## 6. SITE 71

#### Shipboard Scientific Party<sup>1</sup>

# SITE DATA

Occupied: November 2-November 10. Position: Latitude 04° 28.28'N. Longitude 140° 18.91'W.

Water Depth: 4419 meters.

Total Depth: 558 meters in Eocene chert.

Holes Drilled: Three holes (including heat flow hole).

Cores Taken: Fifty-two cores. Continuous 0 to 436 meters, spot cores at 472 meters, 528 meters, 553 to 558 meters.

#### RESULTS

Continuous core from the surface to 436 meters provides an excellent record of the stratigraphic succession from Quaternary into upper Oligocene sediments. In redrill Hole 71A, using a heavier bit, lower cores were taken in lower Oligocene chalky limestones; and probable upper Eocene siliceous limestone and calcareous chert.

#### BACKGROUND

Site 71 is located about 50 miles south of the southern boundary of the Clipperton Fracture Zone near 140°W. It is one of the sites along the N-S line drilled during Leg 8 to investigate the east-west trending accumulation of sediments centered about 2°N near 140°W, and lies about 120 miles south of Site 70 and 260 miles north of Site 72. Site 71 and Site 70, immediately north of the fracture zone, were chosen by the JOIDES Pacific Advisory Panel (PAP Sites 25 and 24) in order to compare the stratigraphy of the sediments and the age and nature of the basement on either side of the fracture zone. The SCAN survey established that the area was one of gently undulating topography with an occasional hill protruding up to 600 meters above the sea floor. Except for the larger hills, acoustic basement showed small scale relief (0.05 to 0.10 second peak to trough, 2 to 4 miles across) smoothing out upward through 0.50 to 0.65 seconds of overlying sediment. The overlying sediments were found to be nearly transparent; acoustic basement was interpreted as either 'true' basement or more opaque sediments. The proposed drilling site (04° 27.6'N, 140° 14.8'W) was over a northwest trending zone of relatively smooth acoustic basement. A piston core taken at the proposed site recovered 9.9 meters of calcareous-siliceous ooze, Quaternary at top and Middle to Upper Pliocene at the bottom.

The *Challenger* survey data are in agreement with the SCAN results. However, under the assumption that smooth acoustic basement might be a cherty horizon and that the 'hills' in the acoustic basement might be true basaltic basement, an attempt was made to drill on a basement high. This attempt was unsuccessful and Site 71 is located near the base of a 0.10 second bump in the basement (Figure 1 and Figure 10, Chapter 2).

At Site 71 the prominent reflectors are at 0.050, 0.185, 0.375 and 0.595 seconds. The upper reflector (0.050 second) correlates with the bottom of a cyclic unit of alternating siliceous and calcareous ooze at 43 meters and the 0.185 second reflector correlates with a cherty horizon and general increase in resistance to drilling that occurs near 160 meters (Figures 6, 7 and 8, Chapter 2). The 'basement' reflector (0.595 second) correlates with the top of a thick section of semi-indurated chalk, capped by a 3-centimeter chert layer at 470 meters near the bottom of Hole 71.

Geothermal heat flow measurements attempted at Site 71 indicate a value somewhat greater than 1.0 HFU (10<sup>-6</sup> cal cm<sup>-2</sup> sec<sup>-1</sup>) and are discussed in detail in Chapter 18. A measurement during the SCAN survey at the proposed site gave 1.55 HFU; values lower than 1.0 HFU were found in the vicinity by other investigators.

A topographic map of the vicinity of Site 71, airgun records, and further site information are given in Chapter 25.

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Figure 1. Airgun record across Site 71 and interpretation.

# **OPERATIONS**

Hole 71 was cored continuously from the sea floor to a depth of 436 meters with excellent recovery, except for some of the cores taken in Miocene and Oligocene nannofossil ooze, which were "soupy" and much disturbed. Below about 160 meters the ooze was stiffer and the pump was used occasionally during coring.

Below 436 meters it was decided to drill ahead, coring every 30 to 50 meters. A core of thin chert overlying 2 meters of Oligocene chalk was recovered from 472 meters, but another hard layer a little lower could not be penetrated after several hours drilling. The drill string then was pulled in order to replace the bit. A successful Welex log was run on pulling out of the first hole. Hole 71A was drilled through the hard layers to

	Core No.	Interval Below Seafloor (meters)	Cored (m)	Recovered (m)	Comments
Hole 71	1	0-9	9.1	9.1	
	2	9-18	9.1	7.0	Seven foot loss assigned to top of core
	3	18-27	9.1	9.1	
	4	27-34	6.1	6.1	20 feet cored; 30 feet re- covered; "gain" distributed
	5	34-43	9.1	9.1	
	6	43-52	9.1	9.1	
	7	52-61	9.1	9.1	
	8	61-69	9.1	7.6	5 foot loss at bottom of core
	9	70-79	9.1	9.1	
	10	79-88	9.1	9.1	
	11	89-98	9.1	9.1	
	12	98-107	9.1	9.1	
	13	107-116	9.1	9.1	
	14	116-125	9.1	9.1	
	15	125-134	9.1	9.1	
	16	134-143	9.1	1.5	Loss at top
	17	143-152	9.1	9.1	
	18	152-161	9.1	9.1	
	19	161-170	9.1	9.1	
	20	170-179	9.1	9.1	
	21	179-188	9.1	9.1	
	22	189-198	9.1	8.8	
	23	198-207	9.1	9.1	
	24	207-216	9.1	9.1	
	25	216-225	9.1	7.6	
	26	225-234	9.1	8.2	
	27	235-244	9.1	0.9	One meter recovered, core probably near bottom
	28	244-253	9.1	9.1	
	29	253-262	9.1	8.8	
	30	262-271	9.1	9.1	
	31	271-280	9.1	7.9	Loss probably at top
	32	280-289	9.1	9.1	
	33	290-299	9.1	3.0	Core mostly liquid
	34	299-308	9.1	8.8	
	35	308-317	9.1	9.1	
	36	317-326	9.1	9.1	

	TABLE 1
Summary	of Coring at Site 71

	Core No.	Interval Below Seafloor (meters)	Cored (m)	Recovered (m)	Comments
Hole 71 – 6	Continued				
	37	326-335	9.1	6.1	
	38	336-345	9.1	9.1	
	39	345-354	9.1	1.8	Very poor core at bottom of barrel
	40	354-363	9.1	9.1	
	41	363-372	9.1	1.5	Very poor core recovery assigned to bottom
	42	372-381	9.1	9.1	
	43	381-390	9.1	3.1	Loss probably at top
	44	390-399	9.1	9.1	
	45	399-408	9.1	3.1	Loss probably at bottom
	46	408-417	9.1	8.8	
	47	418-427	9.1	6.1	
	48	427-436	9.1	3.4	
		436-468			Drilled down to hard layer
	49	472-474	6.1	2.1	
		474-475			Drilled
					Core attempted at 16,091 feet; no recovery, no pene- tration
Total	49	475	442.0	369.1	84% recovery
Hole 71A	1	528-537	9.1	1.1	
	2	553-555	1.8	1.8	
	3		2.7	2.7	
	4	555-558			
Total		558	13.7	5.7	41% recovery

528 meters, where a core of Oligocene chalky limestone was recovered, and two more cores were taken in limestone and chert of probable upper Eocene age, from 553 to 558 meters. The hole was terminated because of time. Penetration in the limestone and chert ranged from 0.3 meter to 0.6 meter per hour.

A third hole, Hole 71B, was drilled as a heat probe hole. Measurements were made at 30, 100, and 250 meters (see Von Herzen and others in Part III, this volume).

## LITHOLOGY AND STRATIGRAPHY

Three sedimentary formations are present at Site 71: the Clipperton Oceanic Formation (0 to 188 meters) consisting of a cyclic unit (0 to 43 meters) of alternating calcareous and siliceous ooze, and a varicolored unit (43 to 188 meters) of calcareous ooze; the Marquesas Oceanic Formation (188 to 545 meters) consisting of grayish calcareous ooze; and the Line Islands Oceanic Formation (545 to 558 meters) of silicified limestone with chert intergrowths.

## **Clipperton Oceanic Formation**

The Clipperton Oceanic Formation is composed of two units at Site 71. The upper cyclic unit consists of calcareous oozes alternating with more siliceous oozes from the sea floor to a depth of 43 meters. The contacts between the two lithologies are usually sharp and marked by color changes. Individual lightercolored layers typically exhibit sharp basal contacts and grade upward through mottled zones into darkercolored layers. Although the compositional changes are not as great as in the cyclic unit of the Clipperton Oceanic Formation at Sites 69 and 70, they are distinguishable. Individual beds are of the order of 5 to 20 centimeters in thickness. Much of the bedding, however, has been badly disturbed during coring due, in part, to the plasticity of the sediment. The more calcareous beds are radiolarian-nannofossil oozes (50 to 90 per cent calcareous nannoplankton, 10 to 50 per cent Radiolaria) and are white to very light brown. The more siliceous beds are nannofossil-radiolarian oozes (50 to 70 per cent Radiolaria, 30 to 50 per cent calcareous nannoplankton) and are various shades of brown. In general the darker brown the color the lower the carbonate content.

The cyclic unit is Quaternary, Pliocene and late Miocene in age. The contact of the cyclic unit with the underlying varicolored unit is sharp and is placed at the top of the uppermost pastel-hued bed.

The varicolored unit of the Clipperton Formation (43 to 188 meters) is distinguished mainly by its pastel colors. Compositionally it is mostly radiolariannannofossil ooze as are the lighter-colored beds of the overlying cyclic unit and the light grayish beds of the underlying Marquesas Formation. Most of the varicolored unit is composed predominantly of calcareous nannoplankton (75 per cent) with Radiolaria (25 per cent). No compositional differences were noted among the various colored beds making up the unit. The 150 to 180 meter interval contains more foraminifera than the rest and has an average composition of 65 per cent calcareous nannoplankton, 20 per cent foraminifera, and 15 per cent Radiolaria. The varicolored unit is characterized by pastel hues of bluish and greenish white and in the upper part of the unit (43 to 68 meters), of purple. This varicolored nature of the unit is more pronounced in the upper portion than in the lower portion resulting in a gradational contact with the underlying Marquesas Formation. The varicolored unit is Miocene in age, most of it being middle Miocene.

#### Marquesas Oceanic Formation

The Marquesas Oceanic Formation at Site 71 from 188 to 545 meters is a relatively homogeneous highly calcareous (mostly 80 to 90 per cent) nannoplankton ooze, bluish white to very light gray in color. Radiolaria, foraminifera, and diatoms are locally important constituents. The formation appears structureless except for the presence of gray streaks and diffuse layers. The Marquesas Oceanic Formation is more indurated and less disturbed by coring than the overlying Clipperton Oceanic Formation. Induration gradually increases downward from a depth of about 207 meters, apparently due to diagenetic overgrowths of secondary calcium carbonate (CaCO<sub>3</sub>) particularly on discoasters. A 3-centimeter thick zone of greenishgray volcanic ash occurs at a depth of 433.5 meters and a 3-centimeter thick fragment of dark gray chert occurs at 470 meters. Both are within highly calcareous, semi-indurated oozes of late Oligocene age.

Most of the section below 436 meters was drilled rather than cored, thus details concerning the sequence are lacking. However, from the nature of the drilling and of the recovered core, we infer that the Oligocene interval is mainly semi-indurated ooze (chalk) similar to that in the Marquesas at Site 70 between 177 and 324 meters. Several harder layers in the uncored interval that took longer to penetrate may represent thin chert stringers within the Marquesas.

The basal contact of the Marquesas Oceanic Formation lies in the uncored interval between 537 and 553 meters and is tentatively placed at 545 meters. The Marquesas is early Miocene and Oligocene in age.

#### Line Islands Oceanic Formation

The Line Islands Oceanic Formation at Site 71 is composed of an upper Eocene chert-silicified limestone association cored from 553 meters to the bottom of the hole at 558 meters.

Chert (see Chapter 16) occurs as dark olive-gray anastomizing intergrowths and small "whisks" within white silicified limestone. The chert is subordinate to limestone and the intergrowths range in dimension from several centimeters down to fractions of a millimeter. Along with the olive gray chert, a small amount of intergrown vitreous yellowish-brown chert is occasionally present.

In thin section, ghosts of foraminifera and siliceous microfossils are evident, both in the silicified limestone and the chert. The olive gray chert contains many fossil ghosts, ranging in composition from unreplaced calcium carbonate ( $CaCO_3$ ) to total replacement by cristobalite. The yellowish-brown vitreous chert consists of a cryptocrystalline mosaic of quartz. In this type of chert fossil ghosts are rare, due to obliteration by recrystallization.

The silicified limestone exhibits bedding laminae in places, generally less than one millimeter thick. Minute dragfolding of the laminae is seen along slip planes or microfaults that cut the laminae at moderate angles. These microstructures formed before the silicification of the limestone. Burrow structures are numerous, imparting a hieroglyphic appearance. The hole terminated at 558 meters in what appears to be an increasingly cherty sequence.

Figure 6 is a plot of age versus depth, based on the biostratigraphic zonations of the foraminifera, nannoplankton, and Radiolaria, with the time scale, in millions of years, based on that of Berggren (1969).

#### PHYSICAL PROPERTIES

Porosities range from less than 40 to about 85 per cent and velocities range between about 1.49 and 1.68 km/sec. In Figure 2 it can be seen that most of the sediment sampled is highly calcareous and that the velocity-porosity data fall near and above the theoretical curve for a grain-matrix density of 2.65 g/cm<sup>3</sup>. In general, sonic velocity and impedance increase, and porosity and penetrability decrease, monitonically with depth (Figures 6, 7 and 8, Chapter 2). Sonic velocity first exceeds that for sea water at a depth of about 100 meters.

Velocities and densities were determined for several pieces of limestone, cherty limestone, chert and chalk (Chapter 2). The highest velocity measured from this site, 6.10 km/sec, was for a chert of density 2.55 g/cm<sup>3</sup>. Another sample, a cherty limestone, measured 6.03 km/sec and 2.38 g/cm<sup>3</sup>.

Maximum natural gamma radiation of about 1250 counts was measured for the very top of the sedimentary section. Activity drops off with depth to a low level and remains low until it increases again near the bottom of the section within the Line Islands Oceanic Formation.

Thermal conductivities measured for this site are given in Chapter 18.

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

#### PALEONTOLOGY

## Foraminifera

Of the two holes drilled at this Site, Hole 71 (with 49 cores) reached a depth of 475 meters. In Hole 71A, deeper penetration was achieved down to 558 meters, and three spot cores were recovered in the Lower Oligocene and Eocene. The 48 continuous cores of Hole 71 have furnished a nearly complete section from the Quaternary down to the Oligocene (*Globorotalia opima opima* Zone, P. 21). The planktonic foraminifera are richer than in Site 70 and permit a fairly reliable and continuous zonation. The Quaternary and Pliocene are relatively thin, but there is an excellent, thick Miocene section. The Oligocene and Eocene were not continuously cored. They appear to be similar in



Figure 2. Sonic velocity versus porosity of unlithified sediments from Site 71 for two ranges of calcium carbonate content. No measured samples contained less than 35 per cent calcium carbonate. Theoretical curves are based on the equation of Wood (1941). Upper curve, grain matrix density 2.2 g/cm<sup>3</sup>, appropriate for siliceous ooze. Lower curve, grainmatrix density 2.65 g/cm<sup>3</sup>, appropriate for calcareous ooze.

thickness to Site 70, but slightly more calcareous. In the Oligocene and Eocene, the rocks become progressively harder, and in the three cores of Hole 71A we find many compressed specimens of planktonic foraminifera, indicating that the sediment has been affected by compaction. Although the foraminiferal assemblages of Site 71 are often fairly rich, they are highly variable in preservation, number of specimens, and species diversity. The typically thin-walled genera (*Candeina*, *Globigerinita*) are practically absent. Small-sized specimens are often missing, and there is a remarkable scarcity of *Globigerinoides* and *Orbulina* throughout the section. These observations indicate that calcium carbonate solution is a main controlling factor. Although the benthonic foraminifera form a lesser percentage of the faunas than in Sites 69 and 70, they are richer in species, particularly of the genera *Dorothia* and *Cibicides*.

Quaternary faunas are found down to Section 71-1-5 (depth 8 meters). The upper Quaternary appears to be much reduced in thickness, since the coiling change from random to dextral in *Pulleniatina* spp., which normally occurs about in the middle of the Pleistocene, is found here only about 150 centimeters below the sea floor (bottom of Section 1 of Core 1). The major constituents of the Quaternary faunas are *Globorotalia tumida*, *Pulleniatina* spp., *Sphaeroidinella dehiscens* and *Globigerina dutertrei*.

The Pliocene was recognized from the core catcher sample of Core 1 to the bottom of Core 2 (8 to 18 meters). Possibly the three zones N. 21, N. 20 and N. 19 are all present. *Globorotalia tosaensis* occurs in the core catcher sample of Core 1 (its presence at the bottom of Core 2 is probably due to contamination). The earliest *Globorotalia pseudopima*, indicating the base of N. 20, is found in Section 71-2-2. A little below this, in Section 71-2-4, the highest Sphaeroidinellopsis seminulina and S. paenedehiscens are recorded.

The uppermost Miocene unit, N. 18, characterized by the concurrence of *Sphaeroidinellopsis* spp. and *Globorotalia tumida* (without *Sphaeroidinella*), extends from 71-3-1 to 71-4-2 (18 to 30 meters). The next lower unit, N. 16-17, extends to 71-7-1 (53 meters), where the earliest *Globorotalia acostaensis* appears. *Globorotalia* cf. *plesiotumida* is found down to Section 71-6-3. The interval from 71-7-2 to the bottom of 71-8 (53 to 70 meters) is assigned to the *Globorotalia menardii* Zone (N. 15).

In the Upper Miocene, the foraminifera are usually clearly outnumbered by the Radiolaria, but in the Middle Miocene there is a gradual downward increase of the calcareous microfauna until Core 21. The *Globorotalia mayeri* Zone includes the whole of Core 9 (70 to 79 meters). Below a short poorly defined interval (N. 13?) in the upper part of Core 10, the sample at 71-10-5 shows the youngest representatives of the *Globorotalia fohsi* lineage. The successive zone boundaries are located as follows:

Base of *Globorotalia foshi robusta* Zone: Section 71-12-1 (depth 99 meters).

Base of G. f. lobata Zone (approximate base N. 12) at 71-13-5 (115 meters).

Base of G. f. praefohsi Zone (N. 11): core catcher sample of 71-15 (134 meters).

Base of G. f. peripheroacuta Zone (N. 10) at 71-17-2 (146 meters).

Base of G. f. peripheroronda Zone (N. 9), as indicated by the earliest Orbulina suturalis, at 71-19-1 (162 meters).

Base of N. 8 (earliest *Globigerinoides sicanus*) at 71-22-6 (198 meters).

The general scarcity of *Orbulina* and *Globigerinoides* at Site 71 has already been mentioned; it is therefore possible that the base of N. 8 and of N. 9 were placed a little too high. In Cores 23 to 25, whose age is most probably N. 7, there is again a temporary increase in the frequency of the Radiolaria.

The highest Catapsydrax dissimilis, which marks the top of N. 5-6 (combined Catapsydrax dissimilis and C. stainforthi Zones), is found at the top of Core 26 (depth 225 meters). The Globorotalia kugleri Zone (N. 4) is recognized in Cores 31 to 38 (272 to 345 meters). The earliest Globigerinoides primordius was seen in the core catcher sample of Core 36. Cores 39 and 40 are predominantly siliceous and may be either Globorotalia kugleri Zone or Globigerina ciperoensis ciperoensis Zone. Within Core 41, the samples become again more calcareous and can be placed with more confidence in the G. ciperoensis ciperoensis Zone (P. 22). The top of the Globorotalia opima opima Zone (P. 21) coincides with the top of Core 46 (at 409 meters). This Zone extends as far down as the spot core 49 (474 meters) and most probably into the uncored interval below.

The Lower Oligocene *Pseudohastigerina/Cassigerinella* chipolensis Zone (P. 18-19) is represented in the spot core 71A-1 (535 to 537 meters). Cores 71A-2 and 71A-3 can be tentatively determined as Upper to upper Middle Eocene (P. 13 or younger) because of the presence of *Catapsydrax dissimilis, Globigerina linaperta* and *Alabamina dissonata*.

C	SDP	Leg 8	Site 71				ira															cens	~	
DEPTH in meters	BARREL No.	D FORAMINIFERA 50 percentage of total fauna in > 80 mesh fraction	-1:10 -1 FORAMINIFERA -10 planktonic/benthonic -100 ratio	strong SOLUTION EFFECTS weak	Globigerina nepenthes	Globigerinoides fistulosus	Globoquadrina altispira altisp	Globorotalia acostaensis	Globorotalia fohsi robusta	Globorotalia humerosa	Globorotalia mayeri	s Globorotalia cf. plesiotumide	Globorotalia pseudopima	Globorotalia tosaensis	Globorotalia truncatulinoides	s Globorotalia tumida d	Pulleniatina finalis	s Pulleniatina obliqueloculata d	s Pulleniatina primalis d	Sphaeroidinella dehiscens	Sphaeroidinellopsis seminuline	Sphaeroidinellopsis paenedehis	BIOSTRATIGRAPH	AGE
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Figure 3. Foraminifera of Site 71. Frequency distribution, ranges of important species, and biostratigraphy.

D	SDP	Leg 8 Sit	e 71 (cont.)						:=		acuta	ronda					na	۲۲	
S DEPTH in meters	BARREL No.	<ul> <li>PORAMINIFERA</li> <li>FORAMINIFERA</li> <li>percentage of total</li> <li>fauna in &gt; 80 mesh</li> <li>fraction</li> </ul>	-1:10 FORAMINIFERA -1 FORAMINIFERA -10 planktonic/benthonic -100 ratio	strong SOLUTION EFFECTS	Clavatorella bermudezi	Globigerinatella ? sp.	Globigerinoides sicanus	Globigerinoides transitorius	Globorotalia archaeomenard	Globorotalia fohsi lobata	Globorotalia fohsi periphero	Globorotalia fohsi periphero	Globorotalia fohsi praefohsi	Globorotalia mayeri	Orbulina spp.	Praeorbulina glomerosa	Sphaeroidinellopsis seminuli	BIOSTRATIGRAPH	A G E
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DEPTH in meters	BARREL No.	- 0 FORAMINIFERA -50 percentage of total fauna in > 80 mesh fraction	–1:10 FORAMINIFERA 1 FORAMINIFERA 10 planktonic/benthonic 1000 ratio	strong SOLUTION EFFECTS	Catapsydrax dissimilis	Globigerinoides primordius	Globoquadrina praedehiscens	Globorotalia fohsi peripheror	Globorotalia kugleri	Globorotalia mayeri	Sphaeroidinellopsis seminulin	BIOSTRATIGRAP	AGE
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DEPTH in meters	BARREL No.	<ul> <li>PORAMINIFERA</li> <li>FORAMINIFERA</li> <li>50 percentage of total</li> <li>50 fauna in &gt; 80 mesh</li> <li>fraction</li> </ul>	-1:10 FORAMINIFERA -10 FORAMINIFERA -100 planktonic/benthonic -1000	strong weak SOLUTION EFFECTS	Catapsydrax dissimilis	Globigerinoides primordius	Globorotalia brevispira	Globorotalia kugleri	Globorotalia mayeri	Globorotalia pseudokugleri	BIOSTRATIGRAPH	AGE
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Figure 3. Continued.

D	SDP	Leg 8 Site	71 (cont.)									>	
DEPTH in meters	BARREL No.	D FORAMINIFERA 50 percentage of total fauna in > 80 mesh fraction 100	-1:10 -1 FORAMINIFERA -10 planktonic/benthonic -100 ratio	strong solution EFFECTS	Cassigerinella chipolensis	Catapsydrax dissimilis	Chiloguembelina cubensis	Globigerina prasaepis	Globorotalia brevispira	Globorotalia mayeri	Globorotalia opima opima	BIOSTRATIGRAPH	A G E
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					?	i	i	i					

Figure 3. Continued.

	DSDP	Leg 8 Site	71 (cont.)								sis		
DEPTH in meters	BARREL No.	<ul> <li>6 FORAMINIFERA</li> <li>FORAMINIFERA</li> <li>Forentage of total</li> <li>50 fauna in &gt; 80 mesh</li> <li>fraction</li> <li>100</li> </ul>	-1:10 FORAMINIFERA 1 planktonic/benthonic -10 planktonic/benthonic -100 ratio	strong SOLUTION EFFECTS weak	Catapsydrax dissimilis	Chiloguembelina cubensis	Globigerina ampliapertura	Globigerina linaperta	Globigerina prasaepis	Globorotalia gemma	Pseudohastigerina barbadoen	BIOSTRATIGRAPHY	AGE
	A 1						1				?	P.19 to P.18	Lower OLIGOCENE
	A 2 A 3			?				-1	?	?	     	P.13 or younger	MidUp. EOCENE

Figure 3. Continued.



Figure 4. Calcareous nannoplankton of Site 71. Distribution and biostratigraphy.





Figure 5. Radiolaria at Site 71. Frequency, distribution and biostratigraphy.



Figure 5. Continued.

Figure 5. Continued.

SI	FE 71																		
RARE																			
FEW																			
соммо	N																		
ABUND	ANT	-		р,	s	ntensis	ta	lerus	tata	cipata	ħ		uta	pera	iis	5	es.	icus	
OMMENTS	1. 81a	512		is ala	iconu	lelmo	costa	immi	s den	is for	volf	olina	com	tetra	virgir	bariu	m bip	smat	
D - Suspect	ted dow	wn-working		unds	us lat	nys c	etta	om si	spyri	adds	( sila	us vic	osella	sella	letta	us m	nino.	us pri	
during	urning	8		rcado	marti	choco	ocyc	marti	rcado	reade	choce	mart	rtoca	tocal	locyc	mart	out	mart	IS
R – Suspec older n	ted rew nicrofo	vorked ssils	ONE	Do	Can	Sti	Cal	Can	$D_{0}$	Do	Sti	Cai	Cŷi	Cyn	Ca	Can	Lye	Can	MMEN
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/1 19	1	01-05						ļ	Т		Т		T.						
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19	cc		s alati																R
20	2	76-78	spyri								Т								R
20	4	81-83	orcado.			I							1						R
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21	6	81-83										1	T	•		1			
21	cc					t				1				Т					D
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22	cc		21a					L						L	Ī	Ì			
23	3	81-83	ta cost						I				I	Ī					
23	cc		ycleti					-		I		Ι						I	
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24	6	81-83										Ι							R
24	cc		5														1.751		
25	3	81-83	C. virgini:					T	1							L			R

Figure 5. Continued.

FEW COMMON ABUNDA!	ат		rcipata	n		nuta	apera	nis	nplex	S	pes	ticus	ta	uchus	teforcipata	ontensis	
D - Suspected	down-working		yris fo	tow su	violina	sella co	ella tet	tta virgi	yris sin	tubariı	nium b	prisma	a robus	yris at	yris pr	vs delm	
during dri	lling		cados	hocor	nartus	tocap	tocaps	cycle	cadosi	nartus	hnoca	nartus	cylett	cados	cados	hocor	2
R – Suspected older mic	ofossils	E	Dor	Stic	Can	Cyn	Cyr	Calc	Dor	Can	Lyc	Can	Calc	Dor	Dor	Stic	MEN
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Figure 5. Continued.

Figure 5. Continued.

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UNCORED INTERVAL	11111.		rosa	acilis	quadrip	ravida	lopnəsa	mnstum	triceros	totelis	Jacchia	ırbaden	ngolfiei	tbylonis	turris	omia	
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D – Suspected down during drilling	n-working		cyrtis	phori	adost	robot	adosp	ocych	adosp	cycli	ocyri	nona	camp	ochyt	ldopa	socyr	s
R - Suspected rewo	orked		Theo	Arto	Dorc	Cent	Dorc	Litho	Dorc	Lithe	Loph	Arto	Theo	Sethu	Cycl	Thyn	IENT
older microfoss	iils	ONE	1.5859														MMO
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2 1 2 2 2 cc 3 1 3 1 3 1 3 1 3 2	21-22 1-2 107-108 108-109 61-62	Thyrsocyrtis bromia						uxu									C T T

Figure 5. Continued.





Figure 6. Age versus depth at Site 71, based on the biostratigraphic zonations of the foraminifera, calcareous nannoplankton and Radiolaria. Ages based on the time scale of Berggren (1969).

Species	Occurrences (Hole/Core Nos.)
Calcareous Nannoplankton	
Catinaster coalitus Martini and Bramlette	71/9, 10
Ceratolithus cristatus Kamptner	71/1-3
C. rugosus Bukry and Bramlette	71/1-3
C. tricorniculatus Gartner	71/2-5
Coccolithus bisectus (Hay, Mohler and Wade) as figured by Bramlette and Wilcoxon	71/42-49; 71A/1-3
Coronocyclus nitescens (Kamptner) Bramlette and Wilcoxon	71/12-22, 24-30, 47
Cyclococcolithus formosus Kamptner	71A/1-3
C. leptoporus (Murray and Blackman) Kamptner	71/1-8, 11-15
C. neogammation Bramlette and Wilcoxon	71/16-49
Discoaster adamanteus Bramlette and Wilcoxon	71/24-31, 33-39, 41-43, 46 47, 49
D. asymmetricus Gartner	71/2
D. barbadiensis Tan Sin Hok	71A/3
D. brouweri Tan Sin Hok	71/2-12
D. calcaris Gartner	71/4-10
D. challengeri Bramlette and Riedel	71/2-10
D. deflandrei Bramlette and Riedel	71/12, 13, 15-49
D. dilatus Hay	71/6, 7, 10, 11, 13, 14, 16, 24, 39, 49
D. druggii Bramlette and Wilcoxon	71/25-30, 35?
D. exilis Martini and Bramlette	71/2-4, 9-12, 14-24
D. extensus Hay	71/2, 3, 5-7, 9, 10, 13, 16
D. hamatus Martini and Bramlette	71/7-9
D. kugleri Martini and Bramlette	71/10
D. lautus Hay	71/10, 11, 13-15, 19, 22-27 29, 46-49
D. pentaradiatus Tan Sin Hok	71/2,3
D. perplexus Bramlette and Riedel	71/28-30, 33
D. quinqueramus Gartner	71/3-7
D. saipanensis Bramlette and Riedel	71A/3
D. surculus Martini and Bramlette	71/2-6
D. variabilis Martini and Bramlette	71/2-7,9
Discolithina rectipons Haq	71A/3
Gephyrocapsa oceanica Kamptner	71/1,2
Helicopontosphaera ampliaperta (Bramlette and Wilcoxon)	71/24, 25, 28, 29
H. euphratis (Haq) Martini	71/14-21, 33, 34
H. intermedia (Martini) Hay and Mohler	71/5,6,10-13,20,21,30-32

 TABLE 2

 Calcareous Nannoplankton and Silicoflagellate Occurrences in Holes 71 and 71A

Species	Occurrences (Hole/Core Nos.)
H. kamptneri Hay and Mohler	71/1, 4, 8, 10-16, 20, 21
H. recta (Haq) Martini	71/21,48
Micrantholithus cf. M. concinnus Bramlette and Sullivan	71A/3
Oolithotus antillarum (Cohen) Cohen and Reinhardt	71/1, 4, 8, 10-16, 20, 21
Pseudoemiliania lacunosa (Kamptner) Gartner	71/1
Scyphosphaera intermedia Deflandre	71/17
Sphenolithus belemnos Bramlette and Wilcoxon	71/25-27, 32-34, 36?, 40?, 41?
S. ciperoensis Bramlette and Wilcoxon	71/40, 42-44, 45?
S. distentus (Martini) Bramlette and Wilcoxon	71/47-49
S. heteromorphus Deflandre	71/15-26, 28, 30-41
S. moriformis (Bronnimann and Stradner) Bramlette and Wilcoxon	71/4, 6, 7, 9, 12, 23-49
S. predistentus Bramlette and Wilcoxon	71/45-49
Thoracosphaera cf. T. deflandrei Kamptner	71/12,39
Triquetrorhabdulus carinatus Martini	71/26-45
T. rugosus Bramlette and Wilcoxon	71/4-13
Silicoflagellates	
Corbisema tricantha (Ehrenberg) Hanna	71/12-31
Dictyocha fibula Ehrenberg	71/1-31
D. mutabilis Deflandre	71/1-37
D. crux Ehrenberg	71/1-35
Distephanus speculum (Ehrenberg) Haeckel	71/1-32
Mesocena circularis (Ehrenberg) Ehrenberg	71/3
M. elliptica (Ehrenberg) Ehrenberg	71/1
Naviculopsis navicula (Ehrenberg) Deflandre	71/3

TABLE 2 - Continued

## Calcareous Nannoplankton and Silicoflagellates

Calcareous nannoplankton are abundant in samples from Site 71. In the Oligocene part of the section, secondary recrystallization of the nannoplankton makes specific recognition difficult. Silicoflagellates are present sparsely throughout the Miocene but were absent in the Oligocene. Forty-eight species of nannoplankton and seven silicoflagellates were recognized in this material (Table 2).

This section provided the most complete biostratigraphic zonation during Leg 8. Eighteen nannoplankton zones were recognized.

Hole 71	
Core 1-1 to 1-3:	Gephyrocapsa oceanica Zone
Core 1-4 to 1-CC:	Pseudoemiliania lacunosa Zone
Core 2-1 to 2-4:	Discoaster brouweri Zone
Core 2-5 to 2-CC:	Discoaster pentaradiatus Zone
Core 3-1 to 3-2:	Ceratolithus rugosus Zone
Core 3-3 to 3-6:	Ceratolithus tricorniculatus Zone
Core 3-CC to 5-3:	Discoaster quinqueramus Zone
Core 5-4 to 7-5:	Discoaster calcaris Zone
Core 7-6 to 9-4:	Discoaster hamatus Zone

Core 9-5 to 10-2:	Catinaster coalitus Zone
Core 10-3 to 10-CC:	Discoaster kugleri Zone
Core 11-1 to 15-5:	Discoaster exilis Zone
Core 15-6 to 24-4:	Sphenolithus heteromorphus Zone
Core 24-5 to 28-3:	Sphenolithus belemnos and Helicopontosphaera amplia- perta Zone
Core 28-4 to 30-6:	Discoaster druggii Zone
Core 30-CC to 41-CC:	Triquetrorhabdulus carinatus Zone
Core 41-CC to 45-CC:	Sphenolithus ciperoensis Zone
Core 46-2 to 49-CC:	Sphenolithus distentus Zone
Hole 71A	
Core 1-1 to 1-CC:	Lower Oligocene
Core 2-1 to 3-CC:	Eocene

## Radiolaria

The Radiolaria are numerous and moderately wellpreserved in the Neogene sediments cored at this site. The Middle and Lower Miocene sediments are particularly thick at this location and show scant sign of reworked Radiolaria. This section should provide excellent material for more detailed stratigraphic studies. Above this part of the record, the Upper Miocene, Pliocene and Quaternary sections do contain reworked material as old as the Early Miocene. Below the Lower Miocene, the Upper Oligocene is thick, but, beginning in the lowermost Miocene (*Lychnocanium bipes* Zone) and continuing into the middle part of the Oligocene, the Radiolaria are not well preserved and the assemblages contain a small number of reworked Lower Oligocene microfossils. The Upper to Lower Oligocene and Lower Oligocene to Upper Eocene boundaries are probably located in the uncored intervals (474 to 528 meters and 537 to 553 meters, respectively). Core 71A-1 is within the middle part of the *Theocyrtis tuberosa* Zone.

Cores 71A-2 and 71A-3 contain a few, very poorly preserved Upper Eocene Radiolaria. Considering the fact that Eocene Radiolaria are generally more robust and resistant to solution than the Radiolaria of younger Tertiary epochs, it is not absolutely certain that finding sparse Eocene Radiolaria indicates an Eocene age for these cores. However, one species present in Cores 71A-1, -2, and 3, Theocyrtis tuberosa, is usually abundant in both the uppermost Eocene and Lower Oligocene. In the Lower Oligocene it has very pronounced knobby protuberances on its thorax; in the Eocene its thorax is comparatively smooth, marked primarily by longitudinal plicae. Because all specimens of T. tuberosa present in these cores are of the Eocene variety, it is concluded that these samples are probably from the Eocene. Because no specimens of Lower Eocene, Middle Eocene, or lower Upper Eocene Radiolaria are present, it is probably correct that Cores 71A-2 and -3 are no older than the latest Eocene. Based on the several species preserved in 71A-2 and -3, these cores are approximately correlative to the lower part of Core 70A-27 at the previous site.

#### REFERENCE

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

AGE	NATURAL GAMMA * 1.0 (Counts/7.6 cm/1.25 min) × 10 <sup>3</sup>	CORE NO.	METERS	LITHOL.	LITHOLOGIC DESCRIPTION	% CaCO <sub>3</sub> 0 50 100
MIOCENE PLIOCENE QUATERNARY	Here John wat have not	1 2 3 4 5	-		Mostly nanno rad ooze and rad nanno ooze. Interbedded in thin (5-10cm) layers of white and brown colors. Smear summary nannos 30-90% rads 5-70% forams in upper portion	
UPPER	المراجع الم	6 7 8	50			
		9 10 11			Rad nanno ooze. Bluish white to light greenish gray, occassionally purple.	
MIDDLE MIOCENE		12 13 14	1 1		CLIPPERTON OCEAN	
hun.		16 17 18			Foram nanno ooze to rad foram nanno	
DCENE	- No la Jones de la coltan	19 20 21			ooze. Bluish white. Smear summary $\begin{cases} nannos 60-70\% \\ rads \sim 15\% \\ forams \sim 20\% \end{cases}$ Rad nanno ooze, as above Gradational.	
LOWER MIC		22	-			



Physical Properties, Site 71, 0-200 Meters

AGE	NATURAL GAMMA * .0 (Counts/7.6 cm/1.25 min) 1 × 10 <sup>3</sup>	CORE NO.	METERS	LITHOL.	LITHOLOGIC DESCRIPTION	% CaCO3 0 50 10
1. J. J. J.		23 24 25 26	- 		<pre>A Rad nanno ooze - semi indurated, very light gray. More indurated from base barrel 23 to top barrel 26. Smear summary</pre>	
רסאבר איזראליער איזראליערער איז איזערערער איז איזערערער איז איזערערער איזערערערער איזערערערערערערערערערערערערע	27-	28 29 30 31 32 33 34 35 36			Foram nanno ooze, semi indurated in part. Bluish white. Traces of siliceous fossils. Smear summary Smear summary Smear summary	
UPPER OLIGOCENE		37 38 39 40 41 42 43 44			Nanno ooze to foram rad nanno ooze, semi indurated. Bluish white.	



AGE	NATURAL GAMMA * 1.0 (Counts/7.6 cm/1.25 min) × 10 <sup>3</sup>	CORE NO.	METERS	LITHOL.	LITHOLOGIC DESCRIPTION		% CaCC 0 50	D <sub>3</sub>
1	Links made by	45	-		Nanno ooze. Bluish white. semi- indurated.	+		4
OCENE		48	2	-AAAAAAAA	Ashy layer (3cm).			/
UPPER OLIG			450		Hard layer (driller).	ORMATION		
		<u>49</u>	-	<u>A* A *A * R</u>	Chert (3cm) in foram nanno ooze. Hard layer (driller).	SAS OCEANIC F		
			500		Hard layer (driller) 20 min. to penetrate.	MARQUE		
OLIGOCENE			-		Hard layer (driller).			
LOWER		1A==	-	· · · · ·	Nanno ooze. bluish white semi- indurated. Hard layer reported in barrel 14.	т		
		2A- 3A-	550		Silicified limestone with chert intergrowths. Limestone is greenish gray and mottled. Chert is light olive gray to yellowish brown.	ORMATION +		
PPER EOCENE					DS OCEANIC F(			
D			-			+ LINE ISLAN		



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	% CaCO <sub>3</sub> 0 50 10	0
QUATERNARY	N. 22- N. 23 FORA	doemiliaria lacunosa (dephyrocapsa oceanica NAN	Quaternary - undifferentiated RAI	LLEW     1     1     1     1     1       1     1     1     1     1     1     1       3     1     1     1     1     1     1       6     7     1     1     1     1       8     7     1     1     1     1	1 2 3 4		Nanno Ooze, Nanno Rad Ooze, Nanno Foram Ooze,         Section 6 has voids.         Section 6 has voids.         Nanno Ooze, Nanno Rad Ooze, Nanno Foram Ooze,         Rad Nanno Ooze, About sediment types interbedded         ed in thin (5-10cm) beds. Contrasting brown         (10YR5/3) and pale brown (10YR6/3). Generally         individual beds exhibit white calcareous ooze         at base with a sharp basal contact. This grades         up with burrow mottling into brown ooze lower         in carbonate a higher in siliceous organisms.         Smear summary         Nanno Ooze:       Nannos 90%         Rads 5%         Diatoms 5%         Nanno Rad Ooze: Rads 55%         Nanno Rad Ooze: Rads 55%         Nanno Rad Ooze: Rads 55%         Nannos 40%         Diatoms 5%         Microfossil group       Preservation Abundance         Foraminifera       Moderate-good Common         Calcareous       Poor (1-3)       Abundant		0
		Pseu		11111	6	unopened	(4-6) Radiolaria Good Common Comments: Possible reworking or contamination		
	N.21		ocene				of nannofossils.		
			Ρl			19 (j. 19)		hunnin	

# SITE 71 Core 1 Cored interval: 0-9 m





AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	% CaCO <sub>3</sub> ) 50 100
PLIOCENE	N. 19 – N. 20	Discoaster browneri	aster pentas		1 2 3 4		Sections 2, 3 and 5 badly disturbed. <u>Foram Ooze, Nanno Rad Ooze, Rad Nanno Ooze</u> . Above sediment types interbedded as in barrel 1.	
	N		ponga	7			Microfossil group Preservation Abundance	
							Calcareous Moderate Common	
				8	e		Radiolaria Moderate Common	
		diatus		111111	5		Comments: Reworked older nannofossils and Middle to Upper Miocene radiolaria.	1
		D. pentara						пппп

SITE 71 Core 2 Cored interval: 9-18 m


AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	% CaCO <sub>3</sub> 50 10
UPPER MIOCENE	N. 18	Ceratolithus tricorniculatus	Stichocorys peregrina Spongaster pentas	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 2 3 4 5 6		Sections 2 and 5 partly disturbed.         Nanno Ooze.       Light gray (10YR7/2) and pale brown (10YR6/3). Series of light and dark beds Similar to barrel 1. Contacts sharp or diffuse. Moderately mottled. Radiolaria common.         Smear summary       Nanos 90% Rads 5-15% Diatoms < 5%	



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	% CaCO <sub>3</sub> 0 50 100
AGE	N. 18 FORAM	r quinqueramus	Stichocorys peregrina RADS	4919W	2 SECT. N	LITHOL	Rad Nanno Ooze       (2.5YR6/2 light brownish gray).         Nanno Rad Ooze.       (White). Above sediment         types interbedded in Sections 1 and 2, as in       barrel 1. More uniform in texture in barrels         3, 4 and 5.	CaCO <sub>3</sub> 0 50 100 11111111 1 1 1 1 1 1 1 1 1 1
UPPER MIOCENI	N. 16 - N. 17	Discoaster	Ommatartus penul timus	5 6 7 11 11 11 11 11 11 11 11 11	4 5.		Smear summary         Rad Nanno Ooze:       Nannos 70% Rad 30% Diatoms < 5%	•

SITE 71 Core 4 Cored interval: 27-34 m



Site 71, Core 4, Physical Properties

AGE	ORAMS	NANNOS	RADS	METERS	ECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	% CaC	6 203
AGE MIOCENE	N. 16 - N. 17 FORAMS	viscoaster calcaris Discoaster quinqueranus NANNOS	Ommatartus artepenultimus RADS	Meters         Meters<	2 3 3 4 5 6	LITHOL.	Microfossil group       Preservation       Abundance         Foraminifera       Moderate       Common         Calcareous       Moderate (to       Common         Calcareous       Moderate       Common         Radiolaria       Moderate       Common         Comments:       Reworked older nannofossils. Con- tamination (downworking) in Section 5.         Nanno Ooze.       White (N9), Homogeneous.         Rad Nanno Ooze.       Brown.       Sharp contacts.         Rad Nanno Ooze.       Brown.       Sharp contacts.		
								1111	1111

### SITE 71 Core 5 Cored interval: 34-43 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	% CaCO <sub>3</sub> 0 50	100
UPPER MIOCENE	N. 16 - N. 17	Discoaster calcaris	Omnatartus antepenultimus		1 2 3 4 5 6	Unopened	Sections 4 and 5 disturbed.         Rad Nanno Ooze.       White (N9). Homogeneous in Section 1 and 3. Mixed with disturbed darker beds in Section 4.         Smear summary       Section 1 and 3. Mixed with disturbed darker beds in Section 4.         Smear summary       Nannos 60%         Rads 40%       Diatoms < 5%		
			_					huntu	11

SITE 71 Core 6 Cored interval: 43-52 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC D	DESCRIPTION		Cat 0 5	% CO <sub>3</sub>
UPPER MIOCENE	N. 15 N. 17	Discoaster calcaris	Ommatartus antepenultimus		1 2 3 4 5		Section 5 partly disturb <u>Rad Nanno Ooze</u> . Bluish y light greenish gray (568) <u>Microfossil group</u> <u>Pres</u> Foraminifera Mode good	white (2.5% /1). servation erate to d	(8/0) to <u>Abundance</u> Few		
			soni	7			Calcareous Good nannoplankton Radiolaria Mode	d erate	Common Common		
MIDDLE MIOCENE		D. P. Hamatus	Cannartus pettersi	8	6		Comments: Reworked of o	lder nannof	ōossils.		•

CORE 71 Core 7 Cored interval: 52-61 m



STORE	AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	Ca 0 5	% CO <sub>3</sub> 50 1	00
	MIDDLE MIOCENE	N. 15	Discoaster hamatus	Canartus petterssoni		1 2 3 4 5	Top	Core badly disturbed. Rad Nanno Ooze. Bluish to greenish white (2.5Y8/0). Microfossil group Preservation Abundance Foraminifera Moderate to Few good Calcareous Good Common nannoplankton Radiolaria Moderate Common Comments: Reworked of older nannofossils.			

SITE 71 Core 8 Cored interval: 61-69 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	Ca(	% CO <sub>3</sub> 50 100
MIDDLE MIOCENE	N. 14	Discoaster hamatus	Camartus petterssoni	W 111111111111111111111111111111111111	1 1 2 3 4 5 6	Unopened	Core badly disturbed.         Rad Nanno Ooze.         Very light gray (N8).         Uniform texture.         Microfossil group       Preservation         Abundance         Foraminifera       Good         Common         Calcareous       Good         nannoplankton         Radiolaria       Moderate         Common         Comments:       Reworked older nannofossils.		
		Ceratolithus coa							

# SITE 71 Core 9 Cored interval: 70-79 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	9 CaC 0 5	6 CO <sub>3</sub> 0 10
AGE WIDDLE MIDDLE	si robusta) ? N. 13 FORAM	Discoaster kugleri Deratolithus coalitus	is laticanus Camartus petterssoni RADS	ABLEM 111111111111111111111111111111111111	1 2 3 4 5 6		LITHOLOGIC DESCRIPTION         Core slightly disturbed.         Rad Nanno Ooze. Very light gray (N8) uniform texture. Streaked with olive gray and black.         Smear summary         Nannos 75%         Rads 25%         Microfossil group       Preservation         Abundance         Foraminifera       Good         Good       Common         nannoplankton       Poor to       Co-mon         Radiolaria       Poor to       Co-mon         Comments:       Reworked older nannofossils.		
	N. 12 (G. fon		Cannarti						1

### SITE 71 Core 10 Cored interval: 79-88 m



Core badly disturbed.	1111
Image: State of the state	

## SITE 71 Core 11 Cored interval: 89-98 m

m	G.R.A.P.E. POROSITY (%)	BULK DENSITY (g/cm <sup>3</sup> )	GRAIN MATRI ( DENSITY (g/cm <sup>3</sup> )	X SONIC VELOCIT (km/sec)	Y SONIC IMPEDANCE (× 10 <sup>6</sup> MKS units)	NATURAL GAMMA * ( × 10 <sup>3</sup> counts/7.6 cm/ 1.25 min)
20	40 60 80	1.0 1.5 2.0 2.	.5 2.0 2.5	3.0 1.5 1	.6 1.7 2.7	7 1.0 1.5
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6	1					
7					8	
8						
9						

AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	% CaCO <sub>3</sub> 0 50	100
MIDDLE MIOCENE	N. 12 (Gr. foshi lobata)	Discoaster exilis	Cannartus Laticonus		1 2 3 4 5 6	Unopened	Section 1 disturbed. <u>Nanno Rad Ooze to Rad Nanno Ooze</u> . Very light gray (N8) with black streaks. Forams present. Rare gray diffuse laminae. <u>Microfossil group</u> <u>Preservation</u> <u>Abundance</u> Foraminifera Good Common Calcareous Good Common nannoplankton Radiolaria Moderate Common Comments: Reworked older nannofossils.		

## SITE 71 Core 12 Cored interval: 98-107 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	% CaCo 0 50	D <sub>3</sub>
MIDDLE MIOCENE	N. 12 (Gr. foshi lobata	Discoaster exilis	Camactus laticonus	<b>W</b>	1 2 3 4	Unopened	Core disturbed. <u>Nanno Ooze</u> . Trace of rads. Light gray (N7). <u>Nanno Rad Ooze</u> . Some forams. Light gray (N7).		
				7	5		<u>Rad Nanno Ooze</u> . Light gray (N7). <u>Microfossil group</u> <u>Preservation</u> <u>Abundance</u>		
				III			Foraminifera Good Common		
				8	6		Calcareous Good Common nannoplankton		
					0	Unopened	Radiolaria Moderate Common		
							Comments: Reworked older nannofossils.		
	1								_
	N 71		ala	ta					

SITE 71 Core 13 Cored interval: 107-116 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	0 50	6 2O <sub>3</sub> 0 10
MIDDLE MIOCENE	I LI .N	Discoaster exilis	Doreadospyris alata		2 3 4	Unopened	Section 3 badly disturbed. <u>Rad Nanno Ooze</u> . Medium light gray (N5). <u>Smear summary</u> <u>Nannos 80%</u> Rads 20% Diatoms < 5%		
						· · · · · · · · · · · · · · · · · · ·	<u>Microfossil group</u> <u>Preservation</u> <u>Abundance</u> Foraminifera Good Common		
				8	6	Unopened	Calcareous Good Common nannoplankton		
				11111			Radiolaria Moderate Common Comments: Reworked older nannofossils(Sect. 1).		
								mu	шп



UDDU       1       Core badly disturbed.         1	AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	0 5	% CO <sub>3</sub>
	MIDDLE MIOCENE	N. 11	S. heter- omorphus Discoaster exilis	Dorcadospyris alata			Unopened	Rad Nanno Ooze.       Very light gray (N8).         Microfossil group       Preservation       Abundance         Foraminifera       Good       Common         Calcareous       Good       Common         Radiolaria       Moderate       Common         Radiolaria       Moderate       Common         Comments:       Some contamination (downworking) noted in radiolarians (Section 5).		

CORE 71 Core 15 Cored interval: 125-134 m



Site 71, Core 15, Physical Properties

AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	Ca0	% CO <sub>3</sub> 0 10
AGE IDDLE MIOCENE	N. 10 FORA	milithus heteromorphus NANN	adospyris alata		1 SECT.	Top Void	Core badly disturbed.         Core badly disturbed.         Rad Nanno Ooze.         Forams present.         Very light         gray (N8).         Microfossil group       Preservation         Foraminifera       Good         Good       Common         Radiolaria       Moderate       Common		
		$d_S$	DO						

SITE 71 Core 16 Cored interval: 134-143 m

AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	% CaC 0 50	O <sub>3</sub>
MIDDLE MIOCENE	N. 9 N. 10 N. 10	Sphenolithus heteromorphus	Doreadospyris alata		1 2 3 4 5 6	Unopened	Portions of sections 4 and 5 disturbed.         Rad Foram Nanno Ooze         Smear summary         Nannos 65%         Rads 10%         Forams 15%         Diatoms < 5%		
								huul	nnl

### SITE 71 Core 17 Cored interval: 143-152 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	% CaCO <sub>3</sub> 0 50 10
MIDDLE MIOCENE	N. 9	Sphenolithus heteromorphus	Doroadospyris alata		1 2 3 4 5 6	Unopened	Sections 2 and 5 disturbed. Rad Foram Nanno Ooze, Light gray (N7). Smear summary Nannos 60% Rads 15% Forams 20% Diatoms < 5% Foram Nanno Ooze, Light gray (N7). <u>Microfossil group Preservation Abundance</u> Foraminifera Good Common Calcareous Good Common Calcareous Good Common Radiolaria Moderate Common	
					_			

SITE 71 Core 18 Cored interval: 152-161 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLO	OGIC DESCRIPTION		Cat	% CO <sub>3</sub>
	N. 9				1		Top of core disturbe barrel. <u>Foram Nanno Ooze to</u> gray (N8).	ed. Chert chips <u>Rad Nanno Ooze</u> .	at top of Very light	ŤŦŦŦŤ	ŤŦŦŤ
				2	2		<u>Smear summary</u> Nannos 55% Forams 40% Rads < 5% Diatoms < 5%				
CENE		s heteromorphus	yris alata	4	3	Unopened	<u>Microfossil group</u> Foraminifera Calcareous nannoplankton Radiolaria	<u>Preservation</u> Good Good Moderate	<u>Abundance</u> Common Common Common		
WIDDLE MID	N. 8	Sphenolithu	Doreadospi	5 6 7	4		<u>Foram Rad Nanno Ooze</u> Smear summary	2.			
				8	6	Unopened	Nannos 70% Forams 20% Rads 5-15% Diatoms < 5% Spicules < 5%			1111	

SITE 71 Core 19 Cored interval: 161-170 m



AGE	FORAMS	NANNC	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	Ca 0	% iCO <sub>3</sub> 50 10
MIDDLE MIDCENE	N. 8	Sphenolithus heteromorphus	Doreadospyris alata	4 1 1 1 1 1 1 1 1 1 1 1 1 1	1 2 3 4 5	Unopened	Sections 2 and 6 disturbed. <u>Foram Nanno Ooze</u> . Very light gray (N8) to whit	e.	
LOWER MIOCENE				8111111	6		Microfossil groupPreservationAbundanceForaminiferaGoodCommonCalcareous nannoplanktonGoodCommonRadiolariaModerateCommon		

SITE 71 Core 20 Cored interval: 170-179 m


AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	Cat 0 5	% CO <sub>3</sub>
LOWER MIOCENE	N. 8	Sphenolithus heteromorphus	Doreadospyris alata		1 2 3 4 5 6	Unopened	Core disturbed.         Rad Nanno Ooze. Very light gray (N8). Section 6 richer in diatoms.         Smear summary         Nannos 70%         Rads 20%         Diatoms 5-15%         Microfossil group       Preservation         Abundance         Foraminifera       Good         Good       Common         Calcareous       Good         nanoplankton       Moderate         Radiolaria       Moderate		



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DE	SCRIPTION		0 5	% CO <sub>3</sub>
LOWER MIDCENE	N. 8	Sphenolithus heteromorphus	Calocycletta costata	1 2 3 4 4	1 2 3 4	Unopened	Core slightly disturbed. <u>Rad Nanno Ooze</u> to <u>Nanno Rad</u> ish gray (5GY8/1) with slight	<u>d Ooze</u> . L <sup>.</sup> ght white r	ight green- nottling.		
				7	5	Unopened	Microfossil group Prese	ervation	Abundance		
						· · · · · ·	Calcareous Good nannoplankton		Common		
	7.7 N.7			81111111	6		Radiolaria Moder	rate	Common		

	SITE 71	Core 22	Cored	interval:	189-198 m
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AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLO	OGIC DESCRIPTION		% CaC	O <sub>3</sub>
LOWER MIDCENE	N. 7	Sphenolithus heteromorphus	Calocycletta costata		1 2 3 4 5 6	Unopened	Core slightly disture <u>Foram Rad Nanno Ooze</u> . <u>Rad Nanno Ooze</u> . With (N8) to light greenis <u>Microfossil group</u> Foraminifera <u>Calcareous</u> nannoplankton Radiolaria <u>Rad Nanno Semi-indura</u> duration increasing a show addition of seco	h forams. Very sh gray (5GY8/1 <u>Preservation</u> Good Good Moderate to good <u>ated Ooze</u> . Degn at this level. ondary CaCO <sub>3</sub> .	light gray <u>Abundance</u> Common (scarcer in Section 6) Common Common Common		

SITE 71 Core 23 Cored interval: 198-207 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	Cat 0 5	% CO <sub>3</sub>
LOWER MIDCENE	N. 7	phenolithus belemnos and elicopontosphaera ampliaperta	calocycletta costata	4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 2 3 4 5 6 8	Top	Rad Nanno Semi-indurated Ooze. Light greenish gray (5GY8/1).         Smear summary         Nannos 60%         Rads 30%         Forams 10%         Diatoms < 5%		
		Sp He						huu	im

## SITE 71 Core 24 Cored interval: 207-216 m



AGE	FORAMS	NANNOS	RADS	METERS	ECT. NO.	THOL.	LITHOL	OGIC DESCRIPTION		CaC	% CO <sub>3</sub>
AGE ICOMER MIDCENE	N. 7 FORAM	Sphenolithus belemnos and Heicopontosphacra ampliaperta	Calocycletta virginis	WETER 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		op pened	LITHOL Sections 1 and 2 ve Rad Nanno Semi-indu gray (5GY8/1). <u>Microfossil group</u> Foraminifera Calcareous nannoplankton Radiolaria	OGIC DESCRIPTION Pry watery. Preservation Good Good Moderate	ht greenish Abundance Common Common Common		° CO3 0 100 11111
-				11111							

SITE 71 Core 25 Cored interval: 216-225 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	9 CaC 0 5	6 CO <sub>3</sub> 0 10
		ad Helicopentosphaera ampliaperta	118	1	2	Unopened	Core slightly disturbed. <u>Foram Nanno Ooze.</u> Very light gray (N8). <u>Smear summary</u> Nannos 55% Forams 40% Rads < 5% Diatoms < 5%		
LOWER MIOCENE	N.5 - N.6	Sphenolithus belemnos an	Calocycletta virgin	5 6 7 8	5	Unopened	Rad Nanno (Semi-indurated) Ooze.Light gray(N7).Microfossil groupPreservationAbundanceForaminiferaGoodCommonCalcareousGoodCommonnannoplanktonModerateCommonRadiolariaModerateCommonForam Nanno Ooze.Light gray (N7).		
								1111	

SITE 71 Core 26 Cored interval: 225-234 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHO	LOGIC DESCRIPTION		9 CaC	% CO₃ 50 10
		ins belemnos and Helicopantolsphacra ampliaperta			S						
		Sphenoi		7			Foram Nanno Ooze	Preservation	Abundance		
				H			Foraminifera	Good	Common		
	_			81111		Тор	Calcareous nannoplankton	Good	Common		
LOWER MIOCENE	N.5-N.6	¥	Calocyletta virginis	1111111	1	Unopened	Radiolaria Comments: Contamina radiolari	Moderate ation (downmixing ians from core ca	Common g) noted in atcher.		
										1111	

SITE 71 Core 27 Cored interval: 235-244 m

AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	9 CaC 0 5	6 CO3 0 10
LOWER MIDCENE	N.5 - N.6	Sphenolithus belemios and Helicopentosphaera	Calocycletta virginis		1 2 3 4	Unopened	Core slightly disturbed. Foram Nanno Ooze. Very light gray (N8).		
		iggi			5	Unopened	<u>Microfossil group</u> <u>Preservation</u> <u>Abundance</u> Foraminifera Good Common		
		ter dm		×			Radiolaria Mederato Common		
		Discoas			6		Comments: Probable reworked older nannofossils in Section 2.		1
									1111

## SITE 71 Core 28 Cored interval: 244-253 m



Section 1 disturbed.	AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	% CaCO <sub>3</sub> 0 50	100
Wicrofossil group       Preservation       Abundance         3        Foraminifera       Good       Common         Calcareous       Good       Common       Calcareous       Good       Common         Calcareous       Good       Common       Calcareous       Good       Common         Calcareous       Good       Common       Calcareous       Common       Calcareous       Common         Calcareous       Good       Common       Calcareous       Good       Common       Common         Comments:       Some reworked Upper Oligocene -       Lower Miccene radiolarians in core       Catcher.       Rad Nanno Ooze.       Very light gray (N8).         State	LOWER MIOCENE	N.5 - N.6	Discoaster druggi	Calocycletta virginis		1		Section 1 disturbed. Foram Nanno Ooze. Microfossil group Preservation Abundance Foraminifera Good Common Calcareous Good Common nannoplankton Radiolaria Moderate Common Comments: Some reworked Upper Oligocene - Lower Miocene radiolarians in core catcher. Rad Nanno Ooze. Very light gray (N8).		

SITE 71 Core 29 Cored interval: 253-262 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOL	OGIC DESCRIPTION		9 Ca0 0 5	% CO <sub>3</sub>
DWER MLOCENE	N.5 - N.6	wter åruggi	etta virginis	1 2 3 4	1 2 3 4	Unopened	Core slightly distu <u>Foram Nanno Ooze</u> .	Bluish white (5B	9/1).		
_		Disco	locyc	6	_		Microfossil group	Preservation Good	Abundance		i
			Ca	1111			Calcareous nannoplankton	Good	Common		
					5	Unopened	Radiolaria	Moderate	Common		
				8 1 1 1 1 1 1	6						1         
		I. car	inat	tus						1111	



AGE	ORAMS	ANNOS	RADS	<b>IETERS</b>	SCT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	9 CaC	6 2 <b>0</b> 3
LOWER MIDCENE	N. 4	Triquetrorhabdulus carinatus	Calocycletta virginis	M 11 11 11 11 11 11 11 11 11 11 11 11 11	1 2 3 4	Unopened	Section 2 disturbed. <u>Foram Nanno Ooze</u> . Bluish white (5B9/1) to light gray (N7).		
				8111111	6	Unopened	Microfossil groupPreservationAbundanceForaminiferaGoodCommonCalcareousGoodCommonnannoplanktonRadiolariaPoor to mod- erateComments:Reworked older nannofossils in Sec. 6 and Upper Oligocene to Lower Miocene Radiolaria in core catcher.		

SITE 71 Core 31 Cored interval: 271-280 m



BEDOUND FUNCTION       Foram Nanno Ooze, Bluish white (5B9/1).         State of the state of th	AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	Ca(	% CO3 50
	LOWER MIOCENE	N.4	Triquetrorhabdulus carinatus	Calocyaletta virginis		1	Unopened	Core slightly disturbed.         Foram Nanno Ooze.       Bluish white (5B9/1).         Microfossil group       Preservation       Abundance         Foraminifera       Good       Common         Calcareous       Good       Common         Radiolaria       Moderate       Common		

SITE 71 Core 32 Cored interval: 280-289 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHO	LOGIC DESCRIPTION		9 Cat 0 5	6 CO <sub>3</sub> 0 100
LOWER MIOCENE	N.4	Triquetrorhabdulus carinatus	Calocycletta virginis		1 2 3 4 5 6	Unopened	Section 1, 2 and 5 Section 1, 2 and 5 Foram Nanno Ooze. Smear summary Nannos 5: Forams 4: Rads < Diatoms < Sponge spicules < Microfossil group Foraminifera Calcareous nannoplankton Radiolaria Comments: Reworked Miocene F	very watery. Bluish white (589 5% 4% 5% 5% <u>Preservation</u> Good Good Poor to mod- erate Upper Oligocene Radiolaria in cor	Abundance Common Common Common to Lower e catcher.		
			-								1111

## SITE 71 Core 33 Cored interval: 290-299 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHO	OGIC DESCRIPTION		0 5	76 CO3 50 100
LOWER MIDCENE	N.4	Triquetrorhabdulus carinatus	Calocycletta virginis		1 2 3 4 5 6	Unopened	Section 2 very wate	ry. Bluish white (5B Preservation Good Good Poor to mod- erate	Abundance Common Common Common		
1			-		_						

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SITE 71 Core 34 Cored interval: 299-308 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	9 CaC 0 5	% CO <sub>3</sub>
LOWER MIOCENE	N.4	Triquetrorhabdulus carinatus	Lychnocanium bipes		1 2 3 4 5 6	Unopened	Core slightly disturbed.         Foram Nanno Ooze.         Sections 2 and 4.         Microfossil group       Preservation         Abundance         Foraminifera       Good         Calcareous       Good         nannoplankton       Good         Radiolaria       Moderate         Radiolaria       Bluish white (589/1),forams		
					-			1111	1111

SITE 71 Core 35 Cored interval: 308-317 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOL	OGIC DESCRIPTION		9 CaC 0 5	6 20 <sub>3</sub> 0 100
		T. carinatus		1	1	Unopened	Section 4 and 6 dis	turbed. <u>2.</u>			
LOWER MIOCENE	N.4	iquetrorhabdulus carinatus	Lychmocanium bipes	4 5 6 7	3	Unopened	<u>Microfossil group</u> Foraminifera Calcareous nannoplankton Radiolaria <u>Rad Foram Nanno (Ser</u> <u>Smear summary</u> Nannos 75 Rads 10 Forams 10 Diatoms < 9 Sponge spicules < 9	Preservation Moderate to good Good Moderate <u>ni-indurated</u> ) <u>Oo</u>	Abundance Common Common Common		
		$T_{T}$		8	6		<u>Foram Nanno Ooze</u> . /	\ll bluish white	(589/1).		

## SITE 71 Core 36 Cored interval: 317-326 m

Si	te	71, Core 36,	Physica	al Pro	opert	ies								C110(1 *
		G.R.A.P.E.	BULK	DENS	ITY	G	DENSITY	LX.	SON	IC VELOCITY	SONIC IMPED	ANCE	$(\times 10^3 \text{ col})$	ints/7.6 cm/
m	20	POROSITY (%)	()	$g/cm^3$ )			(g/cm <sup>3</sup> )	2.0		(km/sec)	(X 10 <sup>6</sup> MKS	units)	1.25	min)
0 -	1			2.0	2.5	2.0	2.5	3.0	1.5	1.6	2.0	3.0	1.0	1.5
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AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHO	LOGIC DESCRIPTION		Cat	% CO <sub>3</sub>
LOWER MIDCENE	N.4	Iriquetrorhabdulus carinatus	Lychnocanium bipes		1 2 3 4 5	Top	Core all very water <u>Foram Nanno Ooze</u> <u>Microfossil group</u> Foraminifera Calcareous nannoplankton Radiolaria	y. <u>Preservation</u> Good Good Moderate	Abundance Common Common Common		

SITE 71 Core 37 Cored interval: 326-335 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOL	OGIC DESCRIPTION		0 5	6 203 0 100
LOWER MIDCENE	N.4	Triquetrorhabdulus carinatus	Lychnocarium bipes		1 2 3 4 5	Unopened	Section 4 disturbed. <u>Nanno Ooze and Foran</u> gray (N8) to bluish	<u>1 Nanno Ooze</u> . Ve white (5B9/1).	ry light		
							<u>Microfossil group</u> Foraminifera Calcareous	<u>Preservation</u> Good Good	<u>Abundance</u> Common Common		1
				8	6		Radiolaria	Poor to moderate	Common		
											1111

SITE 71	Core 38	Cored interval:	336-345 m


AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	% CaCO 0 50	) <sub>3</sub>
LOWER MIOCENE				1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			Section 1 very watery.		
				4		Тор			
UPPER OLIGOCENE	N.4 or P.22	Triquetrorhabdulus carinatus	Lychnocanium bipes	8 7 8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1	Unopened	Rad Nanno (Semi-indurated) Ooze.       Bluish white         (5B9/1).       Microfossil group       Preservation       Abundance         Foraminifera       Good       Few         Calcareous       Good       Common         nannoplankton       Poor to       Common         Radiolaria       Poor to       Common		· · · · · · · · · · · · · · · · · · ·

SITE 71 Core 39 Cored interval: 345-354 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	9 CaC 0 5	6 CO <sub>3</sub> 0 100
UPPER OLIGOCENE	N.4 or P.22	Triquetrorhabáulus carinatus	Ly chnocarium bipes		1 2 3 4 5 6		Core slightly disturbed in parts.         Nanno(Semi-indurated) Ooze to Rad Nanno(Semi-indurated) Ooze.         Bluish white and uniform.         Sections 5 and 6 show chalky bands, somewhat fragmented, separated by soft ooze.         Microfossil group       Preservation       Abundance         Foraminifera       Good       Common         Calcareous       Good       Common         Radiolaria       Poor to       Common         Nationaria       Poor to       Common		

SITE 71 Core 40 Cored interval: 354-363 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	9 CaC 0 5	6 2O3 0 100
UPPER OLIGOCENE	P. N.4 or P.22	N. Ciperoeners	Lychnocanium bipes	$\frac{1}{2}$	1 2 3	Top	Core all very watery.         Nanno Ooze to Rad Nanno Ooze         Microfossil group       Preservation       Abundance         Foraminifera       Good       Common         Calcareous       Good       Common         nannoplankton       Moderate       Common		

## SITE 71 Core 41 Cored interval: 363-372 m

AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	% CaCO <sub>3</sub> 0 50 10
					1		Section 5 very watery. Foram Rad ( <u>Semi-indurated</u> ) <u>Nanno Ooze</u> .	
				2	2		Nanno (Semi-indurated) Ooze. Microfossil group Preservation Abundance	
							Foraminifera Good Common	
				3			Radiolaria Poor to mod- Common	
				4	3		Comments: Some contamination (downworking) in radiolarians from Section 6.	
ENE		oensis	pilio	5			Nanno (Semi-indurated)Ooze.	
UPPER OLIGOC	P.22	olithus ciper	cadospyris pa		4		Foram Rad Nanno ( <u>Semi-indurated</u> ) <u>Ooze</u> .	
		Sphen	Dore		5		Nanno Ooze.	
				8 1 1 1 1 1 1 1	6		<u>Nanno (Semi-indurated) Ooze</u> . All bluish white (5B9/1).	<b>•</b>

SITE 71 Core 42 Cored interval: 372-381 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	% CaCO <sub>3</sub> 0 50 10
UPPER OLIGOCENE	P. 22	Sphenolithus ciperoensis	Doreadospyris papillo		1	Top Unopened	Nanno (Semi-indurated) Ooze.         Bluish white (5B9/1) to light gray (N7).         Smear summary         Nannos       95%         Rads       < 5%	

SITE 71 Core 43 Cored interval: 381-390 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOG	IC DESCRIPTION	Ċ	% CaC	6 203 0 10
UPPER OFIGOCENE	P.22	chenolithus ciperoensis	Dorcadospyris papillo		1 2 3 4		All sections disturbe <u>Nanno Ooze to Semi-i</u> Very light gray (N8)	ndurated Nanno Od to bluish white (S	3. 589/1).		
		50		7	5		<u>Microfossil group</u> Foraminifera Calcareous nannoplankton Radiolaria	Preservation Good Good Poor to moderate	Abundance Common Common Common		•
				8	6					1111	

SITE 71 Core 44 Cored interval: 390-399 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	0 50	6 CO <sub>3</sub> 0 100
						Тор	Sections all very watery.		
UPPER OLIGOCENE	P.22	Sphenolithus ciperoensis	Dorcadospyris papillo		2	Unopened	Nanno OozeMicrofossil groupPreservationAbundanceForaminiferaGoodCommonCalcareousGoodCommonnannoplanktonPoor to mod- erateCommonRadiolariaPoor to mod- erateCommon erateComments:Contamination (downworking) noted in Foraminifera. Reworked older Oligocene Radiolaria in core catcher.		

SITE 71 Core 45 Cored interval: 399-408 m

AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	Cat	% CO <sub>3</sub>
UPPER OLIGOCENE	P. 21	Sphenolithus distentus	Theocyrtis amosa		1 2 3 4 5 6		Core slightly disturbed. Nanno (Semi-indurated) Ooze. Bluish white (589/1). Microfossil group Preservation Abundance Foraminifera Good Common Calcareous Good Common Calcareous Good Common nannoplankton Radiolaria Poor to moderate Co-mon Comments: Reworked older Oligocene Radiolaria in Section 2.		

SITE 71 Core 46 Cored interval: 408-417 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOL	OGIC DESCRIPTION	1	9 CaC 0 5	6 2O <sub>3</sub> 0 100
	FO	NA	R		1 SEC	Top	Core slightly dist	urbed.		0 5	
UPPER OLIGOCENE	P. 21	Sphenolithus distentus	Theocyrtis annosa	4 4 5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	3		<u>Nanno</u> ( <u>Semi-indurat</u> (5B9/1) to very lig	<u>ted</u> ) <u>Ooze</u> . Blu ht gray (N8).	ish white		
				8	5		<u>Microfossil group</u> Foraminifera Calcareous nannoplankton Radiolaria	Preservation Good Good Poor to moderate	Abundance Common Common Few to common		

SITE 71 Core 47 Cored interval: 418-427 m



			2		Core slightly disturb	ed		
OCENE	istentus	us ten tus nnosa	4	I Top Unopened	<u>Nanno (Semi-indurated</u> (5B9/1) to light gray ← <u>Ash-Rich Layer</u> . <u>Smear summary</u> Nannos 80% Rads < 5% Shards 5-15%	<u>1) Ooze</u> . Bluish (N7).	white	
UPPER OLI	P. 22 Sphenolithus	opnenoutunus ( Theocyrtis (		3 * * * * * * * * * * * * * * * * * * *	<u>Microfossil group</u> Foraminifera Calcareous nannoplankton Radiolaria	Preservation Good Good Poor to mod-	<u>Abundance</u> Common Common Few to	

SITE 71 Core 48 Cored interval: 427-436 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHO	LOGIC DESCRIPTION		9 CaC 0 5	6 20 <sub>3</sub> 30 100
AGE	21 FORAMS	distentus	s amosa RADS	Meters     Meters       8     8	2 SECT. NO		<pre>Microfossil group Foraminifera Calcareous nannoplankton Radiolaria </pre> •Chert Layer. 3cm t limestone adhering. Nanno (Semi-indurat)	DOGIC DESCRIPTION	Abundance Common Common Very rare Very rare	9 Cat 0 5	
UPPER OL	Ъ.	phenolithus	Theocyrti	11111			<u>Microfossil group</u> Foraminifera Calcareous nannoplankton Radiolaria	<u>Preservation</u> Good Good Poor	<u>Abundance</u> Common Common Very rare		1
		S							5 	ш	пп

## SITE 71 Core 49 Cored interval: 472-474 m

AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	Cat 0 5	% CO <sub>3</sub>
LOWER OLIGOCENE	P.18-P.19	LOWER OLIGOCENE (undifferentiated)	heocyrtis tuberosa ??		1		Nanno (Semi-indurated) Ooze.         Bluish white (5B9/1) well indurated, but soft enough to be scratched with fingernail. Some fine (0.5mm) laminae present. (See detailed section description).         Smear summary         Nannos       85%         Rads       5%         Sponge spicules < 5%		

SITE 71A Core 1A Cored interval: 528-537 m



AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLOGIC DESCRIPTION	% CaCO 0 50	) <sub>3</sub>
ER EOCENE	Eocene FORAM	ocyrtis bromia NANNO	RADS RADS	WELEK	1 SECT. N		Microfossil groupPreservationAbundanceForaminiferaModerateRareCalcareous nannoplanktonPoorCommonRadiolariaPoorRareComments:Foraminifera, partially crushed or compressed.Silicified limestone greenish gray (568/1) with intergrown chert, light olive gray (576/1).Silicified limestone intergrown chert, light olive gray (576/1).With intergrown chert, light olive gray (576/1)."Heiroglyphic" 	•	•
5	200	z huji	Uppé						

SITE 71A Core 2A Cored interval: 553-555 m

Si	te 71A, G.H	Core 2 R.A.P.E.	, Phy	sica BULK	DENS	pert ITY	ties G	RAIN MATR DENSITY	IX	SON		SONIC IMPEDANCE	NATURAL GA (× 10 <sup>3</sup> counts/ 1 25 min)	MMA * 7.6 cm/
m	20 40	60 80	10	1.5	20	25	20	(g/cm )	3.0	15	(KIII/Sec) 1.6	(× 10 MK3 ullis)	10	1.5
0 -				1.5	1	1	2.0	1	3.0	1.5	1.0			
1-	MMM													-
2-		_												-
-														-
3—														-
4—														-
5-														
-														-
6—														-
7—														-
8-														-
9—						_								-





AGE	FORAMS	NANNOS	RADS	METERS	SECT. NO.	LITHOL.	LITHOLO	OGIC DESCRIPTION		Cat 0 5	% CO <sub>3</sub> 50 10
? UPPER EOCENE	? Eocene	Eocene	Thyrsocyrtis bromia		1		Silicified Limestone intergrowths of <u>Chert</u> Similiar lithology to Limestone dominant. (See detailed section <u>Microfossil group</u> Foraminifera Calcareous nannoplankton Radiolaria	greenish gray ( t, light olive g o previous barren n description). <u>Preservation</u> Moderate Poor Poor	5G8/1) with ray (5Y6/1). 1. <u>Abundance</u> Few Common Rare		

## SITE 71A Core 3A Cored interval: 555-558 m

Sit	te 7	1A,	Core	3,	Phy	sical	Pro	pert	ies	DAINIMATO	NV.				NATURAL CAM	*
		G.R.	A.P.E	•		BULK	DENS	ITY	0	DENSITY	A	SO	NIC VELOCITY	SONIC IMPEDANCE	$(\times 10^3 \text{ counts}/7.0)$	6 cm/
	P	OROS	ITY (	(%)		(g/	cm <sup>3</sup> )		• •	(g/cm <sup>3</sup> )			(km/sec)	(× 10 <sup>-3</sup> MKS units)	1.25 min)	1.6
0 —	1 1	40	1	80	1.0	1.5	2.0	2.5	2.0	2.5	3.0	1.5	1.6		- 1 <u>.</u>	1.5
2	1															-
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2-	{														L	$\vdash$
35					11											F
3—					11											⊢
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-																-
5—																-
-																-
6-																F
-																-
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Site 71, Core 1, Sections 1-5.



Site 71, Core 2, Sections 1-5.



Site 71, Core 3, Sections 1-5.


Site 71, Core 4, Sections 1-5.









Site 71, Core 6, Sections 1, 3, 4, 5.



Site 72, Site 71, Core 7, Sections 1-6.





Site 71, Core 8, Sections 1, 2, 5.



Site 71, Core 9, Sections 1-5.



Site 71, Core 10, Sections 1-6.









Site 71, Core 12, Sections 1, 2, 4, 5.



Site 71, Core 13, Sections 1, 3, 5.

Site 71, Core 14, Sections 1, 3, 5.



Site 71, Core 15, Sections 1, 5.



Site 71, Core 16, Sections 1, 2.





Site 71, Core 18, Sections 2-5.



Site 71, Core 19, Sections 1, 2, 5.

Site 71, Core 20, Sections 2, 4, 6.



Site 71, Core 22, Sections 2, 3, 4, 6.



Site 71, Core 23, Sections 3, 4, 6.

Site 71, Core 24, Sections 3, 4, 6.





Site 71, Core 26, Sections 2, 4, 6.



Site 71, Core 28, Sections 2, 4, 6.

Site 71, Core 29, Sections 1, 3, 5.



Site 71, Core 30, Sections 2, 4, 6.





Site 71, Core 33, Sections 5, 6.











Site 71, Core 38, Sections 1, 2, 4, 6.

Site 71, Core 39, Section 2.



Site 71, Core 40, Sections 1-6.



Site 71, Core 42, Sections 1-6.



Site 71, Core 43, Sections 2, 3.



Site 71, Core 44, Sections 1-6.



Site 71, Core 46, Sections 1-6.

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Site 71, Core 47, Sections 2-5.

Site 71, Core 48, Sections 2,3.



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Site 71A, Core 2, Section 1.

Site 71A, Core 3, Sections 1, 2.