FORAMINIFERAL SEQUENCE

BARRACOUTA # 4

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SUMMARY

Barracouta # 4 is an anomalous sequence when compared with the other Barracouta sequences. This was because of differences in energy conditions which caused the inversion of the biostratigraphic sequence in Oligocene and early Miocene times and prolonged canyon fill sedimentation during the mid to late Miocene.

INTRODUCTION

Sixty-one side-wall cores were examined from BARRACOUTA # 4. No conventional cores or rotary cuttings were examined. All depths cited in this report and on accompanying sheets are in feet as labelled on side-wall core jars.

The following sheets accompany this report:-

Distribution Chart Sheet 1 - showing distribution of planktonic foraminifera and the basis of biostratigraphic zonation.

Distribution Chart Sheet 2 - giving distribution of benthonic foraminifera.

Distribution Chart Sheet 3 - summarising the environmental analysis.

Biostratigraphic Data Sheet

Two Sample Data Sheets - tabulation of zonation and quality of individual samples.

Biostratigraphic data sheets for Barracouta # 1, # 2 and # 3 have not been revised despite the difficulty in correlating them with Barracouta # 4 (refer conclusions in this report).

BIOSTRATIGRAPHY

No foraminifera were found in the "greensand" interval at or below 3430.

EARLY OLIGOCENE - 3412 to 3386:- The presence of *Subbotina angiporoides* associated with *Globigerina angiporoides* is indicative of Zone J, but the low diversity of the planktonic fauna precludes distinction between Zones J-2 and J-1.

LATE OLIGOCENE to EARLY MIOCENE - 3323 to 3181:- The sequence of faunal events in this interval are abnormal when compared with other sequences on the Barracouta structure. Also they are not in the order of sequence recorded elsewhere in the Gippsland Basin, apart from Trevally # 1, nor for that matter in New Zealand.
The sequence of events, in ascending order was:-

Depth	Faunal events	Zone	Epoch
3181	*Globigerinoides bisphericus & Praeorgulina glomerosa curva*	E-2	early Miocene
3200	*Globigerina woodi woodi* without *G. woodi connecta*	H-2	late Oligocene
3214	*Globigerinoides bisphericus & G. trilobus*	F	early Miocene
3272	*Globigerina euapertura & Globorotalia opima opima*	I-1	late Oligocene
3323	*G. euapertura*	?I-1	late Oligocene

The major abnormality is the reversal of the order of appearance of Zones H-2 and F. Despite the sample gap between 3272 and 3214, it is probable that Zones H-1 and G are absent. It is believed that this disturbance of the sequence was due to post depositional slumping associated with canyon cutting and not due to faulting (see other sections of this report).
The transition from early Miocene (Zone E-2) to mid Miocene (Zone E-1) appears to have been normal, with the easily recognisable E-2 association present at 3181.

MID MIOCENE - 3181 to 2088:- The base of the mid Miocene was marked by a diverse E-1 fauna at 3181. The quality of faunas above this vary with no fauna found at 3100. The fauna at 2930 definitely represents Zone E-1, but low confidence is placed on the apparent top of Zone E-1 at 2762.
As for E-1, the interval assigned to Zone D-2 varies in diversity and numerical frequency of planktonic faunas. Only samples at 2706 and 2520 contain the characteristic association of *Globorotalia peripheroronda* and *G. conica* with *Orbulina universa*.
The lack of complete and characteristic assemblages also reduces the reliability of intervals assigned to Zones D-1 and C. The abbreviation of the Zone D-1 interval, compared with that of Zone D-2, is abnormal and environmental conditions were probably responsible. Usually, the Zone D-1 intervals were the thickest in the Gippsland sequences.
The top of Zone C and the top of the mid Miocene was not well marked and has been placed at the sample immediately below the first appearances of Zone B-2 species.

LATE MIOCENE - 2050 to 1668 to ? :- The base of the late Miocene and the base of Zone B-2 have been taken at the initial appearance of *Globorotalia acostaensis* and *G. miotumida miotumida*. *G. acostaensis* does not extend above 2050, whilst *G. miotumida miotumida* occurs sporadically, with its highest appearance at 1668. In the absence of *G. miotumida conomiozea* the fauna at

1668 is regarded as being within Zone B-2. This may not be the top of the zone and the top of the late Miocene, as the faunas above are biostratigraphically non-diagnostic. Thus the Mio/Pliocene boundary cannot be designated in Barracouta # 4, especially as *G. miotumida conomiozea* was not present in the sequence.

PLIOCENE:- As for the rest of the Barracouta sequences, no definite Pliocene species were recorded in Barracouta # 4. The inability to identify the Pliocene was a function of the environmental conditions which restricted the planktonic diversity to four biostratigraphically ubiquitous species and does not imply that Pliocene sediment was absent from the four Barracouta sequences. The benthonic fauna in the interval between 1632 and 1029 was typical of that of the Pliocene in other Gippsland offshore wells and onshore Gippsland sections.

PLEISTOCENE - ? to 758 to ? :- The bounds of the Pleistocene could not be established, but the presence of *Globorotalia tosaensis* and *Globoquadrina dutertrei* at 758 suggests that the base of the Pleistocene is just below 758 which was assigned to Zone A-2.

ENVIRONMENT

Data relating to this interpretation is tabulated on Distribution Chart Sheets 2 and 3.

There is a conspicuous absence of deep water benthonic species in the sequence which, for the most part, is dominated by *Cibicides* spp. The percentage of planktonic specimens in the fauna was never consistently high and very few numerically rich and specifically diverse faunas were encountered. The whole faunal aspect suggests that the entire marine sequence was deposited on the continental shelf.

At first the early Oligocene benthonic faunas were dominated by arenaceous species which were gradually replaced in dominance by *Cibicides* spp. The percentage of planktonic specimens was at first extremely low but increased towards the top of the Oligocene. The trend is interpreted as that of subsidence of the continental shelf from a fairly shallow depth.

In the biostratigraphically confused section between 3272 and 3181, the faunal constituents (both qualitatively and quantitatively) indicate an outer

continental shelf environment in the proximity of the shelf/slope break as is evident by the presence of *Euuvigerina mayni* and *Siphouvigerina proboscidae* at 3214. The reversal of the sequence (i.e. Zone H-2 on top of Zone F) can be explained in terms of slumping at the shelf edge. This was a prelude to canyon cutting, as is demonstrated by the presence of proximal canyon fill sediment at and above 3164.

The calcarenites between 3164 and 2654 were often dominated by highly worn bryozoal fragments and contain worn specimens of shallow water benthonic foraminifera such as *Amphistegina lessonii*. Numerically the faunas were poor and benthonic diversity low, though often the planktonic component registered a high percentage. The quartz sandstones in this interval appear to have been devoid of fauna, including bryozoa. Obviously this was a stressed environment with shallow water skeletal detritus contributing to most, if not all, of the benthonic elements in the faunas. A canyon head situation at or near the shelf edge is postulated. The canyon filling commenced in Zone E-1. As this was closely preceded by a Zone E-2 sample (15 feet between samples), there is little evidence of a time lapse between canyon cutting and canyon filling. It is noted that Zones E-2 and E-1 combined, represent less than 1 m.y. on the radiometric time scale.

The termination of this phase of high energy sedimentation was marked by a rich and diverse benthonic fauna at 2608 in the Zone D-2 interval. Although this sample was dominated by *Cibicides* spp., there was a high proportion of Buliminacea (e.g. *Brizalina* spp. and *Euuvigerina* spp.). This gross faunal combination lives today on the outer southeastern portion of the Gippsland continental shelf.

Above 2608 energy conditions fluctuated as is demonstrated by the erratic variation in specimen frequency and diversity. Planktonic specimens dominated the fauna and sponge spicules were common. Thus this fine-grained micritic limestone interval between 2560 and 2218 has the characteristic of canyon fill sediment beyond the proximal position. However, it does not contain any continental slope foraminifera and the shelf forms present are not worn. The explanation is that sedimentation was still in the canyon head, but that supply of detrital material and/or energy was dissipated.

A diverse benthonic fauna was present between 2117 and 2000, suggesting normal outer shelf conditions. This was disrupted at 1900 (Zone B-2) by another phase of fluctuating energy conditions, terminating with the deposition of skeletal

calcarenites, dominated by worn bryozoal fragments. In part, this could be canyon head facies, but could also be mid to inner continental shelf situations with strong bottom currents.

The fauna in the highest sample (at 758) was indicative of the inner continental shelf and has many of the components of the onshore Jemmy Point and Tambo River Formations. As this sample is Pleistocene, there is further evidence of a late Cainozoic regression in the Gippsland Basin.

CONCLUSIONS

Correlation of Barracouta # 4 with the other Barracouta wells appears difficult and confusing. For instance:-

1) The presence of Zone F which was absent in the other wells.
2) The probable absence of Zones H-1 and G.
3) The inversion of Zone H-2 and F.
4) Thickness variations of Zones E to B.

These biostratigraphic abnormalities can be explained by the fact that environmental conditions which affected sedimentation in Barracouta # 4 were different to those which prevailed in the other three sequences. For instance:-

1) The Oligocene and early Miocene sediments, though partially removed, were not disturbed in the other three wells.
2) There appears to have been longer periods of high energy and canyon fill sedimentation in Barracouta # 4.

These factors would suggest that canyon cutting was more extensive and thus canyon filling more prolonged at Barracouta # 4. It would follow that Barracouta # 4 was in a more distal position in the canyon system that the other Barracouta wells. This would have resulted in marked differences in sedimentation rates between the sequences.

MICROPALEONTOLOGICAL MATERIAL

WELL NAME AND NO: BARRACOUTA # 4 *DATE:* 11.5.77

PREPARED BY: DAVID TAYLOR *SHEET NO:* 1 of 2

DRAW:

DEPTH	*SAMPLE TYPE*	*SLIDES*	*ADDITIONAL INFORMATION*
758	SWC 60		A-2 (1)
929	SWC 30		No planktonics
1042	SWC 29		indeterminate
1088	SWC 59		"
1138	SWC 58		"
1181	SWC 28		"
1252	SWC 57		"
1320	SWC 56		"
1362	SWC 55		"
1405	SWC 54		"
1452	SWC 53		B (2)
1493	SWC 52		No planktonics
1533	SWC 51		indeterminate
1576	SWC 50		"
1600	SWC 49		"
1632	SWC 48		"
1668	SWC 47		B-2
1715	SWC 46		indeterminate
1764	SWC 45		"
1816	SWC 44		"
1860	SWC 43		"
1900	SWC 42		B-2 (1)
2000	SWC 40		B-2 (1)
2050	SWC 39		B-2 (0)
2088	SWC 38		C (1)
2117	SWC 37		C (1)
2218	SWC 35		indeterminate
2260	SWC 27		"
2300	SWC 26		C (1)
2341	SWC 25		C (1)
2395	SWC 24		C (1)

MICROPALEONTOLOGICAL MATERIAL

11.5.77

WELL NAME AND NO: BARRACOUTA # 4 *DATE:* ~~XXXXXXXX~~

PREPARED BY: DAVID TAYLOR *SHEET NO:* 2 of 2

DRAW:

DEPTH	*SAMPLE TYPE*	*SLIDES*	*ADDITIONAL INFORMATION*
2435	SWC 23		D-1 (1)
2480	SWC 22		D-1 (1)
2520	SWC 21		D-2 (0)
2566	SWC 20		D-2 (1)
2608	SWC 19		D-2 (1)
2654	SWC 18		D-2 (2)
2663	SWC 17		indeterminate
2706	SWC 16		Base D-2 (1)
2730	SWC 34		No planktonics
2762	SWC 15		E-1 (2)
2803	SWC 14		No planktonics
2930	SWC 32		E-1 (0)
3100	SWC 6		N.F.F.
3120	SWC 5		E-1 (1)
3140	SWC 4		No planktonics
3164	SWC 3		E-1 (2)
3181	SWC 2		E-2 (0)
3200	SWC 1		H-2 (1)
3214	SWC 90		F (0)
3272	SWC 89		I-1 (1)
3323	SWC 88		I-1 (2)
3377	SWC 87		indeterminate
3386	SWC 86		J-1 (2)
3400	SWC 85		No planktonics
3412	SWC 84		J-1 (2)
3430	SWC 83		N.F.F.
3438	SWC 82		N.F.F.
3443	SWC 81		N.F.F.
3447	SWC 80		N.F.F.
3450	SWC 79		N.F.F.

N.F.F. = No foraminifera found

Form R 193 3/71

BASIN GIPPSLAND BY David Taylor

WELL NAME BARRACOUTA #4 DATE 11-5-77 ELEV. +83'

Foram Zonules

		Highest Data	Quality	2 Way Time	Lowest Data	Quality	2 Way Time
	A	758	1		758	1	
		Alternate					
MIOCENE	B	1452	2		2050	0	
		Alternate					
	C	2088	1		2395	1	
		Alternate					
	D_1	2435	1		2480	1	
		Alternate					
	D_2	2520	0		2706*	1	
		Alternate					
	E	2762	2		3181*	0	
		Alternate	2930	0			
	F	3214	0		3214	0	
		Alternate					
	G						
		Alternate					
	H_1						
		Alternate					
	H_2	3200	1		3200	1	
		Alternate					
OLIGOCENE	I_1	3272	1		3323	2	
		Alternate					
	I_2						
		Alternate					
	J_1	3386	2		3412	2	
		Alternate					
	J_2						
		Alternate					
EOC.	K						
		Alternate					
	Pre K						

* right on zonal change

COMMENTS: Sequence is anomalous when compared with Barracouta #1, #2, and #3. This is because of slumping, canyon cutting and greater thickness of proximal canyon fill. N.B. reversal of H-2 and F and probable absence of H-1 and G. Refer paleontology report 1977/14.

Note: If highest or lowest data is a 3 or 4, then an alternate 0, 1, 2 highest or lowest data will be filled in if control is available.

If a sample cannot be interpreted to be one zonule, as apart from the other, no entry should be made.

0 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).

Date Revised _____

By _____

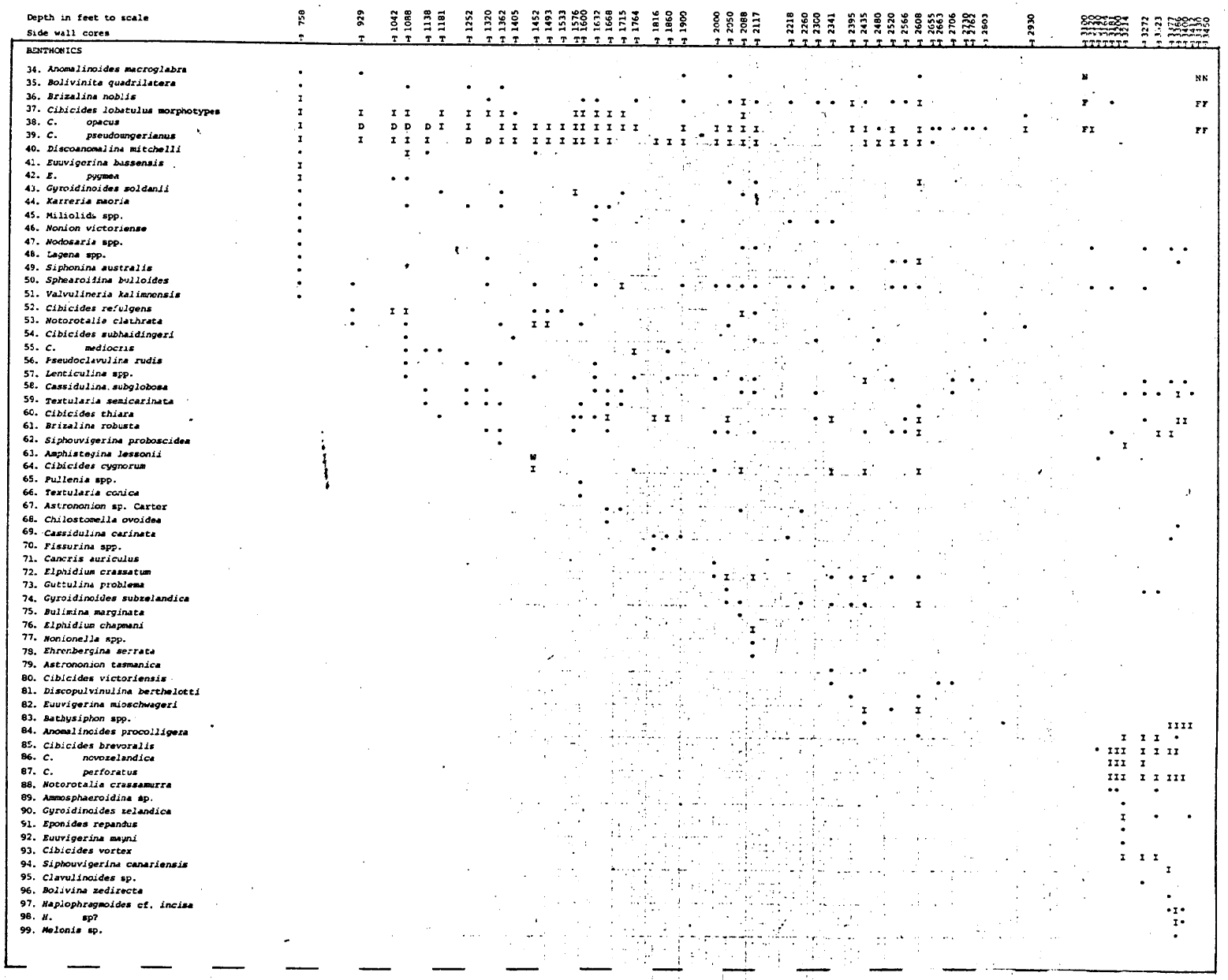
BARRACOUTA # 4

Depth in feet to scale	758	929	1042	1088	1138	1181	1252	1320	1362	1405	1452	1493	1533	1576	1600	1632	1668	1715	1764	1816	1860	1900	2000	2050	2088	2117	2218	2260	2300	2341	2395	2435	2480	2520	2566	2608	2654	2663	2706	2730	2782	2803	2930	3100	3120	3129	3164	3181	3214	3272	3323	3377	3386	3402	3430	3450
Side wall cores	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
PLANKTONICS																																																								
1. *Globigerina bulloides*	I		•	I	•					•				•	•	I	•	•		•	•		•	I	I					I	I	I	I	I		I				NI			I			NN								
2. *G. decoraperta*	I				•									••		•	•	•		•	•	•	•	I	I	I	•	•	I			I																						
3. *G. falconensis*	I			•	•		•	•	•	•																										I				F						FF								
4. *Globoquadrina dutertrei*	•																																																					
5. *Globorotalia tosaensis*	•																																																					
6. *Orbulina universa*				•		•		•					•	••	I	•		•		•	•	•		I	I	I	•		•	I		I	I	I	I	I	I	I•	I																	
7. *Globorotalia scitula*							•																				•			•	I	I																							
8. *Globigerina woodi woodi*											•							•						I	I	•		•	I	I	I	I		I	I	I	I	I•	I				I		I	III								
9. *Globorotalia miotumida miotumida*																	•					•	•	I																															
10. *G. acostaensis*																								•																															
11. *G. menardii*																								•																															
12. *G. miozea conoidea*																								•	I	•					I	I		•	•	I																	
13. *Globoquadrina dehiscens* (s.s.)																								•	•																							I	•					
14. *Globorotalia mayeri*																									•	•		•		•	•	•	•			•																	
15. *G. miocenica*																														I	I	I																						
16. *G. conica*																																I	•	•	•																	
17. *G. miozea miozea*																																		I	I	I	•								I		I						
18. *G. peripheroronda*																																		•					•														
19. *Globigerinoides trilobus*																																		•	•	I											I	I				
20. *G. bisphericus*																																			•				I									I	•				
21. *Globorotalia praescitula*																																			•	•													•				
22. *Globigerina ciperoensis*																																							•										•				
23. *Globorotalia zealandica*																																							•														
24. *Orbulina suturalis*																																								•	•													
25. *Praeorbulina glomerosa glomerosa*																																							•														
26. *Globigerina woodi connecta*																																																						
27. *G. apertura*																																																						
28. *Praeorbulina glomerosa curva*																																																					
29. *Globigerina praebulloides*																																																					
30. *G. euapertura*																																																					
31. *Globorotalia opima opima*																																																					
32. *Globigerina* spp. indeterminate																																																					
33. *Subbotina angiporoides*																																																					

T = side wall core
• = 1-20 specimens
I = over 20 specimens
D = Dominant (over 40%)
W = worn ? reworked
N.F.F. = no foraminifera found
? = zonal definition not possible

Depth in feet to base of ZONE	758					2050			2395	2480		2706			3164				3323		3412	
	A-2	?	?	?	B	?	B-2		C	D-1		D-2		E-1	E-2	F	?	H-2	I-1	?	J	

BARRACOUTA 4



BARRACOUTA # 4