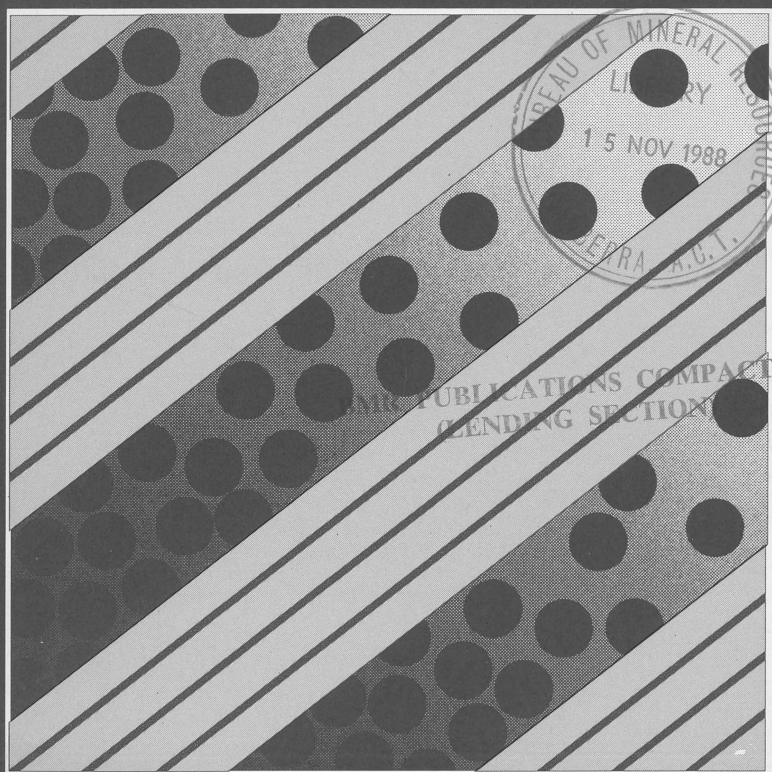
GROUNDWATER 15

Studies in Hydrogeology

PALYNOLOGICAL ANALYSIS, BMR PIANGIL WEST-1 BOREHOLE, MURRAY BASIN

M.K. MACPHAIL



BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

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Department of Primary Industries & Energy
BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

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PALYNOLOGICAL ANALYSIS,

B.M.R. PIANGIL WEST-1 BOREHOLE,

MURRAY BASIN

by

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Murray Basin Hydrogeological Project

FOREWORD

The major geological resource of the Murray Basin is groundwater. Four regional aquifer systems occur in the Tertiary infill of fluvio-lacustrine and shallow marine sediments: the Renmark Group aquifer, the Murray Group aquifer, the Pliocene Sands aquifer, and the Shepparton aquifer.

Major confining beds include the Geera Clay, a sequence of silts and clays which accumulated during the Late Oligocene and Miocene geological epochs, in a variety of shallow to marginal-marine environments. This formation forms an arc across the centre of the basin, extending East-Southeast from the Flinders Ranges to the Grampians, with the thickest section recorded just south of the present day confluence of the Murray and Murrumbidgee Rivers. This sedimentological unit influences groundwater flow within, and discharge from, the Renmark Group Aquifer.

As part of the joint Commonwealth-States Murray Basin Hydrogeological Project, the Geera Aquitard is being studied through a series of regionally spaced boreholes. This report, by Dr M.K. Macphail, dealing with the borehole PIANGIL WEST-1, is one of a number of detailed palynological studies designed to provide a chronological framework within which the deposition of the Geera Clay and related units can be interpreted.

P.J. Cook
Chief
Division of Continental Geology

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ABSTRACT

Palynological examination has been made of twenty seven conventional cores and eleven cuttings samples from the Piangil West-1 borehole in northwest Victoria. Age determinations and zone boundaries within the sequence have been made using criteria established for palynological zonation in the Gippsland Basin. The oldest sequence identified in the hole, that between 383 and 335m, is based on cuttings only, and is assigned to the middle *Nothofagidites asperus* Zone, of probable late Eocene age. Samples between 320m and 241m possibly equate with the Upper *Nothofagidites asperus* Zone of the Gippsland Basin, of Late Eocene to Early Oligocene age. From 238 to 164m, samples are assigned to the *Proteacidites tuberculatus* Zone, of Oligocene through Early Miocene age; those from 159 to 110m to the *Triporopollenites bellus* Zone, spanning the late Early Miocene to Late Miocene.

In quantitative terms, changes in relative abundance of pollen of major tree taxa correspond in direction and timing with those recorded in the Oakvale-1 borehole in the western Murray Basin, and with those in Manilla-1 in the Wentworth Trough.

INTRODUCTION

This report is one of four detailed palynological studies designed to provide a zonation within which the deposition of the Geera Clay and related units can be interpreted. The borehole analysed here is PIANGIL WEST-1 (35°03'9"S 143°13'17"E) in north-west Victoria, drilled through part of the thickest section of the Geera aquitard.

Other boreholes intersecting the Geera Clay and for which detailed palynological data are available are:

(a) Oakvale-1 (Truswell & others, 1985), drilled on the western margin of the basin where the Cainozoic infill onlaps Precambrian basement rocks of probable Adelaidean age; (b) Manilla-1 (Macphail, 1987), drilled within the Wentworth Trough where the Cainozoic infill overlies a sequence of nonmarine sediments deposited within an Early Cretaceous infra-basin; (c) Woodlands-1, drilled near the centre of the Lake Victoria - Lake Wintlow gravity high.

The Piangil West-1 borehole was drilled in two separate operations:

(a) 0-185.88m. This section was conventionally cored although recovery ranged from non-existent for the upper 67m to less than 30% down to 120m. Because of the relatively unconsolidated nature of the sediments penetrated, no cuttings samples could be recovered to offset the loss of core. A very detailed description of the sedimentology and diagenesis of sediments between 81.5 and 185.88m is provided by Radke (1987).

(b) 185.88-383m. This section was conventionally cored down to ca. 232m. Below this depth, only cuttings samples are available for palynological study. At the time of writing, no geological data were available for this lower section, and no electric log data for the entire borehole.

Twenty seven conventional core and eleven cuttings samples processed by B.M.R. were examined for spore-pollen and dinoflagellates. Recovery was variable, with good yields of well-preserved palynomorphs separated by intervals of low to negligible recovery. Nevertheless many samples contained zone species, allowing confident age-determinations to be made. As in Manilla-1, dinoflagellates were rare and most occurrences difficult to identify due to preservation or orientation of the cysts.

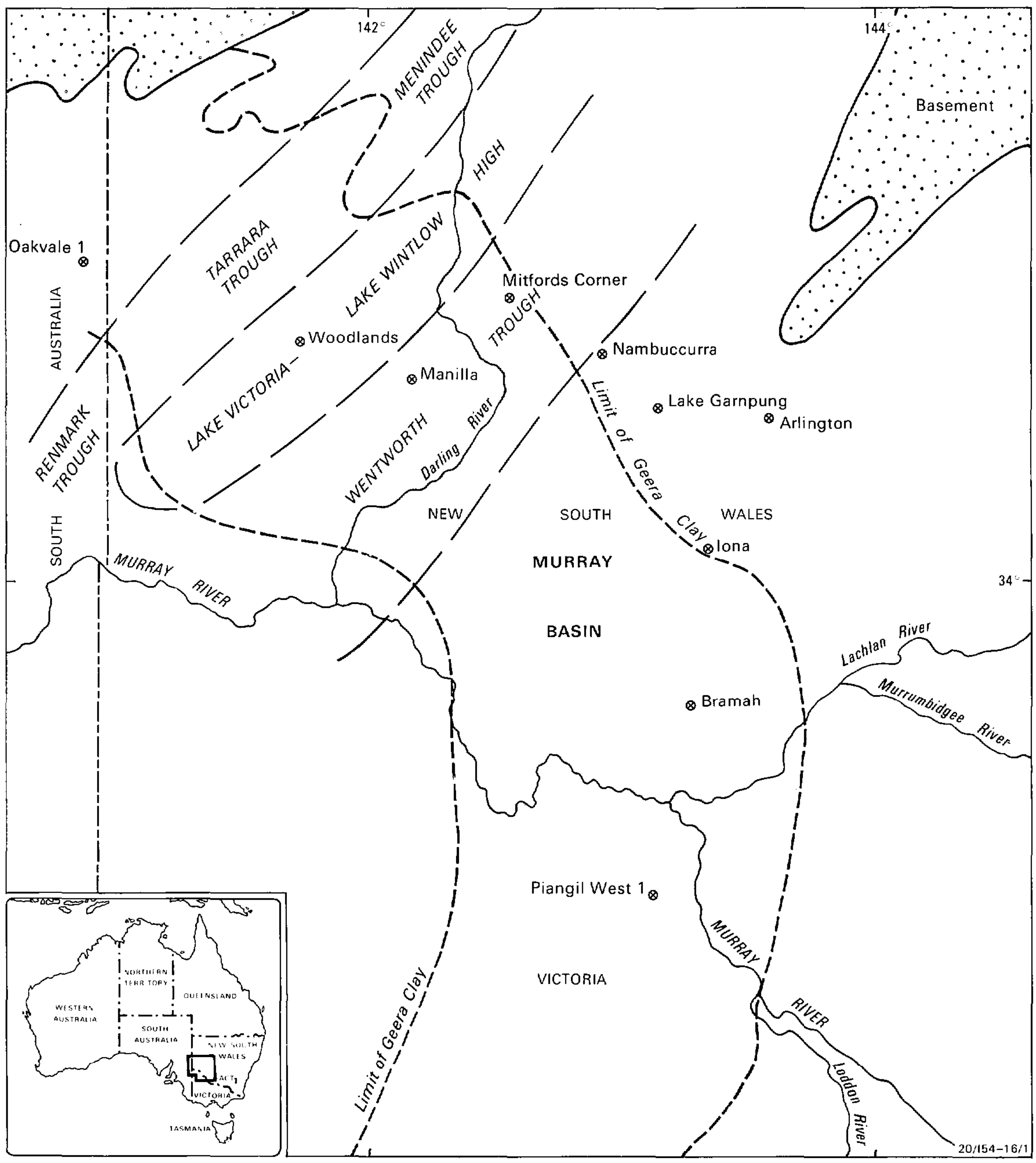


Fig.1. Central Murray Basin showing locality of
Piangil West-1 borehole

Lithological units and palynological zones below 110m in Piangil West-1 are summarized below. Interpretative data on the age and zonal assignment of each sample are given in Table 1. The distribution of all identifiable spore-pollen taxa is tabulated in the range charts (Table 5). The relative abundances of the more common taxa (those constituting at least 1% of the total identifiable spore-pollen count in any one sample) are given in Table 2. Anomalous occurrences and records of rare species are given in Table 3, and basic data on diversity and yield listed in Table 4.

GEOLOGICAL COMMENTS

1. Piangil West-1 contains essentially the same sequence of Oligocene-Miocene clastic facies and spore-pollen zones as Manilla-1 and Oakvale-1, except that an Upper *N. asperus* Zone unit *might* be present. All samples above 238m are interpreted as Geera Clay, based on the first appearance of the spore *Cyatheacidites annulatus*. This depth is likely to be conservative. Sediments containing Middle *N. asperus* Zone palynofloras – those below 335m – are considered to be Renmark Group.

2. The biostratigraphic data confirm geological evidence for a marked thickening of the Geera Aquitard between Oakvale-1 and Piangil West-1, i.e. away from the western margin of the basin. Using the first appearance of *C. annulatus* as a datum, the minimum thickness of Geera Clay increases from ca. 52m in Oakvale-1 to 127m and 142m in Manilla-1 and Piangil West-1 respectively.

3. Based on the first appearance of the zone species *Triporopollenites bellus*, the thickness of Geera Clay deposited at each of the above borehole sites during the late Early to Middle Miocene was similar – 46m, 51m and 49m respectively. Accordingly the bulk of the Geera Clay was deposited during the (?)Late Oligocene and Early Miocene. Global sea levels over this period (Berggren Foraminiferal Zones P21-N5) show an overall relative rise (cycles TB1.1-1.5 and TB2.1 of Haq & others, 1987). The model of Haq & others (*ibid*) shows a major drop in relative sea level at 30Ma ('mid' Oligocene) and it is possible that an unconformity related to this event occurs in Piangil West-1, presumably somewhere between 238-335m.

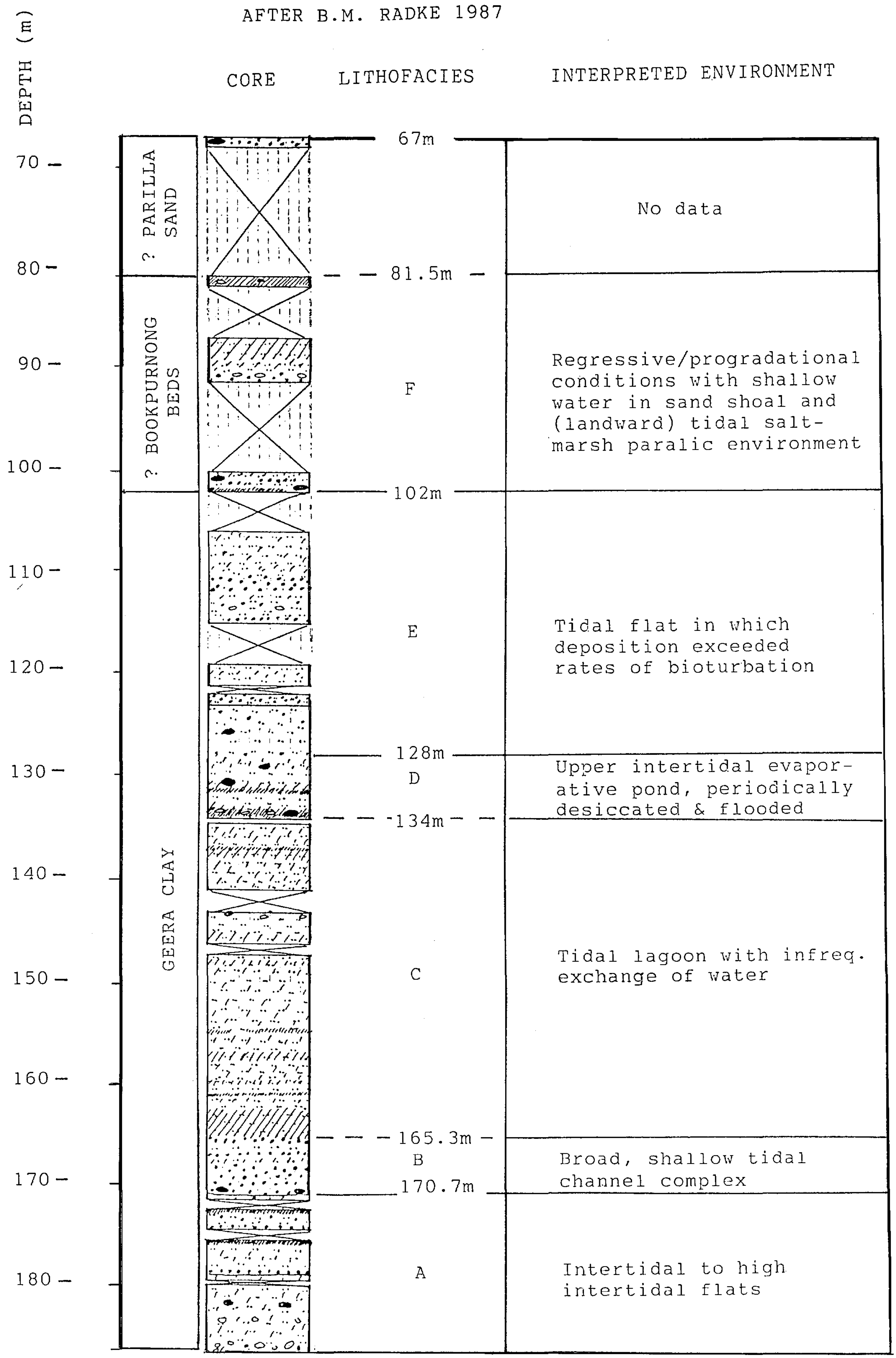
4. Radke (1987) has recognized six distinctive lithofacies above 185.88m (*T. bellus* and top of *P. tuberculatus* Zone sections) in Piangil West-1 (Fig. 2). Detailed quantitative data are available for four of these lithofacies (A,C,D,E). Except that Lithofacies E contains the only sustained, above trace values of *Nothofagus menziesii*-type pollen, there are few indications that the composition and relative abundance of spore-pollen derived from dryland plant species was influenced by the depositional environment. Predictably, a stronger correlation appears to exist between Radke's lithofacies and taxa whose modern representatives are characteristic of shoreline and wetland habitats. For example, the sedges (Cyperaceae), cord-rushes (Restionaceae) and peat-moss (*Sphagnum*) are most prominent in the tidal flat facies (A,D,E) and least abundant in the tidal lagoon facies (C).

5. The only values of dinoflagellates exceeding 1% of the spore-pollen sum occur between 149-159m, i.e. within the lower half of Lithofacies C interpreted by Radke (*ibid*) as representing a tidal lagoon with infrequent exchange of water. The same lithofacies contains the maximum numbers of the fresh/brackish water algae *Pediastrum* and *Botryococcus*, as well as maximum sequence. These data indicate periodic major shifts in water salinity within the lagoon and (143.8m) a significant injection of terrestrially-derived clastics. Whether the dinoflagellate maximum at 159m is related to a change in relative sea level across the site or merely a local ecological event is unknown.

6. Spore-pollen at 119.9, 127.1 and 133m are swollen, a morphological change that in the Gippsland Basin is believed to be due to prolonged saturation with liquid hydrocarbons. Interestingly, Radke (*ibid*) has recorded resinous organic material of probably terrestrial plant origin between 120-185.88m in Piangil West-1. Although it is possible that part of these 'bitumens' have been generated *in situ,* concentrations do not appear high enough to have affected the spore-pollen. Accordingly it is suggested that imma-

FIG. 2 LITHOSTRATIGRAPHY OF PIANGIL WEST-1 CORE (67.0 - 185.88m)

AFTER B.M. RADKE 1987



ture oils sourced from strata underlying the Geera Clay have migrated through this unit and (temporarily) saturated sediments within the lower half of Lithofacies E and Lithofacies D. Porosities between ca. 120-134m are the lowest in the section of Piangil West-1 analysed by Radke.

7. Sample MFP 8781, 116.5m, is mis-labelled since there was no core recovered from this depth (see Radke, 1987). On the basis of the spore-pollen recovered, a depth slightly higher than 110.2m is indicated.

BIOSTRATIGRAPHY

As for Manilla-1, age-determinations and zone boundaries have been made using criteria established for the Gippsland Basin by Stover & Partridge (1973) and Partridge (1976). Because the age-ranges of 'accessory' indicator species appear to vary between the Gippsland and Murray basins, only those samples containing the zone indicator taxa such as *Triporopollenites bellus* or *Cyatheacidites annulatus* are considered to have confident palynological dates. It is anticipated that biostratigraphic data from the fully conventionally cored Woodlands-1 borehole (Macphail, in prep.) will provide a more reliable indication of the ranges of 'accessory' species in the Murray Basin.

PREVIOUS STUDIES

Zonation schemes based on qualitative and quantitative palynological data from the Murray Basin have been discussed by Truswell & others (1985), Martin (1986) and Macphail (1987). The first presents a comparison of Oligocene-Miocene palynofloras in the Murray Basin with palynofloras of equivalent age elsewhere in south-east Australia.

CONTAMINATION

The majority of Piangil West-1 samples contained trace numbers of exotic and modern Australian pollen. At least some of these contaminants have been introduced into the samples during processing. As for Manilla-1, the probability that at least some of the fossil *Tubulifloridites antipoda* grains recorded are recent or subfossil Compositae pollen derived from the semi-arid zone flora of inland Australia, has greatly lessened the stratigraphic value of *T. antipoda* as an indicator of *T. bellus* Zone age. A number of the cuttings samples contained immature and fused aggregates of subfossil Compositae pollen, presumably derived from dust at the borehole site. Surprisingly since salt-bush along with composites is a major component of the semi-arid zone vegetation, no examples of contaminant Chenopodiaceae pollen were recorded.

PIANGIL WEST-1 ZONATION

1. Middle *Nothofagidites asperus* (Late Eocene) 335-383m

All palynofloras in this interval were recovered from cuttings and therefore of intrinsically low confidence. Nevertheless marked differences in yield, preservation, reaction to safranin staining, and kerogen type, suggest that little down-hole contamination has occurred.

Nothofagus brassii-type and Casuarinaceae pollen dominate all assemblages, with the next most common taxa being gymnosperms (*Lagarostrobos*, *Podocarpus*) and woody angiosperms (Proteaceae, Euphorbiaceae). The lowermost sample (380-383m) contains *Proteacidites rectomarginis*, *P. stipplatus* and *P. tuberculatus*, all species which first appear in the upper part of the Middle *N. asperus* Zone in the Gippsland Basin. Other samples within the interval contain taxa which range no higher than this zone in the Gippsland Basin, notably *P. grandis*, *P. incurvatus*, *P. leightonii*, *P. recavus* and *P. reticulatus*.

The samples at 368-371 and 371-374m contain occasional grains of *Perisyncolporites pokornyi,* a type produced by the Malpighiaceae plant family. These records and that of *Dodonaea triquetra*-type pollen at 380-383m are the earliest occurrences of the species in the Murray Basin to date. The upper boundary of the Zone is picked at 335m, the highest occurrence of *P. reticulatus.*

2. Upper *Nothofagidites asperus*/Lower-Middle (?) *P.tuberculatus* Zone (Late Eocene-Early Oligocene) 241-320m

Five samples are provisionally assigned to this 'zone'. All lack taxa with ranges confined to the Middle *N. asperus* Zone (see above) as well as taxa which first appear in the *P. tuberculatus* Zone in the Gippsland Basin. Nevertheless an Early Oligocene age remains possible since there is some evidence (Partridge & Macphail, unpubl. data) that *C. annulatus* first appears in the Gippsland Basin significantly earlier than in basins to the west. The sample at 304-320m contains *Periporopollenites demarcatus*, a species which ranges no higher than the Middle *P. tuberculatus* Zone in the Gippsland Basin.

Relative abundance values show that the interval is clearly related to the underlying unit of Middle *N. asperus* Zone sediments and also to the basal part of the overlying *P. tuberculatus* Zone interval, e.g. *Lagarostrobos*.

3. *Proteacidites tuberculatus* Zone (Late? Oligocene) 164-238m

Samples within this zone are dominated by *Nothofagus brassii*-type pollen with generally lower amounts of Casuarinaceae pollen than in the underlying intervals. As with *Lagarostrobos* in the previous zone, the relative abundance of *Nothofagus fusca*-type pollen decreases markedly part-way through the zone making it difficult to apply quantitative criteria such as those proposed by Martin (1986) within the qualitative Gippsland zonation scheme.

The lower boundary is defined by the first appearance of *Cyatheacidites annulatus.* The same sample contains the lowest records of the accessory *P. tuberculatus* Zone species *Chenopodipollis chenopodiaceoides* and *Cyathidites subtilis* as well as an apparently *in situ* specimen of *Santalumidites cainozoicus*, a species which does not range above the Middle *N. asperus* Zone in the Gippsland Basin.

The interval is characterized by the presence of a number of rare species, including *Perisyncolporites pokornyi, Margocolporites vanwijhei, Podosporites erugatus, Gothanipollis bassensis, Cranwellia striata* and *Granidiporites nebulosus*. The last species is the first for the Murray Basin and may represent an extension in the age-range of this taxon in south-east Australia. In the Gippsland Basin and northern Tasmania, the species ranges no higher than the Lower *P. tuberculatus* Zone.

The upper boundary is provisionally placed at 164m, a sample dominated by gymnosperm pollen, especially Araucariaceae.

4.*Triporopollenites bellus* Zone (Late Early-Late Miocene) 110.2-159m

The lower boundary is placed at the first unequivocal occurrence of the nominate species. However it is noted that a closely similar, apparently triporate grain occurs at 208.14m. The chief difference between this crushed grain and *T. bellus* is that the reticulum diminishes in size across the poles.

Samples within the interval are dominated by gymnosperms such as Araucariaceae, *Dacrydium* Group B spp., *Dacrycarpus* and *Podocarpus*, and Casuarinaceae. There is a tendency for ferns to be more prominent than previously whilst the maximum values of *Phyllocladus*, Liliaceae, Cyperaceae, Restionaceae and Sparganiaceae in the sequence occur in this zone.

As with the underlying interval, the *T. bellus* Zone section contains a number of rare/first records for the Murray Basin including a *Psiladiporites* sp. (also present at 242-244m) which closely resembles a modern *Alyxia* pollen and a specimen of

Asseretospora sp. of Foster (1982). Also present are apparently *in situ* specimens of *Rugulatisporites trophus*, *Proteacidites stipplatus*, *Latrobosporites crassus* and *Ilexpollenites*, taxa that do not range into the *T. bellus* Zone in the Gippsland Basin.

The occurrence of *Haloragacidites haloragoides* with *Triporopollenites bellus* at '116.5m' (see Geological Comments) indicates that top samples are Middle or possible Late Miocene.

QUANTITATIVE ZONATION

Changes in relative abundance of the three major tree taxa in Piangil West-1 broadly correspond in direction and timing with those recorded in Oakvale-1 and Manilla-1. Specific differences that may warrant further investigation are:

(a) the earlier rise to prominence/dominance of Araucariaceae at Oakvale-1 (Early Miocene) than at Piangil West-1 (late Early Miocene), and (b) the markedly lower values of Myrtaceae pollen recorded at Piangil West- 1 relative to both Oakvale-1 and Manilla-1; similarly Gramineae.

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TABLE 1

SUMMARY OF INTERPRETATIVE PALYNOLOGICAL DATA

SAMPLE MFP	DEPTH (m)	SPORE-POLLEN ZONE	AGE	CONF. RTG.	COMMENTS
8782	110.2	T. bellus	Mid/Late Miocene	0	T. bellus
8783	113.8	No older than P. tuberculatus		-	C. annulatus
8781	"116.5"	T. bellus	Mid/Late Miocene	0	H. haloragoides T. antipoda
8784	119.9	T. bellus	late Early- Middle Miocene	0	T. bellus
8786	127.1	No younger than T. bellus		-	T. adelaidensis
8787	129.2	T. bellus	late Early- Middle Miocene	1	T. antipoda C. annulatus
8788	133	T. bellus	as above	0	T. bellus
8789	138	Indeterminate		-	abund. Pediastrum
8790	143.8	Indeterminate		-	abund recycled Mesozoics
8791	149	T. bellus	late Early- Middle Miocene	0	T. bellus
8792	154	No younger than T. bellus		-	S. rotundus
8793	159	T. bellus	late Early Miocene	0	T. bellus
8794	164	P. tuberculatus	Oligocene- Early Miocene	2	D. triquetra-type
8796	174	No younger than T. bellus		-	P. rectomarginis
8797	179	P. tuberculatus	Oligocene- EarlyMiocene	1	C. annulatus
8798	184	P. tuberculatus	as above	2	V. cristatus
8933	194.16	Indeterminate		-	
8934	196.35	Indeterminate		-	
8935	199.65	P. tuberculatus	Oligocene- EarlyMiocene	1	Chenopodipollis
8936	205.28	P. tuberculatus	as above	1	Chenopodipollis
8937	208.14	P. tuberculatus	as above	2	N. brassii-type dom.
8932	214.23	P. tuberculatus	as above	2	Malvacearumpollis
8927	220.5	P. tuberculatus	as above	2	N. brassii-type dom.
8928	222.19	P. tuberculatus	as above	0	C. annulatus G. nebulosus
8929	224.57	Indeterminate		-	
					cont.

Please note that each age-determination is based on the internal evidence of that sample

0 SWC or Core High Confidence. Assemblage contains index fossil(s)

1 SWC or Core Medium Confidence. Diverse, well-preserved assemblage, lacking index species but otherwise characteristic of zonule

2 SWC or Core Low Confidence. Low diversity/poorly preserved assemblage of long-ranging species

3 Cuttings or badly contaminated SWC Low to Very Low Confidence

4 Barren Samples

TABLE 1

SUMMARY OF INTERPRETATIVE PALYNOLOGICAL DATA

SAMPLE MFP	DEPTH (m)	SPORE-POLLEN ZONE	AGE	CONF. RTG.	COMMENTS
8930	228.23	P. tuberculatus	Oligocene-Early Miocene	0	C. annulatus
8931	231.6	P. tuberculatus	as above	0	C. annulatus
8915	235-38	P. tuberculatus	as above	3	C. annulatus
8916	241-44	Indeterminate		-	
8917	259-62	Indeterminate		-	
8921	296-304	Indeterminate		-	P. rectomarginis
8918	304-20	No younger than Middle P. tuberculatus		-	P. demarcatus
8919	335-38	Middle N. asperus	Late Eocene	3	P. reticulatus
8920	341-44	Middle N. asperus	as above	3	P. leightonii
8922	356-59	Middle N. asperus	as above	3	P. leightonii
8923	368-71	Middle N. asperus	as above	3	P. reticulatus
8924	371-74	Middle N. asperus	as above	3	A. sectus, P. leightonii
8925	380-83	Middle N. asperus	as above	3	P. tuberculatus, R. trophus

Please note that each age-determination is based on the internal evidence of that sample

0 SWC or Core High Confidence. Assemblage contains index fossil(s)

1 SWC or Core Medium Confidence. Diverse, well-preserved assemblage, lacking index species but otherwise characteristic of zonule

2 SWC or Core Low Confidence. Low diversity/poorly preserved assemblage of long-ranging species

3 Cuttings or badly contaminated SWC Low to Very Low Confidence

4 Barren Samples

TABLE NO. : 2

Well Name PIANGIL WEST-1 Basin MURRAY

FOSSIL NAMES / DEPTHS	110.2m	113.8m	116.5m	119.9m	127.1m	129.2m	133m	138m	143.8m	149m	154m	159m	164m	174m	179m	184m
SAMPLE TYPE OR NO. * MFP	8782	8783	8781	8784	8786	8787	8788	8789	8790	8791	8792	8793	8794	8796	8797	8798
TREES & SHRUBS																
Nothofagus menziesii-type	4	1	3	2	+		1					2	+		4	+
N. brassii-type	17	19	11	8	6	1	7			12	9	29	8		32	5
N. fusca-type	1	1	2				+				+	1				+
Casuarinaceae	14	19	24	19	21	25	28			14	25	9	20		14	36
Myrtaceae	5	5	2	+		+				4	2	8	2		+	+
Araucariaceae	12	5	7	10	10	3	15			33	22	19	31		5	5
Dacrydium Group B spp.	16	7	5	15	18	18	12			9	10	2	8		9	13
Dacrycarpus	3	2	3	3	1	5	1			4	2	1	1		2	4
Lagarostrobos					+								1			
Phyllocladus	+	3	+	+	+	+	2					+	1			
Podocarpus	8	11	8	10	7	4	9			8	8	5	8		8	4
Podosporites microsaccatus						+				+	+	+	+			
Banksia					1			Insufficient Spore-Pollen	Insufficient Spore-Pollen					Insufficient Spore-Pollen		+
Epacridaceae/Ericaceae	+		1		+		+				+	+	+		1	
Euphorbiaceae				+	+					+	+	+			+	
Proteaceae	+		+	+	1	+	1				+	+	2		2	2
HERBS																
Cyperaceae				+	3	3	2				1	+	+			2
Gramineae			+	+									+			1
Liliaceae	+	1	+	3	1	6	3			+	+	+	1		3	3
Restionaceae	2	1	2	+	2	6	2			+	+	+	+		2	3
Sparganiaceae		1	1	2	+	3	2			+		+	+		+	3
ANGIOSPERMS OF UNKNOWN HABIT																
Aglaoreidia qualumis																
Arecipites																
Periporopollenites demarcatus/vesicus			+													
Tricolpites	1	+	2	2	+	2	2			+		+	2		3	5
Tricolporites		4	3	2	+	1	1			8	7	5	1		1	1
CRYPTOGAMS																
Cyatheaceae	7	5	11	8	15	3	4			2	5	6	2		4	5
Dicksoniaceae		+	+			1					+	+	+		+	
Dictyophyllidites		+					1				1		1			
Gleicheniaceae	+	+	1	+	1		+			+	1	+	+		+	+
Monolete Fern Spores	2	4	6	8	4	9	2			1	3	4	2		5	2
Lycopsida			+	+		1	1			+		+	+		2	+
Hepaticae	1	+				1					+	3	+			
Sphagnum	+	1														
FRESHWATER ALGAE																
Botryococcus			+				+			+			15		+	2
Pediastrum				2		+	+									7
Rouseisporites				+			+				1		1			1
Zygnonemales			+		+	+							+			1
MARINE/MARGINAL MARINE DINOS.					+		+				2	17				+
FUNGAL GERMLINGS																
REWORKED PRE-TERTIARY SPP.									∞	+		1	4			
POLLEN SUM	365	283	304	331	279	204	295			283	305	306	283		297	
UNIDENTIFIED SPORE-POLLEN	7	7	5	5	9	5	6			5	2	5	2		8	

FOSSIL NAMES / DEPTHS			194.16m	196.35m	199.65m	205.28m	208.14m	214.23m	220.5m	222.19m	224.57m	228.23m	231.6m	235-35m	241-244m	259-262m	296-304m	304-320m	335-338m	341-344m	356-359m	368-371m	371-374m	380-383m
SAMPLE TYPE OR NO. * MFP			8933	8934	8935	8936	8937	8932	8927	8928	8929	8930	8931	8915	8916	8917	8921	8918	8919	8920	8922	8923	8924	8925
TREES & SHRUBS																								
Nothofagus menziesii-type							2	1	1	3		+	+	1	+		+	+		2	+	+		1
N. brassii-type							50	56	53	36		44	35	39	43		54	47	44	43	56	27	30	39
N. fusca-type							2	3	5	3		4	+	4	+				1	5	2	2	6	5
Casuarinaceae							10	9	11	18		10	12	10	29		17	27	26	13	23	36	26	24
Myrtaceae							5	4	7	3		5	1	14	+		2		3	2	1	+	2	5
Araucariaceae							6	2	+	8		1	+	6				5	+	1		1	+	+
Dacrydium Group B spp.							2	+	+	2		1	4	1	4		2	2		3	3	2	3	+
Dacrycarpus							1	1		+		1		+			1		+	+	+	+	+	+
Lagarostrobos							+			+		1	+		+		8	+	4	3	3		2	3
Phyllocladus									+			+	1				+		+				+	+
Podocarpus							7	3	5	11		11	20	+	4		5	6	3	8	3	2	6	6
Podosporites microsaccatus							+		+				+	+	+		4		1	5	+		+	
Banksia			Insufficient Spore-Pollen	Insufficient Spore-Pollen	Insufficient Spore-Pollen	Insufficient Spore-Pollen					Insufficient Spore-Pollen					Insufficient Spore-Pollen						+	+	
Epacridaceae/Ericaceae													+	+	+				+		+			
Euphorbiaceae									+	+		+	+					1	1	+	2	10	6	3
Proteaceae							+	3	2	1		3	2	4	3		4	3	8	4	4	6	4	5
HERBS																								
Cyperaceae								+				+	+	+	+					+	+	+	+	
Gramineae							+								+			+						
Liliaceae									+	+			1	+	1			+	+	2		1	+	+
Restionaceae								+				+	+	1	+		+	2	+	1	+	4	1	+
Sparganiaceae							+			+		+		1	+						+	+		
ANGIOSPERMS OF UNKNOWN HABIT																								
Aglaoreidia qualumis							1		+	+		+	2	2	+							+		
Arecipites																								
Periporopollenites demarcatus/vesicus							+			+			+		+		+	+	+	+	+	+	3	+
Tricolpites							+		3	+			+	1			+		+		+	+	1	1
Tricolporites							2	7	4	3		4	3	6	2				1	3	1	2	2	3
CRYPTOGAMS																								
Cyatheaceae							1	2		2		4	3	1	3				+	+		1	+	
Dicksoniaceae							1		+	+								+						
Dictyophyllidites								1		3		1		+	+									+
Gleicheniaceae							+	1					+	1	+				2	1			+	
Monolete Fern Spores							+			+		2	3	2	2		+		+		+	+	+	+
Lycopsida									+	+		+	+	+	+				+				+	
Hepaticae									+			+										+	+	
Sphagnum										+		+		+	+									
FRESHWATER ALGAE																								
Botryococcus								6		+				+	4			+		2		2		1
Pediastrum							3	2				1	1	+	13			6				3		
Rouseisporites																								
Zygnonemales																								
MARINE/MARGINAL MARINE DINOS.										+				1	+			+		+	1	1		
FUNGAL GERMLINGS																								
REWORKED PRE-TERTIARY SPP.							+	+	+				+	+	3			+	+	+		3		
POLLEN SUM							170	203	271	313		282	303	279	268		262	232	254	279	278	281	306	278
UNIDENTIFIED SPORE-POLLEN							-	2	-	5		-	8	8	3		3	3	6	6	4	5	3	4

TABLE 3

ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE-POLLEN SPP. IN PIANGIL WEST-1

110.2m	Rugulatisporites trophus	Not recorded above Middle N. asperus Zone in Gippsland Basin
"116.5m"	Alyxia	Type (Psiladiporites sp.) not previously recorded in Murray Basin
133m	Asseretospora sp.	V. rare sp. previously recorded by Foster (1982) from Eocene strata, Yaamba Basin, Queensland
133m	Perfotricolpites cf digitatus	Rare sp.
149m	Perisyncolporites pokornyi	Malpighiaceae pollen, uncommon
164m	Cranwellia striata	V. rare sp.
164m	Gothanipollis bassensis	Rare sp.
220.5m	Podosporites erugatus	Rare sp.
222.19m	Granodiporites nebulosus	V. rare sp.
222.19m	Margocolporites vanwijhei	Rare sp.
228.23m	Cyperaceaepollis sp. C	Periporate type resembling modern Baumea/ Gymnoschoenus type
231.6m	Gothanipollis bassensis	Rare sp.
231.6m	Tricolporites retequetrus	Rare sp.
231.6m	Palaeocoprosmadites sp.	Rare undescribed sp.
235-238m	Santalumidites cainozoicus	Not recorded above Middle N. asperus Zone in Gippsland Basin
235-238m	Perisyncolporites pokornyi	As above
241-244m	Alyxia	As above
335-338m	Anacolosidites acutullus	Not recorded above Middle N. asperus Zone in Gippsland Basin
341-344m	Podosporites erugatus	As above
368-371m	Perisyncolporites pokornyi	Earliest record to date in Southern Australia; also present at 371-374m
371-374m	Gyrostemonaceae	Rare Late Eocene occurrence
371-374m	Proteacidites sp. A of Macphail (1987)	very rare sp. resembling P. pachypolus but with much coarser reticulum
380-383m	Dodonaea triquetra-type (= cf Nuxpollenites sp. of Truswell et al., 1985)	Not previously recorded in Eocene sediments from Murray basin
380-383m	Proteacidites cf tuberculiformis	Large (greater than 80 microns) undescribed Proteacidites sp. closely resembling P. tuberculiformis except that the large verrucae are lacking
371-374m	Cranwellia costata	V. rare N.Z. sp. Recorded once in Middle N. asperus Zone palynoflora in Gippsland Basin

TABLE 4

BASIC DATA

SAMPLE MFP NO.	DEPTH (m)	LITHOLOGY	YIELD		PRESERV'N	DIVERSITY	
			S-P	DINOS		S-P	DINOS
8782	110.2	Slt., peaty, glau	Good	V. low	Fair	High	Low
8783	113.8	as above	Good	V. low	Fair	High	Low
8781	"116.5"		Good	V. low	Good	High	Low
8784	119.9	Slt., pyr.	Good	V. low	Poor	High	Low
8786	127.1	Slt., peaty	Fair	V. low	Poor	High	Low
8787	129.2	Slt., clayey	Low	V. low	Poor	Medium	Low
8788	133	Slt., carb. nodules	Good	V. low	Poor	High	Medium
8789	138	Slt., clayey	V. low	V. low	Poor	Low	Low
8790	143.8	as above	V. low	V. low	Poor	Low	LOw
8791	149	Slt.	Good	-	Fair	High	-
8972	154	Slt.	Fair	Low	Fair	High	Low
8793	159	Slt., clayey	Fair	High	Fair	High	Medium
8794	164	as above	Good	Low	Fair	High	Low
8796	174	Glau. sand	V. low	-	Fair	Medium	-
8797	179	Slt., forams	Good	V. low	Fair	High	Low
8798	184	Slt. clayey	Good	V. low	Fair	High	Low
8933	194.16	not available	Negl.	-	Fair	Low	-
8934	196.35	"	V. low	-	Fair	Low	-
8935	199.65	"	V. low	V. low	Good	Low	Low
8936	295.28	"	V. low	V. low	Good	Medium	Low
8937	208.14	"	Low	-	Fair	Medium	-
8932	214.32	"	V. low		Fair	Low	-
8927	220.5	"	Low	-	Fair	Medium	-
8928	222.19	"	Good	V. low	Good	High	Low
8928	224.57	"	V. low	-	Good	-	
8930	231.6	"	Good	V. low	Good	High	Low
8915	235-38	"	Good	Low	Good	High	Low
8916	241-44	"	Fair	V. low	Fair	High	Low
8917	259-62	"	Negl.	-	Good	Low	-
8921	296-304	"	Low	-	Fair	Medium	-
8918	304-20	"	Low	V. low	Fair	Medium	Low
							cont.

DIVERSITY: SPORE-POLLEN low = less than 10 spp., medium = 10-30, high = greater tha 30 spp.

DINOS low = 1-3 spp., medium = 3-10 spp., high = greater than 10

TABLE 4

BASIC DATA

SAMPLE MFP NO.	DEPTH (m)	LITHOLOGY	YIELD		PRESERV'N	DIVERSITY	
			S-P	DINOS		S-P	DINOS
8919	335-38	? coal	Low	-	Fair	Medium	-
8920	341-44	not available	Good	Low	Good	High	Low
8922	356-59	"	Good	Low	Good	High	Low
8923	368-71	"	Good	Low	Good	Medium	Low
8924	371-74	"	Good	V. low	Good	High	Low
8925	380-83	"	Fair	V. low	Good	High	Low
8931	231.6	"	Good	V. low	Good	High	Low

DIVERSITY: SPORE-POLLEN low = less than 10 spp., medium = 10-30, high = greater tha 30 spp.

DINOS low = 1-3 spp., medium = 3-10 spp., high = greater than 10

TABLE NO.: 5

Well Name PIANGIL WEST-1 Basin MURRAY Sheet No. 1 of 4

SAMPLE TYPE OR NO.	8782	8783	8781	8784	8786	8787	8788	8789	8790	8791	8792	8793	8794	8796	8797	8798		8933	8934	8935	8936	8937	8932	8927	8928	8929	8930	8931	8915	8916	8917	8921	8918	8919	8920	8922	8923	8924	8925
FOSSIL NAMES / DEPTHS	110.2m	113.8m	116.5m	119.9m	127.1m	129.2m	133m	138m	143.8m	149m	154m	159m	164m	174m	179m	184m		194.16m	196.35m	199.65m	205.28m	208.14m	214.23m	220.5m	222.19m	224.57m	225.23m	231.6m	235-238m	241-244m	259-262m	296-304m	304-320m	335-338m	341-344m	356-359m	368-371m	371-374m	380-383m
SPORES																																							
Asseretospora sp. of Foster 1982							●																																
Baculatisporites comaumensis (R)									●						●																								
B. disconformis		●										●																	●									●	
B. cf B. scabridus		●	●	●						●	●	●			●					●									●										
Cicatricosisporites australiensis (R)																					●																		
Cingulatisporites bifurcatus														●																									
Clavifera triplex		●																																					●
Cyathea palaeospora	●		●		●	●	●	●		●					●	●					●			●	●			●	●						●			●	
Cyatheacidites annulatus	●	●	●	●		●	●			●					●										●		●	●	●										
Cyathidites australis (R)							●	●	●	●			●												●			●	●										●
C. minor	●					●			●			●		●	●			●	●		●	●	●	●			●	●	●	●								●	●
C. splendens													●		●																						●		
C. subtilis	●	●								●	●	●			●														●										
Cyclosporites hughesii (R)																																						●	
Dictophyllidites cf D. arcuatus			●	●	●		●			●	●	●	●			●							●		●		●	●	●	●									●
Dictyotosporites speciosus																																						●	
Didecitriletes (R)												●																●											
Foveotriletes balteus				●																					●														
F. crater	●	●	●	●	●	●	●								●	●									●														
F. lacunosus	●					●									●	●																							
F. palaequetrus																●																							
Gleicheniidites spp.	●		●	●	●		●	●	●	●	●	●	●	●	●			●	●	●		●	●					●	●	●					●		●	●	●
Ginkocycadophytus								●		●		●	●			●																							
Herkosporites elliotii						●						●			●																				●				
Ischyosporites spp.	●	●	●	●	●	●	●			●						●				●							●		●	●	●			●	●			●	●
Klukisporites scaberis (R)									●																										●				
Kuylisporites waterbolkii																																						●	
Laevigatosporites	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			●	●	●	●		●	●		●	●	●	●	●	●		●		●	●		●
Leptolepidites verrucosus (R)																																						●	
Lycopodiumsporites (some R)	●	●		●		●					●	●			●	●																					●		
Matonisporites ornamentalis	●		●			●			●	●	●					●			●		●	●		●	●		●	●	●			●			●			●	●
Monolites alveolatus	●	●		●		●																			●													●	
Neoraistrickia truncata (R)																									●				●										
Osmundacites wellmanii (R)										●																						●							
Peromonolites vellosus			●				●																																
undescribed P. spp.		●								●																		●											
P. sp. cf Hypolepis spinyspora	●		●																																				
Polypodiaceoisporites cf P. obscurus																																					●		
P. sp. cf P. retirugatus					●		●					●				●												●	●										
Polypodiisporites cf P. usmensis	●	●	●													●												●											
Polypodiites spp.		●	●	●	●	●	●			●	●	●			●	●					●				●			●										●	●
Rouseisporites sp. of Truswell et al. 1985			●	●		●	●	●		●	●	●	●		●	●													●								●	●	
Rugulatisporites mallatus	●	●	●		●		●			●	●	●			●										●		●											●	●
R. trophus	●		●	●																																			●
Stereisporites spp.	●	●	●						●	●		●		●											●		●		●	●								●	●
Triletes tuberculiformis	●		●		●							●			●							●			●													●	
Verrucosisporites cristatus	●	●														●							●		●														
V. kopukuensis	●		●																																			●	●
GYMNOSPERM POLLEN																																							
Alisporites grandis (R)									●			●																											●
A. similis (R)								●				●																											
Araucariacites australis	●	●	●	●	●	●	●		●	●		●	●	●	●	●			●	●	●	●		●	●	●	●	●	●	●				●	●		●		●
Classopollis cf C. classoides (R)									●																								●						
Cupressaceae-Taxodiaceae	●	●	●	●																					●		C		●										

R = REWORKED SP

C = CONTAMINANT

TABLE NO.: 5

Well Name PIANGIL WEST-1 Basin MURRAY Sheet No. 2 of 4

SAMPLE TYPE OR NO. *MFP	8782	8783	878[illegible]	8784	8786	8787	8788	8789	8790	8791	8792	8793	8794	8796	8797	8798		8933	8934	8935	8936	8937	8932	8927	8928	8929	8930	8931	8915	8916	8917	8921	8918	8919	8920	8922	8923	8924	8925
FOSSIL NAMES / DEPTHS	110.2m	113.8m	116.5m	119.9m	127.1m	129.2m	133m	138m	143.8m	149m	154m	159m	164m	174m	179m	184m		194.16m	196.35m	199.65m	205.28m	208.14m	214.23m	220.5m	222.19m	224.57m	228.23m	231.6m	235-236m	241-244m	259-262m	296-304m	304-320m	335-335m	341-344m	356-359m	368-371m	371-374m	380-383m
GYMNOSPERM POLLEN cont.																																							
Dacrycarpites australiensis			•	•	•	•	•	•		•	•	•				•		•		•		•	•				•		•				•	•	•	•	•	•	•
Dilwynites granulatus					•				•	•		•	•		•	•					•	•		•	•		•								•				
D. tuberculatus				•	•		•									•					•																	•	
Ephreda notensis																						•																	
Lygistepollenites florinii	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Microcachrydites antarcticus		•	•	•					•			•				•									•		•	•				•	•		•			•	
Parvisaccites catastus	•			•	•					•		•			•									•												•			
Phyllocladidites mawsonii	•	•			•					•	•	•	•		•					•		•			•	•	•	•	•	•		•	•	•	•	•		•	•
Phyllocladus palaeogenicus		•	•	•	•		•			•	•	•	•							•	•			•	•		•	•				•		•	•	•		•	•
Podocarpidites spp.	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•		•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•		•	•
Podosporites erugatus																								•											•				
P. microsaccatus	•	•		•		•	•			•	•		•									•		•	•	•		•	•	•		•		•	•	•		•	•
taeniate bisaccate spp. (R)															•														•	•							•		
Tsugaepollenites (R)																•																							
ANGIOSPERM POLLEN																																							
Acaciapollenites myriosporites												•																											
Aglaoreidia qualumis																						•		•	•		•	•	•	•					•		•	•	•
Alyxia			•																											•									
Anacolosidites acutullus																																		•					
A. sectus																																						•	
Arecipites spp.	•			•	•	•							•										•		•														
Banksieaeidites arcuatus																																					•	•	•
B. elongatus-minimus			•	•	•		•						•			•									•			•	•							•			
Basopollis spp.																													•										
Beaupreadites elegansiformis							•				•														•								•				•		
B. verrucosus																																				•	•	•	•
Bluffopollis scabratus							•																		•				•										
Canthiumidites cf oblatus			•	•			•			•					•										•					•	•					•	•	•	
Rhoipites sp. C. of Foster 1982																																							
Chenopodipollis chenopodiaceoidites	•						•					•									•				•				•										
Clavatipollenites glarius		•		•																																			
Cranwellia costata																																						•	
Crotonipollis		•																																					
Cunoniaceae 2-p/Eucryphiaceae										•		•																											
Cunoniaceae 3-p		•				•				•					•							•		•				•											
Cupanieidites orthoteichus			•				•									•					•				•		•	•	•						•			•	
C. reticularis										•																			•										
Cyperaceae sp. A.		•	•	•		•	•			•		•	•			•													•	•		•				•	•		
Cyperaceae sp. B			•		•	•	•														•		•		•		•	•							•	•			
Cyperaceae sp. C																											•												
Dodonaea cf. D. sphaerica	•										•																												
D. sp. (= cf Nuxpollenites of Truswell et al. 1985)			•	•			•			•	•	•	•																•										•
Elaeocarpaceae		•					•			•		•										•																	
Ericipites crassiexinous	•		•	•	•		•				•																	•										•	
E. scabratus	•	•	•	•	•		•			•	•		•		•				•						•			•	•	•		•	•	•	•	•		•	
Eucalyptus	•		•							•	•		•					•											•										•
Gothanipollis bassensis												•	•															•											
Graminidites spp.	•		•	•	•	•	•			•		•			•	•						•								•			•		•				
Granodiporites nebulosus																									•														
cf. Guettardidites			•				•					•			•	•														•						•			
Gyrostemonaceae							•								•																							•	
Haloragacidites haloragoides			•																																				
H. harrisii	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
H. trioratus	•																																						
Ilexpollenites spp.				•								•											•		•					•					•		•	•	•

R = REWORKED SP

C = CONTAMINANT

TABLE NO.: 5

Well Name PIANGIL WEST-1 Basin MURRAY Sheet No. 3 of 4

SAMPLE TYPE OR NO. (MFP) / DEPTHS / FOSSIL NAMES	8782 110.2m	8783 113.8m	8781 116.5m	8784 119.9m	8786 127.1m	8787 129.2m	8788 133m	8789 138m	8790 143.8m	8791 149m	8792 154m	8793 159m	8794 164m	8796 174m	8797 179m	8798 184m	
ANGIOSPERM POLLEN cont.																	
Liliacidites lanceolatus																	
indeterminate L. spp.		•	•	•	•	•	•		•	•	•	•	•	•	•	•	
Lymingtonia sp.													•				
Malvacearumpollis sp.															•		
Malvacipollis diversus																	
M. subtilis	•	•	•	•		•	•			•		•	•		•		
undescr. M. spp.	•	•	•	•	•		•				•	•	•		•		
Margocolporites vanwijhei																	
undescr. M. spp.																	
Milfordia homeopunctata	•		•		•		•			•		•	•		•	•	
M. hypolaenoides	•	•	•	•	•	•	•	•				•			•	•	
Myrtaceidites eucalyptoides										•	•	•				•	
M. parvus-mesonesus	•	•	•			•	•			•	•	•		•	•	•	
M. verrucosus	•	•															
Nothofagidites asperus	•	•	•	•	•		•		•	•		•	•		•	•	
N. brachyspinulosus	•		•								•	•	•			•	
N. deminutus-vansteenii	•		•	•	•		•				•				•	•	
N. emarcidus-heterus	•	•	•	•	•		•			•	•	•	•	•	•	•	
N. falcatus	•	•	•	•	•		•			•	•	•		•	•	•	
N. flemingii		•	•	•			•			•				•	•	•	
N. goniatus													•		•		
Palaeocoprosmadites													•			•	
Perfotricolpites cf digitatus				•			•										
Periporopollenites demarcatus																	
P. vesicus			•														
Perisyncolporites pokornyi										•	•	•	•				
Polycolporopollenites esobalteus																	
Polyorificites oblatus	•	•	•	•			•			•	•	•		•			
Propylipollis annularis	•		•		•		•						•			•	
P. cf annularis of Dudgeon 1983													•				
P. callosus					•		•										
P. latrobensis																	
Proteacidites adenanthoides																	
P. crassus																	
P. grandis																	
P. incurvatus																	
P. ivanhoensis	•																
P. kopiensis		•													•		
P. leightonii																	
P. pachypolus							•										
P. pseudomoides												•					
P. recavus																	
P. rectomarginis						•								•	•	•	
P. rectus			•														
P. cf reflexus						•											
P. reticulatus																	
P. reticuloscabratus															•		
P. stipplatus					•	•	•								•		
P. symphyonemoides															•		
P. tuberculatus																	
P. sp. A of Macphail 1987																	
Undescr. P. spp.	•	•	•	•	•	•	•			•	•	•	•	•	•	•	
Pseudowinterapollis calathus			•				•										
P. cranwellae	•	•	•	•	•												

SAMPLE TYPE OR NO. (MFP) / DEPTHS / FOSSIL NAMES	8933 194.16m	8934 196.35m	8935 199.65m	8936 205.28m	8937 208.14m	8932 214.23m	8927 220.5m	8928 222.19m	8929 224.57m	8930 228.23m	8931 231.6m	8915 235-238m	8916 241-244m	8917 259-262m	8921 296-304m	8918 304-320m	8919 335-338m	8920 341-344m	8922 356-359m	8923 369-371m	8924 371-374m	8925 380-383m
ANGIOSPERM POLLEN cont.																						
Liliacidites lanceolatus															•			•	•		•	
indeterminate L. spp.							•				•	•	•			•	•	•	•		•	•
Lymingtonia sp.																						
Malvacearumpollis sp.						•		•					•									
Malvacipollis diversus													•				•					
M. subtilis							•	•		•	•		•			•	•	•		•	•	•
undescr. M. spp.								•			•	•				•	•	•	•	•	•	•
Margocolporites vanwijhei								•														
undescr. M. spp.												•										
Milfordia homeopunctata						•		•			•	•	•		•	•	•	•	•		•	•
M. hypolaenoides							•			•	•	•	•			•		•	•	•	•	•
Myrtaceidites eucalyptoides								•				•			•							•
M. parvus-mesonesus		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•
M. verrucosus											•											•
Nothofagidites asperus		•	•	•	•	•	•	•		•	•	•	•		•	•	•	•	•	•	•	•
N. brachyspinulosus	•			•			•	•		•	•	•	•				•	•	•	•	•	•
N. deminutus-vansteenii		•		•	•	•	•	•	•	•	•	•	•			•	•	•	•	•	•	•
N. emarcidus-heterus	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
N. falcatus		•		•	•		•	•	•	•	•	•	•		•				•	•	•	•
N. flemingii			•	•	•	•	•	•	•	•	•	•	•		•		•	•	•	•	•	•
N. goniatus								•										•			•	•
Palaeocoprosmadites											•											
Perfotricolpites cf digitatus																						
Periporopollenites demarcatus		•										•			•	•	•	•	•	•	•	•
P. vesicus		•			•			•			•		•		•			•	•	•	•	•
Perisyncolporites pokornyi								•				•								•	•	
Polycolporopollenites esobalteus											•						•	•			•	•
Polyorificites oblatus				•		•					•	•									•	
Propylipollis annularis											•	•	•		•	•				•	•	•
P. cf annularis of Dudgeon 1983								•				•				•	•	•	•	•	•	•
P. callosus															•							
P. latrobensis																					•	
Proteacidites adenanthoides							•										•	•	•		•	•
P. crassus																	•	•	•	•	•	•
P. grandis																		•	•		•	•
P. incurvatus																		•	•	•		•
P. ivanhoensis																						
P. kopiensis																					•	
P. leightonii																		•	•		•	
P. pachypolus																	•		•	•		•
P. pseudomoides										•		•							•			
P. recavus																		•	•			
P. rectomarginis								•			•	•	•		•	•	•	•	•	•	•	•
P. rectus																						
P. cf reflexus								•					•									
P. reticulatus																	•	•		•	•	
P. reticuloscabratus																			•		•	
P. stipplatus								•													•	•
P. symphyonemoides																						
P. tuberculatus																						•
P. sp. A of Macphail 1987																					•	
Undescr. P. spp.	•			•	•	•	•	•		•	•	•	•	•	•	•		•	•	•	•	•
Pseudowinterapollis calathus												•									•	
P. cranwellae										•												

R = REWORKED SP

C = CONTAMINANT

TABLE NO.: 5

Well Name PIANGIL WEST-1 Basin MURRAY Sheet No. 4 of 4

SAMPLE TYPE OR NO.	8782	8783	8781	8784	8786	8787	8788	8789	8790	8791	8792	8793	8794	8796	8797	8798		8933	8934	8935	8936	8937	8932	8927	8928	8929	8930	8931	8915	8916	8917	8921	8918	8919	8920	8922	8923	8924	8925
FOSSIL NAMES / DEPTHS	110.2m	113.8m	116.5m	119.9m	127.1m	129.2m	133m	138m	143.8m	149m	154m	159m	164m	174m	179m	184m		194.16m	196.35m	199.65m	205.28	208.14m	214.23m	220.5m	222.19m	224.57m	228.23m	231.6m	235-238m	241-244m	259-262m	296-304m	304-320m	335-338m	341-344m	356-359m	368-371m	371-374m	380-383m
ANGIOSPERM POLLEN cont.																																							
Quintinia psilatispora	•									•	•		•	•	•	•					•							•	•	•								•	•
Q. sp.	•		•				•		•	•		•																•											
Rhoipites alveolatus										•															•													•	•
R. sphaerica	•						•					•																	•										
Santalumidites cainozoicus																													•									•	•
Sapotaceoidaepollenites rotundus	•									•	•														•				•						•			•	•
Schizocolpus sp. cf Ranunculacidites communis Salt 1967																																			•				
Simplicepollis meridianus																																						•	•
Simpsonipollis spp.													•		•									•					•							•			
Sparganiaceaepollenites barungensis	•		•		•	•	•		•			•			•	•					•			•						•									•
S. robustisporis			•	•	•		•						•		•	•			•			•						•	•	•						•	•	•	
Stephanocolpites oblatus	•		•				•			•	•	•	•									•						•	•						•	•		•	
Tetracolporites cf palynius	•					•				•															•											•			
Tricolpites cf geranioides																																•						•	
T. reticulatus				•																																			
T. simatus																													•										
undescr. Tricolpites spp.	•	•	•	•	•	•	•			•		•	•		•	•					•	•	•	•	•		•	•	•			•		•	•	•	•	•	•
Tricolporites adelaidensis	•			•	•																				•										•	•		•	•
T. angurium		•			•					•					•																							•	
T. leuros																													•										
T. retequetrus																												•											
T. scabratus																												•										•	
T. cf valvatus	•		•			•					•												•											•					
pseudostriate T. spp.	•						•			•	•	•		•	•							•					•							•				•	
undescr. Tricolporites spp.	•	•	•	•	•	•	•			•	•	•	•	•	•	•				•	•	•	•	•	•	•	•	•	•	•	•			•	•	•	•	•	•
Triporopollenites ambiguus	•			•																																		•	
T. bellus	•			•			•			•		•																											
undescr. Triporopollenites spp.	•	•	•	•	•		•					•	•		•					•	•	•								•				•	•	•	•		
Tubulifloridites antipoda			•			•																						C	C								C	C	C
cf Weinmannia							•			•																		•											
FRESHWATER ALGAE																																							
Botryococcus							•	•	•	•			•	•		•							•		•			•	•	•	•				•		•		•
Pediastrum				•		•	•	•		•			•	•	•	•		•			•	•	•		•			•	•	•		•		•	•	•	•	•	•
Saeptodinium					•	•	•																		•			•	•					•			•		
Zygnonemales				•	•	•				•					•																						•		
MARINE/MARGINAL MARINE																																							
DINOFLAGELLATES (a) Tertiary		•	•		•	•	•	•	•	•	•	•	•		•	•				•	•				•			•	•		•			•	•	•	•	•	•
(b) Cretaceous																																							
FUNGAL GERMLINGS		•			•							•																								•			
ADDITIONAL TAXA																																							
Cranwellia striatus													•																										
Crassiretitriletes vanraadshoovenii																													•										
Dulhuntyispora parvithola (R)																																			•				
Latrobosporites crassus												•									•																		•
Liliacidites cf bainii										•					•																								
Micrantheum spinyspora			•																																				
Myrtaceidites rhodamnoides										•		•																											
Proteacidites obscurus																											•							•	•	•		•	
P. cf tuberculiformis																																							•
Verrucatosporites attinatus																									•														

R = REWORKED SP.

C = CONTAMINANT