PALYNOLOGY OF MINORA WINDERMERE-1,

ONSHORE OTWAY BASIN, VICTORIA

BY

ROGER MORGAN (1987)

CONTENTS

I SUMMARY

605.3m (swc) : middle M. diversus Zone : early Eocene : very marginally marine : immature

660m (cutts)-710m (cutts) : apparently upper L. balmei Zone (A. homomorphum Dinoflagellate Zone) : late Paleocene : nearshore marine : immature

719.0m (swc)-802.0m (swc) : T. longus Zone (719.0-779.0m I. druggii Dinoflagellate Zone) : Maastrichtian : nearshore marine : immature

876.3m (swc) : N. senectus Zone : Campanian : marginal marine : immature

931.5m (swc) : upper T. pachyexinus Zone (N. aceras Dinoflagellate Zone) : Santonian : marginally marine : immature

980m (cutts)-1050m (cutts) : apparently T. pachyexinus Zone, but could be partly older with heavy caving : Late Cretaceous, apparently Santonian : nearshore marine : immature

1090m (cutts)-1180.0m (swc) : T. pannosus Zone : late Albian : non-marine : marginally mature

1205.0m (swc)-1330m (cutts) : upper C. paradoxa Zone : mid Albian : non-marine : marginally mature

1512.5m (swc) : lower C. paradoxa Zone : mid Albian : non-marine : early mature

1550m (cutts)-1750m (cutts) : lower C. paradoxa to C. striatus Zones : early to mid Albian : early mature

1830-40m (cutts) : C. striatus Zone : early Albian : non-marine : mature

II INTRODUCTION

Ed Kopson of Minora Resources submitted 20 samples (9 swcs and 11 cuttings samples) from Windermere-1 for palynological analysis for the completion report. Verbal results were conveyed as available, and a written preliminary breakdown submitted on 1st May 1987. This report details the final interpretation of results of these samples.

Palynomorph occurrence data are shown as Appendix I and form the basis for the assignment of the samples to nine spore-pollen units of early Albian to early Eocene age. The Tertiary spore-pollen zonation is that of Stover and Evans (1973) and Stover and Partridge (1973) as modified by Partridge (1976) and shown on figure 1. The zones of Harris (1965) are not preferred as they only span part of the interval and are less widely used. The Cretaceous spore-pollen zonation is essentially that of Playford and Dettmann (1969), but has been significantly modified and improved by various authors since, and most recently discussed in Helby et al. (1987), as shown on figure 1.

No formal dinoflagellate zonation has been published for the Tertiary of the Bass or Gippsland Basins although Harris (1985) has recently published some zones for part of the Eocene of the Otway and St. Vincent Basins. Partridge (1976) published a table showing zone names in the Gippsland Basin but charts defining these zones were never published, although they are informally available. Very few Tertiary dinoflagellates were seen, and they are discussed within the Partridge (1976) framework, as it is more precise and more widely used. Cretaceous dinoflagellates are seen in only a few samples, and are discussed within the recent zonation framework of Helby et al. (1987), as on figure 1.

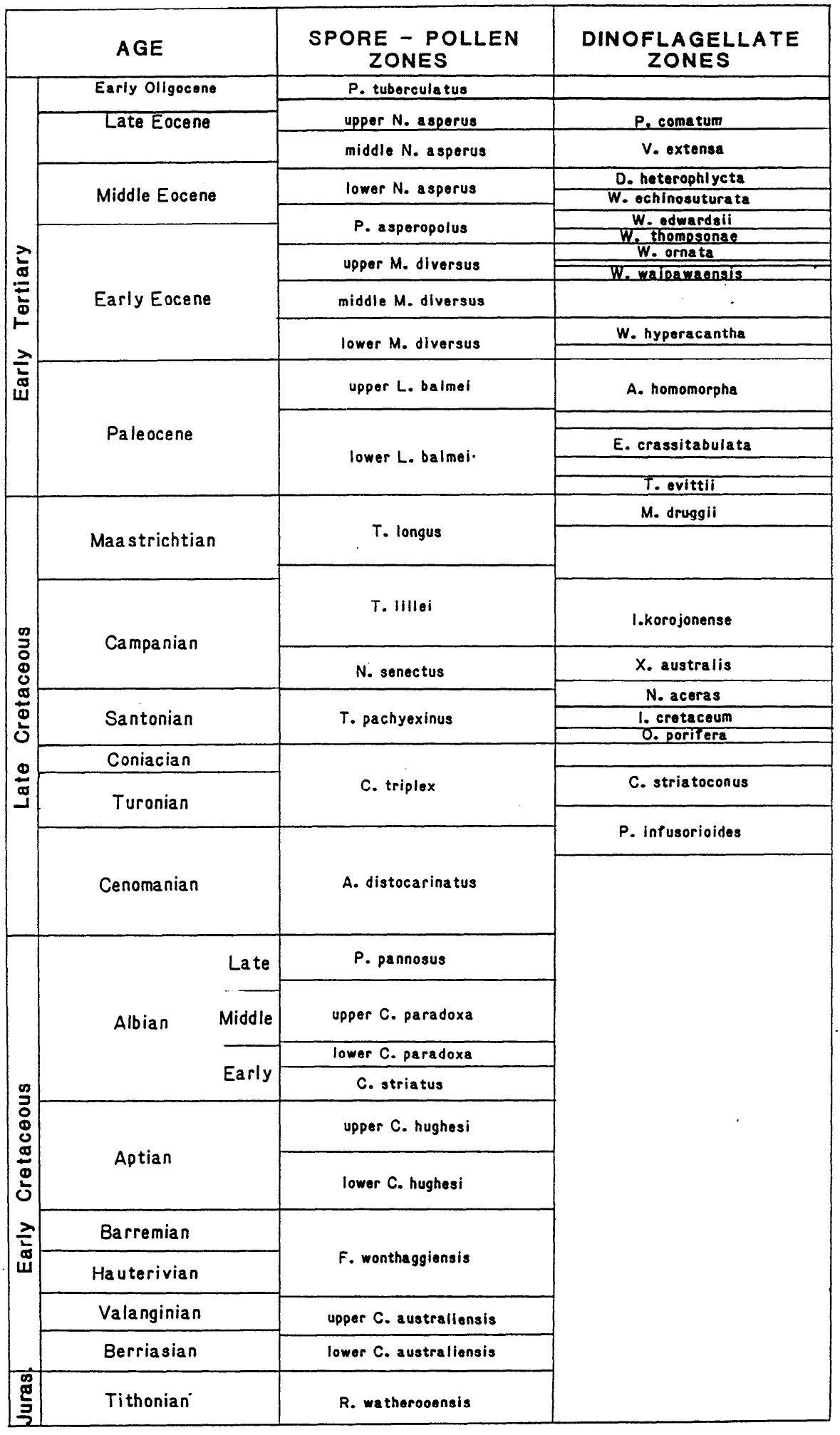

FIGURE 1 ZONATION FRAMEWORK

Maturity data was generated in the form of Spore Colour Index, and is plotted on figure 2 Maturity profile of Minora Windermere-1. The oil and gas windows on figure 2 follow the general concensus of geochemical literature. The oil window corresponds to spore colours of light-mid brown (Staplin Spore Colour Index of 2.7) to dark brown (3.6). These correspond to vitrinite reflectence values of 0.6% to 1.3%. Geochemists, however, have not reached universal agreement on these values, and argue variations on kerogen type, basin type and even basin history. The maturity interpretation is thus open to reinterpretation using the basic colour observations as raw data. However, the range of interpretation philosophies is not great, and probably would not move the oil window by more than 200 metres.

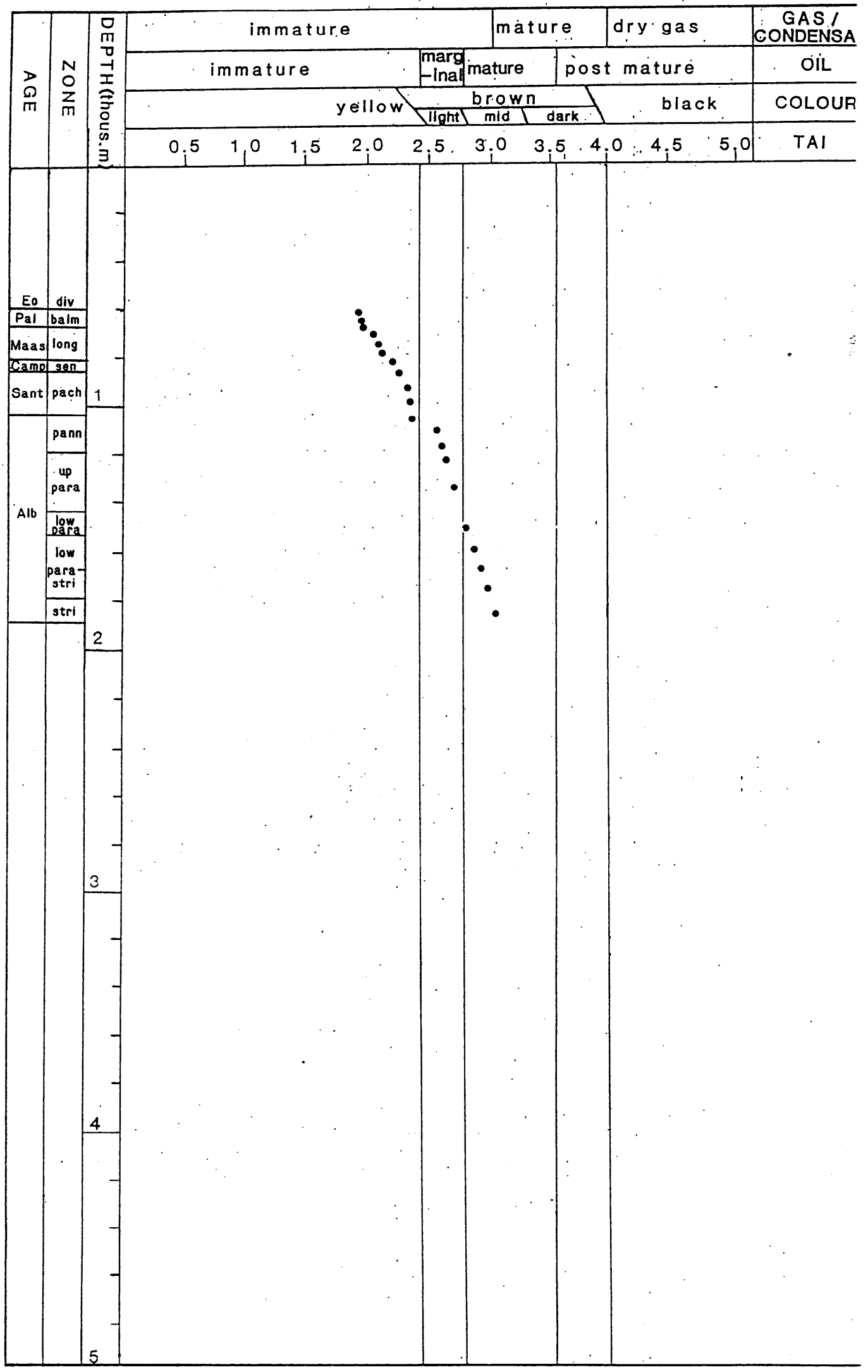

FIGURE 2 MATURITY PROFILE MINORA WINDERMERE-1

III PALYNOSTRATIGRAPHY

A. 605.3m (swc) : mid M. diversus Zone

This sample is assigned to the middle Malvacipollis diversus Zone of early Eocene age on the oldest occurrences of Bankseidites elongatus, Proteacidites clarus and P. ornatus, and on the absence of younger indicators. The assemblage is dominated by Haloragacidites harrisii and Proteacidites spp. with very minor Cretaceous reworking.

The very rare dinoflagellates are not age significant.

Very marginally marine environments are indicated by the very rare dinoflagellates in a rich and diverse pollen and spore assemblage.

Yellow spore colours indicate immaturity for hydrocarbon generation.

This interval is usually associated with the lower Dilwyn Formation.

B. 660m (cutts)-710m (cutts) : apparently upper L. balmei Zone (A. homomorphum Dinoflagellate Zone)

These cuttings samples contain an assemblage dominated by dinoflagellates, especially Areoligera senonensis. Downhole caving appears to be significant and apparently includes elements from as young as the early Oligocene P. tuberculatus Zone (Cyatheacidites annulatus). Interpretation is therefore not straight forward, and some uncertaintly must exist.

Assignment to the upper Lygistepollenites balmei Zone is on the basis of the youngest occurrence of Stereisporites regium defining an upper limit, and oldest Proteacidites incurvatus and the dinoflagellate Apectodinium homomorphum (indicating assignment to the A. homomphum Dinoflagellate Zone and its correlative upper L. balmei Zone). It is, however, possible that P. incurvatus and A. homomorphum are caved from younger horizons and that these samples could be as old as lower L. balmei Zone (older indicators not having been seen).

The dominance (70% of palynomorphs) and high diversity of dinoflagellates indicates offshore marine environments. However, some of the diversity of dinoflagellates may be caved from younger horizons.

Yellow spore colours indicate immaturity for hydrocarbon generation.

These features are usually associated with the Pebble Point Formation and equivalents.

C. 719.0m (swc)-802.0m (swc) : T. longus Zone (719.0-779.0m I. druggii Dinoflagellate Zone)

Assignment to the Tricolpites longus Zone is indicated at the top on youngest T. longus, Tricolpites confessus, T. waipawaensis and Triporopollenites sectilis, and at the base on oldest T. longus and Tetracolporites verrucosus. Phyllocladidites mawsonii, Dilwynites spp. and Gambierina rudata are all prominent, with plant cuticle very common. Age diagnostic dinoflagellates include Manumiella druggii, Canninginopsis "bretonica" and Isabelidinium pellucidum at 719-779m, indicating the I. druggii Dinoflagellate Zone.

Nearshore marine environments are indicated by common dinoflagellates (10-50%) and their moderate diversity (up to 10 species).

Yellow spore colours indicate immaturity for hydrocarbon generation.

These features are usually associated with the Timboon Sand and its correlatives, although the extent of marine influence is unusual.

D. 876.3m (swc) : N. senectus Zone

Assignment to the Nothofagidites senectus Zone is based on the presence of Tricolpites sabulosus without younger indicators. Proteacidites spp. are dominant, and Nothofagidites are notably absent. The dinoflagellates present include Heterosphaeridium spp. and Odontochitina porifera and confirm the assignment, but key index species are absent.

Marginal marine environments are indicated by the very scarce low diversity dinoflagellates.

Yellow spore colours indicate immaturity for hydrocarbon generation.

These features are usually seen in the Paratte Formation and equivalents.

E. 931.5m (swc) : upper T. pachyexinus Zone (N. aceras Dinoflagellate Zone)

Assignment to the upper Tricolporites pachyexinus Zone of Santonian age is indicated by the absence of younger indicators, and the presence of Tricolpites gillii to the interval base. The presence of the dinoflagellate Nelsoniella aceras without younger indicators confirms the spore-pollen assignment and indicates the N. aceras Dinoflagellate Zone. The sample is dominated by Proteacidites spp.

Marginally marine environments are indicated by the presence of only very rare low diversity dinoflagellates amongst the pollen and spore dominated assemblage.

Yellow to yellow/brown spore colours indicate immaturity for hydrocarbon generation.

These features are usually associated with the Paratte Formation and equivalents.

F. 980m (cutts)-1050m (cutts) : apparently T. pachyexinus Zone

These three cuttings samples contain Tricolporites pachyexinus (980-90m, 1010-20m) and Tricolpites confessus (980-90m, 1040-50m) and so appear to belong to the upper T. pachyexinus Zone. Age diagnostic dinoflagellates include Nelsoniella aceras (980-90m, 1010-20m) Isabelidinium cretaceum (980-90m, 1010-20m) Odontochitina porifera/cribropoda and Trithyrodinium spp. (980-90, 1010-20m, 1040-50m) and Amphidiadema denticulata (1040-50m) suggesting assignment to the N. aceras (980-1020m) and I. cretaceum (1040-50m) Zones, correlative with the upper T. pachyexinus Zone. However, these samples also contain caved

elements from younger zones (including Tricolpites waipawaensis from the lillei-longus Zones at 1010-20m and about 2% to 30% Tertiary contamination), and may be partly caved themselves, masking possible older zonal assignments. Regional experience however suggests that the caving is probably minor, and the interval is likely to belong largely or wholly to the T. pachyexinus Zone.

Nearshore marine environments are indicated by the moderate dinoflagellate content (20% to 980-90m, 40% at 1010-20m, 30% at 1040-50m) and diversity (10-15 species) amongst the dominant spores and pollen. The Tertiary caved dinoflagellates are easily distinguished and excluded from these data. Several new species of Odontochitina were seen in these preparations.

Yellow to yellow/brown spore colours indicate immaturity for hydrocarbon generation.

These features are usually associated with the Belfast Mudstone and correlatives.

G. 1090m (cutts)-1180.0m (swc) : T. pannosus Zone

Assignment to the Tricolpites pannosus Zone is indicated at the top by youngest Coptospora paradoxa and at the base by oldest Phimopollenites pannosus. Cyathidites spp. dominate both assemblages, and Foraminisporis asymmetricus is consistently seen. At 1180.0m (swc), Liliacidites peroreticulatus is unusually frequent.

Non-marine environments are indicated at 1180m where freshwater Schizosporis is the only microplankton seen

amongst common cuticle, spores and pollen. At 1090-1100m (cutts) minor late Cretaceous caving (including dinoflagellates) is seen.

Light brown spore colours indicate marginal maturity for oil, but immaturity for gas/condensate.

These features are normally seen in the topmost Eumeralla Formation.

H. 1205.0m (swc)-1330m (cutts) : upper C. paradoxa Zone

Assignment to the upper Coptospora paradoxa Zone is indicated at the top on the absence of younger indicators and at the base on oldest Pilosisporites grandis confirmed by the absence of older indicators. Cyathidites spp. and Cicatricosisporites spp. are common, as is plant cuticle.

Non-marine environments are indicated by the presence of abundant and diverse spores and pollen, common cuticle, and absence of dinoflagellates. Rare freshwater Schizosporis is the only microplankton seen.

Light to mid brown spore colours indicate early maturity for oil generation, but immaturity for gas/condensate.

These features are normally associated with the upper Eumeralla Formation.

I. 1512.5m (swc) : lower C. paradoxa Zone

Assignment to the lower Coptospora paradoxa Zone is indicated at the top on youngest Coptospora striata and confirmed by

the absence of younger indicators, and at the base on oldest Coptospora paradoxa in sidewall cores. Cyathidites and cuticle fragments are common.

Non-marine environments are indicated by the common and diverse spores and pollen, common cuticle, and freshwater alga Botryococcus.

Light to mid brown spore colours indicate early maturity for oil, and immaturity for gas/condensate.

These features are normally seen in the mid Eumeralla Formation.

J. 1550m (cutts)-1750m (cutts) : lower C. paradoxa - C. striatus Zone

This interval is assigned at the top on youngest Dictytosporites speciosus (confirmed by the overlying sample) and at the base on oldest Coptospora paradoxa. However, being an oldest occurrence in cuttings, this lower event may be caved a short distance. Spore colours indicate that the specimens of C. paradoxa at 1750m could be "in place", and that the whole interval may therefore belong to the lower C. paradoxa Zone. However, early Cretaceous (P. pannosus, P. grandis), late Cretaceous and Tertiary caving comprises 5% of the assemblage and suggests that the lower part of this interval may belong to the C. striatus Zone, but contain caved C. paradoxa specimens. The alternatives cannot be distinguished without sidewall cores. Oldest Trilobosporites trioreticulosus (cuttings at 1550-60m) and youngest Pilosisporites notensis (cuttings at 1740-50m) are consistent.

Non-marine environments are indicated by the absence of early Cretaceous dinoflagellates, and the abundant and diverse spores and pollen.

Mid to light brown spore colours indicate early maturity for oil and immaturity for gas/condensate.

These features are normally seen in the mid Eumeralla Formation.

K. 1830-40m (cutts) : C. striatus Zone

Assignment to the Crybelosporites striatus Zone is indicated at the top by the absence of younger indicators and at the base by oldest Crybelosporites striatus, confirmed by the absence of older indicators. Cicatricosisporites spp. and Cingutriletes clavus are common, and leaf cuticle is abundant.

Non-marine environments are indicated by the freshwater Schizosporis spp., common cuticle and spores and absence of Early Cretaceous dinoflagellates.

Mid brown spore colours indicate maturity for oil and marginal maturity for gas/condensate.

These features are normally seen in the mid Eumeralla Formation, the abundant leaf cuticle often associated with coaly facies.

IV CONCLUSIONS

A. The well total depth is in the mid Eumeralla Formation of early Albian age and so is some distance short of the Pretty Hill Sandstone. The section at T.D. is mature for oil generation, but peak maturity lies deeper (about 2400m). Clearly there is exiting potential if the structure persists at top Pretty Hill level.

B. The Eumeralla Formation appears complete, with little truncation at the top, and was deposited in non-marine conditions.

C. The Cenomanian and Coniacian (*A. distocarinatus* to *C. triplex* Zones) have not been seen and may be absent on a mid Cretaceous hiatus, or developed in thin sandy facies.

D. The Santonian *T. pachyexinus* Zone is relatively thick and marine displaying palynofacies typical of the Belfast Mudstone and Paratte Formation. It is usual in onshore locations to see this interval as the best developed part of the Late Cretaceous. It represents a major highstand producing marine facies far inland.

E. The Campanian *N. senectus* and *T. lillei* Zones are represented only by a single *N. senectus* sample, and may be largely absent by hiatus or condensed into the 74m sample gap. This interval is frequently not seen in onshore locations and can be extremely thin in some offshore ones.

F. The Maastrichtian *T. longus* Zone is well developed and contains nearshore marine facies. This is relatively rare in the onshore Otway Basin where the section is often vitually

barren in very sandy Timboon Sand facies.

G. The early Paleocene lower L. balmei Zone is apparently absent by hiatus, and a thin late Paleocene strongly marine upper L. balmei Zone is seen, typical of the Pebble Point Formation in this part of the basin.

H. The early Eocene middle M. diversus Zone is marginally marine as is usual in the Dilwyn Formation. The earliest Eocene lower M. diversus Zone may be absent or present in the 95m sample gap. These possibilities cannot be resolved without sidewall cores.

V REFERENCES

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APPENDIX I

PALYNOMORPH RANGE DATA

- SPORES AND POLLEN
- DINOFLAGELLATES

SPECIES LOCATION INDEX

Index numbers are the columns in which species appear.

INDEX NUMBER	SPECIES
1	AEQUITRIRADITES SPINULOSUS
51	AEQUITRIRADITES TILCHAENESIS
2	AEQUITRIRADITES VERRUCOSUS
96	AMOSOPOLLIS CRUCIFORMIS
81	APPENDICISPORITES DISTOCARINATUS
3	ARAUCARIACITES AUSTRALIS
4	ARAUCARIACITES FISSUS
71	AUSTRALOPOLLIS OBSCURUS
37	BALMEISPORITES HOLODICTYUS
63	BALMEISPORITES TRIDICTYUS
132	BANKSIEACIDITES ELONGATUS
114	BANKSIEAEIDITES ARCUATUS
62	CALLIALASPORITES DAMPIERI
45	CALLIALASPORITES TURBATUS
5	CERATOSPORITES EQUALIS
6	CICATRICOSISPORITES AUSTRALIENSIS
38	CICATRICOSISPORITES CUNEIFORMIS
46	CICATRICOSISPORITES HUGHESI
7	CICATRICOSISPORITES LUDBROOKIAE
8	CINGUTRILETES CLAVUS
74	CLAVIFERA TRIPLEX
52	CONCAVISSIMISPORITES PENOLAENSIS
9	CONTIGNISPORITES COOKSONIAE
53	COPTOSPORA "WRINKLY"
39	COPTOSPORA PARADOXA
40	COPTOSPORA STRIATA
10	COROLLINA TOROSUS
82	CORONATISPORA PERFORATA
11	CRYBELOSPORITES STRIATUS
115	CUPANIEIDITES ORTHOTEICHUS
68	CUPULIFEROIDAEPOLLENITES PARVULUS
133	CYATHEACIDITES ANNULATUS
109	CYATHEACIDITES TECTIFERA
12	CYATHIDITES AUSTRALIS
13	CYATHIDITES MINOR
116	CYATHIDITES SP.
14	CYCADOPITES FOLLICULARIS
64	DENSOISPORITES VELATUS
15	DICTYOPHYLLIDITES MORTONI

65 DICTYOTOSPORITES COMPLEX
112 DILWYNITES GRANULATUS
113 DILWYNITES TUBERCULATUS
69 EPHEDRIPITES SP.
110 ERICIPITES SCABRATUS
16 FALCISPORITES GRANDIS
17 FALCISPORITES SIMILIS
18 FORAMINISPORIS ASYMMETRICUS
83 FORAMINISPORIS DAILYI
55 FORAMINISPORIS WONTHAGGIENSIS
19 FOVEOSPORITES MORETONENSIS
41 FOVEOTRILETES PARVIRETUS
102 GAMBIERINA EDWARDSII
103 GAMBIERINA RUDATA
97 GEPHROPOLLINITES WAHOOENSIS
20 GLEICHENIIDITES
86 HALORAGACIDITES HARRISII
98 HERKOSPORITES ELLIOTTII
75 HOEGISPORIS LENTICULIFERA
136 ILEXPOLLENITES SP.
137 INTRATRIPOROPOLLENITES NOTABILIS
117 ISCHYOSPORITES GREMIUS
21 ISCHYOSPORITES PUNCTATUS
56 JANUASPORITES SPINULOSUS
22 KLUKISPORITES SCABERIS
134 LATROBOSPORITES CRASSUS
76 LATROBOSPORITES OHAIENSIS
47 LEPTOLEPIDITES MAJOR
23 LEPTOLEPIDITES VERRUCATUS
70 LILIACIDITES PERORETICULATUS
24 LYCOPODIACIDITES ASPERATUS
87 LYGISTEPOLLENITES FLORINII
118 MALVACIPOLLIS DIVERSUS
119 MALVACIPOLLIS SUBTILIS
48 MATONISPORITES COOKSONIAE
25 MICROCACHRYIDITES ANTARCTICUS
120 MYRTACEIDITES PARVUS/MESONESUS
26 NEORAISTRICKIA TRUNCATA
111 NOTHOFAGIDITES BRACHYSPINULOSUS
88 NOTHOFAGIDITES EMARCIDUS
99 NOTHOFAGIDITES ENDURUS
121 NOTHOFAGIDITES FALCATUS
138 NOTHOFAGIDITES FLEMINGII
122 NOTHOFAGIDITES GONIATUS
104 NOTHOFAGIDITES SENECTUS
89 ORNAMENTIFERA SENTOSA
27 OSMUNDACIDITES WELLMANII
28 PERINOPOLLENITES ELATOIDES
90 PERIPOROPOLLENITES DEMARCATUS
91 PERIPOROPOLLENITES POLYORATUS
123 PERIPOROPOLLENITES VESICUS
42 PEROTRILETES JUBATUS
72 PEROTRILETES MAJUS
57 PHIMIPOLLENITES PANNOSUS
100 PHORMIUM SP.
77 PHYLOCLADIDITES MAWSONII
105 PHYLOCLADIDITES VERRUCOSUS

WINDERMERE #1 S/P

DESCRIPTION:

PALYNOLOGICAL INTERPRETATION OF DATA BY ROGER MORGAN FOR MINORA - MAY 1987.

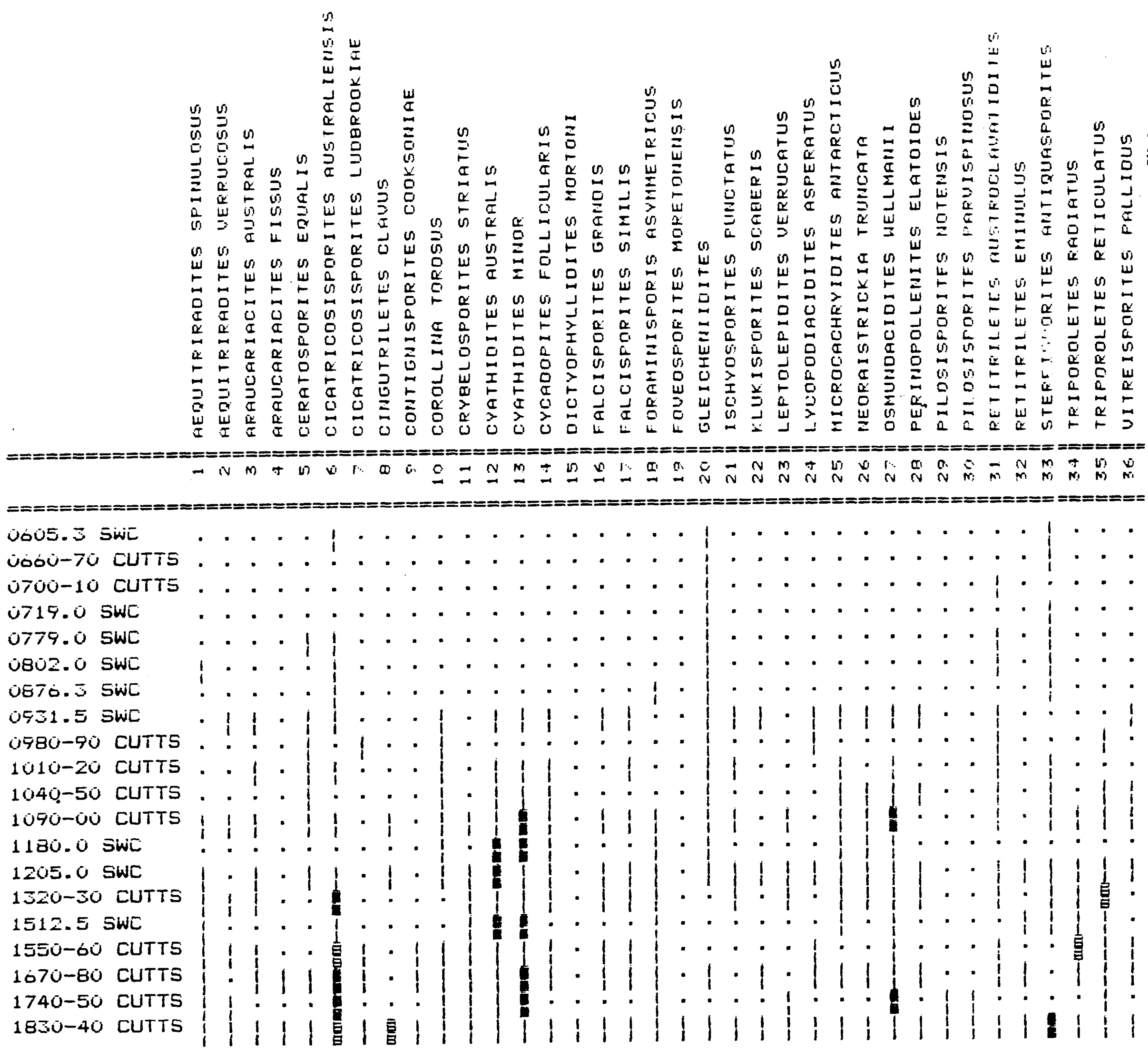
ALL SAMPLE DEPTHS ARE IN METRES.

CHECKLIST OF GRAPHIC ABUNDANCE BY LOWEST APPEARANCE


= Abundant
= Common
= Few
= Rare
= Very Rare

? = Questionably Present

. = Not Present



1 AEQUITRIRADITES SPINULOSUS
2 AEQUITRIRADITES VERRUCOSUS
3 ARAUCARIACITES AUSTRALIS
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18 FORAMINISPORIS ASYMMETRICUS
19 FOVEOSPORITES MORETONENSIS
20 GLEICHENIIDITES
21 ISCHYOSPORITES PUNCTATUS
22 KLUKISPORITES SCABERIS
23 LEPTOLEPIDITES VERRUCATUS
24 LYCOPODIACIDITES ASPERATUS
25 MICROCACHRYIDITES ANTARCTICUS
26 NEORAISTRICKIA TRUNCATA
27 OSMUNDACIDITES WELLMANII
28 PERINOPOLLENITES ELATOIDES
29 PILOSISPORITES NOTENSIS
30 PILOSISPORITES PARVISPINOSUS
31 RETITRILETES AUSTROCLAVATIDITES
32 RETITRILETES EMINULUS
33 STEREISPORITES ANTIQUASPORITES
34 TRIPOROLETES RADIATUS
35 TRIPOROLETES RETICULATUS
36 VITREISPORITES PALLIDUS
0605.3 SWC
0660-70 CUTTS
0700-10 CUTTS
0719.0 SWC
0779.0 SWC
0802.0 SWC
0876.3 SWC
0931.5 SWC
0980-90 CUTTS
1010-20 CUTTS
1040-50 CUTTS
1090-00 CUTTS
1180.0 SWC
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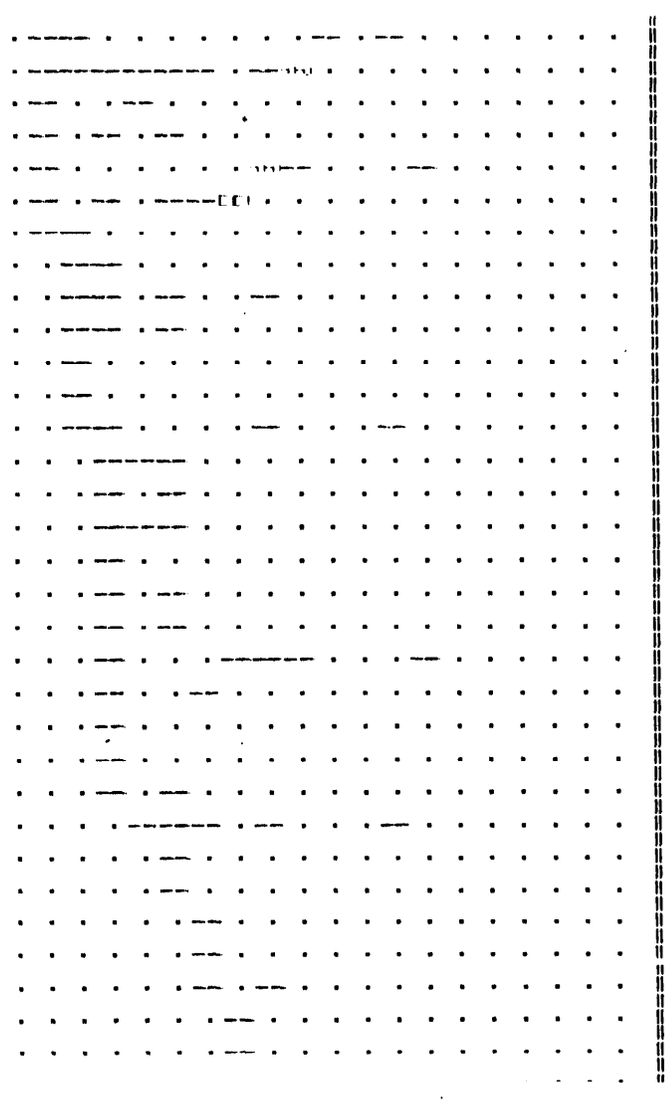
1830-40 CUTTS



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40	COPTOSPORA STRIATA
41	FOVEOTRILETES PARVIRETUS
42	PEROTRILETES JUBATUS
43	PILOSISPORITES GRANDIS
44	TRIPOROLETES SIMPLEX
45	CALLIALASPORITES TURBATUS
46	CICATRICOSISPORITES HUGHESI
47	LEPTOLEPIDITES MAJOR
48	MATONISPORITES COOKSONIAE
49	PODOCARPIDITES ELLIPTICUS
50	TRICOLPITES SP.
51	AEQUITRIRADITES TILCHAENESIS
52	CONCAVISSIMISPORITES PENOLAENSIS
53	COPTOSPORA "WRINKLY"
54	DICTYOSPORITES SPECIOSUS
55	FORAMINISPORIS WONTHAGGIENSIS
56	JANUASPORITES SPINULOSUS
57	PHIMIPOLLENITES PANNOSUS
58	RETICULATISPORITES PUDENS
59	TRILOBOSPORITES PURVERULENTUS
60	TRILOBOSPORITES TRIORETICULOSUS
61	VELOSPORITES TRIQUETRUS
62	CALLIALASPORITES DAMPIERI
63	BALMEISPORITES TRIDICTYUS
64	DENSOISPORITES VELATUS
65	DICTYOTOSPORITES COMPLEX
66	RETITRILETES CIRCOLUMENUS
67	RETITRILETES FACETUS
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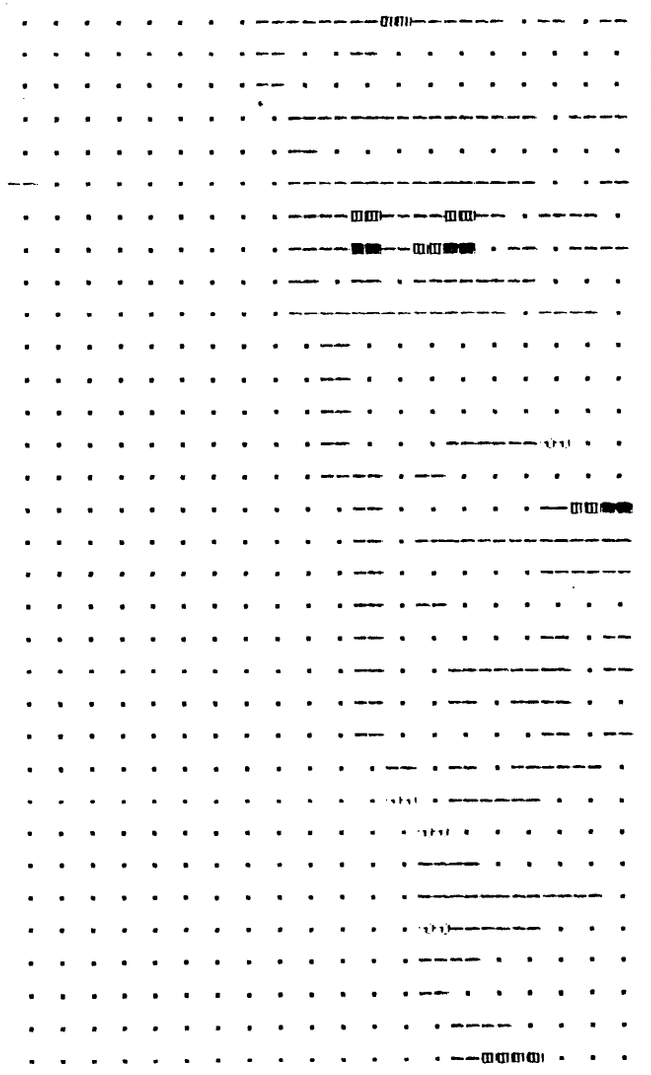
69	EPHEDRIPITES SP.
70	LILIACIDITES PERORETICULATUS



71	AUSTRALOPOLLIS OBSCURUS
72	PEROTRILETES MAJUS
73	RETITRILETES NODOSUS
74	CLAVIFERA TRIPLEX
75	HOEGISPORIS LENTICULIFERA
76	LATROBOSPORITES OHAIENSIS
77	PHYLOCLADIDITES MAWSONII
78	PROTEACIDITES
79	TRICOLPITES CONFESSUS
80	TRICOLPITES GILLII
81	APPENDICISPORITES DISTOCARINATUS
82	CORONATISPORA PERFORATA
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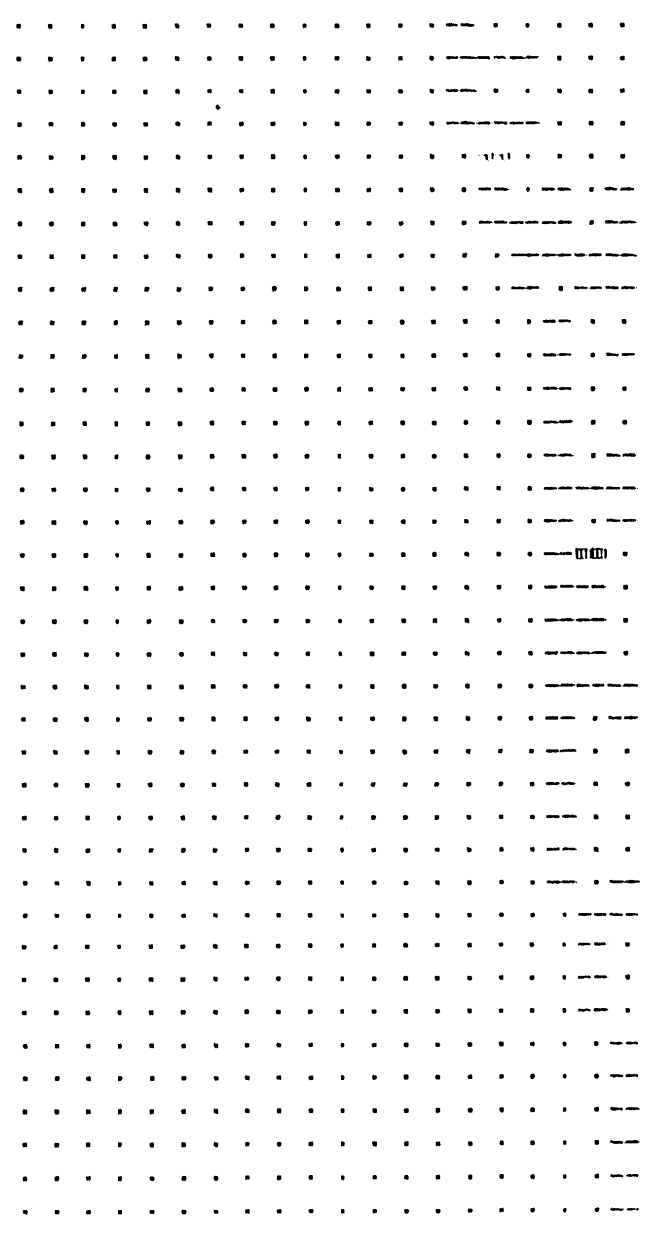
84	TRICOLPITES WAIPAWAENSIS
85	TRICOLPORITES PACHYEXINUS
86	HALORAGACIDITES HARRISII
87	LYGISTEPOLLENITES FLORINII
88	NOTHOFAGIDITES EMARCIDUS
89	ORNAMENTIFERA SENTOSA
90	PERIPOROPOLLENITES DEMARCATUS
91	PERIPOROPOLLENITES POLYORATUS
92	PODOSPORITES MICROSACCATUS
93	STEREISPORITES (TRIPUNCTISPORIS) SPP.
94	STEREISPORITES REGIUM
95	TETRACOLPORITES VERRUCOSUS
96	AMOSOPOLLIS CRUCIFORMIS
97	GEPHROPOLLINITES WAHOOENSIS
98	HERKOSPORITES ELLIOTTII
99	NOTHOFAGIDITES ENDURUS
100	PHORMIUM SP.
101	TRICOLPITES SABULOSUS
102	GAMBIERINA EDWARDSII
103	GAMBIERINA RUDATA



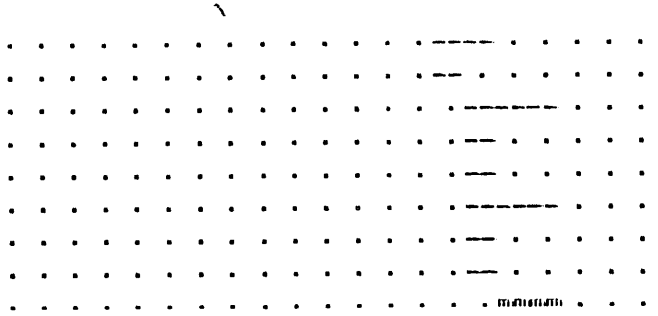
105	PHYLOCLADIDITES VERRUCOSUS
106	TRICOLPITES LONGUS
107	TRICOLPORITES LILLEI
108	TRIPOROPOLLENITES SECTILIS
109	CYATHEACIDITES TECTIFERA
110	ERICIPITES SCABRATUS
111	NOTHOFAGIDITES BRACHYSPINULOSUS
112	DILWYNITES GRANULATUS
113	DILWYNITES TUBERCULATUS
114	BANKSIEAEIDITES ARCUATUS
115	CUPANIEIDITES ORTHOTEICHUS
116	CYATHIDITES SP.
117	ISCHYOSPORITES GREMIUS
118	MALVACIPOLLIS DIVERSUS
119	MALVACIPOLLIS SUBTILIS
120	MYRTACEIDITES PARVUS/MESONESUS
121	NOTHOFAGIDITES FALCATUS
122	NOTHOFAGIDITES GONIATUS
123	PERIPOROPOLLENITES VESICUS
124	PROTEACIDITES ADENANTHOIDES
125	PROTEACIDITES ANNULARIS
126	PROTEACIDITES INCURVATUS
127	PROTEACIDITES KOPIENSIS
128	PROTEACIDITES LEIGHTONII
129	TETRACOLPORITES TEXUS
130	TRICOLPORITES PUNCTATE CF LILLEI
131	VERRUCOSISPORITES KOPUKUENSIS
132	BANKSIEACIDITES ELONGATUS
133	CYATHEACIDITES ANNULATUS
134	LAIROBOSPORITES CRASSUS
135	TETRACOLPORITES OAMARUENSIS
136	ILEXPOLLENITES SP.
137	INTRATRIPOROPOLLENITES NOTABILIS
138	NOTHOFAGIDITES FLEMINGII
139	PROTEACIDITES CLARUS
140	PROTEACIDITES GRANDIS
141	PROTEACIDITES ORNATUS

7	ODONTOCHITINA "NO HORNS"
25	ODONTOCHITINA "STUBBYHORNS"
1	ODONTOCHITINA COSTATA
15	ODONTOCHITINA CRIBROPODA
11	ODONTOCHITINA OPERCULATA
16	ODONTOCHITINA PORIFERA
29	ODONTOCHITINA SINGHII
30	ODONTOCHITINA STRIATOPERFORATA
35	OLIGOSPHAERIDIUM PULCHERRIMUM
62	OPERCILIDINIUM "SPINY"
75	OPERCULIDINIUM "SHORT/SOLID"
48	OPERCULODINIUM CENTROCARPUM
45	PALAEOCYSTODINIUM GOLZOWENSE
31	PALAEOHYSTRICHOPHORA INFUSORIOIDES
46	PALAEOPERIDINIUM PYROPHORUM
26	PARALECANIELLA INDENTATA
49	PHONEROCYSTA CERATOIDES
76	SCHEMATOPHORA SPECIOSUS
2	SCHIZOSPORIS PARVUS
3	SCHIZOSPORIS RETICULATA
5	SPINIFERITES FURCATUM/RAMOSUS
77	SYSTEMATOPHORA PLACACANTHA
78	TECTATODINIUM OVATUM
63	THALASSIPHORA PELAGICA
33	TRITHYRODINIUM "PSILATE"
17	TRITHYRODINIUM "RETICULATA"
12	TRITHYRODINIUM "VERMICULATE"
18	TRITHYRODINIUM GLABRUM
13	TRITHYRODINIUM SP.

SPECIES LOCATION INDEX

Index numbers are the columns in which species appear.

INDEX NUMBER	SPECIES
64	ACHOMOSPHAERA SEPTATA
65	ACHOMOSPHAREA ALICORNU
50	ALISOCYSTA CIRCUMTABULATA
32	ALTERBIA SP.
4	AMPHIDIADEMA DENTICULATA
51	APECTODINIUM HOMOMORPHUM *LONG
66	APECTODINIUM HOMOMORPHUM *SHORT
67	APTEODINIUM "ORNAMENTED"
68	APTEODINIUM SPIRIOIDES
69	AREOLIGERA CORONATA
27	AREOLIGERA SENONENSIS
70	AREOSPHAERIDIUM MULTICORNUTUM
19	BACCHIDINIUM POLYPES
9	BOTRYOCOCCUS SP.
20	CALLAIOSPHAERIDIUM ASYMMETRICUM
36	CANNINGINOPSIS "BRETONICA"
79	CEREBROCYSTA SP.
8	CHATANGIELLA MICRACANTHA
37	CIRCULODINIUM DEFLANDREI
71	CORDOSPHAERIDIUM INODES
28	CRIBROPERIDINIUM SPP
47	CYCLOPSIELLA VIETA
52	DAPSILIDINIUM PASTIELSII
21	EXOCHOSPHAERIDIUM PHRAGMITES
72	GLAPHYROCYSTA PASTIELLII
53	GLAPHYROCYSTA RETIINTEXTA
54	HEMICYSTODINIUM "PYRAMIDALIS"
80	HERERAULACACYSTA SP.
14	HETEROSPHAERIDIUM "LATEROBRACHIUS"
6	HETEROSPHAERIDIUM HETERACANTHUM
38	HYSTRICHODINIUM SP.
55	HYSTRICHOKOLPOMA EISENACKII
56	HYSTRICHOKOLPOMA RIGAUDAE
57	HYSTRICHOSPHAERIDIUM TUBIFERUM
58	HYSTRICHOSPHAEROPSIS OVUM
73	IMPAGIDINIUM DISPERTITUM
59	IMPLETOSPHAERIDIUM SP.1
22	ISABELIDINIUM COOKSONIAE
23	ISABELIDINIUM CRETACEUM
10	ISABELIDINIUM GLABRUM
42	ISABELIDINIUM PELLUCIDUM
34	ISABELIDINIUM SP.
60	LINGULODINIUM MACHAEROPHORUM
43	MANUMEILLA DRUGGII
44	MANUMIELLA CORONATA
39	MANUMIELLA SP.
40	MEMBRANILARNACIA "ROUGHRANGENSIS"
61	MILLIOUDIDINIUM TENUITABULATUM
74	MURATODINIUM FIMBRIATUM
24	NELSONIELLA ACERAS
41	NUMMUS MONOCULATUS



34	ISABELIDINIUM SP.
35	OLIGOSPHAERIDIUM PULCHERRIMUM
36	CANNINGINOPSIS "BRETONICA"
37	CIRCULODINIUM DEFLANDREI
38	HYSTRICHODINIUM SP.
39	MANUMIELLA SP.
40	MEMBRANILARNACIA "ROUGHRANGENSIS"
41	NUMMUS MONOCULATUS
42	ISABELIDINIUM PELLUCIDUM

WINDERMERE #1 DINOS

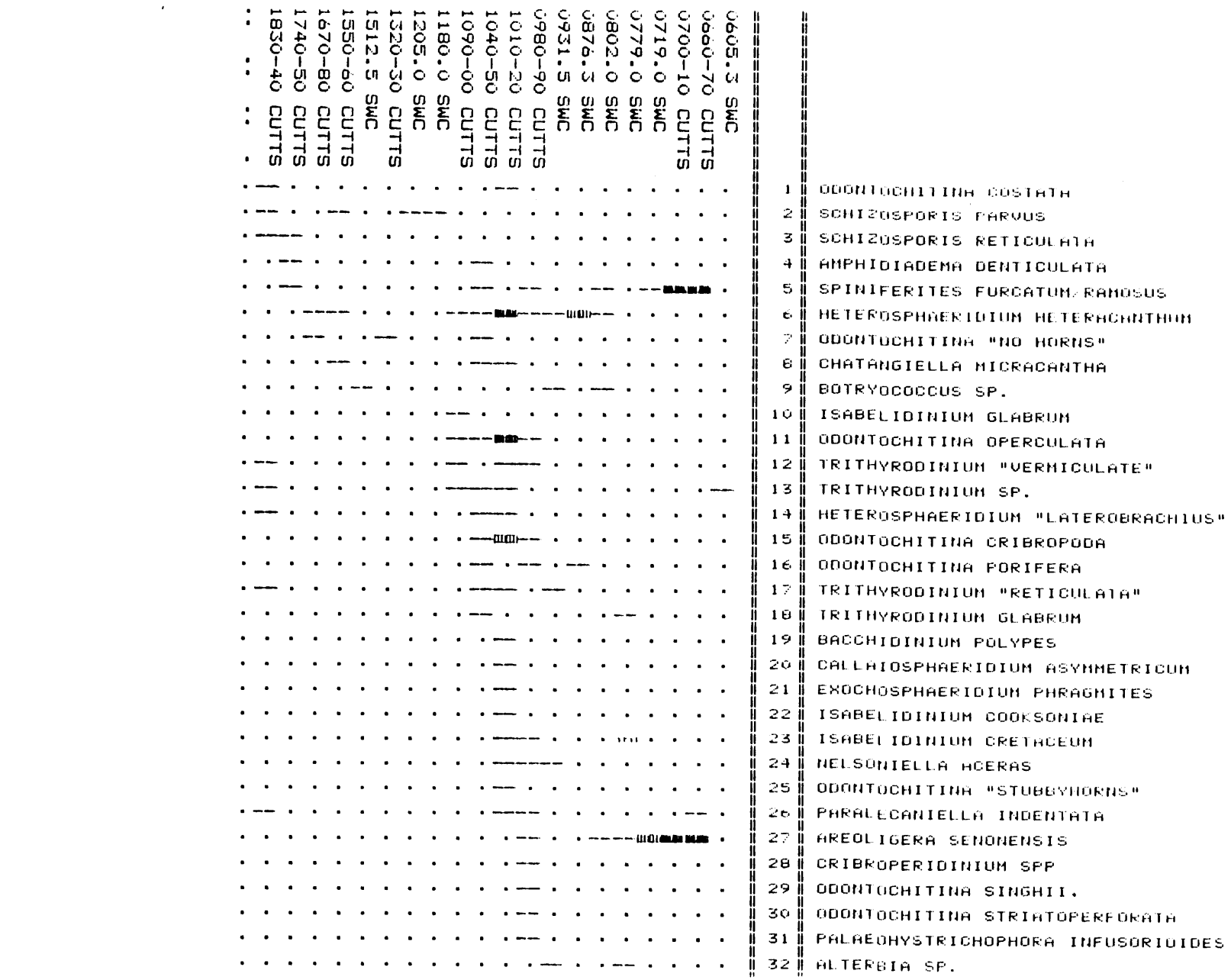
DESCRIPTION:

PALYNOLOGICAL INTERPRETATION OF DATA BY ROGER MORGAN FOR MINORA - MAY 1987.

ALL SAMPLE DEPTHS ARE IN METRES.

CHECKLIST OF GRAPHIC ABUNDANCE BY LOWEST APPEARANCE

= Abundant
= Common
= Few
= Rare
= Very Rare
? = Questionably Present
. = Not Present


0605.3 SWC
0660-70 CUTTS
0700-10 CUTTS
0719.0 SWC
0779.0 SWC
0802.0 SWC
0876.3 SWC
0931.5 SWC
0980-90 CUTTS
1010-20 CUTTS
1040-50 CUTTS
1090-00 CUTTS
1180.0 SWC
1205.0 SWC
1320-30 CUTTS
1512.5 SWC
1550-60 CUTTS
1670-80 CUTTS
1740-50 CUTTS
1830-40 CUTTS
1 ODONTOCHITINA COSTATA
2 SCHIZOSPORIS PARVUS
3 SCHIZOSPORIS RETICULATA
4 AMPHIDIADEMA DENTICULATA
5 SPINIFERITES FURCATUM/RAMOSUS
6 HETEROSPHAERIDIUM HETERACANTHUM
7 ODONTOCHITINA "NO HORNS"
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21 EXOCHOSPHAERIDIUM PHRAGMITES
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23 ISABELIDINIUM CRETACEUM
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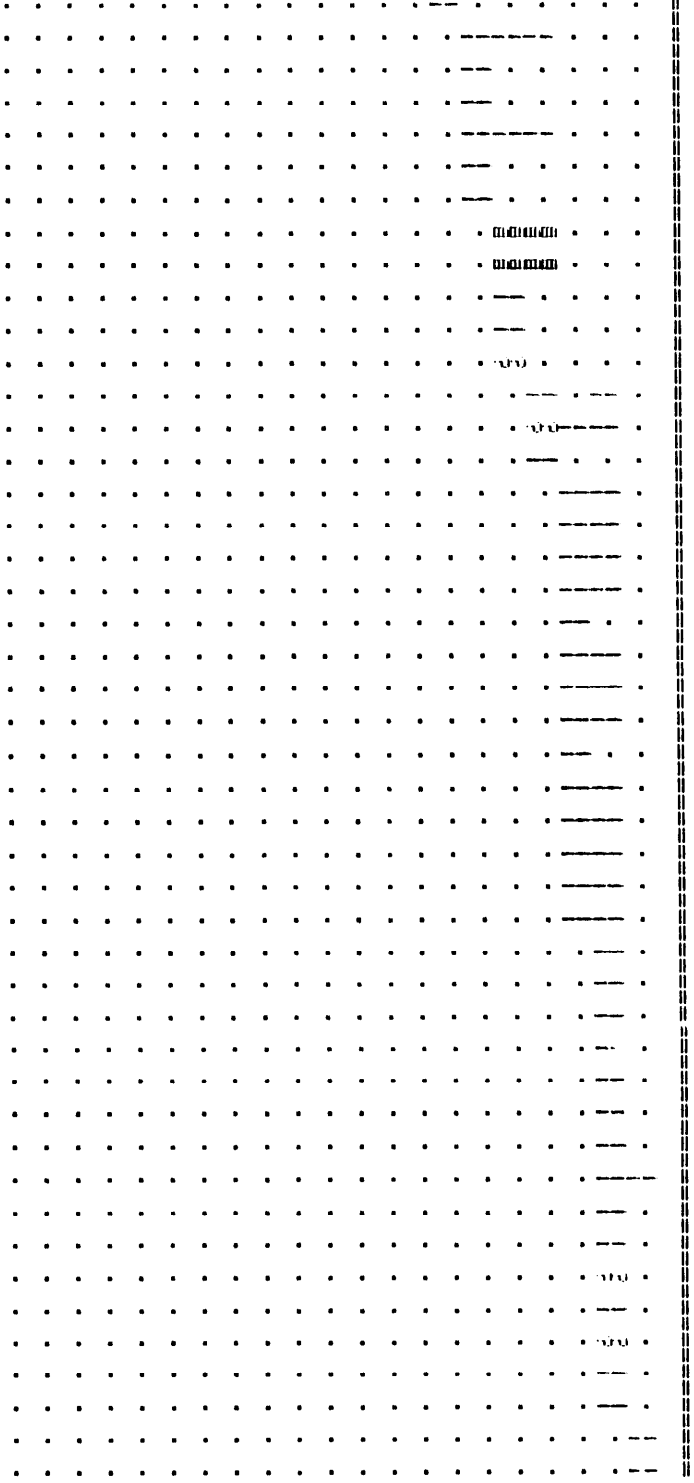
27 AREOLIGERA SENONENSIS
28 CRIBROPERIDINIUM SPP
29 ODONTOCHITINA SINGHII.
30 ODONTOCHITINA STRIATOPERFORATA
31 PALAEOHYSTRICHOPHORA INFUSORIOIDES
32 ALTERBIA SP.



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48	OPERCULODINIUM CENTROCARPUM
49	PHONEROCYSTA CERATOIDES
50	ALISOCYSTA CIRCUMTABULATA
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75	OPERCULIDINIUM "SHORT/SOLID"
76	SCHEMATOPHORA SPECIOSUS
77	SYSTEMATOPHORA PLACACANTHA
78	TECTATODINIUM OVATUM
79	CEREBROCYSTA SP.
80	HERERAULACACYSTA SP.

43	PILOSISPORITES GRANDIS
29	PILOSISPORITES NOTENSIS
30	PILOSISPORITES PARVISPINOSUS
49	PODOCARPIDITES ELLIPTICUS
92	PODOSPORITES MICROSACCATUS
78	PROTEACIDITES
124	PROTEACIDITES ADENANTHOIDES
125	PROTEACIDITES ANNULARIS
139	PROTEACIDITES CLARUS
140	PROTEACIDITES GRANDIS
126	PROTEACIDITES INCURVATUS
127	PROTEACIDITES KOPIENSIS
128	PROTEACIDITES LEIGHTONII
141	PROTEACIDITES ORNATUS
58	RETICULATISPORITES PUDENS
31	RETITRILETES AUSTROCLAVATIDITES
66	RETITRILETES CIRCOLUMENUS
32	RETITRILETES EMINULUS
67	RETITRILETES FACETUS
73	RETITRILETES NODOSUS
93	STEREISPORITES (TRIPUNCTISPORIS) SPP.
33	STEREISPORITES ANTIQUASPORITES
94	STEREISPORITES REGIUM
135	TETRACOLPORITES OAMARUENSIS
129	TETRACOLPORITES TEXUS
95	TETRACOLPORITES VERRUCOSUS
79	TRICOLPITES CONFESSUS
80	TRICOLPITES GILLII
106	TRICOLPITES LONGUS
101	TRICOLPITES SABULOSUS
50	TRICOLPITES SP.
84	TRICOLPITES WAIPAWAENSIS
107	TRICOLPORITES LILLEI
85	TRICOLPORITES PACHYEXINUS
130	TRICOLPORITES PUNCTATE CF LILLEI
59	TRILOBOSPORITES PURVERULENTUS
60	TRILOBOSPORITES TRIORETICULOSUS
34	TRIPOROLETES RADIATUS
35	TRIPOROLETES RETICULATUS
44	TRIPOROLETES SIMPLEX
108	TRIPOROPOLLENITES SECTILIS
61	VELOSPORITES TRIQUETRUS
131	VERRUCOSISPORITES KOPUKUENSIS
36	VITREISPORITES PALLIDUS