

This report is released as part of AER/AGS Open File Report 2017-08. It includes biostratigraphic charts updated on 20 April 2009. See Appendix 5 of AGS Open File Report 2017-08 for updated results and interpretations.

**PALYNOLOGICAL ANALYSIS OF
CORE AND OUTCROP SAMPLES
FROM THE McMURRAY FORMATION**

AGS Tarsands Report #3

by
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Twenty outcrop samples and 57 core samples from 17 coreholes in the Fort McMurray area were processed for palynological analysis. The objective of the study was to determine the palynological successions and environments of deposition in order to sub-divide the McMurray Formation.

The Barremian and basal Aptian assemblages seen in the previous study (99.33) were not encountered here.

Recoveries varied but were generally good. However, in some samples, an oily or waxy residue obscured the kerogen as well as the palynomorphs. Charts showing palynomorph group abundances are included with the text. Charts showing species distributions in the coreholes are placed in an appendix.

SECTION 2**SUMMARY OF RESULTS**

COREHOLES

Depth	Age	Salinity	Environment
10-30-76-4W4			
340.5m	Aptian	3 ⁺	Estuarine
348.85m	Aptian	3	Restricted marine
361m	Aptian	1 - 1 ⁺	Fluvial
384.75	Aptian	1	Fluvial channel
390.5	Aptian	1	Overbank
408.5	Aptian	?1	?Fluvial
15-35-76-4W4			
352m	Aptian	3	Restricted marine
354.35m	Aptian	2	Upper estuarine
357m	Aptian	?1	?Flood deposit
366.5m	Aptian	1 - 1 ⁺	Fluvial
10-5-95-5W4			
244.55	Aptian	2	U. estuarine or prox. lagoonal
6-15-76-6W4			
342.7m	Aptian	3 ⁻ - 3	Restricted marine, distal lagoon/ estuarine bay
351.3m	Aptian	1	Fluvial
365.65m	Aptian	1	Fluvial
9-17-88-6W4			
109m	Aptian	1 ⁺ - ?2 ⁻	Fluvial
10-26-93-6W4			
259.5m	Aptian	3	Rest. marine/lagoonal
264m	Aptian	2 ⁺	Upper estuarine
10-1-77-7W4			
1120'	Aptian	Indeterminable	?Channel
1130'	Aptian	1 - ?1 ⁺	Probably overbank
1151'	Aptian	1 - ?1 ⁺	Probably overbank
1194'	Aptian	1	Fluvial
8-14-76-7W4			
361.6m	Aptian	3	Restricted marine
380m	Aptian	1 ⁺ - 2 ⁻	Fluvial to upper estuarine

11-15-77-7W4

1089'	Aptian	1	Fluvial
1150'	Aptian	1 ⁺ - 2 ⁻	Upper estuarine
1195'	Aptian	1 - 1 ⁺	Fluvial

10-26-83-7W4

369m	Aptian	Indeterminable	Indeterminable
384m	Aptian	1	Fluvial
397m	Aptian	1	Fluvial

10-8-90-7W4

139.7m	Aptian	1	Fluvial
143.2m	Aptian	1	Fluvial
155.2m	Aptian	Indeterminable	Indeterminable

11-8-75-8W4

426.25m	Aptian	3	Restricted marine
438.2m	Aptian	3 ⁻	Estuarine
444.8m	Aptian	2 ⁻	V. high estuarine
459m	Aptian	1	Fluvial
462.5m	Aptian	1	Fluvial
478.5m	Aptian	1-1 ⁺	Fluvial to v. high estuarine

11-1-77-8W4

1053'	Aptian	2	Restricted brackish, lagoon/swamp
1116'	Aptian	1	Fluvial

4-14-95-11W4

49.2m	Aptian	1	Swamp margin/overbank
62.05	Aptian	1	Fluvial

9-2-96-12W4

290m	Aptian	1	Fluvial
359.7m	Aptian	1	Fluvial
365.84m	Aptian	1	Overbank

16-17-101-13W4

1576.56'	Aptian	3 ⁻ - 3	Restricted marine
1626.1'	Aptian	3	Restricted marine
1681'	Aptian	?1 ⁺ - ?3	?Upper estuarine
1737'	Aptian	1 ⁺	Fluvial
1741'	Aptian	1 ⁺ - ?2 ⁻	Fluvial to v. high estuarine
1746'	Aptian	1	Overbank flood
1751'	Aptian	1	Overbank flood
1755.6'	Aptian	1	Overbank flood

11-9-99-15W4

430m	Latest Aptian-basal Albian	3	Restricted marine
436m	Aptian	3	Restricted marine
444m	Aptian	2 ⁻	V. high estuarine
556m	Aptian	?1 ⁺ - ?3	?Upper estuarine

OUTCROPS**Daphne Island West**

1	Aptian	1	Fluvial
2	Aptian	1	Fluvial
3	Aptian	1	Fluvial
4	Aptian	1	Fluvial
5	Aptian	1	Fluvial
6	Aptian	?1	?Fluvial channel
7	Aptian	1	Fluvial
8	Aptian	1	Fluvial
9	Aptian	1	Fluvial
10	Aptian	1	Fluvial

Daphne Island East

Indeterminable	Indeterminable
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Pierre Creek

Upper	Aptian	1	Overbank flood
Lower	Aptian	1	?Channel

Marl

?Aptian	?1	Fluvial
---------	----	---------

Euymundson Creek

Indeterminable	Indeterminable
----------------	----------------

Sink Hole North

?Aptian	1	Indeterminable
---------	---	----------------

Athabasca River

Indeterminable	Indeterminable
----------------	----------------

Christina River

Aptian	1	Fluvial
--------	---	---------

Syncrude North Mine

Indeterminable	Indeterminable
----------------	----------------

Stoney Rapids

Late Albian	4	Marine
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To determine the proportions of the palynomorph taxa, a count of 200 specimens was made where possible. In some poor samples there were less than 200 specimens on the entire slide. The palynomorphs were assigned to biological groups to aid in the interpretation of the environments of deposition. The groups used are:

Group	Environment
Pteridophyte spores misc.	Swamp
Bisaccate pollen	Hinterland contribution
Taxodiaceae	Lowland floodplain swamps
Other gymnosperms	
Algae (Freshwater)	
Botryococcus	Lacustrine
Zygnemataceous spores	
Algae (Marine)	
Dinocysts Ceratoid	Abundance of some forms indicates reduced salinity
Peridinioid	Abundance of some forms indicates reduced salinity
Chorate	More abundant in open marine
Proximate	
Simple (indet.)	Unassignable. Usually fragments.
Hyaline	Essentially freshwater

The proportions and degree of sorting of the organic macerals was also determined where possible to help with the environmental interpretation. Unfortunately, some of the residues were unavoidably contaminated with an oily or waxy substance from the heavy oil in the core, which obscured the macerals.

The data are presented in percentage abundance histogram formats for the measured sections and in spreadsheet format for the outcrops.

Table 1: General palynological indicators of degree of marine influence (Leckie et al. 1990)

ENVIRONMENT		DESCRIPTION
1	CONTINENTAL	Palynoflora composed of land derived microspores, megaspores and pollen.
2	SLIGHTLY BRACKISH	Introduction of saline water into an essentially fresh water environment, e.g., coastal lakes with outlets to the sea, inlets, upper estuaries and intertributary channels. Littoral. Contains rare specimens of ceratioid dinocysts (e.g., <i>Nyktericysta</i> , <i>Vesperopsis</i> and <i>Balmula</i>) and a few acritarchs. Land derived spores and pollen abundant.
3	BRACKISH	Marginal marine conditions found in bays, estuaries, lagoons and barrier-associated backwaters. Increase in salinity. Dinocyst species diversity low. Certain species of ceratioid and peridinioid dinocysts (e.g., <i>Luxadinium primulum</i> , <i>Palaeoperidinium cretaceum</i>) appear in abundance. Assemblages often monospecific. Land - derived spores and pollen abundant.
4	NEARSHORE MARINE	Inner neritic environment. Shallow marine. Dinocyst diversity higher due to increased salinity but assemblages still dominated by land derived spores and pollen.
5	OPEN MARINE	Outer neritic environment. Close to the shelf margin. Fully saline. Dinocyst diversity high. Land derived spores and pollen reduced in quantity. Assemblages dominated by dinocysts.

10-30-76-4W4

Six samples were processed and all yielded good to excellent assemblages.

Depth: 480.5m
Environment: ?Fluvial
Salinity: ?1

Remarks

This sample contains rare dinocysts but, since some are undoubted mud contaminants, they are all considered to be out of place.

The remainder of the assemblage is dominated by bisaccates and was probably deposited in a fluvial environment. The kerogen proportions cannot be determined due to the presence of bitumen.

Depth: 390.5m
Environment: Overbank
Salinity: 1

Remarks

This sample contained 28% schizaceous spores which were derived from plants that favored settings subject to flooding/drying out cycles.

Depth: 384.75m
Environment: Fluvial channel
Salinity: 1

Remarks

The kerogen is well sorted and the proportion of structured sapropels is low indicating a moderately high energy environment such as a channel.

Sample: 361m
Environment: Fluvial
Salinity: 1 - 1⁺

Remarks

The sample contains rare ceratioid and hyaline dinocysts which indicate fresh to barely brackish waters. Bisaccate pollen dominate and pteridophyte spores comprise a small proportion. The sorting is extremely poor indicating low energy.

Sample: 348.85m, 340.5m
Environment: Restricted marine, estuarine
Salinities: 3, 3⁺

Remarks

The lower sample contains abundant dinocysts but most are simple ceratioid forms and the assemblage is restricted. The upper one contains a slightly more varied dinocyst assemblage and the kerogen has a bimodal size distribution indicating the possibility of tidal influence.

Well Name : 10-30-76-4W4

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Well Code : 20251PK

Interval : 340.00m - 409.00m

PALYNOFACIES

Scale : 1:1000

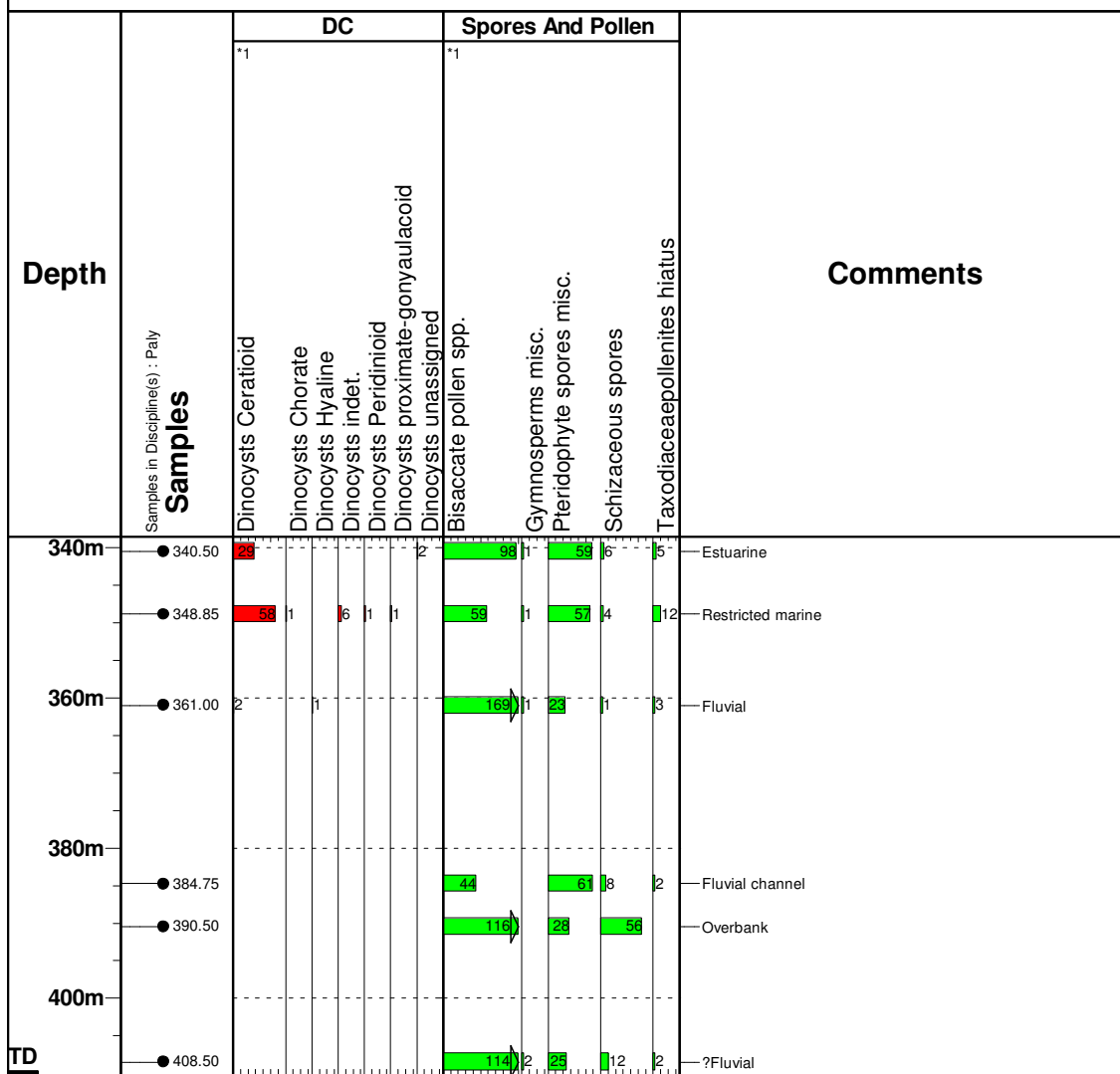
Chart date: 20 April 2009

G.DOLBY

Project : 2025
Chart : 10-30

Text Keys

*1 Absolute abundance (10mm=100 counts)



15-35-76-4W4

Four samples were processed and three yielded rich assemblages.

Depth: 366.5m
Environment: Fluvial
Salinity: 1 - 1⁺

Remarks

This rich assemblage contains a modest number of *Hurlandsia rugosa* indicating fresh to barely brackish salinities. There is some degree of sorting and the kerogen is dominated by oxidized vitrinite. A shallow, fluvial setting is proposed.

Depth: 357m
Environment: ? Flood deposit
Salinity: ?1

Remarks

Palynomorphs are extremely rare. The kerogen size distribution is bimodal and the composition is mainly oxidized vitrinite and semi-fusinite. A flood deposit, possibly mid-splay, is suggested.

Depth: 354.35m
Environment: Upper estuarine or proximal lagoonal
Salinity: 2

Remarks

Balmula tripenta and *Nyktericysta* spp. are numerous and signify a brackish, upper estuarine or proximal lagoonal setting.

Depth: 352m
Environment: Restricted marine
Salinity: 3

Remarks

This assemblage is dominated by a dinocyst resembling *Hapsocysta* as well as numerous ceratioid and some hyaline cysts. There is a slight tendency to bimodality in the kerogen suggesting the possibility of some tidal influence.

Well Name : 15-35-76-4W4

G.Dolby and Associates
Calgary

Well Code : 20252PK

Interval : 350.00m - 367.00m

PALYNOFACIES

Scale : 1:1000

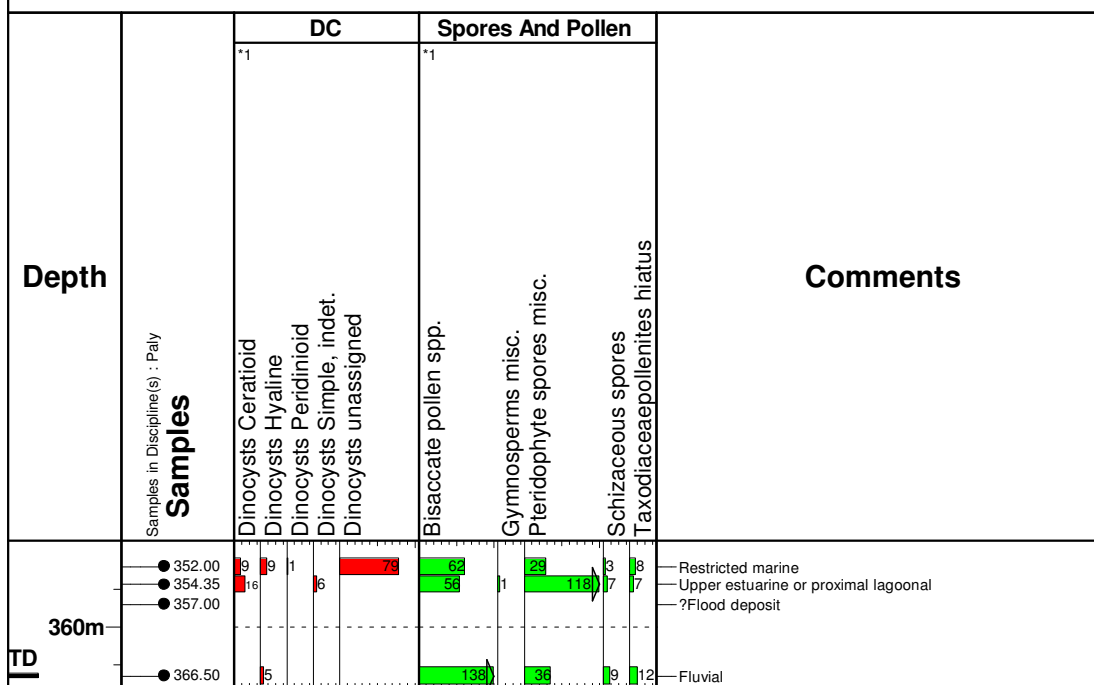
Chart date : 20 April 2009

G. DOLBY

Project : 2025
Chart : 15-35PA

Text Keys

*1 Absolute abundance (10mm=100 counts)



10-5-95-5W4

Only one sample was processed.

Depth: 244.55m
Environment: Upper estuarine or proximal lagoonal
Salinity: 2

Remarks

This rich assemblage contains abundant pteridophyte spores (43%) and bisaccate pollen (48%) with numerous *Balmula tripenta*, *Nyktericysta* spp. and *Pseudoceratium interiorensense*. An upper estuarine or proximal lagoonal setting with brackish salinities is indicated.

Well Name : 10-05-95-5W4

Well Code : 20253PK

Interval : 240.00m - 250.00m

PALYNOFACIES

Scale : 1:1000

Chart date : 20 April 2009

G.DOLBY

Project : 2025
Chart : 10-05PA

Text Keys

*1 Absolute abundance (10mm=100 counts)

Depth	Samples Samples in Discipline(s) : Paly	DC	Spores And Pollen				Comments
		*1	*1				
		Dinocysts Ceratioid					
		Dinocysts indet.					
		Bisaccate pollen spp.					
		Gymnosperms misc.					
		Pteridophyte spores misc.					
		Schizaceous spores					
		Taxodiaceae pollenites hiatus					
240m	● 244.55	4 2	102 5	91 4	3		Upper estuarine or proximal lagoonal

6-15-76-6W4

Three samples were processed and all yielded rich assemblages.

Depths: 365.65m, 351.3m
Environment: Fluvial
Salinity: 1

Remarks

Both samples contained essentially similar spore-pollen assemblages. The upper one also yielded a single hyaline dinocyst. Freshwater, low energy environments are indicated.

Depth: 342.7m
Environment: Restricted, distal lagoon or estuarine bay
Salinity: 3 - 3

Remarks

This rich assemblage contains a modest number of dinocysts, mainly ceratioid, which signifies sub-normal salinities. The sorting is extremely poor, indicating a low energy environment, and the spore numbers suggest proximity to a swamp.

Well Name : 6-15-76-6W4

Well Code : 20254PK

Interval : 342.00m - 366.00m

PALYNOFACIES

Scale : 1:1000

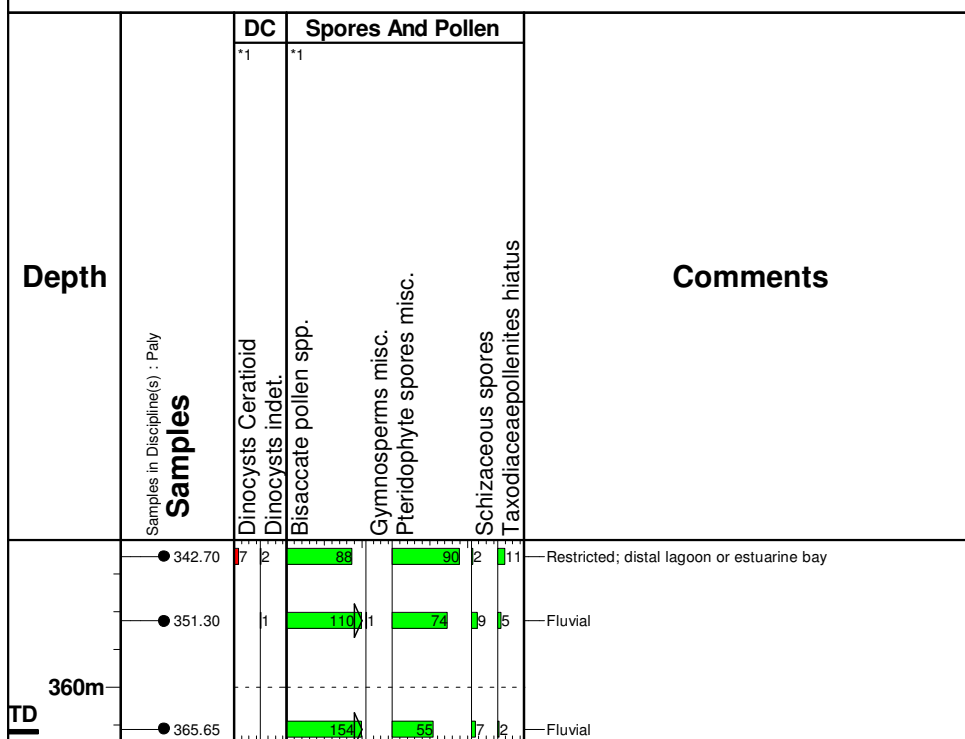
Chart date : 20 April 2009

G.DOLBY

Project : 2025
Chart : 6-15PA

Text Keys

*1 Absolute abundance (10mm=100 counts)



9-17-88-6W4

Only one sample was prepared from this well.

Depth: 109m
Environment: Fluvial
Salinity: 1⁺ - 2⁻

Remarks

This is a rich assemblage with 57% bisaccate pollen and 41% pteridophyte spores. Extremely rare dinocysts such *Hurlandsia rugosa*, *Nyktericysta* spp. and *Pseudoceratium interiorensense* indicate a faint, saline influence.

Well Name : 9-17-88-6W4

Well Code : 20255PK

Interval : 100.00m - 110.00m

PALYNOFACIES

Scale : 1:1000

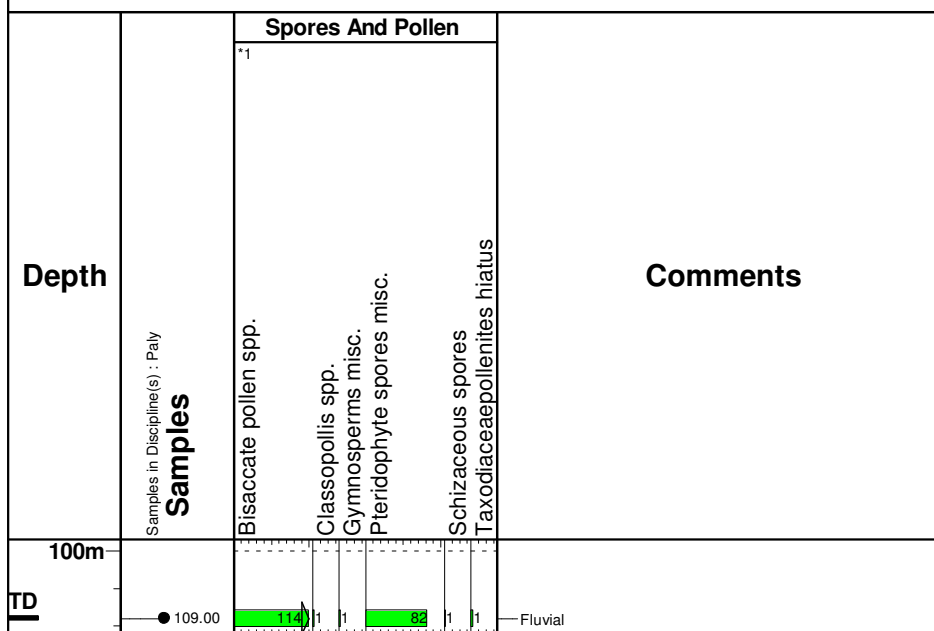
Chart date : 20 April 2009

G. DOLBY

Project : 2025
Chart : 9-17PAU

Text Keys

*1 Absolute abundance (10mm=100 counts)



10-26-93-6W4

Two samples were processed and each contained rich assemblages.

Depth: 264m
Environment: Upper estuarine
Salinity: 2⁺

Remarks

Among the numerous specimens of *Balmula tripenta* and *Nyktericysta* spp. are a few specimens of *Circulodinium brevispinosum* and *Pseudoceratium retusum*. This mix indicates a brackish environment, Zone 2+ rather than 2. The kerogen is extremely poorly sorted and dominated by vitrinite.

Depth: 259.5m
Environment: Restricted marine/lagoonal
Salinity: 3

Remarks

The assemblage contains abundant dinocysts, mostly simple (?ceratioid) forms which indicate lower than normal salinities. There are also modest numbers of such species as *Circulodinium brevispinosum* and *Palaeoperidinium cretaceum* which usually characterise Zone 3 salinities.

The extremely poor sorting and abundance of simple dinocysts suggest a restricted marine/lagoonal setting rather than an estuary.

Well Name : 10-26-93-6W4

Well Code : 20256PK

Interval : 250.00m - 270.00m

PALYNOFACIES

Scale : 1:1000

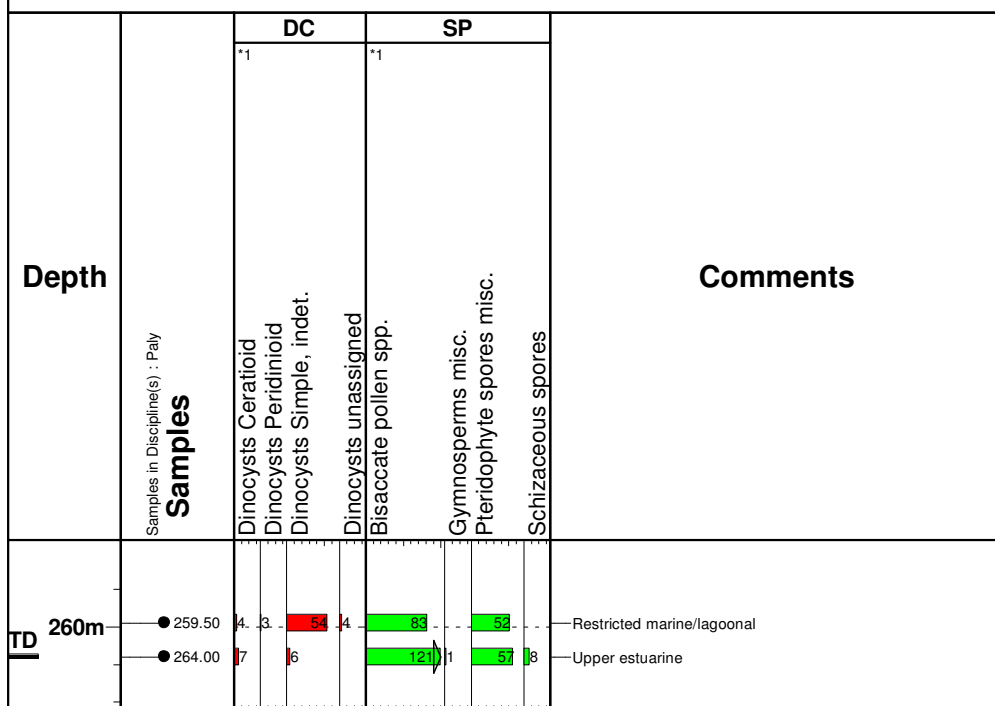
Chart date : 20 April 2009

G. DOLBY

Project : 2025
Chart : 10-26-93PA

Text Keys

*1 Absolute abundance (10mm=100 counts)



10-1-77-7W4

Four samples were processed of which three proved to be rich but the uppermost one is virtually barren.

Depth: 1194'
Environment: Fluvial
Salinity: 1

Remarks

The kerogen is fairly well sorted indicating current activity, possibly in a fluvial channel. Otherwise the assemblage resembles most of the fluvial ones in the study where bisaccate pollen are dominant.

Depths: 1151; 1130'
Environment: Probably overbank
Salinity: 1 - ?1⁺

Remarks

Although schizaceous spores comprise only 7% and 9% of the assemblages respectively, they are abundant in absolute terms. Overbank, flood-prone settings are suggested. Two specimens of *Hurlandsia rugosa* at 1151' may be indicative of a very faint saline influence as this species is known to characterise fresh to barely brackish environments. Five, indeterminate dinocysts at 1130' suggest a similar salinity level.

Depth: 1120'
Environment: ?Channel
Salinity: Indeterminable

Remarks

Only four palynomorphs are present. The kerogen appears well-sorted, probably due to winnowing in a high-energy, channel environment.

Well Name : 10-1-77-7W4

Well Code : 20257PK

Interval : 1100' - 1200'

PALYNOFACIES

Scale : 1:1000

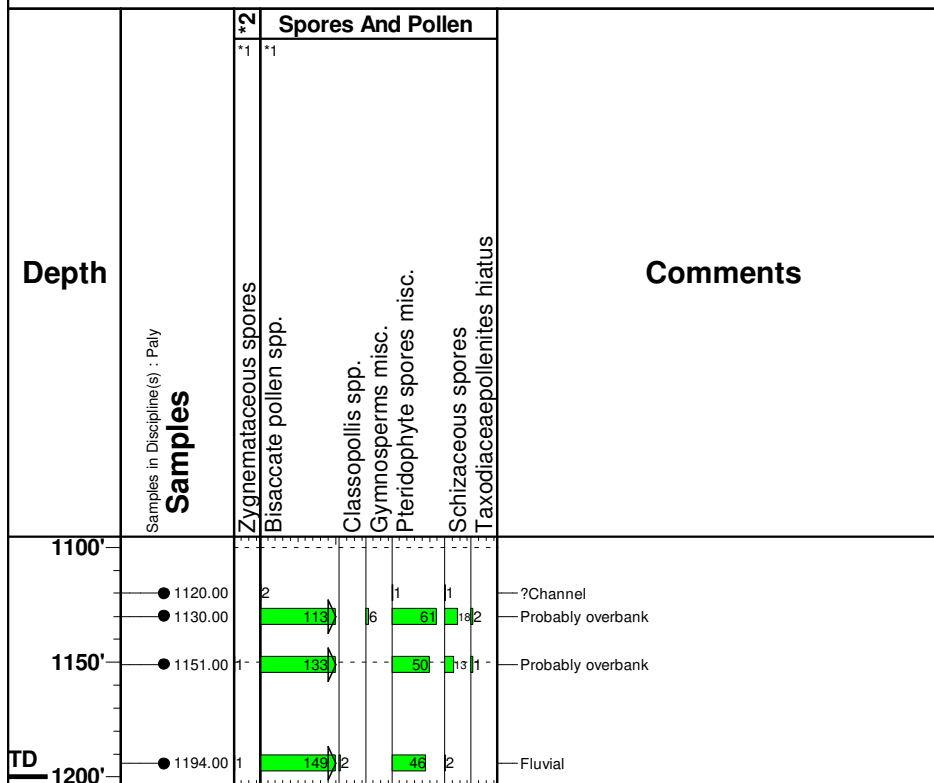
Chart date : 20 April 2009

G. DOLBY

Project : 2025
Chart : 10-1-77PA

Text Keys

- *1 Absolute abundance (10mm=100 counts)
- *2 ALBO



8-14-76-7W4

The two samples processed contained rich assemblages with brackish microplankton.

Depth: 380m
Environment: Fluvial to upper estuarine
Salinity: 1⁺ - 2⁻

Remarks

This fluvial assemblage contains a few freshwater dinocysts as well as *Hurlandsia rugosa*. Also present are small numbers of the brackish species *Nyktericysta* spp. and *Vesperopsis* spp. A very low salinity environment is indicated.

Depth: 361.6m
Environment: Restricted marine
Salinity: 3

Remarks

Circulodinium brevispinosum is abundant here in as assemblage typical of Salinity Zone 3. The lack of variety indicates a restricted environment rather than a more open estuarine setting.

Well Name : 8-14-76-7W4

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Well Code : 20258PK

Interval : 360.00m - 390.00m

PALYNOFACIES

Scale : 1:1000

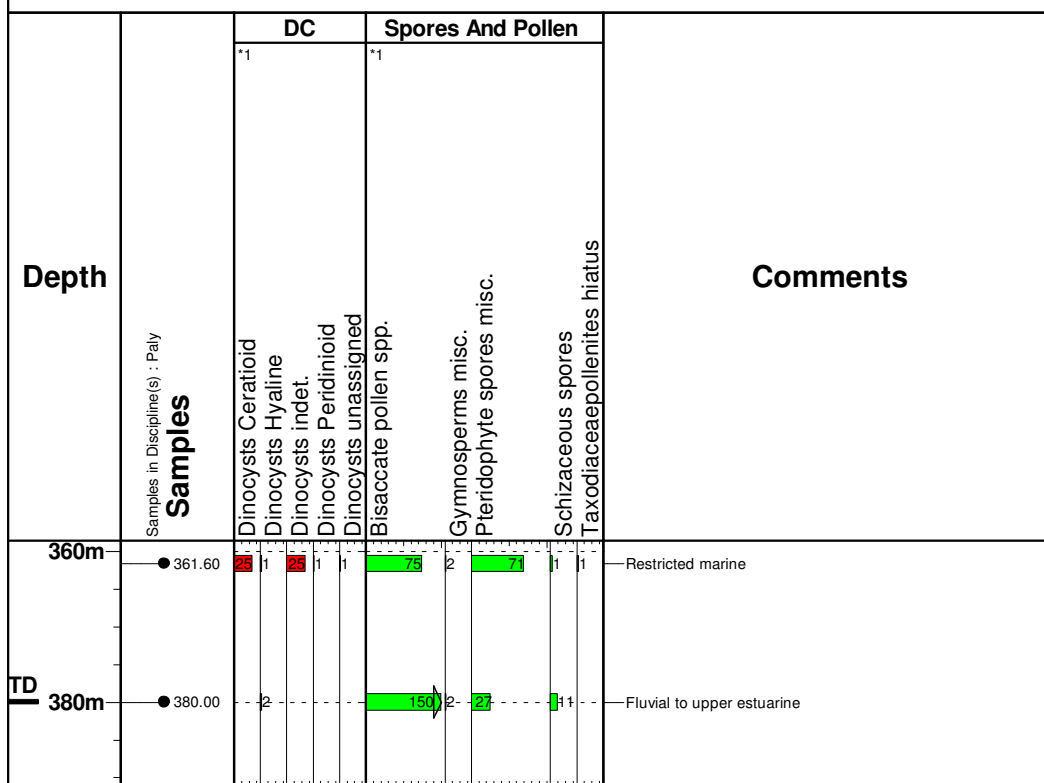
Chart date : 20 April 2009

G. DOLBY

Project : 2025
Chart : 8-14PALY

Text Keys

*1 Absolute abundance (10mm=100 counts)



11-15-77-7W4

Three samples were processed and they contain fluvial to very high estuarine assemblages.

Depth: 1195'
Environment: Fluvial
Salinity: 1 - 1⁺

Remarks

This rich assemblage contains two specimens of *Hurlandsia rugara*, a species which tolerated fresh to faintly brackish conditions.

Depth: 1150'
Environment: Upper estuarine
Salinity: 1⁺ - 2⁻

Remarks

Hurlandsia rugara and hyaline cysts are more numerous here but a small number of specimens of *Nyktericysta* spp. and *Pseudoceratium interiorensense* indicate a slightly higher salinity than at 1195:

Depth: 1089'
Environment: Fluvial
Salinity: 1

Remarks

This rich, bisaccate dominated assemblage contains only one, hyaline cyst indicating a freshwater environment.

Well Name : 11-15-77-7W4

Well Code : 20259PK

Interval : 1080' - 1200'

PALYNOFACIES

Scale : 1:1000

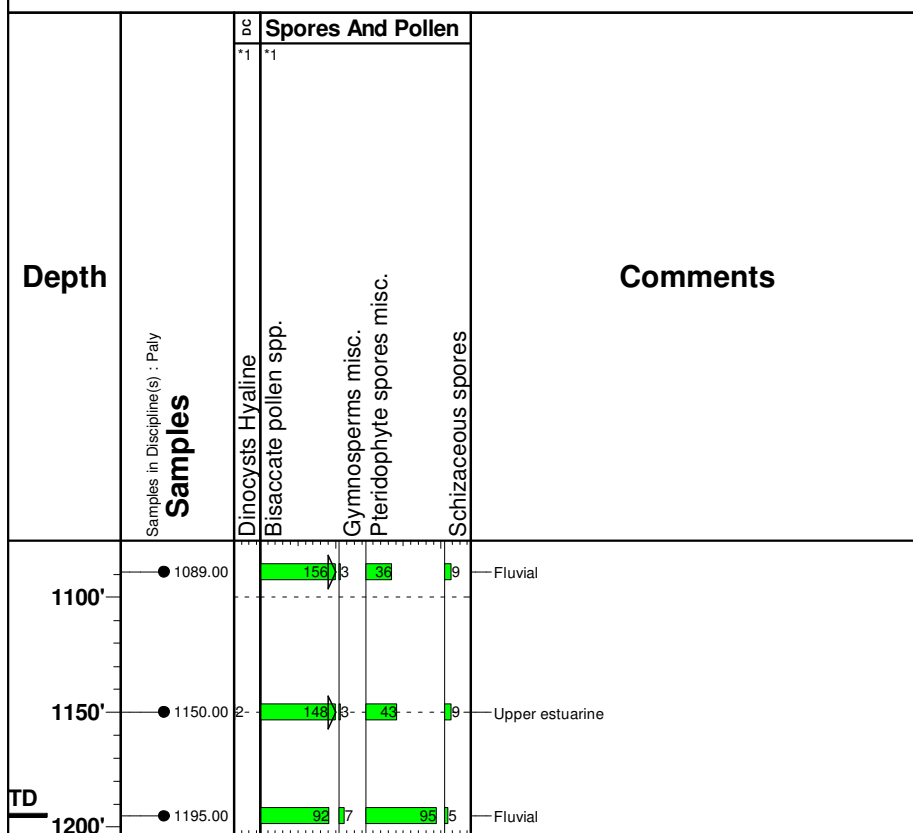
Chart date : 20 April 2009

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Project : 2025
Chart : 11-15PALY

Text Keys

*1 Absolute abundance (10mm=100 counts)



10-26-83-7W4

Three samples were processed of which the lower two are fluvial in origin. The uppermost sample was virtually barren.

Depth: 397m, 384m
Environment: Fluvial
Salinity: 1

Remarks

These assemblages are essentially similar in richness and diversity, both being dominated by bisaccate pollen. Small numbers of hyaline cysts are typical of freshwater environments.

Depth: 369m
Environment: Indeterminable
Salinity: Indeterminable

Remarks

The kerogen consists of amorphous, ?vitrinitic debris as well as bitumen. Only 12 spores and pollen were recorded.

Well Name : 10-26-83-7W4

Well Code : 202510PK

Interval : 360.00m - 400.00m

PALYNOFACIES

Scale : 1:1000

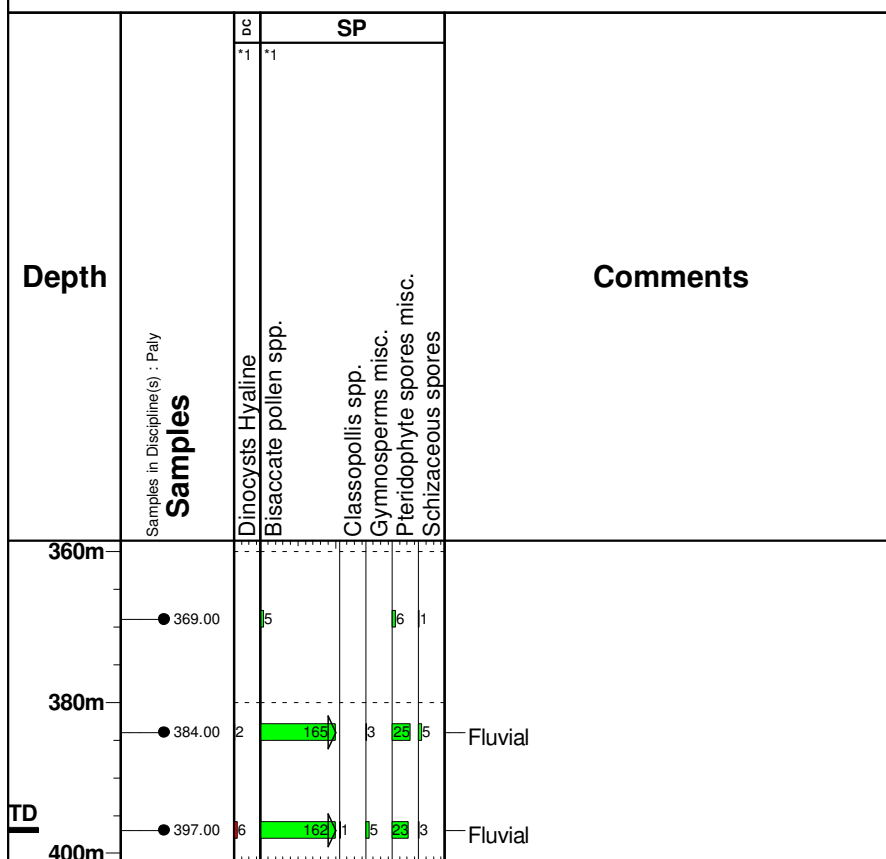
Chart date : 20 April 2009

G. DOLBY

Project : 2025
Chart : 10-26-83PA

Text Keys

*1 Absolute abundance (10mm=100 counts)



10-8-90-7W4

Of the three samples processed, the upper two contained rich fluvial assemblages but the lowermost one is too poor to interpret.

Depth: 155.2m
Environment: Indeterminable
Salinity: Indeterminable

Remarks

Apart from 29 bisaccate pollen, only 3 spores were recorded. The sample consists mainly of bitumen and a waxy residue.

Depth: 143.2m, 139.7m
Environment: Fluvial
Salinity: 1

Remarks

Both contain rich terrestrial assemblages dominated by bisaccate pollen. Spore numbers are higher in the upper sample indicating a stronger swamp influence. There are no dinocysts present.

Well Name : 10-8-90-7W4

Well Code : 202511PK

Interval : 139.00m - 156.00m PALYNOFACIES

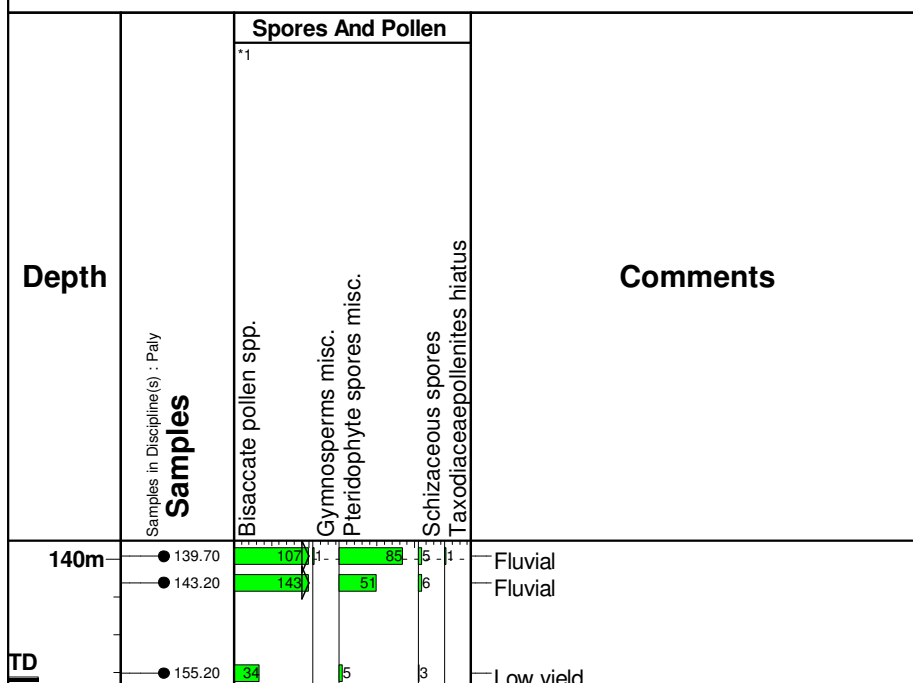
Scale : 1:1000

Chart date : 20 April 2009 G. DOLBY

Project : 2025
Chart : 10-8PALY

Text Keys

*1 Absolute abundance (10mm=100 counts)



11-8-75-8W4

Six samples were processed. The lower three are essentially of freshwater origin and the upper three contain brackish assemblages with signs of increasing salinity upsection.

Depth: 478.5m
Environment: Fluvial to very high estuarine
Salinity: 1 - 1⁺

Remarks

This is a rich assemblage dominated by small spores and pollen of probable swamp origin. Four dinocysts including *Nyktericysta* sp. and *Vesperopsis* cf. *longicornis* as well as *Hurlandsia rugosa* suggest the possibility of faintly brackish waters.

Depths: 462.5m, 459m
Environment: Fluvial
Salinity: 1

Remarks

Both assemblages are of limited composition and dominated by bisaccate pollen. Rare hyaline or indeterminate dinocysts are present but nothing to indicate a saline or brackish environment.

Depths: 444.8m, 438.2m, 426.25m
Environments: Very high estuarine; estuarine; restricted marine
Salinities: 2⁻; 3⁻; 3

Remarks

These samples are considered together as they appear to comprise a transgressive sequence.

The 444.8m sample contains a biodegraded assemblage with a modest number of Zone 2 dinocysts including *Nyktericysta* spp. and *Hapsocysta*(?) sp. The kerogen sorting is fair, indicating some current activity and a very high estuarine environment is suggested.

There is a distinct increase in the salinity level in the 438.2m sample. Dinocysts are much more abundant and include a moderate number of *Circulodinium brevispinosum* which often dominates Zone 3. Indeterminate dinocysts are very abundant but the more marine species are rare. Therefore, a Zone 3⁻ salinity in an estuarine (?mid-estuarine) setting is assigned. There is a slight tendency to bimodal sorting suggesting some tidal influence.

The 426.25m assemblage contains an abundance of Zone 3 dinocysts and the assemblage is more diverse but still somewhat restricted. There is a very slight tendency to bimodality in the kerogen suggesting tidal influence. A restricted marine environment is assigned.

Well Name : 11-8-75-8W4

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Calgary

Well Code : 202512PK

Interval : 425.00m - 480.00m

PALYNOFACIES

Scale : 1:1000

Chart date: 20 April 2009

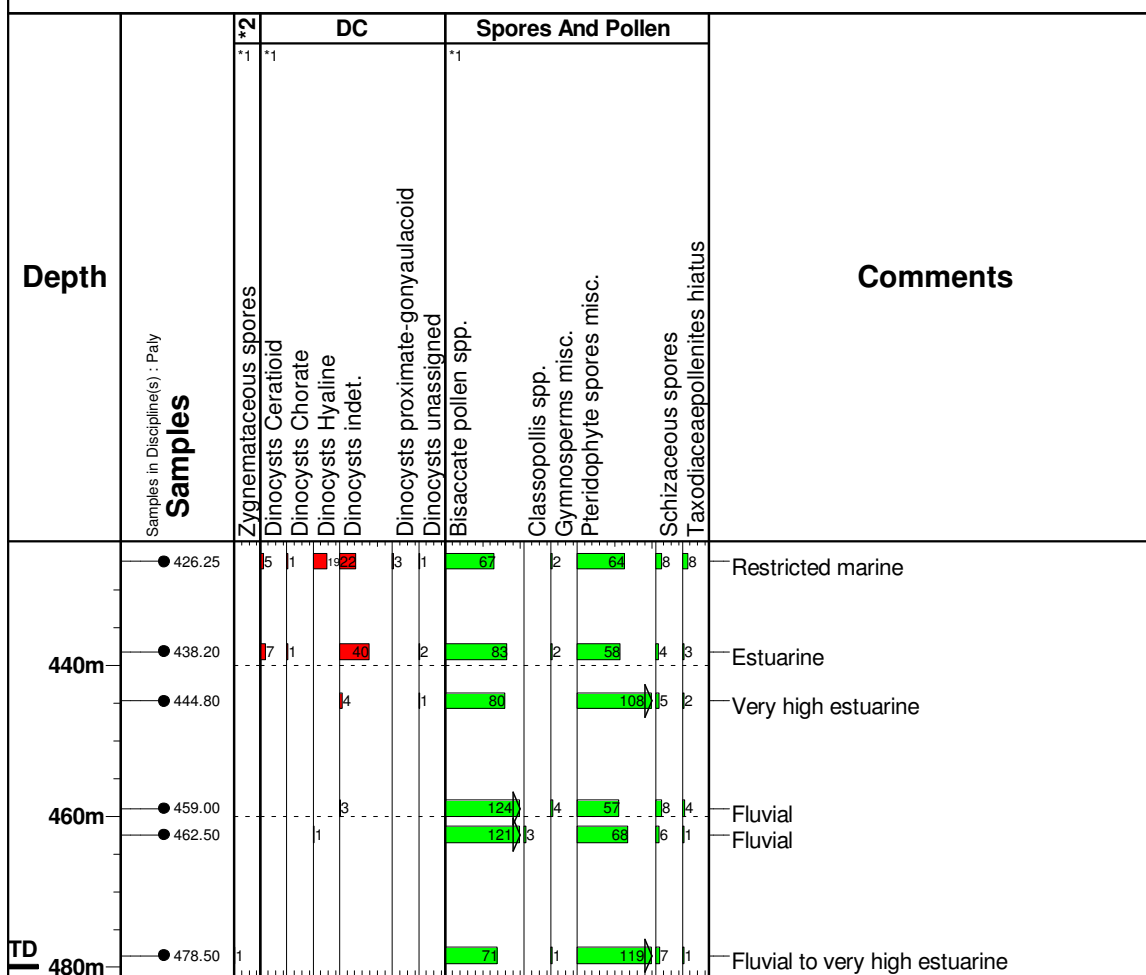
G.DOLBY

Project : 2025
Chart : 11-8PALY

Text Keys

*1 Absolute abundance (10mm=100 counts)

*2 ALBO



11-1-77-8W4

Two samples from this well were prepared. Both are rich and come from a fluvial to upper estuarine section.

Depth: 1116'
Environment: Fluvial
Salinity: 1

Remarks

This sample resembles most of the other fluvial samples in this study in that bisaccate pollen dominate and there are extremely rare, hyaline dinocysts.

Depth: 1053'
Environment: Restricted, brackish, lagoonal swamp
Salinity: 2

Remarks

Small, swamp-derived spores and pollen dominate this assemblage (83%) and bisaccate pollen comprise only 12%. This is a much more restricted assemblage than usual in this project. A moderate number of Zone 2 dinocysts such as *Nyktericysta* spp., *Vesperopsis* spp. and *Pseudoceratium interiorensense* indicate brackish salinities.

Well Name : 11-1-77-8W4

Well Code : 202513PK

Interval : 1050.00' - 1120.00'

PALYNOFACIES

Scale : 1:1000

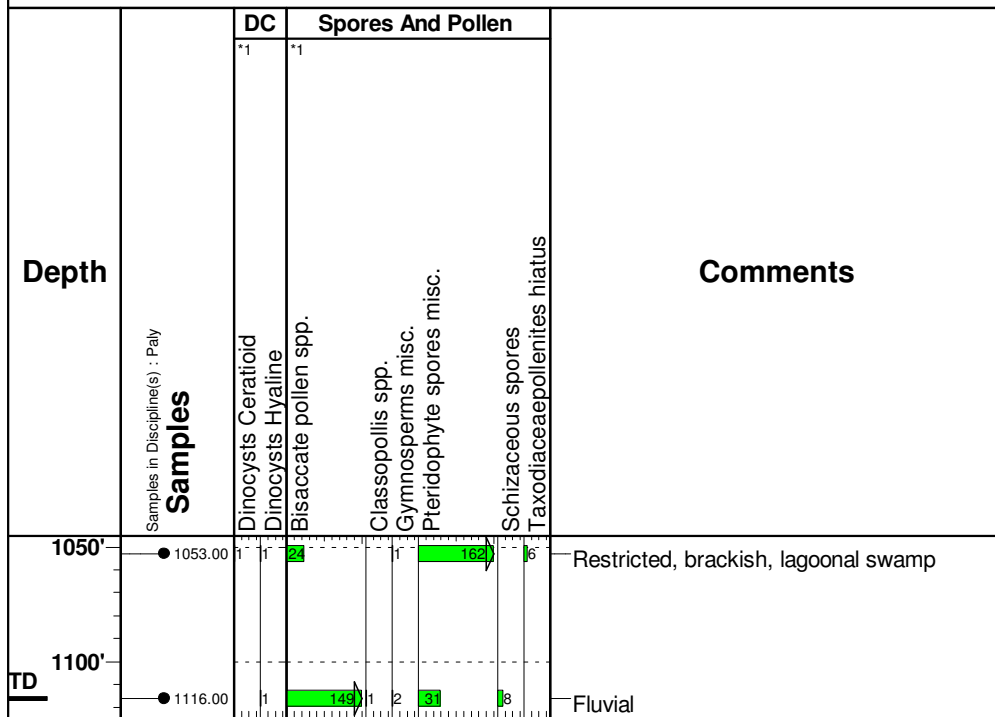
Chart date: 20 April 2009

G. DOLBY

Project : 2025
Chart : 11-1-77PALY

Text Keys

*1 Absolute abundance (10mm=100 counts)



4-14-95-11W4

Two samples were prepared from fluvial and possibly swamp margin settings respectively.

Depth: 62.05m
Environment: Fluvial
Salinity: 1

Remarks

This is dominated by bisaccate pollen (88%) and contains fewer pteridophyte spores than usual for the environment.

Depth: 49.20m
Environment: Swamp margin/overbank
Salinity: 1

Remarks

Schizaceous spores comprise 52% of the assemblage and indicate an environment subject to flooding/drying out cycles such as an overbank or floodplain setting. However, there is an unusually large number of megaspores present suggesting that the sample may have come from a swamp margin.

Well Name : 4-14-95-11W4

Well Code : 202514PK

Interval : 48.00m - 65.00m

PALYNOFACIES

Scale : 1:1000

Chart date : 20 April 2009

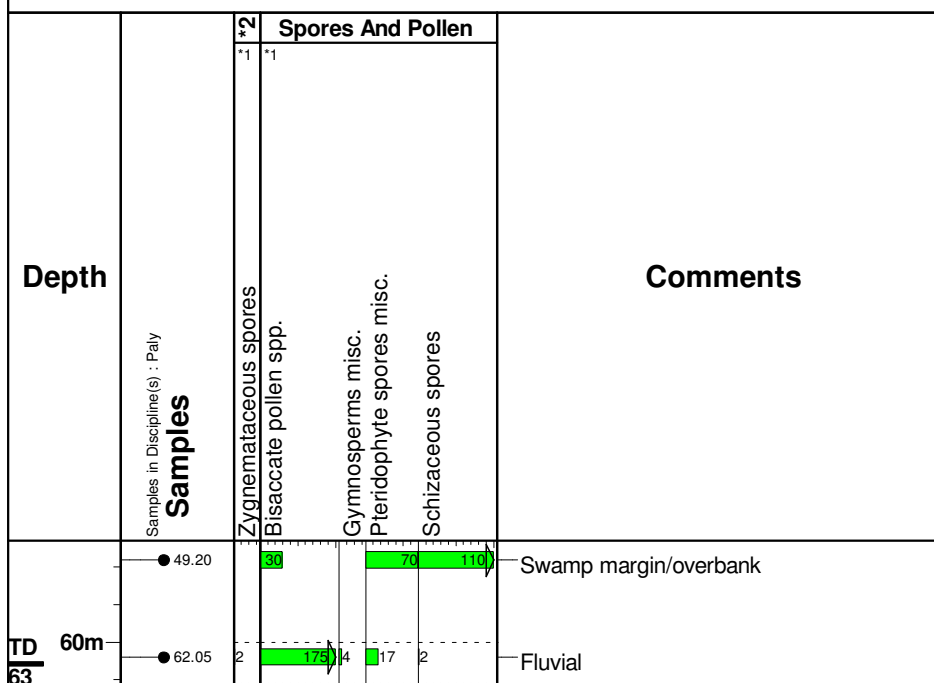
G. DOLBY

Project : 2025
Chart : 4-14PALY

Text Keys

*1 Absolute abundance (10mm=100 counts)

*2 ALBO



9-2-96-12W4

Three samples were processed, the uppermost being separated from the others by some 70m of section.

Depth: 365.84m
Environment: Overbank
Salinity: 1

Remarks

Schizaceous spores are abundant in this sample comprising 13% of the assemblages. An overbank setting subject to flooding/drying out cycles is indicated.

Depths: 359.7m, 290m
Environment: Fluvial
Salinity: 1

Remarks

Both samples contained essentially similar, bisaccate-dominated assemblages similar to other fluvial samples in this study. The lower one contains a ceratioid dinocyst but this may have been reworked as there are several Jurassic dinocysts in the assemblage.

Well Name : 9-2-96-12W4

Well Code : 202515P

Interval : 285.00m - 370.00m

PALYNOFACIES

Scale : 1:1000

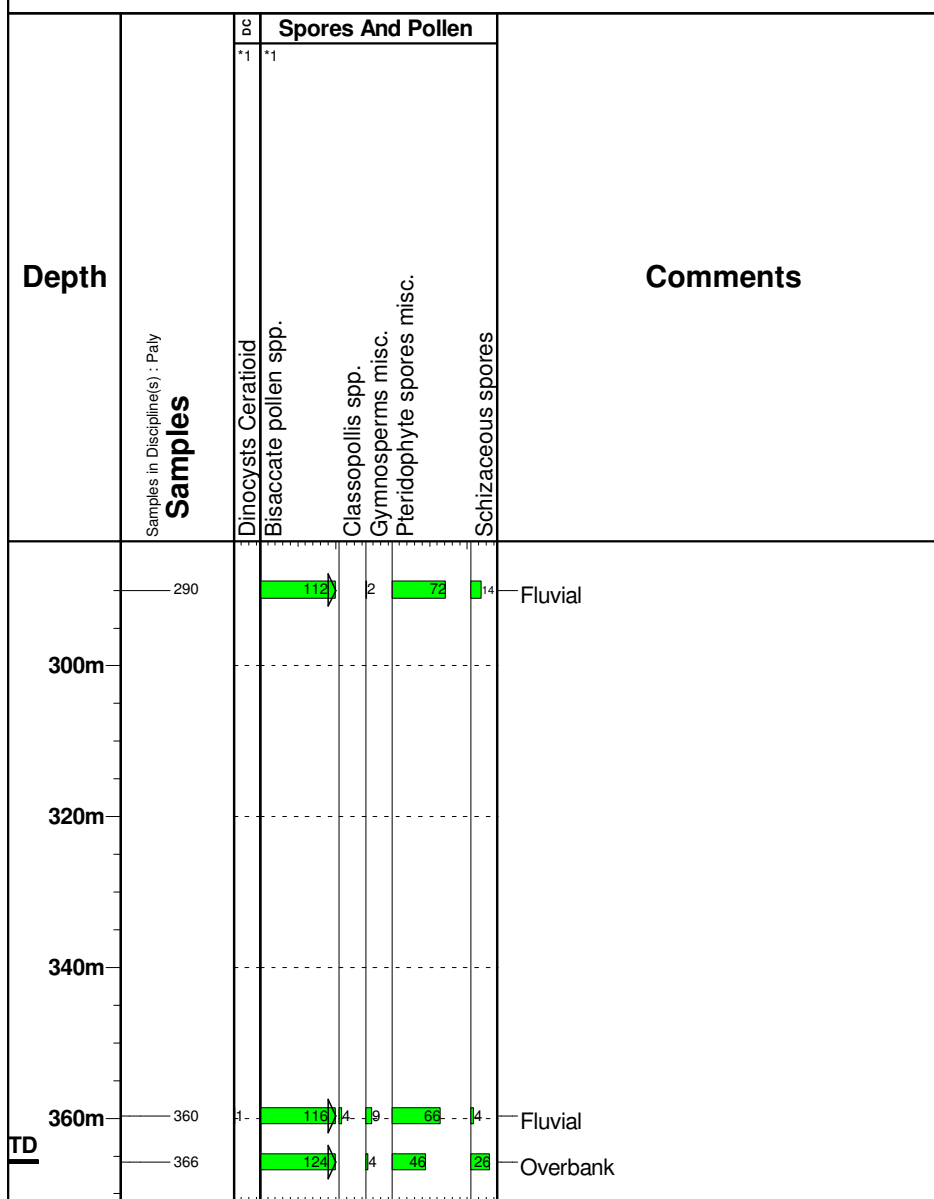
Chart date : 20 April 2009

G.DOLBY

Project : 2025
Chart : 9-2PALY

Text Keys

*1 Absolute abundance (10mm=100 counts)



16-17-101-13W4

Eight samples were processed over the 1576.56' - 1755.6' interval with five closely spaced below 1737'.

Depths: 1755.6', 1751', 1737'
Environment: Overbank flood
Salinity: 1

Remarks

The spore-pollen assemblages are similar to others from fluvial settings in this study and the proportions of schizaceous spores are above average suggesting an overbank setting. The kerogen is well sorted in 1755.6' fairly well sorted in 1751' and slightly winnowed in 1746' indicating varying levels of current activity. Laths of fusinite (bogen debris) derived from wild fires are prominent.

Depth: 1741'
Environment: Fluvial to very high estuarine
Salinities: 1⁺ - 2⁻

Remarks

This is an essentially fluvial sample but a very small number of *Nyktericysta* spp. specimens indicate a faint brackish influence.

Depth: 1737m
Environment: Fluvial
Salinity: 1

Remarks

The assemblage is little different from other fluvial samples in this study. A single specimen of *Nyktericysta* sp. suggests the possibility of a very faint brackish influence.

Depth: 1681'
Environment: ?Upper estuarine
Salinity: ?1⁺ - ?3

Remarks

The yield from this sample was low and the organic residue is dominated by bitumen and waxy residue. The spore/pollen assemblage is typical of an open, fluvial or estuarine environment. A single specimen of *Hurlandsia rugosa* is more typical of fluvial to very high estuarine settings but a single specimen of *Circulodinium brevispinosum* suggests that the salinity may be as high as 3. The yield is too small to be definitive.

Depth: 1626.1', 1576.56'
Environment: Restricted marine
Salinity: 3, 3⁻ - 3

Remarks

The lower sample is rich in Zone 3 indicators such as *Circulodinium brevispinosum* and *Palaeoperidinium cretaceum*. The assemblage is somewhat restricted in that more open marine species are relatively rare.

In the upper sample, the assemblage is slightly more diverse with the introduction of numerous to abundant Zone 2 markers such as *Nyktericysta* spp. and *Vesperopsis* spp.

It is possible that the lower sample is distal lagoonal (seaward) in origin and the upper one more proximal (landward).

Well Name : 16-17-101-13W4

**G.Dolby and Associates
Calgary**

Well Code : 202516PK

Interval : 1575' - 1756'

PALYNOFACIES

Scale : 1:750

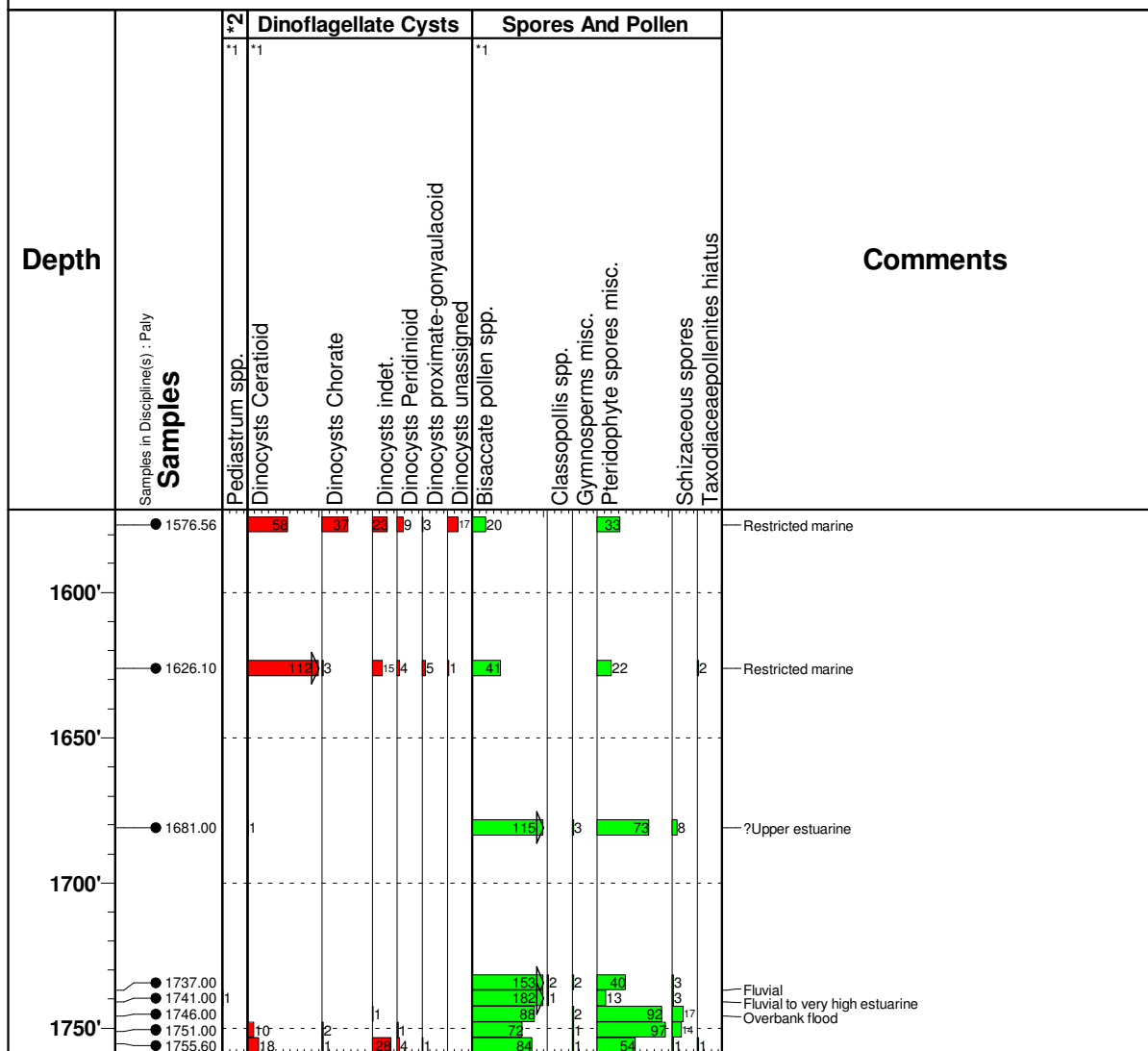
Chart date: 20 April 2009

G.DOLBY

Project : 2025
Chart : 16-17PALY

Text Keys

- *1 Absolute abundance (10mm=100 counts)
- *2 ALBO



11-9-99-15W4

Four samples were processed and the results closely resemble those from the 16-17-101-13W4 well.

Depth: 556m
Environment: ? Upper estuarine
Salinity: ?1⁺ - ?3

Remarks

This is a sparse assemblage of essentially open, fluvial character. However, a single specimen of *Circulodinium brevispinosum* suggests that the salinity may be as high as 3 but the yield is too poor to be definitive. The sample closely resembles 1681' in 16-17-101-13W4.

Depth: 444m
Environment: Very high estuarine
Salinity: 2⁻

Remarks

This is an essentially fluvial assemblage with very small numbers of *Nyktericysta* spp. and *Vesperopsis* spp. indicating a faint brackish influence.

Depths: 436m, 430m
Environment: Restricted marine
Salinity: 3

Remarks

The lower sample is dominated by simple, ceratioid dinocysts and *Palaeoperidinium cretaceum*. The dinocyst assemblage composition is relatively limited indicating a restricted marine environment.

The 430m assemblage is much more diverse with numerous specimens of more marine taxa such as *Oligosphaeridium* spp. and *Cleistosphaeridium* spp. However, brackish forms such as *Nyktericysta* spp. are also numerous.

It is possible that the lower sample is from a proximal (landward) lagoonal setting whereas the upper one is more distal (seaward).

Well Name : 11-9-99-15W4

G.Dolby and Associates
Calgary

Well Code : 202517PK

Interval : 425m - 560m

PALYNOFACIES

Scale : 1:1500

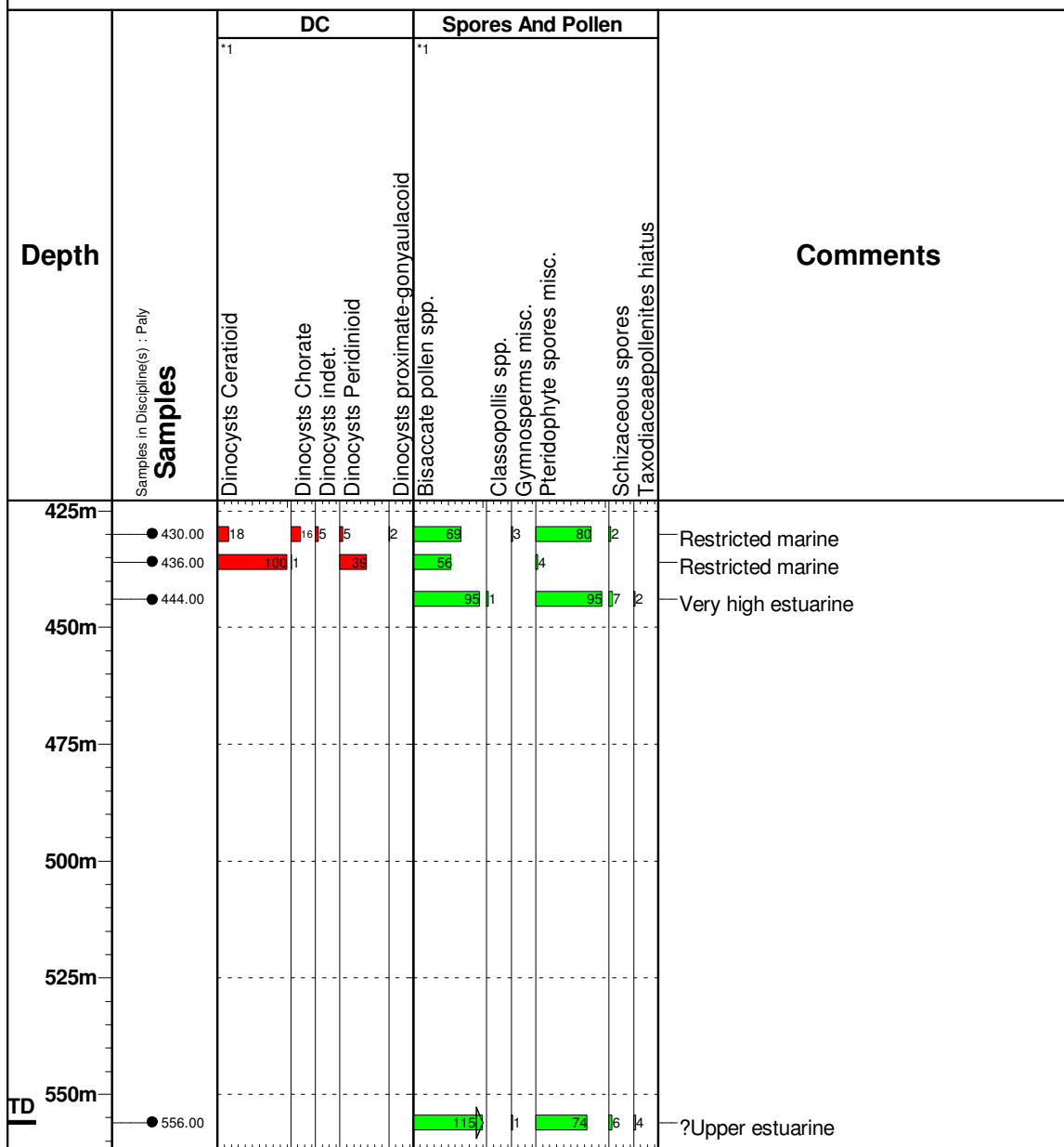
Chart date : 20 April 2009

G. DOLBY

Project : 2025
Chart : 11-9-99PAL

Text Keys

*1 Absolute abundance (10mm=100 counts)



In the previous study, two zones were defined in the deeper parts of the basin. The lower one, characterised by *Trilobosporites* spp. was assigned to the Barremian. A thin zone overlying this, characterised by *Aequitriradites "grandis"*, was assigned to the basal Aptian. None of the coreholes in this study penetrated these zones.

Most of the corehole sections yielded long-ranging spore and pollen assemblages typical of the Aptian and Albian. Some samples also contain brackish to freshwater microplankton. The uppermost assemblages in 8 of the coreholes contain marine microplankton most of which have relatively long stratigraphic ranges. These probably come from the Wabiskaw. The uppermost sample (430m) in 11-9-99-15W4 contains *Leptodinium delicatum* which is usually considered to be an Albian species. It is present in the Horse River Section (Report 9933) which was assigned latest Aptian - basal Albian age.

A distinctive cyst, temporarily assigned to *Hapsocysta* (?) which may have potential for correlation, occurs in the following samples:

15-35-76-4W4	352m
8-14-76-7W4	361.6m
11-8-75-8W4	438.2m, 444.8m
11-9-99-15W4	436m

The first appearances of a number of species were tabulated for the wells in Report 9933, p. 35. The equivalent data are tabulated here for future use in the RASC computer program.

The palynomorph occurrences for each well are plotted in semi-quantitative abundance format (Appendix).

TABLE 1						
BASES	10-26-83-7W4	15-35-76-4W4	10-5-95-5W4	6-15-76-6W4	9-17-88-6W4	10-26-93-6W4
Foraminisporis asymmetricus	384m	366.5m		365.65m	109m	264m
Dictyotriletes granulatus	384m	366.5m	244.55m		109m	259.5m
Concavissimisporites tribotrys	397m	366.5m				
C. trioreticulosus	397m			365.65m		264m
C. purverulentus	397m	357m	244.55m	365.65m	109m	264m
Microreticulatisporites uniformis	397m			351.3m	109m	264m
OTHER BASES						
Cicatricosisporites augustus		366.5m		365.65m		264m
Appendicisporites bilateralis						
A. potomacensis	384m					
A. erdtmannii						
Plicatella jansonii		366.5m				
Kuylisporites lunaris						
BASES	10-1-77-7W4	8-14-76-7W4	11-15-77-7W4	10-26-83-7W	10-8-90-7W4	11-8-75-8W4
Foraminisporis asymmetricus	1194'	380m	1195'	384m	139.7m	478.5m
Dictyotriletes granulatus	1151'	381m		384m	139.7m	444.8m
Concavissimisporites tribotrys	1194'		1195'	397m		
C. trioreticulosus	1151'	381m	1195'	397m		478.5m
C. purverulentus	1194'	381m	1195'	397m	143.2m	478.5m
Microreticulatisporites uniformis	1130'	361.6m		397m	143.2m	426.25m
OTHER BASES						
Cicatricosisporites augustus	1194'	380m	1195'		139.7m	478.5m
Appendicisporites bilateralis						
A. potomacensis	1151'			384m		
A. erdtmannii	1151'	380m	1150'			478.5m
Plicatella jansonii						
Kuylisporites lunaris						
BASES	11-1-77-8W4	4-14-95-11W4	9-2-96-12W4	16-17-101-13	11-9-99-15W4	
Foraminisporis asymmetricus		492m	365.84m	1751m	556m	
Dictyotriletes granulatus				1741'	444m	
Concavissimisporites tribotrys				1737'		
C. trioreticulosus	1116'					
C. purverulentus	1116'	492m		1751'	556m	
Microreticulatisporites uniformis	1053'	492m	365.84m		436m	
OTHER BASES						
Cicatricosisporites augustus	1116'	49.2m	365.84m	1751'	444m	
Appendicisporites bilateralis						
A. potomacensis	1116'					
A. erdtmannii						
Plicatella jansonii						
Kuylisporites lunaris			365.4m	1741'		

Twenty outcrop samples were processed and the data are presented on a spreadsheet. The Stoney Rapids sample is from the Late Albian and not from the McMurray.

Daphne Island West

Samples: 1 - 5, 9
Environment: Fluvial
Salinity: 1

Remarks

All the samples yielded bisaccate dominated assemblages similar to other fluvial samples in this study. Bogen debris from wildfires is prominent in #1 and #2 and these two assemblages also contain a significant number of cycad pollen grains which are usually rare. It is possible that these plants were fire survivors producing pollen before the other vegetation re-established.

Samples: 6 - 8, 10
Environment: Fluvial channel
Salinity: 1

Remarks

The sample 6 residue is well sorted and comprised of fusinite and oxidized vitrinite but not palynomorphs. A high energy, fluvial channel is suggested. Samples 7, 8 and 10 contain moderate numbers of spores and pollen and the degree of sorting is not so marked. These probably come from low-energy channels.

Daphne Island East

Environments: Indeterminable
Salinity: Indeterminable

Remarks

The residue consisted of amorphous ?vitrinitic particles and bitumen only.

Pierre Creek

Sample: Lower
Environment: ?Channel
Salinity: 1

Remarks

A poor yield dominated by bitumen and wax. Rare pollen and large laths of vitrinite suggest a well sorted kerogen consistent with a channel environment.

Sample: Upper
Environment: Overbank flood
Salinity: 1

Remarks

Schizaceous spores are abundant and comprise 9% of the assemblage. These, with the high proportion of spore-pollen debris suggest an overbank flood deposit.

Marl

Environment: ?Fluvial
Salinity: ?1

Remarks

The organic residue is dominated by bitumen. The spore-pollen assemblage resembles the other fluvial samples in this study however, the poor preservation of the palynomorphs (biodegraded) is not typical.

Euymundson Creek

Environment: Indeterminable
Salinity: Indeterminable

Remarks

The residue is too poor to interpret. It is dominated by bitumen and amorphous ?vitrinite.

Sink Hole North**Environment:** Indeterminable**Salinity:** 1**Remarks**

This sample yielded a small assemblage of spores and pollen. If this is a sinkhole fill sample, it was probably deposited in fresh water.

Athabasca River**Environment:** Indeterminable**Salinity:** Indeterminable**Remarks**

The residue consists of amorphous ?vitrinitic particles only.

Christina River**Environment:** Fluvial**Salinity:** 1**Remarks**

This is a rich and diverse assemblage but bisaccate pollen dominate as they do in the other fluvial samples in this study.

Syncrude North Mine**Environment:** Indeterminable**Salinity:** Indeterminable**Remarks**

The residue consists almost entirely of bitumen and some vitrinite. There are too few spores and pollen to interpret the environment of deposition.

Stoney Rapids**Environments:** Marine**Salinity:** 4**Remarks**

This is a Late Albian sample and is not part of the McMurray. The extremely rich and diverse dinocyst assemblage is of open marine origin.

OUTCROPS: Palynofacies data

	Daphne W1	Daphne W2	Daphne W3	Daphne W4	Daphne W5	Daphne W7	Daphne W8
Spores & pollen							
Bisaccate pollen	57	57	70	67	71.5	52	66
Gymnosperms misc.	0.5	6.5	4.5	1		4	2.5
Pteridophyte spores	80	33.5	33	29	27	42	29
Schizaceae	2	2	2	0.5	0.5		2
Taxodiaceae	0.5	0.5	0.5	0.5	1	2	
Classopollis				0.5			0.5
Angiosperms		0.5					
Algae				1.5			
	Daphne W9	Daphne W10	Pierre Uppe	Marl	Sink Hole N.	Christina R.	
Spores & pollen							
Bisaccate pollen	75.5	62	44	51	56	52	
Gymnosperms misc.	2.5	3.5		3	4		
Pteridophyte spores	21.5	33	47	46	37	47.5	
Schizaceae		0.5	9		3	0.5	
Taxodiaceae	0.5						
Classopollis							
Angiosperms							
Algae		1		1			

Twenty outcrop samples were processed and one of these (Stoney Rapids, Athabasca River) is much younger than the McMurray and another four yielded very little material.

Daphne Island West

Samples: 1 - 10
Age: Probably Aptian

Remarks

The 10 samples from this section yielded variable assemblages of relatively long-ranging spores and pollen, typical of the Aptian and Albian of the area. Coming from the McMurray, they are most probably Aptian in age.

Significant species

<i>Concavissimisporites purverulentus</i>	<i>C. apiverrucatus</i>
<i>C. irroratus</i>	<i>C. subgranulosus</i>
<i>Cicatricosisporites hallei</i>	<i>Cic. ludbrookii</i>
<i>C. hughesii</i>	<i>C. augustus</i>
<i>C. exilioides</i>	<i>C. cf. imbricatus</i>
<i>Polycingulatisporites reduncus</i>	<i>Crybelosporites vectensis</i>
<i>Densoisporites microrugulosus</i>	<i>D. velatus</i>
<i>Kuylisporites lunaris</i>	<i>Microreticulatisporites uniformis</i>
<i>Foraminisporis wonthaggiensis</i>	<i>F. dailyi</i>
<i>F. asymmetricus</i>	<i>Pilosporites trichopapillosus</i>
<i>Ischyosporites areolatus</i>	<i>I. foveolatus</i>
<i>I. pseudoreticulatus</i>	<i>Aequitriradites spinulosus</i>
<i>Couperisporites tabulatus</i>	<i>Cycadopites sp.</i>

Daphne Island East

Sample: 1
Age: Indeterminable

Remarks

A barren sample.

Pierre Creek

Sample: Lower
Age: Indeterminable

Remarks

An essentially barren sample.

Sample: Upper
Age: Probably Aptian

Remarks

This rich assemblage is grossly similar to those from Daphne Island West but with the addition of:

Concavissimisporites tribotrys
Contignisporites cooksonii

C. trioreticulosus
Plicatella jansonii

Marl
Age:

Probably Aptian

Remarks

This small degraded assemblage contains a few of the elements seen in Daphne Island West.

Euymundson Creek

Age: Indeterminable

Remarks

An essentially barren sample.

Sink Hole North

Sample: 1
Age: Cretaceous

Remarks

A poor sample of long-ranging pollen with rare spores. Of the latter, the only species of note are *Cicatricosisporites* cf. *hughesii* and *Concavissimisporites* cf. *irroratus*.

Athabasca River Section 2

Sample: #1, 3.3m
Age: Indeterminable

Remarks

A barren sample.

Christina River

Age: Probably Aptian

Remarks

This rich assemblage is similar to those from Daphne Island West and Pierre Creek.

Syncrude N. Mine

Sample: Middle McMurray
Age: Presumably Aptian

Remarks

The residue consists of amorphous and oily material. Spores and pollen are extremely rare and are long-ranging, Early Cretaceous species.

Stoney Rapids, Athabasca River

Age: Mid to Late (but not latest) Albian

Remarks

This is an extremely rich marine assemblage containing several mid Albian and younger species such as *Chichaouadinium vestitum*, *Luxadinium propatulum*, *Batioladinium shaftesburyense*, *Litosphaeridium arundum*, *Stephodinium australicum*, *Apteodinium reticulatum* and *Odontochitina singhii*.

Assemblages such as this characterise the Joli Fou, Viking and Lower Westgate formations, however the lack of *Ovoidinium* spp. suggests that the sample is more likely from the Joli Fou or Viking.

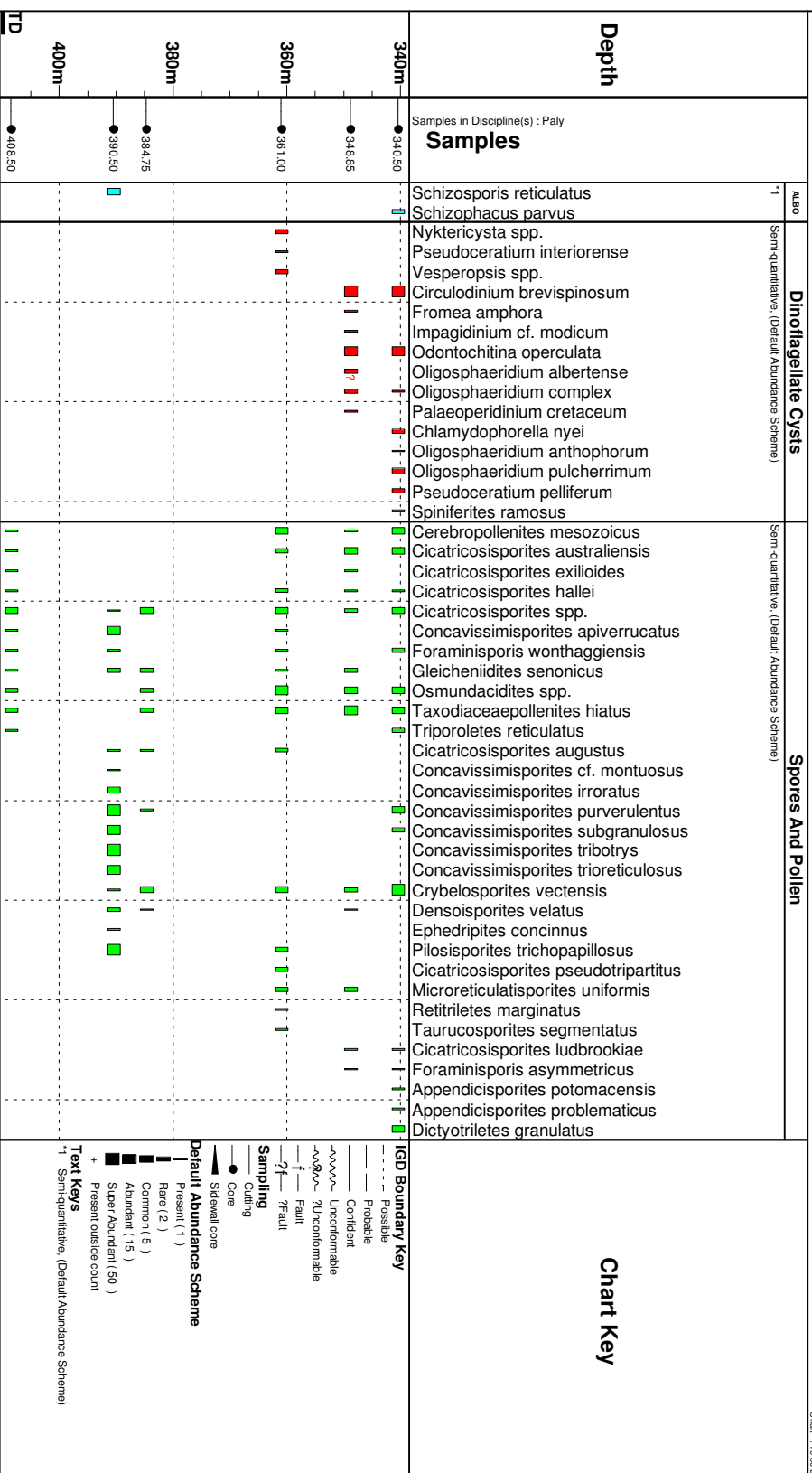
Significant species

Chichaoudinium vestitum (A)
Batioladinium shaftesburyense
Litosphaeridium arundum
Apteodinium reticulutum
O. operculata
Trichodinium spinosum
Exochodinium scitulum

Luxadinium propatulum
B. jaegerii
Stephodinium australicum
Odontochitina singhii
Ellipsodictyum imperfectum
Pterodinium cingulatum
Pseudoceratium retusum

APPENDIX

Biostratigraphic range charts.



Well Name : 15-35-76-4W4

**G.Dolby and Associates
Calgary**

Well Code: 20252B

Interval : 350.00m - 367.00m

CHART 2

Scale : 1:1000

SPECIES DISTRIBUTION

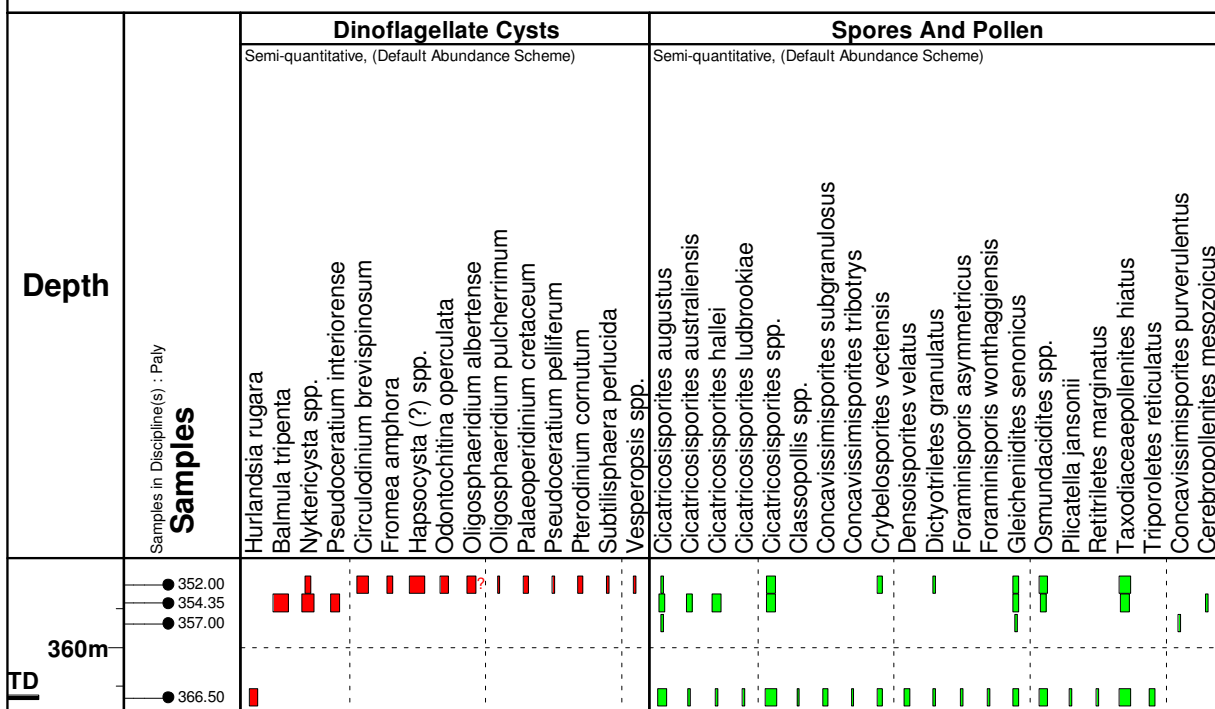
Chart date: 20 April 2009

G. DOLBY

Project : 2025
Chart : 15-35 BIC

Default Abundance Scheme

- Present (1)
- Rare (2)
- Common (5)
- Abundant (15)
- Super Abundant (50)
- + Present outside count



Well Name : 10-05-95-5W4

Well Code : 20253B

Interval : 240.00m - 250.00m

CHART 3

Scale : 1:1000

SPECIES DISTRIBUTION

Chart date: 20 April 2009

G. DOLBY

Project : 2025
Chart : 10-05B10

Default Abundance Scheme

- Present (1)
- Rare (2)
- Common (5)
- Abundant (15)
- Super Abundant (50)
- + Present outside count

Text Keys

*1 Semi-quantitative, (Default Abundance Scheme)

*2 ALBO

Depth	Samples	*2		DC	Spores And Pollen
		*1	*1		Semi-quantitative, (Default Abundance Scheme)
	Samples in Discipline(s) : Paly				
	Samples				
	Lecaniella foveata				
	Balmula tripenta				
	Circulodinium brevispinosum				
	Hurlandsia rugata				
	Nyctericysta spp.				
	Pseudoceratium interiorensense				
	Vesperopsis spp.				
	Cerebropollenites mesozoicus				
	Cicatricosisporites australiensis				
	Cicatricosisporites ludbrookiae				
	Cicatricosisporites spp.				
	Concavissimisporites purverulentus				
	Concavissimisporites subgranulosus				
	Crybelosporites vectensis				
	Dictyotrites granulatus				
	Foraminisporis wonthaggiensis				
	Gleicheniidites senonicus				
	Osmundacidites spp.				
	Retritiletes austroclavatidites				
	Retritiletes reticulumsporites				
	Taurucosporites segmentatus				
	Taxodiaceapollenites hiatus				
	Tigrisporites scurrandus				
	Triporoletes reticulatus				
TD	240m				
	● 244.55				

Well Name : 6-15-76-6W4

G.Dolby and Associates
Calgary

Well Code : 20254B

Interval : 342.00m - 366.00m

CHART 4

Scale : 1:1000

SPECIES DISTRIBUTION

Chart date: 20 April 2009

G.DOLBY

Project : 2025
Chart : 6-15BIO

Default Abundance Scheme

- Present (1)
- Rare (2)
- Common (5)
- Abundant (15)
- Super Abundant (50)
- + Present outside count

Text Keys

- *1 Semi-quantitative, (Default Abundance Scheme)
- *2 ALBO

Depth	Samples Samples in Discipline(s) : Paly	*2	DC	Spores And Pollen
		*1	*1	Semi-quantitative, (Default Abundance Scheme)
		Schizophacus parvus		
		Circulodinium brevispinosum		
		Fromea amphora		
		Nyctericysta spp.		
		Oligosphaeridium albertense		
		Palaeoperidinium cretaceum		
		Pseudoceratium pelliferum		
		Vesperopsis spp.		
		Cerebropollenites mesozoicus		
		Cicatricosisporites augustus		
		Cicatricosisporites australiensis		
		Cicatricosisporites hallei		
		Cicatricosisporites hughesii		
		Cicatricosisporites ludbrookiae		
		Cicatricosisporites spp.		
		Classopolis spp.		
		Concavissimisporites purverulentus		
		Concavissimisporites trioreticulosus		
		Crybelosporites vectensis		
		Foraminisporis asymmetricus		
		Gleicheniidites senonicus		
		Osmundacidites spp.		
		Pilosporites trichopapillosus		
		Taxodiaceapollenites hiatus		
		Triporoletes reticulatus		
		Aequitriradites verrucosus		
		Calliasporites dampieri		
		Concavissimisporites apiverrucatus		
		Concavissimisporites subgranulosus		
		Contignisporites cooksoniae		
		Foraminisporis wonthaggiensis		
		Microreticulatisporites uniformis		
		Microreticulatisporites "interruptus"		

Well Name : 9-17-88-6W4

Well Code : 20255B

Interval : 100.00m - 110.00m

CHART 5

Scale : 1:1000







SPECIES DISTRIBUTION

Chart date: 20 April 2009

G. DOLBY

Project : 2025
Chart : 9-17BIC

Default Abundance Scheme

-  Present (1)
-  Rare (2)
-  Common (5)
-  Abundant (15)
-  Super Abundant (50)
-  Present outside count

Text Keys

*1 Semi-quantitative, (Default Abundance Scheme)

Depth	Samples	DC	Spores And Pollen
		*1	Semi-quantitative, (Default Abundance Scheme)
		Hurlandsia rugata	
		Nyctericysta spp.	
		Pseudoceratium interiorensense	
		Aequitriradites spinulosus	
		Cerebropollenites mesozoicus	
		Cicatricosisporites australiensis	
		Cicatricosisporites hallei	
		Cicatricosisporites ludbrookiae	
		Cicatricosisporites spp.	
		Classopollis spp.	
		Concavissimisporites apiverrucatus	
		Concavissimisporites purverulentus	
		Concavissimisporites subgranulosus	
		Crybelosporites vectensis	
		Dictyotriletes granulatus	
		Foraminisporis asymmetricus	
		Foraminisporis wonthaggiensis	
		Januasporites spiniferus	
		Microreticulatisporites uniformis	
		Osmundacidites spp.	
		Perinopollenites elatoides	
		Retitriletes austroclavatidites	
		Taxodiaceapollenites hiatus	
		Triporoletes reticulatus	
100m			
TD	● 109.00		

Project: 2025
Chart : 10-26-93B

Well Name : 10-1-77-7W4

Well Code : 20257B

Interval : 1100' - 1200'

Scale : 1:1000

Chart date: 20 April 2009

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CHART 7

SPECIES DISTRIBUTION

G. DOLBY

Default Abundance Scheme

- Present (1)
- Rare (2)
- Common (5)
- Abundant (15)
- Super Abundant (50)
- + Present outside count

Text Keys

*1 Semi-quantitative, (Default Abundance Scheme)

Depth	Samples		Spores And Pollen
	ALBO	DC	
1100'	*1	*1	Semi-quantitative, (Default Abundance Scheme)
1150'	● 1120.00 ● 1130.00	■	Schizophacus parvus Schizosporis reticulatus Hurlandsia rugara Dinocysts indet.
			Aequitriradites "grandis" Aequitriradites spinulosus Callialasporites dampieri Cerebropollenites mesozoicus Cicatricosisporites augustus Cicatricosisporites australiensis Cicatricosisporites ludbrookiae Cicatricosisporites spp. Classopollis spp. Concavissimisporites apiverrucatus Concavissimisporites purverulentus Concavissimisporites subgranulosus Concavissimisporites tribotrys Contignisporites cooksoniae Couperisporites tabulatus Crybelosporites vectensis Foraminisporis asymmetricus Foraminisporis wonthaggiensis Gleicheniidites senonicus Osmundacidites spp. Pilosisporites trichopapillosus Retitriletes austroclavatidites Retitriletes reticulumsporites Triporoletes reticulatus Appendicisporites erdtmannii Appendicisporites potomacensis Callialasporites trilobatus Cicatricosisporites halleii Cicatricosisporites hughesii Cicatricosisporites pseudotripartitus Concavissimisporites cf. montuosus Concavissimisporites trioreticulosus Dictyotriletes granulatus Retitriletes marginatus Taxodiaceapollenites hiatus Tigrisporites scurrandus Cicatricosisporites cf. mohrioides Contignisporites glebulentus Microreticulatisporites uniformis
TD 1200'	● 1194.00	■	

Well Name : 8-14-76-7W4

G.Dolby and Associates
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Well Code : 20258B

Interval : 360.00m - 390.00m

CHART 8

Scale : 1:1000

SPECIES DISTRIBUTION

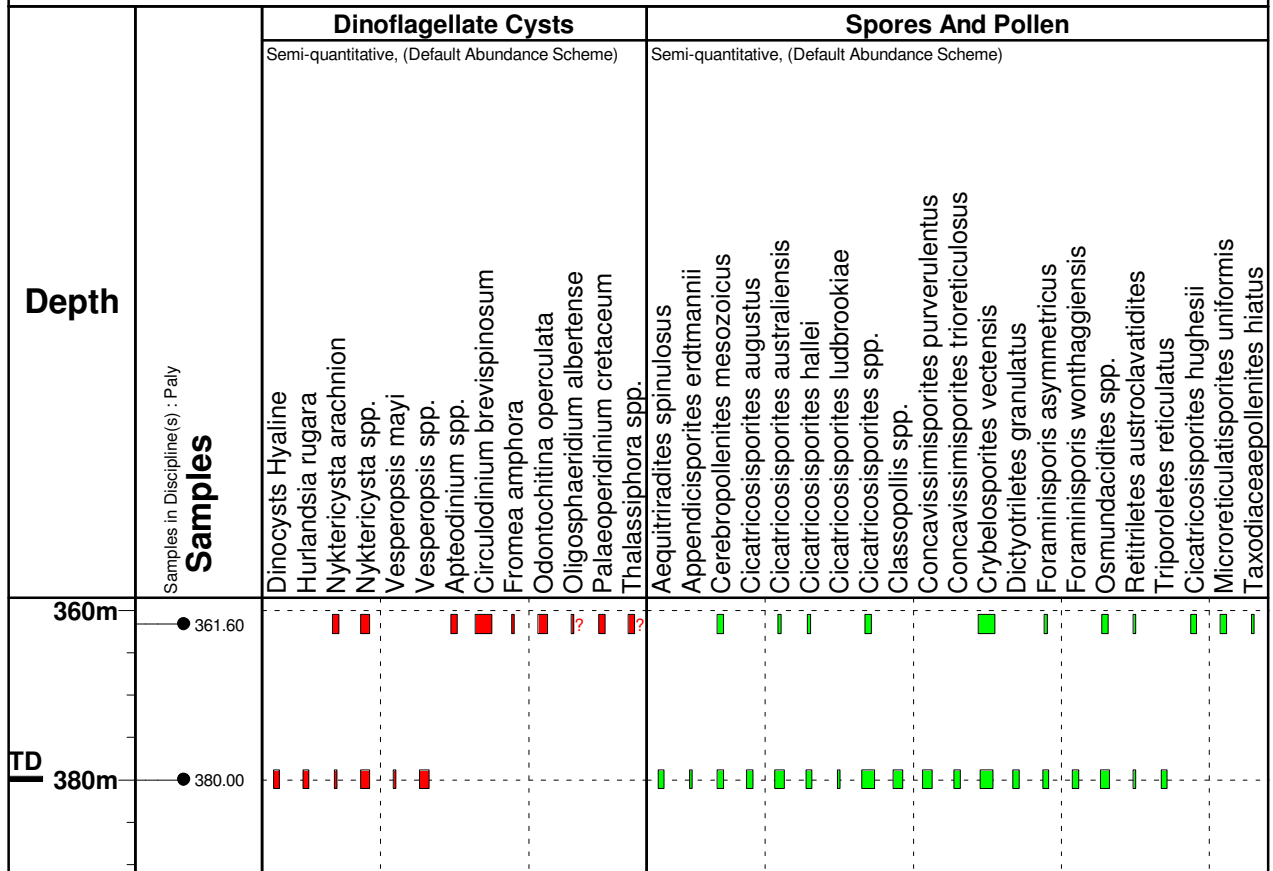
Chart date: 20 April 2009

G. DOLBY

Project : 2025
Chart : 8-14B10

Default Abundance Scheme

- Present (1)
- Rare (2)
- Common (5)
- Abundant (15)
- Super Abundant (50)
- + Present outside count



Well Name : 10-26-83-7W4

G.Dolby and Associates
Calgary

Well Code: 202510B

Interval : 360.00m - 400.00m

CHART 10

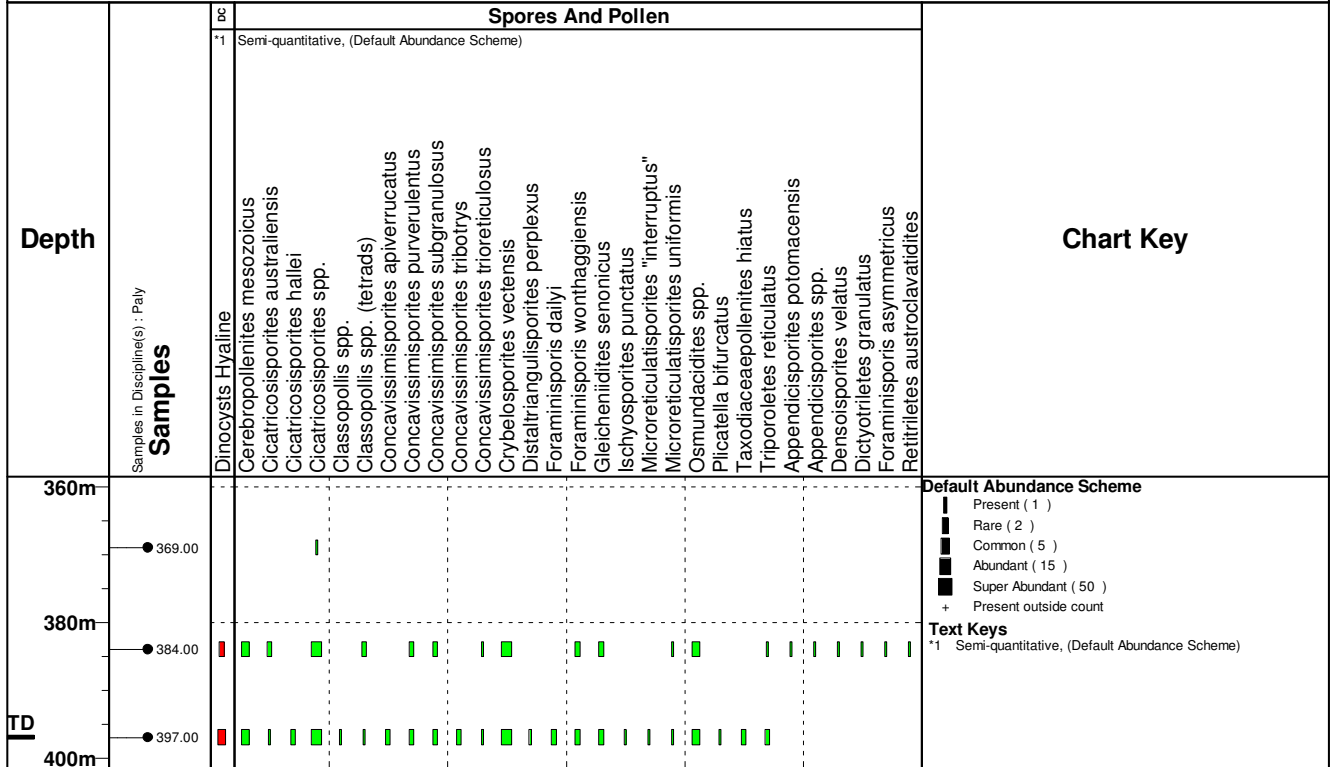
Scale : 1:1000

SPECIES DISTRIBUTION

Chart date: 20 April 2009

G. DOLBY

Project : 2025
Chart : 10-26-83BK



Well Name : 10-8-90-7W4

Well Code : 202511B

Interval : 139.00m - 156.00m

CHART 11

Scale : 1:1000

SPECIES DISTRIBUTION

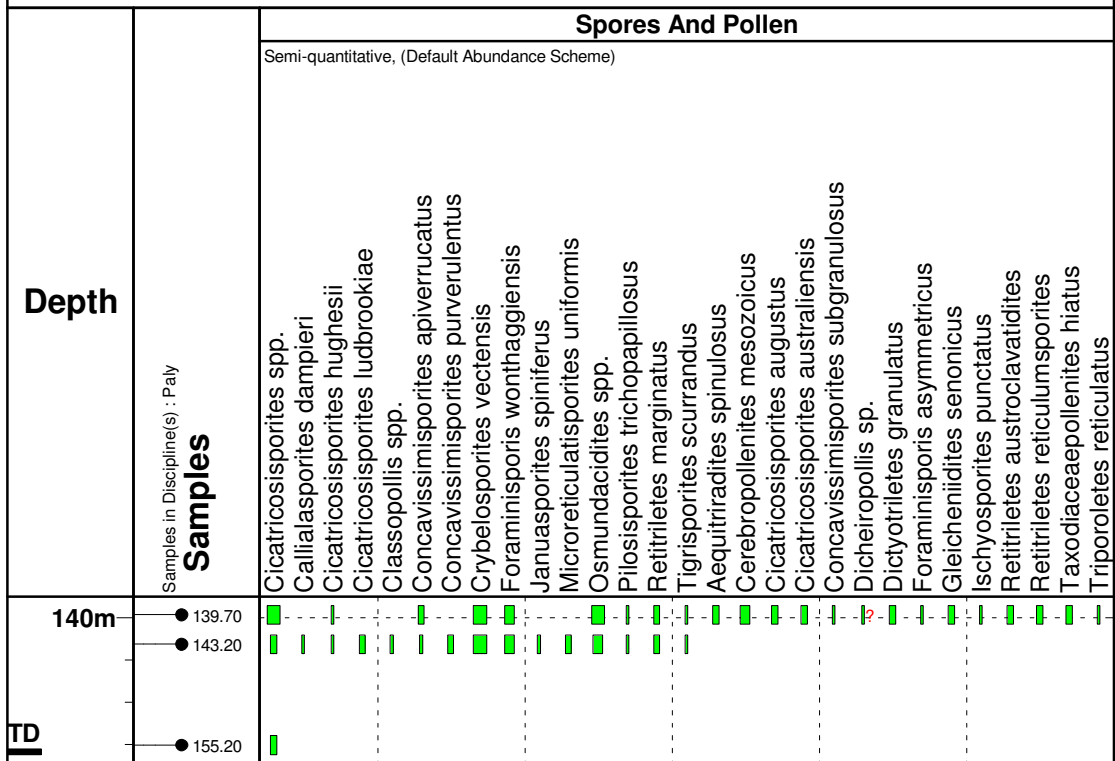
Chart date: 20 April 2009

G. DOLBY

Project : 2025
Chart : 10-8B10

Default Abundance Scheme

- Present (1)
- Rare (2)
- Common (5)
- Abundant (15)
- Super Abundant (50)
- + Present outside count



Well Name : 11-8-75-8W4

Well Code : 202512B

Interval : 425.00m - 480.00m

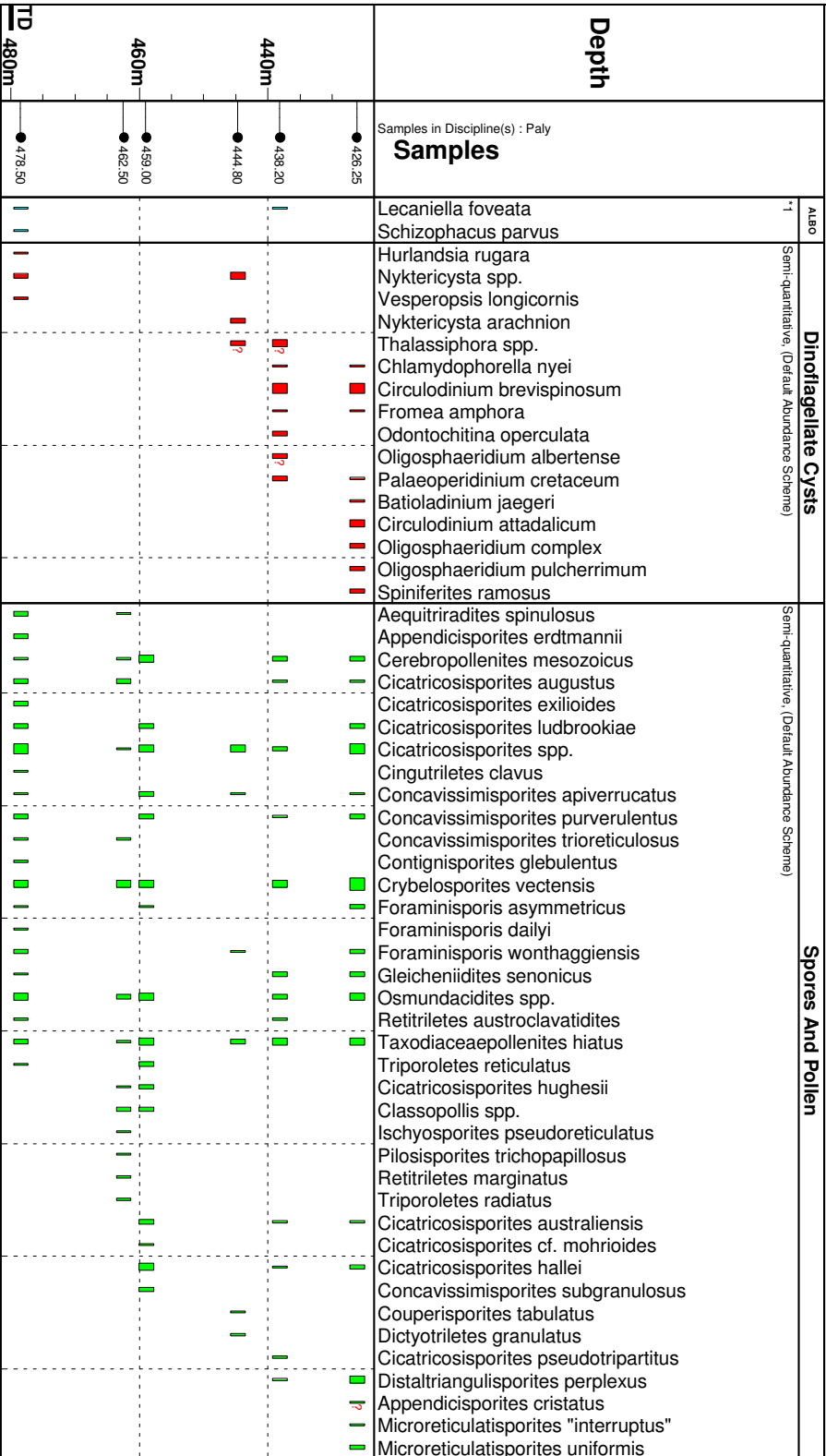
Scale : 1:1000

Chart date: 20 April 2009

CHART 12

SPECIES DISTRIBUTION

G.DOLBY

**G.Dolby and Associates
Calgary****Default Abundance Scheme**Present (1)
Rare (2)Common (5)
Abundant (15)
Super Abundant (50)+ Present outside count
Text Keys
*1 Semi-quantitative, (Default Abundance Scheme)Project: 2025
Chart : 11-8B12

Well Name : 4-14-95-11W4

Well Code : 202514B

Interval : 48.00m - 65.00m

CHART 14

Scale : 1:1000







SPECIES DISTRIBUTION

Chart date: 20 April 2009

G.DOLBY

Project : 2025
Chart : 4-14BIO

Default Abundance Scheme

-  Present (1)
-  Rare (2)
-  Common (5)
-  Abundant (15)
-  Super Abundant (50)
-  + Present outside count

Text Keys

*1 Semi-quantitative, (Default Abundance Scheme)

Depth	Samples in Discipline(s) : Paly Samples	ALBO	Spores And Pollen
		*1	Semi-quantitative, (Default Abundance Scheme)
		Lecaniella foveata	
		Schizophacus parvus	
		Schizosporis reticulatus	
		Cerebropollenites mesozoicus	
		Cicatricosisporites spp.	
		Crybelosporites vectensis	
		Gleicheniidites senonicus	
		Osmundacidites spp.	
		Taurucosporites segmentatus	
		Aequitriradites spinulosus	
		Aequitriradites verrucosus	
		Cicatricosisporites augustus	
		Cicatricosisporites australiensis	
		Cicatricosisporites hallei	
		Cicatricosisporites ludbrookiae	
		Concavissimisporites apiverrucatus	
		Concavissimisporites irroratus	
		Concavissimisporites purverulentus	
		Concavissimisporites subgranulosus	
		Couperisporites tabulatus	
		Foraminisporis asymmetricus	
		Foraminisporis wonthaggiensis	
		Ischyosporites punctatus	
		Megaspore spp.	
		Microreticulatisporites uniformis	
		Pilosporites trichopapillosus	
TD 60m 63	● 49.20 ● 62.05		

Well Name : 9-2-96-12W4

Well Code : 202515B

Interval : 285.00m - 370.00m

Scale : 1:1000

Chart date: 20 April 2009

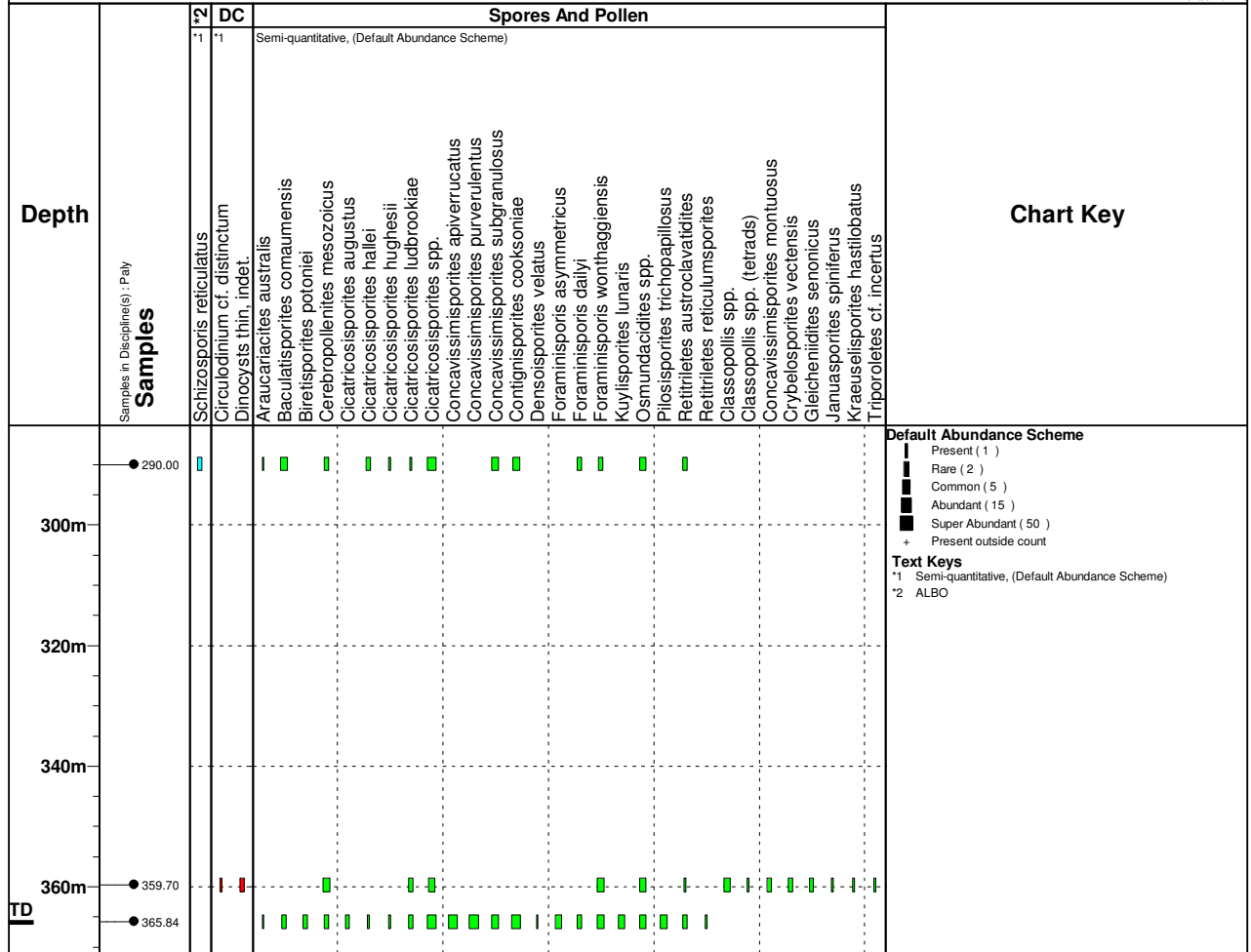
CHART 15

SPECIES DISTRIBUTION

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Project: 2025
Chart : 9-2515



	Depth	Samples
1750'		<div> <div>1737.00</div> <div>1741.00</div> <div>1746.00</div> <div>1751.00</div> <div>1755.60</div> </div>
1700'		<div> <div>1681.00</div> </div>
1650'		<div> <div>1626.10</div> </div>
1600'		<div> <div>1576.56</div> </div>
		<div> <div>Samples in Discipline(s) : Paly</div> <div>Samples</div> </div>
		<div> <div>Pediastrum spp.</div> <div>Circulodinium brevispinosum</div> <div>Circulodinium cf. distinctum</div> <div>Nyktericysta spp.</div> <div>Odontochitina operculata</div> <div>Oligosphaeridium pulcherrimum</div> <div>Palaeoperidinium cretaceum</div> <div>Pseudoceratium retusum</div> <div>Dinocysts Hyaline</div> <div>Hurlandsia rugara</div> <div>Apteodinium spp.</div> <div>Batioladinium jaegeri</div> <div>Cleistosphaeridium spp.</div> <div>Odontochitina nuda</div> <div>Oligosphaeridium albertense</div> <div>Vesperopsis longicornis</div> <div>Vesperopsis spp.</div> <div>Balmula tripenta</div> <div>Cleistosphaeridium araneosum</div> <div>Dinocysts indet.</div> <div>Ellipsoidictyum imperfectum</div> <div>Fromea amphora</div> <div>Fromea fragilis</div> <div>Nyktericysta arachnion</div> <div>Oligosphaeridium complex</div> <div>Pseudoceratium aff. toveae</div> <div>Pseudoceratium pelliferum</div> <div>Vesperopsis mayi</div> </div>
		<div> <div>Cerebropollenites mesozoicus</div> <div>Cicatricosisorites spp.</div> <div>Osmundacidites spp.</div> <div>Taxodiaceapollenites hiatus</div> <div>Cicatricosisorites augustus</div> <div>Concavissimisporites purverulentus</div> <div>Foraminisporis asymmetricus</div> <div>Foraminisporis dailyi</div> <div>Foraminisporis wonthaggiensis</div> <div>Gleicheniidites senonicus</div> <div>Ischyosporites punctatus</div> <div>Concavissimisporites irrortatus</div> <div>Crybelosporites vectensis</div> <div>Pilosisorites trichopapillosus</div> <div>Aequitriradites spinulosus</div> <div>Callialasporites dampieri</div> <div>Cicatricosisorites australiensis</div> <div>Cicatricosisorites hallei</div> <div>Classopollis spp. (tetrads)</div> <div>Concavissimisporites apiverrucatus</div> <div>Concavissimisporites subgranulosus</div> <div>Couperisporites tabulatus</div> <div>Densoisorites velatus</div> <div>Dictyotrilletes granulatus</div> <div>Januasporites spiniferus</div> <div>Kuylisporites lunaris</div> <div>Retitritelles austroclavitudites</div> <div>Cicatricosisorites ludbrookiae</div> <div>Classopollis spp.</div> <div>Concavissimisporites tribotrys</div> <div>Araucariacites australis</div> <div>Triporeletes reticulatus</div> </div>

Well Name : 11-9-99-15W4
Well Code: 202517B
Interval : 425m - 560m
Scale : 1:1500
Chart date: 20 April 2009

CHART 17
SPECIES DISTRIBUTION
G. DOLBY

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Project: 2025
Chart: 11-9-99-15W4

