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OPEN FILE REPORT

"Interpretation of Quaternary and upper Neogene seismic stratigraphy on the continental slope off St. Pierre Bank" by L. Meagher, Earth and Ocean Research Ltd.

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INTERPRETATION OF QUATERNARY AND UPPER NEOGENE SEISMIC STRATIGRAPHY ON THE CONTINENTAL SLOPE OFF ST. PIERRE BANK

Submitted to

Supply and Services Canada
Atlantic Regional Supply Centre.
2 Morris Drive
Burnside Industrial Park
Dartmouth, N.S.
B3B 1K5

Submitted by

Earth & Ocean Research Ltd.
22 Waddell Ave.
Dartmouth, N.S.
B3B-1K3
(902) 465-3974

Scientific Authority:	Dr. David Piper
DSS Science Procurement Assistant:	Susan Thorpe
Earth & Ocean Research Project Manager:	Lauchlin Meagher
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2.Ø) DATA BASE

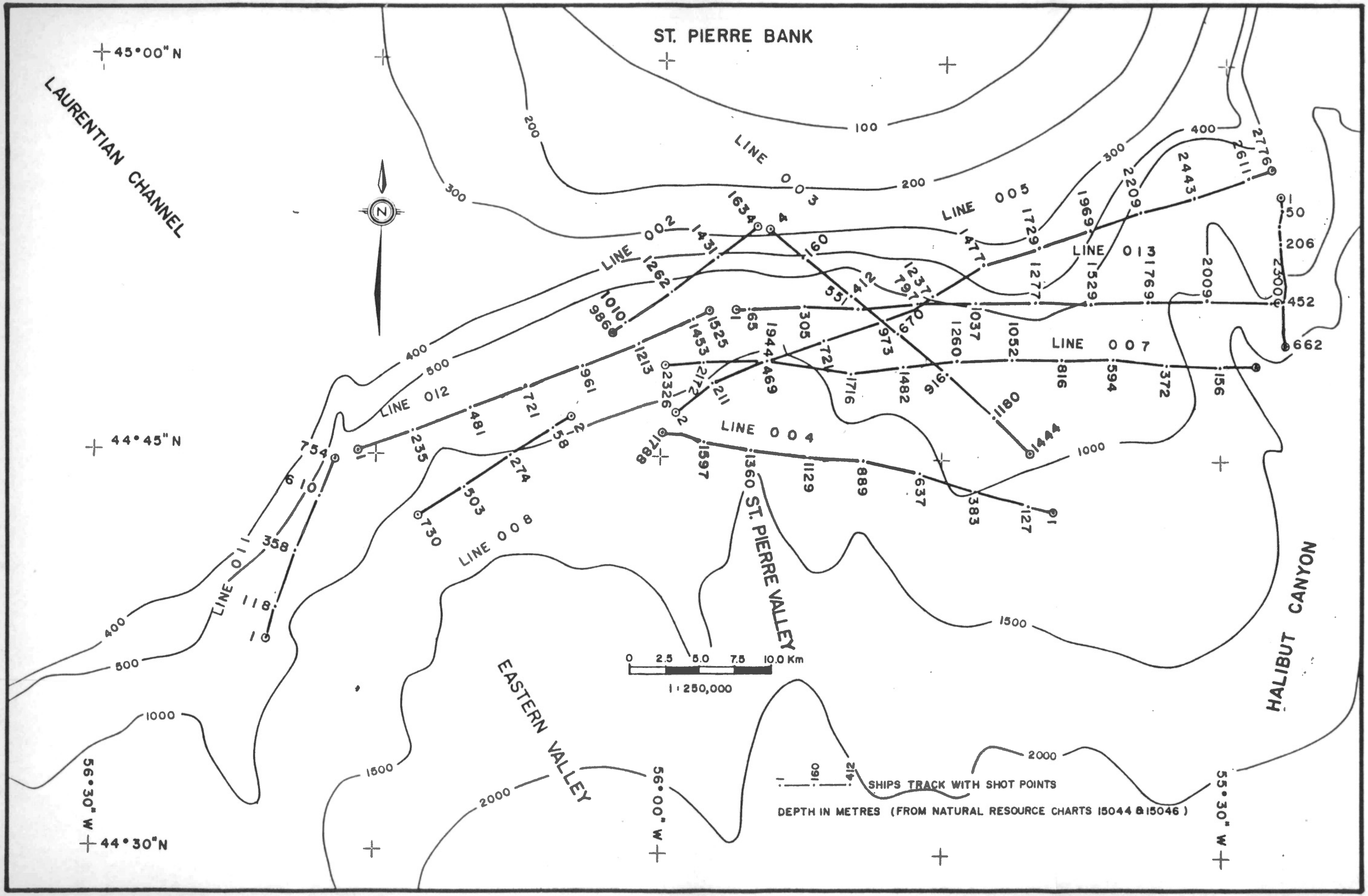
The data base consists of 256 line Km of high resolution seismic profiles run over an irregular but generally east-west oriented grid (fig 1). The sound source employed was a 4Ø cubic inch air gun. The return signal was received on a 4ØØ meter long, 24 channel, Teledyne streamer and recorded at a 1 msec sample rate using a Texas Instrument DFS IV recording system. The data was processed by GSI in Calgary to produce 12 fold stacked profiles of 3 seconds record length. A total of 1Ø profiles were produced for this area.

The quality of the resultant sections is generally very good. A maximum penetration to 1.6 seconds (two way time) sub-seafloor was achieved with a general penetration to Ø.8 to 1 second. Where the geology permits, the sections are noise-free and reflectors are clear and well defined. Data quality is degraded significantly over the western part of the survey due to noise generated from within the geologic sequence and is not related to faulty collection or processing. Gaps along seismic lines do occur but they are not significant. Interpretation of seismic character in the shallower areas is made difficult by the 1st primary multiple, which otherwise occurs below the zone of good seismic return.

More critical constraints on interpretation are the paucity of line cross-overs and positioning uncertainties. For the 1Ø lines processed,there are only 5 cross-over points and lines 2, 4, 6, 8, 11, and 12 do not intersect with any other processed lines. Jump correlations are required to extend correlations to the majority of lines and correlation by the "close the loop" method is virtually impossible. Jump correlations assume that reflector characteristics will remain constant over intervening distances, where as in this geographic area reflector variability is quite common.

Positioning discrepancies were discovered during attempts to tie profiles at their cross-over points. Water depth, reflector character, and reflector spacing combine to produce a unique vertical set of data points that will, in most instances, align at only one position on an intersecting line. By aligning the profiles in this manner, positioning errors of varying magnitude were discovered, some as large as 6 Km. Since the relative position of survey lines was in doubt, a reconstruction of their true geographic position from the cross-over method was not attempted.

Well control or other seismic control does not exist within this area, and the very noisy seismic character in the western area prevents the carrying over of time horizons from the nearest well, the Dauntless D 35, located 3Ø Km to the northeast on Banquereau Bank.



ST. PIERRE BANK
LAURENTIAN CHANNEL
ST. PIERRE VALLEY
EASTERN VALLEY
HALIBUT CANYON
45°00"N
44°45"N
44°30"N
56°30"W
56°00"W
55°30"W
LINE 002
LINE 003
LINE 004
LINE 005
LINE 007
LINE 008
LINE 011
LINE 012
LINE 013
0 2.5 5.0 7.5 10.0 Km
1:250,000
SHIPS TRACK WITH SHOT POINTS
DEPTH IN METRES (FROM NATURAL RESOURCE CHARTS 15044 & 15046)

FIGURE I

3.Ø) PHYSICAL SETTING

The survey area, bounded by latitudes 44 3Ø and 45 ØØ N, and longitudes 55 25 and 56 4Ø W, is located due south of St. Pierre Bank, on the eastern flank of the Laurentian Channel. The continental slope descends to the south in this area. Water depths on the seismic sections away from submarine channels increase north to south from 3Ø2 meters to approximately 1ØØØ meters.

The topography is dominated by a high that plunges southeastward from the southern tip of St. Pierre Bank. The high is located in the east-central sector of the map area. The eastern flank of the high descends into a significant submarine canyon that leads south from the mouth of the Halibut Channel, and a depth of 1586 meters is recorded on seismic section ØØ7 in this area. This canyon is informally called Halibut Canyon. The western flank descends more gradually onto the floor of the East Valley of the Laurentian Fan.

The seafloor over the high is flat and exhibits a rough micro-relief of 1Ø meters or so at its shallower end. Away from the crest of the high this micro-relief is generally absent and the seafloor becomes undulous, with local swells and swales generally of 25 to 1ØØ meters amplitude.

As well as the large canyon developed on the eastern edge of the area, a smaller canyon occurs on the southwestern edge. This is seen on a more regional map as the head of a small, unnamed canyon extending to the south of the site and has been informally called St. Pierre Valley by Piper et al (in press). Where line ØØ4 crosses this feature, a water depth of 135Ø meters is recorded.

4.Ø) GENERAL DESCRIPTION of SEISMIC CHARACTER

The area is subdivided into east and west provinces on the basis of seismic character (Figure 2, Table 1).

The eastern province is dominated by a domed sedimentary wedge developed on a regularly southward dipping plane. The wedge thins to the south and is composed of several smaller prograded wedges that are separated by unconformities and paraconformities. The wedges are of variable thickness over their length and width, the result of both contemporaneous but uneven sedimentation and of subsequent erosion.

Within individual wedges, reflectors are generally closely spaced and continuous, of moderate amplitude, and are parallel to sub-parallel. Occasional zones of irregular to chaotic reflectors are interspersed within these units.

The western province is dominated by an irregular to rough surface and chaotic to poorly continuous, low amplitude internal reflectors. The noise generated by the irregular surfaces precludes good definition of the base of the sequence and units within the sequence are poorly defined. The sequence thickens to the south and west from feather edges that interfinger with the well defined wedges to the east or, possibly in some cases, grade laterally into them.

TABLE 1

STRATIGRAPHIC UNIT DESCRIPTIONS

Unit	Hor.	Approx. Measured Thickness	Relation to Underlying Unit(s)	Reflector Character	Inferred Geology
H-2		50Msc.	Unconformable	Widely spaced, low amplitude,parallel continuous	Fine grained upper slope facies
H-1		160	Conformable to Unconformable	Short, closely spaced, steeply dipping	Coarse grained shelf edge facies
	7				
G-4		250	Unconformable	Chaotic to discon-tinuous	Glacial deposit
G-3		100	Unconformable	Short, closely spaced, steeply dipping	Coarse grained shelf edge facies
G-2		170	Conformable	Moderate amplitude parallel to sub-parallel, contin-uous	Fine grained upper slope facies
G-1		150	Unconformable	Chaotic	Channel fill
	6				
F-3		100	Unconformable	Low amplitude, dis-continuous to chaotic	Coarse grained shelf edge facies
F-2		200	Conformable to Unconformable	Moderate amplitude, parallel to sub-parallel, contin-uous	Fine grained upper slope facies
F-1		250	Unconformable	Chaotic to discon-tinuous	Glacial deposit
	5				
E-3		100	Not seen	Low amplitude, widely spaced, dis-continuous	Coarse grained shelf edge facies

E-2		200	Conformable to Unconformable	Moderate to high amplitude, parallel continuous	Fine grained upper slope facies
E-1		300	Unconformable	Chaotic to discon- tinuous, low ampli tude	Glacial deposit
	4				
D		200	Unconformable	Low amplitude, par- allel, continuous	Fine grained mid to upper slope
	3				
C		275	Conformable to Unconformable	Moderate to high amplitude, parallel continuous	Fine grained mid to upper slope
	2				
B		1000	Conformable	Low amplitude, div- ergent, continuous	Fine grained mid slope or deeper
	1				
A		N.A.		Low amplitude, closely spaced, sub-parallel or parallel	Fine grained mid slope or deeper

DIAGRAMATIC REPRESENTATION OF STRATIGRAPHIC UNITS
(NOT TO SCALE)

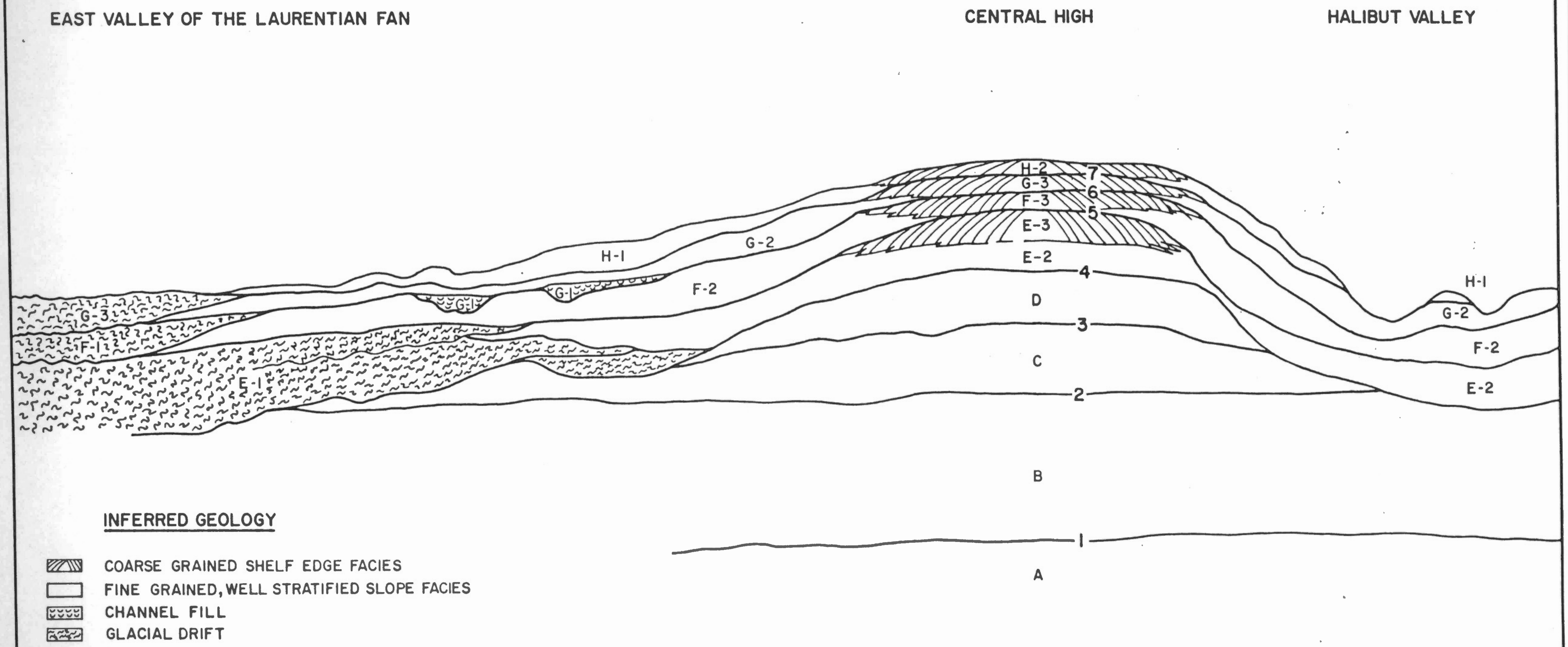


FIGURE 2

5.0) KEY HORIZONS AND SEQUENCES

Key horizons were selected on the basis of their strength and continuity, or for their significance as interfaces between reflector groups of different character or angular relationships. Over much of the area the majority of key horizons represent unconformities as indicated by angular discordance between the overlying and underlying reflectors. In some cases the unconformity is clearly an erosion surface, as evidenced by truncation of the lower reflectors, while in others the lack of truncation of these lower reflectors accompanied by onlap or downlap of overlying reflectors indicates that a change in depositional environment has occured without seafloor erosion.

Seven key horizons have been identified and correlated, and are numbered 1 to 7 from oldest to youngest. Between the key horizons the units are, in some cases, subdivided into sub-units where the seismic signatures indicate significant changes in either depositional mode or facies composition. The units are labeled A to H-2, oldest to youngest.

Correlation of horizons and identification of units is weakest in the western sector, due to the chaotic nature of the strata and the resultant noise imparted from this geology, and in the far eastern area, beyond a steep paleo-slope that forms the western wall of Halibut Canyon. Correlation across this slope is tenuous and somewhat subjective.

6.0) DESCRIPTIONS of SEISMIC HORIZONS AND UNITS

6.1) Unit A (from 3.0 seconds depth to Horizon 1)

Unit A extends from the limit of recording (3.0 seconds) to Horizon 1. The deepest horizon identified, Horizon 1 is not obviously an erosion surface. It appears to be conformable with both the overlying and underlying reflectors. It is notable, however, for its unusually high amplitude. It is observed within the northeast corner of the area , on lines 005, 006, and 013, where i slopes southwards from a minimum depth of 2.2 seconds to beyond the limit of recording at 3 seconds. It is significant in that its high amplitude and depth in the section suggest that it may represent the Wyandot Chalk or Petrel Limestone, prominent regional marker horizons of Late Cretaceous age observed on the Scotian Shelf and Grand Banks.

A lower limit to Unit A is not observed, and its thickness is not measured. Resolution of the unit is inhibited by weak reflector strength and acoustic masking by the 1st primary multiple. Where seen, the reflector within the unit are parallel, closely spaced, and of low amplitude, although this last observation is possibly due to the unit's depth in the section. The sequence dips to the south, is featureless and flat surfaced, and is conformable with the overlying Unit B. These characteristics suggest that the unit was deposited in a low energy, deep water environment, and is composed of predominantly fine grained sediments.

6.2) Unit B (Horizon 1 to Horizon 2)

Unit B rests conformably on Unit A. The unit underlies the entire eastern sector where it is the deepest unit observed except for Unit A in the extreme northeast. It is presumed to extend under the western sector as well where it is masked by noise. The maximum measured thickness is approximately 1 second.

The sequence consists of a series of closely spaced, continuous, low amplitude reflectors. The reflectors diverge slightly down-dip causing the unit to thicken to the south (line ØØ6). The morphology is regular with some subdued channel and levee development observed near the top of the sequence (line ØØ3).

Horizon 2 delimits the unit upsection beneath the central high. To the east, beneath the Halibut Channel, channel excavation at Horizon 4 time has eroded into the upper part of the sequence. This event places Horizon 4 at the top of the sequence in this area and unconformably overlays Unit E onto Unit B.

Unit B appears to represent an upward continuation of Unit A. It is conformable with it and suggests low energy, deep water, fine grained deposition. The top of the unit marks a significant transition in depositional environment. The incipient channel and levee development observed toward the top of the unit represent the deepest occurance of these features and indicate an evolution towards the more dynamic depositional environment witnessed upsection. The flat-lying nature of Horizon 2 in cross section across the high, best seen on lines ØØ5 and Ø13, is in contrast to the domed profiles of the younger horizons. Unit B also thickens downslope via divergent reflectors whereas the overlying units thin downslope. It is surmized from these observations that the dynamics responsible for the irregular topography that presently exists began during Horizon 2 time, and that they are possibly related to a transition from deep water slope to shallow water slope conditions.

6.3) Unit C (Horizon 2 to Horizon 3)

Unit C rests conformably to disconformably on Horizon 2 and Unit B. It extends beneath the central high and is thin or absent in the low to the east of the high. It is continuous to the south but may be eroded away to the southwest (line ØØ5). The unit's extent into the western sector cannot ascertained due to seismic noise. At its westernmost limit of recognition on line ØØ7 it does not appear to have undergone erosion. On line Ø13, however, it is seen to cut into Unit B west of the high and this erosion may extend westward under the East Valley. The unit is thickest beneath the high, where it is 275 msec. thick.

The unit consists of continuous, moderate to high amplitude reflectors. They are parallel and dip away to the south and west from the central high. On the west flank of the high the reflectors become more irregular and hummocky (line ØØ7).

The sequence drapes, and in some instances, accentuates the underlying topography. This is seen on line ØØ3, where a broad channel and levee feature, developed on Horizon 2, is maintained upsection throughout Unit C with the levees increasing in height through time.

The sequence is bounded upsection by two unconformities. Horizon 3 caps the sequence over the central high. There is no truncation of Unit C reflectors at this horizon, however the overlying reflectors rest unconformably on this surface and a change in depositional pattern is indicated. This is best viewed on dip section ØØ3. On the east and west flanks of the high there is significant erosion of Unit C strata by Horizon 4. Line ØØ5 best displays this relationship.

6.4) Unit D (Horizon 3 to Horizon 4)

Unit D unconformably overlies Unit C and drapes and infills the topography developed on Horizon 3. At its maximum thickness it is measured to be approximately 2ØØ msec. It is restricted to the central high and the area south of the high. Its original extent to east and west was greater but the erosion event represented by Horizon 4 has removed material from these flanks. The unit is domed over the central high and the bevelling of the flanks has accentuated this topography.

The base of the unit is marked by thin lenses (25-75 msec) of chaotic reflectors that rest unconformably on Horizon 3. The lenses are not seen on the northern lines ØØ5 and Ø13, and are most marked on the southernmost line ØØ4. These lenses in some instances infill depressions but more often are found on the flat areas of the horizon. Line ØØ3 displays an example of each instance. The chaotic nature of the reflectors, the flattened, lens-like aspect, and their occurance away from local depressions, suggest that these are ancient slump or debris flow deposits.

Overlying the lenses, reflectors within the unit are generally poorly developed, being parallel but of low amplitude and continuity. This suggests a more homogenous lithology than the underlying units. An exception to this is a high amplitude reflector which occurs approximately half way up in the sequence and is continuous throughout the unit.

It is during this time that the St. Pierre Valley seen on line ØØ4 began to develop, as evidenced by the existence of levees on the east wall of the canyon in Unit D strata.

Minor channel and levee development is observed (line ØØ5), and it is noted that deposition within the channel occured simultaneously with the build up on the levees and surrounding area. This maintained the channel as a low relief feature throughout the deposition of the unit.

Unit D is bounded upsection by Horizon 4. This horizon represents the oldest significant period of erosion observed. Over the crest of the high and extending to the south the erosion is marked by numerous small channels (lines ØØ3, Ø13). These channels, in contrast to the channel and levee developed during the deposition of Unit D, truncate the underlying strata.

Erosion was more significant on the flanks ofthe high. On the west flank the event has excavated down to Unit C and possibly into Unit B (line ØØ5). While Horizon 4 can be traced with limited success onto line Ø12 where it extends across the area immediately south of the Laurentian Channel, the underlying section contains no geologic information and no relationships can be determined.

Positive correlation is not possible across the steep paleoslope developed on the east flank. However, the horizon is tentatively matched with the deepest significant erosion event visible east of the slope within the Halibut Canyon. The event is seen to cut down into Unit B strata (line Ø13). This erosion pattern accentuates the relief of the high and its adjacent valleys that began with the deposition of Units C and D. It is during this time that the Halibut Canyon was developed as a significant topographic feature.

6.5) Unit E (Horizon 4 to Horizon 5)

Unit E encompasses the seismic sequences lying between Horizons 4 and 5. The unit has been divided into sub-units E-1, E-2, and E-3.

Unit E-1 extends from the western flank of the central high westward into the East Valley. While boundaries are only indistinctly seen beneath the valley, it appears that the chaotic nature and degradation of the seismic sections there, are due to the continuation of this sub-unit beneath the channel and its coalescence with younger units of similar character.

The sub-unit consists of several overlapping wedges of chaotic to discontinuous, low amplitude reflectors. The surfaces of the wedges are hummocky to irregular. The sequences thicken to the west and south to a maximum measured thickness of approximately 300 msec. They rise to the east where they pinch out against and interfinger with the western edge of sub-unit E-2 (line 007). They are thus contemporaneous with this sub-unit.

The chaotic nature of the reflectors, and the irregular topography of the sequences indicate deposition under very high energy conditions. The sub-unit is extremely thick to have been deposited as a series of slump or debris flows and very irregular and unstratified to have been laid down as channel fill, unless the source were very close at hand and the currents both very active and variable. That the deposits occur beneath the East Valley, which is known to have been glaciated, suggests that they may be till tongues or glacial outwash laid down in a dump truck manner in front of an active ice front. That they interfinger laterally with the stratified sediments of sub-unit E-2 indicates that they are a marine deposit, and, if glacially derived, that the glacier was restricted to the Laurentian Channel.

Sub-units E-2 and E-3

Sub-units E-2 and E-3, although seismically distinct, are felt to be different facies of the same deposit. Together they form a sheet of variable thickness that slopes away to the east, south, and west from the axis of the central high.

Sub-unit E-2 occupies the flanks of the high and, in deeper water, the crest as well (line 004). The sub-unit is composed of continuous, moderate to high amplitude, parallel reflectors that drape the erosion surface of Horizon 4. This unit grades updip into Sub-unit E-3, which is observed on the crest of the high in the shallow water area to the north (lines 005 and 013).

Sub-unit E-3 displays very few reflectors, and such reflectors as are present are faint and discontinuous. This pattern suggests that E-3 represents a coarse grained shelf-edge facies and E-2 represents the finer grained down dip facies of a unit deposited in water depths similar to or shallower than present sea level stand. The lower sea level is consistent with a glacial origin for Sub-unit E-1 which is coeval with these sub-units.

Unit E is bounded upsection by Horizon 5. This horizon represents the second significant erosion cycle recorded within the seismic sections. Down-cutting is not as extensive as is seen on Horizon 4 and a limited number of clear-cut truncations of underlying reflectors is observed. Angular discordance with overlying reflectors is pronounced, however, particularly on the flanks of the high on lines 005, 007, and 013. The topography etched by the erosion generally follows that developed by Horizon 4.

6.6) Unit F (Horizon 5 to Horizon 6)

Unit F encompasses the strata lying Horizons 5 and 6 and has been divided into sub-units F-1, F-2, and F-3 on seismic character which is a repetition of Unit E.

Sub-unit F-1

Sub-unit F-1 is a southwestward thickening wedge of chaotic to continuous, low amplitude reflectors that extends out beneath the East Valley from a pinch-out on the west flank of the central high. It overlays Sub-unit E-1 and in character is indistinguishable from it. It does not extend as far to the east as E-1 and is seen to pinch-out against Sub-unit F-2. As with Sub-unit E-1, a glacial or glacial front origin is suggested.

Sub-units F-2 and F-3

As with Sub-unit E-2, Sub-unit F-2 occupies the flanks of the central high and, in the deeper water the crest of the high as well. The sequence consists of continuous, parallel to sub-parallel, moderate amplitude reflectors. The reflectors variously infill and mute the underlying topography, as on the western flank of line ØØ5; conformably drape, as on the crest on line ØØ7; or build up into mounds and troughs through differential deposition, as seen on the east flank of line ØØ5.

Sub-unit F-3 lies on the crest of the high in the northern, shallow area traversed by lines ØØ5 and Ø13. It is 1ØØ msec thick, is slightly arched and consists of low amplitude, discontinuous to chaotic reflectors. The chaotic nature of the unit diminishes from the northernmost and shallowest traverse of line ØØ5 to the more southern and deeper traverse of line Ø13, indicating a down-dip gradation from coarse to less coarse material within the sub-unit.

This sub-unit grades laterally into, and progrades over sub-unit F-2. This relationship is best observed on line ØØ5. Here, the continuous reflectors of F-2 form wedges that pinch-out against the east and west flanks of Horizon 5 and are capped by the chaotic reflectors of F-3. This pattern indicates a lowering of sea level or rejuvenation of source through Unit F time. A lowering of sea level is consistent with the occurance of the possibly glacially derived F-1 sub-unit overlying F-2 to the west, and the occurance of an erosion surface, represented by Horizon 6, capping the entire unit.

Horizon 6 represents the 3rd significant erosion cycle seen within the seismic sequence. The character of the surface is quite variable. Over the central high, its eastern flank, and to the south it is identified as a high amplitude, continuous reflector generally conformable with the underlying strata. On the western flank it marks the boundary between underlying well stratified sediments of Sub-unit F-2 and chaotic channel fill deposits of Sub-unit G-1. Farther to the west this pattern is reversed and it marks the boundary between the underlying chaotic reflectors of Sub-unit F-1 and the well stratified reflectors of Sub-unit G-2. Still farther to the west, beneath the East Valley, it is identified as the only continuous reflector separating the chaotic reflectors of Sub-unit F-1 from the chaotic reflectors of Sub-unit G-4.

Erosion during this time was most active on the west flank where several channels were excavated into the stratified deposit of Sub-unit F-2. The channels are best observed on line Ø13. Depth of excavation is measured as about 15Ø msec. Elsewhere truncation is uncommon, and the surface is conformable, as on the crest of the high on line ØØ7, or is noted as an unconformity by the discordance of overlying reflectors, as on the crest of the high on line ØØ5.

6.7) Unit G (Horizon 6 to Horizon 7)

Unit G rests conformably to unconformably on Unit F and Horizon 6. It extends upsection to Horizon 7 or the seafloor. The unit is exposed on the seafloor on the crest of the central high at its shallow north end, on the crests of the smaller mounds located on the floor within the Halibut Channel, and on the floors of the valleys developed in the overlying unit. These seabed exposures have come about either by non-deposition or subsequent erosion of the overlying Unit H.

The unit is generally 1ØØ to 15Ø msec thick but may be up to 25Ø msec thick beneath the East Valley. It has been divided into sub-units G-1, G-2, G-3, and G-4.

G-1 is the oldest sub-unit and consists of chaotic reflectors localized on the west flank of the high within the channels excavated into Sub-unit F-2 by Horizon 6. The deposits are best seen on line Ø13.

G-2 and G-3 are upper slope and shelf edge facies, respectively, deposited contemporaneously, and are younger equivalents of Sub-units E-2/E-3, and F-2/F-3.

G-2 consists of parallel to sub-parallel, moderate amplitude reflectors that are generally conformable with the underlying strata. Within the Halibut Channel the unit has been preferentially deposited on the crests of the mounds, thereby further accentuating the relief of the mound and valley topography developed there. On the flanks of the central high, and on the high itself in the deeper, southern sections, the reflectors conform to the underlying strata and grade upslope into unit G-3.

The unit is unevenly distributed over the area, being thin to absent on the west flank of the central high and appreciably thicker on the east flank and within the Halibut Canyon. The western edge of the unit is seen on line Ø12. Here the reflectors downlap onto Horizon 6 to form a zero edge.

Sub-unit G-3 covers the shallow northern end of the central high. It is exposed at the seafloor on line ØØ5 and has a rough micro topography of 1Ø-25 metres relief. It has a uniform thickness of 1ØØ msec or so, and arches across the top of the high. The unit consists of numerous short, steeply dipping reflectors that prograde to the east and west away from the axis of the high. The reflectors prograde over the lower facies of more gently dipping and conformable strata of Sub-unit G-2. This apparent seaward advance of a coarse grained shelf edge facies suggests that the unit was laid down during a period of decreasing sea level.

Sub-unit G-4

Sub-unit G-4 extends from the pinch-out of Sub-unit G-3, which it overlaps, westward into the East Valley. It is identified only on line Ø12, and cannot be extended for any distance westward with confidence. The unit consists of chaotic to discontinuous reflectors. It thickens westward on line Ø12 to a maximum measured thickness of 25Ø msec. It is exposed on the seafloor where it forms a broken, hummocky surface. As with Sub-units E-1, and F-1, the unit's seismic character, thickness, and location suggest a glacial, or possibly, a channel fill mode of deposition.

6.8) Unit H (post Horizon 7)

Unit H is the youngest deposit recorded on the seismic sections. It extends over the southern part of the central high and its east and west flanks, and thins to a zero edge westward into the East Valley (line Ø12). It is generally conformable with Unit G and is separated from it by Horizon 7, a wide, high amplitude, continuous reflector. It is separated into upper slope and shelf edge facies, Sub-units H-1 and H-2, respectively.

Sub-unit H-1

Within Sub-unit H-1, reflectors are very low amplitude, parallel, and widely spaced, indicating a homogenous, fine grained texture. Reflectors within the Halibut Channel show better continuity and higher amplitude, being more similar to those of the underlying G-2 strata, and indicate a greater variability in textural content.

The unit achieves a maximum thickness of 16Ø msec, recorded on the west flank of the high, but thickness is quite variable due primarily to uneven deposition. The unit drapes the older topography but is generally thicker on the highs and thinner in the lows, accentuating the mound and trough morphology developed by older units. Differential deposition has further modified this drape surface into a shape independent of the earlier topography.

There is little evidence that erosion has played a significant role in forming the resulting uneven topography. The surface of the unit is generally smooth and undisturbed and the internal reflectors of the mounds and troughs are conformable with the seafloor. Erosion through mass transport is indicated in areas that exhibit a rough micro-topography imprinted on an otherwise undisturbed, well stratified sequence. The roughness is evidenced by numerous closely spaced hyperbolae generated at the seafloor. The clearest example of this is seen at the southern end of line 003, with other examples visible on the west flank of the high on lines 004, 005, and 007. This is distinct from the rough surface of Sub-unit H-2 observed on the crest of the central high. This surface is the expression of the underlying irregularly dipping to chaotic reflectors rather than a secondary imprint on them.

Sub-unit H-2 occupies the crest of the central high on lines 003 and 013. To the north it is absent from the crest on line 005 and presumably thins to a zero edge between lines 013 and 005. To the south, on line 007, the reflectors appear transitional between Sub-units H-1 and H-2.

The sub-unit consists of short, steeply dipping reflectors that prograde over Sub-unit H-1 and grade laterally into them. As with Sub-units E-2, F-2, and G-2, this sequence is considered to be the coarser grained shelf edge facies of a two facies unit.

7.0) EVIDENCE OF SEDIMENT INSTABILITY

Sediment instability is recorded in the seismic sequence primarily in the form of faults, highly disturbed strata, and unusual reflectors suggestive of gas charged sediments.

7.1) Faulting

Faults are notably absent within the sequence. A few small throw faults are observed, as noted on lines 003, 005, and 007. These faults are restricted to the deeper section and are considered to be old and inactive for some time. One very anomalous and possibly significant break in the seismic section is seen at shot point 1280 on line 007. At this point a precipitous scarp occurs at the seafloor. Below this scarp, and extending down section for 750 msec, well defined horizons are offset in the same direction, i.e. down to the west, to mark what appears to be a large and very recent normal fault.

Caution must be exercized with this interpretation, however, for a number of reasons. First, the throw apparently decreases down section, even taking into account the effect of increasing interval velocity with depth. While this is not impossible, it is unlikely. Second, some of the reflectors, most notably Horizon 6, appear to be continuous across the fault. Thirdly, a data break occurs immediately to the west of the feature, breaking the continuity of the section at a very critical point.

7.2) Slumping

Much more widespread than faulting are small, lens-shaped zones of chaotic reflectors not apparently channel fill and not associated with the extensive chaotic zone underlying the East Valley. They are also distinguished from the chaotic zones, interpreted as coarse grained facies, that lie atop the crest of the central high.

These features are interpreted as slump or debris deposits. They commonly rest on a smooth surface and have a hummocky upper surface and are usually from 25-50 msec thick but can be as much as 125 msec thick (S.P. 2020, line 005). They are draped and onlapped by younger strata. The features are most common in the middle part of the section, within Units D, E, and F, where they are associated with the flanks of the central high. None are observed within sediments younger than Unit F. This would indicate that the phenomenon of slump material being deposited into the area from elsewhere was more active in the past.

There is evidence, however, that material has been removed by slumping from the area in later times. It has been noted above, in section , that the present day surface shows some evidence of slump scars. A slump scar is also observed on Horizon 6 on line 004. This may indicate that the zone of slump material deposition has migrated down slope through time.

7.3) Gas charged sediments

The sections were examined for indications of gas charged sediments such as anomalously high amplitude reflectors, flat spots, shadow zones, etc. No features of this nature were identified which could not be more simply explained by simple lithologic variations, or structural characteristics of the geologic units, and it is concluded that gas charged sediments are uncommon, or entirely absent, in this area.

8.Ø) CONCLUSIONS

Eight time stratigraphic units are identified within the seismic sequence, with all but the deepest two separated by horizons that represent periods of significant erosion or nondeposition. The lowest two units are separated by a significant but conformable horizon that may represent the Wyandot Chalk or Petrel Limestone of Late Cretaceous age.

The units consist of stratified to unstratified sedimentary deposits that dip to the south. The deepest deposits are regular, well stratified and flat lying. Their paleotopography is that of a featureless southward dipping inclined plane. These evolve upsection into southward thinning stratified wedges that are domed over a central high. The domed effect is in part due to erosion of the flanks during the formation of the East Valley of the Laurentian Fan and the Halibut Valley, but more predominantly due to uneven deposition between the central high and the flanking valleys.Lenses of chaotic reflectors, suggestive of slump deposits, are interspersed through the middle units and slump scars are identified on the youngest units.

To the west, beneath the East Valley the well stratified wedges interfinger with southward thickening wedges of chaotic reflectors that, from their thickness, morphology, and location are interpreted as glacial drift. These wedges coalesce beneath the East Valley to form a till sequence of undetermined but substantial thickness, the surface of which is exposed on the floor of the East Valley.

The middle and younger units exhibit a two facies composition. Coarser grained, poorly stratified shelf edge material occupies the crest of the central high and grades down slope into finer grained, well stratified upper slope deposits. The youngest unit displays this relationship and suggests that the units that formed the dome and valley topography were deposited in water depths that fluctuated around or were shallower than that of the present.

The general impression is that of a depositional environment that evolved from a deep water, possibly mid to lower slope environment during the Late Cretaceous to a shelf edge- upper slope environment through the Quaternary and into the Present. This evolution is possibly related to a slow down in the relative subsidence of the region.

Apart from this phenomenon there is little evidence of tectonic activity. There are very few faults observed and no post depositional structural developments. Slumps are common within the middle units and slump scars are observed in the younger units and at the seafloor. The time equivalence of these units with glacial material beneath the East Valley suggests that the mass movements may be related to a unique set of shelf edge conditions obtaining through the Quaternary rather than tectonic instability.