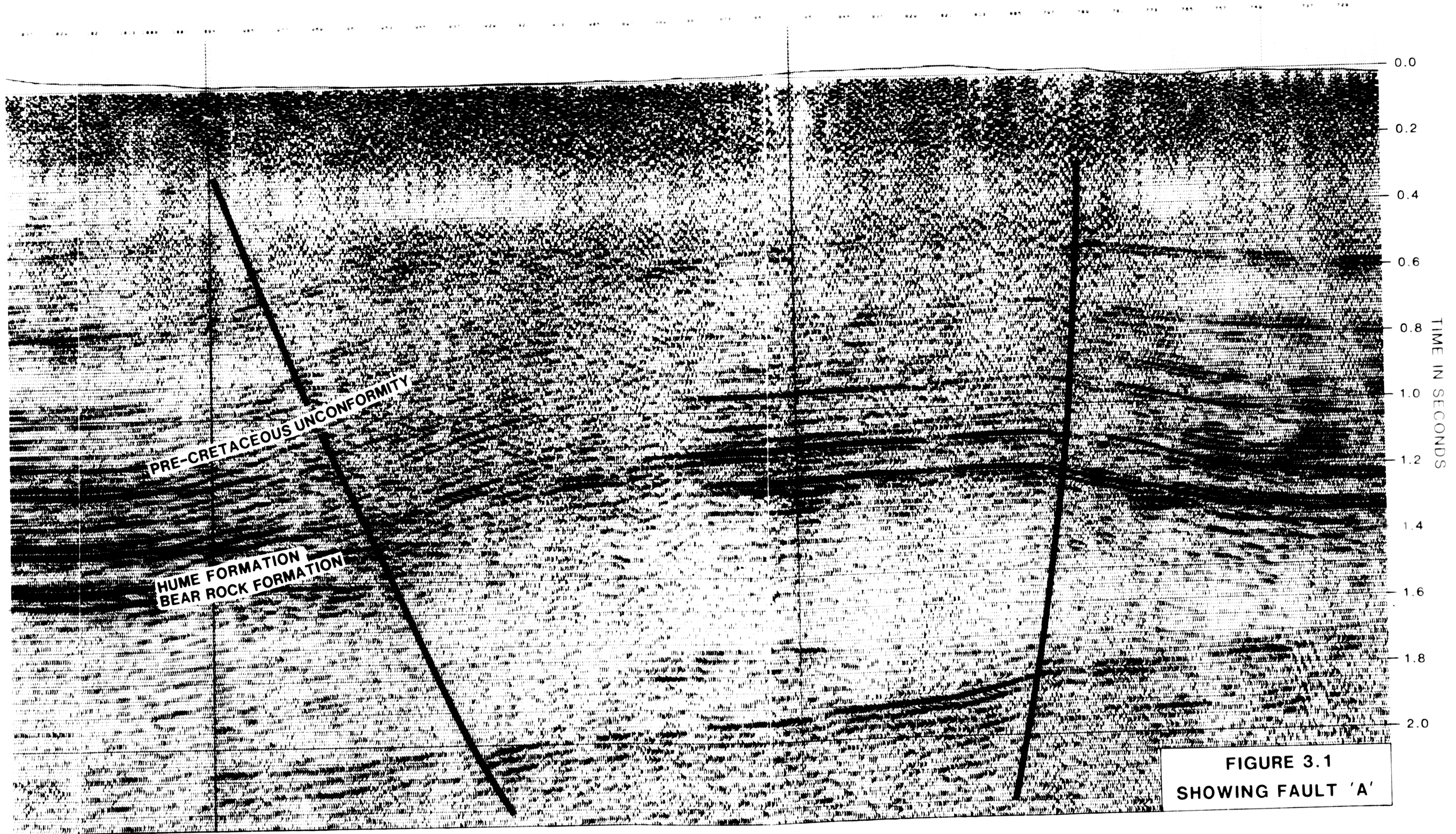


LINE 85 - 08A

NE →

0 1km





3F

Report on the
GEOPHYSICAL EXPLORATION SURVEY

PROGRAM No. 9229-P28-11DA

in

RAMPARTS and MOUNTAIN RIVER
NORTHWEST TERRITORIES

APRIL, 1986

Petro-Canada Resources

P.O. Box 2844
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April 7, 1986



Canada Oil and Gas Land Administration
355 River Road
Ottawa, Ontario
K1A 0E4

Attention: Mr. Don Sherwin
Director Resource Evaluation

Dear Sir:

Re: PROGRAM #9229-P28-11DA
RAMPARTS 1984/85
PCI File: NOR Program 9229-P28-11DA

Please find enclosed in triplicate, copies of the final report for the Ramparts and Mountain River Seismic Program No. 9229-P28-11DA.

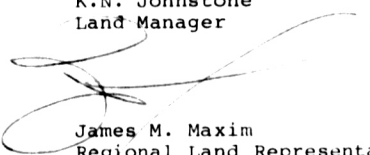
Please acknowledge receipt of the final report and return one copy of the transmittal list to the attention of the writer.

Thank you.

Sincerely,

PETRO-CANADA INC.

K.N. Johnstone
Land Manager


James M. Maxim
Regional Land Representative

JMM/kcb
enclosure: 1984/85 Ramparts & Mountain River Seismic
Report
Transmittal List 005448
x.c.: B. Palmiere 730 PCCW

TRANSMITTAL LIST

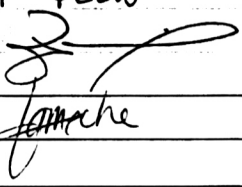
No 005448

PETRO-CANADA

DATE

April 3rd

1986

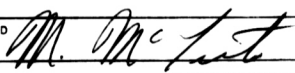
TO James Maxim 1008 PCCW	FROM B. Lameche 709 PCCW 
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AS
FOLLOWS☐ UNDER
SEPARATE
COVERSENDER'S
SIGNATURE

REFERENCE

NO	ITEM
	Rainparts and Mountain River (NWT)- - 3 Reports on the Geophysical Exploration Survey 9229-P28-11DA for COGLA.

REMARKS

RECEIVED
BY:

DATE

April 17/86

19

176-8411

PLEASE ACKNOWLEDGE RECEIPT BY SIGNING AND RETURNING ATTACHED COPY

1985 RAMPARTS AND MOUNTAIN
RIVER N.W.T.

PROGRAM NUMBER: 9229-P28-11DA

YEAR: 1985

Filed under same Project Number YES or

(a) WRITTEN REPORTS:

(1) Operations Report Number:

(2) Interpretation Reports Number: 1

-INTERP REPORT

(b) MAPS:

(1) Shotpoint Maps Number: 4

-T.S.M. PRE-CRETACEOUS UNCONFORMITY
-T.S.M. TOP OF KEE SCARP
-TIME INTERVAL TOP OF KEE SCARP TO TOP OF HUME
-TIME INTERVAL BASE OF CARBONATES TO TOP OF PROTEROZOIC

(2) Interpretation Maps Number:

(3) Other Maps Number: 0

(c) SEISMIC SECTIONS

TRADE DATA Seismic under.

9229 540 1P

Number: 0

PROJECT ACTION SHEET

RESOURCE EVALUATION BRANCH

PROJECT NUMBER:..... 9229-P28-11DA

COMPANY:..... PETRO-CANADA

REPORT TITLE:..... GEOPHYSICAL EXPLORATION SURVEY RAMPARTS AND MOUNTAIN RIVER

The following action has been taken:

Receipt acknowledged APRIL 17/86...

Reports and maps date-stamped YES

Memo sent to Land Management NO

Reports for review list edited YES

Inventory sheet made YES

Mylar NO

REVIEW AND APPROVAL made by:

NO SECTIONS WITH THIS REPORT in 9229 S4 1P

COMMENTS:

Laura Richards

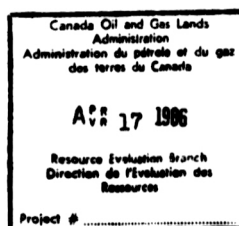
Report on the
Geophysical Exploration Survey

Program No. 9229-P28-11DA

**RAMPARTS and MOUNTAIN RIVER
NORTHWEST TERRITORIES**

by
Petro-Canada Inc.

April, 1986



BRANCH

Field Work Period:

Area Co-ordinates:

Data Acquisition:

Operator:

January - May, 1985

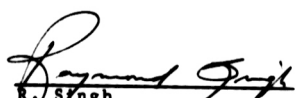
Latitude 65°20' - 66°20'

Longitude 128°15' - 131°00'

Beaver Geophysical, a Division
of Line Resource Information
Inc.

Sigma Exploration Ltd.

Submitted by:


R. Singh
Project Geophysicist
N.W.T./Beaufort Region


J. B. Henry, P. Geoph.
Regional Geophysicist
N.W.T./Beaufort Region

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- BOSTOCK, H. S., 1970. Physiographic Regions of Canada; Geol. Surv. Can., Map 1254A.
- KARY, W. M., 1980. Preliminary Report on Imperial Anticline and Basal Cambrian Sands.
- AITKEN, J. D., et al, 1982. Upper Ramparts River (106G) and Sans Sault Rapids (106H) map areas, District of Mackenzie. Geol. Surv. Can., Memoir 388.

SECTION ONE

INTRODUCTION

Petro-Canada participated in a geophysical survey conducted by Sigma Exploration (1978) Ltd. in the Mackenzie Valley area during the 1984/85 winter season. This report summarizes the results obtained from that survey. The location of the above mentioned area is given in Figure 1.1.

The reason PCR participated in this program was to evaluate this area and locate structures that have the potential of containing commercial hydrocarbons.

This report combines the results of the interpretation of the data. All maps produced during the work period of January - March, 1986 are included in the report.

SECTION TWO

INTERPRETATION AND PRESENTATION OF RESULTS

2.1 Regional Physiography and Geology

The project area is located within the Northern Interior Plain of the N.W.T. and lies between the Arctic Red River and Mountain River. The town of Norman Wells is approximately 125 kilometers southeast of the area on the Mackenzie River. The location of the project area is shown in Figure 1.1.

The project area is bounded by the following co-ordinates: 65°20' - 66°20' north and 128°15' - 131°00' west and lies on the eastern part of the physiographic sub-province of the Peel Plain and Peel Plateau as shown in Figure 2.1. The Mackenzie Mountains border the southwestern edge of the prospect. Topographically the project area varies from an elevation of about 100 metres in the northern part to around 550 metres in the southern part.

2.1.1 Stratigraphic Column

The stratigraphic column of the Ramparts area includes Proterozoic, Cambrian, Ordovician, Silurian, Devonian and Cretaceous units. The stratigraphic units of the Peel Plain and Peel Plateau are shown in Table 2.1.

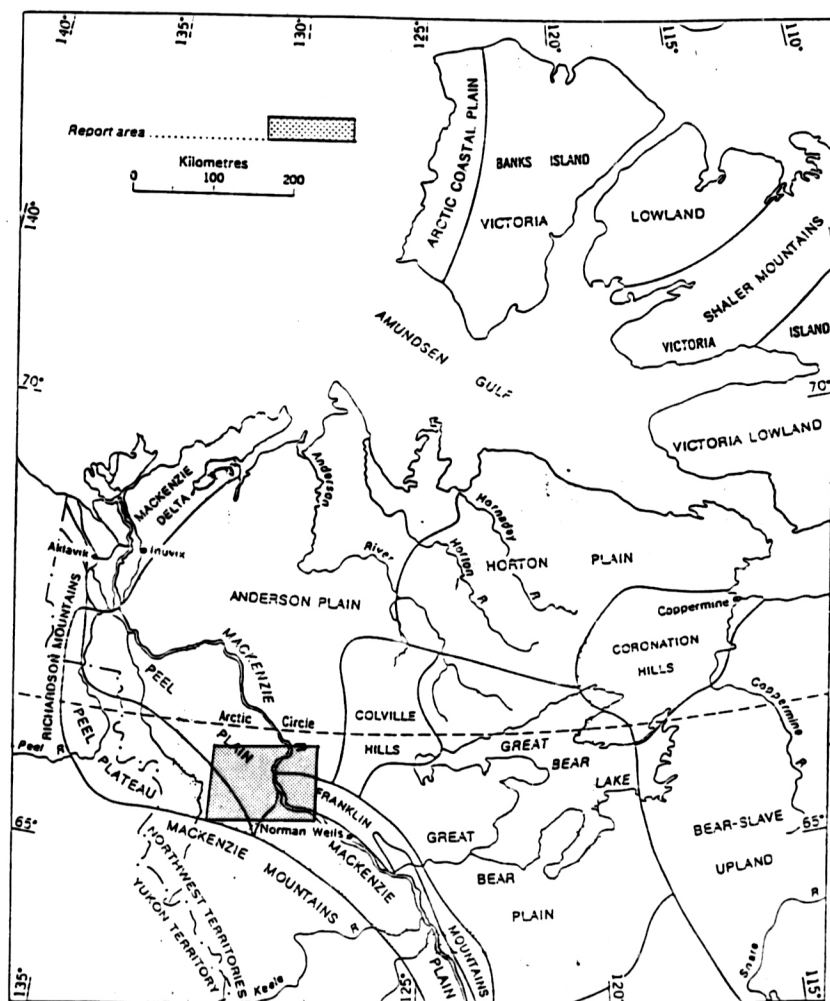


Fig. 2.1. Index map showing position of report area with respect to regional physiographic provinces (after Bastock, 1970).

ERA	PERIOD	NORMAN WELLS FORT NORMAN
CENOZOIC	QUATERNARY	HOLOCENE alluvium
		PLEISTOCENE glacial drift
	TERTIARY	
MESOZOIC	CRETACEOUS	UPPER LITTLE SEAR FM. 60
		LOWER ARCTIC SEA FM. 40-50, 60
	JURASSIC	
	TRIASSIC	
PALEOZOIC	PERMIAN	
	PENNSYLVANIAN	
	MISSISSIPPIAN	UPPER
		LOWER
	DEVONIAN	UPPER IMPERIAL SH. 60
		MIDDLE SAGE INDIAN FM. 10
		LOWER SAGE INDIAN FM. 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240, 250, 260, 270, 280, 290, 300, 310, 320, 330, 340, 350, 360, 370, 380, 390, 400, 410, 420, 430, 440, 450, 460, 470, 480, 490, 500, 510, 520, 530, 540, 550, 560, 570, 580, 590, 600, 610, 620, 630, 640, 650, 660, 670, 680, 690, 700, 710, 720, 730, 740, 750, 760, 770, 780, 790, 800, 810, 820, 830, 840, 850, 860, 870, 880, 890, 900, 910, 920, 930, 940, 950, 960, 970, 980, 990, 1000, 1010, 1020, 1030, 1040, 1050, 1060, 1070, 1080, 1090, 1100, 1110, 1120, 1130, 1140, 1150, 1160, 1170, 1180, 1190, 1200, 1210, 1220, 1230, 1240, 1250, 1260, 1270, 1280, 1290, 1300, 1310, 1320, 1330, 1340, 1350, 1360, 1370, 1380, 1390, 1400, 1410, 1420, 1430, 1440, 1450, 1460, 1470, 1480, 1490, 1500, 1510, 1520, 1530, 1540, 1550, 1560, 1570, 1580, 1590, 1600, 1610, 1620, 1630, 1640, 1650, 1660, 1670, 1680, 1690, 1700, 1710, 1720, 1730, 1740, 1750, 1760, 1770, 1780, 1790, 1800, 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The Proterozoic rocks are thought to consist of predominantly clastic sequences. The overlying Cambrian units are composed of a mixed lithology of clastics, evaporites and a lower member of the Ronning Group carbonates. The Lower Cambrian Mount Clark Formation, which consists of orthoquartzite and siltstone, lies unconformably on the Proterozoic and seems to be discontinuous in this area. In the northeastern part of this area shales and siltstones of the Mount Cap Formation lie either on the Mount Clark or unconformably on the Proterozoic. The Cambro-Ordovician and then Silurian carbonate sequences overlie the Mount Cap in the southwest area which rests unconformably on the Proterozoic. The Mount Kindle Formation, which consists of Silurian carbonates, rests unconformably on the Franklin Mountain Formation which is the lower member of the Ronning Group. The Ronning Group underlies Lower and Middle Devonian Carbonates which consist of Bear Rock limestone and dolomites, and Hume Formation limestone. Overlying Middle Devonian Carbonates is the Hare Indian Formation which primarily consists of dark grey to black limey shales with some thin limestone beds. The youngest members of the Middle Devonian period are the Ramparts and Kee Scarp Formations. The Ramparts consists of grey, massive limestones in the lower part followed by limey shales and massive buff limestones in the upper part. The Kee Scarp, on the other hand, consists of light grey coralline reef rock in the upper part and finer and more compact limestone in the lower part. The Upper Devonian Canol Formation unconformably overlies the Kee Scarp Formation, or the Hare Indian Formation where the Kee Scarp is absent. It consists of black to dark brown non-calcareous siliceous shale. The Imperial Formation is another Upper Devonian formation which overlies the Canol Formation and consists of green, fine-grained sandstones and shales, which in part are non-marine and marine in other places. It lies disconformably below the Lower Cretaceous beds.

2.1.2 Structural Aspects

A major structural feature in this area is the Imperial Anticline which underlies the geographic area called the Imperial Hills. It runs almost parallel to the Mackenzie Arch which is oriented northwest-southwest. Tectonically, according to Aitken et al (1973), the Mackenzie Arch originated in the Hadrynian. Gabrielse (1967), on the other hand, suggests that the significant unconformity beneath the Rapitan Group is the expression of the same tectonic pulse and introduced the name of Raklan Orogeny for it. The parallel form of the Imperial Anticline seems to have begun with the Raklan Orogeny which is dismissed by the above authors as an extensional block faulting and tilting event.

2.1.3 The Target: General Distribution and Control

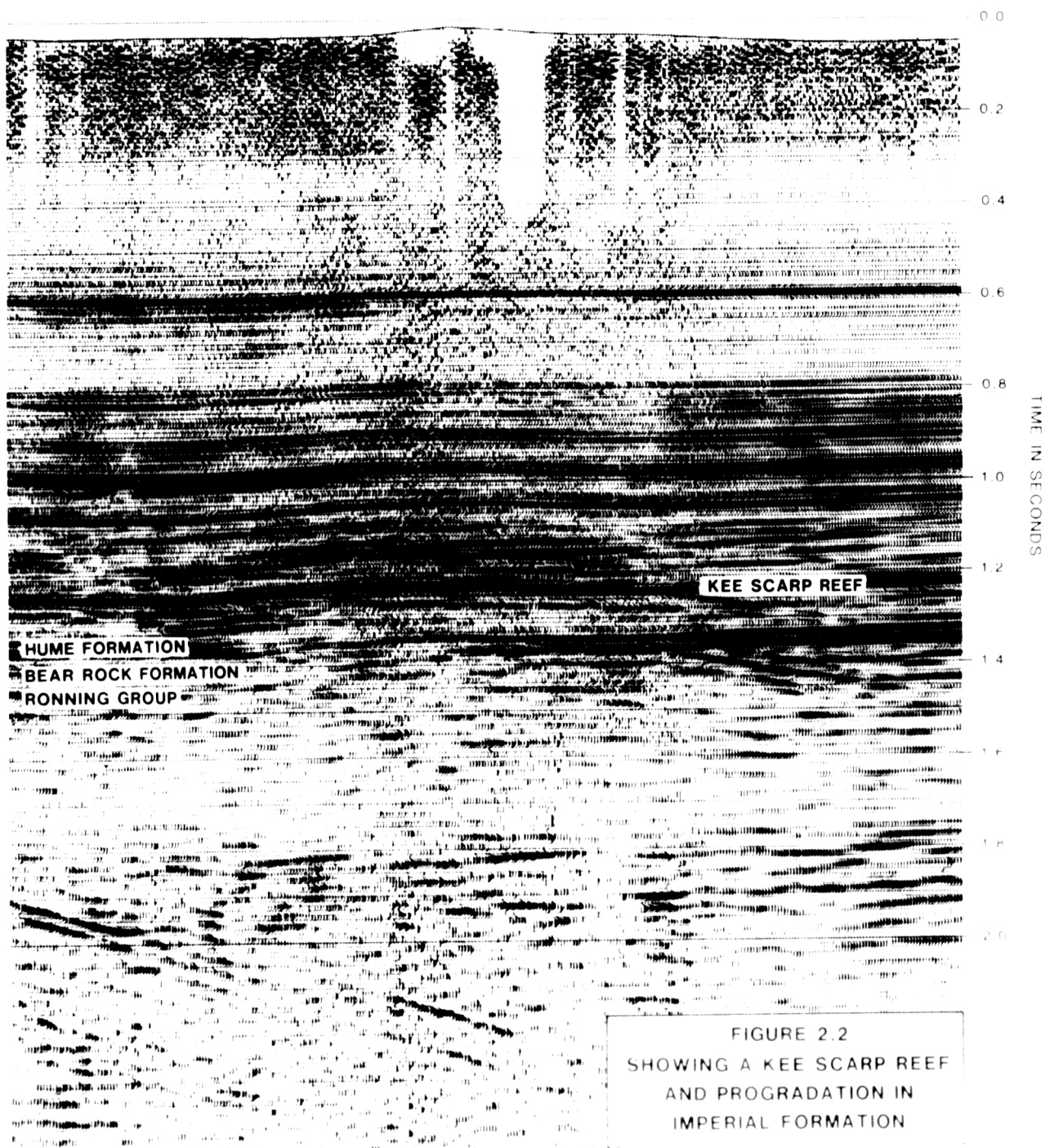
The Kee Scarp reefs of Middle Devonian age are the primary exploration target. These coral reefs seem to have developed in the southeast corner of the project area, whereas the platform is present throughout. The average build up of these reefs is anywhere from 30 metres to 80 metres with their lateral extents ranging from approximately 1 kilometre to about 4 kilometres. An example is shown on line #85-08A in Figure 2.2.

The secondary target involves porous channel-filling sands in the basal Cretaceous especially southwest of the project area where it has been buried quite deeply (approximately 1500 metres) which is an adequate depth for hydrocarbon generation. An example of a channel is shown on line #85-15A in Figure 2.3.

LINE 85 - 08A

0 500metres

NE →



LINE 85 - 15A

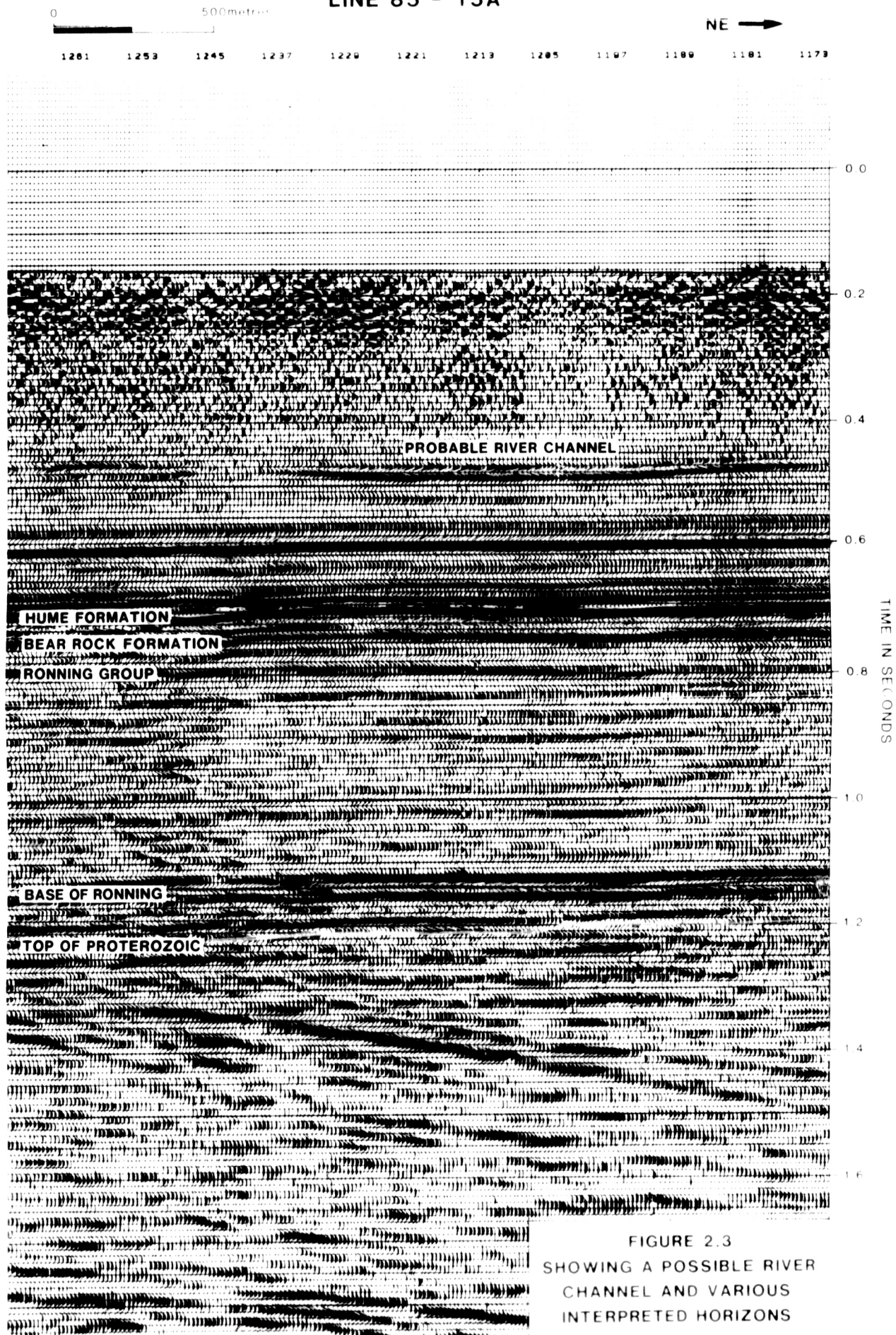


FIGURE 2.3
SHOWING A POSSIBLE RIVER
CHANNEL AND VARIOUS
INTERPRETED HORIZONS

2.2 Correlation Between Well Data and Seismic Data

The seismic base map in Figure 1.1 shows the location of the seismic lines and the wells used in the report area. Correlation from geology to geophysics was based on the Mountain River A-23 and Hume River D-53 wells. The A-23 well is located less than 1 kilometre from shot point 789 on line 85-11 and the D-53 well is located close to shot point 309 on line 85-13. The Mountain River A-23 well and Hume River D-53 both penetrate the Mount Kindle Formation.

An example of the interpreted seismic is given in Figure 2.3. The line shown is 85-15A, a northeast-southwest trending line illustrating the horizons correlated in the project area. From the oldest to youngest horizons there is the top of the Proterozoic, base of Silurian-Ordovician carbonates or top of the Cambrian, top of Ronning, top of Bear Rock Formation, top of Hume Formation, top of Kee Scarp Formation and the Pre-Cretaceous Unconformity.

The quality of the 1985 seismic data varies from good to very good. Most of the interpreted events were continuous throughout the prospect except for the top of the Proterozoic event which is difficult to follow mainly because of the small reflection coefficient. Sometimes when the inter-Proterozoic truncations are present the event (the unconformity) becomes quite obvious.

2.2.1 Velocity Information

Velocity information was obtained using the above mentioned wells. The approximate values of the average velocities for certain formations and intervals are given in Table 2.2.

<u>Formations</u>	<u>Interval Velocity (m/sec)</u>
Cretaceous	3048
Imperial	3650
Canol	3300
Kee Scarp	5300
Hare Indian	3400
Hume	5400
Bear Rock	5800
Mount Kindle and Franklin Mt.	6200

TABLE 2.2 APPROXIMATE INTERVAL VELOCITIES OF
FORMATIONS IN THE PROJECT AREA

2.3 Presentation of Seismic Results

All the interpretation was done using the reverse polarity section, with a horizontal scale of 1:9,851 and a vertical scale of 7.5 inches/sec.

The interpretive maps made are as follows:

Time Structure

- i) Pre-Cretaceous Unconformity (Figure 2.4)
- ii) Top of the Kee Scarp Formation (Figure 2.5)

Time Interval

- i) Top of the Kee Scarp - Top of the Hume Formation (Figure 2.6)

- 11 -

ii) Base of Carbonates (Top of Cambrian) - Top of the
Proterozoic (Figure 2.7)

All maps made are at a scale of 1:150,000.

SECTION THREE

DISCUSSION OF RESULTS

3.1 The Pre-Cretaceous Unconformity

3.1.1 Present Morphology

In the project area the relief of the Pre-Cretaceous Unconformity varies from outcrop in the north-northeast to a depth of 1280 metres two-way travel time in the southwest. The unconformity and the overlying Cenozoic strata dip gently to the southwest with an approximate dip of 1°.

3.1.2 Cretaceous Structures

As mentioned above, the Cretaceous and the overlying strata are dipping gently towards southwest and most of the northern part of the project area is fault-free except in south-southwestern part at the edge of the Mackenzie Mountains where there is substantial thrusting. The most significant of all the thrust faults is shown in Figure 3.1 and labelled "A" on line 85-08A. Fault "A", and other major faults seem to cut all of the strata and have a southeasterly trend. A few fault-bounded closures were encountered, unfortunately most of them had been drilled. In the Hume River D-53 well the Cretaceous sand was found to be oil stained. The other possible Cretaceous play is the river channel comprised of porous basal sandstone, Figure 2.3.

3.2 The Kee Scarp Formation

3.2.1 Present Morphology

In the project area the relief of the Kee Scarp Formation varies from outcrop in the north-northeast to a low of 1500 msec two-way travel time in the southwest. It should be mentioned that in this report the Kee Scarp Formation is actually the Ramparts Formation, except when there is reef build-up which would then be a Kee Scarp reef.

3.2.2 Kee Scarp Structure

Most of the structures present in this formation are similar to the one discussed in the previous section except for the reefal buildup in the southeast corner of the project area. Again, the majority of reefs in this area have been drilled. An example of such undrilled reef build-up is shown on line 85-08A in Figure 2.2.

In Figure 2.6, which is the Time Interval Map of Top of the Kee Scarp to Hume Formation, it is shown that the interval is thinning towards the southwest with two-way travel time of 160 msec to 80 msec. Also, the thickening of the interval whenever there is a reef build-up can be seen quite clearly. An example of this is on line 85-08A in the vicinity of SP 581 (Figure 2.2).

3.3 The Cambrian Section

The time-Interval map of the Base of Silurian-Ordovician Carbonates or Top of Cambrian to the Top of the Proterozoic

(Figure 2.7) illustrates the change in Cambrian thickness in the project area. It varies from a two-way travel time of 130 msec. in the east and 100 msec. in the north to the zero edge in the southwest where the Ordovician carbonates lie on the Proterozoic unconformity.

The presence of the outer fold belt in this may explain this pinching out of the Cambrian. This fold belt consists of two to three anticlines and synclines, and the one that may be affecting this area is the Stony Anticline. Red and grey sandstones present in the Saline River Formation (Upper Cambrian) are not so important in the thicker section but become increasingly prominent in the thinner sections near the pinchout of the formation. This indicates that the zero edge of the Saline River is depositional. Also, the Top of the Proterozoic is not a very good reflector where there are Cambrian clastics because of a poor reflection coefficient, but it is easy to follow where Ordovician carbonates overlie the Proterozoic unconformity.