PENOBSCOT PROSPECT:

GEOLOGICAL EVALUATION

AND OIL RESERVE ESTIMATES

FOR

NOVA SCOTIA RESOURCES (VENTURES) LTD.

BY

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INTRODUCTION

The Penobscot Prospect is a deceptively simple appearing faulted anticline offshore Nova Scotia at 44◦ 10'N Lat., and 60◦04'W Long.; approximately 280 km ESE of Halifax and 25 km NNW of Sable Island (Figure 1).

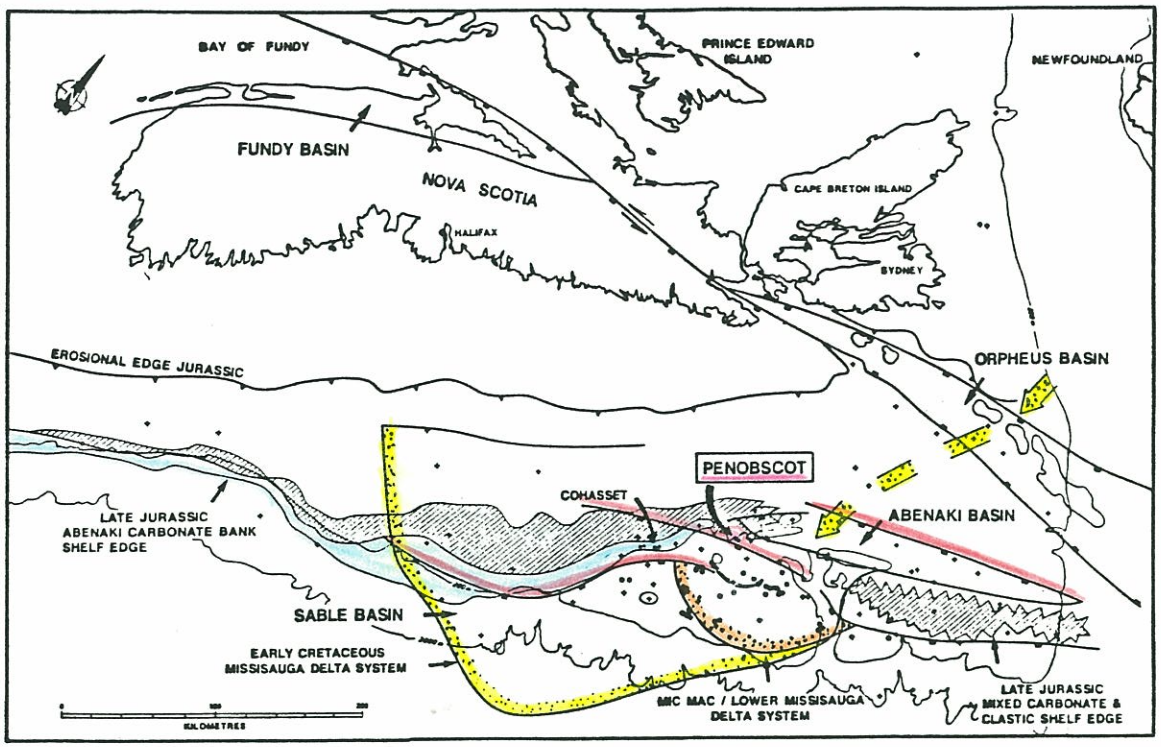
The first test on the prospect, Petro-Can Shell Penobscot L-30, was drilled to 14,000' (-4237.5m) in 451' (137.5m) of water, before being abandoned in September 1976. Total depth was in the Misaine Member of the Abenaki Formation (Figure 1). Petrophysical evidence and RFT tests indicated light oil or condensate and gas in five sands of the Middle Missisauga Formation.

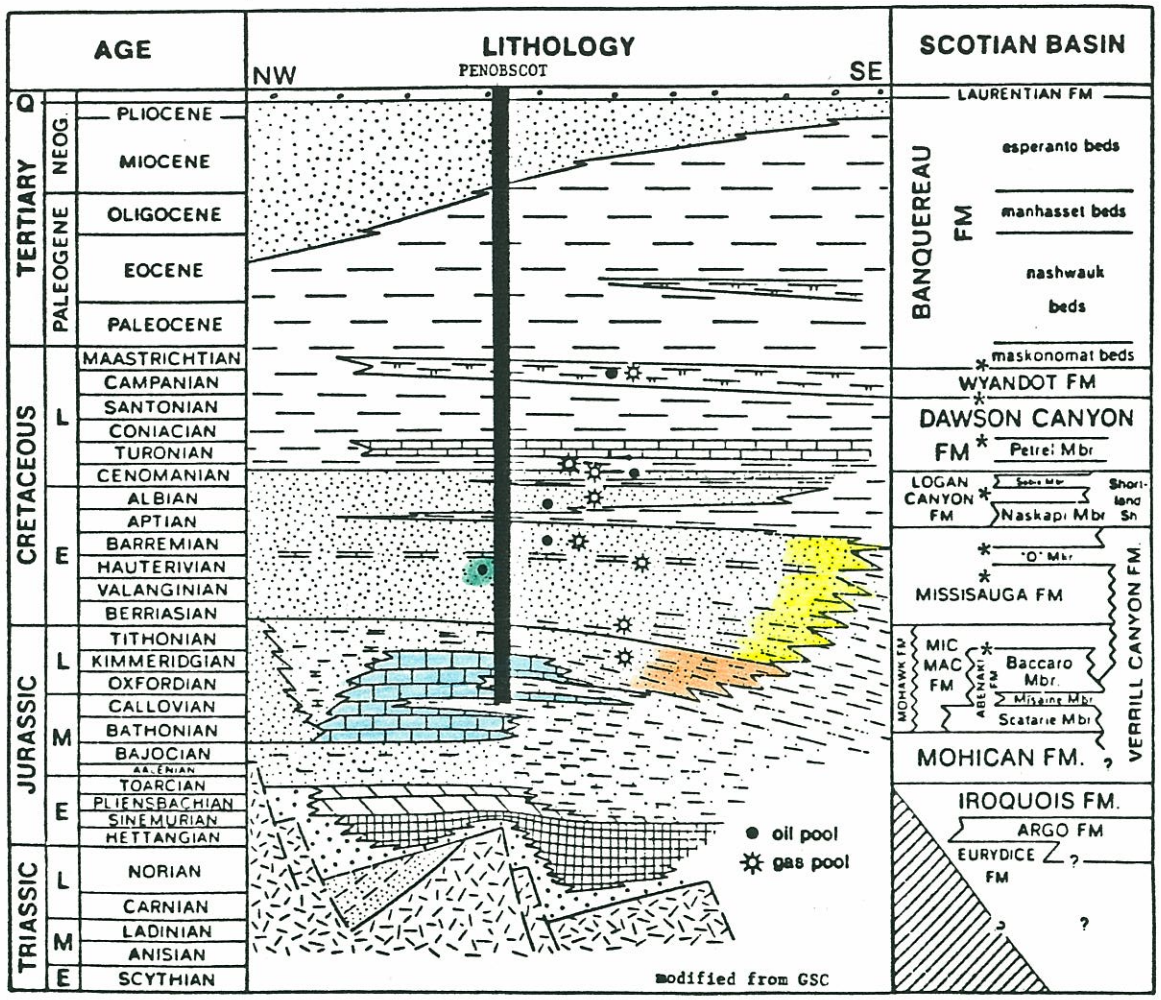
A follow-up well, Shell Petro-Can B-41, was drilled in 1977 to 11,300' (-3414.4m) in 387' (118.0m) of water. It was located on an eastern satellite structure which appeared much higher on seismic than L-30. Stratigraphic tops in B-41 turned out to be within 20m of those in L-30. There were no indications of significant hydrocarbon accumulations, and no tests were run.

The results at B-41 indicated that seismic two-way time does not accurately indicate actual elevation because of facies changes in the Upper Cretaceous Wyandot Chalk. The variations in carbonate thickness were compensated for by using the layer stacking method to calculate elevations from two-way times obtained in a 1991 3-D seismic survey (Crane and Clack, 1992). The depth structure map of the "0" Limestone, 70 to 291m above the reservoir sands in L-30, indicated that the well was located on the southern flank of the structure and that there is potential for significant hydrocarbon reserves at higher elevations.

A time structure map over part of the structure on the lowest reservoir (Sand #5), as well as an Isochron map between the "0" Limestone and Sand #5, indicated that the structure at that level has greater vertical relief above L-30 and is shifted slightly from the "0" structure.

Subsequently, a depth structure map on Sand #5 has been produced over the entire area (enclosure B). This report is based on well data, the original geophysical report, various monthly progress reports, and the new map to evaluate the geologic history and potential reserves at Penobscot.





*Mapped seismic events

Location map, geologic setting and generalized lithology and stratigraphy of Penobscot Prospect

FIGURE 1

PENOBSCOT AND OTHER HYDROCARBON OCCURRENCES ON THE SCOTIAN SHELF

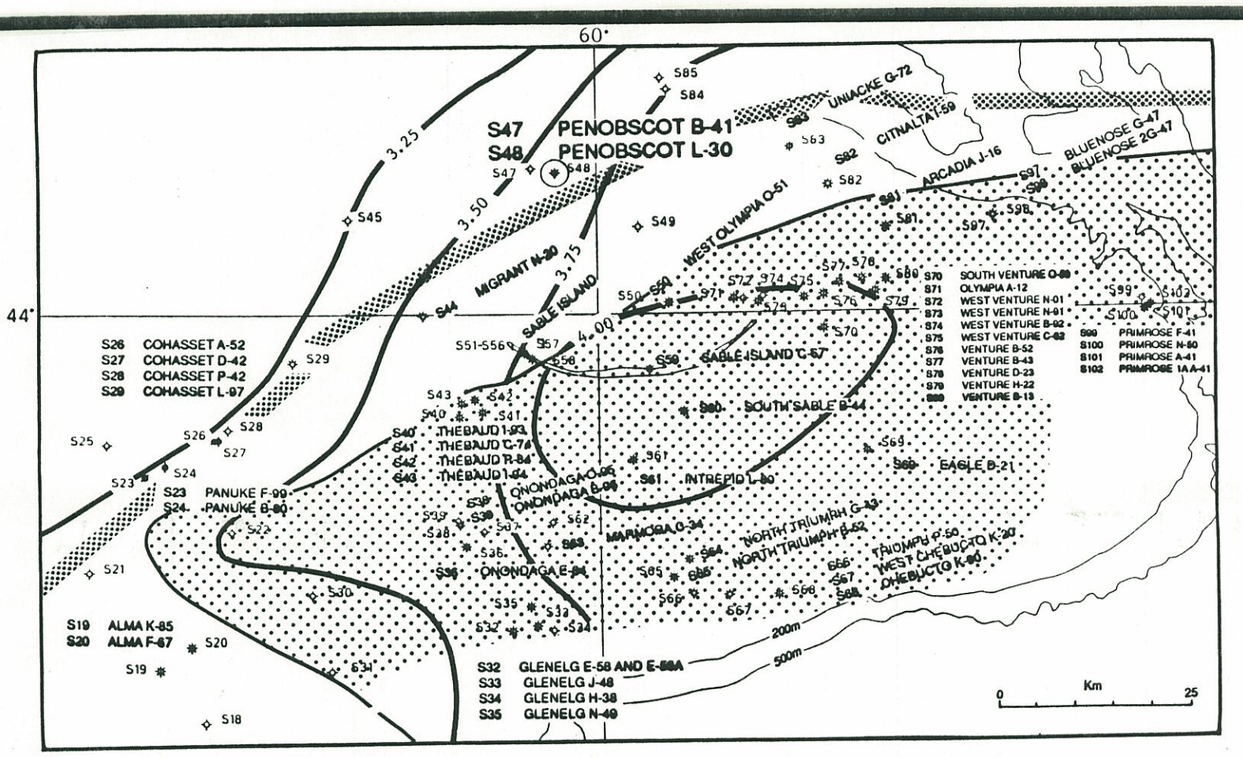
All of the significant hydrocarbon discoveries on the Scotian Shelf have been made in the Sable Subbasin in the vicinity of Sable Island (Figure 2). Penobscot is situated just updip of the area of geopressure, as are the Cohasset and Panuke oil fields; the only producing fields to date. They have oil pooled in sands of the Logan Canyon and Upper Missisauga Formations respectively, while the oil and gas occurrences at Penobscot are near the top of the Middle Missisauga.

The main hydrocarbon generating "kitchen" of the Sable Subbasin lies immediately downdip to the south southeast of Penobscot. The elevation of the Verrill Canyon potential source rock unit at Penobscot L-30 is -3666.7 m, near the top of the oil window. Nantais (1983: reported in Bell and Campbell, 1990) calculated the subsea depths to Ro 0.7% to be 3.63 and 3.48 km at Penobscot B-41 and L-30 respectively.

STRATIGRAPHY

The position of the Penobscot Prospect with respect to the Scotian Basin stratigraphy and major Jurassic/Early Cretaceous facies belts is indicated in Figure 1. Penobscot L-30 and B-41 well log correlations are shown on the Prospect Montage (enclosure A) and the stratigraphic tops are listed in Appendix A.

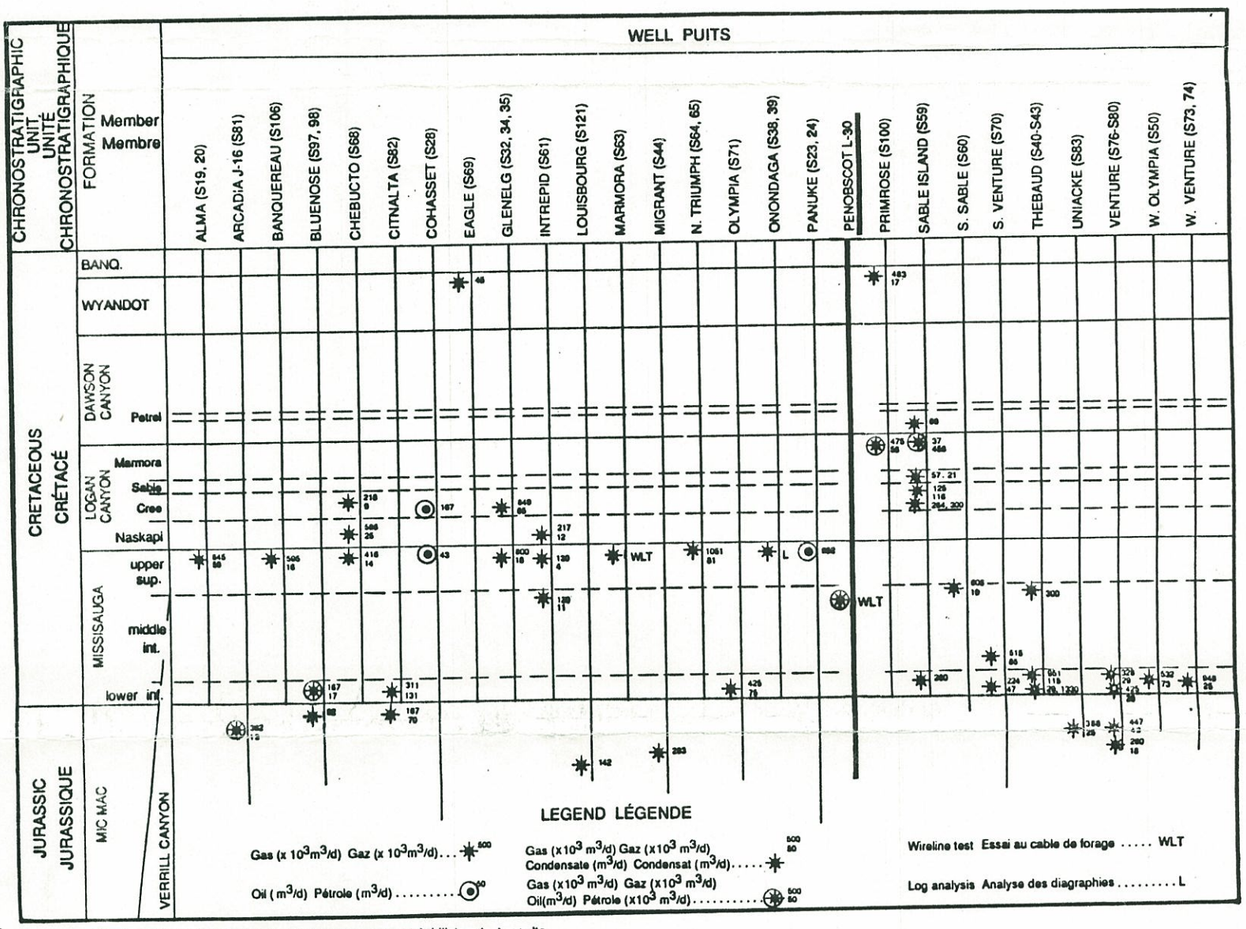
The prospect is at the edge of the Abenaki carbonate shelf, west of a major clastic sediment source. The shelf edge in this area is ramp-like rather than abrupt, as in the Cohasset area, with generally muddy tight limestones, sandstones and shales. L-30 sample descriptions indicate some tubular branching corals, algal fragments and minor oolite in lime wackestones. Clean bioclastic and/or oolitic shoal deposits may have been localized by growth of the Penobscot structure during Abenaki deposition, and by an underlying horst at the western end. These deposits may have preferentially developed porosity updip from L-30 during late faulting and diagenesis and constitute a potential reservoir.



Updip limit of geopressure occurrences

3.75 Subsea depth (km) to calculated Ro 0.7%
(Nantais, 1983: reported in Wade, 1991)

Calculated Ro greater than 0.7% at top of Jurassic
(Nantais,1983 - compares with mature zone
mapped by Powell, 1982; both reported by
Bell and Campbell, 1990)



Stratigraphic position of hydrocarbon occurrences and drillstem test results
Position stratigraphique des gisements d'hydrocarbures et résultats des essais aux tiges

PENOBSCOT PROSPECT
RELATIVE TO OTHER SCOTIAN SHELF
HYDROCARBON OCCURRENCES

WJFC (modified after Wade, 1991)

Figure 2

Potential source rock sequences of the Verrill Canyon Formation and the Misaine Member thicken seaward of the structure, tongues of both units being encountered in L-30 on the southern flank.

The Lower Missisauga/Mic Mac is a sequence of delta front to pro-deltaic sands and shales with some limey stringers. Individual sands cannot be correlated the 3.25 km between L-30 and B-41. Any oil pools in this unit updip from L-30 would have a stratigraphic component and probably not be continuous over the structure.

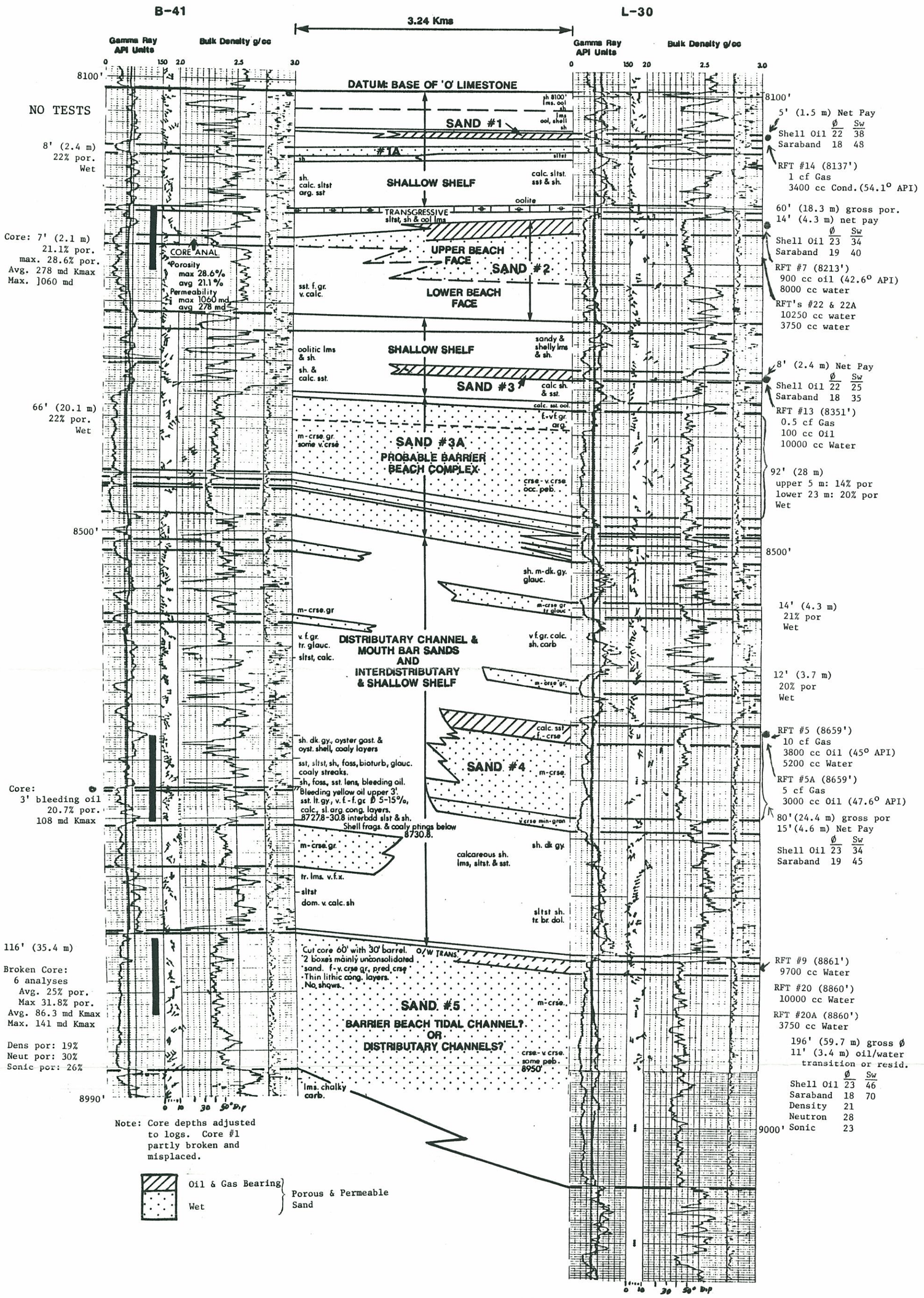
The Middle Missisauga consists of thicker sands and less shale than the Lower Missisauga/Mic Mac. The sands in the lower half of the unit cannot be correlated between the wells and appear to be distributary channel, mouth bar and possibly barrier beach sands in a delta margin to delta plain setting. A trace of oil with water was recovered from a thin sand in this unit by RFT #8 in L-30.

The thick sands in the upper half of the Middle Missisauga are much more correlative between the wells, and include the oil and gas bearing sands at L-30. Correlations of the reservoir sands are shown in Figure 3. Notes concerning petrophysical properties and tests on the margins of the diagram will be discussed later when reserve potential is discussed.

Interpreted environments of deposition are indicated down the centre of the diagram. They are based on sample descriptions (see notes beside logs), log character and apparent degree of continuity. The environments include shallow shelf, beach, distributary channel, mouth bar and barrier island, all consistent with a delta margin setting. Generally the sequence becomes less deltaic and more marine upwards with increasing glauconite, shelly fossils, oolites and limestone, reflecting the transgression that culminated in the deposition of the overlying "0" Limestone.

Sands 2, 3A and 5 occur in both wells and represent barrier beach/tidal channel complexes of considerable thickness (up to 59.7m) and wide distribution. Sands 1, 3, 4 and other thinner sands represent distributary channels and shallow shelf sand bodies of probable limited individual extent.

CORRELATION OF U. MIDDLE MISSISAUGA AT PENOBSCOT



Note: Core depths adjusted to logs. Core #1 partly broken and misplaced.

MIDDLE MISSISAUGA RESERVOIR SANDS AT PENOBSCOT

FIGURE 3

The sequence was deposited during a time of active structural growth, as demonstrated by the "0" Limestone to #5 sand Isochron map of Figure 4. There was over 30m of structural relief and reverse fault throw on the #5 sand at the end of "0" Limestone time. This was a continuation of the structural growth that had started shortly before the end of Abenaki deposition.

Of the reservoir sands, only the thick #5 sand is well expressed on seismic and obviously widespread. The weak trough associated with the #4 sand at L-30 (Figure 5) extends nearly to the fault, approximately 1 km to the north suggesting it is more widespread than would be expected for a distributary channel. The seismic event associated with the #5 sand varies from the broad doublet trough associated with the 59.7m thickness at L-30 to a broad singlet trough to a tighter singlet trough. Even the latter character would suggest a sand thickness of at least 25m.

Dipmeter data (centre of logs in Figure 3) are highly variable in dip and direction. Most of the dips are less than 10°, but a few are as high as 25 to 30°. There are some coherent patterns of increasing upward and downward dips, but they are not consistent and are even in opposing directions in some units. A detailed analysis has not been made, but the patterns seem consistent with a complex interplay of strong ebb and flood tidal and longshore drift currents.

Some of the inline seismic sections display northwestward downlapping events in the reservoir interval.

It is suggested that the Middle Missisauga sands were brought into the area by a delta from the north, and that the low relief sea floor structure associated with structural growth at Penobscot localized the development of well winnowed thick barrier island and shallow shelf sands. These sands migrated across the structure towards the northwest, resulting in a greater areal extent of individual sands than would be expected normally in a delta front environment.

Overlying the "0" Limestone, the thick Upper Missisauga sands are probably distributary channel deposits representing the final progradation of the Misssisauga delta. No hydrocarbons were encountered in these sands in the two Penobscot wells drilled to date. They may have reservoir potential, as at Panuke, updip from L-30 unless the "0" Limestone has prevented upward

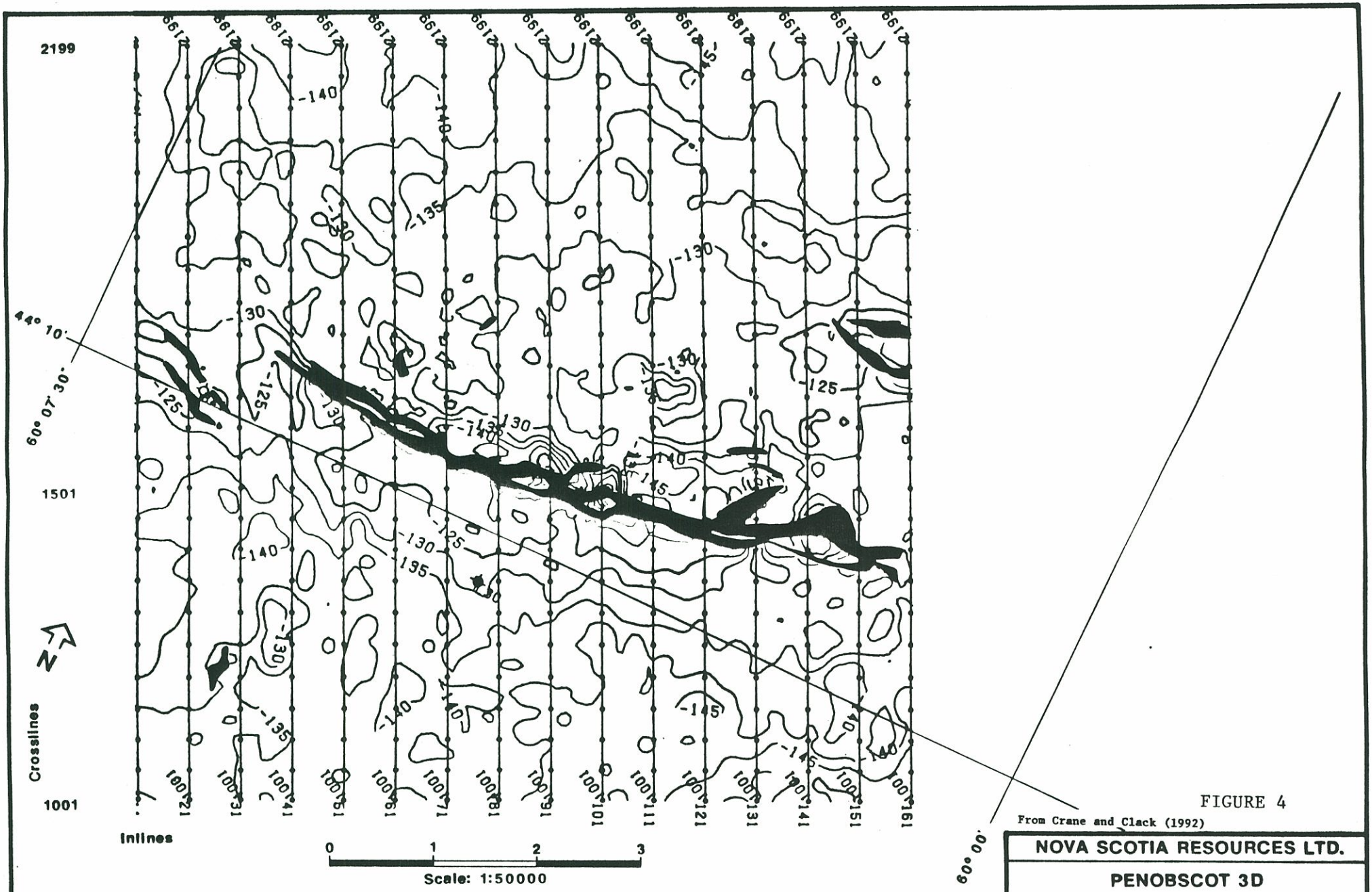


FIGURE 4

From Crane and Clack (1992)

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PENOBSCOT 3D

'O' MARKER TO #5 SAND ISOCHRON

CONT. INT. .005"	J.D.T. CRANE	FEBRUARY, 1992

migration.

A reduction in sediment supply and regional transgression resulted in deposition of the Naskapi shales and thin sands over the Missisauga, followed by progradation of Logan Canyon sands and shales. The Logan Canyon consists of thinner, more widespread sands with more shale than the Missisauga, and was deposited in strand plain and shallow shelf environments. No potential is considered for the Logan Canyon, which is the reservoir at Cohasset, since L-30 is at the crest of the structure at the mid Logan Canyon level (Crane and Clack, 1992).

In early Late Cretaceous time sediment supply to the entire Scotian Shelf was greatly reduced and the rate of subsidence increased, resulting in the deposition of Dawson Canyon shale and limestone and Wyandot chalk.

The latest Cretaceous and Tertiary Banquereau Formation is mainly shelf shale.

STRUCTURE

In Figure 1 the Penobscot Prospect is shown as lying on the transition zone from the western end of the Abenaki subbasin to the northern updip flank of the Sable Subbasin. The structure may be associated with a basinal transfer fault zone. This would account for the offset of the northeast structure, which is on trend with the Abenaki salt ridge, from the main structure, and for the complex nature and growth history of the main structure. Wade and MacLean (1990) interpret approximately 12 to 14 km of Triassic/Early Jurassic to Tertiary sedimentary rocks overlying block faulted Lower Palaeozoic metasedimentary and igneous basement in the area. Seismic does not show reliable events below approximately 3.0 seconds (5 km), approximately at the level of the Middle Jurassic Mohican Formation.

Figure 5 shows the correlation of stratigraphy in L-30 to seismic section 77 across the main Penobscot structure. Note the thickening of Jurassic basinal shales (Verrill Canyon Fm. and Misaine Mbr.) off the southern flank of the structure, and that these potential source rocks are cut

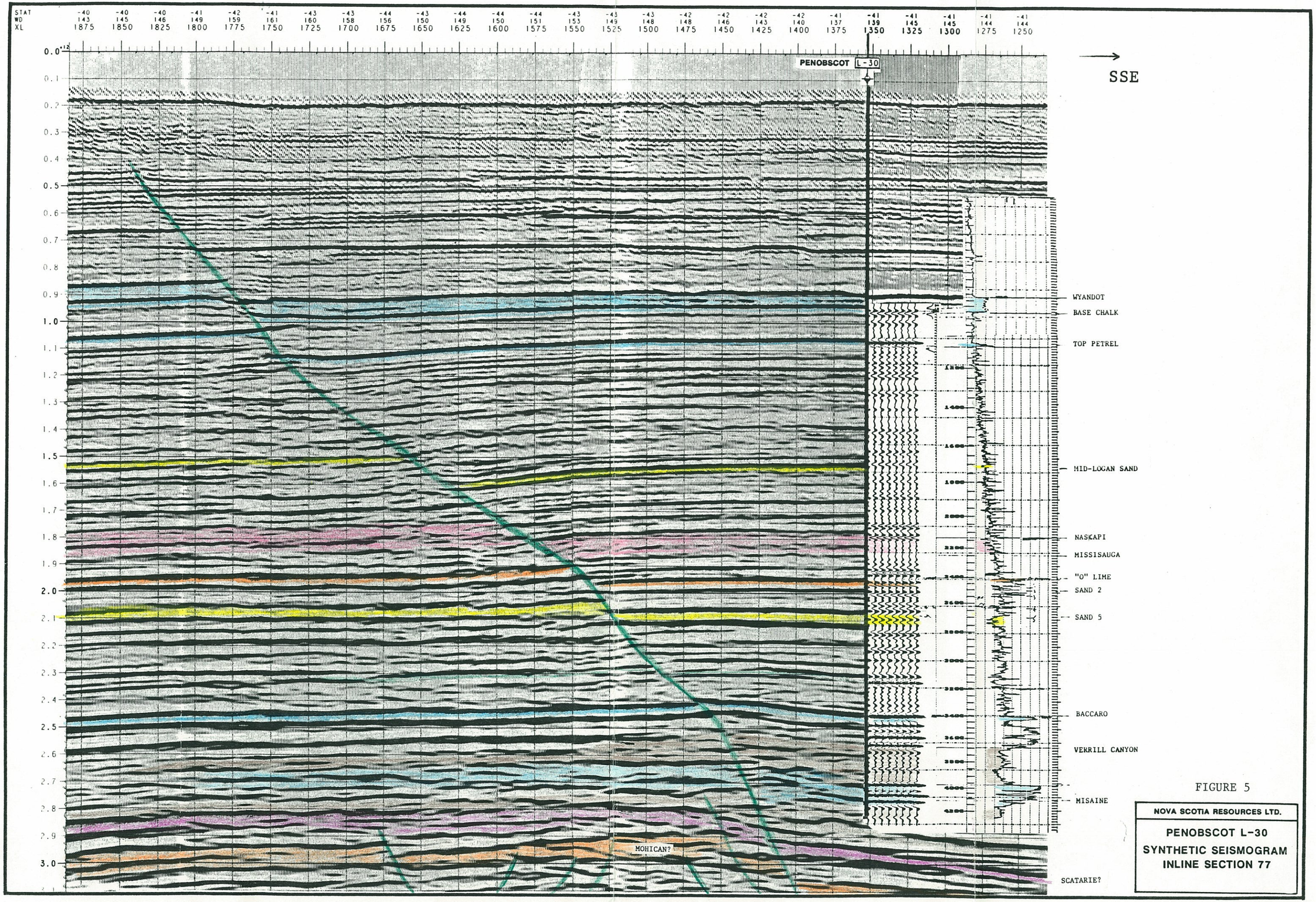

FIGURE 5

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PENOBSCOT L-30
SYNTHETIC SEISMOGRAM
INLINE SECTION 77

by the main fault. Also, the sense of movement on the fault is reverse in the upper Abenaki Formation and normal at all other horizons.

While attempting to evaluate fault throws and the potential for sand/shale juxtaposition and sealing across the main fault, it became apparent that the faulting pattern is more complex than indicated on the structure maps. The "O" Limestone (Fig. 6), #5 Sand (Fig. 7) and Baccaro (Fig.8) depth structure maps all show a continuous main fault with minor spur faults. However, there are offsets in the fault traces, often associated with changes in the amount of throw and even the throw direction. Reinterpretation of the printed seismic sections (every fifth NNW-SSE inline section and every fiftieth WSW-ENE crossline section) indicates that the main fault consists of a series of *en echelon* faults, particularly in the eastern half of the map area.

Portions of six representative sections are shown in Figure 9 and the fault patterns at the various levels in Figure 10. It would appear that the south side of the fault trend is continuous with the north side in the vicinity of lines 110 to 120, near the crest of the overall structure and well above the elevation of L-30. It is doubtful that fault sealing plays a significant role in the trapping of hydrocarbons at Penobscot. Any continuous sand containing hydrocarbons at L-30 is a reservoir on both sides of the fault.

Connection of faulting at the higher levels to faulting at the Mohican level is variable and difficult to interpret. Most of the main faults are connected to a major down-to-the basin fault which is at the front of a horst underlying the western end of the structure. Faulting at the Mohican level is less continuous than that at higher levels and there appear to be NW-SE, NE-SW and N-S elements that may be related to transfer faulting associated with early rift faulting.

The maps in Figures 6, 7, 8 and 10 show the Penobscot Prospect to be a complexly faulted anticline connected across a broad saddle to the *en echelon* faulted anticline in the northwest part of the map area. A smaller high lies off the western end of the of the main fault and was tested by B-41.

The anticlines are anything but simple, with multiple subsidiary culminations. Fault independent closures are generally small, the largest being at the "O" Limestone level on the

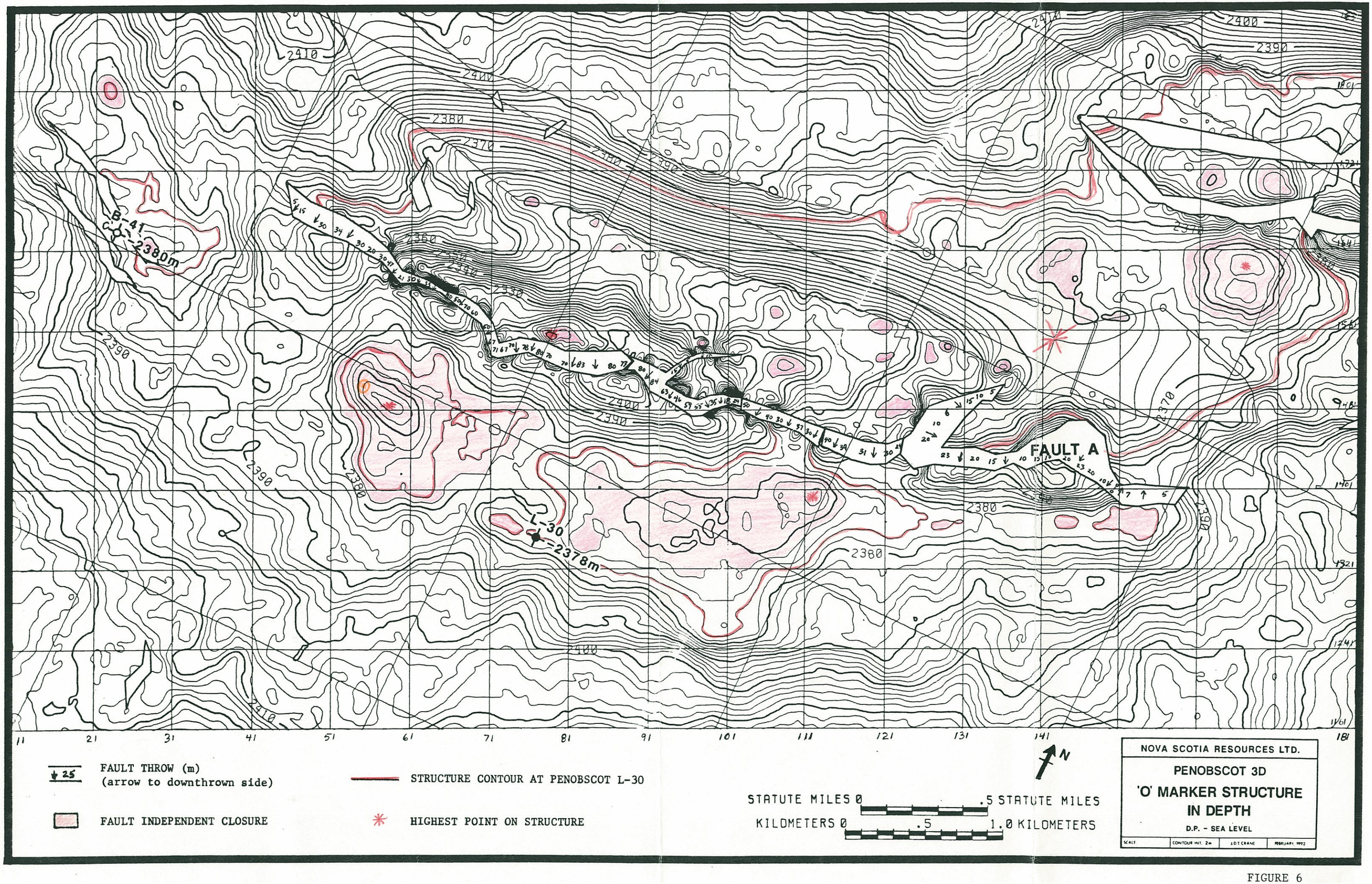

B-41
-2380m
L-30
-2378m
FAULT A
2410
2400
2390
2380
2370
2360
2350
2340
2330
11
21
31
41
51
61
71
81
91
101
111
121
131
141
181
FAULT THROW (m)
(arrow to downthrown side)
FAULT INDEPENDENT CLOSURE
STRUCTURE CONTOUR AT PENOBSCOT L-30
HIGHEST POINT ON STRUCTURE
STATUTE MILES 0 .5 STATUTE MILES
KILOMETERS 0 .5 1.0 KILOMETERS
N
NOVA SCOTIA RESOURCES LTD.
PENOBSCOT 3D
'O' MARKER STRUCTURE
IN DEPTH
D.P. - SEA LEVEL
SCALE
CONTOUR INT. 2m
J.D.T. CRANE
FEBRUARY 1992

FIGURE 6

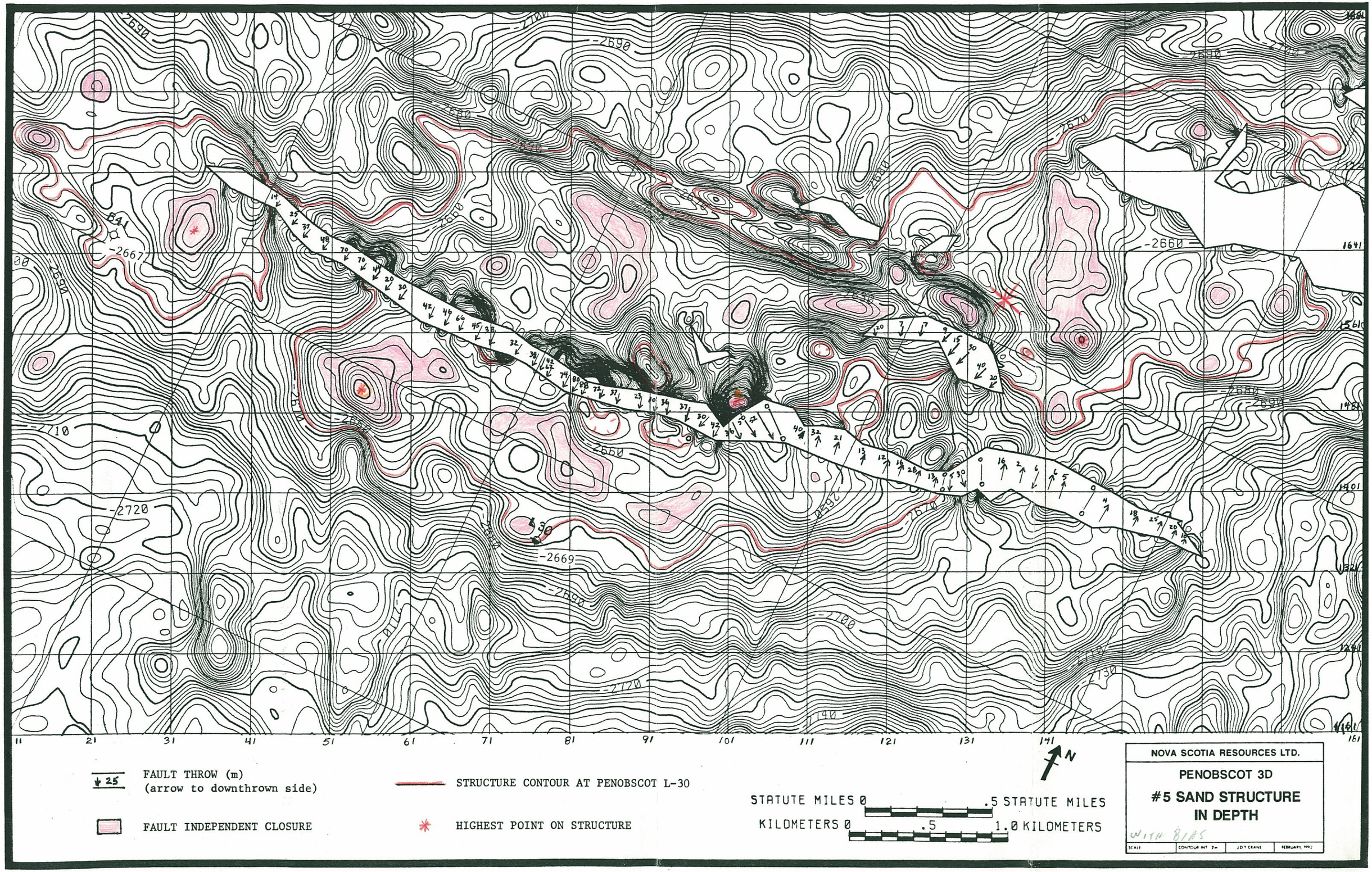

-2690
-2700
-2660
-2670
-2680
-2667
-2710
-2720
-2669
-2730
-2740
11
21
31
41
51
61
71
81
91
101
111
121
131
141
181
FAULT THROW (m)
(arrow to downthrown side)
FAULT INDEPENDENT CLOSURE
STRUCTURE CONTOUR AT PENOBSCOT L-30
HIGHEST POINT ON STRUCTURE
N
STATUTE MILES 0 .5 STATUTE MILES
KILOMETERS 0 .5 1.0 KILOMETERS
NOVA SCOTIA RESOURCES LTD.
PENOBSCOT 3D
#5 SAND STRUCTURE
IN DEPTH
WITH BIAS
SCALE
CONTOUR INT. 2m
J.D.T. CRANE
FEBRUARY, 1992

FIGURE 7

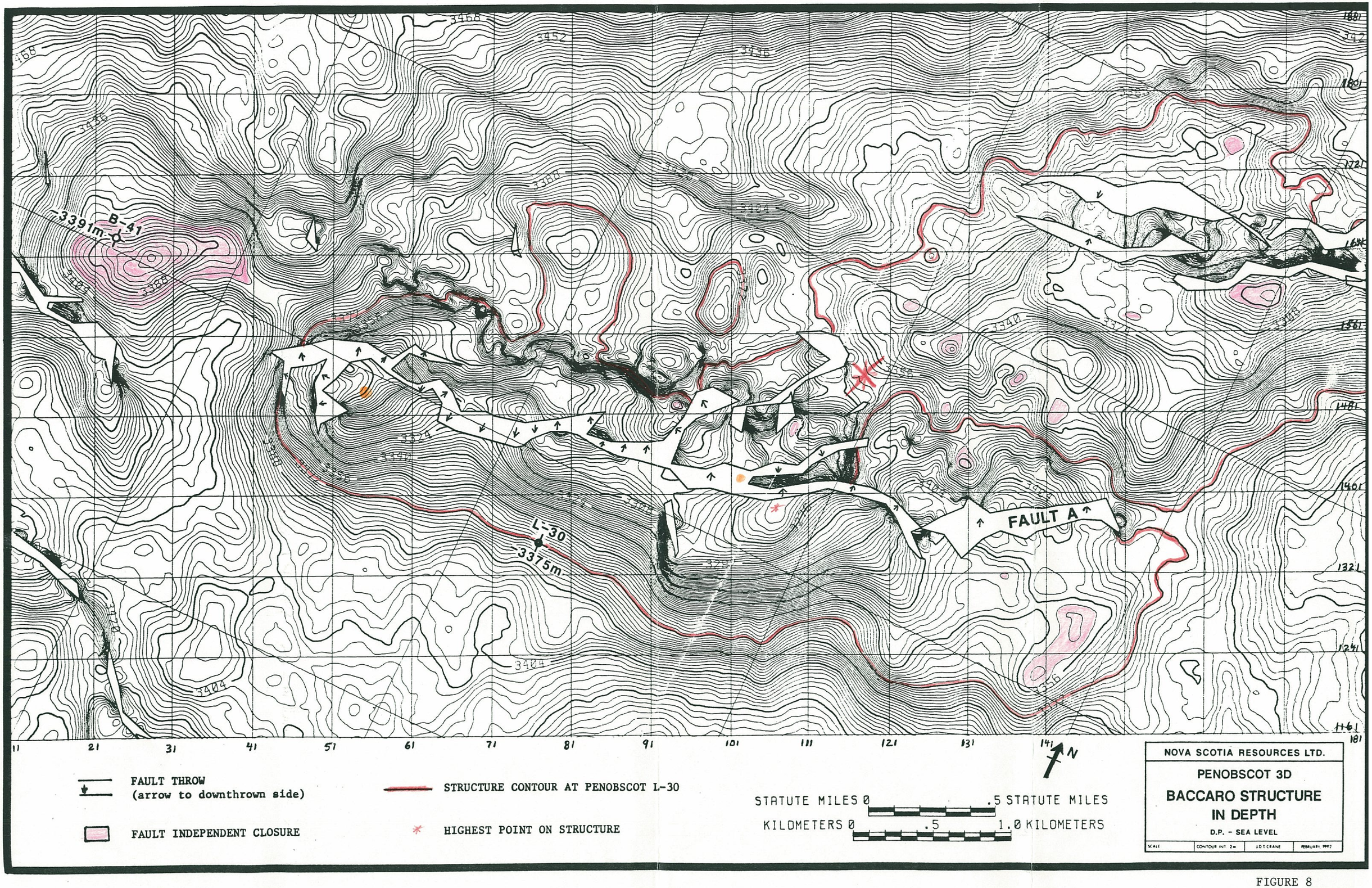
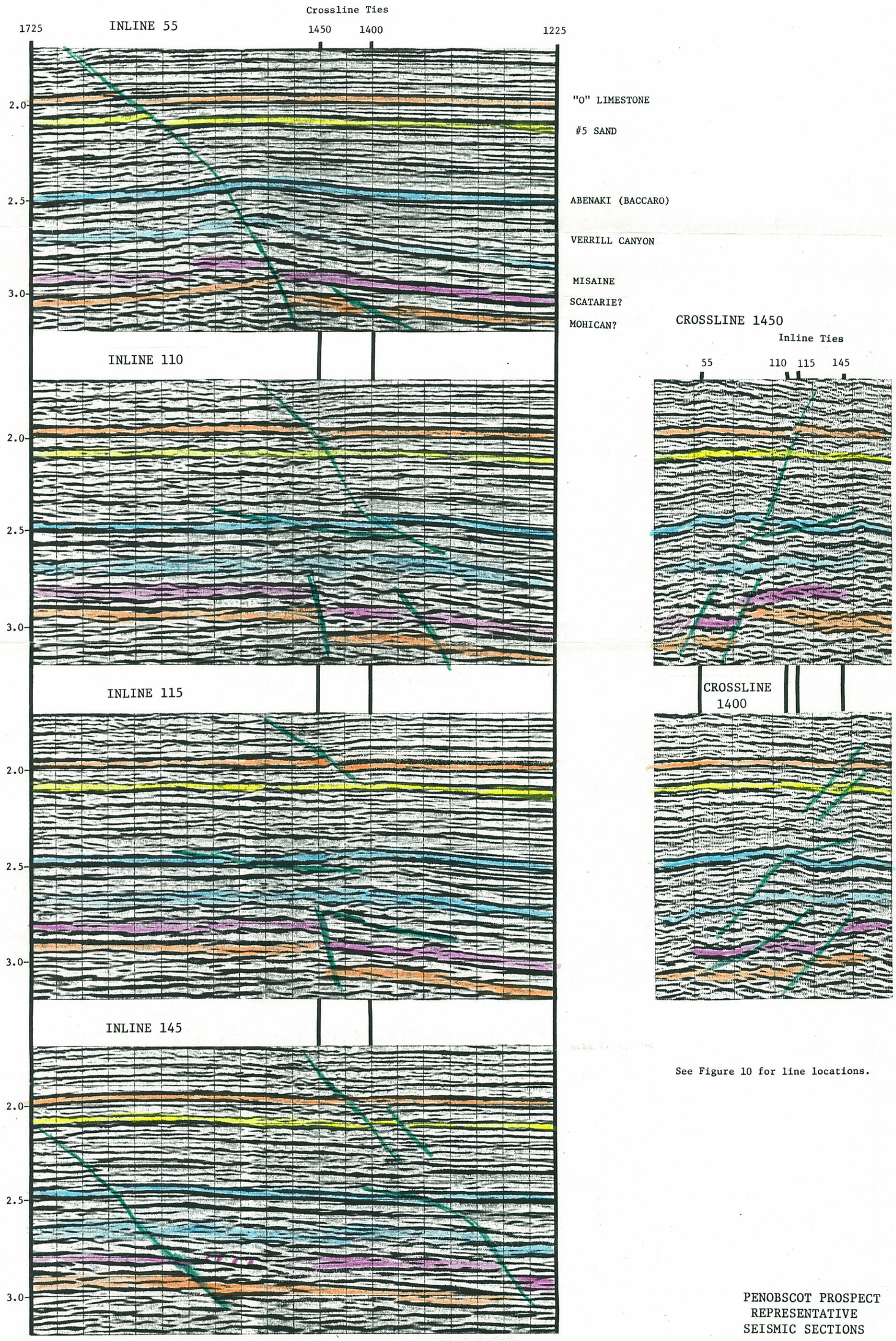

B-41
-3391m-
L-30
-3375m
FAULT A
FAULT THROW
(arrow to downthrown side)
STRUCTURE CONTOUR AT PENOBSCOT L-30
FAULT INDEPENDENT CLOSURE
HIGHEST POINT ON STRUCTURE
STATUTE MILES 0 .5 STATUTE MILES
KILOMETERS 0 .5 1.0 KILOMETERS
N
NOVA SCOTIA RESOURCES LTD.
PENOBSCOT 3D
BACCARO STRUCTURE
IN DEPTH
D.P. - SEA LEVEL
SCALE
CONTOUR INT. 2m
J.D.T. CRANE
FEBRUARY, 1992

FIGURE 8

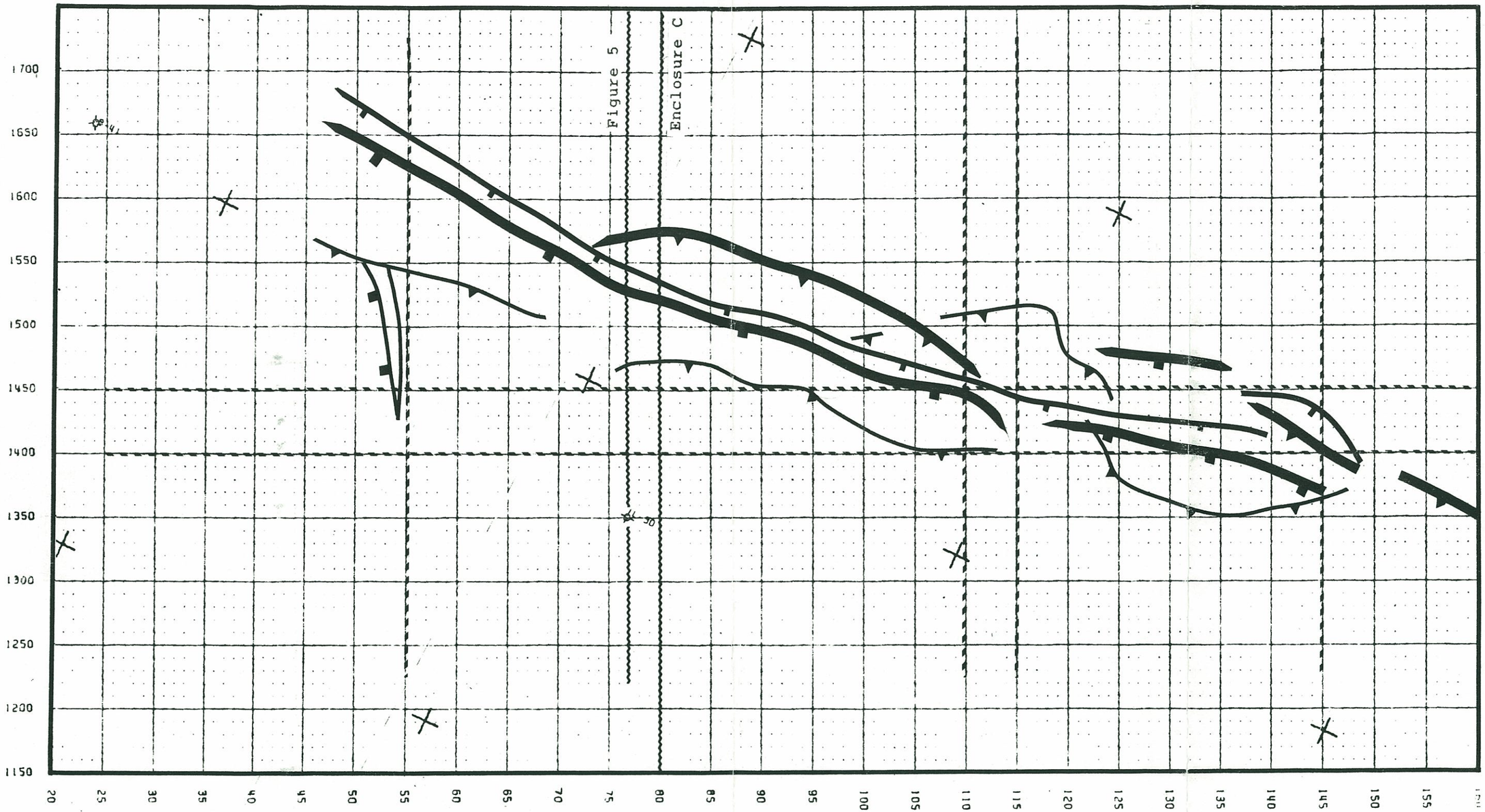


See Figure 10 for line locations.

PENOBSCOT PROSPECT
REPRESENTATIVE
SEISMIC SECTIONS

WJFC July, 1992

FIGURE 9



FAULT TRACES

Seismic Lines, Figure 9

Seismic Lines, other Figures

"O" Limestone Level (normal)

#5 Sand Level (normal & reverse)

Abenaki (Baccaro) Level (normal & reverse)

FAULT PATTERNS
MAIN PENOBSCOT STRUCTURE

WJFC July, 1992

FIGURE 10

south side of the fault (Figure 6). L-30 is below fault independent closure at all levels. It is also below the spill point elevation of the saddle between the north half of the main structure and the northwest structure, raising the possibility of reserves in the northwest.

STRUCTURAL HISTORY AND FACIES

Structural history and facies development across the Penobscot structure can be illustrated best by the reconstruction of seismic and depth sections at different levels. Seismic section 77 and a depth interpretation of section 80 immediately to the west were selected, and the reconstructions are shown in Figure 11 and enclosure C respectively. Movements on faults active at the reconstructed levels are shown by arrows. The present day configuration of section 77 is correlated to L-30 in Figure 5.

Section 77 is reconstructed to the Mohican(?) level in Figure 11a. Pre-existing faults, wedging of section, apparent unconformities, and clinoform bedding events indicate that the structure probably existed much as re-constructed, or at least as a hinge line, rather than as a flat sea floor.

In Figure 11b, section 77 is reconstructed to the top of the mid Abenaki carbonate in L-30. Early two-way dip because of the underlying horst was filled in on the landward (northern) side, leaving a well defined hinge line monocline at the site of the outermost (southern) fault. The time following deposition of the Misaine shale was structurally quiescent, allowing the mid Abenaki carbonate to prograde southward.

The upper half of the carbonate must have existed at or near sea level for a considerable time to be able to shed the thick tongue of slope carbonate over the over the underlying Misaine. Also, there was sufficient time for overlying lower Verrill Canyon shale to fill the basin floor nearly to the level of the shelf. These conditions would be ideal for the development of prospective carbonate shoal facies (biostromal or clastic) at the shelf edge.

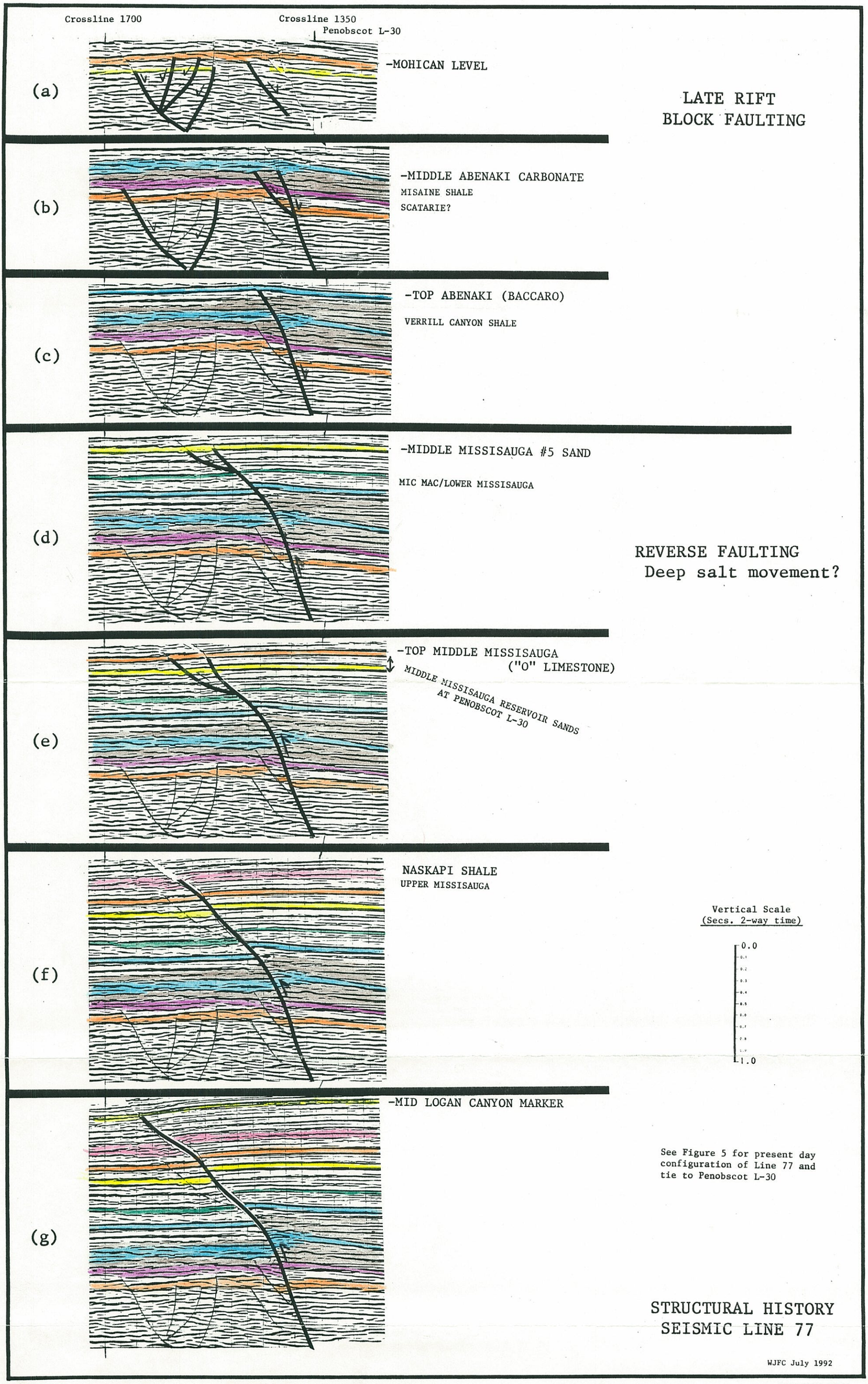

Crossline 1700
Crossline 1350
Penobscot L-30
(a)
-MOHICAN LEVEL
LATE RIFT
BLOCK FAULTING
(b)
-MIDDLE ABENAKI CARBONATE
MISAINE SHALE
SCATARIE?
(c)
-TOP ABENAKI (BACCARO)
VERRILL CANYON SHALE
(d)
-MIDDLE MISSISAUGA #5 SAND
MIC MAC/LOWER MISSISAUGA
REVERSE FAULTING
Deep salt movement?
(e)
-TOP MIDDLE MISSISAUGA
("O" LIMESTONE)
MIDDLE MISSISAUGA RESERVOIR SANDS
AT PENOBSCOT L-30
(f)
NASKAPI SHALE
UPPER MISSISAUGA
Vertical Scale
(Secs. 2-way time)
0.0
1.0
(g)
-MID LOGAN CANYON MARKER
See Figure 5 for present day
configuration of Line 77 and
tie to Penobscot L-30
STRUCTURAL HISTORY
SEISMIC LINE 77
WJFC July 1992

FIGURE 11

The section in Figure 11c is restored to the top of the Abenaki Formation (top Baccaro Mbr.). A similar depth reconstruction of section 80 is presented in A section of enclosure C. Only the southernmost fault has remained active, with down-to-the-basin normal movement to the end of Verrill Canyon time and initiation of reverse movement shortly thereafter. Verrill Canyon shales extend northward at least as far as crossline 1550,sealing the prospective mid Abenaki shelf edge carbonate. Sands deposited within the Baccaro Member may also be prospective if diagenesis adjacent to the fault has improved the porosity over that seen in L-30.

Figures 11d and section B of enclosure C show restorations to the top of Middle Missisauga #5 sand, near the base of the reservoir section in L-30. Reverse movement intensified after Abenaki time, with approximately 80 m of vertical movement prior to the end of #5 sand time, including possibly 45 m of movement during deposition of the sand.

The simplest explanation of reverse fault movement in an extensional tectonic regime is that sediment loading mobilized deep Argo salt seaward of the horst underlying Penobscot. This salt flowed to the front of the horst, causing reverse movement along the pre-existing faulted plane of weakness.

Between #5 sand time and the time of deposition at the top of the "O" Limestone (Figure 11e and section C of enclosure C) there was an additional approximately 40 m of reverse fault movement. There was approximately 85 m of fault movement between deposition of the base of #5 sand and the top of the "O" Limestone, a section that is 350.8 m and 322.5 thick in L-30 and B-41 respectively.

Fault movement that is approximately one quarter of the thickness of the deposited section would have a considerable effect on deposition. From section C of enclosure C, the section is 217 m thick on the south side of the fault and 402 m thick on the north side of the fault, where it does not thin to the thickness at L-30 until approximately 450 m further north. Well winnowed, excellent reservoir quality barrier bar sands are expected to extend over most of the structure on the south side. Depending on the rate of sediment supply and the direction of transport, the north side of the fault may be the site of shaley, marine deposition with thin sands or it may be the site of extensive thick sand aprons of good reservoir quality. The character of the #5 sand seismic

event north of the fault (see Fig. 9) suggests that it is sand.

Reverse fault movement continued through Upper Missisauga and Naskapi time (Figure 11f) until shortly before deposition of the mid Logan Canyon seismic marker (Figure 11g and section D of enclosure C). The amount of movement was approximately 45 m. There was little or no further fault movement until after Petrel Member time (section D of enclosure C).

Immediately after deposition of the Petrel Member the direction of fault movement changed again (Section E of Enclosure C). Normal fault movement of approximately 125 m occurred, ending in upper Banquereau time. Again, the simplest explanation for the change in sense of fault movement invokes salt. Sediment weight may have reached the point that a normal let-out fault, common to the Scotian Shelf, developed and following the pre-existing faulted plane of weakness, soled out in the salt.

Isochron maps included in Crane and Clack (1992) support the above analysis of structural history and indicate that the movements occurred as described along the length of the main fault, except for variations in the amount of movement.

HYDROCARBON GENERATION AND MIGRATION

There are no published geochemical data for the Penobscot wells. However, regional trends can be applied.

Verrill Canyon shales, basinal facies equivalent of the Abenaki, Mic Mac and Missisauga Formations are generally recognized as the major potential source rocks on the Scotian Shelf (Wade and MacLean, 1990). However, many geochemical studies, including the most recent by Mukhopadhyay (1990), in which 30 oil and condensate samples from 22 wells were analyzed, have failed to definitely correlate the hydrocarbons to known potential source rocks. The last paper and another by Mukhopadhyay and Wade (1990) on organic facies and maturation provide significant information pertinent to Penobscot.

The majority of analyzed potential source rocks are gas-condensate and gas prone. Only some samples of distal Verrill Canyon shales at Alma F-17, Glenelg J-48 and SW Banquereau F-34 are oil prone source rocks, and these locations are 59 to over 78 km from Penobscot (Figure 2).

Light oil-condensate prone source rocks are more common than oil prone, but have been identified only in thin, local units in the Logan Canyon, Upper Missisauga, and Abenaki (Misaine Mbr.). Source rocks of this type may have supplied the under saturated light oils at Cohasset, Panuke and Sable Island.

Of 25 shale samples from South Venture O-59 and Venture B-43, approximately 39 km to the southeast of Penobscot, 5 were light oil-condensate prone, 9 were condensate-gas-minor oil prone, 2 were condensate-gas prone and 9 were gas-condensate or gas prone. The samples from O-59 were considerably more oil and condensate prone than those from B-43, only 6 km away, attesting to the local distribution of the organic facies. The oil-condensate prone samples were interpreted to be deposited in partially anoxic delta front and pro-delta environments. The samples were shales of the Missisauga and Mic Mac Formations with a biostratigraphic range equivalent to the Lower Missisauga to Misaine Member section penetrated at the bottom of Penobscot L-30.

Given the early structural growth at Penobscot, it is likely that anoxic shale facies of the Misaine and Verrill Canyon are present in the vicinity. They would be capable of supplying the light oil and condensate-gas that was recovered at Penobscot.

Mukhopadhyay (1990) and Mukhopadhyay and Wade (1990) found that source rocks between 3700 to 4000 m and 4400 to 5700 m are in the main phase of oil and condensate rich gas generation. This is slightly deeper than Nantais' (1983: reported in Wade, 1991) depth of approximately 3600 m to a calculated Ro 0.7% at Penobscot.

That the oil, condensate and gas were generated in Verrill Canyon and/or Misaine shales and migrated into the Penobscot structure up the main fault is probable. The reconstructed depth sections of enclosure C and time sections of Figure 11 provide a model on which possible

hydrocarbon generation and migration events can be superimposed. At Petrel Member time (section D of enclosure C) the Misaine and Verrill Canyon were just above -3600 m and probably marginally mature. It is shortly after this time, as the source beds became mature, that the sense of movement on the main fault became normal and tensional stress developed across the fault.

The fault became a conduit for migrating fluids (arrows on section E of enclosure C), the first of which were probably acidic waters that would attack the Abenaki limestones and calcareous sands, enhancing their reservoir potential adjacent to the fault. The following hydrocarbons migrated at least as high as the Middle Missisauga sands. Whether they migrated above the "O" Limestone into the Upper Missisauga can only be shown by drilling higher elevations on the structure. That they did not "spiral" up the fault from sand to sand is indicated by the lack of shows in the Logan Canyon at the crest of its structure at L-30. It may be that the Naskapi shales provided the barrier to further upward migration.

On the basis of the fault conduit model, any sand containing hydrocarbons must extend to the fault, and cannot be a stratigraphic trap on the flank of the structure. This means that the five sands having indications of hydrocarbons at L-30 (Figure 3) extend at least 1 km to the fault, and possibly have considerable areal extent on the structure. The possibility of other sands that are present at the fault and on the crest of the structure, but do not extend to L-30, increases the potential for more pay sands.

Hydrocarbons migrating up the main fault system would drain into adjacent reservoirs and migrate to the structural highs. Analysis of the structure maps in Figures 6, 7 and 8 indicates that the main Penobscot structure north and south of the main fault system would receive most of the hydrocarbons.

At the "O" Limestone and #5 sand levels, the main structures would receive their charge from the faults between line 52 and approximately line 41, a length of approximately 4.6 km. The B-41 satellite structure would receive its charge from the fault west of line 52, a length of only approximately 370 m. This and the lack of shows at B-41 downgrades that structure significantly. The northeast structure would receive its charge from the fault east of line 141, a length of approximately 840 m. It could also receive hydrocarbons spilled from the main north structure,

a possibility since L-30 is at an elevation below the spill point. The northeast structure is considered a higher risk secondary target at this time.

At the Abenaki (Baccaro) level, the main fault system from the west end to line 128 would charge the main structure and from line 128 to line 150 would charge the northeast structure. Since the highest points on the structure are adjacent to the fault, and there is almost no independent closure, the fault would either have to be sealed or filled with oil above the Abenaki. This, coupled with the unproven, but possible, presence of reservoir makes the Abenaki a very high risk target.

RESERVE ESTIMATIONS

Facts and interpretations from the preceding sections that have an effect on estimates of potential hydrocarbon reserves over the complexly faulted Penobscot anticline are as follows:

1) At Penobscot L-30 four sands, with 172' (52.4 m) of porosity near the top of the Middle Missisauga, tested light oil, condensate and gas from 42'(12.8 m) net pay. A fifth, lower, thick (196' - 59.7 m) sand has 11' (3.4 m) at the top, from which a sidewall core had very "slight, slow, solvent cut fluorescence" (Well History Report). A Saraband log indicated a water saturation of 70 %, and the interval tested water. The zone is either a transitional oil/water interface or residual oil left after remigration towards the structural crest. Four other porous, wet sands occur within the 918' (279.8 m) interval containing the pay sands.

2) Four of the nine sands in the reservoir interval are correlatable to the Penobscot B-41 well, on a separate substructure 3.24 km west. Only the lowermost, thickest #5 sand produces a mappable seismic event, and it appears to be continuous over the prospect. The event changes somewhat in character and apparent thickness, but the porous sand is probably never thinner than approximately 25m. The amount of continuity of the sands is consistent with a log and sample based interpretation of mainly shallow shelf and barrier beach environments of deposition.

3) In our previous report on the Penobscot 3D seismic program we produced depth structure maps on top of the "O" Limestone, 71 m above the top of the reservoir interval, and on top of the lowermost #5 sand. From the maps, there are up to 340 ha (840 ac) of prospective area and 92 m (302') of vertical relief above the L-30 well location.

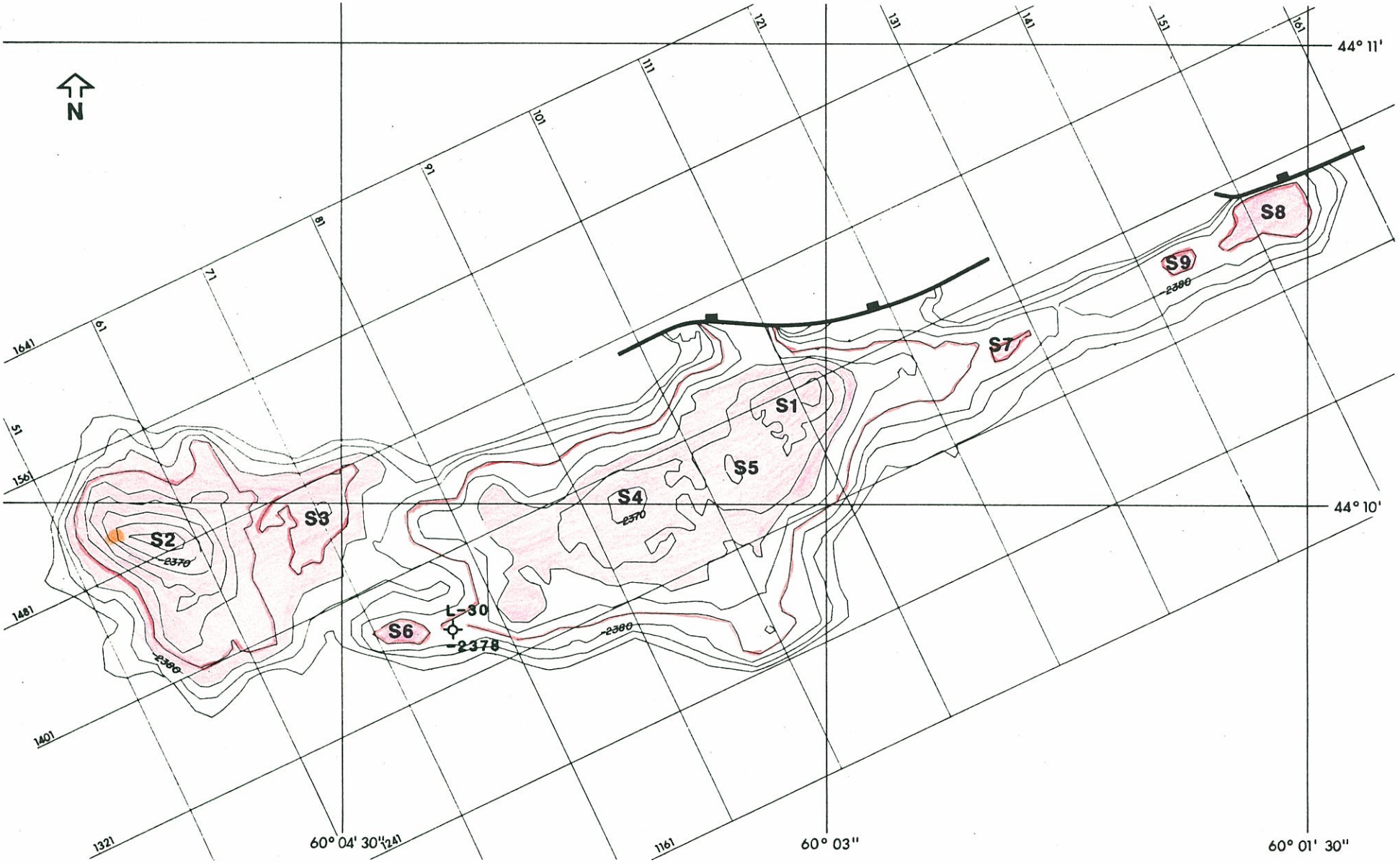
4) Oil has not "spiralled" up the faults from sand to sand across the faults, but fault sealing of individual sands in a lateral direction is not likely. A widespread continuous sand probably has a single oil/water line over the structure.

5) The structure had a nearly continuous growth history from Late Jurassic to Middle Tertiary time. But the sense of fault movement changed at least twice, from normal to reverse and back to normal; related to rift block faulting, salt movement and sediment loading.

6) The last period of normal faulting occurred just as deeper potential source rock shales were entering the window of maximum oil generation. The shales, which thicken immediately seaward of the structure, are cut by the faults. Light oil, condensate and gas migrated up the faults into the Penobscot Prospect. Sands containing hydrocarbons on the flank of the structure, as at L-30, must extend to the fault source of the oil near the crest. It is highly unlikely that separate stratigraphic traps exist on the flanks of the structure. Vertical migration of the hydrocarbons was stopped by the "O" Limestone immediately above the reservoir sequence at L-30, or by the dominantly argillaceous Naskapi Formation above the thick porous sands of the Upper Missisauga. Reserves have not been assigned to the Upper Missisauga sands, but they may be prospective above the elevation of L-30.

7) High risk potential reservoirs in possible Abenaki bioclastic units and Abenaki/Mic Mac sands have not been included in the reserves estimates. These units require porosity enhancement by acidic waters migrating up the faults in front of the hydrocarbons to be prospective.

Three reserve estimates were made for each sand. These and the totals are summarized in Table 1. "Maximum reserves" were calculated assuming the sand extends over the entire prospect and that high estimates of reservoir parameters prevail. "P-50 reserves were calculated



S4 Substructure.

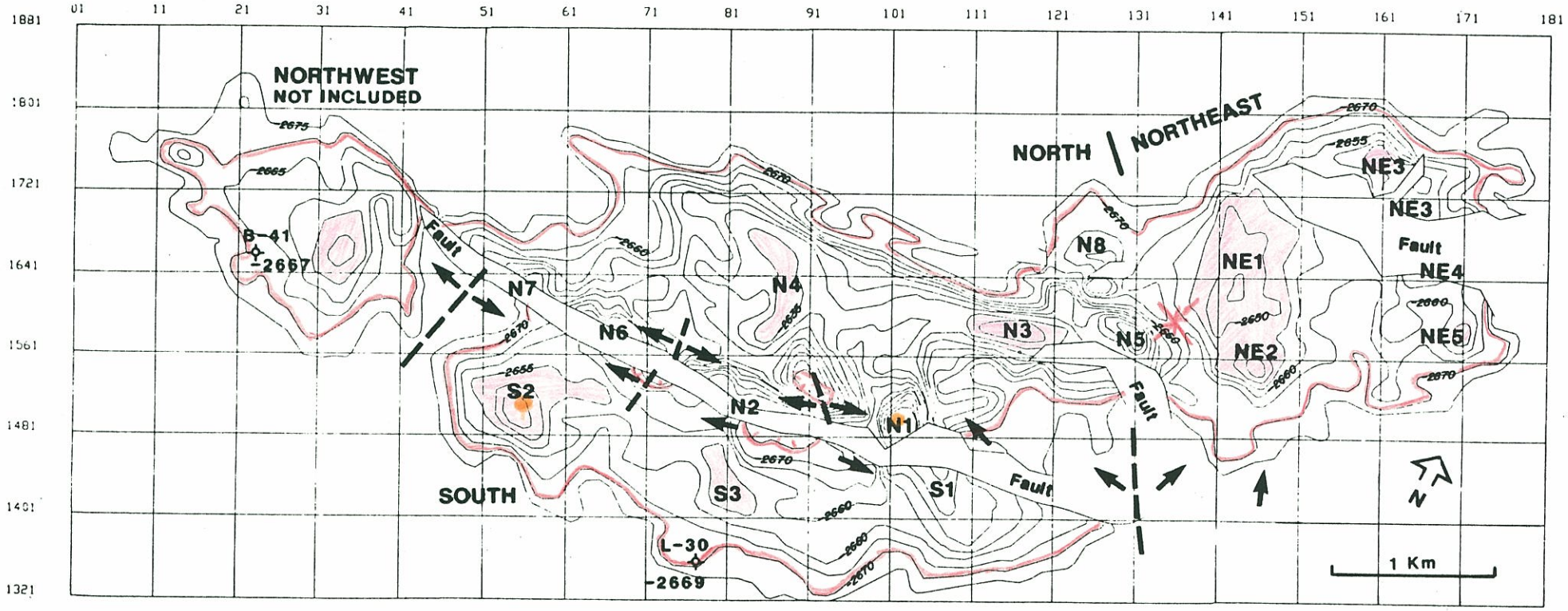
1 Km

NOVA SCOTIA RESOURCES LTD.

SOUTH PENOBSCOT 3D
STRUCTURE ON 'O' LIMESTONE

Contour Interval: 2m

FIGURE 12



Drainage divide for hydrocarbons migrating from fault.

Direction of oil migration.

N3 Substructure.

NOVA SCOTIA RESOURCES LTD.

PENOBSCOT 3D
#5 SAND STRUCTURE

Contour Interval: 5m

FIGURE 13

using conservative "probable" estimates of reservoir extent and parameters. "P-10 reserves" were calculated using low, pessimistic estimates.

The parameters used are summarized in Table 2. They are based on digitized depth structure maps of the "O" Limestone and #5 sand and on the reservoir parameters of the sands in the wells. The latter are noted beside the well logs in Figure 3 and discussed for each sand in a following section.

RESERVOIR VOLUMES

The depth structure maps of the "O" Limestone and #5 sand were digitized and the areas within each contour computed. Both the "O" Limestone map (Figure 11) and the #5 sand map (Figure 12) were used to calculate volumes for south Penobscot. Compare the maps with the original maps in Figures 5 and 6. Note that the values of the contours have been changed by 2 m to better tie at the wells.

Only the #5 sand map was used for north and northeast Penobscot, since it is closer to most of the reservoirs and is closed to the northeast at the elevation of L-30; unlike the "O" map, which has a gentler structure.

The structure maps have been divided into substructures (heavy letters and numbers on the maps) to facilitate calculation of the areas and volumes in a hierarchy of decreasing elevation. Using the digitally computed areas, the areas between contours were calculated. For each sand thickness and established or estimated waterline, the average net pay was multiplied by the area to obtain reservoir volume. The values for each elevation and the totals for each substructure and the entire structure are presented in Appendix B, Tables B1, B2, and B3. The hierarchal organization of this data will allow estimation of reserve drainage and facilitate optimization of a drilling program.

Table 1:

SUMMARY RECOVERABLE OIL RESERVES IN MIDDLE MISSISAUGA SANDS AT PENOBSCOT

SUB-STRUCTURE	RESERVOIR	MAX. RESERVES x10^6 m3	MAX. RESERVES x10^6 Bbls	P-50 RESERVES x 10^6 m3	P-50 RESERVES x10^6 Bbls	P-10 RESERVES x10^6 m3	P-10 RESERVES x10^6 Bbls
SOUTH	#1 Sand*	0.244	1.53	0.087	0.55	0.024	0.15
	#2 Sand*	1.256	7.90	0.640	4.02	0.270	1.70
	#3 Sand*	0.403	2.54	0.137	0.86	0.038	0.24
	#3A Sand	0.964	6.06	0.395	2.49	0.064	0.40
	#4 Sand *	2.264	14.24	0.648	4.07	0.224	1.41
	#5 Sand*	1.605	10.10	0.381	2.40	0.038	0.24
SUBTOTAL		6.736	42.37	2.288	14.39	0.658	4.14
NORTH & NORTHEAST	2-20m Sands	11.022	69.34	4.768	30.04	1.676	10.54
	2-2m Sands	1.576	9.92	0.574	3.60	0.162	1.02
SUBTOTAL		12.598	79.26	5.342	33.64	1.838	11.56
GRAND TOTAL		19.334	121.63	7.63	48.03	2.496	15.70

* Reservoirs with indicated hydrocarbons at Penobscot L-30.

Notes:

The assumed reservoir section on northside of fault consists of 2-20 m sands and 2-2 m sands. This is conservative, since L-30 had indicated hydrocarbons in 3 thick sands and 2 thin sands.

Northwest Penobscot structure adjacent to B-41 was not included since it has limited drainage of hydrocarbons from fault.

High risk reserves in Abenaki of 14.99 x 10 Bbls maximum, 5.81 x 10 Bbls P-50, and 0.55 x 10 Bbls P-10 are not included.

There is potential for other sands higher on the structure.

Table 2
PARAMETERS USED TO CALCULATE ESTIMATED RESERVES AT PENOBSCOT

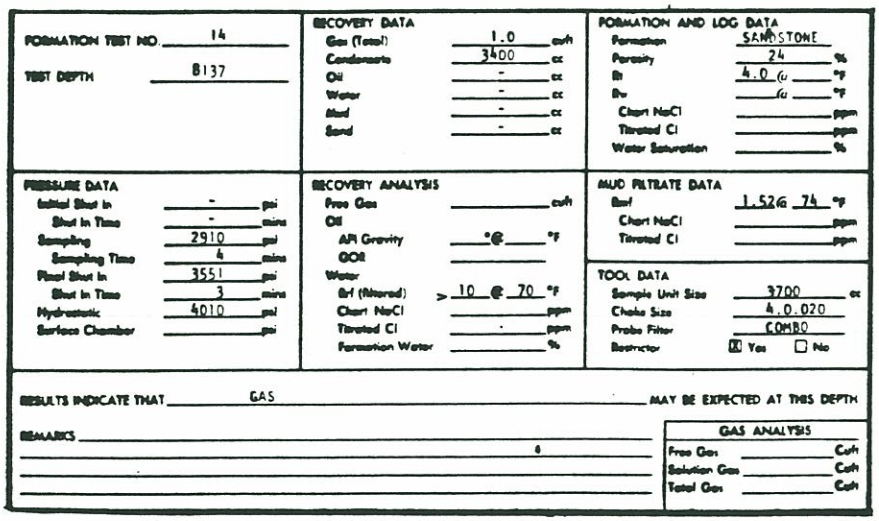
	Reservoir Volume (10^6 x m3)			Porosity (%)			Water Saturation (%)			Recovery Factory (%)			Shrinkage Factor (%)		
	Max.	P-50	P-10	Max.	P-50	P-10	Max	P-50	P-10	Max	P-50	P-10	Max	P-50	P-10
SOUTH															
#1 Sand	4.09	2.05	0.82	23	21	19	30	35	40	40	35	30	1.08	1.12	1.16
#2 Sand	19.90	13.93	7.96	23	21	20	30	35	40	40	35	30	1.02	1.04	1.06
#3 Sand	6.08	3.04	1.22	23	21	19	25	35	40	40	35	30	1.04	1.06	1.08
#3A Sand	16.27	9.21	2.14	22	20	18	30	35	40	40	35	30	1.04	1.06	1.08
#4 Sand	37.96	15.19	7.59	23	21	19	30	35	40	40	35	30	1.08	1.12	1.16
#5 Sand	25.92	8.46	1.20	23	21	19	30	35	40	40	35	30	1.04	1.06	1.08
N&NE															
20m Sand	89.01	52.96	26.49	23	21	19	30	35	40	40	35	30	1.04	1.06	1.08
2m Sand	12.73	6.36	2.55	23	21	19	30	35	40	40	35	30	1.04	1.06	1.08

RESERVOIR PARAMETERS AND RESERVES FOR INDIVIDUAL SANDS

SOUTH PENOBSCOT

SAND #1

In L-30: 1.5m shallow shelf, m-f. grained, well sorted, loosely consol., kaol., good porosity and good fluorescence and solvent cut.



FORMATION TEST NO. 14
TEST DEPTH 8137

RECOVERY DATA
Gas (Total) 1.0 cuft
Condensate 3400 cc
Oil - cc
Water - cc
Mud - cc
Sand - cc

FORMATION AND LOG DATA
Formation SANDSTONE
Porosity 24 %
Rt 4.0 @ °F
Rw @ °F
Chart NaCl ppm
Titrated Cl ppm
Water Saturation %

PRESSURE DATA
Initial Shut In - psi
Shut In Time - mins
Sampling 2910 psi
Sampling Time 4 mins
Final Shut In 3551 psi
Shut In Time 3 mins
Hydrostatic 4010 psi
Surface Chamber psi

RECOVERY ANALYSIS
Free Gas cuft
Oil
API Gravity °@ °F
GOR
Water
Rw (Measured) > 10 @ 70 °F
Chart NaCl ppm
Titrated Cl ppm
Formation Water %

MUD FILTRATE DATA
Rmf 1.526 74 °F
Chart NaCl ppm
Titrated Cl ppm

TOOL DATA
Sample Unit Size 3700 cc
Choke Size 4.0.020
Probe Filter COMBO
Restrictor ☒ Yes ☐ No

RESULTS INDICATE THAT GAS MAY BE EXPECTED AT THIS DEPTH

REMARKS

GAS ANALYSIS
Free Gas Cuft
Solution Gas Cuft
Total Gas Cuft

RFT 14
Indicates risk of mainly gas with condensate updip

54.1° API

Elevation: - 2448.2m
5' (1.5m) porosity and net pay
Porosity (%): 22 (Shell Oil), 18 (Saraband), 20 (Density), 20 (Neutron) 23 (Sonic). approach of density and neutron porosities supports interpretation of gas charge in spite of low gas recovery.
Water Saturation (%): 38 (Shell Oil), 48 (Saraband)
o/w: deeper than -2449.7m, Placed at -2451 for Reservoir Volume Calculations

In B-41: Sand #1 is absent but similar Sand #1A, approximately 5m stratigraphically lower, is 2.4m thick and wet.

Maximum Reserves:

Reservoir Volume: 4,091,502 m^3 (used "O" map, which is 71m higher; 1.5m thickness;
o/w @ - 2451m; Area of 299.9854 ha; assumed one sand (#1, #1A, or another in interval) present over entire structure.

Porosity: 23%, Sw: 30%, Recovery: 40%, Vol. Factor: 1.08
Oil in Place: 0.659 x $10^6 m^3$ (4.14 x 10^6 Bbls)

Recov. Oil: 0.244 x 10^6m³ (1.53 x 10^6 Bbls)

P50 Reserves:

Reservoir Volume: 2,045,751 m³ (Pay sand on 50% of structure)
Porosity: 21%, Sw: 35%, Recovery: 35% Vol. Factor: 1.12
Oil in Place: 0.279 x 10^6m³ (1.75 x 10^6 Bbls)
Recov. Oil: 0.087 x 10^6m³ (0.55 x 10^6m³ Bbls)

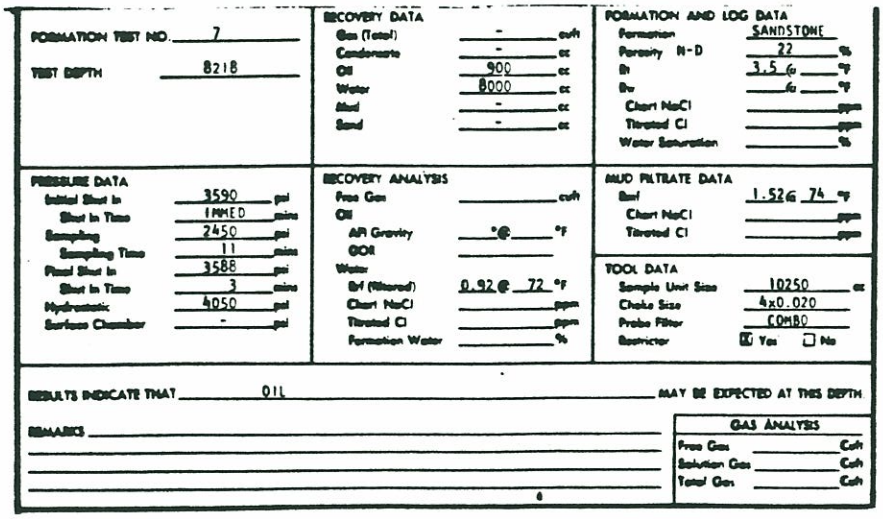
P10 Reserves:

Reservoir Volume: 818,300 m³ (Pay sand on 20% of structure)
Porosity: 19%, Sw: 40%, Recovery: 30% Vol. Factor: 1.16
Oil in Place: 0.093 x 10^6m³ (0.59 x 10^6 Bbls)
Recov. Oil: 0.024 x 10^6m³ (0.15 x 10^6m³ Bbls)

SOUTH PENOBSCOT

SAND #2

In L-30: 18.3m beach sand, m. grained with abundant f & c grains, good porosity semi consolidated, calc., 4 sidewall cores recovered f-vfgr, consol, sand, v. calc, poor porosity. (Logs correspond to sample rather than swc sample descriptions) 4.3m net pay at top.
Elevation: -2472.5m, o/w @ -2476.8m
Porosity (%): 23(Shell Oil, 19 (Saraband), 20 (Density), 25 (Neutron), 21 (Sonic).
Water Saturation (%): 34 (Shell Oil), 40 (Saraband)



FORMATION TEST NO. 7
TEST DEPTH 8218

RECOVERY DATA
Gas (Total) - cu ft
Condensate - cc
Oil 900 cc
Water 8000 cc
Mud - cc
Sand - cc

FORMATION AND LOG DATA
Formation SANDSTONE
Porosity N-D 22 %
Bt 3.5 @ °F
Bw @ °F
Chart NaCl ppm
Titrated Cl ppm
Water Saturation %

PRESSURE DATA
Initial Shut In 3590 psi
Shut In Time IMMED mins
Sampling 2450 psi
Sampling Time 11 mins
Final Shut In 3588 psi
Shut In Time 3 mins
Hydrostatic 4050 psi
Surface Chamber - psi

RECOVERY ANALYSIS
Free Gas cu ft
Oil
API Gravity °@ °F
GOR
Water
Rw (Filtered) 0.92 @ 72 °F
Chart NaCl ppm
Titrated Cl ppm
Formation Water %

MUD FILTRATE DATA
Rmf 1.526 74 °F
Chart NaCl ppm
Titrated Cl ppm

TOOL DATA
Sample Unit Size 10250 cc
Choke Size 4x0.020
Probe Filter COMBO
Restrictor ☒ Yes ☐ No

RESULTS INDICATE THAT OIL MAY BE EXPECTED AT THIS DEPTH

REMARKS

GAS ANALYSIS
Free Gas Cu ft
Solution Gas Cu ft
Total Gas Cu ft

RFT 7

Recov. light oil & water 42.6° API

In B-41: 2.4m f-c grained, g-p sort, good porosity, sl. calc., core anal.: average 21.1% ø (max. 28.6%), average 278 md Kmax (max 1060 md).

Maximum Reserves:

Reservoir Volume: 19,895,583 m^3 (used "O" map, with is 94m higher; 18m thickness;
o/w @ - 2476m; Area of 369.4113 ha.

Porosity: 23%, Sw: 30%, Recovery: 40%, Vol. Factor: 1.02
Oil in Place: 3.203 x $10^6 m^3$ (20.15 x 10^6 Bbls)
Recov. Oil: 1.256 x $10^6 m^3$ (7.90 x 10^6 Bbls)

P50 Reserves:

Reservoir Volume: 13,926,908 m^3 (70% of structure)
Porosity: 21%, Sw: 35%, Recovery: 35% Vol. Factor: 1.04
Oil in Place: 1.901 x $10^6 m^3$ (11.96 x 10^6 Bbls)
Recov. Oil: 0.640 x $10^6 m^3$ (4.02 x $10^6 m^3$ Bbls)

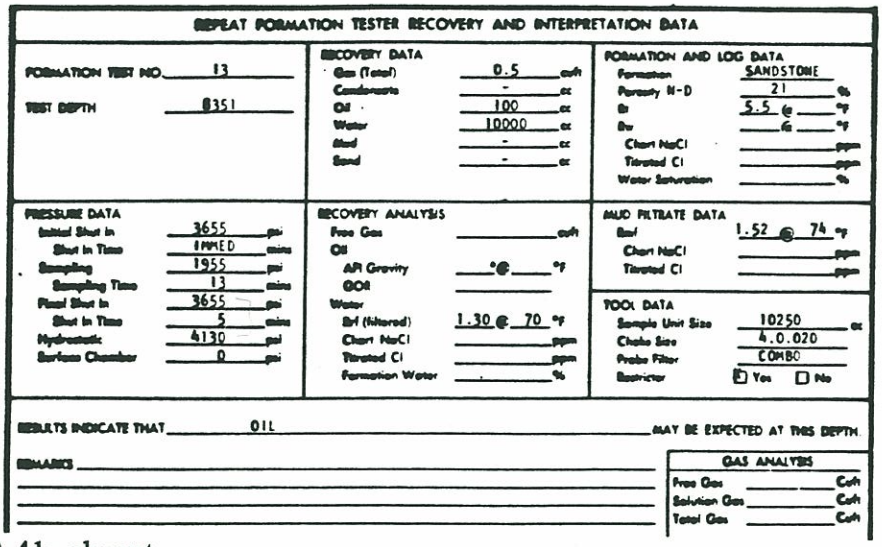
P10 Reserves:

Reservoir Volume: 7,958,233 m^3 (40% of structure)
Porosity: 20%, Sw: 40%, Recovery: 30% Vol. Factor: 1.06
Oil in Place: 0.955 x $10^6 m^3$ (6.01 x 10^6 Bbls)
Recov. Oil: 0.270 x $10^6 m^3$ (1.70 x $10^6 m^3$ Bbls)

SOUTH PENOBSCOT

SAND #3

In L-30: 2.4m, shallow shelf, Limestone on samples, sidewall core was sst, f-c gr., mod sort, compact, fair porosity, slow solv. cut.
Elevation: -2513.1m o/w @ -2515.4m
Porosity (%): 22 (Shell Oil), 18 (Saraband), 20 (Density), 24 (Neutron), 23 (Sonic)
Water Saturation (%): 25 (Shell Oil), 35 (Saraband)



REPEAT FORMATION TESTER RECOVERY AND INTERPRETATION DATA

FORMATION TEST NO. 13
TEST DEPTH 8351

RECOVERY DATA
Gas (Total) 0.5 cuft
Condensate - cc
Oil 100 cc
Water 10000 cc
Mud - cc
Sand - cc

FORMATION AND LOG DATA
Formation SANDSTONE
Porosity N-D 21 %
Rt 5.5 @ °F
Rw @ °F
Chart NaCl ppm
Titrated Cl ppm
Water Saturation %

PRESSURE DATA
Initial Shut In 3655 psi
Shut In Time IFMED mins
Sampling 1955 psi
Sampling Time 13 mins
Final Shut In 3655 psi
Shut In Time 5 mins
Hydrostatic 4130 psi
Surface Chamber 0 psi

RECOVERY ANALYSIS
Free Gas cuft
Oil
API Gravity °@ °F
GOR
Water
Rw (filtered) 1.30 @ 70 °F
Chart NaCl ppm
Titrated Cl ppm
Formation Water %

MUD FILTRATE DATA
Rmf 1.52 @ 74 °F
Chart NaCl ppm
Titrated Cl ppm

TOOL DATA
Sample Unit Size 10250 cc
Choke Size 4.0.020
Probe Filter COMBO
Restrictor ☑ Yes ☐ No

RESULTS INDICATE THAT OIL MAY BE EXPECTED AT THIS DEPTH

REMARKS

GAS ANALYSIS
Free Gas Cu ft
Solution Gas Cu ft
Total Gas Cu ft

RFT:13
Recovery Oil
and water, no gas

In B-41: absent

Maximum Reserves:

Reservoir Volume: 5,985,047 m³ (on "O" map, which is 135m higher; o/w @ - 2515m; 2.4m thick)
6,167,796 m³ (on #5 map, which is 156m lower, o/w -2514, 2.4m thick)

Average: 6,076,422m³

Porosity: 23%, Sw: 25%, Recovery: 40%, Vol. Factor: 1.04
Oil in Place: 1.048 x 10^6m³ (6.59 x 10^6 Bbls)
Recov. Oil: 0.403 x 10^6m³ (2.54 x 10^6 Bbls)

P50 Reserves:

Reservoir Volume: 3,038,211 m³ (50% of structure)
Porosity: 21%, Sw: 35%, Recovery: 35% Vol. Factor: 1.06
Oil in Place: 0.415 x 10^6m³ (2.61 x 10^6 Bbls)
Recov. Oil: 0.137 x 10^6m³ (0.86 x 10^6m³ Bbls)

P10 Reserves:

Reservoir Volume: 1,215,284 m³ (20% of structure)
Porosity: 19%, Sw: 40%, Recovery: 30% Vol. Factor: 1.08
Oil in Place: 0.139 x 10^6m³ (0.87 x 10^6 Bbls)
Recov. Oil: 0.038 x 10^6m³ (0.24 x 10^6m³ Bbls)

SOUTH PENOBSCOT

SAND #3A

In L-30; 28m Barrier Beach sand, c-vc grained, minor gran., semi-consol., poor sort, good porosity, wet.
Porosity (%): 14-18 (Saraband), 18 (Denisty), 23 (Sonic)
Water Saturation (%): 100, spotty 75-90 (Saraband)
Elevation: -2524.4m

In B-41: 20m Barrier Beach sand, f-vc grained, clean, unconsol., poor sort. wet.
Elevation: -2525.0m
Porosity (%): 20 (Density), 24 (Neutron), 23 (Sonic)

Maximum Reserves:

Reservoir Volume: 16,273,367 m^3 (on #5 map o/w @ - 2520m, 20m thick)

Porosity: 22%, Sw: 30%, Recovery: 40%, Vol. Factor: 1.04
Oil in Place: 2.506 x $10^6 m^3$ (15.76 x 10^6 Bbls)
Recov. Oil: 0.964 x $10^6 m^3$ (6.06 x 10^6 Bbls)

P50 Reserves:

Reservoir Volume: 9,207,616 m^3 (Average on "0" - # 5 Maps)
o/w @ -2520m, 20m thick
Porosity: 20%, Sw: 35%, Recovery: 35% Vol. Factor: 1.06
Oil in Place: 1.197 x $10^6 m^3$ (7.53 x 10^6 Bbls)
Recov. Oil: 0.395 x $10^6 m^3$ (2.49 x $10^6 m^3$ Bbls)

P10 Reserves:

Reservoir Volume: 2,141,874 m^3 (on "0" map, o/w @ -2520, 20m thick)
Porosity: 18%, Sw: 40%, Recovery: 30% Vol. Factor: 1.08
Oil in Place: 0.231 x $10^6 m^3$ (1.45 x 10^6 Bbls)
Recov. Oil: 0.064 x $10^6 m^3$ (0.40 x $10^6 m^3$ Bbls)

Note: difference in reservoir volumes from "0" and #5 maps is effect of difference in vertical closure on thick sand. #3A sand is 146m below "0" and 145m above #5 sand.

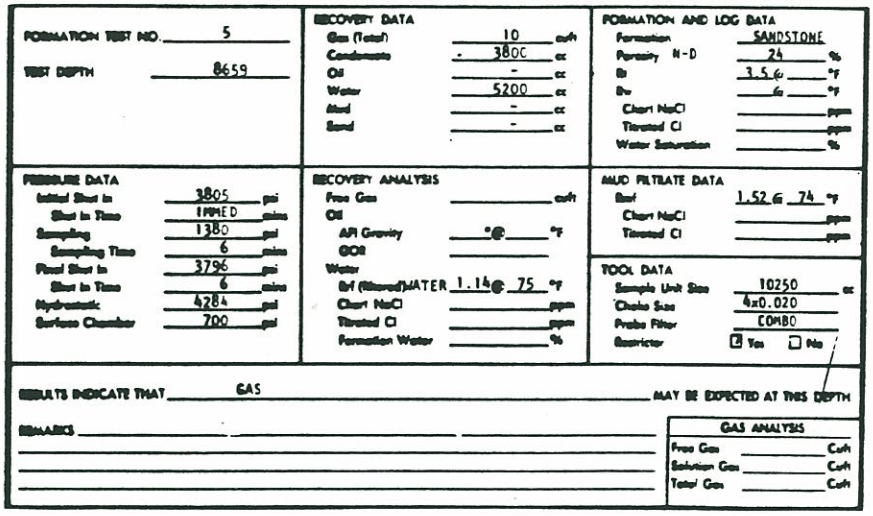
SOUTH PENOBSCOT

SAND #4:

In L-30: 24.4m distributary mouth bar sands, m-c grained, mod. sort, semi-consol, good porosity.

Porosity (%): 23 (Shell Oil), 19 (Saraband), 21 (Density), 28 (Neutron), 23 (Sonic) Separation of denisty and neutron porosities does not support gas dominant.

Water Saturation (%): 34 (Shell Oil), 45 (Saraband)



FORMATION TEST NO. 5
TEST DEPTH 8659

RECOVERY DATA
Gas (Total) 10 cuft
Condensate 3800 cc
Oil - cc
Water 5200 cc
Mud - cc
Sand - cc

FORMATION AND LOG DATA
Formation SANDSTONE
Porosity N-D 24 %
Bt 3.5@ °F
Bv @ °F
Chart NaCl ppm
Titrated Cl ppm
Water Saturation %

PRESSURE DATA
Initial Shut In 3805 psi
Shut In Time IMMED mins
Sampling 1380 psi
Sampling Time 6 mins
Final Shut In 3796 psi
Shut In Time 6 mins
Hydrostatic 4284 psi
Surface Chamber 700 psi

RECOVERY ANALYSIS
Free Gas cuft
Oil
API Gravity °@ °F
GOR
Water
Brf (filtered)WATER 1.14@ 75 °F
Chart NaCl ppm
Titrated Cl ppm
Formation Water %

MUD FILTRATE DATA
Brf 1.52@ 74 °F
Chart NaCl ppm
Titrated Cl ppm

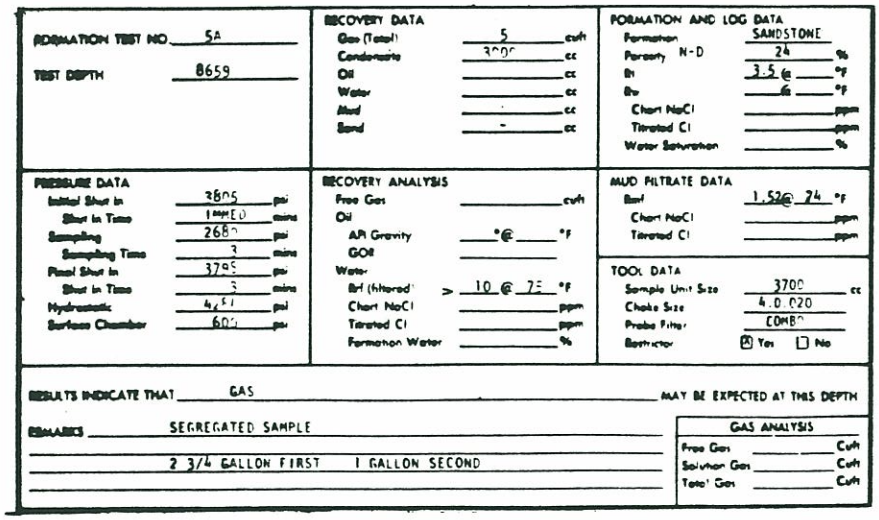
TOOL DATA
Sample Unit Size 10250 cc
Choke Size 4x0.020
Probe Filter COMBO
Restrictor ☒ Yes ☐ No

RESULTS INDICATE THAT GAS MAY BE EXPECTED AT THIS DEPTH

REMARKS

GAS ANALYSIS
Free Gas Cuft
Solution Gas Cuft
Total Gas Cuft

RFT #5
Light Oil/Condensate
47.6° API
Considerable gas



FORMATION TEST NO. 5A
TEST DEPTH 8659

RECOVERY DATA
Gas (Total) 5 cuft
Condensate 3000 cc
Oil cc
Water cc
Mud cc
Sand - cc

FORMATION AND LOG DATA
Formation SANDSTONE
Porosity N-D 24 %
Bt 3.5@ °F
Bv @ °F
Chart NaCl ppm
Titrated Cl ppm
Water Saturation %

PRESSURE DATA
Initial Shut In 3805 psi
Shut In Time IMMED mins
Sampling 2680 psi
Sampling Time 3 mins
Final Shut In 3795 psi
Shut In Time 3 mins
Hydrostatic 4451 psi
Surface Chamber 600 psi

RECOVERY ANALYSIS
Free Gas cuft
Oil
API Gravity °@ °F
GOR
Water
Brf (filtered) > 10 @ 75 °F
Chart NaCl ppm
Titrated Cl ppm
Formation Water %

MUD FILTRATE DATA
Brf 1.52@ 74 °F
Chart NaCl ppm
Titrated Cl ppm

TOOL DATA
Sample Unit Size 3700 cc
Choke Size 4.0 020
Probe Filter COMBO
Restrictor ☒ Yes ☐ No

RESULTS INDICATE THAT GAS MAY BE EXPECTED AT THIS DEPTH

REMARKS SEGREGATED SAMPLE
2 3/4 GALLON FIRST 1 GALLON SECOND

GAS ANALYSIS
Free Gas Cuft
Solution Gas Cuft
Total Gas Cuft

RFT #5A

Elevation: -2607.9 o/w @ -2612.5m

In B-41: Absent

Maximum Reserves:

Reservoir Volume: 37,962,970 m^3 (on #5 map, which is 61m lower; o/w @ - 2612.5; 24m thick)

Porosity: 23%, Sw: 30%, Recovery: 40%, Vol. Factor: 1.08
Oil in Place: 6.112 x $10^6 m^3$ (38.44 x 10^6 Bbls)
Recov. Oil: 2.264 x $10^6 m^3$ (14.24 x 10^6 Bbls)

P50 Reserves:

Reservoir Volume: 15,185,188 m^3 (40% of structure)

Porosity: 21%, Sw: 35%, Recovery: 35% Vol. Factor: 1.12
Oil in Place: 2.073 x $10^6 m^3$ (13.04 x 10^6 Bbls)
Recov. Oil: 0.648 x $10^6 m^3$ (4.07 x $10^6 m^3$ Bbls)

P10 Reserves:

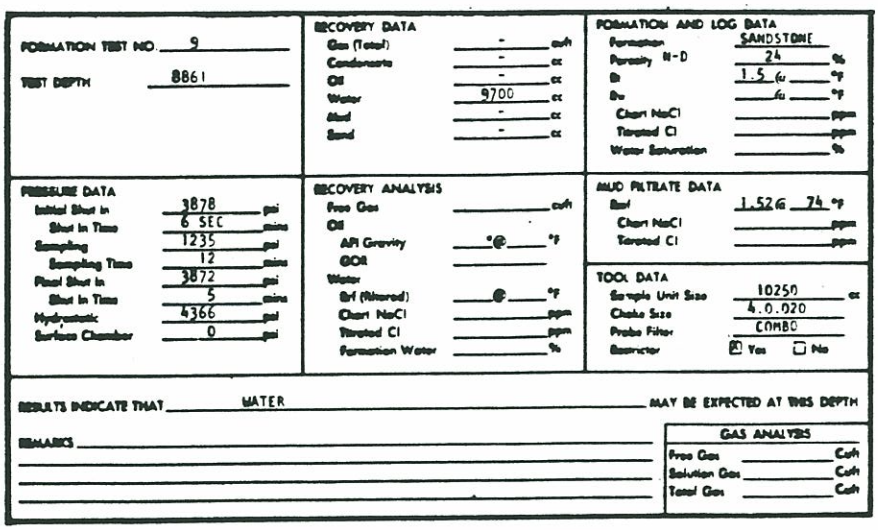
Reservoir Volume: 7,592,594 m^3 (20% of structure)
Porosity: 19%, Sw: 40%, Recovery: 30% Vol. Factor: 1.16
Oil in Place: 0.856 x $10^6 m^3$ (5.44 x 10^6 Bbls)
Recov. Oil: 0.224 x $10^6 m^3$ (1.41 x $10^6 m^3$ Bbls)

SOUTH PENOBSCOT

#5 SAND

In L-30: 59.7m, Barrier Beach sand, f-vc grained, fining up, non calc., semi-to unconsolidated, mod. sort, good porosity, v. slow solv. cut fluor at top.
Porosity (%): 23 (Shell Oil), 18 (Saraband), 21 (Density), 28 (Neutron), 23 (Sonic)
Water Saturation (%): 46 (Shell), 70 (Saraband)
Elevation: -2669.1m, o/w transition from top to -2672.5m or residual oil.

In B-41: 35.4m, Barrier Beach sand as L-30, 6 core frags had 25% average porosity (31.8% max.) and average Kmax 86.3 md (141 md max.).
Porosity (%): 19 (Density), 30 (Neutron), 26 (Sonic)
Elevation: -2667.6m, wet.



FORMATION TEST NO. 9
TEST DEPTH 8861

RECOVERY DATA
Gas (Total) - cuft
Condensate - cc
Oil - cc
Water 9700 cc
Mud - cc
Sand - cc

FORMATION AND LOG DATA
Formation SANDSTONE
Porosity N-D 24 %
Bt 1.5 @ °F
Bw @ °F
Chlori NaCl ppm
Titrated Cl ppm
Water Saturation %

PRESSURE DATA
Initial Shut In 3878 psi
Shut In Time 6 SEC mins
Sampling 1235 psi
Sampling Time 12 mins
Final Shut In 3872 psi
Shut In Time 5 mins
Hydrostatic 4366 psi
Surface Chamber 0 psi

RECOVERY ANALYSIS
Free Gas cuft
Oil
API Gravity °@ °F
GOR
Water
Brf (Filtered) @ °F
Chlori NaCl ppm
Titrated Cl ppm
Formation Water %

MUD FILTRATE DATA
Brf 1.526 74 °F
Chlori NaCl ppm
Titrated Cl ppm

TOOL DATA
Sample Unit Size 10250 cc
Choke Size 4.0.020
Probe Filter COMBO
Reverse ☒ Yes ☐ No

RESULTS INDICATE THAT WATER MAY BE EXPECTED AT THIS DEPTH

REMARKS

GAS ANALYSIS
Free Gas Cuft
Solution Gas Cuft
Total Gas Cuft

RFT #9
Recov. water

Maximum Reserves:

Reservoir Volume: 25,924,537 m³ (#5 map;
o/w @ - 2669m; 30m thick)

Porosity: 23%, Sw: 30%, Recovery: 40%, Vol. Factor: 1.04
Oil in Place: 4.174 x 10^6m³ (26.25 x 10^6 Bbls)
Recov. Oil: 2.264 x 10^6m³ (10.10 x 10^6 Bbls)

P50 Reserves:

Reservoir Volume: 8,460,863 m³ (#5 map;
o/w @ -2660m; 30m thick
Porosity: 21%, Sw: 35%, Recovery: 35% Vol. Factor: 1.06
Oil in Place: 1.155 x 10^6m³ (7.26 x 10^6 Bbls)
Recov. Oil: 0.381 x 10^6m³ (2.40 x 10^6m³ Bbls)

P10 Reserves:

Reservoir Volume: 1,196,067 m³ (#5 map, Fault independent, 30m thick)
Porosity: 19%, Sw: 40%, Recovery: 30% Vol. Factor: 1.08

Oil in Place: 0.136 x $10^6 m^3$ (0.86 x 10^6 Bbls)
Recov. Oil: 0.038 x $10^6 m^3$ (0.24 x $10^6 m^3$ Bbls)

NORTH AND NORTHEAST

20m SAND

Assumed barrier beach sand similar to #5 sand in south Penobscot (seismic character supports this). Used #5 Sand Map.

Maximum Reserves:

Reservoir Volume: 89,005,004 m^3 (N&NE connected and o/w @ - 2670m)

Porosity: 23%, Sw: 30%, Recovery: 40%, Vol. Factor: 1.04
Oil in Place: 14.330 x $10^6 m^3$ (90.13 x 10^6 Bbls)
Recov. Oil: 5.511 x $10^6 m^3$ (34.67 x 10^6 Bbls)

P50 Reserves: (o/w @ -2660 & North & NE are separate)

North:
Reservoir Volume: 44,230,941 m^3
Porosity: 21%, Sw: 35%, Recovery: 35% Vol. Factor: 1.06
Oil in Place: 6.037 x $10^6 m^3$ (37.97 x 10^6 Bbls)
Recov. Oil: 1.994 x $10^6 m^3$ (12.54 x $10^6 m^3$ Bbls)

Northeast:
Reservoir Volume: 8,734,453 m^3 other parameters as above
Oil in Place: 1.192 x $10^6 m^3$ (7.50 x 10^6 Bbls)
Recov. Oil: 0.394 x $10^6 m^3$ (2.48 x $10^6 m^3$ Bbls)

P10 Reserves:

North:
Reservoir Volume: 22,115,470 m^3 (50% of P-50 Value)
Porosity: 19%, Sw: 40%, Recovery: 30% Vol. Factor: 1.08
Oil in Place: 2.521 x $10^6 m^3$ (15.86 x 10^6 Bbls)
Recov. Oil: 0.700 x $10^6 m^3$ (4.40 x $10^6 m^3$ Bbls)

Northeast:
Reservoir Volume: 4,367,227 m^3 (50% of P-50 Value)
Oil in Place: 0.498 x $10^6 m^3$ (3.13 x 10^6 Bbls)
Recov. Oil: 0.138 x $10^6 m^3$ (0.87 x $10^6 m^3$ Bbls)

NORTH AND NORTHEAST

2m SAND

Assumed shallow marine sand similar to sands 1 & 3 in L-30. Used #5 Sand Map.

Maximum Reserves:

Reservoir Volume: 12,729,231 m^3 (o/w @ -2670 N&NE)
Porosity: 23%, Sw: 30%, Recovery: 40%, Vol. Factor: 1.04
Oil in Place: 2.049 x $10^6 m^3$ (12.89 x 10^6 Bbls)
Recov. Oil: 0.788 x $10^6 m^3$ (4.96 x 10^6 Bbls)

P50 Reserves:

Reservoir Volume: 1,364,616 m^3 (50% of structure)
Porosity: 21%, Sw: 35%, Recovery: 35% Vol. Factor: 1.06
Oil in Place: 0.869 x $10^6 m^3$ (5.46 x 10^6 Bbls)
Recov. Oil: 0.287 x $10^6 m^3$ (1.80 x $10^6 m^3$ Bbls)

P10 Reserves:

Reservoir Volume: 2,545,846 m^3 (20% of structure)
Porosity: 19%, Sw: 40%, Recovery: 30% Vol. Factor: 1.08
Oil in Place: 0.290 x $10^6 m^3$ (1.83 x 10^6 Bbls)
Recov. Oil: 0.081 x $10^6 m^3$ (0.51 x $10^6 m^3$ Bbls)

CONCLUSIONS AND RECOMMENDATIONS

The Penobscot Prospect is a good prospect with the proven presence of light oil, condensate and gas. Maximum recoverable oil reserves are 19.334 X 10^6 m^3 (121.63 X 10^6 Bbls). Probable recoverable oil reserves are 7.63 X 10^6 m^3 (48.03 X 10^6 Bbls). There is potential for one half again to twice the stated reserves if additional potential reservoirs were considered.

No additional definition is required, except possibly for some detailed reservoir engineering analysis. It is recommended that the first well confirm the existence of a significantly thick pay section on the south side of the structure at a point that is high on both the "O" Limestone and #5 sand depth structure maps. The best location is at the intersection of seismic inline 55 and crossline 1504, which is in an approximate water depth of 125m. This location is approximately 29 m higher than Penobscot L-30 at the #5 sand level, and 8 m higher at the "O" Limestone level. It would also be a good place to evaluate the potential for reservoir in the Abenaki, the location being approximately 100 m above the L-30 location at that level, and within 150 m of faults.

Full scale inline and crossline seismic sections should be printed and evaluated before a location is finally selected.

A possible follow-up location to evaluate the structure on the north side is at the intersection of seismic inline 102 and crossline 1498 in an approximate water depth of 178m. The "O" Limestone would be approximately 30 m higher than at L-30, and the #5 sand would be approximately 88 m higher. Problems could occur at this location because the structure is very steep and faults are within 50 m.

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APPENDIX A:

FORMATION TOPS AND ELEVATIONS AT PENOBSCOT WELLS

FORMATION TOPS

Stratigraphic Unit (GR-Sonic)	Well: Petro-Can Shell Penobscot L-30 Location: 44-09'43.558" N. Lat, 60-09.335" W. KB & RT: 99'(30.2m) & (29.9m) Water Depth: 451' (137.5m) Drill Depth (ft. from RT)	Elevation (m)	Well: Shell Petro-Can Penobscot B- Location: 44-10'02.27" N. Lat, 60-06.34.53 W KB & RT: 99'(30.2m) & 98 (29.9m) Water Depth: 387' (118.0m) Drill Depth (ft. from RT)	Elevation (m)
Unknown thickness of Quat/Pleist over Tertiary Banquereau Fm.	549	-137.5	485	-118.0
WYANDOT FORMATION (Main Chalk)	2845	-837.3	2817	-828.8
Transitional Claystone and argillaceous chalk	3086	-910.7	3144	-928.4
DAWSON CANYON FM. (GSC picked 3122' in L-30, Equiv. in B-41 @ 3126')	3230	-954.6	3232	-955.2
PETREL MEMBER	3539	-1048.8	3586	-1063.1
LOWER DAWSON CANYON FORMATION	3592	-1065.0	3653	-1083.6
LOGAN CANYON FORMATION	3730	-1107.0	3796	-1127.2
Mid Logan Canyon Seismic Pick (Approx. Reservoir @ Cohasset)	5616	-1681.9	5728	-1716.0
NORMAL FAULTS IN B-41 (6975' - 7028 - Approx. 24m missing)			6975	-2096.1
NASKAPI MEMBER	7018	-2109.2	7031	-2113.2
UPPER MISSISAUGA FORMATION	7386	-2221.4	7372	-2217.1
MIDDLE MISSISAUGA FM. (TOP "0" LIMESTONE MRKR.)	7900	-2378.0	7908	-2380.5
BASE "0" LIMESTONE MARKER	8099	-2438.7	8110	-2442.1
Sand #1 (1.5m in L-30, Tight Siltstone in B-41)	8130	2448.2	8142	-2451.8
Sand #2 (18.3m in L-30, 2.7m in B-41)	8212	-2473.1	8245	-2483.2
Sand #3 (2.7m in L-30, Absent in B-41)	8345	-2513.7		
Sand #4 (29.9m in L-30, Absent in B-41)	8656	-2608.5		
Sand #5 (59.4m in L-30, 35.4m in B-41)	8856	-2669.4	8850	-2667.6
LOWER MISSISAUGA/MIC MAC	10468	-3160.8	10468	-3160.8
ABENAKI FORMATION - BACCARO MEMBER	11169	-3374.4	11224	-3391.2
MIC MAC FORMATION TONGUE	11278	-3407.7		
MIDDLE BACCARO MEMBER	11434	-3455.2		
VERRILL CANYON FORMATION TONGUE	12128	-3666.7		
LOWER BACCARO MEMBER	13007	-3934.7		
ABENAKI FORMATION - MISAINE MEMBER	13492	-4082.5		
TOTAL DEPTH	14000	-4237.5	11300	-3414.4

APPENDIX B:

RESERVOIR VOLUMES

Table B-1:

SOUTH PENOBSCOT - RESERVOIR VOLUMES BASED ON "0" LMS MAP

SAND #'S 1, 2, 3, 3A (Assuming Congruency with "0" Elevation Difference as in L-30)

SUB-STRUC-TURE	STRUCTURE SUBSEA (M) SANDS					AREA ENCLOSED BY CONTOUR	AREA BETWEEN CONTOURS	#1 SAND (1.5m) O/W @ -2,451 m		#2 SAND (18 m) O/W @ -2,476 m		#3 SAND (2.4 m) O/W @ -2,515 m		#3A SAND (20 m) O/W @ 2,520 m	
	"0"	#1	#2	#3	#3A	m2	m2	Net Pay (m)	RES. VOL. m3	NP (m)	RES. VOL. m3	NP (m)	m3	Net Pay (m)	m3
South 2	2,368	2,439	2,462	2,503	2,514	9,950		1.5	14,925	14	139,300	2.4	23,880	6	59,700
							30,335	1.5	45,503	13	394,355	2.4	72,804	5	161,675
	2,370	2,441	2,464	2,505	2,516	40,285									
							41,010	1.5	61,515	11	451,110	2.4	98,424	3	123,030
	2,372	2,443	2,466	2,507	2,518	81,295									
							67,308	1.5	100,962	9	605,772	2.4	161,539	1	67,308
	2,374	2,445	2,468	2,509	2,520	148,603									
							107,795	1.5	161,692	7	754,565	2.4	258,708	0	0
	2,376	2,447	2,470	2,511	2,522	256,398									
							198,566	1.5	297,849	5	992,830	2.36	468,616	0	0
	2,378	2,449	2,472	2,513	2,524	454,964									
Subtotal						454,964		1.5	682,446	Avg. 7.34	3,337,932	Avg. 2.38	1,083,971	Avg. 2.7	401,713
South 3	2,376	2,447	2,470	2,511	2,522	3,162		1.5	4,743	6	18,972	2.4	7,589		0
							78,971	1.5	118,457	5	394,855	2.36	186,372		0
	2,378	2,449	2,472	2,513	2,524	82,133									
Subtotal						82,133		1.5	123,200	Avg. 5.04	413,827	Avg. 2.36	193,961		
South 2 & 3	2,378	2,449	2,472	2,503	2,524	537,097		1.5	805,646	6.99	3,751,759	2.38	1,277,932		0
							277,835	1.5	416,752	3	833,505	1	277,835		0
	2,380	2,451	2,474	2,515	2,526	814,932				Avg.		Avg.			
Subtotal						814,932		1.5	1,222,398	5.63	4,585,264	1.91	1,555,767		
South 1	2,368	2,439	2,462	2,503	2,514	8,465		1.5	12,698	14	118,510	2.4	20,316	6	50,790
							54,158	1.5	81,237	13	704,054	2.4	129,979	5	270,790
	2,370	2,441	2,464	2,505	2,516	62,623				Avg.		Avg.		Avg.	
Subtotal						62,623		1.5	93,935	13.14	822,564	2.4	150,295	5.14	321,580
South 4	2,370	2,441	2,646	2,505	2,516	16,819		1.5	25,228	12	201,828	2.4	40,366	4	67,276
South 5	2,370	2,441	2,464	2,505	2,516	5,321		1.5	7,982	12	63,852	2.4	12,770	4	21,284
South 1, 4 & 5	2,370	2,441	2,464	2,505	2,516	84,763		1.5	127,145	12.84	1,088,244	2.4	203,431	4.84	410,142
							310,701	1.5	466,051	11	3,417,711	2.4	745,682	3	932,103
	2,372	2,443	2,466	2,507	2,518	395,464									
							397,916	1.5	596,874	9	3,581,244	2.4	954,998	1	397,916
	2,374	2,445	2,468	2,509	2,520	793,380									
							376,599	1.5	564,899	7	2,636,193	2.4	903,838	0	0
	2,376	2,447	2,470	2,511	2,522	1,169,979									
							377,268	1.5	565,902	5	1,886,340	2.36	890,353	0	0
	2,378	2,449	2,472	2,513	2,524	1,547,247									
Subtotal						1,547,247		1.5	2,320,871	Avg. 8.15	12,609,732	2.39	3,698,302		1,740,161
South 6	2,378	2,449	2,472	2,513	2,524	16,956		1.5	25,434	4	67,824	2	33,912		0
South 7	2,378	2,449	2,472	2,513	2,524	6,534		1.5	9,801	4	26,136	2	13,068		0
South 1, 4, 5, 6 & 7	2,378	2,449	2,472	2,513	2,524	1,570,737		1.5	2,356,106	8.09	12,703,692	2.38	3,745,282		
							420,127	0.75	315,095	3	1,260,381	1	420,127		
	2,380	2,451	2,474	2,515	2,526	1,990,864		Avg.		Avg.		Avg.			
Subtotal						1,990,864		1.34	2,671,201	7.01	13,964,073	2.09	4,165,409		
South 8	2,378	2,449	2,472	2,513	2,524	60,138		1.5	90,207	4	240,552	2	120,276		
South 9	2,378	2,449	2,472	2,513	2,524	9,675		1.5	14,512	4	38,700	2	19,350		
South 8 & 9	2,378	2,449	2,472	2,513	2,524	69,813		1.5	104,719	4	279,252	2	139,626		
							124,245	0.75	93,184	3	372,735	1	124,245		
	2,380	2,451	2,474	2,515	2,526	194,058				Avg.		Avg.			
Subtotal						194,058		Avg. 1.02	197,903	3.36	651,987	1.36	263,871		
South 1-9 All	2,380	2,451	2,474	2,515	2,526	2,999,854			4,091,502	6.4	19,201,324		5,985,047		
							694,259	0	0	1	694,259	0	0		
	2,382	2,453	2,476	2,517	2,528	3,694,113									
							561,847	0	0	0	0	0	0		
	2,384	2,455	2,478	2,519	2,530	4,255,960									
Total						4,255,960		Avg. 1.36	4,091,502	Avg. 5.38	19,895,583	Avg. 2.00	5,985,047	Avg. 2.27	2,141,874

See Figure 11 for Contour Map and Substructure designatio

Table B-2:

SOUTH PENOBSCOT - RESERVOIR VOLUMES BASED ON #5 SAND DEPTH MAP - SAND #'S 5, 4, 3A, 3

SUB-STRUC-TURE	STRUCTURE SUBSEA (m) SANDS				AREA ENCLOSED BY CONTOUR	AREA BETWEEN CONTOURS	#5 SAND 30 M Thick						#4 SAND (2.4 m) O/W @ -2,612.5 m		#3A SAND (20 m) O/W @ -2,520 m		#3 SAND (2.4 m) O/W @ 2,514 m	
							O/W @ -2,669 m		O/W @ -2,660 m		FAULT INDEPENDENT							
	#5	#4	#3	#3A	m2	m2	Net Pay (m)	RES. VOL. m3	Net Pay (m)	RES. VOL. m3	Net Pay m3	RES. VOL. m3	Net Pay (m)	RES. VOL. m3	Net Pay (m)	RES. VOL. m3	Net Pay (m)	RES. VOL. m3
SOUTH 1	2,640	2,579	2,495	2,484	6,354		29	184,266	20	127,080			24	152,080	20	127,080	2.4	15,250
						42,591	26.5	1,128,662	17.5	745,343			24	1,022,184	20	851,820	2.4	102,218
	2,645	2,584	2,500	2,489	48,945													
						114,658	21.5	2,465,147	12.5	1,433,225			23.98	2,749,499	17.5	2,006,515	2.4	275,179
	2,650	2,589	2,505	2,494	163,603													
						113,552	16.5	1,873,608	7.5	851,640			21	2,384,592	12.5	1,419,400	2.4	272,525
	2,655	2,594	2,510	2,499	277,155													
Subtotals					277,155		Avg. 20.39	5,651,683	Avg. 11.39	3,157,288			Avg. 22.76	6,308,771	Avg. 15.89	4,404,815	Avg. 2.4	665,172
SOUTH 2	2,645	2,584	2,500	2,489	25,865		26.0	672,490	17.0	439,705	12.0	310,380	24	620,760	20	517,300	2.4	62,076
						47,667	21.5	1,024,841	12.5	595,838	7.5	357,503	23.98	1,143,055	17.5	834,173	2.4	114,401
	2,650	2,589	2,505	2,494	73,532													
						150,104	16.5	2,476,716	7.5	1,125,780	2.5	375,260	21	3,152,184	12.5	1,876,300		360,250
	2,655	2,594	2,510	2,499	223,636													
Subtotals					223,636		Avg. 18.66	4,174,047	Avg. 9.66	2,161,323	Avg. 4.66	1,043,143	Avg. 21.98	4,915,999	Avg. 14.43	3,227,773	Avg. 2.4	536,737
SOUTH 3	2,655	2,594	2,510	2,499	76,462		16.0	1,223,392	7.0	1,223,392	2	152,924	20.5	1,567,471	12.0	917,544	2.4	183,509
SOUTH 1, 2 & 3	2,655	2,594	2,510	2,499	577,253		19.14	11,049,122	11.33	6,542,003			22.16	12,792,241	14.81	8,550,132	2.4	1,385,408
						767,544	11.5	8,826,756	2.5	1,918,860			16	12,280,704	7.5	5,756,580	2.4	1,842,106
	2,660	2,599	2,515	2,504	1,344,797													
						786,658	6.5	5,113,277	0	0			11	8,643.238	2.5	1,966,645	2.4	1,887,979
	2,665	2,604	2,520	2,509	2,131,455													
						584,614	1.6	935,382	0	0			6	3,507,684	0	0	1.8	1,052,305
	2,670	2,609	2,525	2,514	2,716,069													
						607,586	3	0	0	0			1.2	729,103	0	0	0	0
	2,675	2,614	2,530	2,519	3,323,655													
TOTALS					3,323,655	Area Above -2,669 m 2,599,146	Avg. 9.97	25,924,537	Avg. 11.02	8,460,863	Avg. 3.99	1,196,067	Avg. 11.42	37,962,970	Avg. 7.63	16,273,357	Avg. 2.27	6,167,796

Structure on individual sands assumed congruent to structure on #5 Sand.
Elevation difference is that in L-30 well.

See Figure 12 for contours and substructure designation

Table B-3:

NORTH & NORTHEAST PENOBSCOT - RESERVOIR VOLUMES BASED ON #5 SAND MAP FOR ONE 20 m SAND AND ONE 2m SAND

SUB-STRUC-TURE See Map	STRUCTURE SUBSEA (m)	AREA ENCLOSED BY CONTOUR (m2)	AREA BETWEEN CONTOURS (m2)	20 m Thick Sand o/w @ -2670m		20 m Thick Sand o/w @ -2660m		2 m Thick Sand o/w @ -2670m		2 m Thick Sand o/w @ -2660m	
				Net Pay (m)	RES. VOL. m3	Net Pay (m)	RES. VOL. m3	Net Pay (m)	RES. VOL. m3	Net Pay (m)	m3
North 1	2,600	27,791		20	555,820	20	555,820	2	55,582	2	55,582
			8,350	20	167,000	20	167,000	2	16,700	2	16,700
	2,605	36,141									
			12,239	20	244,780	20	244,780	2	24,478	2	24,478
	2,610	48,380									
			12,103	20	242,060	20	242,060	2	24,206	2	24,206
	2,615	60,483									
			11,210	20	224,200	20	224,200	2	22,420	2	22,420
	2,620	71,693									
			29,922	20	598,440	20	598,440	2	59,844	2	59,844
	2,625	101,615									
			44,343	20	886,860	20	886,860	2	88,686	2	88,686
	2,630	145,958		Avg.		Avg.		Avg.		Avg.	
Subtotals		145,958		20	2,919,160	20	2,919,160	2	291,916	2	291,916
North 2	2,620	35,768		20	715,360	20	715,360	2	71,536	2	71,536
			18,753	20	375,060	20	375,060	2	37,506	2	37,506
	2,625	54,521									
			21,166	20	423,320	20	423,320	2	42,332	2	42,332
	2,630	75,687									
Subtotals		75,687		Avg. 20	1,513,740	Avg. 20	1,513,740	Avg. 2	151,374	Avg. 2	151,374
North 1 & 2	2,630	221,645		20	4,432,900	20	4,432,900	2	443,290	2	443,290
			136,897	20	2,737,940	20	2,737,940	2	273,794	2	273,794
	2,635	358,542									
Subtotals		358,542		20	7,170,840	20	7,170,840	2	717,084	2	717,084
North 3	2,630	32,772		20	655,440	20	655,440	2	65,544	2	65,544
		90,490	57,718	20	1,154,360	20	1,154,360	2	115,436	2	115,436
Subtotals	2,635	90,490		Avg. 20	1,809,800	Avg. 20	1,809,800	Avg. 2	180,098	Avg. 2	180,098
North 4	2,635	103,733		20	2,074,660	20	2,074,660	2	203,466	2	207,466
North 1, 2, 3 & 4	2,635	552,765		20	11,055,300	20	11,055,300	2	1,105,530	2	1,105,530
			517,313	20	10,346,260	20	10,346,260	2	1,034,626	2	1,034,626
	2,640	1,070,078									
Subtotals		1,070,078		Avg. 20	21,401,560	Avg. 20	21,401,560	Avg 2	2,140,156	Avg. 2	2,140,156
North 5	2,630	13,734		20	274,680	20	274,680	2	27,468	2	27,468
			19,797	20	395,940	20	395,940	2	39,594	2	39,594
	2,635	33,531									
			24,806	20	496,120	20	496,120	2	49,612	2	49,612
	2,640	58,337									
Subtotals		58,337		Avg. 20	1,166,740	Avg. 20	1,166,740	Avg 2	116,674	Avg. 2	116,674
North 1, 2, 3, 4 & 5	2,640	1,128,415		20	22,568,300	20	22,568,300	2	2,256,830	2	2,256,830
			487,041	20	9,740,820	17.5	8,523,218	2	974,082	2	974,082
	2,645	1,615,456									
Subtotals		1,615,456		Avg. 20	32,309,120	Avg. 19.25	31,091,518	Avg 2	3,230,912	Avg. 2	3,230,912
North 6	2,625	21,605		20	432,100	20	432,100	2	43,210	2	43,210
			17,972	20	359,440	20	359,440	2	35,944	2	35,944
	2,630	39,577									
			9,552	20	191,040	20	191,040	2	19,104	2	19,104
	2,635	49,129									
			21,282	20	425,640	20	425,640	2	42,564	2	42,564
	2,640	70,411									
Subtotals		70,411		Avg. 20	1,408,220	Avg. 20	1,408,220	Avg 2	140,822	Avg. 2	140,822
North 7	2,640	8,225		20	164,500	20	164,500	2	16,450	2	16,450
North 6 & 7	2,640	78,636		20	1,572,720	20	1,572,720	2	157,272	2	157,272
		151,199	72,563	20	1,451,260	17.5	1,269,853	2	145,125	2	145,126
Subtotals	2,645	151,199		Avg. 20	3,023,980	Avg. 18.8	2,842,573	Avg 2	302,398	Avg. 2	302,398
North 1, 2, 3, 4, 5, 6 & 7 (All North above 2,660)											
	2,645	1,766,655		20	35,333,100	19.21	33,934,091	2	3,533,310	2	3,533,310
			516,235	20	10,324,700	12.5	6,452,937	2	1,032,470	2	1,032,470
	2,650	2,282,890									
			394,650	17.5	6,906,375	7.5	2,959,300	2	789,875	2	789,300
	2,655	2,677,540									
			353,615	12.5	4,420,108	2.5	884,038	2	707,230	1.4	495,061
	2,660	3,031,155									
Subtotal		3,031,155		Avg. 18.80	56,984,363	14.59	44,230,941	Avg 2	6,062,310	Avg. 1.93	5,850,141
Northeast 1	2,645	11,805		20	236,100	15	177,075	2	23,610	2	23,610
			184,153	20	3,683,080	12.5	2,301,913	2	368,306	2	368,306
	2,650	195,958									
Subtotals		195,958		Avg. 20	3,919,160	Avg. 12.65	2,478,988	Avg 2	391,916	Avg. 2	391,916
Northeast 2	2,645	10,058		20	201,160	15	150,870	2	20,116	2	20,116
			26,833	20	536,660	12.5	335,412	2	53,666	2	53,666
	2,650	36,891									
Subtotals		36,891		Avg. 20	737,820	Avg. 13.18	486,282	Avg 2	73,782	Avg. 2	73,782
Northeast 1 & 2	2,650	232,849		20	4,656,980	12.73	2,965,270	2	465,698	2	465,698
			309,754	17.5	5,420,695	7.5	2,323,155	2	619,508	2	619,508
	2,655	542,603									
Subtotals		542,603		Avg. 18.57	10,077,675	Avg. 9.75	5,288,425	Avg 2	1,085,206	Avg. 2	1,085,206
Northeast 3	2,645	41,650		20	833,000	15	624,750	2	83,300	2	83,300
			49,995	20	999,900	12.5	624,938	2	99,990	2	99,990
	2,650	91,645									
			119,797	17.5	2,096,448	7.5	898,477	2	239,594	2	239,594
	2,655	211,442									
Subtotals		211,442		Avg. 18.58	3,929,348	Avg. 10.16	2,148,165	Avg 2	422,884	Avg. 2	422,884
Northeast 1, 2 & 3	2,655	754,045		18.50	14,007,023	9.86	7,436,590	2	1,508,090	2	1,508,090
			339,537	12.5	4,244,213	2.5	848,843	2	679,074	1.4	475,352
	2,660	1,093,582									
Subtotals		1,093,582		Avg. 16.69	18,251,236	Avg. 7.58	8,285,453	Avg 2	2,187,164	Avg. 1.81	1,983,442
Northeast 4	2,655	15,823		15	237,345	5	79,115	2	31,646	2	31,646
Northeast 5	2,655	12,091		15	181,365	5	60,455	2	24,182	2	24,182
Northeast 4 & 5	2,655	27,914		15	418,710	5	139,570	2	55,828	2	55,828
			123,780	12.5	1,547,250	2.5	309,450	2	247,560	1.4	173,292
	2,660	151,694									
Subtotals		151,694		Avg. 12.9	1,965,960	Avg. 2.96	449,020	Avg 2	303,388	Avg. 1.51	229,120
Northeast All above - 2,660m	2,660	1,245,276		Avg. 16.24	20,217,196	7.01	8,734,453	Avg 2	2,490,552	Avg. 1.78	2,212,562
All North & Northeast	2,660	4,276,431		18.05	77,201,559	Avg. 12.38	52,965,394	2	8,552,862	Avg. 1.86	8,062,703
			1,106,174	7.5	8,296,305	0		2	2,212,348	0	
	2,665	5,382,,605									
			1,402,872	2.5	3,507,180	0		1.4	1,964,021	0	
	2,670	6,785,477									
Total above-2670m				Avg. 13.12	89,005,044			Avg 1.88	12,729,231		

See Figure 12 for Contours and Substructure designation.