APPENDIX NO. 7

MICROPALEONTOLOGICAL REPORT

STRATIGRAPHY
of the
FORAMINIFERAL SEQUENCE
in
SELENE # 1,
GIPPSLAND BASIN.

for: PHILLIPS AUSTRALIAN OIL COMPANY.

March 3rd, 1983.

David Taylor,
23 Ballast Point Road, Birchgrove, 2041.
AUSTRALIA. (02) 82 5643.

SELENE # 1

STRATIGRAPHIC SUMMARY.

Sample Depth m	ZONE*	AGE†	¶STRAT UNIT & PALEOENVIRONMENT¶	E-LOG PICK
1270 to 1715	B-2 to C	LATE to MID MIOCENE	CANYON FILL MEMBER of GIPPSLAND LIMESTONE shelf edge at base (≈200m) filling to shallower depth (<200m) at top	
				1740 or 1810
1815 to 2232	poor assemblages ? D-1	MID MIOCENE	CANYON FILL MEMBER of GIPPSLAND LIMESTONE. Upper Slope situation (400-200m). High energy with slumping at base	
				2234
2234 to 2400	D-1 to D-2	MID MIOCENE	TASMAN SEA CARBONATES with deep water oozes. Anoxic between 2275 & 2234. Oxic between 2800 & 2300 where energy regime was higher with influxes of detrital quartz etc.	
2500 to 2800	F to H-1	EARLY MIOCENE		
(12 m.y.)				2807
2810 to 2820	J-2	EARLIEST OLIGOCENE	LAKE ENTRANCE MARL equivalent shelfal environment - high energy with detrital quartz etc. Paleodepth increasing upsection to 100-200m.	
				2821
2822	K	LATEST EOCENE	COLQUHOUN FORMATION Intertidal (<10m)	
(2 m.y.)				2822.5
2826 to 2838	N	late MID EOCENE	GURNARD FORMATION "Greensands" Intertidal near entrance of Estuarine system.	
(7 m.y.)				2839
2840 to 2842	O	early MID EOCENE	FLOUNDER FORMATION equivalents Barrier/Dune/lagoonal system.	
?	?	?		2842
2843 to 2852	low diversity assemblages	EARLY EOCENE on dinoflagellates		
2848 to 2852	no planktonics	EARLY EOCENE on dinoflagellates		
(≈17 m.y.)				?2870
2879.5 to 3151	? no planktonics	Latest CRETACEOUS on spore/ pollen (no dinoflagellates)	Swamp/Marsh ponds slightly saline at 3020 with arenaceous foraminiferal assemblage.	

† Summary of results of examination of fifty sidewall cores and one conventional core sample as listed on Tables 2 to 5.

* Based mainly on planktonic foraminifera with available palynological results. See palynology report by Helene Martin & David Taylor for final synthesis. Detailed planktonic foraminiferal distribution on Table 2 for Eocene to base Miocene on Table 4 for Miocene. Table 1 gives reliability for planktonic foraminiferal zonal boundary picks.

¶ Interpretations based on distribuiton of planktonic, benthonic and plant microfossil as well as other sediment grains (>.075mm). On Table 3 for Eocene to base Miocene Table 5 for Miocene.

BIOSTRATIGRAPHY.

This discussion is based on the distribution of Tertiary planktonic foraminifera in the Gippsland sector of the Tasman Sea Provence. At the time of compilation of this report, palynological results were not complete, but note is made of preliminary results where applicable. The palynological compilation report by Helene Martin and David Taylor will contain synthesis of the planktonic foraminiferal and palynostratigraphy, with any necessary reconciliation.

LATE CRETACEOUS-? to 3181 to 2879.5m.

Age is based entirely on identification of the spore/pollen Zone of *Tricolpites longus* by Helene Martin. No planktonic foraminifera were found in four samples examined. However, the sidewall core at 3020m contained a late Cretaceous/Paleocene morphologically primitive arenaceous foraminiferal assemblage similar to those described from the Otway Basin by Taylor (1965).

EARLY EOCENE - 2870 to 2843m.

Age determination based on dinoflagellates (see Palynology Report), as there were only sporadic occurrences of low diversity assemblages of *Globigerina* spp which were ubiquitous in both early and mid Eocene times.

MID EOCENE ZONE O - 2842 to 2840m.

The association of *Globorotalia centralis, G. collactea, G. turgida* and *Globigerina frontosa* places the assemblage at 2842 in a biostratigraphic position equivalent to Zone P11 of Blow (1979); thus deposition took place in the early part of the Mid Eocene.

MID EOCENE ZONE N - 2838 to 2826.

At or near the top of the mid Eocene on range overlap of elements in these assemblages. In the Tasman region (refer Jenkins, 1974) *Globorotalia collactea, Globigerina primitiva* and *G. angiporoides* all became extinct at or near the top of the Mid Eocene; whilst *Globigerinatheka index* and *Globorotalia aculeata* first appear in mid Eocene and continued into the late Eocene. Middle Eocene dinoflagellates are recorded in this interval in Selene # 1.

A hiatus with an estimated time span of 7 million years was evident at 2839m (E-log) between Zone 0 and the overlying Zone N assemblages. The apparent abbreviation of the Zone 0 interval may have been due to erosion during the onslaught of the Zone N marine ingression.

LATE EOCENE ZONE K - 2822.

After a hiatus of some 2 million years, sediment was deposited at the top of the Eocene. This very high Eocene placement is evident by the presence of the keeled morphotype of *Globorotalia cerroazulensis cocoaensis* (refer Stainforth et al, 1975, p.258). The very thin development of Zone K (1.5m on E-log) was followed without a discernible break, by earliest Oligocene, Zone J-2 assemblage at 2820m.
The planktonic assemblage at 2822 was surprisingly diverse with warm water elements, such as *G. cerroazulensis cocoaensis,* whilst the early Oligocene faunas were composed entirely of species endemic to the Southern Ocean (Jenkins, 1974), with a total absence of tropical elements. This faunal change from cosmopolitan to parochial reflected the rapid paleotemperature deterioration in the Southern Ocean on the Eo/Oligocene boundary (Shackleton & Kennett, 1975 and Loutit & Kennett, 1981, p.60). All evidence presented indicates strongly that the sample at 2822 was deposited 37 million years ago, on the Eo/Oligocene boundary.

EARLY OLIGOCENE ZONE J-2 - 2820 to 2810m.

Assemblages contain elements typical of the Tasman Early Oligocene Zone of *Globigerina brevis* (Jenkins, 1974). The widespread Oligocene Hiatus of Gippsland (the *COBIA EVENT* of Taylor, 1983) and in the Tasman-Coral Sea region (Kennett et al, 1975 and Loutit & Kennett, 1981, p.57), was apparent at 2807 (E-log pick) with a time gap of some 12 million years.

MIOCENE - 2800 to 1270.

Sedimentation resumed in earliest Miocene times, as is evident by the presence of Zone H-1 assemblages between 2800 and 2765m. Above 2800, a continuous sequence of Miocene deep water and canyon carbonate sediments were present with the highest sample examined (at 1270m) representing the Late Miocene Zone B-2. A sampling gap of 100m between 2500m and 2400m occurred over the levels of occurrence of Zones E-2 & E-1. Usually those E Zone faunas occupy a very thin sediment interval in Gippsland deep water sequences. Moreover, the Zones E-2

& E-1 time span was very brief as species evolution was accelerated by oceanic warming.

Biostratigraphic control was poor to non-existant in the canyon carbonate fill sequence at and above 2232m. This is a common phenomenon in Gippsland wells, due to the high energy regime which sorts and concentrates mainly very small sized specimens, which, being juvenile are specifically indeterminate. Another factor, regarding species recognition, is the poor preservation, cuased by carbonate diagenesis of the fill. It is assumed that Zone D-1 occupied the thick interval from 2232m to at least 1815m in Selene # 1.

PALEOENVIRONMENT and ROCK STRATIGRAPHY.

Some of the remarks below, may be expanded or slightly amended in the final paleoenvironmental and rock stratigraphic conclusions are drawn in the paleontological synthesis section of the Selene # 1 palynology report.

? to 3181 to 2879m - Latest Cretaceous - Latrobe Delta Complex.

Predominantly non-marine, but with at least one marginal marine episode at 3020m; evidenced by an association of the arenaceous foraminifera *Haplophragmoides* spp. with pellet glauconite and biogenic pyrite. Such a benthonic fauna was euryhaline, withstanding fluctuation in salinity to as low as $4^{o}/oo$ as well as anaerobic conditions (Taylor, 1965). Dinoflagellates were not recorded in this sample which was usually the case in sediment containing *Haplophragmoides* spp assemblages from the Late Cretaceous to early Tertiary of the Otway Basin.

2870 to 2840m - EARLY EOCENE to MID EOCENE - FLOUNDER FORMATION EQUIVALENTS.

In this interval, the dominant sediment grains (>.075mm) are frosted, pitted and/or impact fractured quartz grains, features probably cuased by eolian processes (Margolis & Krinsley, 1974). Limonitic clays are common and could have been from paleo-soil horizons. Within this interval, were indications of marine ingressions into marginal marine environments. Dinoflagellates occurred throughout, with sporadic planktonic and arenaceous benthonic foraminiferal associations in five out of the nine sidewall cores. Foraminiferal frequency increased upsection, reaching a peak at 2842m (refer Table 5). Distribution of glauconite and biogenic pyrite also demonstrates an up-sequence frequency increase. One sample, at 2845m, contained an appreciable amount of crystalline carbonate, which was probably dolomite, though possibly siderite. The total of these observations is that sedimentation took place within a barrier/dune/estuarine regime analagous to that of the present day Gippsland Lakes - Ninety Mile Beach system (Taylor, 1983).

This interval is equated with the Flounder Formation having been deposited over the same time-span and within a marginal-marine regime. However, the sedimentary facies in Selene differs from that defined for the Flounder Formation. But the rock type is dependent on the exact position at any one time that sedimentation took place within such a barrier/dune/estuarine system. The typical siltstones and mudstones of the Flounder Formation were deposited in deep protected estuaries behind and to the lee of the dunes, whilst the Selene sequence was deposited on or just windward of the dunes. It should be noted that the lower part of the Formation in the type section contains an abundance of quartz with at least one coarse sandy lens (refer Flounder # 1 tabulation in Taylor, 1983, p.13).

2838 to 2826m - LATEST MID EOCENE - GURNARD FORMATION.

Sedimentation took place in a lagoonal situation in proximity to the entrance to the system from a shallow platform continental shelf. The basal sample at 2838m was the only one to contain quartz grains, sculptured by eolian processes. No doubt this was a surface of the underlying unit, reworked during the onslaught of the late Mid Eocene ingression. Apparent abbreviation has already been noted at the top of the Flounder Formation in Selene (refer p.2 this report).

Age, faunal characteristics and sediment types are all consistant with a designation of Gurnard Formation for this unit.

2822 to 2810m - LATE EOCENE to EARLY OLIGOCENE - COLQUHOUN FORMATION and LAKES ENTRANCE MARL EQUIVALENTS.

A sequence of fine quartz sandy marls were deposited at the very top of the Eocene and continue into early Oligocene times, before the effects of the *COBIA EVENT* resulted in all the mid to late Oligocene sediment being absent in this sequence. The encroachment of the late Eocene-early Oligocene transgression is demonstrated by changes in the benthonic foraminiferal assemblages and the high percentages of planktonic specimens in the total foraminiferal faunas. Rapid increases in paleodepth are evident with a litteral situation in the latest Eocene progressively becoming an outer shelf one in the early Oligocene (refer Table 3).

On lithology alone it is not possible to differentiate between the Colquhoun Formation and the Lakes Entrance Marl equivalents. However there are marked E-log character changes at 2821m which correspond to the paleoenvironmental changes from the Late Eocene litteral fauna at 2822 to the Early Oligocene shelfal faunas from 2820 to 2810m. Therefore:-
The E-log interval 2822.5 to 2821m is considered to be the Colquhoun Formation:
whilst the E-log interval 2821m to 2807m is Lakes Entrance Marl equivalent.

2800 to 2234 - MIOCENE - TASMAN SEA CARBONATES and OOZES.

A thick sequence of biogenic carbonates with fluctuating proportions of quartz grains and non carbonate silts and clays. There is no meaningful pattern to variations in the degree of carbonate diagenesis (refer Table 5).

The entire unit was deposited on the upper part of the continental shelf in estimated water depth between 200 and 400m. So there was a marked environmental disruption associated with the *Cobia Event*, as the early Oligocene deposition was on the continental shelf.

A change in available oxygen to the depositional surface is noted between 2275 and 2245m; conditions at and below 2275 were oxic, whilst those above 2275 were distinctly anoxic. The anoxic conditions are evident from the sudden appearance of 30% biogenic pyrite in the sediment grain spread. Bioturbation, with faecal pellets and worm tubes accompanied this incoming of pyrite. Benthonic foraminiferal assemblages also reflect a physico-chemical change; especially with the presence of a calcareous spiculitic shelled form referable to the unusual genus *Carterina*. A similar change from aerobic to anaerobic deposition was documented in Helios # 1, where it occurred in Zone F, earlier than the Zone D-1 occurrence in Selene # 1.

2232 to 1270m - MIOCENE CANYON FILL MEMBER of the GIPPSLAND LIMESTONE.

The base of the canyon fill sequence is recognised at 2232 by the deterioration in frequency and diversity of foraminifera. The very high proportion of small sized specimens of planktonics resulted in the loss of biostratigraphic control from 2232 and 1815m (refer p.4). Progressive progradation and infilling of the canyon is interpreted from microfossil distribution. The change from an upper slope to shelf edge situation was marked by the influx of siliceous sponge spicules at 1715m and a general improvement in the variety and preservation of the foraminifera; biostratigraphic control was re-assumed at this level.

REFERENCES.

BLOW, W.H., 1979 - *The Cainozoic Globigerinida. A Study of the Morphology, Taxonomy, Evolutionary Relationships and the Stratigraphical Distribution of some Globigerinida (mainly Globigerinacea). 3 Volumes as Sections I & II + Atlas.* Leiden, E.J. Brill.

JENKINS, D.G., 1974 - Paleogene Planktonic Foraminifera of New Zealand and the Austral Region. *J. Foram Res., 4(4);* 155-170.

KENNETT, J.P. et al, 1975 - Cenozoic Paleoceanography in the Southwest Pacific Ocean, Antarctic Glaciation, and the Development of the Circum-Antarctic Current. *Initial Reps. Deep Sea Drilling Project, 29;* 1155-1169.

LOUTIT, T.S. & KENNETT, J.P., 1981 - Australasian Cenozoic Sedimentary Cycles, Global Sea Level Changes and the Deep Sea Sedimentary Record. *Oceanologica ACTA, No. SP;* 45-63.

MARGOLIS, S.V. & KRINSLEY, D.H., 1974 - Processes of Formation and Environmental Occurrence of Microfeatures in Detrital Quartz Grains. *Amer. J. Sci., 274;* 449-464.

SHACKLETON, N.J. & KENNETT, J.P., 1975 - Paleotemperature History of the Cenozoic and the Initiation of Antarctic Glaciation: Oxygen and Carbon Isotope Analyses in DSDP Sites 277, 279 and 281. *Initial Reps. Deep Sea Drilling Project, 29;* 743-755.

STAINFORTH, R.M. et al, 1975 - Cenozoic Planktonic Foraminiferal Zonation and Characteristics of Index Forms. *Uni. Kansas Paleont. Conts. Article 62.*

TAYLOR, D.J., 1965 - Preservation, Composition and Significance of Victorian Lower Tertiary "*Cyclammina* faunas". *Proc.Roy.Soc.Vict. 87;* 143-160.

TAYLOR, David, 1983 - The Gippsland Basin Enigma - Top Latrobe. *Report to Phillips Australian Oil Company.* Final copy dated Jan. 26, 1983.

TABLE 1

MICROPALEONTOLOGICAL DATA SHEET

BASIN: GIPPSLAND ELEVATION: KB: 23m GL: -268m

WELL NAME: SELENE # 1 TOTAL DEPTH:

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										
		A_4										
		B_1										
MIOCENE	LATE	B_2	1270	1				1415	1			
		C	1515	1				1715	1			
	MIDDLE	D_1	2215	2	2234†	0		2240†	1			
		D_2	2245	0				2400	0			
		E_1	* *					* *				
		E_2	* *					* *				
	EARLY	F	2500	0				2500	0			
		G	2635	1				2745	1			
		H_1	2765	1				2800	1			
OLIGOCENE	LATE	H_2										
		I_1										
		I_2										
	EARLY	J_1										
		J_2	2810	0				2820	0			
EOCENE		K	2822	0				2822	0			
		Pre-K	2826	1				2842	1			

COMMENTS: †The very thin representation of D-1, due to adverse environmental factors operating in Miocene canyon at & above 2232. Actual top D-1 may be as high as 1740m E-log.

**Sampling gap of 100m, probably responsible for non-recognition of Zones E-1 & E-2.

¶ Zone N (late Mid Eocene) between 2826(1) & 2838(1) Zone 0(Early Mid Eocene) at 2842(1). Low diversity Early to Mid Eocene planktonic assemblage between 2843 & 2852.

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

SIDEWALL CORES & CONVENTIONAL CORES Depth in metres	PLANKTONIC FORAMINIFERA *G'ina indet - poor pres.*	*G'ina frontosa*	*G'ina senni*	*G'ina linaperta*	*G'alia centralis*	*G'alia collactea*	*G'alia turgida*	*G'alia increbescens*	*G'ina angiporoides minima*	*G'ina primitiva*	*G'theka index*	*G'alia aculeata*	*G'alia cerroazulensis cocoaensis*	*G'ina angiporoides angiporoides*	*G'alia gemma*	*G'ina brevis*	*G'ina tripartita*	*G'alia munda*	*G'alia nana*	*G'alia continuosa*	*G'ina tapurensis*	*G'ina venezuelana*	*G'ina praebulloides*	*G'ina euapertura*	*G'ina woodi connecta*	*G'ina woodi woodi*	*G'ina bulloides*	*Cat. dissimilis*	*G'quad dehiscens (S.L.)*	*G'alia siakensis*	PLANKTONIC FORAMINIFERAL BIOSTRATIGRAPHY ZONE	Depth at Base	AGE
2800.0→																			°	°					x	x	x	°	°	°	H-1	-2800	EARLY MIOCENE
	∿∿∿∿																														∿∿∿∿		∿∿∿∿
2810.0→														°		°			°				°	°							J-2		EARLY OLIGO-CENE
2815.0→														°		x	x	°	°	°	°	x	°	°									
2818.0→														x		°		°	°														
2820.0→														x	°	x	x	°														-2820	
2822.0→				°				°			°		°	x	°																K	-2822	LATE EOCENE
	∿∿∿∿																														∿∿∿∿		∿∿∿∿
2826.0→			°	x		°	°		x	°																					N		latest MID EOCENE
2829.0→			°	x		°	°	°	x	°	°	°																					
2838.0→	D				°	°		°	°																							-2838	
	∿∿∿∿																														∿∿∿∿		∿∿∿∿
2840.0→	D																														0		MID EOCENE to EARLY EOCENE
2842.0→		°	°	°	°	°	°																									-2842	
	— ? —																														?		
2843.0→	D																														?		
2845.0→	D ?																																
2848.0→	N.F.F.																														?		
2852.0→	°	°																														-2852	
2855.0→																																	
2860.5→																															?		?
2870.0→	N.F.F																																
2875.0→																																	
2933.0→																																	
3020.0→	ARENACEOUS ONLY																														?		?
3121.0→	N.F.F.																																
3151.5→																																	
CC # 1																																	

<u>KEY</u>:

° = <20 specimens
x = >20 specimens
D = Dominant >60% specimens
? = determination queried

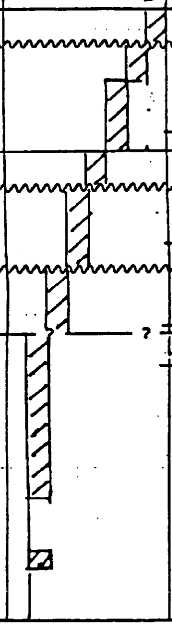
N.F.F. = no foraminifera found
∿∿∿∿ = definite hiatus
—?—? = hiatus - uncertain

TABLE 2: EOCENE to EARLY MIOCENE PLANKTONIC FORAMINIFERAL DISTRIBUTION - SELENE # 1.

refer Table 4 for Miocene Distribution above 2800.0m.

David Taylor, 18/2/83.

SIDEWALL CORES & CONVENTIONAL CORES Depth in metres	BENTHONIC FORAMINIFERA																										RESIDUE LITHOLOGY MAJOR COMPONENTS	MINOR COMPONENTS													¶PALEO-ENVIRONMENTAL ASSESSMENT	PLANKTONIC FORAMINIFERAL BIOSTRATIGRAPHY		
	Haplophragmoides sp.B Taylor	*H. rotundata*	*H. paupera*	*H.* cf. *incisa*	*Ammodiscus parri*	*Bathysiphon angleseaensis*	*Trochammina* sp. ?	*Cibicides thiara*	*C. perforatus*	*C. notocenicus*	*Nuttallides* cf. *trumpyi*	*Bulimina bortonica*	*Gyroidina subzealandica*	*Siphonina australis*	*Gaudryina convexa*	*Textularia subcarinata*	*Lagena & Nodosaria* spp.	*Cassidulina subglobosa*	*Haeuslerella textilarformis*	*Siphouvigerina canariensis*	*Oridoralis umbonatus*	*Sphaeroidina bulloides*	*Bathysiphon* (porcelaineous)	*Discammina* sp.	"*Cyclammina*" *incisa*	*Trochammina globiginiformis*	Ψ: recrystallised biomicrite o: m-c ang. qtz. †.†: f. qtz. sandy marl o-.: polymodal quartz silty sandstone .G: pellet glauc. Δ∇: frosted & fractured quartz P: pyrite -.-: qtz. sandy siltstone ϕϕ: dolomite or ? siderite -†: calc. siltst. -P-: pyritic siltst.	f-c ang qtz	mica	pyrite	glauconite - pellet	limonitic clay	subrd qtz pebbles - frosted	fish fragments	clay & glauc faecal pellets	? Diatom discs ?	echinoid spines	ostracods	foram count	planktonic %	MAJOR E-LOG CHARACTER CHANGE	ZONE	Depth at Base	AGE
2800.0																								•	•	•	ΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨ ooooo			r	A	A		A					200	98	2807	H-1	2800	EARLY MIOCENE
2810.0				•										•							•	•	•				†.†.†.†.†.†.†.†.†.†.	A		r	r	A							?	?		J-2		EARLY OLIGO-CENE
2815.0													•				x	•		•							.†.†.†.†.†.†.†.†.†.†	A			r	A						C	250	95				
2818.0	indet																										†.†.†.†.†.†.†.†.†.†.	A			r								?	?				
2820.0				•										•			x	•	•								.†.†.†.†.†.†.†.†.†.†										C		250	80	2821		2820	
2822.0															•	•	•										†.†.†.†.†.†.†.†.†.†.	A			r	A				A			100	95	2822 .5	K	2822	LATE EOCENE
2826.0		•		x	•	x	?	•	•	•		•	•	•	•	•											.o-.o-.o-.o GGGGGGGG												100	60		N		latest MID EOCENE
2829.0		•		x		x			•	•	?	•															o-.o-.o-.o-. GGGGGGG								A				100	60	2835			
2838.0				x				•																			Δ∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ∇ GGGGG					A							?	?	2839		2838	
2840.0			•				•																				∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ PGGGG						A		A				?	?		O		MID EOCENE to EARLY EOCENE
2842.0			•																								Δ∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ∇ -.G-.					A		A					25	80	2843		2842	
2843.0						•	•	•																			∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ .G-.G			A		A							?	?	2847 to 2850	?		
2845.0		?	?	?	•																						Δ∇Δ ϕϕϕϕϕϕϕϕϕϕ PPPPP							A					?	?		?		
2848.0	N.F.F.																										∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ																	
2852.0		?	?	?	•																						Δ∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ -†-†			r	r	A							-	-		?	2852	
2855.0	N.F.F.																										∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ					A							20	?				
2860.5																											Δ∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ∇		A			A							-	-				
2870.0																											∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ∇ -†-†		C			A							-	-				
2875.0																											Δ∇Δ∇Δ∇∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ∇Δ		A			A							-	-		?		?
2933.0																											-.-.-.-.-.-.-.-.-.-.					A							-	-				
3020.0	•	x	•																								o-.o-.o-.o-.o-.o-.o-		r	r									-	-				
3121.0	N.F.F.																										.-.-.-.-.-.-.-.-.-.-			A	A	A							10	-				
3151.5 CC # 1																											-P-P-P-P-P-P-P-P-P-P	A	A										-	-		?		?



KEY: • = <20 specimens
x = >20 specimens
D = Dominant >60% specimens
? = determination queried

N.F.F. = no foraminifera found
∿∿∿ = definite hiatus
—?—? = hiatus - uncertain

A = abundant 1-5% grains
C = common >20 grains
r = rare <20 grains

¶Paleowater depth in parentheses

TABLE 3: PALEOENVIRONMENTS - EOCENE to EARLY MIOCENE - SELENE # 1

Refer Table 5 for Miocene Paleoenvironments (2800-1270m)

David Taylor, 22/2/1983.

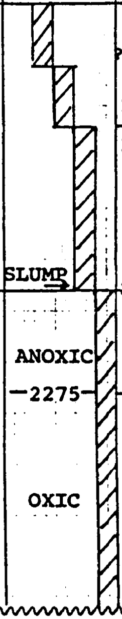
SIDEWALL CORES Depth in metres	PLANKTONIC FORAMINIFERA																																BIOSTRATIGRAPHY		
	G'ina woodi connecta	*G'ina woodi woodi*	*G'ina bulloides*	*Cat. dissimilis*	*G'quad dehiscens* (S.L.)	*G'alia continuosa*	*G'alia nana*	*G'ina & G'alia indet* (<.2mm)	*G'alia siakensis/mayeri*	*G'quad dehiscens* (S.S.)	*G'quad altispira*	*G'quad advena*	*G'alia zealandica* (S.S.)	*G'oides trilobus*	*G'oides bisphericus*	*G'alia miozea miozea*	*G'alia praescitula*	*G'alia bella*	*G'oides ruber* (S.L.)	*Orb. universa*	*Orb. suturalis*	*G'alia peripheronda*	*G'alia praemenardii*	*G'alia miozea conoidea*	*G'alia conica*	*G'alia foshi* (S.L.)	*G'alia panda*	*G'alia miotumida* (S.S.)	*G'alia scitula*	*G'ina nepenthes*	*G'ina decoraperta*	*G'alia acostaensis*	ZONE	Depth at Base	AGE
1270.0→		x	x					D												x								x	x		x	x	B-2		LATE MIOCENE
1315.0→		x	x																	°											x				
1415.0→		x	x																									x	x	x	x	x		1415	
1515.0→		x	x			x														x								x	x	x	x		C		MID MIOCENE
1615.0→		x	x					D												°								x	°	x	x				
1715.0→								D												°								x	°	°				1715	
1815.0→								D																									?		
1915.0→								D												°															
2015.0→								D																											
2115.0→		°	x						°																		°							2115	
2215.0→			x																														D-1		
2225.0→		x	x						°											x					°										
2229.0→		°																		°				°											
2232.0→		°																		°															
2234.0→		x	x						x							°				°				x	°	°	x								
2237.0→		x	x						°							°				x		°		°	°										
2240.0→		x	x						°							°				x		°		°										2240	
2245.0→		x	x						x	x		x		x	x	x	x			x		x	x	x	x								D-2		
2275.0→		x	x						x					°	°	x	x			x		x	x	x	x										
2300.0→		x	x						x					°	°	x	x			x		x	x	x	x										
2400.0→		x	x						x		°	x		x	x	x	x	x	x	x	x	x	x	x										2400	
2500.0→		x	x			°	°		°				°	x	x	x	x	x	x														F	2500	EARLY MIOCENE
2635.0→		x	x	x		°	°	D			x	x		x																			G		
2705.0→		°	x											°																					
2725.0→	x	x	x	x		°	°	D						x																					
2745.0→	x	x		°		°	°	D						x																				2745	
2765.0→	x	x			°			D	°	°	°	°	°																				H-1		
2785.0→								D																											
2800.0→	x	x	x	°	°	°	°	x	°																										
Refer Table 2 for Oligocene to Eocene distribution below 2800.0m.																																	J-2		EARLY OLIGO-CENE

KEY: ° = <20 specimens
x = >20 specimens
D = Dominant >60% specimens

∿∿∿∿∿∿∿∿ definite hiatus

TABLE 4: MIOCENE PLANKTONIC FORAMINIFERAL DISTRIBUTION - SELENE # 1.

David Taylor, 25/2/1983.

SIDEWALL CORES & CONVENTIONAL CORES Depth in metres	BENTHONIC FORAMINIFERA																																			RESIDUE LITHOLOGY												¶PALEO-ENVIRONMENTAL ASSESSMENT		BIOSTRATIGRAPHY		
																																				MAJOR COMPONENTS	MINOR COMPONENTS													ZONE	Depth at Base	AGE
	Discammina sp.	*"Cyclammina" incisa*	*Trochammina globigeriniformis*	*Reophax* spp.	*Bathysiphon* (Porcelaineous)	*Epistomella exigua*	*Cassidulina subglobosa*	*Orodoralis umbonatus*	*Cibicides temperate & mediocris*	*Nodosaria* spp.	*Gyroidina zealandica* Gp.	*Lagena* spp.	*Brachisiphon* sp.	*Hoeglundina elegans*	*Cibicides karreriformis*	*Martinottiella communis*	*Sphaeroidina bulloides*	*Ceratobulimina* sp.	*Gaudryina crespinae*	*Textularia carinata* Gp.	? *Carterina* sp.(with calcareous spicules)	*Sigmoilopsis schlumbergeri*	*Osangularia bengalensis*	*Cibicides pseudoungerianus & opacus*	*Fissurina* spp.	*Cassidulina leavigata*	*Euuvigerina peregrina*	*Anomalina macroglabra*	*Lenticulina* spp.	*Cibicides vortex*	*Cibicides subhaidingeri*	*Elphidium macellum*	*Cibicides lobatulus*	*Spirillina* sp.	*Astrononion* sp.	Sp=siliceous sponge spicules ∩=recrystallised calcarenite ᗩ=silty calcarenite m=biogenic micrite Ψ=recrystallised micrite P=pyrite & limonite o=m-c ang qtz	glauconite pellets	pyrite	limonitic clay	f-c ang-subrd qtz	fish fragments	sponge spicules	? worm tubes & ? faecal pellets	bryozoal fragments	echinoid spines	foram count	planktonic %	Mid-Inner Shelf (<100m) Outer Shelf Canyon (<200m) Shelf Edge Canyon (≈200m) Slope Canyon (<500m) Upper Slope (200-400m)	MAJOR E-LOG CHARACTER CHANGE			
1270.0							•		x		•	x					•							x	x		x									∩∩∩∩∩∩∩∩∩∩								A		1000	75			B-2		LATE MIOCENE
1315.0																	•																	•	•	∩∩∩∩∩∩∩∩∩				A		A		A	C	200	90		?1374			
1415.0											•	x												•	•	x		•				•	•			∩∩∩∩∩∩∩∩∩						A				1000	95				1415	
1515.0										x		x					•							x												∩∩∩∩∩∩∩ SpS										500	95			C		
1615.0									x	•																x					x					∩∩∩∩∩∩∩ SpSp	r									1000	90		1740			
1715.0												x															x									∩∩∩∩∩∩∩∩∩	r	r	A	A		A				1000	98		-or		1715	
1815.0										•		•					•							•	x	x	x			x						∩∩∩∩∩∩∩∩∩										1000	90		1810			
1915.0												•												w	•					•						∩∩∩∩∩∩∩∩∩										1000	98			?		
2015.0																									x	x				x						∩∩∩∩∩∩∩∩∩	A									1000	98					
2115.0																								w					w							ᗩ∩∩∩∩∩∩∩∩				A						?	?				2115	MID
2215.0																		•																		∩∩∩∩∩∩∩∩∩				A						?	?					
2225.0												•													•				w							∩∩∩∩∩∩∩∩∩										100	99					
2229.0																								w												∩∩∩∩∩∩∩∩∩			A	A						?	?	SLUMP				MIOCENE
2232.0							•																	w	x	x	•	w								ᗩᗩᗩᗩᗩᗩᗩᗩᗩ	r		r	A									2234	D-1		
2234.0										x										•																ΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨ			A	A						500	99					
2237.0								•	•	•										•	•		x													mmmmmmmmmmmmmmmm PPPPP										500	90					
2240.0								•	x	•											•	•	•													mmmmmmmmmmmmmmmm PPPPP							C			500	95	ANOXIC			2240	
2245.0									x	•		•							•		•	•														mmmmmmmmmmmmmmmm PPPPP					C		A			500	99					
2275.0	•				•			•	x		x				x		x	•	•	•	•	x														mmmmmmmmmmmmmmmm PPPPP			A	A		C	A			1000	95	—2275—	—?	D-2		
2300.0					x			•		x																										mmmmmmmmmmmmmmmmmmmmmmmmmmmmmmm						C				1000	99					
2400.0									x	x		x				•	•	•																		mmmmmmmmmmmmmmmmmmmmmmmmmmmmmmm		r	r							1000	99				2400	
2500.0	•	•		•					x				•	•	x																					mmmmmmmmmmmmmmmmmmmmmmmmmmmmmmm	r				A					1000	95			F	2500	
2635.0								•	•	x	•	•																								mmmmmmmmmmmmmmmm ooooo			A							1000	99					
2705.0							•			•																										ΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨ				A						?	?	OXIC		G		EARLY
2725.0		•																																		ΨΨΨΨΨΨΨΨΨΨΨΨΨ oooo	r	r	r							500	99					
2745.0					x		x	•	•																											mmmmmmmmmmmmmmmmmmmmmmmmmmmmmmm				A						3000	98				2745	MIOCENE
2765.0	•			•	x	•	•																													ΨΨΨΨΨΨΨΨΨΨΨΨ ooooo	r									200	80			H-1		
2785.0	indet																																			ΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨ			A		r					?	?					
2800.0	•	•	•																																	ΨΨΨΨΨΨΨΨΨΨΨΨ ooooo	A	r	A							200	98					
	refer Table 3 for Oligocene to Eocene paleoenvironment data.																																																2807	J-2		EARLY OLIGOCENE

KEY: • = <20 specimens
x = >20 specimens
w = worn shallow water - displaced specimens.

A = 1-5% of grains
C = >20 grains
r = <20 grains

¶Paleowater depth in parentheses.

TABLE 5: MIOCENE PALEOENVIRONMENT - SELENE # 1.