10. SITE 84

The Shipboard Scientific Party[1]

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°45'N and longitude 82°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

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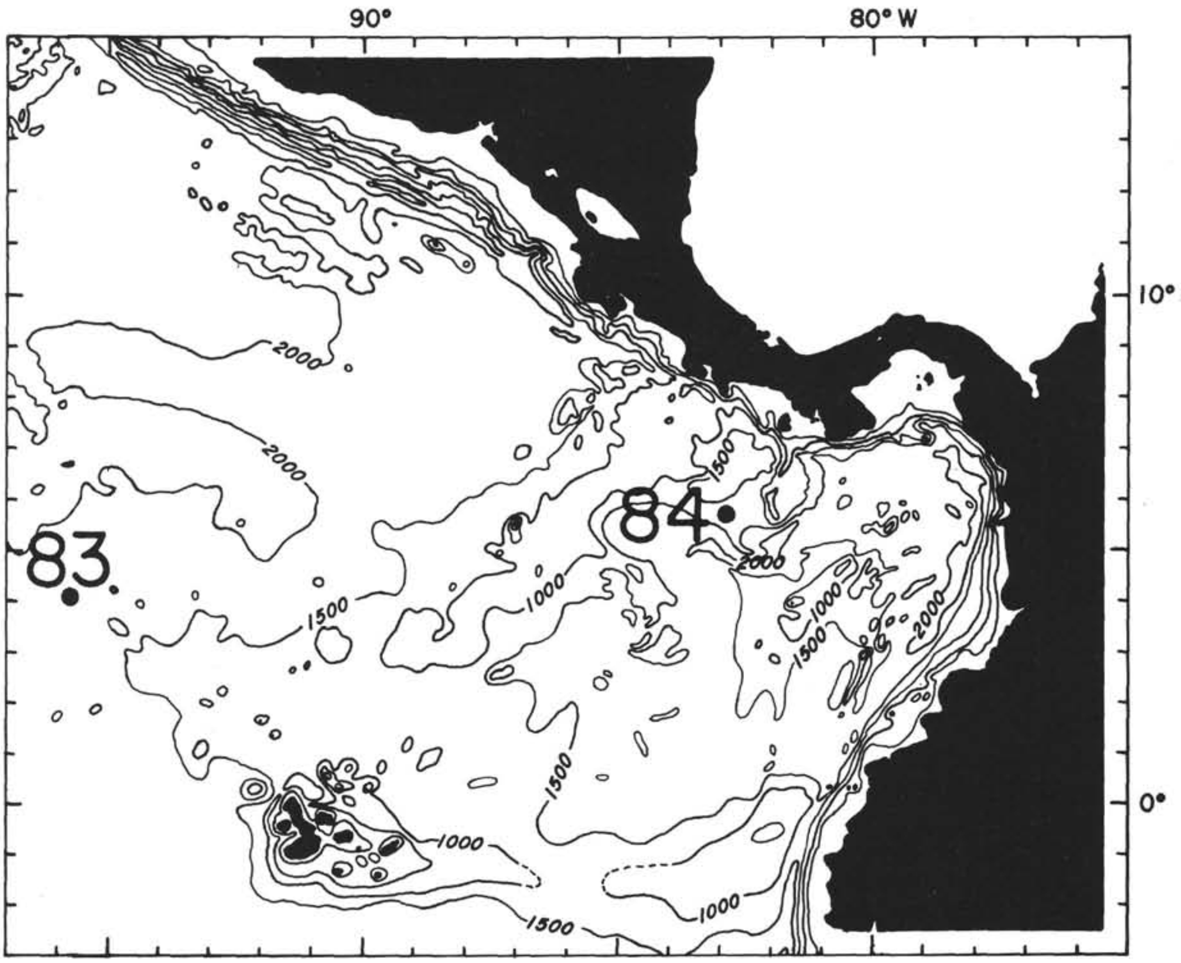


Figure 1. *Location of Sites 83 and 84.*

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 nannofossil (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 greenish-gray, 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-radiolarian-calcareous 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 plesiotumida.*

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 (m)	Cores Attempted	Cores Recovered	Per Cent Cored	Recovery (m)	Per Cent 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 Below Sea Floor (m)	(ft)	Drilled	Core	Core Cut (m)	(ft)	Core Recovered (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			

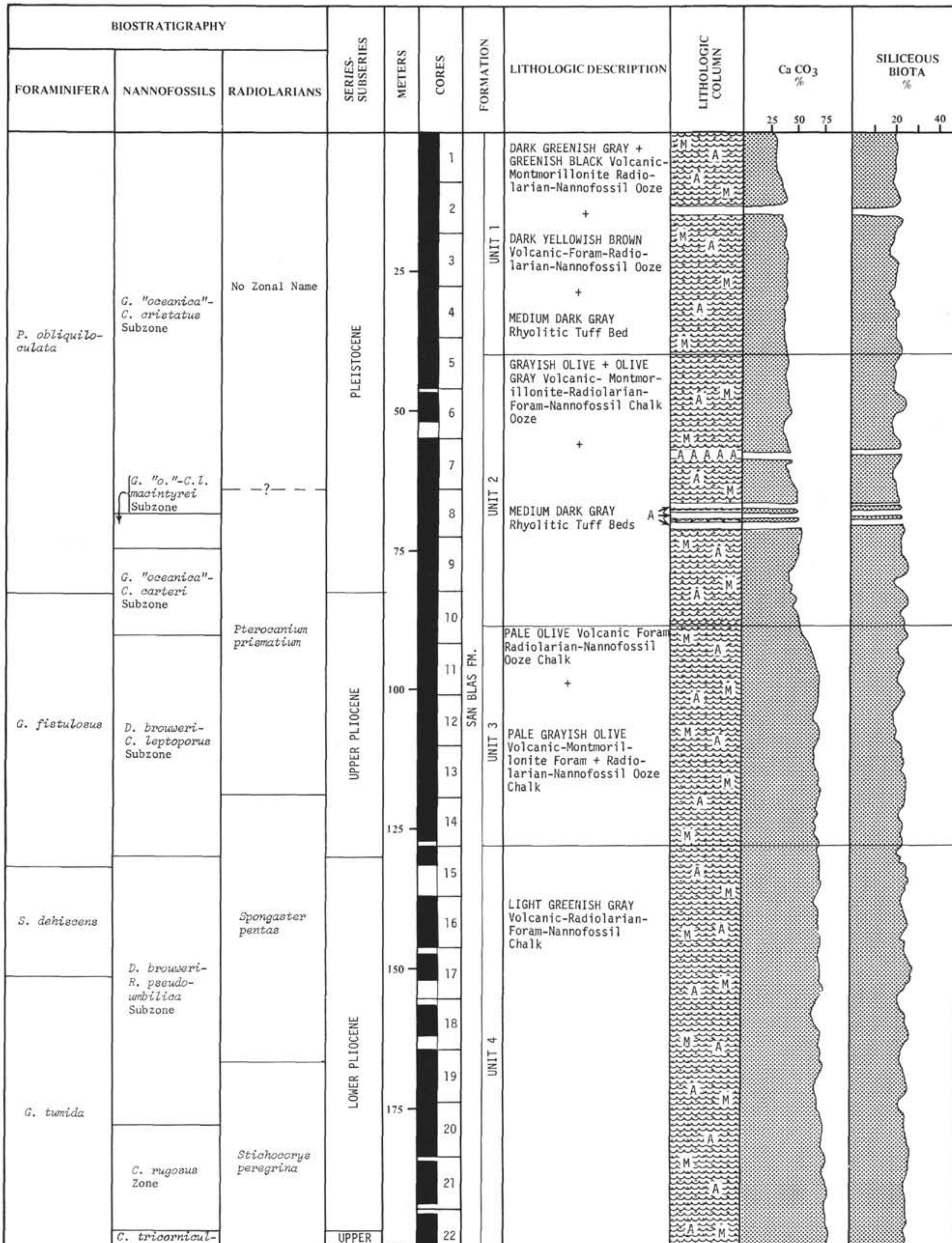


Figure 2. *Site 84 summary.*

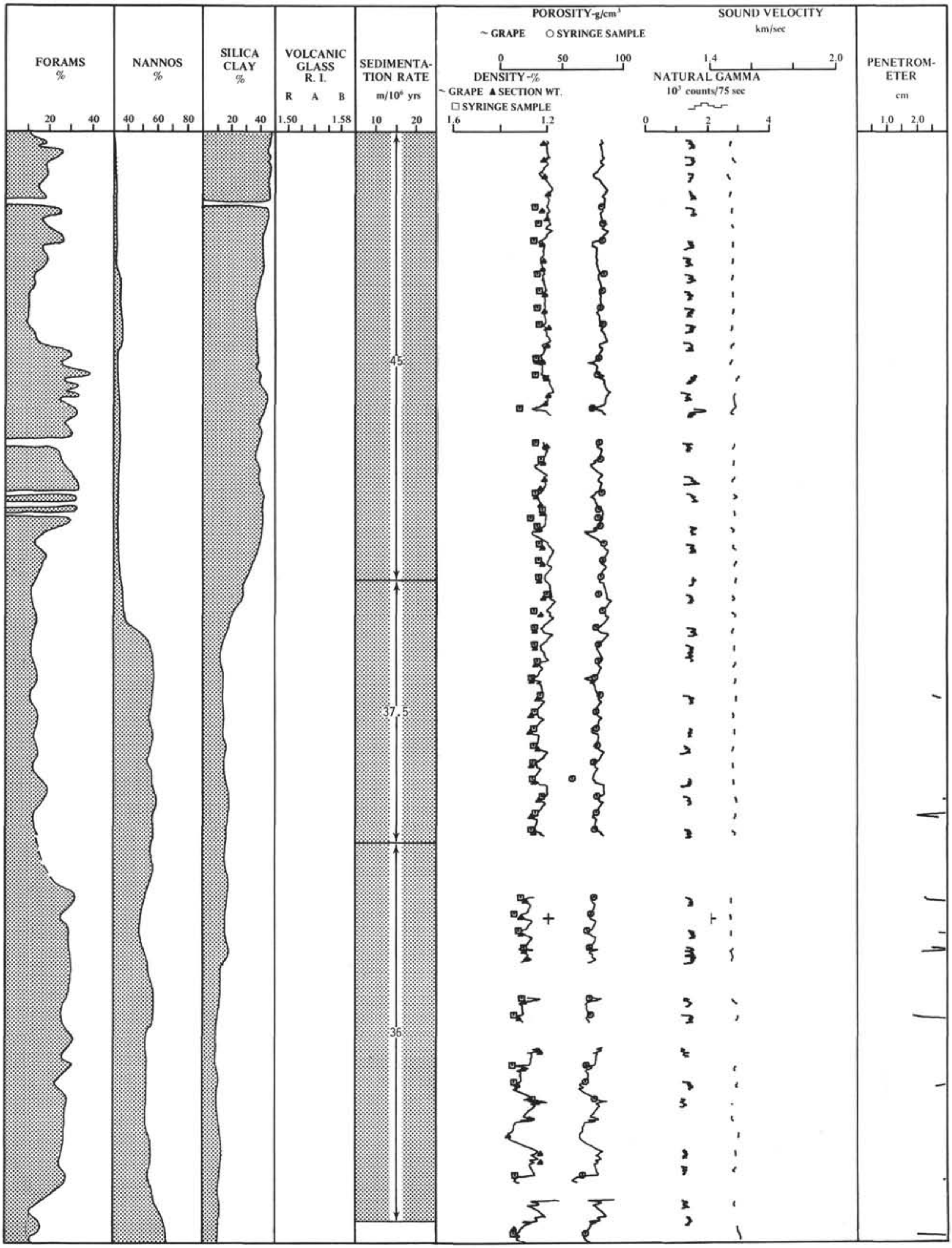


Figure 3. *Site 84 summary.*

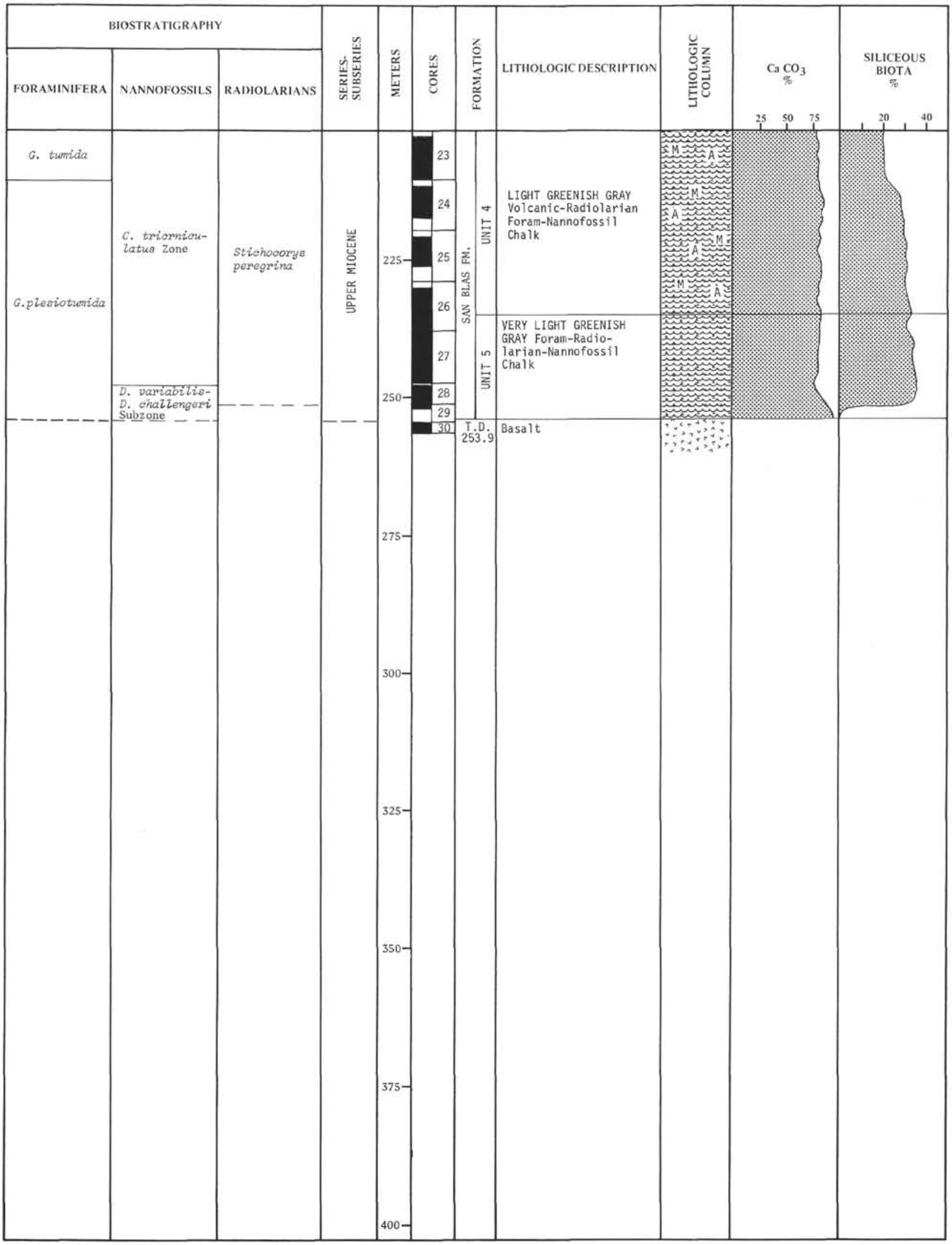


Figure 4. *Site 84 summary (continued).*

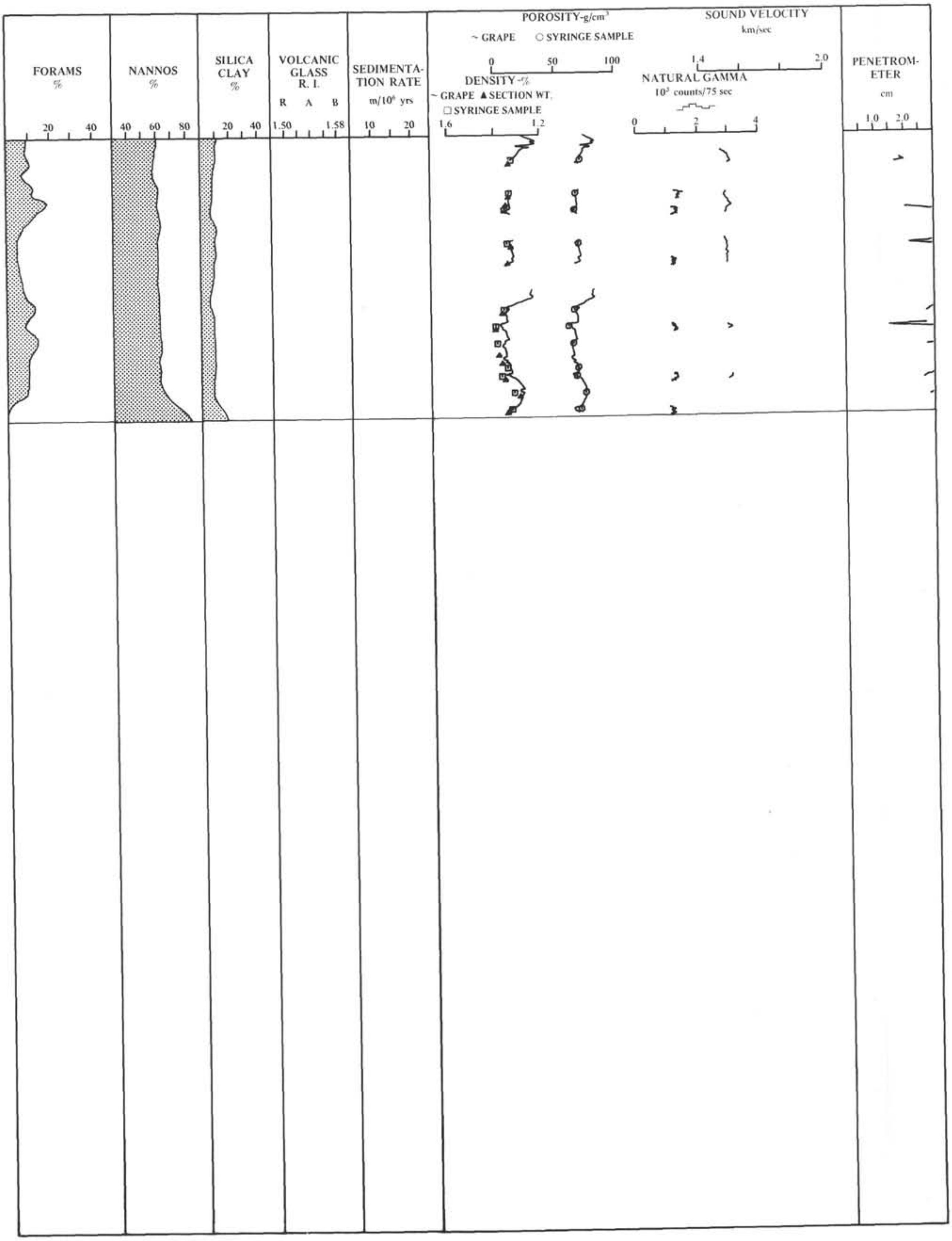


Figure 5. *Site 84 summary (continued).*

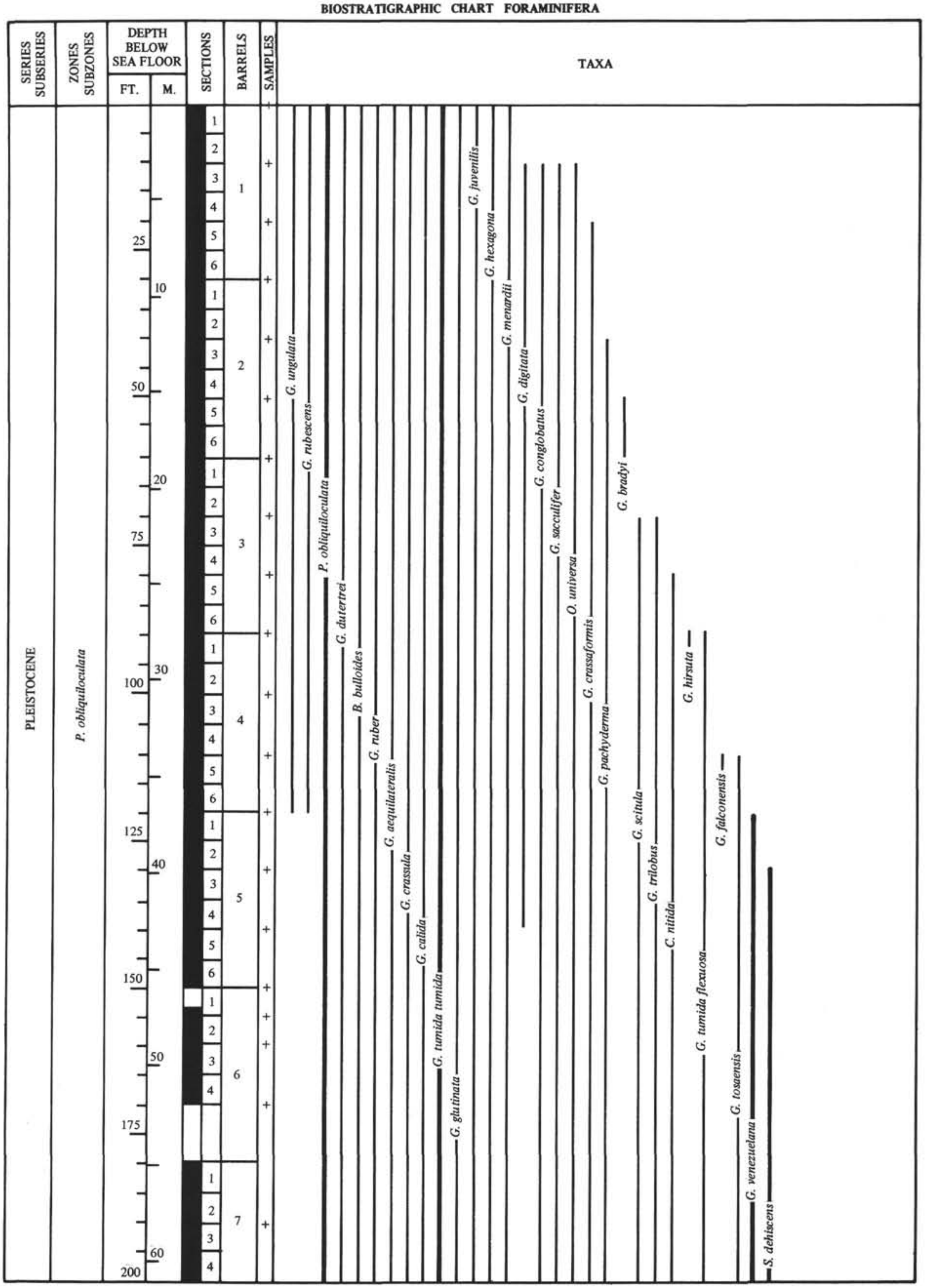


Figure 6. *Biostratigraphic Chart Foraminifera (0 to 200 feet).*

BIOSTRATIGRAPHIC CHART FORAMINIFERA

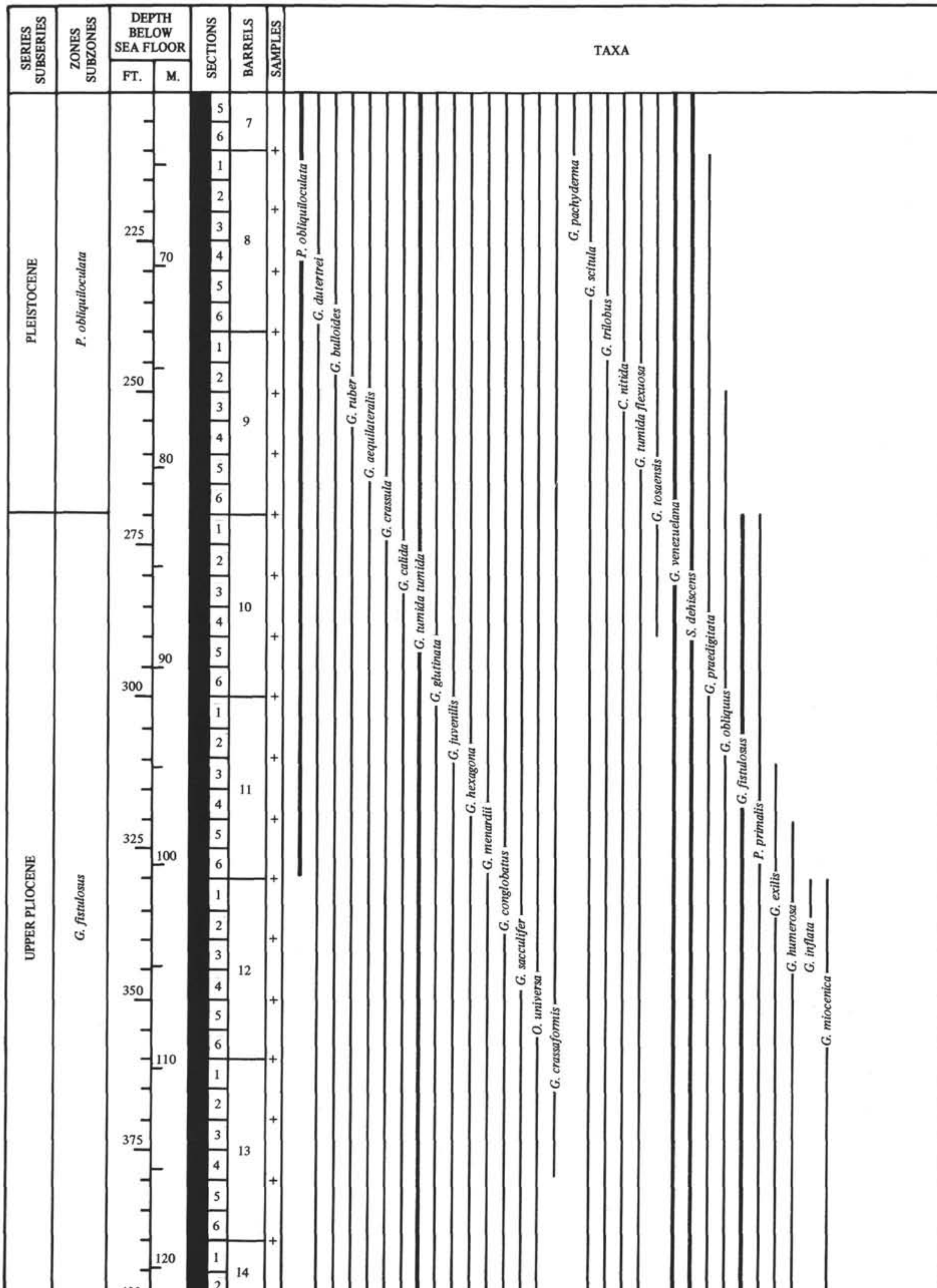


Figure 7. *Biostratigraphic Chart Foraminifera (200 to 400 feet).*

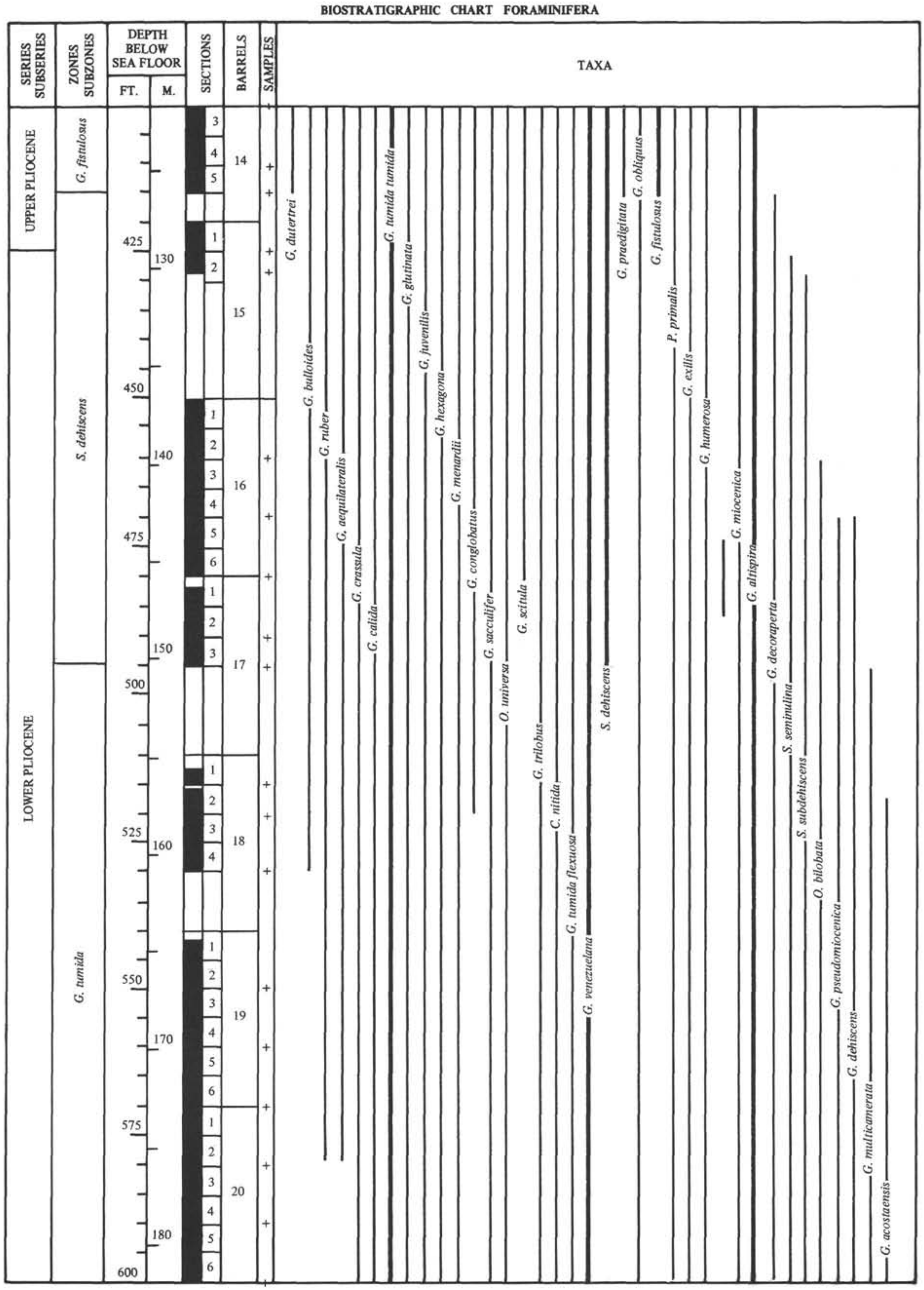


Figure 8. *Biostratigraphic Chart Foraminifera (400 to 600 feet).*

BIOSTRATIGRAPHIC CHART FORAMINIFERA

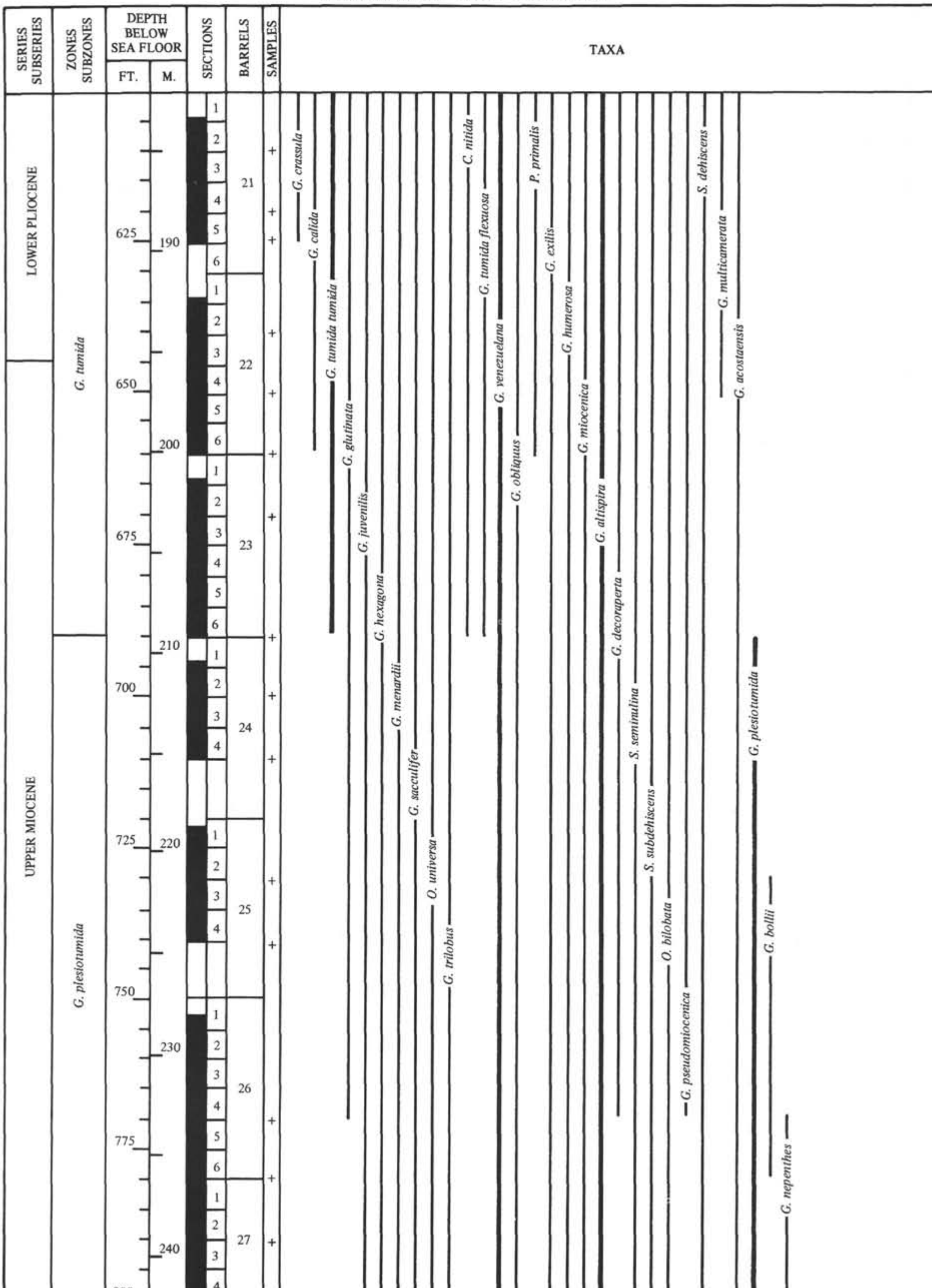


Figure 9. *Biostratigraphic Chart Foraminifera (600 to 800 feet).*

BIOSTRATIGRAPHIC CHART FORAMINIFERA

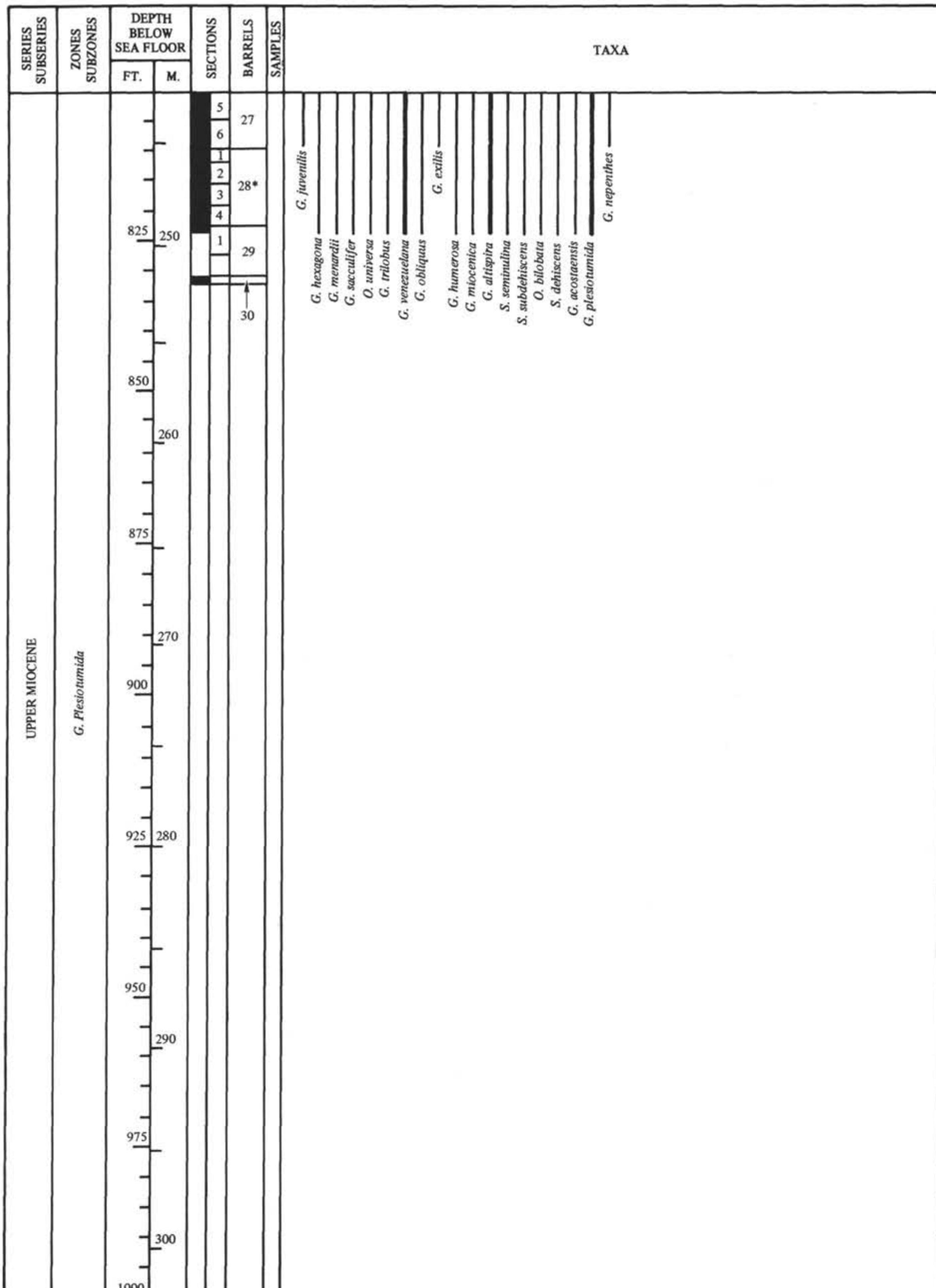


Figure 10. *Biostratigraphic Chart Foraminifera (800 to 1000 feet).*

BIOSTRATIGRAPHIC CHART RADIOLARIA

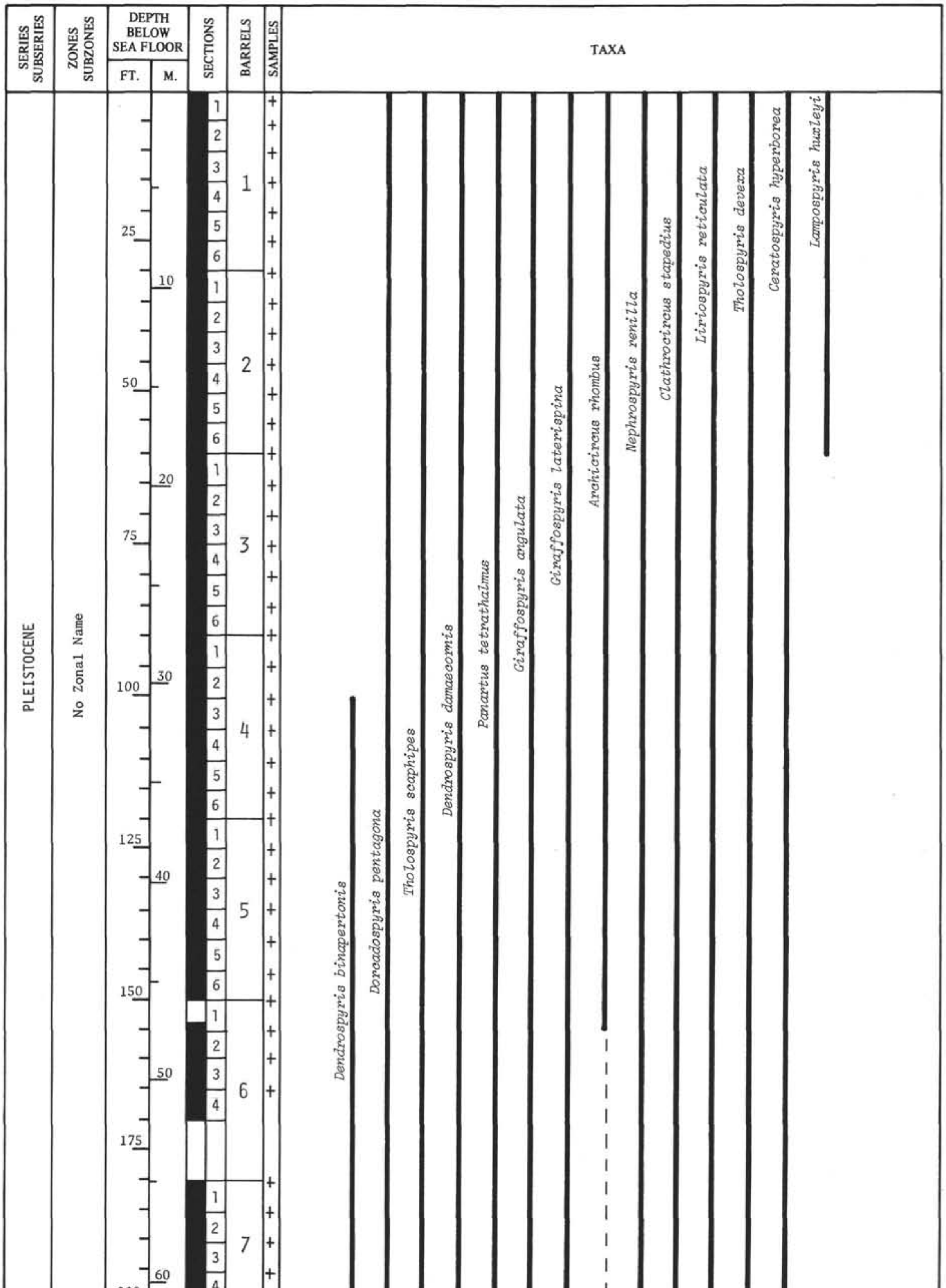


Figure 11. *Biostratigraphic Chart Radiolaria (0 to 200 feet).*

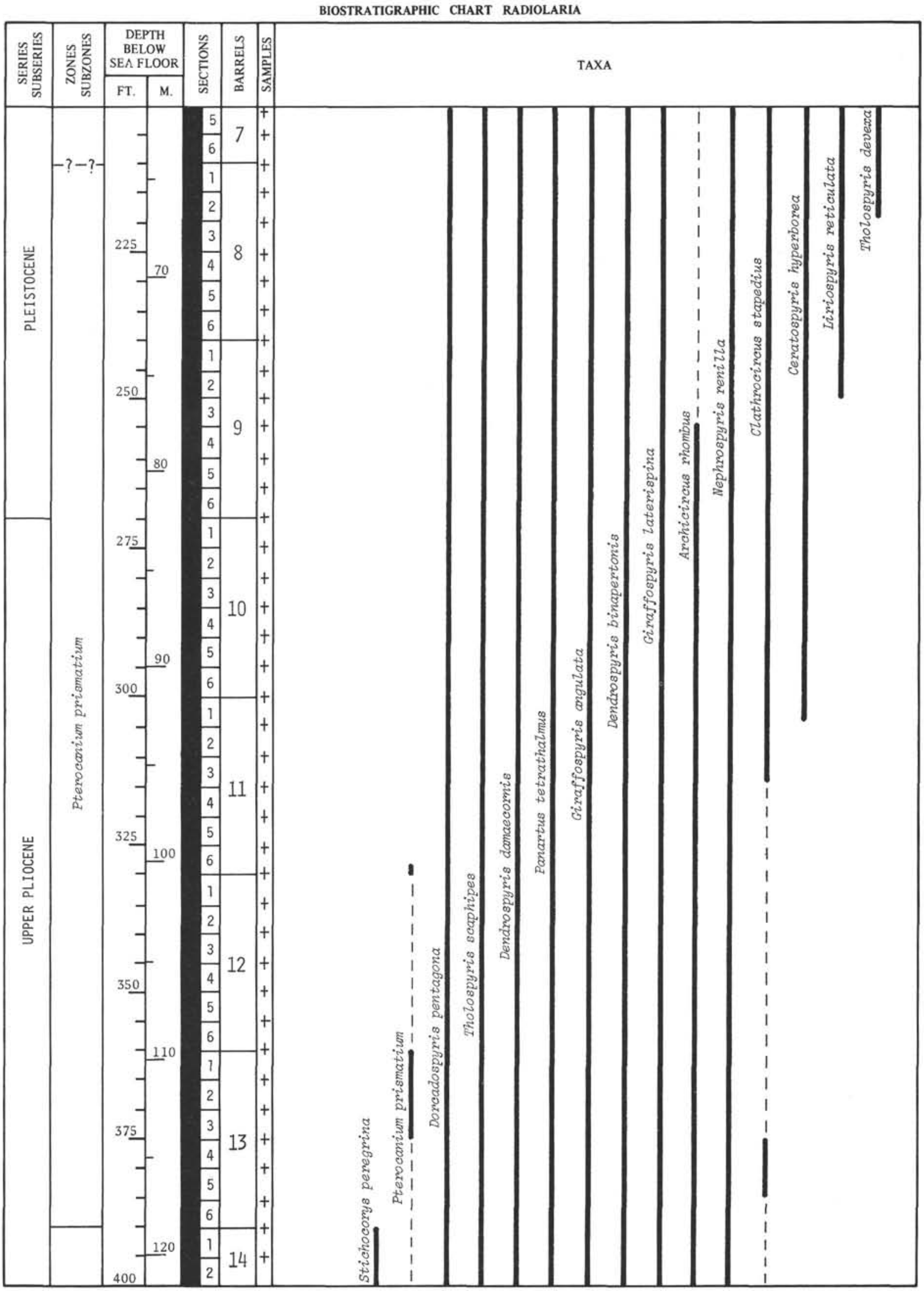


Figure 12. *Biostratigraphic Chart Radiolaria (200 to 400 feet).*

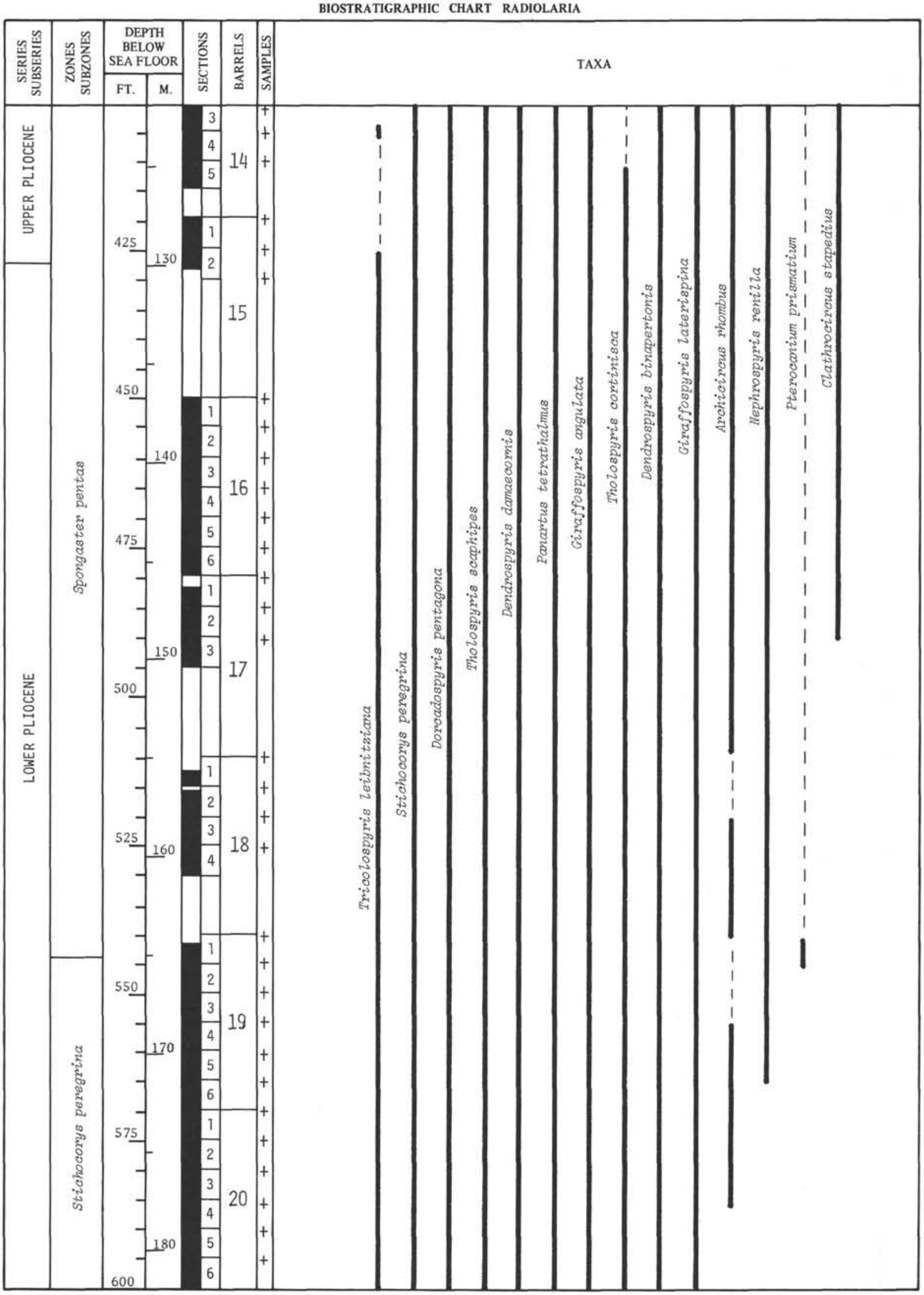


Figure 13. *Biostratigraphic Chart Radiolaria (400 to 600 feet).*

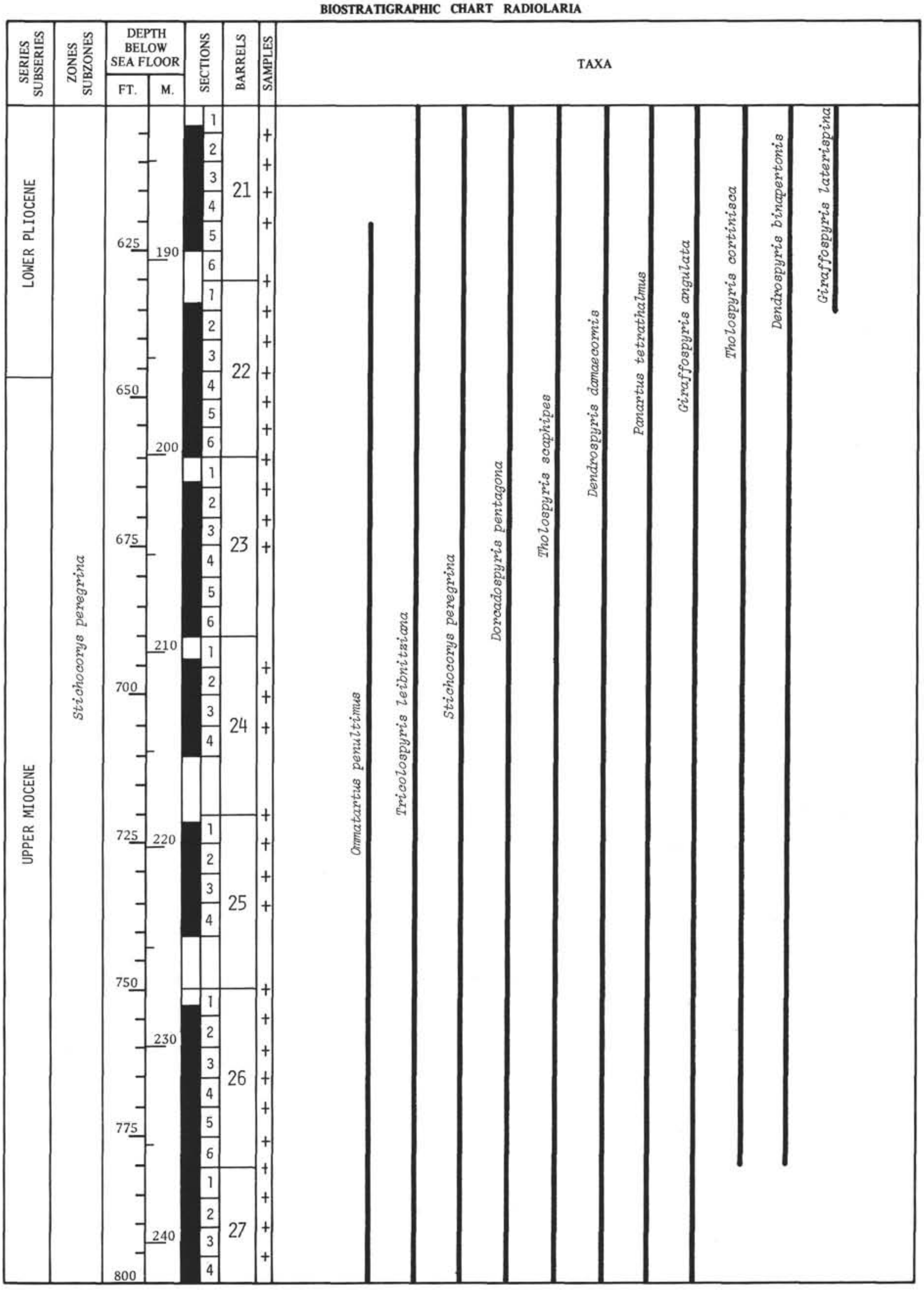


Figure 14. *Biostratigraphic Chart Radiolaria (600 to 800 feet).*

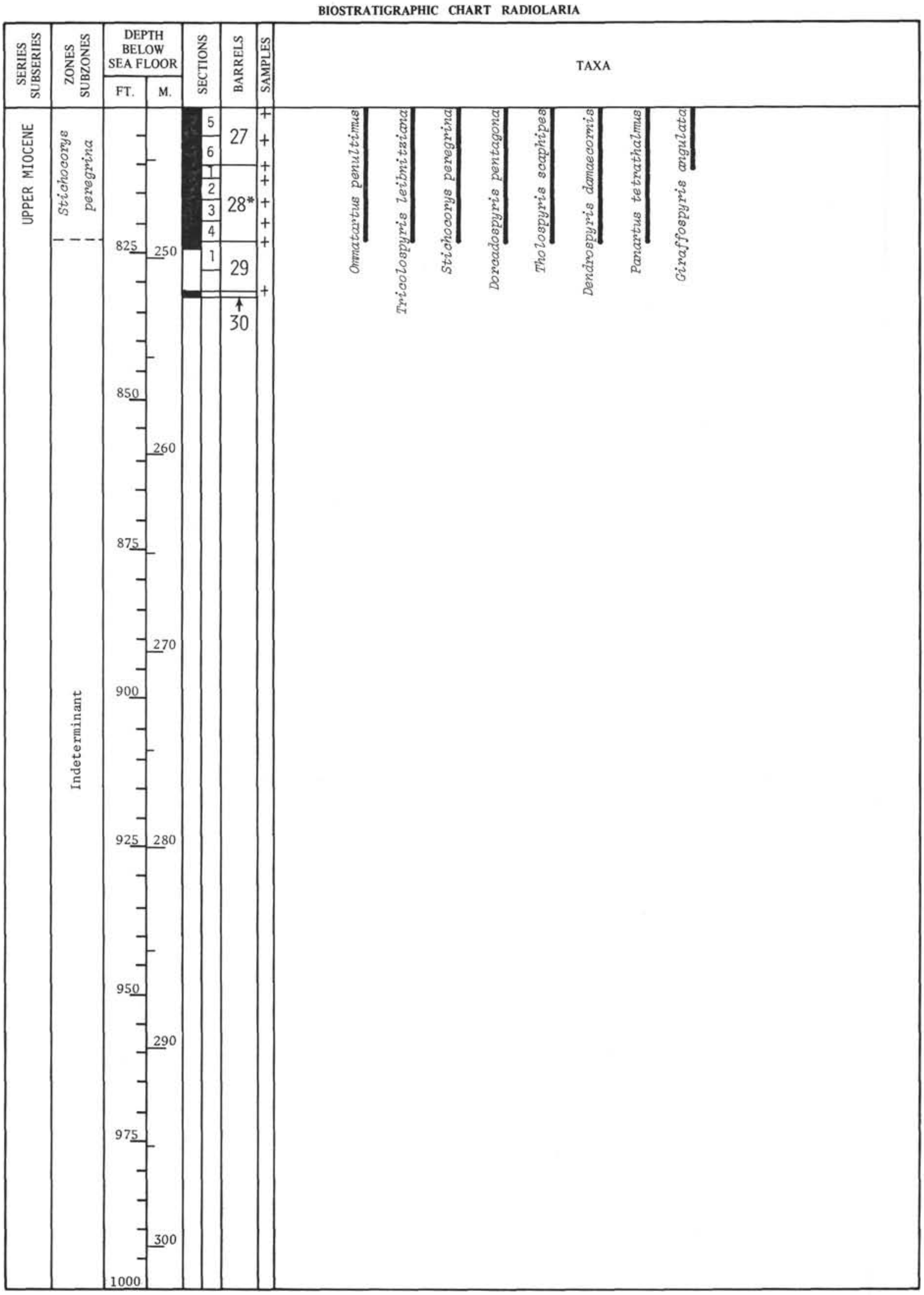


Figure 15. *Biostratigraphic Chart Radiolaria (800 to 1000 feet).*

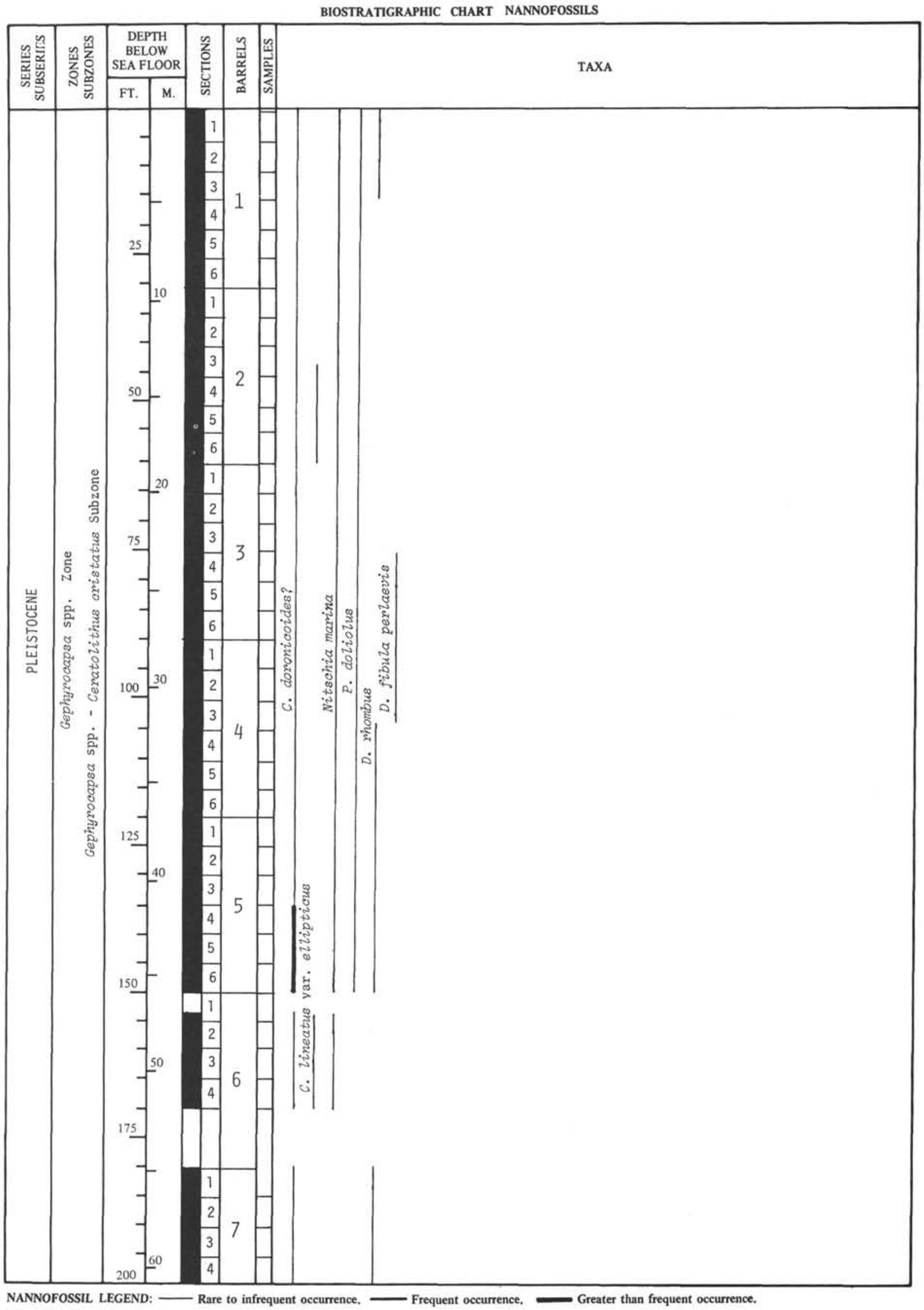
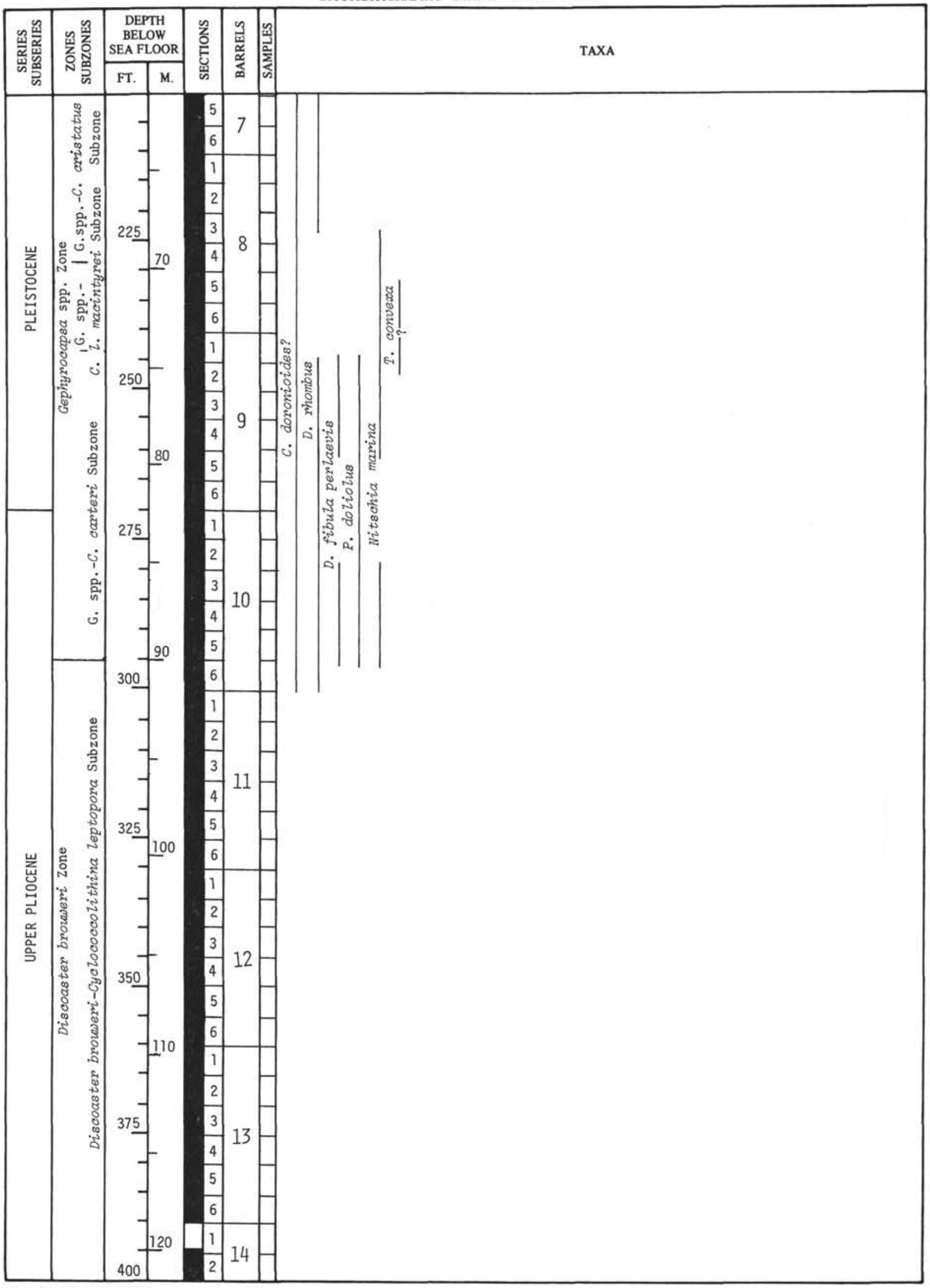


Figure 16. *Biostratigraphic Chart Nannofossils (0 to 200 feet).*

BIOSTRATIGRAPHIC CHART NANNOFOSSILS



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

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

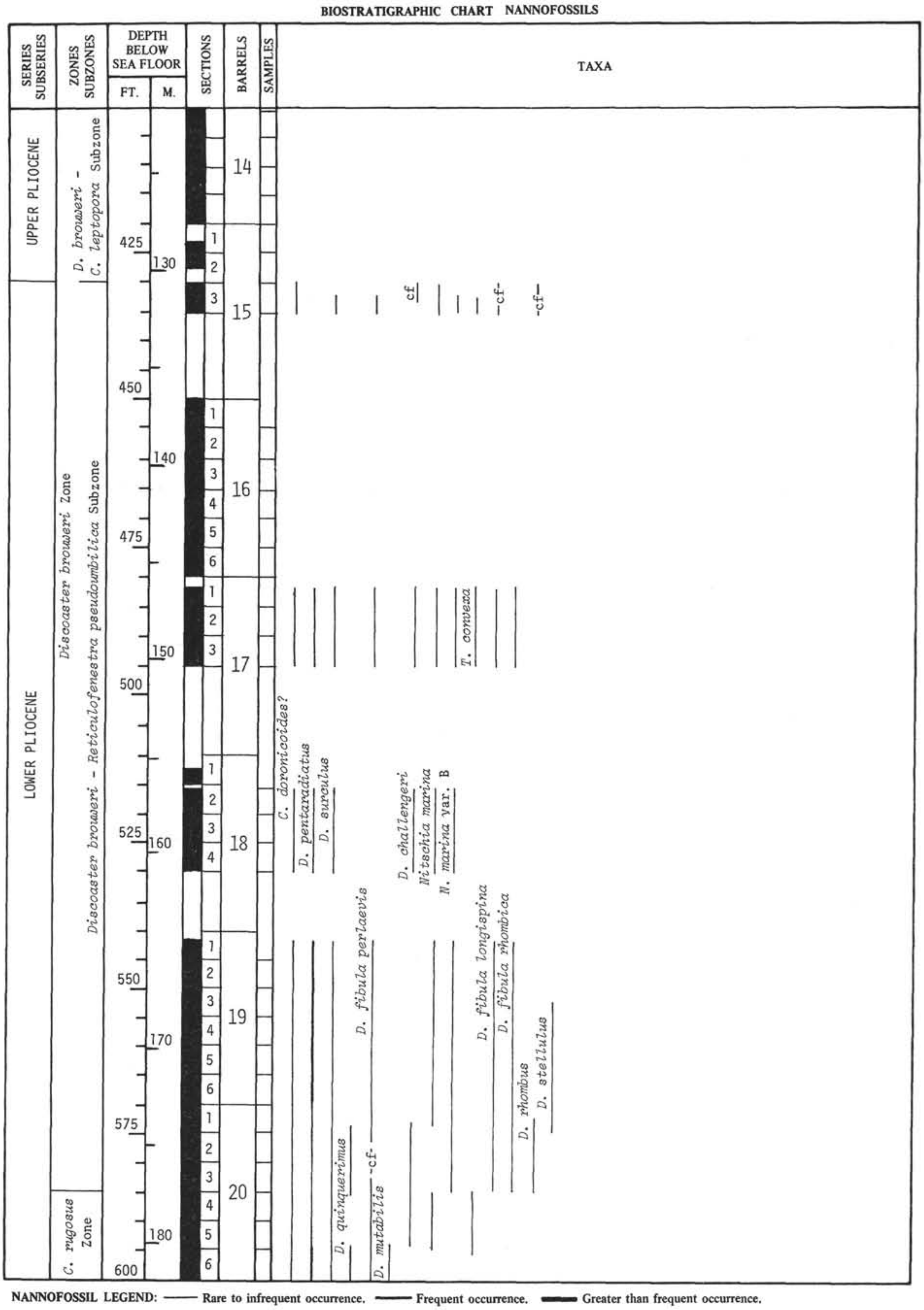


Figure 18. *Biostratigraphic Chart Nannofossils (400 to 600 feet).*

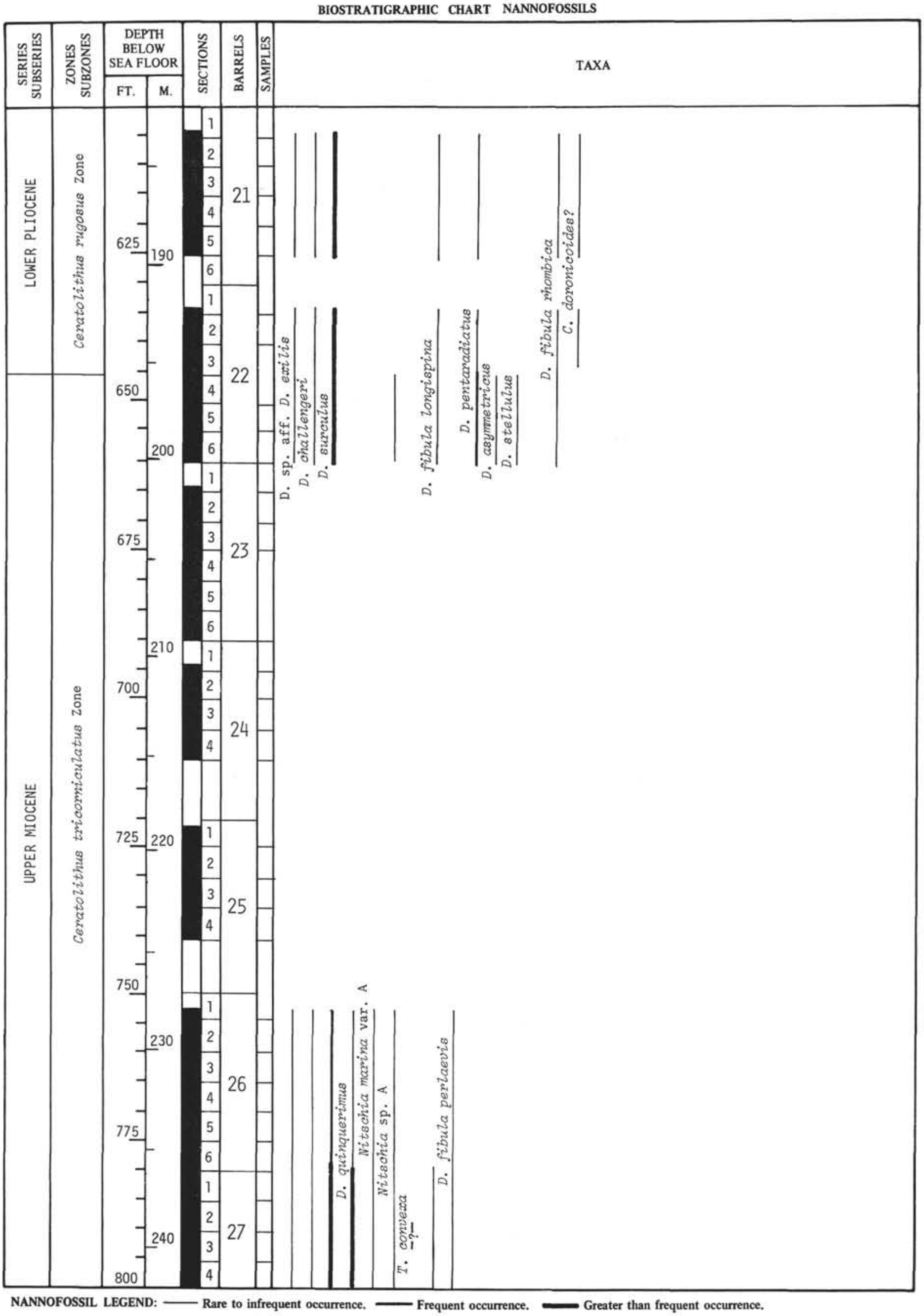


Figure 19. *Biostratigraphic Chart Nannofossils (600 to 800 feet).*

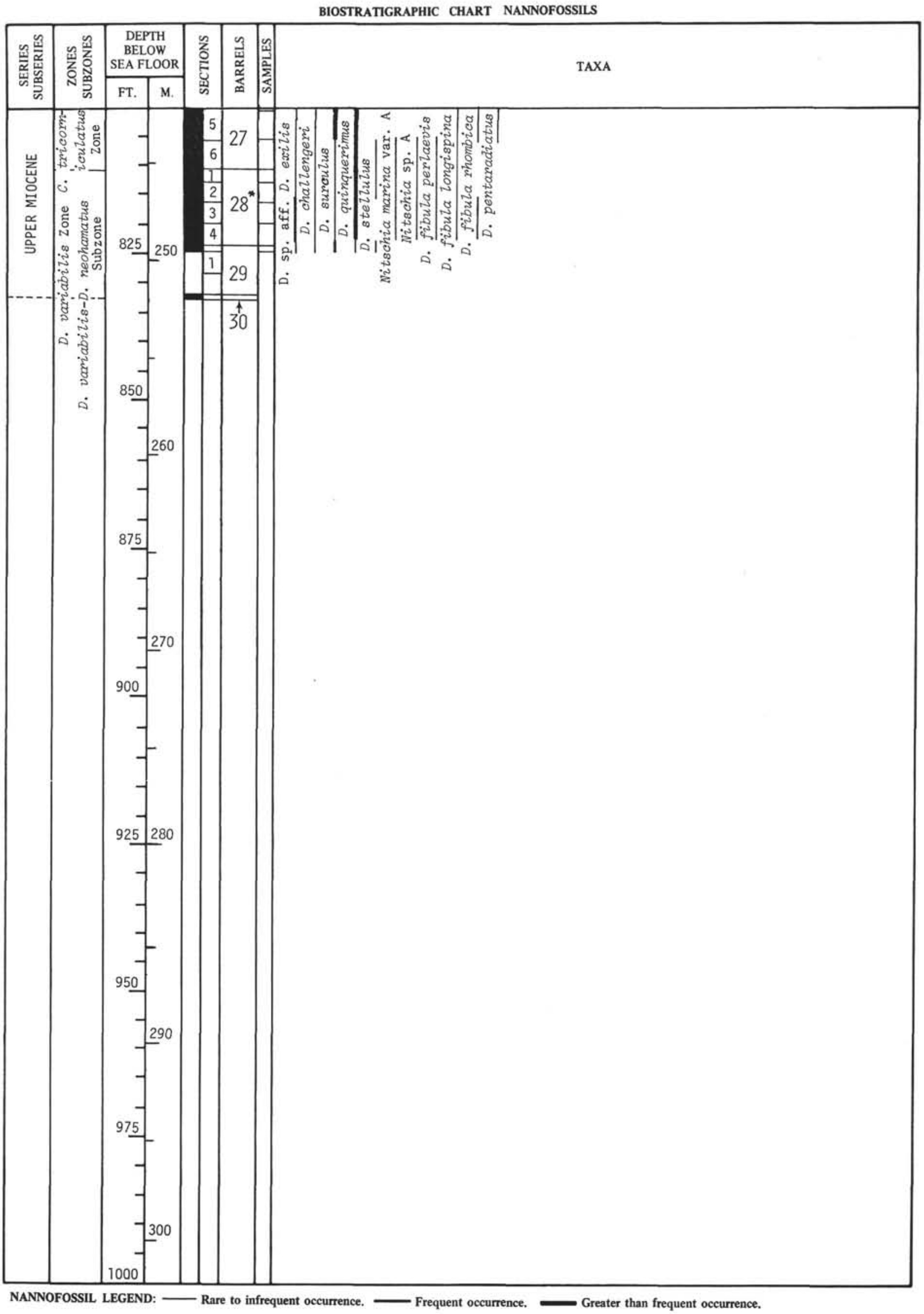


Figure 20. *Biostratigraphic Chart Nannofossils (800 to 1000 feet).*

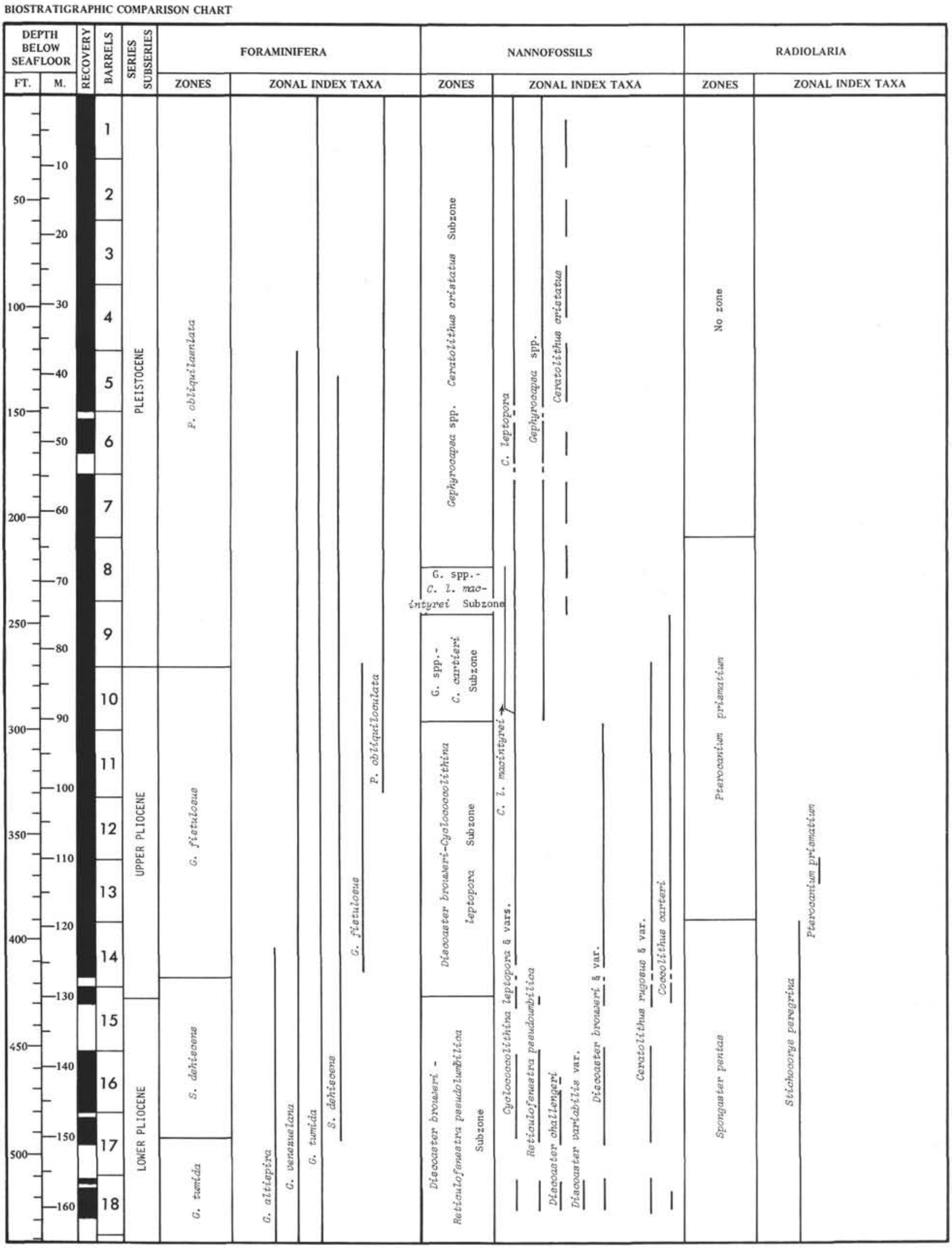


Figure 21. *Biostratigraphic Comparison Chart.*

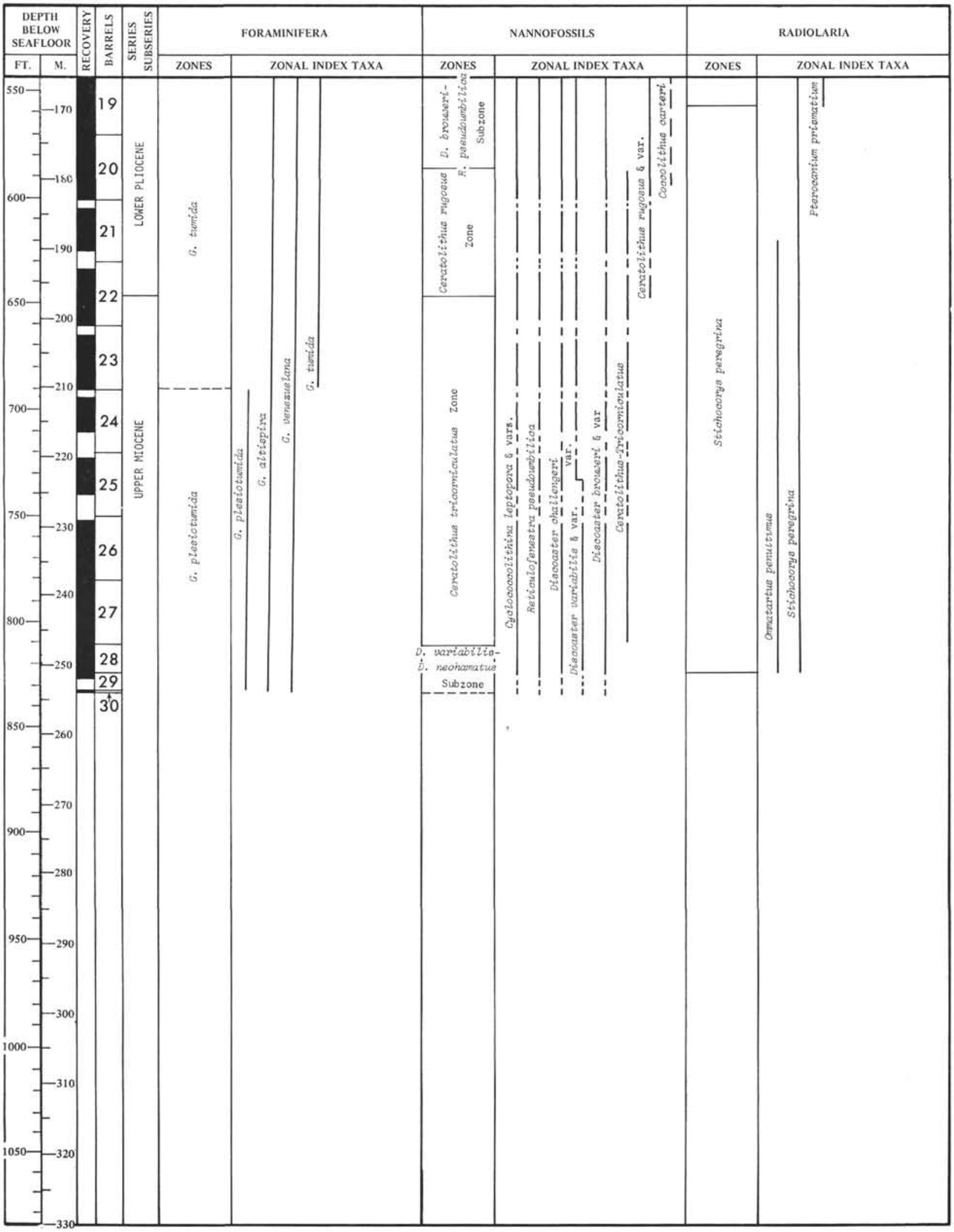


Figure 22. *Biostratigraphic Comparison Chart (continued).*

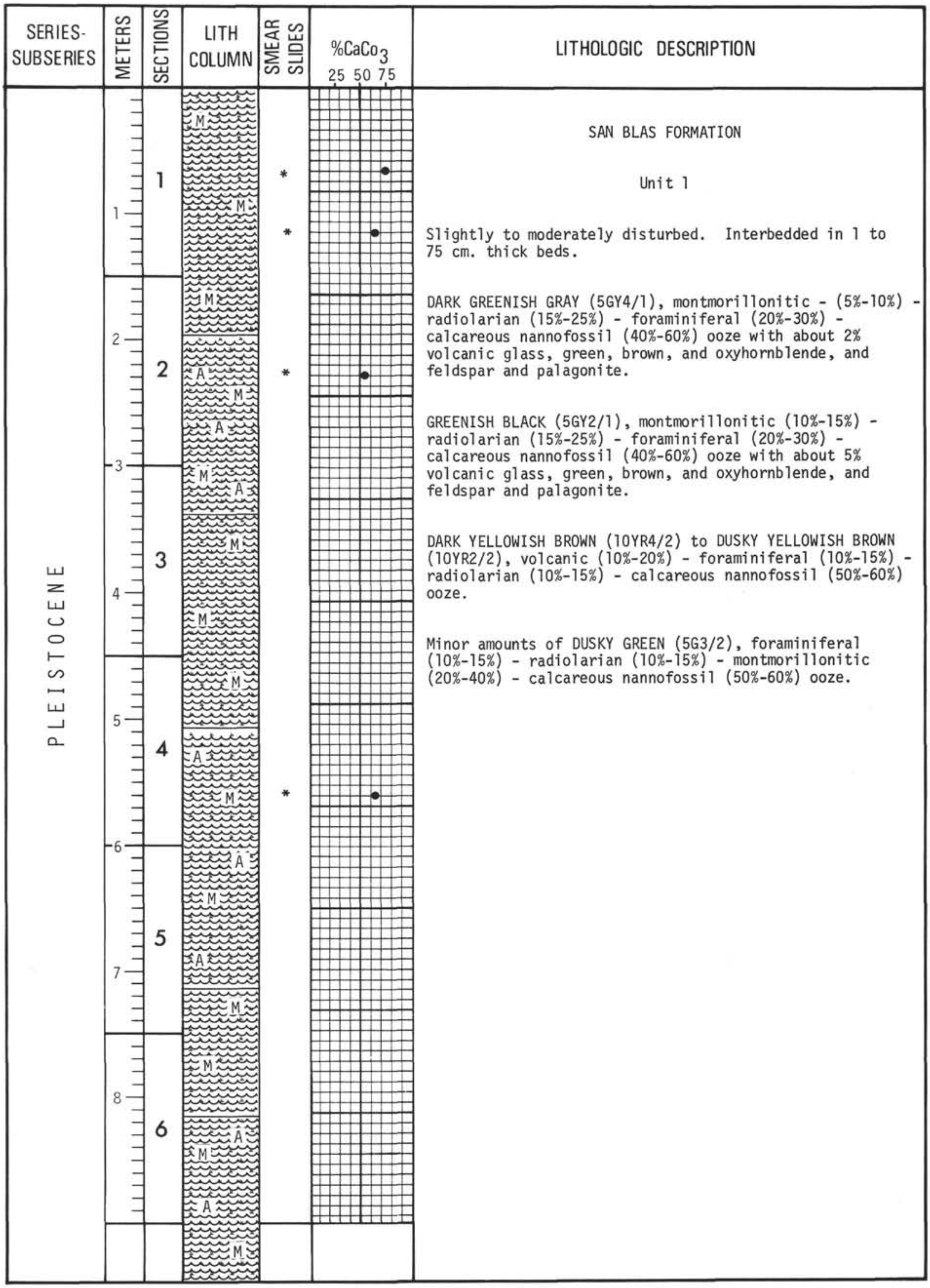


Figure 23. *Hole 84, Core 1 (0 to 9.2 m).*

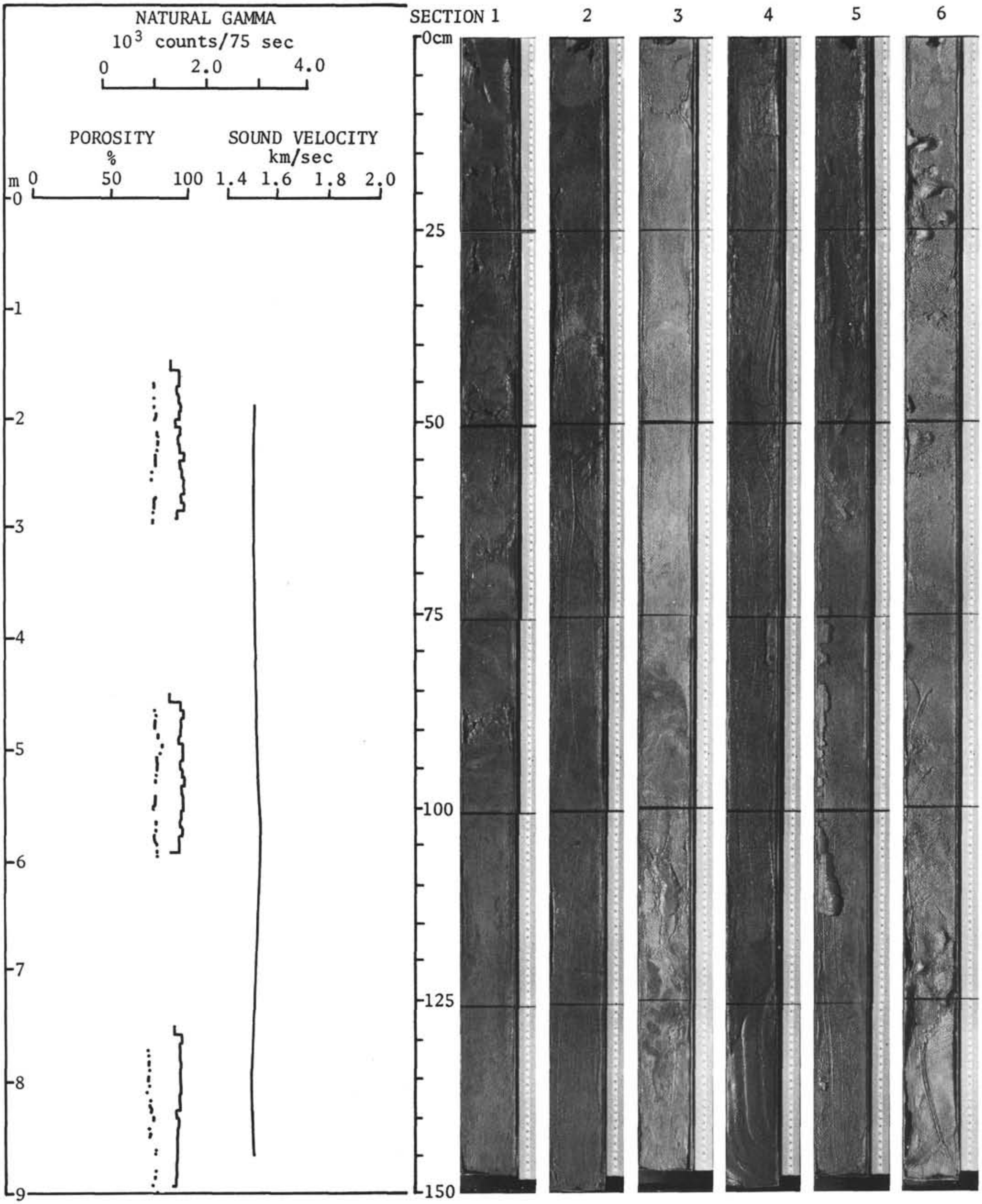


Figure 24. *Hole 84, Core 1, Sections 1-6, Physical Properties.*

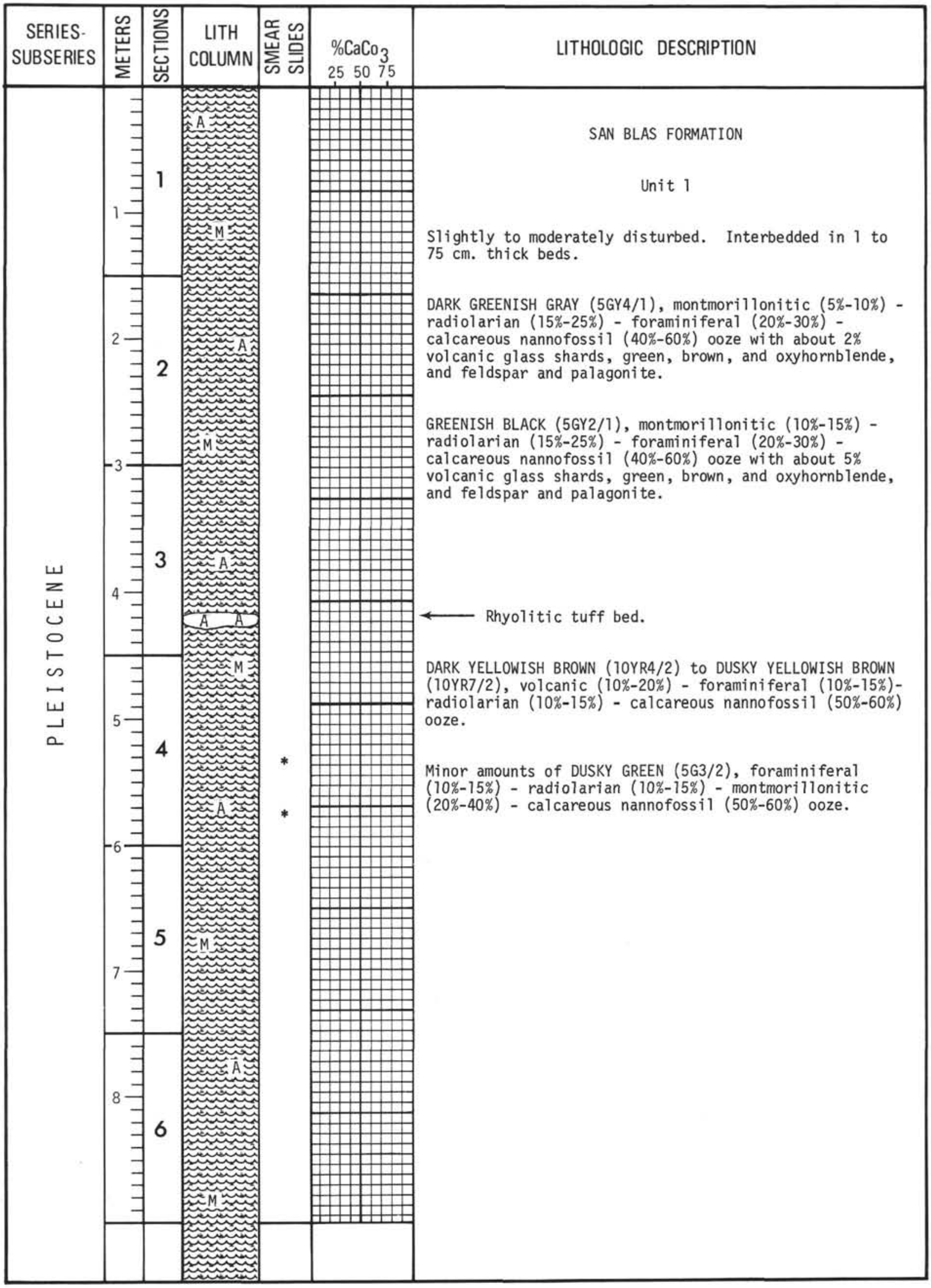


Figure 25. *Hole 84, Core 2 (9.2 to 18.3 m).*

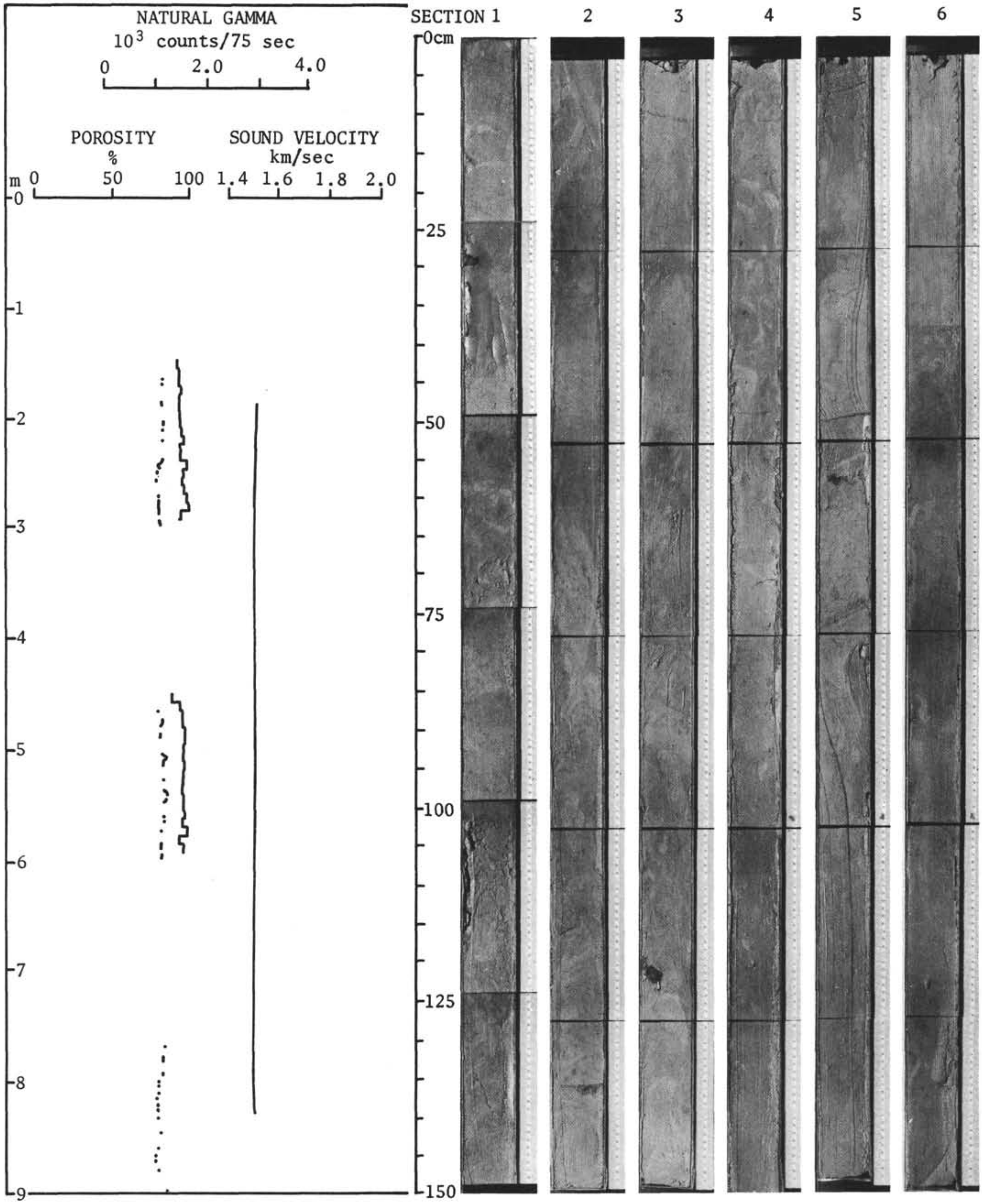


Figure 26. *Hole 84, Core 2, Sections 1-6, Physical Properties.*

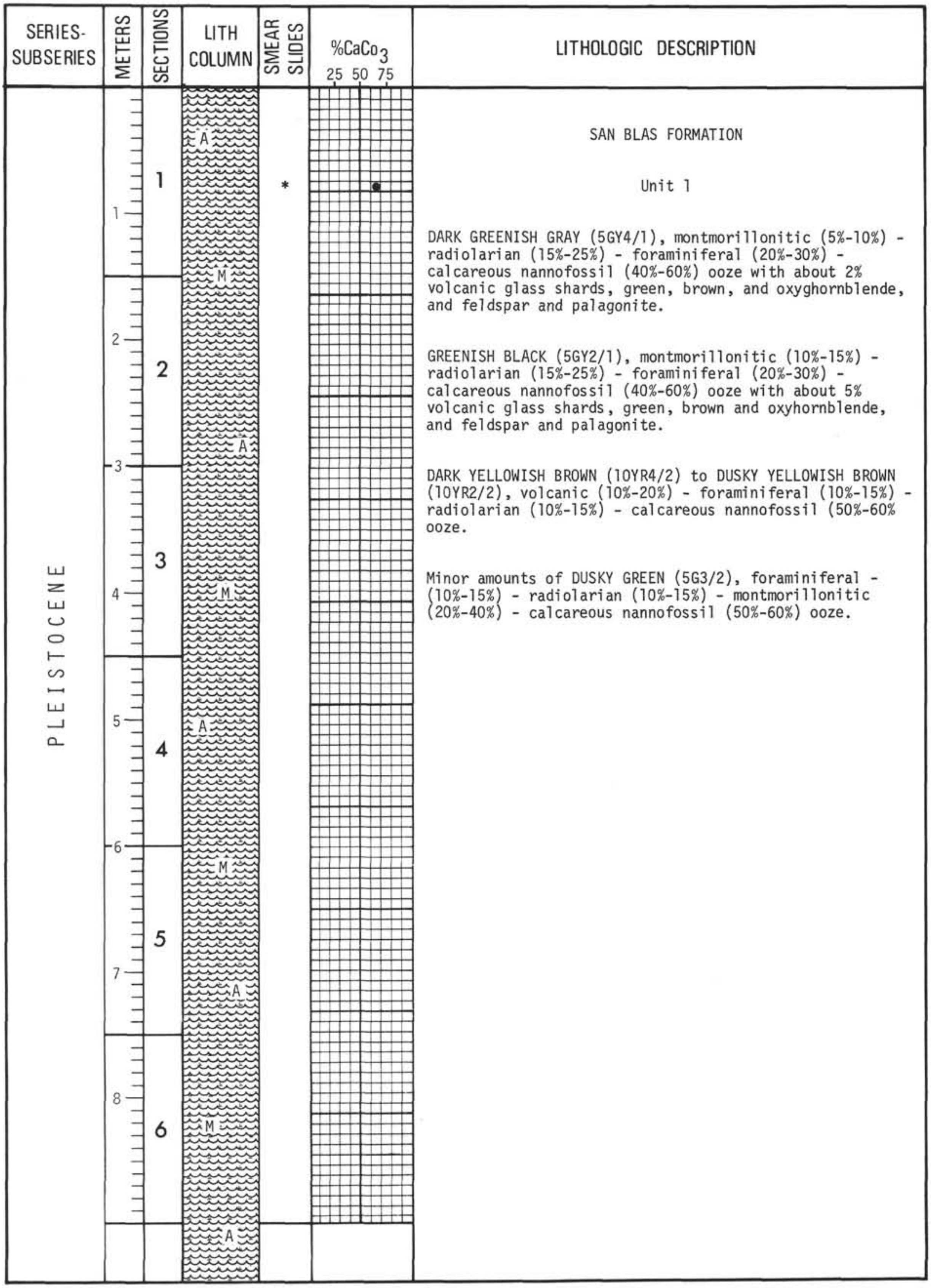


Figure 27. *Hole 84, Core 3 (18.3 to 27.4 m).*

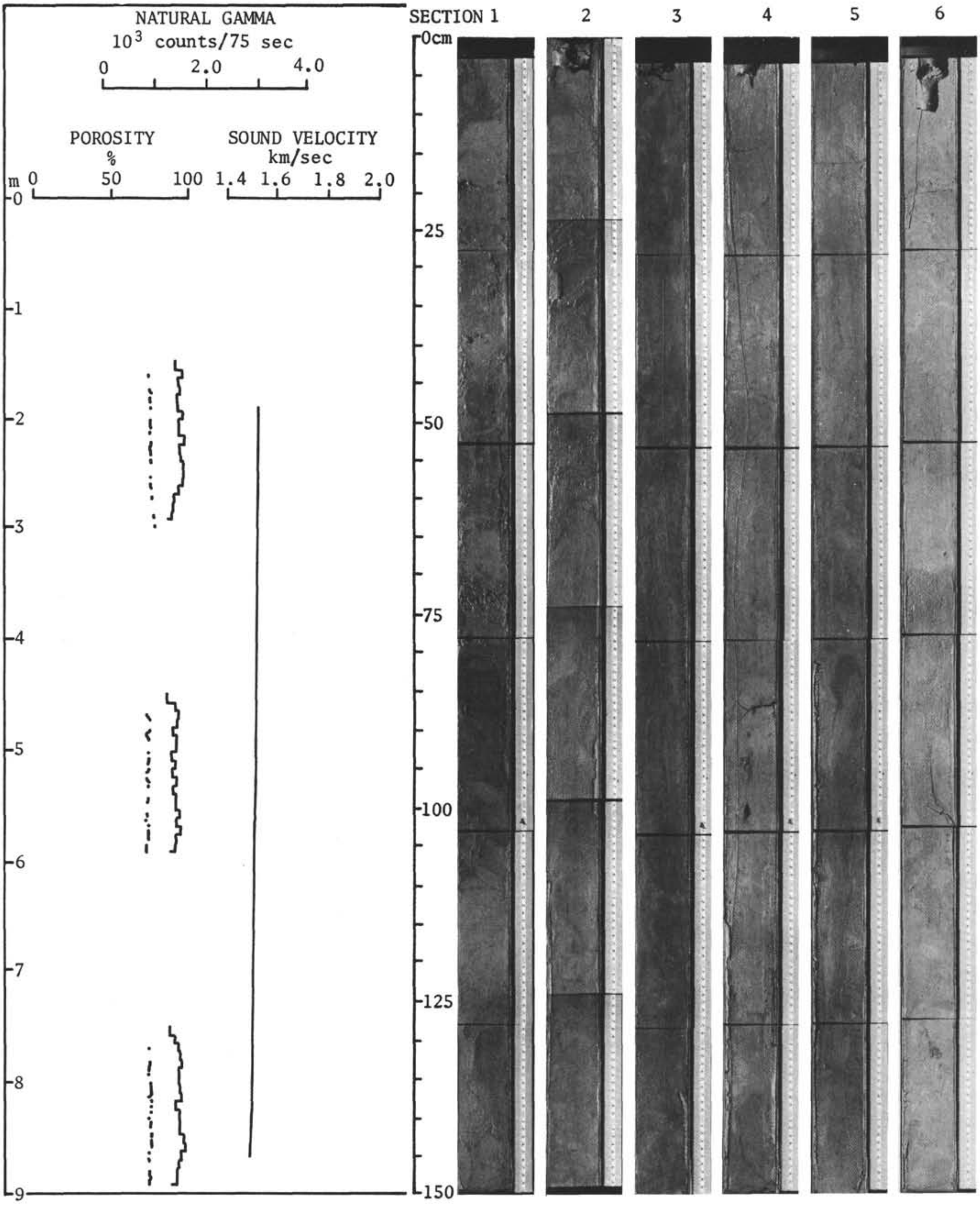


Figure 28. *Hole 84, Core 3, Sections 1-6, Physical Properties.*

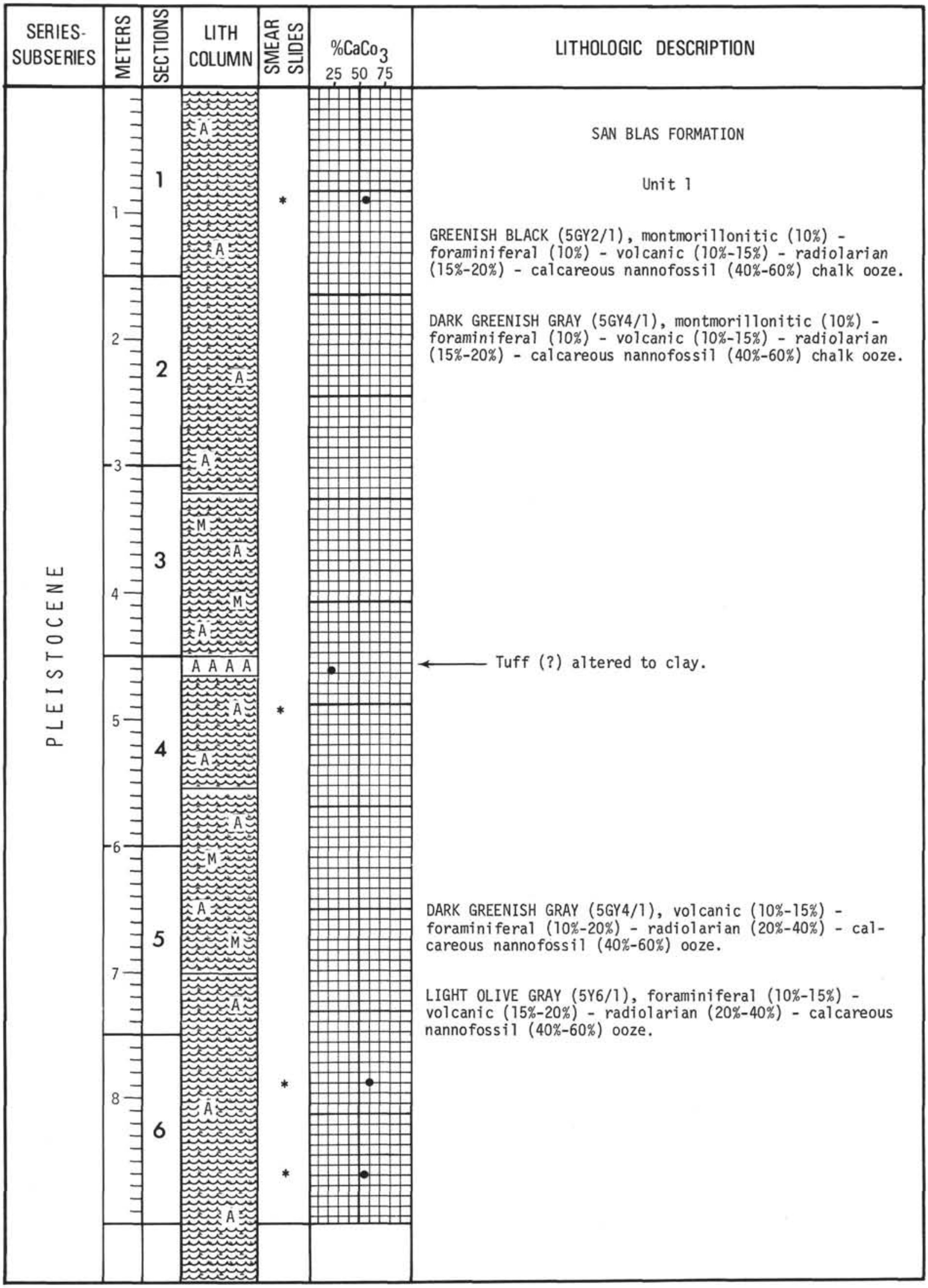


Figure 29. *Hole 84, Core 4 (27.4 to 36.6 m).*

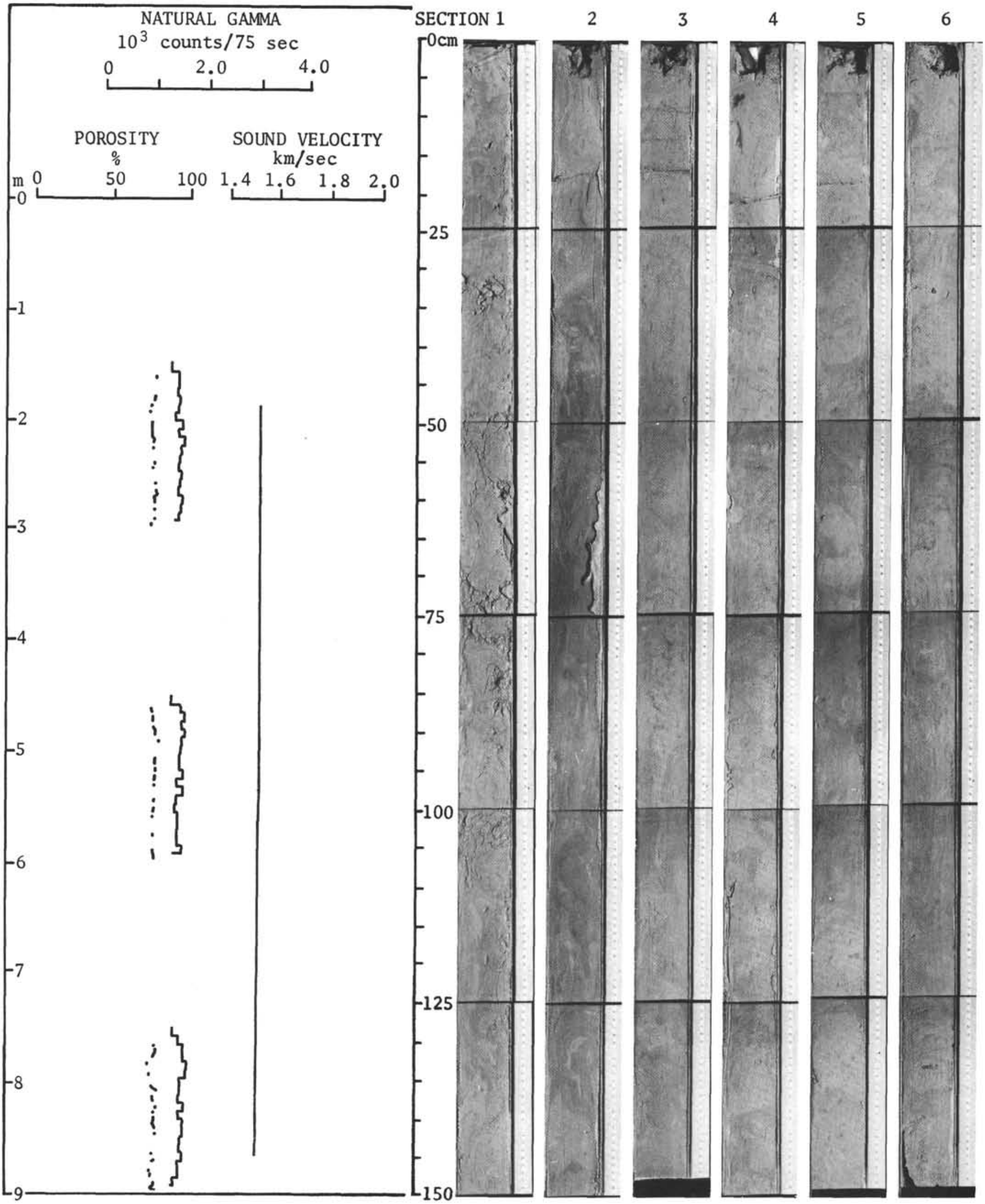


Figure 30. *Hole 84, Core 4, Sections 1-6, Physical Properties.*

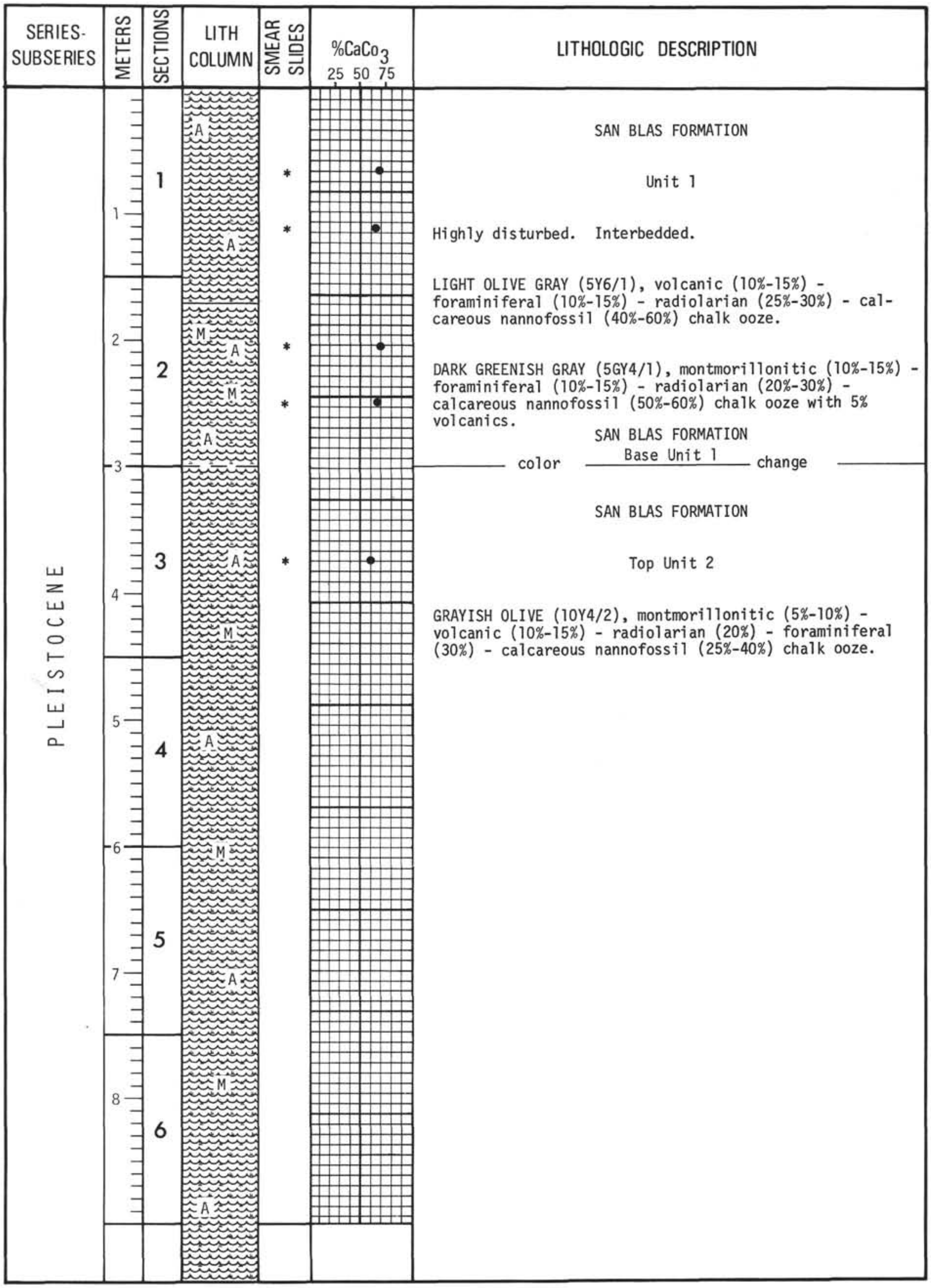


Figure 31. *Hole 84, Core 5 (36.6 to 45.7 m).*

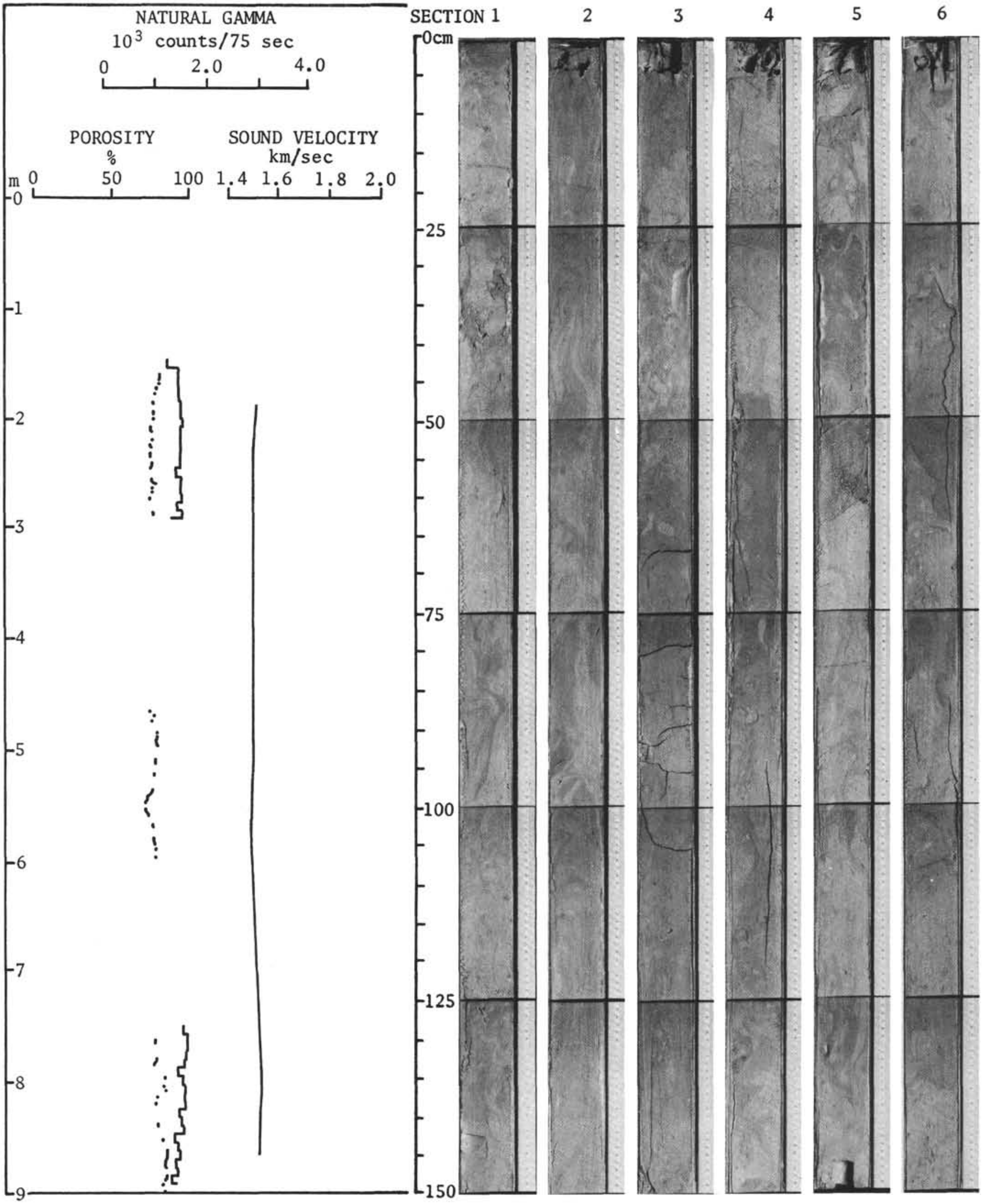


Figure 32. *Hole 84, Core 5, Sections 1-6, Physical Properties.*

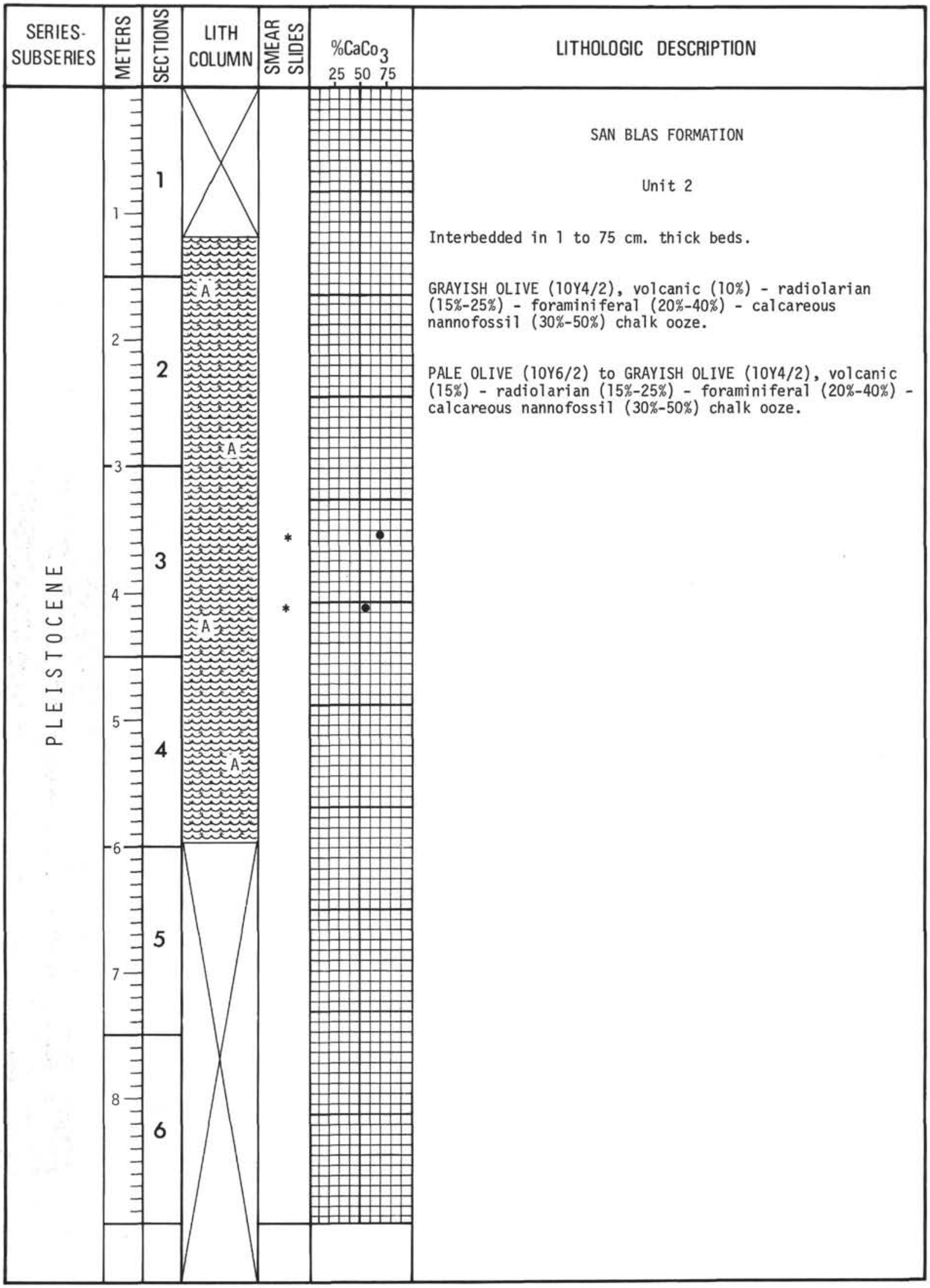


Figure 33. *Hole 84, Core 6 (45.7-54.9 m).*

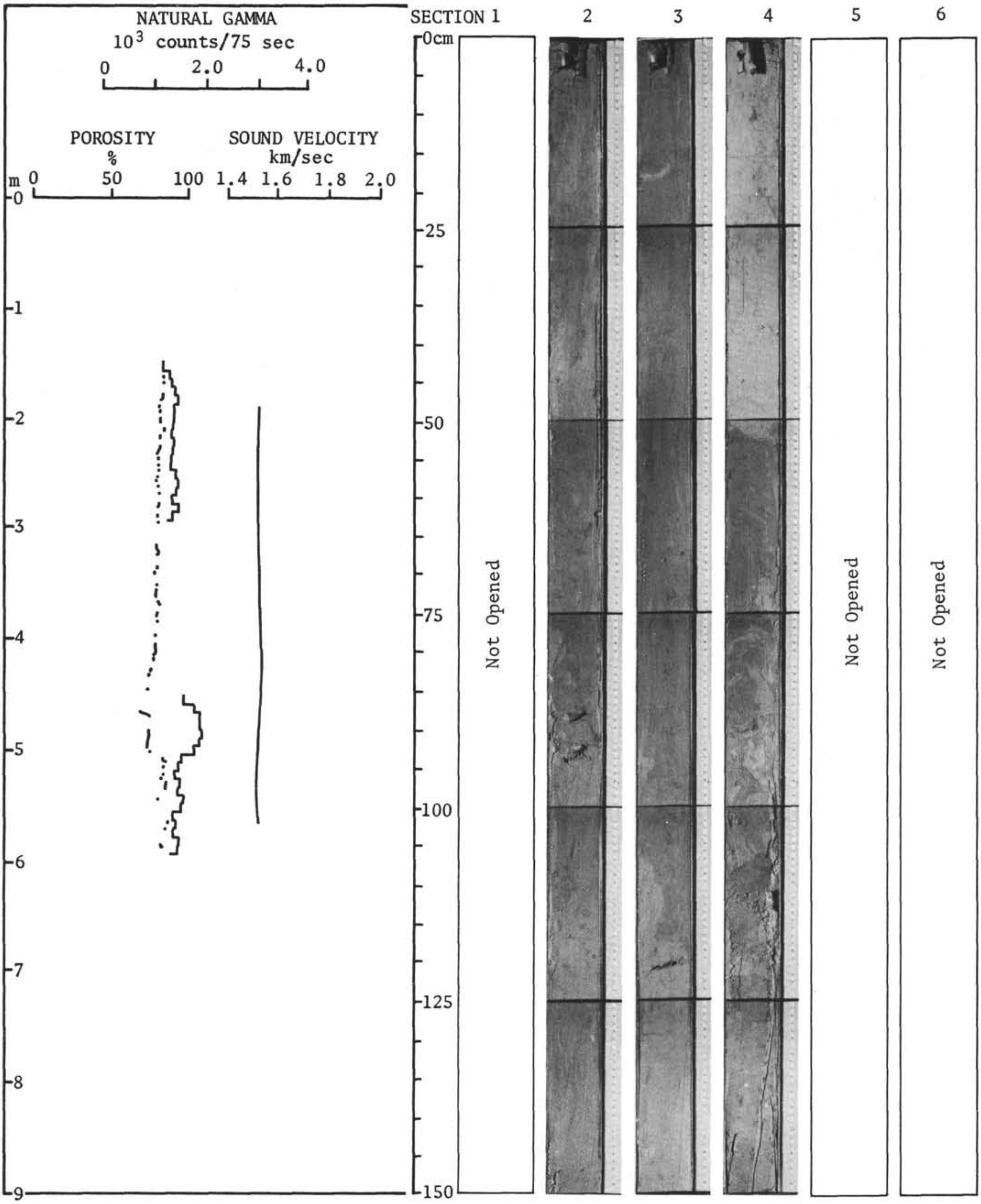


Figure 34. *Hole 84, Core 6, Sections 1-6, Physical Properties.*

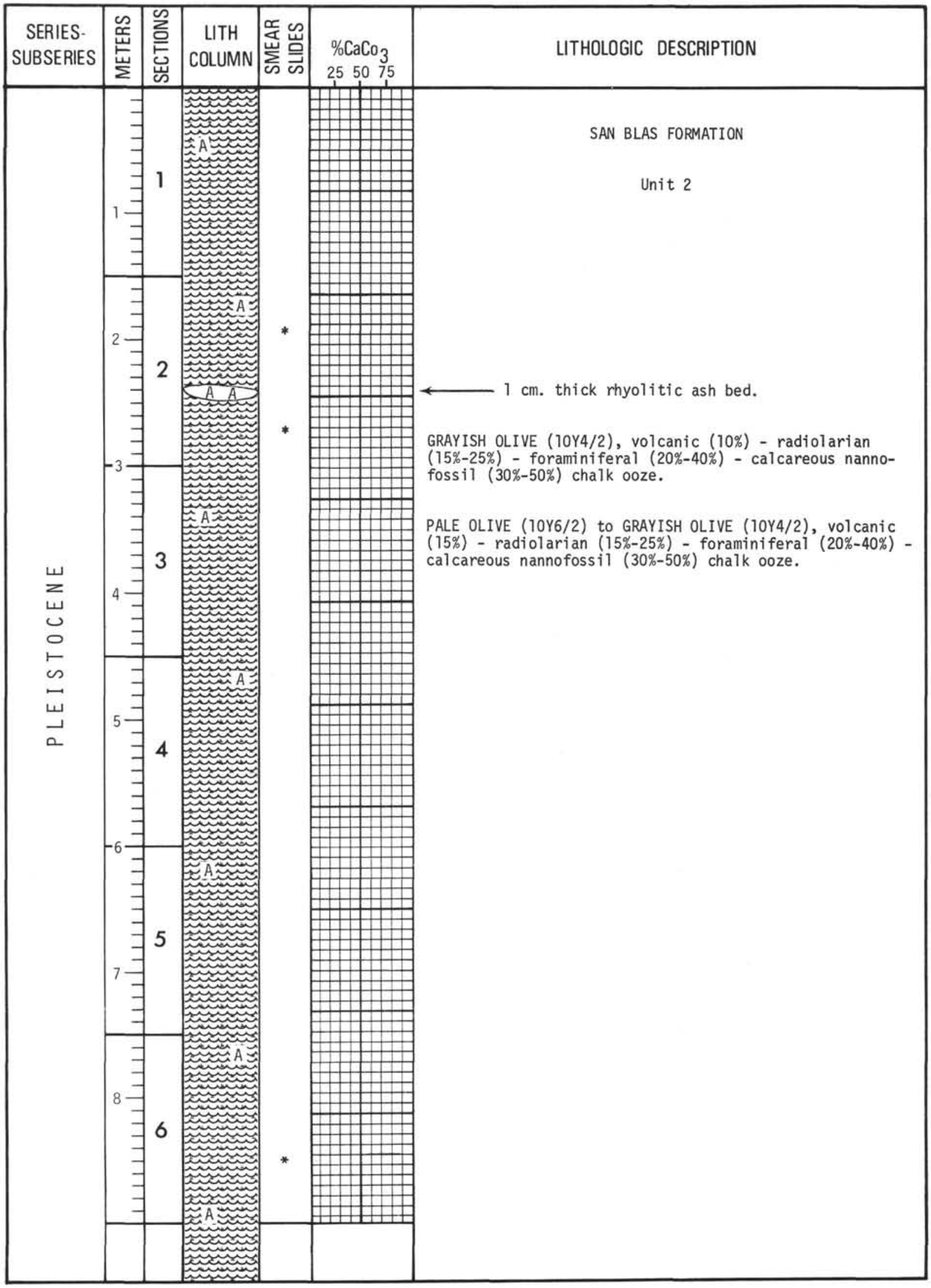


Figure 35. *Hole 84, Core 7 (54.9 to 64.0 m).*

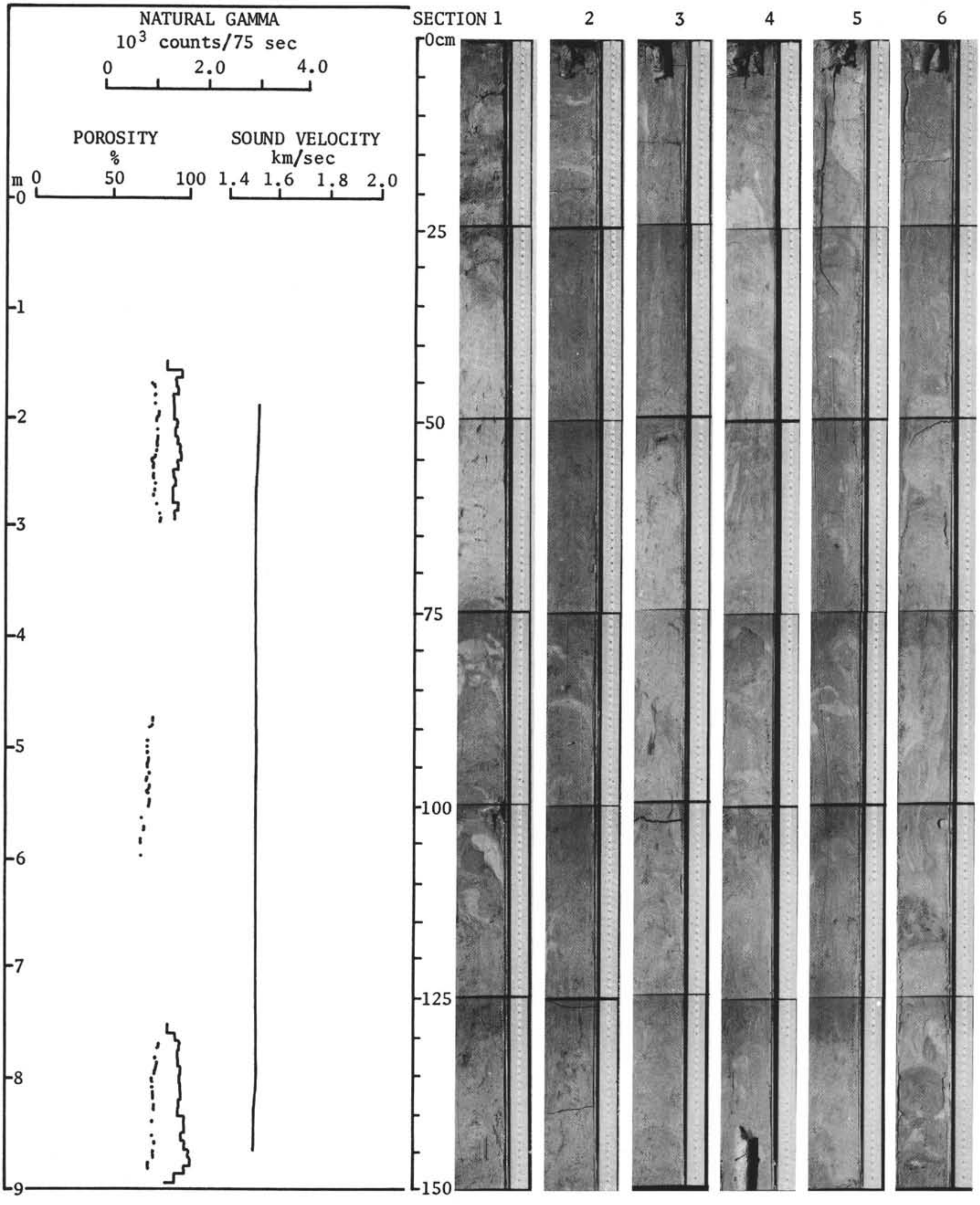


Figure 36. *Hole 84, Core 7, Sections 1-6, Physical Properties.*

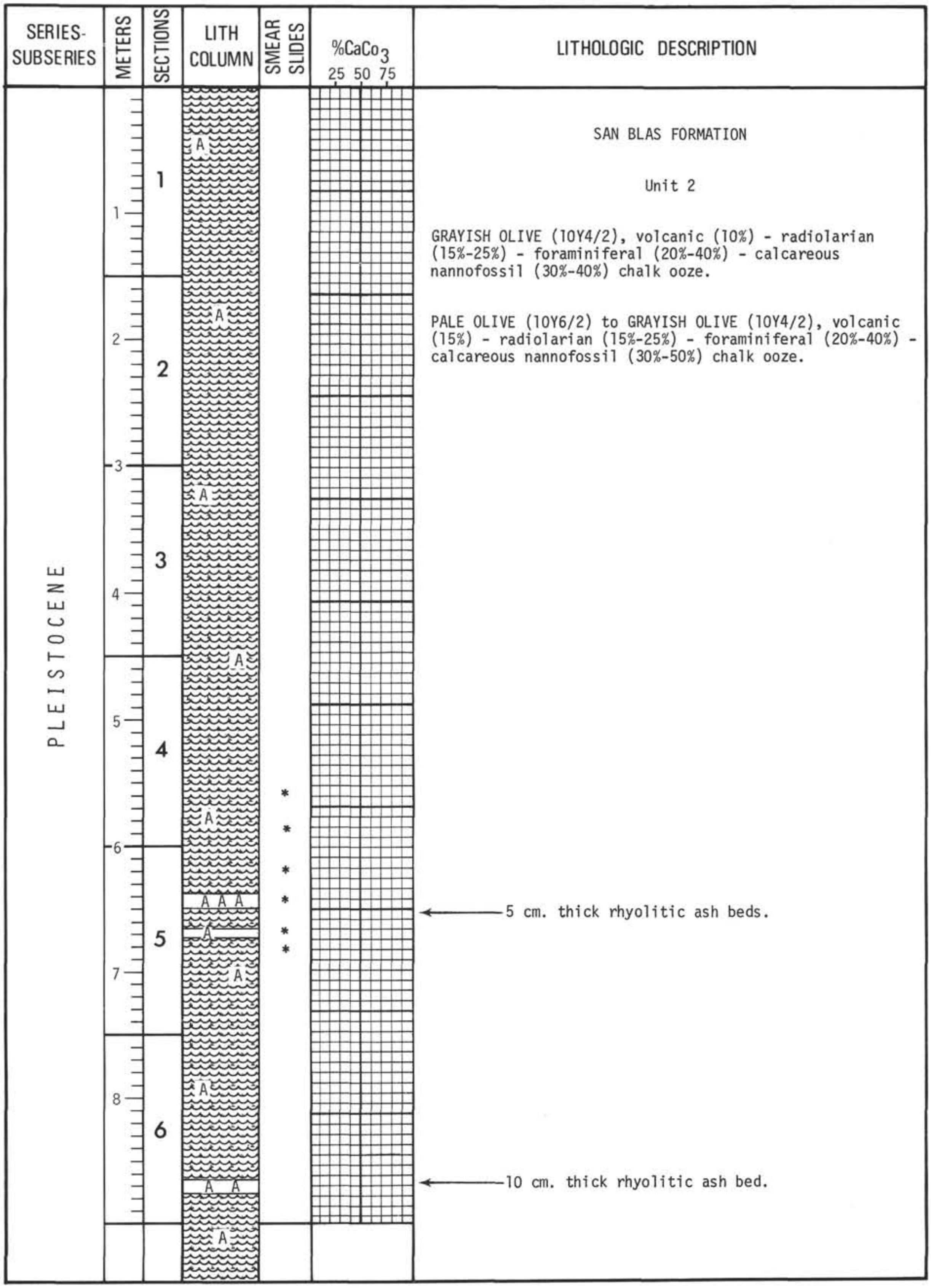


Figure 37. *Hole 84, Core 8 (64.0 to 73.1 m).*

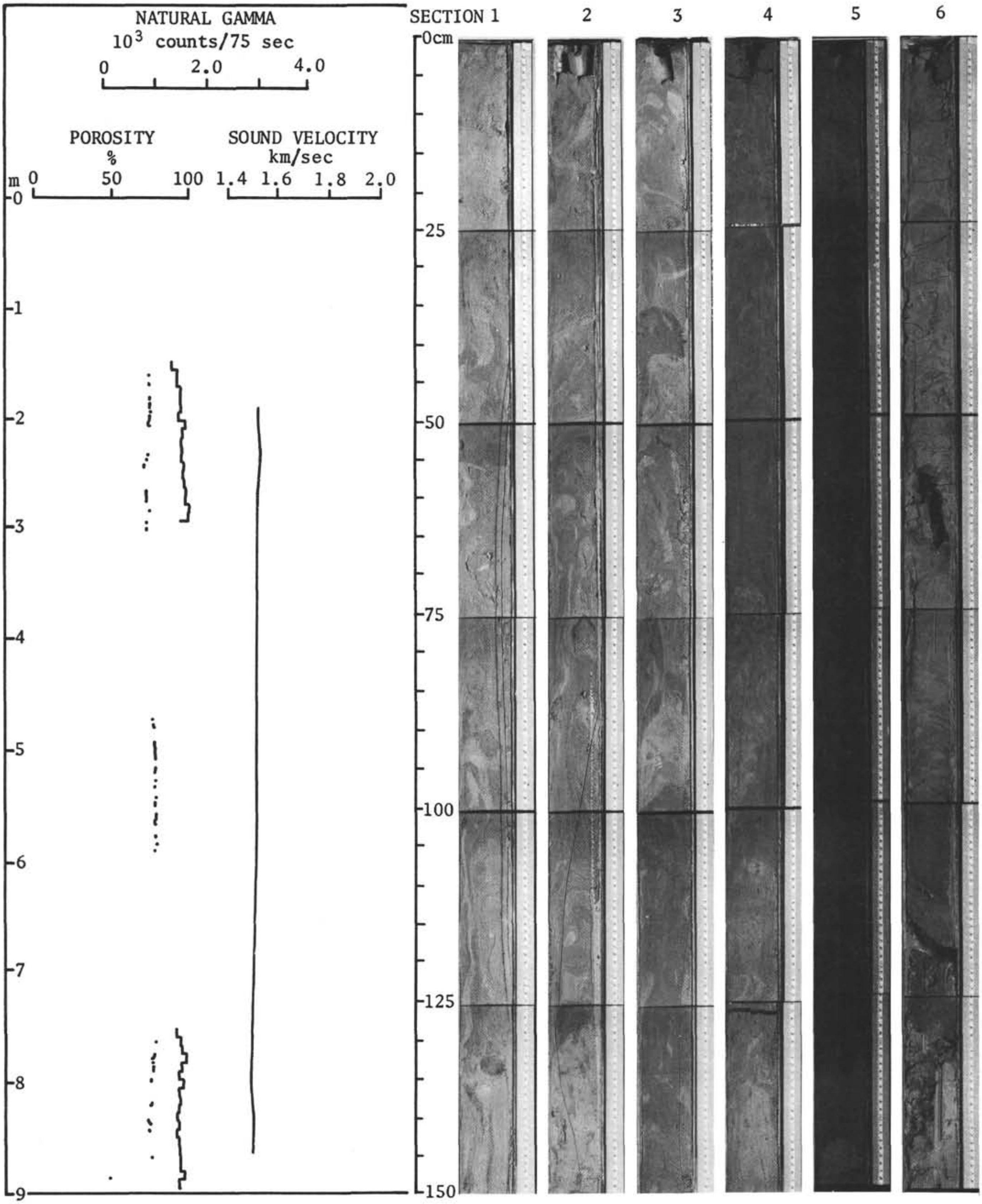


Figure 38. *Hole 84, Core 8, Sections 1-6, Physical Properties.*

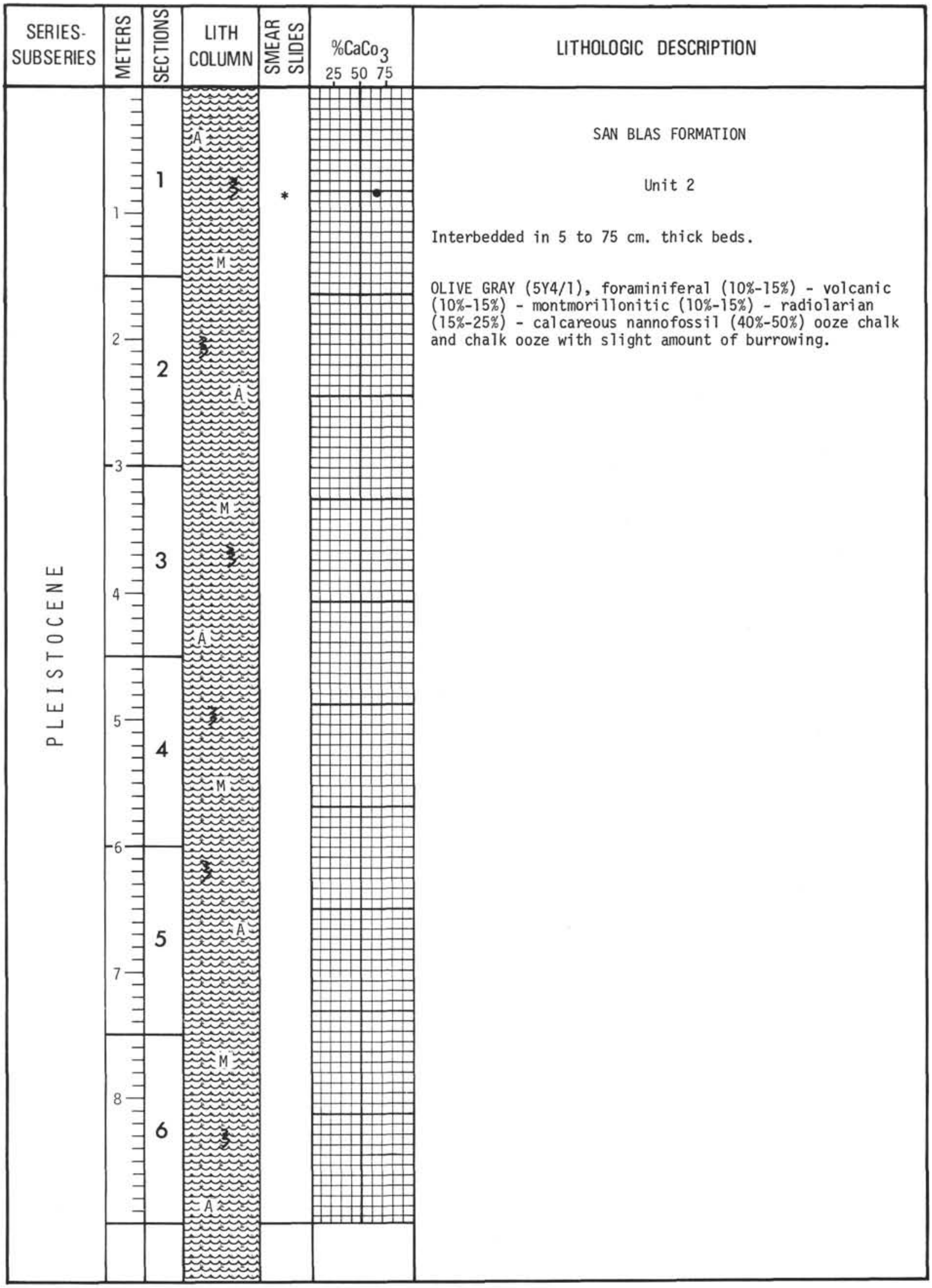


Figure 39. *Hole 84, Core 9 (73.2 to 82.3 m).*

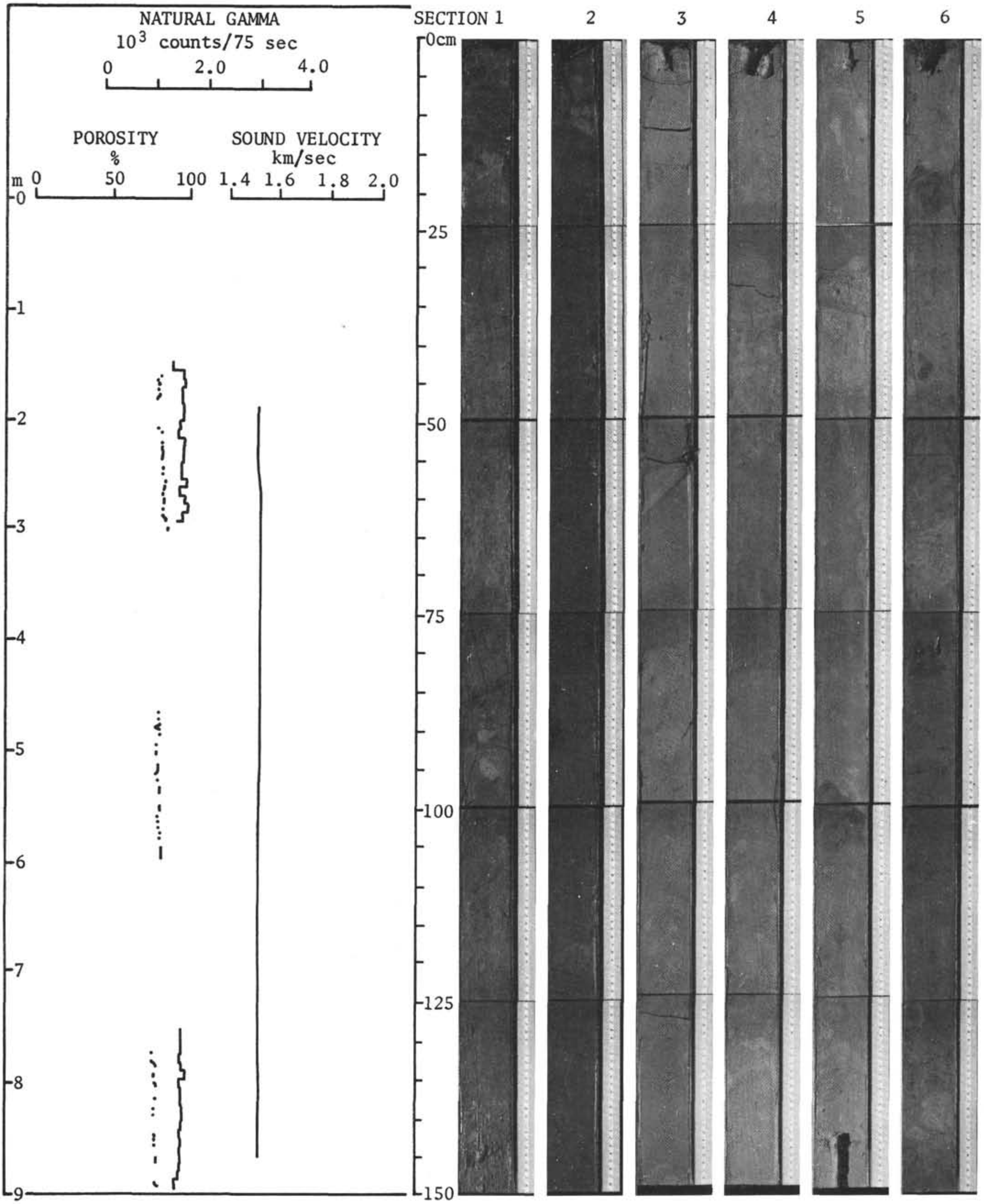


Figure 40. *Hole 84, Core 9, Sections 1-6, Physical Properties.*

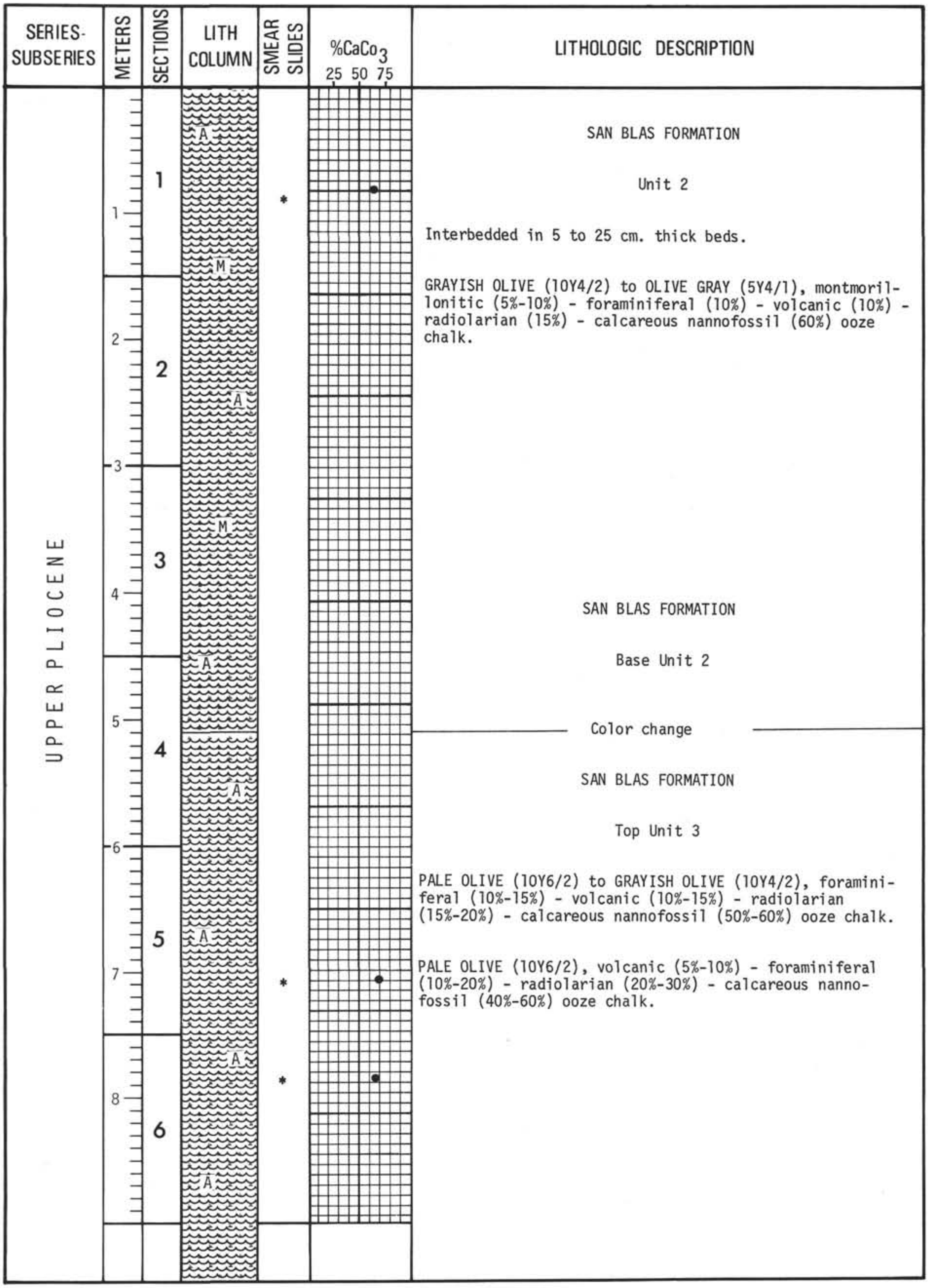


Figure 41. *Hole 84, Core 10 (82.3 to 91.4 m).*

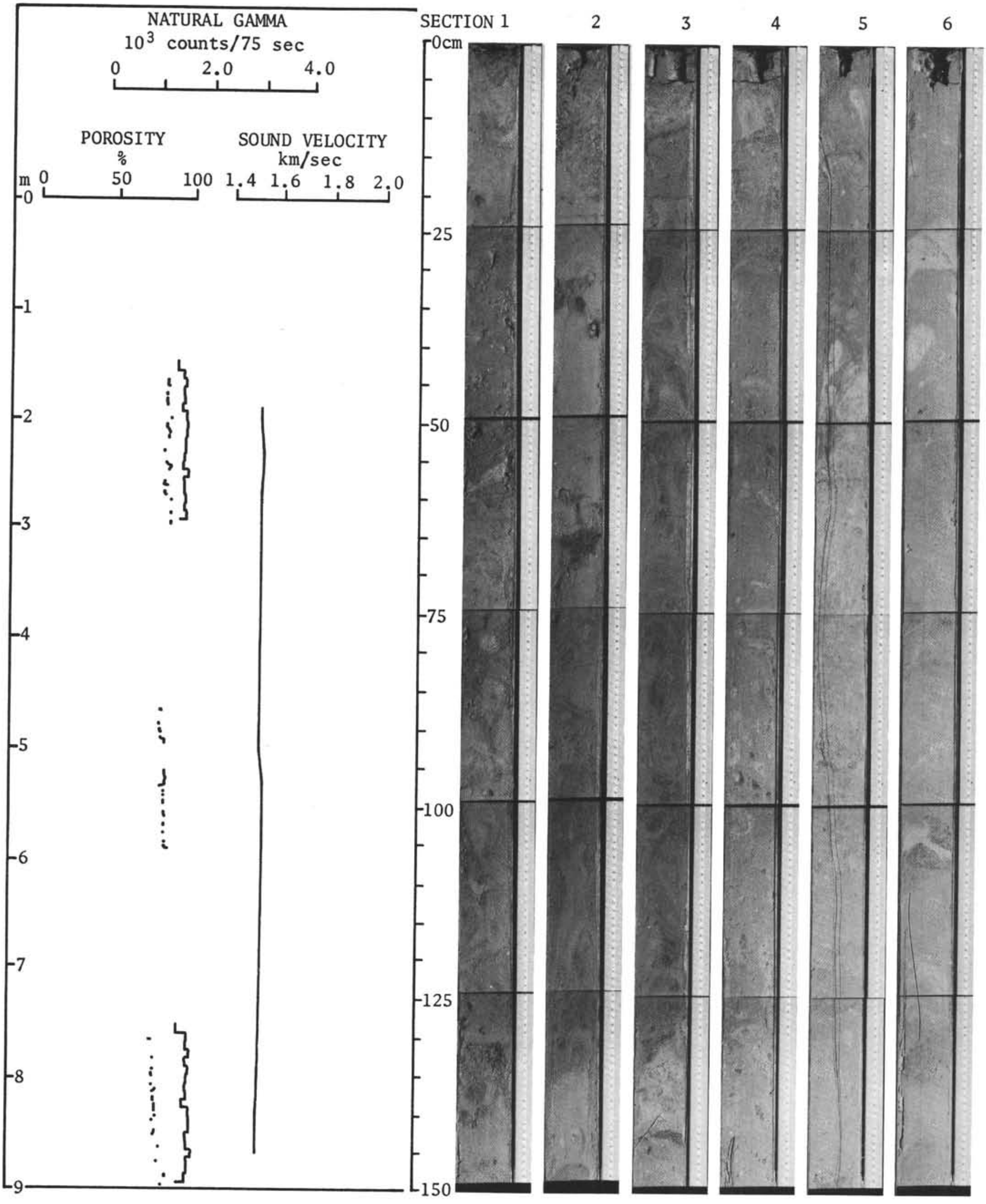


Figure 42. *Hole 84, Core 10, Sections 1-6, Physical Properties.*

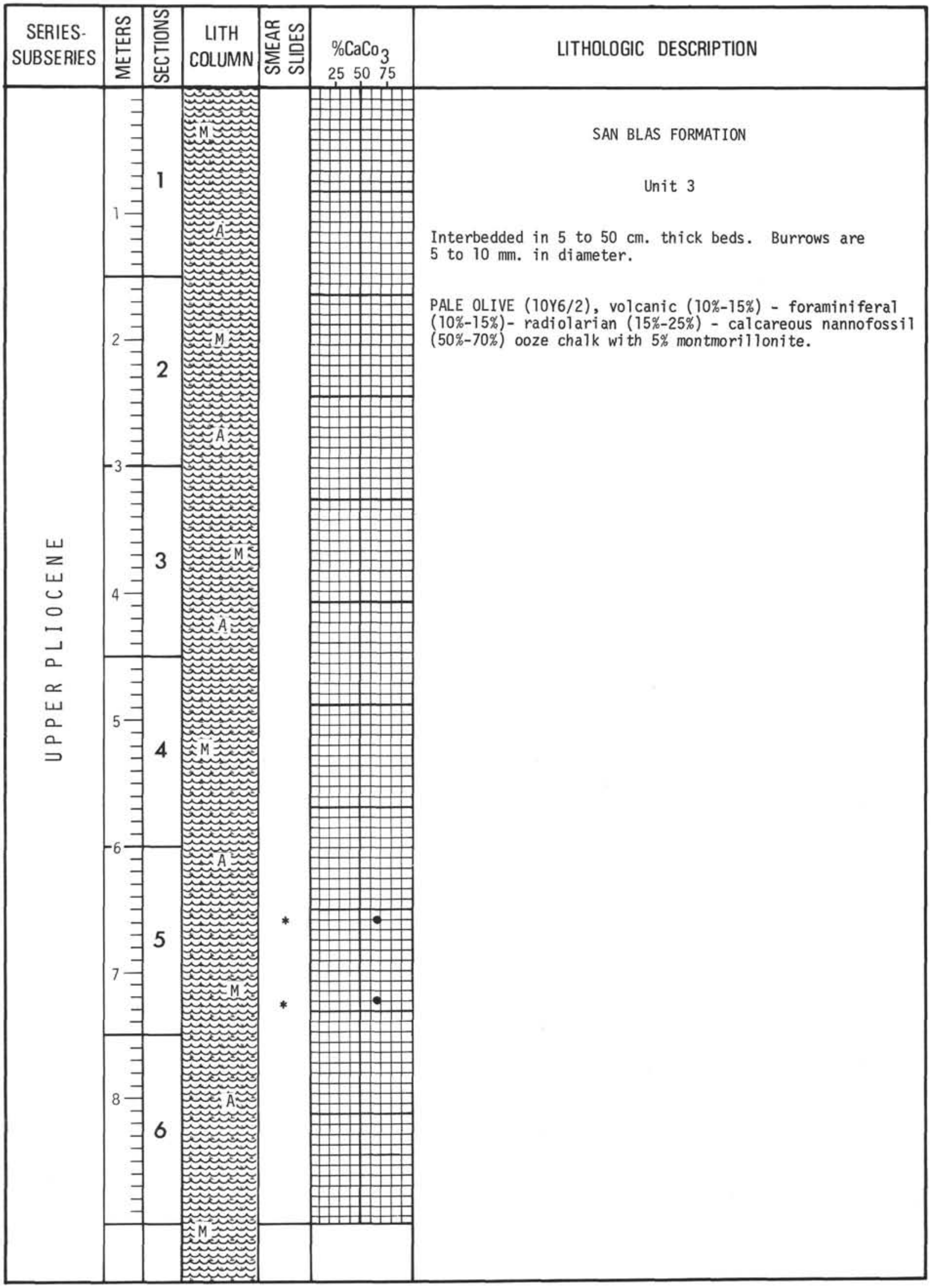


Figure 43. *Hole 84, Core 11 (91.4 to 100.6 m).*

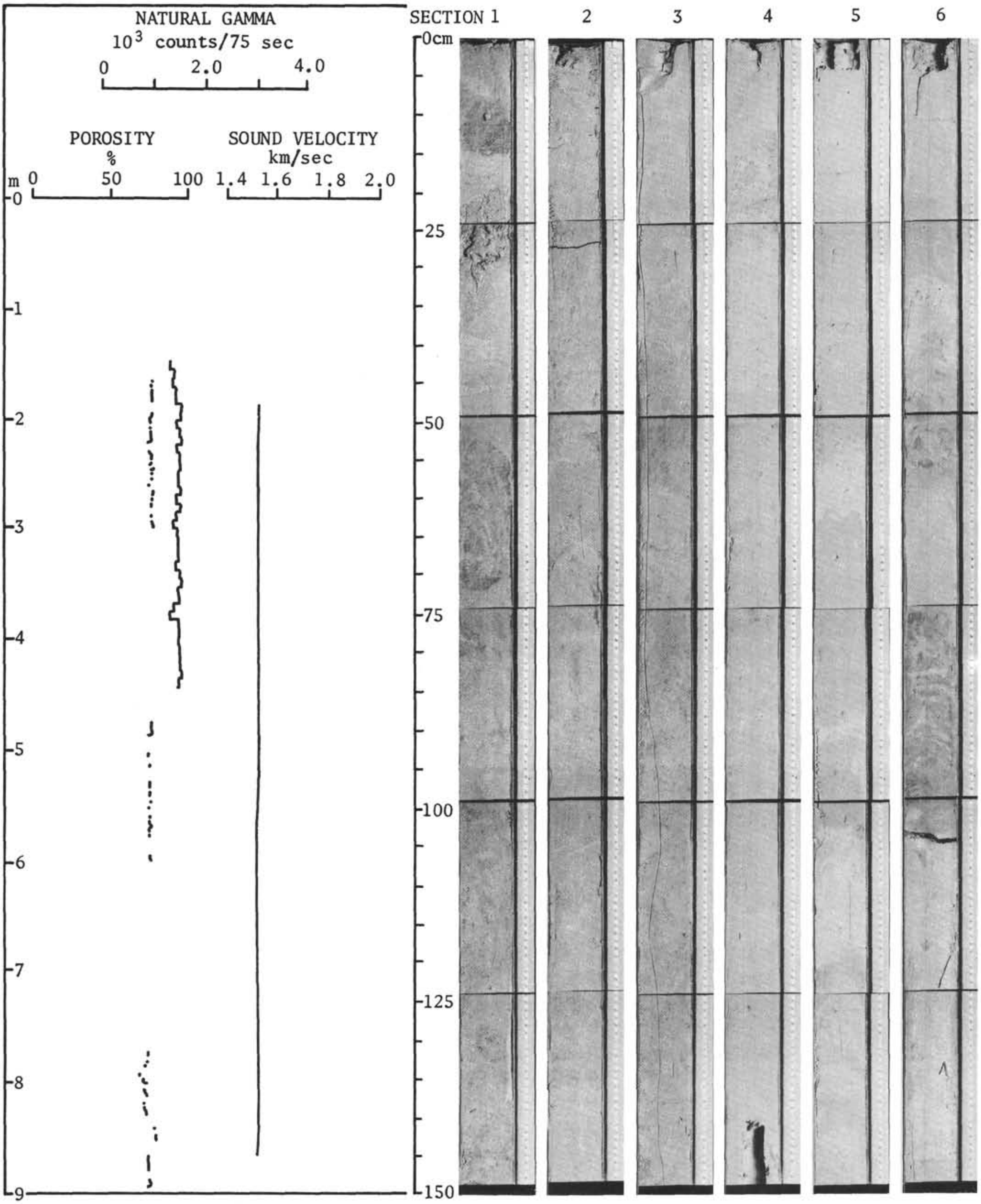
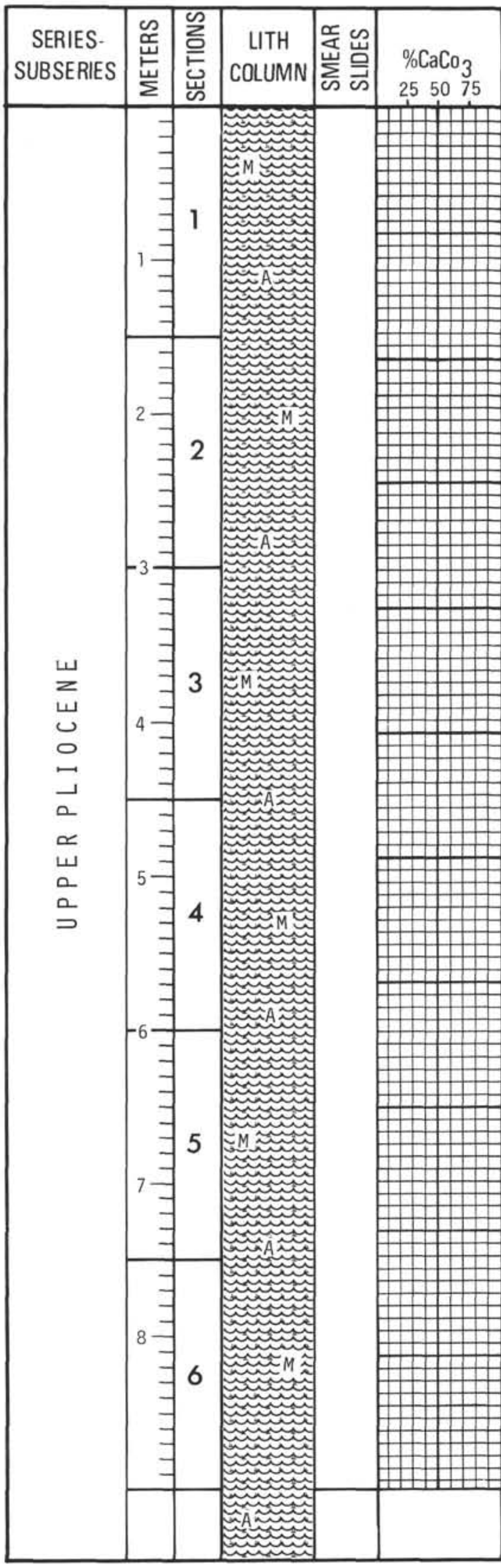


Figure 44. *Hole 84, Core 11, Sections 1-6, Physical Properties.*



LITHOLOGIC DESCRIPTION

SAN BLAS FORMATION

Unit 3

Interbedded in 1 to 20 cm. thick beds.

PALE OLIVE (10Y6/2), volcanic (10%-15%) - foraminiferal (10%-15%) - radiolarian (15%-25%) - calcareous nannofossil (50%-70%) ooze chalk with 5% montmorillonite.

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

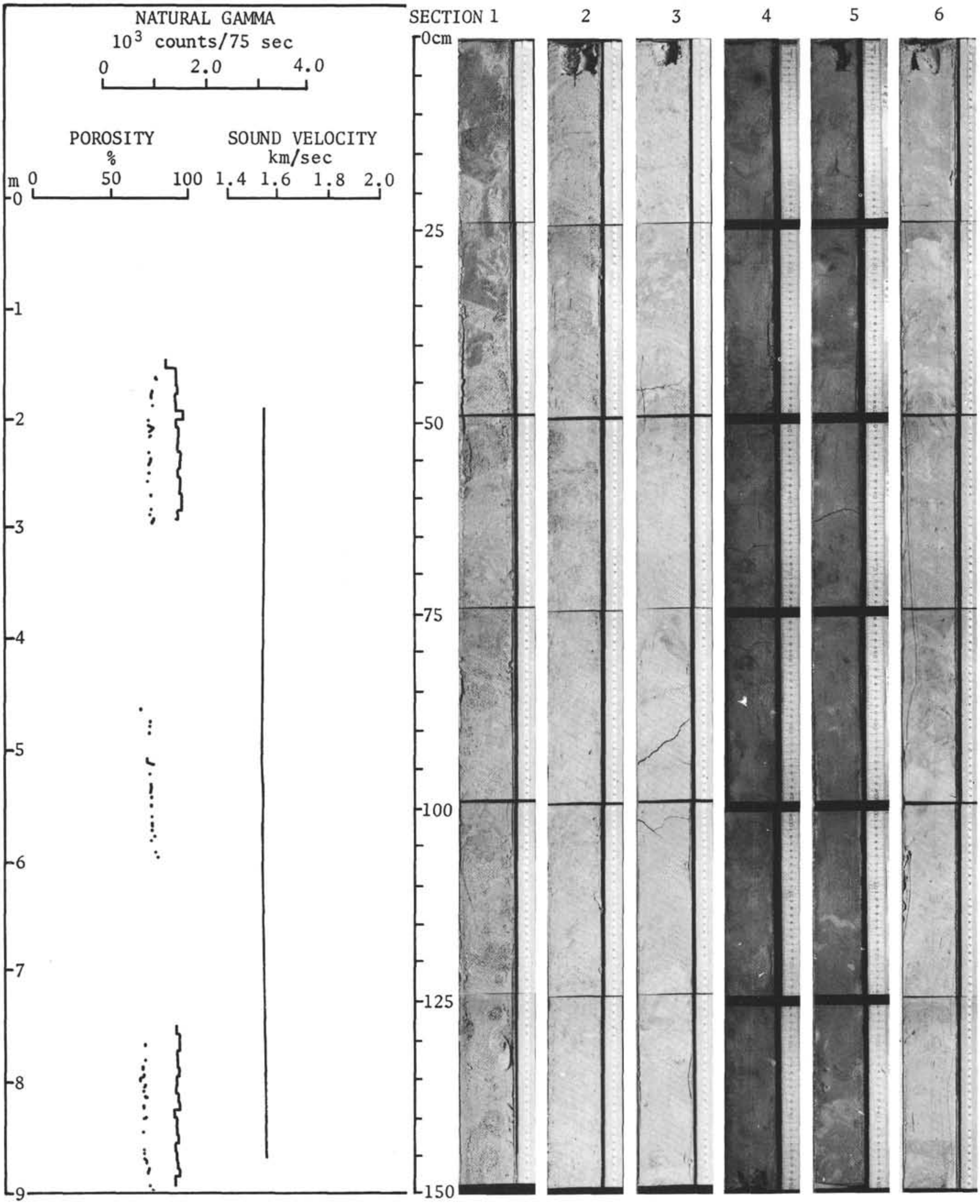


Figure 46. *Hole 84, Core 12, Sections 1-6, Physical Properties.*

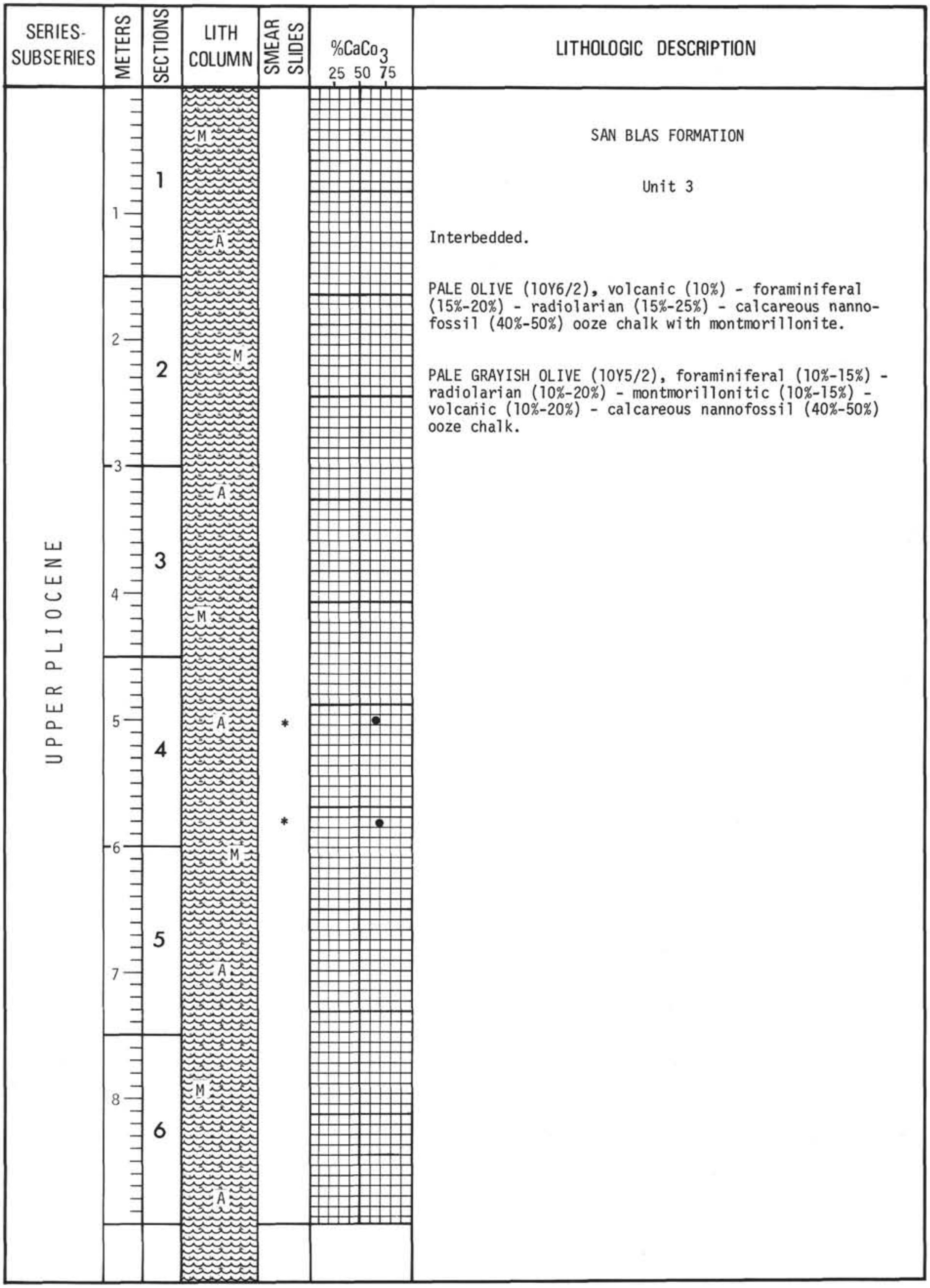


Figure 47. *Hole 84, Core 13 (109.7 to 118.9 m).*

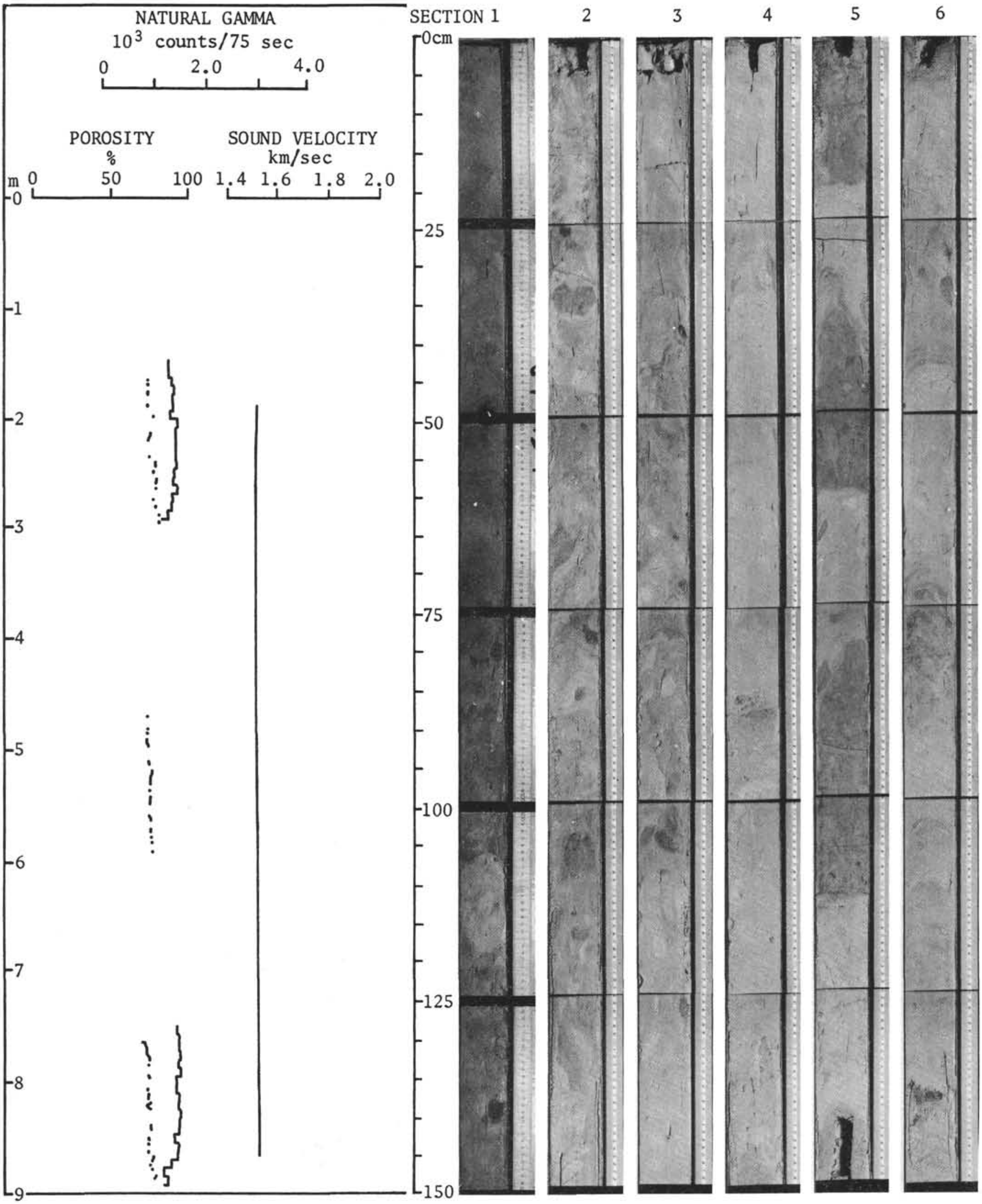


Figure 48. *Hole 84, Core 13, Sections 1-6, Physical Properties.*

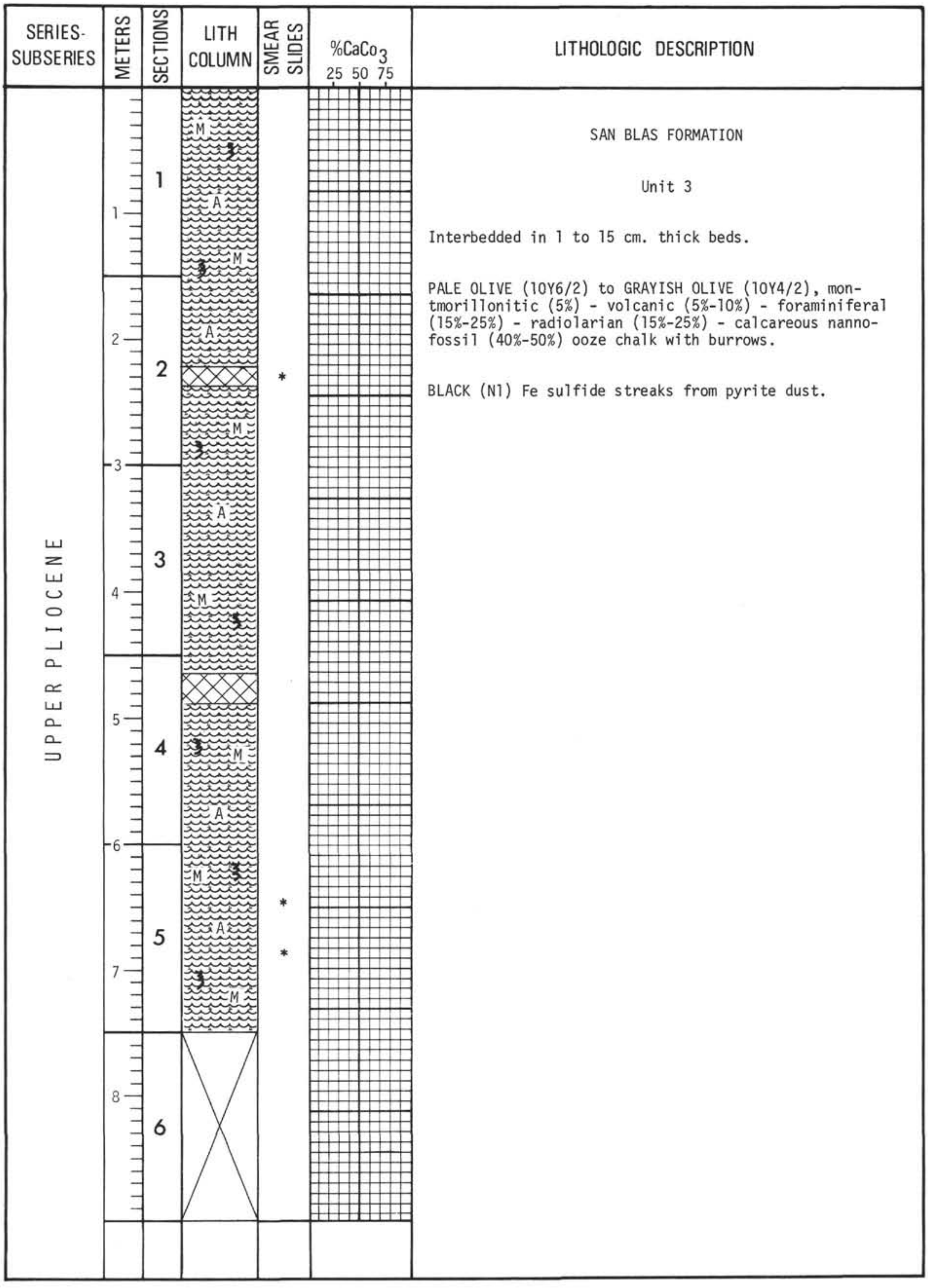


Figure 49. *Hole 84, Core 14 (118.9 to 128.0 m).*

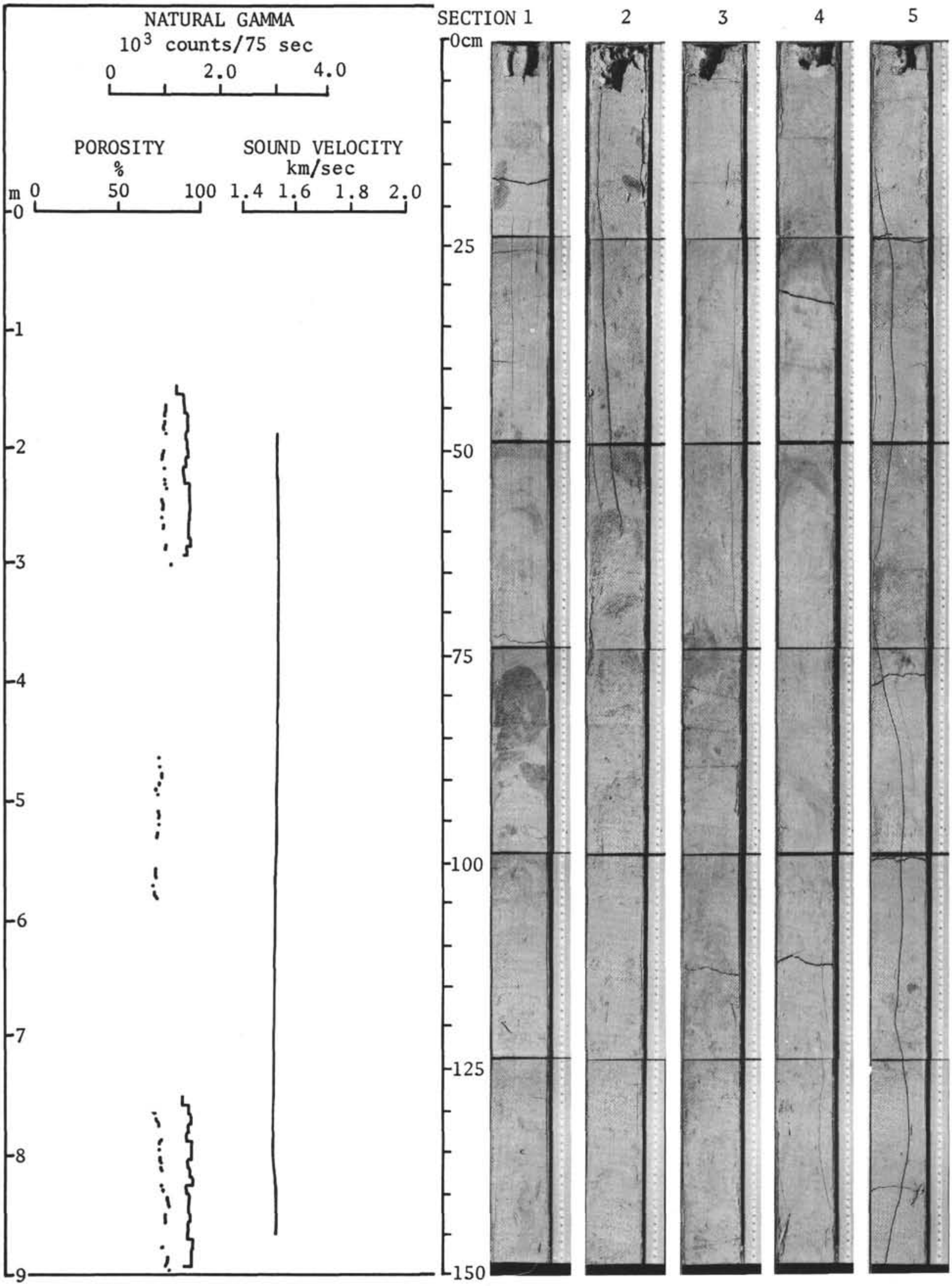
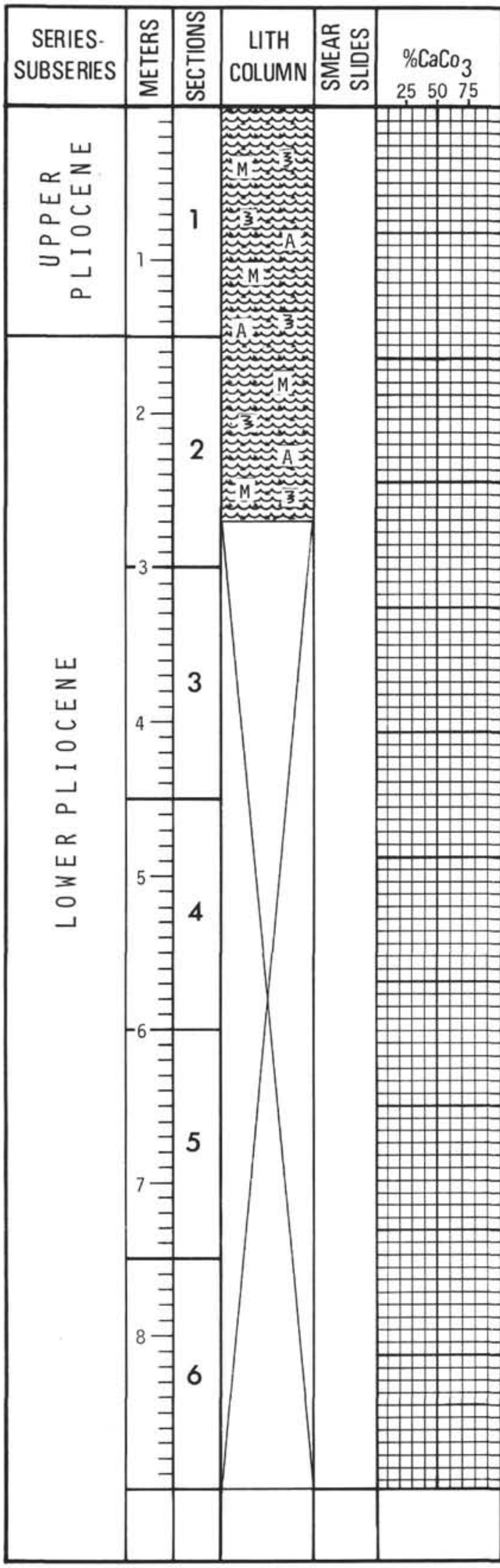


Figure 50. *Hole 84, Core 14, Sections 1-5, Physical Properties.*



LITHOLOGIC DESCRIPTION

SAN BLAS FORMATION

Top Unit 4

PALE OLIVE (10Y6/2) to GRAYISH OLIVE (10Y4/2), montmorillonitic (5%) - volcanic (5%-10%) - foraminiferal (15%-25%) - radiolarian (15%-25%) - calcareous nannofossil (40%-50%) ooze chalk with burrows.

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

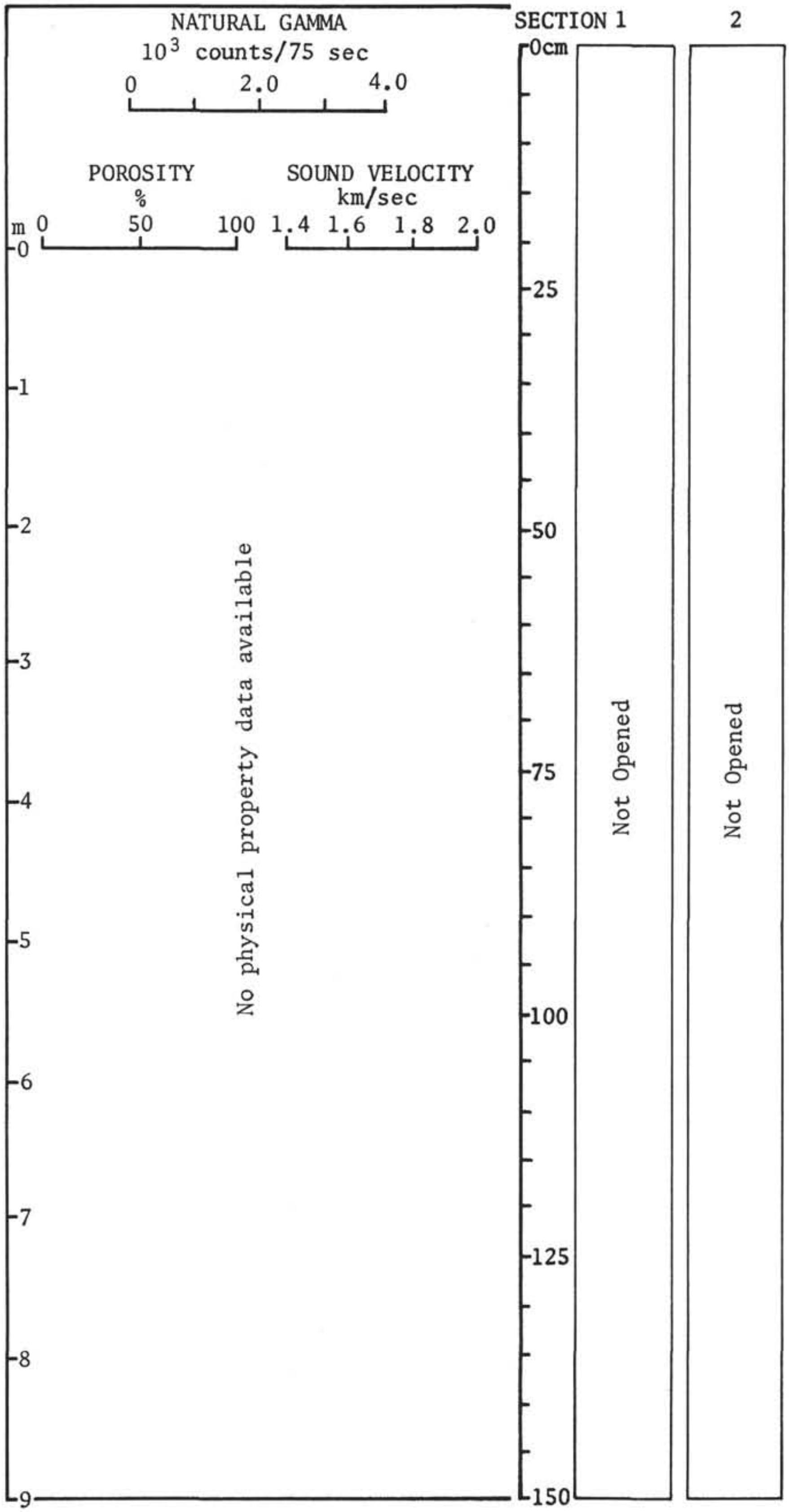
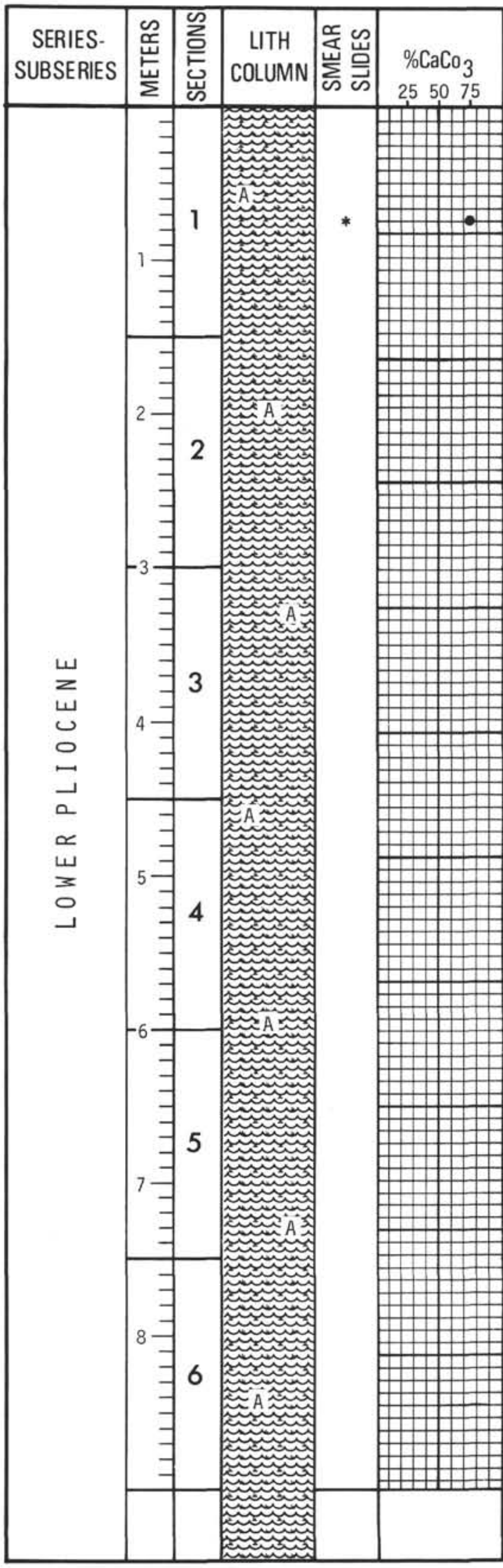


Figure 52. *Hole 84, Core 15, Sections 1 and 2, Physical Properties.*



LITHOLOGIC DESCRIPTION

SAN BLAS FORMATION

Unit 4

Intensely burrowed and mottled. Interbedded in 5 to 25 cm. thick beds.

LIGHT GREENISH GRAY (5GY8/1), volcanic (2%-5%) - radiolarian (15%-20%) - foraminiferal (20%-30%) - calcareous nannofossil (50%-60%) chalk.

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

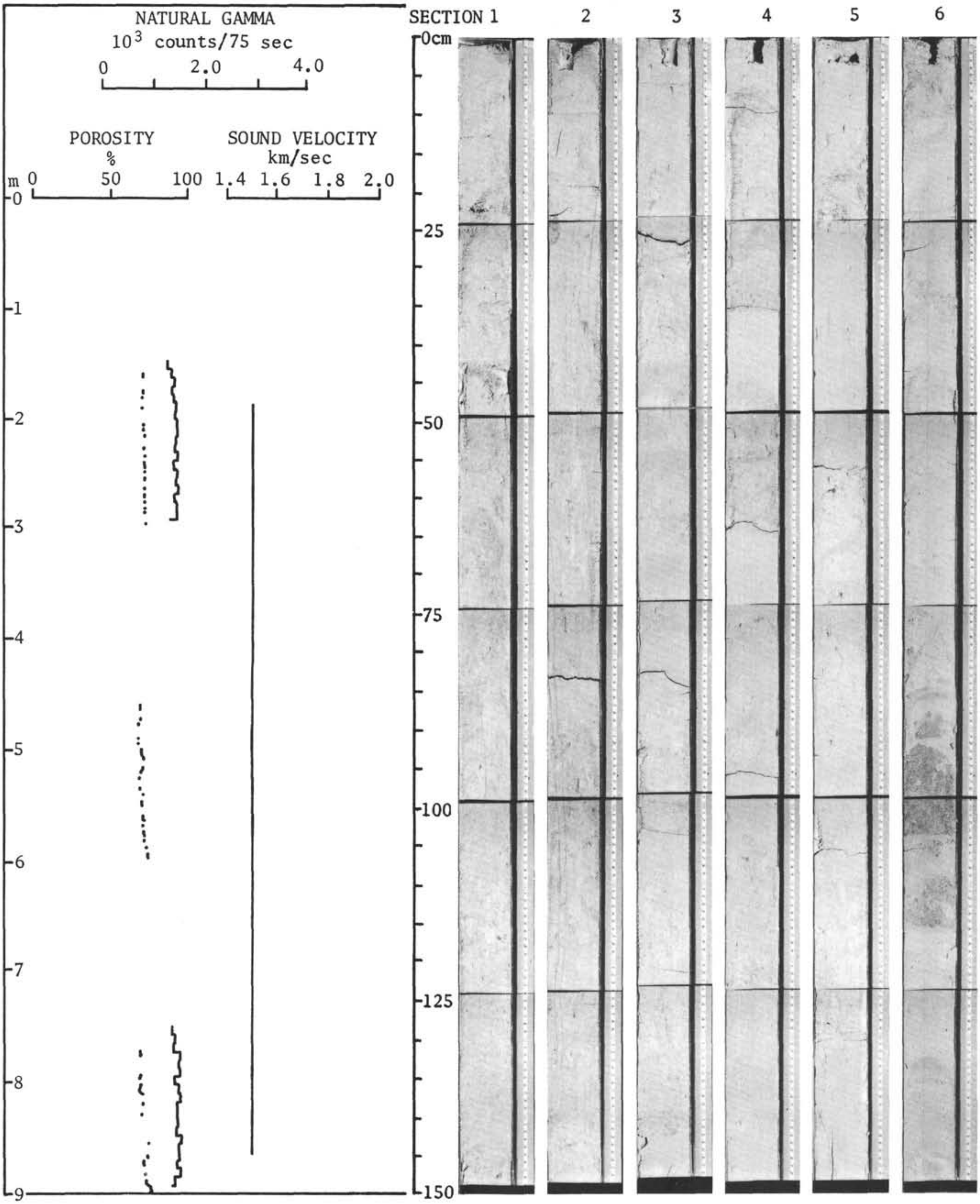


Figure 54. *Hole 84, Core 16, Sections 1-6, Physical Properties.*

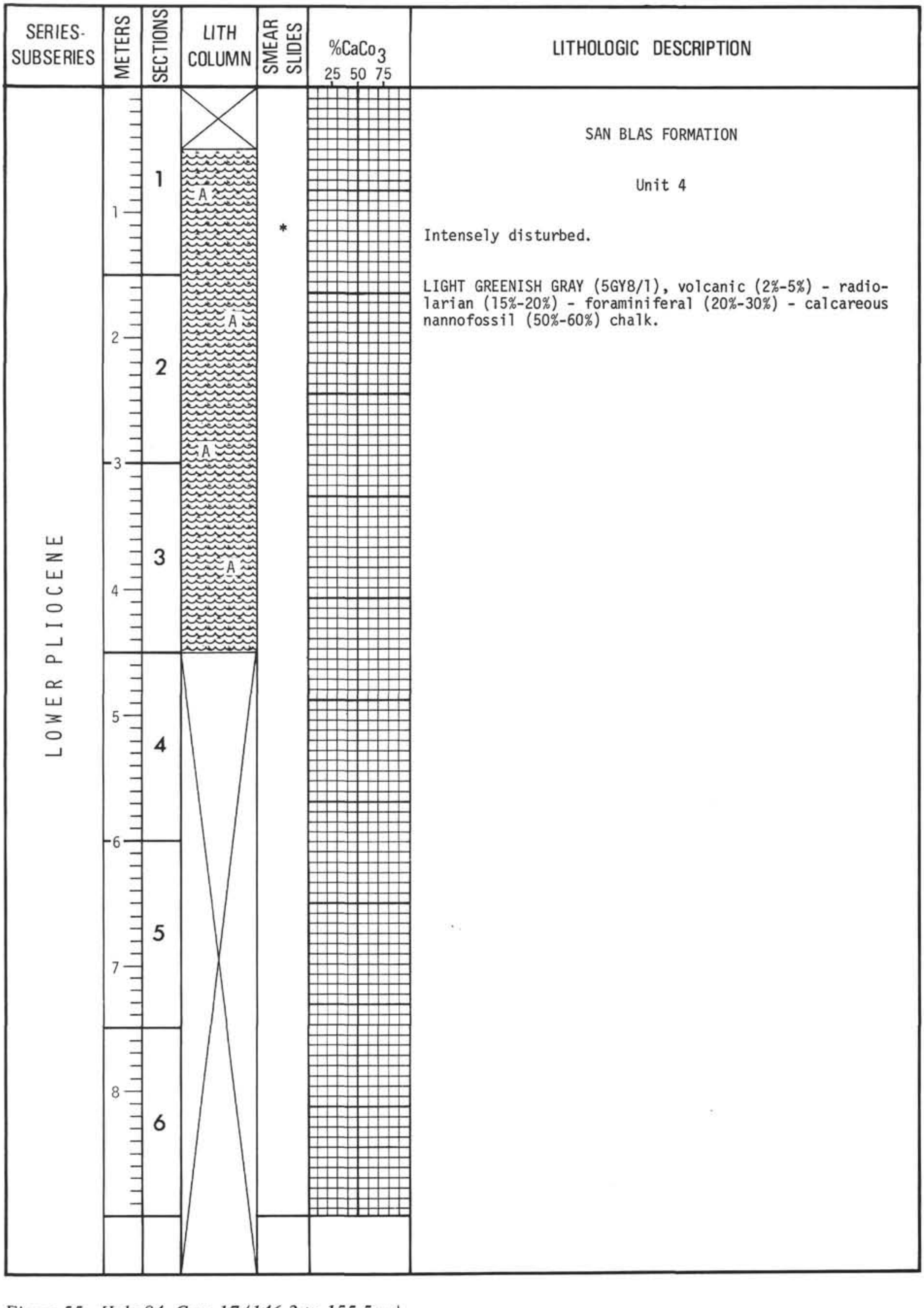


Figure 55. *Hole 84, Core 17 (146.3 to 155.5 m).*

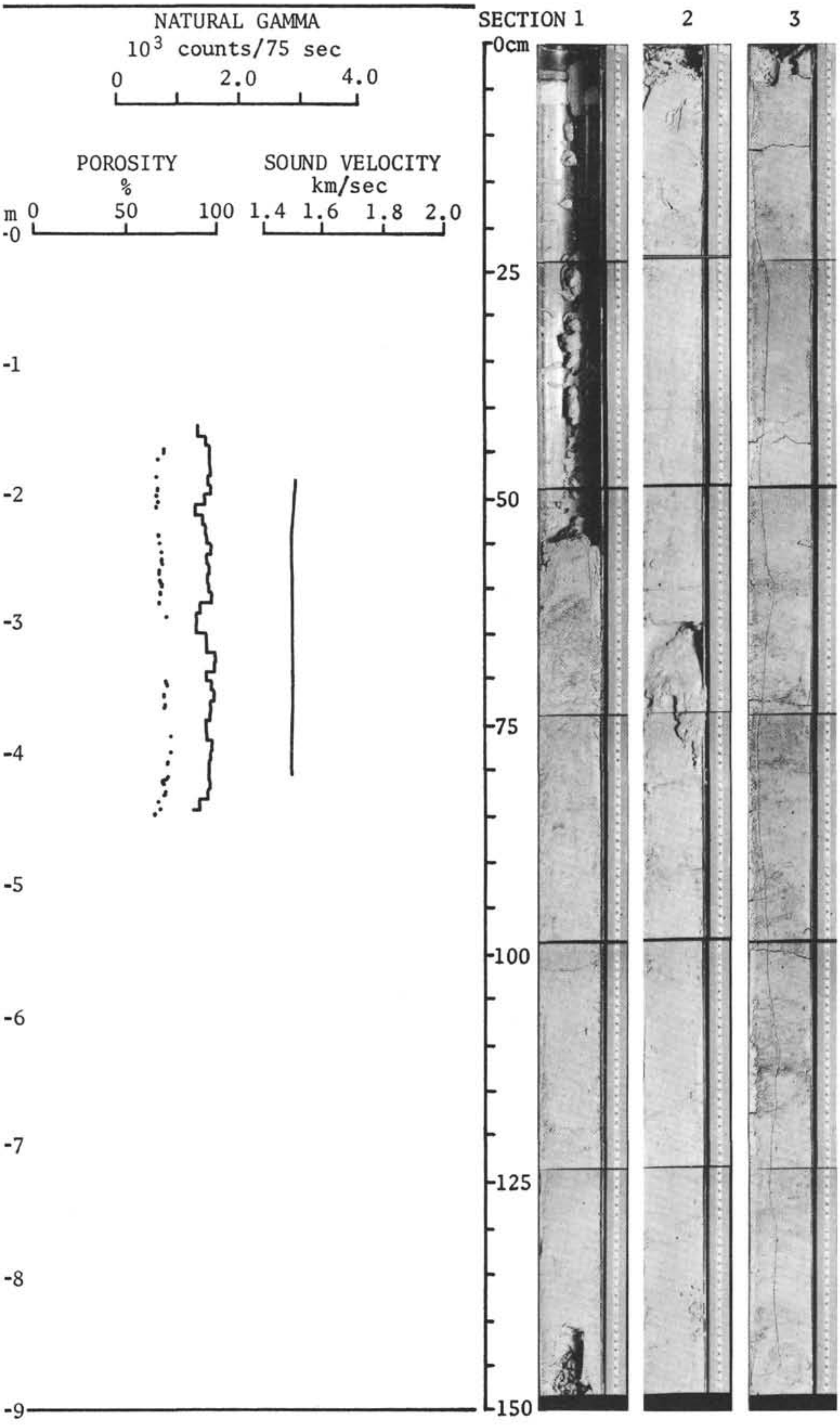
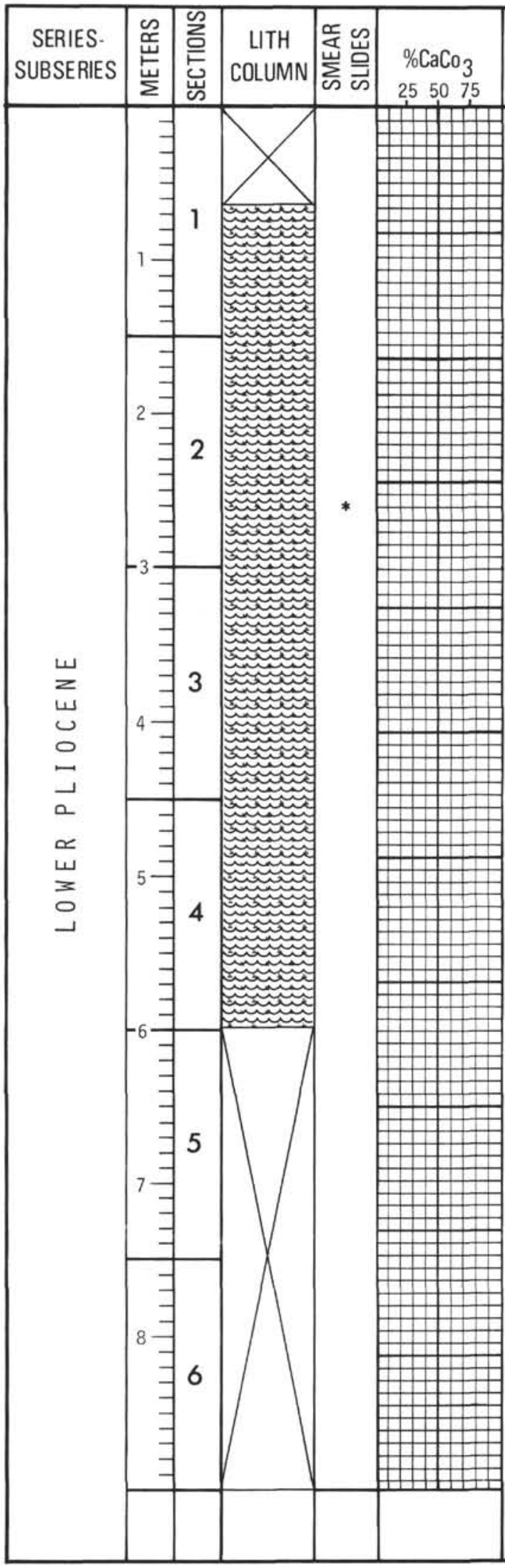


Figure 56. *Hole 84, Core 17, Sections 1, 2, 3, Physical Properties.*



LITHOLOGIC DESCRIPTION

SAN BLAS FORMATION

Unit 4

Intensely disturbed.

LIGHT GREENISH GRAY (5GY8/1), radiolarian (15%-20%) - foraminiferal (20%) - calcareous nannofossil (60%) chalk.

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

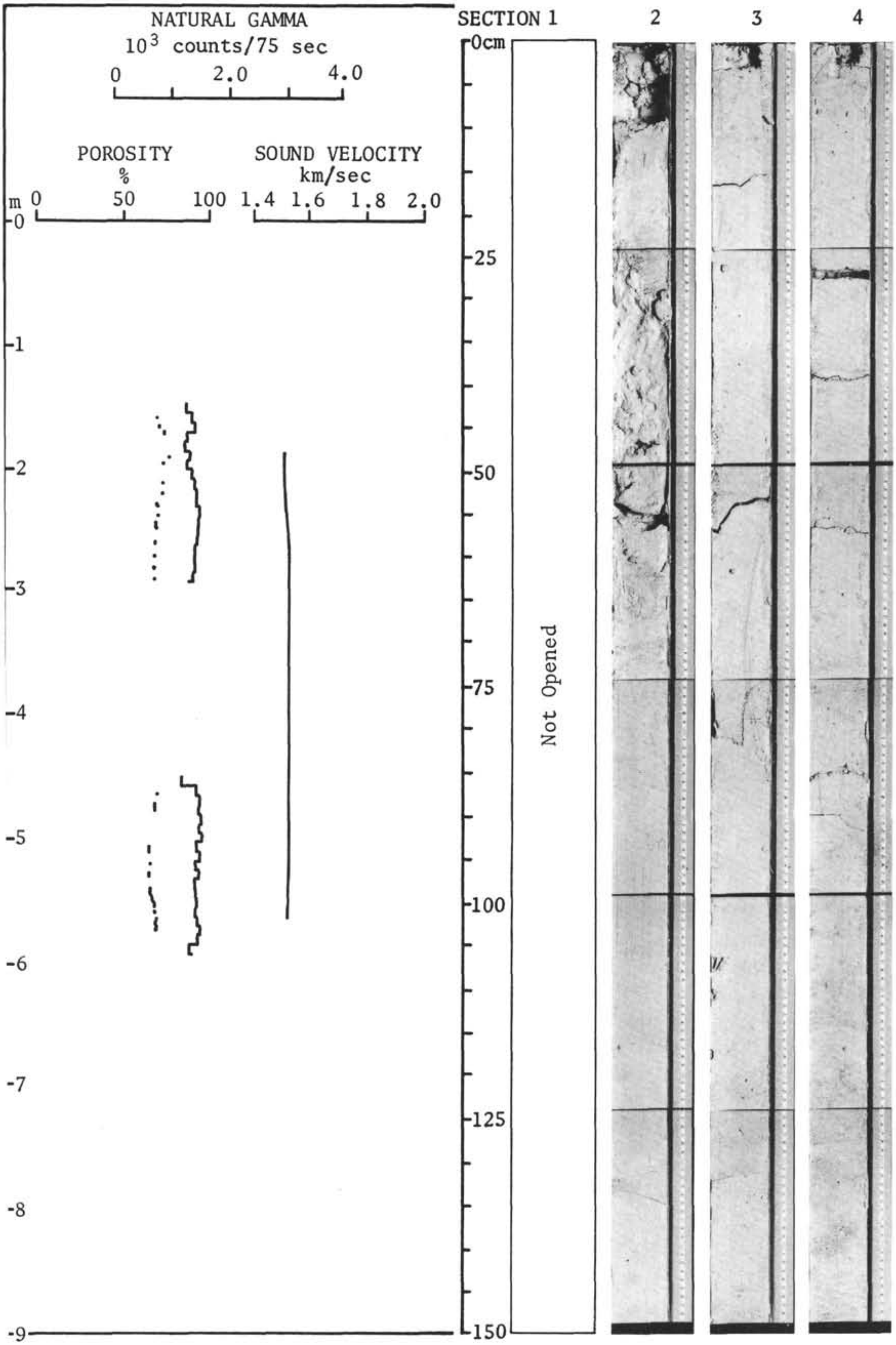


Figure 58. *Hole 84, Core 18, Sections 1-4, Physical Properties.*

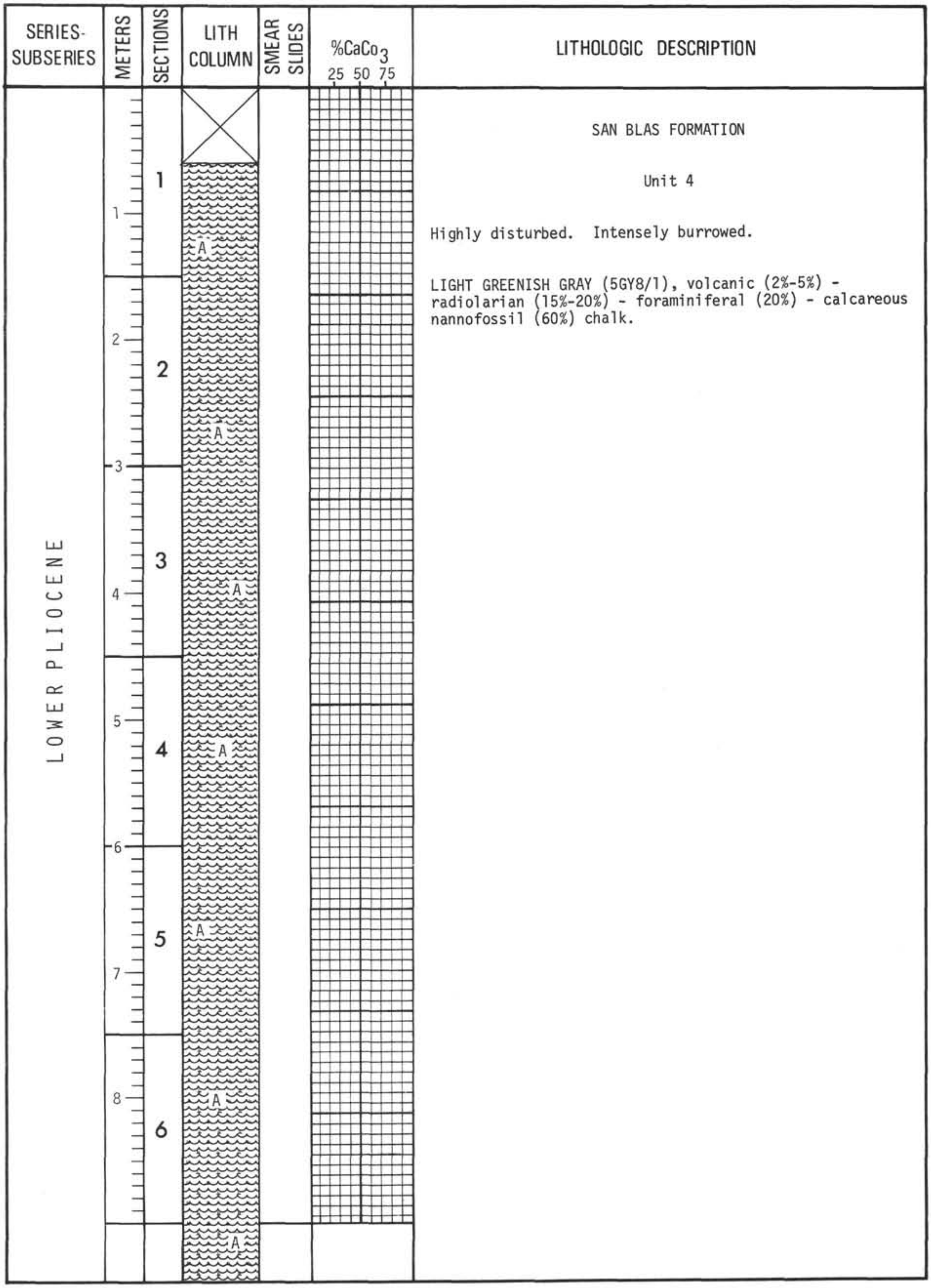


Figure 59. *Hole 84, Core 19 (164.6 to 173.7 m).*

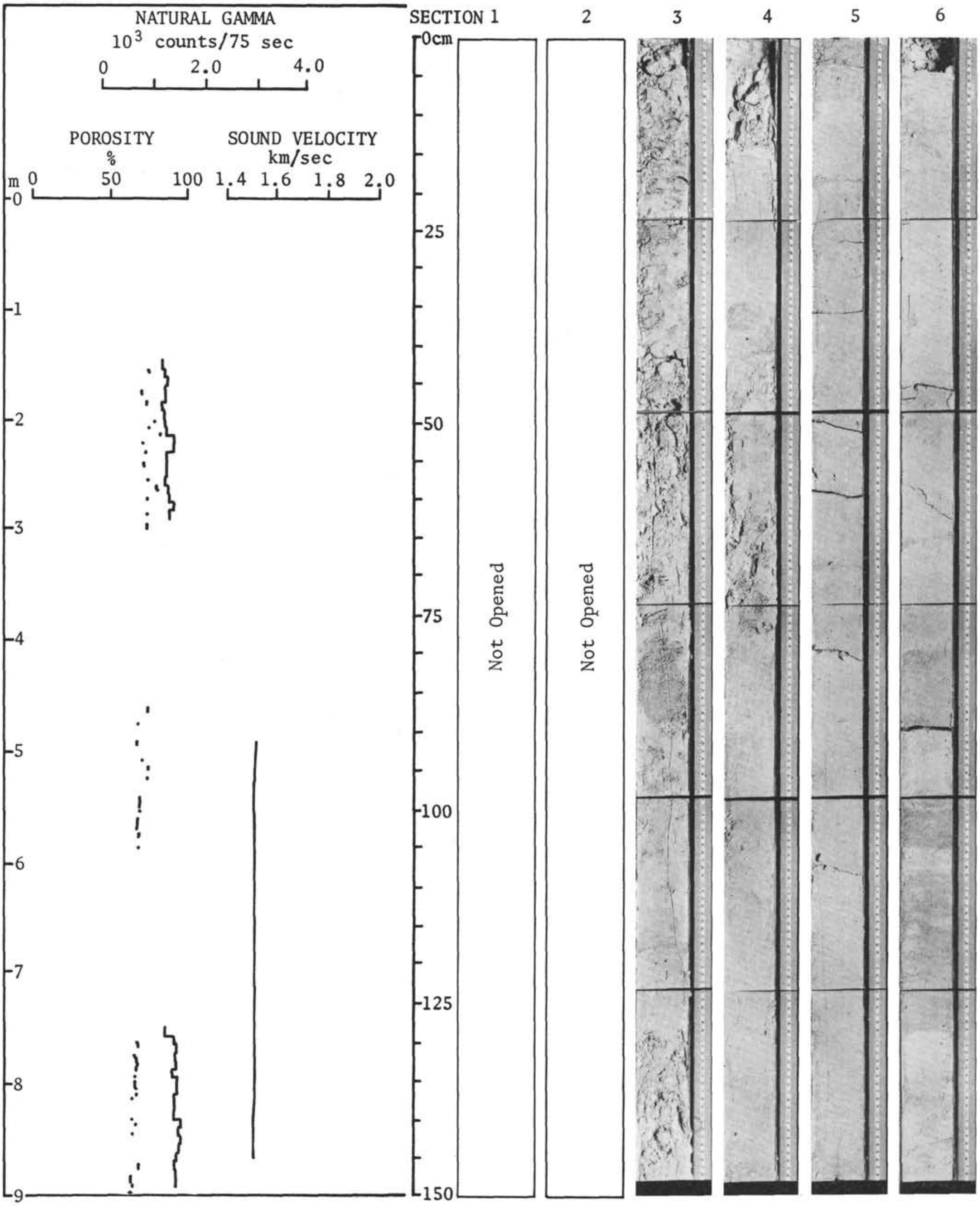


Figure 60. *Hole 84, Core 19, Sections 1-6, Physical Properties.*

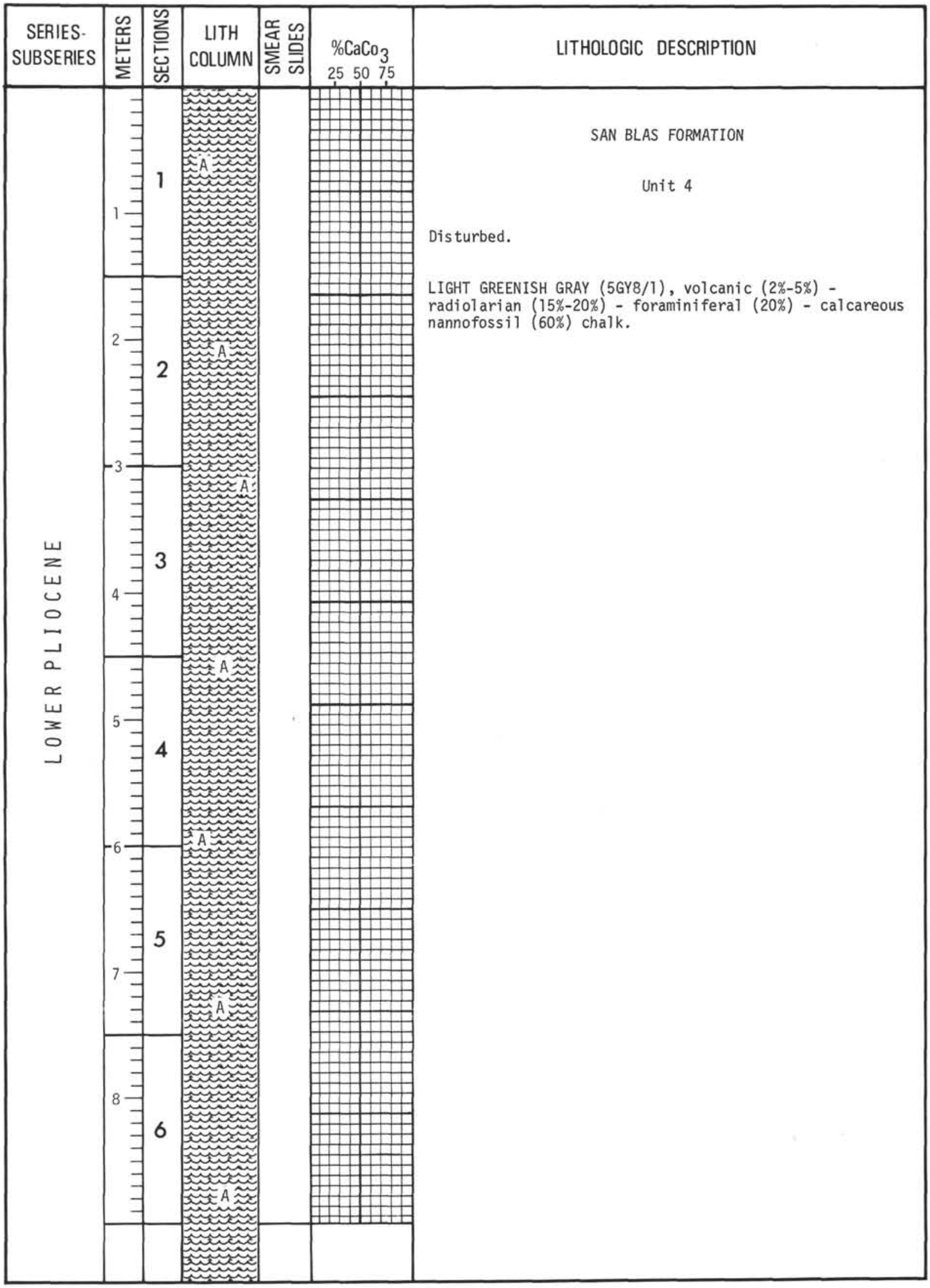


Figure 61. *Hole 84, Core 20 (173.7 to 182.9 m).*

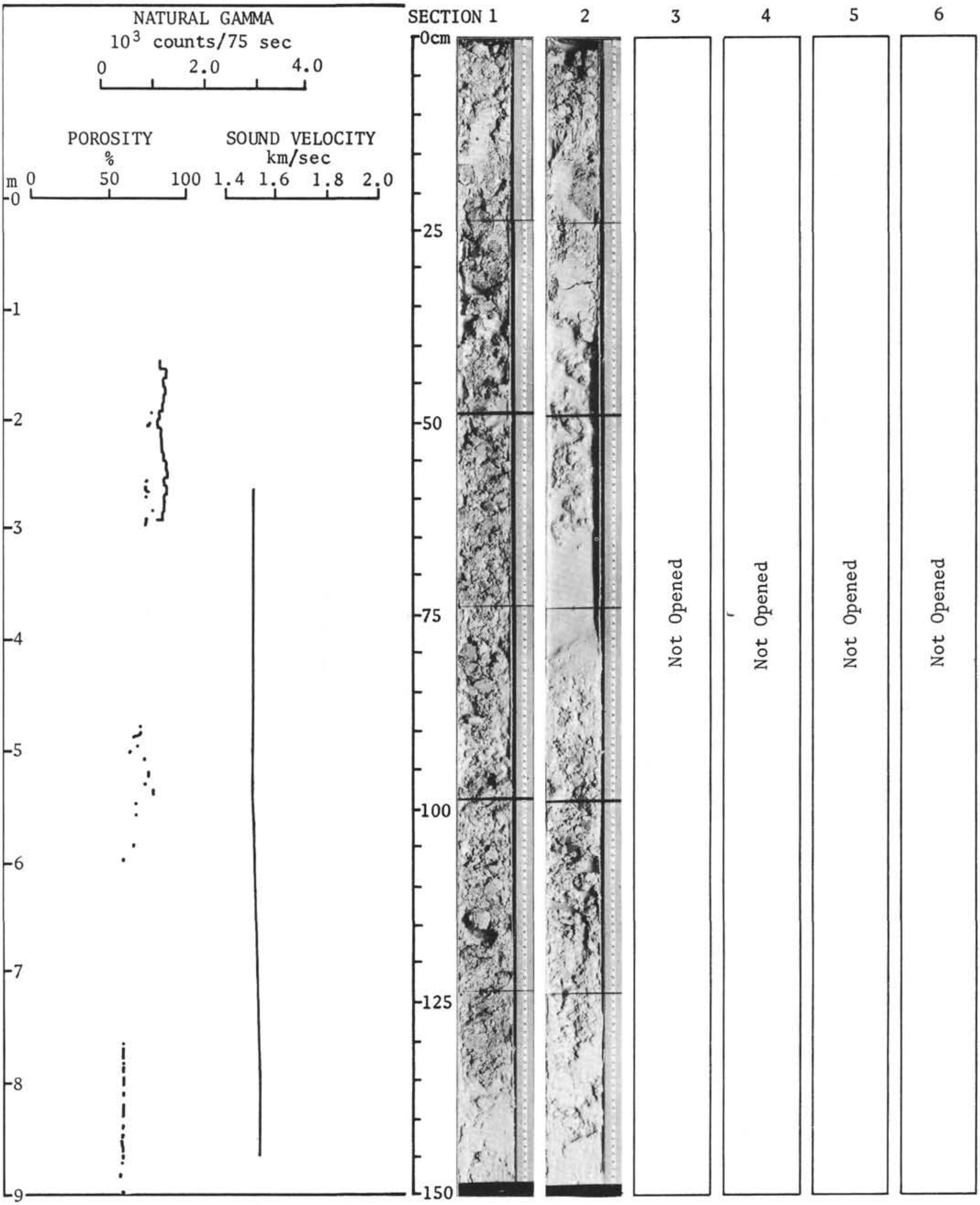


Figure 62. *Hole 84, Core 20, Sections 1-6, Physical Properties.*

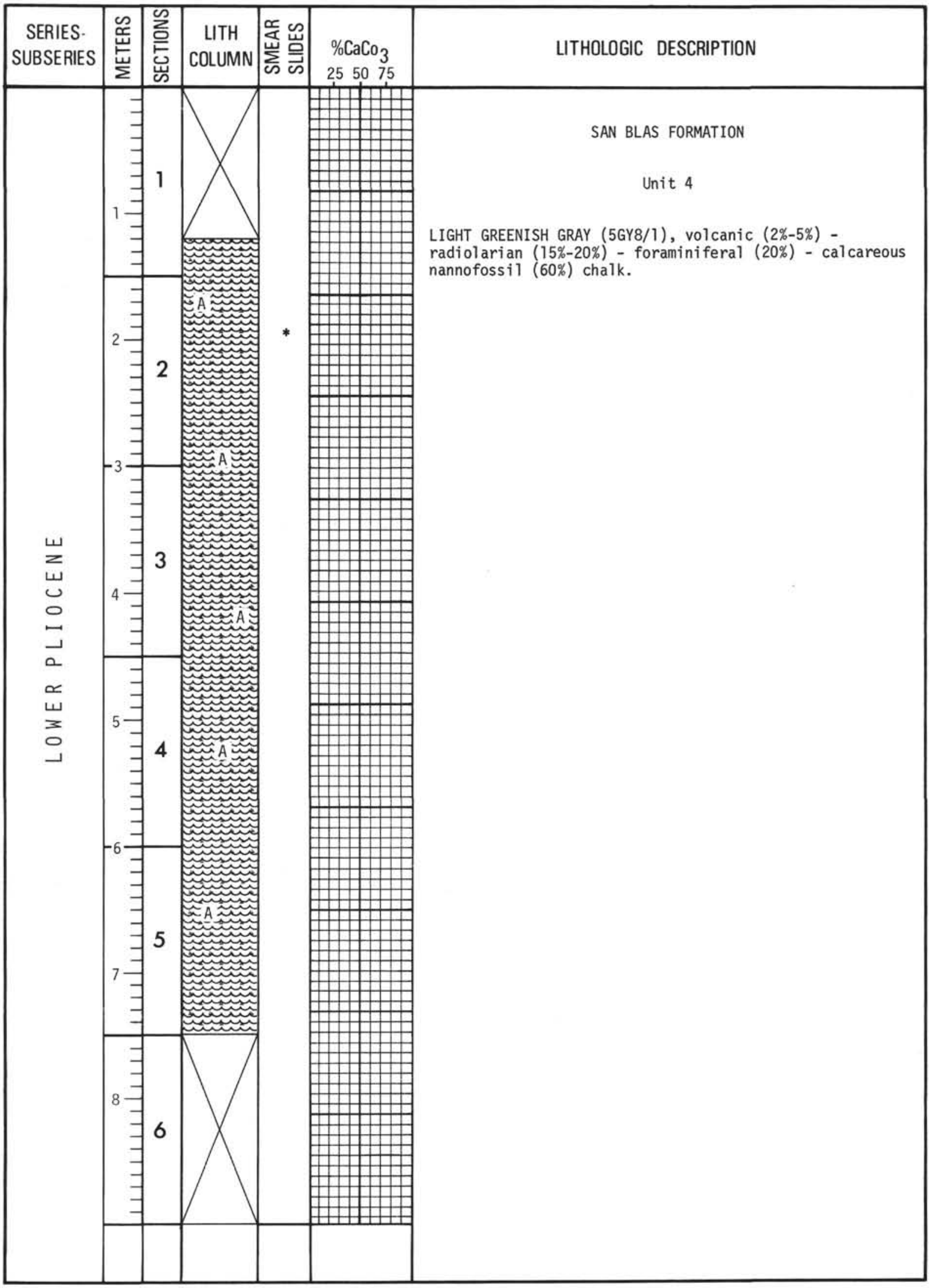


Figure 63. *Hole 84, Core 21 (182.9 to 192.0 m).*

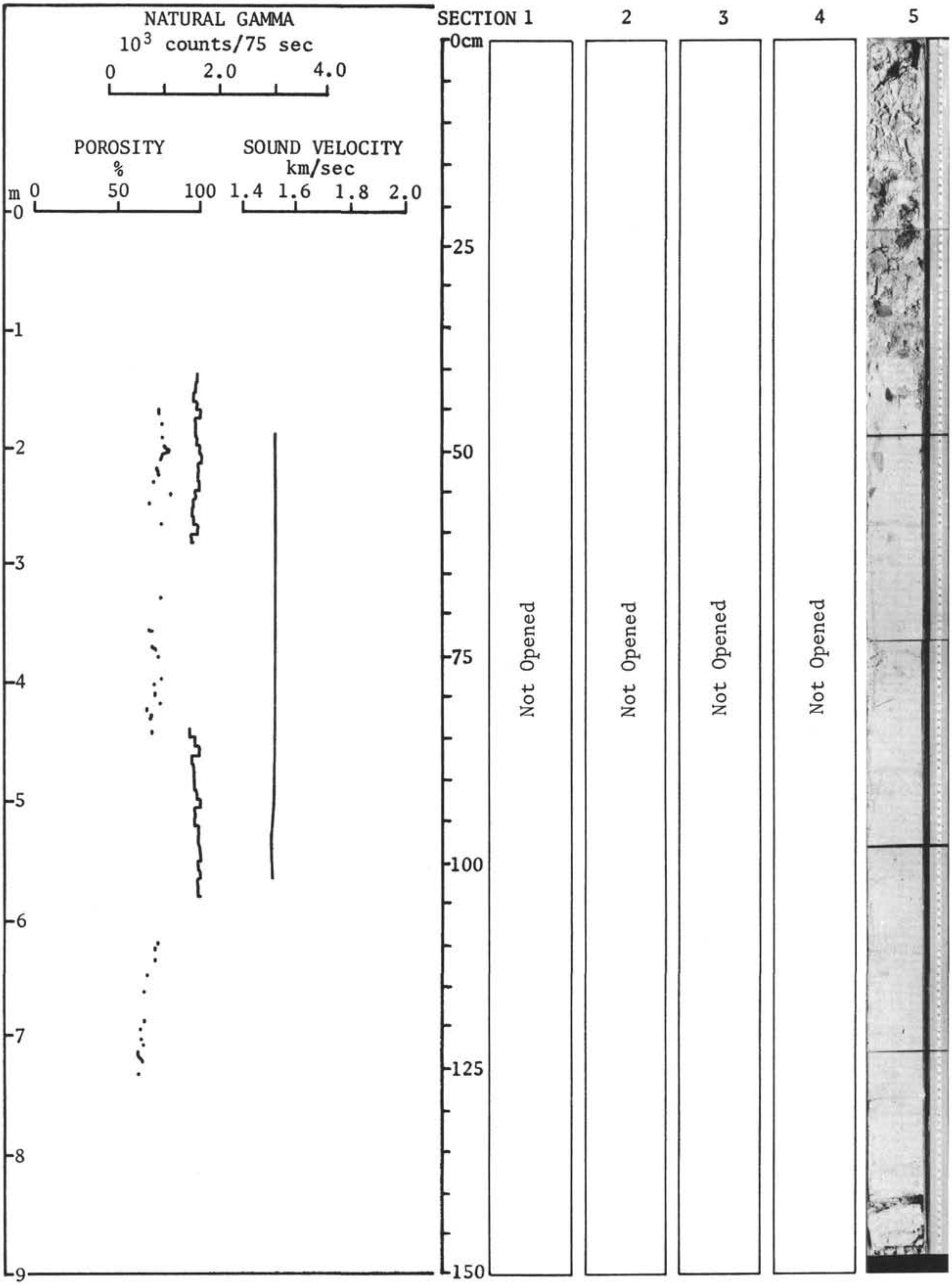
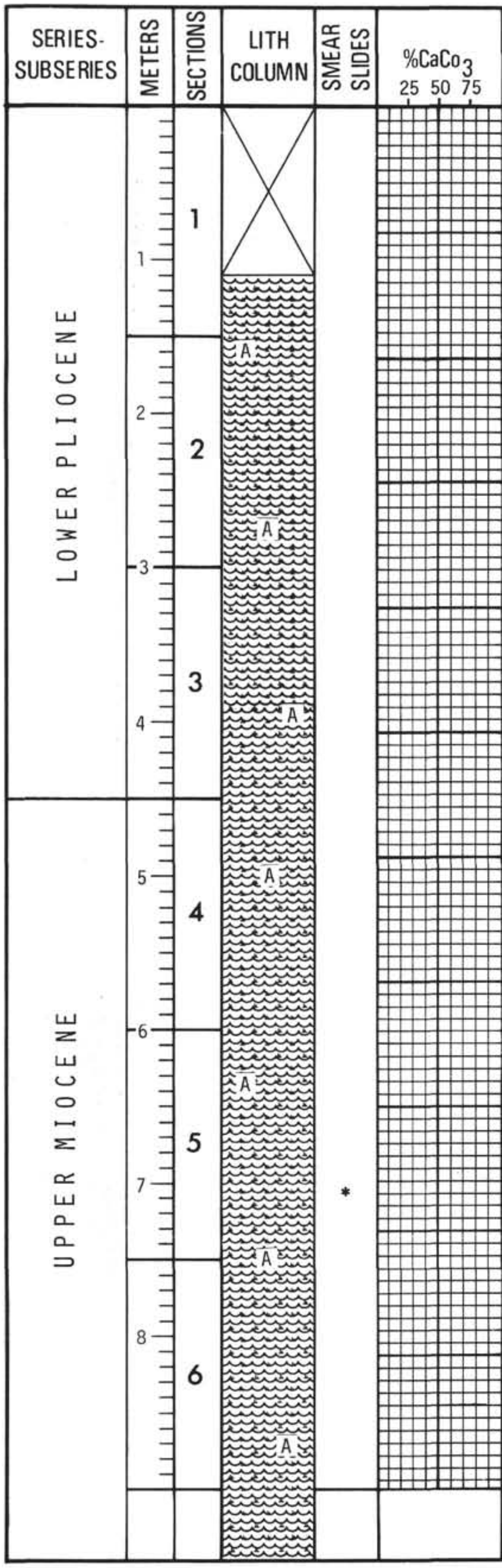


Figure 64. *Hole 84, Core 21, Sections 1-5, Physical Properties.*



LITHOLOGIC DESCRIPTION

SAN BLAS FORMATION

Unit 4

Disturbed.

LIGHT GREENISH GRAY (5GY8/1), volcanic (2%-5%) - radiolarian (15%-20%) - foraminiferal (20%) - calcareous nannofossil (60%) chalk.

LIGHT GREENISH GRAY (5GY8/1), volcanic (2%-5%) - radiolarian (15%-25%) - calcareous nannofossil (60%-80%) chalk with about 1% volcanics.

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

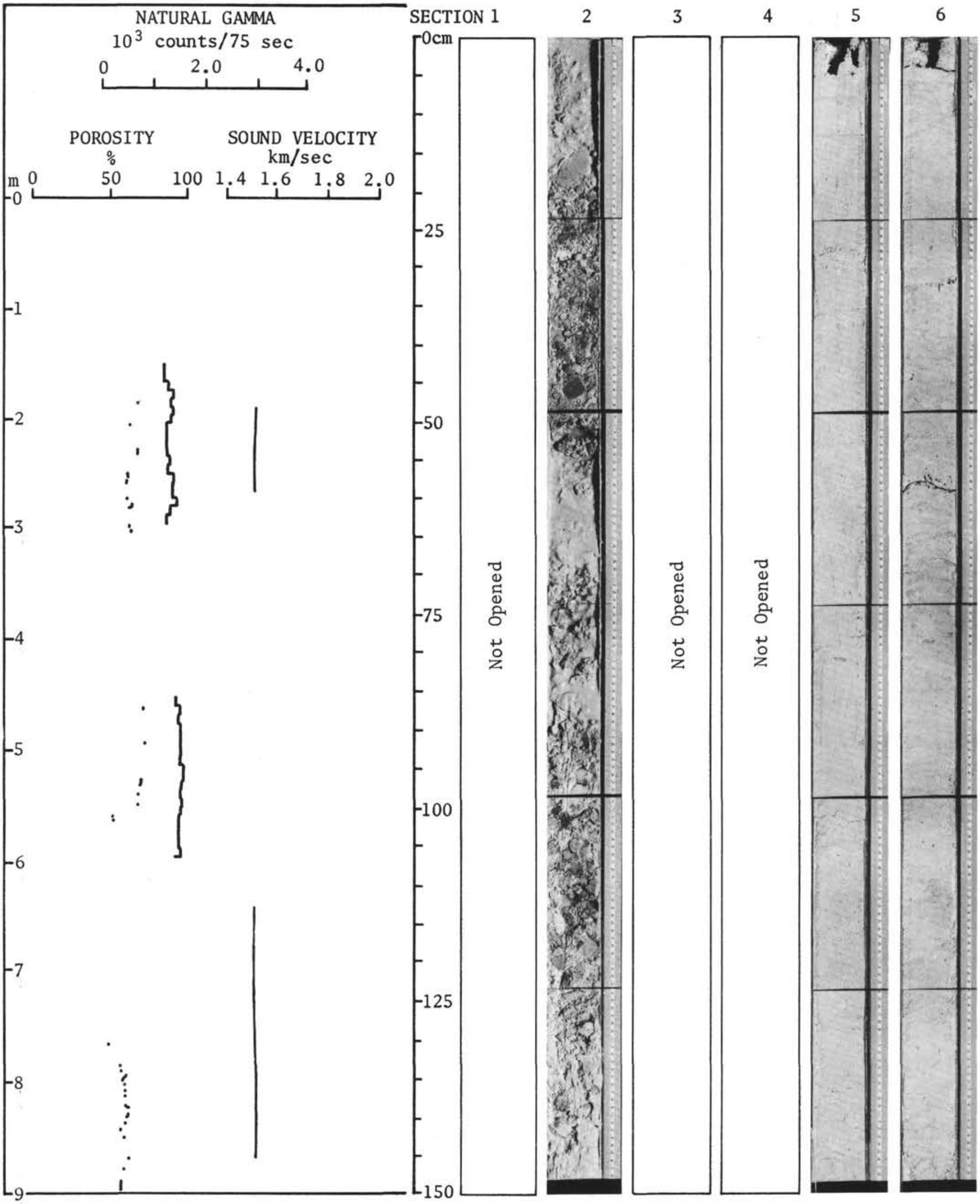


Figure 66. *Hole 84, Core 22, Sections 1-6, Physical Properties.*

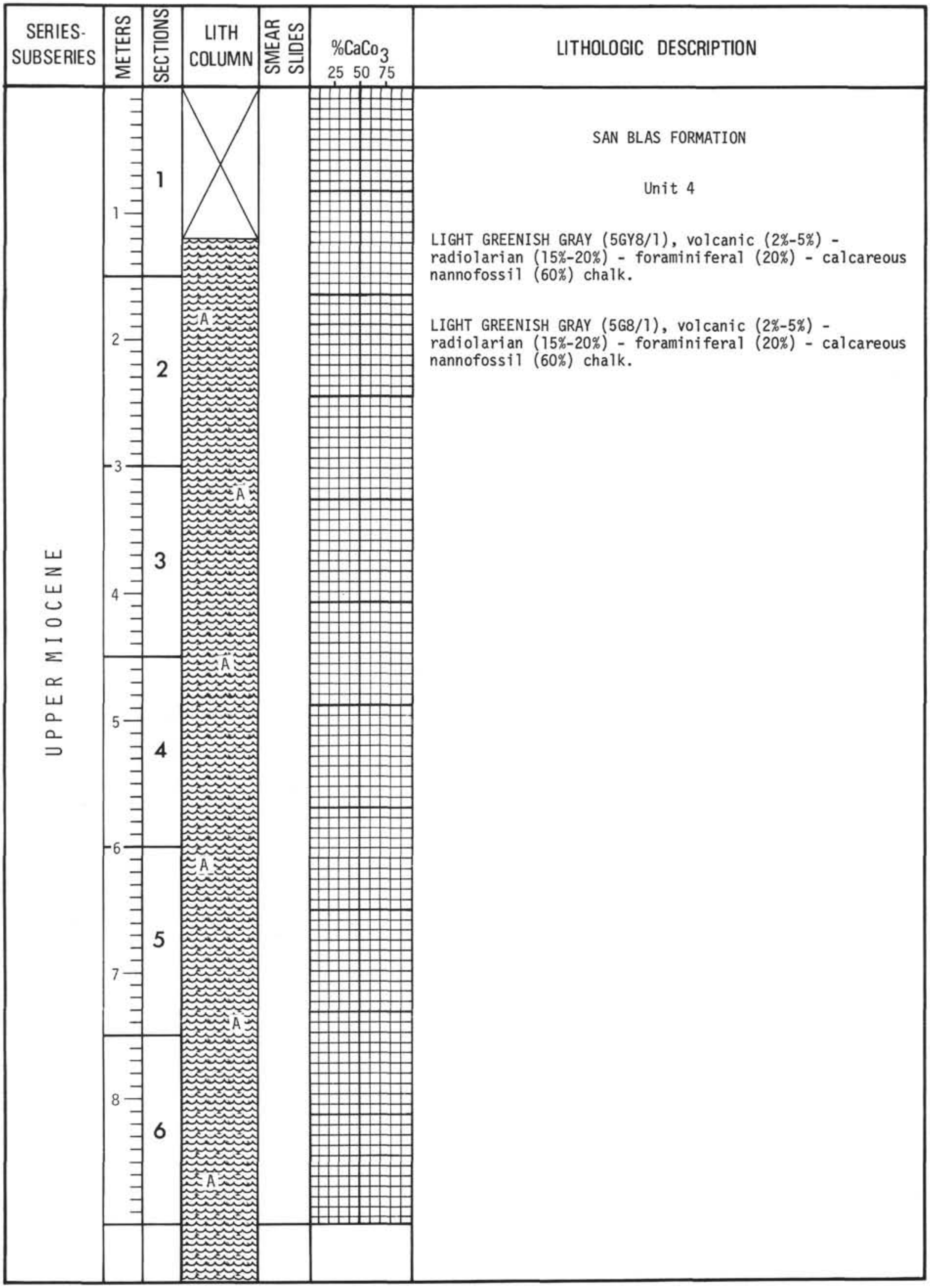


Figure 67. *Hole 84, Core 23 (201.2 to 210.3 m).*

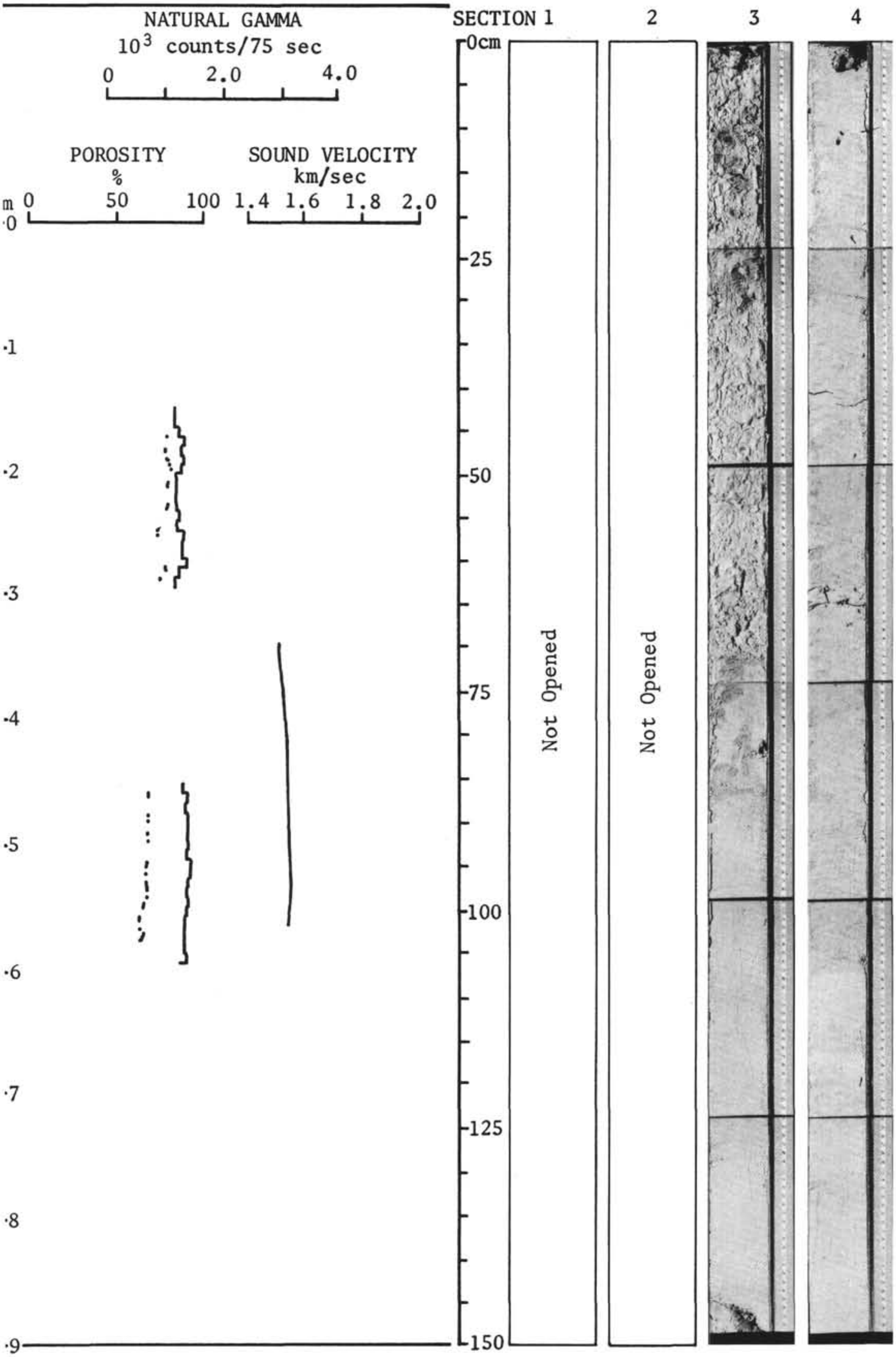
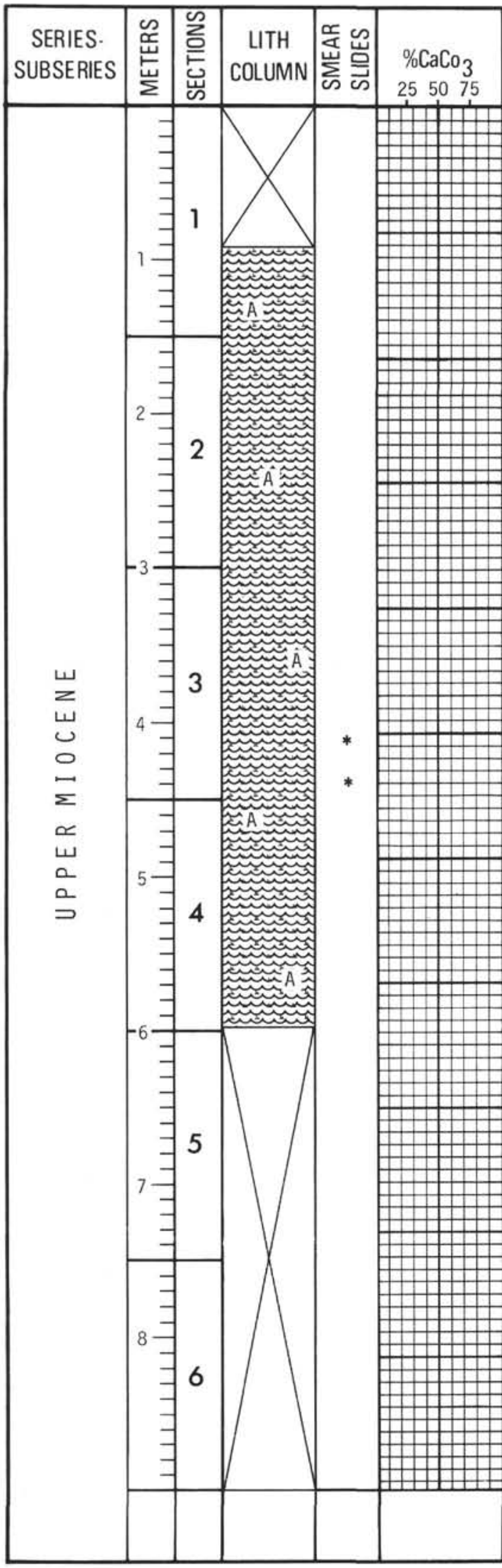


Figure 68. *Hole 84, Core 23, Sections 1-6, Physical Properties.*



LITHOLOGIC DESCRIPTION

SAN BLAS FORMATION

Unit 4

Interbedded in 25 to 75 cm. thick beds.

LIGHT GREENISH GRAY (5GY8/1), radiolarian (15%-25%) - calcareous nannofossil (60%-70%) chalk with less than 10% foraminifera.

LIGHT GREENISH GRAY (5G8/1), foraminiferal (10%-20%) - radiolarian (20%-30%) - calcareous nannofossil (50%-70%) chalk with about 10% volcanics.

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

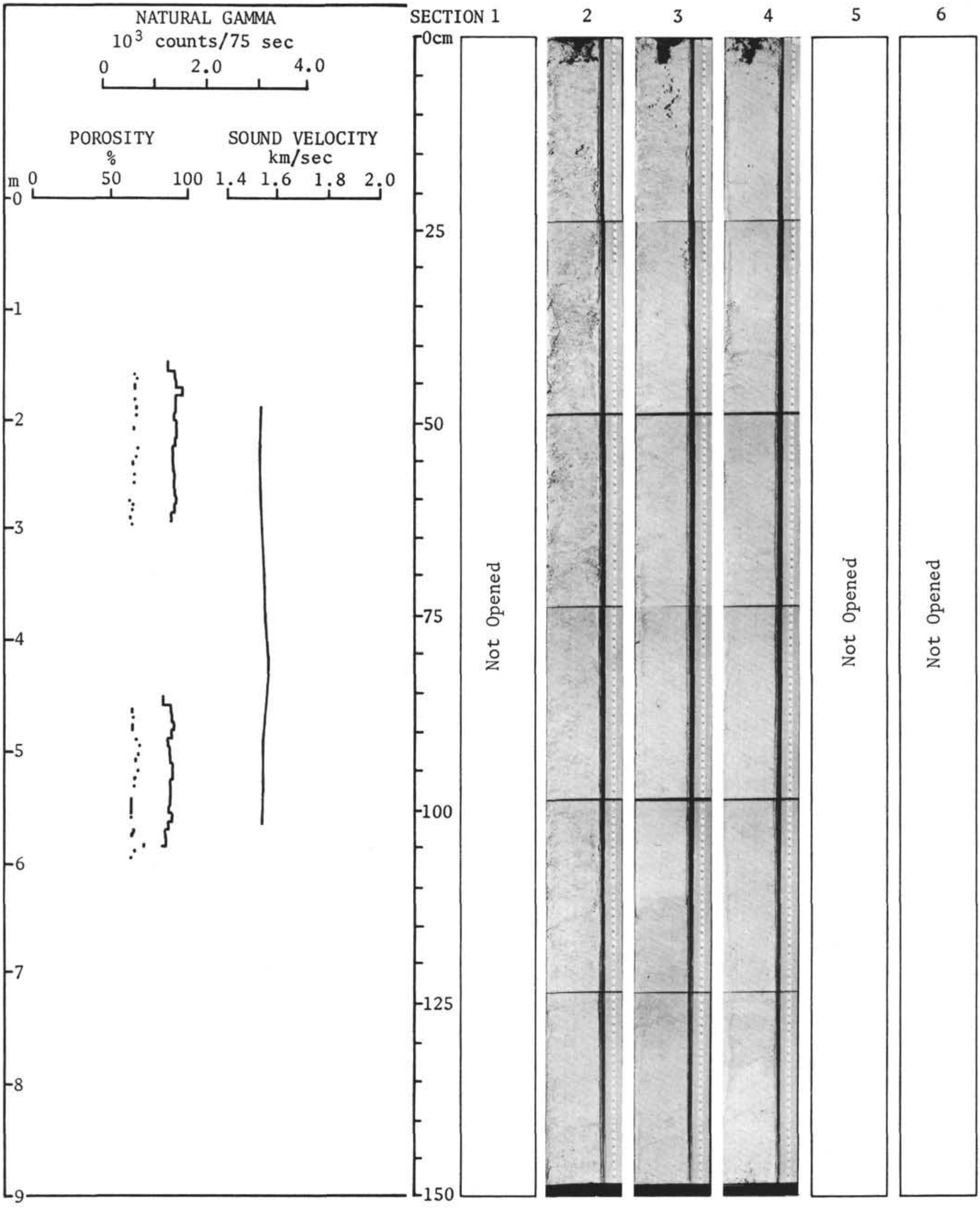


Figure 70. *Hole 84, Core 24, Sections 1-6, Physical Properties.*

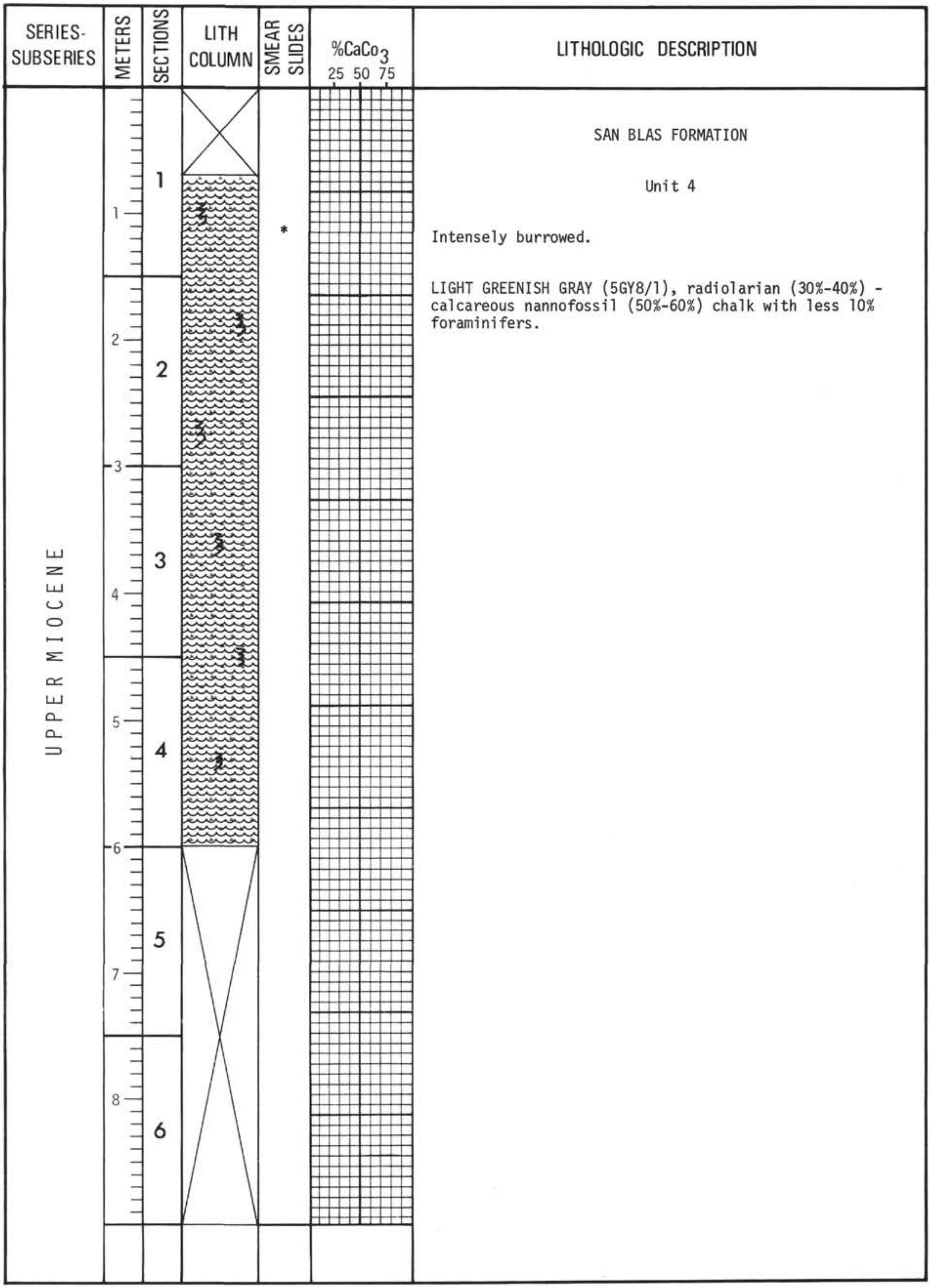


Figure 71. *Hole 84, Core 25 (219.5 to 228.6 m).*

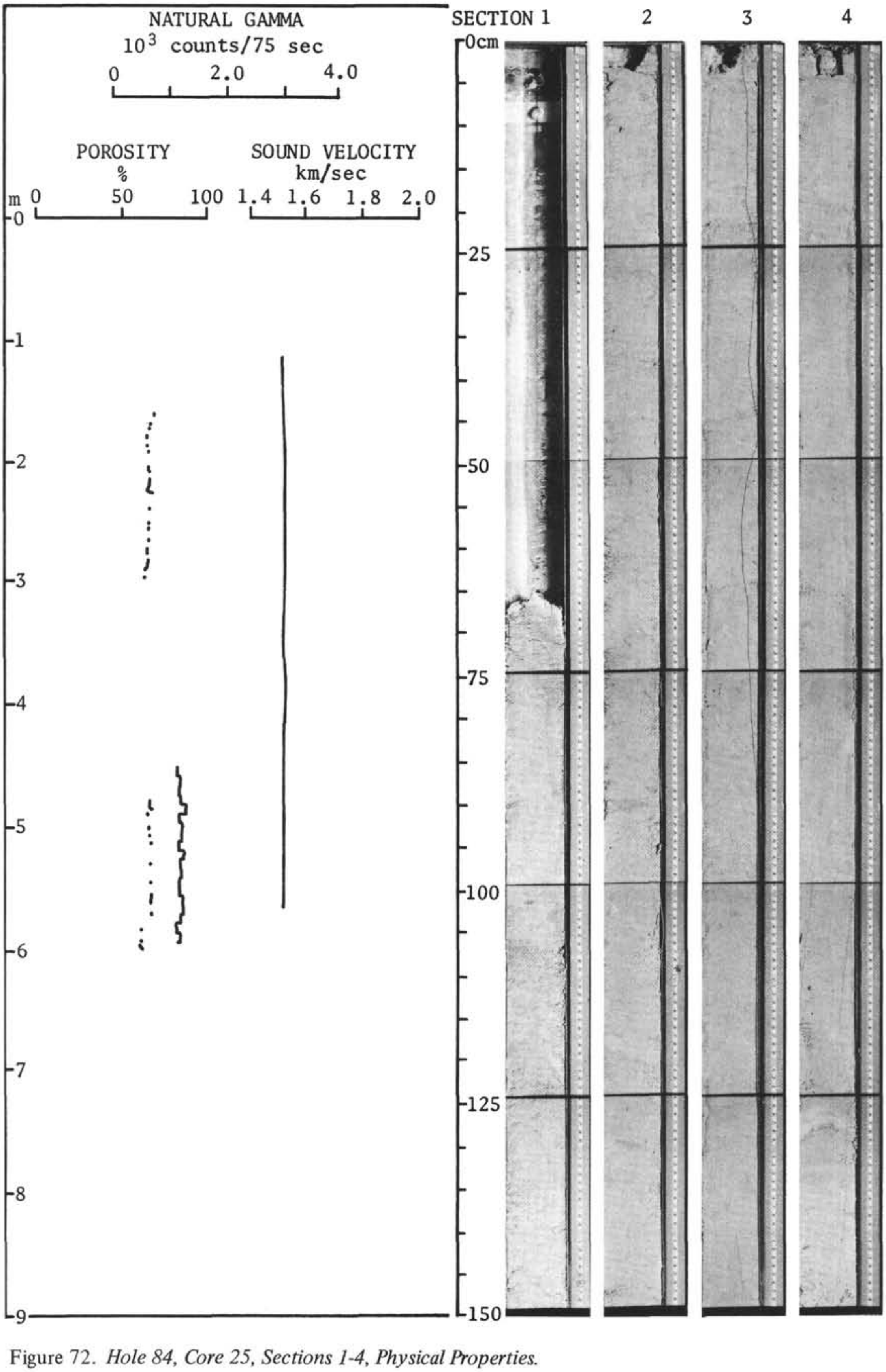


Figure 72. *Hole 84, Core 25, Sections 1-4, Physical Properties.*

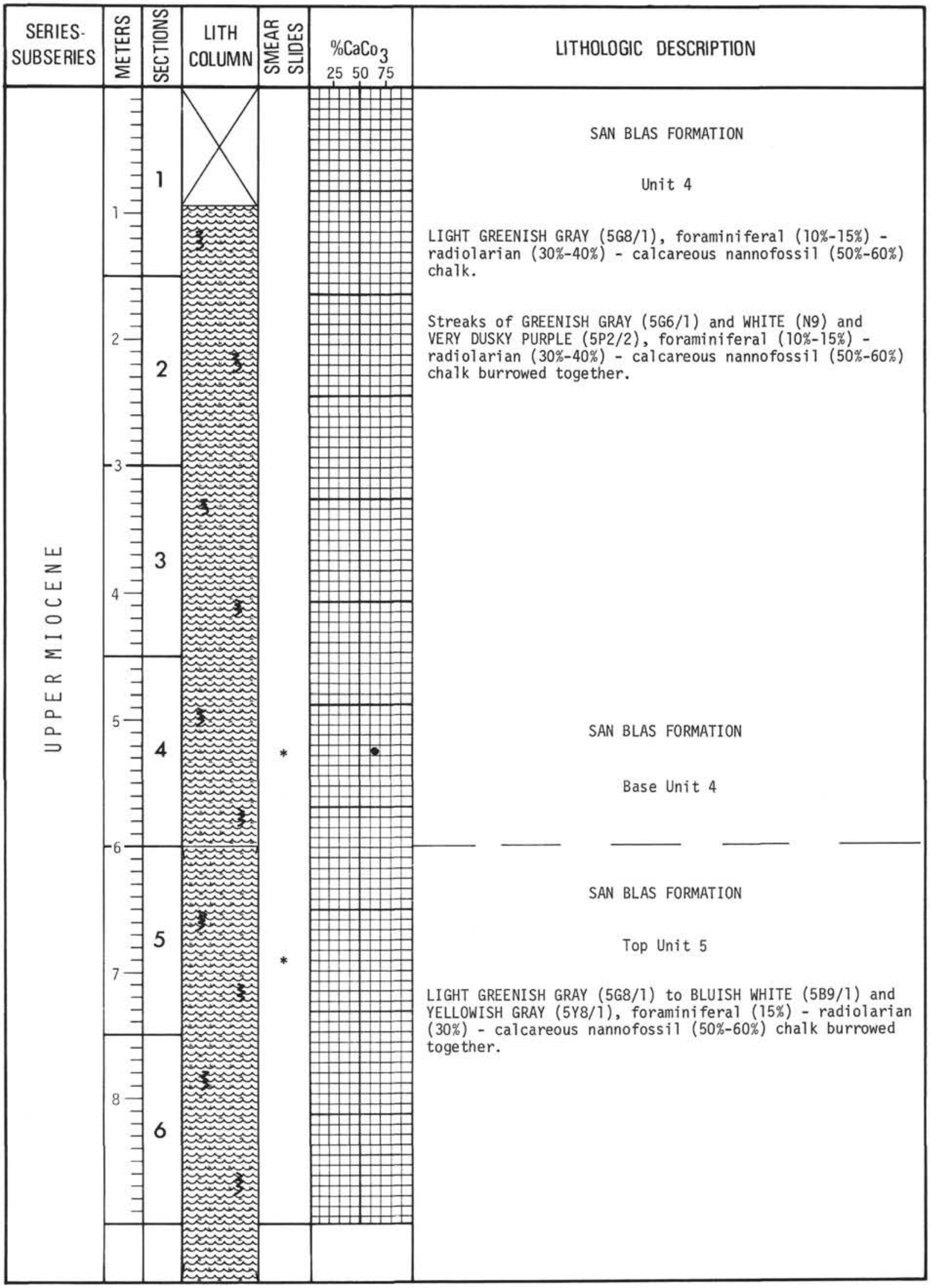


Figure 73. *Hole 84, Core 26 (228.6 to 237.8 m).*

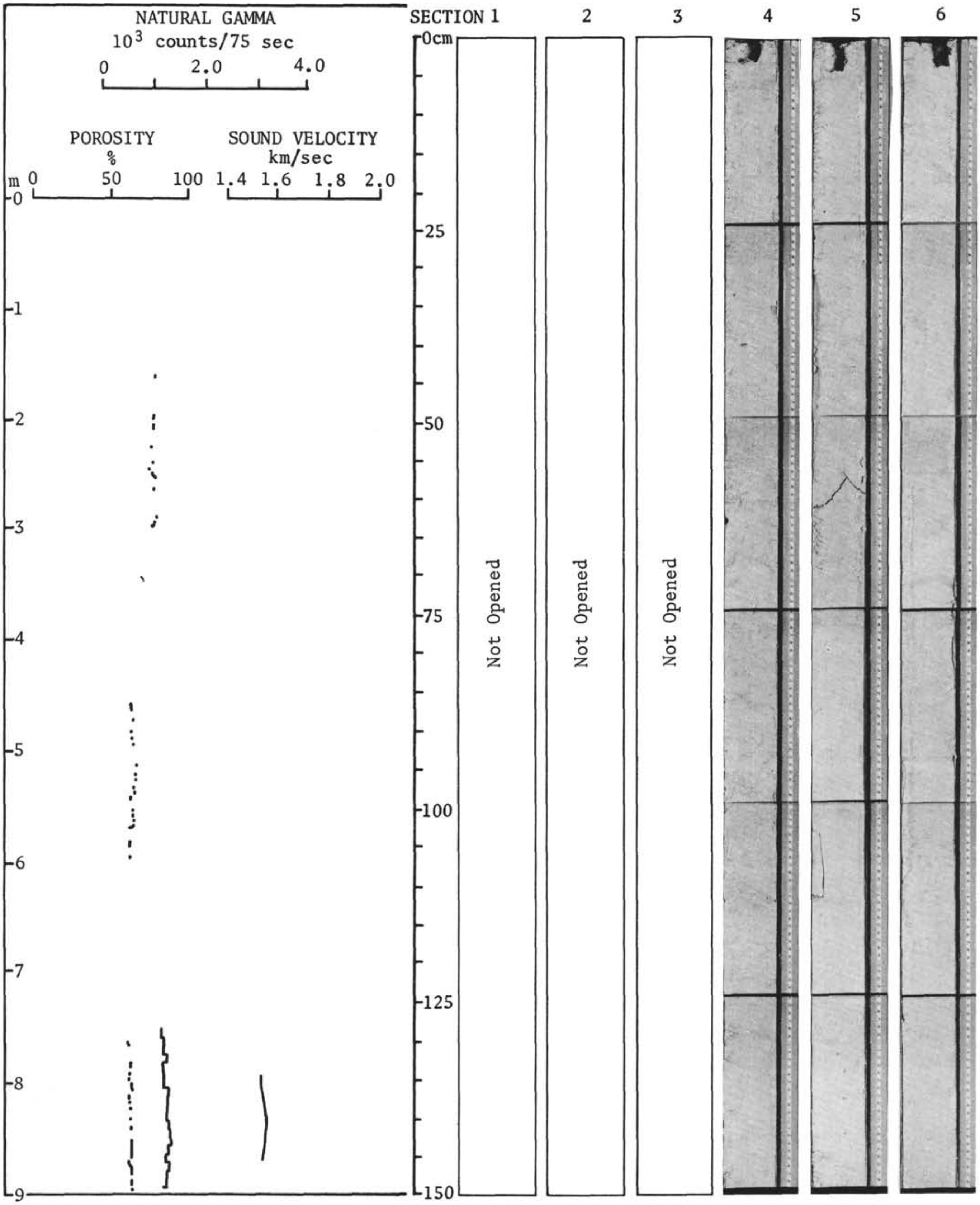


Figure 74. *Hole 84, Core 26, Sections 1-6, Physical Properties.*

SERIES-SUBSERIES	METERS	SECTIONS	LITH COLUMN	SMEAR SLIDES	%CaCo3 25 50 75	LITHOLOGIC DESCRIPTION
UPPER MIOCENE	1	1				SAN BLAS FORMATION Unit 5 LIGHT GREENISH GRAY (5G8/1) to BLUISH WHITE (5B9/1), foraminiferal (15%) - radiolarian (30%) - calcareous nannofossil (50%-60%) chalk. YELLOWISH GRAY (5Y8/1), foraminiferal (15%) - radiolarian (30%) - calcareous nannofossil (50%-60%) chalk.
	2	2				
	3, 4	3				
	5	4		*		
	6, 7	5				
	8	6				

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

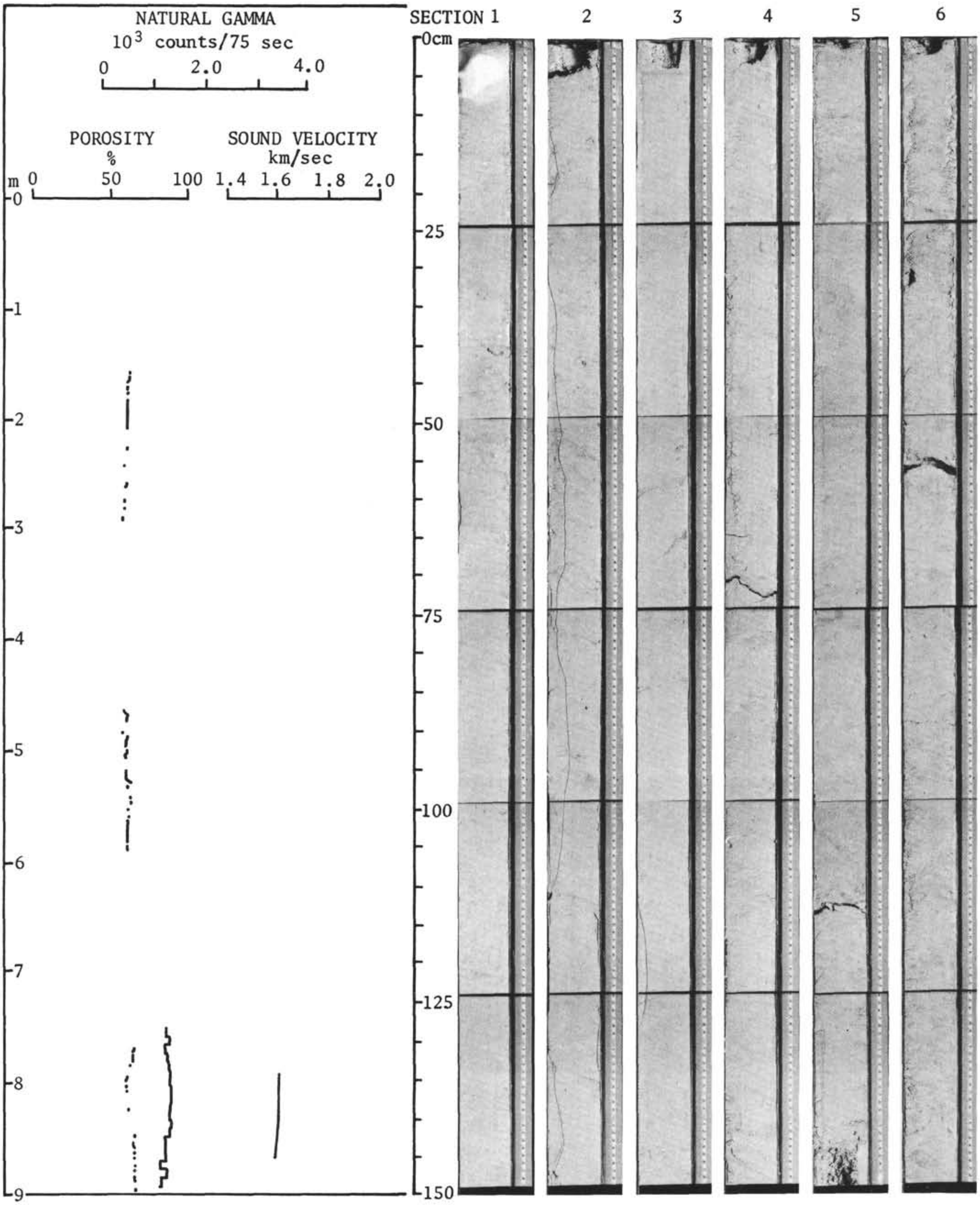


Figure 76. *Hole 84, Core 27, Sections 1-6, Physical Properties.*

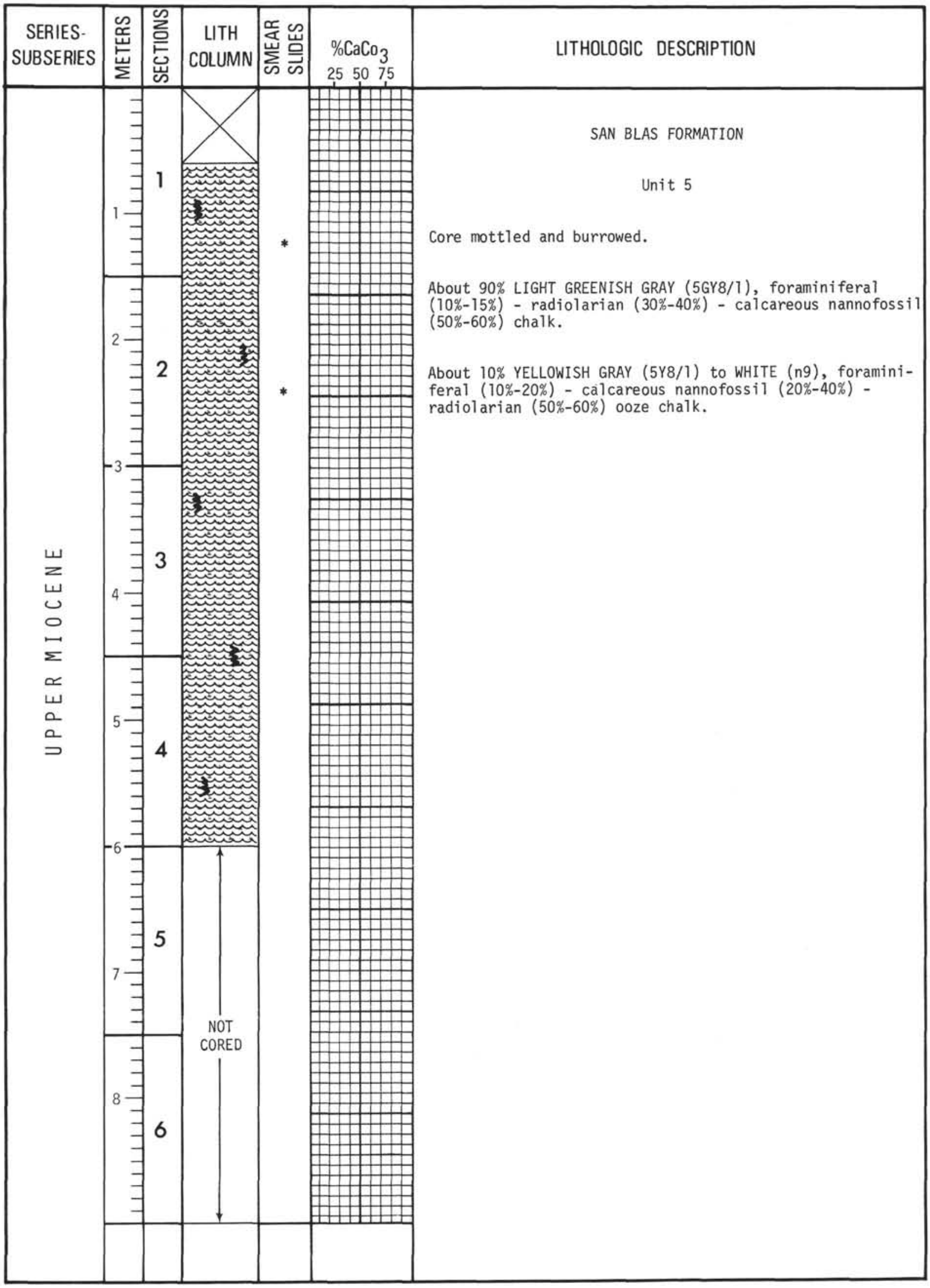


Figure 77. *Hole 84, Core 28 (246.9 to 250.9 m).*

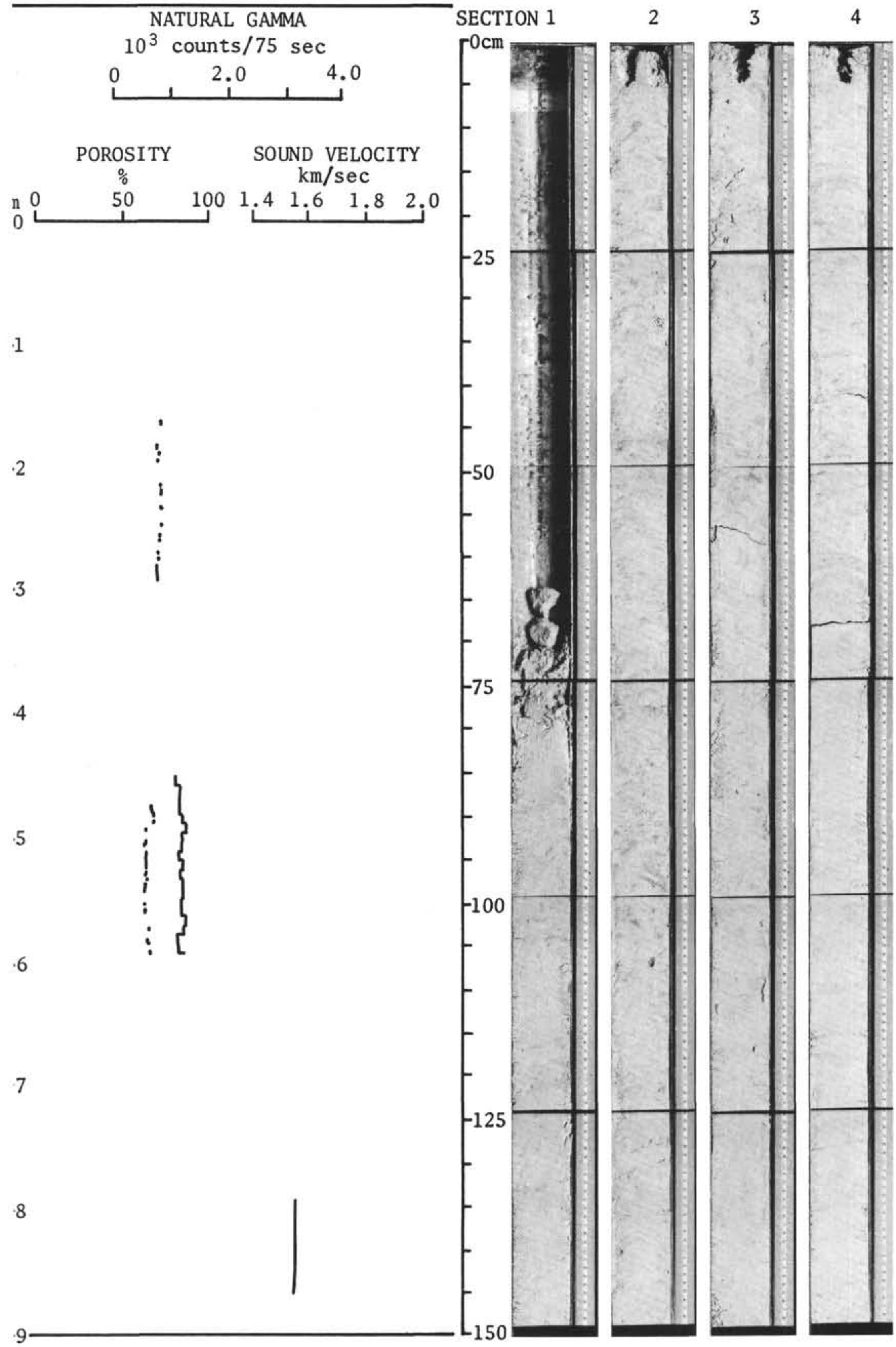


Figure 78. *Hole 84, Core 28, Sections 1-4, Physical Properties.*

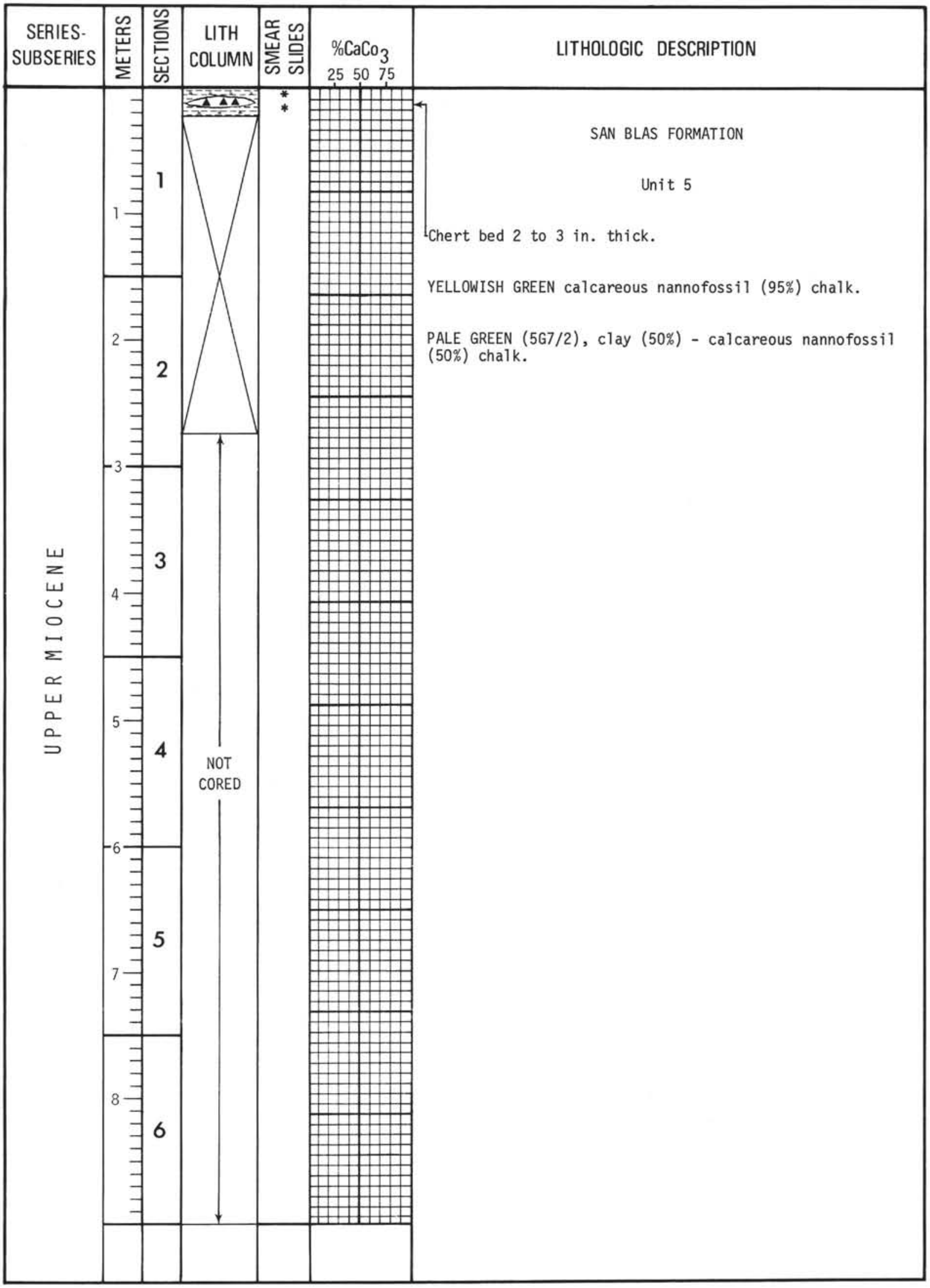


Figure 79. *Hole 84, Core 29 (250.9 to 253.9 m).*

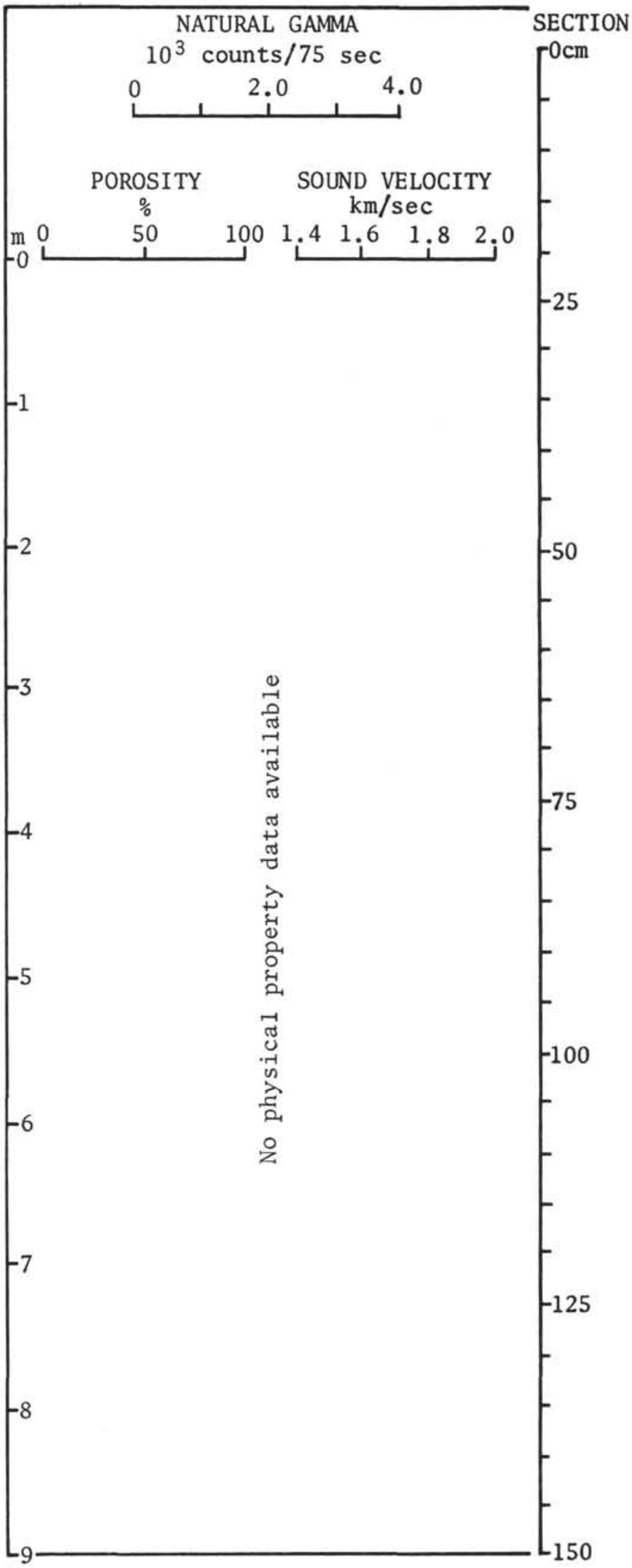


Figure 80. *Hole 84, Core 29.*

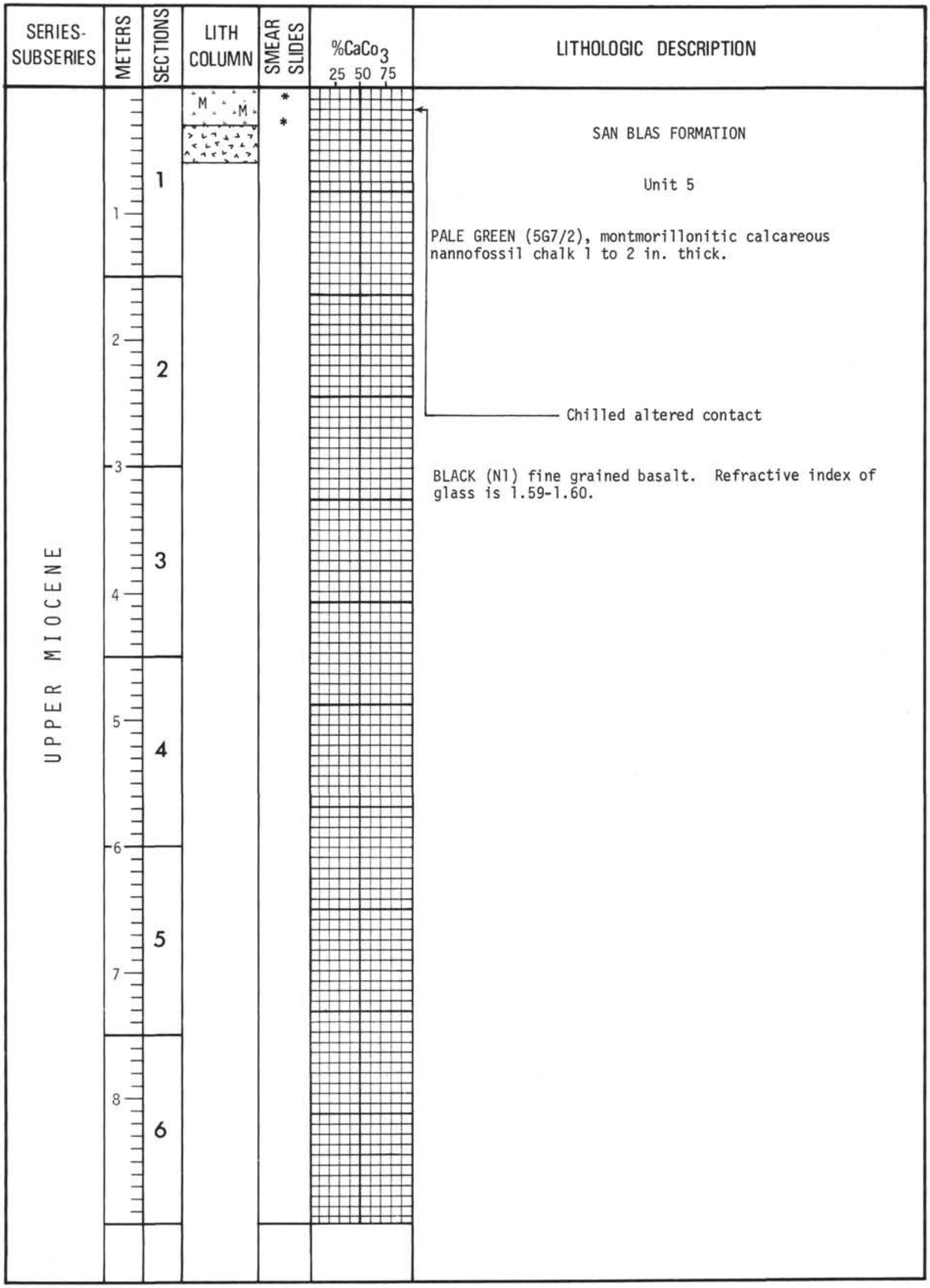


Figure 81. *Hole 84, Core 30 (253.6 to 253.9 m).*

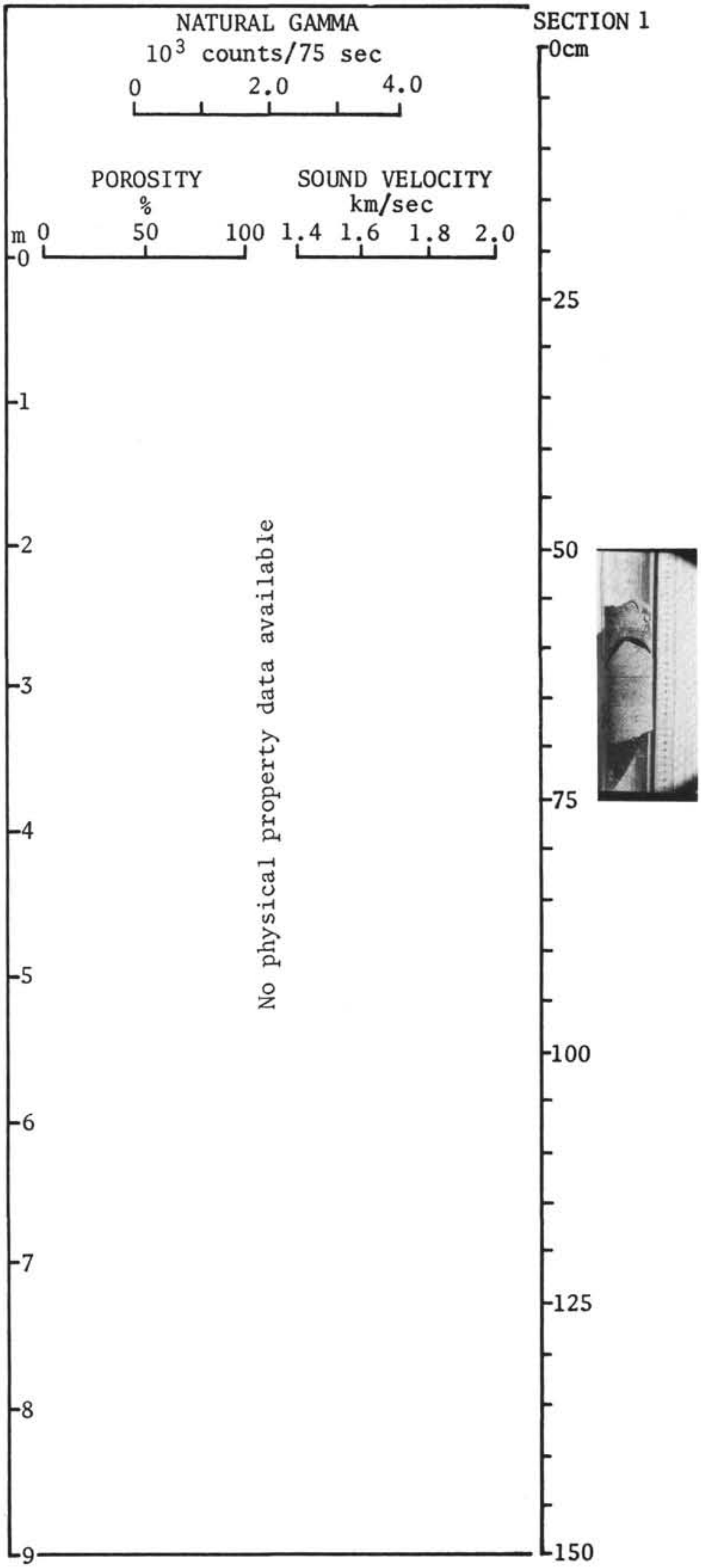


Figure 82. *Hole 84, Core 30, Section 1, Physical Properties.*

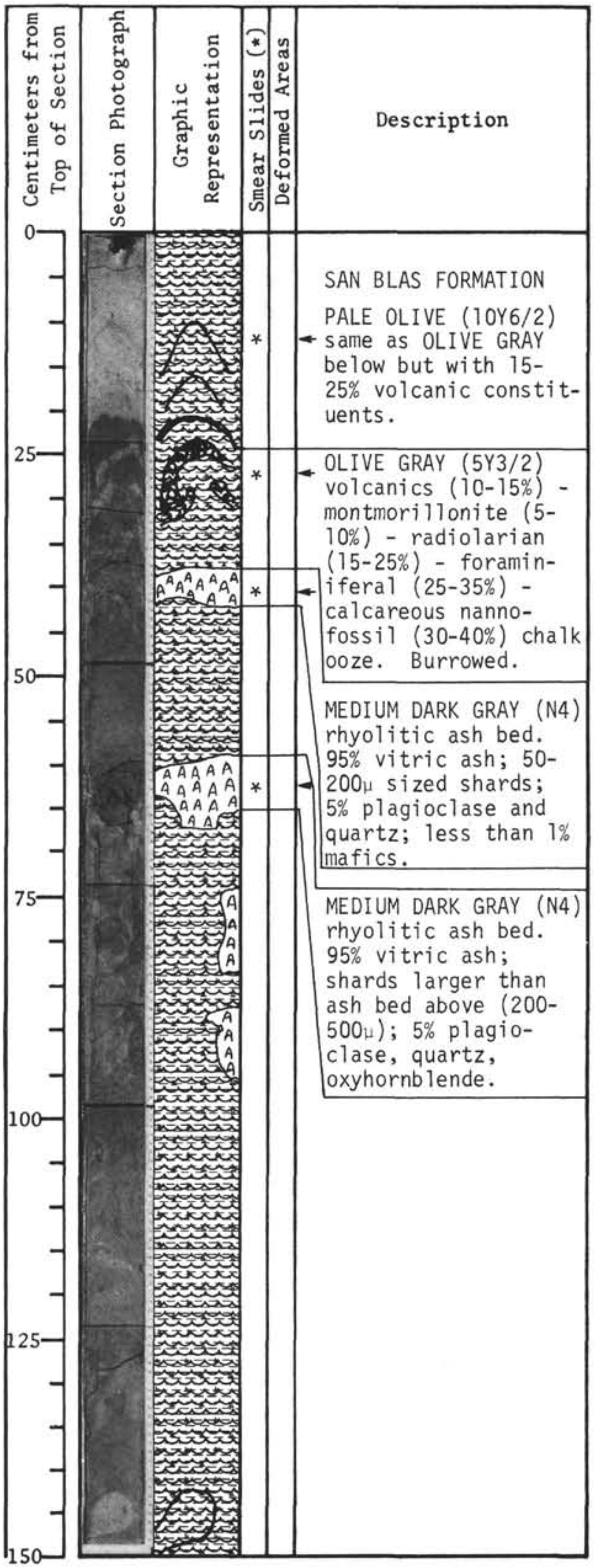


Figure 83. *Hole 84, Core 8, Section 5.*