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FORAMINIFERAL SEQUENCE

in HAMMERHEAD # 1

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PALTECH PTY LTD

MARINE MICROPALEONTOLOGISTS
SYDNEY NEW SOUTH WALES
MIDLAND WESTERN AUSTRALIA

THE FORAMINIFERAL SEQUENCE
in HAMMERHEAD # 1.

The biostratigraphy and paleoenvironment deduced from forty five sidewall cores is summarised below. The base of the Miocene, marine carbonate sequence, at 1282.5m contains a Zone F planktonic foraminiferal assemblage (≈ 17 m.y. B.P.). At 2.5m below this, there was a planktonic association indicating the early Oligocene, Zone J (≈ 33 to 30 m.y. B.P.) at the top of a marginal marine unit. Thus a hiatus, with a time span between 13 and 16 million years is postulated between the marginal marine unit and the overlying marine carbonate. Such an event was not unique in the offshore Gippsland Basin; especially where progradation and submarine canyon cutting at the shelf edge was evident, as is the case in Hammerhead.

Sidewall† Cores Depth (m)	Approx. E-Log Unit Boundary	Age	Zone*	Paleoenvironment¶
600 to 1055		LATE to MID MIOCENE	B-2 to D-1	Canyon in outer continental shelf (≈150m)
	- - - 1055 - - -			
1060 to 1203	- - - 1170 - - -	MID MIOCENE	D-1 to D-2	Canyon in continental shelf edge (≈200m) N.B. slumping with re-cycled sediment at 1203 & 1170.
	- - - 1205 - - -			
1225 to 1282.5		MID to EARLY MIOCENE	E-1 to F	Prograding edge of continental shelf (150 → 200m)
	∼∼∼ 1282.5 ∼∼∼			
1285 to 1291		EARLY OLIGOCENE	J	Marginal marine with ingressions into lagoonal/estuarine environment.
	——— 1291 ———			

* Planktonic foraminiferal zonation after Taylor (in prep). This report includes distribution chart for Hammerhead on Table 1 with reliability of zonal determinations on Data Sheet.

¶ Interpretation based on distribution of selected benthonic foraminiferal species and other sediment grains (<.075mm) as shown on Table 2 of this report. Paleobathymetric ranges are in parentheses.

† The individual depths of the forty five sidewall cores examined are listed on both Tables 1 & 2.

The paleoenvironmental sequence is divisible into two intervals; namely -

2) Upper units of MARINE CARBONATE Sediments.

1) A lower MARGINAL MARINE Unit.

1) The MARGINAL MARINE Unit of lagoonal and/or estuarine sediments has a basal, quartz sand at 1291m, followed by three sidewall cores, from 1288 to 1285m; containing dolomitic limestone. The fauna of all four samples was dominated by arenaceous foraminifera, mainly of types characterizing Eo/Oligocene estuarine sediments of the Southern Australia margin. However, the occurrence of *Glomospira corona* is confusing as extant species of *Glomospira* live in deep water (>2000m). But *G. corona* occurs frequently in shallow water Oligo/Miocene sediment in New Zealand where it is believed to have been "reworked from Cretaceous and lower Tertiary series" (Hayward & Buzas, 1979, p.18 & p.34). Such reworking is difficult to envisage for the Hammerhead site as the nearest occurrence of such *in situ* fauna are at DSDP Site 283 in the deep, Tasman Sea (Webb, 1975).

Dolomitic limestones are fairly common in these Eo/Oligocene estuarine units at the base of the foraminiferal sequences on the southern margin; for instance within the "Lakes Entrance Greensand" in the Lakes Entrance area. Dolomitic sediments are accumulating today in various lagoons and estuaries along the southern Australian coast.

Into this restricted estuarine/lagoonal environment were at least two ingressions of oceanic waters bearing planktonic foraminifera, thus enabling biostratigraphic as well as paleoenvironmental correlation of the unit with the "Greensand" at the base of the Lakes Entrance Formation of onshore Gippsland.

2) The MARINE CARBONATES, at the base of the sequence contained benthonic foraminiferal assemblages, analogous with those of the Modern Gippsland Outer Continental Shelf and consistant with early Miocene faunas from similar paleoenvironments in New Zealand (refer Hayward & Buzas, 1979). A paleodepth increase is interpreted for assemblages in sidewall cores at and above 1240m, with the paleoenvironmental situation shifting to or just below the shelf/slope break. Shelf edge progradation is suspected but the depth increase may have been also a reflection of the rapid eustatic sea level rise at the early/mid Miocene boundary.

Further evidence of this progradation as well as submarine canyon cutting was the presence of recycled glauconitic moulds of shallow water benthonic foraminifera, typical of the *onshore* Lakes Entrance Formation. Indications of redistribution of older sediments by submarine canyon mechanisms are apparent by the abundance of glauconite between 1203 and 1195m. Not as apparent but still recognisable as redistributed older sediment, is the interval of fine quartz sandy siltstone between 1170 and 1160m. The interpretation is that the proximal canyon first cut into Lakes Entrance Formation then later extended into the "Latrobe Sands". Hammerhead was in a distal position, relative to this canyon system.

Canyon fill sedimentation persisted to the top of the sampled sequence. Upsequence water depth shallowing was evident, being a function of both fill progradation and eustatic sea level decline.

Numerically and in terms of species diversity, planktonic foraminiferal faunas were sparsely represented as ingressions in the Oligocene estuarine sediment. But specimen counts increased dramatically within the Miocene marine carbonates as did specific diversity which is reflected by increase in biostratigraphic reliability of zonal picks (see Data Sheet). The eastern part of the Miocene Gippsland shelf edge is characterized in Zone F, E & D-2 interval by both high counts and high specific diversity making trans-Tasman correlation very precise, as can be demonstrated by comparison with various Southern Ocean schemes summarised in Kennett (1980). The general warming of the Southern ocean during the Zone F to D-2 units (17 to 14 m.y.) allowed further southward penetration of the sub-tropic water mass; the *Proto-East Australian Current*. The effects of this warm water was more noticeable in the extreme east of the Basin. As shown by Kennett (loc. cit., fig.5) there was a paleotemperature deterioration at approximately 14 m.y. explaining the statistical decline in planktonic faunas within and above Zone D-1.

REFERENCES

HAYWARD, B.W. & BUZAS, M.A., 1979 - Taxonomy and Paleoecology of Early Miocene Benthic Foraminifera of Northern New Zealand and the North Tasman Sea. *Smithsonian Conts. to Paleobiology, 36;* 1-54.

KENNETT, J.P., 1980 - Paleoceanographic and Biogeographic Evolution of the Southern Ocean during the Cenozoic, and Cenozoic Micro-Fossil Datums. *Palaeogeog., Palaeoclimatol., Palaeoecol., 31;* 123-152.

WEBB, P.N., 1975 - Paleocene Foraminifera from DSDP Site 283, South Tasman Basin. *I.R.D.S.D.P. 29.*

18 AUG 1982

OIL and GAS DIVISION

Foraminiferal Sequence by Paltech

PLANKTONIC FORAMINIFERA

SIDEWALL CORE Depth in metres	G'ina angiporoides (S.S.)	G'ina euapertura	G'quad tripartita	G'oides bisphericus	G'oides trilobus	G'ina bulloides	G'ina woodi connecta	G'ina woodi woodi	G'alia miozea miozea	G'alia peripheroronda	G'alia praescitula	G'alia zealandica (S.S.)	G'alia continuosa Gp.	G'alia nana Gp.	G'quad dehiscens (S.S.)	G'quad advena	G'quad altispira	Globigerinids - indet (<.25mm)	G'ina ciperoensis	G'alia bella	Praeorb. glomerosa Gp.	G'oides trilobus (elongate)	S'ellopsis seminulina	G'alia praemenardii	Orb. suturalis	G'alia conica	Orb. universa	G'alia panda	G'alia miozea conoidea	G'alia siakensis/mayeri	G'alia peripheroacuta	G'alia lenguaensis	G'alia miotumida miotumida	G'alia scitula	G'alia acostaensis
600.0						•		•										D									•						•	•	•
625.0				•		•		•										D									•						•		•
663.0						x		•																			•						•		
690.0					•													D									•								
720.0																		D											x						
750.0						D		x										D									•						•	•	
782.0																		D									•								
805.0					x	x																					x						x	x	•
830.0								•										D																	
849.0						x		x								•		D									•						x		•
897.0								•										D									•								
928.0					x	x		x																			x		x	x			x		
965.0								•							•			D						•			x		•	x		•	•	•	
980.0																		D									•								
1010.0																		D									•								
1040.0									•									D	x									•	x						
1055.0								x			•					•								•			•								
1060.0						x		x	x		x				x											•	x		x	x		•			
1077.0								x			•																•		x	•					
1092.0					•	x		•	•															•			x	•	x	x	•				
1110.0					•	x		x	x	•														•			x	•	x	•	•				
1115.0					•	x																					•		•	•					
1130.0						x		x	x		•																x		x	x	•				
1140.0					•	x		x																			x		x	x	•				
1150.0					•	x		x																			x		x	x	•				
1160.0				x	x			x	x												•			x					x						
1170.0				x	x			x	x	•		x			x	•					•					x	x	•		•					
1180.0				x	x	x		x	x	x	x	•			x				x	•	•			x	•	•	x	•	x	x					
1187.0				x	x	x		x	x	•	x	•							•	•	x	•		x	•	x	x	•	x	•					
1195.0				x	x	x		x	x	x	x	x								x	•			x	x	•	x	•	x	x					
1199.0		R		x	x	x		x	x	x	x	x	x	x	x	x	x		x	•	x	x		x	•	•	x	•	x						
1203.0				x	x	x		x	x	•	x	x	x	x	x	x	x		x	•	x	x	•	x	•	•	x	•	x						
1207.0				•	•	x		x	•																	•									
1225.0				x	x	x		x	x		•	•		x	x					•	•	•	•	•	•										
1240.0				x	x	x		x	x	•	x									x	x	x	•	•											
1256.0				x	x	x		x	x	•	x	x		x	x	•	•		x	x															
1265.0				•	•	x		x	x		•	•								•															
1270.0				•	x	x		x				x	x	x					x	x															
1278.0				x	x								x	x	x	x	•	D																	
1282.5				•	•	x	x	x	x	•	x	x																							
1285.0	•	•	•																																
1286.5	NO PLANKTONICS FOUND																																		
1288.0	•	•	•																																
1291.0	NO PLANKTONICS FOUND																																		

PLANKTONIC FORAMINIFERAL ASSEMBLAGE

ZONE	Depth at Base	AGE
B-2	849.0	LATE MIOCENE
C	965.0	MID MIOCENE
?	1010.0	MID MIOCENE
D-1	1150.0	MID MIOCENE
D-2	1203.0	MID MIOCENE
?	1207.0	MID MIOCENE
E-1	1225.0	MID MIOCENE
E-2	1240.0	EARLY MIOCENE
F	1282.5	EARLY MIOCENE
J	1288.0	EARLY OLIGOCENE
?		?

Key: • = <20 specimens D = >60% specimens
x = >20 specimens R = recycled specimens

TABLE 1: PLANKTONIC FORAMINIFERAL DISTRIBUTION - HAMMERHEAD # 1

Paltech Report 1982/19

OIL and GAS DIVISION 18 AUG 1982

MICROPALEONTOLOGICAL DATA SHEET

FORAMINIFERAL SEQUENCE
BY PALTECH

BASIN: GIPPSLAND ELEVATION: KB: ______ GL: ______

WELL NAME: HAMMERHEAD # 1 TOTAL DEPTH: ______

AGE		FORAM. ZONULES	HIGHEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time	LOWEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time
PLEISTOCENE		A_1										
		A_2										
PLIOCENE		A_3										
		A_4										
		B_1										
MIOCENE	LATE	B_2	600	1				849	1			
		C	928	1				965	1			
	MIDDLE	D_1	1040	1	1060	0		1150	0			
		D_2	1160	0				1203	0			
		E_1	1225	0				1225	0			
		E_2	1240	0				1240	0			
	EARLY	F	1256	0				1282.5	1			
		G										
		H_1										
OLIGOCENE	LATE	H_2										
		I_1										
		I_2										
	EARLY	J_1	1285*	2								
		J_2						1288*	2			
EOCENE		K										
		Pre-K										

COMMENTS: *Estuarine arenaceous foraminiferal assemblages in SWCs at 1285, 1286.5, 1288 and 1291.
Early Oligocene planktonics found at 1285 and 1288 but not diagnostic for precise zonation. However suspect interval 1285 to 1291 was early Oligocene.

CONFIDENCE RATING:

- O: SWC or Core - Complete assemblage (very high confidence).
- 1: SWC or Core - Almost complete assemblage (high confidence).
- 2: SWC or Core - Close to zonule change but able to interpret (low confidence).
- 3: Cuttings - Complete assemblage (low confidence).
- 4: Cuttings - Incomplete assemblage, next to uninterpretable or SWC with depth suspicion (very low confidence).

NOTE: If an entry is given a 3 or 4 confidence rating, an alternative depth with a better confidence rating should be entered, if possible. If a sample cannot be assigned to one particular zone, then no entry should be made, unless a range of zones is given where the highest possible limit will appear in one zone and the lowest possible limit in another.

DATA RECORDED BY: *Paltech* Pty. Ltd. DATE: July 1, 1982.

DATA REVISED BY: ______ DATE: ______