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NEW PALYNOLOGY OF PECTEN-1A

OFFSHORE OTWAY BASIN, AUSTRALIA

BY

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for BHP PETROLEUM

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CONTENTS

I SUMMARY

New examination (including grain counts of 20 existing swc preparations plus 13 new cuttings preparations) has produced a high resolution breakdown. It is expressed below in formal zones, but is also discussed in the text in terms of fifteen major horizons and twenty three minor horizons. These produced a much tighter correlation web to nearby wells when plotted on logs. Likely maximum flooding surfaces and sequence boundaries can also be located using the dinoflagellate content and diversity as a index of marine influence.

1126m(swc) - 1233m(swc) : longus Zone (druggii dino Zone at 1126m) : Maastrichtian : nearshore to marginal marine

1271m(cutts) - 1295m(swc) (?1369m swc) : lillei Zone (korojonense dino Zone) : Campanian : nearshore to marginal marine

1387m(cutts) - ?1570(cutts) : upper to middle senectus Zone (upper australis dino Zone 1387-1428m, lower australis dino Zone 1460m, aceras dino Zone 1500-1722m) : Campanian : nearshore to marginal marine

1579m(swc) - ?1722(swc) : lower senectus Zone (aceras dino Zone 1579-1722m) : Campanian : offshore at the base, passing to marginal marine at the top

1734m(cutts) : upper apoxyexinus Zone (cretacea dino Zone) : Santonian : offshore marine

1748m(swc) : mawsonii Zone : Santonian to Turonian : nearshore to marginal marine

1765m(cutts) : mawsonii - distocarinatus Zones (infusorioides dino Zone) : Turonian to Cenomanian : nearshore to

marginal marine

1776m(swc) - 1789(cutts) : distocarinatus Zone (infusorioides dino Zone) : Cenomanian : marginal marine

1804m(swc) : pannosus Zone : late Albian : non-marine

Thick Early Cretaceous occurs below this point but lies beyond the scope of this study.

II INTRODUCTION

Paul Carroll and David Pickavance of BHP Petroleum initiated palynological review of several wells pertinent to their acreage. In Pecten-la, they sought improved resolution throughout the late Cretaceous to facilitate sequence stratigraphic analaysis. Restudy of the existing preparations to produce new data from a modern view point, including specimen counts, was clearly worthwhile. Some large sample gaps existed however, and new cuttings were selected to infill to around 30m spacing.

Extensive cuttings study has two main advantages but also two main disadvantages. The first advantage is that the data becomes semicontinuous and key horizons can be seen in the cavings and not missed because they occur between the point sampling of swcs or due to unfavourable facies at the swc depth. An example is the flood of X. australis (horizon 6 herein) which is quite thin but is clearly seen in cuttings and caves to the bottom of the hole. The second advantage is that a downhole or extinction based zonation can be developed which works in cuttings and therefore provides a powerful tool to monitor drilling and enable cost efficient drilling and engineering decisions especially early TD. Quite accurate predictions ahead of swcs, logs and the bit are possible.

The first major disadvantage is that potential caving renders all oldest occurrences (or inceptions in time) of doubtful value. Thus the established zonations which particularly in Australia are based on oldest occurrences from extensive swc suites, do not work well. Youngest occurrence or extinction events in close proximity to the established zone boundaries need to be established to continue to use the established zonation. Alternatively, the existing zonation can be abandoned and a new one erected based on extinction events.

I have tried to do both herein, working within the established zonaton of Helby, Morgan and Partridge (1987), but initiating a set of 38 numbered horizons. The most obvious (and therefore most reliable) bear the whole numbers 1 to 15 from youngest to oldest and are all extinction or major acme events reliably identifiable from cuttings. The other twenty three horizons bear a number and a lower case letter to show their lower level of confidence and their usual stratigraphic location. For example, horizons 7a, 7b, 7c and 7d occur from youngest to oldest, between major horizons 7 and 8, but are less reliable and therefore may crosscut the major horizons. They comprise mostly oldest occurrences in cuttings or youngest occurrences of rare species. The relationship of the two schemes are shown in figure 1 and the discussions herein is within the existing zonal framework.

The second major disadvantage to extensive cuttings study is that heavy caving can obscure subtle events due to dilution. Inspection of a caliper log can indicate the extent of caving, but even small quantities of a richly fossiliferous rock can obscure subtle horizons in a sparsely fossiliferous rock beneath. In Mussel-1, heavy caving of the dinoflagellate rich Campanian and Santonian occurs into the dinoflagellate poor Cenomanian. Caving of this sort will clearly distort statistical counts. In Mussel-1, high dinoflagellate contents in the Cenomanian are plainly caved, so identification of marine maxima and maximum flooding surfaces must be tempered with caution.

The best of both alternatives can be achieved by a mix of swcs and cuttings. Downhole monitoring can be readily achieved by 50 to 100m cuttings, followed up by extensive swc suites to close sampling gaps to around 30m.

Detailed correlation is possible using the data herein and is the subject of a separate report. Raw data are presented in Appendix I.

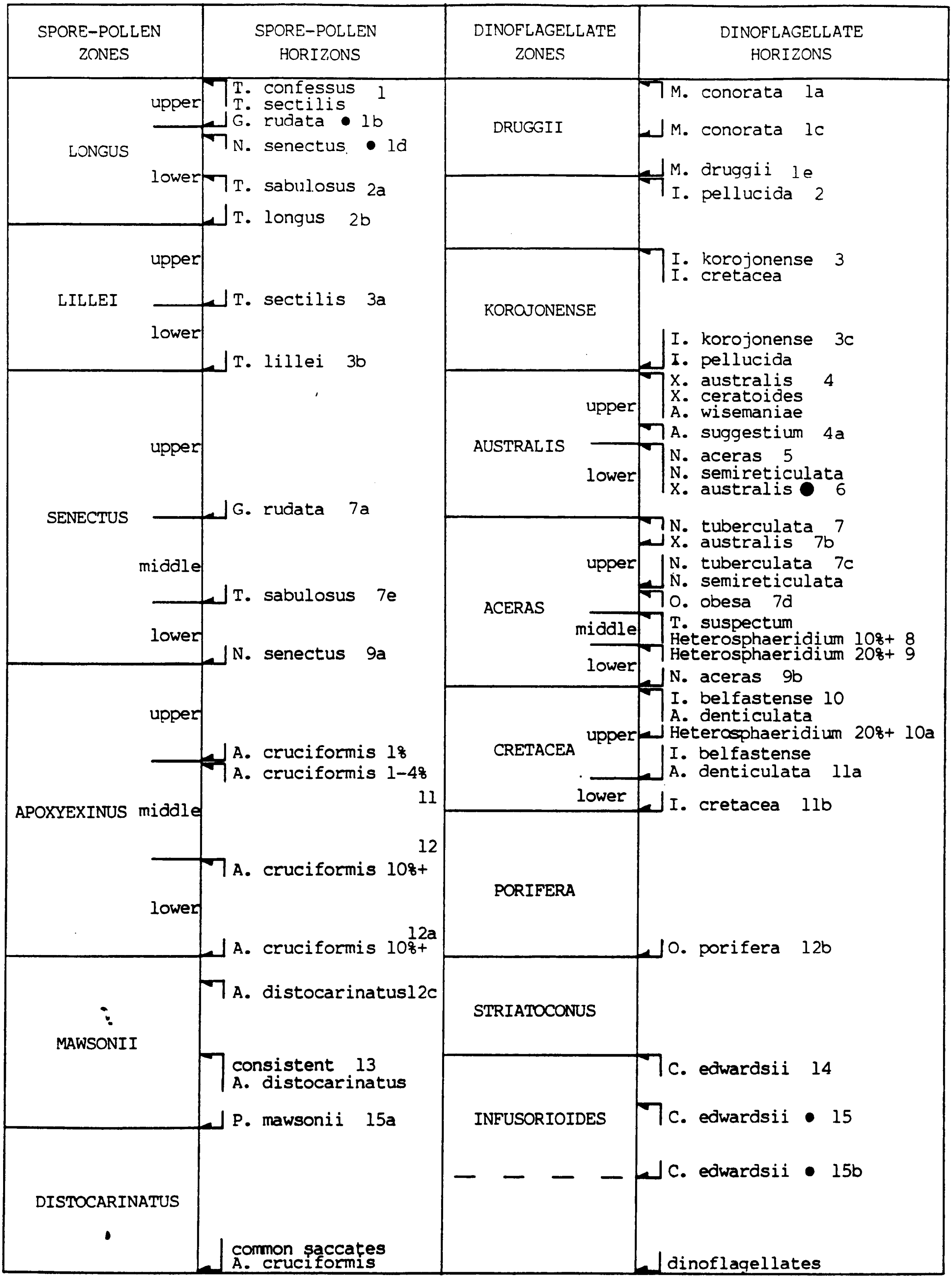

FIGURE 1 ZONATION USED HEREIN SHOWING THE NUMBERED HORIZONS AGAINST THE EXISTING FORMAL ZONATION.

● = frequent (4–10%) ● = common (11–30%)

III PALYNOSTRATIGRAPHY

A 1126m(swc) - 1233m(swc) : longus Zone (druggii dino Zone at 1126m only)

Assignment to the Tricolpites longus Zone of Maastrichtian age is indicated at the top by youngest T. longus, Tricolporites lillei and Triporopollenites sectilis (horizon 1 at 1126m swc), and confirmed by youngest Manumiella conorata (horizon 1a at 1126m swc). The base is defined by oldest T. longus (horizon 2b at 1233m swc). Within the interval, 1126m swc is assigned to upper longus Zone as it contains common Gambierina rudata (horizon 1b) and the druggii dinoflagellate zone on oldest M. conorata (horizon 1c) and M. druggii. Proteacidites and G. rudata are common with Nothofagidites endurus frequent. At 1158m(swc), yields are very low, but G. rudata outnumbers N. endurus, suggesting the upper longus Zone with horizon 1b at this point. At 1168m(swc) an extremely lean assemblage includes youngest Isabelidinium pellucidum (horizon 2) and Canninginopsis bretonica and may therefore belong to the lower longus Zone, although the assemblage is really too lean to be definitive. Another lean assemblage at 1201m (Shell cuttings) contains more N. endurus than G. rudata and so is probably lower longus with horizon 1d at this point. At 1233m(swc) a good assemblage contains more N. senectus than G. rudata and youngest Tricolpites sabulosus (horizon 2a) and is clearly lower longus Zone. C. bretonica has its oldest occurrence here in swcs, but occurs in one cuttings sample beneath.

Overall, Proteacidites dominate all assemblages with G. rudata frequent at the top and N. endurus, Phyllocladidites mawsonii and Tricolpites confessus frequent. Dinoflagellates are very rare in all samples studied but with M. conorata frequent at the top and C.

bretonica at the base.

Environments are all nearshore to marginal marine with very low dinoflagellate content and diversity.

B 1271m(cutts) - 1295m(swc) (?1369m swc) : lillei Zone (korojonense dino Zone)

Assignment to the Tricolporites lillei Zone of Campanian age is indicated at the top by the absence of younger spore-pollen indicators but confirmed by dinoflagellate horizon 3 (youngest I. cretacea) and coincident here with youngest Odontochitina spp. At 1295m, oldest T. lillei in swc (horizon 3b) indicates the zone base and is confirmed by oldest I. pellucida herein (horizon 3c) indicating the base of the korojonense dino Zone. In the original Pecten-1A report, Dettmann recorded I. pellucida at 1369m but I cannot duplicate it in the existing slide set. I suspect the slide set is incomplete. If her identification is accepted, horizon 3c would lie at 1369m, placing this thicker interval in both the T. lillei spore-pollen zone and the I. korojonense dinoflagellate zone. Neither Dettmann nor I saw T. lillei below 1295m(swc). Since no older markers were seen, it seems likely that 1271-1369m should all be assigned. Oldest Triporopollenites sectilis (horizon 3a) occurs at 1271m(swc). Canninginopsis bretonica and Manumiella conorata occur at 1271m but are considered caved in these cuttings.

Within the interval, Proteacidites spp are common to abundant with frequent Cyathidites and intermittently frequent Camarozonosporites ohaiensis, Dilwynites granulatus, Phyllocladidites mawsonii, Tricolpites confessus and Nothofagidites endurus.

Environments are nearshore to marginal marine, with dinoflagellate content from <1% with very low diversity, to 12% with moderate diversity at 1271m (although this may be partly caved). The marine maximum at 1271m may be close to a maximum flooding surface.

C 1387m(cutts) - ?1570m(cutts) : upper to middle senectus Zone (upper australis dino Zone 1387-1428m, lower australis Zone 1460m, aceras Zone 1500-1722m swc).

Assignment to the middle to upper Nothofagidites senectus Zone of Campanian age is indicated at the top by the absence of younger spore-pollen markers and confirmed by the dinoflagellate horizon 4 (youngest Xenikoon australis, here associated with youngest Xenescus ceratoides and Anthosphaeridium wisemaniae). The base is poorly defined on spore-pollen criteria with oldest Tricolpites sabulosus (horizon 7e) occurring in swc at 1533m but consistently in cuttings to 1570m. Considering other data, the cuttings base is probably more reliable. Oldest G. rudata (horizon 7a) occurs at 1428m in swc and only rarely in cuttings beneath but is so inconsistent that its true base may be slightly deeper. Amongst the dominant spore-pollen, Proteacidites spp, Falcisporites and P. mawsonii are common while Nothofagidites endurus, Stereisporites antiquasporites, Dilwynites granulatus, Tricolpites sabulosus and Gleicheniidites are intermittently frequent.

Amongst the dinoflagellates, youngest Areosphaeridium suggestium (horizon 4a), youngest Nelsoniella aceras and N. semireticulata (horizon 5) and the downhole acme of X. australis (horizon 6) all occur at 1460m(cutts). A single specimen of N. aceras at 1411m is anomolously high and is considered reworked. Beneath this, youngest Nelsoniella tuberculata (horizon 7) occurs at 1500m(cutts) and oldest N. tuberculata and N. semireticulata occur at 1570m(cutts) (horizon 7c).

Within the interval, dinoflagellates are never common with X. australis and Nelsoniella spp the most consistent towards the top and Heterosphaeridium spp the most frequent below 1533m.

Environments all appear to be nearshore to marginal marine, with dinoflagellate contents from <1% to 7%. Marine maxima appear to be at 1500m, 1536m and 1561m, but these are all cuttings and may be partly contaminated.

D 1579m(swc)-?1722(swc) : lower senectus Zone (aceras dino Zone 1579-1722m)

This interval is not adequately defined on spore-pollen ranges but relies on the dinoflagellates for firm correlation. The top is taken in the sample beneath oldest T. sabulosus (horizon 7e) and the base in the sample above I. belfastense (horizon 10). Oldest N. senectus (horizon 9a) occurs at 1548m and is in swc. Oldest N. endurus (usually equivalent to 9a) occurs at 1579m(swc) but both species are very rare near their baseranges. Within the interval, spore-pollen are dominant at the top with Proteacidites common to abundant and Falcisporites, Cyathidites and P. mawsonii frequent. Towards the base, spore-pollen are subordinate with Falcisporites, Microcachryidites antarcticus and P. mawsonii frequent.

Amongst the dinoflagellates, important correlative datums include oldest X. australis in swcs (horizon 7b) at 1579m, oldest N. aceras (horizon 9b) in swc at 1645m although it occurs deeper in cuttings, youngest O. obesa (horizon 7d) and Heterosphaeridium 10%+ (horizon 8) at 1679m(cutts) and youngest Heterosphaeridium 20%+ (horizon 9) and youngest Trithyrodinium suspectum at 1722m(swc). Within the interval, Heterosphaeridium spp are the most numerous throughout and become common to abundant at the base.

Environments grade rapidly from apparently offshore near the base (60% but moderate diversity at 1722m) through intermediate marine (27% at 1679m) and nearshore (12% at 1645m, 9% at 1615m) to marginal marine (<1% at 1579m), The marine maximum is clearly at the base in the sample at 1722m and probably represents a major maximum flooding surface.

E 1734(cutts) : upper apoxyexinus Zone (cretacea dino Zone)

Assignment to the Tricolporites apoxyexinus Zone is indicated at the top on the dinoflagellate horizon 10 youngest Isabelidinium belfastense and Amphidiadema denticulata and at the base on oldest rare A. cruciformis (here 2% and overlies horizon 11) and oldest I. belfastense and A. denticulata (horizon 11a). Heterosphaeridium at 29% suggests also horizon 10a but is equivocal as an older Heterosphaeridium flood occurs in the swc sample below. At this stage the two appear to be distinctive as the upper flood contains the heavier and larger H. solida while the lower flood does not.

In this sample the spore pollen contain frequent Cyathidites, Falcisporites and Osmundacidites while the dinoflagellates are totally dominated by common Heterosphaeridium spp with frequent Odontochitina operculata and many rare partly caved elements including Nelsoniella spp.

Offshore marine environments are indicated by the slight dominance (52%) of diverse microplankton. Clearly a major marine maximum lies nearby but as these are cuttings, it may lie slightly above this point possibly near 1722m(swc) in the zone above. Environments therefore appear to be offshore marine but may be caved.

F 1748m(swc) : mawsonii Zone

Assignment to the Phyllocladidites mawsonii Zone (= former Clavifera triplex Zone) of Coniacian-Turonian age is indicated at the top by youngest Appendicisporites distocarinatus (horizon 12c or possibly 13) and at the base by oldest P. mawsonii in swc (horizon 15a). A single operculum of possible Cribroperidinium edwardsii suggests that horizon 14 has been penetrated, but this is only tentatively suggested in the absence of whole specimens.

Amoungst the dominant spore pollen (79% of palynomorphs), Cyathidites are common and Dilwynites granulatus, Falcisporites and Microcachryidites antarcticus and A. distocarinatus are frequent. A rare component is Cyatheacidites tectifera. Of the dinoflagellates, Heterosphaeridium heteracanthum is common with other components rare.

Nearshore marine environments are indicated by the dinoflagellate content (21%) although the low diversity (6 species) suggests that a nearshore to marginal marine range may be more appropriate.

G 1765m(cutts) : mawsonii to distocarinatus Zone (infusoriodes dino zone)

Spore-pollen zonal assignment is uncertain in this cuttings sample. Both P. mawsonii and A. distocarinatus are present and in swc would indicate the mawsonii Zone. However, if the P. mawsonii is caved (as is likely given the Campanian caving seen), then the distocarinatus Zone is indicated. Within the sample, Dilwynites granulatus is very common and Appendicisporites tricornitatus occurs, along with common Falcisporites and frequent A. cruciformis, Gleicheniidites and M. antarcticus.

Amongst the dinoflagellates, heavy Campanian and Santonian caving is seen, but new elements include youngest C. edwardsii (horizon 14 or possibly 15) youngest Aptea sp, Cleistosphaeridium huguonioti, Cyclonephelium membraniphorum, Microdinium sp and Xiphopheridium alatum. Several of these horizons may have correlative value but need to be tested first. C. edwardsii only occurs as 1% in the grain count but is heavily diluted by caving and may be frequent (4%+) in uncontaminated rock. If so, horizon 15 has been penetrated. In any case, youngest C. edwardsii indicates the Palaeohystrichophora infusorioides Zone of Cenomanian-Turonian age.

Environment appear to be intermediate marine (24% dinoflagellates) but are clearly heavily contaminated. Nearshore to marginal marine environments appear much more likely.

H 1776m(swc) - 1789m(cutts) : distocarinatus Zone (infusorioides dino Zone)

Assignment to the A. distocarinatus Zone is indicated at the top by the absence of P. mawsonii and at the base by oldest A. cruciformis, coincident with oldest dinoflagellates and the base of saccate pollen dominated floras. Amongst the spore-pollen, Cyathidites, Falcisporites and M. antarcticus are common, with Araucariacites australis and Osmundacidites frequent. Amongst the dinoflagellates, C. membraniphorum and C. edwardsii are consistent, with the cuttings at 1789m hopelessly contaminated with caved Santonian and

Campanian. Youngest Palaeoperidinium cretaceum occurs at 1776m and an influx of Circulodinium deflandrei occurs at 1789m and these may have future correlative potential.

Environments are probably marginal marine, with low content (7%) and diversity (4 species) of dinoflagellates.

I 1804m(swc) : pannosus Zone

Assignment to the Phimopollenites pannosus Zone of latest Albian age is indicated by the downhole influx of spore dominated assemblages including frequent Cicatricosisporites australiensis and rare Aequitriradites spp, Crybelosporites striatus and Perotriletes jubatus. At the base, oldest P. pannosus indicates the assignment. Amongst the spore-pollen, Cyathidites are totally dominant (43%) with frequent C. australiensis, O. wellmannii, Retitriletes austroclavatidites and Stereisporites antiquasporites. The only frequent pollen is Falcisporites. Dinoflagellates are totally absent.

Slightly brackish environments are indicated by the totally dominant and diverse spore-pollen and only a single spiny acritarch (Micrhystridium sp).

J Beneath this point, a thick Early Cretaceous section exists but was beyond the scope of this project.

IV CONCLUSIONS

A The new cuttings based palynostratigraphy has vastly increased resolution and confidence in this section, providing tighter correlation, and proving its potential as a fast turnaround downhole exploration tool.

B Grain counts have helped locate likely sequence boundaries and maximum flooding surfaces. Although clearly interpretative, likely major sequence boundaries might be 68my at 1120m, 71my at 1195m, 75my at 1238m, 80my at 1360m, 85my and 87.5my at 1745m, 90my at 1752m, 94my at 1772m and 98my at 1792m. Maximum flooding surfaces might be 69.5my at 1183m, 73.5my at 1237, 79.5my at 1333m, 83.75my at 1725m, 89my at 1745m, and 97my at 1776m.

C Deposition above base Campanian senectus Zone is rapid and even, while deposition in the Cenomanian to Santonian is extremely condensed. This change in depositional style may be related to Tasman Sea rifting as described by Lowry and Longley (1991).

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A N A L Y S T: ROGER MORGAN D A T E : FEBRUARY 1992
N O T E S: ALL DEPTHS IN METRES
FIGURES ARE PERCENTAGES

RANGE CHART OF OCCURRENCES BY HIGHEST APPEARANCE DINOS & S/P

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	HETEROSPHAERIDIUM HETEROCANTHUM	MANUMIELLA CORONATA	MANUMIELLA DRUGGII	CANNINGINOPSIS BRETONICA	ISABELIDINIUM PELLUCIDUM	CORDOSPHAERIDIUM INODES	CORDOSPHAERIDIUM MULTISPINOSUM	DEFLANDREA SPECIOSA	SENONIASPHAERA ABSCONDIATA	SPINIFERITES FURCATUS/RAMOSUS	NUMMUS	SPINIDINIUM ECHINOIDEA	ALTERBIA ACUTULA	AREOLIGERA SENONENSIS	CRIBROPERIDINIUM SP	ISABELIDINIUM CRETACEUM	ODONTOCHITINA CF INDISTINCTA	ODONTOCHITINA STUBBY	SPINIDINIUM SP	TRITHYRODINIUM	TRITHYRODINIUM THIN FINE RETICULATE	EXOCHOSPHAERIDIUM PHRAGMITES
-103 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1126 SWC	1	2	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

1158	SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1168	SWC	.	.	.	X	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1201	CUTTS	.	.	.	.	.	1	1	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.
1233	SWC	1	.	.	4	.	.	.	.	.	.	X	X	.	.	.	.	.	.	.	.	.	.
1271	CUTTS	.	1	.	2	3	.	.	.	.	.	6	.	X	3	1	1	?	X	1	X	.	.
1295	SWC	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.
1342	SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1369	SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X
1387	CUTTS	.	.	.	.	X	.	.	.	.	.	4	.	.	.	X	.	1	.	X	.	.	.
1408	SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1411	CUTTS	X	X	X	.	.	.	.	.	.	X	2	.	.	.	.	X	.	.	.	.	.	.
1428	SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.
1460	CUTTS	.	.	.	.	X	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.
1500	CUTTS	1	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	X
1533	SWC	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1536	CUTTS	.	.	.	.	X	.	.	.	.	X	.	X	.	.	.	.	.	.	.	.	.	.
1548	SWC	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
1561	CUTTS	2	.	.	.	.	.	.	.	.	2	1	.	.	.	.	.	.	.	.	.	.	X
1570	CUTTS	1	.	.	.	X	.	.	.	.	.	X	.	.	.	X	X	.	.	.	.	.	.
1579	SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1615	SWC	5	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.
1645	SWC	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1679	CUTTS	2	.	.	.	.	.	.	.	.	2	.	.	.	.	.	1	.	.	.	.	.	1
722	SWC	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1734	CUTTS	27	.	.	.	.	.	.	.	.	2	.	.	.	.	.	1	.	X	.	.	.	1
1748	SWC	15	.	.	.	.	.	.	.	.	2	.	.	.	.	2	.	.	.	.	.	.	1
1765	CUTTS	12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	X	.	.	.	1
1776	SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.
1789	CUTTS	5	.	.	.	.	.	.	.	.	2	2	.	.	.	.	.	.	X	.	.	.	2
1804	SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

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126 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1158 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1168 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
201 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
233 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1271 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
295 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
342 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1369 SWC	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
387 CUTTS	.	X	X	X	1	1	1	3	X	.	.	.	.	.	.	.	.	.	.	.	.	.
408 SWC	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.
1411 CUTTS	.	.	.	.	.	.	X	X	1	X	X	X	?	X	1	X	X	1	.	.	.	.
1428 SWC									X													

1460	CUTTS	.	.	.	.	.	.	.	.	3	.	.	.	.	X	.	.	.	.	X	2	X	X
1500	CUTTS	.	.	.	.	.	.	.	.	3	.	.	.	2	X	.	.	.	.	.	.	.	.
1533	SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1536	CUTTS	.	.	.	.	.	.	.	.	3	.	.	.	X	X	.	.	.	.	.	1	.	.
1548	SWC	.	.	.	.	.	.	.	.	1	.	.	.	.	X	.	.	.	.	.	R	.	.
1561	CUTTS	.	.	.	.	1	1	.	2	2	.	.	X	.	.	X	.	X	.	.	.	.	.
1570	CUTTS	.	.	.	.	.	.	X	1	2	.	.	.	X	1	1	.	.	.	.	X	X	.
1579	SWC	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.
1615	SWC	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	2	.	.
1645	SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.
1679	CUTTS	.	.	.	.	.	.	1	.	X	.	.	.	.	1	1	.	.	.	.	.	.	.
1722	SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1734	CUTTS	.	.	.	.	1	.	.	.	.	.	.	.	X	1	1	.	.	X	.	2	X	.
1748	SWC	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1765	CUTTS	1	.	.	.	X	.	.	.	.	.	.	.	X	X	2	.	.	X	.	.	.	.
1776	SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1789	CUTTS	1	.	.	.	3	.	.	X	X	.	.	.	.	X	.	.	.	X	.	.	.	.
1804	SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Sample	45 MILLIOUDODINIUM TENUITABULATUS	46 NELSONIELLA SEMIRETICULATA	47 NUMMUS MONOCULATUS	48 ODONTOCHITINA OPERCULATA	49 SENONIASPHAERA LORDII	50 HETEROSPHAERIDIUM LATEROBRACHIUS	51 HETEROSPHAERIDIUM SOLIDA	52 ISABELIDINIUM NUCULUM	53 NELSONIELLA TUBERCULATA	54 ODONTOCHITINA PORIFERA	55 OLIGOSPHAERIDIUM DICTYOPHORUM	56 ODONTOCHITINA COSTATA	57 CHATANGIELLA TRIPARTITA	58 EURYDINIUM INGRAMII	59 HETEROSPHAERIDIUM CONJUNCTUM	60 OLIGOSPHAERIDIUM PULCHERRIMUM	61 APTEODINIUM GRANULATUM	62 NELSONIELLA PSILATE	63 NELSONIELLA MINI ACERAS	64 ODONTOCHITINA CRIBROPODA	65 ODONTOCHITINA OBESOPERCULATA	66 ODONTOCHITINA OBESOPORIFERA
1103 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1126 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1158 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1168 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1201 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1233 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1271 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1295 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1342 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1369 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1387 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1408 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1411 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1428 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1460 CUTTS	X	X	3	X	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1500 CUTTS	.	X	.	.	.	X	X	X	X	X	X	.	.	.	.	.	.	.	.	.	.	.
1533 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1536 CUTTS	.	X	.	.	.	X	4	.	X	.	.	X	.	.	.	.	.	.	.	.	.	.
1548 SWC	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1561 CUTTS	.	X	.	.	X	.	1	.	X	X	.	.	X	1	X	X	.	.	.	.	.	.
1570 CUTTS	.	X	.	.	.	X	.	.	X	X	.	.	1	.	.	.	X	.	.	.	.	.
1579 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1615 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1645 SWC	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	?	.	.	.	.
1679 CUTTS	.	.	.	4	.	X	13	.	.	X	.	X	.	.	.	.	.	.	X	1	X	X

1734 CUTTS	.	.	.	5	.	X	2	.	.	X	.	2	.	.	.	.	.	.	3	X	X	.
1748 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1765 CUTTS	X	.	.	3	.	X	X	.	.	X	.	.	.	.	.	2	.	.	.	X	X	.
1776 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1789 CUTTS	.	.	.	3	.	.	2	.	.	2	.	1	.	.	.	2	.	.	.	X	.	.
1804 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

	CASSICULOSPHAERIDIA MEGARETICULATA	CHATANGIELLA VICTORIENSIS	TRITHYRODINIUM SUSPECTUM	AMPHIDIADEMA DENTICULATA	CASSICULOSPHAERIDIA MEGAFINE	ISABELIDINIUM BELFASTENSE	ISABELIDINIUM BELFASTENSE ROTUNDA	SUBTILISPHAERA FOLIACEA	TRITHYRODINIUM THICK PSILATA	TRITHYRODINIUM THICK VERRUCATE	CRIBROPERIDINIUM EDWARDSII	ALTERBIA ACUMINATUM	APTEA SP	CHLAMYDOPHORELLA NYEI	CIRCULODINIUM DEFLANDREI	CLEISTOSPHAERIDIUM HUGUONIOTI	CYCLONEPHELIUM MEMBRANIPHORUM	DINOGYMNIUM ACUMINATUM	MICRODINIUM SP	ODONTOCHITINA STUBBY SOLID	XIPHOPHORIDIUM ALATUM	CALLAOISPHAERIDIUM ASYMMETRICUM
	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88
1103 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
126 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1158 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1168 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
201 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
233 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1271 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1295 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
342 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1369 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1387 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
408 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
411 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1428 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
460 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
500 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1533 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1536 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
548 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1561 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1570 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
579 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
515 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1645 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
679 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
722 SWC	9	4	13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1734 CUTTS	.	X	1	X	X	1	X	1	1	X	.	.	.	.	.	.	.	.	.	.	.	.
1748 SWC	.	.	.	.	.	.	.	.	.	.	?	.	.	.	.	.	.	.	.	.	.	.
765 CUTTS	.	X	.	.	X	X	X	.	X	.	1	X	X	1	1	X	X	X	X	X	X	.
776 SWC	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	3	.	.	.	.	.
1789 CUTTS	.	X	X	X	.	.	.	.	X	.	X	.	.	1	5	.	.	.	.	X	.	X
804 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

S

TES

	CLEISTOSPHAERIDIUM SP	CYCLONEPHELIUM COMPACTUM	MICRHYSTRIDIUM	PALAEOPERIDINIUM CRETACEUM	GAMBIERINA RUDATA	ARAUCARIACITES AUSTRALIS	CAMEROZONOSPORITES OHAIENSI	CYATHIDITES AUSTRALIS	CYATHIDITES MINOR	DILWYNITES GRANULATUS	DILWYNITES TUBERCULATUS	ERICIPITES SCABRATUS	GAMBIERINA EDWARDSII	GLEICHENIIDITES	MICROCACHRYIDITES ANTARCTIC	NOTHOFAGIDITES ENDURUS	OSMUDACIDITES WELLMANII	PHYLLOCLADIDITES MAWSONII	PHYLLOCLADIDITES VERRUCOSUS	PROTEACIDITES HAPUKUI	PROTEACIDITES SP	RETITRILETES AUSTROCLAVATID
	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110
103 SWC	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1126 SWC	.	.	.	.	23	1	4	1	5	1	3	1	1	2	1	6	2	8	1	X	22	1
158 SWC	.	.	.	.	3	.	.	1	2	.	.	.	.	.	1	.	.	2	.	.	8	1
168 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	3	.
1201 CUTTS	.	.	.	.	1	.	.	2	3	2	.	.	.	5	1	3	.	6	.	.	.	3
1233 SWC	.	.	.	.	1	.	2	2	3	3	.	1	.	.	2	3	.	6	.	.	40	1
271 CUTTS	.	.	.	.	.	1	8	5	7	4	.	.	.	3	2	3	.	3	.	.	18	3
295 SWC	.	.	.	.	X	2	X	3	6	13	.	1	1	1	2	2	1	9	.	.	27	4
1342 SWC	.	.	.	.	.	.	.	.	4	.	.	.	.	1	.	.	.	2	.	.	4	.
369 SWC	.	.	.	.	.	7	.	3	8	4	.	.	.	3	2	6	1	4	.	.	29	2
387 CUTTS	.	.	.	.	X	2	X	2	5	9	.	.	.	4	2	5	1	17	.	.	8	4
1408 SWC	.	.	.	.	.	1	1	4	11	3	.	.	.	1	3	4	1	8	.	.	33	4
411 CUTTS	.	.	.	.	.	5	1	1	1	2	.	.	.	1	.	10	1	19	.	.	7	1
428 SWC	.	.	.	.	1	1	2	5	10	3	.	.	.	5	4	3	5	5	.	.	23	3
460 CUTTS	.	.	.	.	.	.	1	2	7	3	.	.	.	.	6	1	7	10	X	.	14	7
1500 CUTTS	.	.	.	.	.	2	X	4	5	10	.	.	.	3	6	1	5	13	.	.	8	4
533 SWC	.	.	.	.	.	1	X	4	6	9	.	.	.	7	4	1	.	12	.	.	20	3
536 CUTTS	.	.	.	.	.	.	3	2	7	7	.	.	.	3	3	.	1	16	1	.	10	3
1548 SWC	.	.	.	.	.	2	.	3	5	10	.	.	.	2	3	1	1	8	2	.	21	1
561 CUTTS	.	.	.	.	.	.	1	3	2	9	.	.	X	1	9	3	.	13	1	.	8	.
570 CUTTS	.	.	.	.	1	6	1	4	6	5	.	.	.	3	2	3	3	8	.	.	14	3
1579 SWC	.	.	.	.	.	3	X	.	.	6	.	.	.	4	2	X	1	4	.	.	34	3
615 SWC	.	.	.	.	.	1	.	3	9	10	1	.	.	3	6	.	1	8	.	.	22	5
645 SWC	.	.	.	.	?	.	X	4	6	5	.	.	.	5	5	.	6	8	1	.	17	4
679 CUTTS	.	.	.	.	.	3	.	1	4	6	.	.	.	1	3	.	10	9	.	.	4	2
1722 SWC	.	.	.	.	.	.	2	1	4	4	.	.	.	2	7	.	.	1	.	.	.	2
734 CUTTS	.	.	.	.	.	.	.	4	7	2	.	.	.	3	3	.	6	X	.	.	1	1
748 SWC	.	.	.	.	.	2	.	8	14	5	.	.	.	5	7	.	2	3	.	.	.	3
1765 CUTTS	.	.	.	.	.	.	X	2	4	19	.	.	.	5	7	.	1	2	.	.	X	.
776 SWC	.	.	.	.	.	9	.	3	20	4	.	.	.	2	17	.	7	.	.	.	.	1
789 CUTTS	1	X	2	3	.	3	1	3	4	13	.	.	.	6	6	.	4	4	1	.	3	.
1804 SWC	.	.	1	.	.	1	.	29	14	.	.	.	.	2	.	.	7	.	.	.	.	8

ORITES ANTIQUASPORITES

ORITES REGIUM

TES LONGUS

RITES LILLIEI

OLLENITES SECTILIS

ITES MICROSACCATUS

DITES LARGE

TES CONFESSUS

LIS CRUCIFORMIS

POLLIS OBSCURUS

RITES SIMILIS

POLLENITES POLYORATUS

DITES SMALL

TES FOLLICULARIS

RITES ELLIOTTII

OLLENITES BALMEI

IDITES SENECTUS

ETES JUBATUS/MORGANII

DITES RETICULOCONCAVUS

TES SABULOSUS

TES WAIPARAENSIS

RITES

		STEREIS	STEREIS	TRICOLP	TRICOLP	TRIPORO	PODOSPO	PROTEAC	TRICOLP	AMOSOPO	AUSTRAL	FALCISP	PERIPOR	PROTEAC	CYCADOP	HERKOSP	LYGISTE	NOTHOFA	PEROTRI	PROTEAC	TRICOLP	TRICOLP	TRICOLP
		111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132
1103	SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
126	SWC	4	1	4	2	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
158	SWC	1	1	.	.	.	1	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1168	SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
201	CUTTS	.	.	.	.	.	.	1	.	2	2	6	1	8	.	.	.	.	.	.	.	.	.
233	SWC	4	X	X	X	X	3	.	6	1	1	.	.	.	2	X	2	3	1	X	X	X	1
1271	CUTTS	.	.	.	.	1	.	.	.	.	1	3	.	.	.	.	3	.	.	.	1	.	.
295	SWC	3	.	.	1	.	1	.	7	4	2	4	.	.	.	.	X	.	.	.	.	.	.
342	SWC	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
1369	SWC	2	.	.	.	.	2	.	3	1	1	9	.	.	4	.	X	.	X	.	5	.	.
1387	CUTTS	X	X	.	.	.	.	1	.	.	.	15	1	.	1	.	X	.	1	.	2	.	.
408	SWC	1	.	.	.	.	2	3	.	.	.	7	1	.	.	.	2	5	.	.	X	.	.
411	CUTTS	1	2	.	.	X	3	1	X	1	.	14	X	.	.	.	3	.	.	.	3	.	.
1428	SWC	7	.	.	.	.	2	3	2	.	2	2	.	.	1	.	.	6	.	.	4	.	.
460	CUTTS	2	.	.	.	.	1	2	.	X	2	19	X	.	.	.	.	X	.	.	7	.	.
500	CUTTS	X	X	.	.	.	2	1	.	.	4	11	.	.	1	.	.	.	.	.	4	.	.
1533	SWC	4	.	.	.	.	3	3	2	.	5	4	.	.	.	.	.	2	X	.	1	.	.
1536	CUTTS	2	.	.	.	.	.	.	.	1	6	18	.	.	1	.	.	.	.	.	1	.	.
548	SWC	5	.	.	.	.	4	2	4	X	3	10	.	.	2	.	.	X	X	.	.	.	.
561	CUTTS	.	.	.	.	.	2	1	.	1	2	21	.	.	.	.	X	.	1	.	5	.	.
1570	CUTTS	.	.	.	.	.	2	3	.	2	3	11	.	.	.	.	X	.	2	.	1	.	.
579	SWC	12	.	.	.	.	13	2	1	.	1	7	1	.	3	.	.	.	X	.	.	.	1
615	SWC	.	.	.	.	.	3	2	1	1	3	7	.	.	1	.	.	.	.	.	.	.	.
1645	SWC	2	.	.	.	.	4	2	2	2	3	5	.	.	.	.	.	.	.	.	.	.	.
679	CUTTS	1	.	.	.	.	1	.	.	2	2	17	.	.	.	.	.	.	.	.	.	.	.
722	SWC	2	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	X	.	.	.	.
1734	CUTTS	X	.	.	.	.	.	.	.	2	.	7	.	.	.	.	.	.	X	.	.	.	.
1748	SWC	2	.	.	.	.	3	.	.	4	.	9	.	.	.	.	.	.	.	.	.	.	.
765	CUTTS	1	.	.	.	.	3	.	.	9	.	13	.	.	.	.	.	.	.	.	.	.	.
776	SWC	4	.	.	.	.	4	.	.	2	.	13	.	.	2	.	.	.	.	.	.	.	.
1789	CUTTS	1	.	.	.	.	.	.	.	2	.	13	.	.	.	.	.	.	2	.	.	.	.
804	SWC	6	.	.	.	.	3	.	.	.	.	9	.	.	.	.	.	.	2	.	.	.	.

	133 CERATOSPORITES EQUALIS	134 CICATRICOSISPORITES AUSTRALIENSIS	135 CINGUTRILETES CLAVUS	136 CLAVIFERA TRIPLEX	137 DICTYOPHYLLIDITES	138 GEPHRAPOLLENITES WAHOOENSIS	139 ISCHYOSPORITES PUNCTATUS	140 LYGISTEPOLLENITES FLORINII	141 ORNAMENTIFERA SENTOSA	142 TETRACOLPORITES OAMARUENSIS	143 TETRACOLPORITES RETICULATUS	144 TRICOLPORITES APOXYEXINUS	145 CICATRICOSISPORITES RADIATUS	146 LILIACIDITES POROREТICULATUS	147 TRICOLPITES GILLII	148 BALMEISPORITES HOLODICTYUS	149 NEORAISTRICKIA	150 CONTIGNISPORITES COOKSONIAE	151 FORAMINISPORIS DAILYI	152 AEQUITRIRADITES SPINULOSUS	153 CAMEROZONOSPORITES BULLATUS	154 LEPTOLEPIDITES VERRUCATUS
103 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
126 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1158 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

[illegible]	SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1201	CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1233	SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1271	CUTTS	2	1	1	2	2	X	1	2	X	1	1	1	.	.	.	.	.	.	.	.	.	.
1295	SWC	2	X	.	2	.	.	.	.	.	.	.	.	X	1	1	.	.	.	.	.	.	.
1342	SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1369	SWC	.	X	.	.	.	.	.	2	.	.	.	2	.	.	X	.	.	.	.	.	.	.
1387	CUTTS	3	.	X	X	3	.	.	.	.	.	.	.	.	.	.	X	1	.	.	.	.	.
1408	SWC	1	.	.	1	.	.	.	.	.	.	.	.	.	.	2	.	.	X	1	.	.	.
1411	CUTTS	3	X	.	1	4	.	.	X	1	.	.	.	.	.	2	.	.	.	.	X	X	1
428	SWC	2	1	X	1	.	.	.	.	.	.	X	.	.	.	2	.	.	.	.	X	.	2
1460	CUTTS	1	X	1	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.
1500	CUTTS	3	.	1	5	1	.	.	.	X	.	.	.	.	.	.	.	1	X	.	.	.	.
533	SWC	4	X	.	X	1	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.
536	CUTTS	3	X	.	2	.	.	.	.	X	.	.	X	.	.	X	X	.	.	.	.	.	.
1548	SWC	2	X	X	.	.	.	.	.	.	.	.	1	.	.	2	.	.	.	.	X	.	.
561	CUTTS	2	X	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	1	X	.
570	CUTTS	4	1	.	1	3	1	.	.	1	.	.	.	.	.	X	X	X	X	.	.	X	X
1579	SWC	.	.	.	1	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.
1615	SWC	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1	X	.	.	.	.	1	.
645	SWC	.	.	.	1	.	.	.	.	2	.	.	.	1	.	2	.	.	.	X	.	.	X
679	CUTTS	2	1	1	1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
1722	SWC	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
734	CUTTS	1	X	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
748	SWC	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1765	CUTTS	2	X	1	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
776	SWC	3	1	X	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
789	CUTTS	1	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
1804	SWC	3	4	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	3

	155 RETITRILETES FACETUS	156 COROLLINA TOROSUS	157 DICTYOTOSPORITES SPECIOSUS	158 FALCISPORITES GRANDIS	159 INTERULOBITES INTRAVERRUCATUS	160 COPTOSPORA PILEOSA	161 LYCOPODIACIDITES ASPERATUS	162 PEROTRILETES MAJUS	163 TRIPOROLETES SIMPLEX	164 AEQUITRIRADITES TILCHAENSIS	165 CAMEROZONOSPORITES	166 KLUKISPORITES SCABERIS	167 LAEVIGATOSPORITES OVATUS	168 MUROSPORA FLORIDA	169 POLYCINGULATISPORITES CRENULATUS	170 TRILOBOSPORITES TRIORETICULOSUS	171 FOVEOGLEICHENIIDITES	172 KUYLISPORITES ZIPPERI	173 PHIMOPOLLENITES PANNOSUS	174 CYATHEACIDITES TECTIFERA	175 TRIPOROLETES RADIATUS	176 VITREISPORITES PALLIDUS
1103 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1126 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
158 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
168 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1201 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
233 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
271 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1295 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
342 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
369 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1387 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1408 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
411 CUTTS	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
428 SWC	.	X	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1460 CUTTS	.	.	1	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

1500 CUTTS	.	1	.	.	.	X	X	X	X	.	.	.	.	.	.	.	.	.	.	.	.	.
1533 SWC	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1536 CUTTS	.	.	1	.	.	.	1	.	.	X	1	1	.	.	.	.	.	.	.	.	.	.
1548 SWC	.	X	.	1	.	.	.	.	.	.	.	.	1	X	X	X	.	.	.	.	.	.
1561 CUTTS	.	X	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1570 CUTTS	X	1	.	.	.	1	.	.	.	X	.	.	.	.	.	.	X	1	.	.	.	.
1579 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
1615 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.
1645 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	1	1
1679 CUTTS	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1722 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1734 CUTTS	.	3	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1748 SWC	.	1	.	.	.	.	2	.	.	.	.	.	1	.	.	.	.	.	.	X	.	.
1765 CUTTS	.	.	.	2	.	.	X	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
1776 SWC	.	.	.	2	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1789 CUTTS	.	X	.	.	.	.	1	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
1804 SWC	.	2	.	1	.	.	.	.	X	.	.	X	.	.	.	.	.	.	X	.	.	.

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1103 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1103 SWC
1126 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1126 SWC
1158 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1158 SWC
1168 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1168 SWC
1201 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1201 CUTTS
1233 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1233 SWC
1271 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1271 CUTTS
1295 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1295 SWC
1342 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1342 SWC
1369 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1369 SWC
1387 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1387 CUTTS
1408 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1408 SWC
1411 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1411 CUTTS
1428 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1428 SWC
1460 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1460 CUTTS
1500 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1500 CUTTS
1533 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1533 SWC
1536 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1536 CUTTS
1548 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1548 SWC
1561 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1561 CUTTS
1570 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1570 CUTTS
1579 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1579 SWC
1615 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1615 SWC
1645 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1645 SWC
1679 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1679 CUTTS
1722 SWC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1722 SWC
1734 CUTTS	1	1	X	1	.	.	.	.	.	.	.	.	.	.	.	1734 CUTTS

1748 SWC	.	.	.	.	6	.	.	.	.	.	.	.	.	.	.	1748 SWC
1765 CUTTS	.	.	.	X	?	X	1	.	.	.	.	.	.	.	.	1765 CUTTS
1776 SWC	.	.	.	.	.	.	.	X	X	.	.	.	.	.	.	1776 SWC
1789 CUTTS	.	1	.	X	X	.	.	.	.	X	X	.	.	.	.	1789 CUTTS
1804 SWC	.	X	.	X	.	X	.	.	.	.	X	X	1	1	1	1804 SWC

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114 TRICOLPORITES LILLIEI
170 TRILOBOSPORITES TRIORETICULOSUS
175 TRIPOROLETES RADIATUS
180 TRIPOROLETES RETICULATUS
163 TRIPOROLETES SIMPLEX
115 TRIPOROPOLLENITES SECTILIS
20 TRITHYRODINIUM
39 TRITHYRODINIUM FINEGRANULATE
69 TRITHYRODINIUM SUSPECTUM
75 TRITHYRODINIUM THICK PSILATA
76 TRITHYRODINIUM THICK VERRUCATE
21 TRITHYRODINIUM THIN FINE RETICULATE
40 TRITHYRODINIUM THIN PSILATE
176 VITREISPORITES PALLIDUS
30 XENASCUS CERATOIDES
31 XENIKOON AUSTRALIS
87 XIPHOPHORIDIUM ALATUM

PALYNOLOGICAL DATA SHEET

BASIN: OTWAY SPORE-POLLEN ZONES ELEVATION: KB: ______ GL: ______

WELL NAME: PECTEN-1A TOTAL DEPTH: ______

AGE		PALYNOLOGICAL ZONES	HIGHEST DATA Preferred Depth	Rtg	HIGHEST DATA Alternate Depth	Rtg	LOWEST DATA Preferred Depth	Rtg	LOWEST DATA Alternate Depth	Rtg
NEOGENE	Plei	T. pleistocenicus								
	Plio	M. lipsus								
	Mio	C. bifurcatus								
		T. bellus								
		P. tuberculatus								
	Olig	upper N. asperus								
PALEOGENE	L.Eo	mid N. asperus								
	Mid Eo	lower N. asperus								
		P. asperopolus								
	Earl Eo	upper M. diversus								
		mid M. diversus								
		lower M. diversus								
	Pale	upper L. balmei								
		lower L. balmei								
LATE CRETACEOUS	Maas	upper T. longus	1126	0			1126	1	1158	2
		lower T. longus	1168	2			1233	0		
	Camp	T. lillei	1271	2			1295	1	1369	?
		N. senectus	1387	3			1579	0	1722	?
	Sant	up T. apoxyexinus	1734	3			1734	4		
		mid T. apoxyexinus								
	Con	low T. apoxyexinus								
	Tur	P. mawsonii	1748	2			1748	0		
	Ceno	A. distocarinatus	1776	2			1789	4		
EARLY CRETACEOUS	Alb	P. pannosus	1804	1						
		upper C. paradoxa	Early Cretaceous present but							
		lower C. paradoxa	outscope the scope of this review.							
		C. striatus								
	Apt	upper C. hughesi								
		lower C. hughesi								
	l.Ne	F. wonthaggiensis								
	e.Ne	up C. australiensis								

Environments :

- o lacustrine (algal acritarchs).
- non-marine (no or very few 5% algal acritarchs).
- brackish (spiny acritarch, no or very few dinoflagellates 1%).
- marginal marine (1-5% very low diversity dinoflagellates).
- nearshore marine (6-30% low to medium diversity dinoflagellates).
- intermediate marine (31-60% medium diversity dinoflagellates).
- offshore marine (61%-80% medium to high diversity dinoflagellates).
- far offshore marine/oceanic (81%-100% high diversity dinoflagellates and/or planktonic forams).

Confidence Ratings :

0 : good to excellent with numerous zone fossils in core/swc.
1 : fair with rare zone fossils in core/swc.
2 : poor with non-diagnostic assemblage in core/swc. Often occurs next to a distinctive 0 to 1 rating, lacking the zone fossil seen adjacent.
3 : good with extinction event (top range) in cuttings.
4 : poor to fair with inception event (base range) in cuttings and therefore may be picked too low if caved or too high if swamped by cavings.
5 : poor with non-diagnostic assemblage in cuttings. Usually seen adjacent to a higher rating and picked on the absence of key zone fossil.
? : no confidence. Picked as a best guess in very poor data.

Data recorded by : Roger Morgan Feb 1992

Data revised by : Roger Morgan Feb 1992

PALYNOLOGICAL DATA SHEET

BASIN: OTWAY DINOFLAGELLATE ZONES ELEVATION: KB: ______ GL: ______

WELL NAME: PECTEN-1A TOTAL DEPTH: ______

AGE		PALYNOLOGICAL ZONES	HIGHEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	LOWEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg
LATE CRETACEOUS	Maas	M. druggii	1126	0			1126	0		
	Maas									
	Camp	I. korojonense	1271	3			1295	0	1369	?
	Camp	upper X. australis	1387	3			1428	4		
	Camp	lower X. australis	1460	3			1460	4		
	Sant	N. aceras	1500	3			1722	4		
	Sant	I. cretaceum	1734	3			1734	4		
	Con	O. porifera								
	Turo	C. striatoconus								
	Ceno	P. infusorioides	1765	3			1789	4		

Environments :

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- marginal marine (1-5% very low diversity dinoflagellates).
- nearshore marine (6-30% low to medium diversity dinoflagellates).
- intermediate marine (31-60% medium diversity dinoflagellates).
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