

A GEOLOGICAL REPORT

of

THE HORN RIVER AREA

N.W.T.

by

R. H. Tatham

Imperial Oil Limited

1960



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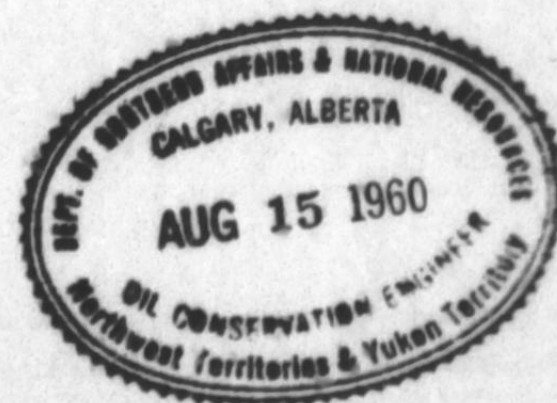


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Figure 1. Geological Map (Structure Contours on
PreCambrian, Permit Numbers, Access Roads)

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GEOLOGICAL REPORT OF THE HORN RIVER AREA

I. INTRODUCTION

Imperial Oil Limited and Triad Oil Co. Ltd., shared equally the cost of drilling three wells in the Horn River area of the Northwest Territories during the winter of 1960. The wells, Imp. Triad Davidson Creek P-2, Imp. Triad Willow Lake B-28, and Imp. Triad Harris River F-71 were drilled on Permits 2175, 2172, and 2182 respectively.

The Horn Mountains, on which the wells are located, form a glacial plateau rising approximately 1500 feet above the surrounding plains.

Access to the wells was provided by the construction of 100 miles of winter road from Mile 12 on the Yellowknife highway, to the Horn Mountains, and an additional 75 miles to the individual locations (see geological map for roads and mileages). The old winter tractor road between Ft. Nelson and Norman Wells skirts the west flank of the Horn Mountains 15 miles west of the Harris River well. This road was not used during the drilling of the above three wells. Airstrips were cleared at each location, but it was found that nearby lakes were smoother and more practical.

II. STRATIGRAPHY

A. Pleistocene

Thick sections of glacial drift were encountered in all wells. The drift consisted of uncemented sand, gravel and boulders, from igneous and sedimentary rocks, with variable amounts of clay matrix. The ratio of sedimentary to igneous rocks in the drift increases to the west. Sections of 460 feet and 730 feet were encountered at Davidson Creek P-2 and Harris River F-71 respectively, while at Willow Lake B-28, 1275 feet of drift were penetrated. This would indicate an infilled glacial valley.

B. Cretaceous/Devonian Shale

The Cretaceous/Devonian shales may be divided into three main types. A medium grey, subfissile shale overlies light grey-green, fissile, splintery shale. The bottom section is a dark brown shale with a bituminous appearance. Approximately 1350 feet of Cretaceous/Devonian shale were encountered at Davidson Creek P-2 and Harris River F-71. Due to erosion of the top section, Willow Lake B-28 had only 800 feet of Cretaceous/Devonian shale.

C. Keg River Formation

The Keg River limestone is predominantly micritic skeletal with fragments of ostracods, crinoids, brachiopods and gastropods. Pellets are also present in minor amounts. The basal 40 feet of the formation is partially dolomitized, often with an earthy appearance, ineffective porosity, and scattered oil staining. No tests were run. The Keg River varies in thickness from 160 feet to 190 feet.

D. Chinchaga Formation

The Chinchaga is essentially a massive anhydrite with minor primary dolomite interbeds. The formation tends to become progressively more dolomitie to the east. The Chinchaga is approximately 270 feet thick at Davidson Creek P-2 and Willow Lake B-28, and 470 feet thick at Harris River F-71.

E. Pre-Devonian

The Pre-Devonian consists of a thick massive salt section overlying a section of interbedded dolomite, anhydrite, and salt. The massive salt section varies from 260 feet to 309 feet in thickness. The interbedded sequence is approximately 280' feet

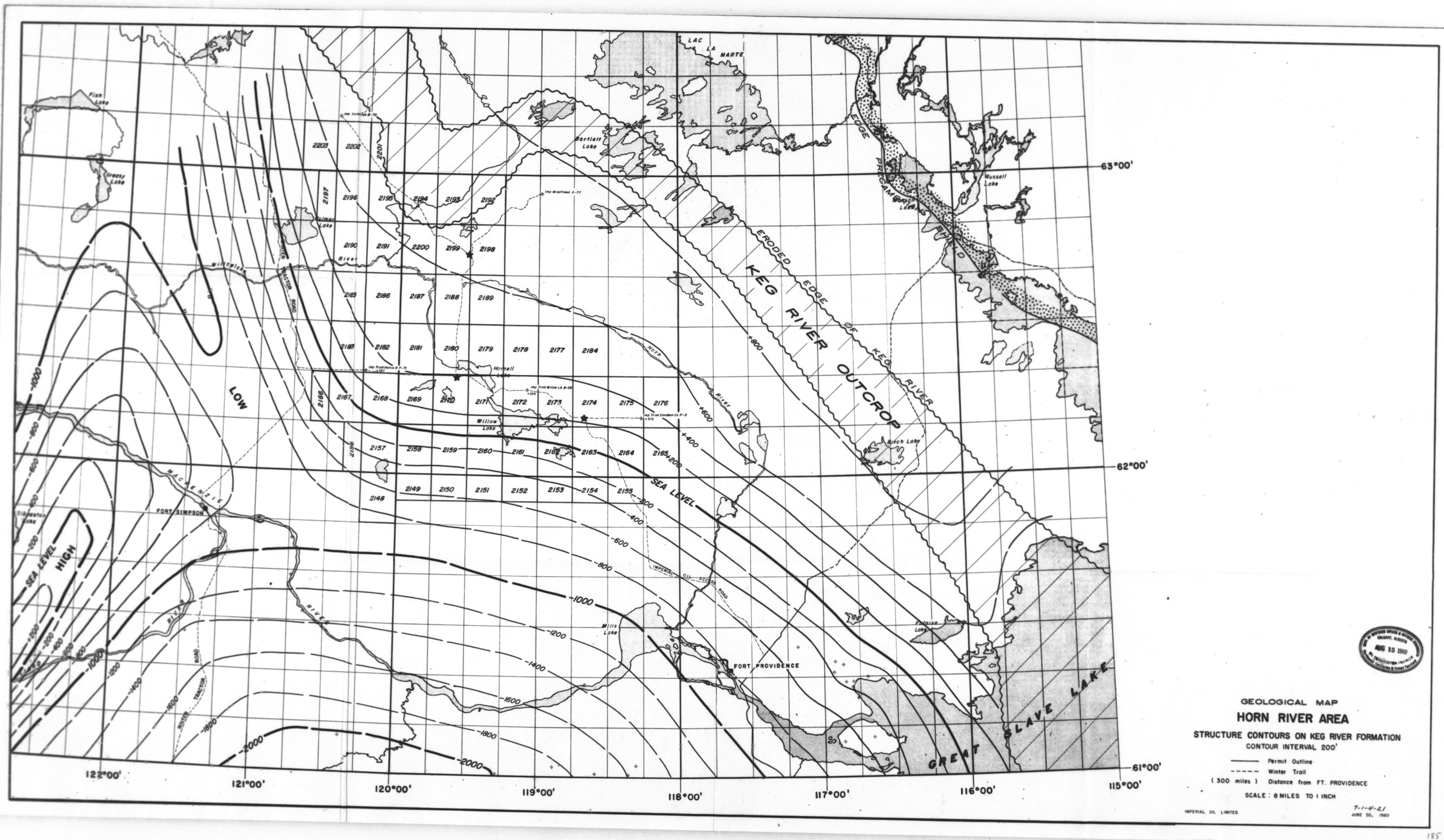
thick at Willow Lake B-28 and Harris River F-71, and 530 feet thick at Davidson Creek P-2.

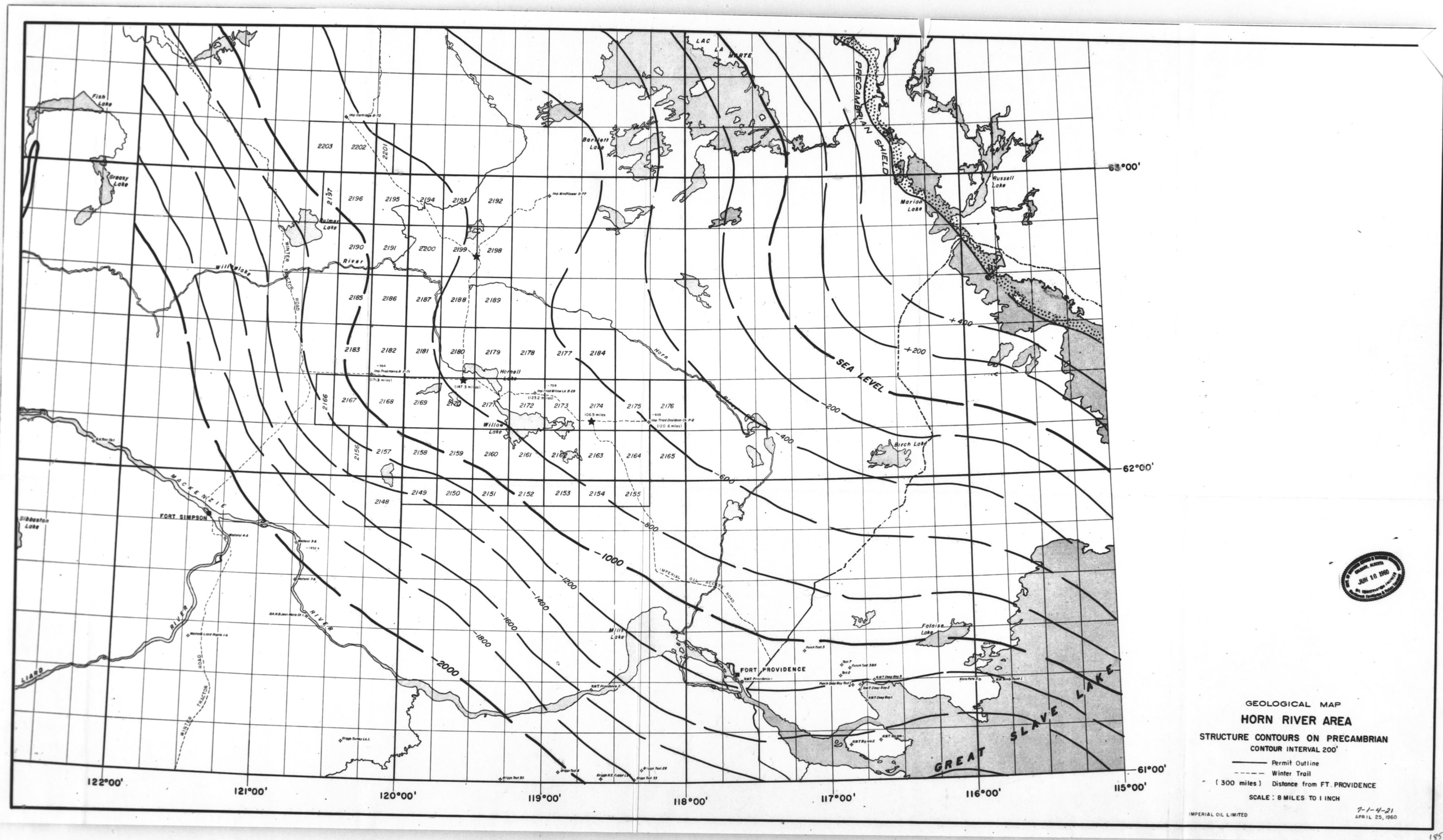
F. PreCambrian

The basement at Davidson Creek P-2 was a weathered, pink, coarsely crystalline granite, while at Willow Lake B-28 it was a grey-green finely crystalline basic igneous rock. The PreCambrian at Harris River F-71 was a finely crystalline pink granite.

III. CONCLUSIONS

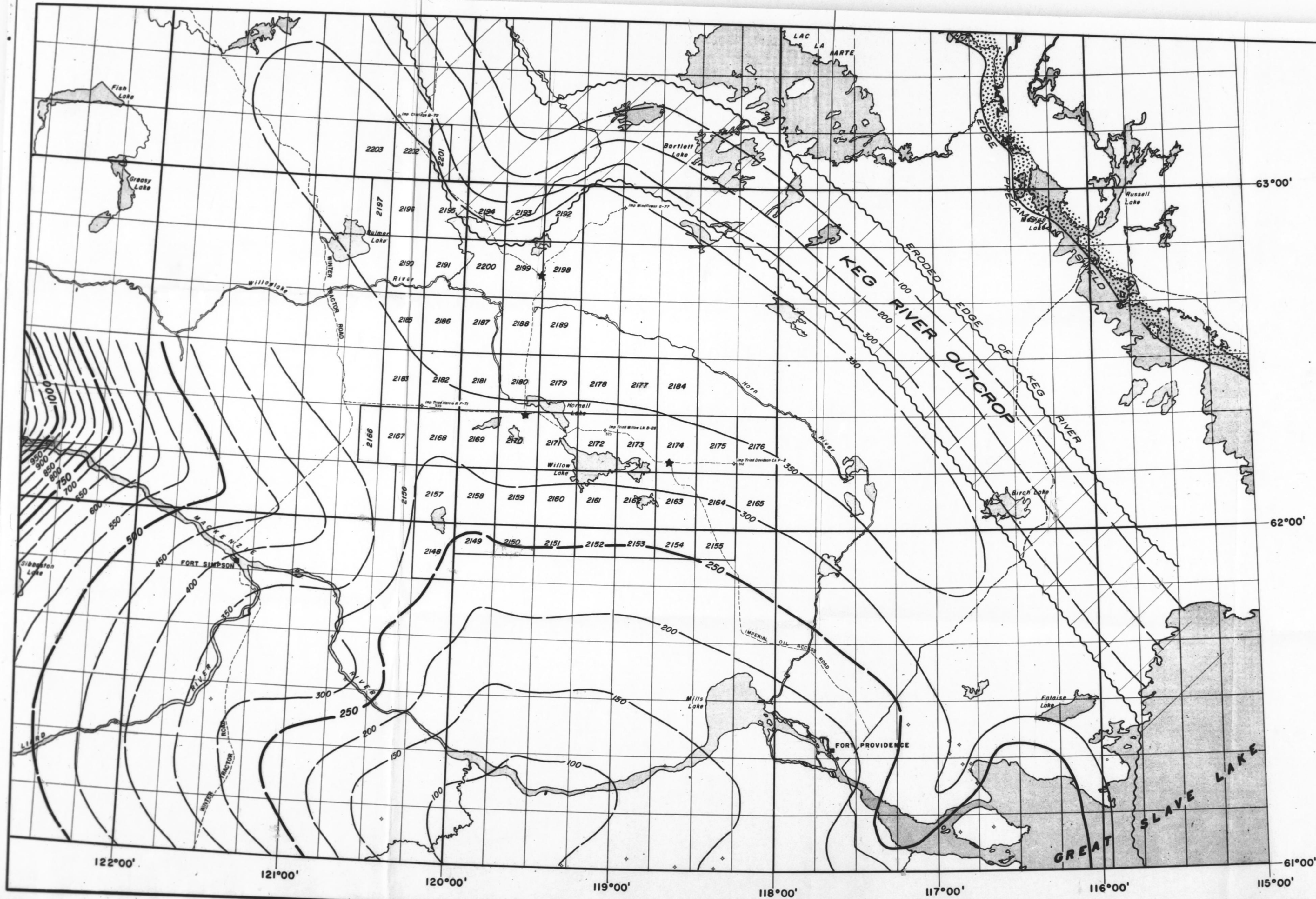
Although there is shale cover to provide a cap for Devonian reservoirs, the Keg River formation is essentially tight. Formations below the Keg River are too evaporitic to be prospective reservoirs.





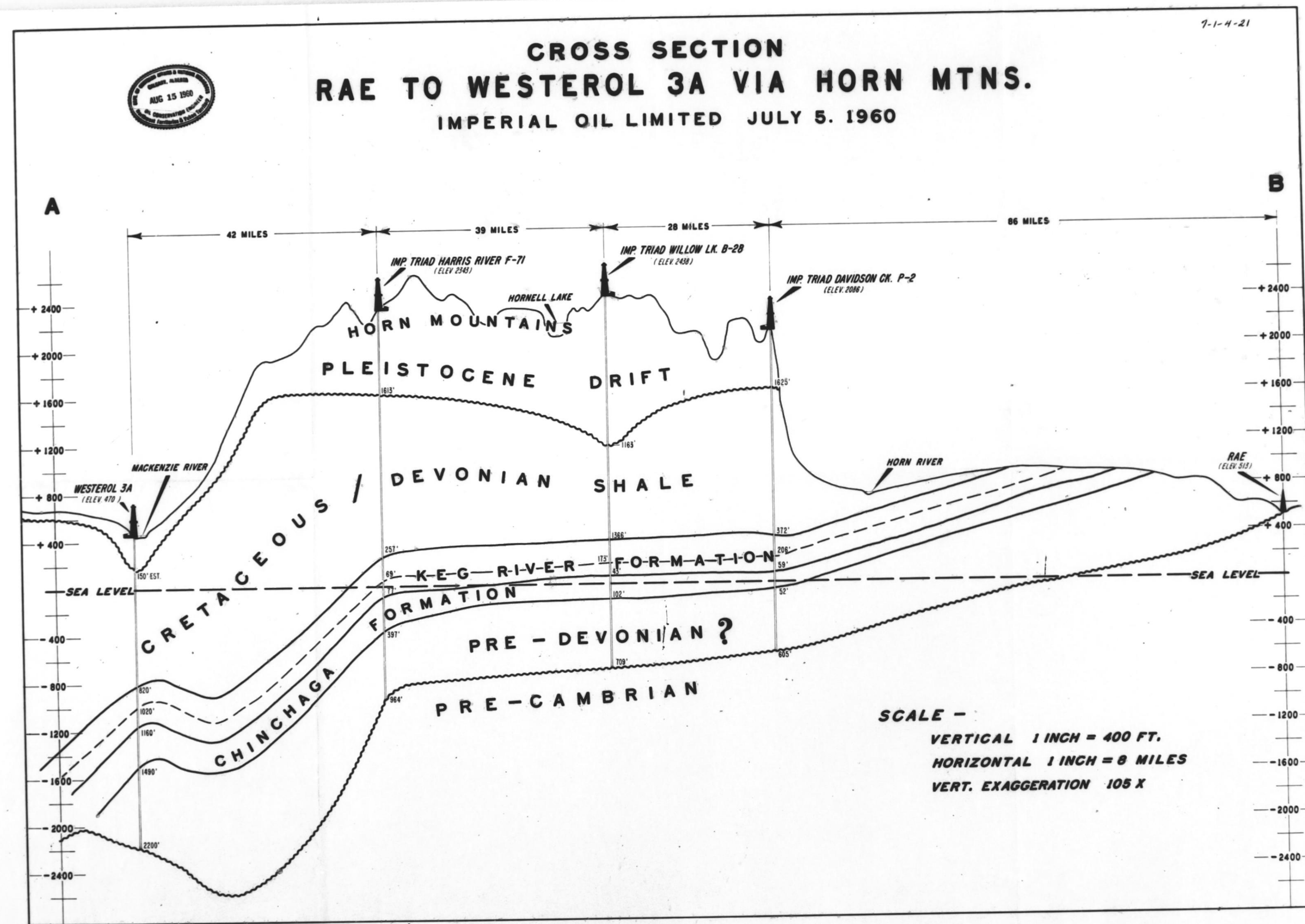
GEOLOGICAL MAP
HORN RIVER AREA
STRUCTURE CONTOURS ON PRECAMBRIAN
CONTOUR INTERVAL 200'
— Permit Outline
--- Winter Trail
- (300 miles) Distance from FT. PROVIDENCE
SCALE : 8 MILES TO 1 INCH
IMPERIAL OIL LIMITED
7-1-4-21
APR 11 25, 1960

30x



GEOLOGICAL MAP
HORN RIVER AREA
ISOPACH OF KEG RIVER FORMATION
CONTOUR INTERVAL 50'
— Permit Outline
--- Winter Trail
(300 miles) Distance from FT. PROVIDENCE
SCALE: 8 MILES TO 1 INCH
IMPERIAL OIL LIMITED
7-1-4-21
JULY 4, 1960





SURFACE GEOLOGY
of the
SOUTH NAHANNI AREA
between

Petitot River, Latitude 60° 00'
and
Gli Lake, Latitude 62° 00'

by

R. A. MENELEY

IMPERIAL OIL LIMITED

1960



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STRATIGRAPHIC SECTIONS

P.R. 2-59-8	Bluefish Lake	in pocket
-9,10,11,12	First Canyon	in pocket
-13	East Nahanni Butte	in pocket
-107	Little Doctor Lake	in pocket
-108	Red Rock Pass	in pocket
-109	Liard Range	in pocket
-207	Cleft Creek	in pocket
-208	Paradox Creek	in pocket
-209	Mattson Creek	in pocket
-332 & 337,		
444, 445	Beaver River	in pocket

SURFACE GEOLOGY OF THE SOUTH NAHANNI RIVER AREA

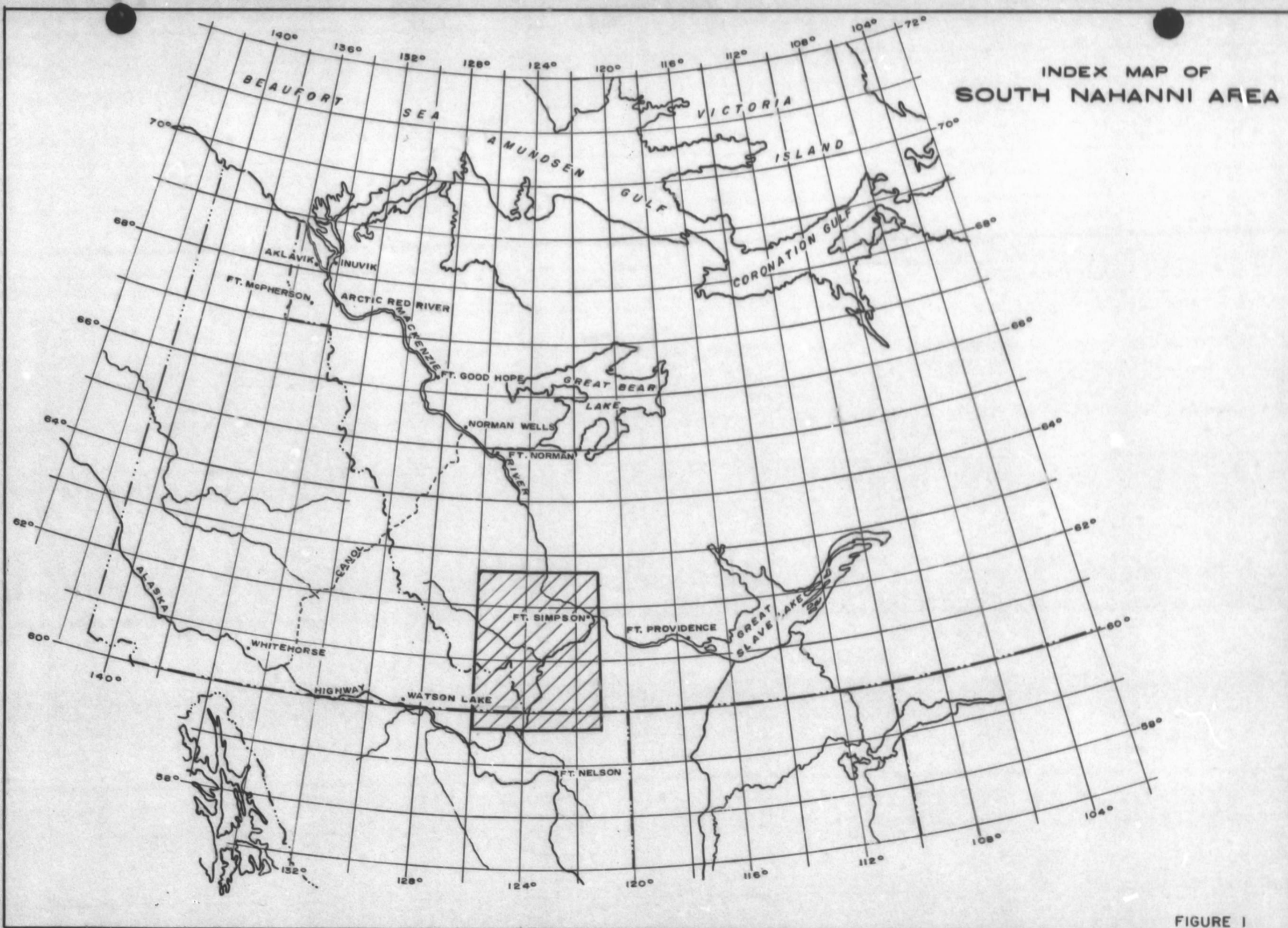
INTRODUCTION

Present Study

Description of Area. -- The South Nahanni river area (Fig. 1) extends from Petitot river at Latitude $60^{\circ} 00'$ to C11 Lake at Latitude $62^{\circ} 00'$. The area comprises nearly 20,000 square miles and includes parts of the Interior Plains, the Liard Range and Liard Plateau, the Nahanni Range and the southern extension of the Mackenzie Mountains and Mackenzie Plain.

Method of Study. -- Imperial Oil party PR 2-59 spent the period from July 15 to September 11, 1959 on geological field work in the South Nahanni river area. Stratigraphic work was done primarily in the northern part of the area while some longer reconnaissance flights extended to the southern part to tie into geological work done by PR 2-58 during the previous year (Progress Report for P. & N. G. Permit #1143). The 1959 operations are summarized under the following headings:

Weather. -- Good weather during the first part of the season facilitated field work. The last couple of weeks were not so favourable. Rain, alternating with a few days



INDEX MAP OF
SOUTH NAHANNI AREA

FIGURE 1

of helicopter trouble, limited operations and early snow on the higher mountain ranges finally put an end to the season's work.

Transportation. -- The field party was moved from Norman Wells to Shell Liard Rapids #2 landing strip in two trips with a company DC-3. Personnel and equipment were met by Don Turner with a shallow draught barge to be taken some 25 miles up the Liard river to South Nahanni Butte near the junction of the Liard and South Nahanni rivers. Aviation fuel, food supplies and other camping equipment had previously been moved by barge from Fort Nelson.

Base Camp. -- Field operations were carried out from the base camp at the foot of South Nahanni Butte. With the kind permission of Mr. Dick Turner, trader, trapper and bargeman, the camp was set up on the clearing in front of his trading post. Drinking and washing water was obtained from the South Nahanni river which was always silt laden yet drinkable.

Communications. -- Communications with the District Office in Dawson Creek were maintained with a 60-watt Kaar radio. The Canadian National Telegraph station in Fort Nelson relayed the messages. Transmission to and reception

from Fort Nelson varied from fair to good with only rare exceptions when it was impossible to reach the outside world.

Geology. -- The geological crew consisted of the following personnel:

R. A. Meneley	Party Chief
M. Mazurkewich	Assistant Party Chief
B.J.G. Patsch	Senior Assistant
H. R. Balkwill	" "
G. A. Cackles	Junior Assistant
D. A. Coulombe	" "
D. Cowling	" "
E. Steadman	Cook

A bell G-2 helicopter was supplied by Okanagan Helicopters Ltd., of Vancouver with the crew:

E. Phillips	Pilot
A. Johnson	Engineer

The crew was divided into three sub-crews of two men each who were engaged solely with measuring stratigraphic sections, while observations on structure and stratigraphy at traverse stations were made by the party chief.

Fly-camps were used on all stratigraphic sections. The general practice of operations was to rotate the sub-crews so that two fly-camps were out at all times with the third sub-crew in base-camp where they compiled field data from sections previously measured. This system worked well during the initial period of good weather but had to be abandoned when prolonged bad weather set in towards the end and all crews

were sent out to make use of the occasional good day. A total of 174 hours were flown during the nearly two month period.

Measurement and Sampling. -- A variety of measuring techniques were used, the choice depending on the type of exposure which existed on the section. Pegstick, tape and brunton and plane-table surveying were each used. Sections were mostly confined to river cuts in the mountain ranges, and the exposure of the sections was generally very good.

A consistent sample interval of 10' was maintained. Ideally, one rock chip was taken from each 5' interval. Lithologic breaks within the 10' interval were noted in the field descriptions.

Accessibility. -- Supplies and equipment reach the South Nahanni river area during the summer months by small, flat-bottomed barges from Fort Nelson via the Fort Nelson and Liard rivers. Some rapids exist along the Liard river between South Nahanni and Fort Simpson but they present no serious obstacle to experienced bargemen. Gasoline and supplies can also reach the area from the Mackenzie water system, the reverse flow is however more common, especially in the early summer, since break-up of the Liard occurs some two weeks earlier than on Great Slave Lake, a part of the Mackenzie transportation route. Small, powered river boats can ascend

the South Nahanni river as far as Virginia Falls, although much fast and dangerous water is encountered.

Float equipped planes, of course, can reach the area and can land on many places along the Liard and South Nahanni rivers. Caution has to be used during low water periods because of shifting mud and sand bars in these rivers.

Previous Investigations

Early geological work in the South Nahanni river area was of a reconnaissance nature and consisted of traverses along the Fort Nelson, Liard and South Nahanni rivers. McConnell (1888) was the first to visit the area, followed by Hume and Williams (1922) and Cameron (1935). Geological investigations for the wartime Canol project extended as far south as the South Nahanni area and Nauss (1943) descended the Liard River as part of this study. Until recently, the most comprehensive report was by Hage (1945) which was based on work done during the summer of 1944 along 200 miles of the Liard river below the mouth of the Fort Nelson river. The latest addition to geological literature is a report by Douglas and Norris (1959) covering the Fort Liard and La Biche map-areas and it is based on the 1957 Operation Mackenzie by the Geological Survey of Canada.

In 1958, Imperial Oil party PR 2-58 spent the period from June 1 - June 19 carrying out surface geological work in

the Fort Liard-Bovie Lake area to evaluate the Company's acreage held under P. & N. G. Permit #1143, and in 1959 the same party, PR 2-59, continued geological work in the northern part of the area. A summary of the findings follows.

STRATIGRAPHY

General Remarks

Rocks ranging in age from Precambrian to Quaternary are found in the South Nahanni river area. Proterozoic and older Paleozoic rocks outcrop in the western part of the report area and were only noted in traverses. The only good exposure of older Paleozoic rocks in the eastern part of the report area occurs at Red Rock Pass in the Nahanni Range. The lowest of the strata are thought to be of possible Middle Cambrian age. Stratigraphic nomenclature in the South Nahanni river area is rather incomplete, often confusing and full of correlation problems. It is hoped that a standardized terminology will soon be put forth as a result of Operation Mackenzie by the Geological Survey of Canada. The use of formation names in this report has been avoided until such names become published. Instead, where necessary, as in the Devonian Carbonate unit, lithological units were established and named according to some characteristic aspect. In

Imperial Oil's P. & N. G. Permit #1143 the best reservoir prospects are expected to occur in the Middle Devonian Carbonate unit. The chief purpose of the summer's work was to study trends of this unit in outcrop to the west and to the north in order to evaluate reservoir possibilities within the permit area.

Pre-Devonian Stratigraphy

Proterozoic rocks were not studied during the 1959 field season. Douglas and Norris (1959), however, report outcrops of green and red, siliceous, laminated, platy to massive argillite in the southwestern part of the area to the west of the Beaver River basin. Very little Pre-Devonian section is exposed in the eastern part of the Mackenzie Mountains in the South Nahanni area. The only good exposure is at Red Rock Pass in the Nahanni Range, where 2085 feet of Silurian, Ordovician and possible Middle Cambrian strata are exposed. The base of the section consists of 600 feet of unfossiliferous, red to buff weathering, argillaceous, sandy dolomite, from which Red Rock Pass derives its name. The age of this unit is not known but it is tentatively considered to be Middle Cambrian. These red beds are overlain by the basal sandy dolomite and orthoquartzite of the Ordovician and Silurian part of the section. The remainder of the Ordovician to Silurian sequence consists of 1480 feet of grey, fine to microcrystalline, slightly silty, slightly argillaceous, massive dolomite, with

scattered poor vuggy porosity. The Ordovician - Silurian strata may be directly correlated to the Ronning formation of the Norman Wells area.

Devonian Carbonate Unit

General Remarks. -- Within the South Nahanni area the very thick and complex Devonian Carbonate unit overlies the Silurian strata with a very slight unconformity. The unit may be subdivided into five mappable lithologic divisions which may be correlated with a fair degree of reliability within the area even though rapid facies changes are common. These five units are:

Micritic Limestone unit

Bluefish Dolomite unit

Banded Dolomite unit

Primary Dolomite unit

Sandy Dolomite unit

The total Devonian Carbonate unit increases in thickness from 1000 feet in the Interior Plains to over 10,000 feet in the western Mackenzie Mountains. Each of these lithologic units will now be briefly discussed in the order of deposition.

Sandy Dolomite Unit. -- This is a basal unit laid down by the transgressive Devonian sea. It consists of

interbedded light grey, fine to coarse, rounded, well sorted orthoquartzite; and grey, green, sandy, silty, cryptocrystalline dolomite. It is a massive, buff weathering unit which forms an easily recognisable marker for the base of the Devonian system in the South Nahanni area.

Primary Dolomite Unit. -- The Primary Dolomite unit is well developed in the interval 2460' to 3180 feet in the Red Rock Pass section. It consists of fine to microcrystalline uniform weathering dolomite, light to medium grey and olive grey to buff in colour, slightly silty, with varying thin to massive bedding.

Banded Dolomite Unit. -- The Banded Dolomite unit is characterized by grey and dark grey dolomite which has been cyclically deposited, so as to give it a banded appearance. The dark grey bands are a fine crystalline, sometimes bituminous, sometimes organic dolomite, occasionally with poor vuggy porosity. The light bands are very fine crystalline dolomite with some relict pellet texture. The unit forms a wedge of sediment which rapidly thickens to the west. It is not known to be present in subsurface east of the Nahanni Mountains.

Bluefish Dolomite Unit. -- This unit is made up of two main lithologies. One is a coarse crystalline, white

and grey, irregularly massive bedded dolomite, with varying vuggy porosity. The second is a micritic to micritic skeletal, often dolomitized, grey and brown grey limestone. The coarse crystalline dolomite facies is well developed in the 430' thick Bluefish Lake section where it makes up the entire interval. In other sections more than 50 per cent of the rock is limestone. The upper contact is defined by a recessive weathering argillaceous limestones zone.

Micritic Limestone Unit. -- The Micritic Limestone unit forms the uppermost part of the Devonian Carbonate section in the South Nahanni area.

The upper contact is defined by a sharp lithologic break between the limestone and the overlying Devonian shales. The dominant lithology is micritic and micritic skeletal limestone. The skeletal components include stromatoporoids, colonial corals, crinoids, and occasional brachiopods. The matrix is micrograined limestone which has in part been dolomitized. The unit is resistant, massive bedded and light grey weathering. The thickness increases from just over 500 feet in the Nahanni Range to just over 700 feet in the Ram Range to the west.

Pennsylvanian to Devonian

General Remarks. -- The Pennsylvanian to Devonian section is a continuous depositional sequence which ranges in age from Lower Pennsylvanian to Middle Devonian. In the South Nahanni river area this interval is subdivided into the Besa River, and Mattson formations. The term Besa River formation is here used in its broadest sense, and is considered to include the Hare Indian, Canol and Rundle formations, or their time equivalents.

Besa River Formation. -- The Besa River formation is mainly a shale unit. It extends from the Devonian Carbonate unit to the overlying Mattson sandstone. Over most of the area, often because of poor exposure, no breaks can be recognized within this shale section. The shales of the lower part of the formation, which are thought to include the Hare Indian and Canol equivalents, consist of black, calcareous, often bituminous shale, with some minor limestone interbeds. These are overlain by soft, dark olive grey, slightly silty, slightly calcareous shales of probable Upper Devonian age which in turn are overlain by poorly exposed brown calcareous silty bituminous shales that grade to argillaceous limestone, and skeletal micritic limestone with coral and crinoid fragments. Thick sections of the Besa River formation are found west of

the Nahanni Range and in the eastern part of the Liard Plateau.

Mattson Formation. -- The Mattson formation was not examined in the field. Some excellent sections were noticed in the Liard Range and the Tlogotsho Mountains. The type section of the formation, according to Patton (1958), consists of 3764 feet of quartzose, light grey to white, fine to medium grained, massive sandstone. This is not a complete section as the upper beds are not exposed. The lower part contains minor coal beds and lenses. Patton (1958), considered the Mattson to be Mississippian in age, however Hage (1945), found fossils of possible Lower Pennsylvanian age. It seems that at least the upper part of the formation is therefore of Pennsylvanian age.

Permian. -- Permian chert beds which are found in the southern part of the Liard Plateau area appear to be absent north of Latitude 60° 30'. Here the Mattson formation is overlain by Lower Cretaceous shales. This observation was corroborated by Douglas and Norris (1959).

Mesozoic. -- Beds of Mesozoic age were only cursorily examined in a few localities in the Interior Plains.

STRUCTURAL GEOLOGY

General Remarks. -- The physiographic provinces of the

Mackenzie Mountains, Liard Plateau and the Interior Plains outline corresponding structural provinces within the South Nahanni area. The Mackenzie Mountains and the Liard Plateau form a continuous south plunging structural unit which will be referred to as the Mackenzie Mountains Fold Belt. The physiographic boundary between them marks the boundary of the outcrops of the Upper Paleozoic sands and shales to the south and the resistant Lower Paleozoic Carbonate to the north. The eastern edge of the Mackenzie Mountains Fold Belt is marked by the prominent scarp of the Nahanni Range and the less well defined eastern flank of the Liard Range.

Mackenzie Mountains Fold Belt. -- The Mackenzie Mountains are flat-topped, folded mountains which are cut by deeply incised canyons. The mountains reach a maximum elevation of 7000 feet above sea level, and the maximum relief is about 2500 feet.

The Mackenzie Mountains Fold Belt is characterized by a certain assemblage of structures. Folding is the dominant form of disturbance, anticlines are broad, flat-topped and steep limbed, while synclines are much compressed. Faults are present but play a relatively minor role in developing the structures, except at the eastern front of the Nahanni Range.

Most other fault zones are confined to the compressed synclinal areas. Normal cross-faults occur in the down-plunging end of the larger anticlines.

Interior Plains. -- The Interior Plains area is one of low relief. It has been glaciated and is very poorly drained even in the vicinity of major stream valleys such as the Liard and Mackenzie rivers. The highest hills reach an elevation of 2000 to 2500 feet above sea level and the lowest elevation of the major streams is about 600 feet. East of the Nahanni Range the Interior Plains consist of nearly flat lying strata of Upper Devonian shale. An intrusive plug sticks up near Shell Liard Rapids #2.

East of the Liard Range the outcropping of Mississippian limestones through an otherwise Cretaceous cover indicates the presence of two large structures which have been termed Celibeta Lake and Bovie Lake structures. Douglas and Norris (1959), have mapped and described numerous other faults and folded structures in the southern part of the area.



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Description of Traverse Stations

Visited by R. A. Meneley, P.R.-2-59

P.R. 2-59-386

BLUEFISH LAKE

2' - 6'

Massive white quartz dike which intrudes well into the Ramparts group. The contacts are sharp with some apophyses extending beyond the dike margins. Abundant white quartz mineralization in this area is not directly connected with the dike but appears to have been an earlier stage of mineralization.

Strike of dike 335° dip 67° NE
Strike of bedding 337° dip 31° SW

The dikes are fairly numerous along the Nahanni Range as far north as Grainger Creek.

P.R. 2-59-387

GRAINGER CREEK, Nahanni Range

Limestone, grey weathering, dark grey to black, micritic trace skeletal slightly dolomitic grading to —

Dolomite, very fine to fine-crystalline, very calcareous, 20% skeletal porous.

P.R. 2-59-388

BELOW THE FIRST CANYON ON THE
SOUTH NAHANNI RIVER

Shale, grey and yellowish grey weathering, brownish grey, siliceous, possibly bituminous, well bedded, platy 1/4" to 3" beds, hard, brittle. This shale overlies less than 200 feet of softer, less siliceous, shale and is overlain by soft grey shale.

Limestone, grey weathering, black, micritic, 30% very fine crystalline dolomite, trace silicified algal growths, massive, tight.

P.R. 2-59-389

Limestone, grey weathering, black and grey, micritic, trace skeletal consisting of corals and stromatoporoids.

This station is on a feature which juts up very sharply from the surrounding flat-dipping limestone terrain. The first impression

/ . . Cont'd

P.R. 2-59-389 (Cont'd)

is that it is a reef body sitting on the top of the Ramparts group. The dips on this feature, however, are steeply quaquaversal and the lithology is definitely non-reefal. A structural dome is present which is most likely due to an isolated intrusive plug although no evidence of an intrusive body or a metamorphic is exposed.

P.R. 2-59-390

RAM RIVER

Limestone, light grey and grey-brown weathering, grey, micritic, silty very platy, brittle. This underlies the upper part of the Ramparts group and represents the lateral equivalent of at least part of the dolomite in the Ramparts. 1,000 - 1,500 feet of this platy limestone is exposed here.

P.R. 2-59-391

RAM RIVER

This limestone forms the massive cliff in the upper part of the Ramparts group overlying the platy limestone facies in Station 390.

Limestone, grey weathering, black, micritic, trace skeletal, some siliceous fossil replacement, massive.

P.R. 2-59-392

RAM RIVER

The massive limestone cliff in Station 391 is overlain by 50 feet of 1 to 2 foot bedded limestone with minor interbedded shale. This unit is overlain by about 100 feet of siliceous platy to blocky shale with some large limestone concretions. The siliceous shale is overlain by several hundred feet of grey and grey-brown shale which is much softer than the siliceous shale.

P.R. 2-59-393

TLOGOTSHO MOUNTAINS

Sandstone, grey weathering, light grey arkose, fine to medium grained well sorted, subrounded equant massive-bedded with some interbedded shale low in the section.

P.R. 2-59-393 (Cont'd)

This appears to be at the top of the Mattson formation. The Permian chert, which is present to the south, is absent here due to erosion, either recent or post-Permian. About 1,000 - 1,500 feet of Mattson formation is exposed along the north face of the Tlogotsho Mountains. A thin sandstone bed outcrops 300 - 500 feet below the main sand body in the Mattson formation.

P.R. 2-59-394

FIRST CANYON, S. Nahanni River

Approximately 3,300 - 4,000 feet of Ramparts group is exposed in an incomplete section with no base.

P.R. 2-59-395

From the massive limestone at the top of the Ramparts group. This definitely overlies the section which is passing to shaly limestone. This is the most southernly point in this area where the platy limestone facies may be recognized.

P.R. 2-59-396

The most southernly appearance of the platy limestone facies in the Ramparts group.

P.R. 2-59-397

HEADWATERS OF PRAIRIE CREEK

Collected from a 600 - 700 foot section of the upper cliff-forming limestone which overlies about 800 feet of platy limestone with no base exposed.

P.R. 2-59-399

RAM RIVER

Dolomite, dark grey weathering, dark grey and white,

. . . Cont'd

P.R. 2-59-399 Cont'd

medium to coarse crystalline, euhedral and sub-hedral, massive.

P.R. 2-59-400

Dolomite, grey and rusty buff weathering, grey, very fine to medium crystalline, thin to medium bedded with thin beds of black chert. This underlies the platy limestone in Stn. 390.

P.R. 2-59-401

RAM ANTICLINORIUM

Limestone, rusty buff weathering, grey, micritic, silty, argillaceous, pyritic. Minor laminae show cross bedding and possible penecontemporaneous deformation.

P.R. 2-59-402

RAM ANTICLINORIUM

490' of Slave Point are exposed in a cliff along this canyon.

P.R. 2-59-403

ACROSS THE RIVER AND UPSTREAM
FROM SHELL LIARD RAPIDS #2.

This is the dike described by Hage (1945).

The following structural data were observed:

Dike	Strike	340°	dip	90°	
Bedding	Strike	98°	dip	8°	NE
	"	90°	dip	7°	N
	"	15°	dip	9°	NE

. . . Cont'd

P.R. 2-59-403 (Cont'd)

Joints	Strike	340°	dip	80° SW
	"	56°	dip	80° NW

The rock is broken by a number of other secondary fracture systems.

P.R. 2-59-404

300 YARDS DOWNSTREAM FROM STN. 403

Bedding	Strike	89°	dip	4° N
Joints	"	328°	dip	87° SW
	"	62°	dip	85° NW
	"	26°	dip	80° NW

✓ numerous other minor fractures

300' upstream

Bedding	Strike	336°	dip	3° SW
Joints	Strike	336°	dip	80° NE
	"	58°	dip	76° NW

The above strikes and dips define a northwest plunging nose of an anticline with an amplitude of less than 10 feet.

P.R. 2-59-405

Black shale outcrops in the footwall of the Liard Range fault.

P.R. 2-59-407

LIARD RIVER

Limestone — Mississippian

	Strike	45°	dip	17° NW
Joints	Strike	313°	at	90°
	"	50°	at	90°

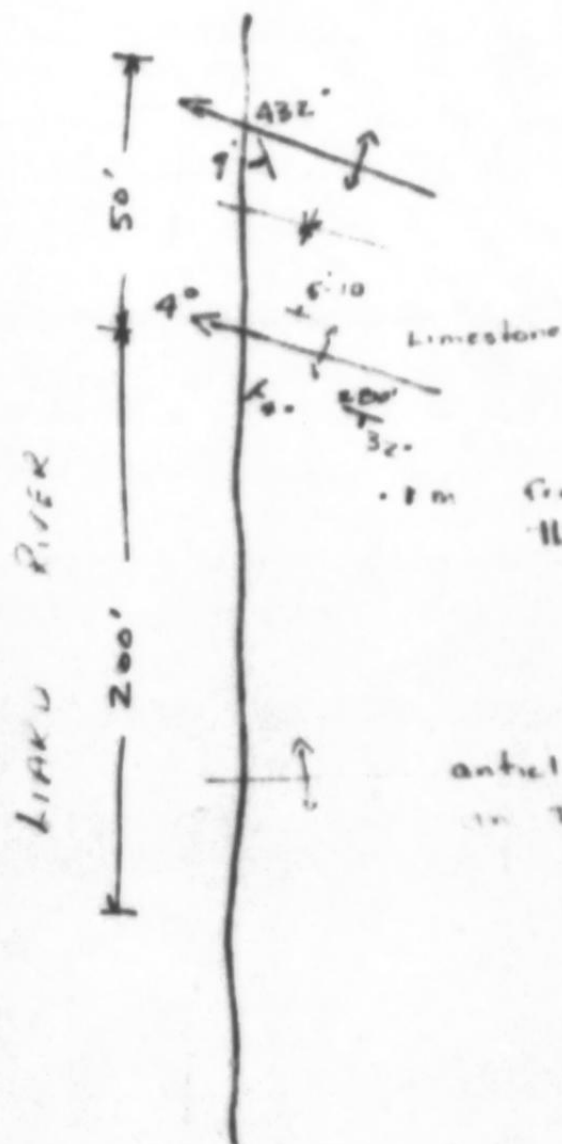
P.R. 2-59-408

LIARD RIVER

Dip component of 2° - 3° at a bearing of 260°.
No joints.

P. R. 2-59-406

LIARD RIVER



Joints
- near vertical
strike $315^{\circ} - 90^{\circ}$
 $50^{\circ} - 90^{\circ}$
not well-developed

P. R. 2-59-409

LIARD RIVER

Limestone -- Mississippian

Bedding Strike 328° Dip 21° NE

P. R. 2-59-410

LIARD RIVER

An apparently flat-lying limestone scarplet about 50 - 100' above the river.

P.R. 2-59-411

LIARD RIVER

Limestone **Bedding 280°** **Dip 4° SW**

A low amplitude anticline is present in outcrop which extends for 100 yards.

P.R. 2-59-412

LIARD RIVER

Limestone -- Mississippian

Strike 310° dip 14° SW

P.R. 2-59-414

LIARD RIVER

Limestone -- Mississippian

Strike 333° dip 28° SW

The dip decreases upstream to a few degrees SW.

P.R. 2-59-415

MOUTH OF MUSKEG RIVER

Sandstone, Scatter formation

Strike 295° dip 6° NE

P.R. 2-59-416

LIARD RANGE

Sandstone, Mattson formation

No Permian is present in this area although a thin section of it may be present on the long dip slope west of this outcrop.

P.R. 2-59-417

KOTANEELKEE RIVER

1 M

Silty shale and shaly siltstone rusty weathering, grey numerous ironstone concretions. Mapped as Fort Nelson formation by Geophoto.

P.R. 2-59-418

KOTANEELKEE RIVER

Orthoquartzite -- grey weathering, light grey very friable, porous, overlies strata in 317. Mapped by Geophoto as Kotaneelke formation. It may be a fluvial deposit derived from the nearby Mattson outcrops.

P.R. 2-59-419

PARADOX CREEK

This section has been duplicated by Stn. 208 A Paradox Creek.

. . . Cont'd

P.R. 2-59-420

PARADOX CREEK

The top of the Ramparts group weathers to hoodoo forms in this area, however, there is no apparent lithologic reason.

P.R. 2-59-421

PARADOX CREEK

A small fault repeats a portion of the Ramparts limestone here.

P.R. 2-59-422

LIARD RIVER

Conglomerate Strike 342° 21° NE

Sandstone, lithologically similar to the Mattson formation.

Shale, black.

Sandstone, orthoquartzite, fine-grained, porous

Strike 7° dip 17° E

Sandstone, as above.

P.R. 2-59-423

PLAINS AREA

Shale, dark grey, silty, rusty weathering patches.

Strike 0° ± 15° dip 2° W.

This outcrop is contorted on the eastern side, possibly by tectonics, but more likely due to ice-shove on an exposed outcrop. Minor east-dipping thrust faults are present.

P.R. 2-59-424

LIARD RIVER

A mass of silicified and quartz-veined black shale is morphologically similar to the basic dike exposed at Stn. 403 on the Liard River.

Strike 307° dip 90°

P.R. 2-59-425

Grumbler outcrop.

Strike 25° dip 62° NW } Separated by a con-
Strike 63° dip 31° NW } torted zone

The abundance of soft green shale talus for a mile downstream suggests that that material forms the bedrock. The contortion here is due to ice shove and slumping as described by Hage (1945)

P.R. 2-59-426

NAHANNI RANGE

A silicified zone is present within the upper part of the Ramparts in local areas along the Nahanni Range. This may be due to precipitation of silica at the water table of an erosional surface. An alternate, however, is that the silica is due to hydrothermal mineralisation of quartz which is prevalent in the area.

P.R. 2-59-427

NAHANNI RANGE

The reef-like mass on the backslope of the Nahanni Range north of Bluefish Lake is not an organic reef. It is a sheared mass of limestone heavily mineralised by white calcite which owes its resistance to its more massive nature.

P.R. 2-59-428

NAHANNI RANGE

Top of Ramparts formation.

Strike 320° dip 22° SW. Elev. 1530' ASL
Brg. to Stn. 429 257° Slope 3° ?
Regional strike of this part of Nahanni Range is 343°

P.R. 2-59-429

BLUEFISH RANGE

Base of a 90 foot sandy limestone unit which marks the base of the Rundle formation.

Strike 343° Dip 35° Elev. 2700 A.S.L.

The thickness of section between the base of the Rundle and the top of the Ramparts has been calculated between these two stations to be 7000 feet ± .

P.R. 2-59-430

LIARD RAPIDS

The Grumbler outcrop here is very nearly flat lying. Local outcrops along the beach all dip riverward. This lends some doubt as to the reliability of the outcrops further upstream on the Liard.

P.R. 2-59-431

HEADWATERS OF THE JACKFISH RIVER

Collected from the oldest shale exposed in the core of the Jackfish dome. No limestone is exposed below the shale.

P.R. 2-59-436

LABICHE RIVER

Collected from the oldest shale exposed in the core of the Boundary anticline where it crosses the Labiche River.

P.R. 2-59-432

BEAVER RIVER North of Larsen Lake

Sandstone, buff weathering -- Mattson formation

Strike 337° Dip 27° NE

P.R. 2-59-433

As above.

Shale, grey and black weathering, yellow effervescence, black, siliceous platy.

This is the siliceous shale zone which overlies the Middle Devonian limestone section.

Strike 322° Dip 43° NE

Brg to Stn. 434 -- 239° slope 0° distance 1300 feet.

P.R. 2-59-434

As above.

Limestone or dolomite, interpreted as the top of the Ramparts group. A hot, non-sulphurous spring issues from this contact on the south side of the Beaver River.

P.R. 2-59-435

As above.

100'

Dolomite, dark grey weathering, dark grey, very fine crystalline, anhedral, friable, up to 30% relict skeletal material no visible bedding.

This unit is overlain by more dolomite which was inaccessible. It appears to be similar in every respect to the dolomite just described.

100'

Dolomite, as above.

Dolomite, grey weathering, grey, very fine crystalline, subhedral trace relict skeletal. This dolomite becomes friable where it is deeply weathered.

P.R. 2-59-436

As previous.

Dolomite, buff and grey weathering, light grey, very fine to microcrystalline, hard.

P.R. 2-59-437

As above.

Dolomite, grey and buff weathering, dark grey, fine crystalline, hard.

Strike 317° Dip 34° NE

The dips steepen rapidly and the section faults back to Mattson formation. This is the base of the Beaver River section.

P.R. 2-59-438

Dolomite, as above.

The silicified shale zone above it is exposed in a small creek across the river.

P.R. 2-59-439

As above.

This marks the base of a thick carbonate section which is continuous from Stn. 438 with a dip of 10° - 20°. At the base, the dolomite exposed resembles the Silurian more than it does the Ramparts dolomite. No fossil evidence could be found.

P.R. 2-59-440

BETWEEN BEAVER RIVER & LARSEN LAKE

Dolomite, buff weathering, grey and buff, micro-crystalline. This dolomite has an abnormal tuff-like appearance although it is definitely above the level and upstream from the hot spring which rises here.

P.R. 2-59-441

TRIBUTARY OF THE WHITEFISH RIVER

Dolomite -- reefal -- exposed low in the core of a major anticline. No evidence of any seepage.

P.R. 2-59-442

TRIBUTARY OF THE WHITEFISH RIVER

There is a well exposed Besa River shale section here.

P.R. 2-59-444

BEAVER RIVER TRAVERSE

Top of Mattson formation.

P.R. 2-59-445

BEAVER RIVER TRAVERSE

Base of Mattson formation.

Thickness calculation for Beaver River traverse.

Total section

Stns. 444 to 437

Distance : 3.5 miles	=	18,500'	Slope = 0°
Dip (average)		31° NE	
Strike (average)		325°	
Bearing (average)		<u>257°</u>	

Azimuth 68°

Thickness = 8,850 feet from the top of the Mattson formation to the lowest Ramparts group exposure.

P.R. 2-59-443

FRONT OF NAHANNI RANGE

North of Grainger Creek

Shale, grey weathering, grey brown, soft, frangible, abundant dark rusty brown weathering ironstone concretions and minor greenish grey sandstone stringers.

Strike 347° Dip 55° SW

This shale lies in the footwall of the fault which elevated the Nahanni Range.

P.R. 2-59-446

TLOGOTSHO RANGE

100 - 200 feet below the top of the Mattson formation.
Elevation 5180' Strike 305° Dip 10° SW.
Base of Mattson / Rundle = 3,000 feet.

P.R. 2-59-454

NAHANNI RIVER -- Head of First Canyon

Top of Ramparts group.
Strike on contour line through the Station 320°
Dip 32° SW

Thickness from Stn. 446 to 454

Distance	4.1 miles	Elev. 3,000 - 1,500 = 1500' diff.
		Slope 4°
Strike (average)	313°	Dip 18°
Bearing	14°	
Azimuth	61°	
Thickness of Besa River formation = 7300 feet = 7000'		

P.R. 2-59-447

MEILLEUR RIVER

Limestone, grey weathering, dark grey, micritic to micritic skeletal. 0% to 30% very fine crystalline dolomite; skeletal material consists of brachiopods and trilobites with a few corals. The skeletal content is higher than usual but the rock is not reefal. This limestone thins rapidly toward the southwest.

P.R. 2-59-448

HEADWATERS OF MEILLEUR RIVER

This station is southwest of Stn. 447.

90%

Limestone, grey weathering, dark grey, micritic, slightly argillaceous, slightly bituminous, pyritic, 6 inch to 1 foot beds with partings of :

10%

Shale, dark grey weathering, black, fissile, very bituminous.

. . . Contd.

P.R. 2-59-448 (cont'd.)

Underlain by:

Dolomite, dark grey weathering, black, microcrystalline to fine crystalline trace relict skeletal, hard with abundant black chert in irregular blobs and fragments. The rock is quite variable in its skeletal and chert content and it could be mixed by slumping along a reef slope. The uppermost beds are almost 100% chert.

P.R. 2-59-449

HEADWATERS OF THE MEILLEUR RIVER

Limestone and shale as above.

P.R. 2-59-450

HEADWATERS OF THE MEILLEUR RIVER

Limestone and shale as above.

P.R. 2-59-451

MEILLEUR RIVER

Hot Spring (not visited on the ground).

P.R. 2-59-452

MEILLEUR RIVER

Shale, black and dark grey weathering with yellow and white effervescence, dark grey; silty, siliceous, pyritic, non-bituminous, hard, blocky fracture.

Dip 15° E.

P.R. 2-59-453

MEILLEUR RIVER

Limestone, resistant.

P.R. 2-59-454

NAHANNI RIVER -- First Canyon

Top of Ramparts group Dip 32°
Strike on contour through the station.

Thickness from the base of the Rundle to top of Ramparts Stn. 446 - 454

. . . Contd.

P.R. 2-52-154 (Contd.)

Distance	4.1 miles	Elev. 3000 & 1500'
		Diff. 1500
Slope	4°	
Strike	320° } 313°	
	305° }	
Average dip	18°	
Azimuth	61°	
Thickness	7,310'	taken to <u>7,000</u> feet.

P.R. 2-52-155

TRAVERSE TO VIRGINIA FALLS

Resistant limestone underlain by dolomite.

P.R. 2-52-156

VIRGINIA FALLS TRAVERSE

Lithology as above.

P.R. 2-52-157

VIRGINIA FALLS TRAVERSE

Partially resistant limestone underlain by reefal dolomite.

P.R. 2-52-158

VIRGINIA FALLS TRAVERSE

Thin resistant limestone at the top underlain by shaly limestone.

Silurian carbonate is present in the core of the anticline.

P.R. 2-52-159

VIRGINIA FALLS TRAVERSE

Ordovician Sunbleed formation on the top of Sunbleed Mountain.

Strike 335° Dip 13° N3

P.R. 2-52-160

VIRGINIA FALLS TRAVERSE

Dark grey weathering Roming dolomite.

P.R. 2-59-461

VIRGINIA FALLS TRAVERSE

Shale, dark grey, badly sheared.
This overlies the Middle Devonian carbonate section.

P.R. 2-59-462

VIRGINIA FALLS TRAVERSE

Limestone, grey weathering, dark grey, micritic,
trace skeletal 2 to 8 inch beds nodular irregular
bedding.

Strike 297° Dip 12° NE

P.R. 2-59-463

VIRGINIA FALLS TRAVERSE

Limestone, grey weathering, grey and tan micritic,
trace skeletal 6 inch to 2 foot beds.

P.R. 2-59-464

VIRGINIA FALLS TRAVERSE

Dolomite, grey weathering, light and dark grey,
medium to coarse crystalline, euhedral to subhedral.
Fetid odor.

The following dips were observed while walking over the massive
dolomite unit about 2,000 feet thick.

Strike	308°	18°	NE	
"	315°	17°	NE	
"	332°	31°	NE	* rejected as unreliable due to slumping.

P.R. 2-59-465

VIRGINIA FALLS TRAVERSE

Limestone, rusty buff and grey weathering grey,
micritic, very silty, slightly argillaceous, platy
habit highly fractured.

Strike 318° Dip 17° NE

P.R. 2-59-466

VIRGINIA FALLS TRAVERSE

Base of Middle Devonian section.

Thickness calculations:

Stations	462 to 463	
Distance	2 miles	Slope 0°
Dip	16°	
Strike	309°	

. . . Cont'd.

P.R. 2-59-466 (contd.)

Brg. 348°
Azimuth 39°
Thickness 1830 feet.
Stations 464 - 466
Distance 3.9 miles Slope = $\arctan \frac{1500}{20600} = 4^\circ$
Strike 314°
Bearing 10°
Azimuth 56°
Thickness 5000' ± 500'.

P.R. 2-59-467

VIRGINIA FALLS TRAVERSE

Thin massive limestone at top underlain by platy limestone followed by massive dolomite.

P.R. 2-59-468

VIRGINIA FALLS

The section here is similar to that at Stn. 467.

P.R. 2-59-469

HEADWATERS OF THE RAM RIVER

Elevation 5350' A.S.L.
Near the top of a massive dolomite unit which appears to be similar to the Silurian.
Dolomite, grey weathering, massive, cryptocrystalline, no fossils.
This is underlain by a rusty buff weathering section similar to the Sunblood formation at Virginia Falls.

P.R. 2-59-470

HEADWATERS OF THE RAM RIVER

Elevation of the base of the Middle Devonian is at 5400' A.S.L.

Rusty weathering bands with silty grey cryptocrystalline dolomite, generally thin bedded.
Strike 355° Dip 67° East.

Approximately one-half of the section between here and Stn. 473 consists of thin-bedded dolomite with numerous rusty weathering beds, the upper half is more massive and consists of alternating bands of grey and dark grey dolomite.

P.R. 2-59-471

HEADWATERS OF RAM RIVER

Elevation 5920' A.S.L.
Strike 345° Dip 60° NE
" 345° Dip 50° NE

Stations 470 to 473 are along a ridge top. The traverse runs from west to east.

P.R. 2-59-472

HEADWATERS OF RAM RIVER

Strike 352° Dip 55° NE

P.R. 2-59-473

HEADWATERS OF RAM RIVER

Elevation 4330 feet A.S.L. at the top of the massive dolomite c.f. Virginia Falls section.

Dip 50 - 60° NE to here.

P.R. 2-59-474

HEADWATERS OF RAM RIVER

Elevation 4740 at Base of upper limestone section.
Dip changes between here and Stns. 473.
Dip approximately 20° NE.

P.R. 2-59-475

HEADWATERS OF RAM CREEK

Top of Ramparts
Elevation 4560 feet A.S.L.
Dip 13° NE

Thickness from Station 470 to 473

Distance 1.9 miles
Dip 59° Slope 6.1°
Strike 351°
Bearing 273°
Azimuth 73°
Thickness 7575' taken as 7500'

Thickness from Station 473 to 475

Distance 1.8 miles Slope = 0°
Dip 25°
Strike 351°
Bearing 251°
Azimuth 80°
Thickness 3900 feet.

PR. 2-50-186

PETITOT RIVER

Shale, rusty grey weathering, grey, soft, blocky, ?
Kotanees formation possible drift. Abundant green
weathering fine grained sandstone along the creek
talus but it does not outcrop. Flat lying.

P.R. 2-50-187

PETITOT RIVER

Shale, grey weathering, dark grey, soft, slightly
bituminous, rusty weathering in part, prominent
rusty weathering clay ironstone bands but no visible
concretions. It appears to be flat-lying but the
outcrop is badly slumped.

P.R. 2-50-188

PETITOT RIVER

Limestone, grey weathering, grey and rusty buff
skeletal, medium to very coarse grained, well
cemented, crinoids and indeterminate material
2 inch to 6 inch beds.

Strike 289° Dip 7° SW General south to southwest
dip but surface is very irregular.

Joints are very prominent

Strike 270° Dip vertical
Strike 0° Dip vertical

Appears to be Rundle

P.R. 2-50-189

MUSKEG RIVER

Shale, grey weathering, with rusty weathering clay
ironstone bands and concretions; dark grey, fissile
soft trace bituminous, selenite crystals. Cf. Stn.
437.

Slight dip component to the east which may be due to
slump.

P.R. 2-50-190

MUSKEG RIVER

Sandstone, green grey and buff weathering, green-
grey, orthoquartzite to protoquartzite, fine grained,
massive to 1/4 inch beds, soft nearly flat lying.
Definitely no Scatter formation.
Possibly Sikanni or Kotanees type. Slight dip
component downstream or west is evident.

LITHOPERCENTAGE LOG
OF OUTCROP SECTIONSTATION NO. P.R. 2-59-332-337
444, 445
BEAVER RIVERLOCATION: L.S.D. SEC. TWP. RGE. W. M.
UNIT ZONE N.T.S.
N. 23. 1/2 SEC. 23 LAT. 60° 30' LONG. 125° 30'Description of location: Measured along the Beaver River
in the vicinity of Pool Creek.ELEVATION: MEASURED:
METHOD:

FORMATIONS

TO ACCOMPANY REPORT

Surface Geology of the South Nahanni Area

BY: R. A. MENELEY

DATE: 1960

BY: R. A. Meneley

DATE: August 19, 1959

DESCRIBED

LEGEND

Coal Salt Anhydrite Dolomite Limestone Massive Chert Conglomerate Sandstone Siltstone Shale

IMPERIAL OIL LIMITED

EXPLORATION DEPARTMENT

PEACE RIVER DISTRICT

Resistance Lithopercantage Footage Samples Description

The thicknesses on this log were calculated from strikes and dips obtained by field observation. Horizontal distances were scaled from a 1" = 4 mile topographic map. The lithology is very approximate except in the Ramparts group.

Overlain by Triassic or Cretaceous.

0' Stn. 444 PENNSYLVANIAN to DEVONIAN

Interbedded rusty-buff weathering massive sandstone and dark grey brown siltstone and silty shale.

Stn. 432

Stn. 445

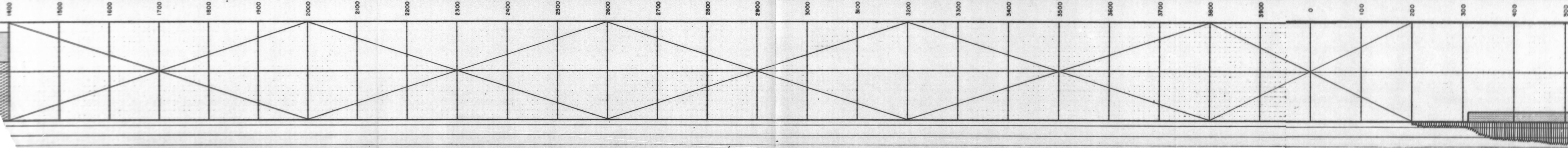
Mostly covered, probably shale.

NOTE: The interval base of Mattson to Devonian carbonate was calculated by H. 2 to be 3900'. Douglas & Morris report a thickness of 3400' for this interval. The lesser thickness is more apt to be correct.

Stn. 445

Mostly covered, probably shale.

NOTE: The interval base of Mattson to Devonian carbonate was calculated by PR 2 to be 3900'. Douglas & Norris report a thickness of 3400' for this interval. The lesser thickness is more apt to be correct.



NOTE: Corr. to map unit 4a Douglas & Norris, 1959 they estd. the thickness to be 700'.

Shale, grey and rusty grey weathering siliceous, bituminous, blocky weathering habit, resistant.

NOTE: Core to map unit 4a Douglas & Norris, 1959 they estd. the thickness to be 700'.

Shale, grey and rusty grey weathering siliceous, bituminous, blocky weathering habit, resistant.

Stn. 433 - 1m

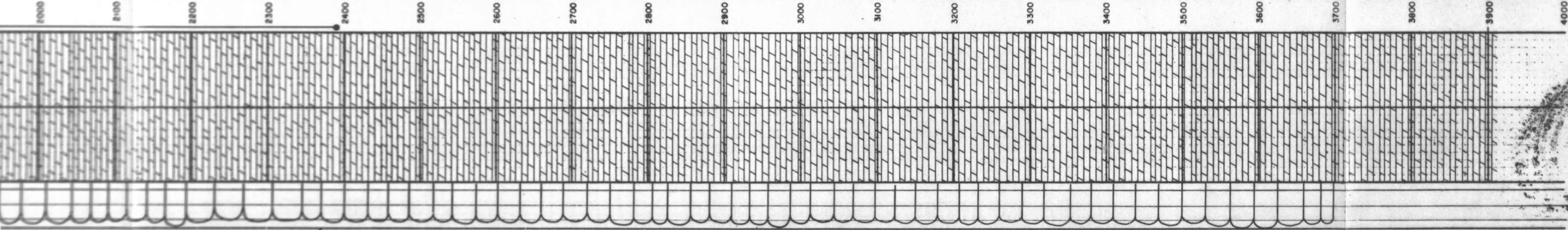
NOTE: Douglas & Norris, 1959 report this interval is 675' thick.

Stn. 434
5300' DEVONIAN Carbonate (2600'.)

Dolomite, grey weathering grey brown, very fine-to fine-crystalline, euhedral trace calcite groundmass, up to 30% relict skeletal material, excellent intercrystalline porosity in upper part grading down to poor fine-vuggy porosity toward the base. The upper part is completely unbedded.

6900' Stn. 435 Banded Dolomite Unit ???
(NOTE: See Douglas & Norris, 1959 G.S.C. paper 59-6).

Stn. 436



Stn. 436

Stn. 437

Fault - no further exposure of carbonate.

7900'

Douglas & Norris, 1959 (U.S.G. paper 59-6) estimate a total of 8000' of carbonate from the Devonian Carbonate top to Precambrian.

No. 1

LITHOPERCENTAGE LOG OF OUTCROP SECTION
STATION NO. P.L. 2-59-207
CLIFF CREEK

FORMATIONS

IMPERIAL OIL LIMITED

LOCATION: LSD. SEC. TWP. RGE. W. M.
UNIT. ZONE N.T.S.
S.W. 1/4 SEC. 16. LAT. 61° 10' LONG. 123° 15'

Description of location:

ELEVATION: MEASURED: METHOD:

TO ACCOMPANY REPORT
Surface Geology of the South Nahanni Area

BY: R. A. MURRAY
DATE: 1960

DESCRIBED
DATE: August 10, 1959

LEGEND
Limestone Massive Chert Conglomerate Sandstone Siltstone Shale
Dolomite Anhydrite Salt

EXPLORATION DEPARTMENT **PEACE RIVER DISTRICT**

DESCRIPTION

Shale, siliceous-bituminous; dark grey to black; dark grey to rust brown to pale olive weathering - iron and sulphur staining.

Shale; calcareous and silty as concretions up to 4' in diameter; black fresh colour.

100' Micritic Limestone Unit (1970*)

Limestone, micritic skeletal (brachiopods, corals, crinoid-very coarse); trace of chert in part; dolomitic as very fine crystalline matrix dolomite; dark grey; light brown grey weathering.

100' Bluefish Dolomite Unit (1970*)

Limestone, micritic skeletal (brachiopods, corals, crinoids); scattered stromatolite; trace of silt; dark grey, light brown grey weathering.

Limestone, micritic, scattered skeletal as brachiopods, crinoids and stromatolite.

100' Banded Dolomite Unit (1970*)

Limestone, micritic, scattered skeletal; shaly and silty partings; dark grey; light brown grey to grey buff weathering; fossiliferous in partings; corals, brachiopods, crinoids, trilobite pygidia.

Limestone, micritic, scattered skeletal, dark grey to dark olive; argillaceous and silt partings, bands and laminations.

Limestone, micritic, trace of skeletal; brown grey, light brown grey to grey buff weathering; semi-fissile to platy to lumpy.

Limestone, micritic; very argillaceous and silty; greenish grey to dark grey; light brown grey to grey buff weathering; platy, semi-fissile to lumpy-like, laminated.

2270'

No. 2

LITHOPERCENTAGE LOG OF OUTCROP SECTION
STATION NO. P.L. 2-59-13
EAST NAHANNI BUTTE

FORMATIONS

IMPERIAL OIL LIMITED

LOCATION: LSD. SEC. TWP. RGE. W. M.
UNIT. ZONE N.T.S.
S.W. 1/4 SEC. 16. LAT. 61° 10' LONG. 123° 15'

Description of location:

ELEVATION: MEASURED: METHOD:

TO ACCOMPANY REPORT
Surface Geology of the South Nahanni Area

BY: R. A. MURRAY
DATE: 1960

DESCRIBED
DATE: August 10, 1959

LEGEND
Limestone Massive Chert Conglomerate Sandstone Siltstone Shale
Dolomite Anhydrite Salt

EXPLORATION DEPARTMENT **PEACE RIVER DISTRICT**

DESCRIPTION

0' Micritic Limestone Unit (1970*)

Limestone, micritic skeletal, mostly dark grey, dolomitic content weathers out in dark irregular patches on surface, slightly argillaceous, black chert stringers and nodules in part, silty to massive bedded, disseminated pyrite in very argillaceous zone 300 to 320'.

320' Butte marker

Dolomite, mottled brown-grey and white, very coarse to coarse crystalline, abundant very coarse white dolomite in part, very slightly calcareous, massive, **SEE NOTE** and **INTERPRETATION** section.

This section is underlain by about 500 feet of dolomite to the Nahanni River fault.

No.

LITHOPERCENTAGE LOG
OF OUTCROP SECTION

STATION NO. P.F. 2-59-8
BLUEFISH LAKE

FORMATIONS

LOCATION: LSD. SEC. TWP. RGE. W. M.
UNIT ZONE N.T.S.
S.M. 1/4 SEC. 22 LAT. 61° 20' LONG. 123° 15'

Description of location:

ELEVATION: MEASURED METHOD

TO ACCOMPANY REPORT
Surface Geology of the South Nahanni Area

BY: R. A. MURPHY
DATE: 1960

DESCRIBED

BY: N. Nagurkovich
DATE: July, 1959

LEGEND

Imperial Oil Limited Exploration Department Peace River District

Cool

Salt

Anhydrite

Dolomite

Limestone

Massive Chert

Conglomerate

Sandstone

Siltstone

Shale

Resistance

Lithopercantage

Footage Samples

Description

0

100

200

300

400

500

600

700

800

900

1000

1100

1200

1300

1400

1500

1600

1700

1800

1900

2000

2100

2200

2300

2400

2500

2600

2700

2800

0' Micritic limestone unit (570')
Limestone, micritic to micritic-skeletal, very slightly argillaceous in part, very slightly siliceous in part, interbedded with dolomite, light brown grey, finer to very coarse-crystalline, with much white crystalline replacement and infill.

570' Bluefish dolomite unit (440')
Dolomite, very coarse-to coarse-crystalline, with much very coarse white dolomite infilling and replacement, irregular massive bedding, good intercrystalline and xuzuy porosity.

1010' Banded Dolomite Unit (720')
Dolomite, fine-crystalline to crypto-crystalline, mostly fine, alternating dark and light colours. some good xuzuy porosity in dark beds, thin-to thick-bedded.

Local brecciation between 1720'-1810', collapse breccia ?
1730' "primary" Dolomite unit (560')
Dolomite, mostly microcrystalline to crypto-crystalline, very slightly silty in part, very hard and brittle, massive.

Measured with tape and Brunton and 5 foot staff.
Top of section partly truncated by erosion. 20 feet ± ?

Residual mass in covered interval, unconformity ?

0' Micritic limestone unit (570')
Limestone, micritic to micritic-skeletal, very slightly argillaceous in part, very slightly siliceous in part, interbedded with dolomite, light brown grey, finer to very coarse-crystalline, with much white crystalline replacement and infill.

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Residual mass in covered interval, unconformity ?

THIS SECTION IS UNDERLAIN BY ABOUT 300 FEET OF DOLOMITE AS INDICATED BY SCATTERED OUTCROP ABOVE THE NAHANNI RANGE FAULT.

LITHOPERCENTAGE LOG
OF OUTCROP SECTION
STATION NO. P.R. 2-59-109
LIAND RANGE

LOCATION: L.S.D. SEC. TWP. RGE. W. M.
UNIT ZONE N.T.S.
R.W. 1/4 of SEC. 21 L.A.T. 60° 50' LONG. 123° 45'

Description of location: On Liand Range 5 miles west of
Mn. Platt.

ELEVATION: MEASURED:
METHOD

FORMATIONS

TO ACCOMPANY REPORT

Surface Geology of the South Liand Area



BY: R. A. NEWBLEY

DATE: 1960

BY: B. Patach

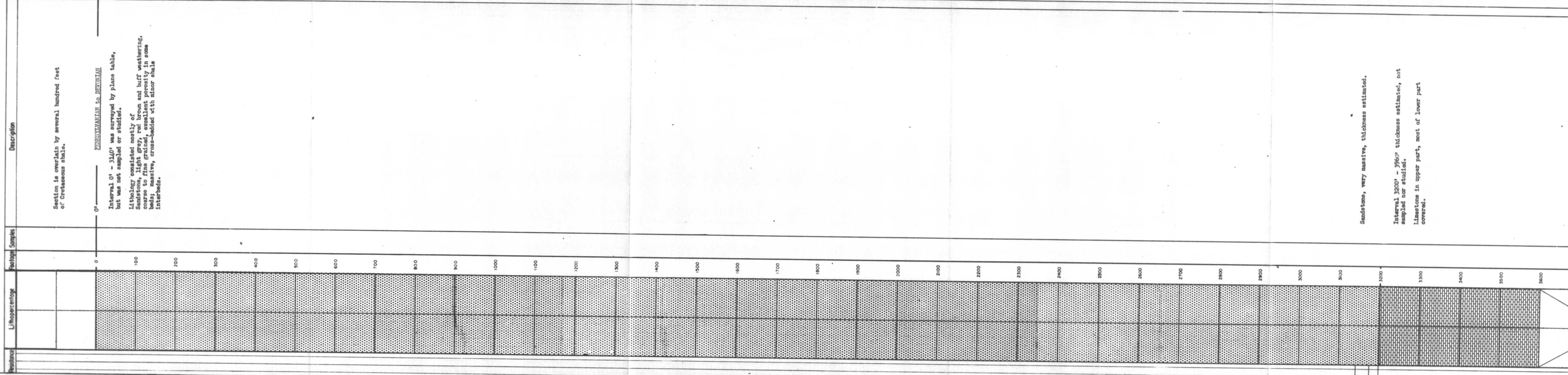
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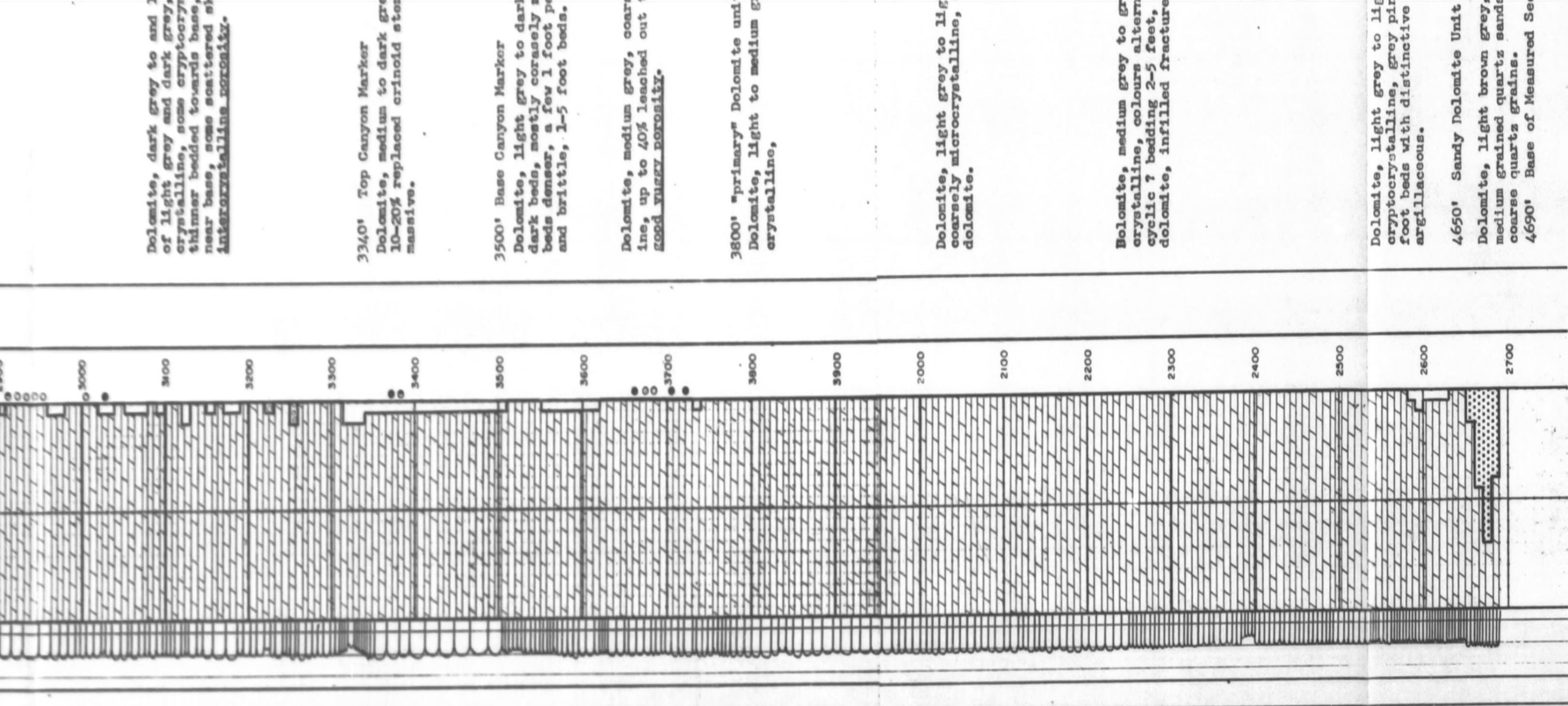
DATE: September, 1959

LEGEND

- Coal ☐ Dolomite ☐ Limestone ☐ Massive Chert ☐ Conglomerate ☐ Sandstone ☐ Siltstone ☐ Shale ☐

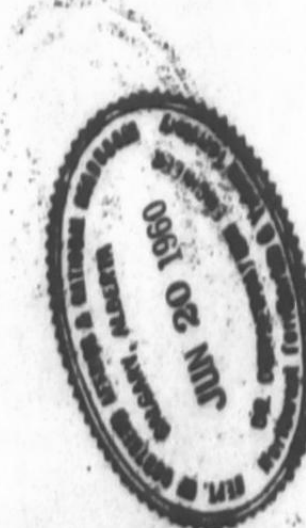
IMPERIAL OIL LIMITED EXPLORATION DEPARTMENT PEACE RIVER DISTRICT





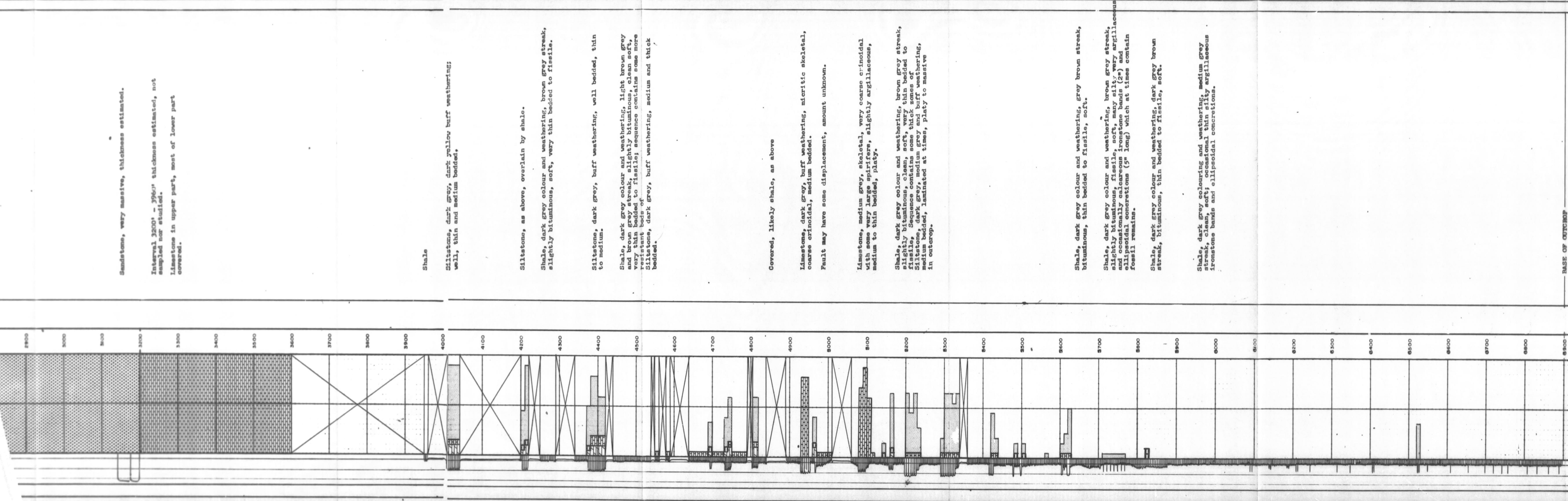
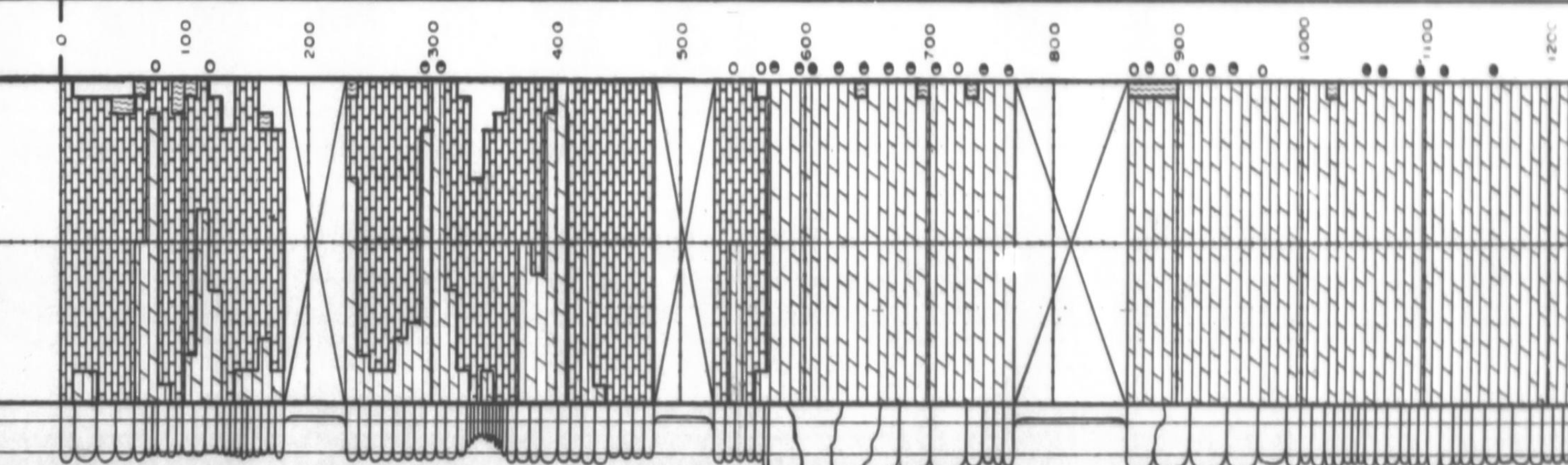
LITHOPERCENTAGE LOG
OF OUTCROP SECTION
STATION NO. P.F. 2-59-8
BLUEFISH LAKE

FORMATIONS



LOCATION: 130° 30' W. 32° 30' N. SEC. 22
Description of location
ELEVATION: MEASUREMENT METHOD
TO ACCURACY
Surface Geology
BY: R. A. NEUBERGER
DATE: 1960
DEPARTMENT: EXPLORATION DEPARTMENT

LEGEND
Limestone Measure Chart
Conglomerate
Dolomite
Anhydrite
Salt
Coal



BASE OF OUTCROP

LITHOPERCENTAGE LOG

OF OUTCROP SECTION

PR 2-59-107

LITTLE DOCKYER LAKE

FORMATIONS

Imperial Oil Limited

Exploration Department

Peace River District

LOCATION: L.S.D. SEC. TWP. RGE. W. M.

UNIT ZONE N.T.S. LAT. LONG.

DESCRIPTION OF LOCATION: South side of lake.

ELEVATION:

7-1-4-19

FROM: TO ACCOMPANY REPORT

Surface Geology of the South Nahma Area

BY: R. A. MEHELEY

DESCRIBED BY: B. Patash

DATE: 1960

DATE: July 1959

REVISED

DATE:

LEGEND

Cool

Salt

Anhydrite

Dolomite

Limestone

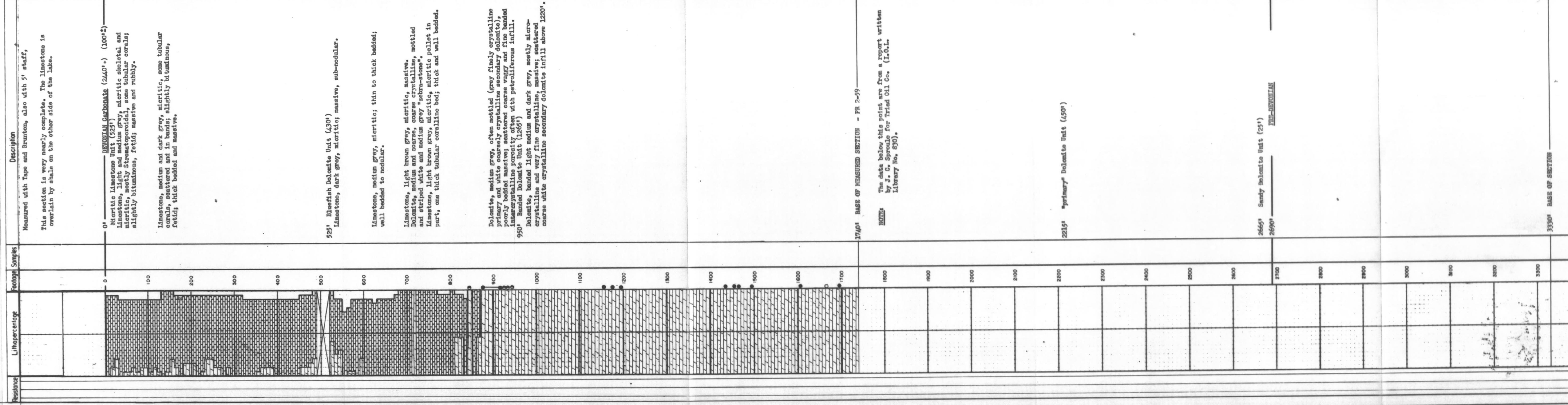
Massive Chert

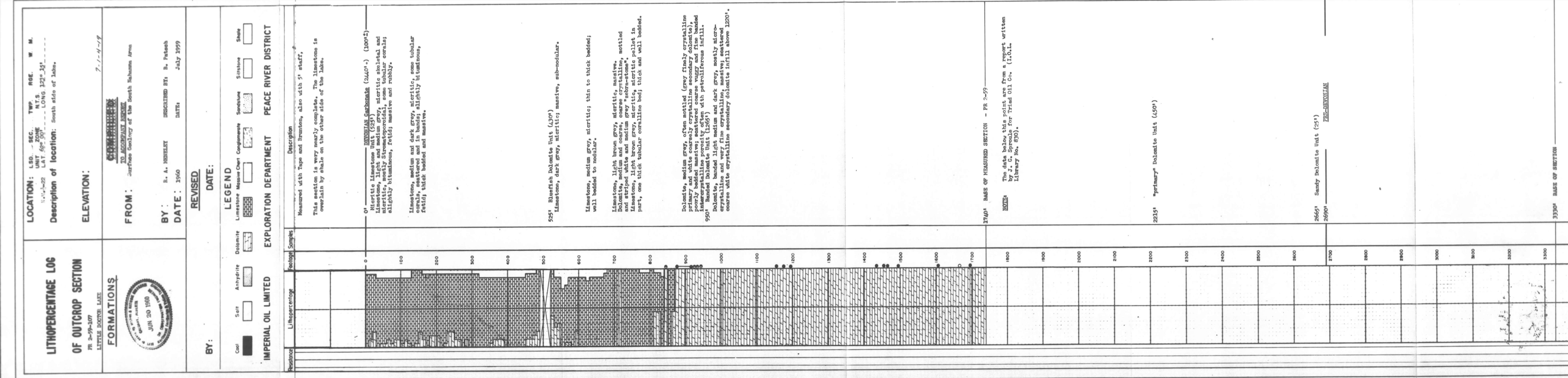
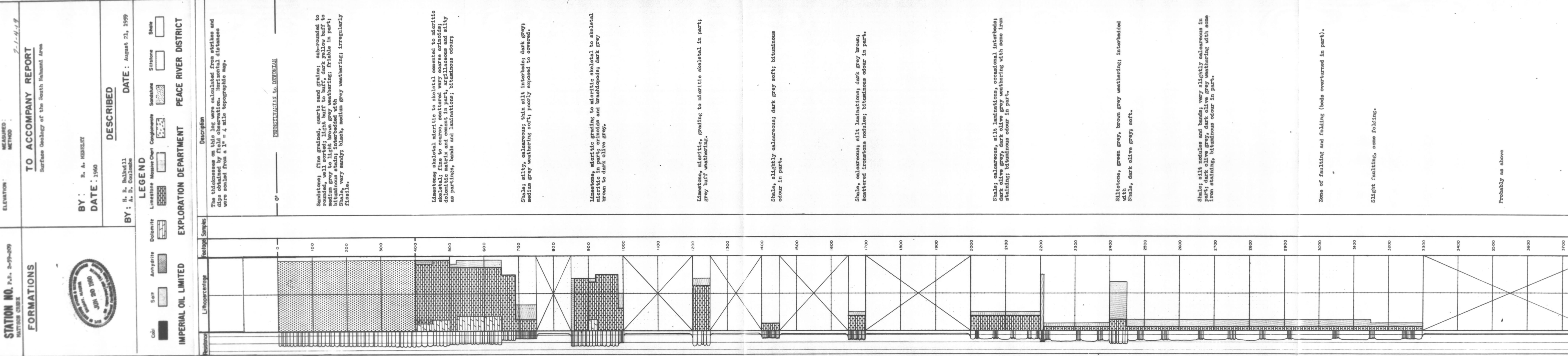
Compagments

Sandstone

Siltstone

Shale





Shale, slightly calcareous; dark grey soft; bituminous odour in part.

Shale, calcareous; silt laminations; dark grey brown; scattered ironstone nodules; bituminous odour in part.

Shale; calcareous, silt laminations, occasional interbeds; dark olive grey, dark olive grey weathering with some iron staining; bituminous odour in part.

Siltstone, green grey, brown grey weathering; interbedded with shale, dark olive grey; soft.

Shale; silt nodules and bands; very slightly calcareous in part; dark olive grey, dark olive grey weathering with some iron staining, bituminous odour in part.

Zone of faulting and folding (beds overturned in part).

Slight faulting, some folding.

Probably as above

Shale, dark olive grey, dark olive grey weathering with some iron staining; bituminous odour in part.

Shale, dark olive grey, dark olive grey to brown weathering; fissile.

Shale, silt laminations and occasional interbeds; black; dark olive grey to dark grey brown weathering.

Shale, black; dark olive grey to brown to pale olive weathering, slightly bituminous odour.

Shale; black; dark olive grey to brown to pale olive weathering; silty; very slightly siliceous in part; scattered large ironstone nodules; fissile; very hard; bituminous.

LITHOPERCENTAGE LOG
OF OUTCROP SECTION

STATION NO. P.R. 2-59-208
PARADOX CREEK

LOCATION: LSD. SEC. TWP. RGE. W. M.
UNIT ZONE N.T.S.
S.M. 1/4 of SEC. 27 LAT. 61° 40' LONG. 123° 45'

Description of location: Measured on the northeast side of Paradox Creek.

ELEVATION: MEASURED:
METHOD:

7-1-4-19

FORMATIONS

TO ACCOMPANY REPORT

Surface Geology of the South Nahanni Area

BY: R. A. MENFLEY

DATE: 1960

DESCRIBED

BY: H. Balkwill

DATE: August 16, 1959

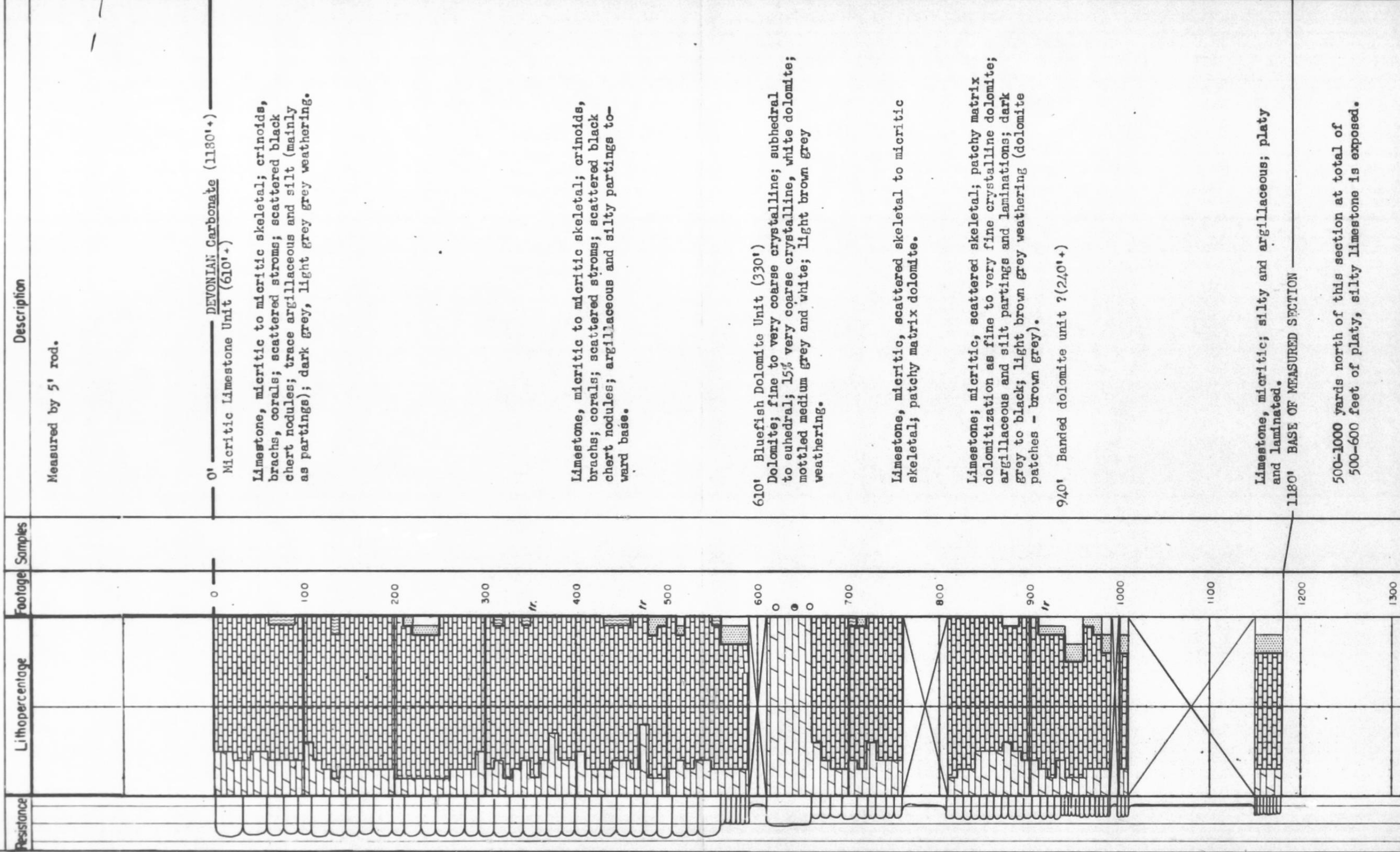
LEGEND

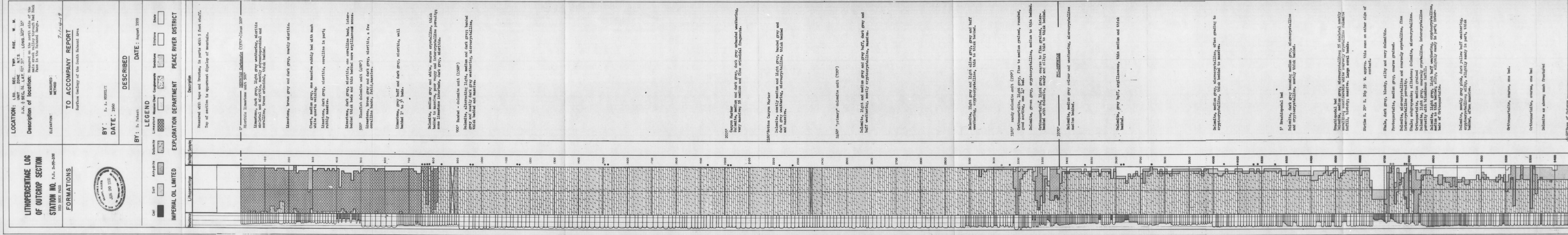
Coal Salt Anhydrite Dolomite Limestone Massive Chert Conglomerate Sandstone Siltstone Shale

IMPERIAL OIL LIMITED

EXPLORATION DEPARTMENT

PEACE RIVER DISTRICT





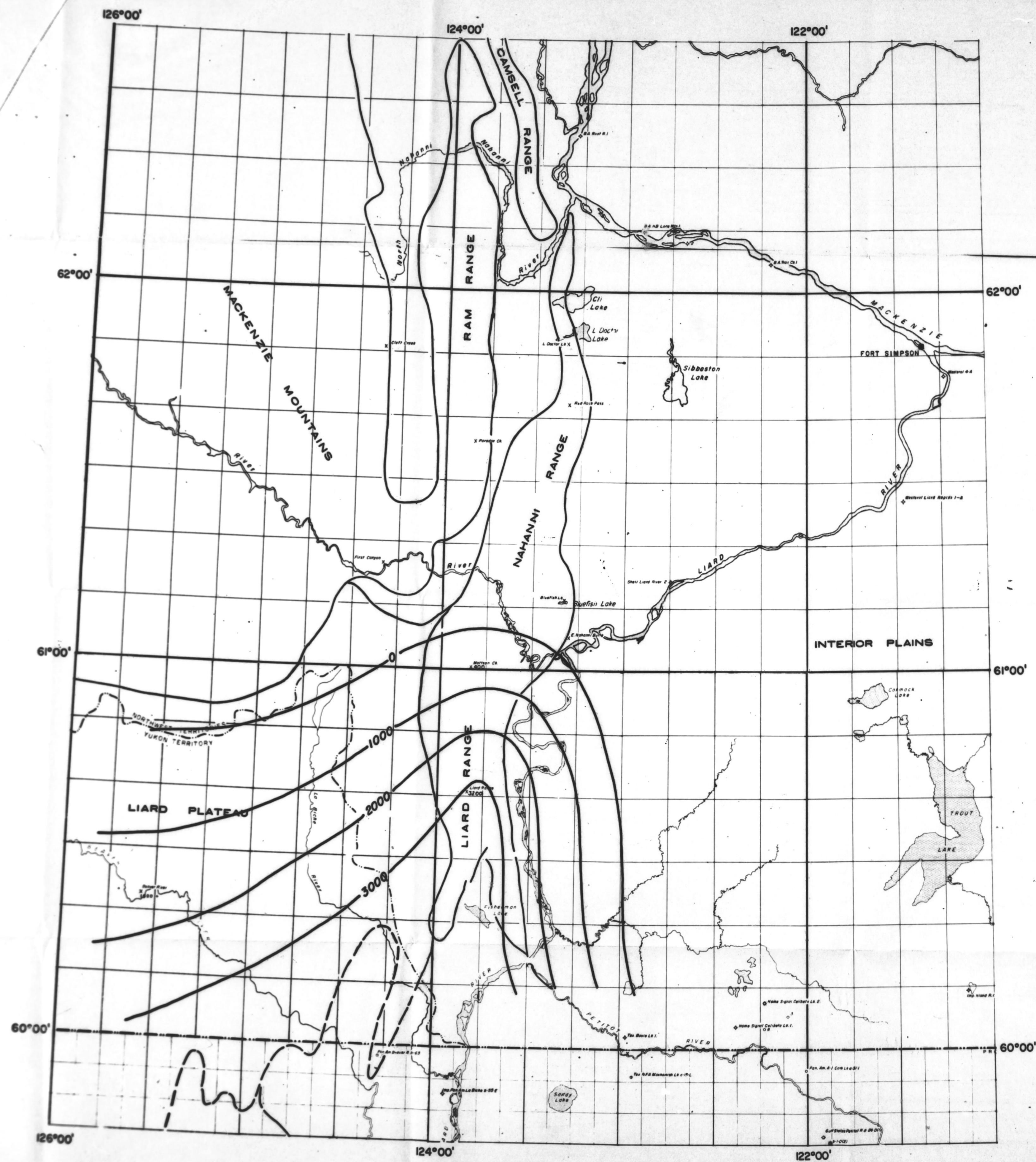


FIGURE 3
ISOPACH
MATTSON FM.
CONTOUR INTERVAL - 1000 FT.

32 MILES

LEGEND

- | | | |
|-------------------|---------------------------------|---------------------------|
| ○ LOCATION | ◊ ABANDONED LOCATION | ◊ SUSPENDED |
| ● DRILLING | ◊ ABANDONED DRY HOLE | ◊ INJECTION WELL |
| ● OIL PRODUCER | ◊ ABANDONED OIL PRODUCER | ◊ ABANDONED WELL WITH OIL |
| ● GAS PRODUCER | ◊ ABANDONED GAS PRODUCER | ◊ ABANDONED WELL WITH GAS |
| ✕ OUTCROP SECTION | ✕ ABANDONED WELL WITH OIL & GAS | |

To accompany report: Surface Geology of the South Nahanni area
between Pellet River, Lat. 60°00', and Ch. Lake, Lat. 62°00'. By
R. A. Menzies - PR2-39

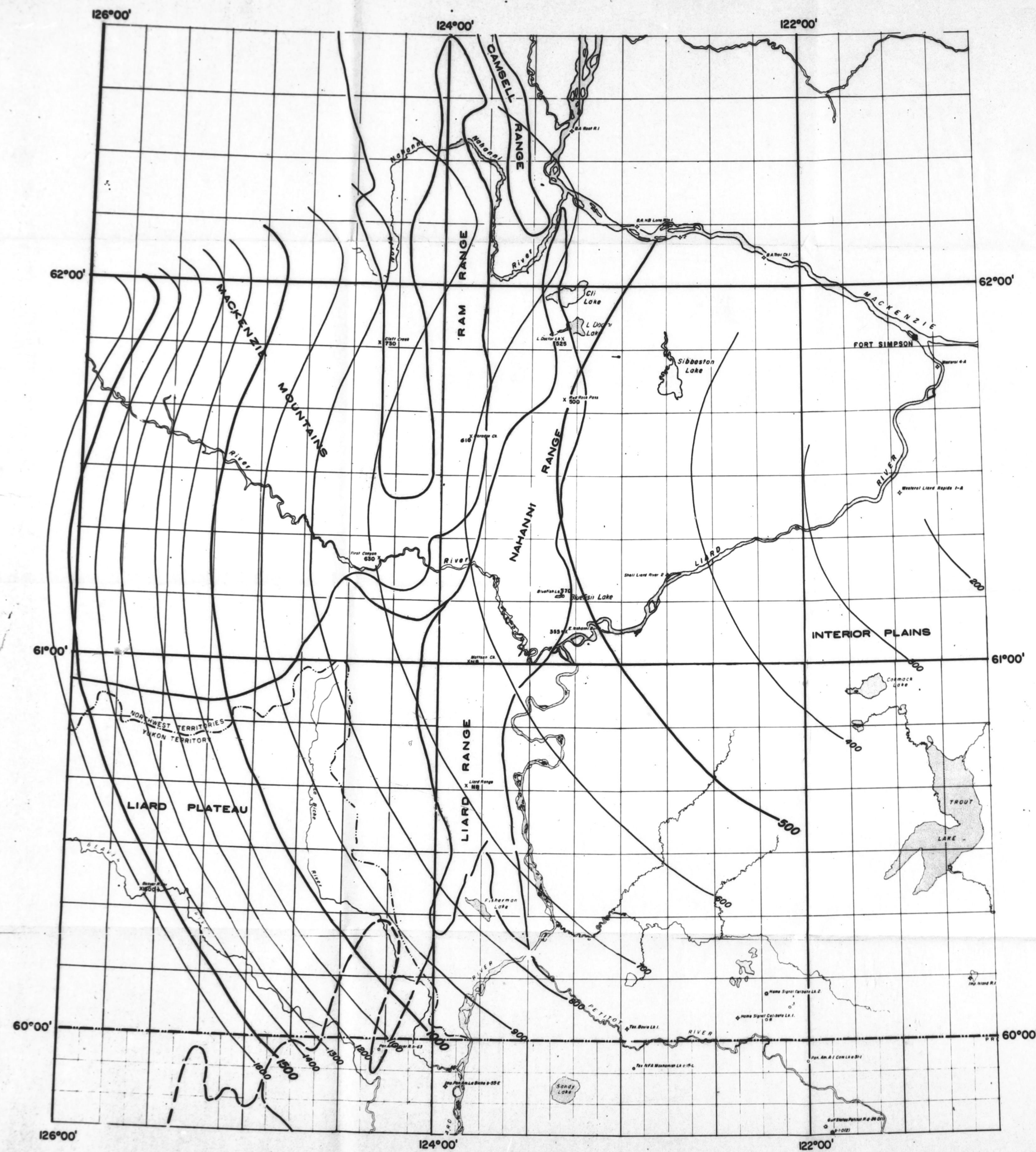


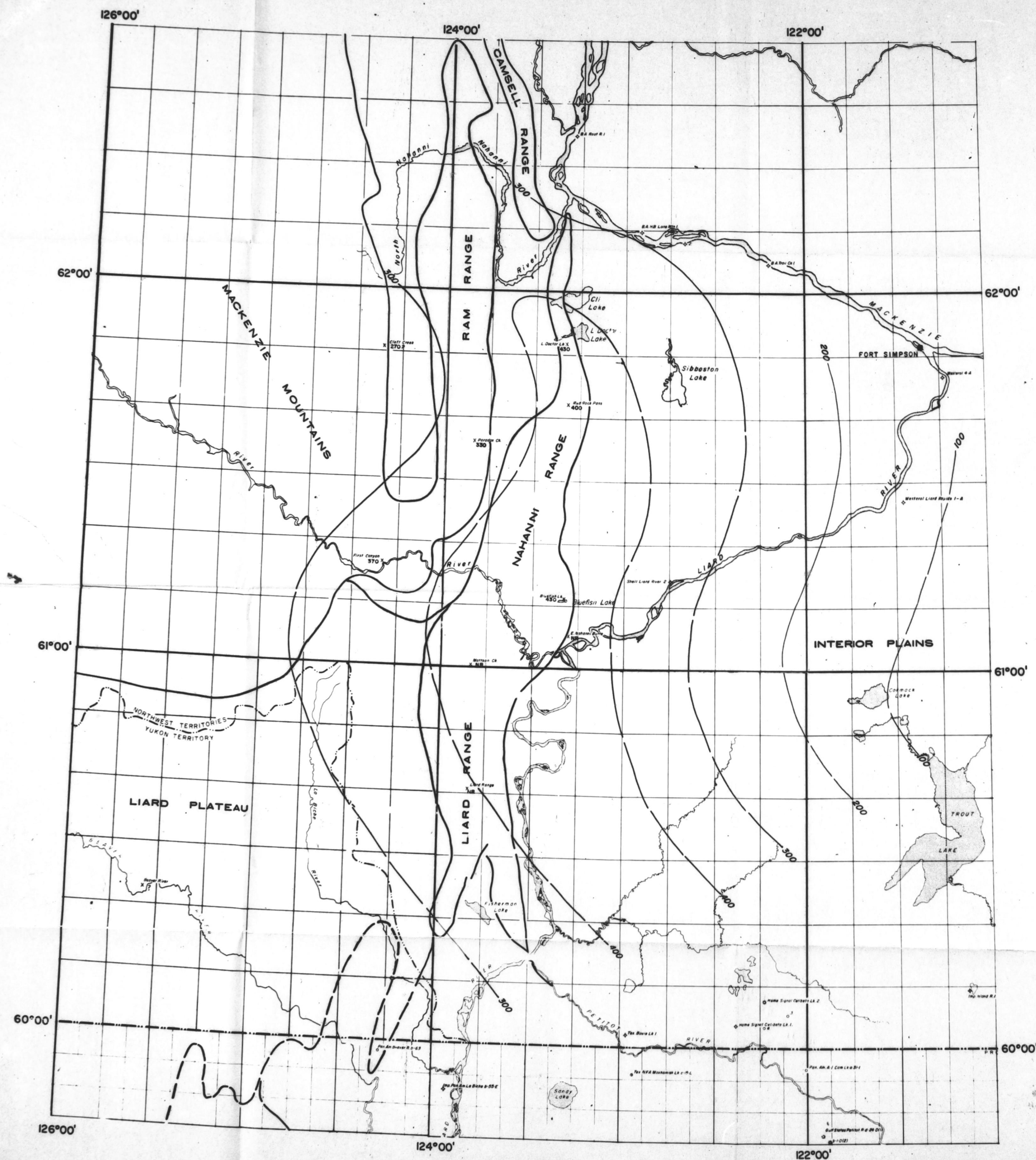
FIGURE 4
ISOPACH
MICRITIC LIMESTONE UNIT
CONTOUR INTERVAL - 100 FT.

32 MILES

LEGEND

- | | | |
|-------------------|---------------------------------|---------------------------|
| ○ LOCATION | ✱ ABANDONED LOCATION | ⊙ SUSPENDED |
| ● DRILLING | ✱ ABANDONED DRY HOLE | ⊙ INJECTION WELL |
| ⊙ OIL PRODUCER | ✱ ABANDONED OIL PRODUCER | ⊙ ABANDONED WELL WITH OIL |
| ⊙ GAS PRODUCER | ✱ ABANDONED GAS PRODUCER | ⊙ ABANDONED WELL WITH GAS |
| ✱ OUTCROP SECTION | ✱ ABANDONED WELL WITH OIL & GAS | |

To accompany report: Surface Geology of the South Nahanni area
between Pellet River, Lat. 60°00', and Li Lake, Lat. 62°00'. By
R. A. Menzies - PR2-59



7-1-4-79
FIGURE 5
ISOPACH
BLUEFISH DOLOMITE UNIT
CONTOUR INTERVAL - 100 FT.

32 MILES

LEGEND

- | | | |
|-------------------|---------------------------------|---------------------------|
| ○ LOCATION | ■ ABANDONED LOCATION | ○ SUSPENDED |
| ● DRILLING | ◊ ABANDONED DRY HOLE | ○ INJECTION WELL |
| ● OIL PRODUCER | ■ ABANDONED OIL PRODUCER | ■ ABANDONED WELL WITH OIL |
| ● GAS PRODUCER | ■ ABANDONED GAS PRODUCER | ■ ABANDONED WELL WITH GAS |
| ✕ OUTCROP SECTION | ✕ ABANDONED WELL WITH OIL & GAS | |

To accompany report: Surface Geology of the South Nahanni area
 between Pelletier River, Lat. 60°00', and Ch. Lake, Lat. 62°00'. By
 R. A. Menzies - PRS-59

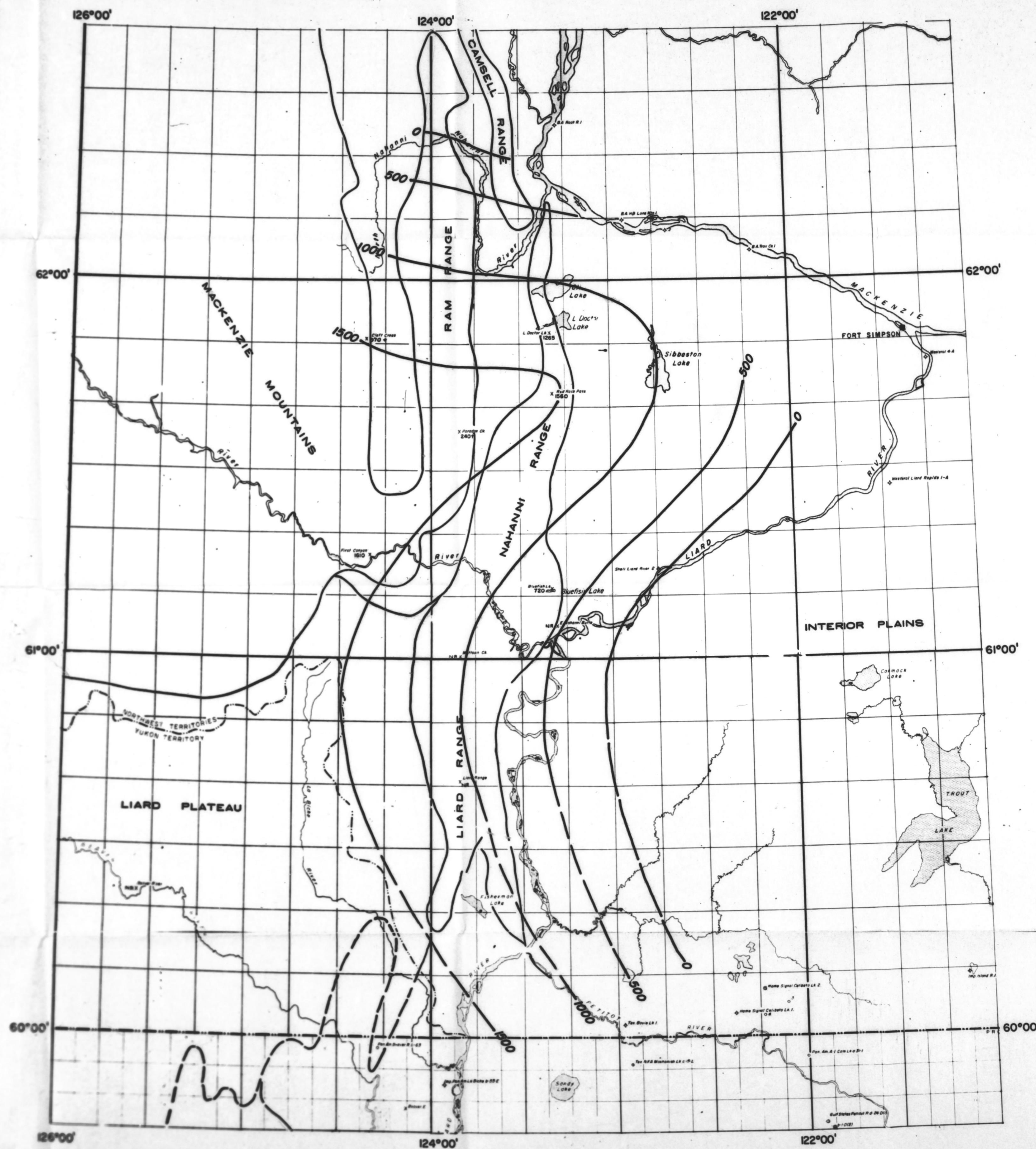


FIGURE 6
ISOPACH
BANDED DOLOMITE UNIT
CONTOUR INTERVAL - 500 FT.

32 MILES

LEGEND

- | | | |
|-------------------|---------------------------------|---------------------------|
| ○ LOCATION | ✱ ABANDONED LOCATION | ⊙ SUSPENDED |
| ● DRILLING | ✱ ABANDONED DRY HOLE | ⊙ INJECTION WELL |
| ⊙ OIL PRODUCER | ✱ ABANDONED OIL PRODUCER | ✱ ABANDONED WELL WITH OIL |
| ⊙ GAS PRODUCER | ✱ ABANDONED GAS PRODUCER | ✱ ABANDONED WELL WITH GAS |
| ✱ OUTCROP SECTION | ✱ ABANDONED WELL WITH OIL & GAS | |

To accompany report: Surface Geology of the South Nahanni area
between Pellet River, Lat. 60°00', and Citi Lake, Lat. 62°00'. By
R. A. Menzies - PR-2-59

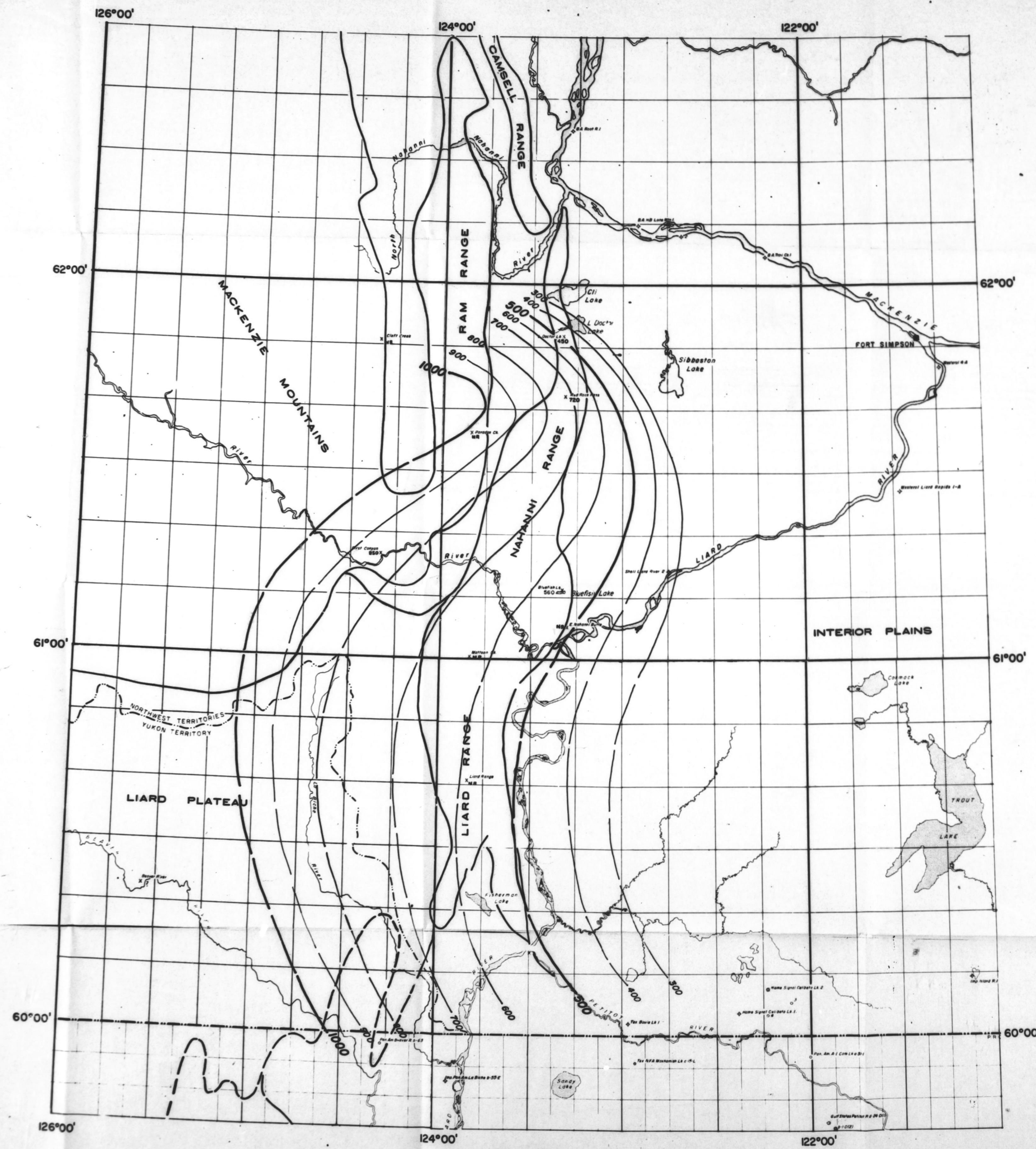


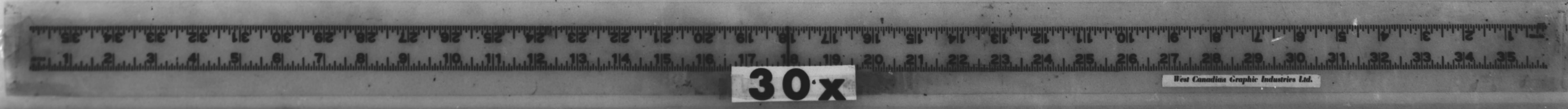
FIGURE 7
ISOPACH
PRIMARY DOLOMITE UNIT
CONTOUR INTERVAL - 100 FT.

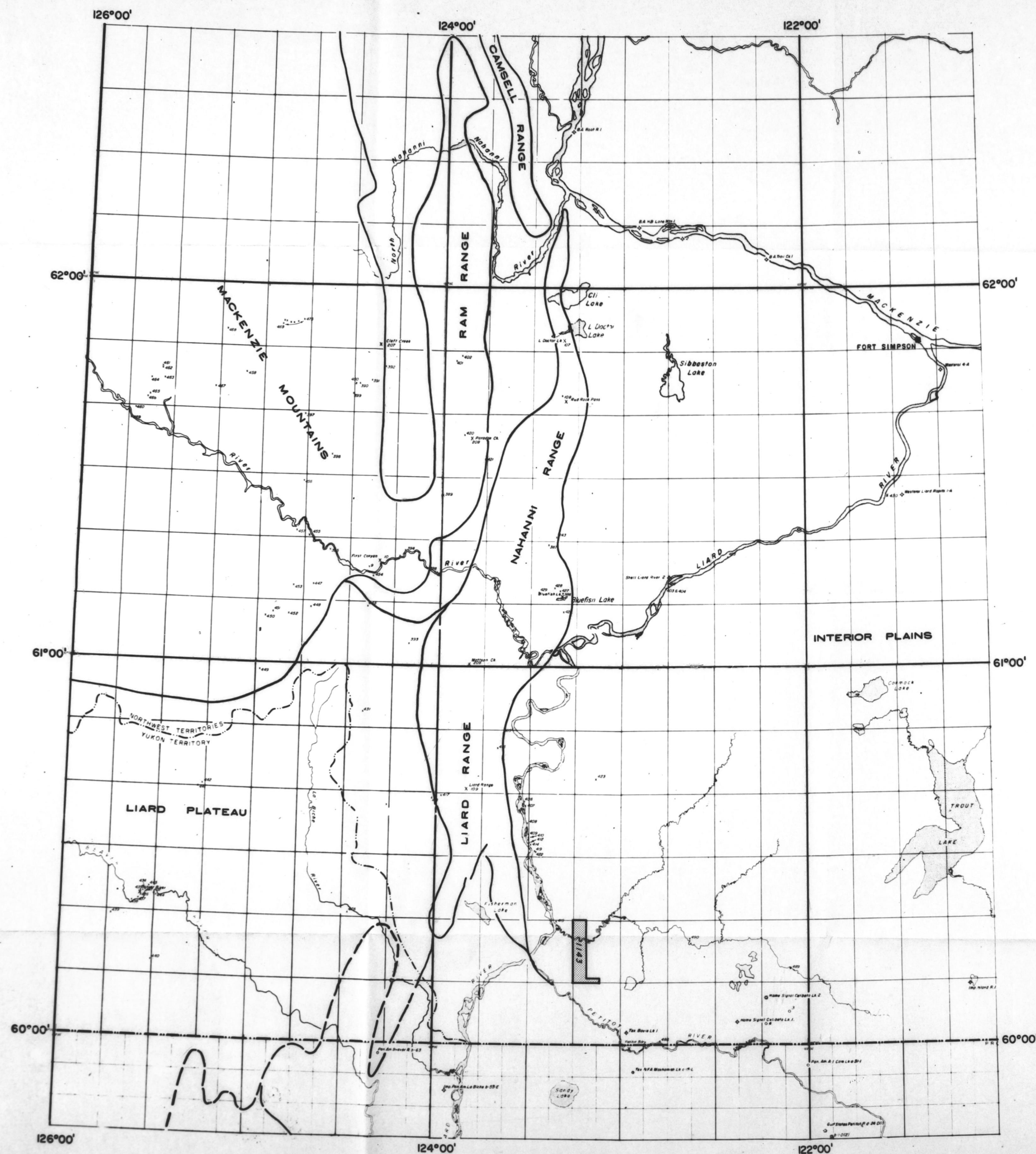
32 MILES

LEGEND

- | | | |
|-------------------|---------------------------------|---------------------------|
| ○ LOCATION | ✱ ABANDONED LOCATION | ⊙ SUSPENDED |
| ● DRILLING | ✱ ABANDONED DRY HOLE | ⊙ INJECTION WELL |
| ⊙ OIL PRODUCER | ✱ ABANDONED OIL PRODUCER | ⊙ ABANDONED WELL WITH OIL |
| ⊙ GAS PRODUCER | ✱ ABANDONED GAS PRODUCER | ⊙ ABANDONED WELL WITH GAS |
| ✱ OUTCROP SECTION | ✱ ABANDONED WELL WITH OIL & GAS | |

To accompany report: Surface Geology of the South Nahanni area
between Petibet River, Lat. 60°00', and Cili Lake, Lat. 62°00'. By
R. A. Menzies - PRE-59





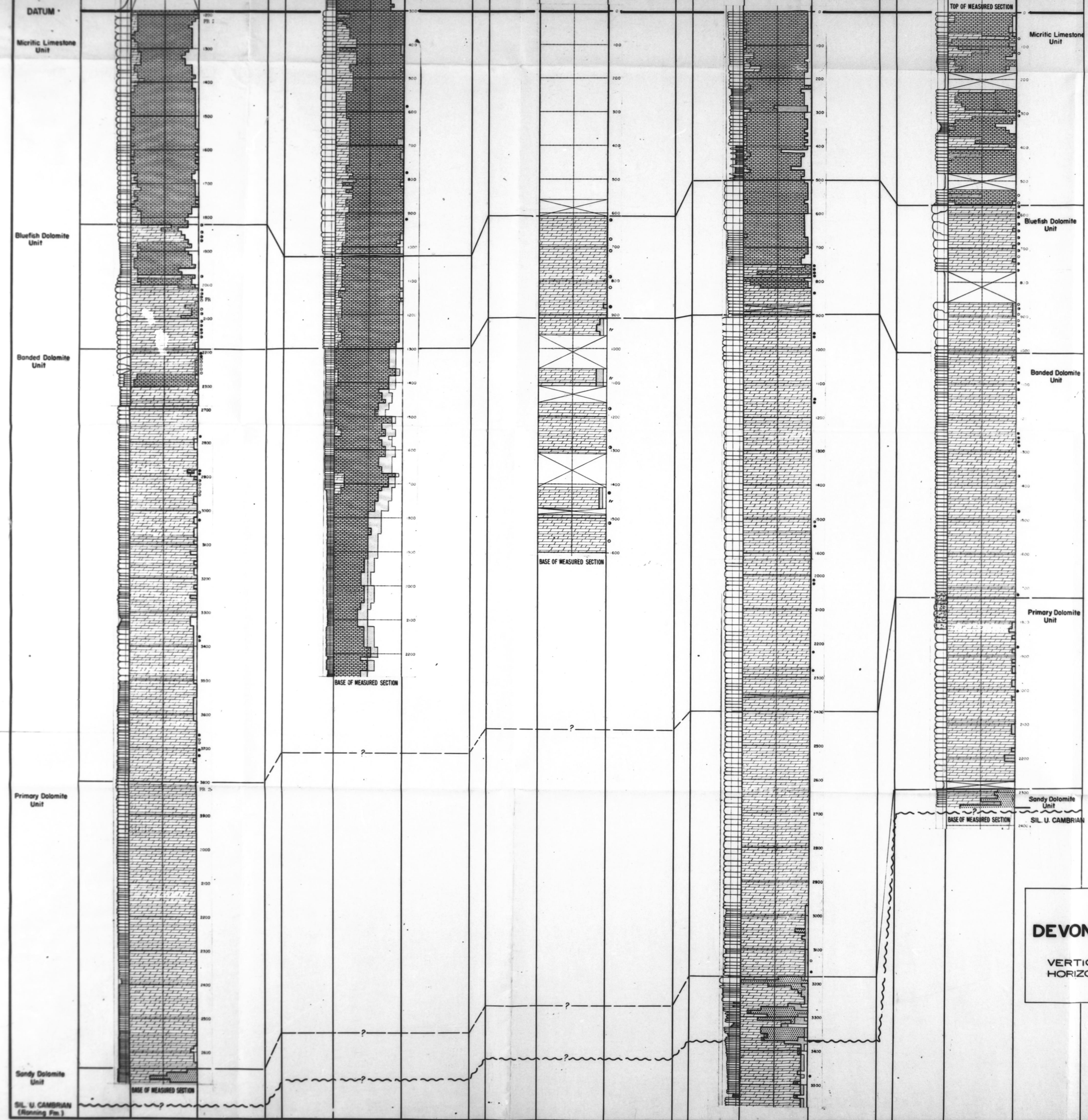
STATION LOCATION MAP 7-1-4-19

SCALE: 1 INCH = 8 MILES

TO ACCOMPANY REPORT:
Surface Geology of the SOUTH NAHANNI Area
between Petitot River - Lat. 60°00', and
Li Lake - Lat. 62°00', by R. A. Menzies - May 1960.

MAY 11, 1960

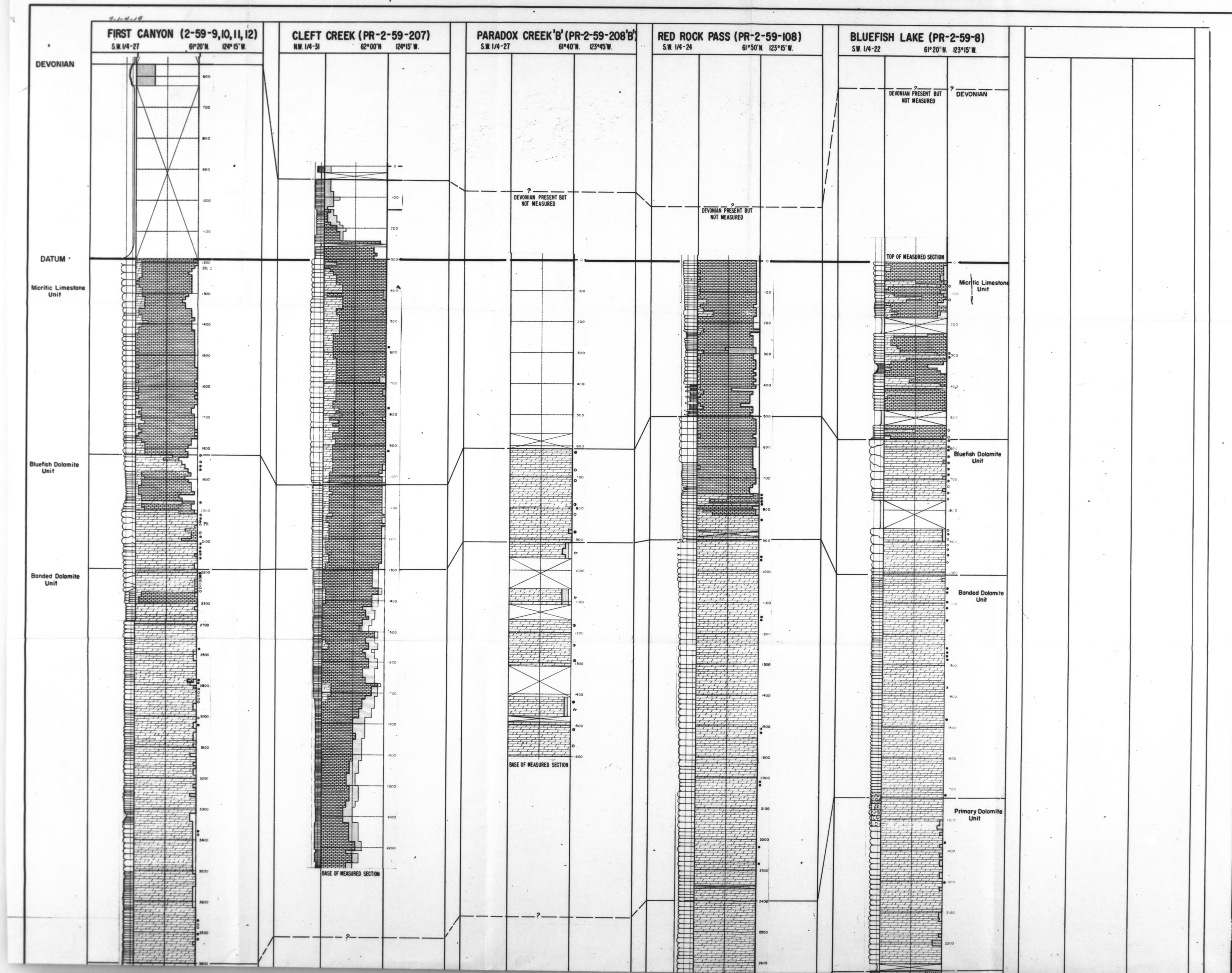




**GEOLOGICAL
CORRELATION SECTION
DEVONIAN - UPPER CAMBRIAN**

VERTICAL SCALE - 1 INCH TO 200 FT.
HORIZONTAL SCALE - NONE

1960 FIG. 8
FOR PERMIT 1193



30x

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