PALYNOLOGY OF BEACH IONA-1, OTWAY BASIN, VICTORIA

BY

ROGER MORGAN

FOR BEACH PETROLEUM

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CONTENTS

I SUMMARY

331.0m (swc) : upper N. asperus Zone : latest Eocene to earliest Oligocene : nearshore marine : immature : usually Nirranda SubGroup

middle and lower N. asperus Zones not seen : hiatus or condensation likely

402.5m (swc) : P. asperopolus Zone : latest Early Eocene : marginal marine : immature : usually Dilwyn Formation

543.0m (swc) : upper M. diversus Zone : Early Eocene : nearshore marine : immature : usually Dilwyn Formation

middle and lower M. diversus Zones : not seen : hiatus or condensation

586.0m (swc) : upper L. balmei Zone : Paleocene : marginally marine : immature : usually Pember

602.0m (swc)-621.0m (swc) : lower L. balmei Zone : Paleocene : nearshore marine : immature : usually Pember/Pebble Point

652.0m (swc)-664.5m (swc) : upper T. longus Zone (M. druggii Dinoflagellate Zone) : Maastrichtian : marginal marine : immature : usually Timboon Sandstone

704.0m (swc) : lower T. longus Zone : mid Maastrichtian : brackish : immature : usually Paaratte Formation

772.0m (swc) : T. lillei Zone : early Maastrichtian - late Campanian : brackish : immature : usually Paaratte Formation

858.0m (swc)-1054.0m (swc) : N. senectus Zone (1018-1054 N. aceras Dinoflagellate Zone) : Campanian : nearshore marine : immature : usually Paaratte Formation/upper Belfast

1075.5m (swc)-1254.0m (swc) : T. pachyexinus Zone (1075.5m N. aceras Dinoflagellate Zone, 1240-54m I. cretaceum Dinoflagellate Zone, O. porifera Zone not seen, possibly lost by hiatus) : Santonian : offshore marine : immature : usually Belfast Mudstone

1276.5m (swc) : upper C. triplex Zone (C. striatoconus Dinoflagellate Zone) : Coniacian : nearshore marine : immature : usually Belfast/Flaxmans

1287.0m (swc)-1347.5m (swc) : lower C. triplex Zone (P. infusorioides Dinoflagellate Zone) : Turonian : very nearshore to offshore, mixed : immature : usually Flaxmans Formation

A. distocarinatus Zone : not seen : missing Cenomanian may be apparent if caving of drilling mud and its penetration into swcs is major, but more likely due to hiatus

1383.0m (swc)-1481.0m (swc) : P. pannosus Zone : late Albian : non-marine to slightly brackish : marginally mature for oil : usually Eumeralla Formation

II INTRODUCTION

Andrew Buffin of Beach Petroleum submitted 25 swc samples from Iona-1 for palynological analysis for the completion report on March 29th. Results were faxed on 12th May 1988. This report details the final interpretation of results of these samples.

Palynomorph occurrence data are shown as Appendix I and form the basis for the assignment of the samples to thirteen spore-pollen units of late Albian to earliest Oligocene 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. Very few Tertiary dinoflagellates were seen, and they are discussed within the Partridge (1976) framework, as it is more precise and more widely used. Cretaceous dinoflagellates were not seen.

Maturity data was generated in the form of Spore Colour Index, and is plotted on figure 2 Maturity profile of Beach Iona-1. The oil and gas windows on figure 2 follow the

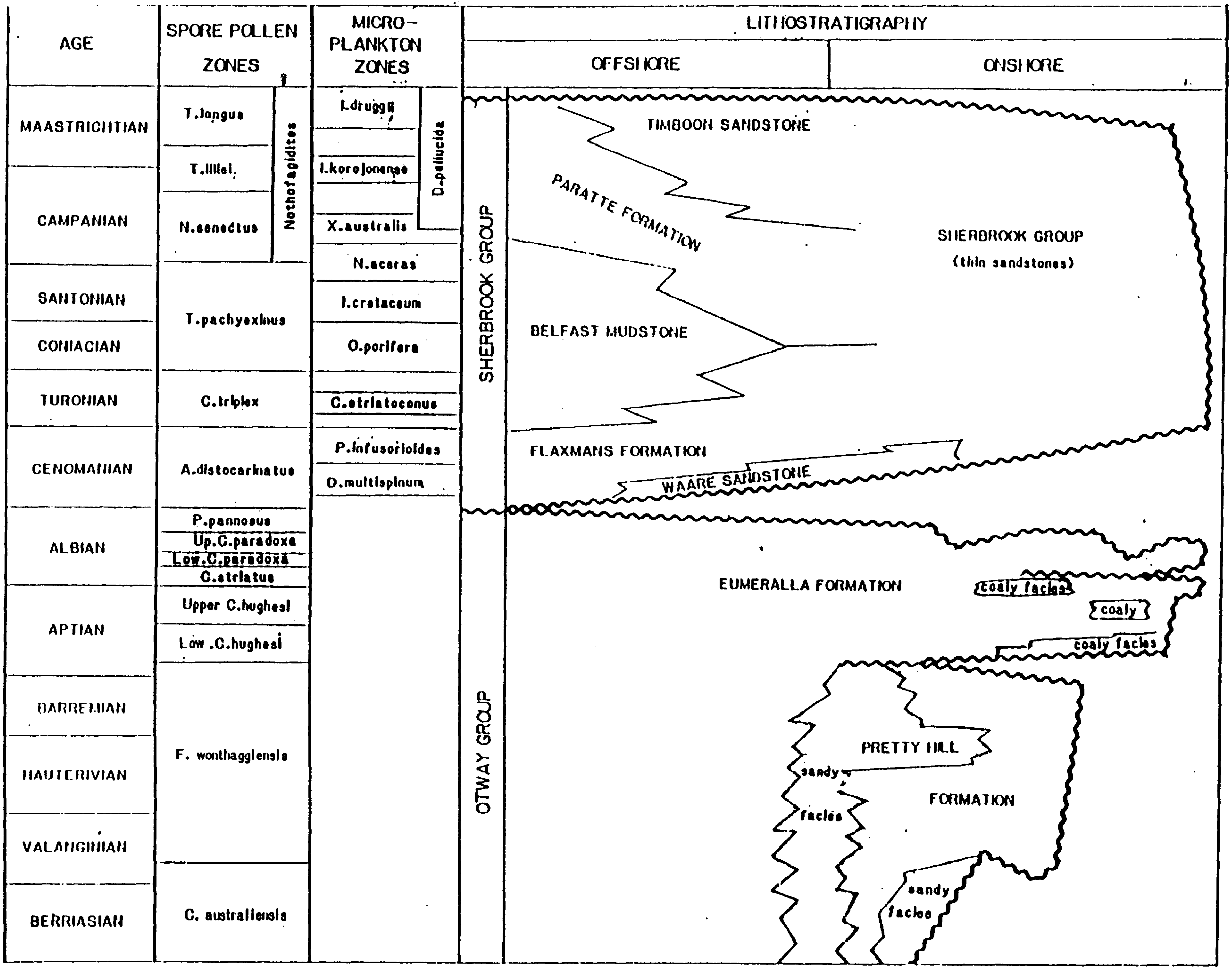

FIGURE 1. CRETACEOUS REGIONAL FRAMEWORK, OTWAY BASIN

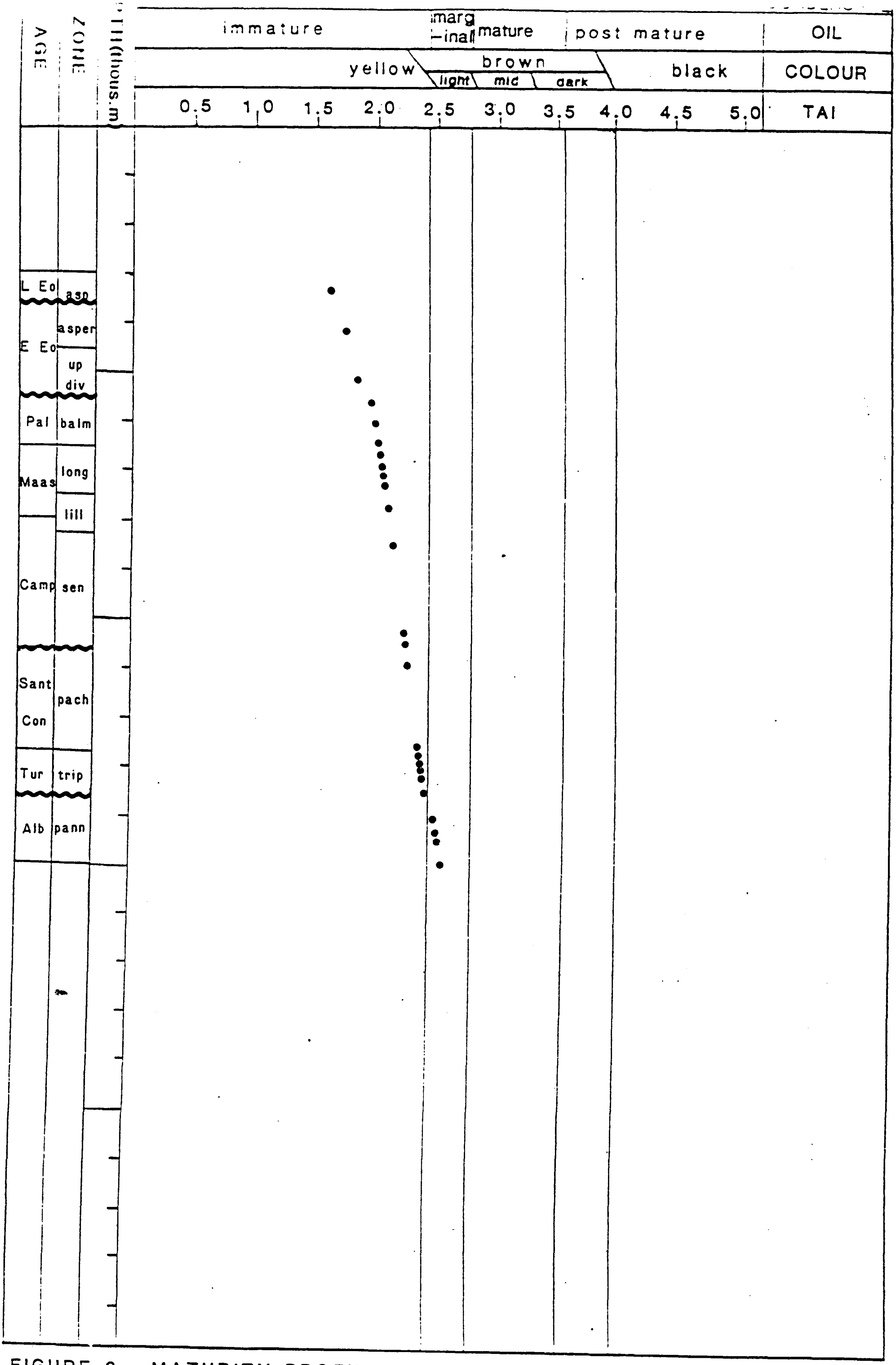

FIGURE 2 MATURITY PROFILE, IONA-1

general concensus 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%. Geochemists, however, have not reached universal agreement on these values, and argue variations on kerogen type, basin type and even basin history. The maturity interpretation is spore colours as basic data. However, the range in thus open to reinterpretation using the basic interpretation philosophies is not great, and probably would not move the oil window by more than 200 metres.

III PALYNOSTRATIGRAPHY

A. 331.0m (swc) : upper N. asperus Zone

Assignment to the upper Nothofagidites asperus Zone is indicated by oldest Foveotriletes crater without older indicators. Youngest Polycolpites esobalteus and Proteacidites asperopolus suggest a point near the base of the subzone. Oldest Tricolpites simatus and T. thomasii are consistent with the assignment. Nothofagidites spp. are dominant. Minor reworking (M. tenuis, G. rudata) was seen.

Nearshore marine environments are suggested by the rare microplankton. Micrhystridium spp. are frequent,with a few low diversity dinoflagellates. These features are normally seen in the Niranda Sub Group.

Colourless fossils indicate immaturity for hydrocarbon generation.

B. middle and lower N. asperus Zones : not seen

The absence of these zones suggests an important unconformity in the gap 331-402.5m.

C. 402.5m (swc) : P. asperopolus Zone

Asssignment to the Proteacidites asperopolus Zone is indicated at the top by youngest frequent Haloragacidites harrisii, youngest Malvacipollis diversus, and the scarcity of Nothofagidites spp. At the base, assignment is indicated by oldest Myrtaceidites tenuis and Proteacidites asperopolus. Proteacidites spp. are common, and Dilwynites granulatus and H. harrisii frequent.

Marginal marine environments are indicated by the scarce very low diversity dinoflagellates.

These features are normally seen in the Dilwyn Formation.

Immaturity for hydrocarbon generation is indicated by the colourless palynomorphs.

D. 543.0m (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. H. harrisii and Proteacidites spp. are frequent, and M. diversus is consistent.

Nearshore marine environments are indicated by the moderate content (30%) of moderate diversity (10 species) dinoflagellates. Spores and pollen are clearly dominant and diverse. Of the dinoflagellates, the Kenleyia spp. are consistent with the spore-pollen zonal assignment.

These features are normally seen in the Dilwyn Formation.

Light yellow spore colours indicate immaturity for hydrocarbon generation.

E. middle and lower M. diversus Zones : not seen

The apparent absence of these Early Eocene Zones suggests a hiatus in the gap 543-586m, although condensation is also possible.

F. 586.0m (swc) : upper L. balmei Zone

Assignment to the upper Lygistepollenites balmei Zone is indicated at the top by youngest L. balmei and Gambierina rudata, and at the base by oldest Proteacidites grandis and P. incurvatus. Proteacidites spp. are common, with frequent Gleicheniidites circinidites.

Marginally marine environments are indicated by the scarce (2%) microplankton, dominated by Paralecaniella indentata with low diversity dinoflagellates (4 species). Spores and pollen are common and diverse, and leaf fragments comprise 50% of the residue.

These features are normally seen in the Pember Member of the Dilwyn Formation.

Yellow spore colours indicate immaturity for hydrocarbon generation.

G. 602.0m (swc)-621.0m (swc) : lower L. balmei Zone

Assignment is indicated by the absence of younger or older indicators from an assemblage containing L. balmei. Proteacidites is common, with G. circinidites and P. mawsonii frequent. Gambierina edwardsii and G. rudata were seen at 621m.

Nearshore marine environments are indicated by the relatively rare dinoflagellates (5%) and their moderate diversity (about 10 species). Deflandrea speciosa is the most common, and confirms the Paleocene age. Spores and pollen are common and diverse and indicate the substantial land derived contribution to the microflora.

These features are normally seen in the Pebble Point Formation and its correlatives.

Yellow spore colours indicate immaturity for hydrocarbon generation.

H. 652.0m (swc)-664.5m (swc) : upper T. longus Zone

Assignment to the upper part of the Tricolpites longus Zone is clearly indicated by the youngest occurrences of Tricolpites confessus, T. longus, T. waipawensis, Tricolporites lillei and Triporopollenites sectilis, and confirmed by the dinoflagellates. At the base, oldest Stereisporites punctatus indicates the assignment, and is confirmed by the dinoflagellates. Proteacidites spp. dominate these assemblages, with frequent G. rudata and Nothofagidites.

Assignment to the Manumiella druggii Dinoflagellate Zone is indicated by the presence of M. conorata in all samples, and confirmed by oldest Canninginopsis bretonica at the interval base.

Marginal marine environments are indicated by the low dinoflagellate contents (2-5%) and their very low diversity (3-5 species). Micrhystridium are frequent at 652.5m. The dominant terrestrial contribution is seen in the dominant and diverse spores and pollen.

These spore colours indicate immaturity for hydrocarbon generation.

I. 704.0m (swc) : lower T. longus Zone

Assignment is indicated at the top on the absence of younger indicators, and at the base on oldest Tetracolporites verrucosus. Proteacidites spp. are common, with Nothofagidites endurus and Phyllocladidites mawsonii frequent.

Brackish environments are indicated by the total dominance of high diversity spores and pollen, and trace quantities of a single species of dinoflagellate (Isabelidinium pellucidum).

These features are normally seen in the topmost Paaratte Formation and its correlatives.

Yellow spore colours indicate immaturity for hydrocarbons.

J. 772.0m (swc) : T. lillei Zone

Assignment to the Tricolporites lillei Zone is indicated at the top by the absence of younger indicators and at the base by oldest T. lillei. Proteacidites spp. are common, and N. endurus and P. mawsonii are frequent. Minor Permian reworking was seen.

Brackish environments are indicated by the extremely rare dinoflagellates amongst the common and diverse spores and pollen.

These features are normally seen in the upper Paaratte Formation.

Yellow spore colours indicate immaturity for hydrocarbons.

K. 858.0m (swc)-1054.0m (swc) : N. senectus Zone

Assignment to the Nothofagidites senectus Zone is indicated at the top by the absence of younger indicators, and at the base by oldest N. senectus. This may be picked slightly too low, as other caving (Eocene) is seen at 1054m and so base ranges may be unreliable. Proteacidites spp. are the most common, with Nothofagidites and P. mawsonii frequent.

Age diagnostic dinoflagellates include Nelsoniella aceras at 1018m and below, without younger indicators. Heterosphaeridium laterobrachius was also seen at 1018m. These indicate assignment of the interval 1018-1054n to the N. aceras Dinoflagellate Zone (correlative with the lower N. senectus and underlying topmost T. pachyexinus Spore-pollen Zone).

Despite their age significance, dinoflagellates are scarce and of low diversity, while spores and pollen are common and diverse. Nearshore marine environments are therefore indicated.

These features are normally seen in the lower Paaratte Formation and upper Belfast Mudstone.

Yellow spore-colours indicate immaturity for hydrocarbons.

L. 1075.5m (swc)-1254. 0m (swc) : T. pachyexinus Zone

Assignment to the Tricolporites pachyexinus Zone (=T. apoxyexinus Zone) at the top on the absence of younger indicators and at the base on oldest Ornamentifera sentosa. Proteacidites, M. antarcticus and Cyathidites are intermittently common. The assignment is confirmed by the associated dinoflagellates.

Age diagnostic dinoflagellates are present in all samples. At 1075.5m, oldest N. aceras indicates assignment to N. aceras Dinoflagellate Zone. At 1240 and 1254m, the presence of Isabelidinium cretaceum without younger elements, indicates assignment to the I. cretaceum Zone. The absence of samples contining Odontochitina porifera without I. cretaceum, suggests a minor hiatus removing Othe O. porifera Dinoflagellate Zone, somewhere in the interval 1254 - 1276.5m.

Offshore marine environments are indicated at 1240 - 1254m by the relatively high dinoflagellate contents (30 - 40%) and their moderate to high diversity (12 - 18 species). At 1075.5m, nearshore environments are suggested on the low content (5%) and diversity (8 species) of dinoflagellates.

These features are normally seen in the Belfast Mudstone.
Mid yellow spore colours indicate immaturity for hydrocarbons.

M. 1276.5m (swc) : upper C. triplex Zone.

Assignment to the Clavifera triplex Zone (= P. mawsonii Zone) is indicated at the top and base on the absence of younger and older indicators. Dinoflagellates confirm the assignment. Amosopollis cruciformis is common, with frequent M. antarcticus. Minor Permian reworking was seen.

The age diagnostic dinoflagellate Conosphaeridium striatoconus indicates assignment to the C. striatoconus Dinoflagellate Zone.

dinoflagellates of low diversity (8 species). These alternating environments could suggest turbidites, with the offshore environments real, and the nearshore ones artificially produced by turbidite flow of shallow derived sediment. The passage of a particularly deep interdistributary bay could alternatively account for the sequence.

The age of this sequence suggest a normal Flaxmans Formation. The unusual reworking and environmental data are not normal.

Mid yellow spore colours indicate immaturity for hydrocarbons.

O. A. distocarinatus Zone : not seen.

The apparent absence of this zone suggests a hiatus in the gap 1347.5 - 1383m. Condensation is also possible, as is the presence of the Zone (masked by caving), as suggested above. Mud penetration was a problem in processing, due to the shattering of these small diameter sidewall cores.

P. 1383.0 (swc) - 1481.0m (swc) : P. pannosus Zone.

Assignment to the Phimopollenites pannosus Zone is indicated at the top by youngest Coptospora paradoxa and at the base by oldest P. pannosus. Cyathidites, F. similis and A. australis are intermittently common. Minor Permian, Triassic and Jurassic reworking were intermittently seen.

Mostly non-marine environments are indicated by the absence of saline microplankton (except isolated caved late Cretaceous forms) presence of freshwater types and

Nearshore marine environments are indicated by the low content (5%) and moderate diversity (10 species) of dinoflagellates

These features are usually seen in the Flaxmans Formation.

Mid yellow spore colours indicate immaturity for hydrocarbons.

N. 1287.0m (swc) - 1347.5m (swc) : lower C. triplex Zone.

Assignment is indicated at the top on youngest Appendicisporites distocarinatus, and at the base on oldest Phyllocladidites mawsonii. This base may be picked too low, as younger (and lighter coloured) elements are seen caved at 1347.5m but spore colours of critical specimens appear consistent with being in place. Amosopollis cruciformis, M. antarcticus and F. similis are intermittently common. Reworking from the Permian, Triassic and Jurassic are all seen at 1347.5m, suggesting a location above a sizable unconformity. At 1287.0m, however, Permian and Triassic reworking are again seen, with the Permian reworking very common, comprising 5% of the assemblage. This suggests the possibility of turbidites, although massive reworking in a more normal situation is not precluded.

Alternating environments are suggested. At 1347.5m, very nearshore environments are suggested, with trace quantities of dinoflagellates showing low diversity (6 species). At 1297 m. offshore environments are suggested, with dominant dinoflagellates (60%) of high diversity (20 species). At 1287 m. very nearshore environments are again suggested, with 5%

the dominance and diversity of spores and pollen. At 1423m, a single spiny acritarch appears, and suggests slightly brackish environments.

These features are normally seen at the top of the Eumeralla Formation.

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

IV CONCLUSIONS

A. The palynology is generally compatible with the lithostratigraphy and suggests unconformities in the gaps.

331 - 402.5 (probably at the Nirranda Group/Dilwyn boundary, removing much of the Middle and Late Eocene).
543 - 586 (intra Dilwyn Formation - frequently condensed or absent in the Gippsland and Otway Basins).
1256 - 1276.5 (at the Belfast/Flaxmans boundary, confirmed by logs).
1347.5 - 1383 (at the Flaxmans/Eumeralla boundary).

B. The top Late Cretaceous is picked palynologically slightly higher than the original log pick. Two sidewall core samples suggest this location, and reworking is unlikely cause of palynological error. This duplicates a similar observation in Henke - 1 and suggests a terminal Cretaceous unit of Pebble Point like lithology. Close swc sampling across this boundary in future will provide a test, although the change is sufficiently obvious that it should be detectable in cuttings.

C. The lower C. triplex sequence (Flaxmans Formation) is unusual, featuring wildly alternating environments (offshore to very nearshore), heavy Permian reworking (5%) at 1287m, and multiple clean sands. These features occur in turbidite sand sequences, but are not necessarily restricted to them.

D. An unpublished dinoflagellate (Canninginopsis bretonica) is recorded here (659.5m, 664.5m) for the first time in the Otway Basin. Until now, it was known only from

Western Australia (Perth and Carnarvon Basins) and from the offshore Gippsland Basin (Pisces - 1). By correlation via nannofossil and planktonic foraminiferal zones seen in Western Australia, the Maastrichtian age of the T. longus Zone is confirmed.

E. Some mud contamination of swcs is noted. This is more frequent with small diameter swcs used in this well, where shattering and consequent mud penetration occur. Larger diameter swcs are more expensive, but provide generally better samples.

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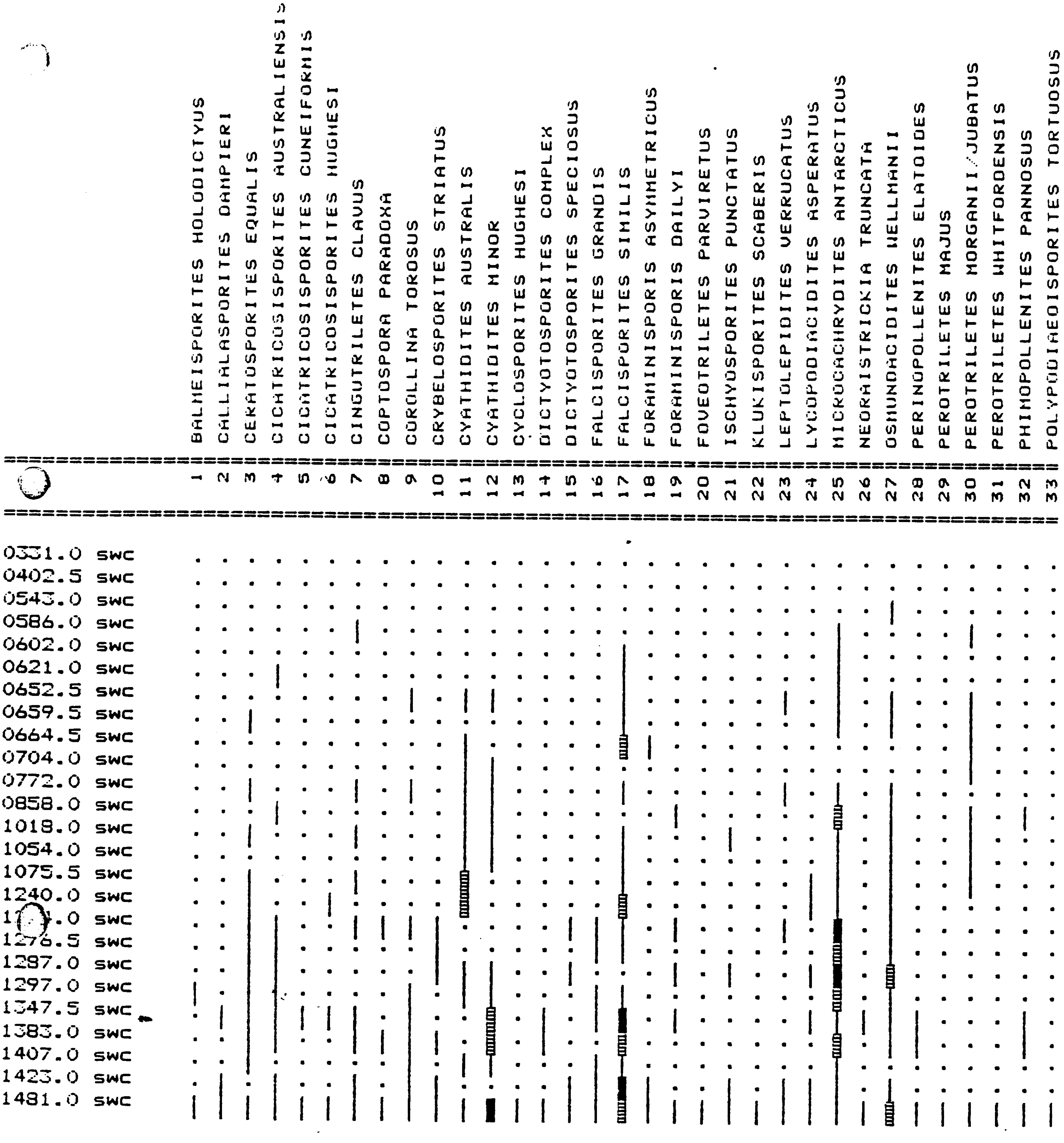
IONA #1 PALYNOLOGICAL DATA

RANGE CHART OF GRAPHIC ABUNDANCES BY LOWEST APPEARANCE (by group)

Key to Symbols

| = Very Rare
□ = Rare
▤ = Few
▮ = Common
█ = Abundant
? = Questionably Present
. = Not Present


1 BALMEISPORITES HOLODICTYUS
2 CALLIALASPORITES DAMPIERI
3 CERATOSPORITES EQUALIS
4 CICATRICOSISPORITES AUSTRALIENSIS
5 CICATRICOSISPORITES CUNEIFORMIS
6 CICATRICOSISPORITES HUGHESI
7 CINGUTRILETES CLAVUS
8 COPTOSPORA PARADOXA
9 COROLLINA TOROSUS
10 CRYBELOSPORITES STRIATUS
11 CYATHIDITES AUSTRALIS
12 CYATHIDITES MINOR
13 CYCLOSPORITES HUGHESI
14 DICTYOTOSPORITES COMPLEX
15 DICTYOTOSPORITES SPECIOSUS
16 FALCISPORITES GRANDIS
17 FALCISPORITES SIMILIS
18 FORAMINISPORIS ASYMMETRICUS
19 FORAMINISPORIS DAILYI
20 FOVEOTRILETES PARVIRETUS
21 ISCHYOSPORITES PUNCTATUS
22 KLUKISPORITES SCABERIS
23 LEPTOLEPIDITES VERRUCATUS
24 LYCOPODIACIDITES ASPERATUS
25 MICROCACHRYDITES ANTARCTICUS
26 NEORAISTRICKIA TRUNCATA
27 OSMUNDACIDITES WELLMANII
28 PERINOPOLLENITES ELATOIDES
29 PEROTRILETES MAJUS
30 PEROTRILETES MORGANII/JUBATUS
31 PEROTRILETES WHITFORDENSIS
32 PHIMOPOLLENITES PANNOSUS
33 POLYPODIAEOISPORITES TORTUOSUS
0331.0 swc
0402.5 swc
0543.0 swc
0586.0 swc
0602.0 swc
0621.0 swc
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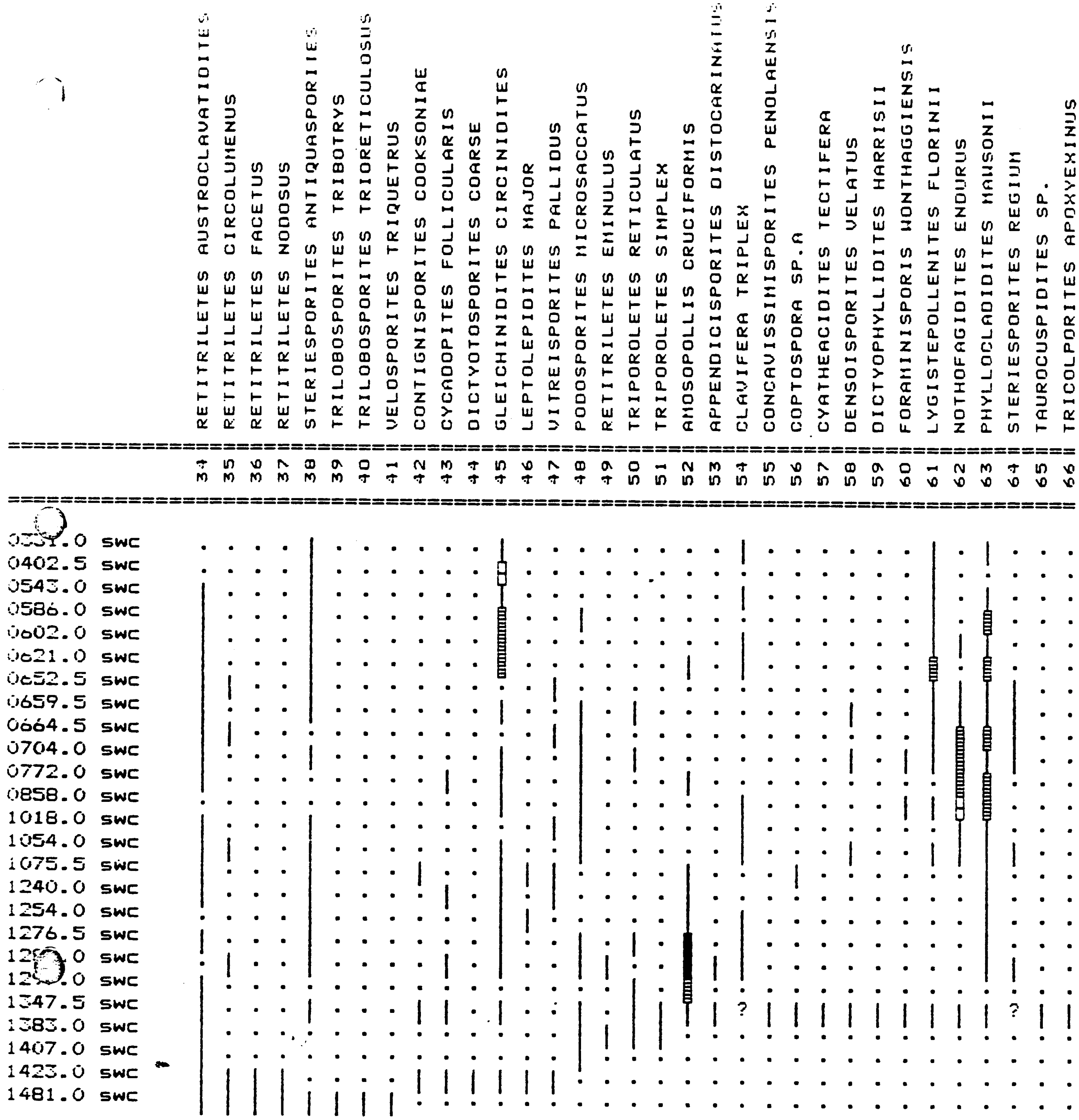
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RETITRILETES CIRCOLUMENUS 35
RETITRILETES FACETUS 36
RETITRILETES NODOSUS 37
STERIESPORITES ANTIQUASPORITES 38
TRILOBOSPORITES TRIBOTRYS 39
TRILOBOSPORITES TRIORETICULOSUS 40
VELOSPORITES TRIQUETRUS 41
CONTIGNISPORITES COOKSONIAE 42
CYCADOPITES FOLLICULARIS 43
DICTYOTOSPORITES COARSE 44
GLEICHINIDITES CIRCINIDITES 45
LEPTOLEPIDITES MAJOR 46
VITREISPORITES PALLIDUS 47
PODOSPORITES MICROSACCATUS 48
RETITRILETES EMINULUS 49
TRIPOROLETES RETICULATUS 50
TRIPOROLETES SIMPLEX 51
AMOSOPOLLIS CRUCIFORMIS 52
APPENDICISPORITES DISTOCARINATUS 53
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CONCAVISSIMISPORITES PENOLAENSIS 55
COPTOSPORA SP.A 56
CYATHEACIDITES TECTIFERA 57
DENSOISPORITES VELATUS 58
DICTYOPHYLLIDITES HARRISII 59
FORAMINISPORIS WONTHAGGIENSIS 60
LYGISTEPOLLENITES FLORINII 61
NOTHOFAGIDITES ENDURUS 62
PHYLLOCLADIDITES MAWSONII 63
STERIESPORITES REGIUM 64
TAUROCUSPIDITES SP. 65
TRICOLPORITES APOXYEXINUS 66
0331.0 SWC
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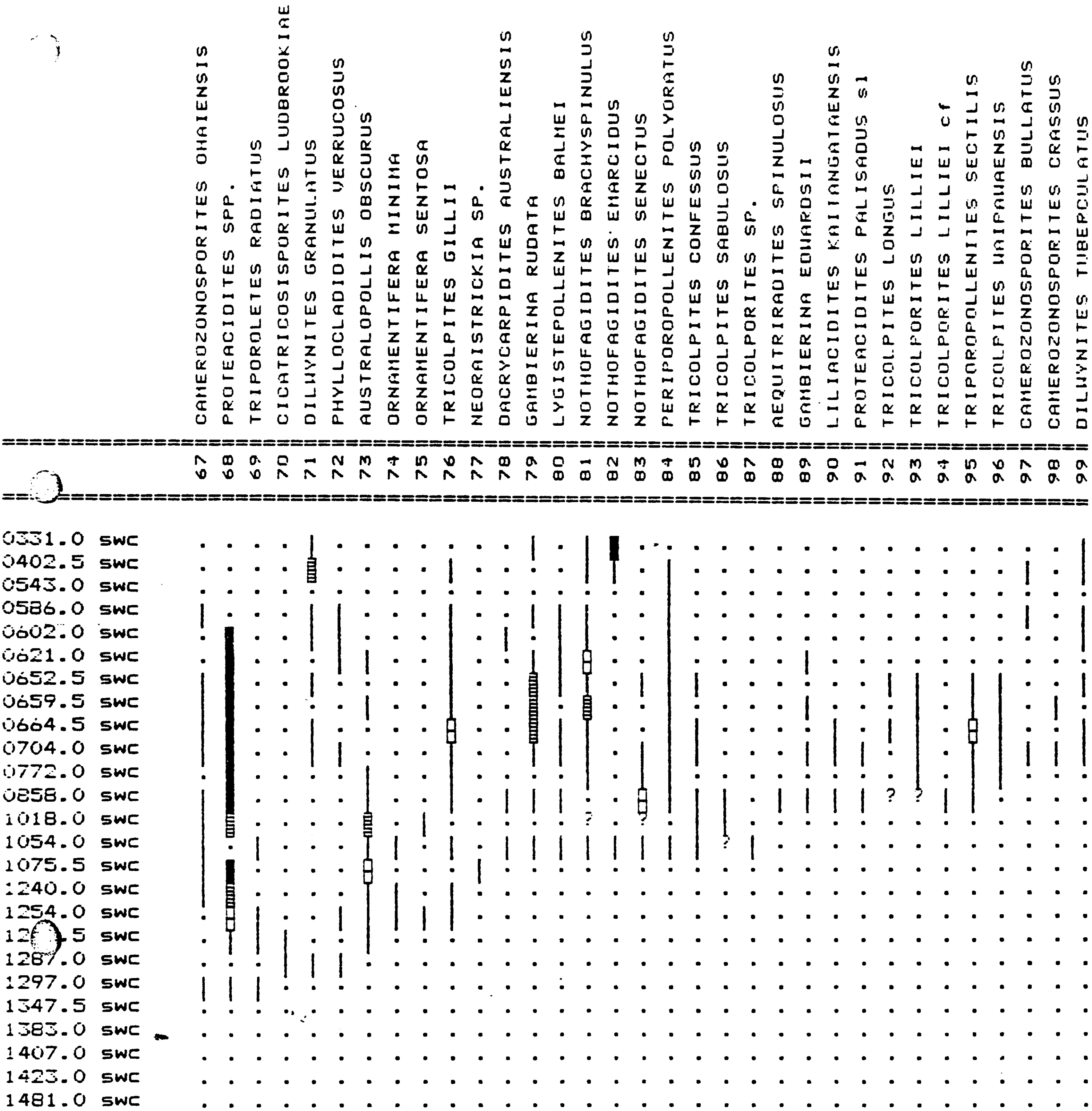
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72 PHYLLOCLADIDITES VERRUCOSUS
73 AUSTRALOPOLLIS OBSCURUS
74 ORNAMENTIFERA MINIMA
75 ORNAMENTIFERA SENTOSA
76 TRICOLPITES GILLII
77 NEORAISTRICKIA SP.
78 DACRYCARPIDITES AUSTRALIENSIS
79 GAMBIERINA RUDATA
80 LYGISTEPOLLENITES BALMEI
81 NOTHOFAGIDITES BRACHYSPINULUS
82 NOTHOFAGIDITES EMARCIDUS
83 NOTHOFAGIDITES SENECTUS
84 PERIPOROPOLLENITES POLYORATUS
85 TRICOLPITES CONFESSUS
86 TRICOLPITES SABULOSUS
87 TRICOLPORITES SP.
88 AEQUITRIRADITES SPINULOSUS
89 GAMBIERINA EDWARDSII
90 LILIACIDITES KAITANGATAENSIS
91 PROTEACIDITES PALISADUS s1
92 TRICOLPITES LONGUS
93 TRICOLPORITES LILLIEI
94 TRICOLPORITES LILLIEI cf
95 TRIPOROPOLLENITES SECTILIS
96 TRICOLPITES WAIPAWAENSIS
97 CAMEROZONOSPORITES BULLATUS
98 CAMEROZONOSPORITES CRASSUS
99 DILWYNITES TUBERCULATUS
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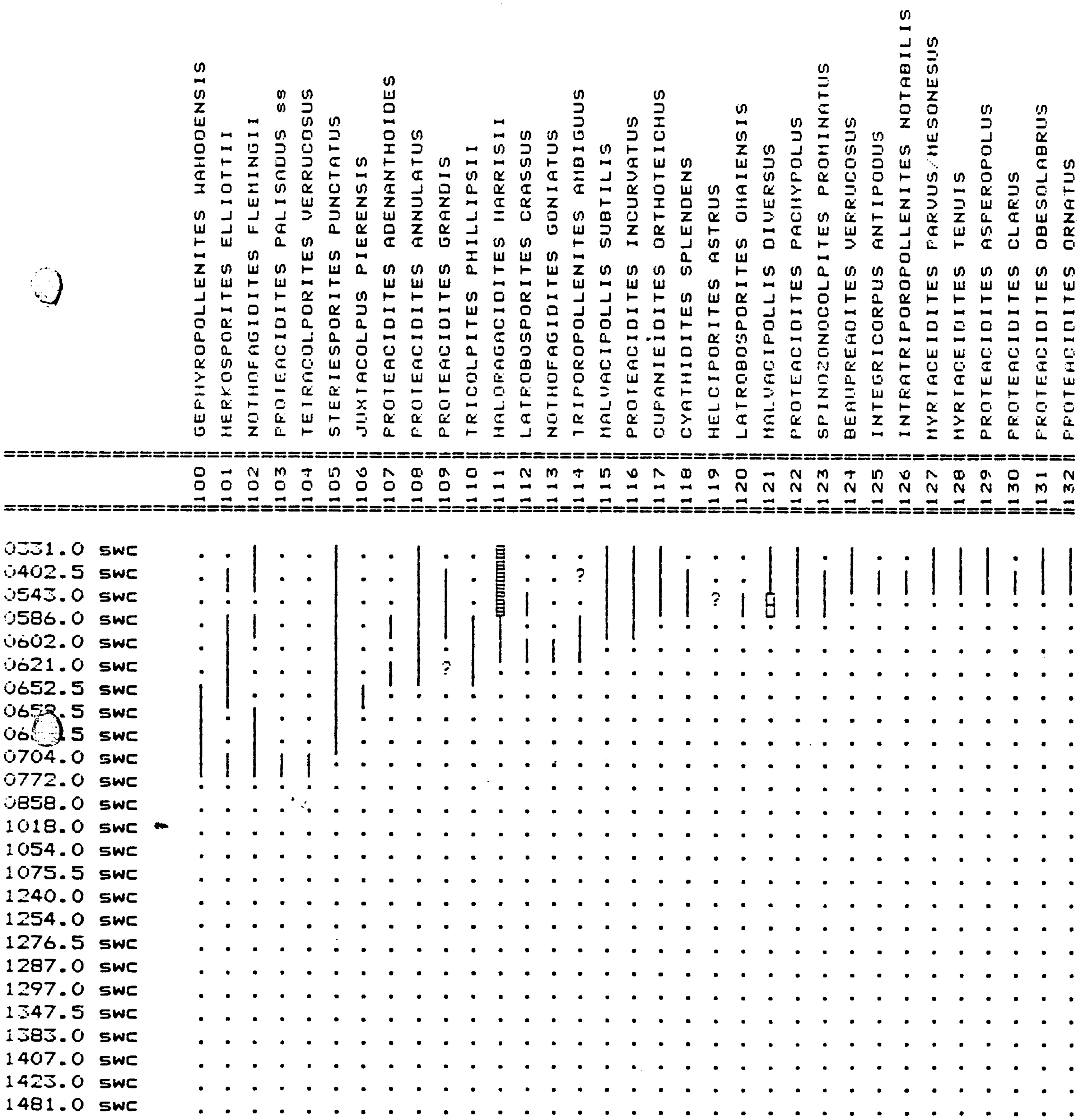
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105 STERIESPORITES PUNCTATUS
106 JUXTACOLPUS PIERENSIS
107 PROTEACIDITES ADENANTHOIDES
108 PROTEACIDITES ANNULATUS
109 PROTEACIDITES GRANDIS
110 TRICOLPITES PHILLIPSII
111 HALORAGACIDITES HARRISII
112 LATROBOSPORITES CRASSUS
113 NOTHOFAGIDITES GONIATUS
114 TRIPOROPOLLENITES AMBIGUUS
115 MALVACIPOLLIS SUBTILIS
116 PROTEACIDITES INCURVATUS
117 CUPANIEIDITES ORTHOTEICHUS
118 CYATHIDITES SPLENDENS
119 HELCIPORITES ASTRUS
120 LATROBOSPORITES OHAIENSIS
121 MALVACIPOLLIS DIVERSUS
122 PROTEACIDITES PACHYPOLUS
123 SPINOZONOCOLPITES PROMINATUS
124 BEAUPREADITES VERRUCOSUS
125 INTEGRICORPUS ANTIPODUS
126 INTRATRIPOROPOLLENITES NOTABILIS
127 MYRTACEIDITES PARVUS/MESONESUS
128 MYRTACEIDITES TENUIS
129 PROTEACIDITES ASPEROPOLUS
130 PROTEACIDITES CLARUS
131 PROTEACIDITES OBESOLABRUS
132 PROTEACIDITES ORNATUS
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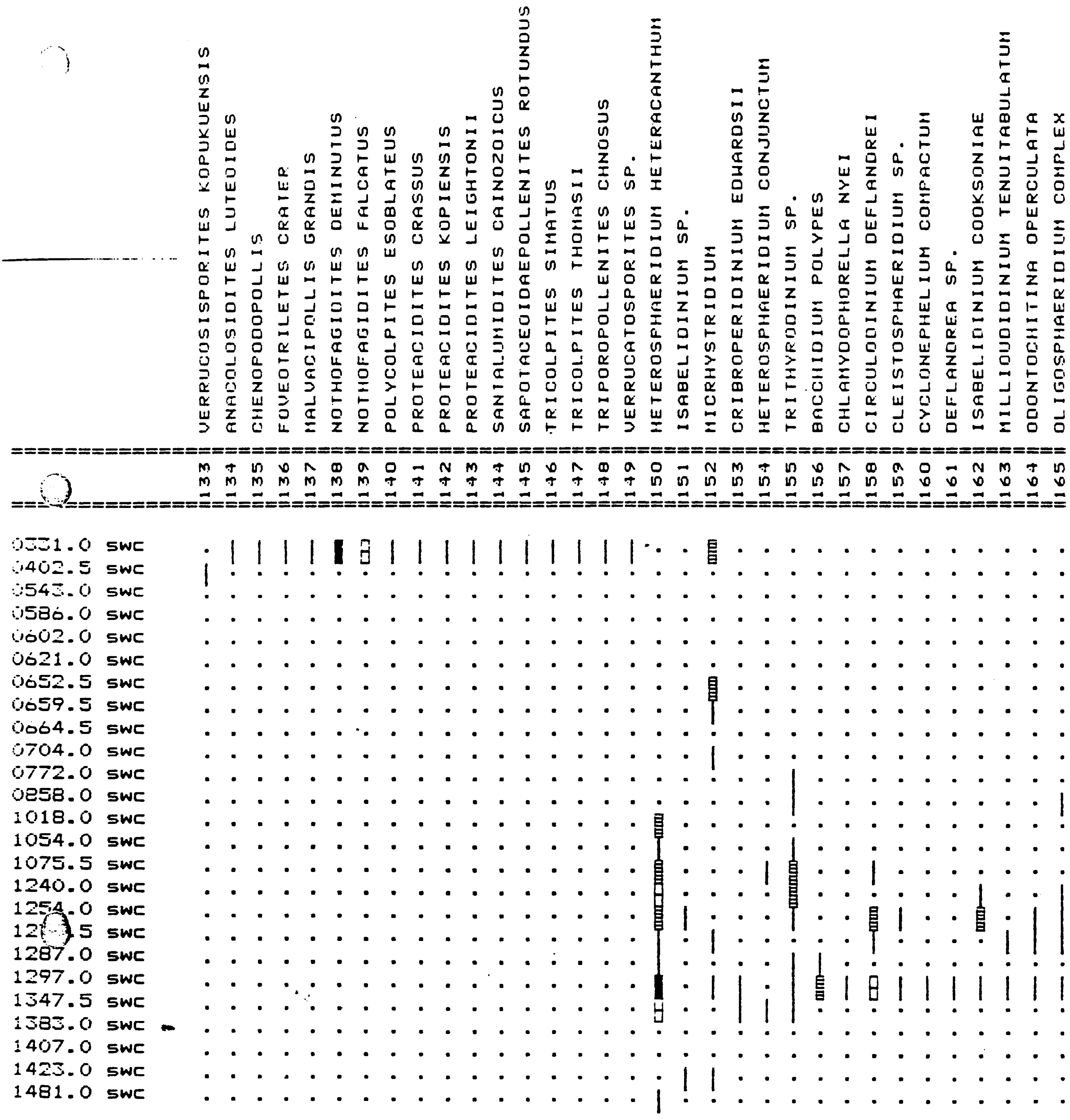133 VERRUCOSISPORITES KOPUKUENSIS
134 ANACOLOSIDITES LUTEOIDES
135 CHENOPODOPOLLIS
136 FOVEOTRILETES CRATER
137 MALVACIPOLLIS GRANDIS
138 NOTHOFAGIDITES DEMINUTUS
139 NOTHOFAGIDITES FALCATUS
140 POLYCOLPITES ESOBLATEUS
141 PROTEACIDITES CRASSUS
142 PROTEACIDITES KOPIENSIS
143 PROTEACIDITES LEIGHTONII
144 SANTALUMIDITES CAINOZOICUS
145 SAPOTACEOIDAEPOLLENITES ROTUNDUS
146 TRICOLPITES SIMATUS
147 TRICOLPITES THOMASII
148 TRIPOROPOLLENITES CHNOSUS
149 VERRUCATOSPORITES SP.
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151 ISABELIDINIUM SP.
152 MICRHYSTRIDIUM
153 CRIBROPERIDINIUM EDWARDSII
154 HETEROSPHAERIDIUM CONJUNCTUM
155 TRITHYRODINIUM SP.
156 BACCHIDIUM POLYPES
157 CHLAMYDOPHORELLA NYEI
158 CIRCULODINIUM DEFLANDREI
159 CLEISTOSPHAERIDIUM SP.
160 CYCLONEPHELIUM COMPACTUM
161 DEFLANDREA SP.
162 ISABELIDINIUM COOKSONIAE
163 MILLIOUDIDINIUM TENUITABULATUM
164 ODONTOCHITINA OPERCULATA
165 OLIGOSPHAERIDIUM COMPLEX
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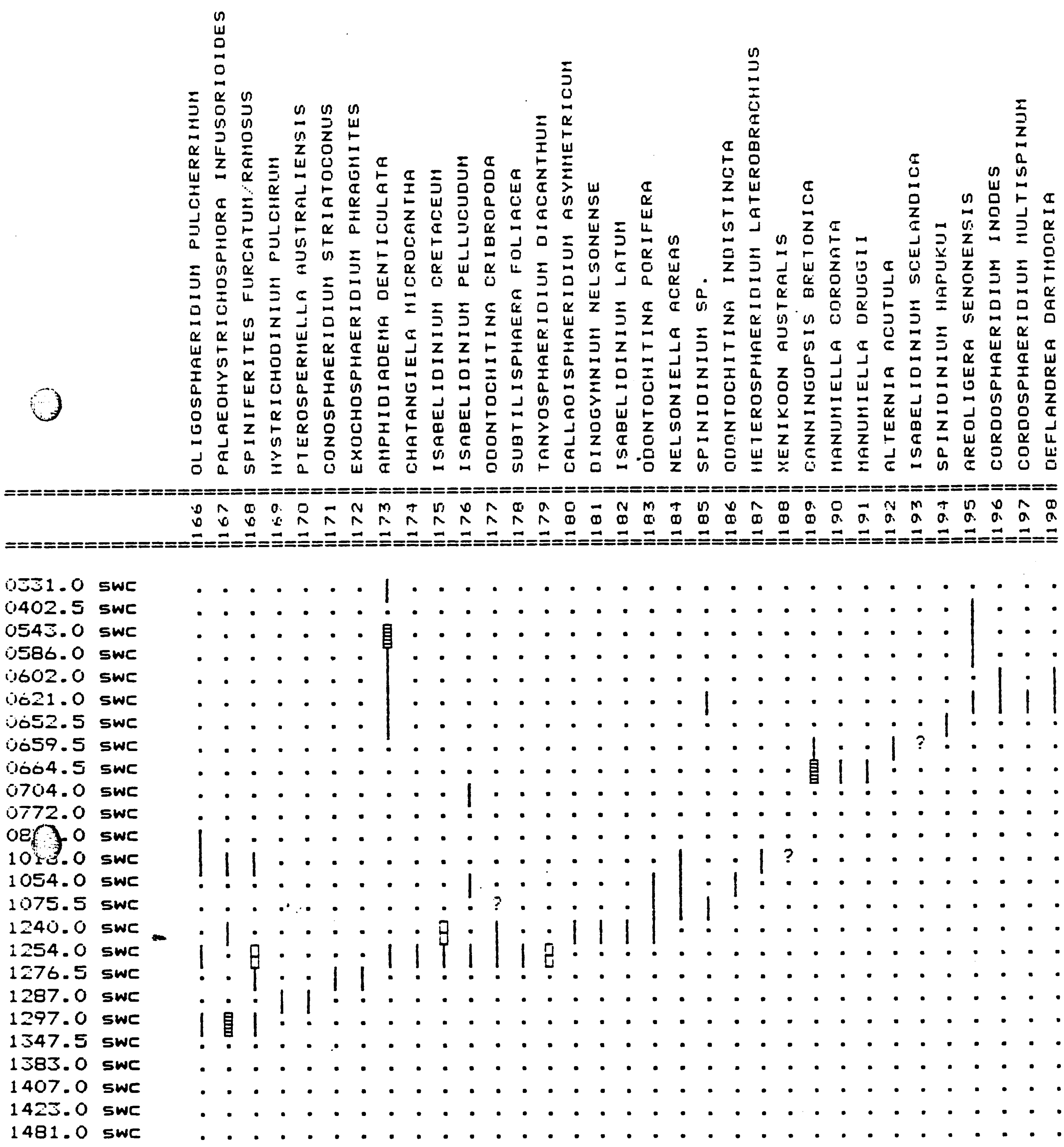
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167 PALAEOHYSTRICHOSPHORA INFUSORIOIDES
168 SPINIFERITES FURCATUM/RAMOSUS
169 HYSTRICHODINIUM PULCHRUM
170 PTEROSPERMELLA AUSTRALIENSIS
171 CONOSPHAERIDIUM STRIATOCONUS
172 EXOCHOSPHAERIDIUM PHRAGMITES
173 AMPHIDIADEMA DENTICULATA
174 CHATANGIELA MICROCANTHA
175 ISABELIDINIUM CRETACEUM
176 ISABELIDINIUM PELLUCIDUM
177 ODONTOCHITINA CRIBROPODA
178 SUBTILISPHAERA FOLIACEA
179 TANYOSPHAERIDIUM DIACANTHUM
180 CALLAOISPHAERIDIUM ASYMMETRICUM
181 DINOGYMNIUM NELSONENSE
182 ISABELIDINIUM LATUM
183 ODONTOCHITINA PORIFERA
184 NELSONIELLA ACREAS
185 SPINIDINIUM SP.
186 ODONTOCHITINA INDISTINCTA
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197 CORDOSPHAERIDIUM MULTISPINUM
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		199 DEFLANDREA SPECIOSA	200 OPERCULODINIUM CENTROCARPUM	201 ACHOMOSPHAERA SEPTATA	202 DEFLANDREA DILWYNENSIS	203 APECTODINIUM HOMOMORPHUM	204 APECTODINIUM HYPERCANTHUM	205 DAPSILIDINIUM PASTIELSII	206 DYPHES COLLIGERUM	207 IMPLETOSPHAERIDIUM SP.	208 KENLEYIA LEPTOCERATA	209 KENLEYIA LOPHOPHORA	210 KENLEYIA SP.	211 PHTHANOPERIDINIUM EOCENICUM	212 RHOMBODINIUM GLABRUM	213 TRITONITES MARSHALLII	214 NUMMUS MONOCULATUS	215 SCHIZOSPORIS RETICULATA	216 BOTRYOCOCCUS	217 SCHIZOSPORIS PSILATA	218 PARALECANIELLA INDENTATA	219 NUMMUS SP.		
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1481.0	swc	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	|	|	.	.	.	.	1481.0	swc

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[illegible]5	GLEICHINIDITES CIRCINIDITES
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23	LEPTOLEPIDITES VERRUCATUS
[illegible]	LILIACIDITES KAITANGATAENSIS
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130	PROTEACIDITES CLARUS
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116	PROTEACIDITES INCURVATUS
142	PROTEACIDITES KOPIENSIS
143	PROTEACIDITES LEIGHTONII
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95	TRIPOROPOLLENITES SECTILIS
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