# 6. SITE 80

The Shipboard Scientific Party[1]

## MAIN RESULTS

An apparently continuous 200-meter section of sediment ranging in age from lower Miocene to Quaternary was intermittently cored. Basalt was encountered at the base of the section and recovered. The baked sediment immediately overlying the basalt is included in the same foraminiferal and nannofossil zones as those at the base of Site 79. Because these two sites are located on the same latitude, such age equivalence is in accord with concepts of sea floor spreading and although the basalt encountered at Site 80 is a sill, suggests that the silling process does not invalidate the basal sediment age as an indicator of basement age. The estimated age of basement at this site is 21 ±1 million years B.P.

The lithologies at this site are similar to those encountered at earlier sites, consisting of alternating layers of more and less siliceous calcareous ooze. At Site 80, as at Site 77, a layer of iron and manganese rich clay immediately overlies the basalt. The sediments throughout the section are rich in foraminifera, coccoliths, diatoms and Radiolaria.

The accumulation rates at this site are highest at the top of the section in the Pliocene and Pleistocene, then decline in the Upper and Middle Miocene, and rise again in the Lower Miocene but to levels well below those of the Pliocene and Pleistocene. The average accumulation rate is about 9 m/m.y.

## INTRODUCTION

### Background and Objectives

The first three sites of Leg 9 in the equatorial region (77, 78 and 79) raised several questions that called for answers before the *Challenger* proceeded farther east into regions of younger basement age. These problems were:

1. Reliability of paleontological estimates of basement age. At each of the aforementioned sites, the sediments immediately overlying basalt are baked and show good evidence of thermal alteration. This indicates that the basalts are sills, and casts doubt on the reliability of the paleontological age of the oldest sediments at these sites as an indicator of the age of the crust. The question then is how reliably do the paleontological ages represent the age of basement.

   The rate of spreading, calculated from the sediment ages at Sites 77 and 79, of 8 cm/yr is higher than any recent spreading rates reported from this part of the Pacific and yet not out of line with recent spreading rates from some other areas of the ocean.

2. Variation of accumulation rates from site to site. At Site 77 the rates are at a maximum in the Upper Miocene to Pleistocene and are lower in the lower Miocene and Oligocene. The pattern is reversed at Site 78 where accumulation was negligible above the middle Miocene and at a maximum in the lower Miocene and Oligocene. At Site 79 the rates reach a maximum in the middle Miocene and were lower before and after. The pattern of accumulation rates through time then varies from site to site and may be a function of latitude.

In order to solve the first question concerning the reliability of basement age, we would either have to drill through the sill to see if a significant thickness of sediment underlies it or, from present knowledge of sea floor motion, pick a location which should have the same age as the site already drilled, and drill it. With the present technical capabilities of the *Challenger* the first alternative was unfeasible. Not only was it unlikely that we could drill through the sill before the bit wore out, but the attempt would cost many hours of precious ship time. The second alternative had more to recommend it. Reasoning that the sea floor during the Oligocene and lower Miocene was probably moving parallel to the major fracture zones, such as the

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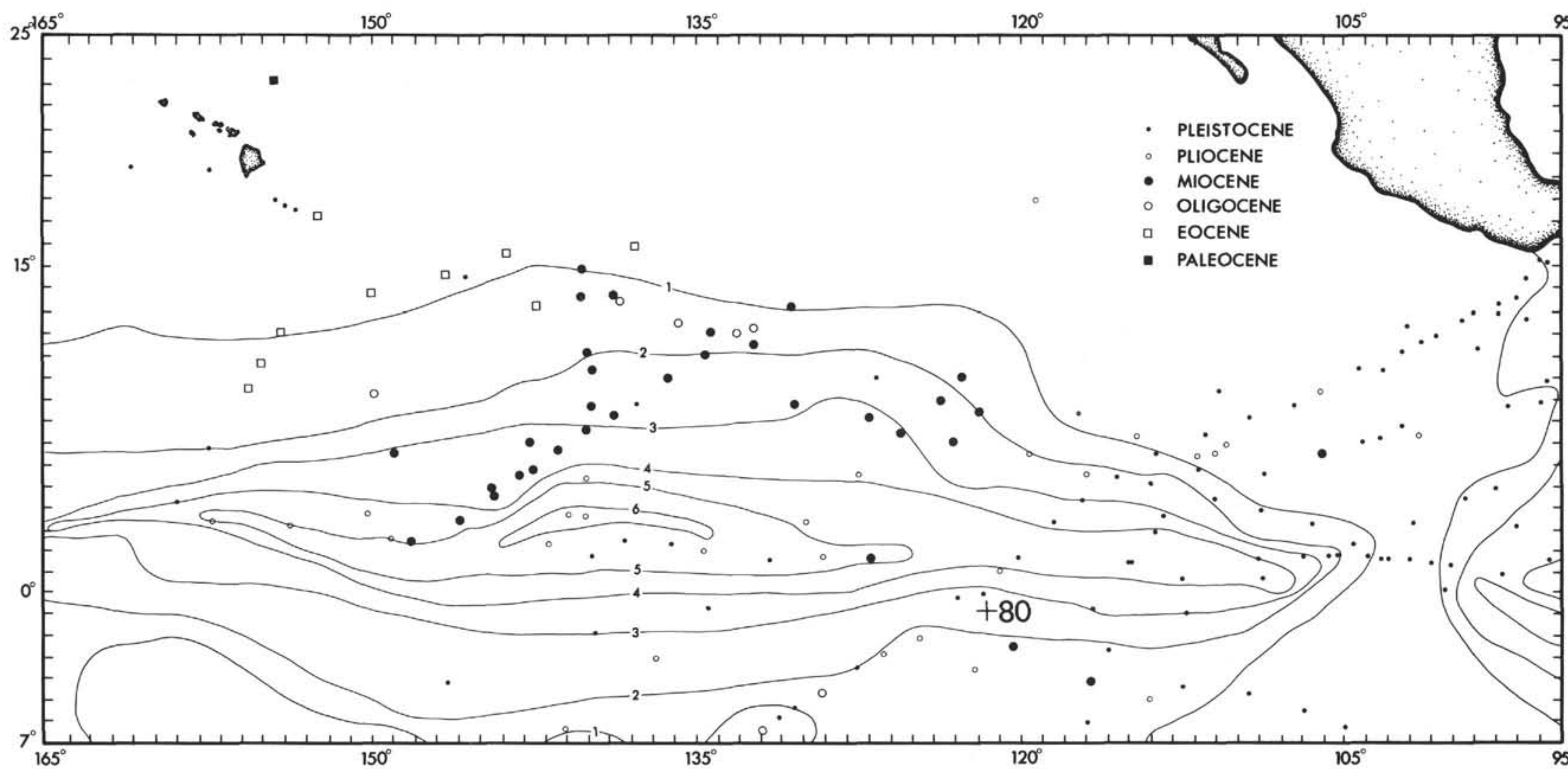



Figure 1. *Location of Site 80; sediment isopachs in hundreds of meters after Ewing* et al. *(1968); distribution of piston core ages after Hays* et al. *(1969).*

Clipperton, Clarion, etc., then its movement should have been nearly east-west. The time lines of the basement should run nearly north-south, being offset, of course, by major fracture zones.

A hole, therefore, several degrees directly south of Site 79 would serve to: test the reliability of the basal sediment age at Site 79 as a measure of basement age; and, clarify the pattern of accumulation rates for sites south of the Equator by examining the accumulation rates at such a site. Accordingly, on a decision by the Chief Scientist, the *Challenger* proceeded to an unscheduled site at 00° 57.72'S and 121° 33.22'W (Figure 1).

## Operations

### Site Survey

Site 80 had not been previously surveyed by the *Argo* so a short survey was conducted by the *Challenger.* During the survey, sediments that were apparently up to 0.3-second thick were encountered. The basement topography was rough, but the ocean floor topography was somewhat smoothed by the sediment cover (Figure 2). During the site survey, changes in depth of the ocean floor were minor. As at previous sites the location selected for the site was where the sediments were thickest. During the survey the ultimate site was crossed twice. After the second crossing the seismic gear was retrieved and the ship returned to the selected spot, where a Burnett beacon was dropped.

### Coring

When the beacon reached the sea floor, the drill string was lowered and the section cored at approximately 55-meter intervals until basalt was reached at a depth of 199 meters below the sea floor. After one foot of this basalt was cored and one-half foot recovered, the bit was raised to the mud line and a second hole was cored (Hole 80A). Five cores were taken in this second hole at selected depths to recover intervals that were deemed important for paleontological and lithological control. Pertinent operational data for this site is summarized in Tables 1 and 2.

**TABLE 1**
**Site Operational Summary**

Site 80

Latitude: 00° 57.72'S; Longitude: 121° 33.22'W.

Time of arrival: 1310 hours, 1/4/70; Time of departure: 1115 hours, 1/6/70.

Total time on site: 1 day, 23 hours, 5 minutes.

Water depth: 4399 meters.

Sediment thickness determined by drilling: 199 meters.

Acoustical thickness: 0.20 second.

Average sound velocity of sediments: 2.0 km/sec.

| Hole | Penetration (m) | Cores Attempted | Cores Recovered | Per Cent Cored | Recovery (m) | Per Cent Recovered |
|---|---|---|---|---|---|---|
| 80 | 199.7 | 6 | 6 | 23.9 | 39.8 | 93.9 |
| 80A | 165.0 | 5 | 5 | 27.7 | 45.7 | 100.0 |
| Total 2 | 199.7 | 11 | 11 | 44.1 | 85.5 | 97.0 |

**TABLE 2**
**Hole Drilling Summary, Site 80**
**(Latitude 00° 57.72′S, Longitude 121° 33.22′W; 4399 meters)**

**Hole 80**

| Interval Below Sea Floor (m) | (ft) | Cores 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 | 9.10 | 30.0 | – | – | |
| 9.1-61.0 | 30-200 | | | | | | | | | |
| 61.0-70.1 | 200-230 | | 2 | 9.1 | 30 | 9.10 | 30.0 | – | – | |
| 70.1-128.0 | 230-420 | | | | | | | | | |
| 128.0-137.2 | 420-450 | | 3 | 9.1 | 30 | 9.10 | 30.0 | | Int | |
| 137.2-166.5 | 450-546 | | | | | | | | | |
| 166.5-174.1 | 546-571 | | 4 | 7.7 | 25 | 7.70 | 25.0 | Cont | Int | |
| 174.1-192.4 | 571-631 | | | | | | | | | |
| 192.4-199.4 | 631-654 | | 5 | 7.0 | 23 | 4.40 | 15.0 | Cont | Cont | |
| 199.4-199.7 | 654-655 | | 6 | 0.3 | 1 | 0.15 | 0.5 | Cont | Cont | |
| Total 199.7 | 655 | | 6 | 42.4 | 139 | 39.80 | 130.5 | | | |

**Hole 80A**

| Interval Below Sea Floor (m) | (ft) | Cores 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 | | | | | | | |
| 9.1-18.3 | 30-60 | | | 9.1 | 30 | 9.1 | 30 | – | – | |
| 18.3-42.7 | 60-140 | | 2 | | | | | | | |
| 42.7-51.8 | 140-170 | | | 9.1 | 30 | 9.1 | 30 | – | – | |
| 51.8-86.6 | 170-284 | | 3 | | | | | | | |
| 86.6-95.7 | 284-314 | | | 9.1 | 30 | 9.1 | 30 | | – | |
| 95.7-109.1 | 314-358 | | 4 | | | | | | | |
| 109.1-118.3 | 358-388 | | | 9.1 | 30 | 9.1 | 30 | | Int | |
| 155.4-164.6 | 510-540 | | 5 | 9.1 | 30 | 9.1 | 30 | | Int | |
| Total 164.6 | 540 | | 5 | 45.7 | 150 | 45.7 | 150 | | | |

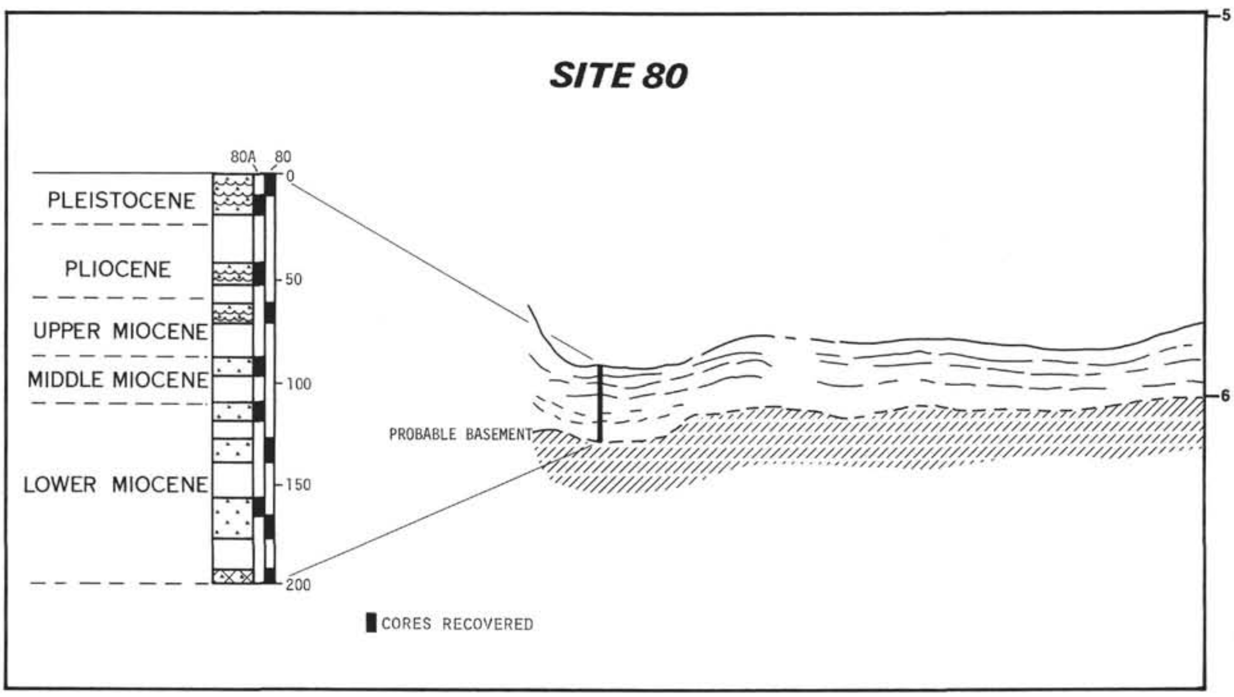



Figure 2. *Sketch of seismic reflection record in vicinity of Site 80 showing interval cored in each hole.*

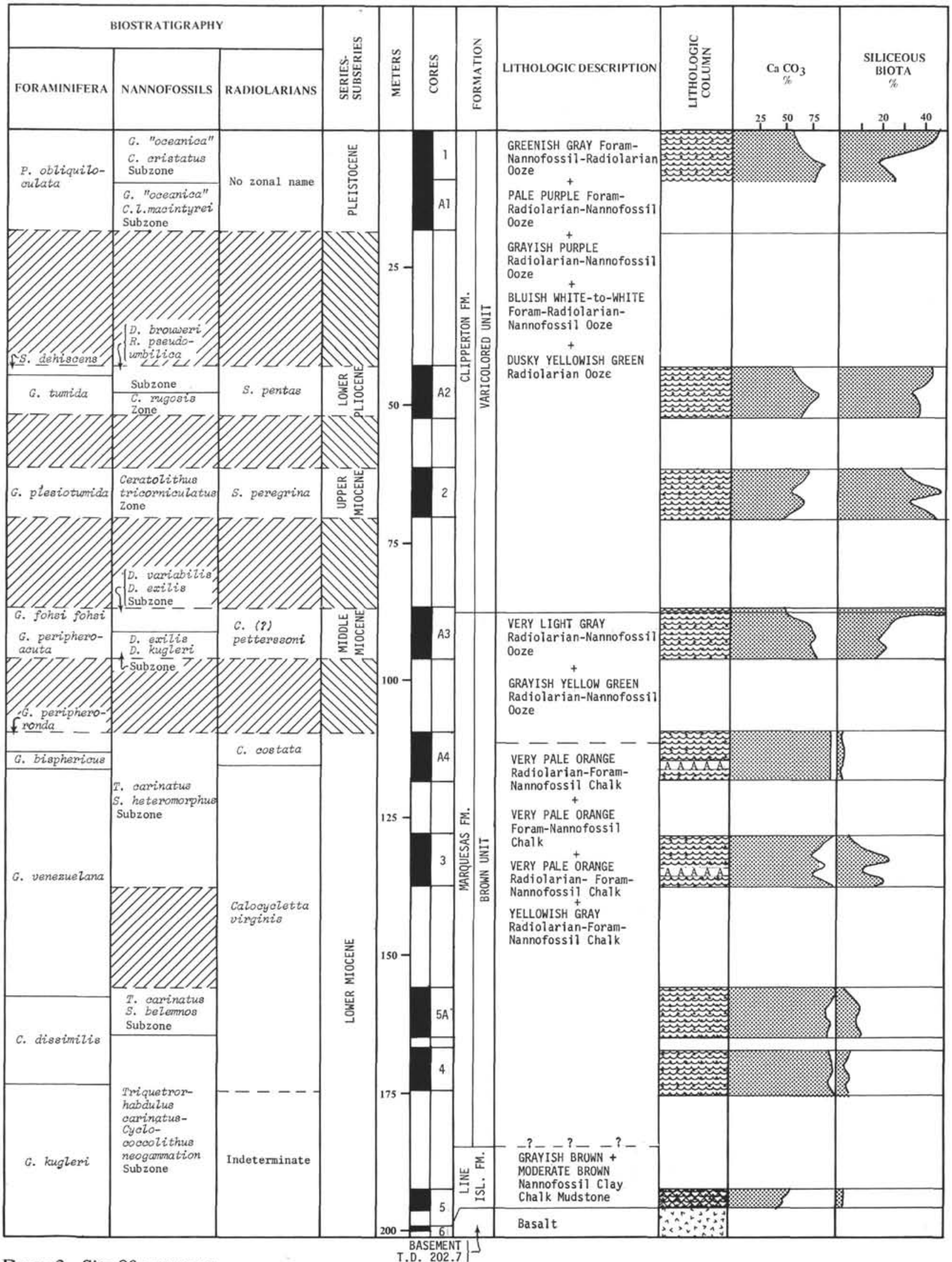



Figure 3. *Site 80 summary.*

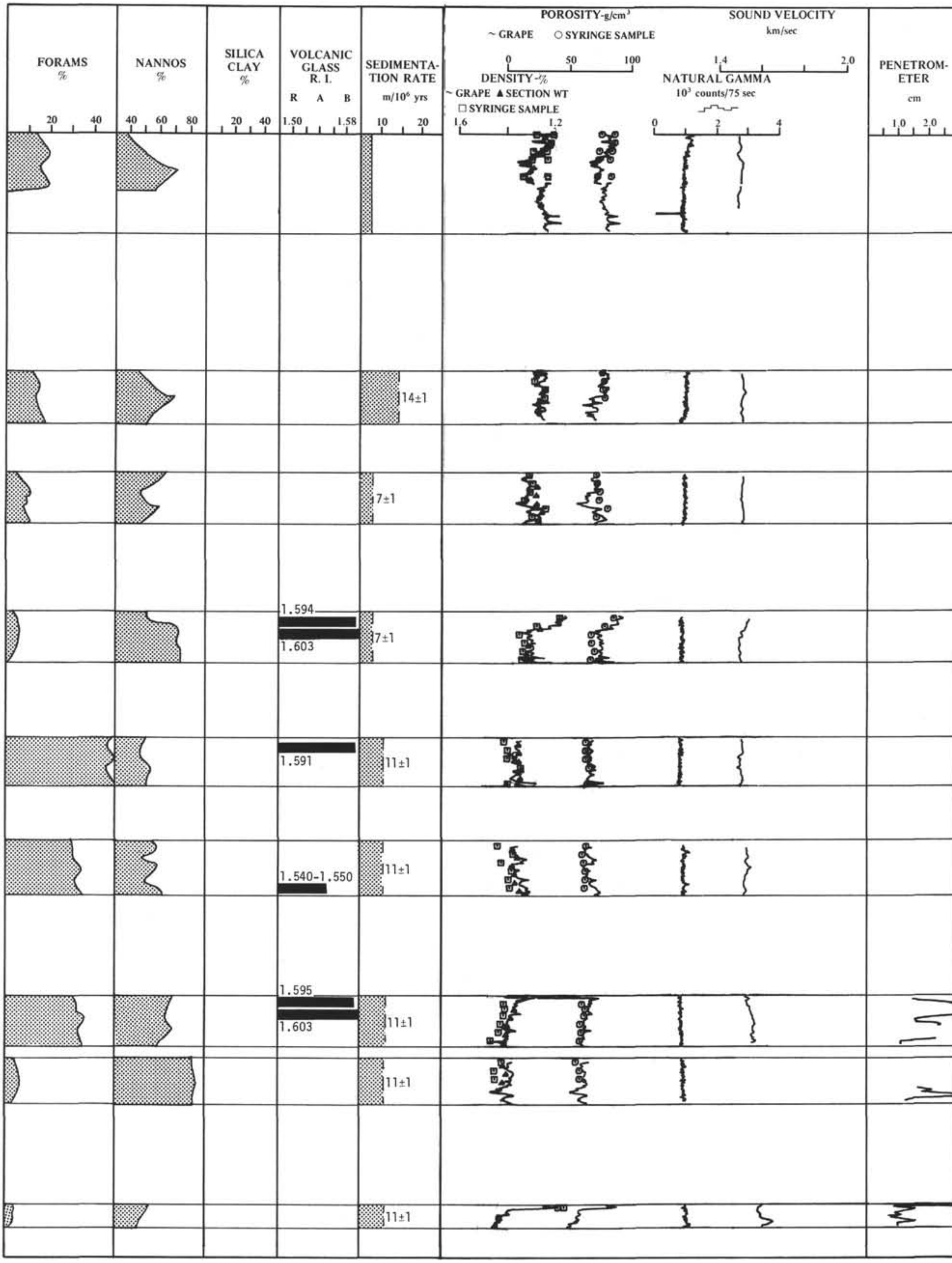



Figure 4. *Site 80 summary.*

## LITHOLOGY

At this site three formations are present: The Clipperton Oceanic Formation (0 to 90.6 meters) which consists of a varicolored unit of purple, green, and white calcareous oozes; the Marquesas Oceanic Formation (90.6 to 185 meters) consisting of calcareous sediments; and the Line Islands Oceanic Formation (185 to 202.6 meters) consisting of dark brown calcareous chalks and mudstones rich in "red clay" which is amorphous iron and (?) manganese oxides. Basement is basalt interpreted to be intrusive.

### Clipperton Oceanic Formation

#### Varicolored Unit (0 to 90.6 meters)

As at previous sites the varicolored unit is characterized by interbedded, purple, green and white oozes. These colors easily distinguish it from the subjacent orange and brown oozes and chalks of the Marquesas Oceanic Formation.

The various colors occur in 5 to 25-centimeter thick beds with sharp upper and lower contacts. Usually, the cores are so intensely disturbed that laminations are not preserved; however, in undisturbed intervals individual beds exhibit 0.5 to 2-millimeter thick laminations.

The dominant lithologies are:

1. Greenish-gray (5G6/1) foraminiferal (15 to 20 per cent)–calcareous nannofossil (30 to 40 per cent)–radiolarian (40 to 50 per cent) ooze.

2. Bluish-white (5B9/1) to white (N9) foraminiferal (15 to 20 per cent)–radiolarian (30 to 40 per cent)–calcareous nannofossil (40 to 60 per cent) ooze.

3. Pale purple (5P6/2) foraminiferal (15 to 25 per cent)–radiolarian (15 to 25 per cent)–calcareous nannofossil (50 to 70 per cent) ooze.

4. Grayish-purple (5P4/2) radiolarian (25 to 35 per cent)–calcareous nannofossil (55 to 75 per cent) ooze.

5. Dusky yellowish-green (10GY3/2) radiolarian (10 to 15 per cent)–diatom (85 to 90 per cent) ooze.

The base of the Clipperton Oceanic Formation at this site is defined by the base of a dusky yellowish-green, diatom-rich bed.

### Marquesas Oceanic Formation

The Marquesas Oceanic Formation at this site is virtually all yellowish oozes and chalks, and in this respect is very similar to the brown units at Site 77.

#### Brown Unit (90.6 to 185 meters)

Approximately the upper 15 meters is well bedded in 5 to 25-centimeter thick beds that have sharp upper and lower contacts. These beds consist of:

1. Very light gray (N8) to bluish-white (5B9/1) radiolarian (20 to 30 per cent)–calcareous nannofossil (55 to 65 per cent) ooze.

2. Grayish-yellow green (5GY7/2) radiolarian (10 to 15 per cent)–calcareous nannofossil (80 to 85 per cent) ooze.

3. Yellowish-gray (5Y7/2) radiolarian (10 to 25 per cent)–calcareous nannofossil (80 to 85 per cent) ooze.

The lower 95 meters is characterized by massive yellow chalks. Occasionally, beds 5 to 30-centimeters thick interrupt the massive nature, but these beds are rare. Pumice fragments and burrows are common throughout this interval. The dominant lithologies are:

1. Very pale orange (10YR8/2) calcareous nannofossil (45 to 50 per cent)–foraminiferal (45 to 50 per cent) chalk.

2. Very pale orange (10YR8/2) foraminiferal (35 to 45 per cent)–calcareous nannofossil (45 to 55 per cent) chalk.

Minor amounts of the following occur:

3. Grayish-orange (10YR7/4) to pale yellowish-brown (10YR6/2) radiolarian (30 to 35 per cent)–foraminiferal (30 to 35 per cent)–calcareous nannofossil (30 to 35 per cent) chalk.

4. Light olive gray (5Y5/2) calcareous nannofossil chalk.

The contact between the Marquesas and the underlying Line Islands Oceanic Formation was not cored.

### Line Islands Oceanic Formation

The dark brown color and high "red clay" (amorphous iron and manganese oxides) percentage serves to distinguish this formation from other formations. In all sites the first occurrence of the Line Islands Oceanic Formation served as an indication that basaltic basement was within about 10 to 15 meters. No crystalline phases of iron or manganese oxides were detected in the samples submitted for X-ray analyses (Cook and Zemmels, 1971).

Various shades of brown are separated by gradational contacts which give this formation a bedded appearance. These beds vary from 5 to 15 centimeters in thickness. Occasionally, 1 to 2-millimeter thick laminations are present. Another characteristic is abundant–very pale orange, slightly compressed burrows.

The three lithologies include:

1. Grayish-brown (5YR3/2) calcareous nannofossil (45 to 50 per cent)–clay (45 to 50 per cent) chalk

mudstone.

2. Moderate brown (5YR3/4) calcareous nannofossil (45 to 50 per cent)–clay (45 to 50 per cent) chalk mudstone.

3. Pale yellowish-brown (10YR6/2) calcareous nannofossil (45 to 50 per cent)–clay (45 to 50 per cent) chalk mudstone.

The contact between the Line Islands Oceanic Formation and the underlying basalt was not cored; however, the presence of tridymite in the brown chalk mudstones and chilled glassy margins on the underlying basalt strongly suggests that the basalt is intrusive at this site also.

### Basalt

Basement consists of a black (N-1), very fine-grained basalt with chilled glass margins.

## PHYSICAL PROPERTIES

### Natural Gamma

Natural gamma readings at Site 80 ranged from 816 to 1226 counts.

The varicolored unit of the Clipperton Oceanic Formation shows readings from 832 to 1226 counts. From 0 to 8.6 meters, high readings of 950 to 1226 counts were recorded. These readings were probably the result of devitrified volcanic glass. At 47.5 meters readings of 1000 were recorded. These readings were probably the result of montmorillonite in the sediments (Cook and Zemmels, 1971).

The brown unit of the Marquesas Oceanic Formation shows natural gamma emissions from 850 to 950 counts with occasional increases to 1000 counts. These increases are probably the result of small amounts of pumice.

The Line Islands Oceanic Formation is characterized by high readings of 975 to 1173 counts, and can be distinguished from the overlying brown unit of the Marquesas Oceanic Formation. These high readings in the Line Islands Formation are probably due to montmorillonitic clay and the potassic zeolite clinoptilolite.

### Porosity

Porosity at Site 80 ranges from 91 per cent in dusky yellow-green radiolarian-calcareous nannofossil oozes to 56 per cent in grayish-brown and moderate brown calcareous nannofossil-clay chalks and mudstones. Stratigraphic intervals which contain large amounts of sand-sized radiolarians have higher porosities than beds of dominantly clay-sized calcareous nannofossils. The sand-sized biotic constituents produce a grain-supported texture with both interparticle and intrabiotic porosity whereas calcareous nannofossil oozes form mud-supported textures with only interparticle porosity.

There does appear to be a general correlation between depth and porosity at this site (Figure 4). In Core 1, porosity is 82 per cent, whereas in Core 5, porosity decreases to 56 per cent. This decrease may be due to compaction and/or incipient cementation.

The interstitial water content roughly corresponds to the porosity recorded by the GRAPE.

### Sonic Velocity

The sound velocities at Site 80 range from 1485 to 1627 m/sec (Figure 4). The velocities generally increase downhole as a probable result of compaction. Much of the minor fluctuation in this trend is the result of increases of water in the sediments due to drilling procedures and sediment disturbance.

### Bulk Density

The bulk densities ranged from 1.174 g/cc at the top to 1.718 g/cc at the bottom. In general, there is an increase in density downhole that may be due to compaction (Figure 4). However, there are fluctuations in the bulk densities throughout the hole which are probably due to various causes. In Core 2 the density is less than in Core 1, and may be due to a higher proportion of radiolarians forming a more open framework. Other fluctuations in the bulk densities may be due to water injected into the sediments during drilling and other reasons not readily apparent.

### Penetrometer

Some downhole decrease–possibly due to compaction–is apparent. Penetrometer readings range from 0.1 centimeter to over 3 centimeters with a moderate amount of fluctuation due largely to coring disturbance. Some fluctuations in the undisturbed intervals may be real and due to differences in compaction, lithology and/or incipient cementation.

## BIOSTRATIGRAPHY

### Foraminifera

Despite considerable discontinuous coring at this site, some of the important foraminiferal zonal boundaries were within cored intervals. Preservation of specimens in sediments at this site was good with the exception of two cores. In Hole 80, Core 1, there was evidence of solution. Hole 80A, Core 3, faunas displayed an even greater degree of solution than Core 1. Diversity in Core 3 (Hole 80A) was very low due to the destructive effect of solution and Radiolaria were the dominant microfossil.

The site comprises a sequence from the Pleistocene *Pulleniatina obliquiloculata* Zone to the lower Miocene

*Globorotalia kugleri* Zone. As in previous holes on Leg 9, there is evidence of metamorphic alteration of sediments immediately overlying the basalt at the base of the hole. Specimens of the lower Miocene zonal species *Globorotalia kugleri* were recovered from these baked chalks directly overlying the basalt.

### Radiolaria

Radiolaria at Hole 80 are absent in Core 5, common in Core 4, and abundant in Cores 1, 2 and 3; and abundant in Hole 80A, Cores 1 through 5. Orosphaerid Radiolaria are common in Hole 80, Core 4 and the lower half of Hole 80A, Core 5, but scarce in higher cores. Conversely, diatoms are abundant in the upper portions of Hole 80A, Core 5 and higher cores.

The radiolarian assemblages range from the *Calocycletta virginis* Zone to the Pleistocene. At Site 80, the *Calocycletta costata* Zone reaches its maximum thickness of at least 27 meters. In Sites 77 and 78, this zone is 17 and 16 meters thick, respectively. As a consequence, the maximum total thickness at the *Brachiospyris alata* and *Cannartus laticonus* Zones must have a thickness of no more than the 13 meter unrecovered interval between Cores 3 and 4 (Hole 80A). In Site 77 these two zones span a thickness of 43 meters. It appears that, at best, the rates of sediment accumulation are irregular in Site 80. The large gaps between the recovered intervals make interpretation difficult, and large scale hiatuses may be present.

## DISCUSSION AND INTERPRETATION

After the set of original cores at 55-meter intervals were recovered (Hole 80), additional cores were taken (Hole 80A) to recover or closely bracket paleontological boundaries. We were able to gain good control on the Pliocene/Pleistocene boundary, the Miocene/Pliocene and Middle Miocene/Upper Miocene boundary. Consequently, in calculating sedimentation rates we must calculate an average sedimentation rate for the Middle and Upper Miocene.

Table 3 presents information dealing with the sediment thickness to various paleontological boundaries and the rates of deposition between these boundaries. As at previous sites the Pleistocene has a considerably slower rate of deposition than the Pliocene which could be caused in part by our not coring the entire Pleistocene. Coring began just above the indicated PDR depth of the sea floor, and the first core was full. However, if the surficial sediment was very soft and the driller did not notice it, we could have started coring too late, thus losing part at the Pleistocene and making it appear thinner than it actually is.

The Pliocene has the highest sedimentation rate of the section and the Upper and Middle Miocene is considerably slower. The Lower Miocene, while considerably slower than the Pliocene, shows a higher sedimentation rate than the Middle and Upper Miocene. This pattern of sedimentation rates fits the pattern that would be expected if the sea floor at this site during the last 10 to 15 million years had been moving in a West-North-West direction carrying the site into zones of progressively higher productivity. The somewhat higher rates in the Lower Miocene than in the Middle and Upper Miocene could be explained if at this time (Lower Miocene), the site was well up on the ridge flank and solution was less, therefore increasing the overall accumulation rate. The overall accumulation rates are within the same general range as those encountered at other sites on this leg.

A second major objective of this site was to determine if the paleontological estimate of basement age at Site 79 has regional significance or whether it has only local significance. The age of the sediments immediately above basalt at Site 80 were deposited in the Lower Miocene (*Globorotalia kugleri* foraminiferal zone). This is the same zone in which the basal sediments at Site 79 were deposited. In Site 80 the top of the *G. kugleri* foraminiferal zone is 30 meters above the basalt and the estimated accumulation rate in the lower part of this site is about 9 m/m.y. (Table 3). Accordingly, the basal sediments at this site would be about 23 million years B.P. using an age of 20 ±1 million years B.P. for the age of the top of the *G. kugleri* Zone. The base of the *G. kugleri* Zone was not penetrated and it has an estimated age of 22.5±1 million years. This suggests that the sedimentation rates in the basal sediments are higher than the average accumulation rate for the lower 60 meters of the section. There is some indication that the sediments at Site 80 are somewhat older than those at Site 79, but this difference in age is small. The spreading rate between Sites 77 and 79 of 80 km/$10^6$ yr is confirmed.

The basal sediments at Site 80 are similar to those at Site 77 consisting of nonsiliceous reddish-brown clay. It may be significant that both our southernmost sites (77 and 80) have basal sediments of this type, while the contacts in the other sites are baked limestone or chalk. As suggested in the report for Site 77, the origin of this clay may be iron-manganese-rich hydrothermal emanations from the crestal region of the East Pacific Rise. According to our two direction spreading model, both of these sites should have been out of the zone of highest productivity when they were at the ridge crest. One possible explanation of the different kinds of contacts (clay versus limestone) is that the type and intensity of hydrothermal activity is constant along the ridge crest, and the various kinds of contact deposits are a result of the degree of carbonate productivity over the ridge crest. A second possibility is that the intensity of hydrothermal activity varies along the

**TABLE 3**
**Rates of Sedimentation, Site 80**

| Geologic Interval | Duration Geologic Interval (m.y.) | Sediment Thickness (meters) | Accumulation Rate (m/$10^6$ yrs) |
|---|---|---|---|
| Pleistocene | 1.8 | 9 | 5 |
| Pliocene | 3.2 | 45±5 | 14±1 |
| Upper and Middle Miocene | 9.0 | 62±10 | 7±1 |
| Lower Miocene (to base of section estimated age 21±1 m.y.) | 7.0 | 58±5 | 11±1 |

ridge crest producing different kinds of contact phenomena. A third possibility is that the contact phenomena at the ridge crest is the same along the length of the crest, but subsequent silling away from the crest may destroy the initial iron-manganese deposit and produce a baked limestone deposit.

## REFERENCE


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

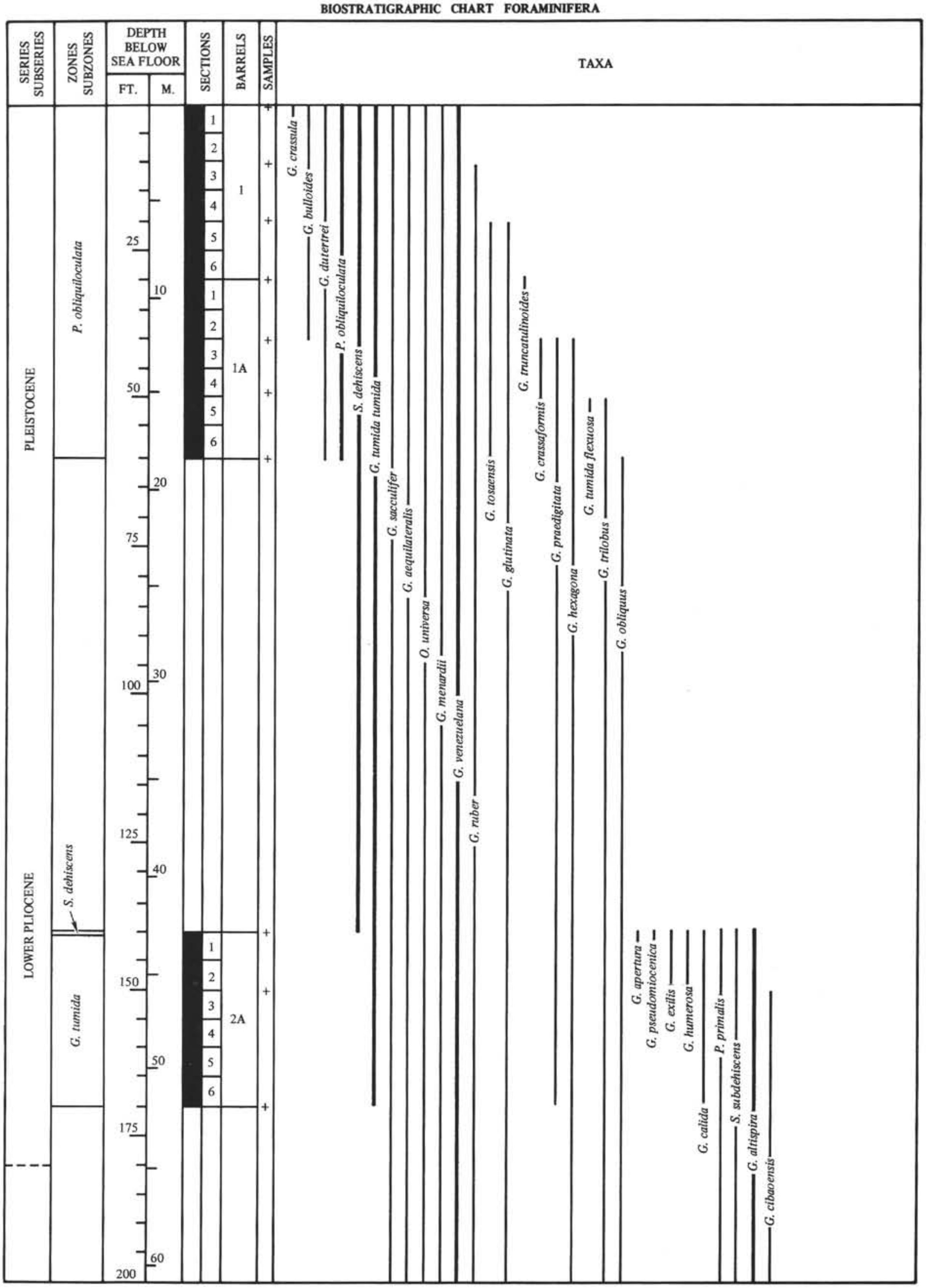



Figure 5. *Biostratigraphic Chart Foraminifera (0 to 200 feet).*

BIOSTRATIGRAPHIC CHART FORAMINIFERA

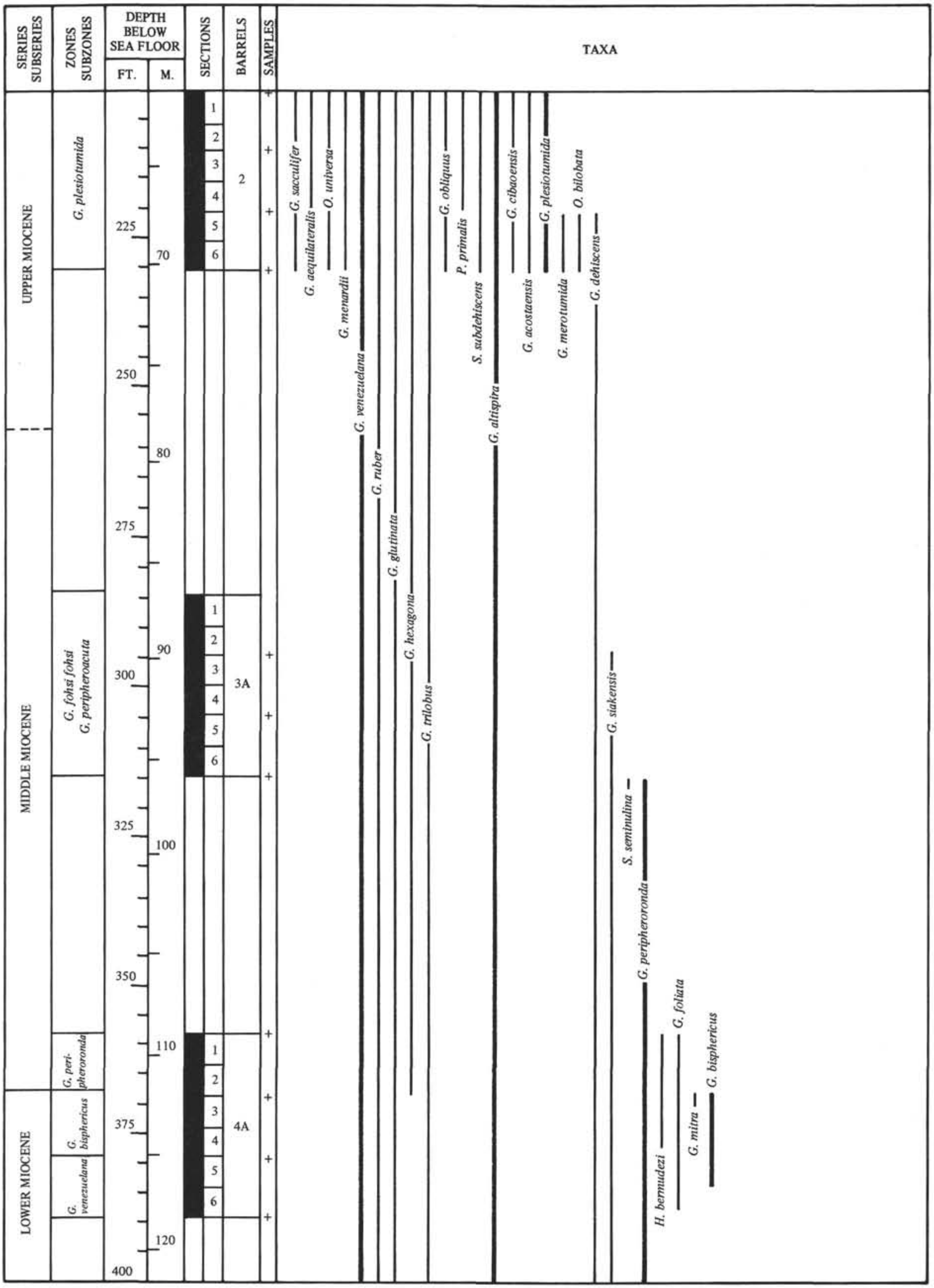



Figure 6. *Biostratigraphic Chart Foraminifera (200 to 400 feet).*

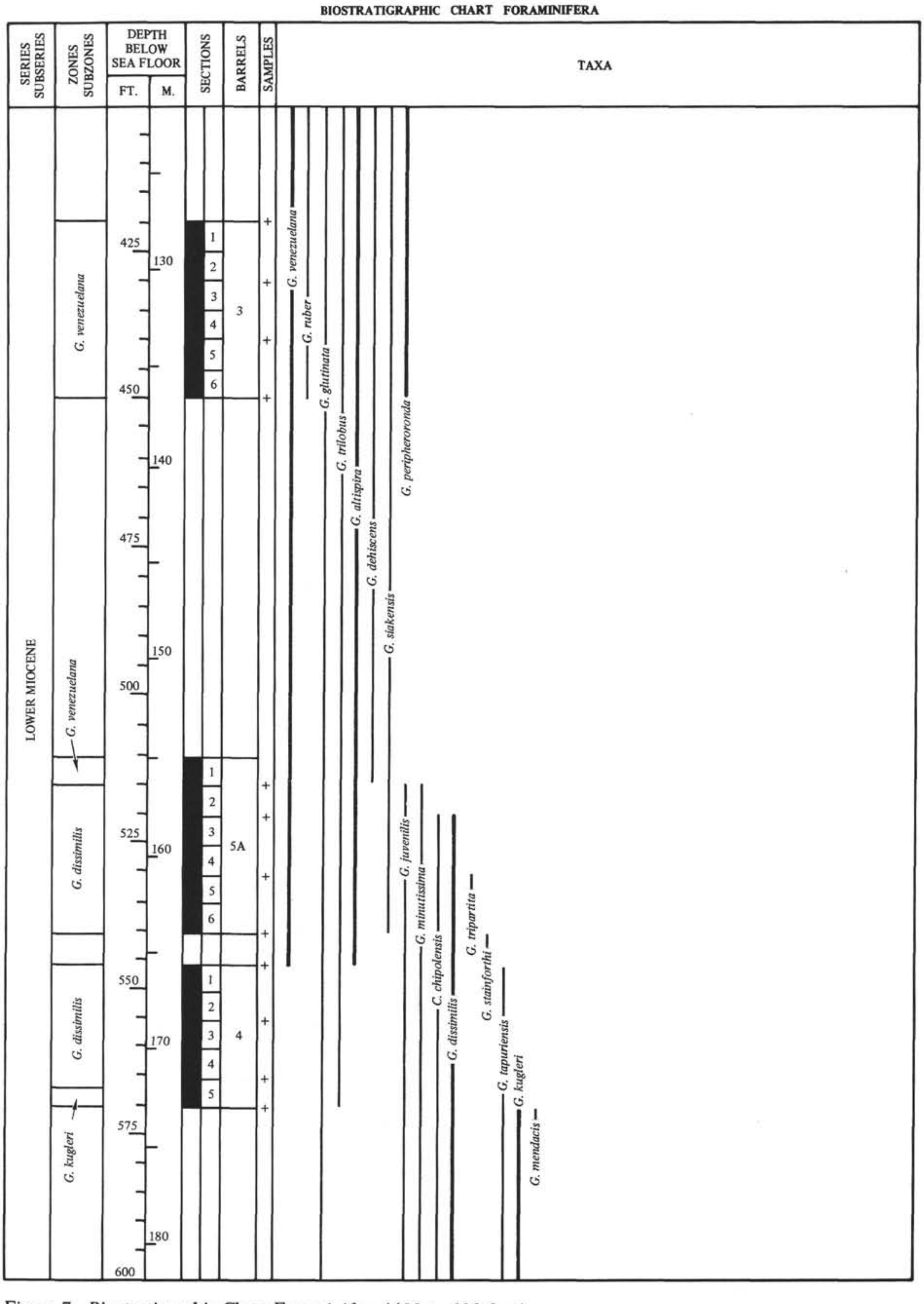



Figure 7. *Biostratigraphic Chart Foraminifera (400 to 600 feet).*

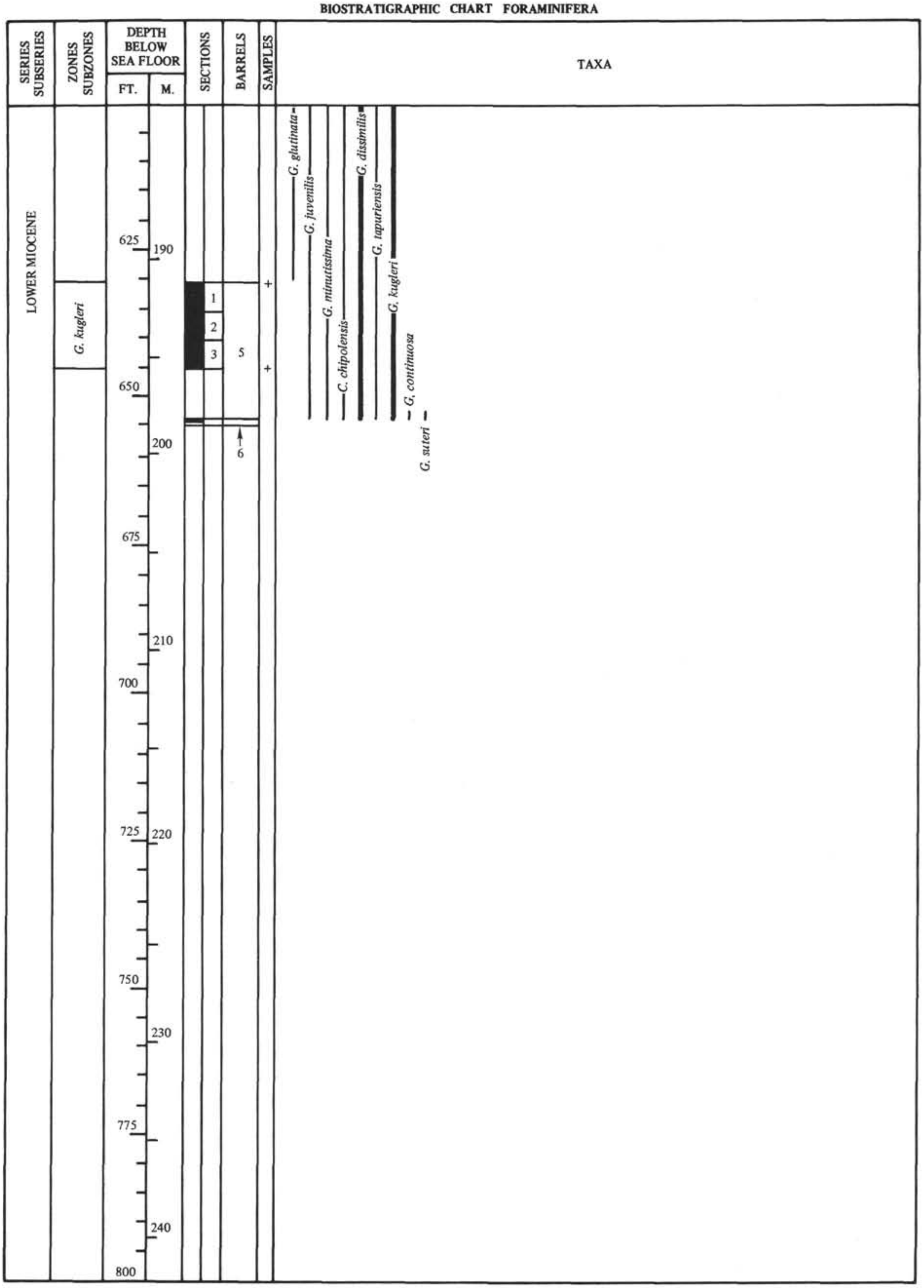



Figure 8. *Biostratigraphic Chart Foraminifera (600 to 800 feet).*

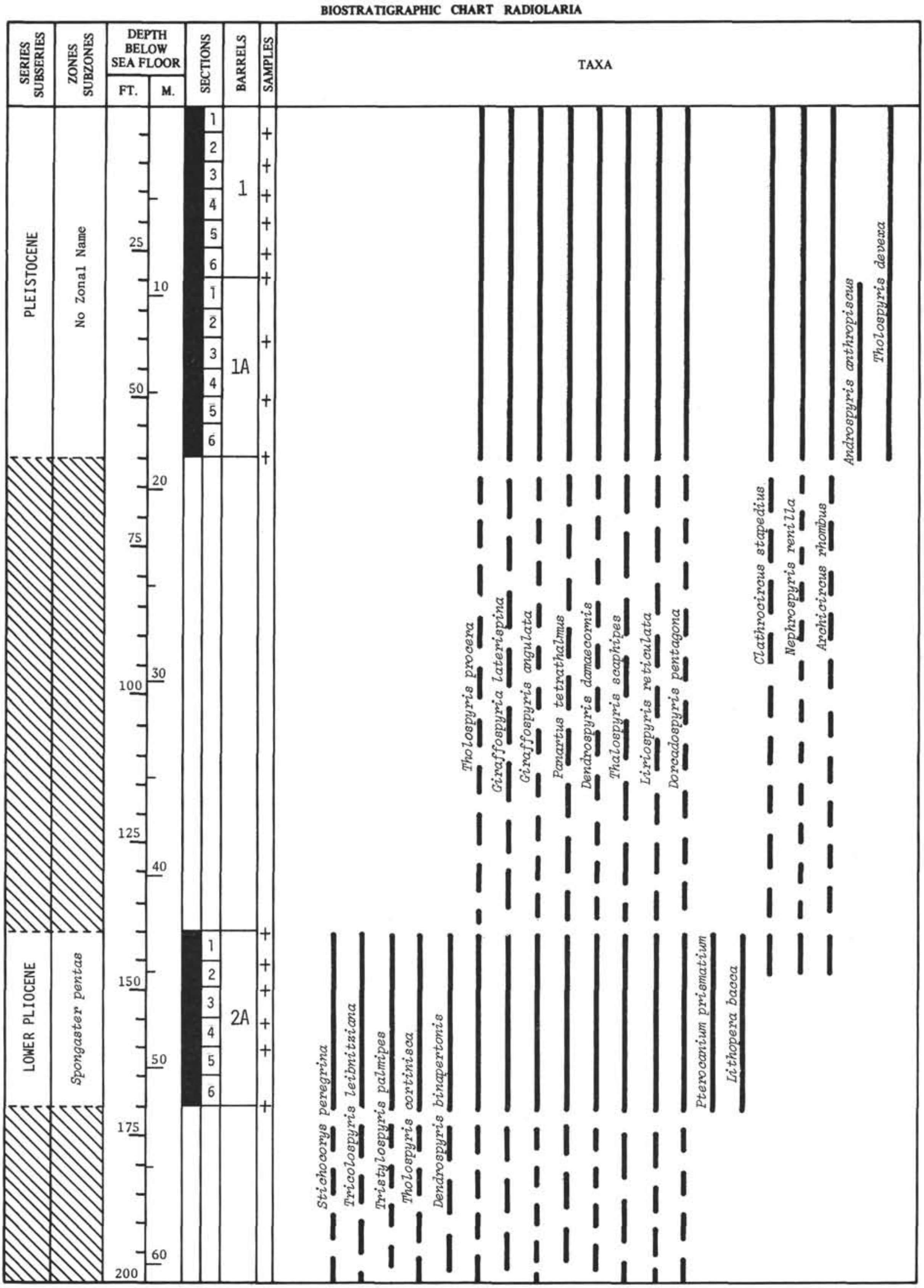



Figure 9. *Biostratigraphic Chart Radiolaria (0 to 200 feet).*

BIOSTRATIGRAPHIC CHART RADIOLARIA

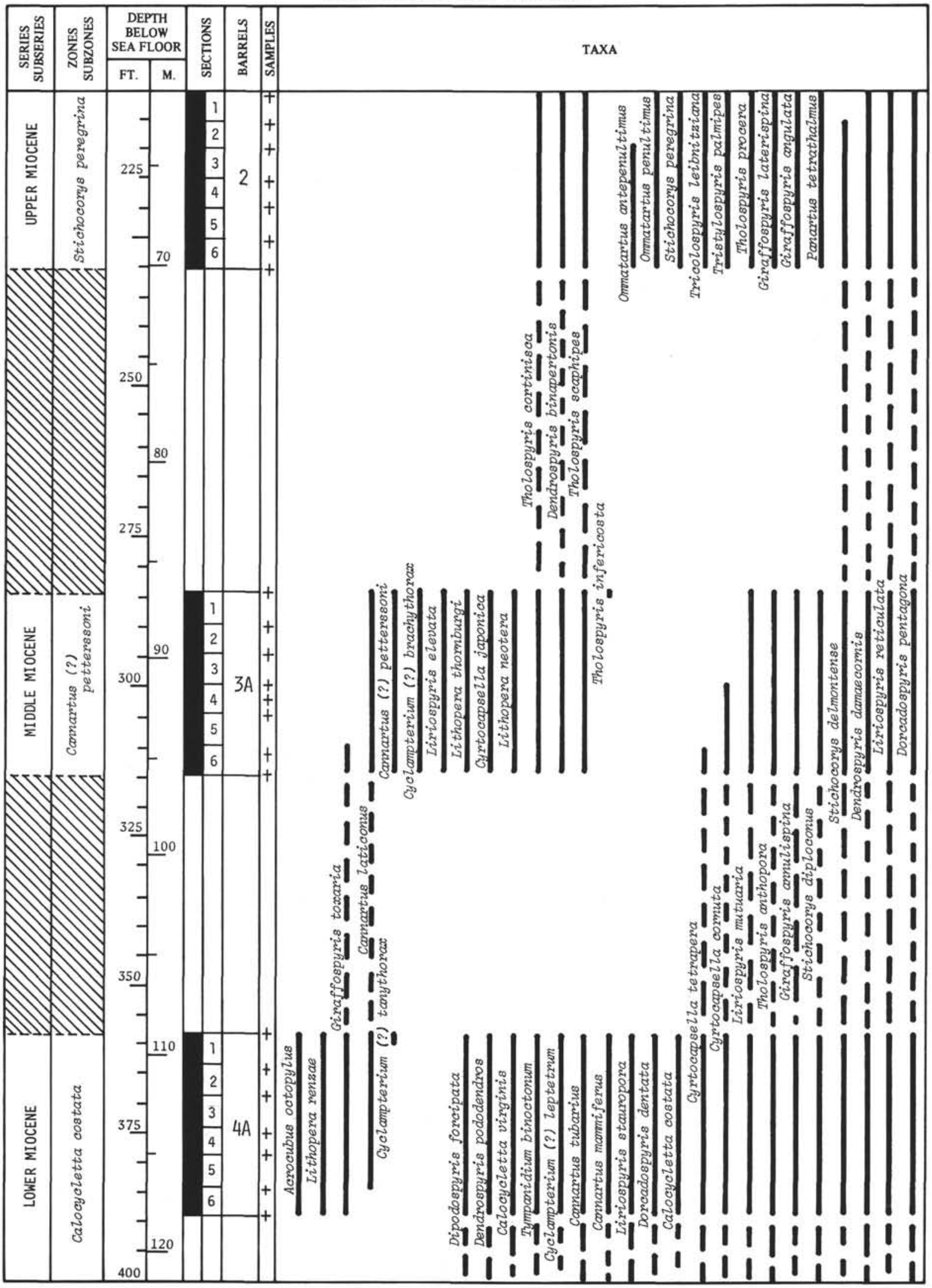



Figure 10. *Biostratigraphic Chart Radiolaria (200 to 400 feet).*

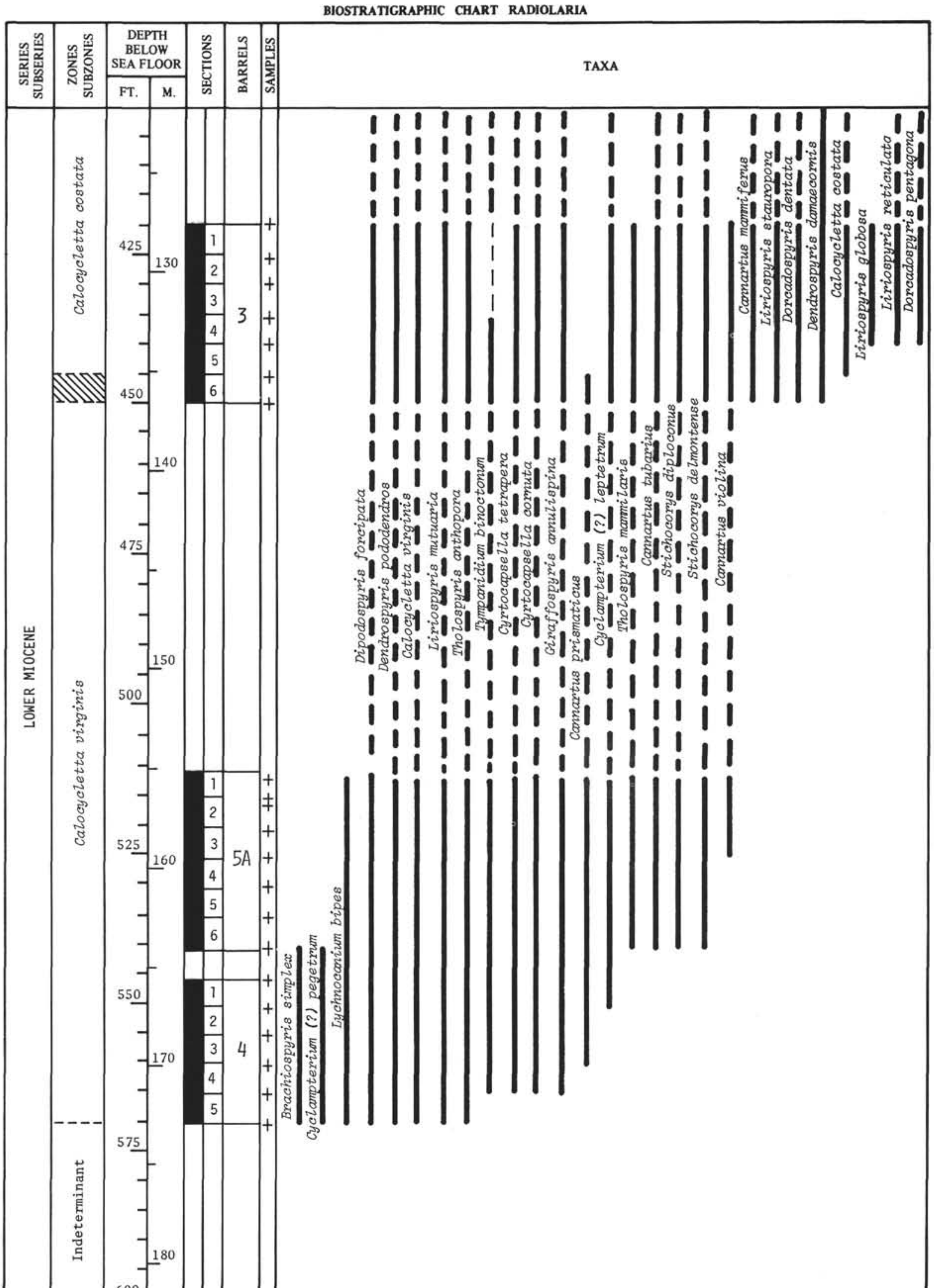



Figure 11. *Biostratigraphic Chart Radiolaria (400 to 600 feet).*

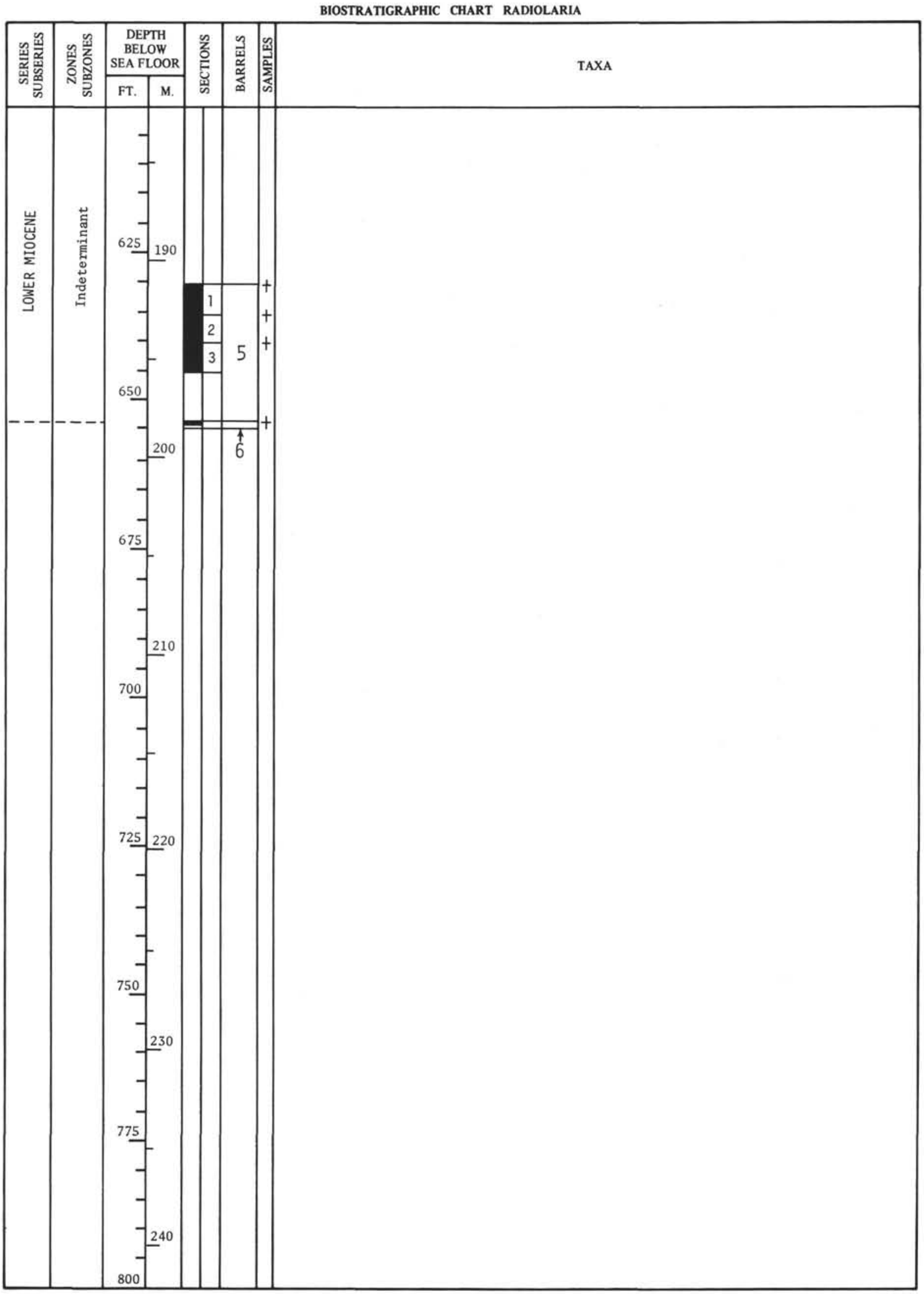
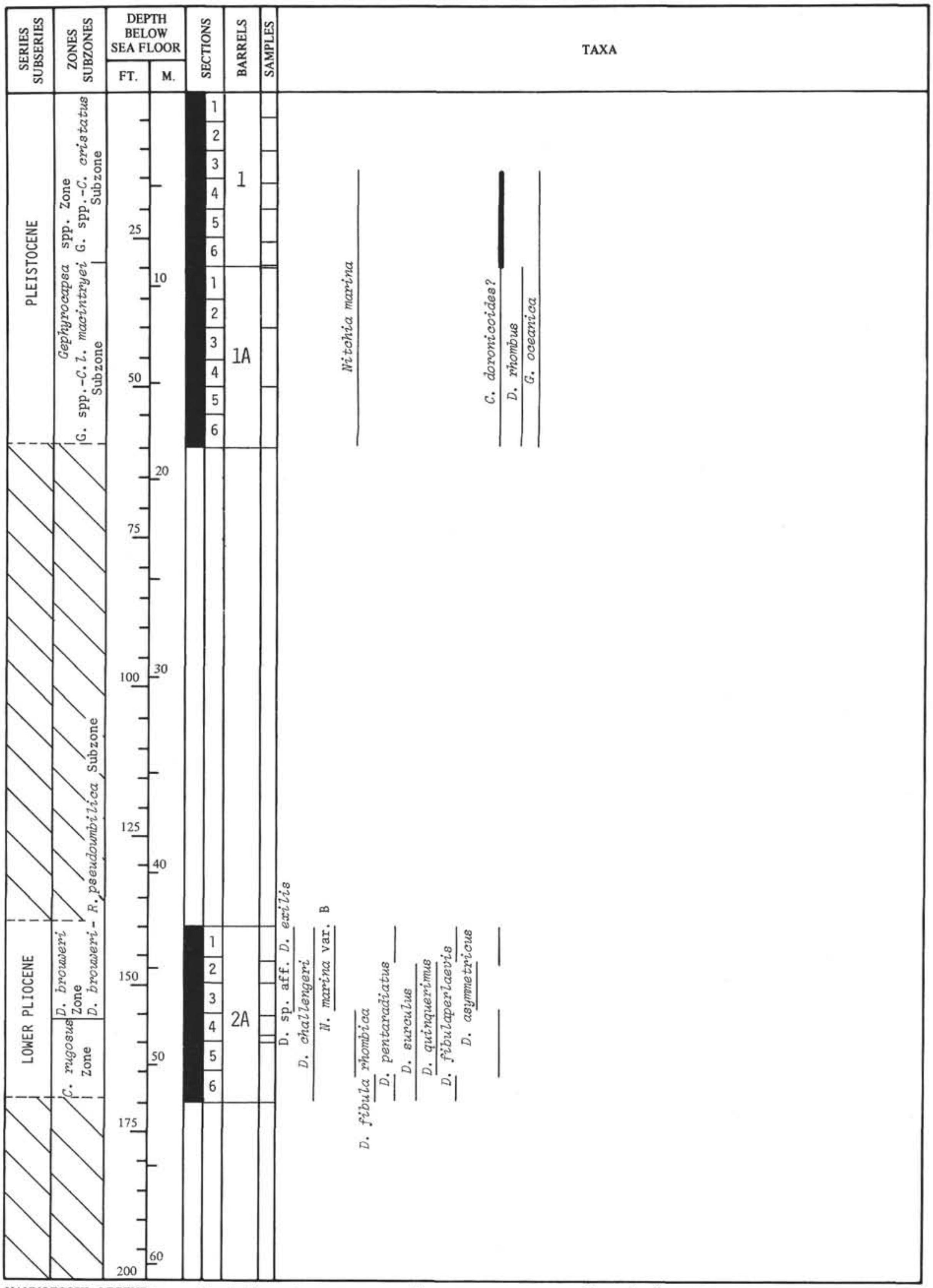


Figure 12. *Biostratigraphic Chart Radiolaria (600 to 800 feet).*

BIOSTRATIGRAPHIC CHART NANNOFOSSILS




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

Figure 13. *Biostratigraphic Chart Nannofossils (0 to 200 feet).*

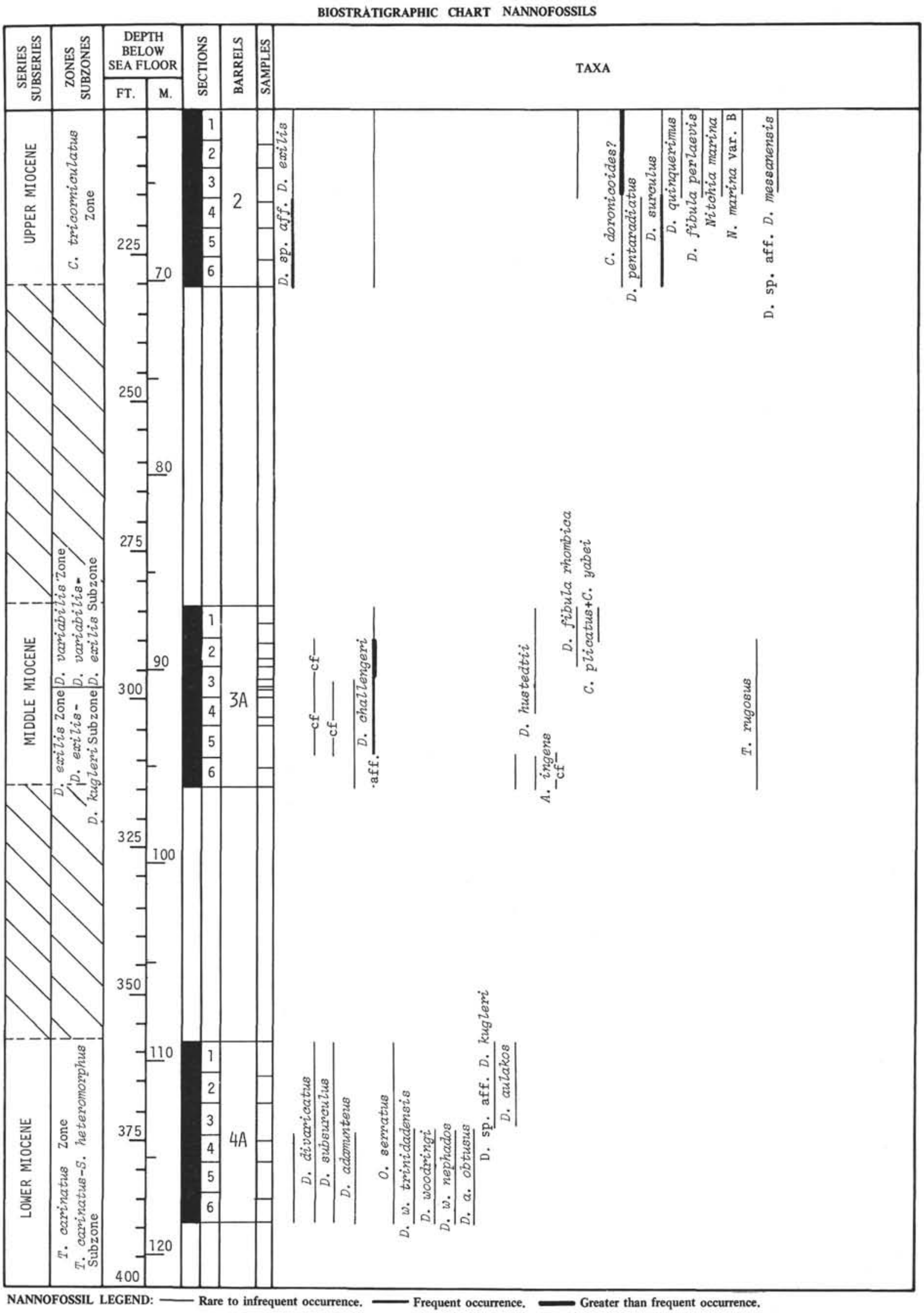



Figure 14. *Biostratigraphic Chart Nannofossils (200 to 400 feet).*

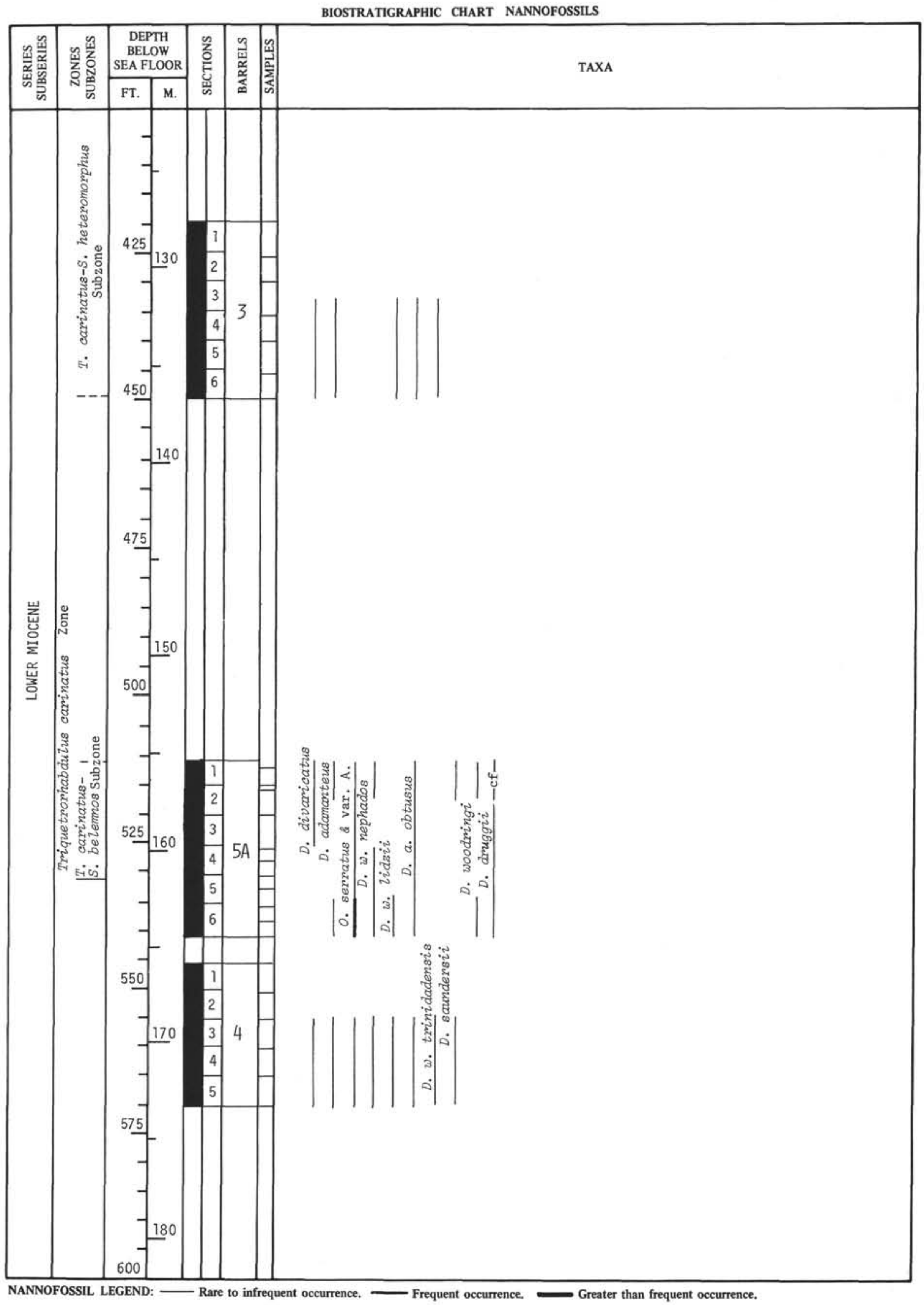
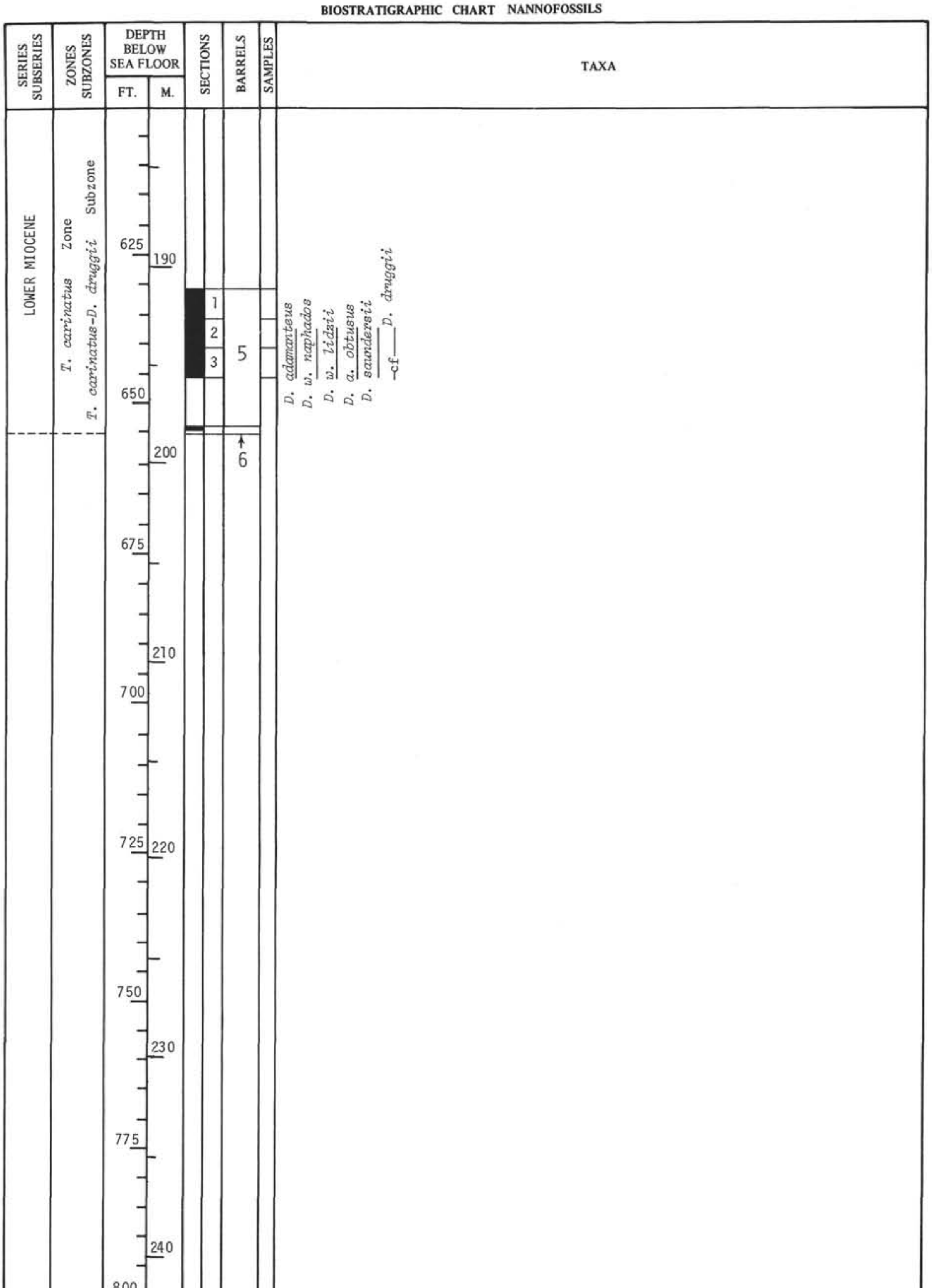



Figure 15. *Biostratigraphic Chart Nannofossils (400 to 600 feet).*




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

Figure 16. *Biostratigraphic Chart Nannofossils (600 to 800 feet).*

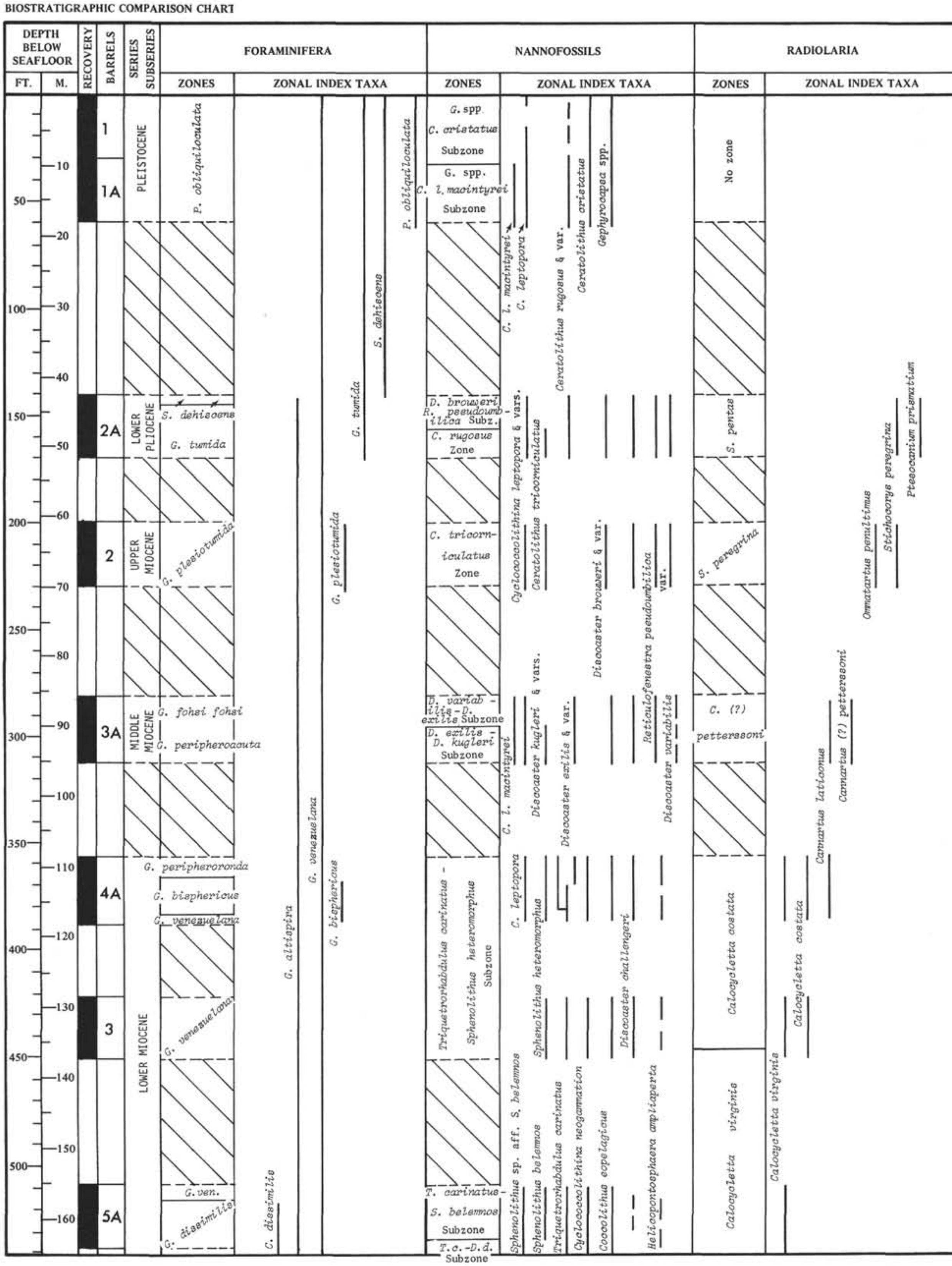



Figure 17. *Biostratigraphic Comparison Chart.*

BIOSTRATIGRAPHIC COMPARISON CHART

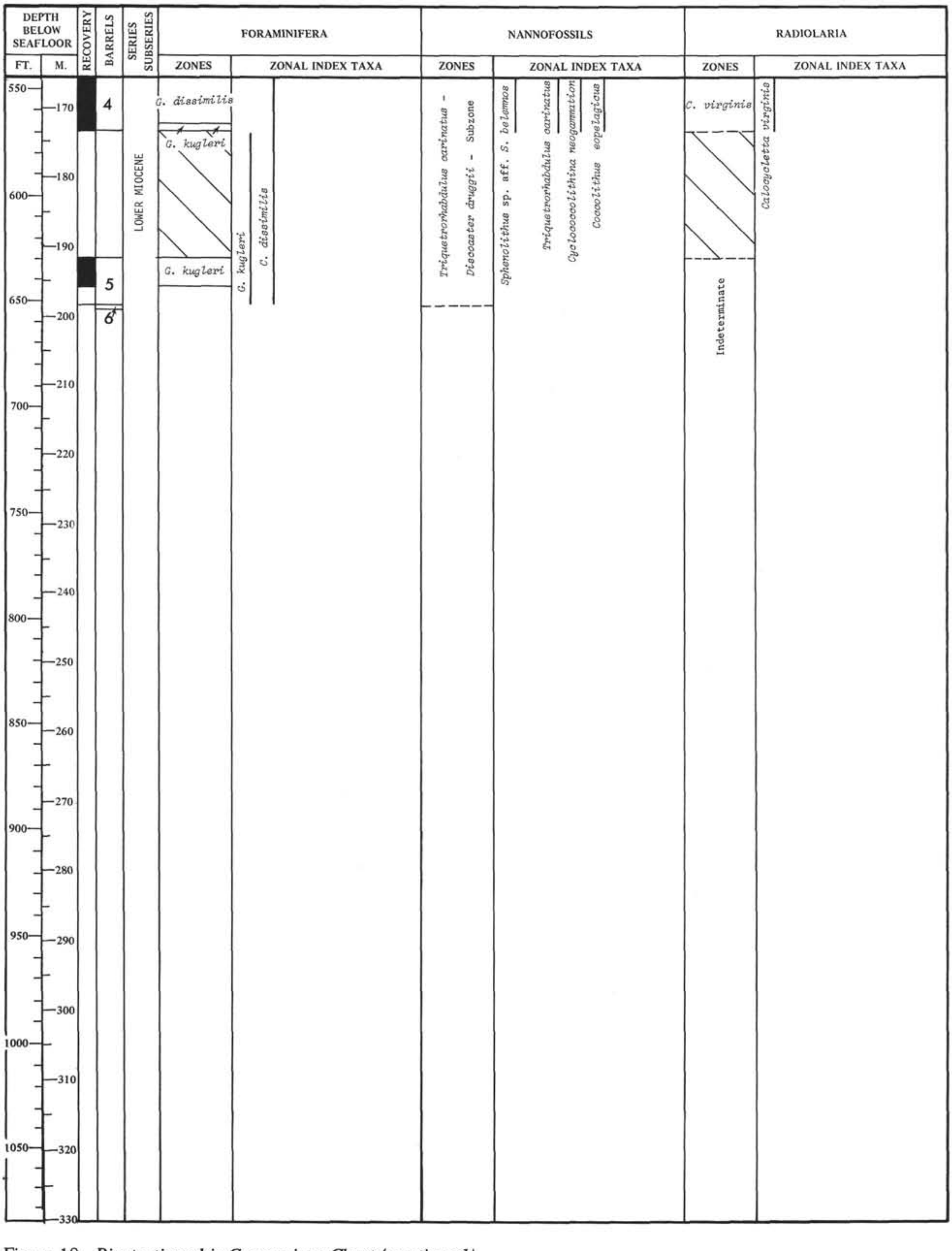



Figure 18. *Biostratigraphic Comparison Chart (continued).*

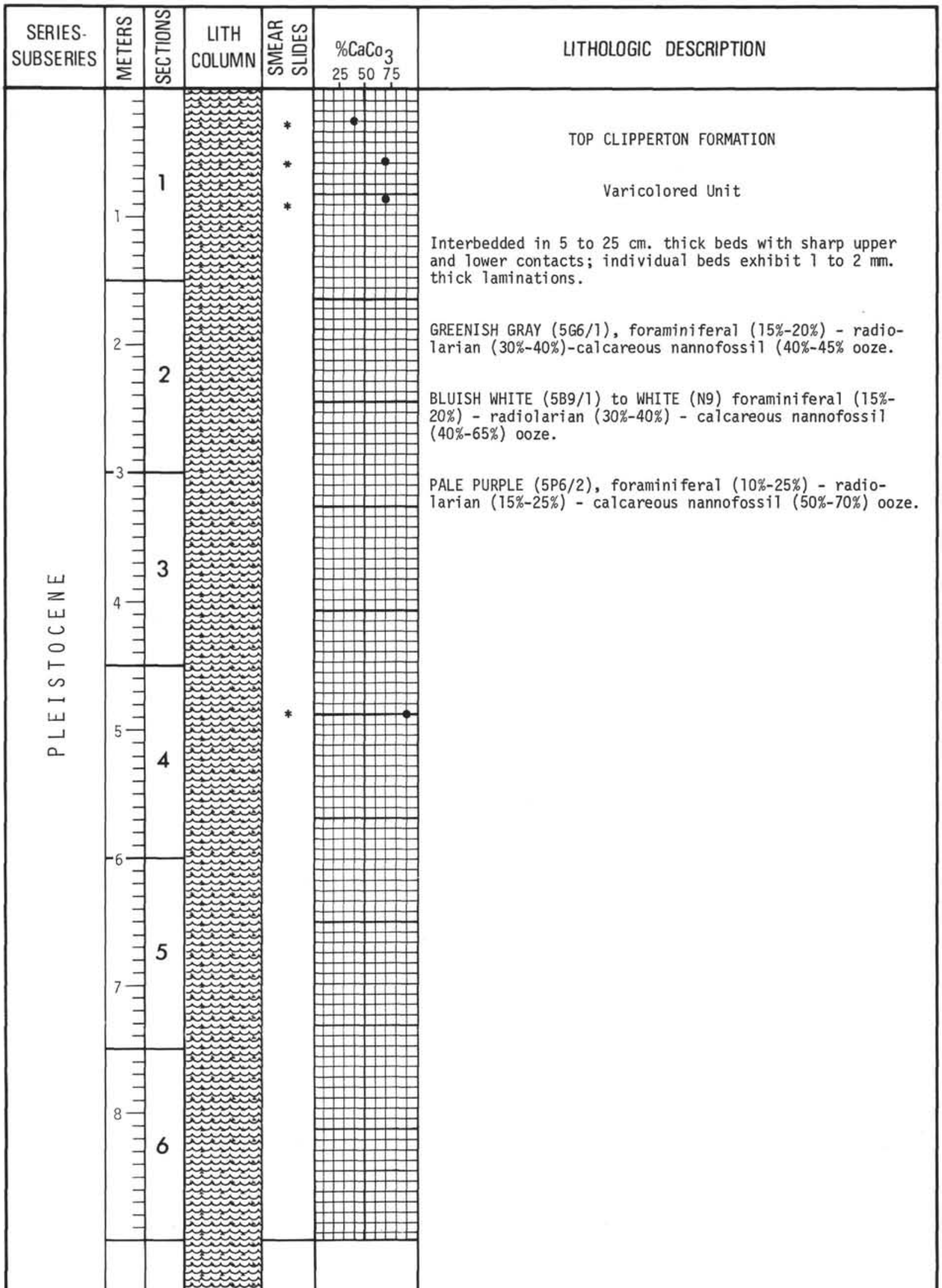



Figure 19. *Hole 80, Core 1 (0 to 9.2 m).*

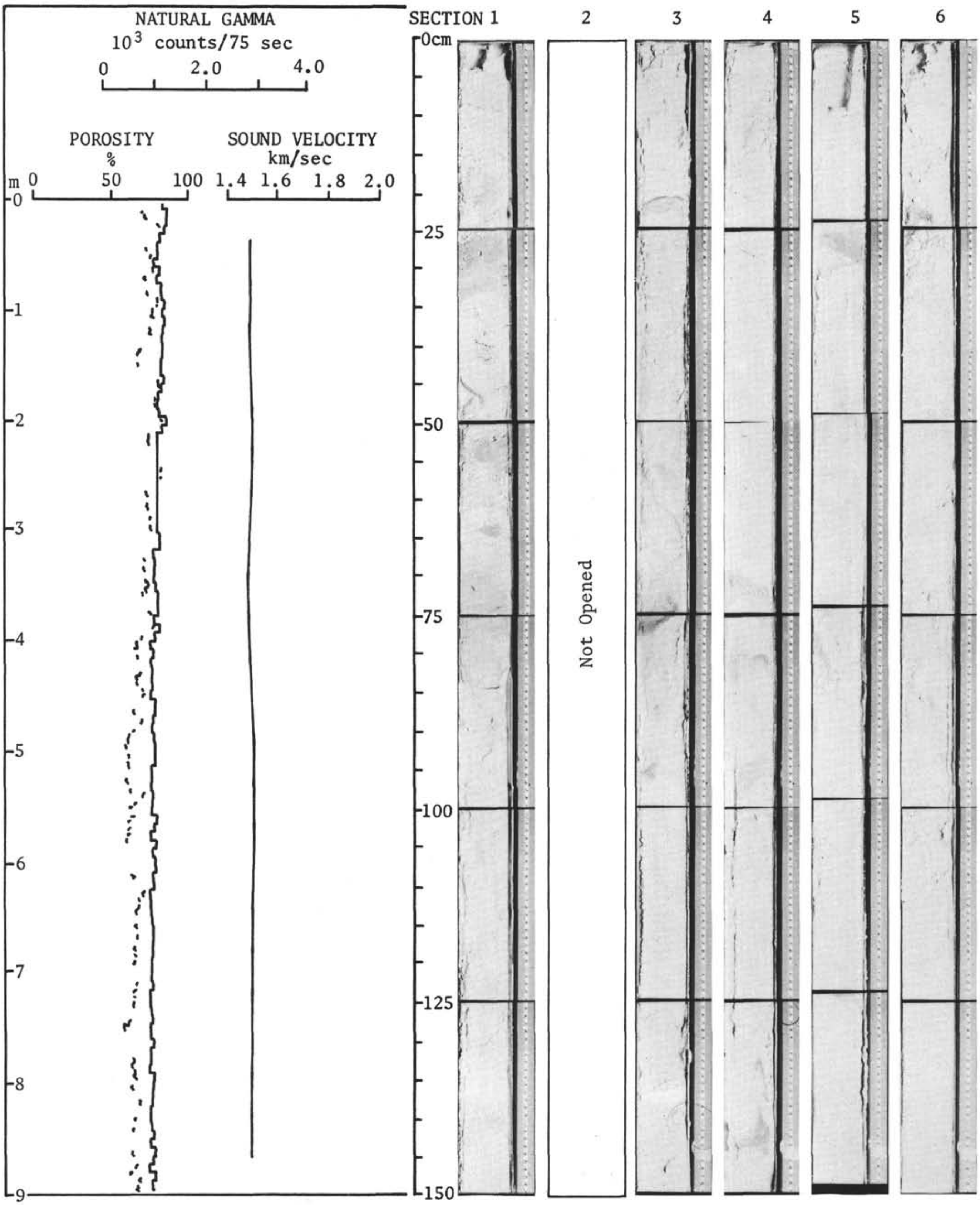



Figure 20. *Hole 80, Core 1, Sections 1-6, Physical Properties.*

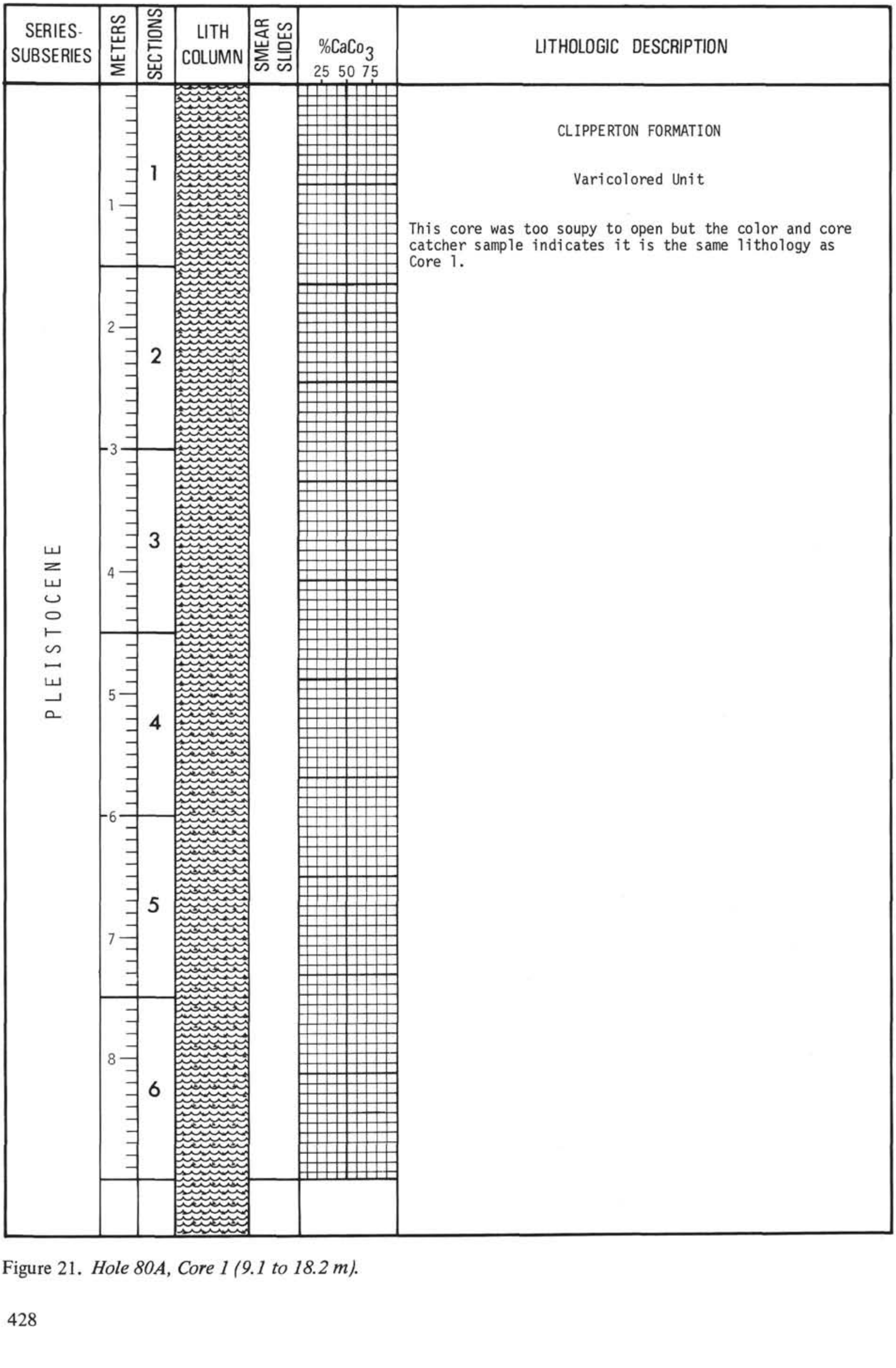



Figure 21. *Hole 80A, Core 1 (9.1 to 18.2 m).*

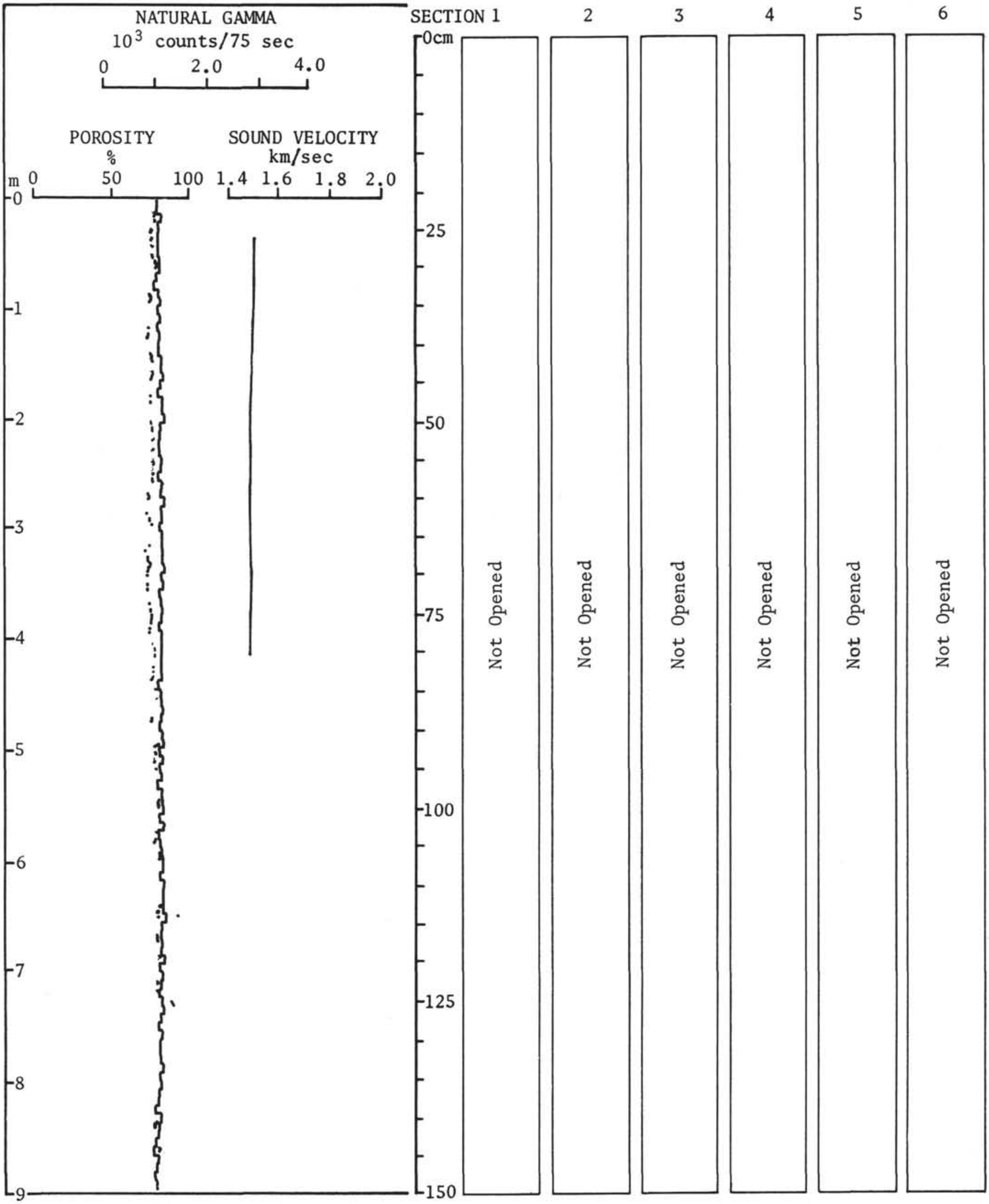



Figure 22. *Hole 80A, Core 1, Sections 1-6, Physical Properties.*

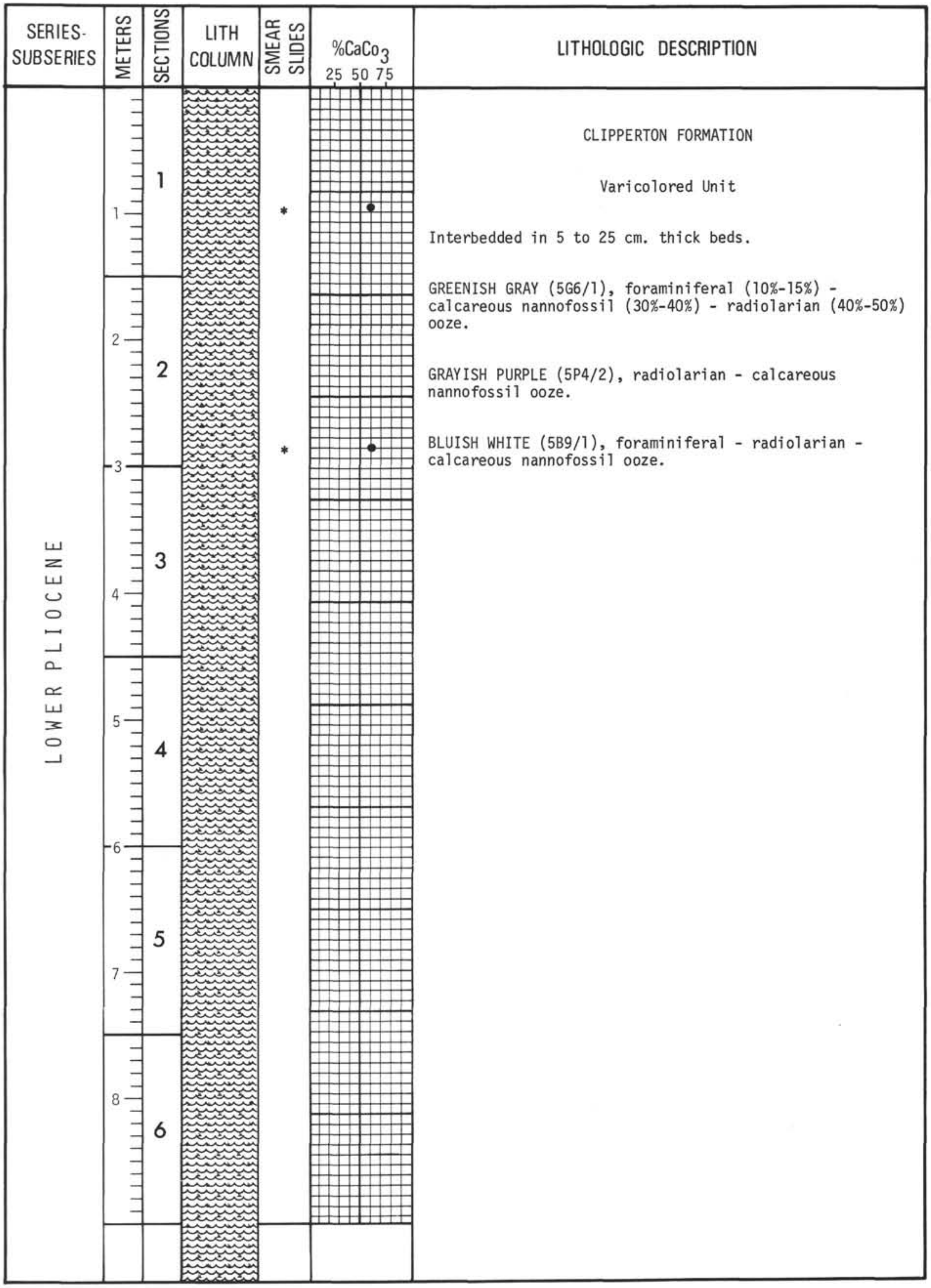



Figure 23. *Hole 80A, Core 2 (42.8-51.8 m).*

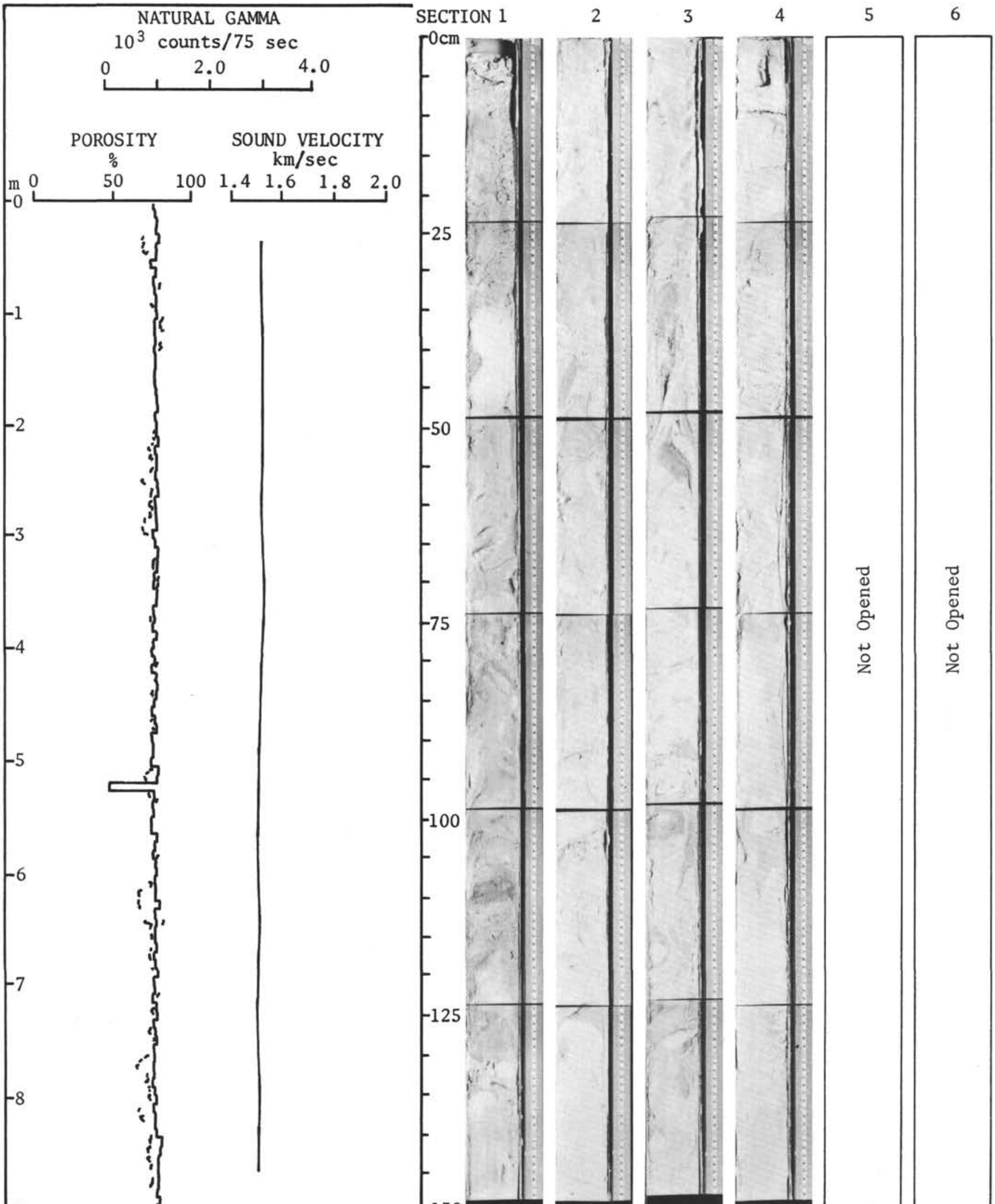
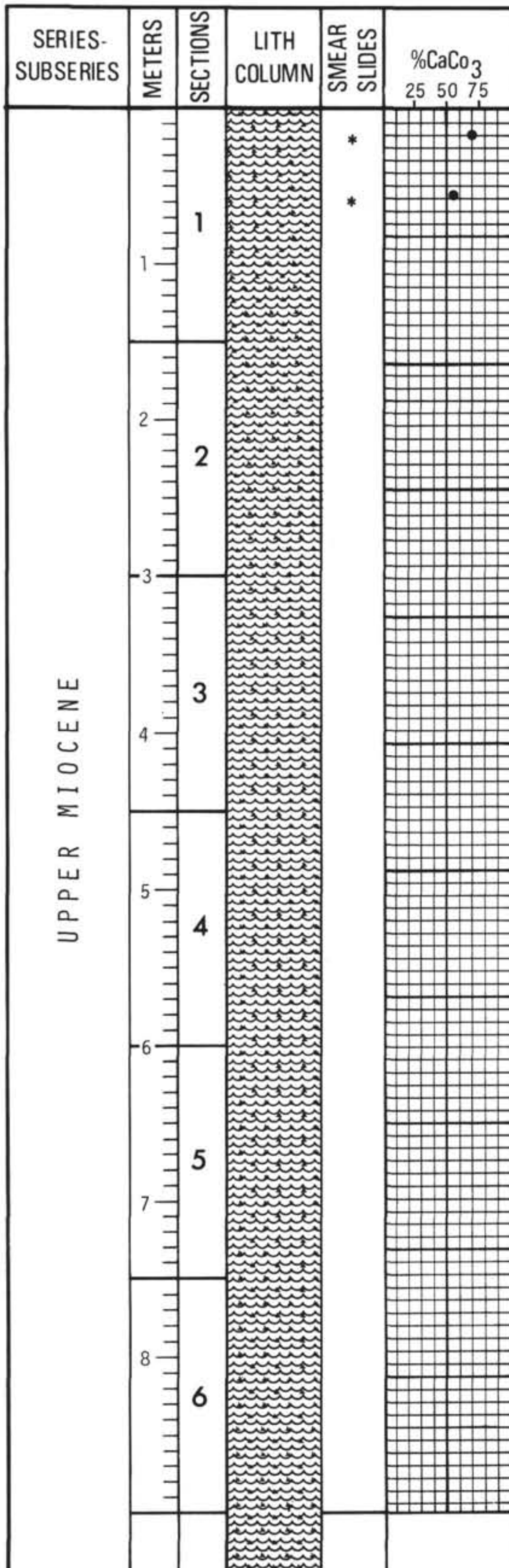



Figure 24. *Hole 80A, Core 2, Sections 1-6, Physical Properties.*




LITHOLOGIC DESCRIPTION

CLIPPERTON FORMATION

Varicolored Unit

Interbedded in 5 to 75 cm. thick beds.

LIGHT BLUISH GRAY (5B7/1), calcareous nannofossil (40%-50%) - radiolarian (45%-55%) ooze.

GRAYISH PURPLE (5P4/2), radiolarian (25%-35%) - calcareous nannofossil (55%-70%) ooze.

LIGHT OLIVE (5Y5/2) to GREENISH GRAY (5GY6/1), calcareous nannofossil - radiolarian - ooze and radiolarian - calcareous nannofossil ooze.

Figure 25. *Hole 80, Core 2 (61.0 to 70.1 m).*

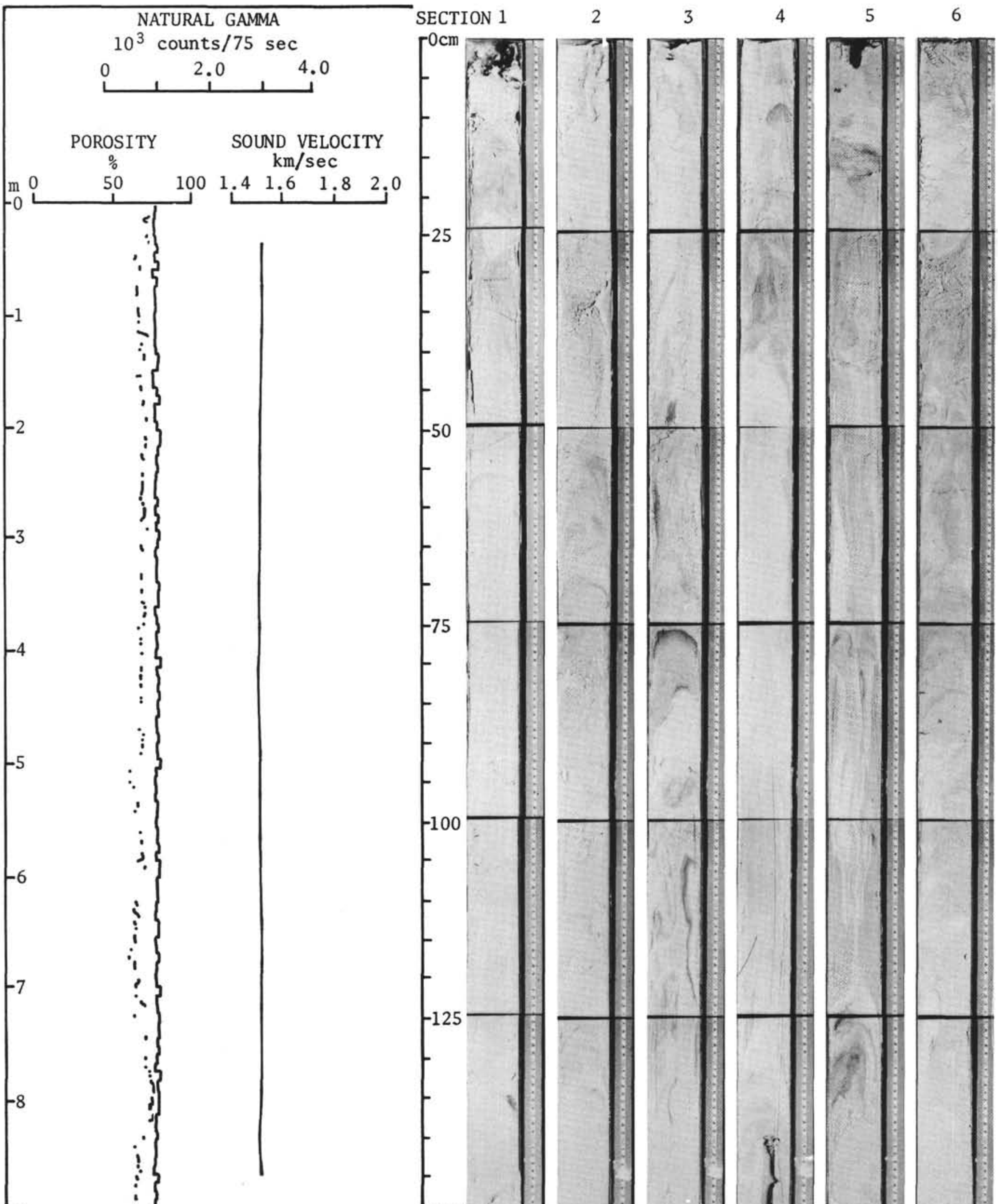



Figure 26. *Hole 80, Core 2, Sections 1-6, Physical Properties.*

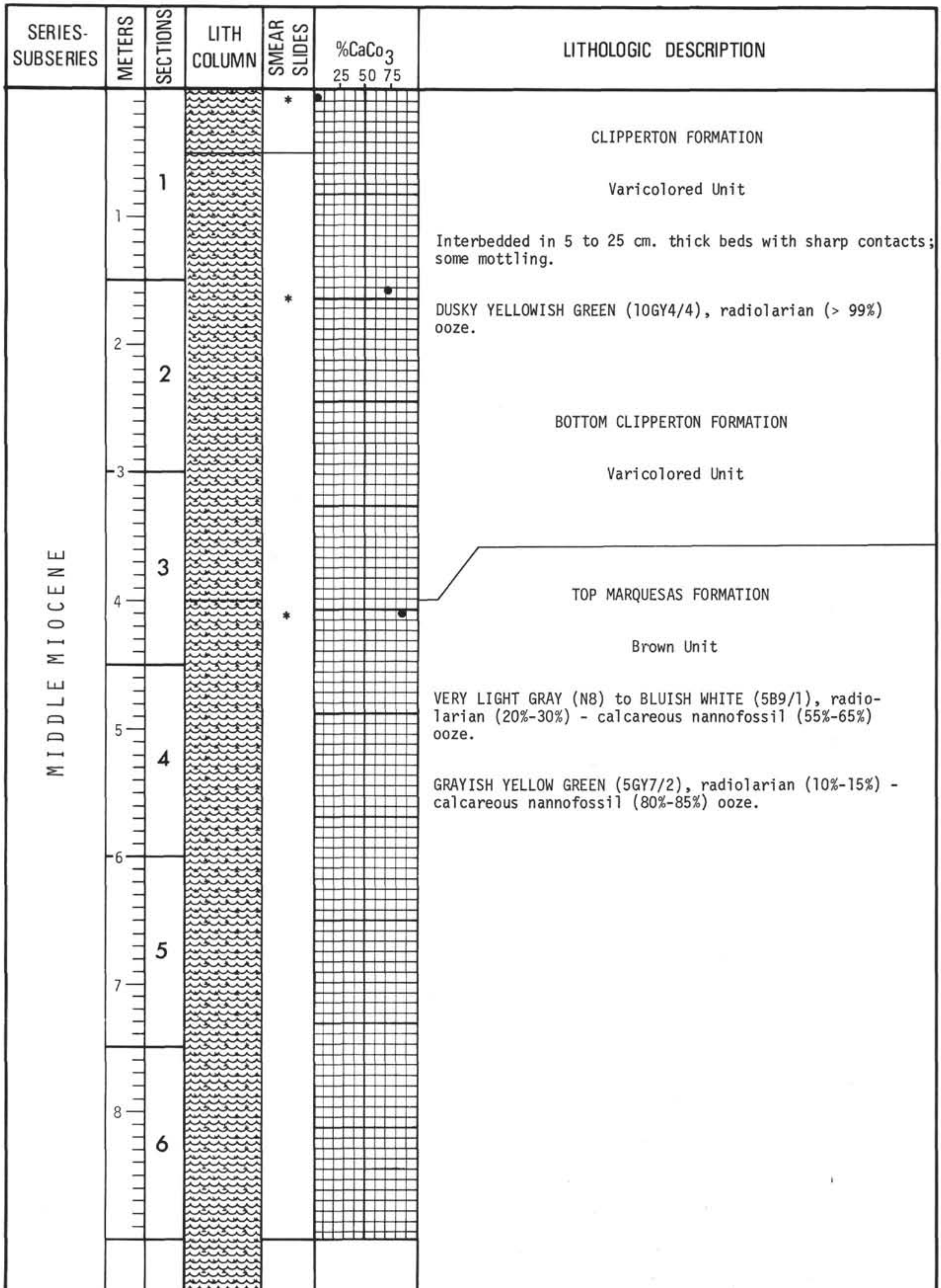



Figure 27. *Hole 80A, Core 3 (86.6 to 95.7 m).*

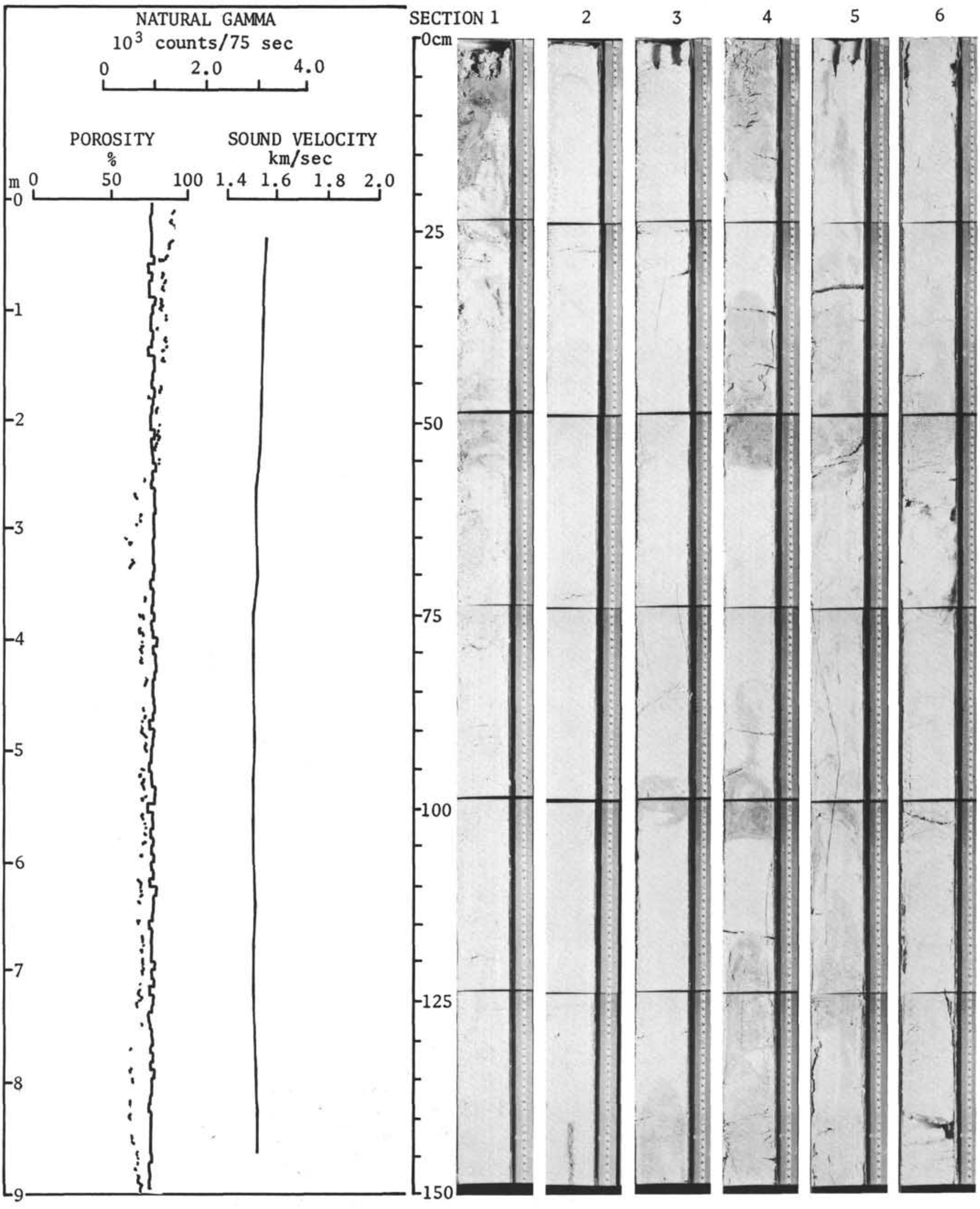



Figure 28. *Hole 80A, Core 3, Sections 1-6, Physical Properties.*

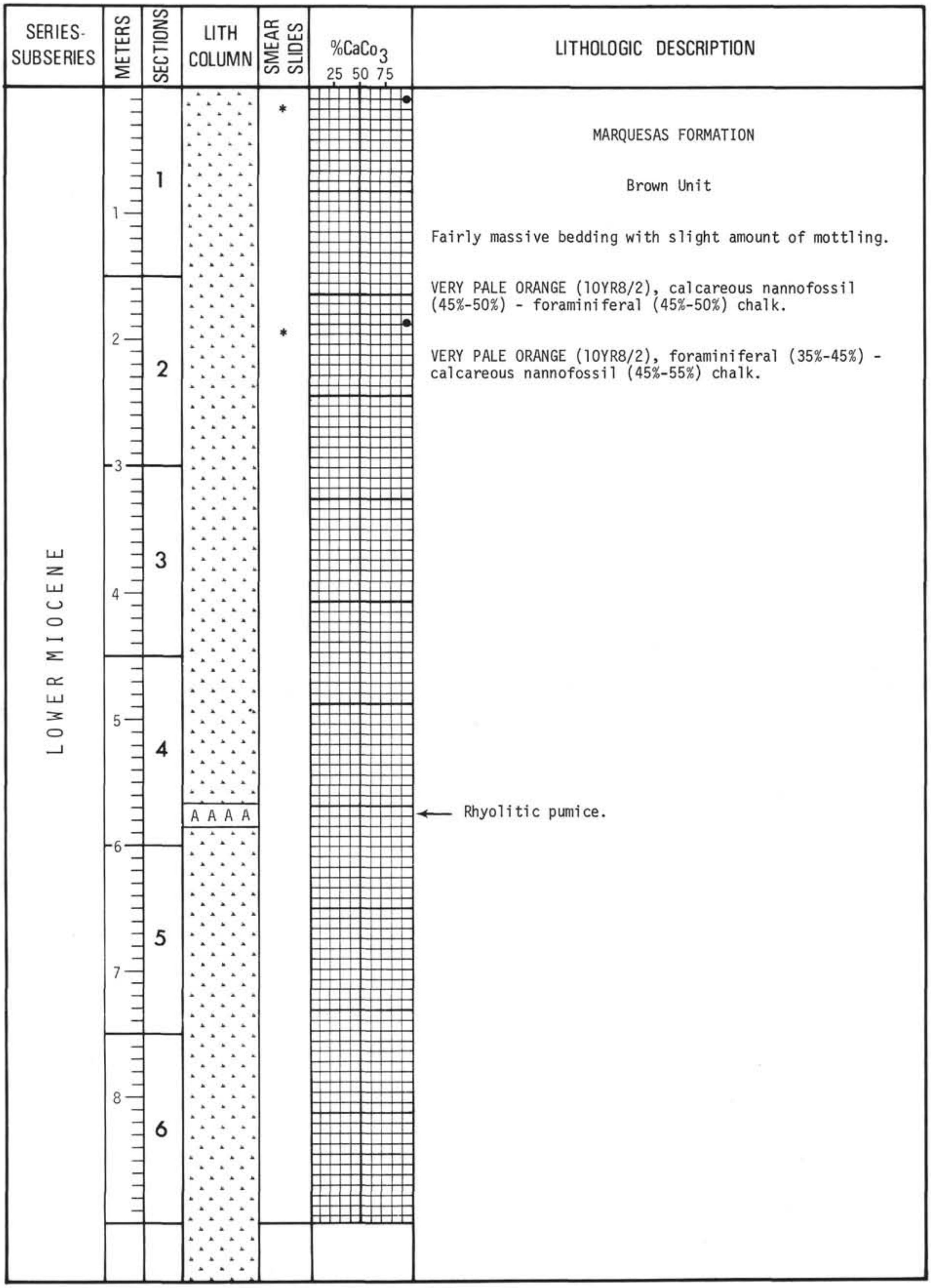



Figure 29. *Hole 80A, Core 4 (109.1 to 118.2 m).*

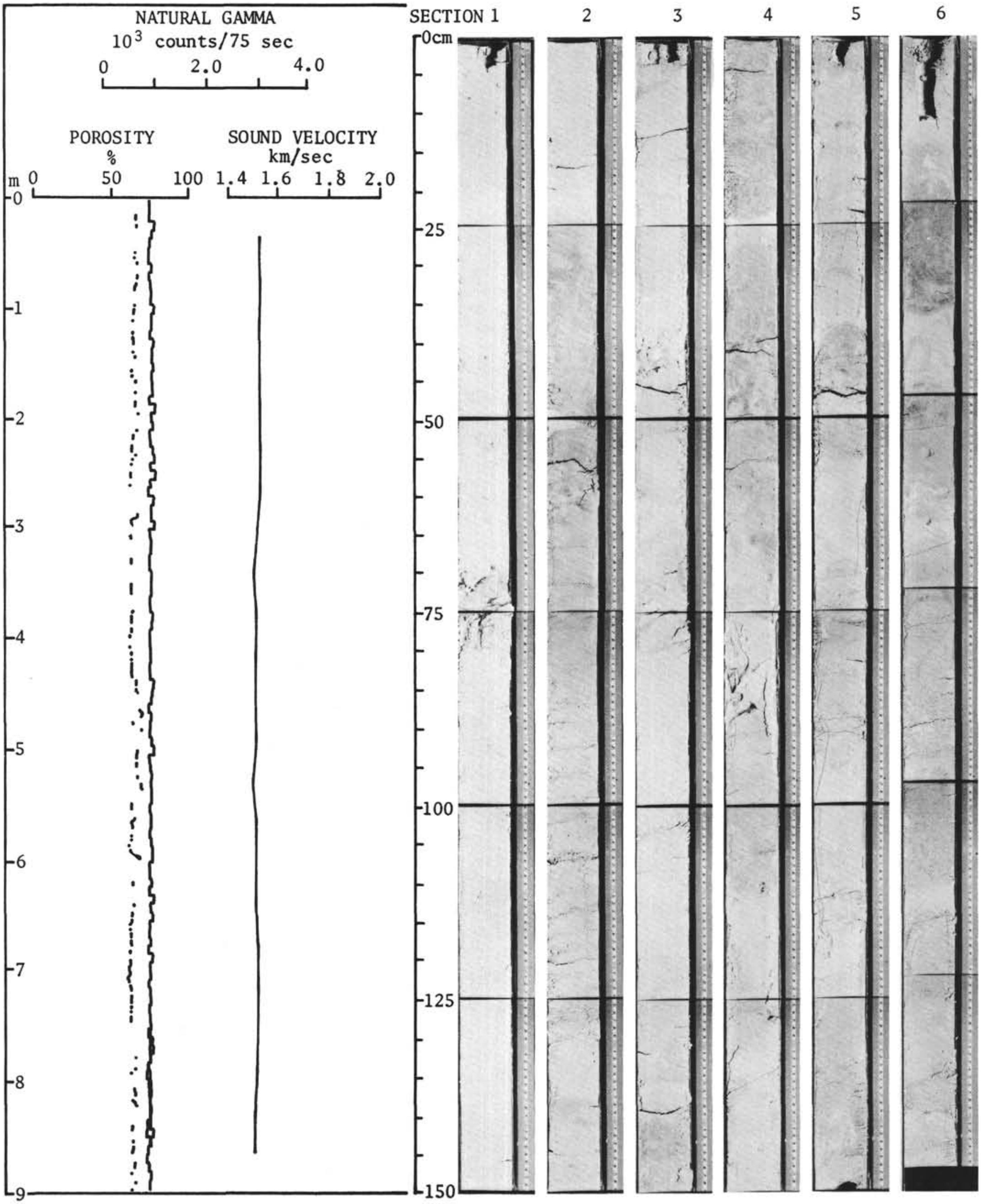



Figure 30. *Hole 80A, Core 4, Sections 1-6, Physical Properties.*

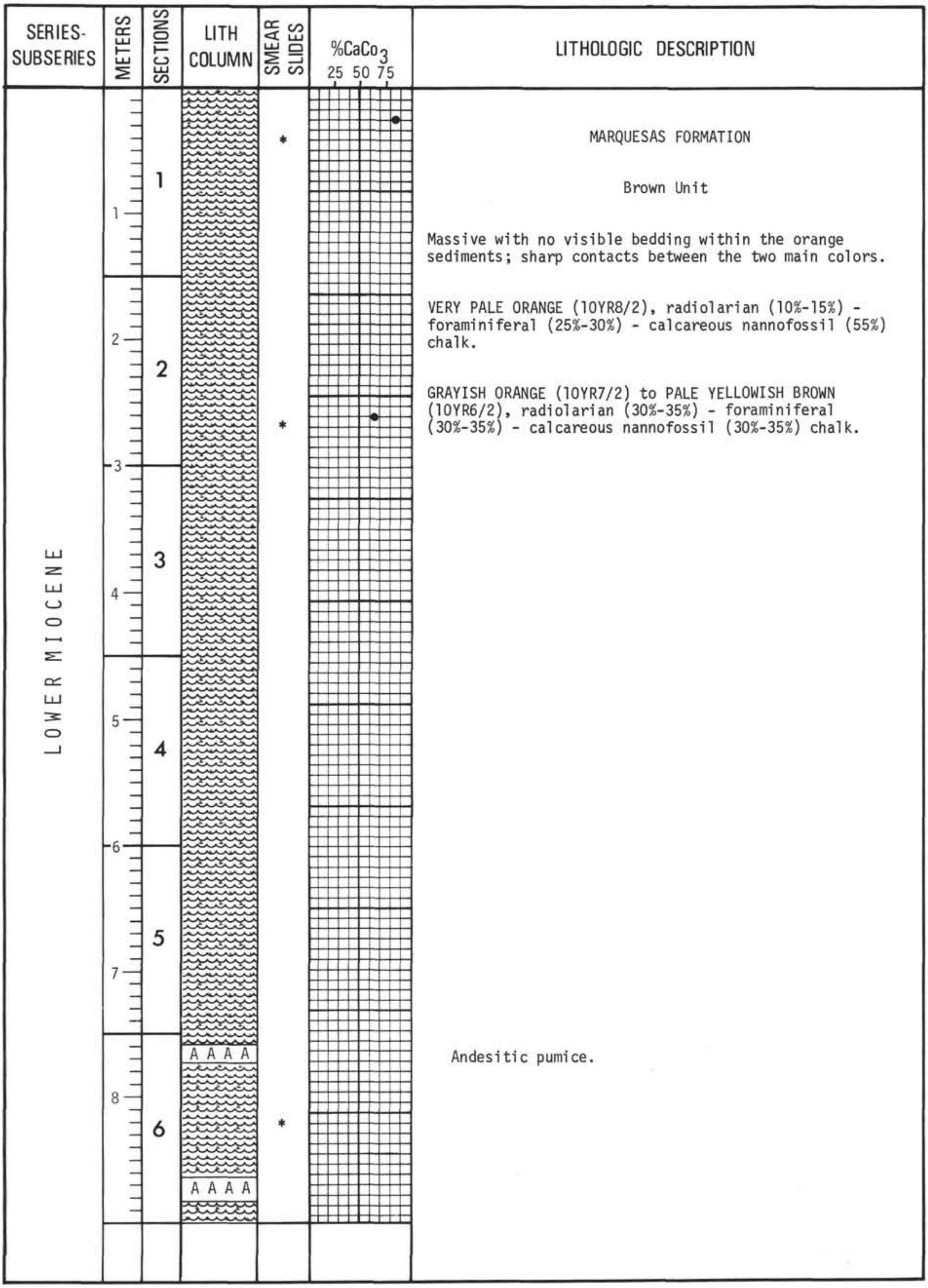



Figure 31. *Hole 80, Core 3 (127.5 to 136.6 m).*

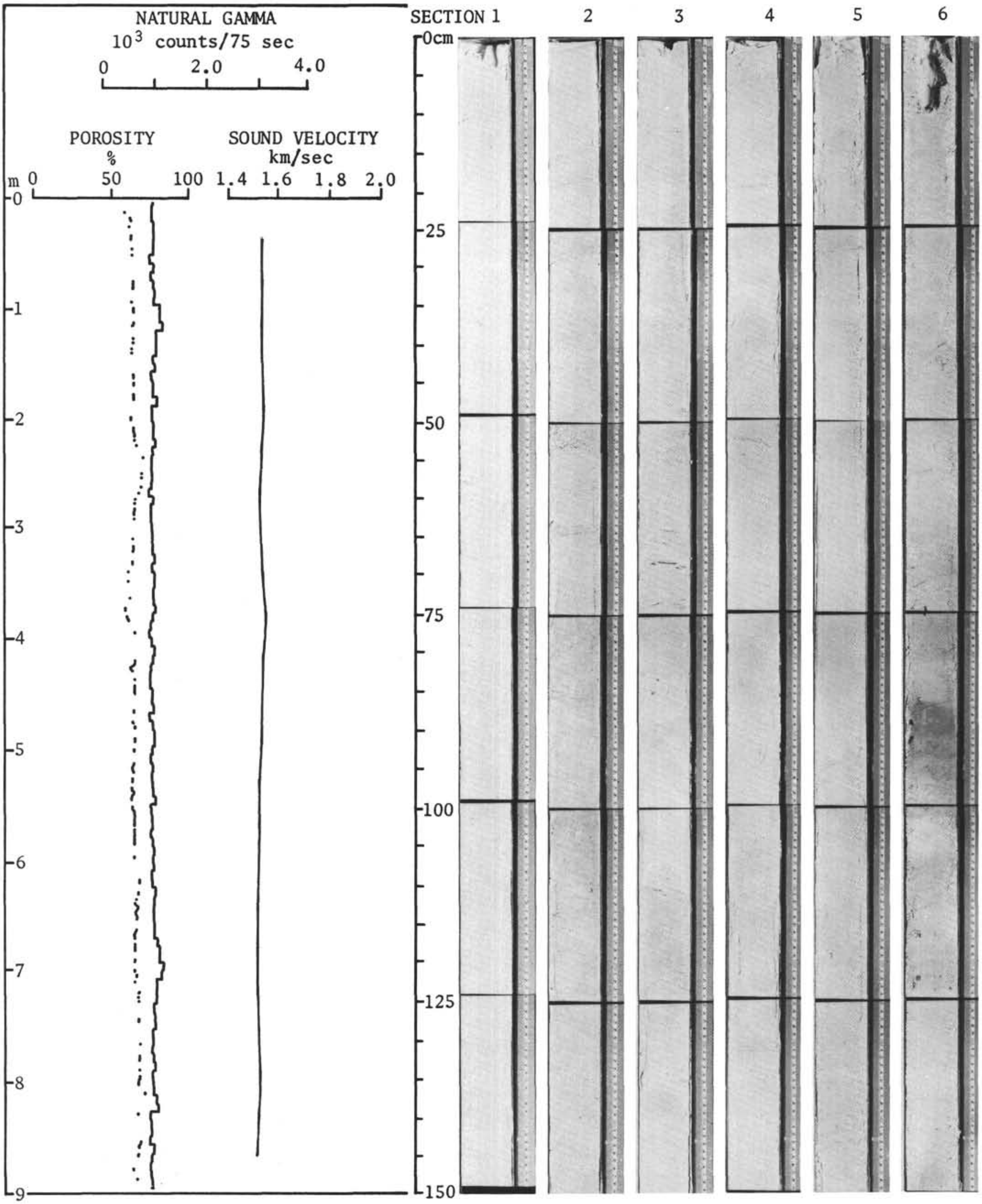



Figure 32. *Hole 80, Core 3, Sections 1-6, Physical Properties.*

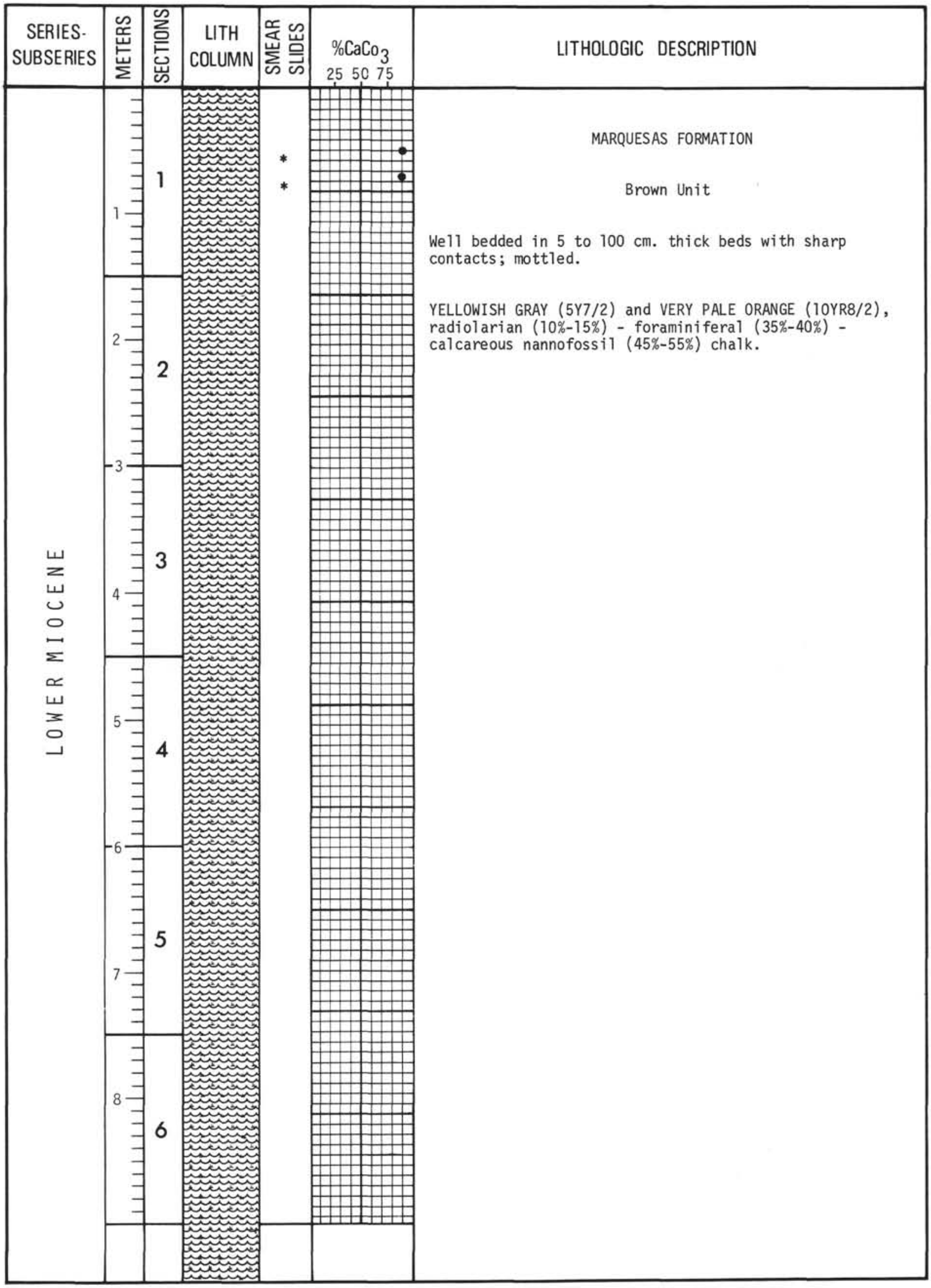



Figure 33. *Hole 80A, Core 5 (146.6 to 157.7 m).*

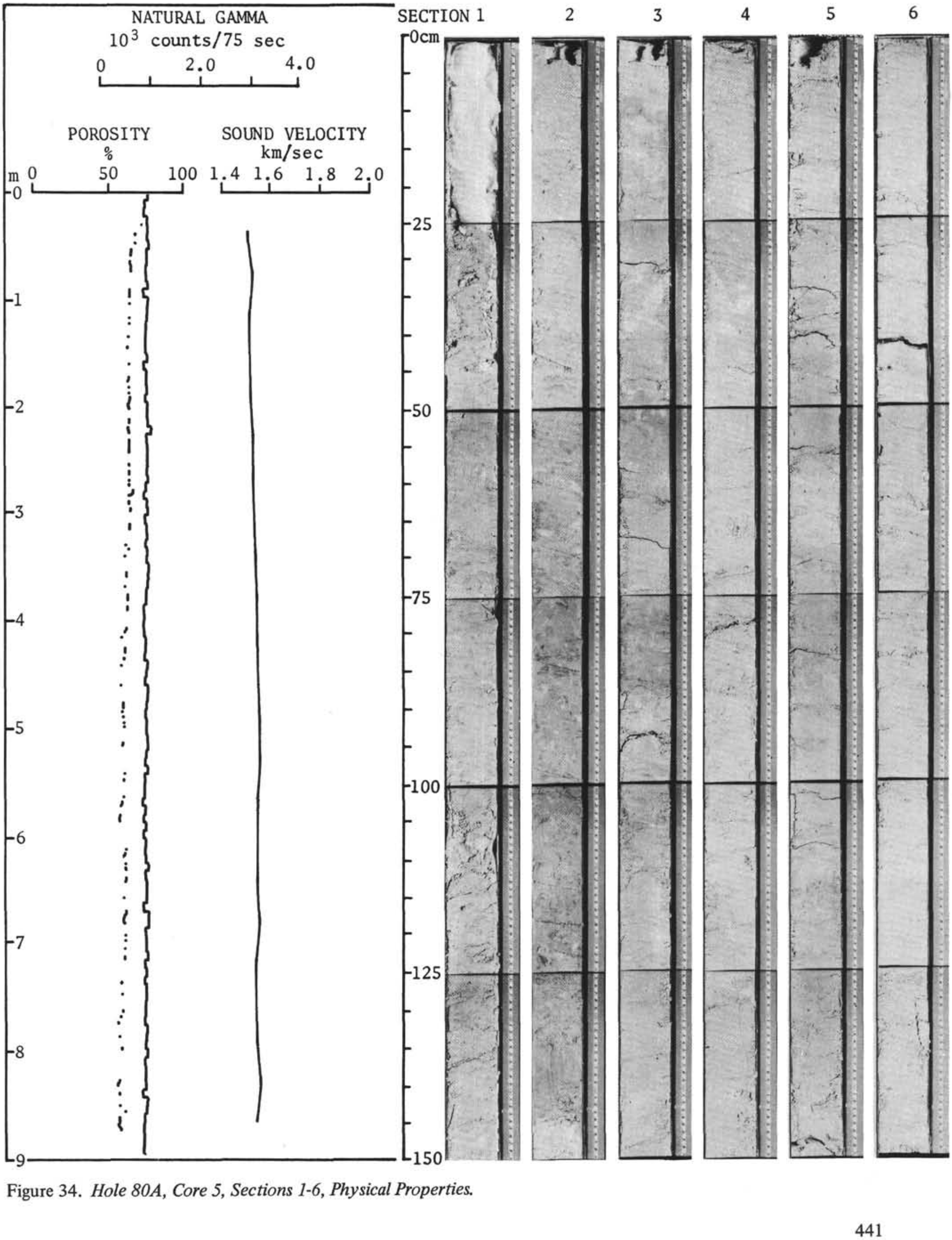



Figure 34. *Hole 80A, Core 5, Sections 1-6, Physical Properties.*

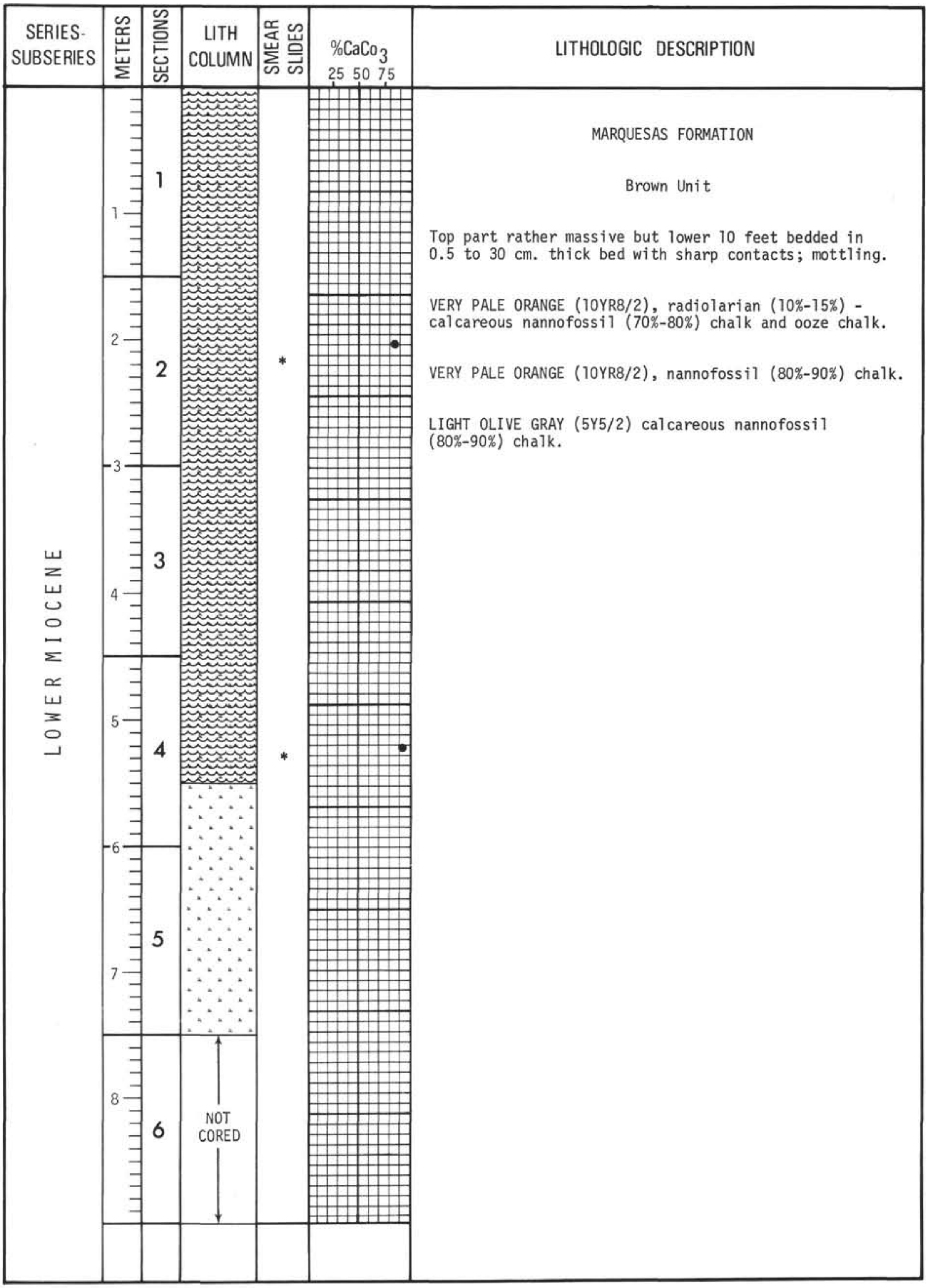



Figure 35. *Hole 80, Core 4 (165.7 to 175.0 m).*

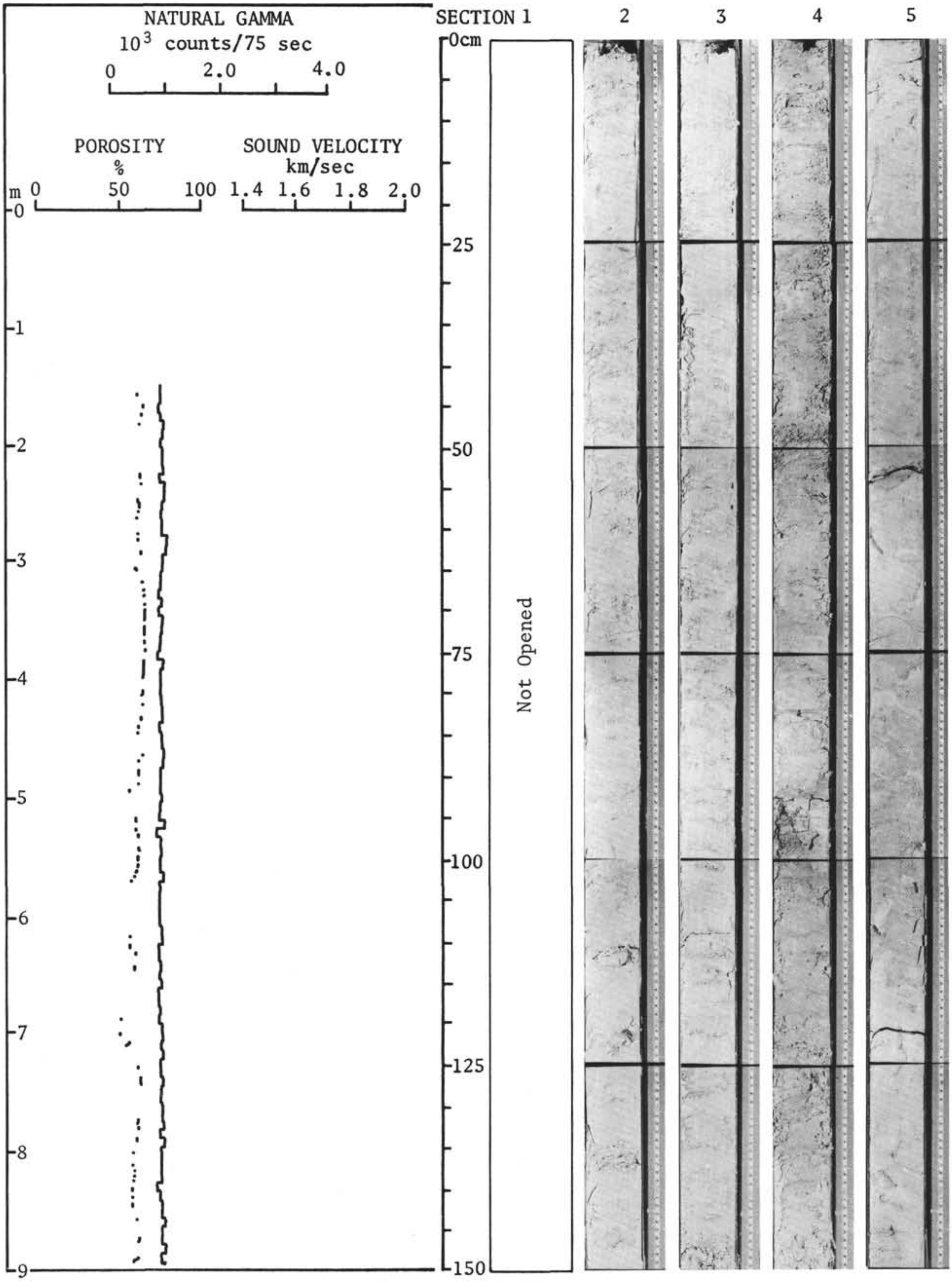



Figure 36. *Hole 80, Core 4, Sections 1-5, Physical Properties.*

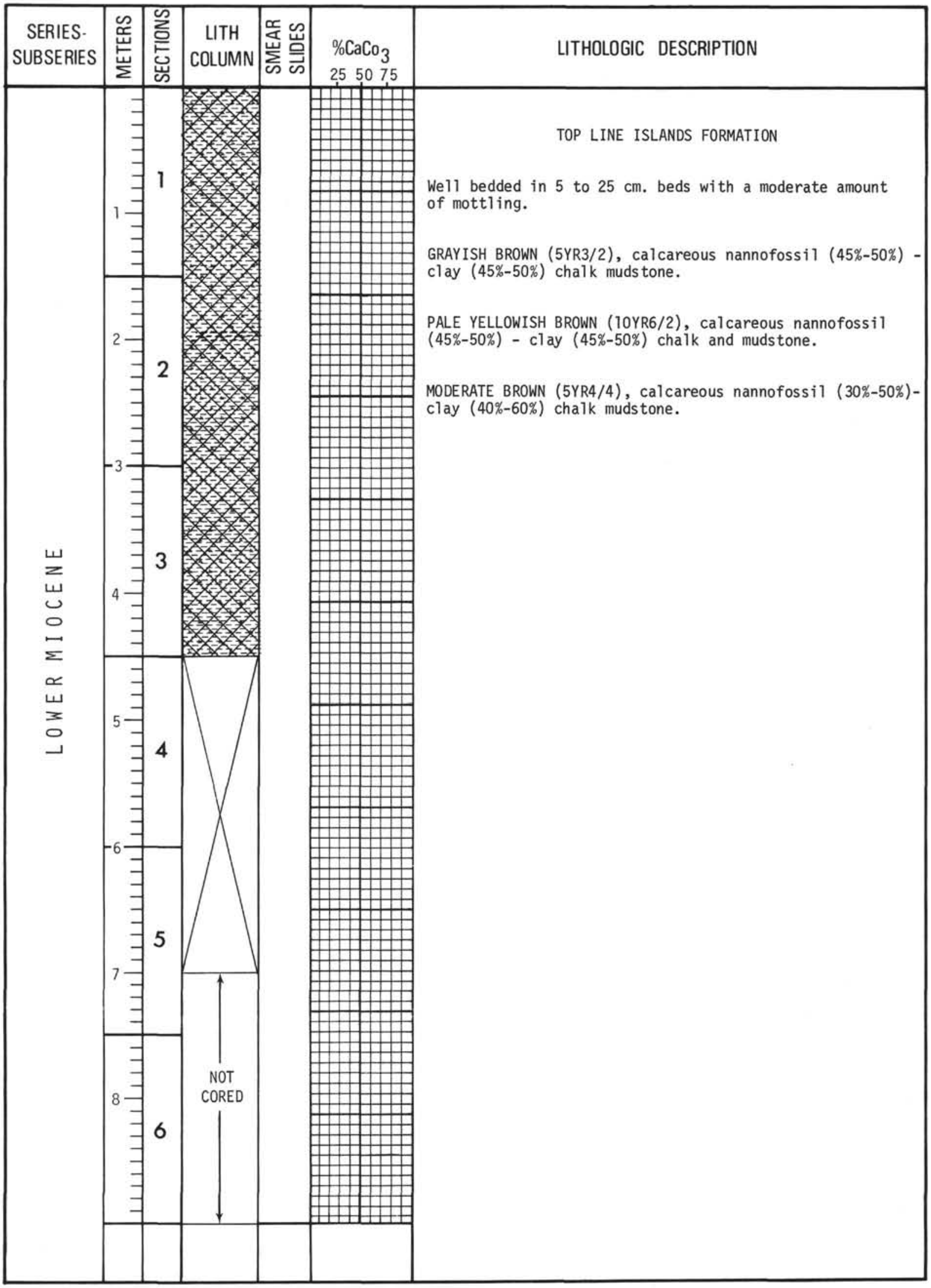



Figure 37. *Hole 80, Core 5 (193.3 to 202.4 m).*

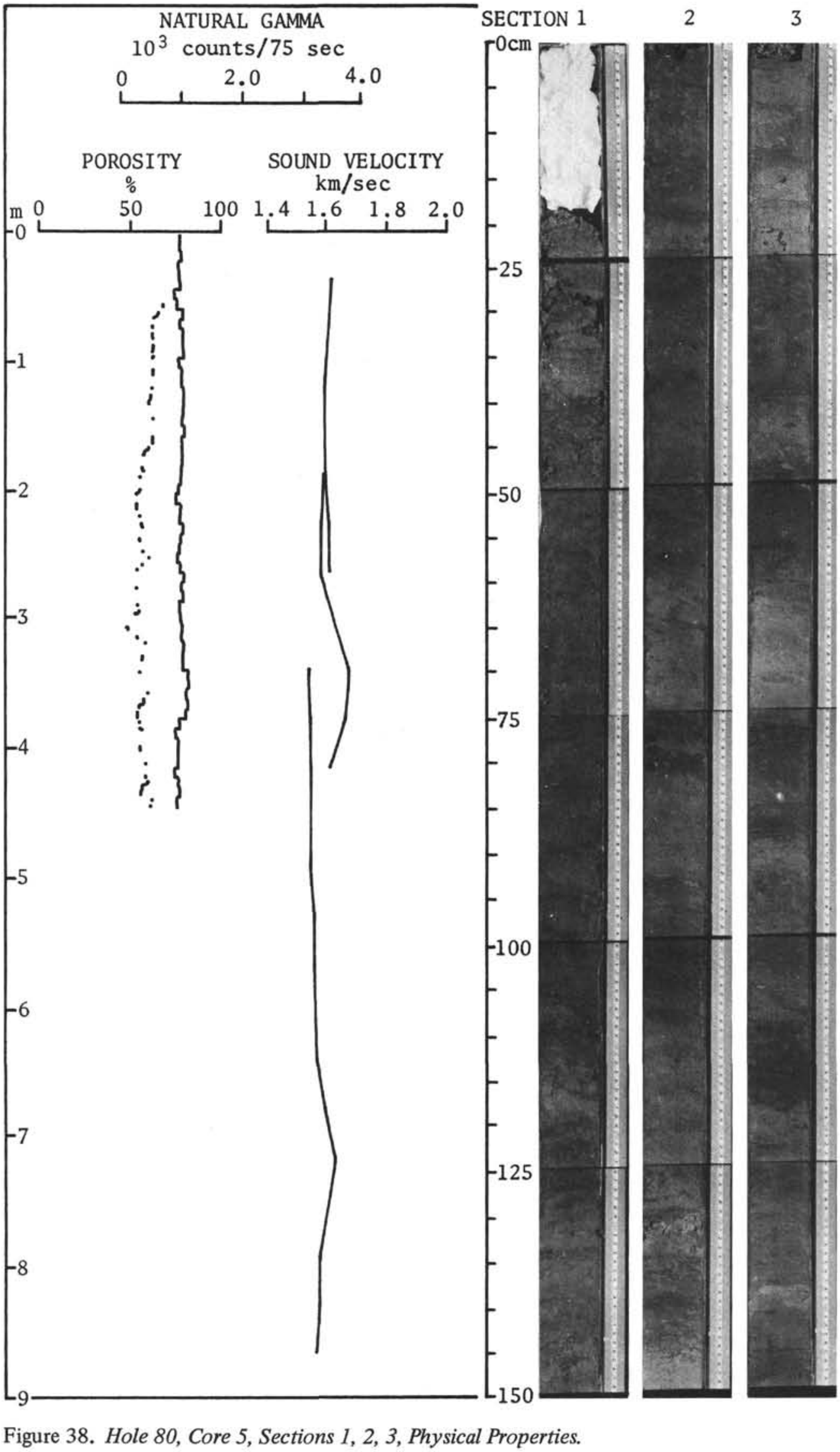



Figure 38. *Hole 80, Core 5, Sections 1, 2, 3, Physical Properties.*

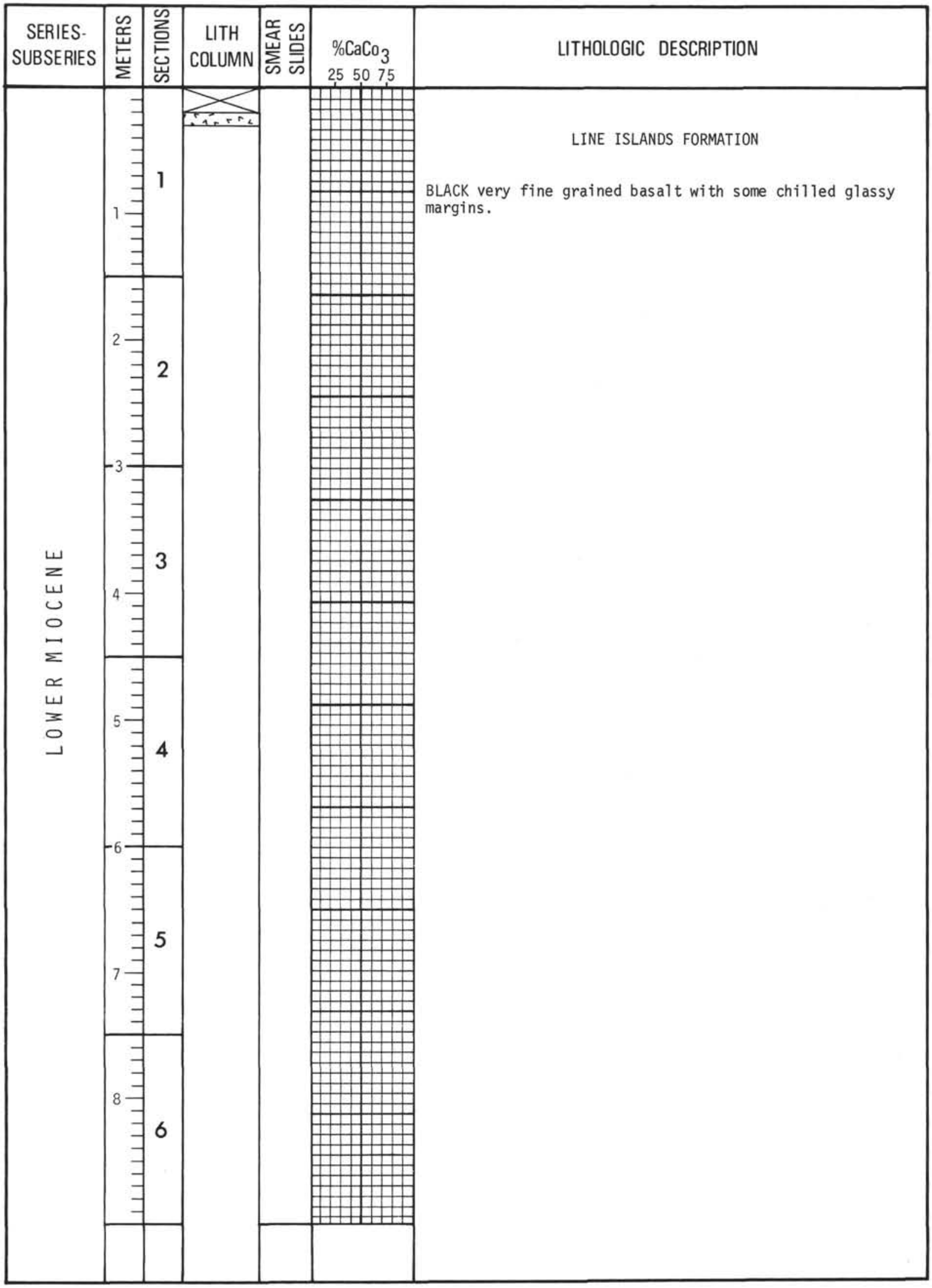



Figure 39. *Hole 80, Core 6 (202.4 to 202.7 m).*

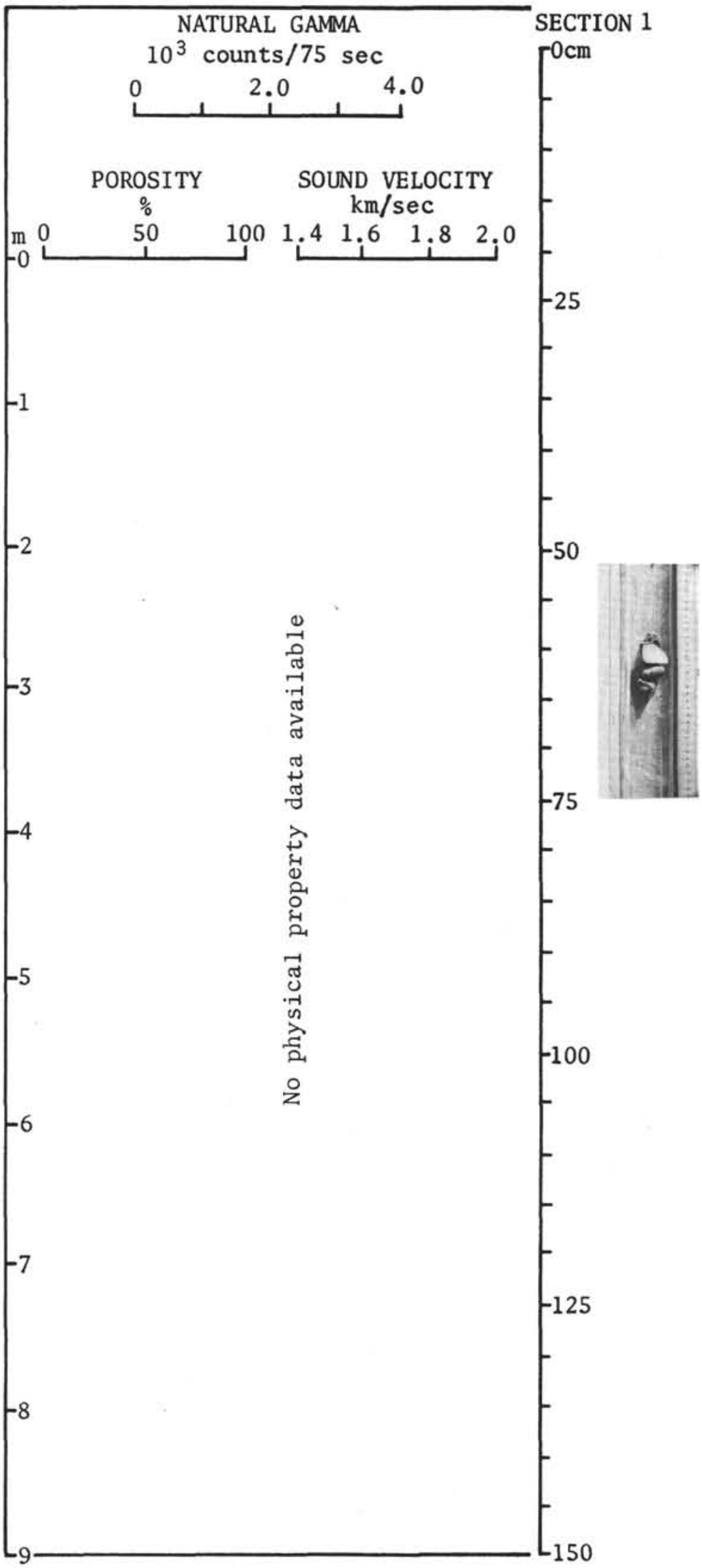



Figure 40. *Hole 80, Core 6, Section 1, Physical Properties.*