

# Mirrabooka M345: palynology of 8 samples from the GSWA Perth Core Library

by  
J Backhouse\*

## Material and localities

Mirrabooka M345 water bore;  
31.795926650°S 115.923093090°E;  
AWRC no. 61615091

<i>F number</i>	<i>GSWA no.</i>	<i>Depth (m)</i>
F55291	n/a	52.20 – 52.27
F55292	n/a	71.35 – 71.40
F55293	n/a	76.90 – 76.95
F55294	n/a	91.90 – 91.95
F55295	n/a	109.10 – 109.20
F55296	n/a	132.95 – 133.00
F55297	n/a	178.36 – 178.40
F55298	n/a	203.20 – 203.25

NOTES: Slides stored in GSWA Paleontology collection  
Geographic coordinates in Geocentric Datum of Australia 1994 (GDA94)

## Recommended reference for this publication

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\* Backhouse Biostrat Pty Ltd

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**BB588**

**Mirrabooka M345**  
**Palynology of 8 samples from the GSWA Perth Core**  
**Library**

**by**

**John Backhouse**

January 2021

# BB588. Mirrabooka M345 palynology of 8 samples from the GSWA Perth Core Library

## Summary of dinocyst zones in M345

Depth (m)	Dinocyst Zone	Age	Suggested Stratigraphic unit
52.20–52.27	<i>Xenascus asperatus</i>	Late Albian	Mirrabooka Member, Osborne Formation
71.35–71.40	<i>Xenascus asperatus</i>	Late Albian	Mirrabooka Member, Osborne Formation
76.90–76.95	<i>Xenascus asperatus</i>	Late Albian	Mirrabooka Member, Osborne Formation
91.90–91.95	<i>Xenascus asperatus</i>	Late Albian	Mirrabooka Member, Osborne Formation
109.10–109.20	<i>Xenascus asperatus</i>	Late Albian	Mirrabooka Member, Osborne Formation
132.95–133.00	<i>Xenascus asperatus</i>	Late Albian	Mirrabooka Member, Osborne Formation
178.36–178.40	<i>Dioxya armata</i> – <i>Xenascus asperatus</i>	Late Albian	?Mirrabooka Member, Osborne Formation
203.20–203.25	Barren	Indeterminate	Indeterminate

## INTRODUCTION

**Bore name:** Mirrabooka M345 (M345 1/07, abandoned corehole)

**Location:** Mirrabooka East, MGA Z50 398041.460 E, 6481672.941 N. Elevation approx. 46 m AHD

**Interval:** 52.27m to 203.25 m (core depths). Note: only the lower depth in the sample depth range is used in the text.

**Table 1. M345: palynological distribution chart (GSWA samples)**

## Sample lithology

DEPTH TOP (m)	DEPTH BASE (m)	LITHOLOGY
52.20	52.27	Siltstone, clayey, silt and clay closely bedded but irregular
71.35	71.40	Sst, fine grained, clayey, medium grey
76.90	76.95	Siltstone, clayey, medium grey with yellow (pyritic) patches

91.90	91.95	Sst, fine grained, clayey, medium to dark grey, glauconitic
109.10	109.20	As above
132.95	133.00	As above
178.36	178.40	Sst, fine grained, light grey with dark mineral grains, ?glauconitic
203.20	203.25	Claystone, silty, dark green-grey

Eight core samples were processed and the slides examined under a transmitted light microscope. Seven samples were productive, with low to high yields of palynomorphs and exceptional preservation. The sample from 203.20–203.25 m was barren despite being processed twice and having a promising lithology. Samples were examined in detail and counts of 100 specimens were made for all productive samples. The counts are presented in the range chart (Table 1).

## Historical background and zonation of the Osborne Formation

During the 1970s and 1980s a series of boreholes located in the Mirrabooka area encountered a largely sandstone unit of Albian age overlying the Leederville Formation.

One borehole was drilled at the M345 site in 1979/80 and the palynology report (Backhouse, 1980) reveals that only the 90 m and 210 m SWC samples yielded results from the Mirrabooka Member or Kardinya Shale Member of the Osborne Formation. In this original M345 borehole, the 215 m and 230 m samples yielded assemblages I would now assign to the *Cyclonephelium attadalicum* Assemblage of the *Batioladinium jaegeri* Dinocyst zone (= *Muderongia australis* Zone of Helby et al. 1987), which is associated with the Pinjar Member of the Leederville Formation. These samples also belong in the *Balmeiopsis limbata* Spore-pollen zone.

Davidson (1995) indicated a type section for the Mirrabooka Member, in AM30Z, 34–199 m, a short distance to the south of the M345 site. The current borehole, M345 1/07, is a far better reference section and is fully cored.

## Dinocyst zones

The zonal scheme for the Albian-Cenomanian currently in use was introduced by Helby et al. (1987), modified by Helby et al. (2004) and again by Partridge (2006). It places 6 zones in the *Heterosphaeridium* Superzone. Three zones are relevant to this report.

***Diconodinium multispinum* Interval zone:** base defined as the oldest occurrence of *D. multispinum*, top defined as the youngest occurrence of *E. ludbrookiae*. This zone is currently regarded as Cenomanian in age (Partridge, 2006).

It should be noted that most palynologists had originally assigned morphotypes with longer baculate spines to *Diconodinium dispersum*. Stover and Helby (1987, p. 103) regarded *D. dispersum* as a junior synonymy of *D. multispinum*. Until 1987 most palynologists placed specimens of *Diconodinium* with shorter spines in *D. multispinum* and regarded this as the species of *Diconodinium* recorded in significant numbers through the Late Albian. Many of these records are now regarded as being *Diconodinium cristatum*, which ranges from finely spinose to granulate. Most specimens encountered in the Late Albian (*E. ludbrookiae* Zone to *X. asperatus* Zone) are granulate. Stover and Helby suggested placing

granulate forms in *D. pusillum* Singh 1971. *D. pusillum* is recorded from north western Alberta and though it may belong in *Diconodinium* it is unlikely to be the exact morphotype encountered extensively in the Perth Basin. In this report, finely spinose, granulate and almost psilate forms with some tabulation expressed are referred to *D. cristatum* Cookson and Eisenack 1974 with a holotype from the Moora Bore, near Moora, 170 km north of Perth.

***Xenascus asperatus* Interval zone:** base originally defined as the oldest occurrence of *X. asperatus*, but now as the youngest occurrence of *Dioxya armata* (Helby et al., 2004). The top is defined as the “oldest consistent, abundant occurrence of *D. multispinum*”, i.e. the FAD of this species. This zone is currently regarded as latest Albian in age (Partridge, 2006)

This definition of the top of the zone is a good fit with what is known in the Perth basin sequences. The use of the last occurrence of *D. armata* is better than using the first occurrence of *X. asperatus*, which is notoriously rare. However, in the Perth Basin *D. armata* is also rare leaving no reliable biostratigraphic definition for the base of the zone in this basin.

The species *Xenascus asperatus* was erected by Stover and Helby (1987) from samples from a borehole on Groote Eylandt and the petroleum exploration well, Gull-1, both in the Bonaparte Basin. These authors opined that *Xenascus australensis* Cookson and Eisenack 1969, originally described from the Balcatta No. 1 bore, near Perth, possesses a shorter, broader antapical horn than *X. asperatus*. However, they also noted that “the nature of the illustrations and description and the absence of details of the apical horn prohibit closer comparison. The present material in which specimens of *Xenascus* occur in at least 4 samples between 71.4 m and 133.0 m is approximately 6.5 km north east of Balcatta No. 1 bore. What is currently known of the geology suggests the Mirrabooka Member extends to the southwest of the Mirrabooka area. It is therefore almost certain that some of the interval from the Mirrabooka Member in M345 correlates with some of the interval in the Balcatta No. 1 bore. The present specimens appear morphologically similar to *X. asperatus* and *X. asperatus* is probably a junior synonym of *X. australensis*.

***Dioxya armata* Interval zone:** base defined as the oldest occurrence of *D. armata* and the top defined by the youngest occurrence of *D. armata*. This zone is currently regarded as latest Albian in age (Partridge, 2006; Backhouse, 2006).

The comments above refer to the rarity of *D. armata* and therefore the difficulty in consistently identifying the top of this zone in the Perth Basin. The zone is described in some detail from the onshore Carnarvon Basin (Backhouse, 2006), where the *D. armata* Zone is significantly thicker than other Albian zones. It immediately overlies the *Endoceratium ludbrookiae* Interval zone and in the absence of *D. armata* these two zones are difficult to distinguish.

### Spore-pollen zones

All productive samples from M345 examined for this report can be assigned to the *Hoegisporis* Superzone of Helby et al. (1987), renamed as the *Hoegisporis* Microflora (Partridge, 2006). Helby et al. (1987) show three zones in the *Hoegisporis* Microflora, in descending order the *Appendicisporites distocarinatus*, *Phimopollenites pannosus* and

*Coptospora paradoxa* Zones. For the southern margin of Australia Partridge (2006) renamed the *A. distocarinatus* Zone the *Hoegisporis uniforma* Zone based on the oldest occurrence of *H. uniforma* at the base of the zone. This datum is unlikely to prove useful in the Perth Basin and Albian – Cenomanian units can usually only be identified as belonging in the *Hoegisporis* Microflora.

## PALYNOSTRATIGRAPHY

### 52.27 m, 71.40 m and 76.95 m

**Yield.** High with excellent preservation

**Zone.** *Xenascus asperatus* Dinocyst zone, and *Hoegisporis* Microflora.

**Comments.** *X. australensis* was not recorded in the 52.27 m dinocyst assemblage, but otherwise this assemblage resembles those from 71.4 m and 76.95 m with a high diversity of dinocysts, which make up approximately 40-50% of each of the palynomorph counts. The absence of *Diconodinium multispinum* places this interval below the *D. multispinum* Zone and the absence of *D. armata* and *Craspedodinium indistinctum* suggests it is above the *D. armata* Zone, though as indicated above *D. armata* is rare in the Perth Basin.

Cysts of the *D. cristatum* complex are the most common dinocysts. Specimens of *Canninginopsis denticulata* with complete tabulation are absent and all specimens seen to date in this interval are forms identified in Table 1 as *Canninginopsis denticulata* B with few rows of grana and exaggerated antapical horns.

Spore-pollen assemblages are well preserved and include some species that appear to be undescribed. This is to be expected as there are few, if any, academic papers devoted to spore-pollen assemblages from the west Australian Albian–Cenomanian. *Balmeiopsis limbata* and *B. robusta* are rare, but their presence indicates they range up to this stratigraphic level. A number of small angiosperm pollen are recorded down to 91.95 m and may represent the oldest unequivocal angiosperms in the Perth Basin.

Acritarchs of the *Micrhystridium*–*Veryhachium* group are consistently c. 5% of the total assemblage and simple *Veryhachium* forms are most common.

### 91.95 m, 109.20 m and 133.00 m

**Yield.** These assemblages are possibly even richer and more diverse than those above.

**Zone.** *Xenascus asperatus* Dinocyst zone, and *Hoegisporis* Microflora.

**Comments.** These 3 samples are all of similar lithology and more sandy and darker in colour than the samples above. *X. australensis* is rare in the highest and lowest samples. The dinocyst count is consistently higher in these samples than in the interval above, despite the high count of *Veryhachium* in the 133 m sample somewhat distorting the spore-pollen : dinocyst ratio. This suggests a slightly more open marine environment. Qualitatively the assemblages are little different than those above and are probably little different in age. *Canninginopsis denticulata* B is present at least as low as 109.2 m.

Spore-pollen assemblages are particularly well preserved and, as above, include some apparently undescribed species. Angiosperms are not recorded, to date, below 91.95 m, but further work may reveal older occurrences.

Acritarchs of the *Micrhystridium*–*Veryhachium* group are surprisingly rare at 91.95 and 109.20 m, but comprise 15% of the assemblage at 133.0 m. Backhouse (2006) shows a decrease in *Veryhachium* in the lowest part of the *X. asperatus* Zone in Boollogoro 1 in the Carnarvon Basin. The decline in *Veryhachium* may be a correlatable event, but more data is needed to demonstrate that it is not a local feature.

#### **178.40 m**

**Yield.** This sample gave very low yield and only one slide was prepared.

**Zone.** Possibly *Xenascus asperatus* or *Dioxya armata* Dinocyst zone, and the *Hoegisporis* Microflora.

**Comments.** There is little evidence for a zonal allocation given the relatively sparse dinocyst assemblage. *D. cristatum* is sufficiently common to suggest the assemblage is no older than the *E. ludbrookiae* Zone. The assemblage is possibly in the *X. asperatus* Zone, but may also be in the upper *D. armata* Zone. Though there is a lithological change from the samples above, there is no evidence for a major break and this lower yield assemblage probably reflects a less marine facies. A troubling aspect is the presence of several pollen of recent aspect (chenopod and *Proteacidites* pollen). They appear to be from drilling mud penetration of the core, which suggests greater care is needed in selecting sample points and perhaps more care in preparing the samples for analysis. It is therefore also possible that the very low yield of Cretaceous palynomorphs also represents mud contamination.

Acritarchs are common but rather than mainly *Veryhachium* spp., as in samples above, the acritarchs are predominantly *Nummus parvus* and *Brazilea* spp.

#### **203.25 m**

**Yield.** The sample is barren of palynomorphs. The lithology appears promising with no obvious oxidation so there is no obvious cause for the lack of organic material.

**Zone.** Indeterminate.

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**TABLE 1. M345: PALYNOLOGICAL DISTRIBUTION CHART (GSWA SAMPLES)**

DEPTH (M)	52.27	71.40	76.95	91.95	109.20	133.00	178.40	203.25
SAMPLE TYPE	CO	CO	CO	CO	CO	CO	CO	CO
SPORE-POLLEN								
Amosopollis cruciformis	3	6	5	5	5	2		
Appendicisporites grandis						x		
Araucariacites spp.						1	1	
Asteropollis asteroides (angiosperm)		x	x	x				
Baculatisporites spp.			x	x			1	
Balmeiopsis limbata	x		1	x	x	x		
Balmeiopsis robusta		x		x	x	x		
Bisaccate pollen	2	3	2	2	4	1	5	
Callialasporites dampieri			x	x				
Camazonosporites australiensis	x	x	x	x		x	1	
Clavifera triplex	3	x	x	x	x	x		
Contignisporites cooksoniae					x			
Corollina spp.	1	x	2	1	x	x		
Cyathidites spp.	21	18	22	12	23	12	38	
Dictyophyllidites spp.	1	2	1	1	x			
Dictyotosporites complex		x	x	x				
Ephedripites EA		x						
Foraminisporis cf. wonthaggiensis			x	1				
Foveogleicheniidites confossus	1	x	x		1	x		
Foveosporites spp.				3	x	x		
Gleicheniidites finely granular				x				
Gleicheniidites spp.	5	10	9	6	5	7	13	
Granular small spore						x	2	
Hoegisporis lenticulifera	x	x	x		x	x		
Laevigatosporites ovatus	x	x	1	x	x	x	1	
Leptolepidites spp.	x				x			
Liliacidites? sp. (angiosperm)	2	1						
Lycopodiacidites spp.	x			x				
Microcachryidites antarcticus	2	8	3	5	2	3	6	
Microfoveolatosporis canaliculatus		x	1	x	x	x	1	
Neoraistrickia equalis			x					
Perotriletes majus	x	x	x	x	x	x		
Perotriletes oepikii	x	x	x			x	x	
Polycingulatisporites cf. clavus	x		1			x		
Retitriletes spp.	x	x	x	x		x		
Ruffordiaspora spp.	x			x	x	x		
Rugulatisporites CCC	x	1			x	x		
Trilobosporites trioreticulosus				x				
Vitreisporites pallidus	1			x		x		

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DEPTH (M)	52.27	71.40	76.95	91.95	109.20	133.00	178.40	203.25
SAMPLE TYPE	CO	CO	CO	CO	CO	CO	CO	CO
DINOCYSTS								
Dinocysts indet.	10	6	7	7	12	10	6	
Achomosphaera AF						1		
Aptea cf. A. polymorpha		x	x	1	1	1		
Aptea cf. A. polymorpha subtype B						x		
Aptea cf. A. polymorpha subtype C				x				
Apteodinium maculatum	2	1	1	3	2	4	1	
Batiacasphaera spp.	x	1	1	5	x	x	1	
Batioladinium micropodum	x	x	x	x				
Callaiosphaeridium asymmetricum		x	x				1	
Canninginopsis denticulata				1		3		
Canninginopsis denticulata B	x	1	3	4	1			
Chlamydophorella nyei	x	2	x	10	3	5	1	
Cleistosphaeridium spp.	1	2	x	x	1	x		
Coronifera oceanica		x		x	x			
Cribroperidinium apione	x	x		x	x	x	1	
Cribroperidinium edwardsii	x	1	1		2	x	1	
Cyclonephelium compactum							1	
Cyclonephelium membraniphorum	2	1	x	x	x			
Diconodinium cristatum	10	11	11	11	19	10	3	
Diconodinium DG (?L. inflatum)	1			2		x		
Dinopterygium tuberculatum		x	x		x			
Endoceratium ludbrookiae	x	1	x	1	2	1		
Endoscrinium sp.		x			x	x		
Exochosphaeridium spp.	x	x	2	1	1	2	1	
Florentinia spp.	x							
Heslertonina striata	1	1		?				
Heterosphaeridium spp.	2	x	1	3	2	1		
Hystriodinium pulchrum	1	x	x					
Kiokansium polypes	3	2	2	1		x		
Leberidocysta chlamydata		x				x		
Litosphaeridium arundum						x		
Litosphaeridium siphoniphorum	x		x	x	1	x		
Microdinium spp.	1	3	4	x	1	1		
Odontochitina operculata	x	x	2	x	1	x		
Odontochitina striatoperforata	x	x	1	x	x			
Oligosphaeridium complex	4	1	x	x	1	2		
Palaeoperidinium cretaceum		2	x	x		x		
Prolixosphaeridium parvispinosum	x					x		
Protoellipsoidinium densispinosum	x	x	x			1		
Sentusidinium spp. short	3	x		2	2	1		
Sepispinula ancorifera	2	x	2	2		5		
Spiniferites spp.	6	7	8	4	4	6	1	
Tanyosphaeridim spp.						x		
Trichodinium intermedium	x	x	1	1	1	x		

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DEPTH (M)	52.27	71.40	76.95	91.95	109.20	133.00	178.40	203.25
SAMPLE TYPE	CO	CO	CO	CO	CO	CO	CO	CO
<i>Wallodinium luna</i>				x				
<i>Wrevittea cassidata</i>		x	x	x	x	x		
<i>Xenascus australensis</i>		x	x	1		x		
<i>Xiphophoridium alatum</i>						1		
ACRITARCHS / ALGAE								
<i>Brazilea</i> spp.	1	x			1	2	5	
<i>Fromea amphora</i>	x	x	x	1	x		1	
<i>Fromea fragilis</i>	x	x		1	x	x		
<i>Lecaniella dictyota</i>		x		x		x	1	
<i>Micrhystridium</i> spp.		1	1	x	1	2		
<i>Nummus parvus</i>		x		x		x	4	
<i>Palambages</i> A type			x					
<i>Platycystidia</i> diptera	x	x				x		
<i>Pterospermella aureolata</i>	1	x			1			
<i>Rhombodella</i> sp. triang. or natans	1							
<i>Schizocystia laevigata</i>				x		x		
<i>Veryhachium</i> 4 spine	1	1	x		x			
<i>Veryhachium</i> 3 spine	5	6	4	2		15	2	
<b>TOTAL COUNT</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>0</b>
Spore-pollen %	42	49	48	37	40	26	69	0
Dinocyst %	49	43	47	61	57	55	18	0
Acritarch %	9	8	5	2	3	19	13	0

x = present outside the count