



APPENDIX 5

PALYNOLOGICAL REPORT (by J.G. Wilschut)

SUMMARY

Palynological investigations of sidewall samples taken in well North Eumeralla-1 have resulted in the recognition of Neocomian to Upper Eocene strata.

Hiatuses were observed between Upper and Lower Eocene, Lower Paleocene and Upper Cretaceous and Upper and Lower Cretaceous. For a significant hiatus on seismic evidence present in the Lower Cretaceous no time break could be established but a change of sporomorph colours could be observed around that level.

The investigations confirmed environmental evidence observed in earlier wells in the basin.

INTRODUCTION

A total of 56 sidewall samples suitable for palynological investigations were analysed in well North Eumeralla-1. They are listed below.

The samples were subjected to a standard chemical treatment by means of hydrochloric and hydrofluoric acid and zinc bromide. Usually one standard slide of 4 x 2 cm was counted yielding sufficient sporomorphs for identification and in only few instances had the number of slides to be increased.

Determinations were made using types published in various palynological publications on South and Southeastern Australia (see references). All determinations are plotted on a distribution chart presented in Enclosure 12 showing the actual amounts counted.

For early Cretaceous and Tertiary sediments use was made of the zonal scheme presented by Stover and Evans (Ref. 43) while in the remainder of the Cretaceous the one established by Dettmann and Playford (Ref. 34) and Dettmann (Ref. 32) applies. The biostratigraphy derived from these schemes is presented in Text Figure 5 together with hiatuses determined palynologically but placed on marked lithologic breaks between the limits. To facilitate comparison with nearby wells Eumeralla-1 and Pretty Hill-1 a penetration chart is presented in Text Figure 6 using the same palynological criteria in these wells.

LIST OF SAMPLES STUDIED

SWS 1172'	SWS 2431'	SWS 3241'	SWS 4686'	SWS 6294'
" 1244'	" 2526'	" 3332'	" 4892'	" 6707'
" 1316'	" 2632'	" 3402'	" 4953'	" 6815'
" 1423'	" 2706'	" 3534'	" 5227'	" 6934'
" 1552'	" 2792'	" 3596'	" 5269'	" 7300'
" 1636'	" 2852'	" 3706'	" 5467'	" 7477'
" 1771'	" 2946'	" 3790'	" 5594'	" 7544'
" 1815'	" 3020'	" 3920'	" 5729'	" 8100'
" 1990'	" 3079'	" 4042'	" 5884'	" 8289'
" 2069'	" 3151'	" 4150'	" 6100'	" 8575'
" 2283'	" 3217'	" 4308'	" 6196'	" 8647'
				" 8777'

For detailed description of these samples see under Appendix 3.

TEXT FIGURE 5BIO-STRATIGRAPHY NORTH EUMERALLA-1

(based on palynological data)

0 - 1100'	no sidewall samples available
1172'	Upper Eocene
disconformity ~~~~~ circa	1210'
1244'-2526'	Lower Eocene
2632'-2792'	Upper Paleocene
2852'	Lower Paleocene
disconformity ~~~~~ circa	2895'
2946'-3241'	Santonian - Coniacian
disconformity ~~~~~ circa	3315'
3332'-5729'	Albian
5884'-8289'	Aptian
probable disconformity ~~~~~ circa	6300'
probable disconformity ~~~~~ circa	7300'
8575'-8777'	Lower Aptian-Neocomian

MICROFLORAL SUBDIVISION

Generally speaking samples were rich to very rich in particular those in the Tertiary section of the well where they were rich both in species and specimen. A deterioration in the preservation of sporomorphs was noted below 6300'. Reworked sporomorphs from Permian-Triassic were noted in a considerable number of samples of Cretaceous and Tertiary age indicating at least partly the source material for these sediments. They have not been included in the counts and as a result are not represented on the distribution chart.

Only the Tertiary and Upper Cretaceous strata present in the well contained some microplankton although often very scarce. In the thick Lower Cretaceous section below 3315' only one specimen of Michrystidium was observed at 8289'. On basis of the microfloras determined the following subdivisions could be established (from young to old):

1172' Upper Eocene

In contrast to samples below this depth the microfloras are dominated by Nothofagidites spp notably Nothofagidites emarcidus and N. heterus. Triorites harrisii on the other hand occurs less frequent than before. Significant species recorded are:

Kuylisporites waterbolkkii, Myrtaceidites parvus, M. verrucosus
Malvacipollis subtilis, Nothofagidites emarcidus, N. heterus,
N. flemingii, N. asperus, N. vansteenisii, Proteacidites
clintonensis, P. annularis, Rugulatisporites mallatus,
Triporopollenites chmozus, Triorites harrisii, P. rectomarginus.

The microfloras closely resemble those described by Evans and Stover in the Nothofagidites asperus zone of the Gippsland Basin who noted a sudden and dramatic influx of Nothofagidites spp at the base of that zone (Ref. 43). No specimen of Aglaoreidia spp and Malvacipollis diversus were observed. Only a few mostly indeterminate microplankton species were noted. Worth mentioning is the presence of Diphyes colligerum believed restricted to Eocene and Paleocene strata. The presence of well mixed microfloras and scarce microplankton would point to a brackish - marine near shore depositional environment.

MICROFLORAL ZONATION : NOTHOFAGIDITES ASPERUS ZONE
DEPOSITIONAL ENVIRONMENT : LAGOONAL - NEAR SHORE FACIES

1244' - 2526' LOWER EOCENE

Microfloras encountered on this interval were rich to very rich. Significant sporomorphs recorded are:

Baculatisporites disconformis, Beaupreaidites elegansiformis,
Drytopollenites semilunatus, Casuarinidites cainozoicus,
Cupaneidites orthoteichus, Malvacipollis diversus,
Myrtaceidites eugenoides, M. tenuis, Proteacidites dilwynensis,
P. grandis, P. pachypolus, Peromonolites densus,
esobalteus, Sapotaceidites rotundus, Spinizonocolpites prominatus,
Tiliaepollenites notabilis.

Unlike the overlying sample of the Nothofagidites asperus zone all samples in this interval were generally poor in Nothofagidites spp. Proteacidites species are well represented as are Triorites harrissi and Malvacipollis diversus. At 1552' a specimen of Dryptopollenites semilunatus was found. According to Stover and Evans this species is restricted to the Proteacidites asperopolus zone but Stover and Partridge (Ref. 44) indicate it to be present also in the uppermost part of the Malvacipollis diversus zone. Nothofagidites goniatus was also observed at this depth. The samples between 1244' and 1552' were generally richer in Nothofagidites spp. than in the deeper part of the interval. Proteacites asperopolus was not observed. As this type usually occurs in abundance in the Proteacidites asperopolus zone this zone is therefore believed to be absent in North Eumeralla-1 although its presence between 1244' and 1552' cannot be ruled out entirely.

Rare microplankton includes species as Deflandrea obliquipes, Deflandrea pachyceros and Wetzeliella homomorpha. The depositional environment is considered similar as that mentioned for sample 1172'.

MICROFLORAL ZONATION: MALVACIPOLLIS DIVERSUS ZONE

DEPOSITIONAL ENVIRONMENT: LAGOONAL - NEAR SHORE FACIES

2632'-2792' UPPER PALEOCENE

This interval was generally rich in sporomorphs. Microplankton occurred scarce with the exception of the highest sample at 2632' which contained a fair amount of microplankton. Significant sporomorphs recorded are:

Camazonosporites bullatus, Ericipites scabratus, Krauselisporites papillatus, Lygistepollenites balmei, L. ellipticus, L. australiensis, Tricolpites philipsii.

Microplankton species recorded are:

Baltispaeridium liniferum, B. septatum, Cyclonephelium retintextin, Diphyes colligerum, Deflandrea dartmooria and an unidentified well preserved species belonging to Lejeunia spp.

Diphyes colligerum, observed regular only at 2632', is believed restricted to Paleocene/Eocene strata. Deflandrea dartmooria was only present at 2706'. It was believed to occur not older than Lower Eocene (Ref. 42). However, since these strata are undoubtedly of Paleocene age its range may have to be extended into the Upper Paleocene.

The microfloras in this interval only partly compare with those described from Paleocene outcrops in the Princetown area of Victoria (Harris, Ref. 36). Triorites edwardsii is not observed in quantities in this interval and Triorites harrissi was absent. Co-occurrences of Triorites edwardsii and Cupaneidites orthoteidius were not observed.

MICROFLORAL ZONATION : LYGISTEPOLLENITES BALMEI ZONE

DEPOSITIONAL ENVIRONMENT : LAGOONAL - NEAR SHORE FACIES

2852' LOWER PALEOCENE

Only one sample could be determined to belong to this interval. It was rich in sporomorphs but unfortunately only a few indeterminate microplankton species were observed. Significant sporomorphs recorded were:

Camarazonosporites amplus, Dilwynites granulatus, D. tuberculatus, Latrobosporites crassus, Liliacidites lanceolatus, Proteacidites crassus, Tricolpites longus, T. fissilus, T. pachyexinus, T. pannosus, Triorites edwardsii, Tripunctisporites sp.

The deepest occurrences of both Dilwynites spp and Tripunctisporites sp were found in this sample in which also the only occurrence of Tricolpites longus in this well was determined. In the Gippsland basin these species are believed to indicate the basal Tertiary unit. The samples in which this microflora occurs has been included in the Pebble Point because of its Tertiary age. These microfloras were absent from the Pebble Point Formation outcrop in the Princetown area. However it could well represent a formation of rare or extremely thin occurrence in the Otway Basin between Pebble Point formation and Upper Cretaceous unconformity.

MICROFLORAL ZONATION : TRICOLPITES LONGUS ZONE

DEPOSITIONAL ENVIRONMENT : LAGOONAL - NEAR SHORE FACIES

2946' - 3241' SANTONIAN-CONIACIAN

Samples in this interval were generally rich in sporomorphs, while microplankton was observed in all of them often in fair quantities. Significant sporomorphs recorded are:

Beaupreaidites verrucosus, Camarazonosporites ohaiensis, Cicatricosisporites australiensis, Clavifera triplex, Cyathidites splendens, Klukisporites scaberis, Krauselisporites jubatus, K. papillatus, Leptolepidites verrucosus, Ornamentifera sentosa, Phyllocladidites verrucosus, Proteacidites amolosexinus, Stephanopollenites obscurus, Tricolpites lilliei, T. simatus, Vitreisporites pallidus.

Significant microplankton observed are:

Areoligera cf. medusettiformis, Cyclonephelium variabilis, Deflandrea bakeri, D. cf. cretacea, D. belfastensis, Dinogymmium spp., Heterosphaeridium conjunctum, Nelsoniella aceras, Odontochitina operculata.

Phyllocladidites mawsonii, Microcachriidites antarcticus and Stephanopollenites obscurus occur regular and often in appreciable quantities. Tricolpites spp and Tricolporites spp are well represented in this interval. Deflandrea belfastensis, found at 3217', indicates this interval to be not older than Coniacian, the presence of Odontochitina operculata in the top sample that Maastrichtian strata are absent.

However, microplankton characteristic of Maastrichtian and Campanian such as Gillinea hymenophora was not observed and a Santonian-Coniacian age seems therefore most likely. This would agree with sporomorph evidence since both Nothofagidites senectus and Tricolpites lilliei zones (Nothofagidites microflora of Dettmann) were not observed.

MICROFLORAL ZONATION : TRICOLPITES PACHYEXINUS ZONE

DEPOSITIONAL ENVIRONMENT : NEAR SHORE FACIES

3332' - 5729' ALBIAN

With only few exceptions most samples were poor to fair in sporomorphs. Unfavourable lithologies in this interval may in part account for this. Microplankton was not observed. Significant sporomorphs recorded are:

Aequitriradites spinulosus, Cicatricosisporites hughesi, C. ludbrookii, C. pseudotripartitus, Classopollis spp, Coptospora sp. A, C. paradoxa, Coronatispora perforata, C. telata, Cribelosporites striatus, Densoisporites velata, Dictyophylledites concavus, Dictyotosporites complex, Foraminisporis asymmetricus, F. dailyi, F. wonthaggiensis, Ischyosporites punctatus, Krauselisporites major, Leptolepidites major, L. verrucosus, Rouseisporites reticulatus, R. simplex, Schizosporis parvus, Trilobosporites trioreticulatus.

The first introduction of angiospermous elements in the microfloras is observed in the upper part of this interval, allowing for the recognition of the Tricolpites pannosus zone. Reworked elements from the Dictyotosporites speciosus zone were noted here. Coptospora spp. were found regular although in small quantities. Below 5467' Dictyotosporites speciosus makes its first appearance. A hiatus at the top of this interval is indicated by the absence of the overlying Appendicisporites distocarinatus and Clavifera triplex zones. The absence of Appendicisporites distocarinatus and Cicatricosisporites cuneiformis from the top part of this interval could indicate the absence of the uppermost part of the Tricolpites pannosus zone too.

MICROFLORAL ZONATION: 3332'-3534' TRICOLPITES PANNOSUS ZONE
 3596'-5269' COPTOSPORA PARADOXA ZONE
 5467'-5729' DICTYOTOSPORITES SPECIOSUS
 ZONE (UPPER PART).

DEPOSITIONAL ENVIRONMENT: CONTINENTAL.

5884' - 8289' APTIAN

As for the previous interval samples were in general poor to fair. No microplankton was recorded except for a single specimen of Michrystidium at 8289'. Significant sporomorphs are:

Beretisporites spectabilis, Cyclosporites hughesi, Dictyotosporites filosus, D. speciosus, Pilosporites notensis, Tsugaepollenites dampieri, T. segmentatus, T. trilobatus, Velosporites triguetrus.

A change in microfloras possibly related to a hiatus is noted below 6294'. Cicatricosporites spp., notably Cicatricosisporites australiensis which occur regular and often in high quantities above this depth have not been observed in the deeper part of the well despite an effort was made to detect these types. Paucity of the microfloras could not be considered as an explanation. Cicatricosisporites spp. are the main criteria to distinguish Neocomian from Upper Jurassic strata in Australian Mesozoic palyno-stratigraphy. In case of its absence and poor representation of types as Cyclosporites hughesi, Cribelosporites stylosus and Dictyotosporites speciosus, as is the case in this well, these strata may well be considered as Upper Jurassic. Cicatricosisporites spp. exhibit a similar distribution pattern in well Pretty Hill-1 where a base was observed between 6070' and 6370'.

Seismic records indicate a hiatus intersected in this well at \pm 7100'. Palynological investigations were unable to detect any break in the sequence at that level although a slight darkening of sporomorphs was observed from 7300' downwards.

MICROFLORAL ZONATION : DICTYOTOSPORITES SPECIOSUS ZONE
(FORAM. ASYMMETRICUS/ROUS RETICULATUS UNIT)

DEPOSITIONAL ENVIRONMENT : CONTINENTAL

8575' - 8777' EARLY APTIAN - NEOCOMIAN

The presence of Murospora florida in this interval indicates that the Murospora florida unit of the Dictyotosporites speciosus zone has been penetrated. Besides its presence little difference is noted with the microfloras of the overlying strata. Samples were generally rich. Most common types observed were Baculatisporites comaunensis, Ceratosporites equalis and Lycopodiumsporites spp which often dominate the microfloras. Contignisporites spp. such as Contignisporites cooksonae, C. fornicatus and C. multimuratus were observed for the first time in this interval in North Eumeralla-1. Metamorphic rocks of a possible Palaeozoic age were penetrated below 8850' marking an end to palynological age determinations.

MICROFLORAL ZONATION : DICTYOTOSPORITES SPECIOSUS ZONE -
MUROSPORA FLORIDA UNIT.

DEPOSITIONAL ENVIRONMENT : CONTINENTAL.

CONCLUSIONS

All suitable sidewall samples analysed in well North Eumeralla-1 contained microfloræ and only very few samples proved barren or practically so. The Tertiary section closely compared with that reported from the Gippsland Basin and the palynological scheme presented by Stover and Evans there could easily be applied. Microplankton present in North Eumeralla-1 supported their age in terms of Time stratigraphy.

The presence of over 5600' of Lower Cretaceous strata were determined ranging in age from Neocomian to Albian. The possible Neocomian interval in the well is thin and cannot exceed 500'.

The Upper Cretaceous was incomplete with Cenomanian-Turonian and Campanian-Maastrichtian strata not observed. The total thickness is approximately 300'.

Though a number of diastems occur sedimentation was more continuous from early Tertiary to Upper Eocene times. The absence of proven middle Eocene sediments may be the result of differences developing in the microfloras of the Otway region as compared with Gippsland in the Eocene. However, microfloras believed by Harris to represent middle Eocene (Ref. 38) also were observed.

On the absence of any marine indications in Lower Cretaceous the depositional environment is believed continental. These sediments are unconformably overlain by Lower Senonian strata deposited in a near shore possibly shallow marine depositional environment. Near shore to lagoonal conditions prevailed during the Tertiary period studied palynologically in this well.

A number of important regional hiatuses were recognised in the well. Sedimentation during Neocomian - Albian times is believed continuous as for the only clearly indicated hiatus on seismic evidence no time gap could be determined palynologically. Upper Cretaceous strata are incomplete and only during a possibly short period were sediments deposited.

AGE	MICROFLORAL ZONATION			NORTH	PIPERALLA-I	PRETT	REMARKS
	ZONE	SUB-ZONE	UNIT	EMPERALLA-I	EMPERALLA-I	HILL-I	
POCENE	MIDDLE-UPPER	NOTHOFAGID.		?			<div style="border: 1px solid black; width: 10px; height: 10px; display: inline-block;"></div> DETERMINATION CERTAIN <div style="border: 1px solid black; width: 10px; height: 10px; display: inline-block;"></div> DETERMINATION UNCERT.
		ASPERUS		1172'			
		PROTEACIDIT.					
POCENE	LOWER	MALYACI POLLIS		1244'			NR: NOT REACHED
		DIVERSUS		1552'			
PALEOCENE	UPPER	LYGISTEPOLL.		2632'			ALL DEPTHS BELOW B.F.
		BALMEI		2792'			
		TRICOLPITES					
PALEOCENE	LOWER	LONGUS		2852'			
MAMA CARTERONE		TRICOLPITES					
		LILLIEI					
		NOTHOFAGID.					
		SENECTUS					
		TRICOLPITES		2946'			
ALBIAN		PACHYEXINUS		3241'	2835'	2726'	
		CLAVIFERA					
		TRIPLEX					
		APPENDICISP.					
		DISTOCARINAT.					
ALBIAN		TRICOLATES		3332'			
		PANNOSUS		3534'	3311'	2928'	
		COPTOSPORA		3596'	3800'	3340'	
		PARADOXA			5816'	4655'	
ALBIAN			DICTYOTOSPOR.				
			FILOSUS				
				5269'		4940'	
		CRIBELOSPORIT.		5467'	6034'		
		STRIATUS		5729'	6720'		
ALBIAN		DICTYOTOSPOR.	FORAMINISPOR.	5884'	7225'	5420'	
		SPECIOSUS	ASYMMETRICUS		7717'	5967'	
						6070'	
		CYCLISPORIT.	ROUSEISPORIT.	8143'			
ALBIAN		MAGNESI	RETICULATUS	8289'	9890'		
NEOZOICIAN	LOWER ALBIAN		MURDOSPORA	8575'			
			FLORIDA	8777'	10,300'		6288'
NEOZOICIAN	LOWER ALBIAN	CRIBELOSPOR				6690'	
		STYLOSUS				7214'	
TOP BASEMENT				8850'	NR	7872'	
TOTAL DEPTH				9737'	10308'	8124'	TEXT FIG. 16

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