TEXACO Explor

GEOLOGICAL RECONNAISSANCE NORMAN WELLS - WRIGLEY AREA, NORTHWEST TERRITORIES

R.G. Edwards April 26, 1960

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TEXACO EXPLORATION COMPANY

CALGARY, ALBERTA

GEOLOGICAL RECONNAISSANCE
NORMAN WELLS - WRIGLEY AREA,
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By

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During the 1959 field season, geologists of Texaco Exploration Company conducted a geological reconnaissance of the Norman Wells-Wrigley area of the Northwest Territories. The area of investigation includes the Canyon (i.e. eastern) Ranges of the Mackenzie Mountains, the Franklin Mountains and the intervening Mackenzie Plains between 62°30' and 66°00' North Latitude, and covers approximately 35,000 square miles. The purpose of this study was to evaluate the hydrocarbon potential and obtain stratigraphic and structural information in an area only sparsely described in published literature.

The study was designed to provide regional surface control in an area where drilled wells, with the exception of the Norman Wells area, are rare. Outcrops in and immediately surrounding Texaco permits were examined in somewhat more detail in an attempt to more fully evaluate the possibility of hydrocarbon accumulations within the permit areas. Fifty-four sections with a total footage of 89,000 feet were measured and described. In addition, 35 field checks were made.

Field party personnel boarded a river boat and barge at Fort Nelson, British Columbia on May 17. The barge transported personnel, camp equipment and initial food supplies to Norman Wells, Northwest Territories. Norman Wells was used as a main supply point for the entire field season. The boat and barge arrived at Norman Wells on June 3. The 47G-2 Bell helicopter and De Havilland Beaver aircraft which accompanied the party throughout the summer, arrived at Norman Wells on June 1.

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Throughout the summer three base camps were established. Distance between base camps varied between 60 and 80 miles. Field work for this report was initiated June 4 at Stick Lake and progressed southward to Stewart Lake and Mackenzie River (at Ochre River) in that order (see Area of Operations Map, Figure 1).

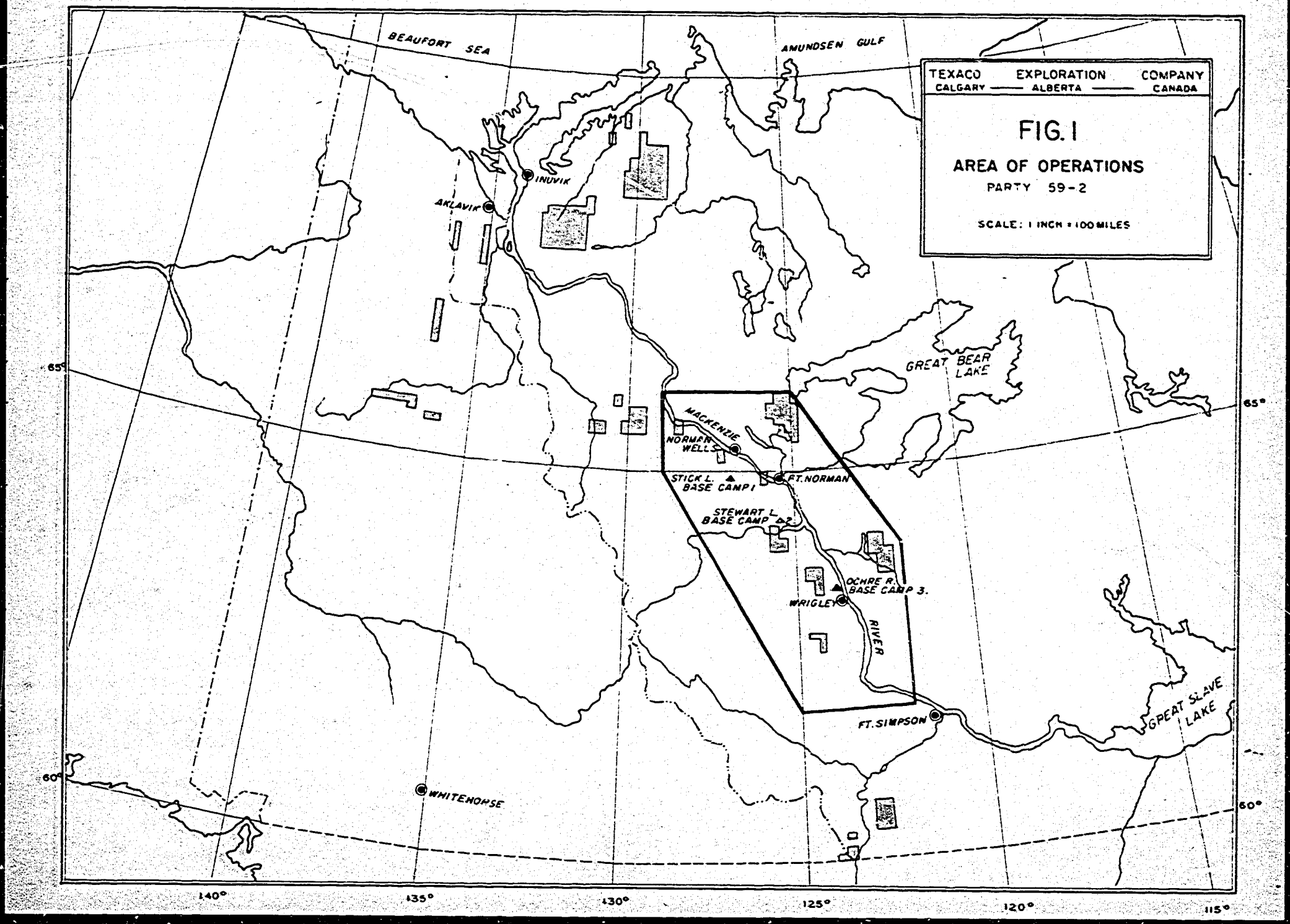
Weather conditions were fair throughout the summer. Eighteen days were lost due to inclement weather. The field season terminated August 12.

Communications with the aircraft and the Department of Transport radio station at Norman Wells were maintained by use of a Spilsbury-Tyndal MRT-600 radio telephone which was very satisfactory. Fresh food shipments were shipped weekly by air freight from Edmonton to Norman Wells by Pacific Western Airlines. Shipments were picked up at Norman Wells by the party aircraft.

Acknowledgments

This report was prepared under the direction of H.M. Kroon, Texaco Exploration Company, to whom the writer is indebted for valuable suggestions and assistance. The drafting of maps, fence diagrams and cross-sections was done by L. Nemethy and J. McDougall, Texaco Exploration Company.

Field personnel, besides the author, included geologists O.S. McGuire, H. Corkin, H. Heise and B. Robbins. B.J. Pfeffer and R. Jull were assistant geologists. All are to be commended for their efforts. H. Parzyk served as cook and F. Stromstedt as cook's helper. Both the Associated Helicopters crew, comprised of D. Cassady, pilot, and D. McKinnon, engi-


TEXACO EXPLORATION COMPANY
CALGARY — ALBERTA — CANADA
FIG. 1
AREA OF OPERATIONS
PARTY 59-2
SCALE: 1 INCH = 100 MILES
BEAUFORT SEA
AMUNDSEN GULF
INUVIK
AKLAVIK
GREAT BEAR LAKE
MACKENZIE
NORMAN WELLS
STICK L. BASE CAMP 1
FT. NORMAN
STEWART L. BASE CAMP 2
OCHRE R. BASE CAMP 3.
WRIGLEY
RIVER
FT. SIMPSON
GREAT SLAVE LAKE
WHITEHORSE
65°
60°
140°
135°
130°
125°
120°
115°

neer, and the Pacific Western Airlines crew, comprised of W. McKinney, pilot, and A. Loutitt, engineer, gave outstanding service. The river boat and barge were capably handled by Charlie Jensen and his helper, W. Whitehead.

The author is indebted to the Geological Survey of Canada, Ottawa, for identification of some fossil collections.

Scope of Work

This report, although it includes a discussion of rocks ranging from Precambrian to Tertiary in age, deals primarily with Paleozoic sediments.

Correlation and facies changes have been determined and are demonstrated by facies maps, cross-sections and/or fence diagrams. In some instances, especially in lower Paleozoic strata, fossils are rare and correlations are based primarily on lithology.

The most important structural features of the area are discussed. Two semi-diagrammatic structure sections across the study area are shown in Figure 17.

Field methods used by Party 59-2 are those accepted as standard field procedure and need only slight elaboration. Samples were collected at every major lithologic break. Fossil collections were made as often and as complete as possible. Sections were measured with a 5-foot staff. Approximately one-half of the sections were measured from fly camps usually 20 to 70 miles from a base camp. The remaining sections were worked directly from a base camp.

Sections were named after some nearby topographic fea-

ture and were coded with two or three letters. For example, the code for a section near Inlin Brook was INL-3-59-2. INL indicated the section name, and the numeral 3 signified that it was the third section at that locality. The numerals 59-2 stated year and party number respectively. In several instances, visited localities were coded with the day, month and the number of the locality visited that day. For example, IL-1-3-7-59-2 was the first inspected locality visited on July 3 by Party 59-2.

The locations of all measured sections and inspected localities are shown on the Section Location Map (Figure 2, in pocket).

Previous Work

Most early explorations within the area were undertaken for reasons other than the study of geology. In the late part of the 19th century and early part of the 20th century, Keele, Camsell, and McConnell traversed various parts of the study area, but much of their time was spent studying the physiographic aspects.

The first work of much importance was done in the early 1920s. Williams spent several summers studying the geology of the Wrigley area, and Hume (1922) worked in the North Nahanni area, immediately to the south. Hume (1923) and Link (1921) worked in the Carcajou River area south of Norman Wells.

The most important work carried out to date within the report area and nearby vicinities was the Canol Project.

It was undertaken during the Second World War to explore and drill for oil in the Fort Norman and adjoining areas. The results of surface geological investigations were compiled into 15 reports which cover an area from the Nelson-Liard Rivers area in the south to the Upper Peel River area in the north. In addition, the Norman Wells area was studied in more detail and the geology of this region was presented in 22 reports.

In 1950, Laudon described a nearly complete Paleozoic section at Imperial River, on the west side of the report area. In the Wrigley area, Dann (1953) and Geophoto Services, Ltd. (1953) have presented important information in their government submittal reports. In the same area, Bell (1959) has contributed significantly to the available information concerning the Ordovician and older sediments.

Only the more important references are mentioned here. A detailed list, including minor references, is given in the bibliography. An especially good bibliography of early exploration in the area is given by Camsell and Malcolm (1921).

Physiography

The study area includes parts of three major physiographic subdivisions as defined by Bostock (1948). These subdivisions are shown in Figure 3.

Approximately in the centre of the report area and running its entire length is the Mackenzie Plain. Predominantly tree and muskeg covered with low relief, outcrop is con-

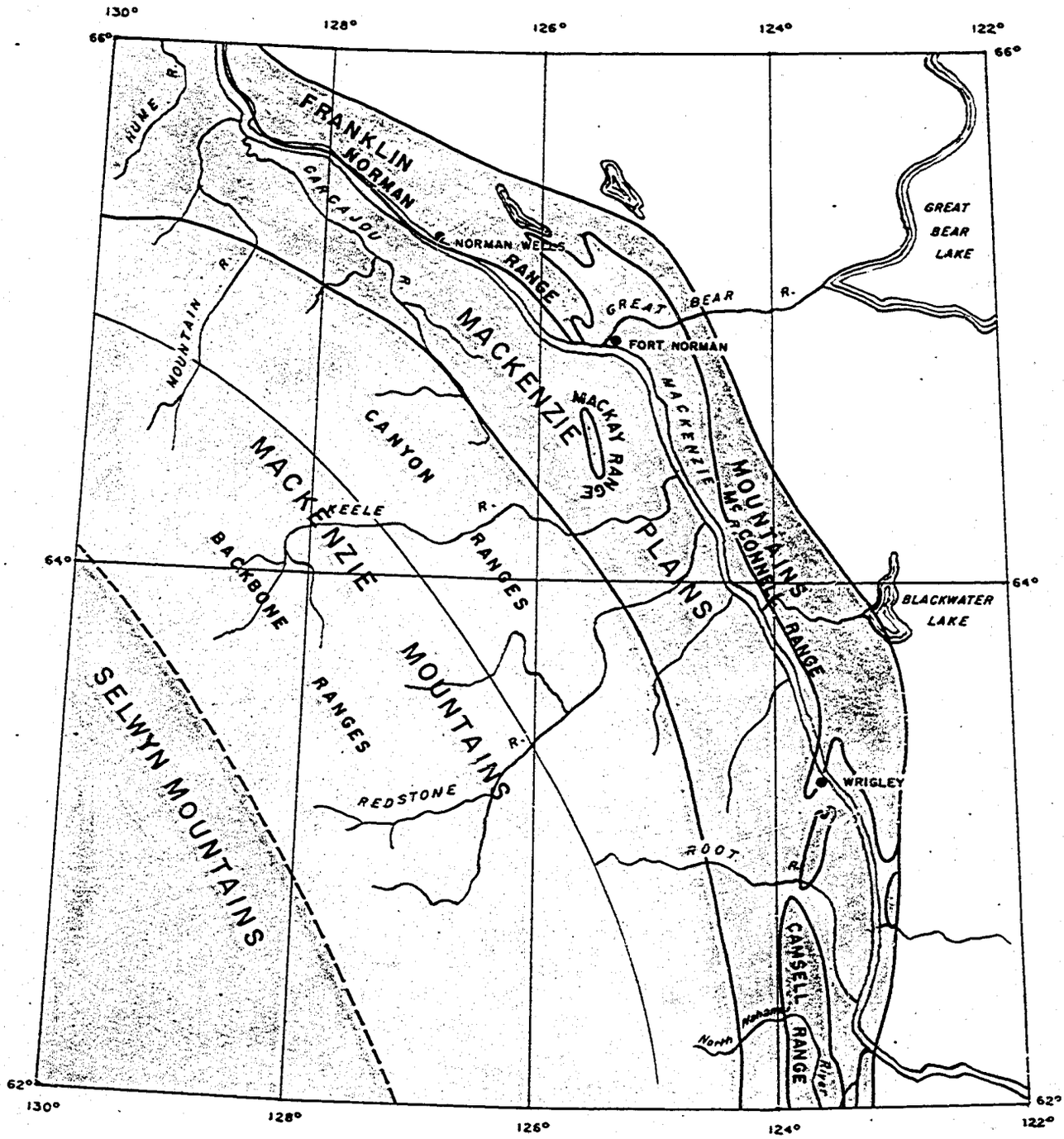


FIG. 3

PHYSIOGRAPHIC SUBDIVISIONS OF THE

NORMAN WELLS — WRIGLEY AREA

(AFTER BOSTOCK, 1946)

SCALE:

0 20 40 MILES

fined to creek valleys and low ridges. In some places, innumerable small lakes dot the Plain. The Mackenzie Plain appears to be a strip of the Interior Plains left almost undisturbed within the Mackenzie Mountain area when the front structures emerged from the plains far out in front of the main area of deformation.

In several places, as in the MacKay and Imperial Ranges, Paleozoic rocks project through the Cretaceous strata and stand as conspicuous ridges above the surrounding terrain.

West of the Mackenzie Plain are the Canyon Ranges of the Mackenzie Mountains. The Canyon Ranges occupy the lower, eastern portions of the Mackenzie Mountains, and north of the Redstone River, the major features are high plateaux of nearly horizontal strata. Along the eastern flanks of the Canyon Ranges, where dip is steeper, "flat-iron" mountain ridges are common. In the vicinity of the Redstone River, the plateaux give way to several ridges of mountains which converge southward. In the vicinity of North Nahanni River, these ridges become inseparable from the Backbone (i.e. western) ranges of the Mackenzie Mountains.

East of and parallel to the Mackenzie Plain are the Franklin Mountains. In general, they form an elevated and broken tract of country apparently representing the easternmost zone of the mountain structures bordering the Interior Plains. In the report area, the Interior Plains occupy all that area east of the Franklin Mountains.

Climate and Vegetation

Climate in the area is essentially one of long, cold win-

ters and short, cool summers. Precipitation varies between ten and twenty inches per year, with four to six inches falling from June to September. The Mackenzie River breaks up the last week in May and begins to run ice the last week in September. Lakes in the area are usually ice-free by the first week of June.

Fair weather may be expected between June 1 and August 15. After August 15, conditions gradually worsen and generally poor weather may be expected in the mountain ranges of the area. Most geological crews terminate field work the first week in September.

Tree growth is confined mainly to the Mackenzie Plain and larger creek valleys of the mountain ranges. The Franklin Mountains, somewhat lower than the Mackenzie Mountains, are tree-covered over all but the higher peaks and ridges.

Large areas of muskeg are common throughout the Mackenzie Plain. Tree growth in muskeg areas is confined to scattered and stunted spruce. In some areas, however, (e.g. Texaco's Bear River permit) both evergreen and deciduous (poplar and birch) trees reach heights between 50 and 70 feet.

Permafrost underlies the entire report area. In the southern parts it is discontinuous in extent, but permafrost boundaries have not as yet been determined. In muskegs, where the ground is insulated with moss, permafrost is less than 12 inches below the surface in summer. Permafrost is 150 feet thick at Norman Wells and undoubtedly thins southward.

STRATIGRAPHY

General Statement

In the following pages, discussion of stratigraphy is, for the most part, kept on a regional basis. In the Norman Wells area, however, the importance of the producing Kee Scarp formation of the Fort Creek group warrants a somewhat more detailed discussion and all available information concerning this zone is incorporated.

Stratigraphic interpretations as contained in this report are greatly aided by outcrops which occur in both the Franklin and Mackenzie Mountains, thus allowing regional control in more than one direction. Fence diagrams were constructed to show Middle and Lower Devonian and Silurian-Ordovician general correlations and lithologies. Facies and isopach maps, regional though they are, were prepared to present all field information collected to date. All wells drilled in the area of study have been considered in the completion of this report.

The correlation chart shown in Figure 4 summarizes past as well as present correlations of the study area and adjacent regions.

Precambrian

On the basis of stratigraphic position, Precambrian strata have been recognized on Cap Mountain in the Franklin Mountains, along the Keele River, and at Doris Lake in the MacKenzie Mountains.

Williams (1923, page 73B) was the first to imply a Pre-

FIG. 4

PALEOZOIC CORRELATION CHART

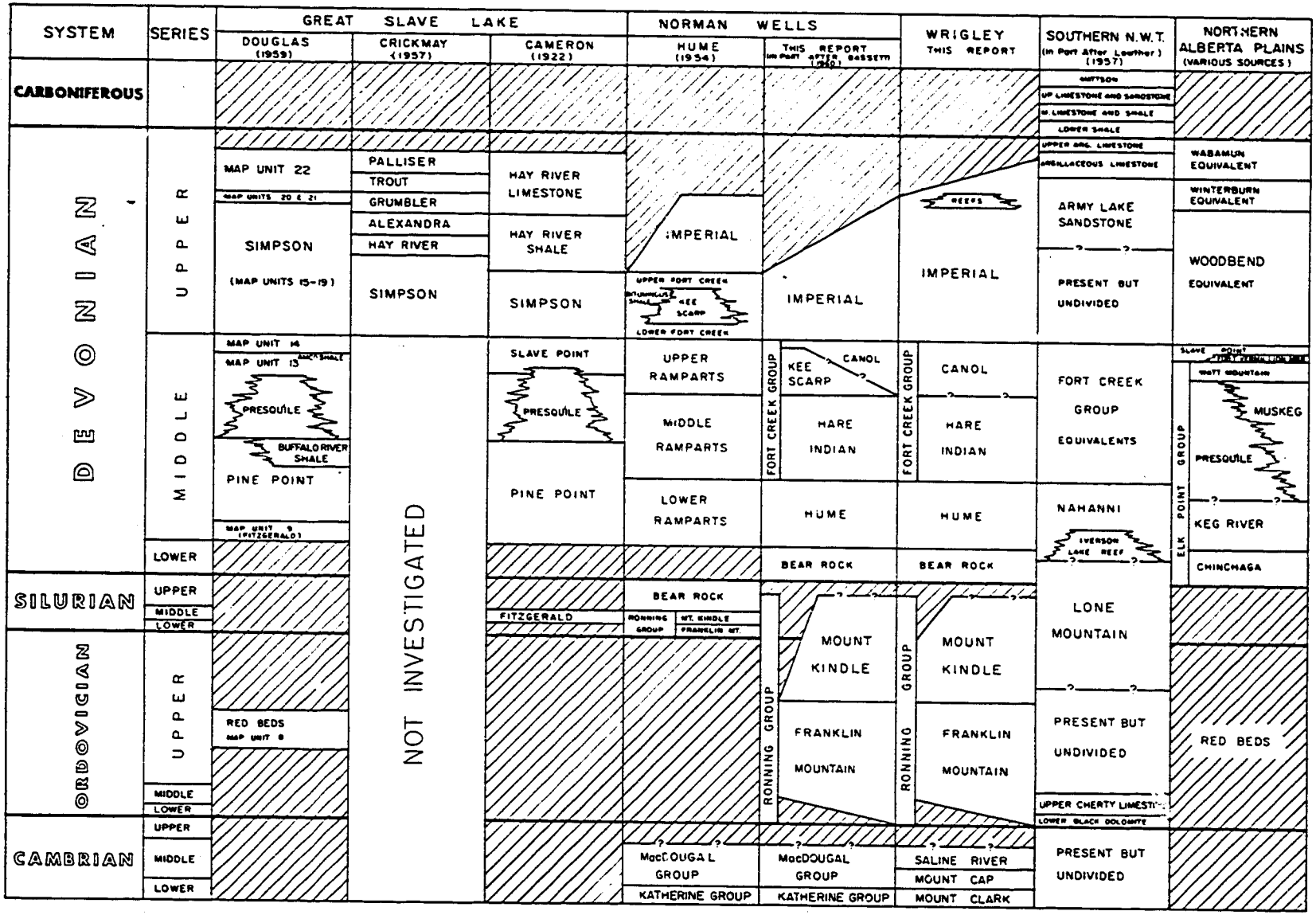


FIG. 5

TABLE OF FORMATIONS

NORMAN WELLS - WRIGLEY AREA N.W.T.

SYSTEM OR SERIES	GROUP OR FORMATION		THICKNESS (FEET)	LITHOLOGY
TERTIARY	UNDIVIDED		600-1200	UNCONSOLIDATED SANDS AND CLAY WITH LIGNITE
UNCONFORMITY				
UPPER CRETACEOUS	EAST FORK		780-850	GREY SHALES
	LITTLE BEAR		620-780	SANDSTONES AND SHALES WITH COAL
	SLATER RIVER		1000	DARK GREY SHALES WITH SILTSTONES AND SANDSTONES
LOWER CRETACEOUS	SANS SAULT		1400	GLAUCONITIC SANDSTONES, SANDY SHALES & CONGLOMERATES
UNCONFORMITY				
UPPER DEVONIAN	IMPERIAL		500-2000	GREYISH GREEN SANDSTONES, SILTSTONES AND SHALES WITH LIMESTONE BEDS AND REEFS IN THE WRIGLEY AREA
MIDDLE DEVONIAN	FORT CREEK GROUP	CANOL	0-400	BLACK BITUMINOUS, NON-CALCAREOUS SHALE
		KEE-SCARP	0-800	CORAL & STROMATOPOROID REEFS WITH A BASAL BEDDED LIMESTONE
		HARE INDIAN	500-700	DARK GREY TO GREENISH GREY, OFTEN CALCAREOUS SHALE WITH SOME BLACK BITUMINOUS SHALE
	HUME		200-1400	GREY FOSSILIFEROUS LIMESTONES, DARK GRAY SHALES AND OCCASSIONAL STROMATOPOROID REEFS
LOWER DEVONIAN	BEAR ROCK		400-6000	BRECCIATED CARBONATES, BEDDED CARBONATES, ANHYDRITE AND GYPSUM
UNCONFORMITY				
ORDO-SILURIAN	RONNING GROUP	MT. KINDLE	0-1500	GREY, DOLOMITES COMMONLY CHERTY WITH A WIDESPREAD CORAL ZONE MARKING THE BASE
		FRANKLIN MOUNTAIN	1000-1800	GREY SPARSELY FOSSILIFEROUS DOLOMITE
UNCONFORMITY				
MIDDLE CAMBRIAN	McDOUGAL GROUP	SALINE RIV.	500-2700	EVAPORITES WITH GREY & GREEN SHALES & MINOR DOLOMITE
		MT. CAP	700-800	GREY GREEN AND MAROON SHALES, CARBONATES AND MINOR SANDSTONES
LOWER CAMBRIAN	KATHERINE GROUP	MT. CLARK	700-3000	REDDISH QUARTZITES AND SANDSTONES WITH SOME SHALES

cambrian age for dark shales on Cap Mountain which underly the Lower Cambrian Mount Clark quartzite. Underlying these shales on Cap Mountain are more than 5,000 feet of predominantly maroon weathering shales and sandstones with some carbonates.

West of Cap Mountain, along the Keele River in the Mackenzie Mountains and 90 miles west of the Mackenzie River, maroon and green shales which are lithologically similar to Precambrian strata on Cap Mountain, outcrop along the north edge of the river. These beds are below a marked angular unconformity below quartzites tentatively assigned to the Lower Cambrian, although no fossils were found in them. A photograph of this unconformity is presented by Bell (1959, page 10).

In the Doris Lake area, along the front range of the Mackenzie Mountains near the west side of the report area, about 500 feet of maroon and grey to grey-green siltstones and sandstones at the base of a thick clastic section are assumed to be Precambrian. These sediments are in some ways similar to Precambrian beds on Cap Mountain and along the Keele River, although no shales are present at Doris Lake. The contact between Precambrian and Cambrian beds at Doris Lake was not examined, but no obvious bedding angularity was visible.

Cambrian

Distribution.-Cambrian strata are present throughout the report area. Exposures are especially abundant in the Mac-

kenzie Mountains behind the front ranges. In the Franklin Mountains, exposures are less common. Near Norman Wells, only the uppermost beds of the Cambrian are exposed. Southward, along the east side of the Franklin Mountains between Mount Clark and Cap Mountain, Cambrian exposures occur occasionally.

Contacts.-In the Cap Mountain area, contact between Precambrian and Cambrian rocks has been tentatively placed by Bell (1959, page 9) at the base of a 18-inch thick conglomerate at the base of the Mount Clark formation on Cap Mountain. No bedding angularity is visible at this locality, but 70 miles west of Mackenzie River, along Keele River, Bell (1959, page 10) describes a very obvious Precambrian-Cambrian nonconformity. Here, nearly vertically dipping Precambrian varicolored shales and phyllites are overlain by gently west-dipping Lower Cambrian quartzites. Throughout the rest of the report area, delineation of the Precambrian-Cambrian contact is more difficult.

Definite contacts between Upper, Middle and Lower Cambrian sediments within the Cambrian system are not always recognized in the field. Major lithologic changes may or may not exist between beds containing fossils of different ages.

The Cambrian-Ordovician contact is unconformable, but no bedding angularity was observed.

Lithology, Correlation and Thickness.-The Cambrian system is divisible into two groups near Norman Wells and correlation to the Wrigley area is reasonably straightforward. Cor-

relation of Cambrian sections used in this report is shown in Figure 7.

KATHERINE GROUP (LINK, 1921): The name is applied to a sequence of pink, white and rusty quartzites with interbedded, black, platy shales exposed below shales containing a Middle to Upper Cambrian fauna in the Carcajou Canyon-Imperial River area of the Mackenzie Mountains.

In only section, measured by Party 58-1 (Murray and Teitz, 1959) near Doris Lake on the extreme west side of the report area (Section DLS-1-58-1), is it likely that the base of the Katherine group was encountered. Here, about 2,400 feet of cross-bedded sandstone with minor maroon and green shales and rare dolomite and conglomerate overlie about 500 feet of maroon to greenish-grey sandstones and siltstones. The lowermost 500 feet of this section is tentatively assigned to the Precambrian on the basis of lithologic similarity to sediments of assumed Precambrian age in the Mount Clark-Cap Mountain area. The 2,400 feet of sandstones are assigned to the Lower Cambrian Katherine group, although they contain no fossils. On lithologic similarity and stratigraphic position, the Katherine group is equated to the Mount Clark formation of the Fort Wrigley area.

The name Mount Clark formation was applied by Williams (1923) to a sequence of red to pink quartzites and sandstones with some conglomerates and shales near the base, which is exposed on Mount Clark and Cap Mountain in the Franklin Mountains north of Fort Wrigley. On Mount Clark, Salterello and Olenel-

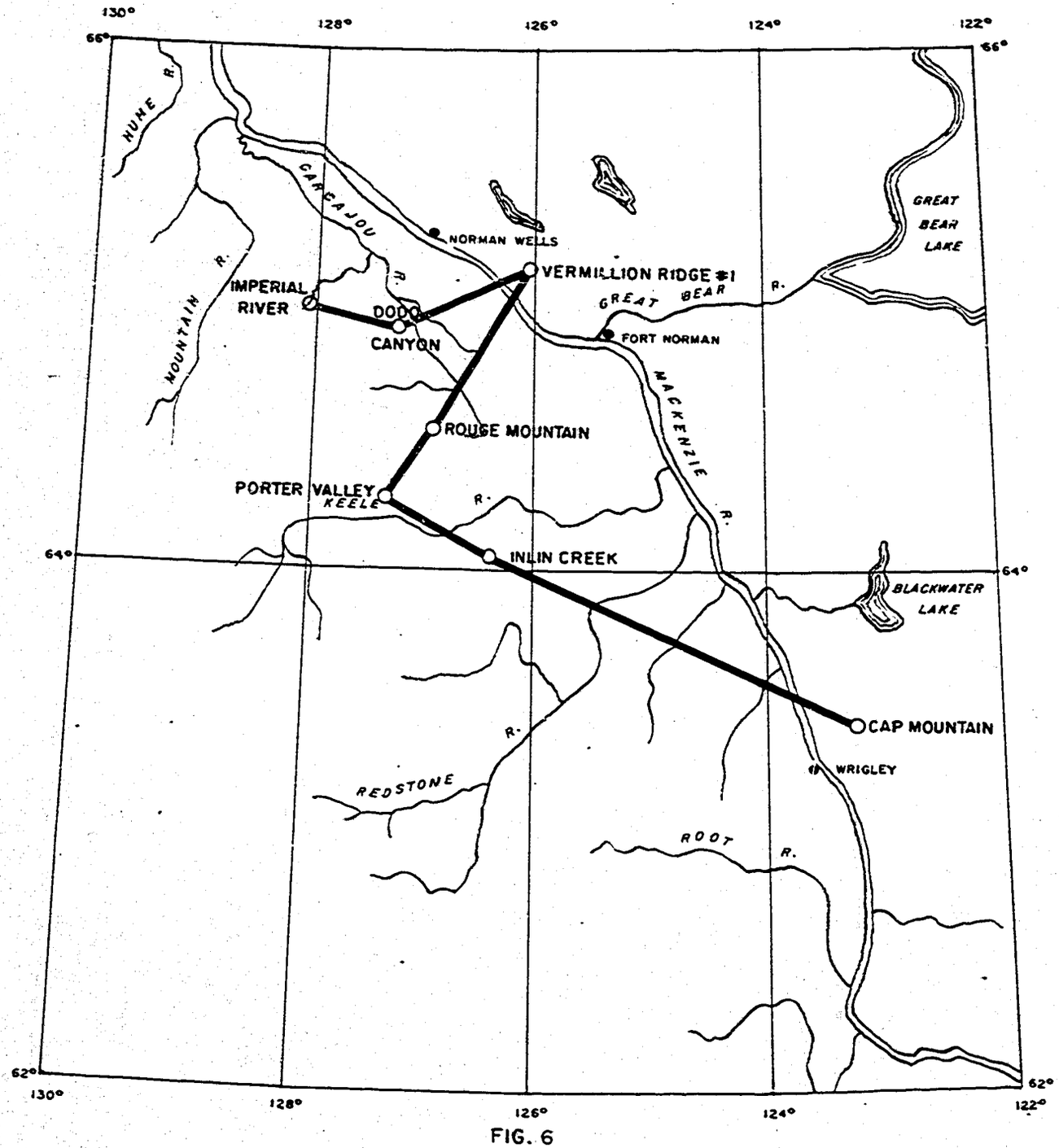


FIG. 6

LOCATION MAP

OF

CAMBRIAN SECTIONS

LINE OF CAMBRIAN SECTION, FIGURE 7

1" = 40 MILES 40 30 20 10 0 40

CORRELATION OF CAMBRIAN SECTIONS

IN THE MACKENZIE AND FRANKLIN MOUNTAINS

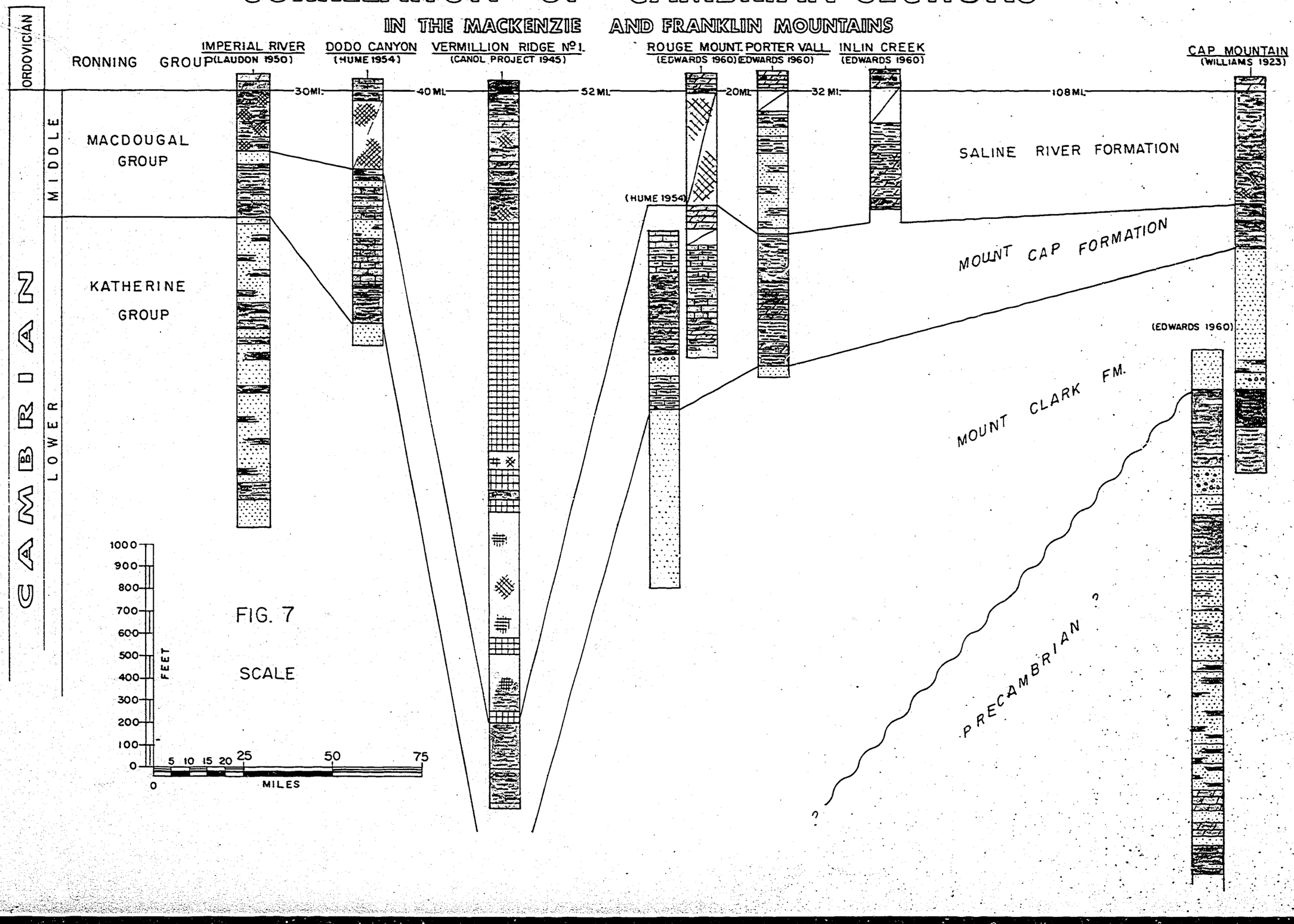


FIG. 7

lus canadensis were found in shales near the top of the Mount Clark quartzite (Williams, 1923, page 75B). On the basis of these fossils, a Lower Cambrian age for the Mount Clark formation is generally accepted.

In the Cap Mountain-Mount Clark area, the Mount Clark formation averages 700 to 800 feet in thickness. The formation thickens westward, and 80 miles west of Cap Mountain, along the Keele River, a quartzite and sandstone unit, estimated by the author to be in excess of 3,000 feet, is similar in lithology to the Mount Clark formation and occupies an equivalent stratigraphic position.

MACDOUGAL GROUP (LINK, 1921): These beds were first described in Macdougal Creek Valley, with 997 feet of sediments included in the group at its type section (Nauss, in Hume, 1954, page 10). Here, they consist of a sequence of chocolate-colored to red and green shales, limestones and sandstones, with abundant gypsum in the upper 200 to 500 feet.

In general, the Macdougal group may be divided into two lithologic units. These are a lower, predominantly shale and carbonate unit and an upper evaporitic unit. The upper evaporite unit is the only lithologic unit within the Cambrian which can be traced with any certainty throughout the report area.

Northwestward from the type section, in the Mackenzie Mountain front at Imperial River, the lower beds of the Macdougal group are predominantly shales with minor sandstones, and are about 300 feet thick. The upper beds, also 300 feet thick, are varicolored shale with abundant, massive beds of gypsum.

Ninety miles west of the Mackenzie River and immediately north of the Keele River, near Nainlin Brook (Section PVW-1-59-2), Cambrian beds, assumed equivalent to the Macdougal group, underlie the Ronning group. The Lower Macdougal consists of 500 feet of shale and dolomite which overlie a thick sequence of sandstones assigned to the Katherine group. The upper 550 feet of the Macdougal group at this locality is mainly sandstone with interbedded red shales. This is the only section in which abundant sandstones were discovered in the upper beds of the Macdougal. The lack of gypsum in these upper beds is conspicuous.

Overlying the Mount Clark formation on Cap Mountain, Williams (1923, page 73B) describes about 200 feet of green and grey shales, and red sandstones and shales, from which he collected Middle Cambrian fossils. These usually poorly exposed beds Williams called the Mount Cap formation.

The Mount Cap formation is equated approximately to the lower part of the Macdougal group of the Carcajou River area in the Mackenzie Mountains, but an exact correlation is not attempted.

In the Mount Clark-Cap Mountain area, beds equivalent to the upper evaporite sequence of the Macdougal group were named Saline River formation by Williams (1923). From observations he made in the vicinity of Cap Mountain, Williams suggested that the Saline River formation is approximately 500 feet thick at this locality, with red and grey shales containing salt and gypsum forming the lower 200 feet, and

calcareous shales with some red and green shale forming the upper 300 feet.

The Saline River formation is the oldest exposed rock present in the Discovery Range of the Franklin Mountains. At Bear Rock, 100 feet of very gypsiferous shales are exposed and are included in the Saline River formation.

The author agrees with Williams (1922, page 77B) who suggests a Middle Cambrian age for the Saline River formation.

Only one well has penetrated Cambrian strata in the subsurface of the Mackenzie Plain. This well, Vermilion Ridge No. 1, encountered 2,700 feet of Saline River formation evaporites including 1,200 feet of pure rock salt (Hume, 1954, page 103). This seemingly anomalous thickness may be the result of surface leaching of the salt in outcrop, with the result that only a gypsiferous shale residue remains where the formation crops out. The possibility of an increased thickness of salt due to structural thickening cannot be ruled out.

Source & Reservoir Rocks.-The lower half of the Macdougal group and its equivalents commonly contain some shales, which in occasional instances are petroliferous (e.g. 230 feet of petroliferous shale in the lower part of the Macdougal group type section). At some localities, shales are also present within the Katherine group but they are usually thin and the possibility of their acting as an important source for hydrocarbons is doubtful.

Porosity is not common in Cambrian sediments in outcrop.

On present evidence, Cambrian strata within the report area can only be considered as fair to poor for hydrocarbon accumulation.

Paleogeography.--Early Cambrian sediments consist predominantly of coarse clastics with minor shales which were deposited in a widespread but shallow sea, with abundant but minor fluctuations of the shore line. Ripple marks, cross-bedding and mud cracks exist at many localities. In the Franklin Mountains, Lower Cambrian sediments are much thinner than to the west, implying a deepening of the sea behind the Front Ranges of the Mackenzie Mountains.

In Middle Cambrian time, sand deposition gave way to shale and limestone throughout much of the area as recorded by the lower beds of the Macdougal group. It is very likely that the shale was deposited in the early stages of formation of a large, restricted, intracratonic basin which developed in the Norman Wells-Wrigley area and flanked the craton during Middle Cambrian time. The upper Macdougal sediments, containing abundant evaporites and red and green shale, were deposited over the area now occupied by the Front Ranges of the Mackenzie Mountains, the Mackenzie Plain, and Franklin Mountains. The evaporitic sequence thins westward and is not present at Arctic Red River. Similarly, no evaporites were present at section PVW-1-59-2 which is near the Keele River on the west side of the area. Southern limit of the evaporites is unknown. Replacement of the evaporites by sandstones to the west suggests that a positive area which

could have provided necessary restriction for evaporite formation may have existed in the Arctic Red River area and extended southward and eastward into the area now occupied by the central and/or western portion of the Mackenzie Mountains.

Ordovician-Silurian

General Statement.--Most Canol geologists used the name Mount Ronning formation for rocks which occur between the Lower Devonian Bear Rock formation and the Cambrian Macdougal group. The Mount Ronning was raised to group status by Hume (1954) when he renamed it the Ronning group.

The name "Ronning group" is applied to a thick sequence of Ordovician and Silurian dolomites which is present throughout the study area. To date, exact delineation of the Ordovician-Silurian contact has proved impossible. Earlier previous workers placed much of the Ronning group in the Silurian on the basis of a coral zone which, until recently, was considered Niagaran in age. In recent years, however, this "Niagaran" coral zone has been redated (Bell, 1959, page 8) and is now placed in the Upper Ordovician. This coral zone is in the upper half of the Ronning group.

One fossil prevents placing the Ronning entirely within the Ordovician. This fossil, Conchidium sp., is definitely of Silurian age and, although almost never found in place, it is occasionally identified from Upper Ronning talus fossils. In that beds containing Conchidium sp. are lithologically similar to underlying beds and no contact is visible between them, Ordovician and Silurian strata are grouped into one obvious major

field unit. The Ordovician-Silurian contact falls somewhere within the upper part of the Mount Kindle formation.

Distribution.-Orodovician-Silurian strata outcrop abundantly thoughout the report area. Well exposed sections are common along the Mackenzie Mountain front. Behind the front ranges, exposures are abundant but good sections are less common. In the Franklin Mountains around Norman Wells, Ronning sections are fair. Southward, in the Cap Mountain area, exposures are badly talus-covered and good sections are scarce.

Northwest of Norman Wells, in the vicinity of Mahony Lake, Ronning forms the surface bedrock over large areas. Only in the Mackenzie Plain are Ronning outcrops absent. (The MacKay Range is an exception.)

Contacts.-The lower contact of the Ronning group with underlying Cambrian sediments is unconformable. In the Imperial River Canyon, Laudon (1950, page 569) describes the contact as abrupt and states that there is local evidence of truncation of underlying Cambrian strata. Grey sandstones and chert conglomerate appear in local pockets along the contact.

The upper limits of the Ronning group are sharply delineated by a marked disconformity plainly visible in an exposed rock face such as in the Carcajou Canyon (see Plate 1). Hume (1954, page 21) described a zone of sandstone and conglomerate between typical Bear Rock and Ronning beds in Canyon Creek near Norman Wells, giving further evidence of the disconformity at the top of the Ronning group.

Lithology, Correlation and Thickness.-In 1922, Williams (page 60) subdivided beds now known as the Ronning group into an upper Mount Kindle formation and a lower Franklin Mountain formation, and this terminology has been accepted for this report.

Correlations of Ronning group sections measured by Party 59-2 are shown in the fence diagram of Figure 8. An isopach map is shown in Figure 9.

FRANKLIN MOUNTAIN FORMATION: The Franklin Mountain formation is present throughout the report area. Its thickness and lithology are remarkably uniform. The thickest measured section of the Franklin Mountain formation is in the Mackenzie Mountains on the west side of the area at Mountain River (MRS-1-58-1). Here the Franklin Mountain is 1,800 feet thick and is composed of finely crystalline, light to medium grey, unfossiliferous, sometimes silty and cherty dolomite.

Eastward and northward from the Mackenzie Mountain front at Mountain River, thickness decreases only slightly (1,700 feet at Imperial River in the Mackenzie Mountains and 1,500 feet near Norman Wells). Lithology in these sections is very similar to that at Mountain River, but no silty dolomites are present.

Behind the front ranges of the Mackenzie Mountains south of Norman Wells, the Franklin Mountain formation thins to about 1,000 feet (at CJLS-59-2). Throughout the rest of the report area, east of Norman Wells along the Franklin Mountains and the Mackenzie Mountains, thickness remains rela-

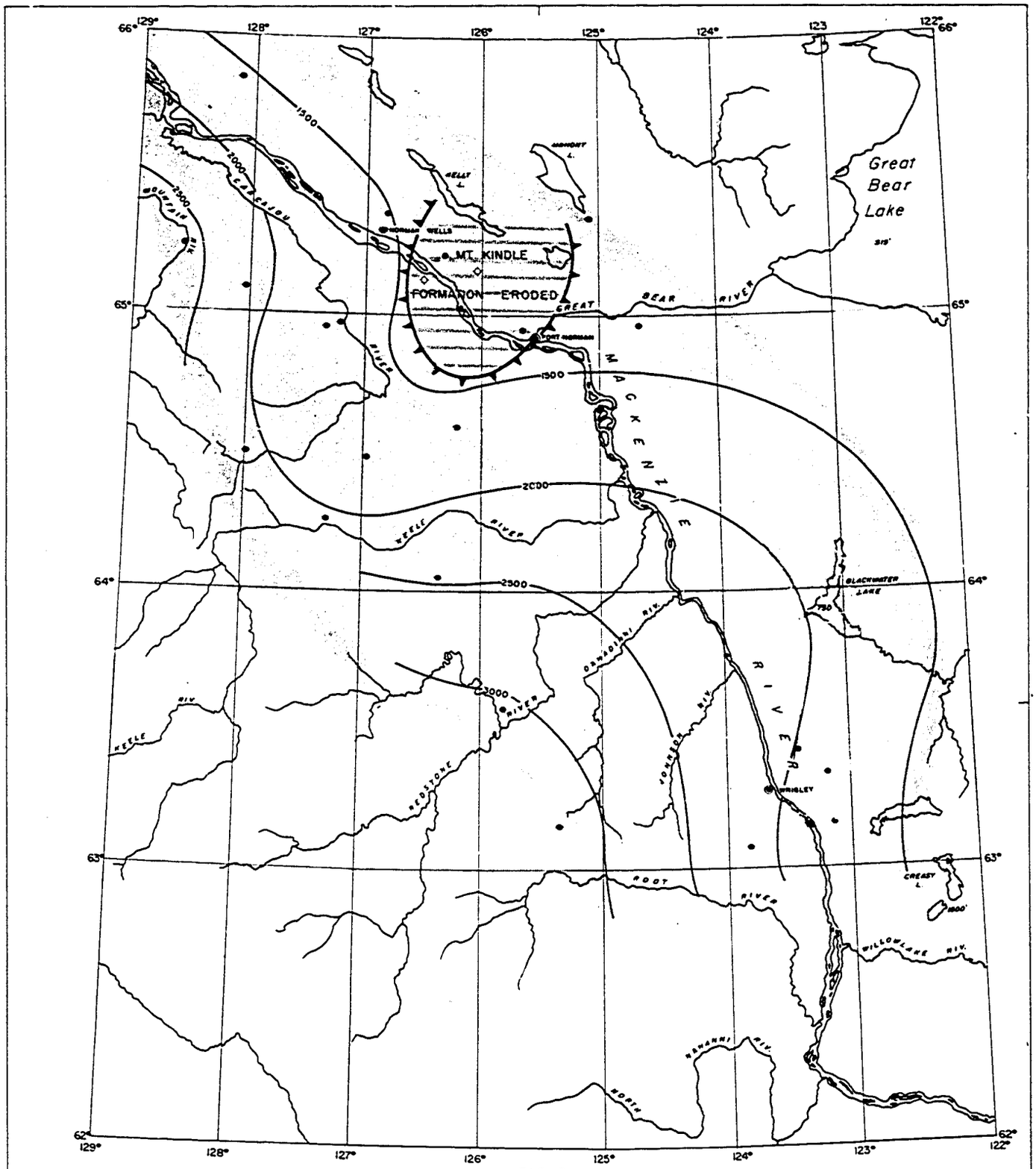
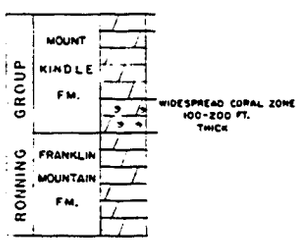


FIG. 9

RONNING GROUP

(FRANKLIN MOUNTAIN AND MT. KINDLE FORMATIONS)

GENERALIZED LITHOLOGIC ASPECT & ISOPACH MAP



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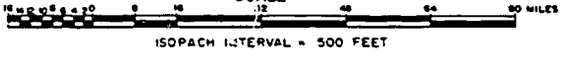

ISOPACH INTERVAL = 500 FEET

LEGEND

- LIGHT COLORED DOLOMITE (FRANKLIN MT. & MT. KINDLE FMS.)
- EROSIONAL LIMIT OF MT. KINDLE FORMATION
- 2000 — ISOPACH
- OUTCROP LOCALITY
- WELL LOCATION

tively constant between 1,200 and 1,500 feet. The only exception is at section RAT-1-59-2 where the Franklin Mountain formation is 800 feet thick, although the base may be placed too high.

At Bear Rock, near Fort Norman, Stelck (in Hume, 1954, page 16) placed only 600 feet of section in the Ronning group. It is highly likely that faulting, as well as erosion, has thinned the section measured by Stelck. He is probably correct, however, in stating that the Mount Kindle formation has been eroded, as it is known to be missing west of Bear Rock between Bear Rock and Norman Wells.

In the Franklin Mountains of the Wrigley area, the Franklin Mountain formation shows a slight change from its typical lithology. At several sections in this vicinity (sections OTC-1-59-2 and CAPMS-59-2), the Franklin Mountain formation weathers medium to light grey-brown and contains abundant zones of silty dolomites. At section CAPMS-59-2, thin, local lenses of chert and quartz pebbles occur occasionally throughout the formation. Ripple marks and mud cracks have been observed in Franklin Mountain sediments in this region.

Party 59-2 found no fossils in the Franklin Mountain formation but Williams (1923, page 78B) describes two species of Rhipidomella which he collected 15 feet below the Mount Kindle-Franklin Mountain contact. He indicates that these fossils have affinities with Lower Silurian fossils of Ontario. However, since the lower beds of the overlying Mount Kindle are now known to be of Upper Ordovician rather than Middle Silurian age as

once thought, the Franklin Mountain formation is Upper Ordovician or older.

In only one section (RED-2-59-2) were Middle Ordovician sediments identified. Identification was based on fossils collected in the lowermost 100 feet of the exposed Ordovician at RED-2-59-2 and it is lithologically identical to Upper Ordovician sediments. These Middle Ordovician sediments are included in the Franklin Mountain formation.

MOUNT KINDLE FORMATION: The Mount Kindle formation is the upper formation of the Ronning group and is present throughout the report area, except in the Norman Wells-Fort Norman area where it has been removed by pre-Devonian erosion (see Figure 9).

Thickness of the Mount Kindle formation is controlled by pre-Devonian erosion. In the Franklin Mountains north of Fort Norman, only the lowermost beds of the Mount Kindle are present, or the formation is eroded entirely. Southward from Fort Norman, the Mount Kindle varies between 600 and 800 feet in thickness in the Franklin Mountains. Thickness is approximately the same along the Mackenzie Mountain front. Behind the front ranges of the Mackenzie Mountains, the Mount Kindle thickens and reaches a maximum thickness of 1,500 feet near Wrigley Lake (section INL-1, 2-59-2) and Redstone River (section RED-2-59-2).

In general, the Mount Kindle formation may be divided into a lower, fossiliferous coral zone and an upper, less fossiliferous zone. The fossiliferous coral zone in the lower beds

of the Mount Kindle formation is the "Niagaran" coral zone of most previous workers, now known to be Upper Ordovician in age.

Coral zone thickness varies between 40 and 300 feet. The conformable lower contact with the underlying Franklin Mountain formation is obvious and abrupt, but the upper limits of the coral zone are usually gradational into the upper, less fossiliferous beds of the Mount Kindle. Average thickness of the coral zone is between 100 and 200 feet.

The coral zone is composed predominantly of dark grey, finely crystalline, often cherty dolomite with abundant fossils. Fossil content varies from scattered solitary corals to as much as 60 to 70 percent coralline material (e.g. CAPMS-59-2).

Fossils found within the coral zones include several species of Catenipora, Manipora sp., several species of Paleophyllum, Paleofavosites sp., Homoeospira sp., Halysites sp., and Plasmopora sp. Borden (see Bell, 1959) discusses the Upper Ordovician fauna of the Mount Kindle formation in some detail.

The upper, sparsely fossiliferous beds above the coral zone average 500 to 700 feet in thickness, with a maximum of 1,200 feet present near the Keele River (INL-1-2-59-2). The upper beds of the Mount Kindle are predominantly finely crystalline, light grey dolomites, occasionally cherty, usually only sparsely fossiliferous to unfossiliferous.

At several localities, the upper beds of the Mount Kindle contain light grey, fine to medium crystalline, coralline

dolomite which may represent reefal sedimentation.

The Ronning group in the report area is equivalent to the upper part of the Cambrian-to-Silurian graptolitic shale facies of the Richardson Mountains, although exact correlation is not possible. Southward from Wrigley, the Ronning group is equivalent to the lower beds exposed at the Lone Mountain formation type section on Lone Mountain, plus at least part of a thick sequence of dolomite which is known to exist below beds exposed at the type section of the Lone Mountain formation.

Source and Reservoir Rocks.--The Mount Kindle formation is the more prospective formation of the Ronning group. The coral zone at its base is porous in some outcrops and may provide suitable reservoir rocks in the subsurface of the Mackenzie Plain.

The upper beds of the Mount Kindle may be prospective if reef bodies, suggested in outcrop, can be located in the subsurface.

No porosity was observed by the author in the Franklin Mountain formation, but Bell (1959, page 14) describes the lower beds of the Franklin Mountain as being so porous as to be cave-forming at several localities in the Wrigley area.

No source beds were observed in the Ronning group.

Palaeogeography.--Following Cambrian time, Lower Ordovician sedimentation was confined to the deeper synclinal trough which existed well to the west of the present-day front ranges of the Mackenzie Mountains. It seems likely that gradual expansion of the Lower Ordovician sea continued through Middle Ordovician time, and by the close of Middle Ordovician had reached the

western edges of the report area.

Early Upper Ordovician time saw a very rapid advance of the sea over large parts of the craton and the Franklin Mountain carbonate was deposited over large areas. The early Upper Ordovician sea extended onto the craton at least as far east as Great Bear Lake, while to the west, in the western Mackenzie Mountains, graptolitic, deep-water sediments were deposited in the syncline.

Conditions in late-Upper Ordovician time were such as to support widespread coral growth as evidenced by the lower, coraliferous beds of the Mount Kindle formation. The upper beds of the Mount Kindle contain coralline, possibly reefoid zones which grew between late-Upper Ordovician and late Silurian. It is possible that these zones were contemporaneous with late Silurian erosion at other localities within the report area.

The entire report area became very gently positive for at least part of the Upper Silurian time and likely for the early part of Lower Devonian. Erosion was not severe, however, and no major amount of previously deposited sediments was removed.

Lower Devonian

Distribution.-Lower Devonian sediments are confined to one formation, the Bear Rock. Outcrops are poorly exposed in the Franklin Mountains but occasionally, good sections occur in the front range of the Mackenzie Mountains. Bear Rock correlations are shown in the fence diagram of Figure 10.

Contacts.-At its type section, Stelck (in Hume, 1954, page 21)

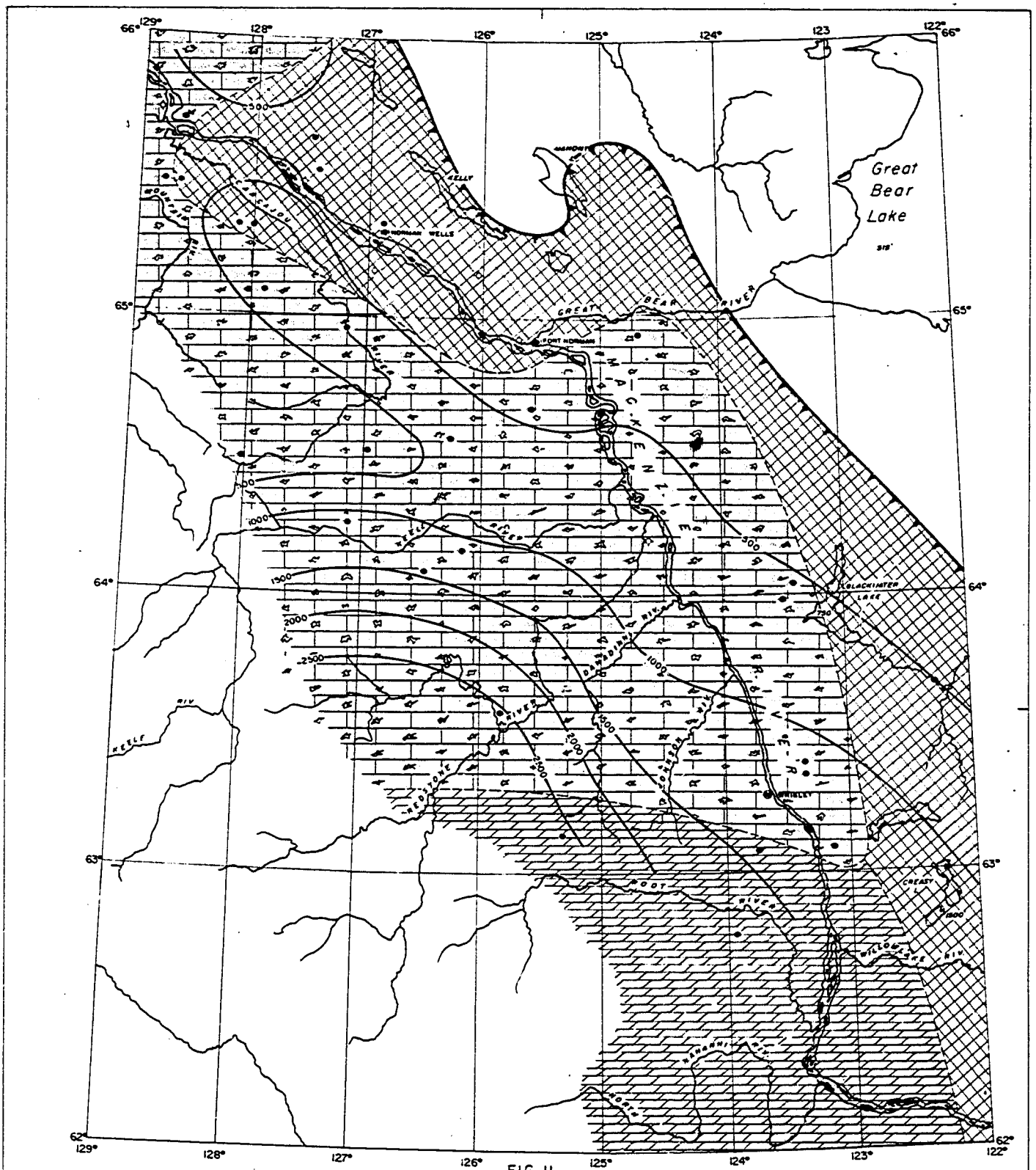

FIG. 11

BEAR ROCK FORMATION

(and equivalents)

GENERALIZED LITHOLOGIC ASPECT & ISOPACH MAP

SCALE:

0 16 32 48 64 80 MILES

ISOPACH INTERVAL = 500 FEET

LEGEND

- EVAPORITES WITH MINOR CARBONATE
- CHIEFLY BRECCIATED CARBONATE
- NON BRECCIATED CARBONATES, MAINLY DOLOMITE
- 500 ISOPACH
- EROSIONAL LIMIT
- FACIES BOUNDARY
- OUTCROP LOCALITY
- WELL LOCATION

states that the Bear Rock formation is overlain conformably and transitionally by Middle Devonian limestone at Bear Rock. This transitional contact is not uniform throughout the area, however. In Carcajou Canyon, the contact is sharp (Hume, 1923a), and near Moon Lake (section MLN-1-59-2), in the northwestern corner of the study area, the upper contact is similarly abrupt.

The lower contact of the Bear Rock formation in the Norman Wells area is abrupt and disconformable. About five miles south of Mahony Lake, at inspected locality SML-1-VL-2, the Ronning group is overlain by 20 feet of conglomeratic sandstone, containing chert and quartz pebbles. This clastic very likely is equivalent to a sandstone and quartzite sandstone unit described by Hume (1954, page 21) as occurring between the Bear Rock and Ronning formations in Canyon Creek, near Norman Wells.

In the southern part of the area, the lower contact is less obvious. In the Franklin Mountains, it is almost always covered and it is placed at the base of gypsiferous limestones in the lower part of the Bear Rock formation. In the Mackenzie Mountains of the southern part of the report area, the lower contact is arbitrarily placed at the base of brecciated Bear Rock carbonates.

Lithology, Correlation and Thickness.-The name, Bear Rock, was first applied by Canol geologists to the predominantly brecciated and unbedded, often gypsum-bearing limestones below the Ramparts (i.e. Hume) formation and above the Ronning group. The Bear Rock formation and its equivalents as used

in this report consist of several associated but distinctly different facies. These facies are shown in Figure 11.

In the general area north and east of the Franklin Mountains between Wrigley and Sans Sault Rapids (70 miles northwest of Norman Wells), the Bear Rock contains abundant gypsum and anhydrite. Evaporitic sediments are usually confined to the lower half of the formation, but at some localities, gypsum forms 75 to 80 percent of the formation, interbedded carbonates are commonly bedded, and brecciated carbonates are not abundant. West of Norman Wells, the evaporitic facies extends southward from the Franklin Mountains into the Imperial Range.

The brecciated facies covers large areas in the Mackenzie Plain, the Mackenzie Mountains and parts of the Franklin Mountains. Where this facies exists, the formation is composed predominantly of brecciated, grey, fine-grained, unfossiliferous carbonates. Limestones are most common, but dolomites are abundant in some sections. Bedded carbonates are not common within the area of this facies.

The third facies is one of normal bedded carbonate which, as the Bear Rock is traced southward from Wrigley and westward from Sans Sault Rapids, gradually replaces the brecciated carbonate facies.

In the vicinity of Moon Lake, East Mountain and Imperial ranges (section MLN-1-59-2, IA-I-59-2, and GMS-59-2) the average thickness is 400 to 500 feet. Westward from this part of the report area, brecciation dies out and near the Arctic Red River the formation thins to 350 feet. No equivalents have been

recognized in the Bonnet Plume River area or in the Ogilvie Mountains.

In both the Franklin and Mackenzie Mountains, between the East Mountain area and Keele River, thickness is remarkably uniform and varies between 400 and 600 feet. South of Keele River, a marked increase in thickness is noted.

In the western part of the area south of the Keele River (section INL-3-59-1) about 1,500 feet of occasionally brecciated carbonates are present.. Farther south, at section RED-2-59-2, similar rocks are 3,000 feet thick. Bassett (1960, oral presentation at First International Symposium on Arctic Geology) indicated that the Bear Rock is 6,000 feet thick in the upper Redstone River area, west of the report area.

In the Franklin Mountains near Wrigley, the formation is between 1,100 and 1,300 feet.

In the southernmost part of the report area, and in the area to the south covered by Lowther (1958), the term "Lone Mountain formation" is applied to a thick, unfossiliferous dolomite sequence underlying fossiliferous Middle Devonian limestone. Originally described by Kindle and Bosworth (1921, page 44B) on Lone Mountain near the mouth of the North Nahanni River, the term, Lone Mountain formation, was applied to 1,550 feet of magnesian limestone with 50 feet of dark grey limestone containing Silurian (Niagaran) corals at the base. The base of the formation is not exposed at the type section on Lone Mountain.. The term has been generally accepted in the Lone Mountain area and is now applied to a thick sequence of

Ordovician-Silurian carbonate below the fossiliferous Middle Devonian limestones.

Williams (1923, page 80) correctly correlated the "Niagaran" fossils in the lower 50 feet of Kindle's Lone Mountain type section to the Mount Kindle formation of the Upper Ronning group in the Franklin Mountains of the Wrigley area. However, he also infers correlation of the overlying 1,500 feet of magnesian limestones at Lone Mountain to rocks between the Mount Kindle formation and Middle Devonian limestones near Wrigley. It is more likely that the uppermost beds of the Lone Mountain formation at its type section are Middle Devonian in age and represent the lower beds of the Hume formation of the Iverson Lake and Wrigley areas and farther north. The Bear Rock equivalents at Lone Mountain are contained in the remainder of the 1,500 feet of magnesian limestone overlying the "Niagaran" coral zone, although the beds immediately overlying the coral zone are probably of the same age as the coral zone itself.

The Lone Mountain formation sometimes contains thin, brecciated zones in its upper 1,000 feet south of the report area, although it is not reported as brecciated at its type section on Lone Mountain, nor does it contain brecciated zones in the northern end of the Camsell Range (section CRS-1-59-2).

Source and Reservoir Rocks.-The Bear Rock formation is the most porous formation in the report area. Porosity is almost always present in varying degrees and amounts in outcrops and in several sections, bitumen infills pore spaces. No hydro-

carbons have been recovered from the formation by drilling, but several wells yielded flowing water, which attests to porosity in the subsurface. In some instances, porosity has been destroyed by anhydrite infilling.

Porosity is proportional to the degree of brecciation. Negligible porosity is present in the predominantly unbrecciated facies in the southern part of the report area.

The large lateral extent over which the porous Bear Rock formation is known to exist makes it highly prospective as a reservoir rock in an area known to contain hydrocarbons.

Paleogeography.--As the seas began to flood the craton in the latter part of Lower Devonian time, evaporite pans formed over much (or all) of the area paralleling the edges of the craton (e.g. north of Mount St. Charles and in the East Mountain-Moon Lake area). Limestone and dolomites also formed contemporaneously and evaporites and chemical limestones form a complex which varies in composition between localities. Seaward (i.e. westward) from the edge of the craton, bedded carbonates become more and more abundant. In the Arctic Red River area to the west and in the southern part of the report, normal bedded marine carbonates form the Bear Rock section.

The brecciated nature of the Bear Rock sediments has been explained by several theories. The theory favored by the author is one of solution of the evaporites and resultant collapse and brecciation of the overlying beds. Volume change from anhydrite to gypsum may have also played an important part in the brecciation process. The great extent over which

brecciation exists in Bear Rock sediments would, however, require removal of fantastic amounts of evaporites to create the brecciation present to-day within Bear Rock sediments.

Middle Devonian

General Statement.-This report essentially follows the correlation and terminology as presented by Bassett (1960, oral presentation at First International Arctic Symposium) who, in the author's opinion, has come closest to solving the Middle Devonian correlation problem of the Norman Wells area.

For this report, Middle Devonian sediments have been divided into four formations. In ascending order, they are the Hume, Hare Indian, Kee Scarp and Canol formations. The upper three are combined to form the Fort Creek group.

Distribution.-Middle Devonian sediments occur throughout the report area. In both the Franklin and Mackenzie Mountains, Hume exposures are common and relatively complete. Hume exposures in the Mackenzie Plain are confined to the Imperial and MacKay ranges. Good outcrops of the Fort Creek group are rare but occasionally good sections are available in the front ranges of the Mackenzie Mountains. Partially complete sections of Fort Creek shale exist along stream valleys in the Mackenzie Plain and in stream cuts along the south side of the Franklin Mountains. The Kee Scarp formation of the Fort Creek group is not found south or east of Norman Wells. Its reefal nature resulted in rapidly varying thickness, with the result that Kee Scarp outcrops are sporadic. Kee Scarp outcrops are exposed in the Franklin

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Mountains between Norman Wells and Sans Sault Rapids, and also in the Imperial Range on the west side of the report area.

Contacts.-The lower contact of the Hume formation has been described by Stelck (in Hume, 1954, page 21) as gradational at Bear Rock. However, in many places in the report area, the contact is sharp, although no direct evidence for a disconformable contact is visible.

The contact of the Hume and Fort Creek group is conformable. At all localities inspected by Party 59-2, this contact was abrupt and sharp, but nowhere was there any evidence of a disconformity.

Within the Fort Creek group, no obvious disconformities have been identified between the formations. The Hare Indian-Kee Scarp and Kee Scarp-Canol contacts are conformable. Within the Kee Scarp itself, it is possible that a short period of erosion did exist between deposition of the upper and lower beds. The relationship of the Kee Scarp to its enclosing formation is far from simple and is not fully understood.

The Canol-Imperial (i.e. the Fort Creek group-Imperial) contact appears conformable, although it is not often exposed.

In 1950, Warren and Stelck (page 139) published a paper suggesting a major unconformity during late Middle Devonian time. To quote Warren and Stelck:

> "In the field the (Upper Devonian) Fort Creek shales are found directly overlying three dif-

> ferent formations, the Beavertail formation, Ramparts formation, and Hare Indian formation.... This bevelling below the unconformity is most marked below Fort Good Hope ... and elsewhere on the Arctic Slope....."

Bassett, 1960 (oral presentation at the First International Arctic Symposium), has shown that such is not the case and that such widespread bevelling did not exist. The Hare Indian and lower Fort Creek shales are the same unit rather than separate units as suggested by Warren and Stelck. The prime reason for the confusion is the fossil zone of Lieoryhnchus castanea which, until Bassett showed it to be of pre-Stringocephalus age, was considered as post-Stringocephalus in age.

Lithology, Correlation, and Thickness.-A fence diagram, Figure 10 (in pocket), summarizes general lithologies and correlations.

HUME FORMATION (BASSETT, 1960): The Hume formation is the lowest Middle Devonian formation. In the Franklin and Mackenzie Mountains north of the Keele River, it averages 400 to 550 feet in thickness and is composed of light to dark grey, finely to sparsely fossiliferous limestone with interbedded dark grey shales. In many of the sections north of the Keele River, the upper and lower parts are predominantly limestone with the central beds containing much more interbedded shale. Minimum thickness in the report area is in the Norman Wells-East Mountain area of the Franklin Mountains where thickness averages 200 to 300 feet. Major facies and isopachs of the Hume are shown in Figure 12.

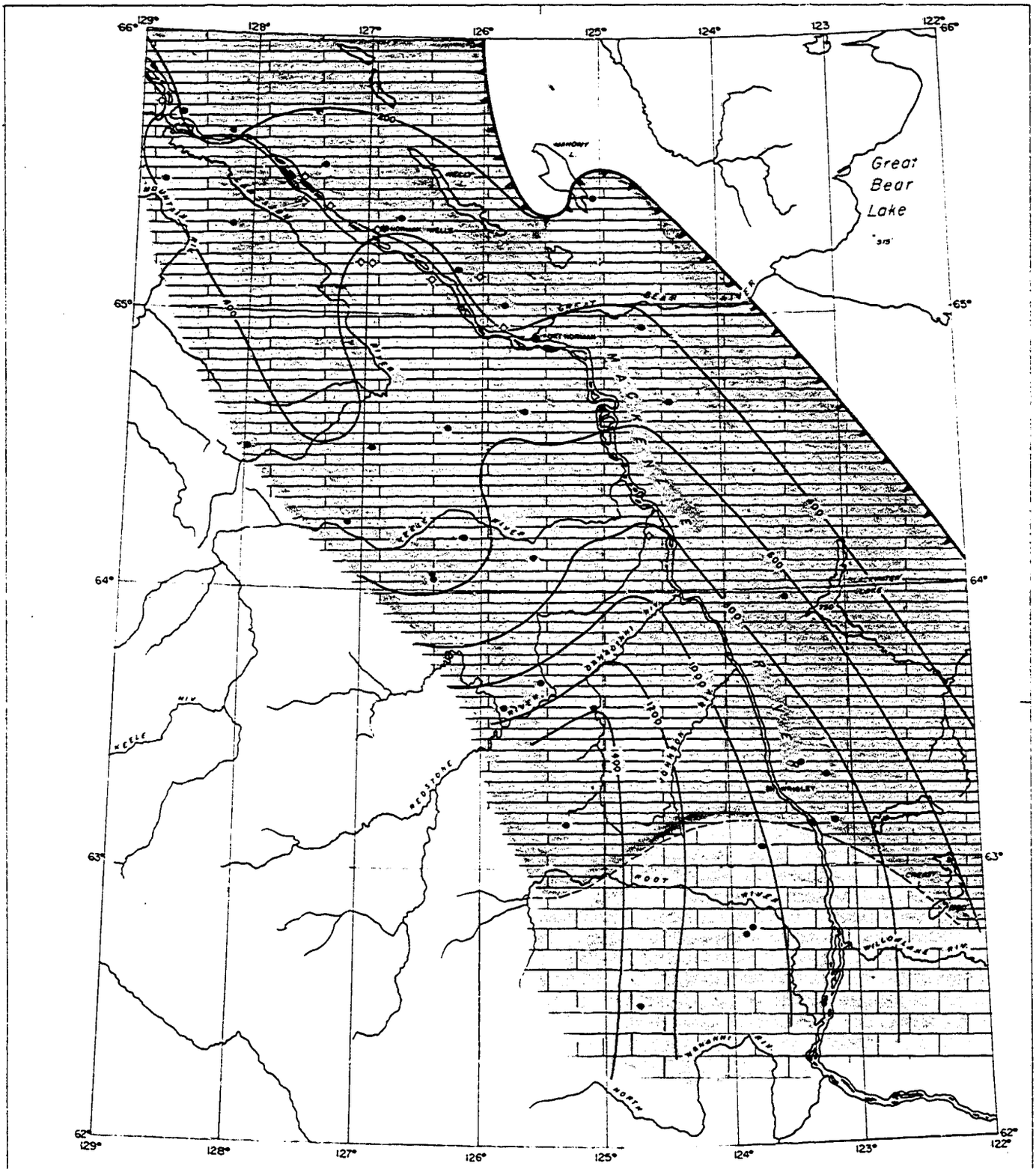


FIG. 12

HUME FORMATION

GENERALIZED LITHOLOGIC ASPECT & ISOPACH MAP

SCALE:

16 0 0 8 16 32 48 64 80 MILES

ISOPACH INTERVAL 200 FEET

LEGEND

- MASSIVE LIMESTONE AND DOLOMITE
- LIMESTONE WITH SHALE - (occasional Stromatoporoidal Reefs
- 400 — ISOPACH
- EROSIONAL LIMIT
- FACIES BOUNDARY
- OUTCROP LOCALITY
- WELL LOCATION

South of the Keele River, the formation thickens noticeably and is about 800 feet thick in the Wrigley area. West of Wrigley, in the Mackenzie Mountains (section CCK-1-59-2), it reaches its maximum thickness of 1,400 feet. Near and west of Wrigley, lithology is similar to that at Norman Wells although it contains less shale. Neither are the shale beds confined to the central part of the formation. Southward from Wrigley, shale bands disappear entirely and the formation forms a massive limestone unit.

Throughout the report area, stromatoporoid buildups are not uncommon. These stromatoporoid remains are usually very difficult to recognize and they are quite possibly more abundant than is apparent. None of the stromatoporoid beds exhibits any porosity in outcrop. In several instances, pelletoidal limestone beds were identified and it is likely they are much more common than would appear on cursory examination.

The Hume formation has equivalents in the Anderson River area and parts of the northern Yukon. At some localities, however, the Middle Devonian is eroded within these regions. Southward from Wrigley, it is equivalent to the Nahanni formation of the North Nahanni River area, and to the lower two-thirds of the Pine Point formation of Great Slave Lake.

Several faunal zones occur which are worthy of note. At the base is the Schuchertella nevadensis zone. In the upper Hume, a Productella sp. zone exists which, although it contains more than one species of Productella, forms a distinctive faunal zone.

HARE INDIAN FORMATION (KINDLE AND BOSWORTH, 1921): The Hare Indian is the lowest formation of the Fort Creek group. It is composed of shales which vary slightly in lithology from place to place.

The type section, as defined here, is on Thunder River, 120 miles downstream from Good Hope, and is the old type section of the Fort Creek formation as defined by Kindle and Bosworth (1921, page 47). In this area, Hume (1954, page 34) described a 45-foot thick petroliferous basal sand. No such basal sand was observed in the report area.

In general, the Hare Indian is a greenish-grey to dark grey, often calcareous shale, sometimes bituminous. In some places it is formed almost entirely of dark grey to black shales and at other localities contains abundant argillaceous limestone.

At Mountain River and Powell Creek, near the west side of the report area in the Mackenzie Mountains, it is 350 feet thick and consists of dark grey, commonly silty shales with some argillaceous limestone and thin, bituminous shale zones near the base.

Northward from Powell Creek, in the ImperialRange and at East Mountain in the Franklin Mountain area, thickness increases to 700 feet. Here, it is typically greenish-grey to grey-brown and contains abundant argillaceous limestone. Silty, argillaceous limestones are especially well-developed at East Mountain.

Near Norman Wells, it averages about 500 feet in thickness, and is composed of dark grey to black shale, occasionally

bituminous and sometimes burned bright red.

Southward from Norman Wells, where the Kee Scarp limestone is not developed, it is difficult to separate the Hare Indian and Canol formations, and for this report, "Fort Creek group" is preferred in areas where the Kee Scarp is missing. South of Norman Wells, the Fort Creek group increases in thickness westward into the Mackenzies and thins eastward towards the interior plains. Maximum thickness in the southwestern part of the area is 1,500 to 2,000 feet. Figure 13 is an isopach and general facies map of the Fort Creek group.

The calcareous content decreases markedly south of Norman Wells and dark grey shales with minor limestone stringers make up the Fort Creek group.

KEE SCARP FORMATION (BASSETT, 1960): The term "Kee Scarp limestone" was first used by Canol geologists and applied to the limestone unit which they considered as the middle member of the Fort Creek formation. As used here, Kee Scarp formation applies to the same limestone unit but the unit is raised by Bassett to formational status.

At Norman Wells, the Kee Scarp limestone is composed of a lower, bedded limestone unit, varying between 0 and 160 feet in thickness, and an upper, predominantly reefoid limestone, which is in excess of 400 feet at some locations.

The lower, or platform, beds are well bedded, finely crystalline limestones. They are present at almost all inspected localities and drilled wells north and west of the line which marks the southern and eastern limits of Kee Scarp oc-

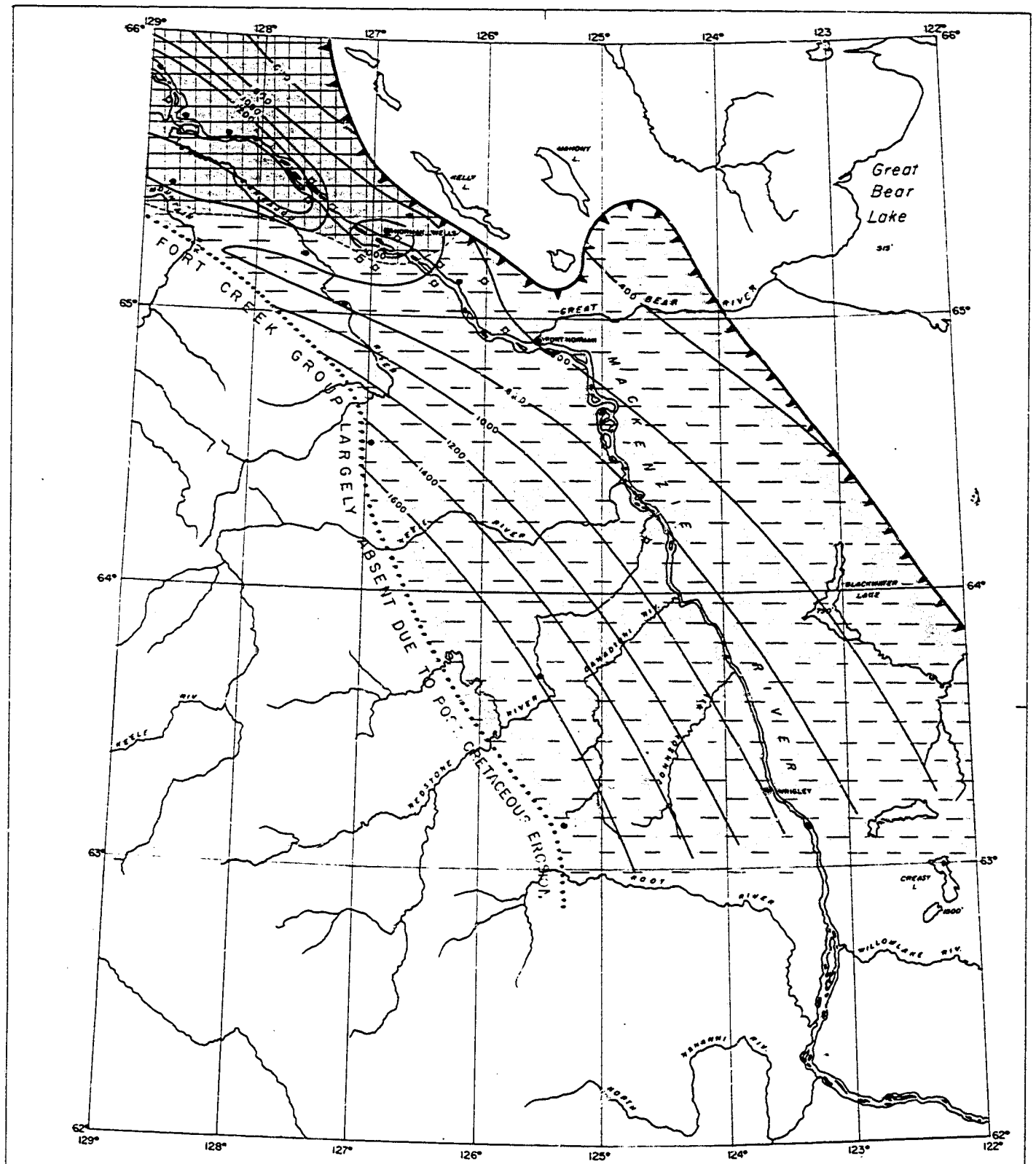


FIG. 13

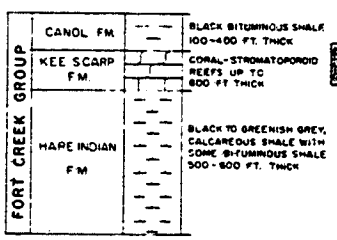
FORT CREEK GROUP

GENERALIZED LITHOLOGIC ASPECT & ISOPACH MAP

SCALE:

16 8 0 16 32 48 64 80 MILES

ISOPACH INTERVAL = 200 FEET



LEGEND

BLACK TO DARK GRAY SHALE GENERALLY CALCAREOUS, WITH LOCAL SANDSTONE BEDS NEAR TOP IN NORMAN WELLS AREA

AREA OF KEE SCARP REEF DEVELOPMENT

1000 ISOPACH

FACIES BOUNDARY

EROSIONAL LIMIT

OUTCROP LOCALITY

WELL LOCATION

currences. It was these platform beds which provided a base for the upper Kee Scarp reefs.

The upper reef zone varies rapidly in thickness between localities and is not nearly so widespread as are the platform beds. Reefs are composed of corals, stromatoporoids, bryozoans and coral sand, and rapid lithologic variations, both vertical and horizontal, are common.

Porosity in outcrop is usually poor to negligible in Kee Scarp reefs. However, the producing reef at Norman Wells is reported to have good porosity and it is likely that porosity in surface outcrops of Kee Scarp reefs has been destroyed by surface cementation.

The Kee Scarp is present in the Franklin Mountains between Norman Wells and East Mountain. It also crops out in the area of Moon Lake, but here reefoid beds are usually poorly developed. In the Imperial Range, thick sections crop out in the western half of the range but no Kee Scarp limestones, either platform beds or otherwise, exist in the eastern end of the Imperial Range. No Kee Scarp beds occur in the Mackenzie Mountains in the report area.

Fossils identified by the Geological Survey of Canada for Party 59-2 suggest that the upper beds of the Kee Scarp may be Upper Devonian. Bassett, however, correlates the lower and upper beds of the Kee Scarp to the Presqu'ile formation and Slave Point formation in the Great Slave Lake area respectively. The lower beds of the Kee Scarp contain the well-known Stringocephalus bertini fauna, allowing definite cor-

relation of this horizon.

CANOL FORMATION (BASSETT, 1960): The name, Canol formation, has been applied to dark grey to black, commonly bituminous shales which overlie the Kee Scarp formation. It is closely associated with the reefs of the Kee Scarp and where the Kee Scarp is thick, the Canol formation is thin, and vice versa.

In some sections, the Canol formation is missing (e.g. MTN-1-58-1). At most localities, however, it is between 100 and 200 feet thick. It is very difficult to separate the Canol from the rest of the Fort Creek group when the Kee Scarp is missing, and it is therefore preferred to use the term "Canol" only in the area where Kee Scarp exists.

The Canol is tentatively correlated to the Spence River shale of the Great Slave Lake area. Its age is assumed as Middle Devonian, but no evidence has been presented as yet to prove this assumption. It does seem, however, that the black, bituminous shales are more closely related to Middle Devonian rather than Upper Devonian sediments.

Source and Reservoir Rocks.-The Hume formation contains no indication of important porous zones throughout most of the area. Small stromatoporoid reefs which occur in the Hume throughout most of the area may provide localized traps in the subsurface.

The bituminous nature of some beds within the Hare Indian and Canol formations, coupled with their wide lateral extent, make these formations especially favorable as source

rocks.

The Kee Scarp formation, which contains large, thick, biohermal reefs, is the most important potential reservoir rock in the area. The Norman Wells field produces from a Kee Scarp reef and it is likely that similar oil reservoirs exist in the general Norman Wells area.

Paleogeography.-If the seas withdrew from the report area following Lower Devonian Bear Rock sedimentation, it was only for a short time. The early Middle Devonian sea onlapped the craton over large areas and extended from the trough in the west across the entire report area and likely had its eastern shoreline somewhere in the vicinity of Great Bear Lake. Carbonate and shale were deposited simultaneously, depending on local variation in depositional environment. Coraline and stromatoporoidal reefs developed in local areas. Small stromatoporoid buildups in the Hume formation show no obvious trend and occur throughout the area. Lack of shale and the abundance of marine limestone within the Hume formation in the southern part of the area may indicate carbonate bank deposition in the southern limits of the area.

Deposition of Hume carbonates terminated abruptly and conditions suitable for shale deposition were widespread. In the Norman Wells-Sans Sault area, calcareous shales are much more common, possibly an early indication of a gentle uplift which initiated Kee Scarp carbonate sedimentation.

Although it is likely that the Kee Scarp carbonate deposited on a gentle positive, the relationship of the known

reefs to the trend of the high is uncertain. It is believed that a high existed in the Good Hope area, but present knowledge of the extensions of this high is vague.

Kee Scarp deposition began with the development of lower, bedded "platform beds". Where conditions were favorable, reef development began following platform bed deposition. It is possible that erosion may have removed the platform beds in some areas, preventing later development of the upper Kee Scarp reefs.

Shale was deposited in the inter-reef areas and farther south, where no reefs developed, shale deposition was continuous from the Hare Indian into the Canol equivalent.

Kee Scarp reefs were probably initiated and controlled by local relief on the sea floor. They likely caused at least some of the restrictions which resulted in euxinic conditions, prevalent during deposition of the partly contemporaneous Canol formation.

Upper Devonian

General Statement.--Upper Devonian sediments are confined to one formation, the Imperial, and are present throughout most of the report area. The name was first suggested by Link and has its type section 10 miles southwest of the confluence of the Imperial and Carcajou Rivers.

Further refinement of the Imperial formation was undertaken by Bassett (1960, oral presentation at First International Arctic Symposium). As defined by him, the base of the Imperial

formation was lowered to include nonbituminous, silty shale beds previously placed within the upper part of the Fort Creek formation.

Generalized isopachs and major facies distribution are shown in Figure 14.

Distribution.-The Imperial formation is present south and west of the Mackenzie River within the report area. It also occurs in scattered outcrops between the Norman Range and the Mackenzie River from Bear Rock northward to and beyond Norman Wells.

North of the Norman Range no outcrops of Upper Devonian strata were inspected and it is highly doubtful that an Imperial formation equivalent is present. On Great Bear River, a few miles east of Mount St. Charles, Hume (1954, Map 1032A, Sheet #1) mapped Imperial outcrop and it is highly likely that Imperial strata exist southward along the east side of the McConnell Range of the Franklins. Along the Willowlake River, on the east side of the McConnell Range, a thick sequence of Devonian shale contains Imperial equivalents in its upper beds.

Contacts.-In all sections where the Canol-Imperial contact is exposed, it appears conformable and is usually abrupt. The contact is delineated by an abrupt change from black, bituminous shale of the Canol to the greenish-grey, silty shale of the Imperial. The lower beds of the Imperial (i.e. those previously placed within the Fort Creek formation) are unfossiliferous and assignment of these beds to the Imperial is based on lithology.

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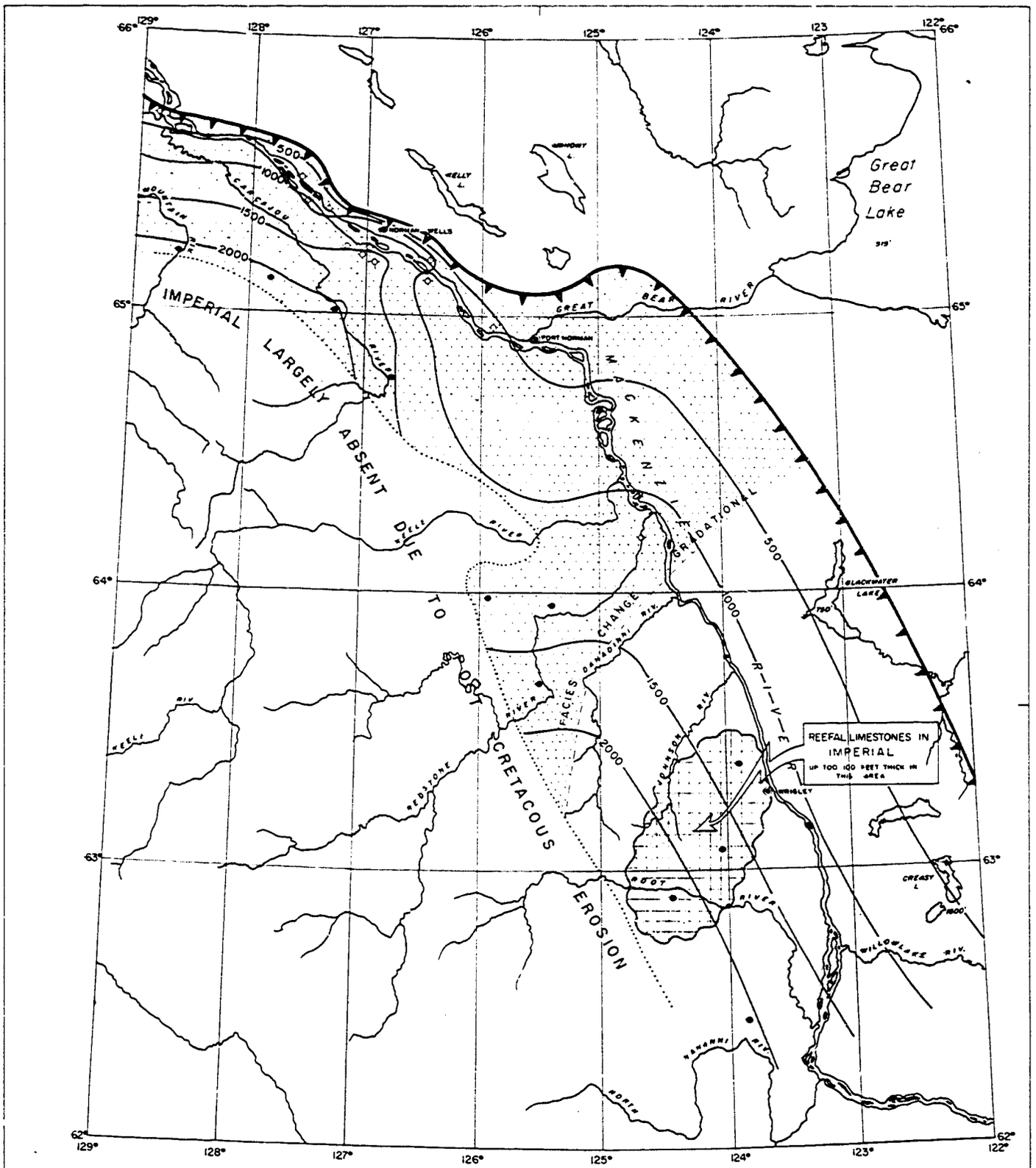


FIG. 14

IMPERIAL FORMATION

GENERALIZED LITHOLOGIC ASPECT & ISOPACH MAP

SCALE:

ISOPACH INTERVAL = 500 FEET

LEGEND

- PREDOMINANTLY GREYISH GREEN SHALES, SILTSTONES, AND SANDSTONES
- GRAY TO GREENISH GREY SHALES AND SANDSTONES WITH SOME LIMESTONES
- REEFAL LIMESTONES IN IMPERIAL CONTAINING AN ABUNDANT CRINOID - CORAL - BRACHIOPOD FAUNA
- EROSIONAL LIMIT
- 500 ISOPACH
- FACIES BOUNDARY
- LOCATION OF IMPERIAL OUTCROP
- WELL LOCATION

The upper contact with the overlying Cretaceous is disconformable. In the northwestern corner of the report area, the formation is badly eroded or entirely missing due to pre-Cretaceous erosion. The upper contact is marked by a 20-foot zone containing pebble conglomerates and quartz sands.

Lithology, Correlation, and Thickness.-The Imperial formation is composed predominantly of soft, sandy shales and silty sandstones, dark grey to grey-green in color and contains minor limestone beds in the southern part of the area, with limestone content increasing southward.

Along the Imperial River immediately north of the Mackenzie Mountain front, Laudon (1950) described a nearly complete section of the Imperial formation (Party 59-2, section IRS-2-59-2) which has been generally accepted as the type section of the Imperial formation. Interbedded sands and shales occur in approximately equal amounts, although no sands are present in the upper 400 feet. Sands are very fine to fine-grained and vary from medium grey to green-grey. Shales are commonly dark to light grey and weather light grey to green-grey. At its type section, about 1,900 feet of the Imperial formation is exposed. Although the base is covered, it is not thought to be far below the exposed portion of the section.

At Fort Norman, Stelck describes no Imperial formation as being present in the Bluefish No. 1A well. It is known to exist in the immediate vicinity, however, and it is likely that the upper 757 feet of his Fort Creek formation belongs to the Imperial formation, as defined by this report.

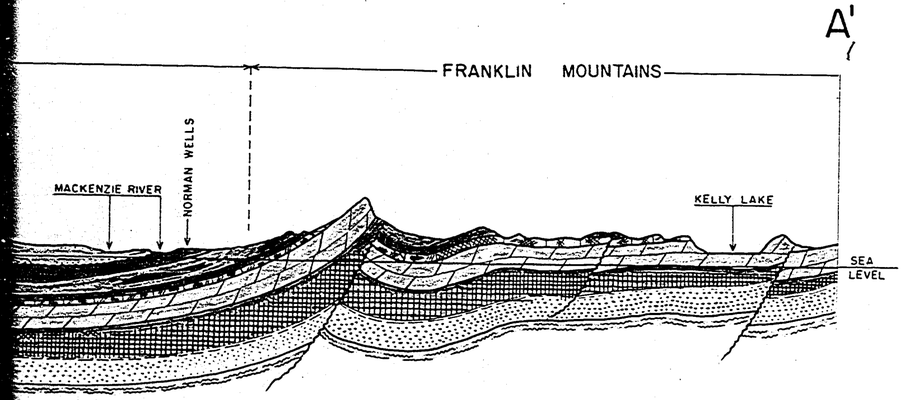
At the same locality, a silty limestone known as the Jungle Ridge limestone is developed in the lower beds of the Imperial formation. It occurs in outcrop at Jungle Ridge and was encountered in the Bluefish No. 1A well. It had previously been considered as occurring within the Fort Creek group.

Hume (1922, page 70) mapped the area in the vicinity of the Root and North Nahanni Rivers, immediately west of the Mackenzie River. Overlying his "Shale Zone No. 1" (which he indicates is Simpson-Fort Creek shale equivalent), Hume has an alternating shale and limestone sequence, 800 to 1,100 feet thick which he calls the "Leiorhynchus zone". The Spirifer disjunctus fauna which it contains indicates that it is equivalent to the Imperial formation at Norman Wells. The exact limits of the zone are not defined, and it is possible that the lower part of Hume's "Shale and limestone unit" overlying the "Leiorhynchus zone" may be equivalent to the upper part of the Imperial formation.

Imperial reefs west of the Camsell Range, several miles northwest of Wrigley occupy the crest of a topographic high and form small, cliff-sided mesas. These reefs, approximately 100 feet thick, are in the middle to upper part of the Imperial formation equivalent and have also been described in the Leiorhynchus zone by Hume near Root River (Hume, 1922, page 72).

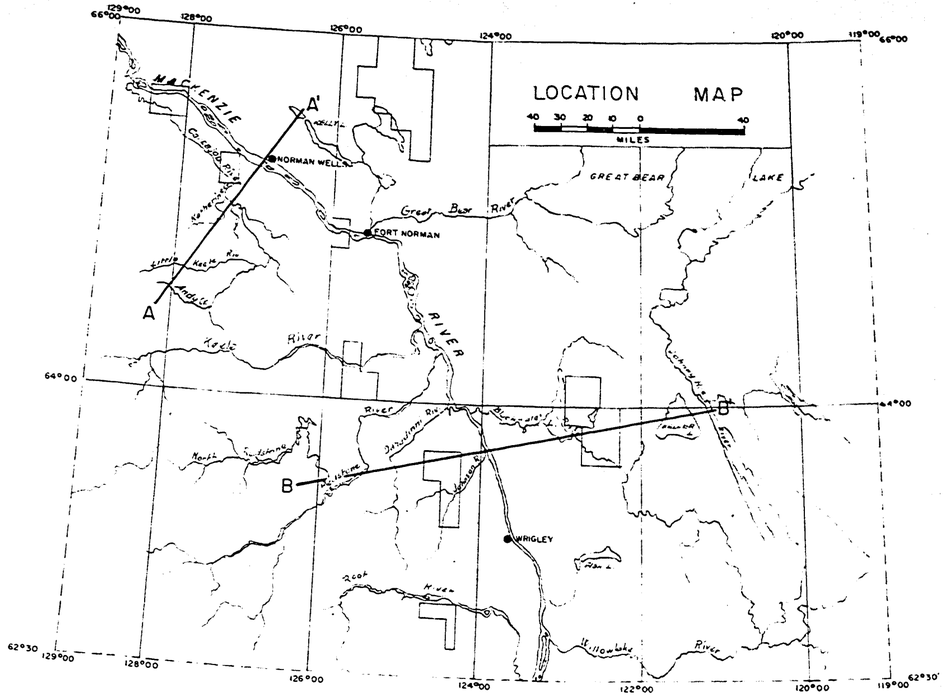
Source and Reservoir Rocks.-The Imperial sandstone and shale sequence constitutes a zone which contains oil shows in the Norman Wells area where the sands were penetrated by subsurface

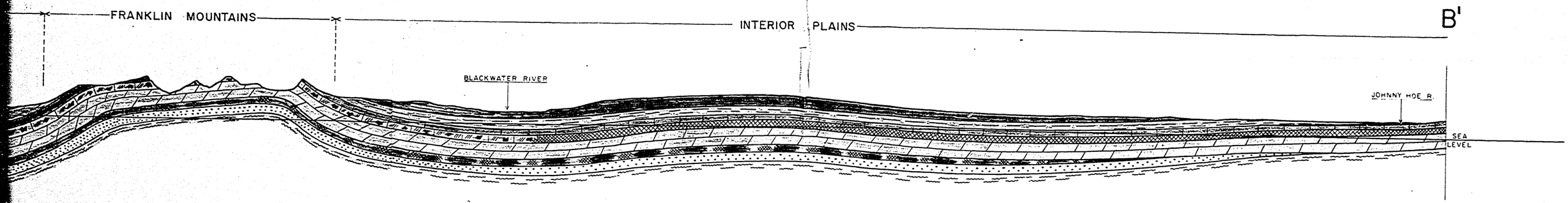
UNTAINS



LEGEND

- CRETACEOUS
  - EAST FORK FORMATION
  - LITTLE BEAR FORMATION
  - SLATER RIVER FORMATION
  - SANS SAULT FORMATION
- UPPER DEVONIAN
  - IMPERIAL FORMATION
- MIDDLE AND LOWER DEVONIAN
  - FORT CREEK GROUP
  - HUME FORMATION
  - BEAR ROCK FORMATION
- SILURIAN – ORDOVICIAN
  - RONNING GROUP
- CAMBRIAN
  - MACDOUGAL GROUP
  - KATHERINE GROUP
- PRECAMBRIAN





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Franklin Mountains, and the Gambill Range in the Mackenzie Mountains deserve special mention. These three ranges are likely associated with a major shear zone which is almost perpendicular to and cuts both the Franklin and Mackenzie Mountains. Although the Gambill Mountains are a relatively simple fault block, the Mackay Range and Bear Rock are very badly deformed. The Mackay Range is not in direct alignment between the other two ranges, but it is likely associated with the same shear zone. The southwestern limit of this zone cannot be traced far behind the front of the Mackenzie Mountains, and the northeastern limit cannot be followed beyond Mahony Lake.

Surface expressed anticlines and synclines in the immediate vicinity of this shear zone are perpendicular to the regional trend of the Franklin and Mackenzie Mountains, and are very close to paralleling the direction of the shear zone.

The Mackenzie Mountains are divided by Bostock into two physiographic subdivisions: namely, the Canyon and Backbone Ranges. In the northern part of the Mackenzie Mountains, the Canyon Ranges and eastern parts of the Backbone Range are included in the region of moderate deformation. Southward, fewer and fewer of the Mackenzie Mountains are included in the moderately deformed zone until, at Root River, only the eastern parts of the Canyon Ranges fall within this region.

Region of Severe Deformation.-No line may be drawn exactly delineating the change from moderate to severe deformation.

Rather, the change is gradual. The region of severe deformation in the Mackenzie Mountains is confined to the southwestern parts of the Backbone Ranges in the western side of the report area. Southward, however, in the Root River area, the region of severe deformation includes all the Mackenzie Mountains, with the exception of the outer parts of the Canyon Ranges.

West of the Mackenzie Mountains are the Selwyn Mountains, also included in the region of severe deformation.

Age of Deformation

As far as may be determined, only one major period of orogeny (Laramide) has affected the report area, although several periods of uplift and erosion have modified the stratigraphic sequence as it exists to-day.

There is poor evidence to suggest that a large, broad, gently positive feature expressed itself from time to time in the area between Norman Wells and Fort Norman. It is in this area that pre-Devonian erosion removed most or all of the Mount Kindle formation. In the same vicinity, the Imperial formation has also been strongly eroded by pre-Cretaceous erosion. Present-day outcrop patterns indicate that to the north and east of the area of maximum pre-Devonian erosion there is a northeast trending, gentle, but obvious, structural high on which Ordovician strata form the surface bedrock.

Age dating of igneous rock (Baadsgaard, et al, 1960, oral presentation at First International Symposium on Arctic Geology) has indicated that Devonian intrusives are present to

the west of the report area in the Selwyn Mountains, suggesting extensive orogeny and granite emplacement at that time. No Caledonian folding is indicated within the report area.

South of the report area, at Shell Liard No. 1 well, nepheline syenite from a known basement high indicated a Precambrian age. Baadsgaard, however, presented evidence to suggest that this age may be in error, and may be of the same age as nepheline syenites found in the mountains to the west which indicate a Caledonian age.

Interpretation of Regional Structure.-Structure in the Franklin and Mackenzie Mountains is markedly different from the structure of the eastern Rocky Mountains of southern Canada. In many places in the Franklin and Mackenzie Mountains, folding, rather than faulting, is the dominant structural feature.

To explain the great difference in structural features between the Rocky Mountains and the eastern part of the Mackenzie Mountains, including the Franklins, Dowling (1922, page 85) points out that "the Alberta mountains are formed from the fractured and folded extra thick beds of the western part of this (Rocky Mountain) geosyncline" whereas "the northern mountains, on the other hand, are formed from much thinner deposits that overly the Precambrian and they present phenomena which suggest that in their formation a comparatively thin sheet of the stratified crust was crumbled by compressive strain."

As pointed out by Goodman (page 348), the foreland of the Mackenzie Mountains is under basement control. In the centre of the geosyncline, to the west, the underlying basement com-

plex is probably broken so badly as not to have any effective strength. Thus in the main ranges, basement control has very little effect.

If, bearing in mind Dowling's concept, it is considered that it was the basement in the eastern part of the Mackenzies that transmitted compressive stress, and that the beds overlying the basement took up the resultant shortening, then this is the "basement control" concept of the foreland area, as suggested by Goodman (page 348).

Goodman (page 350) presents the following explanation to account for the marked difference between structural patterns north and south.

> "In the Mackenzie region, pre-existing weaknesses in the crystalline basement permitted the shortening to take place over a belt some 160 miles wide. This wide distribution resulted in comparatively gentle structures both in the main mountains and in the foreland. In the foreland, the basement is block-faulted and a similar condition may well be present beneath a part of the main ranges. Stress intensity apparently never reached the overthrusting stage."

> "In the Rocky Mountains region, all the shortening took place in the mountains and foothills. The plains area is comparatively undisturbed. At Banff, the mountains and foothills belt is about 70 miles wide. If the total crustal shortening is of the same order as that in the Northwest Territories, it is apparent that intensity of structural disturbance should be much greater in this narrower belt. It also appears that the Rocky Mountain geosyncline was narrower but deeper than that of the Mackenzie Mountains."

Local Structures of Possible Economic Value

General Statement.--Anticlines are numerous in the report area and, although there are too many to discuss all of them

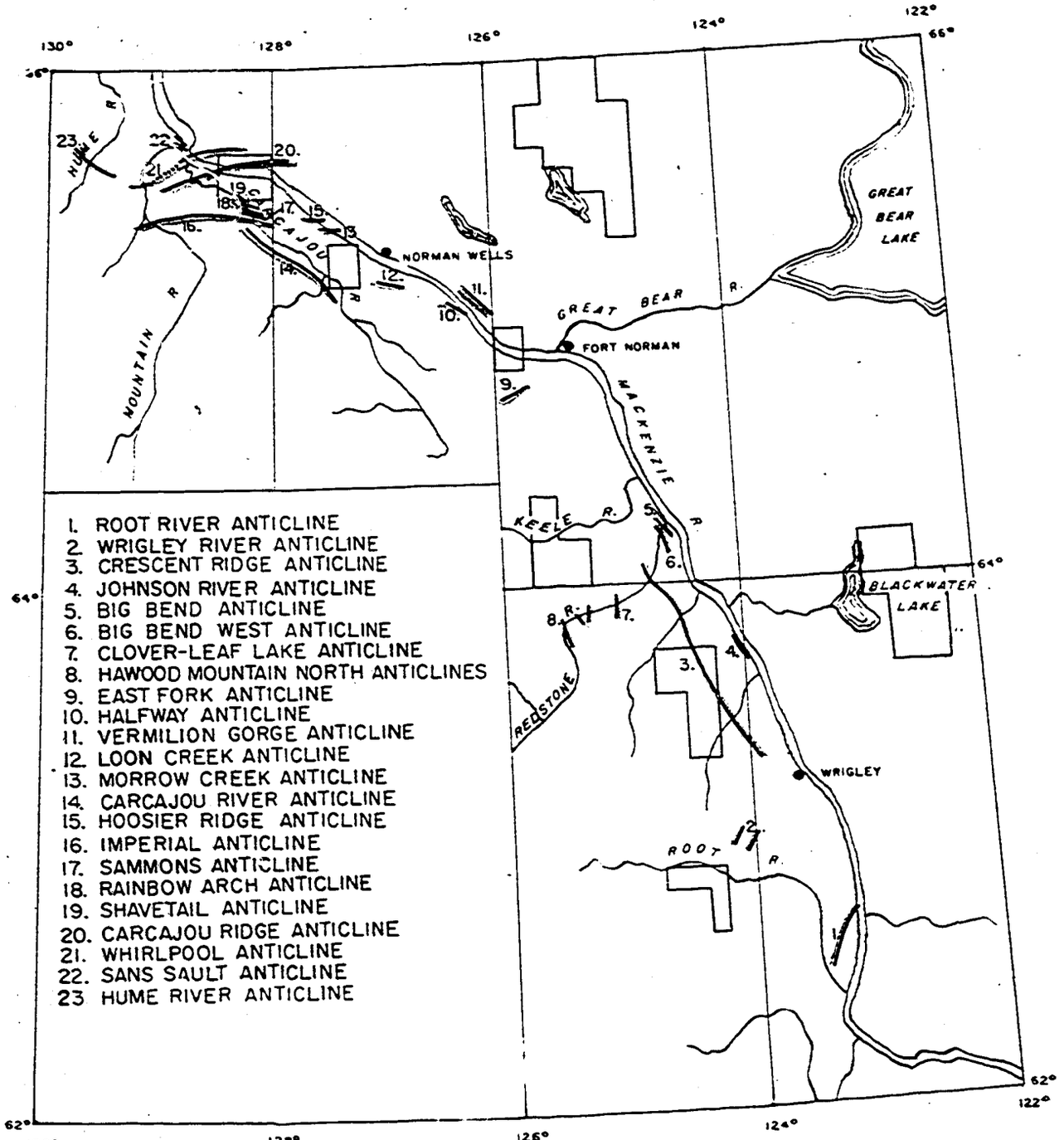

FIG. 17

LOCATION MAP SHOWING

POSSIBLE ECONOMIC STRUCTURES

NORMAN WELLS – WRIGLEY AREA N.W.T.

SCALE

40 30 20 10 5 0 40 80 MILES

LEGEND

14. ANTICLINE

TEXACO ACREAGE

individually, an attempt is made to describe the most prospective of them. All of the known prospective structures occur in the Mackenzie Plain.

Undoubtedly many more prospective anticlines exist in the Mackenzie Plain which have not as yet been recognized. Outcrops in the Plain are confined to poor exposures in creek beds. In the Mackay Mountains area, Tertiary strata blanket the Cretaceous of the Mackenzie Plain, thereby obscuring pre-Tertiary structures expressed in Cretaceous strata.

The structures discussed in the following pages are listed from south to north and not in order of importance.

Root River Anticline.-The Root River anticline is subparallel to the Mackenzie River and is immediately north of the mouth of the Root River. The anticline was first mapped by Hume in 1922.

Location:	123°25'W, 62°30'N
Length:	Ten miles
Width:	Five miles
Strike:	N10°E
Flank Dips:	Approximately 25° to 40°W and 15°E
Plunge:	Plunge of the north and south ends of the anticline is not as yet established. Southern end of the anticline is terminated against the Camsell Range.

Exposed beds: Middle Devonian Fort Creek group.

Photogeology suggests that the area in the immediate vicinity of the Root River anticline is more complex than suggested by Hume's (1922) Map. However, outcrop is sparse and photogeologic evaluation of the anticline is uncertain.

Wrigley River Anticline.-The feature was originally mapped by Monnett (in Hume, 1954, page 80) and is actually a doubly crested anticline. It is parallel to and is immediately northwest of the northern end of the Camsell Range.

Location:	123°50'W, 63°10'N
Length:	Four miles
Width:	Six miles (includes both crests)
Strike:	N30°E
Flank Dips:	12°NW, 9°SE; syncline flanks between anticlinal crests dip inward at 1° to 3°.
Plunge:	Plunge has not been determined and little is known of the character of the anticline except on the cross-section along the river valley in which the structure was originally mapped.
Exposed beds:	Upper Devonian Imperial formation

It is likely that geophysical methods will be necessary to provide further evidence on this feature.

Crescent Ridge Anticline.-The Crescent Ridge anticline is the largest known anticline in the report area and has been partially mapped by Bath (in Hume, 1954, page 77) and Dann (1953). It is in the approximate centre of the Mackenzie Plain and is subparallel to it.

Location:	123°45'W, 63°20'N to 125°00'W, 64°00'N
Length:	60 miles
Width:	Four to eight miles
Strike:	N30°W
Flank Dips:	5° to 25°NE, 10° to 30°W
Plunge:	No directions of plunge have been deter-

mined as yet, but it is likely that several plunge reversals occur along strike of the axial line.

Exposed Beds: Upper Devonian Imperial formation in its southern end; Cretaceous in its northern end.

Johnson River Anticline.-This anticline is parallel to and lies about three miles west of the Mackenzie River, approximately midway between the mouths of the Johnson and Blackwater Rivers. Dann (1953) was the first to map this structure and little is known of it. As shown in his Map No. 5, the anticline is about six miles long and two miles wide. It exposes Upper Devonian Imperial formation on its crest. Nothing is known concerning flank dips, plunge or closure.

Redstone River Anticlines.-At least four anticlines are known to cross Redstone River in the region of the Mackenzie Plain. One is the Crescent Ridge anticline already discussed. The second is the Big Bend anticline which crosses Redstone River, five miles upstream from its mouth. This anticline has been tested (Redstone No. 1 well) as deep as the Upper Ronning group but no hydrocarbons were recovered.

Two miles west of Big Bend anticline, Hannock (in Hume, 1954, page 75) mapped another anticline which is called here Big Bend West Anticline. Its presence is based on only two dips, and nothing is known of plunge, closure or length. It exposes Cretaceous strata in its crest.

In Cretaceous beds near the west side of the Mackenzie Plain,

Hume discusses an anticline which crosses the Redstone River. This anticline, here called the Cloverleaf Lake anticline, is suggested from areal photos only and was not observed from surface outcrop.

West of the Cretaceous basin, several folds were observed by Hannock (in Hume, 1954, page 77) in Upper and Middle Devonian rocks. Little is known of these anticlines, except that they expose Imperial and Fort Creek shales. They are on strike with Mount Haywood and Hume feels that at least one of these anticlines has no south closure. Details concerning closure on the other two are unknown. This group of anticlines is shown in Figure 17 as the Haywood Mountain North Anticlines.

East Fork Anticline.--This anticline strikes perpendicular to the main trend of the Franklin and Mackenzie Mountains and is associated with the structural elements responsible for the Gambill and Mackay Mountains.

Location:	125°55'W, 64°45'N
Length:	Six miles
Width:	One to two miles
Strike:	N60°E
Plunge:	Unknown; northern end may be cut off by a fault.
Exposed Beds:	Cretaceous

This structure is the only known hydrocarbon prospect in the vicinity of Mackay Mountains. However, Tertiary strata mask most of the Cretaceous outcrops in this vicinity.

Halfway Anticline?.--The presence of this anticline is not definitely proven. Concerning this anticline, Hume (1954,

page 63) makes the following statement:

> "The north end of Halfway Islands in Mackenzie River is 3 miles south of the mouth of Vermilion Creek. Between these places there are beds on the west side of the river showing a reversal from the normal southwest dip. There is a difference of opinion, however, about this supposed Halfway anticline in that the reversal, based on two outcrops within a distance of 100 feet may be on beds that have been disturbed by ice action or slump. The anticline, if present, is quite small (Foley)."

Vermilion Gorge Anticline.-Some minor folds occur on the southwest flank of the Norman Range. One of the largest of these is exposed in the Fort Creek group on Vermilion Creek, five miles from Mackenzie River, and apparently extends northwestward to Prohibition Creek. Another fold occurs on Vermilion Creek about 1½ miles above the first, but there is not sufficient information to suggest that it has any considerable magnitude. It is this second structure which was tested to the Cambrian by Vermilion No. 1 well.

Information on Vermilion Gorge anticline is as follows:

Location:	126°00'W, 65°07'N to 126°15'W, 65°12'N
Length:	Nine miles
Width:	One-half to three-quarter miles
Strike:	N50°W
Flank Dips:	5° to 8°N, 5° to 9°S
Plunge:	Unknown; anticline dies out in both directions on a major homocline.
Exposed Beds:	Fort Creek group

Loon Creek, Hoosier Ridge, and Morrow Creek Anticlines.-These three anticlines are in the vicinity of Norman Wells and

all have been tested by unsuccessful wells. In view of these wells, the structures are not discussed here, but are shown in Figure 17.

Carcajou River Anticline.-The Carcajou River anticline has been previously mapped as the eastern end of the Imperial anticline, but since it is separate from the Imperial anticline proper, it is considered separately. It is one of the major features of the Mackenzie Plain west of Norman Wells. The structure is several miles west of and subparallel to the Carcajou River in front of the Mackenzie Mountains.

Location:	127°50'W, 65°05'N to 128°30'W, 65°28'N
Length:	Thirty-five miles
Width:	Three to four miles at south end; eight miles at north end
Strike:	Approximately N45°W
Plunge:	In general, plunge of the anticline is to the southwest but at least two plunge reversals are known and it is highly likely that others exist.
Exposed Beds:	Upper Devonian Imperial to Middle Devonian Bear Rock

Imperial, Sammons, Rainbow Arch and Shavetail Anticlines.-

As can be seen from photogeology, the Imperial anticline is far from simple in its structural makeup. Located on the west side of the report area, it is the most prominent feature of the Mackenzie Plain in this region. It is actually an east-west striking anticlinorium which contains several unnamed anticlines as well as the Sammons, Rainbow Arch and Shavetail anticlines. These three anticlines are essentially eastward

plunging noses of the main Imperial anticline, and although they show no closure in their western parts, it is possible that plunge reversal may occur to the east where the three anticlines are overlain by Cretaceous sediments.

The major portion of the Imperial anticline is unprospective in that beds as low as lower Bear Rock (and possibly Upper Ronning) are exposed in its crest. It is possible that its eastward extension may be prospective where it is covered by Cretaceous sediments, although no indication of closure in this direction has been observed.

Carcajou Ridge Anticline.-Carcajou Ridge, located 45 miles downstream from Norman Wells, is essentially an asymmetrical east-west trending anticline exposing the Hume formation on its crest. Although the anticline is not prospective on Carcajou Ridge, dip reversals may occur on its westward extension where it passes beneath the Mackenzie Plain.

Sans Sault Anticline.-On the west side of the Mackenzie River at Sans Sault Rapids, two small anticlines are present in Cretaceous. Dip of rocks upstream and downstream from these anticlines shows that they are minor wrinkles on the crest of a large anticline. Sans Sault No. 1 well was drilled on this structure but no hydrocarbons were discovered.

This structure is far from fully mapped and little is known of plunge and closure. It is obscure on photographs, and all that is known of it comes from surface reports by Canol geologists.

Whirlpool Anticline.-The Whirlpool anticline is on the west

side of Mountain River, 20 miles upstream from its mouth. This structure was located by Link and mapped by Parker (in Hume, 1954, page 68). Trend and form of the structure cannot be outlined accurately from the few rock exposures but Parker indicates that the trend of the anticlinal axis is about east-west with a curvature to the northeast on the east side of Mountain River.

Parker indicates that structural relief is in the order of 1,000 feet. He was able to establish east closure, but west closure is still in question. Hume (1954) implies that critical closure may occur on an eastward extension of the anticlinal axis between Whirlpool anticline and West Mountain, but this is unproven.

Whirlpool No. 1 well tested this anticline where it crosses Mountain River, but no hydrocarbons were discovered.

Hume River Anticline.-The Hume River anticline crosses the Hume River 24 miles west of Sans Sault Rapids. Hume (1954, page 69) believes it to be a westward extension of the Whirlpool anticline, but photogeology suggests that it is a separate structure. Low dips occur in Cretaceous rocks and the anticline has relatively small closure. No information is available other than from exposures along Hume River.

CONCLUSIONS

Stratigraphy throughout the report area is, in general, remarkably uniform, although minor changes do occur.

Devonian sediments form the most favorable source and reservoir rocks. The upper beds of the Ordovician-Silurian sequence are also considered to be favorable. Cretaceous sediments are usually too deeply eroded to be considered for important hydrocarbon accumulations.

Late or post-Silurian erosion has removed the upper beds of the Ronning group between Norman Wells and Fort Norman with a resultant thinning of the Ronning group.

Of the three facies which constitute the Bear Rock, only the porous, brecciated facies is considered important as containing significant reserves of hydrocarbons. Fortunately, it is this facies which underlies large portions of the Mackenzie Plain within the report area.

Over most of the report area the Hume formation contains small stromatoporoidal reefs which are possibly porous in the subsurface of the Mackenzie Plain. At present, it is impossible to delineate exact areas of Hume Porosity.

The Kee Scarp is the most prospective formation. It is present only in the northeastern side of the report area but probably extends westward and northward. It is overlain and underlain by shales which are often bituminous and it is known to contain thick and abundant biohermal reef buildups.

As far as is known to date, only the Mackenzie Plain contains structures prospective for hydrocarbon accumulation.

Broad structures occur within the mountain ranges which flank the Mackenzie Plain but the structures are too strongly eroded to be considered of any economic value. East of the Franklin Mountains, important structural traps may exist, but seismic evaluation will be necessary to establish their locations.

RECOMMENDATIONS

It is recommended that:

1. All but the southernmost permit of Texaco's Mahony Lake block be dropped. Lower Devonian and Ordovician-Silurian strata outcrop over large portions of this block and the prospects for hydrocarbon accumulations are very discouraging. The southern permit of this block contains beds as young as Cretaceous, however, and is much more favorable than the permits to the north.
2. The Keele River block be dropped. Although several large anticlinal structures occur within the block, they are deeply eroded in their crests and expose beds as old as lower Hume and/or upper Bear Rock. The eastern part of the northern permit is badly masked by Tertiary sediments, but photogeology suggests no favorable structure.
3. Detailed surface studies, both structural and stratigraphic, be conducted over selected portions of the report area, now that the regional study has been completed. This is especially necessary in the southern part of the study area.

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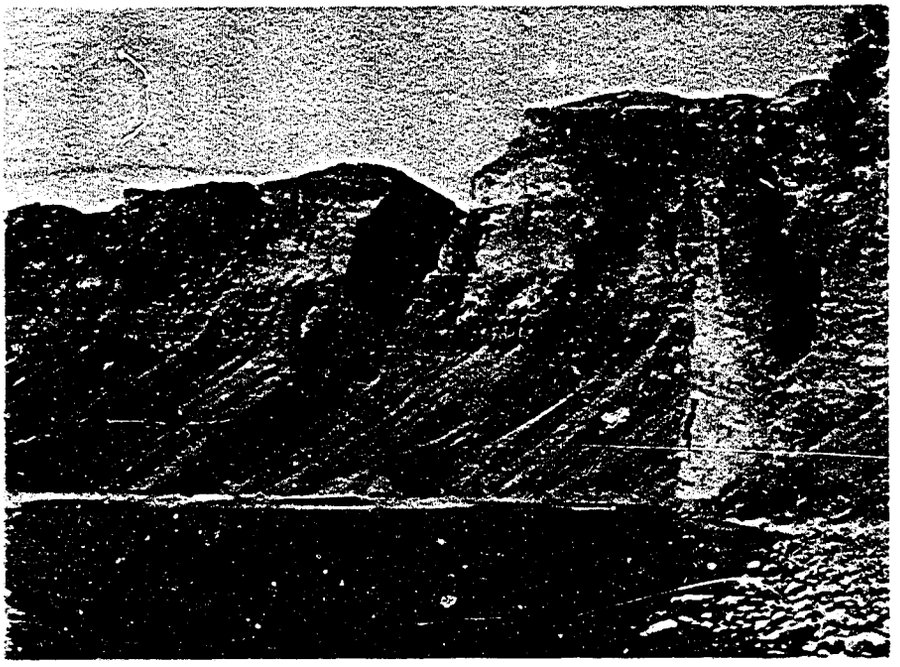
PLATE 1



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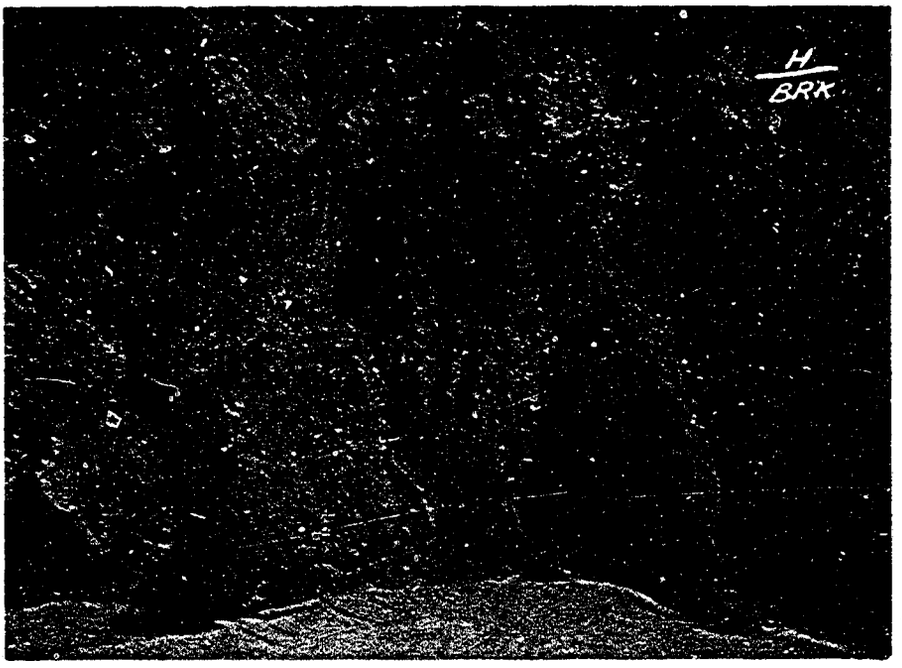

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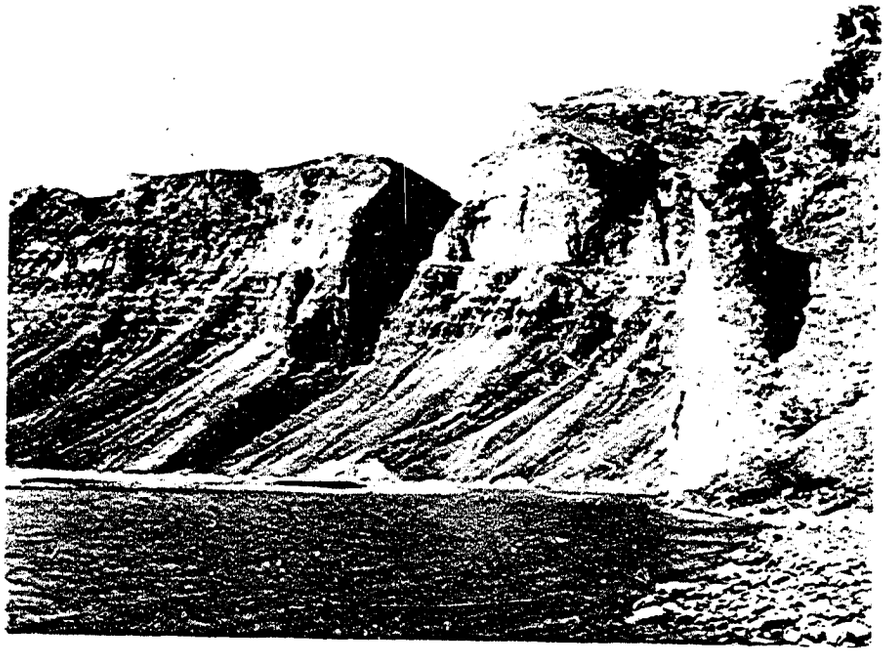
PLATE I



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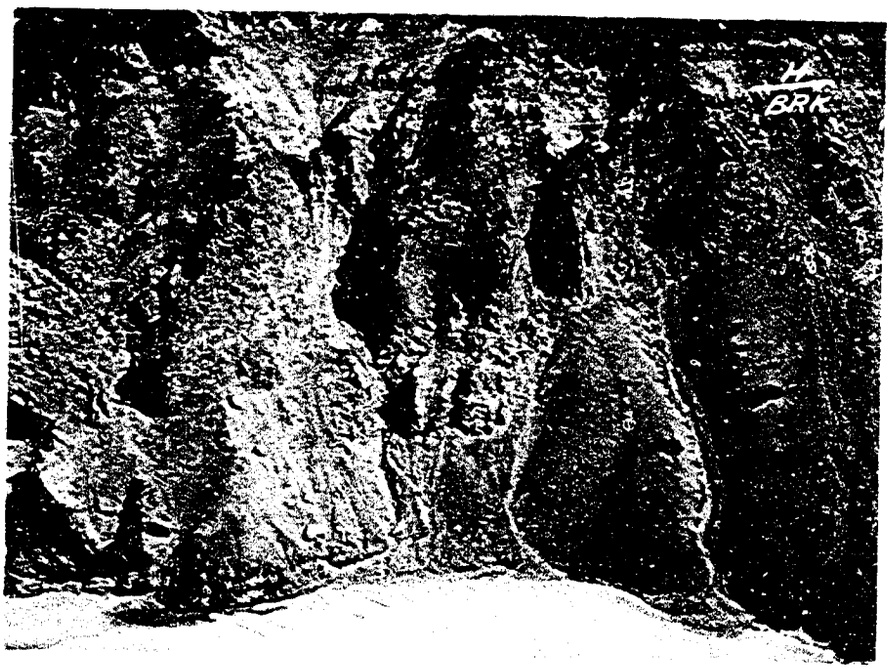


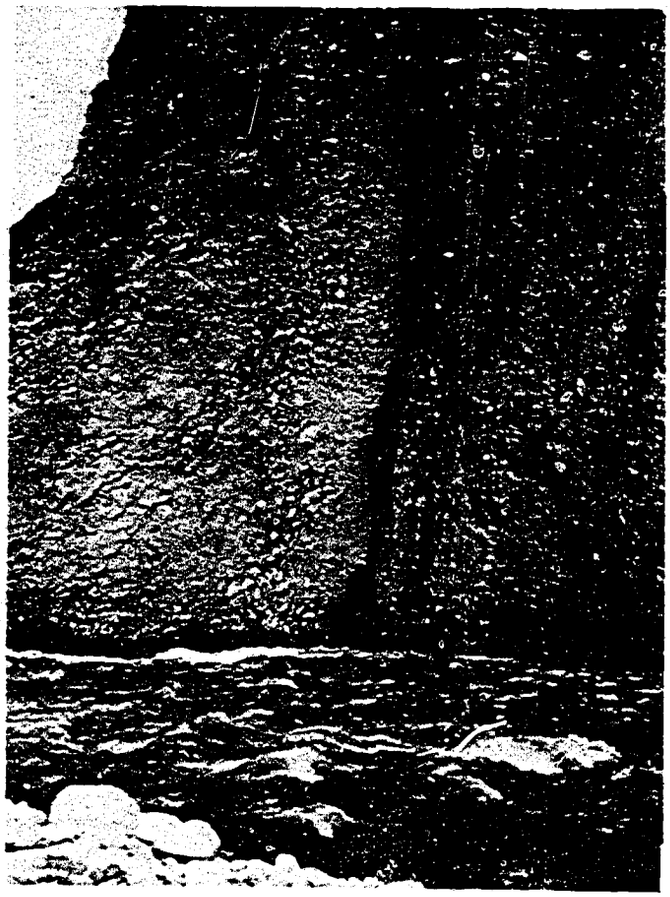
B

PLATE 1

A. Bear Rock and Ronning outcrop in west wall of Carcajou Canyon where Carcajou River leaves Mackenzie Mountains. The abrupt contact between the two units is obvious near the center of the cliff. View to the southwest.

B. Typical Bear Rock outcrop on east side of Carcajou River, nine miles south-southeast of Mirror Lake. The Hume-Bear Rock contact is visible in the upper beds of the outcrop. Note the general lack of bedding and "hoodoo" type of weathering, characteristic of Bear Rock outcrops in the Norman Wells area. View to the east. Bear Rock formation (BRk), Hume formation (H).

PLATE 2



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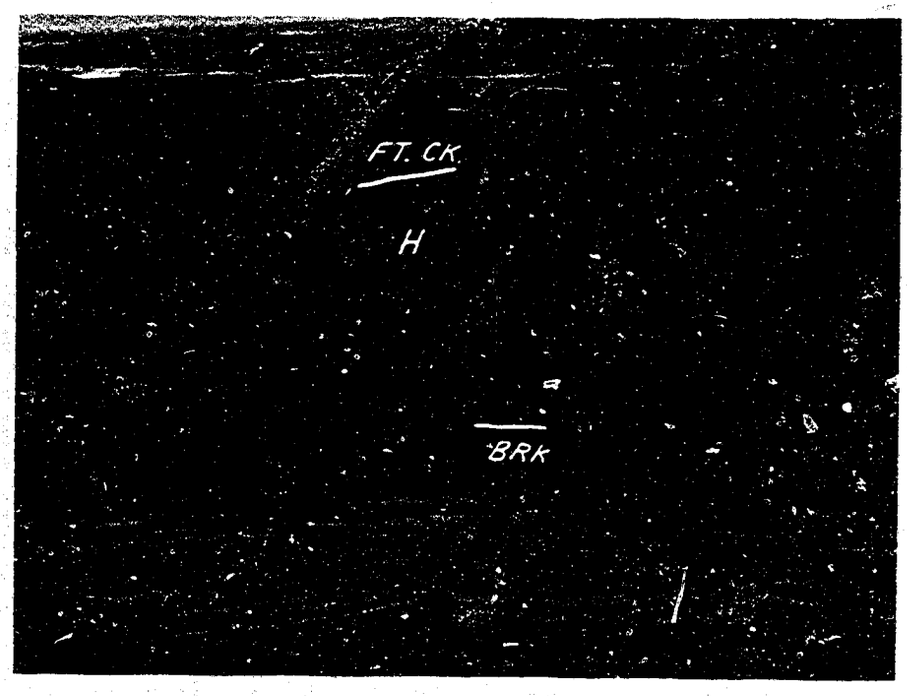

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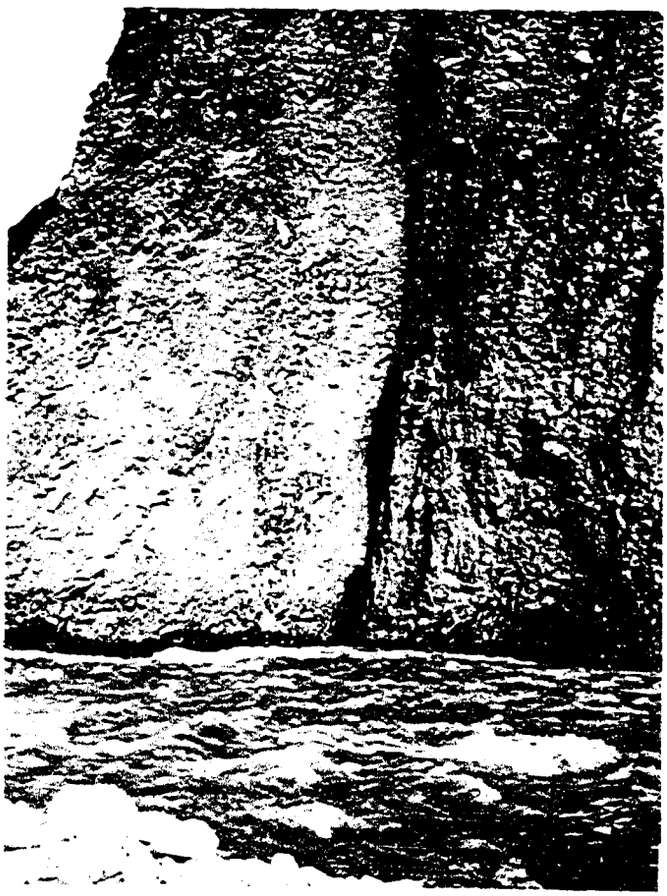
PLATE 2



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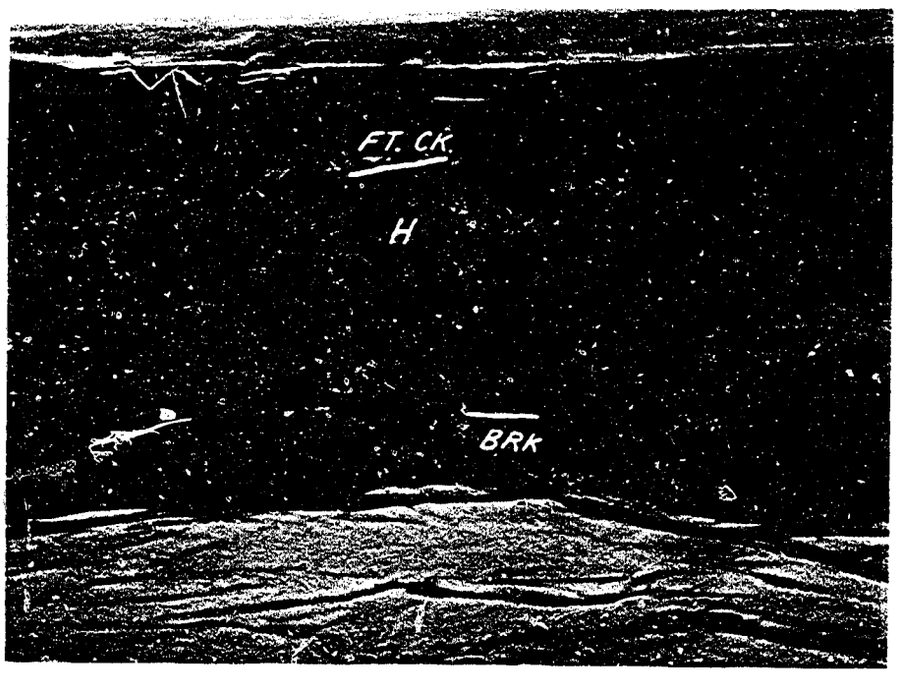

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PLATE 3

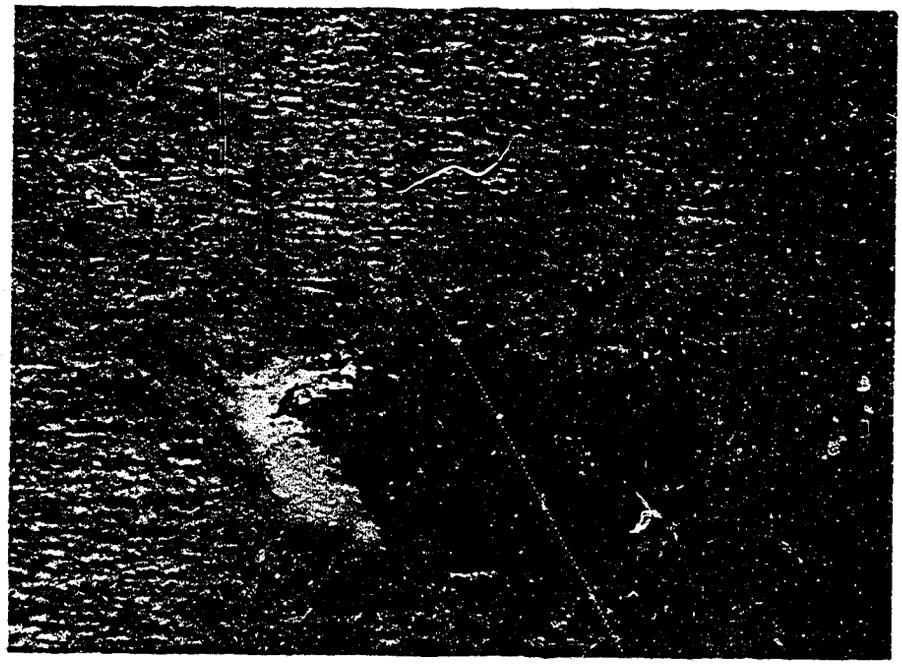

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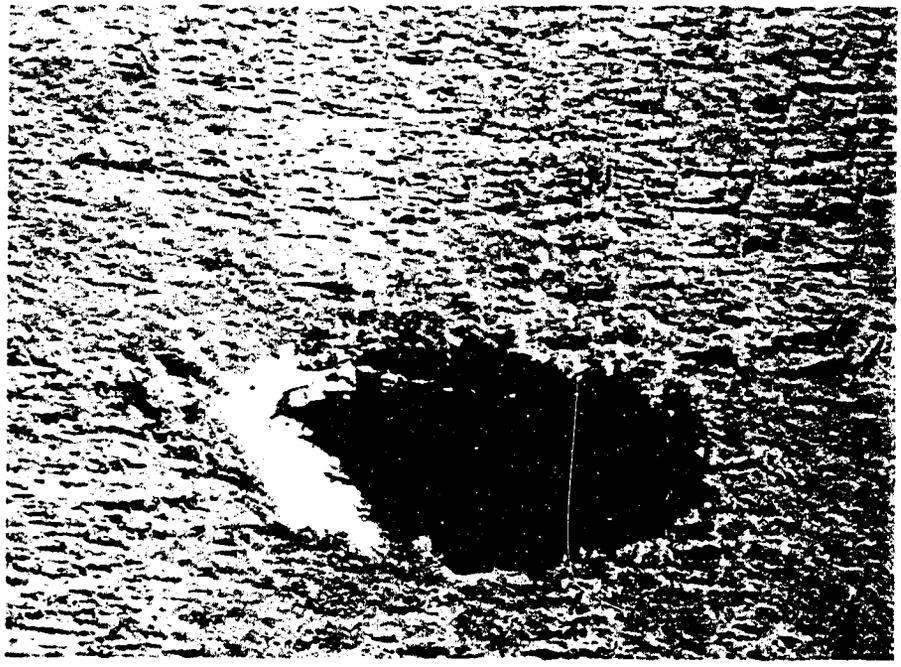
PLATE 3



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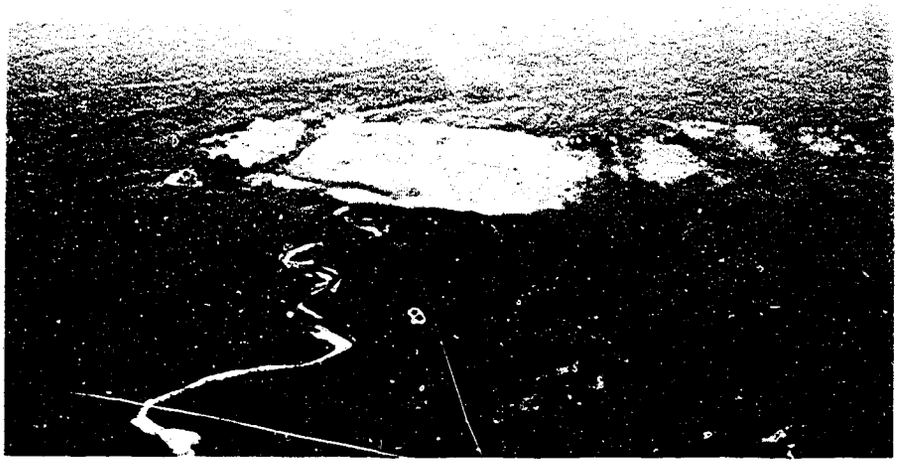


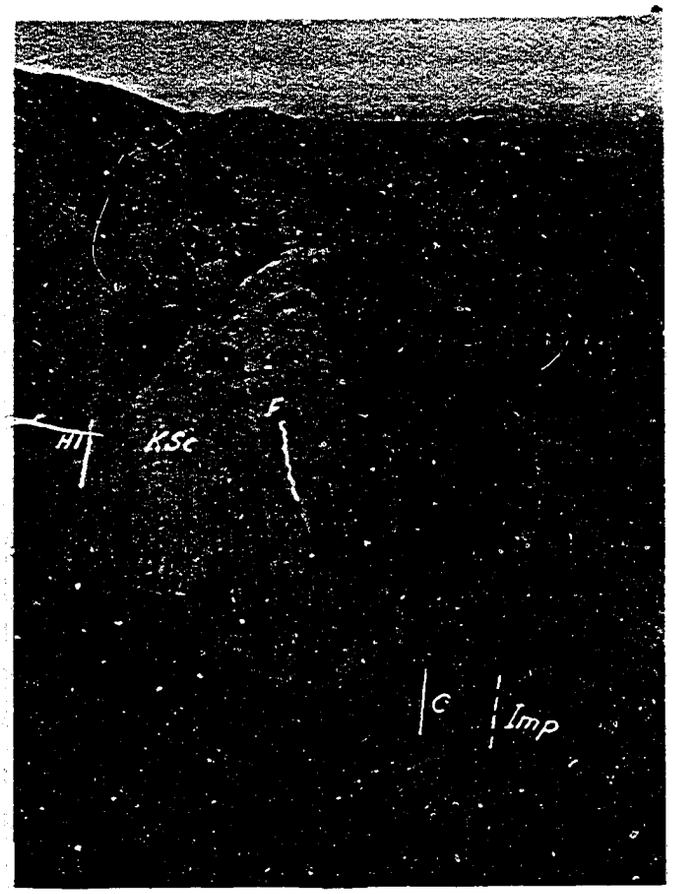
B

PLATE 3

A. Sinkhole in Hume formation approximately five miles east of Moon Lake. This is only one of numerous sinkholes in an area where the underlying Bear Rock formation is composed predominantly of evaporites.

B. Low escarpment of Hume formation limestones, twelve miles due east of Old Fort Point. Beds dip very gently northward. Looking northwest. Section CMS-1-59-2 was measured on this escarpment.

PLATE 4



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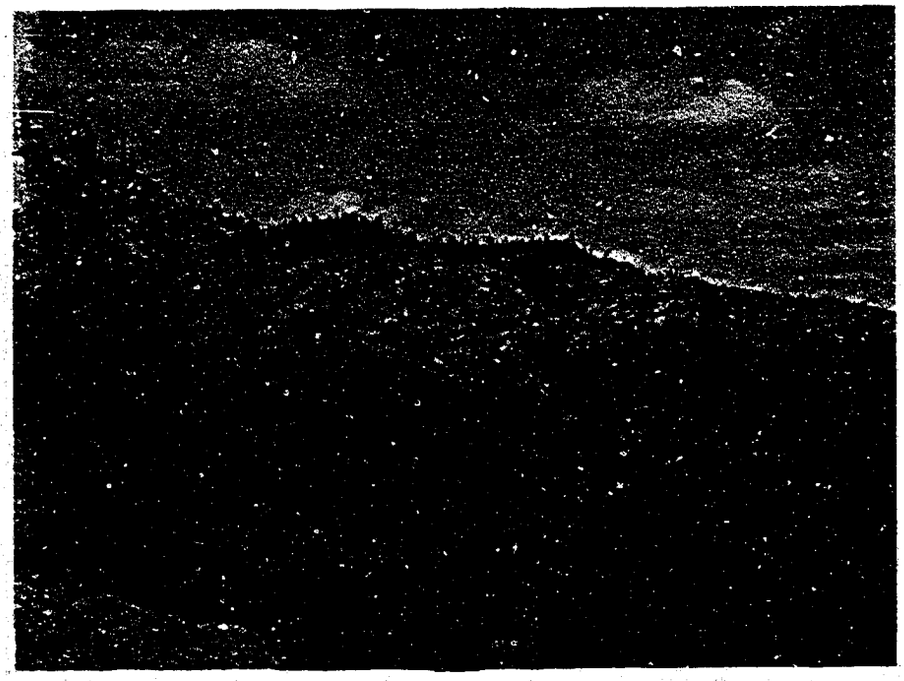

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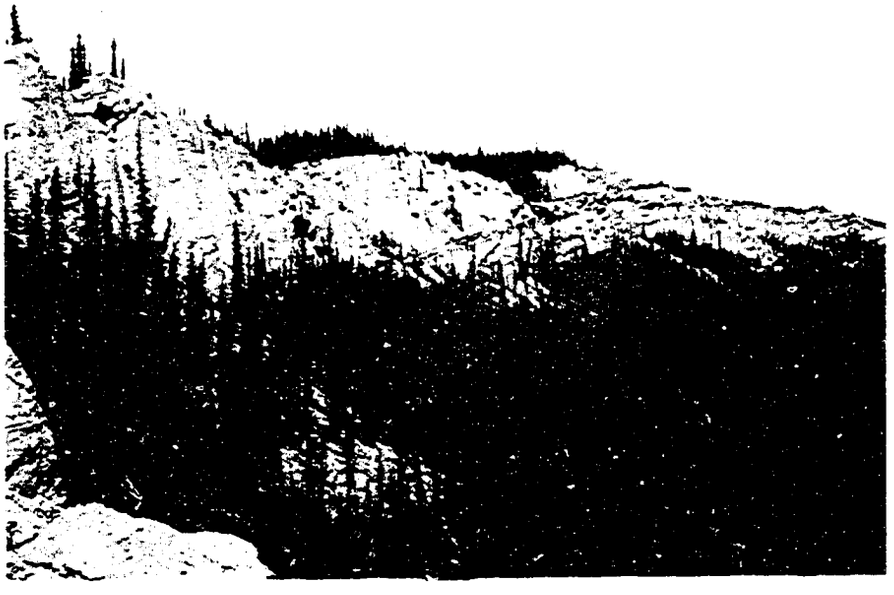
PLATE 4

A



B

PLATE 5

A. Contact between Fort Creek and Hume formations on east side of Macdougal Creek where it leaves Mackenzie Mountains. The Leiorhynchus castanea fossil zone occurs 10 feet above the Hume-Fort Creek contact. Hume formation (H), Fort Creek group (Ft Ck). Looking south.

B. Fort Creek group outcrops on east side of Macdougal Creek at front of Mackenzie Mountains. Canol road lies at base of cliff. Youngest beds visible on left side of photograph may be lower Imperial in age. Looking northeast.

PLATE 5

A

B

TEXACO EXPLORATION COMPANY

GEOLOGIC RECONNAISSANCE OF

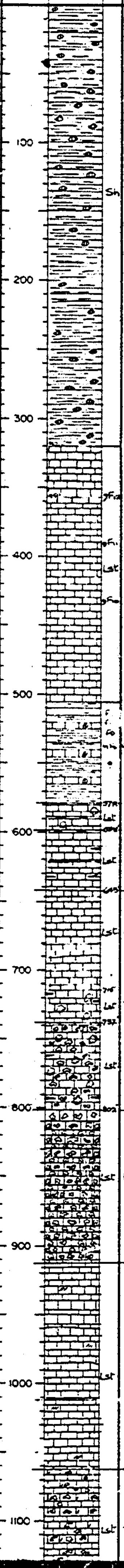
UPPER and CENTRAL MACKENZIE BASIN NORTHWEST TERRITORIES

DETAILED STRATIGRAPHIC SECTION

Section Name: ROUGE CANYON **Code:** ROU-1-59-2

Location: 126°58' to 126°47'W, 64°32' to 64°35'N. Along upper part of Rouge Mountain River, lowest part of section located 3 miles N80°E of Rouge Mountain. Section continues 6 miles down stream to top of section

SYSTEM	SERIES	FORMATION	MEMBER	TYPE SECTION EQUIVALENT	SCALE	LITHOLOGY		LITHOLOGIC DESCRIPTION



System	Series	Formation
DEVONIAN	MIDDLE DEVONIAN	FORT CREEK GP.
DEVONIAN	MIDDLE DEVONIAN	HUME FM.
DEVONIAN	LOWER DEVONIAN	BEAR ROCK FM.

Sh — blk, wthers. brn-yel/lt.gy. fiss./sub.fiss. v.thinbed. 1/8" → 1/2", occas. Fe-stone concretions up to 12" dia., silty, non-calc. nonfossil. The section was measured down-hill from covered interval. Top of section near base of red sh.

Foss. Coral

Foss. Hexagonaria

Lst — med./dk.gy., wthers lt.yel./orange, v.f.grnd., thk./mass. bdd., nubbly appearance, [illegible], hd. & dns.

Foss. Coral

Coral

Foss. Brach.

Lst. as below & interbdd. sh., latter is 70% of unit, - mainly unit covered with occas. fossil. bds found throughout the unit

578'

Lst — lt./med. gy., wthers. lt.yel., lith, thin bdd., ca. veins & vugs, highly fract., a few interbdd. sh. bands

Lst — dk.gy./blk, wthers. dirty yel'/med.gy., lith, thin/med bdd., highly fract., ca. stringers hd., shaly partings in places

645'

Lst — dk gy./blk., wthers lt. orangy yel, v.f.grnd. thin/med. bdd., dns., hd., no vugs; [illegible] & ca. absent. Rock color distinctive - may contain a tinge of green

715'

Lst — lt. brn-gy., wthers. dk gy./yel-orange, v.f./f.grnd. laminated/thin bdd., & laminations in thk. ca. fract. filling, rk. sl. [illegible] but well fract. [illegible]

737'

Lst — med gy., wthers lt.gy./or'-yel., lith., bdng. absent, sl. brec., highly fract., ca. veins & vugs.

802'

Lst — lt.gy. matrix, dk.gy. breccia, wthers brt.orange, matrix v.f.grnd. brec. lith., bedding obliterated, brec. highly developed, particles being ang./subang., soft, & matrix powders when struck, diff. to obtain from surface, no trace of white surface wthering, brn Fe oxide staining quite common, ca. xstals present but rare, non-vuggy.
Base of unit covered by talus.

Lst — lt.gy., wthers. cream/lt.yel., bdng absent, lith/v.f.grnd., ca. xstals, present, gypsum (?) occur in localized area. brec. absent, hd. This unit forms a [illegible] cliff, only sl. vugular wthg

Lst — lt. gy., wthers med.-dk.gy. orangy yellow, brec. to a small degree, sl. dolo(ic), brec. varies in size from 1/4" → 12" dia., bdng absent, numerous irreg. wthering features such as: nat'l bridges, pinnacles. [illegible]

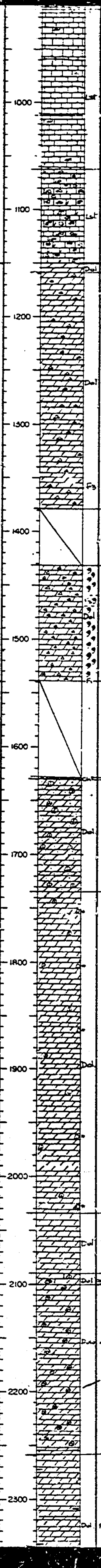
LOWER DEVO... | BEAR ROCK

MOUNT KINDLE FM.

...OVICIAN – SILURIAN

...RDOVICIAN to MIDDLE SILURIAN

...ANKLIN MOUNTAIN FM.



Lst lt. gy, wthers. cream /lt. yel, bdding absent, lith / v.f. grnd., ca. xstals, present, gypsum (?) occur in localized areas, brecciated, hd. This unit forms a ... cliff, only sl. vugular wthg

Lst lt. gy, wthers med-dk. gy orange yellow, brec. to a small degree, sl. dolo(ic), "brec." varies in size from ½" — 12" dia., bdding absent, numerous irreg. wthering features such as: nat'l bridges, pinnacles. Extremely vuggy, with breccia & matrix. litho, sharp contact

Dol prominent bed, cliff forming, lt. gy/blue, wthers lt. brn-yel, lim, thn bdd, hd., [illegible].

Dol lt. brn/lt. gy, wthers lt. gy /med-gy. litho /fn. grnd., thin /med. bdd., v. vugular wthg, wht. cht., hd. resis

Fs

Covered Interval (trees & grass)

Dol lt. gy / lt. brn., wthers lt gy /med-dk gy, mass. bdd, v.fn /fn grnd., reefal zone, cht. inclusions, hd., resis., This Dolo is v. vugular wthg, Cht. v. common. Approx. thickness reefal zone is 80'

Fs

Covered Interval

Cht. Dolo., wther. same, highly [illegible], 12" beds approx.

Dol lt gy, wthers. brn / brt. orange, fn. grnd., silty, mass. bdng, hd., resis, ca. stringers & vugs.

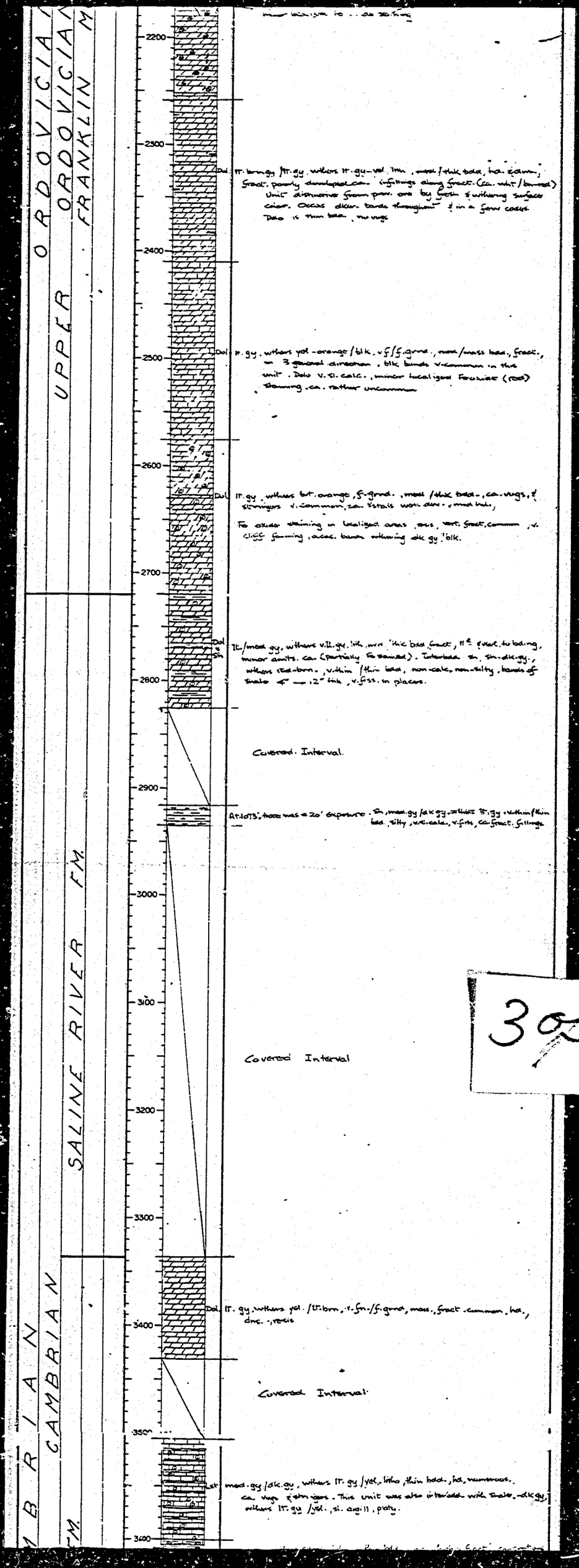
Dol lt./med. gy., wthers. orange/med. gy, f. grnd., thk/mass. bdd., surface Fe oxide staining abun., hd., vert. fract., cliff forming, little ca. pres. 200' of this unit covered. Vugs also with qtz. xstals

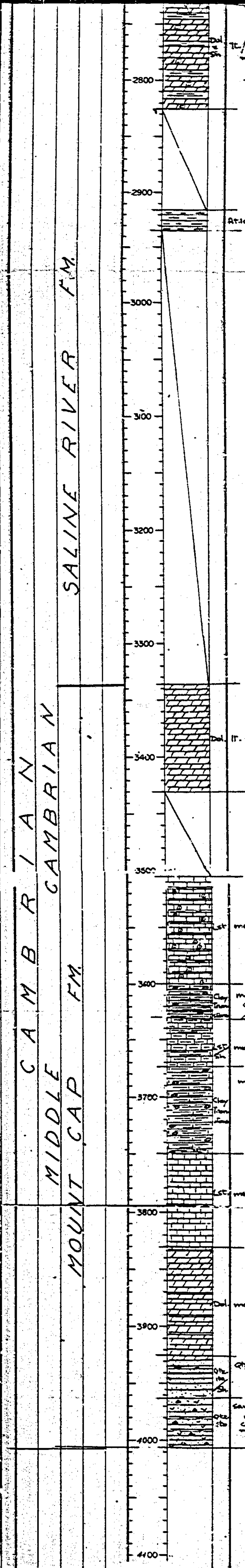
Dol lt. brn-gy /purp., wthers. v. lt. yel. /cream, litho, med. bdd., v. hd., dense, resis, vert. fract. common.

Dol brownish-tan, wthers brn-gy, f. grnd., med. bdd., small cavings, sl. calc. wthers knobbly, hd.

Dol med. olive-gy, wthers orange /blk, f. grnd., thin/thk. bdd., rock finely banded, well dev. vert. fract., cavings & stringers (small vugs), minor localized Fe oxide staining

Dol lt. brn-gy /lt. gy, wthers lt. gy-yel, lith, med /thk bdd, hd. & dense, fract. poorly developed. ca. infillings along fract. (ca. wht / brn-red) [illegible]


ORDOVICIAN
UPPER ORDOVICIAN
FRANKLIN M.
SALINE RIVER FM.
CAMBRIAN
LIBRIAN
FM.
2200
2300
2400
2500
2600
2700
2800
2900
3000
3100
3200
3300
3400
3500
3600
Dol
Dol
Dol
Dol & Sh
Lst
Covered Interval.
Covered Interval
Covered Interval.
32



Dol & Sh: lt./med. gy, wthers v.lt. gy, lith. m/m, thic bdd, fract, n± equal to bdng, minor amts. ca. (partially Fe-stained). Interbdd Sh, Sh-dk.gy., wthers red-brn., v.thin/thin bdd, non-calc, non-silty, bands of Shale 4" — 12" thk, v.fiss. in places.

Covered Interval.

At 1075', there was a 20' exposure. Sh, med.gy/dk.gy, wthers lt.gy, v.thin/thin bdd, silty, v.sl.calc., v.fiss, Ca-fract. fillings

Covered Interval

Dol. lt. gy, wthers yel./lt.brn., v.fn./f.grnd, mass., fract. common, hd., dns., resis.

Covered Interval

Lst: med.gy/dk.gy, wthers lt. gy/yel, litho, thin bdd., hd., numerous ca. vugs & stringers. This unit was also interbdd. with Shale, dk.gy, wthers lt.gy/yel., sl. argill, platy.

Clay Ironstone: maroon, wthers same, litho, v.thin bdd., calc., highly fract., concretions common up to 3" dia., hd., dns., interbdd. Sh. – lt.gy, wthers lt.yel/brn, calc, laminated, fiss.

Lst/Sh: med.gy, wthers lt.yel/lt.brn, litho/v.fn.grnd, argill, thin bdd., platy cl., Interbdd. with Sh – lt gy., wthers same, laminated/thin bdd., hd., calc.

Clay Ironstone: maroon, wthers same, litho, v.thin bdd, sl./v.calc., highly fract., Concretions common up to 3" dia. occur in most bds, hd, dns., resis. The Clay Ironstone bds are interbdd. with a maroon-coloured Shale, which is v.sl. calc. & v.fiss.

Lst: med. gy, wthers lt.yel/litho, thin bdd., highly fract, dns., ca. stringers

Dol. med gy, wthers lt.gy/lt.yel. litho v.fn.grnd., med.bdd., hd. & dns., resis. Very occas. thin sh. bds. occur towards the top of this interval.

Qtz.ite/Sh.: Qtzite – as below but has become highly pyritized. Sh, lt.gy/med.gy, wthers lt.gy/pale yel, v.thin bdd./papery, fiss/sub-fiss, Shale, are interbdd. with the Qtzite bds.

Qtz. Sts: sandy, lt.gy/lt.yel., wthers. lt.yel./brn., fn/med grnd, thin bdd, tourmaline inclusions (green), micro-micaceous, surface covered by ripple marks, hd., dns, contains minor pebbles of lt.gy. chc. qtzite interbdd. with Sh = maroon, wthers maroon, v.thin bdd./papery, sub-fissile, sl.calc. At base of this unit there is 20' of pure qtzite which is v.fgy. & is not interbdd. with Sh.

END OF SECTION

TEXACO EXPLORATION COMPANY

GEOLOGIC RECONNAISSANCE OF

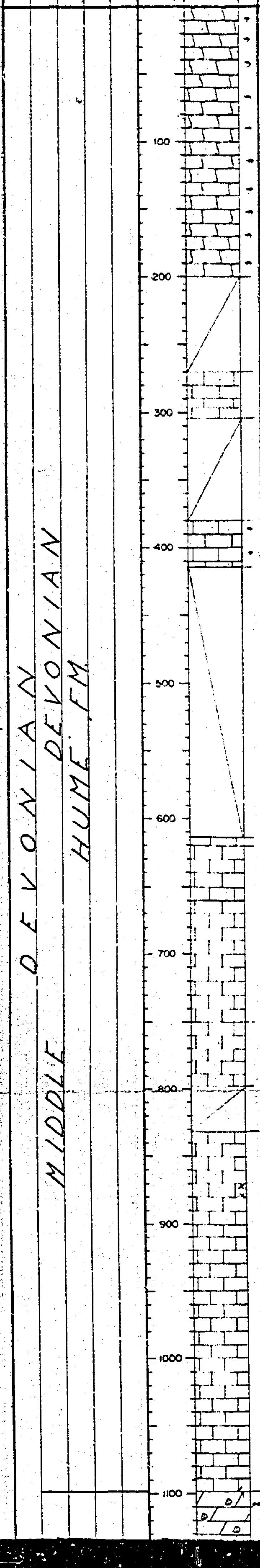
UPPER and CENTRAL MACKENZIE BASIN NORTHWEST TERRITORIES

DETAILED STRATIGRAPHIC SECTION

Section Name: *REDSTONE RIVER* Code: *RED-1.2-59-2*

Location: *125°49'W., 63°35'N., In small stream cut on west side of mountains 2 miles west of Redstone River, & 5 miles north of confluence of North Redstone & Redstone Rivers.*

SYSTEM | SERIES | FORMATION | MEMBER | TYPE SECTION EQUIVALENT | SCALE | LITHOLOGY | LITHOLOGIC DESCRIPTION



Ls. Dk. gy f.s., pale yel. to gy. wthd, thk to mass bdd, irreg., mod. silty, rubbly, reefoid, stroms form large percentage of rock, also brach and coral frags

Covered Talus slope

Ls. Bk f.s., med gy to pale yel wthd, sl silty, v.f.xln, hd, tight, resis, forms top of bench, rubbly, med to thk bdd, no fossils found

Covered Talus slope

Ls. Bk f.s., gy to pale orgh yel wthd, med to v. silty, thk to mass bdd, reg. v. hd, mass rubbly, foss. incl brachs, horn corals, hexagonaria. No visible Por

Covered, Talus slope

Ls. Bk f.s., lt yelsh gy wthd, mod arg, lith thin bdd, tight, hd, recess

Ls. Pale gy f.s., lt yelsh gy wthd, lith to v.f.xln, med to thk bdd at base becoming thin to med bdd toward top, v resis, wthd surf is flat but pitted, generally as unit = 30 - 797-1097'

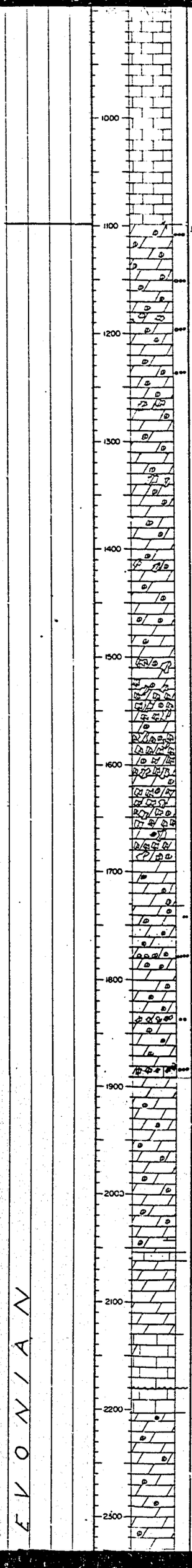
Scattered outcrops but recessive, thin to med. bdd, gen as 832'-1097'

Covered interval

Ls. Uniform lt gy f.s., v.dk.gy wthd, v.f.xln to lith, med. to mass bdd, v irreg., v.hd dns, resis, contact w. underlying dol not seen but assumed grad within a space of 18'. dol lam. standout on wthd surf. but barely visible on f.s., at 877-880' zone of ls is present with numerous cubes of pyrite wthd out on wthd. surf

Dol. Bk. f.s., v.dk gy. to bk, occas. pale yel wthd, f. xln, mass. to med. bdd, irreg., v.hd, resis, highly frac normal to bdding frac. infilled with secondary wh. xln calc., numerous zones [illegible]

1 of



Dol. Bk fg, v dk gy to bk, occas pale yel wthd, f xln, mass to mod. bdd, irreg, v hd, resis, highly frac normal to bdg frac. infilled with secondary wh xln calc, numerous tubes of calc infilled tubes (worm borings). numerous wholly infilled calc. vugs and stringers. brec zones very numerous from 1512' - 1682' forming abt 75% of the rock between 1512' - 1682' occas thin brec zones were encountered above 1512' brec. Angular dol frags 1/8" to 1" across occur in calc dol matrix f xln, frags form 60% to 80% of the brecciated zones

Note: The bedding throughout the unit was generally medium to thick bdd with occas thin bdd zones occurring in the middle of the unit and generally thicker more thick bdd zones occurring at the top. Occas zones of good inter xln por were encountered in the upper 150' of the unit in the thick resis beds. Zones of worm borings avg 2' thk are common in the lower 75' of the unit and occured occas above that.

29

Dol. Med. to dk gy. f.s., yel ish. lm. to bk. wthd, v.f. to f xln, thick to massive bdd, irreg, occas fenestral. staining, hd., resis, numerous large 1" to 6" calc. vugs and stringers

Brec. zones occur at 1884' to 1887', 1897-1898'

Sl. to moderately silty dol. occurs at 1882-1902, 1752'-1770' occas. zones of v.g. fracture por occur throughout the unit, fracture por. is generally partially infilled with calcite

Brec: frags avg 1/2" to 2" across, sub ang, form about 85% of brec. zone, matrix calcite. The zone is fairly porous.

A zone of excellent vuggy porosity occurs at 1977' to 1980'. The vugs are partially infilled with calcite

A ls bed occurs at 2042' to 2043' # ls: dk. gy. f.s., lt. gy. wthd f. xln, v. highly frac.

Ls. lt gy. f.s., pale yel. sh. gy. wthd, lith., sl. silty, thin to med bdd, irreg, occ. blocky frac., recessive compared to dol., unconf. lower contact is abrupt

Dol. Med gy f.s, ltgy. to dk gy. wthd, f to v f xln, med. to thk bdd, hd. resis, frac. v. little in cont rast to underlying ls, gen. quite calc., occas. bk color lam. occur on wthd surf. occas. deep blue wthd surf

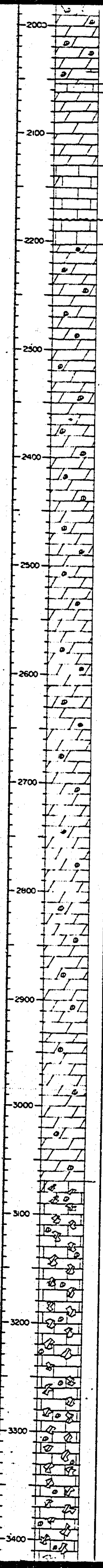
Ls. Med. to sh. gy. f.s., lt to sh. yel. to bk wthd, v.f. xln., med. bdd, reg. Contact with underlying unit grad. over a 3' interval, hd. tight, resis, moderately frac. at rt. ∠s to bedding, wthd. surf has an angular blocky appearance, fetid when struck. Crossed fault at 2182'. Slickensides present.

Dol. dk gy to bk f.g, dk gy. wthd, lith. to v.f xln, thk. to massive bdd. Calc. vugs & stringers, Calc. assoc. w. all minor fault traces. Small local Pockets of brec. assoc. with fault traces occur in places, resis., hd and, fetid when struck. Worm tube zones varying from 1' to 5' thick repeatedly occurred between 2489 and 2689'

LOWER DEVONIAN

DEVONIAN

BEAR ROCK FM.



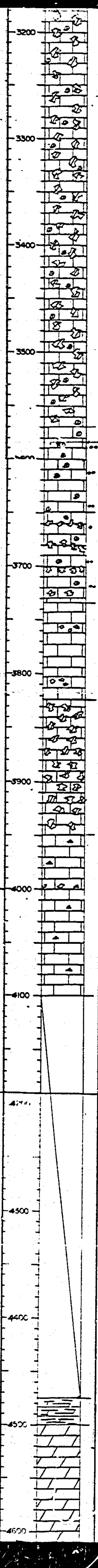
Ls. lt gy f.s., pale yelsh gy wthd, lith., sl slty, thin bd bdd, reg. ang. blocky frac, recessive compared to dol, upper lower contact is sharp

Dol. Med gy f.s, lt gy to dk gy wthd, f to v.f. xln, med. to thk bdd, hd resis frac v little in contrast to underlying ls, gen. quite calc., occas bk color lam occur on wthd surf, occas. deep blue wthd surf

Ls. Med brnsh. gy f.s., lt brnsh. yel. to bk wthd, v.f. xln., med. bdd, reg. Contact with underlying unit grad. over a 5' interval, hd tight, resis, moderately frac. at rt. ∠s to bedding, wthd. surf has an angular blocky appearance, fetid when struck. Crossed fault at 2182'. slickensides present.

Dol. dk gy to bk f.s., dk gy wthd, lith to v.f. xln, thk. to mass bdd, Calc vugs & stringers, Calc assoc w. all minor fault traces. Small local pockets of brec assoc. with fault traces occur in places, resis., hd dns, fetid when struck. Worm tube zones varying from 1' to 5' thick repeatedly occurred between 2489' and 2689'

Ls. lt gy. to olive, with v. lt. gy., lith., med. bdd. to thk. bds., hd. dns. resis, well brec. throughout, (dol. frags in ls matrix as seen at ...) Size range: Pin head to 2" across, Calc vugs and stringers, fetid when struck



<u>Ls.</u> lt.gy. to med. gy., wth. lt gy., lith, med bdd to mass, numerous & calcite vugs & stringers, vugular por. in part, recrs, hd, pitted with appearance, brec. zones that do occur are assoc. with fault trace

<u>Scattered Brec. Zone</u> As 3824'-3865' except for Is. beds occurring w/ no staining, brec. or flow structure, sl. ferrug. staining, <u>Unbrec. ls</u> dk.gy., wth. lt.gy. to med. gy., lith., med. to thk. bdd, calc., vugs, localized areas of pinpoint por., recess,

<u>Ls.</u> Lt.gy. to med. dk.gy., wth. lt gy., lith, thk. bdd to mass, hd., mosaic, dns, calc. stringers ferr. staining in part, few localized brec. pockets

<u>Brec. Zone</u> <u>Mott.</u> ls, lt. to med. gy., wth. med. to dk. gy. ~~to blk~~, lith., <u>Frags</u>; dol, dk. gy. to bk., ranging from pea size to two inches, few calc. stringers throughout, localized zones of med ferrug. weath., from 3847'-3850' a continuous brt. red ls bed occurs. This bed is resis. Flow structure is present

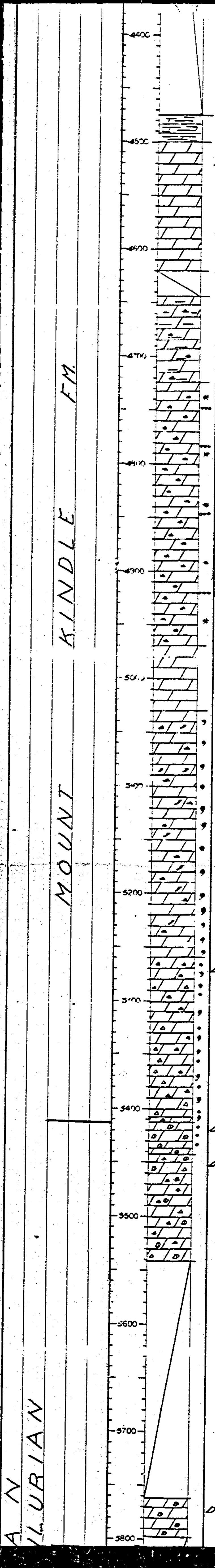
<u>Ls.</u> Med. gy. to olive, wth. lt gy., lith, thin to med bdd, hd, dns, chty, numerous wthd out vugs, at 3955' a 2' brec. zone occurs

<u>Covered</u>: Grass & Jackpine

<u>Dolc sh</u> Olive gn, with some, papery to thin bdd, ~~hd, dns~~, fiss to subfiss, frac easily along bedding planes

<u>Dol</u> Dk gy, wth dk. gy to bk, lith, thin bdd, hd, dns, calc stringers

4 of



Dolc sh Olive gn, with some, Papery to thin bdd, indurated, fiss to subfiss, frac easily along bedding planes

Dol Dk gy, with dk gy to bk, lith, Thin bdd, hd, dns, Calc stringers

Covered Grassy slope

Dol Med gy, with v dk gy to lt gy, med to thk bdd, arg, lith to vf gn, Calc stringers, Pitted wth, highly frac at rt ∠s to the bedding Planes, wthd out cht. stringers are common

Inbd dk & lt gy dol dol med to dk gy, with dk gy to bk, vf grn to f grn, med bdd, hd, resis, sl fetid, v chty in part. Dol lt gy, with v lt gy, Thin to med bdd, good por, resis, & non foss, qtz. crystals common.

Dol Med gy, with med gy to dk gy, vf grn, rock type PD, med hd, sl fetid, no shows

Dol Med gy to dk gy, with dk gy to bk & vf grn, hd, resis, foss incl. cup corals, halysites, Cht vugs & stringers, inbd w dol lt gy f & f wthd, vf grn, hd, Calc stringers, thin to med bdd, no foss in the light Colored beds

Dol, dk gy, wths. dk gy to bk, f to med grnd, v fetid, p.p. por, rst, foss w/corals (Halysites, cup corals) & chty (wh),

Dol, lt gy, wths. lt gy, med grnd, num sm ca. vugs, pitted wthg., p.p. por, rst.

Dol, lt gy, wths. med to dk gy, med grnd, ca. stringers & vugs, rst, fe stn in pl, white cht nods.

Dol, lt gy, wths. lt to dk gy to bk, f to med grnd, ca. stringers & vugs, wthd surf pitted

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ORDOVICIAN - SILURIAN

MIDDLE SILURIAN

UPPER ORDOVICIAN to MIDDLE SILURIAN

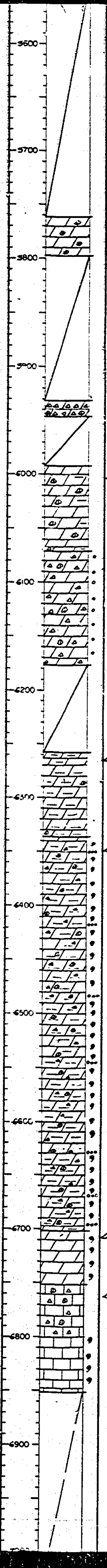
MOUNTAIN FM.

UPPER ORDOVICIAN

FRANKLIN MOUNTAIN FM.

MIDDLE ORDOVICIAN

FRANKLIN MTN. Fm.



Dol. lt.gy., wth. lt. to dk.gy. to bk., f. to med. gran. ca. stringers & vugs., wthd. surf. pitted

Dol & CHT.; Dol., med.gy., wth lt.gy., f.gran., ti., ca. vugs & fract. CHT., wh. ... weat. sl.ool., strong fetid odor. Dol. 60%

Dol. med.gy., wth med. to lt.gy., xl. ang., ca. in vugs, occ. bdg indistinct.

Dol. med. to dk.gy., wth. med. & dk.gy. to bk., f. to med. gran., occ. ca. stringers & vug infillgs., wh. cst. ool., bdg. indistinct, pp. por., fetid odor, occ. muddy wthg.

Dol. dk.gy. to bk., wth. dk.gy., ang., f.gran., med. to th. bdd., crumbly in places, tr. of ca. in places.

Dol., dk.gy. to bk., cryptoxln. to xl. gran., ang., wth med. to dk.gy., num. inclusions & stringers of bk. cht. & ca., ool., vuggy, fract., u. foss., gd. por. in places, strong fetid odor. Thin lt. gray to lt.gy. dol. present at 6602

Above 6602 sup. small amt. foss

Dol., dk.gy. to bk., wth. med. gy., cryptoxln, u. fract., num. ca. stringers, foss., med. bdd.

Ls., med. to dk.gy., wth lt. to med.gy., cryptoxln, foss., bdg. indistinct, platy, above 6802 ls. is dk.gy. to bk., & has many cht & ca. nod. & stringers & is unfoss.

NOTE

The exact thickness between beds above & below this interval is unknown. It may be more than the 200' assumed here

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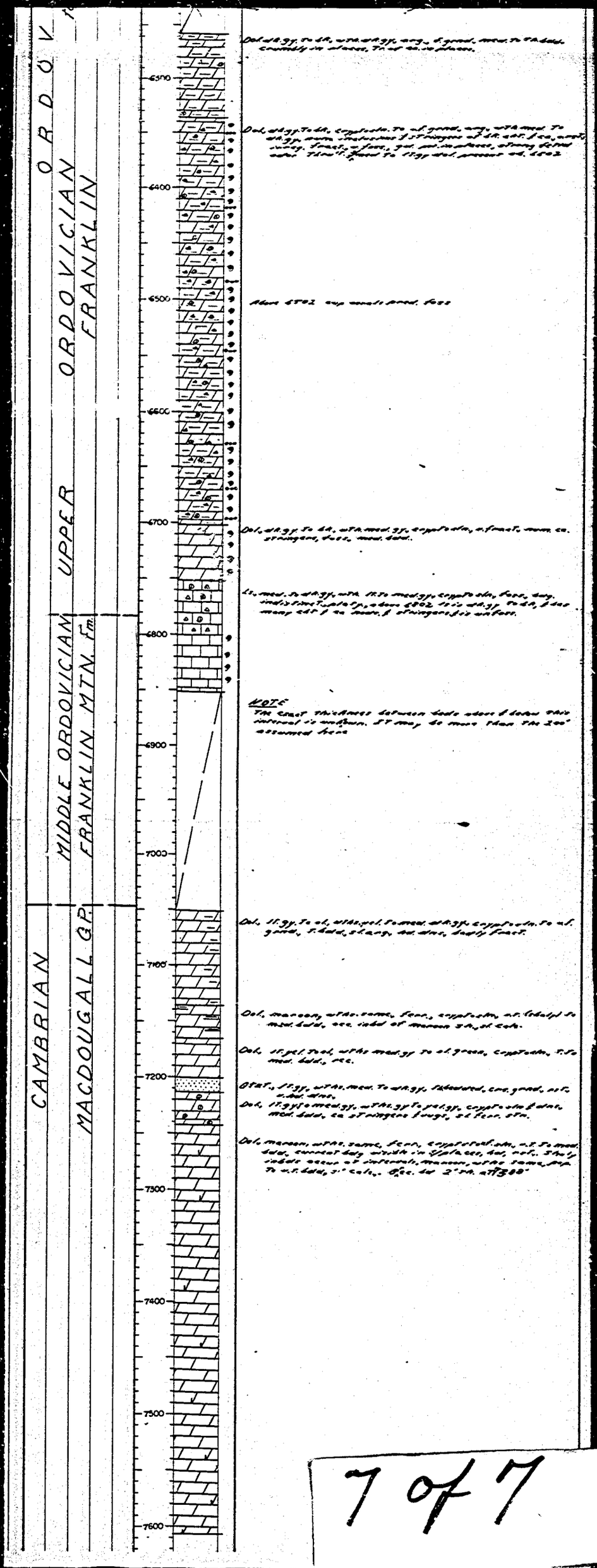
ORDOV
UPPER ORDOVICIAN
FRANKLIN
MIDDLE ORDOVICIAN
FRANKLIN MTN. fm.
CAMBRIAN
MACDOUGALL GP.
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6600
6700
6800
6900
7000
7100
7200
7300
7400
7500
7600
NOTE

707

TEXACO EXPLORATION COMPANY

GEOLOGIC RECONNAISSANCE OF

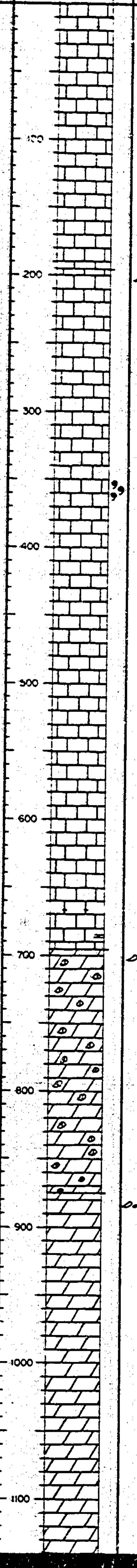
UPPER and CENTRAL MACKENZIE BASIN
NORTHWEST TERRITORIES

DETAILED STRATIGRAPHIC SECTION

Section Name *CAMSELL RANGE* Code *CAMS-1-59-2*

Location *125°43'W., 63°05'30"N. On west side of Camsell Range, 2½ miles east of Wrigley River at a point 13 miles upstream from its mouth.*

SYSTEM	SERIES	FORMATION	MEMBER	TYPE SECTION EQUIVALENT	SCALE	LITHOLOGY	LITHOLOGIC DESCRIPTION
DEVONIAN	MIDDLE DEVONIAN	HUME FM					



Ls., sim. to unit below, not as well bdd. & more nodly.

Ls., med. gy. to dk. gy., wth. med. gy. to lt. bn. gy., v.f. xln. to micro xln., med. to th. bdd. below 556', med. to t. bdd. ab. 556', ... at base on bdg. plns., also nodly in frags. & bdg. plns.

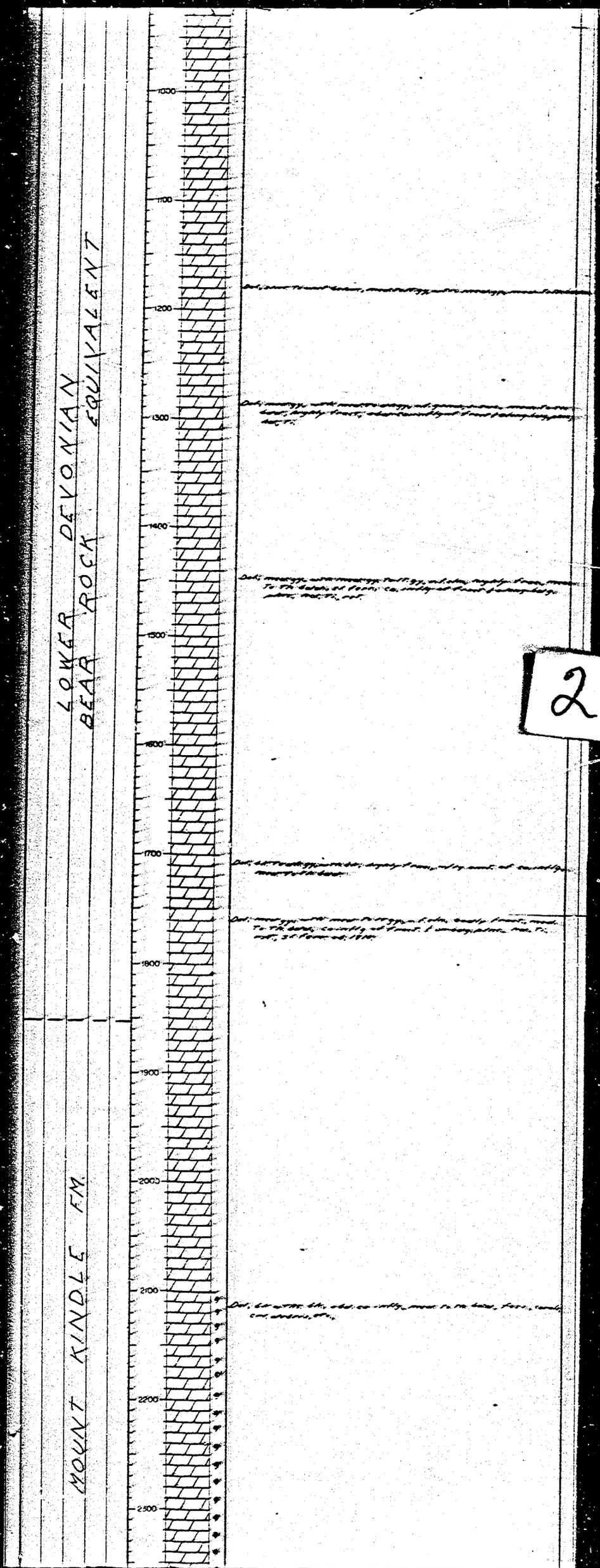
At 351 to 366' Ls. v. foss. w/ Favosites, Phillipsastrea, cup corals.

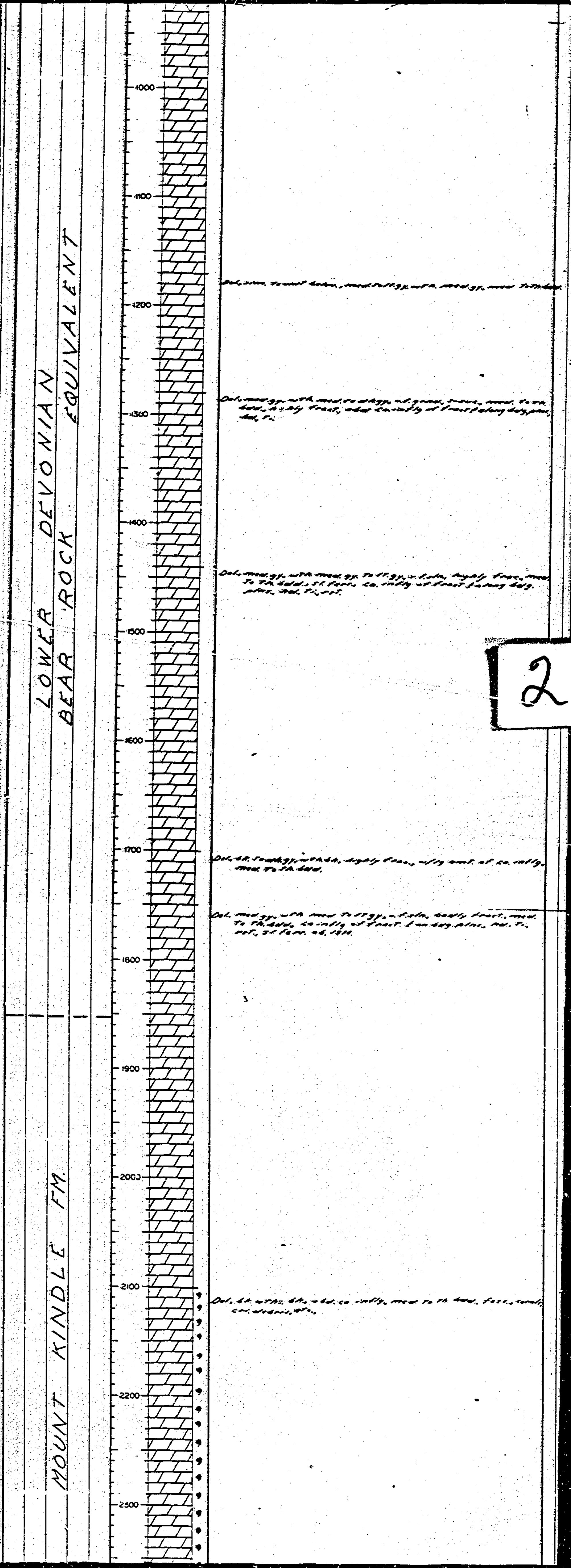
At 680-686' 1' Ls. med. gy. v.f. xln. dol.

Dol., med. to dk. gy., wth. med. to lt. bn. gy., v.f. to crs. xln. and gran., med. to th. bdd., highly fract., lg. amt. (up to 20%) of secondary magnesite and/or lime.

Dol., med. to dk. gy., wth. med. gy., v.f. gran., and calc., nodly., med. to th. bdd.

1 of [illegible]


LOWER DEVONIAN
BEAR ROCK EQUIVALENT
MOUNT KINDLE FM.
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
2c


LOWER DEVONIAN
BEAR ROCK EQUIVALENT
MOUNT KINDLE FM.
1000
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1200
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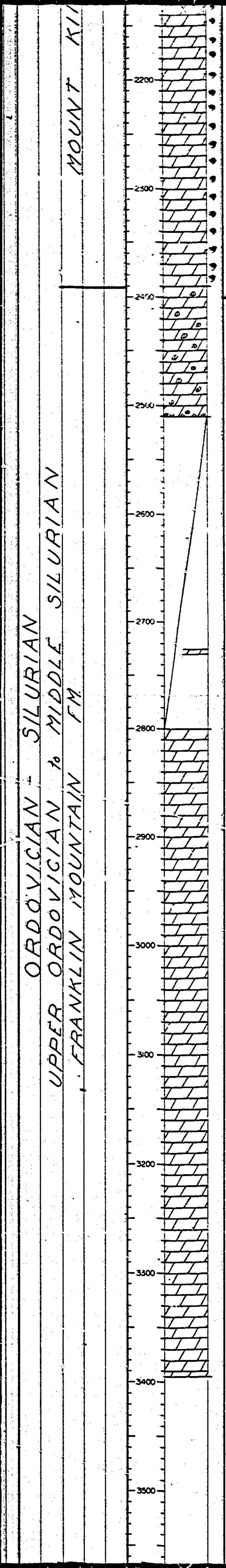
2200
2300



Dol. lt. gy. to med. gy., wth med. gy. to sl. dk. gy., v.f. gran., med. to thk. bdd., sl. frac., co. vnfly at vugs & fracts. Lower 2' is brec., dol. frags ang. to v. ang. 1/4" to 2" long.

2720-2725- Dol., med. gy., wth mnr. to lt. bn. gy., v.f. xln., v. fract., co. vnfly at fract., med. to thk. bdd. f.

Dol. lt. gy. to dk. gy., to blk., wth med. gy. to pale bn., to white, pel., microxln., v. frac., fracs. infld w/ calc., ti. sl. fern., bdg. varies from t. to mass., pred. thk. mass. unit v. uniform w/ changes only in color bdg.

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TEXACO EXPLORATION COMPANY

GEOLOGIC RECONNAISSANCE OF

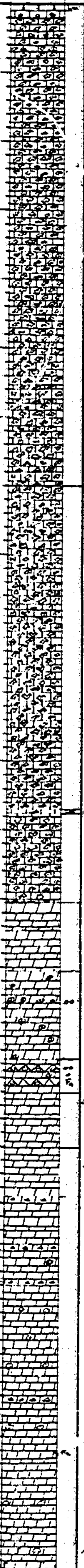
UPPER and CENTRAL MACKENZIE BASIN NORTHWEST TERRITORIES

DETAILED STRATIGRAPHIC SECTION

Section Name: IMPERIAL RIVER WEST — Code: IMP 1-59-2

Location: 128°02'W., 65°06'N., In Imperial River Canyon, starting from Mackenzie Mountain front & continuing upstream; four miles south of Jordan Creek.

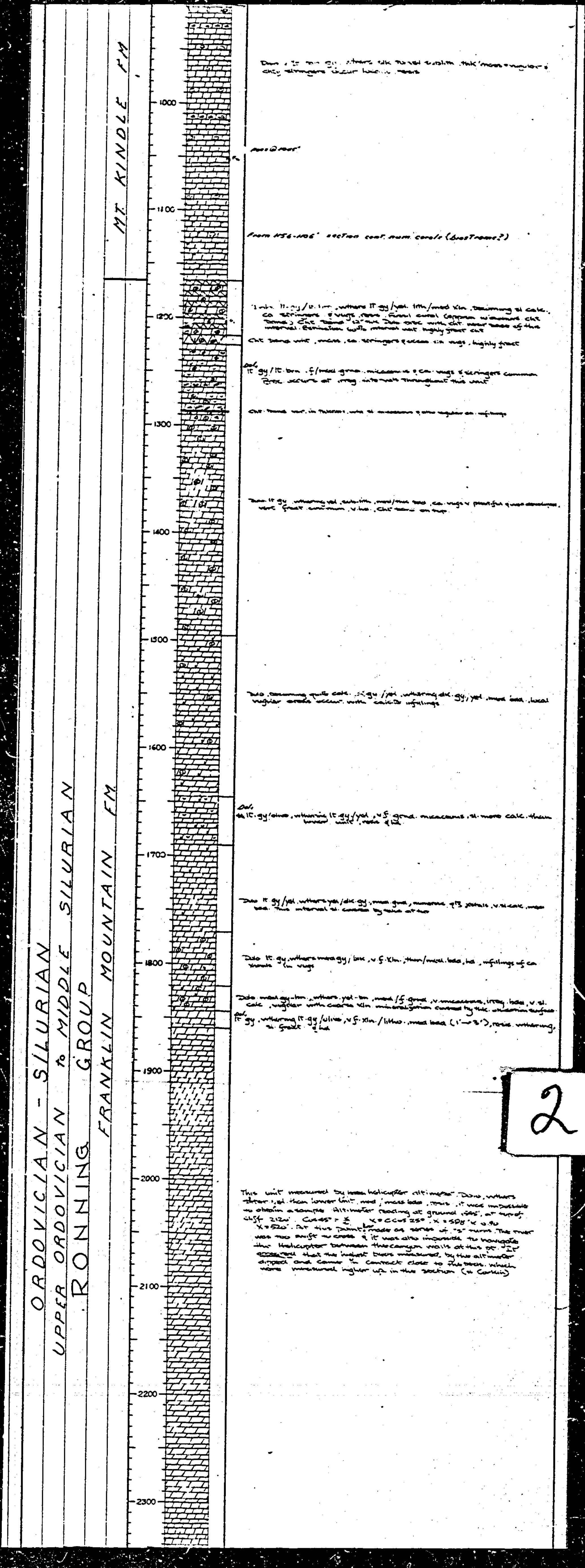
SYSTEM	SERIES	FORMATION	MEMBER	TYPE SECTION EQUIVALENT	SCALE	LITHOLOGY	LITHOLOGIC DESCRIPTION
DEVONIAN	LOWER DEVONIAN	BEAR ROCK FM			0–650		
		MT. KINDLE FM			650–1150		



Scale: 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100

LITHOLOGIC DESCRIPTION

- Lst. lt gy, weathering yel-brn, [illegible], highly fract., [illegible]
- Lst. cream, weathering lt/med gy & yel, f grnd, [illegible] texture, well brec., brec. [illegible], [illegible] completely, [illegible] weathering
- Lst. lt gy, weathers lt gy/yel, bdng var. from indistinct to thin, highly fract., well brec. locally, brec. blocks up to 6", lst. highly indurated, complete absence calcite, cyclic bdng prevalent in localized areas
- [illegible] appearance of [illegible], yel weathering [illegible], brec. bds, var. from 1' - 3' thick, [illegible]
- Lst. lt gy, weathering brn-yel, v.f. grnd/lith., v. brec., being [illegible] sample taking at the [illegible] Ronning - Bear Rk contact
- Do. weathering dk gy/yel, v.f./f. grnd, highly fract., thin bdd
- Dolo. lt gy, weathering blk/yel, v.f. grnd/lith, [illegible] thk/mass bdd, resis., irregular [illegible] throughout
- Cht. bds approx 2" thick, highly irregular, weathering brn-yel. Cht. mainly interbdd with Dolo (as above) but former dominant (60-70%)
- Dol, lt gy, weathering dk gy, yel, sublitho mass bdd, resis.
- Dol, lt gy, weathering lt gy/yel, sublitho, thin bdd., v. resis., [illegible] of calcite, well developed vert. fract., [illegible] whole of exposed unit resulting in steep walled cliffs. [illegible] Dip 26°E
- Dolo, lt. [illegible] gy, weathers blk to yel, sublith., thk/mass & irregular; chty stringers occur locally, resis.
- Fos @ 1065'
- From 1156-1106' section cont. num. corals (biostrome?)



ORDOVICIAN - SILURIAN
UPPER ORDOVICIAN to MIDDLE SILURIAN
RONNING GROUP
MT. KINDLE FM
FRANKLIN MOUNTAIN FM
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
From 456-1106' section cont. num. corals (biostrome?)
lt gy/lt brn, f/med grnd, micaceous & ca. vugs & stringers common
This unit measured by helicopter altimeter.

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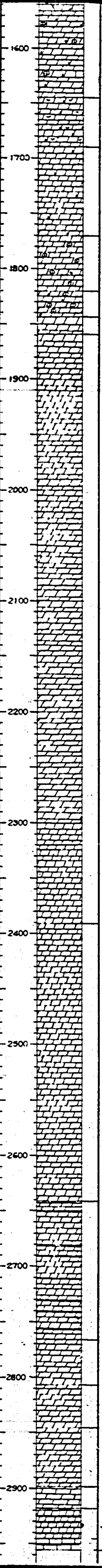
ORDOVICIAN - SILURIAN

UPPER ORDOVICIAN to MIDDLE SILURIAN

RONNING GROUP

FRANKLIN MOUNTAIN FM.



Dol. lt. gy/olive, weathering lt gy/yel, v.f. grnd. micaceous, sl. more calc than lower unit, [illegible]

Dolo lt. gy/yel, weathers yel/dk gy, med. grnd., numerous [illegible], v. sl. calc, med. bdd. This interval sl. covered by [illegible]

Dolo lt. gy, weathers med. gy/blk, v.f. xln, thin/med. bdd, [illegible], infillings of ca[illegible] in vugs

Dolo med gy-brn, weathers yel-brn, med/f. grnd, v. micaceous, irreg. bdd, v. sl. calc, vuggy with coarse xln mineralization covered by the [illegible] surface

Dol. lt. gy, weathering lt gy/olive, v.f. xln/litho, med bdd (1'–3'), [illegible] weathering, sl. fract. [illegible]

This unit measured by helicopter altimeter. Dolo, weathers [illegible] yel than lower unit, med; mass bdd, [illegible]. It was impossible to obtain a sample. Altimeter reading at ground [illegible], at top of cliff 2121'. Cos 25° = [illegible] X = C cos 25°. X = 508 × 0.90 X = 520'. At this point [illegible] made a series of "S" turns. The river was too swift to cross & it was also impossible to navigate the helicopter between the canyon walls at this pt. "It" appeared that the highest beds measured by the altimeter dipped and came in contact close to the river, which were measured higher up in the section (in Cambrian)

Dolo lt gy, weathers lt gy, olive, litho, v.f. grnd, med bdd

Dolo same as above but hackly weathering & thk bdd., occas. bds. of shale up to 4" this were found in this unit

Dolo med gy, [illegible], weathers lt gy/yel, litho, thin/med bdd, fract.

Cambrian - Ronning (Ord.) contact

Estimated thickness (inaccessible due to river), presumably Dolo as measured below but thin bdd. Є - Ronning Contact

Dolo as below only med. bdd

Dolo lt/med gy, weathers lt gy/yel, litho, thin bdd, [illegible]

thin/med bdd, med gy, weathers yel/olive, litho, argil. Interbdd with zones of thin to papery bdd. Sh. [illegible] gy/blk, non-calc, [illegible], friable

Ls. lt gy, weathers yellow, v.f./f. grnd, [illegible] (not [illegible]), exposed surface covered with Ricutts [illegible] thin/med bdd, [illegible]

CAMBRIAN MACDOUGAL GP.

END OF SECTION

3 of 3

TEXACO EXPLORATION COMPANY

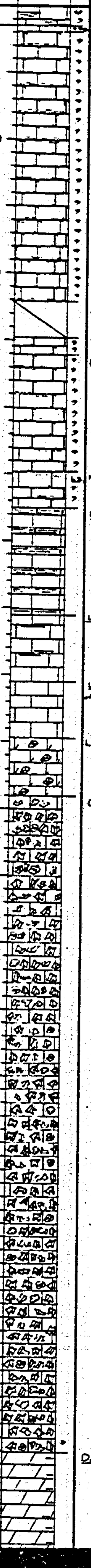
GEOLOGIC RECONNAISSANCE OF
UPPER and CENTRAL MACKENZIE BASIN
NORTHWEST TERRITORIES
DETAILED STRATIGRAPHIC SECTION

Section Name: RATION CREEK   Code: RAT-1-59-2

Location: 126°16'W., 64°35'N. Along Ration Creek, where Creek cuts through a mountain ridge, which is parallel to and one mile east of Little Bear River.

SYSTEM	SERIES	FORMATION	MEMBER	TYPE SECTION EQUIVALENT	SCALE	LITHOLOGY	LITHOLOGIC DESCRIPTION
DEVONIAN	MIDDLE DEVONIAN	FT. CREEK / HUME FM.			0–500		see below
	LOWER DEVONIAN	BEAR ROCK FM.			600–1100		see below

Scale: 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100



Sh-ls inbds Sh 30% hard, bitum, foss, bears Tentaculites, ls 67%, at 15–19' occ in 3" to 12" beds at intervals avg 8".

Ls Br. f.s. lt gy wthd, bitum, mod bdd, Composed ent of Tentaculites & Stylio[illegible] [illegible] & [illegible] mott.

~~[illegible]~~

Ls Med. blsh. gy. f.s., yelsh gy wthd, dns to stron to microfrag'l, mass, highly irreg, bedding evident at intervals from 1' to 10', reefoid, stroms many, lenses of microfrag. bioclast debris, occ. corals, Hexagonaria, Syringopora(?) Common at (1/4" to 1") dk gy. calc. sh. breaks, irreg discont surfaces, Thin Hexagonaria bands at at 72' & 88' Zone of bdding Pl faulting begins at 190' Evidenced by slickensides & extends nearly to the top of the unit, also fault brec. & breaks across mass. bds. At 195' there is a prominent mixed coral zone (Hexagonaria, Syringopora et al) Similar Zones occur at 200', 201' to 206', 185 to 186, 195 to 197, 198 to 204'. Some corals are up to 4" in diameter.

Partially Covered: Scattered outcrops, as below

Ls Med gy f.s., blsh. gy. to yel. wthd, v.f. xln, mass, irreg bdd in 1' to 5' bds, many gen reefoid. V. abund stroms, & commutated remains of corals & brachiopods, [illegible]

Ls As underlying unit except non resistant & contains shale breaks. Sh. dk gy to blk, wthd lt gy to med gy, foss, calc, splits into irreg concave-convex [illegible], grading to ls, Partially covered.

Ls Med gy to blsh gy. f.s., blsh gy wthd, v.f. gn to crs frag, med bdd to mass bdd, Calc Stringers Common, Sugg of reefal buildup, foss. incl stroms, favositids, crinoid debris, brachs, Proetus

Ls & Sh inbds Ls 70% lt gy to lt yel f.s., med gy wthd, lith to frag to Coq, thin to med bdd, foss brach, snails, Pelecypods, ostracods et al. Sh 30% dk gy f.s. with lt gy to [illegible] gy, sub foss, calc in inbds avg 3".

Ls Med. to dk gy wthd, lt gy to yel f.s., v f. xln to lith, alt thick & thin beds, bd f dns, Common 1" to 6" lt gy plastic [illegible] non foss sh breaks, non foss, forms cliff

Ls Med gy to yelsh gy f.s., dk gy wthd, v f gn to lth, alternating thick and thin bdd at intervals of 5', thick bds v hard, thin beds badly frac.

Ls (sl dolc & dolc) Lt gysh bn f.s., med gy to yelsh bn wthd, v f gn, v. thin to thick bdd, irreg. unbrec, Calc filled vugs & stringers common, highly frac at rt. ∠s to bedding Pl. dns. Ramparts - Bear Rock Contact sharp & Conformable at Top of this unit.

Bear Rock Ls lt gy. f.s., gy. to brnsh yel wthd, v f to f gn, mass unbdd. well brec, frags ranging from 1/4" to 12", often forms brec. blocks of dol in matt of ls, numerous wthd vugs, gyps infill common.

Dol lt gy. f.s., med gy. to yel wthd, lith to v f gn, thick to mass. bdd, sl. arg no brec.

1 of

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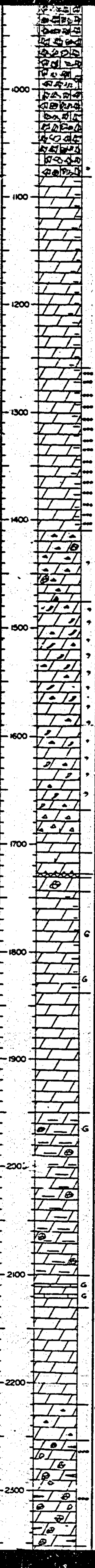
ORDOVICIAN - SILURIAN
UPPER ORDOVICIAN to MIDDLE SILURIAN
SILURIAN
FRANKLIN MOUNTAIN FM.
MOUNT KINDLE FM.



Dol. lt gy f.s., mod gy to yel-wthd, lith to f gn, thick to mass. bdd, sl. arg. no ...

Dol. lt.gy. f.s., olive to cream wthd, lith. to v.f.gn, thick to mass. bdd, arg., sl arg.; very porous, no trace of calcite, fetid when struck, hard & resis.

Chty. dol. lt.gy. to mod. dk.gy., dk.gy. to reddish brown wthd, regular, highly frac. with frac. running at 90° to bdding Planes, few calc vugs & infillings, cup corals occur sparsely throughout unit. Cht. nodules present.
Cht. dk.gy. f.s., brt. red wthd, thin bdd, hard, sl. less resis than chty dol. fetid when struck.

dol: lt.gy. to lt.bn. f.s., lt gy. to mod. dk.gy wthd., v.f.gn. mass bdd, fossiliferous. Corallines the top 41' of the unit is mass, with common cup corals present, chtinol, forms terraces which are hard and resis. dk.gy. ... com.

Dol. v lt.bnsh. gy. f.s., lt.yel. to cm. wthd, lith to f.gn, thin bdd to mod. bdd, fairly resis, occ. beds of limey dol occur within the unit.
wh. to lt gy. cht. occurs in upper 20' of this unit & is scattered rather than being in beds. The unit is Partly grass covered
Dol lt. bnsh. gy. f.s, lt gy. wthd, lith, thin to mod. bdd, v. hard, dns, resis,
Cht. wh. f.s. & wthd, hard, resis, overlain by 2' of thin bdd. cht. sl ...
Dol. v lt gy. f.s. & wthd, ..., lith, mod bdd, small calc vugs & stringers, v hd. & resis.
Dol: Lt.gy. to mod. bn. f.s., dk gy. to brt. yelsh orange wthd, v.f. to f.xln, thin to thick bdd, sl arg., v. glauc. in Places, & hard & dns.

Dol. maroon to purp. f.s., maroon to reddish bn wthd, lith, mod. to mass. bdd v. hard & resis, current bedding very obvious.

Dol. Mod gy. f.s., dk.gy. to dk.yel wthd, v.f. to f.xln, arg., thin to mass bdd, reg. Traces of calc vugs, hard, resis, V. glauc. towards the top of the unit, forming beds in Places.

Glauconitic ls. & dol. intbds: Dol. as in underlying unit, Glau'c. ls. Pale gn. to dk gn. f.s., v l gy to cream wthd, ~~lith mod to thick bdd, hard, resis, fetid when struck~~, v f to f gn, lam. to thin bdd, current bedding obvious, glauc. ls. conc. into beds, intbd. w. dol. in 1' to 2' beds, Approx. 80% dol., 20% glauc. ls.
Dol. mod. to dk. gy. f.s., dk gy. to lt. yel. wthd, lith, mod to thick bdd, hard resis, fetid when struck

Chty. dol. lt gy. to olive f.s., yelsh orange wthd, lith, ~~thin bdd to ...~~ in Places mod. to thick bdd, hard, resis, sl. fetid when struck. Occ. thin bands & lenses of cht. dk. gy. f.s., gnsh. to v lt. bn. wthd.

Dol. Lt. to med gy. f.s., vel. ~~brown~~ orange wthd, ~~nodules~~ lith, thin to thick bdd, vugs and stringers infilled with calcite. Por. good in places, intercln. and vuggy; vy hd and resis., fetid when struck.

Dol. ...

ORDOVICIAN - SILURIAN

UPPER ORDOVICIAN to MIDDLE SILURIAN

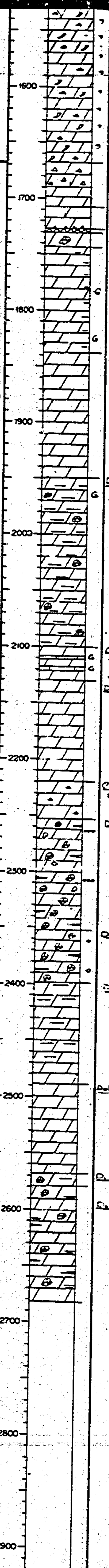
FRANKLIN MOUNTAIN FM.

SILURIAN

MOUN

CAMBRIAN

MID. CAMBRIAN MACDOUGAL GP.



Dol v lt brnsh. gy f.s., lt yel to crm. wthd, lith to f.gnn, thin bdd tomed. bdd, fairly resis., occ beds of limey dol occur within this unit. wh. to lt gy. cht occurs in upper 20' of this unit & is scattered rather than being in beds. The unit is partly grass covered

Dol lt brnsh gy f.s. lt gy wthd, lith, thin to med. bdd, v. hard, dns, resis.,

Cht wh f.s. & wthd, hard, resis., overlain by 2' of thin bdd. cht, sl. pulverized.

Dol v lt gy f.s. & wthd, ..., resis., lith, med bdd, small calc vugs & stringers, v hd & resis.

Dol: lt gy to med bn f.s., dk gy. to brt yelsh orange wthd, v.f. to f. xln, thick bdd, sl arg., v glauc. in places, v hard & dns.

Dol maroon to purp. f.s., maroon to reddish bn wthd, lith, med to mass. bdd v. hard & resis, current bedding very obvious

Dol Mod gy. f.s., dk gy. to dk yel wthd, v.f. to f. xln, arg., thin to mass bdd., rare traces of calc vugs, hard, resis, v. glauc. towards the top of the unit, forming beds in places.

Glauconitic ls. and dol intbds: Dol. as in underlying unit, Glauc'c ls. Pale gn. to dk gn f.s., v lgn to cream wthd, ~~...~~ v.f. to f. gnn, lam. to thin bdd, current bedding obvious, glauc. conc. into bands, intbd. w dol. in 1' to 2' beds, Approx. 80% dol., 20% glauc. ls.

Dol. med. to dk gy f.s., dk gy. to lt yel. wthd, lith., med to thick bdd, hard resis, fetid when struck

Chty. dol lt gy. to dk f.s., yelsh orange wthd, lith, ~~...~~ in places med to thick bdd, hard, resis, sl. fetid when struck. Occ. thin bands & lenses of wh. lt. dk gy. f.s., wthd. to v. lt. bn. wthd.

Dol lt to med gy. f.s., yel orange wthd, lith, ~~...~~, thin to thk bdd, vugs and stringers infilled with calcite. Por. good in places, intercrystalline and vuggy; vy hd and resis, fetid when struck.

Dol lt to med. gy. f.s., yel. to crm. wthd., med xln., thin to thick bdd, vugs and stringers infilled w/ calc, trace of intercryst. por., hd, resis., wthd surf. shows sandy texture.

Dol Lt gy. f.s., yel to crm wthd, lith to v.f. gnn, thin lamd. bdd, highly frac, current bedding obvious in places, hard, arg in part.

Dol. Alternating beds of lith. dol. and med gnn. dol, the lith. dol. is similar to unit # directly below. med gn. dol v.f. crystalline med. gy to yel. gy. f.s., choc. bn. wthd, med. gnn, arenaceous texture, hd., regular med to thin bdd.

Dol. Med. bdk. gy. f.s, yel. to med gy. wthd, lith. to v.f. gnn, med to thk bdd., vy hd., sl. arg., calc. vugs & stringers, forms massive cliff.

Dol Med gy to lt. bn f.s., dk gy. to lt yel. wthd, lith. to v.f. gnn, thin to mass. bdd, hd. resis, fetid when struck, occ. v. thin intbds. of f.s. to subfiss. sh. dk. gn. f.s., lt. gy. wthd., occ. vugs and stringers of calcite, top of unit possible ←Running contact, gradational.

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TEXACO EXPLORATION COMPANY

GEOLOGIC RECONNAISSANCE OF

UPPER and CENTRAL MACKENZIE BASIN
NORTHWEST TERRITORIES

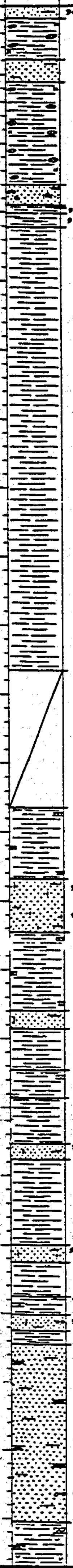
DETAILED STRATIGRAPHIC SECTION

Section Name: IMPERIAL RIVER EAST   Code: IRS-2-59-2

Location: 127°49'W., 65°07'30"N. On east side of Imperial River where it leaves Mackenzie Mountain front; 11 miles south west of confluence of Imperial & Carcajou Rivers.

SYSTEM	SERIES	FORMATION	MEMBER	TYPE SECTION EQUIVALENT	SCALE	LITHOLOGY	LITHOLOGIC DESCRIPTION
CRETACEOUS	LOWER CRET.	SANS SAULT GP.					
DEVONIAN		FM.					

Scale marks: 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100



Ss., med. gysh. bn., wthr. lt. bn., non-calc., sl. ang., f. gnd., foss., strong x-bdg., t. to med. bdd., ppn. to ti.

Sh., bk., wthr. dk. gy. to bk., fam., sl. pyt'c., non-calc., fri., slpt. conc. ±6" long, 1½" d., rec.

Ss., as ab., unfoss.

Sh., as ab.

Ss., med. bn., wthr. yel. bn., sl. gtz'c., glauc., non-calc., ppn., th. bdd. to mass., crs. gnd., sl. congl'c. in lower ..., chrt & gtz. pebs. ... 1. 4" lam. to at. bdd ... crs. gnd. as rest of unit.

Congl. chrt, gtz. pebs., ply. std., ¼"–2" diam., gen. rd., occ. s. ang., mtx. med. gnd. ... ss., ply. cons., rusty wth., w/ sh. ch. incl.

Sh., dd, wthr. rusty bn., rst., ang., non-calc., foss., str. ... ¼" th.

Sh., dk. gy., wthr. lt. gysh. bn., same as ab.

Sh., dk. gy., wthr. ... gy., non calc., v. fri., rec.

Covered.

Sh., med. gy., wthr. lt. gy., non-calc., melanterite on wthd. surf., occ. v. f. gnd. ss. bdn < 2" th.

Ss., med. gy., wthr. lt. gy., sl. arg., sl. calc., 1.2' form, f. to med. gnd., gen. size decr. downward, sl. foss.

Sh., as in unit 583-630'

Ss., med. grsh. gy., wthr. lt. grsh. gy., v. sl. calc., f. gnd., s/ ... arg., sl. x-bdg., lam. to t. bdd.

Sh., dk. gy., wthr. lt. gy. to bnsh. gy., sl. ..., non calc., well indurated, melanterite on wthd. surf., unfoss., rst., @ 753 color and wthg. chgs. of ft. ch. sh.

Sh., as ab., intbdd. ss. bdns 1"–2" th., as in unit 730-745'

Sh., as ab.

Ss., as ab., foss. @ 827-828

Sh., as ab.

Ss., as ab., calc. at 905'–906', foss. at 905'–906'.

Sh. as ab.

Sh., as ab., ss. bdns 6" th. w/ abd. foss. frags at 938.6-939, 940.5-941; 942.5-948'

Ss., as ab., at 960' 6" bdn sl. cgl'c. cont. sh & foss. frags.

Sh., as ab.

Ss., med. gy., wthr. steel-gy. to sl. to rusty bn., non-calc., sl. arg., f. gnd., med. gnd. in places, med. bdd., w/ sh. intbds.

At 1061' ss. is lam. to t. bdd., occ. med. bdd., arg., f. gnd., abd. sh. intbds. in places.

At 1083', 2 cgl. bdns. in ss., w/ sh. incl. & foss. frags.

Intbd. sh & ss., sh., med. gy., wthr. lt. gy., non-calc., mic., well indurated, ss., grsh. gy., wthr. lt. grsh. gy., arg., fi. v. f. gnd., unit mainly sh. but cont. abd. ss. bdns. < 2" th.

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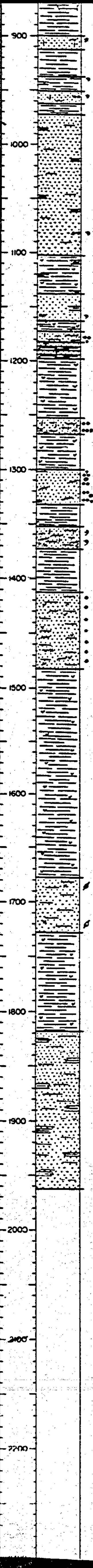
UPPER DEVONIAN

DEVONIAN

IMPERIAL FM



Ss., as ab., calc. at 905'-906', foss. at 905'-906'.

Sh. as ab.

Sh., as ab., lt. lam. 6" th. w/obd. foss. frags at 933.5-937, 944.5-944', 952.5-946'

Ss., as ab., at 960' 6" ban. of cgl's. cont. sh. & foss. frags.

Sh., as ab.

Ss., med. gy., wthr. steel-gy. to ol. to rusty bn., non-calc., sl. arg., f. grnd., med. grnd in places, mod. bdd., frac. in bdr.

At 1061' ss. is lam. to t. bdd., occ. med. bdd., arg., f. grnd., oxidized, cindy in places.

At 1083', 2 cgl. bans. in ss., w/sh. incl. & foss. frags.

Intbd. sh. & ss., sh., med. gy., wthr. lt. gy., non-calc., mic., well indurated, ss., grnd. gy., wthr. lt. grnd. gy., arg., tr. of grn., limit ored. sh. but conf. abd. ss. bans. = 2" th.

Ss., med. grnd. gy., wthr. lt. grnd. gy. arg. lam., occ. sh. ban., f. grnd., lam. to v. t. bdd.

@1158'- 1" ban. ss. w/sh. incl., cgl's. w/occ. foss. frags.

Intbd. sh. & ss., as unit 1183-1138'

Ss., grnd. gn., wthr. lt. gn., arg., v. sl. calc., sl. mic., f. grnd., well indurated, f. por., t. bdd., lam. of arg. mtrl and sh., unfoss. except for lt. masses = 2" th., 6" long. In. sn. local folding.

Intbd. sh. & ss., sh., dk. gy., wthr. lt. gy., to foss. small fault. dark gy., mic., well indurated, ss., med. gy., wthr. lt. gy., mic., fem., v. f. grnd., v. t. bdd., unfoss.

Sh., as in unit in 1183-1198

Ss., lt. gy. to lt. gn., wthr. lt. bn. to grnd. bn., calc., mic., sl. arg., f. grnd., fn. por., v. t. bdd., to t. bdd., at 1263.5 f. grnd. ban. is w/foss. frags., 6" th.

Sh., as ab.

Ss., med. gy., wthr. lt. grnd. bn., arg., dif. bdd., mtrl. com. in frac.'s & bdg. pl., v. f. grnd., f. por., med. to t. bdd. At 1301' to 3d w/obd. foss. frags. At 1328'- 6" ban. f. grnd. ls. w/ foss. (cri., brach., bryozoan) form lg. pt. of ss.

Sh., dk. gy., wthr. grnd. bn., fem., fri., a-ss.

Ss., med. gy., wthr. lt. grnd. bn., arg., mic., calc., fem., occ. carb. plgs., f. grnd., foss., sl. t. bdd.

Sh., as ab.

Ss., med. gy., wthr. grnd. bn., arg., a. sl. pyt., mic., v. f. grnd., n. por., well indurated, occ. carb. plgs., med. bdd., rot.

Sh., dk. gy., wthr. med. gy., mic., fri., bdd. = 6"

Ss., med. gy., wthr. grnd. bn., arg., non-calc., sl. pyt., v. f. grnd., t. bdd., plant rmns. on bdg. pl., approaching silts. in gr. size.

Sh., as ab.

Intbd. sh. & ss., ss., med. dark gy., wthr. lt. bn., arg., cont. sm. sh. lenses, 1" long, v. f. grnd., well indurated, x-bdd., foss., t. to med. bdd. ss. forms bulk of unit. Sh. as ab.

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TEXACO EXPLORATION COMPANY

GEOLOGIC RECONNAISSANCE OF

UPPER and CENTRAL MACKENZIE BASIN NORTHWEST TERRITORIES

DETAILED STRATIGRAPHIC SECTION

Section Name: *INLIN CREEK NORTH* Code *INL-1-59-2*

Location: *126°21'38"W, 64°04'30"N, On south side of large unnamed tributary river to Keele River, 13 miles N12°W of northwest tip of Wrigley Lake.*

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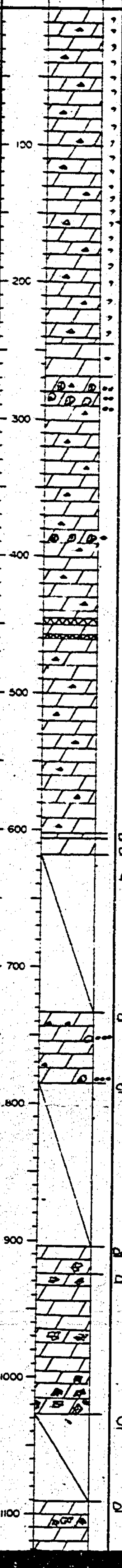
SYSTEM	SERIES	FORMATION	MEMBER	TYPE SECTION EQUIVALENT	SCALE	LITHOLOGY	LITHOLOGIC DESCRIPTION
...OVICIAN	ORDOVICIAN	MT. KINDLE Fm.					
		FRANKLIN MOUNTAIN FM.					



MT. KINDLE Fm.

Dol Dk gy f.s., dull gy wthd, mass., rubbly, rounded abund lenses and discont. bds of cht — usually dk gy, f.s., bk, wthd, occ. wh f.s. & wthd, very fos., mst. colonial corals "Streptelasma, halysites", horn corals, crin. brachs, abund crinoid & gastropod debris, very resis, forming crest of mountain

Dol Metallic grey to blk pur f.s., yelsh bn to bk wthd, med xln, thk to mass bdd, poor intercln fxr in places, mainly hd, not well exposed at top of the slope

FRANKLIN MOUNTAIN FM.

Dol Med Pksh gy to med gy f.s., mott yelsh gy to lt gy wthd, f xln to v.f. xln, hd, dns, resis to weath, occ irreg. lenses of cht throughout. Cht wh. f.s. & wthd, occ. some are pinkish stained in lower 125' of unit. O chty band occurs at 445', cht mott v lt gy to wh f.s. & wthd. The band is rather thin and fairly continuous but shows much pinch and swell. At 385' a band of very vuggy dol (vugs → 2" dia) occurs vugs infilled mainly with coa wh. xln secondary calcite. A second vuggy zone occurs at 275' to 295' similar to the one described above, except the secondary infilling is less complete. A second band of cht similar to 445' occurs at 456'

Dol Maroon f.s., bnsh. mar. wthd, v.f. gn, occ dk lam. on f.s., v thin to thin bdd, vy resis.

Dol Lt blsh gy f.s., lt gy to pale yel mott wthd, v.f. xln, v hd, dns, thick to mass bdd, v resis

<u>Covered</u> Talus slope

Dol Med gy f.s., pale yelsh gy to dk yelsh bn wthd, med xln, occas thin discontinuous zones of good vuggy por, thin to thick bdd, occurs v.t. & v discont. bands of ~~good vuggy por~~ cht along fairly continuous zones. <u>Cht</u> wh. wthd & f.s., hard, frac normal to the bedding.

<u>Covered</u> Talus slope

Dol Dk gy f.s., bnsh yel wthd, v.f. xln, v.hd, dns, med. bdd, resis, hily frac

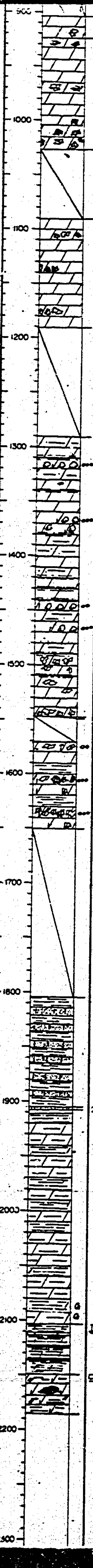
Dol med. gy f.s., med. gy to pale yel mott. wthd, lith, hd, dns, med. bdd. to mass, occas. brec. zones in mass beds. Tabular calcite frags up to 2" across and ¼" thk, well rounded in f xln dol matrix. The matrix is brought into positive relief by weathering. Frags form 80% of brec. zone. Brec. zone forms 25% of the unit, more predominant towards the base. Brec. zones show dull orange on wthd. surf, recessive.

<u>Covered</u> Talus slope.

Dol: Dk gy f.s., bnsh gy to bnsh yel wthd, med. xln to lith, often lam on wthd surf, med. to thk. bdd, w. occ. thin bdd zones, vy hd. dns, resis, forms steep cliff, occas. thin zones of brec. round frags of crystaln dol

UPPER ORDOVICIAN — FRANKLIN (OR…)

MIDDLE CAMBRIAN — CAMBRIAN — MACDOUGAL GP.



Dol Dk.gy.f.s, bnsh.yel.wthd, v.f.xln, v.hd, dns, mod.bdd, resis, hily frac.

Dol Mod.gy.f.s, mod.gy. to pale yel.mott.wthd, lith, hd.dns, mod.bdd. to mass, occas brec. zones in mass beds, Tabular calcite frags up to 2" across and ¼" thk, well founded in f.xln dol matrix. The mottling is brought into positive relief by weathering. Frags form 80% of brec. zone. Brec. zone forms 25% of the unit, more predominant towards the base. Brec. zones show dull orange on wthd. surf, recessive.

Covered Talus slope.

Dol Dk.gy.f.s, bnsh.gy to bnsh.yel.wthd, med.xln. to lith, often lam. on wthd surf, med. to thk. bdd, w. occ. thin sdd. zones, vy hd. dns, resis, forms steep cliff, occas thin zones of brec., round frags of cryptoxln. dol in a medium grained matrix.

Covered probably as below.

Dol. Mod.gy.f.s, bnsh.gy.wthd, lith, alternating thin and thick bdd, occas. Continuous zones of good vuggy por. in thick beds, vuggy zones are Calc, thin bdd zones are very arg., occas silty, show very regular and distinct dk.gy.-lt.yel color lam. on f.s., hd.dns, well developed frac. at rt ∠s to bedding, resis., forms steep cliff. Also occas. beds of sh. avg. 1' thick. mod.gy.f.s, bnsh.gy wthd, lam., non fiss., conch. frac., sl. dol'c. Arg. dol 50%, thick bdd dol 40%, sh. 10%. The thick bdd. dol is brec. at base of unit. Frags are v.ang, cubic, avg ¼" to ½" per side, in dol. matrix, frags 30% of brec. Brec present in lower 60' of the unit.

Covered Mud slope

Dol Brec - dol - Sh. inbds Dol. 65% occurs in two types; Dol brec mainly in lower ⅔ of unit, mod.gy.f.s, bnsh.gy.wthd, frags sharp Tabular, up to 1" across and ⅛" thk, dol in f. to med. xln calc dol matt, frags form 40% of brec. interval, good vuggy por in vugs 1/16" to ¼" dia. in brec. interval, med. to thk. bdd., grading to — dol 40%, color lam. lt. to med. gy. f.s, bnsh.gy.wthd, v.sl. calc., lith, dns., thin to med. bdd, reg., grading sharply into — Sh. dk.gy. f.s, lt.gy.wthd, sub.fiss, fairly hd, conch. frac., pure, breaks into ⅛" sherds. The unit is resistant, and well exposed in a cliff face. Sh. 35%

Covered Uniform mud and talus slope.

Ss. Sh. inbds. Sh. 60% maroon f.s. & wthd, lam. non-fiss., v hd, breaks into small, rectangular sharp cornered blocks, non-calc, occas lt.-dk. maroon color banding on f.s.
Ss 40% wh.f.s, dirty white wthd, v calc, gen. as in 1906'-1908' recessive and poorly exposed. Well developed frac. pattern at rt ∠s to bedding.

Ss lt.gnsh.wh.f.s, lt.gy. to dk. reddish bn. wthd, v.calc, f.grn, well sorted, sub ang. grains, thk bdd., crumbly where exposed to wth. resis, sl. silty.

Arg.dol.-sh. inbds. Arg. dol. 65% dk marsh bn. to lt.gn. f.s., v. dp maroon wthd, v.arg, v.f.xln, regular bdd. in alternating thin bdd. To med. bdd. intervals, characteristic green oxidation product mineral on f.s. on thin bdd. intervals (greenalite?) occ. reg. thin bdd. bands of glauconite at base of unit forming 25% of rock. Base of unit is resis and well exposed, the upper ⅓ of the unit is recessive and generally poorly exposed, Glau. char gn f.s. pelleted, bnsh.yel.wthd, f.grn Sh. 35% Maroon f.s. & wthd, sl dol'c in places. v.thin bdd. to thin bdd, non fiss, occ frac. infilled w. coarse wh. xln. secondary calcite.

Dol'c sh 85% yelish gn.f.s, deep mar. wthd, thin bdd to lam, discont, non fiss, occas thin (⅛") discont beds of dol. similar to underlying unit.

Dol Gnsh.yel.f.s, rusty. yelsh. bn. wthd, v.arg., sl.calc., v.f.xln, thin bdd., irreg. and discont, numerous localized lenses of gyp.— wh.f.s. & wthd, med.grn, fairly pure, occas. lam., showing lt.yelsh. bn. staining on wthd. surf., sl.calc.dns, recessive, poorly exposed on face of steep slope.

Bottom of section.

2 of 2

TEXACO EXPLORATION COMPANY

GEOLOGIC RECONNAISSANCE OF

UPPER and CENTRAL MACKENZIE BASIN
NORTHWEST TERRITORIES

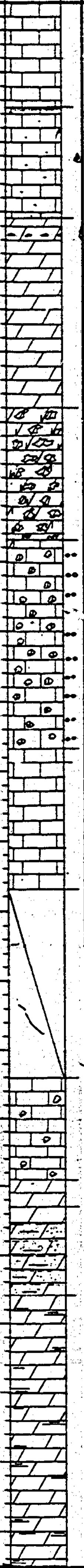
DETAILED STRATIGRAPHIC SECTION

Section Name: INLIN CREEK SOUTH **Code:** INL-3-59-2

Location: 126°24'W., 64°05'30"N. On west side of large Tributary river To Keele River, 2½ miles upstream from INL-1-59-2.

SYSTEM	SERIES	FORMATION	MEMBER	TYPE SECTION EQUIVALENT	SCALE	LITHOLOGY		LITHOLOGIC DESCRIPTION
	MIDDLE DEVONIAN	HUME FM						
...EVONIAN	DEVONIAN	ROCK... FM						

Scale: 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100



Ls. V. dk. gy. f.s., med. gy. wthd., lith., med. to thk. bdd., hd., dns., resis., Caps high topog. ridge, finely frac., infilled w. f. xln. wh. calc. that forming paper-thin stringers

Ls. Lt. gy. f.s. & wthd., f. xln., sl. silty, med. bdd., fairly reg., occ. wt. stringers of crs white xln. 2ndary calcite, the unit becomes v.y. silty to sandy in the top two feet.

Dol: dk. brnsh. gy. f.s., lt. gy. wthd., f. xln., thin to med. bdd., to v. f. bdd. in upper 1/3 of unit. A Chty. zone 1' thk. was observed at 166'. Cht. wh. f.s. lt. gy. wthd., dol'c., fairly continuous but highly deformed. The unit is fairly resis. to wth. forms steep slope.

Dol. Brec. Frags 40% of rock: med. to dk. gy. f.s., dk. brnsh. gy. wthd., v.f. xln., ang., ranging in size from 1/16" to 1" and larger, not wthd. into relief. Matrix: lt. gy. to yelsh. gy. f.s., yelsh. bn. to orange wthd., vf. xln., v. calc., less resis. to wth. than underlying unit, forms thinly covered Talus slope.

Ls. lt. gy. f.s., med. gy. to brnsh. yel. wthd., mass. bdd., v.g. vuggy Por., vugs 1/4" to 1" dia., completely infilled w. crs. xln. 2ndary calcite which often shows bright rusty red (Fe) stain on wthd. surf., v. resis. to wth. forming a vertical cliff, becoming irreg. med. bdd. & less resis. to wth. in top 1/3 of the unit.

Ls. dk. gy. f.s., lt. gy. wthd., v.f. xln., thk. to mass. bdd., fairly reg. to irreg., v.y. hd. dns., resis., forms topog. bench, wth. pocked raindrop pattern mark pattern as 770'–845', fetid when struck, wthd. surf. freq. shows yelsh. staining.

<u>Covered</u>. Talus slope.

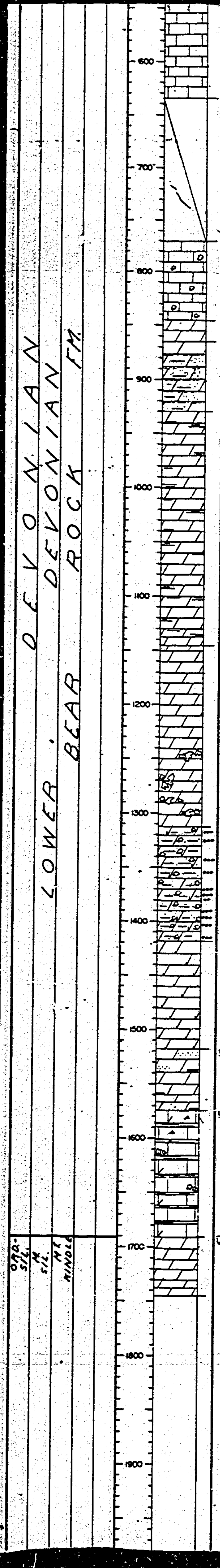
Ls. Med. gy. f.s., lt. gy. wthd., v.f. xln., thick to mass. bdd., fairly reg. to irreg., hd., dns., v. occas. discont. vuggy zones, wthd. surf. shows pocked raindrop pattermark pattern, not as resis. as underlying ls.

Dol. Med. gy. f.s., lt. gy. wthd., v.f. xln., med. to thk. bdd., irreg., hd., dns., pure, resis.

<u>Arg.–silty dol.–Sh. inbds.</u> Dol. 90%: lt. brnsh. gy. f.s., lt. gy. to brnsh. yel. wthd., v. silty to arg. w. occas. beds of pure dol., med. to thin bdd., fairly reg., freq. inbds. of sh. avg. one ft. thk. grading into silty dol. Sh 10% lt. gy. to med. gy. f.s., brnsh. gy. wthd., blocky but not crumbly, non-fos., silty, generally recessive, highly frac., occas. brec.

Dol. lt. gy. to lt. grnsh. gy. f.s., lt. gy. to med. brnsh. yel. wthd., v.f. xln., highly irreg., occas. arg., bds. avg. 1" thick, v. occas. shale beds avg. 1' thk. showing soft, mass. silty to sandy sh. grading quickly into pure dol. Beds of bk. dol. as desc. in unit 845' to 1312' occur in lower 1/3 of unit, gen. resis., hd. & dns.

1 of



... ing resis, forms Topog bench, with Pocked raindrop Pattern Mark Pattern as 770'-865', fetid when struck, wthd. surf. freq. shows yelsh. staining

Covered. Talus slope.

Ls. Med gy f.s., lt gy wthd., v.f. xln, thick terrace bdd., fairly reg. to irreg., hd., dns., v. occas discont vuggy zones, wthd surf. shows Pocked raindrop Pattermark pattern, not as resis as underlying...

Dol. Med gy f.s., lt. gy wthd., v.f. xln, med to thk bdd., irreg., hd., dns. Pure, resis

Arg - silty dol - sh. inbds. Dol. 90% : lt brnsh gy fs, lt gy to brnsh yel wthd., v. silty to arg. w. occas. beds of Pure dol., med to thin bdd., fairly reg., freq. inbds of sh. avg. one ft thk, grading into silty dol. Sh 10% lt gy to med gy f.s., brnsh gy wthd., blocky but not crumbly, non fiss., silty, generally recessive, highly frac., occas brec

Dol. lt gy. to lt gnsh gy. f.s., lt gy. to med. brnsh yel wthd., v.f. xln, highly irreg., occas arg. dol. bds. avg. 1" thick, v occas shale beds avg 1" thk showing soft, mass. silty to sandy sh. grading quickly into Pure dol. Beds of bk dol. as desc. in unit 1105' to 1312' occur in lower 1/3 of unit, gen. resis, hd. & dns.

Dol. Dk. gy. to bk. f.s., lt. gy. to dk. gy. to yelsh. bn. wthd., lith. med. to mass bdd., vy. irreg. freq. brec. zones in lower Part of unit avg. 6" thick, inver. in bk. dol., ang. frags. avg. 1/16" to 1" in dia., in lt brnsh yel. matr. matr. comprises 20% of brec. zone. Red Staining occurs on wthd. surf. of brec. zone. Brec. zone grades to very highly frac. rock in the upper Part of the unit, frac. Completely infilled w. wh. calcite, forming a fine network of interlacing air mail stationery thin stringers of calcite.
Note: The unit is composed mainly of gy. dol. w. occas. 1' to 5' bands of bk. dol. comprising no more than 20% of the unit. The bk. dol. is more highly frac. or brec. in general. The unit is vy. hd., dns., resis. to wth., yelsh. bn. wthd. surf. appears due to iron staining.

Dol. lt gy. to dk gy. f.s., lt. tan med. gy. to yelsh. bn. wthd., vy. slty. to arg., v. good vuggy Por. in general w. occas. tight zones. ~~vuggy Porosity~~ vugs mainly 1/32" occ >1" dia., f to v.f. xln, resis to wth, sl. calc., thin to mass. bdd., highly irreg.

Dol. lt. gy. f.s., lt. brnsh gy. wthd., lith. to v.f. xln., med to thk bdd., highly irreg., hd., dns., resis., occas. discont. rusty red thin lam on wthd. surf., gen. sl. calc., occas. thin stringers of crs. xln white secondary calcite.

Dol. Med. gy. f.s., lt. gy. to yelsh gy. wthd., f. xln to crs. xln, thin to med bdd., irreg., discont. lt. gy. pure sh. breaks, freq. silty bands towards the top, silty bands are brought into relief by weathering, resistant.

Ls.-Sh. inbds. Ls: 80% lt. gy. to yelsh gy. to dk. gy. wthd., med. gy. f.s., occas dol'c., mainly thin bdd., reg., w. localized thin zones of shadow brec. f. to v.f. xln, occas. stringers of crs. wh. xln secondary calcite, inbd. w. Sh. 20% lt. gy. f.s., pale yelsh gy. wthd., lam., pure hard, brittle, nonfiss., occurs in massive 3' to 5' beds within the ls., occas. chty. vugs near the top of the unit, not as resis. as underlying unit.

Dol. Med. gy. f.s., lt. gy. to yel. wthd., v.f. xln to lith., thin bdd. to occas. med. bdd., fairly reg., splits readily along bdding. pl., hd., resis., forms cliff.

Bottom of section

2 of 2

TEXACO EXPLORATION COMPANY

GEOLOGIC RECONNAISSANCE OF

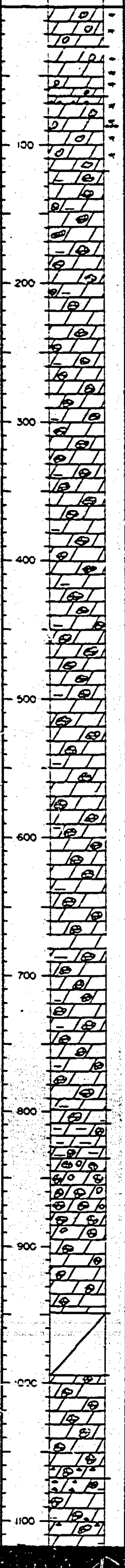
UPPER and CENTRAL MACKENZIE BASIN NORTHWEST TERRITORIES

DETAILED STRATIGRAPHIC SECTION

Section Name NORMAN RANGE Code NRS-1-59-2

Location 126°48'W., 65°22'30"N. Seven miles due north of the east end of the Norman Wells airstrip, on the north facing scarp of the Norman Range.

SYSTEM	SERIES	FORMATION	MEMBER	TYPE SECTION EQUIVALENT	SCALE	LITHOLOGY	LITHOLOGIC DESCRIPTION
ORDOVICIAN - SILURIAN	SILURIAN	MT. KINDLE					
	UPPER ORDOVICIAN to MIDDLE SILURIAN	FRANKLIN MOUNTAIN FM.					



Dol., lt. gy., wths. lt. gy. to brnsh. gy. f. gr., intense intlg of vugs & fract., gives unit recfal app., but contains no fos., med. bdd.

Dol., as ab., med. grnd. w/a bd. vugs & fract.

Dol. lt. gy., wths. lt. gy. to brnsh. gy., med. grnd., med. bdd., qtz intlg of frac. & vugs.
@ 69'-5" bnn wd. cht.
92'-99' - crs. grnd., fri. on wthd. surf., gd. por.

Dol. lt. gy. to brnsh. gy., wths. brnsh. gy., f. grnd., vuggy, w/ca. intlg., t. to med. bdd., sl. arg., unfoss. Lith. of unit remarkably uniform, w/minor variation in color, grn size & bdg. thnss.

160'-179' - med. grnd., approaching crs. grnd. in places., fe. stnd., abd ca. intlg., ca crs xln.

559'-569' - med. grnd. as in unit 160'-179'

Dol., lt. gy., wths. dk. gy. to brnsh. gy., med. grnd., v. sl. arg., fe. stn. com., abd. ca. intlg. thru't., ca. is crs. xln.

Dol., dk. bn., arg., vuggy w/secondary ca in[illegible] f. grnd., 824'-30' bds. at. to lam., 824-834 med. to th. bdd.

Dol., lt. brnsh. gy., wths. lt. gy. to yel. bn., f. grnd., vuggy w/ca. intlg., med. to th. bdd., v. pure, only slightest tr. of arg. mtrl.

Above 889' dol. is v. vuggy, ca. intlg of frac. com.
890'-899' - dol. v. t. bdd.
904'-3" bnn dol. has green color on fresh & wthd. surf., sim. bnn. at 903'-904'

Covered.

Dol., med. to lt. gy., wths. yell. bn. to bk., f. grained, th. bd., vugs and fract. infld w/ca. com.

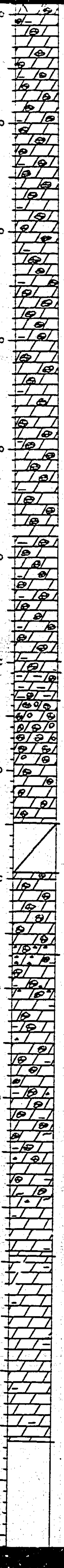
1054'-2" bnn med. to dk. gy. dol. cht.

Dol., med. to lt. gy., wths. yel'sh. bn to bk. f. xln., v. sl. arg., v. th. to t. bdd. below 1214', th. bd. ab. 1214', ab. 1319' wd. cht. lam. occ. occasionally., occasionally dol is med grnd., carb. mtgs. occasional in bnns to 5" th. (eg. 1294-1299)
Above 1299 vugs & fract. infld w/ca. com.
1090'-1104' - wd. cht. bnns to 1" th., dol med. bdd.

ORDOVICIAN - SILURIAN

UPPER ORDOVICIAN to MIDDLE SILURIAN

FRANKLIN MOUNTAIN FM.



559'-569' - med. good as in unit 144'-179'

Dol., lt. gy., w/tho. dk. gy. to brnsh. gy. med. good, v. sl. arg. Fe. stn. com., abd. ca. infllg. thru't., ca. is [illegible]
Dol., dk. brn., arg., vuggy w/secondary ca. infllg., f. grnd., 824'-[illegible] bds. at. to lam., 824-834 med. to th. bdd.

Dol., lt. brnsh. gy., w/tho. lt. gy. to yel. brn., f. grnd., vuggy w/ca. infllg. med. to th. bdd., v. pure, only [illegible] of arg. mtrl.

Above 889' dol. is v. vuggy, ca. infllg. of frac. com.
890'-899' - Dol. v. t. bdd.
904' - 3" bed dol. has green color on faces [illegible] surf., sim. 1" bed. at 905'-906'

Covered.

Dol., med. to lt. gy. w/tho. yell. brn. to bk., f. grained. th. bdd., vuggy and fract. infld w/ca. com.

1064' - 2" bed med. to dark gy. dol. [illegible]

Dol., med. to lt. gy., w/tho. yel'sh. brn to bk. f. xln., v. sl. arg., v. th. to t. bdd. below 1214', th. bdd. ab. 1214', [illegible] 1319' [illegible]
lam. occ. occasionally., occasionally dol. is med. grnd.,
Carb. mtrl. occasional in bds to 5" th. (eg. 1294'-1299')
Above 1299 vugs & fract. infld w/ca. com.
1098'-1104' - [illegible] bds 5-6" th., dol. med. bdd.
1077-1078 - local green stn on dol.
1075 - lenses and nod. of dol. [illegible] to 1½" diam.
1071 - dol. [illegible] bed.

Carb. mtrl. and Fe stn. occur in local bds.

Dol., med. gy., w/th. lt. gy'sh. brn. to yel'sh. brn. sl. sucr., v. sl. arg., v. t. bdd. to t. bdd., [illegible], unfoss.

1484-1494' - dol. lam., otherwise as rest of unit.

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TEXACO EXPLORATION COMPANY

GEOLOGIC RECONNAISSANCE OF

UPPER and CENTRAL MACKENZIE BASIN

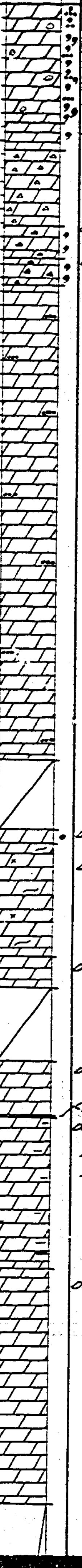
NORTHWEST TERRITORIES

DETAILED STRATIGRAPHIC SECTION

Section Name: CAP MOUNTAIN SOUTH   Code: CAPMS-59-2

Location: 123°14'W., 63°21'N. Immediately south of headwaters of Hodgson Creek and 5 miles S15°E of Mount Kindle.

SYSTEM	SERIES	FORMATION	MEMBER	TYPE SECTION EQUIVALENT	SCALE	LITHOLOGY	LITHOLOGIC DESCRIPTION
SILURIAN		MT. KINDLE Fm.			0–200		Dol., dk.-med. gy., weath. gy. [illegible], f. xln., med. to mass. bdd., v. [illegible] gdsomething [illegible] in places, [illegible] vug. por. in [illegible], foss., abd. colonial corals form 75% of unit, [illegible] adj.
							From 15' to 23' yel. gy. sparsely foss. dol., otherwise as ab.
					100		Dol. med. gy., weath. lt. gy., v.f. xln., th. bdd., [illegible], sparsely foss. w/ [illegible] Halysites [illegible].
							Two types of dol.: dk. gy. dol., weath. gy., f. to v.f. xln., [illegible] (75%) [illegible], f. xln., bd., Ti., occurs in [illegible] lenses (15%) & dol. [illegible] gy. [illegible] (10%)
							Con't. med. to th. bdd., [illegible], rst., foss.
							Dol., med. gy. to dk., weath. med. gy., v.f. xln., prod. th. to mass. bdd., [illegible] bd., rst., abd. dk. cht. nods., foss. w/ [illegible] corals & occ. Halysites [illegible]
							Dol., med. gy., weath. lt. med. gy., v.f. gran., prod. th. bdd., occ. med. to mass. bdd., abund. foss., [illegible] & colonial corals, abd. dk. cht. nods., foss. form 8 to 10% of rock.
					200		Dol. lt. med. gy., weath. lt. med. yel. gy., v.f. gran., t. to med. bdd., to th. bdd., bd. & Ti., rst., [illegible] along bdg. plns. & fract. Dol. is locally congl.'c w/ [illegible] cht. & qtz. grains < 1 mm. diam.
							Above 297 dol. has fetid odor.
					300–600		
					600		Dol., med. dk. gy., weath. lt. med. gy. to dk. gy., f. gran., med. to th. bdd., foss., occ. bitumen inclusions.
							Dol., med. gy., weath. dk. gy., v.f. gran., occ. cord. pt. qz., occ. [illegible], bd. & Ti., med. to th. bdd. Above 689 occ. bright red stn. on bdg. plns.
ORDOVICIAN - SILURIAN	ORDOVICIAN ?/ MIDDLE	FRANKLIN MOUNTAIN FM.			700		Dol., lt. med. gy., weath. lt. med. yel. gy., v.f. gran., med. to th. bdd., bd., Ti., rst.
							Dol., med. gy. to med. dk. gy., weath. yel. bn. to med. dk. gy., v.f. xln., prod. med. to occ. t. bdd. & th. bdd., bd., Ti.
					800		Cgl., qtz. pebbles & dk. cht., rd., well sorted, grns. 5 & 3 mm., matrix [illegible] med. dk. gy. dol., bd. & Ti.
							Dol., med. to lt. dk. gy., weath. yel. bn. to med. dk. gy., v.f. gran. to microxln., t. to med. bdd., bd., Ti., rst., [illegible]
							At 819-821 - red dol. as 849-853
							At 849-853 - red dol. as 910-912, no pebbles or sh. ptgs.
					900		At 889-890 - red dol., as at 910-912 - only sl. congl.'c.
							At 910-912 dol. is hem. red. & congl.'c, dol. cont. cht. & qtz. pebbles, also cont. green waxy sh. ptgs., dol. is f. xln.
							Dol., lt. sl. dk. gy. to med. gy., weath. med. dk. gy. to lt. gy. to sl. yel. bn., v.f. to microxln., prod. med. bdd., occ. t. bdd., sl. foss., bd., Ti., rst.
					1000–1100		



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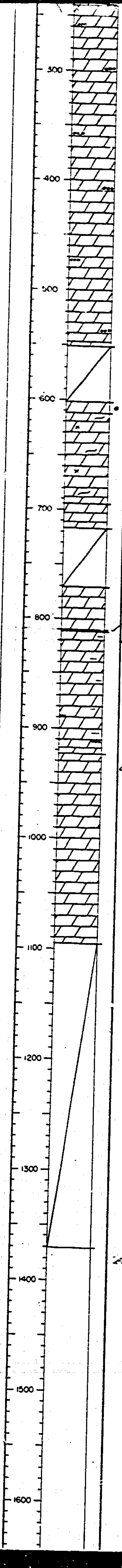
ORDOVICIAN - SILURIAN

UPPER ORDOVICIAN to MIDDLE SILURIAN

FRANKLIN MOUNTAIN FM.



Above 297 dol. has fetid odor.

Dol., med. bngy., with lt. med. gy. to bngy., f. gran., med. to th. bdd., frac., occ. bitum. inclusions.

Dol., med. gy., with dk. gy., v.f. gran., occ. carb. ptgs., occ. pyt. mas., bd. fr., med. to th. bdd. Above 689 occ. bngy. & red stn. on bdg. plns.

Dol., lt. med. gy., with lt. med. yelgy., v.f. gran., med. to th. bdd., hd., ti., rst.

Dol., med. gy. to med. bngy., with yel. bn. to med. bngy., v.f. xln., arnd. med. to occ. t. bdd. & th. bdd., hd., ti.

Cgl., qtz. pebble & bn. cht., rd., well sorted, pebs. < 4.3 mm, matrix arg. med. bn. gy. dol., hd. fr.

Dol., med. to lt. bn. gy., with yel. bn. to med. bngy., v.f. gran. to microxln., t. to med. bdd., hd., ti., rst., v. sl. arg.

At 819-821 - red dol. as 849-853

At 849-853 - red dol. as 910-912, no pebbles or sh. ptgs.

At 889-890 - red dol. as at 910-912 - only sl. congl's.

At 910-912 dol. is hem. red. & congl's., dol. cont. clasts of qtz pebbles also cont. green waxy sh. ptgs., dol. is f. xln.

Dol., lt. sl. bngy. to med. gy., with med. bngy. to lt. gy. to sl. yel. bn., v.f. to microxln., brd. med. bdd., occ. t. bdd., sl. frac., hd., ti., rst.

Estimated Top of Cambrian at 1370'

TEXACO EXPLORATION COMPANY

GEOLOGIC RECONNAISSANCE OF

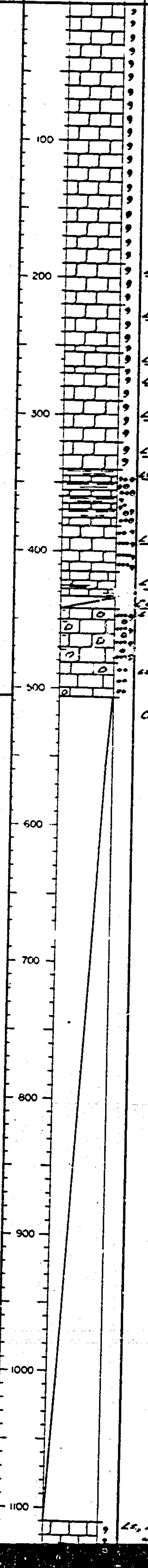
UPPER and CENTRAL MACKENZIE BASIN NORTHWEST TERRITORIES

DETAILED STRATIGRAPHIC SECTION

Section Name: *IMPERIAL ANTICLINE* Code: *IA-1-59-2*

Location: *128°45'W. 65°27'30"N. On north flank of Imperial Anticline, five miles northeast of mouth of Campsite Creek.*

SYSTEM	SERIES	FORMATION	MEMBER	TYPE SECTION EQUIVALENT	SCALE	LITHOLOGY	LITHOLOGIC DESCRIPTION
		KEE SCARP FM.					Bedding plane fault at top of section.
							Ls., lt. gy. to dk. gy. bn., wthd. lt. gy., mass., reefoid, ls. abt. 60% stroms., remainder cladopora, other corals & coral debris in a cln. mtx. of varying grade size. Occ. zones of nod. cht. in upper 50'.
							Ls., th. bdd., same lith. as unit above.
							Ls., lith. as unit 0'-190'.
							Ls., th. bdd., lith. as unit 0'-190'
							Ls., lith. as unit 0'-190'
							Ls., lith as unit 0'-190', th. bdd.
							Ls., lith. as unit 0'-190'. *Stringocephalus* sp. 5' ab. base.
							Ls. & Sh., Ls., bn. gy. to dk., wthd. dull yel. gy., f. to med. grained to frag., p. to fr. inter. and intfrag. por., t. to med. irreg. bdd., s. petrolif., foss., cladopora & other coral frags abd., Sh., dk. gy. to blk., wthd. same, bitum. impt., occasionally looks burned w/red-bn color, Coral frags com., stroms. com., *Productus* sp. pres., Ls. 50%, sd. inbds. to 12" th. forms 50%. Ls. almost entirely strom. mtrl.
							Ls., wh. to thick to med. bdd. bn.-gy., wthd. lt. gy. to bn. yel., cryptoln. to microfrag. to crs. frag., med. bdd. to mass., med. to excellent por., s. petrolif. in pt., reefoid, stroms., colonial corals, brachs., crinoid debris.
							Ls. & Sh., as unit 340'-382' but less Sh., Ls. 90%, Sh. 10%
							Covered. Prob. as ab.
							Ls., bn. gy., wthd. lt. gy. to gy. yel., comp. mainly of p. pres. corals and coral frags. in fine mtx., mass. unbdd., rarely jntd., & frac. gd. vug & frac. por., s. petrolif., v. foss., occ. brach zones, dom. discont. arg. lenses to 6" th. & 3' long, comp. almost entirely of cladopora frags in bitum. arg. ls. mtx., occ. stroms. per. p. destroyed by recryst.
							Ls., med. gy. to bn. gy., wthd. dull gy. to yel. gy., crypto-cln. to med. xln., med. bdd., fairly reg., fr. vuggy intmational por., foss. comp. pred. of ... and ...
DEVONIAN	MIDDLE DEVONIAN	HARE INDIAN FM.					Covered.
							Ls., lt. flesh gy. to med. gy., wthr. lt. yel. gy., med. to v.f. grand, mass., ... reefoid ...



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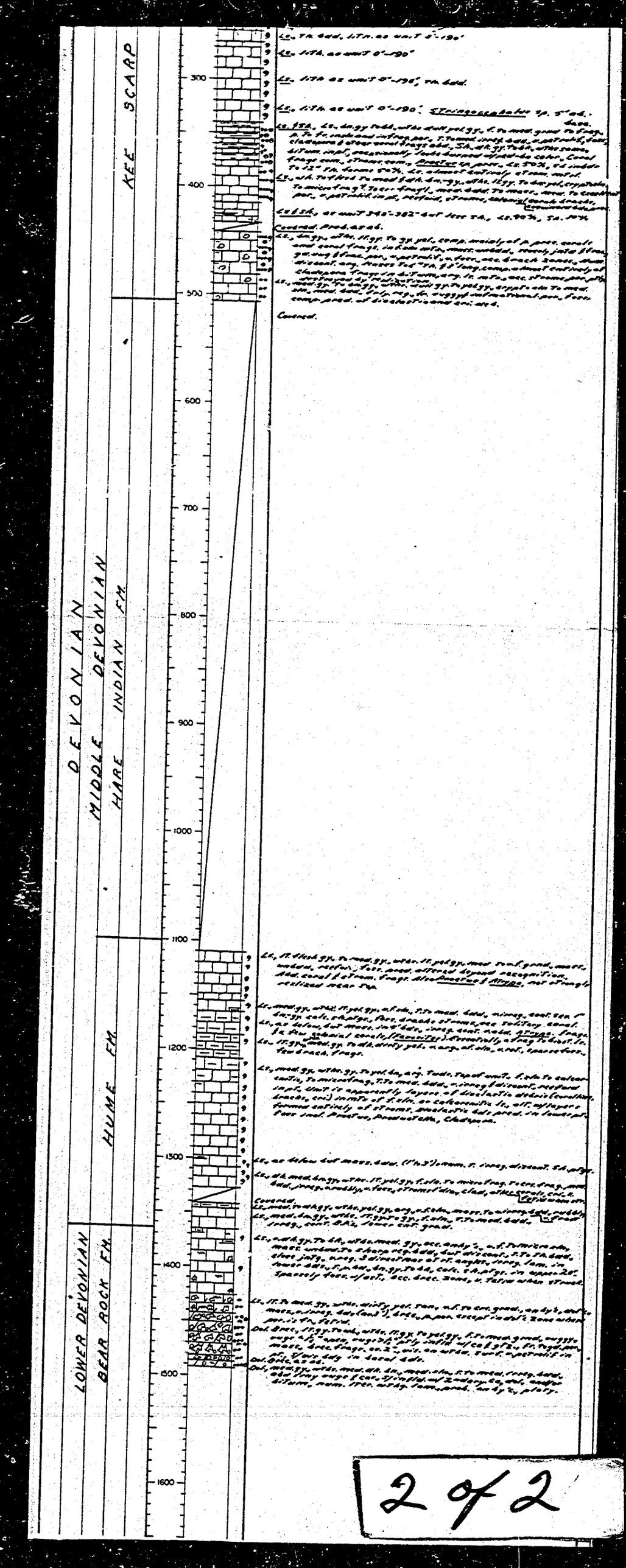

DEVONIAN
MIDDLE DEVONIAN
HARE INDIAN FM.
KEE SCARP
HUME FM.
LOWER DEVONIAN
BEAR ROCK FM.
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600

TEXACO EXPLORATION COMPANY

GEOLOGIC RECONNAISSANCE OF

UPPER and CENTRAL MACKENZIE BASIN
NORTHWEST TERRITORIES

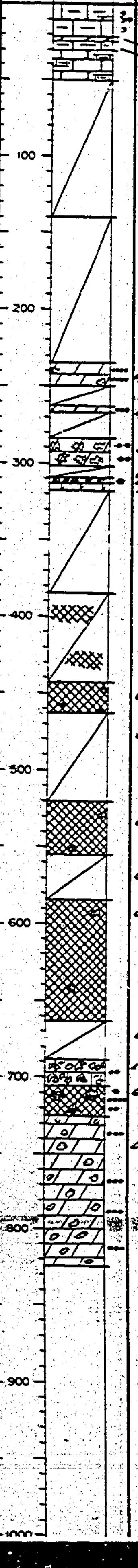
DETAILED STRATIGRAPHIC SECTION

Section Name: *THOMAS MOUNTAIN* Code: *TM-1-55-2*

Location: *127°37'W, 65°32'30"N. On south scarps of several low ridges two miles southwest of southern tip of Moon Lake.*

SYSTEM	SERIES	FORMATION	MEMBER	TYPE SECTION EQUIVALENT
DEVONIAN	MIDDLE DEVONIAN	HUME FM		
DEVONIAN	LOWER DEVONIAN	BEAR ROCK FM.		
ORD.-SIL.	U.ORD.-M.SIL.	MT. KINDLE		

SCALE / LITHOLOGY



LITHOLOGIC DESCRIPTION

Ls. lt. tan-gy., wthg. lt. gy. to yel. gy., arg., cryptoxln., mass. but discont. bds. every 1'-2'; contains com. coral frags., 1" dia. @ 2' conc. almost entirely of crinoids.
Ls. med. gy., wthg. yel. gy., mass., nubbly, [illegible]
Ls. lt. olive gy., wthg. lt. gy. to yel., arg., cryptoxln., [illegible]
Ls. [illegible], med. gy., f. xln., [illegible] frags., [illegible] bdd., arg., nubbly, [illegible], abund. [illegible] and [illegible] corals, [illegible] crinoid [illegible], Sh. lt. gy., wthg. lt. yel. to lt. gy., calc., [illegible], discont. & grades to ls. along strike.

Covered.

Covered.

Dol., med. brn. gy., wthg. med. gy., med. gr., excellent [illegible] por., lt. & dk. lam. grading to shadow lams., t. bdd. to mass. appearing.
Covered.
Dol., med. gy., wthg. same, f. xln., [illegible], calc., med. lam. to mass. appearing., lt. [illegible] lam. on [illegible] wthd. surf. & fetid when struck.
Covered.
Dol., med. gy., wthg. lt. gy. to yel. brn., f. xln., mass., brec., no [illegible] por., poor vuggy & intfrag'l por., petrolif.
Covered.
Dol., lt. & dk. gy., wthg. dk. gy., f. xln., mass., brec., petrolif.
Ls., dk. gy. to blk., wthg. dk. brn. to yel. brn., dol., f. xln., th. bdd., [illegible], slty., [illegible] irreg. discont. lam.

Covered.

Covered. Apparently gyp. as below.

Gyp., w/ls. frags., u. ply. exp.

Covered.

Gyp., w/ls. frags. as unit 705-724, u. ply. exp.

Covered.

Gyp., w/ls. frags., as unit 705-724, less 1%

Covered.

Ls., med. brn. gy., wthd. crm. gy., gyp., vuggy to cavernous, mass. & brec. on lg. scale (8" blks), v. fetid when struck, rotten.
Gyp., no ls., wthg. wh., v. deeply wthd., por., arg., pumice-like text., v. por. and porous mass., crumbly, fluffy, 2"-4" ls. frags. com., med. brn. gy., wthg. lt. gy., med. xln., [illegible] por., vuggy, gyp., petrolif., faint discont. lam.
Dol., lt. gy. to med. brn. gy., wthd. lt. gy. to yel. [illegible], med. xln., sacch., w/ v. gd. xln. por. in [illegible], vuggy, vugs to [illegible] diam., prly. filled w/ dol. [illegible], fetid when struck, mass. bdd., bds. rge. from 1'-8', regular.

TEXACO EXPLORATION COMPANY

GEOLOGIC RECONNAISSANCE OF

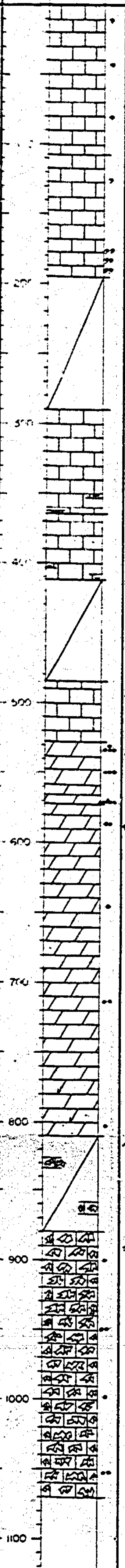
UPPER and CENTRAL MACKENZIE BASIN NORTHWEST TERRITORIES

DETAILED STRATIGRAPHIC SECTION

Section Name *HODGSON CREEK* Code *HOD-1-59-2*

Location *123° 24' W., 65° 22' 30" N. On west side of small south-flowing tributary to Hodgson Creek, 3 miles north of Hodgson Creek & 7½ miles due east of north end of Mt. Gaudet.*

SYSTEM	SERIES	FORMATION	MEMBER	TYPE SECTION EQUIVALENT	SCALE	LITHOLOGY	LITHOLOGIC DESCRIPTION
DEVONIAN	MIDDLE DEVONIAN	HUME FM.					Ls. med. dk. to med. lt. gy., wt. to microxln., hd. & tr., conch. fract. Stroms & foss. frags. rare, rs to thk. bdd., mdly to bly wthg.
							Ls. dk gy., pred. microxln. below 135'; pred. wt. xln. ab. 135', hd & tr., conch. fract. R wth co units, sparsely foss. Stroms com. in 1.20', cri. & brach. frags rare, th to v th bdd., wthg med. lt. gy. and slty, occ. sl. fetid odor
				200			Covered
				300			Ls. med. lt. to med. dk. gy., wthg med. to med. lt. gy., pred. crypto to microxln., occ. wt. xln near centre of unit, rare pel. ls. w/ patchy ply wx., clear wt patches of co in many bds. lower 15' cont. 15% T. bdd. sl. arg. ls. in 6" to 3" bds.
				400			Ls., med. dk. to med. lt. gy., micro to crypto xln., occ. wt. xln., rare pel. ls., Cryptoxln bds contain wt co filled vug-like [illegible], wthg med. gy. and slty, 20% of 1.40' is 6"-3" bds. of sl. arg. ply wthg ls.
							Covered
				500			Ls. med. dk. to med. lt. gy., pred. cryptoxln w/ conch. fract. [illegible] cont. ply pres. pellets and at least [illegible] bds are calcarenite. Calcarenites are f. sd. size or smaller, bds wth. dk. to med. lt. gy., th. bdd., ply exposed, rec.
							Dol. wht. to lt. bn., occ. med. bn., crs. to v. crs. xln, por. excellent to nil, pred. fr. to gd., about 20% of bds porous, bds rotten and usually semi-fri., t. bd. to lam., w/ plys between bds med. dk. bn. gy., wthg v. lt. gy., wthr slty to mass., cryptoxln are well developed and unit is not a calcarenite. 15' bd. sl. calc. cryptoxln, lt. bn. gy. dol @ 565'
				600			Dol. med. to dk. gy. bn., wthg med. gy. bn. to med. bn. gy., f. to v. f. xln., occ. microxln., lower 5' med. xln., r. wf. vug. por. nr top, hd., upper 5' semi-fri., r. bds in lower 60' sl. calc., lam., slty wthg, 1.20' occ. sl. slty
				700			
				800			
	LOWER DEVONIAN	BEAR ROCK FM.					Pred. Covered, r. o/c similar to unit below.
				900			Ls. brec., med. dk. bn. gy. to med. dk. gy., occ. lt. gy. bn., mtx always ls., frags. both ls. and dol., dol. is lt. to med. gy., micro to f. xln, lam. ls. in 1/4 frags., ls. frags and ls. mtx vary markedly within nodes. Colour varies between med. dk. bn. to med. dk. gy., mtx and most of ls. frags hd., but por., semi-fri.; lt. gy. bn. ls. occur. Vugs rare in 1/4 dor. Ab. 960' bds wth. med. gy., below 960 wth lt. gy., mtx matt., no vis. bdg.
				1000			
				1100			



TEXACO EXPLORATION COMPANY

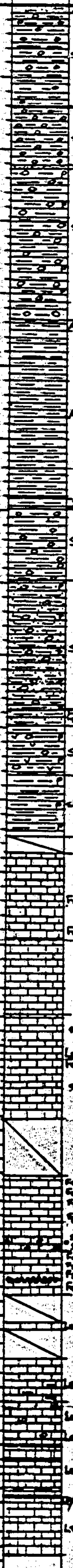
GEOLOGIC RECONNAISSANCE OF UPPER and CENTRAL MACKENZIE BASIN NORTHWEST TERRITORIES

DETAILED STRATIGRAPHIC SECTION

Section Name: Prohibition Creek **Code:** Pro 1-59-2

Location: 12 6°14' N., 65° W. Along Prohibition Creek, about four miles upstream from its mouth. Prohibition Creek is 18 miles southeast of Norman Wells.

SYSTEM	SERIES	FORMATION	MEMBER	TYPE SECTION EQUIVALENT	SCALE	LITHOLOGY		LITHOLOGIC DESCRIPTION
DEVONIAN		FORT CREEK GP.					Ss	lt. gy., weathers same/lt. yel., small, f.-grained, non-calc., [illegible], rare.
							Sh	blk., weathers lt. gy./lt. yel., non-calc., [illegible], 90% of this unit covered, thin bdd.
								lt. gy., weathers same/lt. yel., sl. argill., non-calc., [illegible], f.-grained, [illegible], rare.
					100		Sh	blk., weathers same/lt. gy., fiss., non-calc. v. thin bdd., covered by [illegible] in most pts., concretions common throughout interval.
								lt. gy., weathers lt. brn./yel. f.-grained, [illegible] bdd., non-calc., [illegible], rare, sl. [illegible] staining.
							Sh	Covered Interval (shaly talus). Sh - lt. gy./med. gy., weathers lt. gy./wht., v. thin bdd., fissile/sub-fissile, iron-stone concretions which are sl. pyritized, non-calc.
					200		Arg	shaly in pt., argillaceous, gy./blk., weathers bright yel., bd., concoidal fract., [illegible] (bdg. indistinct) [illegible]
							Arg	sl. shaly, argillaceous blk., weathers lt. gy./bright yel., highly argill., traces coal, bd., concoidal fract., bdg. indistinct, rare.
					300			[illegible]
							Sh	lt. gy., weathers lt. brn./yel., v. thin bdd./papery, v. fiss., concoidal fract., brittle, non-calc., small concretions approx. 1" in diameter, recessive weathering, highly fract., ironstone concretions.
					400		Sh	med. gy./dk. gy., weathers lt. brn./yel., thin bdd. (1/4"), laminated, becoming v. sandy, micaceous, non-calc., recessive weathering, concretions which are pyritic & composed of ironstone.
					500			blk., weathers blk./yel., calc. [illegible], thin bdd., platy, sl. silty/sandy.
							Sh	med. gy./dk. gy., weathers brn./yel., thin bdd. (1/2"), highly laminated, non-calc., [illegible], sub-fiss., [illegible] with [illegible], concretions which are pyritic, sl. micaceous.
							Sh	blk., weathers lt. brn.-gy., thin/platy bdg., non-calc., fiss./sub-fiss., recessive weathering, [illegible], sl. pyritic in places.
								Covered Interval.
					600		Fm	
							Fm	dk. gy./blk., weathers bright-yel.-orange, lith., bd., dense, mass., bd., few calcite stringers.
	MIDDLE DEVONIAN	HUME FM.			700		Lst	dk. gy./med. brn., weathering med. gy./med. brn., f.-grained, alternating thin & med. bdd., loosely held together (fract.), sl. fossil, [illegible] in v. small quantities
								Covered Interval.
					800		Lst	lt. gy./blk., weathers [illegible]/med. gy., [illegible] f.-grained, [illegible] bdd. with [illegible]/thin bdd., [illegible] large fossil content. This unit [illegible] unit [illegible] in [illegible]
								[illegible]
					900			Covered Interval.
							Lst	dk. gy., weathers yel.-brn., [illegible] f.-grained [illegible]
								Covered Interval.
							Lst	dk. gy./blk., weathers lt. brn.-gy., [illegible] [illegible] in this unit.
							Lst	[illegible] in small quantities [illegible]
					1000		Lst	[illegible]
							Lst	med./dk. gy., weathers [illegible], appearance of nodular lith. [illegible] med./thick bdd., [illegible] fract., [illegible] but rare [illegible]
								dk. gy./blk., weathers [illegible]
							Lst	med./dk. gy., weathers lt. yel.-gy., lith./f.-grained, med./thick bdd., highly fract., dense, fract. easily along bdg. plane.
					1100			



TEXACO EXPLORATION COMPANY

GEOLOGIC RECONNAISSANCE OF

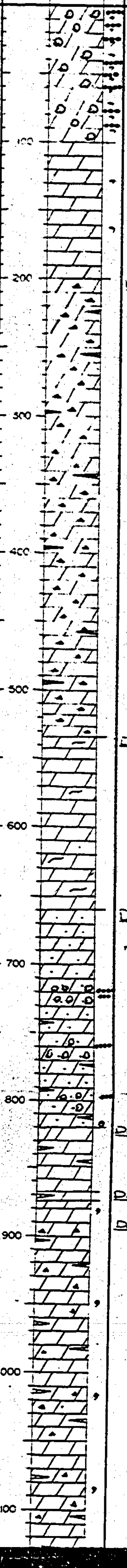
UPPER and CENTRAL MACKENZIE BASIN
NORTHWEST TERRITORIES

DETAILED STRATIGRAPHIC SECTION

Section Name: INLIN CREEK EAST Code: INL-2-59-2

Location: 125°22'W. 66°03'N. On east side of same large tributary as INL-1-59-2, 2 miles due south of INL-1-59-2.

SYSTEM	SERIES	FORMATION	MEMBER	TYPE SECTION EQUIVALENT	SCALE	LITHOLOGY	LITHOLOGIC DESCRIPTION
ORDOVICIAN - SILURIAN	ORDOVICIAN + MIDDLE SILURIAN	MOUNT KINDLE FM.					



Dol. Lt brnsh gy f.s., lt gy wthd, med bdd V + wh to f. xln, silty texture, numerous scattered vugs making it extremely porous, foss. containing colonial corals

Dol. Med gy f.s., lt gy wthd, med bdd, weathering f. xln, [illegible] thk bdd at base of unit but thin to thin bdd towards the top. A well silicified algae was seen.

Dol. Dk gy to bk f.s., dk gy wthd, v f. xln grn, [illegible] bk stringers and vugs, huge bk c[illegible] lenses up to 6" across, recur nd dns, resis.

Dol. lt gy to olive f.s., lt gy to wh wthd, lith. to f. grn, med to thk bdd, hd, resis., carbonaceous in part, frac. at rt ∠s to bedding pl. fetid when struck

Dol. dk gy to dk choc. bn. f.s., mott dirty wh. to dk gy. wthd., f. xln, nodular appearance, silty, calcite stringers, resis, porous in part, lower 1' of this unit is very bitum, in places the unit has excellent vugular porosity.

Dol. Med gy f.s., lt gy to olive wthd, thin to med. bdd, dns, hd, resis, calcite stringers, unfoss.

Dol. lt gy f.s., white to olive wthd, lith, dns, hd, splinters when struck, thk bdd to mass, resis.

Dol. dk gy to bk f.s., med gy to dk gy wthd, f. grn to med grn, resis, hd, calc stringers, corals sparse, occas bk & wh. chert, vugs, halysites was seen in places.

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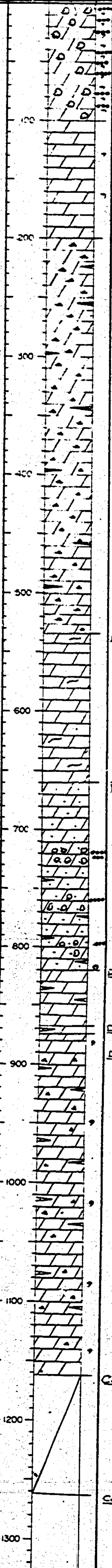
ORDOVICIAN - SILURIAN

UPPER ORDOVICIAN to MIDDLE SILURIAN

MOUNT KINDLE FM.



Dol. Lt brsh gy f.s., lt gy wthd, mass bdd, [illegible] xln to f xln, silty texture, numerous scattered vugs making it extremely porous, foss. containing colonial corals.

Dol. Med gy f.s., lt gy wthd, med bdd, [illegible], [illegible] to thk bdd, at base of unit but thin to thn bdd towards the top. A well silicified algae was seen.

Dol. Dk gy to blk. f.s., dk gy wthd, v.f. xln grn, [illegible] stringers and vugs. Large blk. cht lenses up to 6" across occur [illegible] nd dns, resis.

Dol. lt. gy. to olive f.s., lt gy to wh wthd, lith to f. grn, med to thk bdd, hd, resis., carbonaceous in part, frac. at rt < to bedding pl. fetid when struck.

Dol. dk. gy to dk. choc. bn. f.s., mott dusty wh. to dk. gy. wthd, f. xln, nodular appearance, silty, calcite stringers, resis, porous in part, lower 1' of this unit is very bitum, in places the unit has excellent vugular porosity.

Dol. Med. gy. f.s. lt gy to olive wthd, Thn to mass. bdd, dns, hd, resis, Calcite stringers, unfoss.

Dol. lt gy. f.s., white to olive wthd, lith, dns, hd, splinters when struck, Thk bdd to mass., resis.

Dol. dk. gy. to bk. f.s., med. gy. to dk. gy. wthd, f. grn to med. grn, resis, hd, calc. stringers, corals sparse, occas blk & wh. cht. [illegible] halysites was seen in place.

Covered. Talus slope.

Covered. Trees & grass - small valley

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TEXACO EXPLORATION COMPANY

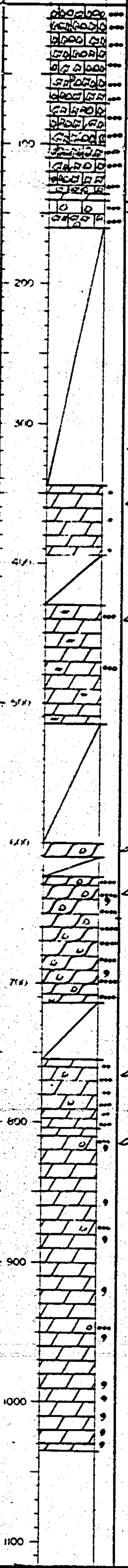
GEOLOGIC RECONNAISSANCE OF
UPPER and CENTRAL MACKENZIE BASIN
NORTHWEST TERRITORIES

DETAILED STRATIGRAPHIC SECTION

Section Name *CAP MOUNTAIN WEST* Code *CM-N-1-59-2*

Location *125°26'30"W, 65°24'30"N. On west side of an unnamed mountain, 5 miles southwest of Cap Mountain and 8 miles west of the Mackenzie River.*

SYSTEM	SERIES	FORMATION	MEMBER	TYPE SECTION EQUIVALENT	SCALE	LITHOLOGY	LITHOLOGIC DESCRIPTION
DEVONIAN	LOWER DEVONIAN	BEAR ROCK FM.					
ORDOVICIAN - SILURIAN	RONNING GP.	MOUNT KINDLE FM.					



Ls., sim. to below, lt. gy. to v. lt. gy.

Ls., occ. stylol., f. xln., med. gy. to med. bn. gy., f. xln., v. vuggy, vugs 5"-1.1" dia., rotten from str., comp. in bdg., most is entirely brec., good vuggy por. is direct result of brec.

Dol., med. gy. bn., v.f. xln., v. sdy.

Ls., lt. gy. to lt. gy. bn., v.f. to microxln., v. vuggy, vugs to 3" dia., about 3 of 4 bds are brec., bdg. ply. poor, but vis. in upper bds.

At 320 poor exp. of dol., as below.

Dol., v. lt. gy. bn. to med. lt. gy. bn., f. to v.f. xln., occ. microxln., ply. exp., hd., r. pp. pp. por. in occ. bd.; wthr. lt. gy., ply. bdd.

Dol., lt. gy. to v. lt. gy., micro to crypto xln., occ. v.f. xln., no f'ls. occ. bd. has gd. vuggy por., wthr. v. lt. gy. to lt. yel., may be gypsiferous, th. to v. th. bdly. wthg.

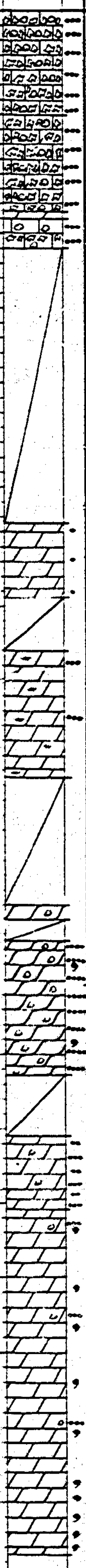
Dol., sim. to that below, no. out good vuggy por.

Dol., lt. bn. gy., yel. tinge, to med. lt. gy. bn., f. to v.f. xln., excellent vuggy & inter-xln. por. in 60% of bds., 2/3 bds. have granular text. & are semi-friable, por. occ. lg. colonial coral, but most fossils destroyed by recrystallization, med. to th. bdd., likely reefoid origin.

Dol., as below, good to fr. vuggy por. in most bds.

Dol., med. gy. bn. to lt. bn. gy., f. to v.f. xln., occ. microxln., abd. foss., esp. in lower 50', above 985 abd. horn corals & stromatoporoids, com., rec., occ. gd. vuggy por., th. to v. th. bdd., etc. wthr. med. to med. dk. gy.

SYSTEM	SERIES	FORMATION	MEMBER	TYPE SECTION EQUIVALENT	SCALE	LITHOLOGY	LITHOLOGIC DESCRIPTION
DEVONIAN	LOWER DEVONIAN	BEAR ROCK FM.					Ls., sim. to below, lt. gy. to v. lt. gy.
					100		Ls. occ. [illegible], f. xln., mod. gy. to med. brn. gy., f. xln., v. vuggy, vugs [illegible] dia., [illegible] upper bds. [illegible]
							Dol. med. gy. brn., v.f. xln., [illegible]. Ls. lt. gy. to lt. gy. brn., v.f. to microxln., v. vuggy, vugs to [illegible] dia., about [illegible] of bds. are [illegible] upper bds.
					200		
					300		At 320 poor smpl. of dol. as below.
							Dol. v. lt. gy. brn. to med. lt. gy. brn., f. to v.f. xln., occ. microxln., [illegible]
					400		Dol. lt. gy. to v. lt. gy., micro to crypto xln., occ. v.f. xln., [illegible] gd. vuggy por., [illegible] lt. gy. to lt. yel. may be gypsiferous, [illegible]
					500		
ORDOVICIAN - SILURIAN	RONNING GP.	MOUNT KINDLE FM.			600		Dol., sim. to that below, [illegible] but good vuggy por.
							Dol. lt. brn. gy., yel. tinge, to med. lt. gy. brn., f. to v.f. xln., excellent vuggy & intxln. por. in 60% of bds., [illegible] most fossils destroyed by recrystallization, [illegible]
					700		
							Dol., as below, good to fr. vuggy por. in most bds.
					800		Dol. med. gy. brn. to lt. brn. gy., f. to v.f. xln., occ. microxln., abd. foss., esp. in lower 50', above 985 abd. horn corals & stroms. com., [illegible] occ. gd. vuggy por., [illegible] med. to med. dk. gy.
					900		
					1000		
					1100		
					1200		
					1300		



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TEXACO EXPLORATION COMPANY

GEOLOGIC RECONNAISSANCE OF

UPPER and CENTRAL MACKENZIE BASIN NORTHWEST TERRITORIES

DETAILED STRATIGRAPHIC SECTION

Section Name *DAHADINNI RIVER* Code *DAH-1-59-2*

Location *125°02'30"W, 63°55'N. Along edge of canyon cut by Dahadinni River, where river cuts through a mountain ridge on west side of Dahadinni Range. 5 miles south southwest of Mt. Dahadinni.*

SYSTEM	SERIES	FORMATION	MEMBER	TYPE SECTION EQUIVALENT	SCALE	LITHOLOGY	LITHOLOGIC DESCRIPTION
DEVONIAN	MIDDLE DEVONIAN	HUME FM.					Ft. Creek contact very close to Top of Section.

1 of 1

Covered Interval

DEVONIAN
MIDDLE DEVONIAN
HUME FM.

LOWER DEVONIAN
BEAR ROCK

1300
1400
1500
1600

END OF SECTION

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FIG NO. 8
FENCE DIAGRAM OF THE
SILURIAN - ORDOVICIAN
GENERAL LITHOLOGY AND CORRELATION OF MEASURED SECTIONS
NORMAN WELLS - WRIGLEY AREAS N.W.T.

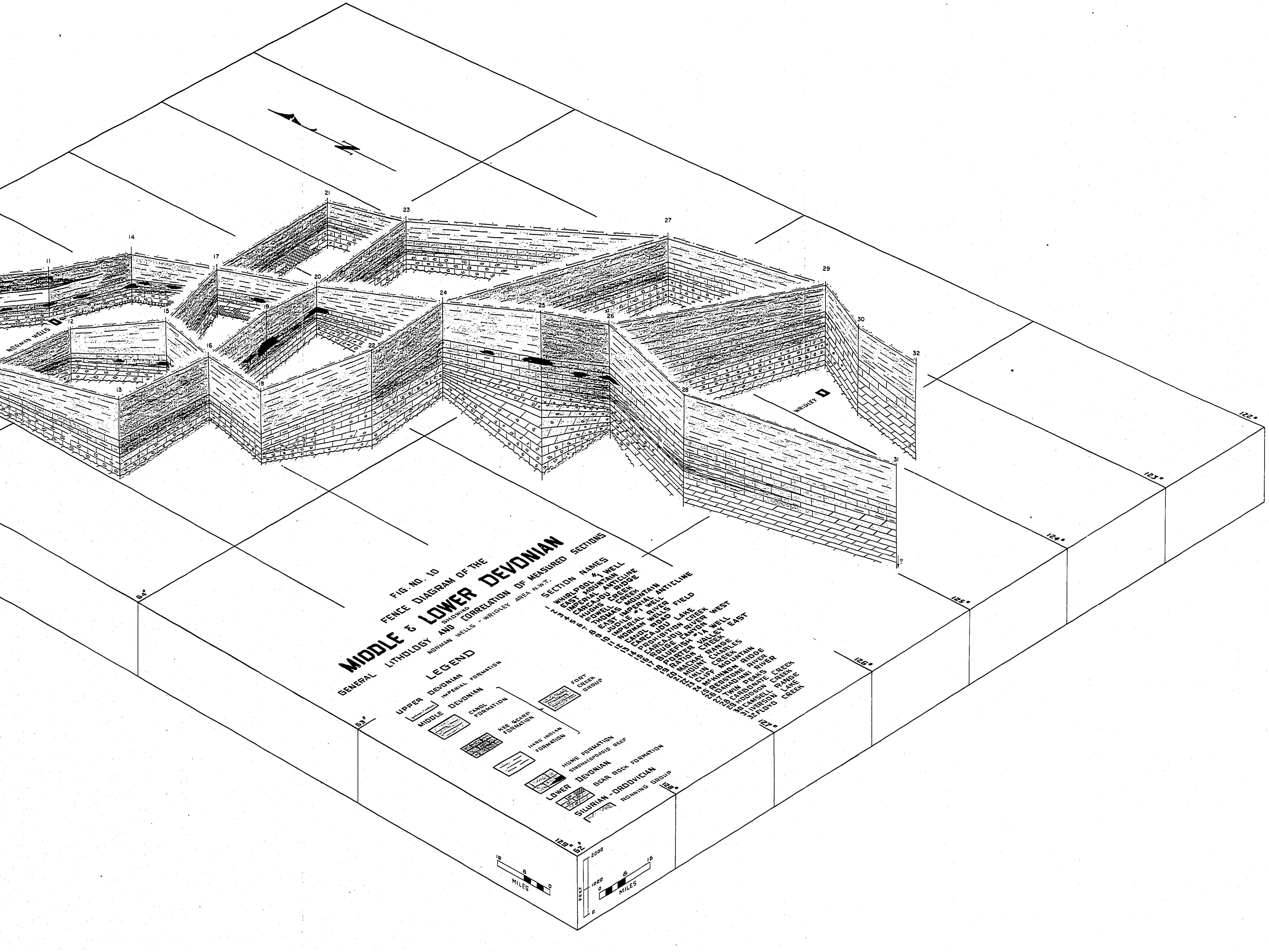
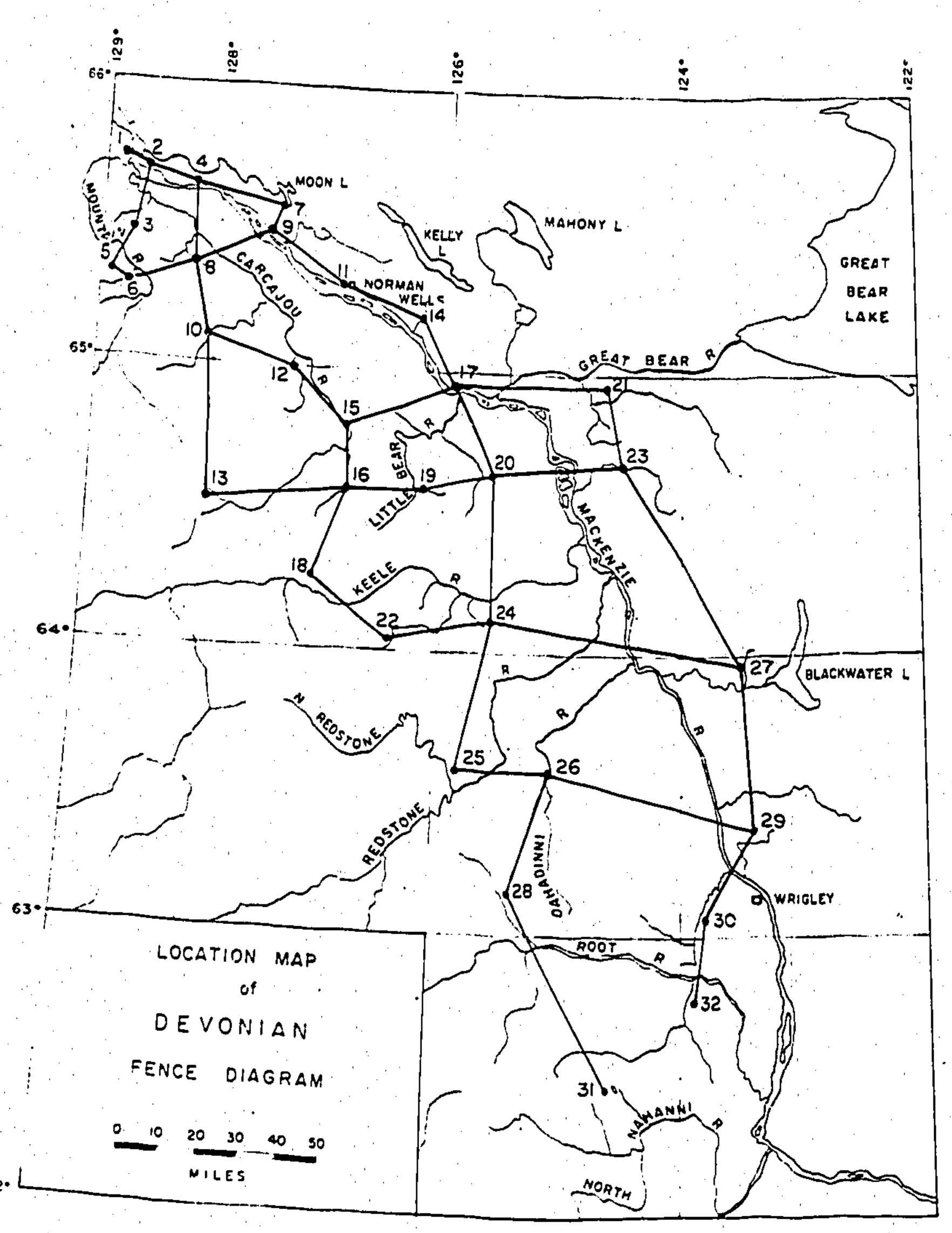


FIG. NO. 10
FENCE DIAGRAM OF THE
MIDDLE & LOWER DEVONIAN
SHOWING
GENERAL LITHOLOGY AND CORRELATION OF MEASURED SECTIONS
NORMAN WELLS - WRIGLEY AREA N.W.T.
SECTION NAMES
1 WHIRLPOOL #1 WELL
2 EAST MOUNTAIN
3 IMPERIAL ANTICLINE
4 CARCAJOU RIDGE
5 HUGHS CREEK
6 FOWELL CREEK
7 THOMAS MOUNTAIN
8 EAST IMPERIAL ANTICLINE
9 JUDILE #1 WELL
10 IMPERIAL RIVER
11 NORMAN WELLS FIELD
12 CANOL ROAD
13 CARCAJOU LAKE
14 PROHIBITION CREEK
15 CARCAJOU RIVER WEST
16 ROUGE CANYON
17 BLUEFISH #1A WELL
18 PORTER VALLEY EAST
19 RATION CREEK
20 MACKAY RANGE
21 MOUNT CHARLES
22 INLIN CREEK
23 CLIFF MOUNTAIN
24 McKINNON RIDGE
25 REDSTONE RIVER
26 DAHADINNI RIVER
27 TWIN PEAKS
28 CARBONATE CREEK
29 HODGSON CREEK
30 CAMSELL RANGE
31 IVERSON LAKE
32 FLOYD CREEK
LEGEND
UPPER DEVONIAN
IMPERIAL FORMATION
MIDDLE DEVONIAN
CANOL FORMATION
KEE SCARP FORMATION
HARE INDIAN FORMATION
FORT CREEK GROUP
HUME FORMATION
STROMATOPOROID REEF
LOWER DEVONIAN
BEAR ROCK FORMATION
SILURIAN - ORDOVICIAN
RONNING GROUP
NORMAN WELLS
WRIGLEY
N
MILES
FEET
2000
1000
0
16
8
0
62°
63°
64°
65°
122°
123°
124°
125°
126°
127°
128°
129°


LOCATION MAP
of
DEVONIAN
FENCE DIAGRAM
0 10 20 30 40 50
MILES
GREAT BEAR LAKE
NORMAN WELLS
WRIGLEY
BLACKWATER L
KELLY
MAHONY L
MOON L

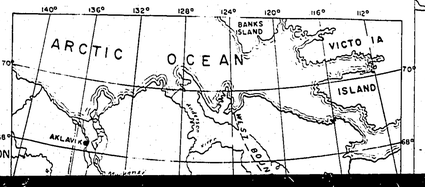
LOCATION MAP
OF
STRATIGRAPHIC SECTIONS
NORMAN WELLS — WRIGLEY AREA

SCALE

MILES 8 7 6 5 4 3 2 1 0 8 16 24 32 MILES

FIG. 2

INDEX MAP



LEGEND

● STRATIGRAPHIC SECTION LOCATION

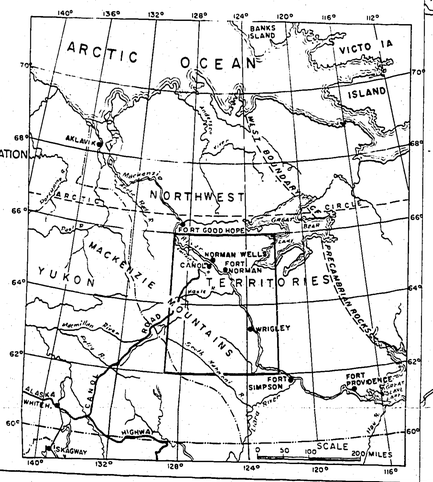
1 of

LOCATION MAP
OF
STRATIGRAPHIC SECTIONS
NORMAN WELLS — WRIGLEY AREA

SCALE
MILES 8 7 6 5 4 3 2 1 0 8 16 24 32 MILES

FIG. 2

INDEX MAP



LEGEND

- ● STRATIGRAPHIC SECTION LOCATION
- ▲ INSPECTED LOCALITY
- ✧ CANOL WELL LOCATION
- □ BASE CAMP LOCATION
- TEXACO ACREAGE

MEASURED SECTIONS

CODE	NAME
FLOYD-1	FLOYD CREEK EAST
FLOYD-2	FLOYD CREEK WEST
CCK-1	CARBONATE CREEK
CAMS-1	CAMSELL RANGE
WCS-1	WATERFALL CREEK
CAPMS-1	CAP MOUNTAIN SOUTH
HOD-1	HODGSON CREEK
CMW-1	CAP MOUNTAIN WEST
CAP-1	CAP MOUNTAIN NORTH
RED-1	REDSTONE RIVER NORTH
RED-2	REDSTONE RIVER SOUTH
DAH-1	DAHADINNI RIVER
RTS-1	REDSTONE TRIBUTARY
KRS-1	KEELE RIVER SOUTH
FMS-1	FALLING MOUNTAIN
TWP-1	TWIN PEAKS
INL-1,2,3,4	INLIN CREEK
KIN-1	McKINNON RIDGE
OTC-1	OUTCROP MOUNTAIN SOUTH
PVW-1	PORTER VALLEY WEST
PVE-1	PORTER VALLEY EAST
KRT-1	KEELE RIVER TRIBUTARY
CJLS-1	CARCAJOU LAKE SOUTH
ROU-1	ROUGE CANYON
RAT-1	RATION CREEK
TEH-1	TERTIARY HILLS
MCR-1	MACKAY RANGE
CMS-1	CLIFF MOUNTAIN
CJRS-3	CARCAJOU RIVER EAST
CJRS-4	CARCAJOU RIVER WEST
DCS-1	DODE CANYON
CJRS-1	CARCAJOU RIVER NORTH
CAR-1	CARCAJOU CANYON
MCS-1	MOUNT CHARLES
CHAR-2	ST. CHARLES MOUNTAIN
CRS-1	CANOL ROAD
IMPRS-2	IMPERIAL RIVER EAST
IMP-1	IMPERIAL RIVER WEST
HC-1	HAWK CLIFFS
PRO-1	PROHIBITION CREEK
JACK-1	JACKFISH LAKE
IA-1	IMPERIAL ANTICLINE
GMS-1	GYPSUM MOUNTAIN
EIA-1	EAST IMPERIAL ANTICLINE
NRS-1	NORMAN RANGE
BOSCK-1	BOSWORTH CREEK
CR-1	CARCAJOU RIDGE
TM-1	THOMAS MOUNTAIN
EM-1,2	EAST MOUNTAIN
MLN-1	MOON LAKE NORTH

INSPECTED LOCALITIES

CODE	NAME
WIL-1	WEST IVERSON LAKE
WIL-1A	WILLOWLAKE RIVER
WRP-2	WEST ROOT PERMIT
RP-3	ROOT PERMIT
IL-8-8	OCHRE RIVER
WIG-1	WRIGLEY
JON-1	JOHNSON RIVER
IL-19-7	KEELE RIVER EAST
OTC-2	OUTCROP MOUNTAIN NORTH
IL-CJL	CARCAJOU LAKE NORTH
ELB-1	LITTLE BEAR RIVER SOUTH
MR-1	MACKENZIE RIVER
LBR-1	LITTLE BEAR RIVER NORTH
IL-1-3-7	ST. CHARLES CREST
JR-1	JUNGLE RIDGE
IL-1-7	WEST IMPERIAL RANGE
EIA-1A	EAST IMPERIAL ANTICLINE
SMC-1	SOUTH MAHONY CREEK
SML-2	SOUTHEAST MAHONY LAKE
IS-2-29-6	EAST MAHONY LAKE
IS-1-29-6	NORTHEAST MAHONY LAKE
SML-1	SOUTH MAHONY LAKE
CLM-1	CLEAVER MOUNTAIN
ML-1	MOON LAKE
GC-1	GREEN HORN CREEK
MAH-1	MAHONY PERMIT
MAH-2	NORTH MAHONY LAKE
BM-1	BROKENOFF MOUNTAIN

2 of 2

drilling. In many instances, the fine-grained nature of the sand, which is often argillaceous and silty, detracts somewhat from the favorability as a reservoir rock, but in no way excludes it. The lenticular nature of the sandstones may provide important stratigraphic traps at any locality within the area where the Imperial formation exists.

None of the Imperial shales have been described as bituminous. It is believed that the oil shows present in the subsurface at Norman Wells are a result of oil migration upwards through fractures from underlying strata.

In the area immediately west of Wrigley, the upper part of the Imperial formation contains coral reefs about 100 feet thick. Although beds equivalent to the reef zone outcrop north and west of Wrigley, it is possible that the reef horizon, if it exists, may be buried sufficiently to be important as a hydrocarbon reservoir in the area south of Wrigley and west of the Mackenzie River.

Paleogeography.-Depcsition of the dark grey to black Canol formation ended abruptly and early Imperial sediments, marked by an abrupt increase in sand and silt, were laid down over large areas. The rapid and general increase of coarser clastics into the sea in earlier Imperial time is indicative of general emergence of the surrounding land areas. In general, sandstone content decreases upward, indicating gradual submergence of the surrounding landmass following initial uplift.

In the southern part of the area, reefs occur in the upper half of the Imperial formation. The exact relationship of the

depositional environment of the reefs to that of the sandstone and sandy shales is unknown, but the two facies were deposited simultaneously within a relatively short distance. Sandstone content decreases southward from the report area and limestone content increases in the same direction.

At some localities, post-Devonian erosion removed many of the Upper Devonian sediments previously deposited (e.g. East Mountain area). Martin (1960, oral presentation at First International Symposium on Arctic Geology) suggested the possibility that some folding took place in the Franklin Mountains in late Paleozoic time. Whether or not actual folding occurred is as yet unknown, but epirogenic movement of the general area of the Franklin Mountains seems likely.

A basin which was initiated in upper Fort Creek time in the southernmost part of the area was well developed and continued to accumulate sediments after deposition of Imperial sediments ended in the Norman Wells area. Several thousand feet of strata, younger than any beds farther north, exist in this basinal area. Although it is possible that beds equivalent to post-Imperial sediments were deposited throughout the report area (and have been subsequently removed) it is not likely.

Following Upper Devonian sedimentation, much of the shelf area on the outer part of the craton became positive throughout the report area and over large portions of the Northwest Territories. A huge positive dome known as the Yukon high occupied the central part of the Yukon Territory. It was

joined to the craton to the east, forming a large nose over which no sediments were deposited from late Upper Devonian to late Lower Cretaceous time. The extent of this very important high is very well illustrated in successive stages by Warren and Stelck (1958, page 38-41).

Cretaceous

General Statement.-Cretaceous sediments are very poorly exposed and in the report area occur only in river and stream cuts of the Mackenzie Plains.

A brief discussion of Cretaceous sediments is presented here, but the reader is referred to the summary of the Canol Project (Hume, 1954, page 47) for a more detailed discussion of Cretaceous sediments.

Contacts.-The Cretaceous disconformably overlies Devonian beds. Near Sans Sault Rapids, Upper Devonian sediments, which are present farther south, are entirely missing, and Cretaceous rocks rest directly on Middle Devonian carbonates. On Imperial River (section IRS-1-59-2), the Cretaceous-Upper Devonian contact is marked by a chert and quartz pebble conglomerate and conglomeratic sandstone interval 20 feet thick. The conglomerate occurs as thin beds within the sandstone. This conglomerate zone has been reported by Parker (in Hume, 1954, page 48) on the Mountain River.

Lithology, Correlation, and Thickness.-Cretaceous sediments have been divided into four divisions within the report area, as follows: Sans Sault formation (oldest), Slater River formation, Little Bear formation and East Fork formation (youngest).

The term "Sans Sault group" has been applied to marine shales and sandstones which overly Devonian beds in the Sans Sault Rapids and Mountain River areas. Parker (in Hume, 1954, page 48) described the group and states that they are about 1,400 feet thick. The upper beds contain Lower Cretaceous fossils. Nowhere in published literature is the term "Sans Sault group" used southeast of the East Mount-Imperial River area.

The Slater River overlies the Sans Sault group and is composed of black shales with characteristic thin bands of bentonite throughout. Its thickness is approximately 1,000 feet, although Parker describes an anomalous 2,150 feet of shale with minor sandstone on Mountain River which he assigns to the Slater River formation. Stewart (1945) states that fossils present in it are thought to be Upper Cretaceous in age.

The Little Bear formation has its type section on Little Bear River. It consists of sandstones, conglomerates, sandy shales, shales and some coal seams (lignite). No complete sections are exposed, but 780 feet of Little Bear formation has been measured on Little Bear River (Stewart, 1945).

The uppermost formation of the Cretaceous is the East Fork. It overlies the Little Bear and consists of grey, marine shales 850 feet thick at its type section on the East Fork of Little Bear River. The East Fork is not recognized north of Little Bear River.

One major discrepancy in correlation exists between the Sans Sault and the Bear Rock areas. At Sans Sault Rapids,

the Sans Sault group was identified as Lower Cretaceous. In outcrop near Bear Rock, however, Stelck (in Hume, 1954, page 51) collected Upper Cretaceous fossils in outcrop and in his description of the Cretaceous sediments in the Bluefish No. 1A well, does not give any of them a Lower Cretaceous age. He places them in the Slater River and Little Bear formations. If Stelck is correct, an estimated 1,500 feet of Lower Cretaceous Sans Sault equivalent are missing at Bear Rock. Since Sans Sault equivalents are present in northern Alberta, and the sea which inundated northern Alberta transgressed from north to south, it is likely that Sans Sault sediments were deposited in the Bear Rock area. If not present today, they have been eroded by post-Lower Cretaceous erosion. No evidence for such an unconformity exists, and it is not impossible that the Cretaceous sediments in Bluefish No. 1A are Sans Sault equivalents.

Source and Reservoir Rocks.-Although the Cretaceous shales and sandstones are favorable as possible source and reservoir rocks, their favorability is offset by the fact that over most of the Mackenzie Plains, the Cretaceous has been strongly eroded. The Little Bear formation which is composed predominantly of sandstone is often porous in outcrop and is the most favorable formation suitable for hydrocarbon accumulation. Unfortunately, it occurs high in the Cretaceous and is often exposed or missing. The more deeply buried sandstones within the Sans Sault group are more favorable as a possible reservoir rock, but little is known of

them in the subsurface.

Paleogeography.-In Lower Cretaceous time, the boreal sea gradually advanced from the Arctic in successive stages and inundated the interior of the Northwest Territories. Early Lower Cretaceous time saw the sea confined to the lower Mac-Kenzie River area northwest of the report area. By late Lower Cretaceous, it had advanced southward and well onto the plains of western Canada. The crest of the Yukon high was still positive but it was separated from the craton by the Cretaceous seas. Sands and shales greatly predominate Cretaceous sedimentation and it is likely that both the Yukon high and the major craton to the east contributed sediments to the Cretaceous sea of the Northwest Territories.

Upper Cretaceous sedimentation was a continuation of Lower Cretaceous conditions but the sea was more widespread.

Tertiary

Tertiary sediments are present in a localized area roughly bounded by the Mackenzie Mountains and Little Bear River on the west, the Keele River to the south, and the McConnell Range of the Franklin Mountains to the east. The northern limits of the Tertiary are less definite but it is unlikely that Tertiary sediments are present farther than 10 miles north of Great Bear River.

In the MacKay Mountains area, Tertiary sediments dip to the northeast. Equivalent beds at Old Fort Point on the Mackenzie River dip to the southwest, implying that Tertiary sediments occupy a basin with its centre approximately

at the headwaters of MacKay Creek. No other Tertiary basins are present in the report area.

Tertiary sediments overly the Cretaceous with an angular unconformity, although none of the known literature describes the contact from field-observed outcrop. Recent erosion has strongly truncated Tertiary sediments outward from the centre of the present Tertiary basin.

Only one partial section of Tertiary strata was inspected by Party 59-2 (section TEH-1-59-2). It consists of pebble conglomerates, sandstones, shales and claystones with minor siltstones and occasional lignite bands up to 10 feet thick. Although this section does not represent the entire Tertiary section, it typifies the general lithology as reported by previous workers. Most outcrops are unconsolidated, poorly exposed and earthy in appearance.

Thickness of Tertiary strata varies considerably as a result of recent erosion, but according to Hume (1954, page 4), it is over 1,200 feet thick along the east fork of Little Bear River. Bell (1959, page 7) suggests that the maximum thickness is in the order of 3,000 feet but this is likely excessive.

Plants collected from Tertiary strata along the Mackenzie River indicate a Lower Eocene age (Bell, 1922, page 76).

Following Cretaceous time, the seas withdrew from the study area. Tertiary basins formed in localized areas at a later date and coal swamps were common in these basins. The location of the major seaway in Tertiary time is unknown. Other

Tertiary basins have been reported by Camsell (1906) in the Wind River and Bonnet Plume areas west of the report area.

STRUCTURE

Major Tectonic Divisions

General Statement.-The study area can be divided into three major areas of tectonic activity: namely, a stable region with only minor deformation, a region of moderate deformation, and a region of severe deformation. These major tectonic divisions, superimposed on the major physiographic divisions of the report area, are shown in Figure 15.

Stable Region.-The stable region of the report area is part of the central stable region described by Eardly (1951, page 12) and is the western edge of the cratonic interior present since Precambrian time. It consists of a foundation of Precambrian crystalline rock, which is a westward continuation of the Canadian Shield, overlain by a veneer of sedimentary rock. For the most part, the sediments dip very gently westward. Deformation is at a minimum and, aside from slow and prolonged vertical movement, this tectonic division properly deserves the name, the central stable region.

Region of Moderate Deformation.-The region of moderate deformation is characterized by broad, open folding and high angle, normal or reverse faulting. With the exception of several shear zones, fault blocks show relatively little deformation, and it is unlikely that horizontal movement was important during time of faulting.

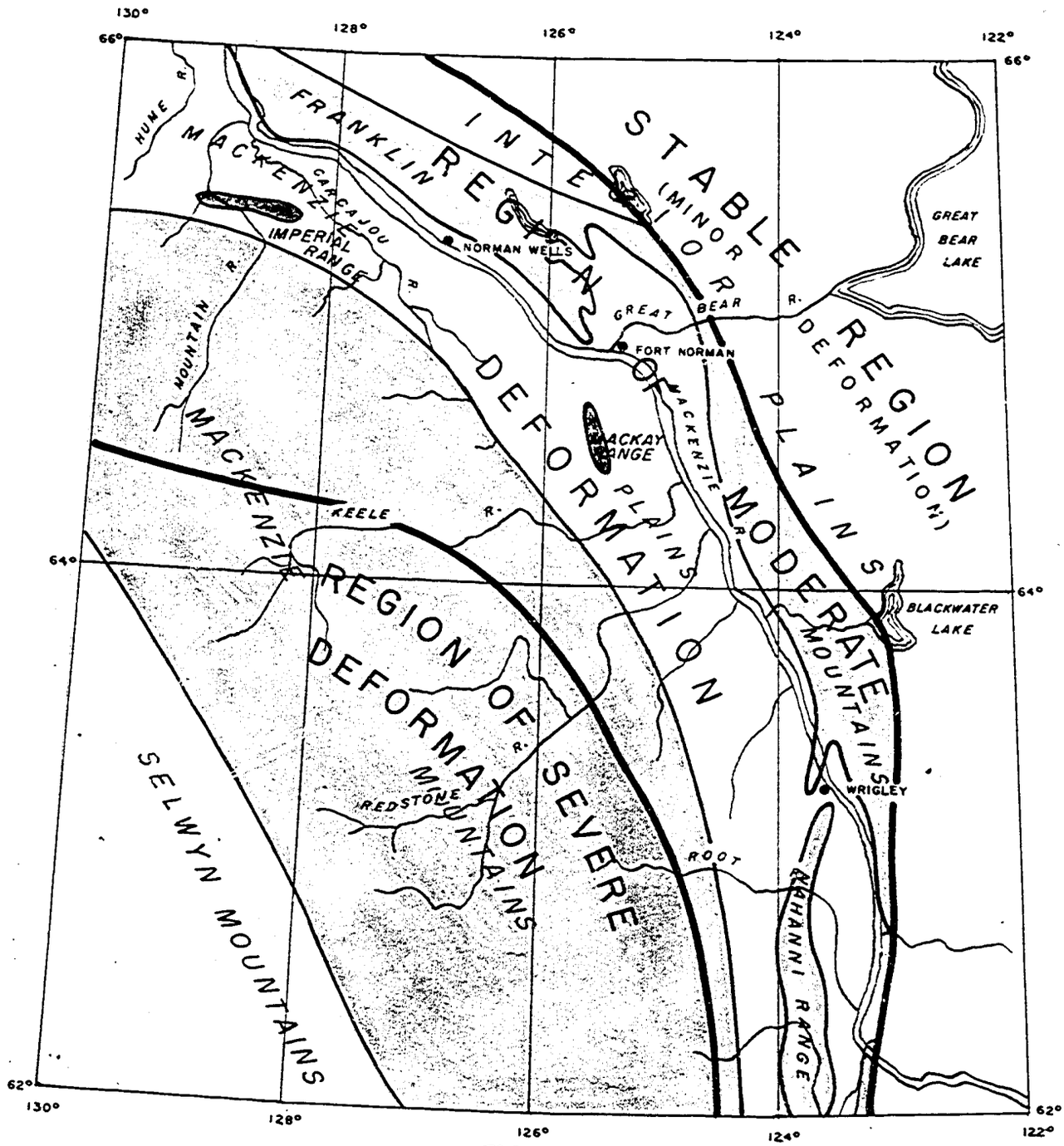


FIG. 15

MAP SHOWING THE

MAJOR STRUCTURAL DIVISIONS

OF THE

NORMAN WELLS — WRIGLEY AREA N.W.T.

SCALE

MILES 40 30 20 10 0 20 40 80 MILES

As pointed out by Goodman (1954, page 374), the most significant faulting in this region is in the Franklin Mountains between Norman Wells and Sans Sault Rapids, and north of the Mackenzie River. Here, a series of tilted fault blocks dip in various directions and in some cases "scissor" or rotational faulting occurs between adjacent blocks. It is apparent, according to Goodman (page 347), that these surface features reflect conditions in the basement complex which has been broken into blocks and these, under compressive stress, have become adjusted to take up crustal shortening.

The remainder of the Franklin Mountains southward from Norman Wells are, in general, less complicated by faulting. The McConnell Range is essentially an asymmetrical anticline, with a high angle reverse fault along the anticlinal axis (e.g., Cap Mountain) at some localities. Both high-angle normal and reverse faults occur throughout this range at intervals along its length.

The Mackenzie Plain appears to be a strip of the Interior Plains left relatively intact during uplift of the Franklin and Mackenzie Mountains. It does, however, contain numerous open folds throughout its length. In addition, several small ranges of Paleozoic rocks crop out in the Mackenzie Plain.

The Imperial Range is essentially a large asymmetrical anticline which exposes Paleozoic strata within the Mackenzie Plain. Occasional steep-dipping faults are present in the Imperial Range.

The Mackay Range of the Mackenzie Plain, Bear Rock in the

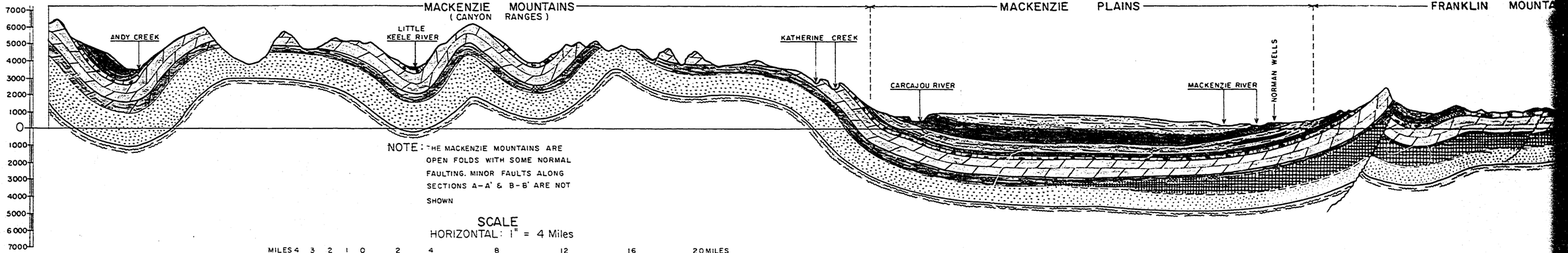
FIG. 16

SEMI – DIAGRAMMATIC

STRUCTURE SECTIONS ACROSS MACKENZIE & FRANKLIN MOUNTAINS

NORMAN WELLS - WRIGLEY AREA, N.W.T.

A



NOTE: THE MACKENZIE MOUNTAINS ARE OPEN FOLDS WITH SOME NORMAL FAULTING. MINOR FAULTS ALONG SECTIONS A–A' & B–B' ARE NOT SHOWN

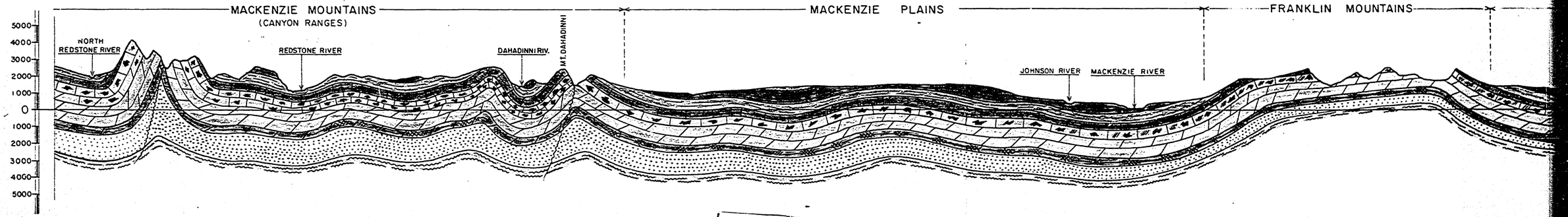
SCALE

HORIZONTAL: 1" = 4 Miles

MILES 4 3 2 1 0 2 4 8 12 16 20 MILES

VERTICAL: 1" = 4000 FT.

B



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