PALYNOLOGY OF BEACH WILSON-1,

OTWAY BASIN, AUSTRALIA

BY

ROGER MORGAN

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I SUMMARY

1089m (swc) - 1173m (swc) : upper M. diversus Zone : Early Eocene : Marginally marine : immature.

1194m (swc) : indeterminate : nearly barren.

1195m (swc) - 1223.5m (swc) : upper L. balmei Zone (E. crassitabulata Dinoflagellate Zone) : Paleocene : immature offshore marine.

1237m (swc) : lower L. balmei (T. evittii Dinoflagellate Zone : Paleocene : offshore marine : marginally mature.

1274m (swc) - 1281.5m (swc) : very lean - presumed Tertiary.

1285m (swc) - 1308.5m (swc) : T.longus Zone : Maastrichtian : marginally marine at 1308.5m, marine (M.druggii Dinoflagellate Zone) at 1285m : marginally mature.

II INTRODUCTION

Eleven sidewall cores were examined from Beach Wilson-1 for biostratigraphy and spore colour. Yields were generally good. The samples are assigned to four palynological zones on the basis of the supporting data presented here as Appendix I. The Cretaceous zonation used is basically that of Helby, Morgan and Partridge (1987), which draws an all previous work. The Tertiary zonation is that of Stover and Partridge (1973) and Stover and Evans (1973) as modified by Partridge (1976).

Maturity data was generated on the Thermal Alteration Index (TAI) Scale of Staplin and plotted on Figure 2 as a Maturity Profile. The oil and gas windows on Figure 2 follow the general consensus of geochemical literature. The oil window corresponds to spore colours of light-mid brown (2.7) to dark brown (3.6) and would correspond to Vitrinite Reflectances of 0.6% to 1.3%. Geochemists, however, have not reached universal agreement on these values and argue variations based on kerogen type, basin type and 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 would probably not move the oil window by more than 200 metres. Instrumental geochemistry offers quantitative and repeatable raw data.

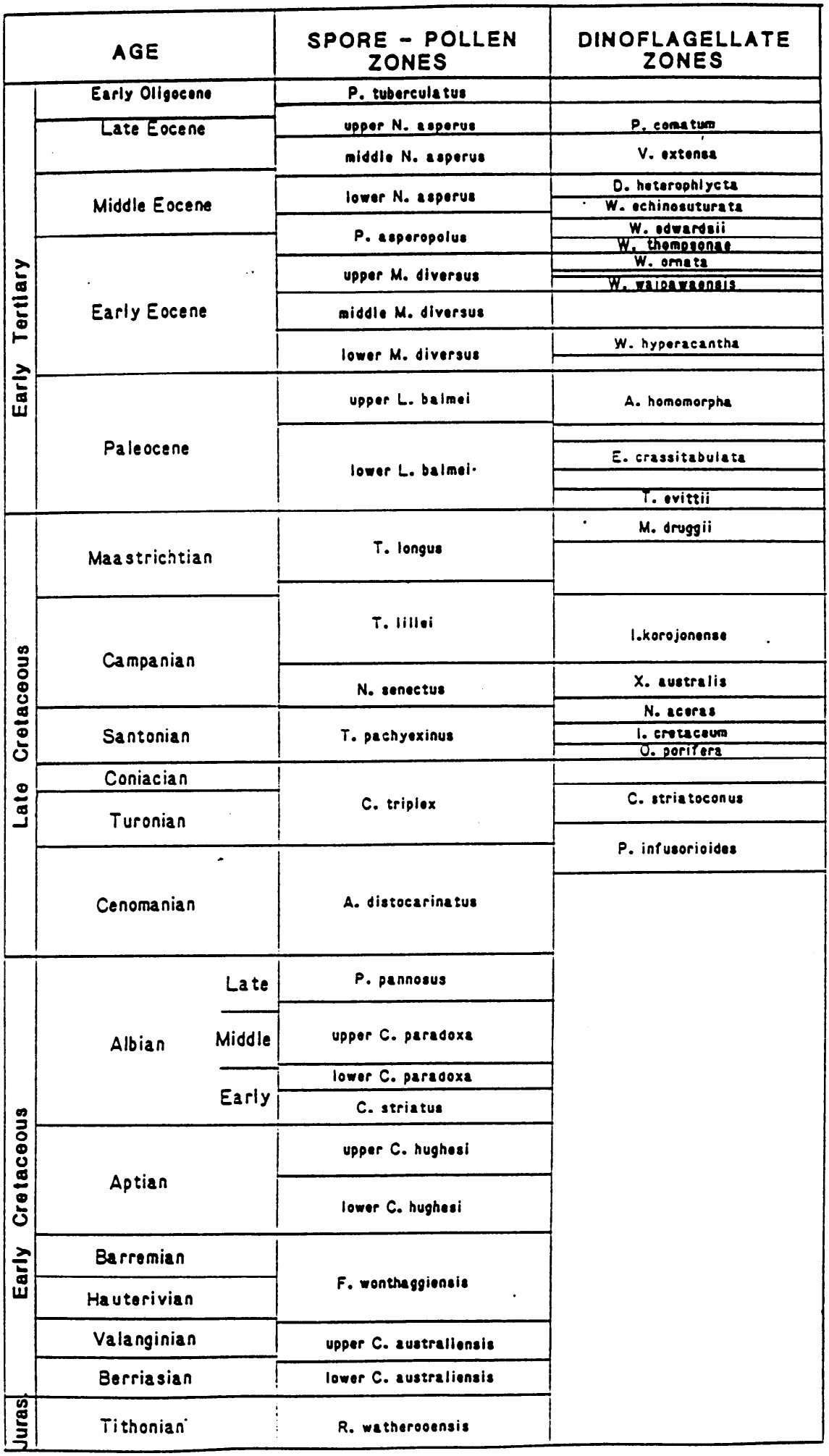

FIGURE 1 ZONATION FRAMEWORK

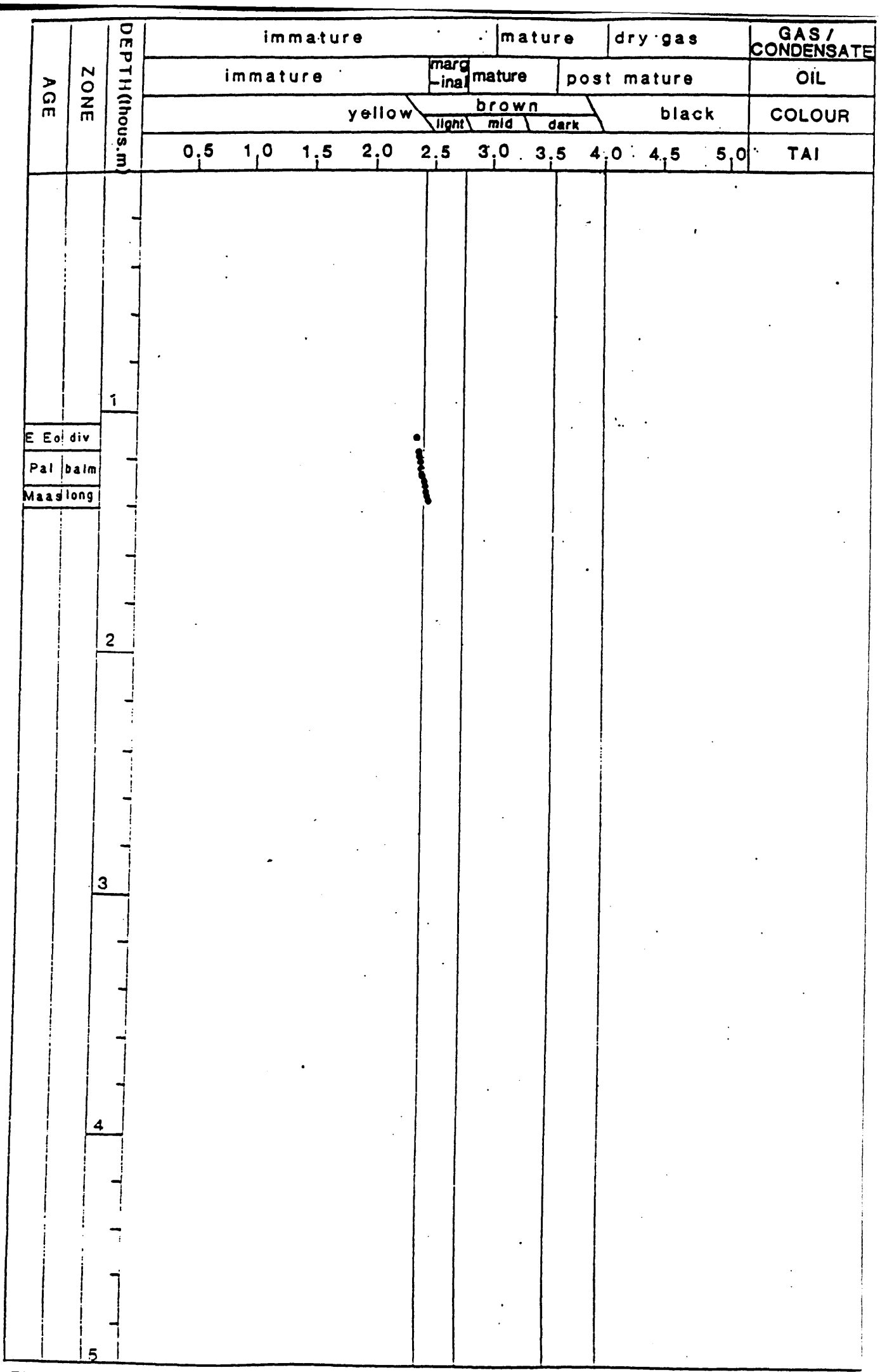

FIGURE 2 MATURITY PROFILE, WILSON-1

III PALYNOSTRATIGRAPHY

A. 1089m (swc) - 1173m (swc) : upper M.diversus Zone

Assignment to the upper Malvacipollis diversus Zone is indicated at the top by the absence of younger indicators and at the base by oldest Proteacidites pachypolus. Assemblages are dominated by Proteacidites spp. and Cyathidites spp., with minor Cretaceous and Permian reworking. The presence of Cyathidites gigantis, Proteacidites grandis, P. kopiensis, P. ornatus, Spinozonocolpites prominatus and consistent Malvacipollis diversus offer general support to the assignment.

The very scarce dinoflagellates include Apectodinium homomorphum, Deflandrea obliquipes and Muratodinium fimbriatum and are consistent with the spore-pollen assignment. The assemblages lack the key taxa to enable dinoflagellate zonal assignment.

Marginally marine environments are indicated by the abundant and diverse spores and pollen, and only very scarce low diversity dinoflagellates. The presence of the freshwater alga Botryococcus indicates some freshwater influence.

Spore colours of yellow to yellow/brown indicate immaturity for hydrocarbon generation.

B. 1194m (swc) : indeterminate

The yield from this sample was too lean to enable zonal assignment. The taxa observed may therfore be partly or largely mud contamination. The presence of Proteacidites grandis and P. incurvatus however, suggests an upper L.balmei or younger assignment.

Amongst the very few dinoflagellates seen, Apectodinium homomorphum suggests assignment to the A. homomorphum or younger zones (equivalent to the upper L. balmer or younger

spore-pollen assignment). Manumiella coronata is reworked from the Cretaceous.

Marine environments are suggested by the presence of dinoflagellates, although too few were seen to accurately assess their relative abundance.

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

C. 1195m (swc) - 1223.5m (swc) : upper L. balmei Zone (E. crassitabulata Dinoflagellate Zone).
Assignment to the upper Lygistepollenites balmei Zone is indicated at the top by youngest Gambierina rudata, supported by dinoflagellate evidence, and at the base by oldest Proteacidites grandis and P. incurvatus. However, the shallowest sample (1195m swc) does contain some anomalies such as Anacolosidites acutullus (suggesting a M. diversus Zone assignment) as well as Tricolpites longus and T. sabulosus (suggesting a late Cretaceous age). It is possible that 1195m could belong to the M. diversus Zone with significant reworking, but an upper L. balmei assignment is considered more likely. The other samples (1215.5 and 1223.5m) contain common L. balmei indicators and lack any evidence of caving or significant reworking, and their assignment is more confident.

Dinoflagellates are relatively common but are mostly longranging taxa. Eisenackia crassitabulata occurs at 1195m and 1223.5m without older indicators, and suggests assignment of the entire interval to the E. crassitabulata Zone. If, however, the species is reworked at 1195m, as discussed above, only the sample at 1223.5m may belong to the Zone.

Offshore marine environments are indicated by the common dinoflagellates (50% of palynomorphs) and their moderate diversity.

Yellow to yellow/brown spore colours indicate immaturity for

hydrocarbon generation.

D. 1237m (swc) : lower L.balmei Zone (T. evittii Dinoflagellate Zone)

Assignment to the lower Lygistepollinites balmei Zone is indicated by youngest L. balmei without older or younger indicators, and confirmed by the dinoflagellates. Assemblages are lean, with Gleicheniidites common.

Dinoflagellates are common but not very diverse. The sample contains dominant Palaeoperidinium pyrophorum, seen in the Gippsland Basin as typical of the basal Paleocene T. evittii Dinoflagellate Zone, and worldwide as a Danian or older feature.

Marine environments, possibly offshore, are indicated by the high content (90%) but low diversity dinoflagellates and the rare low diversity spores and pollen.

Spore colours are yellow/brown, indicating marginal maturity for oil, and immaturity for gas condensate.

E. 1274m (swc) - 1281.5m (swc) : very lean - presumed Tertiary.

These samples were very lean, partly due to previous sampling by AMDEL resulting in small rock volumes being available. The sample at 1274m was almost barren, and lacks any age diagnostic species. The sample at 1281.5m is very lean and contains some obvious caving. However, the presence of G. rudata, L. balmei and H. harrisii without older indicators suggests L. balmei Zone assignment. The non-descript dinoflagellates include frequent Alisocysta margarita, E. crassitabulata and Deflandrea spp., but lack any Manumiella spp. usually common in the Cretaceous. The samples are therefore probably Tertiary, but assignment is not confident.

The presence of frequent dinoflagellates with moderate diversity, suggests offshore marine environments. At 1281.5m (swc), mid to dark brown spore colours suggest maturity for oil, but this is considered anomalous and caused by some factors related to the lithology.

F. 1285m (swc) - 1308.5m (swc) : T.longus Zone (1285m M.druggii Dinoflagellate Zone)

Assignment to the Tricolpites longus Zone is indicated at the top by youngest Grapnelispora evansii, Tricolpites waiparaensis and Triporopollenites sectilis, and confirmed by the dinoflagellates. At the base, assignment is indicated by oldest Tetracolporites verrucosus, Tripunctisporis punctatus and Tricolpites longus. Assemblages are dominated by Proteacidites spp., with subordinate Phyllocladidites mawsonii.

At 1285m, common Isabelidinium pellucidum with some Manumiella druggii and M. coronata indicate assignment to the M. druggii Dinoflagellate Zone. At 1308.5m, very rare dinoflagellates include I. pellucidum, consistent with the spore pollen assignment, but not sufficient for dinoflagellate zone assignment.

Marine environments are indicated at 1285m by the very common (90%) dinoflagellates, although diversity is low. Marginal marine environments are indicated at 1308.5m by the very rare low diversity dinoflagellates.

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

IV CONCLUSIONS

A. Log picks are a little unclear due to non-typical lithologies encountered, including a sandy section with shows at 1192.5m - 1220.5m. The usual situation is for a Pember Formation (upper *L. balmei* Zone at the base) to conformably overlie a Pebble Point Formation (upper *L. balmei* and correlative *E. crassitabulata* Dinoflagellate Zone) which in turn unconformably overlies a Curdies or Paaratte Formation (*T. longus* and correlative *M. druggii* Dinoflagellate Zone).

This well fits this pattern if the Pebble Point is taken to be 1192.5m to 1283m (that is, if the sandy section is seen as a facies variant of the normal Pebble Point Formation). However, if the sample at 1195m is assigned to the *M. diversus* Zone, a top Pebble Point pick at 1220.5m would fit better. The PEF log indicates a top Pebble Point at 1192.5m. In either case, the presence of abundant *P. pyrophorum* at 1237m (*T. evittii* Dinoflagellate Zone) is unusual in the Otway Basin, and may suggest that Pebble Point deposition at this locality predates deposition elsewhere. To my knowledge, this feature and Zone has not previously been seen west of the Gippsland Basin.

B. Environmental data are consistent with regional knowledge, with the strongest marine influence in the latest Cretaceous and Paleocene. The Eocene Dilwyn Formation is much less marine.

C. Maturity data indicate that the base of the section is only marginally mature for oil. Deeper burial offstructure and th undrilled section could have provided suitable mature source rocks.

V REFERENCES

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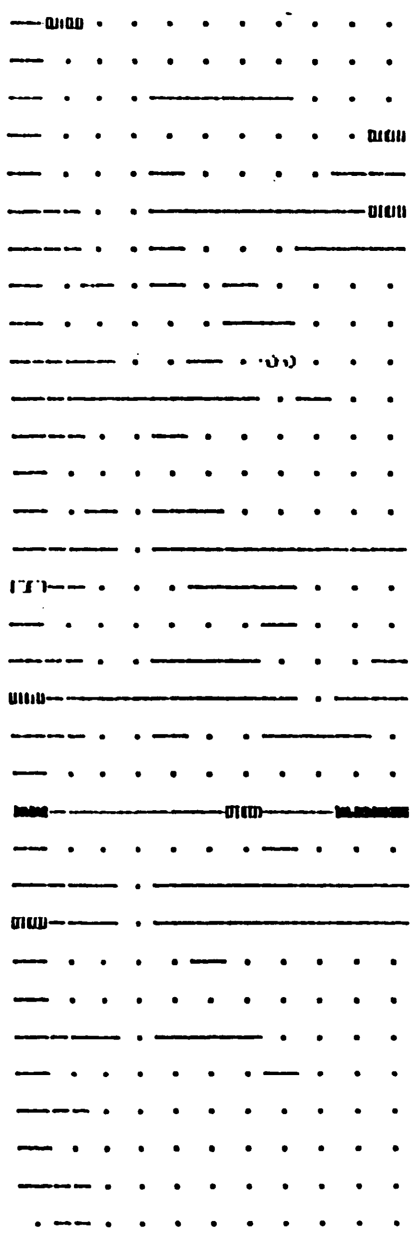
APPENDIX I

PALYNOMORPH OCCURRENCE DATA

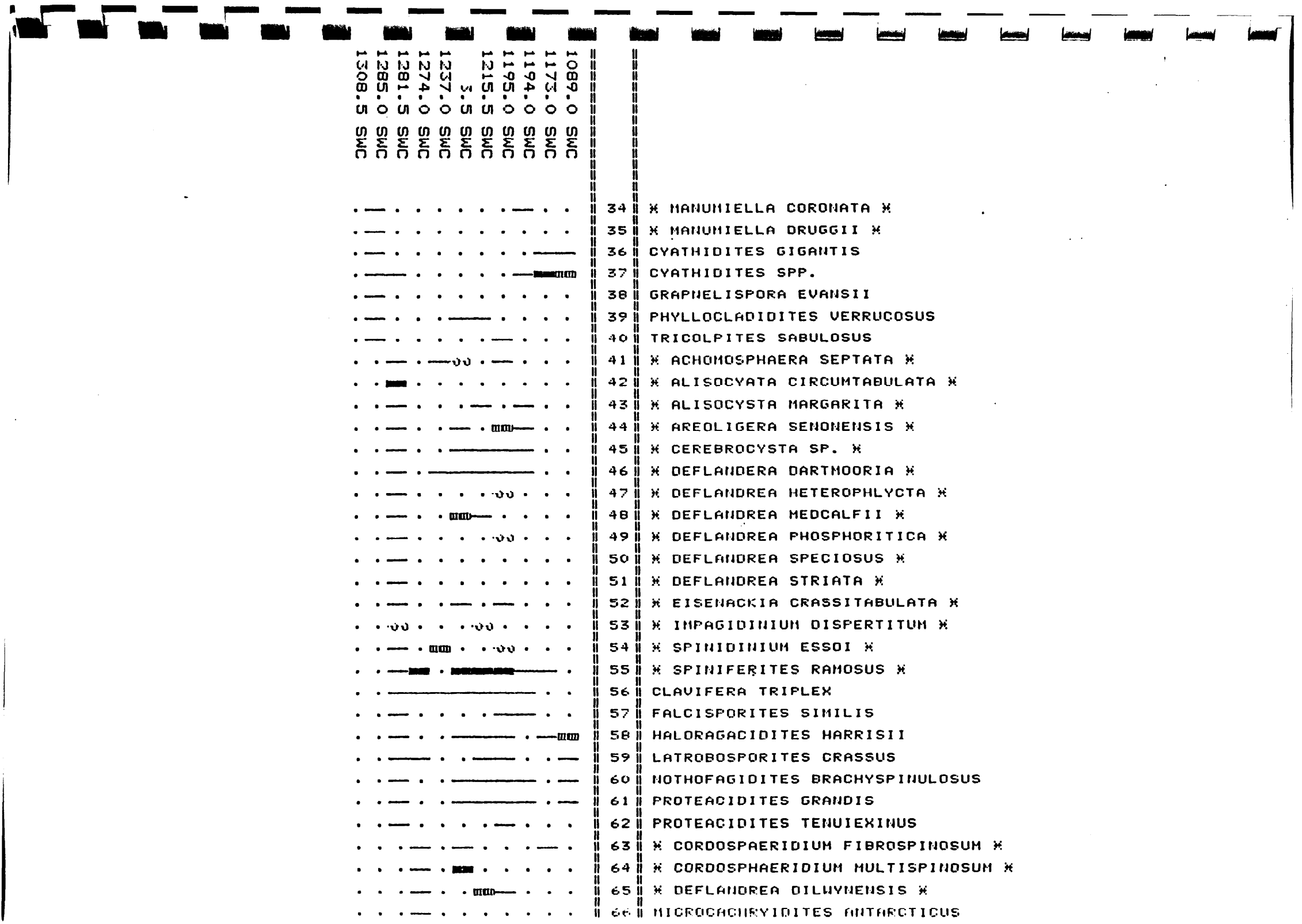
CHECKLIST OF GRAPHIC ABUNDANCE BY LOWEST APPEARANCE

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

1089.0 SWC
1173.0 SWC
1194.0 SWC
1195.0 SWC
1215.5 SWC
1223.5 SWC
1 .0 SWC
1274.0 SWC
1281.5 SWC
1295.0 SWC
1308.5 SWC



1 * ISABELIDINIUM PELLUCIDUM *
2 * TRITHYRODINIUM "RETICULATA" *
3 AUSTRALOPOLLIS OBSCURUS
4 CYATHIDITES SPLENDENS
5 DACRYCARPITES AUSTRALIENSIS
6 DILWYNITES GRANULATUS
7 DILWYNITES TUBERCULATUS
8 ERICIPITES SCABRATUS
9 GAMBIERINA EDWARDSII
10 GAMBIERINA RUDATA
11 HERKOSPORITES ELLIOTTII
12 LATROBOSPORITES OHAIENSIS
13 LILIACIDITES MAGNIFICUS
14 LYGISTEPOLLENITES BALMEI
15 LYGISTEPOLLENITES FLORINII
16 NOTHOFAGIDITES ENDURUS
17 NOTHOFAGIDITES SENECTUS
18 PERIPOROPOLLENITES POLYORATUS
19 PHYLLOCLADIDITES MAWSONII
20 PODOSPORITES MICROSACCATUS
21 PROTEACIDITES PALISADUS
22 PROTEACIDITES SPP.
23 RETITRILETES AUSTROCLAVATIDITES
24 STEREISPORITES (TRIPUNCTISPORIS) SPP.
25 STEREISPORITES ANTIQUASPORITES
26 TETRACOLPORITES VERRUCOSUS
27 TRICOLPITES CONFESSUS
28 TRICOLPITES GILLII
29 TRICOLPITES LONGUS
30 TRICOLPITES WAIPARAENSIS
31 TRICOLPORITES LILLEI
32 TRIPOROPOLLENITES SECTILIS
33 * HYSTRICHOSPHAERIDIUM TUBIFERUM *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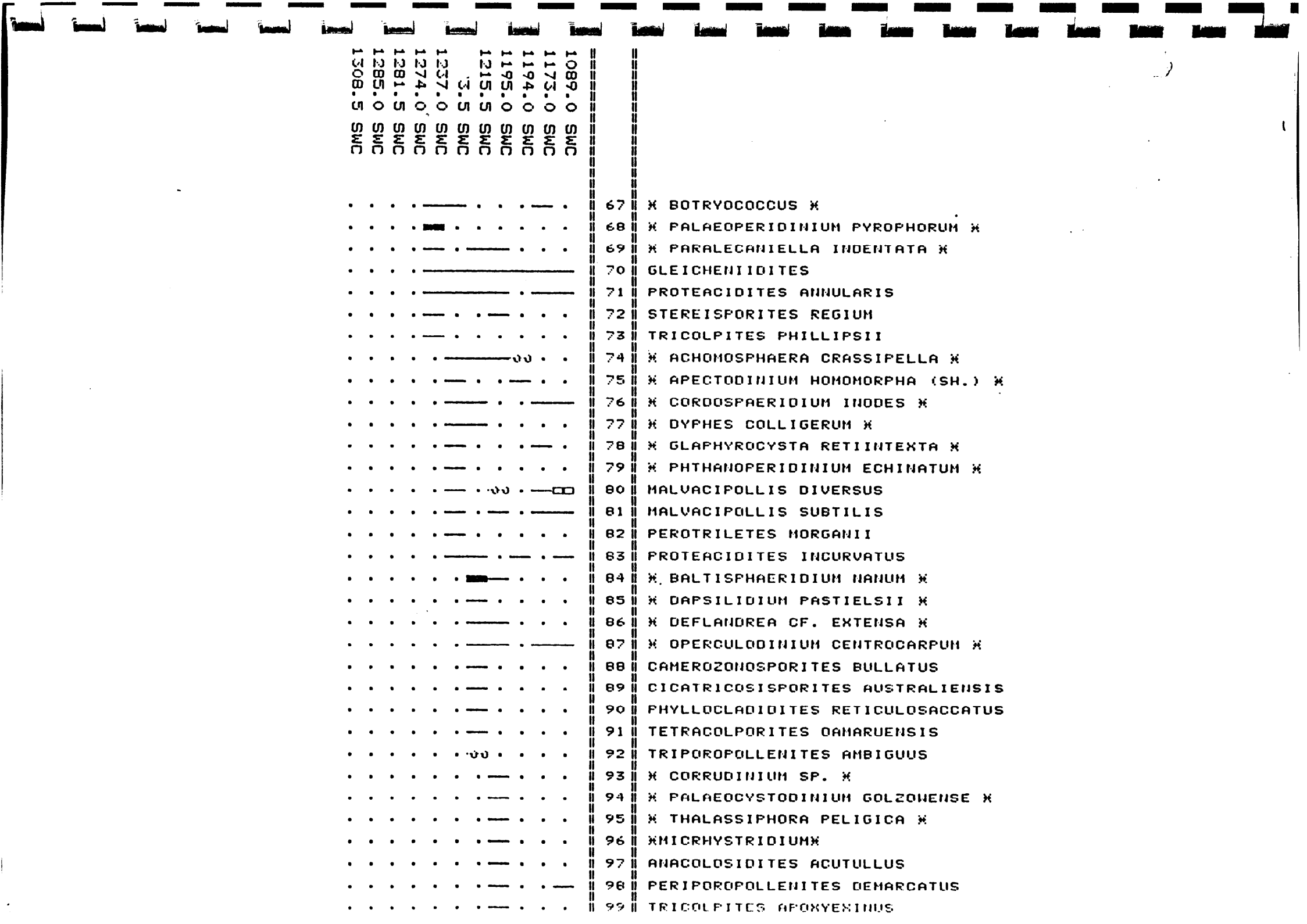
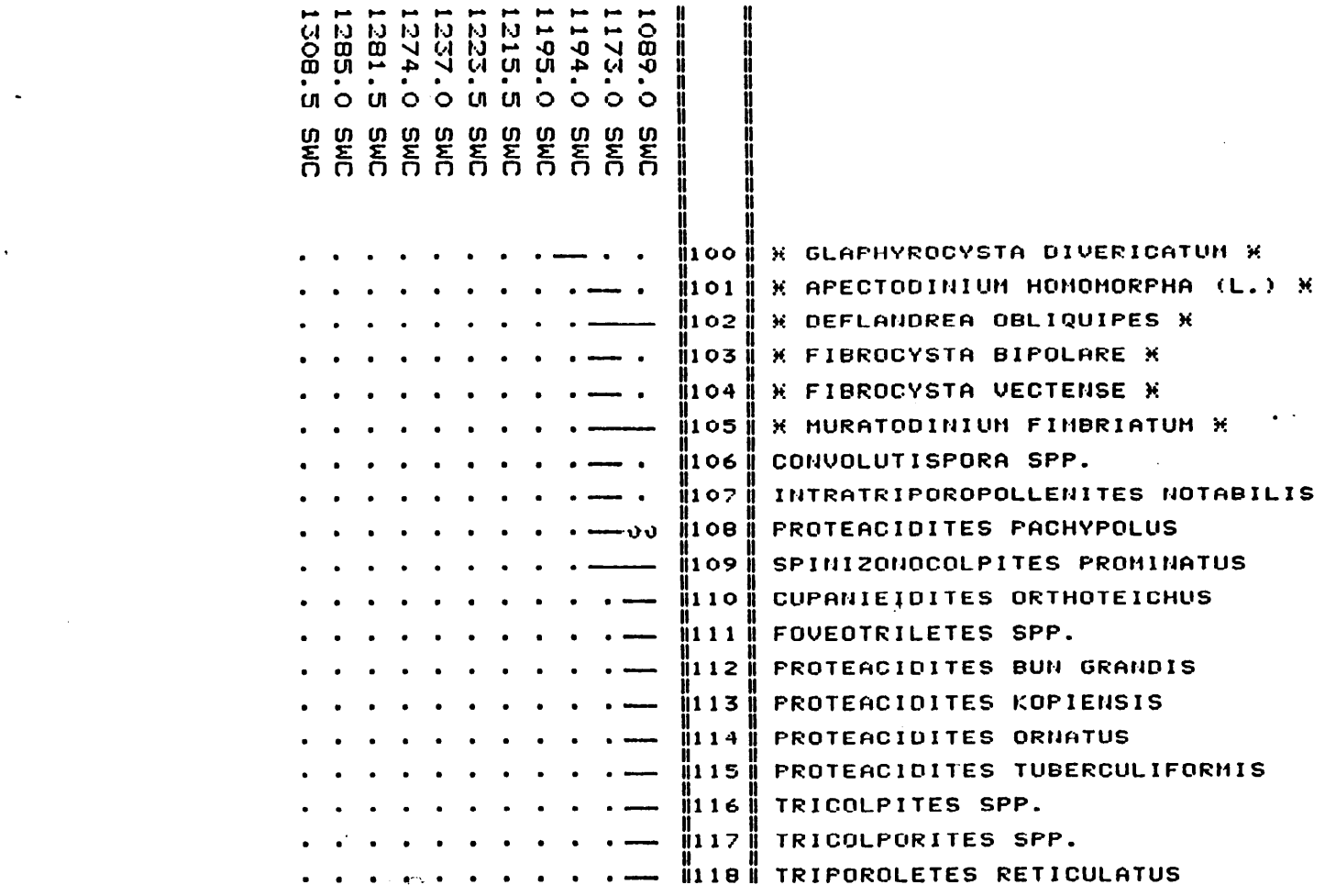
1285.0 SMC
1281.5 SMC
1274.0 SMC
1237.0 SMC
3.5 SMC
1215.5 SMC
1195.0 SMC
1194.0 SMC
1173.0 SMC
1089.0 SMC
34 * MANUMIELLA CORONATA *
35 * MANUMIELLA DRUGGII *
36 CYATHIDITES GIGANTIS
37 CYATHIDITES SPP.
38 GRAPNELISPORA EVANSII
39 PHYLLOCLADIDITES VERRUCOSUS
40 TRICOLPITES SABULOSUS
41 * ACHOMOSPHAERA SEPTATA *
42 * ALISOCYATA CIRCUMTABULATA *
43 * ALISOCYSTA MARGARITA *
44 * AREOLIGERA SENONENSIS *
45 * CEREBROCYSTA SP. *
46 * DEFLANDERA DARTMOORIA *
47 * DEFLANDREA HETEROPHLYCTA *
48 * DEFLANDREA MEDCALFII *
49 * DEFLANDREA PHOSPHORITICA *
50 * DEFLANDREA SPECIOSUS *
51 * DEFLANDREA STRIATA *
52 * EISENACKIA CRASSITABULATA *
53 * IMPAGIDINIUM DISPERTITUM *
54 * SPINIDINIUM ESSOI *
55 * SPINIFERITES RAMOSUS *
56 CLAVIFERA TRIPLEX
57 FALCISPORITES SIMILIS
58 HALORAGACIDITES HARRISII
59 LATROBOSPORITES CRASSUS
60 NOTHOFAGIDITES BRACHYSPINULOSUS
61 PROTEACIDITES GRANDIS
62 PROTEACIDITES TENUIEXINUS
63 * CORDOSPAERIDIUM FIBROSPINOSUM *
64 * CORDOSPHAERIDIUM MULTISPINOSUM *
65 * DEFLANDREA DILWYNENSIS *
66 MICROCACHRYIDITES ANTARCTICUS


1308.5 SWC
1285.0 SWC
1281.5 SWC
1274.0 SWC
1237.0 SWC
1215.5 SWC
1195.0 SWC
1194.0 SWC
1173.0 SWC
1089.0 SWC
67 * BOTRYOCOCCUS *
68 * PALAEOPERIDINIUM PYROPHORUM *
69 * PARALECANIELLA INDENTATA *
70 GLEICHENIIDITES
71 PROTEACIDITES ANNULARIS
72 STEREISPORITES REGIUM
73 TRICOLPITES PHILLIPSII
74 * ACHOMOSPHAERA CRASSIPELLA *
75 * APECTODINIUM HOMOMORPHA (SH.) *
76 * CORDOSPAERIDIUM INODES *
77 * DYPHES COLLIGERUM *
78 * GLAPHYROCYSTA RETIINTEXTA *
79 * PHTHANOPERIDINIUM ECHINATUM *
80 MALVACIPOLLIS DIVERSUS
81 MALVACIPOLLIS SUBTILIS
82 PEROTRILETES MORGANII
83 PROTEACIDITES INCURVATUS
84 * BALTISPHAERIDIUM NANUM *
85 * DAPSILIDIUM PASTIELSII *
86 * DEFLANDREA CF. EXTENSA *
87 * OPERCULODINIUM CENTROCARPUM *
88 CAMEROZONOSPORITES BULLATUS
89 CICATRICOSISPORITES AUSTRALIENSIS
90 PHYLLOCLADIDITES RETICULOSACCATUS
91 TETRACOLPORITES OAMARUENSIS
92 TRIPOROPOLLENITES AMBIGUUS
93 * CORRUDINIUM SP. *
94 * PALAEOCYSTODINIUM GOLZOWENSE *
95 * THALASSIPHORA PELIGICA *
96 *MICRHYSTRIDIUM*
97 ANACOLOSIDITES ACUTULLUS
98 PERIPOROPOLLENITES DEMARCATUS
99 TRICOLPITES APOXYEXINUS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1173.0 SWC
1194.0 SWC
1195.0 SWC
1215.5 SWC
1223.5 SWC
1237.0 SWC
1274.0 SWC
1281.5 SWC
1285.0 SWC
1308.5 SWC
100 * GLAPHYROCYSTA DIVERICATUM *
101 * APECTODINIUM HOMOMORPHA (L.) *
102 * DEFLANDREA OBLIQUIPES *
103 * FIBROCYSTA BIPOLARE *
104 * FIBROCYSTA VECTENSE *
105 * MURATODINIUM FIMBRIATUM *
106 CONVOLUTISPORA SPP.
107 INTRATRIPOROPOLLENITES NOTABILIS
108 PROTEACIDITES PACHYPOLUS
109 SPINIZONOCOLPITES PROMINATUS
110 CUPANIEIDITES ORTHOTEICHUS
111 FOVEOTRILETES SPP.
112 PROTEACIDITES BUN GRANDIS
113 PROTEACIDITES KOPIENSIS
114 PROTEACIDITES ORNATUS
115 PROTEACIDITES TUBERCULIFORMIS
116 TRICOLPITES SPP.
117 TRICOLPORITES SPP.
118 TRIPOROLETES RETICULATUS

55	* SPINIFERITES RAMOSUS *
95	* THALASSIPHORA PELIGICA *
2	* TRITHYRODINIUM "RETICULATA" *
96	*MICRHYSTRIDIUM*
97	ANACOLOSIDITES ACUTULLUS
3	AUSTRALOPOLLIS OBSCURUS
88	CAMEROZONOSPORITES BULLATUS
89	CICATRICOSISPORITES AUSTRALIENSIS
56	CLAVIFERA TRIPLEX
106	CONVOLUTISPORA SPP.
110	CUPANIEIDITES ORTHOTEICHUS
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4	CYATHIDITES SPLENDENS
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