BIOSTRATIGRAPHY AND MATURATION OF 17 LABRADOR AND BAFFIN SHELF WELLS

Volume 9:
South Hopedale L-39 & South Labrador N-79

Report No. 86-0058
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EXPLANATION OF CONTENTS

This volume contains the following results of analyses on South Hopedale L-39 and South Labrador N-79.

1. **General drilling information**

2. **Consensus Age**

   The consensus age based on micropaleontology (M) and palynology (P).

3. **Palynological Results**

   The palynological zones and assigned ages in order of increasing depth within each well. The more important taxa are listed alphabetically, with miospores and fungal spores being denoted by an asterisk (*). Marker species are highlighted in bold type. The degree of confidence is given for each zonal assignment as follows:

   "4" The highest degree of confidence regarding both the zonal assignment and the sample level to which the top of the zone is assigned.

   "3" A high degree of confidence regarding the zonal assignment, but including the possibility that the zonal assignment may be slightly too low.

   "2" Indicates that the zonal asignment is probably correct but that the sample level indicated for the top of the zone is probably too low due to a scarcity of marker species.

   "1" A highly tentative zonal assignment due to extreme scarcity of marker species.

4. Micropaleontological Results

The micropaleontological zones and assigned ages in order of increasing depth. Within each zone the more important taxa are listed alphabetically with planktonic foraminiferal species being denoted by an asterisk (*) and diatom species by a cross (+). Marker species are highlighted in bold type. The degree of confidence is given for each zonal assignment as follows:

"4" The highest degree of confidence regarding both the zonal assignment and the sample level to which the top of the zone is assigned. This degree of confidence indicates the presence of planktonic foraminifera together with the main benthonic foraminiferal markers.

"3" A high degree of confidence regarding the zonal assignment. Indicates the presence of the main benthonic foraminiferal markers.

"2" Indicates that the zonal assignment is most probably correct. The assignment is based only on taxa occurring commonly within the zone, due to the scarcity of marker species.

"1" A tentative zonal assignment. Based solely on stratigraphic position due to extreme scarcity of marker species.

5. Paleobathymetric Interpretations

The interpreted paleobathymetries are in order of increasing depth, together with the criteria upon which they are based. The interpreted environments and corresponding paleobathymetries reported are: Non-marine (above sea level), Transitional (approx. 0m), Inner Neritic (approx. 0-20m), Middle Neritic (approx. 20-100m), Outer Neritic (approx. 100-200m), Upper Bathyal (approx. 200-1000m), and Lower Bathyal (>1000m).

6. Kerogen, TAI and Vitrinite Reflectance

Data on kerogen types and TAI are listed in a table, and are then discussed relative to petroleum source rock potential and the consensus ages assigned in this report. Data on vitrinite reflectance are listed and are discussed relative to their degree of reliability and indicated maturation level.

All references are given in Volume 1 of the report.

The following charts are included for each well:

1. A Palynological Summary Chart showing the assigned palynological zones, inferred ages, lithology, formational assignments provided by P.N. Moir, studies in progress, important palynological events (mostly species tops).

2. Sawtooth diagrams showing the relative abundances of the following palynological categories: Apectodinium homomorphum, Areoligera senonensis, marine dinoflagellates, Azolla, Pediastrum, gymnosperm pollen, angiosperm pollen, miospores, Late Cretaceous reworking, Early Cretaceous reworking.

3. A Micropaleontological Summary Chart showing the assigned micropaleontological zones, inferred ages, lithology, important micropaleontological events (mostly species tops), paleobathymetry.

4. A Kerogen Summary Chart showing the consensus ages, levels of Thermal Alteration (TAI), relative abundances of kerogen types.

5. A Vitrinite Summary Chart showing the consensus ages, histograms of the vitrinite reflectance measurements which are divided into three categories: caved (blue), in situ (green) and reworked (red). The in situ category is further subdivided into poor readings (horizontal lines) and good to excellent reading (solid colour). The means of the three main categories are indicated by correspondingly coloured triangles.

South Hopedale L-39:

BIOSTRATIGRAPHY AND MATURATION OF

SOUTH HOPEDALE L-39

CANTERRA et al. SOUTH HOPEDALE L-39

GSC locality: 55° 48' 32.567"N, 58° 50' 48,675"W
KB elevation: 12m Water depth: 580m
Casing set at: 641m, 948m, 1780m
Total depth: 2364m
Interval studied for palynology: 955-2360m
Interval studied for micropaleontology: 955-2360m

CONSENSUS AGE

955-1170m	middle to late Eocene (P)
1190-1200m	middle Eocene (P)
1220-1500m	early Eocene (P)
1520-1530m	late Paleocene (P)
1550-1590m	early Paleocene (P)
1610-1800m	Maastrichtian (M,P)
1820-1830m	late Campanian (P)
1850-1890m	early Campanian (P)
1910-1920m	Santonian (P)
1940-1950m	middle Albian (P)
1970-2070m	early to middle Albian (P)
2090-2220m	late Aptian (P)
2240-2360m	no age assignment

SOUTH HOPEDALE L-39

PALYNOLOGICAL ZONATION

955-1170m	Areosphaeridinium fenestratum Zone (middle to late Eocene)
1190-1200m	Eocladopyxis #LA Zone (middle Eocene)
1220-1350m	Trinovantedinium #LA Zone (early Eocene)
1370-1500m	Dracodinium condylos Zone (early Eocene)
Not observed	Ceratiopsis speciosa Zone (late Paleocene)
1520-1530m	Alisocysta circumtabulata Zone (late Paleocene)
1550-1560m	Palaeoperidinium pyrophorum Zone (early Paleocene)
1580-1590m	Spongodinium #LA Zone (early Paleocene)
1610-1620m	Spongodinium delitiense Zone (Maastrichtian)
1640-1710m	Impagidinium #LL Zone (Maastrichtian)
1730-1800m	Isabelidinium cooksoniae Zone (Maastrichtian)
1820-1830m	Chatangiella tripartita Zone (late Campanian)
Not observed	Hystrichosphaeridium difficile Zone (Campanian)

1850-1890m	Palaeohystrichophora infusorioides Zone (early Campanian)
1910-1920m	Surculosphaeridium longifurcatum Zone (Santonian)
Not observed	Cometodinium obscurum Zone (Coniacian to Turonian)
Not observed	Kiokansium polypes Zone (Cenomanian)
Not observed	Epelidosphaeridia spinosa/Trilobosporites crassus Zone (middle Albian)
1940-1950m	Trilobosporites humilis Zone (middle Albian)
Not observed	Parvasaccites amplus Zone (early to middle Albian)
1970-2070m	Muderongia asymmetrica Zone (early to middle Albian)
2090-2220m	Oligosphaeridium asterigerum /Pilosisporites trichopapillosus Zone (late Aptian)
Not observed	Pseudoceratium pelliferum Zone (Barremian to early Aptian)
Not observed	Cicatricosisporites #EAL Zone (Barremian to early Aptian)
2240-2360m	No zonal assignment (no age assignment)

SELECTED PALYNOMORPHS

955-1170m: Areosphaeridinium fenestratum Zone (middle to late Eocene)

955m	Hystrichosphaeridium patulum
	Kisselovia tenuivirgula
	Hystrichokolpoma salacium
	Phthanoperidinium geminatum
	Paralecaniella indentata
	Wetzeliella articulata
	Momipites coryloides *
	Juglanspollenites nipripites *
	Rouseisporites #LA *
	Pterocaryapollenites stellatus *
	Quercoidites #LA *
	Quercoidites #LG *
1015m	**Cicatricososporites auritus** *
	Ilexpollenites margaritus *
1045m	**Trudopollis plena** *
1105m	Deflandrea #LR
	Tiliaepollenites vescipites *
1130m	Momipites coryloides * (common)
1160m	Cicatricosisporites dorogensis *

Degree of Confidence: 3

Remarks: Penetration of the A. fenestratum Zone in the highest examined sample from the well at 955-975m is indicated by the presence of several dinoflagellate marker species indicated above in bold.

1190-1200m: Eocladopyxis #LA Zone (middle Eocene)

1190m **Pistillipollenites mcgregorii** *
Phthanoperidinium alectrolophum

Degree of Confidence: 2

Remarks: Penetration of the Eocladopyxis #LA Zone is tentatively indicated by the presence of the pollen P. mcgregorii which is a middle Eocene marker in high-latitudes such as the Canadian Beaufort.

1220-1350m: Trinovantedinium #LA Zone (early Eocene)

1220m Dinopterygium cladoides
Dapsilidinium pastielsii
Hystrichokolpoma cinctum
Nyssa kruschii *
Systematophora placacantha
Trinovantedinium #LA
Systematophora #LE
Tiliaepollenites crassipites

1250m **Kisselovia edwardsii**
Systematophora #LC

1280m Apectodinium homomorphum
Ceratiopsis pannucea
Hystrichosphaeridium patulum (abundant)
Homotryblium pallidum
Trinovantedinium #LL
Trinovantedinium #LS

Ericipites antecursorioides *

1310m Azolla *
Apectodinium homomorphum (common)
Apectodinium hyperacanthum
Areoligera senonensis
Cordosphaeridium multispinosum
Cordosphaeridium inodes
Eocladopyxis #LA
Homotryblium tenuispinosum
Cordosphaeridium tiara
Polysphaeridium subtile

1340m Lentinia wetzelii

Degree of Confidence: 4

Remarks: Dinoflagellate assemblages of the Trinovantedinium #LA Zone are well-represented throughout this interval.

1370-1500m: Dracodinium condylos Zone (early Eocene)

1370m **Isabelidinium #LP**

1400m **Dracodinium condylos**
Thalassiphora pelagica

1430m **Apectodinium homomorphum (abundant)**
Achilleodinium biformoides sensu Heilman-Clausen 1985
Momipites rotundus *

1460m **Apectodinium augustum**
Hafniasphaera cryptovesiculata

1490m **Areoligera senonensis (abundant)**
Hystrichokolpoma #LP

Degree of Confidence: 4

Remarks: Assemblages of the D. condylos Zone are well-represented below the sample at 1370-1390m in the South Hopedale L-39 well.

1520-1530m: Alisocysta circumtabulata Zone (late Paleocene)

1520m Ceratiopsis speciosa glabra
Alisocysta circumtabulata
Eisenackia crassitabulata

Degree of Confidence: 4

1550-1560m: Palaeoperidinium pyrophorum Zone (early Paleocene)

1550m Caligodinium aceras
Ceratiopsis striata
Ceratiopsis speciosa speciosa
Deflandrea denticulata
Hystrichosphaeridium tubiferum

Pervosphaeridium pseudhystrichodinium
Phelodinium tricuspe
Palaeocystodinium lidiae
Palaeoperidinium pyrophorum
Cordosphaeridium inodes longipes
Trithyrodinium #LS (?reworked)

Degree of Confidence: 4

Remarks: The marker species P. pyrophorum has its highest occurrence at 1550-1570m where it is common, and it occurs persistently in samples below 1550-1570m, strongly indicating penetration of the P. pyrophorum Zone.

1580-1590m: Spongodinium #LA Zone (early Paleocene)

1580m Palaeoperidinium basilium
Palaeocystodinium australinum
Spongodinium #LA

Degree of Confidence: 3

Remarks: Penetration of the Spongodinium #LA Zone is indicated by rare specimens of the dinoflagellate Spongodinium #LA at 1580-1600m and 1610-1630m.

1610-1620m: Spongodinium delitiense Zone (Maastrichtian)

1610m Ceratiopsis diebelii sensu McIntyre 1974
Spongodinium delitiense
Trithyrodinium evittii
Tanyosphaeridium variecalamus

Paraalnipollenites confusus *
Phelodinium magnificum

Degree of Confidence: 3

Remarks: Penetration of the S. delitiense Zone is indicated by the highest occurrence of the dinoflagellate S. delitiense at 1610-1630m where it is common. The next highest occurrence of this species is at 1700-1720m.

1640-1710m: Impagidinium #LL Zone (Maastrichtian)

1640m	Hystrichosphaeropsis sp., McIntyre 1974
	Impagidinium #LL
	Manumiella cretacea
	Ceratiopsis diebelii
1700m	Fromea fragilis

Degree of Confidence: 4

1730-1800m: Isabelidinium cooksoniae Zone (Maastrichtian)

1730m	**Chatangiella biapertura**
	Isabelidinium belfastense
1760m	Cyclonephelium distinctum
	Oligosphaeridium complex
	Oligosphaeridium #LV
	Isabelidinium cookoniae

1790m Exochosphaeridium bifidum

Degree of Confidence: 3

1820-1830m: Chatangiella tripartita Zone (late Campanian)

1820m **Chatangiella tripartita**
Surculosphaeridium longifurcatum

Degree of Confidence: 3

1850-1890m: Palaeohystrichophora infusorioides Zone (early Campanian)

1850m **Hystrichodinium pulchrum**

Degree of Confidence: 2

Remarks: Penetration of the P. infusorioides Zone is tentatively indicated by the occurrence of a single specimen of the dinoflagellate H. pulchrum.

1910-1920m: Senoniasphaera rotundata Zone (Santonian)

1910m Hystrichosphaeridium difficile
Senoniasphaera rotundata
Senoniasphaera protrusa
Hystrichosphaeridium sequanaportus

Degree of Confidence: 3

1940-1950m: Trilobosporites humilis Zone (middle Albian)

1940m

Aptea polymorpha
Aptea eisenackii
Cleistosphaeridium huguoniotii
Ctenidodinium #ES
Clavatipollenites hughesii *
Diplofusa gearlensis
Rugubivesiculites rugosus *
Retitricolpites vulgaris *
Trilobosporites humilis *

Degree of Confidence: 4

Remarks: A strong hiatus is indicated between 1920-1940m and 1940-1960m where sediments of late Albian to Coniacian age are missing. The presence of Ctenidodinium #ES and T. humilis indicate penetration of the T. humilis Zone.

1970-2070m: Muderongia asymmetrica Zone (early to middle Albian)

1970m

Eucommiidites minor *
Muderongia asymmetrica
Nodosisporites babsae *
Parvisaccites amplus *
Parvisaccites radiatus *
Rugubivesiculites minutus *
Tigrisporites scurrundus *

2000m	Clavatipollenites minutu *
2060m	Atopodinium prostatum (reworked Jurassic) **Cicatricosisporites imbricatus** * Corniculatisporites striatus * **Muderongia** #EY Phyllocladites microreticulatus *

Degree of Confidence: 4

Remarks: A diverse spore and pollen assemblage in association with M. asmmetrica indicates penetration of the Muderongia asymmetrica Zone.

2090-2220m: Oligosphaeridium asterigerum/Pilosisporites trichopapillosus Zone (late Aptian)

2090m	Clavatipollenites rotundus * **Interlobites triangularis** * Parvisaccites hortonensis *
2120m	**Pilosisporites trichopapillosus** *
2210m	Anulisporites annulatus (derived Carboniferous)

Degree of Confidence: 3

Remarks: The highest occurrence of I. triangularis at 2090-2110m suggests the P. trichopapillosus Zone. This is confirmed by the presence of P. trichopapillosus in the next lower sample at 2120-2140m. The presence of A. annulatus at 2210-2230m is probably due to reworking. This specimen is highly corroded and is associated with Lower Cretaceous palynomorphs.

2240-2360m: No zonal assignment (no age assignment)

Remarks: Due to the carbonate lithology which is of probable Paleozoic age, no palynomorphs are considered to be in situ in this interval.

MICROPALEONTOLOGICAL ZONATION

955-1110m	No zonal assignment (No age assignment)
Not observed	*Cassidulina teretis* Zone (late Miocene or younger)
Not observed	*Asterigerina guerichi* Zone (early Miocene or older)
Not observed	*Asterigerina bartoniana* Zone (late Oligocene)
Not observed	*Ceratobulimina contraria* Zone (early Oligocene)
1130-1290m	*Spiroplectammina adamsi* Zone (late Eocene)
1310-1320m	*Cyclammina amplectens* Zone (late Eocene)
Not observed	*Haplophragimoides acutidorsatum* Zone (middle Eocene)
1340-1350m	*Bulimina ovata* Zone (early Eocene)
1370-1440m	*Karreriella apicularis* Zone (early Eocene)
1460-1530m	*Spiroplectammina grzybowski* Zone (early Eocene)
1550-1560m	*Glomospira charoides* Zone (late Paleocene)
1580-1590m	*Glomospira corona* Zone (early Paleocene)
Not observed	*Praecystammina globigerinaeformis* Zone (early Paleocene)

1610-1860m	*Rzehakina epigona* Zone (Maastrichtian)
1880-2010m	*Arenobulimina dorbigny* Zone (?Campanian)
2030-2360m	No zonal assignment (No age assignment)

SELECTED FORAMINIFERA

955-1110m: No zonal assignment (No age assignment)

955m	Lenticulina costata
1045m	Nodosaria sp.

1130-1290m: Spiroplectammina adamsi Zone (late Eocene)

1130m	Cyclammina placenta **Haplophragmoides eggeri**
1160m	Bathysiphon discreta
1190m	**Haplophragmoides walteri** Coscinodiscus #H 1
1220m	Trochammina deformis **Coscinodiscus #H 2 +**

Degree of Confidence: 3

1310-1320m: Cyclammina amplectens Zone (late Eocene)

1310m	**Ammodiscus peruvianus** Recurvoides walteri

Degree of Confidence: 2

1340-1350m: Bulimina ovata Zone (early Eocene)

1340m **Spiroplectammina mexiaensis**

Degree of Confidence: 3

1370-1440m: Karreriella apicularis Zone (early Eocene)

1370m **Karreriella apicularis**
Praecystammina cf. globigerinaeformis (reworked)

1400m Trochamminoides sp.
Trochammina globigeriniformis

Degree of Confidence: 3

1460-1540m: Spiroplectammina grzybowski Zone (early Eocene)

1460m **Spiroplectammina grzybowski**

1490m Cyclammina cancellata

Degree of Confidence: 3

1550-1560m: Glomospira charoides Zone (late Paleocene)

1550m **Glomospira charoides**
Ammobaculites polythalamus

Degree of Confidence: 3

1580-1590m: Glomospira corona Zone (early Paleocene)

1580m	**Glomospira corona**
	Rhizammina indivisa

Degree of Confidence: 3

1610-1860m: Rzehakina epigona Zone (Maastrichtian)

1610m	**Rzehakina epigona**
	Saccammina placenta
	Spiroplectammina navarroana
	Glomospira irregularis
1640m	**Dorothia oxycona**
1670m	Trochamminoides subtrullisatus
1730m	Saccammina sphaerica
1820m	**Ammolagena clavata**
1850m	Spirosigmoilinella compressa
	Glomospirella sp.

Degree of Confidence: 3

1880-2010m: Arenobulimina dorbigny Zone (Campanian)

1880m	Uvigerinammina jankoi
	Arenobulimina dorbigny

1940m	Globigerina aff. pseudobulloides * (caved)
2030m	Reophax duplex

2090-2360m: No zonal assignment (no age assignment)

PALEOBATHYMETRY

955-1110m	Transitional to Inner Neritic
Criteria:	Lenticulina costata, Nodosaria sp.
1130-1140m	Inner Neritic to Middle Neritic
Criteria:	Cyclammina placenta, Haplophragmoides eggeri
1160-1170m	Middle Neritic
Criteria:	Bathysiphon discreta
1190-1290m	Outer Neritic
Criteria:	Haplophragmoides walteri, Coscinodiscus spp.
1310-1320m	Outer Neritic to Upper Bathyal
Criteria:	Ammodiscus peruvianus, Recurvoides walteri
1340-1380m	Upper Bathyal
Criteria:	Spiroplectammina mexiaensis, Karreriella apicularis
1400-1530m	Upper Bathyal to Lower Bathyal
Criteria:	Trochammina globigeriniformis, Cyclammina cancellata, Trochamminoides sp.
1550-1860m	Lower Bathyal
Criteria:	Glomospira spp., Ammobaculites polythalamus, Saccammina spp., Glomospirella sp.
1880-2040m	Upper Bathyal to Lower Bathyal
Criteria:	Arenobulimina dorbigny, Reophax duplex

Remarks: Paleoenvironments interpreted from 1910m to 2070m are only tentative, due to the high probability of cavings.

2060-2070m Outer Neritic to Upper Bathyal

Criteria: Decrease in diversity and abundance

KEROGEN & TAI

Depth	AM	AT	AG	SA	M	BT	ST	I	R	TAI
955.0	10	0	0	5	10	20	50	5	0	2-
1045.0	15	0	0	5	5	20	50	5	0	2-
1220.0	15	5	0	5	10	15	45	5	0	2-
1310.0	45	10	0	5	10	15	10	5	0	2-2
1340.0	50	10	0	5	5	10	15	5	0	2-2
1400.0	50	10	0	5	5	10	15	5	0	2-2
1520.0	45	15	0	5	5	15	10	5	0	2-2
1610.0	0	5	0	5	10	15	40	25	0	2
1640.0	0	0	0	5	5	15	55	20	0	2
1700.0	0	0	0	10	5	10	55	20	0	2
1760.0	0	0	0	10	5	5	50	30	0	2
1850.0	0	0	0	5	5	10	50	30	0	2
1910.0	0	0	0	5	5	15	55	25	0	2+
1940.0	30	15	0	5	5	10	25	10	0	2+
1970.0	50	15	0	0	5	10	10	10	0	2+
2000.0	50	10	0	0	5	10	15	5	0	2+
2030.0	40	5	0	0	5	15	25	10	0	2+
2040.0	40	5	0	0	5	15	25	10	0	

KEROGEN, TAI AND VITRINITE REFLECTANCE

The lower to upper Eocene interval from 955-1240m contains 10% to 15% marine amorphous kerogen, with other amorphous kerogen types being absent. Herbaceous kerogen comprises 25% to 35%, woody kerogen comprises 45% to 50%, and coaly inertinitic kerogen comprises 5%. The upper Paleocene to lower Eocene interval from 1310-1540m contains high relative abundances of amorphous kerogen comprising 10% to 15% degraded terrestrial material and 45% to 50% marine amorphous material. Woody kerogen is strongly reduced compared to the overlying interval, comprising less than 15%, with herbaceous kerogen being slightly reduced, and coaly inertinitic kerogen comprising 5%. The interval from 1610-1920m of Santonian to early Paleocene age is devoid of amorphous kerogen except for 5% terrestrial amorphous material at 1610m. Woody and coaly inertinitic kerogen are both well-represented and comprise approximately 50% and 25% respectively. Herbaceous kerogen comprises appoximately 25% to 30%. The lowest interval examined from the well at 1940-2060m of Early Cretaceous age contains high relative abundances of amorphous kerogen which mostly comprises marine amorphous material (30% to 50%). The other kerogen types are reduced compared to the overlying interval.

The level of Thermal Alteration increases from a value of 2⁻ at 955-1240m in the lower Eocene to middle-upper Eocene section, to a value of 2⁻ to 2 from 1310-1540m in the upper Paleocene to lower Eocene section. It reaches a value of 2 from 1610-1870m in the lower Campanian to lower Paleocene section, and possibly reaches a value of 2+ at 1910-1920m in strata assigned a Santonian age. TAI values of 2+ were recorded for all samples from the Lower Cretaceous section examined for kerogen analysis between 1940m and 2040m.

The following levels of thermal maturity are indicated by vitrinite reflectance analysis.

955-1460m: Immature (Ro% = 0.322% to 0.379%)
1490-2350m: Mature (Ro% = 0.606% to 0.924%)

The uppermost sample at 955m contains abundant reworking and therefore is unreliable. The basal part of the well below 1490m contains multiple populations of vitrinite and does not follow a conventional increase in Ro with depth. This may reflect the presence of volcanic rock.

VITRINITE REFLECTANCE

Key to Measurement Qualifying Labels

E = Excellent
= Good
P = Poor
C = Caved
R = Reworked

Sample Depth : 955.0

0.142	C	0.148	C	0.152	C	0.163	C	0.242		0.281		0.357	P
0.385	P	0.390	P	0.413		0.464	P	0.500		0.546	R	0.594	R
0.606	R	0.773	R	0.790	R	0.790	R	0.832	R	0.892	R	1.021	R
1.163	R	1.239	R	1.682	R								

Actual Mean = 0.607 Actual Standard Deviation = 0.394

Edited Mean = 0.379 Edited Standard Deviation = 0.086

Sample Depth : 1045.0

0.177	C	0.267	P	0.290		0.409	P

Actual Mean = 0.286 Actual Standard Deviation = 0.096

Edited Mean = 0.322 Edited Standard Deviation = 0.076

Sample Depth : 1220.0

0.158	C	0.201	C	0.222	C	0.245	C	0.264	P	0.277	P	0.278	
0.282	P	0.293	P	0.317	P	0.323	P	0.338	P	0.346	P	0.357	P
0.357	P	0.371		0.388		0.536	R	0.649	R	1.050	R		

Actual Mean = 0.363 Actual Standard Deviation = 0.196

Edited Mean = 0.322 Edited Standard Deviation = 0.041

Sample Depth : 1310.0

0.270	P	0.284	P	0.293	P	0.302	P	0.309		0.323	P	0.382	P
0.416		0.499	R										

Actual Mean = 0.342 Actual Standard Deviation = 0.076

Edited Mean = 0.322 Edited Standard Deviation = 0.051

Sample Depth : 1400.0

0.235

Actual Mean = 0.235 Actual Standard Deviation = 0.000

Edited Mean = 0.235 Edited Standard Deviation = 0.000

Sample Depth : 1460.0

0.249	P	0.252	P	0.393	P	0.411		0.419		0.549	R		

Actual Mean = 0.379 Actual Standard Deviation = 0.114

Edited Mean = 0.345 Edited Standard Deviation = 0.087

Sample Depth : 1490.0

0.305	C	0.367	C	0.524	P	0.539	P	0.600	P	0.646	P	0.662	P
0.665	P	0.721	R	0.787	R	0.806	R	0.814	R	0.912	R	0.923	R
0.931	R	0.963	R	1.019	R	1.046	R	1.179	R	1.193	R	1.194	R

Actual Mean = 0.800 Actual Standard Deviation = 0.257

Edited Mean = 0.606 Edited Standard Deviation = 0.062

Sample Depth : 1520.0

0.930 P

Actual Mean = 0.930 Actual Standard Deviation = 0.000

Edited Mean = 0.930 Edited Standard Deviation = 0.000

Sample Depth : 1550.0

0.410	C	0.506	C	0.565		0.623	P	0.744	P	0.860	P	0.920	P
0.927	P	0.973	R	1.038	R	1.312	R						

Actual Mean = 0.807 Actual Standard Deviation = 0.267

Edited Mean = 0.773 Edited Standard Deviation = 0.155

Sample Depth : 1580.0

0.343	C	0.366	C	0.400	C	0.425	C	0.482	C	0.491	C	0.603	P
0.614	P	0.699	P	0.715	P	0.739	P	0.754	P	0.770	P	0.771	P
0.851	E	0.944	R	0.946	R	0.998	R	1.012	R	1.061	R	1.250	R
1.250	R	1.360	R	1.370	R	1.445	R	1.676	R				

Actual Mean = 0.859 Actual Standard Deviation = 0.365

Edited Mean = 0.724 Edited Standard Deviation = 0.078

Sample Depth : 1610.0

0.365	C	0.378	C	0.407	C	0.468	C	0.540	C	0.587	P	0.589	
0.600		0.601		0.603		0.606		0.627	P	0.673		0.678	P
0.746		0.764		0.792		0.801		0.824		0.829	P	0.830	P
0.870		0.921		0.932	E	0.936		0.950		0.972	R	1.015	R
1.019	R	1.020	R	1.028	R	1.093	R	1.200	R	1.249	R	1.901	R

Actual Mean = 0.812 Actual Standard Deviation = 0.296

Edited Mean = 0.750 Edited Standard Deviation = 0.130

Sample Depth : 1640.0

0.467	C	0.471	C	0.510	C	0.551	C	0.605	C	0.650		0.661	
0.667		0.673		0.770		0.807		0.854		0.859		0.873	
0.892		0.920		0.921		0.973		1.032	R	1.069	R	1.107	R
1.289	R	1.519	R	1.601	R								

Actual Mean = 0.864 Actual Standard Deviation = 0.301

Edited Mean = 0.809 Edited Standard Deviation = 0.114

Sample Depth : 1700.0

0.516	C	0.559	C	0.574	C	0.598	C	0.647		0.661	P	0.663	
0.666		0.678		0.681		0.693		0.742		0.742	P	0.765	P
0.770		0.849		0.890		0.905		0.918		0.924		0.924	E
0.924		0.928		0.958	R	1.036	R	1.050	R	1.068	R	1.075	R
1.082	R	1.105	R	1.131	R	1.158	R	1.170	R	1.190	R	1.190	R
1.260	R	1.260	R	1.273	R	1.316	R	1.339	R	1.440	R		

Actual Mean = 0.935 Actual Standard Deviation = 0.248

Edited Mean = 0.788 Edited Standard Deviation = 0.112

Sample Depth : 1760.0

0.347	C	0.400	C	0.402	C	0.460	C	0.655	P	0.681	P	0.740	P
0.808		0.830	P	0.835	P	0.895		0.940	R	0.940	R	0.946	R
0.960	R	0.970	R	1.050	R	1.075	R	1.202	R	1.219	R		

Actual Mean = 0.818 Actual Standard Deviation = 0.259

Edited Mean = 0.778 Edited Standard Deviation = 0.088

Sample Depth : 1790.0

0.552	C	0.557	C	0.619	C	0.702	C	0.778	P	0.780	P	0.789	
0.836	P	0.842	P	0.856	P	0.894	P	0.927		0.933	P	0.965	P
0.972	P	1.003		1.013		1.043	P	1.077	P	1.080	P	1.121	R
1.172	R	1.173	R	1.180	R	1.203	R	1.217	R	1.317	R	1.321	R
1.391	R	1.412	R	1.450	R	1.785	R						

Actual Mean = 1.030 Actual Standard Deviation = 0.278

Edited Mean = 0.924 Edited Standard Deviation = 0.103

Sample Depth : 1820.0

0.237	C	0.241	C	0.336	C	0.372	C	0.392	C	0.396	C	0.412	C
0.434	C	0.454	C	0.588	C	0.591	C	0.687	P	0.694	P	0.703	P
0.746	P	0.772		0.790		0.859		0.870		0.882	P	0.899	P
0.986		1.023	P	1.028	P	1.044		1.053		1.062	P	1.099	
1.157	R	1.160	R	1.260	R	1.315	R	1.462	R				

Actual Mean = 0.788 Actual Standard Deviation = 0.331

Edited Mean = 0.894 Edited Standard Deviation = 0.144

Sample Depth : 1880.0

0.332	C	0.669		1.504	R

Actual Mean = 0.835 Actual Standard Deviation = 0.603

Edited Mean = 0.669 Edited Standard Deviation = 0.000

Sample Depth : 1940.0

0.241	C	0.403	C	0.407	C	0.458	C	0.528	C	0.684		0.752	P
0.757		0.762	P	0.959	P	1.429	R						

Actual Mean = 0.671 Actual Standard Deviation = 0.327

Edited Mean = 0.783 Edited Standard Deviation = 0.104

Sample Depth : 1970.0

0.131	C	0.270	C	0.425	C	0.511	P	0.535	P	0.544	P	0.561	P
0.597	P	0.633	P	0.650	P	0.698	P	0.704		0.770	P	1.112	R
1.173	R	1.204	R	1.280	R								

Actual Mean = 0.694 Actual Standard Deviation = 0.326

Edited Mean = 0.620 Edited Standard Deviation = 0.085

Sample Depth : 2000.0

0.484	C	0.534	C	0.596	P	0.636	P	0.643	P	0.653	P	0.678	P
0.686	P	0.805	R	0.878	R	1.112	R	1.370	R				

Actual Mean = 0.756 Actual Standard Deviation = 0.256

Edited Mean = 0.649 Edited Standard Deviation = 0.032

Sample Depth : 2030.0

0.115	C	0.518	C	0.545	C	0.641	P	0.681	P	0.688	P	0.710	P
0.769	P	0.855	R	0.903	R	0.968	R	0.979	R	1.115	R	1.149	R
1.252	R	1.373	R	1.392	R								

Actual Mean = 0.862 Actual Standard Deviation = 0.334

Edited Mean = 0.698 Edited Standard Deviation = 0.047

Sample Depth : 2200.0

0.283	C	0.323	C	0.360	C	0.420	C	0.473	C	0.478	C	0.507	C
0.524	C	0.534	C	0.555	C	0.597	P	0.607	P	0.626	P	0.634	P
0.642	P	0.652	P	0.664	P	0.690	P	0.702	P	0.746	P	0.752	P
0.782	P	0.810	P	0.838	P	0.842		0.853	P	0.864	P	0.885	P
0.917	P	0.943	R	0.946	R	0.980	R	0.988	R	1.005	R	1.150	R
1.165	R	1.237	R	1.275	R	1.285	R	1.316	R	1.351	R	1.375	R
1.383	R	1.686	R										

Actual Mean = 0.833 Actual Standard Deviation = 0.328

Edited Mean = 0.742 Edited Standard Deviation = 0.105

Sample Depth : 2350.0

0.452	C	0.483	C	0.748	E	0.924	P	0.933	P	0.983	P	1.085
1.268	R	1.741	R									

Actual Mean = 0.957 Actual Standard Deviation = 0.396

Edited Mean = 0.935 Edited Standard Deviation = 0.122

South Labrador N-79:

BIOSTRATIGRAPHY AND MATURATION OF

SOUTH LABRADOR N-79

CHEVRON et al. SOUTH LABRADOR N-79

GSC locality: 55° 48' 45.22"N, 58° 26' 32.83"W
KB elevation: 11.3m Water depth: 450m
Casing set at: 535m, 715.7m, 1493m
Total depth: 3571m
Interval studied for palynology: 750-3571.5m
Interval studied for micropaleontology: 720-3495m

CONSENSUS AGE

720- 730m	No age assignment
750- 760m	Plio-Pleistocene or older (P)
810- 970m	early Miocene (P)
990-1150m	late Oligocene (P)
1170-1300m	early Oligocene (P)
1320-1690m	late Eocene (P)
1710-1900m	middle Eocene (M)
1920-2380m	early Eocene (M,P)
2400-2895m	late Paleocene (M)
2915-3255m	early Paleocene (M)
3275-3375m	Maastrichtian (M)
3395-3405m	late Campanian (P)
3425-3465m	early Campanian (P)
3485-3495m	Santonian (P)
3515-3571.5m	Barremian to early Aptian (P)

SOUTH LABRADOR N-79

PALYNOLOGICAL ZONATION

750- 760m	Tsugaepollenites igniculus Zone or older (Plio-Pleistocene or older)
Not observed	Operculodinium centrocarpum Zone (late Miocene)
Not observed	Systematophora ancyrea Zone (middle Miocene)
780- 790m	possible Cordosphaeridium cantharellum Zone (possible early Miocene)
810- 820m	Cordosphaeridium cantharellum Zone (early Miocene)
840- 970m	possible Chiropteridium mespilanum Zone (possible late Oligocene)
990-1150m	Chiropteridium mespilanum Zone (late Oligocene)
1170-1300m	Areosphaeridium arcuatum Zone (early Oligocene)
1320-1420m	Deflandrea #LR Zone (late Eocene to early Oligocene)
1440-1870m	Areosphaeridium fenstratum Zone (middle to late Eocene)
1890-1930m	Eocladopyxis #LA Zone (middle Eocene)
1950-2200m	Trinovantedinium #LA Zone (early Eocene)

2220-2620m	Dracodinium condylos Zone (early Eocene)
2640-2740m	Ceratiopsis speciosa Zone (late Paleocene)
2760-2925m	Alisocysta circumtabulata Zone (late Paleocene)
2945-2985m	Palaeoperidinium pyrophorum Zone (early Paleocene)
3005-3315m	Spongodinium #LA Zone (early Paleocene)
3335-3345m	Spongodinium delitiense Zone (Maastrichtian)
3365-3375m	Impagidinium #LL Zone (Maastrichtian)
3395-3405m	Isabelidinium cooksoniae Zone (late Campanian)
3425-3465m	Palaeohystrichophora infusorioides Zone (early Campanian)
3485-3495m	Senoniasphaera rotundata Zone (Santonian)
Not observed	Cometodinium obscurum (Turonian to Coniacian)
Not observed	Kiokansium polypes Zone (Cenomanian)
Not observed	Epelidosphaerida spinosa Zone (early Cenomanian to late Albian)
Not observed	Trilobosporites humilis Zone (middle Albian)
Not observed	Parvisaccites amplus Zone (early to middle Albian)

Not observed *Muderongia asymmetrica* Zone (early to middle Albian)

Not observed *Oligosphaeridium asterigerum/Pilosisporites trichopapillosus* Zone (late Aptian)

3515-3525m *Pseudoceratium pelliferum* Zone (Barremian to early Aptian)

3545-3571.5m *Cicatricosisporites* #EAL Zone (Barremian to early Aptian)

SELECTED PALYNOMORPHS

750-760m: Tsugaepollenites igniculus Zone or older (Plio-Pleistocene or older)

750m All contaminants

Degree of Confidence: 1

780-790m: possible Cordosphaeridium cantharellum Zone (possible early Miocene)

780m **Lejeunecysta hyalina**
Osmundacidites claytonites *
Tiliaepollenites vescipites *

Degree of Confidence: 1

Remarks: Assignment to the C. cantharellum Zone highly tentative, being based on the occurrence of L. hyalina whose stratigraphic range is uncertain on the Labrador Shelf.

810-820m: Cordosphaeridium cantharellum Zone (early Miocene)

810m **Cordosphaeridium cantharellum**
Distatodinium paradoxum
Lycopodiumsporites annotinioides *

Operculodinium centrocarpum
Tsugaepollenites igniculus *
Ericipites antecursorioides *

Degree of Confidence: 3

Remarks: The presence of C. cantharellum and D. paradoxum indicate the penetration of lower Miocene strata providing the observed specimens are in place.

840-970m: possible Chiropteridium mespilanum Zone (possible late Oligocene)

840m
Alnipollenites verus *
Caryapollenites simplex *
Corylus #LA *
Momipites coryloides * (?reworked)
Faguspollenites #LA *
Quercoidites #LA *
Quercoidites #LG *
Tricolpites #LR *

870m
Azolla *
Cicatricososporites auritus * (?reworked)
Carpinipites #LA *
Lentinia cf. serrata

900m
Lingulodinium machaerophorum

960m
Ulmipollenites undulosus *

Degree of Confidence: 1

Remarks: Penetration of the C. mespilanum Zone is tentatively indicated by the presence of several angiosperm species, although the ranges of these taxa are uncertain in the Labrador Shelf. A single specimen of the spore C. auritus at 870-890m is interpreted as being reworked.

990-1150m: Chiropteridium mespilanum Zone (late Oligocene)

990m	**Deflandrea phosphoritica**
	Retitricolpites #LA *
1020m	**Rouseisporites #LA ***
	Systematophora ancyrea

Degree of Confidence 2

1170-1300m: Areosphaeridium arcuatum Zone (early Oligocene)

1170m	**Cicatricosisporites dorogensis ***
	Ericipites compactipolleniatus *
1200m	**Areosphaeridium multicornutum**
	Deflandrea #LR
	Chiropteridium mespilanum
	Cyclonephelium sp. B, Williams & Brideaux 1975
1260m	Pterocaryapollenites stellatus *

Degree of Confidence: 3

Remarks: Assignment of the sample at 1170-1190m to the A. arcuatum Zone is tentative, but a more confident assignment is indicated at 1200-1220m being based on the occurrences of A. multicornutum and Cyclonephelium sp. B of Williams & Bridreaux (1975).

1320-1420m: Deflandrea #LR Zone (late Eocene to early Oligocene)

1320m	**Deflandrea #LR** Paralecaniella indentata
1350m	Lentinia serrata
1380m	Glaphyrocysta intricata

Degree of Confidence: 3

1440-1870m: Areosphaeridium fenestratum Zone (middle to late Eocene)

1440m	**Chiropteridium #LS**
1470m	Cicatricosisporites paradorogensis Dinopterygium cladoides **Glaphyrocysta laciniiformis**
1500m	**Cordosphaeridium inodes**
1590m	**Wetzeliella articulata**
1680m	**Kisselovia crassiramosa**

1740m **Cicatricososporites auritus**
Deflandrea phosphoritica

1770m **Cordosphaeridium gracile**

Degree of Confidence: 4

1890-1930m: Eocladopyxis #LA Zone (middle Eocene)

1890m **Apectodinium homomorphum**
Cribroperidinium giuseppei
Eocladopyxis #LA
Hystrichokolpoma unispinum
Lentinia wetzelii
Systematophora placacantha
Thalassiphora pelagica

Degree of Confidence: 4

1950-2200m: Trinovantedinium #LA Zone (early Eocene)

1950m Achilleodinium biformoides
Homotryblium pallidum
Systematophora #LC
Trinovantedinium #LA
Trinovantedinium #LS
Ceratiopis pannucea

1980m Areoligera senonensis
Areosphaeridium sp. A, Williams & Brideaux 1977
Glaphyrocysta semitecta

Kisselovia edwardsii
Wetzeliella ovalis
Systematophora #LE
Trinovantedinium #LL
Hystrichokolpoma salacium
Palaeocystodinium golzowense

2010m **Deflandrea oebisfeldensis**
Duosphaeridium nudum
Eatonicysta ursulae
Homotryblium tenuispinosum
Wetzeliella meckelfeldensis

2040m Adnatosphaeridium robustum
Cordosphaeridium tiara
Diphyes colligerum
Heteraulacacysta leptalea
Homotryblium abbreviatum

2070m **Achilleodinium biformoides sensu Heilman-Clausen 1985**

2190m Intratriporopollenites sp., Rouse 1977 *

Degree of Confidence: 4

2220-2620: Dracodinium condylos Zone (early Eocene)

2220m **Isabelidinium #LP**

2250m Apectodinium homomorphum (common)
Apectodinium hyperacanthum
Dracodinium condylos

2310m	Hystrichokolpoma #LP
2340m	Polysphaeridium subtile
2400m	Hafniasphaera septata
2430m	Apectodinium homomorphum (abundant) Areoligera senonensis (common)
2460m	Apectodinium augustum
2520m	Apectodinium senonensis (abundant)
2610m	Camarozonosporites #LB *

Degree of Confidence: 3

2640-2740m: Ceratiopsis speciosa Zone (late Paleocene)

2640m	Ceratiopsis striata Ceratiopsis speciosa glabra

Degree of Confidence: 3

2760-2925m: Alisocysta circumtabulata Zone (late Paleocene)

2760m	Phelodinium magnificum Eisenackia crassitabulata (?reworked)

Degree of Confidence: 2

Remarks: Assignment of the sample at 2760-2780m to the A. circumtabulata Zone is based on a single specimen of E. crassitabulata which may be reworked.

2945-2985m: Palaeoperidinium pyrophorum Zone (early Paleocene)

2945m	Ceratiopsis speciosa speciosa Cordosphaeridium inodes longipes Deflandrea denticulata Alisocysta circumtabulata **Palaeocystodinium australinum** **Palaeoperidinium pyrophorum**
2975m	**Palaeoperidinium basilium** **Phelodinium tricuspe**

Degree of Confidence: 4

3005-3315m: Spongodinium #LA Zone (early Paleocene)

3005m	**Caligodinium aceras** **Hystrichosphaeridium tubiferum** Palaeocystodinium lidiae **Spongodinium #LA** **Trithyrodinium #LS**
3065m	Eisenackia crassitabulata
3125m	**Trithyrodinium evittii**
3185m	Oligosphaeridium #LV

3215m Ceratiopsis diebelii sensu McIntyre 1976
Ceratiopsis diebelii
Pervosphaeridium pseudhystrichodinium

Degree of Confidence: 4

3335-3345m: Spongodinium delitiense Zone (Maastrichtian)

3335m **Spongodinium delitiense**

Degree of Confidence: 3

Remarks: The highest occurrence and persistent presence of S. delitiense below 3335-3355m indicates assignment to the S. delitiense Zone.

3365-3375m: Imagidimium #LL Zone (Maastrichtian)

3365m Gonyaulacysta clathrata
Impagidinium #LL
Manumiella cretacea

Degree of Confidence: 4

3395-3405m: Isabelidinium cooksoniae Zone (late Campanian)

3395m Cyclonephelium distinctum
Isabelidinium cooksoniae

Degree of Confidence: 2

Remarks: A single specimen of the dinoflagellate I. cooksoniae tentatively indicates assignment to the I. cooksoniae Zone.

3425-3465m: Palaeohystrichophora infusorioides Zone (early Campanian)

3425m	Isabelidinium belfastense
	Palaeohystrichophora infusorioides
3455m	Chatangiella scheii
	Chatangiella tripartita

Degree of Confidence: 2

3485-3495m: Senoniasphaera rotundata Zone (Santonian)

3485m	Chatangiella verrucosa
	Hystrichosphaeridium difficile
	Hystrichosphaeridium stellatum
	Surculosphaeridium longifurcatum

Degree of Confidence: 1

Remarks: The sample at 3485-3495m mostly contains dinoflagellates which range into the Campanian, but the presence of a single specimen of H. stellatum suggests possible assignment to the Santonian S. rotundata Zone.

3515-3525m: Pseudoceratium pelliferum Zone (early Aptian to Barremian)

3515m	Hystrichodinium pulchrum
	Odontochitina costata

Odontochitina operculata
Pseudoceratium #LA
Pilosisporites trichopapillosus

Degree of Confidence: 4

Remarks: Penetration of the P. pelliferum Zone is indicated by the highest occurrence of Pseudoceratium #LA at 3515-3525m. A marked hiatus is indicated between 3495m and 3515m by the absence of late Aptian to Coniacian assemblages.

3545-3571.5m: Cicatricosisporites #EAL Zone (early Aptian to Barremian)

3545m Astrocysta cretacea
Pseudoceratium pelliferum (depressed top)
Cedripites canadensis *
Cicatricosisporites #EAL *
Rotverrusporites #EC *

Degree of Confidence: 4

Remarks: Penetration of the Cicatricosisporites #EAL Zone is indicated at 3545m by the presence of Cicatricosisporites #EAL.

MICROPALEONTOLOGICAL ZONATION

720- 730m	No assignment
750- 910m	*Cassidulina teretis* Zone (late Miocene or younger)
930-1000m	*Asterigerina guerichi* Zone (early Miocene or older)
1020-1120m	*Asterigerina bartoniana* Zone (late Oligocene)
1230-1390m	*Ceratobulimina contraria* Zone (early Oligocene)
1410-1630m	*Spiroplectammina adamsi* (late Eocene)
1650-1690m	*Cyclammina amplectens* Zone (late Eocene)
1710-1900m	*Haplophragmoides acutidorsatum* Zone (middle Eocene)
1920-2110m	*Bulimina ovata* Zone (early Eocene)
2130-2200m	*Karreriella apicularis* Zone (early Eocene)
2220-2380m	*Spiroplectammina grzybowski* Zone (early Eocene)
2400-2895m	*Glomospira charoides* Zone (late Paleocene)
2915-3045m	*Glomospira corona* Zone (early Paleocene)
3065-3255m	*Praecystammina globigerinaeformis* Zone (early Paleocene)
3275-3375m	*Rzehakina epigona* Zone (Maastrichtian)
3395-3495m	*Arenobulimina dorbigny* Zone (?Campanian)

SELECTED FORAMINIFERA

750-910m: Cassidulina teretis Zone (late Miocene or younger)

750m	Melonis affinis
	Cibicidoides boueanus
	Epistominella acutimargo
810m	Triloculina trigonula
	Heterolepa lobatula
870m	Triloculina trigonula
900m	Nodosaria emaciata
	Pullenia bulloides

Degree of Confidence: 1

930-1000m: Asterigerina guerichi Zone (early Miocene or older)

930m	Dentalina inornata
	Globorotaloides suteri *
960m	Heterolepa sp.

Degree of Confidence: 4

1020-1210m: Asterigerina bartoniana Zone (late Oligocene)

1020m	**Coscinodiscus** #H 1 +
1110m	Lenticulina #H 1

Degree of Confidence: 2

1230-1390m: Ceratobulimina contraria Zone (early Oligocene)

1230m	**Alveolophragmium** #H 1
1320m	Trochammina inflata
	Cyclammina placenta
	Bathyisphon discreta
	Cibicidoides proprius
	Ammodiscus cretaceus
	Nodosaria elegantissima
	Alabamina wilcoxensis
	Lenticulina #H 2

Degree of Confidence: 2

1410-1630m: Spiroplectammina adamsi (late Eocene)

1410m	**Haplophragmoides walteri**
	Trochammina deformis
1450m	**Cyclammina cancellata**
	Glandulina laevigata
1470m	Guttulina problema
	Stilostomella midwayensis (reworked)
1500m	**Recurvoides walteri**
	Turrilina alsatica
	Bulimina alazanensis
	Cribrostomoides cf. subglobosus

	Pullenia quinqueloba
	Cassidulina subglobosa
	Nodosaria soluta
1560m	**Pseudohastigerina micra** *
	Cibicidoides blanpiedi
	Gyroidinoides girardana
1590m	Gyroidinoides angustiumbilicata
	Spiroplectammina adamsi (depressed top)

Degree of Confidence: 3

1650-1690m: Cyclammina amplectens Zone (late Eocene)

1650m	**Cyclammina amplectens**
	Karreriella siphonella
	Haplophragmoides eggeri
	Vaginulinopsis decorata

Degree of Confidence: 3

1710-1900m: Haplophragmoides acutidorsatum Zone (middle Eocene)

1710m	**Haplophragmoides acutidorsatum**
	Trochammina globigeriniformis
	Globigerina higginsi *
1740	Trochammina collyra
	Anomalinoides praespissiformis

1800m	Cribrostomoides scitulus
1830m	**Bulimina trigonalis**
1860m	Epistominella oveyi Anomalinoides preacuta Trochammina rota Trifarina abbreviata
1890m	**Plectofrondicularia lirata**

Degree of Confidence: 4

1920-2110m: Bulimina ovata Zone (late Eocene)

1920m	**Bulimina ovata** **Uvigerina batjesi** Ammodiscus peruvianus
1950m	Budashevaella multicamerata Nodosaria latejugata Oridorsalis umbonatus Uvigerina spinicostata
2010	Anomalinoides acuta Hoeglundina eocenica
2040m	Cibicidoides mirificus Lenticulina midwayensis

2070m	**Stilostomella paleocenica**
	Heterolepa grimsdalei
	Marginulina glabra
	Globigerina frontosa *
	Globigerina linaperta *

Degree of Confidence: 3

2130-2200m: Karreriella apicularis Zone (early Eocene)

2130m	**Ammobaculites expansus**
	Karreriella apicularis
2160m	Nodosaria minor
	Spiroplectammina eocenica
2190m	**Nuttallides truempyi**
	Pseudonodosaria discreta
	Reophax pilulifer

Degree of Confidence: 3

2220-2380m: Spiroplectammina grzybowski Zone (early Eocene)

2220m	**Spiroplectammina grzybowski**
	Spiroplectammina navarroana
	Haplophragmoides impensus
2250m	Globigerina triloculinoides * (reworked)
	Eponides plummerae

2280m	**Trochamminoides subtrullisatus** **Haplophragmoides aff. linki** **Allomorphina subtriangularis**
2310m	Ammobaculites expansus
2370m	**Bulimina quadrata**

Degree of Confidence: 3

2400-2895m: Glomospira charoides Zone (late Paleocene)

2400m	**Glomospira charoides** Ammobaculites polythalamus
2430m	Chilostomella cylindroides Vulvulina cf. haeringensis
2460m	Chilostomelloides eocenica
2490m	Trochammina cf. boehmi
2550m	Pseudonodosaria cf. pygmea Bulimmina ovata
2580m	Spiroplectammina carinata
2610m	**Psammosphaera sphaerica** Pseudonodosaria cf. midwayensis

2700m	Dentalina colei
2730m	Epistominella oveyi
2885m	Lenticulina wilcoxensis **Glomospirella** sp. Clavulina parisiensis Bathysiphon discreta

Degree of Confidence: 3

2915-3045m: Glomospira corona Zone (early Paleocene)

2915m	**Glomospira corona** Glomospira charoides (common)
2975m	Ammodiscus glabratus
3005m	Gavelinella micra

Degree of Confidence: 3

3065-3255m: Praecystammina globigerinaeformis Zone (early Paleocene)

3065m	Spirosigmoilinella compressa **Praecystammina globigerinaeformis** Saccammina placenta
3185m	**Dorothia retusa**
3215m	Saccammina complanata

Degree of Confidence: 3

3275-3375m: Rzehakina epigona Zone (Maastrichtian)

3275m	**Rzehakina epigona**
	Rhabdammina linearis
3335m	Pelosina sp.
	Glomospira irregularis
3365m	**Uvigerinammina jankoi**

Degree of Confidence: 3

3395-3495m: Arenobulimina dorbigny Zone (?Campanian)

3395m	**Arenobulimina dorbigny**
	Melonis pompilioides
	Paratrochamminoides sp.

Degree of Confidence: 3

PALEOBATHYMETRY

720- 730m	Transitional to Inner Neritic
Criteria:	No foraminifera, quartz grains
750- 910m	Inner Neritic
Criteria:	Melonis affinis, Pullenia bulloides
930-1300m	Inner Neritic to Middle Neritic
Criteria:	Globorotaloides suteri, Coscinodiscus #H1, Marine dinoflagellates
1320-1495m	Middle Neritic to Outer Neritic
Criteria:	Cyclammina placenta, Ammodiscus cretacens, Bathysiphon discreta
1500-1690m	Outer Neritic
Criteria:	Recurvoides walteri, Cyclamina amplecteus, Bulimina alazanensis, Haplophragmoides eggeri
Remarks:	This assemblage could also be interpreted as indicative of outer neritic to upper bathyal environments.
1710-1930m	Outer Neritic to Upper Bathyal
Criteria:	Haplophragmoides acutidorsatum, Trochammina globigeriniformis, Plectofrondicularia lirata Ammodiscus peruvianus
1950-2170m	Upper Bathyal
Criteria	Budashevaella multicamerata, Oridorsalis umbonatus, Stilostomella paleocenica, Karreriella apicularis

2190-2895m	Upper Bathyal to Lower Bathyal
Criteria:	Nuttallides truempyi, Reophax pilulifer, Ammobaculites polythalamus, Chilostomella cylindroides, Clavulina parisiensis
2915-3465m	Lower Bathyal
Criteria:	Glomospira spp., Ammodiscus glabratus, Saccammina complanata
3485-3515m	Middle Neritic to Outer Neritic
Criteria:	Decrease in diversity and abundance of foraminifera, marine dinoflagellates
3515-3525m	Inner Neritic to Middle Neritic
Criteria:	Marine dinoflagellates and angiosperm pollen

KEROGEN & TAI

Depth	AM	AT	AG	SA	M	BT	ST	I	R	TAI
760.0	5	0	0	5	15	15	40	20	0	2-
850.0	10	5	0	5	15	15	30	20	0	2-
970.0	30	25	0	0	10	10	15	10	0	2-
1090.0	30	20	0	0	5	15	20	10	0	2-
1180.0	30	20	0	0	0	25	20	5	0	2-
1270.0	30	20	0	0	0	25	20	5	0	2-
1360.0	20	35	0	0	0	20	20	10	0	2-
1480.0	20	35	0	0	0	25	15	5	0	2-
1570.0	20	30	0	0	5	20	15	5	0	2-2
1690.0	20	30	0	0	10	20	10	10	0	2-2
1780.0	30	30	0	0	0	25	10	5	0	2-2
1870.0	30	30	0	0	0	25	10	5	0	2-2
1990.0	30	25	0	0	0	20	20	5	0	2-2
2110.0	25	25	0	0	0	25	20	5	0	2-2
2200.0	25	25	0	0	5	20	20	5	0	2-2
2290.0	30	20	0	0	0	25	20	5	0	2-2
2410.0	30	25	0	0	0	20	20	5	0	2
2500.0	30	25	0	0	0	20	15	5	0	2
2590.0	25	20	0	0	5	20	25	5	0	2
2680.0	20	25	0	0	5	25	20	5	0	2
2770.0	20	25	0	0	5	20	25	5	0	2
2860.0	20	20	0	0	0	25	25	10	0	2
2985.0	25	20	0	0	0	25	20	10	0	2
3075.0	15	10	0	0	5	5	40	20	0	2+
3195.0	25	10	0	0	0	15	30	20	0	2+
3285.0	20	15	0	0	0	15	30	20	0	2+
3405.0	10	15	0	0	0	10	35	30	0	2+
3495.0	0	0	0	5	10	15	40	30	0	2+3-
3571.5	0	0	0	0	5	10	35	25	0	2+3-

KEROGEN, TAI AND VITRINITE REFLECTANCE

The Plio-Pleistocene or older interval from 750-760m contains 40% woody kerogen, 20% inertinitic kerogen, 35% herbaceous kerogen and 5% amorphous kerogen. The relative abundance of amorphous kerogen increases strongly in the Eocene to upper Miocene interval between 780-2380m, reaching a peak of 60% in the middle Eocene. This amorphous kerogen comprises approximately equal amounts of marine and degraded terrestrial material. The woody kerogen decreases in this interval to a minimum of 10% in the middle Eocene, whereas herbaceous kerogen comprises approximately 25% with the majority being terrestrial plant remains. Inertinitic coaly kerogen is rare throughout most of this section.

The Upper Cretaceous to Paleocene interval from 2400-3495m has a gradual decrease in the relative abundance of amorphous kerogen downhole to a minimum of 25% in the Santonian. This amorphous kerogen comprises approximately equal amounts of marine and degraded terrestrial material. The relative abundance or woody kerogen generally increases downhole to a value of 35% in the Santonian, and the relative abundance of inertinitic coaly kerogen increases strongly from a value of 5% in the upper Paleocene to 30% in the Santonian. The relative abundance of herbaceous kerogen is similar to that in the overlying section of the well.

The interval assigned a Lower Cretaceous age based on palynology from 3515-3525m, is devoid of amorphous kerogen, comprising 35% woody kerogen, 25% coaly inertinitic kerogen, and 15% herbaceous kerogen. The sample at 3495m was assigned an indeterminate age based on palynology, but the kerogen composition is similar to that below 3515m, indicating that it is also Early Cretaceous providing the observed kerogen is in place.

The level of Thermal Alteration increases from a value of 2⁻ at 760m, to a value of 2⁻ to 2 at the base of the lower Eocene. It increases from 2 at the top of the Paleocene interval, to a value of 2+ in the Santonian, with the increase from 2 to 2+ occurring within the lower Paleocene. The level of Thermal Alteration and kerogen types indicate that the marine amorphous kerogen is mature below approximately 1570m and has some potential for sourcing thermogenic liquid hydrocarbons. The TAI and kerogen types indicate that the herbaceous, woody and terrestrial amorphous kerogen is mature below approximately 3075m and has some potential for sourcing predominantly gaseous hydrocarbon.

The following levels of thermal maturity are indicated by vitrinite reflectance analysis.

1150-2320m: Immature (Ro% = 0.315% to 0.425%)
2110-2320m: Onset of maturation (Ro% = 0.452% to 0.479%)
2560-3045m: Mature (Ro% = 0.829% to 0.878%)

The decreasing values in Ro% within the onset of maturation zone at 2200m and 2440m may reflect the generation of in situ hydrocarbons which have saturated the vitrinite particles and therefore decreased their reflectance. This is a commonly occurring phemomona at reflectance values of 0.5% to 0.6%. This saturation of the vitrinite particles is also supported by a peak in amorphous kerogen within this interval. The subsequent jump in Ro% between 2440m and 2560m probably reflects the desaturation of the vitrinite particles. The lowest sample at 3040m has a strong peak which is interpreted as reworking at 1.0%, although these may be in situ particles and therefore would be rated as highly mature.

VITRINITE REFLECTANCE

Key to Measurement Qualifying Labels

E = Excellent
= Good
P = Poor
C = Caved
R = Reworked

Sample Depth : 1150.0

0.354		0.397		0.443	P	0.576	R	1.030	R

Actual Mean = 0.560 Actual Standard Deviation = 0.276

Edited Mean = 0.398 Edited Standard Deviation = 0.045

Sample Depth : 1300.0

0.191	P	0.203	P	0.235	P	0.239	P	0.241		0.262		0.262	P
0.271	E	0.273		0.291		0.293		0.294		0.295		0.301	E
0.309		0.316		0.317		0.317		0.318		0.322	E	0.332	
0.341		0.345		0.345		0.346		0.353		0.356	P	0.362	
0.362		0.370		0.371		0.380		0.389		0.411		0.411	
0.431	R	0.445	R	0.547	R	0.602	R	0.690	R	0.864	R	0.887	R

Actual Mean = 0.369 Actual Standard Deviation = 0.150

Edited Mean = 0.315 Edited Standard Deviation = 0.055

Sample Depth : 1450.0

0.191	C	0.221	C	0.267	P	0.275	P	0.275	P	0.308		0.324
0.332		0.346		0.347	P	0.349		0.349		0.354		0.354
0.354		0.355	E	0.357		0.360	P	0.373	P	0.373	P	0.375
0.381		0.388		0.392		0.431	R	0.438	R	0.563	R	0.828	R

Actual Mean = 0.366 Actual Standard Deviation = 0.114

Edited Mean = 0.345 Edited Standard Deviation = 0.035

Sample Depth : 1780.0

0.282	C	0.291	C	0.301	C	0.303	C	0.306	C	0.319	C	0.325	C
0.344		0.352		0.356		0.365		0.366		0.368		0.375	
0.385	P	0.390		0.391	P	0.407		0.408		0.409		0.427	
0.443	R	0.445	R	0.450	R	0.453	R	0.480	R				

Actual Mean = 0.375 Actual Standard Deviation = 0.056

Edited Mean = 0.382 Edited Standard Deviation = 0.025

Sample Depth : 1870.0

0.302	P	0.306		0.327		0.329		0.330		0.334		0.350	
0.374		0.388		0.390		0.437	P	0.467	R	0.477	R	0.548	R
0.576	R												

Actual Mean = 0.396 Actual Standard Deviation = 0.087

Edited Mean = 0.352 Edited Standard Deviation = 0.041

Sample Depth : 2020.0

0.268	C	0.286	C	0.328	C	0.333	C	0.346	C	0.346	C	0.372	
0.380		0.400		0.422		0.423		0.437		0.443		0.448	
0.457		0.471		0.531	R	0.675	R						

Actual Mean = 0.409 Actual Standard Deviation = 0.095

Edited Mean = 0.425 Edited Standard Deviation = 0.033

Sample Depth : 2110.0

0.326	C	0.343	C	0.346	C	0.359	C	0.379	C	0.406		0.420	
0.430		0.433	P	0.437		0.441		0.448		0.456		0.467	
0.469		0.473	E	0.481		0.485		0.487		0.506	R	0.534	R
0.553	R	0.610	R	0.716	R	0.842	R						

Actual Mean = 0.474 Actual Standard Deviation = 0.115

Edited Mean = 0.452 Edited Standard Deviation = 0.026

Sample Depth : 2200.0

0.400	0.414	0.427	0.452	0.472	0.475	0.487
0.563 R						

Actual Mean = 0.461 Actual Standard Deviation = 0.051

Edited Mean = 0.447 Edited Standard Deviation = 0.033

Sample Depth : 2320.0

0.343	C	0.366	C	0.431		0.438		0.444		0.459		0.469	
0.471	P	0.491		0.508	P	0.513		0.521		0.527		0.707	R
0.796	R	0.881	R	1.047	R	1.207	R						

Actual Mean = 0.590 Actual Standard Deviation = 0.241

Edited Mean = 0.479 Edited Standard Deviation = 0.035

Sample Depth : 2440.0

0.250	C	0.294	C	0.329	C	0.349	C	0.355	C	0.375	C	0.397	P
0.397	P	0.402	P	0.415	P	0.431	P	0.465		0.477		0.492	
0.595	R	0.609	R	0.963	R	1.016	R	1.104	R				

Actual Mean = 0.511 Actual Standard Deviation = 0.247

Edited Mean = 0.435 Edited Standard Deviation = 0.038

Sample Depth : 2560.0

0.461	C	0.482	C	0.547	P	0.558	P	0.574	P	0.595	P	0.602	
0.650	P	0.663		0.717	P	0.740		0.740		0.770		0.792	E
0.813		0.839		0.846		0.847	P	0.864		0.891		0.912	E
0.918		0.932	P	0.943		0.950		0.962		0.983		0.986	
0.989	P	0.992		0.996	E	1.004	E	1.015	R	1.027	R	1.039	R
1.045	R	1.049	R	1.071	R	1.079	R	1.089	R	1.095	R	1.112	R
1.134	R	1.159	R	1.166	R	1.237	R	1.360	R	1.664	R	1.838	R

Actual Mean = 0.933 Actual Standard Deviation = 0.266

Edited Mean = 0.821 Edited Standard Deviation = 0.150

Bujak Davies Group **South Labrador N-79.....33**

Sample Depth : 2680.0

0.356	C	0.404	C	0.440	C	0.483	C	0.496	C	0.515	C	0.520	C
0.524	C	0.537	C	0.545	C	0.597	C	0.772	P	0.779		0.794	
0.820		0.854		0.893	C	0.895		0.901	E	0.914		0.958	
0.986	P	0.990		1.028	R	1.061	R	1.152	R	1.200	R	1.237	R
1.373	R	1.511	R	1.528	R								

Actual Mean = 0.841 Actual Standard Deviation = 0.323

Edited Mean = 0.878 Edited Standard Deviation = 0.080

Sample Depth : 2800.0

0.350	C	0.363	C	0.409	C	0.433	C	0.473	C	0.481	C	0.523	C
0.525	C	0.549	C	0.599	C	0.616	P	0.623		0.623		0.655	P
0.655		0.681		0.706		0.728		0.771	P	0.790		0.802	
0.815		0.848		0.849		0.882	E	0.883		0.889	P	0.906	
0.912		0.931	E	0.959		0.968		0.983		0.991		0.997	
1.016		1.023		1.050	R	1.053	R	1.054	R	1.056	R	1.062	R
1.078	R	1.091	R	1.118	R	1.215	R	1.234	R	1.396	R	1.483	R
1.738	R	1.761	R										

Actual Mean = 0.874 Actual Standard Deviation = 0.314

Edited Mean = 0.833 Edited Standard Deviation = 0.134

Sample Depth : 2925.0

0.342	C	0.479	C	0.499	C	0.503	C	0.526	C	0.576	C	0.664	C
0.694		0.733		0.736		0.761		0.762		0.851		0.869	
0.878	E	0.916		0.959		0.963		1.018	R	1.062	R	1.087	R
1.109	R	1.113	R	1.142	R	1.192	R	1.246	R	1.306	R	1.308	R

Actual Mean = 0.868 Actual Standard Deviation = 0.271

Edited Mean = 0.829 Edited Standard Deviation = 0.096

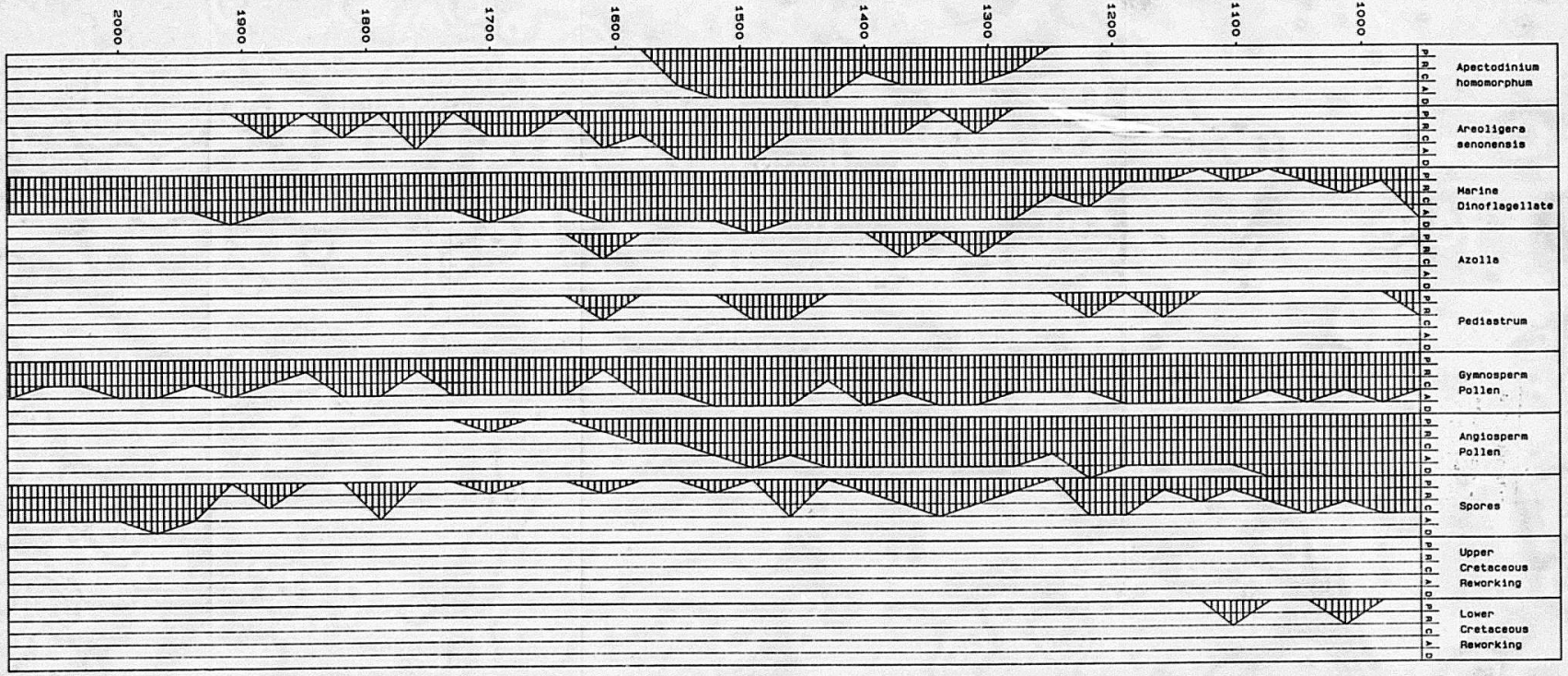
Sample Depth : 3045.0

0.503	C	0.524	C	0.576	C	0.588	C	0.605	C	0.636	C	0.694	C
0.708	C	0.746		0.756		0.768		0.773		0.774		0.836	
0.870		0.884	E	0.944		0.951		1.009	R	1.018	R	1.021	R
1.063	R	1.098	R	1.116	R	1.150	R	1.151	R	1.152	R	1.169	R
1.240	R	1.251	R	1.279	R	1.318	R	1.339	R	1.464	R	1.518	R
1.550	R	1.600	R	1.800	R	1.929	R						

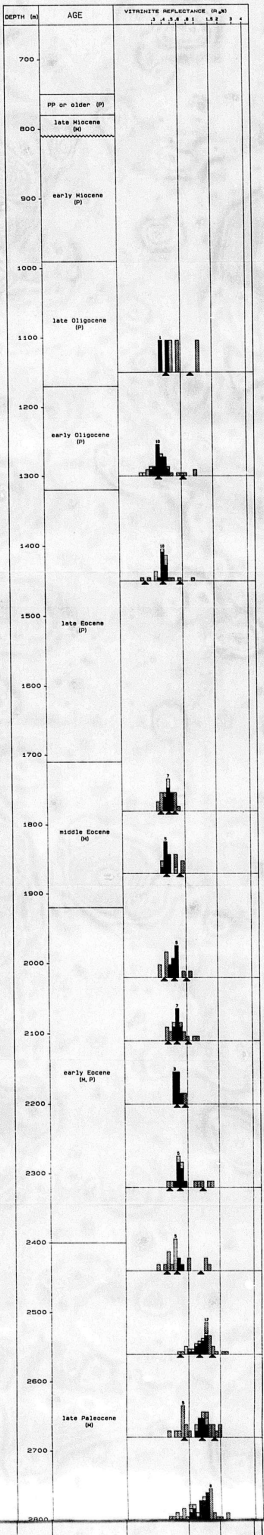
Actual Mean = 1.035 Actual Standard Deviation = 0.354

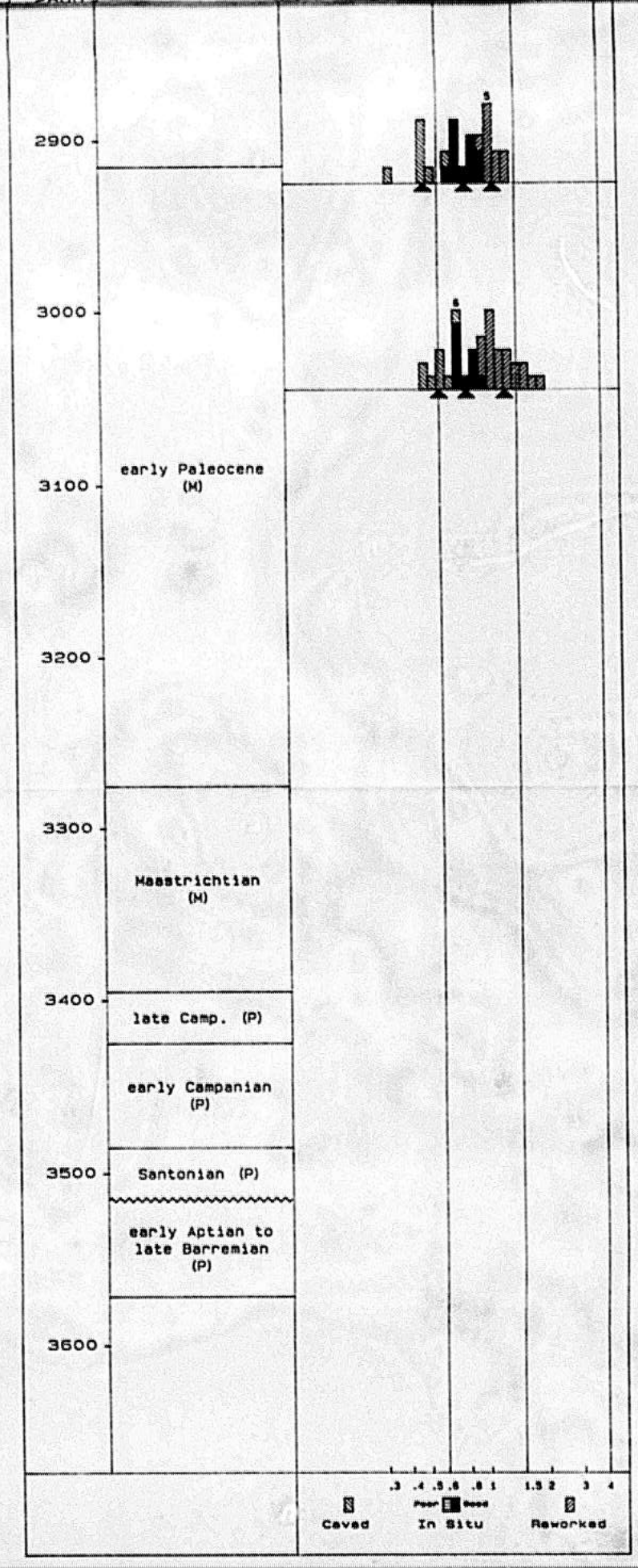
Edited Mean = 0.830 Edited Standard Deviation = 0.078

Charts


2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
Apectodinium homomorphum
Areoligera senonensis
Marine Dinoflagellate
Azolla
Pediastrum
Gymnosperm Pollen
Angiosperm Pollen
Spores
Upper Cretaceous Reworking
Lower Cretaceous Reworking

BUJAK DAVIES GROUP VITRINITE: South Labrador N-79




2900
3000
3100
3200
3300
3400
3500
3600
early Paleocene
(M)
Maastrichtian
(M)
late Camp. (P)
early Campanian
(P)
Santonian (P)
early Aptian to
late Barremian
(P)
.3 .4 .5 .6 .8 1 1.5 2 3 4
Caved
In Situ
Reworked

PALYNOLOGICAL ANALYSIS CHART

BUJAK DAVIES GROUP

CLIENT: G.S.C.
WELL: South Labrador N-79
AREA: Labrador Shelf

SCIENTIST: Bujak Davies Group
DATE: April 1987
SCALE: 1 cm = 25 metres

AGE	ZONE	FORMATIONS
Plio-Pleistoc. or older	T. igniculus or older	Saglek
possible early Miocene	possible C. cantharellum	Hopedale
early Miocene	Cordosphaeridium cantharellum	
possible late Oligocene	possible Chiropteridium mespilanum	
late Oligocene	Chiropteridium mespilanum	Mokami
early Oligocene	Areosphaeridium arcuatum	
early Oligocene to late Eocene	Deflandrea #LR	
middle to late Eocene	Areosphaeridium fenestratum	Kenamu
middle Eocene	Eocladopyxis #LA	
early Eocene	Trinovantedin. #LA	
	Dracodinium condylos	
late Paleocene	Caratiopsis speciosa	
	Alisocysta circumtabulata	Cartwright
	Palaeoperidin. pyrophorum	

LITHOLOGY / IMPORTANT SAMPLE DEPTHS

PALYNOLOGICAL EVENTS / SAMPLE LEVEL

750 — All contaminants

780 — *D.claytonites, T.vesciplites* plus common Late Cretaceous reworking

810 — *C.cantharellum, D.paradoxum, L.annetinioides, G.centrocarpum, T.igniculus, E.antescurariei*

840 — *A.verus, C.simplex, Corylus* #LA, *H.corylioides, Fagusdubilanisis* #LA, *Quercoidites* #LA & LG, *Triozolites* #LA

870 — *Azolla, C.aurium, Carpinipites* #LA *L.ist.serrata*

900 — *L.machaerophorum*

960 — *U.umbilicus*

990 — *D.phosphoritica, Haltipriciolites* #LA

1020 — *Nuuaalaporites* #LA, *S.ancyrea*

1170 — *C.dunagensis, E.compactiollenlatus*

1200 — *A.multiporoviium, Deflandrea* #LR, *C.megalianum, Cyclonephelium* sp.B, Williams & Brideaux 197

1260 — *P.atalatus*

1325 — *Deflandrea* #LR, *P.indentata*

1350 — *L.serrata*

1380 — *G.intricata*

1440 — *Chiropteridium* #LS

1470 — *C.paradubrensis, D.clathidea, G.lacinilifera*

1500 — *C.inodes*

1590 — *W.articulata*

1680 — *H.crassiramosa*

1740 — *C.aurium, D.phosphoritica*

1770 — *Azolla, C.pusilla*

1890 — *A.homomorphus, C.glomerata, Eocladopyxis* #LA, *H.uncinatus, L.ventzelii, S.placentina, T.pelagica*

1950 — *A.biformaidea, H.palliata, Systematophora* #LC, *Trinovantedinium* #LA & LS, *C.pannucea*

1980 — *A.senonensis, Areosphaeridium* sp.A, W & B 1977, *E.senilicta, H.palliata, K.edwardii, Systematophora* #LC, *Trinovantedinium* #LC, *H.helicten, P.polymorpha, K.vellis*

2010 — *D.condylos, D.ambonis, D.pulchrum, H.tenuiplicatum, K.mackaiphlomis*

2040 — *A.rhomatum, O.tiara, D.coelligerum, H.lactejae, H.edwardsiae*

2070 — *A.biformaidea* sensu Helleman-Clausen 1985

2220 — *Isabelidinium* #LP

2250 — *A.homomorphus* (common), *A.hyperacanthum, D.condylos*

2310 — *Hystrichokolpoma* #LP

2340 — *P.subtile*

2400 — *H.saptata*

2430 — *A.homomorphus* (abundant), *A.senonensis* (common)

2480 — *A.augustum*

2520 — *A.senonensis* (abundant)

2580 — *Muratodinium* #LA

2610 — *Cannosphaeropsites* #LS

2640 — *C.striata, C.speciosa globra*

2760 — *P.magnifium, E.crassitabulata* (frameworks)

2945 — *C.speciosa speciosa, C.inodes longissma, O.denticulata, A.circumtabulata, P.australis P.pyrophorum*

2975 — *P.hastilum, P.triceuse*

3005 — *C.aceras, H.tubiferum, P.lidia, Spongodinium* #LA, *Trichophodinium* #LS

3065 — *E.crassitabulata*

3100					
3200	early Paleocene	Spongodinium #LA		3185	*Oligosphaeridium* #LV
				3215	*C.diebelii* sensu McIntyre 1978, *C.diebelii*, *P.pseudhystrichodinium*
3300				3335	*S.delitiense*
	Maastrichtian	Spongodinium delitiense		3365	*G.clathrata*, *Impagidinium* #LL, *H.cretacea*
		Impagidinium #LL		3395	*C.distinctum*, *I.cooksoniae*
3400	late Campanian	Isabelidinium cooksoniae		3425	*I.belfastense*, *P.infusorioides*
	early Campanian	Palaeohystrich. infusorioides	Markland	3455	*C.schell*, *C.tripartita*
3500	Santonian	Senoniasphaera rotundata		3485	*C.verrucosa*, *H.difficile*, *H.stellatum*, *R.rugosus*, *S.longifurcatum*
				3515	*H.pulchrum*, *O.costata*, *O.operculata*, *Pseudoceratium* #LA, *P.trichopapillosus*
	early Aptian to late Barremian	Pseudoceratium pelliferum	Freydis	3545	*A.cretacea*, *P.pelliferum*, *C.canadensis*, *Cicatricosisporites* #EAL, *Rotverrusporites* #EC, TAI jump to approximately 3-
		Cicatrico. #EAL	Precambrian		

MICROPALEONTOLOGICAL ANALYSIS CHART

BUJAK DAVIES GROUP

CLIENT: G.S.C.
WELL: South Labrador N-79
AREA: Labrador Shelf

SCIENTIST: Bujak Davies Group
DATE: April 1987
SCALE: 1 cm = 25 metres

AGE	ZONE
No assignment	No assignment
late Miocene or younger	C. teratis
early Miocene or older	A. guerichi
late Oligocene	A. bartoniana
early Oligocene	C. contraria
late Eocene	S. adamsi
	C. amplectens
middle Eocene	H. acuticorestum
early Eocene	B. ovata
	K. spicularis
	S. grzybowski
late Paleocene	G. charoides

LITHOLOGY

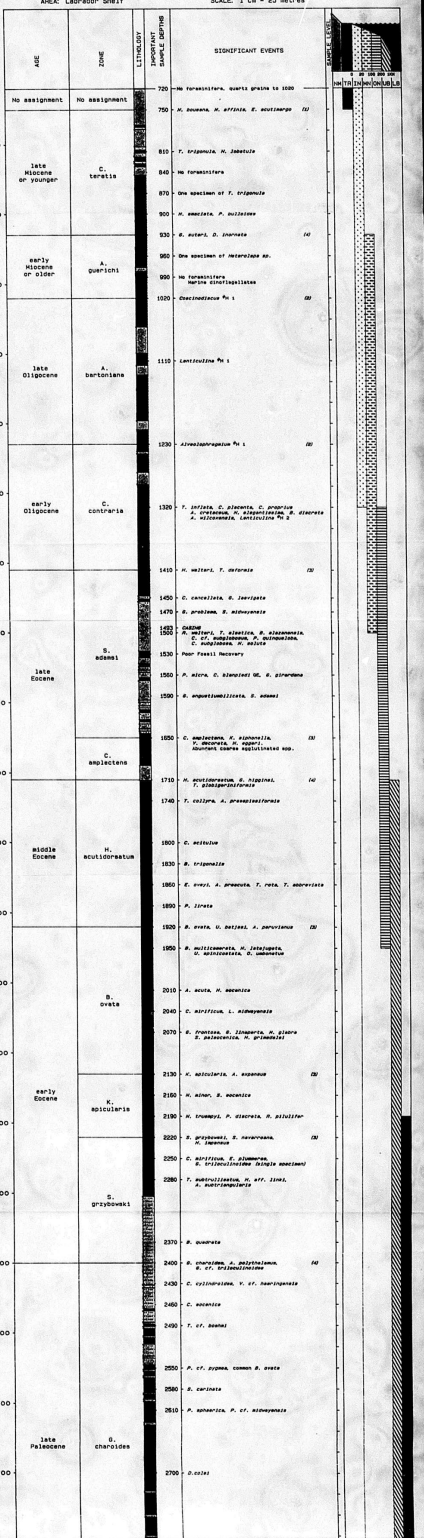
IMPORTANT SAMPLE DEPTHS

SIGNIFICANT EVENTS

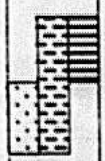
SAMPLE LEVEL

NM TR IN NN ON LB LR

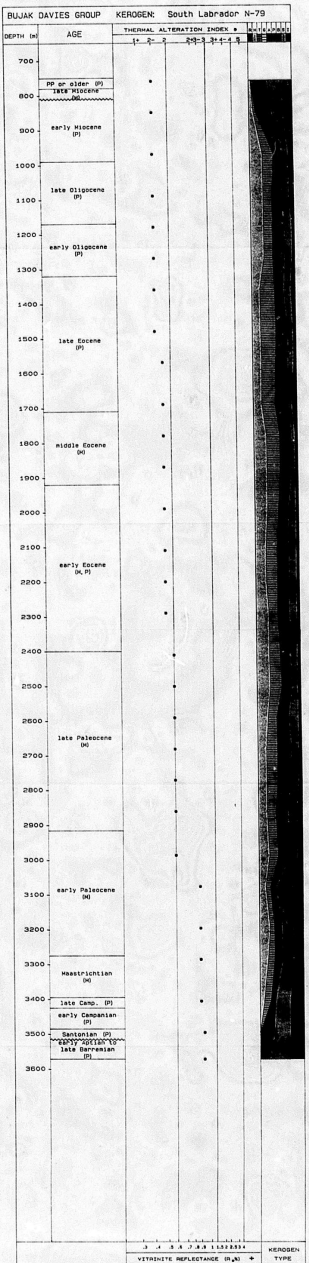
720 - No foraminifera, quartz grains to 1020
750 - H. bowana, H. affinis, E. acutimargo (1)
810 - T. trigonula, H. labatula
840 - No foraminifera
870 - One specimen of T. trigonula
900 - H. semelata, P. bulbiaina
930 - S. autari, D. inornata (4)
960 - One specimen of Heterolepa sp.
990 - No foraminifera
Marine dinoflagellates
1020 - Enaindiscus Pn 1 (3)
1110 - Lenticulina Pn 1
1230 - Alveolophragmium Pn 1 (2)
1320 - T. infiata, C. planata, C. progrisa
A. cretacea, H. elongatissima, B. discrete
A. mizovensis, Lenticulina Pn 2
1410 - H. walteri, T. deformis (3)
1450 - C. cancellata, G. laevigata
1470 - B. problema, E. midwayensis
1493 - CARDNE
1500 - H. walteri, T. elastica, B. alazanensis,
C. cf. nuuqiaensis, P. quinquelobe,
C. nuuqiaensis, P. solute
1530 - Poor Fossil Recovery
1560 - P. micra, C. blowiana GE, G. girardana
1590 - B. angustumbilicata, S. adamsi
1650 - C. amplectens, K. siphonella, (3)
V. decorata, H. eggeri,
Abundant coarse agglutinated spp.
1710 - H. acuticorestum, S. nigginsi, (4)
T. glaessneriformis
1740 - T. colijma, A. praeaniniformis
1800 - C. aciculus
1830 - B. trigonalis
1860 - E. ovoji, A. praecuta, T. rota, T. eocenicata
1890 - P. jirsta
1920 - B. ovata, U. baltica, A. parvulanus (3)
1950 - B. multicamerata, M. intaglupata,
U. spinicostata, G. umbonatus
2010 - A. acuta, H. eocenica
2040 - C. mirifica, L. midwayensis
2070 - E. frontosa, B. linaperta, K. glabra
S. paleocenica, H. grimsdalei
2130 - K. spicularis, A. expansus (3)
2160 - H. minor, S. eocenica
2190 - H. trumpoyi, P. discreta, B. pilulifer
2220 - S. grzybowski, S. navarrana, (3)
H. lamenus
2250 - C. mirifica, E. plummerae,
G. trilocculinidae (single specimen)
2280 - T. wabrulliaatus, H. aff. linki,
A. subtriangularis
2370 - B. quadrata
2400 - B. charoides, A. palythalamus, (4)
G. cf. trilocculinidae
2430 - C. cylindrolina, V. cf. haeringensis
2460 - C. eocenica
2490 - T. cf. baumi
2550 - P. cf. pygmea, common B. ovata
2580 - S. carinata
2610 - P. sphaerica, P. cf. midwayensis
2700 - D.colei



Depth	Stage	Zone	Events
2900			
	early Paleocene	G. corona	2885 *L. wilcoxensis*, *Glomospirella* sp., *C. parisiensis*, fine-grained *B. discrete*
			2915 *G. corona*, common *G. charoides* (3) Change to greyish, fine agglutinated spp.
3000			2975 *A. glabratus*
			3005 *G. micra*
		P. globigerinaeformis	3065 *P. globigerinaeformis*, *S. compressa* (3) *S. placenta*
3100			
			3185 *D. retusa*
3200			3215 *S. complanata*
			3275 *R. epigona* (3) Common *R. linearis*.
3300	Maastrichtian	R. epigona	3335 *Palosina* sp., *G. irregularis*
			3365 *U. jankoi*
3400	Campanian?	A. dorbigny	3395 *A. dorbigny*, *H. pompilioides*, *Paratrochamminoides* sp. (3)
			3485 Marine dinoflagellates
			3495
3500	No assignment	No assignment	3515 Marine dinoflagellates and pollen
			3571



BUJAK DAVIES GROUP KEROGEN: South Labrador N-79



MICROPALEONTOLOGICAL ANALYSIS CHART

BUJAK DAVIES GROUP

CLIENT: G.S.C.
WELL: South Hopedale L-39
AREA: Labrador Shelf

SCIENTIST: Bujak Davies Group
DATE: April 1987
SCALE: 1 cm = 25 metres

AGE	ZONE	LITHOLOGY	IMPORTANT SAMPLE DEPTHS	SIGNIFICANT EVENTS	SCALE & FLOW
			958	CASING	
No assignment	No assignment		1045	*Hedbergella* sp.	
			1130	*C. placenta*, *H. eggeri* (3)	
			1160	*B. discrete*	
			1190	*H. waltari*, *Coscinodiscus* ^{sp} 1	
late Eocene	S. adamsi		1220	*T. deformis*, *Coscinodiscus* ^{sp} 2	
			1310	*A. parvulanus*, *H. waltari* (3)	
	C. anplectens		1340	*S. mississipia* (3)	
	B. ovata		1370	*K. apiculata*, *P. globigerinaeformis?* (3)	
early Eocene	S. grzybowski		1400	*Trochamminiates* sp., *T. globigeriniformis*	
			1450	*S. grzybowski* (3)	
			1490	*C. cancellata*	
late Paleocene	G. charoides		1550	*G. charoides*, *S.* cf. *grzybowski*, *A. dolychoderum* (3)	
early Paleocene	G. corona		1580	*G. corona*, *H. indivisa* (3)	
			1610	*R. epigona*, *S. placenta*, *E. irregularis*, *S. navarronae* (3)	
			1640	*D. oxyona*	
			1870	*T. subtrullisatum*	
Maastrichtian	R. epigona		1730	*B. sphaeriza*	
			1802	CASING	
			1820	*A. clavata*	
			1850	*B. compressa*, *Rhomboaspirella* sp.	
			1880	*A. dorbigny*, *U. jamesi* (3)	
Campanian?	A. dorbigny		1940	*B.* aff. *pseudobulloides* CV	
			2030	*R. duplex*	
			2060		
			2090	Barren to T.D.	
No assignment	No assignment				

Depth scale: 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2100, 2200, 2300

Scale & flow: 0 25 100 200 300 400 m; NM TR IN MO OX UB LB

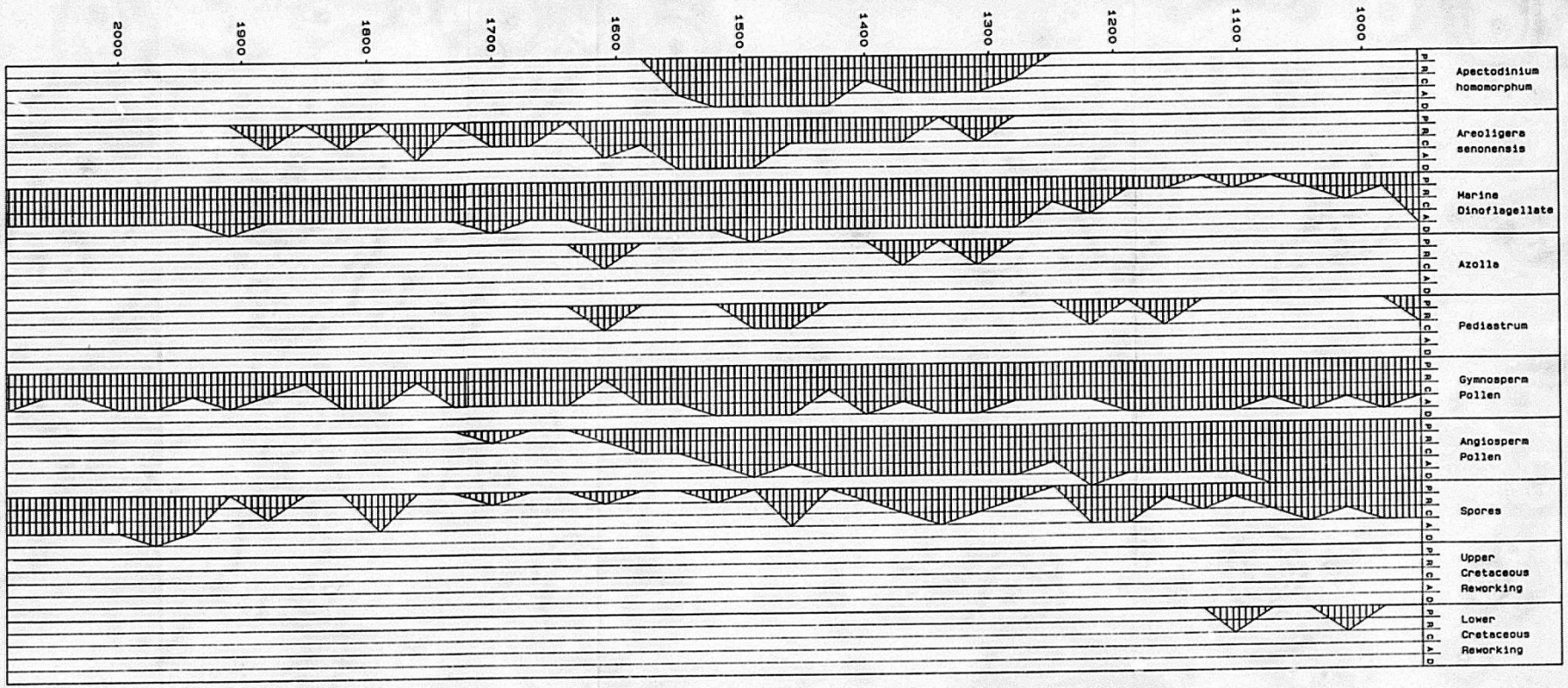
PALYNOLOGICAL ANALYSIS CHART

BUJAK DAVIES GROUP

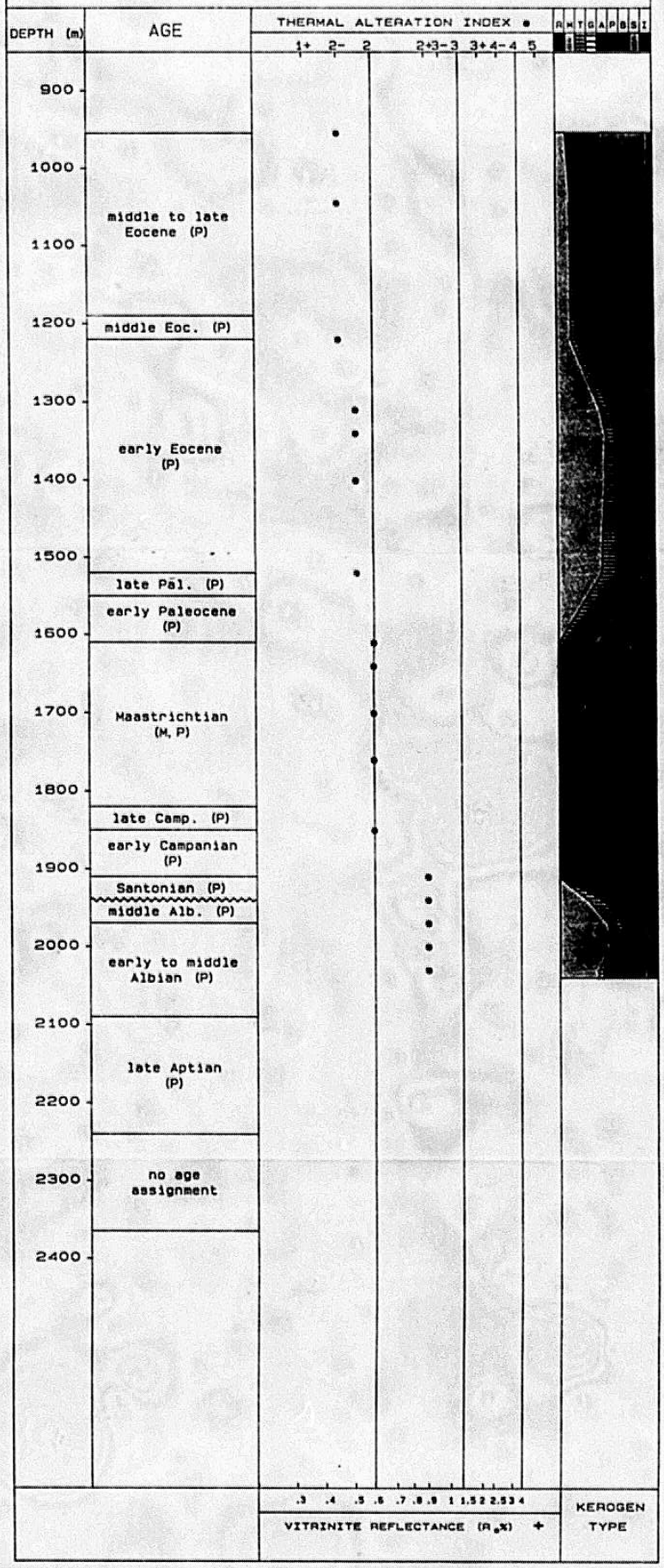
CLIENT: G.S.C.
WELL: South Hopedale L-39
AREA: Labrador Shelf

SCIENTIST: Bujak Davies Group
DATE: April 1987
SCALE: 1 cm = 25 metres

AGE	ZONE	FORMATIONS	IMPORTANT SAMPLE DEPTHS	PALYNOLOGICAL EVENTS	SAMPLE LEVEL
		no assignment	955	*H.petalum, H.tenuirimpile, H.velleium, P.peninsulum, P.indentata, H.antiquium, H.cornigerum, O.ingrisiana, Muwaria.* PLA, *H.aculeatum, Quantodinium* PLA & LB	
1000	middle to late Eocene	Areosphaeridium fenestratum	1015	*C.murdum, I.marginatum*	
			1045	*T.plana*	
1100			1105	*Deflandrea* PLA, *T.vecisiates*	
			1130	*M.corylioides* (common)	
			1160	*C.dorugensis*	
1200	middle Eocene	Eocladopyxis #LA	1190	*P.magnaporis, P.electrolophum*	
		Kenamu	1220	*D.diaboldea, D.centimirsis, H.cinctum, H.krusehii, D.dolacaudata, Trichomanidinium* PLA, *Systematophora* PLA, *T.crassiatum*	
			1250	*M.edwardsii, Systematophora* PLC	
1300		Trinovantedin. #LA	1280	*A.homomorphum, C.panurgum, H.petalum* (abundant), *H.pallidum, Trinovantedinium* PLL & LA, *E.meteorinoides*	
			1310	*Apiale, A.homomorphum* (common), *A.hyperacanthum, A.aeronautis, C.multisiphonum, C.lindsay, Eocladopyxis* PLA, *H.tenuistriatum, D.tiara, P.mobile*	
			1340	*L.umbellii*	
	early Eocene		1370	*Isabelidinium* PLP	
1400			1400	*D.condylos, T.pelagica*	
		Dracodinium condylos	1430	*A.homomorphum* (abundant), *A.bifurcatum* sensu Heilman-Clausen 1985, *H.rotundum*	
			1460	*A.augustum, H.crystomesiulata*	
		Cartwright	1490	*A.sanonensis* (abundant), *Hystrichokolpoma* PLP	
1500	late Paleocene	Alisocysta circumtabulata	1520	*C.species glabra, A.circumtabulata, E.crassiabulata*	
			1550	*C.aceras, C.cirrata, C.species spectosa, D.centiculata, H.tubifarum, P.pseudhystrich., L.trichum, P.lizae, P.pyrophorum, C.indaea, longispina, Trithyrodinium* PLB	
	early Paleocene	Palaeoperidin. pyrophorum	1580	*P.dictyum, P.pseudhystrich.* sensu Heilman 1971, *P.pulchrum, Spongodinium* PLA	
1600		Spongodinium #LA	1610	*C.diebelii* sensu McIntyre 1975, *S.delitiense, T.evitii, T.varicelatum, P.confusum, P.magnificus*	
		Spongodinium delitiense	1640	*Hystrichosphaeraepsis* sp., McIntyre 1974, *Impagidinium* PLL, *H.striatum, C.diebelii*	
1700	Maastrichtian	Impagidinium #LL	1700	*F.fragile*	
			1730	*C.disperturba, I.baltheserea*	
		Markland	1760	*C.distinctum, O.complex, Glaphyrocysta* PLV *I.cassandra*	
1800		Isabelidinium cooksoniae	1790	*E.difficum*	
	late Campanian	Chatangiella tripartita	1820	*C.tripartita, S.longifurcatum*	
	early Campanian	Palaeohystrich. infusoriloides	1850	*H.pulcherrum*	
1900	Santonian	Senoniasphaera rotundata	1910	*C.wetzelii, H.difficile, S.rotundata, S.protruba, P.alifferum, H.sexuanaborius*	
	middle Albian	Trilobosporites humilis	1940	*A.polymorpha, A.eisenackii, C.hughesii, Cleistosphaeridia* PLB, *Cleistosphaeridium, Hughesi, C.williamsii, D.geerlandsia, P.pseudomacro., P.rugulata, S.aculeata, T.obscura, T.ludwigii*	
			1970	*E.ehrenbergii, Spongodinium, T.ovum, P.neptuna, P.radiatum, A.nichuka, T.scurrundula*	
2000	early to middle Albian	Muderongia asymmetrica	2000	*C.minutus*	
		Bjarni	2060	*A.apetalum* (reworked Jurassic), *C.imperfectum, C.antiquum, Muderongia* PA, *P.microreticulatus*	
2100	late Aptian	Oligosphaerid. asteriguru/ Aulosporites trichopapillos.	2090	*C.deltoideum, C.rotundum, C.triangularis, P.hartenbergii*	
		Paleozoic	2120	*P.trichopapillosus*	
2200			2210	*A.annulatus*	
2300	no age assignment	no zonal assignment / Precambrian	2240	all palynomorphs below 2225m are interpreted as being caved	


2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
Apectodinium homomorphum
Areoligera senonensis
Marine Dinoflagellate
Azolla
Pediastrum
Gymnosperm Pollen
Angiosperm Pollen
Spores
Upper Cretaceous Reworking
Lower Cretaceous Reworking
PRCAD

BUJAK DAVIES GROUP KEROGEN: South Hopedale L-39



BUJAK DAVIES GROUP VITRINITE: South Hopedale L-39