THE FORAMINIFERA SEQUENCE IN SWEEP-1,

GIPPSLAND BASIN

by

David Taylor, Consultant

ESSO AUSTRALIA LTD

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FORAMINIFERAL SEQUENCE

- SWEEP # 1

by DAVID TAYLOR

Consultant

Esso Australia Ltd.,

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SUMMARY

The foraminiferal sequence commenced in "Greensand" sediment deposited in the late Oliogcene (Zone H-2). Although the most biostratigraphic units, apart from B-2, were recognised, the sedimentary record is far from complete. This is demonstrated by dramatic fluctuations in the accumulation rates for the Zones. Episodic canyon cutting and filling cycles are evident over a period of some 14m.y., between late early Miocene (F) to Pliocene (A-3). This is the longest recorded span for submarine canyon activity in the Gippsland Basin. Probably the Sweep site was at the proximal end of the modern Bass Canyon and that the last fill episode did not cease till the Quaternary (17,000 yr. BP).

INTRODUCTION

Fiftynine sidewall cores were examined from SWEEP # 1. No planktonic fauna was found in the eleven SWCs between 785 and 757. All depths quoted are in metres as labelled on submitted samples.

Data is collated on the following sheets.

FACTUAL Biostratigraphic Data Sheet
FACTUAL Sample data Sheets with observations on residue grains.
FACTUAL Distribution Chart - Sheet 1 - for planktonic foraminifera.
FACTUAL Distribution Chart - Sheet 2 - for benthonic foraminifera and other grains.

BIOSTRATIGRAPHY.

LATE OLIGOCENE - ZONE H-2 - 755 to 747.

The foraminiferal sequence commences with a low diversity H-2 association of *Globigerina woodi woodi* and *G. ciperoensis*. The apparent condensation of the zonal interval was probably due to the slow sedimentation rate of the "Greensand" which contains the H-2 faunas.

EARLY MIOCENE - ZONES H-1 to E-2 - 744.5 to 660.

The base of early Miocene (= H-1) is designated at the *Globigerina woodi connecta* FAD*with the top (= E-2) at 660, below the *Orbulina* FAD at 650. Units H-1 and G were extremely condensed, suggesting very slow sedimentation rates (see Environment section).

MID MIOCENE - ZONES E-1 to C - 650 to 507.5.

The base of the mid Miocene corresponds to the appearance of a poorly preserved specimen of *Orbulina suturalis* within a typical E-1 association. The fauna

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*FAD = First Appearance Datum.

at 630 was more diverse and contained definite, though rare, specimens of *O. suturalis*.

The Zones D-2 and D-1 intervals were unusually thin. This interval was designated as that between the *Orbulina universa* FAD (at 605) and the *Globorotalia miotumida miotumida* FAD at 553.

LATE MIOCENE - ZONE B-2 - ? Absent.

Zone B-2 faunas were not recorded in Sweep # 1. As there was little or no room for B-2 sediments between the *G. mayeri* LAD*at 507.5 (= Zone C) and the *G. conomiozea* FAD at 498.2, it must be concluded that Zone B-2 is absent or extremely condensed in this section.

PLIOCENE - ZONES B-1 to A-3; 498.2 to 241.5.

Base of Pliocene in Austral region is believed to approximate the *G. conomiozea* FAD. Base of Zone A-4 at 397 was established on *G. puncticulata* FAD, whilst base of Zone A-3 has been tentatively positioned in next sample above the *G. conomiozea* LAD.* The quality rating for the A-3 pick is very low as faunas at and above 327 lack definite *G. inflata*. As this cool temperate minimal layer species was normally common in A-3, its absence is puzzling. The presence of *G. miotumida* in Zones A-4 and A-3 is anomalous and probably due to reworking.

ENVIRONMENT.

Sweep # 1 is by far the best sample sequence on the northern margin of offshore Gippsland. A cyclic environmental pattern of:-

3) Shallow shelf platform sedimentation in
2) Episodic shelf and slope canyon cutting and filling events from high in the early Miocene (Zone F) to the Pliocene (? Zone A-3).
1) Shallow shelf platform sedimentation in latest Oligocene and early Miocene (Zones H-2, H-1 & G).

This pattern is evident from the benthic foraminiferal distribution chart (Sheet 2) on which species are grouped according to their comparative distribution in other sections. Distribution of other grains (e.g. sponge

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* LAD = Last Appearance Datum.

spicules or bryozoal fragments) show coincidence with a particular benthic group. More detailed observations on grain components are summarised on the six data sheets.

Canyon fill sedimentation occupy a longer time span than normally observed in the Gippsland Miocene; some 14m.y. compared with 2 to 4m.y. in other sequences. The Sweep fill was characterised by reworked older planktonic foraminifera in younger faunas (e.g. D-2 mixed with C or B-1), together with deeper water benthic associations. Differences in preservation, both from corrosion and abrasion (e.g. the Battered *Robulus* fauna), separate the displaced specimens from the better preserved autochthonous specimens. Adhering limonite and pyrite as well as pyritic infilling (see below) is common on the allochthonous specimens.
Sporadic accumulation of siliceous sponge spicules are another feature of Gippsland canyon fills, as is size and/or shape sorting of foraminifera.

The fill indicators extend from 734 at base of F to 241.5 within ? A-3. However the canyon fill was episodic being interspersed by errosive canyon cutting episodes. This is evident from condensation or abbreviation or even absence of some biostratigraphic intervals interspersed with disproportionate developments of other units. This is illustrated by the following uncorrected accumulation rates (UR).

ZONE	SPAN IN M.Y.	THICKNESS IN M.	U.R. cm/1,000 yrs.
A-3	1	86	860
A-4	1	46	460
B-1	1.7	88	517
B-2	5.5	<9	16
C	2.5	45.5	182
D1/D2	1.3	41.7	321
E-1	.2	28	1400
E-2	.3	30	1000
F	.5	30	500

The UR for Zones D-2/D-1 are unusually low. For instance in Halibut # 1 the UR for D-2/D-1 approximates 8,000cm/1,000 years. But Halibut was in the distal canyon situation, compared with a proximal one for Sweep. Therefore the disproportionate difference in URs probably reflects an up canyon decline in nutrient availibility affecting biogenic productivity. Another factor is that canyon fill commenced in Zone F in Sweep, but later in Halibut (i.e. Zone D-2). The initial accumulation of most Gippsland Canyon fill sequences were coarser grained than higher in the sequences and thus had greater porosity and features, suggesting rapid dump/fill deposition. This could explain also the differences in URs for Zones D-2/D-1 between initial rapid filling (i.e. Halibut) and finer grained later sequence fill in Sweep.

It can be logically ascertained that canyons developed from the shelf into deeper water in a progressive and diachronous manner of cutting and filling with fill higher in the canyon constantly being redistributed down the canyon. Therefore the UR values for Sweep are artificial in that they imply constant sedimentation during a selected time span. The abbreviation of some units and exaggeration of thickness of other units indicates cycles of dumping, followed by non deposition and/or removal of previous fill, then more dumping. This model assumes fluctuation in energy within the system and rapid burial of accumulations. Fluctuating down canyon current energy is apparent from such observations as specimen number, benthic diversity, size and shape sorting and specimen abrasion. Rapidity of burial is an essential phenomenon in the anaerobic formation of iron sulphides from protoplasm in the presence of iron sulphates (e.g. Sugden, 1966). The observations of limonite and pyrite adhering or infilling foraminiferal specimens is noted on the data sheets.

Thus the Sweep canyon fill sequence is regarded as a discontinuous one, recording repeated episodes of cutting, filling and probably non deposition in a proximal or "Canyon Head" situation. The depth to the canyon floor, at any one time, is difficult to estimate as a number of the Basin Deep species (listed on Distribution Sheet 2) could have been "elevated" by the upwelling of cold, nutrient enriched waters. This "faunal elevation" was demonstrated by Taylor & Mee (1970) in modern Gippsland Canyon floor samples. However the canyon

initiation was sudden with a drop in base level at base of Zone F. This base level drop could have been from 100m with an inner shelf Zone G fauna to 200m, with an "elevated" slope fauna at base of Zone F.

Although circumstantial, the geographic linear fit of the Snowy River mouth, Sweep and the northern Tributary of the Bass Canyon (refer Conolly, 1968, figs. 1 & 2) is more than coincidental. Samples from the present North Bass Canyon floor (Taylor & Mee, 1970) showed that the canyon was dormant regarding mass sediment dumping, but that there was a steady supply of debris from the sponge gardens and bryozoal forests at the canyon head. This canyon head is an exposure at 120m of consolidated Quaternary calcarenite, which has all the features of having been deposited in much shallower water during a glacio-eustatic sea level low (21,000 to 14,-00 years, BP-data in Jongsma, 1970). This barrier would have caused backfill of the canyon towards the shoreline.

The paucity of terrestial detritus in the Sweep Canyon fills, could preclude the connection with the Snowy River. But it must be remembered that the bed of the Snowy is at present incised and obviously a rejuvenation of the meandering, tortuous course it took pre-uplift. The terrestial detritus reaching the sea, would have been minimal. This is confirmed by the purity of the Miocene (Zones F to D-2 - pers. obs.) calcarenites outcropping along the Snowy Valley in the vicinity of Orbost.

REFERENCES

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MICROPALEONTOLOGICAL MATERIAL

WELL NAME AND NO. SWEEP # 1. *DATE:* 21.1.79.

PREPARED BY: DAVID TAYLOR. *SHEET NO.* 1 of 6.

DRAW:

DEPTH IN METRES	*SAMPLE TYPE*	*SLIDE*	*ADDITIONAL INFORMATION*
785	SWC 41		N.F.F. - Dom - m ang qtz - rare subrd. qtz. & rock frags.
780.5	SWC 71		N.F.F. *ibid*
774	SWC 42		N.F.F. *ibid*
771	SWC 43		N.F.F. orange f-m ang qtz sdst - r. green glauc. but common limonite "books" after glauc, after mica.
769	SWC 73		N.F.F. dom m. ang qtz. sdst with pellet glauc - r. c. ang. & subrd. rock frags. (? Paleozoic quatzite).
767	SWC 44		*Cassidulina* sp? (5 specs) "L.E. GREENSAND" Dom. m. ang. qtz. sdst + 20% glauc of 2 species - (1) book - brighter green (2) irregular pellets light apple green.
765	SWC 74		N.F.F. 60% f-m ang clear qtz,. 40% orange f ang qtz sdst.
763	SWC 45		N.F.F. Dom orange f ang qtz sdst with 10% "book" & irreg. pellet glauc; r ang. rock frags.
761	SWC 75		N.F.F. Dom clear f-c ang qtz sdst 10% glauc - "book" pellet & irregular in various stages of oxidation. 5% pyrite. (? biogenic) r subr rock frags.
759	SWC 46		N.F.F. Dom l. bn limonitic clay after glauc - some in pellet form. 10% orange f. ang. qtz sdst; r c subr. qtz. Bioturbation evident.
757	SWC 76		*ibid* + 10% gn glauc clay.
755	SWC 47		H-2(1) - Dom pellet glauc & limonite. shallow water benths with Dom. *Cibicides*.
749	SWC 78		H-2(1) - *ibid* + fish teeth.
747	SWC 49		H-2(1) *ibid*
744.5	SWC 79		H-1(1) - 70% pellet glauc - 25% forams + r f ang qtz sdst & bry count 500. 10% planks benth diversity 20, all shallow water.

MICROPALEONTOLOGICAL MATERIAL

WELL NAME AND NO. SWEEP # 1. *DATE:* 21.1.79.

PREPARED BY: DAVID TAYLOR. *SHEET NO.* 2 of 6.

DRAW:

DEPTH IN METRES	*SAMPLE TYPE*	*SLIDE*	*ADDITIONAL INFORMATION*
740	SWC 51	H-1(1)	bry. calcaren ± r. f. ang. qtz. sdst. with orange limonite staining + r. ech. count 1000, 40% planks - v. shallow benths with abundant *Carpentaria* spp., *Cibicides* spp. & *Karrieras*pp.
738	SWC 81	G(1)	bry. calcaren with ech spines, fecal pellets - coal frags. Count 100, 40% planks, benth suggest slight deepening.
736	SWC 52	G(1)	c. bry. calcaren with ech spines & count 800, 35% planks, displaced incl. rafted bry. adherent benths.
734	SWC 82	F(0)	Dom limonitic stained lst. frags. r ang qtz & sponge spics bry, ech, ost. count 800, planks 50% benth diversity 15-17 + ? reworked. N.B. r *Cassidulina carinate.*
732	SWC 53	F(1)	75% forams 20% limonitic stained lst. frags + r. glauc & bry. count 1500, 60% planks, benths indicate slight deepening. not as diverse as 734.
730	SWC 83	F(1).	Dom l gy. calc. mdst. + limonite, v.r. dirty coal frags, vein qtz frags, mica, bry. ech. *Tubiporid coral* Count 1900, 45% planks. good pres. benth diversity 16 with rafted adherent forms & corroded miliolids. Obvious deepening & mixing with shallow water displaced spp.
728	SWC 54	F(0)	Dom forams. r. ang. qtz., ? epidote & botryoidal glauc. Charophyphyites. Some glauc in filling of planks. Count 9000 planks 70%. good pres. Benth diversity 12 + displaced spp. incl. BATTERED *ROBULUS*. Shelf edge.
724	SWC 55	F(1)	Dom. forams, limonite staining, r.c. ang. qtz. lst. frags, r. coal epidote & glauc ech. count 800. 85% planks pres. poor sugary recryst. Benth low diversity. Spherical spap sorted (benth planks & benth). High energy shelf edge.
720	SWC 85	F(1)	Dom Forams, ost. bry. ech. count 3500, planks 70% - mod. pres sugary. Benth diversity 12 + etched miliolids. Shelf/slope break.

MICROPALEONTOLOGICAL MATERIAL

WELL NAME AND NO. SWEEP # 1. *DATE:* 28/2/79.

PREPARED BY: DAVID TAYLOR.

SHEET NO. 3 of 6.

DRAW:

DEPTH IN METRES	*SAMPLE TYPE*	*SLIDE*	*ADDITIONAL INFORMATION*
709	SWC 56	F(1)	Dom forams - 10% bright grn. blauc. r. pyr. Count 4500, 65% planks. Benths with 45% reworked limonitic stained shallow water spp.
700	SWC 86	indet	- Dom micrite r. ost. ech. spic. count 10 - lens shape sorted. High energy shelf/slope break.
690	SWC 57	E-2(1)	Dom micrite Count 500, 60% planks. Pres. poor - recryst. after limonite stained slope benths + displaced spp. ? Canyon Head.
680	SWC 87	E-2(0)	Dom forams, 20% micrite frags, worn bry. frags. spic. count 6000, 70% planks. pres. good often limonite stained. Slope benths + 10% displaced spp. incl. BATTERED *ROBULUS*.
670	SWC 58	E-2(1).	Dom forams count 2000. planks 60%.Slope Benths + displaced spp. with adherent limonite.
660	SWC 88	E-2(0)	Dom. forams. r.c. rd. qtz. common spics. 2 spp. charophytes, count 10,000, planks 80%. Small residue, spec. size 90% .2mm. size sorted. High energy slope benths + displaced spp.
650	SWC 59	E-1(2)	60% forams, 30% micrite, limonite adherent grains. Count 4500, 75% planks. Slope benths + displaced spp.
630	SWC 60	E-1(0)	Dom forams r. adherent pyr. & limonite. r. pitted subrd. qtz. Count 3000, 65% planks slope benths.
622	SWC 90	E-1(1)	- 60 % forams, 30% limonitic lst, 10% pyrite infilled cibicidids. r. rd. qtz, ech, worn bry. frags. count 450, 35% planks slope benths - high energy canyon fill (e.g. *Cassidulina carinata)*. Displaced *Cibicides* with twofold burial history.
605	SWC 1	D-2(0)	- forams, abundant limonite, r. adherent pyr. common spics, ost., count 800 40% planks. slope benths (Dom. *Siphouvigerina canariensis*) + displaced shalf benths & planks.

MICROPALEONTOLOGICAL MATERIAL

WELL NAME AND NO. SWEEP # 1 *DATE:* 28/2/79.

PREPARED BY: DAVID TAYLOR.

SHEET NO. 4 of 6.

DRAW:

DEPTH IN METRES	*SAMPLE TYPE*	*SLIDE*	*ADDITIONAL INFORMATION*
592	SWC 2	D-2(1)	Dom forams. 30% benths pyr. infilled & limonitic stained + pyr. infilled ech. spines. Count 500, 30% planks. Most benths displaced with Dom. *Cibicides victoriensis*.
563.3	SWC 4	D-1(2)	Dom forams (recryz). limonite to pyrite adherents r. ang. qtz. spics (4), osts. count 450, 45% planks, slope benths (e.g. *Cassidulina carinata*) + displaced spp. High energy canyon fill.
553	SWC 5	C(1)	Dom forams with adherent limonite, spics, ech., count 2500, 65% planks, shelf/slope break benths + displaced shelf benths + reworked planks (D-2 or E).
537	SWC 6	C(1)	Dom forams - limonite + r. pyr. adhering. Count 2400, 65% planks - mainly reworked D-2 spp. High % ? displaced benths.
533.7	SWC 7	C(1)	Dom C_a, F_e bonded clay (difficult to dis limonite & pyr. after limonite abundant common spics, ech, bry. ost. Most specs. pyr. infilled. Count 120, 40% planks, 90% infilled, displaced & recrys. see below.
527.5	SWC 8	C(2)	Dom forams. Abundant limonite & pyr after limonite. Common pyr. infilling of both *Cibicides* spp. & reworked *Globorotalia* spp. Pyr. also adhering to externally *Cibicides* spp. Count 2000, 50% planks, 90% displaced specs incl. D-2 planks. Rapidly buried in anaerobic environment of high energy proximal canyon fill.
517	SWC 9	C(2)	Dom forams. Abundant limonite, common spics, r. charophytes & reworked gastr. Count 6000, planks 60%, reworked shallow benths & D-2 planks - 90% Canyon fill but not as rapid as at 527.5 & 533.7 (note absence of Pyr.).
507.5	SWC 10	C(1)	foram & calc. clay abundant limonite, commom spics, r. ost. count 500, 30% planks incl. D-2 reworkings. 90% displaced benths (incl. *Massilina lapidera* & corroded miliolids) with outer shelf *Cassidulina carinate*. Most specs, recrys. Proximal canyon fill but not instantaneous burial.
498.2	SWC 11	B-1(1)	Dom. planks Count 4500, 75% planks, incl. some reworked D-2 spp. Outer shelf *Cibicides* spp. and *Cassidulina carinata*.

MICROPALEONTOLOGICAL MATERIAL

WELL NAME AND NO. SWEEP # 1 *DATE:* 28/2/79

PREPARED BY: DAVID TAYLOR.

*SHEET NO.*5 of 6.

DRAW:

DEPTH IN METRES.	*SAMPLE TYPE*	*SLIDE*	*ADDITIONAL INFORMATION*
469	SWC 13	B-1(1)	Dom. forams & clay. Abundant limonite. ech. bry. ost. Count 1200, 60% planks with minor D-2 reworked. Outer to mid shelf benths. with minor displaced spp. inc. rafted.
446.5	SWC 14	B-1(1).	Dom forams & clay. Common spics. ech. ostr. Count 1200, 65% planks incl. reworked Zone C. Benths mid to outer shelf with displaced forms incl. *Massilina lapidigera* & corod. miliolids.Pres. poor.
430.6	SWC 15	B-1(1).	Dom. forams & clay limonite common. Abundant spics. r. ech. & ost. Count 3000, 45% planks. Shelf benths + reworked incl. corroded miliolids.
410.5	SWC 16	B-1(2) -	Dom calc. clay with secondary calcite. Abundant spics, ost. ech., gast., Pres. poor. Count 200, 10% planks shelf benths incl. corroded miliolids.
397	SWC 17	A-4(1).	Calc. clay with limonite - limonitic infills of forams with pyr. externally as aggregates or isolated "spots". Common spics, v. poorly pres. bry. frags. Count 400, 30% planks of v. small size. *Cibicides* spp = Dom benth -some incoarse fraction.
382.5	A-4(1).	Dom limonitic calc. clay + 40% forams. Abundant spics, gastr., ost., Count 1000, 10% planks - heavy calc. overgrowth on most specs. Diverse mid to innershelf benths + abundant corroded miliolids.	
351	SWC 20	A-4(1) -	Dom. biogenic with abundant diverse bry. gastr & ech Count 3000, 20% planks diverse inner shelf benths - similar in composition to modern fauna (e.g. "Challenger" Sta. 162).
327	SWC 22	A-3(2) -	calc. clay + spic, bry., ech., ost. Count 500 55% planks. Inner shelf benths.
315.5	SWC 23		- calc. clay v.r. glauc. Count 300, 10% planks. Inner shelf benths with ? reworking (e.g. ? *Hofkerina semiornata).*
300	SWC 24		- bryo. calcaren + ech. ostr. Count 300, 15% planks - shallow shelf benths. Dom. *Cibicides.*

MICROPALEONTOLOGICAL MATERIAL

WELL NAME AND NO. *SWEEP # 1* *DATE:* *28/2/79.*

PREPARED BY: *DAVID TAYLOR.*

SHEET NO. 6 of 6.

DRAW:

DEPTH IN METRES.	*SAMPLE TYPE*	*SLIDE*	*ADDITIONAL INFORMATION*
273.5	SWC 26		*ibid* - Count 100, 10% planks shallow shelf benths. Dom. *Cibicides.*
264.5	SWC 27		*ibid* - Count 500, 10% planks, very shallow water benths. N.B. *Lenticulina megalophoto* & *Elphidium crassatum.* Dom. *Cibicides* & adherent spp.
254.3	SWC 28		80% bry. Count 500 - 5% planks. Shallow water benths as for 264.5.
241.5	SWC 29		bry calcaren. Mixture of fresh & worn bry. frags. & ech spines. Count 1000, 15% planks. Shallow benths as for 264.5. Highest occurrence of reworked planks(eg. *G.miotumida)*
230.5	SWC 30		80% bry. frags. + ech. Moll. ostr, tubiporid coral, count 400, 10% planks. Shallow benths

MICROPALEONTOLOGICAL DATA SHEET

BASIN: GIPPSLAND ELEVATION: KB: +25.3m GL: -69m

WELL NAME: SWEEP # 1 TOTAL DEPTH: 900m

AGE		FORAM. ZONULES	HIGHEST DATA					LOWEST DATA				
			Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time	Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time
PLEISTOCENE		A_1										
		A_2										
PLIOCENE		A_3	241.5	2				327	2			
		A_4	351	1				397	1			
MIOCENE	LATE	B_1	410.5	2	430.6	1		498.2	1			
		B_2										
		C	507.5	1				553	1			
	MIDDLE	D_1	563.3	2				563.3	2			
		D_2	592	1				605	0			
		E_1	622	1				650	2	630	0	
		E_2	660	1				690	1			
	EARLY	F	709	0				734	1			
		G	736	1				738	1			
		H_1	740	1				744.5	1			
OLIGOCENE	LATE	H_2	747	1				755	1			
		I_1										
		I_2										
	EARLY	J_1										
		J_2										
EOCENE		K										
		Pre-K										

COMMENTS:

CONFIDENCE RATING:

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).

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: DAVID TAYLOR DATE: NOVEMBER 10, 1978

DATA REVISED BY: DAVID TAYLOR DATE: FEBRUARY 26, 1979.

PLANKTIC SPECIES GROUP	SIDEWALL CORES IN METRES	230.5	241.5	254.3	264.5	273.5	300	315.5	327	351	382.5	397	410.5	430.6	446.5	469	498.2	507.5	577	527.5	533.7	537	553	563.3	592	605	622	630	650	660	670	680	690	700	709	720	724	728	730	732	734	736	738	740	744.5	747	749	755
ORBULINA UNIVERSA		•	•	•	•	•	•	•	I	I		•	I	I	I	I	I	I	I	I	I	•	•	I	I																				
GLOBIGERINA DECORAPERTA		•	•	•	•	•		•	•			•										•					•		•							cf									
G. BULLOIDES		•	•	•	•	•	•		•	•	.		•	I	I			I	I	I		•	I	I		I	I		I	I	I		I	I	I	I	I	I		•		•			
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G. TRILOBUS			•	•	•	•	•							•	I	I	I	I	I	I	•		I	I	I	I	•	I	•	I	I	I			I	I	I	D	I	I	I	cf	•	•			
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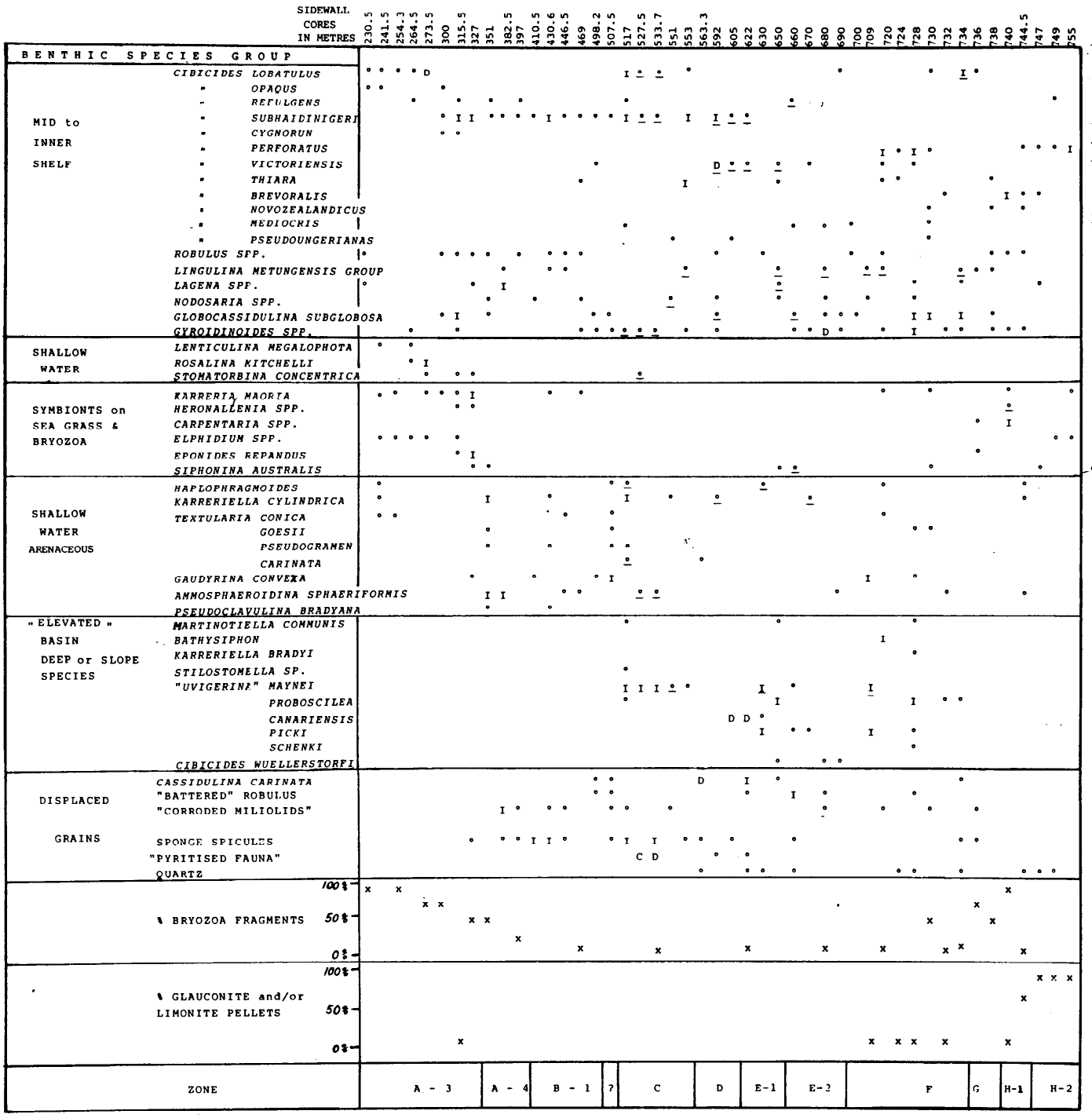
GLOBOQUADRINA DEHISCENS (S.S.)			•							•	•			•						•									•	•	•										•		I	•		
GLOBIGERINA APERTURA			•	•																																										
GLOBIGERINOIDES RUBER				?						?									•							•		•	•	•	•	•		•	•		•		?						
GLOBOROTALIA MIOZEA MIOZEA					?					a				a	a	a	a		a		a	a	a	•	•	•	•	•	•	•	•	?	•													
G. CRASSAFORMIS						?				•																																					
G. MIOCENICA						a																																									
GLOBIGERINA WOODI WOODI							•	•	•	•																•		I		•	•				I		•	I	I		I	I	I	•	•	•	•
GLOBOROTALIA CONOMIOZEA										•	•		cf		•		•	cf																													
G. MIOZEA CONOIDEA										•						•	•	G	•	•	•	•	•	•					cf		cf																
G. SCITULA										•					•	?																															
G. SPHERICOMIOZEA											•																																				
GLOBOQUADRINA ADVENA											•																																				
GLOBOROTALIA PRAEMENARDII												?		•	•	•		a	a		a		•	•	•	•	•	•	•	•	•	•			•	•			•								
G. MENARDII														•				a		•			cf	•	•																						
G. OBESA														•	•	•		a	•	•																											
GLOBIGERINELLOIDES AEQUILATERALIS														•	•																															
GLOBOQUADRINA ALTISPIRA														?									?					•				•		•												
GLOBIGERINOIDES SACCULIFER															•																															
GLOBOROTALIA MAYERI															a			a	•		?			•																						
G. PANDA															a					a																											
G. PRAESCITULA																•	•		a	a	?					•	•	•	•			•		•	•		•		•		•					
GLOBIGERINOIDES SICANUS																•										•		•	•	•	•	•	•	•		I	?	I	I	•						
GLOBOROTALIA PERPHEROACUTA																	a					2																									
G. PERIPHERORONDA																		a	a	a		a								•		•															
G. CONICA																		a					a		a	?	?																			
PRAEORBULINA GLOMEROSA																		a						•	•		•	a	?	?	•	•		?			?								
ORBULINA UNIVERSA PARKERAE																		a	•	•																											
GLOBIGERINA WOODI CONNECTA																						a					I	•									•	I	•	•	I	I				
ORBULINA SUTURALIS																											a	?																		
GLOBOROTALIA ZEALANDICA																											a											•								
GLOBIGERINOIDES TRILOBUS (elongate)																													•								•								
GLOBOROTALIA SIAKENSIS																														•							•								
G. OPIMA CONTINUOSA																															•						•	•							
G. c.f. KUGLERI																																					•	•							
G. BELLA																																					•	•							
GLOBIGERINOIDES TRILOBUS — SICANUS																																						•							
GLOBIGERINA CIPEROENSIS																																							•	•			•		•
GLOBOQUADRINA DEHISCENS (S.L.)																																							•			I	•	•	•
GLOBOROTALIA NANA (S.L.)																																							•		I				
G. OPIMA NANA																																								•					
GLOBIGERINA PRAEBULLOIDES																																									I	I	•		•	
G. EUAPERTURA																																											•		

Base in metres				327	397	498.2	553	D/I	605	650	690	734	738	744	755
of ZONE	?	?		A-3	A-4	B-1	C		D-2	E-1	E-2	F	G	H-1	H-2

SWEEP #1


SIDEWALL CORES IN METRES
230.5 241.5 254.3 264.5 273.5 300 315.5 327 351 382.5 397 410.5 430.6 446.5 469 498.2 507.5 517 527.5 533.7 551 553 563.3 592 605 622 630 650 660 670 680 690 700 709 720 724 728 730 732 734 736 738 740 744.5 747 749 755
BENTHIC SPECIES GROUP
MID to INNER SHELF
CIBICIDES LOBATULUS
" OPAQUS
" REFULGENS
" SUBHAIDINIGERI
" CYGNORUN
" PERFORATUS
" VICTORIENSIS
" THIARA
" BREVORALIS
" NOVOZEALANDICUS
" MEDIOCRIS
" PSEUDOUNGERIANAS
ROBULUS SPP.
LINGULINA METUNGENSIS GROUP
LAGENA SPP.
NODOSARIA SPP.
GLOBOCASSIDULINA SUBGLOBOSA
GYROIDINOIDES SPP.
SHALLOW WATER
LENTICULINA MEGALOPHOTA
ROSALINA KITCHELLI
STOMATORBINA CONCENTRICA
SYMBIONTS on SEA GRASS & BRYOZOA
KARRERIA MAORIA
HERONALLENIA SPP.
CARPENTARIA SPP.
ELPHIDIUM SPP.
EPONIDES REPANDUS
SIPHONINA AUSTRALIS
SHALLOW WATER ARENACEOUS
HAPLOPHRAGMOIDES
KARRERIELLA CYLINDRICA
TEXTULARIA CONICA
GOESII
PSEUDOGRAMEN
CARINATA
GAUDYRINA CONVEXA
AMMOSPHAEROIDINA SPHAERIFORMIS
PSEUDOCLAVULINA BRADYANA
"ELEVATED" BASIN DEEP or SLOPE SPECIES
MARTINOTIELLA COMMUNIS
BATHYSIPHON
KARRERIELLA BRADYI
STILOSTOMELLA SP.
"UVIGERINA" MAYNEI
PROBOSCILEA
CANARIENSIS
PICKI
SCHENKI
CIBICIDES WUELLERSTORFI
DISPLACED GRAINS
CASSIDULINA CARINATA
"BATTERED" ROBULUS
"CORRODED MILIOLIDS"
SPONGE SPICULES
"PYRITISED FAUNA"
QUARTZ
% BRYOZOA FRAGMENTS
100%
50%
0%
% GLAUCONITE and/or LIMONITE PELLETS
100%
50%
0%
ZONE
A - 3
A - 4
B - 1
?
C
D
E-1
E-2
F
G
H-1
H-2