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PALYNOLOGY OF VICTORIAN GEOLOGICAL SURVEY

WARRACBARUNAH-2, OTWAY BASIN, VICTORIA

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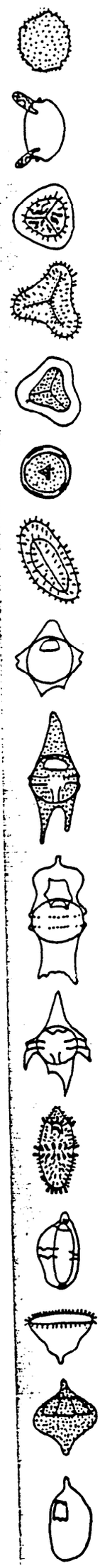
REF: DW.OTW.WARRACBA

FOR VICTORIAN GEOLOGICAL SURVEY

OCTOBER, 1991.



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CONTENTS

I SUMMARY

The studied sample set yielded the following breakdown

438m (cutts) : lower P. tuberculatus zone : Early Oligocene nearshore marine : immature for hydrocarbons

489.4m (CORE) : middle N. asperus zone : Late Eocene : marginally marine : immature

552m (cutts) : upper L. balmei zone : late Paleocene : apparently non-marine : immature

583.6m (CORE) indeterminate

743.4m (CORE) - 864m (cutts) : C. hughesi zone : Aptian : non-marine : usually lower Eumeralla Formation including Windermere Member : immature

903m (cutts) - 1032.9m (CORE) : upper F. wonthaggiensis zone : latest Neocomian : non-marine with algal M. evansii bloom at 999m suggesting lacustrine maximum : usually upper Crayfish D-C of Kopsen and Scholefield : marginal mature for oil

1110m (cutts) - 1445.7m (CORE) : lower F. wonthaggiensis zone : late Neocomian : non-marine : marginal mature for oil

1) Top Pretty Hill unconformity therefore expected in the gap 864m to 903m.

2) Volcanics 580m - 710m, if extrusive, must be post Aptian and pre late Paleocene and therefore possible correlatives of the Pentland Hill Volcanics in the Ballan Graben.

II INTRODUCTION:

Nineteen core and cuttings samples were processed, to provide information on age, environment and maturity.

Palynomorph occurence data are shown as Appendix I and form the basis for the assignment of the samples to six spore-pollen units of Oligocene to late Neocomian 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 Warracbarunah-2. 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%.

	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
				N. aceras
	Santonian		T. pachyexinus	I. cretaceum
				O. porifera
	Coniacian		C. triplex	
	Turonian			C. striatoconus
				P. infusorioides
	Cenomanian		A. distocarinatus	
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	
Jurassic	Tithonian		R. watherooensis	

FIGURE 1 ZONATION FRAMEWORK

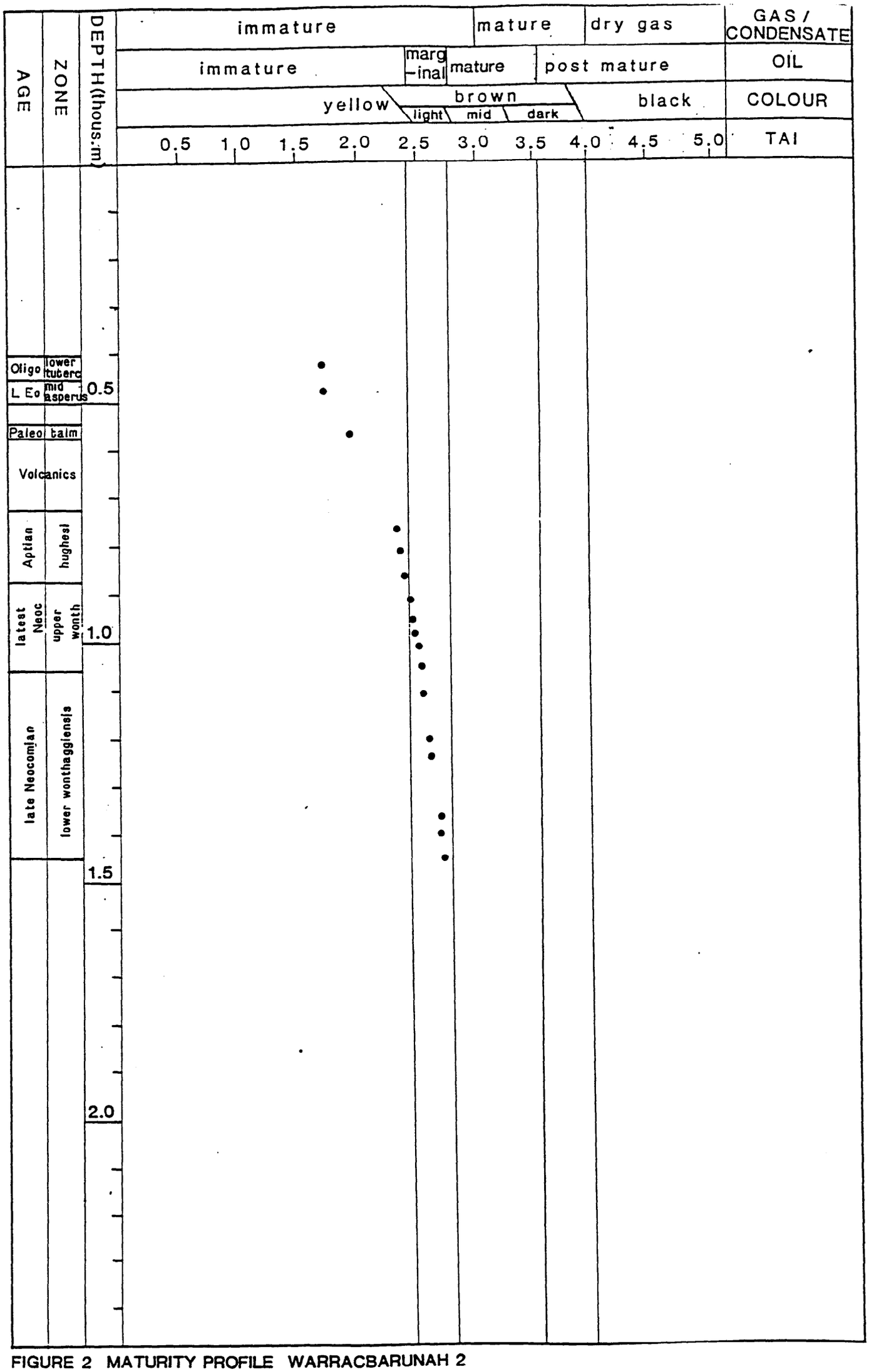

FIGURE 2 MATURITY PROFILE WARRACBARUNAH 2

III PALYNOSTRATIGRAPHY

A 438m (cutts) : lower P. tuberculatus zone

Assignment to the lower subzone ofthe Proteacidites tuberculatus zone is indicated at the top on youngest Beaupreadites verrucosus, Periporopollenites vesicus and Nothofagidites flemingii, and at the base on oldest Cyatheacidites annulatus. Nothofagidites spp. dominate the assemblage and comprise 60% of palynomorphs, with Haloragacidites harrisii, and Cyathidites frequent. Proteacidites rectomarginus and Nothofagidites asperus are rare. The rare dinoflagellates are not age distinctive, but include common Operculodinium spp.

Very nearshore marine environments are suggested by the total dominance of the spores and pollen and the rare low diversity dinoflagellates.

Colourless palynomorphs indicate immaturity for hydrocarbon generation.

B 489.4m (CORE) : middle N. asperus zone

Assignment to the middle subzone of the Nothofagidites asperus zone is indicated by Proteacidites reticulatus and Triorites magnificus, both of which are confined to the subzone. Nothofagidites spp. again dominate with 70% of the assemblage. Minor Cretaceous reworking includes Coptospora paradoxa and Cicatricosisporites australiensis. The very lean dinoflagellate asssemblage is not zone distinctive, but the presence of Deflandrea phosphoritica is consistent with the spore-pollen zonal assignment.

Very nearshore marine environments are indicated by the dominance of spore-pollen and the rare low diversity dinoflagellates. Frequent Paralecaniella indentata suggests lacustrine influence.

Colourless palynomorphs indicate immaturity for hydrocarbon generation.

C 552m (cutts) : upper L. balmei zone

This rich sample is assigned to the upper Lygistepollenites balmei zone at the top on youngest Gambierina rudata and G. edwardsii and at the base on oldest Proteacidites grandis and the absence of other indicators. Clavifera triplex is common, with frequent Australopollis obscurus, Nothofagidites brachyspinulosus and Periporopollenites polyoratus. Dinoflagellates are absent.

Non-marine environments are indicated by the dominance of diverse spores and pollen and total absence of dinoflagellates.

Yellow spore colours indicate immaturity for hydrocarbon generation.

D 583.6m (CORE) : indeterminate

This sample is extremely lean and contains only trace quantities of longranging taxa of late Cretaceous to Tertiary age including C. triplex, Phyllocladidites mawsonii and Nothofagidites emarcidus. These are considered most likely mud contamination given the volcanic lithologies.

E 743.4m (CORE) - 864 (cutts) : C. hughesi zone

This group of four samples is assigned to the Cyclosporites hughesi spore pollen zone at the top on youngest C. hughesi without younger indicators, and at the base on oldest Pilosisporites notensis. Dictyotosporites speciosus and Cicatricosisporites australiensis occur consistently with the latter very rare beneath the interval. Common species include Cyathidites minor, Falcisporites similis and Stercieporites antiquasporites. Cooksonites variabilis occurs at 864m (cutts) only.

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

Yellow to light brown spore colours indicate immaturity for hydrocarbon generation.

These features are normally seen in the lower Eumeralla Formation and correlatives of Kopsen and Scholefield (1989).

F 903m (cutts) - 1032.9m (CORE) : upper F. wonthaggiensis zone

Assignment to the upper part of the Foraminisporis wonthaggiensis zone is indicated at the top by the absence of younger indicators and the downhole influx of Contignisporites cooksoniae, and at the base by oldest C. australiensis, F. wonthaggiensis and Triporoletes reticulatus. Common forms are Cyathidites spp, Osmundacidites spp and Falcisporites similis.

Non-marine mostly fluvial environments are indicated by common and diverse spores and pollen and virtual absence

of acritarchs of any kind down to 960.9m. Microfasta evansii occurs at 999m (cutts) only as 2% of palynomorphs and represents a lacustrine maximum.

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

These features are normally seen in the upper part of the Crayfish Formation (D-C members of Kopsen and Scholfield) and correlatives.

G 1110m (cutts) - 1445.7m (CORE) : lower F. wonthaggiensis zone

Assignment to the lower subzone is indicated at the top by the absence of younger indicators and at the base by oldest D. speciosus. C. hughesi also occurs to the interval base. Common taxa include Cyathidites spp and O. wellmanii with F. similis intermittently frequent.

Non-marine environments are indicated throughout by common and diverse spores and pollen and the absence of saline indicators. Some lacustrine influence is suggested in most samples however by the rare presence of algal acritarchs (Schizospiris spp).

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

These features are normally seen in the mid Crayfish Formation B-C units of Kopsen and Scholefield.

IV CONCLUSIONS

A At the base of the well, an apparently conformable Otway Basin Early Cretaceous sequence occurs, spanning the lower wonthaggiensis to hughesi zones (equivalent to the mid Crayfish to lower Eumeralla Formations. Within this interval, the basal Eumeralla unconformity is most likely to lie in the sample gap 864m to 903m. The sequence is therefore strongly truncated at the top with all of the Albian missing.

B Above this truncated Eumeralla Formation, a sequence of Volcanics 580m - 710m occur which are barren of palynomorphs.

C Above volcanics, a thin Paleocene interval occurs, age equivalent to the upper Pebble Point and lower Dilwyn Formation, and places a younger age limit to the Volcanics.

D Apparently unconformably above the Paleocene, Late Eocene and Early Oligocene very nearshore marine section occurs up to 438m at least. Younger section was not sampled.

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WARRACBARANAH #2

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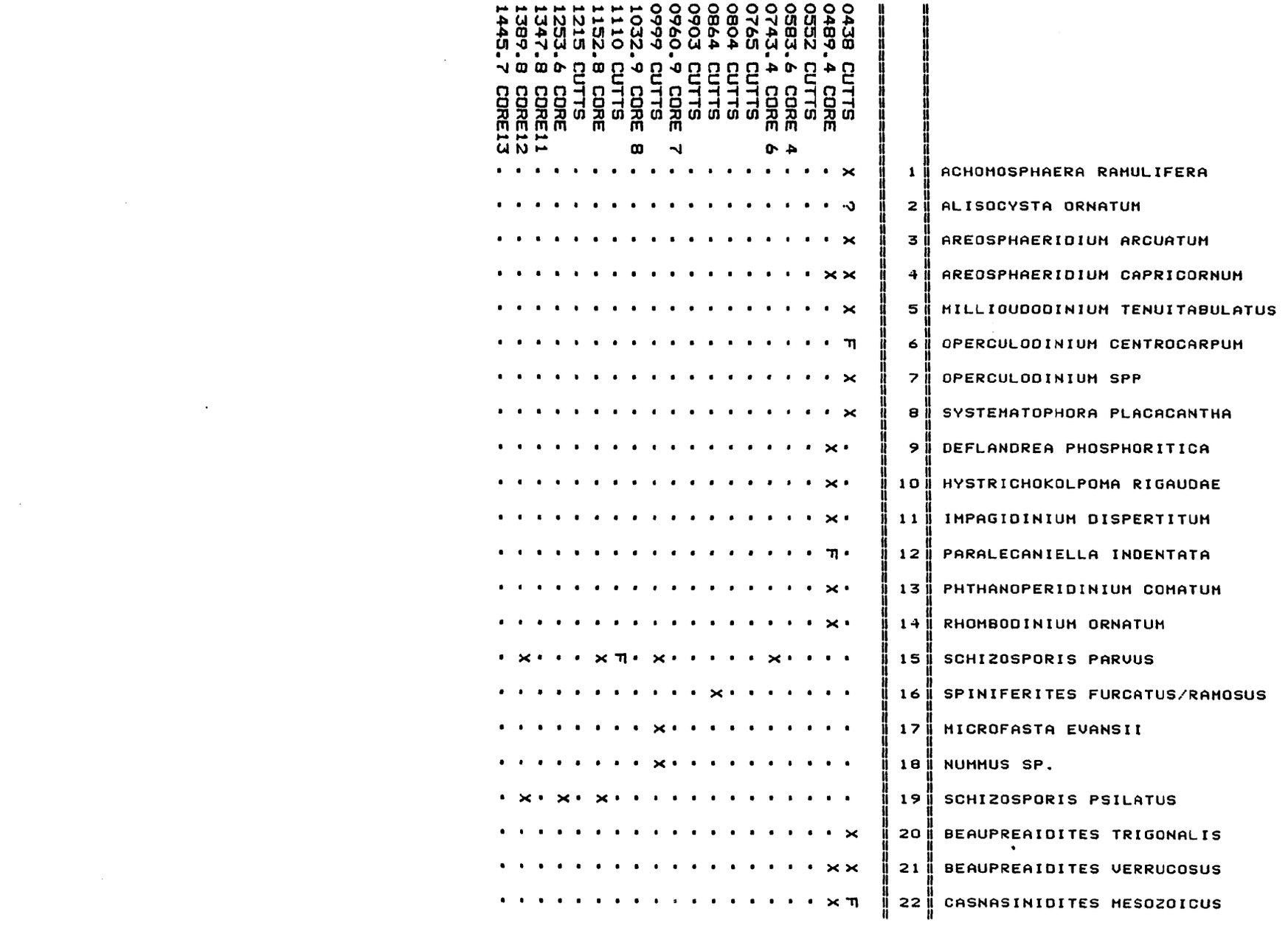
W E L L: WARRACBARUNAH #2
F I E L D / A R E A: OTWAY BASIN

A N A L Y S T: ROGER MORGAN D A T E : JULY 1991
N O T E S: ALL DEPTHS IN METRES

RANGE CHART OF OCCURRENCES BY HIGHEST APPEARANCE (by group)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1347.8 CORE11
1389.8 CORE12
1445.7 CORE13
1 ACHOMOSPHAERA RAMULIFERA
2 ALISOCYSTA ORNATUM
3 AREOSPHAERIDIUM ARCUATUM
4 AREOSPHAERIDIUM CAPRICORNUM
5 MILLIOUDODINIUM TENUITABULATUS
6 OPERCULODINIUM CENTROCARPUM
7 OPERCULODINIUM SPP
8 SYSTEMATOPHORA PLACACANTHA
9 DEFLANDREA PHOSPHORITICA
10 HYSTRICHOKOLPOMA RIGAUDAE
11 IMPAGIDINIUM DISPERTITUM
12 PARALECANIELLA INDENTATA
13 PHTHANOPERIDINIUM COMATUM
14 RHOMBODINIUM ORNATUM
15 SCHIZOSPORIS PARVUS
16 SPINIFERITES FURCATUS/RAMOSUS
17 MICROFASTA EVANSII
18 NUMMUS SP.
19 SCHIZOSPORIS PSILATUS
20 BEAUPREAIDITES TRIGONALIS
21 BEAUPREAIDITES VERRUCOSUS
22 CASNASINIDITES MESOZOICUS

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X	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	23	CORRUDINIUM SP
X	X	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	24	CUPANIEIDITES ORTHOTEICHUS
X	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	25	CYATHEACIDITES ANNULATUS
F	X	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	26	CYATHIDITES SPP
X	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	27	DACRYCARPITES AUSTRALIENSIS
X	X	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	28	EOXLADOPYXIS PENICULATA
X	X	X	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	29	GLEICHENIIDITES CIRCINIDITES
F	•	X	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	30	HALORAGACIDITES HARRISII
X	X	X	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	31	LYGISTEPOLLENITES FLORINII
X	X	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	32	MALVACIPOLLIS SUBTILIS
X	X	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	33	MYRTACEIDITES PARVUS/MESONESUS
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X	X	X	X	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	40	PHYLLOCLADIDITES MAWSONII
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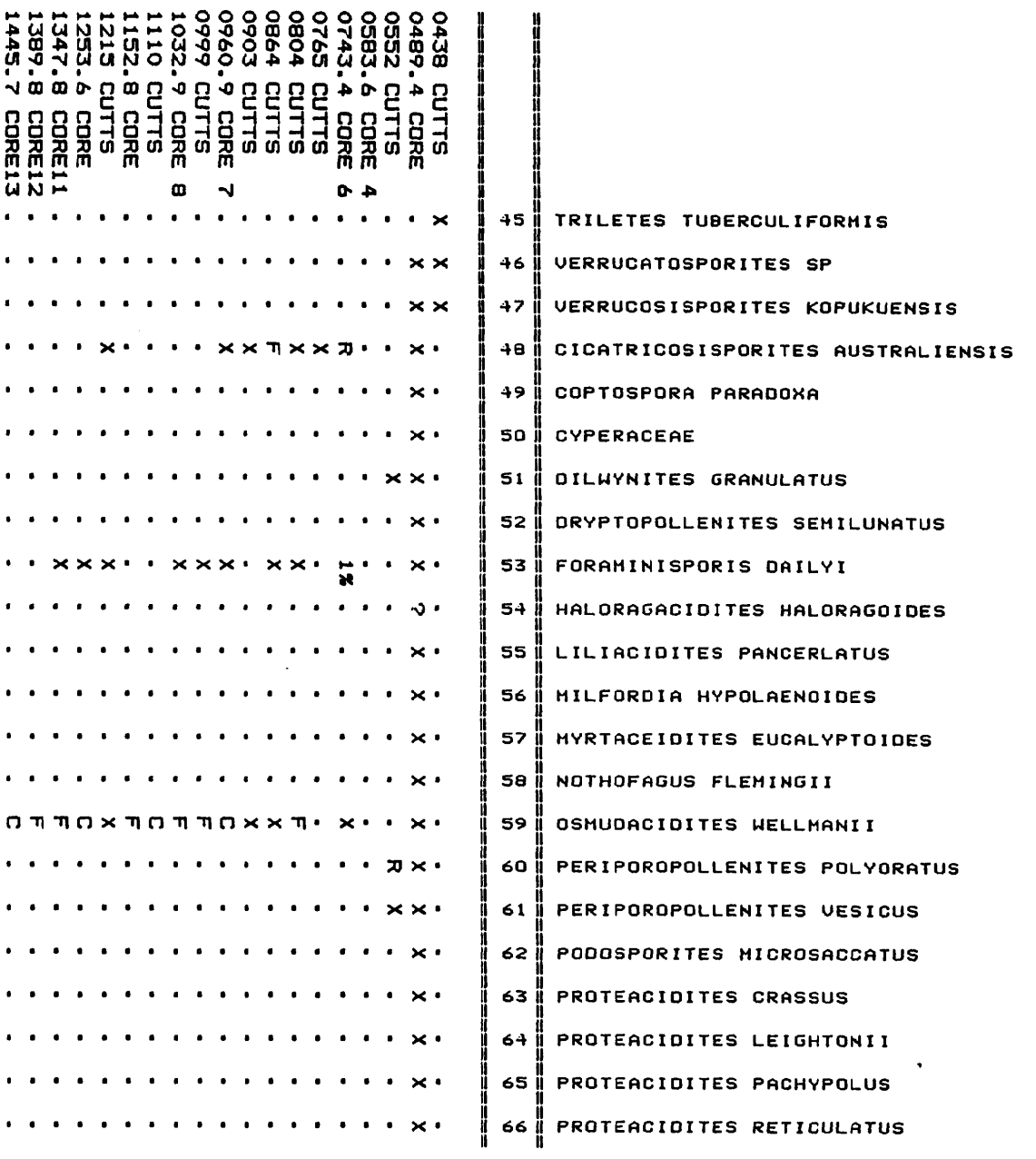
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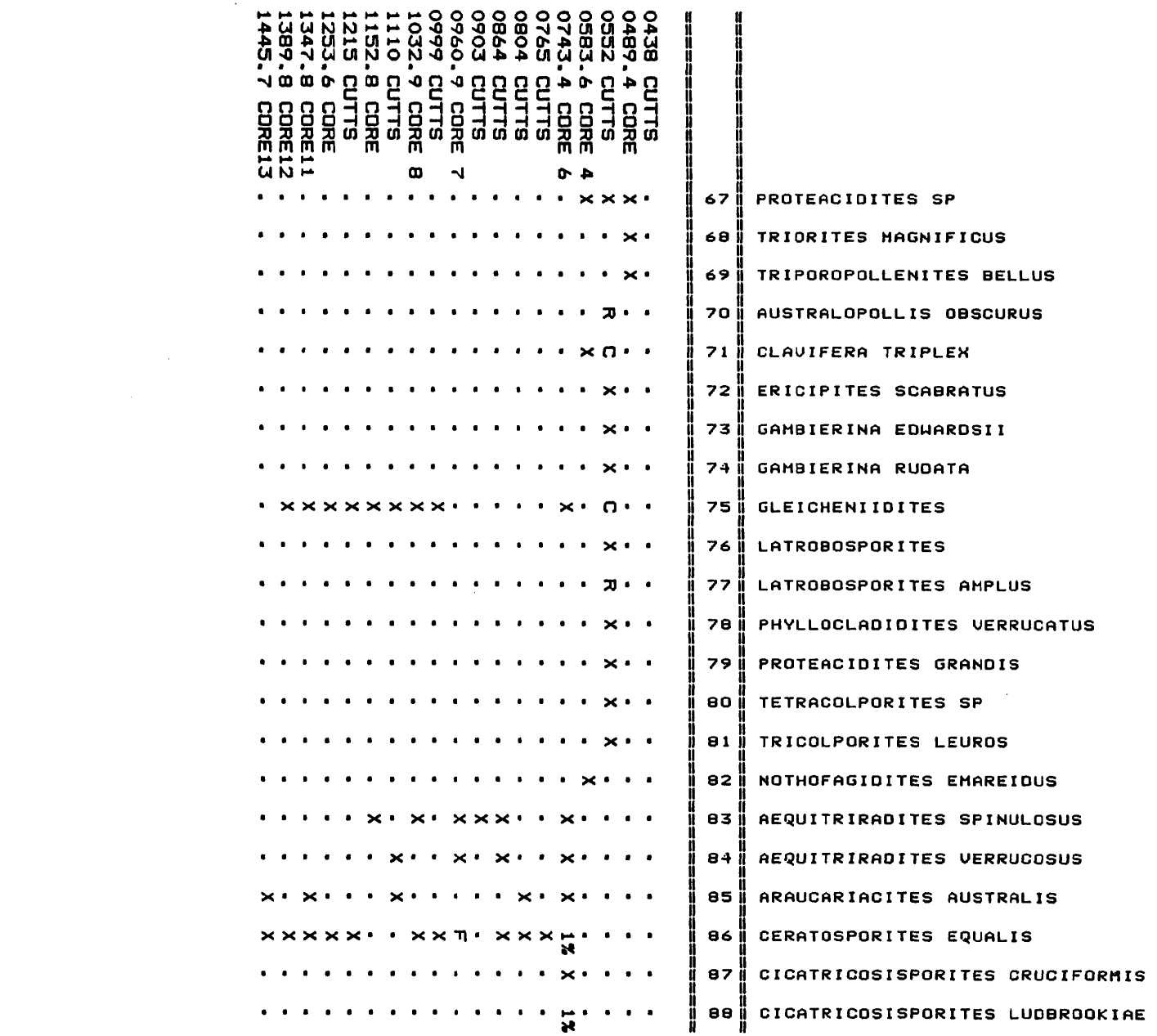
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	89 COROLLINA TOROSUS	90 CYATHIDITES ASPER	91 CYATHIDITES MINOR	92 CYCADOPITES FOLLICULARIS	93 CYCLOSPORITES HUGHESI	94 DICTYOTOSPORITES COMPLEX	95 DICTYOTOSPORITES SPECIOSUS	96 FALCISPORITES GRANDIS	97 FALCISPORITES SIMILIS	98 FORAMINISPORIS CAELATUS	99 FORAMINISPORIS RETICULATUS	100 FORAMINISPORIS RETICULOWONTHAGGIENSIS	101 FORAMINISPORITES WONTHAGGIENSIS	102 KLUKISPORITES SCABERIS	103 LEPTOLEPIDITES VERRUCATUS	104 MICROCACHRYIDITES ANTARCTICUS	105 NEORAISTRICKIA	106 PEROTRILETES WHITFORDENSIS	107 PILOSISPORITES NOTENSIS	108 RETITRILETES AUSTROCLAVATIDITES	109 RETITRILETES CIRCOLUMENUS	110 RETITRILETES FACETUS
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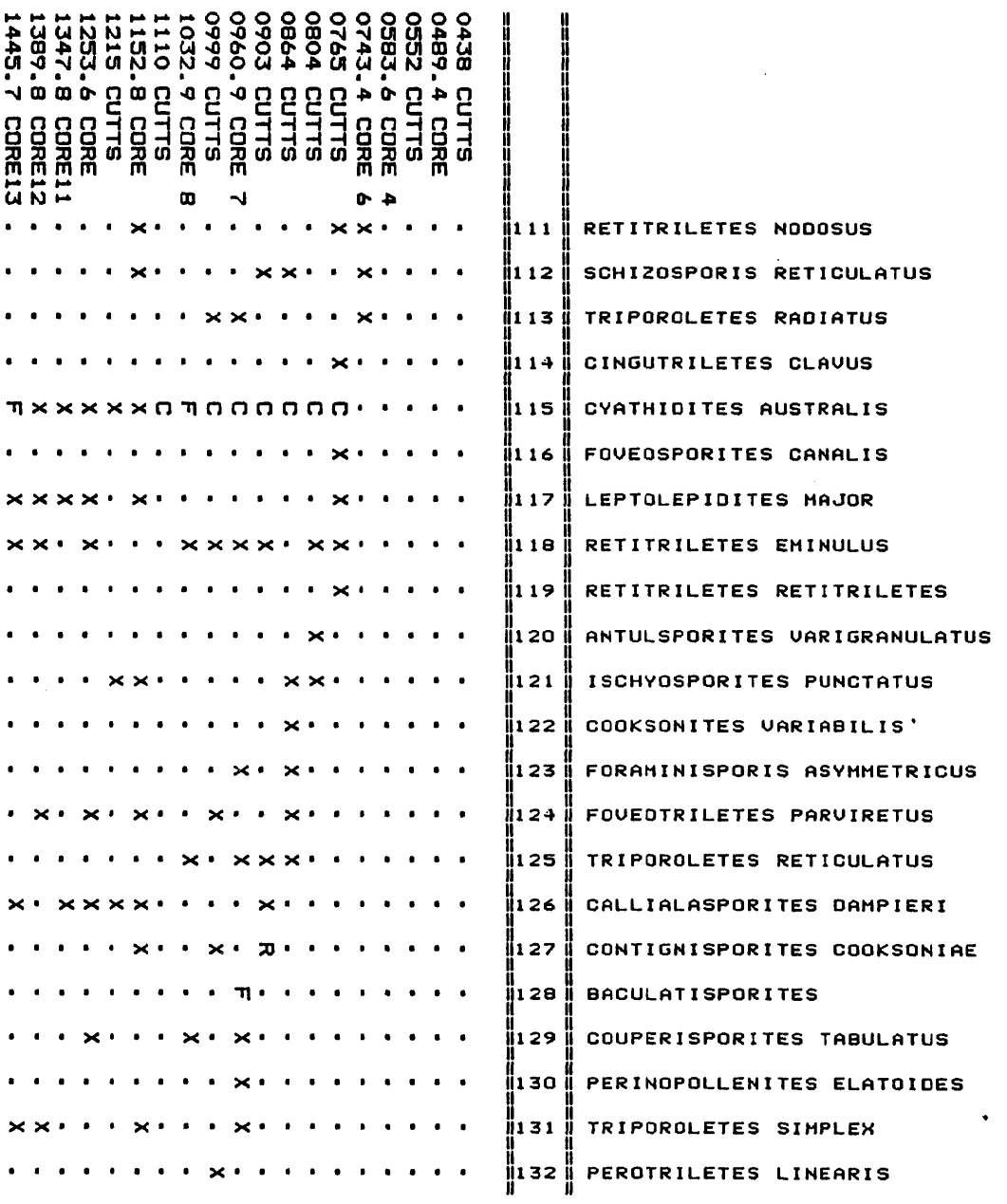
1253.6 CORE	X	.	X	.	X	.	?	X	F	.	.	.	.	.	.	X	X	.	.	X	.	X
1347.8 CORE11	X	.	F	X	.	.	.	X	F	.	.	.	.	.	X	X	.	.	.	X	.	.
1389.8 CORE12	X	.	X	X	X	.	X	X	F	.	.	.	.	.	.	X	X	.	.	F	X	.
1445.7 CORE13	X	.	F	.	.	X	X	X	X	.	.	.	.	.	X	X	.	.	.	X	X	X


0438 CUTTS
0489.4 CORE
0552 CUTTS
0583.6 CORE 4
0743.4 CORE 6
0765 CUTTS
0804 CUTTS
0864 CUTTS
0903 CUTTS
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121 ISCHYOSPORITES PUNCTATUS
122 COOKSONITES VARIABILIS'
123 FORAMINISPORIS ASYMMETRICUS
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130 PERINOPOLLENITES ELATOIDES
131 TRIPOROLETES SIMPLEX
132 PEROTRILETES LINEARIS

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0489.4 CORE	.	.	.	.	.	.	.	.	.	.	.	.	.	0489.4 CORE
0552 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	0552 CUTTS
0583.6 CORE 4	.	.	.	.	.	.	.	.	.	.	.	.	.	0583.6 CORE 4
0743.4 CORE 6	.	.	.	.	.	.	.	.	.	.	.	.	.	0743.4 CORE 6
0765 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	0765 CUTTS
0804 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	0804 CUTTS
0864 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	0864 CUTTS
0903 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	0903 CUTTS
0960.9 CORE 7	.	.	.	.	.	.	.	.	.	.	.	.	.	0960.9 CORE 7
0999 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	0999 CUTTS
1032.9 CORE 8	X	X	X	.	.	.	.	.	.	.	.	.	.	1032.9 CORE 8
1110 CUTTS	.	.	.	X	X	X	.	.	.	.	.	.	.	1110 CUTTS
1152.8 CORE	.	.	.	.	.	X	.	.	.	.	.	.	.	1152.8 CORE
1215 CUTTS	.	.	.	X	.	.	X	.	.	.	.	.	.	1215 CUTTS
1253.6 CORE	.	.	.	.	.	.	.	X	X	.	.	.	.	1253.6 CORE
1347.8 CORE11	.	.	.	.	.	X	.	.	.	.	.	.	X	1347.8 CORE11
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