The Shipboard Scientific Party¹

MAIN RESULTS

Site 84 is within 240 miles of the coast of Panama and the sediments reflect this proximity to land. The upper 81 meters (Pleistocene) contain numerous ash layers and other continentally derived mineral material. No ash layers occur below the Pleistocene section; however, admixed volcanic glass occurs throughout the section but decreases in abundance with depth. The site was continuously cored in a hole which bottoms in basalt. The sediment immediately overlying the basalt is of late Miocene age, and is therefore younger than the basal sediment at Site 83.

The rates of accumulation are highest in the upper part of the section and decrease with increasing sediment age. The calcium carbonate concentration increases with depth.

INTRODUCTION

Background and Objectives

Site 84 was chosen by the Leg 9 Shipboard Party. Its location was chosen in order to bring the *Challenger* as near the Coast of Panama as possible and still have a thick sequence of sediments to sample, that is, sediments that are primarily of pelagic origin (Figure 1).

The objective was to obtain sediments which contained a mixture of continental and pelagic constituents so that events on land, such as volcanic eruptions, could be dated by the planktonic stratigraphy.

Argo had crossed a deposit of sediment about 300 meters thick in the vicinity of latitude $5^{\circ}45'N$ and longitude $82^{\circ}52'W$. This same sequence of sediment

was located on an R/V *Conrad* (of Lamont-Doherty Geological Observatory) seismic reflection profile and chosen as the area for our final site. Since we had sufficient time, and any study that involved the periodicity at volcanic eruptions or the beginning of such activity would require a nearly complete section, it was decided to continuously core this site.

Operations

Site Survey

The *Challenger* approached Site 84 on course 090°. During its approach the relief of the sea floor was small, amounting to 50 to 100 fathoms. The sea floor relief is considerably less than basement relief, indicating more sediment smoothing of basement than had been encountered at sites to the west. The sediment thickness averages about 0.35 second reflection time and shows stratification which is particularly strong in the upper 0.05 second. The P.D.R. record shows one continuous subbottom reflector and above it a discontinuous subbottom reflector.

The sediment lens noted on the R/V Conrad and Argo profile is bordered on the east by rough topography. This same rough topography was crossed by D/V Challenger. The ship was turned back and an appropriate site selected in the thick sediment that lies to the west. The sediment during the final survey was about 0.38 second thick with a group of closely spaced reflectors in the upper 0.05 seconds or 42 meters (139 feet). The Site 84 P.D.R. record showed the strong continuous reflector at a depth of about 10 fathoms (60 feet) and the discontinuous reflector at about 6 fathoms.

Coring

Challenger arrived at the drilling site at 1832 hours, January 23, 1970 and dropped one Burnett beacon. The drill string was lowered to the sea floor and the first core taken at the water-sediment interface. The first core was taken 12 feet below the P.D.R. depth of the sea floor and a full 30 feet (9.1 meters) was recovered. The hole was continuously cored but the recovery was not as good as on previous sites. In Core 15 the liner jammed in the core barrel and the barrel had to be cut with a torch to recover the retrieved

¹J. D. Hays, Lamont-Doherty Geological Observatory, Palisades, New York; H. E. Cook, University of California, Riverside; D. G. Jenkins, University of Canterbury, Christchurch, New Zealand; F. M. Cook, independent; J. Fuller, Kennecott Exploration, Inc., San Diego, California; R. Goll, Lamont-Doherty Geological Observatory, Palisades, New York; E. D. Milow, Scripps Institution of Oceanography, La Jolla, California; W. Orr, University of Oregon, Eugene, Oregon.

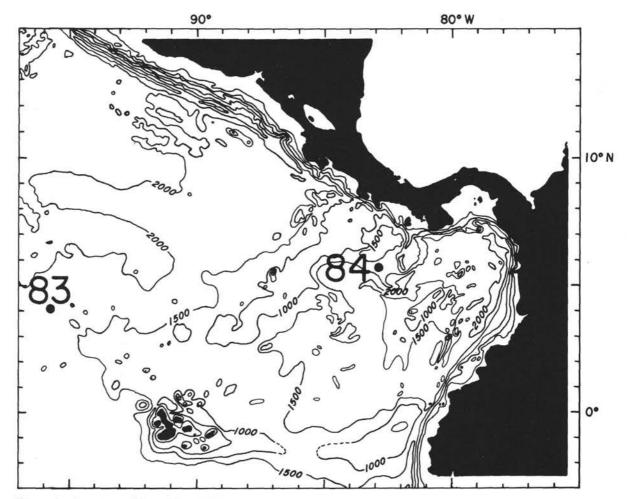


Figure 1. Location of Sites 83 and 84.

sediment. The core barrel was cut into three sections and capped. [Section 1, 55 centimeters; Section 2, 70 centimeters; Section 3, 140 centimeters.] Beginning with Core 13, the sediment became stiffer and supported 5000 to 10,000 pounds of weight. Slow continuous circulation resulted in a loss of recovery. We tried rapid coring (placing 20,000 pounds of weight on the bit) and breaking circulation many times. This seemed to give the best results. The site was continuously cored with a total of 833 feet penetrated and 703.5 recovered, giving a recovery percentage of 84.4 per cent.

After completing the operations at this site, the ship made a pass over the beacon. The ship passed within 20 feet of being directly over the beacon and depth to basement was 0.32 second, indicating 272 meters of sediment which closely approximated the depth when basement was encountered at 252 meters.

LITHOLOGY

At this site only the San Blas Oceanic Formation is present (0 to 253.9 meters). Basement consists of black (N-1), fine-grained basalt.

San Blas Oceanic Formation

At this site the San Blas is divided into five units on the basis of different shades of green, and burrowing (Figures 2 and 4). No attempt is made to correlate any of these units with those at Site 83; rather, these are separated into distinct units for possible future correlation value when more coring is done in this area. The dominant characteristic of the San Blas Oceanic Formation is its green coloration which is due to the large amount of green montmorillonite (Cook and Zemmels, 1971) that forms as an alteration product of pyroclastic materials.

Unit 1 (0 to 39.6 meters)

Unit 1 is the darkest green unit and consists of 1 to 75 centimeter thick beds of:

1. Dark greenish-gray (5G4/1) montmorillonite (5 to 10 per cent)-radiolarian (15 to 20 per cent)foraminiferal (20 to 30 per cent)-calcareous nannofossil (40 to 60 per cent) ooze. In addition, there are 1 to 2 per cent volcanic shards, and volcanic pyroxenes and amphiboles.

2. Greenish-black (5GY2/1) montmorillonite (10 to 15 per cent)-radiolarian (10 to 15 per cent)foraminiferal (15 to 25 per cent)-calcareous nannofossil (35 to 55 per cent) ooze with about 5 per cent volcanic shards, pyroxenes and amphiboles.

3. Dark yellowish-brown (10YR4/2) to dusky yellowish-brown (10YR2/2) volcanics (10 to 20 per cent)-foraminiferal (10 to 20 per cent)-radiolarian

(10 to 20 per cent)-calcareous nannofossil (40 to 70 per cent) ooze.

4. Minor amounts of dusky green (5G3/2) montmorillonite (100 per cent) chalk.

5. One medium dark gray (N4) rhyolitic vitric tuff bed one centimeter thick.

Unit 2 (39.6 to 87.4 meters)

Unit 2 is a lighter color than unit 1. It occurs in 1 to 75 centimeter thick beds that are slightly burrowed in the basal 15 meters.

The four main sediment types are:

1. Grayish-olive (10Y4/2) and olive gray (5Y3/2) volcanics (10 to 15 per cent)-montmorillonite (5 to 10 per cent)-radiolarian (15 to 25 per cent)-foraminiferal (25 to 35 per cent)-calcareous nanno-fossil (30 to 40 per cent) chalk ooze.

2. Pale olive (10Y6/2) chalk ooze; same as above, but with 15 to 25 per cent volcanic constituents.

3. Four medium dark gray (N4) rhyolitic vitric ash beds each about one centimeter thick.

Unit 3 (87.4 to 128 meters)

This unit is a lighter green color than units 1 or 2. The degree of burrowing is probably more intense in this unit (see Core 2, Section 6, 75 to 95 centimeters photo). These sediments occur in 1 to 15 centimeter-thick beds and consist of:

1. Pale olive (10Y6/2) to grayish-olive (10Y4/2) volcanics (10 to 15 per cent)-foraminiferal (10 to 15 per cent)-radiolarian (15 to 20 per cent)-calcareous nannofossil (50 to 60 per cent) ooze chalk.

2. Very pale olive (10Y7/2) montmorillonite (2 to 5 per cent)-volcanics (5 to 10 per cent)-foraminiferal (10 to 15 per cent)-radiolarian (15 to 25 per cent)-calcareous nannofossil (50 to 70 per cent) ooze chalk.

3. Pale grayish olive (10Y5/2) volcanics (10 to 20 per cent)-montmorillonite (10 to 15 per cent)foraminiferal (10 to 15 per cent)-radiolarian (10 to 15 per cent)-calcareous nannofossil (40 to 60 per cent) ooze chalk.

Unit 4 (128 to 234.6 meters)

This unit is intensely burrowed, exhibits a marked decrease in volcanic constituents, and is a light greenish gray. Beds range from 5 to 25 centimeters in thickness with bedding breaks being defined by different intensities of burrowing. The main sediment type is:

1. Light greenish-gray (5GY6/1) and (5G8/1) volcanics (0 to 5 per cent)-radiolarian (15 to 20 per cent)-foraminiferal (20 to 30 per cent)-calcareous nannofossil (50 to 60 per cent) chalk.

Unit 5 (234.6 to 253.9 meters)

Unit 5 consists of intensely burrowed light greenishgray, bluish-white, and yellowish-gray sediments. Where the burrowing has churned all three colors together the result is a very pale greenish-gray sediment.

1. About 90 per cent of this unit is a very light greenish-gray (5GY9/1) foraminiferal (10 to 15 per cent)-radiolarian (30 to 40 per cent)-calcareous nannofossil (50 to 60 per cent) chalk.

2. About 10 per cent is a yellowish-gray (5Y8/1) and white (N9) foraminiferal (10 to 20 per cent)-calcareous nannofossil (20 to 40 per cent)-radiolarian (50 to 60 per cent) chalk.

3. Within the basal 3 meters is a green calcareous nannofossil chalk which has been replaced by chert.

The contact with the underlying basalt is interpreted to be an intrusive contact which exhibits baking of the unit 5 green calcareous nannofossil chalk.

Basalt

Basement is a black, fine-grained basalt. It has an isotropic glass rind with refractive index of 1.59 to 1.60. The refractive index of this apparently non-devitrified glass suggests an SiO_2 content of about 50 per cent.

PHYSICAL PROPERTIES

Natural Gamma

Natural gamma emission readings ranged from 1028 to 1913 counts/sec. Sediments of the San Blas Oceanic Formation at this site yield the highest overall reading of any Leg 9 site which probably is due to pyroclastic material disseminated throughout. The upper part of the San Blas records higher readings than the lower part (Figure 00, Hole Summary) which correlates with more pyroclastic ash, sanidine, and authigenic clay in the upper than the lower part.

Porosity

Porosity at Site 84 ranges from 88 per cent in olive gray volcanic-montmorillonite-radiolarian-foraminiferal-calcareous nannofossil oozes to 65 per cent in very light greenish-gray foraminiferal-radiolariancalcareous nannofossil chalks. There is an overall porosity decrease of about 20 per cent which may be due, in part, to compaction. This downhole porosity decrease becomes most pronounced below Core 10 (Figures 4 and 6).

Sonic Velocity

Sound velocities range from 1487 to 1558 m/sec. A general increase in sound velocities is noted downhole

and is probably a reflection of compaction. Minor fluctuations in the readings are probably due to lithologic changes or differences in amounts of contained water, either naturally occurring or due to drilling procedures.

Bulk Density

The bulk density readings range from 1195 to 1607 g/cc, with averages at the top of the hole lower than averages at the bottom of the hole. However, on a detailed scale there is no systematic variation between density and depth or changes in lithology. Some of the fluctuations in the readings may be due to water injected into the sediments during coring.

Penetrometer

In general, the penetrometer readings decrease downhole at a relatively even rate with few fluctuations. This steady downhole decrease is probably the result of compaction within these high clay-content sediments. The readings range from 3 centimeters at the top to 0.2 centimeter at the 250 meter basal depth. Four intervals of 3 centimeters penetration were recorded at 4 to 8 meters, 27 meters, 52 meters, and 175 meters. These very sharp increases in readings probably reflect sea water injection into the sediments during coring. The highest reliable readings of induration are about 2.7 centimeters.

BIOSTRATIGRAPHY

Foraminifera

Site 84 was continuously cored throughout and, with the exception of a few short cores, the column was relatively complete without any apparent stratigraphic breaks. The cored interval included the Pleistocene *Pulleniatina obliquiloculata* Zone to the upper Miocene *Globorotalia plesiotumida* Zone. The Pleistocene interval cored at this site was thicker than any other on Leg 9. With the exception of samples from Cores 20 through 26, foraminiferal faunas were diverse, well preserved, and abundant throughout the hole. In Cores 20 through 26 there was strong evidence of downhole contamination from the Pliocene-Pleistocene.

The proximity of this hole to the continental mass of Central America was expressed in the foraminiferal faunas by the increased abundance of benthonic foraminifera. There was no evidence in the hole of secondary solution of the foraminiferal tests. This may have been due to the shallow water depth at the site. In the late Miocene, Pliocene and Pleistocene in this hole—as at Site 83—there was some evidence of cooler water with the appearance of *Globorotalia inflata* and *Globigerina bulloides*.

The hole was drilled to 254 meters and terminated in a basalt which had baked the overlying calcareous

sediments. The fauna from this "chalk" included the upper Miocene zonal species *Globorotalia plesio-tumida*.

Radiolaria

Siliceous microfossils are not present in the core catcher of Core 29, which is the only sample taken from that core. In all the samples from Cores 1 through 28, Radiolaria are present in variable abundance as well as diatoms, silicoflagellates and sponge spicules. Preservation is generally good, except for Cores 1 and 2, wherein solution effects were evident. Throughout the section high quantities of clay and humus are present, rendering the samples difficult to clean for radiolarian preparations.

The oldest definitive samples containing Radiolaria belong to the Stichocorys peregrina Zone. Two factors make this site difficult to correlate with the other sites by means of Radiolaria. First, the radiolarian fauna appears to be reworked. Reworked specimens average about five per cent of the assemblages, and much higher quantities of reworked specimens are apparent at some horizons. Second, many faunal peculiarities exist due to the position of this site in the eastern extremity of the Pacific. Site 84 underlies the eastern equatorial Pacific water mass, which contains many endemic species. Many species typical of the western and central equatorial Pacific are not present here or are very rare. Examples of the latter circumstance are Liriospyris ovalis, Lithopera bacca and Tholospyris procera. Archicircus rhombus and Clathrocircus stapedius are absent during portions of their stratigraphic ranges. Tholospyris cortinisca, Dendrospyris binapertonis and Giraffospyris angulata have initial appearances which are younger here than in the other sites. Androspyris pithecus occurs only in Core 2 and may be a contaminant. Pterocanium prismatium is very rare and has a very sporadic occurrence. Its first and last occurrences here probably do not represent the evolutionary first appearance and extinction of this species. At Site 77 Pterocanium prismatium overlaps Tholospyris devexa by about six meters, and it appears before the first occurrence of Archicircus rhombus in Site 80. The aberrant range of Pterocanium prismatium in Site 84 is unfortunate, because the base of the Spongaster pentas Zone and the top of the Pterocanium prismatium Zone are defined by the lower and upper limits of its range.

DISCUSSION AND INTERPRETATION

The rates of accumulation at this site were among the highest recorded on this leg. Table 3 gives the rates for selected intervals of time. The rates are highest in the Pleistocene, and decrease with increasing age. The Pleistocene sediments are green oozes with an admixture of continentally derived material, primarily volcanic glass. Discrete ash layers occur within the Pleistocene section (0 to 81 meters) but not below. There is admixed glass between the discrete layers within the Pleistocene, and this continues below the Pleistocene but generally decreases with depth. The carbonate content increases with depth. The high rates of sedimentation in the Pleistocene are attributed to the influx of material from continental sources. The increasing rates of accumulation with decreasing age can be explained by two alternatives. One possibility is that increasing elevation and volcanism in Panama during post Miocene and particularly post Pliocene time induced increased erosion and concomitant increases in depositional rates on the nearby sea floor. A second possibility is that the motion of the sea floor during the time represented by the sediments at this site caused the site location to move closer to Panama, thereby bringing it progressively into regions of higher depositional rates. Additional drilling sites and/or additional geophysical measurements will be necessary to test these two alternatives.

The basalt/sediment contact at this site was altered. A thin layer of chert overlies the basalt and a layer of glauconite immediately overlies a chilled glassy basalt. The alteration of the sediments at this site is different from that at the previous sites, in that it does not include the altered clay found earlier or the abundance of magnetite. This may be due to a different kind of intrusion or sediment, or both.

The sediments immediately overlying basalt are in the G. *plesiotumida* foraminiferal zone, which would give the basement a maximum age of 7 to 9 million years which is younger than the basal sediments at Site 83.

REFERENCE

Cook, H. E. and Zemmels, I., 1971. X-ray mineralogy studies-Leg 9. In Hays, J. D. et al., Initial Reports of the Deep Sea Drilling Project, Volume IX. Washington (U. S. Government Printing Office), in press.

TABLE 1 Site Operational Summary

Site 84

Latitude: 05° 44.92'N; Longitude: 82° 53.29'W. Time of arrival: 1832 hours, 1/23/70; Time of departure: 0400 hours, 1/26/70. Time on site: 2 days, 9 hours, 28 minutes. Water depth: 3097 meters. Sediment thickness determined by drilling: Acoustical thickness: 0.38 second. Average sound velocity of sediments: 1.34 km/sec.

Hole	Penetration	Cores	Cores	Per Cent	Recovery	Per Cent
	(m)	Attempted	Recovered	Cored	(m)	Recovered
84	255	30	30	96.7	216.15	87.6

TABLE 3 Rates of Sedimentation, Site 84

Geologic Interval	Duration Geologic Interval (m.y.)	Sediment Thickness (meters)	Accumulation Rate (m/10 ⁶ yrs.)
Pleistocene	1.8	81	45.0
Upper Pliocene	1.2	45	37.5
Lower Pliocene	2.0	72	36.0

TABLE 2
Hole Drilling Summary, Site 84
(Latitude 05° 44.92'N, Longitude 82° 53.29'W; 3097 meters depth)

Hole 84

Interval Bea Flo				Core	Cut	Core Red	owarad	Drill Store	Dume	Drilling Patr
(m)	(ft)	Drilled	Core	(m)	(ft)	(m)	(ft)	Drill Stem Rotated	Pump Circ	Drilling Rate (ft/min)
0.00-9.10	0-30		1	9.1	30	9.10	30.0			
9.10-18.30	30-60		2	9.1	30	9.10	30.0			
18.30-27.40	60-90		3	9.1	30	9.10	30.0			
27.40-36.60	90-120		4	9.1	30	9.10	30.0			
36.60-45.70	120-150		5	9.1	30	9.10	30.0			
45.70-54.90	150-180		6	.9.1	30	4.90	16.0			
54.90-64.00	180-210		7	9.1	30	9.10	30.0			
64.00-73.20	210-240		8	9.1	30	9.10	30.0			
73.20-82.30	240-270		9	9.1	30	9.10	30.0			
82.30-91.40	270-300		10	9.1	30	9.10	30.0			
91.40-100.60	300-330		11	9.1	30	9.10	30.0			
100.60-109.80	330-360		12	9.1	30	9.10	30.0			
109.80-118.90	360-390		13	9.1	30	9.10	30.0			
118.90-128.00	390-420		14	9.1	30	7.60	25.0			
128.00-137.20	420-450		15	9.1	30	2.70	9.0			
137.20-146.30	450-480		16	9.1	30	9.10	30.0			
146.30-155.50	480-510		17	9.1	30	4.00	13.0			
155.50-164.60	510-540		18	9.1	30	5.20	17.0			
164.60-173.70	540-570		19	9.1	30	8.50	28.0			
173.70-182.90	570-600		20	9.1	30	9.10	30.0			
182.90-191.80	600-630		21	9.1	30	6.40	21.0			
191.80-201.20	630-660		22	9.1	30	7.90	26.0			
201.20-210.00	660-690		23	9.1	30	7.90	26.0			
210.00-219.50	690-720		24	9.1	30	4.90	16.0			
219.50-228.70	720-750		25	9.1	30	5.50	18.0			
228.70-237.80	750-780		26	9.1	30	8.20	27.0			
237.80-247.00	780-810		27	9.1	30	9.10	30.0			
247.00-250.90	810-823		28	4.0	13	5.50	18.0			
250.90-254.96	823-832		29	2.7	9	0.15	0.5			
254.96-254.99	832-833		30	0.3	1	0.30	1.0			
Total 254.99	833		30	246.7	833	216.15	711.5			

	BIOSTRATIGRAPHY	r	S			2			2		
FORAMINIFERA	NANNOFOSSILS	RADIOLARIANS	SERIES- SUBSERIES	METERS	CORES	FORMATION		LITHOLOGIC DESCRIPTION	COLUMN	Ca CO 3 %	SILICEOUS BIOTA %
					1	-		DARK GREENISH GRAY + GREENISH BLACK Volcanic- Montmorillonite Radio- larian-Nannofossil Ooze +	2 М		
	G. "oceanica"- C. cristatus	No Zonal Name		25 -	3		UNIT	DARK YELLOWISH BROWN Volcanic-Foram-Radio- larian-Nannofossil Ooze + MEDIUM DARK GRAY	M A A		<pre>{</pre>
P. obliquilo- culata	Subzone		PLEISTOCENE		5			Rhyolitic Tuff Bed GRAYISH OLIVE + OLIVE GRAY Volcanic- Montmor- illonite-Radiolarian- Foram-Nannofossil Chalk	A M		2
	(G. "o."-C.1. C ^{macintyrei}	?		50 —	6 7		5	Ooze +		\leq	
	G. "oceanica"-			75 —	8		UNIT	MEDIUM DARK GRAY A 🛠 Rhyolitic Tuff Beds	M A A	-	
	C. carteri Subzone	Pterocanium prismatium			10	FM.		PALE OLIVE Volcanic Foram Radiolarian-Nannofossil Ooze Chalk	M A		}
G. fistulosus	D. brouweri- C. Leptoporus Subzone		UPPER PLIOCENE	100 —	11 12 13	AN BLAS	UNIT 3	+ PALE GRAYISH OLIVE Volcanic-Montmoril- lonite Foram + Radio- larian-Nannofossil Ooze	A : M		
				125 -	14			Chalk	M M		
S. dehiscens		Spongaster pentas			15 16			LIGHT GREENISH GRAY Volcanic-Radiolarian- Foram-Nannofossil Chalk	A M M		
	D. brouweri- R. pseudo- umbilica Subzone		LIOCENE	150 —	17		T 4		A M M A		\$
G. tumida		Ctu ale annu a	LOWER PLIOCENE	175 —	19 20		UNIT		A M		
	C. rugosus Zone C. tricornicul- atus Zone	Stichocorys peregrina	UPPER MIOCENE	200 -	21				A A		

Figure 2. Site 84 summary.

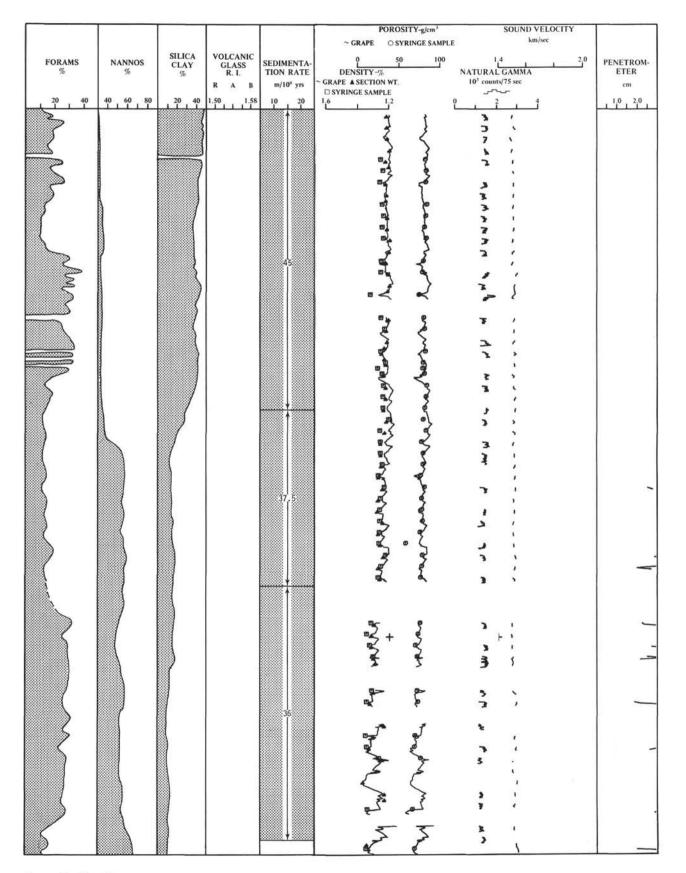


Figure 3. Site 84 summary.

623

	BIOSTRATIGRAPHY	(S			z		<u>u</u>		
FORAMINIFERA	NANNOFOSSILS	RADIOLARIANS	SERIES- SUBSERIES	METERS	CORES	FORMATION	LITHOLOGIC DESCRIPTION	COLUMN	Ca CO 3 %	SILICEOUS BIOTA %
G. tumida					23			M A		
G.plesiotumida	C. triorniou- latus Zone	Stichoaorys peregrina	UPPER MIOCENE	225-	24 25 26	SAN BLAS FM.	Foram-Nannofossil Chalk	м А		
	D. variabilis- D. challengeri Subzone			250—	29	UNIT 5	VERY LIGHT GREENISH GRAY Foram-Radio- larian-Nannofossil Chalk Basalt			
				275—				1999-9-4 1999-9-4		
				300—						
	-			325-						
				350-						
				375-						
				400-						

Figure 4. Site 84 summary (continued).

					PORC	OSITY-g/cm ³		SOUND VELO	CITY	
1					~ GRAPE 0 S			km/sec		
FORAMS	NANNOS	SILICA CLAY %	VOLCANIC GLASS R. I.	SEDIMENTA-		0 100	I.4 NATURAL	GAMMA	2;0	PENETROM- ETER
%	%		R.I. R A B	TION RATE m/10 ⁶ yrs	DENSITY -% - GRAPE A SECTION WT	8	10 ³ counts/	75 sec		cm
20 40	40 60 80		.50 1.58	10 20	SYRINGE SAMPLE					1,0 2,0
TIT					7	7		>		
15					2	ø		3		-
2					D	7	7	5		_
					*	*	,			
II .					5	5		}		×
					-	C	2			
\mathbb{N}				÷	and the second s	a l				-
$ \zeta $					₽Z	5	>	>		
17					1	Ę				
						5	د	د		1
					2		- 3			
		1 1			ĺ					
		1 1								
					1					1 1
	5									
					1					1 1
	1	1								
		1		1	1					
1	1									
					l.					
		4								
		1								
			1		1					
			1	1						
					1					
					1					
				1	1					-
					1					
					1					
			1							1

Figure 5. Site 84 summary (continued).

MARSTOCKIR: MARSTOCKIR:
1 2 -

Figure 6. Biostratigraphic Chart Foraminifera (0 to 200 feet).

_				_	BIOSTRATIGRAPHIC CHART FORAMINIFERA
SERIES	ZONES	DEPTH BELOW SEA FLOOR FT. M.	BARRELS	SAMPLES	ТАХА
PLEISTOCENE	P. obliquiloculata	225 70 250 80	5 7 1 2 3 8 5 6 1 2 3 9 4 5 6 1 2 3 4 5 6 1 2 3 4 5 6 1	+ + + + + +	P. obliquiloculata -G. turber -G. acquitateratis -G. traitida -G. traitida -G. traitida
UPPER PLIOCENE	G. fittulosus	$ \begin{array}{c} 275 \\ - \\ 90 \\ 300 \\ - \\ - \\ 325 \\ 100 \\ - \\ - \\ 350 \\ - \\ - \\ 110 \\ - \\ 350 \\ - \\ - \\ 120 \\ 400 \\ \end{array} $	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	* * * * * * * * * * *	- G. tanka - G. tanka tarmita - G. tarmita tarmita

Figure 7. Biostratigraphic Chart Foraminifera (200 to 400 feet).

SERIES	ZONES	DEPTH BELOW SEA FLOOR FT. M.	SECTIONS	BARRELS	SAMPLES		8103										TAX	A											
UPPER PLIOCENE	G. fistulosus		3 4 5	14	+++	ei			G. tumida tumida										-G. obliquus	15					1				
UPP		425 130	1	15	+ +	G, dutertrei			G. tum	G. humilie	o, jurcaus-							G. praedigitata		G. fistulosus	e 10								
	S. dehiscens	450	1 2 3 4 5 6	16	+ +	-G. bulloides-	G. nuber	G. crassula			G. hexagona	G. condobotus	congrotates								G. exilis	G. humerosa	G. miocenica	G. altispira-					
OCENE		500	1 2 3	17	+			G. ci				9	3. sacculifer-	G. scitula -	G. trilobus		C 1411	S. deniscens						G. al	G. decoraperta	numeros co			
LOWER PLIOCENE		525 160	1 2 3 4	18	+										G. h	tumida flexuos										S. subdehiscens	 enica -		
	G. tumida	550 - 170	1 2 3 4 5 6	19	+ +											-0.	G. venezuelana										G. dehiscens.	erata	
		575 - - - - - - - - - - - - - - - - - -	1 2 3 4 5 6	20	+ +																							G. multicamerata	G. acostaensis

Figure 8. Biostratigraphic Chart Foraminifera (400 to 600 feet).

SERIES	ZONES	DEPT BELC SEA FL FT.	M.	BARRELS	SAMPLES	BIOSTRA							IXA						 	
LOWER PLIOCENE		-		1 2 3 21 5 6 1 2	+ + + +	-G. calida -G. calida -G. crassula -G. tumida tumida -G. calida -G. tumida tumida -G. tumida -G. tumida tumida -G. tumida			- C. nitida — G. tumida flexuosa – C. nitida –		G humeroso				C Abhbaar	- G. multicamerata	1313			
	G. tumida	650	_200	3 22 4 5 6 1	+	-G. glutinata			oneprisonov J	G. obliquus - C. Para	9	-G. miocenica					G. acostaensis			
		675	-	2 3 4 5 6	+	G. juvenilis.	ю. лехадола			G. ob		G altimira	G. decoraperta							
ENE		700	_210	1 2 3 24	+++		G. sacculifer						G. c. S. seminulinaG. c				G. plesiotumida			
UPPER MIOCENE	G. plesiotumida		_220	1 2 3 25 4	+		°.	G. trilobus — O. universa –						O hilohuta S. subdehiscens						
	6.1	750	_230	1 2 3 26 4 5 6	+										- G. pseudomiocenica -			ities —		
		800	_240	6 1 2 3 4	+													G. nepenthes		

Figure 9. Biostratigraphic Chart Foraminifera (600 to 800 feet).

SUBSERIES	ZONES	DEPTH BELOW SEA FLOOR FT. M.	SECTIONS	BARRELS	SAMPLES	TAXA
8	G. Plesionmida	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	5 6 1 2 3 4 1			C. Androma C. Strattering C. Strattering

Figure 10. Biostratigraphic Chart Foraminifera (800 to 1000 feet).

Figure 11. Biostratigraphic Chart Radiolaria (0 to 200 feet).

BIOSTRATIGRAPHIC CHART RADIOLARIA

SERIES	ZONES	DEPTH BELOW SEA FLOOR FT. M.	SECTIONS	BARRELS	SAMPLES	BIOSTRATIGRAPHIC					XA							
	-7-7-	-	5 6	7	+++++++++++++++++++++++++++++++++++++++									1			ta	s devexa
PLEISTOCENE		22 <u>5</u> 70	1 2 3 4 5 6	8	++++++										s stapedius	Ceratospyris hyperborea	Liriospyris reticulata	Tholospyris devena
		25 <u>0</u> - <u>80</u> -	1 2 3 4 5 6	9	+ + + +							tterispina	Archicircus rhombus	Nephrospyris renilla	Clathrocircus stapedius	Сега		
	rismatium	27 <u>5</u> 30 <u>0</u>	1 2 3 4 5 6	10	+++++++					ngulata	Dendrospyris binapertonis	Giraffospyris laterispina	Archi					
L OCENE	Pterocarium prismatium	- - - 325 - 100	1 2 3 4 5 6	11	+ + + + +	ŗ	88	Dendrospyris danaecornis	Panartus tetrathalmus	Giraffospyris angulata	Den				1 1 1 1			
UPPER PLIOCENE			1 2 3 4 5 6	12	+ + + +	a m prismatium	Tholospyris scaphipes	Dendrospy1							1 1 1 1 1 1 1			
		- 37 <u>5</u> -	7 2 3 4 5 6	13	+++++++++++++++++++++++++++++++++++++++	Stichooorys peregrina Pterocarium prismatium Doreadospyris												
		120 400	1 2	14	+	Stichc									1			

Figure 12. Biostratigraphic Chart Radiolaria (200 to 400 feet).

SERIES SUBSERIES	ZONES	DEPTH BELOW SEA FLOOR FT. M.	SECTIONS	BARRELS	CCUT INFO				1 14	DIOLA		XA							
UPPER PLIOCENE			3 4 5	14	+ + +												 	dius	
		42 <u>5</u> - - - -	2	15	-						a	tinisca	Dendrospyris binapertonis	Giraffospyris laterispina	Archicircus rhombus	Nephrospyris renilla	Pterocanium prismatium	Clathrocircus stapedius	
	Spongaster pentas	45 <u>0</u> - <u>1</u> 40 - 47 <u>5</u>	3 4 5	16	-			phipes	Dendrospyris damaecornis	Panartus tetrathalmus	Giraffospyris angulata	Tholospyris cortinisca	Dendrospyris	Giraffosp	Archie	llephr		0	
LOWER PLIOCENE	Brodg	500	6 1 2 3	17	-	peregrina	Doroadospyris pentagona	Tholospyris scaphipes	Dendrosp	đ									
LOWER P		52 <u>5</u> 160	1 2 3 4	18	ndis leib	Stichocorys peregrina	DOJ												
	Stichocorys peregrina	- 550 - 170 - 575 - - - - - - - - - - - - - - - - -	4 5 6 1 2 3																

Figure 13. Biostratigraphic Chart Radiolaria (400 to 600 feet).

SERIES	ZONES	DEPTH BELOW SEA FLOOR FT. M.	SECTIONS	BARRELS	SAMPLES						TAX	A					
LOWER PLIOCENE		- - 62 <u>5</u> 190	1 2 3 4 5 6	21	+++++++++++++++++++++++++++++++++++++++							87	gulata	Tholospyris cortinisca	Dendrospyris binapertonis	Giraffospyris Laterispina	
		- - 65 <u>0</u> - 200	1 2 3 4 5 6	22	+++++++++++++++++++++++++++++++++++++++				a	scaphipes	Dendrospyris damaecornis	Panartus tetrathatmus	Giraffospyris angulata	Tholospyri	Dendro	67.1	
	Stichocorys peregrina	67 <u>5</u> - - - - 210	1 2 3 4 5 6 1	23	+ + +		siona	Stichocorys peregrina	Dorcadospyris pentagona	Tholospyris scaphipes	Dend						
UPPER MIOCENE	Stichocor	- 70 <u>0</u> - - - -	2 3 4 1	24	+++++++++++++++++++++++++++++++++++++++	Ommatartus penultimus	Tricolospyris leibnitziana	Stichocol									
UPPE		72 <u>5</u> 220	2 3 4	25	++++++	Onn											
		- <u>23</u> 0 	2 3 4 5 6 1	26	+ + + + + +												
		<u>24</u> 0 800	2 3 4	27	+++												

Figure 14. Biostratigraphic Chart Radiolaria (600 to 800 feet).

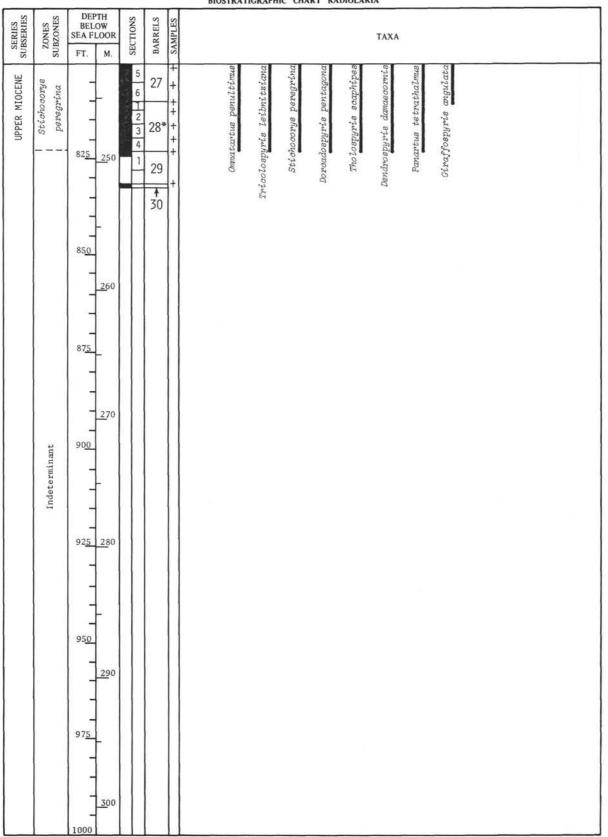


Figure 15. Biostratigraphic Chart Radiolaria (800 to 1000 feet).

SERIES SUBSERIES	ZONES SUBZONES	DEPTH BELOW SEA FLOO FT. M		BARRELS	SAMPLES	BI			ТАХА
		25	1 2 3 4 5 6	1					
	e		1 2 3 4 5 6 1	2					
PLEISTOCENE	sphyrocapea spp. Zone - Ceratolithus cristatus Subzone	20 	2 3 4 5 6	3	C. doronicoides?	Nitschia marina	P. doliolus	D. fibula perlaevie	
PLE	Gephyrocapsa spp Ceratolithus o		1 2 3 4 5 6	4	C. doron	Nitschic	P. do	v. inomous D. fibul	
	Gept	125 -40 	1 2 3 4 5 6	5		var. ellipticus			
		- 50 - 175	1 2 3 4	6	_	C. lineatus			
		60 200 EGEND:	1 2 3 4	7					- Frequent occurrence, Greater than frequent occurrence.

Figure 16. Biostratigraphic Chart Nannofossils (0 to 200 feet).

RIES	IES	DEPTH BELOW SEA FLOOR	IONS	LES	BIOSTRATIGRAPHIC CHART NANNOFOSSILS
SUBSERIES	ZONES SUBZONES	FT. M.	SECTIONS	SAMPLES	ТАХА
	cristatus Subzone	-	5 6	-	
]	1 2		
CENE	Zone G.spp rei Subz	22 <u>5</u> 70	2 3 4	3	
PLEISTOCENE	Gephyrocapsa spp. Zone 16. spp G.sppC. C. 1. macintyrei Subzone	-	5 6		2 - 2-meaa
	hyrocap G. C. L.	250	1 2		
		- 80	3 4	,	C. doronicide D. Mombus aevis Irina T
	teri Sul		5 6		C. do D. F. doliolus P. doliolus Nitschia marina
	G. sppC. carteri Subzone	27 <u>5</u>	1	E	D. fib P. d
	G. spp	-	3 4		
		<u>90</u> 30 <u>0</u>	5	F	
	ubzone	-	1 2	F	
	topora S	325	3 4		
CENE	Zone iina lepi	32 <u>5</u> 100	5 6 1	-	
UPPER PLIOCENE	proventit	-	2	E	
UPI	Discoaster browneri Zone weri-Cyclococcolithina 1	350	4 5	2	
	Disc	-110	6	-	
	Discoaster browneri Zone Discoaster browneri-Cyclocococithina leptopora Subzone	375	2		
	Dis	-	4 5	3 –	
		- 120	6		
NAMO		400 .EGEND:	2 1	_	uent occurrence, — Frequent occurrence, — Greater than frequent occurrence.

Figure 17. Biostratigraphic Chart Nannofossils (200 to 400 feet).

~

\$	s	DEPTH	8 8	1.0	BIOSTRATIGRAPHIC CHART NANNOFOSSILS
SERIES	ZONES	DEPTH BELOW SEA FLOOR FT. M.	SECTIONS BARRELS	SAMPLES	TAXA
UPPER PLIOCENE	D. broweri – C. leptopora Subzone		- 14		
	D. br C. lep	425 - - -	1 2 3 15	- - -	Cf cf
	Discoaster browneri Zone tra pseudownbilica Subzone	450 - 140 - 475	1 2 3 4 5 6		
	Discoaster b iculofenestra pseudoumi	- - - - - - - - - - - - - - - - - - -	1 2 3 17	11	T. convexa
LOWER PLIOCENE	Discoaster browneri - Reticulofenestra pseudoumbilica Subzone	525 160	1 2 3 4 18	Н	vis <u>D. entaradiatus</u> <u>D. ohallengeri</u> <u>Nitschia marina</u> <u>N. marina var.</u> B ea
	Dis	- 550 - 170	1 2 3 4 5 6		D. fibula perlaevis n. n. D. fibula longispina b. fibula mombica b. stellulus
	C. rugosus Zone	575 - - - - - - - - - - - - - - - - - -	6 1 2 3 4 5 6		D. quinquerimus D. mutabilis -cf- D. rhombus D. rhombus

NANNOFOSSIL LEGEND: ----- Rare to infrequent occurrence. ----- Frequent occurrence. ----- Greater than frequent occurrence.

Figure 18. Biostratigraphic Chart Nannofossils (400 to 600 feet).

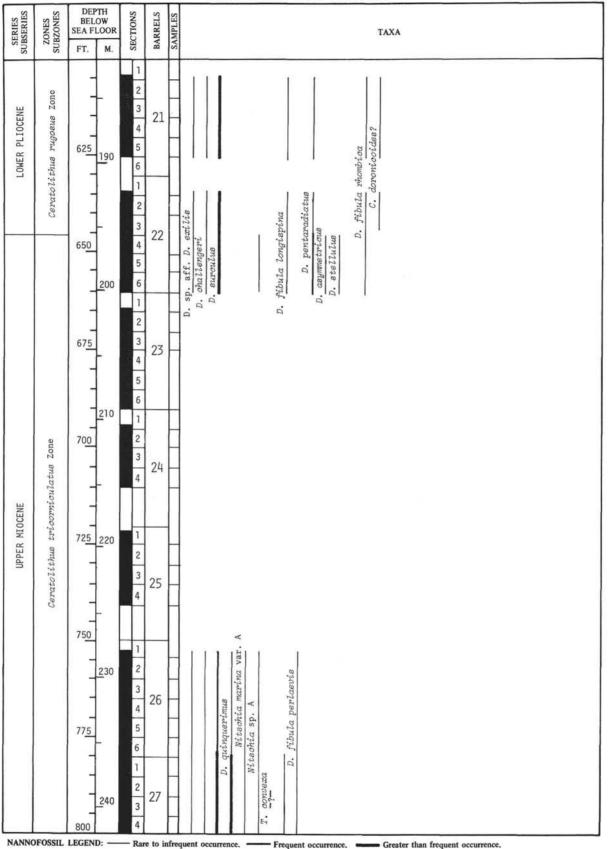


Figure 19. Biostratigraphic Chart Nannofossils (600 to 800 feet).

SERIES SUBSERIES ZONES SUBZONES	DEPTH BELOW SEA FLOOR FT. M.	SECTIONS BARRELS	SAMPLES	ТАХА
UPPER MIOCENE D. variabilis Zone C. tricorn- D. variabilis Zone C. tricorn-		5 27 1 29 30 30	B. sp. aff. D. exilis B. sire D. exilis D. challengeri D. ginquerimus D. fibula periary D. fibula rongien D. fibula rongien	
NANNOFOSSIL				

NANNOFOSSIL LEGEND: ----- Rare to infrequent occurrence. ----- Frequent occurrence. ----- Greater than frequent occurrence.

Figure 20. Biostratigraphic Chart Nannofossils (800 to 1000 feet).

BIOSTRATIGRAPHIC COMPARISON	CHART
biositianitokatine coali Akisola	CHARI

DEI BEI SEAF	PTH LOW FLOOR	RECOVERY	BARRELS	SERIES SUBSERIES		FORAM	UNIFI	ERA						NANI	NOFO	OSSIL	s				RAD	IOLARIA	
FT.	М.	REC	BA	SUB	ZONES	ZC	ONAL	IND	DEX	TAXA	ù	ZONES	Γ	Z	ONA	L IN	DEX T	AXA		ZONES	Z	ONAL INDEX TAXA	
			1 2 3 4 5 6 7 8	PLEISTOCENE	P. obliquilaenlata							G. spp Ceratolithus oristatus Subzone C. I. mao- ntyrei Subz			a mutatotio					No. come			
			9 10 11		87					P. obliquiloculata		oolithina G. spp c. cartieri Subzone	1. macinturei 🔸							Ptarocontian priamatium			
- 350 - - - - 400 -	-110		12 13 14	UPPER PLIOCENE	G. fictulosus	1				G. fietuloeue		Dissonster browneri-cyclococolithina Leptopora Subzone		ra q vars.			var.	us 6 var.	olithus carteri	M		Pteroaatium prismatium	
- - 450- - - -			15 16	LOWER PLIOCENE	S. dehiecens		ue lana	6. tumida	S. dehiscens			Dieocaster brunderi - Reticutofenestra pesudolumbilica Subzone		lydiococcolithina lepiopora a Reticulofenestra pseudoumbilica		Discoaster variabilis var.	Discoaster broweri & var.	Ceratolithus rugos	Coccolithus carteri	Sponguster pentus	Stichocorys peregrina		
500— - -		Ī	17 18	LOWER	G. timida	G. altispira	G. venezuelana	G. t				Discoast Reticulofenest Su		Ret	Discoaster challengeri	Discoaster			1				

Figure 21. Biostratigraphic Comparison Chart.

DEI BEI SEAF	PTH LOW LOOR	RECOVERY	BARRELS	SERIES SUBSERIES		F	ORA	MIN	FER			NAN	NOFOSSI	LS				RADIOLARIA
FT.	М.	REC	ΒA	SUB	ZONES		7	ON	AL IN	TAXA	ZONES	3	ZONAL IN	DEX T	AXA	ZONES		ZONAL INDEX TAXA
550 — - - - 500 — - -	-170		19 20 21	LOWER PLIDCENE	6. tsunîda						Ceratolithus rugoaue D. browneri- R. pesudoundition Zone R. pesudoundition				Ceratolithus rugoeue & var. Cocoolithus carteri			Pteroccritium priematium
- 550	200		22						ida		Cerato				Ceratol	કુમ્પ્રેમવ		
- 700— -	-210 - -220		23 24	UPPER MIOCENE		mida	G. altispina	G. venezuelana	G. tunida		éculatus Zone	ra & vars.	var.	aster browert f var Cerrtolitina-Tricorniculatue		Stichcoorys peregrina		
	-230		25 26	UPPE	G. plesiotunida	G. plestotumida	<i>a</i> .				Cerctolithus tricorriculatus	Cyalococcolithina leptopora § vars.	Discoaster challengeri Variabilis § var.	Disconter brounent & var Centolithua-Tricorni			Ommatartus penultraus	Stichcorys peregrind
 100 	- 240 250		27 28 29								C. variabilis D. variabilis D. neohamatu Subzone	3-	Discouster vari				Ommatartu	Stiah
	-260		3'0									*		27 - 1221				
	-270 																	
	- 290																	
-)50	-320																	

BIOSTRATIGRAPHIC COMPARISON CHART

Figure 22. Biostratigraphic Comparison Chart (continued).

SERIES- SUBSERIES	METERS	SEC TIONS	LITH Column	SMEAR SLIDES	%CaCo3	LITHOLOGIC DESCRIPTION
	11111111	1		*	•	SAN BLAS FORMATION Unit 1 Slightly to moderately disturbed. Interbedded in 1 to 75 cm. thick beds.
	2	2	A	*		DARK GREENISH GRAY (5GY4/1), montmorillonitic - (5%-10%) - radiolarian (15%-25%) - foraminiferal (20%-30%) - calcareous nannofossil (40%-60%) ooze with about 2% volcanic glass, green, brown, and oxyhornblende, and feldspar and palagonite. GREENISH BLACK (5GY2/1), montmorillonitic (10%-15%) - radiolarian (15%-25%) - foraminiferal (20%-30%) -
O C E N E	4	3	1 M A 3			 Calcareous nannofossil (40%-60%) ooze with about 5% volcanic glass, green, brown, and oxyhornblende, and feldspar and palagonite. DARK YELLOWISH BROWN (10YR4/2) to DUSKY YELLOWISH BROWN (10YR2/2), volcanic (10%-20%) - foraminiferal (10%-15%) - radiolarian (10%-15%) - calcareous nannofossil (50%-60%) ooze. Minor amounts of DUSKY GREEN (5G3/2), foraminiferal
PLEIST	5 1111111	4	A	*		(10%-15%) - radiolarian (10%-15%) - montmorillonitic (20%-40%) - calcareous nannofossil (50%-60%) ooze.
14 ¹	7	5	A 2			
	8	6	н М 1 М 1 М 1 А 1			
			M S			

Figure 23. Hole 84, Core 1 (0 to 9.2 m).

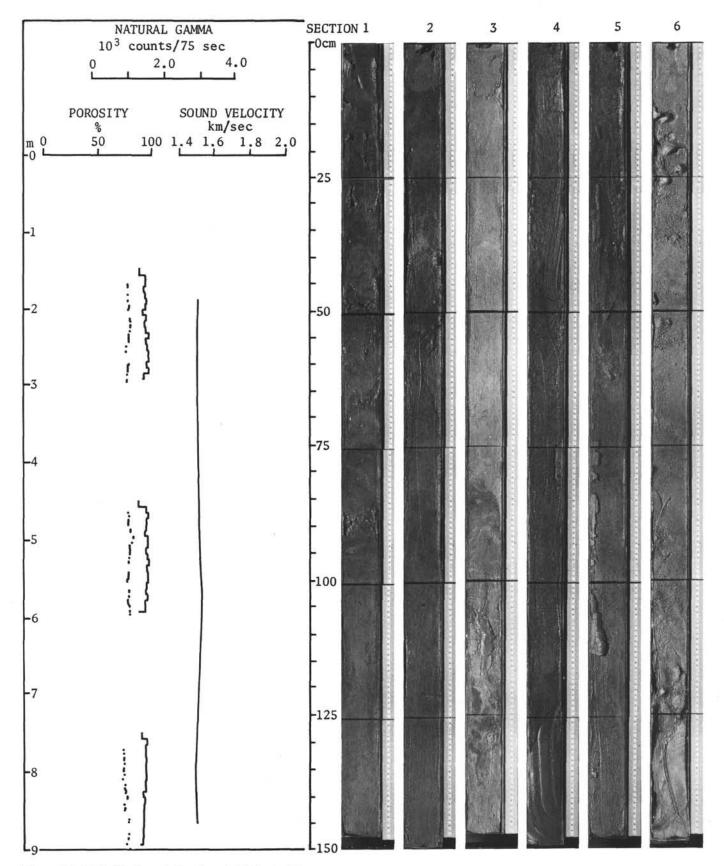


Figure 24. Hole 84, Core 1, Sections 1-6, Physical Properties.

SERIES- SUBSERIES	METERS	SECTIONS	LITH Column	SMEAR	% CaCo 3 25 50 75	LITHOLOGIC DESCRIPTION
PLEISTOCENE	1111111	1	л А м			SAN BLAS FORMATION Unit 1 Slightly to moderately disturbed. Interbedded in 1 to 75 cm. thick beds.
	2 1 1 1 1 1	2	Λ			DARK GREENISH GRAY (5GY4/1), montmorillonitic (5%-10%) - radiolarian (15%-25%) - foraminiferal (20%-30%) - calcareous nannofossil (40%-60%) ooze with about 2% volcanic glass shards, green, brown, and oxyhornblende, and feldspar and palagonite. GREENISH BLACK (5GY2/1), montmorillonitic (10%-15%) - radiolarian (15%-25%) - foraminiferal (20%-30%) -
	-3	3		*		calcareous nanofossil (40%-60%) ooze with about 5% volcanic glass shards, green, brown, and oxyhornblende, and feldspar and palagonite. Rhyolitic tuff bed.
	511111111	4	n A			DARK YELLOWISH BROWN (10YR4/2) to DUSKY YELLOWISH BROWN (10YR7/2), volcanic (10%-20%) - foraminiferal (10%-15%)- radiolarian (10%-15%) - calcareous nannofossil (50%-60%) ooze. Minor amounts of DUSKY GREEN (5G3/2), foraminiferal (10%-15%) - radiolarian (10%-15%) - montmorillonitic (20%-40%) - calcareous nannofossil (50%-60%) ooze.
	-6 	5	2 M			
	8 1111111	6	Â.			

Figure 25. Hole 84, Core 2 (9.2 to 18.3 m).

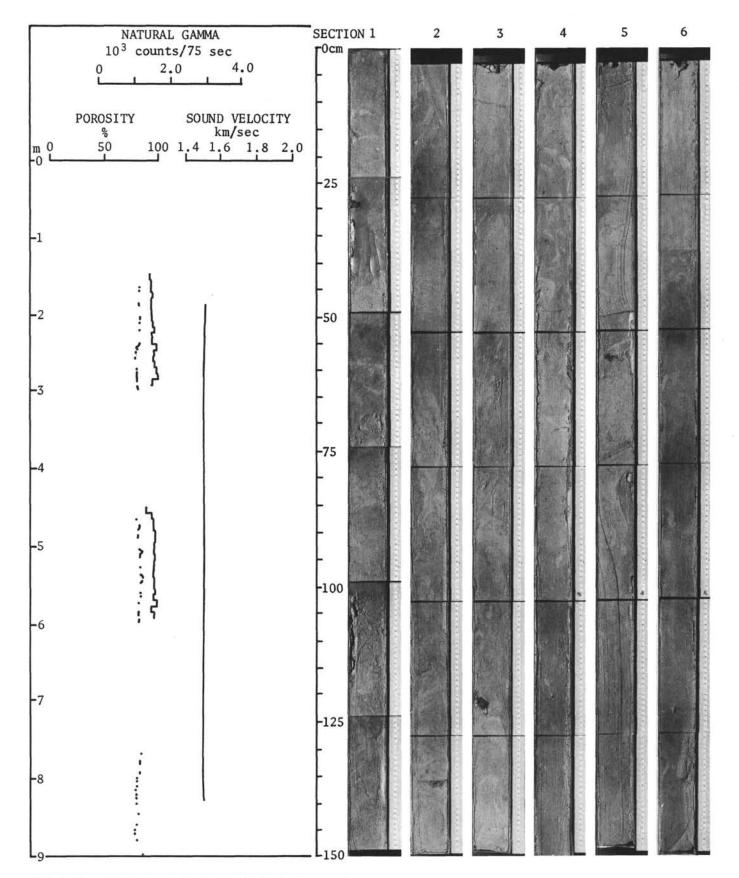


Figure 26. Hole 84, Core 2, Sections 1-6, Physical Properties.

SERIES- SUBSERIES	METERS	SECTIONS	LITH COLUMN	SMEAR	%CaCo3	LITHOLOGIC DESCRIPTION
P L E I S T O C E N E		1	Â	*		SAN BLAS FORMATION Unit 1 DARK GREENISH GRAY (5GY4/1), montmorillonitic (5%-10%) - radiolarian (15%-25%) - foraminiferal (20%-30%) - calcareous nannofossil (40%-60%) ooze with about 2%
	2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	2				 GREENISH BLACK (5GY2/1), montmorillonitic (10%-15%) - radiolarian (15%-25%) - foraminiferal (20%-30%) - calcareous nannofossil (40%-60%) ooze with about 5% volcanic glass shards, green, brown and oxyhornblende, and feldspar and palagonite.
	4	3	M			<pre>DARK YELLOWISH BROWN (10YR4/2) to DUSKY YELLOWISH BROWN (10YR2/2), volcanic (10%-20%) - foraminiferal (10%-15%) - radiolarian (10%-15%) - calcareous nannofossil (50%-60% ooze.</pre> Minor amounts of DUSKY GREEN (563/2), foraminiferal - (10%-15%) - radiolarian (10%-15%) - montmorillonitic (20%-40%) - calcareous nannofossil (50%-60%) ooze.
	5 1111111	4	Α			
	7	5	M			
	8	6				

Figure 27. Hole 84, Core 3 (18.3 to 27.4 m).

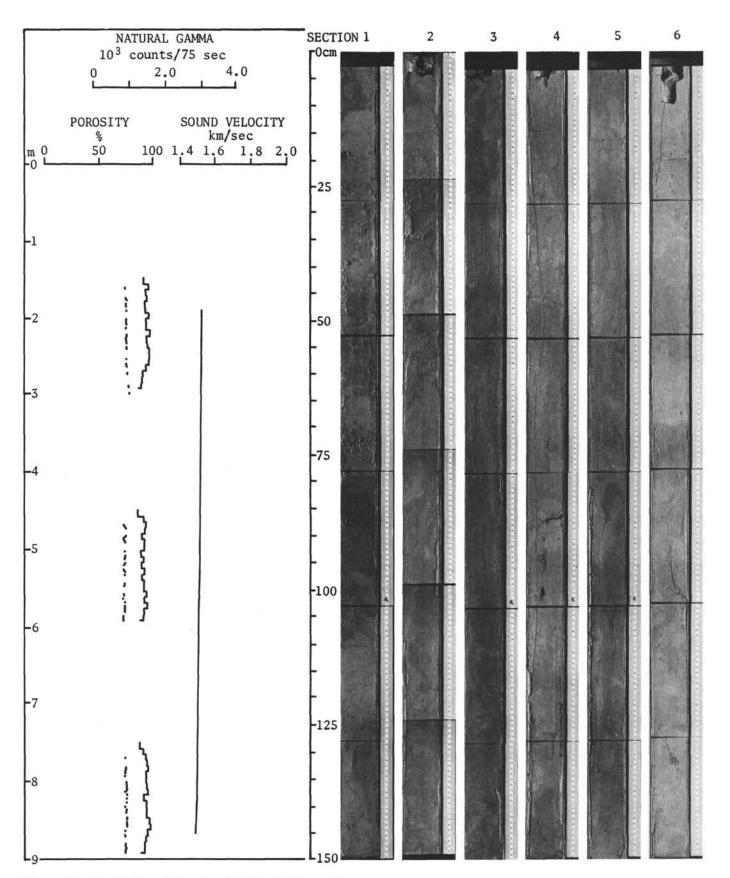


Figure 28. Hole 84, Core 3, Sections 1-6, Physical Properties.

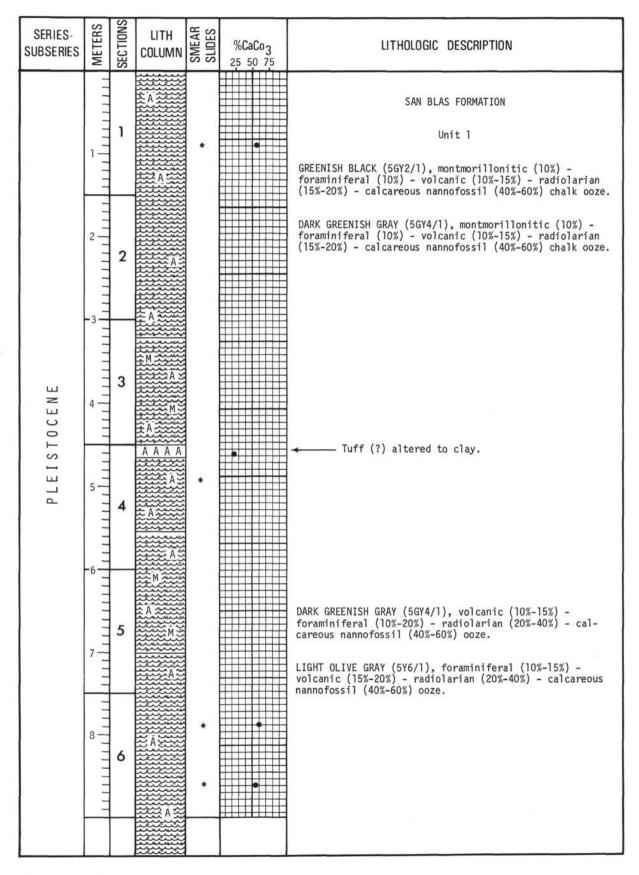


Figure 29. Hole 84, Core 4 (27.4 to 36.6 m).

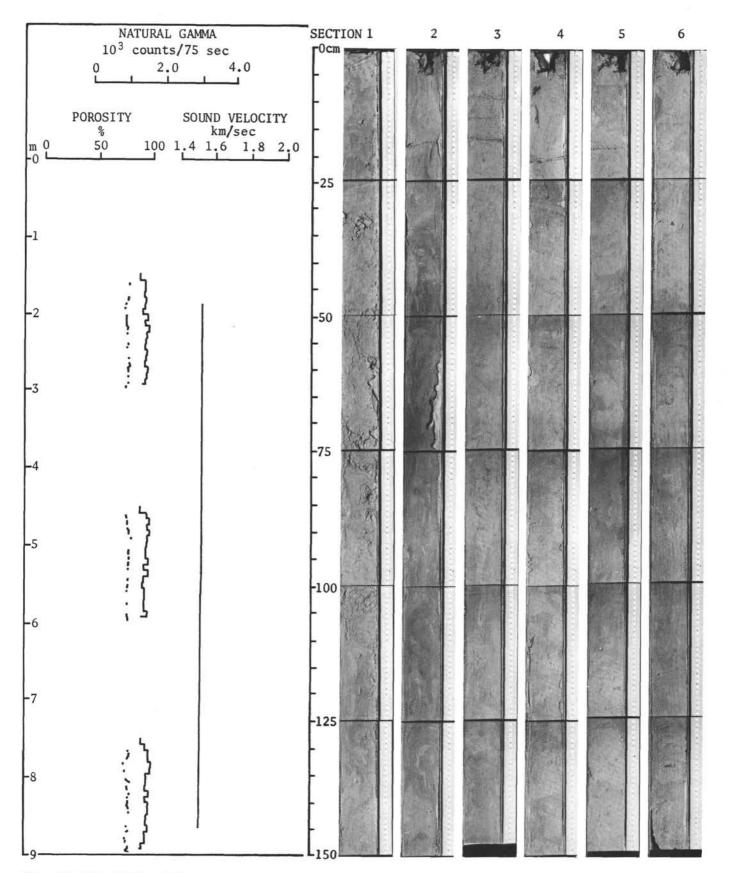


Figure 30. Hole 84, Core 4, Sections 1-6, Physical Properties.

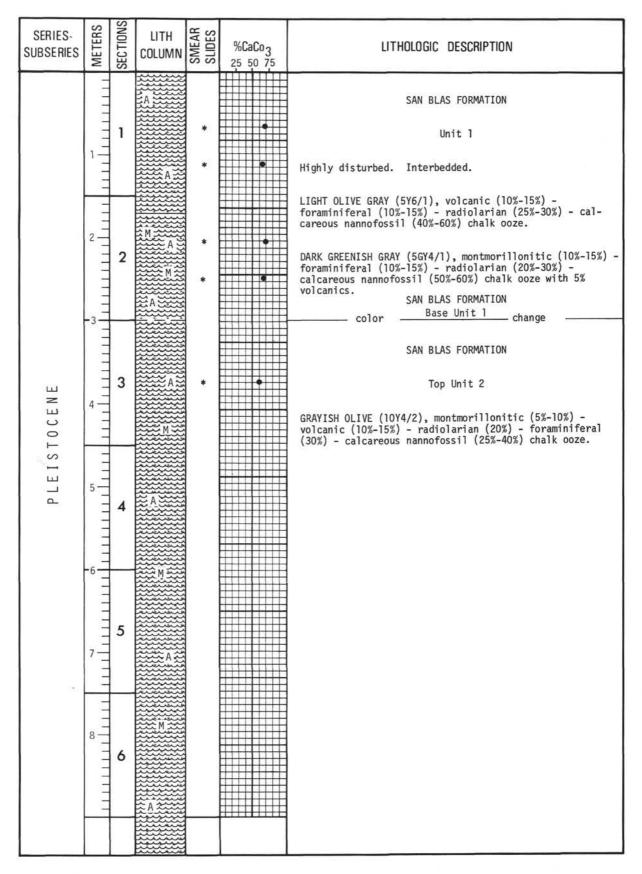


Figure 31. Hole 84, Core 5 (36.6 to 45.7 m).

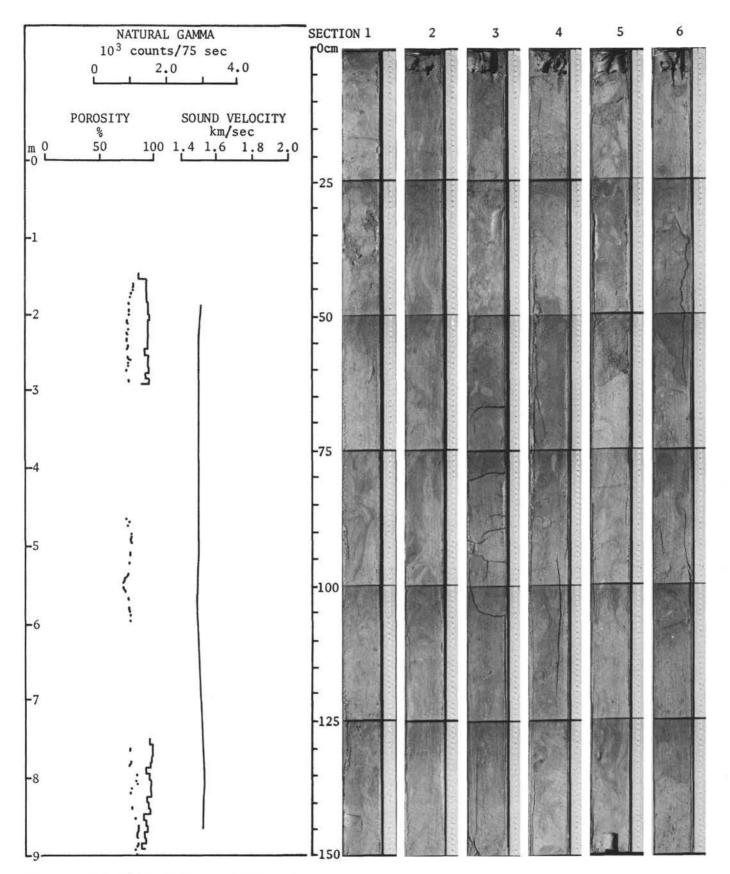


Figure 32. Hole 84, Core 5, Sections 1-6, Physical Properties.

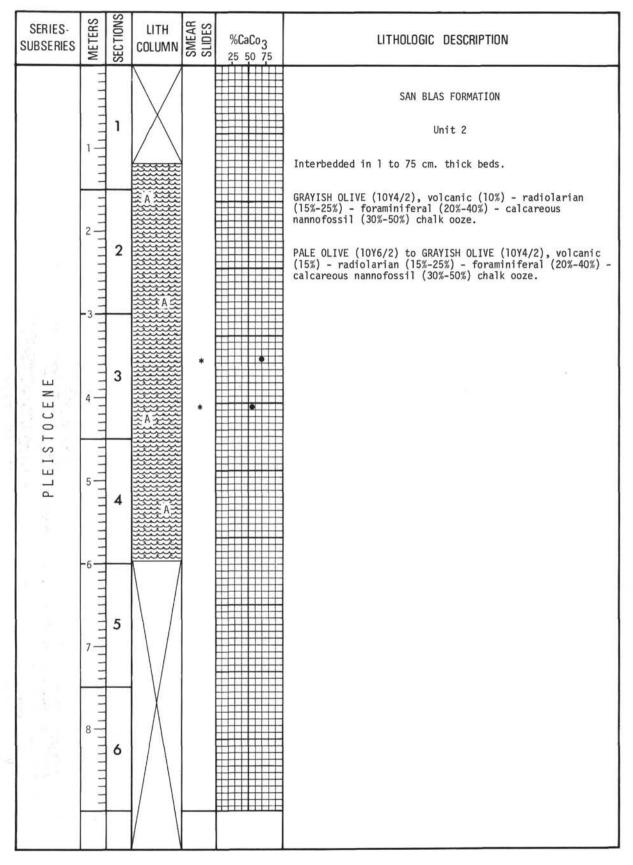


Figure 33. Hole 84, Core 6 (45.7-54.9 m).

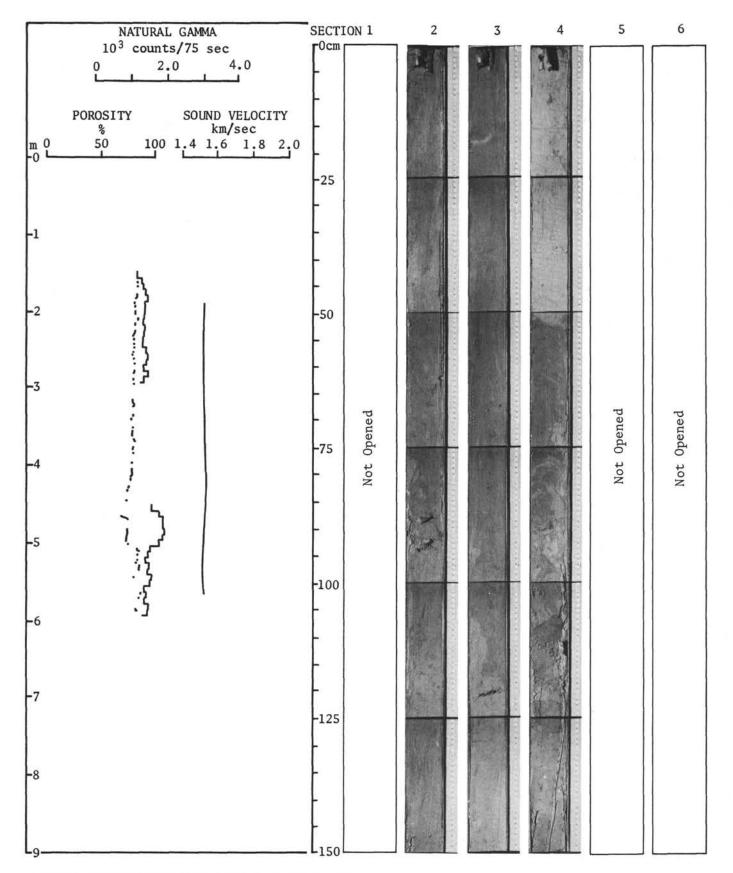


Figure 34. Hole 84, Core 6, Sections 1-6, Physical Properties.

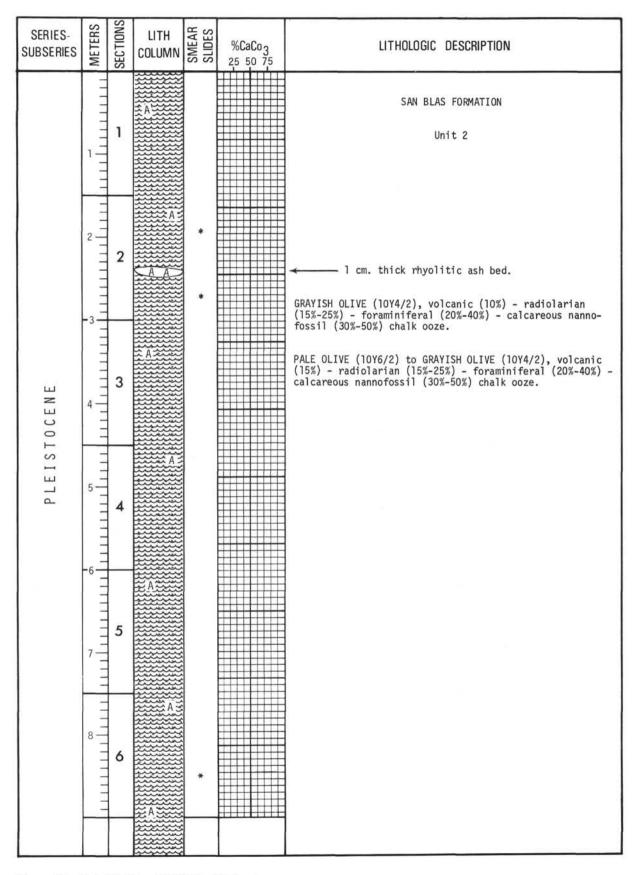


Figure 35. Hole 84, Core 7 (54.9 to 64.0 m).

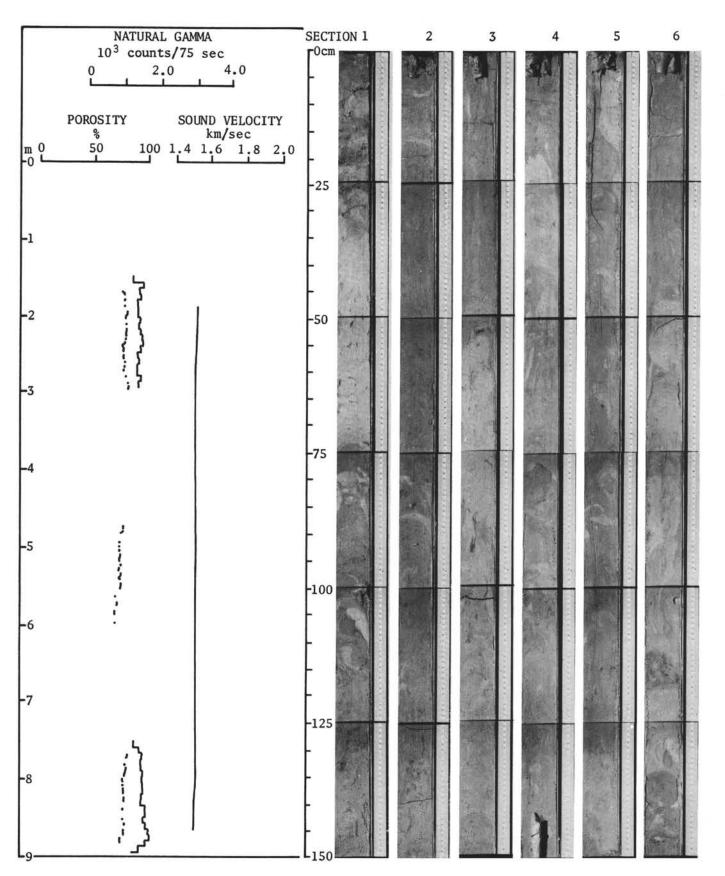


Figure 36. Hole 84, Core 7, Sections 1-6, Physical Properties.

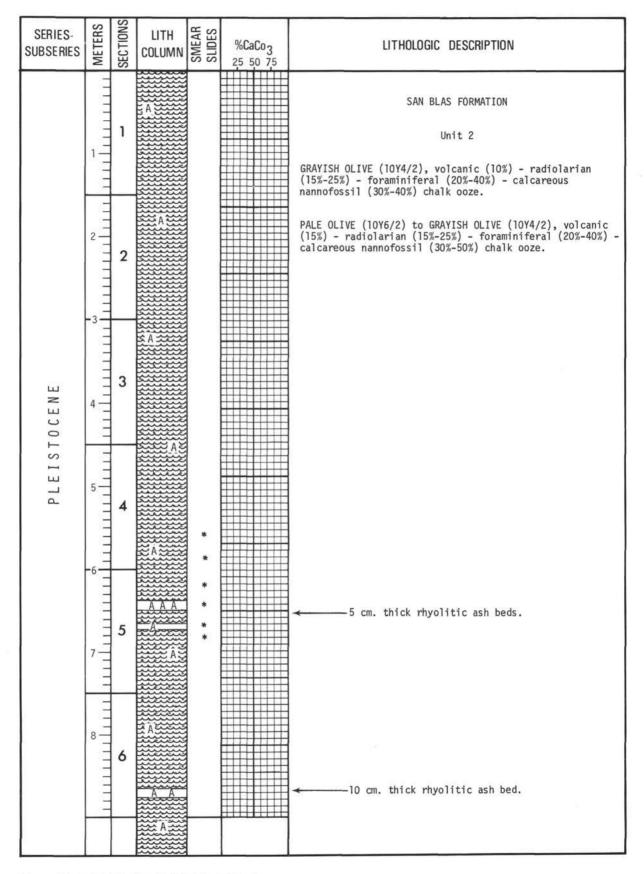


Figure 37. Hole 84, Core 8 (64.0 to 73.1 m).

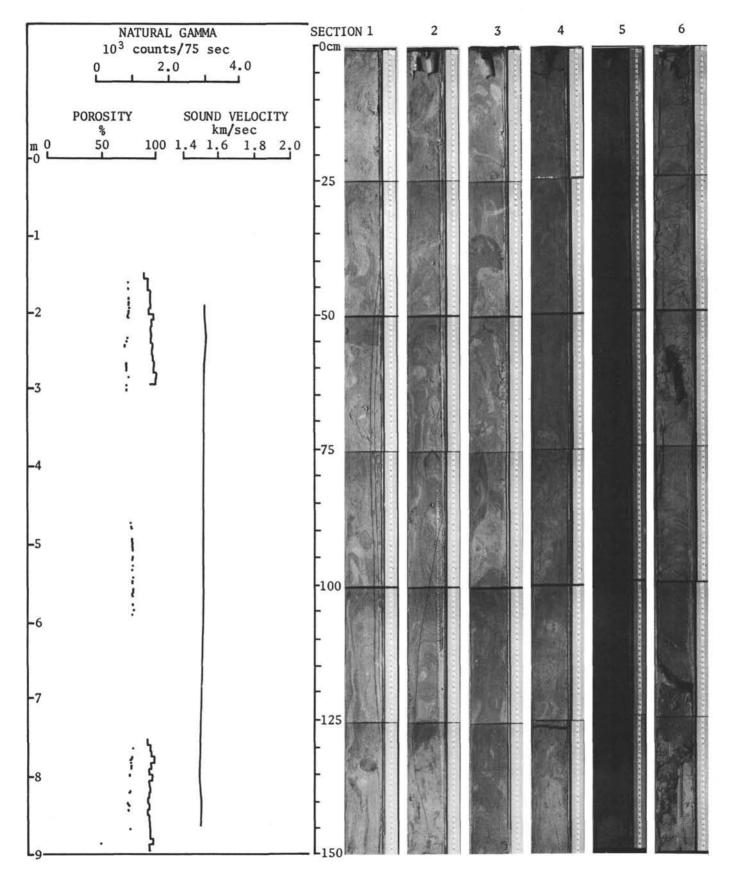


Figure 38. Hole 84, Core 8, Sections 1-6, Physical Properties.

SERIES- SUBSERIES	METERS	SECTIONS	LITH COLUMN	SMEAR	%CaCo3	LITHOLOGIC DESCRIPTION
		1	гл Э ў	*		SAN BLAS FORMATION Unit 2 Interbedded in 5 to 75 cm. thick beds.
	2	2	3			OLIVE GRAY (5Y4/1), foraminiferal (10%-15%) - volcanic (10%-15%) - montmorillonitic (10%-15%) - radiolarian (15%-25%) - calcareous nannofossil (40%-50%) ooze chalk and chalk ooze with slight amount of burrowing.
0 C E N E	4	3	M 3 2			
P L E I S T 0 C E	5	4	B			
	7	5	3			
	8	6	M			

Figure 39. Hole 84, Core 9 (73.2 to 82.3 m).

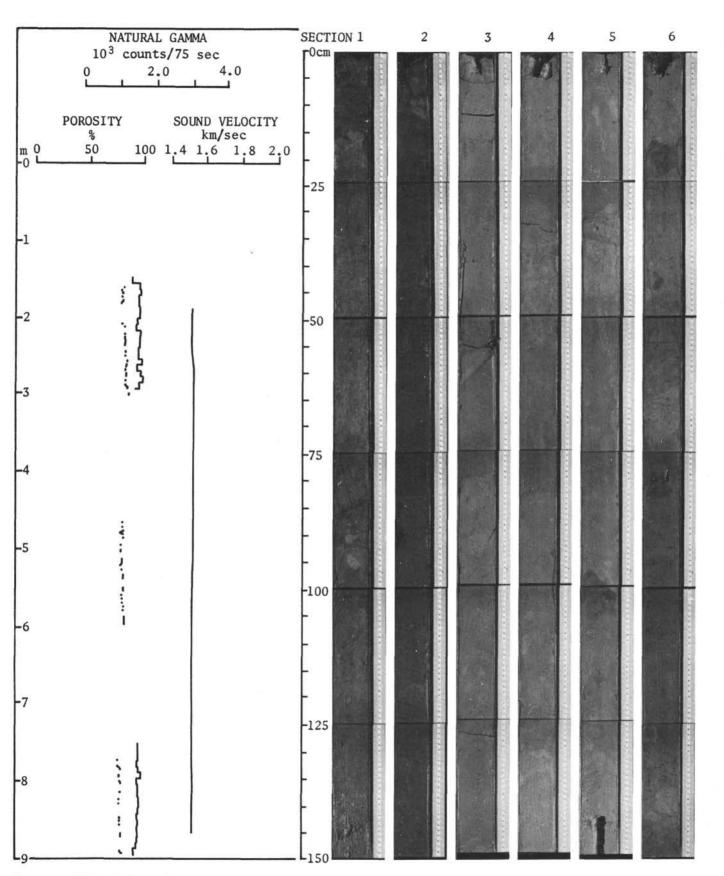


Figure 40. Hole 84, Core 9, Sections 1-6, Physical Properties.

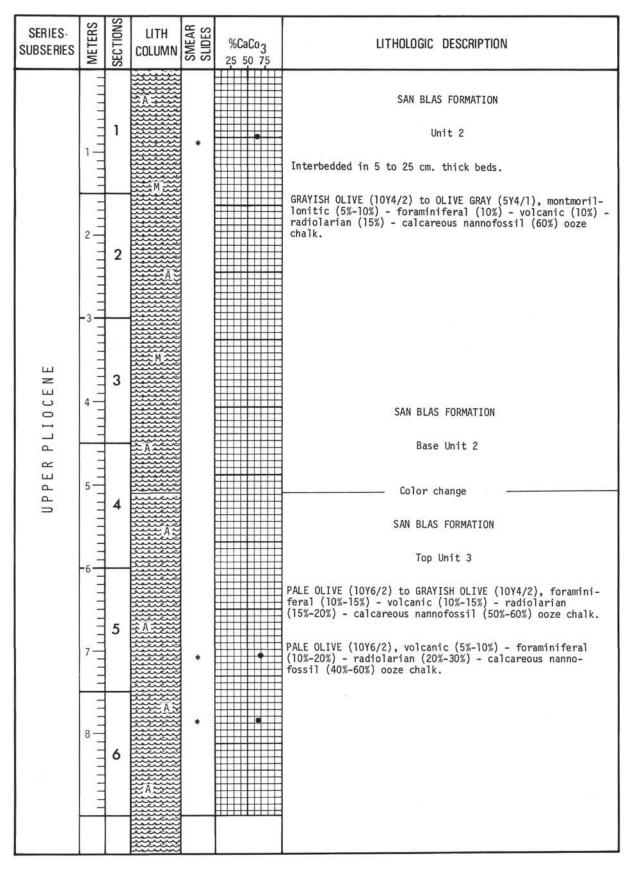


Figure 41. Hole 84, Core 10 (82.3 to 91.4 m).

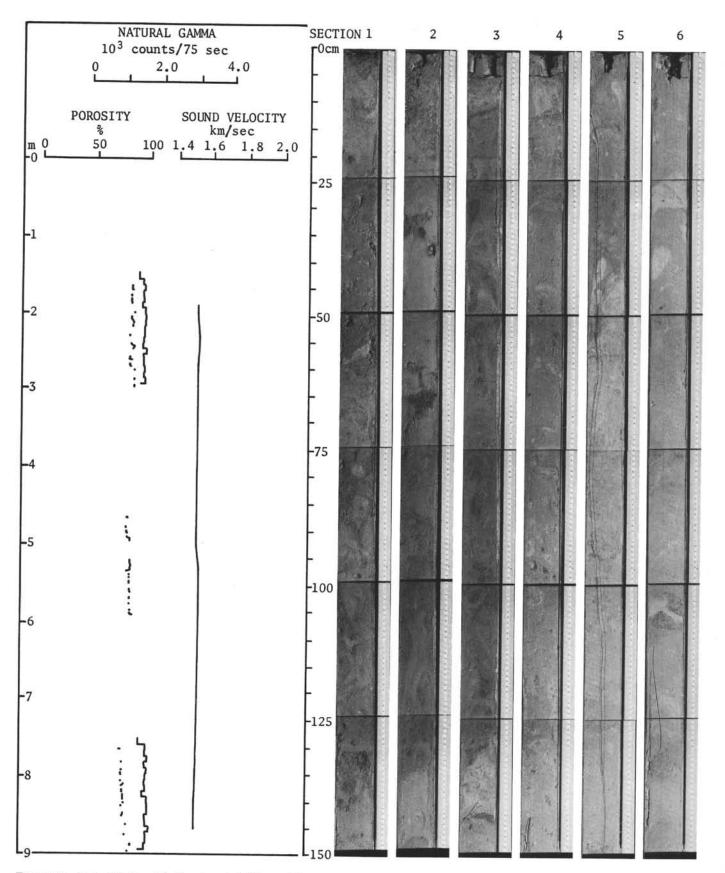


Figure 42. Hole 84, Core 10, Sections 1-6, Physical Properties.

SERIES- SUBSERIES	METERS	SEC TIONS	LITH Column	SMEAR SLIDES	% CaCo 3 25 50 75	LITHOLOGIC DESCRIPTION
		1	M State			SAN BLAS FORMATION Unit 3 Interbedded in 5 to 50 cm. thick beds. Burrows are 5 to 10 mm. in diameter.
		2	M Â			PALE OLIVE (10Y6/2), volcanic (10%-15%) - foraminiferal (10%-15%)- radiolarian (15%-25%) - calcareous nannofossil (50%-70%) ooze chalk with 5% montmorillonite.
UPPER PLIOCENE	-3 -1 4 -1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	3	M S			
	5	4	S. M.	* *		
	7	5	A M			
	8	6	A			

Figure 43. Hole 84, Core 11 (91.4 to 100.6 m).

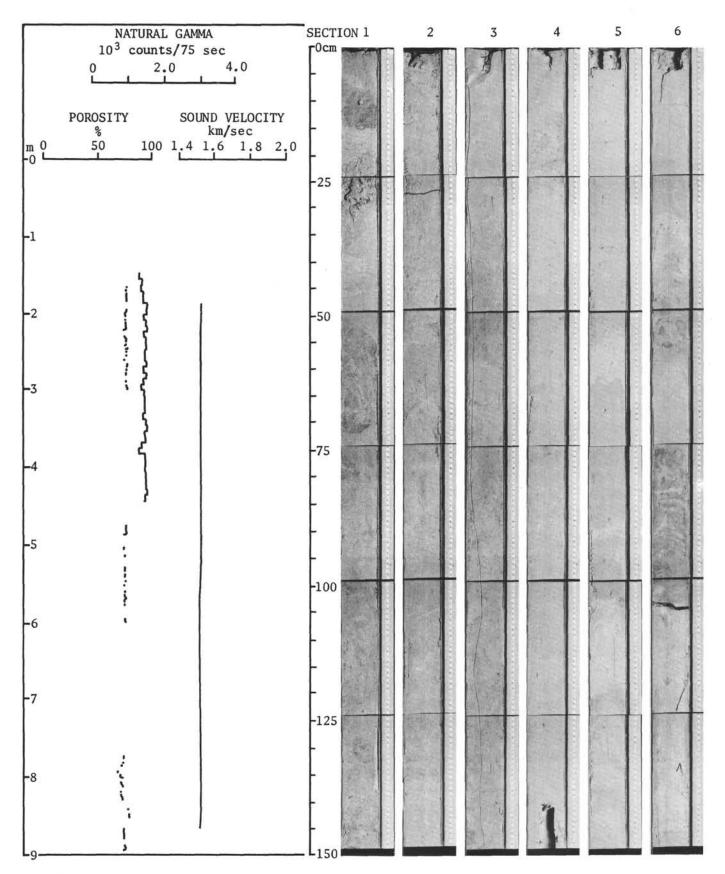


Figure 44. Hole 84, Core 11, Sections 1-6, Physical Properties.

SERIES- SUBSERIES	METERS	SEC TIONS	LITH Column	SMEAR	% CaCo 3 25 50 75	LITHOLOGIC DESCRIPTION
	11111111111	1	M			SAN BLAS FORMATION Unit 3 Interbedded in 1 to 20 cm. thick beds.
	2	2	М			PALE OLIVE (10Y6/2), volcanic (10%-15%) - foraminiferal (10%-15%) - radiolarian (15%-25%) - calcareous nanno- fossil (50%-70%) ooze chalk with 5% montmorillonite.
LIOCENE	4	3				
UPPERPI	5 111111	4	A M M M M M			
	7	5	M M			
	8 1 1 1 1 1 1	6	E M			

Figure 45. Hole 84, Core 12 (100.6 to 109.7 m).

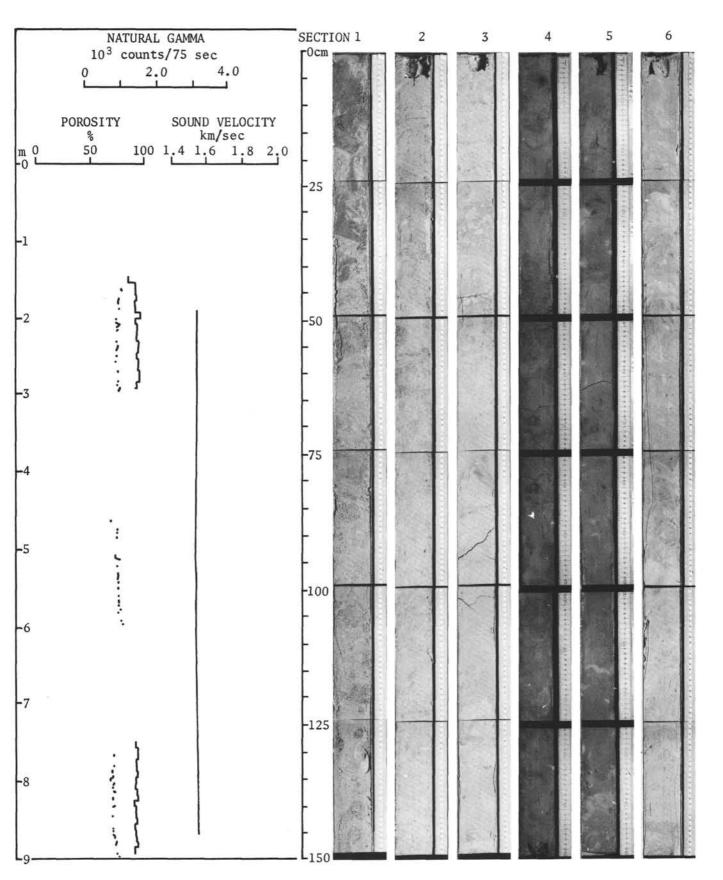


Figure 46. Hole 84, Core 12, Sections 1-6, Physical Properties.

SERIES- SUBSERIES	METERS	SEC TIONS	LITH COLUMN	SMEAR	%CaCo3	LITHOLOGIC DESCRIPTION
	111111111	1	M			SAN BLAS FORMATION Unit 3 Interbedded.
	2	2	M			<pre>PALE OLIVE (10Y6/2), volcanic (10%) - foraminiferal (15%-20%) - radiolarian (15%-25%) - calcareous nanno- fossil (40%-50%) ooze chalk with montmorillonite. PALE GRAYISH OLIVE (10Y5/2), foraminiferal (10%-15%) - radiolarian (10%-20%) - montmorillonitic (10%-15%) - volcanic (10%-20%) - calcareous nannofossil (40%-50%) ooze chalk.</pre>
LIOCENE	4	3	A s			
UPPERP	5 1 1 1 1 1 1 1 1 1	4	Â.	* * *		
	7	5	M .			
	8	6	M			
						8

Figure 47. Hole 84, Core 13 (109.7 to 118.9 m).

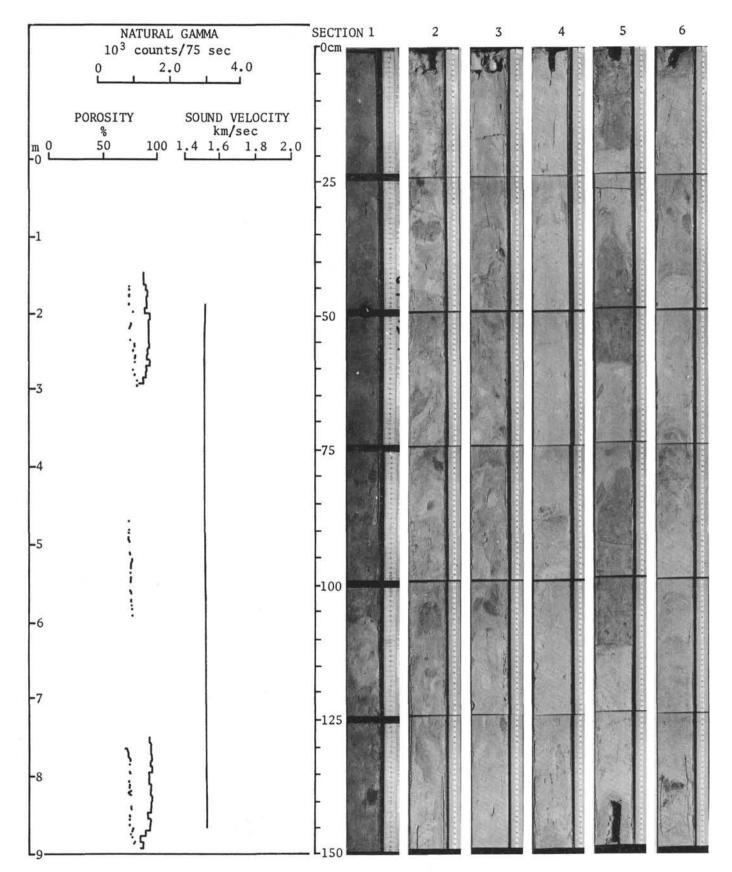


Figure 48. Hole 84, Core 13, Sections 1-6, Physical Properties.

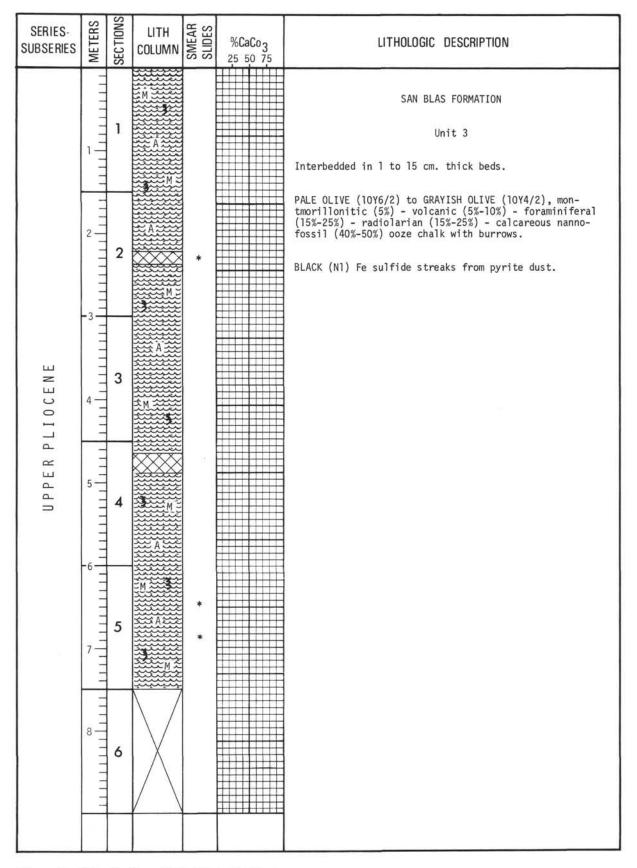


Figure 49. Hole 84, Core 14 (118.9 to 128.0 m).

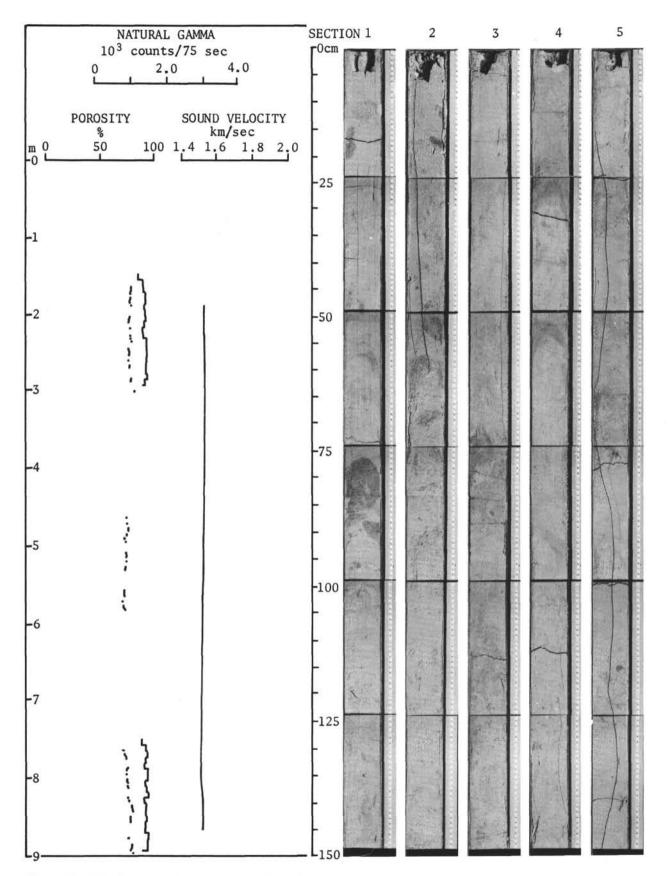


Figure 50. Hole 84, Core 14, Sections 1-5, Physical Properties.

SERIES- SUBSERIES	METERS	SECTIONS	LITH Column	SMEAR	%CaCo3	LITHOLOGIC DESCRIPTION
U P P E R P L I O C E N E		1	M B M			SAN BLAS FORMATION Top Unit 4 PALE OLIVE (10Y6/2) to GRAYISH OLIVE (10Y4/2), mon- tmorillonitic (5%) - volcanic (5%-10%) - foraminiferal (15%-25%) - radiolarian (15%-25%) - calcareous nanno- fossil (40%-50%) ooze chalk with burrows.
	2	2				(15%-25%) - radiolarian (15%-25%) - calcareous nanno- fossil (40%-50%) ooze chalk with burrows.
P L I O C E N E	4	3				
LOWER P	5	4				
	⁻⁶	5				2
	8 1 1 1 1 1 1 1 1 1	6				

Figure 51. Hole 84, Core 15 (128.0 to 137.2 m).

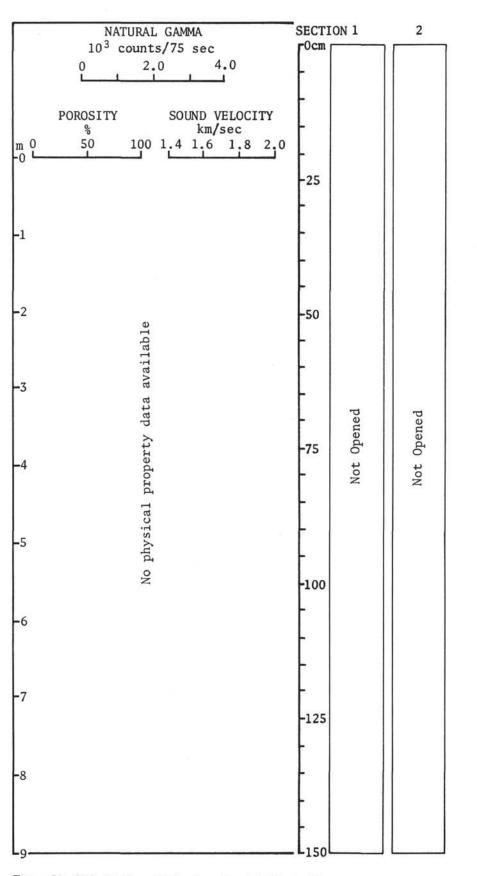


Figure 52. Hole 84, Core 15, Sections 1 and 2, Physical Properties.

SERIES- SUBSERIES	METERS	SEC TIONS	LITH Column	SMEAR	%CaCo ₃ 25 50 75	LITHOLOGIC DESCRIPTION
	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	1	Λ	*		SAN BLAS FORMATION Unit 4 Intensely burrowed and mottled. Interbedded in 5 to 25 cm. thick beds.
	2	2	Α			LIGHT GREENISH GRAY (5GY8/1), volcanic (2%-5%) - radiolarian (15%-20%) - foraminiferal (20%-30%) - calcareous nannofossil (50%-60%) chalk.
LIOCENE	4	3	Â.			
LOWER P	5111111	4				
	⁻⁶	5	λ.			
	8	6	A A			

Figure 53. Hole 84, Core 16 (137.2 to 146.3 m).

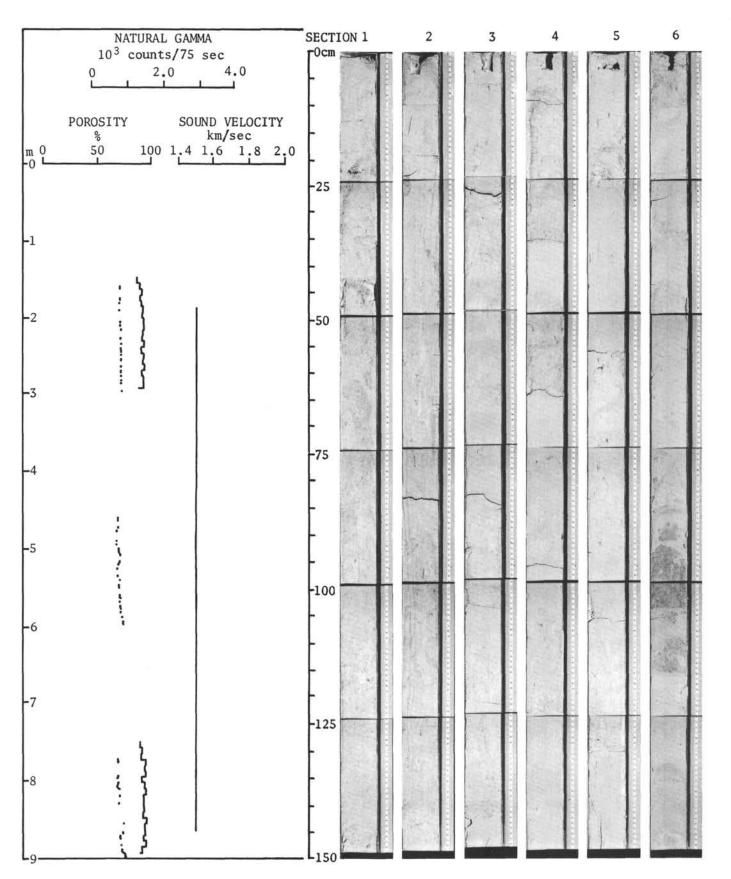


Figure 54. Hole 84, Core 16, Sections 1-6, Physical Properties.

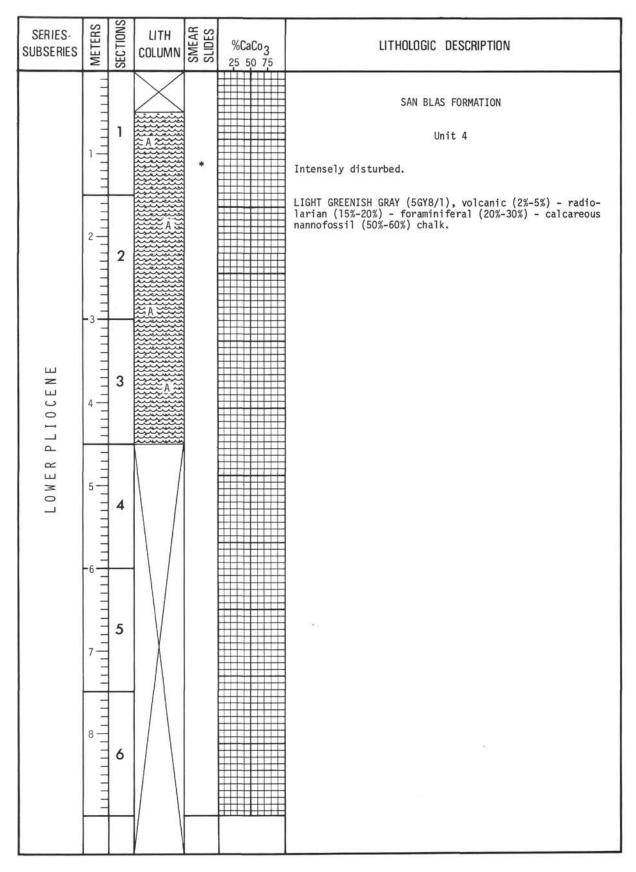


Figure 55. Hole 84, Core 17 (146.3 to 155.5 m).

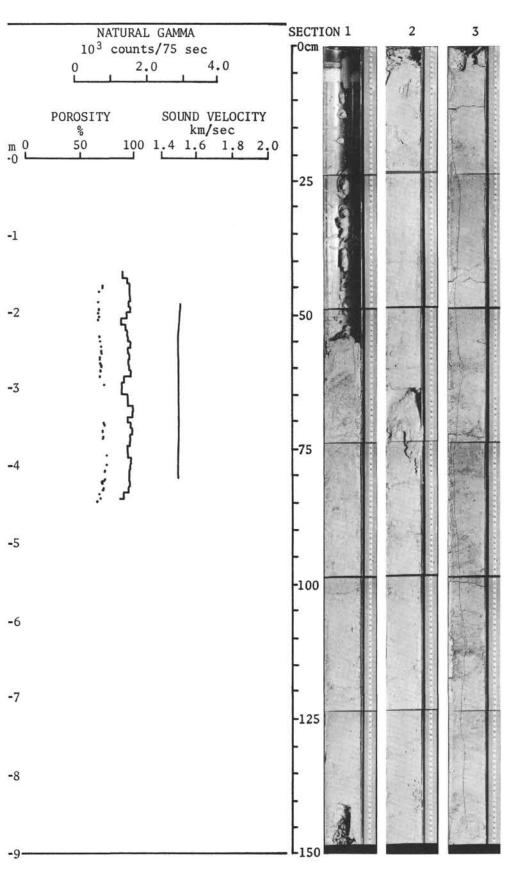


Figure 56. Hole 84, Core 17, Sections 1, 2, 3, Physical Properties.

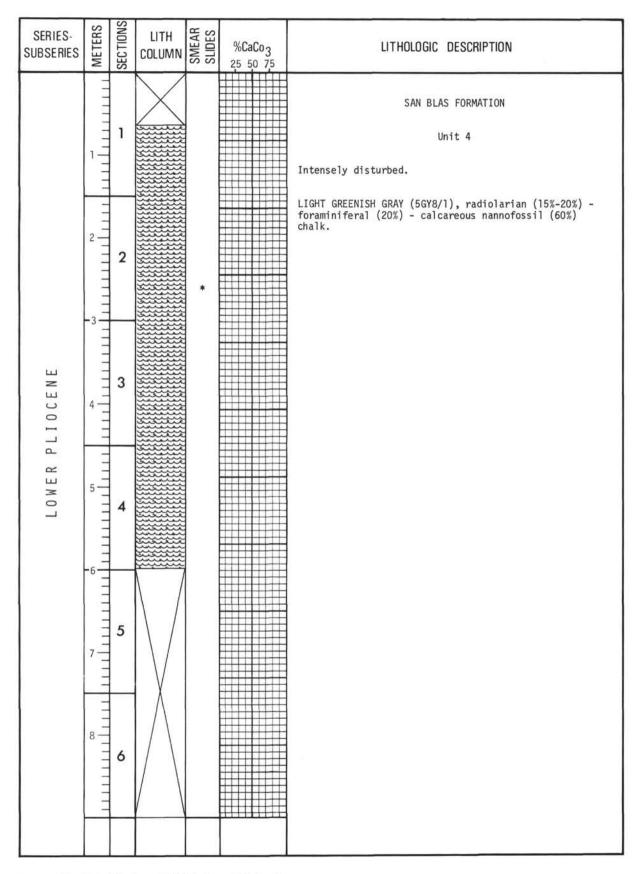


Figure 57. Hole 84, Core 18 (155.5 to 164.6 m).

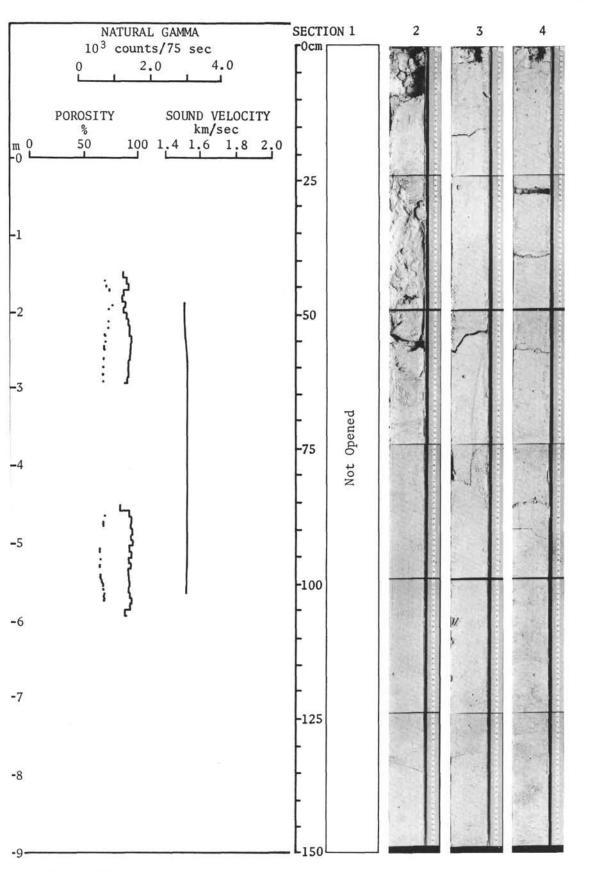


Figure 58. Hole 84, Core 18, Sections 1-4, Physical Properties.

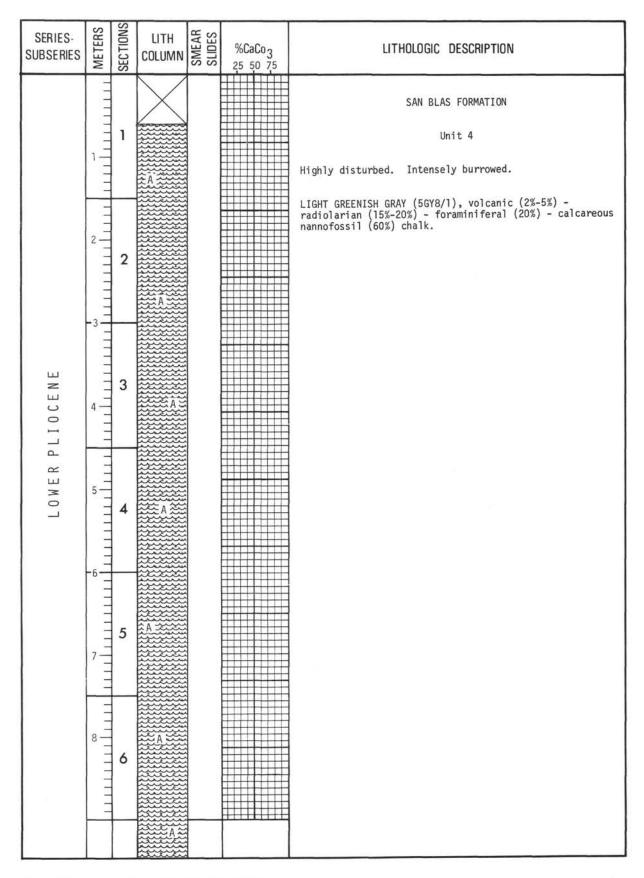


Figure 59. Hole 84, Core 19 (164.6 to 173.7 m).

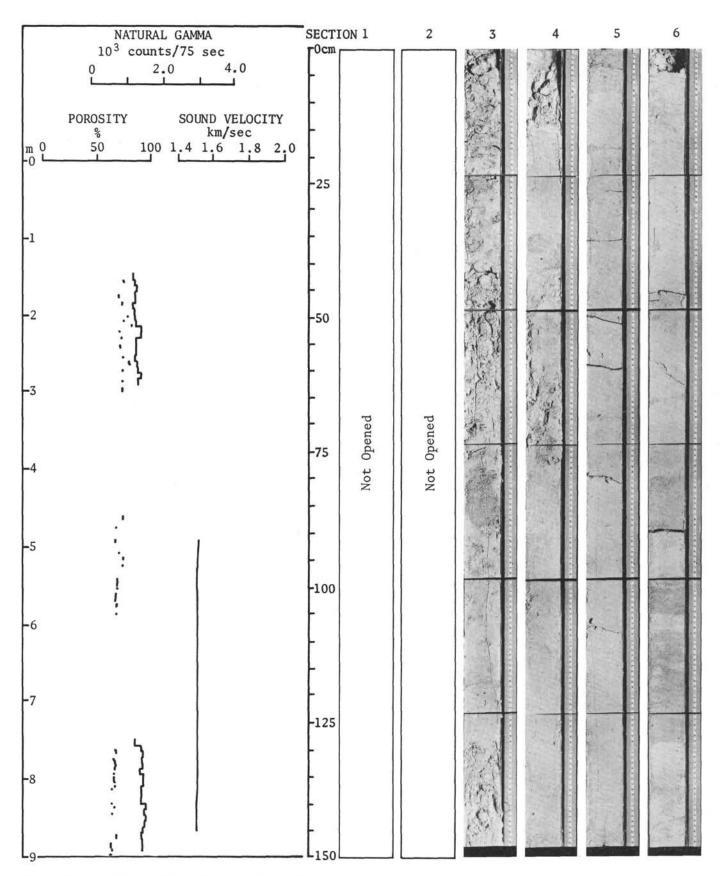


Figure 60. Hole 84, Core 19, Sections 1-6, Physical Properties.

SERIES- SUBSERIES	METERS	SEC TIONS	LITH COLUMN	SMEAR	% CaCo 3 25 50 75	LITHOLOGIC DESCRIPTION
	THE THEFT	1				SAN BLAS FORMATION Unit 4 Disturbed.
	2 1111111	2				LIGHT GREENISH GRAY (5GY8/1), volcanic (2%-5%) - radiolarian (15%-20%) - foraminiferal (20%) - calcareous nannofossil (60%) chalk.
P L I O C E N E	4	3				
LOWER PL	5	4				
	⁻⁶	5				
	8 8 1 1 1 1 1 1 1 1 1 1	6				

Figure 61. Hole 84, Core 20 (173.7 to 182.9 m).

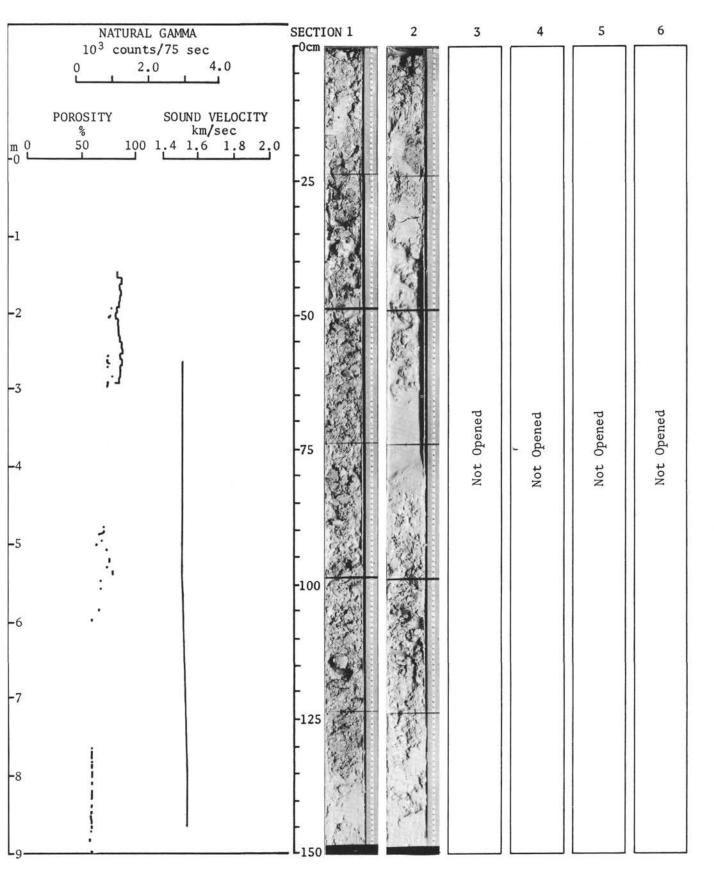


Figure 62. Hole 84, Core 20, Sections 1-6, Physical Properties.

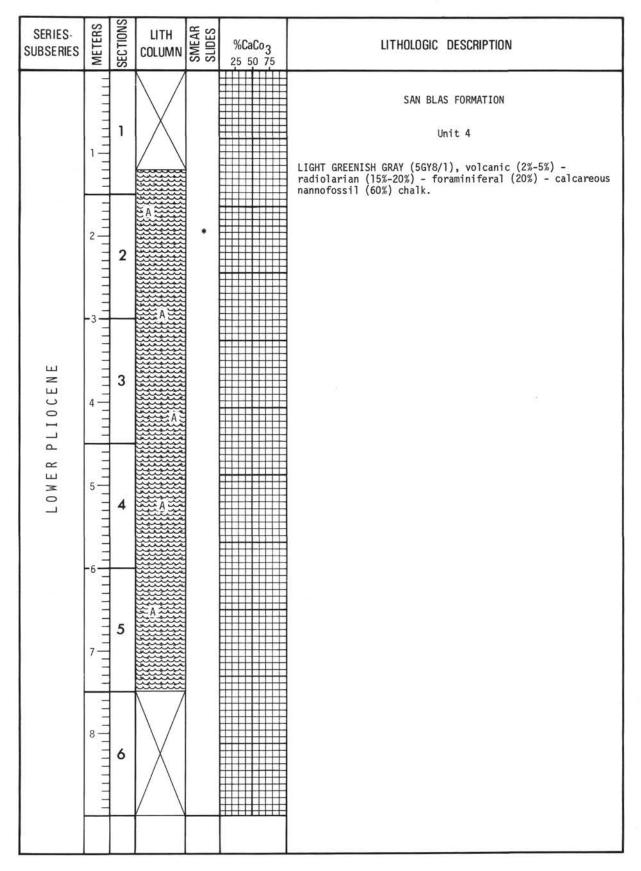


Figure 63. Hole 84, Core 21 (182.9 to 192.0 m).

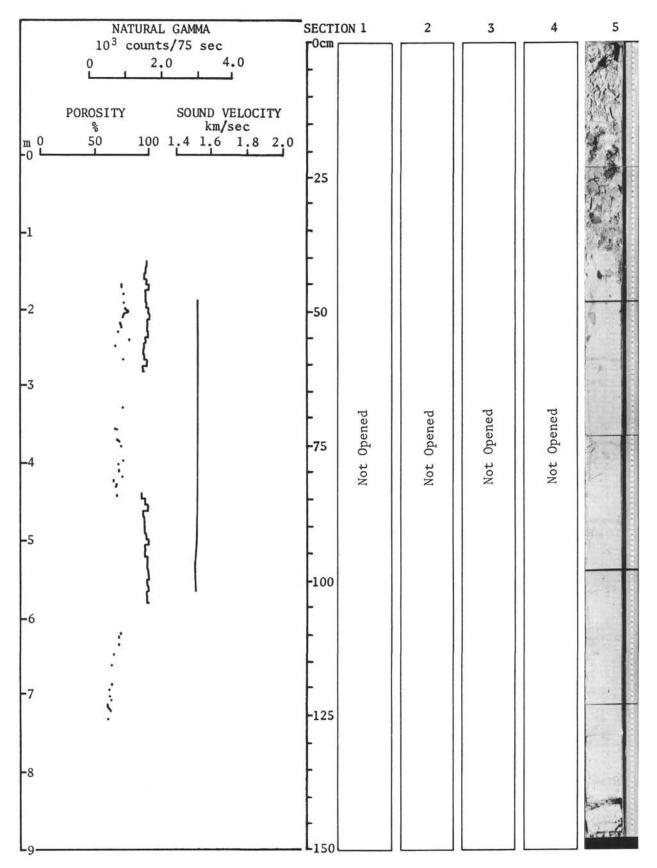


Figure 64. Hole 84, Core 21, Sections 1-5, Physical Properties.

SERIES- SUBSERIES	METERS	SEC TIONS	lith Column	SMEAR	%CaCo3	LITHOLOGIC DESCRIPTION
Е	111111111111111111111111111111111111111	1				SAN BLAS FORMATION Unit 4 Disturbed.
LOWER PLIOCEN	R PLIOCEN	2				LIGHT GREENISH GRAY (5GY8/1), volcanic (2%-5%) - radio- larian (15%-20%) - foraminiferal (20%) - calcareous nannofossil (60%) chalk. LIGHT GREENISH GRAY (5GY8/1), volcanic (2%-5%) - radio- larian (15%-25%) - calcareous nannofossil (60%-80%) chalk with about 1% volcanics.
Γ	4	3				
ш	51111111	4	λ			
UPPER MIOCENE	7	5	*			
	8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	6	S			

Figure 65. Hole 84, Core 22 (192.0 to 201.2 m).

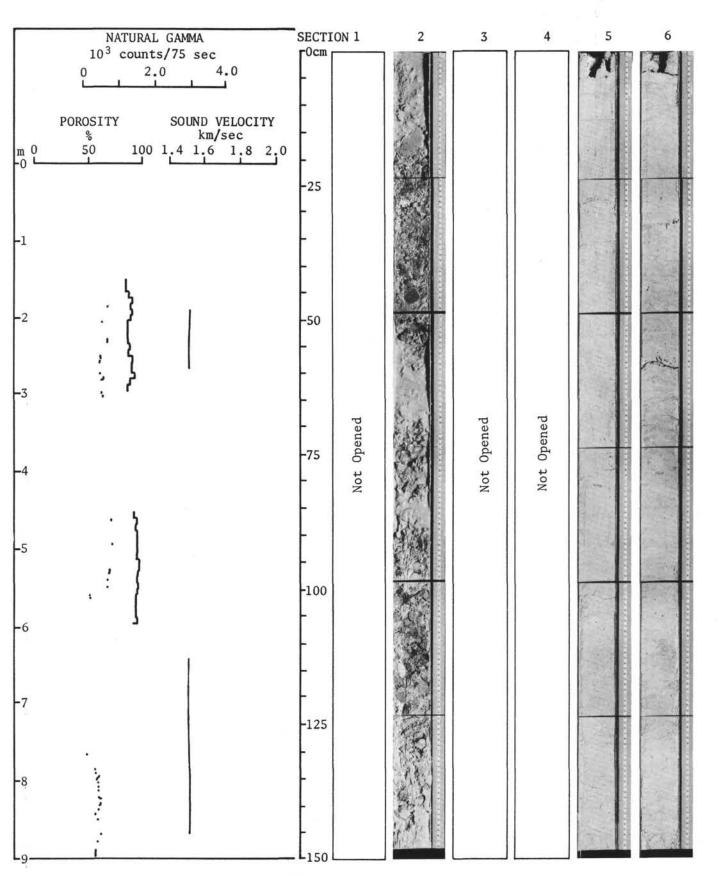


Figure 66. Hole 84, Core 22, Sections 1-6, Physical Properties.

SERIES- SUBSERIES	METERS	SEC TIONS	LITH Column	SMEAR	% CaCo 3 25 50 75	LITHOLOGIC DESCRIPTION
	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1				SAN BLAS FORMATION Unit 4 LIGHT GREENISH GRAY (5GY8/1), volcanic (2%-5%) - radiolarian (15%-20%) - foraminiferal (20%) - calcareous nannofossil (60%) chalk. LIGHT GREENISH GRAY (5G8/1), volcanic (2%-5%) -
	2	2				LIGHT GREENISH GRAY (5G8/1), volcanic (2%-5%) - radiolarian (15%-20%) - foraminiferal (20%) - calcareous nannofossil (60%) chalk.
MIOCENE	4	3	À Ì			
UPPER	5	4	A			
	7	5	A			
	8111111	6	A			

Figure 67. Hole 84, Core 23 (201.2 to 210.3 m).

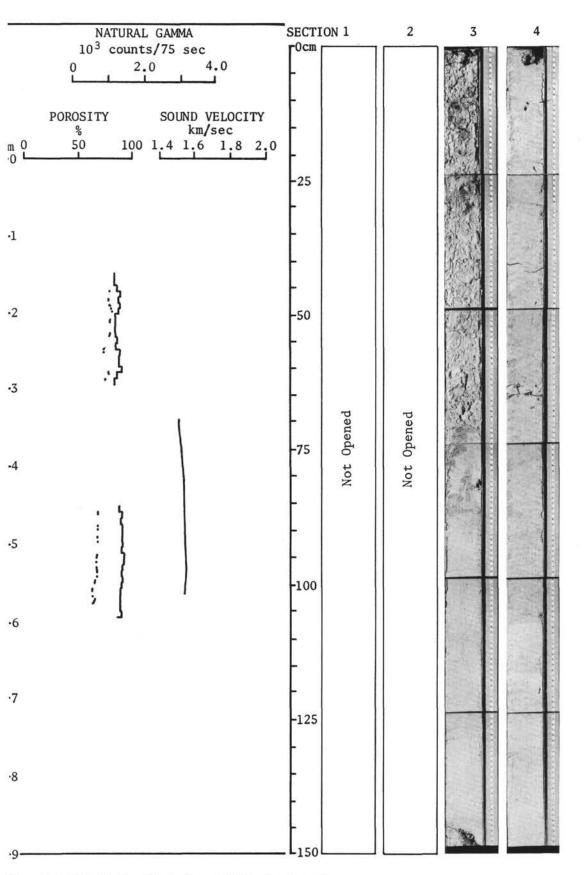


Figure 68. Hole 84, Core 23, Sections 1-6, Physical Properties.

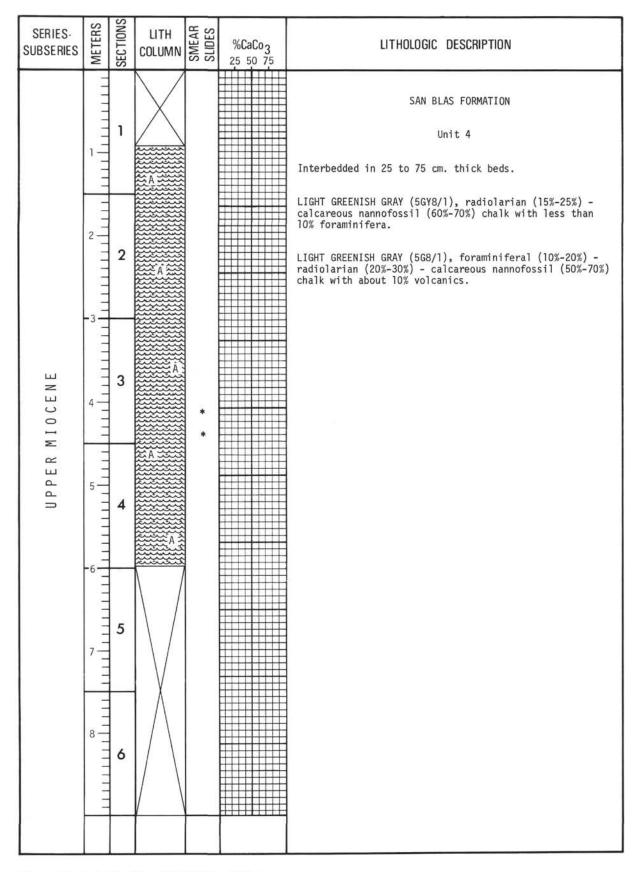


Figure 69. Hole 84, Core 24 (210.3 to 219.5 m).

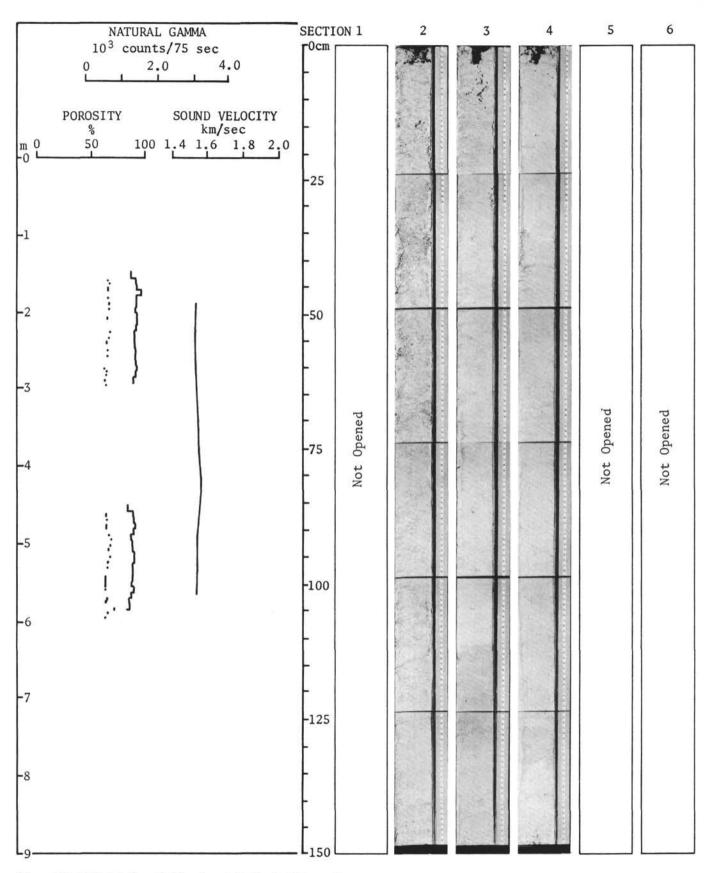


Figure 70. Hole 84, Core 24, Sections 1-6, Physical Properties.

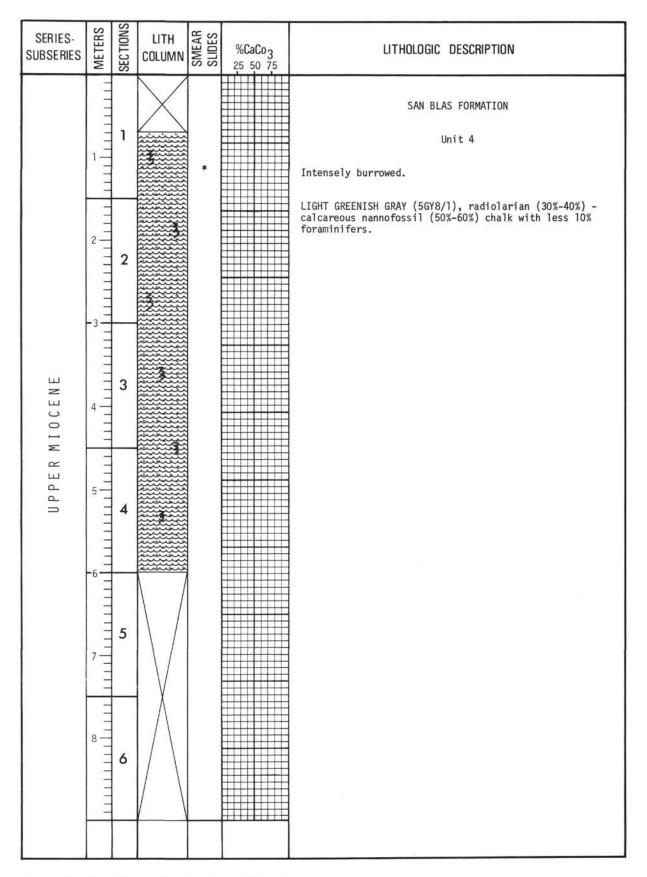


Figure 71. Hole 84, Core 25 (219.5 to 228.6 m).

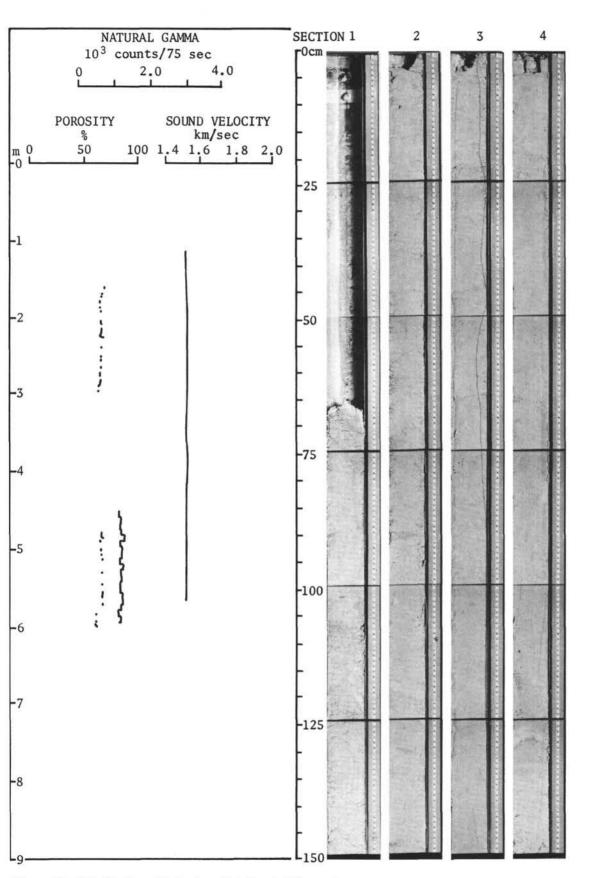


Figure 72. Hole 84, Core 25, Sections 1-4, Physical Properties.

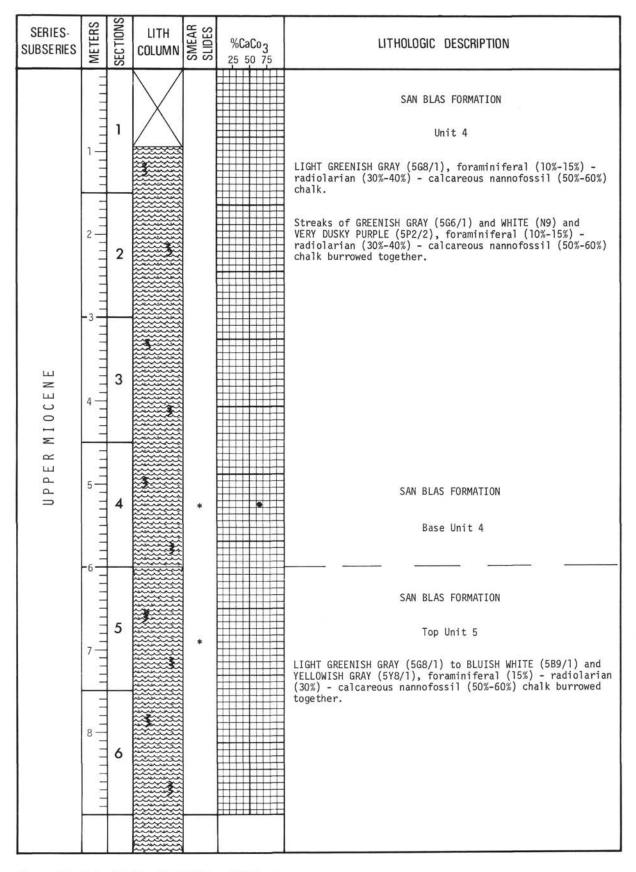


Figure 73. Hole 84, Core 26 (228.6 to 237.8 m).

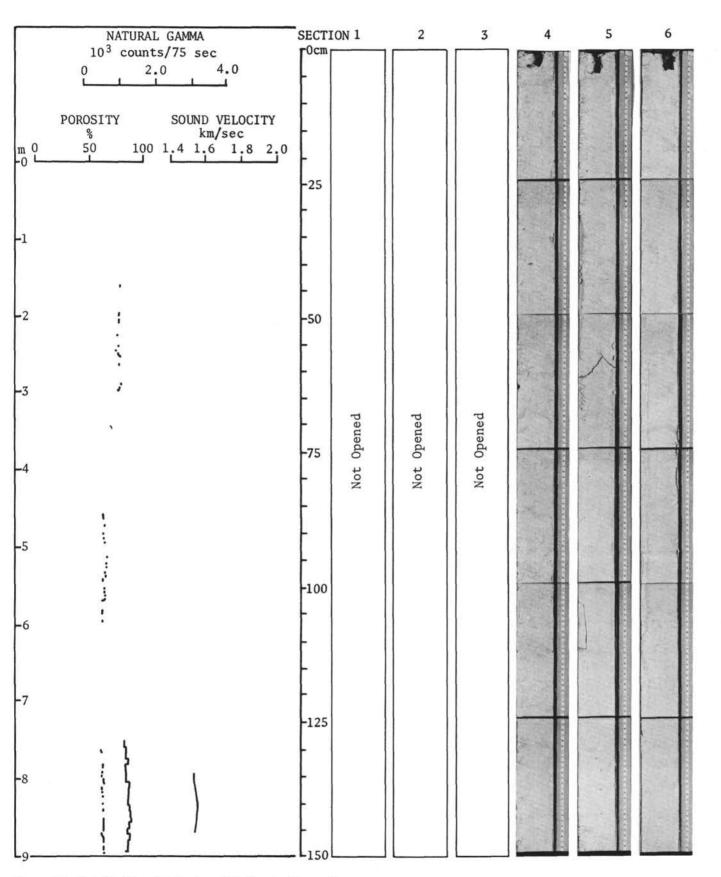


Figure 74. Hole 84, Core 26, Sections 1-6, Physical Properties.

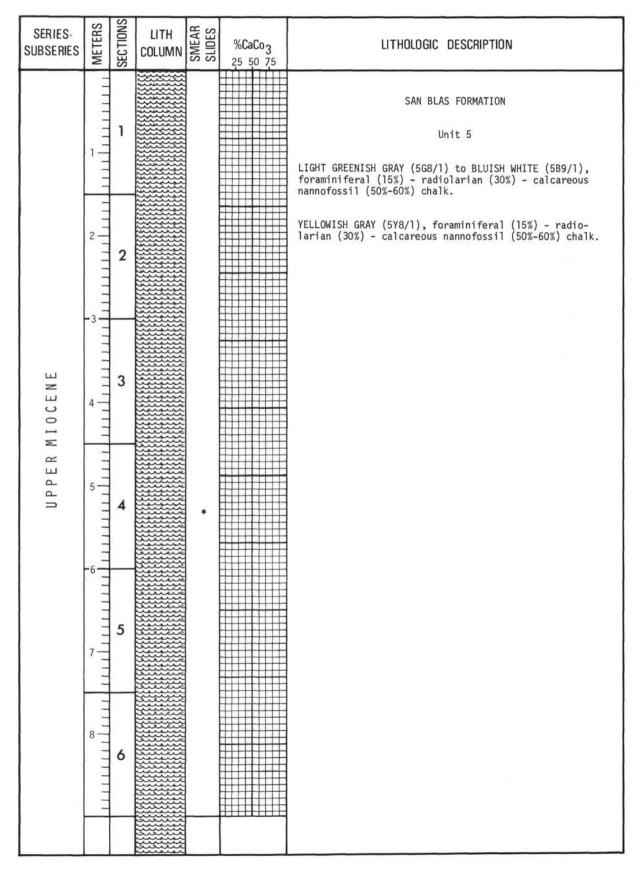


Figure 75. Hole 84, Core 27 (237.8 to 246.9 m).

696

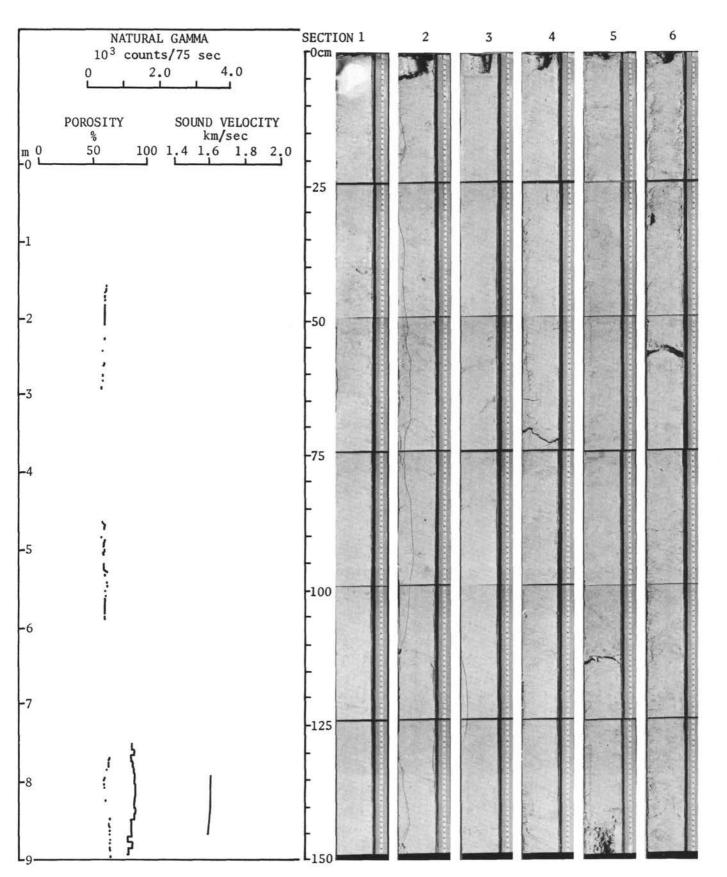


Figure 76. Hole 84, Core 27, Sections 1-6, Physical Properties.

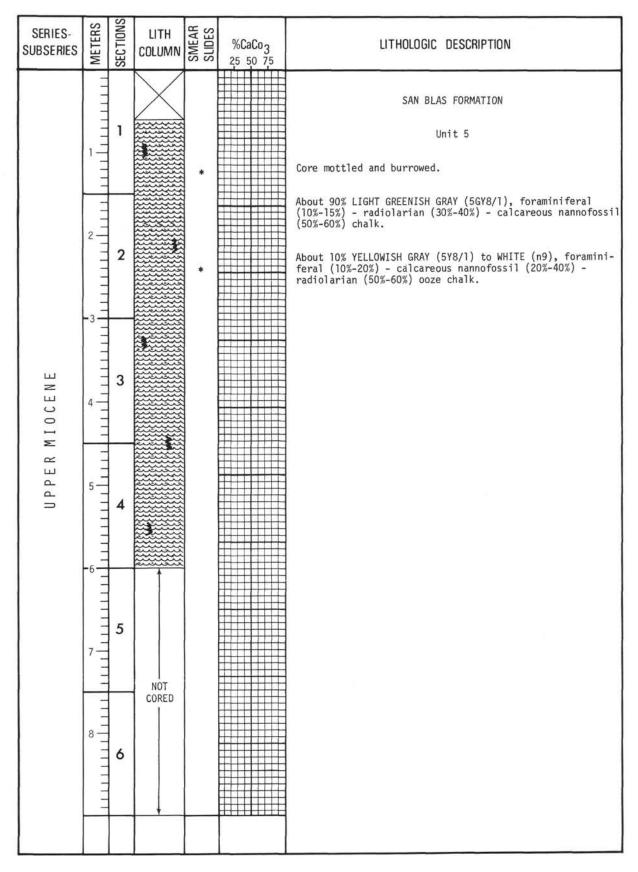


Figure 77. Hole 84, Core 28 (246.9 to 250.9 m).

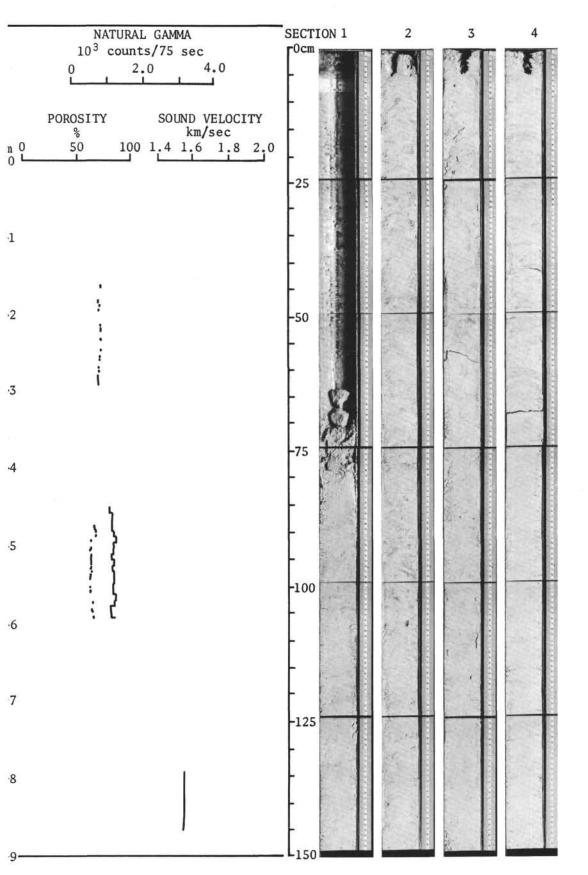


Figure 78. Hole 84, Core 28, Sections 1-4, Physical Properties.

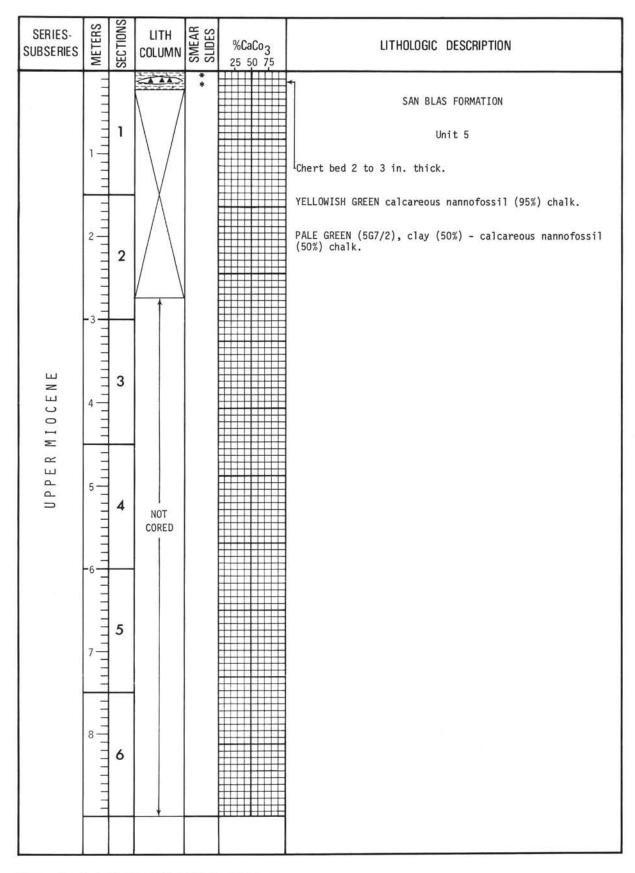


Figure 79. Hole 84, Core 29 (250.9 to 253.9 m).

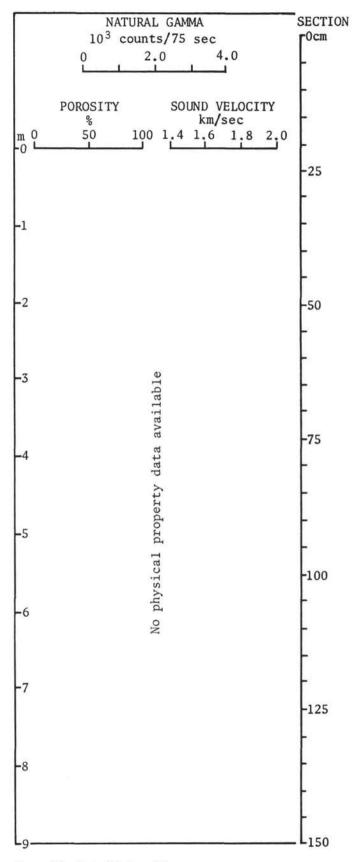


Figure 80. Hole 84, Core 29.

701

SERIES- SUBSERIES	METERS	SECTIONS	LITH Column	SMEAR SLIDES	% CaCo 3 25 50 75	LITHOLOGIC DESCRIPTION
	en l'en en er	1	M	*		SAN BLAS FORMATION Unit 5 PALE GREEN (5G7/2), montmorillonitic calcareous nannofossil chalk 1 to 2 in. thick.
	² ²	2				Chilled altered contact
MIOCENE	4					BLACK (N1) fine grained basalt. Refractive index of glass is 1.59-1.60.
UPPER	5	4				
	7	5				
	8 1 1 1 1 1 1 1	6				

Figure 81. Hole 84, Core 30 (253.6 to 253.9 m).

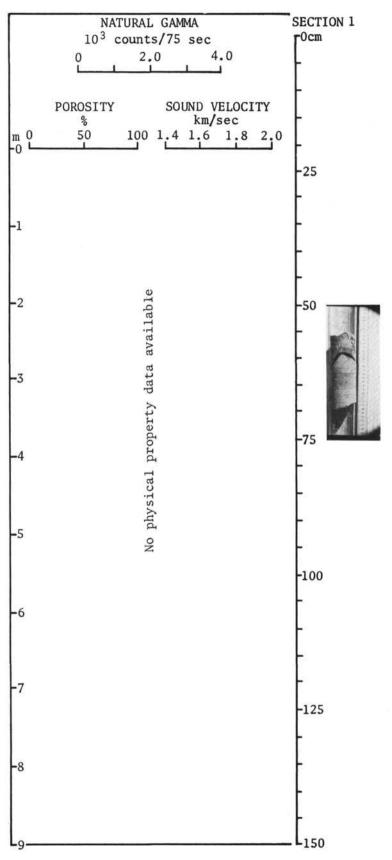


Figure 82. Hole 84, Core 30, Section 1, Physical Properties.

703

Centimeters from Top of Section	Section Photograph	Graphic Representation	Smear Slides (*)	Deformed Areas	Description
	1 × 10		¥		SAN BLAS FORMATION PALE OLIVE (10Y6/2) - same as OLIVE GRAY below but with 15- 25% volcanic constit- uents.
25			*		 OLIVE GRAY (5Y3/2) volcanics (10-15%) - montmorillonite (5- 10%) - radiolarian (15-25%) - foramin-
50			*		 iferal (25-35%) - calcareous nanno- fossil (30-40%) chalk ooze. Burrowed.
			*		MEDIUM DARK GRAY (N4) rhyolitic ash bed. 95% vitric ash; 50- 200μ sized shards; 5% plagioclase and guartz; less than 1%
75					MEDIUM DARK GRAY (N4) rhyolitic ash bed. 95% vitric ash;
					shards larger than ash bed above (200- 500μ); 5% plagio- clase, quartz, oxyhornblende.
100					
125-					
	For				
-					

Figure 83. Hole 84, Core 8, Section 5.