PETRO-CANADA

Report on the GEOPHYSICAL EXPLORATION SURVEY

PROGRAM No. 9229-P28-9E

in

CAMERON HILLS

NORTHWEST TERRITORIES

Exploration Agreement No. 164

APRIL, 1986

9229-P28-9E

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Geophysical Exploration Survey

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Cameron Hills
Northwest Territories
EXPLORATION AGREEMENT NO. 164

by

Petro-Canada Inc.
April 1986

FIELD WORK PERIOD:	January - March, 1985
LAND USE PERMIT NO.:	N84B267
AREA COORDINATES:	Latitude 60° 00' - 60° 30' Longitude 116° 00' - 118° 00'
DATA ACQUISITION:	Sefel Geophysical Ltd.

Submitted
By

C. Boyer
Project Geophysicist
NWT Region

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Regional [illegible]
NWT

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PROFESSIONAL ENGINEER ALBERTA J.B. HENRY

NWT

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   1 mylar and 2 paper copies of each section

   2 sections per line: Migrated, 36TPI, N+R polarity

REFERENCES

de Wit, R., Gronberg, E.C., Richards, W.B. and Richmond, W.O., 1973: Tathlina Area, District of Mackenzie, in The Future Petroleum Provinces of Canada; Canadian Society of Petroleum Geologists, Memoir 1, p 187-212

Hriskevich, M.E., 1970: Middle Devonian Reef Production, Rainbow Area, Alberta, Canada; A.A.P.G. Bulletin, Vol. 54, No. 12 (December 1970), p 2260-2281

Hurst, P., 1985: Hydrocarbon Potential of the Middle Devonian in the Cameron Hills Area; Petro-Canada Inc.

McCamis, J.G. and Griffith, L.S., 1967: Middle Devonian Facies Relationships, Zama Area, Alberta; Bull. Can. Petro. Geol., Vol. 15, No.4 (December 1967), p 434-467

SECTION ONE

INTRODUCTION

Petro-Canada Inc. conducted a geophysical survey in the Cameron Hills area during the 1984-1985 winter season. The lands involved were operated under Exploration Agreement number 164. See Figure 1.1 for the location. The land shown on the different maps of this report is the land after the 1985 land relinquishment.

The regional seismic program was designed to obtain subsurface information to locate features with hydrocarbon potential. A total of 456 kilometers of seismic data were shot, Figure 3.2, and 4321 gravity readings were collected along 412.3 kilometers of seismic lines.

This report, submitted to COGLA to partially fulfill the requirements of the Exploration Agreements, summarizes the procedure used in data acquisition, seismic and gravity processing, as well as the results of the interpretation. All maps produced during the work period are included in the report. Data which have been sent separately from this report include one mylar copy of the seismic base map and one mylar and two paper copies of each seismic section.

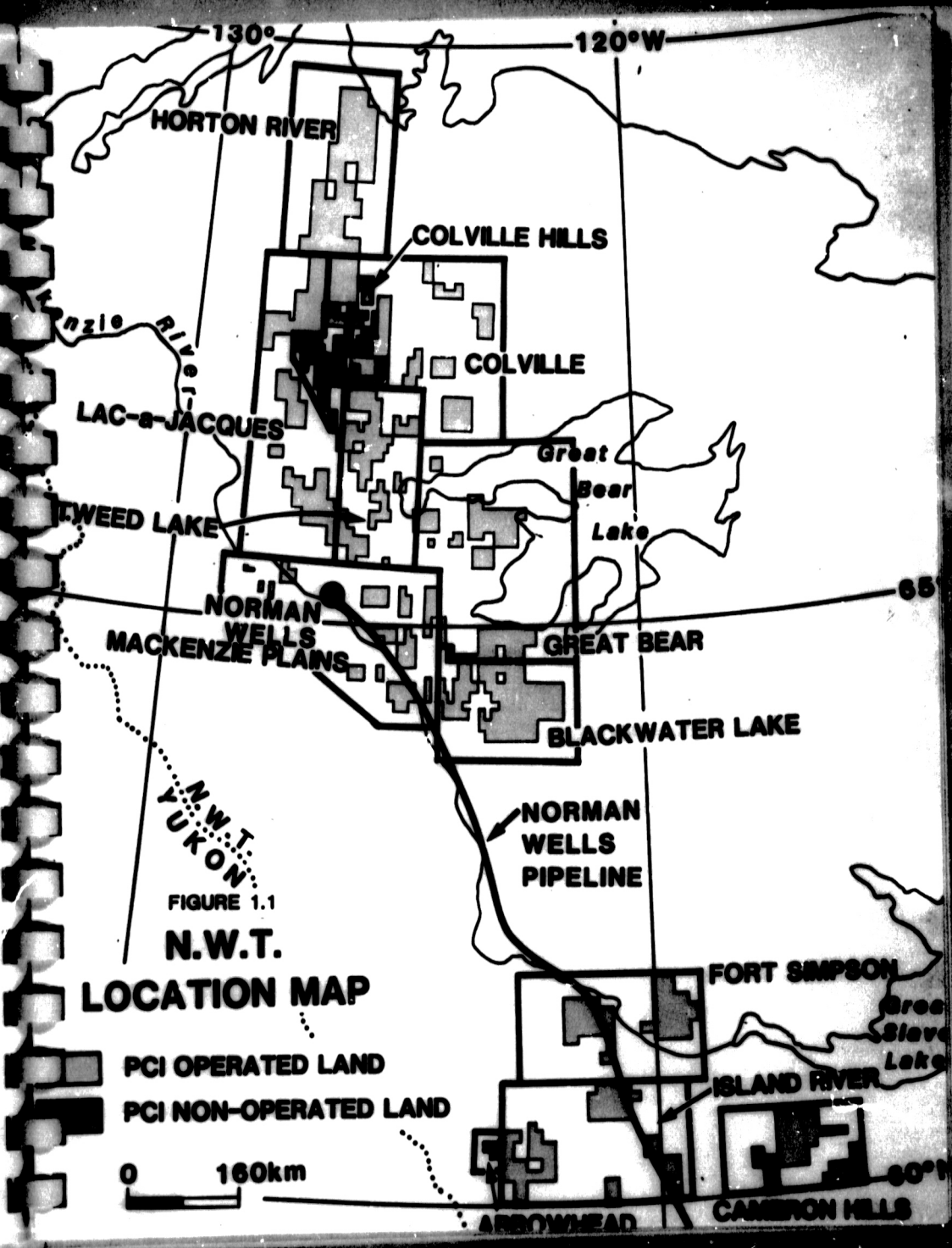


FIGURE 1.1

N.W.T.

LOCATION MAP

SECTION TWO

DATA ACQUISITION AND REDUCTION

2.1 Field Operations Summary

2.1.1 Field Conditions

The Cameron Hills area is divided into two topographical areas. The west side comprises the Cameron Hills where elevations range from 600 to 830 metres. This area is referred to in the text as the hills area. The timber coverage is sparse, except in the valleys, with many open untreed muskeg areas. There were early snow falls on the higher elevations and this resulted in unfrozen ground conditions under the snow. The unfrozen ground held up the drills as they had to wait for the line to freeze after it was cut. The east side is a swampy flat area divided roughly in half by the Hay River. This area is called the plains area. The elevations range from 285 to 300 metres. The terrain is mainly muskeg and very flat, which improved line clearing.

Access to the area was cleared by Exco in January 1985 who put a winter road for well locations on Cameron Hills, and Sefel Geophysical Ltd. obtained the approvals to use the road. Two ice bridges were built across the Hay River to gain access to the east side of the survey area. Because the travel time from camp was long, it was decided to drop 4 of the 7 lines on the east side of the river.

2.1.2 Seismic Operations

The major contractor was Sefel Geophysical Ltd., who subcontracted the bulldozing, drilling, surveying, catering, the building of 2 ice bridges and the clean-up. Trace Exploration Ltd. was also contracted to shoot 1 production line (8019) and 1 test line (8013A). This crew was brought in to test air guns in the plains area and to compare air gun data with the dynamite data of the Sefel crew. For the Sefel crew a total of 59 people were employed, of which 41% were residents of the Northwest Territories.

Tables 2.1, 2.2, 2.3 and 2.4 summarize the project chronology, production, drilling and project organization for the Sefel crew. Tables 2.5 and 2.6 summarize the project chronology and production for the Trace Crew.

Mobilization	January 4, 1985	Cat Camp
	January 12, 1985	Base Camp
	January 15, 1985	Drilling
Drilling Started	January 17, 1985	
Recording Started	January 23, 1985	
Completion	March 16, 1985	Drilling
	March 17, 1985	Line Cutting
	March 23, 1985	Recording
Demobilization	March 24-25, 1985	

Table 2.1 Seismic Project Chronology (Sefel Crew)

Total Recording Days	57
Total Test Days	1
Total Poor Weather Days	1
Production Profiles Shot	4,545
Kilometres Shot	433.3
Average Shot Points per Day	80
Average Kilometres per Production Day	7.60
Total Days Mobilization/Demobilization	4

Table 2.2 Seismic Production (Sefel Crew)

Number of Holes (Location) Drilled	4,545
Total Metres Drilled	105,035
Explosives Used	8,846 Kilograms
Average Explosives per Location	1.94 Kilograms

Table 2.3 Seismic Drilling (Sefel Crew)

Sefel Geophysical Ltd. Crew

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

Drilling:
(Table 2.8 for Contractors)

Drilling Push	1
Drillers	5
Driller's Helpers	5
Water Truck Drivers	2

Bulldozers:
(Carm Construction Ltd.)
(Don Pearson)

Cat Foreman	1
Cat Push	1
Cook	1
Cat Operators	6

Survey:
(Polaris Surveys)

Surveyor	1
Rodman	1
Chainers	2
Observer	1
Junior Observer	1
Shooter	1
Shooter's Helper	1
Cable Truck Drivers	4
Recording Helpers	8

Catering:
(Travers Food Service)

Cook	1
Cook's Helper	1
Camp Attendant	1

Line Clean-up:
(Tu Cho Gha General Contracting)

Line Clean-up	5

Ice Bridge:
(Eric Wilkenson)

Ice Bridge	4

Table 2.4 Project Organization (Sefel Crew)

Surveying Started	March 12, 1985
Recording Started	March 14, 1985
Recording Completed	March 19, 1985

Table 2.5 Seismic Project Chronology (Trace Crew)

Total Recording Days	3
Kilometres Shot	22.6
Average Kilometres per Production Days	7.53

Table 2.6 Seismic Production (Trace Crew)

2.1.3 Gravity Operations

M&H Geophysics Ltd. was contracted to undertake the gravity acquisition. A single gravity operator was employed.

Table 2.7 summarizes the project chronology and production. The demobilization was to the Fort Simpson East project, and took 1.5 days.

Project Chronology

Mobilization Date	January 15-16-17, 1985
Demobilization Date	March 22-23, 1985

Production

Total Number of Stations	4,321
Total Number of Lines	17
Total Line Distance	412.3 km
No. of Production Days	61
Standby Days	2
Average No. of Readings per Production Day	71

Table 2.7 Gravity Project Chronology and Production

2.2 Seismic Data Acquisition (Sefel Crew)

2.2.1 Instruments

Table 2.8 provides a summary of the equipment used in drilling, recording, detection and surveying.

Drilling		
11 Contracted Drilling Rigs	2 Buffalo Lake	Tandem Top Drive
	1 Cofield	Tandem Top Drive
	1 McDell	Tandem Top Drive
	1 Hartigo	Tandem Top Drive
	1 R.W. Millar	Tandem Top Drive
	1 Park Drilling	Tandem Top Drive
	1 Alpine Engi.	Tandem Top Drive
	1 Ardco	Buggy Top Drive
	1 Kault and Seidler	Tandem 5 ft. Sewell
	1 Melin Holdings	Tandem Conv. Air/Water Combined
2 Water Trucks	1 McDell	Tandem Water Truck
	1 Abilds	Tandem Water Truck
Recording		
Amplifiers	T.I.	DFSV
Tape System	SEGB T.I.	DFSV
Camera	SDM400B	Geosource
Detection		
Remote Firing System	Input/Output Encoder/Decoder	
Cables	Seismic Cable 402m - take-outs: 24 at 17.7 m	
Geophone Strings	Geosource GS200 14 Hz.	
Surveying		
1 Wilde T-16 Theodolite		

Table 2.8 Seismic and Survey Instruments (Sefel Crew)

2.2.2 Parameters

The source-detector geometry was a 1220-40-X-40-1220 metres spread except for line 8013T (10 metre group interval) which was a 610-20-X-20-610 metres spread. Each line started and finished with 120 traces live and centre gap in.

Table 2.9 lists the recording parameters used.

Sample Rate	2 milliseconds
Record Length	4 seconds
Recording Filter	Low cut: 12/18, High cut: 128/72 Notch: out
Sub-surface Coverage	1200% (8013T:600%)
No. of Groups	120
Group Interval	20 metres (8013T:10 metres)
Group Array	Inline Array over 20 metres (8013T: 10 metres)
No. of Geophones per Group	9
Shot Point Interval	100 metres
Spread Length	1220-40-X-40-1220 (8013T:610-20-X-20-610)
Energy Source	Dynamite 2 kg., 2 x 1 kg. 3 x 1/2 kg., 5 x 1/2 kg. 3 x 1 kg.
Holes per Shot Location	1 or 2,3, 5 inline over 20 metres
Hole Depth	Various: 3-18 metres

Table 2.9 Recording Parameters (Sefel Crew)

2.3 Seismic Data Acquisition (Trace Crew)

2.3.1 Instruments

Table 2.10 provides a summary of the equipment used in recording, detection, and surveying.

Recording	
Air gun Size	60 cubic inches
Instruments	DFSV
Detection	
Geophones	L-15, 14 Hz. (winter base)
Surveying	
1 Wilde T-16 Theodolite	

Table 2.10 Seismic and Survey Instruments (Trace Crew)

2.3.2 Parameters

The source-detector geometry was 1240-60-X-60-1240 metres. Table 2.11 lists the recording parameters used.

Sample Rate	2 milliseconds
Record Length	3 seconds
Recording Filter	Low Cut: 18/18 High Cut: 128 Hz Notch: out
Sub-surface Coverage	3000%
No. of Groups	120
Group Interval	20 metres
Group Array	Inline Array over 20 metres
No. of Geophones per Group	9
Shot Point Interval	40 metres
Spread Length	1240-60-X-60-1240
Air gun Array	Inline Array over 30 metres
No. of Air guns	3
No. of Pops	4-6

Table 2.11 Recording Parameters (Trace Crew)

2.4 Gravity Data Acquisition

Table 2.12 lists the equipment used for the survey

1 Lacoste and Romberg G-meter #332
1 Hewlett Packard 72B Portable Computer
1 Jeep 4 x 4 Truck
1 All Terrain Cycle

Table 2.12 Equipment Used for Gravity Survey

The observed gravity at Government station #9167 (N.W.T. Border) was tied to three primary field bases; Base #1, Base #2 and Base #5 (Base #1 and Base #2 are at the same location). The further development of the field base network was accomplished by double run loops with drift rates of less than 0.05 milligals per loop. The total number of bases for this project was 37.

The gravity was observed along the seismic lines every 100 metres. The gravimeter was carefully tuned and readings were taken to the nearest 1/100th of a milligal. Inner terrain corrections were made in rough terrain. One-hundred repeats were read (4.8% of total) for an RMS average mistie of 0.03 milligals.

2.5 Geophysical Data Processing

2.5.1 Seismic Processing

The seismic data recorded was processed at Seiscom Delta United in May, 1985. The following format was used; notice that some parameters differ between the hills data (lines 8000, 8021-8035) and the plains data (lines 8005-8019).

1. Demultiplex
   - Processing Sample Rate: 2 millisecond
   - Processing Record Length: 2 seconds (hills data), 1 second (plains data)
   - Reformat to: SEGY, 32 bit, floating point

2. Amplitude Recovery
   - Spherical Divergence: to 600 msec
   - Exponential Gain: 14dB/sec. from 0 to 2000 msec (1000 msec for plains data)

3. Deconvolution
   - Time Constant
   - Type: Spiking
   - Operator Length: 80 msec
   - Prewhitening: 0.1%
   - Design Window Length: 1100 msec (hills data), 650 msec (plains data)

4. Statics
   - Drift Shot and Receiver Statics
   - Weathering Velocity: 610 metres/sec
   - Hills data
     Datum: 750 metres
     Replacement Velocity: 2100 metres/sec
   - Plains data
     Datum: 300 metres
     Replacement Velocity: 4500 metres/sec

5. Preliminary Velocity Analysis
   - Type: Dove velocity spectra (datum referenced)
   - Interval: 4 km.

6. Residual Statics
   - Type: Surface Consistent
   - Window: 400-1100 msec (hills data), 350-650 msec (plains data)
   - Lines 8013A and 8019 Bulk Shift for Airgun Delay: -20 msec

7. Velocity Analysis
   - Type: Dove velocity spectra (datum referenced)
   - Interval: 2 km.
   - Verification: common offset stack

8. N.M.O.
   - Interval Velocities Computed by Dix Equation

9. Front Mute

Hills Data		Plains Data	
Range (metres)	Time (msec)	Range (metres)	Time (msec)
240	0	220	0
280	350	260	300
720	700	1,220	1,000
1,220	900	2,440	1,100
2,440	1,800		

10. Trim Statics (used only for hills data)
    - Window: 400-1100 msec
    - Maximum Allowable Static: 8 msec

11. C.D.P. Stack
    - Fold: 1200% (8013T:600%, 8013A & 8019: 3000%)

12. Wave Equation Migration
    - 80% of Interval Velocity Applied

13. Filter
    - Type: Trapezoidal, Zero phase 20-25-75-95 Hz. (hills data)
      Trapezoidal, Zero phase 20-25-80-100 Hz. (plains data)

14. Trace Equalization
    - Sliding Window Length: 400 msec
    - Percent: 100%

15. Display
    - Horizontal Scale: 12 and 36 traces/inch
    - Vertical Scale: 7.5 inches/sec

Because of the different elevations and surface rocks between the western and eastern part of the project, these areas were processed with different datums and replacement velocities.

2.5.2 Gravity Processing

Field processing was done by the contractor and included conversion of meter reading to milligals, plus drift and tidal corrections. The inner terrain correction was estimated by the operator in the field. In Calgary, the contractor calculated the Bouguer gravity using a crustal density of 2.35 grams/cc.

The data was then delivered to the Gravity and Magnetic Group of Petro-Canada Inc. for final processing as follows:

1. Outer Terrain Corrections

2. Merging the line oriented data into the Merged Survey File (MSF)

3. Plotting of the gravity profiles

4. Editing

5. Plotting of the Bouguer map

SECTION THREE

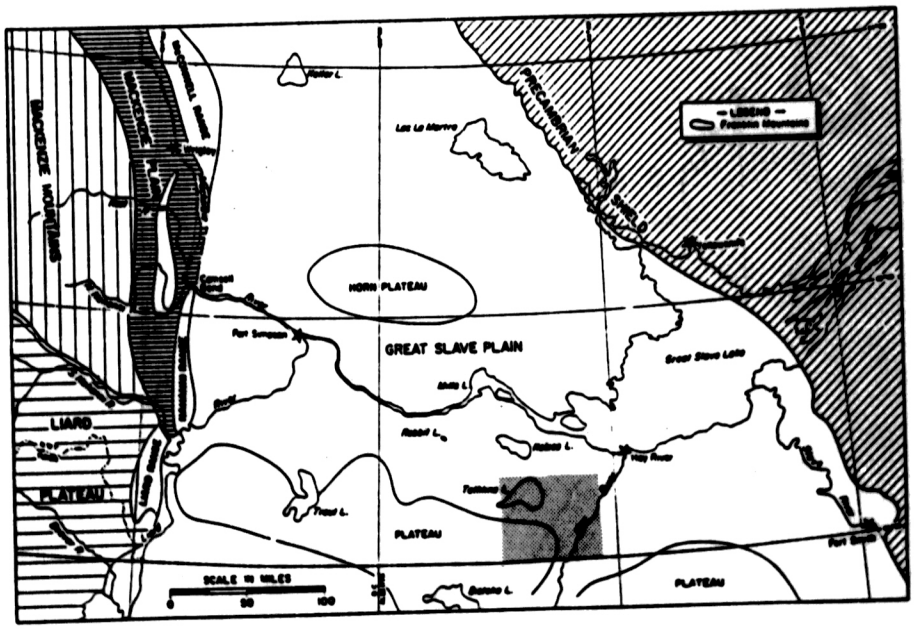
INTERPRETATION OF RESULTS

3.1 Regional Geology

The Cameron Hills geophysical survey was shot in an area of the Great Slave Plain physiographic province, Figure 3.1. The Cameron Hills E.A. lies in an extension of the Northern Alberta Basin and has the same stratigraphy and targets as found in much of the Alberta Basin.

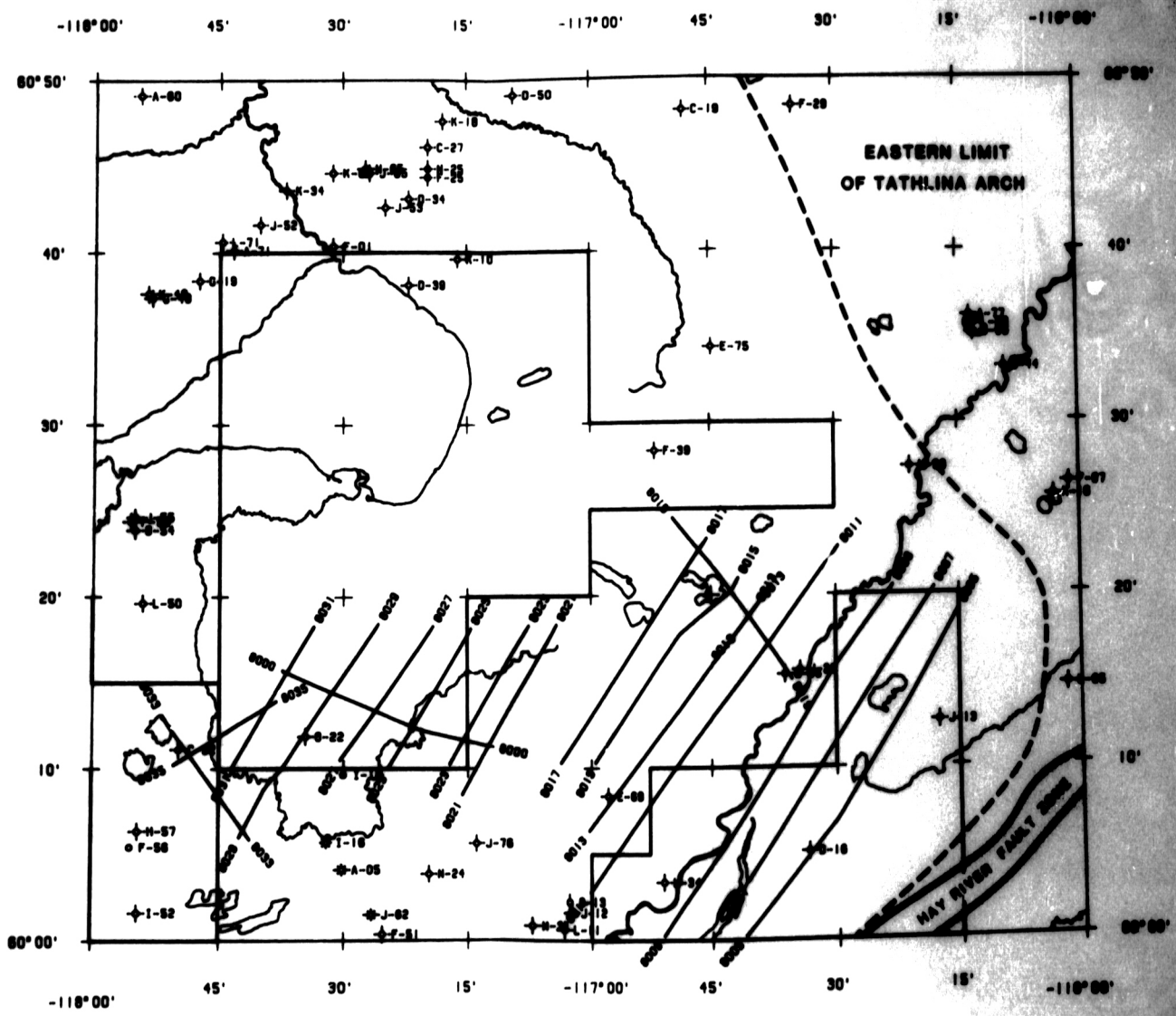
The major structural feature of the area is the Tathlina Arch. The entire E.A. is located on the arch, Figure 3.2. This arch is an uplifted feature consisting of Pre-Cambrian rocks and formed during Early Devonian and possibly prior to this time. The arch was above sea level throughout the Lower Devonian and the early part of the Middle Devonian, therefore the formations of that age were never deposited in this area. Shearing and blockfaulting are thought to have been the major causes for basement relief in this region. On the eastern limit of the E.A. there is the Hay River fault zone striking southwest- northeast with the up side to the east, Figure 3.2. West of this fault the magnetics suggest faults striking in a northwest-southeast direction.

In this area the Pre-Cretaceous unconformity cuts down into the Upper Devonian. In the Cameron Hills (western part of the E.A.) there is 600 metres of Cretaceous material. On the eastern part the Cretaceous cover varies in thickness from 5 to 75 metres.



Project Area

Figure 3.1 Map of the physiographic provinces in the Cameron Hills area (modified from de Wit et al., 1973).



1 : 500 000

0 10 20 30 km

FIGURE [illegible]

LOCATION MAP OF THE
1984-1985 GEOPHYSICAL PROFILES
IN THE CAMERON HILLS [illegible]
SHOWING MAJOR STRUCTURAL FEATURES

3.1.1 Stratigraphy

The stratigraphic succession ranges in age from Pre-Cambrian to Recent, Figure 3.3. In this area the basement is a Pre-Cambrian granite. Overlying the Pre-Cambrian are the Basal Red Beds, which consist mostly of shale. The Silurian and Ordovician formations are absent.

The oldest Devonian formation is the Chinchaga formation which is dolomite and anhydrite. It is overlain by the Keg River formation. This formation is divided in two: the lower member is the limestone platform which may be dolomitized, the upper member may be a dolomite bank. If the area was a basin at the time, then the upper member could be a dolomite reef or be missing entirely. In the latter case the basin may have filled with salt, possibly followed by solution of this salt.

Overlying the Keg River is the Muskeg formation or the Presqu'ile barrier to the north and east. The Muskeg formation is mostly anhydrite with thin dolomite beds. The Presqu'ile barrier is dolomite. Above the muskeg is the Sulphur Point limestone and dolomite which are unconformably overlain by the Watt Mountain green shale. The Slave Point limestone is the uppermost formation of the Middle Devonian.

The Upper Devonian formations are the Muskwa shale, the Hay River shale, the Twin Falls shaley limestone, the Fort Simpson shale, the Jean-Marie limestone, the Redknife limestone, the Kakisa limestone, the Trout River shaley limestone, the Tetcho limestone and the Kotcho limestone.

The Cretaceous overlies the Upper Devonian and consists mostly of shales.

Age	Formation		Lithology
QUARTERNARY	Q (undivided)		gravel, till
Unconformity			
CRETACEOUS	K (undivided)		shale
Pre-Cretaceous Unconformity			
UPPER DEVONIAN	Kotcho		limestone
	Tetcho		limestone
	Trout River		limestone, interbedded sandstone
	Unconformity		
	Kakisa		limestone
	Redknife		limestone, interbedded siltstone
	Jean-Marie		limestone, siltstone
	Fort Simpson		shale
	Twin Falls		limestone, interbedded shale
	Hay River		shale, siltstone
	Muskwa		shale, interbedded limestone
? Unconformity ?			
MIDDLE DEVONIAN	Slave Point		limestone
		Fort Vermillion member	limestone, dolomite, anhydrite, shale
	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			granite

Figure 3.3 Stratigraphic Column for the Cameron Hills Area

3.1.2 The Prospects

The primary targets in the area are the Keg River reefs. These reefs would be similar to the reefs observed in the Rainbow, Zama, Amigo and Shekilie basins of northern Alberta. There are no known basins in the Cameron Hills area, but also, there are very few wells. In the eastern part of the E.A., there could be an extension of the Meandre basin found in northern Alberta. There could be one or more basins to be found south of the Presqu'ile barrier. These reefs can be found on seismic by observing structural draping of the Slave Point caused by salt removal during post Slave Point time.

Other targets are Keg River mounds, Keg River bank porosity, Sulphur Point porosity and Slave Point porosity.

3.2 Correlation of Geology to Geophysics

Correlations from geology to geophysics were based on 5 wells, 2 in the western area and 3 in the eastern area. Synthetic seismograms for the Cameron C-22, Swede O-22, Alexandra Falls G-36, Cameron Hills E-69 and Cameron D-16 are shown in Figures 3.4, 3.5, 3.6, 3.7 and 3.8. The location of these wells, with others, is given in Figure 3.2, together with the location of the seismic lines in the Cameron hills survey. All of the aforementioned wells penetrated the basement. Two other wells in the eastern part were also used in the interpretation: Cameron Hills H-34 and Grumbler J-13.

Four events have been mapped in the hills area, the Basal Red Beds, the Slave Point Formation, the Twin Falls Formation and the Pre- Cretaceous unconformity. All of these reflectors can be easily followed over much of the area. On the synthetic seismograms there is more than one reflector for the Upper Devonian section, but the Twin Falls reflector is the only continuous reflector, the other boundaries probably being gradational contacts.

LINE 8027

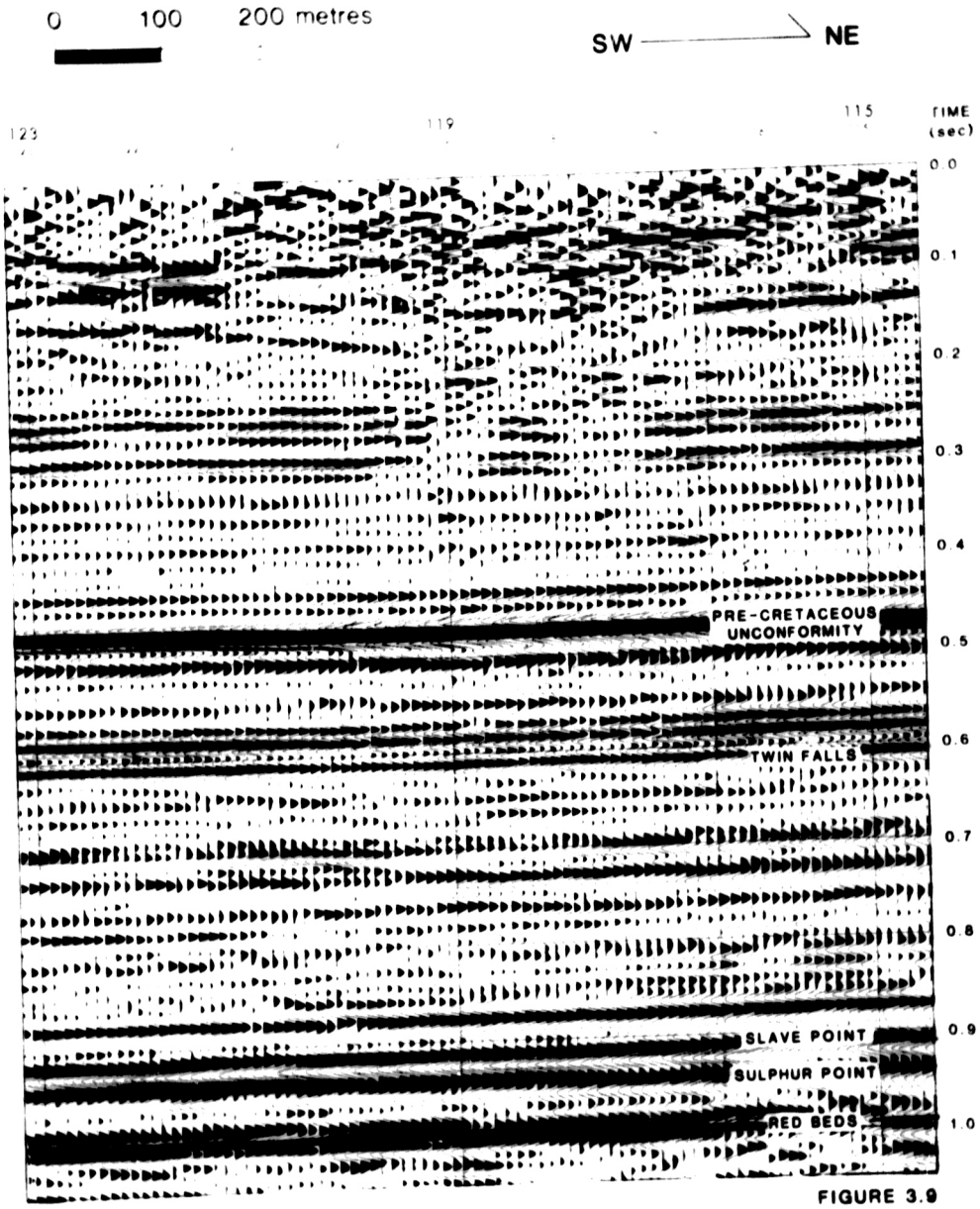


FIGURE 3.9

LINE 8027

EXAMPLE OF INTERPRETED SEISMIC

For the plains area two events have been mapped, the Basal Red Beds and the Slave Point Formation. The other two horizons are too shallow to be observed seismically.

Another identifiable event depending on the velocity contrast with the overlying Watt Mountain shales, is the Sulphur Point Formation. However, this event was not mapped. An example of the interpreted seismic is given in Figure 3.9. The normal polarity sections were used for the hills parts of the project. From tying the seismic to the synthetic seismograms, it was decided to use the reverse polarity sections for the plains data.

3.2.1 Velocity Information

Velocity information was obtained from sonic logs. A stratigraphic column with velocity and density information is given in Figure 3.10.

3.2.2 Seismic Modelling

Seismic modelling was used to confirm new play concepts for the area. Figure 3.11a and b show a model for Keg River porosity. The sonic log data from the Cameron D-16 well was used to generate the model. The porosity was simulated by lowering the velocity of the Upper Keg formation as listed in Table 3.1. The number in brackets is porosity.

Traces	Internal Replaced (metres)	Velocity & Porosity (metres/sec)
1-24	ORIGINAL	
25-32	814-829	5486 (8.3%)
33-40	799-829	5486 (8.3%)
41-80	799-829	4877 (13%)
81-88	799-829	5486 (8.3%)
89-96	814-829	5486 (8.3%)
97-122	ORIGINAL	

Table 3.1 Values Used for Keg River Porosity Model

FIGURE 3.10

CAMERON HILLS

STRATIGRAPHIC COLUMN, VELOCITY AND DENSITY INFORMATION

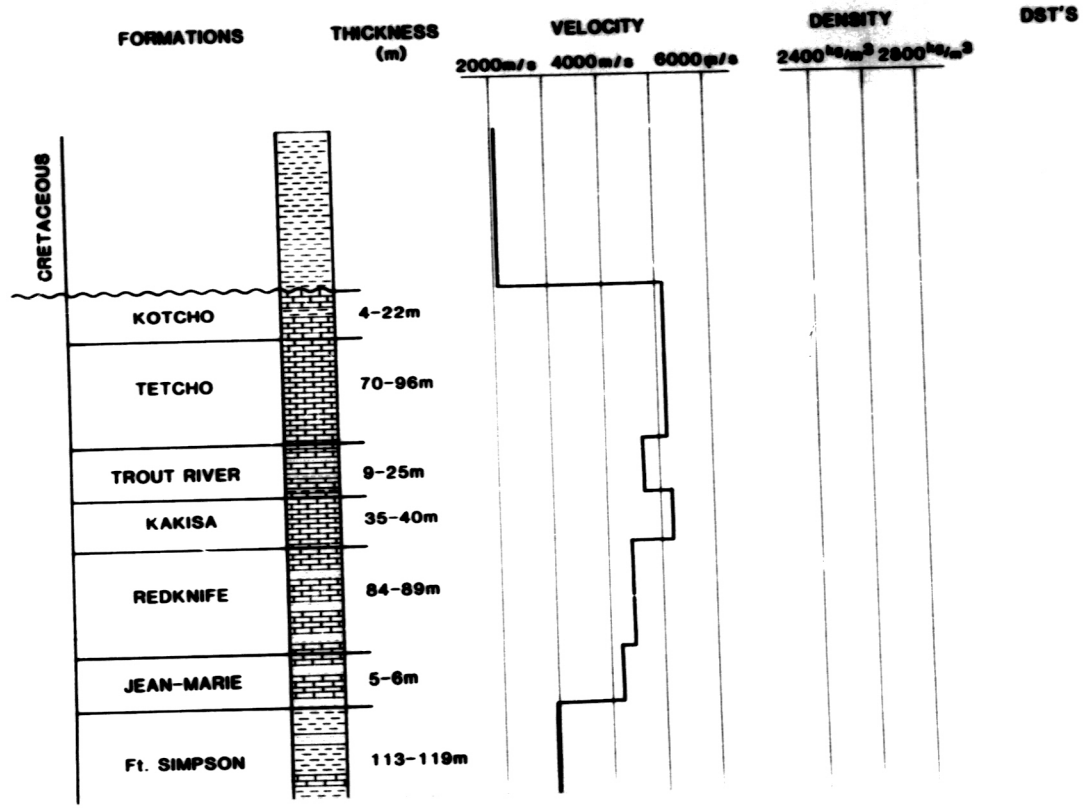
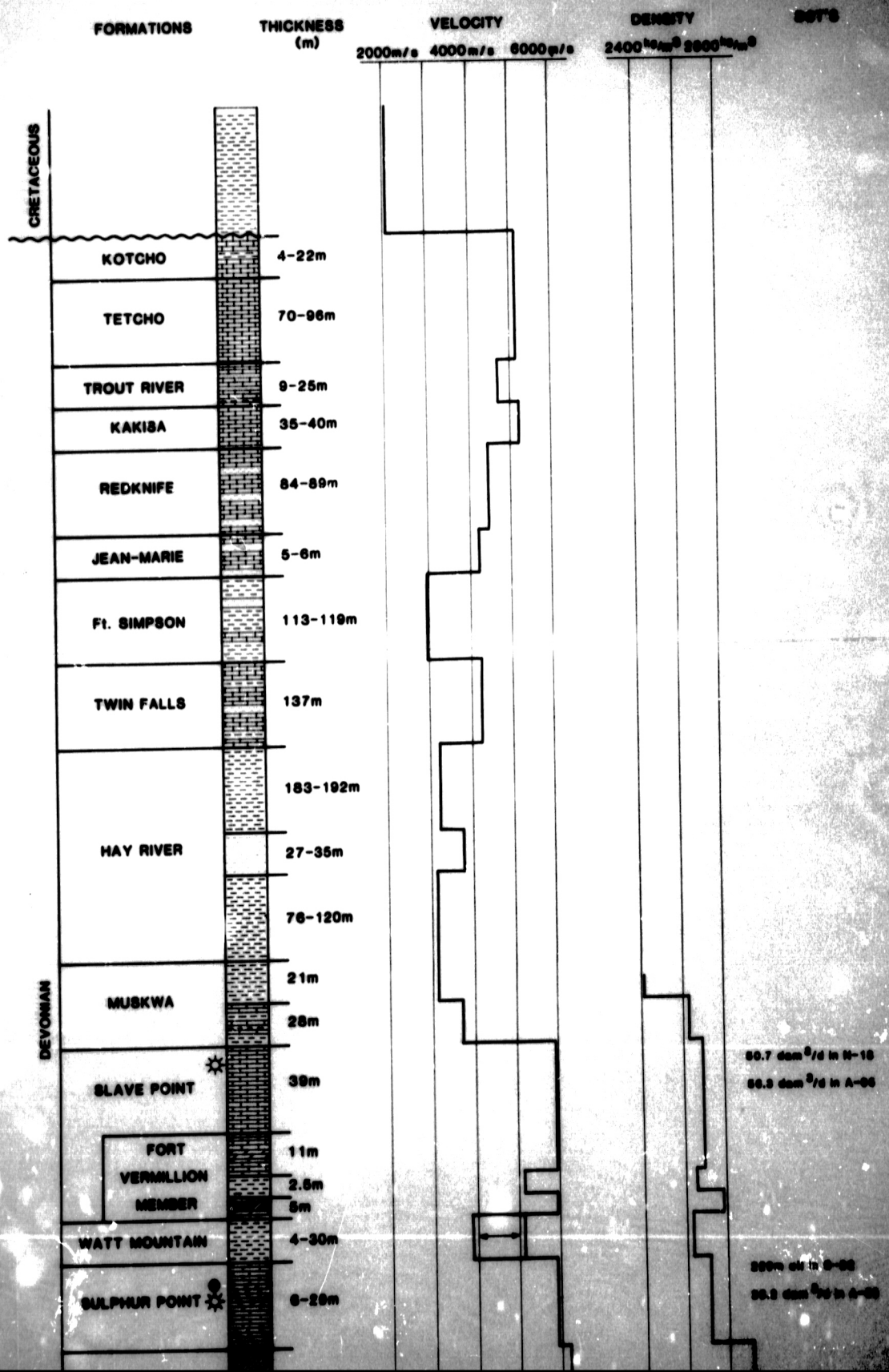
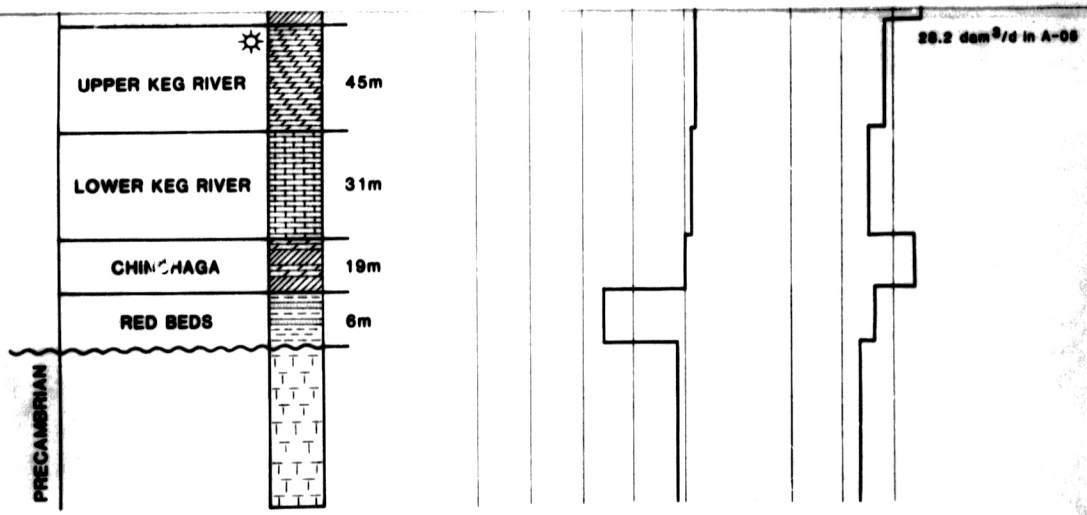


FIGURE 3.10

CAMERON HILLS

STRATIGRAPHIC COLUMN, VELOCITY AND DENSITY INFORMATION





Velocity and Thickness Information from Wells: Cameron C-22 and Swede O-22

Compiled by: Charles Boyer 85-07-05

FILE No.: 4221

Another model was generated to simulate Sulphur Point porosity trapped by "Sulphur Point shales", Figure 3.12a and b. These "Sulphur Point shales" are found in the Swede O-22 well, and therefore this well was used to generate the model. The velocities used to produce this model are listed in Table 3.2

Traces	Internal Replaced (metres)	Velocity & Porosity (metres/sec)
1-10	ORIGINAL	
11-15	1437-1442	5486 (8.3%)
16-20	1434-1442	5486 (8.3%)
21-40	1431-1442	5486 (8.3%)
41-45	1434-1442	5486 (8.3%)
46-50	1437-1442	5486 (8.3%)
51-60	ORIGINAL	

Table 3.2 Values Used for Sulphur Point Porosity Model

3.3 Presentation of Results

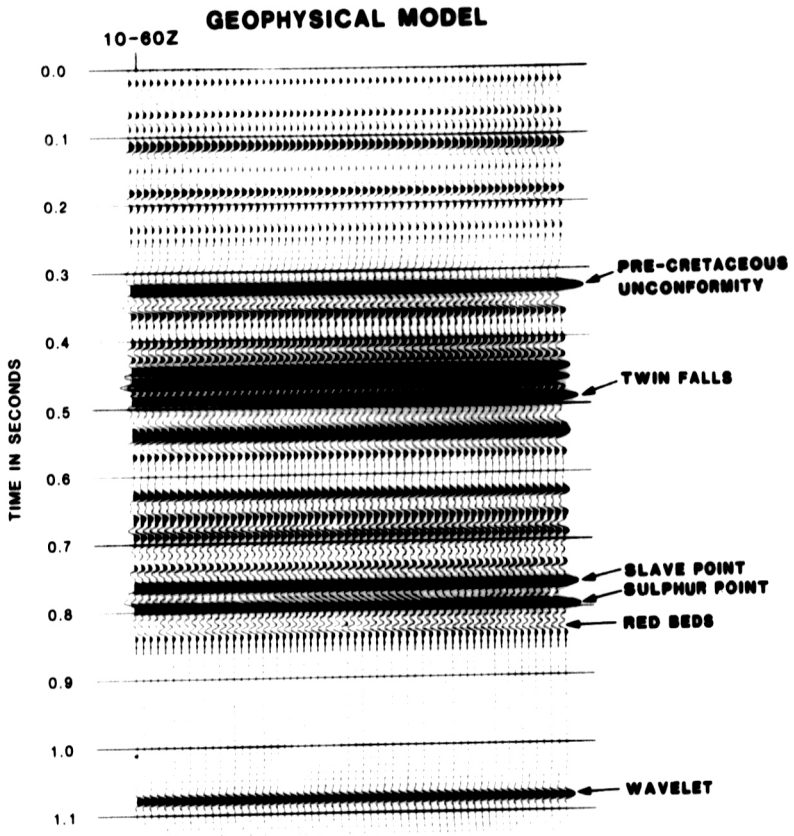
3.3.1 Seismic Data

Seismic data quality is poor to very good in the Cameron Hills survey area. In the hills portion, the data is generally good except for a part of line 8035 that was shot through a ravine. For the plains data, the quality varies depending on surface conditions.

Ten lines from the 1983-1984 Northcor Energy Ltd. Cameron Hills survey were interpreted and included in the mapping.

3.3.2 Seismic Maps

The Cameron Hills project lies within NTS grid 85C. Figure 3.13 is a shot point base map showing the location of the lines.



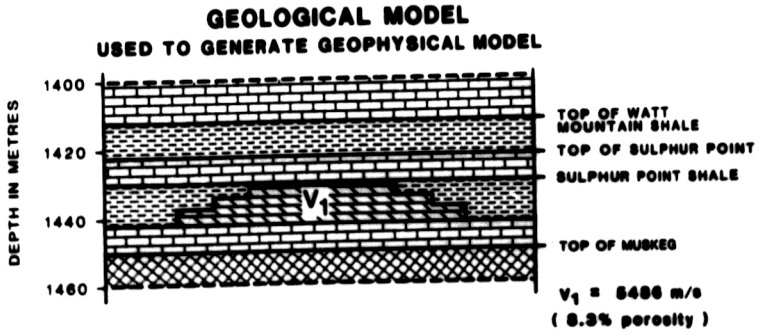


FIGURE 3.12 a
SULPHUR POINT POROSITY MODEL

AUTHOR: C. Boyer FILE: 4617 SF DATE: 88-01-08

The following 1:100,000 interpretive computer contoured maps were produced using the data that has been smoothed using a 5 point smoother.

a) Time Structure
   1) Pre-Cretaceous unconformity (Figure 3.14)
   2) Top of Twin Falls (Figure 3.15)
   3) Top of Slave Point (Figure 3.16)
   4) Top of Basal Red Beds (Figure 3.17)

b) Time Interval
   1) Twin Falls formation - Slave Point formation (Figure 3.18)
   2) Slave Point formation - Basal Red Beds (Figure 3.19)

For the top of Slave Point and top of Basal Red Beds time structure maps, the plains and hills area have different datums and replacement velocities and therefore the contours from one area are independent from the other area.

3.3.3 Gravity Map

A 1:100,000 terrain corrected Bouguer gravity computer contoured map, Figure 3.20, was produced using a 1.0 mgal contour interval and a 1,000 metres grid cell size.

3.4 Discussion of Results

3.4.1 Present Subsurface Morphology

All formations are interpreted to be planar with little relief. The Devonian formations and the basement dip gently to the west-south-west with an average dip of 0.4 degrees. The Pre-Cretaceous unconformity dips to the west-south-west with an average dip of 0.07 degrees. From the time-interval maps (Figures 3.18 and 3.19) there is a thickening of the Twin Falls-Slave Point interval to the east-north-east. There is also a thickening of the Slave Point-Basal Red Beds interval to the east.

3.4.2 Fault Interpretation

There are two types of faults in the area. The first affects only the basement, and usually forms a horst around 1,000 metres wide, Figure 3.21. These create structures on the Slave Point. Notice also the loss of the Basal Red Beds reflector because the Basal Red Beds were not deposited on the highs.

The second type of fault affects the basement to Slave Point formation interval and dies out in the Upper Devonian, Figure 3.22. With the large line spacing (3 km. or more) it is difficult to correlate the faults from line to line.

3.4.3 Keg River Anomalies

There are several Keg River Anomalies which are possible reefs, Figures 3.23 and 3.24. These features show on seismic because the salt solution creates structural draping of the Slave Point formation. The reefs therefore show as a thick on the Slave Point-Basal Red Beds time-interval map (Figure 3.19), as a thin on the Twin Falls-Slave Point time-interval map (Figure 3.18), or as a thin between an Upper Devonian bed and the Slave Point (Figure 3.23). Another condition for reef identification is a continuous Basal Red Beds reflector, indicating that the reef is not a basement high.

Another Keg River anomaly can be observed on Figure 3.25. Notice a similarity between this anomaly and the Keg River porosity model, Figure 3.11. This anomaly could be porosity on the bank. It could also be a reef encased in anhydrite, and therefore there would be no draping because no solution of the anhydrite occurred.

3.4.4 Other Prospects

Another anomaly is shown in Figure 3.26. Note the loss of the Sulphur Point reflector, probably due to the absence of the Watt Mountain shales. This anomaly could be caused by a carbonate build-up in the Keg River or Sulphur Point or else a Pre-Cambrian high. There is also a loss of amplitude in the Slave Point reflector associated with this anomaly.

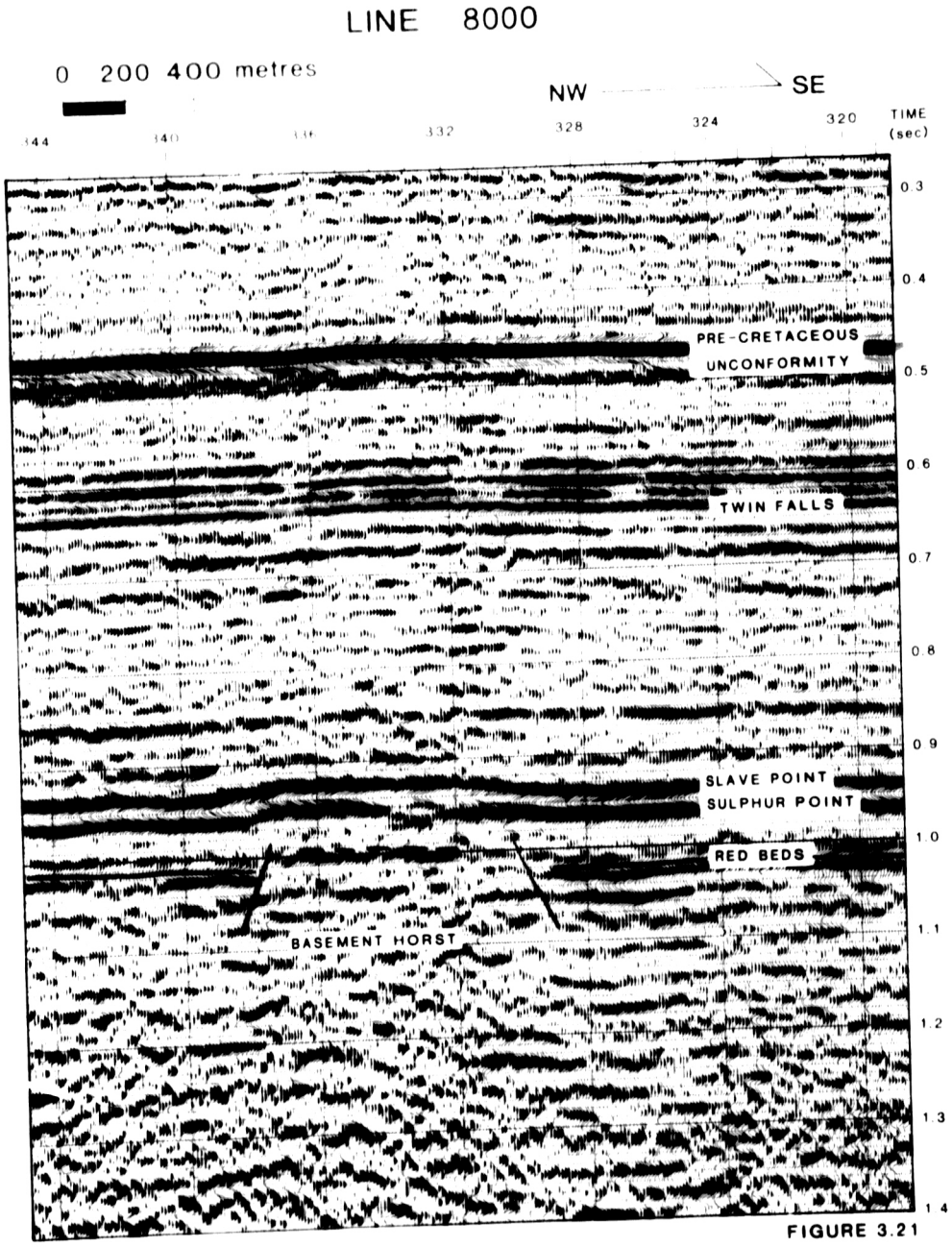


FIGURE 3.21

LINE 8000

SHOWING A HORST STRUCTURE ON THE BASEMENT

LINE 8007

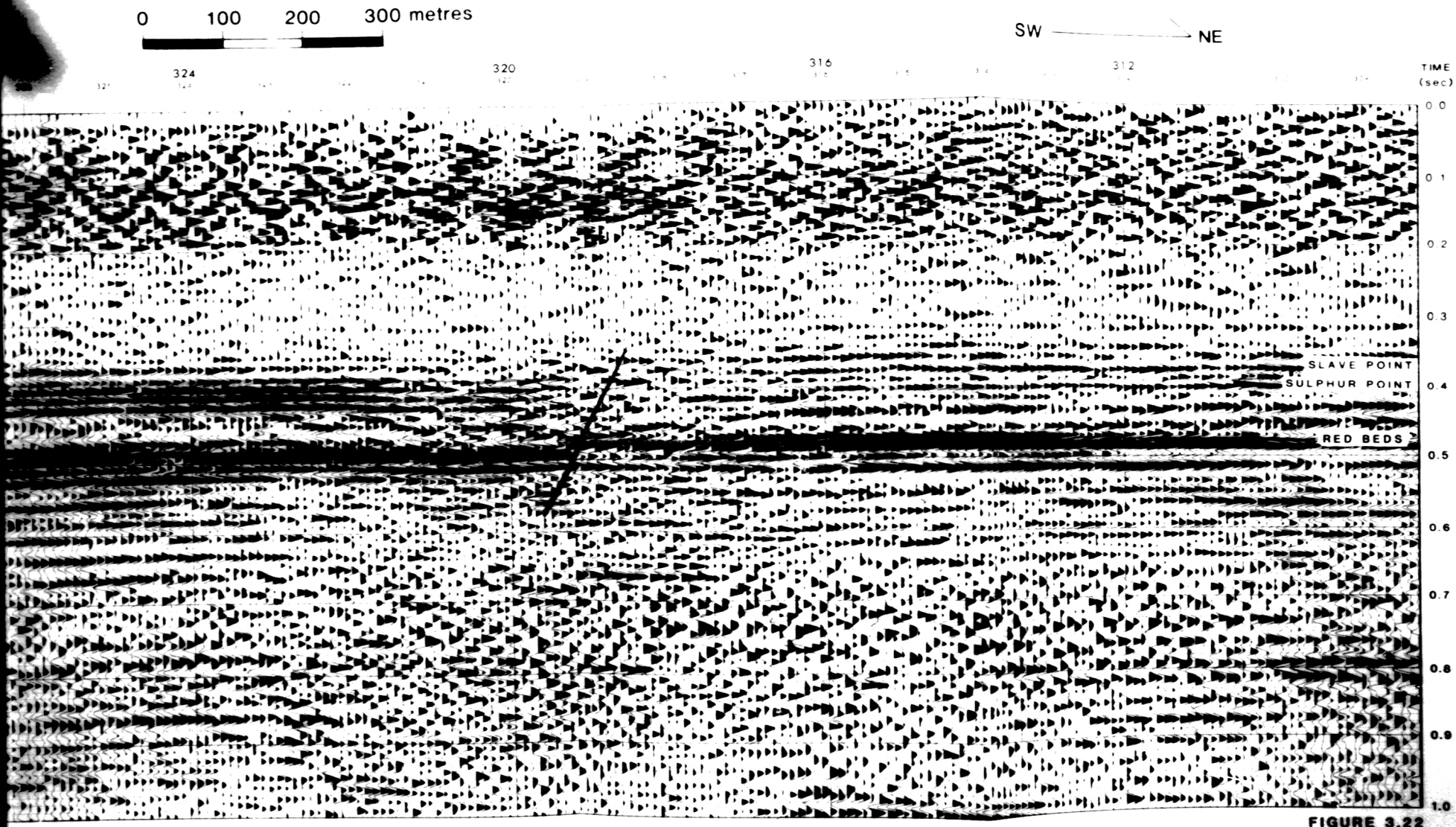


FIGURE 3.22

LINE 8007
SHOWING A FAULT AFFECTING
THE BASEMENT AND MIDDLE DEVONIAN

LINE 8011

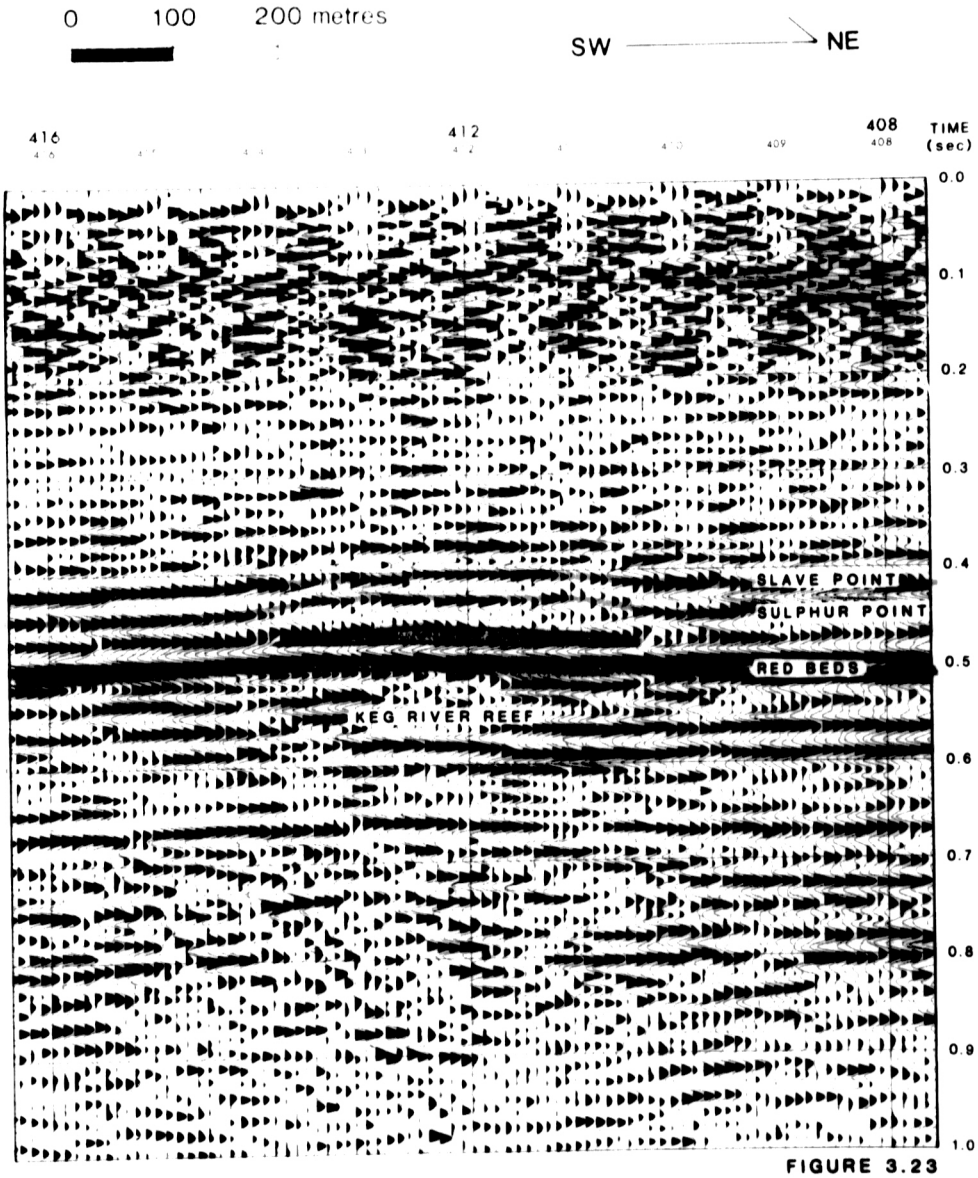


FIGURE 3.23

LINE 8011, SP 412
SHOWING A POSSIBLE KEG RIVER REEF

LINE 8011

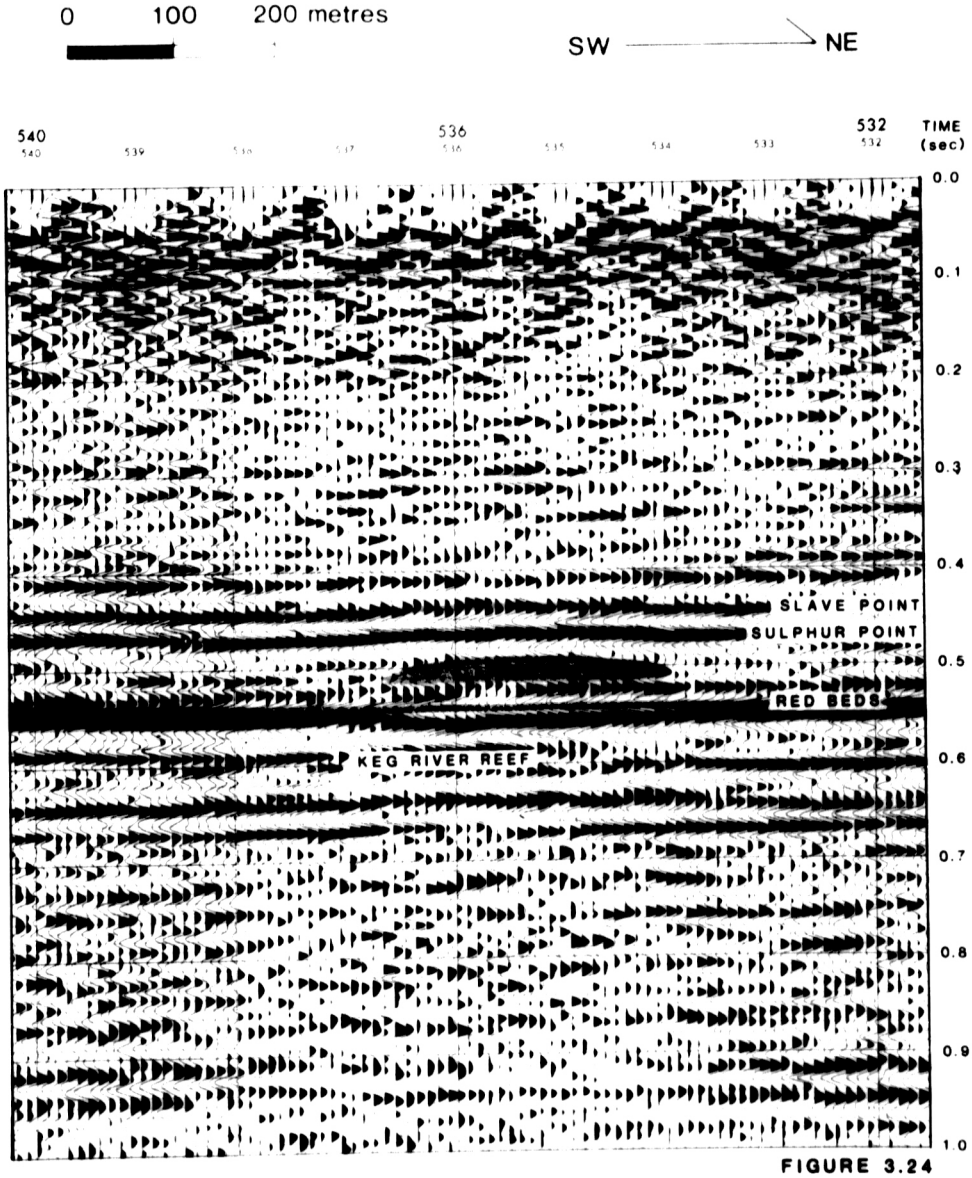


FIGURE 3.24

LINE 8011, SP 535
SHOWING A POSSIBLE KEG RIVER REEF

LINE 8005

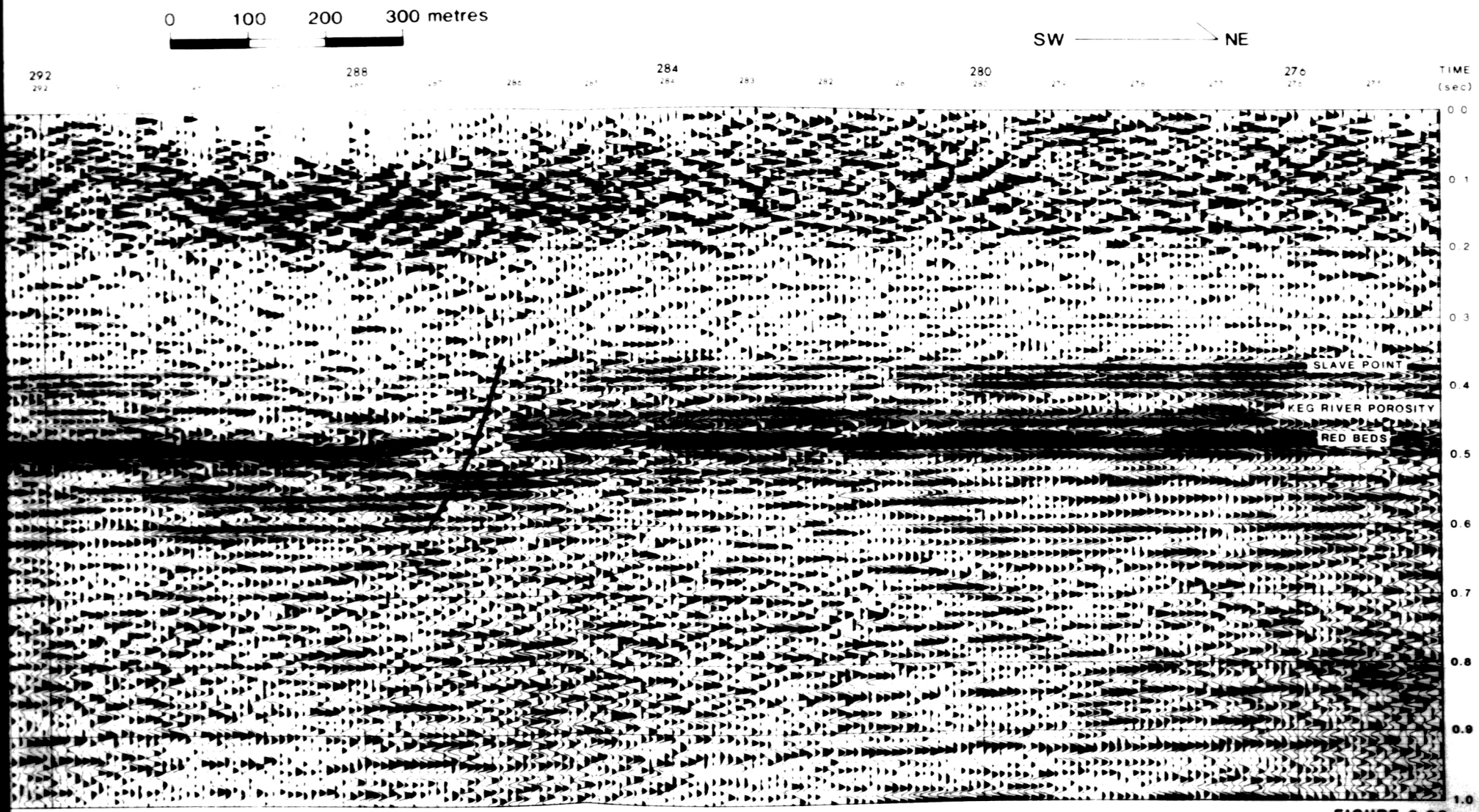


FIGURE 3.25

LINE 8005

SHOWING A KEG RIVER ANOMALY

LINE 8027

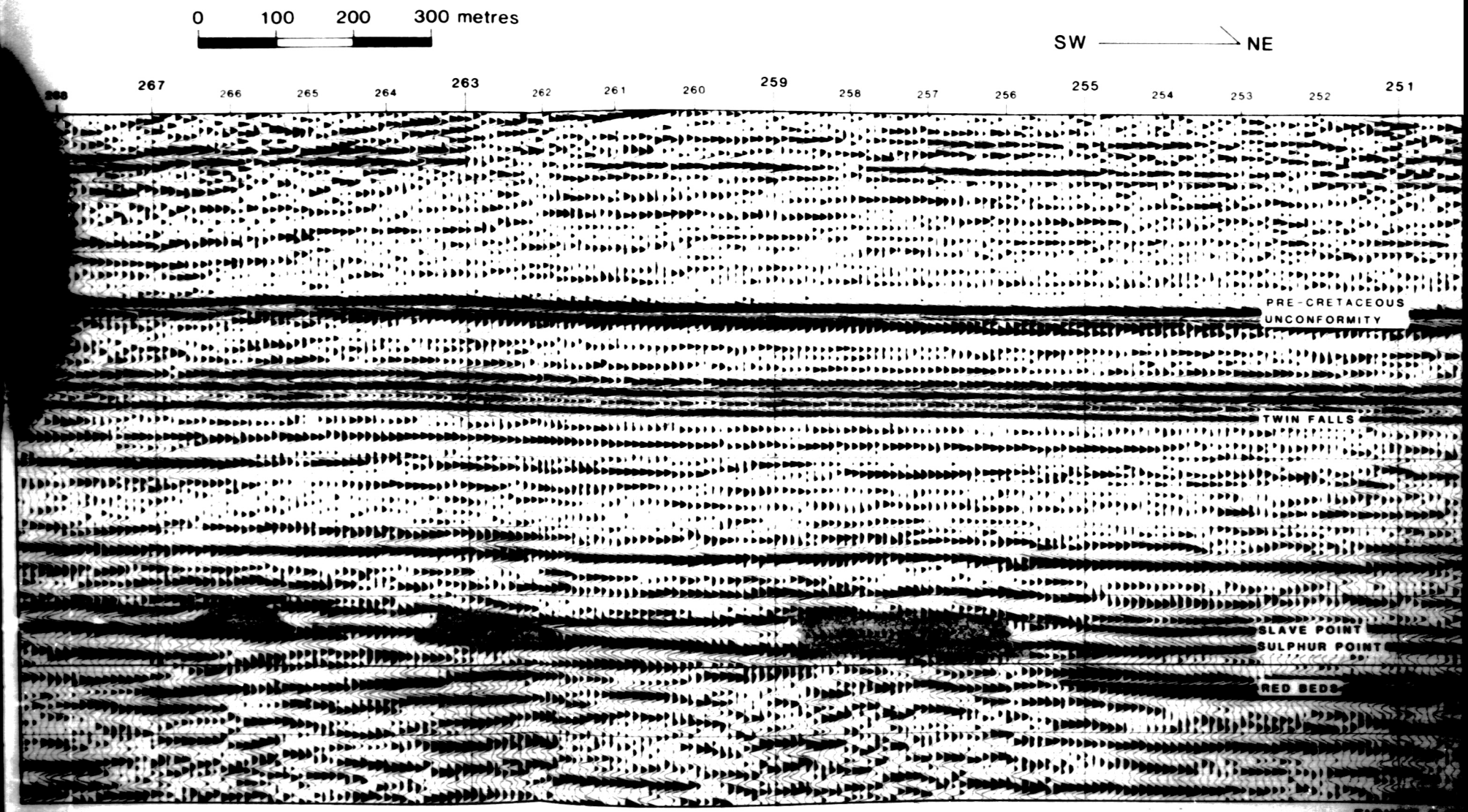


FIGURE 5.

LINE 8027

SHOWING A POSSIBLE CARBONATE BUILD-UP

LINE 8027

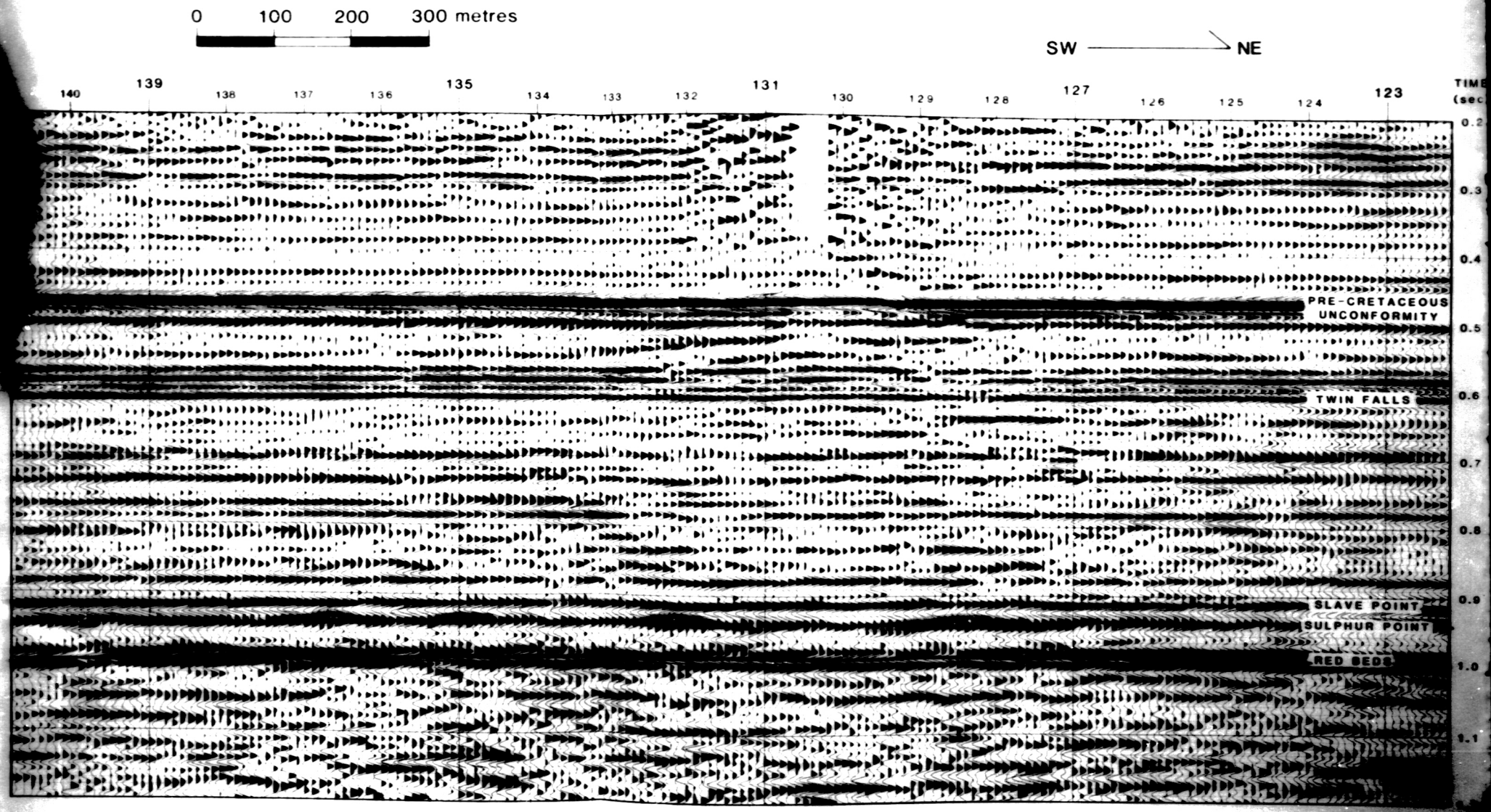


FIGURE 5.27

LINE 8027

SHOWING SULPHUR POINT ANOMALY

In Figure 3.27 there is a change in character in the Slave Point-Sulphur Point interval. This can be compared to the Sulphur Point porosity model, Figure 3.12. This anomaly is caused by a thinning of the "Sulphur Point shale" and/or a thinning of the Watt Mountain shale. The missing shale can then be replaced by porous Sulphur Point dolomite, and the shale would act as a trap.

3.4.5 Gravity

On the computer contoured Bouguer map (Figure 3.20), there is a regional trend with lower gravity values to the west. This trend corresponds to the west-south-west dip of the basement seen on the Basal Red Beds time-structure map (Figure 3.17). The residual gravity on this map (highs and lows) does not correspond to any structure in the Slave Point or basement. It could be caused by lithologic changes in the Pre-Cambrian or strike-slip faulting in the Pre-Cambrian. Also notice that there is no indication of faults on the gravity.