5. SITE 79

The Shipboard Scientific Party[1]

MAIN RESULTS

An apparently continuous stratigraphic section from Lower Miocene to Upper Pleistocene was discontinuously cored (41 per cent) in two holes. The deepest hole terminated in basalt at a depth of 414 meters below the sea floor. The basalt is overlain by a thin layer of baked sediment containing fossils indicative of the basal Miocene *G. kugleri* Zone. The estimated age of basement at this site is about 21±1 million years B.P. The baked sediment shows evidence of hydrothermal alteration with euhedral tridymite crystals lining the inside of foraminiferal tests. The average rate of deposition at this site is about 19 m/m.y. The accumulation rates are maximum in the middle Miocene.

The lithologies at this site are similar to those at previous sites consisting of siliceous calcareous ooze becoming chalk at depth interbedded with calcareous siliceous ooze. The section contains abundant coccoliths, foraminifera, Radiolaria and diatoms. Assuming the age of the basal sediments at Sites 77 and 79 approximate the basement age, then the distance between these sites suggests a spreading rate of about 8 cm/yr between Upper Eocene and Lower Miocene in this part of the Pacific.

INTRODUCTION

Background and Objectives

Site 79 is located on the crest of the equatorial Pacific sediment belt (Ewing and others, 1968) and is the westernmost of a series of sites (79, 81, 82 and 83) that follow the crest of this belt eastward to and across the crest of the oceanic ridge, locally known as the East Pacific Rise (Figure 1). The purpose of these sites is two-fold: 1) to study variations in biostratigraphy and sediment type from west to east across the Pacific and 2) to paleontologically date basement and determine the rate of spreading of the Pacific plate since the time of deposition of the oldest sediments at Site 77. The drilling results at our previous two sites pointed toward additional objectives for this site beyond those prescribed by the JOIDES Pacific Panel. Two facts are apparent: 1) The sedimentation rates do not have a similar pattern in Sites 77 and 78 so the cause of these differing patterns is now an important question, and Site 79 should be used to study it more fully. 2) The contact with the basalt at each of the two previous sites shows alteration—probably thermal alteration—of the basal sediments indicating that the underlying basalt is a sill. An important objective of Site 79 is to recover the contact between the basalt and sediments to determine how widespread a phenomonen this baking is.

The dating of basement at this site will be essential in determining the amount of displacement, if any, and the sense of this displacement along the Clipperton Fracture Zone

Operations

Site Survey

Between Site 78 and 79 the sediments thicken. The sediments are highly stratified in the vicinity of Site 79 with several prominent reflectors in the upper 0.1 second reflection time (Figure 2). As at Sites 77 and 78, the sediments are conformably draped over the basement topography. The sea floor relief is gentle, expressed as low hills usually less than 50 fathoms high. The sediments are of nearly uniform thickness about 0.4 second of reflection time. Because of the uniform nature of the sediments and the fact that *Argo* had previously surveyed the site, no site survey was conducted by the *Challenger*. When the location of the *Argo* survey was reached, the profiler record was closely monitored and a shallow valley selected for the site. One pass was made over the site, and the ship was turned around; a Burnett beacon was dropped when the site was reached.

Coring

When the beacon reached the bottom, we proceeded to lower the drill string. The seismic reflection record was poor at this location but it seemed to indicate about 0.4 second of sediment. Our plan at this site was to drill 55 meters and then core 9 meters, continuing this

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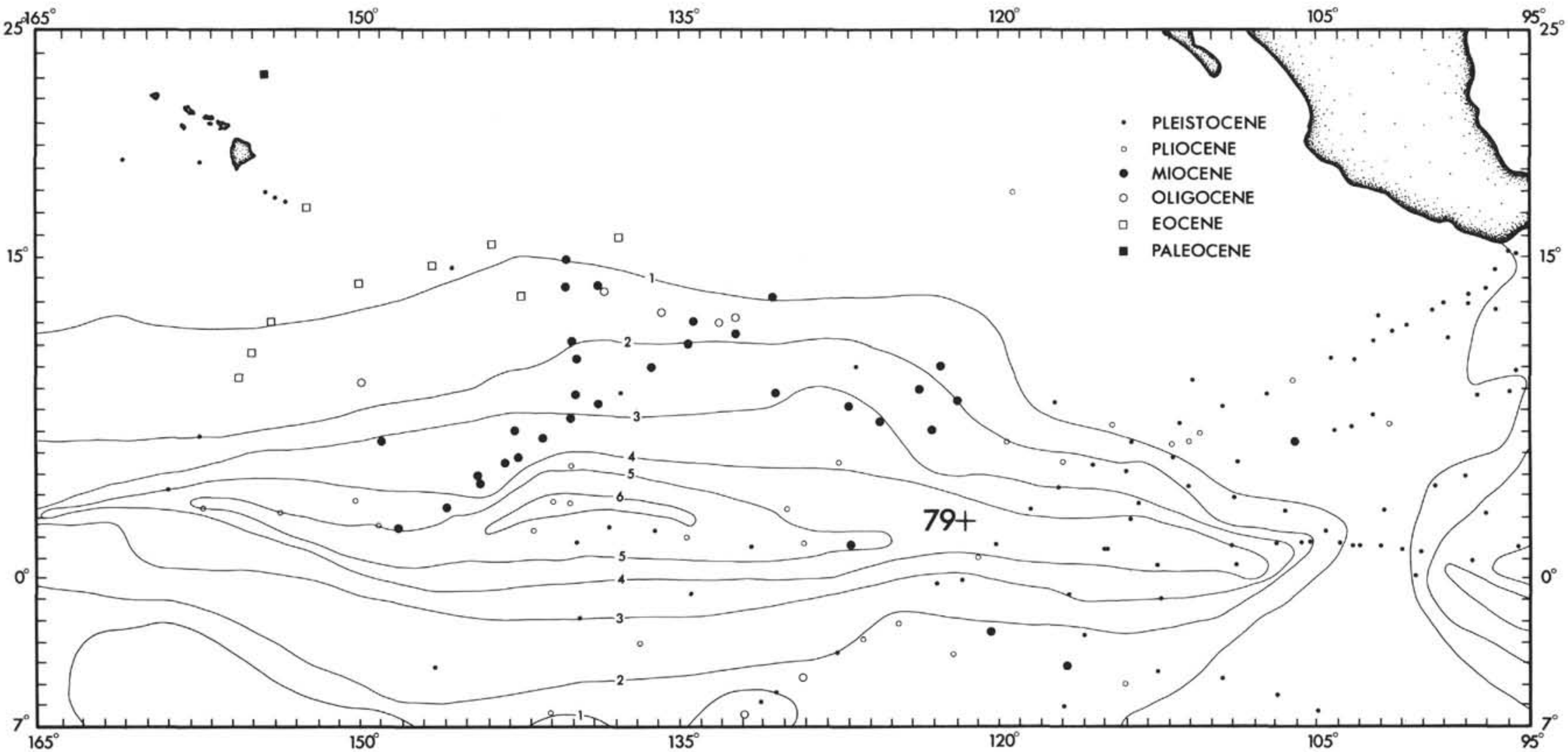


Figure 1. *Location of Site 79; sediment isopachs in hundreds of meters after Ewing* et al. *(1968); distribution of piston core ages after Hays* et al. *(1969).*

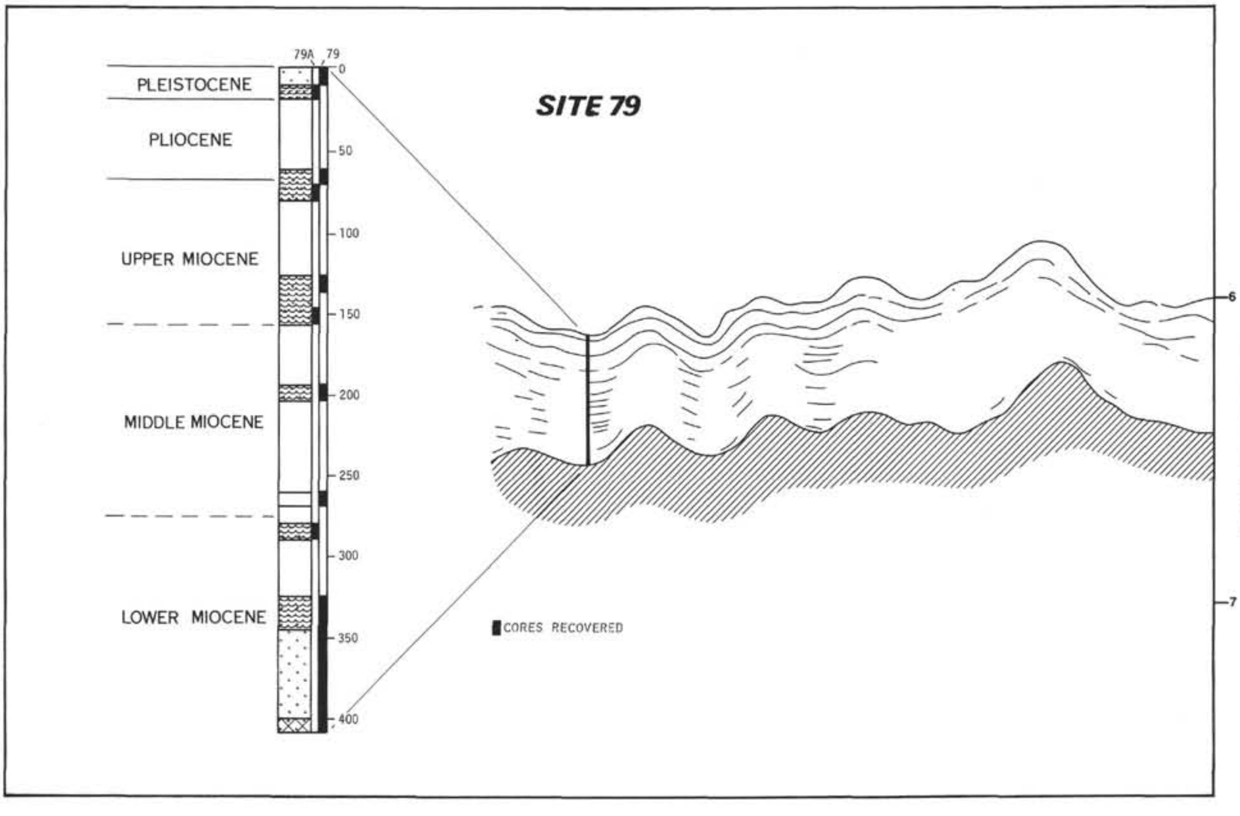


Figure 2. *Sketch of seismic reflection record in vicinity of Site 79 showing interval cored in each hole.*

procedure until we arrived within 30 meters of basement at which time we would continuously core until reaching basement. We followed this procedure until we reached a depth of 327 meters below the sea floor then continuously cored. We reached basement at a depth of 411 meters. After retrieving one-half meter of basalt, we pulled out of the hole and respudded (79A), cutting four cores ranging in depth from just below the sea floor to a depth of 288 meters at levels considered important for paleontological control.

Pertinent aspects of our drilling operations are presented in Tables 1 and 2.

LITHOLOGY

At Site 79 two formations are present: the Clipperton Oceanic Formation (0 to 330 meters) which consists of an upper cyclic unit (0 to 45 meters) of interbedded orange calcareous and dark brown siliceous oozes and a lower varicolored unit (45 to 330 meters) of purple and green calcareous oozes and chalks; and the Marquesas Oceanic Formation (330 to 413.7 meters) which includes brown and gray calcareous chalks and oozes. Basement is interpreted to be intrusive basalt which has hydrothermally altered the overlying brown chalks of the Marquesas.

Clipperton Oceanic Formation

Cyclic Unit (0 to 45 meters)

As at other sites, the cyclic unit is characterized by its orange and brown colors, sharply defined beds which are about 1 to 10 centimeters thick, rapid variation in siliceous biota content, and high percentage of "red clay" (Figure 75).

The main lithologies are:

1. About 40 per cent is pale brown (5YR5/2) clay (5 to 10 per cent)–foraminiferal (15 to 20 per cent)–radiolarian (15 to 20 per cent)–calcareous nannofossil (50 to 60 per cent) ooze.

2. About 30 per cent is dark yellowish-brown (10YR4/2) calcareous nannofossil (15 to 25 per cent)–clay (20 to 30 per cent)–foraminiferal (20 to 30 per cent)–radiolarian (30 to 40 per cent) chalk ooze.

3. About 20 per cent is very pale orange (10YR8/2) clay (1 to 5 per cent)–foraminiferal (15 to 20 per cent)–radiolarian (20 to 25 per cent)–calcareous nannofossil (55 to 65 per cent) ooze.

4. About 10 per cent is medium bluish-gray (5B5/1) foraminiferal (15 to 25 per cent)–calcareous nannofossil (15 to 25 per cent)–clay (25 to 35 per cent)–radiolarian (25 to 35 per cent) ooze.

The boundary between the cyclic unit and varicolored unit was not cored; this boundary is tentatively placed at 45 meters based on the thickness of the cyclic unit at Site 77.

Varicolored Unit (45 to 330 meters)

The varicolored unit at this site is characterized by interbedded and laminated siliceous and calcareous oozes that display brilliant shades of purples and greens (Figure 76). These colors serve to easily distinguish it from the overlying and underlying formations. Contacts between the different colors are sharp, and occasionally one can see one-millimeter thick laminations in the purple and green beds. The purple color is probably due to some manganese mineral(s) that coats the surfaces of radiolarians and which also occurs as individual grains disseminated through the beds.

1. About 60 per cent is pale greenish-yellow (10Y8/2) to light greenish-gray (5G8/1) foraminiferal (10 to 15 per cent)–radiolarian (30 to 40 per cent)–calcareous nannofossil (50 to 60 per cent)–ooze.

2. About 30 per cent is pale purple (5P6/2) to very dusky purple (5P2/2) manganese (?) (10 to 15 per cent)–foraminiferal (10 to 20 per cent)–calcareous nannofossil (30 to 40 per cent)–radiolarian (30 to 40 per cent) ooze.

3. About 10 per cent is white (N9) foraminiferal (10 to 15 per cent) radiolarian (30 to 40 per cent)–calcareous nannofossil (40 to 60 per cent) ooze.

The lower contact of the Clipperton Oceanic Formation was not cored and is placed midway between an uncored interval which separates the bluish-white chalks of the varicolored unit from the greenish-gray chalks of the Marquesas Oceanic Formation.

Marquesas Oceanic Formation

This formation is generally well bedded in 5 to 75 centimeter-thick laminated beds that have fairly sharp upper and lower contacts.

Brown Unit (330 to 352.6 meters)

Pale orange (10YR7/2) and grayish-orange pink (5YR7/2) radiolarian (10 to 20 per cent)–calcareous nannofossil (80 to 90 per cent) chalk, mottled.

Gray Unit (352.6 to 379.2 meters)

Bluish white (5B9/1) foraminiferal (5 to 10 per cent)–calcareous nannofossil (90 to 95 per cent) chalk.

Brown Unit (379.2 to 413.7 meters)

This unit is characterized by being massively bedded and consisting dominantly of very pale orange (10YR8/2) clay (1 to 2 per cent)–radiolarian (5 to 10 per cent)–foraminiferal (5 to 10 per cent)–calcareous nannofossil (80 to 90 per cent) chalk. The lowermost core contains a baked sediment-basalt contact. This

TABLE 1
Site Operational Summary

Site 79

Latitude 02° 33.02′N; Longitude 121° 34.00′W.

Time of arrival: 0045 hours, 12/31/69; Time of departure: 1140 hours, 1/3/70.

Total time on site: 3 days, 10 hours, 55 minutes.

Water depth: 4566 meters (corrected).

Sediment thickness determined by drilling: 411 meters.

Acoustical thickness: 0.405? second.

Average sound velocity of sediments: 1.8 km/sec.

Hole	Penetration (m)	Cores Attempted	Cores Recovered	Per Cent Cored	Recovery (m)	Per Cent Recovered
79	414.2	17	17	32.1	120.0	90.2
79A	287.8	4	4	12.7	34.8	95.1
Totals: 2	Max. Penet. 414.2	21	21	41.2	154.8	91.2

baked sediment is a very pale orange (10YR8/2) to white (N9) foraminiferal (10 to 20 per cent)–calcareous nannofossil (80 to 90 per cent) chalk. This chalk shows hydrothermal alteration as exhibited by tridymite euhedra lining the interior of foraminifera tests and yellowish-green clay and brown iron oxides replacing the nannofossil chalk.

Basaltic Basement

Basement is a black, fine-grained, slightly vesicular basalt which is probably intrusive (Figure 77). The upper 2 to 5 millimeters of the basalt has a chilled isotropic glass rind with a refractive index of 1.59 to 1.60 suggesting a silica content of about 48 to 50 per cent.

PHYSICAL PROPERTIES

Natural Gamma

Natural gamma readings at Site 79 ranged from 749 counts/75 second to 3836 counts.

The cyclic unit of the Clipperton Oceanic Formation yields readings from 826 to 2905 counts. The high readings are probably due to palagonite and potassic mica. The lower part of the cyclic unit was not tested because of a recorder malfunction.

The varicolored unit of the Clipperton Oceanic Formation yielded readings from 774 to 3836 counts with an average reading of about 900 counts. The single isolated, high count of 3836 was from an unopened section with no visible change in lithology seen through the plastic core liner. The cyclic unit can be distinguished from the varicolored unit at this site by the higher average readings in the cyclic unit (Figure 4).

Most of the Marquesas Oceanic Formation averages about 900 counts. Two notable exceptions occur, one at the contact with the overlying Clipperton Oceanic Formation where the Marquesas has readings up to 1526 counts, and one just above basaltic basement where readings of 1385 counts were recorded. These readings probably result from local concentrations of clay.

Porosity

Porosity at Site 79 ranges from 45 per cent in foraminiferal-calcareous nannofossil chalks to 91 per cent in foraminiferal-radiolarian-calcareous nannofossil oozes. However, there is no obvious correlation between lithology and porosity at this site. There does appear, however, to be a correlation between depth and porosity at this site (Figures 4, 6 and 8). The porosity is 87 per cent in Hole 79, Core 1 and decreases to 45 per cent in Core 16. This porosity decrease may be due to compaction and/or incipient cementation.

There is no GRAPE data in Core 8 and Cores 10 through 14 due to malfunctioning of the recorder.

TABLE 2
Hole Drilling Summary, Site 79
(Latitude 02° 33.02'N, Longitude 121° 34.00'W, 4566 meters depth)

Hole 79

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)
0.0-9.1	0-30.0		1	9.1	30.0	9.1	30.0	–	–	3.3
9.0-30.0	30-198.0									
60.4-69.5	198-228.0		2	9.1	30.0	9.1	30.0	–	–	1.9
69.5-126.8	228-416.0									
126.8-136.0	416-446.0		3	9.1	30.0	9.1	30.0	Cont	–	1.7
136.0-193.6	446-635.0									
193.6-202.7	635-665.0		4	9.1	30.0	9.1	30.0	Cont	Int	1.3
202.7-260.36	665-854.0									
260.36-269.5	854-884.0		5	9.1	30.0	9.1	30.0	Cont	Int	0.7
269.5-326.9	884-1072.0									
326.9-336.0	1072-1102.0		6	9.1	30.0	6.7	22.0	Cont	Int	0.6
336.0-334.0	1102-1127.0		7	7.7	25.0	7.7	25.0	Cont	Int	0.5
344.0-350.0	1127-1149.0		8	6.7	22.0	8.2	27.0	Cont	Int	0.4
350.0-355.8	1149-1167.0		9	5.5	18.0	4.5	15.0	Cont	Int	0.3
355.8-364.3	1167-1195.0		10	8.5	28.0	6.1	20.0	Cont	Cont	0.5
364.3-373.5	1195-1225.0		11	9.1	30.0	8.2	27.0	Cont	Cont	Blurred
373.5-380.5	1225-1248.0		12	7.0	23.0	8.5	27.0	Cont	Cont	1.0
380.5-389.6	1248-1278.0		13	9.1	30.0	8.5	28.0	Cont	Cont	0.6
389.6-398.8	1278-1308.0		14	9.1	30.0	9.1	30.0	Cont	Cont	0.7
398.8-406.1	1308-1332.0		15	7.4	24.0	2.4	8.0	Cont	Cont	0.6
406.1-413.7	1332-1357.0		16	7.7	25.0	4.0	12.0	Cont	Cont	Not Recorded
413.7-414.2	1357-1358.5		17	0.5	1.5	0.5	1.5	Cont	Cont	Not Recorded
Total 414.2	1358.5		17	436.5	120.0	393.5				

Hole 79A

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)
0.0-9.1	0-30									
9.1-18.3	30-60		1	9.1	30	7.4	24	–	–	
18.3-69.5	60-228									
69.5-78.6	228-258		2	9.1	30	9.1	30	–	–	
78.6-145.1	258-476									
145.1-154.3	476-506		3	9.1	30	9.1	30		Int	
154.3-278.7	506-914									
278.7-287.8	914-944		4	9.1	30	9.1	30		Int	
Total 287.8	944		4	36.6	120	34.8	114			

Sonic Velocity

Sound velocities ranged from 889 m/sec to 1634 m/sec. The very low sound velocities of 888 m/sec in Core 3, Section 1 are probably due to large amounts of water in the sediments. This section was highly disturbed during coring and does not reflect the condition of the sediments *in situ.* In general the sound velocities increase downhole which is a trend expected because of compaction (Figures 4, 6 and 8). No obvious changes in sonic velocities are directly attributable to lithologic changes.

Bulk Density

Bulk densities at Site 79 ranged from 1.129 g/cc at the top to 1.960 g/cc at the bottom, and increased fairly uniformly downhole probably as a result of compaction (Figures 4, 6 and 8). The minor fluctuations are probably the result of excess water injected into the sediments during drilling. The sediments at 400 meters in Core 15, Section 2 recorded the highest densities on Leg 9. No reason for this high density reading was readily apparent.

Penetrometer

Penetrometer readings at Site 79 range from 0.5 centimeter to 3.47 centimeters and show a general decrease downhole. The readings show a definite drop from 3.49 centimeters to 1.28 centimeters at about 125 meters. From 1 to 8 meters, 65 to 72 meters, and at 190 meters there are areas of erratically high readings of 3.0 centimeters and over due to coring disturbances. Minor real fluctuations in readings may be due to individual lithologic differences.

BIOSTRATIGRAPHY

Foraminifera

Foraminiferal data derived from Site 79 were less than optima for a number of reasons. The hole was spot cored to within about 80 meters of basement where continuous coring was initiated. In the process of spot coring, only the Pliocene-Pleistocene boundary came within a cored interval and the Miocene-Pliocene boundary has been extrapolated. At Site 79 long intervals occurred in which some foraminiferal specimens had been partially or completely removed by solution. The entire foraminiferal fauna was completely destroyed in Hole 79A, Core 3, but in all other cores the remaining specimens were sufficient to establish a relative age in terms of the established planktonic foraminiferal zones.

As in previous holes (for example, Sites 77 and 78) the foraminiferal diversity fluctuates considerably. At Site 79, highest diversities are in the *P. obliquiloculata* to *G. plesiotumida* zonal interval. Below this interval diversity remains low with the exception of slightly higher diversities in the *G. peripheroronda* to *G. kugleri* zonal interval. The low diversity intervals at Site 79 appear to correspond to intervals where the foraminifera display the effects of solution. Diversity trends may therefore all be secondary in origin.

Thermal alteration of the overlying sediments by the basalt encountered at 1355 feet was very evident from the preservation of the foraminiferal tests. Foraminiferal material recovered from the lowermost baked chalks included the zonal species *Globorotalia kugleri.*

Radiolaria

Radiolaria are absent in Core 17. In all the remaining cores, Radiolaria are common to abundant and well-preserved. Orosphaerid Radiolaria are common in Cores 6 through 16 and scarce in the higher portion of the section where diatoms become increasingly abundant.

The radiolarian assemblages at Site 77 range in age from lower Miocene (*Lychnocanium bipes* Zone) to Pleistocene (no zonal name). The large gaps between recovered intervals at this site preclude close comparison of the radiolarian stratigraphic ranges. The stratigraphic ranges of three species in Cores 6 through 16 need discussion. At Site 79, *Calocycletta virginis* does not occur until after the first appearance of *Dendrospyris damaecornis,* whereas the opposite is true at Site 77. At Site 79, *Tholospyris mammilaris* does not occur until after the first appearance of *Stichocorys diploconus,* while in Site 77, *T. mammilaris* appears simultaneously with *Cyrtocapsella cornuta.* At Site 79, *Cyrtocapsella elongata* does not occur until after the first appearance of *Giraffospyris annulispina,* whereas *C. elongata* appears simultaneously with *Cyclampterium* (?) *leptetrum* at Site 77. These anomalous occurrences are difficult to explain. Environmental conditions at Site 79 during the lower Miocene may have been sufficiently different from those at Site 77, so that at least the three species discussed above were unable to exist here. Alternatively, differential solution effects may be the answer to this problem.

DISCUSSION AND INTERPRETATION

The sediments at this site are similar to those at Sites 77 and 78. Here, as at Site 77, an apparently complete or nearly complete sequence is present from the sea floor to the underlying basaltic basement. As at Site 77 an upper tan layer of alternating siliceous and calcareous ooze occurs. This is underlain by a thick sequence of alternating blue white and green highly calcareous sediments which extends down into the middle Miocene. Below this lies a massive unit of blue white radiolarian foraminiferal nannofossil-chalk extending from the Upper middle Miocene down to the upper part of the Lower Miocene. Below this, an alternating pink and green sequence overlies a massive

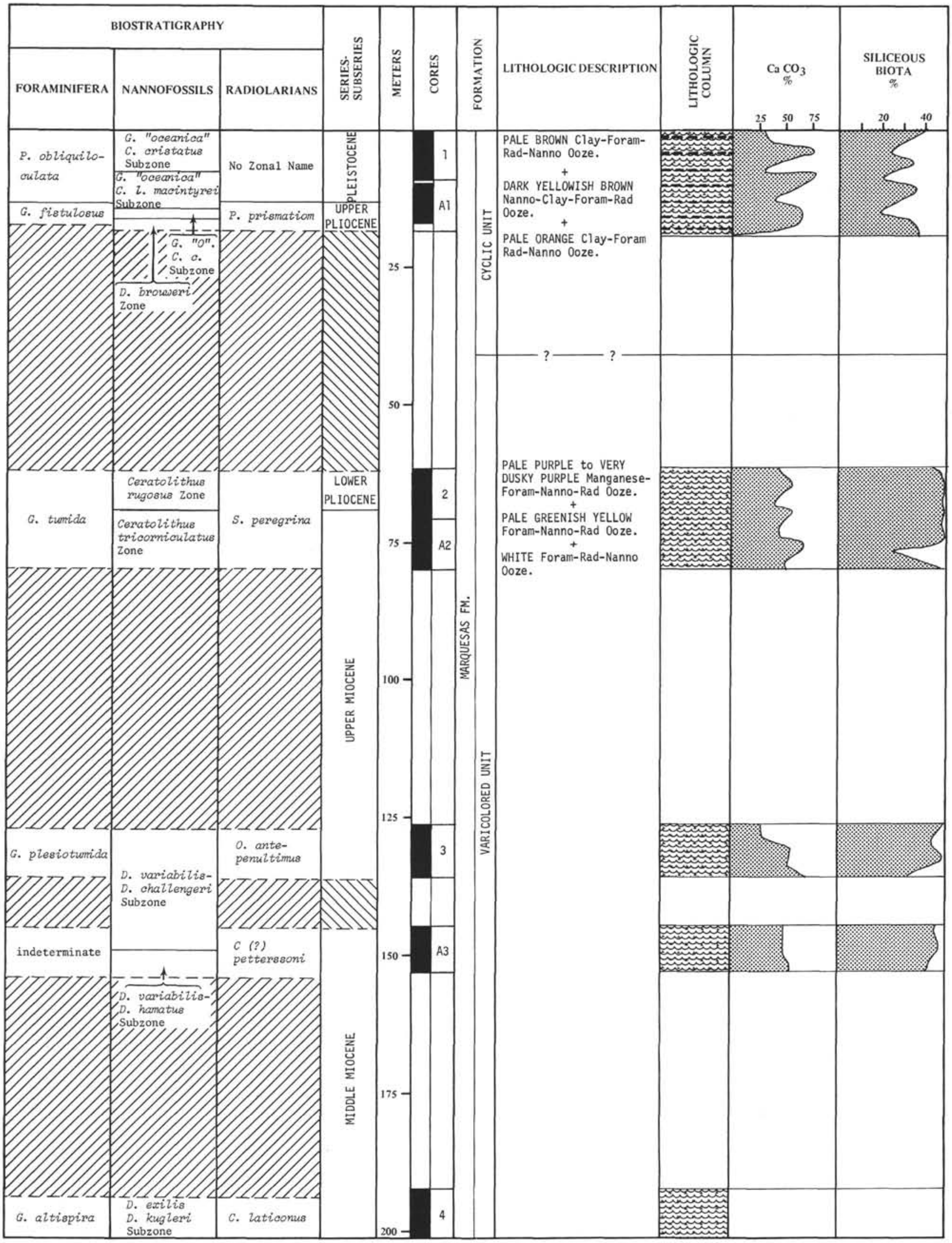


Figure 3. *Site 79 summary.*

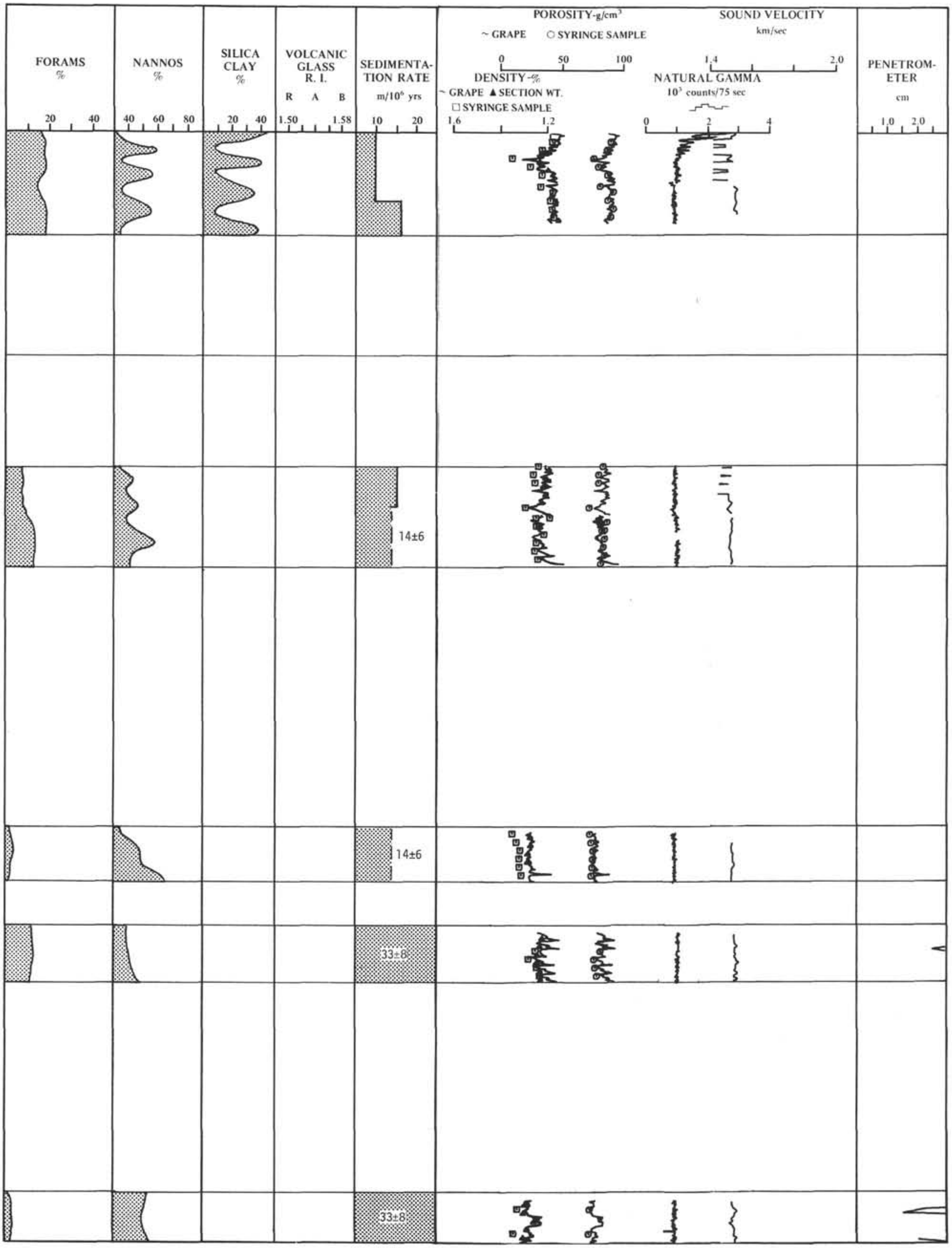


Figure 4. *Site 79 summary.*

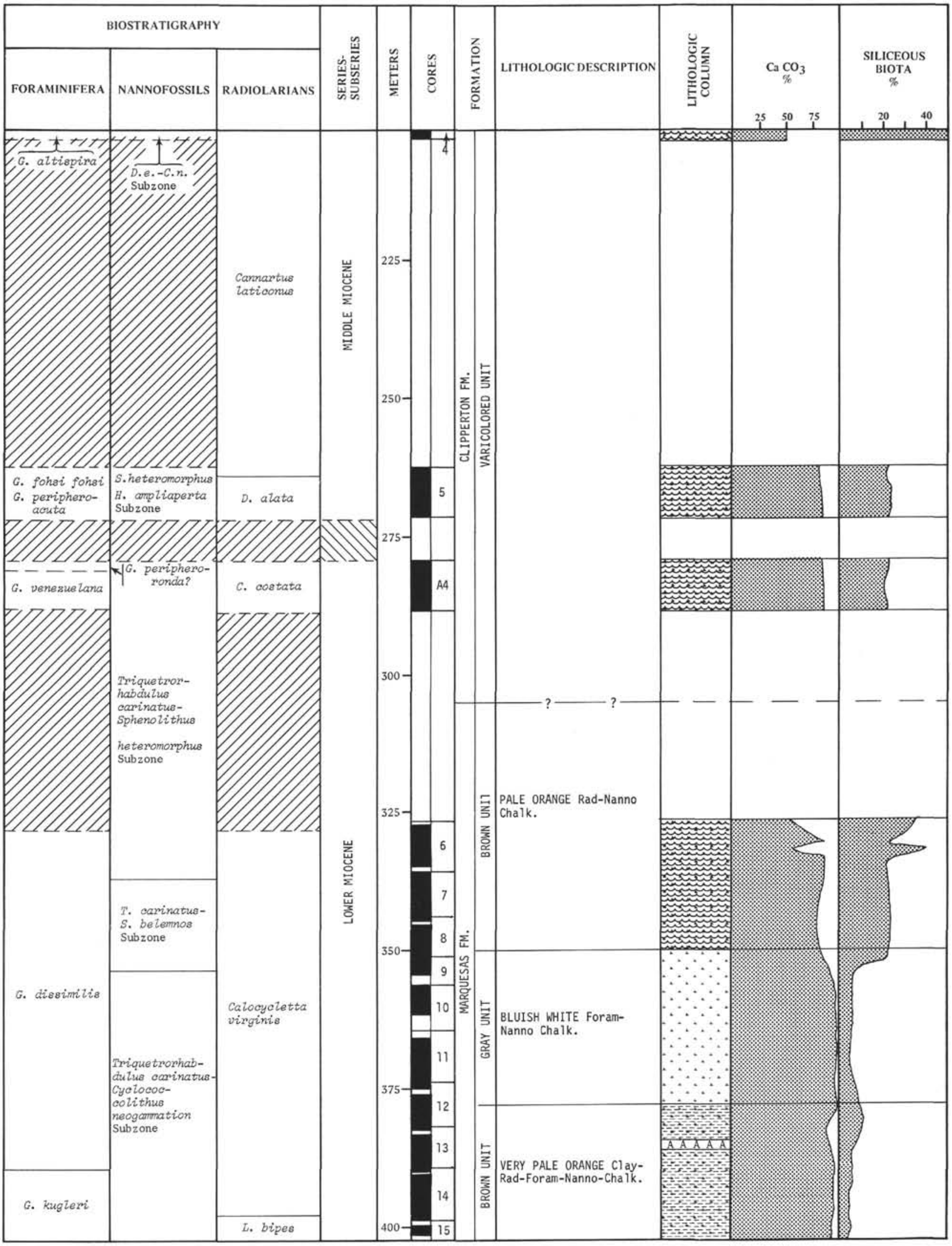


Figure 5. *Site 79 summary (continued).*

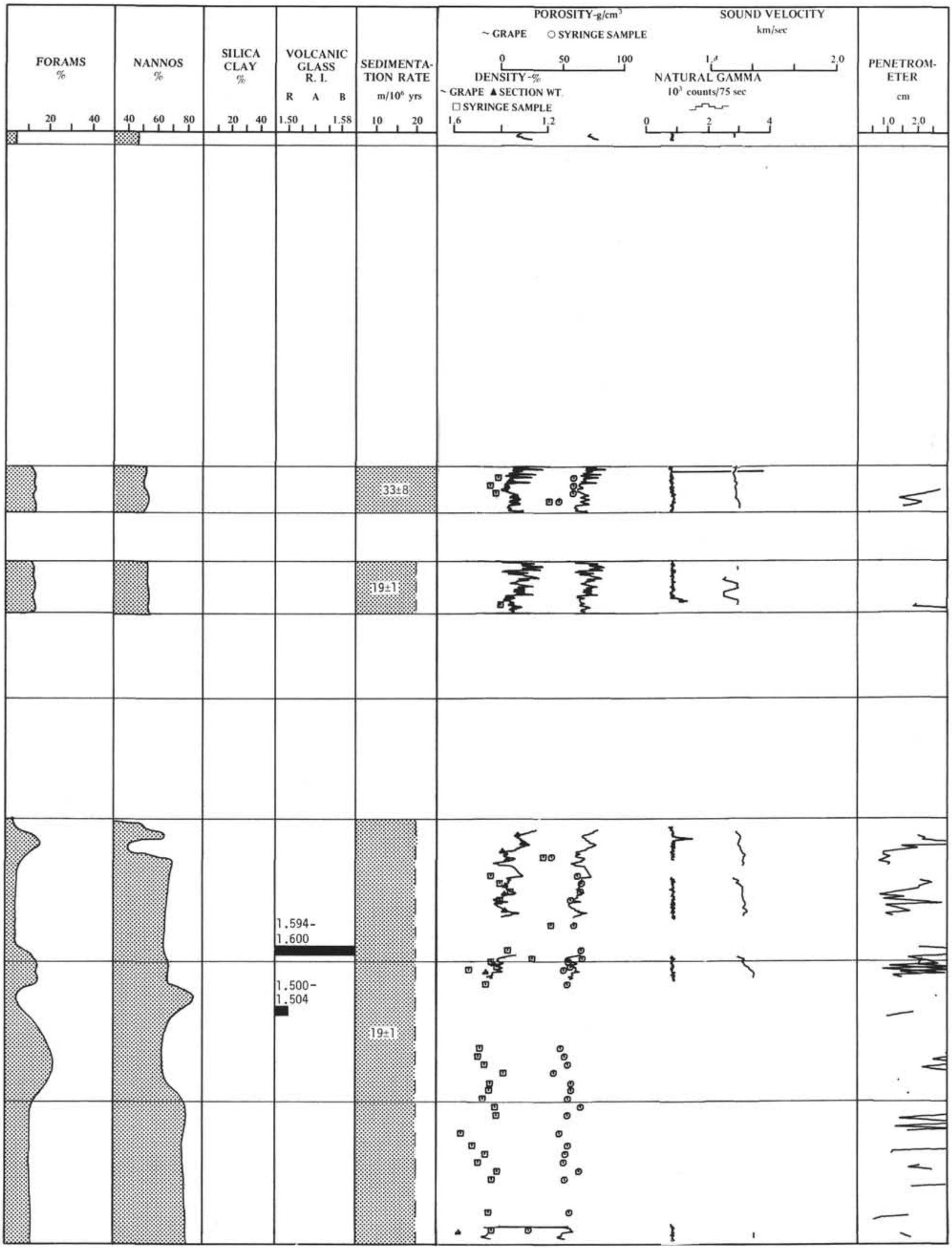


Figure 6. *Site 79 summary (continued).*

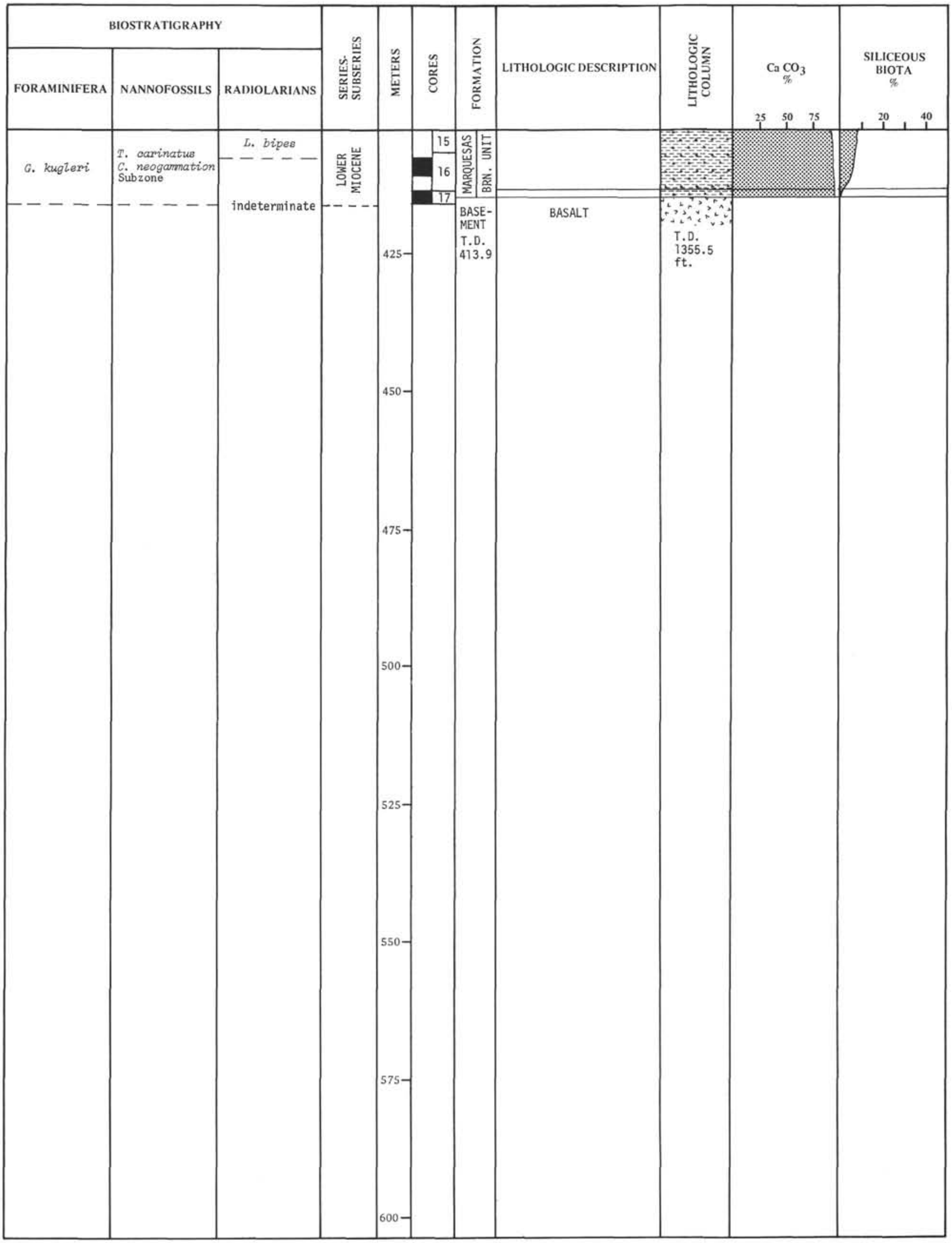


Figure 7. *Site 79 summary (continued).*

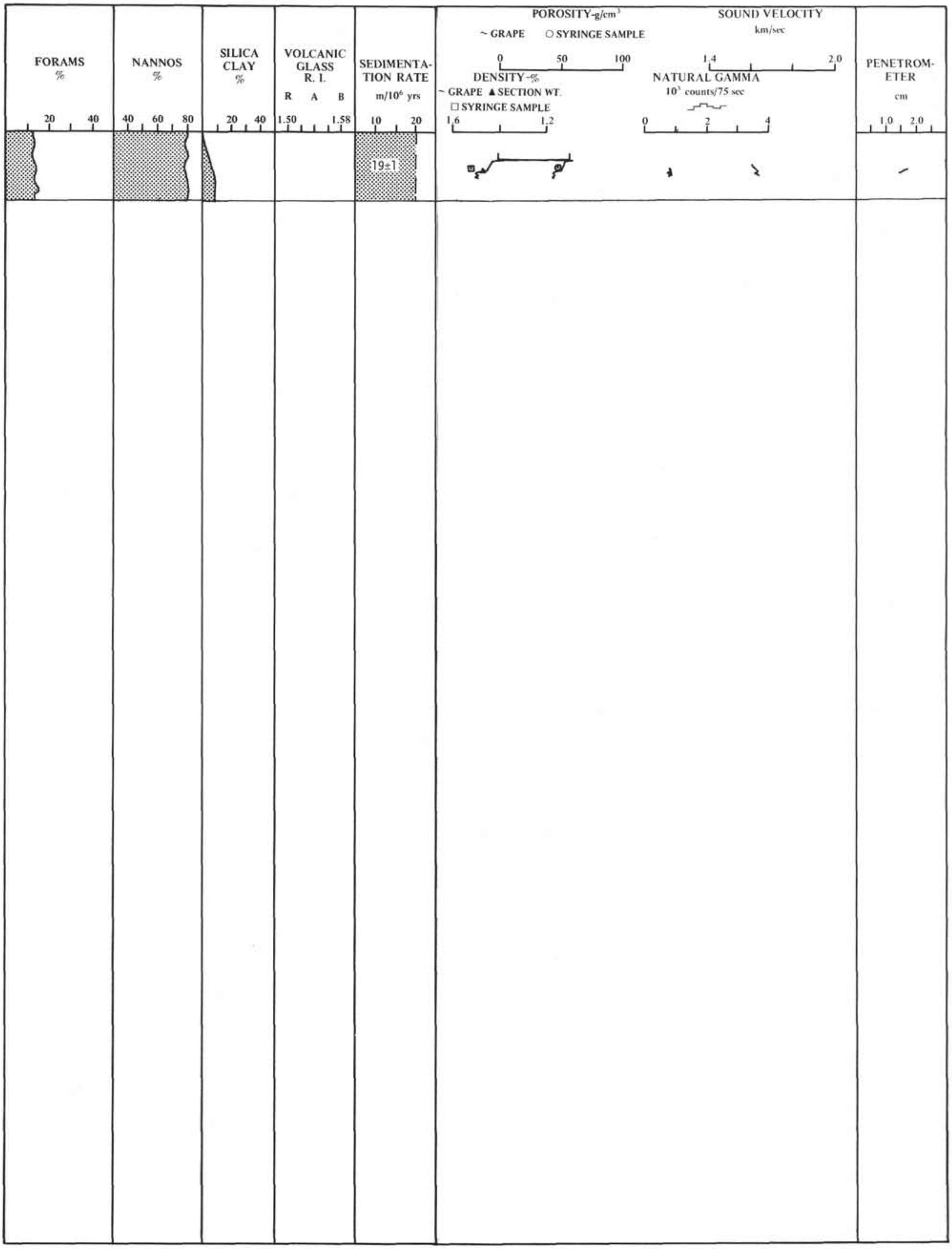


Figure 8. *Site 79 summary (continued).*

TABLE 3
Rates of Sedimentation, Site 79

Geologic Interval	Duration Geologic Interval (m.y.)	Sediment Thickness (meters)	Accumulation Rate ($m/10^6$ yrs)
Pleistocene	1.8	18	10
Pliocene	3.2	51	16
Upper Miocene	5.0	72 ± 30	14 ± 6
Middle Miocene	4.0	133 ± 33	33 ± 8
Lower Miocene (to base of section estimated age 21 ± 1 m.y.)	7.0	137 ± 3	19 ± 1

TABLE 4
Spreading Rates Between Sites 77, 78 and 79

Site	Age of Oldest Sediment $\times 10^6$ yr	Longitude at Site	Degrees of Longitude Between Sites	Distance Between Sites Naut. Miles	Distance Between Sites Kilometers	Difference in Basal Sed Age (m.y.)	Spreading Rate $km/10^6$ yr
77	36	133.1	77-78 = 5.7	352	632	4	155.0
78	33	127.4	78-79 = 5.9	354	651	12	54.2
79	21	121.5	77-79 = 11.6	696	1273	16	79.5

pale orange radiolarian foraminiferal nannofossil-chalk which in turn overlies basement. The oldest unit is of lower Miocene age.

The spot coring at this site has permitted us to determine the depth to various paleontological boundaries and thereby compare the thickness of various units and their rates of accumulation with our previous sites.

Table 3 presents the relevant data. At Site 79 the accumulation rates are about 15 m/m.y., except in the Middle Miocene where they are more than double this rate. One explanation for the high rates indicated in the Middle Miocene part of the section is that the productivity in the Middle Miocene time was much greater than either before or since. This phenomenon was not noted at our previous sites, in fact, at Site 77 the rates in the Middle Miocene, Upper Miocene and Pliocene were uniformly high (18 $m/10^6$ yrs) when compared with the Oligocene and Lower Miocene 9 $m/10^6$ yrs). Another possibility is that some local effect, such as slumping during middle Miocene time, caused these high rates although no extraordinary amount of older mixed fossils was found in this part of the section.

The closest zonal boundary to the base of this site is the top of the *Globorotalia kugleri* planktonic foraminiferal zone at 26 meters above the basalt. The average sedimentation rate in the lower Miocene of this site is about 16 m/m.y. The age of the upper limit of the *G. kugleri* Zone has been estimated as about 20±1 million years B.P. This would put the age of the basal sediments at this site at between 21 and 22 million years B.P.

If we assume that the time lines in the basement are perpendicular to the major fracture zones in the region (Clipperton, Clarion, etc) roughly north-south, then it is possible to compare the age of the sediments immediately overlying basement at the sites drilled so far and calculate the rate of sea-floor spreading between these sites. Table 4 presents the pertinent data.

Using the ages of the oldest sediment at Sites 77 and 79 and the distance between these sites gives a spreading rate of 79.5 km/m.y. The spreading rates between Sites 77 and 78 and between Sites 78 and 79 are very different. Site 78 is north of the Clipperton Fracture Zone and the age of its oldest sediment relative to the distance between it and the longitude lines of Sites 77 and 79 suggest this site has undergone a right lateral displacement relative to Sites 77 and 79 of about 380 kilometers.

REFERENCE

Ewing, J., Ewing, M., Aitken, T. and Ludwig, W. J., 1968. North Pacific sediment layers measured by seismic profiling. **In** The Crust and upper mantle of the Pacific area. Knopoff, L., Drake, C. L. and Hart, P. J. (Eds.), *Am. Geophys. Union, Geophys. Mon. 12.* 147.

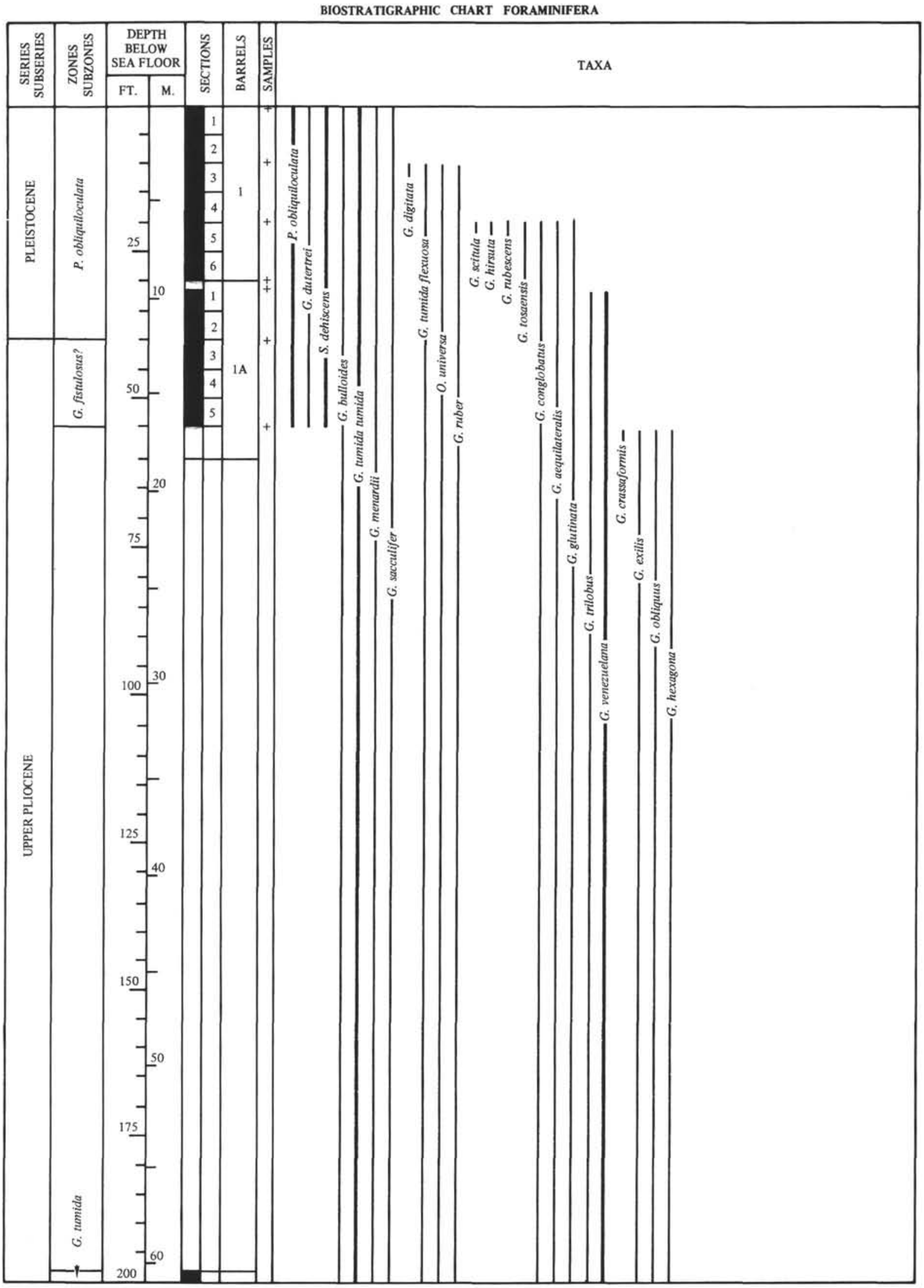


Figure 9. *Site 79 Biostratigraphic Chart Foraminifera (0 to 200 feet).*

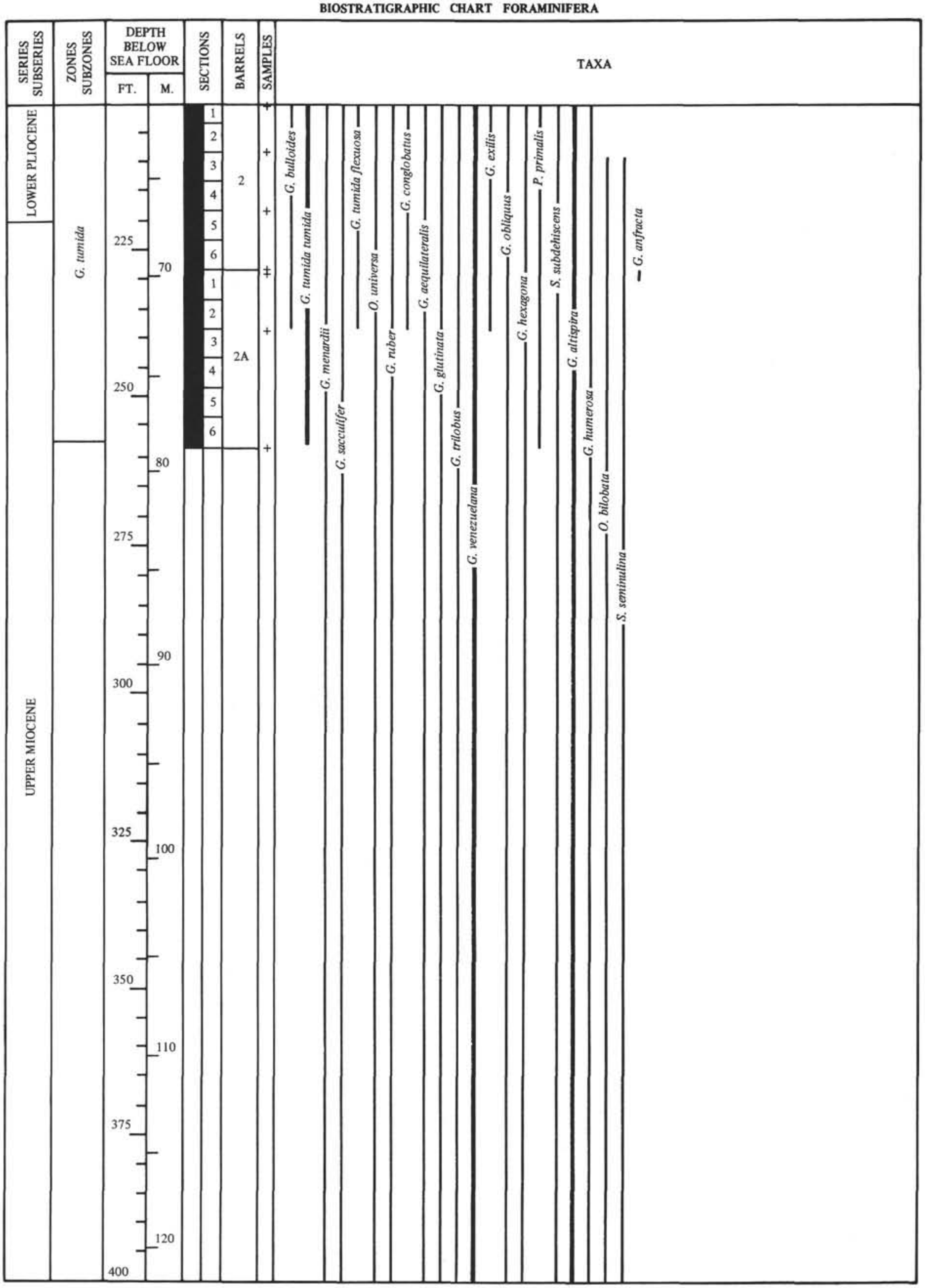


Figure 10. *Site 79 Biostratigraphic Chart Foraminifera (200 to 400 feet).*

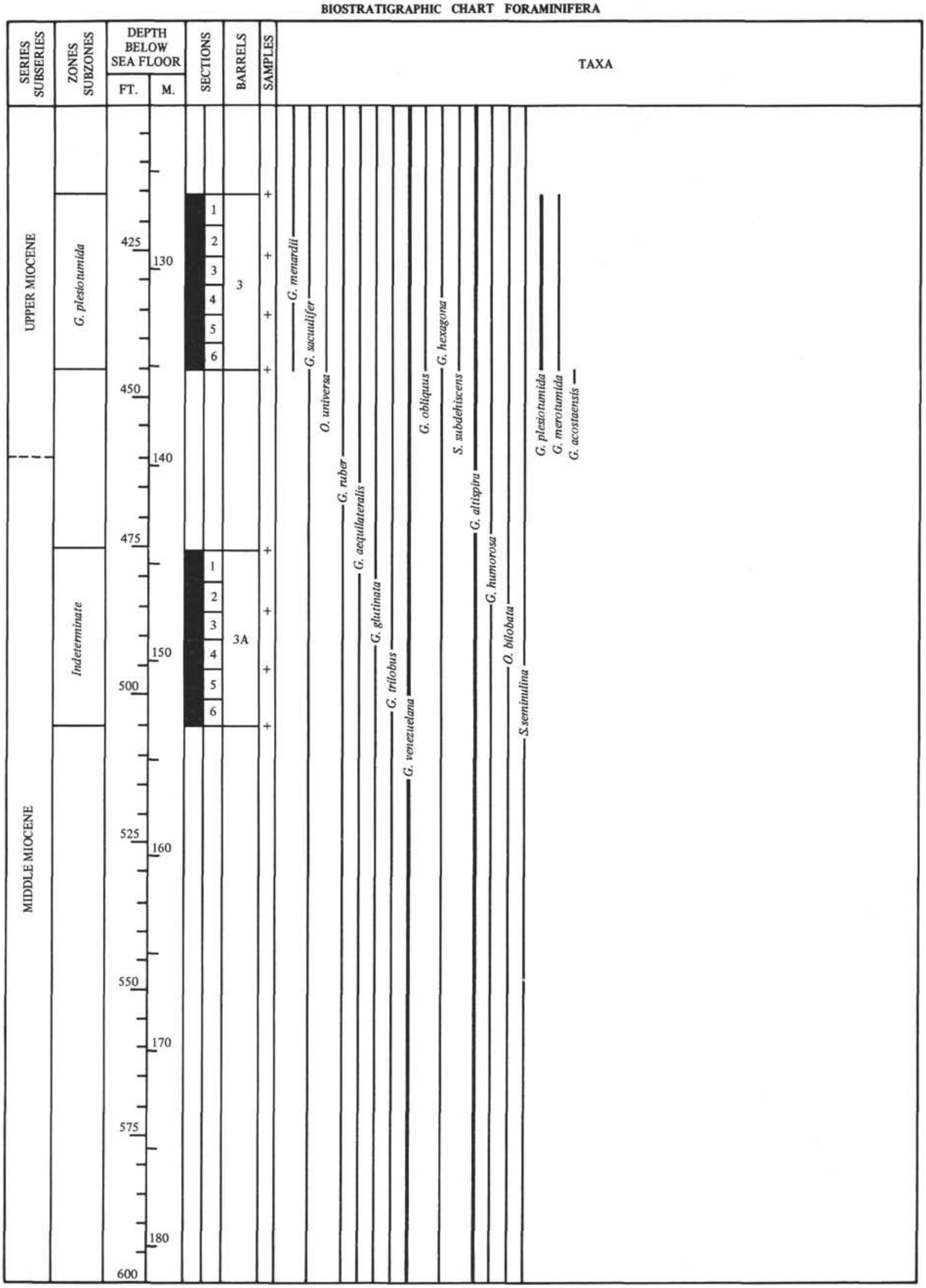


Figure 11. *Site 79 Biostratigraphic Chart Foraminifera (400 to 600 feet).*

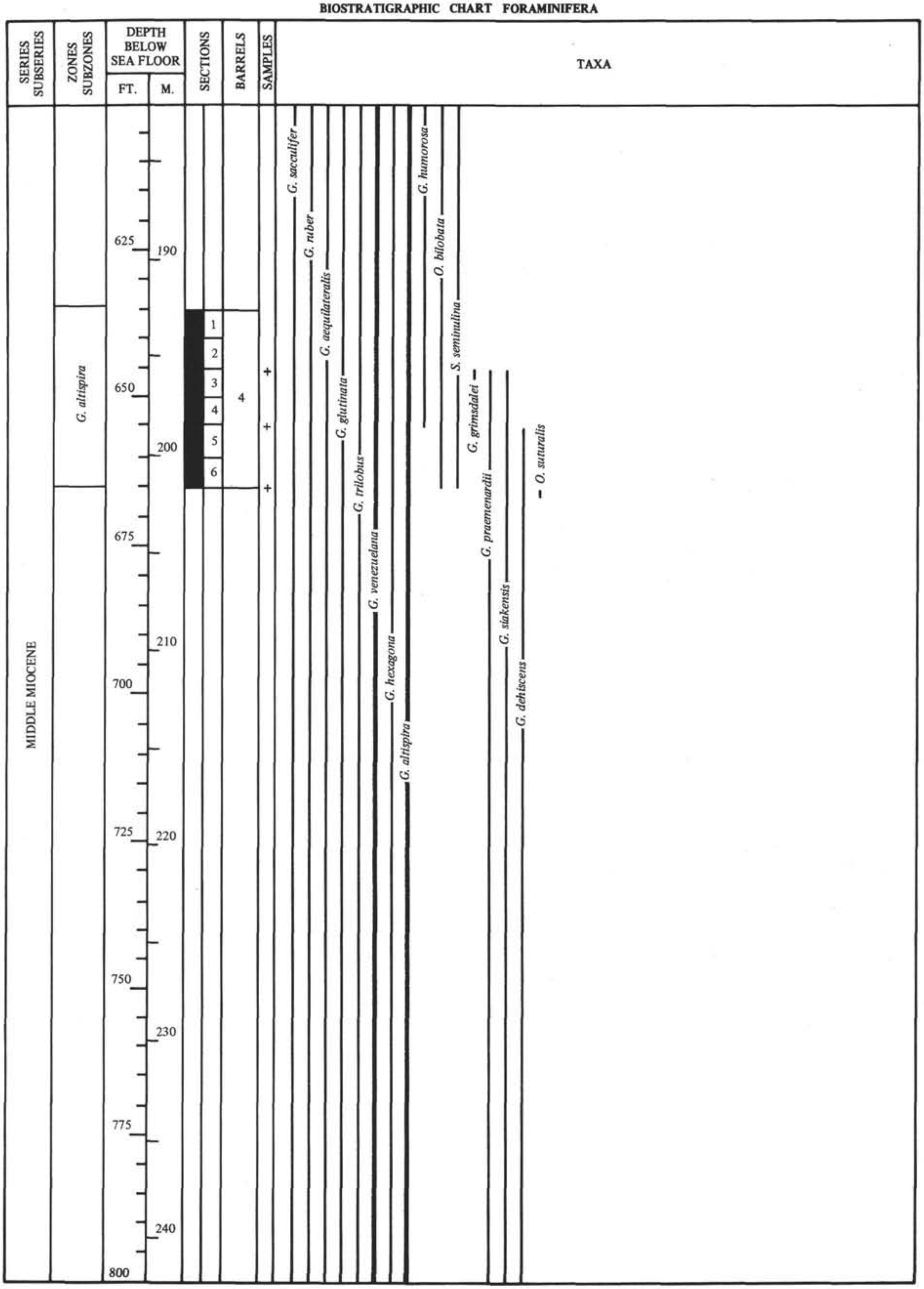


Figure 12. *Site 79 Biostratigraphic Chart Foraminifera (600 to 800 feet).*

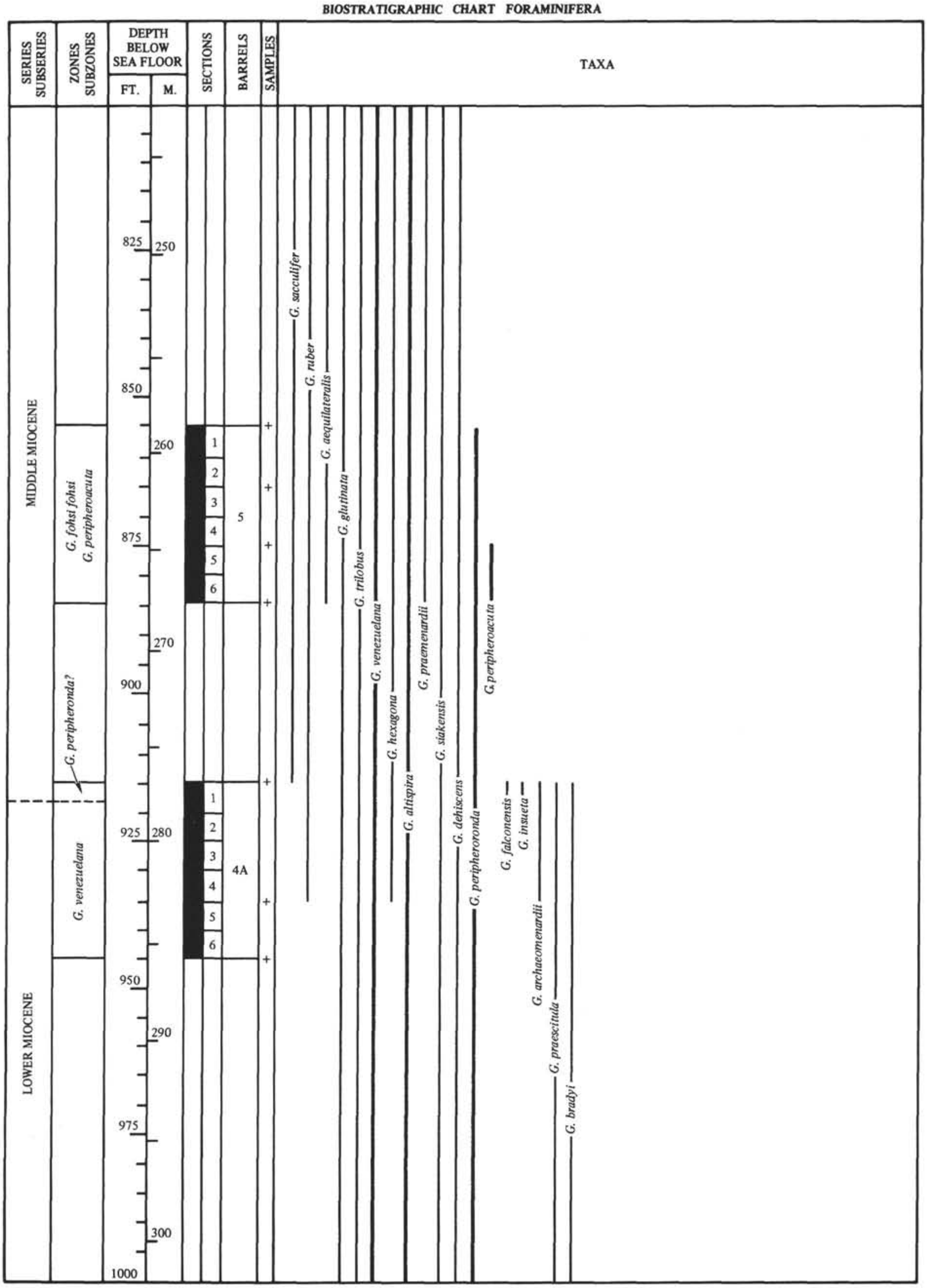


Figure 13. *Site 79 Biostratigraphic Chart Foraminifera (800 to 1000 feet).*

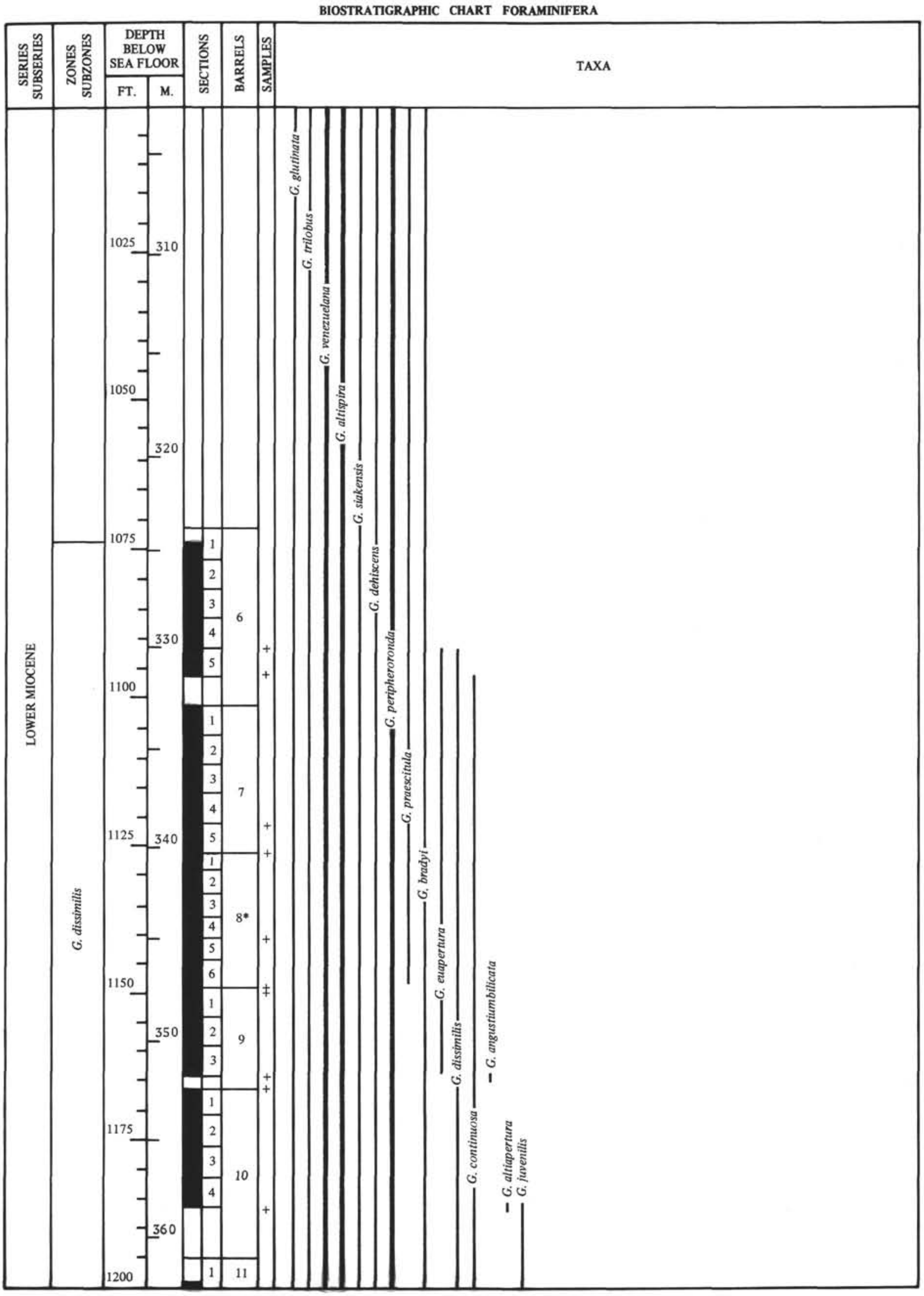


Figure 14. *Site 79 Biostratigraphic Chart Foraminifera (1000 to 1200 feet).*

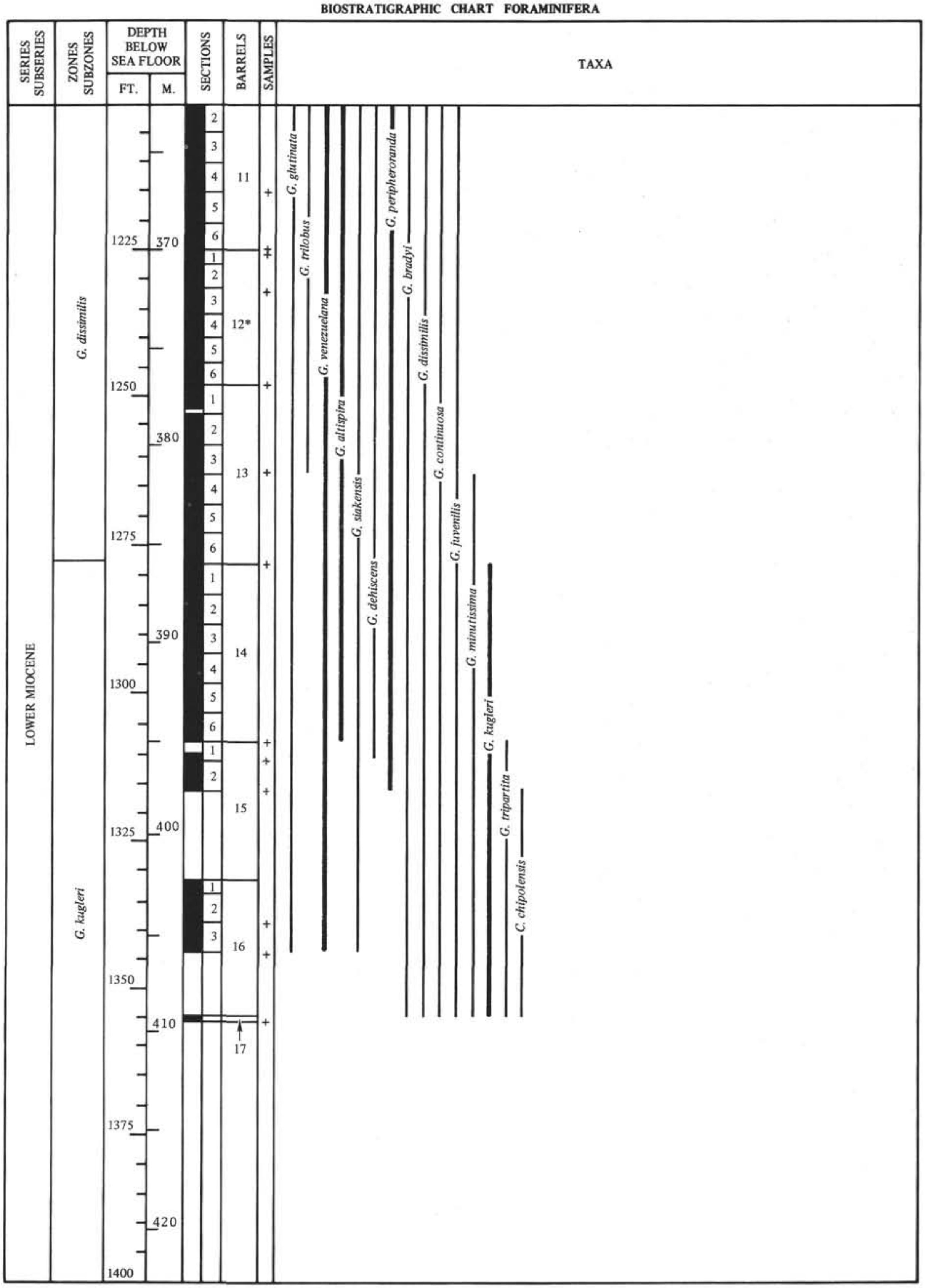


Figure 15. *Site 79 Biostratigraphic Chart Foraminifera (1200 to 1400 feet).*

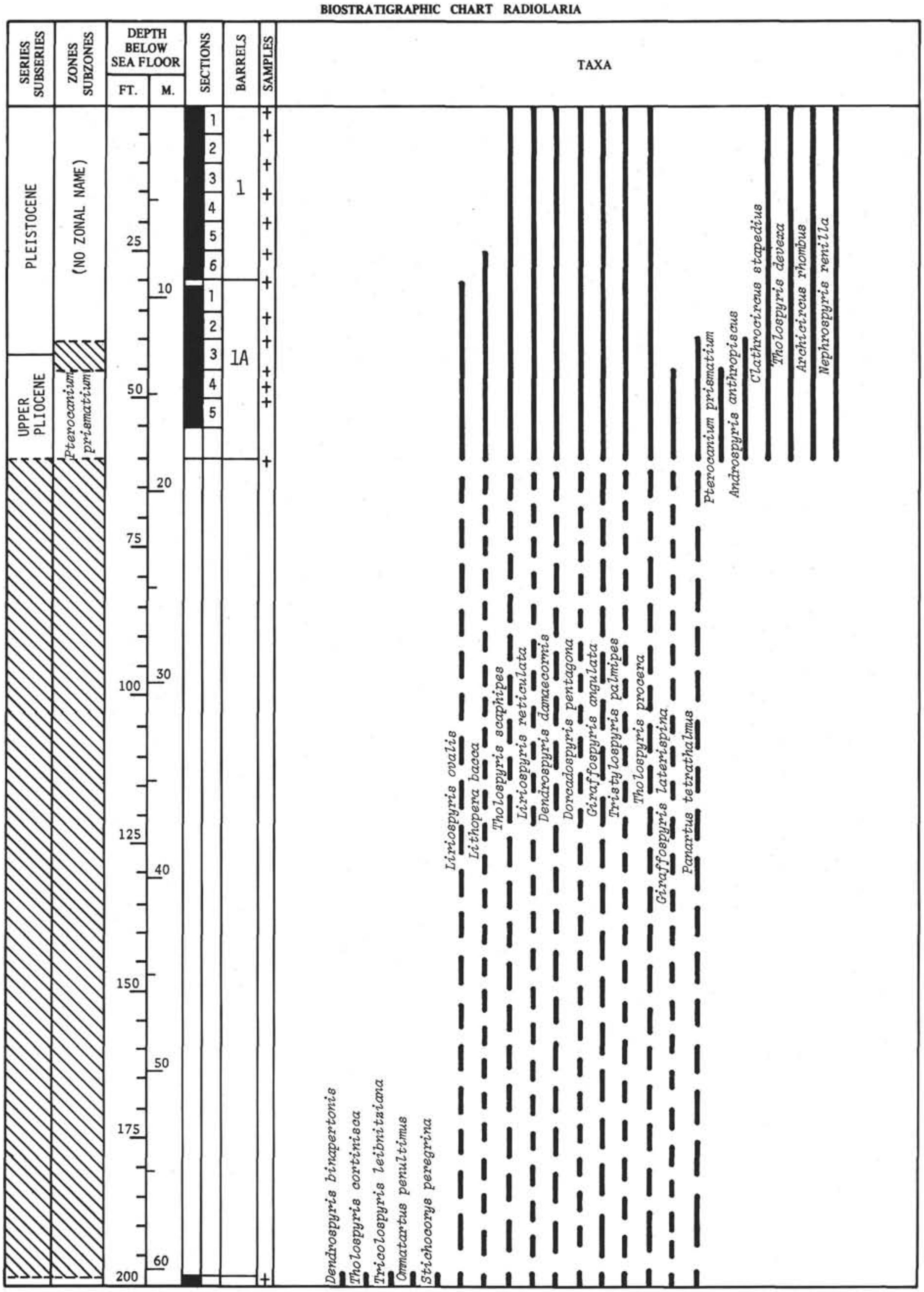


Figure 16. *Site 79 Biostratigraphic Chart Radiolaria (0 to 200 feet).*

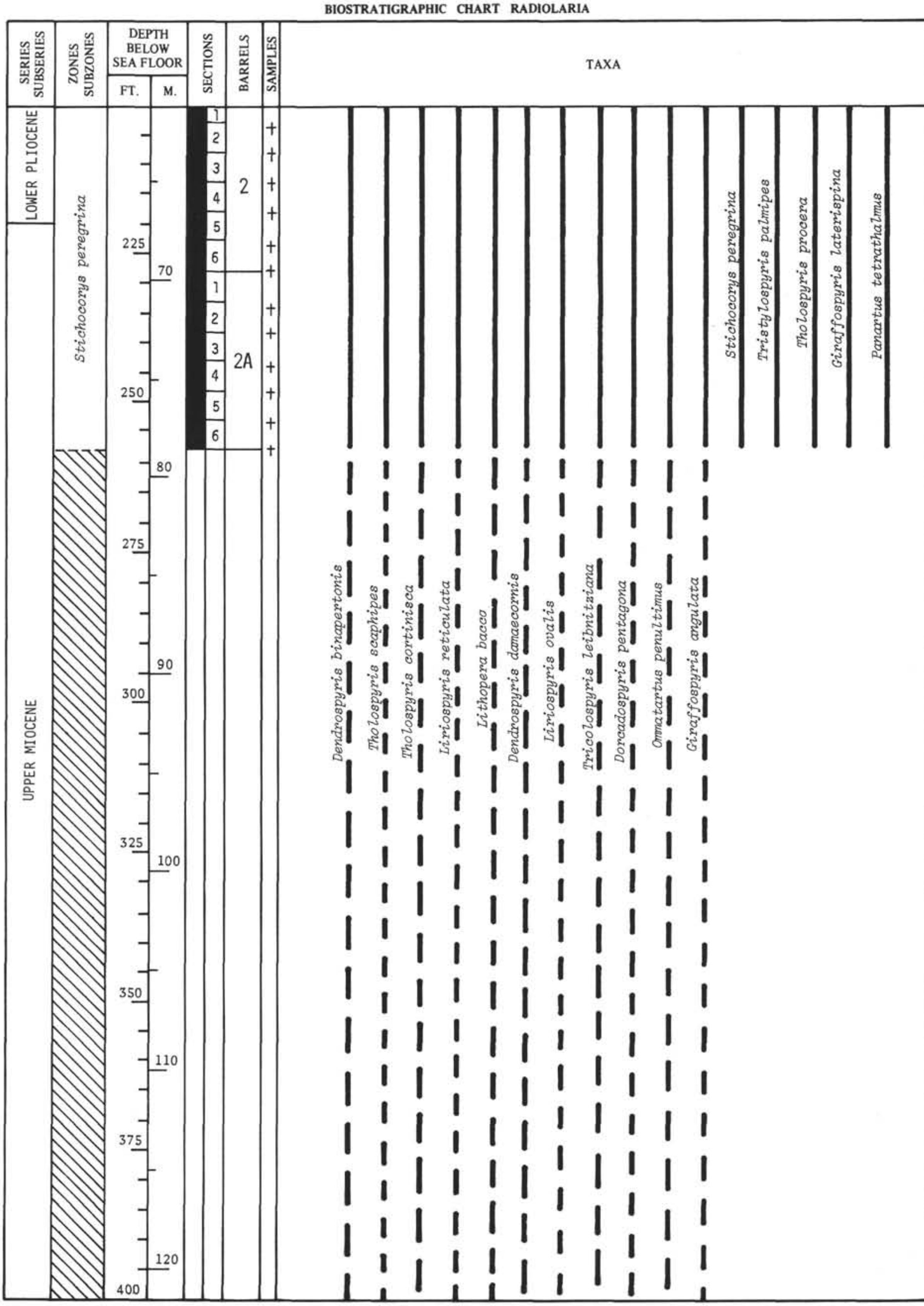


Figure 17. *Site 79 Biostratigraphic Chart Radiolaria (200 to 400 feet).*

BIOSTRATIGRAPHIC CHART RADIOLARIA

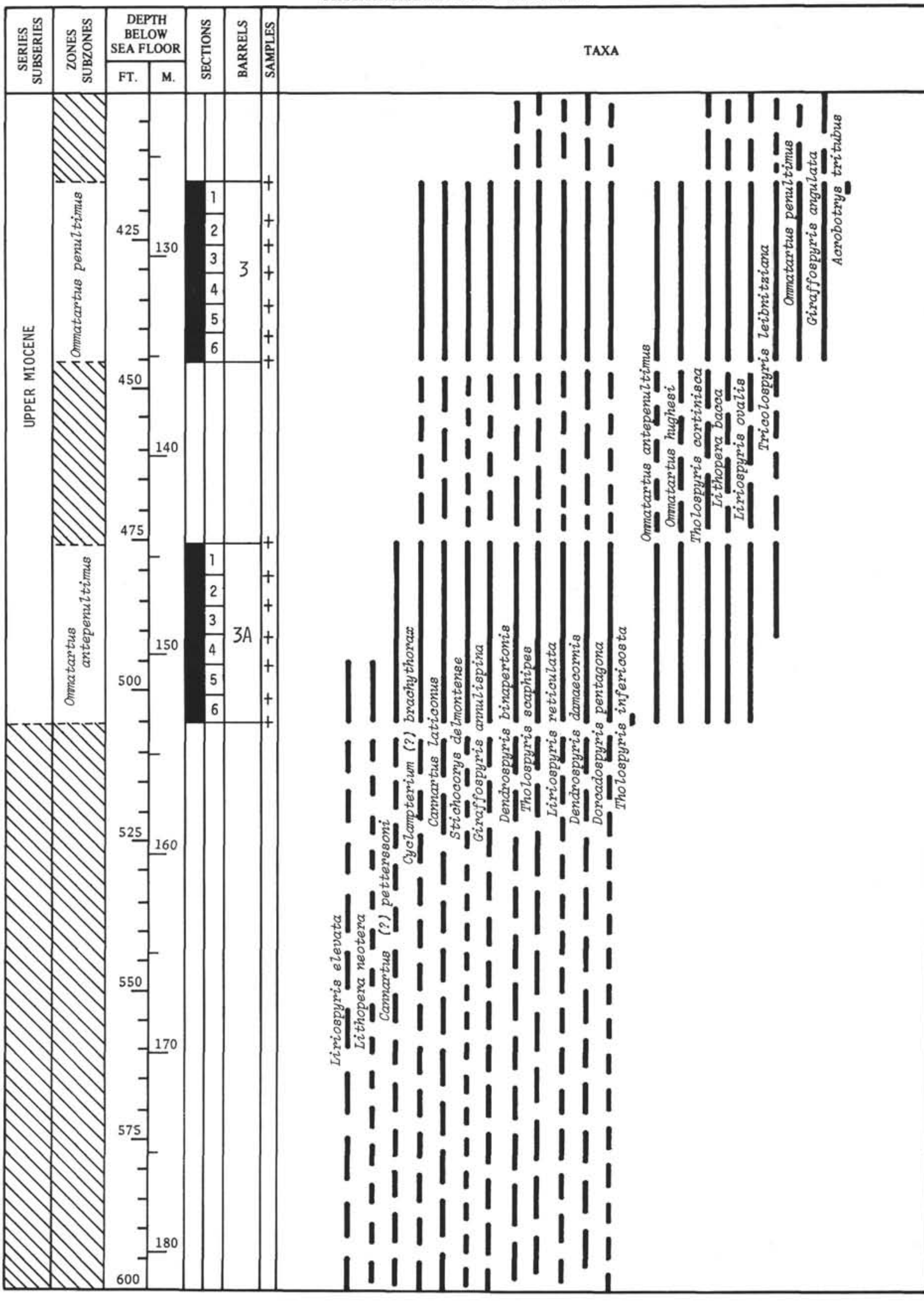


Figure 18. *Site 79 Biostratigraphic Chart Radiolaria (0 to 200 feet).*

BIOSTRATIGRAPHIC CHART RADIOLARIA

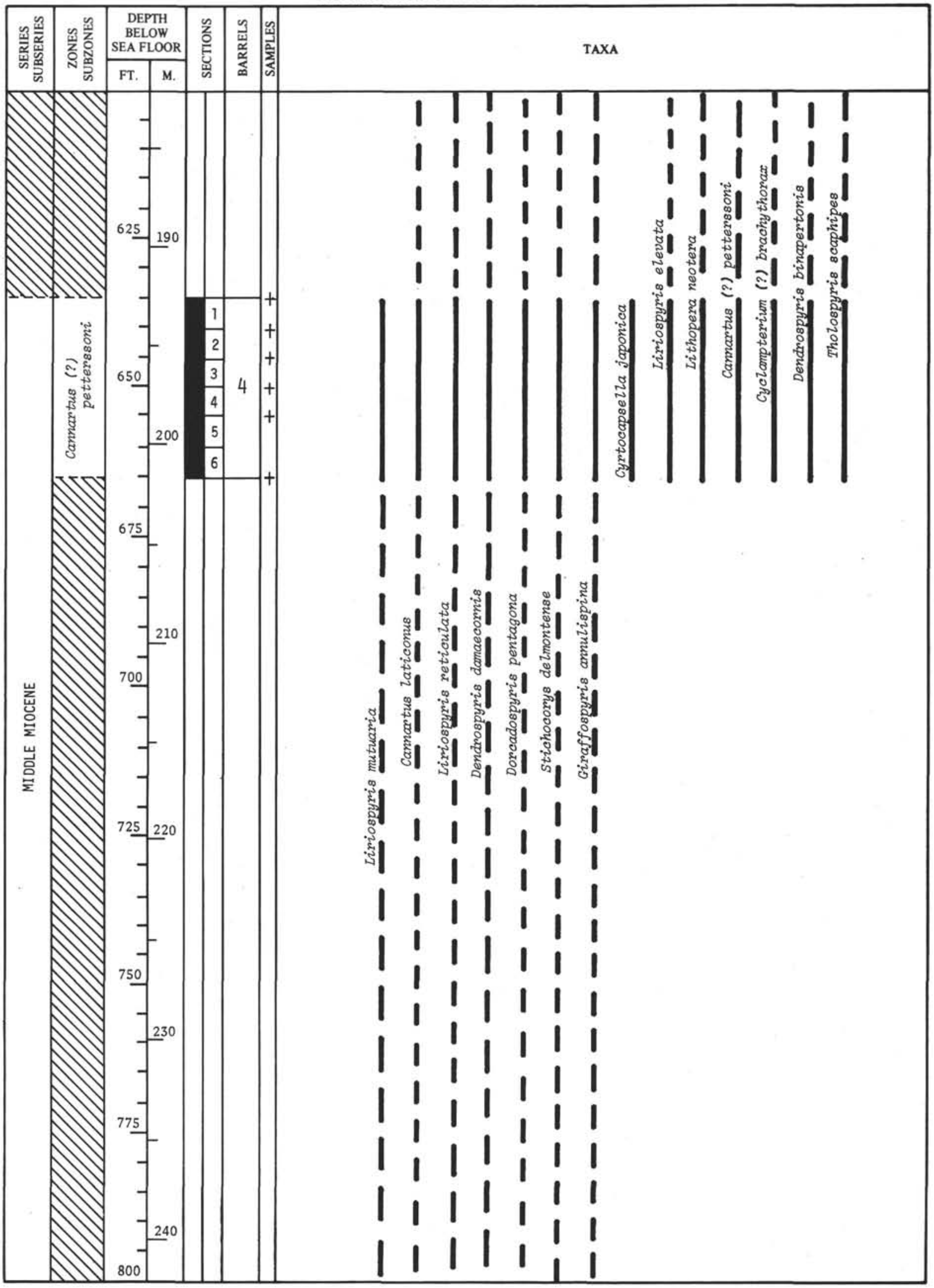


Figure 19. *Site 79 Biostratigraphic Chart Radiolaria (600 to 800 feet).*

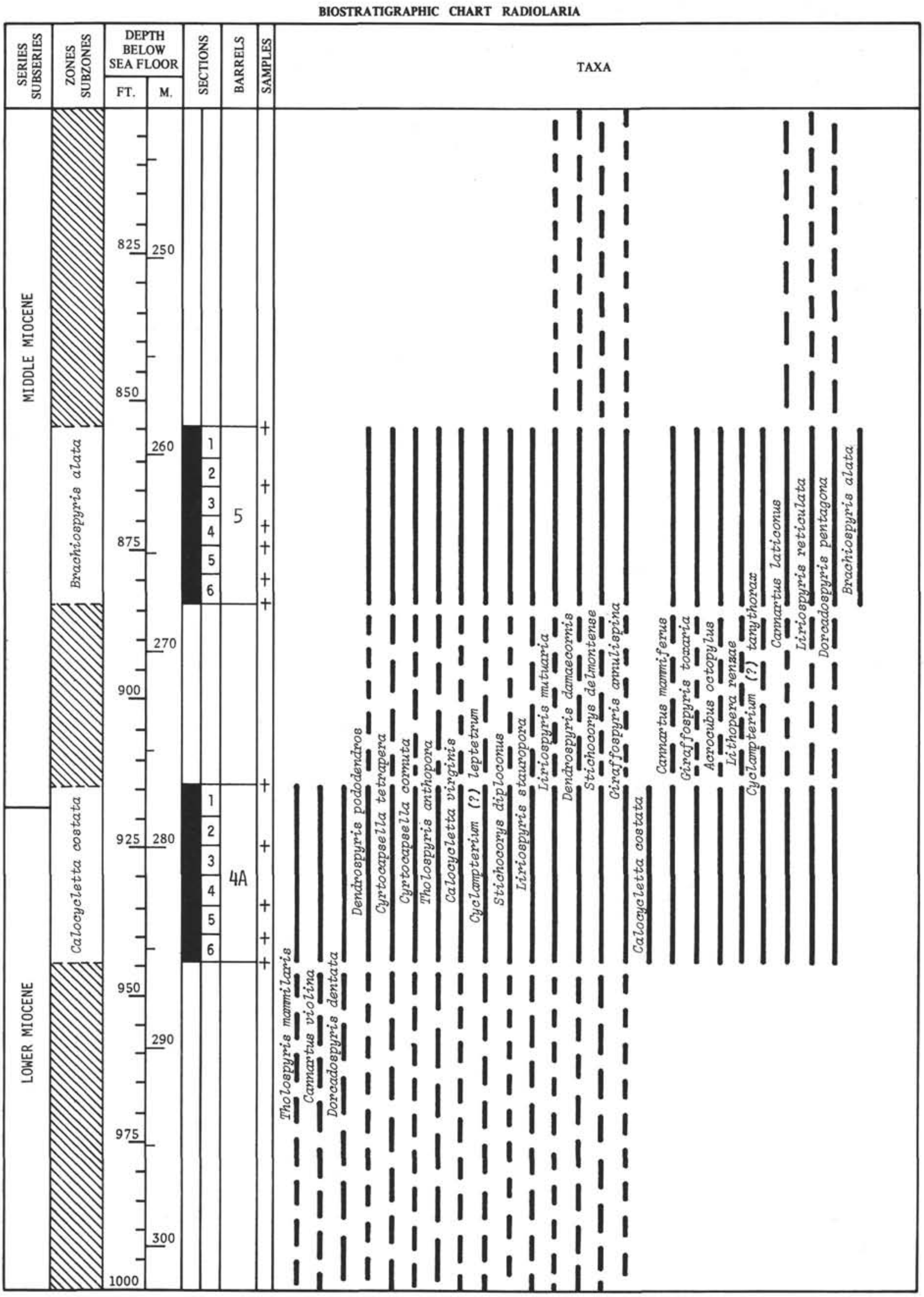


Figure 20. *Site 79 Biostratigraphic Chart Radiolaria (800 to 1000 feet).*

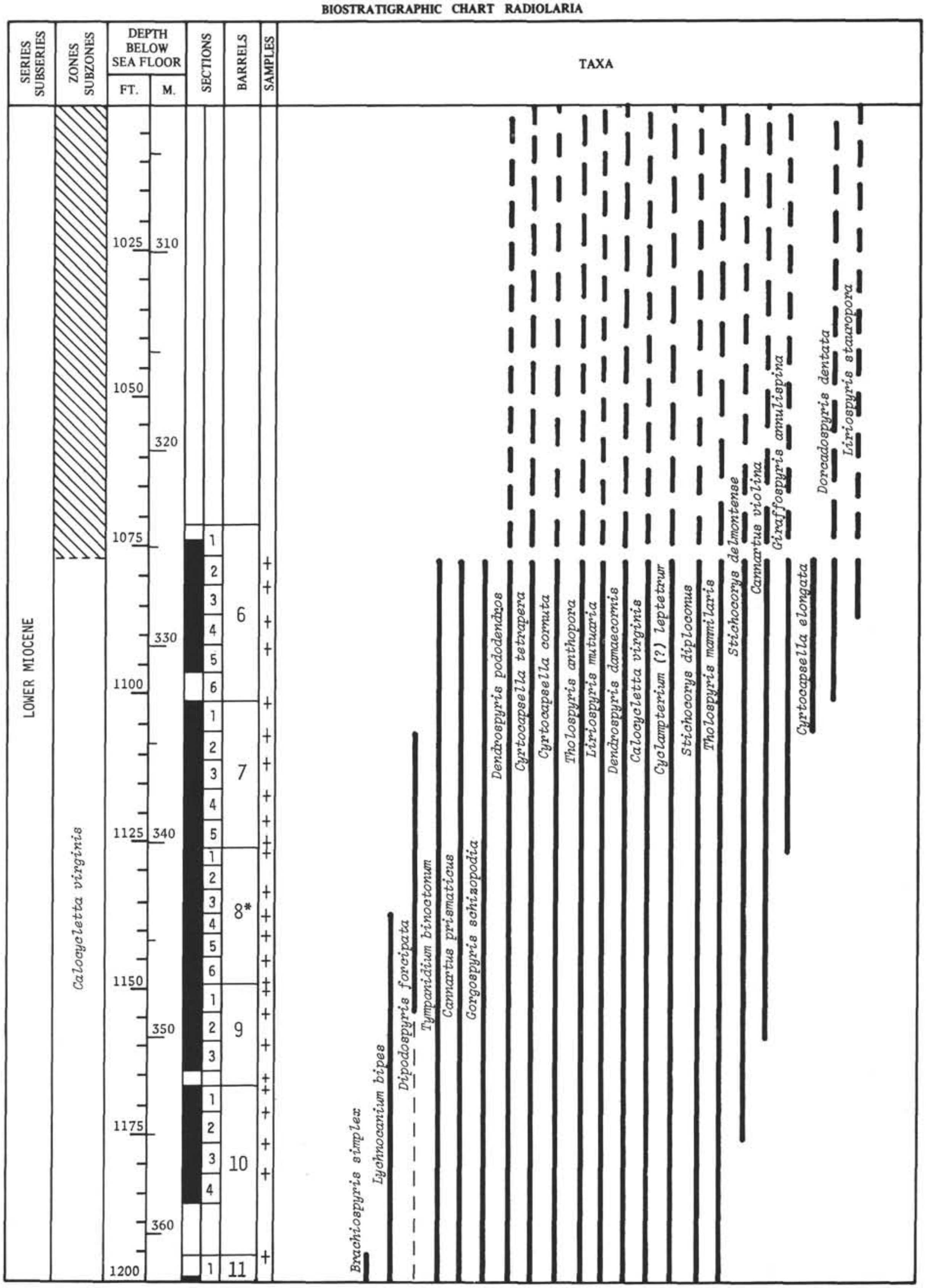


Figure 21. *Site 79 Biostratigraphic Chart Radiolaria (1000 to 1200 feet).*

BIOSTRATIGRAPHIC CHART RADIOLARIA

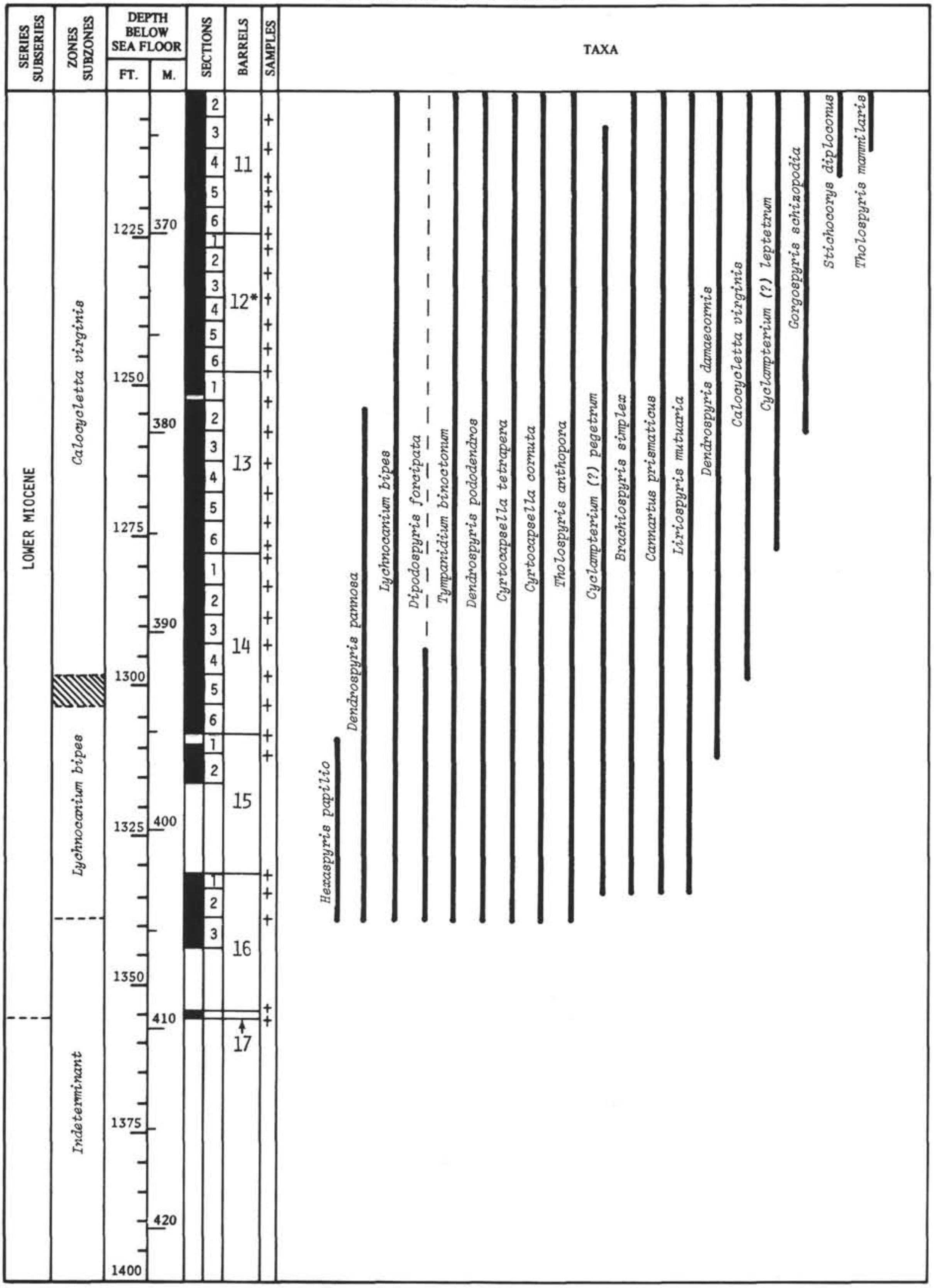


Figure 22. *Site 79 Biostratigraphic Chart Radiolaria (1200 to 1400 feet).*

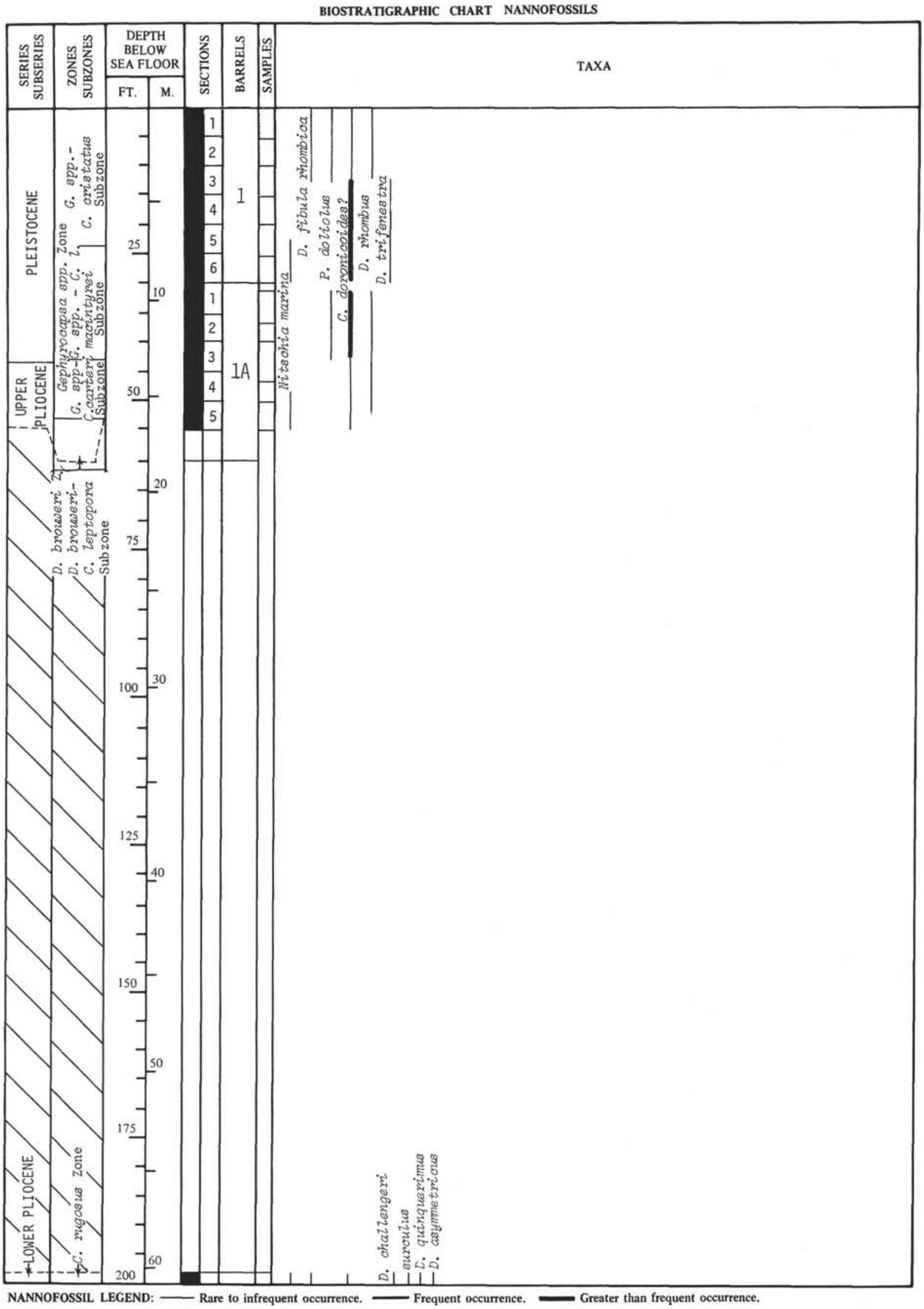
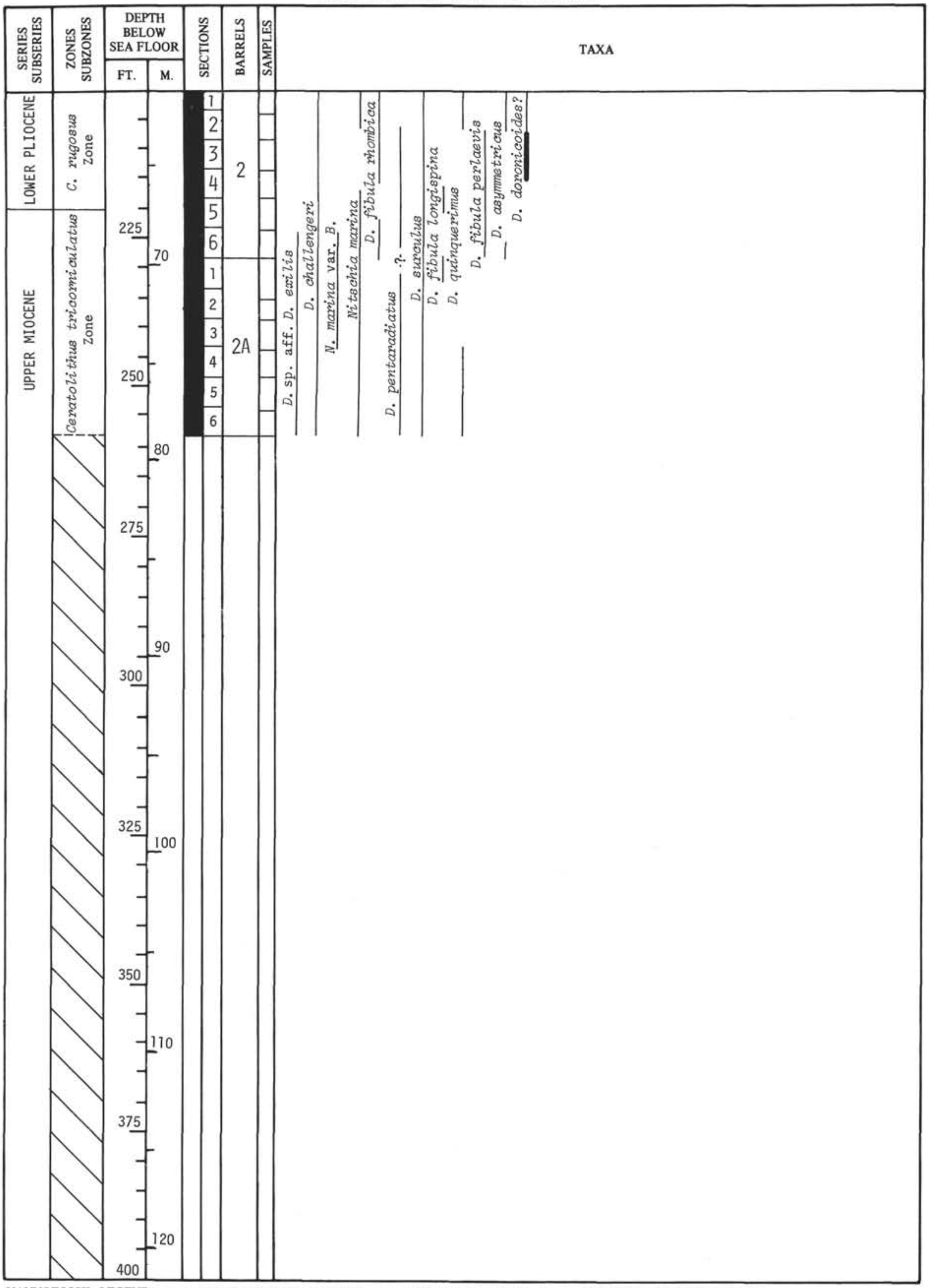


Figure 23. *Site 79 Biostratigraphic Chart Nannofossils (0 to 200 feet).*

BIOSTRATIGRAPHIC CHART NANNOFOSSILS



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

Figure 24. *Site 79 Biostratigraphic Chart Nannofossils (200 to 400 feet).*

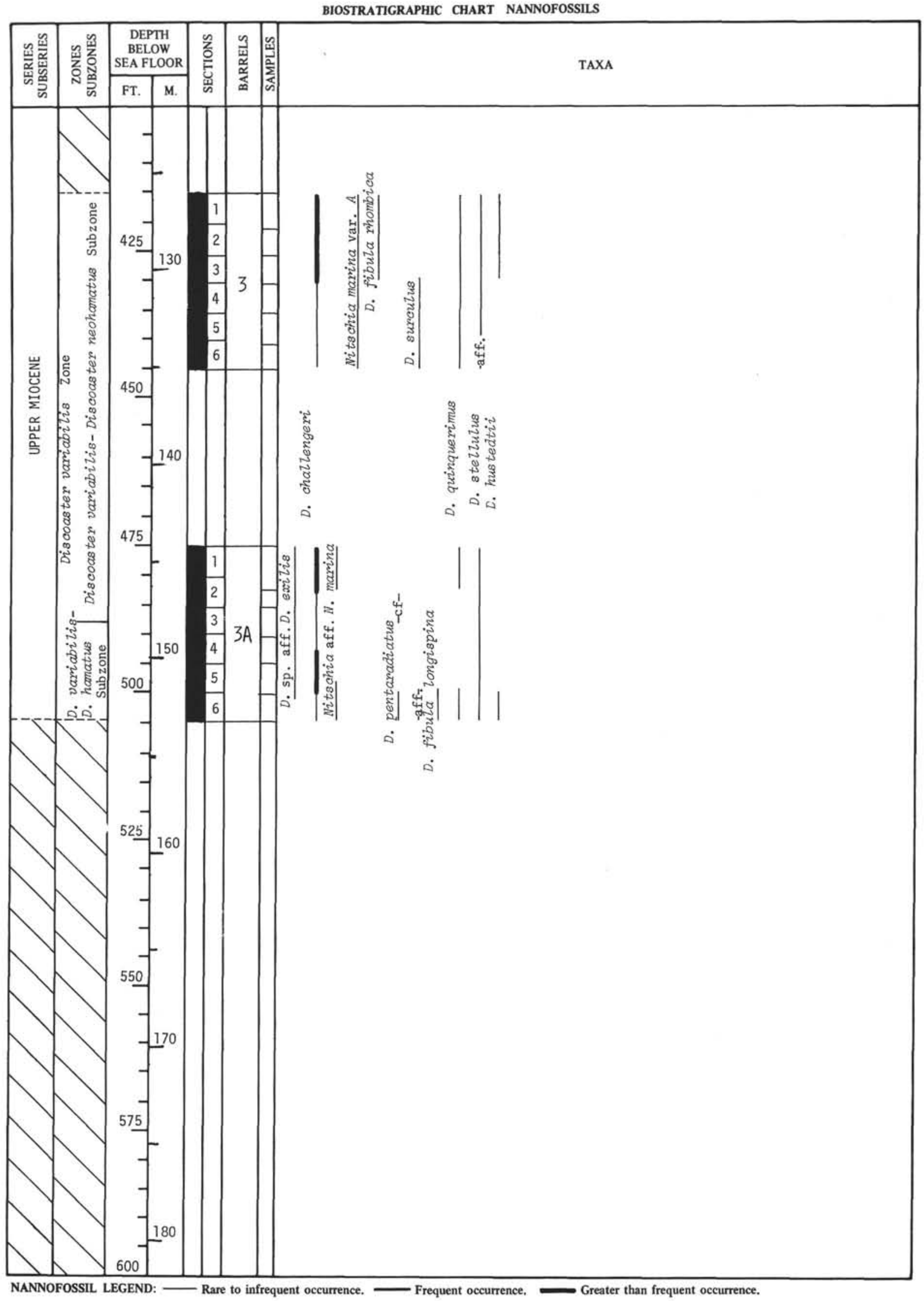
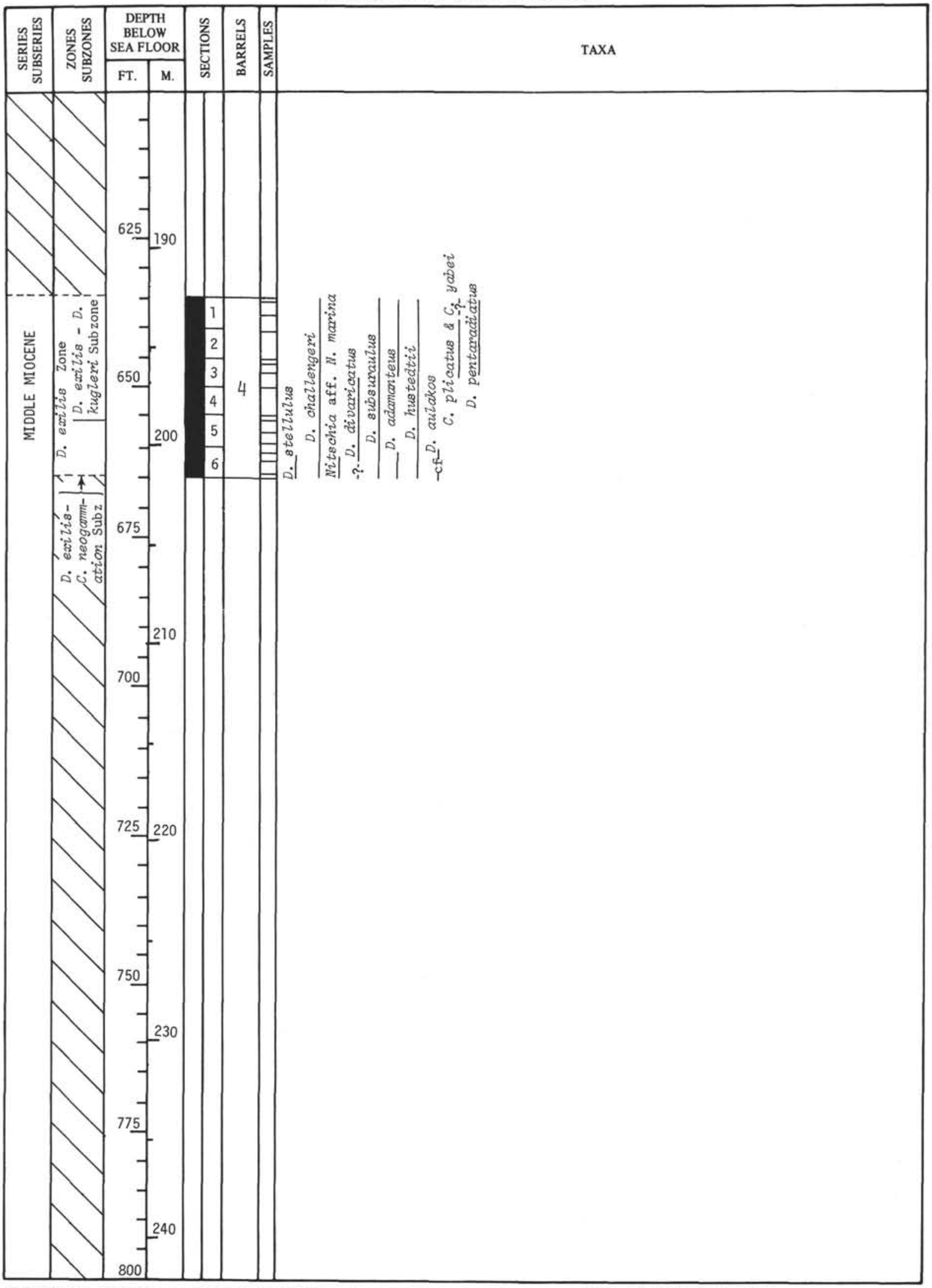


Figure 25. *Site 79 Biostratigraphic Chart Nannofossils (400 to 600 feet).*

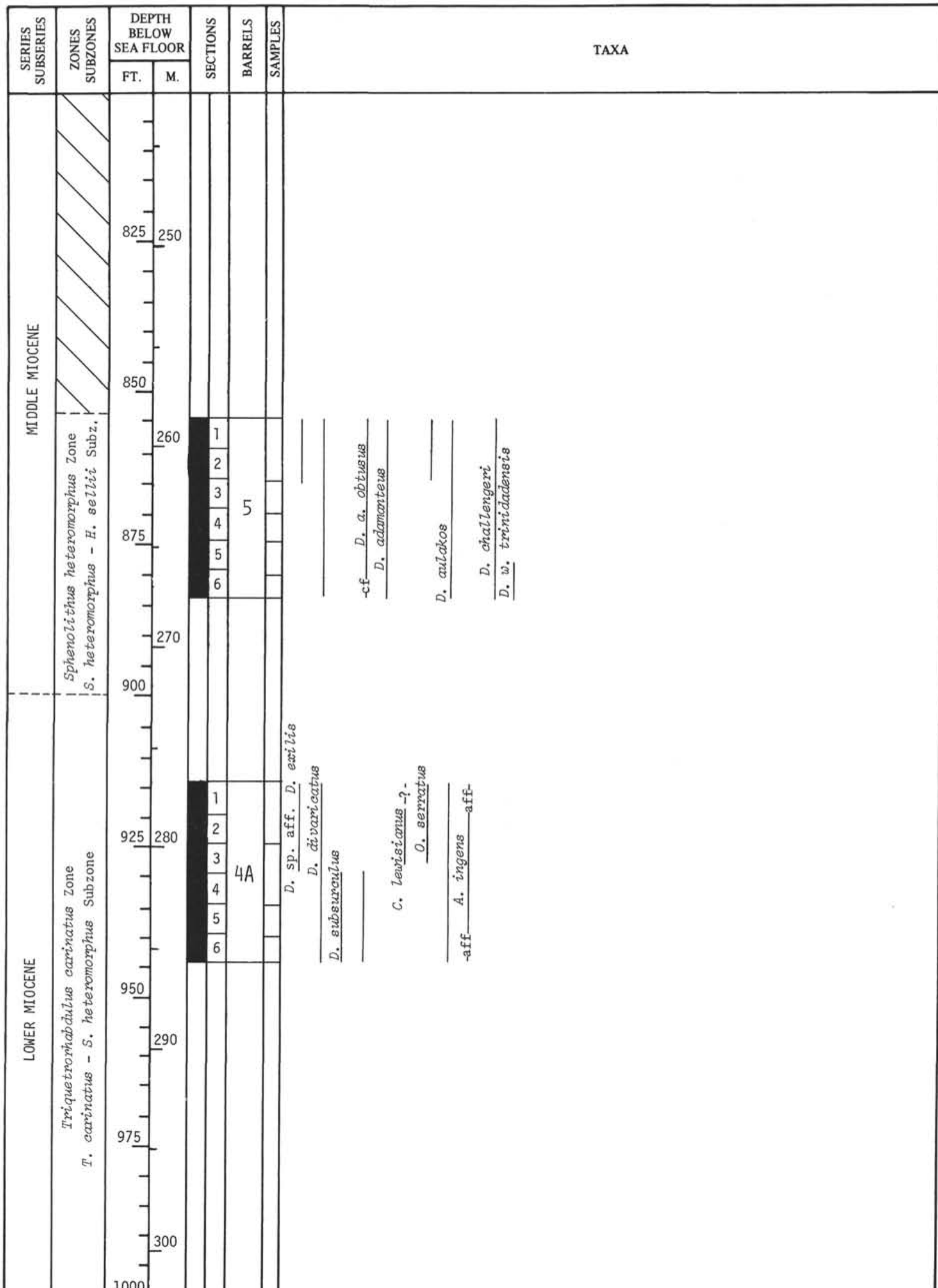
BIOSTRATIGRAPHIC CHART NANNOFOSSILS



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

Figure 26. *Site 79 Biostratigraphic Chart Nannofossils (600 to 800 feet).*

BIOSTRATIGRAPHIC CHART NANNOFOSSILS



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

Figure 27.: *Site 79 Biostratigraphic Chart Nannofossils *800 to 1000 feet).*

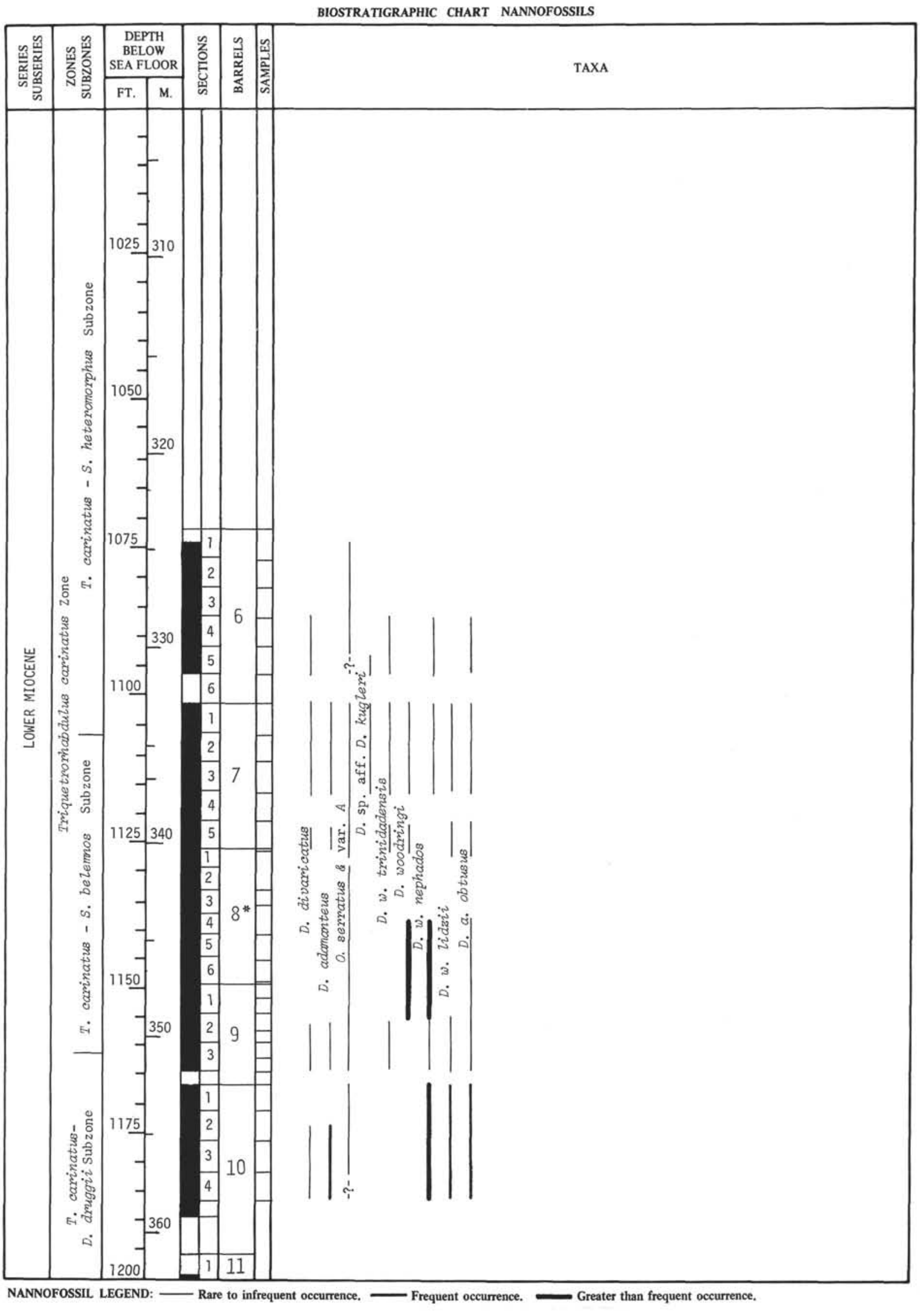
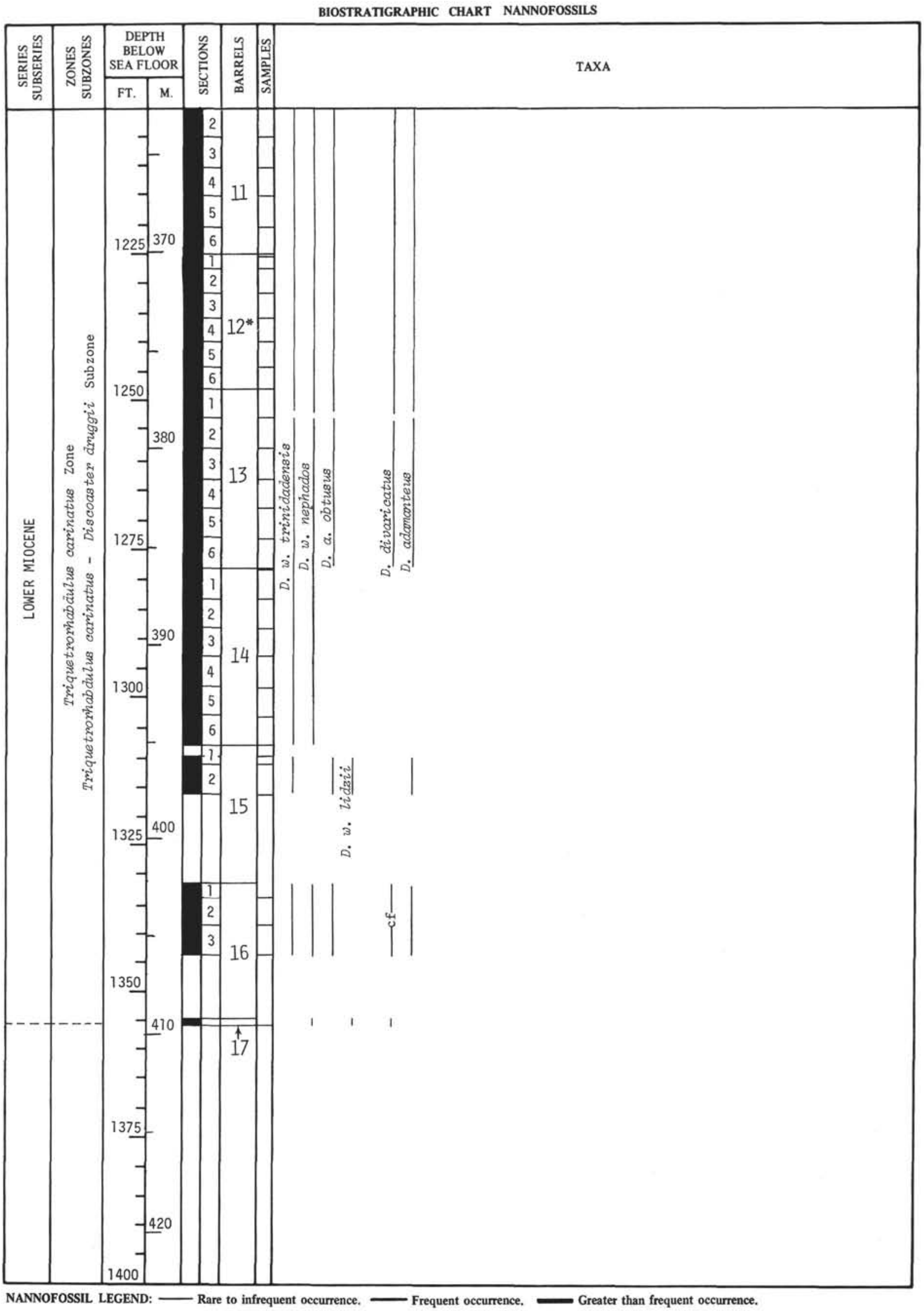


Figure 28. *Site 79 Biostratigraphic Chart Nannofossils (1000 to 1200 feet).*



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

Figure 29. *Site 79 Biostratigraphic Chart Nannofossils (1200 to 1400 feet).*

BIOSTRATIGRAPHIC COMPARISON CHART

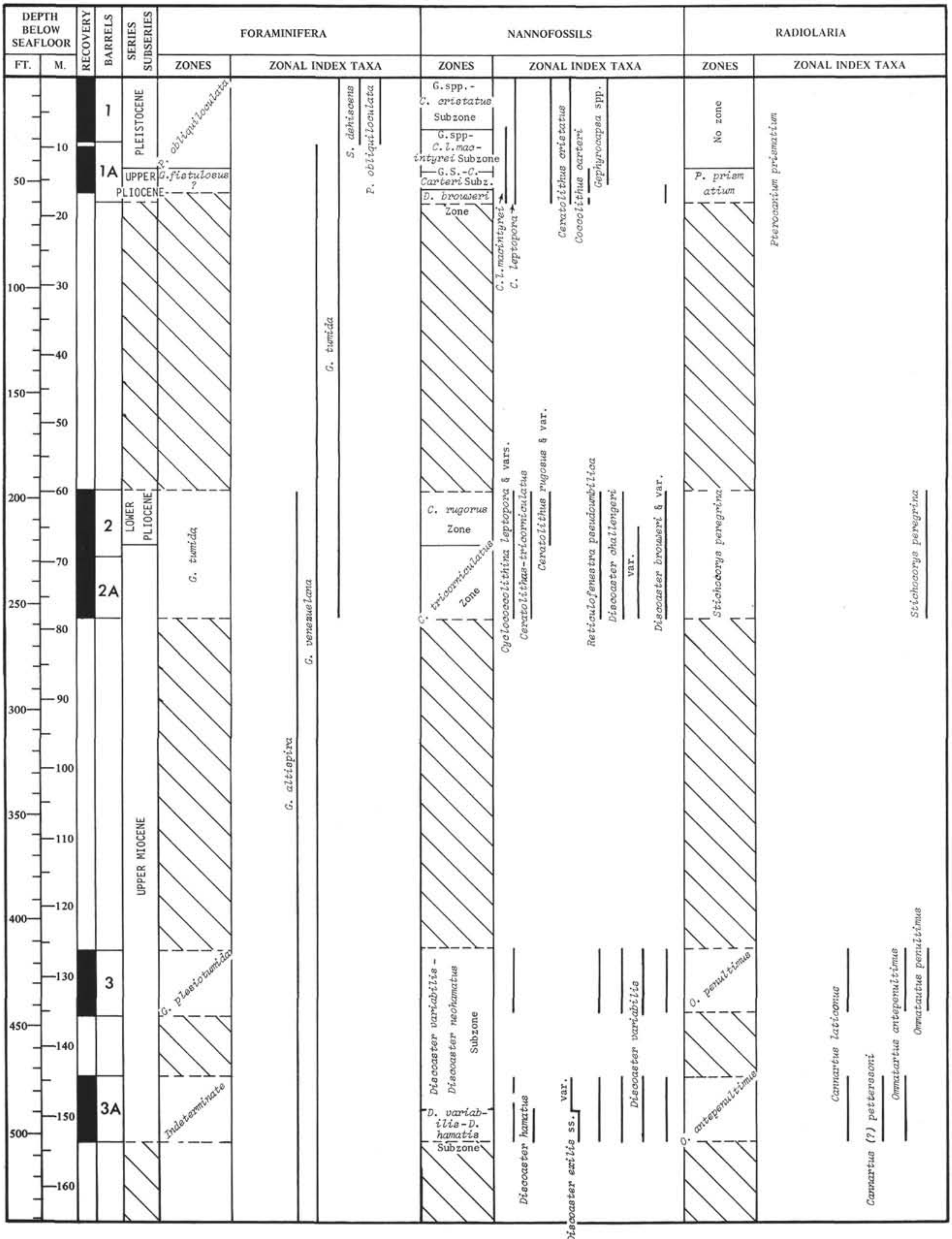


Figure 30. *Site 79 Biostratigraphic Comparisons Chart.*

BIOSTRATIGRAPHIC COMPARISON CHART

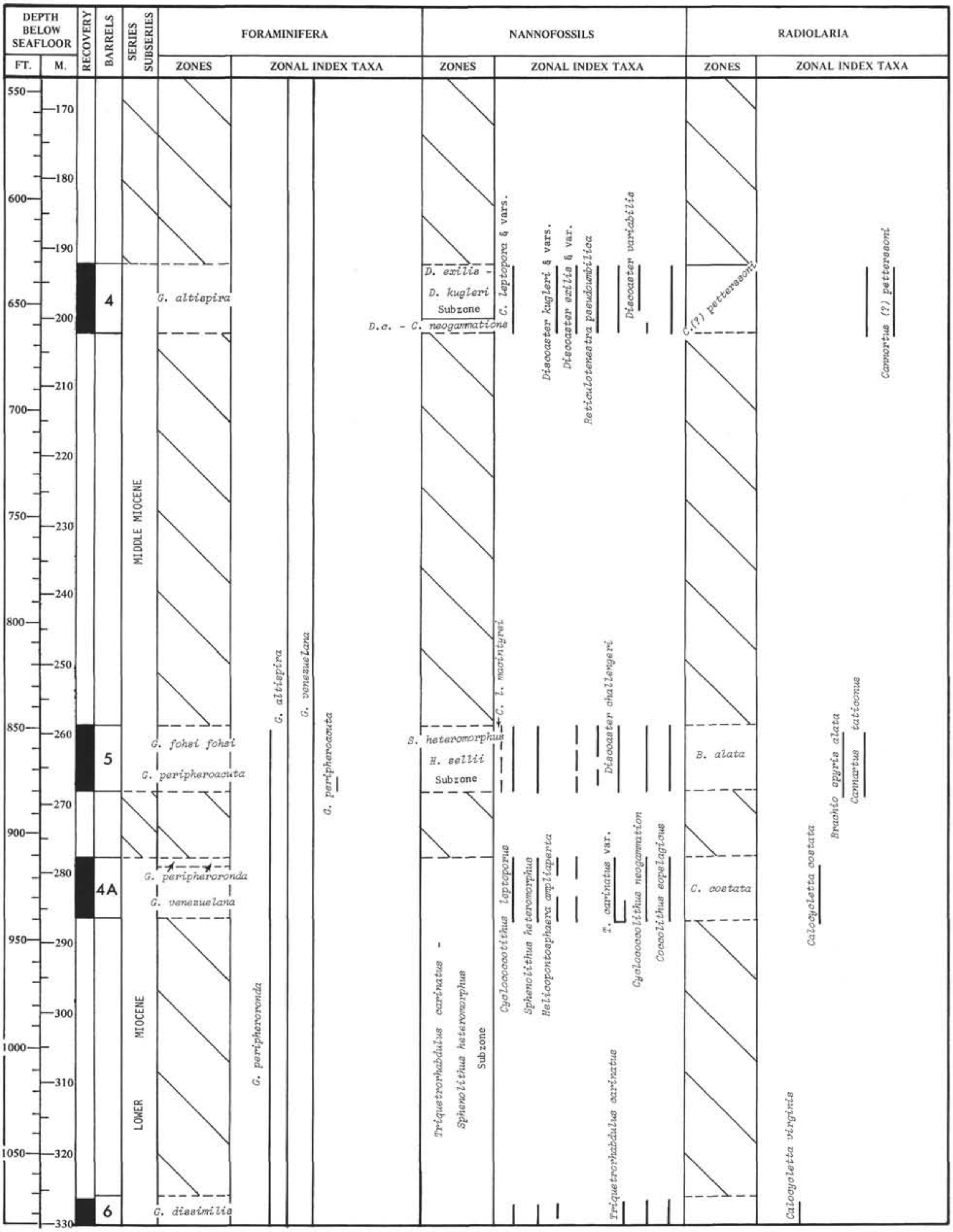


Figure 31. *Site 79 Biostratigraphic Comparisons Chart (continued).*

BIOSTRATIGRAPHIC COMPARISON CHART

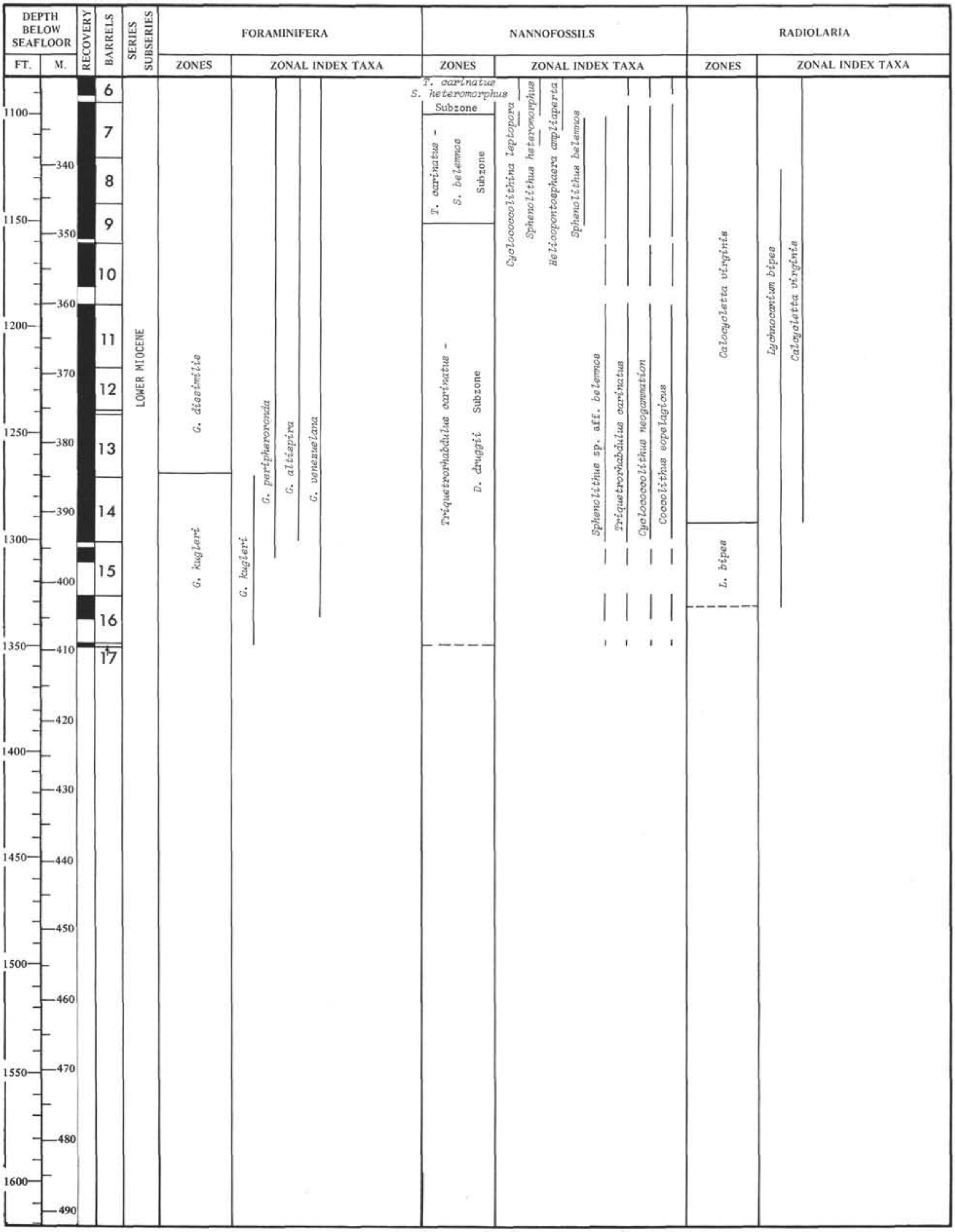


Figure 32. *Site 79 Biostratigraphic Comparisons Chart (continued).*

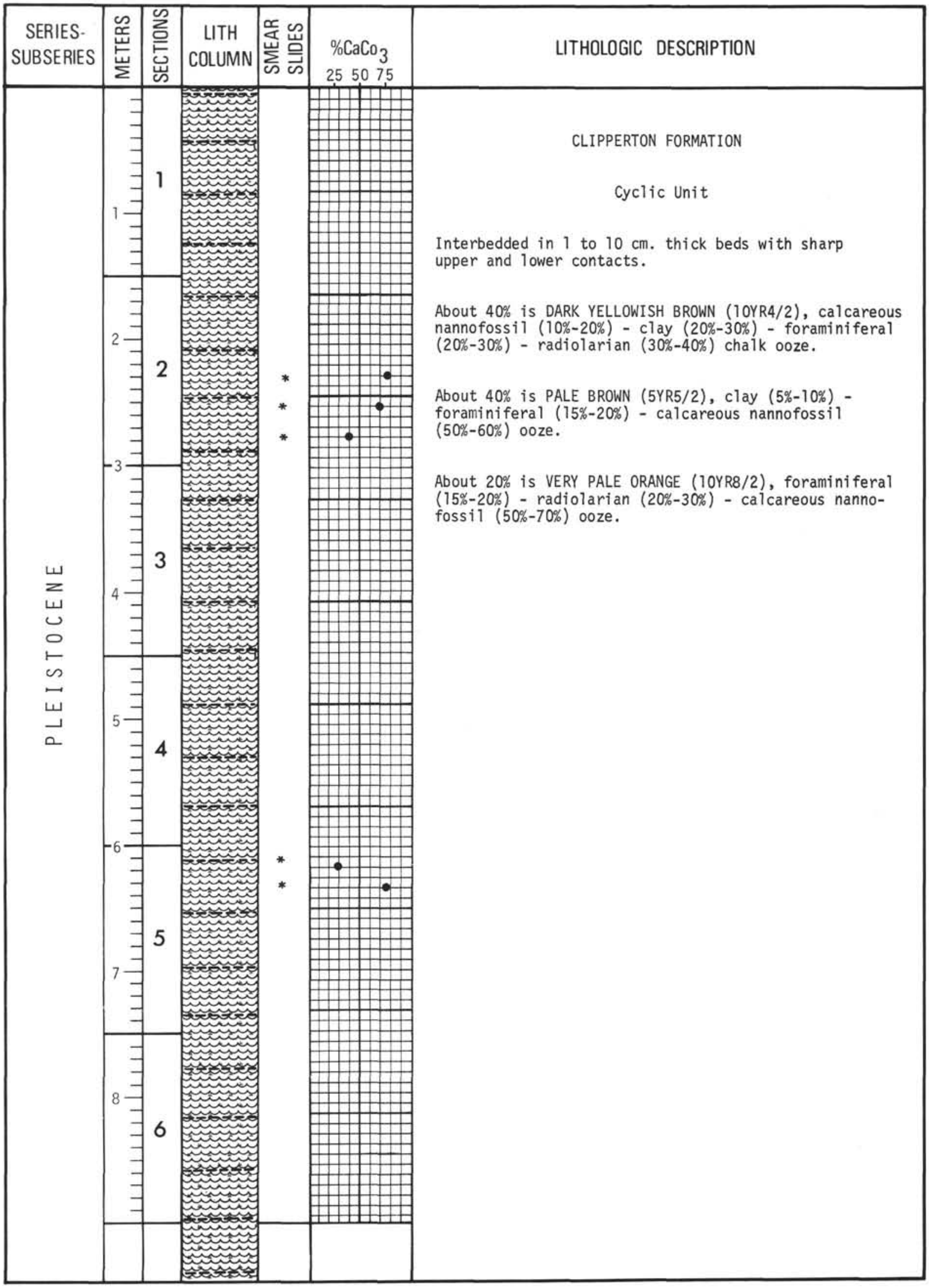


Figure 33. *Hole 79, Core 1 (1 to 9.1 m).*

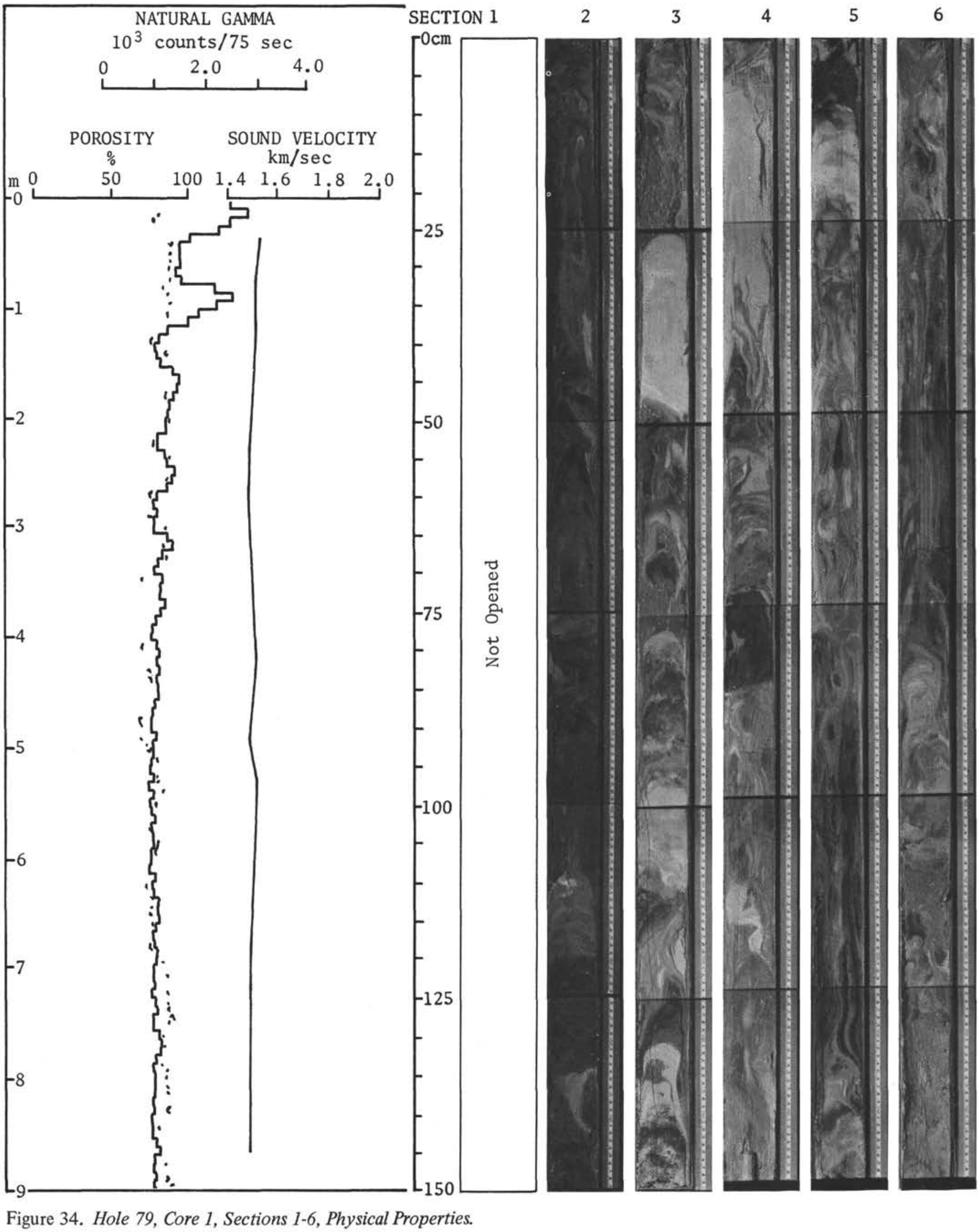
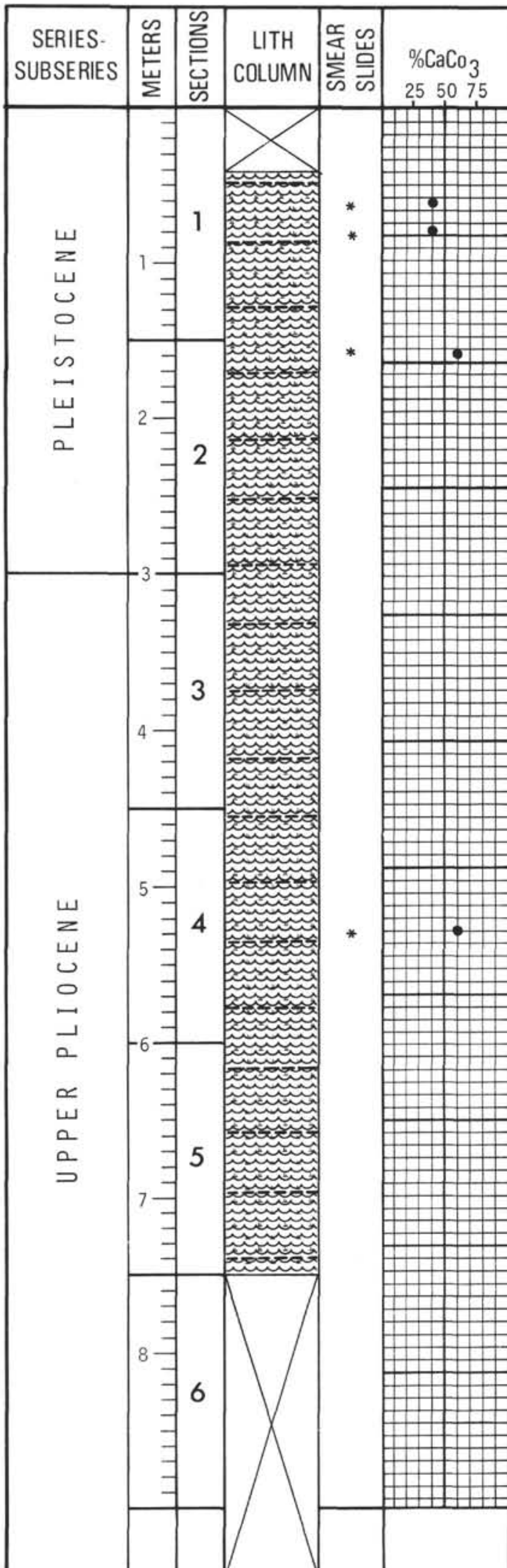


Figure 34. *Hole 79, Core 1, Sections 1-6, Physical Properties.*



LITHOLOGIC DESCRIPTION

CLIPPERTON FORMATION

Cyclic Unit

Interbedded in 1 to 10 cm. thick beds with sharp upper and lower contacts.

About 40% is DARK YELLOWISH BROWN (10YR4/2), calcareous nannofossil (10%-20%) - clay (20%-30%) - foraminiferal (20%-30%) - radiolarian (30%-40%) chalk ooze.

About 40% is PALE BROWN (5YR5/2), clay (3%-10%) - foraminiferal (15%-20%) - calcareous nannofossil (50%-60%) ooze.

About 20% is VERY PALE ORANGE (10YR8/2), foraminiferal (15%-20%) - radiolarian (20%-30%) - calcareous nannofossil (50%-70%) ooze.

Figure 35. *Hole 79A, Core 1 (9.1 to 18.3 m).*

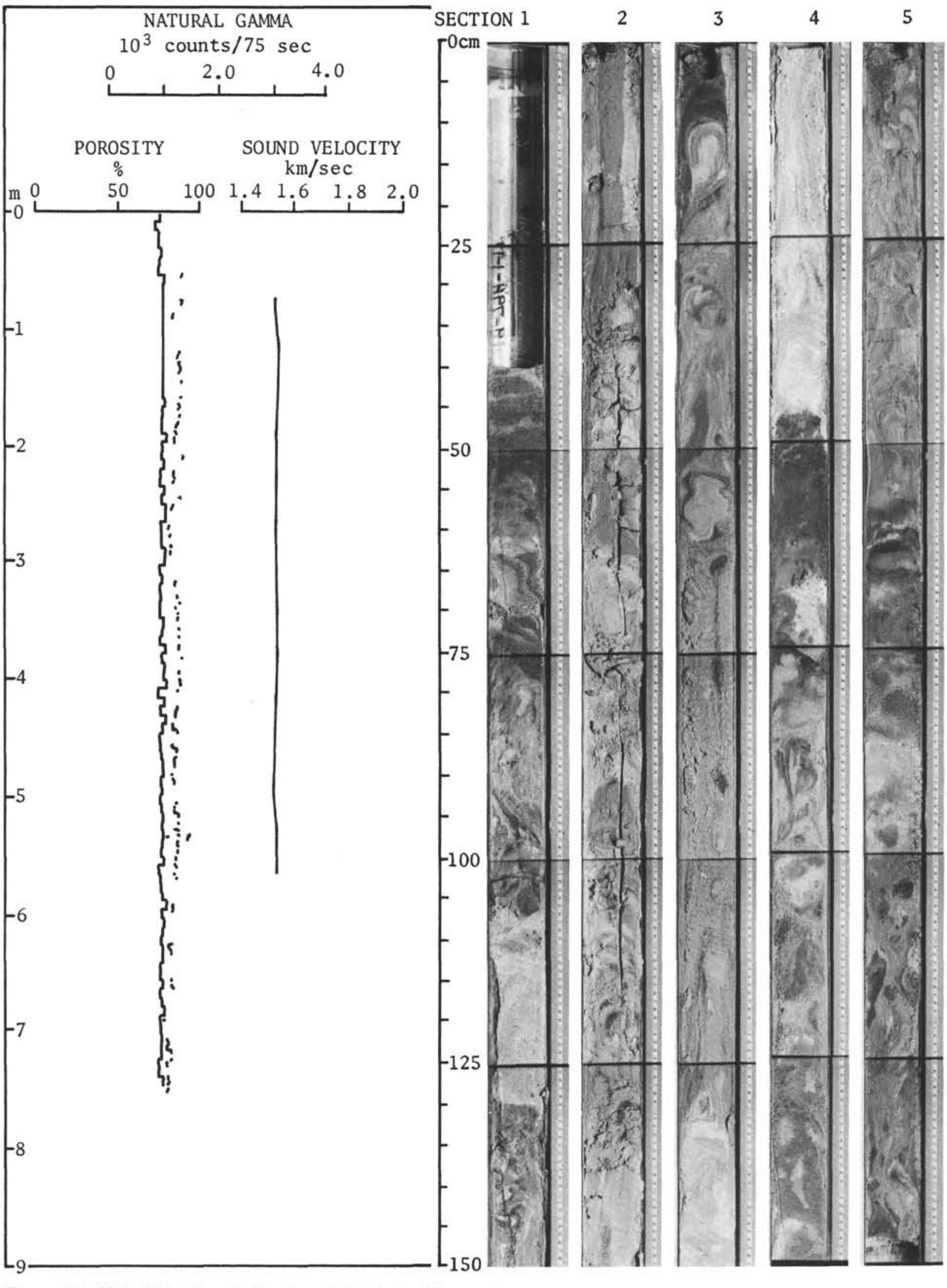


Figure 36. *Hole 79A, Core 1, Sections 1-5, Physical Properties.*

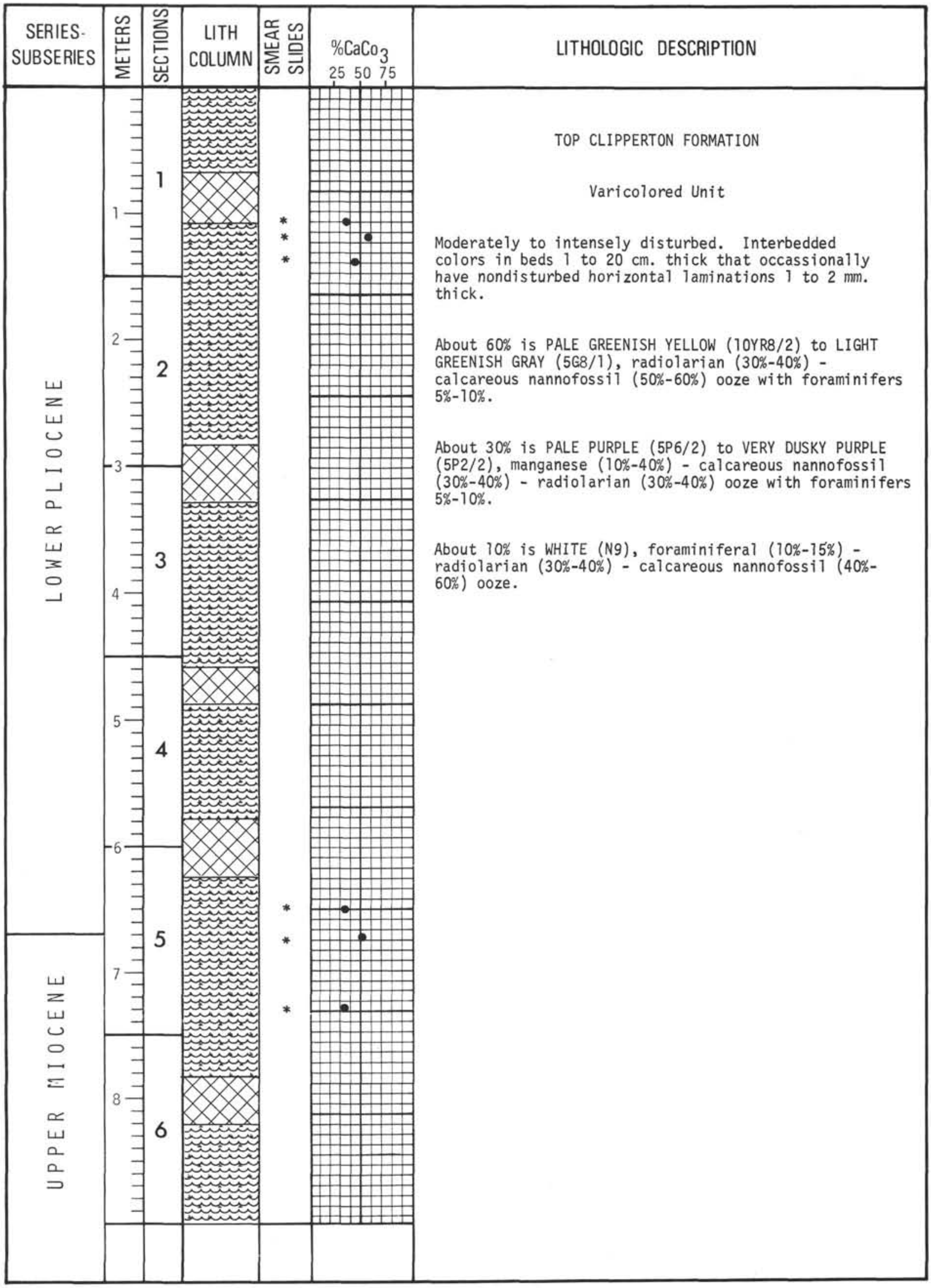


Figure 37. *Hole 79, Core 2 (60.3 to 69.5 m).*

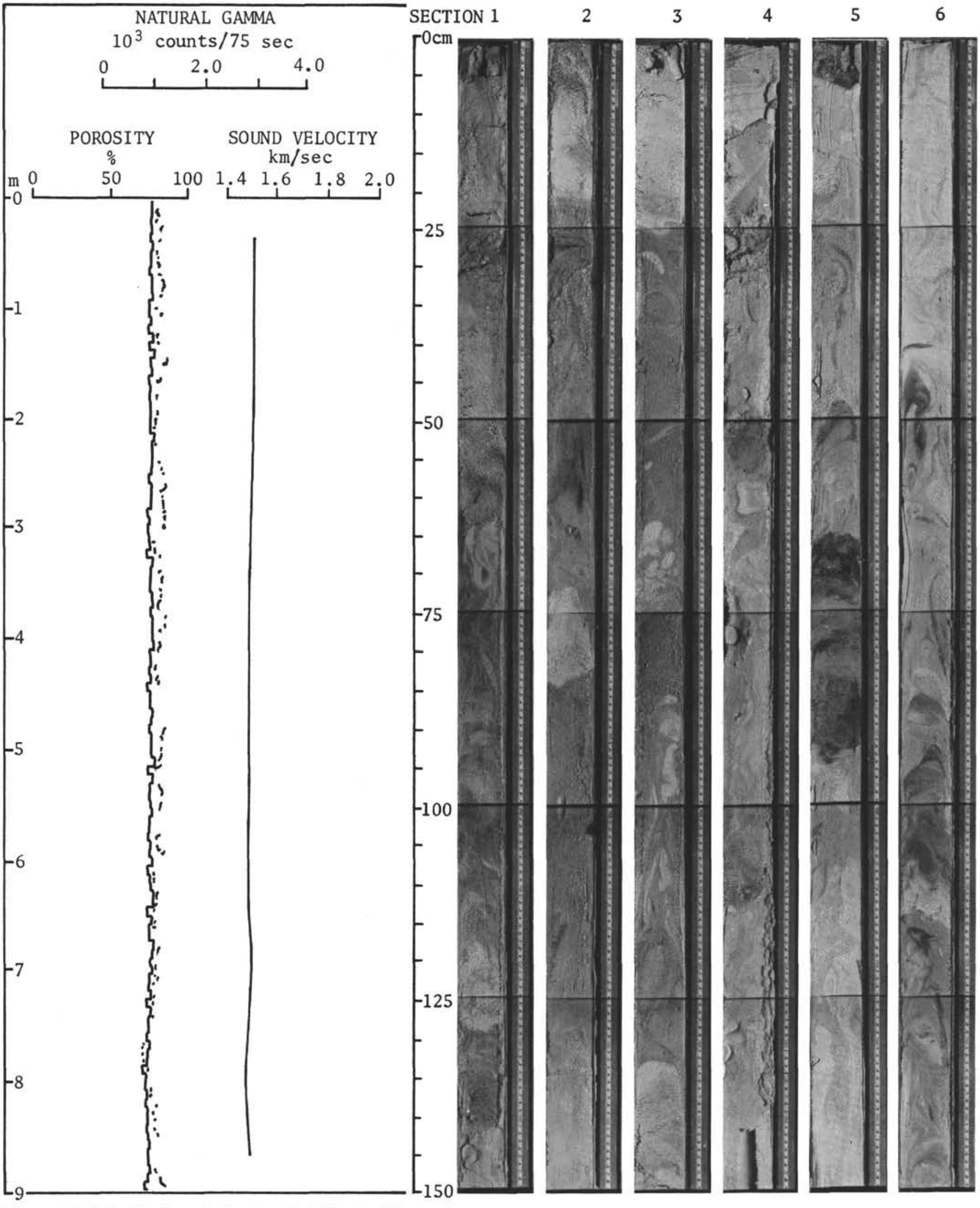


Figure 38. *Hole 79, Core 2, Sections 1-6, Physical Properties.*

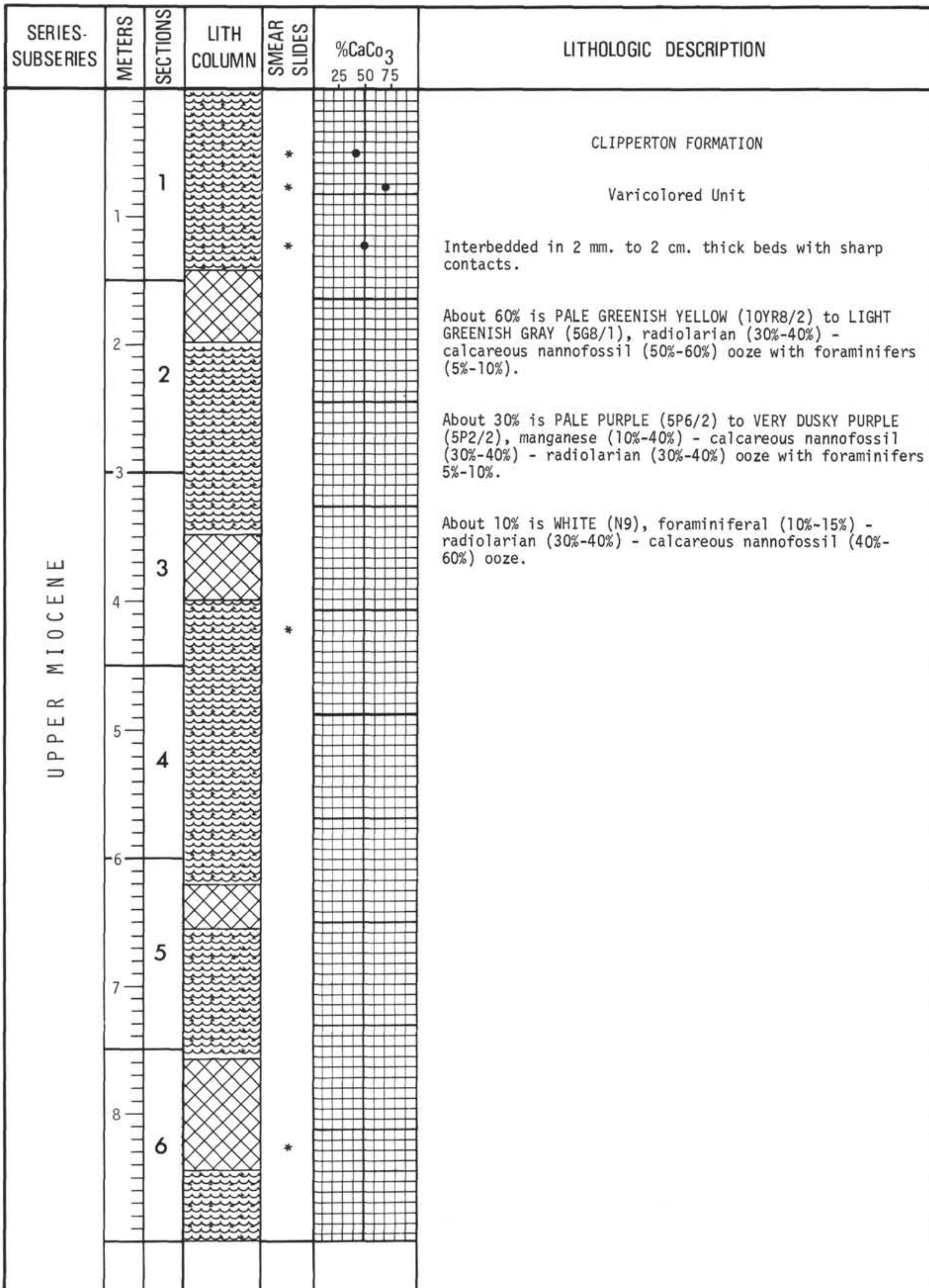


Figure 39. *Hole 79A, Core 2 (69.5 to 78.6 m).*

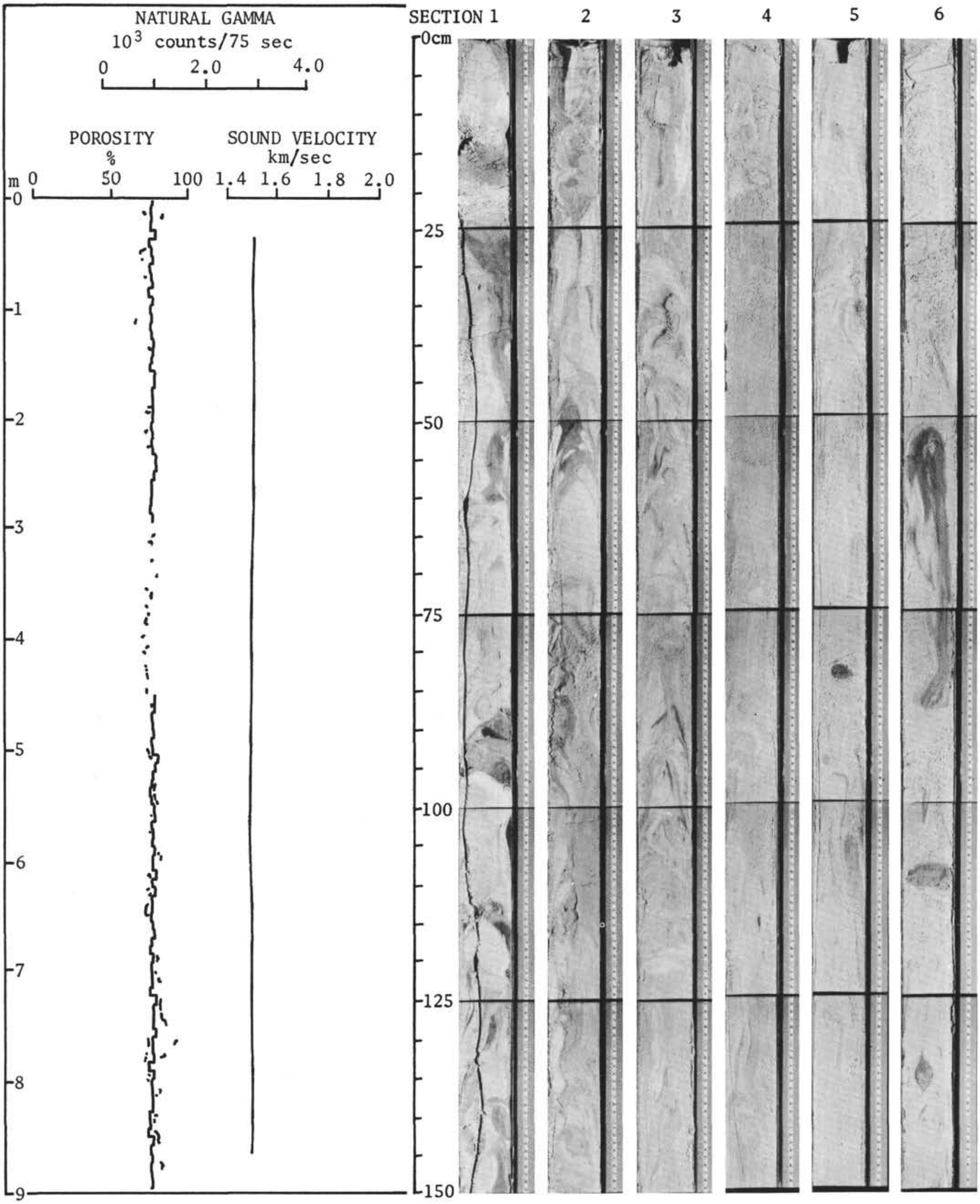
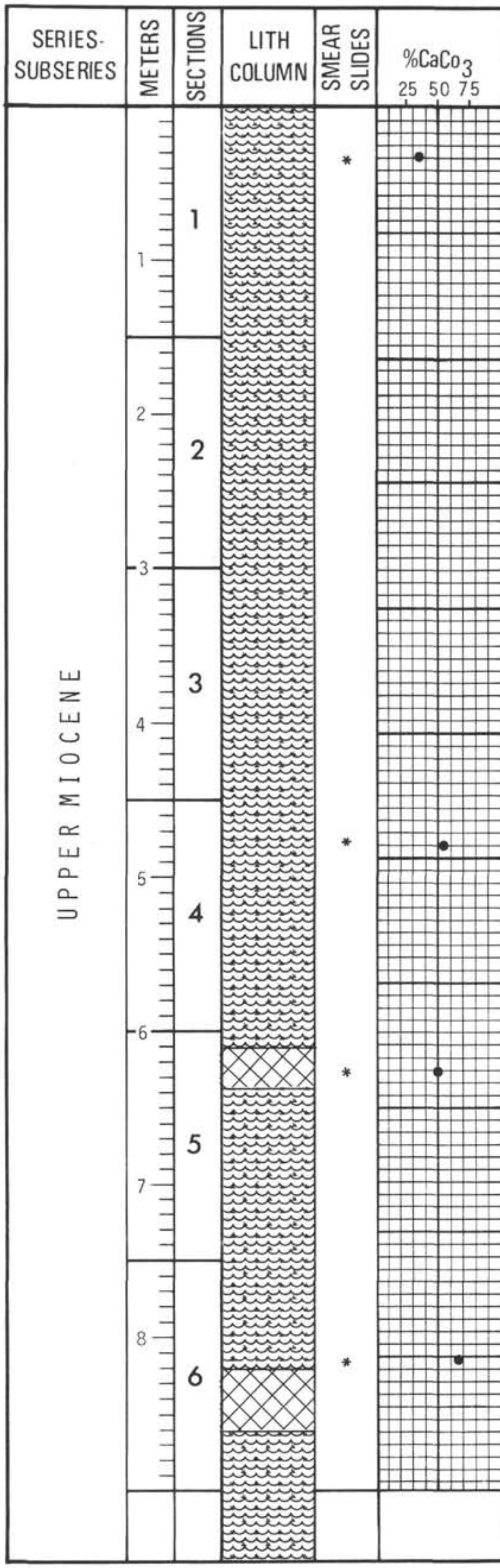


Figure 40. *Hole 79A, Core 2, Sections 1-6, Physical Properties.*



LITHOLOGIC DESCRIPTION

CLIPPERTON FORMATION

Varicolored Unit

Intensely to moderately disturbed. Interbedded colors in 2 mm. to 20 cm. thick beds with both sharp and gradational color contacts.

About 70% is LIGHT BLUISH GRAY (5B7/1), radiolarian (30%-40%) - calcareous nannofossil (60%-70%) ooze with about 5% foraminifers.

About 20% is LIGHT GREENISH GRAY (5G8/1), calcareous nannofossil (30%-40%) - radiolarian (50%-60%) ooze with about 5% foraminifers.

About 10% is PALE PURPLE (5P6/2) to VERY DUSKY PURPLE (5P2/2), manganese (10%-30%) - calcareous nannofossil (30%-40%) ooze with about 5% foraminifers.

Rare VERY PALE ORANGE (10YR8/2), radiolarian (30%-40%) - calcareous nannofossil (60%-70%) ooze.

Figure 41. *Hole 79, Core 3 (126.8 to 135.9 m).*

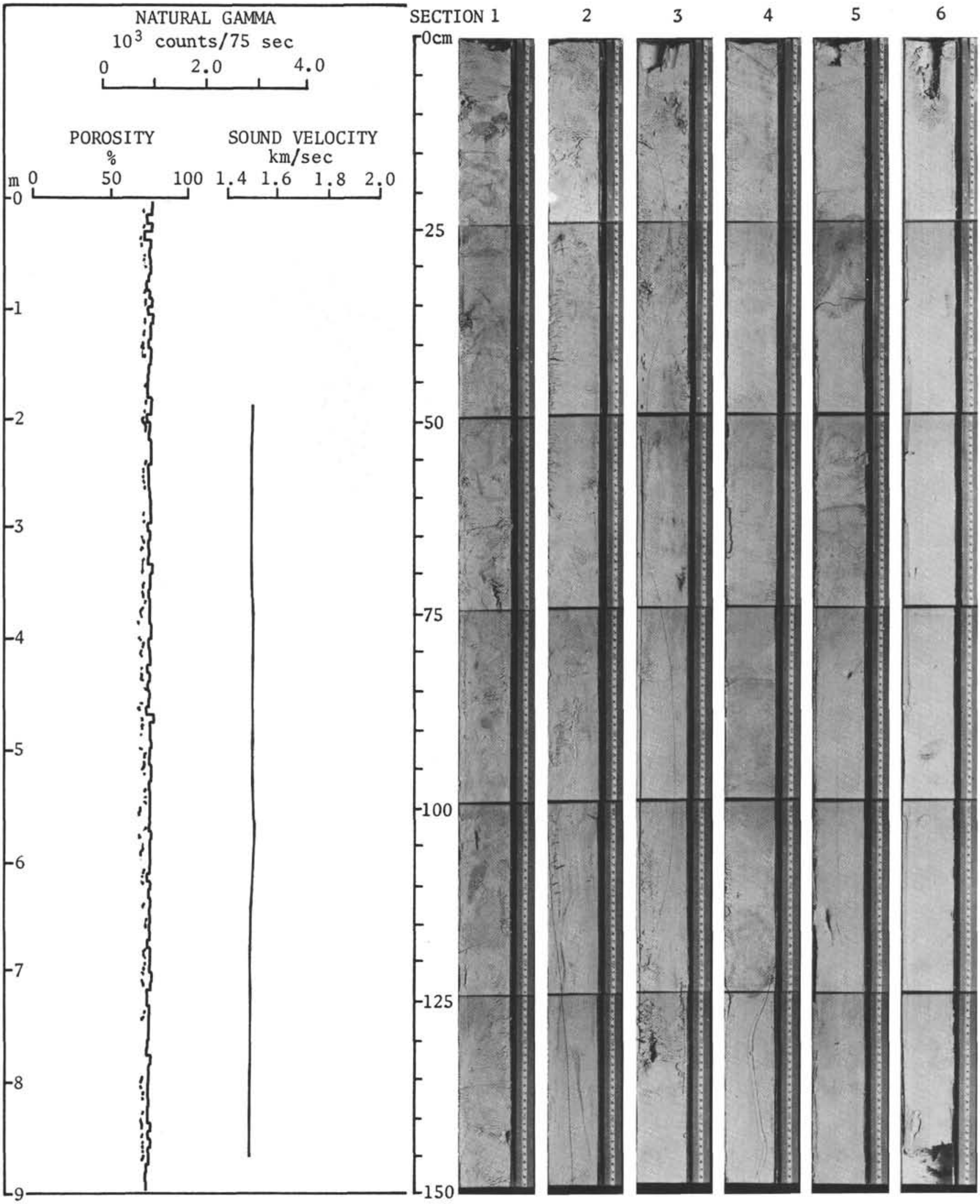
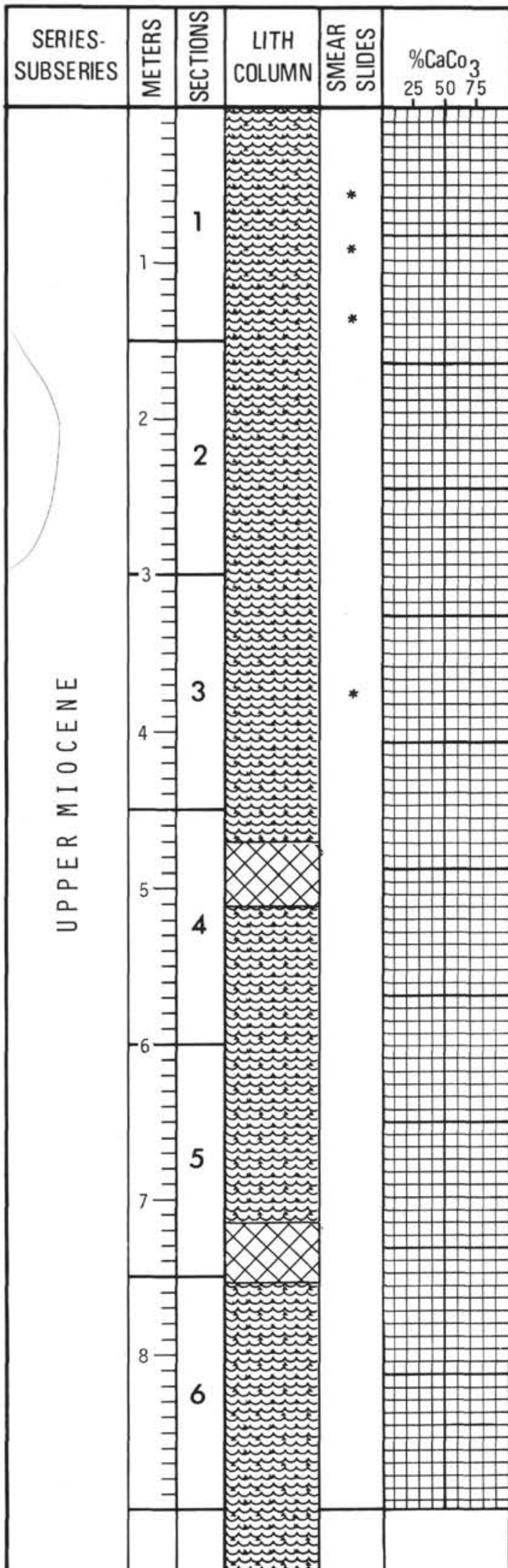


Figure 42. *Hole 79, Core 3, Sections 1-6, Physical Properties.*



LITHOLOGIC DESCRIPTION

CLIPPERTON FORMATION

Varicolored Unit

About 70% is LIGHT BLUISH GRAY (5B7/1), radiolarian (30%-40%) - calcareous nannofossil (60%-70%) ooze with about 5% foraminifers.

About 20% is LIGHT GREENISH GRAY (5G8/1), calcareous nannofossil (30%-40%) - radiolarian (50%-60%) ooze with about 5% foraminifers.

About 10% is PALE PURPLE (5P6/2) to VERY DUSKY PURPLE (5P2/2), manganese (10%-30%) - calcareous nannofossil (30%-40%) - radiolarian (30%-40%) ooze with about 5% foraminifers.

Rare VERY PALE ORANGE (10YR8/2), radiolarian (30%-40%) - calcareous nannofossil (60%-70%) ooze.

Figure 43. *Hole 79A, Core 3 (145.1 to 154.2 m).*

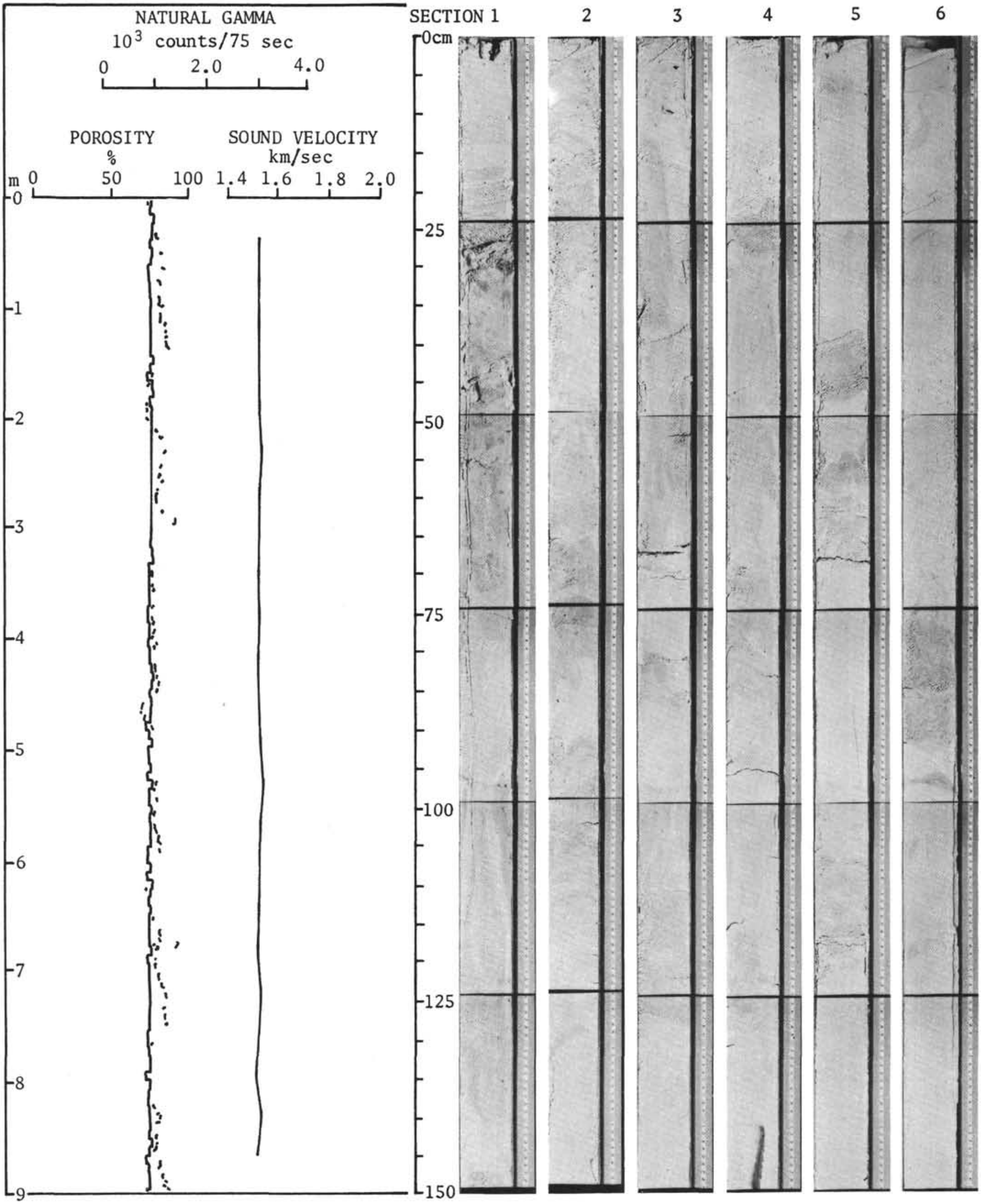


Figure 44. *Hole 79A, Core 3, Sections 1-6, Physical Properties.*

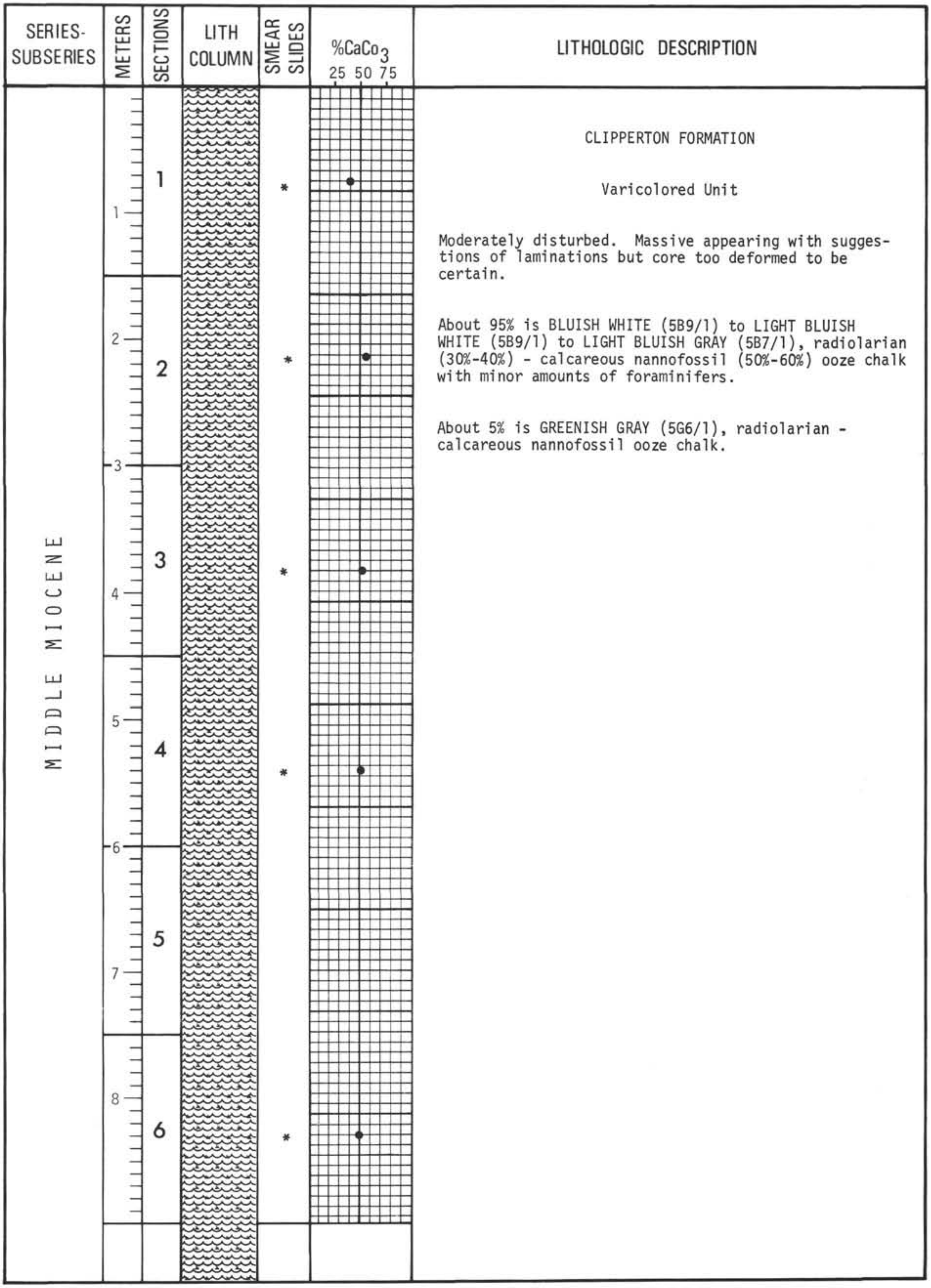


Figure 45. *Hole 79, Core 4 (193.5 to 202.7 m).*

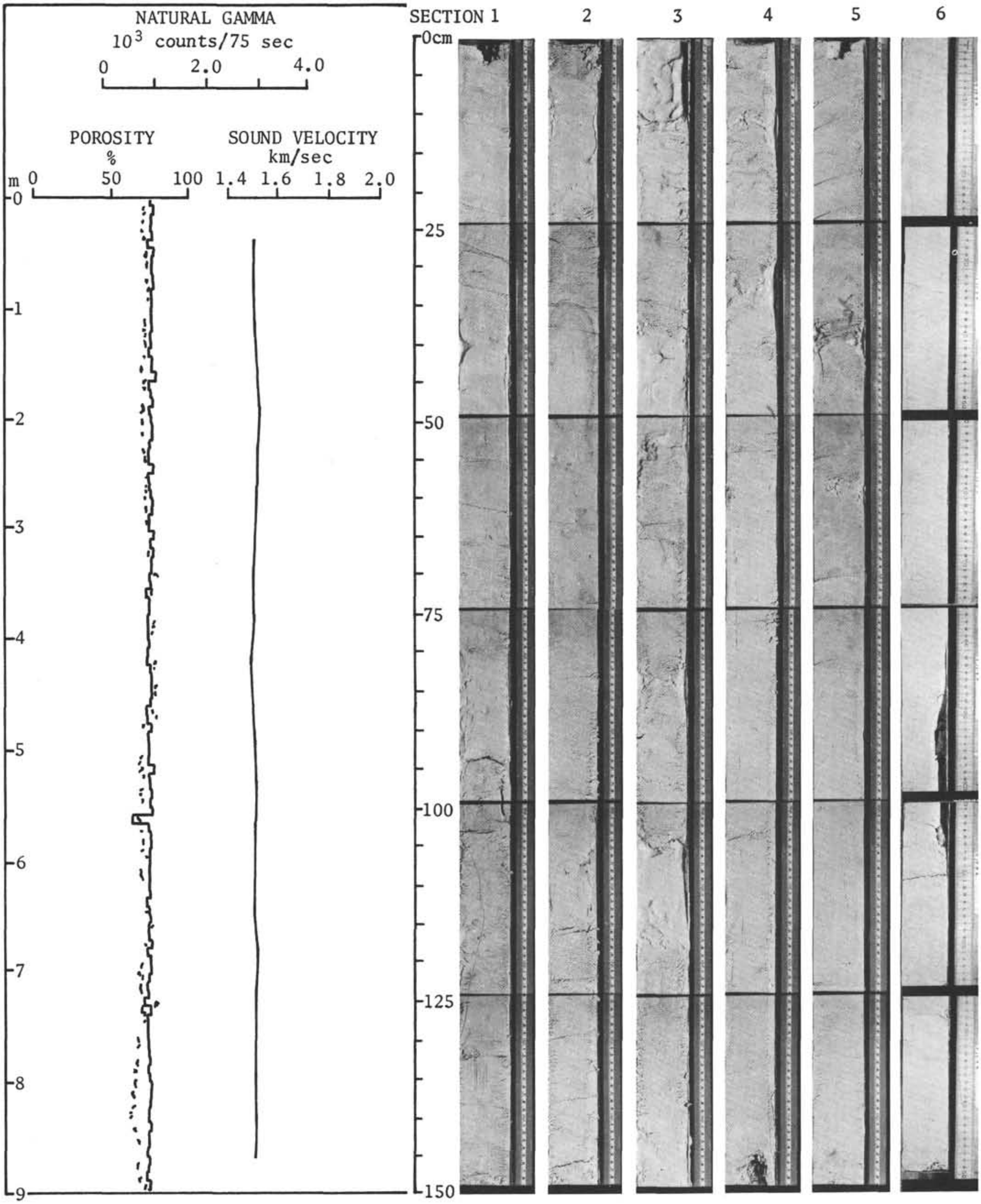


Figure 46. *Hole 79, Core 4, Sections 1-6, Physical Properties.*

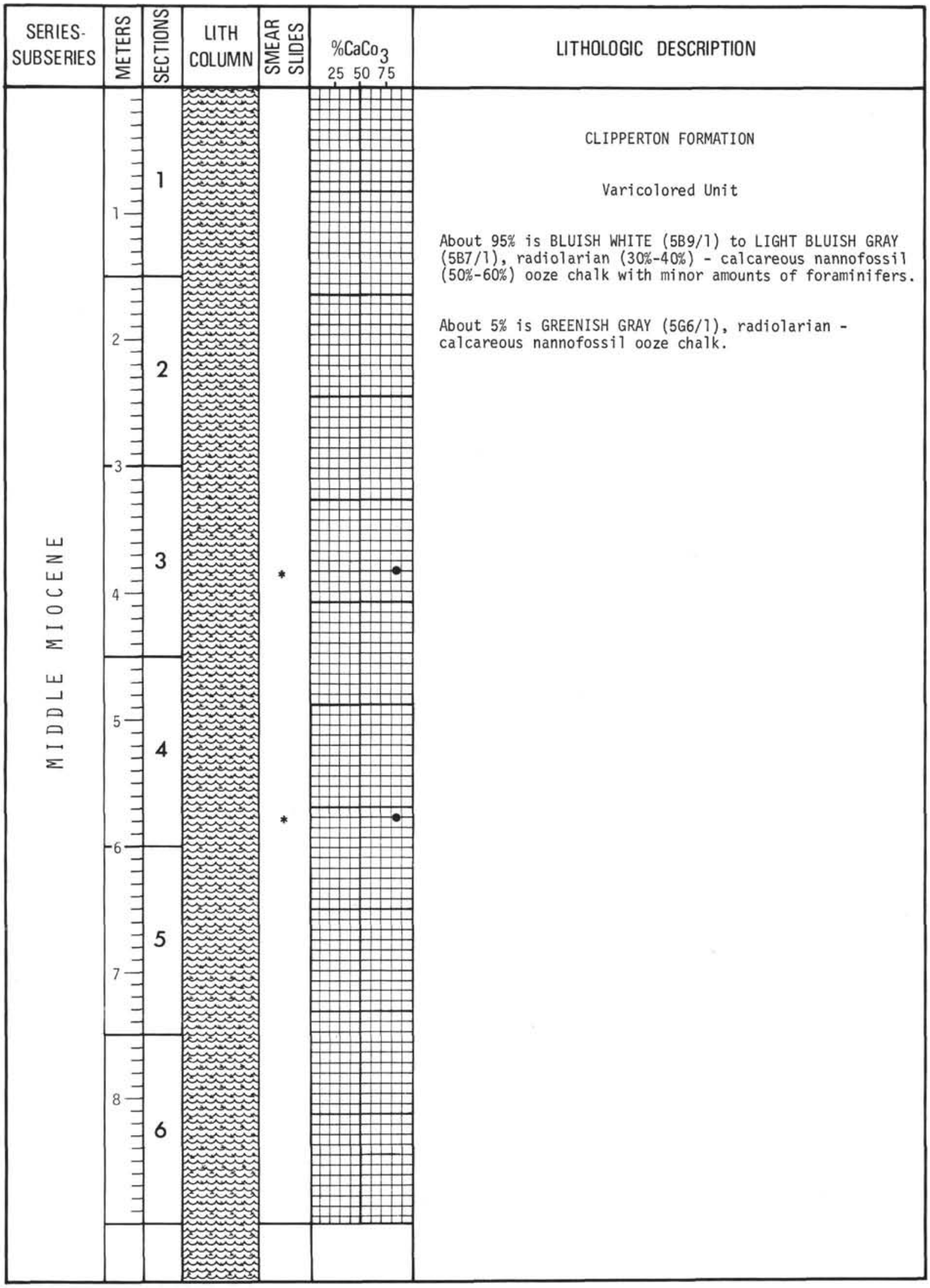


Figure 47. *Hole 79, Core 5 (260.3 to 269.4 m).*

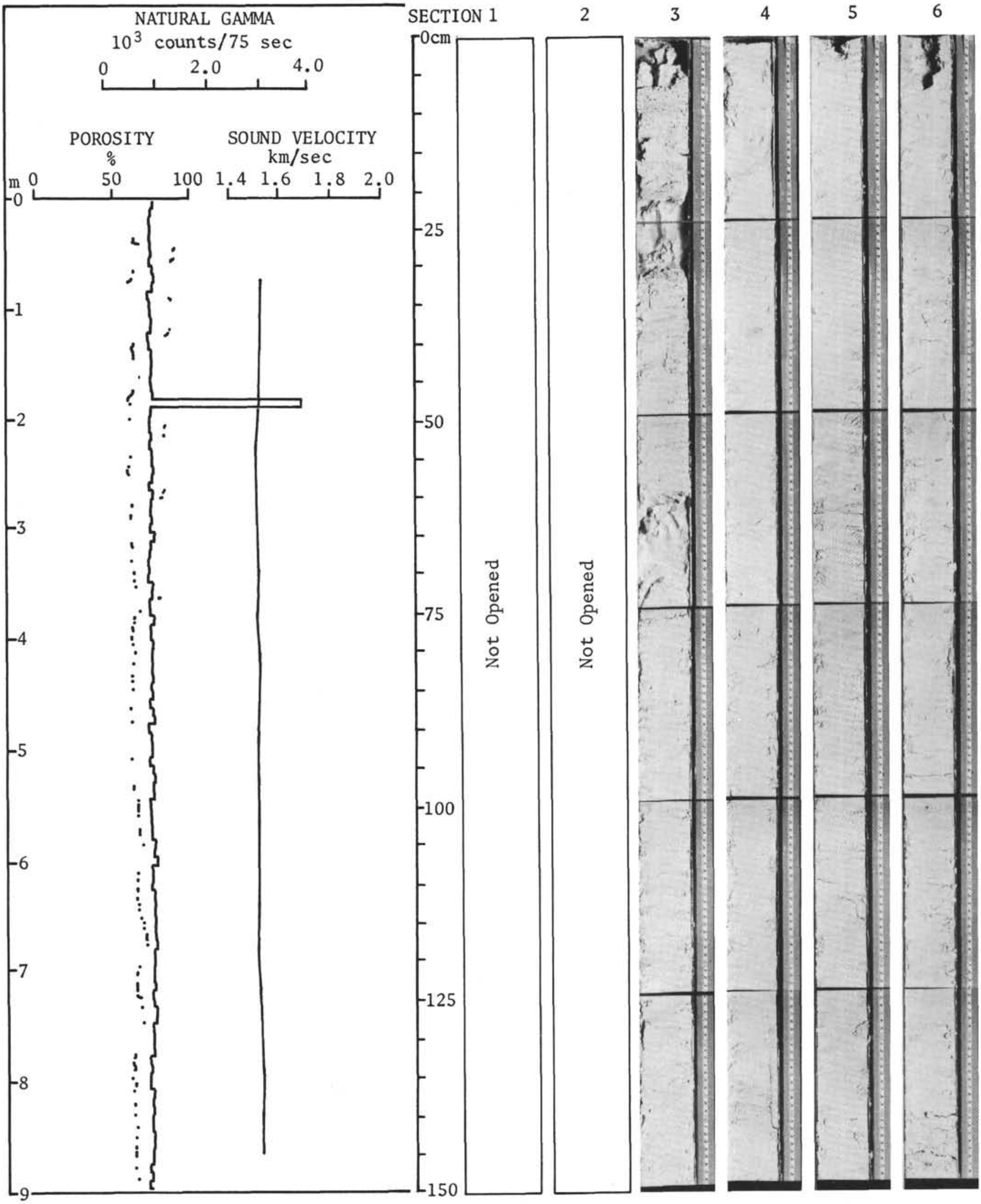


Figure 48. *Hole 79, Core 5, Sections 1-6, Physical Properties.*

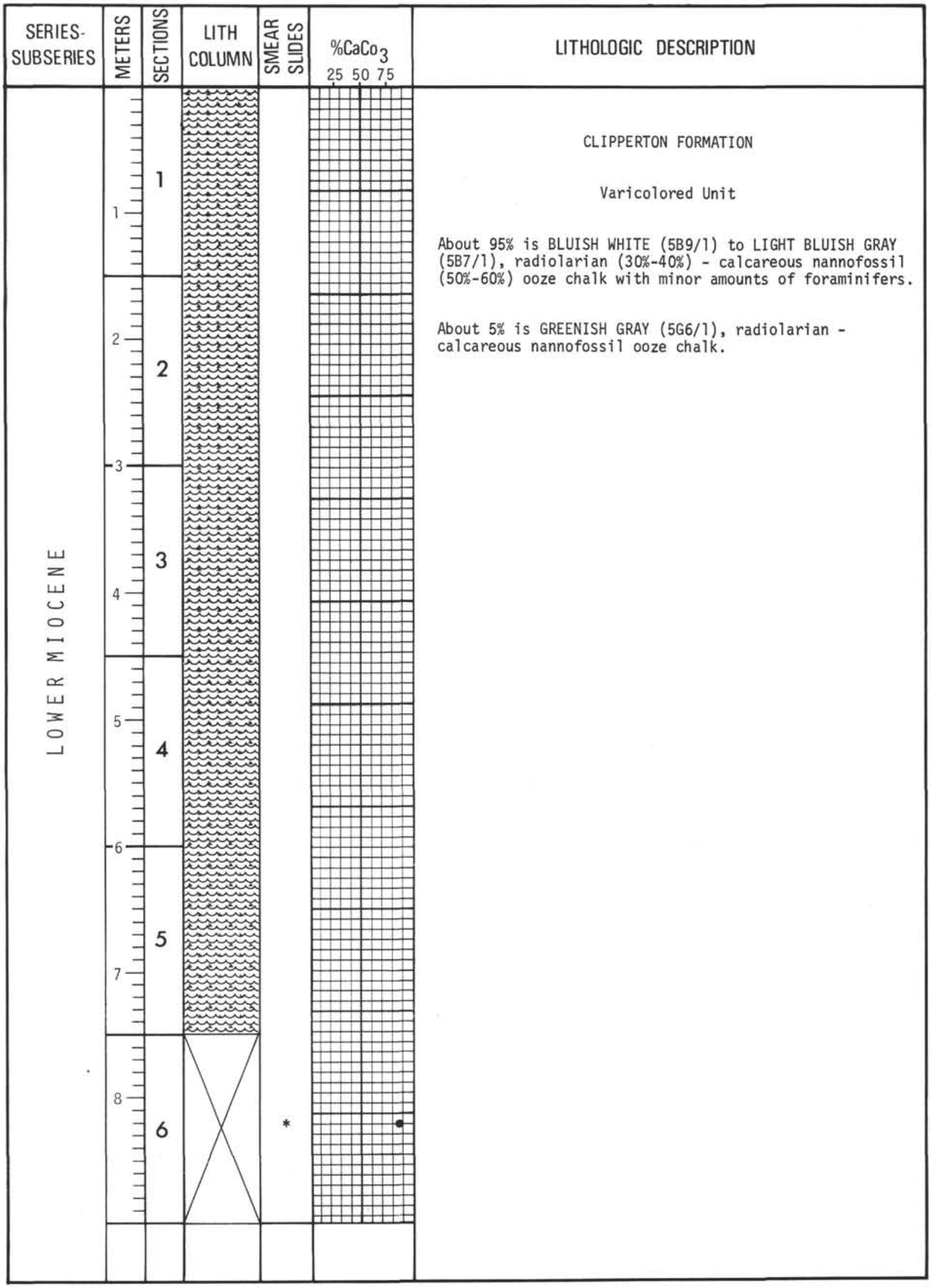


Figure 49. *Hole 79A, Core 5 (278.6 to 287.7 m).*

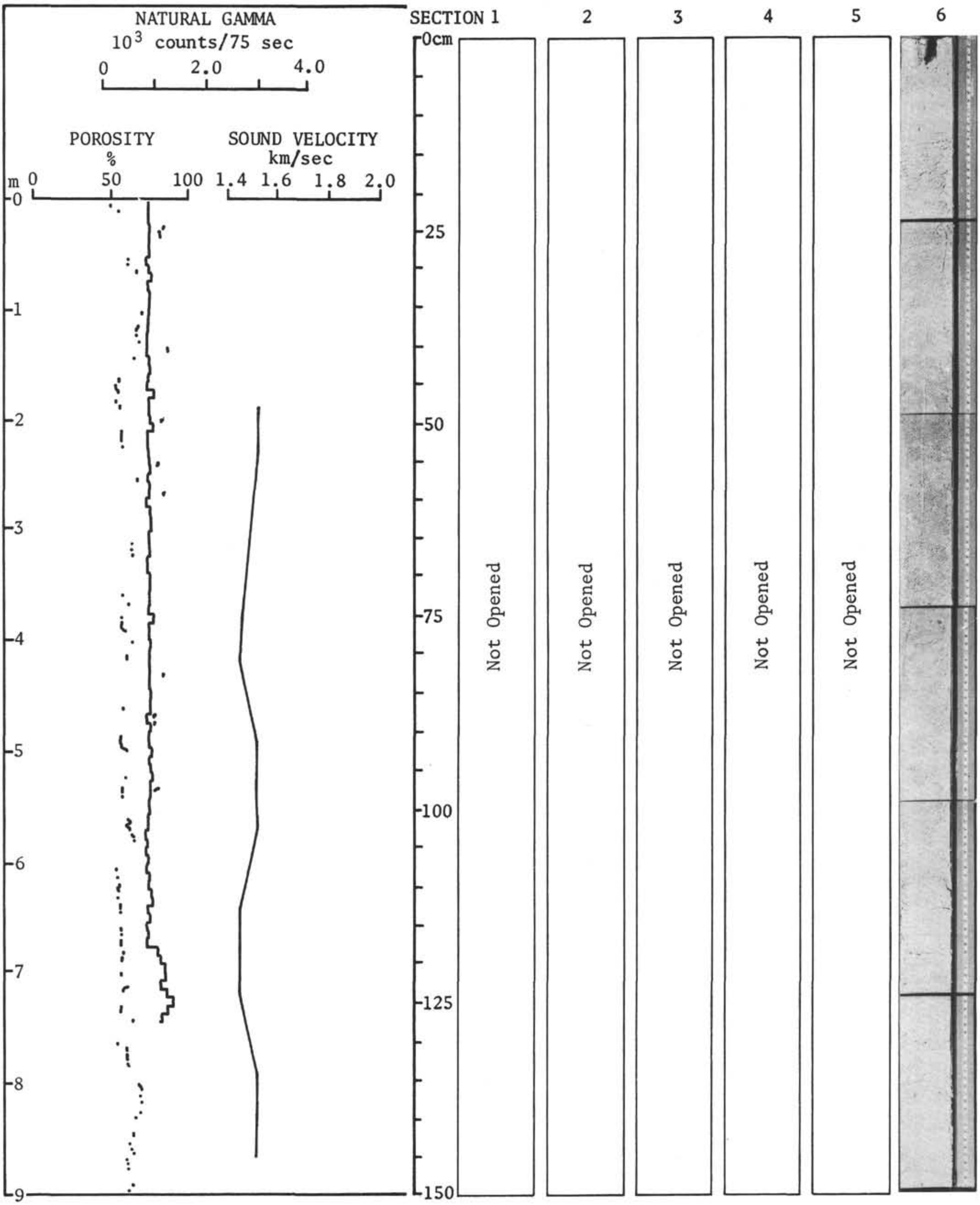


Figure 50. *Hole 79A, Core 4, Sections 1-6, Physical Properties.*

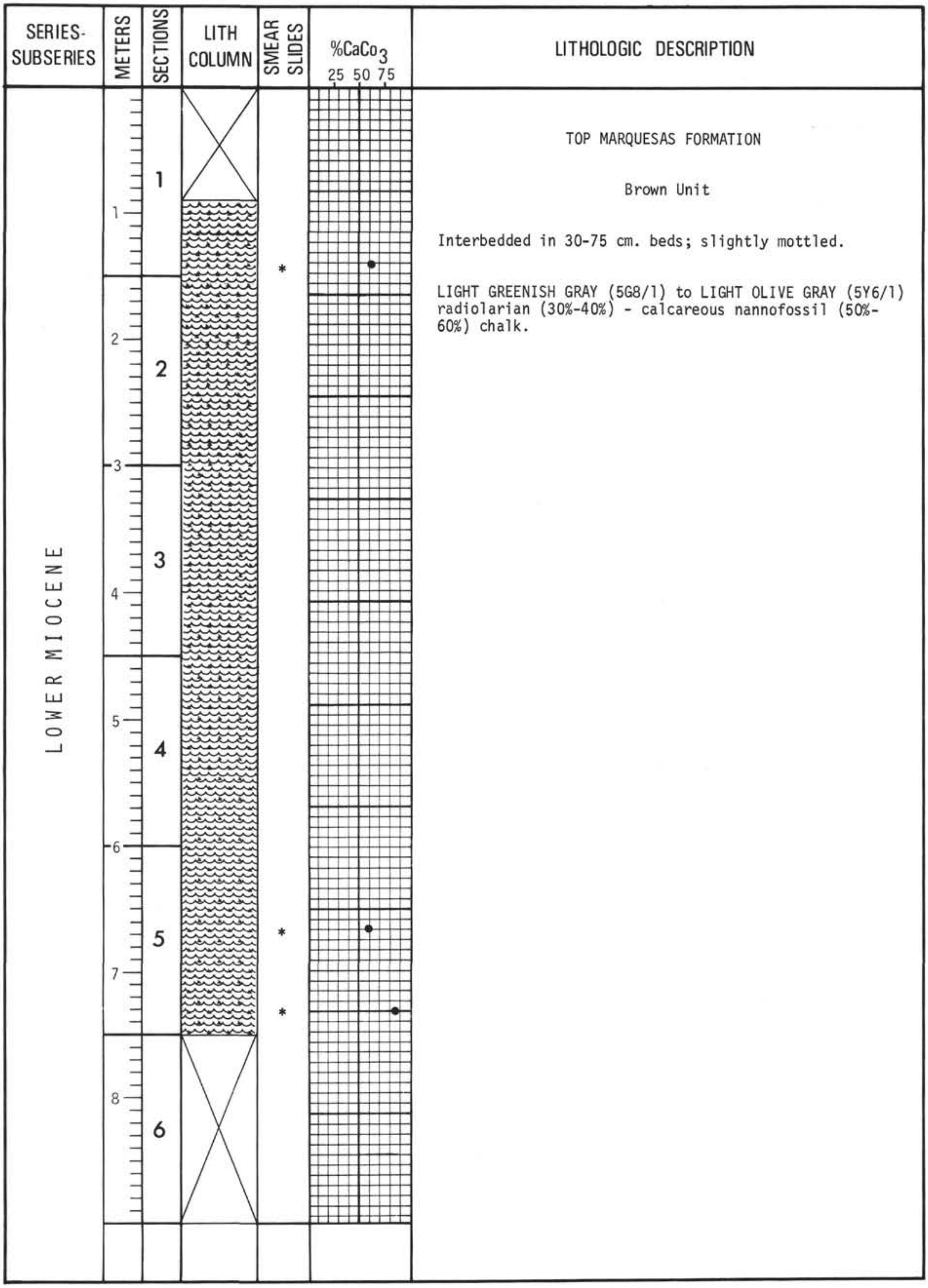


Figure 51. *Hole 79, Core 6 (326.7 to 335.9 m).*

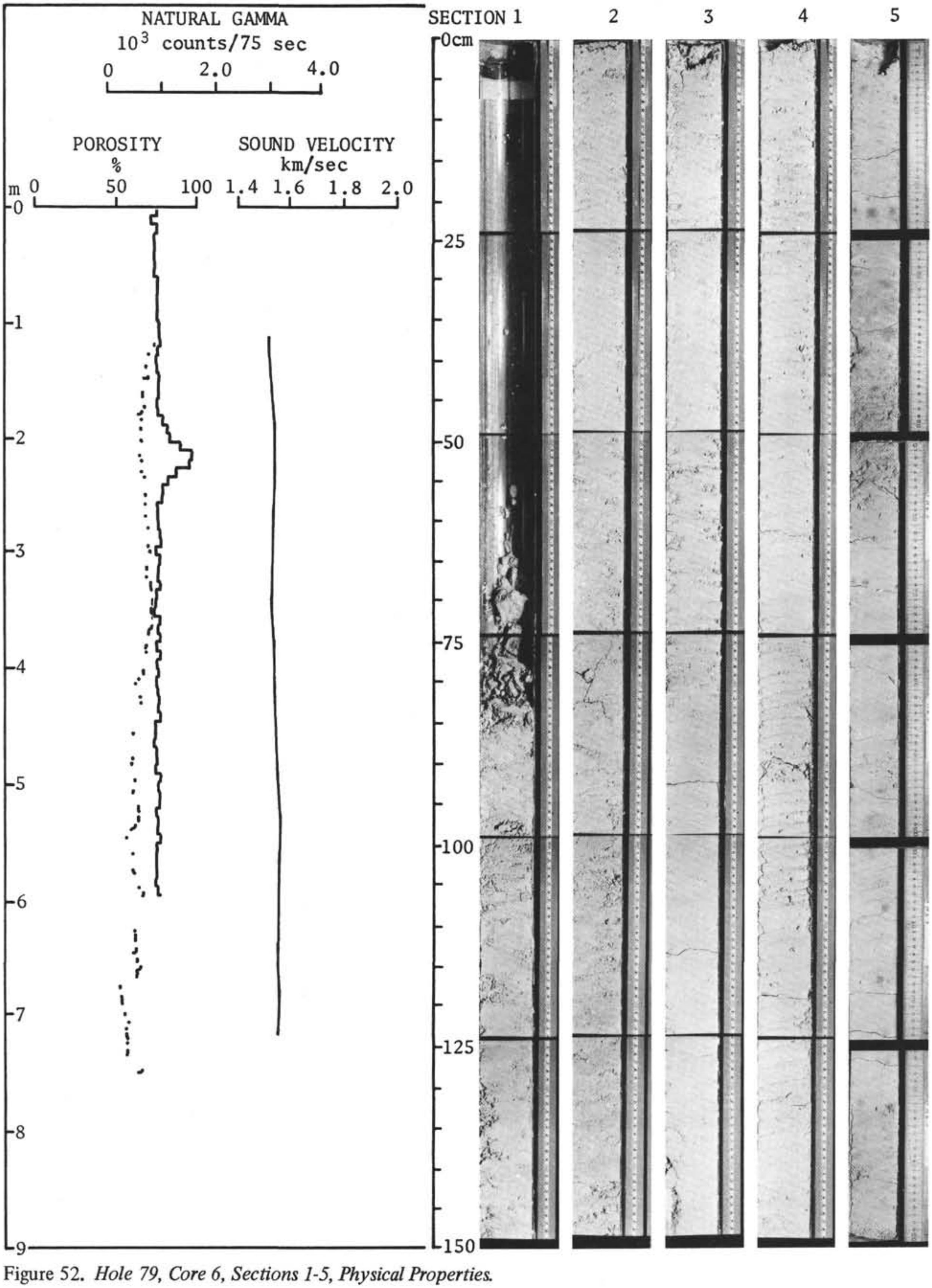


Figure 52. *Hole 79, Core 6, Sections 1-5, Physical Properties.*

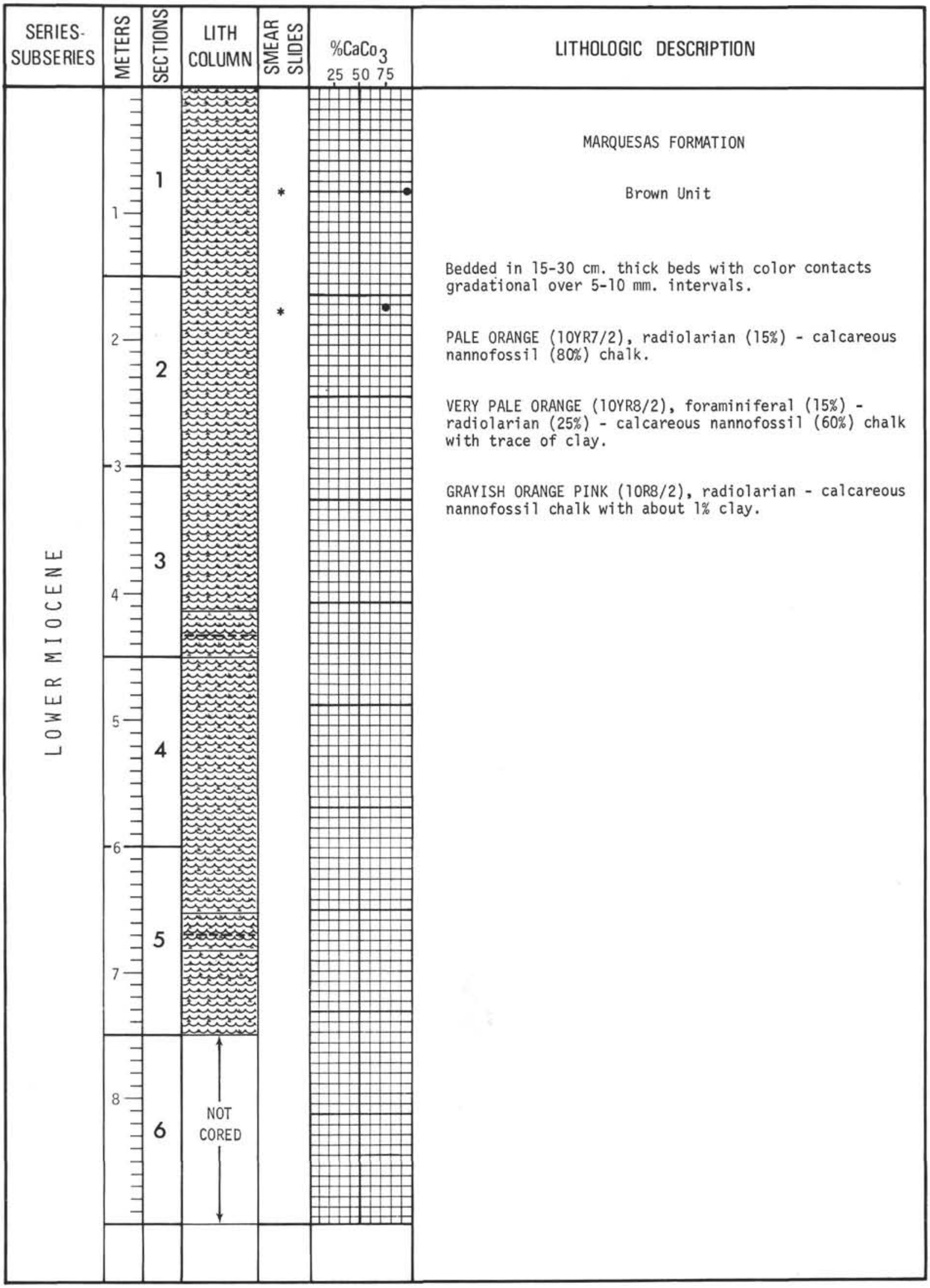


Figure 53. *Hole 79, Core 7 (335.9 to 345.0 m).*

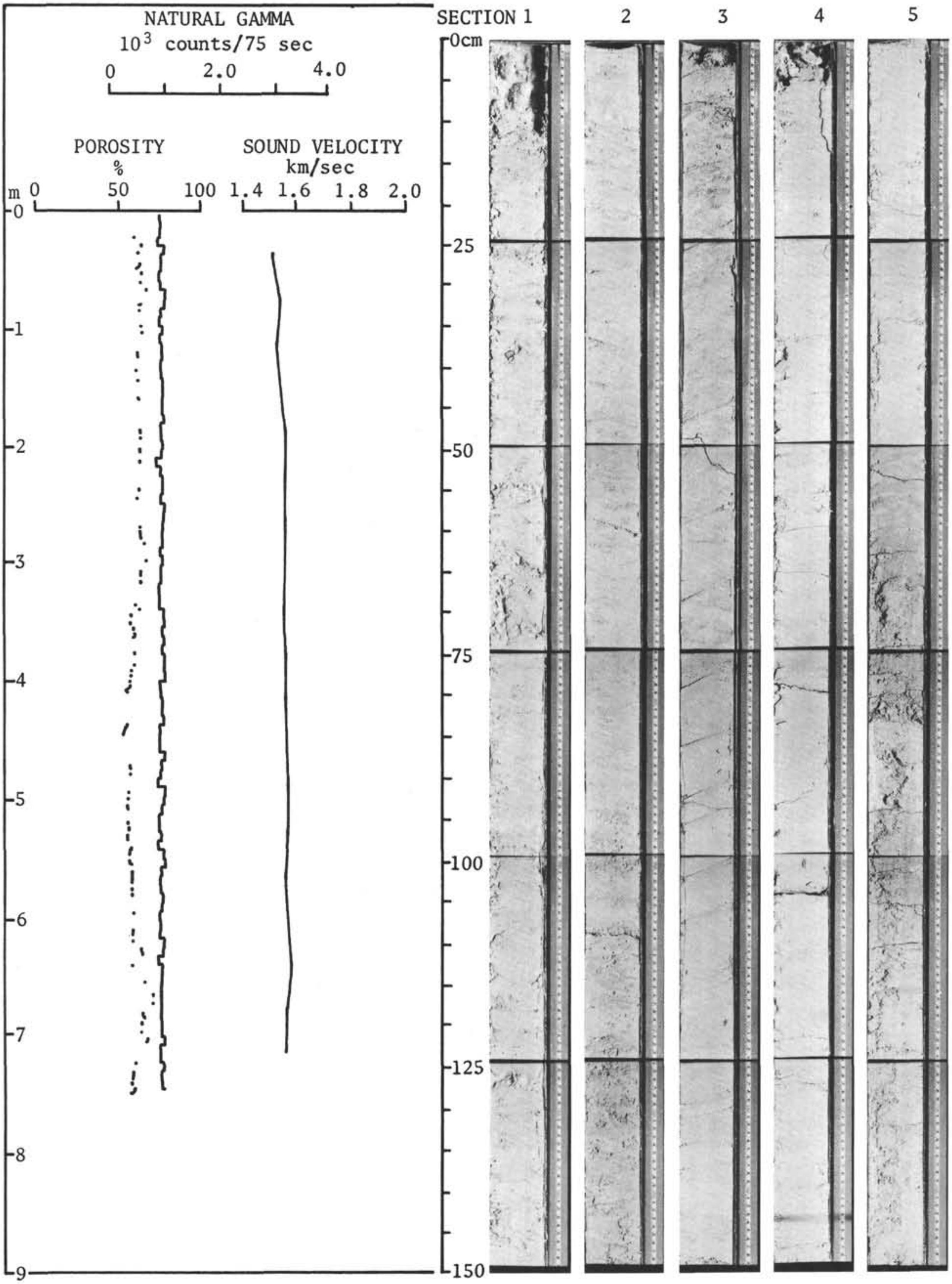


Figure 54. *Hole 79, Core 7, Sections 1-5, Physical Properties.*

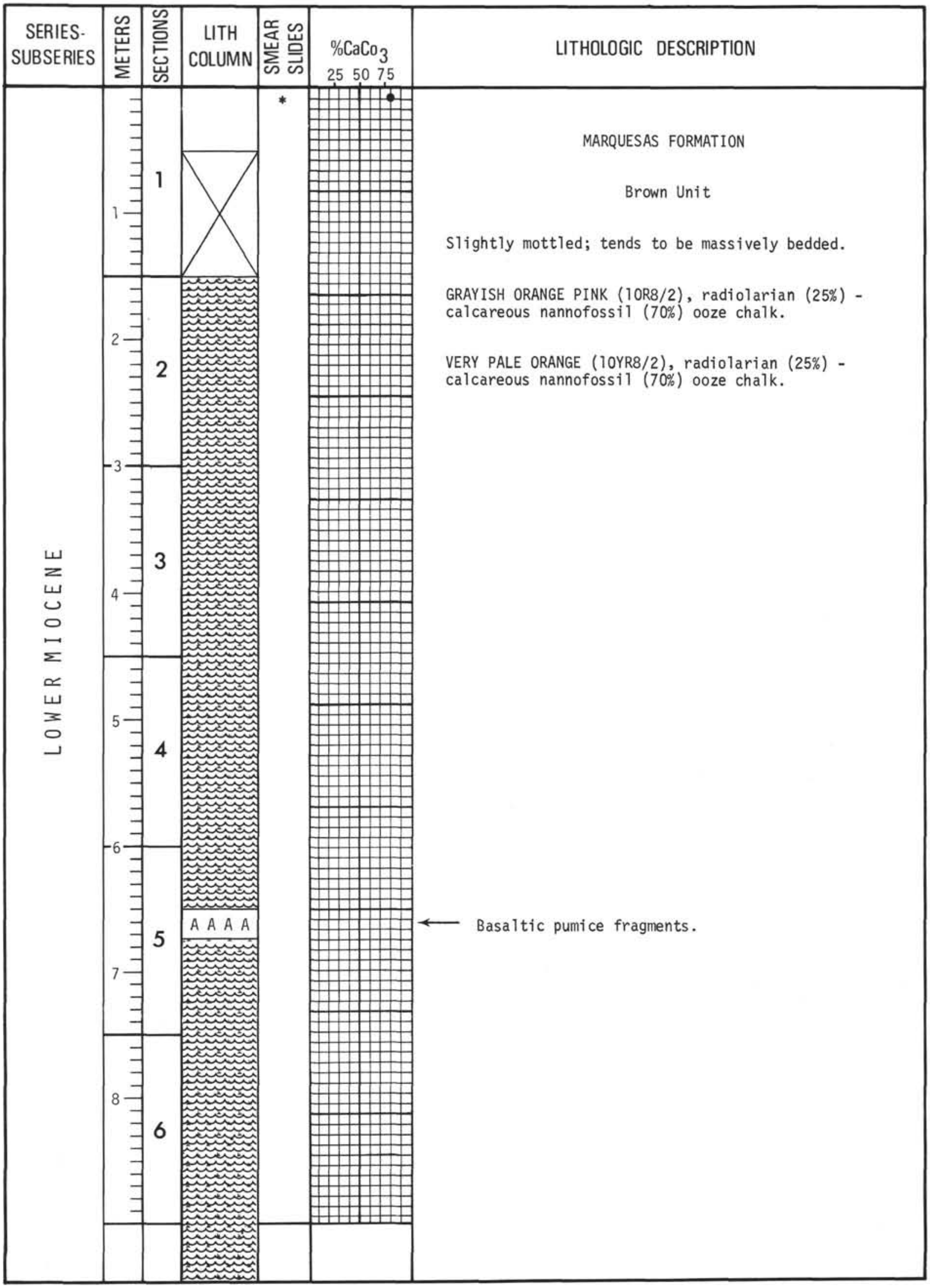


Figure 55. *Hole 79, Core 8 (345.0 to 352.6 m).*

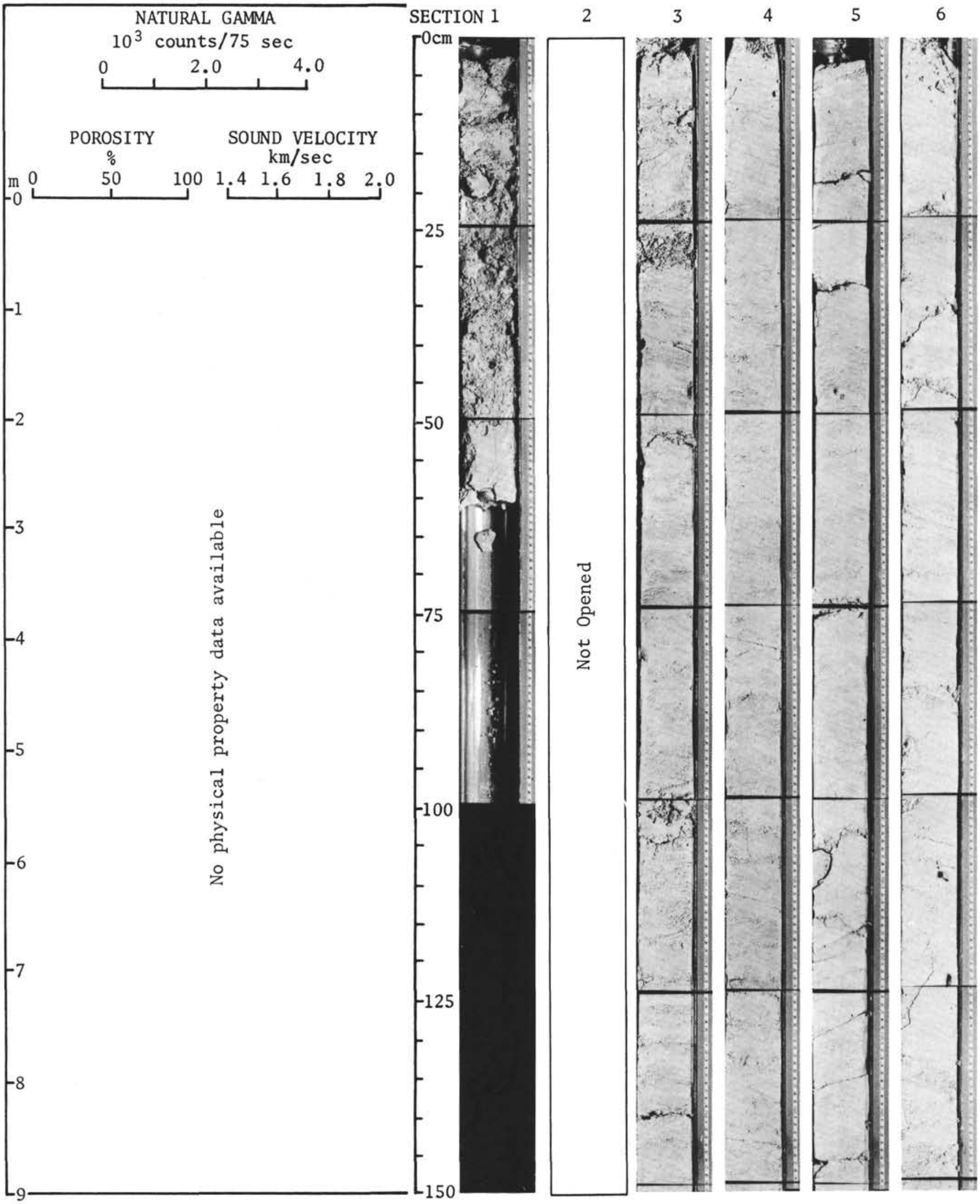


Figure 56. *Hole 79, Core 8, Sections 1-6, Physical Properties.*

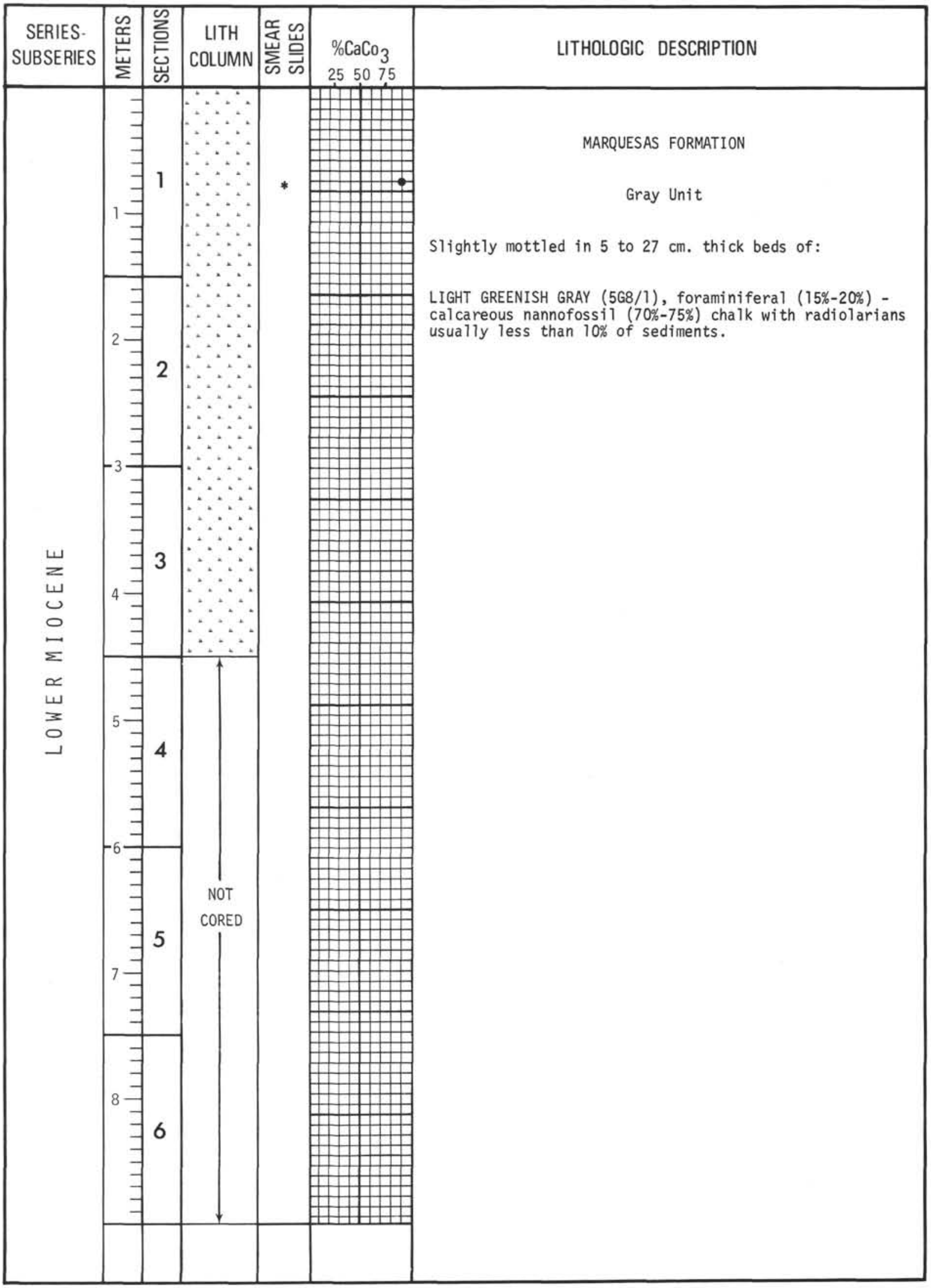


Figure 57. *Hole 79, Core 9 (350.1 to 355.7 m).*

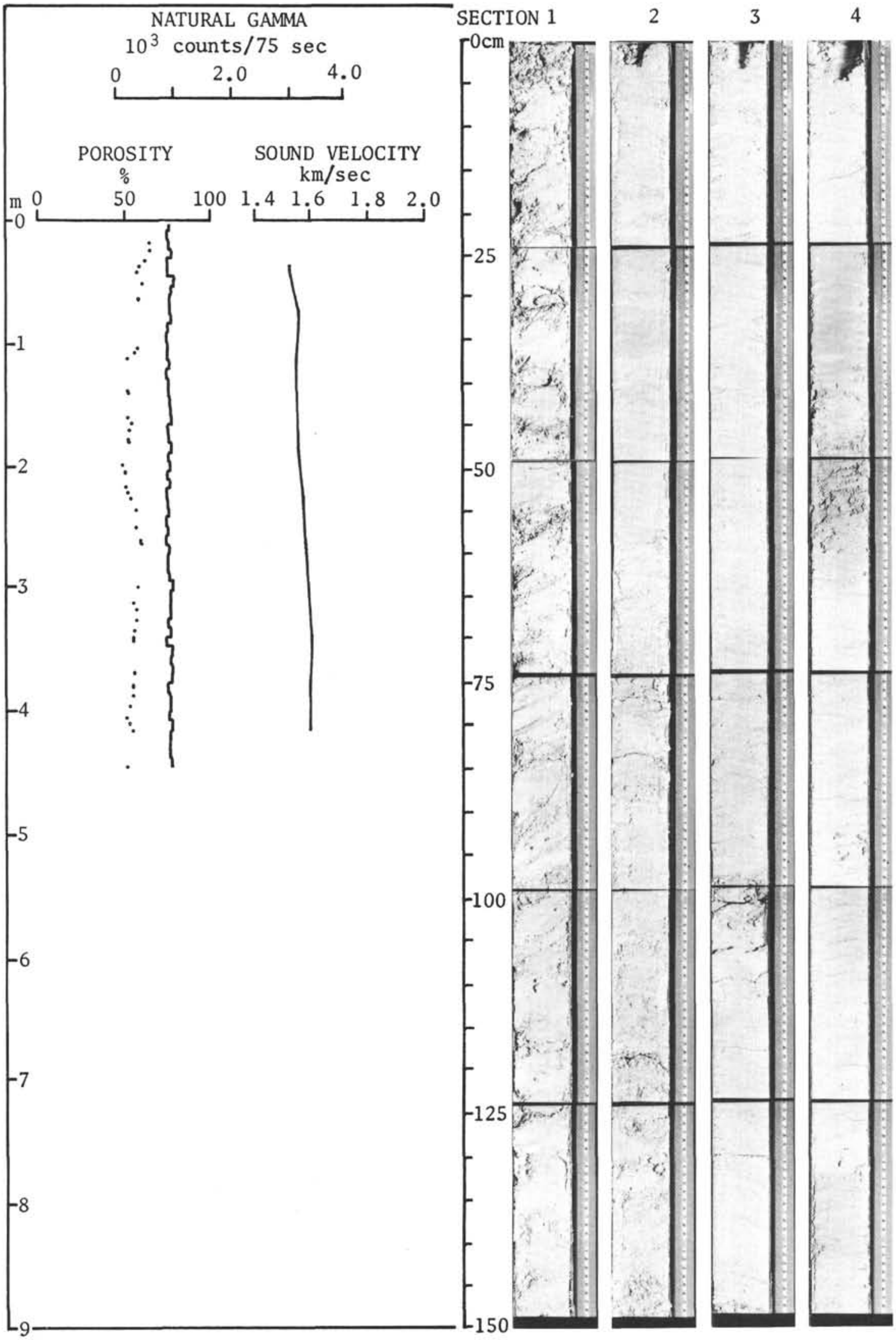


Figure 58. *Hole 79, Core 9, Sections 1-4, Physical Properties.*

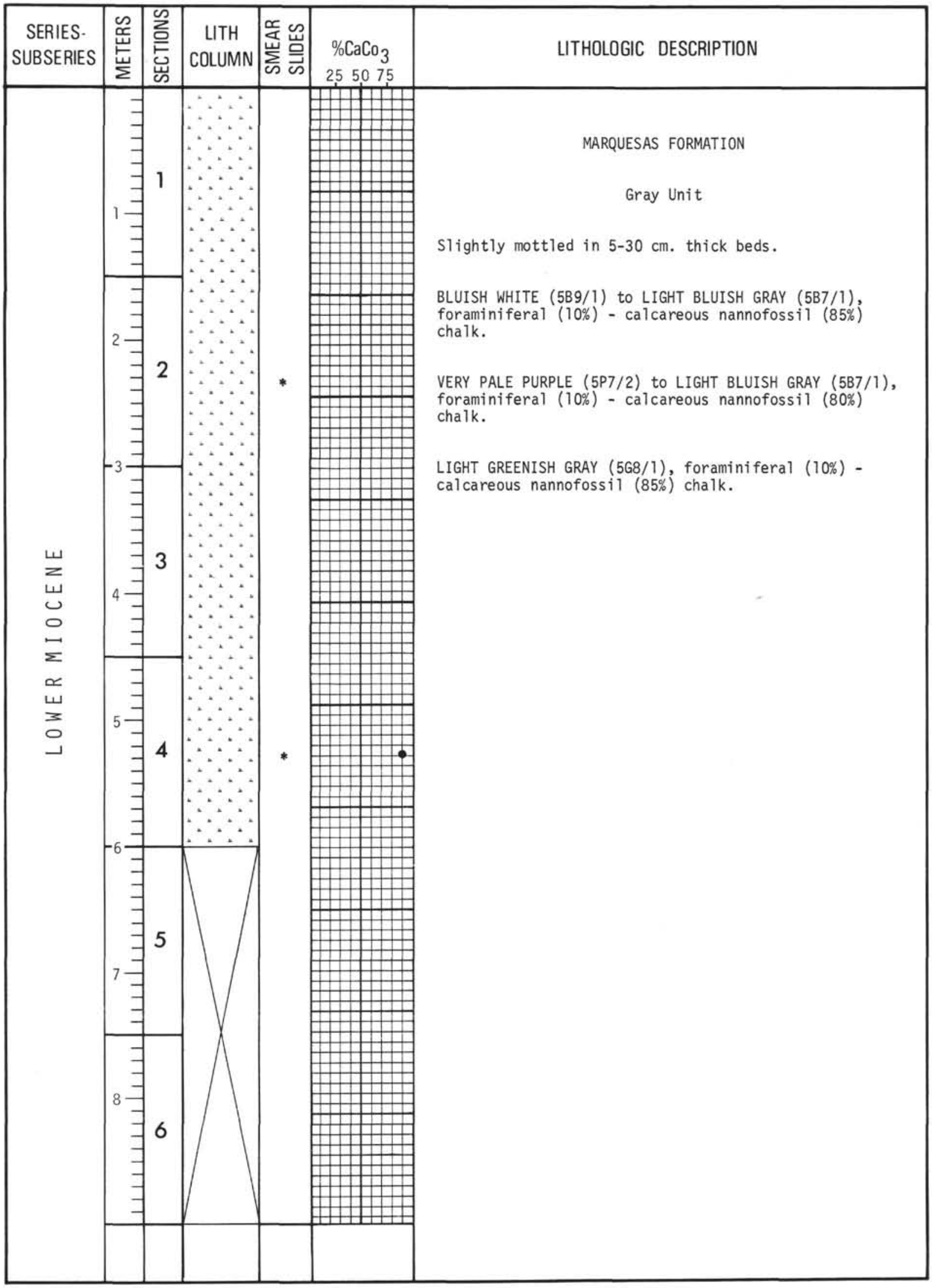


Figure 59. *Hole 79, Core 10 (355.7 to 364.2 m).*

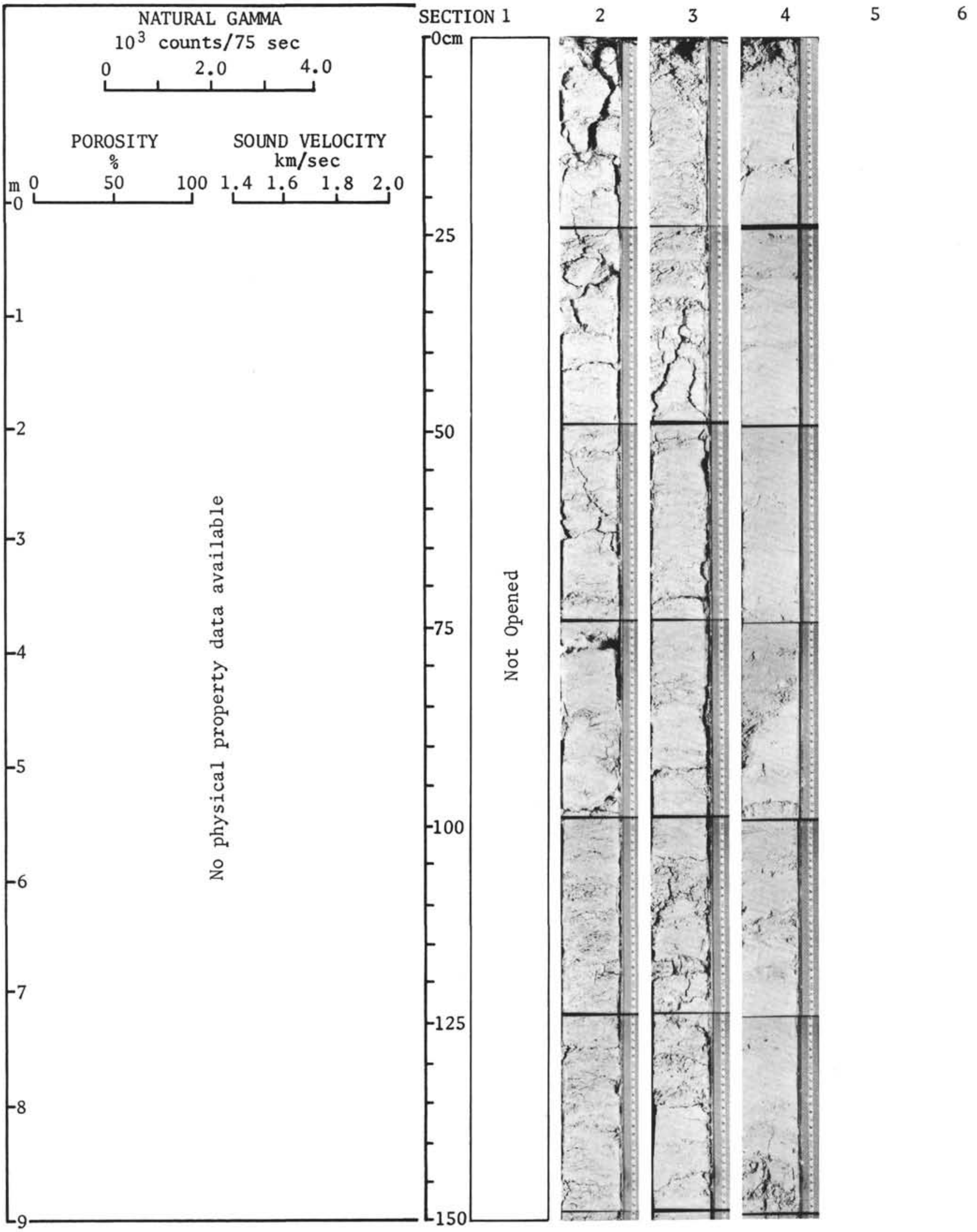


Figure 60. *Hole 79, Core 10, Sections 1-6, Physical Properties.*

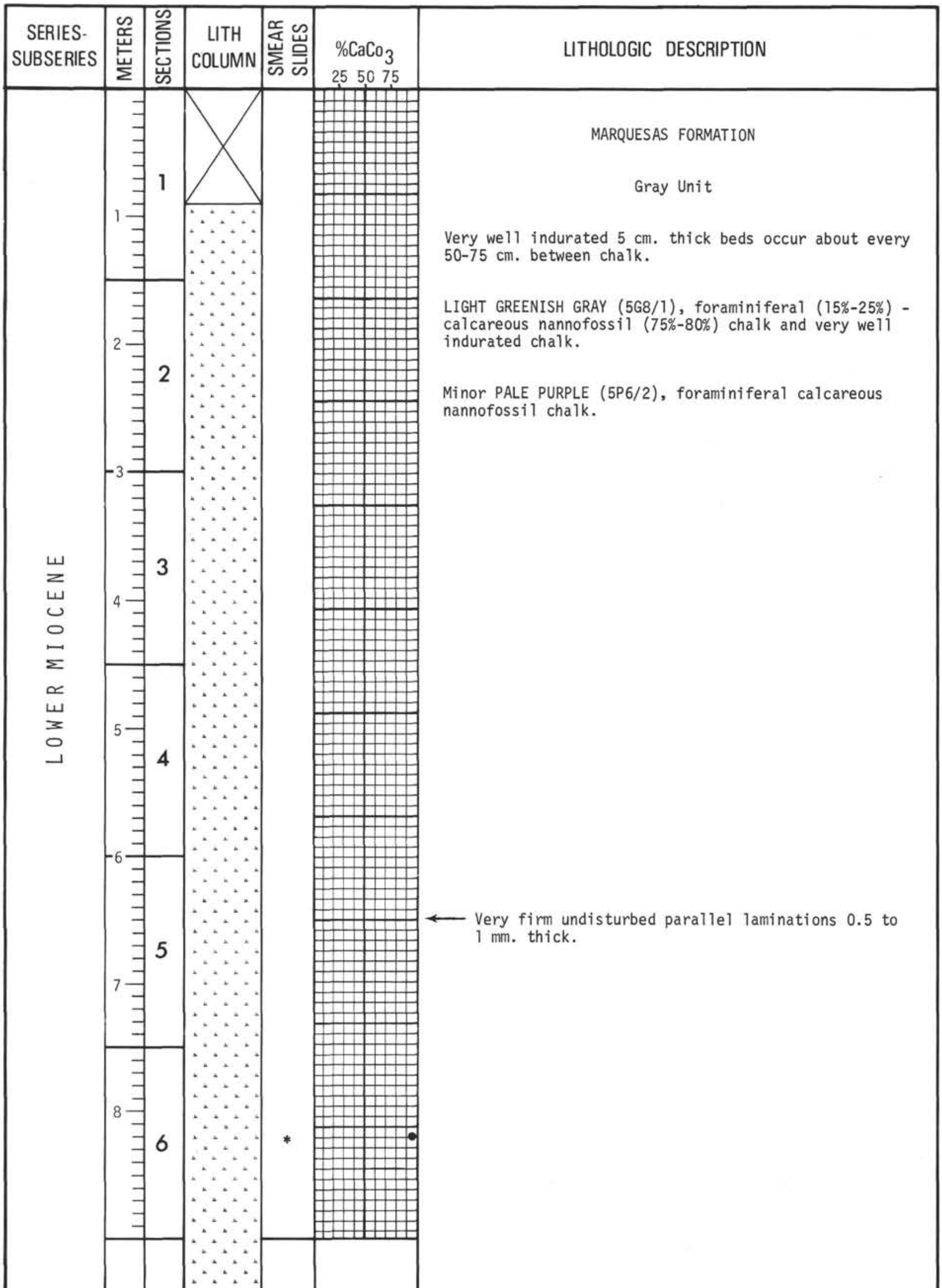


Figure 61. *Hole 79, Core 11 (364.2 to 373.4 m).*

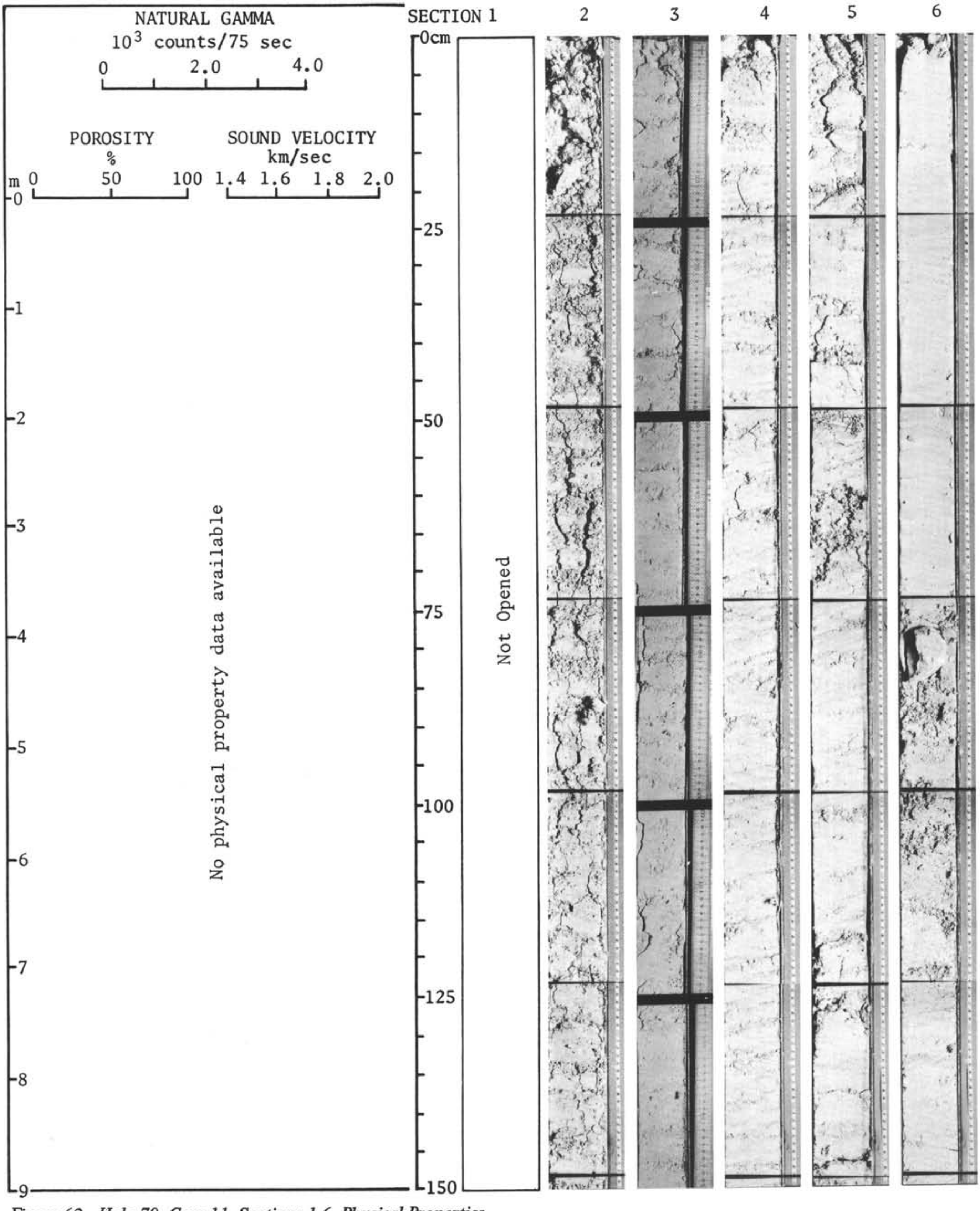


Figure 62. *Hole 79, Core 11, Sections 1-6, Physical Properties.*

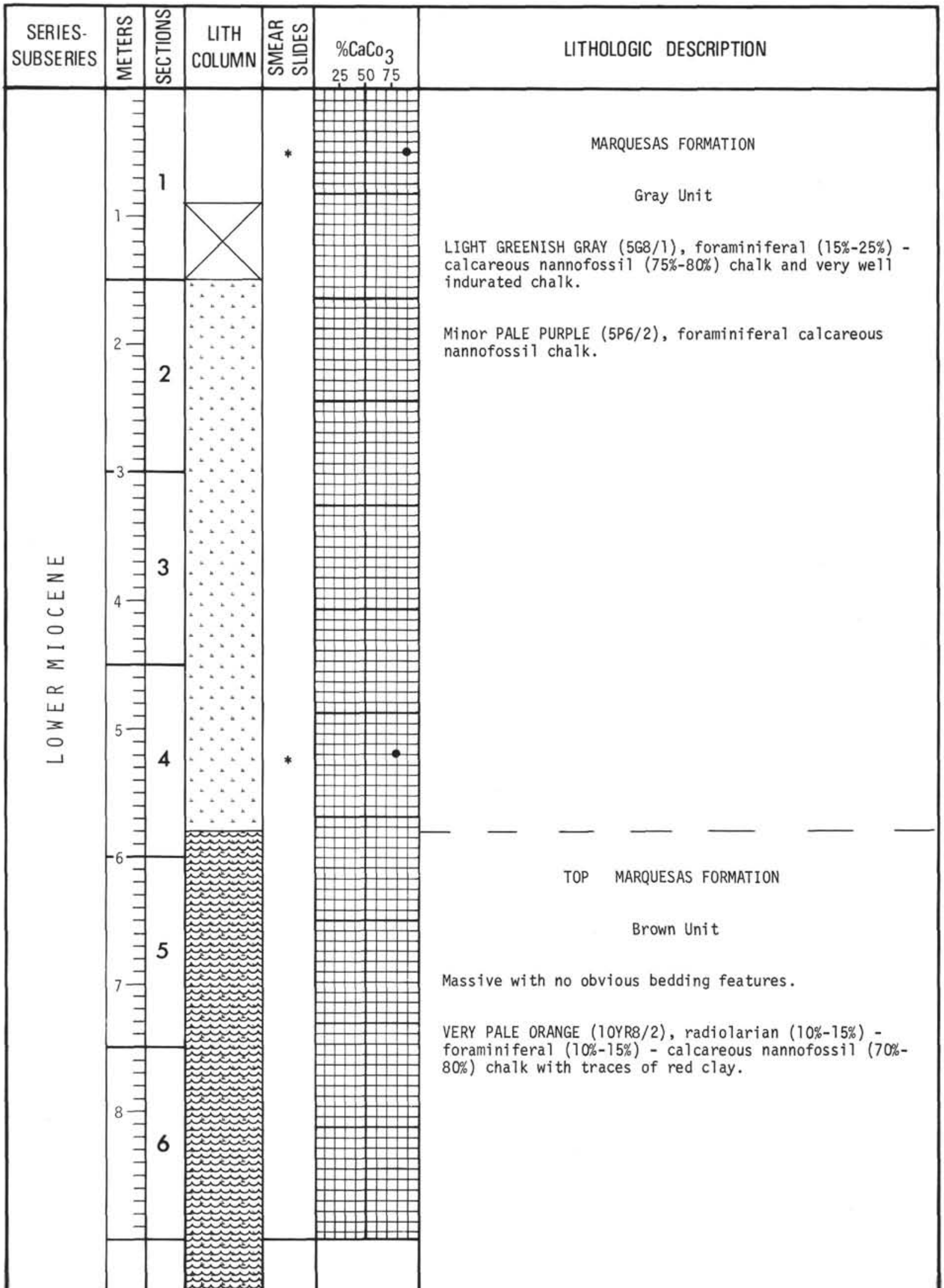


Figure 63. *Hole 79, Core 12 (373.4 to 380.4 m).*

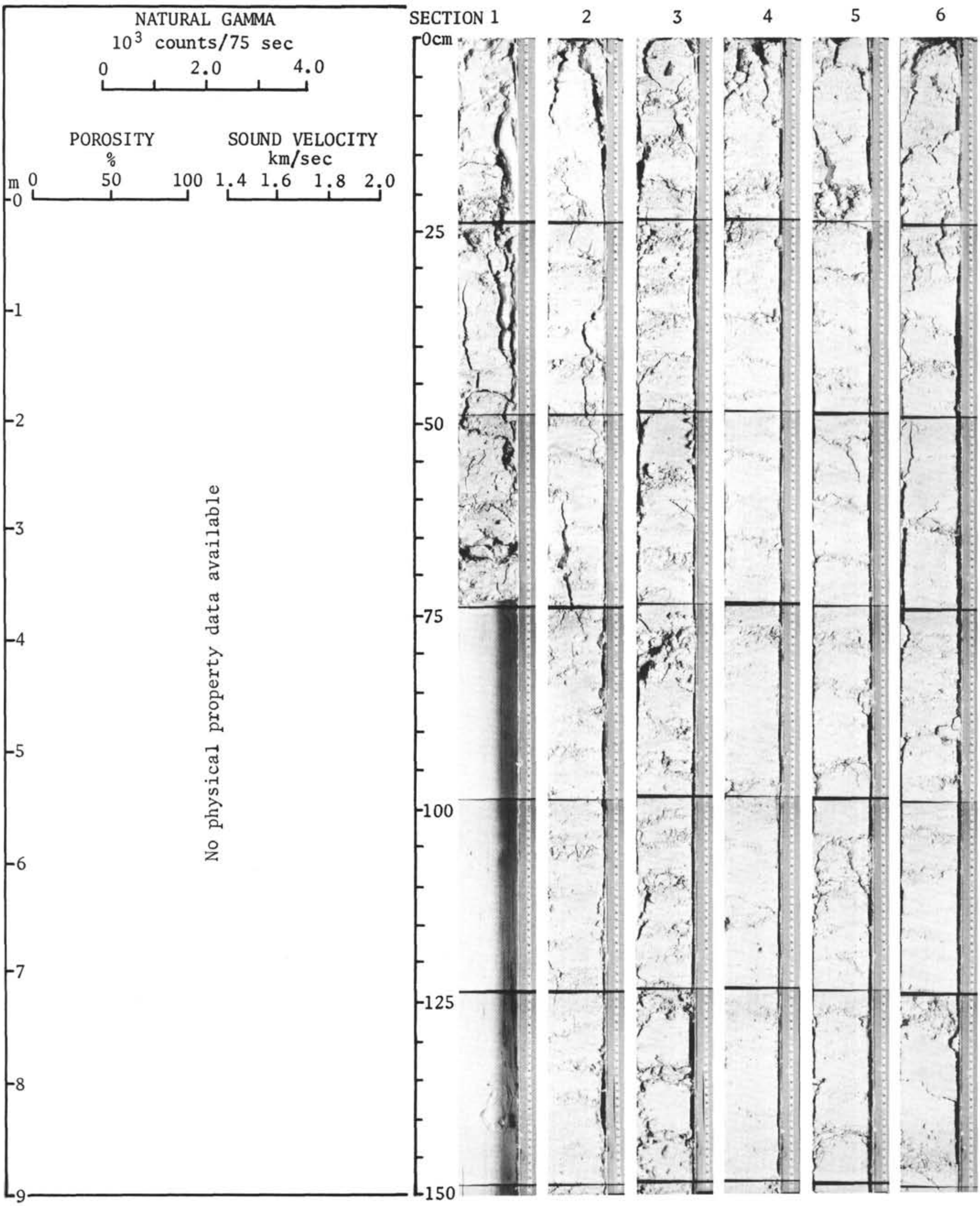


Figure 64. *Hole 79, Core 12, Sections 1-6, Physical Properties.*

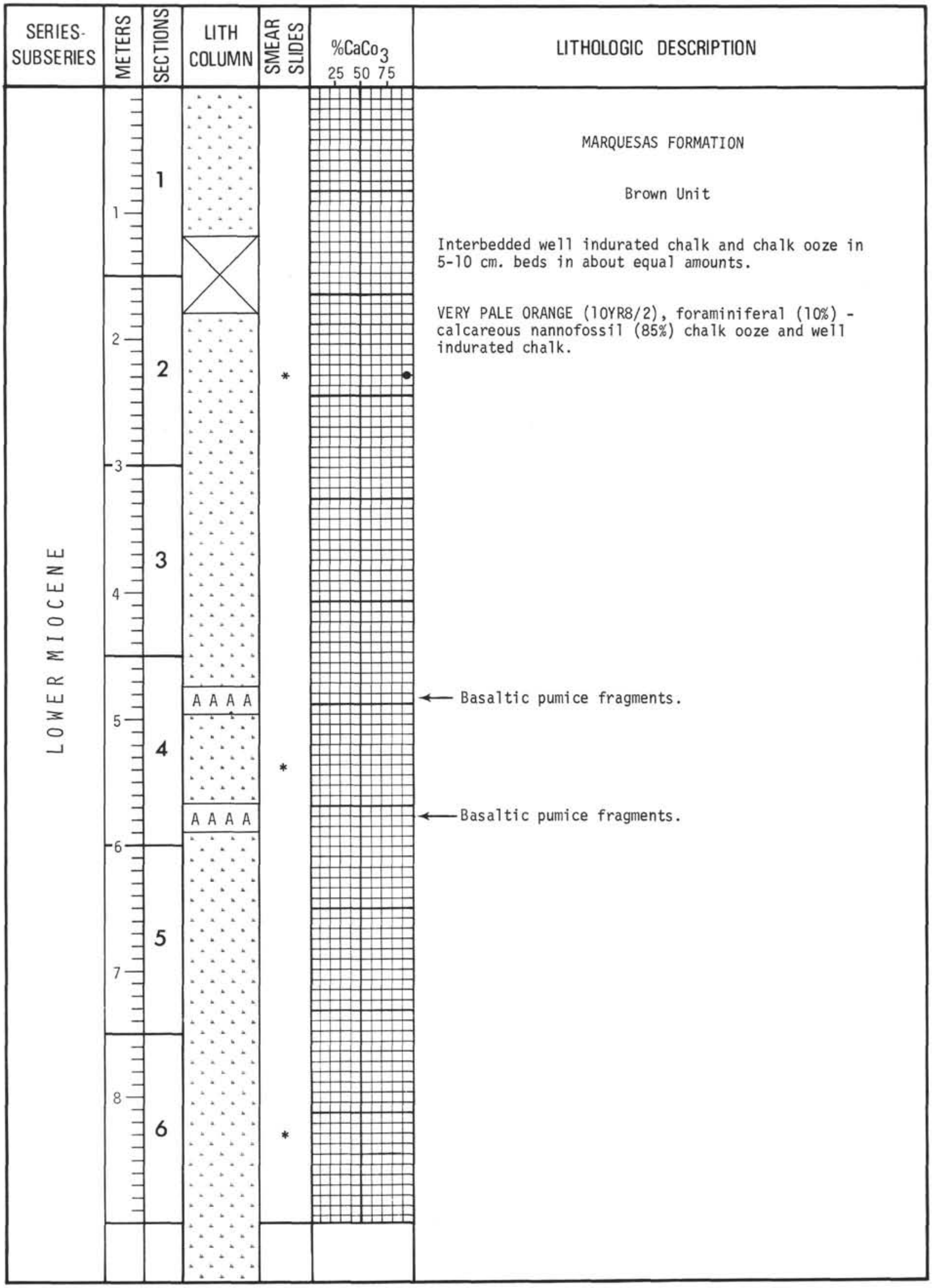


Figure 65. *Hole 79, Core 13 (380.4 to 389.5 m).*

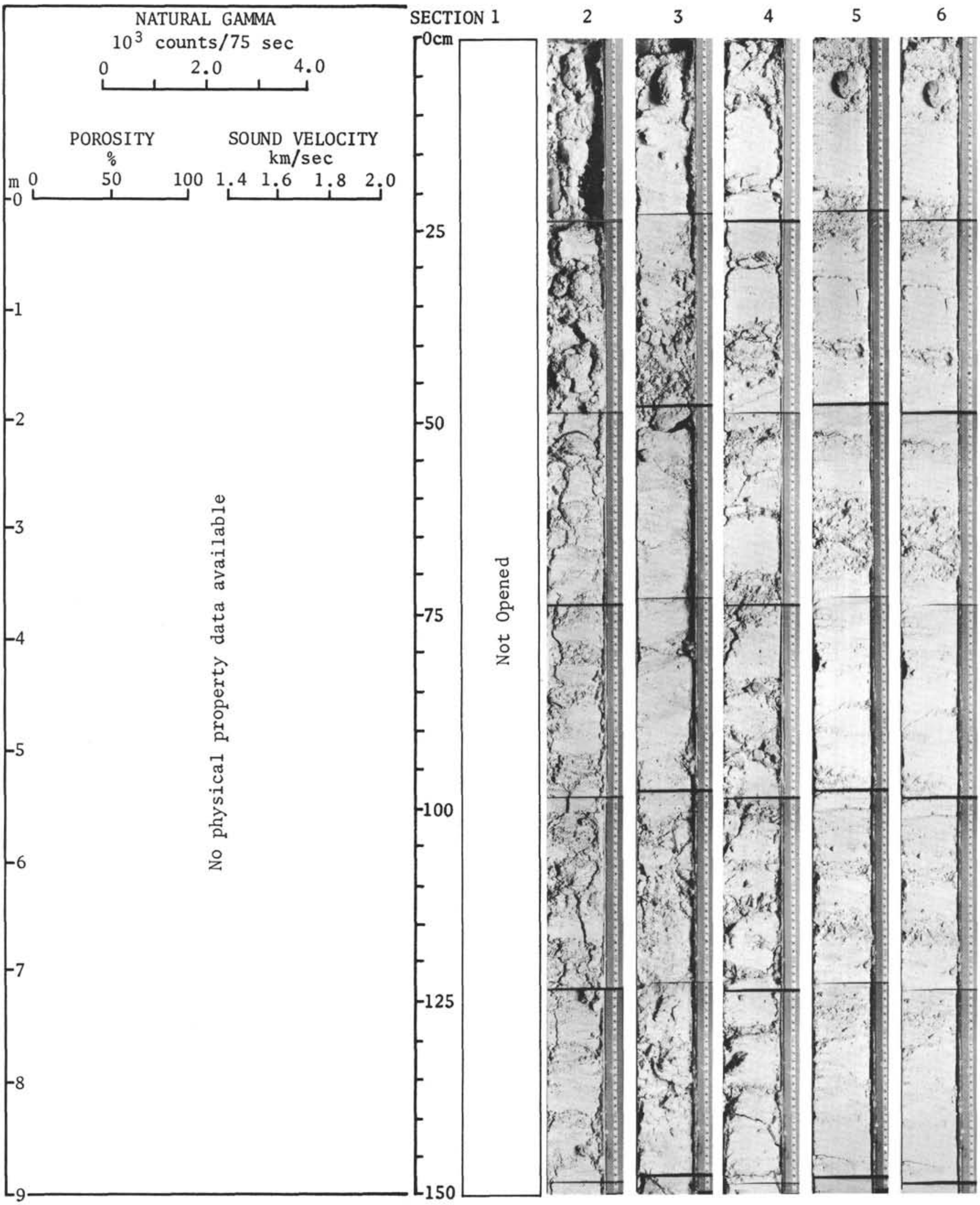
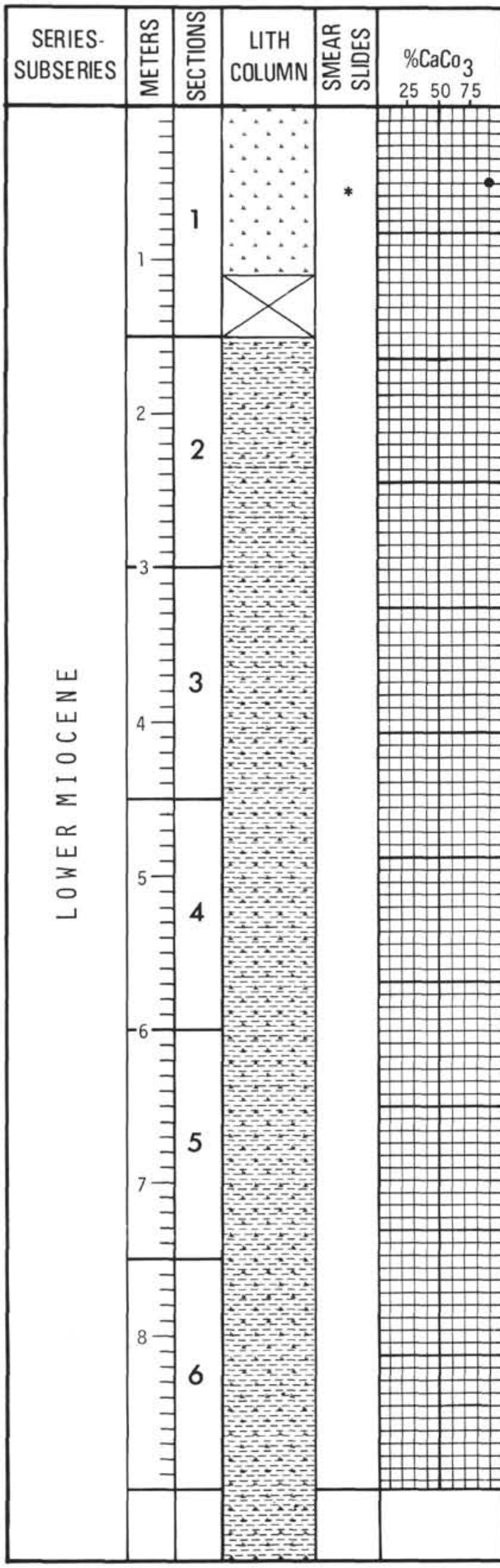


Figure 66. *Hole 79, Core 13, Sections 1-6, Physical Properties.*



LITHOLOGIC DESCRIPTION

MARQUESAS FORMATION

Brown Unit

Massively bedded, no apparent bedding features.

VERY PALE ORANGE (10YR8/2), calcareous nannofossil (80%-90%) chalk with up to about 2% red clay, radiolarians 5%-10%, and foraminifers 5%-10%.

Figure 67. *Hole 79, Core 14 (389.5 to 398.7 m).*

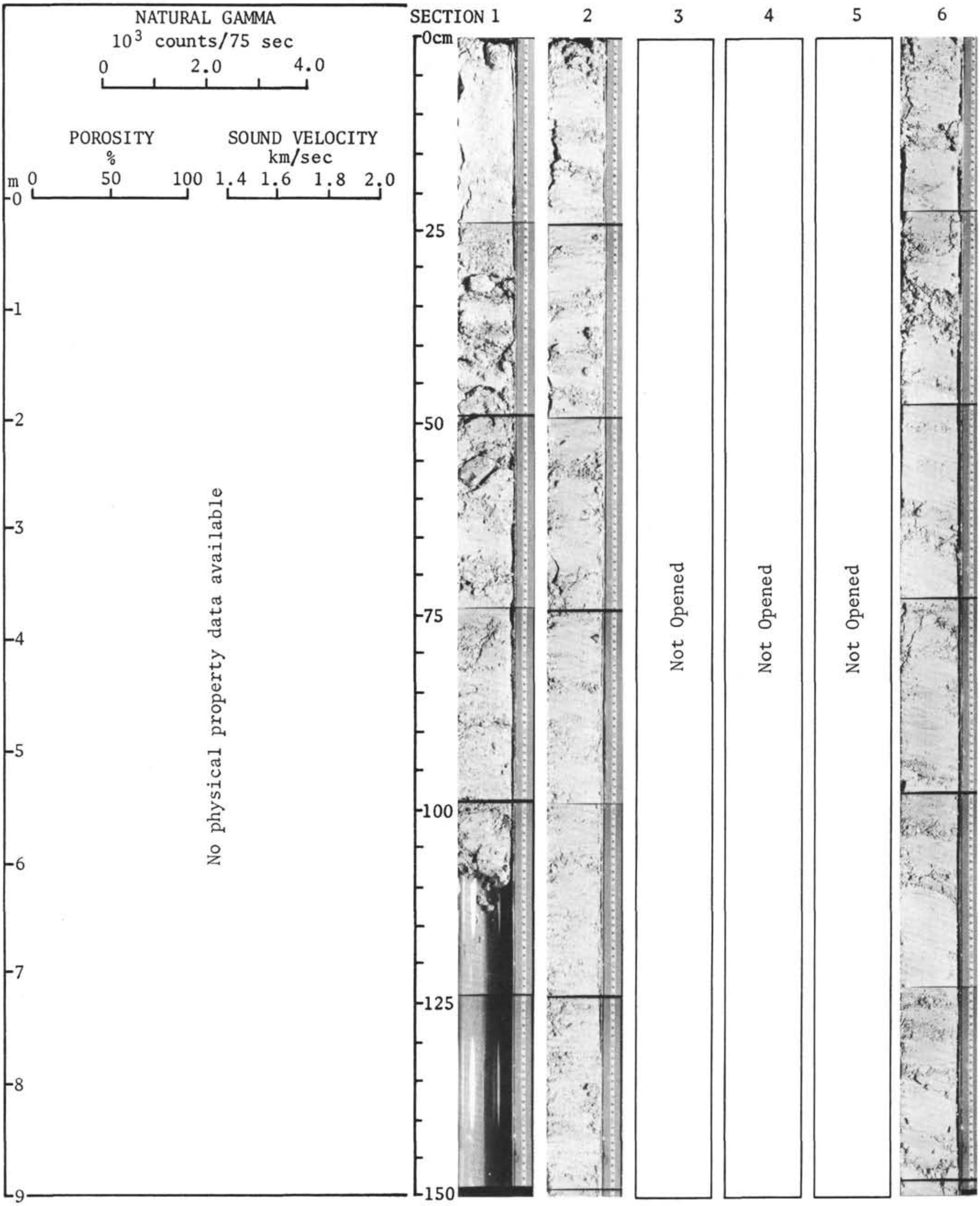


Figure 68. *Hole 79, Core 13, Sections 1-6, Physical Properties.*

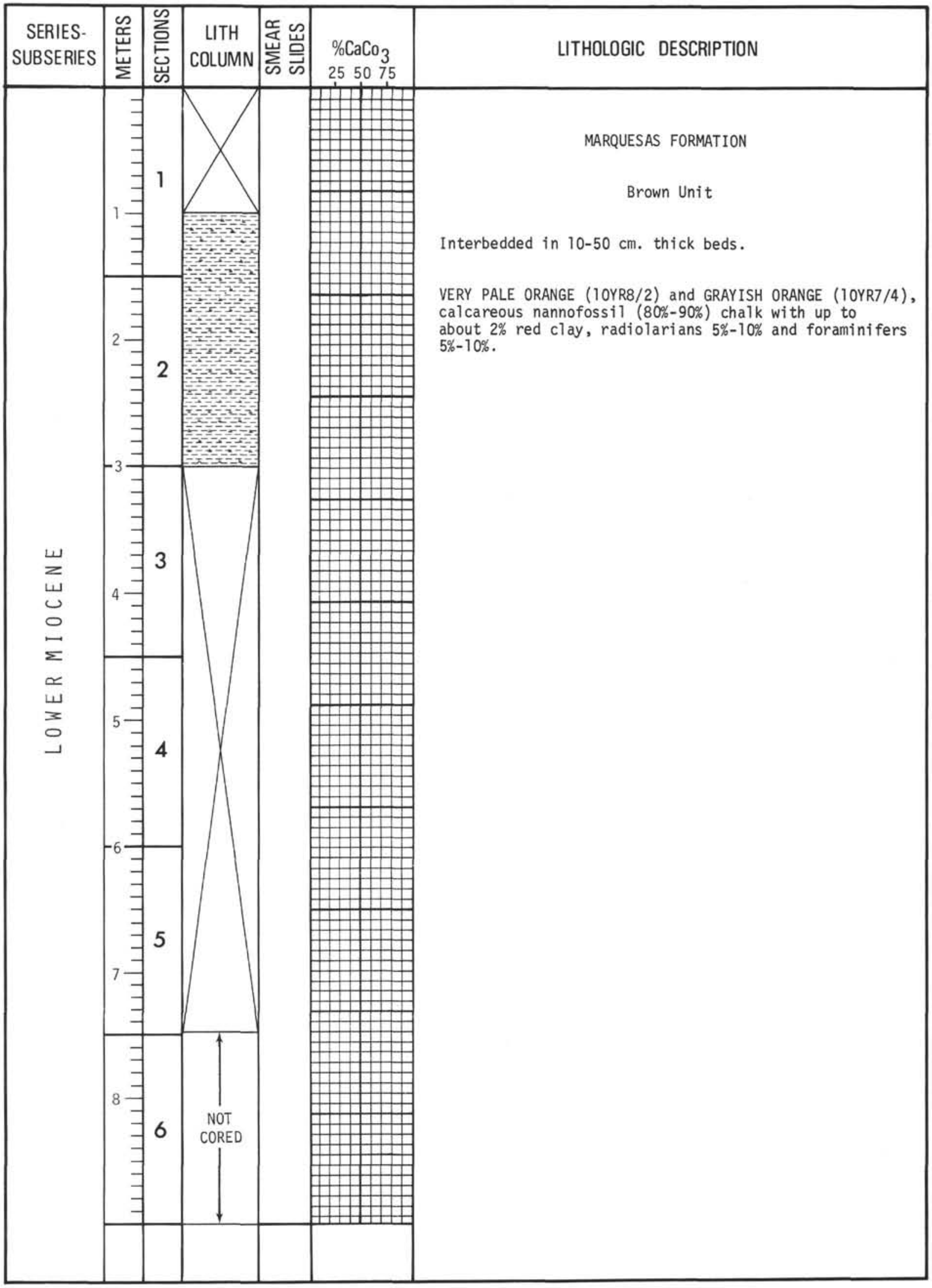


Figure 69. *Hole 79, Core 15 (398.7 to 406.0 m).*

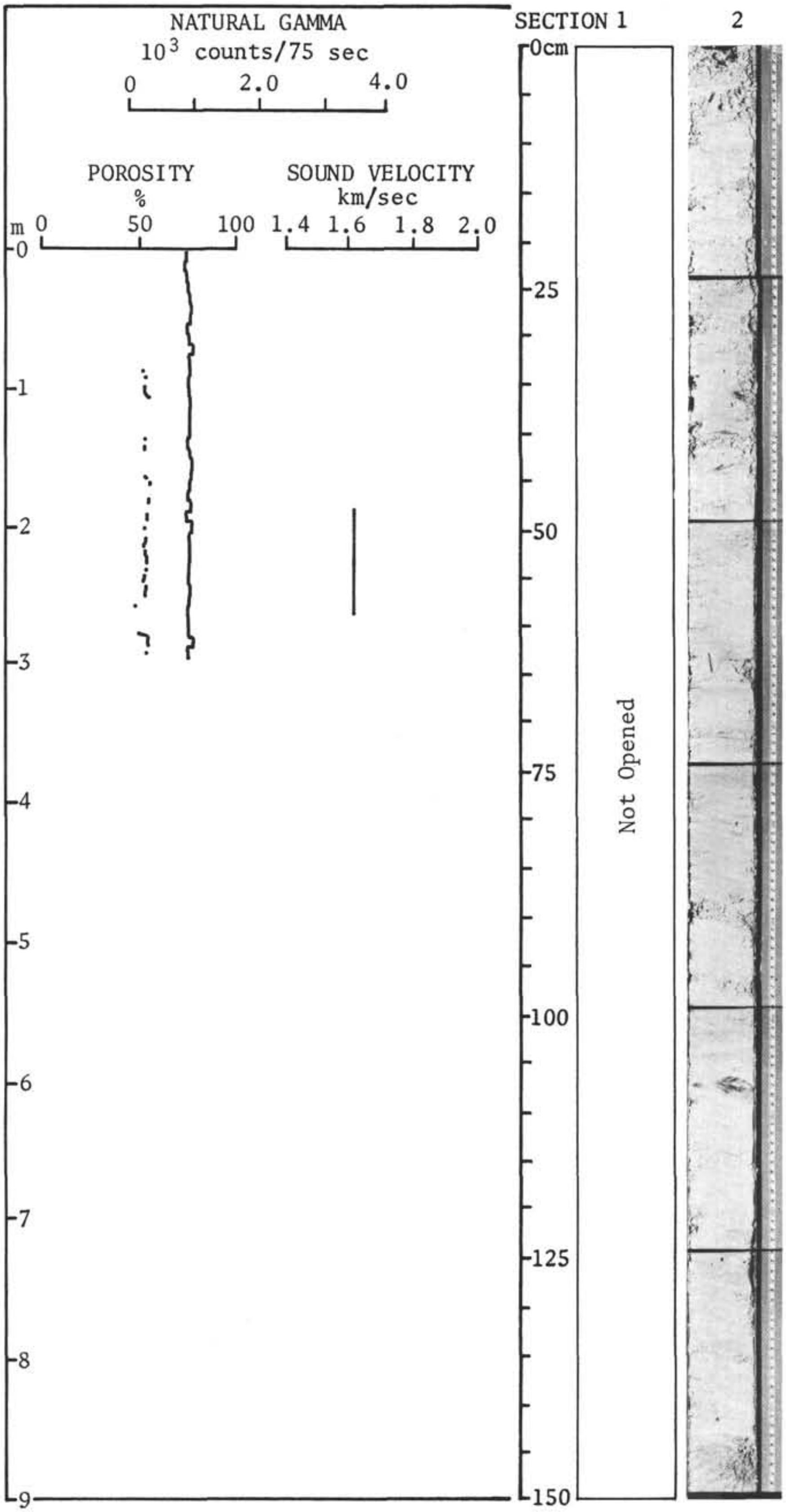


Figure 70. *Hole 79, Core 15, Section 1 and 2, Physical Properties.*

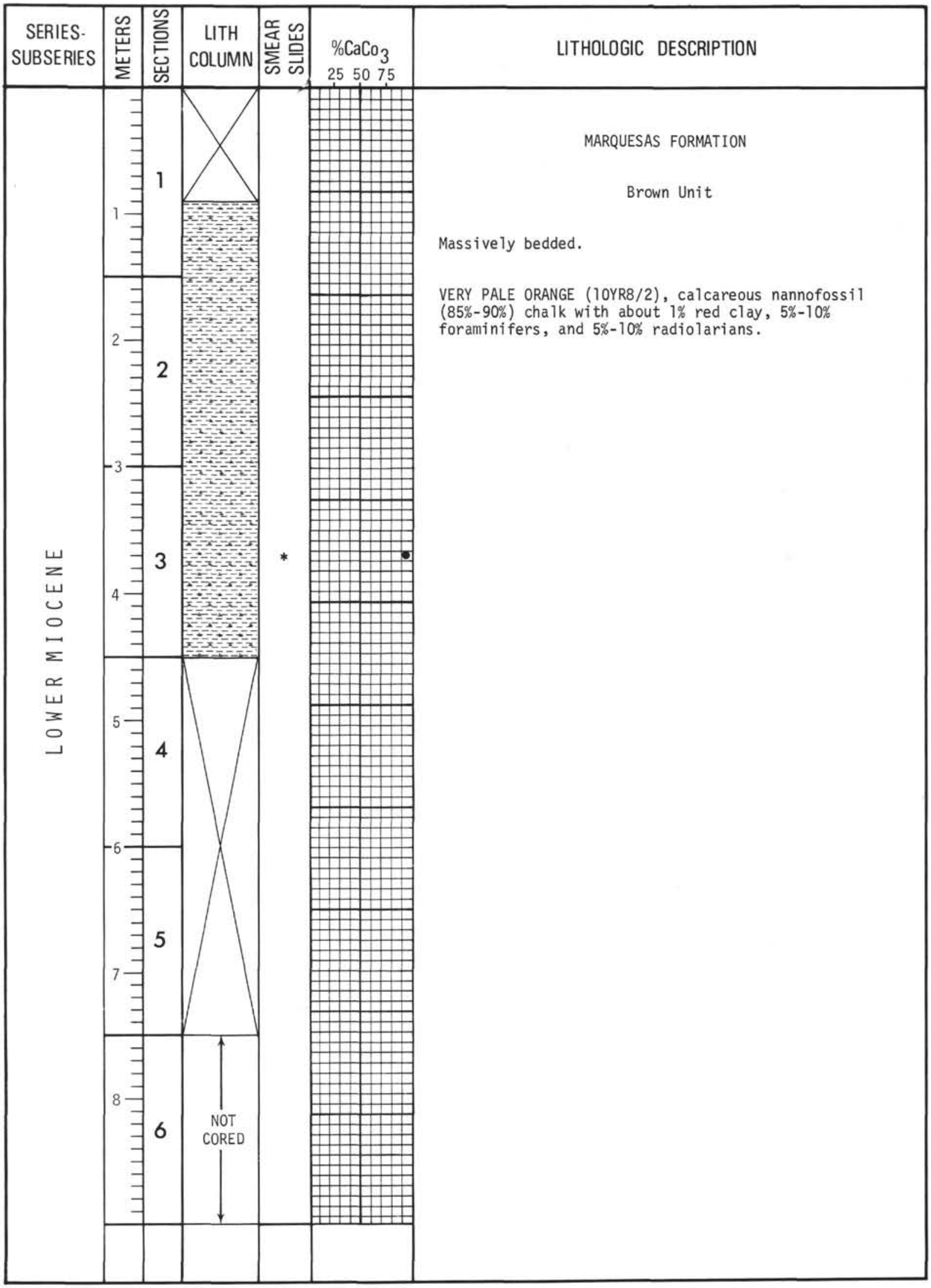


Figure 71. *Hole 79, Core 16 (406.0 to 413.6 m).*

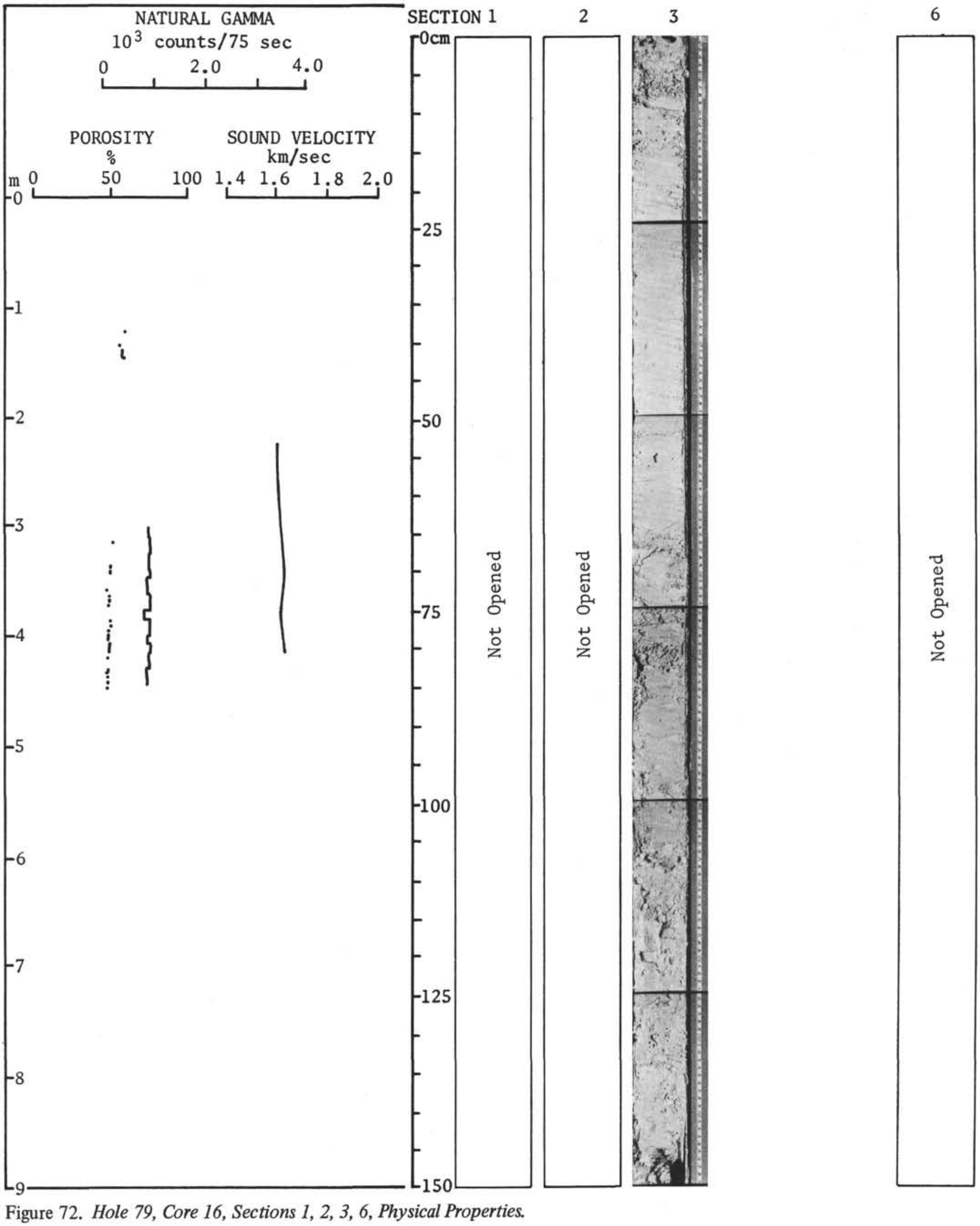


Figure 72. *Hole 79, Core 16, Sections 1, 2, 3, 6, Physical Properties.*

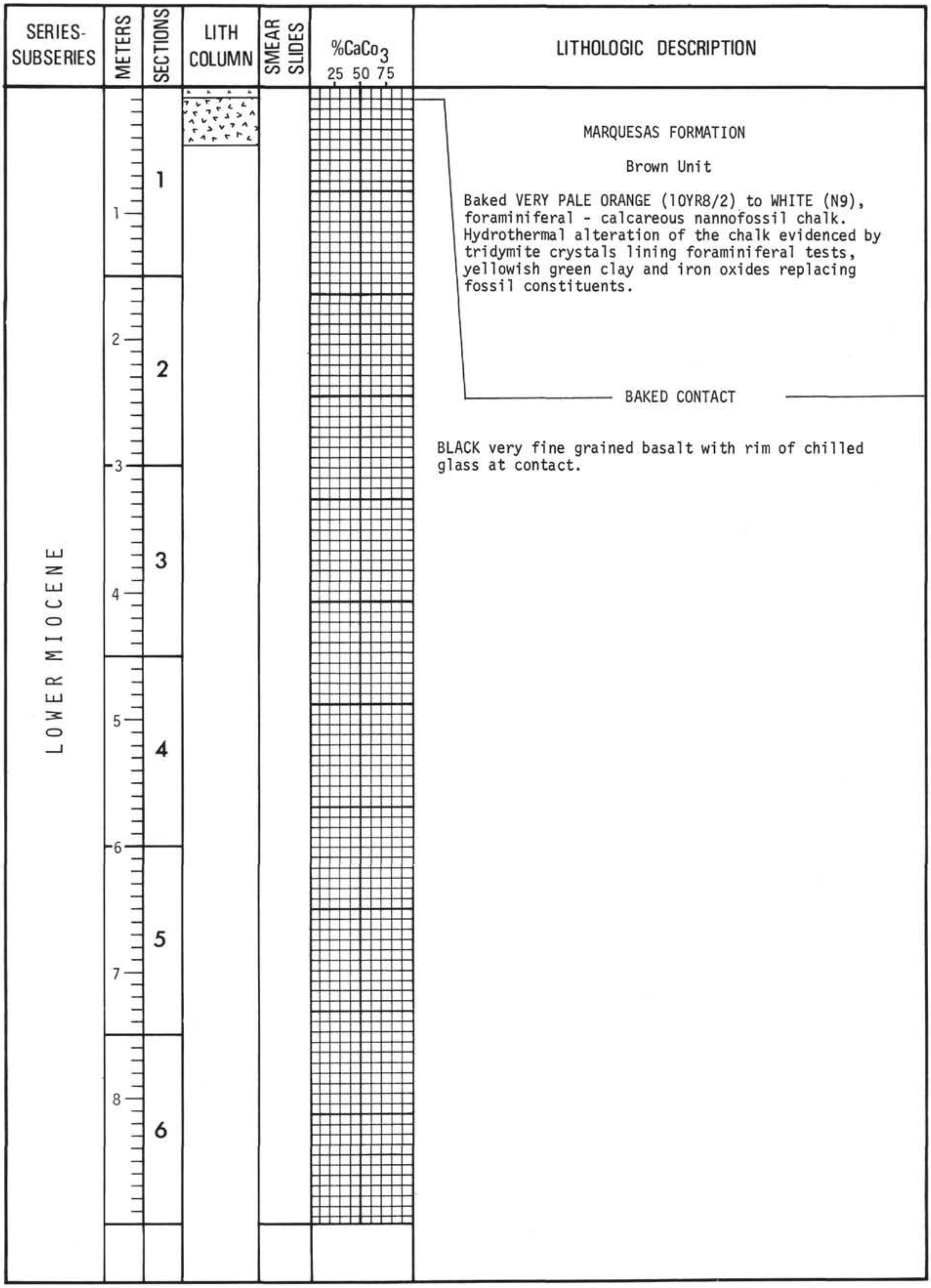


Figure 73. *Hole 79, Core 17 (413.6 to 413.9 m).*

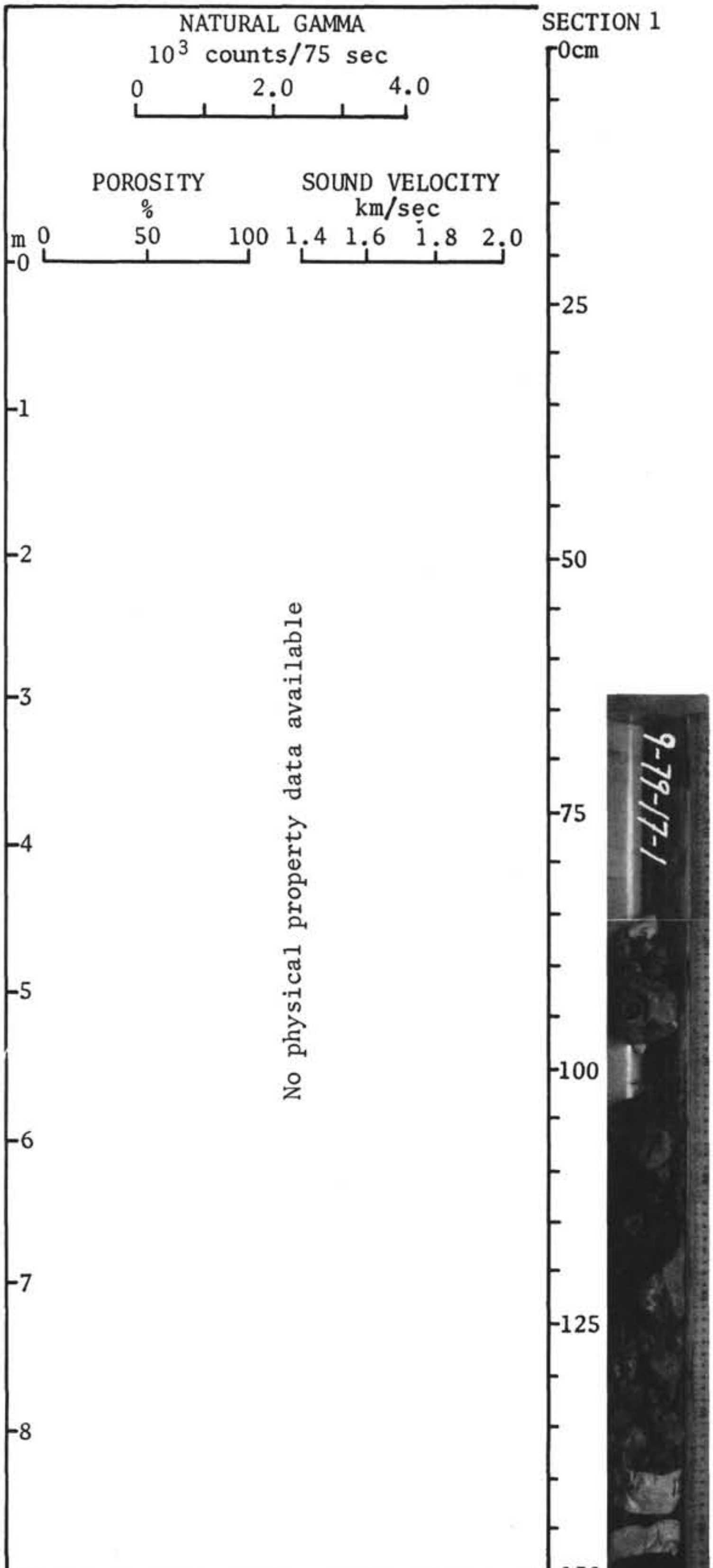


Figure 74. *Hole 79, Core 17, Section 1, Physical Properties.*

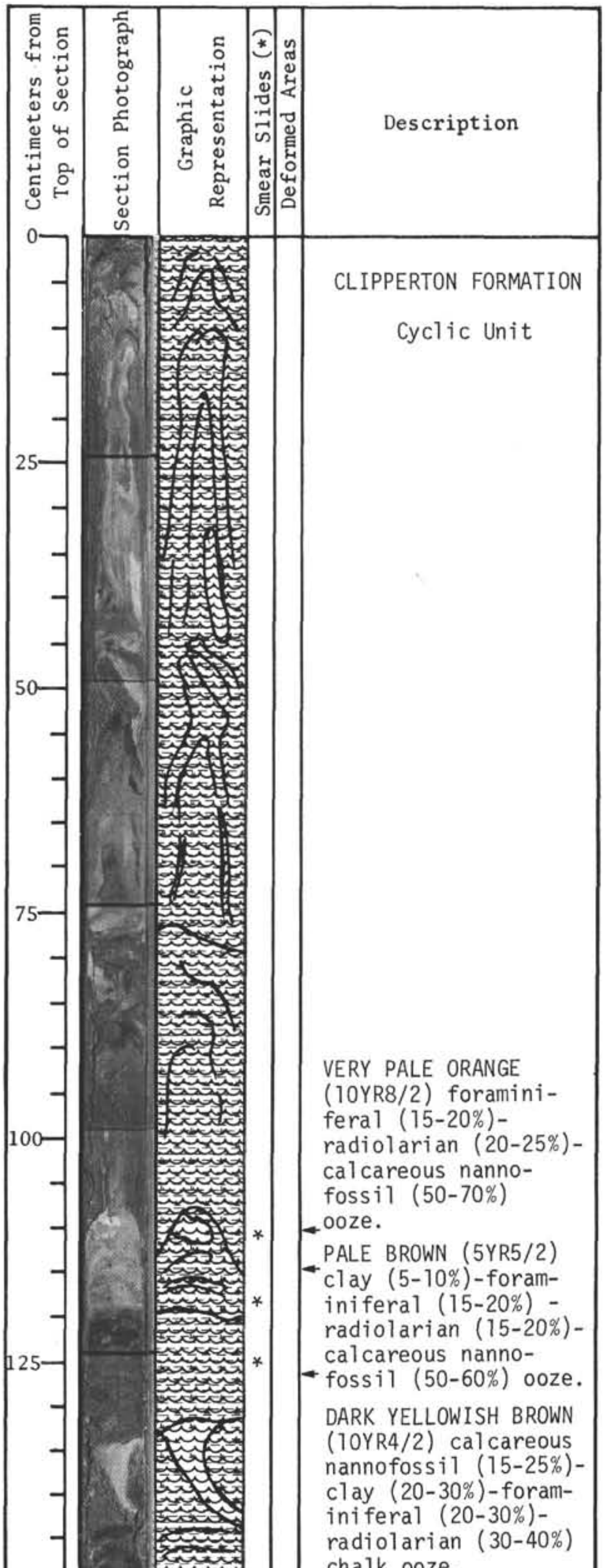


Figure 75. *Hole 79, Core 1, Section 2.*

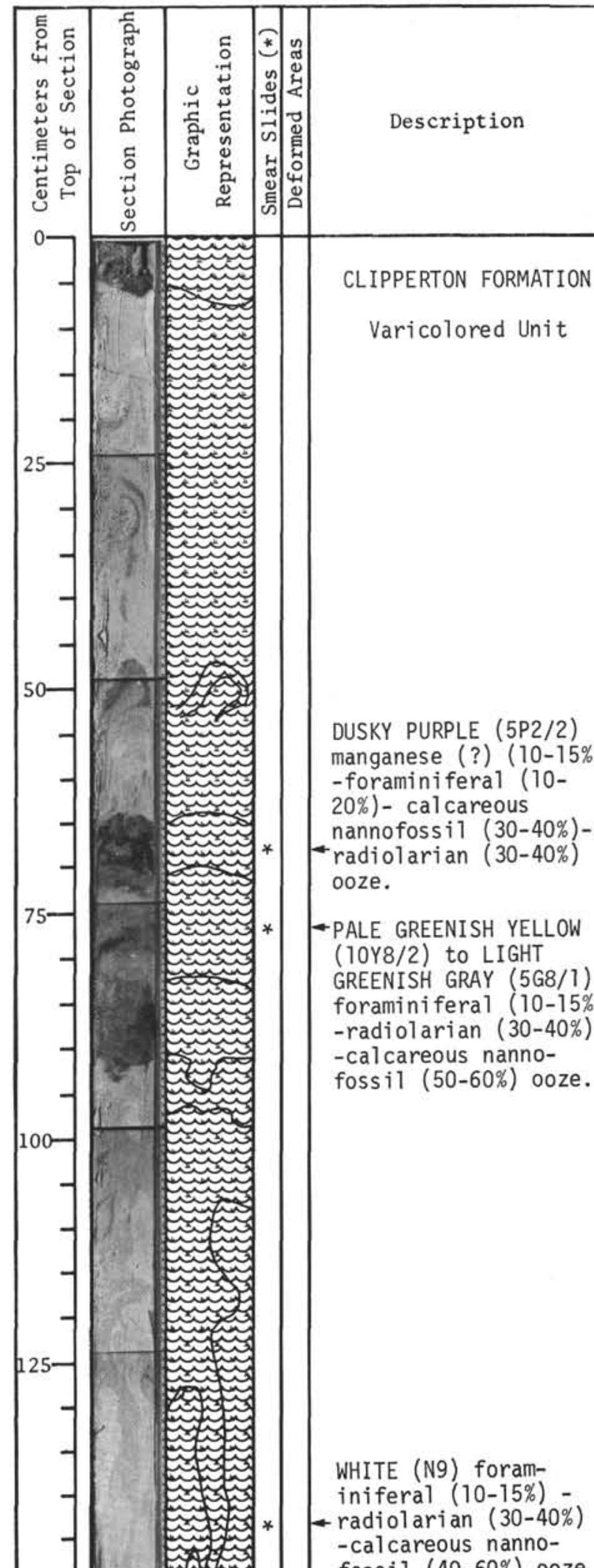


Figure 76. *Hole 79, Core 2, Section 5.*

Centimeters from Top of Section	Section Photograph	Graphic Representation	Smear Slides (*)	Deformed Areas	Description
0					MARQUESAS FORMATION Brown Unit Basement Contact
25					
50					
75					VERY PALE ORANGE (10YR8/2) to WHITE (N9) clay (1-5%) foraminiferal (10-15%) -calcareous nanno-fossil (80-90%)chalk. Chalk is baked and exhibits hydrothermal alteration in the form of green clay and iron oxides partly replacing the chalk and tridymite euhedra lining the interior of foraminifera tests.
100					
125					Chilled basaltic glass contact directly next to overlying chalk. Glass 5 to 10 mm thick Retractive index of nonderitrified, isotropic glass is 1.59-1.60.
150					Very fine-grained BLACK Basalt.

Figure 77. *Hole 79, Core 17, Section 1.*