

SURFACE GEOLOGY

of the

NORTHWEST PORTION

of

GREAT SLAVE LAKE

for

CHERMARC DEVELOPMENTS LTD.

by

RAYALTA PETROLEUMS LTD.

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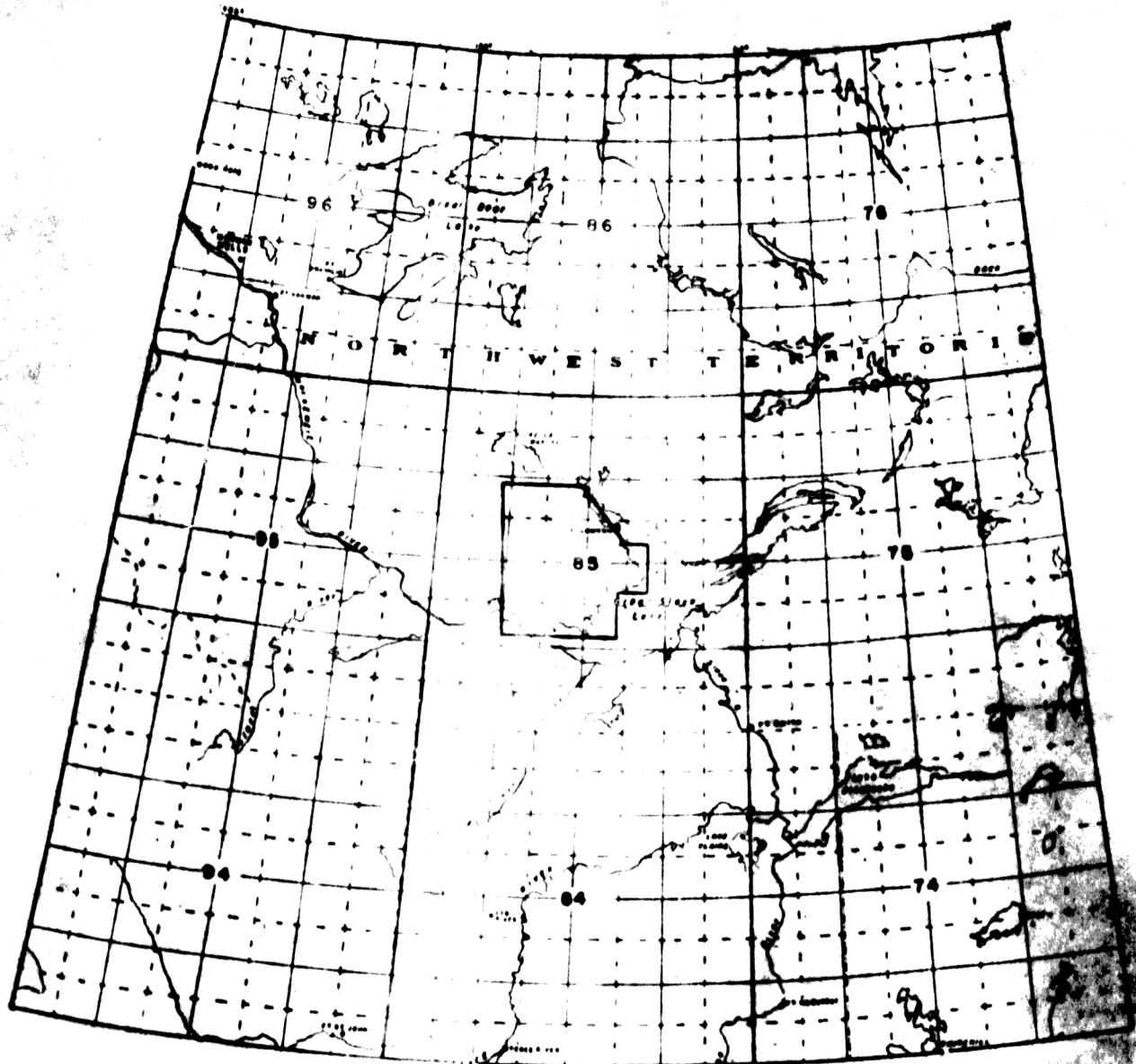
- Geological Map of North Arm - Great  
Slave Lake

## INTRODUCTION

This report deals with the geological evaluation of certain areas located on the North Arm - Great Slave Lake, and two areas bordering The Horn Plateau.

Although all field trips were traversed outside Petroleum and Natural Gas Permits 4569, 4570, 4571 4572, 4575 and 4583, held by Chermarc Developments Ltd., (Latitude 61° 50' - 62° 20'; Longitude 116° 30' - 117° 00'), it was possible to interpolate, to some extent, the structure of the underlying strata, and obtain an estimated thickness of the various rock types of the aforesaid strata.

Surface geological field work was carried out in September, 1968, and incorporated with data from other sources, in order to present this report.



REGIONAL LOCATION MAP

## CLIMATE & ACCESSIBILITY

The climate of the North Arm - Great Slave Lake area is one of extremity. In January and February, the temperature descends to a low of 60° Fahrenheit while July's temperature may ascend to 90° Fahrenheit. Generally, spring conditions commence in April, and, ice begins to form on the lakes again in mid October.

Navigation on the Great Slave Lake commences in late June, and ceases the second week in October. The lake is completely frozen for approximately five and one-half months.

The area is linked to the south by the MacKenzie Highway which is joined to the Yellowknife Highway running from Fort Providence to Yellowknife, N.W.T. Winter tractor roads are numerous, although most are only suitable for snowmobile traffic.

There is daily air service between Edmonton and Yellowknife where aircraft are available for charter. However, there is a period shortly after freeze-up when fixed-wing aircraft are grounded, due to thin ice .

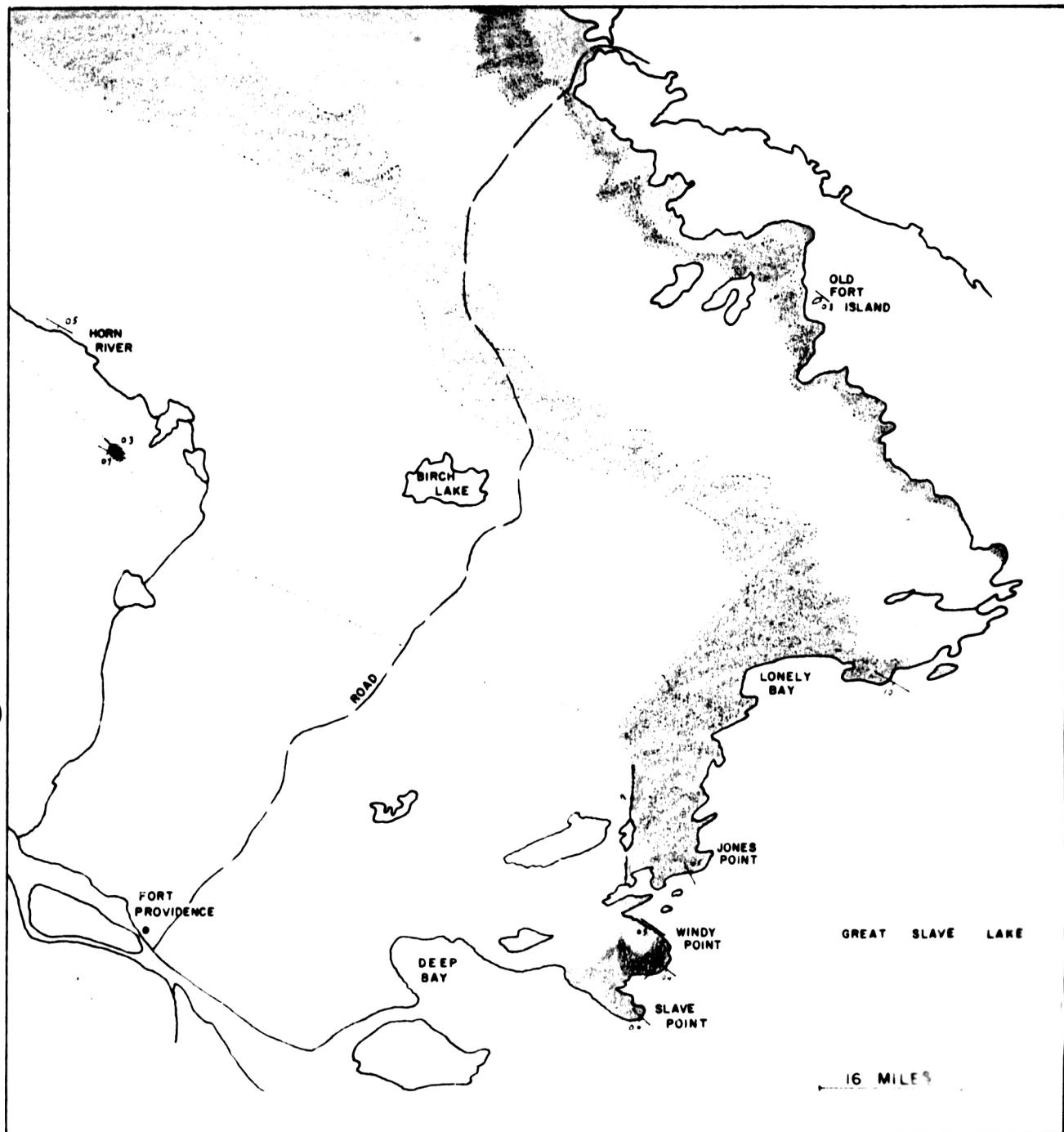
## PHYSICAL FEATURES

The North Arm of Great Slave Lake lies completely in one physiographical region, The Interior Plains.

The principle rivers dissecting the area, are the MacKenzie River, draining Great Slave Lake on the south; the Horn River which drains The Horn Plateau and empties into the MacKenzie River to the south, and Mosquito Creek which empties into Great Slave Lake, nine miles south of Frank Channel.

The elevation of the area rises gently from 570 feet on the shore of Great Slave Lake, to 790 feet at the base of the Horn Plateau. The entire area has been extensively glaciated, and has a strong north-east grain. Glacial striations and grooves are common; however, no moraine was identified. A number of shallow lakes following the glaciation trend dot the landscape. Muskeg is abundant in this area.

Although there are no real areas of predominant relief, certain formations of the Middle Devonian Age from small, cliff-like structures which seldom rise more than 50 feet. The Horn Plateau Reef of Middle Devonian Age is an exception, rising 100 feet above the surrounding area.



MAP NO. 2

GEOLOGICAL MAP OF NORTH  
ARM, GREAT SLAVE LAKE.

LEGEND	
OLD FORT ISLAND	LONELY BAY
LA MARTRE FALLS	HORN RIVER
CHEDABUCTO LAKE	PINE POINT
MIRAGE POINT	PRESQU'ILE
CHINCHAGA	SULPHUR POINT
	SLAVE POINT
	HORN PLATEAU

## STRATIGRAPHY

### TABLE OF FORMATIONS

ERA	PERIOD	FORMATION & THICKNESS	LITHOLOGY & DISTRIBUTIONS
PALEOZOIC	MIDDLE DEVONIAN	HORN PLATEAU	Richly fossiliferous, reefal limestone, fine to coarse grained, buff coloured; found in one location, Horn Plateau Reef.
		40' exposed	
		?	Unconformity
		SLAVE POINT	Fine grained-brown limestone Stromatoporoidal; type location Slave Point
		0' - 310'	
		?	
		SULPHUR POINT	White to buff weathering limestone and occasional interbedded dolomitic - found at Windy Point
		170'	
		PRESQU'ILE	Massive, coarse grained recrystallized dolomitic, sometimes fine grained and vuggy
		260'	
		UPPER LIMESTONE MEMBER	Light gray to buff limestone, richly fossiliferous in spots, and occasional shale
		215' +	

## STRATIGRAPHY

### TABLE OF FORMATIONS

- 2 -

ERA	PERIOD	FORMATION & THICKNESS	LITHOLOGY & DISTRIBUTIONS
PALEOZOIC	MIDDLE	HORN RIVER TONGUE 100' ±	Not exposed, but well information indicates shale and argillaceous limestone.
		LONELY BAY MEMBER 120' ±	Brown to buff massive limestone moderately fossiliferous; found on north shore of Lonely Bay.
		HORN RIVER 270'	Dark gray shale and occasional argillaceous limestone; exposed on Horn River.
		LONELY BAY 125' - 280'	Brecciated, argillaceous limestone medium brown; sometimes massive; exposed around Desert Lake
		CHIN-CHAGA 300' ?	Limestone gypsum, salt and minor green shale.
		?	Unconformity

## STRATIGRAPHY

- 3 -

### TABLE OF FORMATIONS

ERA	PERIOD	FORMATION & THICKNESS	LITHOLOGY & DISTRIBUTIONS
PALEOZOIC	Z	UPPER	CHEDABUCTO LAKE
	A		0 - 280'
	-		?
	O	MIDDLE	LA MATRE
	-		300 - 400'
	→		OLD FORT ISLAND
	O	MIDDLE or OLDER	Mainly quartzose sandstone, medium grained and thickly bedded.
	D		0 - 135' +
	R	MIDDLE or OLDER	
	O		

## ORDOVICIAN

### OLD FORT ISLAND FORMATION

The type section of this formation is exposed on the east tip of Old Fort Island in the Great Slave Lake - North Arm area. It is composed of a sandstone; which unconformably overlies the Pre-Cambrian and is immediately overlain by the La Matre Falls formation.

The exposure on Old Fort Island consists mainly of a white to buff, coarse grained porous quartzose sandstone, with evidence of cross bedding. The sandstone breaks up easily and forms a white sandy beach, immediately to the south; iron staining is common giving the formation a dark brown appearance on weathering. There was no indication of fossilization.

Seventy-five miles to the south, at the northwest Windy Point No. 1 well, located west of Falaise Lake, the Old Fort Island formation was discovered to be at

a depth of 1,640 feet and was 110 feet thick.

#### LA MATRE FALLS FORMATION

This formation did not outcrop on Old Fort Island, but talus slabs of red shale along the shore contributed evidence that it covered the interval between the underlying Old Fort Island formation and the overlying Chedabucto Lake formation. The interval not exposed was 90' feet thick which is the presumed thickness of the La Matre Falls formation at this locality.

#### CHEDEBUCKTO LAKE FORMATION

A 14 foot cap of resistant dolomite outcropping on the high east-end point of Old Fort Island, is assigned to the Chedabucto Lake formation. It is composed of a thickly bedded to massive, cliff forming, fine grained dolomite, weathering a yellowish brown. It is commonly medium brown in colour, non porous, and very resistant.

No fossils were found at this locality, but,  
**Stroptelasma** has been found at other localities indicat-  
ing an Upper Ordovician (Richmond) Age.

The Chedabucto Lake formation is unconformably  
overlain by the Chinchaga formation of the Middle  
Devonian.

## SUMMARY

The above three formations complete the occurrence of Ordovician and older rocks on the north arm of the Great Slave Lake. There is a fourth unit, not previously mentioned, the Mirage Point formation, which is equivalent to the latter two. The total thickness of Ordovician and older rocks, represented in the Northwest Windy Point No. 1 well was 708 feet thick.

## MIDDLE DEVONIAN

### CHINCHAGA FORMATION

The Chinchaga formation is an evaporitic unit, unconformably overlying the Chedabucto Lake formation, and is characterized by low, flat areas and numerous shallow lakes. Because of the soft, non-resistant nature of this unit, few outcrops were observed.

This formation was exposed, however, as a scarp, one mile north of Mosquito Creek on the Yellowknife Highway. It was composed of a medium to thick bedded, fairly resistant argillaceous fine grained limestone; with occasional calcite, and large (one inch) subhedral crystals of gypsiferous anhydrite, weathering gray-brown, and varying in color from a buff white to a medium brown. Twenty-two feet of section was exposed.

Extreme slumping had taken place, but the beds appeared to be flat lying or dipping slightly southwest.

The presence of the Chinchaga formation in this area does not correspond to the mapping of the Geological Surveys - Operation MacKenzie (1957), which places the area in the Middle and Upper Ordovician.

#### LONELY BAY FORMATION

This formation overlies the Chinchaga formation and is in turn overlain by the Horn River formation. Outcrops in this formation are infrequent; the only outcrops observed are located in the Desert Lake vicinity. The rock consisted of a pale brown weathering argillaceous limestone, in scarp-like exposures.

#### HORN RIVER FORMATION

The Horn River formation outcrops at several localities along the Horn River, beginning north of

Ferguson Creek and the Horn River junction and continuing for nine miles northwards. Many outcrops were exposed at water level, although at two localities the rock is exposed as a cut some 30 feet high along the river bank.

This rock consists of a dark grey to black brownish-yellow weathering shale, with minor limestone interbedding, and, at one location thick-bedded fossiliferous gray limestone, weathering white-gray.

Beds along the water line generally consist of black shale, weathering reddish-orange to red; and well jointed.

PINE POINT FORMATION

UPPER LIMESTONE MEMBER

This member is the upper unit of the Pine Point formation and is well exposed on the south, and west flanks of Jones Point, with a water level exposure of three to four feet. The unit consists of a fairly hard buff coloured, fine-grained, limestone with thinly interbedded, calcareous shale. It is richly fossiliferous with *Atrypa* being the most common Brachiopod.

This unit is immediately overlain by the Presquile Formation. A fisherman reported an oil seepage off Caribou Point, 600 yards north of the red barrel buoy marker. This seepage was not observed, due to inclement weather conditions, but the exact location is believed to be designated by a small buoy.

LONELY BAY MEMBER

The Lonely Bay Member is a continuation of the Lonely Bay formation, which conformably overlies the

the Chinchaga Formation, and is in turn overlain by a tongue of the Horn River formation.

The lower beds of this member outcrop along the east side of Lonely Bay, forming a cliff approximately 40 feet high, with six feet to eight feet of exposure. The rock consists of thin to thick bedded, richly fossiliferous fine-grained, pale brown, slightly dolomitized limestone, weathering light gray to yellowish-gray. Some oil staining was present along fractures.

#### HORN RIVER TONGUE

No outcrop information was evident on this unit, however, it is assumed that this unit is similar to the Horn River formation; i.e. soft shale.

#### PRESQU'ILE FORMATION

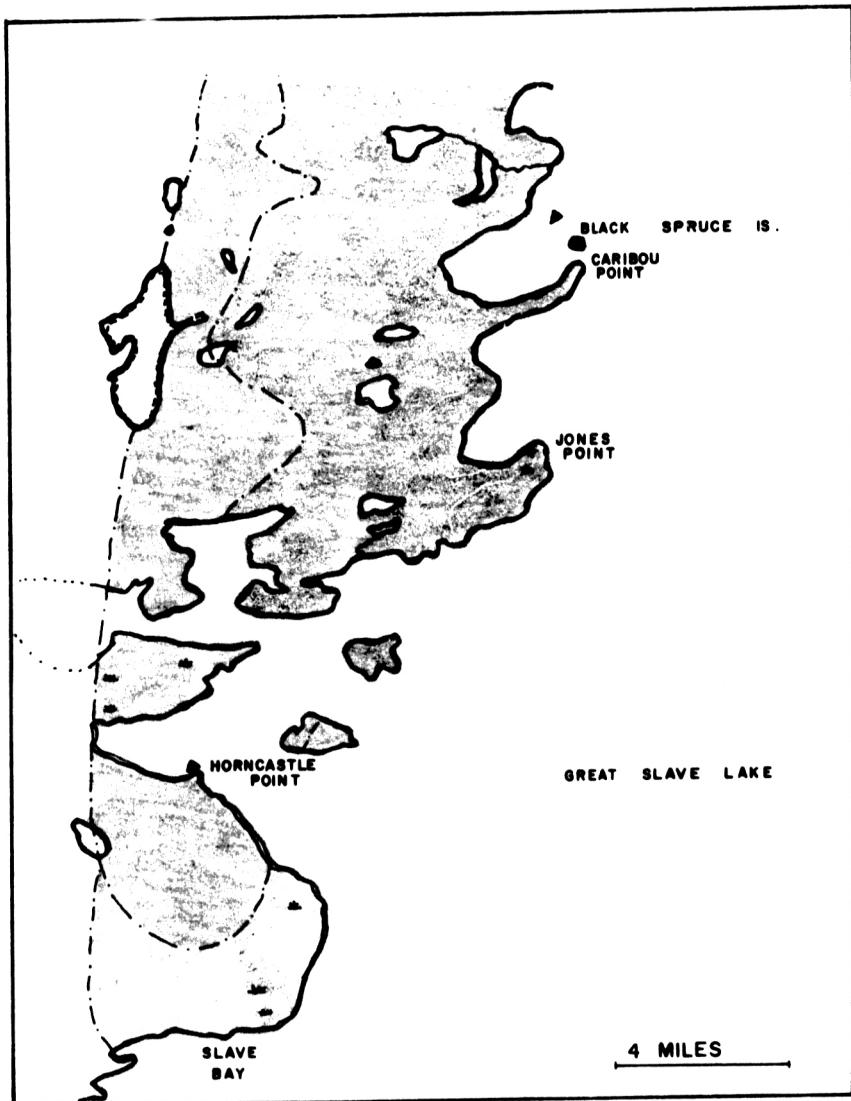
This formation outcrops on the north flank of Windy Point, butting up against, and underlying the

Sulphur Point formation. This rock is composed of light coloured, coarsely re-crystallized dolomite, vuggy in spots, and quite massive. It weathers grayish-brown, coloured buff to brown with little fossilization present.

Outcrops of Presquile were predominant at shore line up to and including Horncastle Point, oil stained rocks and oil seepage was observed. To the Windy Point side of Horncastle Point, the adjoining bay had a sandy beach at least two feet deep which resembled that of the Old Fort Island formation. It is presumed that the Old Fort Island formation outcrops somewhere below surface level, or is faulted upwards.

#### SULPHUR POINT FORMATION

Overlying the Presquile formation and to the east, is the Sulphur Point formation which outcrops on the southeast flank of Windy Point forming a ridge which runs almost the entire length of the peninsula, at a



Map No. 1

SULPHUR BAY  
REGION

LEGEND	
OIL SEEPAGE	▲
SULPHUR BAY	■
PRESQU'ILE	■
PINE POINT	■

height varying between 20 feet to 30 feet. This formation outcrops along the water line at several localities.

Some two to three feet were exposed at certain places along the ridge, towards the southern end. The rock exposed was a thin to medium bedded, whitish fine-grained limestone containing numerous Stromatoporoids. The outcrops along the shore were a slightly harder, argillaceous limestone weather gray-white.

Drill hole results made by Windy Point Mining showed the middle beds to be petroliferous.

#### SLAVE POINT FORMATION

The Slave Point formation outcrops in three areas very close to Slave Point itself with a thickness of two feet. It is exposed as a pavement

at the water line, 0.3 miles and 0.6 miles north of Slave Point.

The rock consists of thinly bedded; medium-grained dolomitized limestone, brownish in color, and, weathering brown at water level, and gray in surface. It contains numerous Stromatoporoids.

The Slave Point formation at this point appears to be thinning to extinction and probably blends into the Horn River or Presquile formation.

#### HORN PLATEAU FORMATION

The only known outcrop of the Horn Plateau Formation occurs two and one-half miles due west of Fawn Lake. The outcrop is located on the periphery of a nearby circular hill, rising 100 feet above the surrounding landscape with predominant

outcrops on the north side.

The rock of which approximately 40 feet is exposed, is composed of reefal limestone. The top 20 feet is composed of an extensively fossiliferous white coral limestone, weathering whitish-gray. The lower 20 feet is composed of a brownish weathering more compact, fossiliferous limestone which probably extends deeply under the surface.

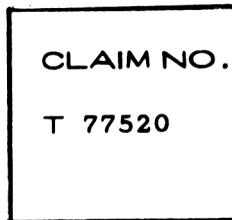
Erosion has produced a number of pillars and stacks mainly on the north side of the hill, attaining a height of 10 to 15 feet.

The change between the upper and lower section, is not sharp, but, a certain pattern of layering, between corals and brachiopods is present in the lower section, that is not present in the upper section. The upper section is slightly more porous than the lower.

**OBSERVATIONS ON PREVIOUS WORK CARRIED  
OUT ON THE HORN PLATEAU REEF**

The formation has had extensive work performed on it. Seismic lines are cut radially from the center point of the hill and extend in.....some cases over a mile. At least two drill holes of undetermined depth were observed; and the entire hill and surrounding area has been staked for minerals.

The following information was obtained from one claim post, located at the center point of the hill:



**POST NO. 1**

WHI #20  
J. Robinson #9694  
August 5, 1968  
5:00 A.M., M.S.T.

**POST NO. 1**

CLAIM NO.

T 77521

POST NO. 2

WHI #21  
J. Robinson

POST NO. 2

CLAIM NO.

T 77528

POST NO. 3

WHI # 28  
J. Robinson

POST NO. 3

CLAIM NO.

T 77529

POST NO. 4

WHI # 29

POST NO. 4

## SUMMARY OF THE MIDDLE DEVONIAN

The total width of area covered by Middle Devonian surface outcrop covers a 60 mile wide belt, following the general north-west strike trend. The total thickness of Middle Devonian strata in the Windy Point area is 1,275 feet.

The area is not influenced by tectonic forces to any extent, and only one possible major fault was observed, that which divides the Presqu'ile formation from the Upper Devonian - Hay River formation.

Although the Horn Plateau is thought to be the youngest Middle Devonian formation in the area, it does line up on strike with the Presqu'ile Reef formation, and possibly there is some correlation between the two.

## RECOMMENDATIONS

The area covered by Map Number One from Slave Bay north through Caribou Point, would seem, after preliminary work, to warrant further investigation.

The presence of two oil seeps enhance the prospects of this area. A second area, Lonely Bay, immediately north, also has localized oil staining.

In the Permit area, the general structure of the subsurface is assumed to follow the general strike of the region. Most of the area is immediately underlain by the Horn River formation; estimated at 250 feet in thickness. The north-east corner of the Permit is probably underlain by the Lonely Bay formation. Since there is no surface outcrop at all in the Permit area, it is impossible to determine exact thickness of the units. At least two test wells should be drilled, preferably near the south-west corner of the lease.

Respectfully submitted by:

RAYALTA PETROLEUMS LTD.

KB/jp

*William A. Crook*

PLATE NO. 1

Stacked coral exposed at Horn  
Plateau Reef Formation.

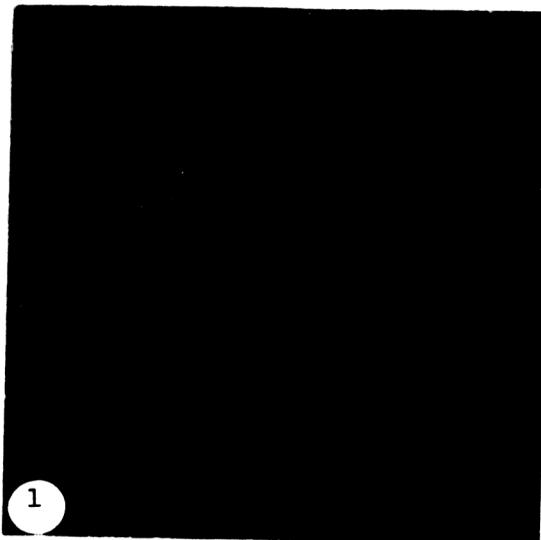


PLATE NO. 2

Typical exposure of Horn Plateau  
Reef; north side of circular hill.

PLATE NO. 3

Minor deformation observed  
at unrelated points in Horn  
Plateau Reef; (Upper section)

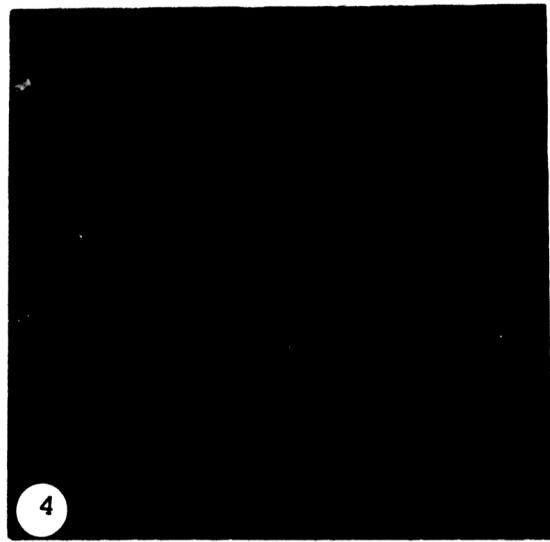
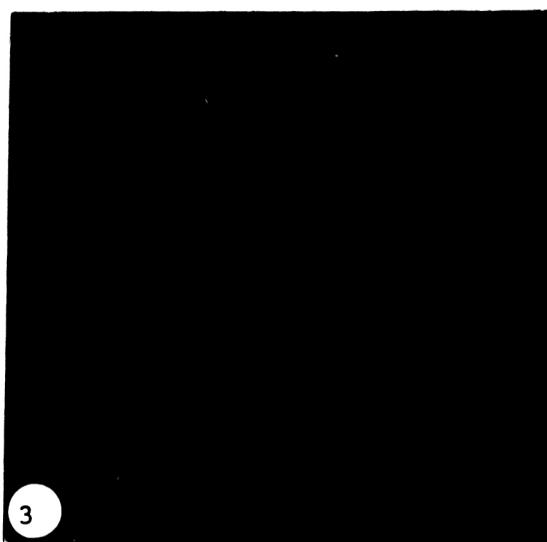


PLATE NO. 4

Massive limestone - Horn Plateau  
Reef; (lower section)

PLATE NO. 5

Limestone of the Sulphur Point Formation; exposed along base of cliff at Windy Point.

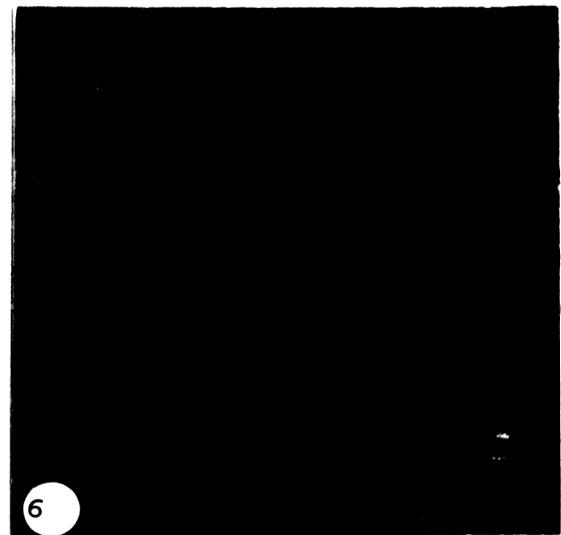
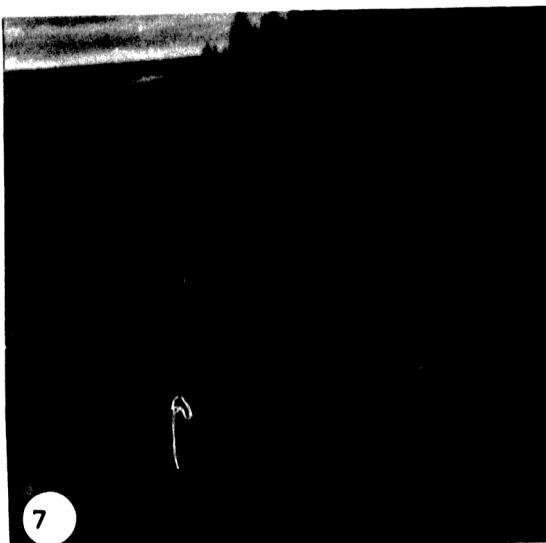


PLATE NO. 6

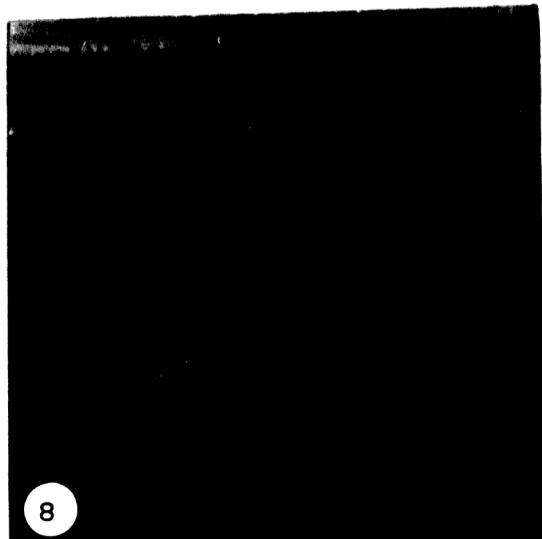
Shoreline exposure of Sulphur Point limestone.

PLATE NO. 7

Outcrop near Horncastle Point;  
Presquile Formation; massive  
dolomite.



7



8

PLATE NO. 8

Shoreline exposure of Upper  
Limestone Member .. Pine Point  
Formation; located near Jones  
Point.

PLATE NO. 9

Cliff forming limestone of the  
Lonely Bay Member - Pine  
Point Formation; west of Long  
Island.

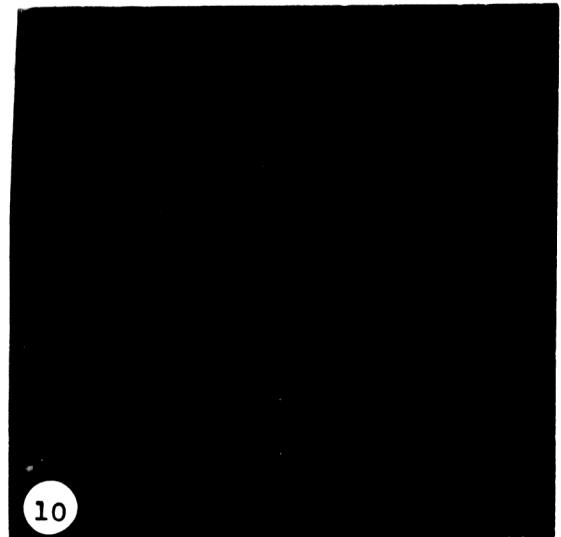
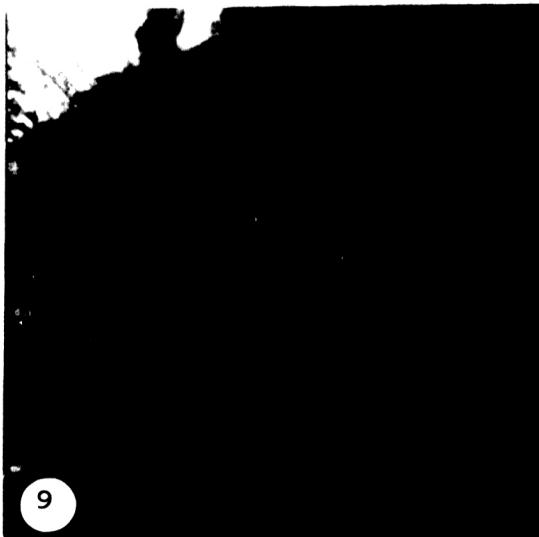
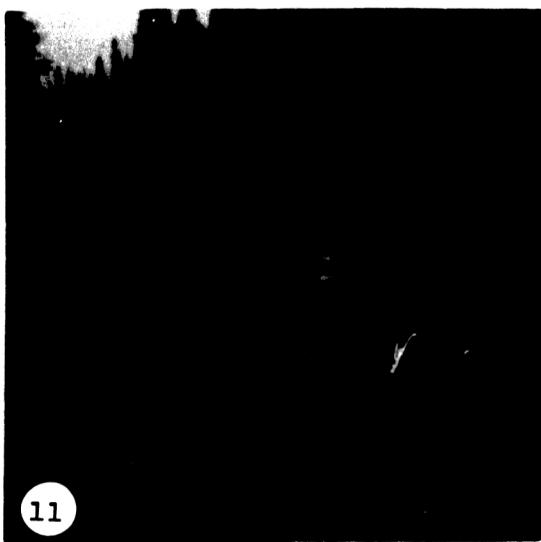


PLATE NO. 10

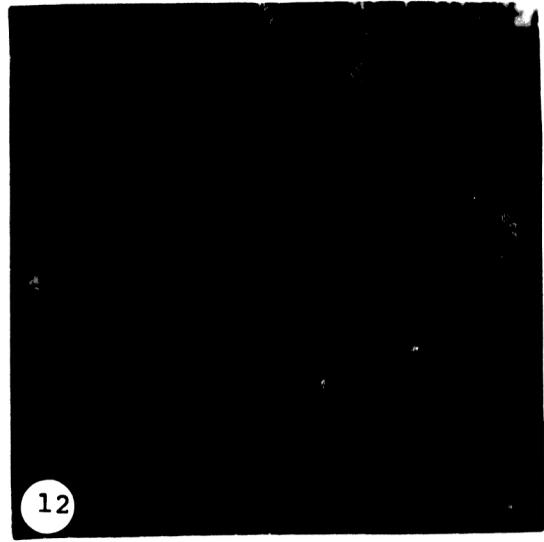
Shale of the Horn River Formation;  
exposed on Horn River

PLATE NO. II

Cliff forming anhydritic limestone,  
occasionally dolomitic; exposed  
one mile northeast of Mosquito Creek.



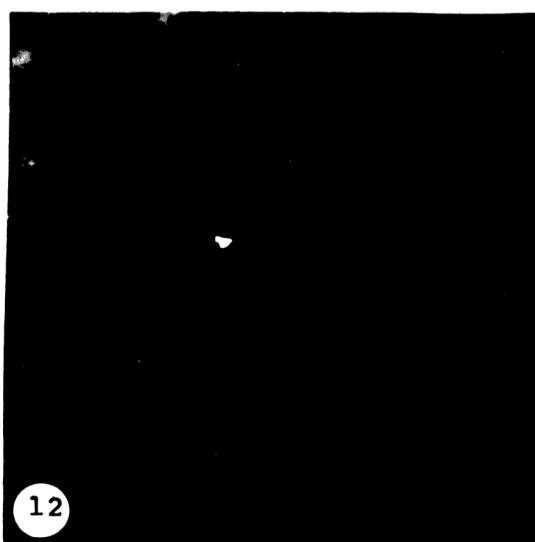
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12

PLATE NO. 12

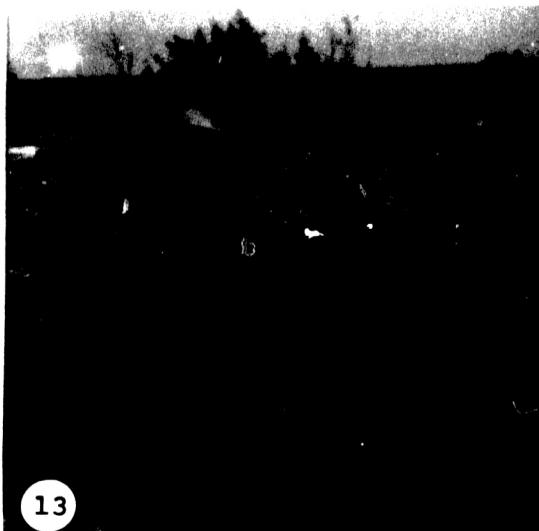
Upper Ordovician: Chedabucto  
Lake Formation; thick-bedded  
to massive dolomite; exposed  
at east end of Old Fort Island



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PLATE NO. 13

**Shoreline exposure of Old Fort Island Formation, showing cross bedding of sandstone; east side of Old Fort Island.**



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## REFERENCES

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