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ARCO

NORTH ALEUTIAN SHELF COST NO. 1

JOB #05820107

PALYNOLOGY REPORT

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CONTENTS

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 dirived 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 Ericaeae 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 vessipites, 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. phosphoritica, 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, Hystrichokolpoma rigaudae and Spinidinium essoi 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 abundancy. 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 dinoflagelate 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 tagluensis, 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 abundancy from 15,347.7' to T.D.

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)
Tsugaepollenits 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)
Osmundacities 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)
Tsugaepollenies 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'

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)
Tsugaepollenits 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)
Lyocpodiumsporites 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)