



BioStratigraphics
Consulting Micropaleontology

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ARCO

NORTH ALEUTIAN SHELF COST NO. 1

JOB #05820107

PALYNOLOGY REPORT

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Alaska

Interpreted by:

Suchit S. Hart

Biostratigrapher Consultant



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January 14, 1983

ARCO Exploration Company
P.O. Box 360
Anchorage, Alaska 99510

ATTENTION: Mr. David M. Hite

SUBJECT: Palynology Report - ARCO North Aleutian
Shelf C.O.S.T. No. 1, Bering Sea, Alaska

Enclosed is the Palynology Report for the ARCO North
Aleutian Shelf C.O.S.T. No. 1 well.

The samples were processed and examined by BioStrat-
igraphics, San Diego, California. The resultant age sub-
divisions were based on the study of recovered spore-
pollen, dinoflagellate cysts, and fungal spores.

If you have any questions, please call us.

Sincerely yours,

Suchit S. Hart
Biostratigrapher Consultant

A. D. Warren
Senior Biostratigrapher
Manager

SSH:ADW/jam

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SUMMARY

Palynological study of the ARCO North Aleutian Shelf C.O.S.T. No. 1 well samples indicates that the well penetrated 17,150 feet of sedimentary rocks of Eocene and younger age.

The top 10,680 feet of the sedimentary sequence was deposited under marginal marine to marine conditions, while the section from 10,680 feet to 17,150 feet T.D. was deposited under nonmarine conditions.

Based on the results of the palynological evaluation, the palynostratigraphy can be summarized as follows:

1380-2370'?	Pliocene to Pleistocene
2370?-3840'	Late Miocene to Pliocene
3840-5010'?	Oligocene to Middle Miocene
5010?-9510'	Oligocene
9510-9969.3'core	Late Eocene to Early Oligocene
9969.3'-14100'	Eocene
14100-17150'T.D.	Eocene. Possibly Early Eocene

INTRODUCTION

Purpose and Scope

BioStratigraphics processed 500 samples from the ARCO North Aleutian Shelf C.O.S.T. No. 1 well for palynological age determinations. The sample total consisted of material from ditch cuttings, sidewall cores, conventional cores, and drilling mud.

- One hundred and seventy-five ditch cutting samples taken at 90-foot composite intervals from 1380' to 17,150' T.D.
- One hundred and fifty-two sidewall core samples taken from the 1450' to 13,340' interval.
- One hundred and forty-five conventional core samples taken from the 3,392.8' to 16,716.2' interval.
- Twenty-eight drilling mud samples taken at 500' intervals from 1,500' to 17,000'.

Based on the palynomorphs observed, an age and environment of deposition are reported for the palynostratigraphic subdivisions.

The depositional environments derived from the palynological preparations can only be categorized as non-

marine, marginal marine, or marine. These categories are based essentially on the absence or presence of dinoflagellate cysts and/or acritarchs.

Procedures

The samples were prepared by standard palynologic techniques using hydrochloric, hydrofluoric, and nitric acid treatments. The resultant kerogen residues were concentrated, and four permanent slide mounts were made for each sample that had sufficient organic recoveries.

The palynomorph frequencies given in the results represent the following quantities: V = very rare (1); R = rare (2-5); F = frequent (6-15); C = common (16-30); and A = abundant (greater than 30).

Report Format

In the following results the age, environment of deposition, and significant palynomorphs are given for each palynostratigraphic subdivision.

Following the results are some general remarks in the conclusions section.

Appendix A and B list the palynomorphs recorded from the conventional cores and mud samples respectively.

Palynomorph distribution charts for the ditch samples and sidewall core samples are included in the pocket at the end of the report (Figures P-1 through P-6).

RESULTS

1380-2370'?

Age. Pliocene to Pleistocene

Environment. Marginal Marine

Palynomorphs. The spore-pollen assemblage is characterized by frequent occurrences of undifferentiated bisaccates, Alnipollenites sp., Tsugaepollenites sp., Osmundacidites sp., Sphagnumsporites sp., Laevigatosporites sp., and pollen grains of Betulaceae, Polypodiaceae and Taxodiaceae. Sporadic and rare occurrences of Compositae and Malvaceae pollen grains, Liquidambarpollenites sp., Tiliaepollenites sp., Ulmipollenites sp. and Salix sp. are also recorded in this interval.

The dinoflagellate cyst assemblage consists of only one indigenous species, Tectatodinium pellitum. Another indigenous microplankton found in this interval is Tasmanaceae. Rare recycled Jurassic and Cretaceous dinoflagellate cyst species occur throughout this interval.

2370?-3840'

Age. Late Miocene to Pliocene

Environment. Marginal Marine

Palynomorphs. The spore-pollen assemblage from the previous interval continues into this interval with the addition of the following species: Pterocaryopollenites sp., Caryapollenites simplex, Juglanspollenites sp., Boisduvalia clavatites, Jussiaea sp., Diervilla echinata, Onagraceae, and Ericaceae pollen grains.

The microplankton assemblage in this interval includes ?Operculodinium sp. 2, Tasmanaceae, and Lejeunia cf. L. paratenella. A single specimen of the dinoflagellate cyst species Lejeunia fallax is noted in sample 3390-3480' indicating that the section below 3390' may possibly be in the Middle Miocene.

3840-5010'?

Age. Oligocene to Middle Miocene

Environment. Marine

Palynomorphs. The spore-pollen assemblage remains the same as in the previous interval.

The dinoflagellate cyst species Lejeunia fallax occurs consistently in this interval in all three different types of samples (ditch, SWC, and cores). Lejeunia hyalina is found only in the ditch samples from 3840' to 4380'. Other microplankton noted in this interval are Baltisphaeridium sp. and Tasmanaceae.

5010?-9510'

Age. Oligocene

Environment. Marine to Marginal Marine

Palynomorphs. The same spore-pollen assemblage continues to occur in this interval with the introduction of the following additional taxa: Rugaepollis kachemakensis, R. fragilis, Nyssapollenites sp., Tricolpites sp., Quercus sp., Castanea sp., Tiliaepollenites ves-sipites, Bombacaceae, Nymphaea cf. N. spinosa, and Ilexpollenites sp.

The microplankton assemblage in this interval includes Lejeunia fallax, L. hyalina, ?Spiniferites septatus, S. spp., Deflandrea cf. D. phosphor- itica, Paralecaniella indentata, Cordosphaeridium sp.

Remarks. The Oligocene age for this interval is based on the co-occurrences of Lejeunia hyalina, Deflandrea sp. cf. D. phosphoritica and Paralecaniella indentata. The influx of a more diverse dinoflagellate cyst assemblage below 9510' marks the base of this interval.

9510-9969.3'(core)

Age. Late Eocene to Early Oligocene

Environment. Marine

Palynomorphs. The spore-pollen assemblage remains the same.

The microplankton assemblage becomes more diverse. The dinoflagellate cyst species Phthanoperidinium comatum, P. cf. P. alectrolophum, Hystriocholpoma rigaudae and Spin- idinium essoii all made their first appearances in this interval. Other

9510-9969.3'(core) (Continued)

microplankton found in this interval are Paralecaniella indentata, Baltisphaeridium sp., Lejeunia fallax, and Tasmanaceae.

9969.3-14,100'

Age.

Eocene

Environment.

Marine from 9969.3' to 10,680'
Nonmarine from 10,680' to 14,100'

Palynomorphs.

The spore-pollen assemblage is essentially unchanged from the previous interval.

All of the dinoflagellate cyst species from the previous interval continue to occur in greater abundance. The top of this interval is defined by the first occurrence of the dinoflagellate cyst species Deflandrea cf. D. wetzelii in the core sample at 9,969.3'. Two common Eocene dinoflagellate cyst species, Adnatosphaeridium reticulense and Areosphaeridium diktyoplokus, are recorded for the first time in the core samples at 9,978.1' and 9,982.2', respectively. Another Eocene dinoflagellate cyst species, Deflandrea sagittula, also occurs for the first time at 9,973' in the sidewall core samples. Other dinoflagellate cyst species in this interval include Cordosphaeridium fibrospinosum, C. exilimurum, Achomosphaera alcicornu, Deflandrea phosphoritica, Spinidinium sp., Lejeunia hyalina, Phthanoperidinium sp. This microplankton assemblage is found consistently down-hole to 10,680'. where?

9969.3-14,100' (Continued)

The depositional environment of the section below 10,680' is nonmarine. From 10,680' to 11,059' the palynological assemblage consists mainly of long ranging tertiary spores and pollen grains.

A fungal palynomorph, Pesavis taglensis, which is restricted to the Eocene in the British Columbia area, occurs for the first time in the sidewall core sample at 11,059'. This Eocene species is found consistently downhole to T.D. Other significant fungal palynomorphs found in this assemblage include Dicellaesporites sp., Multicellaesporites sp. B, Ctenosporites wolfei, Punctodiporites A, Psiladiporites sp., Fusiformisporites A, and Striadiporites sp.

Very rare, recycled Early and Late Cretaceous palynomorphs are found sporadically throughout this interval.

14,100-17,150' (T.D.)

Age. Eocene. Possibly Early Eocene

Environment. Nonmarine

Palynomorphs. The fungal palynomorph assemblage from the previous interval is found throughout this interval. A single occurrence, at 14,100', of a pollen grain Pistillipollenites mcgregorii, which is restricted to the Early Eocene in the British Columbia area, indicates that this interval is possibly Early Eocene in age. Tiliaepollenites sp. and Bombacaceae pollen grains occur in greater abundance from 15,347.7' to T.D.

Early Eocene?

Late Paleocene, Eocene

Very rare, recycled Late and Early Cretaceous palynomorphs are also recorded in this interval.

CONCLUSIONS

Samples between 1380 feet and the total depth of 17,150 feet in the ARCO North Aleutian Shelf C.O.S.T. No. 1 well were examined for palynologic age determinations.

The well penetrated 10,680 feet of marginal marine to marine, Eocene and younger sedimentary strata. The sedimentary rock sequence from 10,680 feet to 17,150 feet T.D. is nonmarine and Eocene in age.

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APPENDIX A

CONVENTIONAL CORE SAMPLE ANALYSES

The palynomorph taxa recorded in each core sample are listed below. The age for each sample is not given in the appendix list, but the core sample data have been incorporated with the ditch and sidewall core data to derive the overall palynostratigraphic age subdivisions.

3392.8'

Undifferentiated bisaccates (C)
Tsugaepollenites sp. (F)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Sphagnumsporites sp. (F)
Taxodiaceae (F)
Alnipollenites sp. (F)
Betulaceae (F)
Tricolpites sp. (R)

4195.9'

Undifferentiated bisaccates (C)
Podocarpidites sp. (R)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (F)
Sphagnumsporites sp. (F)
Taxodiaceae (F)
Alnipollenites sp. (F)
Betulaceae (F)
Cicatricosisporites sp. (V)
Lejeunia fallax (V)

4198.2'

Undifferentiated bisaccates (C)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (F)
Polypodiaceae (R)
Taxodiaceae (F)
Alnipollenites sp. (F)
Betulaceae (F)
Juglanspollenites sp. (R)
Tricolpites sp. (R)

4199.3'

Undifferentiated bisaccates (C)
Podocarpidites sp. (R)
Tsugaepollenites sp. (F)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (F)
Sphagnumsporites sp. (F)
Taxodiaceae (F)
Alnipollenites sp. (F)
Betulaceae (F)
Ericaceae (R)
Lejeunia fallax (R)

4199.4'

Undifferentiated bisaccates (C)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (F)
Sphagnumsporites sp. (F)
Taxodiaceae (F)
Alnipollenites sp. (F)
Betulaceae (F)
Pterocaryapollenites sp. (R)

5228.9'

Undifferentiated bisaccates (F)
Deltoidospora sp. (R)
Laevigatosporites sp. (R)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (R)
Taxodiaceae (R)
Alnipollenites sp. (R)
Betulaceae (R)
Tiliaepollenites sp. (V)

5229.4'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (R)
Deltoidospora sp. (R)
Laevigatosporites sp. (R)
Osmundacidites sp. (R)
Polypodiaceae (R)
Alnipollenites sp. (R)
Betulaceae (R)
Muticellaesporites sp. (V)
Lejeunia hyalina (V)
Pediastrum (V)

5230.3'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (R)
Laevigatosporites sp. (R)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (R)
Sphagnumsporites sp. (F)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Caryapollenites sp. (R)
Castanea sp. (R)
Cicatricosisporites sp. (V)
Multicellaesporites sp. (V)

5231.5'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (R)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (F)
Taxodiaceae (F)
Alnipollenites sp. (F)
Betulaceae (F)
Faguspollenites sp. (R)
Lejeunia hyalina (R)
?Paralecaniella indentata (R)

5235.2'

Undifferentiated bisaccates (F)
Laevigatosporites sp. (R)
Osmundacidites sp. (R)
Caryapollenites sp. (V)
Quercus sp. (R)

5235.7'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (R)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)

5238.3'

Undifferentiated bisaccates (F)
laevigatosporites sp. (R)
Osmundacidites sp. (R)
Taxodiaceae (R)
Alnipollenites sp. (R)
Betulaceae (R)
Cicatricosisporites sp. (V)
?Paralecaniella indentata (V)

5241'

Barren of palynomorphs.

5242.1'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (R)
Deltoidospora sp. (R)
Laevigatosporites sp. (F)
Osmundacidites sp. (R)
taxodiaceae (F)
Betulaceae (F)
Juglanspollenites sp. (F)

5245.1'

Undifferentiated bisaccates (R)
Deltoidospora sp. (R)
Sphagnumsporites sp. (R)
Taxodiaceae (R)
Alnipollenites sp. (R)

5971.5'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (R)
Polypodiaceae (R)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Lejeunia fallax (R)

5972.6'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Taxodiaceae (F)
Alnipollenites sp. (R)
Lejeunia fallax (R)

5974.3'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Laevigatosporites (F)
Osmundacidites (F)
Polypodiaceae (R)
Taxodiaceae (F)
Alnipollenites sp. (F)
Betulaceae (R)
Lejeunia fallax (F)
Paralecaniella indentata (V)

5976.8'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Taxodiaceae (F)
Alnipollenites sp. (F)
Betulaceae (F)
Tiliaepollenites crassipites (V)
Lejeunia hyalina (R)
L. fallax (R)

5979.9'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Osmundacidites sp. (R)
Sphagnumsporites sp. (R)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Lejeunia hyalina (R)
L. fallax (R)

5982.4'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Laevigatosporites sp. (F)
Osmundacidites sp. (F)
Sphagnumsporites sp. (R)
Taxodiaceae (F)
Alnipollenites sp. (R)
Caryapollenites sp. (R)
Lejeunia fallax (R)
?Spiniferites septatus (R)

5985.6'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Laevigatosporites sp. (F)
Polypodiaceae (R)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Faguspollenites sp. (V)
Lejeunia fallax (R)

5987.7'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Laevigatosporites sp. (F)
Osmundacities sp. (R)
Alnipollenites sp. (R)
Betulaceae (R)
Lejeunia fallax (F)

5991.6'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Osmundacidites sp. (R)
Polypodiaceae (V)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Lejeunia fallax (R)

5995.5'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Lycopodiumsporites sp. (V)
Osmundacidites sp. (R)
Taxodiaceae (F)
Alnipollenites sp. (F)
Betulaceae (F)
Lejeunia fallax (R)

6666.4.'

Undifferentiated bisaccates (F)
Laevigatosporites sp. (R)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (R)
Sphagnumsporites sp. (R)
Taxodiaceae (R)
Alnipollenites sp. (R)
Betulaceae (R)

6667.1'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (R)
Deltoidospora sp. (R)
Laevigatosporites sp. (R)
Osmundacidites sp. (R)
Taxodiaceae (R)
Alnipollenites sp. (R)

8047.1'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (F)
Polypodiaceae (R)
Sphagnumsporites sp. (R)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Involutisporites sp. (V)
Spiniferites spp. (V)

8056.3'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Deltoidospora sp. (R)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (R)
Sphagnumsporites sp. (R)
Taxodiaceae (R)
Alnipollenites sp. (R)
Betulaceae (R)
Ulmipollenites sp. (R)

8060.4'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (R)
Osmundacidites sp. (R)
Polypodiaceae (R)
Taxodiaceae (R)
Alnipollenites sp. (R)

8063.4'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (R)
Osmundacidites sp. (R)
Sphagnumsporites sp. (R)
Alnipollenites sp. (R)
Caryapollenites sp. (R)
?Areosphaeridium diktyoplokus (V)

8065.8'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (R)
Laevigatosporites sp. (R)
Polypodiaceae (R)
Taxodiaceae (R)

8066.8'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (R)
Deltoidospora sp. (R)
Osmundacidites sp. (R)
Sphagnumsporites sp. (R)
Taxodiaceae (R)
Alnipollenites sp. (R)
Betulaceae (R)

8069.9'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Laevigatosporites sp. (C)
Osmundacidites sp. (R)
Polypodiaceae (R)
Gonyaulacysta sp. (recycled) (V)
Tasmanaceae (V)

8073.9'

see sorted

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Polypodiaceae (R)
Sphagnumsporites sp. (F)
Taxodiaceae (F)
Alnipollenites sp. (R)
Appendicisporites sp. (V)
Pistillipollenites mcgregorii (V)
Paralecaniella indentata (R)
Schizosporis cf. S. reticulatus (F)

8077.7'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Deltoidospora sp. (R)
Lycopodiumsporites sp. (R)
Polypodiaceae (R)
Taxodiaceae (F)
Alnipollenites (R)
Paralecaniella indentata (V)

8079.1'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Deltoidospora sp. (R)
Osmundacidites sp. (R)
Polypodiaceae (R)
Sphagnumsporites sp. (F)
Taxodiaceae (R)
Alnipollenites sp. (F)
Betulaceae (R)
Paralecaniella indentata (R)

8080.7'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Deltoidospora sp. (R)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (R)
Sphagnumsporites sp. (F)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)

8083.8'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Deltoidospora sp. (R)
Osmundacidites sp. (R)
Polypodiaceae (R)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Caryapollenites sp. (R)
Tiliaepollenites crassipites (V)
Salix sp. (V)

8084.5'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Laevigatosporites sp. (C)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (F)
Polypodiaceae (R)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Involutisporonites sp. (V)
Ulmipollenites sp. (R)
Schizosporis cf. S. reticulatus (R)

8087.9'

Undifferentiated bisaccates (C)
Tsugaepollenites sp. (F)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (F)
Sphagnumsporites sp. (R)
Alnipollenites sp. (R)

8091.8'

Undifferentiated bisaccates (C)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (F)
Polypodiaceae (R)
Sphagnumsporites sp. (F)
Alnipollenites sp. (R)
Tasmanaceae (V)

8092.5'

Undifferentiated bisaccates (C)
Tsugaepollenites sp. (R)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Osmundacidites (R)
Polypodiaceae (R)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)

8632.4'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (R)
Deltoidospora sp. (R)
Laevigatosporites sp. (R)
Osmundacidites sp. (R)
Sphagnumsporites sp. (R)
Taxodiaceae (R)
Alnipollenites sp. (R)

8636.2'

Undifferentiated bisaccates (R)
Deltoidospora sp. (R)
Taxodiaceae (R)

8637.8'

Undifferentiated bisaccates (R)
Deltoidospora sp. (R)
Laevigatosporites sp. (R)
Osmundacidites sp. (R)

8641.7'

Undifferentiated bisaccates (R)
Laevigatosporites sp. (R)
Osmundacidites sp. (R)
Taxodiaceae (R)

8645.3'

Undifferentiated bisaccates (R)
Tsugaepollenites sp. (R)
Deltoidospora sp. (R)
Laevigatosporites sp. (R)
Osmundacidites sp. (R)

8646.7'

Deltoidospora sp. (R)
Osmundacidites sp. (R)
Taxodiaceae (R)

8649.5'

Undifferentiated bisaccates (R)
Deltoidospora sp. (R)
Laevigatosporites sp. (R)
Osmundacidites sp. (R)
Betulaceae (R)

8653.4'

Undifferentiated bisaccates (R)
Deltoidospora sp. (R)
Laevigatosporites sp. (F)
Osmundacidites sp. (F)
Taxodiaceae (R)

8654.1'

Undifferentiated bisaccates (C)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (F)
Sphagnumsporites sp. (F)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Cicatricosisporites sp. (V)
Sernapollenites sp. (V)

8655.8'

Undifferentiated bisaccates (C)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (R)
Polypodiaceae (R)
Sphagnumsporites sp. (F)
Taxodiaceae (F)
Alnipollenites sp. (F)
Betulaceae (F)

9255.4'

Undifferentiated bisaccates (C)
Tsugaepollenites sp. (R)
Deltoidospora sp. (R)
Laevigatosporites sp. (F)
Osmundacidites sp. (R)
Taxodiaceae (F)
Alnipollenites sp. (R)

9257.6'

Undifferentiated bisaccates (R)
Tsugaepollenites sp. (R)
Deltoidospora sp. (R)
Laevigatosporites sp. (R)
Lycopodiumsporites sp. (R)
Sphagnumsporites sp. (R)
Taxodiaceae (R)
Alnipollenites sp. (R)
Betulaceae (R)
Juglanspollenites sp. (R)

9262.0'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (R)
Laevigatosporites sp. (R)
Lycopodiumsporites sp. (R)
Taxodiaceae (R)
Alnipollenites sp. (R)
Betulaceae (R)
Multicellaesporites sp. (R)

9264.1'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Deltoidospora sp. (R)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Sphagnumsporites sp. (F)
Betulaceae (R)
Multicellaesporites sp. (R)

9945.6'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (F)
Taxodiaceae (F)
Betulaceae (F)
Tiliaepollenites sp. (V)

9948.8'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Deltoidospora sp. (R)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (F)
Sphagnumsporites sp. (R)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Lejeunia fallax (R)

9949.5'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Osmundacidites sp. (R)
Sphagnumsporites sp. (F)

9952.0'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Taxodiaceae sp. (F)

9954.3'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (R)
Sphagnumsporites sp. (F)
Taxodiaceae (F)
Alnipollenites sp. (R)

9956.6'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (R)
Sphagnumsporites sp. (F)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Juglanspollenites sp. (R)
Paralecaniella indentata (R)

9962.3'

Undifferentiated bisaccates (C)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (R)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (F)
Juglanspollenites sp. (R)
Multicellaesporites sp. (R)

9963.8'

Undifferentiated bisaccates (C)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (F)
Polypodiaceae (R)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Juglanspollenites sp. (R)

9965.8'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (R)
Deltoidospora sp. (R)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (R)
Polypodiaceae (R)
Betulaceae (R)
Multicellaesporites sp. (R)
Lejeunia fallax (V)
Tasmanaceae (V)

9969.3'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (R)
Deltoidospora sp. (R)
Laevigatosporites sp. (R)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (R)
Sphagnumsporites sp. (F)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Juglanspollenites sp. (R)
Deflandrea cf. D. wetzelii (V)
D. sp. (A)
Baltisphaeridium sp. (V)

9971.5'

Undifferentiated bisaccates (F)
Deltoidospora sp. (F)
Laevigatosporites (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (F)
Sphagnumsporites sp. (F)
Taxodiaceae (F)
Alnipollenites (R)

9974.4'

Undifferentiated bisaccates (C)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (F)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)

9976.8'

Undifferentiated bisaccates (C)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (F)
Polypodiaceae (R)
Sphagnumsporites sp. (F)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Caryapollenites sp. (R)

9976.9'

Undifferentiated bisaccates (C)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (F)
Sphagnumsporites sp. (F)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Juglanspollenites sp. (R)
Faguspollenites sp. (R)
Tiliaepollenites sp. (V)
Baltisphaeridium sp. (V)
Phthanoperidinium comatum (V)

9978.1'

Undifferentiated bisaccates (C)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Osmundacidites sp. (F)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Pterocaryapollenites sp. (R)
Microthyriacites sp. (V)
Adnatosphaeridium reticulense (V)

9981.3'

Undifferentiated bisaccates (C)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (F)
Osmundacidites sp. (R)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Caprifoliipites sp. (R)
Juglanspollenites sp. (R)
Caryapollenites sp. (R)
Pterocaryapollenites sp. (R)

9981.3' (Continued)

Azolla sp. (V)
Ilexpollenites sp. (V)
Tiliaepollenites sp. (V)
Tricolpites sp. (V)
Alternoseptites sp. (V)
?Lejeunia fallax (V)
?L. sp. PC (V)
Phthanoperidinium comatum (R)
Spinidinium sp. (R)

9982.2'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (R)
Deltoidospora sp. (R)
Laevigatosporites sp. (R)
Osmundacidites sp. (F)
Polypodiaceae (R)
Sphagnumsporites sp. (F)
Taxodiaceae (R)
Alnipollenites sp. (R)
Betulaceae (R)
Juglanspollenites sp. (R)
Tiliaepollenites sp. (R)
Tricolporopollenites sp. (V)
Multicellaesporites sp. (V)
Areosphaeridium diktyoplokus (V)
Phthanoperidinium amoenum (F)
P. comatum (A)
P. sp. (R)
Lejeunia fallax (R)

9983.6'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (R)
Deltoidospora sp. (R)
Laevigatosporites sp. (F)
Osmundacidites sp. (F)
Polypodiaceae (R)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Juglanspollenites sp. (R)
Tiliaepollenites sp. (R)
Microthyriacites sp. (V)
Leptodinium sp. (V)
Phthanoperidinium comatum (F)
Spinidinium sp. (V)
Lejeunia fallax (R)

10326.0'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (R)
Deltoidospora sp. (R)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Juglanspollenites sp. (R)
Tiliaepollenites sp. (R)
Areosphaeridium diktyoplokus (V)
Deflandrea sagittula (C)
Paralecaniella indentata (F)

10327.4'

Undifferentiated bisaccates (R)
Laevigatosporites sp. (R)
Taxodiaceae (R)
Alnipollenites sp. (R)
Caryapollenites sp. (R)
Deflandrea sagittula (F)

10328.9'

Undifferentiated bisaccates (R)
Osmundacidites sp. (R)
Polypodiaceae (R)
Sphagnumsporites sp. (R)
Taxodiaceae (R)
Alnipollenites sp. (R)
Juglanspollenites sp. (R)
Tiliaepollenites sp. (V)
?Achomosphaera alcicornu (V)
Areosphaeridium diktyoplokus (R)
Cordosphaeridium fibrospinosum (F)
?Deflandrea phosphoritica (V)
D. sagittula (R)
D. sp. (R)
Wetzeliella homomorpha (R)
W. sp. (R)
Paralecaniella indentata (V)

10330.3'

Undifferentiated bisaccates (R)
Laevigatosporites sp. (R)
Cordosphaeridium sp. (R)
Spiniferites spp. (R)

10334.7'

Barren of palynomorphs.

10731.2'

Essentially barren of palynomorphs.
Undifferentiated bisaccates (V)
Laevigatosporites sp. (V)

10734'

Undifferentiated bisaccates (F)
Deltoidospora sp. (R)
Laevigatosporites sp. (F)
Osmundacidites sp. (V)
Polypodiaceae (V)

10735.8'

Undifferentiated bisaccates (F)
Deltoidospora sp. (R)
laevigatosporites sp. (C)
Osmundacidites sp. (R)
Taxodiaceae (C)
Alnipollenites sp. (R)
Betulaceae (F)
Juglanspollenites sp. (R)
Caryapollenites sp. (R)
Tricolpites sp. (V)

10737.0'

Undifferentiated bisaccates (F)
Laevigatosporites sp. (F)
Osmundacidites sp. (F)
Taxodiaceae (F)
Alnipollenites sp. (R)
Juglanspollenites sp. (R)
Caryapollenites sp. (R)
Dicellaesporites sp. (V)

10738.9'

Undifferentiated bisaccates (F)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Juglanspollenites sp. (R)
Pterocaryapollenites sp. (R)
Tiliaepollenites sp. (R)

10739.5'

Undifferentiated bisaccates (F)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Juglanspollenites sp. (R)
Caryapollenites sp. (R)
Tiliaepollenites sp. (V)
Tricolpites sp. (V)

11085.0'

Essentially barren of palynomorphs.
Undifferentiated bisaccates (R)
Osmundacidites sp. (V)
Taxodiaceae (R)

11089.4'

Barren of palynomorphs.

11093.7'

Barren of palynomorphs.

11098.1'

Undifferentiated bisaccates (F)
Deltoidospora sp. (R)
Laevigatosporites sp. (R)
Lycopodiumsporites sp. (R)
Taxodiaceae (F)
Betulaceae (F)
Pterocaryapollenites sp. (R)
Tiliaepollenites (R)

11098.5'

Undifferentiated bisaccates (F)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Alnipollenites sp. (F)
Juglanspollenites sp. (R)
Tiliaepollenites sp. (R)

11100.7'

Undifferentiated bisaccates (R)
Alnipollenites sp. (R)
?Paralecaniella indentata (V)

11102.4'

Undifferentiated bisaccates (R)
Deltoidospora sp. (R)
Laevigatosporites sp. (R)
Taxodiaceae (R)
Alnipollenites sp. (R)

11103.4'

Undifferentiated bisaccates (R)
Deltoidospora sp. (R)
Pesavis tagluensis (F)
Multicellaesporites sp. (R)

11109.4'

Undifferentiated bisaccates (F)
Deltoidospora sp. (R)
Lycopodiumsporites sp. (R)
Taxodiaceae (R)
Alnipollenites sp. (R)
Betulaceae (R)
Juglanspollenites sp. (V)
Caryapollenites (R)

12249.0'

Undifferentiated bisaccates (F)
Deltoidospora sp. (R)
Laevigatosporites sp. (F)
Osmundacidites sp. (R)
Taxodiaceae (R)
Alnipollenites sp. (F)
Betulaceae (R)
Juglanspollenites sp. (R)
Caryapollenites sp. (R)
Pterocaryapollenites sp. (R)
Ericaceae (R)
Tiliaepollenites sp. (R)
Tricolpites sp. (R)
Ctenosporites wolfei (V)
Multicellaesporites sp. (R)
Deflandrea sagittula (V)
Phthanoperidinium comatum (V)

12251.1'

Undifferentiated bisaccates (F)
Laevigatosporites sp. (R)
Osmundacidites sp. (R)
Betulaceae (C)
Caryapollenites sp. (R)
Pterocaryapollenites sp. (R)
Nyssapollenites sp. (R)
Tiliaepollenites sp. (V)
Punctodiporites sp. (V)

12253.1'

Almost barren of palynomorphs.
Undifferentiated bisaccates (R)

12255.8'

Barren of palynomorphs.

12259.3'

Undifferentiated bisaccates (F)
Deltoidospora sp. (V)
Laevigatosporites sp. (V)
Taxodiaceae (V)
Alnipollenites sp. (R)
Betulaceae (R)
Caryapollenites sp. (R)
Bombacaceae (V)
Multicellaesporites sp. (V)

12260.8'

Undifferentiated bisaccates (F)
Laevigatosporites sp. (R)
Osmundacidites sp. (V)
Taxodiaceae (R)
Alnipollenites sp. (R)
Betulaceae (R)
Juglanspollenites sp. (R)
Caryapollenites sp. (R)
Castanea sp. (R)
Tiliaepollenites sp. (R)
Tricolpites sp. (R)
Pesavis tagluensis (R)
Multicellaesporites sp. (R)

12262.3'

Undifferentiated bisaccates (F)
Laevigatosporites sp. (R)
Caryapollenites sp. (R)
Pterocaryapollenites sp. (R)
Tiliaepollenites sp. (R)
Multicellaesporites sp. (R)
?Paralecaniella indentata (V)

12262.6'

Undifferentiated bisaccates (R)
Deltoidospora sp. (R)
Laevigatosporites sp. (R)
Osmundacidites sp. (R)
Taxodiaceae (R)
Betulaceae (R)
Caryapollenites sp. (R)

12264.3'

Undifferentiated bisaccates (F)
Deltoidospora sp. (R)
Laevigatosporites sp. (R)
Lycopodiumsporites sp. (R)
Alnipollenites sp. (R)
Betulaceae (R)
?Bombacaceae (V)
Tiliaepollenites sp. (V)
Multicellaesporites sp. (V)

12265.1'

Undifferentiated bisaccates (R)
Laevigatosporites sp. (R)
Taxodiaceae (R)
Juglanspollenites sp. (R)
Tiliaepollenites sp. (R)
Pesavis tagluensis (R)
Multicellaesporites sp. (R)
Psiladiporites sp. (V)

12268.4'

Undifferentiated bisaccates (R)
Deltoidospora sp. (R)
Lycopodiumsporites sp. (V)
Osmundacidites sp. (V)
Betulaceae (R)
Caryapollenites sp. (R)
Pesavis tagluensis (V)
Multicellaesporites sp. (R)
Dicellaesporites sp. (V)

12269.4'

Undifferentiated bisaccates (F)
Osmundacidites sp. (R)
Alnipollenites sp. (R)
Betulaceae (R)
Caryapollenites sp. (R)
Ctenosporites wolfei (V)
Multicellaesporites sp. (R)
Dicellaesporites sp. (R)
Punctodiporites sp. (R)

12269.7'

Undifferentiated bisaccates (R)
Deltoidospora sp. (R)
Laevigatosporites sp. (R)
Lycopodiumsporites sp. (R)
Taxodiaceae (R)
Betulaceae (R)
Juglanspollenites sp. (R)
Tiliaepollenites sp. (R)
Multicellaesporites sp. (R)
Multiaesporites (R)

12630.4'

Undifferentiated bisaccates (F)
Deltoidospora sp. (R)
Laevigatosporites sp. (R)
Lycopodiumsporites sp. (R)
Taxodiaceae (R)
Alnipollenites sp. (F)
Betulaceae (F)
Caryapollenites sp. (R)
Liquidambarpollenites sp. (V)
Paraalnipollenites confusus (V)
Acanthotriletes sp. (V)
Ctenosporites wolfei (V)
Pesavis tagluensis (R)
Multicellaesporites sp. (F)
Dicellaesporites sp. (R)
Punctodiporites (F)

12632.1'

Undifferentiated bisaccates (R)
Deltoidospora sp. (R)
Laevigatosporites sp. (R)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (R)
Taxodiaceae (R)
Alnipollenites sp. (F)
Betulaceae (R)
Juglanspollenites sp. (R)
Bombacaceae (R)
Tiliaepollenites sp. (R)
Tricolporopollenites (V)
Tricolpites sp. (V)
?Odontochitina operculata (V)

12633.2'

Undifferentiated bisaccates (R)
Deltoidospora sp. (R)
Laevigatosporites sp. (R)
Osmundacidites sp. (V)
Taxodiaceae (R)
Betulaceae (R)
Bombacaceae (V)
Tiliaepollenites sp. (V)
Fusiformisporites sp. (V)

12635.3'

Undifferentiated bisaccates (R)
Taxodiaceae (R)
Betulaceae (R)
Juglanspollenites sp. (R)
Tiliaepollenites sp. (R)
Pesavis tagluensis (R)
Dicellaesporites sp. (R)
Punctodiporites sp. (F)
Multicellaesporites sp. (V)

12637.5'

Essentially barren of palynomorphs.
Deltoidospora sp. (V)
Multicellaesporites sp. (V)

14165.7'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (R)
Lycopodiumsporites sp. (R)
Taxodiaceae (R)
Betulaceae (R)
Rugubivesiculites sp. (V)

14167.9'

Undifferentiated bisaccates (R)
Osmundacidites sp. (R)
Multicellaesporites sp. (V)

14169.1'

Barren of palynomorphs.

14177'

Barren of palynomorphs.

14179.7'

Essentially barren of palynomorphs.
Undifferentiated bisaccates (V)
Deltoidospora sp. (V)
Taxodiaceae (V)
Nyssapollenites sp. (V)

14183.4'

Essentially barren of palynomorphs.
Multicellaesporites sp. (V)

15347.7'

Undifferentiated bisaccates (R)
Osmundacidites sp. (V)
Betulaceae (R)
Caryapollenites sp. (R)
Tiliaepollenites sp. (V)
Tricolpites sp. (V)
Multicellaesporites sp. (R)

15349.6'

Undifferentiated bisaccates (R)
Deltoidospora sp. (R)
Lycopodiumsporites sp. (V)
Taxodiaceae (F)
Alnipollenites sp. (R)
Tiliaepollenites sp. (R)
Pesavis tagluensis (R)
Multicellaesporites sp. (R)

15349.9'

Undifferentiated bisaccates (F)
Deltoidospora sp. (R)
Osmundacidites sp. (R)
Taxodiaceae (F)
Tiliaepollenites sp. (R)
Tricolpites sp. (V)
Multicellaesporites sp. (R)

15354.5'

Almost barren of palynomorphs.
Undifferentiated bisaccates (R)
Pesavis tagluensis (R)
Multicellaesporites sp. (R)

15358.8'

Undifferentiated bisaccates (R)
Tiliaepollenites sp. (R)
Pesavis tagluensis (R)

15364.9'

Undifferentiated bisaccates (F)
Lycopodiumsporites sp. (R)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Caryapollenites sp. (R)
Tiliaepollenites sp. (R)
— Concavissimisporites verrucosus (V)
Multicellaesporites sp. (R)

15366.1'

Undifferentiated bisaccates (F)
Lycopodiumsporites sp. (R)
Taxodiaceae (F)
Alnipollenites sp. (R)
Bombacaceae (R)
Tiliaepollenites sp. (R)
Pesavis tagluensis (R)
Multicellaesporites sp. (R)
Microthyriacites sp. (V)

15367.1'

Undifferentiated bisaccates (F)
Lycopodiumsporites sp. (R)
Taxodiaceae (F)
Alnipollenites sp. (R)
Tiliaepollenites sp. (R)
Multicellaesporites sp. (R)
Striadiporites sp. (R)

15368.4'

Undifferentiated bisaccates (F)
Deltoidospora sp. (R)
Osmundacidites sp. (R)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Tiliaepollenites sp. (F)
Ctenosporites wolfei (R)
Pesavis tagluensis (F)
Multicellaesporites sp. (R)
Microthyriacites sp. (R)
Punctodiporites (R)

16006.8'

Undifferentiated bisaccates (F)
Alnipollenites sp. (R)
Betulaceae (R)
Pesavis tagluensis (R)
Multicellaesporites (R)
Microthyriacites sp. (V)

16009.2'

Undifferentiated bisaccates (F)
Taxodiaceae (F)
Alnipollenites (R)
Betulaceae (R)
Juglanspollenites sp. (R)
Tiliaepollenites sp. (R)
Tricolpites sp. (R)
Multicellaesporites sp. (R)

16011.9'

Undifferentiated bisaccates (F)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Juglanspollenites sp. (R)
Tiliaepollenites sp. (F)
Tricopites sp. (V)
Pesavis tagluensis (R)
Multicellaesporites sp. (F)
Microthyriacites sp. (R)

16017.5'

Undifferentiated bisaccates (V)
Alnipollenites sp. (V)
Juglanspollenites sp. (V)
Caryapollenites sp. (V)
Cicatricosisporites sp. (V)
Pesavis tagluensis (V)
Multicellaesporites sp. (V)
Punctodiporites sp. (V)
Microthyriacites sp. (V)

late Sabinae → ¹⁵Enace.

16020.7'

Undifferentiated bisaccates (F)
Osmundacidites sp. (R)
Polypodiaceae (R)
Taxodiaceae (R)
Alnipollenites sp. (R)
Betulaceae (R)
Juglanspollenites sp. (R)
Caryapollenites sp. (R)

16020.7' (Continued)

Tiliaepollenites sp. (F)
Tricolpites sp. (R)
Pesavis tagluensis (R)
Multicellaesporites sp. (R)
Diporisporites sp. (R)
Microthyriacites sp. (R)
?Diconodinium arcticum (recycled) (R)
Odontochitina operculata (recycled) (V)

Brit. Columbia + 5/10/1964
Late Paleocene
Eocene

16023.0'

Undifferentiated bisaccates (C)
Taxodiaceae (F)
Betulaceae (R)
Juglanspollenites sp. (R)
Tiliaepollenites sp. (F)
Pesavis tagluensis (F)
Multicellaesporites sp. (R)
Dicellaesporites sp. (R)
Diporisporites sp. (R)

16025.3'

Undifferentiated bisaccates (C)
Taxodiaceae (F)
Betulaceae (R)
Juglanspollenites sp. (F)
Tiliaepollenites sp. (F)
Ulmipollenites sp. (R)
Tricolpites (R)
Pesavis tagluensis (R)
Multicellaesporites sp. (R)
Striadiporites sp. (V)

Eocene

16026.9'

Undifferentiated bisaccates (F)
Taxodiaceae (R)
Betulaceae (R)
Juglanspollenites sp. (R)
Tiliaepollenites sp. (F)
Ulmipollenites sp. (R)

Ellesmere T
British Columbia

16026.9' (Continued)

Multicellaesporites sp. (R)
Dicellaesporites sp. (R)
Microthyriacites sp. (V)
?Muderongia tetracantha (V)
?Diconodinium arcticum (R)

? - paleocene - early Eocene
? - paleocene + Eocene
- "Late Haverfordian"
"Cenomanian"

16029.0'

Undifferentiated bisaccates (F)
Taxodiaceae (R)
Juglanspollenites sp. (R)
Tiliaepollenites sp. (F)
Ulmipollenites sp. (R)
Tricolpites sp. (R)
Tetracolpites sp. (V)
Pesavis tagluensis (V)
Multicellaesporites sp. (R)
Dicellaesporites sp. (R)
?Diconodinium arcticum (V)

- paleocene - late Eocene

16701.2'

Undifferentiated bisaccates (R)
Taxodiaceae (R)
Juglanspollenites sp. (R)
Tiliaepollenites sp. (F)
Pesavis tagluensis (V)
Multicellaesporites sp. (F)
Dicellaesporites sp. (F)
Microthyriacites sp. (R)

16703.7'

Undifferentiated bisaccates (R)
Taxodiaceae (R)
Alnipollenites sp. (R)
Tiliaepollenites sp. (R)
Pesavis tagluensis (V)
Multicellaesporites sp. (F)
Microthyriacites sp. (R)

16705.2'

Undifferentiated bisaccates (R)
Betulaceae (R)
Juglanspollenites sp. (R)
Tiliaepollenites sp. (R)
Pesavis tagluensis (R)
Multicellaesporites sp. (R)
Dicellaesporites sp. (R)

16707.5'

Almost barren of palynomorphs.
Undifferentiated bisaccates (R)
Multicellaesporites sp. (R)
Microthyriacites sp. (R)

16714.6'

Essentially barren of palynomorphs.
Undifferentiated bisaccates (V)
Multicellaesporites sp. (V)

16717.9'

Undifferentiated bisaccates (R)
Juglanspollenites sp. (R)
Caryapollenites sp. (R)
Multicellaesporites sp. (R)
Microthyriacites sp. (R)

16716.2'

Undifferentiated bisaccates (V)
Alnipollenites sp. (R)
Juglanspollenites sp. (R)
Tiliaepollenites sp. (F)
Multicellaesporites sp. (R)
Dicellaesporites sp. (R)

16719.6'

Essentially barren of palynomorphs.
Undifferentiated bisaccates (R)
Betulaceae (R)
Multicellaesporites sp. (R)

APPENDIX B

MUD SAMPLE ANALYSES

Drilling mud samples, taken at about 500 foot intervals were processed for palynological examination. Identification of the palynomorphs circulating in the mud system can be helpful in determining the indigenous elements in other palynology samples. The mud analysis data have been taken into account in deriving the palynostratigraphic sequence of the well.

Listed below are the recorded taxa for each of the mud samples analyzed.

1500'

Undifferentiated bisaccates (R)
Lycopodiumsporites sp. (R)
Sphagnumsporites sp. (F)
Alnipollenites sp. (R)
Triporopollenites sp. (R)

2000'

Undifferentiated bisaccates (F)
Deltoidospora sp. (R)
Laevigatosporites (R)
Lycopodiumsporites sp. (R)
Sphagnumsporites sp. (F)
Taxodiaceae (R)
Alnipollenites sp. (R)

2500'

Undifferentiated bisaccates (F)
Acanthotriletes sp. (R)
Deltoidospora sp. (R)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (R)
Sphagnumsporites sp. (F)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Tasmanaceae (R)

3000'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (R)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (R)
Sphagnumsporites sp. (R)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Caryapollenites simplex (R)
Lilacidites sp. (R)

3500'

Undifferentiated bisaccates (C)
Tsugaepollenites sp. (F)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Osmundacidites sp. (R)
Sphagnumsporites sp. (F)
Alnipollenites sp. (F)
Betulaceae (F)
Diervilla echinata (R)

4000'

Undifferentiated bisaccates (F)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Sphagnumsporites sp. (F)
Alnipollenites sp. (F)
Betulaceae (F)
Caryapollenites sp. (F)
Momiipites sp. (R)
Pterocaryapollenites sp. (R)

4500'

Undifferentiated bisaccates (C)
Podocarpidites sp. (R)
Tsugaepollenites sp. (F)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (F)
Sphagnumsporites sp. (F)
Taxodiaceae (F)
Alnipollenites sp. (F)
Betulaceae (F)
Juglanspollenites sp. (R)
Pterocaryapollenites sp. (R)
Tetracolpites sp. (V)

5000'

Undifferentiated bisaccates (C)
Tsugaepollenites sp. (F)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (F)
Osmundacidites sp. (F)
Sphagnumsporites sp. (C)
Taxodiaceae (C)
Alnipollenites sp. (F)
Betulaceae (F)
Juglanspollenites sp. (R)
Malvaceae (V)

5500'

Undifferentiated bisaccates (C)
Tsugaepollenites sp. (R)
Deltoidospora sp. (F)
Osmundacidites sp. (F)
Sphagnumsporites sp. (F)
Taxodiaceae (F)
Alnipollenites sp. (F)
Betulaceae (F)
Tasmanaceae (V)

6000'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (R)
Deltoidospora sp. (R)
Laevigatosporites sp. (R)
Osmundacidites sp. (R)
Sphagnumsporites sp. (R)
Taxodiaceae (R)
Alnipollenites sp. (R)
Betulaceae (R)

6500'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Deltoidospora sp. (C)
Laevigatosporites sp. (C)
Osmundacidites sp. (R)
Sphagnumsporites sp. (C)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Juglanspollenites sp. (R)

7000'

Undifferentiated bisaccates (C)
Tsugaepollenites sp. (C)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Osmundacidites sp. (R)
Sphagnumsporites sp. (F)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)
Juglanspollenites sp. (R)

7500'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (F)
Deltoidospora sp. (R)
Laevigatosporites sp. (R)
Alnipollenites sp. (F)
Betulaceae (F)
Juglanspollenites sp. (R)

8000'

Undifferentiated bisaccates (F)
Deltoidospora sp. (R)
Osmundacidites sp. (R)
Sphagnumsporites sp. (R)
Taxodiaceae (R)
Pterocaryapollenites sp. (R)

8500'

Undifferentiated bisaccates (F)
Laevigatosporites sp. (F)
Sphagnumsporites sp. (F)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)

9000'

Undifferentiated bisaccates (F)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Osmundacidites sp. (R)
Sphagnumsporites sp. (R)
Taxodiaceae (F)
Alnipollenites sp. (R)
Betulaceae (R)

9500'

Undifferentiated bisaccates (F)
Deltoidospora sp. (R)
Laevigatosporites sp. (R)
Osmundacidites sp. (R)
Alnipollenites sp. (R)
Betulaceae (R)

10,000'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (R)
Deltoidospora sp. (F)
Laevigatosporites sp. (F)
Lycopodiumsporites sp. (R)
Osmundacidites sp. (R)
Polypodiaceae (R)
Sphagnumsporites sp. (R)
Alnipollenites sp. (R)
Betulaceae (R)

11,000'

Undifferentiated bisaccates (F)
Tsugaepollenites sp. (R)
Laevigatosporites sp. (F)
Osmundacidites sp. (R)
Polypodiaceae (R)
Taxodiaceae (R)
Carpinus sp. (F)
Alnipollenites sp. (R)
Betulaceae (R)

12,000'

Mainly woody debris, almost barren of palynomorphs.

13,000'

Undifferentiated bisaccates (R)
Lycopodiumsporites sp. (V)
Taxodiaceae (V)
Alnipollenites (V)
Caryapollenites sp. (R)
Tiliaepollenites sp. (V)
Multicellaesporites sp. (V)
Areosphaeridium diktyoplokus (V)

13,500'

Undifferentiated bisaccates (R)
Tsugaepollenites sp. (R)
Deltoidospora sp. (R)
Taxodiaceae (R)
Alnipollenites sp. (R)
Betulaceae (R)
Caryapollenites sp. (R)
Bombacaceae (V)

14,500'

Undifferentiated bisaccates (R)
Punctodiporites sp. (V)

15,000'

Undifferentiated bisaccates (R)
Laevigatosporites sp. (V)
Taxodiaceae (R)
Alnipollenites sp. (R)
Tricolpites sp. (R)

15,500'

Undifferentiated bisaccates (R)
Deltoidospora sp. (R)
Taxodiaceae (R)
Betulaceae (R)
Tricolporopollenites sp. (R)

16,000'

Undifferentiated bisaccates (R)
Alnipollenites sp. (R)
Betulaceae (R)
Caryapollenites sp. (R)

16,500'

Undifferentiated bisaccates (R)
Tricolpites sp. (R)
Multicellaesporites sp. (V)
Punctodiporites sp. (V)

17,000'

Undifferentiated bisaccates (R)
Laevigatosporites sp. (R)
Taxodiaceae (R)
Alnipollenites sp. (F)
Betulaceae (F)
Caryapollenites sp. (F)