LATE-GLACIAL FORAMINIFERA LOCALITIES IN RAISED MARINE SEDIMENTS IN WESTERN NEWFOUNDLAND

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GEOLOGICAL SURVEY

OTTAWA

Late-Glacial Foraminifera localities in raised marine sediments in Western Newfoundland

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The localities described here were sampled from Oct. 14 to Oct. 26, 1981. They are situated on the western coast of Newfoundland and all are accessible by car with a maximum of 1 km of walking (Fig. 0, Appendix 1). Sampling began near St. Anthony and proceeded southward along Provincial Highway 430 to Bonne Bay. Localities around and west of Bonne Bay were sampled, as were sites on Bay of Islands, Port-au-Port Peninsula and St. George's Bay to the southwest, as far as Highlands.

Many localities other than those reported here were also visited but not sampled, usually because of poor exposure, due to a thick layer of debris had developed over the sections. The time available for the study did not allow for systematic digging and cleaning of the sections.

The purpose of this report is to make available the field data and the results of foraminiferal analyses. Therefore, no paleoecological interpretation or attempt at synthesis will be found here. The author intends to publish these later in a geological journal.

Sampling

Early in the work, most samples were taken with a hand-held coring device of 3.8 cm in diameter. This allowed sample volumes to be measured easily. There were usually 2 core segments per sampling point and they were identified by a suffix letter A or B. Each core segment was stored in a separate plastic vial. From locality WNF-7 onwards, due to failure of the corer, all samples were taken with a spoon. No more than one half

(usually ca. one third) of any given sample has been used for processing, the rest being kept in storage at Atlantic Geoscience Centre, Dartmouth, Nova Scotia.

Laboratory processing

For samples collected by hand-corer, one of the two core segments obtained was completely used for processing. In spoon-collected samples, a 50 or 80 cm^3 portion was measured and processed. In both cases, the processed volume was noted to permit estimattion of the number of specimens per 100 cm^3.

The wet sediment was soaked in a detergent solution of pH=9 and sieved at 63 μm. The dried residue was then poured into a 10:4 mixture of bromoform and acetone (density ca. 2.2) and the floating fraction was recovered. An additional (dry) sieving at 105 μm was done in order to eliminate juveniles which are difficult to identify. These were kept aside for reference purposes. Where too many macrofaunal fragments were present, the fraction >1000 μm was also removed by sieving.

The fraction larger than 105 μm was then repeatedly split into aliquots with the use of a microsplitter until a subfraction of countable size was reached, in principle at least 300 specimens, but usually no more than 600. All of the specimens in the subfraction were then picked and mounted on a microscope slide. Picking all the specimens in a given subfraction eliminates bias toward picking larger specimens. When the total number of specimens in a sample was less than 300, as far as possible all were picked.

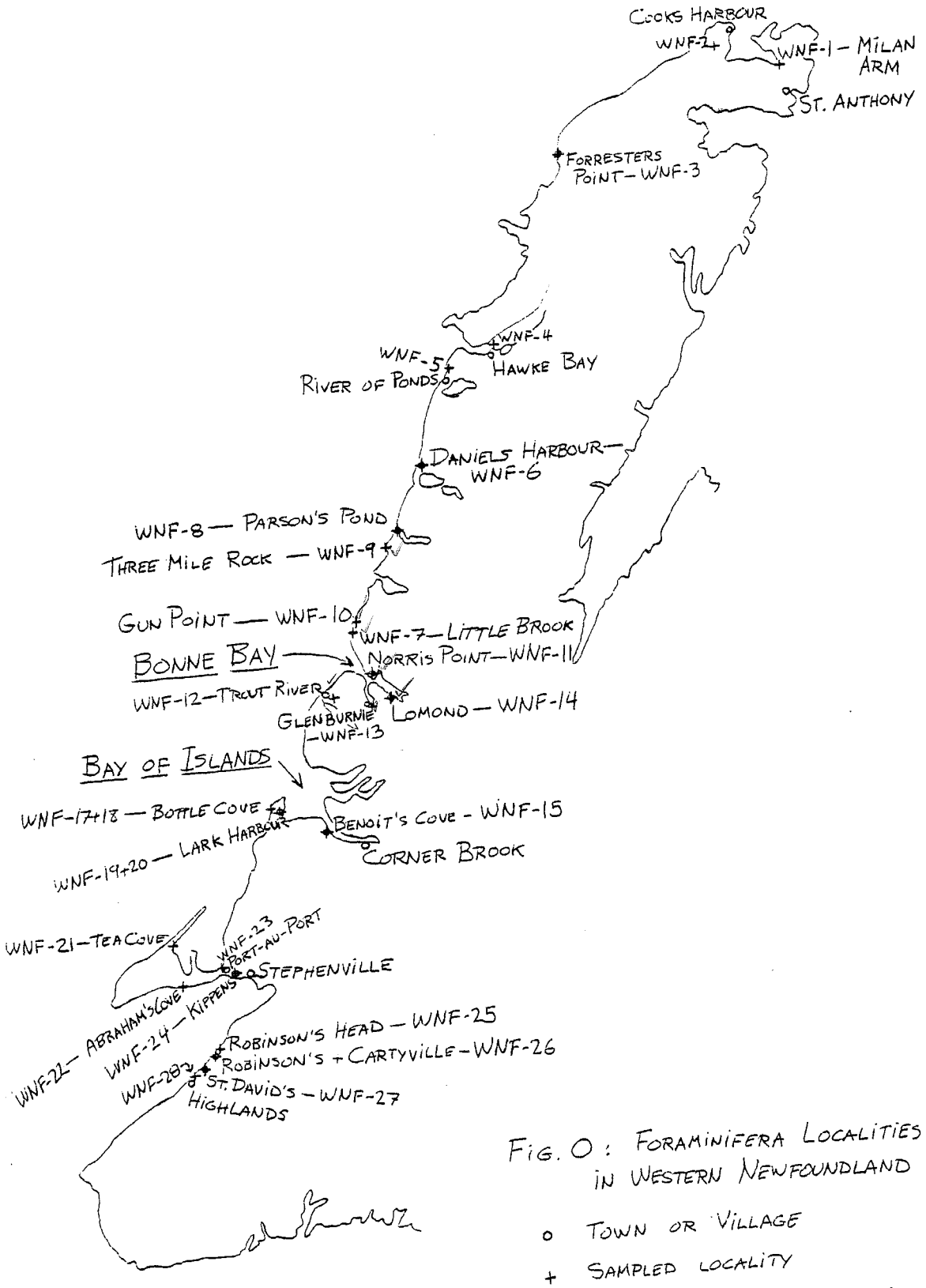


FIG. O: FORAMINIFERA LOCALITIES IN WESTERN NEWFOUNDLAND

o TOWN OR VILLAGE

+ SAMPLED LOCALITY

N.B.: WHEN A SAMPLED LOCALITY IS VERY CLOSE TO A TOWN, THE LOCATION IS SHOWN THUS: ⊕

Locality descriptions

28 localities were described and sampled. The description of every locality includes:

a) Location: the UTM location and the altitude are given. When the section is in a coastal cliff, the height of the base of the exposure above the base of the cliff (or top of beach) is given. Elsewhere, the altitude is taken from the topographic map (1:50000 with contours every 50 feet) or from the estimation of an earlier author.

A paragraph describes the geographic setting of the exposure. If necessary, a drawing is used to illustrate the section's relation to its surrounding.

(b) Lithologic description. The following remarks must be made about lithologic descriptions:

i) some descriptions proceed from the base of the section, others from the top. The direction of description is always specified.

ii) usually, thicknesses were measured with a tape. In some cases, heights were measured with a pick handle (90 cm) and a hand level.

iii) the grain-size classification used is that of Udden-Wentworth. "Blocks" begin at 25 cm.

iv) the numbers given to lithologic units are not meant to correlate units from one locality to the next, although they may do accidentally. On the other hand, at localities with several sections, the same number is usually given to the same lithologic units in all the sections (ex. localities 11, 12, 21, 24).

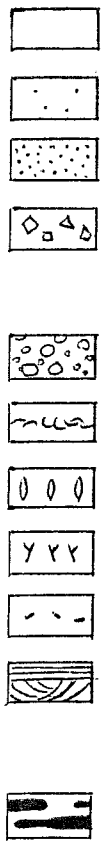
(c) Sample description. The stratigraphic level of every sample is given as well as the unit or lithology to which it belongs. In some cases sample description and lithologic description are combined.

(d) ^{14}C. At localities already dated, pertinent details are given about dating. At a few localities where material has been picked for dating, pertinent data are also given. Collected shells are now with F. Wagner at Atlantic Geoscience Centre, Dartmouth, Nova Scotia.

(e) Stratigraphic column.

The legend for stratigraphic columns is as follows:

N.B.: clay and silt have been left white in order not to overload the drawings.



clay and silt

sandy clay or silt

sand

till or other clayey deposit with angular blocks

gravel (rather rounded)

shells (disarticulated)

molluscs in living position

bryozoans

fossil fragments

stratification, cross-stratification

hydrotroilite clay, either with black patches or totally black.

(f) Foraminiferal distribution charts. Distribution charts are designed to fit beside lithologic columns. Broken lines connecting sample numbers on the lithologic column to the corresponding numbers on the distribution chart indicate how both sheets should be fitted (and taped) together. Although all the foraminiferal species encountered were noted and counted, only a limited number of them are reported in the distribution charts. The species considered are those representing at least 2% of at least one of the samples in the whole material. A list of all the species observed can be found in Appendix 2. Some of the forms listed are probably only ecological variants as in the case of the genus *Buccella*. The limits between *Elphidiella arctica*, *Elphidium frigidum* and *E. hallandense* are not very well established. The forms of *E. excavatum* have not been distinguished. The same set of species is used for all range charts except for locality 4 (Hawke Bay) where mostly arenaceous species were recorded. All species observed at locality 4 are included in the range chart. The calcareous species at all localities have been classified following Knudsen (1971) and the arenaceous following Loeblich and Tappan (1964).

The numbers underlined in distribution charts represent samples with less than 50 specimens and are total numbers of specimens. For samples with 50 specimens or more, the numbers represent percentages. The species diversity is the Shannon-Wiener Information Function:

$$H(S) = -\Sigma p_i \ln p_i$$

where p_i is the proportion of the ith species. For samples with less than 50 specimens in the counted fraction, H(S) was not computed. Species added to the right of the species diversity column are believed to be reworked from pre-Late Wisconsinan deposits. They are found mostly at localities WNF-21 and 22, on Port-au-Port Peninsula, and further to the south.

Appendices

Three appendices follow the text. Appendix 1 is a list of the localities studied. Appendix 2 is a list of all foraminiferal taxa (including some well-defined forms left in open nomenclature) recorded in western Newfoundland. In Appendix 3 the reader will find 11 plates with 54 photographs illustrating the sampled localities, their setting, their facies and facies relationships, etc. The person used as a scale in many pictures is Bhan Deonarine. He is identified in plate captions by his first name.

Acknowledgements

The present author is grateful to the following persons for having helped him during his work: D.R. Grant (GSC in Ottawa) lent him his own maps and field notes and gave him a few samples from Western Newfoundland, I.A. Brookes (York University) and G. Vilks (GSC in Dartmouth) critically read the manuscript and suggested improvements. F. Wagner (GSC in Dartmouth) identified the molluscs collected. The author had enlightening discussions with both Brookes and Grant about the Quaternary of Western

Newfoundland. Vilks helped with problems related to Quaternary foraminifera and arranged the typewriting and final preparation of the manuscript. The help of Bhan Deonarine (GSC in Dartmouth) as a field assistant was greatly appreciated. Finally, the author thanks the authorities of Parks Canada for letting him take samples within the boundaries of Gros Morne National Park. The work reported here was done while the author was a visiting fellow at Atlantic Geoscience Centre.

SAMPLE SITES

WNF-1: Milan Arm

UTM location: 21U WH 955.5 044.5 NTS Sheet: 2 M/5

Altitude: sea level

This section is situated at the head of Milan Arm (Pistolet Bay), where Outardes River reaches the sea. The creek's surface is approx. at sea level. The exposure is on the south side of the creek, just west of the bridge (fig. 1).

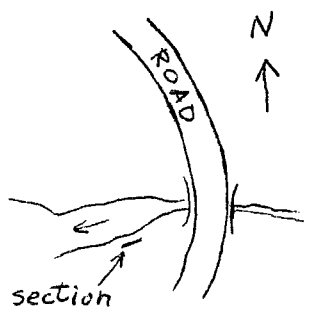


Fig. 1: setting of section WNF-1.
approx. scale: 1cm = 15m

Lithologic description (from bottom upwards) (Fig. 2)

base of section: water level

Unit 1: 0 to 0.90 m: Fossiliferous clayey sand passing gradually upwards into a sandy clay. It is more fossiliferous towards the top. Cobbles and blocks are larger near the base (up to 20 cm) and smaller near the top.

Macrofossils: - *Mya pseudoarenaria*

- *M. truncata* (articulated)
- *Spisula*?
- Pectinids in fragments
- Barnacles incl. basal plates encrusted on cobbles
- numerous large Elphidiids are visible with the hand lens

Unit 2: 0.90 to 1.20 m.

Gray silty clay with brown superficial weathering. Very fossiliferous.

Macrofossils: Bryozoans

Mya ssp.

Spisula?

Hemithyris psittacea

Unit 3: 1.20 to 1.30 - 1.50 m.

Gray clay with few fossils.

Unit 4: 1.30 - 1.50 m to 2.0 - 2.2 m.

Brown clayey sand with pebbles and cobbles.

Top: organic topsoil with gray pebbly fossiliferous material incorporated (artificial deposit made at the time of road construction).

Samples: -WNF-1-1 A & B: two separate 6 cm. cores taken vertically from level 0 downwards.

-WNF-1-2 (corer): 0.80 m

WNF-1-2 A: 9 cm.

B: 8 cm.

-WNF-1-3 (corer): 1.00 m.

1-3 A: 8 cm.

1-3 B: 8 cm.

-WNF-1-4 (corer): 1.30 m.

1-4 A and B: 8 cm each

-WNF-1-5 (spoon): in brown sand (Unit 4) position not noted.

^{14}C:

An age of 10500 ± 150 BP (GSC-1343) was obtained for *Mya truncata* shells collected by D.R. Grant at a locality (51°28.50'N, 55°36.71'W) situated less than 2 km away from WNF-1. The sediment was a "stony pelite" rich in bryozoans and brachiopods (Grant, pers. comm., 1981). This sediment blankets the whole low-lying area surrounding the southernmost part of the road to l'Anse-aux-Meadows, including locality WNF-1, where it is represented by Unit 2.

At locality WNF-1, the present author collected a total of 82.0 g of shells from Units 1 and 2 combined. Of these, 60.2 g belonged to *Mya truncata*.

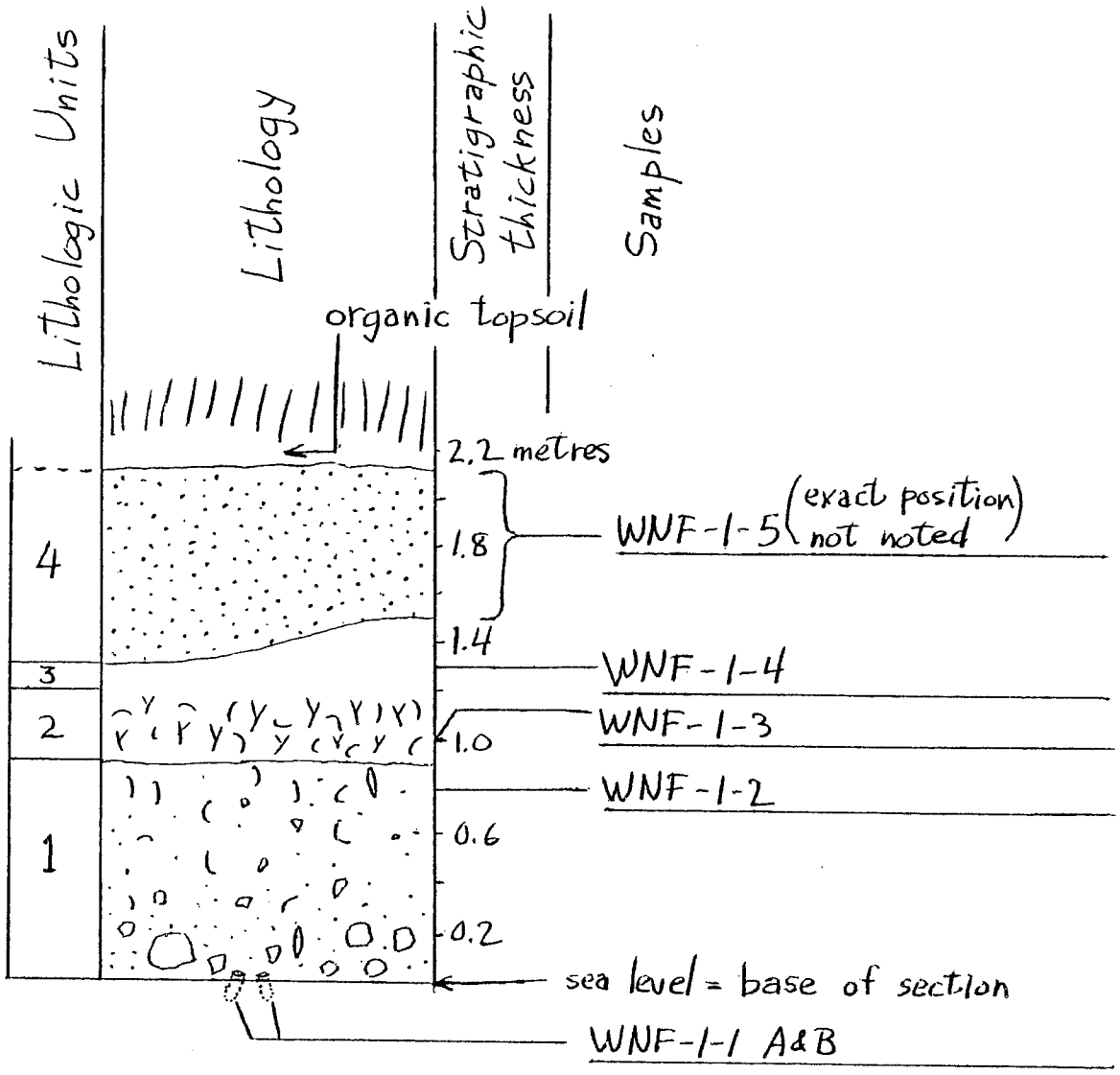


Fig. 2: WNF-1, Milan Arm

WNF-1	Quinqueloculina seminulum	Triloculina trihedra	Virgulina concava	Virgulina schreibersiana	Cassidulina reniforme	Islandiella helenae	Islandiella norcrossi	Buccella frigida	Buccella frigida calida	Buccella hannai	Buccella sp. 1	Gavelinopsis sp.	Trichohyalus bartletti	Cibicides lobatulus	Nonion labradoricum	Astrononion gallowayi	Elphidium excavatum	Elphidium frigidum	Elphidium hallandense	Elphidium incertum	Elphidiella arctica	Haynesina orbiculare	Haynesina paucilocula		% planktonics	% arenaceous	Fraction analyzed	Number of specimens per 100 cm³ of sediment (extrapolated when fraction analyzed < 1)	Number of species	Shannon-Wiener species diversity : H(S)
-5					1						1					1	3	1	2								1	18	6	1
-4B					5.0	8.0		0.4		1.5	2.4		0.2	21.9		5.4	38.5	1.3	6.9	1.1	2.8	2.6	0.2		0.2		1/128	76900	22	1.86
-3A					11.8	5.0	0.3	4.5	2.4	3.4	4.2			6.5		4.7	26.7	1.6	18.8	1.6		7.1					1/256	110900	20	2.31
-2B					4.2	11.0		2.3		1.7	2.3			7.9	0.4	4.2	22.4	4.1	19.4	3.5	2.9	8.7					1/64	37800	18	2.24
-1	1.0				0.6	0.6					2.2		4.5	1.0		16.2	4.1	1.3	45.1	7.5	2.4	12.6			0.2		1/128	119000	19	1.85

WNF-2: Crossroads near Cooks Harbour

UTM location: 21U/WH/715.5/102.5 NTS sheet: 2M/12

Altitude: between 50' and 100' contours (between 15 and 30 metres)

Sand pit on the N side of the old road to St. Anthony, west of the crossroads to Cooks Harbour, just W of Pistolet Bay.

The sand pit seemed abandoned. The walls (<1.5 m) had collapsed. The WNF-2-1 sample was taken with spoon and comes from an apparently *in situ* deposit. Shells are very abundant.

Mainly: *Mesodesma arctatum*

Spisula polynyma

also: ?*Littorina* sp.

Barnacles

?*Buccinum hancocki*

	WNF-2-1
0.3	QUINQUELOCULINA SEMINULUM
	TRILOCULINA TRIHEDRA
	VIRGULINA CONCAVA
	VIRGULINA SCHREIBERSIANA
12.8	CASSIDULINA RENIFORME
1.8	ISLANDIELLA HELENAE
1.0	ISLANDIELLA NORCROSSI
5.0	BUCCELLA FRIGIDA
	BUCCELLA FRIGIDA CALIDA
	BUCCELLA HANNAI
6.8	BUCCELLA SP. 1
	GAVELINOPSIS SP.
1.8	TRICHOHYALUS BARTLETTI
13.3	CIBICIDES LOBATULUS
	NONION LABRADORICUM
14.6	ASTRONONION GALLOWAYI
6.0	ELPHIDIUM EXCAVATUM
8.1	ELPHIDIUM FRIGIDUM
10.2	ELPHIDIUM HALLANDENSE
1.8	ELPHIDIUM INCERTUM
6.5	ELPHIDIELLA ARCTICA.
3.1	HAYNESINA ORBICULARE
0.8	HAYNESINA PAUCILOCULA
	% PLANKTONICS
	% ARENACEOUS
1/4	FRACTION ANALYZED
3110	NUMBER OF SPECIMENS PER 100 cm^3 OF SEDIMENT (EXTRAPOLATED WHEN FRACTION ANALYZED < 1)
19	NUMBER OF SPECIES
2.45	SHANNON-WIENER SPECIES DIVERSITY : H(S)

WNF-3: Forrester's Point

UTM location: 21U/WG/142/702 NTS sheet: 12P/2

Altitude: <15 m (below 50 ft. contour line)

The sampled locality is the last active face in a gravel pit that is otherwise abandoned and now used as a dump.

Lithologic description (from base upwards) (Figure 3):

Base: floor of pit.

Unit 1: 0.0 to 1.25 m.

Sandy coarse gravel with blocks of up to 20 cm. Small shell fragments.

Unit 2: 1.25 to 1.95 m.

Pebbly and cobbly sand, highly fossiliferous. Shells usually broken but not so minutely fragmented as in Unit 1. Clayey bands occur with *Mya truncata* in living position and bryozoans. There is also one band of "*Mytilus* hash". The top of Unit 2 is sharp.

Unit 3: 1.95 to 2.60 m.

Sandy and silty gravel with particles of up to block size. Fossiliferous. Shells are occasionally articulated, but lying horizontally (probably displaced). Darker than Unit 2 probably because less fossiliferous (see photo 9).

Unit 4: 2.60 to 3.30 m or more (top of unit is debris-covered).

Coarse gravel (blocks) with sand and silt. A few very small shell fragments.

NB.: the thicknesses given are those observed on the left hand side of the exposure. As photo 10 shows, they may change slightly across the section.

Macrofossils (irrespective of litho units):

Mytilus edulis

Mesodesma

Chlamys sp.

Astarte sp.

Venericardium sp.

Barnacles

Gastropods incl. one limpet

Bryozoans

Mya truncata in living position in Unit 2

Samples: all samples picked with spoon.

WNF-3-1: 0.70 m. Unit 1

WNF-3-2: 1.50 m. Unit 2

Sandy band in the middle of the unit.

WNF-3-3: 1.25 m. Unit 2.

Clayey band at the base of the unit.

WNF-3-3C: same level as A & B.

This sample consists of *Mya truncata* shells in living position (head down) picked for ^{14}C dating.

WNF-3-4A & B: 2.30 m. Unit 3.

WNF-3-5A & B: 2.90 m. Unit 4.

^{14}C:

Sample WNF-3-3C consists of *Mya truncata* shells in living position picked for radiocarbon dating. They all occur in a thin bed ca. 1.25 m

above the base of the section (see fig. 3). These shells are brittle especially when wet, and seem to be porous. Therefore their preservation may be rather poor. Not weighed but probably sufficient for one assay.

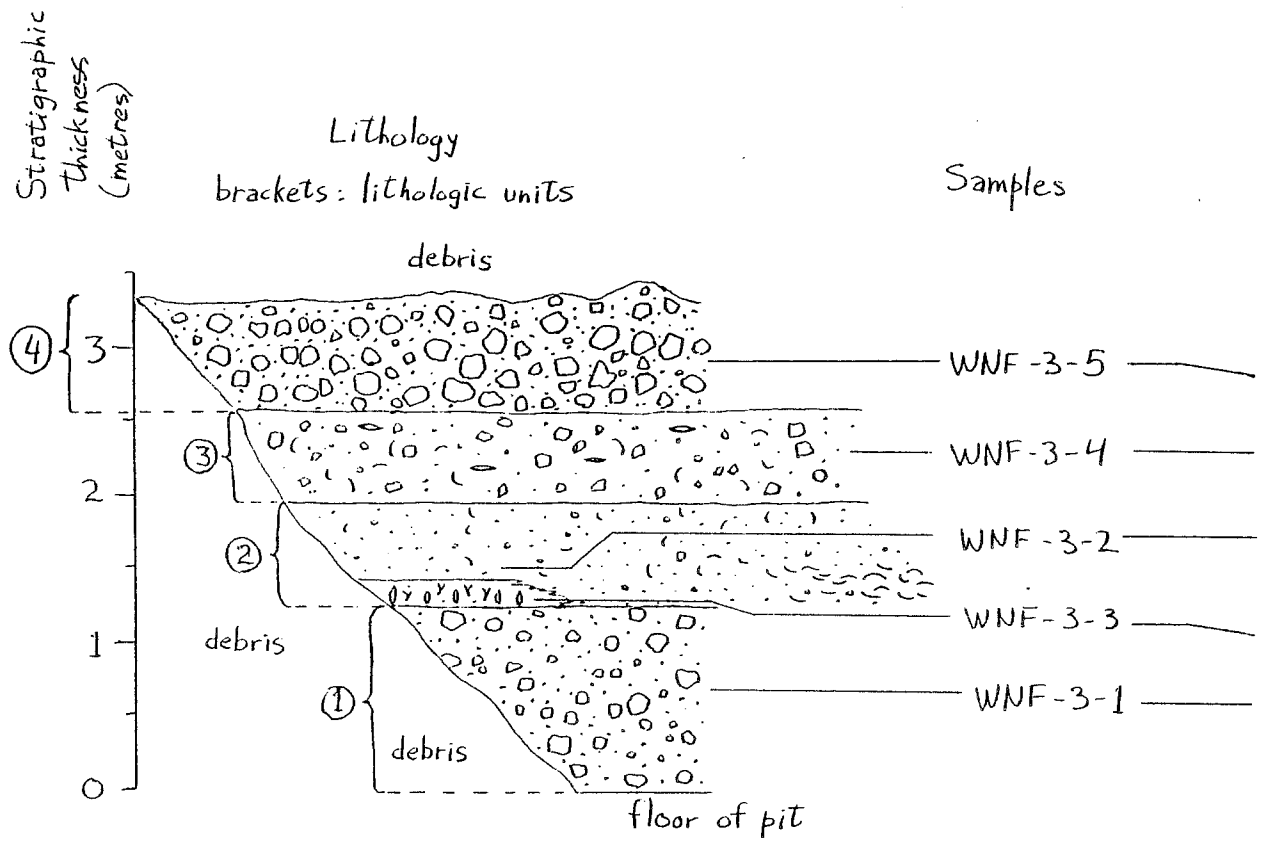


Fig 3: WNF-3, Forrester's Point

WNF-4: Hawke Bay

UTM location: 21U/VG/889.5/072.5 NTS sheet: 12I/11

Altitude: submerged at high tide

Exposed banks of the Little East River, just downstream from Provincial Highway 430. The river is situated 1.2 km along the road to the N of Torrent River, itself at the northern limit of the village of Hawke Bay.

The exposed banks are nowhere more than 1 metre high, so no stratigraphy is observed. The samples have been taken at different points along the banks, but not in stratigraphic sequence. Samples were all taken with the hand corer.

Although this locality is intertidal, the material sampled is not a modern intertidal deposit. Apart for possible contamination of the surface layer (which was removed before sampling), the foraminifera recovered should not be modern.

Samples:

Sampling was done over a distance of 50-60 metres along the river. Sample WNF-4-1 was picked closest to the road and the others at progressively greater distances, in numerical order.

WNF-4-1 (corer): 4-1A: 8 cm.

4-1B: 9 cm.

Silt with bands of very fine, laminated sand. Dispersed pebbles and cobbles. The core was taken in the silt facies. There was one shell in the middle of the core. No other macrofossils were visible. (N side of river).

WNF-3	Quinqueloculina seminulum	Triloculina trihedra	Virgulina concava	Virgulina schreibersiana	Cassidulina reniforme	Islandiella helenae	Islandiella norcrossi	Buccella frigida	Buccella frigida calida	Buccella hannai	Buccella sp. 1	Gavelinopsis sp.	Trichohyalus bartletti	Cibicides lobatulus	Nonion labradoricum	Astrononion gallowayi	Elphidium excavatum	Elphidium frigidum	Elphidium hallandense	Elphidium incertum	Elphidium arctica	Haynesina orbiculare	Haynesina paucilocula		% planktonics	% arenaceous	Fraction analyzed	Number of specimens per 100 cm³ of sediment (extrapolated when fraction analyzed < 1)	Number of species	Shannon-Wiener species diversity : H(S)
-5													B	A	R	R	E	N												
-4					18.8	3.0		5.0	1.0	2.3	4.0			28.8		4.5	24.3	0.5	3.1	0.2	0.2	0.2	2.4				1/32	23440	22	2.02
-2	0.5				11.0	3.2		4.5	1.6	3.6	2.3	0.5		50.5	0.2	5.0	23.9	0.9	3.4	0.2	6.8	0.7	3.6		0.2		1/8	4480	20	2.20
-3	2.4				2.8	1.0		1.2	0.2	2.8	1.0	0.6		55.8		1.0	13.5	1.6	3.4		8.1	2.2	1.6		0.4		1/16	10180	20	1.74
-1		0.1			7.5	1.0		2.6	0.3	1.4	1.0	1.8		56.2		4.1	11.5	0.7	5.7	0.9	0.7	2.3	0.9				1/16	14180	22	1.71

WNF-4-2 (corer): 4-2A: 8 cm.

4-2B: 8 cm.

Silty, sandy and pebbly clay. Soft, very wet and sensitive. A few indeterminate shells.

WNF-4-3 (corer): 4-3A: 8 cm.

4-3B: 8 cm.

Located 85 cm above and 80 cm to the right of WNF-42. Clayey, sandy and gravelly silt, less sensitive than WNF-4-2. The core was taken at the very top of a 30-cm thick fossiliferous level. Fossils: Mya pseudoarenaria (?) in living position, small gastropods, barnacles.

WNF-4-4 (corer): 4-4A: 8 cm.

4-4B: 8 cm.

The sample comes from a 60-cm thick section of clayey, sandy silt with a few pebbles, clearly stratified but not laminated. Fossils: Mya pseudoarenaria in living position, small gastropods, wood. A wood fragment situated immediately below the sampling point was collected for ^{14}C dating (S side of river).

WNF-4-5 (corer): 4-5A: 8 cm.

4-5B: 8 cm.

Stratified sandy and clayey silt with Mytilus beds. Other fossils: small gastropods. The core was taken immediately above a Mytilus bed. (N side of river).

WNF-4	-1A	-2A	-3A	-4B	-5A
MILIAMMINA FUSCA		35	14	5	
SILICOSIGMOILINA GROENLANDICA		1			
CRIBROSTOMOIDES CRASSIMARGO	1	1			
AMMOBACULITES SP.			1		
TEXTULARIA TORQUATA			1		
TROCHAMMINA OCHRACEA			1		
TIPHOTROCHA COMPRIMATA			1		
JADAMMINA MACRESCENS			2		
EGGERELLA ADVENA	12	4	7	1	
CASSIDULINA RENIFORME			3		
ISLANDIELLA HELENAE					4
ASTRONONION GALLOWAYI			1		
ELPHIDIUM EXCAVATUM		1	3		
HAYNESINA ALBIUMBILICATA					1
HAYNESINA GERMANICA					1
HAYNESINA PAUCILOCULA			1		
% PLANKTONICS					
% ARENACEOUS	100	95	77	100	0
FRACTION ANALYZED	1	1/8	1/2	1/8	1/16
NUMBER OF SPECIMENS PER 100 cm^3 OF SEDIMENT (EXTRAPOLATED WHEN FRACTION ANALYZED < 1)	15	386	81	53	123
NUMBER OF SPECIES	2	5	11	2	3
SHANNON-WIENER SPECIES DIVERSITY : H(S)	—	—	—	—	—
LITHOLOGY (SEE TEXT)					

WNF-5: River of Ponds

UTM location: 21U/VF/722.5/989 NTS sheet: 12I-11

Attitude: base of described section ca. 3.5 m above base of cliff, itself at the top of the modern beach.

Coastal cliff ca. 1.5 km N of the village of River of Ponds and ca. 300 m along the shore to the N of the mouth of River of Ponds. The cliff is readily visible from the village, as well as the boundary between the marine facies and the beach facies (see fig. 4).

The cliff contains essentially 3 facies: a tilloid, unstratified material below; a stratified, highly fossilferous marine deposit in the middle; a very coarse beach facies at the top. The exposure was poor, but it was possible to see that the elevation of the top of the tilloid material varied considerably. On the other hand, the base of the beach facies was very regular. As a consequence, the thickness of the shelly beds is highly variable, from more than 3 m down to 0 m (fig. 4).

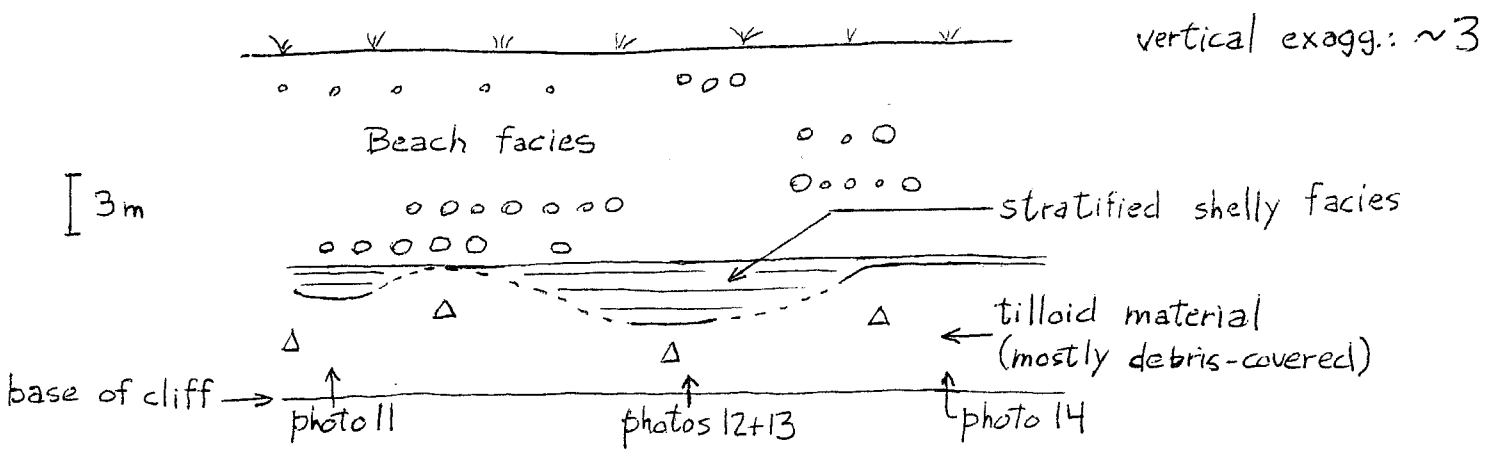


Fig. 4: Site of locality WNF-5. The section depicted in fig. 5 is at the location of photos 12+13.

The extent of the tilloid is difficult to estimate because it lacks stratification, so that it appears similar to slopewash debris. At the site of photo 7, there is a ca. 30-cm thick shelly bed lying in-between the tilloid and the beach gravel. At the section described (fig. 5), 3.15 m of stratified material is exposed. The top of the tilloid is concealed by debris, therefore the true thickness of stratified material is probably higher.

At the site of photo 5, where the tilloid was sampled, the thickness of stratified material was not measured, but according to the photo, it is no more than 2 m thick (it includes the shelly bed just above Bhan, plus the grass patch above).

Main Section (fig. 5)

A) Lithologic description

Base of section 3.5 m above base of cliff. Description from the base upwards

1° Stratified shelly facies (0 - 3.15 m)

Unit 1: 0.0 to 1.0 m

Cobbles, pebbles and sand with minutely fragmented shells.

Unit 2: 1.0 to 2.0 m

Bands of gravelly sand with fossil fragments alternating with bands of stony clay (or clayey gravel) very rich in bryozoans and brachiopods in living position. There are four bands of clayey gravel in Unit 2, each one between 10 and 20 cm in thickness.

Unit 3: 2.0 to 3.15 m

Coarse, gravelly sand with small shell fragments.

2° Beach facies

Unit 4: 3.15 m and above

Coarse gravel with blocks of up to 1 metre. Stratified but not cross-bedded. A few shell fragments are visible near the base. The thickness of this unit was not measured but on the basis of the topographic map and of the measurements made in the lower part of the section, it is probably not more than 7-8 m thick.

B) Samples:

WNF-5-1: 0.55 m. Unit 1. Taken with spoon.

WNF-5-2: 1.10 m. Unit 2. First bed of bryozoan clay. Taken with hand corer.

core: 5-2A - 5 cm long

5-2B - 7.5 cm long

WNF-5-3: 1.25 m. Unit 2. Band of gravelly sand. Hand corer.

core: 5-3A: 6.5 cm long

5-3B: 6 cm long

WNF-5-4: 3.15 m. Taken with spoon at the uppermost part of Unit 3.

WNF-5-5: 1.55 m. Unit 2. Taken with spoon in a band of bryozoan clay.

WNF-5-6: 1.90 m. Unit 2. Taken with spoon in uppermost band of bryozoan clay.

Site of photo 5: ca. 50 m to the left of the main section.

A) Lithology: The tilloid material is covered by less than 2 meters of fossiliferous sand and clay, itself covered by the coarse beach facies. The tilloid material is a compact stony silt, without visible stratification. It contains no macrofossils but a small foraminifer assemblage. The same lithofacies, along with the same biofacies, is found at localities WNF-6, 7, 9 and 10.

B) Sample: WNF-5-7: taken with spoon less than one metre below the fossiliferous level (see photo 5).

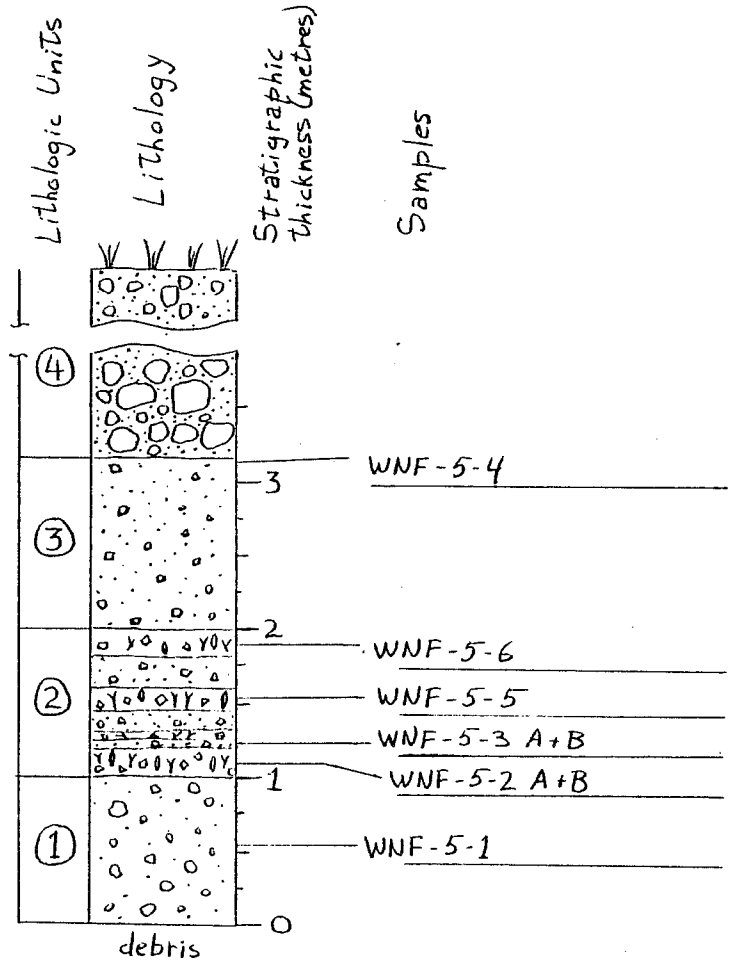
^{14}C: Shells were collected from lithologic unit 2 but their precise stratigraphic level was not noted. This may not be important as all specimens were picked within the same 1-metre unit. Part of the material was in living position. The material includes:

Chlamys sp.: 5.1 g

Venericardium sp.: 10.3 g

Hemithyris psittacea: 17.9 g

Fig. 5: WNF-5, River of Ponds, main section



Tilloid material from site of photo 11. Stratigraphically below Unit 1. ← WNF-5-7

WNF-5	Quinqueloculina seminulum	Triloculina trihedra	Virgulina concava	Virgulina schreibersiana	Cassidulina reniforme	Islandiella helenae	Islandiella norcrossi	Buccella frigida	Buccella frigida calida	Buccella hannai	Buccella sp. 1	Gavelinopsis sp.	Trichohyalus bartletti	Cibicides lobatulus	Nonion labradoricum	Astrononion gallowayi	Elphidium excavatum	Elphidium frigidum	Elphidium hallandense	Elphidium incertum	Elphidiella arctica	Haynesina orbiculare	Haynesina paucilocula		% planktonics	% arenaceous	Fraction analyzed	Number of specimens per 100 cm³ of sediment (extrapolated when fraction analyzed < 1)	Number of species	Shannon-Wiener species diversity : H(S)
-4						1								2			1										1	8	3	—
-6					7.2	4.5	0.3	4.8		4.1	1.0	0.3		62.8	0.3	5.5	5.9		0.3	0.3	0.3	0.7	0.7				1/16	9280	18	1.48
-5	0.1				1.3	1.4		0.3		0.4	0.3	0.1		88.5	0.1	4.3	2.0	0.4	0.1		0.3	0.1	0.1				1/16	15340	17	0.58
-3B					0.9	5.8		0.4		0.1	0.1	0.1		88.3		0.5	2.4	0.4	0.3			0.4			0.3		1/64	69708	13	0.56
-2A	1.2	0.5			0.3	1.5		0.6						89.5	0.3	3.5	0.8	0.3				0.5			0.3		1/128	147000	13	0.56
-1	0.1				0.4	1.2								97.0		0.6	0.3	0.1				0.3					1/4	5780	8	0.18
-7		1.7			58.3	6.2	0.3							5.2	0.7	0.7	17.2			0.3		0.7	0.3		1.7		1	340	11	1.15

WNF-6: Daniel's Harbour

UTM location (northern section): 21U/VF/583/657 NTS sheet: 12 I/4

Altitude: northern section: level 0 is ca. 17.5 m above the top of the beach.

southern section: level 0 is ca. 12 m above the top of the beach.

Two sections were sampled in a coastal cliff at the N limit of the village of Daniel's Harbour. They are reachable from the harbour by walking along the shore.

Northern section: landslide scar

Southern section: ca. 150 m to the S.

Northern section:

A) Lithologic description:

Description from the top downwards. All samples taken with spoon

Unit 1: 0.0 to 2.5 m. Coarse gravel with sand. Clasts of up to 1 metre in diameter. No macrofossils, no sample taken. Probably a beach facies.

Unit 2: 2.5 to 8.5 m. Unstratified, gravelly, sandy and silty clay with blocks of up to cobble size. Becomes progressively less gravelly downwards. Usually sticky and plastic although plasticity is variable. The uppermost 20 cm show an oxidation colour, the rest is gray. No macrofossils.

Unit 3: Unstratified silt with pebbles and cobbles much stiffer than the overlying lithology, with some horizontal fissility. This lithology is

observed just under the 8.5-metre level and also at the base of the cliff, around the 17.5-metre level. The rest of the section is covered but probably in the same material.

Since Unit 2 and 3 are unstratified, it is exceedingly difficult to distinguish in situ material from debris. It is also impossible to get a reliable measurement of stratigraphic thickness. The thicknesses given here represent in fact the vertical difference in height between the successive sampling points as measured by hand level and tape (or pick handle in some cases)[1]. Similarly, the description of the lithologic units are interpolations from what has been observed at the sampling points.

B) Samples: (all taken with spoon)

WNF-6-1: 2.9 m(?) 2152 3300

Clayey silt with sand and gravel. Sticky and sensitive. Top of Unit 2.

WNF-6-2: 4.0 m. Less gravelly and softer than 6-1. Middle part of Unit 2. 3301

WNF-6-3: 5.8 m. Same lithology as 6-2, but stiffer. Middle part of Unit 2. 3302

WNF-6-4: 7.4 m. Less gravelly than 6-3 but softer. Near base of Unit 2. 3303

WNF-6-5: ca. 8.5 m. Stiff gravelly and sandy till. Top of Unit 3. 3304

Southern section

Location: ca. 150 metres (estimated) along the shore south of the northern section.

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[1] All samples have been positioned in relation to the first one. Unfortunately the exact position of the first sample was not noted but it was probably no more than 30 or 40 cm below the top of Unit 2 (see photo 15).

A) Lithologic description:

Description from the base upwards. All samples taken with spoon.

As in the Northern section, the description was mostly centered on the sampling points. However, because of the smaller size of the exposure, the whole of the section could be easily observed (by removing the surface debris) thus making the lithological description of the section more reliable.

Unit A: 0.0 to 0.5 m. Stiff gravelly silt with occasional small shell fragments.

Unit B: 0.5 to 1.4 m. Stiff gravelly silt without macrofossils. At the limit between units 1 and 2, there is a very narrow (a few centimetres wide) shelf with grass growing on it thus suggesting a sharp break between both units.

Unit C: 1.4 to 1.8 m. Very coarse clayey and silty sand with gravel of up to cobble size. Fossils in small fragments. The thickness given in an approximation. The upper and lower boundaries of this unit are gradual.

Unit D: 1.8 to 3.5 m. Sticky silty clay with abundant gravel of up to cobble size. Fossils: barnacle plates, a few pectinids, one gastropod.

Unit E: 3.5 to 3.8 m. Silt with very coarse sand and gravel. Fossils in small fragments. This bed is no more than 30 cm thick and grades into the overlying and underlying facies.

Unit F: 3.8 to 4.3 m. Gravelly silty clay with barnacle fragments.

The top of the section is at 4.3 m. Below level 0.0, there are 12 debris-covered metres (estimated) to the base of the cliff.

Samples:

WNF-6-11: 0 m. Unit A

WNF-6-6: 0.9 m. Unit B

WNF-6-7: 1.6 m. Unit C

WNF-6-8: 2.15 m. Unit D

WNF-6-9: 3.05 m. Unit D. Less soft and sticky than WNF-6-8

WNF-6-10: 3.60 m. Unit E

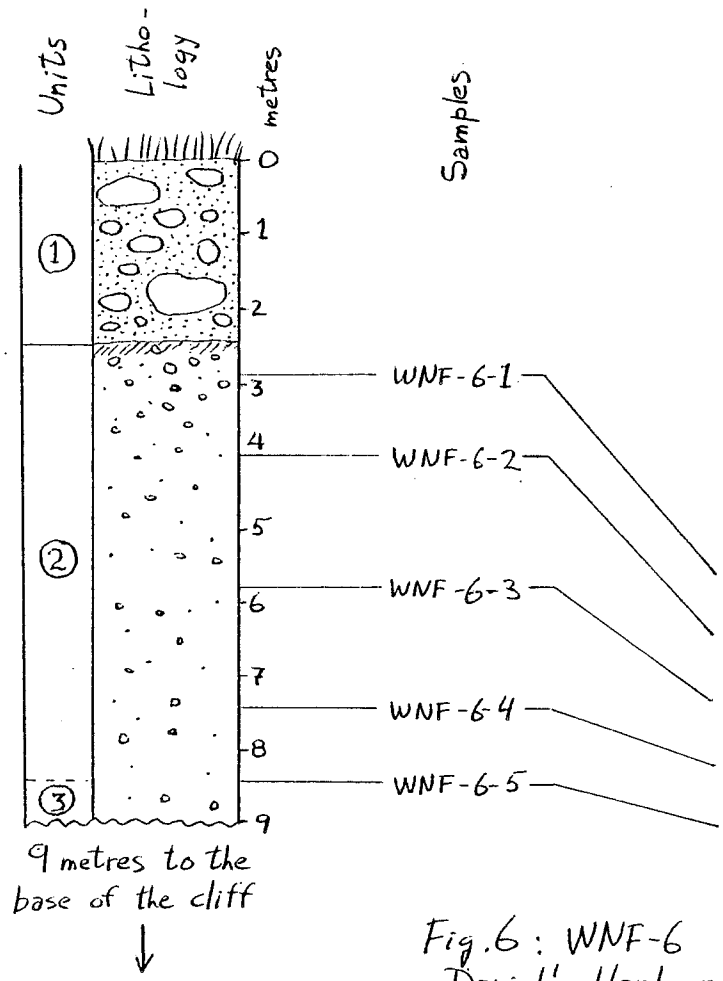


Fig. 6 : WNF-6
Daniel's Harbour
Northern Section

WNF-6, Northern section	Quinqueloculina seminulum	Triloculina trihedra	Virgulina concava	Virgulina schreibersiana	Cassidulina reniforme	Islandiella helenae	Islandiella norcrossi	Buccella frigida	Buccella frigida calida	Buccella hannai	Buccella sp. 1	Gavelinopsis sp.	Trichohyalus bartletti	Cibicides lobatulus	Nonion labradoricum	Astrononion gallowayi	Elphidium excavatum	Elphidium frigidum	Elphidium hallandense	Elphidium incertum	Elphidiella arctica	Haynesina orbiculare	Haynesina paucilocula		% planktonics	% arenaceous	Fraction analyzed	Number of specimens per 100 cm³ of sediment (extrapolated when fraction analyzed < 1)	Number of species	Shannon-Wiener species diversity : H(s)
-1				1.7	58.3	8.3								1.7			30.0										1	120	5	1.02
-2					9	1											3										1	26	3	—
-3	1			1	16	4		1									13										1	72	6	—
-4		0.8			68.3	8.3											20.8								0.8		1	240	4	0.91
-5					74.3	3.1								0.5			22.0										1	477	4	0.69

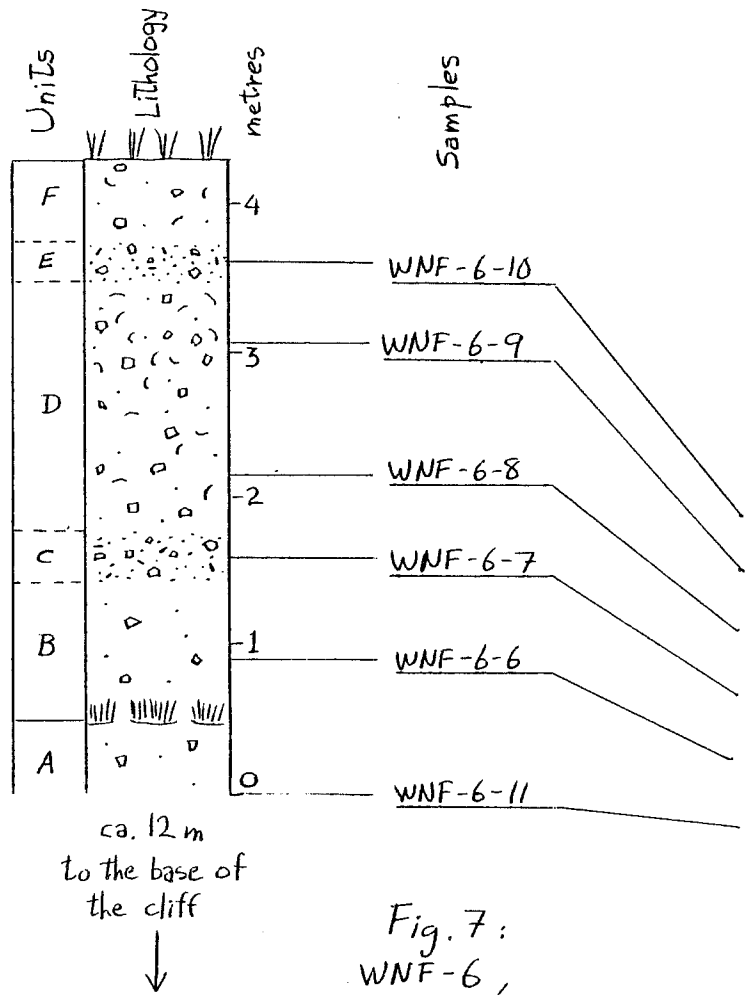


Fig. 7:
WNF-6,
Southern section
Daniel's Harbour

WNF-6, Southern section	Quinqueloculina seminulum	Triloculina trihedra	Virgulina concava	Virgulina schreibersiana	Cassidulina reniforme	Islandiella helenae	Islandiella norcrossi	Buccella frigida	Buccella frigida calida	Buccella hannai	Buccella sp. 1	Gavelinopsis sp.	Trichohyalus bartletti	Cibicides lobatulus	Nonion labradoricum	Astrononion gallowayi	Elphidium excavatum	Elphidium frigidum	Elphidium hallandense	Elphidium incertum	Elphidiella arctica	Haynesina orbiculare	Haynesina paucilocula	% planktonics	% arenaceous	Fraction analyzed	Number of specimens per 100 cm³ of sediment (extrapolated when fraction analyzed < 1)	Number of species	Shannon-Wiener species diversity : H(s)
-10			1.0		11.4	14.7		0.2			0.2	0.2		57.7		0.5	11.4					1.9		0.5		1/8	4200	12	1.34
-9					22.5	17.4			0.3		0.3			43.7		2.1	12.6					0.8				1/4	1900	9	1.43
-8			0.8		12.9	25.8	0.3				0.5			42.7	0.3	2.2	13.2					1.1	0.3			1/8	5900	11	1.50
-7					3.9	14.4								78.1		0.6	2.2					0.6	0.1			1/4	4250	8	0.75
-6					34.5	9.5								31.0		1.2	23.8									1	168	5	1.35
-11					26	4								3			9						2			1	55	5	—

	WNF-7
	QUINQUELOCULINA SEMINULUM
0.7	TRILOCULINA TRIHEDRA
	VIRGULINA CONCAVA
0.3	VIRGULINA SCHREIBERSIANA
60.9	CASSIDULINA RENIFORME
3.1	ISLANDIELLA HELENAE
0.3	ISLANDIELLA NORCROSSI
	BUCCELLA FRIGIDA
	BUCCELLA FRIGIDA CALIDA
	BUCCELLA HANNAI
	BUCCELLA SP. 1
	GAVELINOPSIS SP.
	TRICHOHYALUS BARTLETTI
1.4	CIBICIDES LOBATULUS
	NONION LABRADORICUM
0.3	ASTRONONION GALLOWAYI
33.0	ELPHIDIUM EXCAVATUM
	ELPHIDIUM FRIGIDUM
	ELPHIDIUM HALLANDENSE
	ELPHIDIUM INCERTUM
	ELPHIDIELLA ARCTICA
	HAYNESINA ORBICULARE
	HAYNESINA PAUCILOCULA
0.7	% PLANKTONICS
	% ARENACEOUS
1	FRACTION ANALYZED
588	NUMBER OF SPECIMENS PER 100 cm^3 OF SEDIMENT (EXTRAPOLATED WHEN FRACTION ANALYZED < 1)
8	NUMBER OF SPECIES
0.92	SHANNON-WIENER SPECIES DIVERSITY : H(S)

WNF-7: Little Brook

UTM location: 21U/VF/317.5/054.5 NTS sheet: 12H/12

Altitude: between the 100- and 150-foot (30 and 45 m) contour lines.

Small road cut at the intersection of Little Brook and the main road, ca. 1.8 km south of locality WNF-10. East side of road, north side of brook.

Lithology (from base upwards):

0 to 0.35 m: Gray stony clay with rare shell fragments.

0.35 to 1.60 m: Very coarse gravel, sandy, oxidized, unfossiliferous. Beach facies?

Sample (taken with spoon): 0.0 to 0.1 m in stony clay.

N.B. from this locality onwards, all samples were taken with the spoon, due to failure of the hand corer.

WNF-8: Parson's Pond

UTM location: 21U/VF/480.5/414 NTS sheet: 12-I/4

Altitude: approximately 2 to 3 metres above top of beach.

Exposure in a ravine in a coastal cliff as a sequence of tilted sand beds with Mytilus banks (fig. 8) exposed on the side of a ca. 10 m high terrace at the E limit of the village of Parson's Pond.

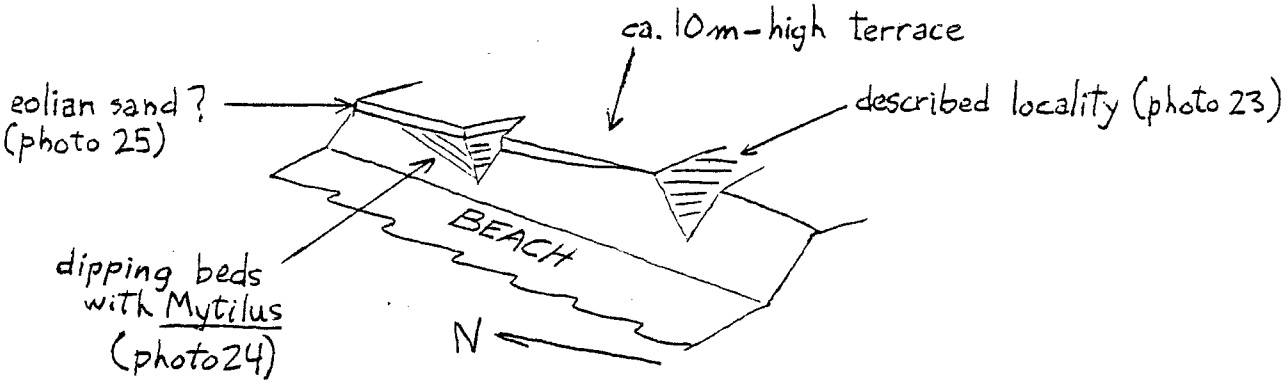


Fig. 8: Site of locality WNF-8.

Lithology: 4.50 metres (mesured perpendicular to bedding) of loose, gravelly sand with two prominent mussel beds, one at 1.3 metres above the base of the section, the other at 2.5 metres. The dip has not been measured. It seems to be towards the S or SE, away from the sea. Apart from mussels, observed fossils include Macoma sp., Mya truncata and barnacles.

Samples (positioned from base upwards):

WNF-8-1: 1.1 to 1.2 m. Medium to coarse sand with pebbles and cobbles. A few Mytilus. 3306

WNF-8-2: 2.55 to 2.65 m. Upper part of the upper Mytilus bed. The lower part of the bed consists in a compact mass of Mytilus but in the sampled part they are less abundant.

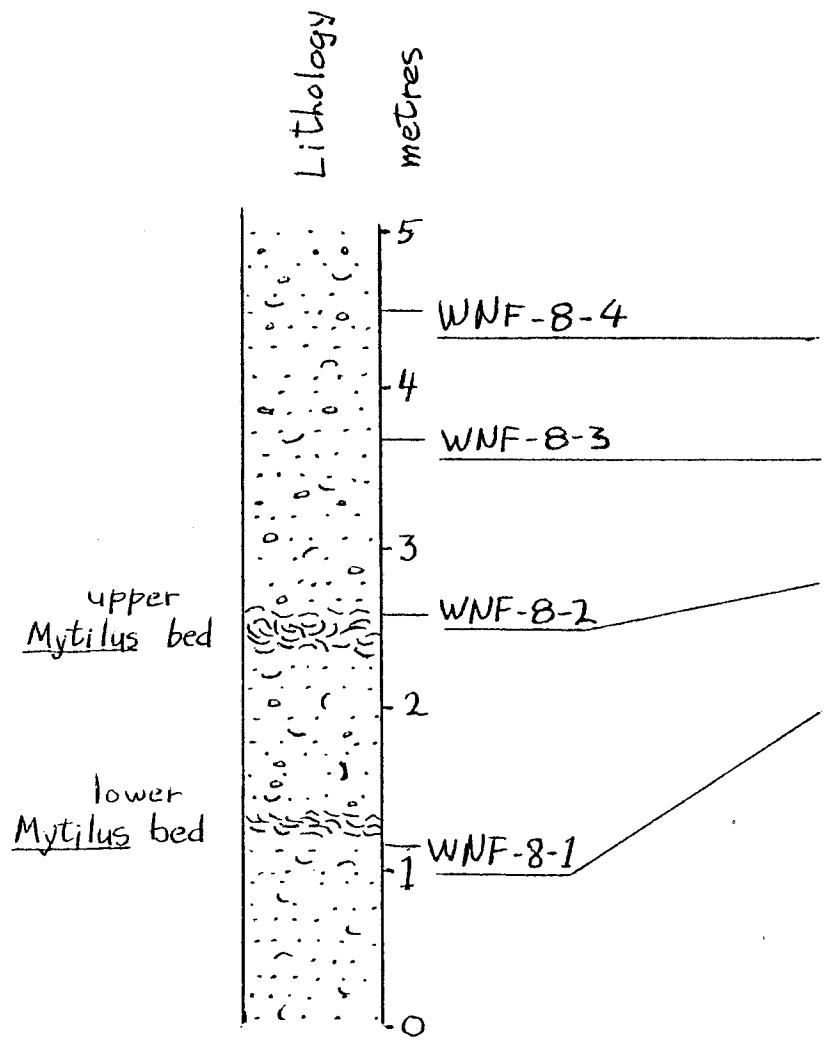
WNF-8-3: 3.7 m. Sand with many pebbles. Few fossils.

WNF-8-4: 4.5 m. Top of section. No lithologic description.

^{14}C: GSC -1762: 8650 ± 140. Collected by D.R. Grant. Mytilus edulis in growth position at an altitude of ca.8m in "mussel banks" and enclosed in arched sandy gravel beds (quotation from Lowdon and Blake, 1977).

Collected by the author: Mytilus edulis from the lower mussel bed, at the 1.3-metre level.

Fig. 9: WNF-8, Parson's Pond



WNF-8	Quinqueloculina seminulum	Triloculina trihedra	Virgulina concava	Virgulina schreibersiana	Cassidulina reniforme	Islandiella helenae	Islandiella norcrossi	Buccella frigida	Buccella frigida calida	Buccella hannai	Buccella sp. 1	Gavelinopsis sp.	Trichohyalus bartletti	Cibicides lobatulus	Nonion labradoricum	Astrononion gallowayi	Elphidium excavatum	Elphidium frigidum	Elphidium hallandense	Elphidium incertum	Elphidiella arctica	Haynesina orbiculare	Haynesina paucilocula	% planktonics	% arenaceous	Fraction analyzed	Number of specimens per 100 cm^3 of sediment (extrapolated when fraction analyzed < 1)	Number of species	Shannon-Wiener species diversity : H(S)
-4					2.7	2.7		0.9						80.9			8.2	0.9			0.9	0.9	0.9			1	220	9	0.82
-3					1.8	38.3		4.8		0.6	1.8			11.4			33.5	0.6			1.2	5.4				1	236	11	1.57
-2					1.1	8.8		0.1		0.1	0.3			78.4		0.5	7.1	0.2	0.9	0.3	0.6	0.8	0.5			1	1100	16	0.88
-1					3.0	8.8		1.1		0.3	0.3			64.9			9.4	2.2	1.7	2.5	2.2	1.4	0.8			1	452	15	1.40

WNF-9: Three Mile Rock

UTM location: 21U/VF/472.5/397 NTS sheet: 121/4

Altitude: level 0 is less than 1 metre above the beach gravel and is probably reached by the highest tides (see fig. 10).

The northern end of Three Mile Rock, where WNF-9 samples were collected, is situated approximately 2 km south of the village of Parson's Pond. The exposure is in a ravine leading to the shoreline. This is an active ravine with water continually pouring in from a pond situated above. The center of the ravine is filled with wet slumped material. Material considered in situ with a reasonable level of certainty can be picked only from the banks. These are sometimes very low when not debris-covered and also very close to the vegetation cover. The lack of stratification makes it virtually impossible to be certain that the sampled material is in situ. Furthermore, there is no way of measuring directly the stratigraphic thickness. The levels given here are vertical elevations above the base of the section measured with a hand level and a 90-cm pick handle.

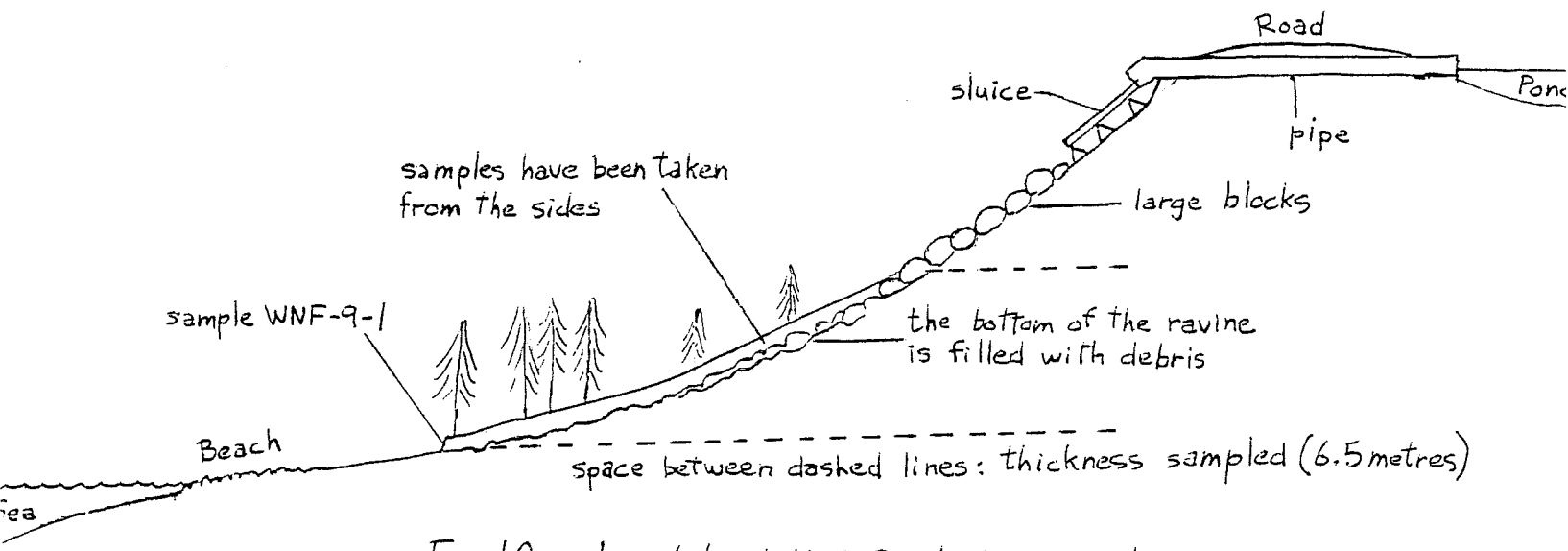


Fig. 10: locality WNF-9, looking north.

Lithologic description

Description has been made only at sampling points because the rest was in very poor state and much too large to clean with the shovel. By interpolating, we get the following general descriptions:

0 to 6 metres: gravelly clay, more or less sticky, with a reduced gravel content in the lowest metre. Fragmented fossils, very dispersed; usually barnacles except for a few mollusc fragments at ca. 5 m.

6 to 6.5 metres: partly clay with very few fossils, partly highly fossiliferous sandy clay (mostly barnacles). The contact between both facies is invisible. The clay was observed at 6.3 m and the sandy clay at 6.2 m, but 1.5 m to the left. The sandy fossiliferous clay probably extends up to the base of the sand.

7.3 metres and above: brown (i.e. oxidized), coarse, gravelly sand with shells and shell fragments, mostly Mytilus. The contact with the underlying facies is hidden by large blocks that appear to have been dumped there artifically (see fig. 10). Similar sands are observed elsewhere in the area, at Parson's Pond (WNF-8) where they are very rich in molluscs and in a sand pit situated a few kilometres N of Parson's Pond where the mollusc content is more similar to that observed at the present locality.

Samples:

WNF-9-1: 0 m. Sticky gravelly clay collected underneath a layer of black earth. The sample is very light gray and does not react to HCl. It has probably been subjected to leaching. All other samples at this locality reacted at least slightly to HCl.

WNF-9-2: 1.5 m. More gravelly than 9-1. A few fossil fragments.

WNF-9-3: 2.7 m. Similar to 9-2. Two barnacle fragments. Possible

leaching from overlying organic earth.

WNF-9-4: 3.9 m. Similar to 9-2. No fossils.

WNF-9-5: 5.1 m. Similar to 9-2. Fragments of barnacles and indeterminate molluscs.

WNF-9-6: 6.3 m. Clay with very few fossils.

WNF-9-7: 6.2 m, 1.5 m. left of WNF-9-6. Highly fossiliferous sandy clay. Collected below organic soil.

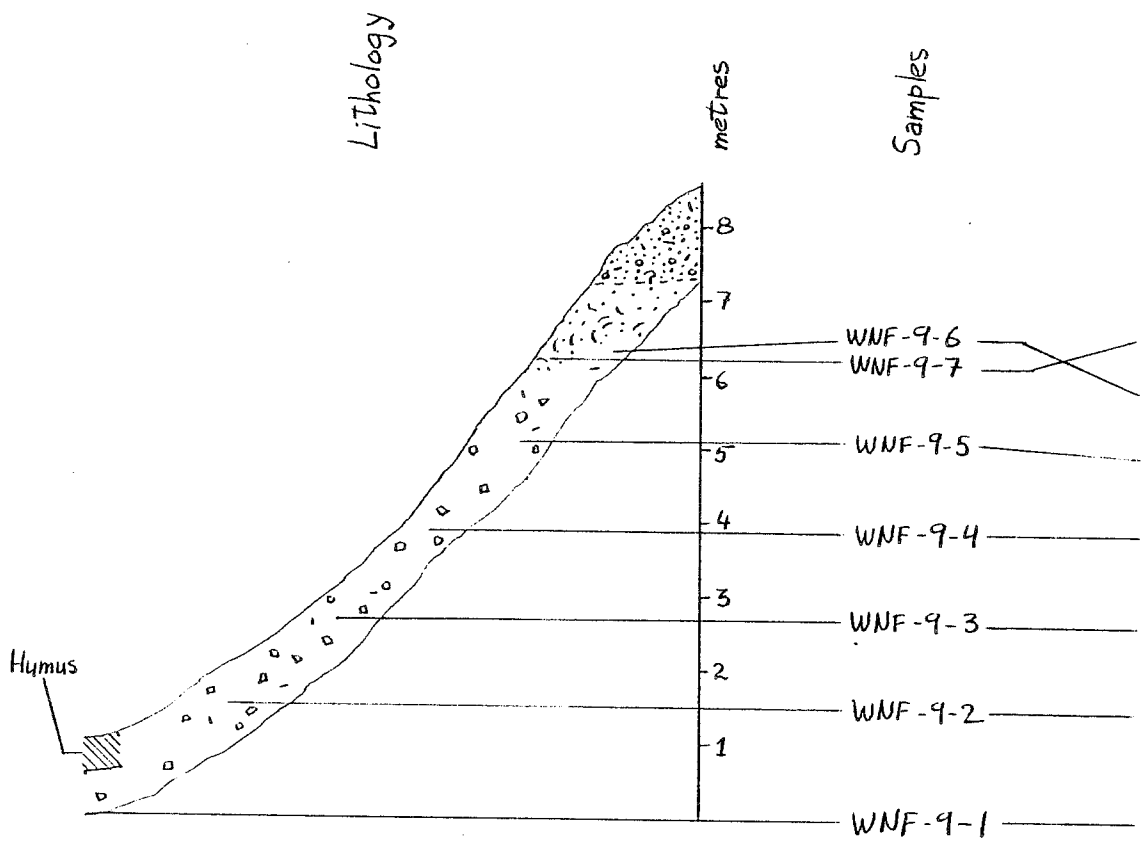


Fig. 11 : WNF-9, Three Mile Rock

WNF-9	Quinqueloculina seminulum	Triloculina trihedra	Virgulina concava	Virgulina schreibersiana	Cassidulina reniforme	Islandiella helenae	Islandiella norcrossi	Buccella frigida	Buccella frigida calida	Buccella hannai	Buccella sp. 1	Gavelinopsis sp.	Trichohyalus bartletti	Cibicides lobatulus	Nonion labradoricum	Astrononion gallowayi	Elphidium excavatum	Elphidium frigidum	Elphidium hallandense	Elphidium incertum	Elphidiella arctica	Haynesina orbiculare	Haynesina paucilocula		% planktonics	% arenaceous	Fraction analyzed	Number of specimens per 100 cm³ of sediment (extrapolated when fraction analyzed < 1)	Number of species	Shannon-Wiener species diversity : H(s)
-7					2.4	6.8		0.6	0.1		0.4	0.1		82.0	0.1	1.4	4.3					1.1			1.1		1/64	102000	14	0.78
-6		1.3			40.0	1.3											54.7								1.3		1	150	6	0.92
-5			0.3		0.9	87.8											5.2	0.3				4.6					1/2	1730	7	0.53
-4													B	A	R	R	E	N												
-3					64.8									1.9			33.3								1.9		1	108	3	0.72
-2					59.1	8.2											30.9										1	220	5	0.96
-1													B	A	R	R	E	N												

WNF-10: Gun Point

UTM location: 21U VF 315.5 072.5 NTS sheet: 12H/12

Altitude: the base of the section (level 0) is about 1 metre above the base of the cliff (see photos).

Coastal cliff situated ca. 1.3 to 1.4 km south of Gun Point and showing the same unstratified gravelly clay as at WNF-9, 7 and 6. It was necessary to dig in order to reach the in situ gravelly clay which was distinguished from the surface debris by the absence of sand fallen down from the overlying beach deposit, as well as by its greater cohesion. There is no continuous description but only point description. The levels given are the elevations above the base of the section. The lithology column is interpolated.

Lithologic description (from base upwards):

Unit 1: 0 m to 3.85 m: More or less sticky, gravelly clay. Gravel up to block size at the base, up to cobble size elsewhere. Near the top, contains sand and granules. Very rare fossil fragments except in the sandy facies near the top where they are more frequent. None were identified. The contact between the sandy facies and the underlying material, if it exists, has not been observed.

Unit 2: 3.85 m and above: Brownish (oxidised) sand and gravel with blocks of up to 1 metre (probably beach facies).

Samples:

WNF-10-1: 0.20 m. Clay with gravel of up to block size.

WNF-10-2: 1.40 m. Clay with gravel of up to cobble size.

WNF-10-3: 2.60 m. Same as 10-2.

WNF-10-4: 3.60 m. Gravelly clay with sand and granules.

WNF-10-5: 4.25 m. Sand and gravel.

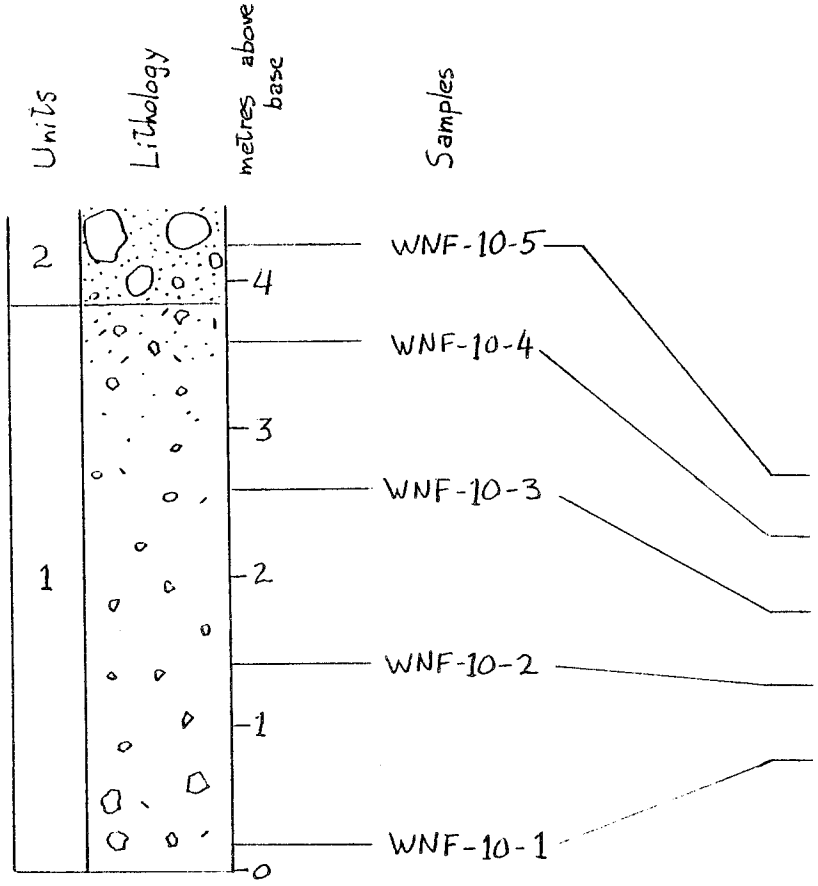


Fig. 12 : WNF-10, Gun Point

WNF-11: Norris Point

UTM location: 21U VF 359 854.5 NTS sheet: 12H/12

Altitude: base of cliff = top of beach. The height of the base of each section is given below.

Section in a coastal cliff on the south side of Sandy Head, on the W side of the village of Norris Point. Sandy Head is a terrace of unconsolidated deposits, ca. 15-18 metres high, bordered by cliffs on the W and S sides. On the W and SW sides, the lower part of the cliff is a sandy coarse gravel while the upper part is a sand (all unfossiliferous). On the S side (sampled locality) the upper sand is underlain by silts, clays and a shell bed, but the lower gravel unit has not been observed.

Lithographic descriptions (from the base upwards):

A) Western section

The base of the western section (level 0) is ca. 7 to 8 m (estimated) above the base of the cliff.

Unit 1: (0.0 to 1.80 m.): Compact unfossiliferous gravel and sand. The gravel content is maximum at the base, reaches a minimum at 0.80 m and increases afterwards.

Unit 1A: (1.80 to 2.10 m.): bed of sandy gravel (max size: pebbles), variable in thickness.

Unit 2: (2.10 m. to 3.70 m.): well-stratified silt, silty clay, fine sand and clayey sand with granules. Unfossiliferous, frequently compact and hard, sometimes soft. Thinnest beds less than 5 mm in thickness.

Unit 3: absent from this section.

Unit 4: (3.70 to 4.20 m.): Shell bed with sand and gravel. Macrofossils:

WNF-10	Quinqueloculina seminulum	Triloculina trihedra	Virgulina concava	Virgulina schreibersiana	Cassidulina reniforme	Islandiella helenae	Islandiella norcrossi	Buccella frigida	Buccella frigida calida	Buccella hannai	Buccella sp. 1	Gavelinopsis sp.	Trichohyalus bartletti	Cibicides lobatulus	Nonion labradoricum	Astrononion gallowayi	Elphidium excavatum	Elphidium frigidum	Elphidium hallandense	Elphidium incertum	Elphidiella arctica	Haynesina orbiculare	Haynesina paucilocula		% planktonics	% arenaceous	Fraction analyzed	Number of specimens per 100 cm³ of sediment (extrapolated when fraction analyzed < 1)	Number of species	Shannon-Wiener species diversity : H(s)	Elphidium groenlandicum	Islandiella inflata
-5												B	A	R	R	E	N																
-4		3.7			60.5									1.2			32.0					1.2			1.2		1	100	5	0.95		
-3		2.4		2.4	55.4	0.3											37.7					0.3			1.0		1	361	10	0.98	0.3	0.3
-2		1.5	0.3	0.3	72.4	0.9											24.0					0.3			0.3		1	416	8	0.75		
-1			1.5		35.3	19.1				4.4				16.2		1.5	20.6	1.5									1	94	8	1.63		

Mytilus, other pelecypods, rare gastropods, barnacles.

Unit 5: (4.20 to 5.00 m. and above): well-sorted, medium to fine sand with dispersed and more or less weathered valves of *Mytilus*. Uppermost metre of cliff seems composed of gravel.

In the western section, the units are well-exposed except for unit 5 which is mostly covered by debris (sand).

B) Eastern section:

The base of the eastern section is 7 metres (measured) above the base of the cliff.

Unit 1: not observed.

Unit 2: (0.0 to ca. 0.3 m): stiff laminated silt.

Unit 3: (ca. 0.3 to 2.35 m): fossiliferous marine unit, irregularly exposed with lithology varying from brown compact medium sand to blue silty clay. The fossils (barnacles and other indeterminate shells) are not in living position.

Unit 4: (2.35 to 2.45 m): mussel bed with gravel.

Unit 5: (2.45 and above): sand similar to that of the western section. The presence of shells was not noted.

Unlike the western section, this section is irregularly exposed and the description--except for the shell bed--has been made at the sampling points.

Samples:

A) Western section

WNF-11-1: 0 metre. Unfossiliferous compact brown gravel and sand.

WNF-11-2: 1.50 m. Same lithology as 11-1, but less gravelly.

WNF-11-3: 2.30 m. Stratified clay and silt. Thin grey beds (<5 mm) alternating with thick reddish beds (ca. 10 cm). Unfossiliferous.

WNF-11-4: 3.0 m. Unfossiliferous compact clayey sand with granules.

WNF-11-5: 3.60 m. Unfossiliferous compact silt, softer than sample 11-4.

WNF-11-6: 3.90 m. Shell bed.

WNF-11-7: 4.90 m. Well-sorted medium sand with dispersed mussel valves.

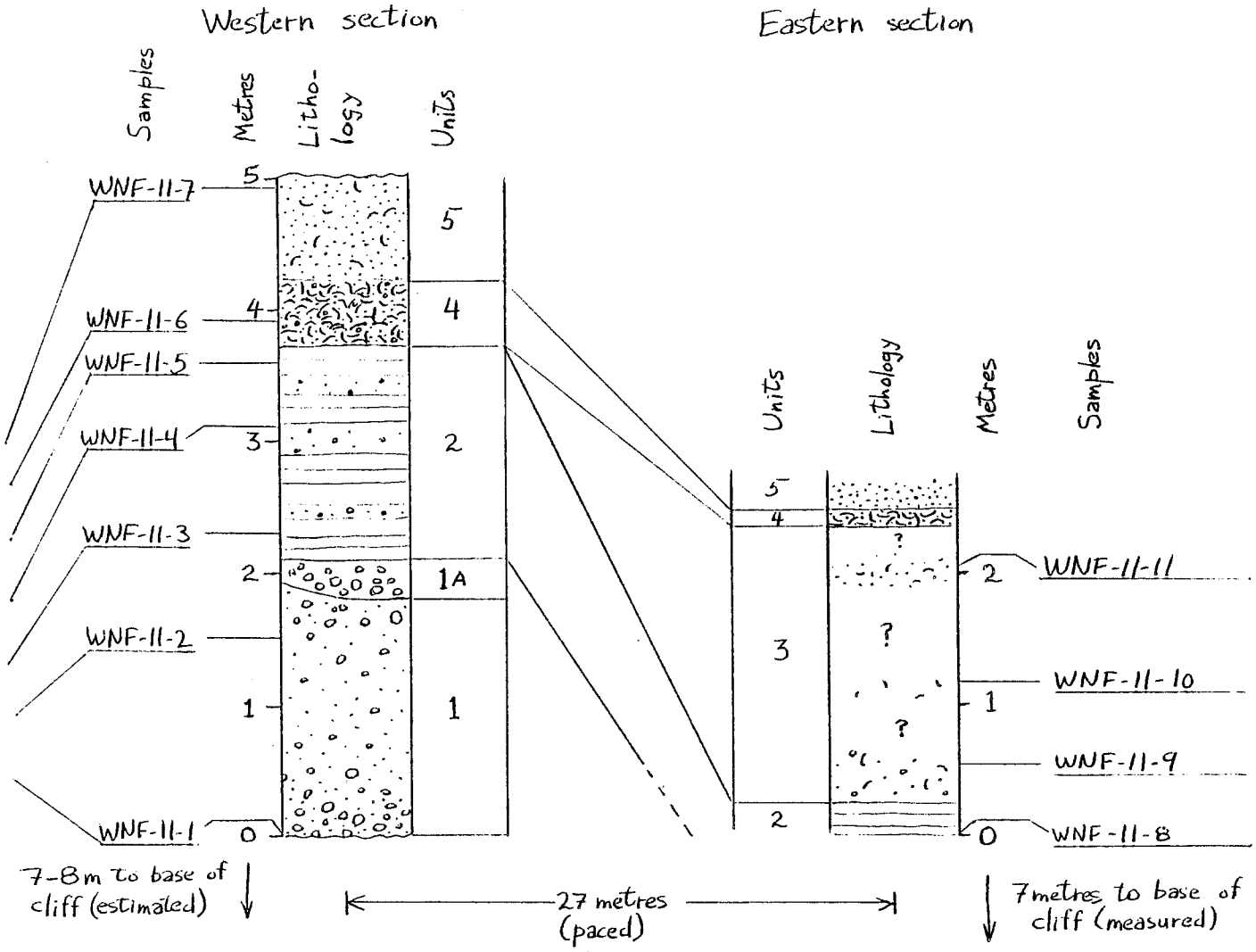
B) Eastern section

WNF-11-8: 0 m. Stiff laminated silt.

WNF-11-9: 0.55 m. Pebbly and clayey sand with barnacles and other fossils.

WNF-11-10: 1.15 m. Blue silty clay with a few undetermined fossils, not in living position.

WNF-11-11: 2.05 m. Compact, brown medium sand with whole, disarticulated valves. *Mytilus* predominates.



← foram distribution chart

Fig. 13 : WNF-11, Norris Point

foram distribution chart →

WNF-11, Western section	-7	-6	-5	-4	-3	-2	-1
QUINQUELOCULINA SEMINULUM							
TRILOCULINA TRIHEDRA							
VIRGULINA CONCAVA							
VIRGULINA SCHREIBERSIANA							
CASSIDULINA RENIFORME					1		
ISLANDIELLA HELENAE	33.0	0.8					
ISLANDIELLA NORCROSSI							
BUCCELLA FRIGIDA	20.9						
BUCCELLA FRIGIDA CALIDA	0.9						
BUCCELLA HANNAI	0.9						
BUCCELLA SP. 1							
GAVELINOPSIS SP.						BARREN	
TRICHOHYALUS BARTLETTI							
CIBICIDES LOBATULUS	15.7	1.6					1
NONION LABRADORICUM							
ASTRONONION GALLOWAYI	0.9						
ELPHIDIUM EXCAVATUM	13.0	96.0	1	9	11		
ELPHIDIUM FRIGIDUM	2.6			1			
ELPHIDIUM HALLANDENSE							
ELPHIDIUM INCERTUM	1.7						
ELPHIDIELLA ARCTICA	1.7						
HAYNESINA ORBICULARE	6.1	1.6					
HAYNESINA PAUCILOCULA							
% PLANKTONICS							
% ARENACEOUS							
FRACTION ANALYZED	½	1	1	1	1		1
NUMBER OF SPECIMENS PER 100 cm^3 OF SEDIMENT (EXTRAPOLATED WHEN FRACTION ANALYZED < 1)	357	157	1	12	24		1
NUMBER OF SPECIES	12	4	1	2	2		1
SHANNON-WIENER SPECIES DIVERSITY : H(S)	1.88	0.21	—	—	—		—

WNF-12: Trout River

UTM location: 21U VE 189 801.5 NTS sheet: 12 G/8

Altitude: the shell bed (Unit 3) in sections 1 and 2 is at 44m (measured by Brookes, pers. comm., 1983). The top of section 4 is below 35 m.

Two localities have been sampled on the NW side of a recently realigned road approximately 1 km SE of the village of Trout River. The first locality is situated on the N side of the road at the point where it reaches a creek locally known as "the Feeder" (see Brookes, 1974, fig. 10). Coordinates given above apply to this locality. Only one section was described there (section 4). The second locality is situated on the same side of the road, 480 metres (odometer measurement) to the NE of section 4. Three sections (1, 2 and 3) were described at that locality; their relative positions are given in fig. 14.

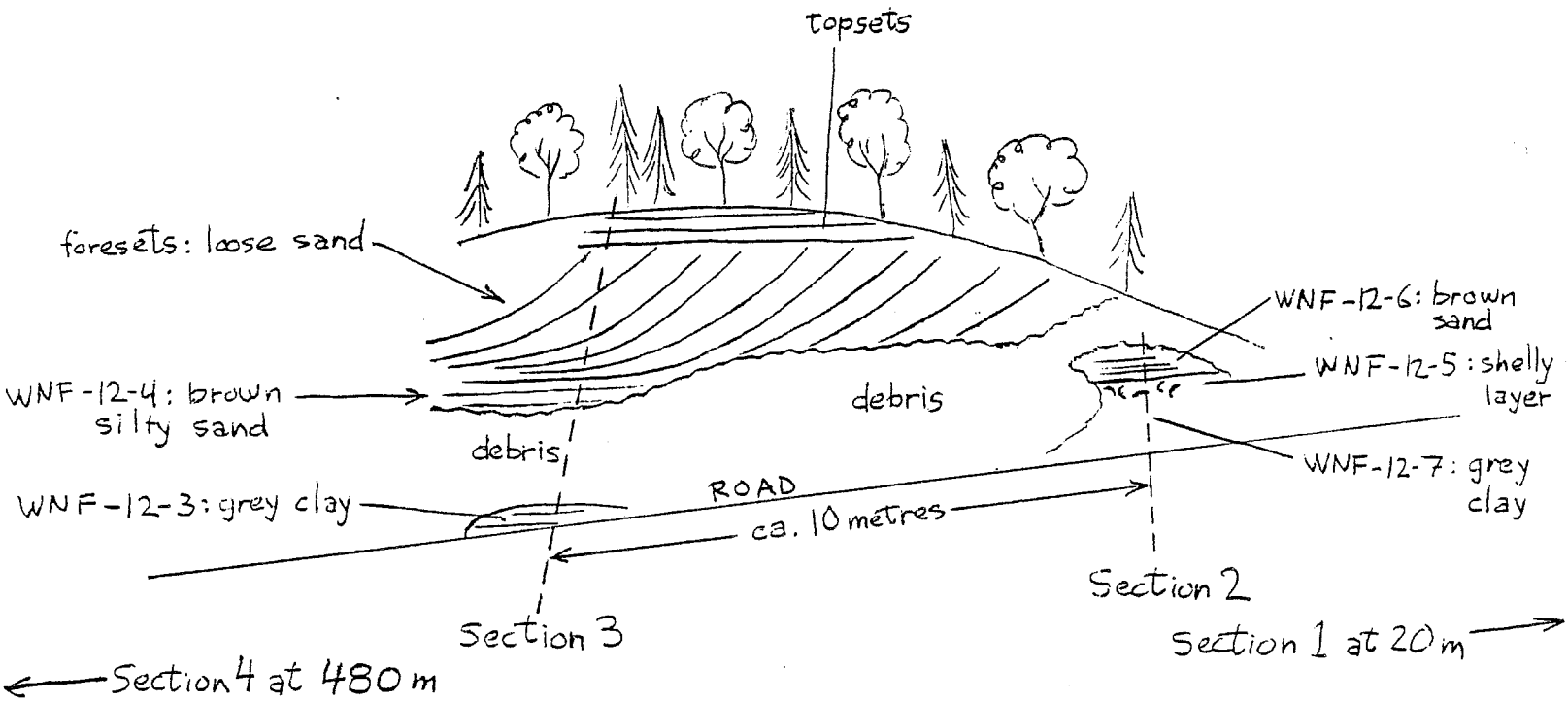


Fig. 14: sections 2 and 3 at Trout River

WNF-11, Eastern section	-11	-10	-9	-8
Quinqueloculina seminulum		0.8		
Triloculina trihedra		0.3		
Virgulina concava	0.3			
Virgulina schreibersiana			0.6	
Cassidulina reniforme	3.8	6.6	11.4	1
Islandiella helenae	42.2	43.2	11.4	4
Islandiella norcrossi				
Buccella frigida	3.3	1.0	8.4	
Buccella frigida calida				
Buccella hannai				
Buccella sp. 1	0.5	0.3		
Gavelinopsis sp.				
Trichohyalus bartletti				
Cibicides lobatulus	8.2	9.2		2
Nonion labradoricum	0.5	0.3		
Astrononion gallowayi	1.8	2.8		
Elphidium excavatum	18.4	14.8	56.3	2
Elphidium frigidum		0.5		
Elphidium hallandense				
Elphidium incertum	1.5	1.5	5.4	
Elphidiella arctica				
Haynesina orbicularis	17.1	17.9	6.0	
Haynesina paucilocula	0.3			
% Planktonics				
% Arenaceous				
Fraction analyzed	1/8	1/8	1/2	1
Number of specimens per 100 cm³ of sediment (extrapolated when fraction analyzed < 1)	4330	4340	425	12
Number of species	15	15	9	4
Shannon-Wiener species diversity : H(S)	1.62	1.73	1.38	—

Lithologic description:

Measurements given are mostly approximate and the lithologic columns are generally extrapolations from the sampling points. The definition of units is interpretative that is, units that were thought to represent the same phase of sedimentation were given the same number in each of the sections although their lithology may vary somewhat from one section to the other, e.g. the clay may be smooth or contain some cobbles. Five units have been observed; they have been numbered from the base upwards. The sequence is well summarized in section 4.

Section 1: Approx. 2-2.5 m of gravelly (max. size: cobbles), clayey silt without macrofossils (Unit 2) are covered by less than 0.5 m of highly fossiliferous silty clay (shell bed, Unit 3). Macrofossils: *Mya pseudoarenaria*, *Macoma calcarea*, *Astarte* sp., *Serripes groenlandicus* and thin-shelled *Hiatella arctica*. In all 4 sections, *H. arctica* shells are thin and blueish.

Section 2: Approx. 2 metres of gray smooth faintly stratified sticky clay without macrofossils (Unit 2) are overlain by 30-40 cm of gray stiff clayey sand with pebbles, cobbles and shells (Unit 3). Above this, a sparsely fossiliferous brown sand marks the beginning of the delta bottomset beds (Unit 4b). The passage from unit 3 to unit 4b is gradual but quick.

Section 3: from the base up:

- a few centimetres of unfossiliferous gray clay (Unit 2)
- 3-4 m: covered by debris
- upper part of section: deltaic sediments of Unit 4 consisting of:

4b: bottomset beds: brown silty sand with mostly disarticulated macrofossils.

4f: foreset beds: dipping sand beds merging into bottomset beds. Occassional macrofossils.

4t: horizontally stratified sand beds. Topsets?

Section 4: from the base up:

- Unit 1: coarse clayey and sandy gravel without macrofossils. Till.
- Unit 2: clayey silt. Thin beds of fine sand are observed, at least at the level of sample WNF-12-8.
- Unit 3: shell bed. Same species as at other sections, plus Astarte sp. and rare barnacles.
- Unit 4: brown sand
- Unit 5: gravel

N.B.: units 3, 4 and 5 were not studied in situ but only observed from a point in unit 2. The shells reported are those that had tumbled from the shell bed.

Samples

section 1: WNF-12-1: Fossiliferous silty clay (shell bed)

WNF-12-2: Unfossiliferous clayey silt with gravel of up to cobble size.

section 3: WNF-12-3: Unfossiliferous gray clay.

WNF-12-4: Brown silty sand with disarticulated fossils.

section 2: WNF-12-5: Clayey sand with pebbles, cobbles and shells.

WNF-12-6: Brown sand with a few fossils.

WNF-12-7: Gray smooth unfossiliferous clay.

section 4: WNF-12-8: Unfossiliferous clayey silt with thin beds of fine sand.

^{14}C dates: two dates have been obtained from the location of sections 1-3.

1° An age of 12500 ± 120 (GSC-2936) was obtained from *Mya truncata* shells collected by Brookes in 1979. The sediment was described by Lowdon and Blake (1980) as a "massive, moderately strong glacio-marine mud", probably the shell bed (Unit 3) of sections 1 and 2. It was not stated whether the shells were in living position or not. The altitude given in Lowdon and Blake's report (60 m) has been revised by Brookes (pers. comm., 1983) and found to be 44 m.

2° A whalebone collected in the topset beds (see fig. 14) by Brookes in 1981 gave an age of 11720 ± 205 BP (S-2149) (Brookes, pers. comm., 1983)

The present author has collected a datable amount of shells from the shell bed (Unit 1) in section 3. The species collected were: *Mya pseudoarenaria*, *Macoma calcarea* and *Astarte* sp. None were in living position.

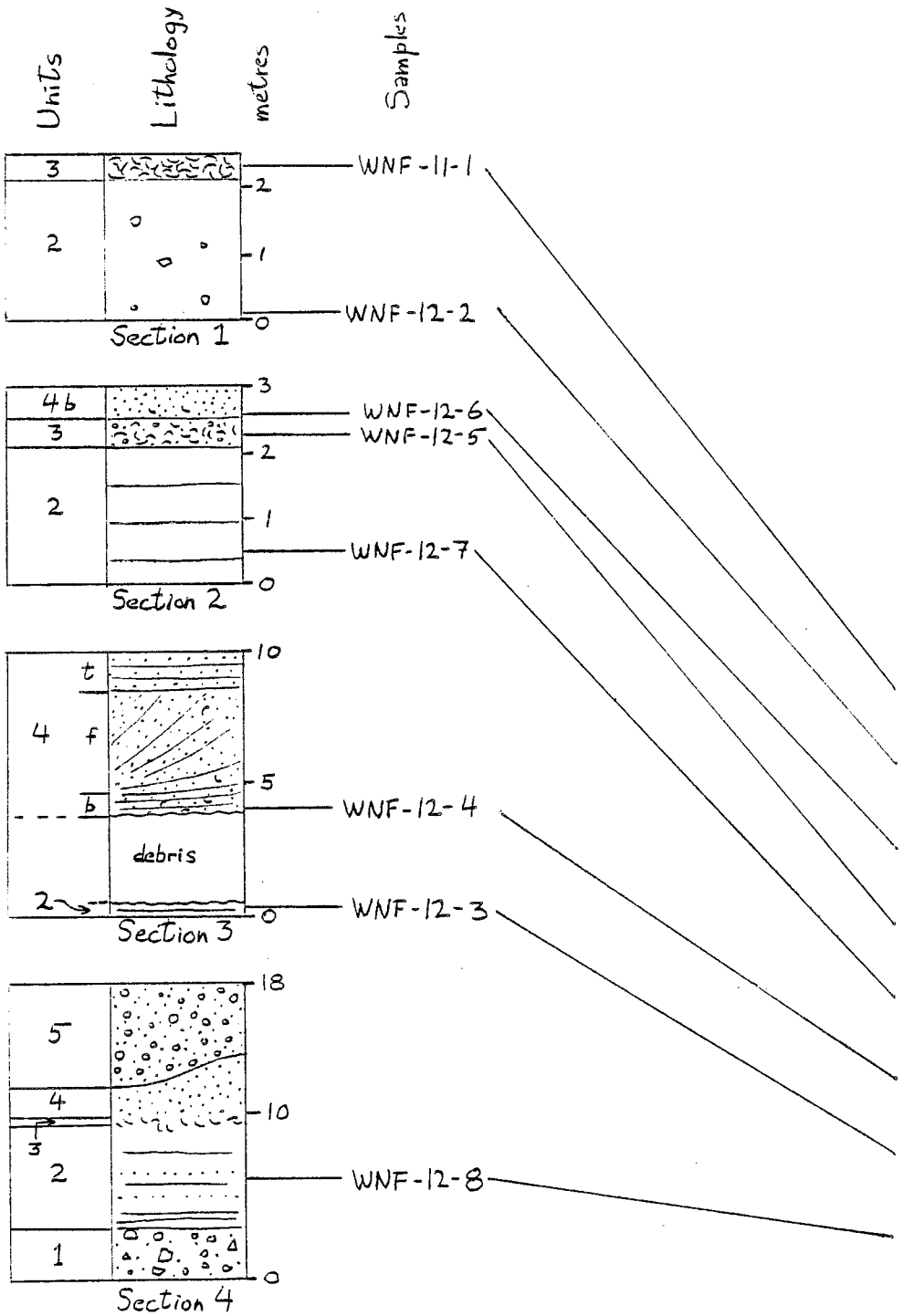


Fig. 15: WNF-12, Trout River.
Vertical scales are approximate.

WNF-12	Quinqueloculina seminulum	Triloculina trihedra	Virgulina concava	Virgulina schreibersiana	Cassidulina reniforme	Islandiella helenae	Islandiella norcrossi	Buccella frigida	Buccella frigida calida	Buccella hannai	Buccella sp. 1	Gavelinopsis sp.	Trichohyalus bartletti	Cibicides lobatulus	Nonion labradoricum	Astrononion gallowayi	Elphidium excavatum	Elphidium frigidum	Elphidium hallandense	Elphidium incertum	Elphidiella arctica	Haynesina orbiculare	Haynesina paucilocula	% planktonics	% arenaceous	Fraction analyzed	Number of specimens per 100 cm³ of sediment (extrapolated when fraction analyzed < 1)	Number of species	Shannon-Wiener species diversity : H(s)
-1	0.5	0.5			46.1	0.5											52.0					0.2				1/2	1050	7	0.80
-2					2	13				1							23					1				1	40	7	—
-6	0.3				2.4	62.8			0.3		0.3			10.0		1.6	4.2			1.3	0.3	16.6				1/4	2020	11	1.24
-5					14.1	2.5		0.8	0.6						0.3		71.7			3.3		5.3		0.3		1/8	3640	13	1.05
-7					3												21									1	31	3	—
-4												B	A	R	R	E	N												
-3					4.2	0.4					0.4						93.3	0.4				0.4	0.4			1	300	8	0.33
-8							3										2									1	6	2	—

WNF-13: Glenburnie

UTM location: 21U VE 362 757.5 NTS sheet: 12H/5

Altitude: less than 15 metres (50 ft.).

Cut along a road (N side of road 431) in construction at approx. 1 km (straight line) west of the village of Glenburnie at the head of the South Arm of Bonne Bay. The section was long (ca. 100 m) and low (<2 m), perfectly exposed, showing regular stratigraphy, fresh unoxidized blueish gray clay and fossils in living position. It is probable that the cut has since been obscured up by road construction (Photo 25).

Lithologic description (from the top downwards):

Unit 4: (0.0 to 0.20 m): clayey sand with rare fossil fragments.

Unit 3: (0.20 to 1.00 m): alternating clay and sand beds with bands of *Mytilus*, partly broken partly complete (in living position??).

Unit 2: (1.00 to 1.30-variable): Silty and sandy clay with a few granules and pebbles. *Mya truncata* and *M. pseudoarenaria* in living position.

Unit 1-2 (1.30 to 1.50 m): More or less gravelly: intermediate between Units 1 and 2.

Unit 1 (1.50 and below): Gravel and clay with fossils in fragments (barnacles).

The preceding units are all blue-gray and positively marine. Above the top of Unit 4, there is a 2-cm rusty bed covered by a ca. 40-50 cm bed of oxidized gravel (Unit 5) made up of flat pebbles deposited subhorizontally (probably a beach deposit). The sequence is covered by the gravel of the old road.

Samples:

WNF-13-1: unit 2

WNF-13-2: unit 3

WNF-13-3: unit 1

WNF-13-4: unit 4

The exact level of the samples was not noted, only the unit to which they belong. Therefore, the levels given on the stratigraphic column are not meant to be accurate.

^{14}C: 72 g of Mya truncata have been picked from Unit 2. All were in living position.

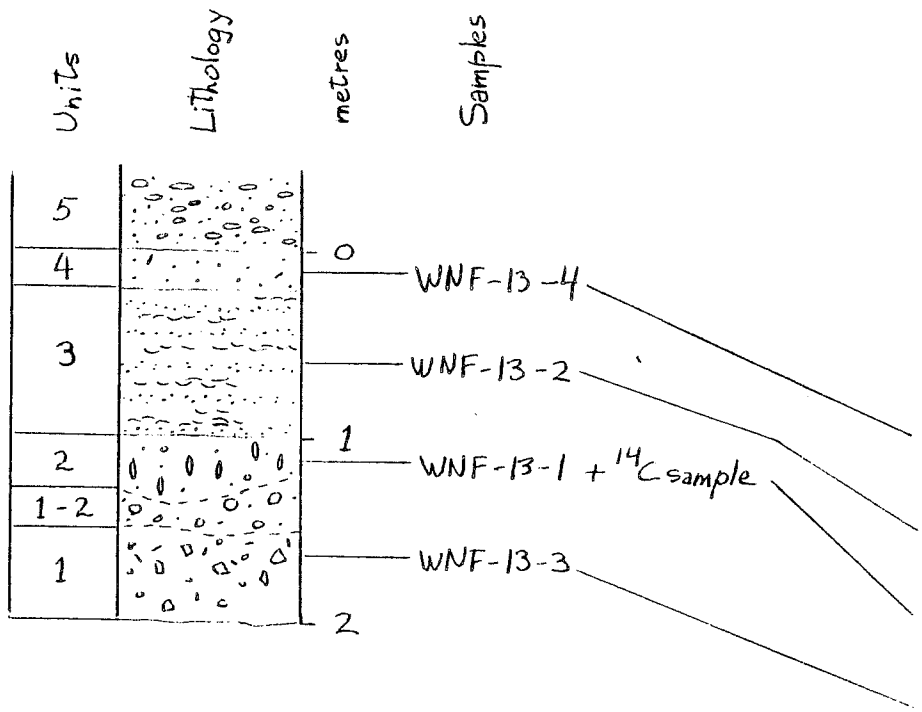


Fig. 16: WNF-13, Glenburnie.

WNF-13	-4	-2	-1	-3
Quinqueloculina seminulum				
Triloculina trihedra				0.3
Virgulina concava				
Virgulina schreibersiana				
Cassidulina reniforme		0.6	1.7	2.9
Islandiella helenae		0.6	32.4	2.6
Islandiella norcrossi				
Buccella frigida	9	48.2	10.0	0.9
Buccella frigida calida				
Buccella hannai		0.2	1.2	
Buccella sp.1		0.2	0.4	
Gavelinopsis sp.				
Trichohyalus bartlettii				
Cibicides lobatulus		0.6	7.3	1.4
Nonion labradoricum				0.6
Astrononion gallowayi			0.4	
Elphidium excavatum	2	49.2	38.6	56.5
Elphidium frigidum			0.4	
Elphidium hallandense				0.6
Elphidium incertum				11.0
Elphidiella arctica				
Haynesina orbicularis			4.4	20.2
Haynesina paucilocula				1.7
% Planktonics	1			
% Arenaceous		0.2		
Fraction analyzed	1	1/2	1/4	1/8
Number of specimens per 100 cm^3 of sediment (extrapolated when fraction analyzed < 1)	11	1170	5300	1700
Number of species	2	8	15	13
Shannon-Wiener species diversity : H(S)	1	0.83	1.41	1.63

WNF-14: Lomond

UTM location: 21U VE 455.5 779 NTS sheet: 12H/5

Altitutde: intertidal

Low cut (<3 m) at least partially covered by water at high tide. Situated less than 1 km SE of the former village of Lomond and approx. 150 m south of Killdevil Lodge. It forms the edge of a small terrace advancing ca. 15 m ahead of the edge of the forest. Elsewhere along the shore, the sea reaches the foot of the forested slope. The strata are tilted landward and northward but the bedding remains very planar and regular (see photos 26-27). There are shells in articulated position in the sediment, but their orientation was not noted. However, because of the minimal disturbance of the bedding, it is most probable that the sequence has not been overturned. It seems that this mass of sediment extending at least 50 m along the shore has slid or tilted as a block, but no landslide scar could be found. Maybe it has become filled up with sediment and subsequently overgrown.

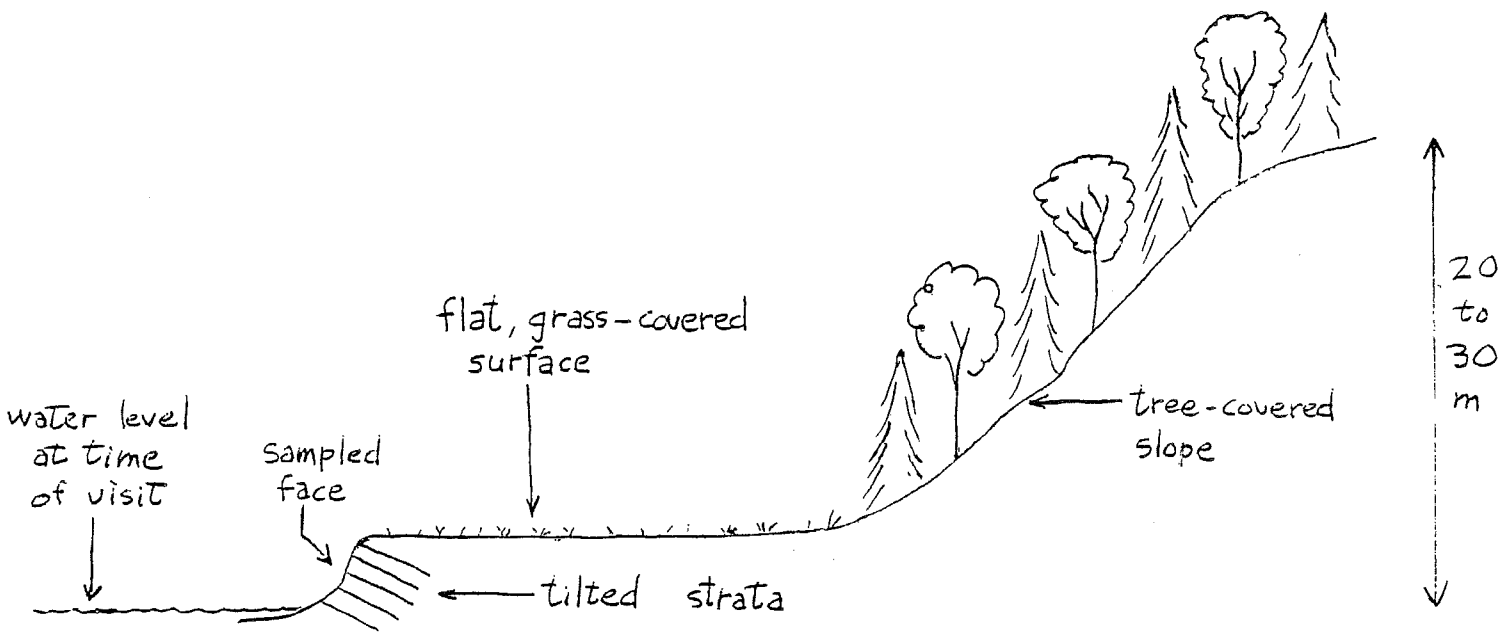


Fig. 17: locality WNF-14, looking south

Lithology:

1° Main section (from base up):

Unit 1 (0.0 to 0.50 m): fine, smooth and sticky reddish clay. Very few macrofossils, not in living position. A bedding joint (corresponding to a halt in sedimentation? see photo 27) occurs within this unit.

Unit 2 (0.50 to 0.85 m): fossiliferous silty clay with granules. Fossils may be or not be in articulated position. This bed is separated from the overlying strata by a bedding joint. Macrofossils: *Mya pseudoarenaria* and/or *truncata*, barnacles, *Nuculana* sp.

Unit 3 (0.85 to 2.60 m): fossiliferous silty clay with sand and gravel. Becomes more sandy and gravelly going up the section. Macrofossils: the same as in unit 2, plus *Astarte* sp. and *Macoma calcarea*.

Samples:

WNF-14-1: 0.15 m. Unit 1.

WNF-14-2: 0.60 m. Unit 2.

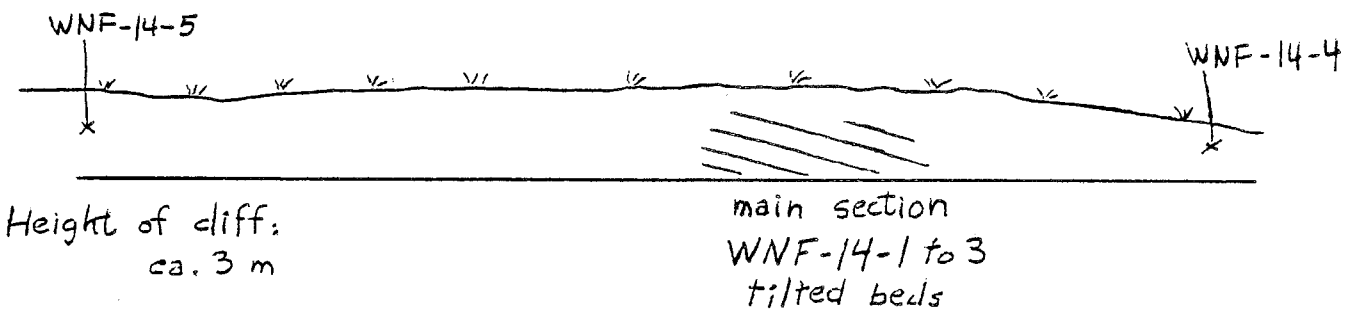
WNF-14-3: 2.25 m. Unit 3.

2° Other sampling points:

Sample WNF-14-4 was picked ca. 15 m north of the main section. Its stratigraphic position was not measured but it is most probably above unit 3. The space betwen WNF-14-4 and the main section was in good part covered by debris. No lithologic description has been made at the location of WNF-14-4.

Sample WNF-14-5 was picked ca. 30 m south of the main section, most probably below Unit 1 in the stratigraphy. Although the strata were well-exposed, no lithologic description was made and the connection with the main section could not be made because of fallen debris. All the sediment surface shows a reddish colour. The colour extends at least for a few centimeters inside the sediment, then becomes less pronounced. No gray sediment has been observed anywhere at locality WNF-14.

Fig. 18: Lomond section looking landward (westward)



^{14}C: an age of 10500 ± 300 BP (GSC-1575) has been obtained for Macoma calcarea shells collected by Brookes at 2.5 to 3.5 m a.s.l. in silt and sand rythmites approximately 100-200 m north of the present locality. His locality could not be found but it may have been closely connected to the present locality since it contained Astarte striata (Brookes, pers. comm., 1983).

WNF-14	-5	-1	-2	-3	-4
QUINQUELOCULINA SEMINULUM					
TRILOCULINA TRIHEDRA				0.8	0.5
VIRGULINA CONCAVA				0.3	
VIRGULINA SCHREIBERSIANA			2.5	0.3	
CASSIDULINA RENIFORME			10.9	5.6	4.2
ISLANDIELLA HELENAE			14.8	38.0	5.1
ISLANDIELLA NORCROSSI					
BUCCELLA FRIGIDA			0.2	0.5	
BUCCELLA FRIGIDA CALIDA				0.3	
BUCCELLA HANNAI					
BUCCELLA SP. 1					
GAVELINOPSIS SP.					
TRICHOHYALUS BARTLETTI					
CIBICIDES LOBATULUS			0.2	8.0	
NONION LABRADORICUM			0.4	0.5	
ASTRONONION GALLOWAYI				11.7	
ELPHIDIUM EXCAVATUM	100.0	17	64.8	20.7	87.6
ELPHIDIUM FRIGIDUM					
ELPHIDIUM HALLANDENSE			0.2	0.3	
ELPHIDIUM INCERTUM			0.2	1.6	
ELPHIDIELLA ARCTICA					
HAYNESINA ORBICULARE			2.9	9.0	1.2
HAYNESINA PAUCILOCULA			1.4	0.3	
% PLANKTONICS				0.5	
% ARENACEOUS					
FRACTION ANALYZED	1	1	1/2	1/4	1/8
NUMBER OF SPECIMENS PER 100 cm^3 OF SEDIMENT (EXTRAPOLATED WHEN FRACTION ANALYZED < 1)	275	21	1400	1900	535
NUMBER OF SPECIES	1	1	19	20	7
SHANNON-WIENER SPECIES DIVERSITY : H(S)	0	—	1.28	1.88	0.55

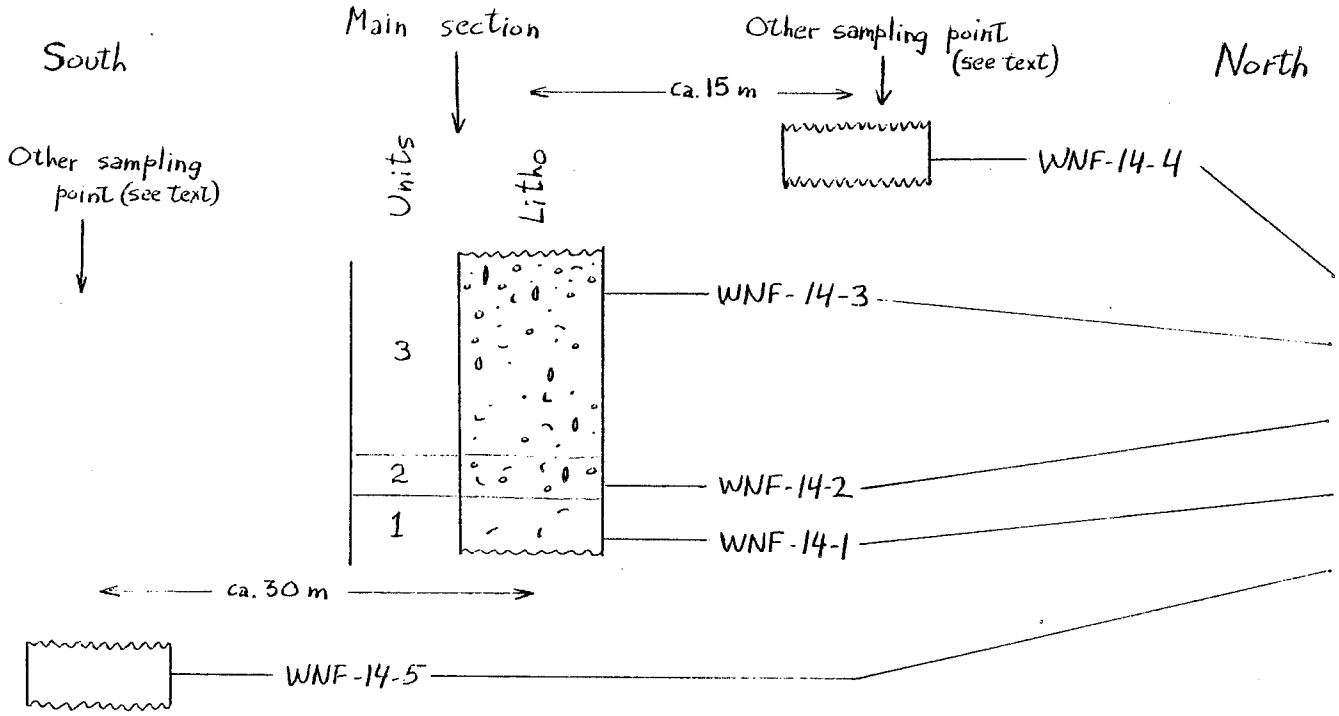


Fig. 19: WNF-14, Lomond.

WNF-15: Benoit's Cove

UTM location 21U/VE/170/485 NTS sheet 12G/1E

Altitude: between 50 and 100 ft (15 to 30 m) at top of section

Active(?) gravel pit at the eastern edge of the village of Benoit's Cove on Bay of Island's Humber Arm. The sampled unit is probably glacifluvial and dips southeastwards, away from the sea. Prof. I.A. Brookes, who drew the author's attention to the present locality, has observed in 1981 a 2-metre thick lens of reddish, very fossiliferous clay in the cross-stratified level (pers. comm. 1981). Brookes also mentioned a pit depth of ca 15 m. Such depths might be found in other parts of the pit, further to the right of Plate VI, fig. 28, but at the place we sampled, the wall was approx. 6 m high. The beds sampled were fossiliferous and conformable with the surrounding dipping beds but consisted of sandy silt, sand and grvel, not clay. It is probable that the face sampled by Brookes had been removed by exploitation by the time of our visit. However it seems near-to-certain that we sampled the same SE-dipping glacifluvial unit as he did.

Lithologic description (from the base upwards):

Unit 1: Dipping beds with alternatively gravel, coarse to fine sand, silty sand and sandy silt with or without granules. Macrofossils occur in the lower part of the unit. Thickness: 3.5 to 4 m.

Unit 2 (observed from the base of the cliff only): very coarse gravel (blocks), stratification indistinct. Thickness: ca. 2.5 m.

Samples (lower part of Unit 1, position not measured):

WNF-15-1: sandy silt with granules. Macrofossils: mostly barnacles.

WNF-15-2: sandy silt without gravel. Macrofossils: *Macoma* sp., barnacles.

WNF-15-3: silty medium sand. A few macrofossils among which *Macoma calcarea* et *Mya truncata*.

WNF-15-4: pebbly gravel (pebble-supported) with clayey and sandy matrix. Macrofossils: barnacles. N.B. excess pebbles have been removed from the sample.

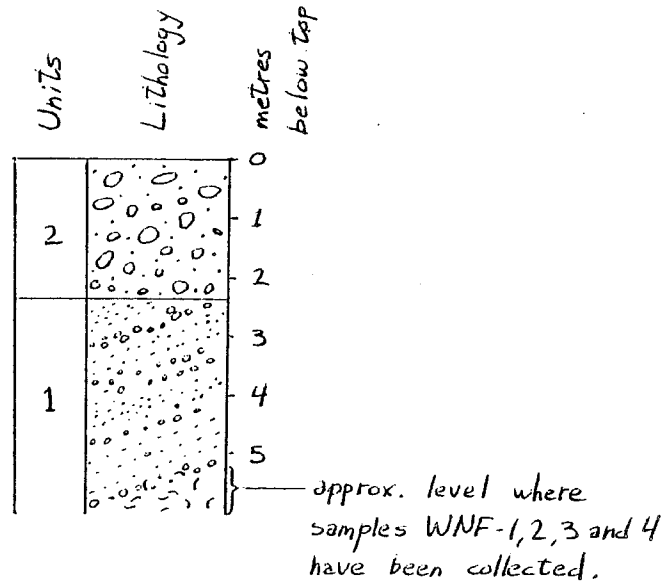


Fig. 20: WNF-15, Benoit's Cove

WNF-15	Quinqueloculina seminulum	Triloculina trihedra	Virgulina concava	Virgulina schreibersiana	Cassidulina reniforme	Islandiella helenae	Islandiella norcrossi	Buccella frigida	Buccella frigida calida	Buccella hannai	Buccella sp. 1	Gavelinopsis sp.	Trichohyalus bartletti	Cibicides lobatulus	Nonion labradoricum	Astrononion gallowayi	Elphidium excavatum	Elphidium frigidum	Elphidium hallandense	Elphidium incertum	Elphidiella arctica	Haynesina orbiculare	Haynesina paucilocula		% planktonics	% arenaceous	Fraction analyzed	Number of specimens per 100 cm³ of sediment (extrapolated when fraction analyzed < 1)	Number of species	Shannon-Wiener species diversity : H(S)	Elphidium cf. ustulatum	Lithology (see text)
-4					28.6	3.4		3.4			0.3			4.4		0.3	56.6			1.3		0.3					1/2	1200	11	1.23		Pebbly gravel with clayey and sandy matrix
-3					12.0	5.1		2.6			0.9			0.9			53.8			20.5		0.9	2.7				1	146	10	1.43		Silty medium sand
-2				0.3	8.8	8.2		3.0			0.3			1.2	0.9		62.5	1.2		9.1		3.6					1/4	1680	14	1.39	0.3	Sandy silt without gravel
-1					18.1	9.2		18.9	0.8		0.8						31.1	1.3		15.5		3.8					1/2	950	10	1.75		Sandy silt with granules

WNF-17: Bottle Cove

UTM location: 21U/VE/871.5/412 NTS sheet: 12G/1W

Altitude: base of cliff = top of beach

Coastal cliff on the N side of Bottle Cove near Lark Harbour, Bay of Islands area. This locality has been reported as fossiliferous by Brookes (1974). At the time of our visit, all of the lower ca. 12 m had collapsed, only the upper 1.75 m were well-exposed and clearly *in situ*.

Lithologic description (from the top downwards):

Unit 1: 0-1.20 m: Well-stratified angular gravel, more or less sandy. Pebbles oriented more or less in the bedding plane. A few fossils. (Beach deposit?)

Unit 2: 1.20 m - 1.80m: Clay with variable gravel content. The only macrofossils identified were *Hiatella arctica* and *Lunatia* at 1.75m.

Samples: 17-1:1.45m. Very gravelly clay.

17-2:1.75m. Less gravelly clay.

17-3: Pebbly clay without macrofossils taken a few metres under and approximately 30m to the right of (east of) 17-2.

^{14}C: *Hiatella* and *Lunatia* were picked between 1.20m and 1.75m. It was not noted if the *Hiatella* were articulated.

WNF-17	-1	-2	-3
QUINQUELOCULINA SEMINULUM			
TRILOCULINA TRIHEDRA	0.8	0.2	2.2
VIRGULINA CONCAVA			
VIRGULINA SCHREIBERSIANA	0.8	0.2	
CASSIDULINA RENIFORME	21.1	27.3	22.6
ISLANDIELLA HELENAE	3.3	5.3	0.8
ISLANDIELLA NORCROSSI			
BUCCELLA FRIGIDA	0.8	1.0	
BUCCELLA FRIGIDA CALIDA			
BUCCELLA HANNAI			
BUCCELLA SP. 1		0.2	
GAVELINOPSIS SP.			
TRICHOHYALUS BARTLETTI			
CIBICIDES LOBATULUS	0.8	0.5	
NONION LABRADORICUM	0.8	0.2	
ASTRONONION GALLOWAYI	0.8		
ELPHIDIUM EXCAVATUM	69.4	60.4	71.8
ELPHIDIUM FRIGIDUM			
ELPHIDIUM HALLANDENSE			
ELPHIDIUM INCERTUM			
ELPHIDIELLA ARCTICA			
HAYNESINA ORBICULARE	1.2	2.9	1.9
HAYNESINA PAUCILOCULA			
% PLANKTONICS	1.7	0.7	1.3
% ARENACEOUS			
FRACTION ANALYZED	1/2	1	1
NUMBER OF SPECIMENS PER 100 cm^3 OF SEDIMENT (EXTRAPOLATED WHEN FRACTION ANALYZED < 1)	928	523	752
NUMBER OF SPECIES	10	13	7
SHANNON-WIENER SPECIES DIVERSITY : H(S)	0.98	1.13	0.82

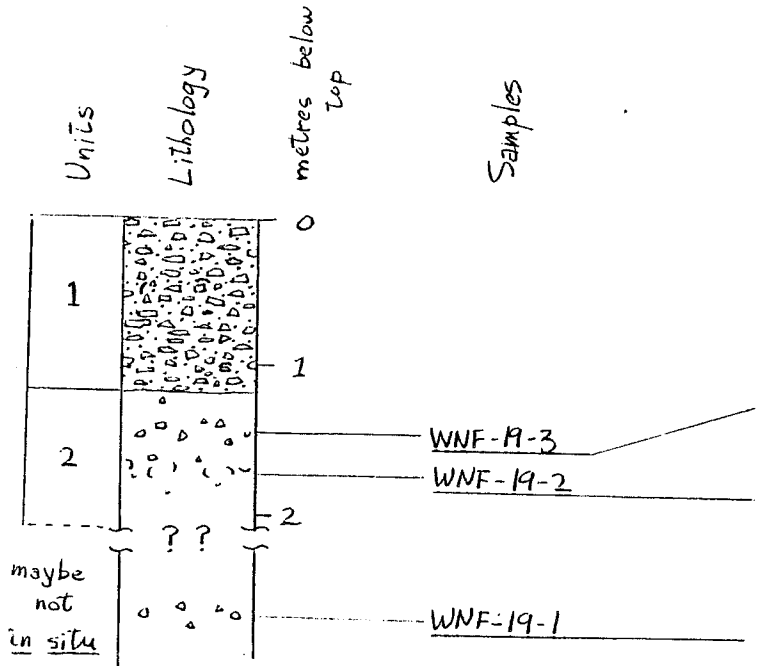


Fig. 21: WNF-17, Bottle Cove

WNF-18: Road to Little Port

UTM location: 21U/VE/968.5/405 NTS sheet 12G/1W

Altitude: ca. 15m.

Single sample collected on the NW side of the road between Bottle Cove and Little Port, near Lark Harbour. Going up the road towards Little Port, the outcrop is to be found near the limit between the clay and the overlying gravel.

The exposure being very small, no stratigraphy could be observed. The sediment was a shelly pebbly clay. The sample (WNF-18-1) was collected more than 20 cm below the turf in order to avoid dissolution.

^{14}C: shells from the nearby and overlying foreset gravel have been dated at 12000 ±320BP (GSC-1462, see Brookes, 1974, p. 16).

	WNF-18
	QUINQUELOCULINA SEMINULUM
0.9	TRILOCULINA TRIHEDRA
	VIRGULINA CONCAVA
1.8	VIRGULINA SCHREIBERSIANA
21.5	CASSIDULINA RENIFORME
3.7	ISLANDIELLA HELENAE
	ISLANDIELLA NORCROSSI
	BUCCELLA FRIGIDA
0.5	BUCCELLA FRIGIDA CALIDA
	BUCCELLA HANNAI
	BUCCELLA SP. 1
	GAVELINOPSIS SP.
	TRICHOHYALUS BARTLETTI
	CIBICIDES LOBATULUS
1.8	NONION LABRADORICUM
0.5	ASTRONONION GALLOWAYI
16.6	ELPHIDIUM EXCAVATUM
	ELPHIDIUM FRIGIDUM
	ELPHIDIUM HALLANDENSE
0.5	ELPHIDIUM INCERTUM
	ELPHIDIELLA ARCTICA
5.5	HAYNESINA ORBICULARE
0.5	HAYNESINA PAUCILOCULA
	% PLANKTONICS
	% ARENACEOUS
1/2	FRACTION ANALYZED
880	NUMBER OF SPECIMENS PER 100 cm^3 OF SEDIMENT (EXTRAPOLATED WHEN FRACTION ANALYZED < 1)
14	NUMBER OF SPECIES
1.28	SHANNON-WIENER SPECIES DIVERSITY : H(S)

WNF-19: Lark Harbour #1

UTM location: 21U/VE/987.5/392 NTS sheet: 12G/1W

Altitude: 15m

This is a road cut on the W side of the road, just ahead of the bridge, when driving into the village of Lark Harbour.

Lithologic description (from the base upwards):

Unit 1: 0-1.20 m: Grey, slightly pebbly, medium sand. Variable macrofossil content.

Unit 2: 1.20 to ca. 3.50-4.00 m (top is inaccessible):
Medium to coarse sand in beds varying from a few millimeters up to 20cm. Oxidation colour.

Unit 3: above 3.50-4.00 m: approximately 1 metre of up to pebble-size gravel.

Samples:

WNF-19-1: 0.35 m. Unit 1. Very few macrofossils.

WNF-19-2: 1.10-1.20 m. Top of Unit 1. Macrofossils more abundant than in 19.1 (*Macoma* sp, barnacles)

WNF-19-3: 1.70-1.80 m. Unit 2.

WNF-20: Lark Harbour #2

UTM location: 21U/VE/986.5/394 NTS sheet: 12G/1W

Altitude: probably no more than 3m a.s.l.

Locality situated 300m ahead of the mouth of the creek passing under the bridge mentioned in locality 19. The sample was picked on the left bank of the creek. The section as a whole is not good for sampling: The lower part is slumped material and the upper part is a poorly preserved landslide scar.

Sample:

WNF-20-1 was picked at the very base of the section in a block having moved by ca. 1 metre. The lithology was a stiff, unfossiliferous sandy and pebbly clay, probably a till.

WNF-21: Tea Cove

UTM location: 21U/UD/552/896 NTS sheet 12B/10

Altitude: sea level

This section is a coastal cliff situated on Tea Cove, in the western corner of West Bay, Port-au-Port Bay, immediately S of Rocky Point. Rocky Point is approx. 1.5 km E of the village of Lourdes. It is a two-pronged, flat-topped, 5 to 7 metre (estimated) high headland composed mainly of steeply dipping shales, sandstones and conglomerates. The Quaternary section is a low cliff forming a southward extension of the bedrock cliff (fig. 23).

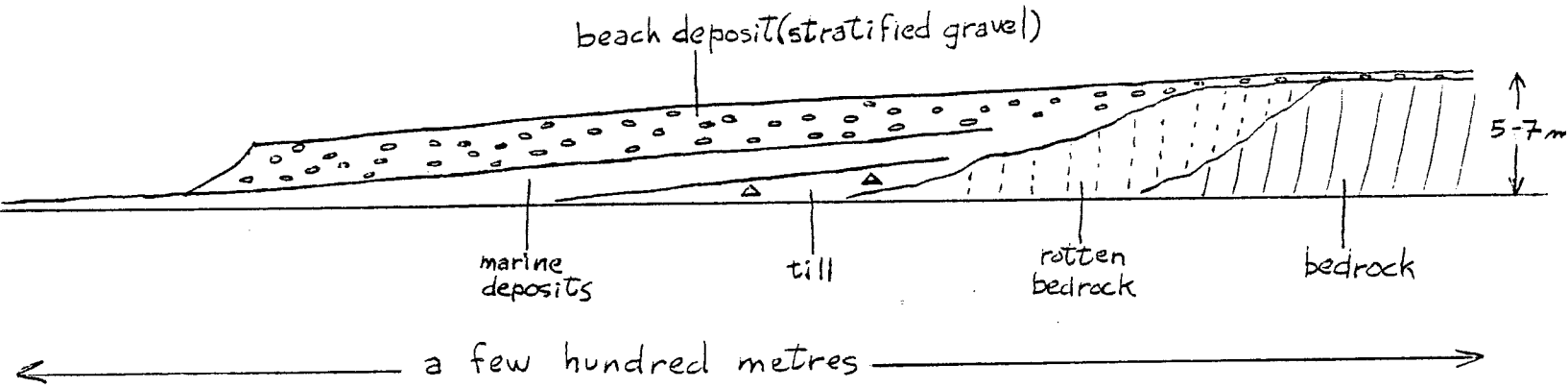


Fig. 23: setting of the marine deposits at Tea Cove (schematic). There is a strong vertical exaggeration.

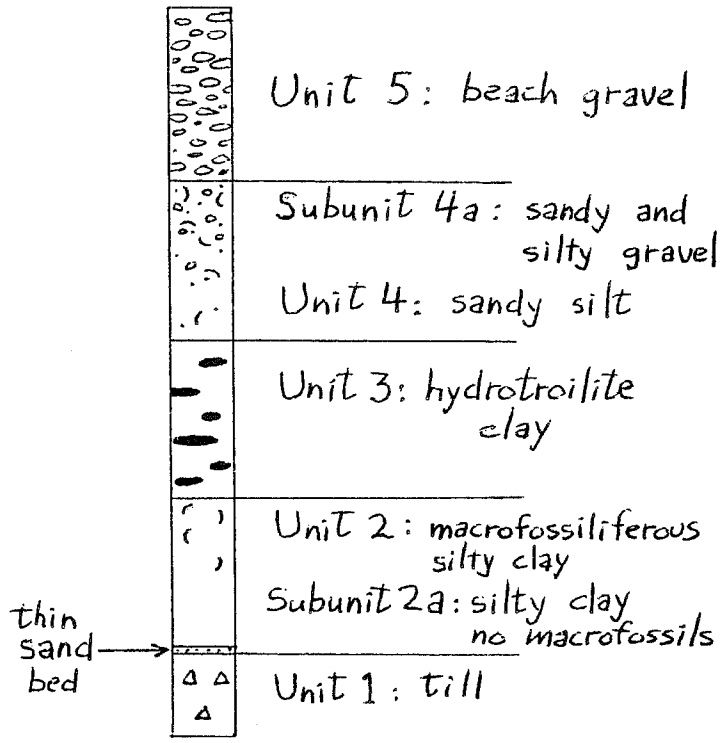


Fig. 24: Composite section

The sampling was done in the area where the till outcrops.

Lithologic units:

6 different short sections were sampled. Nowhere are all the facies simultaneously observed - usually because of a cover of debris. All together, 5 distinct lithofacies occur as well as 2 subfacies. They are, from bottom to top (see fig. 24):

Unit 1: Compact tilloid (heterometric) material, unfossiliferous or at most with fossil fragments. Sharp upper surface.

Unit 2: Fossiliferous silty clay. Subunit 2a: Unfossiliferous silty clay immediately overlying Unit 1. Present in section 1 only.

Unit 3: Soft clay with hydrotroilite.

Unit 4: Fossiliferous sandy silt. Subunit 4a: Unit 4 grades upwards into a very fossiliferous sandy and silty gravel. Present only in section 3.

Unit 5: ca. 2 m of stratified pebbly gravel. Pebbles laid subhorizontally. No cross-bedding. No macrofossil. Probably a beach deposit.

Description of sections (for their relative position, see fig. 25):

Section 1: 0.5 m of unfossiliferous silty clay (2a) overlying the till (Unit 1).

Samples: WNF-21-8: Unit 1, 10 cm below the top.

	WNF-20
	QUINQUELOCULINA SEMINULUM
	TRILOCULINA TRIHEDRA
	VIRGULINA CONCAVA
	VIRGULINA SCHREIBERSIANA
1	CASSIDULINA RENIFORME
	ISLANDIELLA HELENAE
	ISLANDIELLA NORCROSSI
	BUCCELLA FRIGIDA
	BUCCELLA FRIGIDA CALIDA
	BUCCELLA HANNAI
	BUCCELLA SP. 1
	GAVELINOPSIS SP.
	TRICHOHYALUS BARTLETTI
	CIBICIDES LOBATULUS
	NONION LABRADORICUM
	ASTRONONION GALLOWAYI
9	ELPHIDIUM EXCAVATUM
	ELPHIDIUM FRIGIDUM
	ELPHIDIUM HALLANDENSE
	ELPHIDIUM INCERTUM
	ELPHIDIELLA ARCTICA
	HAYNESINA ORBICULARE
	HAYNESINA PAUCILOCULA
	% PLANKTONICS
	% ARENACEOUS
1	FRACTION ANALYZED
14	NUMBER OF SPECIMENS PER 100 cm^3 OF SEDIMENT (EXTRAPOLATED WHEN FRACTION ANALYZED < 1)
3	NUMBER OF SPECIES
1	SHANNON-WIENER SPECIES DIVERSITY : H(S)
1	ELPHIDIUM GROENLANDICUM

WNF-21-9: Unit 2a, 10 cm above the top of Unit 1.

Section 2: 0.5 m of hydrotroilite-rich clay (Unit 3) underlain by fossiliferous silty clay (Unit 2) and overlain by fossiliferous sandy silt (Unit 4).

Samples: WNF-21-10: in Unit 2 - top of the unit.

WNF-21-5: near base of Unit 3.

Section 3: 0.4 m of fossiliferous sandy silt (unit 4) grading upwards into 0.3 m of fossiliferous sandy and silty gravel (unit 4a). Subunit 4a is in turn overlain by 2 metres of the beach gravel of unit 5.

N.B. 1° Unit 5 is present at the top of every section; but the contact with the underlying beds is exposed only in section 3.

N.B. 2° On fig. 25. The presence of Unit 3 at the base of Unit 4 is postulated by extrapolation from section 2, situated 2 metres to the south. However, it has not been observed.

Samples: WNF-21-6: Unit 4.

WNF-21-7: Subunit 4a.

Section 4: At the base: till (Unit 1) overlain by fossiliferous silty clay (Unit 2) (see photo 52). In the middle: close to 1 m of debris. At the top: 0.25 m of sandy silt (Unit 4) covered by the beach gravel (Unit 5). N.B. the lower part of this section is a very small outcrop and might not be <u>in situ</u> although this is unlikely.

Samples: WNF-21-1: Unit 1

WNF-21-2: Unit 2

WNF-21-3: Unit 4, 25 cm below base of Unit 5

Section 5: 1 m of till with fossil fragments (Unit 1) covered by beach gravel (Unit 5).

Samples: WNF-21-4: approx. in the middle of the till unit.

Section 6: A few centimeters of sand sandwiched in between the till (Unit 1) and the silty clay (Subunit 2a) (see left side of photo 53). The whole section is no more than 40 cm high.

Sample WNF-21-11: from the thin sand layers.

In addition, sample WNF-21-12 was picked in an horizontal outcrop of Unit 2 (silty clay with large shells of *Mya truncata*, *M. pseudoarenaria* and *Serripes groenlandicus*) lying in the beach itself at approximately 9 metres S of section 1.

^{14}C: GSC-937: 13200 ± 220 BP. Collected by J.M. Shearer, reported by Brookes (1974) at 3 m alt. Species: mainly *Mya arenaria*.

The present author has collected shells from the site of sample WNF-21-10, in Unit 2. Species were not noted.

Lithology	Unit	Section	Sample	WNF-21	Quinqueloculina seminulum	Triloculina trihedra	Virgulina concava	Virgulina schreibersiana	Cassidulina reniforme	Islandiella helenae	Islandiella norcrossi	Buccella frigida	Buccella frigida calida	Buccella hannai	Buccella sp. 1	Gavelinopsis sp.	Trichohyalus bartletti	Cibicides lobatulus	Nonion labradoricum	Astrononion gallowayi	Elphidium excavatum	Elphidium frigidum	Elphidium hallandense	Elphidium incertum	Elphidiella arctica	Haynesina orbiculare	Haynesina paucilocula		% planktonics	% arenaceous	Fraction analyzed	Number of specimens per 100 cm³ of sediment (extrapolated when fraction analyzed < 1)	Number of species	Shannon-Wiener species diversity : H(s)	Islandiella islandica	Elphidium groenlandicum
	4	III	7						1.8	24.8		1.6	0.2	0.2	0.4			0.2	1.6	0.2	18.6	0.4	0.9	7.3		40.4	0.7				1/8	4590	18	1.63	0.2	
	4	IV	3			0.1	0.7	0.4	7.6	20.1		2.2	0.7	0.1	0.2			0.7	3.2	2.0	28.7	0.2	0.1	2.5		27.8	0.2				1/16	16440	29	1.90	0.2	0.1
		III	6				0.3		7.5	10.1		3.1	0.5						3.1	0.3	34.4		0.3	6.7		28.2	0.8				1/16	7820	21-22	1.92		
	3	II	5					1.5	12.5	3.2		1.1	1.1		0.2				0.7		57.3			4.3		16.5	0.7				1/32	21800	13-14	1.41		
		B	12				0.4	1.2	17.4	11.0		2.0	0.7	0.2	1.6			0.5	2.0	0.4	44.9		0.2	3.4	0.2	11.7	0.5				1/8	5730	25	1.81	0.4	0.2
	2	IV	2		0.2	0.2		1.1	11.0	26.5		0.9	0.2		0.2			0.2	4.9	0.2	24.1			3.0		25.2					1/16	10560	21	1.83	0.2	
		II	10		0.2				11.6	5.3		0.7			0.4			0.2	1.5	0.7	46.8			6.1		25.0	0.9				1	684	15	1.54		
	2a	I	9			0.5		3.0	54.4	0.2					0.5			0.7			37.0	0.2		0.5		2.3					1/4	2160	13	1.07	0.2	
	1-2	VI	11						9.9	5.0	1.9	0.8	0.4	0.4	0.4			2.7	2.3		37.8			3.8	0.4	20.6	5.4				1/2	1100	25	2.14	2.3	0.8
		V	4		1					3	2							2			11								1		1	31	9	—	3	1
	1	IV	1						13.9	14.6	2.1							9.8	2.8		38.2			1.4		4.9	0.7		0.7		1/2	380	17	2.08	2.1	1.4
		I	8						13.3	10.0	5.8	2.5		1.7				12.5	1.7		36.7					5.8			0.7		1	177	13	2.04	4.2	2.[illegible]

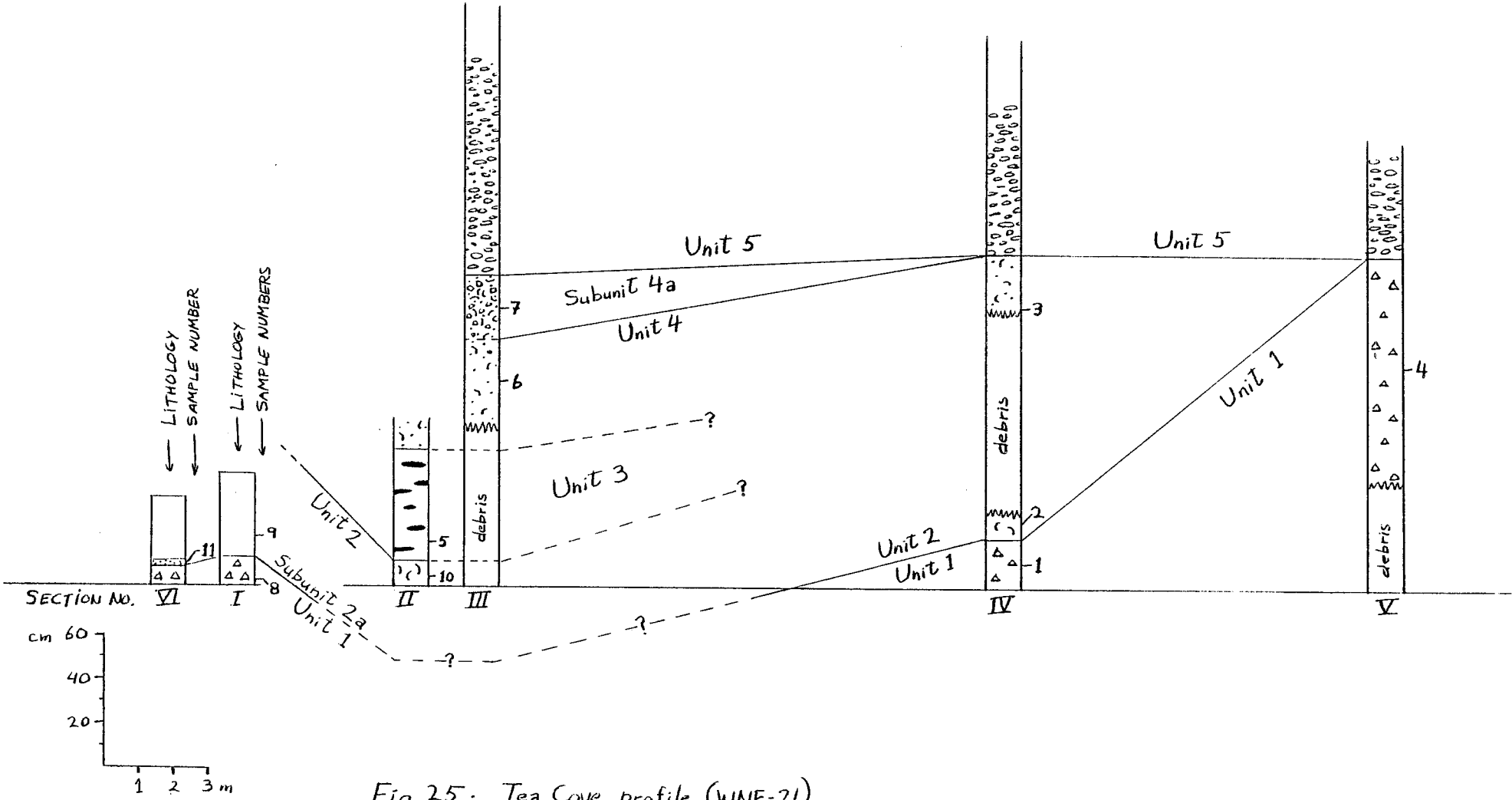


Fig. 25: Tea Cove profile (WNF-21)

WNF-19	-3	-2	-1
Quinqueloculina seminulum			
Triloculina trihedra			
Virgulina concava			
Virgulina schreibersiana			
Cassidulina reniforme		2.0	0.9
Islandiella helenae		11.8	7.8
Islandiella norcrossi		0.3	
Buccella frigida	1	42.9	57.7
Buccella frigida calida			
Buccella hannai			
Buccella sp. 1			
Gavelinopsis sp.			
Trichohyalus bartlettii			
Cibicides lobatulus		0.3	0.9
Nonion labradoricum			
Astrononion gallowayi			
Elphidium excavatum	1	26.6	22.4
Elphidium frigidum		0.3	0.9
Elphidium hallandense			0.9
Elphidium incertum		4.0	0.9
Elphidiella arctica			
Haynesina orbiculare		16.1	6.9
Haynesina paucilocula		0.3	
% Planktonics			
% Arenaceous			
Fraction analyzed	1	1/2	1/2
Number of specimens per 100 cm^3 of sediment (extrapolated when fraction analyzed < 1)	2	817	330
Number of species	2	14	10
Shannon-Wiener species diversity : H(S)	—	1.57	1.29
Islandiella islandica		0.3	

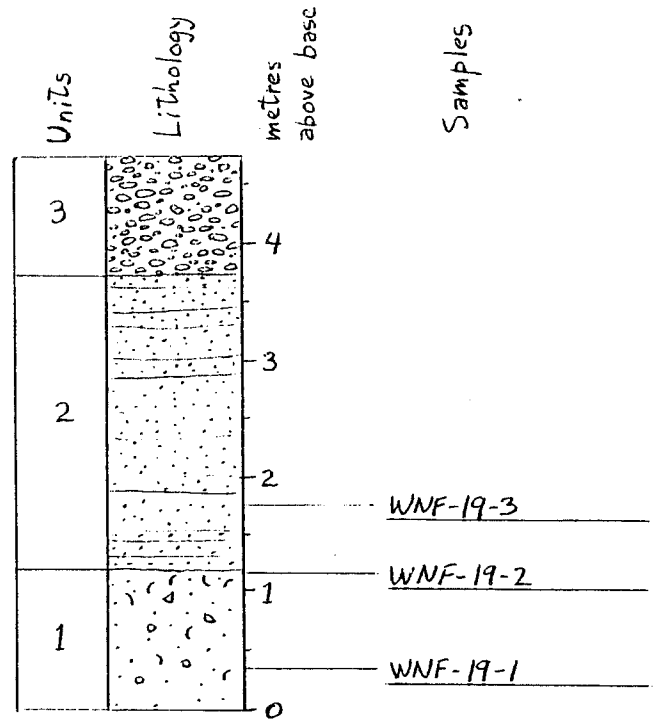


Fig. 22: WNF-19, Lark Harbour #1.

WNF-22: Abraham's Cove

UTM location: 21U/VD/586/755.5 NTS sheet: 12B/10

Altitude: coastal cliff. See fig. 27.

Locality WNF-22 is situated on the S coast of Port-au-Port Peninsula. It is a coastal cliff in unconsolidated sediment occupying a valley in the Ordovician limestone bedrock, in between two bedrock coastal cliffs (see photo 37). The Quaternary cliff is ca. 20m high.

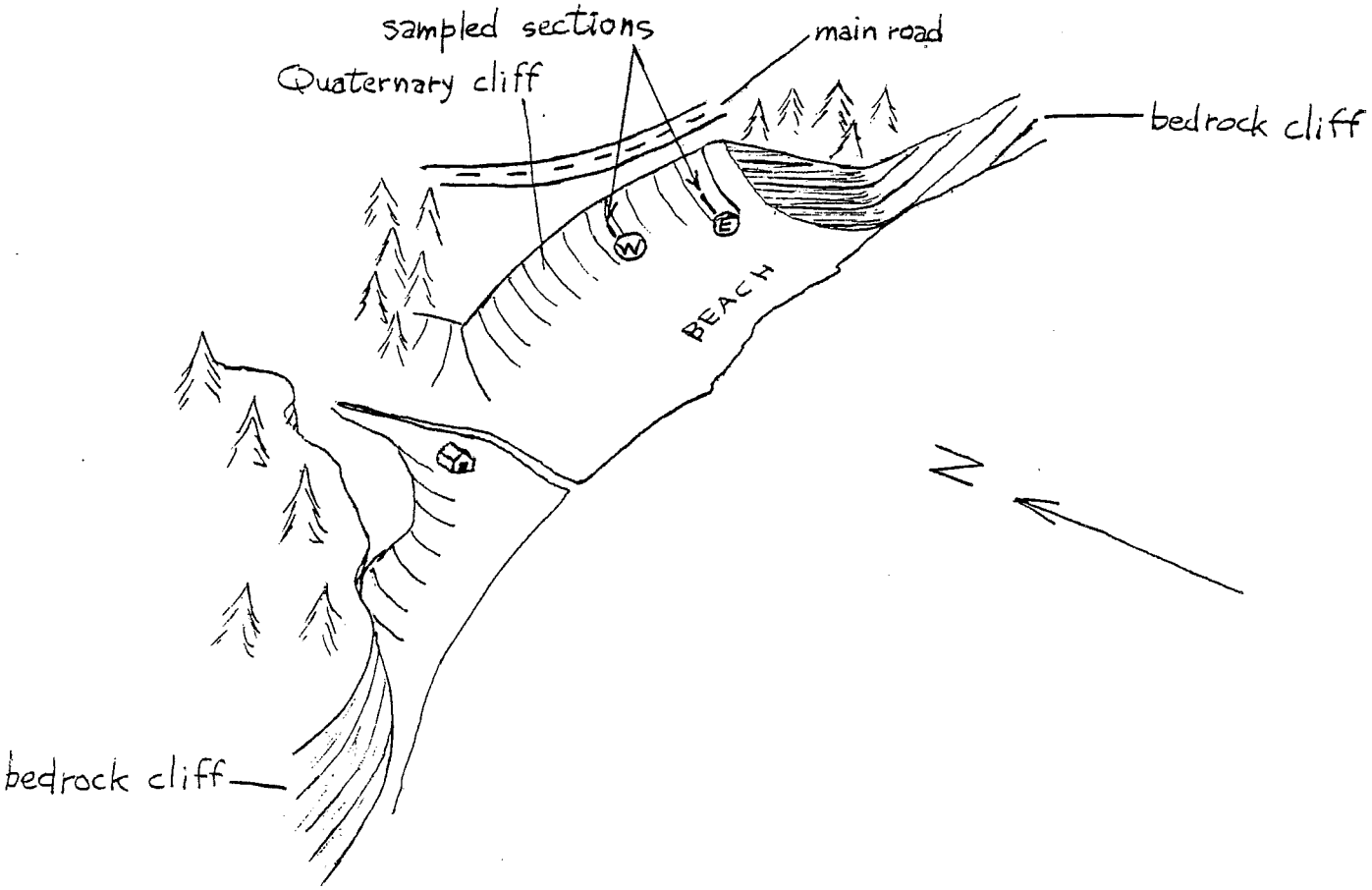


Fig. 26: Schematic view of Abraham's Cove

This section has been studied by Brookes (1974). The terrace on which the main road is built is probably the same as the terrace illustrated on the sketch on Brookes' map. A second, higher limestone cliff is situated further inland and surrounds the location like an amphitheatre (see Brookes' sketch).

Two sections have been studied. Their relation to each other and to the neighboring limestone cliff are shown on fig. 27.

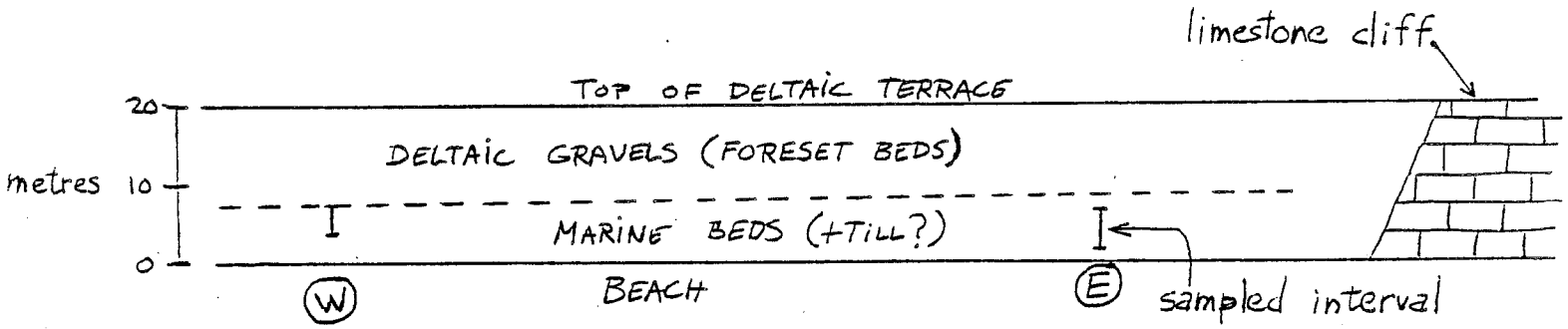


Fig. 27: The Quaternary Cliff looking northwards

vert. scale = horiz. scale = 10 m : 1 cm.

Section E

Lithologic description:

Unit 1: 0 to 30 cm: Compact clayey and stony sand. Gray colour. Few macrofossils. Till?

Unit 2: 30 to 0.90m: Beds of sandy and stony clay alternating with beds of more or less unctuous clay. Beds are well-marked and 10-20 cm thick. Few macrofossils.

Unit 3: 0.90 to 1.80m: Varies from clayey, stony sand to sandy clay. Variations are smooth, without sharp break. Darker than underlying units probably because of higher hydrotroilite content. Sparse macrofossils, disarticulated and lying horizontally in bedding plane. N.B. this is poorly exposed and may not be a separate unit.

Unit 4: 1.80 to 2.55m: Sandy and gravelly clay. The finest granulometry occurs in the middle part of the unit. The top 10 centimetres consists of a well-marked gravel bed. Macrofossiliferous mostly between 2.00 and 2.30m. Shells are disarticulated and broken.

Unit 5: 2.55 to 3.30m: Rather sandy up to 2.70m., then similar to Unit 4, with the finest granulometry in the middle part of the unit. Generally poor in microfossils.

Unit 6: 3.30 to 4.30m: Sandy and gravelly clay, with the coarser granulometries in the lower part of the unit. This unit is distinctly bedded whereas the underlying units are massive. Beds are 5-15cm thick and become more and more inclined above 3.60m. There are no laminations. Macrofossils are very sparse.

Unit 7: 4.30 to 4.95m: Soft, laminated, fine clay, nearly black in colour (rich in hydrotroilite) without macrofossils. There is a break at the base of this unit, the inclined strata of Unit 6 being truncated.

Above Unit 7:

4.95 to approximately 7.00 m: covered.

Above approximately 7.00 m: deltaic gravels (foreset beds).

Samples: WNF-22-1: 0.10m. Unit 1

WNF-22-2: 0.45m. Unit 2. Includes both the unctuous and the sandy clay.

WNF-22-3: 0.90m. Limit of Units 2 and 3.

WNF-22-4: 1.80m. Limit of Units 3 and 4. This is not a sharp limit.

WNF-22-5: 2.20m. Unit 4, fossiliferous level.

WNF-22-6: 2.70m. Unit 5, lower part, rather sandy material.

WNF-22-7: 3.60m. Unit 6.

WNF-22-8: 4.50m. Unit 7.

Section W

Lithologic description:

Unit A: 0.0 to 0.80m: Well-bedded, black (hydrotroilite) silty clay in 2-to-5cm-thick beds. Changing progressively upwards into more thickly bedded, fine to very fine gray sand. Macrofossils rare.

Unit B: 0.80 to ca. 2.10m: Interlayering of sand, silt, clayey silt and silty clay, occasionally hydrotroilite-black in colour. No macrofossils noted. Unit B grades downwards into Unit A but is separated from Unit C by a break in stratification.

Unit C: ca. 2.10 to ca. 2.75m: Cross-bedded sand. One of the inclined beds is not a sand but a slightly fossiliferous sandy and gravelly clay similar to Units 3, 4 and 5 of section E.

Unit D: ca. 2.75 to ca. 3.05m: Horizontally-bedded sand.

Unit E: ca. 3.05 to ca. 3.70m: Cross-bedded, loose, medium sand.

Samples: WNF-22-9: 0.0,. Base of Unit A. Silty clay.

WNF-22-10: 0.80m. Top of Unit A. Sand.

WNF-22-11: 2.15m. Lower part of Unit C Sand.

WNF-22-12: 2.60m. From the clayey bed interalated between sand beds in the upper part of Unit C.

WNF-22-13: 3.40m. Unit E. Loose sand.

^{14}C: Shells collected near the base of the marine section by Brookes (1974) have been dated at 13600± 180BP(GSC-968). This shelly level could not be recognized by the present investigator, though Unit 1 (section E) may be the upper part of it.

Comparison with Brookes' results:

The state of the section at the time of our visit was rather poor and it was impossible to observe the contact between the Quaternary deposits and the underlying Ordovician limestone. Furthermore, it has been impossible to identify positively the till and the overlying sand bed reported by Brookes in his sketch. On the other hand, we saw more than 3

metres (Units 1 through 5) of fossiliferous sandy and stony clay - probably a glaciomarine diamiction - which Brookes does not report. Brookes (pers. comm. 1983) returned to this locality since the publication of his 1974 report and now believes that at some places in the cliff a fossiliferous glaciomarine unit indeed exists between the till proper, which is unfossiliferous, and the clayey bottomset beds. His 1974 sketch describes a part of the cliff where the fossiliferous diamicton happens to be absent. His section is situated a few metres east of the present E section.

The exposure we studied starts within the diamicton and then proceeds upwards through the same sequence as that reported by Brookes (1974):

Brookes (1974)	This report (E Section)	This report (W Section)
Foreset gravels	Foreset gravels	Foreset gravels
Silty-clayey bottomsets	covered segments + Unit 7	Units B to E Unit A
sandy clay	Unit 6	Covered
Fossiliferous diamicton (not reported in 1974 paper)	Units 1 to 5	
sand	covered	
till		

WNF-22, Section W					
Quinqueloculina seminulum					
Triloculina trihedra					0.8
Virgulina concava		0.2		0.5	
Virgulina schreibersiana					2.0
Cassidulina reniforme	7.4	22.2	4.1	44.3	23.1
Islandiella helenae	8.9	5.5	3.3	0.5	0.2
Islandiella norcrossi	0.5				
Buccella frigida	0.7	1.4	1.5	3.0	5.5
Buccella frigida calida		0.9	0.4	1.5	1.8
Buccella hannai					
Buccella sp. 1	0.5	1.6	0.4	4.5	7.1
Gavelinopsis sp.					0.2
Trichohyalus bartletti					
Cibicides lobatulus	5.7	1.6	0.4		
Nonion labradoricum		0.2	1.1		
Astrononion gallowayi	0.2	0.2	0.7	4.28	
Elphidium excavatum	32.0	31.6	37.8		28.3
Elphidium frigidum	8.2	3.9	3.3		2.6
Elphidium hallandense	0.2	0.5		0.5	2.0
Elphidium incertum	13.4	12.0	17.4		6.1
Elphidiella arctica	3.5	1.6	2.2		0.7
Haynesina orbicularis	16.4	15.2	26.7	1.5	18.2
Haynesina paucilocula		0.2		0.5	
% Planktonics		0.2			
% Arenaceous					
Fraction analyzed	1/2	1/4	1/2	1	1/4
Number of specimens per 100 cm³ of sediment (extrapolated when fraction analyzed < 1)	874	2270	~675	267	3325
Number of species	16	19	14	11	20
Shannon-Wiener species diversity : H(S)	2.04	1.93	1.71	1.23	1.98
Elphidium cf. groenlandicum	0.7	0.5			
Islandiella islandica	1.2				
WNF-22, Section W	-13	-12	-11	-10	-9

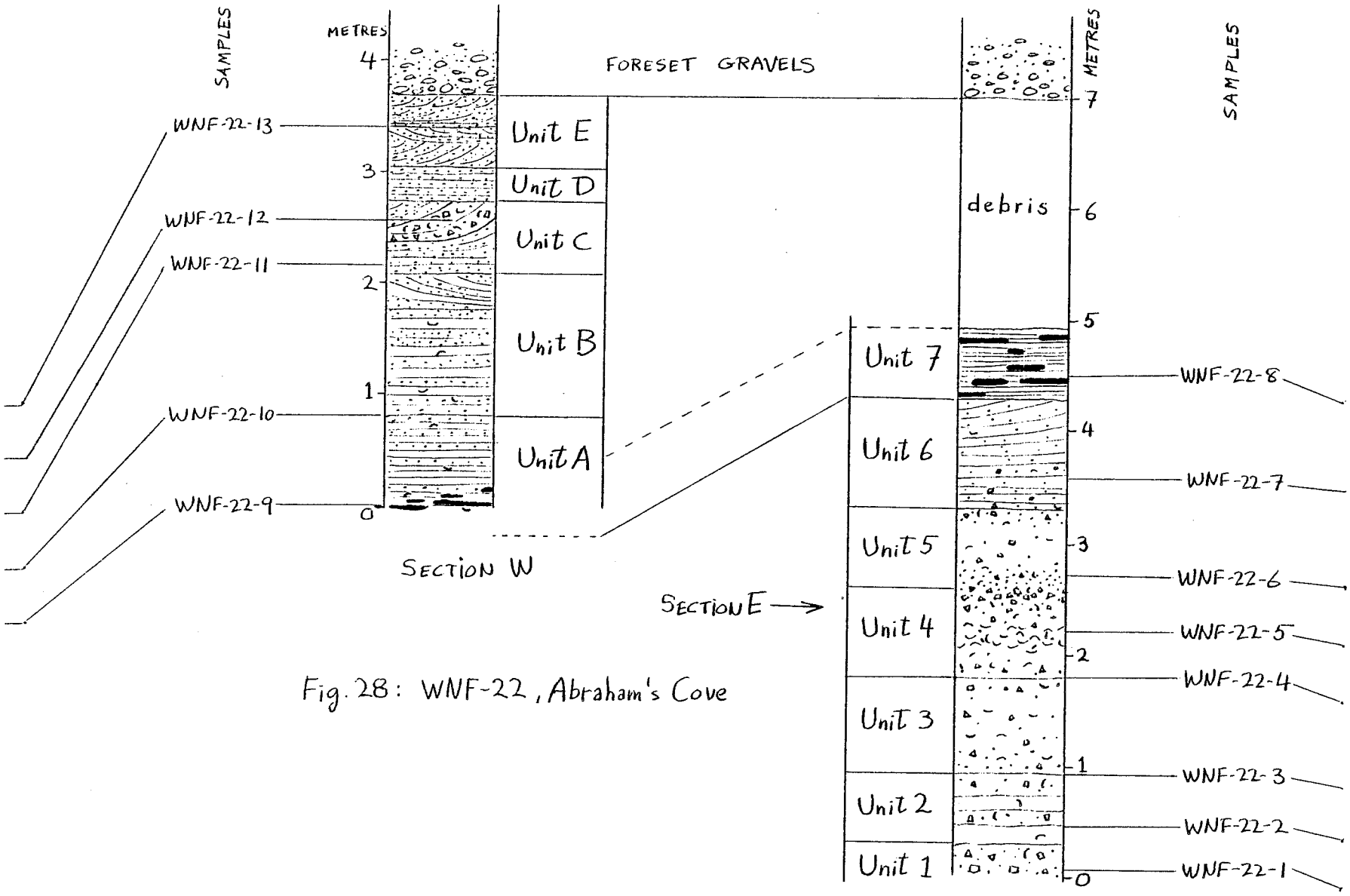


Fig. 28: WNF-22, Abraham's Cove

WNF-23: Port-au-Port

UTM location: 21U/VD/735.5/801 NTS sheet: 12B/10

Altitude: sea level.

Coastal section located approx. 1 km to the NE of the Port-au-Port Isthmus. This section has been studied by Brookes (1974). It is situated 60 to 70 m N of the first limestone outcrop encountered when coming from the south. Most of the cliff on the mainland side of Port-au-Port Isthmus (see photo 40) is made up of steeply dipping deltaic foreset gravels. The till, clay and sand are barely a few metres thick and outcrop only at the northern end of the cliff, where the bedrock also outcrops.

Lithologic description (from the base upwards):

The base of the Quaternary section rests directly on the Paleozoic bedrock (see photo 41) which, at this locality, constitutes the "beach" or intertidal area.

Unit 1: 0.0 to 0.20m: Very compact gravel with sandy matrix. Horizontal fissility. Macrofossils.

Unit 2: 0.20 to 0.40m: Loose stony sand, very rich in fragmented macrofossils.

Unit 3: 0.40 to 1.10m: Sandy and silty gravel. Sparse fragments of macrofossils.

WNF-22, Section E	Quinqueloculina seminulum	Triloculina trihedra	Virgulina concava	Virgulina schreibersiana	Cassidulina reniforme	Islandiella helenae	Islandiella norcrossi	Buccella frigida	Buccella frigida calida	Buccella hannai	Buccella sp. 1	Gavelinopsis sp.	Trichohyalus bartletti	Cibicides lobatulus	Nonion labradoricum	Astrononion gallowayi	Elphidium excavatum	Elphidium frigidum	Elphidium hallandense	Elphidium incertum	Elphidiella arctica	Haynesina orbiculare	Haynesina paucilocula		% planktonics	% arenaceous	Fraction analyzed	Number of specimens per 100 cm³ of sediment (extrapolated when fraction analyzed < 1)	Number of species	Shannon-Wiener species diversity : H(s)	Islandiella islandica	Elphidium groenlandicum	E. sp. aff. groenlandicum	Bulimina aculeata
				1.5	26.6	2.3		0.6	2.1		2.9			0.2	0.5	0.6	29.0		0.2	9.2	16.9	12.7					½	1675	17	1.91				
	0.3	2.7			15.6	14.6		2.4	0.5		1.9			1.3	0.5	0.5	42.2	0.5		3.2	5.6	6.6					½	950	20	1.92	0.3			
					4.8			11.6									59.4			11.1		12.6					1	264	6	1.24				
		0.5		0.5	30.0	2.1		8.9	1.6		1.1			0.5			35.8	1.1		6.3	3.7	7.9					¼	955	13	1.77				
		4.0		3.7	26.6	6.0	0.7	3.7	1.7		1.7			1.3		0.3	31.6		0.3		3.3	11.0			0.7		1	380	19	2.04	1.0	1.0	0.3	
				0.3	17.3	1.4	2.0	1.4	0.3	1.1				1.1	0.6		72.5					0.8			0.3		½	885	13	1.00	0.7			
		0.6			13.6	5.8	1.3	5.2	1.3					7.8	0.6		48.7	2.6			1.3	4.5					½	417	19	1.89	1.9	0.6		
					16.9	5.1	1.0	4.5	2.5	0.6	1.0			11.8	0.6	0.3	42.4	1.3	0.3	0.3	1.3	3.8	0.3				½	855	25	2.04	1.9	1.0		0.3

Unit 4: 1.10 to 1.30m: Fossiliferous coarse sand with a few pebbles. Weathered specimens of Hiatella arctica and basal plates of barnacles encrusting pebbles.

Unit 5: 1.30 to 1.50m: Very fine sand and silt. Smooth. Hiatella arctica occurs in articulated position just above the base of the unit.

Unit 6: 1.50 to 2.20m: Fine sand interbedded with silt. Bed thicknesses in the centimetre range. No macrofossils.

Unit 7: 2.20 to 2.40m: Medium sand.

Unit 8: 2.40 to ca. 2.60m: As Unit 6 but with 2-to-5 cm beds.

N.B.: There is an oxidation colour throughout this section but it is more pronounced in the upper part.

Samples: WNF-23-1: 0 to 15cm. Due to difficult sampling conditions this sample may have been contaminated by material falling from above.

WNF-23-2: 0.30 to 0.40m. Unit 2.

WNF-23-3: 0.70 to 0.80m. Unit 3.

WNF-23-4: 1.15 to 1.25m. Unit 4.

WNF-23-5: 1.30 to 1.35m and 1.80m to the N of sample WMF-23-4. Picked in the level with Hiatella in living position, at the base of Unit 5.

WNF-23-6: ca. 2.10m and 1.20m N of sample WNF-23-5.

^{14}C: shells (barnacles) collected by Brookes (1974)in a sand bed (the

present Unit 4) between the till and the "clayey bottomsets" (Units 5 to 8?) have been dated at 13400 ± 290BP(GSC-1187).

Correlation with Brookes (1974)

The comparison is much easier than for Abraham's Cove. Units 1 to 3 are probably till. They are rich in macrofossil fragments but contain very few foraminifera, whether fresh or reworked. Unit 4 with its barnacle basal plates correlates with Brookes' dated sand bed. Overlying units are most probably the same as his "clayey bottomsets".

WNF-23	-6	-5	-4	-3	-2	-1
QUINQUELOCULINA SEMINULUM						
TRILOCULINA TRIHEDRA		1.8				
VIRGULINA CONCAVA						
VIRGULINA SCHREIBERSIANA						
CASSIDULINA RENIFORME	1	22.4			2	
ISLANDIELLA HELENAE		6.8			1	
ISLANDIELLA NORCROSSI		0.8				
BUCCELLA FRIGIDA		2.5				
BUCCELLA FRIGIDA CALIDA		1.0				
BUCCELLA HANNAI						
BUCCELLA SP. 1		2.5				
GAVELINOPSIS SP.						
TRICHOHYALUS BARTLETTI						
CIBICIDES LOBATULUS		2.3	4			
NONION LABRADORICUM						
ASTRONONION GALLOWAYI			2			
ELPHIDIUM EXCAVATUM	3	52.6	1		8	4
ELPHIDIUM FRIGIDUM		1.3				
ELPHIDIUM HALLANDENSE						
ELPHIDIUM INCERTUM		0.3				
ELPHIDIELLA ARCTICA		0.8				
HAYNESINA ORBICULARE		3.8		1		2
HAYNESINA PAUCILOCULA						
% PLANKTONICS		0.3				
% ARENACEOUS						
FRACTION ANALYZED	1	½	1	1	1	1
NUMBER OF SPECIMENS PER 100 cm^3 OF SEDIMENT (EXTRAPOLATED WHEN FRACTION ANALYZED < 1)	5	1022	11	1	14	7
NUMBER OF SPECIES	2	17	3	1	3	2
SHANNON-WIENER SPECIES DIVERSITY : H(S)	—	1.6	—	—	—	—
cf. ISLANDIELLA ISLANDICA		0.3				

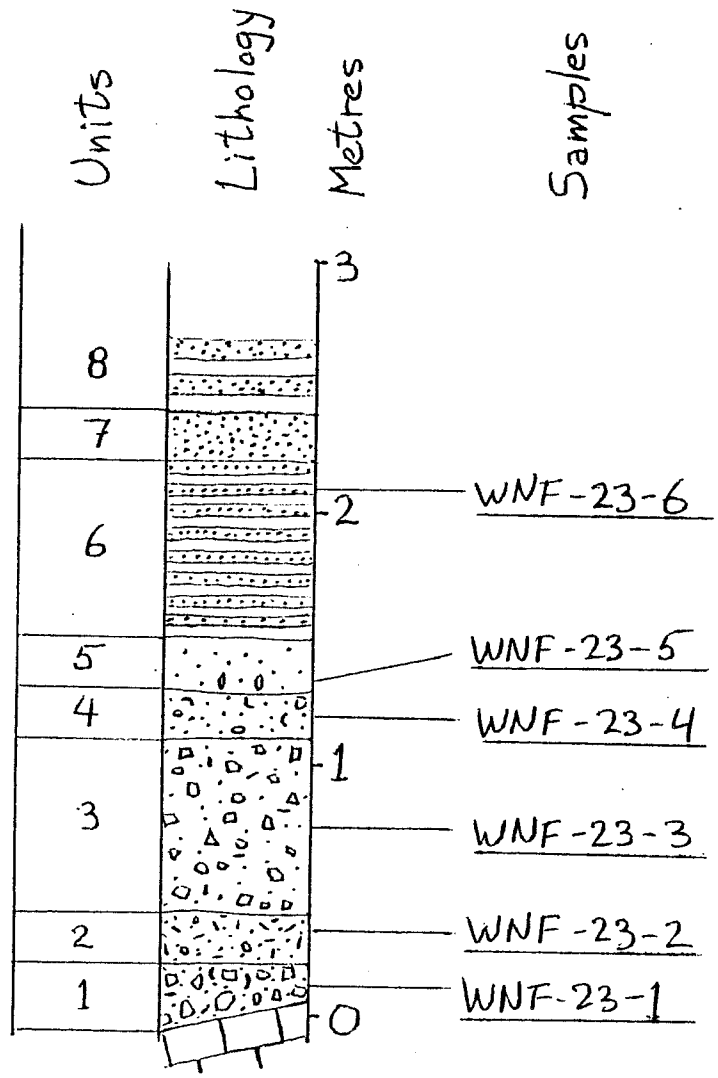


Fig. 29: WNF-23, Port-au-Port.

WNF-24: Kippens

UTM location: 21U/VD/800/777.5 (Section 1) NTS sheet: 12B/10

Altitude: coastal cliffs

These coastal cliffs are situated at Kippens immediately to the west of Stephenville. The purpose of the visit was to sample the shelly bed dated at 12600±140BP(GSC-2295), reported by Brookes (1977). Since this shell bed is intercalated between two thick glacifluvial gravels of the Robinson's Head Drift, it dates that drift.

Four sections have been described. Section I is located at the end of Seaside Drive, a road that goes from the highway directly to the edge of the cliff. This is approximately the point where Brookes collected the dated shells in 1966. Section II is approximately 200-300 metres to the east and the shell bed can be traced continuously between both sections. Section III is at the level of McCarthy Lane, another road that goes from the highway towards the sea (McCarthy Lane does not quite reach the edge of the cliff and some driving has to be done along a small track). Section IV is approximately 300m to the E of Section III.

The correlation between sections I and II is good because the units can be directly traced. However, the correlation between II and III and also IV is more dubious because of the greater distance and the lack of intermediate control. No sampling was done at sections III and IV because of the absence of microfossils and of pelitic sediment.

Lithologic descriptions:

Descriptions proceed from the base upwards. The stratigraphic thicknesses given are visual estimates: no tape measurement was done.

SECTION I:

- 1.5 m of unfossiliferous till (St. George's River Drift) (Unit 1).
- a few metres (6m?) of coarse gravel with indistinct bedding (Unit 2)(St. George's River Drift kame gravels).
- 1 metre or somewhat less of silt and sand, the finest grain size occuring near the base of the unit. Shells are spread throughout the unit, being either articulated or disarticulated. (Unit 3). Macrofossils: mostly Macoma calcarea, plus a few broken Mya sp.
- many metres of tilted beds of well-stratified coarse sand and gravel (Unit 4).
- approximately 1 metre of eolian sand (after Brookes, 1977).

The total height of the section was not measured but is taken as being approximately 20 metres in accordance with Brookes (1977).

SECTION II:

- ca. 3 metres of probable till (St. George's), less compact than in Section I (Unit 1).

- ca. 0 to 4 metres of coarse gravel (Unit 2, St.George's River Drift kame gravels). This unit pinches out laterally giving way to a thickened Unit 3 and then reappears (see Photo 48 and fig. 29).
- ca. 0 to 5 metres of fine to coarse, mostly medium sand with separate valves of Macoma calcarea (Unit 3).
- ca. 5 - 6 metres of gravel and sand in tilted beds (Unit 4).
- ca. 1 metre of aeolian sand.

SECTION III:

- ca. 1 m of till (Unit 1, St. George's River Till).
- ca. 1.20m of medium to coarse, well-stratified sand.
- ca. 5m of very coarse gravel without distinct stratification.
- ca. 1.5 to 2m of stratified sand.
- less than one metre of coarse gravel.

SECTION IV:

- the lowermost 3m are covered with debris.
- ca. 8m of medium to coarse sand, horizontally bedded and cross-bedded. Beds of 1 to 10 cm.
- 3 to 4m of coarse gravel, indistinctly bedded.

Note: on the basis of the nature of the sand and of the gravel and of the lack of fossils, it is reasonable to think of sections III and IV as expanded equivalents of Unit 2 with sandy intervals.

Samples: stratigraphic positions have not been measured.

WNF-24-1: Section I, Unit 3. Fine silty sand near the base of the unit.

WNF-24-2: Section I, Unit 3. Silt from near the base of the unit.

WNF-24-3: Section I, Unit 1. Till.

WNF-24-4: Section II, Unit 1. Upper part of till.

WNF-24-5: Section II, Unit 3. Fine to coarse sand from the thickened part of the unit.

^{14}C: Fragmented valves of Mya truncata from Unit 4 were dated at 12600+140BP(GSC-2295; Brookes, 1977).

Correlation with Brookes' results:

According to Brookes (pers. comm., 1983), Unit 3 is not, as the present author originally thought, the shelly sand layer dated at 12600±140BP. Both Units 1 and 2 belong to the St. George's River Drift while Unit 3 is a marine sediment older (probably ca. 13500BP) than the Robinson's Head Drift. Only the overlying dipping beds (Unit 4) belong to the Robinson's Head Drift. The bed reported by Brookes (1977) was a sand with fragmented Mya truncata occurring within (not at the base of) Robinson's Head Drift (i.e. Unit 4). The bed sampled by the present author (Unit 3) varied from silt to sand and the dominant mollusc was Macoma calcarea. It is probably equivalent to Units 6 to 8 at Port-au-Port.

This Report	Brookes (1977)
Unit 4	Robinson's Head Drift including dated sand bed with shells
Unit 3	not reported*
Unit 2	not reported*
Unit 1	St. George's River Drift till

*illustrated as "clay" in fig. 3 of Brookes (1974)

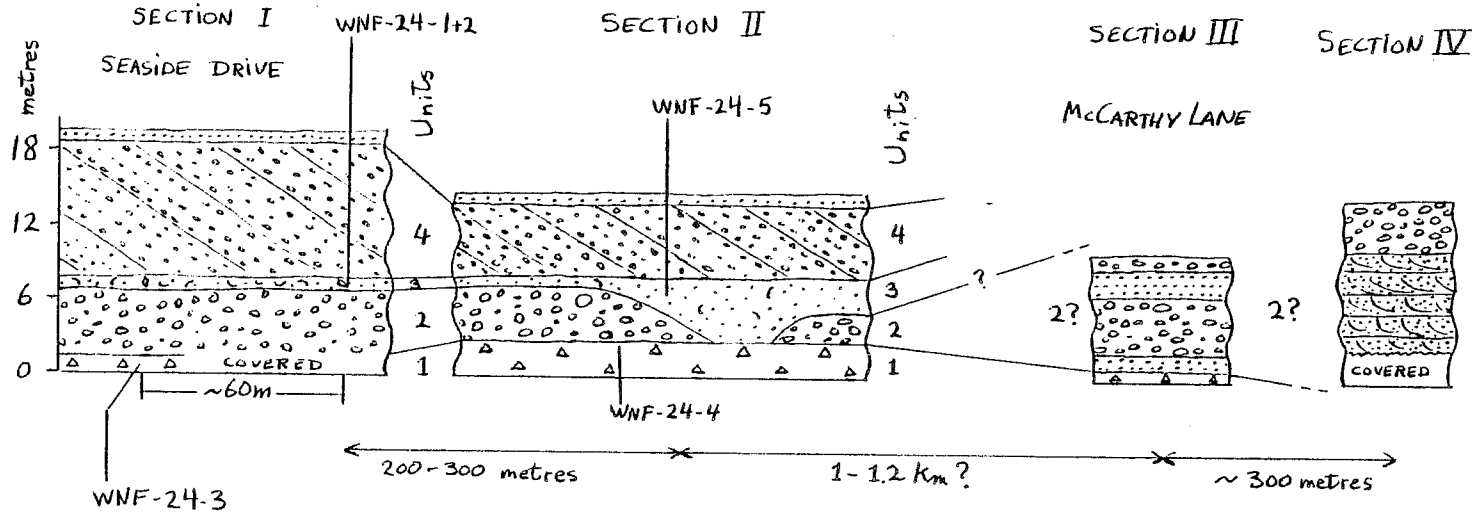


Fig.29: WNF-24, Kippens.

WNF-25: Robinson's Head

UTM Location: 21U/VD/664.5/468 NTS sheet: 12B/7

Altitude: 35 metres (after Brookes 1974).

Fifty-five-metre-high coastal cliff located approx. 2 km NE of the village of Robinson's on the S side of St. George's Bay. Brookes (1974, p. 13 and map) has already described this section and the present report will focus on the clayey marine part. Brookes reported the following sequence, from bottom to top:

1. Bedrock
2. Till and kame gravels of the St. George's River Drift (ca. 15m).
3. Silty-clay bottomsets (1 to 2m).
4. Sand and gravel (foresets?) (ca. 8m).
5. Gravels of the Robinson's Head Drift (ca. 9m).
6. Eolian sand (ca. 2m).

WNF-24

UNIT	AMPLE	SECTION	QUINQUELOCULINA SEMINULUM	TRILOCULINA TRIHEDRA	VIRGULINA CONCAVA	VIRGULINA SCHREIBERSIANA	CASSIDULINA RENIFORME	ISLANDIELLA HELENAE	ISLANDIELLA NORCROSSI	BUCCELLA FRIGIDA	BUCCELLA FRIGIDA CALIDA	BUCCELLA HANNAI	BUCCELLA SP. 1	GAVELINOPSIS SP.	TRICHOHYALUS BARTLETTI	CIBICIDES LOBATULUS	NONION LABRADORICUM	ASTRONONION GALLOWAYI	ELPHIDIUM EXCAVATUM	ELPHIDIUM FRIGIDUM	ELPHIDIUM HALLANDENSE	ELPHIDIUM INCERTUM	ELPHIDIELLA ARCTICA	HAYNESINA ORBICULARE	HAYNESINA PAUCILOCULA		% PLANKTONICS	% ARENACEOUS	FRACTION ANALYZED	NUMBER OF SPECIMENS PER 100 cm^3 OF SEDIMENT (EXTRAPOLATED WHEN FRACTION ANALYZED < 1)	NUMBER OF SPECIES	SHANNON-WIENER SPECIES DIVERSITY : H(S)
UNIT ③ sand with shells	WNF-24-5	II					9	1	1										10								2		1	23	4	—
	WNF-24-2	I					42.8			1.9			1.3						42.8	0.6		2.5	0.6	7.6					1	200	8	1.21
	WNF-24-1	I		1			1			2									1			3		7					1	16	6	—
UNIT ① till	WNF-24-4	II					1												1										1	2	2	—
	WNF-24-3	I											B		A		R		R		E		N						1			

The marine beds reported here (Unit 3, silty-clay bottomsets) contains some macrofossils and is traceable laterally for more than 100 metres southwards of the sampled locality. A further 100 metres to the south, however, in the following ravine, the present writer found no shelly marine sediment. Instead, the overlying sandy unit was resting directly upon the St. George's River Drift.

Lithologic description:

Unit 0: 0m and below: coarse, sandy and silty, grain-supported gravel. Rounded cobbles. Faint stratification (see photo 51). Unfossiliferous.

Unit 1: 0 to 0.40m: Unfossiliferous, stratified, medium sand.

Unit 2: ca. 0.20 to ca. 2.15: Clayey and sandy silt, somewhat stony, with fragmented macrofossils. Horizontal fissility. The upper part of the unit is unfossiliferous and seems to contain more very fine sand. The middle part is covered by debris.

Unit 3: ca. 2.15 to ca. 3.15: Stratified, fine to medium sand.

Unit 4: ca. 3.15 and above: Gravel.

Samples: WNF-25-1: 0.40m. Sand.

WNF-25-2: ca. 0.20m. Clayey and sandy silt with fragmented macrofossils.

WNF-25-3: ca. 2.00m. Unfossiliferous sandy silt.

WNF-25-4: ca. 2.35m. Fine sand.

^{14}C: Shells collected in the silt by Brookes have been dated at 13500±210BP(GSC-1200; Brookes, 1974).

Correlation with Brookes' results:

This Report	Brookes (1974)
Unit 4	foresets
Unit 3	transition between bottomsets and foresets
Unit 2	silty-clay bottomsets
Unit 1 (localized deposit)	not reported
Unit 0	St. George's River Drift

WNF-26: Cartyville

UTM Location: 21U/UD/647/451 NTS sheet 12B/2

Altitude: Coastal cliff.

Section situated immediately to the south of the mouth of Robinson's River, at the beginning of the coastal cliff. Near the base, this section contains a lithofacies made of a rhythmic sequence of silts and sands called "rhythmites" by Brookes (1974). The exact location can be seen on photo 52 at the extreme left hand tip of the cliff. Further to the right, the section is much thicker but most of the stratified material visible on the photos is sand.

Lithologic descriptions:

Unit 0: 0.30 m to 0.0 m: Till extending probably down to the bedrock ca. 2 m underneath. The upper surface of the till is slightly irregular.

Unit 1: 0.0 to 1.45 m: Interstratification of clayey silt and sand (rhythmites) in beds ranging upwards from less than 1 centimetre (Photo 90). At the base: strong predominance of silt. At the top: slight predominance of sand. Rather sharp increase in sand contents around 0.75m.

Unit 2: 1.45 to 2.10 m: Same as Unit 1 but with a slight predominance of the coarser beds.

WNF-25	-4	-3	-2	-1
QUINQUELOCULINA SEMINULUM				
TRILOCULINA TRIHEDRA				
VIRGULINA CONCAVA		1		
VIRGULINA SCHREIBERSIANA				
CASSIDULINA RENIFORME	24.6	3	4.8	
ISLANDIELLA HELENAE	7.0		6.5	3.2
ISLANDIELLA NORCROSSI	3.5		3.2	1
BUCCELLA FRIGIDA	1.8			
BUCCELLA FRIGIDA CALIDA			1.6	
BUCCELLA HANNAI				
BUCCELLA SP. 1				
GAVELINOPSIS SP.				
TRICHOHYALUS BARTLETTI				
CIBICIDES LOBATULUS			3.2	
NONION LABRADORICUM		1		
ASTRONONION GALLOWAYI				
ELPHIDIUM EXCAVATUM	52.6	4	75.8	3
ELPHIDIUM FRIGIDUM				
ELPHIDIUM HALLANDENSE				
ELPHIDIUM INCERTUM				
ELPHIDIELLA ARCTICA				
HAYNESINA ORBICULARE				
HAYNESINA PAUCILOCULA				
% PLANKTONICS			1.3	
% ARENACEOUS				
FRACTION ANALYZED	1	1	1	1
NUMBER OF SPECIMENS PER 100 cm^3 OF SEDIMENT (EXTRAPOLATED WHEN FRACTION ANALYZED < 1)	77	12	79	5
NUMBER OF SPECIES	9	4	9	2
SHANNON-WIENER SPECIES DIVERSITY : H(S)	1.44	—	1.02	—
	1.8		1.6	1.6
	3.5			

Unit 3: above 2.10 m: Stratified, fine to coarse sand.

Samples: WNF-26-1: minus 0.10 to 0.15m. Till.

WNF-26-2: 0.25 to 0.30m. Mostly silty clay.

WNF-26-3: 1.60 to 1.70m. Sand and silt.

WNF-26-4: 2.30 to 2.40m. Sand.

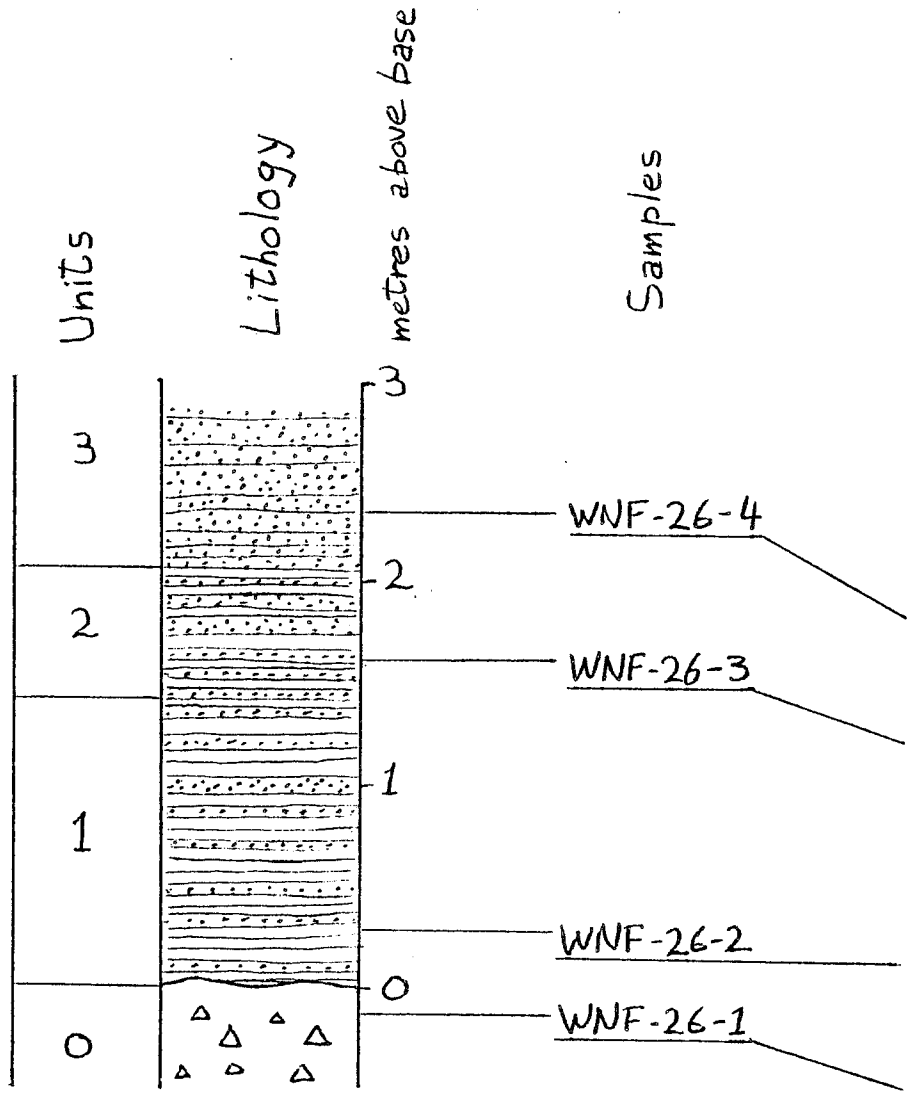


Fig. 31 : WNF-26, Cartyville

WNF-26	-4	-3	-2	-1	
QUINQUELOCULINA SEMINULUM			0.2		
TRILOCULINA TRIHEDRA		1	7.6		
VIRGULINA CONCAVA		2			
VIRGULINA SCHREIBERSIANA					
CASSIDULINA RENIFORME	8	9	6.2	3	
ISLANDIELLA HELENAE	4	1	7.3		
ISLANDIELLA NORCROSSI		2			
BUCCELLA FRIGIDA			3.6		
BUCCELLA FRIGIDA CALIDA		1			
BUCCELLA HANNAI					
BUCCELLA SP. 1			2.4		
GAVELINOPSIS SP.					
TRICHOHYALUS BARTLETTI					
CIBICIDES LOBATULUS	1		1.7		
NONION LABRADORICUM		1	0.5		
ASTRONONION GALLOWAYI					
ELPHIDIUM EXCAVATUM	18	23	41.7	7	
ELPHIDIUM FRIGIDUM		2	6.2		
ELPHIDIUM HALLANDENSE			0.2		
ELPHIDIUM INCERTUM			6.2		
ELPHIDIELLA ARCTICA			4.0		
HAYNESINA ORBICULARE		2	10.2	2	
HAYNESINA PAUCILOCULA					
% PLANKTONICS			0.4		
% ARENACEOUS					
FRACTION ANALYZED	1	1	1	1	
NUMBER OF SPECIMENS PER 100 cm^3 OF SEDIMENT (EXTRAPOLATED WHEN FRACTION ANALYZED < 1)	52	61	539	16	
NUMBER OF SPECIES	8	11	21	3	
SHANNON-WIENER SPECIES DIVERSITY : H(S)	—	—	2.08	—	
ELPHIDIUM GROENLANDICUM			0.5	0.2	
BULIMINA ACULEATA					
BULIMINA MARGINATA	1				
CASSIDULINA TERETIS	1				
ISLANDIELLA ISLANDICA	1				

WNF-27: St. David's

UTM Location: 21U/UD/610.5/418 NTS sheet: 12B/2

Altitude: coastal cliff. Sample taken at 4.5 to 5m above base of cliff.

The sampled locality is situated in a coastal cliff, a few hundred metres SE of the mouth of Crabbes Brook. This is the only place where rythmites were exposed in the 1.5 km of cliff we visited at St. David's. Less than 100 m to the south of the sampling point, in a well-exposed area, well-bedded very fine sand can be observed at the base of the section, but no silt. Therefore, the lateral extent of the marine varves seems limited although it is impossible to make a definitive statement with such a poor exposure.

Lithologic description of the sample locality (from the base upwards):

minus 4.0 to 0.0m: debris-covered from the base of the cliff up to level 0.0.

Unit 1: 0.0 to 1.5m: rythmites. Sand beds alternating with beds of very finely sandy silt.

Unit 2: 1.5 to ca. 9m: slightly tilted sand beds.

Unit 3: Above: the sand beds pass gradually upwards into steeply dipping gravel beds. The thickness of the gravelly horizon was not noted.

Samples: WNF-27-1 was taken in the middle of the rhythmite unit (Unit 1).

	WNF-27
	QUINQUELOCULINA SEMINULUM
	TRILOCULINA TRIHEDRA
1	VIRGULINA CONCAVA
	VIRGULINA SCHREIBERSIANA
18	CASSIDULINA RENIFORME
	ISLANDIELLA HELENAE
3	ISLANDIELLA NORCROSSI
1	BUCCELLA FRIGIDA
1	BUCCELLA FRIGIDA CALIDA
	BUCCELLA HANNAI
	BUCCELLA SP. 1
	GAVELINOPSIS SP.
	TRICHOHYALUS BARTLETTI
2	CIBICIDES LOBATULUS
2	NONION LABRADORICUM
	ASTRONONION GALLOWAYI
12	ELPHIDIUM EXCAVATUM
	ELPHIDIUM FRIGIDUM
	ELPHIDIUM HALLANDENSE
	ELPHIDIUM INCERTUM
	ELPHIDIELLA ARCTICA
	HAYNESINA ORBICULARE
	HAYNESINA PAUCILOCULA
	% PLANKTONICS
	% ARENACEOUS
1	FRACTION ANALYZED
64	NUMBER OF SPECIMENS PER 100 cm^3 OF SEDIMENT (EXTRAPOLATED WHEN FRACTION ANALYZED < 1)
12	NUMBER OF SPECIES
—	SHANNON-WIENER SPECIES DIVERSITY : H(S)
3	BULIMINA MARGINATA
1	BOLIVINA SUBAENARIENSIS

WNF-28: Highland

UTM Location: 21U/UD/574/383.5 NTS sheet: 12B/2

Altitude:

Brookes (1974) studied a coastal section in the neighbourhood of Highlands, probably very near to the present locality, but due to the lack of reliable point of reference in this area, it was impossible to pin-point the site of Brookes' section. Our section is situated 600 metres along the beach to the N of a group of fishing shacks, the only ones visible in this segment of the coastline. A small road (driveable) leads from the main road down to the fishing shacks on the beach.

Lithologic description (from the base up):

- There are a few metres of debris between the base of the cliff and the base of the exposed section.

- 0.0 to 1.80m: stratified sandy silt, not rythmic enough to be called "rhythmites". A few separate pelecypod valves.

- 1.80 to 2.10m: debris-covered.

- 2.10 to 3.90m: sandy silt similar to the preceding one, passing progressively upwards into rythmites. At the top, sand is predominant. The bedding is contorted and undulating and the top of

the unit is irregular. Shells are sparse except around 2.10-2.20 m where they are quite abundant (Mya sp, Macoma calcarea)

- above 3.90m there is 5 to 6 metres (estimated) of sand in more or less thick beds overlain by ca. 3 to 4m (estimated also) of gravel.

The bedrock was observed nowhere along the cliff.

Samples: WNF-28-1: 1.50m

WNF-28-2: 2.20m. Shelly level.

^{14}C: Brookes (1974) has dated shells (Macoma calcarea) from a silty clay layer at the base of the marine sequence at 13420±190BP(GSC-598). Unfortunately it was impossible to find neither the exact location of his section nor the silty clay he reports.

Correlation with Brookes' results:

Due to the poor state of the exposure, the St. George's Drift (till) was not observed. The stratified sandy silt reported here may be the same as Brookes' silty clay (both contain Macoma calcarea), but it seems much too sandy and is more likely to be the lower part of his clayey bottomsets. The sand and gravel above 3.90 m are probably Brookes' foreset beds. It was not checked whether till was present or not at the top of the section.

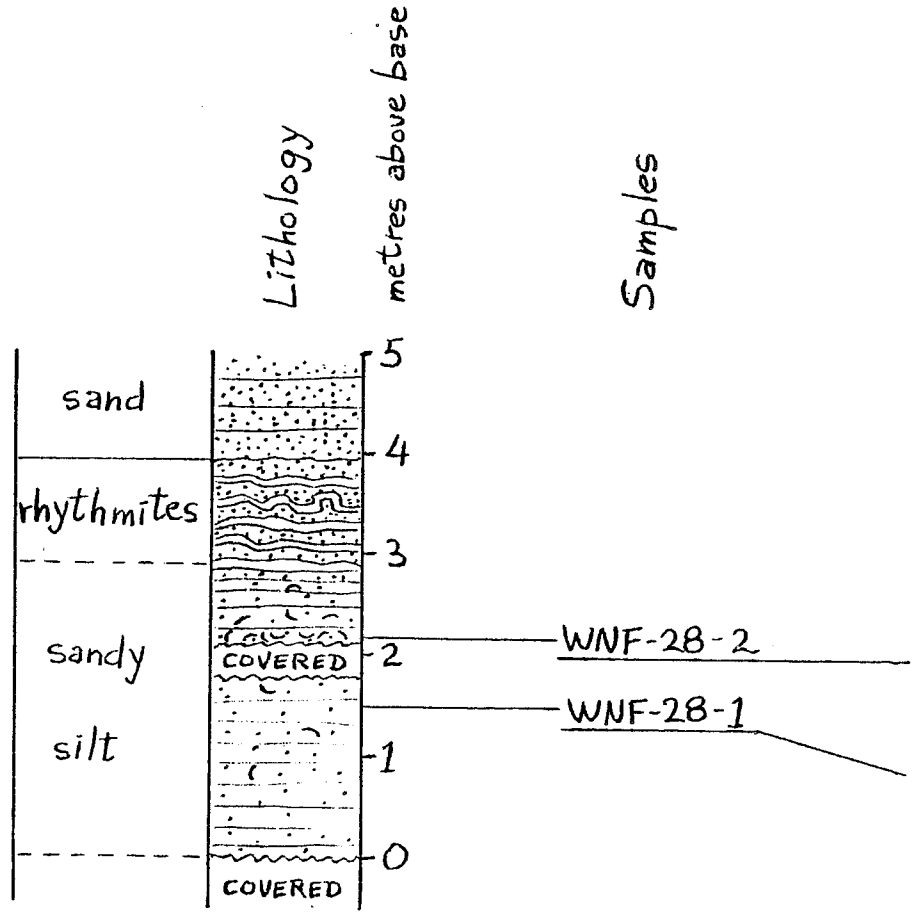


Fig. 32: WNF-28, Highland.

-1	-2	WNF-28
		QUINQUELOCULINA SEMINULUM
	0.3	TRILOCULINA TRIHEDRA
		VIRGULINA CONCAVA
	1.0	VIRGULINA SCHREIBERSIANA
12	33.1	CASSIDULINA RENIFORME
	1.0	ISLANDIELLA HELENAE
	0.3	ISLANDIELLA NORCROSSI
1	2.3	BUCCELLA FRIGIDA
4	6.4	BUCCELLA FRIGIDA CALIDA
		BUCCELLA HANNAI
	4.1	BUCCELLA SP. 1
		GAVELINOPSIS SP.
		TRICHOHYALUS BARTLETTI
		CIBICIDES LOBATULUS
	0.3	NONION LABRADORICUM
	0.3	ASTRONONION GALLOWAYI
21	38.4	ELPHIDIUM EXCAVATUM
2	1.0	ELPHIDIUM FRIGIDUM
		ELPHIDIUM HALLANDENSE
1	4.1	ELPHIDIUM INCERTUM
		ELPHIDIELLA ARCTICA
1	5.3	HAYNESINA ORBICULARE
	0.3	HAYNESINA PAUCILOCULA
2		% PLANKTONICS
		% ARENACEOUS
1	1	FRACTION ANALYZED
55	514	NUMBER OF SPECIMENS PER 100 cm^3 OF SEDIMENT (EXTRAPOLATED WHEN FRACTION ANALYZED < 1)
7	20	NUMBER OF SPECIES
—	1.73	SHANNON-WIENER SPECIES DIVERSITY : H(S)

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APPENDIX I

Localities and samples

Locality No.	Locality	No. of Samples
WNF-1	Milan Arm	5
WNF-2	Crossroads near Cooks Harbour	1 6
WNF-3	Forrester's Point	5 11
WNF-4	Hawke Bay	5 16
WNF-5	River of Ponds	7 23
WNF-6	Daniel's Harbour	11 34
WNF-7	Little Brook	1 35
WNF-8	Parson's Pond	4 39
WNF-9	Three Mile Rock	7 46
WNF-10	Gun Point	5 51
WNF-11	Norris Point	11 62
WNF-12	Trout River	8 70
WNF-13	Glenburnie	4 74
WNF-14	Lomond	5 79
WNF-15	Benoit's Cove	4 83
WNF-16	Sample lost	
WNF-17	Bottle Cove	3 86
WNF-18	Road to Little Port	1 87
WNF-19	Lark Harbour #1	3 90
WNF-20	Lark Harbour #2	1 91
WNF-21	Tea Cove	12 103
WNF-22	Abraham's Cove	13 116
WNF-23	Port-au-Port	6 122
WNF-24	Kippens	5 127

Localities and samples

Locality No.	Locality	No. of Samples
WNF-25	Robinson's Head	4 131
WNF-26	Cartyville	4 135
WNF-27	St. David's	1 136
WNF-28	Highland	2 138

APPENDIX 2

List of foraminiferal species recorded in the West Newfoundland samples. Only the species found in the counted fractions are listed.

Elphidium hallandense Brotzen

Astrononion gallowayi Loeblich and Tappan

Haynesina orbiculare (Brady)

Elphidium incertum (Williamson) and *asklundi* Brotzen

Trichohyalus bartletti L. and T.

Elphidium excavatum (Terquem) (formae not differentiated)

Elphidiella arctica Parker and Jones

Buccella sp. 1

Elphidium frigidum Cushman

Cibicides lobatulus (Walker and Jacob)

Quinqueloculina seminulum (Linné) (3 morphologic variants)

Islandiella norcrossi (Cushman)

Islandiella helenae Feyling-Hanssen and Buzas

Cassidulina reniforme Nørvang

Triloculina trihedra L. and T.

Pyrgo williamsoni (Silvestri)

Glabratella wrightii (Brady)

Oolina lineata (Williamson)

Buccella hannai (Phleger and Parker)

Nonion labradoricum (Dawson)

Buccella frigida (Cush.)

Elphidium bartletti Cush.

Haynesina albiumbilicata (Weiss)

Lenticulina sp.

Oolina melo d'Orbigny

Bolivina pseudopunctata Höglund

Buccella frigida calida Cushman and Cole

Epistominella sp. cf. *vitrea* Parker

Polymorphinidae

Trifarina fluens (Todd)

Oolina borealis L. and T.

Fissurina marginata (Montagu)

Haynesina paucilocula (Cush.)

Fissurina cf. *pseudoglobosa* Buchner

Robertina arctica d'Orb.

Fissurina cf. *lucida* (Williamson)

Fissurina cf. *cucurbitasema* L. and T. (flat form)

Gavelinopsis sp. 1

Parafissurina cf. *himatiostoma* L. and T.

Rosalina sp.

Quinqueloculina stalkeri L. and T.

Rosalina globularis d'Orb.

Fissurina sp. 1

Eggerella advena (Cush.)

Cribrostomoides crassimargo (Norman)

Silicosigmoilina groenlandica Cush.

Miliammina fusca (Brady)

Textularia torquata Parker

Ammobaculites sp.

Tiphotrocha comprimata (Cushman and Bronniman) emend. Saunders

Jadammina macrescens (Brady)

Trochammina ochracea (Williamson)

Haynesina germanica (Ehrenberg)

Miliolinella subrotunda (Montagu) (including hauerinid forms)

Quinqueloculina arctica Cush.

Fissurina sp. 2

Virgulina schreibersiana Czjzek

Virgulina concava Höglund

Esosyrinx curta L. and T.

Elphidium sp.

Triloculina sp.

Elphidium groenlandicum Cush.

Islandiella inflata Gudina

Nonionella auricula Heron-Allen and Earland

Fissurina laevigata Reuss

Epistominella cf. *takayanagii* Iwasa

Quinqueloculina sp. 1

Cyclogyra involvens (Reuss)

Buliminella elegantissima (d'Orb.)

Laryngosigma sp. 1

"*Siphonaperta*"

Oolina acuticosta (Reuss)

Quinqueloculina sp. 2

Islandiella islandica (Nørvang)

Oolina williamsoni (Alcock)

Buccella tenerrima (Bandy)

Lagena semilineata Wright

Cyclogyra foliacea (Philippi)

Haynesina nivea (Lafrenz)

Quinqueloculina sp. 3

Laryngosigma sp. 2

Elphidium cf. *ustulatum* Todd

Fissurina cucurbitasema L. and T. (round form)

Lagena sp. 1

Bulimina aculeata d'Orb.

Elphidium cf. *groenlandicum* Cush.

Patellina corrugata Williamson

Cassidulina teretis Tappan

Buccella aff. *hannai* (Phleger and Parker)

Bulimina marginata d'Orb.

Bolivina subaenariensis Cush.

Glabratella sp. 1

APPENDIX 3

PLATES

PLATE I

WNF-1: Milan Arm

1 + 2: Unit 2, gray silty clay with patches of brown superficial weathering. Note the abundance of bryozoans. Photo 2 shows the holes left by the coring of samples WNF-1-2 (below) and 3 WNF-1-3 (above). There is approximately 20 cm between both holes.

WNF-3: Forrester's Point

3: Bhan is holding the shovel at the limit between Units 2 and 3. Note the difference in colour between both units. This is due mostly to the higher shell content of Unit 2. Blocky Unit 4 is well-visible on top of Unit 3. The limit between Units 1 and 2 does not stand out.

4: The same section seen from a different angle. The limit between Units 2 and 3 is just above Bhan's head.

WNF-5: River of Ponds

5: Bhan points at the sampling point of WNF-5-7

PLATE II

WNF-5, River of Ponds (continued)

6: The main section with the stratified shelly facies just behind and under Bhan.

7: Ca. 30 m to the left of the main section (see Fig. 4). The blocky beach facies seems to lie directly on the top of the tilloid. The stratified shelly facies is too thin and discontinuous to be seen on this picture.

WNF-6, Daniel's Harbour

8: Shows the base of the coarse beach gravel at the northern section and the top of the gravelly clay. Sample WNF-6-1 was taken in the gray material below the spatula.

9: General view of the northern section. The sampling and description were made on the uppermost scarp, above Bhan's head, starting under the beach gravel at upper left and moving to the right. N.B.: the picture was taken looking upwards hence the cliff appears lower than it actually is.

10: Bouldery lenticular bed in the middle of massive gravelly silt and clay. Not sampled. 100 metres (estimated) S of the northern section.

11: Southern section. Only the upper part of this cliff has been sampled, where Bhan is standing.

PLATE III

WNF-8, Parson's Pond

12: The described section seen from above. The 2 white beds are the *Mytilus* beds.

13: The lower *Mytilus* bed (sampled for ^{14}C dating).

14: The described section seen from the sea.

15: Photo looking northwards showing tilted beds in the cliff N of the sampled locality. Some of the beds are packed with *Mytilus*.

16: Horizontal sand beds at the top of the tilted sequence. Eolian? There seems to be a soil horizon (black layer and white layer) covered by an unweathered sand layer. This development is not visible at the sampled locality.

PLATE IV

WNF-10, Gun Point

17: The whole of the section is represented. The shovel is at the contact between the gravelly clay and the gravelly sand. The holes are the sampling points. The boulders at the base of the cliff are part of the beach.

WNF-11, Norris Point

18: Sandy Head across Bonne Bay (to right of poplars) seen from the village of Woody Point (more precisely from Stornoway Lodge). The sampled locality appears as a low cliff at the center of the picture.

WNF-12, Trout River

19: Section 3. Sample WNF-12-4 was taken at the base of the tilted beds. Sample WNF-12-3 was collected below the picture.

20: Section 2. Sampling was done at the right hand side of the picture, where the grayish clay is visible below the deltaic sand.

21: Section 4. Bhan stands on the top of the till (Unit 1). Sample WNF-12-8 was taken approximately 1 metre above his head.

PLATE V

WNF-13, Glenburnie

22: Unit 2 with *Mya truncata* in living position.

23: Unit 3 with *Mytilus*.

24: Top of Unit 3, Unit 4, rusty bed and flat-pebble gravel.

25: A part of the exposed face.

WNF-14, Lomond

26: Looking northward. The beds are dipping northward and landward.

27: Units 1, 2 and 3 with sample bags 1 and 2 lying at their respective sampling points. Note the two joints. The bottom of bag #2 is lying on the base of Unit 2. The top of Unit 2 is the sharp joint above bag #2.

PLATE VI

WNF-15, Benoit's Cove

28: The samples have been taken in the immediate neighbourhood of where Bhan is standing, at the same level. Note that the beds in the lower unit (Unit 1) are dipping to the right i.e. landward.

WNF-17, Bottle Cove

29: North side of Bottle Cove. Sampling was done in the upper part of the treeless slope at the centre of the picture.

30: Closer view of the section. WNF-17-1 and 17-2 were taken a bit left of upper centre, just below the gravel layer at the top. Note log in foreground and compare with photo 49.

WNF-18, Road to Little Port

31: The south side of Bottle Cove with the road to Little Port (centre left). Sample WNF-18-1 was collected on the right hand side of the stretch of road visible here.

WNF-19, Lark Harbour #1

32: Bhan indicates the base of Unit 2. The gravel bed is visible at the top.

PLATE VII

WNF-21, Tea Cove

33: Base of section 4. The lens cap is placed on Unit 2 (fossiliferous silty clay). The coarser facies immediately underneath is the till (Unit 1).

34: Section 1 is on the right. Sample bags WNF-21-8 (till) and WNF-21-9 (silty clay) are lying on their respective sampling points. The top of the till is clearly visible. Section 6 is on the left but is not marked. The exposure is no more than 50 cm high. The beach facies (Unit 5) is above the grass (out of the picture).

35: General view of the sampled profile. The light-coloured beach facies (Unit 5) overlies the dark marine facies and the till. The bedrock outcrops at some places in the intertidal area (foreground). N is on the right.

36: Tea Cove from approximately 1 km. The two low coastal cliffs at centre right are made of bedrock. The sampled localities are at the left end of these outcrops (fig. 23).

PLATE VIII

WNF-22: Abraham's Cove

37: The eastern part of the Quaternary cliff and the limestone cliff, looking eastward (compare with fig. 26).

38: Section E. The shovel marks the base of the described section. The deltaic gravels are visible at the top. N.B. these pictures were shot while looking upwards; therefore, perspective makes the section appear shorter than its actual 5 metres.

39: Section E, from a different angle. Note the shovel near Bhan's feet. Note also the remains of the wooden crate at the top (upper left) of the described section. In this picture, the actual height of the section is easier to perceive.

PLATE IX

WNF-23, Port-au-Port

40: Port-au-Port and mainland Newfoundland seen from Port-au-Port Peninsula (foreground). The two tombolos join the Peninsula to the mainland. The terrace forming the mainland's coastline is constituted of dipping deltaic foreset gravels (foreset beds). Section WNF-23 (not visible here) is situated ca. 1 km past the left-hand corner of the terrace. View to the NE.

41: Locality WNF-23. Units 1 to 4 were described in the trench to the right of Bhan. The head of the hammer rests on the Paleozoic bedrock and marks the base of the section. Units 5 and 6 were described and sampled where the pick and shovel are situated. Units 7 and 8 were observed in the little excavation at the extreme left.

42: Units 1 to 4. Probably Brookes' till.

43: Units 5 to 6. These are probably the clayey bottomsets of Brookes (1974).

PLATE X

WNF-24, Kippens

44: The cliffs west of Stephenville seen from Port-au-Port Peninsula. The sampling locality is probably the long cliff at centre right.

45: Bhan stands at sampling points WNF-24-1 and 2, in Unit 3, at section 1.

46: Dark unit at the base: St. George's River Till (Unit 1). Light coarse gravel: Unit 2. Darker and finer gravel: Unit 4. Unit 3 is not visible. Section 1, sampling point WNF-24-3 (till).

47: St. George's River Till at sampling point WNF-24-3.

48: Section II. Bhan stands on the till (Unit 1). Behind him is the coarse gravel of Unit 2 wedging out towards the right. Above comes sandy Unit 3, thickening up towards the right. Finally there is the finer gravel of Unit 4 and the eolian sand at the top. The hammer (near Bhan) shows sampling point WNF-24-4 and the shovel (in Unit 3), sampling point WNF-24-5.

49: Section IV showing well-stratified sand covered by coarse gravel.

PLATE XI

WNF-25: Robinson's Head

50: The small intermediate corniche just above the shadow is the sampling locality. It marks the limit between the St. George's River Drift (below) and the deltaic deposits and the Robinson's Head Drift (above). Photo looking northwards.

51: Kame gravels of the Robinson's Head Drift (Unit 0) showing a coarse stratification. Immediately to the N of the sampling locality.

WNF-26: Cartyville

52: The sampling location is at the extreme left-hand tip of the cliff. Most of the material exposed elsewhere in the cliff is stratified sand. The light-coloured band at the base of the cliff is steeply dipping Paleozoic bedrock. The whole cliff is 15-20 m high (estimated).

53: The sampled locality with till at the base, followed by silty rhythmites, sandy rhythmites, and sand.

54: Spoon planted in the till at the base of the rhythmites.

N.B.: The red colour in photos 52-54 is due to the setting sun.