PALYNOLOGY OF TEN MAASTRICHTIAN TO OLIGOCENE SAMPLES FROM BOOTHAPOOL-2, BELFAST 11, 12, 13 AND KOROIT-10, ONSHORE OTWAY BASIN, VICTORIA

BY

ROGER MORGAN

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I SUMMARY

Boolapool-2
524m(cutts) : apparently upper *diversus* Zone : Early Eocene : very nearshore : usually Dilwyn

791-97m(cutts) : upper *balmei* Zone : Paleocene : marginally marine : usually lower Pember and Pebble Point

810.5m(cutts) : lower *balmei* Zone (*crassitabulata* Dino Zone) : Paleocene : very nearshore : usually Pebble Point

Belfast-11
476m(cutts), 506m(cutts) : lower *asperus* Zone (*heterophlycta* Dino Zone) : Middle Eocene : nearshore marine : usually Nirranda

931-41m(core) : upper *longus* Zone (*druggii* Dino Zone) : Maastrichtian : usually topmost Paaratte

Belfast-12
432.6-38.5m(core) : lower *asperus* Zone (*heterophlycta* Dino Zone) : Middle Eocene : very nearshore marine : usually Nirranda Group

723-33m(core) : probably middle *diversus* Zone : Early Eocene : very nearshore : usually upper Pember or lower Dilwyn

Belfast-13
423-26m(core) : lower *asperus* to middle *tuberculatus* Zones : Middle Eocene to Oligocene : intermediate marine : usually Nirranda Group

Koroit-10
551-57m(core) : upper *diversus* Zone : Early Eocene : very nearshore : usually Dilwyn.

II INTRODUCTION

This sample suite was submitted by Greg Parker of the Victorian Department of Energy and Minerals as part of a study of the onshore Otway Basin.

Palynomorph occurrence data are shown as Appendix 1 and from the basis for the assignment of the samples to the Tertiary and Late Cretaceous Zones.

The Tertiary zonation is basically that of Stover and Evans (1973) and Stover and Partridge (1973) as modified by Partridge (1976) and shown in Figure 1.

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, as shown in Figure 2.

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 involves the following steps:

(a) scan two traverses at x 10 to log the bulk of the assemblage and get some idea of age.

(b) scan at x 40 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 x 10 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.

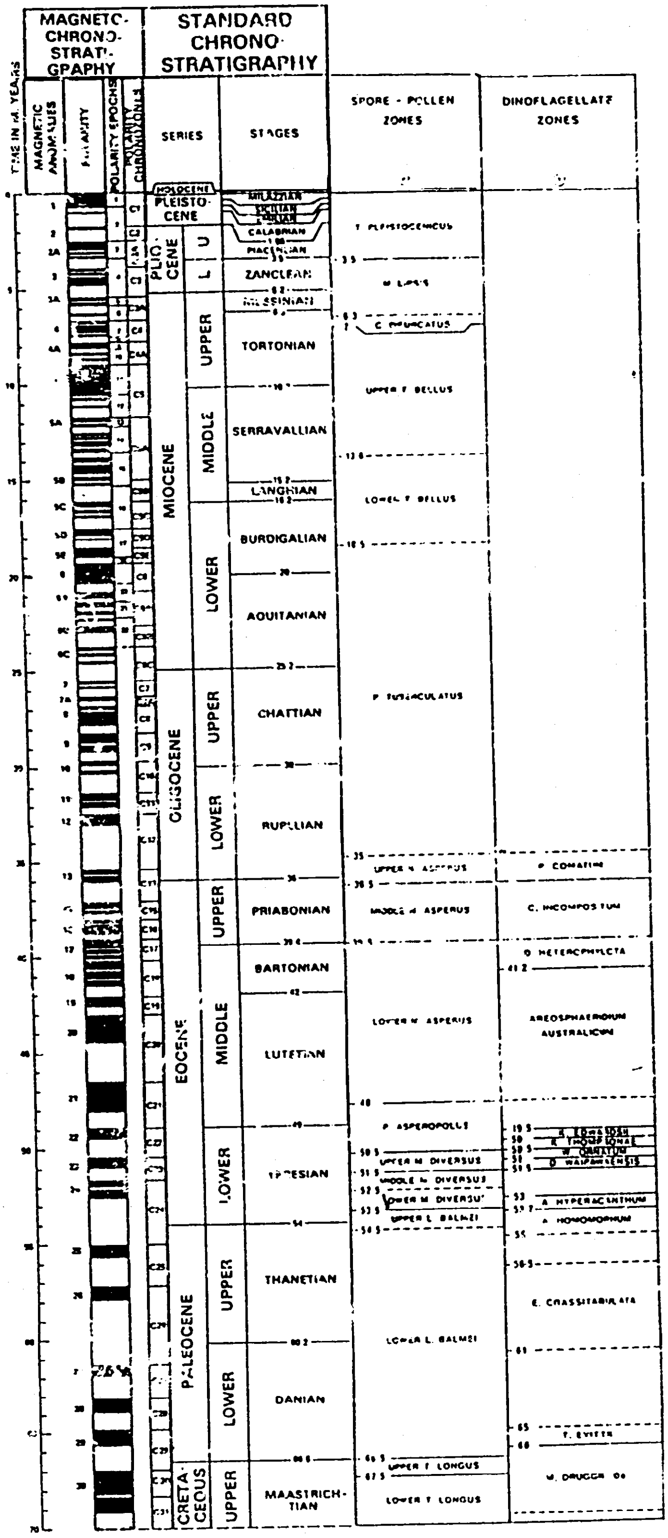

FIGURE 1   ZONAL FRAMEWORK

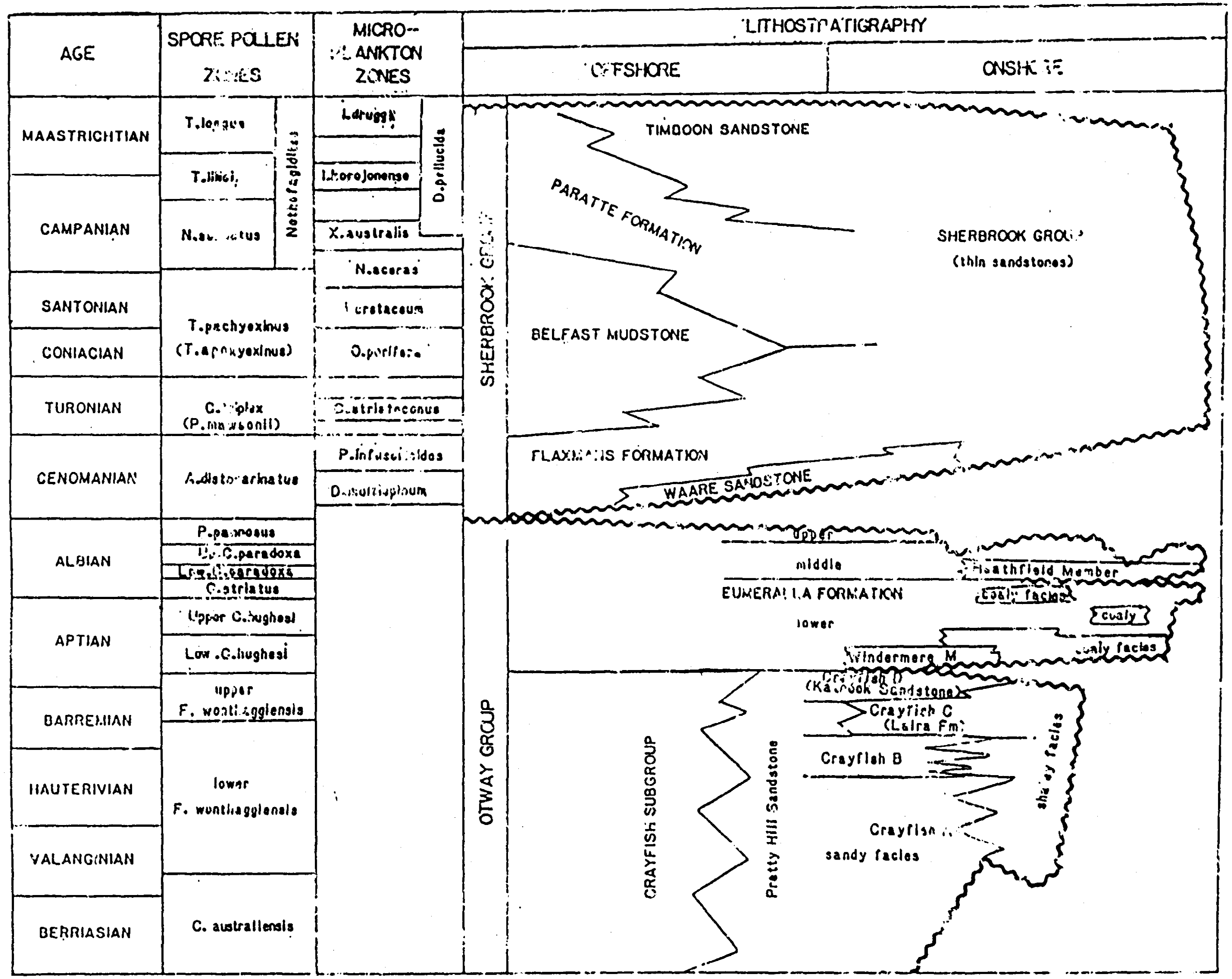

FIGURE 2 CRETACEOUS REGIONAL FRAMEWORK, OTWAY BASIN

III PALYNOSTRATIGRAPHY

A BOOTHAPOOL-2

1 524m(cutts) : apparently upper *diversus* Zone

Assignment to the upper *Malvacipollis diversus* Zone of Early Eocene age is indicated at the top by youngest *Intratriporopollenites notabilis*, *Malvacipollis diversus*, *Myrtaceidites tenuis*, *Proteacidites grandis* and *Spinozonocolpites prominatus* without *Proteacidites asperopolus* and common *Haloragacidites harrisii*. At the base, oldest *Proteacidites pachypolus* and *M. tenuis* are diagnostic, but could conceivably be caved into lower or middle *diversus* Zone from any overlying upper *diversus* or *asperopolus* Zone. Since multiple specimens were seen, they are likely to be in place. Younger caved elements are seen, including *Alisocysta ornata* and *Areosphaeridium arcuatum*, caving from the lower *asperus* Zone Nirranda Group. *H. harrisii* is common with *Nothofagidites emarcidus* very frequent and *Dilwynites granulatus* and *Proteacidites* frequent. Rare elements include *Anacolosidites acutullus*, *Banksieacidites arcuatus*, *Cupanieidites orthoteichus*, *I. notabilis*, *M. tenuis*, *P. pachypolus* and *S. prominatus*.

Dinoflagellates are rare but include *A. ornatum* and *A. arcuatum* diagnostic of the Middle Eocene lower *asperus* Zone. In view of the spore-pollen evidence, these are considered caved. Longranging taxa include *Apectodinium homomorphum* and *Thalassiphora pelagica* with frequent *Spiniferites ramosus* probably caved.

Very nearshore marine environments are indicated by the low dinoflagellate diversity and content (12%) much of which is probably caved. Spores and pollen are abundant and diverse and cuticle fragments are very common.

These features are normally seen in the Dilwyn Formation.

2 791-97m(core) : upper *balmei* Zone

Assignment to the upper *Lygistepollenites balmei* Zone of Paleocene age is indicated at the top by youngest *Gambierina rudata* and *L. balmei* and at the base by oldest *Proteacidites grandis*. Common *Proteacidites*, *Dilwynites* and *Falcisporites* with frequent *Cyathidites*, *Gambierina* and *Laevigatosporites*.

Dinoflagellates are rare and nondescript.

Marginally marine environments are indicated by the very rare low diversity dinoflagellates, common spiny acritarchs (11% *Micrhystridium*) and freshwater algae (5% *Botryococcus*) and dominant and diverse spores and pollen.

These features are normally seen in the lower Pember Member and Pebble Point Formation.

3 **810.5m(cutts) : lower *balmei* Zone (*crassitabulata* Dino Zone)**

Assignment to the lower *L. balmei* Zone of Paleocene age is indicated by consistent *G. rudata* and *L. balmei* without younger or older markers, and confirmed by the dinoflagellates. *Dilwynites* spp are very common with frequent *Falcisporites* and *Proteacidites*. Rare elements include *Australopollis obscurus*, *Amosopollis cruciformis* and *Stereisporites punctatus*.

Dinoflagellates are very rare but include *Deflandrea speciosa*, *Eisenackia crassitabulata* and *Isabelidinium bakeri* indicating the mid Paleocene *crassitabulata* Dinoflagellate Zone.

Very nearshore environments are indicated by the low dinoflagellate content (1%) and diversity, very frequent freshwater algae (9% *Botryococcus*) and abundant and diverse spores and pollen.

These features are normally seen in the Pebble Point Formation.

B BELFAST-11

1 **476m(cutts), 506m(cutts) : lower *asperus* Zone (*heterophlycta* Dino Zone)**

Assignment to the Middle Eocene *Nothofagidites asperus* Zone is indicated by dominant *Nothofagidites* spp (47%) without older markers. At 476m, *Cyatheacidites annulatus* suggests the Oligocene *Proteacidites tuberculatus* Zone, but is considered caved given the dinoflagellate data. *Nothofagidites* totally dominate with *N. deminutus* and *N. falcata* frequent and *N. asperus* rare but consistent. *Dilwynites*, *Cyathidites* and *H. harrisii* are also frequent.

Amongst the dinoflagellates, *A. ornatum*, *Areosphaeridium multicornutum*, *Deflandrea heterophlycta* and *D. phosphoritica* indicate the *D. heterophlycta* Zone of Middle Eocene age, correlative with the lower *N. asperus* Spore-Pollen Subzone. *Spiniferites* and *Micrhystridium* spp are frequent to common. *Pentadinium laticinctum* at 506m is considered caved from the Oligocene.

Environments are nearshore marine with subordinate dinoflagellates of moderate diversity and dominant and diverse spores and pollen. Marine influence increases upsection, with increasing dinoflagellate content, and decreasing freshwater algal content.

These features are normally seen in the Nirranda Subgroup.

2 **931-41m(core) : upper *longus* Zone (*druggii* Dino Zone)**

Assignment to the upper *Tricolpites longus* Zone of Maastrichtian age is indicated at the top by youngest *Quadraplanus brossus*, *T. longus*, *T. waipawaensis*, *Tricolporites lilliei* and *Triporopollenites sectilis*, and at the y oldest *Stereisporites punctatus* and common *G. rudata*. *Proteacidites* are totally dominant (36%) with *G. rudata* common (20%). Other rare elements not already mentioned include *Stereisporites regium* and *Nothofagidites endurus*.

Amongst the rare dinoflagellates, *Canninginopsis bretonica*, *Isabelidinium bakeri* and *Manumiella druggii* indicate the *M. druggii* Dinoflagellate Zone. *C. bretonica* is the most frequent.

These features are normally seen in the topmost Paaratte Formation and equivalents. It frequently occurs as a thin terminal Cretaceous claystone.

C **BELFAST-12**

2 **432.6-38.5m(core) : lower *asperus* Zone**

Assignment to the *N. asperus* Zone of Middle Eocene age is indicated by abundant *Nothofagidites* spp without other markers. The lower Subzone is indicated by the dinoflagellates. *Nothofagidites* totally dominate (63%) with frequent *Cyathidites* and *Falcisporites*. Rare elements include *Beaupreadites verrucosus* and *Kuylisporites waterbolkii*. Clearly caved is the middle Miocene and younger *Acaciapollenites myriosporites*.

Amongst the dinoflagellates are *Deflandrea heterophlycta* and *D. phosphoritica*, indicating the middle Eocene *D. heterophlycta* Dinoflagellate Zone, correlative with the lower *N. asperus* Spore-Pollen Zone.

Very nearshore marine environments are indicated by the low dinoflagellate diversity and content (4%), abundant spores and pollen and consistent freshwater algae.

These features are normally seen in the Nirranda Subgroup, so the Mepunga Formation is quite likely.

2 **723-33m(core) : probably middle *diversus* Zone**

This assemblage is unusual in that zone markers are exceptionally rare. A middle *M. diversus* Zone assignment is most likely with very rare oldest *B. arcuatus*, *P. kopiensis* and *Proteacidites clarus* seen. A lower *diversus* Zone or younger is indicated by oldest *C. orthoteichus* and *Periporopollenites demarcatus*. Rare specimens transitional to *P. pachypolus* suggest the upper *diversus* Zone. Many of the usual Dilwyn/Pember taxa were not seen. A single *L. balmei* is considered reworked.

Amongst the dinoflagellates, *Deflandrea pachyceros* and *D. obliquipes* with *Apectodinium* spp are consistent. *Micrhystridium* spp are frequent.

Very nearshore marine environments are indicated by the rare low diversity dinoflagellates and dominant and diverse spores and pollen.

These features are normally seen in the upper Pember Formation or lower Dilwyn Formation.

D BELFAST-13

1 **423-26m(core) : lower *asperus* Zone to middle *P. tuberculatus* Zones**

This sample is extremely lean and cannot be confidently assigned. Dominance of *Nothofagidites* and *Spiniferites* clearly indicates a post Dilwyn age. Spores and pollen are extremely rare and not very age diagnostic, but common *Nothofagidites* with rare *N. flemingii* and *N. falcata* indicate a lower *asperus* to middle *tuberculatus* interval (mid Eocene to Late Oligocene).

Amongst the dinoflagellates, a single *Schematophora speciosa* suggests a Middle Eocene age, while *Impletosphaeridium* spA and *Pentadinium laticinctum* suggest Oligocene ages.

Environments are intermediate marine as shown by the dominant dinoflagellates (80%) and their high diversity, and the lean yields with very restricted spores and pollen.

These features are certainly more typical of the Nirranda Subgroup than the Dilwyn Formation.

E KOROIT-10

1 551-57m(core) : upper *diversus* Zone

Assignment to the upper *Malvacipollis diversus* Zone of Early Eocene age is indicated at the top by youngest *M. diversus*, *M. tenuis*, *P. grandis*, *P. ornatus* and *S. prominatus* with common *H. harrisii* and without younger markers, and at the base by oldest *M. tenuis* and *P. pachypolus*. *H. harrisii* and *Proteacidites* are common, with frequent *Cyathidites*, *M. diversus* and *Lygistepollenites florinii*. Rare elements include *C. orthoteichus*, *M. tenuis*, *P. demarcatus* and *P. kopiensis*.

Dinoflagellates are very rare and not age diagnostic. *Apectodinium homomorphum* is present.

Very nearshore marine environments are indicated by the extremely rare dinoflagellates (2%) and their low diversity, frequent freshwater algae (7%) and the common and diverse spores and pollen.

These features are normally seen in the Dilwyn Formation and occur in the Burrungule Member.

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E BOOTAHPOOL-2, BELFAST-11, BELFAST-12,BELFAST-13 & KOROIT-10

MORGAN PALAEO ASSOCIATES : Palynological Consultants
Box 161, Maitland, South Australia, 5573.
Phone (088) 322795 ... Fax (088) 322798

C L I E N T: GEOLOGICAL SURVEY OF VICTORIA
W E L L: BOOTHAPOOL-2, BELFAST-11, BELFAST-12, BELFAST-13 AND KOROIT-10
F I E L D / A R E A:

K B E L E V A T I O N: T O T A L D E P T H:
A N A L Y S T: ROGER MORGAN D A T E : NOVEMBER 1994
N O T E S: ALL DEPTHS ARE IN METRES
ALL FIGURES ARE PERCENTAGES BASED ON 100 SPECIMEN COUNT AND
"X" REPRESENTS RARE PRESENCE OUTSIDE THE COUNT
"A"=ABUNDANT, "C"=COMMON, "F"=FEW, "F"=RARE

RANGE CHART OF OCCURRENCES BY ALPHABETICAL LIST WITHIN GROUP

1	--- DINOFLAGELLATES -
2	ACHOMOSPHAERA ALCICORNU
3	ACHOMOSPHAERA RAMULIFERA
4	ADNATOSPHAERIDIUM RETICULENSE
5	ALISOCYSTA ORNATUM
6	APECTODINIUM HOMOMORPHA (L.SP.)
7	APECTODINIUM HOMOMORPHA (SH.SP.)
8	APTEODINIUM AUSTRALIENSE
9	AREOLIGERA SENONENSIS
10	AREOSPHAERIDIUM MICROFENESTRATUM
11	AREOSPHAERIDIUM MULTICORNUTUM
12	AREOSPHAERIDIUM MULTISPINOSUM
13	BOTRYOCOCCUS
14	CANNINGINOPSIS BRETONICA
15	CORDOSPHAERIDIUM INODES
16	CORRUDINIUM SP
17	CORRUDINIUM SP.1
18	CRASSOSPHAERA CONCINNA
19	CYCLOPSIELLA VIETA
20	DEFLANDREA FLOUNDERENSIS
21	DEFLANDREA HETEROPHLYCTA
22	DEFLANDREA OBLIQUIPES

	1 --- DINOFLAGELLATES ---	2 ACHOMOSPHAERA ALCICORNU	3 ACHOMOSPHAERA RAMULIFERA	4 ADNATOSPHAERIDIUM RETICULENSE	5 ALISOCYSTA ORNATUM	6 APECTODINIUM HOMOMORPHA (L.SP)	7 APECTODINIUM HOMOMORPHA (SH.SP)	8 APTEODINIUM AUSTRALIENSE	9 AREOLIGERA SENONENSIS	10 AREOSPHAERIDIUM MICROFENESTRATUM	11 AREOSPHAERIDIUM MULTICARNUTUM	12 AREOSPHAERIDIUM MULTISPINOSUS	13 BOTRYOCOCCUS	14 CANNINGINOPSIS BRETONICA	15 CLEISTOSPHAERIDIUM INODES	16 CORRUDINIUM SP	17 CORRUDINIUM SP.1	18 CRASSOSPHAERA CONCINNIA	19 CYCLOPSIELLA VICTA	20 DEFLANDREA FLOUNDERENSIS	21 DEFLANDREA HETEROPHLYCTA	22 DEFLANDREA OBLIQUIPES
BOOTHAPOOL-2	**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
524 CUTTS	**	.	X	.	X	.	1	X	1	.	X	X	.	.	X	.	.	.	.	X	.	.
791-97 CORE	**	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.
810.5 CUTTS	**	.	.	.	.	.	.	.	.	.	.	.	9	.	.	.	.	.	.	.	.	.
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BELFAST-11	**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
476 CUTTS	**	X	.	.	X	.	.	1	.	.	.	.	8	.	.	.	1	X	1	.	X	.
506 CUTTS	**	.	.	.	X	.	.	2	.	X	X	.	.	.	X	.	.	.	X	.	X	.
937-41 CORE	**	.	.	.	.	.	.	.	.	.	.	.	1	3	.	.	.	.	.	.	.	.
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KOROIT-10	**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
551-557 CORE	**	.	.	.	.	.	1	.	.	.	.	.	7	.	.	.	.	.	.	.	.	.

Sample	23 DEFLANDREA PACHYCEROS	24 DEFLANDREA PHOSPHORITICA	25 DEFLANDREA SP	26 DEFLANDREA SPECIOSA	27 DIPHYES COLLIGERUM	28 EISENACKIA CRASSITABULATA	29 EXOCHOSPHAERIDIUM	30 GLAPHYROCYSTA DIVARICATUM	31 GLAPHYROCYSTA SP	32 HAFNIASPHAERA SEPTATA	33 HAFNIASPHAERA SP	34 HEMIPLACOPHORA SEMILUNIFERA	35 HYSTRICHOCOLPOMA EISENACKII	36 HYSTRICHOKOLPOMA RIGAUDAE	37 HYSTRICHOKOLPOMA SP	38 HYSTRICHOSPHAEROPSIS OVUM	39 IMPAGIDINIUM	40 IMPAGIDINIUM VICTORIANUM	41 IMPLETOSPHAERDUM SP.A	42 ISABELIDIIUM CF PELLUCIDUM	43 ISABELIDINIUM BAKERI	44 LINGULODINIUM MACHAEROPHORUM
BOOTHAPOOL-2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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810.5 CUTTS	.	.	.	X	.	X	.	X	.	.	.	.	.	.	.	.	.	.	.	.	X	.
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BELFAST-11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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506 CUTTS	.	X	.	.	.	.	.	.	.	.	X	.	3	X	.	.	.	X	.	.	.	1
937-41 CORE	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	X	.
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BELFAST-13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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551-557 CORE	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.

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	45 MANUMIELLA DRUGGII	46 MANUMIELLA SP	47 MICRHYSTRIDIUM	48 NUMMUS MONOCULATUS	49 OPERCULODINIUM	50 OPERCULODINIUM CENTROCARPUM	51 PAPHLECHNIELLA INDENTATA	52 PENTADINIUM LATICINCTUM	53 POLYSPHAERIDIUM PSEUDOCOLLIGERUM	54 POLYSPHAERIDIUM SP	55 SCHEMATOPHORA SPECIOSA	56 SPINIFERITES FURCATUS/RAMOSUS	57 SYSTEMATOPHORA PLACACANTHA	58 TECTATODINIUM	59 TECTATODINIUM SPP	60 THALASSIPHORA PELAGICA	61 VERYHACHIUM	62 --- SPORE / POLLEN ---	63 ACACIAPOLLENITES MYRIOSPORITES	64 AMOSOPOLLIS CRUCIFORMIS	65 ANACOLOSIDITES ACUTULLUS	66 ARAUCARIACITES AUSTRALIS
OOTHAPOOL-2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**	.	.	.	.
24 CUTTS	.	.	3	.	.	.	1	.	.	1	.	4	X	.	.	X	.	**	.	.	1	.
91-97 CORE	.	X	11	.	.	.	1	.	.	.	.	1	.	.	.	.	.	**	.	.	.	X
10.5 CUTTS	.	.	.	1	X	.	.	.	.	.	.	X	.	.	.	.	1	**	.	X	.	.
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ELFAST-11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**	.	.	.	.
76 CUTTS	.	.	.	.	.	.	.	.	.	X	.	2	X	4	.	1	.	**	.	.	.	.
06 CUTTS	.	.	8	.	.	2	.	X	.	1	.	20	1	2	.	X	.	**	.	.	.	.
37-41 CORE	X	.	2	.	.	.	.	.	.	.	.	X	.	.	.	.	.	**	.	.	.	X
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ELFAST-12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**	.	.	.	.
32.6-8.5CORE	.	.	.	.	.	.	.	.	X	.	.	3	X	.	X	.	.	**	X	.	.	.
27-33 CORE	.	.	8	.	.	.	.	.	.	.	.	.	.	.	.	X	.	**	.	.	.	.
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ELFAST-13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**	.	.	.	.
23-26 CUTTS	.	.	.	.	.	14	.	X	.	2	X	49	.	.	.	.	.	.	.	.	.	.
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OROIT-10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**	.	.	.	.
51-557 CORE	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	**	.	.	.	.

	67 AUSTRALOPOLLIS OBSCURIS	68 BANKSIEACIDITES ARCUATUS	69 BEAUPREAIDITES VERRUCOSUS	70 CAMEROZONOSPORITES OHAIENSIS	71 CERATOSPORITES EQUALIS	72 CINGUTRILETES CLAVUS	73 CLAVIFERA TRIPLEX	74 COPTOSPORA PARADOXA	75 CUPANIEIDITES ORTHOTEICHUS	76 CYATHEACIDITES ANNULATUS	77 CYATHIDITES	78 CYATHIDITES AUSTRALIS	79 CYATHIDITES MINOR	80 CYCADOPITES FOLLICULARIS	81 DACRYCARPITES AUSTRALIENSIS	82 DILWYNITES GRANULATUS	83 ERICIPITES SCABRATUS	84 FALCISPORITES SIMILIS	85 GAMBIERINA EDWARDSI	86 GAMBIERINA RUDATA	87 GLEICHENIIDITES	88 GLEICHENIIDITES CIRCINIDITES
BOOTHAPOOL-2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
524 CUTTS	.	1	.	.	.	.	.	.	2	.	5	.	.	.	.	7	3	5	.	.	.	1
791-97 CORE	.	.	.	.	.	.	1	.	.	.	.	3	4	.	.	9	.	11	X	4	3	.
810.5 CUTTS	2	.	.	.	1	1	3	.	.	.	.	1	3	.	.	27	.	10	X	X	4	.
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BELFAST-11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
476 CUTTS	.	.	.	.	.	.	.	.	.	X	3	.	.	.	1	5	.	2	.	.	.	1
506 CUTTS	.	.	.	.	.	.	X	.	.	.	3	.	.	.	.	.	.	.	.	.	X	.
937-41 CORE	.	.	.	X	.	.	X	.	.	.	.	2	2	1	.	1	.	5	.	20	.	.
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BELFAST-12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
432.6-8.5CORE	.	.	X	.	.	.	X	.	.	.	7	.	.	.	1	1	X	8	.	.	.	.
727-33 CORE	.	1	.	.	.	.	X	X	X	.	7	.	.	X	.	49	1	3	.	.	.	2
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BELFAST-13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
423-26 CUTTS	.	.	.	.	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
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KOROIT-10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
551-557 CORE	.	.	.	.	.	.	.	.	1	.	11	.	.	1	.	6	3	2	.	.	.	.

	HALORAGACIDITES HARRISII	HERKOSPORITES ELLIOTTII	INTRATRIPOROPOLLENITES NOTABILIS	KUYLISPORITES WATERBOLKII	LAEVIGATOSPORITES OVATUS	LEPTOLEPIDITES VERRUCATUS	LILIACIDITES	LYGISTEPOLLENITES BALMEI	LYGISTEPOLLENITES FLORINII	MALVACIPOLLIS DIVERSUS	MALVACIPOLLIS GRANDIS	MALVACIPOLLIS SUBTILIS	MATONISPORITES ORNAMENTALIS	MICROCACHRYIDITES ANTARCTICUS	MYRTACEIDITES PARVUS/MESONESUS	MYRTACEIDITES TENUIS	MYRTACEIDITES VERRUCOSUS	NOTHOFAGIDITES ASPERUS	NOTHOFAGIDITES BRACHYSPINULOSUS	NOTHOFAGIDITES DEMINUTUS	NOTHOFAGIDITES EMARCIDUS
	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109
BOOTHAPOOL-2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
524 CUTTS	20	.	X	.	1	.	.	.	4	2	.	5	.	1	.	X	X	X	1	2	.
791-97 CORE	1	3	.	.	4	.	.	1	X	.	.	.	.	2	.	.	.	.	1	.	1
810.5 CUTTS	1	1	.	.	.	.	.	X	3	.	.	.	.	6	.	.	.	.	X	.	1
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BELFAST-11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
476 CUTTS	6	.	.	.	.	.	.	.	3	.	X	2	1	.	.	.	.	2	.	7	32
506 CUTTS	3	.	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.	1	.	5	.
937-41 CORE	.	3	.	.	1	1	1	.	1	.	.	.	.	1	.	.	.	.	.	.	5
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BELFAST-12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
432.6-8.5CORE	4	1	.	1	2	.	.	.	3	.	X	X	X	.	X	.	.	X	1	8	.
727-33 CORE	2	.	.	.	2	.	.	X	1	.	.	3	.	1	.	.	.	.	.	.	.
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BELFAST-13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
423-26 CUTTS	1	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1	.
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KOROIT-10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
551-557 CORE	17	.	.	.	2	.	.	.	5	6	.	4	.	.	.	X	.	.	2	.	.

	111 NOTHOFAGIDITES FALCATUS	112 NOTHOFAGIDITES FLEMINGII	113 OSMUNDACIDITES WELLMANII	114 PERIPOROPOLLENITES DEMARCATUS	115 PERIPOROPOLLENITES POLYORATUS	116 PERIPOROPOLLENITES VESICUS	117 PHIMOPOLLENITES PANNOSUS	118 PHYLLOCLADIDITES MAWSONII	119 PODOSPORITES MICROSACCATUS	120 POLYCOLPITES LANGSTONI	121 PROTEACIDITES	122 PROTEACIDITES ANNULARIS	123 PROTEACIDITES ASPEROPOLUS	124 PROTEACIDITES CF ASPEROPOLUS	125 PROTEACIDITES CF PACHYPOLUS	126 PROTEACIDITES CLARUS	127 PROTEACIDITES GRANDIS	128 PROTEACIDITES HAPUKUI	129 PROTEACIDITES INCURVATUS	130 PROTEACIDITES KOPIENSIS	131 PROTEACIDITES ORNATUS	132 PROTEACIDITES OTWAYENSIS
BOOTHAPOOL-2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
524 CUTTS	1	.	.	X	X	.	.	.	2	.	6	1	.	X	.	.	1	.	X	.	X	.
791-97 CORE	.	2	.	.	2	.	.	2	.	X	19	1	.	.	.	.	1	.	.	.	.	1
810.5 CUTTS	.	X	1	.	X	.	2	5	3	.	7	X	.	.	.	.	.	.	.	.	.	.
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BELFAST-11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
476 CUTTS	5	1	.	.	.	.	.	2	1	.	1	2	.	.	.	.	.	.	.	.	.	.
506 CUTTS	8	X	.	.	.	1	.	3	1	.	1	X	X	.	.	.	.	.	.	.	.	.
937-41 CORE	.	.	X	.	.	.	.	2	2	.	36	.	.	.	.	.	.	1	.	.	.	.
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BELFAST-12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
432.6-8.5CORE	6	1	.	.	.	X	.	2	1	.	2	X	.	.	.	.	.	.	.	.	.	.
727-33 CORE	.	X	.	X	1	.	.	2	1	.	9	.	.	.	X	X	X	.	X	X	.	.
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BELFAST-13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
423-26 CUTTS	1	1	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.
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KOROIT-10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
551-557 CORE	.	1	.	1	.	.	.	.	.	.	15	X	.	.	.	.	2	.	.	1	X	.

	PROTEACIDITES PACHYPOLUS	PROTEACIDITES RECTOMARGINIS	PROTEACIDITES SCABRATUS	QUADRAPLANUS BROSSUS	RETITRILETES AUSTROCLAVATIDITES	RICCIA SP	SPINIZONOCOLPITES PROMINATUS	STERIESPORITES ANTIQUASPORITES	STERIESPORITES PUNCTATUS	STERIESPORITES REGIUM	TETRACOLPORITES VERRUCOSUS	TRICOLPITES	TRICOLPITES GILLII	TRICOLPITES LONGUS	TRICOLPITES PHILLIPSII	TRICOLPITES WAIPAWAENSIS	TRICOLPORITES	TRICOLPORITES LILLIEI	TRILETES TUBERCULIFORMIS	TRIPOROPOLLENITES SECTILIS	VERRUCATOSPORITES SP	[illegible]
	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154
BOOTHAPOOL-2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
524 CUTTS	X	X	.	.	1	.	X	.	.	.	.	.	.	.	.	.	2	.	1	.	X	:
791-97 CORE	.	.	.	.	1	.	.	3	.	.	.	.	X	.	.	.	.	.	.	.	.	.
810.5 CUTTS	.	.	.	.	1	.	.	3	X	.	.	.	X	.	.	.	.	.	.	.	.	.
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BELFAST-11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
476 CUTTS	.	X	.	.	.	X	.	2	.	.	.	.	.	.	.	.	.	.	1	.	.	.
506 CUTTS	.	X	.	.	.	.	.	X	.	.	.	.	.	.	.	.	X	.	X	.	.	.
937-41 CORE	.	.	.	1	.	.	.	4	X	X	.	2	.	X	.	X	1	X	.	X	.	.
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BELFAST-12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
432.6-8.5CORE	.	X	X	.	1	.	.	X	.	.	.	.	.	.	.	.	.	.	X	.	.	[illegible]
727-33 CORE	.	.	X	.	1	.	.	.	X	.	?	1	.	.	X	.	1	.	X	.	.	.
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BELFAST-13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
423-26 CUTTS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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KOROIT-10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
551-557 CORE	X	.	.	.	.	.	1	1	.	.	.	1	.	.	.	.	1	.	.	.	.	.

	OTHER SPORES POLLENS 155	
BOOTHAPOOL-2	.	BOOTHAPOOL-2
524 CUTTS	.	524 CUTTS
791-97 CORE	1	791-97 CORE
810.5 CUTTS	3	810.5 CUTTS
.....	.	.....
BELFAST-11	.	BELFAST-11
476 CUTTS	.	476 CUTTS
506 CUTTS	2	506 CUTTS
937-41 CORE	1	937-41 CORE
......	.	......
BELFAST-12	.	BELFAST-12
432.6-8.5CORE	.	432.6-8.5CORE
727-33 CORE	3	727-33 CORE
....	.	....
BELFAST-13	.	BELFAST-13
423-26 CUTTS	.	423-26 CUTTS
....	.	....
KOROIT-10	.	KOROIT-10
551-557 CORE	5	551-557 CORE