8. SITE 82

The Shipboard Scientific Party[1]

MAIN RESULTS

Two holes were drilled at this site and two hundred and nineteen meters of sediment penetrated; the bit was stopped by basalt of which about a third of a meter was recovered. The age of the sediment at the base of the sediment column is late Miocene, near the base of the *G. plesiotumida* Zone. According to Berggren (1969) this sediment has an age of about 9 million years B.P. The average rate of sedimentation at this site is 24 m/m.y. which is a little higher than that at Site 81. The contact between the sediment and the underlying basalt is baked, indicating the basalt is intrusive. Assuming the age of the basalt closely approximates the paleontological age of the basal sediment, the rate of sea floor spreading between Site 81 and 82 is about 133 km/m.y. This rate is similar to the rate calculated between Sites 79 and 81. All of the major siliceous and calcareous microfossil groups are present in all samples studied except those at the very base of the section which are devoid of siliceous fossils.

INTRODUCTION

Background and Objectives

The background and objectives of this site are similar to those of the previous sites along the equatorial east-west traverse—to determine the rate of sea-floor spreading and to study the biostratigraphy of the equatorial Pacific. This site is located as close to the crest of the East Pacific Rise as sediment cover permits (Figure 1). To the east of this site the sediments thin abruptly and remain thin over the crest of the Ridge.

Ewing and others (1968) have pointed out that just to the east of this site the sediment thins abruptly and decreases further east to zero near the ridge crest. They offered two possible explanations: (1) there was an abrupt decrease in sedimentation rate about 10 million years ago, or (2) spreading paused for 10 to 15 million years prior to 10 million years B.P., followed by rapid spreading since 10 million years B.P. (6 cm/yr). This site, positioned near this abrupt thinning of sediment, affords an opportunity to test these suggestions by two means: (1) measuring the rate of sedimentation through the column and (2) if basement can be reached, dated estimates of spreading rates can be made between Site 81 and 82 and between Site 82 and the ridge crest. This site had not been previously surveyed.

Operations

Site Survey

The site was approached on course 078°. The relief of the ocean floor is moderate, consisting of low hills of up to 70 fathoms relief; these are a direct expression of the underlying basement relief (Figure 2). Basement relief is somewhat greater than ocean floor relief due to smoothing of bottom topography by sediment cover. Sediment thickness ranges from up to 0.3 second reflection time to as little as 0.25 over basement highs. The reflection profiler record shows an upper stratified layer 0.001 second thick with the bottom defined by a prominent and persistent reflector. Halfway through the column, at about 0.12 second, is a less persistent reflector. During the site survey it became apparent that the ocean floor was actually more rugged than had been evident during the approach run. This is probably due to the fact that we followed the trend of the basement relief during our approach and when we changed course to conduct the survey we ran across the basement texture. As at the previous sites we crossed the chosen drilling site twice, then retrieved the seismic gear, and dropped a Burnett beacon.

Coring

Our coring procedure was similar to that at Site 80. We took a core at the ocean floor and then continued to core at 55 meter intervals until reaching basement. When taking the first core at the sea floor the driller did not "feel" the sea floor at the P.D.R. corrected depth below the sea surface. The first core was taken at the P.D.R. corrected depth to 30 feet below this, and the first core barrel came up empty. The second core barrel came up full. We can therefore be quite safe in assuming that at this site the top of the sediment column was recovered. After recovering basalt and the contact between the sediment and the basalt, the drill string was pulled up to the mud line and a second hole

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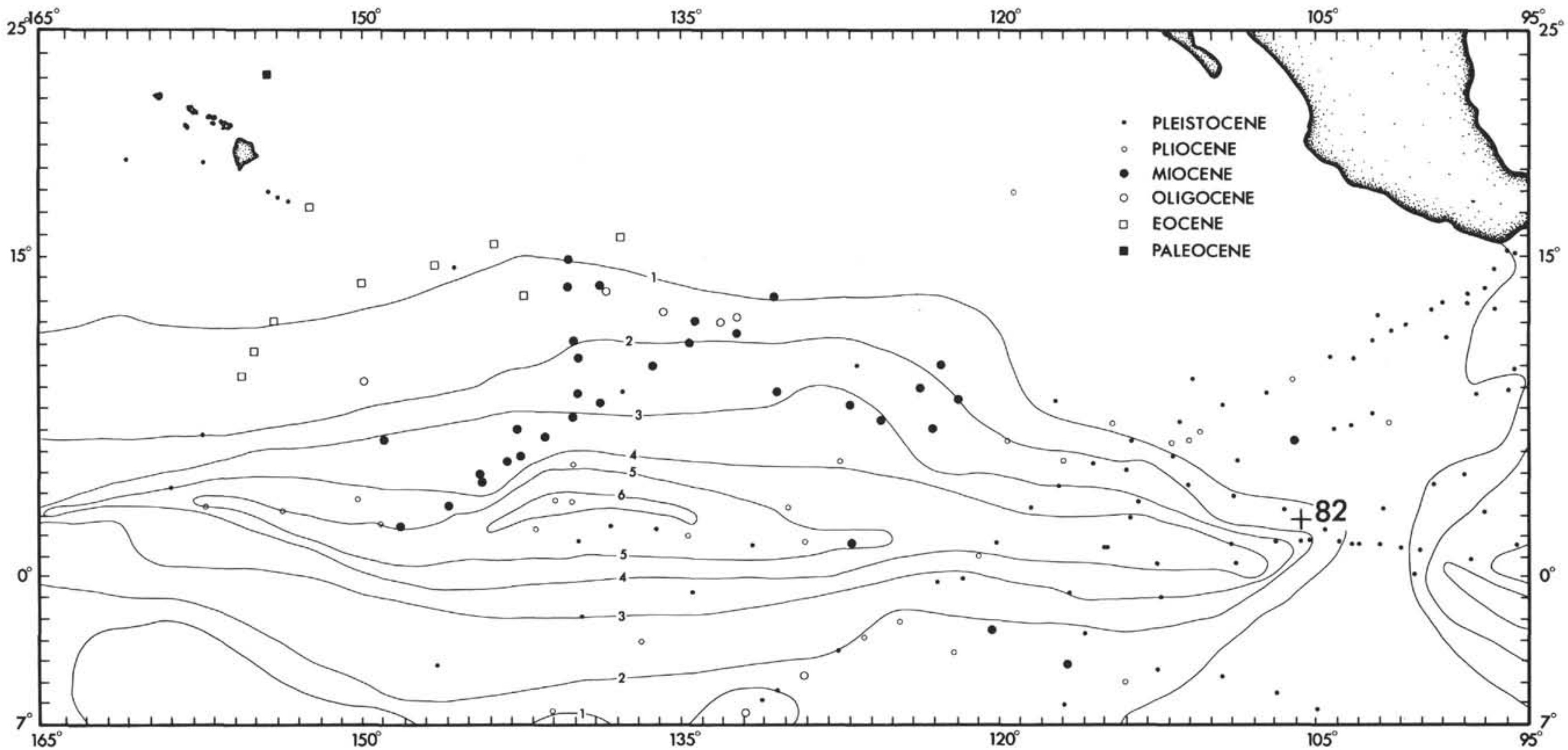

Figure 1. *Location of Site 82; sediment isopachs in hundreds of meters after Ewing* et al. *(1968); distribution of piston core ages after Hays* et al. *(1969).*

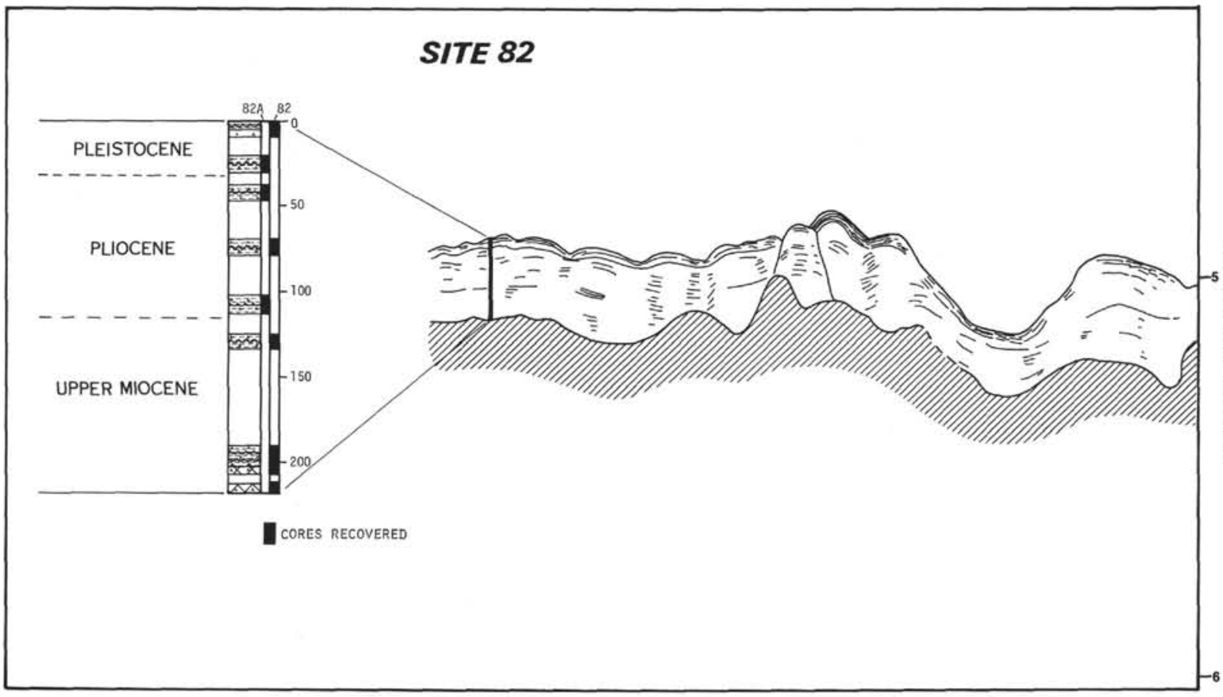

Figure 2. *Sketch of seismic reflection record in vicinity of Site 82 showing interval cored in each hole.*

spudded from which were obtained three additional cores at levels selected for stratigraphic control.

After the bit was returned to the rig floor the ship made a pass over the beacon with all seismic gear streamed to determine again the nature of the site drilled.

Pertinent coring data for this site are included in Tables 1 and 2.

LITHOLOGY

At this site three sedimentary formations are present: the Clipperton Oceanic Formation (0 to 5.8 meters) which consists of the cyclic unit of interbedded siliceous and calcareous ooze; the San Blas Oceanic Formation (5.8 to 202.6 meters) of green calcareous ooze and chalk; and the Line Islands Oceanic Formation (202.6 to 223 meters). Basement is a black, fine-grained basalt.

Clipperton Oceanic Formation

Cyclic Unit (0 to 5.8 meters)

At this site the cyclic unit is characterized by dusky brown and pale orange colors that are interbedded in 10 to 25 centimeter thick beds. These colors occur in about equal amounts. Upper and lower contacts between the different colors are sharp (Figure 41). A slight mottling occurs with the orange beds.

A complete cycle from top to base consists of the following sediment types:

1. Dark yellowish-brown (10YR4/2) clay (10 to 15 per cent)–radiolarian (10 to 20 per cent)–calcareous nannofossil (20 to 30 per cent)–foraminiferal (40 to 50 per cent) ooze.

2. Dusky yellowish-brown (10YR2/2) radiolarian (10 to 15 per cent)–calcareous nannofossil (20 to 25 per cent)–foraminiferal (25 to 30 per cent)–clay (30 to 40 per cent) ooze.

3. Grayish-orange (10YR7/4) radiolarian (10 to 20 per cent)–foraminiferal (10 to 25 per cent)–calcareous nannofossil (60 to 80 per cent) ooze.

4. Very pale orange (10YR8/2) radiolarian (5 to 10 per cent)–foraminiferal (30 to 40 per cent)–calcareous nannofossil (50 to 60 per cent) ooze.

5. Light greenish gray (5GY8/1) foraminiferal (20 to 40 per cent)–radiolarian (20 to 40 per cent)–calcareous nannofossil (20 to 40 per cent) ooze.

A detailed graphic representation of these cycles is shown in Figure 41.

The Clipperton grades into the San Blas Oceanic Formation over a 2.5-meter transitional zone. This transitional interval consists of interbedded colors characteristic of both formations.

San Blas Oceanic Formation

The San Blas is in striking contrast to the brown and orange cyclic unit above. The San Blas is distinguished by its green (montmorillonite) and purple colors and varying proportions of altered pyroclastic material.

Toward the top of the formation the bedding is about 2 to 25 centimeters thick with only a slight amount of burrows. The basal part of the formation occurs in 2 to 5 centimeter thick beds and is intensely burrowed.

Sediment types include:

1. About 80 per cent light greenish-gray (5GY8/1) and dark greenish-gray (5G4/1) montmorillonite (2 to 5 per cent)–radiolarian (10 to 15 per cent)–foraminiferal (40 to 50 per cent)–calcareous nannofossil (40 to 50 per cent) ooze and chalk ooze.

2. About 15 per cent very dusky purple (5P2/2) montmorillonite (2 to 5 per cent) foraminiferal (10 to 15 per cent)–radiolarian (40 to 50 per cent)–calcareous nannofossil (40 to 50 per cent) chalk ooze with about 2 to 5 per cent manganese (?) coating the radiolarians.

3. About 5 per cent very pale orange (10YR8/2) foraminiferal (15 to 25 per cent)–radiolarian (20 to 30 per cent)–calcareous nannofossil (40 to 50 per cent) chalk ooze.

The contact with the underlying Line Islands Oceanic Formation is very sharp with no gradation (Figure 42).

Line Islands Oceanic Formation

The Line Islands Oceanic Formation at this site is characterized by its intensely mottled orange and white colors, abundant manganese (?) dendrites, scattered patches of olive green hydrothermal clay, and deuteric iron oxides.

Bedding is very indistinct due to the intense burrowing; however, remnant bedding can be seen and apparently original beds were about 0.5 to 1.0 centimeter thick.

The three dominant sediment types are:

1. Very pale orange (10YR8/2) foraminiferal (10 to 15 per cent)–calcareous nannofossil (30 to 40 per cent)–radiolarian (40 to 50 per cent) chalk ooze.

2. Very pale orange (10YR8/2) foraminiferal (10 to 15 per cent)–radiolarian (10 to 15 per cent)–calcareous nannofossil (70 to 80 per cent) chalk.

3. White (N9) foraminiferal (10 to 15 per cent)–calcareous nannofossil (30 to 40 per cent)–radiolarian (50 to 60 per cent) ooze chalk.

TABLE 1
Site Operational Summary

Site 82

Latitude: 02° 35.48′N; Longitude 106° 56.52′W.

Time of arrival: 0352 hours, 1/13/70; Time of departure: 1936 hours, 1/14/70.

Total time on site: 1 day, 15 hours, 34 minutes.

Water depth: 3689 meters.

Sediment thickness determined by drilling: 214 meters.

Acoustical thickness: 2.3 seconds.

Average sound velocity of sediments: 1.8 km/sec.

Hole	Penetration (m)	Cores Attempted	Cores Recovered	Per Cent Cored	Recovery (m)	Per Cent Recovered
82	214.3	7	7	23.5	46.0	91.5
82A	111.0	3	3	24.7	26.5	96.7
Total 2	214.3	10	10	36.3	72.5	92.3

Basalt

This is a black (N-1), very fine-grained basalt with a 1 to 2 millimeter thick chilled glass rind at its contact with the overlying Line Islands Formation.

PHYSICAL PROPERTIES

Natural Gamma

Natural gamma emission readings range from 775 to 2139 counts/75 sec.

The cyclic unit of the Clipperton Oceanic Formation yielded high readings from 1244 to 2139 counts. These high readings serve to distinguish it from the underlying San Blas Oceanic Formation. High readings are probably due to mica, potassic feldspar, and montmorillonite (Cook and Zemmels, 1971). The oscillations of the readings in Core 1 directly correspond to interbedded light and dark sediments. The dark sediments, which contain more clay, yield higher readings.

The underlying San Blas Oceanic Formation shows readings from 775 to 1183 counts. The emission readings exhibit an oscillatory pattern of high counts followed by low counts. Usually the high and low readings correspond to areas of greater and smaller clay concentrations, respectively.

The Line Islands Oceanic Formation yielded readings of 859 to 1291 counts. There is a drop in natural gamma emission readings from 1340 to 1291 counts at the boundary between the San Blas Oceanic Formation and the Line Islands Oceanic Formation. The last 2 meters of the San Blas Oceanic Formation shows higher readings than the underlying Line Islands Oceanic Formation.

Porosity

Porosity at Site 82 ranges from 82 per cent in radiolarian-calcareous nannofossil-foraminiferal oozes to 69 per cent in foraminiferal-calcareous nannofossil-radiolarian ooze chalks (Figures 3-6, hole summary). There is an overall decrease in porosity of about 13 per cent downhole which is probably due to compaction or incipient cementation.

There is no definite correlation between porosity and lithology at this site.

Sonic Velocity

The sound velocities range from 1487 to 1561 m/sec and generally show an increase downhole which probably reflects compaction. No changes in lithology exhibited obvious changes in sound velocities.

Bulk Density

The bulk densities range from 1286 g/cc to 1880 g/cc. The density readings at the top of the hole average lower than those at the bottom of the hole. However, there is no systematic correlation between the density readings and changes in lithology or depth.

Penetrometer

Penetrometer readings generally decrease downhole with intervals of wide fluctuation due to sea water

TABLE 2
Hole Drilling Summary, Site 82
(Latitude 02° 35.48'N, Longitude 106° 56.52'W; 3689 meters depth)

Hole 82

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		1	9.1	30	9.1	30	–	–	
9.1-68.9	30-226								Cont	
68.9-78.0	226-256		2	9.1	30	9.1	30	–	–	
78.0-135.4	256-444								Cont	
135.4-144.5	444-474		3	9.1	30	9.1	30		Int	
144.5-191.5	474-628								Cont	
191.5-200.6	628-658		4	9.1	30	9.1	30		Int	
200.6-209.8	658-688		5	9.1	30	1.8	6		Cont	
209.8-214.0	688-702		6	4.3	14	7.3	24		Int	
214.0-214.3	702-703		7	0.3	1	0.3	1		Cont	
Total 214.3	703		7	50.3	165	46.0	151			

Hole 82A

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)
0.0-18.3	0-60								Cont	
18.3-27.4	60-90		1	9.1	30	8.2	27	–	–	
27.4-36.6	90-120								Cont	
36.6-45.7	120-150		2	9.1	30	9.1	30		–	
45.7-101.8	150-334								Cont	
101.8-111.0	334-364		3	9.1	30	9.1	30		Int	
Total 111.0	364		3	27.4	90	26.5	87			

injection during coring. Some of the minor fluctuations in readings may be due to lithologic variations, incipient cementation, and/or subtle compaction differences. The range of reliable readings is from 0.2 centimeter to 2.5 centimeters.

BIOSTRATIGRAPHY

Foraminifera

Site 82 was spot cored at irregular intervals and most of the foraminiferal zonal boundaries did not fall within cored intervals. Ten cores were recovered from a sequence which included the Pleistocene *Pulleniatina obliquiloculata* Zone, the Pliocene *Globigerinoides fistulosus* and *Sphaeroidinella dehiscens* Zones and the upper Miocene *Globorotalia plesiotumida* Zone. Most of the foraminiferal faunas were well preserved, with the exception of specimens from sediments just above the basalt at the base of Hole 82. Unlike previous holes on Leg 9, there were no intervals where solution had destroyed calcareous fossils. The hole was terminated at two hundred and fourteen meters below the ocean floor in a basalt that has severely altered overlying sediments. The foraminiferal fauna from these altered sediments immediately above the basalt showed a slightly reduced diversity but included the upper Miocene zonal species *Globorotalia plesiotumida* as well as *Globorotalia merotumida*.

Radiolaria

Radiolarian preparations yielded large quantities of siliceous microfossils in all the samples from the cores above Core 6. The preservation and abundance of these microfossils are much poorer in Core 6, where the clay content is high. Radiolaria are common to abundant in all of the remaining samples. Diatoms are dominant in many of the samples. Sponge spicules are abundant in Cores 5 and 6, and become increasingly rare in cores from higher strata. Silicoflagellates were not observed.

Because of the presence of large gaps between the cored intervals, the stratigraphic ranges of the Radiolaria cannot be determined with precision. The Radiolaria in Cores 5 and 6 belong to the *Ommatartus penultimus* Zone. The *Stichocorys peregrina* Zone is thicker at Site 82 than at any of the other sites on Leg 9. Its minimum thickness is 96 meters, and it may reach a maximum of 120 meters. Conversely, the combined thicknesses of the *Spongaster pentas* Zone and the *Pterocanium prismatium* Zone must range between 42 and 74 meters.

DISCUSSION AND INTERPRETATION

As was pointed out in the Operational Summary there is every likelihood that the sediment near the sediment-water interface at this site was recovered; therefore, the rates of deposition for the Quaternary are probably reliable. In general the rates of deposition at this site are slowest at the top and increase toward the bottom (Table 3). This is the kind of pattern that might be expected if this site, located at 2°35′ North of the equator, had moved in a west-north-west direction during the last 10 million years, thereby moving the site continuously away from the high productivity axis centered on the equator. The average sedimentation rate for the site is 24.3 m/m.y. which is the highest for any site drilled on this leg (Site 77–16.4 m/10^6 yrs from middle Miocene to Recent) (Site 79–18.3 m/10^6 yrs; Site 81–21.3 m/million yrs). Although part of this may be due to different locations with respect to the productivity axis it is also probable that there is a general decrease in productivity from east to west and a consequent slowing of sedimentation. Throughout, the drill sites on this leg have been well above the compensation depth so solution has probably not been a major factor in reducing the accumulation rate of the western sites.

Age of Basement

The basal sediments at this site occur within the *G. plesiotumida* foraminiferal zone which has an age of about 9 million years according to Berggren (1969).

Sea Floor Spreading

Table 2 gives the ages of the basal sediments at the various sites from 77 to 82 and the distance between these sites. The age of the base of Site 81 is about 14.5 million years and that of Site 82 about 9 million years. The distance between these two sites is 731 kilometers giving a spreading rate of 133 km/m.y. which is somewhat higher than the 124 km/m.y. calculated between Sites 79 and 81. The exact distance to the crest of the East Pacific Rise from Site 82 is not certain but is probably about 5° of longitude or 549 kilometers. Giving the ridge crest a zero age would indicate a spreading rate of 61 km/m.y. during the last 9 million years, which is less than half the rate of the previous 5 million years, indicating a fairly abrupt decrease in spreading rates. This change in rate was probably accompanied by a change in direction from a generally east-west direction to a more west-northwest direction.

In regard to the suggestion of Ewing and others (1968) that the abrupt thinning of sediments to the east of our Site 82 was caused by either (1) an abrupt decrease in sedimentation rate about 10 million years ago continuing to the present or (2) spreading paused for 10 to 15 million years prior to 10 million years B.P. which was followed by rapid spreading since 10 million years B.P. (6 cm/yr); our data show that neither of these explanations is correct. Spreading was more rapid prior to 10 million years B.P. than after and there is no evidence of an abrupt decrease in sedimentation past 10 million years B.P. A third alternative to explain this abrupt increase in thickness of the sediment is as follows: Prior to 9 million years B.P. spreading was nearly east-west parallel to the major fracture zones (Clipperton, Clarion, etc.). During this spreading period one band of sediment remains beneath the high productivity axis centered on the Equator for a long time producing very thick accumulations of sediment.

Since 9 million years B.P. the direction of spreading has been oblique to the Equator, moving any given segment of the Pacific plate across the Equator and not allowing time for thick accumulations to develop but rather spreading the high accumulations formed under the Equator over a broader area.

This type of two directional spreading would produce an abrupt increase in thickness at the time the change in direction of spreading occurred.

The sediments at this site differ from those at the previous site in that the upper few meters are a rich chocolate brown ("red") clay that grades downward into a green ooze. Calcium carbonate content increases with depth. The sediments just above basement are tan clay devoid of Radiolaria but containing calcareous fossils. These tan sediments show brecciation, suggesting movement. At this site the basement again appears to be a sill that has intruded the sediment.

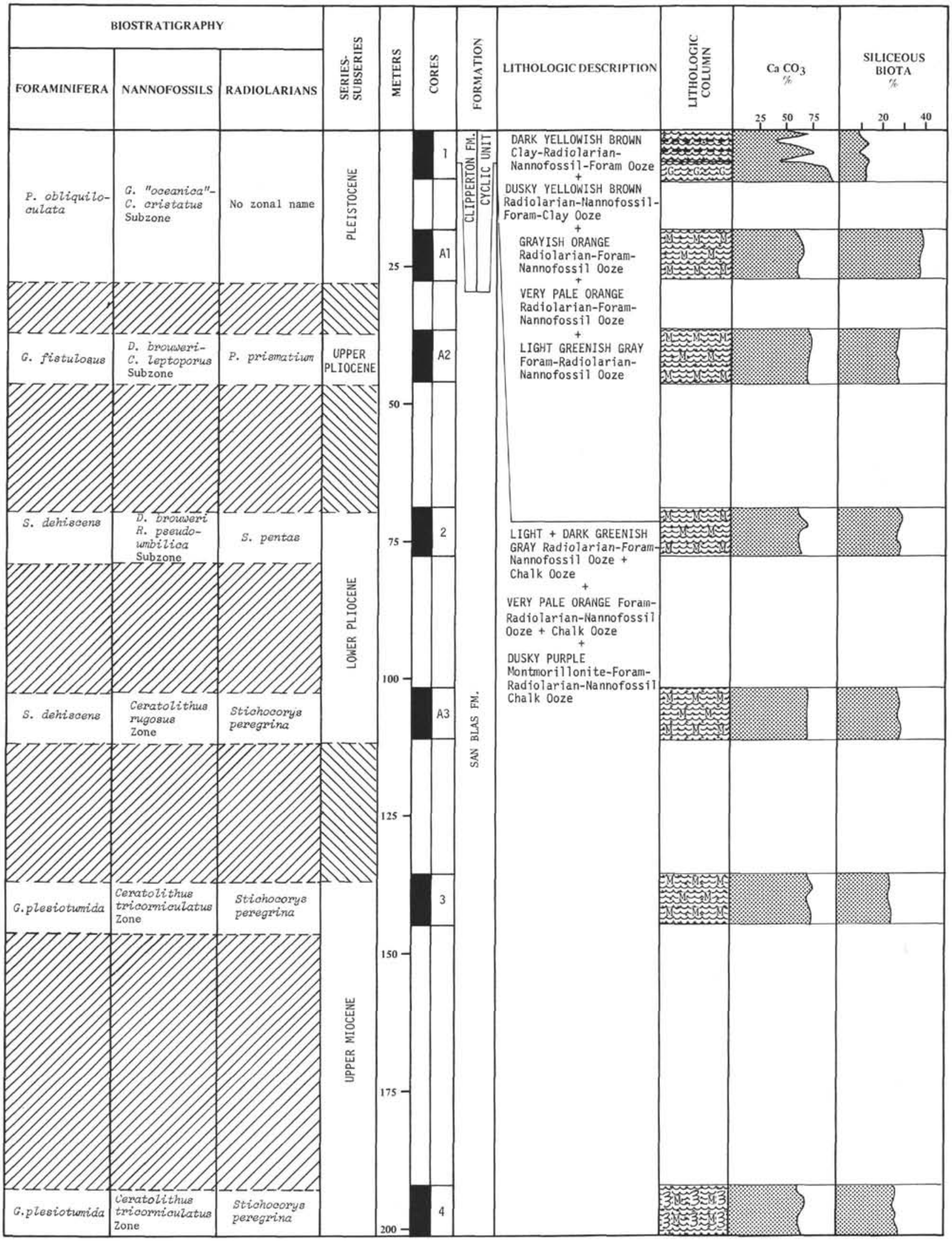

Figure 3. *Site 82 summary.*

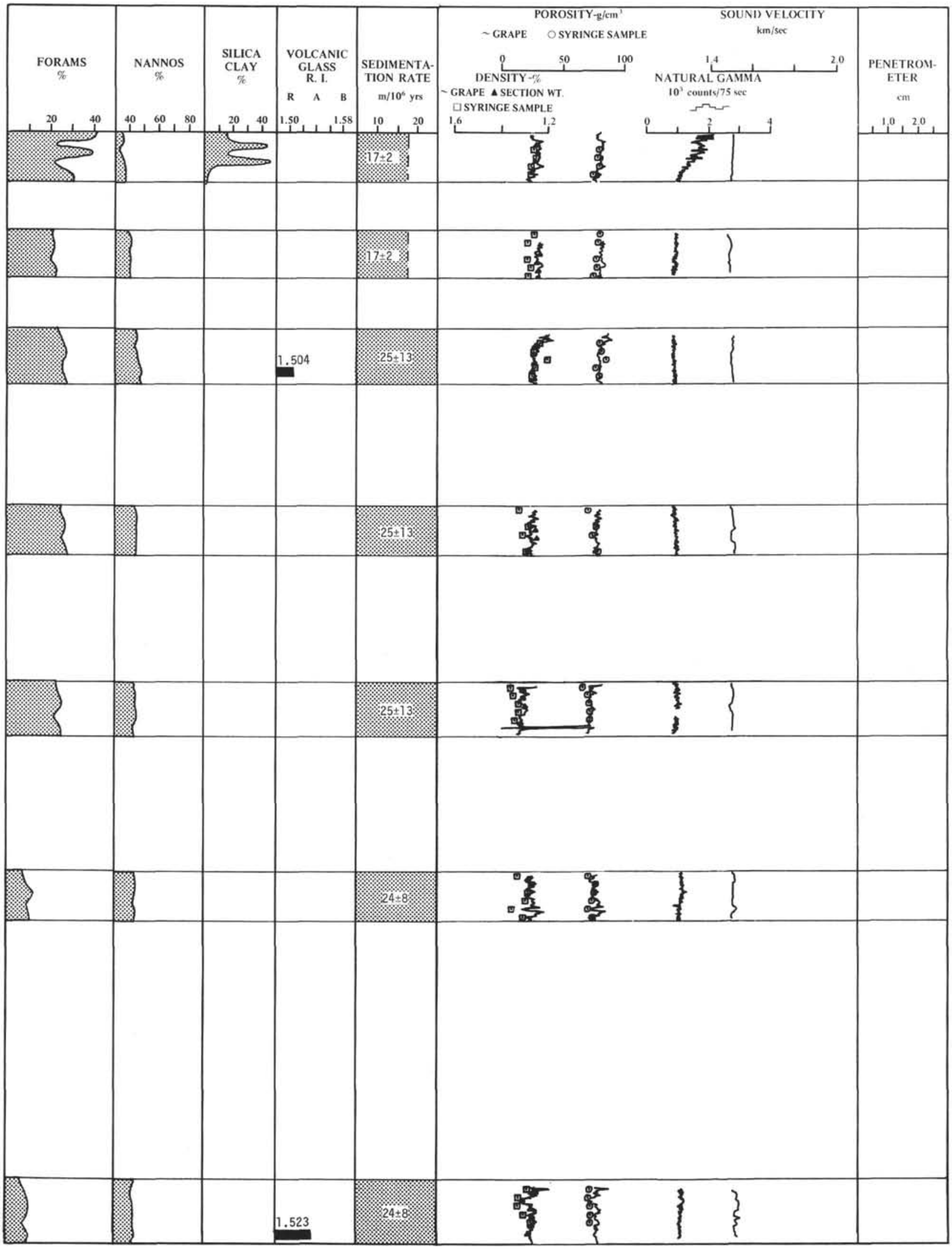

Figure 4. *Site 82 summary.*

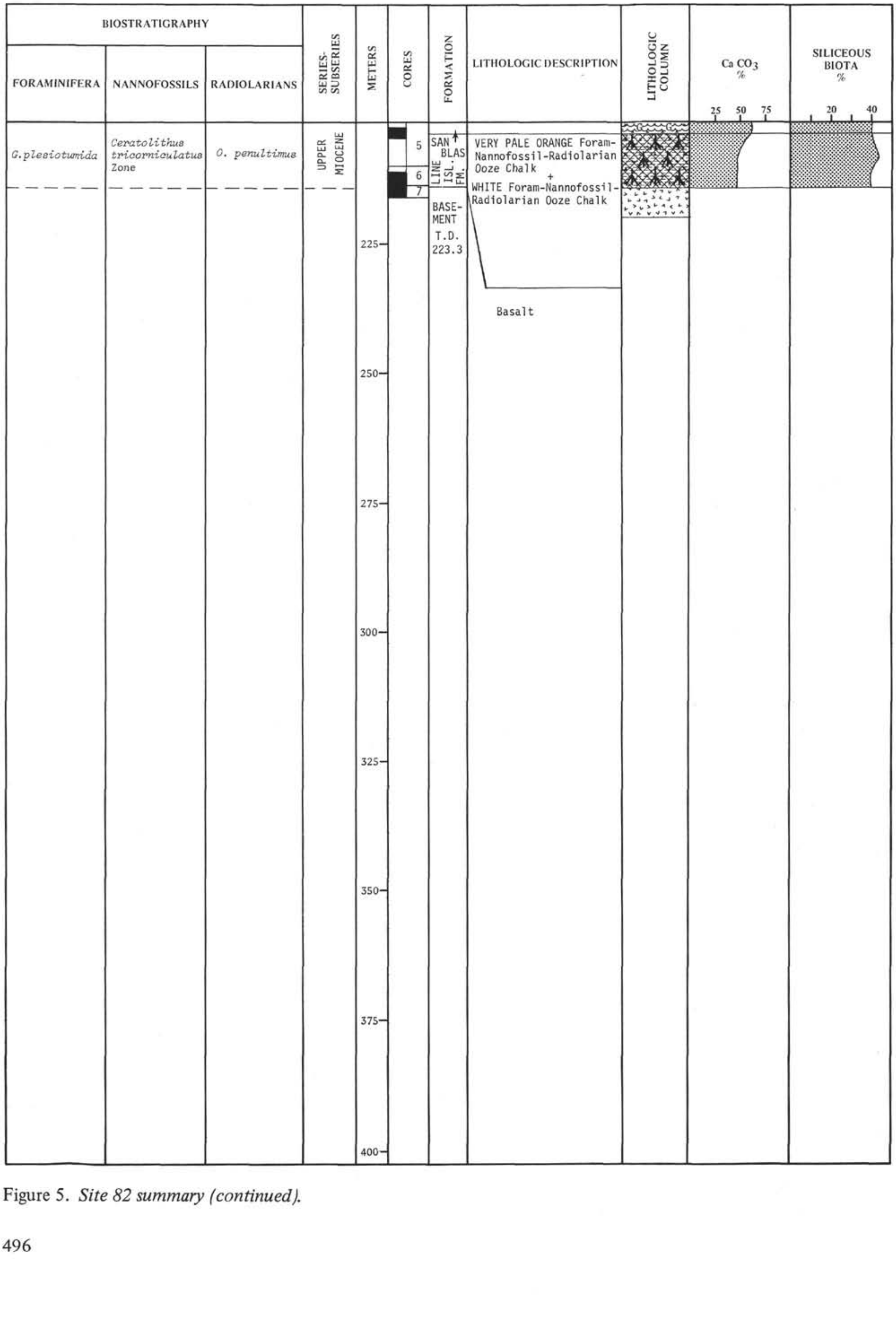

Figure 5. *Site 82 summary (continued).*

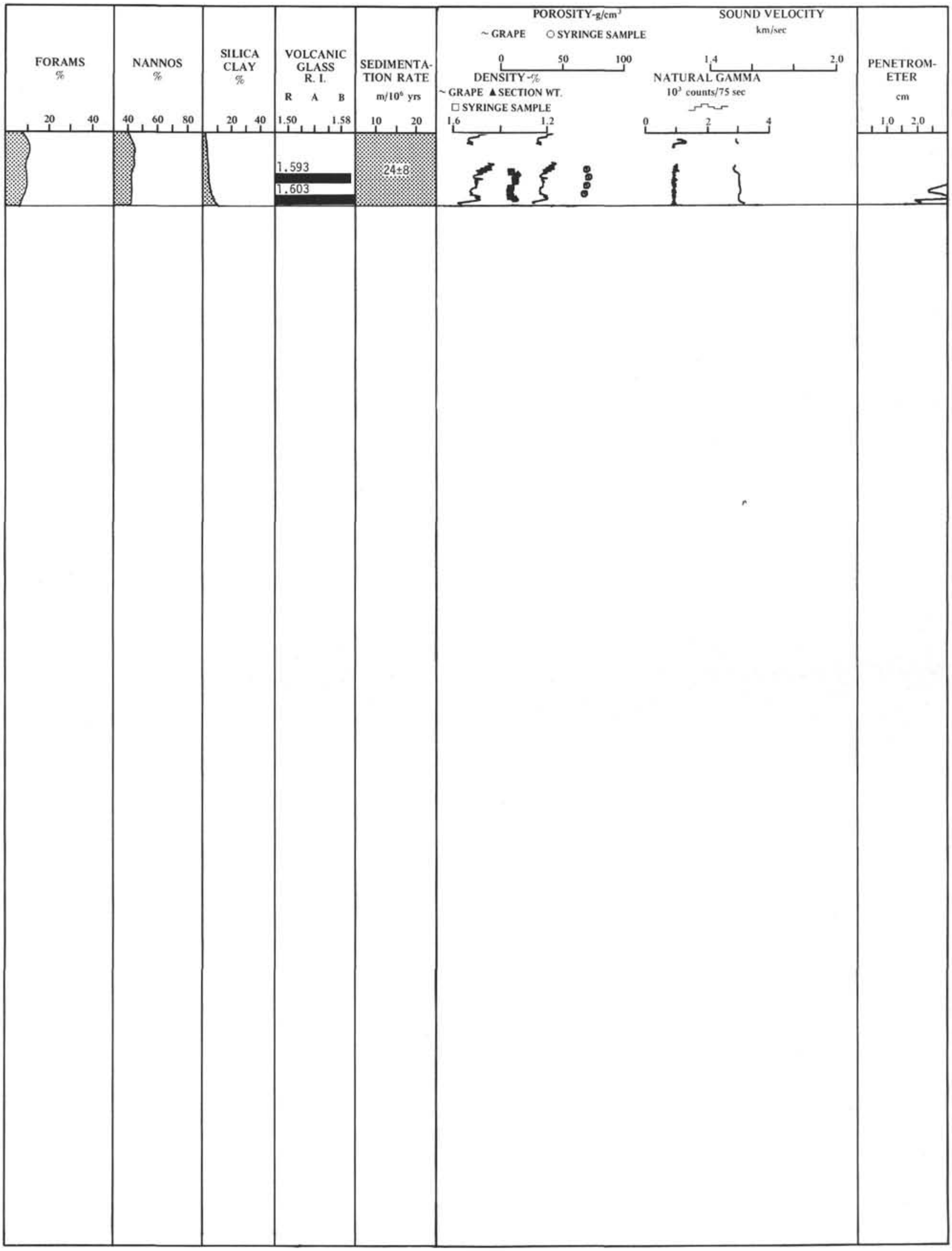

Figure 6. *Site 82 summary (continued).*

TABLE 3
Rates of Sedimentation, Site 82

Geologic Interval	Duration Geologic Interval (m.y.)	Sediment Thickness (meters)	Accumulation Rate ($m/10^6$ yrs)
Pleistocene	1.8	31±4	17±2
Pliocene	3.2	81±42	25±13
Upper Miocene (to base of section estimated age 9.5±5 m.y.)	4.5	107±38	24±8

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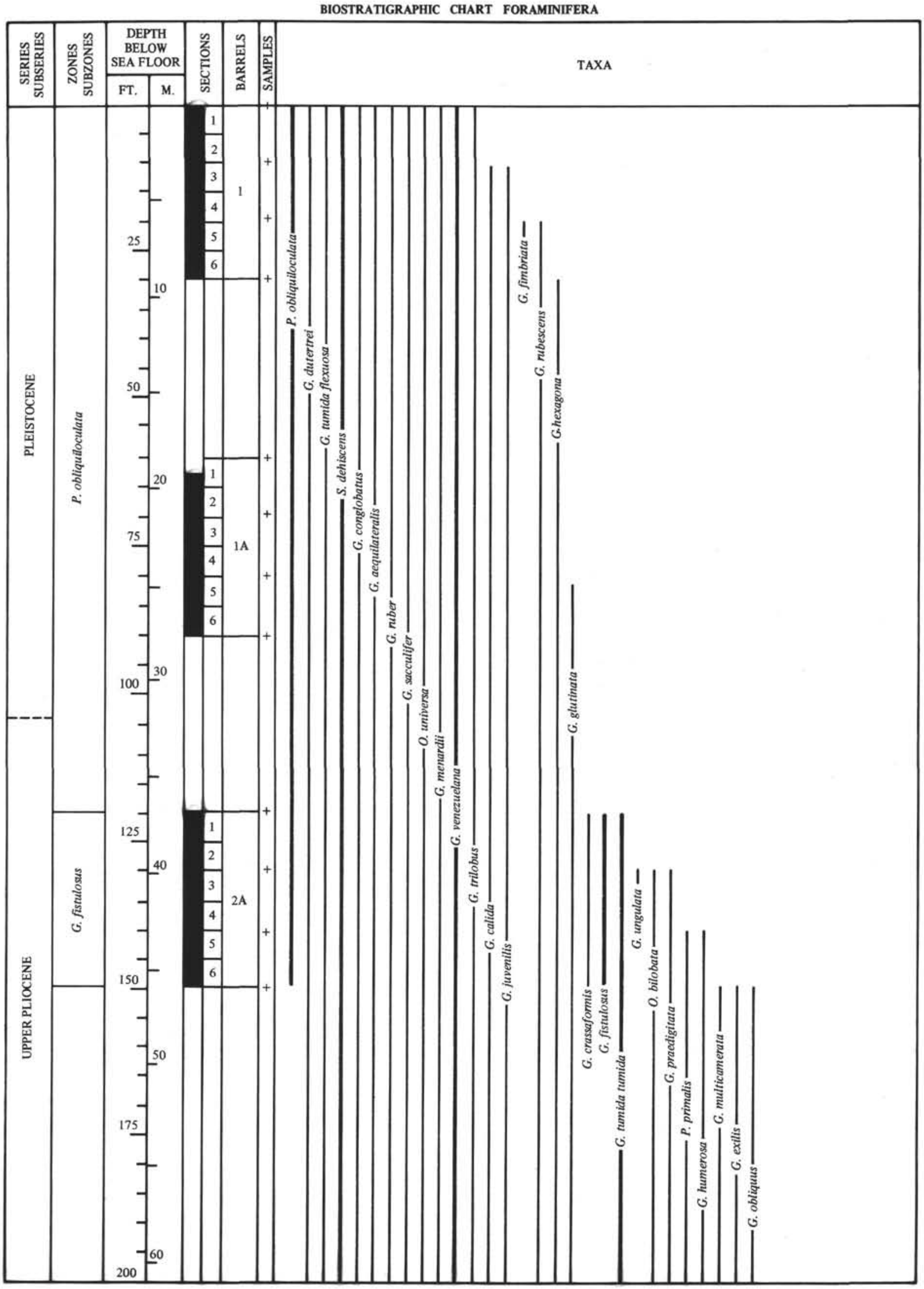


Figure 7. *Biostratigraphic Chart Foraminifera (0 to 200 feet).*

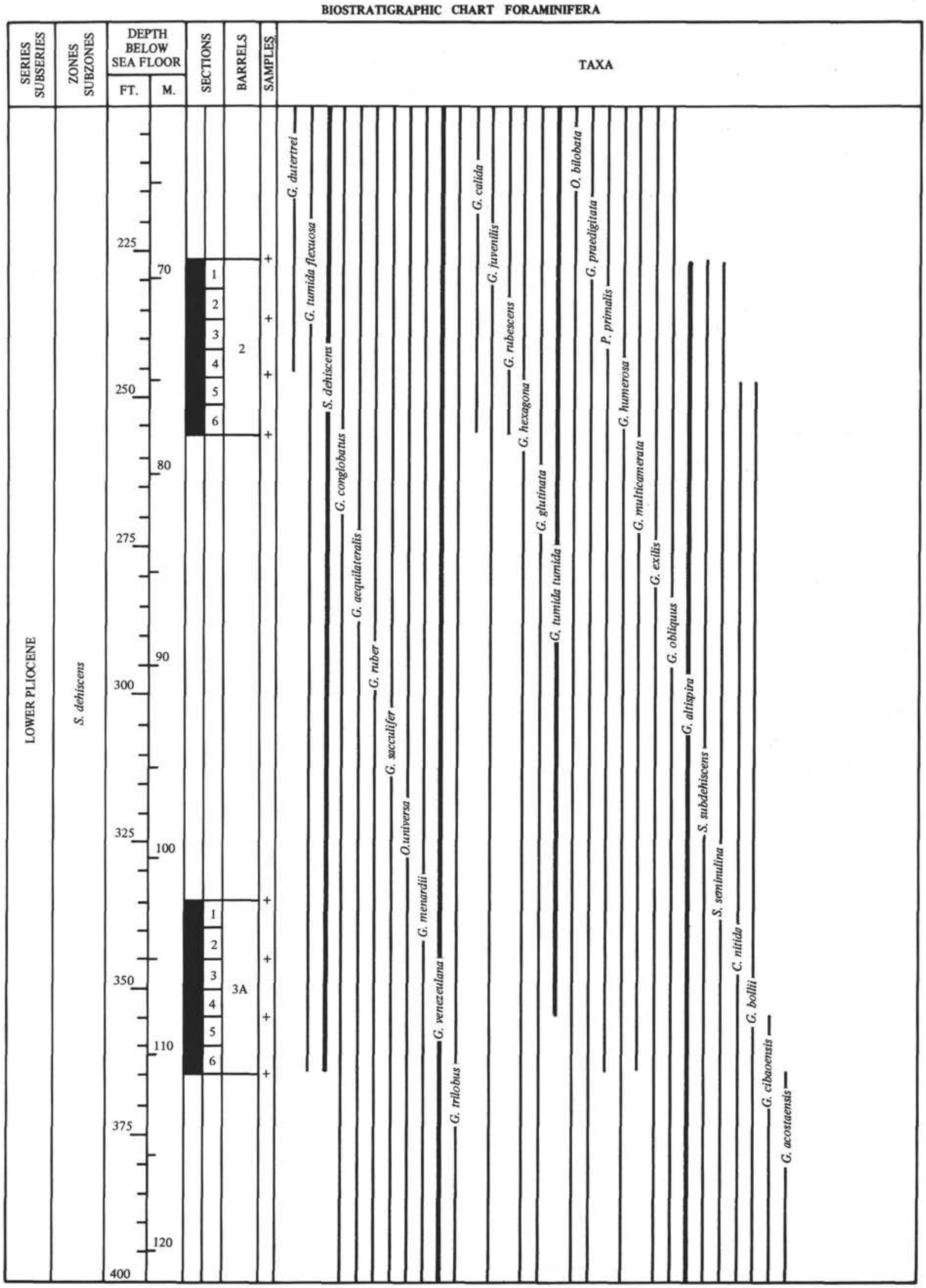


Figure 8. *Biostratigraphic Chart Foraminifera (200 to 400 feet).*

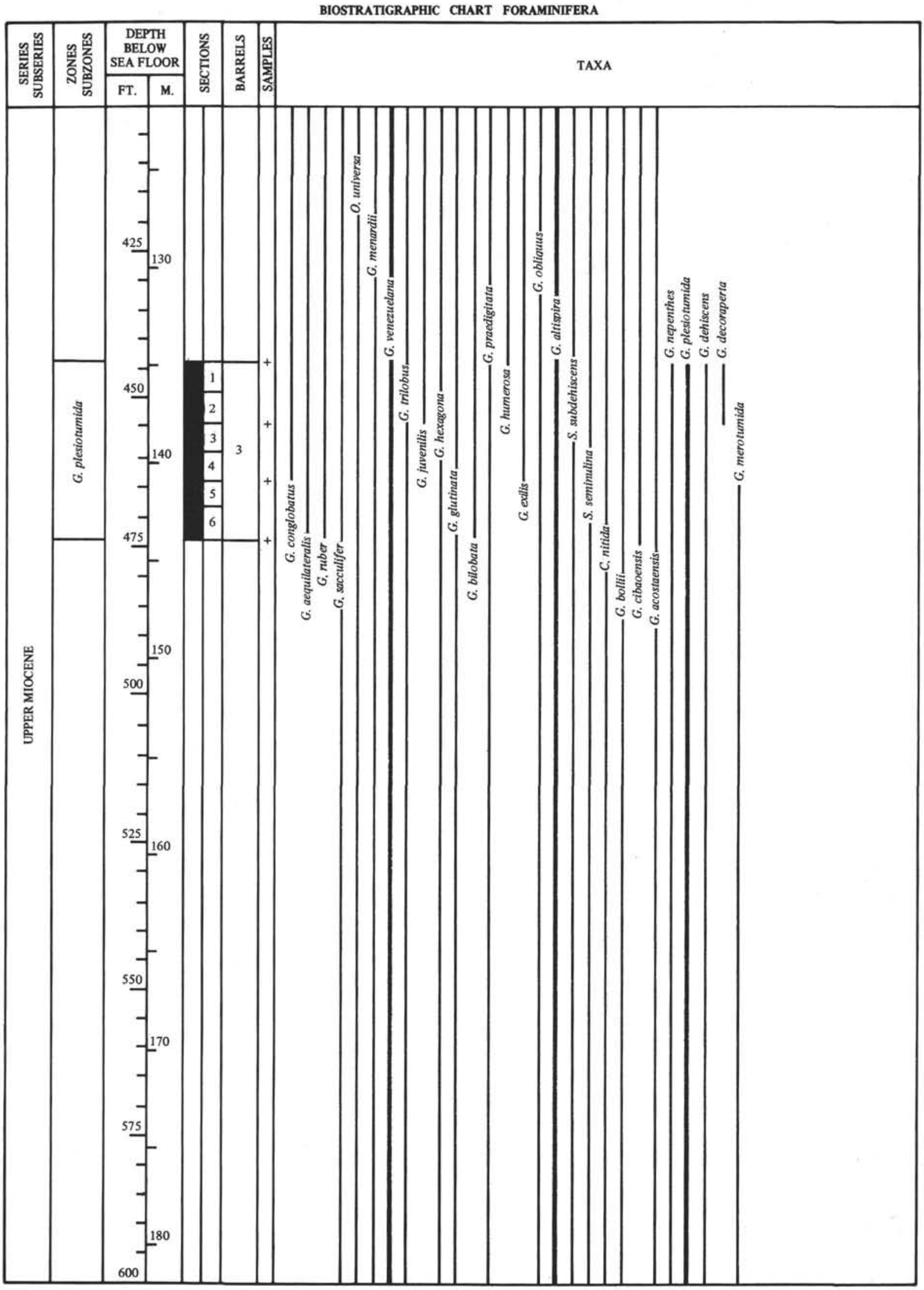


Figure 9. *Biostratigraphic Chart Foraminifera (400 to 600 feet).*

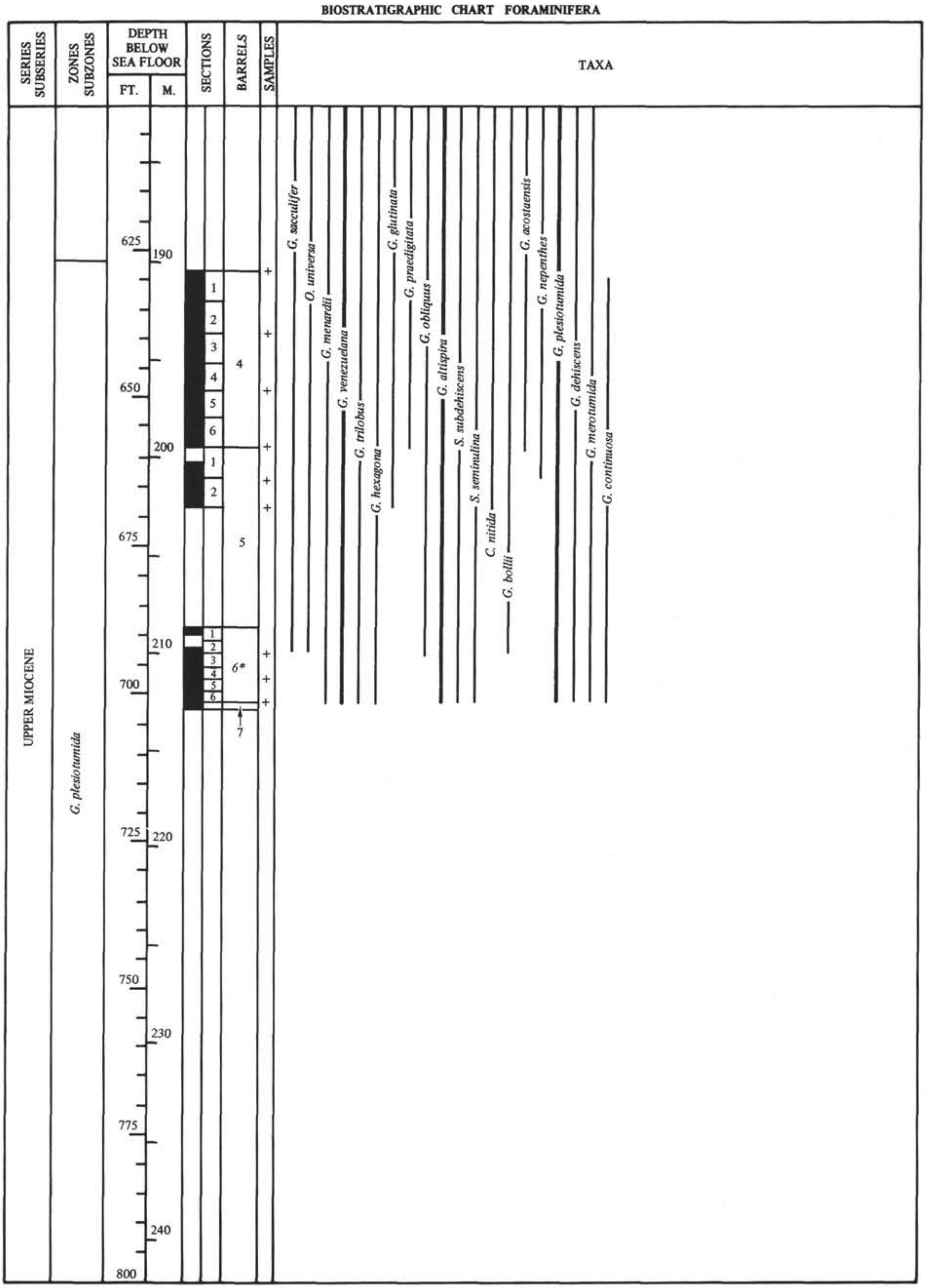


Figure 10. *Biostratigraphic Chart Foraminifera (600 to 800 feet).*

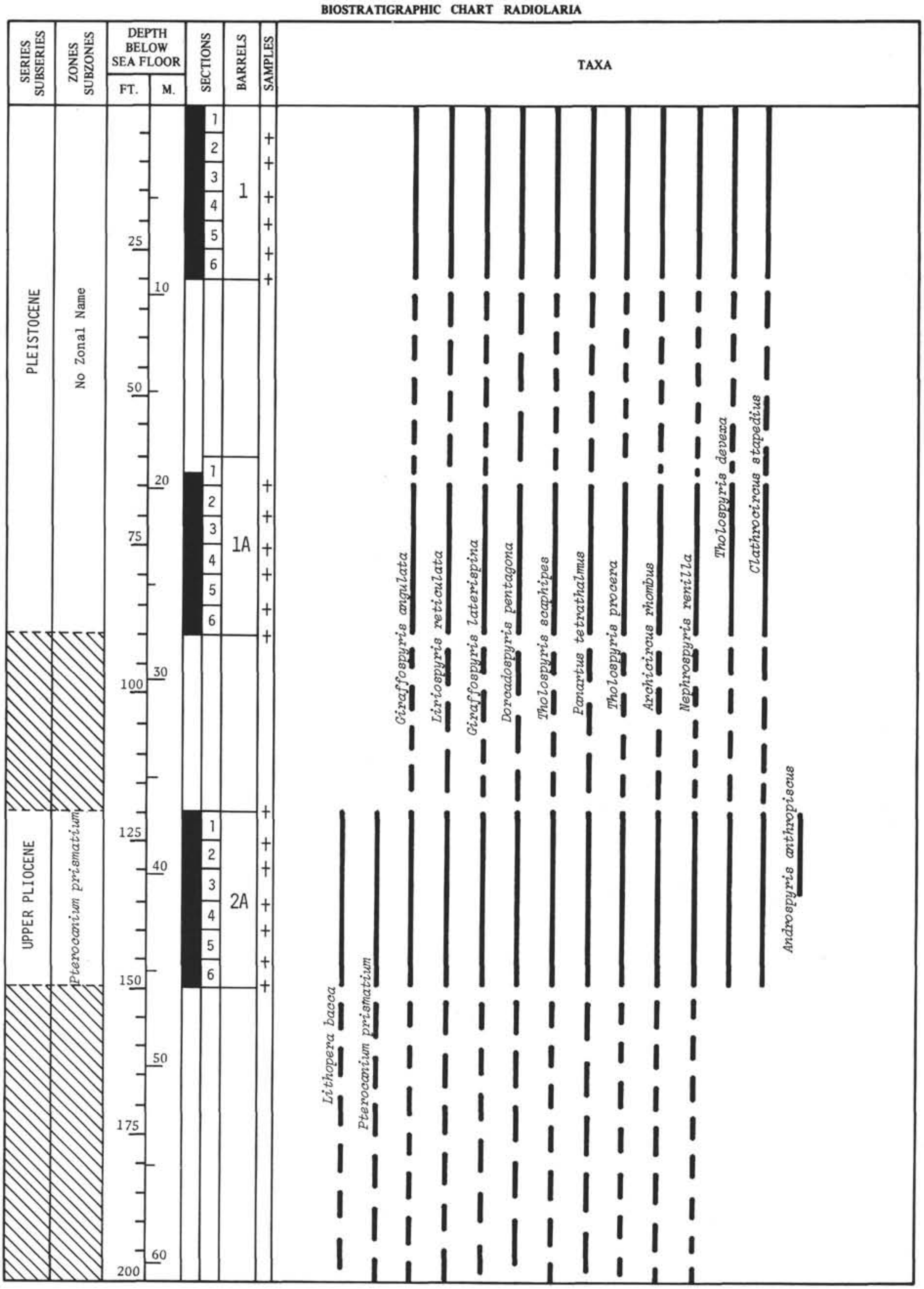


Figure 11. *Biostratigraphic Chart Radiolaria (0 to 200 feet).*

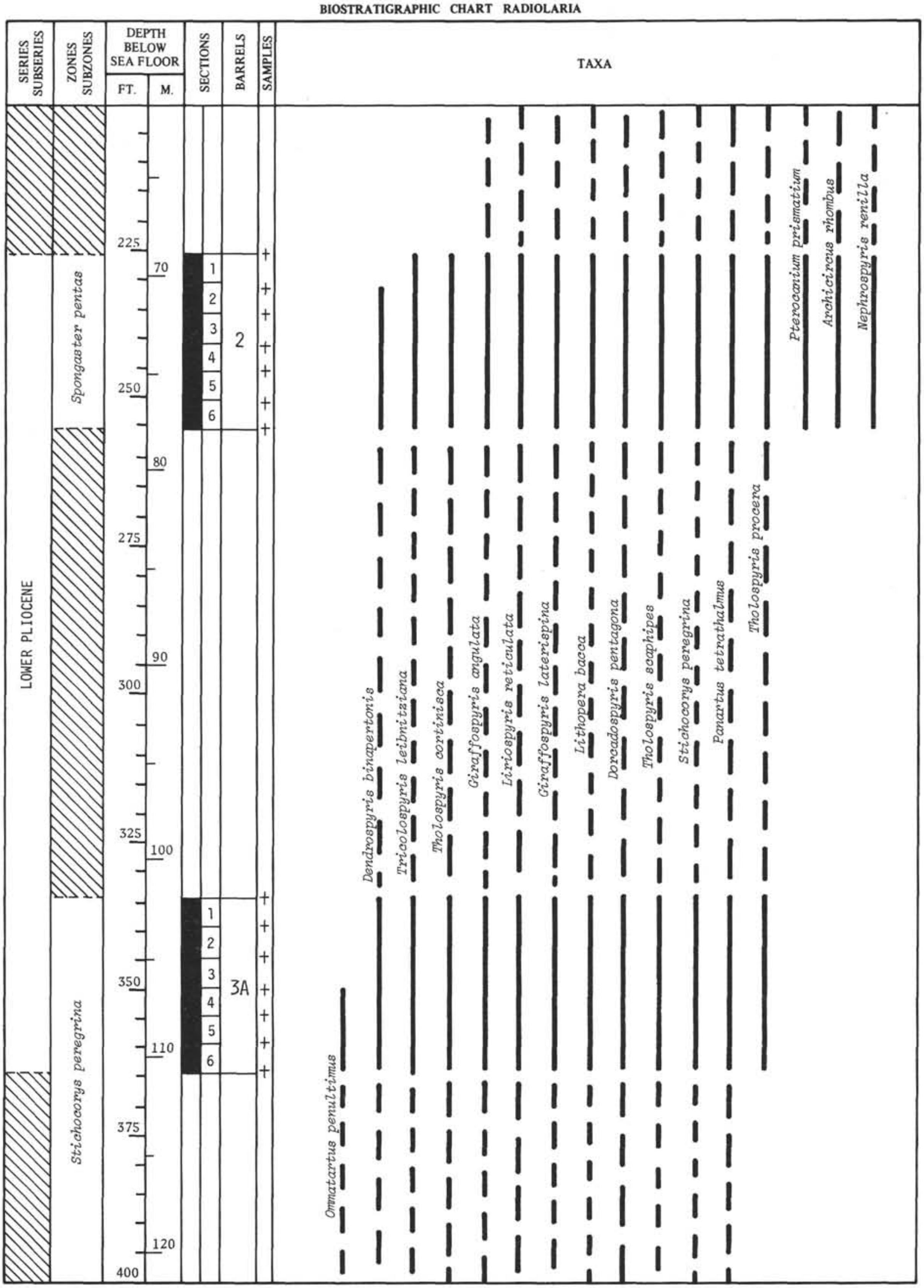


Figure 12. *Biostratigraphic Chart Radiolaria (200 to 400 feet).*

BIOSTRATIGRAPHIC CHART RADIOLARIA

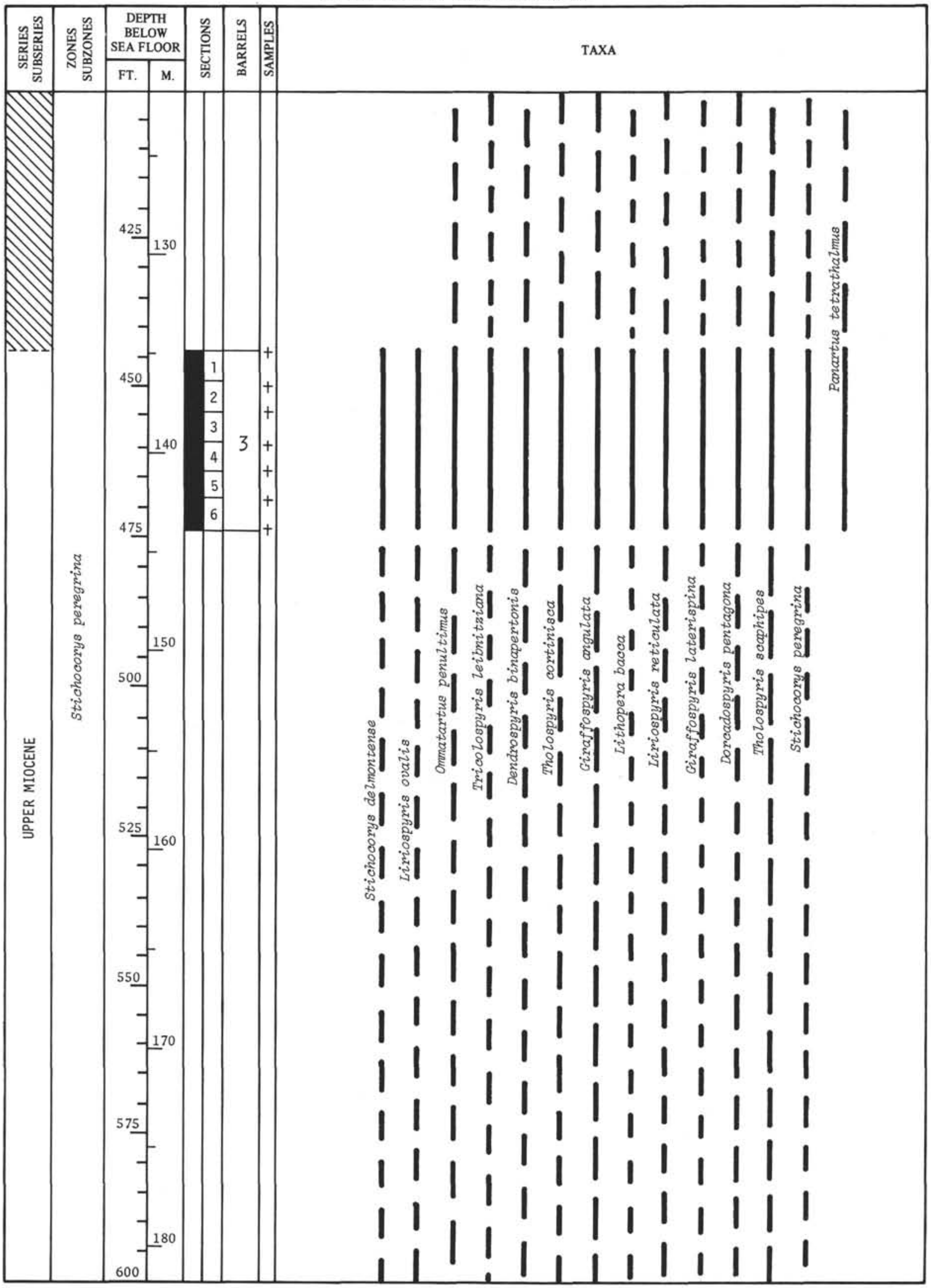


Figure 13. *Biostratigraphic Chart Radiolaria (400 to 600 feet).*

BIOSTRATIGRAPHIC CHART RADIOLARIA

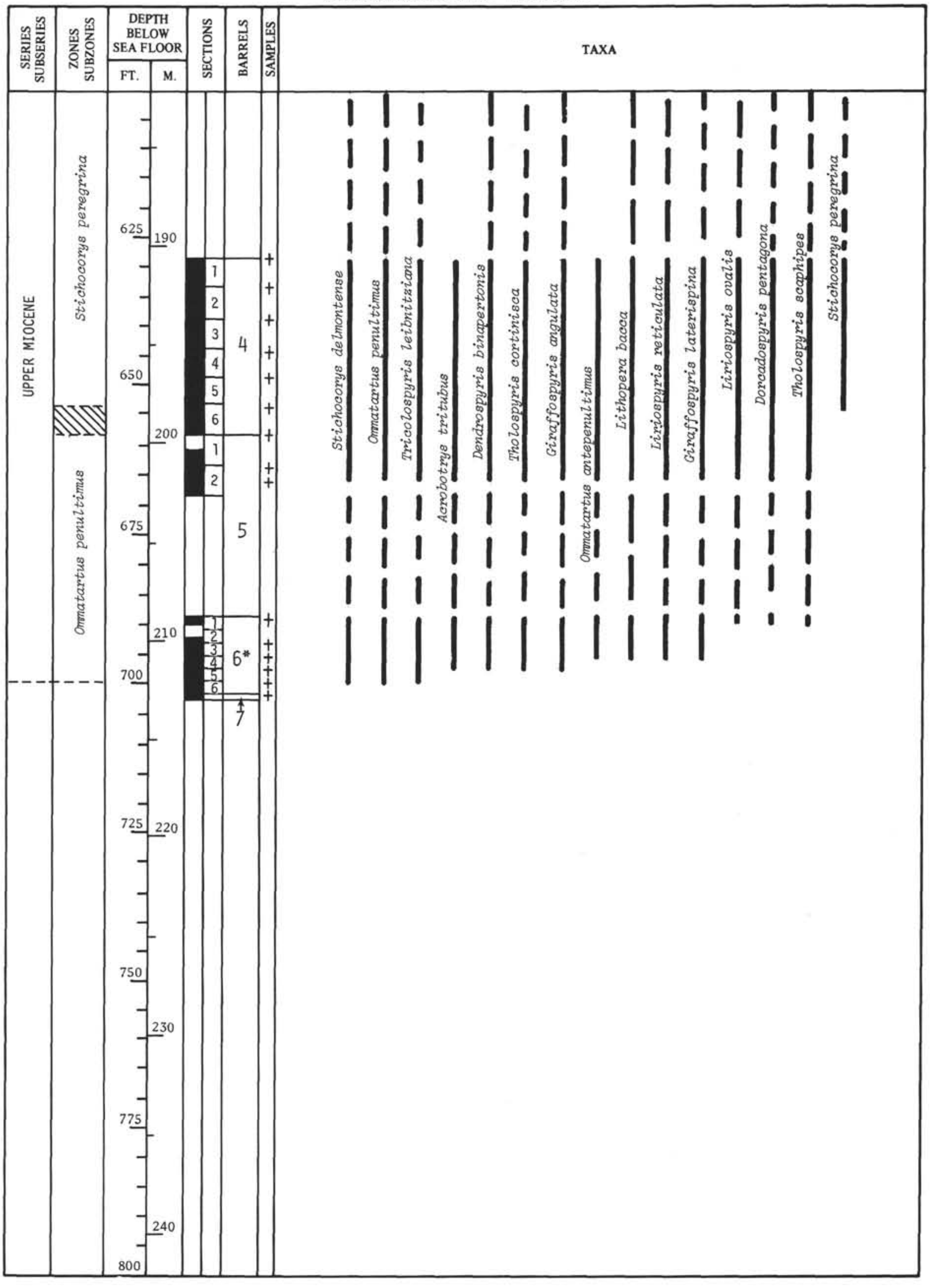


Figure 14. *Biostratigraphic Chart Radiolaria (600 to 800 feet).*

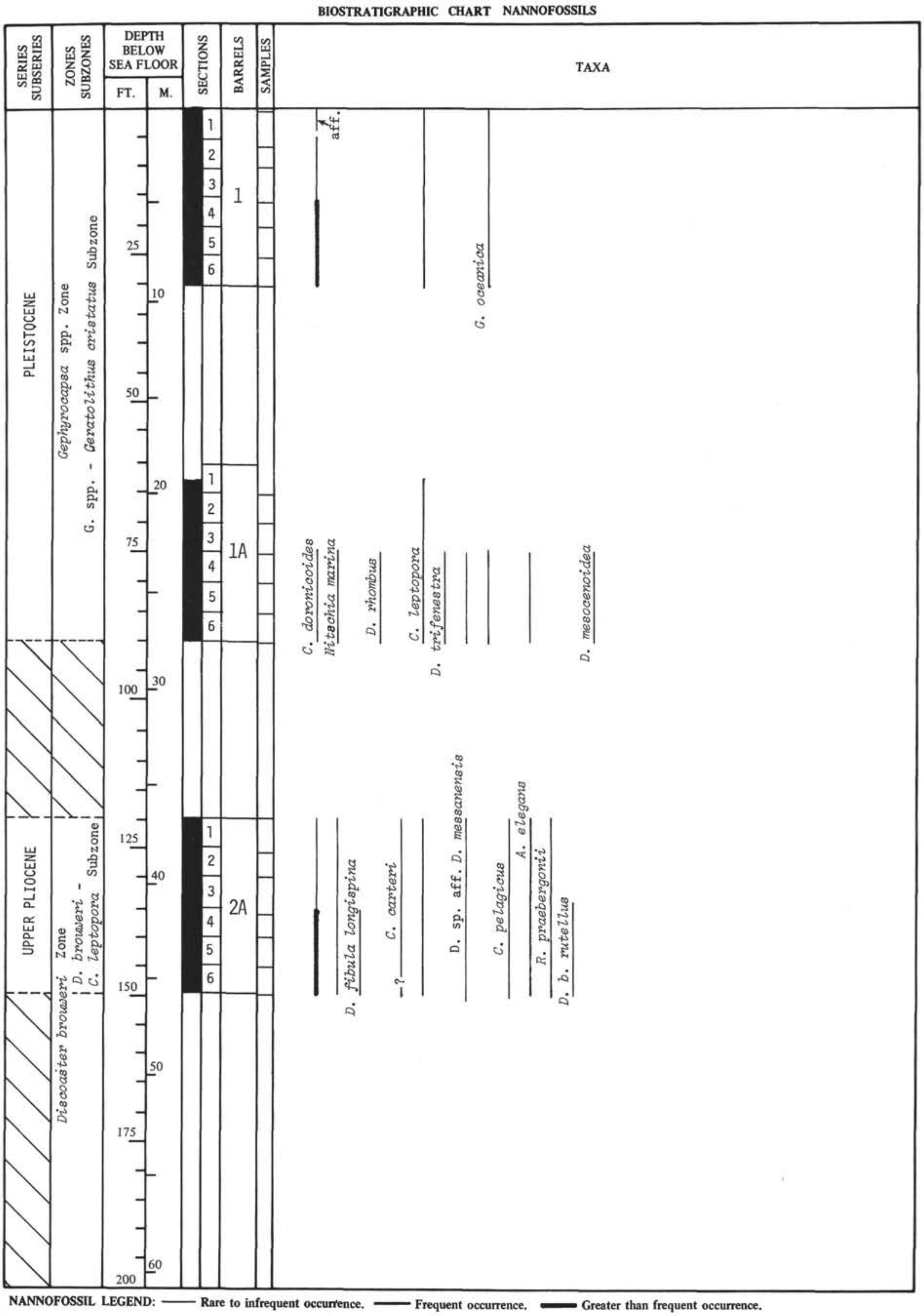
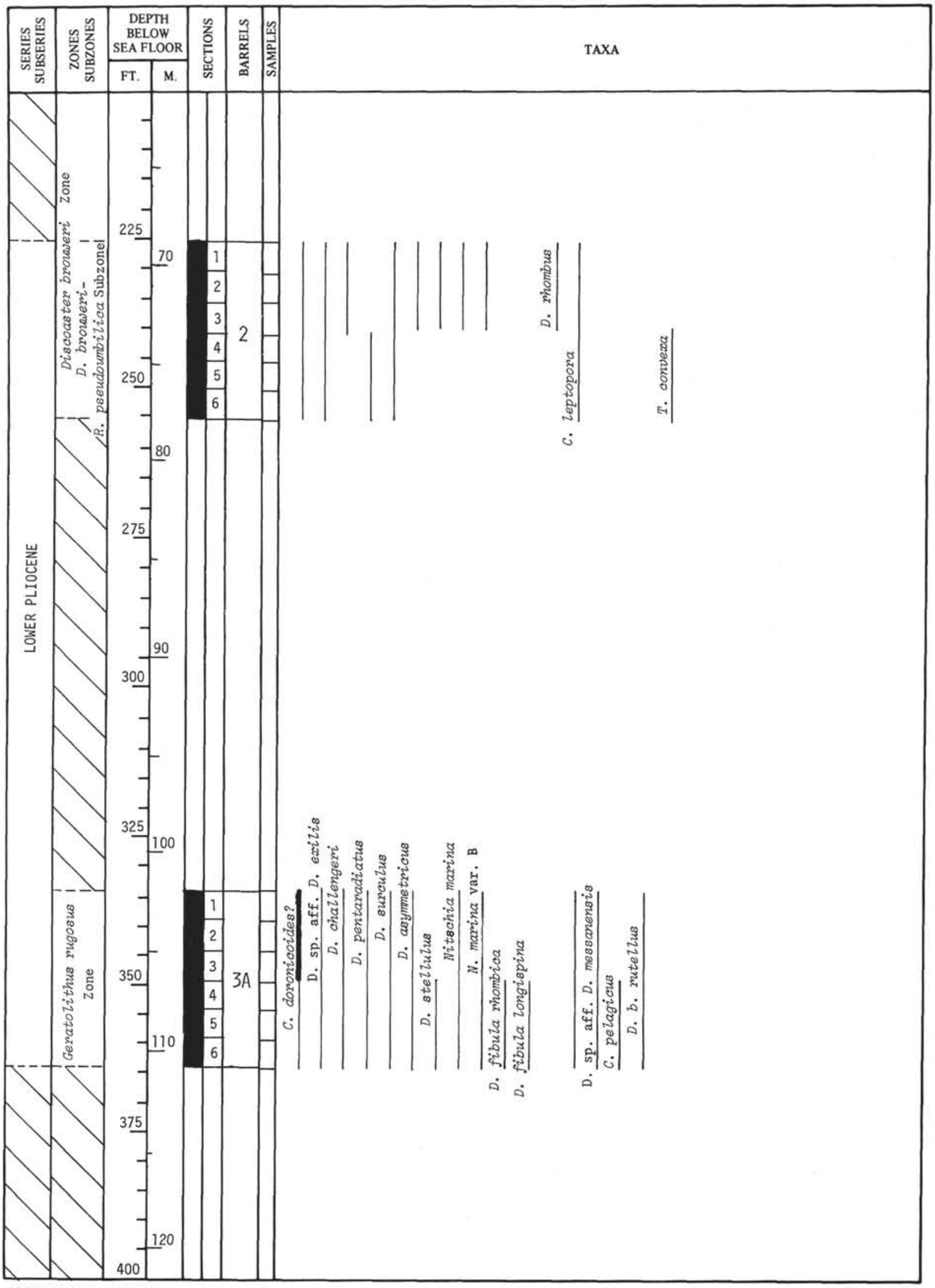


Figure 15. *Biostratigraphic Chart Nannofossils (0 to 200 feet).*

BIOSTRATIGRAPHIC CHART NANNOFOSSILS



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

Figure 16. *Biostratigraphic Chart Nannofossils (200 to 400 feet).*

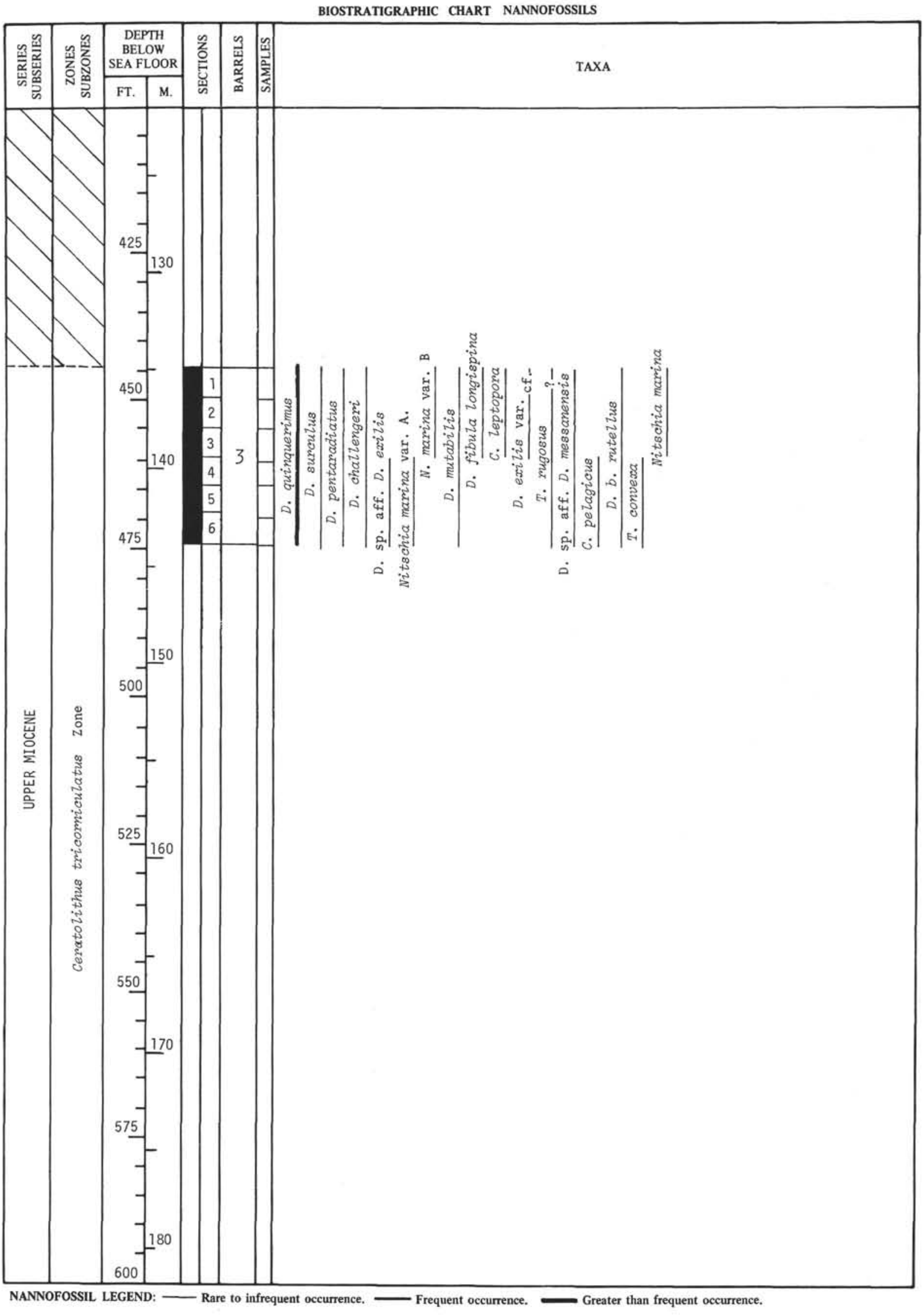
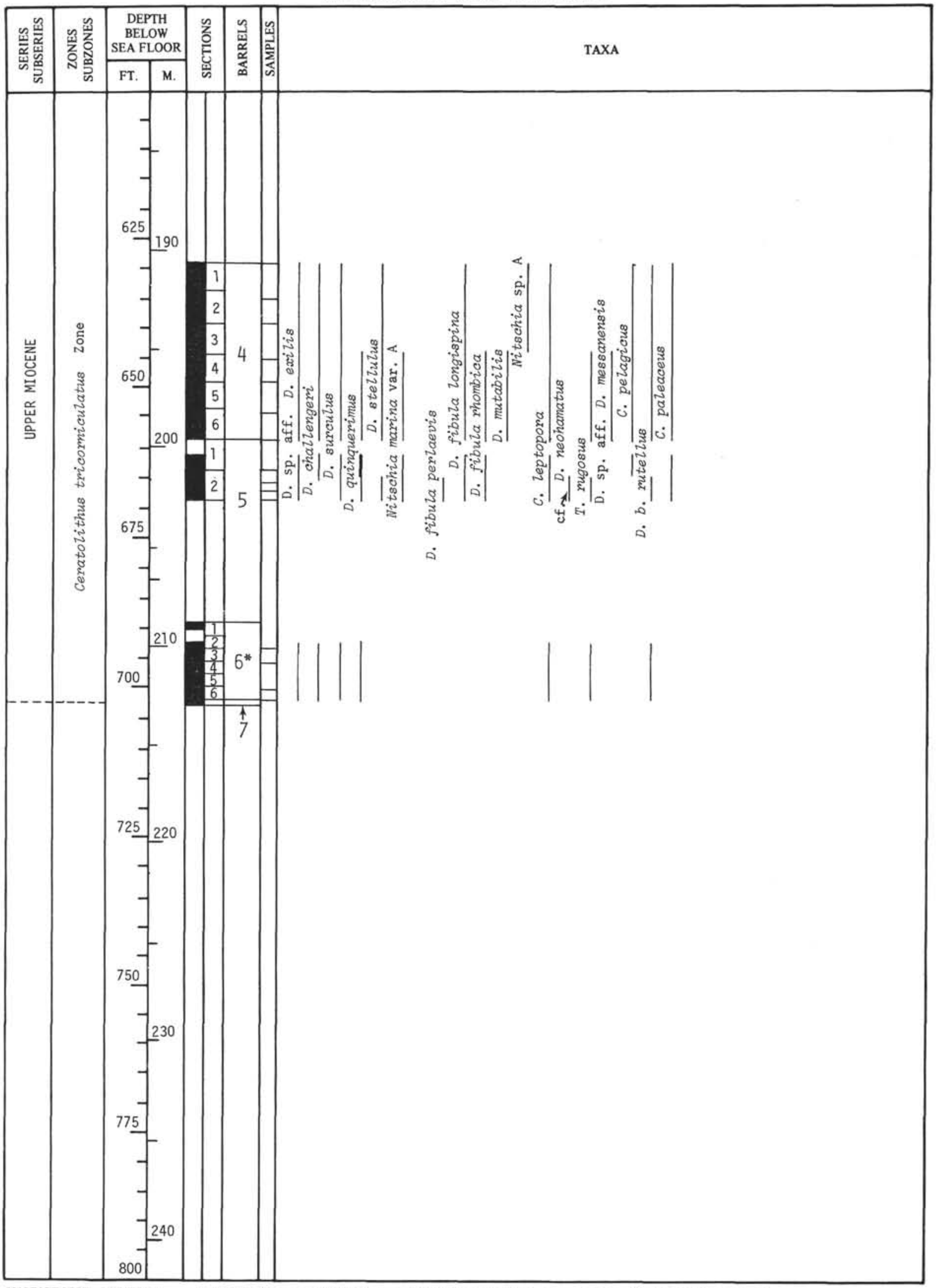


Figure 17. *Biostratigraphic Chart Nannofossils (400 to 600 feet).*

BIOSTRATIGRAPHIC CHART NANNOFOSSILS



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

Figure 18. *Biostratigraphic Chart Nannofossils (600 to 800 feet).*

BIOSTRATIGRAPHIC COMPARISON CHART

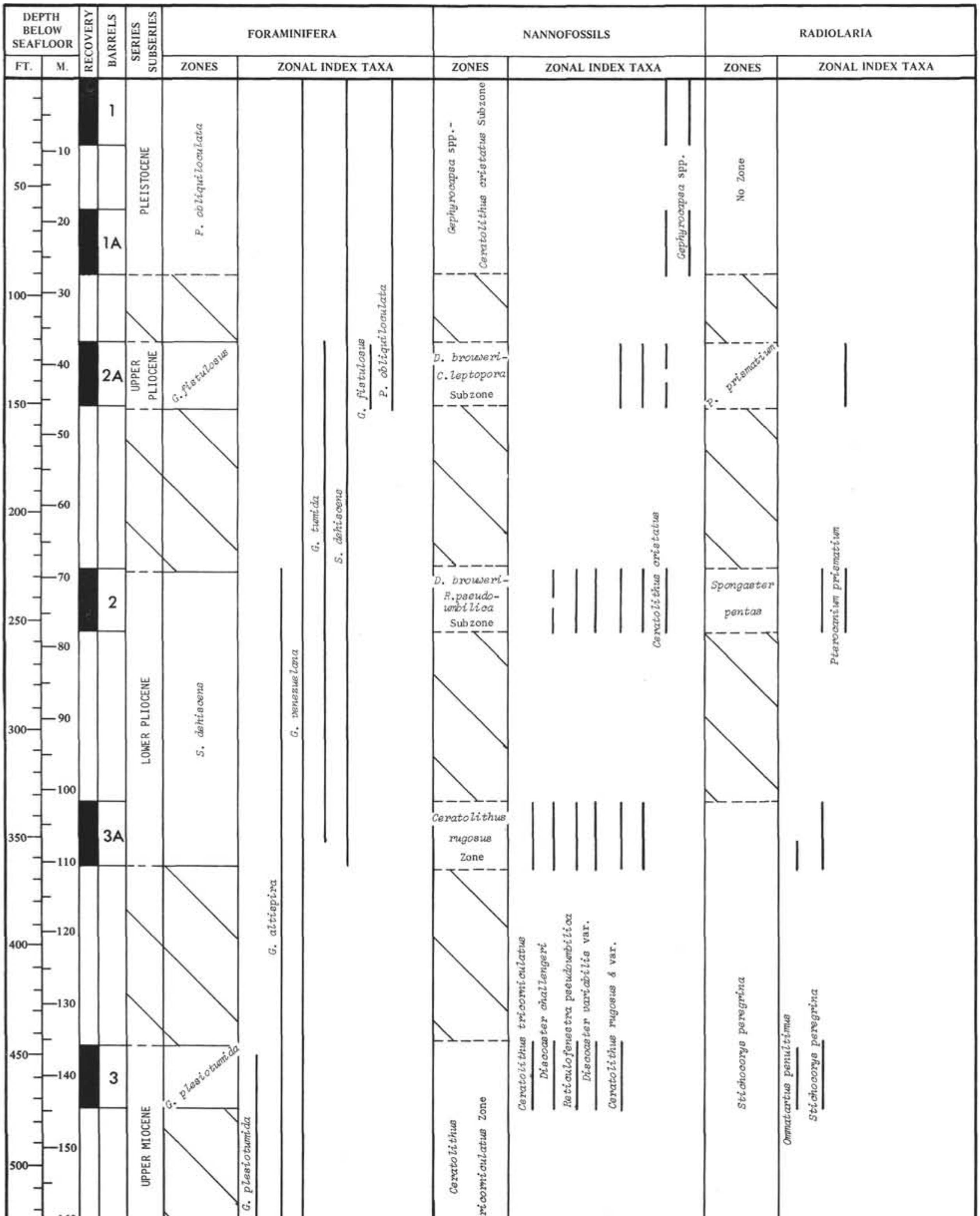


Figure 19. *Biostratigraphic Comparison Chart.*

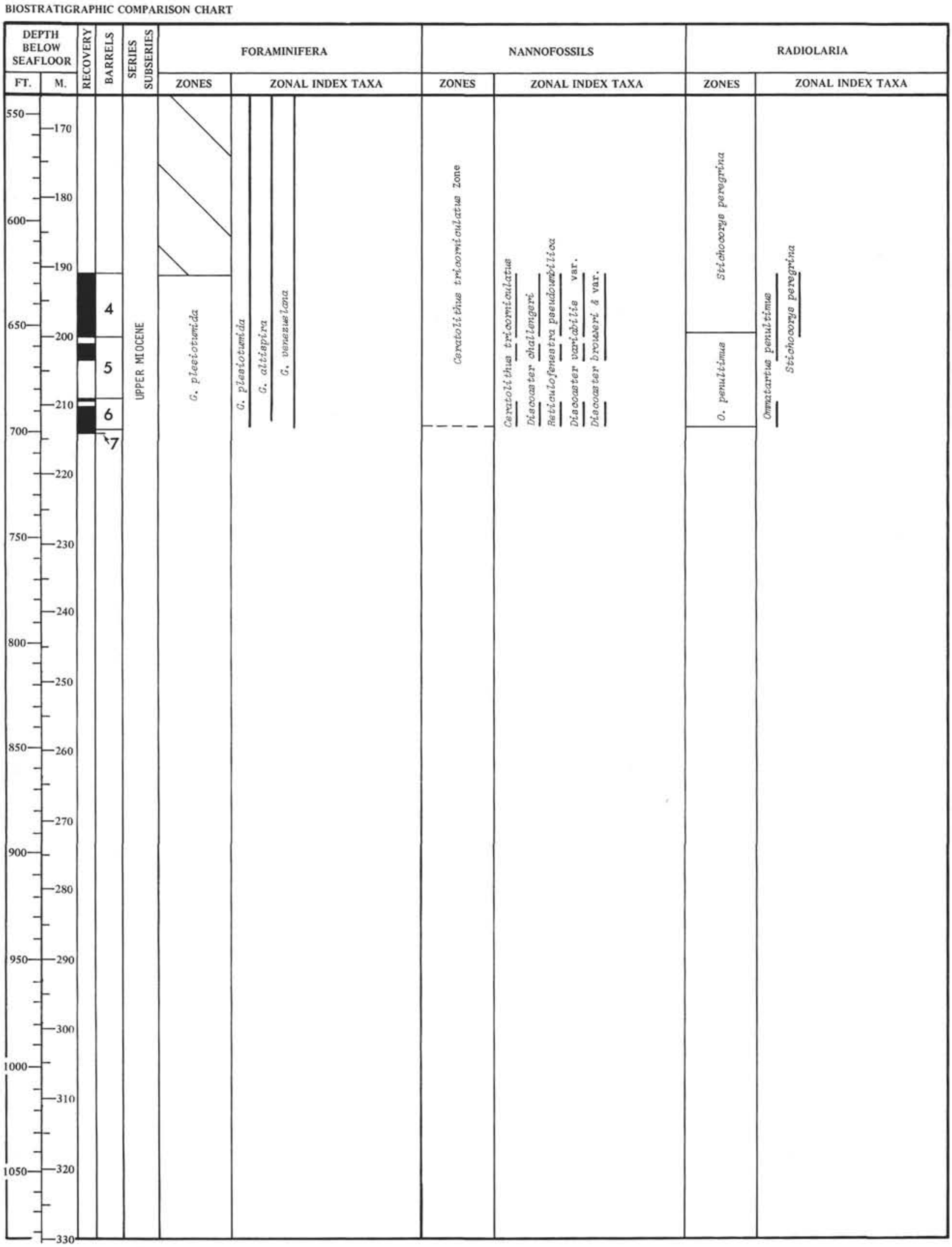


Figure 20. *Biostratigraphic Comparison Chart (continued).*

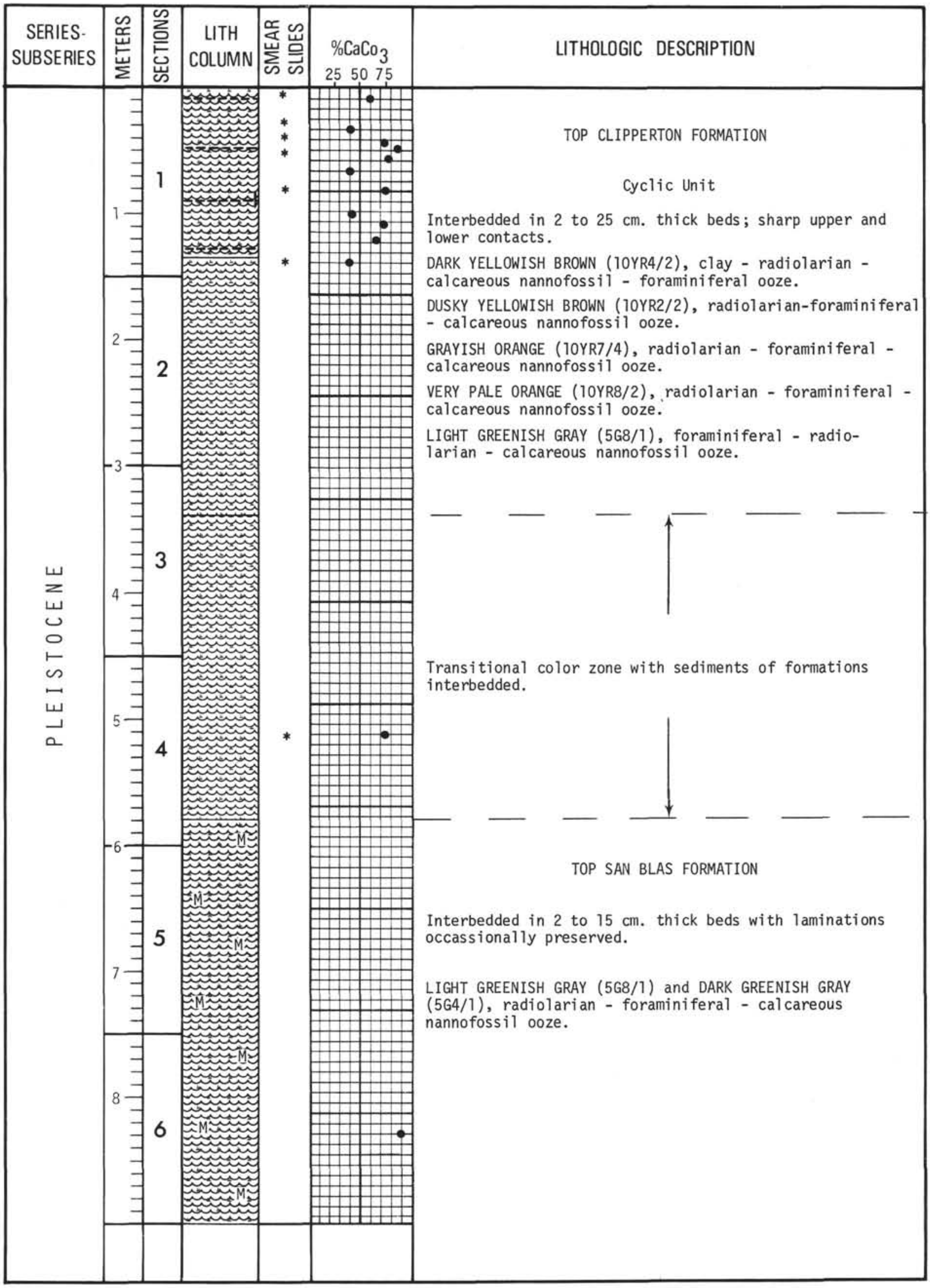


Figure 21. *Hole 82, Core 1 (0 to 9.1 m).*

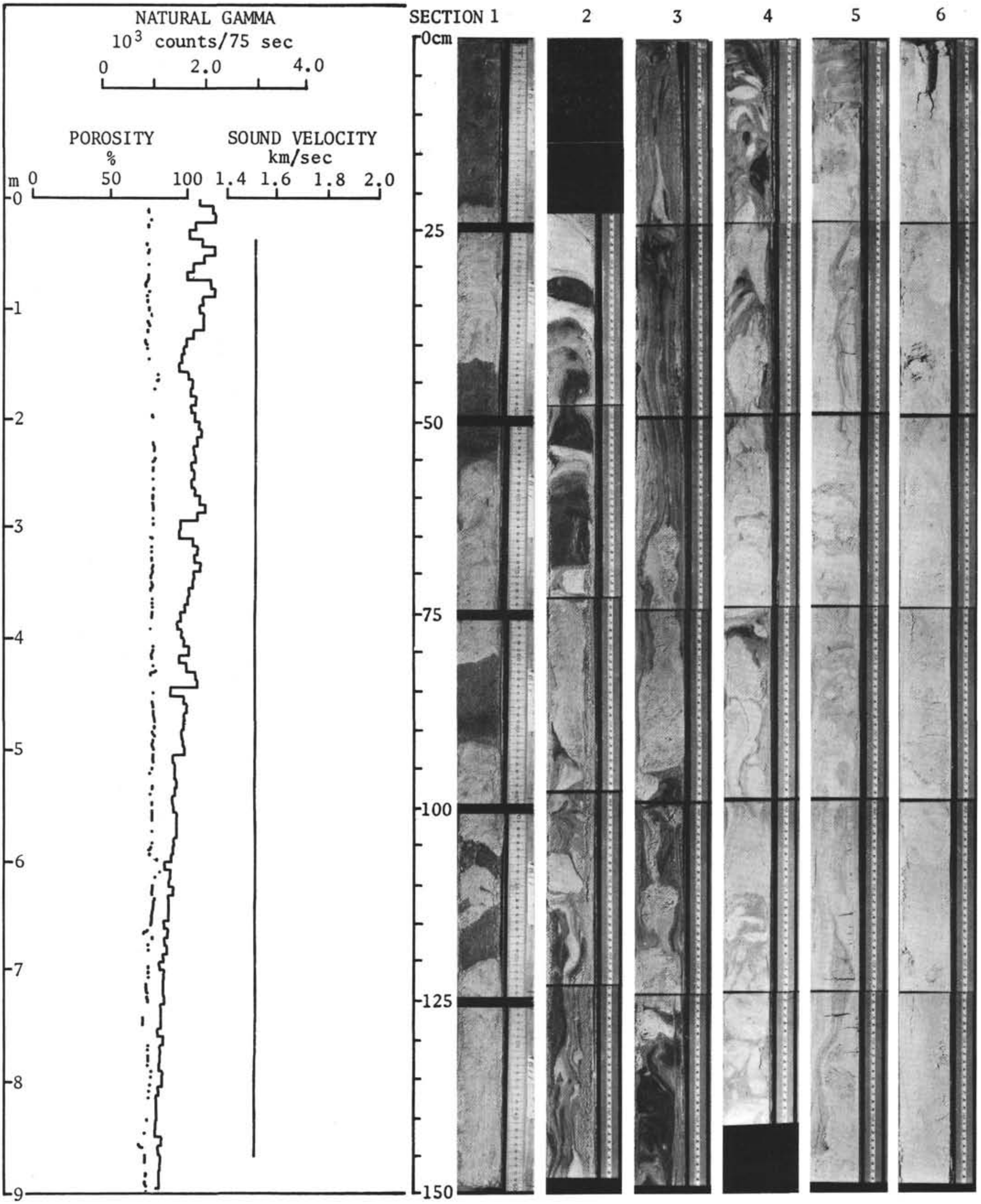
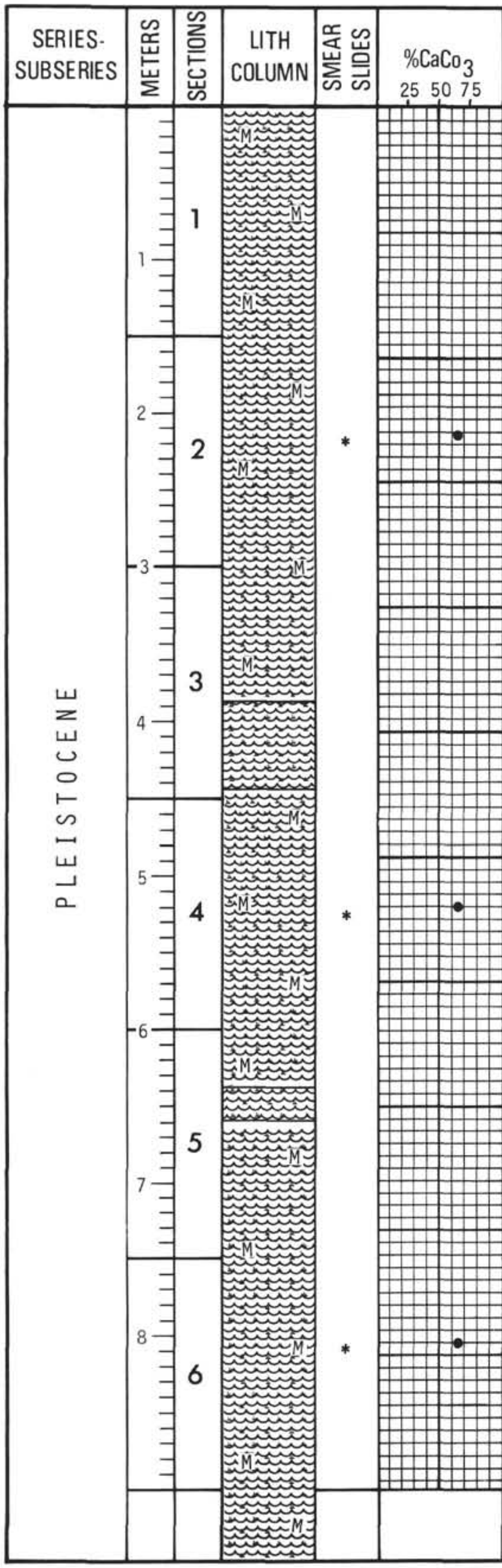


Figure 22. *Hole 82, Core 1, Sections 1-6, Physical Properties.*



LITHOLOGIC DESCRIPTION

SAN BLAS FORMATION

Interbedded in 2 to 25 cm. thick laminated beds.

LIGHT GREENISH GRAY (5G8/1), GREENISH GRAY (5G6/1), and VERY DUSKY PURPLE (5P2/2), montmorillonitic - foraminiferal - radiolarian - calcareous nannofossil chalk ooze.

Minor VERY PALE ORANGE (10YR8/2), foraminiferal - radiolarian - calcareous nannofossil ooze.

Figure 23. *Hole 82A, Core 1 (18.3 to 27.5 m).*

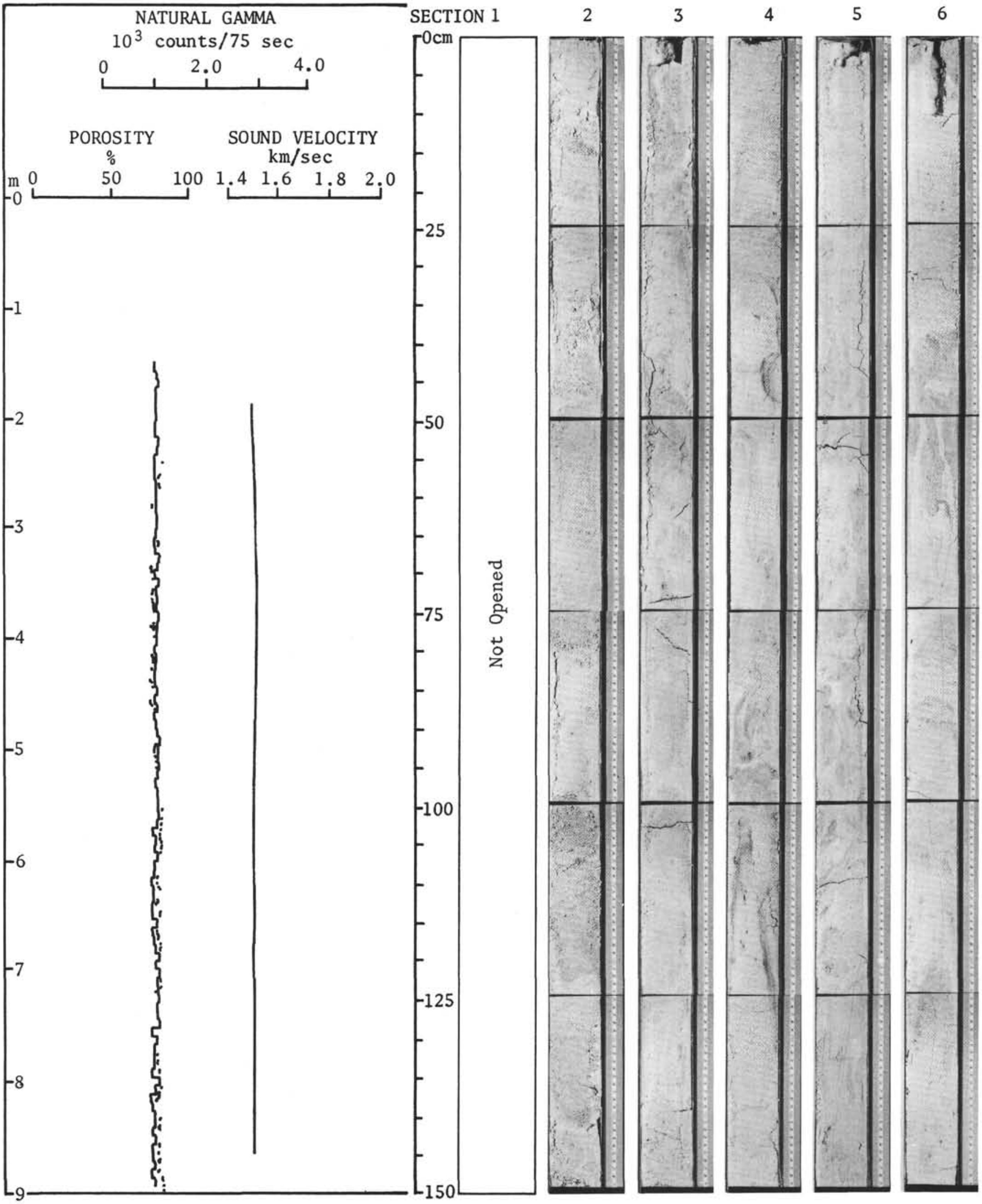


Figure 24. *Hole 82A, Core 1, Sections 1-6, Physical Properties.*

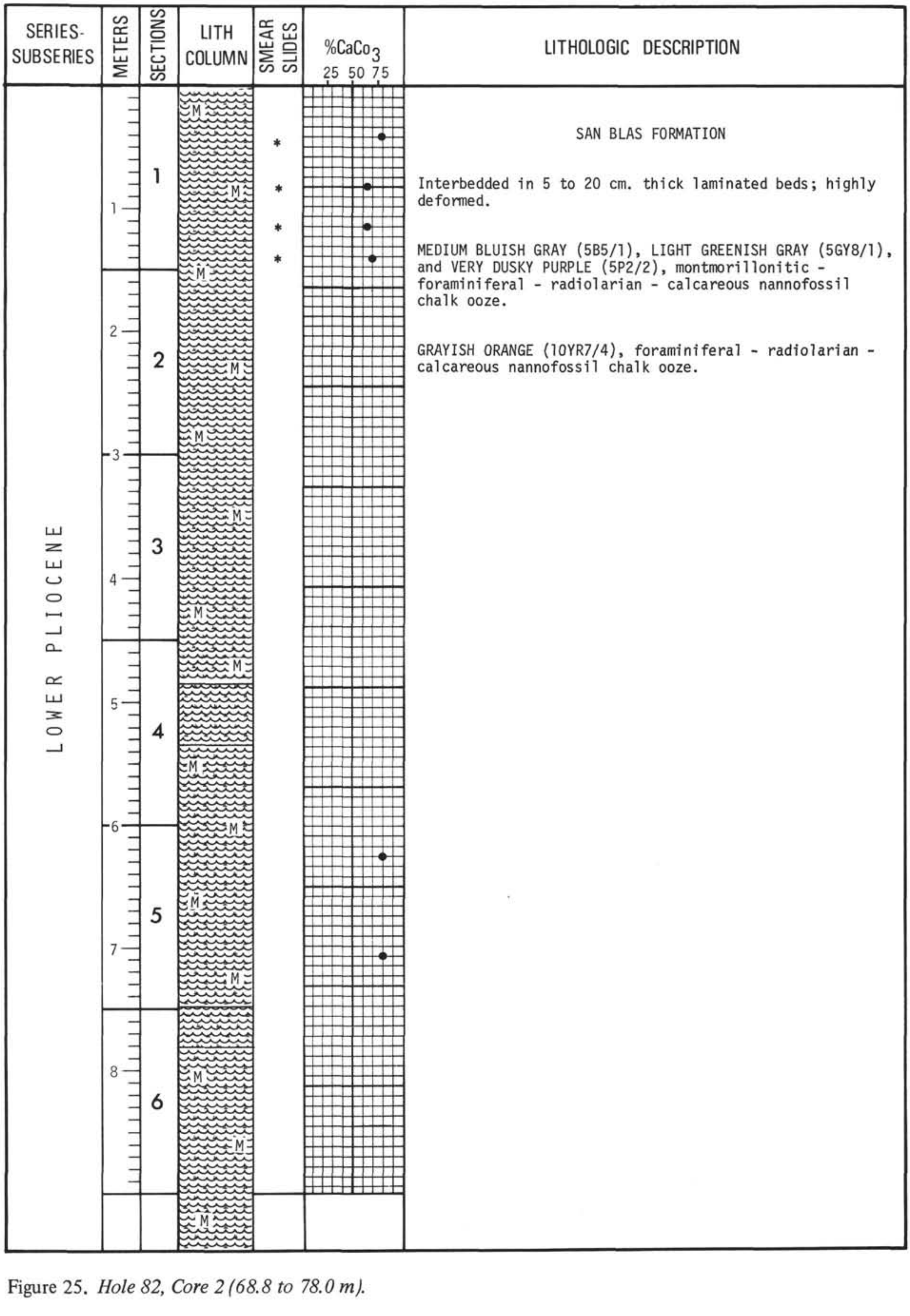


Figure 25. *Hole 82, Core 2 (68.8 to 78.0 m).*

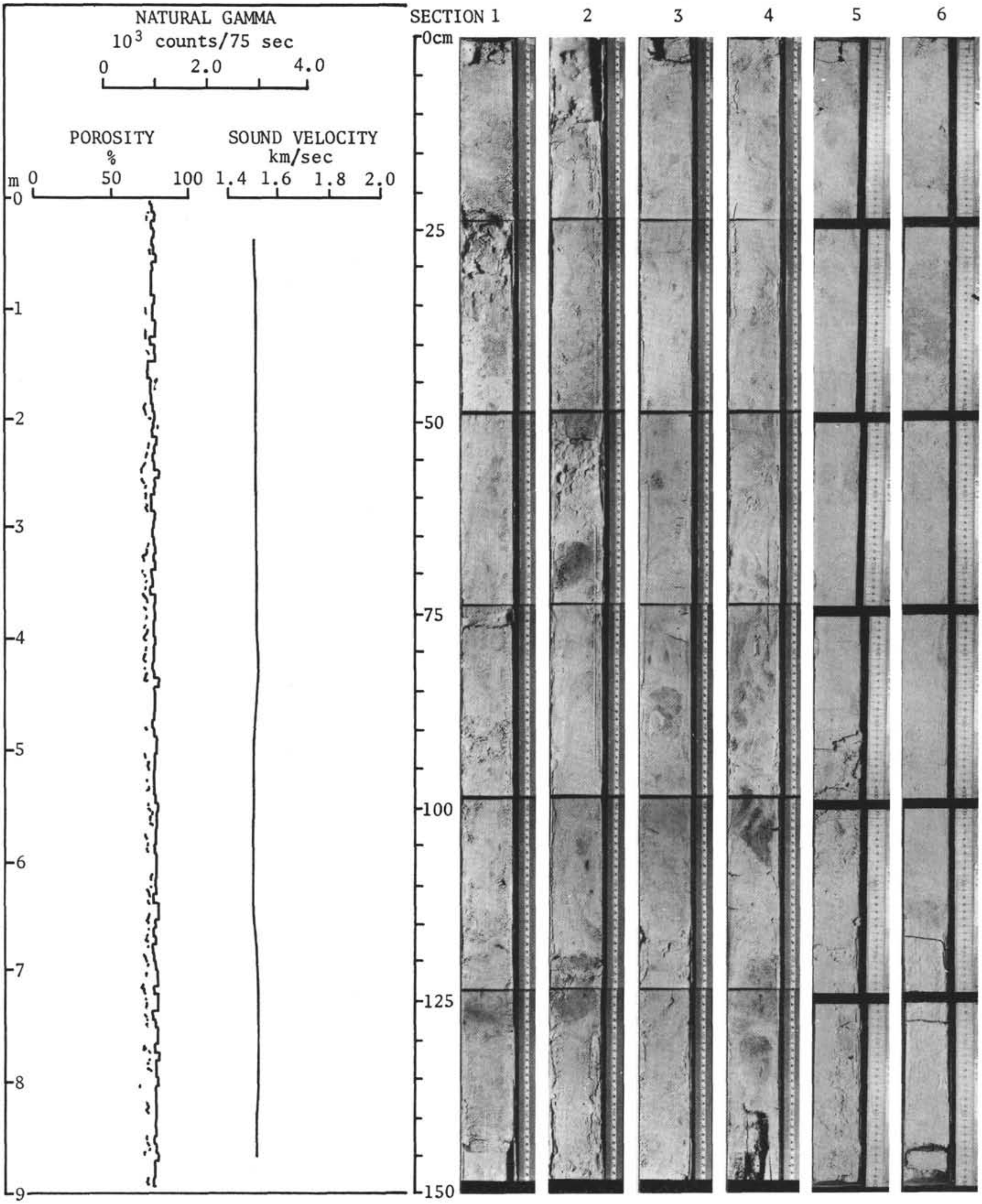


Figure 26. *Hole 82, Core 2, Sections 1-6, Physical Properties.*

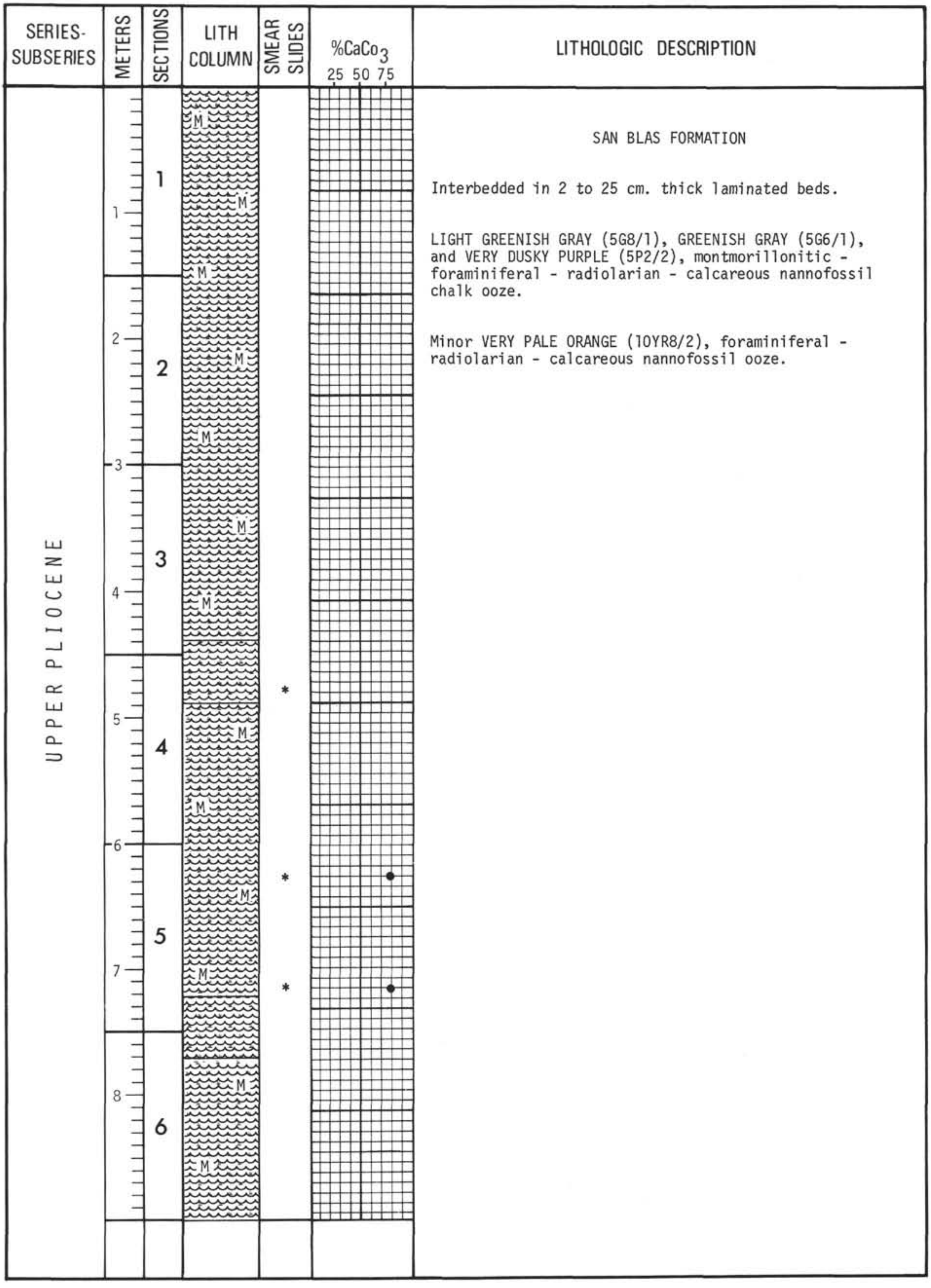


Figure 27. *Hole 82A, Core 2 (36.5 to 45.6 m).*

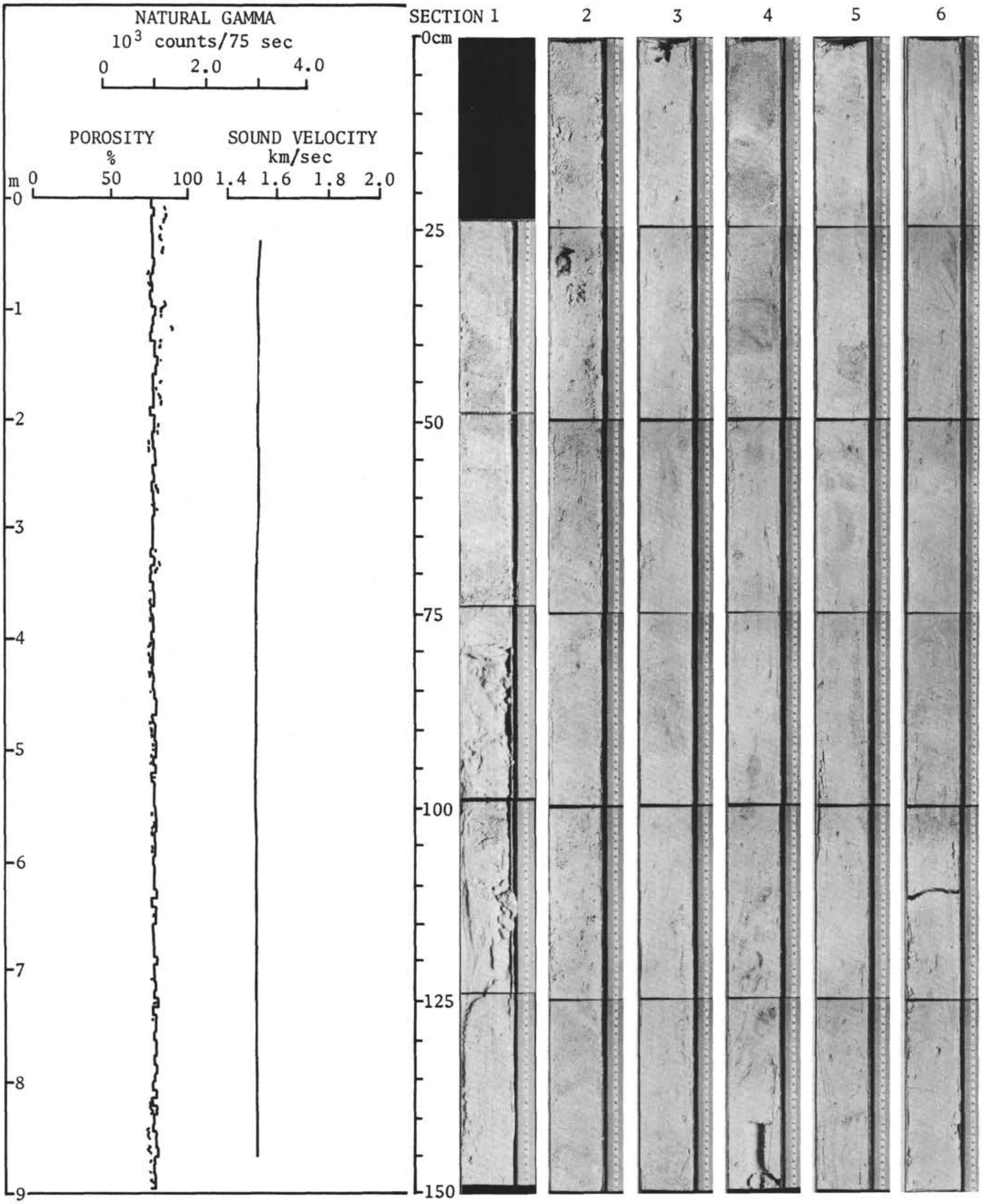
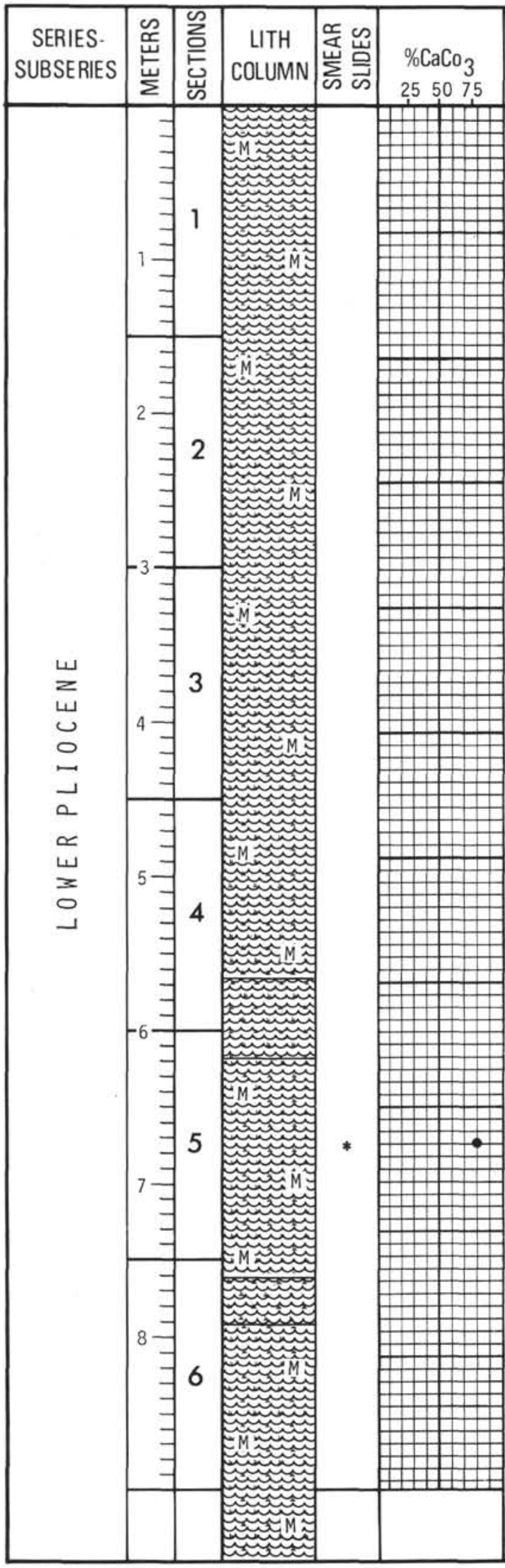


Figure 28. *Hole 82A, Core 2, Sections 1-6, Physical Properties.*



LITHOLOGIC DESCRIPTION

SAN BLAS FORMATION

Interbedded in 1 to 5 mm. thick laminated beds; highly deformed.

MEDIUM BLUISH GRAY (5B5/1), LIGHT GREENISH GRAY (5GY8/1), and VERY DUSKY PURPLE (5P2/2), montmorillonitic - foraminiferal - radiolarian - calcareous nannofossil chalk ooze.

GRAYISH ORANGE (10YR7/4), foraminiferal - radiolarian - calcareous nannofossil chalk ooze.

Figure 29. *Hole 82A, Core 3 (101.7 to 111.0 m).*

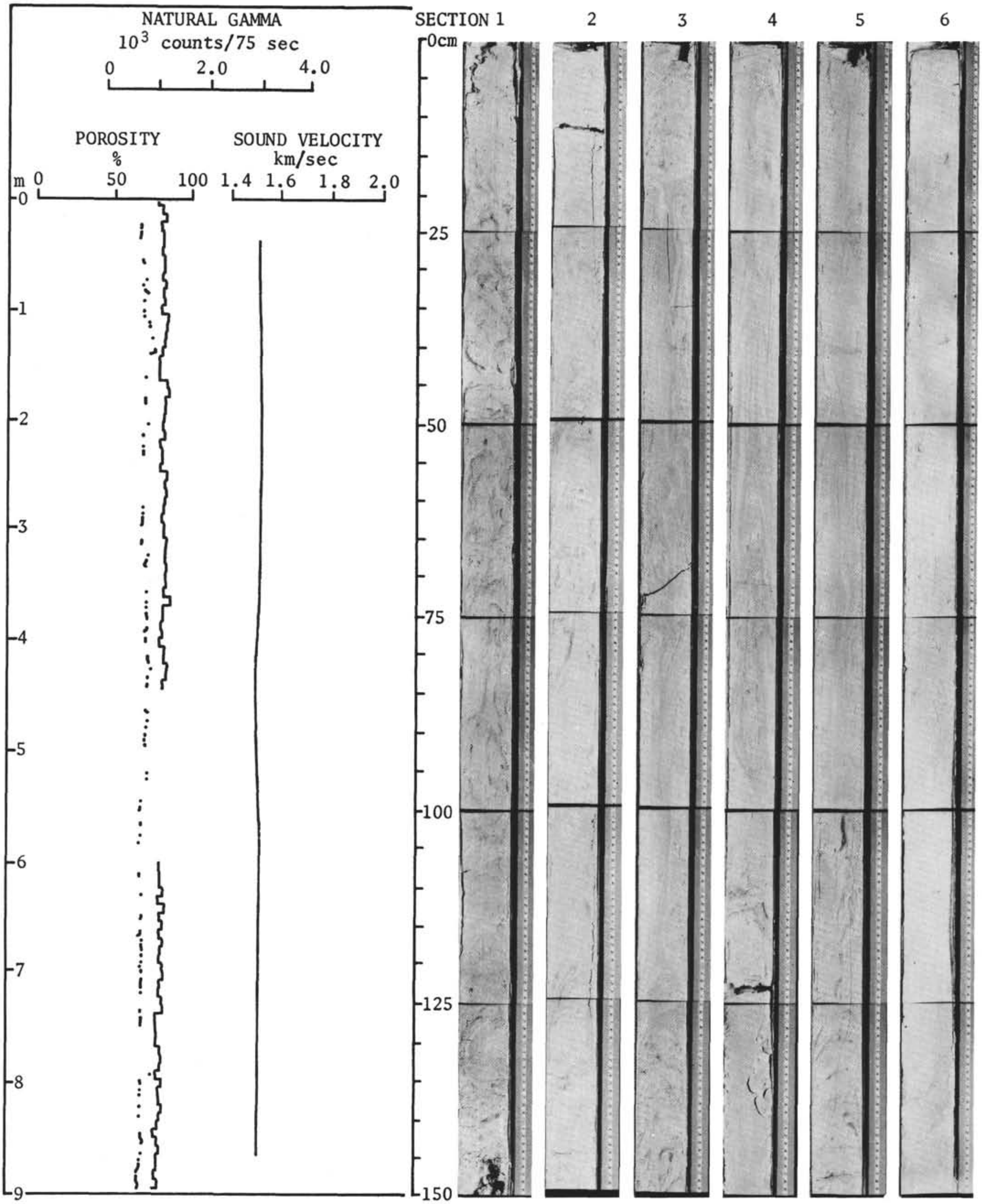
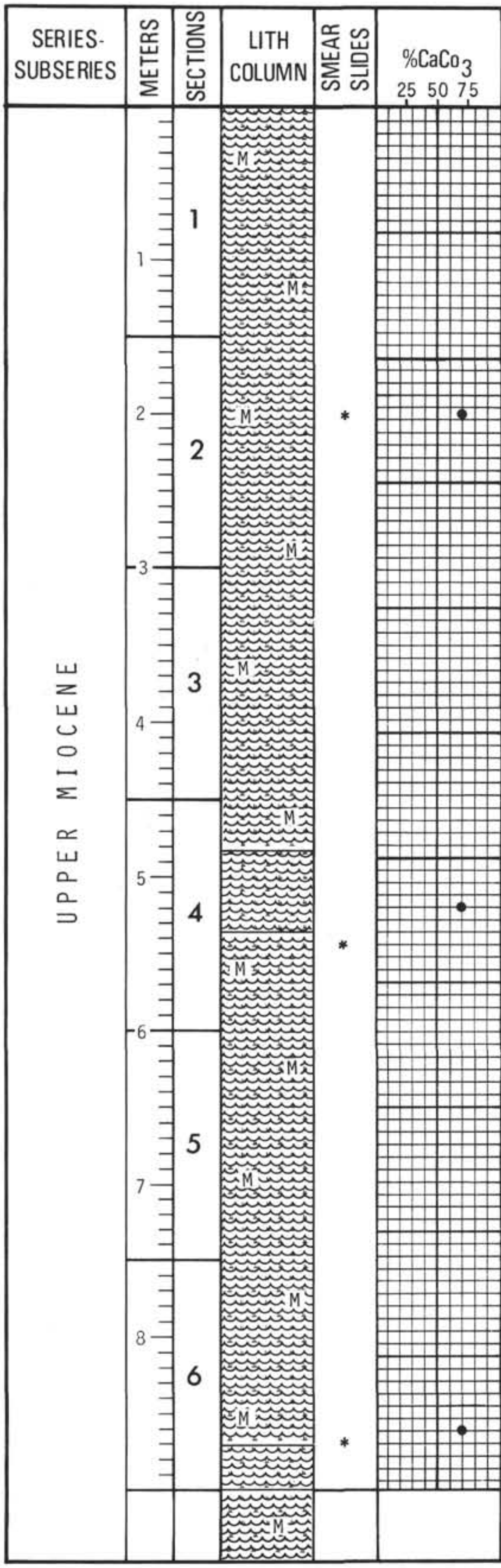


Figure 30. *Hole 82A, Core 3, Sections 1-6, Physical Properties.*



LITHOLOGIC DESCRIPTION

SAN BLAS FORMATION

Thinly bedded in 5 to 10 mm. thick beds.

DARK GREENISH GRAY (5G4/1), LIGHT GREENISH GRAY (5GY8/1), and VERY DUSKY PURPLE (5P2/2), montmorillonitic (<5%) - foraminiferal (10%) - radiolarian (30%-40%) - calcareous nannofossil (50%) chalk ooze.

Rare PALE ORANGE (10YR7/2), foraminiferal (15%-25%) - radiolarian (20%-30%) - calcareous nannofossil (45%-55%) ooze.

Figure 31. *Hole 82, Core 3 (135.3 to 144.5 m).*

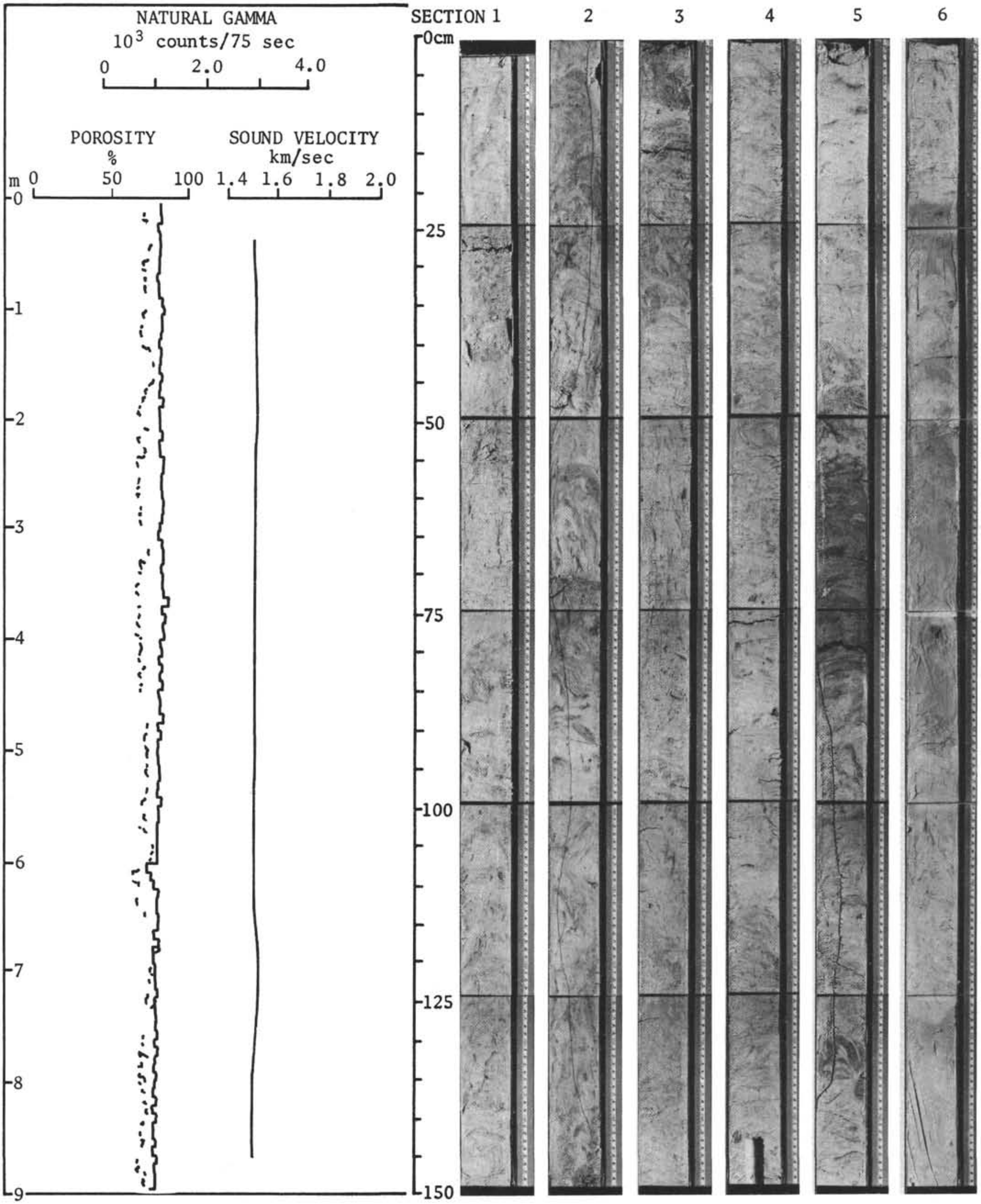
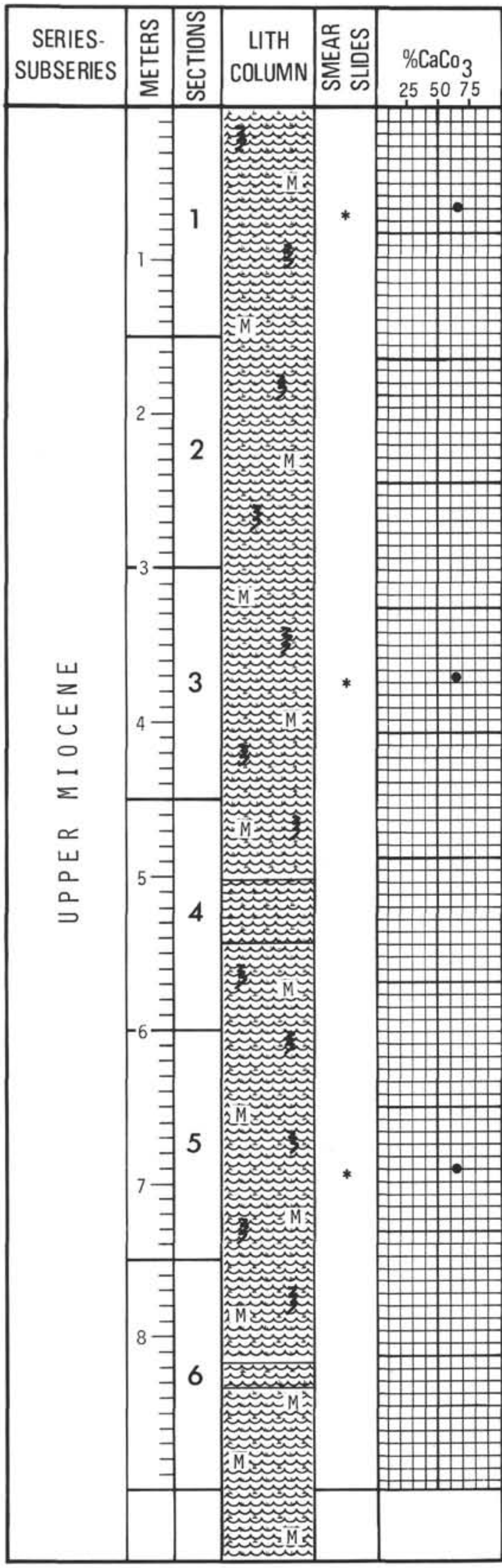


Figure 32. *Hole 82, Core 3, Sections 1-6, Physical Properties.*



LITHOLOGIC DESCRIPTION

SAN BLAS FORMATION

Thinly bedded in 5 to 10 mm. thick beds. Probable burrows very abundant in this core.

DARK GREENISH GRAY (5G4/1), LIGHT GREENISH GRAY (5G8/1), and VERY DUSKY PURPLE (5P2/2), montmorillonitic (<5%) - foraminiferal (10%) - radiolarian (30%-40%) - calcareous nannofossil (50%) chalk ooze.

Rare PALE ORANGE (10YR7/2), foraminiferal (15%-25%) - radiolarian (20%-30%) - calcareous nannofossil (45%-55%) ooze.

Figure 33. *Hole 82, Core 4 (191.3 to 200.5 m).*

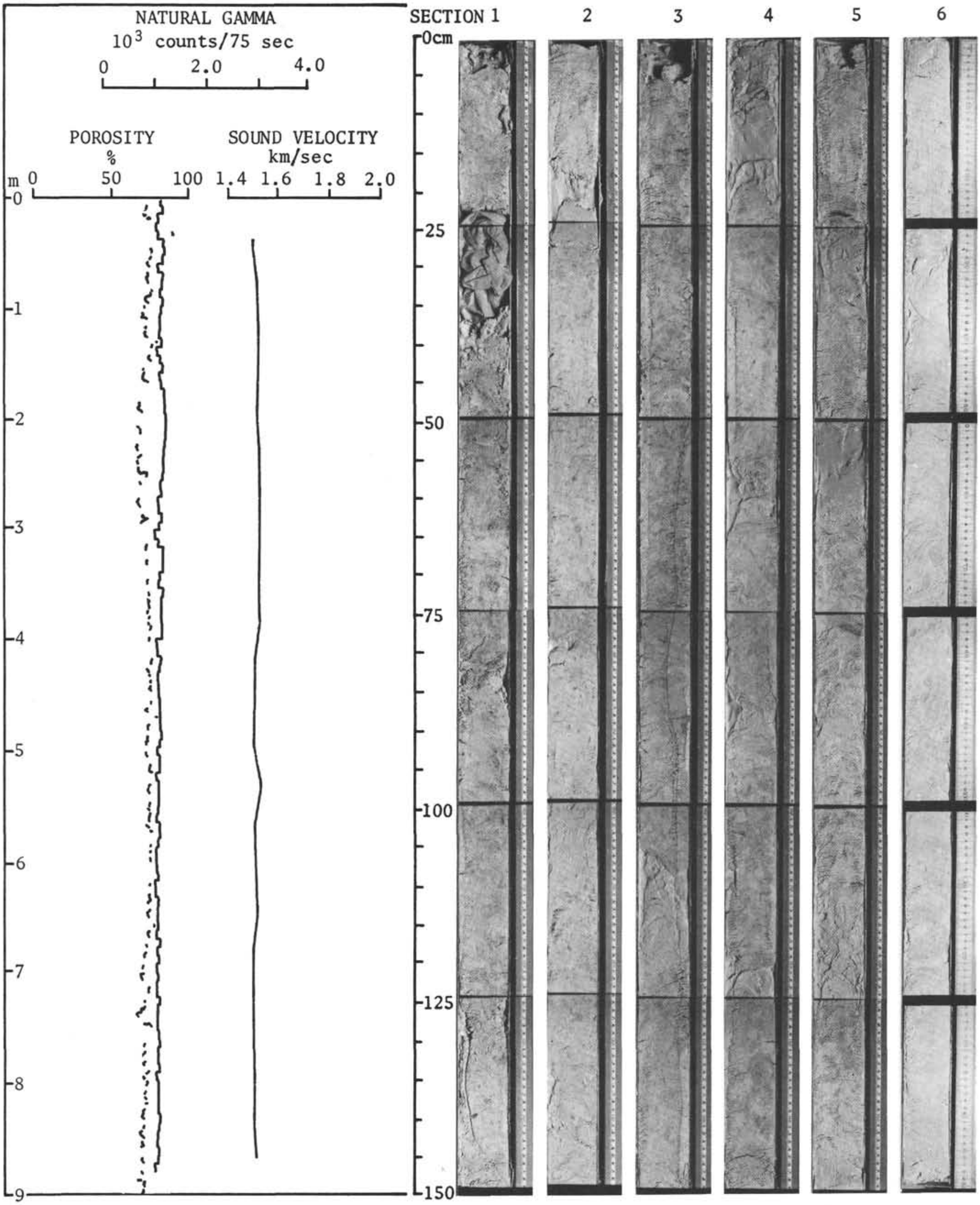


Figure 34. *Hole 82, Core 4, Sections 1-6, Physical Properties.*

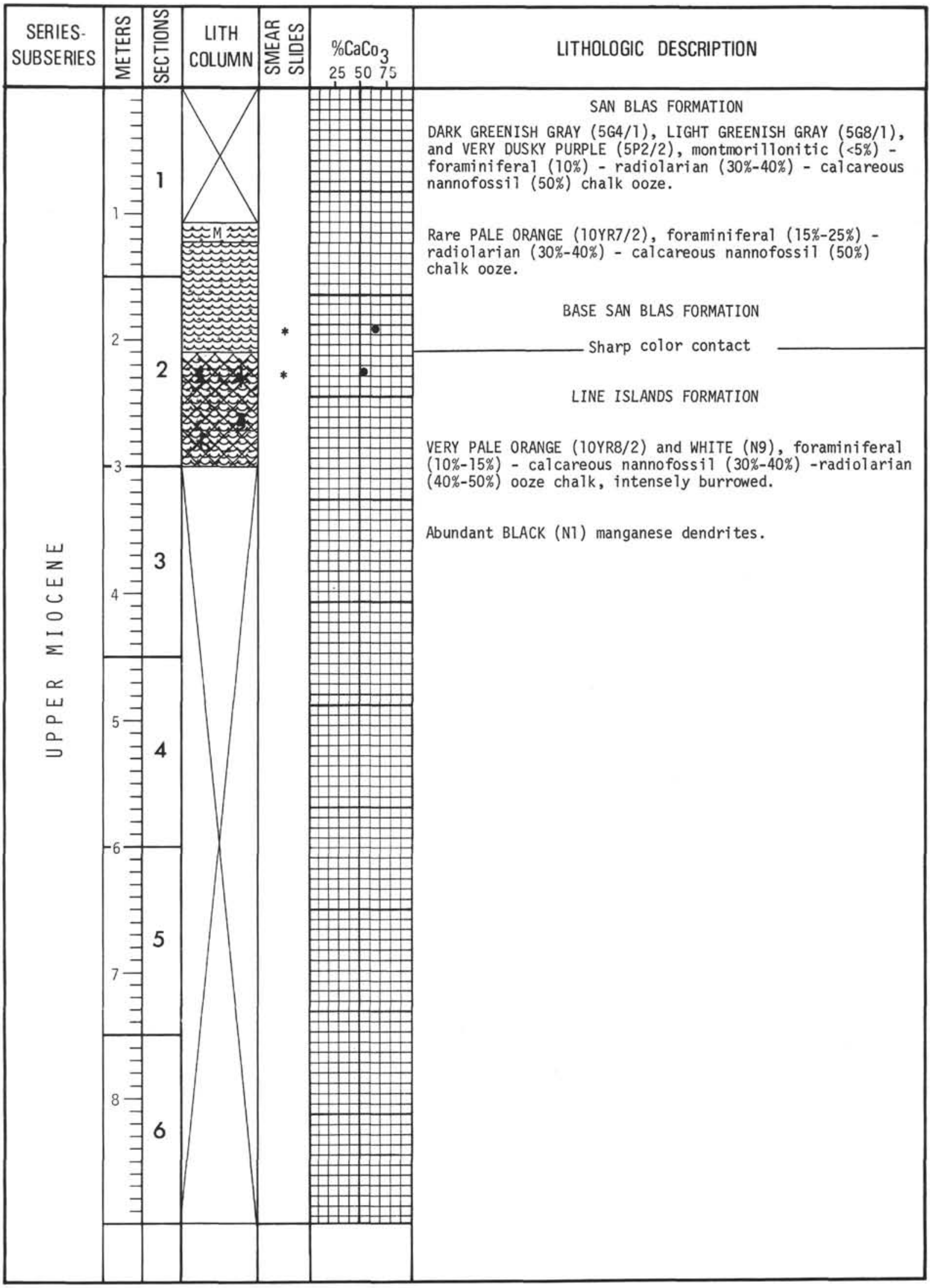


Figure 35. *Hole 82, Core 5 (200.5 to 209.6 m).*

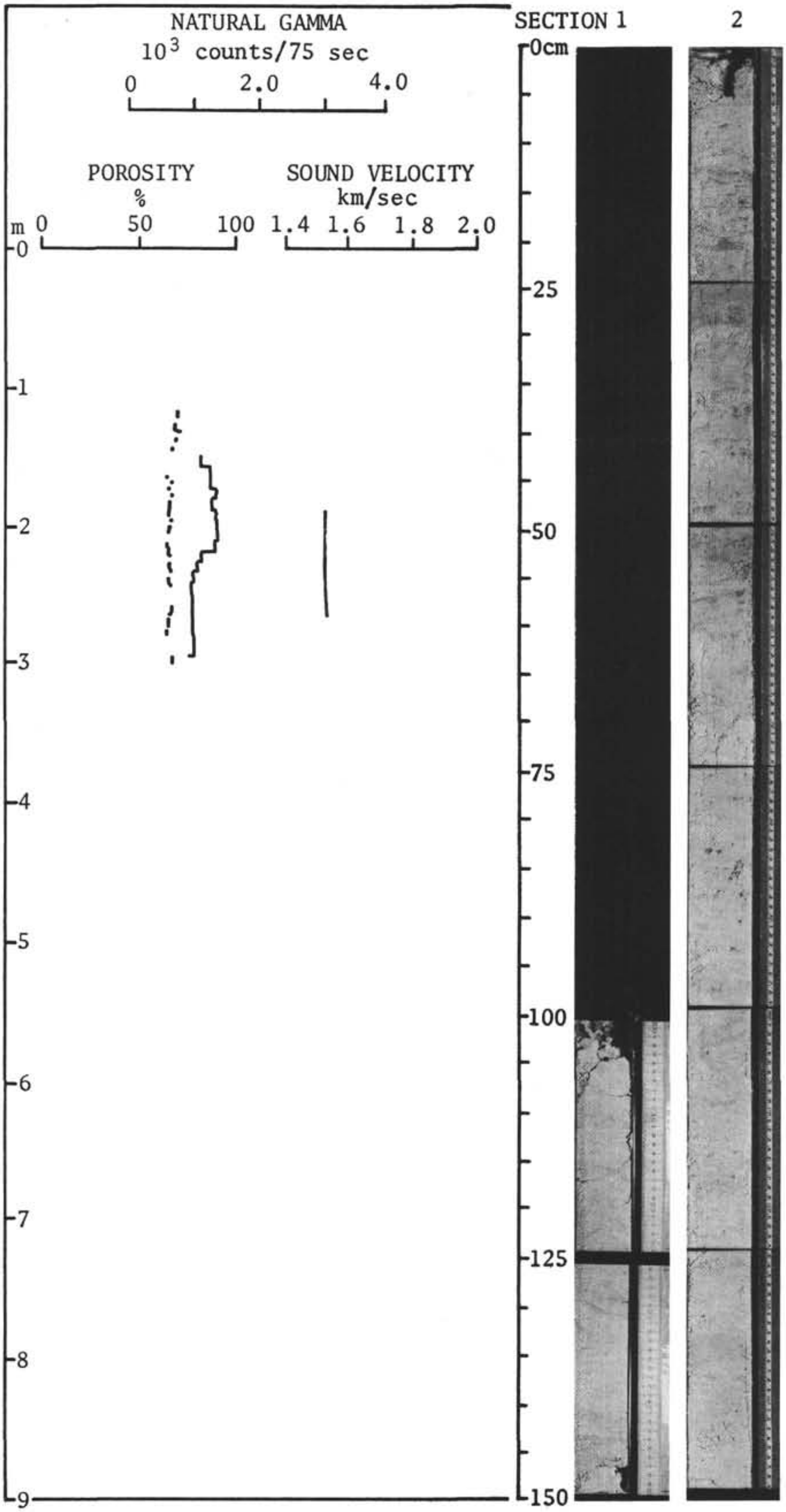
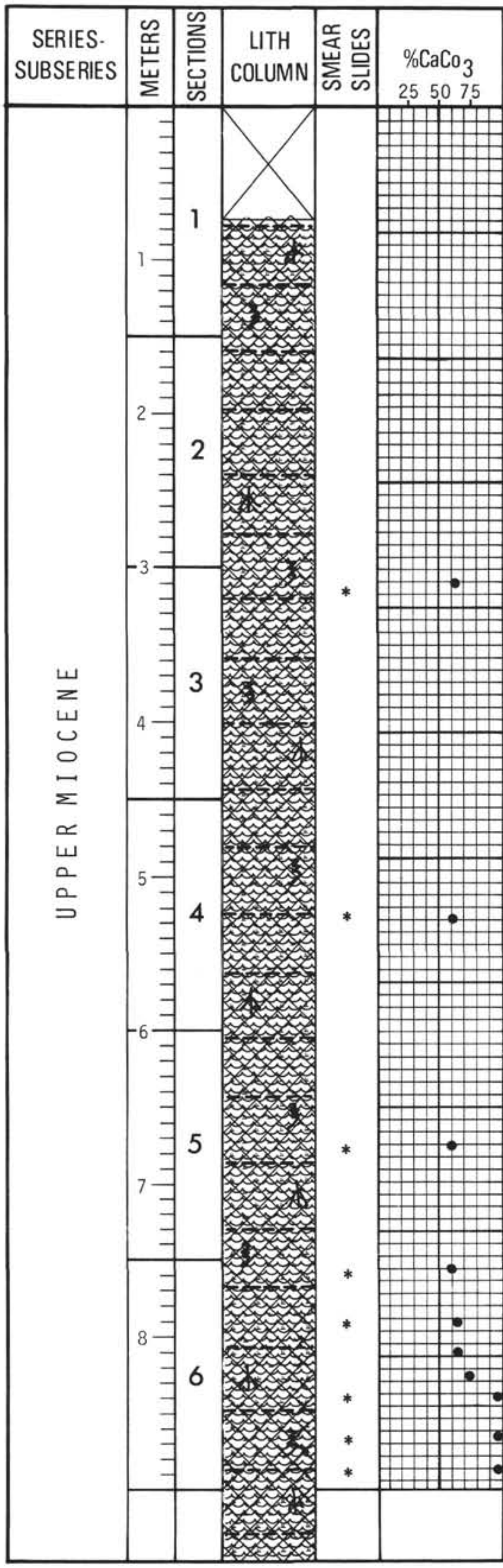


Figure 36. *Hole 82, Core 5, Sections 1 and 2, Physical Properties.*



LITHOLOGIC DESCRIPTION

LINE ISLANDS FORMATION

Same as Core 5 except between 85-100 cm. stratigraphic position in Section 6 the siliceous biota have decreased from about 40% to 0%. Probably due to intrusive contact.

VERY PALE ORANGE (10YR8/2) and WHITE (N9), foraminiferal (10%-15%) - calcareous nannofossil (30%-40%) - radiolarian (40%-50%) ooze chalk, intensely burrowed.

Abundant BLACK (N1) manganese dendrites.

Figure 37. *Hole 32, Core 6 (209.6 to 218.8 m).*

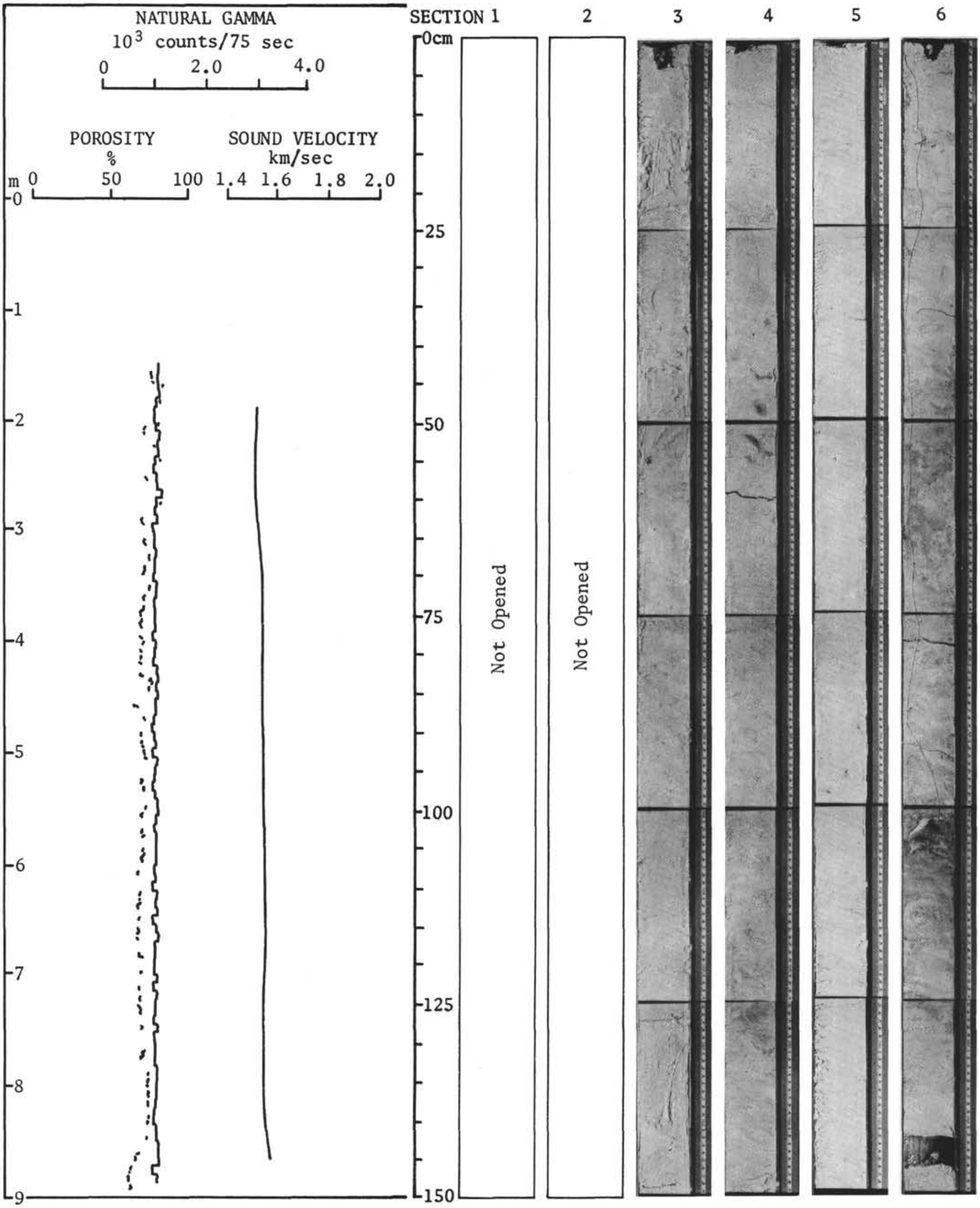


Figure 38. *Hole 82, Core 6, Sections 1-6, Physical Properties.*

SERIES-SUBSERIES	METERS	SECTIONS	LITH COLUMN	SMEAR SLIDES	%CaCo3 25 50 75	LITHOLOGIC DESCRIPTION
UPPER MIOCENE	1 2 3 4 5 6 7 8	1 2 3 4 5 6				BLACK (N1) very fine grained basalt with thin 1 to 2 mm. thick chilled glass rind.

Figure 39. *Hole 82, Core 7 (223.0 to 223.3 m).*

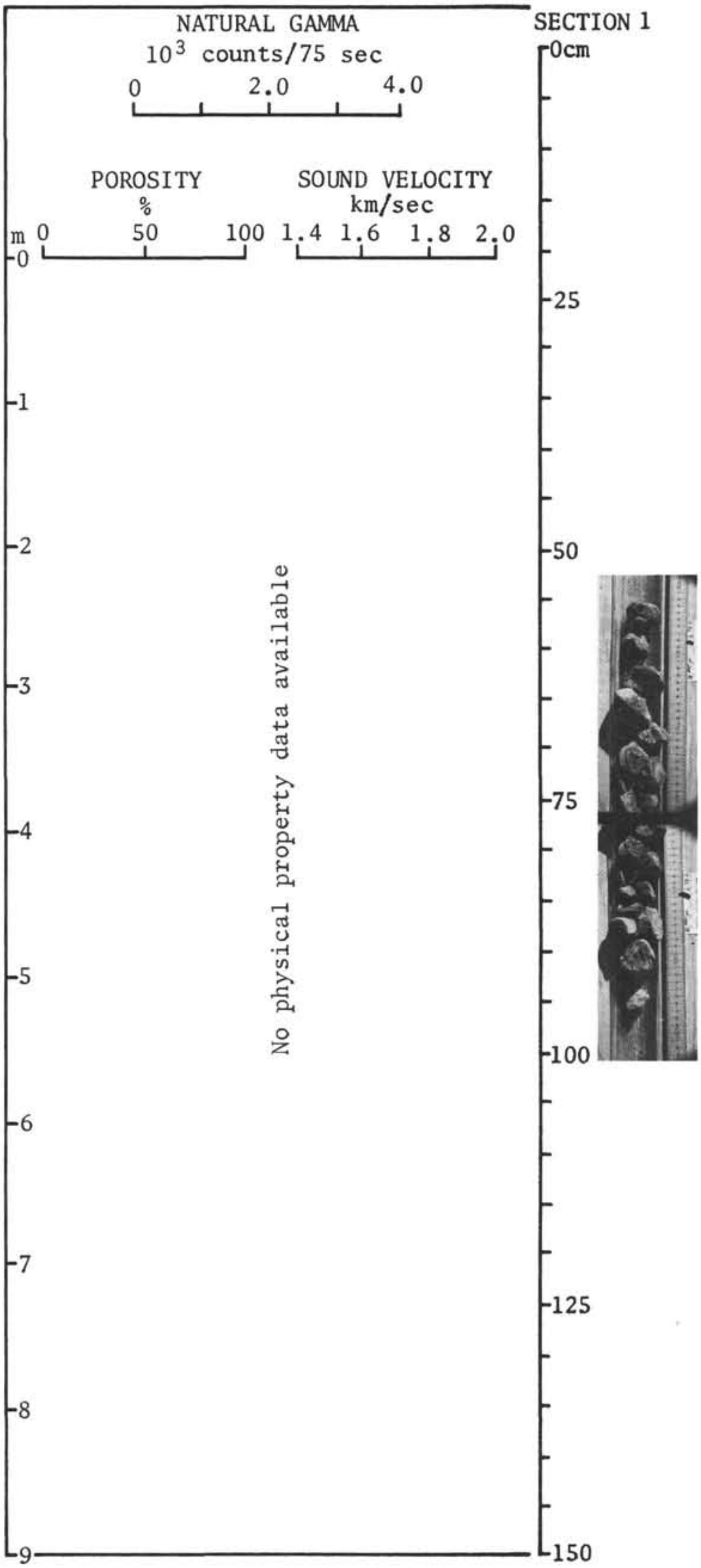


Figure 40. *Hole 82, Core 7, Section 1, Physical Properties.*

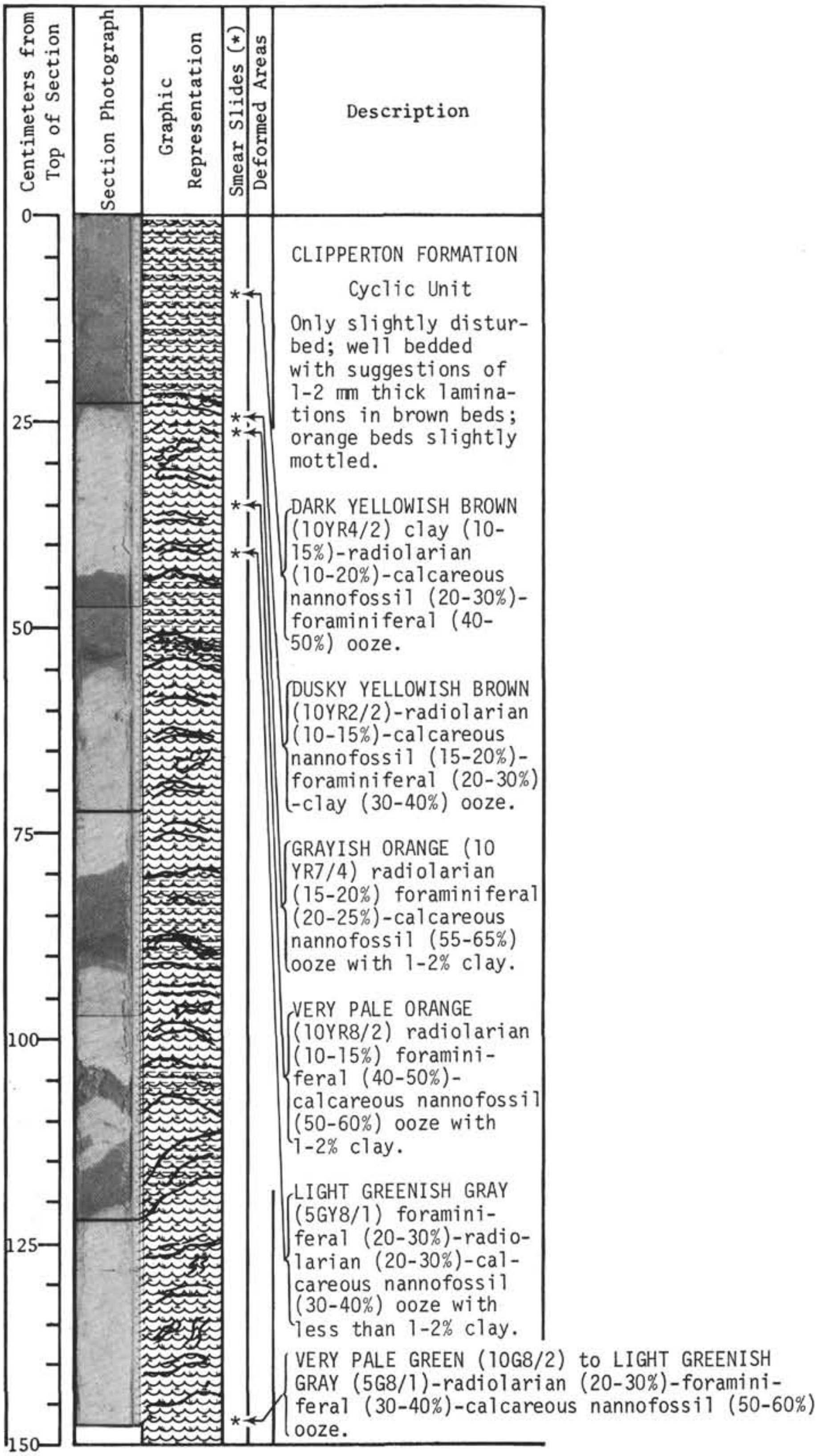


Figure 41. *Hole 82, Core 1, Section 1.*

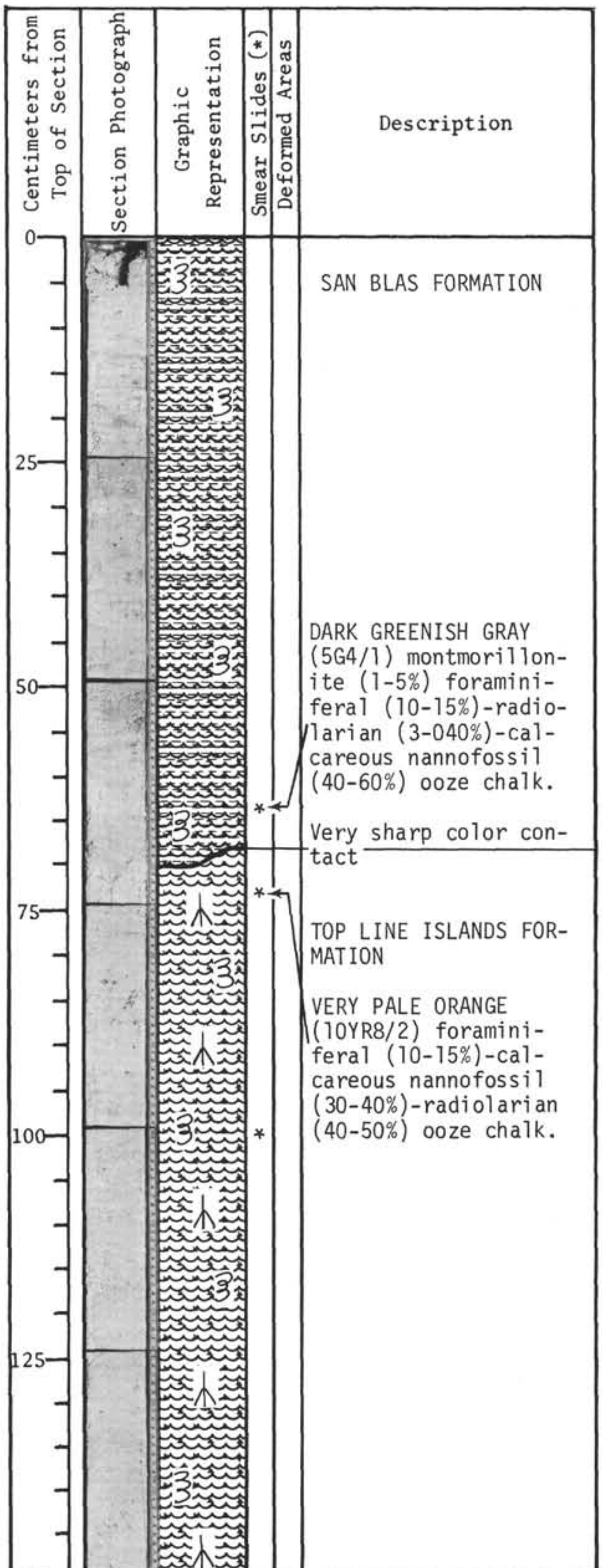


Figure 42. *Hole 82, Core 5, Section 2.*