



**BioStratigraphics**  
**Consulting Micropaleontology**

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ARCO

NORTH ALEUTIAN SHELF COST NO. 1

JOB #05820107

PALYNOLOGY REPORT

Received  
DISTRICT  
OIL AND GAS OFFICE

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Minerals Management Service  
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*

Suchit S. Hart  
Biostratigrapher Consultant

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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 Paralecaneia 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)  
Fusifformisporites 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 → <sup>15</sup>Enace.

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)

ARCO NORTH ALEUTIAN COST NO. 1 BERING SEA, ALASKA

? = Questionable occurrence or identification  
+ Very rare (1)  
- Rare (2-5)  
= Frequent (6-15)  
= Common (16-30)  
= Abundant (30+)  
= Barren

Prepared by: BIOSTRATIGRAPHICS  
Chart 1 of 3

SPORES & POLLEN

MICROPLANKTON

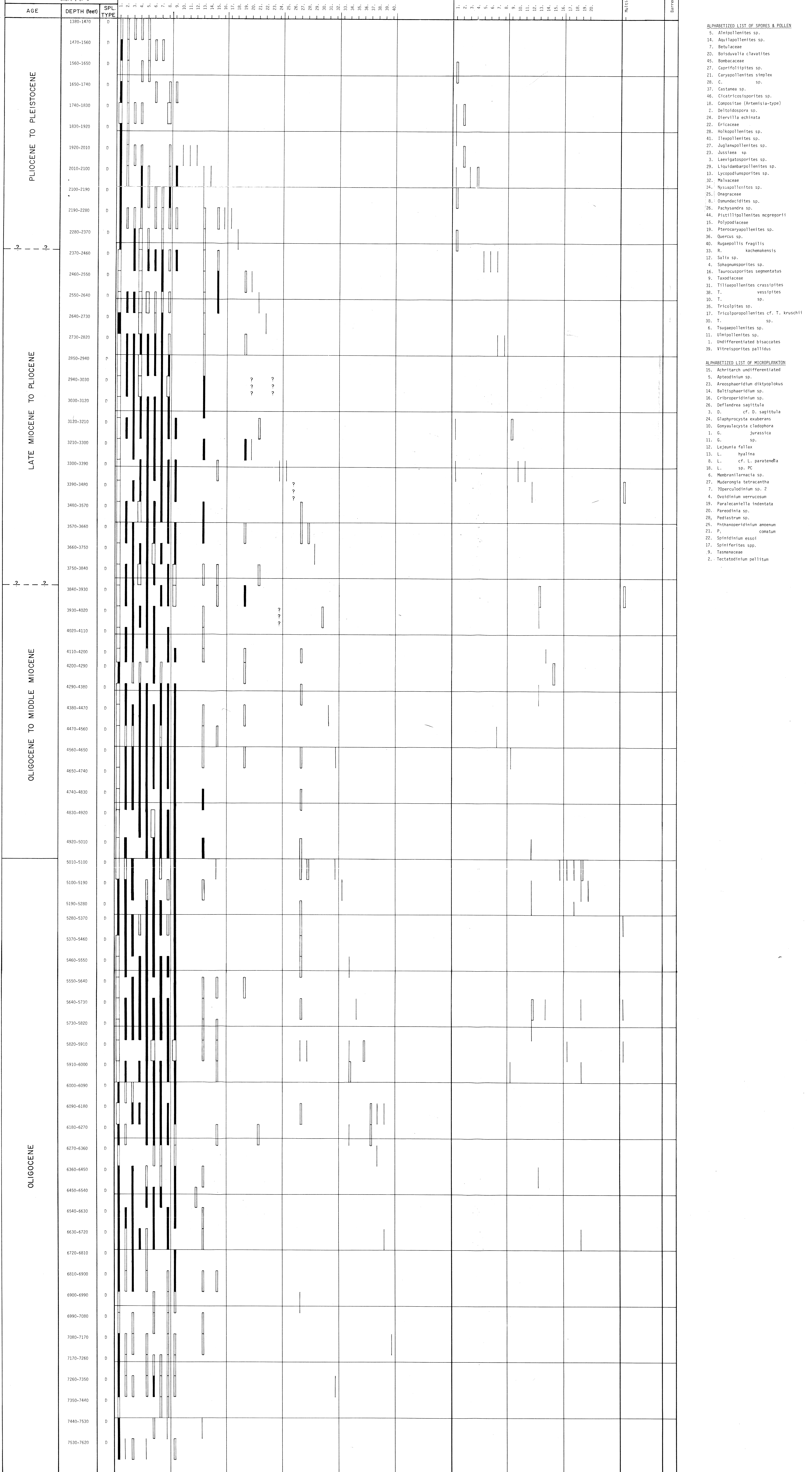
MISCELLANEOUS

Bureau of Paleontology

1. Undifferentiated bisaccates
2. Deltoidospora sp.
3. Levisporites sp.
4. Sphagnumsporites sp.
5. Alnipollenites sp.
6. Aquilapollenites sp.
7. Betulaecolpites sp.
8. Osmundacidites sp.
9. Taxodiaceae
10. Tiliapollenites sp.
11. Ulmiipollenites sp.
12. Salix sp.
13. Lycopodiumsporites sp.
14. Aquilapollenites sp.
15. Polypodiaceae
16. Compositae (Artemisia-type)
17. Tricolporopollenites cf. T. kruschii
18. Compositae (Artemisia-type)
19. Pterocaryapollenites sp.
20. Boidavella clavites
21. Caryapollenites simplex
22. Ericaceae
23. Jussiaea sp.
24. Dierivilla echinata
25. Juglanspollenites sp.
26. Pachysandra sp.
27. Juglanspollenites sp.
28. Caryapollenites sp.
29. Liquidambarpollenites sp.
30. Tripurapollenites sp.
31. Tiliapollenites crassipites
32. Malvaceae
33. Rugosipollis kachemakensis
34. Vitreisporites pallidus
35. Quercus sp.
36. Castanea sp.
37. Tiliapollenites vespillites
38. Vitreisporites pallidus
39. Vitreisporites pallidus
40. Rugosipollis fragilis

1. Gonyaulacysta jurassica
2. Tectatodinium pellitum
3. Deflandrea cf. D. sagittula
4. Ovoidinium verrucosum
5. Azeodinium sp.
6. Membranilarnacia sp.?
7. Membranilarnacia sp.?
8. Lejeunia cf. L. paratenella
9. Tannaceae
10. Gonyaulacysta cladophora
11. G. sp.
12. Lejeunia fallax
13. L. hyalina
14. Baltisphaeridium sp.
15. Achritarcus undifferentiated
16. Cribroperidium sp.
17. Acanthopollis sp.
18. Lejeunia sp.
19. Paralecanitella indentata
20. Paroedinia sp.

- Muticellaesporites sp.



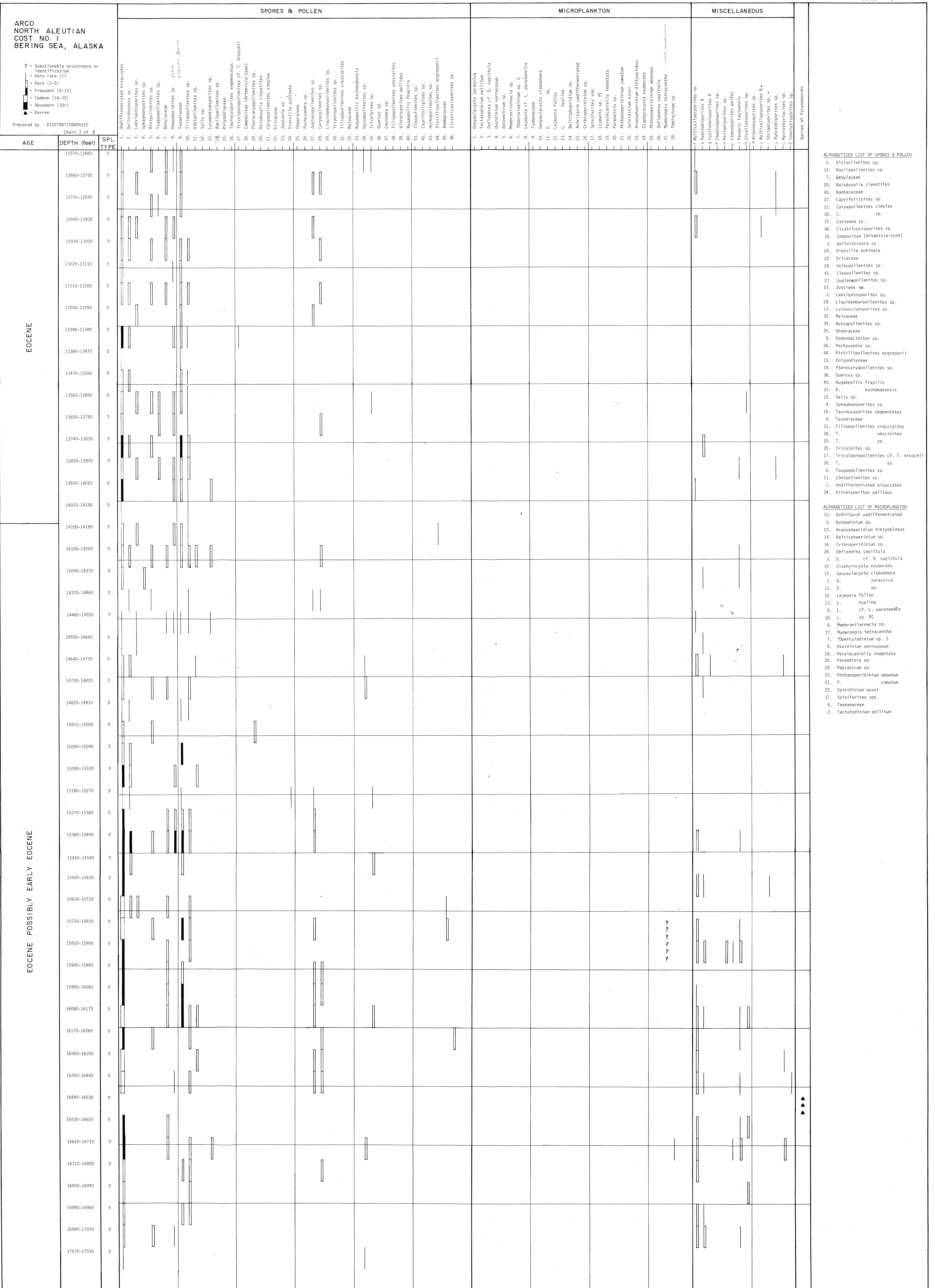
ALPHABETIZED LIST OF SPORES & POLLEN

5. Alnipollenites sp.
14. Aquilapollenites sp.
7. Betulaceae
20. Boidavella clavites
45. Bombacaceae
27. Caprifoliites sp.
21. Caryapollenites simplex
28. C. sp.
37. Castanea sp.
46. Cistacoidisporites sp.
18. Compositae (Artemisia-type)
2. Deltoidospora sp.
24. Dierivilla echinata
22. Ericaceae
28. Holcopollenites sp.
41. Ilxipollenites sp.
27. Juglanspollenites sp.
44. Jussiaea sp.
3. Levisporites sp.
23. Liquidambarpollenites sp.
13. Lycopodiumsporites sp.
32. Malvaceae
34. Myrsinipollenites sp.
25. Onagraceae
8. Osmundacidites sp.
26. Pachysandra sp.
44. Pistillipollenites mcgregorii
15. Polypodiaceae
19. Pterocaryapollenites sp.
36. Quercus sp.
40. Rugosipollis fragilis
33. R. kachemakensis
12. Salix sp.
4. Sphagnumsporites sp.
16. Tauracoidisporites segmentatus
9. Taxodiaceae
31. Tiliapollenites crassipites
38. T. vespillites
10. T. sp.
35. Tricolpites sp.
17. Tricolporopollenites cf. T. kruschii
30. T. sp.
6. Tsugaepollenites sp.
11. Ulmiipollenites sp.
1. Undifferentiated bisaccates
39. Vitreisporites pallidus

ALPHABETIZED LIST OF MICROPLANKTON

15. Achritarcus undifferentiated
5. Apleodinium sp.
23. Acanthopollis cf. A. diktyoplous
14. Baltisphaeridium sp.
16. Cribroperidium sp.
26. Deflandrea sagittula
3. D. cf. D. sagittula
24. Glaphyrocysta exuberans
10. Gonyaulacysta cladophora
1. G. jurassica
11. G. sp.
12. Lejeunia fallax
13. L. hyalina
8. L. cf. L. paratenella
18. L. sp. PC
6. Membranilarnacia sp.
27. Muderongia tetracantha
7. Ovoidinium verrucosum
19. Paralecanitella indentata
20. Paroedinia sp.
28. Pedastrum sp.
25. Pitanaoperidium amoenum
21. P. comutum
22. Spiniferites essoi
17. Spiniferites sp.
9. Tasmaceae
2. Tectatodinium pellitum





ARCO  
NORTH ALEUTIAN  
COST NO. 1  
BERING SEA, ALASKA

? = Questionable identification  
 = Very rare (1)  
 = Rare (2-10)  
 = Frequent (11-33)  
 = Common (33-99)  
 = Abundant (100+)  
 = Barren

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 Chart 3 of 3

FORAMINIFERA

MISCELLANEOUS

MINERALS, ETC.

AGE	DEPTH (feet)	SPL. TYPE	FORAMINIFERA	MISCELLANEOUS	MINERALS, ETC.
	12570-12600	D			
	12600-12630	D			
	12630-12660	D			
	12660-12690	D			
	12690-12720	D			
	12720-12750	D			
	12750-12780	D			
	12780-12810	D			
	12810-12840	D			
	12840-12870	D			
	12870-12900	D			
	12900-12930	D			
	12930-12960	D			
	12960-12990	D			
	12990-13020	D			
	13020-13050	D			
	13050-13080	D			
	13080-13110	D			
	13110-13140	D			
	13140-13170	D			
	13170-13200	D			
	13200-13230	D			
	13230-13260	D			
	13260-13290	D			
	13290-13320	D			
	13320-13350	D			
	13350-13380	D			
	13380-13410	D			
	13410-13440	D			
	13440-13470	D			
	13470-13500	D			
	13500-13530	D			
	13530-13560	D			
	13560-13590	D			
	13590-13620	D			
	13620-13650	D			
	13650-13680	D			
	13680-13710	D			
	13710-13740	D			
	13740-13770	D			
	13770-13800	D			
	13800-13830	D			
	13830-13860	D			
	13860-13890	D			
	13890-13920	D			
	13920-13950	D			
	13950-13980	D			
	13980-14010	D			
	14010-14040	D			
	14040-14070	D			
	14070-14100	D			
	14100-14130	D			
	14130-14160	D			
	14160-14190	D			
	14190-14220	D			
	14220-14250	D			
	14250-14280	D			
	14280-14310	D			
	14310-14340	D			
	14340-14370	D			
	14370-14400	D			
	14400-14430	D			
	14430-14460	D			
	14460-14490	D			
	14490-14520	D			
	14520-14550	D			
	14550-14580	D			
	14580-14610	D			
	14610-14640	D			
	14640-14670	D			
	14670-14700	D			
	14700-14730	D			
	14730-14760	D			
	14760-14790	D			
	14790-14820	D			
	14820-14850	D			
	14850-14880	D			
	14880-14910	D			
	14910-14940	D			
	14940-14970	D			
	14970-15000	D			
	15000-15030	D			
	15030-15060	D			
	15060-15090	D			
	15090-15120	D			
	15120-15150	D			
	15150-15180	D			
	15180-15210	D			
	15210-15240	D			
	15240-15270	D			
	15270-15300	D			
	15300-15330	D			
	15330-15360	D			
	15360-15390	D			
	15390-15420	D			
	15420-15450	D			
	15450-15480	D			
	15480-15510	D			
	15510-15540	D			
	15540-15570	D			
	15570-15600	D			
	15600-15630	D			
	15630-15660	D			
	15660-15690	D			
	15690-15720	D			
	15720-15750	D			
	15750-15780	D			
	15780-15810	D			
	15810-15840	D			
	15840-15870	D			
	15870-15900	D			
	15900-15930	D			
	15930-15960	D			
	15960-15990	D			
	15990-16020	D			
	16020-16050	D			
	16050-16080	D			
	16080-16110	D			
	16110-16140	D			
	16140-16170	D			
	16170-16200	D			
	16200-16230	D			
	16230-16260	D			
	16260-16290	D			
	16290-16320	D			
	16320-16350	D			
	16350-16380	D			
	16380-16410	D			
	16410-16440	D			
	16440-16470	D			
	16470-16500	D			
	16500-16530	D			
	16530-16560	D			
	16560-16590	D			
	16590-16620	D			
	16620-16650	D			
	16650-16680	D			
	16680-16710	D			
	16710-16740	D			
	16740-16770	D			
	16770-16800	D			
	16800-16830	D			
	16830-16860	D			
	16860-16890	D			
	16890-16920	D			
	16920-16950	D			
	16950-16980	D			
	16980-17010	D			
	17010-17040	D			
	17040-17070	D			
	17070-17100	D			
	17100-17130	D			
	17130-17150	D			

INDETERMINATE

ALPHABETIZED LIST OF FORAMINIFERA

- 18. Angulogerina angulosa
- 58. Arenaceus spp.
- 59. Bathysiphon sp.
- 20. Buccella frigida
- 24. B. tenerrima
- 5. Cassidulina californica
- 41. C. cf. crassipunctata
- 6. C. laticamerata
- 21. C. minuta
- 45. "Caucasina" sp.
- 54. Cibicides comoides
- 42. C. cf. evolutus
- 44. C. fletcheri
- 7. C. aff. mckamoi
- 27. C. cf. perlucidus
- 28. C. cf. suppressus
- 50. Cribrononion aff. roemeri
- 40. C. sp.
- 10. Dentalina sp. 1
- 8. D. sp. 2
- 15. D. spp.
- 3. Elphidium bartletti
- 30. E. cf. bartletti
- 1. E. clavatum
- 51. E. aff. minutum
- 32. E. cf. orbiculare
- 34. E. cf. sibiricum
- 9. E. sp.
- 2. Elphidiella "alaskense"
- 29. E. hanna
- 38. E. cf. hanna
- 56. E. aff. hanna
- 49. E. sp.
- 43. Eponides sp.
- 13. Glabratella sp.
- 47. Glandulina sp.
- 22. Globigerina sp.
- 52. Globbulimina affinis
- 25. Guttulina cf. sadoensis
- 46. Haplophragmoides spp.
- 14. Lenticulina nikobarensis
- 53. Nonion (Melonis) sp.
- 17. N. labradoricum
- 57. Nonionella labradorica
- 26. Oolina sp.
- 35. Polymorphina sp.
- 33. Porosorotalia cf. clarki
- 48. Pseudoglandulina inflata
- 19. Pseudopolymorphina spp.
- 36. Pyralina sp.
- 16. Quinqueloculina agglutinata
- 31. Q. bellatula
- 4. Q. spp.
- 39. Rotalia cf. beccarii
- 60. Saccamina sp.
- 37. Signomorphina cf. pseudoschencki
- 55. Textularia sp.
- 11. Uvigerina juncea
- 12. Vaginulina sp. costate
- 23. V. sp. striate

ARCO NORTH ALEUTIAN COST NO. 1 BERING SEA, ALASKA		SPORES & POLLEN				MICROPLANKTON				MISCELLANEOUS				ALPHABETIZED LIST OF SPORES & POLLEN 1. Undifferentiated bisaccates 2. Omundacoidites sp. 3. Taxodiaceae 4. Juglanspollinites sp. 5. Deltoidospora sp. 6. Sphagnuspores sp. 7. Malvaceae 8. Liquidambarpollenites sp. 9. Lycodumsporites sp. 10. Laevigatosporites sp. 11. Nymphaea 12. Callialasporites trilobatus 13. Tomaspollenites sp. 14. Tomaspollenites sp. 15. Clatricosporites sp. 16. Salix sp. 17. Betulaceae 18. Boisduvalia clavulites 19. Podocarpites sp. 20. Pterocaryopollenites sp. 21. Tiliaepollenites crassipites 22. Caryapollenites sp. 23. Ulmipollenites sp. 24. Faguspollenites sp. 25. Tiliapollenites sp. 26. Tricolporopollenites sp. 27. Tricolporopollenites sp. 28. Bombacaceae 29. Nymphaea cf. N. spinosa 30. Ericaceae 31. Ericaceae 32. Asteraceae 33. Valerianaceae 34. Pistillipollenites megregoriai 35. Diervilla echinata 36. Quercus sp. 37. Tricolpites sp. 38. Jusséae sp. 39. Retricolpites sp. 40. Caprifoliites sp.	
AGE	DEPTH (feet)	SPL TYPE													
OLIGOCENE	7771	SWC													
	7824	SWC													
	7900	SWC													
	7922	SWC													
	7993	SWC													
	8041	SWC													
	8073	SWC													
	8082	SWC													
	8084	SWC													
	8120	SWC													
	8170	SWC													
	8277	SWC													
	8313	SWC													
	8351	SWC													
	8404	SWC													
	8461	SWC													
LATE EOCENE TO EARLY OLIGOCENE	8578	SWC													
	8686	SWC													
	8818	SWC													
	8891	SWC													
	8919	SWC													
	8924	SWC													
	8944	SWC													
	9051	SWC													
	9168	SWC													
	9237	SWC													
	9320	SWC													
	9446	SWC													
	EOCENE	9577	SWC												
		9620	SWC												
		9637	SWC												
		9697	SWC												
9767		SWC													
9814		SWC													
9852		SWC													
9895		SWC													
9940		SWC													
9973		SWC													
10000		SWC													
10050		SWC													
10115		SWC													
10136		SWC													
10171		SWC													
10192		SWC													
10223	SWC														
10311	SWC														
10452	SWC														
10552	SWC														
10595	SWC														
10622	SWC														
10659	SWC														
10730	SWC														
10829	SWC														
10910	SWC														
11059	SWC														
11125	SWC														
11177	SWC														
11224	SWC														
11237	SWC														
11365	SWC														
11408	SWC														
11453	SWC														
11597	SWC														
11626	SWC														
11675	SWC														
11783	SWC														
11844	SWC														
11884	SWC														
11910	SWC														
11994	SWC														
12025	SWC														
12116	SWC														
12166	SWC														
12221	SWC														
12284	SWC														
12347	SWC														
12375	SWC														
12439	SWC														
12512	SWC														
12565	SWC														

ALPHABETIZED LIST OF SPORES & POLLEN

- 1. Undifferentiated bisaccates
- 2. Omundacoidites sp.
- 3. Taxodiaceae
- 4. Juglanspollinites sp.
- 5. Deltoidospora sp.
- 6. Sphagnuspores sp.
- 7. Malvaceae
- 8. Liquidambarpollenites sp.
- 9. Lycodumsporites sp.
- 10. Laevigatosporites sp.
- 11. Nymphaea
- 12. Callialasporites trilobatus
- 13. Tomaspollenites sp.
- 14. Tomaspollenites sp.
- 15. Clatricosporites sp.
- 16. Salix sp.
- 17. Betulaceae
- 18. Boisduvalia clavulites
- 19. Podocarpites sp.
- 20. Pterocaryopollenites sp.
- 21. Tiliaepollenites crassipites
- 22. Caryapollenites sp.
- 23. Ulmipollenites sp.
- 24. Faguspollenites sp.
- 25. Tiliapollenites sp.
- 26. Tricolporopollenites sp.
- 27. Tricolporopollenites sp.
- 28. Bombacaceae
- 29. Nymphaea cf. N. spinosa
- 30. Ericaceae
- 31. Ericaceae
- 32. Asteraceae
- 33. Valerianaceae

ALPHABETIZED LIST OF MICROPLANKTON

- 1. Gonyalacysta jurassica
- 2. Tectatodinium pellitum
- 3. Leptodinium sp.
- 4. Tasmanaceae
- 5. Pteroculodinium sp. 2
- 6. Lejeunia fallax
- 7. Deflandrea cf. D. phosphoritica
- 8. Spiniferites spp.
- 9. Baltisphearidium sp.
- 10. Deflandrea sp.
- 11. Hystrichokolpoma rigaudae
- 12. Paralecaniella indentata
- 13. Cordosphaeridium dityoplous
- 14. Cordosphaeridium exillimurum
- 15. P.
- 16. P.
- 17. P. alectrotophom amoenum
- 18. P. comatum
- 19. D. sagittula
- 20. Spinidinium sp.
- 21. L. hyalina
- 22. Palaeoperidinium sp.
- 23. Paralecaniella indentata
- 24. Glaphrocysta exuberans
- 25. Baltisphearidium sp.
- 26. Pedastrum sp.
- 27. Phthanooperidinium cf. P. alectrotophom amoenum
- 28. P. echinatum
- 29. P.
- 30. Spinidinium sp.
- 31. Spiniferites spp.
- 32. Tectatodinium pellitum

MISCELLANEOUS

Multi-cellular spores	▲
Polysaccate	
Microfossils	
Microrhizoids	
Petaloidites	
Peavias sapientis	
Striadipores	
Barren of Polymorphs	▲

ARCO NORTH ALEUTIAN COST NO. 1 BERING SEA, ALASKA			SPORES & POLLEN																																								MICROPLANKTON																										MISCELLANEOUS																	
AGE			DEPTH (feet)			SPL. TYPE			1. Undifferentiated bisaccates 2. Osmundacidites sp. 3. Taxodiaceae 4. Juglanspollenites sp. 5. Deltoidospora sp. 6. Sphagnumsporites sp. 7. Malvaceae 8. Liquidambarpollenites sp. 9. Lycopodiumsporites sp. 10. Laevigatosporites sp. 11. Polypodiaceae 12. Alnipollenites sp. 13. Callialasporites trilobatus 14. Tsugaepollenites sp. 15. Cicatricosisporites sp. 16. Salix sp. 17. Betulaceae 18. Boissduvalia clavatites 19. Podocarpidites sp. 20. Pterocaryapollenites sp. 21. Tiliaepollenites crassipites 22. Caryapollenites sp. 23. Ulmpollenites sp. 24. Faguspollenites sp. 25. Tiliaepollenites sp. 26. Tricolporopollenites sp. 27. Nyssapollenites sp. 28. Bombacaceae 29. Nymphaea cf. N. spinosa 30. Castanea sp. 31. Ericaceae 32. Acanthotriletes sp. 33. Valerianaceae 34. Pistillipollenites mcgregorii 35. Diervilla echinata 36. Quercus sp. 37. Tricolpites sp. 38. Jusseiae sp. 39. Retitricolpites sp. 40. Caprifoliipites sp.																																								1. Gonyaulacysta jurassica 2. Tectatodinium pellitum 3. Leptodinium sp. 4. Tasmanaceae 5. ?Operculodinium sp. 2 6. Lejeunia fallax 7. Deflandrea cf. D. phosphoritica 8. Spiniferites spp. 9. Baltisphaeridium sp. 10. Deflandrea sp. 11. Hystrichokolpoma regaudae 12. Paralecaniella indentata 13. Cordosphaeridium sp. 14. Areosphaeridium diktyoplokus 15. Phthanoperidinium comatum 16. P. amoenum 17. P. cf. P. alectrolophum 18. P. sp. 19. Deflandrea sagittula 20. Spinidinium sp. 21. Lejeunia hyalina 22. Palaeoperidinium sp. 23. Phthanoperidinium echinatum 24. Glaphyrocysta exuberans 25. Cordosphaeridium exilimurum 26. Pedastrum sp.																										Multicellaesporites sp. Dicellaesporites sp. Diporisorites sp. Microthyracites sp. Ptiladiporites sp. Pesavis taquensis Striadiporites sp.						Barren of Palynomorphs					
EOCENE			12635			SWC																																																																																
			12698			SWC																																																																																
			12754			SWC																																																																																
			12783			SWC			<div style="display: flex; justify-content: space-between;"> <div style="width: 10%;"> </div> </div>																																																																													
			12865			SWC			<div style="display: flex; justify-content: space-between;"> <div style="width: 10%;"> </div> </div>																																																																													
			12920			SWC																																																																																
			12947			SWC			<div style="display: flex; justify-content: space-between;"> <div style="width: 10%;"> </div> </div>																																																																													
			12993			SWC																																																																																
			13113			SWC			<div style="display: flex; justify-content: space-between;"> <div style="width: 10%;"> </div> </div>																																																																													
			13207			SWC			<div style="display: flex; justify-content: space-between;"> <div style="width: 10%;"> </div> </div>																																																																													
			13261			SWC																																																																																
			13312			SWC																																																																																
			13340			SWC			<div style="display: flex; justify-content: space-between;"> <div style="width: 10%;"> </div> </div>																																																																													

- ALPHABETIZED LIST OF SPORES & POLLEN
32. Acanthotriletes sp.
  12. Alnipollenites sp.
  17. Betulaceae
  18. Boissduvalia clavatites
  28. Bombacaceae
  13. Callialasporites trilobatus
  40. Caprifoliipites sp.
  22. Caryapollenites sp.
  30. Castanea sp.
  15. Cicatricosisporites sp.
  5. Deltoidospora sp.
  35. Diervilla echinata
  31. Ericaceae
  24. Faguspollenites sp.
  4. Juglanspollenites sp.
  38. Jusseiae sp.
  10. Laevigatosporites sp.
  8. Liquidambarpollenites sp.
  9. Lycopodiumsporites sp.
  7. Malvaceae
  29. Nymphaea cf. N. spinosa
  27. Nyssapollenites sp.
  2. Osmundacidites sp.
  34. Pistillipollenites mcgregorii
  19. Podocarpidites sp.
  11. Polypodiaceae
  20. Pterocaryapollenites sp.
  36. Quercus sp.
  39. Retitricolpites sp.
  16. Salix sp.
  6. Sphagnumsporites sp.
  3. Taxodiaceae
  21. Tiliaepollenites crassipites
  25. T. sp.
  37. Tricolpites sp.
  26. Tricolporopollenites sp.
  14. Tsugaepollenites sp.
  23. Ulmpollenites sp.
  1. Undifferentiated bisaccates
  33. Valerianaceae

- ALPHABETIZED LIST OF MICROPLANKTON
14. Areosphaeridium diktyoplokus
  9. Baltisphaeridium sp.
  25. Cordosphaeridium exilimurum
  13. C. sp.
  7. Deflandrea cf. phosphoritica
  19. D. sagittula
  10. D. sp.
  24. Glaphyrocysta exuberans
  1. Gonyaulacysta jurassica
  11. Hystrichokolpoma rigaudae
  6. Lejeunia fallax
  21. L. hyalina
  3. Leptodinium sp.
  5. ?Operculodinium sp. 2
  22. Palaeoperidinium sp.
  12. Paralecaniella indentata
  26. Pedastrum sp.
  17. Phthanoperidinium cf. P. alectrolophum
  16. P. amoenum
  15. P. comatum
  23. P. echinatum
  18. P. sp.
  20. Spinidinium sp.
  8. Spiniferites spp.
  4. Tasmanaceae
  2. Tectatodinium pellitum