4. SITE 69

Shipboard Scientific Party¹

SITE DATA

Occupied: October 17-20.

Position: Latitude 6° 00.0'N. Longitude 152° 51.93'W.

Water Depth: 4978 meters.

- Total Depth: 230 meters, ending in middle Eocene chert.
- Holes Drilled: Two holes.
- **Cores Taken:** Twenty-one cores (8 in Hole 69, 13 in 69A). Cored 0 to 32 meters, 52 to 162 meters, 187 to 196 meters, 214 to 231 meters.

RESULTS

An almost complete stratigraphic section was cored from middle Miocene to middle Eocene, consisting of three lithologic units:

- Upper radiolarian ooze and bedded siliceous and calcareous ooze 0 to 32 meters of middle and early Miocene age; 32 to 50 meters was not cored.
- Calcareous nannofossil ooze, 50 to 144 meters, of early Miocene and Oligocene age.
- 3) Lower radiolarian ooze, 144 to 227 meters, of upper and middle Eocene age.

Hard chert beds below 227 meters were penetrated to 231 meters, but were not recovered.

The contact between Oligocene nannofossil ooze and Eocene radiolarian ooze was very sharp.

BACKGROUND

Site 69 is located about 350 miles northeast of Christmas Island of the Line Islands, in the crustal block between the Clarion and Clipperton Fracture Zones, about 200 miles north of the Clipperton. Since some time was gained at Site 68, where drilling was terminated in a shallow chert horizon, Site 69 was chosen as an additional site to provide lateral control for the N-S section across the equatorial Pacific belt of high productivity and thick sediments. This N-S section was the main objective of Leg 8. Site 69 provides stratigraphic information between the near-equatorial holes drilled to the west during Leg 7 (Sites 62 through 66) and our line of holes and the E-W section drilled across the East Pacific Rise during Leg 9.

There was no SCAN survey for this site and all site information is derived from the observations on the *Challenger*. Topography in the vicinity of the site is moderate with occasional seamounts; one, about 10 miles south of the site, reaching 900 meters in height. The site is located in a gentle northwest plunging depression, or trough, about 3 miles SW of a 180-meter seamount.

Reflection horizons within the sediment are concordant with the sea floor; acoustic basement is also concordant in general, but not in detail (Figure 1 and Figure 12, Chapter 2). Total 'thickness' to acoustic basement in the area varies between 0.25 and 0.35 seconds, thinning to zero near the seamounts. At the site, prominent reflectors are at 0.020, 0.050, 0.190 and 0.305 seconds; the second and third reflectors are correlated with the top and bottom of the Marquesas Oceanic Formation and the fourth with the indurated Eocene sediments near the bottom of the drilled section (Figures 6, 7 and 8, Chapter 2).

A topographic map of the vicinity of Site 69, airgun records, and further site information are given in Chapter 25.

OPERATIONS

The first hole at Site 69 was drilled as an exploratory hole, and bottomed in chert at 231 meters after taking seven cores. About 60 meters of the section were cored, and 46 meters recovered.

Hole 69A was drilled about 30 meters from the original site in order to recover some of the intervals not cored in the first hole. Thirteen cores were taken totaling 106 meters, and 93 meters were recovered.

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Figure 1. Airgun record across Site 69 and interpretation.

	Core No.	Interval Below Seafloor (meters)	Cored (m)	Recovered (m)	Comments
Hole 69	1	0-9	9.1	9.1	Washed down 2.9 m
	2	14-23	9.1	9.1	
	3	23-32	9.1	9.1	Drilled 19.5 m
	4	52-61	9.1	9.1	Drilled 55.2 m
	5	117-126	9.1	9.1	Drilled 61.0 m
	6	187-196	9.1	0.0	Drilled 31.7 m
	7	227-228	1.2	0.0	Hard layer 69.2 m
	8	228-231	3.0	0.3	Total depth 231 m in chert
Total			59.1	46.4	79% recovery
Hole 69A	1	61-70	9.1		Drilled 61.3 m
	2	70-79	9.1	9.1	
	3	79-88	9.1	7.0	
	4	88-98	9.1	9.1	
	5	98-107	9.1	9.1	
	6	107-116	9.1	9.1	Drilled 36.6 m
	7	126-135	9.1	4.6	Core liner collapsed
	8	135-144	9.1	7.9	
	9	144-153	9.1	7.9	
	10	153-162	9.1	9.1	Drilled 51.8 m
	11	214-223	9.1	9.1	
	12	223-229	6.7	2.1	
	13	229-230	0.9	0.0	Total depth 231 m in chert
Total			108.3	82.6	76% recovery
Total 69 + 69A			165.0	129.0	77% recovery

TABLE 1 Summary of Coring at Site 69

Total coring at the site amounted to 177 meters of which 139 meters (70 per cent) were recovered.

An attempt to run the Welex drill pipe logging device failed, as the tool became stuck in a drill pipe joint.

LITHOLOGY AND STRATIGRAPHY

Core recovery at Site 69 was good, and the cores display a sedimentary sequence from the middle Miocene to the middle Eocene. However, some cores were badly disturbed by drilling, mainly those containing lower Oligocene nannofossil ooze. Three sedimentary formations are present at Site 69: The Clipperton Formation (0 to 35 meters), the Marquesas Formation (35 to 144 meters), and the Line Islands Formation (144 to 231 meters).

Clipperton Oceanic Formation

The Clipperton Oceanic Formation is made up of two lithologic units at Site 69. The upper unit consists of radiolarian ooze and extends from the sea floor to a depth of 19.6 meters. The ooze is dark yellowish brown to yellowish gray, moderately mottled with very pale brown. The texture is somewhat porous or "bready." Radiolaria are the dominant constituent with rare diatoms. The calcium carbonate content is zero. The radiolarian ooze unit is middle Miocene in age. The contact with the lower cyclic unit is sharp and corresponds to the top of the uppermost carbonaterich bed.

The lower unit of the Clipperton Oceanic Formation at Site 69 consists of alternating calcareous (radiolariannannofossil) and siliceous (radiolarian) oozes from 19.6 to 32 meters. The two lithologies in this cyclic unit are separated by sharp contacts marked by color changes. The calcareous beds are generally very pale orange and are composed predominantly of calcareous nannoplankton (60 to 70 per cent) and Radiolaria (30 to 40 per cent). Siliceous beds composed mainly of Radiolaria make up most of the cyclic unit and are dark yellowish brown. In general within the cyclic unit, the darker brown the color, the lower the carbonate content. The basal contact of the cyclic unit was not cored and lies somewhere in the 32 to 52 meter interval. It is tentatively placed at 35 meters. The cyclic unit of the Clipperton Oceanic Formation is middle and early Miocene in age.

Marquesas Oceanic Formation

This formation is composed of nannofossil ooze with variable proportions of Radiolaria. Calcium carbonate content generally ranges from 60 to 95 per cent. The central part of the unit—of upper Oligocene age—is a rather high-carbonate nannofossil ooze, whereas the top and the bottom portions are more siliceous. Coccolithophorids and discoasters are the dominant fossils. The siliceous fraction is composed of Radiolaria and diatoms. As in the oozes of the Clipperton, the diatoms are proportionately rare but are relatively more abundant in the more siliceous top and bottom sections.

The color is white to very pale orange, pale brown and light gray. The top and the base of the formation display darker hues, generally yellowish brown.

Bedding occurs throughout the whole unit. Contacts are sharp between beds of different colors or of slightly different physical properties. Generally the lighter colored beds are richer in calcareous fossils. The texture is firm to stiff in beds rich in Radiolaria, and in contrast is softer and more plastic in the nannofossil oozes. Moderate mottling is noted from the top to the base of the formation.

The contact between the Marquesas Oceanic Formation and the underlying Line Islands Oceanic Formation is a sharp disconformity corresponding to the Oligocene-Eocene boundary. The last core which was recovered from the Marquesas, Core 8, is an Oligocene radiolarian-nannofossil ooze whereas Core 9, drilled immediately below, is a noncalcareous upper Eocene radiolarian ooze.

Line Islands Oceanic Formation

The upper part of the Line Islands Oceanic Formation is composed of radiolarian ooze. The sediment consists almost wholly of Radiolaria and radiolarian debris. Diatoms, although more abundant than in the overlying calcareous Oligocene oozes, are rare. The calcium carbonate content is zero. The color is dark, grading from yellowish to dark brown. The ooze is moderately mottled in orange. Plastic beds with smooth texture alternate with firmer and more porous beds which show a "bready" texture on freshly cut sections.

At 227 meters the core bit hit a hard layer of chert of which one piece was recovered. The chert is dark brown and has a conchoidal fracture. Subsequent coring penetrated an estimated four meters of chert and soft layers, of which only small chert chips were recovered. These lowermost layers are of middle Eocene age.

PHYSICAL PROPERTIES

Porosities range between about 60 and 90 per cent and sonic velocities range between about 1.50 and 1.55 km/sec. Except for a few anomalously low measurements the relationship between velocity and porosity is as expected for siliceous and calcareous ooze mixed in varying proportions (Figure 2). At this site most of the sediments fall near the two extremes of high and low calcium carbonate (CaCO₃). Grain-matrix density averages near 2.0 g/cm³ and 2.6 g/cm³ (with a great deal of scatter) for siliceous and calcareous portions, respectively.

The most striking change in physical properties within the unconsolidated sediments occurs across the Marquesas-Line Islands boundary at a depth of 144 meters where the sediment changes from highly calcareous to highly siliceous ooze. This boundary also correlates with a prominent subbottom reflector. Above the boundary the measured sonic velocities are lower than that for sea water. If the laboratory measurements are representative of *in situ* values, they indicate the existence of a low-velocity channel within the sediments to a depth of 144 meters (Figure 7, Chapter 2).

Velocity and density of one piece of Eocene chert are reported in Chapter 2.

Results of grain-size and carbon-carbonate analyses are tabulated in Appendices II and III, respectively.



Figure 2. Sonic velocity versus porosity of unlithified sediments from Site 69 for three ranges of calcium carbonate content. Theoretical curves are based on the equation of Wood (1941). Upper curve, grain-matrix density 2.2 g/cm³, appropriate for siliceous ooze. Lower curve, grain-matrix density 2.65 g/cm³, appropriate for calcareous ooze.

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Figure 3. Foraminifera of Site 69. Frequency distribution, ranges of important species, and biostratigraphy.

PALEONTOLOGY

Foraminifera

Hole 69 reached a depth of 231 meters. Eight spot cores were cut, but only the first six had significant recovery. In Hole 69A, the uncored intervals of Hole 69 were sampled as far as it was necessary to get a complete record of the Oligocene. This procedure resulted in the somewhat complicated sequence of core numbers shown on Figure 3. Of the thirteen cores taken in Hole 69A, twelve were suitable for paleontological sampling. The faunas at Site 69 are mainly siliceous. Only an interval of about 25 meters in the Oligocene (*Globorotalia opima opima* Zone or P. 21) had microfaunas which consisted of up to 50 per cent foraminifera. Even in the most calcareous samples, the small species (*Cassigerinella chipolensis, Chiloguembelina* spp. and the *Globigerina ciperoensis* group) are absent altogether. The Oligocene is the only part of the section where specific zones could be distinguished with reasonable confidence.

The faunas of Site 69 contain a relatively large percentage of benthonic foraminifera (see the

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B DEPTH in meters	BARREL No.	 0 FORAMINIFERA 50 percentage of total fauna in > 80 mesh fraction 	-1:10 FORAMINIFERA 1 FORAMINIFERA -10 planktonic/benthonic -100	strong SOLUTION EFFECTS	Catapsydrax dissimilis	Globigerina pera	Globigerina prasaepis	Globigerina tripartita	Globigerina sp. A	Globorotalia mayeri	Globorotalia opima opima	Globorotalia opima s. l.	Spiroplectammina trinivatensi	BIOSTRATIGRAPH	AGE
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Figure 3. Continued.

planktonic/benthonic ratio curve on Figure 3). In the Oligocene and Lower Miocene, the most conspicuous forms belong to the genera Eggerella, Vulvulina, Chrysalogonium, Stilostomella Cibicides, Globocassidulina, Gyroidina, Laticarinina and Pullenia. In the Eocene, the foraminifera are exclusively agglutinated forms. The resemblance of these faunas to those of the Oceanic Formation of Barbados (West Indies) has already been pointed out.

The faunas of the upper part of Holes 69 and 69A are predominantly or exclusively siliceous. Planktonic foraminifera occur most abundantly in Core 69-2 (Section 3 to core catcher), at a depth of 17 to 23 meters below the sea floor. They are scarce and include *Globoquadrina dehiscens advena*, *Globorotalia mayeri* and *Sphaeroidinellopsis seminulina*, which indicate an age between N. 7 and N. 14.

In Section 69-3-5 (depth 29 meters) the highest *Catapsydrax dissimilis* was found, associated with *Globoquadrina praedehiscens*. A few small globorotalias, which are probably *G. pseudokugleri*, occur from this depth down to the bottom of Core 69-4 (61 meters) and suggest that this interval might be the *Globorotalia kugleri* Zone (N. 4). In this case the next two Cores, 69A-1 and 69A-2 would essentially represent the *Globigerina ciperoensis ciperoensis* Zone

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Figure 3. Continued.

(P. 22). The Globorotalia opima opima Zone (P. 21) can be identified from the core catcher sample of Core 69A-2 down to 69A-6-6 (79 to 116 meters). As expected, the lowest occurrence of Globorotalia mayeri is found in this Zone, in Section 69A-6-3. Smaller specimens of Globorotalia opima s.l. occur along with occasional Globigerina prasaepis below 116 meters, down to 69A-7-2. Below this, the faunas remain similar, but become successively poorer to the bottom of Core 69A-8 (144 meters). The interval from 116 to 144 meters might include the Globigerina ampliapertura Zone (P. 20) and possibly some slightly older beds. From the top of Core 69A-9 (144 meters) to total depth, the samples contain abundant Radiolaria together with rare agglutinated foraminifera.

Among these, *Spiroplectammina trinitatensis* is probably of some stratigraphic importance, since it is a common form in the Eocene of the Caribbean area.

Calcareous Nannoplankton and Silicoflagellates

With the exception of the upper 10 meters or so, calcareous nannoplankton occur down to about 140 meters. Below this depth, the calcareous fossils have been dissolved. Thirty-one species were identified in the lower Miocene to lower Oligocene section (Table 2). In the lower Oligocene, discoasters are the predominant fossil. The stratigraphic ranges of calcareous nannoplankton are shown in Figure 4.

Species	Occurrences (Hole/Core Nos.)
Calcareous Nannoplankton	
Coccolithus bisectus (Hay, Mohler and Wade) as figured by	
Bramlette and Wilcoxon	69/5;69A/2-8
Cyclococcolithus formosus Kamptner	69A/7-8
C. neogammation Bramlette and Wilcoxon	69A/5-3; 69A/1-5; 69A/7-8
Discoaster adamanteus Bramlette and Wilcoxon	69/2-4; 69A/1-8
D. argutus Hay	69/2
D. brouweri Tan Sin Hok	69/2
D. calcaris Gartner	69/3
D. challengeri Bramlette and Riedel	69/3
D. deflandrei Bramlette and Riedel	69/2-5;69A/1-8
D. dilatus Hay	69/2
D. druggii Bramlette and Wilcoxon	69/3
D. exilis Martini and Bramlette	69/2-3
D. extensus Hay	69/2
D. kugleri Martini and Bramlette	69/2-3
D. lautus Hay	69/2-4;69A/1-4
D. perplexus Bramlette and Riedel	69/3
D. tani nodifer Bramlette and Riedel	69/5;69A/6-8
D. tani ornatus Bramlette and Wilcoxon	69A/6
D. tani tani Bramlette and Riedel	69/5;69A/5-6
D. variabilis Martini and Bramlette	69/2-3
Helicopontosphaera compacta Bramlette and Wilcoxon	69/5?;69/6
Reticulofenestra umbilica (Levin) Martini and Ritzkowski	69A/7-8
Sphenolithus belemnos Bramlette and Wilcoxon	69A/1
S. ciperoensis Bramlette and Wilcoxon	69A/1-3
S. distentus (Martini) Bramlette and Wilcoxon	69A/3-5
S. heteromorphus Deflandre	?
S. moriformis (Bronnimann and Stradner) Bramlette and Wilcoxon	69/3-5;69A/1-8
S. predistentus Bramlette and Wilcoxon	69/5;69A/3-8
S. pseudoradians Bramlette and Wilcoxon	69A/6
Triquetrorhabdulus carinatus Martini	69/4-5; 69A/1-3
T. rugosus Bramlette and Wilcoxon	69/2
Silicoflagellates	
Corbisema tricantha (Ehrenberg) Hanna	69A/9
Dictvocha fibula Ehrenberg	69/1-2
Distephanus speculum (Ehrenberg) Haeckel	69/4
D. speculum brevispinus (Gemeinhardt) Frenguelli	69/1

 TABLE 2

 Calcareous Nannoplankton and Silicoflagellate Occurrences in Holes 69 and 69A



Figure 4. Calcareous nannoplankton of Site 69. Distribution and biostratigraphy.

Silicoflagellates are common in the middle Miocene sediments but are virtually absent below about 30 meters. *Dictyocha tricantha* is present in the upper Eocene.

The following calcareous nannoplankton zones were recognized at Site 69:

Hole 69 Core 1-1 to 1-CC: Barren Core 2-1 to 3-4: Discoaster kugleri Zone Core 3-5 to 3-CC: Discoaster druggii Zone? Core 4-1 to 4-CC: Triquetrorhabdulus carinatus Zone Core 5-1 to 5-CC: Sphenolithus predistentus Zone Core 6-6 to 6-CC: Barren Hole 69A Core 1-1 to 2-4: Triquetrorhabdulus carinatus Zone Core 2-5 to 3-5: Sphenolithus ciperoensis Zone Core 3-6 to 5-CC: Sphenolithus distentus Zone Core 6-1 to 7-1: Sphenolithus predistentus Zone Core 7-2 to 8-CC: Discoaster tani ornatus Zone Core 9-1 to 11-CC: Barren, with younger contamination Core 12-1: Barren, with younger contamination

Radiolaria

The first core (69-1), taken at the sea floor, contains sediments from the uppermost Middle Miocene. From this point down to the Upper Eocene a fairly continuous section was cored. The Lower Miocene-Oligocene section is very thick and contains about 50 meters of section which has not been previously zoned with Radiolaria. A zonation of this interval is proposed in the summary section on Radiolaria. The radiolarian ooze above the chert that terminated Hole 69A was from the lower part of the Middle Eocene.

Radiolaria are numerous and moderately well preserved throughout the section cored. Some solution of the tests is evident in samples from Cores 69-4 (Lower Miocene), 69A-6, 69-5 (the lower part of the Upper Oligocene). Reworking and mixing were frequently encountered in the upper 100 meters of the section and were most common in the noncalcareous part of the section (Cores 69-1, 69A-9, 69A-10) and in Core 69-4. Diatoms are particularly abundant in the Lower Oligocene and uppermost Eocene part of the section.

REFERENCE

Berggren, W. A., 1969. Cenozoic chronostratigraphy, planktonic foraminiferal zonation and the radiometric time scale. *Nature*. 224, 1072.

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Figure 5. Radiolaria at Site 69. Frequency, distribution and biostratigraphy.

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R –	Suspec	ted rev	worked	끹	The	Can	Arte	Lith	Don	Dor	ΓII	The	Dor	Dor	Cen	Dor	Set	Pod	Lith	The	Thy	Eus	Litt	Lith	Cyc	Lop	Arte	Thy	Thy	Thy	Pod	Pod	Pod	The	Lith	Cyc	TUE
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 $\frac{3}{3}$ Figure 5. Continued.

SITE 69 RARE FEW COMMON ABUNDANT UNCORED INTERVAL COMMENTS D – Suspected down-working during drilling R – Suspected reworked older microfossils HOLE[CORE]SECT.[INTERVAL	ZONE	Artophormis gracilis	Dorcadospyris triceros	Theocyrtis tuberosa	Thyrsocyrtis bromia	Thyrsocyrtis tetracantha	Artophornis barbadensis	Cycladophora turris	Lithocyclia aristotelis group	Lithapium (?) mitra (?)	Eusyringtum fistuligerum	Thyrsocyrtis triacantha	Thyrsocyrtis rhizodon	Theocampe mongolfieri	Lithochytris vespertilio	Lithocyclia ocellus group	Podocyrtis papalis	Sethochytris babylonis group	Podocyrtis ampla	Lophocyrtts (?) jacchia	Podocyrtis mitra	Sethochytris triconiscus (?)	Podocyrtis chalara	Cycladophora hispida	Theocorys anapographa			COMMENTS
69A 10 3 81-83 10 cc 69 6 1 82-84 6 cc	P. T. chalara bromia	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,											11011 11011	11-11 11-11				um um	11111. 11111	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		nen. Nen		1141. 1171.	uun uku	8		R R
RARE FEW COMMON ABUNDANT ABUNDANT COMMENTS D - Suspected down-working during drilling R - Suspected reworked older microfossils HOLE CORE SECT. INTERVAL	ZONE	Thyrsocyrtis triacantha	Eusyringium lagena (?)	Podocyrtis diamesa	Thyrsocyrtis rhizodon	Theocampe mongolfieri	Theocotyte venezuelensis	Thyrsocyrtis hirsuta robusta	Lithapium (?) plegmacantha	Theocorys anapographa	Theocotyle cryptoephala cryptocephala (?)	Theocorys anaclasta	Lithochytris vespertilio	Lamptonium (?) fabaeforme (?) chaunothorax	Triactis tripyramis triangula	Lithocyclia ocellus group	Podocyrtis sinuosa (?)	Podocyrtis papalis	Theocotyle (?) ficus	Sethochytris babylonis group	Phormocyrtis striata	Lamptonium (?) fabaeforme (?) constrictum	Triactis tripyramis tripyramis	Lithochytris archaea	Podocyrtis aphorma	Lithocampium sp.	Cycladophora hispida	
69A 11 1 81-83 11 cc	T. triacantha		1	T	I										T							I						

6	6	6	s o	s	S	4	4	4	3 0	3	3	2 c	2	2	69A 1 c	HOLE CORE SE	R - Suspected older micr	COMMENTS D - Suspected during dril	ABUNDAN	COMMON	FEW	RARE	SITE 6
5	3 100-102	1 81-83	ö	3 80-82	1 81-83	Ċ	3 0-2	1 81-83	č	5 81-83	1 81-83	c	5 81-83	1 81-83	°	CT.INTERVA	reworked ofossils	down-working ling	Т		I		9
			7	Theocy	rtis an	nosa							Dorcad papilio	lospyr	is	7	ONE						
																	Car	anartus tubari	us				
		8		2			ŝ		-	_	ŝ				-		Lya	hnocanium b	ipes				
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			D	R	R	D			D	D				R	R,D	0	OMMENT	ſS					

S Figure 5. Continued.

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Figure 6. Age versus depth at Site 69, based on the biostratigraphic zonations of the foraminifera, calcareous nannoplankton and Radiolaria. Ages based on the time scale of Berggren (1969).

SEDIMENT THICKNESS (METERS)





AGE	NATURAL GAMMA * 1.0 (Counts/7.6 cm/1.25 min) × 10 ³	L.5 CORE NO.	METERS	LITHOL.	LITHOLOGIC DESCRIPTION	0	% CaCO ₃ 50 100
MIDDLE EOCENE	****	11 A 7 12 8 A	-		Rad ooze. Cherts interbedded with calcareous ooze.	DS OCEANIC FORMATION +	
		8 A			ooze.	LINE ISLANDS	
			-				



Physical Properties, Site 69, 200-400 Meters G./M. DENSITY (g/cm^3) 2.0 3.0

AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	9 CaC 0 5	6 CO ₃ 0 100
					1		0.3m near top of the barrel <u>Rad ooze</u> - moderate brown (7.5YR3/2) with streaks of pale yellowish orange (10YR8/6).	¥''''	
			irtus antepenultimus	2	2	Void	Smear summaryRads90%Diatoms10Sponge spicules1%		
			Ommata		3		0.4m,near middle of the barrel <u>Rad ooze</u> - as above, contains a patch of pale yellowish brown (10YR6/2) <u>Nanno ooze</u> .	ł	
E TO UPPER MIOCENE	(absent)	(absent)		51111111	4				
MIDDL					5	Void	Microfossil groupPreservationAbundanceForaminiferaBenthonic forms onlyRare onlyCalcareous nannoplanktonAbsentRadiolariaModerateCommon		
			isoni	81111111	6		Comments: Common admixed Upper Eocene - Oligo- cene and Lower Miocene Radiolaria. 0.22m near bottom of the barrel <u>Rad ooze</u> - as above.	-	
			C. petters					1111	

SITE 69 Core 1 Cored interval: 0-9 m

AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	9 CaC	% CO ₃
MIDDLE MIOCENE	N.7 to N.14 (absent) F	? Discoaster kualeri	Dorcadospyris alata		1 2 3 4 5 6		Rad ooze. Dark yellowish brown (10YR3/2). Smear summary Rads 99% Diatoms 1% with paches of Nanno ooze very pale orange (10YR8/2). Microfossil group Preservation Abundance Foraminifera Poor Radiolaria Moderate Common Radiolaria Moderate Common Comments: Admixed Middle and Upper Eocene and Lower Miocene Radiolaria. Some contamination (downworking due to drilling) noted in radiolarians and calcareous nannoplankton. large patch of Rad nanno ooze Nannos 70% Rads 30% below 20.8m: occurrence of beds of Rad nanno ooze (60-70% CaCO ₂) light colored yellowish brown (10YR4/2) t8 olive gray 5YR5/1.		
			· · · · · ·						

SITE 69 Core 2 Cored interval: 14-23 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	% CaCO ₃ 0 50 100
				1111			Rad ooze. Dark yellowish brown (10YR4/2).	
MIDDLE MIOCENE	(absent)	? Discoaster kugleri	Calocycletta costata	1	2		Smear summaryRads96-99 %Nannos0-2 %Diatoms0-1 %Sponge spicules 0-1 %with streaks, swirls and beds of Rad nanno oozevery pale orange (10YR8/2) to light olive gray(5YR6/1).Smear summaryNannos60-70%Rads30-40%Microfossil groupPreservationAbundanceForaminiferaPoorRareCalcareousGoodnannoplanktonRadiolariaModerateCommon	
LOWER MIOCENE	N.4 7 N.6	? Discoaster druggi	C. vir- gin- is	³	4 5 6		<pre>Comments: Admixed Eocene, Oligocene, and Lower Miocene Radiolaria. Some contamina- tion (downworking) noted in 3-6.</pre> 30.1 - 30.3 m interbedded <u>Rad Nanno Oozes</u> 30.5 - 31.2 with <u>Nanno Rad Ooze.</u> 31.5 - 32.0	

SITE 69 Core 3 Cored interval: 23-32 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	% CaCO ₃ 0 50 100
UPPER OLIGOCENE	2 N.4	Triquetrorhabdulus carinatus	Lychnocanium bipes		1 2 3 4 5 6		Rad Nanno Ooze. Dark yellowish brown (10YR4/2) to yellowish gray (5Y7/1). beds of darker and lighter oozes. Lighter beds display higher CaCO3 content. Smear summary Nannos 50-10% Rads 10-50% Sponge spicules trace Microfossil group Preservation Abundance Foraminifera Moderate Rare Calcareous Poor to Common nannoplankton moderate Radiolaria Radiolaria Poor to Common good (highly variable) Comments: Comments: Admixed Eocene - Lower Oligocene Radiolaria. Gouverking) in sections 3, 4, 5 and6. Autor	

SITE 69 Core 4 Cored interval: 52-61 m





Serie of beds of <u>Rad namo ozes</u> , varying CaCO ₃ beds contain only 40% namos. Bedding with sharp basal contact. Pale yellowish brown (10YR6/2) to very pale brown. (10YR8/2) moderate mottling. <u>Pale yellowish brown (10YR6/2) to very pale brown. (10YR8/2) moderate mottling.</u> <u>Smear summary</u> <u>Namos 40-85%</u> Rads 15-60% Diatoms 0-2 % Sponge Spicules trace <u>Microfossil group</u> <u>Preservation</u> <u>Abundance</u> Foraminifera Poor to mod- erate Calcareous Moderate Common namoj lanktom Radiolaria Moderate Few Comments: Scant admixed Eocene Radiolarians in sections 1 and 3. Smee contamination (dowrworking) of calcareous namo- fossils probable. Common diatoms in section 3 and below.	AG	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	% CaCO ₃ 0 50 100
	LIPPER OI L'GOCENE	P. 20	Sphenolithus predistentus	Theocrytis tuberosa		1 2 3 4 5 6		Serie of beds of <u>Rad nanno oozes</u> , varying CaCO ₃ content mostly 70 to 85% of nannos but some beds contain only 40% nannos. Bedding with sharp basal contact. Pale yellowish brown (10YR6/2) to very pale brown. (10YR7/3) with swirls very pale orange (10YR8/2) moderate mottling. <u>Smear summary</u> Nannos 40-85% Rads 15-60% Diatoms 0-2% Sponge Spicules trace <u>Microfossil group</u> <u>Preservation</u> <u>Abundance</u> Foraminifera Poor to mod- erate Calcareous Moderate Common nannoplankton Radiolaria Moderate Few Comments: Scant admixed Eocene Radiolarians in sections I and 3. Some contamination (downworking) of calcareous nanno- fossils probable. Common diatoms in section 3 and below.	

SITE 69 Core 5 Cored interval: 117-126 m





AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	Ca(% CO₃ 50 10
MIDDLE EOCENE	(absent)	(absent)	Podocyrtis chalara		1 2 3 4 5 6		Smear summary (10YR8/4) - moderately mottled, "bready" texture. Smear summary Rads 99-100% Diatoms Rads 99-100% Diatoms Diatoms 1% Sponge Spicules Microfossil group Preservation benthonic forms Calcareous nannoplankton Radiolaria Good Abundant Comments: Some diatoms present.		

SITE 69 Core 6 Cored interval: 187-196 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	9 CaC	6 203
				_	01			ŤΠŤ	ППП
AGE	FORAMS	NANNOS	RADS	State State <th< td=""><td>SECT. NO.</td><td>LITHOL.</td><td>LITHOLOGIC DESCRIPTION Chert (4cm recovered), dark brown, conchoidal fracture. Barrel 8: No recovery. Total drilling: 231m in chert and layers of soft marls.</td><td>9 CaC 0 5</td><td></td></th<>	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION Chert (4cm recovered), dark brown, conchoidal fracture. Barrel 8: No recovery. Total drilling: 231m in chert and layers of soft marls.	9 CaC 0 5	
				81111111			Barrel 8: No recovery.Total drilling: 231m in chert and layers of soft marls.		
								hun	ш

SITE 69 Core 7 Cored interval: 227-228 m

AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	% CaCO ₃ 0 50	100
RE CERTIFICATION OF CERTIFICATIONO OF CERTIFICATION OF CERTIFICATION OF CERTIFICATION OF CE	E	inatus		¥	1 2 3		<u>Rad nanno ooze</u> Pale brown (10YR6/3) to light brownish gray (10YR6/2) to white (10YR8/1), slightly to moderately mottled, occasional bedding. <u>Smear summary</u> Nannos 70-80% Rads 20-30% Diatoms trace		
UPPER OLIGOCENE	7 P. 22	Triquetrophabdulus carin	Dorcadospyris papilio	5 6 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	6		Microfossil group Preservation Abundance Foraminifera Moderate to Few good Calcareous Moderate Common nannoplankton Radiolaria Moderate Common Comments: Scant admixed older calcareous nannofossils and Eocene radiolarians. Some diatoms present.		

SITE 69A Core 1A Cored interval: 61-70 m


AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	9 CaC 0 5	6 CO ₃ 0 10
UPPER OLIGOCENE	2.7 + 22 ? P. 22	Sphenolithus ciperoensis Triquetrorhabdulus carinatus	Doreadospyris papilio		1 2 3 4 5 6		barrel moderately disturbed. Rad nanno ooze. Very pale brown (10YR7/3) to 1ight yellowish brown (2.5Y6/4) to pale olive (5Y3/6) to white (N8). moderately mottled occasional bedding <u>Smear summary</u> Nannos 70-80% Rads 20-30% Diatoms trace <u>Microfossil group Preservation Abundance</u> Foraminifera Moderate Few Calcareous Moderate Few Calcareous Moderate Common nannoplankton Radiolaria Moderate to Common good Comments: Scant reworked older nannofossils and Lower Oligocene radiolarians. Some diatoms present.		
	-1							huul	шц

SITE 69A Core 2A Cored interval: 70-79 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	% CaCO ₃ 0 50 100
AGE OLIGOCENE	P. 21 FORAMS	entus Sphenolithus ciperoensis NANNOS	Theocyrtis amosa	METERS METERS 0 1 <td< td=""><td>1 2 3 4 5 5 6</td><td>LITHOL.</td><td>Lightly disturbed Rad nanno ooze mostly white (10YR8/2) to yellowish brown (10YR5/6), bedded (sharp contacts) Smear summary Nannos 50-80% Rads 20-50% Diatoms trace Microfossil group Preservation Abundance Foraminifera Moderate to good Calcareous Poor to common to abundant Radiolaria Poor to common moderate Comments: Some reworked older nannofossils and some contamination (downworking) noted in radiolarians from section 5 and catcher.</td><td>% CaCO3 0 50 100 1 1 1</td></td<>	1 2 3 4 5 5 6	LITHOL.	Lightly disturbed Rad nanno ooze mostly white (10YR8/2) to yellowish brown (10YR5/6), bedded (sharp contacts) Smear summary Nannos 50-80% Rads 20-50% Diatoms trace Microfossil group Preservation Abundance Foraminifera Moderate to good Calcareous Poor to common to abundant Radiolaria Poor to common moderate Comments: Some reworked older nannofossils and some contamination (downworking) noted in radiolarians from section 5 and catcher.	% CaCO3 0 50 100 1 1 1
		S. dist						

SITE 69A Core 3A Cored interval: 79-88 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	Cat 0 5	% CO ₃ 60 10
UPPER OLIGOCENE	P. 21	Sphenolithus distentus	Theocyrtis amosa		1 2 3 4 5 6	Unopened	Nanno ooze white with yellowish brown (10YR5/6) patches bedded <u>Smear summary</u> Nannos 80-95% Rads 5-20% Diatoms trace <u>Microfossil group Preservation Abundance</u> Foraminifera Moderate Calcareous Moderate to nannoplankton poor Radiolaria Moderate Comments: Some reworked older nannofossils. Bome diatoms present.		

SITE 69A Core 4A Cored interval: 89-98 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	Cat 0 5	% CO₃ 50 100
R OLIGOCENE	21 FORAMS	lithus distentus	cyrtis amosa RADS	WETERS	2 3 3 4		LITHOLOGIC DESCRIPTION disturbed by drilling. Nanno ooze. White (N8) Smear summary Nannos 90% Rads 10% Microfossil group Preservation Froaminifera Moderate Calcareous Moderate Abundant		
UPPI		? Sphen	The	6 7 8 8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	6	Unopened	nannoplankton Radiolaria Moderate Common Comments: Some diatoms present. 106.65 to 106.86m - no core.		

SITE 69A Core 5A Cored interval: 98-107 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITH	OLOGIC DESCRIPTIO	N	9 CaC 0 5	6 CO ₃ 0 10
UPPER OLIGOCENE	p. 21	Sphenolithus predisentus	Theoerytis amosa		1 2 3 4 5 6		Sections 3, 4 and fluids. <u>Nanno ooze</u> . White plastic and stiff 1 <u>Smear summary</u> Nannos 85-90% Rads 10-15% <u>Microfossil group</u> Foraminifera Calcareous nannoplankton Radiolaria	5 badly disturb to yellowish br beds. <u>Preservation</u> Moderate Moderate Poor to moderate	ed by drilling own (10YR5/6) Abundance Few Common to abundant Few to common		
										harl	1111

SITE 69A Core 6A Cored interval: 107-116 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	9 CaC 0 5	6 20 ₃ 0 100
U. OLIG.		tentus				Void	Liner collapsed,core badly disturbed,poor recovery.		
		Sphenolithus predis		2 3 4 1 1	1		1.28 m of <u>Nanno Ooze</u> near the middle of the barrel; white (N8) - badly disturbed. <u>Smear summary</u> Nannos 90% Rads 10%		1 1 1 1
LOWER OLIGOCENE	? P.20		Theocyrtis tuberosa	5 6 7		Void	Microfossil groupPreservationAbundanceForaminiferaModerateFewCalcareous nannoplanktonModerateAbundantRadiolariaModerateCommonComments:Scant admixed Eocene Radiolaria common diatoms present.133.2 to 134.8m.Nanno ooze, white, stiff, undisturbed.Nanno ooze, white, stiff,		
	+ P. 18 to P20	Discoaster tani ornatus		8	2		134.2 to 135.0m. <u>Nanno ooze</u> ,white, stiff, undisturbed.		

SITE 69A Core 7A Cored interval: 126-135 m



Nanno Rad Ooze 1 2 2 2 3 3 Void 4 3 Void 4 3 Void 4 5 6 7 6 6 6 6 6 6 7 6 7 6 7 6 7 7 7 7 7 7 7 7 7 7 7 7 8 9 9 9 9 9 9 10 10 10 10 10 10 <	AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	Cat 0 5	% CO ₃ 50 10
	LOWER OLIGOCENE	P. 18 to P. 20	Discoaster tani orantus	Theocrytis tuberosa		1 2 3 4 5 6	Void	Nanno Rad Ooze mostly white (N8) with beds of very pale brown (10YR8/2) bedding stiff, "bready" texture below Section 2. Smear summary Nannos 50-75% Rads 25-50% Microfossil group Preservation Abundance Foraminifera Moderate Moderate Common calcareous Moderate Common Radiolaria Moderate Common Radiolaria Moderate Common Radiolaria Moderate Common		

SITE 69A Core 8A Cored interval: 135-144 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	9 Ca() 5	% CO ₃
UPPER EOCENE	Eocene undifferentiated	(absent)	Theosyrtis bromia		1 2 3 4 5		Rad Ooze Yellowish brown (10YR5/6) to dark brown (10YR4/4) Lightely mottled (orange) bedding "bready" texture occasional more plastic beds Smear summary Rads 99-100% Diatoms trace Sponge spicules trace No core below 151.5m Microfossil group Preservation Abundance Foraminifera Agglutinated benthonic forms only Calcareous Absent Radiolaria Moderate Abundant Comments: Some reworking of Middle Eocene Radiolaria and contamination (down- working) of younger nanofossils.		

SITE 69A Core 9A Cored interval: 144-153 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	Cat 0 5	% CO3
UPPER EOCENE	Eocene undiffeentiated	(absent)	Theocyrtis bromia		1 2 3 4 5 6		Fragments of caved Nanno ooze. Rad ooze Dark brown (10YR4/4) lightly mottled bedding "bready" texture stiff and more plastic beds Smear summary Rads 99-100% Diatoms trace Sponge spicules trace Sponge spicules trace Foraminifera Agglutinated benthonic forms only Calcareous nannoplankton Absent Radiolaria Moderate Abundant Comments: Some reworked Middle Eocene Radiolaria		
							vounger nannofossils.	im	1111



		_	17.70	· ·		oorea	HOCT VALLE LIT LED III			
AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTIO	N	Cat 0 5	% CO ₃ 50 10
MIDDLE EOCENE	(absent)	(absent)	Iftyrsocyrtis triacantha		1 2 3 4 5 6		Rad ooze dark brown (10YR4/4) light to heavy mottles bedding "bready" texture stiff and more plastic beds Smear summary Rads 99-100% Diatoms trace Sponge Spicules trace Microfossil group Preservation Foraminifera Calcareous nannoplankton Radiolaria Moderate Comments: Some contamination (down younger nannofossils.	Abundance Absent Absent Common to abundant nworking) of		
					- 1				huu	1111

SITE 69A Core 11A Cored interval: 214-223 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	Cat 0 5	% CO ₃
MIDDLE EOCENE	(absent)	(absent)	Thyrsocyrtis triacantha	1 1 2 3 4 1	1	Void Void Void	Near the top of the barrel 2 layers (31 and 32cm) of <u>Rad ooze</u> (99 to 100% rads), dark brown (10YR4/3), with fragments of caved <u>Nanno Ooze</u> Barrel 12 may be entirely caved ! Barrel 12 may be entirely caved ! <u>Abundance</u> Foraminifera Calcareous nannoplankton <u>Absent</u>		
						Void	Radiolaria Moderate Common to abundant Comments: Some contamination (downworking) of younger nannofossils.		
	ā.			7		No recovery	←Core 69A-12 was stopped at 229.7 m by a hard Tayer.		
							Core 69A-13: No recovery. Total drilling 231 m in Cherts and soft Marls.		1111

SITE 69A Core 12A (223-229.7 m) and 13A (229.7-231 m)



Site 69, Core 2, Sections 3-6.



Site 69, Core 3, Sections 1-5.



Site 69, Core 4, Sections 1-6.



Site 69, Core 5, Sections 1-6.

SECTION	1	2	3	4	5	6
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Site 69, Core 6, Sections 1-6.



Site 69A, Core 1, Sections 1-6.

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Site 69A, Core 2, Sections 1-6.



Site 69A, Core 3, Sections 1-6.



Site 69A, Core 4, Sections 1, 2, 5, 6.





Site 69A, Core 5, Sections 1-4, 6.

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Site 69A, Core 6, Sections 1, 2, 6.



Site 69A. Core 8, Sections 1-6.



Site 69A, Core 9, Sections 1-5.



Site 69A, Core 10, Sections 1-6. 132


Site 69A, Core 11, Sections 1-6.



