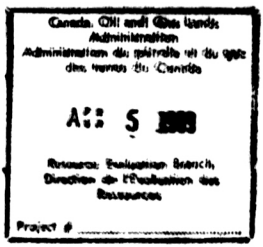
1988 3-D LAND SEISMIC SURVEY

FORT GOOD HOPE AREA

9229-M3-1E

PROJECT NO.:	N88B905
YEAR OF FIELD WORK:	1988
PROGRAM OPERATOR:	Mobil Oil Canada
PRIME CONTRACTOR:	Western Geophysical Ltd.
REPORT PREPARED BY:	S. G. Langton
REPORT DATE:	March 29, 1989
PROFESSIONAL GEOLOGIST:	Jan Nowicki



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PROJECT ACTION SHEET

RESOURCE EVALUATION BRANCH

PROJECT NUMBER: 9229-M3-1E

COMPANY: MOBIL OIL LTD

REPORT TITLE: 3D SEISMIC SURVEY FORT GOOD HOPE

The following action has been taken:

Receipt acknowledged: _____

Reports and maps date-stamped: APRIL 5/89

Reports for review list edited: ✓

Inventory sheet made: ✓

Mylar: YES

REVIEW AND APPROVAL MADE BY: L. Richards Oct/90
L. Richards Oct 27/89

****RETURN APPROVED REPORTS TO MIKE McLINTON******

COMMENTS: Material to request. ① ALL 3D seismic inline data ② All 3D Crossline data ③ Landmark generated maps on the Kee Scarp, Hume and Arnica formations.

PROGRAM NUMBER 9229-M3-1E AREA FORT GOOD HOPE

YEAR 1988 E.A. _____

FILED UNDER: SAME

REPORTS

OPERATIONS REPORT: NUMBER 2

- 1988 3-D LAND SEISMIC REPORT
- SUMMARY OF LOCAL EMPLOYMENT AND EXPENDITURES

INTERPRETATION REPORT: NUMBER _____

MAPS

SHOTPOINT MAPS NUMBER 3

- LINE LOCATION
- AREA of PROPOSED 3-D SEISMIC PROGRAM
- 1988 PROPOSED 3-D SEISMIC PROGRAM

INTERPRETATION NUMBER _____

OTHER NUMBER _____

- FOLD FOR 3-D SURVEY

SECTIONS NUMBER 6

3-D MIGRATED STACK

LINES 120-120

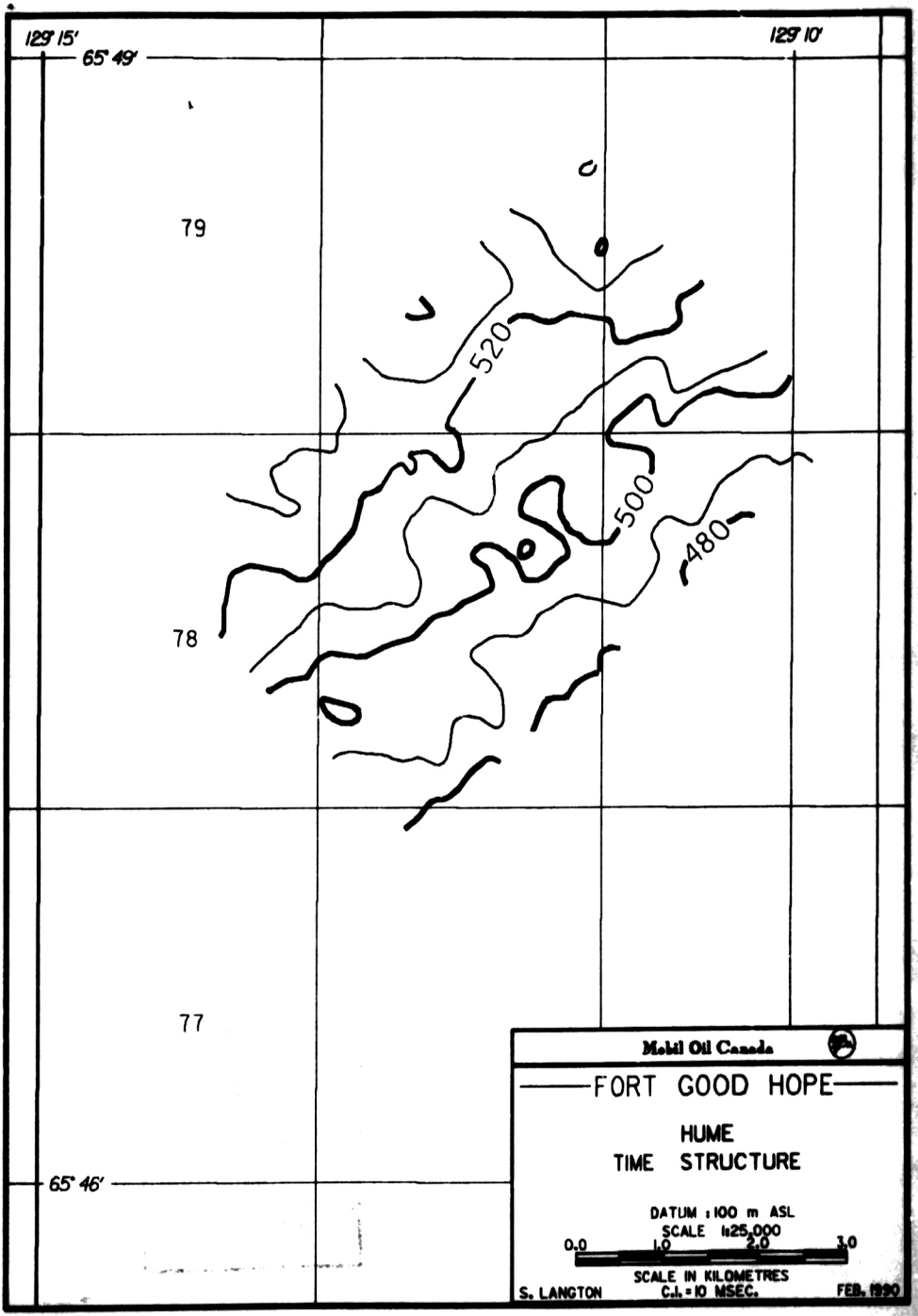
[redacted]

3-122

[redacted]

AS REQUESTED

SE/NW 1-124 (1-31)
(32-62)
(63-93)
(94-124)



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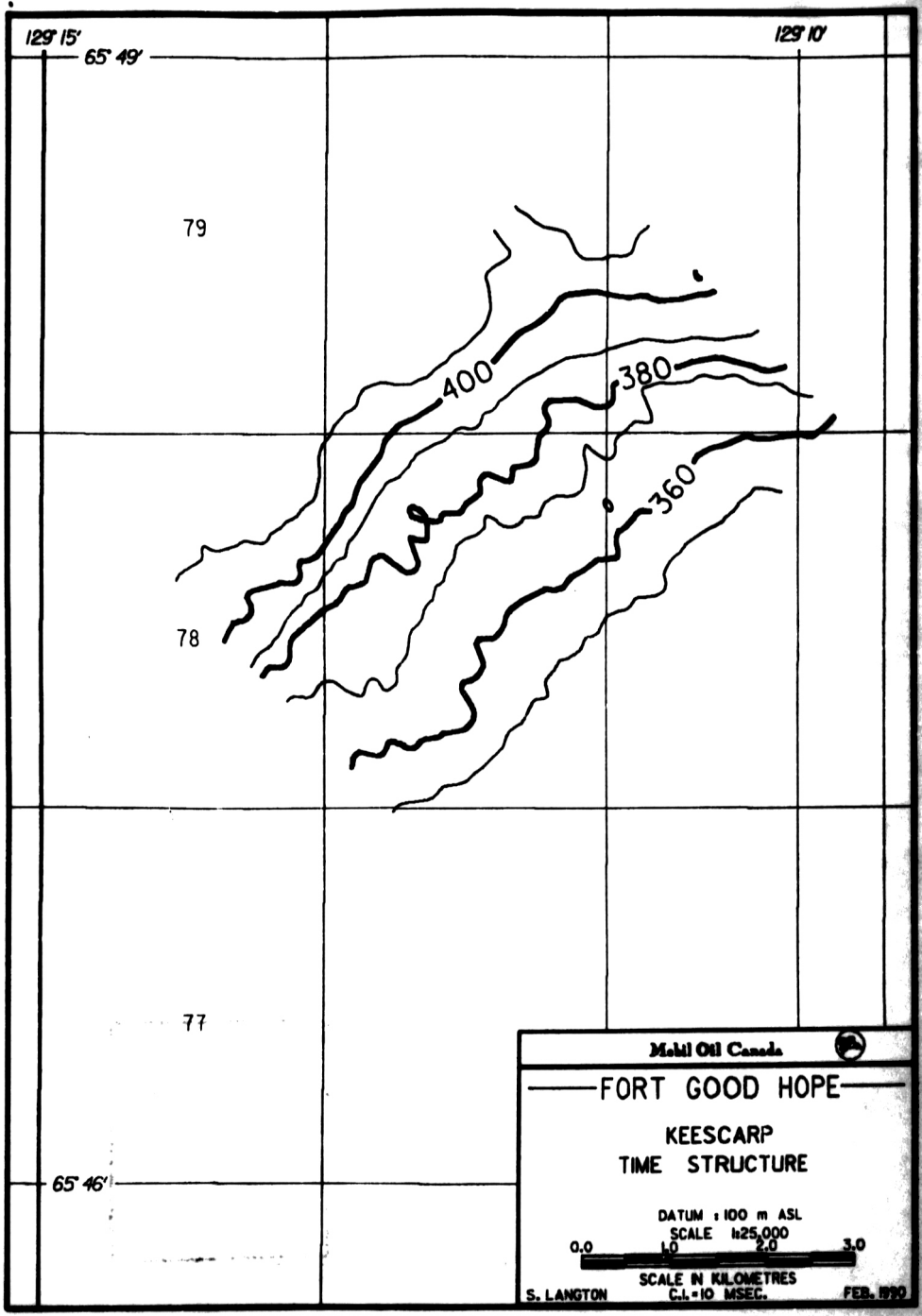
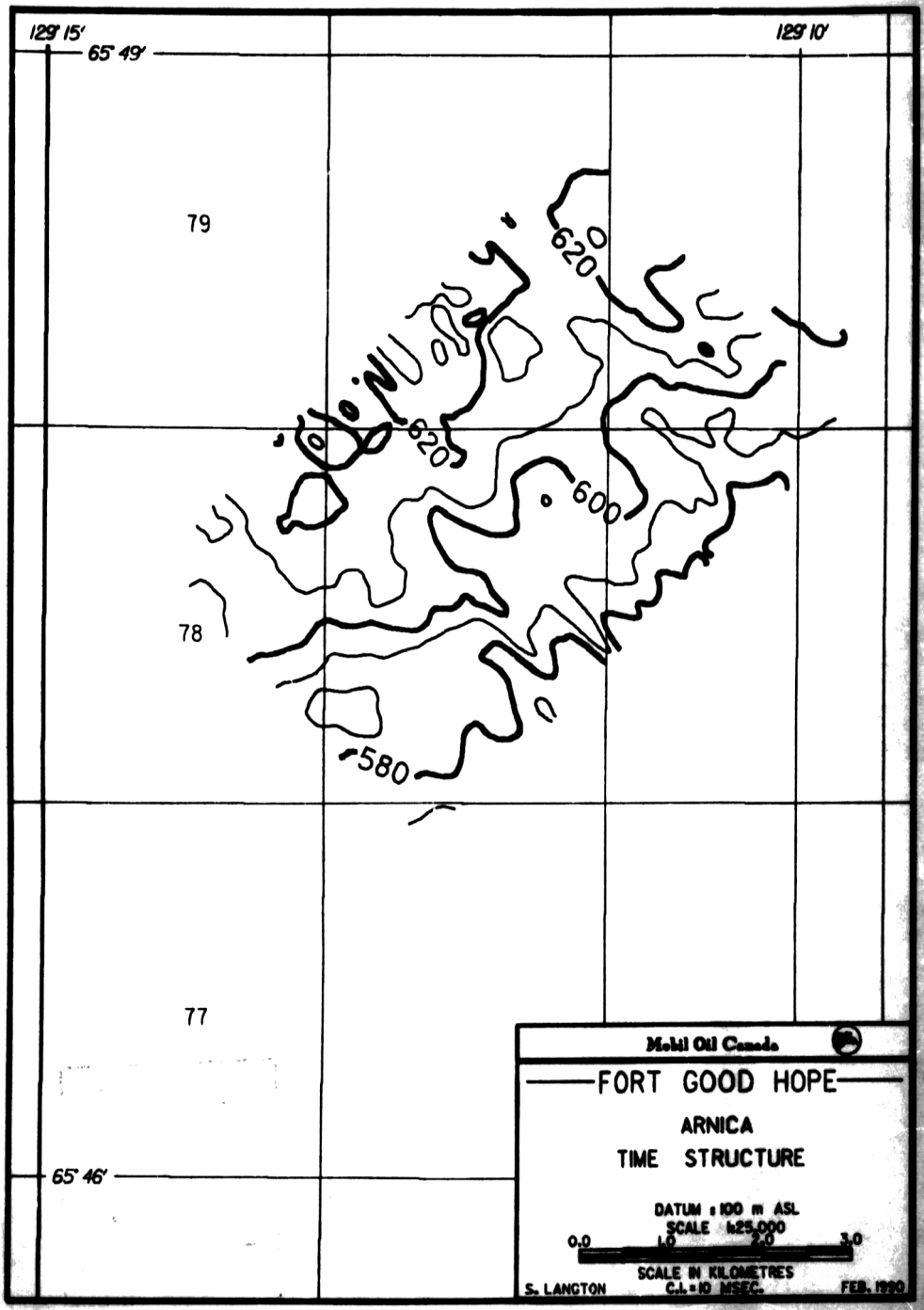
9220-M3-1E


129° 15'
65° 49'
129° 10'
79
78
77
400
380
360
65° 46'
Mobil Oil Canada
FORT GOOD HOPE
KEESCARP
TIME STRUCTURE
DATUM : 100 m ASL
SCALE 1:25,000
0.0
1.0
2.0
3.0
SCALE IN KILOMETRES
C.I. = 10 MSEC.
S. LANGTON
FEB. 1980

9229-M3-1E


129° 15'
65° 49'
129° 10'
79
78
77
620
620
600
580
65° 46'
Mobil Oil Canada
FORT GOOD HOPE
ARNICA
TIME STRUCTURE
DATUM = 100 m ASL
SCALE 1:25,000
0.0
1.0
2.0
3.0
SCALE IN KILOMETRES
C.I. = 10 MSEC.
S. LANGTON
FEB. 1990

9229-M3-1E

FIGURES

1. Generalized Stratigraphy, Mackenzie R., N.W.T.
2. Arnica Reef Model

ENCLOSURES

1. 3-D Seismic Lines
   i) Lines 10 to 120; CDP's 3 to 81
   ii) Cross lines CDP's 10 to 80; Lines 3 to 122
2. Program Area Map
3. Program Map
4. Shot Receiver Diagram
5. Fold Diagram
6. Summary of Local Employment and Expenditures

LAND 3-D SURVEY

FORT GOOD HOPE AREA

This report outlines the 1988 3-D seismic acquisition and processing completed by Mobil Oil Canada on Crown land near Fort Good Hope, N.W.T.

The program consists of a rectangular survey positioned at approximately 45 degrees with respect to north with dimensions of 2.0 km in the northwest-southeast direction and 3.0 km in the southwest-northeast direction. The processed survey consists of 111 lines in the northwest-southeast direction and 79 tie lines in the southwest-northeast direction.

The data was processed up to stack at Western Geophysical and then post stack migrated at G.S.I.

Interpretation and mapping of the data was on a Landmark work station.

GEOLOGICAL SETTING

The Lower Devonian sedimentation in the Fort Good Hope region represents deposition in a stable intracratonic basinal setting, bounded to the west by a deep, narrow shale basin (Richardson Trough) and to the east by crystalline rocks of the Canadian Shield. The sediments are dominantly carbonate, with less than 10% shale. The section rests with low angular unconformity on Silurian aged dolomites in the central and eastern parts of the study region.

Figure 1 shows the generalized stratigraphy in the area.

The Arnica Formation comformably overlies and is contemporaneous with the earlier Fort Norman Formation (shallow subtidal to supratidal dolomite mudstones and anhydrites). The Arnica is primarily algal-laminated dolomite mudstone grading to the top of the formation to black bituminous shales. Carbonates in the Arnica Formation contain intercrystalline, vuggy, and fracture porosity, ranging from six to twelve percent. The depositional setting is proposed to be shallow inter-tidal to supratidal. The Arnica is overlain conformably and interfingers with the Landry Formation. The Landry is predominantly a shaley, laminated, pelleted mudstone with occasional interbeds of black to brown bituminous shale. The depositional setting of the Landry is believed to be shallow sub-tidal waters which fluctuated between aerated and slightly euxinic conditions. The Landry Formation is proposed as the source rock for the Arnica anomalies described below. The basinal shales and tight limestones of the Hume Formation overlie the Landry and Arnica Formations.

A postulated model for the formation of the Arnica anomalies (as reefal bodies) is shown in Figure 2. In the study area, it is believed that subaerial exposure at the top of the Arnica Formation produced patchy, localized areas of brecciation of the dolomite. The degree of brecciation could have produced subtle topographic highs and lows. Rapid subsidence of the platform would have flooded a large area and initiated the formation of crinoidal banks upon the highs near wave base. Continued subsidence and the colonization of the banks by stromatoporoids, coals, and algae would have caused coalescing and stabilization of these proto-reefs and permitted rapid continued reef growth. With the deepening of the water column, the absence of clastics and limited circulation of fresh sea water (caused partially by the presence of the reefs), a stratified water column would have developed. This stratification would produce euxinic conditions at depth with more aerated, normal marine conditions at the surface. In the inter-reef areas and bathymetric lows, black bituminous shales were deposited and are found in the area separating the Arnica Formation from the overlying Landry Formation. A decrease in regional subsidence may have followed, with periods of non-deposition and resumed growth of the reefs resulting in hardground formation and the deposition of the pelleted inter-reef limestones of the Landry Formation.

Several phases of exposure/dolomitization may have followed with the possibility of the final stage of reef growth being incompletely covered by the tight Landry Formation limestones. Renewed regional subsidence resulted in open marine conditions and an influx of clastic material from the northwest. This period of deposition/subsidence corresponds with the final burial of the Arnica reefs by shales and open marine platformal limestones of the Hume Formation.

GENERALIZED STRATIGRAPHY, MACKENZIE R., NWT

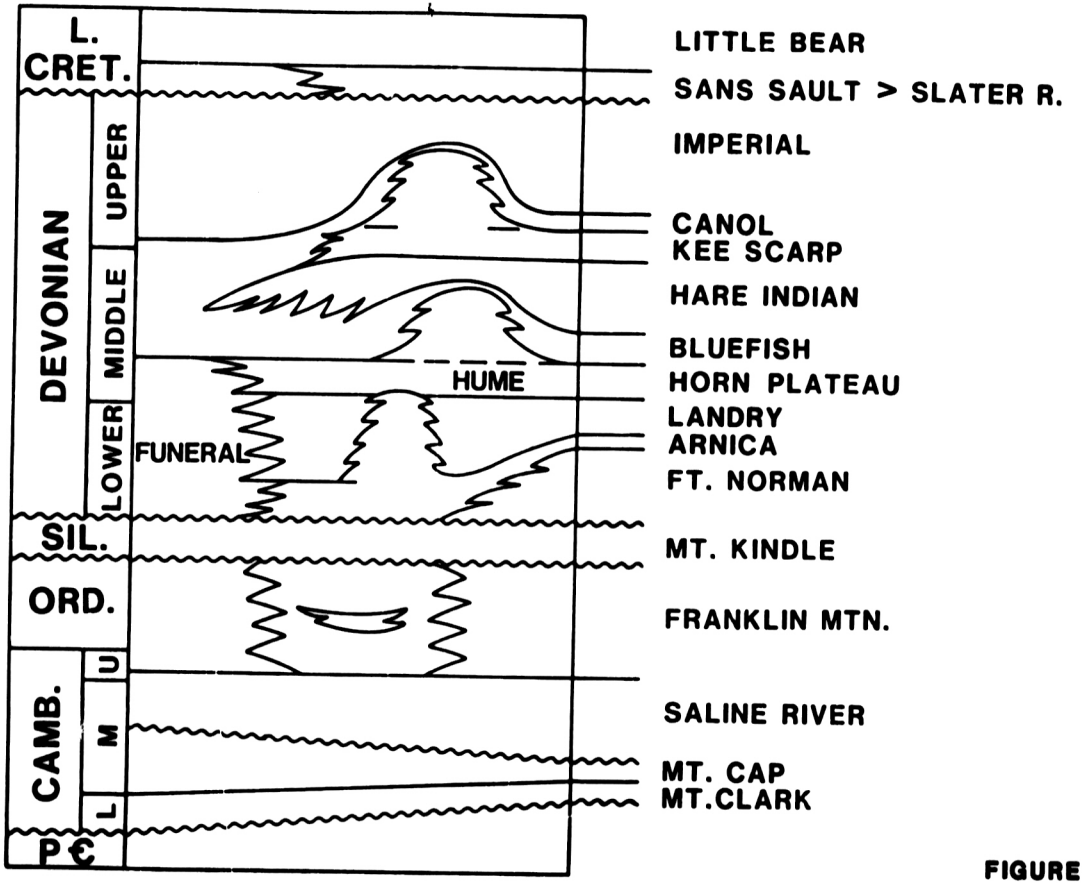


FIGURE 1

Several phases of exposure/dolomitization may have followed with the possibility of the final stage of reef growth being incompletely covered by the tight Landry Formation limestones. Renewed regional subsidence resulted in open marine conditions and an influx of clastic material from the northwest. This period of deposition/subsidence corresponds with the final burial of the Arnica reefs by shales and open marine platformal limestones of the Hume Formation.

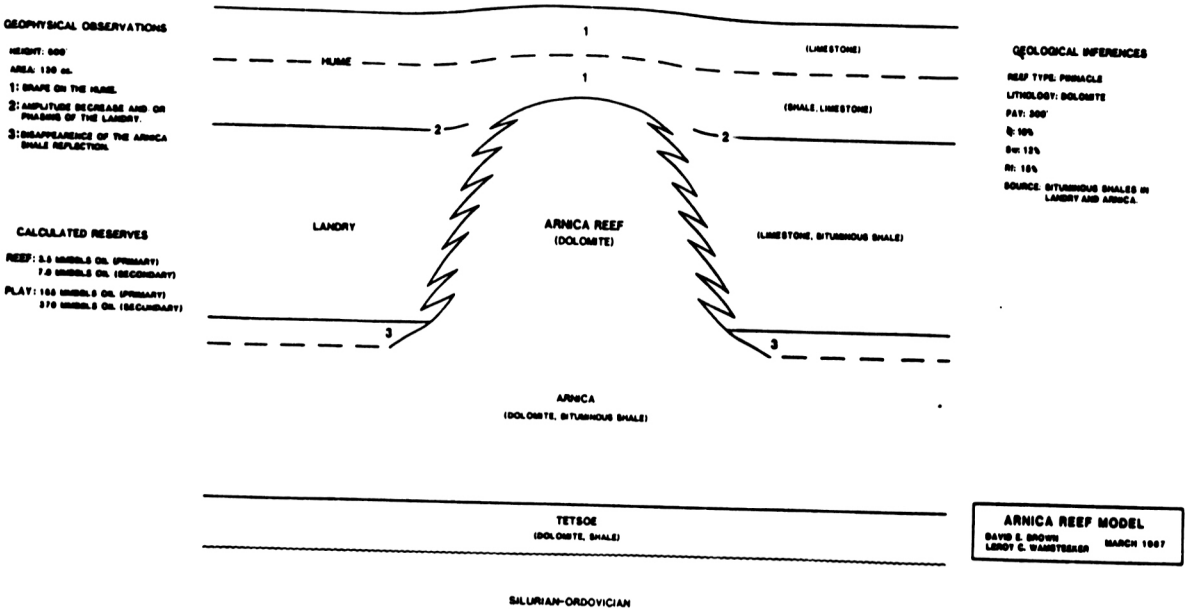

GEOPHYSICAL OBSERVATIONS
HEIGHT: 600'
AREA: 130 ac.
1: SHAPE ON THE HUME.
2: AMPLITUDE DECREASE AND OR PHASING OF THE LANDRY.
3: DISAPPEARANCE OF THE ARNICA SHALE REFLECTION.
CALCULATED RESERVES
REEF: 3.5 MMBBLS OIL (PRIMARY)
7.0 MMBBLS OIL (SECONDARY)
PLAY: 155 MMBBLS OIL (PRIMARY)
370 MMBBLS OIL (SECONDARY)
HUME
(LIMESTONE)
1
1
(SHALE, LIMESTONE)
2
2
LANDRY
ARNICA REEF
(DOLOMITE)
(LIMESTONE, BITUMINOUS SHALE)
3
3
ARNICA
(DOLOMITE, BITUMINOUS SHALE)
TETSOE
(DOLOMITE, SHALE)
SILURIAN-ORDOVICIAN
GEOLOGICAL INFERENCES
REEF TYPE: PINNACLE
LITHOLOGY: DOLOMITE
PAY: 300'
Φ: 10%
Sw: 12%
Rf: 15%
SOURCE: BITUMINOUS SHALES in LANDRY AND ARNICA
ARNICA REEF MODEL
DAVID E. BROWN
LEROY C. WAMSTEKER
MARCH 1987

FIGURE 2

SEISMIC PROGRAM

The interest in the Fort Good Hope area was based on the interpretation of available regional seismic data which showed a number of seismic anomalies in the Lower Devonian section. The anomalies were all on single lines. The quality of the data was relatively poor, with no direct line ties over anomalies, consequently no direct inference could be made regarding the nature of the geology. Up to four criterion were observed on each of the anomalies:

1. Drape on the Middle Devonian Hume Formation.

2. Decrease in wavelet amplitude and change in phase on seismic reflection at top of Landry.

3. Isochron thin between Kee Scarp and Hume reflections.

4. Amplitude decrease/data cutout at Arnica shale.

On the basis of these anomalies and the geological setting, the proposal was made that reef development could have occurred at the Arnica time.

One of the anomalies occurred on line 85-7A which had all four of the above criterion, was located on crown land, and was of sufficient size to be a viable exploration target. The 3-D seismic program was laid out to cover this anomaly to determine the nature and size of the prospect.

The interpretation of the data determined that the amplitude and phase effects observed on the 2-D data (line 85-7A) at the Arnica reflection (anomaly characteristics 2 and 4 above) were a function of resolution of the seismic data. The structural effects (anomaly characteristics 1 and 3) were due to what has been interpreted to be a thrust fault and antithetical faults which occurred immediately preceding the deposition of the Hume Formation.

The size of the 3-D survey being small compared to the size of the thrust sheet, the location of the principal fault is difficult to determine, but the antithetical faults are well defined.

The interpretation on the Landmark work station included mapping on the Kee Scarp, Hume and Arnica formations. The Kee Scarp has regional structure with dip to the northwest due to the Laramide Orogeny effects. The Kee Scarp overlies a late Devonian unconformity observable on the seismic data. The Hume horizon is unfaulted with drape over the fault zones of the Arnica and Landry Formations. The zone between the Hume and Upper Devonian unconformity and Kee Scarp horizons has none of this drape indicating the timing of the thrust faulting would have been mid-Devonian (pre Hume).

The original anomaly observed on the 2-D line when mapped from the 3-D data was made up of several individual structures over the data area. The anomaly on the 2-D line was thus largely made up of information from out of the plane of the section. The consequence of the new mapping was that the size of a single prospect was insufficient for significant reserves. This, combined with the lack of reefal development, made the prospect unattractive for further work.

STATISTICAL SUMMARY

Mobilization Date:	March 17, 1988
Demobilization Date:	April 5, 1988
Start of Recording:	March 29, 1988
Finish Recording:	April 5, 1988
Number of Days Recording:	8
Number of Vibration Points:	840
Number of Receiver Points:	656

Surveying and Control Information:

The elevations and coordinates for the 3-D survey were derived form 4 G.P.S. (Global Positioning System) monuments established by Star Tech Systems in March of 1988. Each G.P. station is marked with an iron bar and marker post, for future relocation.

The surveying of all source and received lines within the 3-D seismic area was by conventional methods. All lines were first chained and then surveyed using an E.D.M. (Electronic Distance Measurement).

The accuracy of the G.P.S. control was +/- 1 metre horizontally and +\- 30 cm vertically.

The accuracy of the seismic survey was +\- 1 metre horizontally and +\- 50 cm vertically.

SEISMIC ACQUISITION AND PROCESSING

Source:

Energy Source:	Vibroseis
Drag Length:	29.7 m
Sweep Frequency:	8 to 100 non-linear
Sweep Length:	10 sec.
Number of Sweeps:	12
Number of Vibrators:	4
Vibrator Layout:	Inline

Instruments:

Model:	DFS-V 120 channels
Field Filter:	out/128 72dB/octave
Sampling Interval:	2 msec.
Record Length:	10 sec.
Tape Format:	SEG-B
Tape Density:	6250 BPI

Receivers:

Geophones:	Litton LRS 1011
Geophone Frequency:	14 Hz.
Geophone Damping:	70%
Geophones per Array:	18 over 58.8 m
Group Interval:	50 m
Average Coverage:	800%
Pattern:	4 lines of 30 receivers

Processing (to stack at Western Geophysical):

Demultiplex:	2 msec. sampling to 10.0 sec.
Correlation:	3.0 record
Gain Recovery:	Exponential C = 2.25
Deconvolution:	Minimum phase spiking 80 msec. operator .1% white noise
Geophone/Instrument Phase Compensation:	Operator length 158 msec.
Cell Sort:	Uniform 25m x 25m cell
Statics:	GEN-3 Refraction modelling 150 m asl datum Replacement vel. 2100 m/sec. Weathering vel. 610 m/sec.
Auto-statics:	Type - 3D Miser (Western Geophysical) NMO with single vel. function. Automatic surface consistent Gate 200 to 1200 msec. Maximum shift + or - 24 msec.

3-D Velocity Analysis:

Type - VELAN (Western Geophysical)
Interpolated Semblance

Velocity Verification:

Common offset stacks with NMO and statics applied.

Auto-statics:

Type - 3D Miser (Western Geophysical)
NMO with 3-D velocity
Automatic surface consistent
Gate 300 to 1200 msec.
Maximum shift + or - 8 msec.

DMO:

Maximum dip: 25 degrees

Mute:

After DMO

Distance (m)	Time (msec)
220	0
225	200
375	240
600	450
1500	900

DMO Stack:

Equal weight
Average Fold: 1200%
Dip limit: 25 degrees
Aperature: 17 traces

Processing (Post Stack at G.S.I):

Migration:

Kirchoff - FK domain
Dip controlled

Filter:

12/18 85/100 Hz.

Scaling:

1000 msec gate
Start time 300 msec.

Display:

Normal Polarity
Horizontal Scale: 400 m/in.
Vertical Scale: 7.5 in./sec.