# BIOSTRATIGRAPHY AND MATURATION OF 17 LABRADOR AND BAFFIN SHELF WELLS

## Volume 6:
## North Leif I-05 & Ogmund E-72

Report No. 86-0058
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## EXPLANATION OF CONTENTS

This volume contains the following results of analyses on North Leif I-05 and Ogmund E-72.

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.

North Leif I-05:

# BIOSTRATIGRAPHY AND MATURATION OF

# NORTH LEIF I-05

**PETRO-CANADA et al. NORTH LEIF I-05**

GSC locality: 54° 24' 38.95"N, 55° 15' 10.57"W
KB elevation: 12m Water depth: 144m
Casing set at: 191m, 396m, 1158m, 2650m, 3486m
Total depth: 3513m
Interval studied for palynology: 430-3485m
Interval studied for micropaleontology: 430-3507m

**CONSENSUS AGE**

| | |
|---|---|
| 430- 490m | early Miocene (M) |
| 510- 930m | early Oligocene (P) |
| 950-1640m | late Eocene (M) |
| 1660-1875m | middle Eocene (M,P) |
| 1895-2235m | early Eocene (M) |
| 2255-2315m | late Paleocene (M,P) |
| 2335-2515m | early Paleocene (M,P) |
| 2535-2670m | Maastrichtian (M,P) |
| 2690-2710m | Campanian (P) |
| 2730-2750m | Turonian (P) |
| 2770-2790m | Cenomanian (P) |
| 2810-2830m | early Albian to late Aptian (P) |
| 2850-2950m | early to middle Albian (P) |
| 2970-3150m | late Aptian (P) |
| 3170-3424m | Barremian to early Aptian (P) |
| 3444-3507m | no age assignment |

## NORTH LEIF I-05

### PALYNOLOGICAL ZONATION

| | |
|---|---|
| 430- 490m | Systematophora ancyrea Zone or older (middle Miocene or older) |
| 510- 930m | Areosphaeridium arcuatum Zone (early Oligocene) |
| 950-1170m | Deflandrea #LR Zone (late Eocene to early Oligocene) |
| 1190-1640m | Areosphaeridium fenestratum Zone (middle to late Eocene) |
| 1660-1915m | Eocladopyxis #LA Zone (middle Eocene) |
| 1935-2035m | Trinovantedinium #LA Zone (early Eocene) |
| 2055-2235m | Dracodinium condylos Zone (early Eocene) |
| 2255-2315m | Ceratiopsis speciosa Zone (late Paleocene) |
| 2335-2355m | Alisocysta circumtabulata Zone to Palaeoperidinium pyrophorum Zone (early to late Paleocene) |
| 2375-2515m | Spongodinium #LA Zone (early Palecene) |
| 2535-2590m | Spongodinium delitiense Zone (Maastrichtian) |
| 2610-2630m | Impagidinium #LL Zone (Maastrichtian) |

2650-2670m *Isabelidinium cooksoniae* Zone (Maastrichtian)

2690-2710m *Chatangiella tripartita* Zone (Campanian)

Not observed *Hystrichospharidium difficile* Zone (Campanian)

Not observed *Palaeophystrichophora infusorioides* Zone (early Campanian)

Not observed *Senoniasphaera rotundata* Zone (Santonian)

2730-2750m *Cometodinium obscurum* Zone (Turonian)

2770-2790m *Kiokansium polypes* Zone (Cenomanian)

Not observed *Epelidosphaeridia spinosa*/*Trilobosporites crassus* (late Albian to early Cenomanian)

Not observed *Trilobosporites humilis* (middle Albian)

2810-2830m *Parvisaccites amplus* Zone (early to middle Albian)

2850-2950m *Muderongia asymmetrica* Zone (early to middle Albian)

2970-3150m *Oligosphaeridium asterigerum* Zone (late Aptian)

3170-3424m *Pseudoceratium pelliferum* Zone (early Aptian to Barremian)

Not observed *Cicatricosisporites* #EAL Zone (Barremian to early Aptian)

3444-3485m No zonal assignment (no age assignment)

SELECTED PALYNOMORPHS

**430-490m: Systematophora ancyrea Zone or older (middle Miocene or older)**

| | |
|---|---|
| 430m | Ceratiacean #LA |
| | Lingulodinium machaerophorum |
| | **Systematophora ancyrea** |
| | Tsugaepollenites igniculus * |
| 470m | **Dapsilidinium pastielsii** |

Degree of Confidence: 2

Remarks: Penetration of middle Miocene or older strata is indicated by the occurrence of S. ancyrea at 430-450m. It is possible that this interval represents strata as old as early Oligocene and that marker species were not observed due to the general scarcity of palynomorphs in this section of the well.

**510-930m: Areosphaeridium arcuatum Zone (early Oligocene)**

| | |
|---|---|
| 510m | **Areosphaeridium arcuatum** |
| | Tsugaepollenites viridifluminipites * |
| 550m | Deflandrea phosphoritica |
| | Membranophoridium aspinatum |
| 630m | **Glaphyrocysta intricata** |
| | **Quercoidites #LA *** |
| | **Rouseisporites #LA *** |

| | |
|---|---|
| 670m | Caryapollenites simplex * |
| | Paralecaniella indentata |
| 710m | **Cyclonephelium sp. B, Williams & Brideaux 1975** |
| | **Lentinia serrata** |
| 790m | **Glaphyrocysta divaricata** |
| | Thalassiphora pelagica |
| 830m | Phthanoperidinium #LG |
| 910m | Alnipollenites verus * |
| | **Phthanoperidinium comatum** |

Degree of Confidence: 3

Remarks: The penetration of lower Oligocene strata is strongly indicated by the presence of several dinoflagellates indicated above in bold text. The stratigraphic ranges of pollen including Quercoidites #LA and Rouseisporites #LA are uncertain on the Labrador Shelf, but they are probably restricted to the Oligocene and possibly the early Oligocene.

**950-1170m: Deflandrea #LR Zone (late Eocene to early Oligocene)**

| | |
|---|---|
| 950m | **Phthanoperidinium alectrolophum** |
| 990m | Corylus #LA * |
| 1030m | Cicatricosisporites dorogensis * |
| 170m | Ulmipollenites undulosus * |

1110m **Araneosphaera araneosa**
Cicatricosisporites paradorogensis *
**Deflandrea #LR**
Quercoidites #LA * (common)

Degree of Confidence: 2

Remarks: Tentative assignment to the Deflandrea #LR Zone is indicated by the presence of P. alectrolophum at 950-970m. A more confident assignment is indicated at the sample at 1110-1130m by the occurrence of Deflandrea #LR.

**1190-1640m: Areosphaeridium fenestratum Zone (middle to late Eocene)**

1190m **Cordosphaeridium gracile**
**Glaphyrocysta semitecta**

1230m **Dinopterygium cladoides**
Kisselovia coleothrypta
Palaeocystodinium golzowense
Rhombodinium perforatum

1265m **Areosphaeridium fenestratum**
**Deflandrea #LB**
**Glaphyrocysta spineta**
Hystrichokolpoma salacium
Spiniferites pseudofurcatus

1385m **Pesavis tagluensis** *

1500m Pterocaryapollenites stellatus *
Systematophora placacantha

1580m Azolla *
**Hystrichokolpoma #LP**

Degree of Confidence: 2 to 3

Remarks: Although the stratigraphic ranges of many dinoflagellate species are uncertain on the Labrador Shelf, the presence of C. gracile, G. semitecta and D. cladoides at 1190-1210m and 1230-1250m probably indicates penetration of the A. fenestratum Zone. A more definite assignment to the zone is indicated at 1265-1285m by the presence of A. fenestratum. The presence of middle Eocene strata is indicated at 1385-1405m by the occurrence of the fungal spore P. tagluensis based on its range established in the Canadian Beaufort-Mackenzie Delta region.

**1660-1915m: Eocladopyxis #LA Zone (middle Eocene)**

1660m **Lentinia wetzelii**
Wetzeliella articulata

1705m Momipites coryloides *

1745m **Eocladopyxis #LA**
Kisselovia crassiramosa

1775m **Ceratiopsis pannucea**
**Thalassiphora patula**

1895m Hystrichokolpoma cinctum
**Homotryblium oceanicum**
**Heteraulacacysta leptalea**

Degree of Confidence: 2

Remarks: The sample at 1660-1680m is tentatively assigned at the Eocladopyxis #LA Zone based on the presence of L. wetzelii whose range is not well established on the Labrador Shelf. A more definite assignment to this zone is indicated at 1745-1765m by the occurrence of Eocladopyxis #LA and at 1895-1915m by the occurrences of H. oceanicum and H. leptalea.

**1935-2035m: Trinovantedinium #LA Zone (early Eocene)**

| | |
|---|---|
| 1935m | Apectodinium homomorphum (common)<br>**Systematophora #LF**<br>**Trinovantedinium #LA** |
| 1975m | Apectodinium homomorphum (common)<br>**Trinovantedinium #LL** |
| 2015m | **Homotryblium tenuispinosum**<br>**Polysphaeridium subtile**<br>Systematophora #LC<br>Eatonicysta ursulae |

Degree of Confidence: 4

Remarks: Penetration of the Trinovantedinium #LA Zone is strongly indicated by the dinoflagellate taxa listed above in bold text.

**2055-2235m: Dracodinium condylos Zone (early Eocene)**

| | |
|---|---|
| 2055m | **Dracodinium solidum**<br>Homotryblium pallidum |

2095m **Dracodinium condylos**
Areoligera senonensis

2135m Areoligera senonensis (common)
Glaphyrocysta exuberans
**Adnatosphaeridium robustum**

2175m Impagidinium californiense

2215m **Apectodinium augustum**

Degree of Confidence: 3

Remarks: Penetration of the D. condylos Zone is indicated by the occurrence of D. solidum at 2055-2075m and more strongly by the occurrence of D. condylos 2095-3015m. Another dinoflagellate marker for this zone, Isabelinium #LP, was not observed in southern Labrador Shelf wells including North Leif I-05.

**2255-2315m: Ceratiopsis speciosa Zone (late Paleocene)**

2255m Apectodinium homomorphum (abundant)
**Ceratiospsis speciosa glabra**
**Ceratiospsis speciosa speciosa**

2295m Areoligera senonensis (abundant)

Degree of Confidence: 4

2335-2355m: Alisocysta circumtabulata Zone to Palaeoperidinium pyrophorum Zone (early to late Paleocene)

2335m
- **Alisocysta margarita**
- Cordosphaeridium inodes longipes
- Ceratiopsis striata
- **Eisenackia crassitabulata**
- **Oligosphaeridium complex**
- **Palaeoperidinium pyrophorum**

Degree of Confidence: 3

2375-2515m: Spongodinium #LA Zone (early Paleocene)

2375m
- **Trithyrodinium evittii**
- Phelodinium tricuspe
- Phelodinium magnificum
- Palaeoperidinium pyrophorum (common)
- **Spongodinium #LA**

2415m
- **Caligodinium aceras**
- Ceratiopsis diebelii
- **Gonyaulacysta clathrata**
- **Hystrichosphaeridium tubiferum**
- **Palaeocystodinium lidiae**
- Palaeoperidinium pyrophorum (abundant)

2455m
- Deflandrea denticulata
- **Hystrichosphaeridium tubiferum brevispinum**

2495m **Isabelidinium #LV**

Degree of Confidence: 3

**2535-2590m: Spongodinium delitiense Zone (Maastrichtian)**

2535m **Spongodinium delitiense**

2575m Ceratiopsis diebelii sensu McIntyre 1974
Cyclonephelium distinctum (?reworked)

Degree of confidence: 3

Remarks: Penetration of the S. delitiense Zone is indicated by the occurrence of a single species, S. delitiense which is common and persistent in samples at and below 2535-2555m.

**2610-2630m: Impagidinium #LL Zone (Maastrichtian)**

2610m **Impagidinium #LL**
Senegalinium laevigatum

Degree of confidence: 3

**2650-2670m: Isabelidinium cooksoniae Zone (Maastrichtian)**

2650m Aptea polymorpha (?reworked)
**Isabelidinium cooksoniae** (questionable identification.)

Degree of Confidence: 1

Remarks: Assignment of this interval to the I. cooksoniae Zone is highly tentative, being based on a single questionably identified specimen of I. cooksoniae in the sample at 2650-2670m.

**2690-2710m: Chatangiella tripartita Zone (Campanian)**

2690m **Odontochitina costata**

Degree of Confidence: 3

**2730-2750m: Cometodinium obscurum Zone (Turonian-Coniacian)**

2730m **Cleistosphaeridium armatum**
**Cometodinium obscurum**
**Stiphrosphaeridium anthophorum**
Rugubivesiculites rugosus *

Degree of Confidence: 4

Remarks: A diverse marine assemblage is present within this zone and contains the zonal markers C. obscurum and C. armatum.

**2770-2790m: Kiokansium polypes Zone (Cenomanian)**

2770m **Cyclonophelium vannophorum**
Florentinia buspina
**Kiokansium polypes**

Odontochitina operculata
**Cicatricosisporites apicanalis** *
Rugubivesiculites reductus *

Degree of Confidence: 4

Remarks: A diverse assemblage of marine dinoflagellates including C. vannophorum and K. polypes associated with the miospore Cicatricosisporites apicanalis indicates the presence of the K. polypes Zone.

**2810-2830m: Parvisaccites amplus Zone (early to middle Albian)**

2810m **Ascodinium scabrosum**
Florentinia cooksoniae
**Oligosphaeridium albertense**
**Senoniasphaera microreticulata**
Stephodinium coronatum
**Parvisaccites amplus** *

Degree of Confidence: 3

Remarks: A hiatus between 2790m and 2810m is indicated and represents strata of late Albian to early Cenomanian age. The highest occurrence of P. amplus at 2810m indicates penetration of the P. amplus Zone.

**2850-2950m: Muderongia asymmetrica Zone (early to middle Albian)**

2850m Callaiosphaeridium asymmetricum
Canningia attadalica cf.
Cyclonephelium compactum

**Muderongia asymmetrica**
**Oligosphaeridium totum**
Subtilisphaera perlucida

2890m Prolixosphaeridium conulum
Acritosporites excavatus *
**Eucommiidites minor** *
**Parvisaccites hortonensis** *
Nodosisporites #EG *

2930m Cicatricosisporites annulatus *
**Muderongia #EY**

Degree of Confidence: 4

Remarks: A diverse marine assemblage including the marker species M. asymmetrica and O. totum at 2870m indicates penetration of the M. asymmetrica Zone.

**2970-3150m: Oligosphaeridium asterigerum Zone (late Aptian)**

2970m Ascodinium verrucosum (depressed top)
Cedripites canadensis
Cicatricosisporites potomacensis *
**Muderongia digitata**
**Oligosphaeridium asterigerum**

3010m Acanthotriletes varispinosus *
**Cicatricosisporites mohrioides** *

3050m Cerebropollenites mesozoicus *
**Microreticulatisporites uniformis** *

3090m Luxadinium #EA
**Distaltriangulisporites irregularis** *
**Interlobites triangularis** *

3130m Cicatricosisporites imbricatus *
Costatoperforosporites fistulosus *
Plicatella undosa *

Degree of Confidence: 4

Remarks: The top of the Oligosphaeridium asterigerum Zone is indicated at 2990m by the highest occurrences of M. digitata and O. asterigerum. This is confirmed below by the highest occurrences of C. mohrioides at 3030m and by I. triangularis at 3110m.

**3170-3424m: Pseudoceratium pelliferum Zone (early Aptian to Barremian)**

3170m **Cicatricosisporites #EN** *
Plicatella tricornitata *
**Pseudoceratium pelliferum**
Subtilisphaera terrula

3210m Cicatricosisporites delicatus * (depressed top)

3255m Podocarpidites tricocca *

3370m Kraeuselisporites linearis *
Trilobosporites marylandensis *

Degree of Confidence: 4

Remarks: The presence of Cicatricosisporites #EN and P. pelliferum at 3170m indicates the top of the P. pelliferum Zone.

**3444-3485m: No zonal assignment (no age assignment)**

| | |
|---|---|
| 3445m | Chasmatosporites major * |
| 3475m | Aptea polymorpha<br>Impardecispora purverulenta * |

Remarks: The lower Cretaceous fossils found within this interval are considered as caved from the overlying sediments.

## MICROPALEONTOLOGICAL ZONATION

Not observed *Cassidulina teretis* Zone (late Miocene of younger)

430- 530m *Asterigerina guerichi* Zone (early Miocene or older)

550- 800m *Asterigerina bartoniana* Zone (late Oligocene)

830-920 *Ceratobulimina contraria* Zone (early Oligocene)

950-1365m *Spiroplectammina adamsi* Zone (late Eocene)

1385-1640m *Cyclammina amplectens* Zone (late Eocene)

1660-1875m *Haplophragmoides acutidorsatum* (middle Eocene)

Not observed *Bulimina ovata* Zone (early Eocene)

1895-2075m *Karreriella apicularis* Zone (early Eocene)

2095-2235m *Spiroplectammina grzybowski* Zone (early Eocene)

2255-2315m *Glomospira charoides* Zone (late Paleocene)

Not observed *Glomospira corona* Zone (early Paleocene)

2335-2515m *Praecystammina globigerinaeformis* Zone (early Paleocene)

2535-2750m *Rzehakina epigona* Zone (Maastrichtian)

| | |
|---|---|
| 2770-3030m | Arenobulimina dorbigny Zone (?Campanian) |
| 3050-3424m | possible Arenobulimina dorbigny Zone (possible upper Cretaceous) |
| 3445-3507m | No zonal assignment (No age assignment) |

SELECTED FORAMINIFERA

**430-530m: Asterigerina guerichi Zone (early Miocene or older)**

| | |
|---|---|
| 430m | Melonis affinis |
| | **Asterigerina guerichi** |
| | Guttulina problema |
| 470m | Hoeglundina elegans |
| | Globulina gibba |

Degree of Confidence: 3

**550-770m: Asterigerina bartoniana Zone (late Oligocene)**

| | |
|---|---|
| 550m | Spiroplectammina carinata |
| | **Coscinodiscus #H 1 +** |
| 630m | Cornuspira involvens |
| | Haplophragmoides sp. |
| 670m | Pullenia quinqueloba |
| | Nonionella spissa |
| 710m | **Asterigerina bartoniana** |
| | Glandulina laevigata |

Degree of Confidence: 2

**830-920m: Ceratobulimina contraria Zone (early Oligocene)**

| | |
|---|---|
| 830m | **Baggina subconica** |
| | Spiroplectammina eocenica |
| | **Ceratobulimina contraria** |
| 870m | Saracenaria hantkeni |
| 910m | Ammodiscus peruvianus (reworked) |
| | Eponides plummerae |

Degree of Confidence: 3

**950-1365m: Spiroplectammina adamsi Zone (late Eocene)**

| | |
|---|---|
| 950m | **Spiroplectammina adamsi** |
| | Heterolepa pygmea |
| 1110m | Uvigerina cocoaensis |
| 1158m | CASING |
| 1190m | Bathysiphon discreta |
| 1230m | Cyclammina placenta |
| | Ammodiscus cretaceus |
| | **Cyclammina cancellata** |
| | **Trochammina globigeriniformis** |

| | |
|---|---|
| 1265m | Trochammina deformis<br>**Haplophragmoides eggeri** |
| 1345m | Nodosaria latejugata |

Degree of Confidence: 3

**1385-1640m: Cyclammina amplectens Zone (late Eocene)**

| | |
|---|---|
| 1385m | **Cyclammina amplectens**<br>Cribrostomoides subglobosus |
| 1425m | Eggerella af. subconica |
| 1460m | Globigerina cf. frontosa * (reworked)<br>Textularia agglutinans |
| 1500m | Recurvoides walteri |
| 1540m | Haplophragmoides walteri<br>**Saccammina sphaerica** |
| 1580m | Lenticulina midwayensis<br>**Vaginulinopsis decorata** |

Degree of Confidence: 3

**1660-1875m: Haplophragmoides acutidorsatum Zone (middle Eocene)**

1660m Karreriella subglabra
**Haplophragmoides acutidorsatum**

1745m Cribrostomoides scitulus

1775m Heterolepa tuxpamensis

Degree of Confidence: 3

**1895-2075m: Karreriella apicularis Zone (early Eocene)**

1895m Spiroplectammina mexiaensis
**Karreriella apicularis**
Budashevaella multicamerata
Karreriella siphonella

1935m Reophax pilulifer
Bulimina cf. ovata (depressed top)

1975m Plectofrondicularia lirata
Plectofrondicularia kerni

Degree of Confidence: 3

**2095-2235m: Spiroplectammina grzybowski Zone (early Eocene)**

2095m Spiroplectammina navarroana
Trochammina aff. albertense

Textularia plummerae
**Spiroplectammina grzybowski**

Degree of Confidence: 3

**2255-2315m: Glomospira charoides Zone (late Paleocene)**

2255m **Glomospira charoides**
Clavulina spp.
Bulimina quadrata
Haplophragmoides impensus

Degree of Confidence: 3

**2335-2515m: Praecystammina globigerinaeformis Zone (early Paleocene)**

2335m Dorothia trochoidea
Glomospira corona
Ammodiscus glabratus
Gavelinella becariiformis
Rhizammina indivisa
**Praecystammina globigerinaeformis**

2455m Saccammina complanata

2495m Dorothia cf. oxycona
Clavulina parisiensis

Degree of Confidence: 3

**2535-2750m: Rzehakina epigona Zone (Maastrichtian)**

| | |
|---|---|
| 2535m | **Rzehakina epigona**<br>Spirosigmoilinella compressa<br>Ammobaculites polythalamus<br>Trochamminoides subtrullisatus |
| 2575m | Bulimina midwayensis |
| 2610m | Gyroidinoides excolata |
| 2650m | CASING |
| 2690m | **Glommospira irregularis**<br>**Uvigerinammina jankoi** |
| 2730m | **Bolivina incrassata gigantea** |

Degree of Confidence: 3

Remarks: The top of this zone could be located at 2495m due to the highest occurrence of D. cf. oxycona.

**2770-3030m: Arenobulimina dorbigny Zone (?Campanian)**

| | |
|---|---|
| 2770m | **Arenobulimina cf. dorbigny**<br>Dorothia cf. smokyensis |
| 2850m | Melonis pompilioides |

Degree of Confidence: 3

**3050-3424m: possible Arenobulimina dorbigny Zone (possible upper Cretaceous)**

3050m Poor fossil recovery

**3444-3507m: No zonal assignment (No age assignment)**

## PALEOBATHYMETRY

| | |
|---|---|
| 430- 760m | Inner Neritic to Middle Neritic |
| Criteria: | Melonis affinis. Hoeglundina elegans, Coscinodiscus sp. Asterigerina spp. |
| 790-800m | Middle Neritic |
| Criteria: | Coscinodiscus sp., Gyroidinoides sp. |
| 830-840m | Middle Neritic to Outer Neritic |
| Criteria: | Baggina subconica, Stilostomella eocenica |
| 870-1080m | Middle Neritic |
| Criteria | Ammodiscus peruvianus, Eponides plummerae, Spiroplectammina adamsi |
| 1110-1150m | Outer Neritic to Upper Bathyal |
| Criteria: | Uvigerina cocoaensis |
| 1158-2225m | Upper Bathyal |
| Criteria: | Cyclammina placenta, Cyclammina cancellata, Trochammina globigeriniformis, Cribrostomoides subglobosus, Karreriella apicularis, Reophax pilulifer |
| 2255-2305m | Upper Bathyal to Lower Bathyal |
| Criteria: | Glomospira charoides, Haplophragmoides impensus, Clavulina spp. |
| 2335-2620m | Lower Bathyal |
| Criteria: | Glomospira glabratus, Saccammina complanata, Ammobaculites polythalamus, Rhizammina indivisa, Clavulina parisiensis |

2650-2830m Upper Bathyal

Criteria: Glomospira irregularis, Arenobulimina cf. dorbigny, decrease in abundance and diversity.

2850-3020m Outer Neritic to Upper Bathyal

Criteria: Haplophragmoides cf. suborbicularis

Remarks: Paleoenvironments interpreted from 2850m to 3420m are only tentative due to the poor fossil recovery and high probability of cavings.

3050-3380m Outer Neritic to Upper Bathyal

Criteria: Decrease in abundance and diversity

3410-3445m Middle Neritic to Outer Neritic

Criteria: Poor fossil recovery

## KEROGEN & TAI

| Depth | AM | AT | AG | SA | M | BT | ST | I | R | TAI |
|---|---|---|---|---|---|---|---|---|---|---|
| 510.0 | 0 | 0 | 0 | 0 | 10 | 10 | 75 | 5 | 0 | 2- |
| 670.0 | 5 | 5 | 0 | 0 | 5 | 15 | 65 | 5 | 0 | |
| 710.0 | 10 | 5 | 0 | 0 | 5 | 10 | 60 | 10 | 0 | 2- |
| 870.0 | 20 | 5 | 0 | 0 | 5 | 20 | 50 | 5 | 0 | 2- |
| 910.0 | 20 | 10 | 0 | 0 | 5 | 20 | 40 | 5 | 0 | 2- |
| 950.0 | 10 | 10 | 0 | 0 | 5 | 30 | 40 | 5 | 0 | 2-2 |
| 990.0 | 15 | 10 | 0 | 0 | 5 | 30 | 35 | 5 | 0 | 2-2 |
| 1030.0 | 15 | 15 | 0 | 0 | 5 | 30 | 30 | 5 | 0 | 2-2 |
| 1110.0 | 10 | 10 | 0 | 0 | 5 | 35 | 35 | 5 | 0 | 2-2 |
| 1150.0 | 5 | 10 | 0 | 0 | 5 | 45 | 30 | 5 | 0 | 2-2 |
| 1190.0 | 0 | 10 | 0 | 0 | 5 | 45 | 35 | 5 | 0 | 2-2 |
| 1230.0 | 0 | 5 | 0 | 0 | 5 | 45 | 40 | 5 | 0 | 2-2 |
| 1265.0 | 0 | 10 | 0 | 0 | 5 | 35 | 40 | 10 | 0 | 2-2 |
| 1345.0 | 0 | 5 | 0 | 0 | 5 | 40 | 40 | 10 | 0 | 2-2 |
| 1385.0 | 0 | 10 | 0 | 0 | 5 | 35 | 40 | 10 | 0 | 2-2 |
| 1425.0 | 0 | 5 | 0 | 0 | 5 | 45 | 35 | 10 | 0 | 2-2 |
| 1460.0 | 0 | 10 | 0 | 0 | 5 | 45 | 35 | 5 | 0 | 2-2 |
| 1500.0 | 0 | 10 | 0 | 0 | 5 | 45 | 35 | 5 | 0 | 2-2 |
| 1540.0 | 15 | 15 | 0 | 0 | 5 | 35 | 25 | 5 | 0 | 2-2 |
| 1580.0 | 15 | 15 | 0 | 0 | 5 | 35 | 25 | 5 | 0 | 2-2 |
| 1705.0 | 10 | 15 | 0 | 0 | 5 | 40 | 25 | 5 | 0 | 2-2 |
| 1745.0 | 10 | 15 | 0 | 0 | 10 | 35 | 25 | 5 | 0 | 2-2 |
| 1775.0 | 10 | 15 | 0 | 0 | 5 | 30 | 35 | 5 | 0 | 2-2 |
| 1815.0 | 10 | 10 | 0 | 0 | 10 | 30 | 35 | 5 | 0 | 2-2 |
| 1855.0 | 5 | 10 | 0 | 0 | 5 | 30 | 40 | 10 | 0 | 2-2 |
| 1895.0 | 5 | 10 | 0 | 0 | 5 | 30 | 40 | 10 | 0 | 2-2 |
| 1975.0 | 10 | 10 | 0 | 0 | 5 | 40 | 30 | 5 | 0 | 2-2 |
| 2015.0 | 5 | 10 | 0 | 0 | 5 | 45 | 30 | 5 | 0 | 2-2 |
| 2055.0 | 5 | 20 | 0 | 0 | 5 | 40 | 25 | 5 | 0 | 2-2 |
| 2095.0 | 5 | 20 | 0 | 0 | 5 | 35 | 30 | 5 | 0 | 2-2 |
| 2135.0 | 5 | 15 | 0 | 0 | 5 | 40 | 30 | 5 | 0 | 2-2 |
| 2175.0 | 5 | 20 | 0 | 0 | 5 | 35 | 30 | 5 | 0 | 2-2 |
| 2215.0 | 5 | 20 | 0 | 0 | 5 | 25 | 40 | 5 | 0 | 2-2 |
| 2255.0 | 5 | 15 | 0 | 0 | 10 | 25 | 35 | 10 | 0 | 2-2 |
| 2335.0 | 5 | 15 | 0 | 0 | 10 | 25 | 35 | 10 | 0 | 2-2 |
| 2375.0 | 5 | 10 | 0 | 0 | 5 | 25 | 45 | 10 | 0 | 2 |
| 2415.0 | 0 | 5 | 0 | 0 | 5 | 30 | 35 | 20 | 0 | 2 |
| 2495.0 | 0 | 0 | 0 | 0 | 10 | 30 | 35 | 25 | 0 | 2 |
| 2535.0 | 0 | 0 | 0 | 0 | 5 | 35 | 35 | 25 | 0 | 2 |
| 2575.0 | 0 | 0 | 0 | 0 | 5 | 35 | 35 | 25 | 0 | 2 |
| 2610.0 | 0 | 0 | 0 | 0 | 5 | 30 | 40 | 25 | 0 | 2 |
| 2650.0 | 0 | 0 | 0 | 0 | 5 | 30 | 35 | 30 | 0 | 2 |
| 2690.0 | 0 | 0 | 0 | 0 | 5 | 25 | 40 | 30 | 0 | 2+ |
| 2730.0 | 0 | 0 | 0 | 0 | 10 | 20 | 45 | 25 | 0 | 2+ |
| 2740.0 | 0 | 0 | 0 | 0 | 5 | 25 | 45 | 25 | 0 | 2+ |
| 2810.0 | 5 | 25 | 0 | 0 | 5 | 30 | 20 | 10 | 0 | 2+ |
| 2850.0 | 5 | 25 | 0 | 0 | 15 | 20 | 25 | 15 | 0 | 2+ |
| 2890.0 | 5 | 30 | 0 | 0 | 5 | 20 | 30 | 20 | 0 | 2+ |
| 2930.0 | 5 | 20 | 0 | 0 | 5 | 20 | 35 | 20 | 0 | 2+3- |
| 2970.0 | 5 | 20 | 0 | 0 | 5 | 20 | 35 | 15 | 0 | 2+3- |
| 3010.0 | 5 | 35 | 0 | 0 | 5 | 10 | 35 | 10 | 0 | 2+3- |
| 3050.0 | 5 | 35 | 0 | 0 | 5 | 10 | 35 | 10 | 0 | 2+3- |
| 3090.0 | 5 | 35 | 0 | 0 | 5 | 10 | 35 | 10 | 0 | 2+3- |
| 3130.0 | 5 | 25 | 0 | 0 | 5 | 25 | 30 | 10 | 0 | 2+3- |
| 3170.0 | 5 | 15 | 0 | 0 | 5 | 35 | 30 | 10 | 0 | 2+3- |
| 3210.0 | 5 | 30 | 0 | 0 | 5 | 30 | 20 | 10 | 0 | 2+3- |
| 3255.0 | 5 | 20 | 0 | 0 | 5 | 35 | 25 | 10 | 0 | 2+3- |
| 3295.0 | 5 | 25 | 0 | 0 | 5 | 30 | 25 | 10 | 0 | 2+3- |
| 3335.0 | 5 | 15 | 0 | 0 | 5 | 35 | 30 | 10 | 0 | 2+3- |
| 3370.0 | 5 | 15 | 0 | 0 | 5 | 30 | 35 | 10 | 0 | 2+3- |
| 3410.0 | 0 | 20 | 0 | 0 | 5 | 30 | 30 | 15 | 0 | 2+3- |
| 3445.0 | 0 | 20 | 0 | 0 | 5 | 30 | 35 | 10 | 0 | 2+3- |
| 3460.0 | 0 | 20 | 0 | 0 | 5 | 30 | 35 | 10 | 0 | |

## KEROGEN, TAI AND VITRINITE REFLECTANCE

With in the upper Paleocene to lower Miocene section from 430-2315m, the relative abundance of amorphous kerogen fluctuates strongly. Little amorphous kerogen is present in the lower Miocene interval, but the relative abundance increases downhole to a peak of 30% in the upper part of the upper Eocene, decreasing to 5% within the lower part of the upper Eocene section. An abrupt increase within the lowermost part of the upper Eocene occurs from 10% at 1500m to 30% at 1540m. The relative abundance of amorphous kerogen decreases slightly downhole through the middle Eocene and lower Eocene, but is generally greater than 20% of the total kerogen content. The marine amorphous component is high (up to 20%) within the upper part of the upper Eocene and in the lower part of the upper Eocene, but no marine amorphous was observed between 1190m and 1500m. Marine amorphous kerogen is also rare, generally comprising 5% in the upper Paleocene to lower Eocene section. The relative abundance of woody kerogen is high in the lower Miocene (75%), but decreases downhole, becoming relatively constant at approximately 25% to 40% through the upper Paleocene to upper Eocene interval. Herbaceous kerogen increases in relative abundance from 20% in the lower Miocene to an average of 30% to 40% throughout the upper Paleocene to upper Eocene section. Coaly inertinitic kerogen comprises between 5% and 10% of the total kerogen.

The level of Thermal Alteration increases from a value of 2⁻ in the lower Oligocene and lower Miocene section, to a value of 2⁻ to 2 in the upper Paleocene to upper Eocene section. This indicates that the marine amorphous kerogen is mature below 950m and has some source rock potential for thermogenic liquid hydrocarbons. The TAI increases to a value of 2 in the Campanian to lower Paleocene interval below approximately 2335m, and to a value of 2+ below 2690m in the Turonian and Campanian. A subsequent increase occurs in the Lower Cretaceous section to a value of 2+ to 3⁻ below 2930m. This indicates that the

herbaceous, woody and terrestrial amorphous kerogen types are mature below 2690m and have some source rock potential for predominantly gaseous hydrocarbons.

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

1275-2265m: Immature (Ro% = 0.340% to 0.426%)
2385-2505m: Onset of maturation (Ro% = 0.455% to 0.589%)
2585-3265m: Mature (Ro% = 0.793% to 0.991%)
3380m: Highly mature (Ro% = 1.64%)

Highly reliable readings were found throughout this well. A rapid increase of approximately 0.2% occurs between 2505m and 2585m.

## VITRINITE REFLECTANCE

### Key to Measurement Qualifying Labels

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

Sample Depth : 1275.0

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.192 | C | 0.192 | C | 0.228 | C | 0.246 | C | 0.246 | C | 0.258 | C | 0.265 | |
| 0.293 | P | 0.296 | P | 0.301 | | 0.304 | P | 0.306 | | 0.313 | | 0.315 | |
| 0.329 | | 0.337 | E | 0.344 | | 0.358 | P | 0.363 | | 0.364 | | 0.372 | P |
| 0.417 | | 0.422 | | 0.427 | | 0.460 | R | 0.462 | R | 0.528 | R | 0.590 | R |
| 0.591 | R | 0.634 | R | 0.686 | R | 0.709 | R | 0.840 | R | 1.131 | R | 1.613 | R |

Actual Mean = 0.449 Actual Standard Deviation = 0.283

Edited Mean = 0.340 Edited Standard Deviation = 0.047

Sample Depth : 1590.0

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.281 | | 0.288 | | 0.329 | | 0.362 | E | 0.367 | | 0.376 | E | 0.376 | P |
| 0.389 | E | 0.393 | P | 0.396 | E | 0.451 | R | 0.462 | R | 0.463 | R | 0.541 | R |
| 0.675 | R | | | | | | | | | | | | |

Actual Mean = 0.410 Actual Standard Deviation = 0.100

Edited Mean = 0.356 Edited Standard Deviation = 0.042

Sample Depth : 1985.0

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.213 | C | 0.312 | C | 0.321 | C | 0.329 | C | 0.353 | C | 0.362 | C | 0.381 | P |
| 0.397 | | 0.400 | | 0.403 | | 0.422 | E | 0.423 | | 0.436 | E | 0.437 | |
| 0.445 | E | 0.445 | | 0.462 | | 0.463 | P | 0.476 | R | 0.492 | R | 0.517 | R |
| 0.536 | R | 0.537 | R | 0.547 | R | 0.560 | R | 0.562 | R | | | | |

Actual Mean = 0.432 Actual Standard Deviation = 0.086

Edited Mean = 0.426 Edited Standard Deviation = 0.026

Sample Depth : 2065.0

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.258 | C | 0.271 | C | 0.284 | C | 0.293 | C | 0.293 | C | 0.298 | C | 0.322 | |
| 0.333 | | 0.334 | P | 0.334 | P | 0.337 | P | 0.345 | P | 0.360 | | 0.375 | P |
| 0.382 | | 0.385 | | 0.392 | | 0.392 | | 0.395 | | 0.400 | | 0.416 | |
| 0.417 | | 0.418 | P | 0.422 | | 0.427 | | 0.439 | | 0.445 | | 0.447 | |
| 0.449 | | 0.464 | | 0.472 | P | 0.473 | | 0.489 | P | 0.496 | P | 0.511 | R |
| 0.701 | R | | | | | | | | | | | | |

Actual Mean = 0.396 Actual Standard Deviation = 0.086

Edited Mean = 0.406 Edited Standard Deviation = 0.051

Sample Depth : 2145.0

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.277 | C | 0.289 | C | 0.309 | C | 0.312 | C | 0.327 | P | 0.338 | P | 0.341 | P |
| 0.374 | P | 0.375 | P | 0.384 | P | 0.394 | P | 0.410 | E | 0.423 | E | 0.439 | E |
| 0.568 | R | 0.749 | R | 0.761 | R | | | | | | | | |

Actual Mean = 0.416 Actual Standard Deviation = 0.145

Edited Mean = 0.381 Edited Standard Deviation = 0.037

Sample Depth : 2265.0

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.288 | C | 0.306 | C | 0.315 | C | 0.330 | C | 0.330 | C | 0.343 | C | 0.352 | C |
| 0.355 | C | 0.365 | | 0.366 | | 0.366 | | 0.374 | | 0.377 | | 0.377 | P |
| 0.384 | | 0.389 | | 0.393 | | 0.395 | | 0.401 | | 0.403 | | 0.410 | |
| 0.413 | | 0.417 | P | 0.424 | | 0.429 | | 0.436 | | 0.461 | E | 0.497 | R |
| 0.517 | | 0.521 | R | 0.532 | R | 0.534 | R | 0.535 | R | 0.552 | R | 0.593 | R |
| 0.627 | R | 0.639 | R | 0.639 | R | 0.642 | R | 0.663 | R | 0.665 | R | 0.691 | R |
| 0.695 | R | 0.747 | R | 0.768 | R | 0.809 | R | 0.862 | R | 0.890 | R | 0.892 | R |
| 1.062 | R | 1.153 | R | | | | | | | | | | |

Actual Mean = 0.528 Actual Standard Deviation = 0.202

Edited Mean = 0.405 Edited Standard Deviation = 0.037

Sample Depth : 2385.0

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.262 | C | 0.420 | | 0.427 | | 0.431 | | 0.437 | P | 0.503 | | 0.509 | |
| 0.563 | R | 0.576 | R | 0.666 | R | 0.723 | R | 0.915 | R | 1.434 | R | | |

Actual Mean = 0.605 Actual Standard Deviation = 0.298

Edited Mean = 0.455 Edited Standard Deviation = 0.040

Sample Depth : 2505.0

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.378 | C | 0.461 | C | 0.536 | | 0.551 | | 0.570 | | 0.570 | | 0.577 | P |
| 0.592 | | 0.631 | | 0.688 | P | 0.788 | R | 0.824 | R | 0.924 | R | 0.945 | R |
| 0.976 | R | 1.217 | R | | | | | | | | | | |

Actual Mean = 0.702 Actual Standard Deviation = 0.224

Edited Mean = 0.589 Edited Standard Deviation = 0.049

Sample Depth : 2585.0

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.000 | | 0.549 | C | 0.554 | C | 0.554 | C | 0.584 | C | 0.637 | P | 0.654 | |
| 0.663 | | 0.686 | | 0.706 | | 0.723 | | 0.727 | | 0.758 | | 0.768 | |
| 0.774 | | 0.789 | | 0.800 | | 0.801 | | 0.802 | | 0.805 | | 0.823 | |
| 0.826 | | 0.832 | | 0.849 | | 0.855 | | 0.858 | | 0.899 | | 0.916 | |
| 0.927 | | 0.939 | | 0.941 | | 0.943 | | 0.949 | | 0.963 | | 0.975 | |
| 1.000 | R | 1.003 | R | 1.005 | R | 1.009 | R | 1.032 | R | 1.043 | R | 1.053 | R |
| 1.069 | R | 1.069 | R | 1.087 | R | 1.089 | R | 1.098 | R | 1.107 | R | 1.140 | R |
| 1.158 | R | 1.161 | R | 1.163 | R | 1.177 | R | 1.184 | R | 1.201 | R | 1.338 | R |

Actual Mean = 0.893 Actual Standard Deviation = 0.224

Edited Mean = 0.793 Edited Standard Deviation = 0.176

Sample Depth : 2740.0

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.739 | | 0.773 | | 0.841 | | 0.856 | | 0.882 | | 0.902 | | 0.934 | |
| 0.944 | | 0.950 | | 0.970 | | 0.981 | | 0.984 | | 0.988 | | 0.990 | |
| 0.992 | | 1.013 | | 1.015 | | 1.028 | | 1.031 | | 1.052 | R | 1.088 | R |
| 1.102 | R | 1.116 | R | 1.116 | R | 1.125 | R | 1.140 | R | 1.146 | R | 1.150 | R |
| 1.169 | R | 1.172 | R | 1.183 | R | 1.184 | R | 1.187 | R | 1.187 | R | 1.197 | R |
| 1.220 | R | 1.239 | R | 1.336 | R | 1.343 | R | 1.351 | R | 1.388 | R | 1.394 | R |
| 1.460 | R | 1.475 | R | 1.512 | R | 1.682 | R | | | | | | |

Actual Mean = 1.120 Actual Standard Deviation = 0.202

Edited Mean = 0.938 Edited Standard Deviation = 0.085

Sample Depth : 2900.0

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.337 | C | 0.367 | C | 0.423 | C | 0.436 | C | 0.534 | C | 0.548 | C | 0.566 | C |
| 0.570 | C | 0.582 | C | 0.604 | C | 0.672 | C | 0.721 | C | 0.755 | C | 0.780 | C |
| 0.794 | P | 0.836 | | 0.839 | | 0.843 | | 0.850 | | 0.852 | | 0.893 | |
| 0.901 | | 0.905 | P | 0.912 | | 0.921 | E | 0.929 | | 0.930 | | 0.934 | E |
| 0.959 | E | 0.966 | | 0.973 | | 0.992 | | 1.001 | | 1.053 | | 1.075 | |
| 1.131 | R | 1.140 | R | 1.162 | R | 1.174 | R | 1.192 | R | 1.204 | R | 1.251 | R |
| 1.302 | R | 1.362 | R | 1.373 | R | 1.400 | R | 1.451 | R | 1.513 | R | 1.767 | R |
| 1.959 | R | | | | | | | | | | | | |

Actual Mean = 0.953 Actual Standard Deviation = 0.343

Edited Mean = 0.922 Edited Standard Deviation = 0.073

Sample Depth : 2980.0

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.515 | C | 0.529 | C | 0.536 | C | 0.570 | C | 0.649 | C | 0.770 | C | 0.829 | P |
| 0.848 | P | 0.857 | | 0.860 | | 0.872 | | 0.888 | | 0.889 | | 0.903 | |
| 0.930 | | 0.959 | E | 0.964 | | 0.971 | E | 0.971 | | 0.994 | | 1.001 | |
| 1.006 | | 1.018 | | 1.019 | E | 1.031 | | 1.033 | | 1.067 | | 1.087 | |
| 1.092 | | 1.095 | | 1.098 | E | 1.107 | | 1.108 | | 1.109 | | 1.134 | E |
| 1.163 | R | 1.167 | R | 1.197 | R | 1.231 | R | 1.232 | R | 1.232 | R | 1.260 | R |
| 1.268 | R | 1.285 | R | 1.386 | R | 1.421 | R | 1.437 | R | 1.500 | R | 1.515 | R |

Actual Mean = 1.033 Actual Standard Deviation = 0.239

Edited Mean = 0.991 Edited Standard Deviation = 0.094

Sample Depth : 3140.0

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.473 | C | 0.506 | C | 0.613 | C | 0.636 | C | 0.654 | C | 0.660 | C | 0.680 | C |
| 0.701 | C | 0.714 | C | 0.716 | C | 0.732 | C | 0.741 | C | 0.741 | C | 0.752 | C |
| 0.759 | C | 0.786 | | 0.794 | C | 0.801 | | 0.801 | | 0.813 | | 0.816 | |
| 0.907 | | 0.925 | | 0.934 | | 0.935 | | 0.942 | | 0.947 | E | 0.956 | |
| 0.981 | | 0.991 | | 0.996 | E | 1.038 | | 1.094 | | 1.098 | | 1.118 | |
| 1.121 | | 1.124 | | 1.124 | | 1.127 | | 1.214 | R | 1.235 | R | 1.293 | R |
| 1.301 | R | 1.337 | R | 1.354 | R | 1.357 | R | 1.500 | R | 1.579 | R | 1.612 | R |

Actual Mean = 0.960 Actual Standard Deviation = 0.274

Edited Mean = 0.973 Edited Standard Deviation = 0.117

Sample Depth : 3265.0

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.425 | C | 0.472 | C | 0.527 | C | 0.614 | C | 0.630 | C | 0.639 | C | 0.692 | C |
| 0.702 | C | 0.733 | C | 0.737 | C | 0.760 | C | 0.799 | | 0.828 | P | 0.831 | |
| 0.832 | | 0.840 | | 0.846 | | 0.865 | | 0.875 | | 0.883 | | 0.928 | |
| 0.934 | | 0.955 | | 0.972 | | 1.016 | | 1.062 | E | 1.085 | | 1.113 | |
| 1.124 | | 1.128 | | 1.179 | R | 1.194 | R | 1.219 | R | 1.228 | R | 1.255 | R |
| 1.279 | R | 1.290 | R | 1.295 | R | 1.359 | R | 1.679 | R | | | | |

Actual Mean = 0.946 Actual Standard Deviation = 0.272

Edited Mean = 0.943 Edited Standard Deviation = 0.113

Sample Depth : 3380.0

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.751 | C | 0.754 | C | 0.768 | C | 0.770 | C | 0.772 | C | 0.780 | C | 0.799 | C |
| 0.802 | C | 0.812 | C | 0.826 | C | 0.828 | C | 0.828 | C | 0.833 | C | 0.836 | C |
| 0.837 | C | 0.841 | C | 0.842 | C | 0.858 | C | 0.861 | C | 0.862 | C | 0.864 | C |
| 0.874 | C | 0.880 | C | 0.912 | C | 0.953 | | 0.959 | | 0.966 | | 0.974 | |
| 0.978 | | 1.013 | E | 1.022 | | 1.033 | | 1.036 | | 1.054 | | 1.071 | |
| 1.087 | | 1.096 | | 1.108 | | 1.158 | | 1.160 | | 1.166 | | 1.181 | |
| 1.192 | | 1.267 | R | 1.286 | R | 1.305 | R | 1.427 | R | 1.445 | R | 1.450 | R |
| 1.468 | R | 1.550 | R | 1.567 | R | 1.617 | R | | | | | | |

Actual Mean = 1.026 Actual Standard Deviation = 0.240

Edited Mean = 1.064 Edited Standard Deviation = 0.081

Ogmund E-72:

# BIOSTRATIGRAPHY AND MATURATION OF

# OGMUND E-72

**PETRO-CANADA et al. OGMUND E-72**

GSC locality: 57° 31' 29.68"N, 60° 26' 37.78"W
KB elevation: 12.8m Water depth: 156.2m
Casing set at: 203.2m, 401.2m, 1208.5m
Total depth: 3094m
Interval studied for palynology: 430-3090m
Interval studied for micropaleontology: 430-2925m

**CONSENSUS AGE**

| | |
|---|---|
| 430- 500m | Plio-Pleistocene or older (P) |
| 520- 530m | middle Miocene (P) |
| 550- 620m | early Miocene (M) |
| 640- 770m | early Oligocene (M) |
| 790- 980m | late Eocene (P) |
| 1000-1160m | middle to late Eocene (P) |
| 1180-1275m | middle Eocene (P) |
| 1295-1515m | early Eocene (M) |
| 1535-1665m | Maastrichtian (P) |
| 1685-1755m | late Albian to early Cenomanian (P) |
| 1775-1905m | middle Albian (P) |
| 1925-2355m | early to middle Albian (P) |
| 2375-2805m | Aptian (P) |
| 2825-3090m | Barremian to early Aptian (P) |

## OGMUND E-72

### PALYNOLOGICAL ZONATION

| | |
|---|---|
| 430- 500m | Tsugaepollenites igniculus Zone or older (Plio-Pleistocene or older) |
| Not observed | Operculodinium centrocarpum Zone (late Miocene) |
| 520- 620m | Systematophora ancyrea Zone (middle Miocene) |
| 640- 770m | Cordosphaeridium cantharellum Zone (early Miocene) |
| Not observed | Chiropteridium mespilanum Zone (late Oligocene) |
| Not observed | Areophaeridium arcuatum Zone (early Oligocene) |
| 790- 980m | Deflandrea #LR Zone (late Eocene to early Oligocene) |
| 1000-1160m | Areosphaeridium fenestratum Zone (middle to late Eocene) |
| 1180-1305m | Eocladopyxis #LA Zone (middle Eocene) |
| 1325-1365m | Trinovantedinium #LA Zone (early Eocene) |
| 1385-1515m | Dracodinium condylos Zone (early Eocene) |
| Not observed | Ceratiopsis speciosa Zone (late Paleocene) |
| Not observed | Alisocysta circumtabulata Zone (late Paleocene) |

Not observed Palaeoperidinium pyrophorum Zone (early Paleocene)

Not observed Spongodinium #LA Zone (early Paleocene)

Not observed Spongodinium delitiense Zone (Maastrichtian)

Not observed Impagidinium #LL Zone (Maastrichtian)

1535-1665m Isabelidinium cooksoniae Zone (Maastrichtian)

Not observed Chatangiella tripartita Zone (late Campanian)

Not observed Hystrichosphaeridium difficile Zone (Campanian)

Not observed Palaeohystrichophora infusorioides Zone (early Campanian)

Not observed Senoniasphaera rotundata Zone (Santonian)

Not observed Cometodinium obscurum (Coniacian to Turonian)

Not observed Kiokansium polypes Zone (Cenomanian)

1685-1755m Trilobosporites crassus Zone (late Albian to early Cenomanian)

1775-1905m Trilobosporites humilis Zone (middle Albian)

1925-1935m Parvisaccites amplus Zone (early to middle Albian)

1955-2355m Muderongia asymmetrica Zone (early to middle Albian)

2375-2805m *Oligosphaeridium asterigerum* Zone (late Aptian)

Not observed *Pseudoceratium pelliferum* Zone (Barremian to early Aptian)

2825-3090m *Cicatricosisporites* #EAL Zone (Barremian to early Aptian)

SELECTED PALYNOMORPHS

**430-500m: Tsugaepollenites igniculus Zone or older (Plio-Pleistocene or older)**

| | |
|---|---|
| 430m | Tsugaepollenites igniculus * |
| 460m | Osmundacidites claytonites * |
| 490m | Tsugaepollenites viridifluminipites * |

Degree of Confidence: 1

Remarks: A Plio-Pleistocene or older age is assigned to this interval, but it is possible that the section is Miocene and that the absence of marker species is due to the scarcity of palynomorphs in this part of the well.

**520-620m: Systematophora ancyrea Zone (middle Miocene)**

| | |
|---|---|
| 520m | Lingulodinium machaerophorum<br>Systematophora ancyrea<br>Spiniferites ramosus |
| 550m | Dapsilidinium pastielsii<br>Impagidinium japonicum<br>Paralecaniella indentata |

580m Spiniferites pseudofurcatus

Degree of Confidence: 3

**640-770m: Cordosphaeridium cantharellum Zone (early Miocene)**

640m Alnipollenites verus *
**Cordosphaeridium cantharellum**
Operculodinium centrocarpum

670m Caryapollenites simplex *

Degree of Confidence: 3

**790-980m: Deflandrea #LR Zone (late Eocene to early Oligocene)**

790m Betulaceoipollenites betuloides *
Caritasphaeridium pseudopoculum
**Deflandrea #LR**
Ilexpollenites margaritus *
Juglanspollenites nigripites *
Quercoidites #LA *
Quercoidites #LG *
Ulmipollenites undolosus *

820m Rouseisporites #LA *

910m Cicatricosisporites paradorogensis *

970m Azolla *
Diervillapollenites echinatus *
Glaphyrocysta sp. indet.
Rouseisporites #LA * (common)

Degree of Confidence: ? to 3

Remarks: Penetration of the Deflandrea #LR Zone is indicated by the dinoflagellate Deflandrea #LR at 790-810m, providing the single observed specimen is in place. C. pseudopoculum which has its highest occurrence in this interval is considered to be caved because its range is late Oligocene to early Miocene.

**1000-1160m: Areosphaeridium fenestratum Zone (middle to late Eocene)**

1000m Jusseaia sp. Peil 1971 *
**Micrhystridium fragile** (common)
**Phthanoperidinium levimurum**

1030m Selaginella perinata *
Selaginella selaginoides *

1060m Glaphyrocysta ordinata
Tiliaepollenites crassipites *

1090m **Pesavis tagluensis** *
Retitricolpites #LA *
Retitricolpites #LL *

1120m Cordosphaeridium inodes
**Chiropteridum** #LS

Degree of Confidence: 3

Remarks: The presence of common specimens of the acritarch M. fragile and a single specimen of the dinoflagellate P. levimurum indicates penetration of the A. fenestratum Zone at 1000-1020m. The fungal spore P. tagluensis which occurs at 1090-1110m indicates the presence of middle Eocene strata based on its established range in the Canadian Beaufort region. The dinoflagellate Chiropteridium #LS is also a marker for the A. fenestratum Zone but was not observed in the well above 1120-1140m.

**1180-1305m: Eocladopyxis #LA Zone (middle Eocene)**

| | |
|---|---|
| 1180m | Cicatricososporites auritus * |
| | Corylus #LA * |
| | **Hystrichokolpoma unispinum** |
| | Lycopodiumsporites annotinioides * |
| 1205m | Cicatricosisporites dorogensis * |
| 1295m | Dinopterygium cladoides |
| | Fagus #LA * |
| | Pterocaryapollenites stellatus * |
| | Systematophora placacantha |

Degree of Confidence: 2

Remarks: Tentative assignment of the sample at 1180-1200m to the Eocladopyxis #LA Zone is based primarily on the dinoflagellate H. unispinum.

**1325-1365m: Trinovantedinium #LA Zone (early Eocene)**

| | |
|---|---|
| 1325m | Deflandrea phosphoritica |
| | **Trinovantedinium #LA** |
| | **Trinovantedinium #LS** |
| 1355m | **Homotryblium pallidum** |

Degree of Confidence: 4

**1385-1515m: Dracodinium condylos Zone (early Eocene)**

| | |
|---|---|
| 1385m | **Apectodinium homomorphum (abundant)** |
| | **Apectodinium hyperacanthum (abundant)** |
| | Areoligera senonensis |
| | **Isabelidinium #LP** |
| 1415m | Momipites rotundus * |
| | Lentinia wetzelii |
| 1445m | **Areoligera senonensis (abundant)** |
| | Ceratiopsis pannucea |
| | Glaphyrocysta exuberans |
| 1475m | **Apectodinium augustum** |
| | Cordosphaeridium gracile |
| | Cribroperidinium giuseppei |
| | Kisselovia edwardsii |
| | Heteraulacacysta leptalea |
| | Wetzeliella meckelfeldensis |

1505m Deflandra oebisfeldensis

Degree of Confidence: 3

Remarks: The association of Isabelidinium #LP with abundant specimens of Apectodinium species at 1385-1405m suggests a possible hiatus within or immediately above this sample. The dinoflagellate markers for the D. condylos and D. solidum Zone were not observed in the well.

**1535-1665m: Isabelidinium cooksoniae Zone (Maastrichtian)**

1535m
Cyclonephelium distinctum
Ceratiopsis diebelii
Ceratiopsis diebelii sensu McIntyre
Gonyaulacysta wetzelii
**Hamulatisporites amplus** *
**Isabelidinium belfastense**
**Isabelidinium cooksoniae**
Manumiella cretacea
Oligosphaeridium complex
Oligosphaeridium #LV
Palambages
Palaeoperidinium pyrophorum

Degree of Confidence: 3

**1685-1755m: Trilobosporites crassus Zone (early Cenomanian to late Albian)**

1685m — Cicatricosisporites minor *
**Trilobosporites crassus***

1715m — **Cicatricosisporites #EU ***
Rugubivesiculites rugosus *

Degree of Confidence: 3

Remarks: Penetration of the T. crassus Zone (nonmarine equivalent of the E. spinosus Zone) is indicated at 16851705m by the highest occurrence of T. crassus. A marked hiatus is indicated between 1665m and 1685m by the lack of sediments of the greater part of the Cenomanian to Campanian.

**1775-1905m: Trilobosporites humilis Zone (middle Albian)**

1775m — **Gleicheniidites distalgranulatus ***
Laevigatosporites mesozoicus *
**Ornamentifera baculata ***
Plicatella bilateralis *
**Scortea tecta ***
**Trilobosporites humilis ***

1805m — **Clavatipollenites hughesii ***
Clavatipollenites rotundus *
Ischyosporites #ED *
Vitreisporites pallidus *

1835m — Cicatricosisporites annulatus *
Cicatricosisporites #EAM *

1865m Afropollis #ED *
**Ischyosporites estherae** *
Parvisaccites rugulatus *

1895m Foveotriletes subtriangularis *
Parvisaccites radiatus *
Scortea #EA *
Taurocusporites spackmanii *

Degree of Confidence: 4

Remarks: Penetration of the T. humilis Zone is indicated by a highly diverse assemblage of miospores including T. humilis and O. baculata at 1775-1795m.

**1925-1935m: Parvisaccites amplus Zone (early to middle Albian)**

1925m **Parvisaccites amplus** *
**Plicatella cristata** *
Rugubivesiculites minutus *

Degree of Confidence: 4

Remarks: The P. amplus Zone is indicated by the highest occurrence of P. amplus at 1925-1945m.

**1955-2355m: Muderongia asymmetrica Zone (early to middle Albian)**

| | |
|---|---|
| 1955m | Cerebropollenites mesozoicus * |
| | **Muderongia asymmetrica** * |
| | Retitricolpites maximus * |
| 1985m | Stellatopollis #ED * |
| 2015m | Cicatricosisporites annulatus * |
| | Chytroeisphaeridia ringnesiorum |
| | **Foraminisporis asymmetrica** * |
| | Plicatella genuina * |
| 2075m | Ellipsoidictyum rugulosum |
| | Plicatella problematica * |
| 2105m | **Ctenidodinium** #ES * |
| 2165m | Cicatricosisporites potomacensis * |
| | Cicatricosisporites subrotundus * |
| 2255m | Cicatricosisproites #EA * |
| | Concavissimisporites cotidianum * |
| | Distaltriangulisporites irregularis * |
| | Tigrisporites scurrundus * |
| 2285m | Podocarpidites canadensis * |
| 2315m | C. teter |
| 2345m | Densoisporites microrugulatus * |
| | Perotriletes #ED * |
| | Rouseisporites simplex * |

Degree of Confidence: 4

Remarks: Penetration of the M. asymmetrica Zone is indicated by the highest occurrence of M. asymmetrica at 1955-1975m. This is confirmed by the presence of Ctenidodinium #ES in the sample at 2105-2135m.

**2375-2805m: Oligosphaeridium asterigerum/Pilosisporites trichopapillosus Zone (late Aptian)**

| | |
|---|---|
| 2375m | **Muderongia digitata** |
| | Nodosisporites babsei * |
| 2405m | Platysaccus megasaccus * |
| 2435m | **Interlobites triangularis *** |
| 2465m | **Cicatricosisporites mohrioides *** |
| 2495m | Plicatella undosus * |
| | Podocarpidites herbstii * |
| 2615m | Plicatella parviangulata * |
| | Striamonoletes auritus * |
| 2675m | Callialasporites dampieri * |
| 2795m | Impardecispora purverulenta * |
| | Muderongia asymmetrica (base) |
| | Podocarpidites epistriatus * |

Degree of Confidence: 4

Remarks: Penetration of the O. asterigerum Zone is indicated by the highest occurrence of M. digitata at 2375-2395m. This is confirmed below by the highest occurrence of I. triangularis at 2435-2455m and C. mohrioides at 2465-2485m.

**2825-3090m: Cicatricosisporites #EAL (Barremian to early Aptian)**

| | |
|---|---|
| 2825m | Plicatella #ES * |
| | Gonyaulacysta jurassica (reworked) |
| 2975m | Cicatricosisporites grabrowensis * (reworked) |
| | Leiotriletes mecklenburgensis * |

Degree of Confidence: 2

Remarks: Penetration of the Cicatricosisporites #EAL Zone is suggested by the presence of Plicatella #ES at 2825-2845m. Within this zone, reworked palynomorphs are found such as the Jurassic dinoflagellate G. jurassica at 2825-2845m and the Berriasian/Valanginian spore C. grabrowensis at 2975-2995m. This may indicate that the marker species Plicatella #ES is also reworked.

MICROPALEONTOLOGICAL ZONATION

| | |
|---|---|
| 430- 470m | No zonal assignment (No age assignment) |
| 490- 530m | *Cassidulina teretis* Zone (late Miocene or younger) |
| 550- 620m | *Asterigerina guerichi* Zone (early Miocene or older) |
| Not observed | *Asterigerina bartoniana* Zone (late Oligocene) |
| 640-1160m | *Ceratobulimina contraria* Zone (early Oligocene) |
| 1180-1245m | *Spiroplectammina adamsi* Zone (late Eocene) |
| 1265-1275m | *Cyclammina amplectens* Zone (late Eocene) |
| Not observed | *Haplophragmoides acutidorsatum* Zone (middle Eocene) |
| 1295-1515m | *Bulimina ovata* Zone (early Eocene) |
| 1535-1665m | No zonal assignment (No age assignment) |
| Not observed | *Karreriella apicularis* Zone (early Eocene) |
| Not observed | *Spiroplectammina grzybowski* Zone (early Eocene) |
| Not observed | *Glomospira charoides* Zone (late Paleocene) |
| Not observed | *Glomospira corona* Zone (early Paleocene) |

1685-1695m Possible Praecystammina globigerinaeformis Zone (early Paleocene)

1715-2925m No zonal assignment (No age assignment)

Not observed Rzehakina epigona Zone (Maastrichtian)

Not observed Arenobulimina dorbigny Zone (?Campanian)

SELECTED FORAMINIFERA

**430-470m: No zonal assignment (No age assignment)**

**490-530m: Possible Cassidulina teretis Zone (late Miocene or younger)**

| | |
|---|---|
| 490m | Asterigerina ? sp. |
| | Pyrgo elongata |
| 520m | **Cibicidoides boueanus** |
| | Pyrolina fusiformis |
| | **Heterolepa tenella** |

Degree of Confidence: 1

**550-620m: Asterigerina guerichi Zone (early Miocene or older)**

| | |
|---|---|
| 550m | **Asterigerina guerichi** |
| | Hoeglundina elegans |
| | Elphidium hiltermanni |
| 580m | Trifarina abbreviata |
| | Triloculina trigonula |
| 610m | Melonis affinis |

Degree of Confidence: 3

640-1160m: Ceratobulimina contraria Zone (early Oligocene)

| | |
|---|---|
| 640m | **Textularia smithvillensis** |
| 670m | **Cibicidoides proprius** |
| 730m | Cassidulina sub lobosa |
| 760m | Coscinodiscus #H 1 + |
| 790m | **Baggina subconica** |
| 1060m | Elphidium subnodosum<br>Scaphopods |
| 1090m | Gyroidinoides angustiumbilicata<br>Epistominella oveyi |
| 1150m | Nodosaria elegantissima<br>Dentalina inornata |

Degree of Confidence: 2

1180-1245m: Spiroplectammina adamsi Zone (late Eocene)

| | |
|---|---|
| 1180m | **Spiroplectammina adamsi**<br>**Trochammina globigeriniformis (?reworked)**<br>Saracenaria triangularis |
| 1205m | Alabamina wilcoxensis<br>Lenticulina #H 2 |
| 1235m | Alveolophragmium #H 1<br>Lenticulina #H 1 |

Bathysiphon discreta
Sigmoidella bornemanni
Nodosaria minor

Degree of Confidence: 3

**1265-1275m: Cyclammina amplectens Zone (late Eocene)**

1265m **Ammodiscus peruvianus**
H-plophragmoides walteri
Haplophragmoides eggeri
Heterolepa dutemplei
Troc-ammina inflata
Trochammina deformis
**Globigerina linaperta** *

Degree of Confidence: 2

**1295-1515m: Bulimina ovata Zone (early Eocene)**

1295m **Bulimina ovata**
Bulimina trigonalis
**Uvigerina batjesi**
Anomalinoides preacuta
Ammodiscus cretaceus
H-plophragmoides acutidorsatum (depressed top)
Cyclammina placenta
Turrilina alsatica

1325m Osangularia velascoensis
Cibicidoides blanpiedi
Cyclammina cancellata
Vaginulinopsis decorata

1355m Cibicidoides mirificus

1415m **Gavelinella danica**
Stilostomella midwayensis
Hoeglundina eocenica

1445m Gavelinella cf. capitata
Marginulina glabra
**Textularia midwayana**

1475m Cibicidoides alleni

Degree of Confidence: 3

**1535-1665m: No zonal assignment (No age assignment)**

1655m Eponides plummerae

**1685-1695m: Possible Praecystammina globigerinaeformis Zone (early Paleocene or older)**

1685m **Praecystammina globigerinaeformis**
Heterolepa tuxpamensis

Degree of Confidence: 2

**1715-2925m: No zonal assignment (No age assignment)**

1835m Saracenaria triangularis(caved)

1955m Haplophragmoides eggeri (caved)

## PALEOBATHYMETRY

| | |
|---|---|
| 430-470m | Non-marine to Transitional |
| Criteria: | No foraminifera, quartz grains |
| 490-740m | Inner Neritic |
| Criteria: | Asterigerina spp., Cibicidoides proprius, Trifarina abbreviata |
| 760-1070m | Inner Neritic to Middle Neritic |
| Criteria: | Coscinodiscus #H 1, Scaphopods, Baggina subconica |
| 1090-1215m | Middle Neritic |
| Criteria: | Gyroidinoides angustiumbilicata, Spiroplectammina adamsi, Trochammina globigeriniformis (reworked?) |
| 1235-1245m | Middle Neritic to Outer Neritic |
| Criteria: | Bathysiphon discreta, Lenticulina #H 1 |
| 1265-1305m | Outer Neritic to Upper Bathyal |
| Criteria: | Ammodiscus peruvianus, Recurvoides walteri, Haplophragmoides eggeri, Globigerina linaperta |
| 1325-1485m | Upper Bathyal |
| Criteria: | Cyclammina cancellata, Osangularia velascoensis, Stilostomella midwayensis, Hoeglundina eocenica |
| 1505-1515m | Outer Neritic to Upper Bathyal |
| Criteria: | Decrease in diversity and abundance. |
| Remarks: | Paleoenvironments interpreted from 1505m to 1815m are only tentative due to poor fossil recovery. |

1535-1635m Inner Neritic to Middle Neritic
Criteria: Lophocythere sp. (ostracod)

1655-1695m Middle Neritic to Outer Neritic
Criteria: Praecystammina globigerinaeformis, Eponides plummerae

1715-1815m Inner Neritic to Middle Neritic
Criteria: Uvigerina batjesi, Vaginulinopsis decorata

## KEROGEN & TAI

| Depth | AM | AT | AG | SA | M | BT | ST | I | R | TAI |
|---|---|---|---|---|---|---|---|---|---|---|
| 610.0 | 0 | 0 | 0 | 0 | 10 | 35 | 45 | 10 | 0 | 2- |
| 790.0 | 0 | 0 | 0 | 0 | 10 | 30 | 45 | 15 | 0 | 2- |
| 910.0 | 0 | 0 | 0 | 0 | 10 | 35 | 40 | 15 | 0 | 2- |
| 1000.0 | 10 | 5 | 0 | 0 | 5 | 25 | 45 | 10 | 0 | 2- |
| 1120.0 | 20 | 10 | 0 | 0 | 5 | 25 | 30 | 10 | 0 | 2- |
| 1205.0 | 15 | 5 | 0 | 0 | 5 | 30 | 35 | 10 | 0 | 2- |
| 1325.0 | 20 | 10 | 0 | 0 | 5 | 20 | 35 | 10 | 0 | 2- |
| 1445.0 | 25 | 15 | 0 | 0 | 5 | 20 | 25 | 10 | 0 | 2-2 |
| 1535.0 | 20 | 15 | 0 | 0 | 5 | 20 | 20 | 20 | 0 | 2-2 |
| 1625.0 | 5 | 10 | 0 | 0 | 5 | 25 | 30 | 25 | 0 | 2-2 |
| 1715.0 | 0 | 0 | 0 | 0 | 5 | 30 | 35 | 30 | 0 | 2-2 |
| 1775.0 | 0 | 0 | 0 | 0 | 10 | 25 | 40 | 25 | 0 | 2 |
| 1865.0 | 0 | 0 | 0 | 0 | 5 | 30 | 45 | 20 | 0 | 2 |
| 1955.0 | 0 | 0 | 0 | 0 | 5 | 30 | 40 | 25 | 0 | 2 |
| 2045.0 | 0 | 0 | 0 | 0 | 10 | 25 | 40 | 25 | 0 | 2+ |
| 2135.0 | 0 | 0 | 0 | 0 | 5 | 35 | 35 | 25 | 0 | 2+ |
| 2225.0 | 0 | 0 | 0 | 0 | 5 | 35 | 30 | 30 | 0 | 2+ |
| 2345.0 | 0 | 0 | 0 | 0 | 5 | 40 | 30 | 25 | 0 | 2+ |
| 2435.0 | 0 | 0 | 0 | 0 | 5 | 25 | 40 | 30 | 0 | 2+ |
| 2525.0 | 0 | 0 | 0 | 5 | 10 | 20 | 35 | 30 | 0 | 2+ |
| 2645.0 | 0 | 0 | 0 | 0 | 5 | 25 | 40 | 30 | 0 | 2+ |
| 2735.0 | 0 | 0 | 0 | 0 | 5 | 25 | 35 | 35 | 0 | 2+ |
| 2825.0 | 0 | 0 | 0 | 0 | 0 | 25 | 40 | 35 | 0 | 2+ |
| 2945.0 | 0 | 0 | 0 | 0 | 5 | 25 | 40 | 30 | 0 | 2+ |
| 3035.0 | 0 | 0 | 0 | 0 | 0 | 25 | 40 | 30 | 0 | 2+ |
| 3080.0 | 0 | 0 | 0 | 0 | 5 | 30 | 35 | 30 | 0 | 2+ |
| 3090.0 | 0 | 0 | 0 | 0 | 5 | 30 | 35 | 30 | 0 | |

## KEROGEN, TAI AND VITRINITE REFLECTANCE

The upper Eocene to Plio-Pleistocene or older section from 610-910m is devoid of amorphous kerogen. Woody kerogen comprises 40% to 45%, herbaceous kerogen comprises 40% to 45%, and coaly inertinitic kerogen comprises 10% to 15% of the total kerogen content. The interval from 1000-1625m of Maastrichtian to middle-late Eocene age contains relatively high abundances of amorphous kerogen, reaching a peak of 40% at 1445m. Marine amorphous kerogen generally comprises 15% to 25%. Woody kerogen is less common than in the overlying interval and generally comprises 30% to 35%. Coaly inertinitic kerogen comprises 10% and herbaceous kerogen comprises 25% to 35%. The interval from 1715-3090m of Early Cretaceous age is devoid of amorphous kerogen. Coaly inertinitic kerogen is more abundant than in the overlying intervals except for the Maastrichtian section, and averages 25% to 30%. Woody kerogen comprises 30% to 40% and herbaceous kerogen generally comprises 25% to 40%, becoming slightly less common downhole.

The level of Thermal Alteration increases from a value of 2⁻ at 610m, to a value of 2⁻ to 2 below 1445m in strata of early Eocene age or older. A value of 2 is reached at 1775m near the top of the Lower Cretaceous section, and a value of 2+ at 2045m in strata of early to middle Albian age. The level of Thermal Alteration and the kerogen types indicate some source rock potential for liquid hydrocarbons from the marine amorphous kerogen in the interval between 1445-1535m near the hiatus between Maastrichtian and lower Eocene strata. Some source rock potential for predominantly gaseous hydrocarbons is indicated below 2045m from the herbaceous and woody kerogen within the Lower Cretaceous interval.

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

445m: Indeterminate
640-1670m: Immature (Ro% = 0.355% to 0.445%)
1850-2370m: Mature (Ro% = 0.612% to 0.957%)
2715-3080m: Onset of maturation (Ro% = 0.527% to 0.580%)

The upper portion of the well between 445m and 1850m contains low populations of poor quality vitrinite particles. Therefore the readings are unreliable. Between 2210m and 2370m, large populations of vitrinite particules indicate high maturity. Below 2715m, a drop in the Ro% to values near the onset of maturation suggests that these populations are caved from younger sediments or that the highly mature populations in the interval above are reworked. Alternatively they may have been thermally matured through hydrothermal activity associated with local volcanic activity.

## VITRINITE REFLECTANCE

### Key to Measurement Qualifying Labels

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

Sample Depth : 445.0

0.000

Actual Mean = 0.000 Actual Standard Deviation = 0.000

Edited Mean = 0.000 Edited Standard Deviation = 0.000

Sample Depth : 640.0

0.304 0.330 0.431 0.680 R 0.817 R 0.990 R

Actual Mean = 0.592 Actual Standard Deviation = 0.281

Edited Mean = 0.355 Edited Standard Deviation = 0.067

Sample Depth : 790.0

0.203 C 0.210 P 0.219 0.220 P 0.234 P 0.312 P 0.365
0.417 P 0.446 0.600 P

Actual Mean = 0.323 Actual Standard Deviation = 0.133

Edited Mean = 0.336 Edited Standard Deviation = 0.134

Sample Depth : 960.0

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.170 | C | 0.241 | C | 0.270 | C | 0.292 | C | 0.354 | P | 0.452 | P | 0.508 | P |
| 0.512 | P | 0.555 | R | 0.592 | R | 0.623 | R | 0.650 | R | | | | |

Actual Mean = 0.435 Actual Standard Deviation = 0.164

Edited Mean = 0.457 Edited Standard Deviation = 0.074

Sample Depth : 1130.0

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.213 | C | 0.224 | C | 0.230 | C | 0.245 | C | 0.245 | C | 0.254 | C | 0.284 | C |
| 0.448 | | 0.613 | R | | | | | | | | | | |

Actual Mean = 0.306 Actual Standard Deviation = 0.135

Edited Mean = 0.448 Edited Standard Deviation = 0.000

Sample Depth : 1295.0

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.359 | P | 0.362 | P | 0.620 | R | 0.640 | R | 0.954 | R | 0.967 | R | | |

Actual Mean = 0.650 Actual Standard Deviation = 0.269

Edited Mean = 0.360 Edited Standard Deviation = 0.002

Sample Depth : 1490.0

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.366 | P | 0.381 | P | 0.560 | R | 1.189 | R | | | | | | |

Actual Mean = 0.624 Actual Standard Deviation = 0.387

Edited Mean = 0.374 Edited Standard Deviation = 0.011

Sample Depth : 1670.0

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.376 | P | 0.477 | P | 0.482 | P | 0.582 | R | 0.617 | R | 0.765 | R | 0.767 | R |
| 0.896 | R | 0.957 | R | 1.023 | R | 1.068 | R | 1.108 | R | 1.265 | R | | |

Actual Mean = 0.799 Actual Standard Deviation = 0.279

Edited Mean = 0.445 Edited Standard Deviation = 0.060

Sample Depth : 1850.0

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.245 | C | 0.294 | C | 0.295 | C | 0.339 | C | 0.342 | C | 0.350 | C | 0.370 | C |
| 0.380 | C | 0.593 | | 0.602 | P | 0.624 | P | 0.628 | P | 0.710 | R | 0.740 | R |
| 0.860 | R | 0.974 | R | | | | | | | | | | |

Actual Mean = 0.522 Actual Standard Deviation = 0.224

Edited Mean = 0.612 Edited Standard Deviation = 0.017

Sample Depth : 2030.0

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.480 | C | 0.527 | P | 0.536 | | 0.572 | | 0.606 | | 0.609 | | 0.630 | P |
| 0.645 | | 0.663 | | 0.672 | | 0.674 | P | 0.702 | | 0.703 | | 0.742 | P |
| 0.746 | | 0.748 | P | 0.762 | P | 0.780 | P | 0.780 | P | 0.782 | | 0.794 | P |
| 0.804 | P | 0.806 | P | 0.812 | P | 0.832 | | 0.840 | | 0.844 | | 0.853 | |
| 0.862 | | 0.877 | | 0.885 | | 0.900 | | 0.920 | | 0.930 | P | 0.932 | P |
| 0.954 | P | 0.980 | | 0.982 | P | 1.016 | | 1.039 | P | 1.055 | P | 1.063 | |
| 1.087 | | 1.135 | P | 1.190 | | 1.212 | | 1.216 | | | | | |

Actual Mean = 0.834 Actual Standard Deviation = 0.184

Edited Mean = 0.841 Edited Standard Deviation = 0.178

Sample Depth : 2210.0

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.376 | P | 0.410 | E | 0.483 | P | 0.583 | P | 0.647 | | 0.676 | P | 0.676 | P |
| 0.685 | | 0.699 | | 0.703 | | 0.710 | P | 0.715 | | 0.718 | P | 0.732 | |
| 0.732 | | 0.785 | | 0.800 | | 0.810 | P | 0.818 | | 0.825 | | 0.880 | E |
| 0.895 | P | 0.900 | | 0.918 | | 0.920 | | 0.935 | | 0.980 | | 0.987 | |
| 0.990 | P | 0.994 | | 1.020 | P | 1.040 | | 1.084 | P | 1.117 | P | 1.180 | |
| 1.188 | | 1.281 | | 1.301 | P | | | | | | | | |

Actual Mean = 0.847 Actual Standard Deviation = 0.220

Edited Mean = 0.847 Edited Standard Deviation = 0.220

Sample Depth : 2335.0

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.374 | C | 0.380 | C | 0.381 | C | 0.421 | C | 0.422 | C | 0.430 | C | 0.432 | C |
| 0.435 | C | 0.482 | C | 0.531 | | 0.533 | P | 0.571 | P | 0.576 | | 0.588 | |
| 0.597 | | 0.608 | | 0.608 | | 0.609 | | 0.631 | | 0.637 | | 0.661 | |
| 0.662 | | 0.673 | | 0.679 | | 0.681 | | 0.707 | | 0.708 | | 0.739 | |
| 0.749 | | 0.751 | | 0.757 | | 0.774 | | 0.798 | | 0.803 | | 0.849 | R |
| 0.873 | R | 0.875 | R | 0.885 | R | 0.900 | R | 0.912 | R | 0.951 | R | 0.953 | R |
| 0.987 | R | 1.074 | R | 1.076 | R | 1.198 | R | 1.285 | R | 1.350 | R | 1.503 | R |

Actual Mean = 0.736 Actual Standard Deviation = 0.258

Edited Mean = 0.665 Edited Standard Deviation = 0.080

Sample Depth : 2370.0

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.171 | C | 0.445 | C | 0.711 | P | 0.794 | | 0.823 | | 0.880 | | 0.906 | P |
| 0.923 | P | 0.990 | | 1.010 | | 1.060 | P | 1.072 | | 1.083 | | 1.092 | |
| 1.094 | P | 1.154 | R | 1.200 | R | 1.241 | R | 1.269 | R | 1.311 | R | 1.320 | R |
| 1.322 | R | 1.351 | R | 1.376 | R | 1.421 | R | 1.508 | R | 1.574 | R | 1.678 | R |

Actual Mean = 1.099 Actual Standard Deviation = 0.329

Edited Mean = 0.957 Edited Standard Deviation = 0.128

Sample Depth : 2715.0

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.412 | C | 0.420 | C | 0.436 | C | 0.443 | C | 0.444 | C | 0.445 | C | 0.447 | C |
| 0.447 | C | 0.448 | C | 0.461 | C | 0.467 | C | 0.490 | E | 0.492 | | 0.495 | |
| 0.497 | E | 0.501 | | 0.501 | | 0.502 | E | 0.507 | | 0.511 | R | 0.513 | |
| 0.514 | | 0.516 | E | 0.518 | | 0.518 | E | 0.520 | E | 0.522 | E | 0.523 | E |
| 0.524 | E | 0.528 | E | 0.532 | | 0.540 | E | 0.542 | E | 0.544 | E | 0.548 | |
| 0.549 | | 0.549 | | 0.550 | E | 0.551 | | 0.564 | E | 0.567 | E | 0.583 | E |
| 0.682 | R | 0.728 | R | 0.784 | R | 0.833 | R | 0.851 | R | 0.861 | R | 0.921 | R |
| 0.942 | R | | | | | | | | | | | | |

Actual Mean = 0.556 Actual Standard Deviation = 0.130

Edited Mean = 0.527 Edited Standard Deviation = 0.024

Sample Depth : 2900.0

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.453 | C | 0.472 | C | 0.500 | E | 0.502 | E | 0.520 | | 0.522 | | 0.530 | |
| 0.543 | | 0.550 | | 0.558 | E | 0.570 | | 0.574 | E | 0.575 | P | 0.583 | E |
| 0.586 | P | 0.592 | P | 0.592 | E | 0.592 | P | 0.595 | P | 0.600 | E | 0.606 | E |
| 0.634 | E | 0.683 | R | 0.718 | R | 0.720 | R | 0.720 | R | 0.746 | R | 0.792 | R |
| 0.800 | R | 0.840 | R | 0.849 | R | 0.850 | R | 0.886 | R | 0.987 | R | 0.996 | R |
| 1.059 | R | 1.092 | R | 1.096 | R | 1.133 | R | 1.278 | R | 1.354 | R | 1.912 | R |

Actual Mean = 0.756 Actual Standard Deviation = 0.293

Edited Mean = 0.566 Edited Standard Deviation = 0.037

Sample Depth : 3080.0

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.536 | E | 0.540 | P | 0.562 | E | 0.568 | E | 0.572 | | 0.585 | E | 0.595 | |
| 0.598 | E | 0.614 | E | 0.625 | E | 0.770 | R | 0.800 | R | 0.806 | R | 0.928 | R |
| 0.957 | R | 1.138 | R | 1.185 | R | 1.400 | R | | | | | | |

Actual Mean = 0.765 Actual Standard Deviation = 0.259

Edited Mean = 0.580 Edited Standard Deviation = 0.029

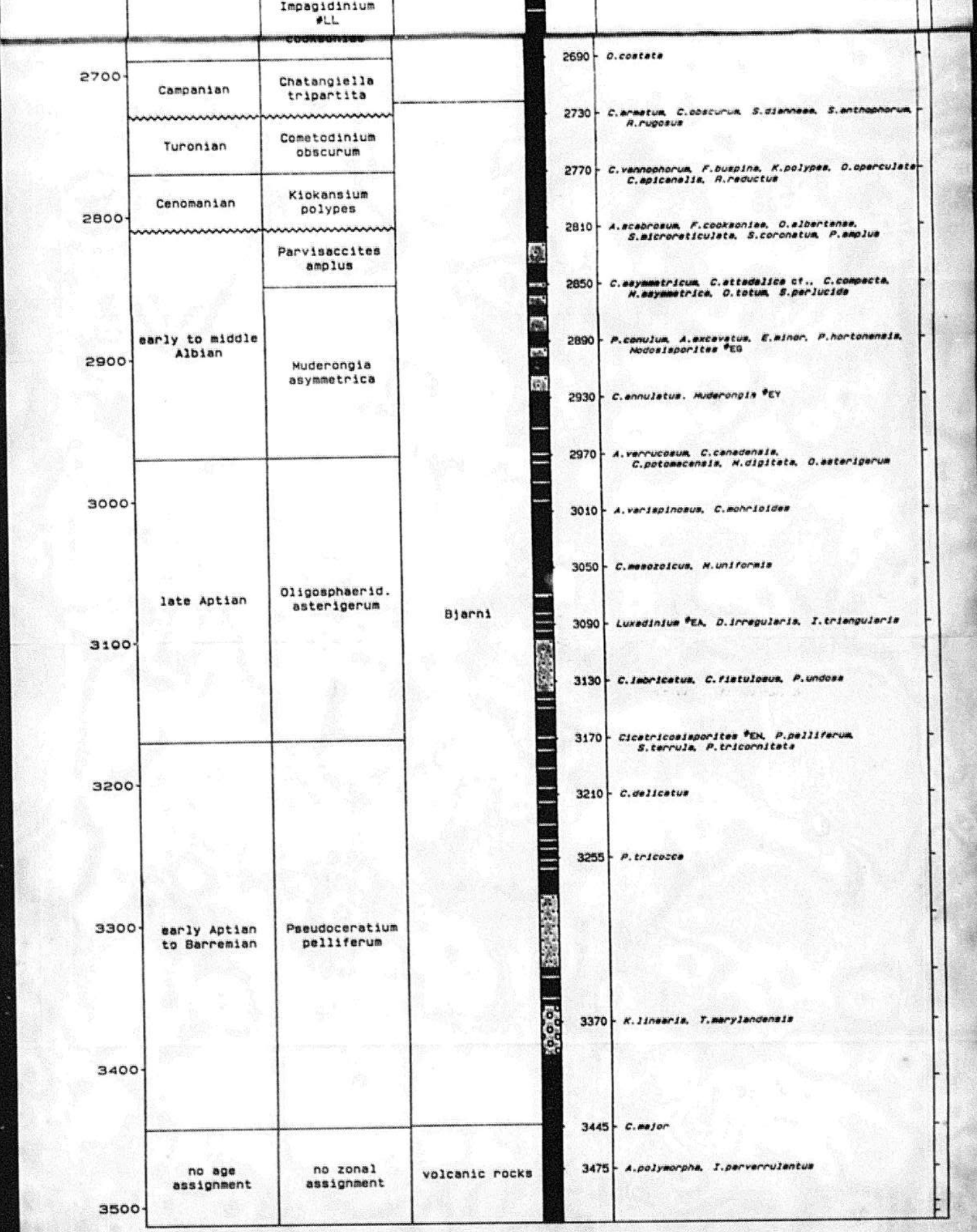
# PALYNOLOGICAL ANALYSIS CHART

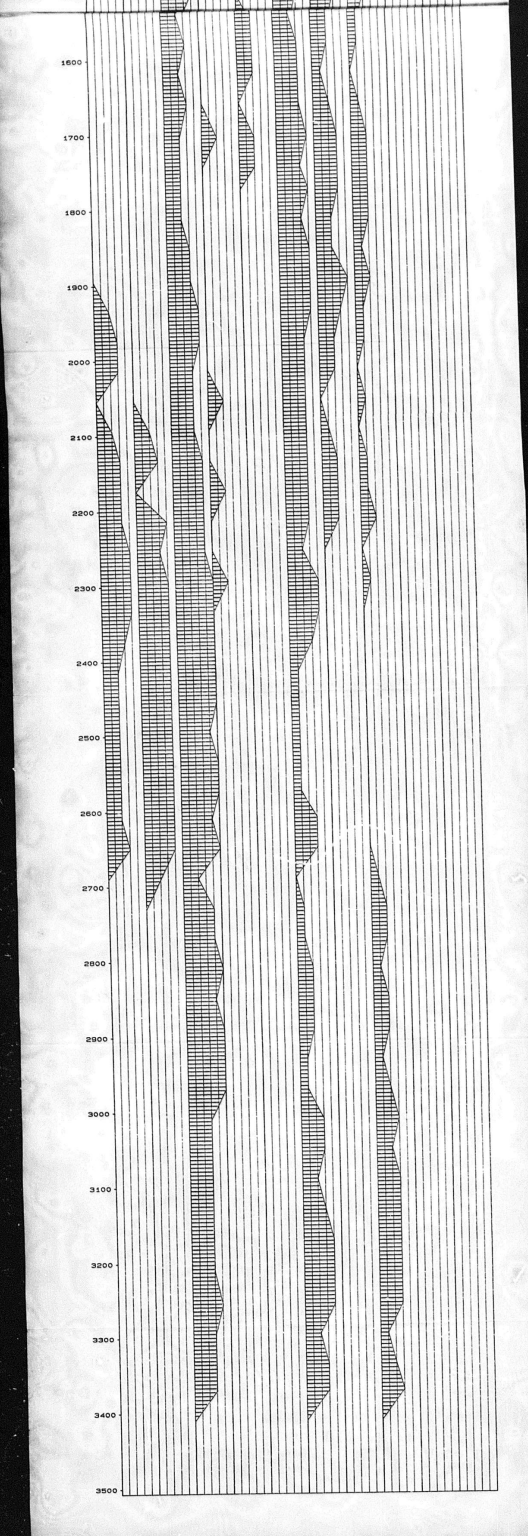
## BUJAK DAVIES GROUP

CLIENT: G.S.C.
WELL: North Leif I-05
AREA: Labrador Shelf

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

| AGE | ZONE | FORMATIONS | LITHOLOGY | IMPORTANT SAMPLE DEPTHS | PALYNOLOGICAL EVENTS | SAMPLE LEVEL |
|---|---|---|---|---|---|---|
| | | | | 430 | Ceratiaceae #LA, *L.machaerophorum*, *S.ancyrea*, *T.ignicoloe* | |
| middle Miocene or older | Systematophora ancyrea or older | Saglek | | 470 | *D.penttelelii* | |
| | | | | 510 | *A.arcuatum*, *C.meaglianum*, *D.spiniferum*, *T.varielfiumlnigites* | |
| | | | | 550 | *D.phosphoritica*, *H.aspinatum* | |
| early Oligocene | Areosphaeridium arcuatum | Mokami | | 630 | *G.intricata*, *Quercoidites* #LA, *Rousseaoporites* #LA | |
| | | | | 670 | *C.simplex*, *P.indentata* | |
| | | | | 710 | *Cyclonephelium* sp.B, Williams & Brideaux 1975, *L.serrata* | |
| | | | | 790 | *B.diverticatum*, *T.pelagica* | |
| | | | | 830 | *Rhenanoperidinium* #LG | |
| | | | | 910 | *A.verus*, *P.cometum* | |
| | | | | 950 | *P.electrolophum* | |
| early Oligocene to late Eocene | Deflandrea #LR | | | 990 | *Corylus* #LA | |
| | | | | 1030 | *D.dorogensis* | |
| | | | | 1070 | *U.undulosus* | |
| | | | | 1110 | *A.aranosa*, *C.pseudorogensis*, *Deflandrea* #LR, *Quercoidites* #LA (common) | |
| | | | | 1190 | *C.gracile*, *G.semitecta* | |
| | | | | 1230 | *D. cladidies*, *K.calochrypta*, *P.golzowense*, *H.perforata* | |
| | | | | 1265 | *A.fenestratum*, *Deflandrea* #LR, *G.spinata*, *H.salacium*, *S.pseudofurcatus* | |
| middle to late Eocene | Areosphaeridium fenestratum | | | 1385 | *P.tepluense* | |
| | | | | 1500 | *P.stellatum*, *B.placacantha* | |
| | | | | 1580 | *Azolla*, *Hystrichosphaera* #LP | |
| | | | | 1660 | *L.wetzelii*, *W.articulata* | |
| middle Eocene | Eocladopyxis #LA | Kenamu | | 1705 | *H.coryliodes* | |
| | | | | 1745 | *Eocladopyxis* #LA, *K.crassicornis* | |
| | | | | 1775 | *C.pannucea*, *T.petula* | |
| | | | | 1895 | *H.cinctum*, *H.oceanicum*, *H.lapidaea*, *L.wetzelii* | |
| | | | | 1935 | *A.homeomorphum*, *Systematophora* #LC, *Trinovantedinium* #LA | |
| early Eocene | Trinovantedin. #LA | | | 1975 | *A.homeomorphum* (common), *Trinovantedinium* #LL | |
| | | | | 2015 | *H.tenuilabinosum*, *P.subtile*, *Systematophora* #LC *E.urnulae* | |
| | Dracodinium condylos | | | 2055 | *D. solidum*, *H.pellinum* | |
| | | | | 2095 | *D.condylos*, *A.senonensis* | |
| | | | | 2135 | *A.senonensis* (common), *G.arubarana*, *A.reticulum* | |
| | | Cartwright | | 2175 | *I.californiense* | |
| | | | | 2215 | *A.augustum* | |
| late Paleocene | Ceratiopsis speciosa | | | 2255 | *A.homeomorphum* (abundant), *C.speciosa glabra*, *C.speciosa speciosa* | |
| | | | | 2295 | *A.senonensis* (abundant) | |
| early to late Paleocene | A. circumtabul. /P. pyrophorum | | | 2335 | *A.margarita*, *C.lindae longicornis*, *C.striata*, *E.crassitabulata*, *S.cooksie*, *P.pyrophorum* | |
| early Paleocene | Spongodinium #LA | Markland | | 2375 | *T.evittii*, *P.trijugus*, *P.magnificum*, *P.pyrophorum* (common), *Spongodinium* #LA | |
| | | | | 2415 | *C.aceras*, *C.diebelii*, *L.clathrata*, *H.tubiferum*, *P.lidia*, *P.pyrophorum* (abundant) | |
| | | | | 2455 | *C.wetzelii*, *D.denticulata*, *H.tubiferum brevispin.* | |
| | Spongodinium delitiense | | | 2495 | *Isabelidinium* #LV | |
| | | | | 2535 | *S.delitiense* | |
| Maastrichtian | | | | 2575 | *C.diebelii* sensu McIntyre 1975, *C.distinctum*, *T.nudo* | |
| | Impagidinium #LL | | | 2610 | *Impagidinium* #LL, *S.laevigatum* | |


Impagidinium #LL
2700
Campanian
Chatangiella tripartita
Turonian
Cometodinium obscurum
Cenomanian
Kiokansium polypes
2800
Parvisaccites amplus
early to middle Albian
Muderongia asymmetrica
2900
late Aptian
Oligosphaerid. asterigerum
3000
3100
early Aptian to Barremian
Pseudoceratium pelliferum
3200
3300
3400
3500
no age assignment
no zonal assignment
Bjarni
volcanic rocks
2690 O.costata
2730 C.armatum, C.obscurum, S.diannaea, S.anthophorum, R.rugosus
2770 C.vannophorum, F.buspina, K.polypes, O.operculata, C.apicanalis, R.reductus
2810 A.scabrosum, F.cookaniae, O.albertense, S.microreticulata, S.coronatum, P.amplus
2850 C.asymmetricum, C.attadalica cf., C.compacta, M.asymmetrica, O.totum, S.perlucida
2890 P.canulum, A.excavatus, E.minor, P.hortonensis, Nodosisporites #EG
2930 C.annulatus, Muderongia #EY
2970 A.verrucosum, C.canadensis, C.potomacensis, H.digitata, O.asterigerum
3010 A.varispinosus, C.mohrioides
3050 C.mesozoicus, H.uniformis
3090 Luxadinium #EA, D.irregularis, I.triangularis
3130 C.imbricatus, C.fistulosus, P.undosa
3170 Cicatricosisporites #EN, P.pelliferum, S.terrula, P.tricornitata
3210 C.delicatus
3255 P.tricocca
3370 K.linearis, T.marylandensis
3445 C.major
3475 A.polymorpha, T.perverrulentus


1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
2600
2700
2800
2900
3000
3100
3200
3300
3400
3500

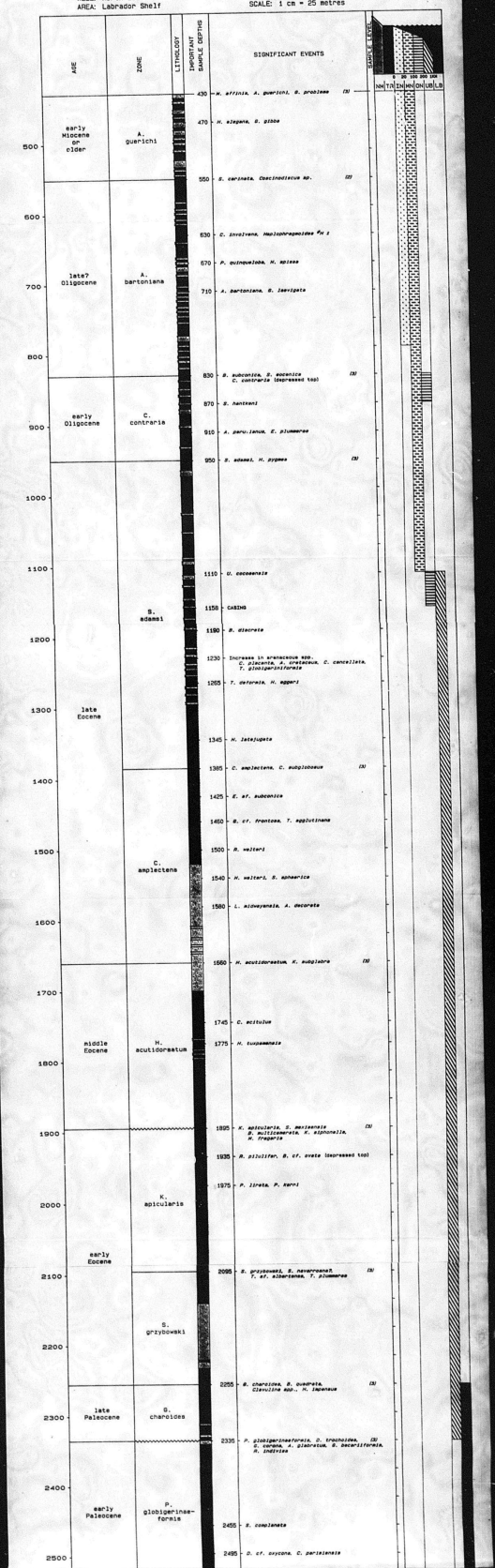
1500
1400
1300
1200
1100
1000
900
800
700
600
500
P R C A D
Apectodinium homomorphum
Areoligera senonensis
Marine Dinoflagellate
Azolla
Pediastrum
Gymnosperm pollen
Angiosperm pollen
Spores
Upper Cretaceous Reworking
Lower Cretaceous Reworking

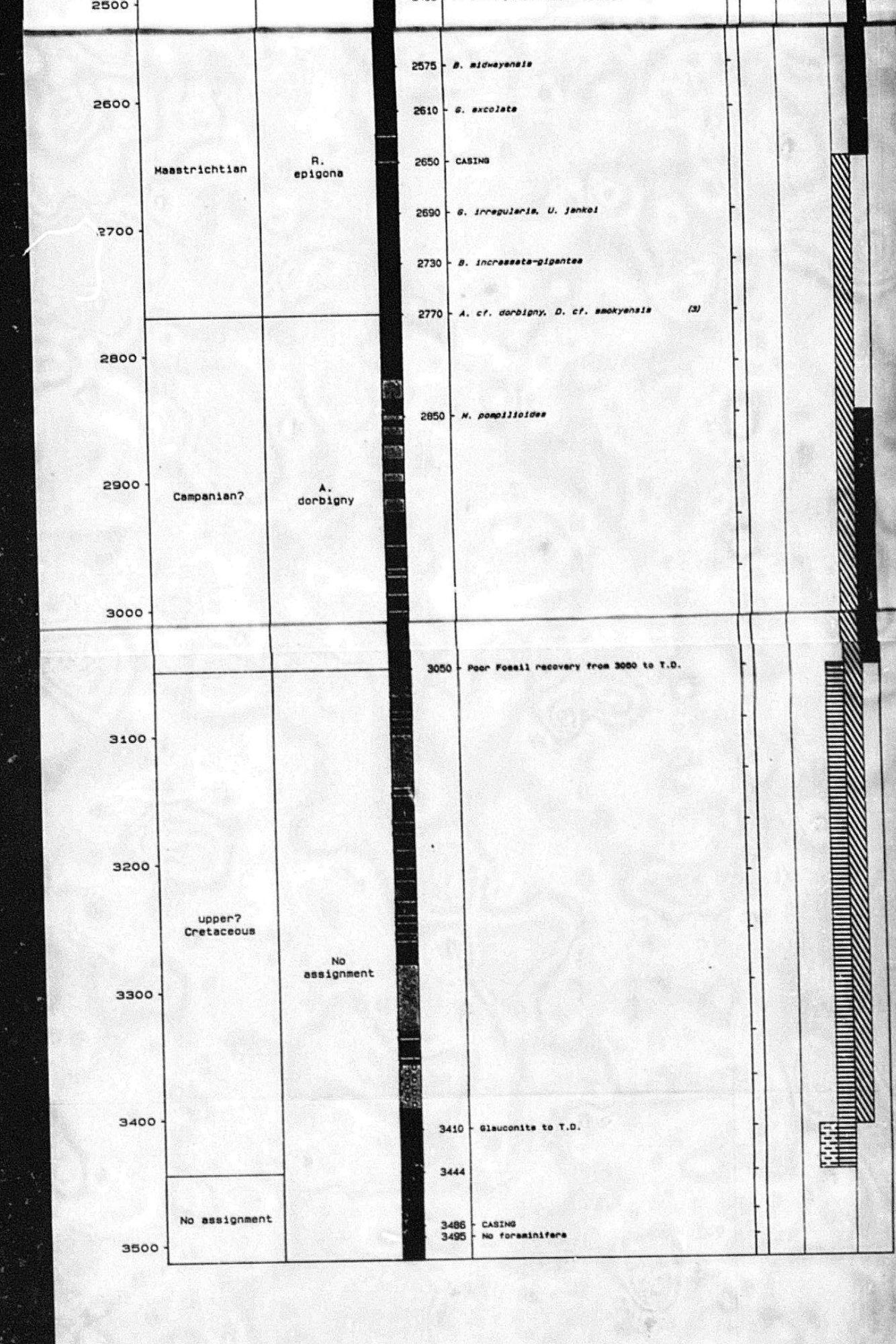
# MICROPALEONTOLOGICAL ANALYSIS CHART

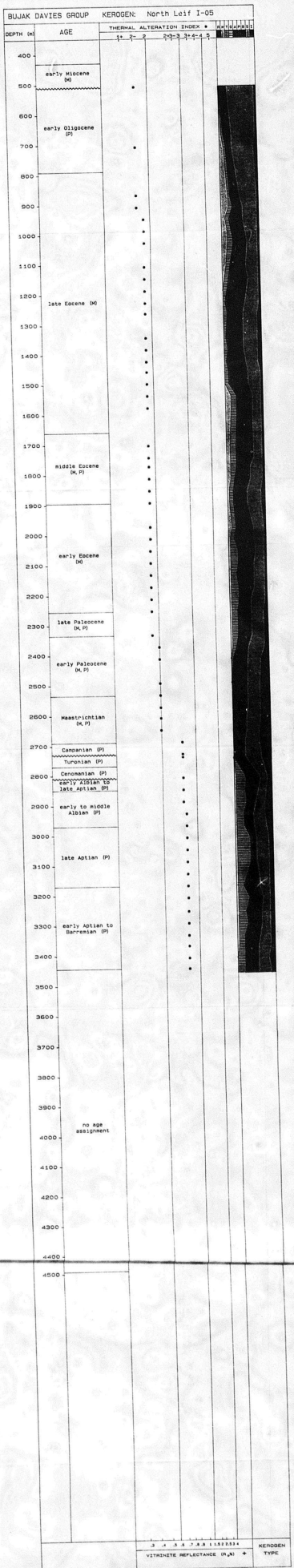
## BUJAK DAVIES GROUP

CLIENT: G.S.C.
WELL: North Leif I-05
AREA: Labrador Shelf

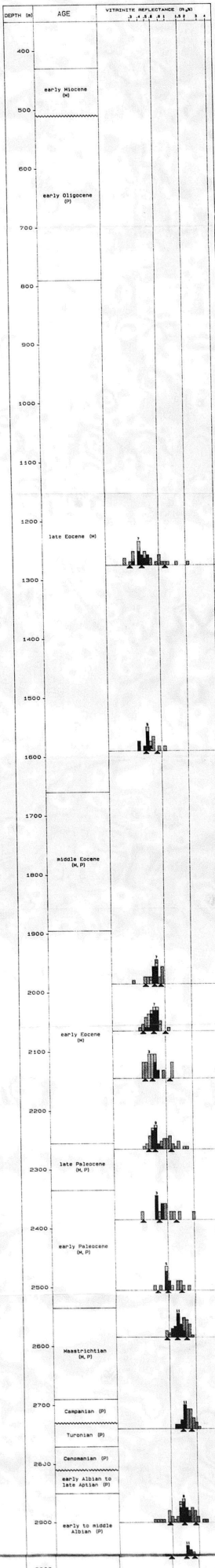
SCIENTIST: Bujak Davies Group
DATE: April 1987
SCALE: 1 cm = 25 metres

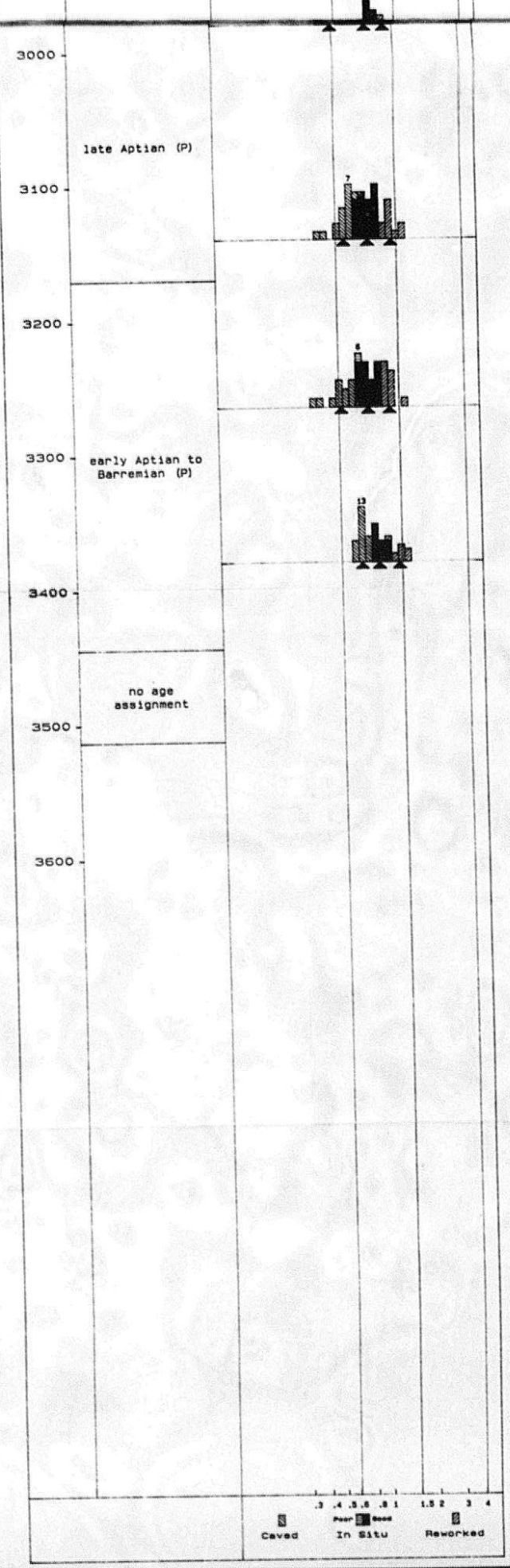



2500
2600
2700
2800
2900
3000
3100
3200
3300
3400
3500
Maastrichtian
R. epigona
Campanian?
A. dorbigny
upper? Cretaceous
No assignment
No assignment
2575 B. midwayensis
2610 G. excolata
2650 CASING
2690 G. irregularis, U. jankoi
2730 B. increassata-gigantea
2770 A. cf. dorbigny, D. cf. smokyensis (3)
2850 H. pompilioides
3050 Poor Fossil recovery from 3050 to T.D.
3410 Glauconite to T.D.
3444
3486 CASING
3495 No foraminifera


BUJAK DAVIES GROUP
KEROGEN: North Leif I-05
DEPTH (m)
AGE
THERMAL ALTERATION INDEX
A
C
H
L
P
R
S
early Miocene (M)
early Oligocene (P)
late Eocene (M)
middle Eocene (M, P)
early Eocene (M)
late Paleocene (M, P)
early Paleocene (M, P)
Maastrichtian (M, P)
Campanian (P)
Turonian (P)
Cenomanian (P)
early Albian to late Aptian (P)
early to middle Albian (P)
late Aptian (P)
early Aptian to Barremian (P)
no age assignment
VITRINITE REFLECTANCE (Ro%)
KEROGEN TYPE

BUJAK DAVIES GROUP VITRINITE: North Leif I-05

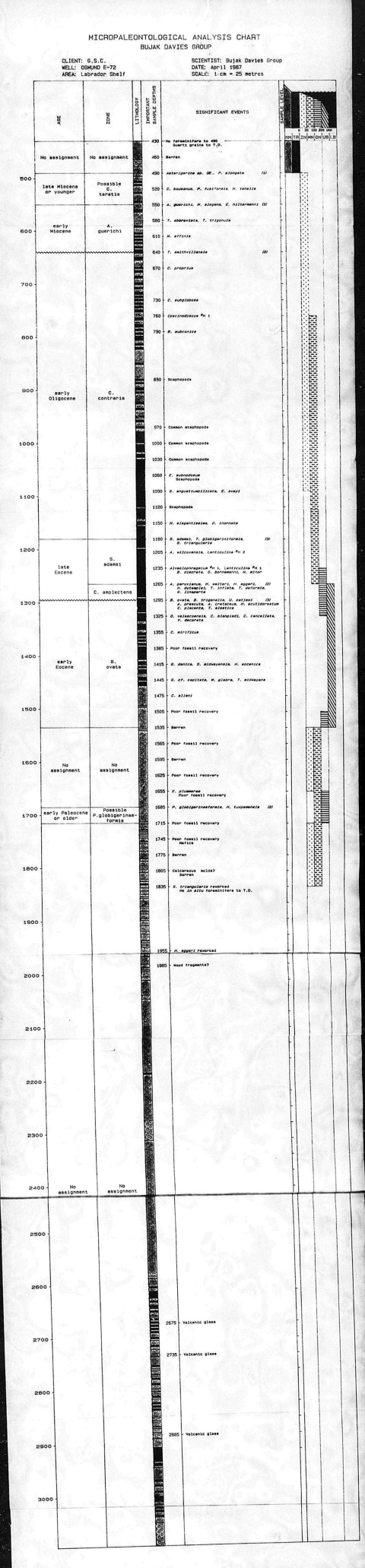



3000
3100
3200
3300
3400
3500
3600
late Aptian (P)
early Aptian to Barremian (P)
no age assignment
7
8
12
.3 .4 .5 .6 .8 1 1.5 2 3 4
Poor
Good
Caved
In Situ
Reworked

# MICROPALEONTOLOGICAL ANALYSIS CHART
## BUJAK DAVIES GROUP

CLIENT: G.S.C.
WELL: OSMUND E-72
AREA: Labrador Shelf

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

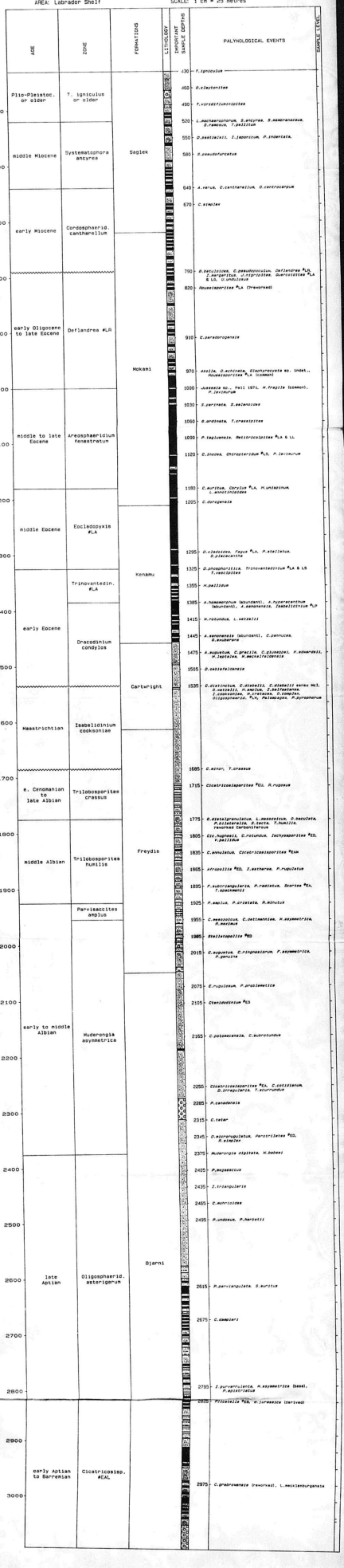


# PALYNOLOGICAL ANALYSIS CHART

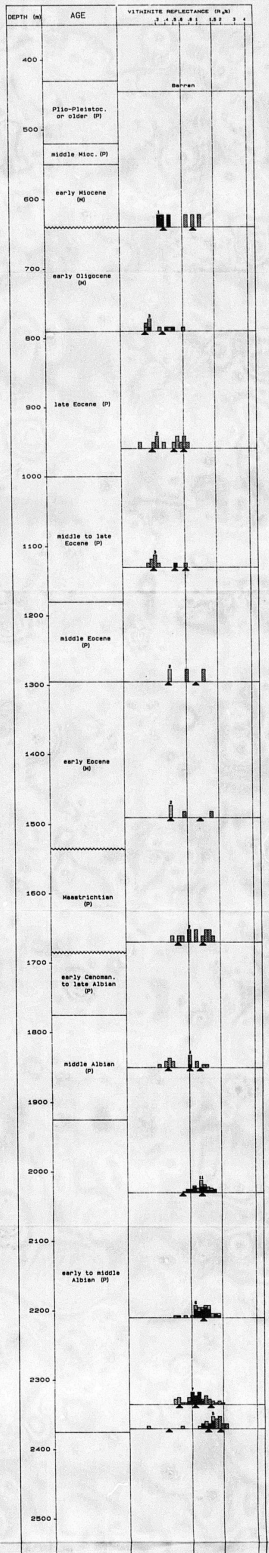
## BUJAK DAVIES GROUP

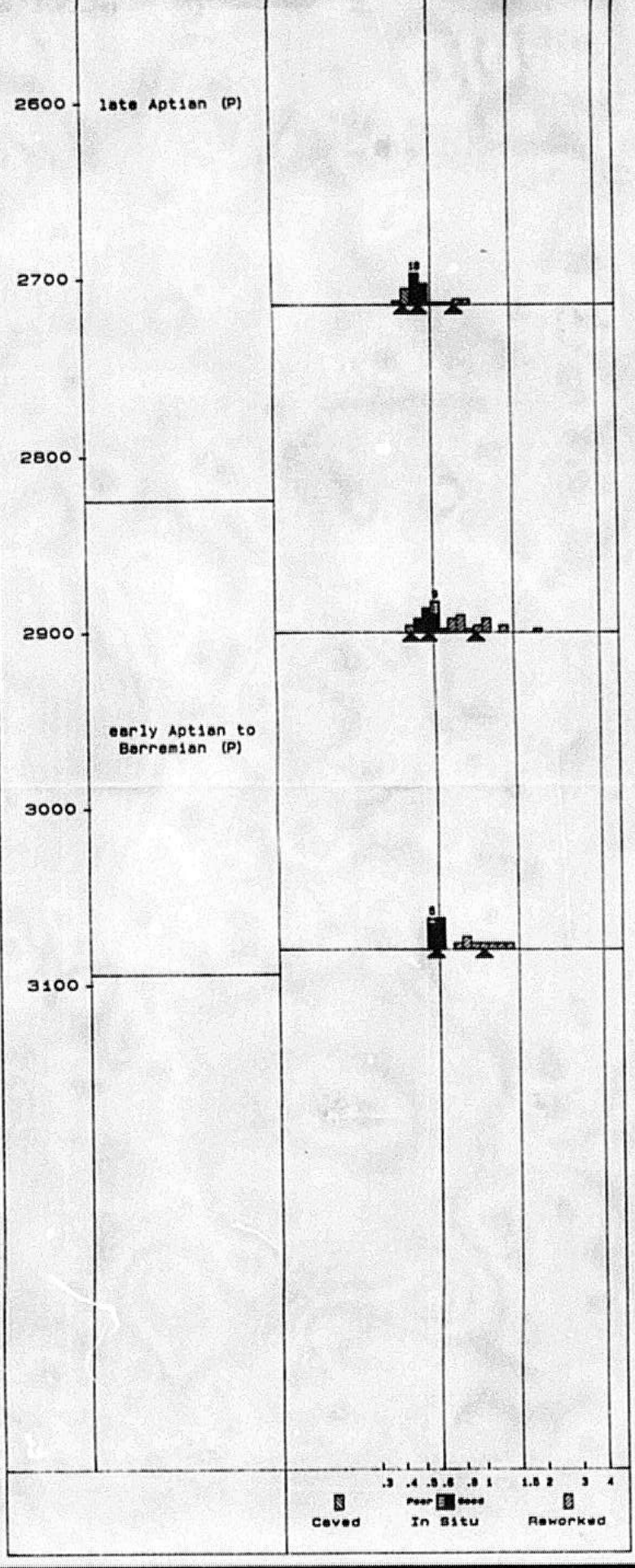
CLIENT: B.S.C.
WELL: GOKUND E-72
AREA: Labrador Shelf

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

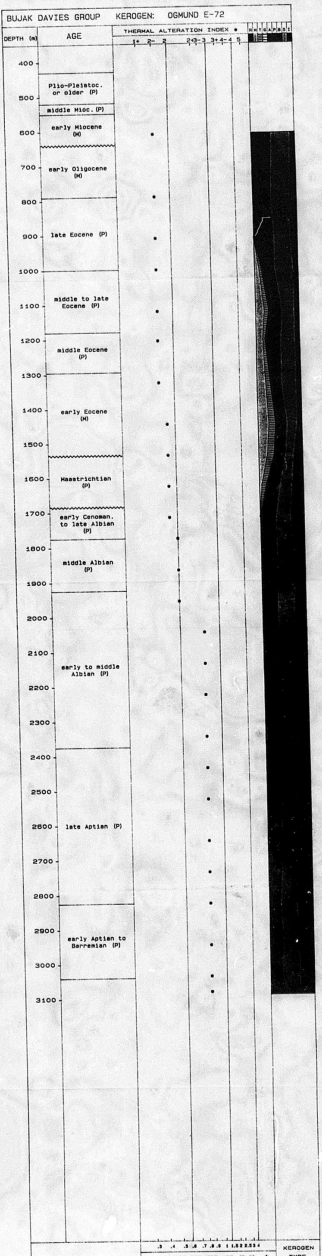


BUJAK DAVIES GROUP VITRINITE: Ogmund E-72




2600
late Aptian (P)
2700
2800
2900
early Aptian to
Barremian (P)
3000
3100
.3 .4 .5 .6 .8 1
1.5 2
3
4
Poor
Good
Caved
In Situ
Reworked

BUJAK DAVIES GROUP KEROGEN: OSMUND E-72



3000
2950
2900
2750
2600
2550
2400
2350
2200
2100
2000
1900
1800
1750
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500

Apectodinium homomorphum

Areoligera senonensis

Marine Dinoflagellate

Azolla

Pediastrum

Gymnosperm Pollen

Angiosperm Pollen

Spores

Upper Cretaceous Reworking

Lower Cretaceous Reworking