PALYNOLOGY OF BEACH CALLISTA-1,

OTWAY BASIN, VICTORIA

BY

ROGER MORGAN

FOR BEACH PETROLEUM

AUGUST, 1988.

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CONTENTS

I SUMMARY

930-40m (cuts) : L. balmei Zone : Paleocene : nearshore marine : immature

940-70m (cutts) : T. longus Zone (M. druggii Dinoflagellate Zone) : Maastrichtian : nearshore marine : immature

1665-1715m (swcs) : lower C. triplex Zone : Turonian : nearshore to offshore marine : immature

1734m (swc) : A. distocarinatus Zone : Cenomanian : nearshore marine : immature

1788m (swc) : Indeterminate : apparently non-marine and therefore probably Eumeralla equivalent : marginally mature

II INTRODUCTION

Andrew Buffin of Beach Petroleum submitted 5 swc samples and 4 cuttings samples from Callista-1 for palynological analysis for the completion report.

Palynomorph occurrence data are shown as AppendiX I and form the basis for the assignment of the samples to four spore-pollen units of probably late Albian to Paleocene 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. Cretaceous dinoflagellate zones are those of Helby, Morgan and Partridge (1987).

Maturity data was generated in the form of Spore Colour Index, and is plotted on figure 2 Maturity profile of Beach Callista-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

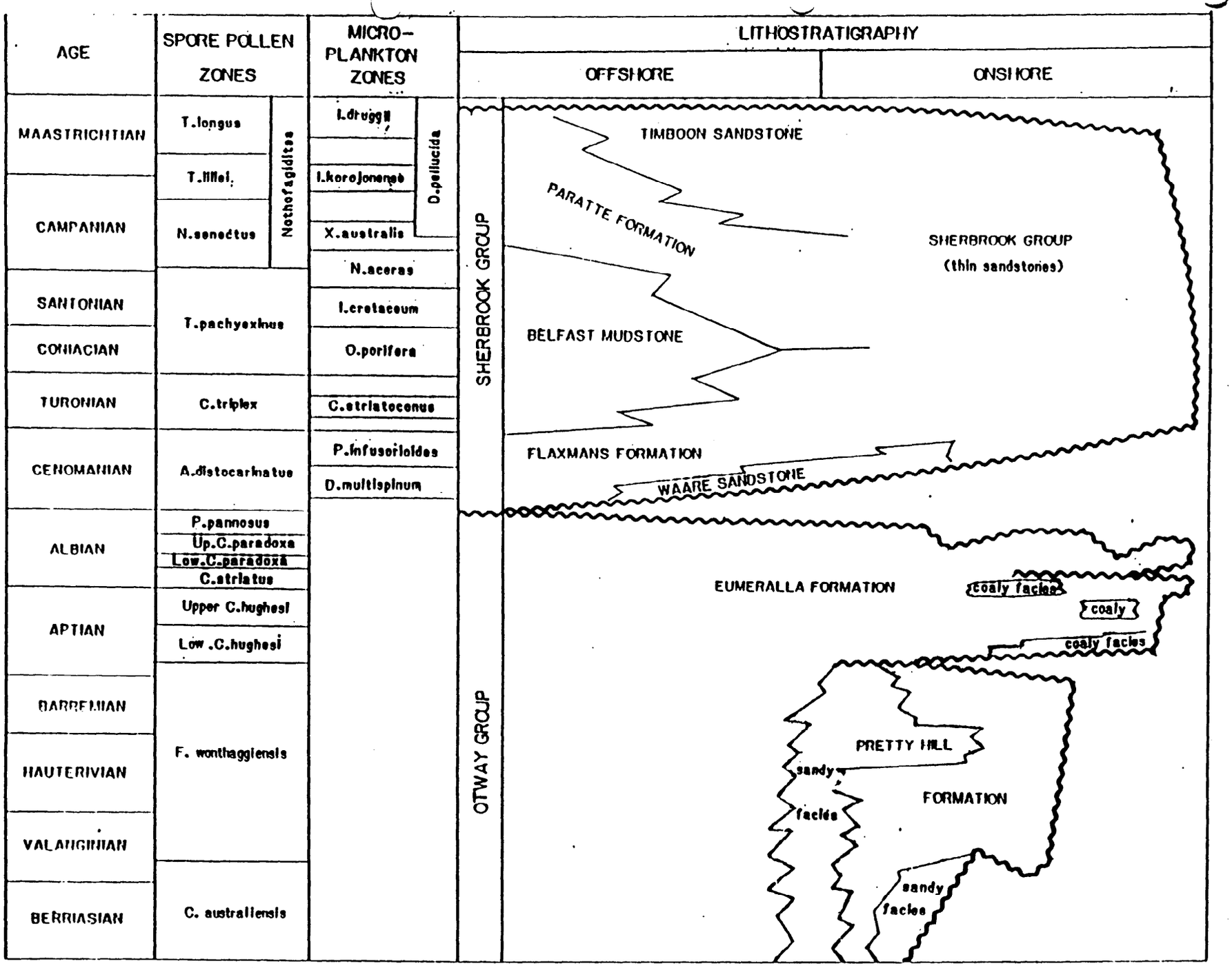

FIGURE 1. CRETACEOUS REGIONAL FRAMEWORK, OTWAY BASIN

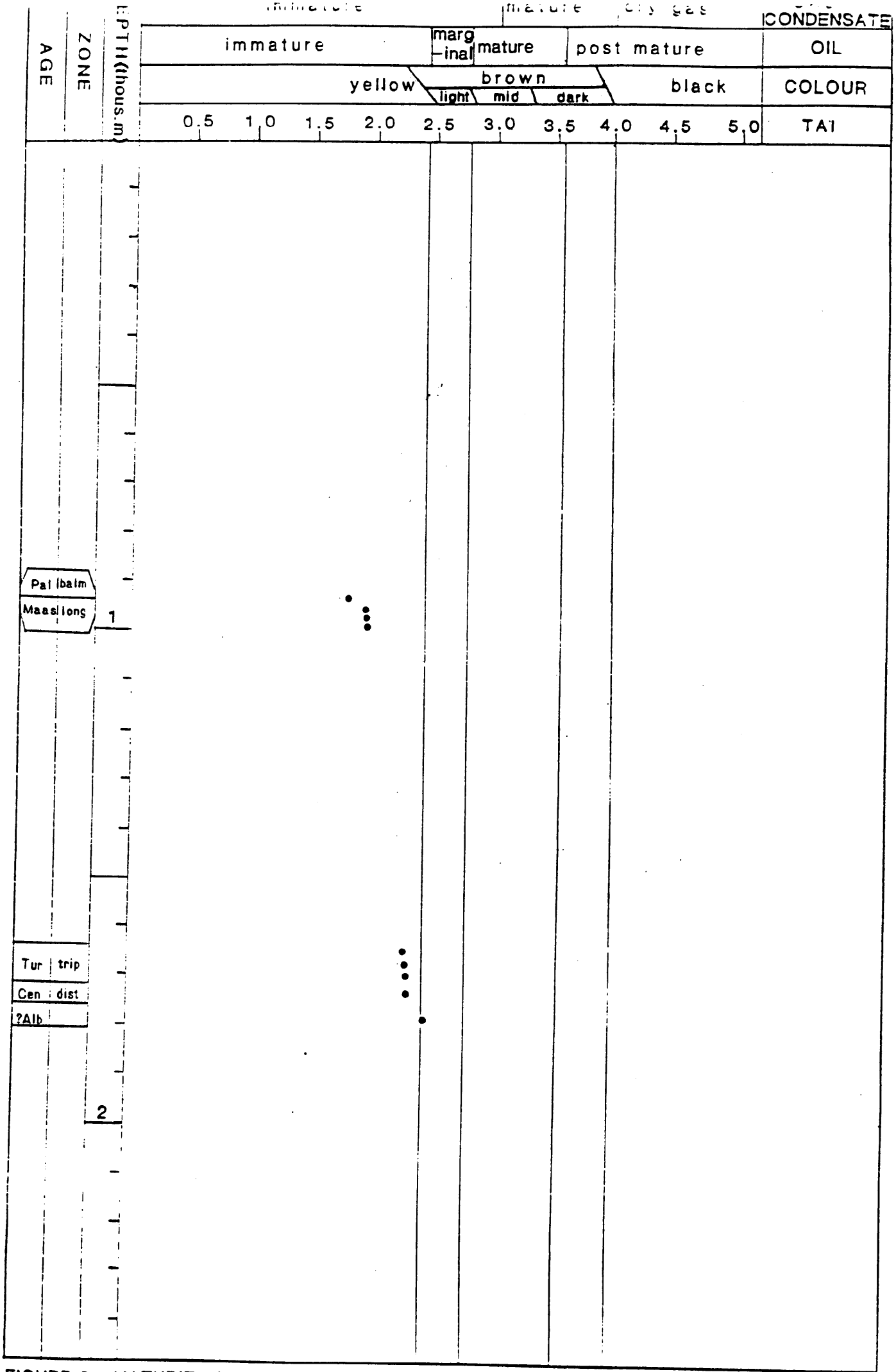

FIGURE 2 MATURITY PROFILE, CALLISTA 1

Spore Colour Index 2.7) to dark brown (3.6). These correspond to vitrinite reflectance values of 0.6% to 1.3%. Geochemists, however, have not reached universal agreement on these values, and argue variations of kerogen type, basin type and even basin history. The maturity interpretation is therefore open to reinterpretation using the spore colours as basic data. However, the range in interpretation philosophies is not great, and probably would not move the oil window by more than 200 metres.

III PALYNOSTRATIGRAPHY

A. 930-40m (cutts) : L. balmei Zone

The presence of Gambierina rudata and Lygistepollenites balmei without older taxa, indicates assignment to the L. balmei Zone of Paleocene age. Proteacidites spp. are dominant, with frequent Cyathidites spp. Downhole caving is clearly present, with taxa such as Triporopollenites ambiguus and Nothofagidites falcatus seen. In view of these, the upper L. balmei indicators (Proteacidites grandis and P. incurvatus) may also be caved and so are disregarded.

Dinoflagellates are rare, but include Deflandrea speciosa, indicating a general Paleocene age.

The dominance of diverse spores and pollen, and scarcity of low diverstiy dinoflagellates, indicates very nearshore marine environments.

Colourless to yellow palynomorphs indicate immaturity for hydrocarbons.

B. 940-70m (cutts) : T. longus Zone

Assignment to the Tricolpites longus Zone is clearly indicated at the top by youngest T. longus, a downhole influx of Gambierina rudata, youngest Triporopollenites sectilis (950-60m) and Tricolporites lillei (960-70m), and confirmed by the dinoflagellates. At the base, oldest T. longus and Stereisporites punctatus indicate the zone, confirmed by the dinoflagellates. Proteacidites spp. are dominant, with frequent

Cyathidites spp. Minor Eocene caving was seen. In the cuttings sample at 940-50m, approximately equal proportions of Paleocene and Maastrichtian are seen. The unconformity therefore probably occurs in that interval.

Dinoflagellates are rare, but include Canninginopsis bretonica and Manumiella conorata, clearly indicating the M. druggii Dinoflagellate Zone, correlative with the upper T. longus Zone. Assemblages are of low diversity, but include taxa such as Alisocysta circumtabulata, Manumiella spp., Isabelidinium spp. and Areoligera senonensis.

Dominance of spores and pollen and scarcity of low diversity dinoflagellates, indicate nearshore marine environments. These assemblages can also be distinguished from the Paleocene above by high inertinite content.

Yellow spore colours indicate immaturity for hydrocarbon generation.

The T. lillei to upper C. triplex Zones are probably present but unsampled in this interval.

C. 1665m (swc)-1715m (swc) : lower C. triplex Zone

Assignment to the lower half of the Clavifera triplex Zone (=P. mawsonii Zone) is indicated at the top by youngest Appendicisporites distocarinatus and at the base by oldest Phyllocladidites mawsonii. Oldest P. eunuchus (1715m) and Clavifera triplex (1689m) confirm the assignment, as do the dinoflagellates. Common taxa

include Cyathidites spp., Falcisporites spp., and Microcachryidites antarcticus. Minor Triassic reworking was seen at 1689m only.

Dinoflagellates are fairly frequent and include consistent Cribroperidinium edwardsii up to 1689m. This event normally occurs within the lower C. triplex Zone, equivalent to a point near the top of the P. infusorioides Dinoflagellate Zone.

Dominant and diverse spores and pollen occur, with increasing dinoflagellate content upwards (2% at 1715m, 25% at 1689m, 50% at 1665m) reflecting transgression. Environments therefore range from very nearshore at the base to offshore at the top.

Yellow to yellow/brown spore colours indicate immaturity for hydrocarbons.

D. 1734m (swc) : A. distocarinatus Zone

Assignment to the Appendicisporites distocarinatus Zone is indicated by the presence of A. distocarinatus (and A. tricornitatus) without younger or older indicators. A downhole influx of Foraminisporis spp. (F. asymmetricus, F. dailyi and F. wonthaggiensis) is consistent with assignment. Cyathidites spp. are frequent.

Dinoflagellates are of low diversity and generally longranging, but do include Xenascus asperatus. This is consistent with the X. asperatus to P. infusorioides Zones. Circulodinium deflandrei is easily the most common species.

Nearshore marine environments are indicated by the dinoflagellate content (25%) and their low diversity (10 species), amongst the dominant and diverse spores and pollen.

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

E. 1788m (swc) : Indeterminate

An extremely sparse palynomorph assemblage was seen, comprising entirely longranging spores and pollen. the probably non-marine environments therefore suggest the non-marine Eumeralla Formation, and so an Early Cretaceous age. The fossils seen are insufficient to definitively confirm this deduction. Rare Botryococcus suggests some freshwater influence.

Yellow/brown spore colours indicate marginal maturity for oil generation, and immaturity for gas/condensate.

IV CONCLUSIONS

A. Palynology suggests two unconformities. The terminal Cretaceous hiatus probably occurs in the interval 940-50m. The middle Cretaceous hiatus may occur in the gap 1734-1788m.

B. The lower C. triplex interval shows a normal environmental pattern of transgression in time. The top common C. edwardsii may be useful for detailed correlation within this interval.

C. The unpublished dinoflagellate C. bretonica is seen here for the second time in the Otway Basin. It may be that close sampling near the top of the Cretaceous will show that it is widely distributed. So far it is always associated with the M. druggii Dinoflagellate Zone throughout Australia, and is an excellent marker for the Late Maastrichtian.

V. REFERENCES

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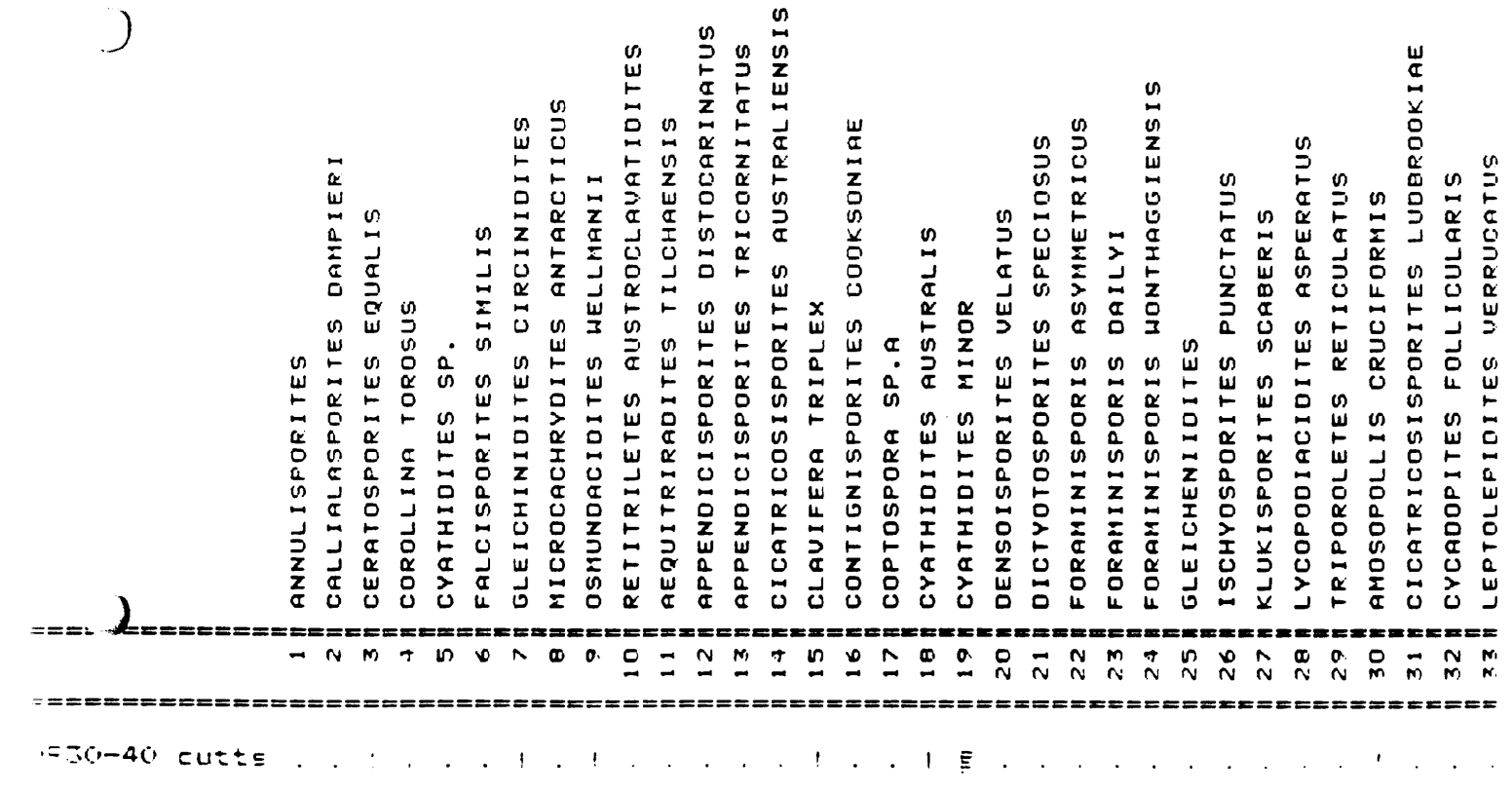
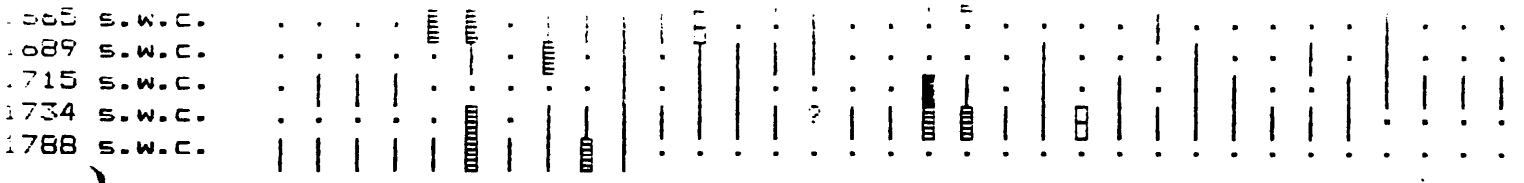
CALLISTA - 1 PALYNOLOGICAL DATA (composite)

RANGE CHART OF GRAPHIC ABUNDANCES BY LOWEST APPEARANCE (By Group)

Key to Symbols

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

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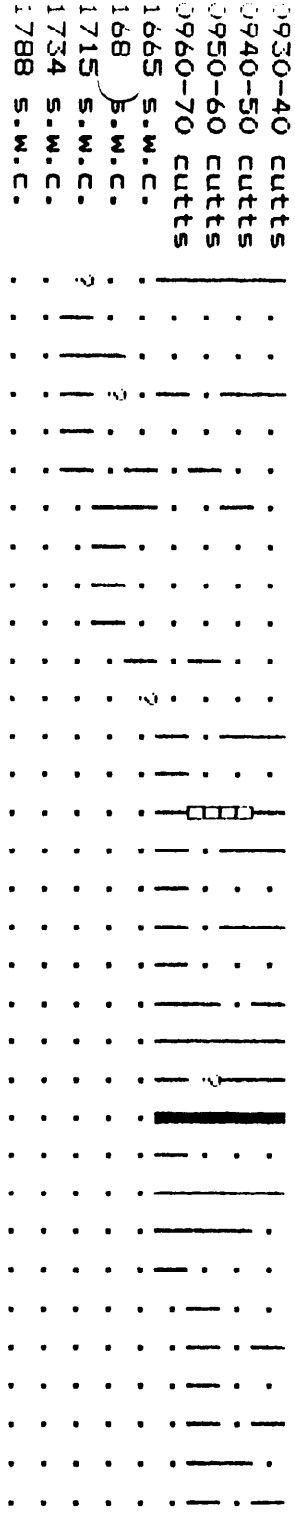
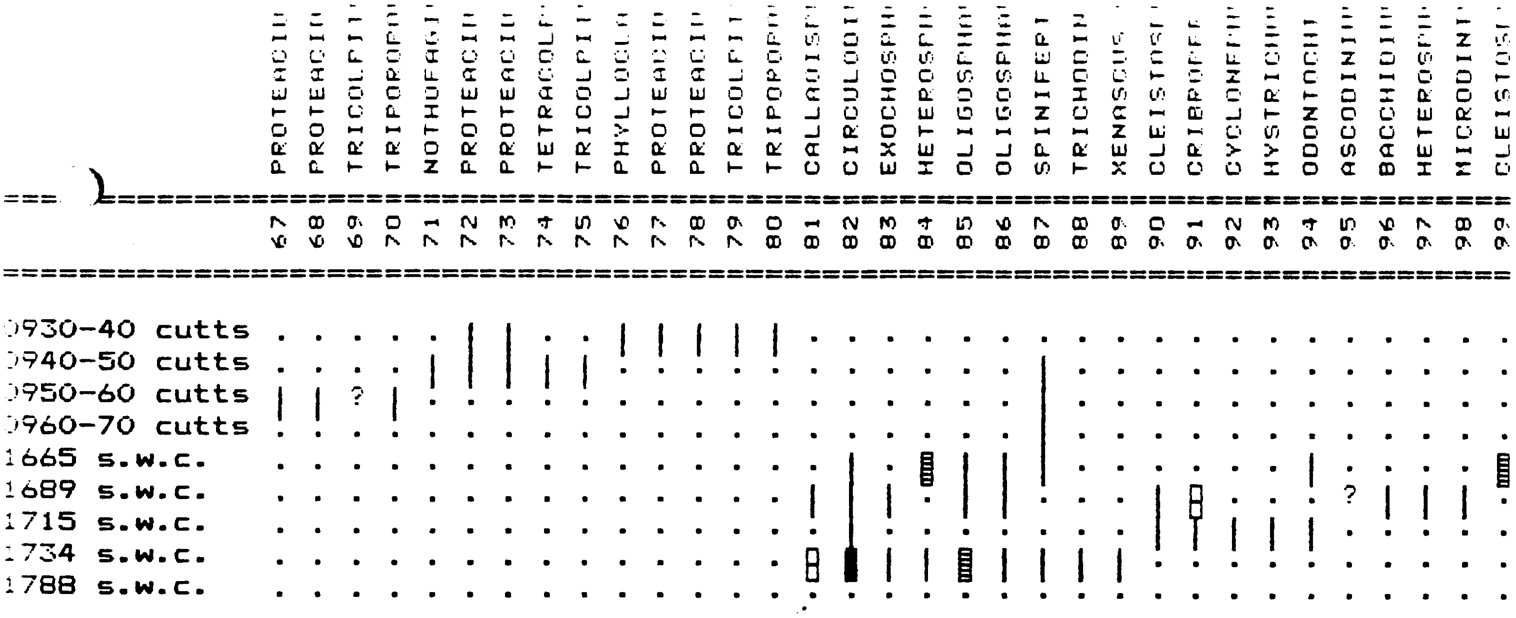


34	LYGISTEPOLLENITES FLORINII
35	PEROTRILETES MORGANII/JUBATUS
36	PHYLLOCLADIDITES EUNUCHUS
37	PHYLLOCLADIDITES MAWSONII
38	SESTROSPORITES PSUEDOALVEOLATUS
39	STERIESPORITES ANTIQUASPORITES
40	AUSTRALOPOLLIS OBSCURUS
41	BALMEISPORITES HOLODICTYUS
42	CYCLOSPORITES HUGHESI
43	TRILOBOSPORITES TRIORETICULOSUS
44	CAMEROZONOSPORITES BULLATUS
45	PHIMOPOLLENITES PANNOSUS
46	CINGUTRILETES CLAVUS
47	CUPANEIDITES ORTHOTEICHUS
48	GAMBIERINA RUDATA
49	HALORAGACIDITES HARRISII
50	LATROBOSPORITES OHAIENSIS
51	LYGISTEPOLLENITES BALMEI
52	MALVACIPOLLITES SUBTILIS
53	NOTHOFAGIDITES EMARCIDUS
54	NOTHOFAGIDITES ENDURUS
55	PERIPOROPOLLENITES POLYORATUS
56	PROTEACIDITES SPP.
57	SPINOZONOCOLPITES PROMINATUS
58	STERIESPORITES PUNCTATUS
59	TRICOLPITES LONGUS
60	TRICOLPORITES LILLIEI
61	BEAUPREADITES ELEGANSIFORMIS
62	CAMEROZONOSPORITES OHAIENSIS
63	DACRYCARPIDITES AUSTRALIENSIS
64	GAMBIERINA EDWARDSII
65	HERKOSPORITES ELLIOTTII
66	NOTHOFAGIDITES FALCATUS

PASSUS
ALISADUS ss
ESSUS
ES SECTILIS
FLEMINGII
PANDIS
NCURVATUS
 OAMARUENSIS
LLIPSII
. VERRUCOSUS
ENANTHOIDES
RESOLABRUS
LII
ES AMBIGUUS
IUM ASYMMETRICUM
FFLANDREI
UM PHRAGMITES
UM HETERACANTHUM
M COMPLEX
M PULCHERRIMUM
PCATUM/RAMOSUS

IUS
IUM HUGUONIOTI
N EDWARDSII
MEMBRANIPHORUM
 PULCHRUM
FFCULATA
UM
ES
UM CONJUNCTUM
ATUM
IUM SP.



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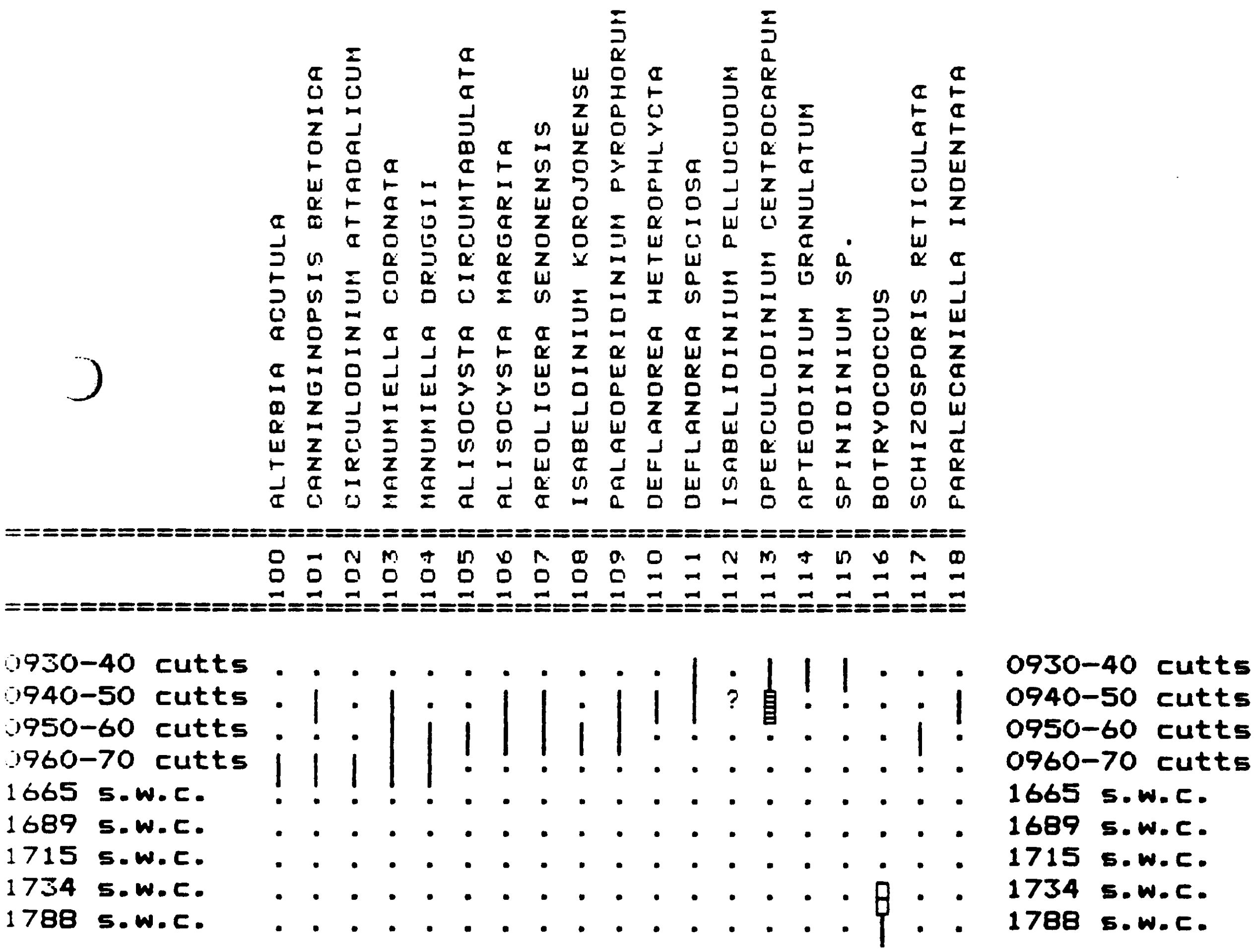
TRIPOROP
CALLAOIS
CIRCULOD
EXOCHOSP
HETEROSP
OLIGOSP
OLIGOSP
SPINIFER
TRICHODI
XENASCUS
CLEISTOS
CRIBROP
CYCLONEP
HYSTRICH
ODONTOCH
ASCODINI
BACCHIDI
HETEROSP
MICRODIN
CLEISTOS
67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99
0930-40 cutts
0940-50 cutts
0950-60 cutts
0960-70 cutts
1665 s.w.c.
1689 s.w.c.
1715 s.w.c.
1734 s.w.c.
1788 s.w.c.
?
?



100 ALTERBIA ACUTULA
101 CANNINGINOPSIS BRETONICA
102 CIRCULODINIUM ATTADALICUM
103 MANUMIELLA CORONATA
104 MANUMIELLA DRUGGII
105 ALISOCYSTA CIRCUMTABULATA
106 ALISOCYSTA MARGARITA
107 AREOLIGERA SENONENSIS
108 ISABELDINIUM KOROJONENSE
109 PALAEOPERIDINIUM PYROPHORUM
110 DEFLANDREA HETEROPHLYCTA
111 DEFLANDREA SPECIOSA
112 ISABELIDINIUM PELLUCIDUM
113 OPERCULODINIUM CENTROCARPUM
114 APTEODINIUM GRANULATUM
115 SPINIDINIUM SP.
116 BOTRYOCOCCUS
117 SCHIZOSPORIS RETICULATA
118 PARALECANIELLA INDENTATA
0930-40 cutts
0940-50 cutts
0950-60 cutts
0960-70 cutts
1665 s.w.c.
1689 s.w.c.
1715 s.w.c.
1734 s.w.c.
1788 s.w.c.
?

SPECIES LOCATION INDEX

Index numbers are the columns in which species appear.

INDEX NUMBER	SPECIES
11	AEQUITRIRADITES TILCHAENSIS
105	ALISOCYSTA CIRCUMTABULATA
10	ALISOCYSTA MARGARITA
100	ALTERBIA ACUTULA
30	AMOSOPOLLIS CRUCIFORMIS
1	ANNULISPORITES
12	APPENDICISPORITES DISTOCARINATUS

40 AUSTRALOPOLLIS OBSCURUS
96 BACCHIDIUM POLYPES
41 BALMEISPORITES HOLODICTYUS
61 BEAUPREADITES ELEGANSIFORMIS
11 BOTRYOCOCCUS
8. CALLAOISPHAERIDIUM ASYMMETRICUM
2 CALLIALASPORITES DAMPIERI
44 CAMEROZONOSPORITES BULLATUS
62 CAMEROZONOSPORITES OHAIENSIS
101 CANNINGINOPSIS BRETONICA
3 CERATOSPORITES EQUALIS
14 CICATRICOSISPORITES AUSTRALIENSIS
31 CICATRICOSISPORITES LUDBROOKIAE
46 CINGUTRILETES CLAVUS
102 CIRCULODINIUM ATTADALICUM
82 CIRCULODINIUM DEFLANDREI
15 CLAVIFERA TRIPLEX
90 CLEISTOSPHAERIDIUM HUGUONIOTI
99 CLEISTOSPHAERIDIUM SP.
16 CONTIGNISPORITES COOKSONIAE
17 COPTOSPORA SP.A
4 COROLLINA TOROSUS
91 CRIBROPERIDINIUM EDWARDSII
4 CUPANEIDITES ORTHOTEICHUS
18 CYATHIDITES AUSTRALIS
19 CYATHIDITES MINOR
5 CYATHIDITES SP.
32 CYCADOPITES FOLLICULARIS
92 CYCLONEPHELIUM MEMBRANIPHORUM
42 CYCLOSPORITES HUGHESI
63 DACRYCARPIDITES AUSTRALIENSIS
110 DEFLANDREA HETEROPHLYCTA
111 DEFLANDREA SPECIOSA
20 DENSOISPORITES VELATUS
21 DICTYOTOSPORITES SPECIOSUS
83 EXOCHOSPHAERIDIUM PHRAGMITES
6 FALCISPORITES SIMILIS
22 FORAMINISPORIS ASYMMETRICUS
23 FORAMINISPORIS DAILYI
24 FORAMINISPORIS WONTHAGGIENSIS
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7 GLEICHINIDITES CIRCINIDITES
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65 HERKOSPORITES ELLIOTTII
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84 HETEROSPHAERIDIUM HETERACANTHUM
93 HYSTRICHODINIUM PULCHRUM
108 ISABELDINIUM KOROJONENSE
112 ISABELIDINIUM PELLUCUDUM
26 ISCHYOSPORITES PUNCTATUS
27 KLUKISPORITES SCABERIS
50 LATROBOSPORITES OHAIENSIS
33 LEPTOLEPIDITES VERRUCATUS
28 LYCOPODIACIDITES ASPERATUS
51 LYGISTEPOLLENITES BALMEI
34 LYGISTEPOLLENITES FLORINII
52 MALVACIPOLLITES SUBTILIS
103 MANUMIELLA CORONATA
104 MANUMIELLA DRUGGII
MICROCACHRYDITES ANTARCTICUS
98 MICRODINIUM ORNATUM
53 NOTHOFAGIDITES EMARCIDUS
54 NOTHOFAGIDITES ENDURUS
66 NOTHOFAGIDITES FALCATUS

33	[illegible] FOLLMERIANUM
113	OPERCULODINIUM CENTROCARPUM
9	OSMUNDACIDITES WELLMANII
109	PALAEOPERIDINIUM PYROPHORUM
118	PARALECANIELLA INDENTATA
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36	PHYLLOCLADIDITES EUNUCHUS
37	PHYLLOCLADIDITES MAWSONII
76	PHYLLOCLADIDITES VERRUCOSUS
77	PROTEACIDITES ADENANTHOIDES
67	PROTEACIDITES CRASSUS
72	PROTEACIDITES GRANDIS
73	PROTEACIDITES INCURVATUS
78	PROTEACIDITES OBESOLABRUS
68	PROTEACIDITES PALISADUS ss
56	PROTEACIDITES SPP.
10	RETITRILETES AUSTROCLAVATIDITES
117	SCHIZOSPORIS RETICULATA
38	SESTROSPORITES PSUEDOALVEOLATUS
115	SPINIDINIUM SP.
87	SPINIFERITES FURCATUM/RAMOSUS
57	SPINOZONOCOLPITES PROMINATUS
3[illegible]	STERIESPORITES ANTIQUASPORITES
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74	TETRACOLPORITES OAMARUENSIS
88	TRICHODINIUM
69	TRICOLPITES CONFESSUS
79	TRICOLPITES GILLII
59	TRICOLPITES LONGUS
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60	TRICOLPORITES LILLIEI
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29	TRIPOROLETES RETICULATUS
80	TRIPOROPOLLENITES AMBIGUUS
70	TRIPOROPOLLENITES SECTILIS
89	XENASCUS ASPERATUS