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NEW PALYNOLOGY OF BELFAST-4, BELFAST-11, BOOTHAPOOL-2, CODRINGTON-1, KOROIT-10, TYENDARRA-13, WANGOOM-2, WANGOOM-6, YAMBUCK-1 AND YANGERY-1, ONSHORE OTWAY BASIN, VICTORIA

BY

ROGER MORGAN

for BHP PETROLEUM and partners **September 1994**

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L. A. Knight

NEW PALYNOLOGY OF BELFAST-4, BELFAST-11, BOOTHAPOOL-2, CODRINGTON-1, KOROIT-10, TYENDARRA-13, WANGOOM-2, WANGOOM-6, YAMBUCK-1 AND YANGERY-1, ONSHORE OTWAY BASIN, VICTORIA

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I SUMMARY

A BELFAST-4

1370.1m(core), 1417.9m(core) : upper *apoxyexinus* Zone (upper *cretacea* Dino Zone) : late Santonian : very nearshore marine : usually Sherbrook above Shipwreck

1512-15m(cutts), 1524-26m(cutts) : *distocarinatus* Zone (*infusorioides* Dino Zone) with caved lower *senectus* Zone (*aceras* and upper *cretacea* Dino Zones) : Cenomanian : nearshore : usually lower Shipwreck

1546.0m(core) : extremely lean, possibly mud contamination but apparently *distocarinatus* Zone (*infusorioides* Dino Zone) with caved lower *senectus* Zone (upper *cretacea* Dino Zone) : Cenomanian : nearshore marine

1631.3m (core) : very lean of spores with inertinite dominant but probably *paradoxa* Zone : mid Albian : usually Eumeralla : non-marine algal rich

These data suggest the Santonian Sherbrook marine maximum overlying Cenomanian lower Shipwreck overlying Albian Eumeralla.

B BELFAST-11

1338-41m(cutts) : upper *apoxyexinus* Zone (upper *cretacea*/*aceras* Dino Zones) : latest Santonian to earliest Campanian : nearshore marine

1353-56m(cutts), 1374.6m(core) : *pannosus* Zone with caved upper *apoxyexinus* (upper *cretacea*/*aceras* Dino Zones) in the cuttings only : latest Albian : probably both non-marine

These data suggest the latest Santonian marine maximum directly overlying the latest Albian Eumeralla without any Cenomanian Shipwreck.

C BOOTHAPOOL-2

1116-19m(cutts) : upper *apoxyexinus* Zone (upper *cretacea* Dino Zone) : latest Santonian : nearshore marine

1143-46m(cutts) : *distocarinatus* Zone (*infusorioides* Dino Zone) with caved upper *apoxyexinus* Zone (upper *cretacea*/*aceras* Dino Zones), *longus* Zone (*druggii* Dino Zone) and Tertiary : Cenomanian : nearshore marine

1200.2m(core) : extremely lean and clearly Eumeralla non-marine but rare key fossils suggest early Albian *striatus* Zone although latest Albian *pannosus* Zone appears more likely on regional evidence : Albian : non-marine

Data suggest that the Late Cretaceous present comprises the early Maastrichtian *longus* marine maximum at unknown depth, and the latest Santonian and latest Cenomanian maxima, overlying the Eumeralla.

D CODRINGTON-1

1131-34m(cutts) : *pannosus* Zone with caved upper *apoxyexinus* Zone (upper *cretacea* Dino Zone) : latest Santonian : non-marine

This sample suggests latest Santonian section directly overlying the latest Albian Eumeralla.

E KOROIT-10

1009.5m(core) : *longus* Zone Maastrichtian : non-marine : usually topmost Sherbrook (?Timboon Sand)

1062.23m(core) : upper *senectus* Zone (upper *australis* Dino Zone) : Campanian : very nearshore marine : usually Sherbrook Group above Shipwreck

1110.69m(core) : middle *apoxyexinus* Zone (lower *cretacea* Dino Zone) : Santonian : very nearshore marine : usually Sherbrook Group above Shipwreck

1162.0m(core) : *distocarinatus* Zone (*infusorioides* Dino Zone) : Cenomanian : nearshore marine

1207.85m(core), 1208.7m(core), 1228-31m(cutts), 1253.5m(core) : *pannosus* Zone with *distocarinatus* Zone (*infusorioides* Dino Zone) and upper *apoxyexinus* Zone (upper *cretacea*/*aceras* Dino Zones) and Tertiary caving in the cuttings sample only : presumed all non-marine : latest Albian

These data indicate a Maastrichtian Sherbrook section overlying the late Santonian/Early Campanian Sherbrook section overlying latest Cenomanian lower Shipwreck section, overlying latest Albian Eumeralla.

F TYENDARRA-13

1317-20m(cutts) : upper *apoxyexinus* Zone (upper *cretacea* Dino Zone with *aceras* Zone caving) : latest Santonian : nearshore marine

1329-32m(cutts) : middle *apoxyexinus* Zone (lower *cretacea* Dino Zone) with minor caved *longus* Maastrichtian : Santonian : nearshore marine : usually Sherbrook Group above Shipwreck Group

1340.3m(core) : virtually barren with very minor Late Cretaceous possibly caved

These data indicate Maastrichtian section at unknown depth overlying Campanian section at unknown depth overlying the latest Santonian marine maximum which from the logs directly overlie Eumeralla.

G WANGOOM-2

Recent work for the Vic DM (Morgan 1994) indicates

808-14m(core) *longus* Zone (*druggii* Dino Zone) : Maastrichtian : nearshore marine

Current BHP sampling indicates

920.3m(core) 930-33m(cutts), 945-48m(cutts) : upper *apoxyexinus* Zone (upper *cretacea* Dino Zone) with Tertiary, Campanian (*aceras* Dino Zone) and Maastrichtian (*longus* Zone) caving in the cuttings: latest Santonian : nearshore marine

957.0m(core) : *pannosus* Zone : latest Albian : non-marine

These data suggest a more complete section than in several other wells including a Maastrichtian *longus* section, more of the Campanian than elsewhere (including the *australis* Dino Zone), the usual latest Santonian section, but then probably directly overlying the latest Albian Eumeralla.

H WANGOOM-6

991.2m(core) : upper *apoxyexinus* Zone (upper *cretacea* Dino Zone) : latest Santonian : nearshore marine

1011.1m(core) : *pannosus* Zone : latest Albian : non-marine

These data suggest the latest Santonian marine maximum directly overlying latest Albian Eumeralla. Other section might be present but undetected by the lack of cuttings.

I YAMBUCK-2

1369-72m(cutts) : upper *apoxyexinus* Zone (upper *cretacea/aceras* Dino Zones) with caved *australis* Dino Zone : latest Santonian to earliest Campanian : nearshore marine

1382.0m(core) : *pannosus* Zone : latest Albian : slightly brackish

These data suggest Campanian at unknown depth overlying the latest Santonian marine maximum directly overlying Albian Eumeralla.

J YANGERY-1

826.0m(core) : upper *apoxyexinus* Zone (upper *cretacea* Dino Zone) : Santonian : nearshore marine : usually Sherbrook Group above Shipwreck

872.0m(core) : *distocarinatus* Zone (*infusorioides* Dino Zone) : Cenomanian : very nearshore marine : usually lower Shipwreck Group/Waara Sandstone

902-05m(cutts) : mostly *distocarinatus* Zone (*infusorioides* Dino Zone) with very minor Eumeralla taxa possibly reworked : probably Cenomanian : nearshore marine

908-11m(cutts) : *pannosus* Zone with caved *distocarinatus* Zone (*infusorioides* Dino Zone) : latest Albian : presumed non-marine

These data indicate the latest Cenomanian marine maximum section overlying latest Albian Eumeralla. Younger parts of the Sherbrook Group may be present but were not seen as caved elements.

II INTRODUCTION

This sample suite was submitted by Simon Horan of BHP Petroleum as part of a study of the onshore Otway Basin adjacent to their offshore gas discoveries in the Otway Basin.

Palynomorph occurrence data are shown as Appendix I and form the basis for the assignment of the samples to the Early and Late Cretaceous Zones.

The Cretaceous spore-pollen zonation is essentially that of Dettmann and Playford (1969) combined with Stover and Evans (1973) and Stover and Partridge (1973). This framework has been significantly modified and improved by various authors since, and most recently discussed in Helby et al (1987), and modified in the Early Cretaceous by Morgan (1985) for application in the Otway Basin. Most recent improvements in the Late Cretaceous are unpublished in reports for BHPP.

Sample processing usually involves the following steps. Extra techniques are only used if required:

(a) digest about 10gm of crushed rock in 50% HF overnight.
(b) wash out several times over 10 micron polyester sieve. Acidify with conc HCl if fluorosilicate gel forms.
(c) heavy liquid separation used concentrated $ZnBr_2$ with SG of 2.0.
(d) wash out float fraction over 10 micron polyester sieve. Acidify if $Zn(OH)_2$ precipitate forms.
(e) mount a sieved kerogen slide.
(f) oxidise in Schultze Solution (conc 30% HNO_3 with crystalline $KClO_3$).
(g) wash out over 10 micron polyester sieve.
(h) add 5% KOH to dissolve humic acids.
(i) wash out over 10 micron polyester sieve.
(j) examine under microscope for satisfactory oxidation. Repeat steps (f) to (i) if required.
(k) heavy liquid separation using $ZnBr_2$ solution (SG of 2.0).
(l) wash out float fraction using polyester sieve. Acidify if $Zn(OH)_2$ precipitate forms.
(m) dehydrate onto coverslip.
(n) mount microscope slides using Eukitt medium.

Sample examination usually involved the following steps:

(a) scan two traverses at x10 to log the bulk of the assemblage and get some idea of age.

(b) scan at x40 and count the first 100 specimens to get percentage contents for each species. From this, "Saline Microplankton Content" (%) can be developed to provide an index of marine influence. Where the sample is too lean to provide 100 specimens, frequency is estimated from the specimens seen with A=abundant, C=common, F=frequent, R=rare.

(c) return to x10 to scan at least two large coverslips to log rare species, and finalise age conclusions. Log more slides if required.

(d) examine sieved kerogen slide for specimens of *Cyathidites* to establish spore colour for Spore Colour Maturity Index.

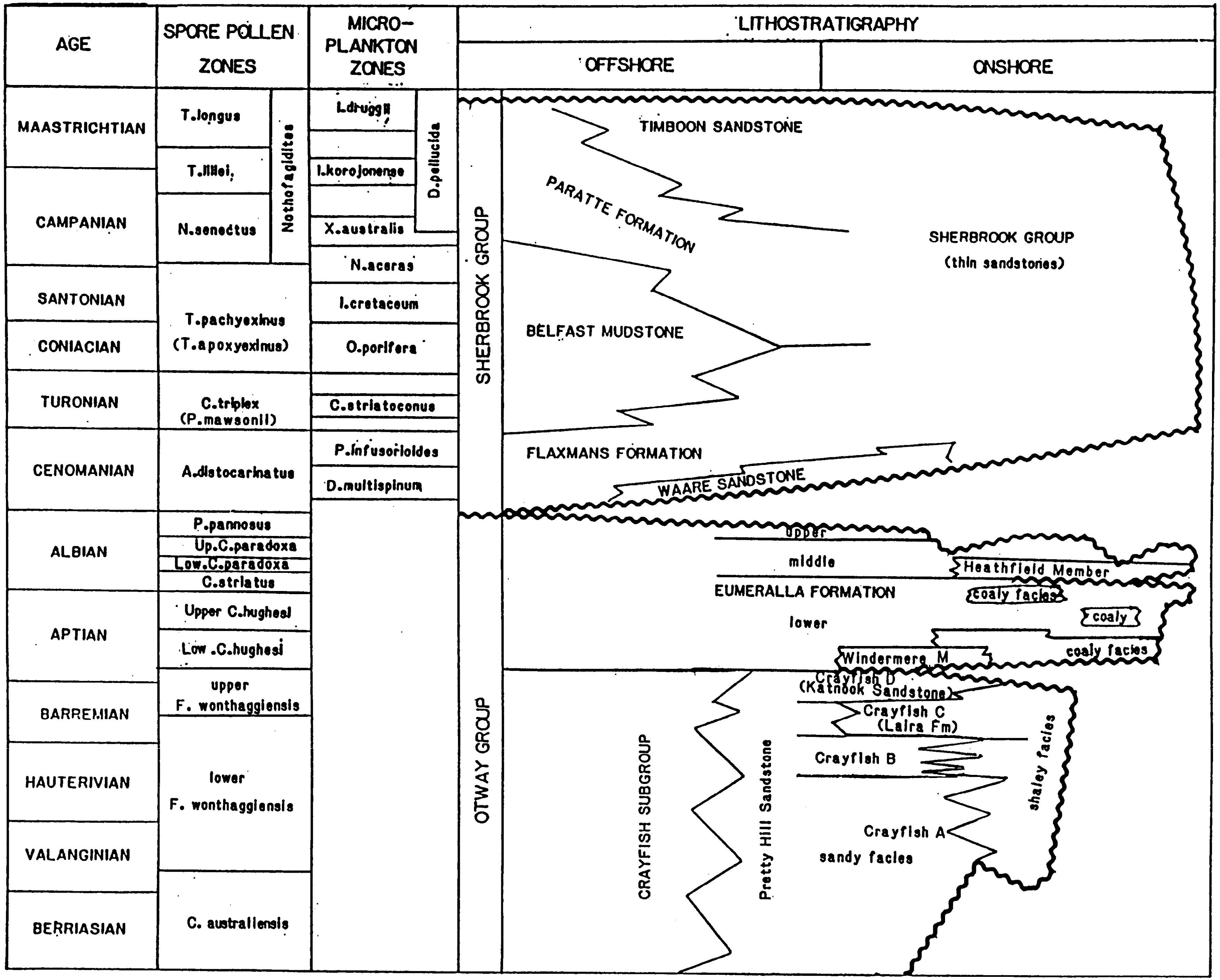

FIGURE 1. CRETACEOUS REGIONAL FRAMEWORK, OTWAY BASIN

TABLE-1 : SAMPLE SUMMARY

Sample Depth (m)	Sample Type	Spore-pollen Zone	Conf Rat.	Micro-plank. Divers.	Micro-plank. %	Algal %	Environment
BELFAST-4							
1370.1	core	up *apoxy* (up *cretac*)	1	10	6	(3)	very nearshore
1512-15	cutts	*disto* (*infus*)	1	(33)	(14)	(4)	nearshore
1524-26	cutts	*disto* (*infus*)	1	(24)	(14)	(1)	nearshore
1546.0	core	?*disto* (?*infus*)	4	12	14	5	nearshore
1631.29	core	intermediate	-	0	0	26	non-marine
BELFAST-11							
1338-41	cutts	up *apoxy* (up *cretac*)	2	(13)	(14)	(2)	nearshore
1353-56	cutts	*pannosus*	2	(18)	(5)	(5)	prob non-marine
1374.6	core	*pannosus*	0	0	0	3	non-marine
BOOTHAPOOL-2							
1116-19	cutts	up *apoxy* (up *cretac*)	2	(22)	(8)	(8)	nearshore
1143-46	cutts	*disto* (*infus*)	2	(20)	(6)	(8)	nearshore
1200.2	core	indeterminate	-	0	0	23	non-marine
CODRINGTON-1							
1131-34	cutts	*pannosus*	1	(13)	(13)	(10)	non-marine
KOROIT-10							
1009.5	core	*longus*	0	0	0	4	non-marine
1062.23	core	up *senect* (up *austral*)	0	8	7	4	very nearshore
1110.69	core	mid *apoxy* (low *cretac*)	0	10	5	6	very nearshore
1162.0	core	*disto* (*infus*)	0	12	13	2	nearshore
1207.85	core	*pannosus*	0	0	0	3	non-marine
1208.7	core	*pannosus*	0	0	0	16	non-marine
1228-31	cutts	*pannosus*	1	(9)	(0)	(3)	non-marine
1253.5	core	*pannosus*	0	0	0	1	non-marine
TYENDARRA-13							
1317-20	cutts	up *apoxy* (up *cretac*)	2	(18)	(15)	(10)	nearshore
1329-32	cutts	mid *apoxy* (low *cretac*)	2	(22)	(17)	(6)	nearshore
1340.3	core	indeterminate	-	2	1	3	indeterminate
WANGOOM-2							
920.3	core	up *apoxy* (up *cretac*)	0	14	2	4	nearshore
930-33	cutts	up *apoxy* (up *cretac*)	2	(11)	(8)	(5)	nearshore
945-48	cutts	up *apoxy* (up *cretac*)	2	(21)	(15)	(6)	nearshore
957.0	core	*pannosus*	0	0	0	-	non-marine
WANGOOM-6							
991.2	core	up *apoxy* (up *cretac*)	0	13	18	4	nearshore
1011.1	core	*pannosus*	0	0	0	3	non-marine
YAMBUCK-2							
1369-72	cutts	up *apoxy* (up *cretac*)	2	(17)	(15)	(12)	nearshore
1382.0	core	*pannosus*	0	1	<1	2	slightly brackish
YANGERY-1							
826.0	core	up *apoxy* (up *cretac*)	0	17	13	2	nearshore
872.0	core	*disto* (*infus*)	0	15	7	2	very nearshore
902-05	cutts	mostly *disto* (*infus*)	3	(16)	(15)	(3)	nearshore
908-11	cutts	*pannosus*	0	(9)	(9)	(4)	prob non-marine

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III PALYNOSTRATIGRAPHY

A BELFAST-4

1 1370.1m(4495ft) (and 1417.9m(core) in Cookson and Eisenack 1961): upper *apoxyexinus* Zone (upper *cretacea* Dino Zone)

Assignment to the upper *Tricolporites apoxyexinus* Zone of Santonian age is indicated by rare *Amosopollis cruciformis* and *T. apoxyexinus* without younger or older markers, and confirmed by the dinoflagellates. *Falcisporites* and *Podosporites* are common with *Australopollis obscurus*, *Cyathidites*, *Microcachryidites* and *Proteacidites* frequent. Very rare but age significant are *Clavifera triplex*, *Ornamentifera sentosa*, *Phyllocladidites mawsonii* and *T. apoxyexinus*. Rare Permian reworking was seen.

Amongst the dinoflagellates, the presence of *Amphidiadema denticulata* and *Isabelidinium belfastense* indicates the upper *Isabelidinium cretacea* Zone. *Heterosphaeridium* spp are the most frequent of the rare dinoflagellates. Cookson and Eisenack (1961) record a similar assemblage indicating assignment of core at 1371.3m and 1417.9m to this interval.

Very nearshore marine environments are indicated by the very low dinoflagellate content (6%) and diversity.

These features are normally seen in the Sherbrook Group above the Shipwreck Group in the offshore Otway Basin.

2 1512-15m(cutts), 1524-26m(cutts) : *distocarinatus* Zone (*infusorioides* Dino Zone)

Assignment to the *Appendicisporites distocarinatus* Zone of Cenomanian age is indicated by the dinoflagellate data. The spores and pollen include *A. distocarinatus* and *P mawsonii* which together suggest the *mawsonii* Zone. However, P. *mawsonii* is considered caved in these cuttings, in the light of the dinoflagellate data. No older markers were seen. Other obvious cavings include *Nothofagidites senectus* and *T. apoxyexinus* at 1515m. Common are *Cyathidites*, *Falcisporites* and *Microcachryidites* with *Podosporites* frequent. Trace Permian reworking was seen.

Amongst the dinoflagellates, consistent *Cribroperidinium edwardsii* indicates the *Palaeohystrichophora infusorioides* Dino Zone of Cenomanian age. The most frequent dinoflagellates are *Heterosphaeridium* spp but these may be largely caved. Obvious caving is seen from the *aceras* Dino Zone (*Nelsoniella aceras*, *Odontochitina obesa*) and upper *cretacea* Dino Zone (*A. denticulata*, *I. belfastense*). *Aptea* sp and *Palaeoperidinium cretaceum* are present and support the *infusorioides* assignment.

Nearshore marine environments are suggested by the low dinoflagellate content (14%) and moderate diversity. Regional knowledge suggests that the dinoflagellate content and diversity may be too high due to caving, and very nearshore environments may be more likely.

These features are normally seen in the uppermost lower Shipwreck Group offshore.

3 **1546.0m(core) : extremely lean, possibly mud contamination but apparently *distocarinatus* Zone (*infusorioides* Dino Zone)**

This assemblage is extremely lean and may all be mud contamination into a barren older lithology. However, the fossils seen suggest a Cenomanian *distocarinatus* Zone based solely on a single specimen of *C. edwardsii* without older markers. Younger caving is clearly evident from the Campanian *senectus* spore-pollen Zone (*N. senectus*) and upper *cretacea* Dino Zone (*I. belfastense*).

Nearshore marine environments are suggested by the dinoflagellate content (14%) and diversity. Many are clearly caved however, and frequent freshwater algae (*Botryococcus*) suggest that very nearshore marine to marginal marine environments may be more likely.

These features suggest equivalents of the lower Shipwreck Group as developed offshore.

4 **1631.3m(core) : possibly *paradoxa* Zone**

This sample contains abundant inertinite fragments and shards but very few spores. However, amongst the rare spores are consistent *Cicatricosisporites australiensis* (3%) and very rare *Crybelosporites striatus*, *Foraminisporis asymmetricus* and *Triporoletes reticulatus*, usually seen in topmost Eumeralla *paradoxa* and *pannosus Zones*. *Cyathidites* spp are abundant with common *Falcisporites* and frequent *Osmundacidites* and *Stereisporites*.

Non-marine environments are suggested by the absence of saline indicators and very common freshwater algae (*Botryococcus* and *Schizosporis*) suggest major lakes.

These features are normally seen in the Eumeralla Formation in the Otway Basin.

5 In summary, Campanian section is seen as caving, Santonian section is firmly identified and unconformably overlies Cenomanian section which overlies Albian Eumeralla.

B BELFAST-11

1 1338-41m(cutts) : upper *apoxyexinus* Zone (upper *cretacea* Dino Zone)

Assignment to the upper *T. apoxyexinus* Zone of Santonian age is indicated at the base by very rare *A. cruciformis* without older indicators and at the top by the dinoflagellates, with extremely rare *N. senectus* considered caved. *Cyathidites*, *Falcisporites* and *Microcachryidites* are common with *Dilwynites*, *Gleichniidites* and *Podosporites* frequent. Very rare Permian reworking was noted.

Assignment to the upper *I. cretacea* Dino Zone is indicated by *A. denticulata* and *I. belfastense* without older markers. Rare Campanian *N. aceras* is considered caved a short distance. *Heterosphaeridium* spp are the most frequent taxa.

Nearshore marine environments are indicated by the low dinoflagellate content (14% of palynomorphs) and their low diversity. Inertinite and abundant diverse spores and pollen dominate the assemblage.

These features are normally seen in the Sherbrook Group above the Shipwreck Group.

2 1353-56m(cutts), 1374.6m(core) : *pannosus* Zone

Assignment to the *Phimopollenites pannosus* Zone of later Albian age is indicated at the top by youngest *Coptospora paradoxa* and at the base by oldest *P. pannosus*. Other distinctive spores confirming the assignment include

Aequitriradites spp, *Crybelosporites striatus*, *Foraminisporis asymmetricus*, *Pilosisporites grandis* and *Triporoletes reticulatus*. Common are *Cyathidites*, *Falcisporites* and *Microcachryidites* with frequent *Osmundacidites* and *Podosporites*. Younger caving is evident in the cuttings at 1356m including *A. cruciformis*, *Coptospora pileosa* and *P. mawsonii*.

Dinoflagellates are absent from the core at 1374.6m and the rare but diverse dinoflagellates in the cuttings are considered caved. They include *Xenikoon australis* (indicating Campanian upper *senectus* Zone), *N. aceras* (indicating Campanian middle or lower *senectus* Zone) and a single *C. edwardsii* (suggesting a thin Cenomanian *distocarinatus* Zone).

Environments are considered non-marine to slightly brackish with the observed dinoflagellates considered all caved.

These features are usually seen in the Eumeralla Formation.

3 In summary, Campanian section is seen only as cavings overlying Santonian section which appears to directly unconformably overlie Albian Eumeralla.

C BOOTHAPOOL-2

1 1116-19m(cutts) : upper *apoxyexinus* Zone (upper *cretacea* Dino Zone)

Assignment to the upper *T. apoxyexinus* Zone of Santonian age is indicated by rare *A. cruciformis* without younger or older markers. Common are *Falcisporites* and *Microcachryidites* with frequent *Cyathidites*, *Dilwynites*, *Osmundacidites* and *Proteacidites*. Caving includes frequent Tertiary and minor Cretaceous taxa (*Tricolpites confessus*) and minor Permian and Triassic reworking was seen.

Assignment to the upper *I. cretacea* Dino Zone is indicated by *A. denticulata* and *I. belfastense* without older markers. *Heterosphaeridium* spp are the most frequent dinoflagellates. Caving includes *Cordosphaeridium inodes* (Tertiary), *Manumiella coronata* (indicating the Maastrichtian *longus* Zone) and *Isabelidinium nucula* (indicating the Campanian upper *senectus* Zone).

Nearshore marine environments are indicated by the low dinoflagellate content (8%) but moderate diversity (perhaps enhanced by caving).

These features usually occur in the Sherbrook Group above the Shipwreck Group.

2 1143-46m(cutts) : *distocarinatus* Zone (*infusorioides* Dino Zone)

Assignment to the *Appendicisporites distocarinatus* Zone of Cenomanian age is indicated at the top by *A. distocarinatus* and the dinoflagellate data and at the base by the lack of older markers. *P. mawsonii* is considered caved in these cuttings, as is *Tricolpites longus* (Maastrichtian *longus* Zone). Minor Early Cretaceous reworking was seen (*P. notensis*). Common are *Cyathidites*, *Falcisporites* and *Microcachryidites* with frequent *Dilwynites*, *Osmundacidites* and *Proteacidites* (considered caved).

Assignment to the *P. infusorioides* Dino Zone is indicated by youngest and consistent *C. edwardsii*. *Heterosphaeridium* spp are the most frequent dinoflagellate but may be largely caved. Younger caving is dominant including *M. druggii* (Maastrichtian *longus* Zone), *X. australis* (Campanian upper *senectus* Zone), *N. aceras* (Campanian middle and lower *senectus* Zone) and *A. denticulata* (Santonian upper *apoxyexinus* Zone).

Nearshore marine environments are suggested by the low dinoflagellate content (6%) but moderate diversity. Many taxa are caved however, and marginal marine coastal lagoon environments may be more likely, especially given the high freshwater algal content (8% *Botryococcus*).

These features are normally seen at the top of the lower Shipwreck Group.

3 1200.2m(core) : extremely lean Eumeralla

This sample is extremely lean of identifiable palynomorphs with the kerogen dominated by inertinite and cuticle fragments. Spores present include *C. striatus*, *F. asymmetricus* and *T. reticulatus* indicating Eumeralla affinities. *C. striatus* without younger markers suggests the early Albian *striatus* Zone but the assemblage is too lean to preclude the more regionally likely *paradoxa* or *pannosus* Zones. Common are *Cyathidites*, *Falcisporites* and *Microcachryidites* with frequent *Microcachryidites* and *Podosporites*.

Non-marine lake environments are suggested by the absence of saline markers, common freshwater algae (23% *Botryococcus*) and abundant cuticle fragments.

These features are normally seen in the Eumeralla Formation.

4 In summary, Maastrichtian section is seen in cavings and overlies Campanian also seen only in cavings overlying Santonian section unconformably over Cenomanian section overlying Albian Eumeralla.

D CODRINGTON-1

1 1131-34m(cutts) : *pannosus* Zone with caved upper *apoxyexinus* Zone

Assignment to the *P. pannosus* Zone of latest Albian age is indicated at the top by youngest *C. paradoxa* and at the base by oldest *P. pannosus*. Other spores consistent with this include *C. striatus*, *F. asymmetricus* and frequent *C. australiensis*. Common are *Cyathidites* and *Microcachryidites* and frequent are *Dilwynites*, *Falcisporites* and *Osmundacidites*. Caving includes *H. harrisii* (Tertiary), *C. triplex* and *P. mawsonii*.

A meagre dinoflagellate assemblage includes *A. denticulata* and *I. belfastense* suggesting the Santonian upper *I. cretacea* Dino Zone which is clearly caved.

Non-marine probably lake environments are likely given that the dinoflagellates are probably all caved and freshwater algae are common (10% *Botryococcus*).

These features are seen in the Eumeralla Formation but caving indicates a Sherbrook section higher in the well.

2 In summary, Tertiary section seen only as caving overlies Santonian section seen only as caving and probably unconformably overlies Albian Eumeralla.

E KOROIT-10

1 1009.50m(core) : *longus* Zone

This sample contains very rare age diagnostic elements indicating assignment to the Maastrichtian *T. longus* Zone at the top on youngest *Tricolpites confessus*, *T. longus*, *T. sabulosus* and *Tricolporites apoxyexinus*, and at the base on oldest *T. longus*. They are so rare that they could be reworked into younger strata, but overlying core control for another client indicates a definite Cretaceous age. Common are *Cyathidites*, *Falcisporites* and *Gleicheniidites* with frequent

Microcachryidites, *P. mawsonii*, *Proteacidites*, *Stereisporites* and *Vitreisporites*. Rare but significant are *Gambierina rudata*, *Lygistepollenites balmei* and *Nothofagidites endurus*.

Non-marine environments are indicated by the absence of saline markers, abundant and diverse pollen and spores, and frequent freshwater algae (4% *Botryococcus*).

These features are seen in the topmost Sherbrook Group including the Paaratte Formation and Timboon Sand.

2 1062.23m(core) : upper *senectus* Zone (upper *australis* Dino Zone)

Assignment to the upper *N. senectus* Zone of Campanian age is indicated at the top by the absence of younger markers, and at the base by oldest *G. rudata*, supported by oldest *T. sabulosus* and *N. senectus*. Common are *Dilwynites*, *Falcisporites*, and *Proteacidites*, frequent are *Cyathidites*, *Microcachryidites*, *Podosporites* and *T. sabulosus*. Rare Permian reworking was seen.

Amongst the rare dinoflagellates, youngest *X. australis* without older markers indicates the upper *X. australis* dinoflagellate Zone. *Heterosphaeridium* spp are the most frequent among a meagre assemblage.

Very nearshore environments are indicated by the low dinoflagellate content (7%) and their low diversity amongst the common and diverse pollen and spores.

These features are normally seen in the upper Sherbrook Group, usually in the Paaratte Formation.

3 1110.69m(core) : middle *apoxyexinus* Zone (lower *cretacea* Dino Zone)

Assignment to the middle *T. apoxyexinus* Zone of Santonian age is indicated by rare *A. cruciformis* supported by the dinoflagellate evidence. *Dilwynites* is common with *Cyathidites*, *Gleicheniidites*, *Microcachryidites*, *Podosporites* and *Vitreisporites* frequent. Oldest *T. confessus* and *T. gillii* support the assignment. *T. apoxyexinus* is present.

Assignment to the lower *I. cretacea* Dino Zone is indicated by oldest *I. cretacea* without younger markers and is confirmed by youngest *Isabelidinium rectangularis*. *Heterosphaeridium* spp are the most frequent dinoflagellates.

Very nearshore marine environments are indicated by the low dinoflagellate content (5%) and their low diversity amongst the dominant and diverse pollen and spores.

These features are normally seen in the lower Sherbrook Group of BHP usage in the Belfast Mudstone and Paaratte Formation and equivalents.

4 **1162.0m(core) : *distocarinatus* Zone (*infusorioides* Dino Zone)**

Assignment to the *A. distocarinatus* Zone of Cenomanian age is indicated by *A. distocarinatus* without younger or older markers, and confirmed by the dinoflagellates. *Cyathidites* spp are abundant with common *Falcisporites* and frequent *Microcachryidites* and *Osmundacidites*. Rare elements are *A. distocarinatus*, *A. cruciformis* and *P. eunuchus*.

Assignment to the *P. infusorioides* Dino Zone is indicated by youngest *C. edwardsii*, supported by *Cyclonephelium compactum*. *Heterosphaeridium* spp are the most frequent dinoflagellates.

Nearshore marine environments are indicated by the low dinoflagellate content (13%) and moderate diversity, amongst the abundant and diverse pollen and spores.

These features are normally seen in the topmost lower Shipwreck Group in the adjacent offshore acreage.

5 **1207.85m(core), 1208.7m(core), 1228-31m(cutts), 1253.5m(core) : *pannosus* Zone**

Assignment to the *P. pannosus* of late Albian age is indicated at the top by youngest *C. paradoxa* and at the base by oldest *P. pannosus*. Other spores confirming the assignment include *Aequitriradites*, *C. striatus*, *F. asymmetricus*, *Pilosisporites grandis*, *T. reticulatus* and frequent *C. australiensis*. *Cyathidites* spp are very common to abundant with *Falcisporites* and *Microcachryidites* frequent to common.

Dinoflagellates occur only in the cuttings sample and are entirely caved including *N. aceras* (Campanian middle and lower *senectus* Zone).

Non-marine environments are indicated by the lack of saline markers in place, abundant and diverse spores and pollen, and consistent to common (1208.7m) freshwater algae (16% *Botryococcus*) suggesting lakes.

These features are normally seen in the topmost Eumeralla Formation.

6 In summary, Maastrichtian section seen in core overlies Campanian section seen in core, overlying Santonian section unconformably overlying Cenomanian section overlying Albian Eumeralla.

F TYENDARRA-13

1 1317-20m(cutts) : upper *apoxyexinus* (upper *cretacea* Dino Zone)

Assignment to the upper *T. apoxyexinus* of Santonian age is indicated by rare *A. cruciformis*, without older markers, and confirmed by the dinoflagellates. *A. cruciformis* is rare with frequent *Proteacidites*, while common are *Falcisporites* and *Microcachryidites* with frequent *A. obscurus, Cyathidites, Dilwynites* and *Gleicheniidites*. A single *Appendicisporites tricornitatus* is present but is considered reworked. Minor younger caving includes *G. rudata* (upper *senectus* Zone or younger) and *Triporopollenites sectilis* (Maastrichtian *longus* to Campanian *lillei* Zones). Trace Permian reworking was also seen.

Assignment to the upper *I. cretacea* Dino Zone is indicated by *I. belfastense* supported by *I. cretaceum*. Younger caving includes *N. aceras* (Campanian lower to middle *senectus* Zone) and *I. nucula* (Campanian upper *senectus* zone).

Environments are nearshore marine as shown by the low dinoflagellate content (15%) and their moderate diversity. Pollen and spores are dominant and diverse, cuticle common, and freshwater algae very frequent (10% *Botryococcus*).

These features are normally seen in the lower Sherbrook Group above the Shipwreck Group. These are cuttings however, and could conceivable be entirely caved.

2 **1329-32m(cutts) : middle *apoxyexinus* Zone (lower *cretacea* Dino Zone)**

Assignment to the upper *apoxyexinus* Zone of Santonian age is suggested by very rare *A. cruciformis* and frequent *Proteacidites*, but the dinoflagellates suggest that this may be slightly caved with a middle *T. apoxyexinus* Zone assignment favoured. *Dilwynites* spp are common with *Cyathidites*, *Falcisporites*, *Laevigatosporites* and *Podosporites* frequent. Younger caving includes *T. longus* (Maastrichtian *longus* Zone).

Assignment to the lower *I. cretacea* Dino Zone is indicated by oldest *I. cretacea* with youngest *I. rectangulare*. Frequent taxa are *Heterosphaeridium* spp and *Trithyrodinium* spp.

Environments are nearshore marine as shown by the low content (17%) and moderate diversity dinoflagellates (which may be enhanced by caving). Pollen and spores are abundant and diverse while freshwater algae are frequent (5% *Botryococcus*).

These features are usually seen in the lower Sherbrook Group immediately above the Shipwreck Group. These are cuttings however, and could conceivably be entirely caved.

3 **1340.3m(core) : almost barren : indeterminate**

This sample contains very few palynomorphs, mostly longranging and not distinctive. A few specimens are Late Cretaceous restricted (*P. mawsonii*, *Trithyrodinium* spp) but these are probably caved. The sample is really indeterminate although it weakly appears to be Late Cretaceous.

Environments appear to be brackish, but the single dinoflagellate specimen seen may represent mud contamination. Pollen and spores dominate the meagre assemblage with freshwater algae (3% *Botryococcus*) consistent components.

4 In summary, Maastrichtian section seen only as caving overlies Campanian section seen only in cavings, overlying Santonian section firmly dated only in cuttings.

G WANGOOM-2

1 808.-14m(core) : *longus* Zone (*druggii* Dino Zone)

This sample is documented in Morgan (1994) for the Victorian Geological Survey.

2 920.3m(core), 930-33m(cutts), 945-48m(cutts) : upper *apoxyexinus* Zone (upper *cretacea* Dino Zone)

Assignment to the upper *T. apoxyexinus* Zone of Santonian age is indicated by very rare *A. cruciformis* with frequent *Proteacidites* and confirmed by the dinoflagellate data. Rare *N. senectus* are considered caved at 933m. *Cyathidites*, *Falcisporites* and *Microcachryidites* are common, with *A. obscurus*, *Dilwynites* and *P. mawsonii* frequent. Younger caving is seen in the cuttings sample including *N. senectus* and *Lygistepollenites balmei*.

Assignment to the upper *I. cretacea* Dino Zone is indicated by *A. denticulata* and *I. belfastense*, although these might be slightly caved in the cuttings samples into section not definitively older than the middle *apoxyexinus* Zone (lower *cretacea* Dino Zone). *Heterosphaeridium* are the most frequent dinoflagellates. Younger caving occurs in the cuttings including *M. coronata* (Maastrichtian *T. longus* Zone), *X. australis* (Campanian upper *N. senectus* Zone), and *N. aceras* (Campanian middle and lower *N. senectus* Zone). A Paleocene dinoflagellate assemblage (*Deflandrea obliquipes*, *D. speciosus*) is a minor component. A single *C. edwardsii* at 948m suggests penetration of the *infusorioides* Zone, but is considered reworked.

Nearshore marine environments are suggested by the low dinoflagellate content (2%, 8% and 15% downhole), and their moderate diversity. Pollen and spores dominate, with freshwater algae (*Botryococcus*) frequent.

These features are normally seen in the lower Sherbrook Group overlying the Shipwreck Group.

3 957.0m(core) : *pannosus* Zone

Assignment to the *P. pannosus* Zone of late Albian age is indicated at the top by youngest *C. paradoxa* and at the base by oldest *P. pannosus*. Other spores confirming penetration of Eumeralla equivalents include *Aequitriradites* spp, *C. striatus*, *F. asymmetricus*, *T. reticulatus* and frequent *C. australiensis*. Common are *Cyathidites*, *Falcisporites* and *Microcachryidites* while frequent are *C. australiensis*, *Osmundacidites* and *Podosporites*.

Non-marine environments are indicated by the absence of saline markers and the abundant and diverse spores and pollen.

These features are seen in the topmost Eumeralla Formation.

4 In summary, Maastrichtian section from core overlies Campanian section seen only as cavings above firm Santonian section unconformably overlying Albian Eumeralla apparently without a Cenomanian section.

H WANGOOM-6

1 991.2m(core) : upper *apoxyexinus* Zone (upper *cretacea* Dino Zone)

Assignment to the upper *T. apoxyexinus* Zone of Santonian age is indicated by very rare *A. cruciformis* without younger or older markers, and confirmed by the dinoflagellates. *Cyathidites* and *Falcisporites* are common, with *Dilwynites*, *Microcachryidites*, *P. mawsonii*, *Podosporites* and *Proteacidites* frequent.

Assignment to the upper *I. cretacea* Dino Zone is indicated by *A. denticulata* and *I. belfastense*. *Heterosphaeridium* spp are the most frequent dinoflagellates.

Nearshore marine environments are indicated by the low dinoflagellate content (18%) and their low diversity. Pollen and spores are dominant and diverse.

These features are normally seen in the Sherbrook Group above the Shipwreck Group in the offshore Otway Basin.

2 1011.1m(core) : *pannosus* Zone

Assignment to the *P. pannosus* Zone of late Albian age is indicated at the top by youngest *C. paradoxa* and at the base by oldest *P. pannosus*. Spores confirming the assignment include *Aequitriradites* spp, *C. striatus*, and *Triporoletes radiatus*. *Cyathidites* spp are abundant with common *Osmundacidites* and frequent *Microcachryidites*.

Non-marine environments are indicated by the absence of saline markers, common and diverse spores and pollen, and consistent freshwater algae (3% *Botryococcus*).

These features are normally seen in the topmost Eumeralla Formation.

3 In summary, Santonian section directly overlies Albian Eumeralla without a Cenomanian section.

I YAMBUCK-2

1 1369-72m(cutts) : upper *apoxyexinus* (upper *cretacea* Dino Zone)

Assignment to the upper *T. apoxyexinus* Zone of Santonian age is indicated by very rare *A. cruciformis* without younger or older markers, and confirmed by the dinoflagellates. Common are *Falcisporites* and *Microcachryidites* with frequent *C. triplex*, *Cyathidites*, *Dilwynites*, *Proteacidites* and *P. mawsonii*. Trace Permian reworking was seen.

Assignment to the upper *I. cretacea* Dino Zone is indicated by *A. denticulata* and *I. belfastense*, with *Heterosphaeridium* spp being the most frequent dinoflagellates. Younger caving includes *X. australis* (Campanian upper *senectus* Zone) and *N. aceras* (Campanian middle to lower *senectus* Zone).

Nearshore marine environments are indicated by the low dinoflagellate content (15%) with moderate diversity amongst the abundant and diverse pollen and spores. Lakes seem likely given the high freshwater algal content (12% *Botryococcus*).

These features are normally seen in the Sherbrook Group above the Shipwreck Group in the offshore Otway Basin.

2 1382.0m(core) : *pannosus* Zone

Assignment to the *P. pannosus* Zone of late Albian age is indicated at the top by youngest *C. paradoxa* and at the base by oldest *P. pannosus*. Other spores supporting the assignment include *C. striatus*, *F. asymmetricus* and *R. reticulatus*.

Common are *Cyathidites*, *Falcisporites* and *Microcachryidites* with frequent *R. austroclavatidites*.

Slightly brackish environments are indicated by extremely rare spiny acritarchs amongst the abundant and diverse spores and pollen. Freshwater algae are minor (2% *Botryococcus*).

These features are normally seen in the topmost Eumeralla Formation.

3 In summary, Campanian section seen only as cavings overlies Santonian section unconformably overlying Albian Eumeralla without Cenomanian section.

J YANGERY-1

1 826.0m(core) : upper *apoxyexinus* (upper *cretacea* Dino Zone)

Assignment to the upper *T. apoxyexinus* Zone of Santonian age is indicated by very rare *A. cruciformis* with frequent *Proteacidites* without other markers, and confirmed by the dinoflagellates. Common are *Cyathidites*, *Dilwynites* and *Microcachryidites* with frequent *Falcisporites*, *Podosporites* and *Proteacidites*. Very rare *A. distocarinatus* suggests the *distocarinatus* Zone but is considered reworked, as is the Albian species *Pilosisporites grandis*.

Assignment to the upper *I. cretacea* Dino Zone is indicated by *A. denticulata* and *I. belfastense*, with *Heterosphaeridium* spp being the most frequent dinoflagellate. Two specimens of *C. edwardsii* were seen but are considered reworked.

Nearshore marine environments are indicated by the low dinoflagellate content (13%) with moderate diversity amongst the common and diverse spores and pollen. Freshwater algae are extremely rare (1% *Botryococcus*).

These features are normally seen in the Sherbrook Group overlying the Shipwreck Group in the adjacent offshore Otway Basin.

2 872.0m(core), 902-05m(cutts) : *distocarinatus* Zone (*infusorioides* Dino Zone)

Assignment to the *A. distocarinatus* Zone of Cenomanian age is indicated at the top by youngest *A. distocarinatus* without *P. mawsonii* supported by the dinoflagellates and at the base by the absence of definitive older markers. In the cuttings sample, youngest *C. striatus* and *F. asymmetricus* suggest possible penetration of the *pannosus* Zone, but are only single specimens and are considered reworked. Common are *Cyathidites*, *Dilwynites* and *Microcachryidites*, with frequent *Gleicheniidites* and *Podosporites*. Trace Permian reworking was seen.

Assignment to the *P. infusorioides* Dino Zone is indicated by *C. edwardsii* in both samples. No younger or older markers were seen, even in the cuttings. *Palaeoperidinium cretaceum* is also present.

Very nearshore environments are indicated by the low dinoflagellate content (7% in core, 15% in cuttings) and their low diversity amongst the common and diverse spores and pollen. Freshwater algae are minor (2% and 3% *Botryococcus*).

These features are usually seen at the top of the lower Shipwreck Group in the offshore Otway Basin.

3 **908-11m(cutts) : *pannosus* Zone**

Assignment to the *P. pannosus* Zone of late Albian age is indicated at the top by youngest *C. paradoxa* and at the base by oldest *P. pannosus*. Other spores confirming the assignment include *Aequitriradites* spp, *C. striatus*, *F. asymmetricus* and *T. reticulatus*. *Cyathidites* and *Falcisporites* are common, with frequent *Gleicheniidites*, *Microcachryidites*, *Osmundacidites* and *Podosporites*. Minor younger caving has occurred.

C. edwardsii suggests the *infusorioides* Zone but the spore pollen data mentioned above indicates that this is caved, along with the rest of the dinoflagellates.

Environments are presumed to be non-marine on regional evidence, assuming that these dinoflagellates are all caved.

These features are seen in the topmost Eumeralla Formation.

4 In summary, Santonian section unconformably overlies Cenomanian section overlying Albian Eumeralla. Younger parts of the Sherbrook Group may be present but were not seen as caved elements.

IV CONCLUSIONS

Overall, the pattern seems to comprise presence or absence of three slices of Late Cretaceous Sherbrook Group separated by sizeable unconformities and overlying the Albian Eumeralla Formation. These probably correspond to the three most major highstands as seen in the more complete offshore section.

At the top, the Maastrichtian *longus* Zone (*druggii* Dino Zone) may occur and has only been sampled in Wangoom-2 (Morgan 1994 for the Victorian Geological Survey) and Koroit-10 (herein) in a blocky sand section (?Timboon Sand) at the top of a marked late Cretaceous S-P and resistivity "funnel." In the BHP samples reported herein, it is also seen as caving in Boothapool-2, Tyendarra-13 and Wangoom-2.

The upper *apoxyexinus* Zone (upper *cretacea* Dino Zone) is the thickest and most widespread interval and occurs in most of a distinctive log "funnel" coarsening from massive shales at the base to sandier section upward. Most of the cores show clean upper *apoxyexinus* (upper *cretacea*) assignments. However, Campanian section (*senectus* Zone, *australis* and *aceras* Dino Zones) is seen in core in Koroit-10 and caved in cuttings in Belfast-4, Belfast-11, Boothapool-2, Tyendarra-13, Wangoom-2 and Yambuck-1 and is clearly widespread. Beneath the upper *apoxyexinus* interval is seen the middle *apoxyexinus* Zone (lower *cretacea* Dino Zone) at Koroit-10 and Tyendarra-13 in the lower part of the "funnel." This section is equivalent to the Sherbrook Group above the Shipwreck Group comprising mostly Belfast Mudstone and Paaratte Formation offshore.

The *distocarinatus* Zone (*infusorioides* Dino Zone) is variable in distribution and can be totally absent (Belfast-11, Codrington-1, Tyendarra-13, Wangoom-2 and -6, Yambuck-2), thin (Boothapool-2) or quite thick (Belfast-4, Koroit-10, Yangery-1). The logs show a flat claystone response with a high resistivity spike at the top. This section corresponds to the lower Shipwreck Group offshore. The upper Shipwreck Group appears to be unrepresented in these wells.

Beneath this, the Eumeralla is dated as *pannosus* Zone wherever good assemblages are present. Log responses are typical of claystones or siltstones, generally interbedded, with uniform low resistivity.

V REFERENCES

Cookson IC and Eisenack A (1961) Upper Cretaceous microplankton from the Belfast No4 bore, southwestern Victoria Proc. R. Soc. Vict 74 69-76

Dettmann and Playford (1969) Palynology of theAustralian Cretaceous : a review In Stratigraphy and Palaeontology. Essays in honour of Dorothy Hill, KSW Campbell Ed. ANU Press, Canberra 174-210

Helby RJ, Morgan RP and Partridge AD (1987) A palynological zonation of the Australian Mesozoic **In** Studies in Australian Mesozoic Palynology Assoc. Australas. Palaeontols. Mem 4 1-94

Morgan RP (1985) Palynology review of selected oil drilling. Otway Basin, South Australia, unpubl rept for Ultramar Australia

Morgan RP (1992) Overview of new cuttings based Late Cretaceous correlation, Otway Basin, Australia unpubl rept for BHPP

Morgan RP (1994) Core palynology of Drik Drik-1, Glenaulin-2, Kaladbro-2, Palpara-1, Pretty Hill-1, Wangoom-2, onshore Otway Basin, Victoria, Australia unpubl rept for Vic DME

Stover LE and Evans PR (1973) Upper Cretaceous-Eocene spore pollen zonation, offshore Gippsland Basin, Australia spec. Publs. geol. Soc. Aust 4, 55-72

Stover LE and Partridge AD (1973) Tertiary and Late Cretaceous spores and pollen from the Gippsland Basin, Southeastern Australia Proc. R. Soc. Vict. 85 237-286.

BELFAST #4 #11, BOOTHAPOOL #2 ... YAMBUCK #1, YANGERRY #1

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C L I E N T: BHP PETROLEUM
W E L L S: BELFAST #4 #11 - BOOTHAPOOL #2 - CODRINGTON #1 - KOROIT #10
TYENDARRA #13 - WANGOOM #2 #6 - YAMBUCK #1 - YANGERRY #1

A N A L Y S T: Roger Morgan Ph.D D A T E: August '94

N O T E S: all sample depths are in metres
all figures are percentages of 100 specimen count
"X" indicates species is very rare and occurred outside the count

RANGE CHART OF OCCURRENCES BY DINO % / ALPHABETICAL LISTS

Sample	1 --- DINOFLAGELLATE % ---	2 AEQUITRIRADITES SPINULOSUS	3 AEQUITRIRADITES VERRUCOSUS	4 AMOSOPOLLIS CRUCIFORMIS	5 APPENDICISPORITES DISTOCARINATUS	6 APPENDICISPORITES TRICORNITATUS	7 ARAUCARIACITES AUSTRALIS	8 ASTEROPOLLIS ASTEROIDES	9 AUSTRALOPOLLIS OBSCURIS	10 BALMEIOPSIS LIMBATA	11 BALMEISPORITES HOLODICTYUS	12 BALMEISPORITES TRIDICTYUS	13 CALLIALASPORITES DAMPIERI	14 CALLIALASPORITES TURBATUS	15 CAMEROZONOSPORITES BULLATUS	16 CAMEROZONOSPORITES OHAIENSIS	17 CAMEROZONOSPORITES SOLIDA	18 CERATOSPORITES EQUALIS	19 CICATRICOSISPORITES AUSTRALIENSIS	20 CICATRICOSISPORITES FOVEOAUSTRALIEN..	21 CICATRICOSISPORITES LUDBROOKIAE	22 CINGUTRILETES CLAVUS	23 CLAVATIPOLLENITES HUGHESI	24 CLAVIFERA TRIPLEX	25 CONCAVISSIMISPORITES PENOLAENSIS	26 CONTIGNISPORITES COOKSONIAE	27 COPTOSPORA PARADOXA	28 COPTOSPORA PILEOSA	29 COPTOSPORA WRINKLY	30 COROLLINA TOROSUS	31 CRYBELOSPORITES STRIATUS	32 CYATHEACIDITES TECTIFERA	33 CYATHIDITES AUSTRALIS	34 CYATHIDITES MINOR	35 CYATHIDITES SPLENDENS	36 CYCADOPITES FOLLICULARIS	37 DENSOISPORITES VELATUS	38 DICTYOPHYLLIDITES
BELFAST #4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1370.08 CORE	6	.	.	2	.	.	.	.	5	.	.	.	.	.	.	X	.	.	1	.	.	.	.	1	.	.	.	.	.	1	.	.	2	5	.	2	.	.
1515 CUTTS	14	.	X	X	X	.	.	.	3	.	.	.	.	X	.	1	.	.	X	X	.	.	.	1	.	.	.	.	X	.	.	.	2	21	.	1	.	.
1526 CUTTS	14	X	.	2	X	.	.	.	1	.	.	.	.	.	.	.	.	2	.	.	.	1	.	1	.	.	.	.	.	1	.	.	1	14	.	.	.	.
1546.0 CORE	14	.	.	.	.	.	2	.	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	3	11	.	.	.	.
1631.29 CORE	0	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	1	.	3	27	.	1	.	.
BELFAST #11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1341 CUTTS	14	.	.	.	.	.	3	.	3	.	.	.	.	.	.	X	.	.	X	.	.	1	.	2	.	.	.	X	.	1	.	.	1	10	.	1	.	.
1356 CUTTS	5	X	X	X	.	.	1	.	4	.	.	.	.	.	.	.	.	2	X	.	.	1	.	.	.	.	X	X	.	X	X	.	1	18	.	.	.	.
1374.6 CORE	0	X	X	.	.	.	2	.	.	.	1	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	1	.	.	3	1	.	7	13	.	1	.	.
BOOTHAPOOL #2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1119 CUTTS	8	.	.	1	.	.	1	.	3	.	.	.	.	.	.	X	.	1	1	.	.	.	1	X	1	.	.	X	.	2	.	.	6	7	.	.	X	.
1146 CUTTS	6	1	1	.	1	1	1	.	2	.	.	.	X	.	1	.	.	.	3	.	.	1	.	X	X	.	.	X	.	3	.	.	2	11	.	X	.	.
1200.2 CORE	0	.	.	.	.	.	1	.	1	.	.	.	.	.	.	.	.	1	.	.	.	3	.	.	.	.	.	.	.	1	X	.	3	17	.	.	.	.
CODRINGTON #1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1134 CUTTS	13	.	.	.	.	.	4	1	.	.	1	.	.	1	.	.	.	1	3	.	.	.	.	X	.	X	X	.	.	1	1	.	2	12	.	.	.	.
KOROIT #10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1009.50 CORE	0	X	.	.	.	.	X	.	.	.	.	.	.	.	X	1	.	X	1	.	.	.	.	2	.	.	.	.	.	.	.	.	5	12	X	.	.	.
1062.23 CORE	7	.	.	X	.	.	.	.	2	.	.	.	.	.	X	1	.	1	.	.	.	.	.	1	.	.	.	.	.	.	.	.	3	4	.	.	.	.
1110.69 CORE	5	.	.	1	.	.	.	2	3	.	.	.	.	.	.	.	.	1	.	.	.	X	.	1	.	.	.	X	.	.	.	.	6	10	.	.	.	.
1162.0 CORE	13	.	.	X	X	.	1	.	X	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.	.	.	.	.	1	.	.	16	21	.	.	.	.
1207.85 CORE	0	.	1	.	.	.	1	.	.	.	X	.	.	.	.	.	.	2	5	.	.	.	.	.	1	X	2	.	.	1	1	.	22	32	.	1	.	.
1208.7 CORE	0	.	.	.	.	.	2	.	.	.	.	.	.	1	.	.	.	.	2	.	.	.	.	.	.	.	X	.	.	.	X	.	2	22	.	.	.	.
1231 CUTTS	3	.	.	X	.	.	.	1	.	.	X	.	1	.	.	.	.	2	8	.	.	.	.	.	X	.	2	.	.	1	.	.	5	25	.	1	.	.
1253.5 CORE	0	X	1	.	.	.	1	.	.	.	X	.	1	.	.	.	.	1	7	.	.	.	.	.	1	.	1	.	.	1	2	.	15	40	.	1	.	.
TYRENDARRA#13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1320 CUTTS	15	.	.	X	.	X	1	.	4	.	X	.	.	.	.	.	.	1	X	.	.	.	.	1	.	.	.	.	.	1	.	.	1	8	.	.	1	.
1332 CUTTS	17	X	1	X	.	.	.	.	2	.	.	.	X	.	.	1	.	1	1	.	.	.	.	1	.	.	.	.	.	X	X	.	3	7	.	1	.	.
1340.3 CORE	1	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.	.	4	4	.	2	.	.
WANGOOM #2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
0920.3 CORE	2	.	.	1	.	.	2	.	12	.	.	.	.	.	.	2	.	.	.	.	.	.	.	X	.	.	.	.	.	1	.	.	3	7	.	.	.	.
0933 CUTTS	8	.	.	.	.	.	1	.	5	.	.	.	.	.	.	.	.	.	.	.	.	X	.	X	.	.	.	.	.	.	?	1	2	12	.	1	.	.
0948 CUTTS	15	.	.	.	.	.	1	.	3	.	.	.	.	.	.	1	X	1	.	.	.	1	.	1	.	.	.	.	.	1	.	.	1	10	.	1	.	.
0957.0 CORE	0	X	X	.	.	.	1	.	.	.	X	.	.	.	.	.	.	2	5	.	.	.	.	X	.	.	3	.	.	1	1	.	7	18	.	1	.	.
WANGOOM #6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
0991.2 CORE	18	.	.	.	.	.	1	.	2	.	.	.	.	.	.	.	.	2	1	.	.	.	.	1	.	1	.	.	.	.	X	.	3	12	.	1	.	.
1011.1 CORE	0	2	1	.	.	.	1	.	.	.	X	.	.	.	.	.	.	1	X	.	.	.	.	.	.	.	X	.	.	3	X	.	26	35	.	.	.	.
YAMBUCK #2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1372 CUTTS	15	X	1	X	.	.	1	.	2	.	.	.	.	.	.	X	.	.	1	X	.	.	.	5	.	.	.	.	.	3	.	.	2	7	.	.	1	1
1382.0 CORE	0	.	.	X	.	.	3	X	.	.	X	X	X	1	.	.	.	3	1	.	.	.	.	.	.	1	X	.	.	1	X	.	3	21	.	.	.	.
YANGERY #1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
0826.0 CORE	13	.	.	.	1	X	1	.	2	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	1	.	4	16	.	1	.	.
0872.0 CORE	7	.	.	.	X	X	.	.	.	.	X	.	.	.	.	.	.	12	1	.	1	.	.	X	.	.	.	.	.	.	.	.	6	16	3	.	.	.
0905 CUTTS	15	.	.	2	.	X	5	.	.	X	.	.	X	.	.	.	1	1	1	.	.	.	.	.	.	.	.	X	.	1	X	.	3	10	.	2	.	.
0911 CUTTS	9	X	.	2	1	.	2	.	3	.	.	.	.	.	.	.	.	.	X	X	X	.	.	.	.	.	1	.	.	1	1	.	7	11	.	1	1	.

	BELFAST #4	1370.08 CORE	1515 CUTTS	1526 CUTTS	1546.0 CORE	1631.29 CORE	BELFAST #11	1341 CUTTS	1356 CUTTS	1374.6 CORE	BOOTHAPOOL #2	1119 CUTTS	1146 CUTTS	1200.2 CORE	CODRINGTON #1	1134 CUTTS	KOROIT #10	1009.50 CORE	1062.23 CORE	1110.69 CORE	1162.0 CORE	1207.85 CORE	1208.7 CORE	1231 CUTTS	1253.5 CORE	TYRENDARRA#13	1320 CUTTS	1332 CUTTS	1340.3 CORE	WANGOOM #2	0920.3 CORE	0933 CUTTS	0948 CUTTS	0957.0 CORE	WANGOOM #6	0991.2 CORE	1011.1 CORE	YAMBUCK #2	1372 CUTTS	1382.0 CORE	YANGERY #1	0826.0 CORE	0872.0 CORE	0905 CUTTS	0911 CUTTS
39 DICTYOTOSPORITES COMPLEX	.	.	.	X	.	.	.	.	X	X	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	X	.	X
40 DICTYOTOSPORITES SPECIOSUS	.	X	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
41 DILWYNITES GRANULATUS	.	8	4	15	7	.	.	9	7	2	.	5	7	1	.	6	.	1	15	14	15	.	.	1	.	.	9	10	1	.	7	10	5	.	.	6	.	.	6	2	.	14	14	10	1
42 FALCISPORITES GRANDIS	.	1	3	3	3	1	.	3	2	4	.	1	1	2	.	3	.	.	2	1	1	1	2	4	1	.	2	1	4	.	4	1	4	3	.	2	2	.	2	2	.	.	.	4	3
43 FALCISPORITES SIMILIS	.	12	16	10	26	11	.	20	15	13	.	15	10	18	.	9	.	10	10	4	9	8	24	15	6	.	13	7	34	.	15	10	12	16	.	14	4	.	10	21	.	8	3	12	18
44 FORAMINISPORIS ASYMMETRICUS	.	.	.	.	.	2	.	.	1	X	.	.	.	X	.	X	.	.	.	.	.	6	.	X	X	.	.	.	.	.	.	.	.	1	.	.	.	.	.	X	.	.	.	X	X
45 FORAMINISPORIS DAILYI	.	.	1	X	.	1	.	.	.	.	.	1	1	X	.	.	.	.	.	.	.	1	X	.	.	.	.	.	.	.	.	.	X	X	.	1	.	.	.	.	.	.	.	.	1
46 FORAMINISPORIS WONTHAGGIENSIS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1	.	X	X	.	.	.	.	X	1	.	X	.	.	.
47 FOVEOTRILETES PARVIRETUS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	1	.	X	1	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	1	.
48 GAMBIERINA EDWARDSI	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
49 GAMBIERINA RUDATA	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	X	.	.	.	.	.	.	.	1	.	.	.	.	1	X	.	.	.	.	.	.	.	.	.	.	X	.
50 GEPHYROPOLLENITES WAHOOENSIS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
51 GLEICHENIIDITES	.	4	2	2	3	.	.	7	4	1	.	2	5	1	.	2	.	15	3	5	2	1	1	2	2	.	4	3	1	.	4	4	6	2	.	1	1	.	1	.	.	2	11	3	5
52 HALORAGACIDITES HARRISII	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
53 HERKOSPORITES ELLIOTTII	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
54 HOEGISPORIS TRIDICTYUS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X
55 ISCHYOSPORITES PUNCTATUS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
56 KLUKISPORITES SCABERIS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
57 KUYLISPORITES ZIPPERI	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.
58 LAEVIGATOSPORITES OVATUS	.	2	4	.	.	2	.	.	.	.	.	1	1	.	.	.	.	5	1	1	.	.	1	.	.	.	.	5	.	.	X	.	.	.	.	1	X	.	1	.	.	1	3	.	.
59 LEPTOLEPIDITES VERRUCATUS	.	.	.	.	.	2	.	X	.	.	.	1	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1	.	X
60 LILIACIDITES PERORETICULATUS	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
61 LILIACIDITES SP.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
62 LYCOPODIACIDITES ASPERATUS	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	1	.	.	.	.	.	1	.	.	1	2	.
63 LYGISTIPOLLENITES BALMEI	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
64 LYGISTIPOLLENITES FLORINII	.	.	.	.	.	.	.	.	2	.	.	1	3	.	.	.	.	X	.	X	.	.	.	.	.	.	1	1	.	.	1	3	1	.	.	.	.	.	.	.	.	.	.	1	1
65 MALVACIPOLLIS SUBTILIS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
66 MICROCACHRYIDITES ANTARCTICUS	.	5	4	13	11	1	.	10	12	20	.	12	11	14	.	12	.	7	8	5	9	1	10	10	3	.	10	3	7	.	10	5	1	18	.	4	8	.	10	16	.	13	2	10	7
67 MUROSPORA FLORIDA	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
68 NEORAISTRICKIA	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
69 NEORAISTRICKIA TRUNCATA	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
70 NOTHOFAGIDITES EMARICIDUS	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
71 NOTHOFAGIDITES ENDURUS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	4	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
72 NOTHOFAGIDITES FALCATA	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
73 NOTHOFAGIDITES PROTOSENECTUS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.
74 NOTHOFAGIDITES SENECTUS	.	.	X	.	X	.	.	X	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	2	1	.	.	.	.	.	.	.	.	.	.	.	.
75 ORNAMENTIFERA SENTOSA	.	X	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	X	.	1	.	.	.	.	.	.	.	.	.	.	.	.
76 OSMUNDACIDITES WELLMANII	.	2	1	2	6	6	.	2	6	5	.	5	4	4	.	6	.	1	3	2	4	3	4	1	10	.	1	1	27	.	1	5	1	8	.	1	10	.	1	8	.	3	2	3	7

		BELFAST #4	1370.08 CORE	1515 CUTTS	1526 CUTTS	1546.0 CORE	1631.29 CORE	BELFAST #11	1341 CUTTS	1356 CUTTS	1374.6 CORE	BOOTHAPOOL #2	1119 CUTTS	1146 CUTTS	1200.2 CORE	CODRINGTON #1	1134 CUTTS	KOROIT #10	1009.50 CORE	1062.23 CORE	1110.69 CORE	1162.0 CORE	1207.85 CORE	1208.7 CORE	1231 CUTTS	1253.5 CORE	TYRENDARRA#13	1320 CUTTS	1332 CUTTS	1340.3 CORE	WANGOOM #2	0920.3 CORE	0933 CUTTS	0948 CUTTS	0957.0 CORE	WANGOOM #6	0991.2 CORE	1011.1 CORE	YAMBUCK #2	1372 CUTTS	1382.0 CORE	YANGERY #1	0826.0 CORE	0872.0 CORE	0905 CUTTS	0911 CUTTS
77	PEROTRILETES JUBATUS/MORGANII	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	X	.	.
78	PEROTRILETES MAJUS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	X	1	.
79	PHIMOPOLLENITES PANNOSUS	.	.	.	.	.	.	.	1	X	2	.	.	1	.	.	1	.	.	.	.	.	X	X	1	X	.	.	3	.	.	2	2	.	1	.	.	X	.	2	X	.	1	2	.	1
80	PHYLLOCLADIDITES EUNUCHUS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
81	PHYLLOCLADIDITES MAWSONII	.	2	3	2	.	.	.	2	2	.	.	2	2	.	.	X	.	.	9	1	1	.	.	.	.	.	2	2	1	.	7	4	3	.	.	6	.	.	4	.	.	1	.	.	.
82	PHYLLOCLADIDITES VERRUCATUS	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
83	PILOSISPORITES GRANDIS	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	2	X	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.
84	PILOSISPORITES NOTENSIS	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
85	PILOSISPORITES PARVISPINOSUS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
86	PODOSPORITES MICROSACCATUS	.	14	5	8	2	2	.	6	2	8	.	4	4	4	.	2	.	4	6	10	.	1	1	1	.	.	3	7	.	.	3	3	4	5	.	6	1	.	1	.	.	5	3	6	6
87	PROTEACIDITES GRANDIS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.
88	PROTEACIDITES HAPUKUI	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
89	PROTEACIDITES PALISADUS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.
90	PROTEACIDITES SP.	.	8	4	1	.	.	.	1	3	.	.	4	7	.	.	.	.	9	10	4	.	.	.	1	.	.	4	8	.	.	2	7	6	.	.	3	.	.	4	.	.	3	.	.	.
91	PROTEACIDITES SP. LARGE	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1	.	.	.	.	.	.	1	.	.	.	.	.	.
92	RETITRILETES AUSTROCLAVATIDITES	.	3	2	2	2	1	.	1	.	5	.	1	1	1	.	3	.	1	1	1	1	1	6	1	1	.	2	2	.	.	2	1	3	3	.	2	2	.	1	6	.	3	5	1	2
93	RETITRILETES EMINULUS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
94	RETITRILETES NODOSUS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.
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96	SESTROSPORITES PSEUDOALVEOLATUS	.	.	.	.	.	.	.	.	.	.	.	X	X	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.
97	STERIESPORITES ANTIQUASPORITES	.	7	2	1	.	9	.	.	X	2	.	2	.	3	.	3	.	6	.	2	1	.	3	X	1	.	3	2	4	.	2	2	1	1	.	2	.	.	1	2	.	2	2	X	.
98	STERIESPORITES PUNCTATUS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
99	TETRACOLPORITES RETICULATA	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.
100	TETRACOLPORITES VERRUCOSUS	.	.	.	.	.	.	.	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.
101	TRICOLPITES	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
102	TRICOLPITES CONFESSUS	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	1	X	1	.	.	.	.	.	.	.	X	.	.	.	.	X	.	.	.	.	.	?	.	.	.	.	.	.
103	TRICOLPITES GILLI	.	.	.	1	.	.	.	.	.	.	.	.	X	.	.	.	.	.	2	1	.	.	.	.	.	.	1	.	.	.	X	.	1	.	.	.	.	.	.	.	.	.	.	1	.
104	TRICOLPITES LONGUS	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	X	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
105	TRICOLPITES SABULOSUS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
106	TRICOLPITES WAIPAWAENSIS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
107	TRICOLPORITES	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
108	TRICOLPORITES APOXYEXINUS	.	X	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	1	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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112	TRIPOROLETES RETICULATUS	.	.	.	.	.	.	.	.	.	2	.	.	.	X	.	.	.	.	.	.	.	1	3	2	1	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1	.	.	.	X	1
113	TRIPOROLETES SIMPLEX	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
114	TRIPOROPOLLENITES SECTILIS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

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