PETRO CANADA

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Approved. Nov 27/86
L. Richards

PROGRAM NUMBER: 9229-P28-17E

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(a) WRITTEN REPORTS:

(1) Operations Report — Number: 1
OPS, PROC + INT. COMBINED

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(b) MAPS:

(1) Shotpoint Maps — Number: 2
1:100,000 95A, 95B

(2) Interpretation Maps — Number: 10
- TSM: PRE-CRETACEOUS UNCONFORMITY 95A, 95B
- TSM TOP OF PEKISKO FORMATION
- TSM TOP OF BANFF FORMATION
- TSM TOP OF JEAN MARIE FORMATION
- TSM TOP OF SLAVE POINT FORMATION
- ISOCHRON: PRE-CRETACEOUS UNCONF. TO CLARK MEMBER
- ISOCHRON BANFF FORMATION TO CLARK MEMBER
- ISOCHRON LETCHO LIMESTONE TO PETCHO FORMATION
- ISOCHRON JEAN MARIE TO SLAVE POINT

(3) Other Maps — Number: 6
- SYNTHETIC SEISMOGRAPH - CELIBETA D-31, D-66, B-25, K-01, TROUT LAKE A-45, ARROWHEAD L-49

(c) SEISMIC SECTIONS — Number: 21

(~~Final Stack and~~ Migrated)

8039	8115
8056	8117
8058	8119
8060	8123
8062B	8129
8064	41223
8066	BMQ-005
8068	BMQ-006
8107	BMQ-008
8109	
8111	
8113	

Approved L. Richards

ISLAND RIVER

PROGRAM NO. 9229-P28-17E

Report on the
Geophysical Exploration Survey

PROGRAM NO. 9229-P28-17E

IN

ISLAND RIVER
NORTHWEST TERRITORIES
EXPLORATION AGREEMENT NO. 165

by

Petro-Canada Inc.
September, 1986

Field Work Period:	January-February, 1986
Land Use Permit No.:	N85-B468
Area Coordinates:	60°00'-61°00' North 119°30'-123°00' West
Data Acquisition:	Seiscom Delta United Ltd.

Submitted by:

for P. Des Roches
Project Geophysicist
N.W.T. Region

B. Palmiere, P. Geoph.
Exploration Manager
Western Frontiers

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REFERENCES

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SECTION ONE

INTRODUCTION

Petro-Canada Inc. conducted a reflection seismic program in the Island River area of the Northwest Territories during the 1985/86 winter season. This report summarizes the acquisition and the results obtained from the survey and includes a summary of work done prior to the 1985/86 program.

The geophysical program consisted of 289.65 km of seismic data coverage and was conducted for the purpose of evaluating the hydrocarbon potential of the area. Figure 1.1 shows the location of the Island River area as well as the land boundary of E.A. No. 165.

The submission of the report is in partial fulfillment of COGLA requirements for the Island River E.A. No. 165, Program No. 9229-P28-17 E.

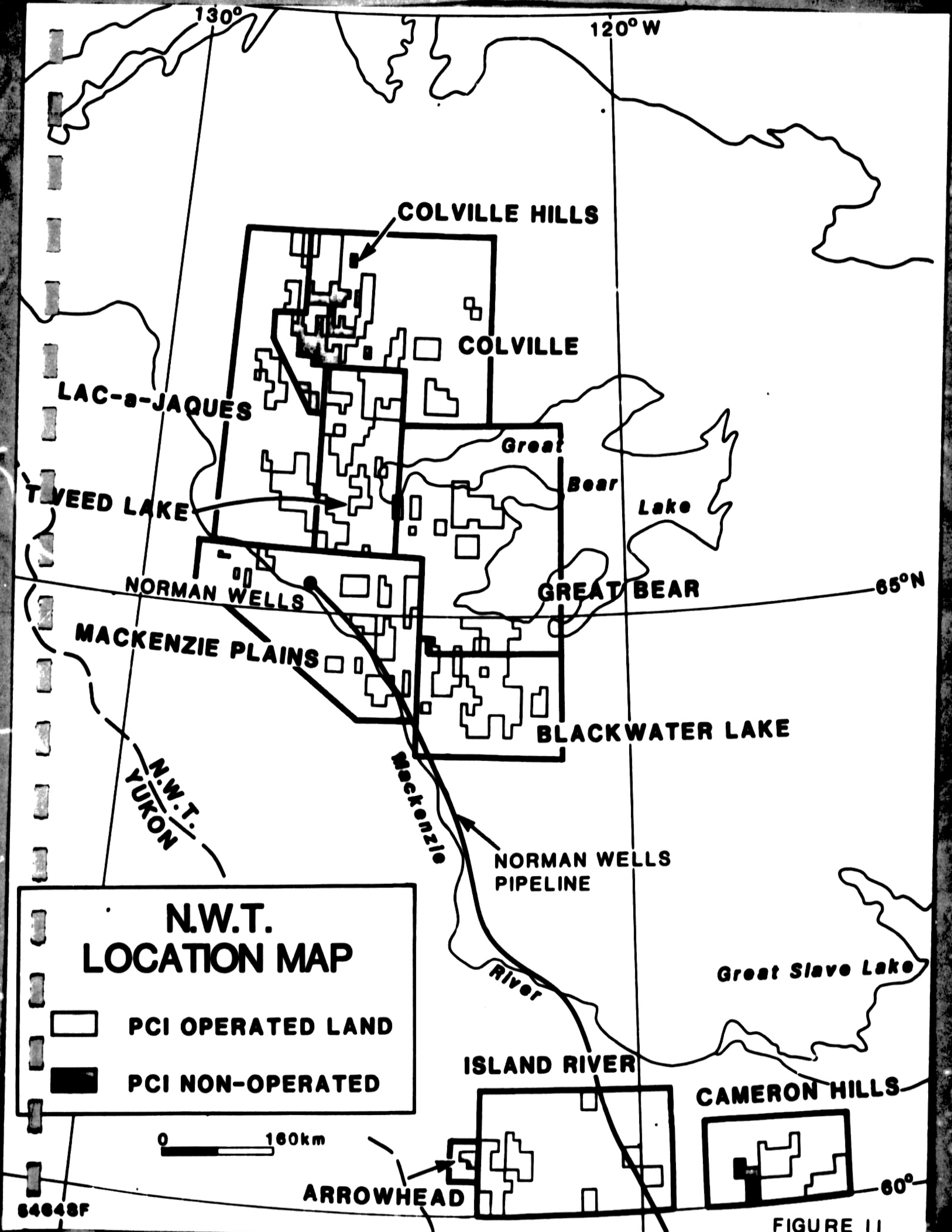

130°
120° W
COLVILLE HILLS
COLVILLE
LAC-a-JAQUES
Great
Bear
Lake
TWEED LAKE
NORMAN WELLS
GREAT BEAR
65°N
MACKENZIE PLAINS
BLACKWATER LAKE
N.W.T.
YUKON
Mackenzie
NORMAN WELLS
PIPELINE
N.W.T.
LOCATION MAP
PCI OPERATED LAND
PCI NON-OPERATED
River
Great Slave Lake
ISLAND RIVER
CAMERON HILLS
0
160km
ARROWHEAD
60°
5484SF

FIGURE 1.1

SECTION TWO

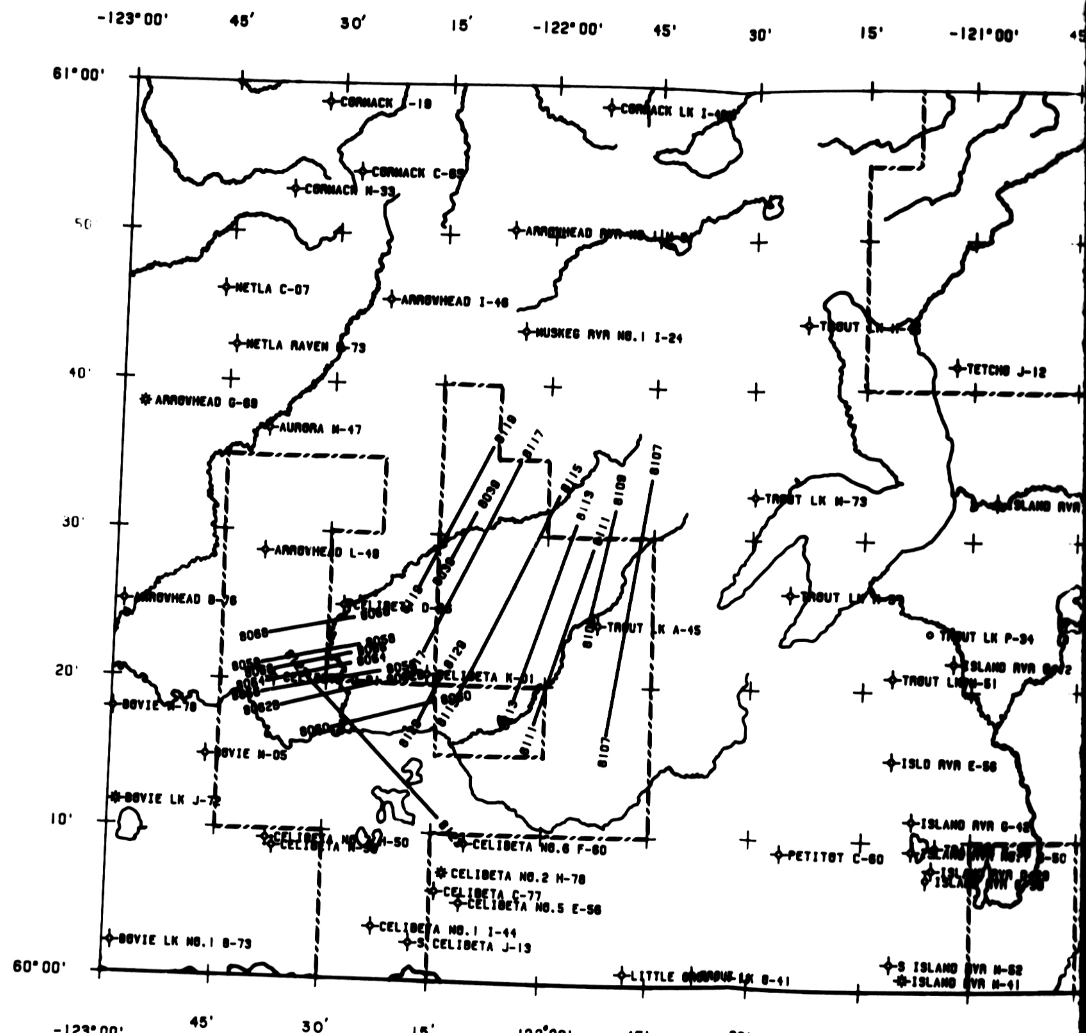
PROGRAM DESCRIPTION

The Island River E.A. 165 consists of five separate blocks of land.

The 1985/86 geophysical program concentrated on the western block, the most prospective portion of the E.A.

A total of seventeen lines totalling 289.65 km of seismic data were shot during the 1985/86 field season (Figure 2.1). The purpose of the program was to delineate two prospects as well as other leads which were identified following the interpretation of the 1984/85 seismic lines.

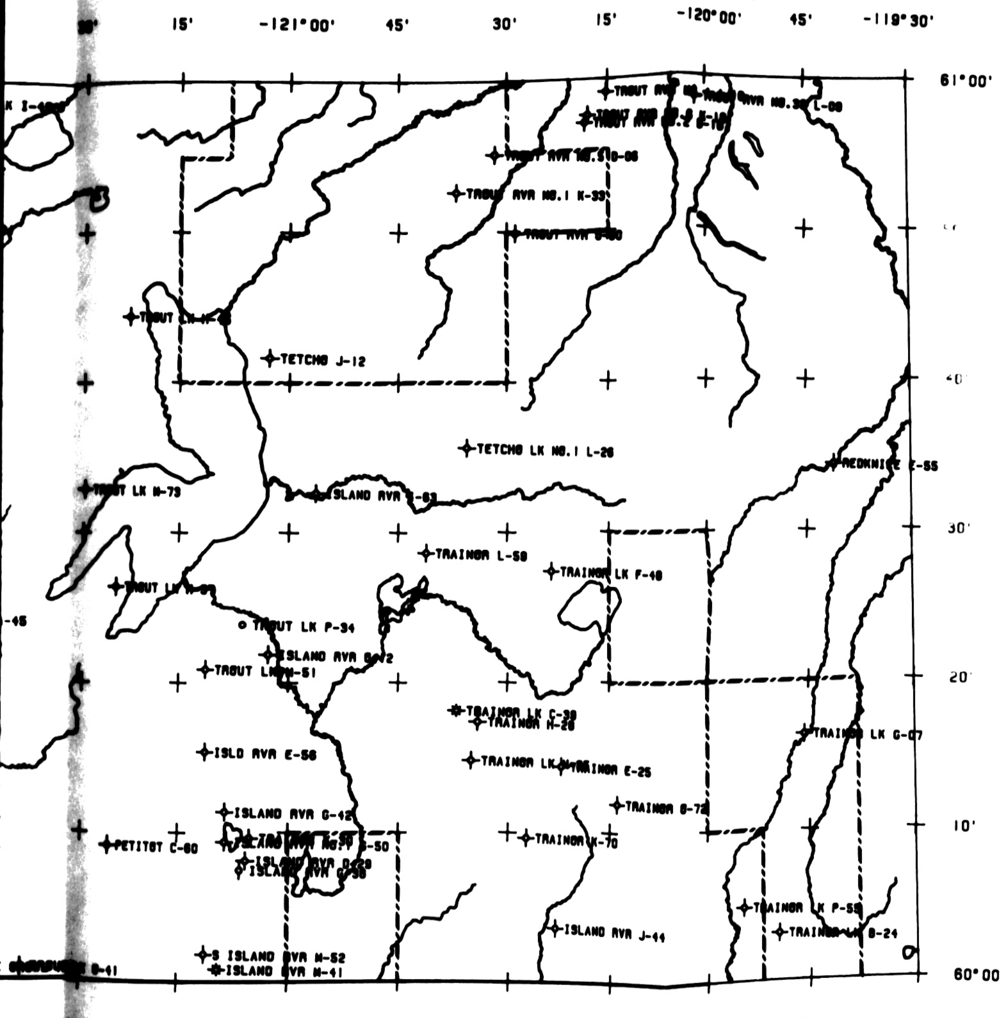
Furthermore, Petro-Canada has purchased and reprocessed 72.55 km of trade seismic data over the western block of the E.A. These have been sent to COGLA under separate cover with the 1985/86 seismic program.



Land boundary as Sept. 1985.

ISLAND RIVER E.A. 165 - NTS 85D,

FIGURE 2.1 Location map of the 1985/86 geophysical program and land in



VER E.A. 165 - NTS 85D, 95 A,B.

SCALE 1:600,000

1985/86 geophysical program and land in the Island River Project area.

SECTION THREE

DATA ACQUISITION

3.1 Field Operations

The program was recorded by Seiscom Delta United (Canada) Ltd. in January and February of 1986.

3.1.1 Project Chronology

A summary of significant dates is present in Table 3.1.

Mobilization date (recording and drill)	January 13, 1986
Cutting start-up	January 5, 1986
Drilling start-up	January 14, 1986
Recording start-up	January 17, 1986
Completion of Drilling	February 22, 1986
Completion of Recording	February 24, 1986
Demobilization date	February 25, 1986

TABLE 3.1 PROJECT CHRONOLOGY OF THE SURVEY

3.1.2 Project Organization

Table 3.2 presents the organization chart for the survey. In total 83 people were employed for the 60 positions available in this project. Of the 60 positions, 62% were occupied by residents of the Northwest Territories.

3.1.3 Production Statistics

Table 3.3 shows data pertinent to the seismic and drilling production.

PETRO-CANADA FIELD SUPERVISOR

SEISCOM DELTA FIELD SUPERVISOR

PARTY MANAGER

Recording

1 Observer
1 Jr. Observer
1 Shooter
1 Shooter's Helper
3 Cable Truck Drivers
8 Recording Helpers

Surveying

2 Surveyors
2 Rodmen

Bulldozing

1 Supervisor
7 Cat Operators
1 Cat Push
12 Slashers

Drilling

4 Drillers
4 Drill Helpers
1 Drill Push
2 Water Truck Drivers

Catering

2 Cooks
1 Cook's Helper
1 Camp Attendant

Support Staff

1 Party Manager
1 Clerk
1 Mechanic
1 Supply Driver
1 Environmental Monitor

TABLE 3.2 ORGANIZATION CHART FOR THE 1985/86 ISLAND RIVER GEOPHYSICAL SURVEY

Seismic	
Total Recording Days	39
Total Weather Days	0
Total number of lines	17
Kilometres shot	289.5
Average kilometres per day	7.7
Drilling	
Total Drilling Days	40
Total Weather Days	0
Total number of holes drilled	3032
Average Holes per Day	76

TABLE 3.3 SEISMIC AND DRILLING PRODUCTION

3.1.4 Terrain and Weather Conditions

The mainly muskeg terrain in the prospect area was very rough. Detours around lakes and snowfills in creeks were necessary due to the warm temperatures since lack of frost in these areas was a problem.

3.1.5 Downtime Factors

The Island River program was broken into two distinct program areas, necessitating some lost production time due to longer travel hours to and from lines. Those longer travel hours were caused by the fact that the recording and drill camp did not move during the program.

3.2 Seismic Data Acquisition

3.2.1 Instrumentation

Table 3.4 summarizes equipment used in recording and in detection for the survey.

Recording	Texas Instruments	DFS V
Detection	Geophone Strings Mark L-10; 14 Hz	

TABLE 3.4 SEISMIC INSTRUMENTS USED FOR THE SURVEY

3.2.2 Seismic Parameters

Table 3.5 lists the recording and shooting parameters utilized for the survey.

Sample Rate	2 milliseconds
Record Length	4 seconds
Recording Filter	Lowcut 18 Hz Highcut 128 Hz
Subsurface Coverage	1200%
No. of Groups	120
Group Interval	20 metres
Geophone Array	9 over 20 metres
Shot Point Location Interval	100 metres
Holes per Location	1
Hole Depth	18 metres
Source Type	Dynamite
Dynamite Charge	1 kilogram
Spread Configuration	1200 - 20 - x -20 - 1200 metres

TABLE 3.5 RECORDING AND SHOOTING PARAMETERS USED FOR THE SURVEY

3.3 Seismic Data Processing

The seismic data were processed by Pulsonic Geophysical Ltd. The processing procedures were as follows:

1. Demultiplex
2. Edit
3. Amplitude Recovery
4. Spiking Deconvolution:
   a) operator length: 80 msec
   b) prewhitening: 0.1%
   c) design window 1 (near offset): 350-1100 msec
      (far offset) : 900-1350 msec
      design window 2 (near offset): 1050-1700 msec
      (far offset) : 1150-1750 msec
   d) application window 1 (near offset): 0-1050 msec
      (far offset) : 0-1150 msec
      application window 2 (near offset): 1050-2200 msec
      (far offset) : 1150-2200 msec
5. CDP trace gather
6. Weathering Corrections
   - refraction statics
   - datum elevation: 700 m
   - replacement velocity: 3000 m/sec
7. Velocity Analysis - coherency spectra

8. Normal Moveout Application - NMO from datum
9. Automatic Surface Consistent Statics
   window: 350-1400 msec
   maximum static: +/-24 msec
10. Automatic Trim Statics
   window: 350-1400 msec
   maximum static: +/-12 msec
11. Trace Muting

offset (m)	190	220	1200
time (msec)	0	400	1000

12. CDP Stacking - 1200% fold
13. Migration - finite difference
   - velocities: 90% of stacking
14. Filter Application - zero phase band pass
   - domain: frequency
   - band pass: 10/15-60/70
   - time: 0-2200 msec
15. Scaling - residual decay adjustment
16. Display to film
   - vertical scale: 7.5 inches/sec
   - horizontal scale: 36 traces/inch
   - normal polarity

SECTION FOUR

GEOLOGIC ASPECTS

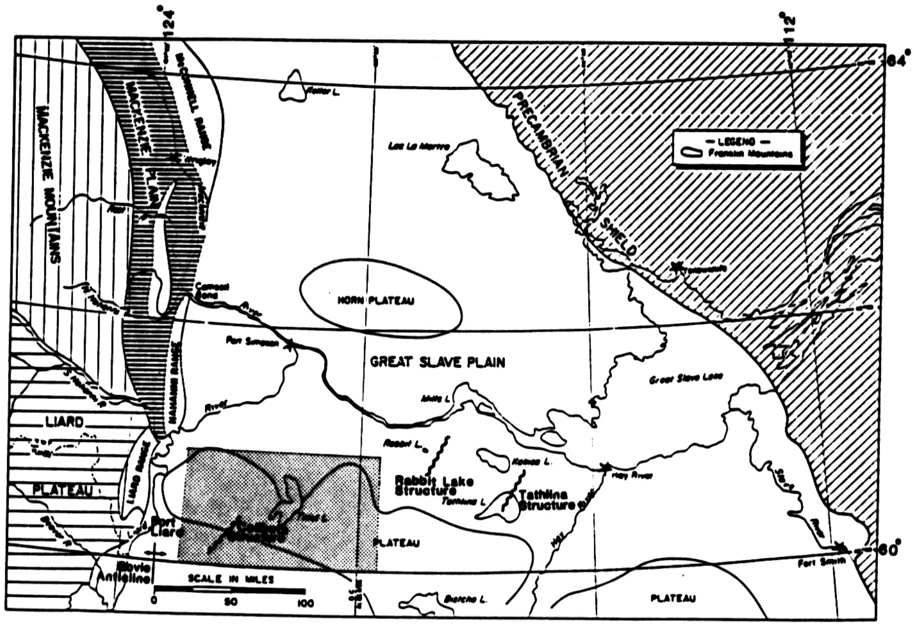
4.1 Regional Setting

The Island River area is located within the Great Slave Plain physiographic sub-province of the Northwest Territories (Figure 4.1). The most prominent structure on the land is the Celibeta high located in the southern part of the western block.

The Celibeta structure has similar characteristics with the Rabbit Lake and the Tathlina structures, located to the southwest of Great Slave Lake. All three of these structures are associated with a northeast trending basement fault zone.

4.2 Stratigraphy

The stratigraphic succession ranges in age from Precambrian to Recent (Table 4.1). The Precambrian rocks are predominantly sediments with some metamorphic and granitic rocks having been encountered. The Precambrian is unconformably overlain by Lower Devonian Basal Red Beds and Middle Devonian Chinchaga evaporites. Conformably overlying the Chinchaga Formation is the Keg River Formation, the basal carbonate of the Elk Point Group. The Sulphur Point reef complex was developed on the Keg River carbonate bank. Evaporites of the Muskeg formation were deposited in the restricted marine basin behind the main barrier. Emergence brought the dehydration of Elk Point carbonates and evaporites to a halt; resumption of subsidence was followed



Project Area

Figure 4.1 Map of the physiographic sub-provinces of the Island River area. Major structural features are also shown.
(Modified from de wit et al, 1973)

Age	Formation		Lithology
QUARTERNARY	Q (undivided)		gravel, till
Unconformity			
CRETACEOUS	K (undivided)		shale
Pre-Cretaceous Unconformity			
PERMIAN	Fantasque		chert, sandstone
	Unconformity		
	Upper Mattson		sandstone
	Unconformity		
MISSISSIPPIAN	Debolt		limestone, interbedded shale
	Shunda		limestone, interbedded shale
	Pekisko		limestone, interbedded shale
	Banff		shale, minor LS and SS
	Exshaw		shale
UPPER DEVONIAN	Kotcho		limestone, shale
	Tetcho		limestone, shale
	Trout River		limestone, shale, sandstone
	Unconformity		
	Kakisa		shale, sandstone
	Redknife		shale
	Jean-Marie		limestone
	Fort Simpson		shale
	Muskwa		shale, interbedded limestone
? Unconformity ?			
MIDDLE DEVONIAN	Slave Point		limestone
	Watt Mountain		shale
	Unconformity		
	Sulphur Point		limestone, dolomite
	Muskeg		anhydrite, interbedded dolomite
	Keg River	upper	dolomite
		lower	limestone or dolomite platform
	Upper Chinchaga		anhydrite, interbedded dolomite
LOWER DEVONIAN?	Basal Red Beds		shale, siltstone
Unconformity			
PRE-CAMBRIAN			sediments, metamorphics, granite

TABLE 4.1 STRATIGRAPHIC COLUMN FOR THE ISLAND RIVER AREA

102120 886802400-A

by the deposition of shales of the Watt Mountain Formation. The Slave Point carbonates were then deposited followed by a major marine transgression which deposited the Muskwa and Fort Simpson shales.

The Jean-Marie shelf carbonate was deposited over the Fort Simpson Formation. The Jean-Marie is conformably overlain by shales of the Redknife, Kakisa and Trout River Formations. These in turn are succeeded by limestones and shales of the Tetcho and Kotcho Formations.

The lower most Mississippian formation is the Exshaw shale followed by a thick sequence of shales of the Banff Formation. The Banff Formation is followed by the deposition of interbedded Clark member carbonates and shales. These are overlain by limestones and shales of the Pekisko, Shunda and Debolt Formations.

Permian rocks lie unconformably on the Mississippian. The Permian occurs in very few areas in the western block of the project areas having been removed by erosion while emergent during the Triassic and Jurassic.

The Cretaceous rocks unconformably overlie the Paleozoic section and consist predominantly of shales and some basal channel sandstones.

Quaternary deposits of glacial drift are ubiquitous to the area.

4.3 Exploration Targets

The primary exploration targets in the western block of the project area are the Mississippian carbonates (Figures 7.1

and 7.2). These horizons dip gently toward the southwest and subcrop to the north against the Pre-Cretaceous Unconformity. The Pre-Cretaceous erosion has created some structural highs in these prospective horizons. These structures are in some cases partly controlled by Pre-Cretaceous faulting as well. Subaerial erosion may have created secondary porosities in these carbonates. These subcrop plays are usually sealed at the top by Cretaceous shales.

Secondary targets are the Basal Cretaceous sandstones, either in structural highs or as updip pinchout plays (Figures 7.1 and 7.2). These sandstones lie unconformably on the Mississippian. Studies of their distribution indicate that these sands were deposited by a northwest trending channel system.

There are other possible targets, such as the shelf carbonates of the Jean-Marie Formation (Figure 7.5). The facies front of the Jean-Marie trends northward, roughly parallel to longitude 122°W. Stratigraphic trapping is controlled by porosity distribution.

There is also the possibility of porosity traps in the Slave Point carbonate and mud mounds in the Upper Devonian Tetcho. These plays are considered very high risk, especially the Slave Point, where porosity traps are of small areal extent.

SECTION FIVE

PREVIOUS GEOPHYSICAL WORK

Many kilometres of seismic have been shot in the past in the Island River area. However, most data sets are low fold, low frequency, and are generally noisy. Furthermore, most data sets are not located over the Petro-Canada land.

During the 1984/85 season, Petro-Canada shot 540 km of 1200% dynamite seismic over 3 blocks of the Island River acreage. All data was of high quality. The 1984/85 data set was used to generate maps in the area. A geophysical and geological model, shown in Figure 5.1 giving the formations lithologies and velocities in the Island River area, was also produced at that time.

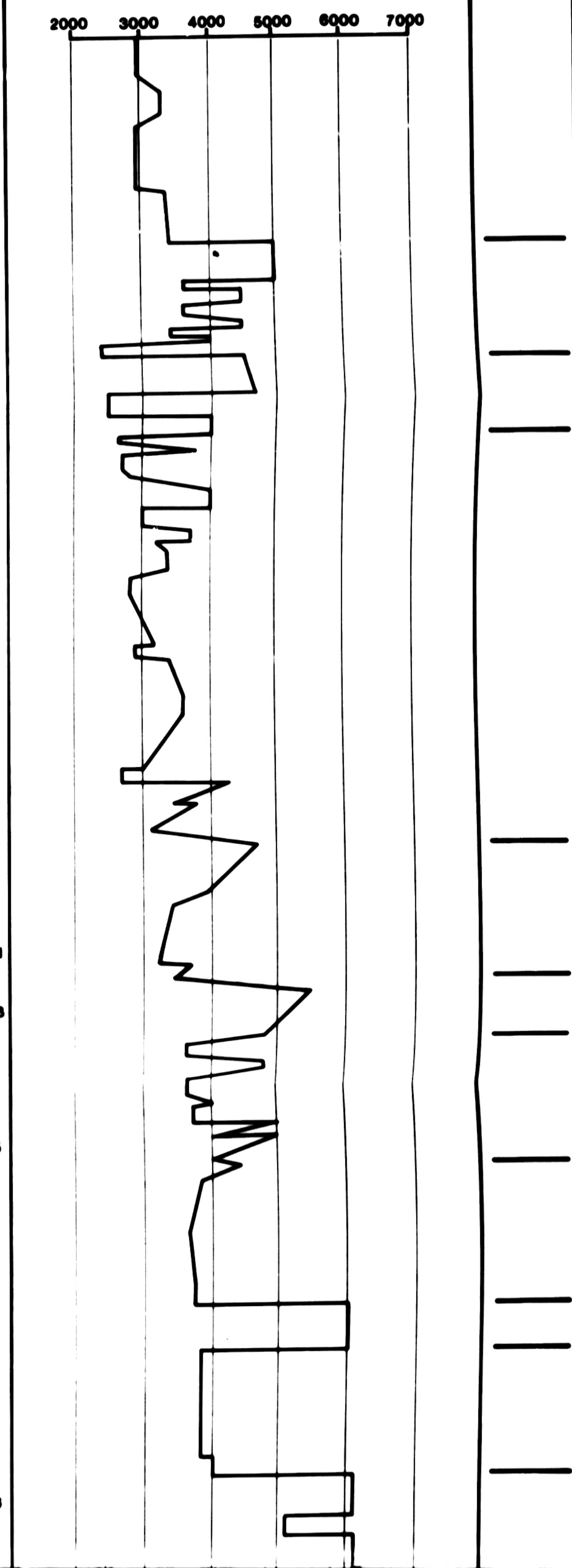
STRATIGRAPHIC COLUMN AND VELOCITY INFORMATION

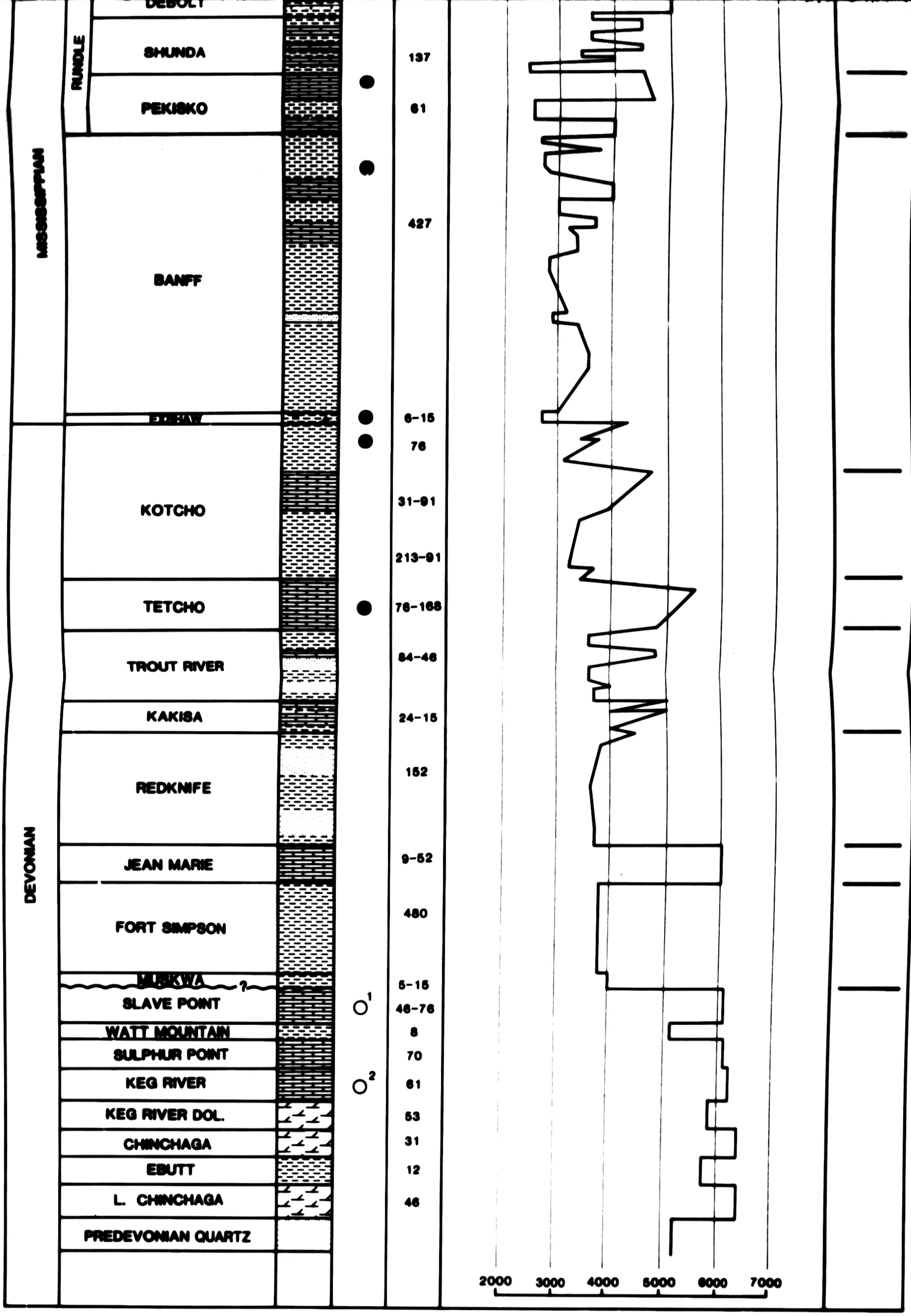
ISLAND RIVER, NORTHWEST TERRITORIES

INFORMATION BASED ON 6 WELLS: CELIBETA D-66, K-01, TROUT LAKE A-45, H-57, TRAINOR LAKE F-48 and ARROWHEAD N-02

	FORMATION	LITH.	SHOWS	THK. (m)
CRETACEOUS				
CRETACEOUS	SCATTER		●	(30)
CRETACEOUS	BASAL CRETACEOUS		●	(30)
MISSISSIPPIAN	RUNDLE: DEBOLT			
MISSISSIPPIAN	RUNDLE: SHUNDA			137
MISSISSIPPIAN	RUNDLE: PEKISKO		●	61
MISSISSIPPIAN	BANFF		●	427
MISSISSIPPIAN	EXSHAW		●	6-15
DEVONIAN	KOTCHO		●	76 31-91 213-91
DEVONIAN	TETCHO		●	76-168
DEVONIAN	TROUT RIVER			84-46
DEVONIAN	KAKISA			24-15
DEVONIAN	REDKNIFE			152
DEVONIAN	JEAN MARIE			9-52
DEVONIAN	FORT SIMPSON			480
DEVONIAN	MUSKWA ?			5-15
DEVONIAN	SLAVE POINT		○[1]	46-76
DEVONIAN	WATT MOUNTAIN			8
DEVONIAN	SULPHUR POINT			70

INTERVAL VELOCITY (m/s) — GOOD REFLECT.





● OIL STAIN

○ GAS SHOW

Figure 5.1

1 73.3 dam^3 (Bovie J-72)

2 9.1 dam^3 (N-02)

AUTHOR: R. Niederauer

FILE NO.:

SECTION SIX

INTERPRETATION

6.1 Correlation Between Well Data and Seismic Data

The seismic base maps of the 1985/86 program are shown in figures 6.1 and 6.2.

Six wells have been used to control the seismic interpretation in the area. They are IOE Chevron Celibeta D-31, Globes et al Celibeta D-66, Northcore et al Celibeta B-25, McDermott et al Trout Lake A-45, Globes et al Celibeta K-01, and IOE et al Arrowhead L-49. Synthetics for those wells are shown in figures 6.3, 6.4, 6.5, 6.6, 6.7 and 6.8.

The Celibeta D-66 well is one of the deepest wells in the area and encountered all of the Mississippian formations. Its synthetic, figures 6.4 and 6.9, was important for the correlation of the geology to the geophysics.

An example of correlation between well data and seismic data in the area is given in figure 6.10. As well, this figure shows an example of the interpreted seismic. The following stratigraphic markers have been correlated in the project area: the Scatter Formation, the Basal Cretaceous sands, the Pre-Cretaceous Unconformity, Debolt markers numbers 1, 2 and 3, the Shunda Formation, the Pekisko Formation, the Banff Formation, the lower limit of the Clark Member, the Kotcho limestone marker, the Tetcho Formation, the Redknife Formation, the Jean-Marie Formation, the Slave Point Formation and the top of the Pre-Devonian rocks or basement.

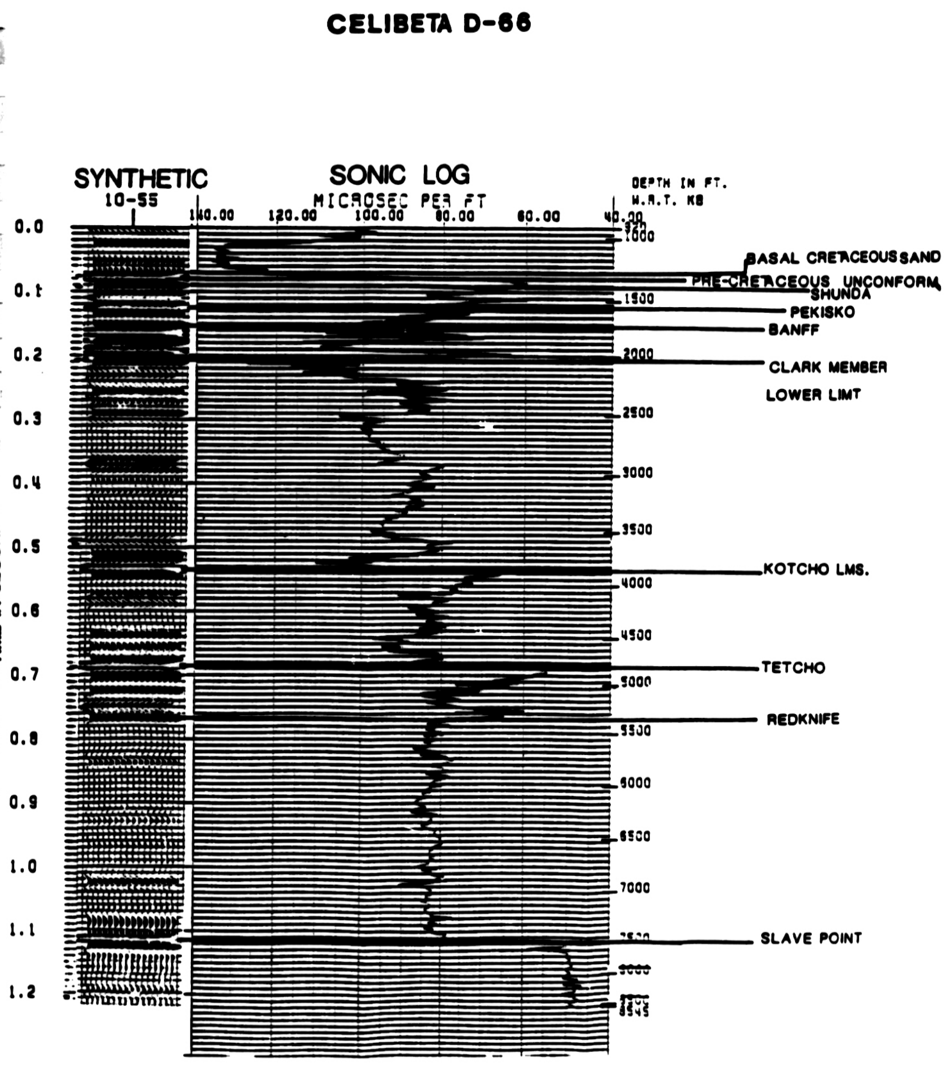
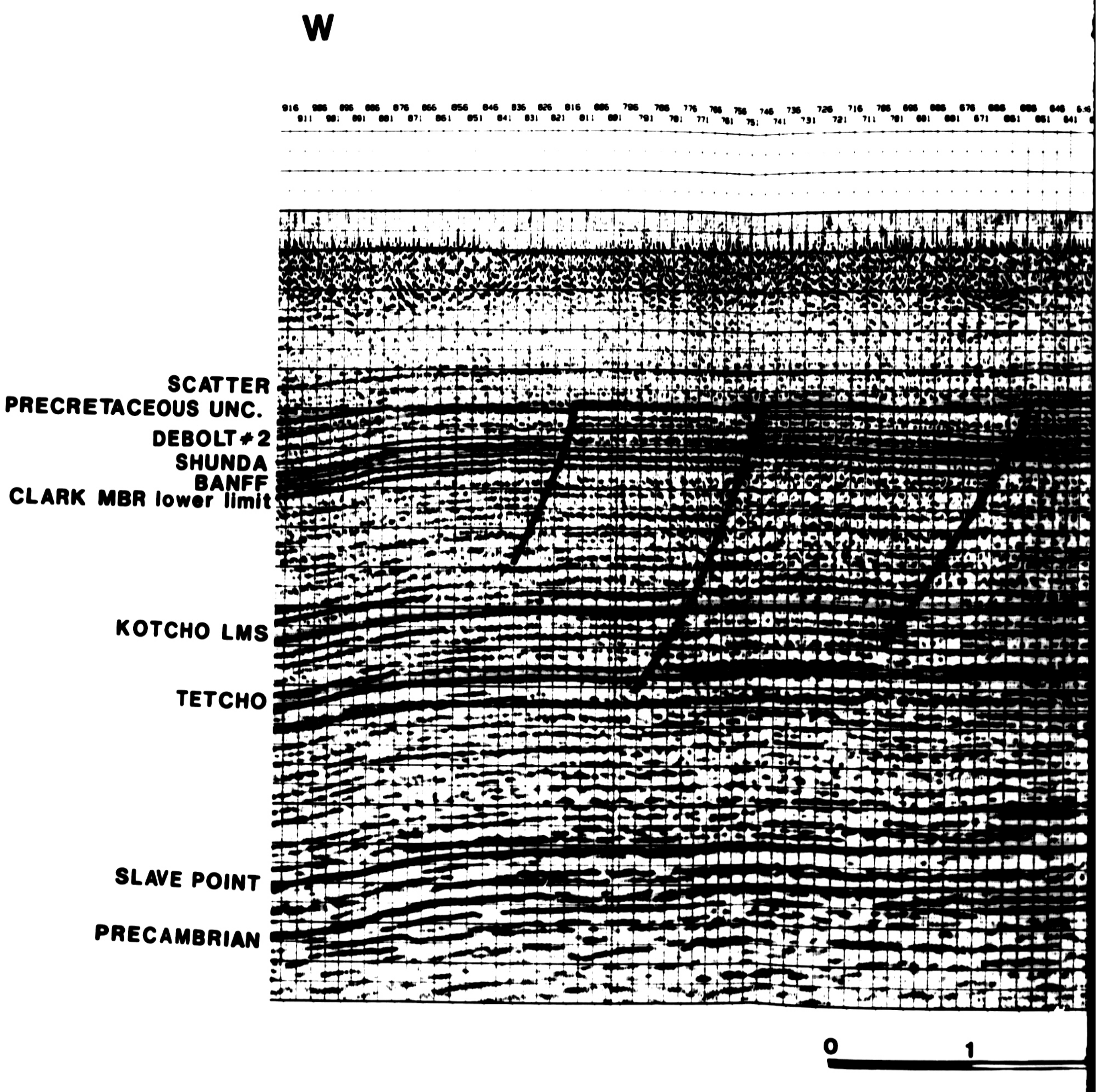


FIGURE 6.9 Example of synthetic and sonic log.


W
SCATTER
PRECRETACEOUS UNC.
DEBOLT #2
SHUNDA
BANFF
CLARK MBR lower limit
KOTCHO LMS
TETCHO
SLAVE POINT
PRECAMBRIAN
0
1

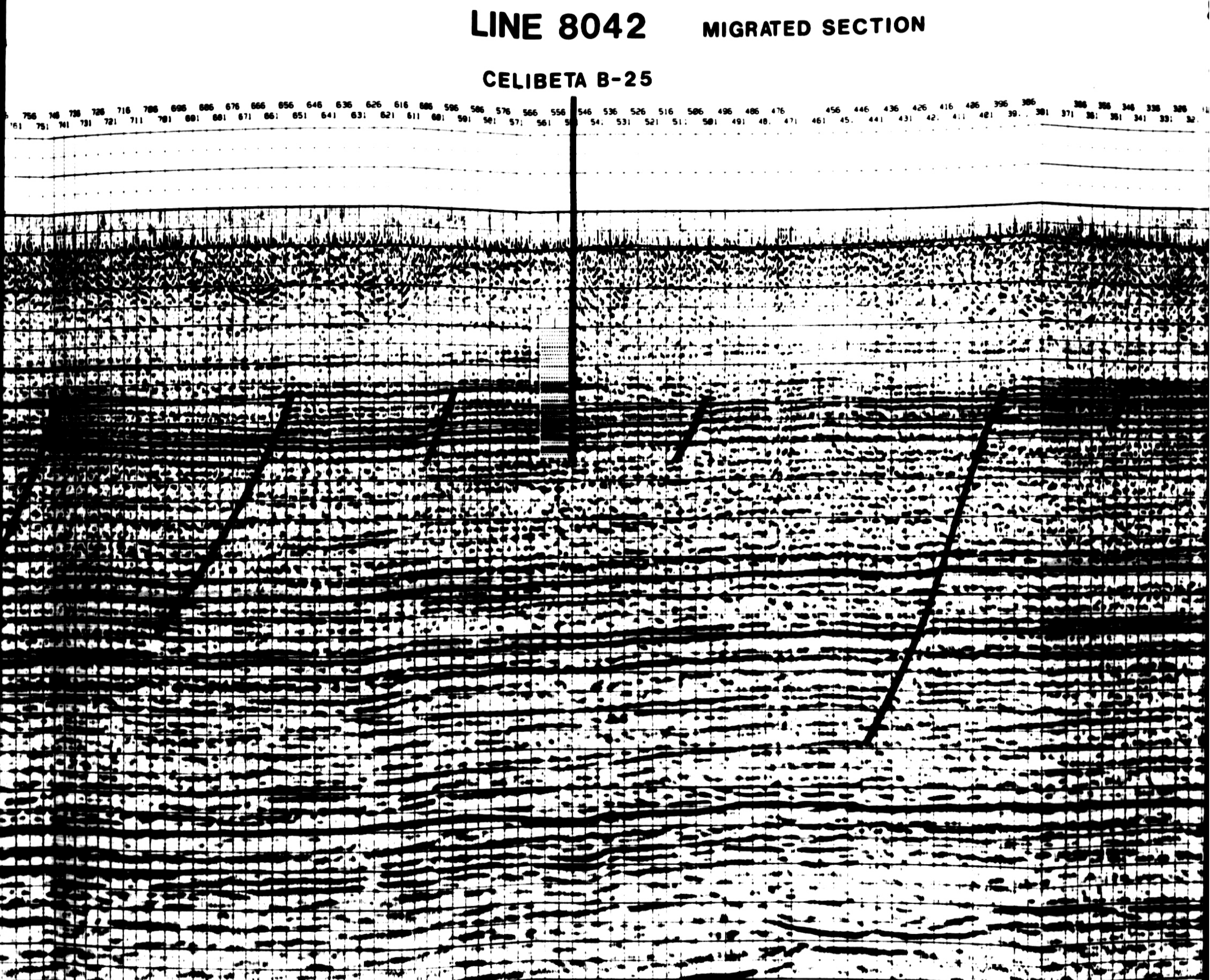


FIGURE 6.10 Example of correlati
well data and seism

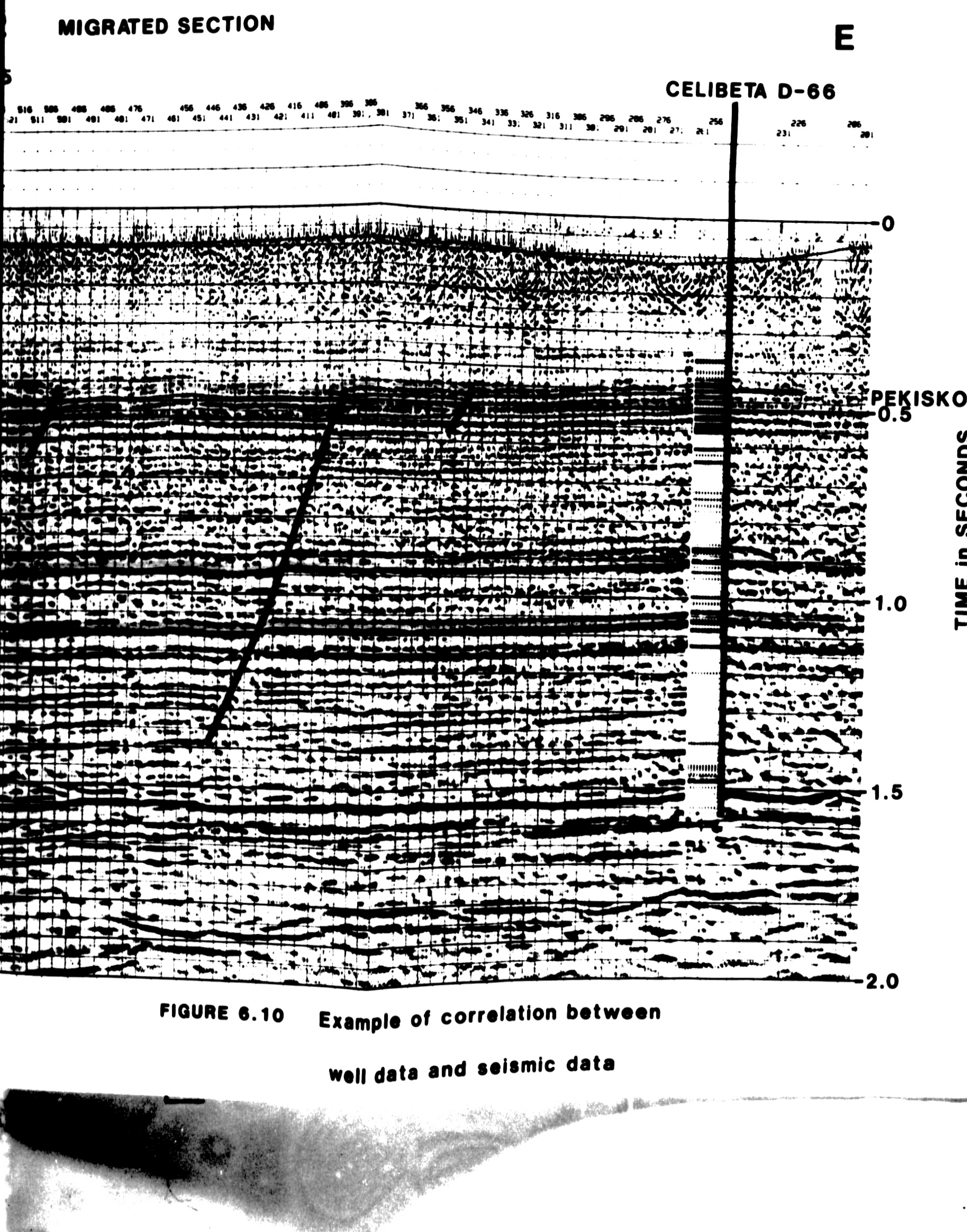


FIGURE 6.10 Example of correlation between well data and seismic data

6.2 Definition of the Seismic Markers

6.2.1 Pre-Cretaceous Unconformity

This horizon is associated with an erosional unconformity. The reflections generated by this surface of erosion are not always strong and continuous because of the nature of the unconformity. This angular unconformity is located on seismic data by the discordance between the underlying truncated reflections and the overlying onlapping reflections. The character of this reflection varies laterally as different rock units subcrop at the unconformity.

6.2.2 Pekisko

This horizon is associated with the top of the Pekisko Formation which is a limestone. The reflection is usually weak and difficult to correlate from line to line. This is probably due to limitations in resolution.

6.2.3 Banff

This horizon is associated with the top of the Banff Formation which is the Clark Member. The lithology is predominantly limestone with interbedded shale. The reflection is usually fairly good. In some areas, limitations in resolution make it difficult to detect the reflection.

6.2.4 Clark Member

This horizon is associated with the lower limit of the Clark Member which is a transition of limestones with interbedded shales to shales. The reflection is fairly strong and continuous throughout the area.

6.2.5 Kotcho

This horizon is associated with the Kotcho Limestone. The reflection is strong and continuous throughout the area.

6.2.6 Tetcho

This horizon is associated with the top of the Tetcho Formation which is a limestone. The reflection is fairly strong and continuous throughout the area.

6.2.7 Jean-Marie and Slave Point

These horizons are associated respectively with the top of the Jean-Marie Formation and the top of the Slave Point Formation which are limestones. These reflections are strong and continuous throughout the area.

6.3 Structural Analysis

The major structure in the project area is the Celibeta High. The Celibeta anticline has associated with it a northeast trending fault zone, probably of Precambrian origin, with some Pre-Devonian topographic relief due to erosion along the fault zone. Minor tectonic adjustments ocurred along the zone during late Middle Devonian time and were possibly rejuvenated during the Phanerozoic producing folds and faults. Figures 7.1 and 7.2 show the effect of the Celibeta structure on different horizons.

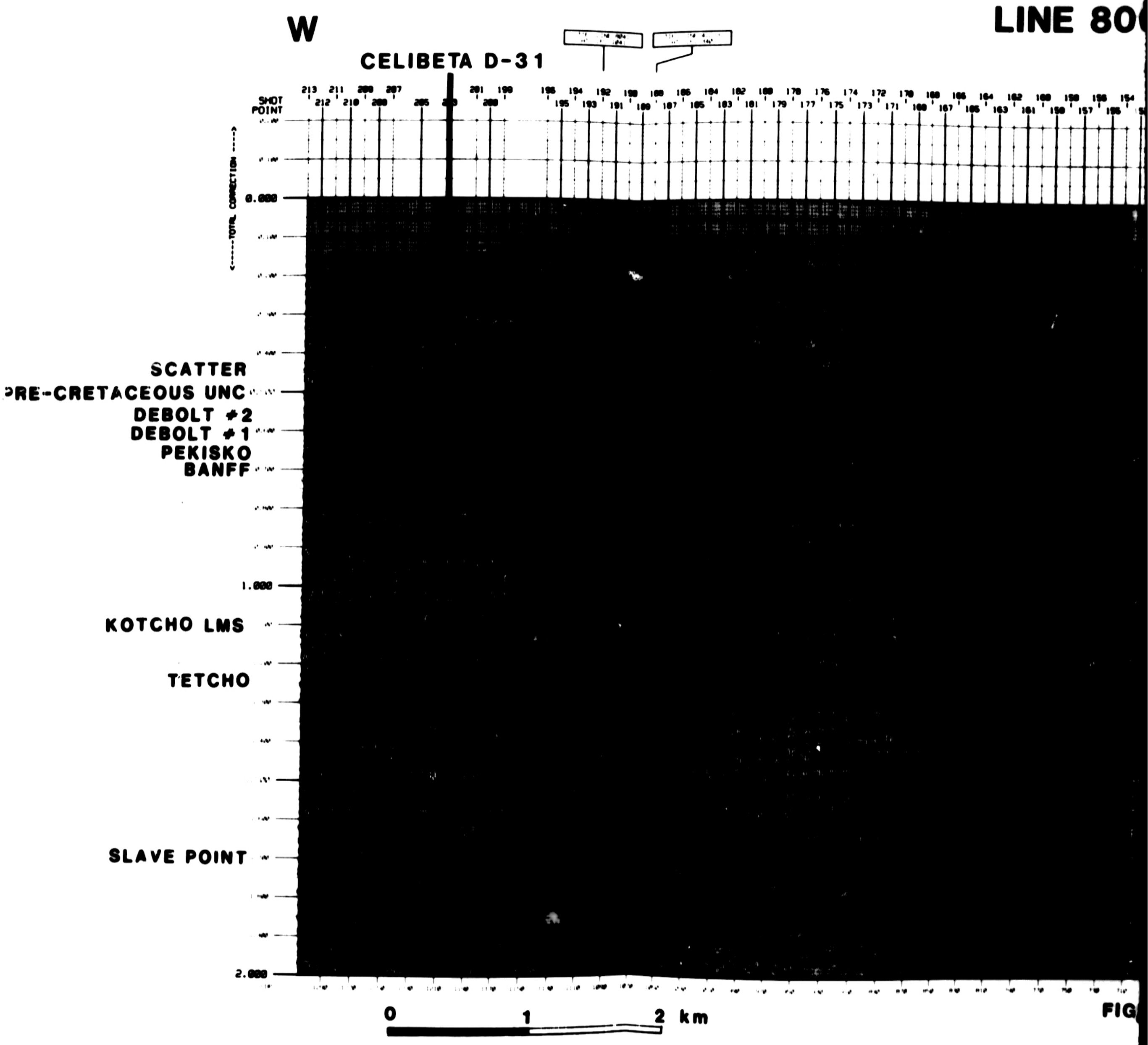
Furthermore, line 8123 indicates that a component of the structural growth of the Celibeta structure is post-

Mississippian and predated the Pre-Cretaceous Unconformity. This is confirmed by the fact that the Pre-Cretaceous Unconformity eroded Mississippian rocks which had already been affected by the Celibeta structure. Also, the southern part of the unconformity shows a structural high that indicates the Celibeta structure was still active during Early Cretaceous time. A major reactivation by the Laramide Orogeny of this older feature formed the present day Celiteta high which brings the Mississippian formation to the surface. Figures 7.1 and 7.2 also show the Pre-Cretaceous faults in the area. Two general trends have been identified: a northerly system and a northwesterly system. Most of these normal faults are dipping toward the southwest.

Some of the faults encountered in the area affect only the Mississippian section, and clearly indicate the presence of tectonic activity and erosion during the Post-Mississippian - Pre-Cretaceous period. Line 8064 (Figure 6.11) shows some of the Pre-Cretaceous faults.

The faults occasionally affect all Pre-Cretaceous rocks in the section, especially in the north. These faults are clearly related to ancient faults or fault zones. In other cases, the faults affect only the Mississippian and Upper Devonian section. Some of these faults are not related to ancient faults as shown on line 8068 at shot point 204 and on line 8111 at shot point 288. Finally, some faults affect only the Middle Devonian section and are related to ancient fault zones.

Occasionally, faults create graben-like features as shown at shot point 140 on line 8115 and at shot point 254 on line 3113. A secondary structure in the project area is a north-northwest trending hinge-line located in the west of


W
LINE 80
CELIBETA D-31
SHOT POINT
TOTAL CORRECTION
0.000
SCATTER
PRE-CRETACEOUS UNC
DEBOLT #2
DEBOLT #1
PEKISKO
BANFF
1.000
KOTCHO LMS
TETCHO
SLAVE POINT
2.000
0
1
2 km
FIG

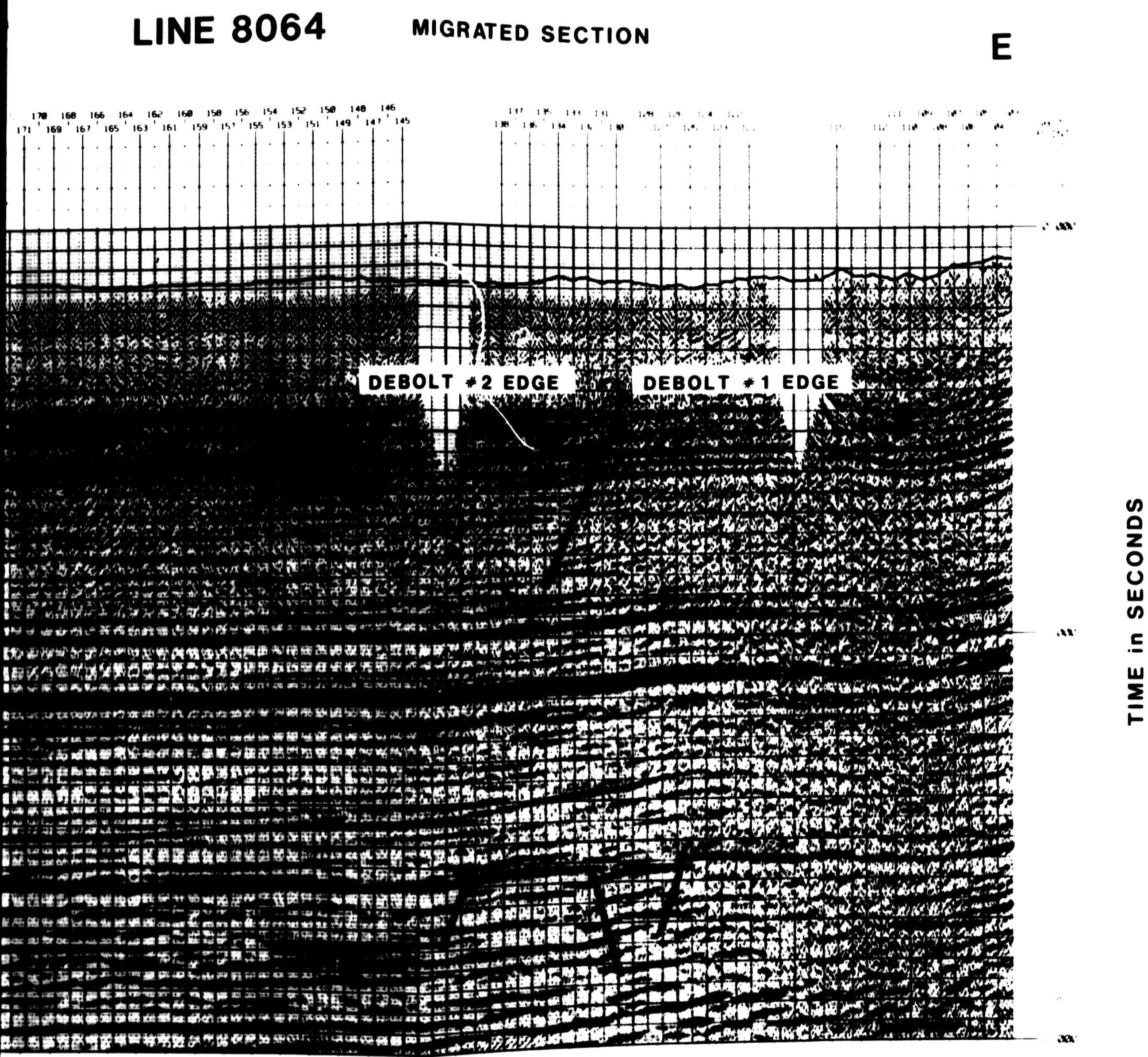


FIGURE 6.11 Example of Pre-Cretaceous faults and Debolt subcrops

the area. The hinge is located at shot point 177 on line 8064. All horizons appear to be affected and dip to the west. Some Pre-Cretaceous faults in the area might be related to this hinge line.

SECTION SEVEN

PRESENTATION OF RESULTS

7.1 Data Reduction

There were nine horizons digitized on the data. They were: Pre-Cretaceous Unconformity, Pekisko, Banff, Clark member (lower limit), Kotcho limestone, Tetcho, Jean-Marie, Slave Point and Basement. The data was digitized by the Technical Services group in PCR.

The 1984/85 seismic data was reinterpreted for certain geologic horizons and then merged with the new data to generate the maps.

The 17 seismic sections of the 1985/86 program and as well the four reprocessed seismic sections were sent separately from this report. The processing version sent was migrated. This version was used in the interpretation of the project area.

7.2 Maps Generated

The interpretive maps generated with the Petro-Ex mapping system were computer contoured except for the time structure map on the Pre-Cretaceous Unconformity which was contoured by hand.

The maps generated are all at a scale of 1:100,000. The interpretative maps are as follows:

A. **Time Structure**

(1) Pre-Cretaceous Unconformity and Mississippian sub-crop edges and Pre-Cretaceous faults (Figures 7.1, 7.2).

(2) Top of Pekisko Formation (Figure 7.3).

(3) Top of Banff Formation (Figure 7.4).

(4) Top of Jean-Marie Formation (Figure 7.5).

(5) Top of Slave Point Formation (Figure 7.6).

B. **Time Interval**

(1) Pre-Cretaceous Unconformity to Clark Member (Lower Limit) (Figure 7.7).

(2) Banff Formation to Clark Member (Lower Limit) (Figure 7.8).

(3) Kotcho Limestone to Tetcho Formation (Figure 7.9).

(4) Jean-Marie Formation to Slave Point Formation (Figure 7.10).

SECTION EIGHT

ELEMENTS OF SYNTHESIS

8.1 The Cretaceous

The Cretaceous rocks conformably overlie the Pre-Cretaceous Unconformity surface and consist mainly of marine shales. However, basal Cretaceous sand deposits are present in structural lows and in channel cuts in the Pre-Cretaceous Unconformity (Figure 8.1). Figures 7.1 and 7.2 show the distribution of these deposits.

The Scatter Formation consists of glauconitic sandstones and silty mudstones and is present over the entire project area.

8.2 The Mississippian

The Mississippian rocks thicken westward from their eroded edge to more than 1525 metres in the Liard Plateau. Figures 7.1 and 7.2 show the erosional edge of the Mississippian rocks which subcrop against the Pre-Cretaceous erosional surface. The Mississippian subcrop plays are the primary targets in the area. The Mississippian rocks have been eroded by Post-Mississippian - Pre-Cretaceous erosional activity.

Structurally, the Mississippian rocks are affected by a Post-Mississippian - Pre-Cretaceous tectonic activity. Figures 7.1 and 7.2 show the location of the faults affecting the Mississippian section. The faults displace all Mississippian rocks. The faults are normal and typicaly have a down to the west throw.

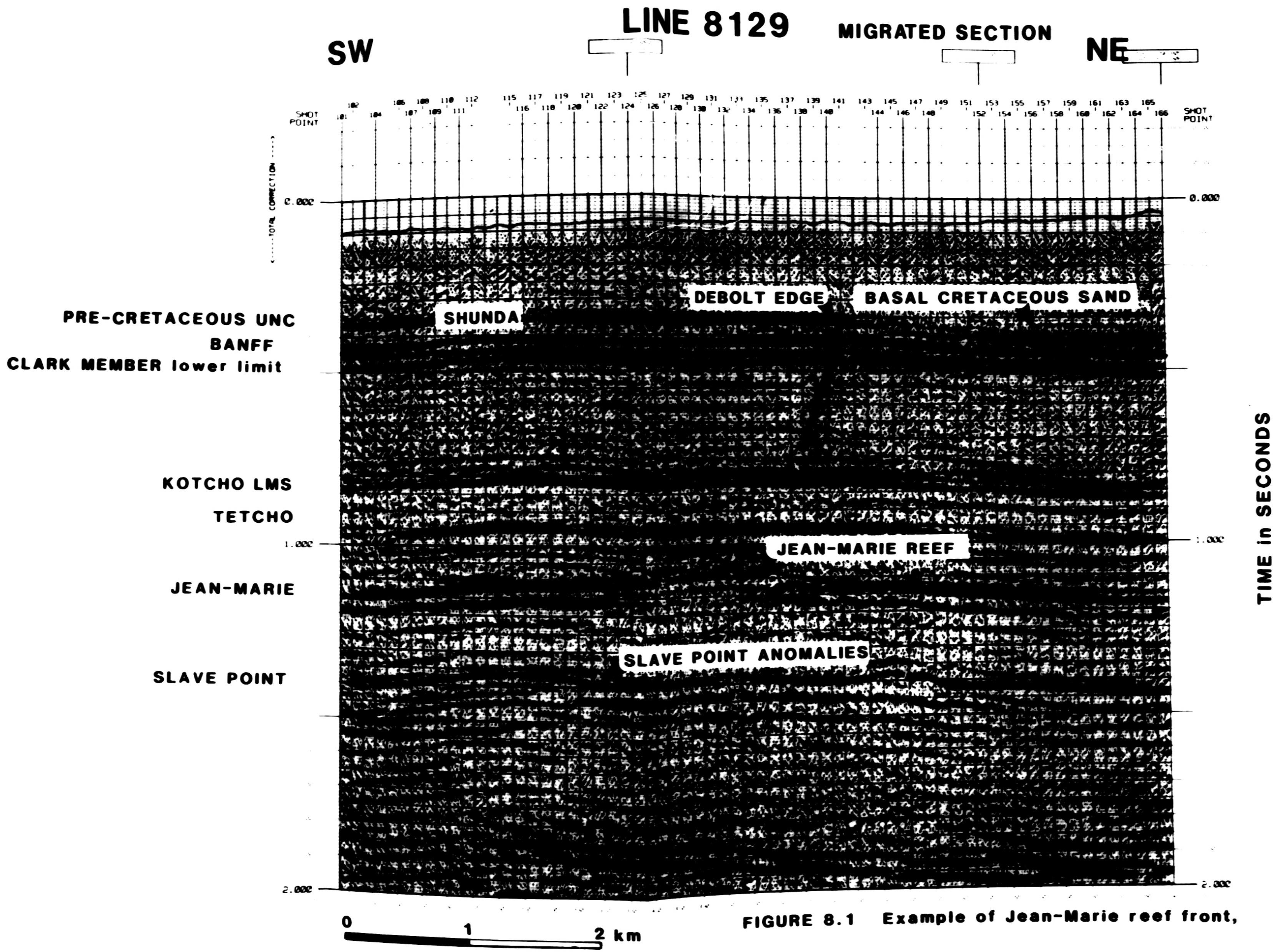


FIGURE 8.1 Example of Jean-Marie reef front, Slave Point anomalies and Basal Cretaceous sand.

The differential erosion of the Mississippian surface may be seen in figure 7.7. This figure represents a time interval map between the Pre-Cretaceous erosional surface and the lower limit of the Clark member. This interval includes all the carbonate horizons of the Mississippian. The map clearly indicates the increase of thickness to the west of the Mississippian section.

8.2.1 The Debolt Formation

The westerly dipping Debolt Formation consists of carbonates and shales which were extensively eroded and truncated prior to deposition of the Cretaceous rocks. Figure 7.1 indicates the location of the subcrop edges of the Debolt Formation which pinch out against impermeable Lower Cretaceous strata. The erosional surface on the top of the Mississippian is irregular in this area creating structural highs. Line 8064 (Figure 6.11) shows the truncation of the Debolt carbonate horizons by the Pre-Cretaceous Unconformity.

8.2.2 The Shunda Formation

The Shunda Formation consists of interbedded carbonates and shales. The formation subcrops against the Pre-Cretaceous erosional surface (Figure 7.1). The Shunda Formation thickens from its eastern erosional edge westward; the average thickness of the formation is 90 metres. The rocks of the Shunda lie conformably on the Pekisko Formation.

8.2.3 The Pekisko Formation

The Pekisko Formation consists of argillaceous limestones which have an average thickness of 40 metres. The formation lies conformably on the Banff Formation. The formation subcrops against the Pre-Cretaceous Unconformity (Figures 7.1 and 7.2).

Figure 7.3 is a time structure map on the top of the Pekisko Formation. The contour lines terminate where the top of the formation is eroded by the Pre-Cretaceous Unconformity. The map shows the type of structures that occur in the Mississippian carbonates as a result of Pre-Cretaceous faulting.

8.2.4 The Banff Formation

The Banff Formation consists mainly of shales with some argillaceous carbonates deposited at the top of the section. These argillaceous carbonates are associated with the Clark Member of the Banff Formation. The formation lies conformably on the Exshaw Formation.

The Clark Member subcrops against the Pre-Cretaceous erosional surface in the north of the area (Figure 7.1 and 7.2). It has an average thickness of 90 metres. Figure 7.8 represents a time interval map between the top and the base of the Clark Member. The interval has relatively little relief except for the western part of the area.

Figure 7.4 represents a time structure map on the top of the Banff Formation. The contour lines stop where the top of the Banff Formation have been eroded by the Pre-Cretaceous Unconformity. The western part of the area is the most affected by the Pre-Cretaceous faulting.

8.3 The Upper Devonian

8.3.1 The Kotcho Formation

The Kotcho Formation consists of a thin shaley horizon at the top, a middle limestone unit and a thick shaley interval at the base. The top of the limestone unit is the seismic event correlated in the area. Figure 8.1 shows this strong and consistent marker. The formation has an average thickness of 300 metres.

8.3.2 The Tetcho Formation

The Tetcho Formation consists of a fine-grained limestone. The average thickness of the formation in the area is 90 metres. Figure 7.9 represents the time interval map between the Kotcho limestone and the Tetcho Formation.

An anomalous area can be identified in the eastern part of the project area where the interval between the Kotcho limestone and the Tetcho Formation thins. Furthermore, the seismic character of the Tetcho Formation changes over the anomalous area. This anomaly is shown on line 8107 between shot point 260 and shot point 340 and it may be associated with a mud mound.

8.3.3 The Jean-Marie Formation

The Jean-Marie Formation consists of an Upper Devonian shelf carbonate which extends over most of the project area to a shelf edge, passing into deep water lime muds of the Fort

Simpson Formation. Figure 7.5 is a time structure map of the Jean-Marie Formation. The western limit of the shelf, which has a north-south trend, is indicated on this map. Close to the shelf edge, the formation develops occasional reef-like masses composed of algal growths. The seismic expression of one of these reef build ups can be seen in figure 8.1. The strong and continuous marker of the Jean-Marie Formation grades into a chaotic reflection. The average thickness of the formation at the reef front is 100 metres.

8.4 The Middle Devonian

The Middle Devonian consists of a sequence of evaporites, carbonates and clastics. At the top of the sequence, the Slave Point carbonate was deposited. Possible carbonate build-ups such as reef, patch or pinnacle, have been noted on the Slave Point bank.

Figure 8.1 shows anomalies which infer the presence of carbonate build-ups. The time structure map of the Slave Point Formation is given in figure 7.6. Figure 7.10 is a time interval map between the Jean-Marie Formation and the Slave Point Formation. These two maps permit the identification of anomalies which are not associated with Precambrian faults.