PETROLEUM DIVISION

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PALYNOLOGY OF EUMERALLA-1

NEW PALYNOLOGY OF EUMERALLA-1,

ONSHORE OTWAY BASIN, VICTORIA

BY

ROGER MORGAN

for MINORA RESOURCES

OCTOBER, 1988.

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I SUMMARY

3311-21 ft. : *P. pannosus* Zone : late Albian : non-marine : usually topmost Eumeralla with flat sonic response

3800-4814 ft. : upper *C. paradoxa* Zone : mid Albian : non-marine to slightly brackish : usually flat response Eumeralla

5297-5309 ft. : *C. paradoxa* Zone, subzone uncertain : mid Albian : slightly brackish

5560-5816 ft. : lower *C. paradoxa* Zone : mid Albian : non-marine : usually Eumeralla, with spikier response than above

6034-6720 ft. : *C. striatus* Zone : early Albian : non-marine : usually intra Eumeralla with spiky response

7225-8465 ft. : upper *C. hughesi* Zone : Aptian : non-marine to slightly brackish : usually Eumeralla with less spiky response than above and below

8914-9385 ft. : lower *C. hughesi* Zone : Aptian : non-marine : usually Eumeralla with sometimes coaly intervals : basal Eumeralla sands sometimes seen

9767-10305 ft. : *F. wonthaggiensis* Zone : late Neocomian : non-marine : usually Pretty Hill sands

II INTRODUCTION

Ed Kopson of Minora Resources submitted 23 samples (20 conventional cores and 3 cuttings samples) from the Early Cretaceous of Eumeralla-1 for palynostratigraphy. This was on behalf of the PEP III operating group, as part of regional appraisal of the area. No raw data from earlier work on the well was available, although a report by Wilschut (1974) on the North Eumeralla-1 well, contained a tabular breakdown for Eumeralla-1. This report details the final interpretation of results of these samples, with some consideration of the Wilschut report.

Palynomorph occurrence data are shown as Appendix I and form the basis for the assignment of the samples to eight spore-pollen units of late Neocomian to late Albian 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. As discussed in Morgan (1986) (Appendix to the Connard report), I have found the Dettmann and Douglas (1976) subdivision unworkable in some respects. The zonation used herein is that of Helby et al (1987) as discussed by Morgan (1986). The C. hughesi Zone of Dettmann and Douglas (1976) is therefore not the same as that herein.

AGE			SPORE - POLLEN ZONES	DINOFLAGELLATE ZONES
Early Tertiary	Early Oligocene		P. tuberculatus	
	Late Eocene		upper N. asperus	P. comatum
			middle N. asperus	V. extensa
	Middle Eocene		lower N. asperus	D. heterophlycta W. echinosuturata
			P. asperopolus	W. edwardsii W. thompsonae
	Early Eocene		upper M. diversus	W. ornata W. waipawaensis
			middle M. diversus	
			lower M. diversus	W. hyperacantha
	Paleocene		upper L. balmei	A. homomorpha
			lower L. balmei	E. crassitabulata T. evittii
Late Cretaceous	Maastrichtian		T. longus	M. druggii
	Campanian		T. lillei	I. korojonense
			N. senectus	X. australis
	Santonian		T. pachyexinus	N. aceras I. cretaceum O. porifera
	Coniacian		C. triplex	
	Turonian			C. striatoconus
	Cenomanian		A. distocarinatus	P. infusorioides
Early Cretaceous	Albian	Late	P. pannosus	
		Middle	upper C. paradoxa	
			lower C. paradoxa	
		Early	C. striatus	
	Aptian		upper C. hughesi	
			lower C. hughesi	
	Barremian		F. wonthaggiensis	
	Hauterivian			
	Valanginian		upper C. australiensis	
	Berriasian		lower C. australiensis	
Juras.	Tithonian		R. watherooensis	

FIGURE 1 ZONATION FRAMEWORK

III PALYNOSTRATIGRAPHY

A. 3311-21 ft. (CORE) : P. pannosus Zone

Assignment to the Phimopollenites pannosus Zone is clearly indicated at the top by the absence of younger indicators, and at the base by oldest P. pannosus, coincident with oldest Cupuliferoidaepollenites parvulus and Phimopollenites augathallaensis. Common Stereisporites antiquaspores and Cicatricosisporites australiensis are consistent with an Albian age. Minor Triassic reworking was also seen.

This assignment is the same as Wilschut (1974).

Non-marine environments are indicated by the frequent and diverse spores and pollen, and the absence of saline indicators. Some lacustrine component is suggested by rare specimens of the algal acritarch Schizosporis psilatus.

These features are usually seen in the topmost Eumeralla Formation. In some wells, this has a spiky log response with associated coaly horizons, but may also have a very flat response.

B. 3800-4814 ft. (CORE) : upper C. paradoxa Zone

Assignment to the upper Coptospora paradoxa Zone is indicated at the top by the lack of younger indicators, and at the base by oldest Perotriletes majus (supported by oldest Pilosisporites grandis in core at 4285-4300 ft.). Cicatricosisporites spp. and Cyathidites spp. are frequent, and the ornate spores Trilobosporites tribotrys and T. trioreticulatus are prominent in this interval. Minor Permian reworking was seen at the base of the interval.

This assignment is consistent with that of Wilschut (1974).

Non-marine environments are indicated by the common and diverse spores and pollen, but a single spinose acritarch at 4796-4814 ft. (CORE) indicates a slight brackish influence. Lacustrine algal indicators are extremely rare and present only at the top.

These features are normally seen in the upper part of the Eumeralla Formation, associated with a very flat sonic and SP log response.

C. 5297-5309 ft. : C. paradoxa Zone, subzone unknown

Fossil yield from this sample was very poor, with plant leaf cuticle fragments and inertinite the major components of the residue. Only a very small assemblage was therefore available. Oxidation during deposition was probably responsible. Amongst the recorded species were Coptospora paradoxa, clearly indicating the Zone. Subzone markers were not seen, however. Obvious reworking included Permian and Triassic taxa, and the Aptian species Cyclosporites hughesi.

Wilschut (1974) assigned this interval to the upper C. paradoxa Zone, but I cannot find evidence to support this.

Spores and pollen were the dominant palynomorph types, but rare spiny acritarchs (Micrhystridium spp.) also occur, and indicate minor brackish influence. Poor overall yields suggest high sedimentological maturity.

The *C. paradoxa* Zone usually embraces the upper Eumeralla Formation.

D. 5560 (cutts)-5816 ft (CORE) : lower *C. paradoxa* Zone

Yields are only moderate in these samples, but assignment to the lower *Coptospora paradoxa* Zone is shown at the top by youngest *Pilosisporites parvispinosus* (supported by youngest *P. notensis* at 5799 ft.) and at the base by oldest *Trilobosporites trioreticulatus* (confirmed by oldest *C. paradoxa* at 5560-70 ft.). *Cyathidites* spp. and *Cicatricosisporites* spp. are frequent. Minor Triassic reworking is seen at 5560-70 ft., and the Aptian spore *Cyclosporites hughesi* is seen at 5799-5816 ft. (CORE) and presumed reworked.

Wilschut (1974) assigned this interval to the upper *C. paradoxa* Zone, but from this and other wells it seems clear that he used different criterea.

Non-marine environments are indicated by the absence of saline indicators and dominance of spores and pollen. Poor palynomorph yields and high inertinite content suggest relative sedimentological maturity, or coaly facies.

E. 6034 (CORE)-6720 ft. (CORE) : *C. striatus* Zone

Yields in the upper two samples (6034-54 ft. and 6242-52 ft., both core) are poor, with inertinite dominant. However, the lack of younger indicators suggests the assignment. At the interval base, oldest *Crybelosporites striatus* and the absence of older taxa, indicate the assignment. *Cyathidites* and *Falcisporites* tend to be dominant, with *Cicatricosisporites* relatively rare. *Pilosisporites* spp. become consistent towards the base, and the cuttings sample (6490-6500 ft.) shows clear caving of taxa such as C. paradoxa and P. grandis. Minor Triassic reworking was seen only at 6034-54 ft.

Wilschut (1974) also assigned this interval to the C. striatus Zone.

Non-marine environments are indicated by the total absence of acritarchs, and the dominance of fairly to very diverse spores and pollen.

These features are normally seen associated with the mid Eumeralla Formation, which often has a spiky sonic response, and sometimes includes coals.

F. 7225-8465 ft. (CORES) : upper C. hughesi Zone

Assignment is clearly indicated at the top by yongest consistent Cyclosporites hughesi in the absence of C. striatus. At the base, oldest Pilosisporites notensis without the older indicator youngest Cooksonites variabilis, indicates the lower limit. Within the interval, Cyathidites are consistently common. Inertinite is fairly common throughout, with cuticle and tracheid more common below 8143-56 ft. Pre-Cretaceous reworking was not seen.

Wilschut (1974) assigned this interval to the F. asymmetricus and partly to the R. reticulatus Subzone of Dettmann's C. hughesi Zone. I cannot support these assignments as I have recorded F. asymmetricus in place down to 9385 ft. (CORE)(compared to 7717 ft. by Wilschut 1974). However, assignment to the general C. hughesi Zone is consistent. I cannot use Dettmann's subzones with any confidence, as I consistently record different relative ranges, or find her key species too rarely.

Most of these samples contain dominant and diverse spores and pollen indicating non-marine environments with generally minor lacustrine influence (extremely rare Schizosporis). However, the core at 7697-7712 ft. contains a spiny acritarch indicating minor brackish influence.

These features are normally seen towards the base of the Eumeralla Formation, where log responses are less spiky than above and below.

G. 8914-9385 ft. (CORES) : lower C. hughesi Zone

Assignment is clearly indicated at the top by youngest Cooksonites variabilis and at the base by oldest Pilosisporites notensis in core. Foraminisporis asymmetricus occurs to the interval base in place, but a single specimen was also seen at 9767-74 ft. If in place, the base of the C. hughesi Zone might be that low. However, its spore colour suggests that it is contaminated, and it is ignored. The kerogen contains common inertinite and leaf fragments, and the spores Cyathidites spp. and Osmundacidites wellmannii are common. Perotriletes linearis has its top range at the interval top. Minor Triassic reworking was seen at 9373-85 ft. only.

Wilschut (1974) assigned this interval to the R. reticulatus Subzone of Dettmann's C. hughesi Zone. I cannot concur as I see F. asymmetricus throughout the interval.

Non-marine environments are indicated by the absence of microplankton, and the common and diverse spores and pollen.

These features are normally seen at the base of the Eumeralla Formation, (which often has a very spiky sonic response, and includes coals) and its correlatives (which may include clean sands).

H. 9767-10305 ft. (CORES) : F. wonthaggiensis Zone

Assignment to the Foraminisporis wonthaggiensis Zone is indicated at the top by the absence of younger indicators in place, and confirmed at 9881-90 ft. (CORE) by youngest Microfasta evansii. At the base, oldest F. wonthaggiensis and Dictyotosporites speciosus indicate the assignment. Cyathidites spp. are the most common, with O. wellmannii and F. similis very frequent. Permian and Triassic reworking are intermittent in the interval. Cuttings samples in this interval show minor caving, as shown by spore colour.

Wilschut (1974) assigned this interval to the R. reticulatus and M. florida Subzones of Dettmann's C. hughesi Zone. I cannot concur as I logged neither key species from these samples.

Non-marine environments are suggested by the absence of spiny microplankton and the dominance and diversity of spores and pollen. Minor lacustrine influence is suggested at 9881-90 ft. by the presence of the probably algal acritarch M. evansii and by a possible specimen of the dinoflagellate Batiacasphaera macrogranulata.

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

IV CONCLUSIONS

A. The section appears to be complete and fairly normal. No whole zones or subzones are missing. At the base there is potential for more Cretaceous section, as the C. australiensis Zone has apparently not been drilled.

B. Confidence in zonal assignments is generally fair to good. Confidence in spore-pollen zones in a non-marine basin can never be as good as in marine Mesozoic section. The best picks are top pannosus, top upper paradoxa and top upper hughesi. Top wonthaggiensis is fairly well based, although it might be one sample lower (in the gap 9774-9881 ft.). The weakest boundaries are top lower paradoxa, top striatus and top low hughesi, due to scarcity of index species and poor yields in some samples. The first and last are likely to be picked too low, while top striatus may be slightly too high.

C. Top wonthaggiensis is usually at, or slightly below, the major "top Pretty Hill unconformity". In this well, the palynology suggests that this is in the sample gap 9385 to 9774 ft. The sudden downhole increase in sonic response near 9480 ft. is a likely candidate, and suggest that the sand up to 9110 ft. (of C. hughesi Zone age) may be above the major unconformity. Intra-Eumeralla log responses against the palynology appear to fit the regional model fairly well, with spiky sonic response in the early Aptian (8200-9110 ft.) and early Albian (6600-6800 ft. at least).

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APPENDIX I

COMPOSITE PALYNOMORPH RANGE DATA

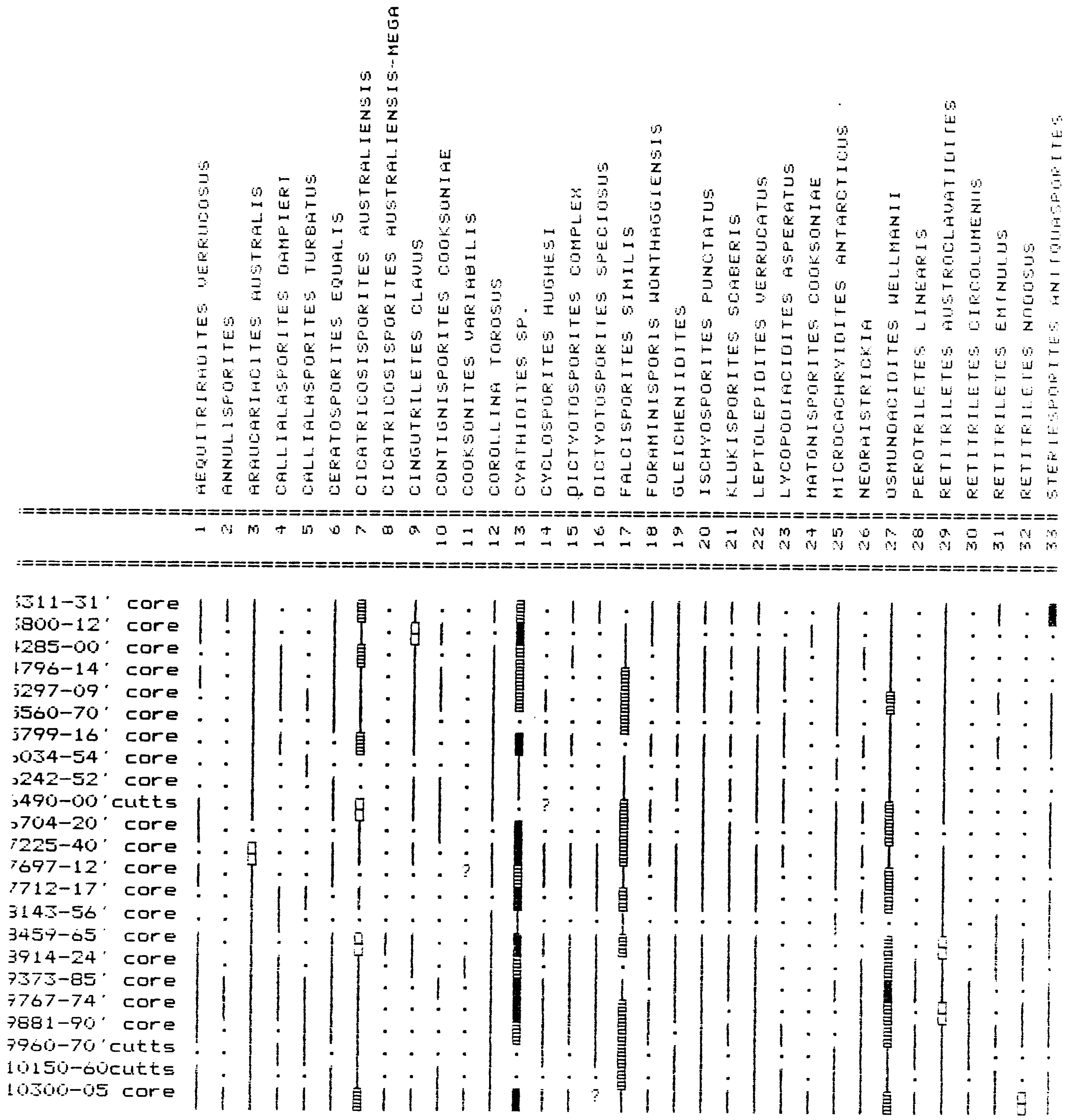
EUMERALLA #1 COMPOSITE PALYNOLOGICAL DATA

RANGE CHART OF GRAPHIC ABUNDANCES BY LOWEST APPEARANCE

Key to Symbols

= Very Rare
= Rare
= Few
= Common
= Abundant

? = Questionably Present
. = Not Present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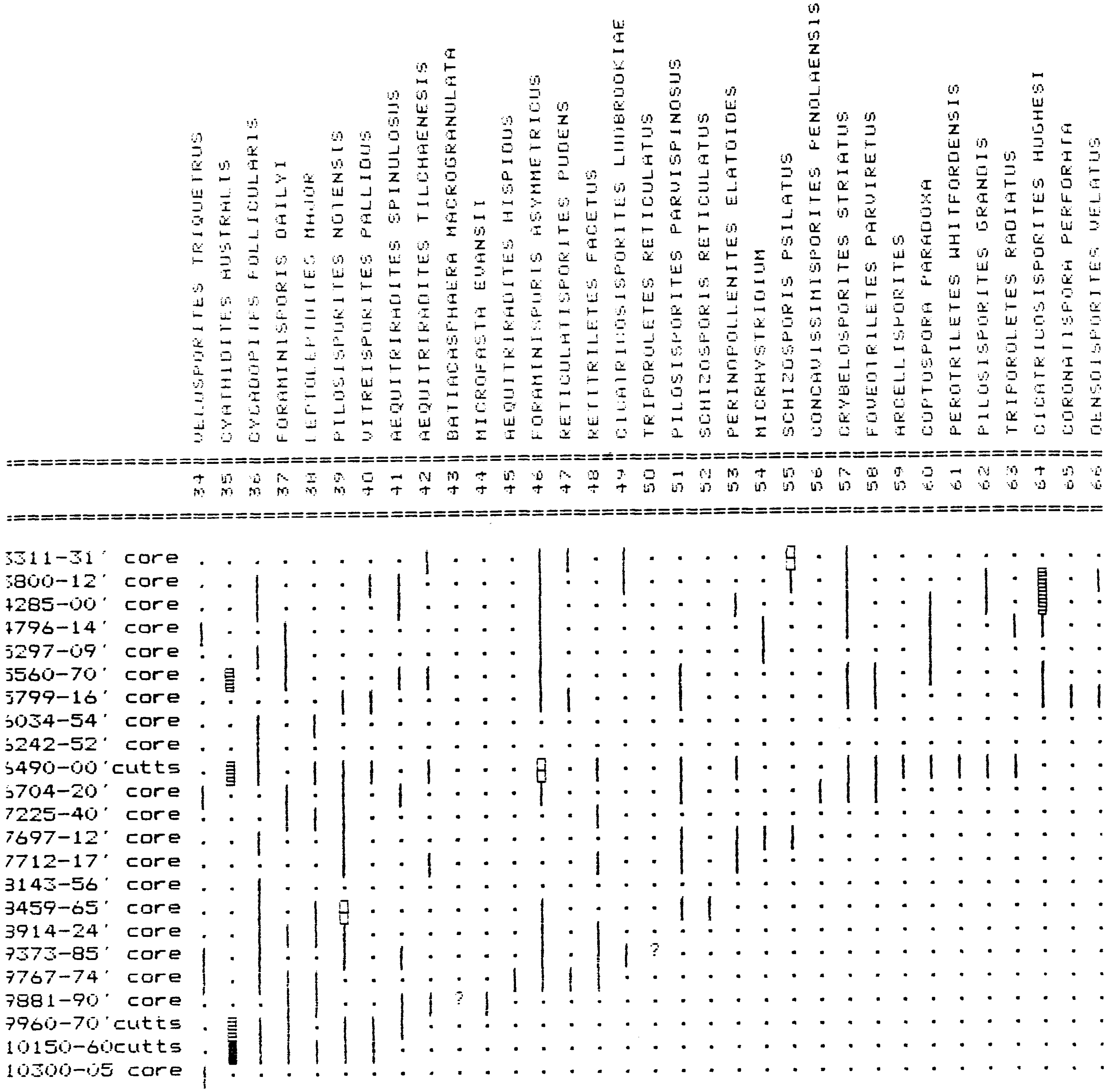
2 ANNULISPORITES
3 ARAUCARIACITES AUSTRALIS
4 CALLIALASPORITES DAMPIERI
5 CALLIALASPORITES TURBATUS
6 CERATOSPORITES EQUALIS
7 CICATRICOSISPORITES AUSTRALIENSIS
8 CICATRICOSISPORITES AUSTRALIENSIS-MEGA
9 CINGUTRILETES CLAVUS
10 CONTIGNISPORITES COOKSONIAE
11 COOKSONITES VARIABILIS
12 COROLLINA TOROSUS
13 CYATHIDITES SP.
14 CYCLOSPORITES HUGHESI
15 DICTYOTOSPORITES COMPLEX
16 DICTYOTOSPORITES SPECIOSUS
17 FALCISPORITES SIMILIS
18 FORAMINISPORIS WONTHAGGIENSIS
19 GLEICHENIIDITES
20 ISCHYOSPORITES PUNCTATUS
21 KLUKISPORITES SCABERIS
22 LEPTOLEPIDITES VERRUCATUS
23 LYCOPODIACIDITES ASPERATUS
24 MATONISPORITES COOKSONIAE
25 MICROCACHRYIDITES ANTARCTICUS
26 NEORAISTRICKIA
27 OSMUNDACIDITES WELLMANII
28 PEROTRILETES LINEARIS
29 RETITRILETES AUSTROCLAVATIDITES
30 RETITRILETES CIRCOLUMENUS
31 RETITRILETES EMINULUS
32 RETITRILETES NODOSUS
33 STERIESPORITES ANTIQUASPORITES
5311-31' core
5800-12' core
4285-00' core
4796-14' core
5297-09' core
5560-70' core
5799-16' core
6034-54' core
6242-52' core
6490-00'cutts
6704-20' core
7225-40' core
7697-12' core
7712-17' core
8143-56' core
8459-65' core
8914-24' core
9373-85' core
9767-74' core
9881-90' core
9960-70'cutts
10150-60cutts
10300-05 core
?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36 CYCADOPITES FOLLICULARIS
37 FORAMINISPORIS DAILYI
38 LEPTOLEPIDITES MAJOR
39 PILOSISPORITES NOTENSIS
40 VITREISPORITES PALLIDUS
41 AEQUITRIRADITES SPINULOSUS
42 AEQUITRIRADITES TILCHAENSIS
43 BATIACASPHAERA MACROGRANULATA
44 MICROFASTA EVANSII
45 AEQUITRIRADITES HISPIDUS
46 FORAMINISPORIS ASYMMETRICUS
47 RETICULATISPORITES PUDENS
48 RETITRILETES FACETUS
49 CICATRICOSISPORITES LUDBROOKIAE
50 TRIPOROLETES RETICULATUS
51 PILOSISPORITES PARVISPINOSUS
52 SCHIZOSPORIS RETICULATUS
53 PERINOPOLLENITES ELATOIDES
54 MICRHYSTRIDIUM
55 SCHIZOSPORIS PSILATUS
56 CONCAVISSIMISPORITES PENOLAENSIS
57 CRYBELOSPORITES STRIATUS
58 FOVEOTRILETES PARVIRETUS
59 ARCELLISPORITES
60 COPTOSPORA PARADOXA
61 PEROTRILETES WHITFORDENSIS
62 PILOSISPORITES GRANDIS
63 TRIPOROLETES RADIATUS
64 CICATRICOSISPORITES HUGHESI
65 CORONATISPORA PERFORATA
66 DENSOISPORITES VELATUS
3311-31' core
3800-12' core
4285-00' core
4796-14' core
5297-09' core
5560-70' core
5799-16' core
6034-54' core
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8914-24' core
9373-85' core
9767-74' core
9881-90' core
9960-70'cutts
10150-60cutts
10300-05 core

Sample	67 TRILOBOSPORITES TRIORETICULOSUS	68 BALMEISPORITES HOLODICTYUS	69 DICTYOPHYLLIDITES	70 TRIPOROLETES SIMPLEX	71 PEROTRILETES MAJUS	72 TRILOBOSPORITES TRIBOTRYS	73 CUPULIFEROIDAEPOLLENITES PARVULUS	74 EPHEDRIPITES	75 PHIMOPOLLENITES AUGATHALLAENSIS	76 PHIMOPOLLENITES PANNOSUS	Sample
3311-31′ core	.	.	.	.	|	.	|	|	|	|	3311-31′ core
3800-12′ core	|	.	.	|	|	|	.	.	.	.	3800-12′ core
4285-00′ core	|	.	.	.	|	.	.	.	.	.	4285-00′ core
4796-14′ core	.	.	.	|	|	.	.	.	.	.	4796-14′ core
5297-09′ core	.	.	.	|	.	.	.	.	.	.	5297-09′ core
5560-70′ core	.	|	|	|	.	.	.	.	.	.	5560-70′ core
5799-16′ core	|	.	.	.	.	.	.	.	.	.	5799-16′ core
6034-54′ core	.	.	.	.	.	.	.	.	.	.	6034-54′ core
6242-52′ core	.	.	.	.	.	.	.	.	.	.	6242-52′ core
6490-00′cutts	.	.	.	.	.	.	.	.	.	.	6490-00′cutts
6704-20′ core	.	.	.	.	.	.	.	.	.	.	6704-20′ core
7225-40′ core	.	.	.	.	.	.	.	.	.	.	7225-40′ core
7697-12′ core	.	.	.	.	.	.	.	.	.	.	7697-12′ core
7712-17′ core	.	.	.	.	.	.	.	.	.	.	7712-17′ core
8143-56′ core	.	.	.	.	.	.	.	.	.	.	8143-56′ core
8459-65′ core	.	.	.	.	.	.	.	.	.	.	8459-65′ core
8914-24′ core	.	.	.	.	.	.	.	.	.	.	8914-24′ core
9373-85′ core	.	.	.	.	.	.	.	.	.	.	9373-85′ core
9767-74′ core	.	.	.	.	.	.	.	.	.	.	9767-74′ core
9881-90′ core	.	.	.	.	.	.	.	.	.	.	9881-90′ core
9960-70′cutts	.	.	.	.	.	.	.	.	.	.	9960-70′cutts
10150-60cutts	.	.	.	.	.	.	.	.	.	.	10150-60cutts
10300-05 core	.	.	.	.	.	.	.	.	.	.	10300-05 core

SPECIES LOCATION INDEX

Index numbers are the columns in which species appear.

INDEX NUMBER	SPECIES
45	AEQUITRIRADITES HISPIDUS
41	AEQUITRIRADITES SPINULOSUS
42	AEQUITRIRADITES TILCHAENESIS
1	AEQUITRIRADITES VERRUCOSUS
2	ANNULISPORITES
3	ARAUCARIACITES AUSTRALIS
59	ARCELLISPORITES
68	BALMEISPORITES HOLODICTYUS
43	BATIACASPHAERA MACROGRANULATA
4	CALLIALASPORITES DAMPIERI
5	CALLIALASPORITES TURBATUS
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11	COOKSONITES VARIABILIS
60	COPTOSPORA PARADOXA
12	COROLLINA TOROSUS
65	CORONATISPORA PERFORATA
57	CRYBELOSPORITES STRIATUS
73	CUPULIFEROIDAEPOLLENITES PARVULUS
35	CYATHIDITES AUSTRALIS
13	CYATHIDITES SP.
36	CYCADOPITES FOLLICULARIS
14	CYCLOSPORITES HUGHESI
66	DENSOISPORITES VELATUS
69	DICTYOPHYLLIDITES
15	DICTYOTOSPORITES COMPLEX
16	DICTYOTOSPORITES SPECIOSUS
74	EPHEDRIPITES
17	FALCISPORITES SIMILIS
46	FORAMINISPORIS ASYMMETRICUS
37	FORAMINISPORIS DAILYI
18	FORAMINISPORIS WONTHAGGIENSIS
58	FOVEOTRILETES PARVIRETUS
19	GLEICHENIIDITES
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22	LEPTOLEPIDITES VERRUCATUS
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24	MATONISPORITES COOKSONIAE
54	MICRHYSTRIDIUM
25	MICROCACHRYIDITES ANTARCTICUS
44	MICROFASTA EVANSII
26	NEORAISTRICKIA
27	OSMUNDACIDITES WELLMANII
53	PERINOPOLLENITES ELATOIDES
28	PEROTRILETES LINEARIS
71	PEROTRILETES MAJUS
61	PEROTRILETES WHITFORDENSIS
75	PHIMOPOLLENITES AUGATHALLAENSIS
76	PHIMOPOLLENITES PANNOSUS
[illegible]	[illegible]

28	PEROTRILETES LINEARIS
71	PEROTRILETES MAJUS
61	PEROTRILETES WHITFORDENSIS
75	PHIMOPOLLENITES AUGATHALLAENSIS
76	PHIMOPOLLENITES PANNOSUS
62	PILOSISPORITES GRANDIS
39	PILOSISPORITES NOTENSIS
51	PILOSISPORITES PARVISPINOSUS
47	RETICULATISPORITES PUDENS
29	RETITRILETES AUSTROCLAVATIDITES
30	RETITRILETES CIRCOLUMENUS
31	RETITRILETES EMINULUS
48	RETITRILETES FACETUS
32	RETITRILETES NODOSUS
55	SCHIZOSPORIS PSILATUS
52	SCHIZOSPORIS RETICULATUS
33	STERIESPORITES ANTIQUASPORITES
72	TRILOBOSPORITES TRIBOTRYS
67	TRILOBOSPORITES TRIORETICULOSUS
63	TRIPOROLETES RADIATUS
50	TRIPOROLETES RETICULATUS
70	TRIPOROLETES SIMPLEX
34	VELOSPORITES TRIQUETRUS
40	VITREISPORITES PALLIDUS