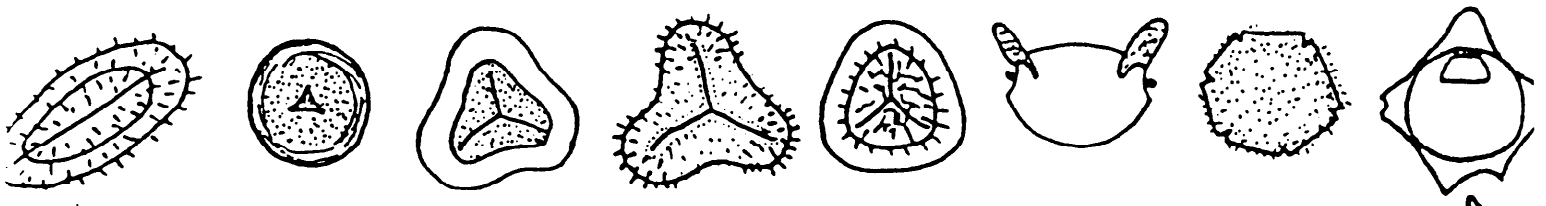

PALYNOLOGY OF LAKES OIL SOUTH CARAMUT-1

OTWAY BASIN, VICTORIA

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for LAKES OIL

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CONTENTS PAGE

I SUMMARY

100m (swc)-140m (swc) : lower to middle P. tuberculatus zone : Late Oligocene to Early Miocene : nearshore marine : immature

162m (swc)-191m (swc) : apparently upper N. asperus zone : Early Oligocene : nearshore marine : immature

196m (swc) : C. hughesi zone : Aptian : lacustrine : early marginal mature for oil

302m (swc)-373m (swc) : lean and indeterminate

379.5m (swc)-381m (swc) : F. wonthaggiensis zone : Late Neocomian : non-marine : marginal mature

393m (swc) : very lean F. wonthaggiensis - C. australiensis zones : Neocomian : non-marine : marginal mature

II INTRODUCTION

Eight sidewall cores were processed, to provide information on age, environment and maturity for the completion report.

Palynomorph occurence data are shown as Appendix I and form the basis for the assignment of the samples to four spore-pollen units of Neocomian to Miocene age. The Cretaceous spore-pollen zonation is essentially that of Dettmann and Playford (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 and modified by Morgan (1985) for application in the Otway Basin. The Tertiary zonation is that of Stover and Partridge (1973) and Stover and Evans (1973) as modified by Partridge (1976).

Maturity data was generated in the form of Spore Colour Index, and is plotted on figure 2 Maturity profile of South Caramat-1. The oil and gas windows in figure 2 follow the general consensus 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 reflectance values of 0.6% to 1.3%.

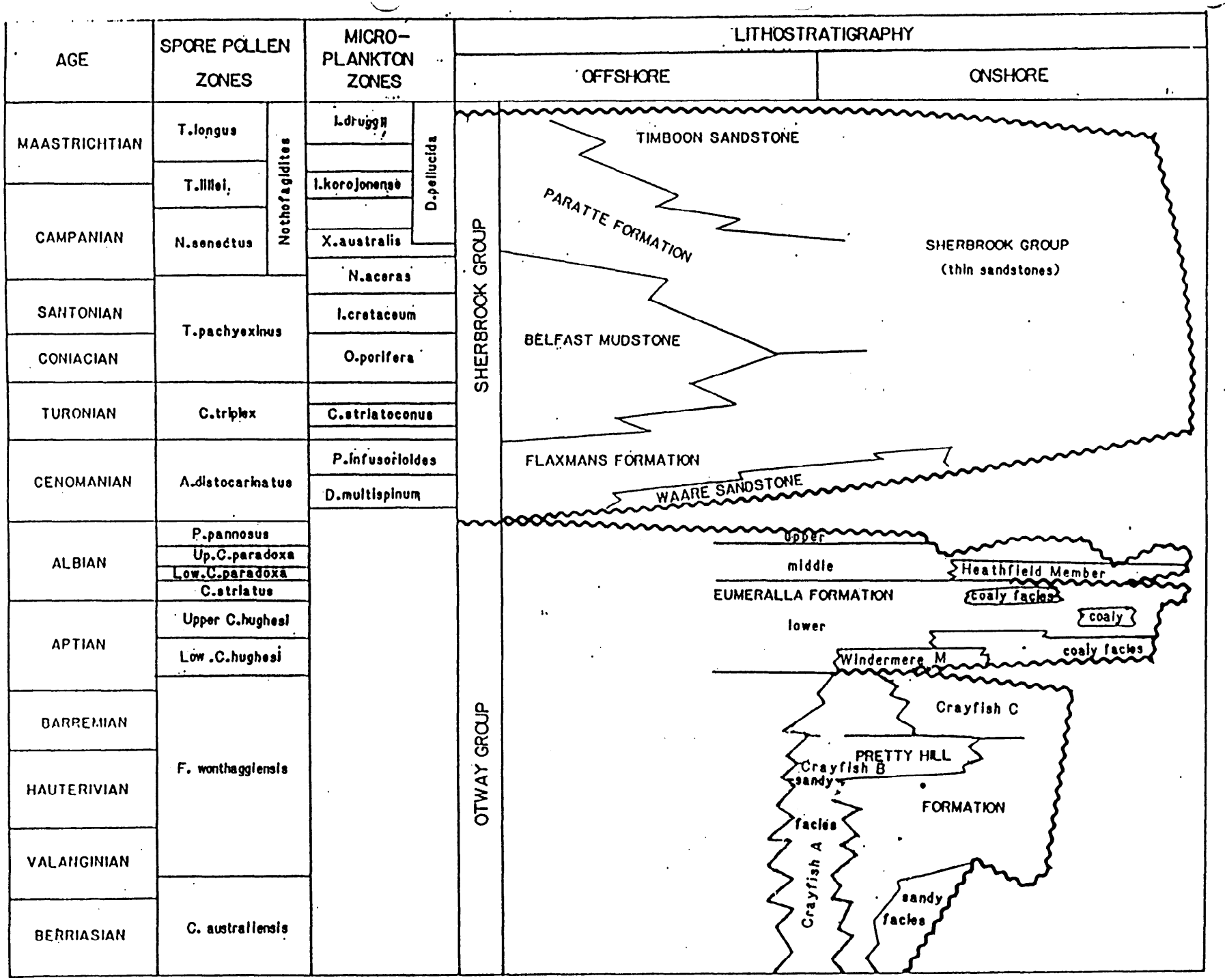

FIGURE 1. CRETACEOUS REGIONAL FRAMEWORK, OTWAY BASIN

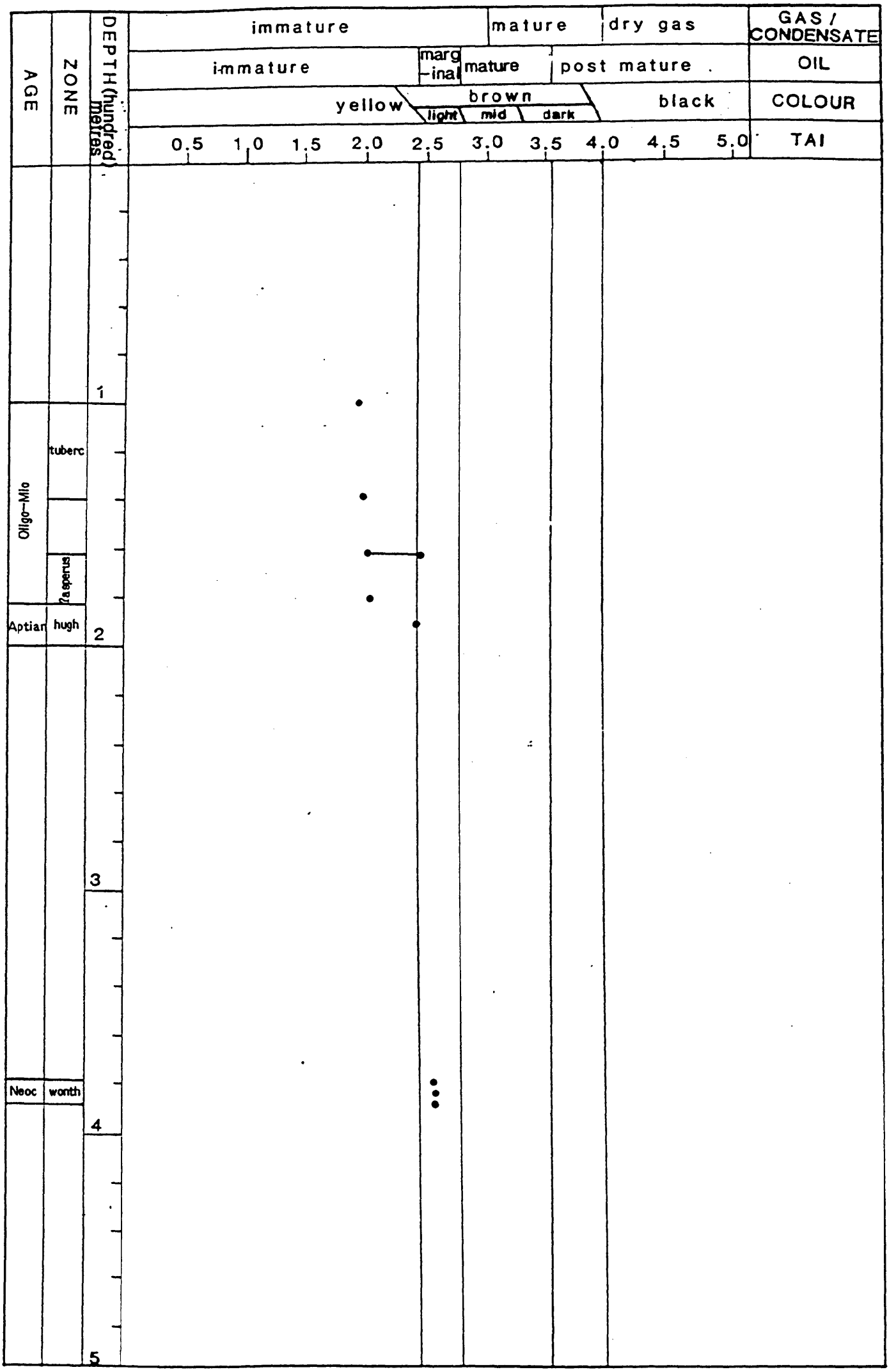

FIGURE 2 MATURITY PROFILE SOUTH CARAMUT 1

III PALYNOSTRATIGRAPHY

A 100m (swc)-140m (swc) : lower to middle *P. tuberculatus* zone

Assignment to the lower-middle *Proteacidites tuberculatus* zone is indicated at the top by youngest *Nothofagidites flemingii* and *Periporopollenites vesicus* and at the base by oldest *Cyatheacidites annulatus*. *Haloragacidites harrisii* is dominant with frequent *Cyathidites minor*, *Lygistepollenites florinii* and *Nothofagidites falcata*. The dinoflagellates are not age diagnostic but frequent *Operculodinium* and *Apteodinium* is consistent with the spore-pollen assignment.

Nearshore environments are indicated by the dominant and diverse spores and pollen and subordinate low diversity dinoflagellates.

These features are normally seen in the Gellibrand Marl, Clifton Formatin and Nirranda Subgroup in the Otway Basin.

Colourless to light yellow palynomorphs indicate immaturity for hydrocarbons.

B 162m (swc)-191m (swc) : apparently upper *N. asperus* zone

These two samples are somewhat problematic. The swc at 162m is lean but contains a fair Early Cretaceous spore-pollen assemblage with trace quantities of Tertiary palynomorphs, and in isolation might be considered Early Cretaceous with minor mud contamination.

The swc at 191m however, contains a very lean but exclusively Tertiary assemblage similar to that from the overlying P. tuberculatus zone, but lacking the key index C. annulatus. H. harrisii is dominant with Nothofagidites falcata and N. emarcidus common. Rare elements inclue Nothofagidites asperus, Banksieacidites elongatus, Cupaneidites orthoteichus and Proteacidites rictomarginus/incurvatus and an upper N. asperus zone assignment is tentatively applied, more on the absence of the other indicators than on firm positive occurrence. The nature of the assemblages indicates that it cannot possibly be older than lower N. asperus zone.

In view of the Tertiary swc at 191m, the shallower swc is considered to be Oligocene-Miocene with heavily reworked Cretaceous.

Nearshore marine environments are indicated by the dominant and diverse spores and pollen, and the subordinate low diversity dinoflagellates.

These features are normally seen in the Gellibrand Marl, Clifton Formation and Nirranda Subgroup or topmost Dilwyn formation in the Otway Basin.

Colourless to light yellow Tertiary palynomorphs indicate immaturity for hydrocarbons.

C 196m (swc) : C. hughesi zone

Assignment to the Cydosporites hughesi zone is indicated at the top by youngest C. hughesi without younger indicators, and at the base by oldest Pilosisporites notensis, P. parvispinosus and

Triporoletes reticulatus. Cyathidites and Falcisporites are common, with frequent Microcacliryidites antarcticus and Osmundacidites wellmannii.

Non-marine lacustrine environments are indicated by the dominance (60% of palynomorphs) of a thin walled leiosphere with rare Microfasta evansii. Spores and pollen are therefore subordinate but of high diversity.

These features are normally seen in the lower Eumeralla Formation and correlatives of Kopsen and Scholefield (1990).

Dark yellow to light brown spore colours indicate early marginal maturity for oil generation.

D 302m-373m : indeterminate

Yields are very low and confident zonal assignment is not possible. Non-marine environments are suggested by the dominant and diverse spores and pollen and absence of marine indicators.

Dark yellow to light brown spore colours indicate early marginal maturity for oil generation.

E 379.5m (swc)-381m (swc) : F. wonthaggiensis zone

Assignment to the Foraminisporis wonthaggiensis zone is indicated at the top by the absence of younger indicators and at the base by olderst Dictyotosporites speciosus. Cyathidites, O. wellmannii and Falcisporites dominate the assemblages.

Non-marine environments are indicated by the dominant

and diverse spores and pollen, common cuticle and absence of marine indicators. Minor lacustrine influence is indicated by the rare non-spiny acritarchs, including M. evansii at 381m.

These features are normally seen in the upper Pretty Hill Formation and correlatives.

Light brown spore colours indicate early maturity for hydrocarbons.

F 393m (swc) : F. wonthaggiensis or C. australiensis zones

Microfossil yield was lean in this sample, but it is essentially similar to that above. The absence of the key marker taxa D. speciosus suggests the C. australiensis zone, but its absence may be due to scarcity in a lean assemblage, and a F. wonthaggiensis age may be possible. The presence of Cicatricosisporites australiensis indicates that it can be no older than the Early Neocomian C. australiensis zone. Cyathidites, Falcisporites and Osmundacidites dominate the assemblage.

Non-marine probably fluvial environments are suggested by the common and diverse spores and pollen, and absence of acritarchs.

These features are normally seen in the Pretty Hill Formation and correlatives in the Otway Basin.

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

IV CONCLUSIONS

The sampled section includes a truncated Early Cretaceous sequence (consisting of Pretty Hill and basal Eumeralla correlatives) unconformably overlain by a thin Tertiary section (consisting of Oligocene to Miocene Gellibrand Marl, to Nirranda Group correlatives).

The Early Cretaceous is marginally mature near surface and suggests that it has been much more deeply buried at some time in the past, probably before deposition of the thin Tertiary section.

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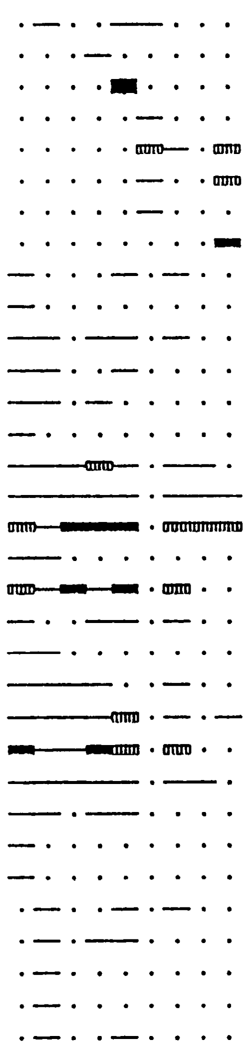
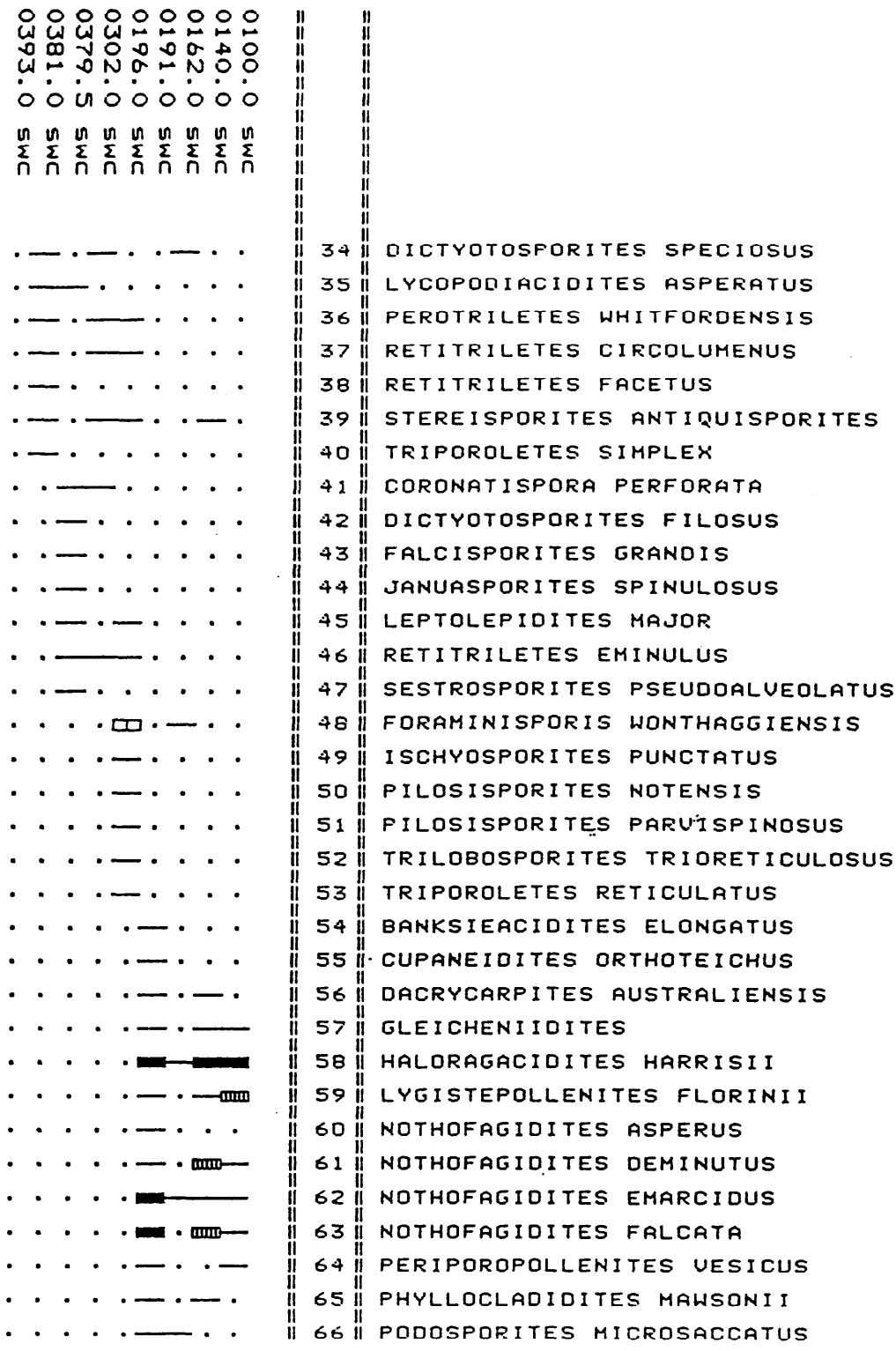
RANGE CHART OF GRAPHIC ABUNDANCES BY LOWEST APPEARANCE: dino & s/p

Key to Symbols

- — = Very Rare
- ▭ = Rare
- ▯ = Few
- ▬ = Common
- ■ = Abundant
- ? = Questionably Present
- • = Not Present



1 MICROFASTA EVANSII
2 SCHIZOSPORIS RETICULATUS
3 LEIOSPHAERIDIA SP.
4 CORDOSPHAERIDIUM FIBROSPINOSUM
5 OPERCULODINIUM SPP
6 SPINIFERITES FURCATUS/RAMOSUS
7 SYSTEMATOPHORA PLACACANTHA
8 APTEODINIUM AUSTRALIENSE
9 AEQUITRIRADITES SPINULOSUS
10 BIRETRISPORITES SPECTABILIS
11 CERATOSPORITES EQUALIS
12 CICATRICOSISPORITES AUSTRALIENSIS
13 CONTIGNISPORITES COOKSONIAE
14 CONTIGNISPORITES GLEBULENTUS
15 COROLLINA TOROSUS
16 CYATHIDITES AUSTRALIS
17 CYATHIDITES MINOR
18 DICTYOTOSPORITES COMPLEX
19 FALCISPORITES SIMILIS
20 FORAMINISPORIS DAILYI
21 KLUKISPORITES SCABERIS
22 LEPTOLEPIDITES VERRUCATUS
23 MICROCACHRYIDITES ANTARCTICUS
24 OSMUDACIDITES WELLMANII
25 RETITRILETES AUSTROCLAVATIDITES
26 RETITRILETES WATHAROOENSIS
27 TRIPOROLETES RADIATUS
28 TRIPOROLETES fine RETICULATUS
29 AEQUITRIRADITES VERRUCOSUS
30 ARAUCARIACITES AUSTRALIS
31 COUPERISPORITES TABULATUS
32 CYCADOPITES FOLLICULARIS
33 CYCLOSPORITES HUGHESI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0393.0 SWC
34 DICTYOTOSPORITES SPECIOSUS
35 LYCOPODIACIDITES ASPERATUS
36 PEROTRILETES WHITFORDENSIS
37 RETITRILETES CIRCOLUMENUS
38 RETITRILETES FACETUS
39 STEREISPORITES ANTIQUISPORITES
40 TRIPOROLETES SIMPLEX
41 CORONATISPORA PERFORATA
42 DICTYOTOSPORITES FILOSUS
43 FALCISPORITES GRANDIS
44 JANUASPORITES SPINULOSUS
45 LEPTOLEPIDITES MAJOR
46 RETITRILETES EMINULUS
47 SESTROSPORITES PSEUDOALVEOLATUS
48 FORAMINISPORIS WONTHAGGIENSIS
49 ISCHYOSPORITES PUNCTATUS
50 PILOSISPORITES NOTENSIS
51 PILOSISPORITES PARVISPINOSUS
52 TRILOBOSPORITES TRIORETICULOSUS
53 TRIPOROLETES RETICULATUS
54 BANKSIEACIDITES ELONGATUS
55 CUPANEIDITES ORTHOTEICHUS
56 DACRYCARPITES AUSTRALIENSIS
57 GLEICHENIIDITES
58 HALORAGACIDITES HARRISII
59 LYGISTEPOLLENITES FLORINII
60 NOTHOFAGIDITES ASPERUS
61 NOTHOFAGIDITES DEMINUTUS
62 NOTHOFAGIDITES EMARCIDUS
63 NOTHOFAGIDITES FALCATA
64 PERIPOROPOLLENITES VESICUS
65 PHYLLOCLADIDITES MAWSONII
66 PODOSPORITES MICROSACCATUS

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No.	Species
67	PROTEACIDITES INCURVATUS
68	PROTEACIDITES SCABORATUS
69	SAPATACEOIDAEPOLLENITES ROTUNDA
70	TRILETES TUBERCULIFORMIS
71	CYATHEACIDITES ANNULATUS
72	MYRTACEIDITES PARVUS
73	NOTHOFAGIDITES FLEMINGII
74	PERIPOROPOLLENITES POLYORATUS
75	PROTEACIDITES SP
76	TETRACOLPORITES OAMARUENSIS
77	VERRUCOSISPORITES KOPUKUENSIS
78	DILWYNITES GRANULATUS

0100.0 SWC
0140.0 SWC
0162.0 SWC