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PALYNOLOGICAL EXAMINATION OF SAMPLES FROM THE OTWAY GROUP IN THE OTWAY BASIN, VICTORIA

by

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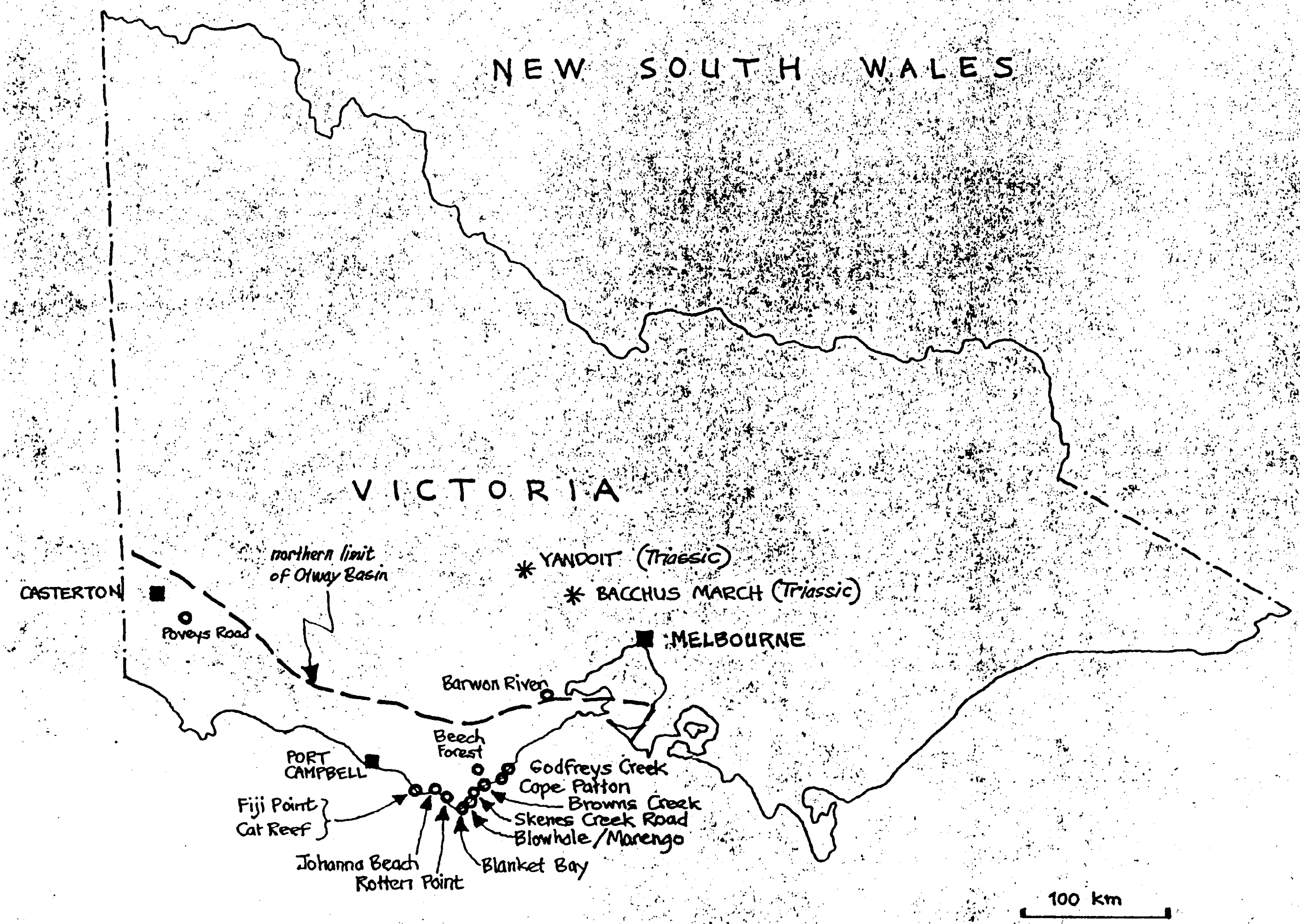

FIGURE 1. <u>Locations of sample points of the Otway Group listed in Table 1 and outcrop areas of Triassic sediments referred to in the text</u>

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SUMMARY

A series of 31 outcrop samples from 14 locations within the Otway Group in the Otway Basin has been examined palynologically to obtain additional evidence of their geological age. Twelve samples yielded spore and pollen assemblages ranging in age from the early Albian *Crybelosporites striatus* Subzone to the late Albian-Cenomanian *Phimopollenites pannosus* Zone. Four samples yielded too few fossils to be accurately dated, and 15 samples were barren.

The composition of several assemblages hints at the existence of plant communities typical of lowland environments, with certain elements locally predominating, and the presence of sporadic dinoflagellates points to recurrent brackish-water environments probably due to shifting margins of a nearby inland sea.

Many assemblages include Triassic and Early Jurassic spores and pollen, and some of the Triassic contaminants may have been derived from strata of possible Triassic age outcropping near Bacchus Marsh and Yandoit.

INTRODUCTION

At the request of Anne Felton, who is studying the Otway Group at the University of Wollongong, a palynological examination was made of a series of outcrop samples in order to provide evidence of the age of the group at several sample points. Most samples were collected from the coastal areas east of Port Campbell, and details are given in Figure 1 and Table 1. Dateable spore and pollen assemblages were recovered from 12 samples. Details of the fossil assemblages are listed in Table 2. Zonal nomenclature for the Otway Basin used in this report has been described by Dettmann & Playford (1969) and Dettmann & Douglas (1976).

TABLE 1. Locations of samples and zonal affinities of associated spore and pollen assemblages

location	latitude south longitude east	field number	palynol. registr. number	recovery of fossils	zonal affinity
BARWON RIVER	38°09'00"/144°18'30"	OB BR10	MFP8627	none	---
BEECH FOREST QUARRY	38°37'00"/143°35'00"	BF1	8628	almost none	---
BLANKET BAY	38°49'18"/143°35'00"	BB4/86	8802	very poor	not determined
		BB10	8633	none	---
BLOWHOLE NORTH	38°47'30"/143°38'15"	OB NBL1/86	MFP8815	none	---
		NBL2/86	8816	moderate	Crybelosporites striatus?
		NBL3/86	8817	poor	Crybelosporites striatus?
BLOWHOLE SOUTH	38°47'30"/143°38'15"	SB1/86	8813	moderate	Crybelosporites striatus?
		SB2/86	8814	moderate	Crybelosporites striatus
BROWNS CREEK	38°42'42"/143°44'52"	OB BC5	MFP8631	poor	not determined
		BC6	8632	poor	not determined
CAPE PATTON	38°41'12"/143°50'18"	CP1/86	8811	almost none	---
		CP6	8629	moderate	not determined
		CP19	8630	poor	Crybelosporites striatus?
CAT REEF	38°44'36"/143°12'54"	OB CR4/86	MFP8803	good	Phimopollenites pannosus?
		CR6/86	8804	none	---
		(CR36)	8638	moderate	Phimopollenites pannosus
FIJI POINT	38°44'34"/143°12'51"	(GF1/86)	8819	poor	Phimopollenites pannosus
GODFREYS CREEK	38°37'12"/143°55'00"	OB GC1	MFP8805	almost none	---
		GC2	8806	almost none	---
		GC3	8812	moderate	Phimopollenites pannosus?
JOHANNA BEACH	38°45'00"/143°21'00"	JB2	8625	moderate	Coptospora paradoxa
		JB3	8626	moderate	Coptospora paradoxa
MARENGO	38°46'52"/143°40'00"	OB M6	MFP8635	almost none	---
POVEYS ROAD	37°38'56"/141°37'00"	PR1/86	8799	none	---
		PR2/86	8800	none	---
		PR3/86	8801	none	---
ROTTEN POINT	38°46'52"/143°24'00"	OB RP1/86	MFP8807	almost none	---
		RP2/86	8808	almost none	---
		RP9	8634	moderate	Crybelosporites striatus
SKENES CREEK ROAD	38°41'10"/143°40'05"	SC1/86	8818	almost none	---

TABLE 2

x - species present

f - fragments only present

● - species common to abundant

? - species determination tentative

	Crybelospor. striatus						Copt. parad.		Phim. pannos.				not determin.			
	NBL2/86	NBL3/86	SB1/86	SB2/86	CP19	RP9	JB2	JB3	CR4/86	CR36	GF1/86	GC3	BB4/86	BC5	BC6	CP6
Aequitriradites hispidus						f										
Aequitriradites spinulosus						x	x					x			x	
Aequitriradites verrucosus			x			x	x	x				x				
Aequitriradites spp. indet.			x									x			x	
Alisporites grandis		x				f	f	?								x
Alisporites similis	●	●	x	x	x	x	x	x	x	x	●	x			x	x
Araucariacites australis		?	x			?	x	x		x						x
Araucariacites fissus								x		?					x	
Asteropollis asteroides						x		?		x						
Baculatisporites comaumensis	x	x	x	x	x	x	x	x	x	●		x	x	●	●	x
Biretisporites eneabbaensis			x			x	x	x			x					
Callialasporites dampieri								x								
Callialasporites trilobatus								?								
Ceratosporites equalis	?	x	x	x		x		?	x	x				?		x
Ceratosporites sp.				x		x		x	x						x	
Cicatricosisporites australiensis	x	x	x	x	x	x	x	x	x	x		●	x	x	●	x
Cicatricosisporites pseudotripartitus								?	x	x						
Cicatricosisporites spp. indet.		x					x	x	x	x		x			x	x
Classopollis spp.			x	x		x	x	x	x	x	x	x		x		x
Concentrisporites hallei						x	x									x
Coptospora paradoxa							x	?		x						
Crybelosporites berberioides						?										
Crybelosporites punctatus			?			x						?				
Crybelosporites striatus	x	x	x	x	x	x	x	x	x			x		x	?	x
Cupuliferoidaepollenites sp.											x	x				
Cyathidites asper							?									
Cyathidites australis	x			?			x	x				x				
Cyathidites minor	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Cyathidites punctatus				?								x				
Cyclosporites hughesii			x	x		x										
Dictyophyllidites crenatus		?		x			x									
Dictyotosporites complex						?						x				
Dictyotosporites speciosus		x	x	x	x											
Foraminisporis asymmetricus			f	x		x	x	x	?			●		x		
Foraminisporis dailyi							x									
Foraminisporis wonthaggiensis		?				?	x	x								
Gleicheniidites circinidites				x	x	?	x	x	x		x	x				x
* Inaperturate pollen grains indet.		x	x	x						x	x	x	x			
Inaperturopollenites turbatus			?					x					?		?	
Klukisporites scaberis								x								
Laevigatosporites major							x					?				
Laevigatosporites ovatus									x	x	x					

	Crybelospor. striatus						Copt. parad.		Phim. pannos.				not determin.			
	NBL2/86	NBL3/86	SB1/86	SB2/86	CP19	RP9	JB2	JB3	CR4/86	CR36	GF1/86	GC3	BB4/86	BC5	BC6	CP6
Leptolepidites major				?		x		?								
Leptolepidites verrucatus			x	x		x		x		x		x				
Lycopodiumsporites austroclavatidites	x	x	x	●	?	x	x	x	x	x	x	x		x	x	x
Lycopodiumsporites circolumenus			x	x		x		x				?				?
Lycopodiumsporites facetus				?												
Lycopodiumsporites nodosus	?		x	x	?	x	?	?							?	?
Lycopodiumsporites rosewoodensis		?	x			?		x	x	x		x				
Lycopodiumsporites watherooensis	x	x	?												x	
Matonisporites cooksoniae	x						x									
Microcachryidites antarcticus	x	x		x	x	x	x	x	x	x		x		x	x	
Microcachryidites sp.								x		x						
Monosulcites minimus		x	x	x							x	x				
Neoraistrickia truncata				?			x	x				x			x	x
Osmundacidites dubius		?		?			x	?								
Osmundacidites wellmanii	x	x	x	x	x	x	x	x		x	x	x		x	x	
Perotrilites laceratus									x	?						
Perotrilites majus									x							
Phimopollenites pannosus										?	x					
Pilosisporites parvispinosus				f												f
Podocarpidites ellipticus	?			x	?		x	x	x	x						
Polycingulatisporites densatus	x														x	
Retimonocolpites peroreticulatus												x				
Rousea georgensis										?	x					
Rugubivesiculites sp.		x						x								
Stereisporites antiquasporites	●	x	x	●	x	x	x	●	●	x		●		?	x	x
Stereisporites pocockii	x			x	x		x	x				x				x
* Tricolpate pollen grains							x		x	●	●	x				
Tricolpites variabilis											x					
* Tricolporoidate pollen grains										x						
Trilites cf. T. tuberculiformis			x													
Triporoletes radiatus							x	x				x				
Triporoletes reticulatus						x		x		x		x				
Triporoletes simplex							x			x		x				
Trisaccites microsaccatus		x				?	?	x	x	x		x				
Velosporites triquetrus			x			x		x		x		x				
Vitreisporites pallidus				x					x		x	x				
Diconodinium sp.															x	
* Dinoflagellate species indet.			x			?		?	?		?					
* Leiosphere acritarchs (sensu lato)	x	●	x	x	x	x	x	x	x	x	●	x	x		x	
Micrhystridium spp.		x	x	x		x	x			x	x	x	x		x	
Schizosporis spp.							?	x	x	x						
Veryhachium singulare											x					

PALYNOSTRATIGRAPHIC COMMENTS

Crybelosporites striatus Subzone

Samples S B 2 / 8 6 and R P 9 yielded moderately species-diverse spore-pollen assemblages which represent the Crybelosporites striatus Subzone of the Dictyotosporites speciosus Zone. Sample S B 1 / 8 6 yielded relatively few fossils, but the presence of Dictyotosporites speciosus and Cyclosporites hughesii suggests that the assemblage is not younger than the subzone (Dettmann & Douglas, 1974), like sample SB2/86 from the same location, but a younger age is not excluded as the two species also occur in younger intervals in the Albian of the Great Artesian Basin.

The assemblage from sample N B L 2 / 8 6 also lacks species diversity as it is dominated by Stereisporites and Alisporites. The absence of Coptospora paradoxa suggests that it represents the sub-zone as well. Samples N B L 3 / 8 6 and C P 1 9 also yielded relatively few fossils, but the presence of Dictyotosporites speciosus and the apparent absence of Coptospora paradoxa is an indication of their association with the subzone.

Coptospora paradoxa Zone

The assemblages from samples J B 2 and J B 3 are reasonably rich in numbers of species. The presence of Coptospora paradoxa and the first sign of the presence of angiosperm (tricolpate) pollen grains is sufficient indication to asign both assemblages to the Coptospora paradoxa Zone.

Phimopollenites pannosus Zone

The assemblages from samples C R 3 6 and G F 1 / 8 6 include substantial numbers of angiosperm (tricolpate) pollen grains which represent a variety of genera and species. The presence of Phimopollenites pannosus establishes them as younger than the assemblages from nearby Johanna Beach, and representing the Phimopollenites pannosus Zone.

Sample C R 4 / 8 6 also includes several types of tricolpate forms. It lacks P. pannosus but includes the spore Perotrilites laceratus, which according to Dettmann & Playford (1968) and Dettmann & Douglas (1976) first appears in the uppermost Coptospora paradoxa Zone. Association of this assemblage with the Phimopollenites pannosus Zone is thought probable also in view of a similar association of sample CR36 from the same location.

Sample G C 3 lacks both Phimopollenites pannosus and Coptospora paradoxa but includes several species of tricolpate pollen, one of which is identified as Phimopollenites sp. A similar form has been observed also in the interval of the Phimopollenites pannosus Zone in the Great Artesian Basin, and suggests association of the sample with that zone as well.

Undated assemblages

The assemblage from sample B B 4 / 8 6 includes only a few species and its age cannot be accurately established, but the presence of <u>Cicatricosisporites australiensis</u> indicates its age to be not older than Late Jurassic. Samples B C 5 and C P 6 yielded very few, poorly preserved spores and pollen grains, among which no significant stratigraphic marker species were found, except for <u>Crybelosporites striatus</u>, which establishes the samples as not older than latest Aptian or basal Albian. A similar association was also suggested for the assemblage from sample CP19 from the same location as CP6.

Sample B C 6 yielded a very poor assemblage, in which the presence of a single specimen tentatively identified as <u>Crybelosporites striatus</u>, and a not yet described species of <u>Cicatricosisporites</u>, suggests this assemblage to represent the subzone or a younger interval.

MACROFLORAL EVIDENCE

Plant fossils from the Otway Group have been studied extensively by Douglas (1969), and in this study 4 major biostratigraphic intervals (Zones A to D) were defined. Their relationship in time with the Cretaceous microfloral zones referred to above has been discussed by Dettmann & Douglas (1976) and provides a certain control on the age determinations suggested in this report (Fig. 2). From the distribution

Douglas (1969)		Dettmann & Playford (1969) Dettmann & Douglas (1976)		Cretaceous time scale	
				Cenomanian	
D	<u>Phyllopteroides dentata</u> Zone	<u>Phimopollenites pannosus</u> Zone		late	Albian
D		<u>Coptospora paradoxa</u> Zone		middle	Albian
C	<u>Ginkgoites australis</u> Zone	<u>Dictyotosporites speciosus</u> Zone	<u>Crybelosporites striatus</u> Subzone	early	Albian
C			<u>Cyclosporites hughesii</u> Subzone	Aptian	
B	<u>Ptilophyllum-Pachypteris austropapillosa</u> Zone			NEOCOMIAN	

FIGURE 2. <u>Cretaceous macrofloral and microfloral zonations in the Otway Basin</u>

of various zones in the outcrop beds of the Otway Group (as delineated in Douglas, 1969) Cat Reef and Fiji Point may fall within the area where Zone D occurs, and this association is supported by the palynological evidence of samples GF1/86 and CR36. Godfrey Creek is located within the stratigraphic interval of Zone C, and this agrees with the palynological age of sample GC3.

The picture along the coastal strip northeast of Cape Otway (near Blanket Bay) is not clear. Douglas (1969) assumed some of the sediments of the Otway Group there to be associated with his Zone B, but the palynological data from Blowhole and Cape Patton indicate affinities with Zone C, which according to Douglas is also present in that area. If this association is correct it indicates (from the correlation of Fig. 2) that samples NBL2 and 3, SB1, and CP19 are not younger than the Crybelosporites striatus Subzone.

PALAEOENVIRONMENTS

Many spore-pollen assemblages are shown (Table 2) to include fair assortments of fern elements, and thus reflect lowland rather than highland plant communities. The presence of appreciable numbers of leiosphere acritarchs in several assemblages suggests that semi-aquatic to aquatic conditions of deposition prevailed during the Albian. The occurrence of rare spinose acritarchs and sporadic dinoflagellates indicates episodes of increased salinity of the aquatic environment, and it seems likely that at times the study area was in the vicinity of embayments of an Albian inland sea (possibly originating from a western direction, see Frakes & others, in press). The infrequent occurrence of marine fossils, however, indicate that there were no substantial marine incursions during deposition of the Otway Group.

REWORKED ELEMENTS

Many samples in the present collection yielded spores and pollen grains (Table 3) which have been described and recorded from Early Jurassic and Triassic sediments in eastern and central Australia by De Jersey (1963, 1968, 1970), Dettmann & Playford (1965), McKellar

	NBL		SB		BC5	BC6	CR	JB2	JB3	RP9
	2/86	3/86	1/86	2/86			4/86			
Alisporites australis	x									
Alisporites lowoodensis									?	
Anapiculatisporites pristidentatus				x						
Annulispora folliculosa							x			
Aratrisporites sp.				x						x
Bisaccate pollen indet.		x	x	x	x	x			x	
Camarozonosporites clivosus				x		x		x	x	
Camerosporites verrucosus			x						x	
Foveosporites moretonensis									?	
Gliscopollis sp.				x						
Grebespora sp.										x
Guttatisporites visscheri									?	
Kraeuselisporites verrucifer									?	
Lycopodiumsporites semimurus	x					?				
Monosaccate pollen									x	
Neoraistrickia spp.			x	x		x		x	x	
Osmundacidites senectus				x					x	
Polypodiisporites ipsviciensis				?					x	
Pustulatisporites blackstonensis									?	
Striatiti group									x	

TABLE 3. Reworked Triassic and Early Jurassic sporomorphs in the Otway Group

(1974), Stevens (1981), and others. It is not known from where the distinctly Jurassic elements (A. lowoodensis, C. clivosus) originate; Jurassic sedimentary rocks are not known to occur in the Otway Basin, although Early Jurassic contaminants have been observed before in assemblages from the Otway Group. Apart from the Jurassic element there is a group of forms which seem to occur first in the Late Triassic (A. pristidentatus, A. folliculosa, C. verrucosus, F. moretonensis, L. semimurus, P. blackstonensis), and there is an element more typical of the Early to Middle Triassic (Grebespora sp., G. visscheri, K. verrucifer, monosaccate pollen, O. senectus, and possibly the striatiti group).

Further work is needed to investigate the time factor in the record of remanie fossils. Clear evidence of the existence of fossil complexes derived from different stratigraphic intervals (which seems likely on the present record) would show that there have been several episodes of (post-Triassic?) widespread erosion in the Otway Basin. The question as to the source area of these fossils is still open. The nearest strata of probable Triassic age occur in outcrop near Yandoit and Bacchus March (Douglas & others, 1976; see Fig. 1). Strata of mid-Triassic age from eastern Tasmania might perhaps be considered to be a source area, depending on the reconstruction of drainage systems in the Otway Group.

REFERENCES

DE JERSEY, N.J., 1963 - Jurassic spores and pollen grains from the Marburg Sandstone. Queensland Geological Survey Publication 313.

DE JERSEY, N.J., 1968 - Triassic spores and pollen grains from the Clematis Sandstone. Queensland Geological Survey Publication 338 (Palaeontological Papers no. 14).

DE JERSEY, N.J., 1970 - Early Triassic miospores from the Rewan Formation. Queensland Geological Survey Publication 345 (Palaeontological Papers no. 19).

DETTMANN, M.E. & DOUGLAS, J.G., 1976 - Palaeontology; in Douglas, J.G. & Ferguson, J.A. (editors), Geology of Victoria. Geological Society of Australia, Special Publication 5. Melbourne, 164-176.

DETTMANN, M.E. & PLAYFORD, G., 1965 - Rhaeto-Liassic plant microfossils from the Leigh Creek Coal Measures, South Australia. Senckenbergiana Lethaea 46, 127-181.

DETTMANN, M.E. & PLAYFORD, G., 1968 - Taxonomy of some Cretaceous spores and pollen grains from eastern Australia. Proceedings of the Royal Society of Victoria 81, 69-93.

DETTMANN, M.E. & PLAYFORD, G., 1969 - Palynology of the Australian Cretaceous: a review; in Campbell, K.S.W. (editor), Stratigraphy and Palaeontology: essays in honour of Dorothy Hill. Australian National University Press, Canberra, 174-210.

DOUGLAS, J.G., 1969 - The Mesozoic floras of Victoria Parts 1 and 2. Geological Survey of Victoria Memoir 28.

DOUGLAS, J.G. & OTHERS, 1976 - Mesozoic; in Douglas J.G. & Ferguson, J.A. (editors), Geology of Victoria. Geological Society of Australia, Special Publication 5. Melbourne, 143-176.

FRAKES, L.A. & OTHERS, in press - Australian Cretaceous shorelines, Stage by Stage. Palaeogeography, Palaeoclimatology, Palaeoecology 59.

MCKELLAR, J.L., 1974 - Jurassic miospores from the upper Evergreen Formation, Hutton Sandstone, and basal Injune Creek Group, north-eastern Surat Basin. Queensland Geological Survey Publication 361 (Palaeontological Papers no. 35).

STEVENS, J., 1981 - Palynology of the Callide Basin, east-central Queensland. University of Queensland, Department of Geology, Papers 9.

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