8. SITE 29

The Shipboard Scientific Party[1]

SETTING AND PURPOSE

The southern Caribbean basins are thought to be part of a relatively old and geologically stable crustal plate (Molnar and Sykes, 1969). Although surrounded by belts of high earthquake activity, the central Caribbean is seismically quiet. The region also constitutes a quiet magnetic zone and appears to have resisted all of the surrounding forces related to ocean floor spreading. The uniformity of sediment distribution, as indicated by the extent of the Carib beds (the acoustically transparent sediments above and below the reflecting A″ Horizon) points to a long and tranquil sedimentary environment. In contrast to the Atlantic, the Caribbean, protected by the island arc from the vigors of deep circulation in the Tertiary, shows little variation in sediment distribution or thickness. This supports the view of a quiet environment existing since the deposition of layer B″, perhaps of Cretaceous age.

The Venezuelan Basin is covered by a sediment blanket of remarkably uniform thickness (1.0 second) and acoustical character. These sediments overlie a smooth reflector, beneath which no other reflectors have been recorded. The smoothness of the basal reflector surface suggests that it is composed of sedimentary material, and the refraction data indicate that it is about 1 kilometer thick. The age and nature of this horizon, referred to as B″, is unknown, but is assumed to be near the Paleozoic-Mesozoic boundary. The sediments above B″ are divided by a strong reflector, called A″, into an upper acoustically transparent layer and a lower layer, which is slightly less transparent. The sediment immediately above A″ had been cored on a fault scarp on a flank of the Beata Ridge and found to be of Lower Eocene age, suggesting that Horizon A″ marks the top of the Cretaceous. [Complete discussions of the sediments of the Caribbean have been given by Ewing, Talwani and Ewing (1965), and by Ewing, Talwani, Ewing and Edgar (1967).] Reflecting layers are seldom recorded below Horizon B″, but Eaton and Driver (1969) show discordant structures within thick sedimentary sequences below B″ across the Venezuelan Basin and Aves Ridge.

The standard planktonic foraminiferal biostratigraphic zonation of the Cretaceous and Tertiary of the western hemisphere has been established in the Caribbean region (Bolli, 1957a, b, c, d; 1966; Blow, 1959). Because of tectonic disturbances which have occurred in the circum-Caribbean region, the stratigraphic succession on each of the islands is incomplete. Continuous coring in the Venezuelan Basin was expected to offer the best opportunity for recovering a relatively complete stratigraphic sequence in the Cretaceous and Tertiary. In addition to providing considerable information on the general geologic history of the Caribbean region, paleontologic studies on cores at Site 29 were expected to provide valuable data on phylogenetic trends within the planktonic foraminifera and calcareous nannoplankton, furnishing more accurate criteria for intercontinental stratigraphic correlation.

SITE SURVEY

Survey work was carried out by the *R/V Vema* in the area of Site 29 between March 6 and 9, 1969. Underway gravity, magnetic, seismic reflection and echo-sounding measurements were taken, as well as piston cores at specific stations. Figure 1 is a topographic contour chart constructed from the *Vema* echo-sounder transects. This area in the central Venezuelan Basin shows a gentle slope downward to the southeast of approximately 1:110.

Figure 2 reproduces a *Vema*-26 reflection profiler record (sheets 1169-1170) along a north-south transect (A-B in Figure 1) near Site 29. It shows two prominent flat-lying reflectors, layers A″ and B″, at 0.3 and 0.48 second subbottom. Figure 3A shows an underway reflection profiler record taken by the *Glomar Challenger* near Site 29, and Figure 3B shows a portion of an on-site reflection record. The *Vema* and *Glomar Challenger* records shows close agreement in reflector depths, including the presence of a discontinuous reflector at about 0.19 second. This uppermost reflector correlated with the top of the radiolarian ooze sampled at 130 meters (426.5 feet) depth. The prominent reflector A″ at 0.32 second (Figure 3A-B) corresponds to the contact

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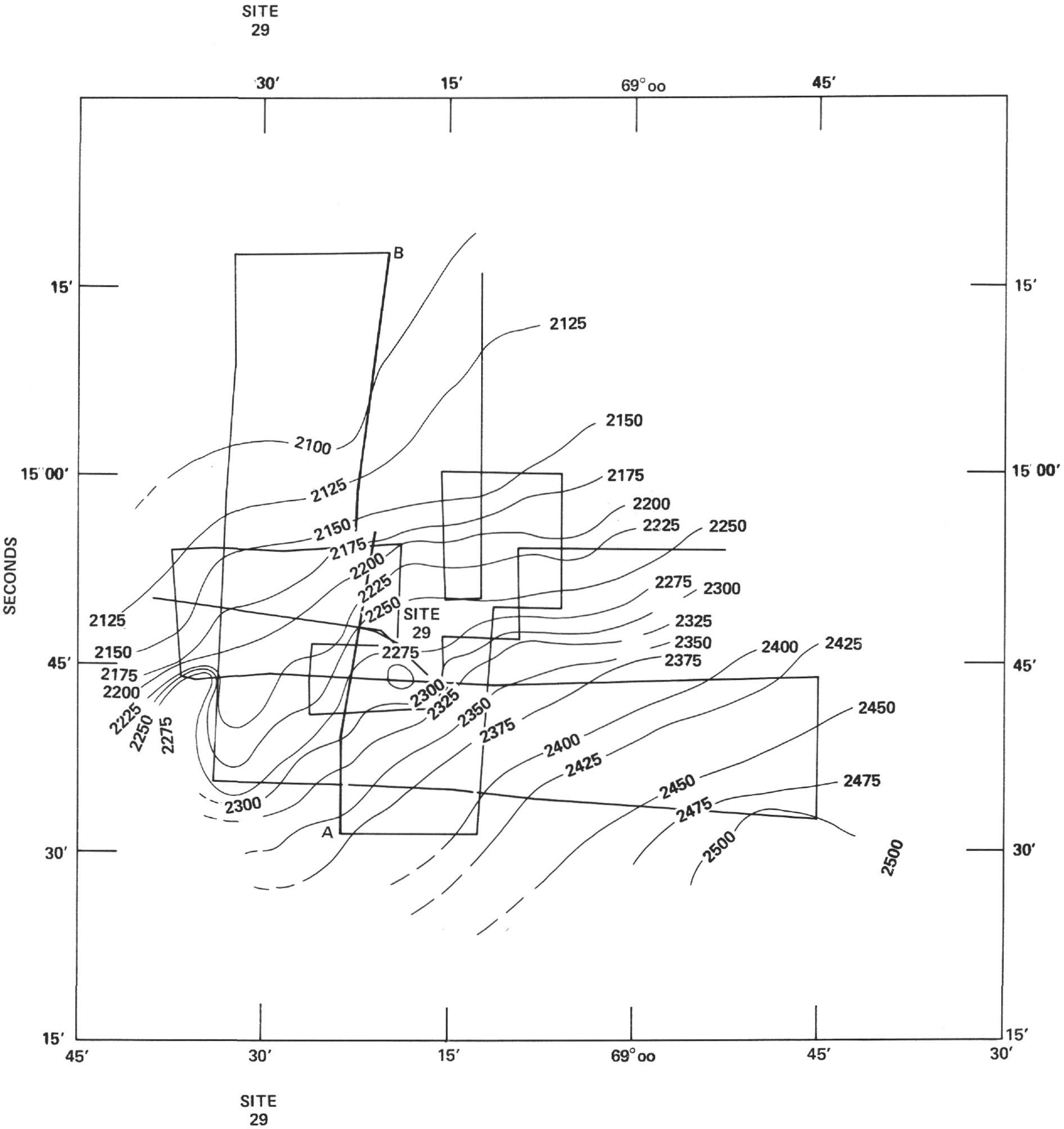

Figure 1. *Topographic chart of the area around Site 29 in the Venezuelan Basin based on* R/V Vema *echo-sounder measurements. Line A-B shows the location of the reflection profiler section shown in Figure 2. Contour interval 25 fathoms.*

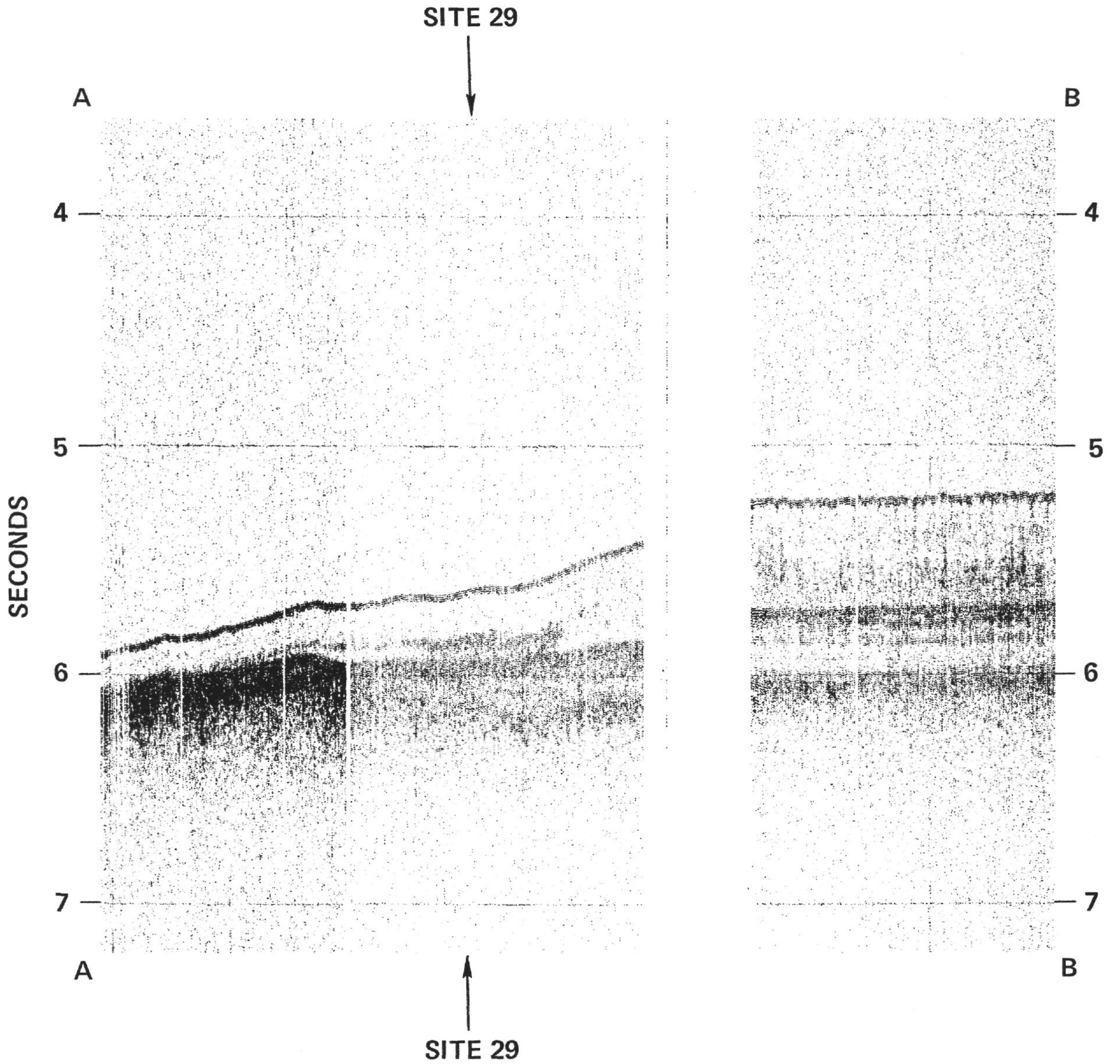

Figure 2. *Reflection profiler record near Site 29 obtained aboard the* R/V Vema *(see Figure 1 for location).*

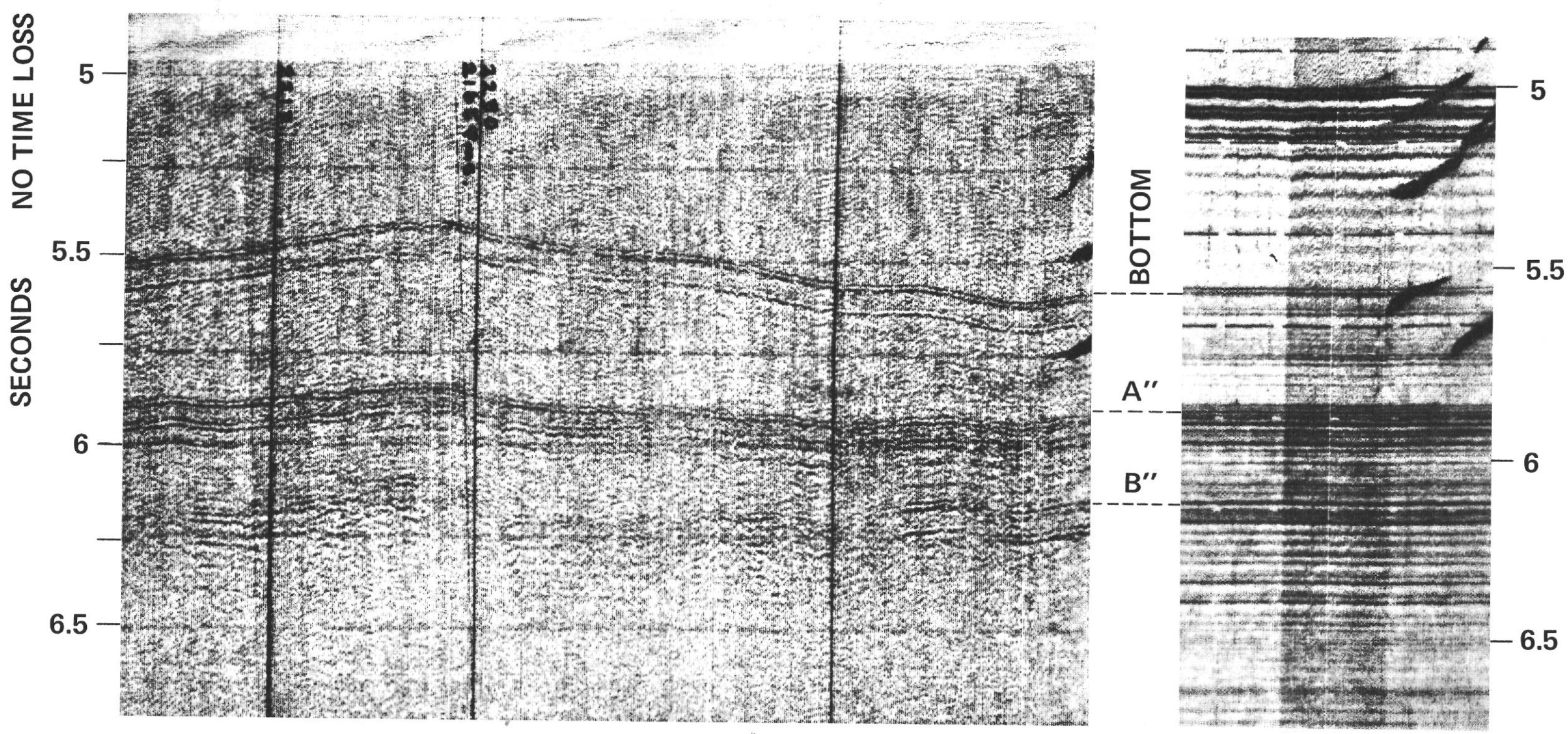

Figure 3A. *Underway reflection profiler record taken by* Glomar Challenger *on the approach to Site 29.*

Figure 3B. *On-site* Glomar Challenger *profiler record at Site 29. Note the two flat reflecting horizons A″ and B″.*

between the radiolarian ooze and the underlying chert at 230 meters (755 feet) depth. The depth of reflector B″ (0.18 second below A″) at this site is assumed to be about 450 meters (1476 feet) below ocean bottom.

DRILLING AND CORING OPERATIONS

The *Glomar Challenger* approached the site from the east on course 260° at 8 knots at 2342 hours on March 8. After passing over the site, speed was reduced, the towed gear retrieved, and the ship returned to the site location at 0128 hours on March 9. Two beacons, a PPM and a PCS were deployed at 0145 hours, and the positioning gear was functioning by 0200 hours.

TABLE 1
Cores Recovered from Hole 29
(Using a Tungsten Carbide Bit)

Core	Drill String (m)	Penetration (m)	Core Recovered (m)
1	4284-4293	0-9	4.6
2	4293-4302	9-18	4.6
3	4302-4311	18-27	0.9
4	4311-4321	27-37	5.2
5	4321-4330	37-46	0.8
6	4330-4339	46-55	0.3
7	4401-4410	117-126	0.9
8	4410-4419	126-135	0.9
9	4419-4428	135-144	9.1
10	4428-4437	144-153	7.6
11	4437-4446	153-162	0.6
12	4446-4456	162-172	9.1
13	4459-4468	175-184	0.6
14	4468-4477	184-193	9.1
15	4477-4486	193-202	9.1
16	4486-4495	202-211	9.1
17	4495-4504	211-220	9.1
18	4504-4509	220-225	3.7
19	4509-4510	225-226	0.3
20	4510-4513	226-230	0.0
1	4325-4334	41-50	0.2
2	4334-4343	50-59	1.1
3	4343-4352	59-68	0.3
4	4352-4361	68-77	0.9
5	4361-4370	77-86	0.9
		Total	85.6

The drill string spudded in at 1230 hours on March 10 in 2322 meters (7612 feet) depth, using a tungsten-carbide bit. Table 1 lists the intervals drilled and the cores recovered at this site. The first core was recovered at 1335 hours from the 0 to 9-meter (0 to 30-foot) level, and continuous coring proceeded to 55 meters (180 feet). At this depth, the absence of calcareous fossils suggested drilling ahead to 117 meters (383 feet) before further coring. Continuous coring was resumed, and a lithologic change from calcareous clay to radiolarian ooze was noted at 126 meters (413 feet). This formation of Eocene age continued to a depth of 227 meters (743 feet), where a hard chert layer was encountered. A brief attempt was made to core the hard layer with negative results: no penetration was recorded, and no core was recovered. Rather than harm the bit by further drilling, the string was raised back to the mud line and spudded in for Hole 29A at 2110 hours on March 10.

Cores Recovered from Hole 29B
(Using a Tungsten Carbide Bit)

Core	Drill String (m)	Penetration (m)	Core Recovered (m)
1	4341-4350	57-66	9.1
2	4352-5361	68-77	4.9
3	4362-4371	78-87	3.0
4	4371-4381	87-97	6.4
5	4381-4390	97-106	6.1
6	4390-4399	106-115	0.6
7	4399-4408	115-124	0.15
8	4408-4417	124-133	9.1
9	4502-4511	218-227	9.1
10	4511-4515	227-231	4.0
		Total	52.45

Cores Recovered from Hole 29C
(Using a Diamond Bit)

Core	Drill String (m)	Penetration (m)	Core Recovered (m)
1	4513-4520	230-236	0.8
2	4520-4526	236-242	0.5
3	4526-4532	242-248	0.08
		Total	1.38

Continuous coring was attempted in the zone from 41 to 86 meters (133 to 283 feet) with very poor recovery. It was assumed that by chance the tools had re-entered the previous hole and were coring disturbed material. Support for this view came from the weight indicator, where the driller could see little or no resistance to penetration. The drill string was, therefore, drawn back to the mud line and the ship moved to achieve a 200-foot offset from the previous position. Hole 29B spudded in at 0600 hours on March 11; and, after drilling to 57 meters (187 feet), continuous coring began. Upon reaching 133 meters (437 feet), coring was discontinued, and the hole drilled to just above the chert contact. Two cores were obtained above the chert layer, and then several hours of attempted coring of the chert ended with no penetration and no core.

It was decided to log the hole using the ES, gamma ray-neutron tool combination in the open hole. Accordingly, the drill stem was pulled up so that about 152 meters (500 feet) of open hole were available for measurement. Logging began at 0300 hours and continued until 0700 without results. It was not possible to lower the logging tools more than 3 meters (10 feet) below the bit, due to an obstruction or bridge in the hole.

At this point it was decided to trip the drill string and replace the bit with a diamond bit in order to make a final attempt to break through the cherty layer. The tools were laid down at 1500 hours on the 12th and put back down at the same water depth and spudded in at 2200 hours. The hard layer was reached at 230 meters (753 feet), and coring began in Hole 29C at 0150 hours on the 13th. The first chert core, 0.8 meter (2.5 feet) in length, was brought up at 0500 hours on March 13. This core represented an estimated 6.1 meters (20 feet) of penetration. A second chert core, representing another 6.1 meters of penetration, was brought up at 0700 hours; this time only 0.5 meter (1.5 feet) of chert-like rock was recovered. A third cherty sample only 0.08 meter (3 inches) long was recovered in a third core at 0900 hours. Thus, in about five hours of coring, some 18 meters (60 feet) of chert and chert-like rock were cored with a recovery rate of 3 per cent. It seems unlikely that the sampled section was as uniformly hard as the recovered samples, since drilling characteristics indicate interbedded hard and soft layers, and subsequent logging confirmed this.

Before another core could be taken, the bit became plugged, and drilling could not be resumed until 1350 hours. Drilling continued until 1900 hours without reaching the depth of the previous core, and it was decided that the bit was no longer usable. The drill string was raised so that the bit was 37 meters (120 feet) above the hole bottom, and in-pipe (and open hole) logging was carried out between 2010 and 2400 hours, using the ES and gamma ray-neutron tools. The drill string was again raised to 150 meters (492 feet) above bottom, and logging was carried out in the open hole (and in-pipe) using the same tools between 0100 and 0500 hours on March 14. A discussion of the well logs obtained at this site is presented in a later section of this volume.

The bottom hole assembly was taken to the mud line at 0630 hours, and the pipe was tripped to the surface and tools laid down by 1530 hours. A total of 315 meters (1033 feet) of coring was attempted at this site in four holes. Total recovery of core amounted to 143 meters (469 feet) for an average recovery rate of 32 per cent.

LITHOLOGIC SUMMARY

For detailed lithology and paleontology see Hole Summaries. (See pages 177-213).

Continuous coring was achieved at Site 29 by drilling four holes. Consequently, the stratigraphy of this section is the best known of those investigated on Leg 4. Relations of the overlapping cores from the different holes are shown in the accompanying figure.

The Late Pleistocene is represented by the surficial deposits yellowish-gray to light olive-gray soft silty clays with abundant planktonic foraminifera and calcareous nannofossils.

The base of the Pleistocene is in Core 2 (Hole 29), and is closely associated with a change in the lithology of the sediment from olive-gray soft clays to olive-gray planktonic foraminiferal ooze. The change in lithology is gradual, and the base of the Pleistocene based on planktonic foraminifera (first appearance of *Globorotalia truncatulinoides truncatulinoides*) and the base of the Pleistocene based on calcareous nannofossils (last occurrence of *Discoaster brouweri*) are not precisely coincident, but all of these events occur within the five-foot length of Section 2 of Core 2 (35 to 40 feet–10.7 to 12.2 meters–below the sea floor).

The ooze is the dominant sediment between 37 feet (11.3 meters) and some level between 65 and 90 feet (19.8 and 27.4 meters) below the sea floor. Core 4 recovered 20 feet (6.1 meters) of light olive gray soft clays between 90 and 120 feet (27.4 and 36.6 meters) beneath the sea floor. These sediments contain abundant planktonic foraminifera but relatively sparse calcareous nannofossils. The base of the Pliocene (base *Globorotalia margaritae* Zone) lies at 109 feet (33.2 meters) below the sea floor.

Recovery in cores taken between 120 and 180 feet (36.6 and 54.9 meters) below the sea floor (Cores 5 and 6, Hole 29; Cores 1, 2 and 3, Hole 29A; Core 1, Hole 29B) was generally poor, except for the last mentioned core, but the sediments in each case are brown to olive soft clays devoid of calcareous and siliceous fossils.

The interval between 227 and 267 feet (69.2 and 81.4 meters) below the sea floor was sampled by a number of cores (Cores 4 and 5, Hole 29A; Cores 2 and 3, Hole 29B). The sediments are olive to brownish soft clays, but are once again slightly calcareous, containing calcareous nannofossils and planktonic foraminifera at some levels, so that this interval can be assigned an early Late Miocene age.

The strata between 267 and 287 feet (81.4 and 87.5 meters) were not recovered, but Core 4, Hole 29B recovered 20 feet (6.1 meters) of core from 287 to 307 feet (87.5 to 93.6 meters) beneath the sea floor. Most of the material is olive to brownish soft clay, with very sparse occurrences of planktonic foraminifera and calcareous nannofossils indicating an Early or Middle Miocene age. At the base of this core is a soft white clayey chalk with abundant calcareous nannofossils and planktonic foraminifera of Early Miocene age.

Core 5 from Hole 29B recovered 20 feet (6.1 meters) of sediment from 317 to 337 feet (96.6 to 102.7 meters) beneath the sea floor. The upper section of this core contains two beds of white clayey chalk, the upper bed only a few inches thick, but the lower bed about two feet (0.6 meter) thick. These are interbedded with brownish soft clays. The lower 15 feet (4.6 meters) of sediment in this core are pale soft planktonic foraminiferal oozes with some calcareous nannoplankton. Two planktonic foraminiferal zones from the Early Miocene (*Praeorbulina glomerosa* and *Globigerinatella insueta* Zones) are represented in this core.

Core 6, Hole 29B, recovered only about two feet (0.6 meter) of mixed sediment probably taken between 347 and 377 feet (105.8 and 114.9 meters) below the sea floor, but possibly slumped from higher in the hole. The sediment is brownish clay and white chalk ooze like that in the overlying core, and also of Early Miocene age.

The only sediment recovered between 377 and 407 feet (114.9 and 124.1 meters) representing an in-place sample was recovered by Core 7, Hole 29B, and is a few cubic centimeters of brown zeolitic clay completely devoid of calcareous or siliceous fossils. Core 7, Hole 29 recovered Miocene ooze with calcareous fossils at a depth of about 383 feet (116.7 meters), but this probably represents material slumped from higher in the hole.

The top of the radiolarian ooze must lie slightly above 407 feet (124.1 meters) below the sea floor, because Core 8, Hole 29B recovered a full 30-foot (9.1-meter) core of this material. The radiolarian ooze is soft, friable, yellowish-brown to pale orange. It is mottled and banded, but remarkably homogeneous in composition, extending to a depth of about 840 feet (256.0 meters) beneath the sea floor (Cores 8 through 19, Hole 29, Cores 8, 9 and 10, Hole 29B). It is slightly calcareous, and contains calcareous nannofossils in Core 9, from 443 to 473 feet (135.0 to 144.2 meters), Core 12, from 533 to 563 feet (162.5 to 171.6 meters), Core 15, from 633 to 663 feet (192.9 to 202.1 meters), and Core 19, from 738 to 743 feet (224.9 to 226.5 meters) of Hole 29. Pumice fragments are present at a few levels, as are chert chips. No resistant chert layer was encountered above about 750 feet (228.6 meters) below the sea floor.

Three attempts were made to core the chert underlying the radiolarian ooze at this site (Cores 1, 2 and 3, Hole 29C). The first core, drilled at 753 feet (229.5 meters), recovered about 3 feet (0.9 meter) of dark brown to reddish-yellow chert, which may be silicified radiolarian ooze, and is slightly calcareous. A second core was retrieved from 780 feet (237.7 meters), and consisted of about 2 feet (0.6 meter) of chert, dark brown with pink laminae, and cut by quartz veinlets. The third core was drilled at 800 feet (243.8 meters) beneath the sea floor and recovered only a few inches of yellowish-brown noncalcareous chert. No softer beds were recovered by these coring attempts, although it seems likely that the hard chert layers are interbedded with softer radiolarian ooze.

PHYSICAL AND CHEMICAL PROPERTIES

The natural gamma radiation from the sediment at Site 29 falls into three intensity levels which correspond to three major lithologies: clays (1700 to 2000 counts), chalk (450 to 950 counts) and radiolarian ooze (100 to 300 counts). The clay values are typical of clay sediment low in organic matter. The radiolarian oozes are typical of biogenic oozes such as those found at Site 25. The high water content may have contributed to making the intensities slightly lower than sometimes observed in biogenic deposits.

The water content, porosity and density of samples from the clays and chalks are similar: water contents fall in the range 37 to 47 per cent, porosities in the range 58 to 68 per cent, and densities in the range 1.54 to 1.64 gm/cc. The water content and porosity of the radiolarian ooze samples are considerably higher, 60 to 68 per cent and 70 to 80 per cent, respectively. The densities of the radiolarian oozes range from 1.22 gm/cc to 1.30 gm/cc. These values are slightly suspect as the cores appeared disturbed and the porous nature of the sediment could facilitate the admixing of drilling fluid (see chemical evidence below).

Sonic velocities were found to be similar to those measured previously in clays from equivalent depths (up to 1540 m/sec). The velocity of sound measured in the cores from the radiolarian ooze reaches 1550 m/sec despite very low density. Because of the apparent disturbance, it is doubtful if these values bear any close relationship to that of the *in situ* sediment. The physical properties of cores at this site are summarized in Figure 4.

Sections 29-1-1 through 29-4-3 contain from 1 to 38 per cent carbonate. The sections from 29-4-4 through 29-14-6 contain virtually no carbonate except for occasional samples with 10 to 25 per cent carbonate. Below 29-15-1 the carbonate fluctuates widely (a few to 25 per cent). Only two samples contained more than 0.2 per cent organic carbon; most contain nil to 0.1 per cent.

Ten interstitial water samples were processed at Site 29; however, due to the porosity of the sediment and apparent disturbance of the cores, the data from these samples are suspect. None of the samples from the radiolarian ooze varies outside the limit of error in salinity (0.3 per mil) from 35.0 per mil. Most carbon dioxide values do not deviate from sea water values more than the limits of error in the analyses (see Figure 5); there are, however, a few large fluctuations. The sediment above 92 meters is predominantly clays and contamination is unlikely. Solutions from these sediments have carbon dioxide contents of 54 to 58 μl/ml. Large fluctuations occur in the radiolarian ooze indicating that at least for those samples with carbon dioxide contents significantly different from sea water, contamination is not severe.

As seen previously there is little correlation between carbon dioxide and *p*H. The range of *p*H values is 7.27 to 7.70. All of the *p*H values measured differ appreciably from the surface sea water used as drilling fluid. On the basis of these data contamination by the drilling fluid was not severe; as mentioned above, the carbon dioxide data from several samples support this conclusion. The sensitivity of such indicators is, however, very low.

At this site eighteen thermal conductivity measurements were obtained, ranging from 1.72 to 2.67 $\times 10^{-3}$ cal/°C/cm/sec (Table 2). Unlike other sites, which show a general increase in thermal conductivity with depth, the

TABLE 2
Thermal Conductivity Data

Hole	Core	Section	Sample Depth Below Bottom (feet)	Sample Depth Below Bottom (meters)	Lithology	Thermal Conductivity $\times 10^{-3}$ cal/°C/cm/sec
29	1	1	0-30	0-9.1	Clay and chalk ooze.	2.42
29	2	2	30-60	9.1-18.3	Olive clay ooze.	2.67
29	4	2	90-120	27.4-36.6	Chalk and olive clay ooze.	2.01
29	5	1	120-150	36.6-45.7	Brown clay.	2.54
29B	1	6	187-216	57.0-65.8	Olive clay.	2.51
29B	2	3	222-252	67.7-76.8	Brown clay.	2.53
29B	3	2	257-287	78.3-87.5	Silty olive clay and	2.28
29B	4	3	287-317	87.5-96.6	brown clay.	2.45
29B	5	3	317-347	96.6-105.8	White chalk.	2.67
29B	8	3	407-437	124.1-133.2		1.85
29	9	3	443-473	135.0-144.2		1.79
29	10	3	473-503	144.2-153.3		1.75
29	12	3	533-563	162.5-171.6		1.82
29	14	2	603-633	183.8-192.9	Radiolarian ooze.	1.74
29	15	3	633-663	192.9-202.1		1.75
29	16	2	663-693	202.1-211.2		1.80
29	17	4	693-723	211.2-220.4		1.72
29	18	2	723-728	220.4-221.9		1.72

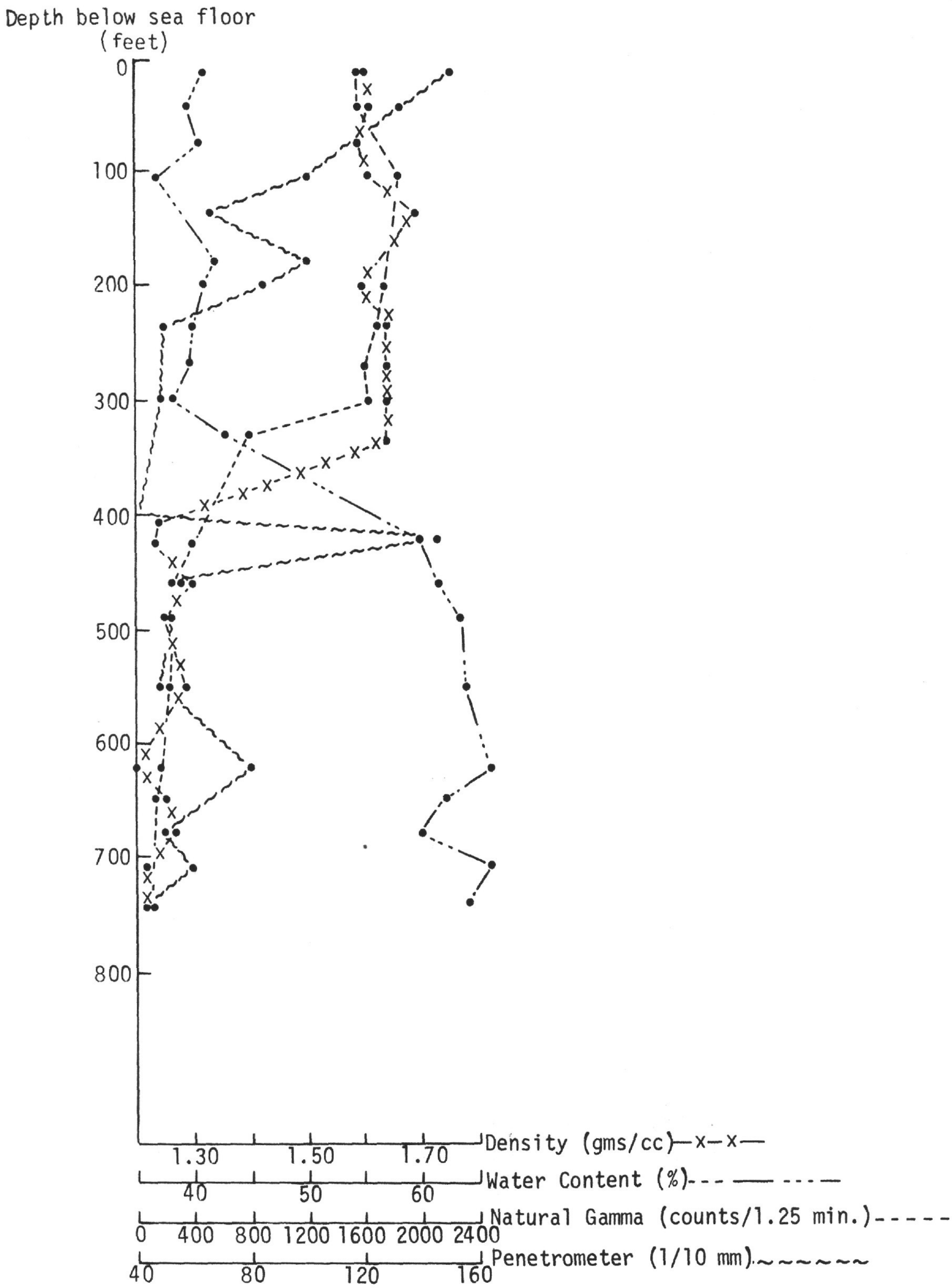

Figure 4. *Summary of physical properties, Site 29.*

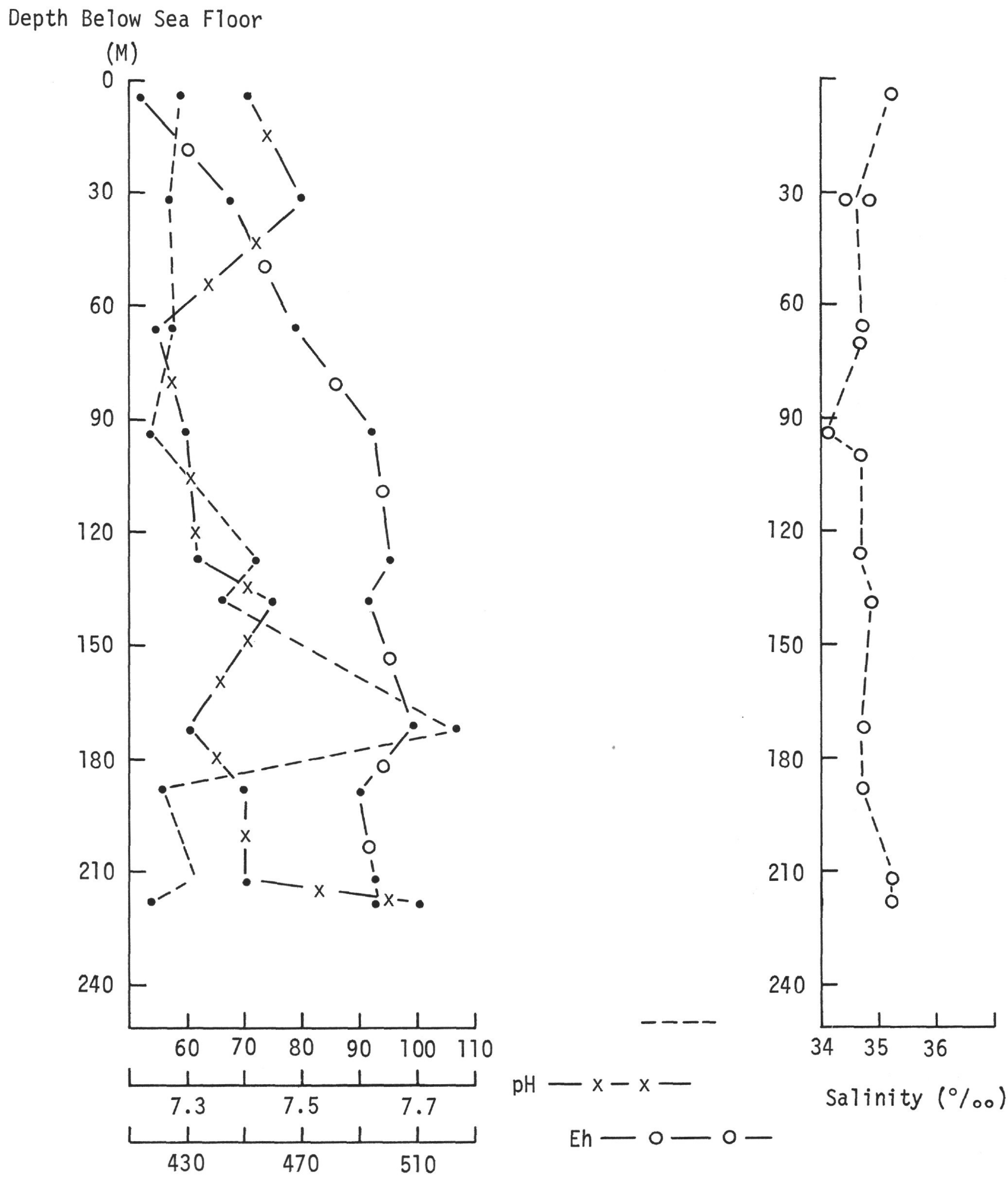

Figure 5. *Summary of chemical properties, Site 29*

lower section, which corresponds to the zone of radiolarian ooze, has consistently low thermal conductivity—the lowest recorded on this leg. The pattern of thermal conductivity values follows closely that of density and natural gamma radiation, both of which are consistently low in the radiolarian ooze, where water content and porosity are high. As mentioned above, the high water content, which contributes to the low thermal conductivity in the radiolarian ooze cores, could be a result of sea water introduced in the drilling process and may not reflect the *in situ* condition.

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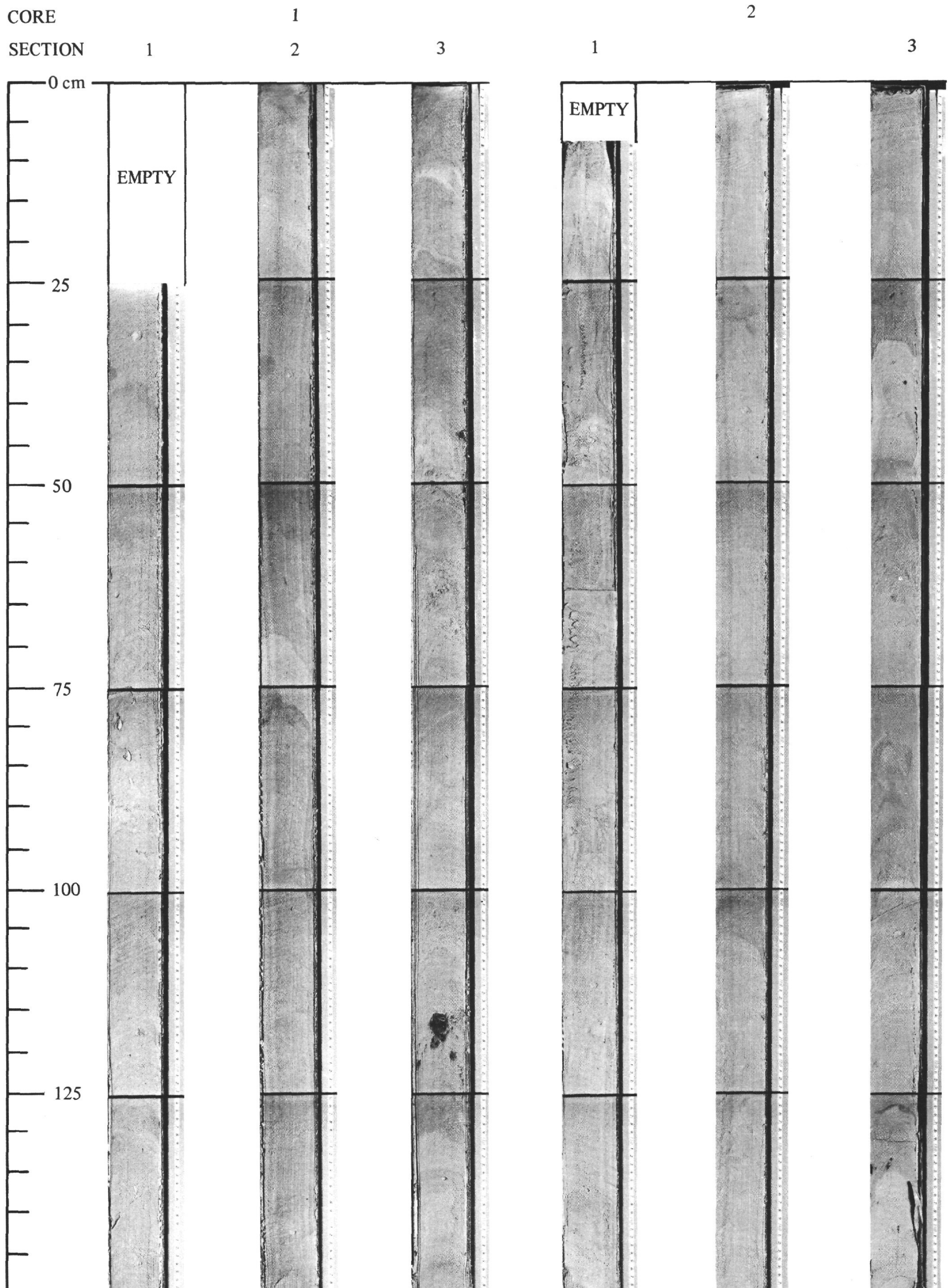

Plate 1. *Cores 1 and 2, Hole 29.*

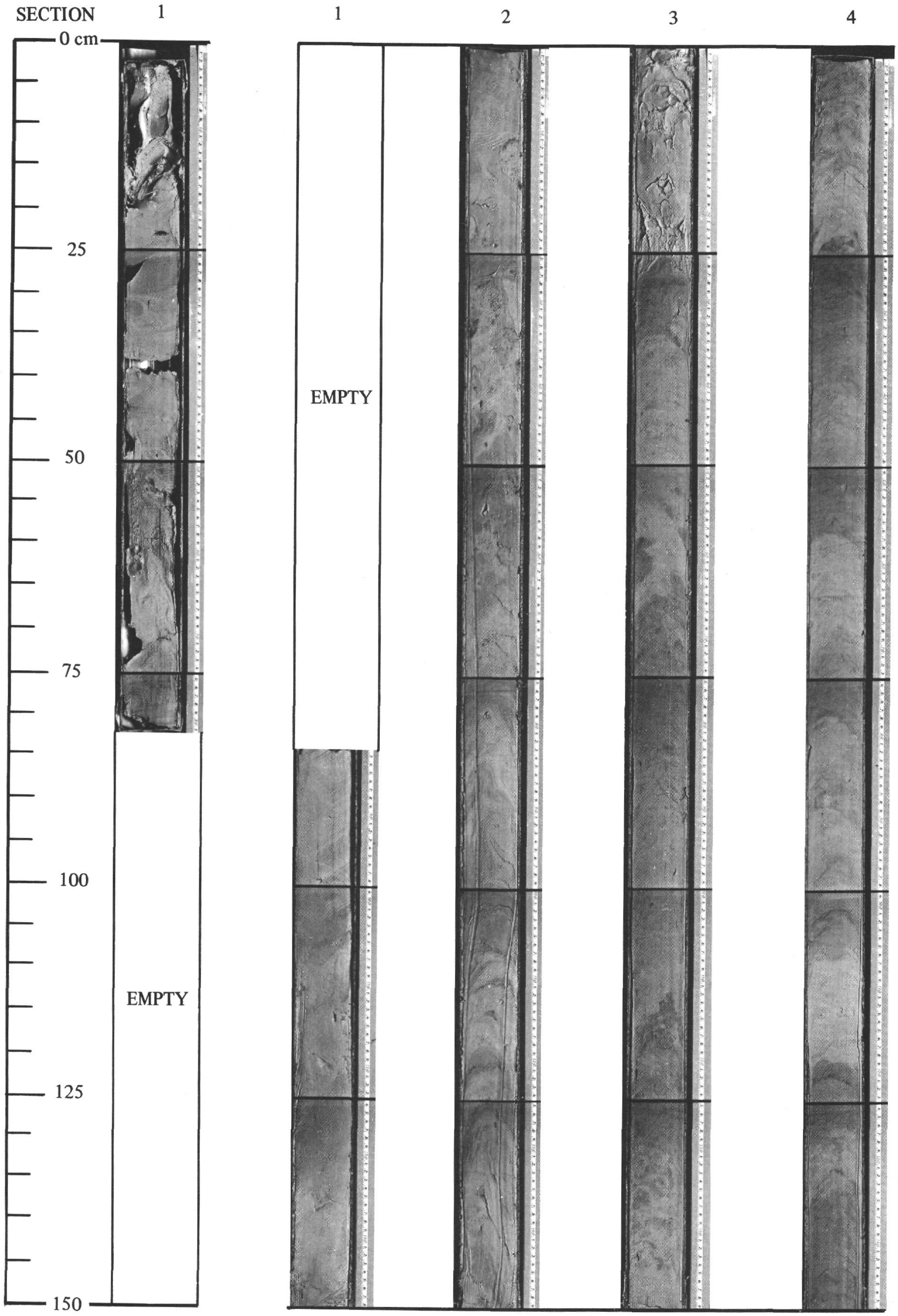

Plate 2. *Cores 3 and 4, Hole 29.*

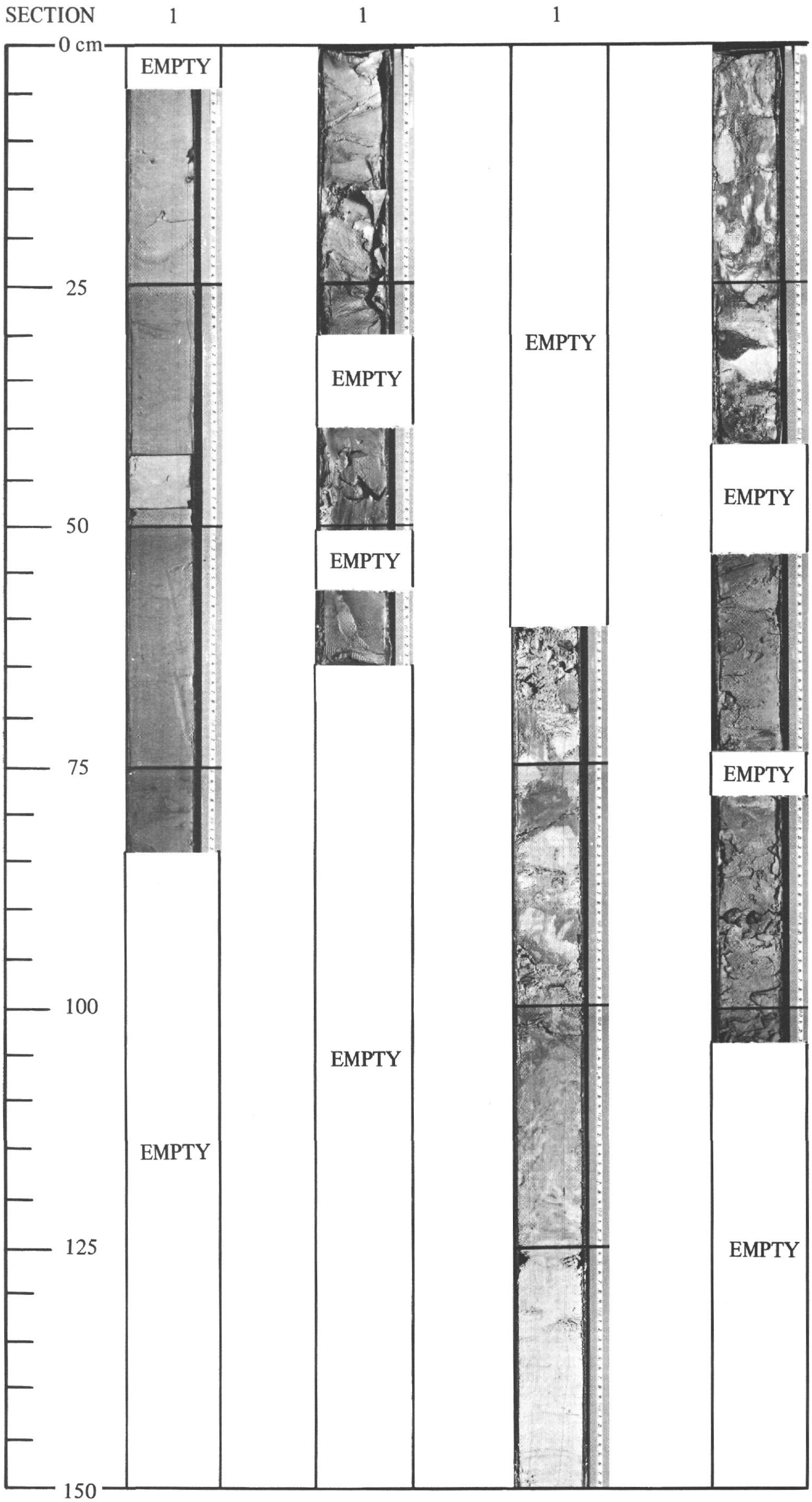

Plate 3. *Cores 5, 6, 7, and 8, Hole 29.*

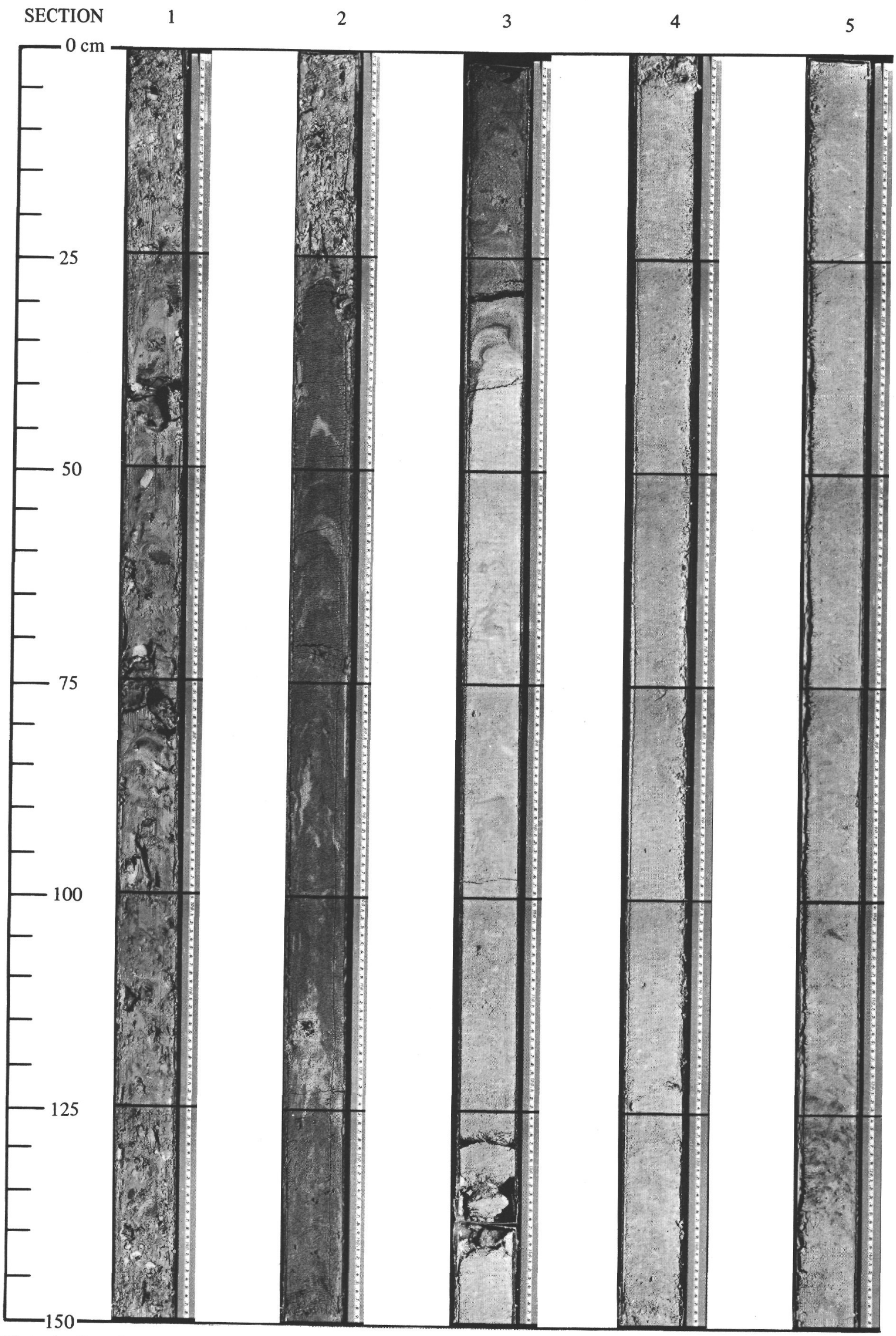

Plate 4. *Core 9, Hole 29.*

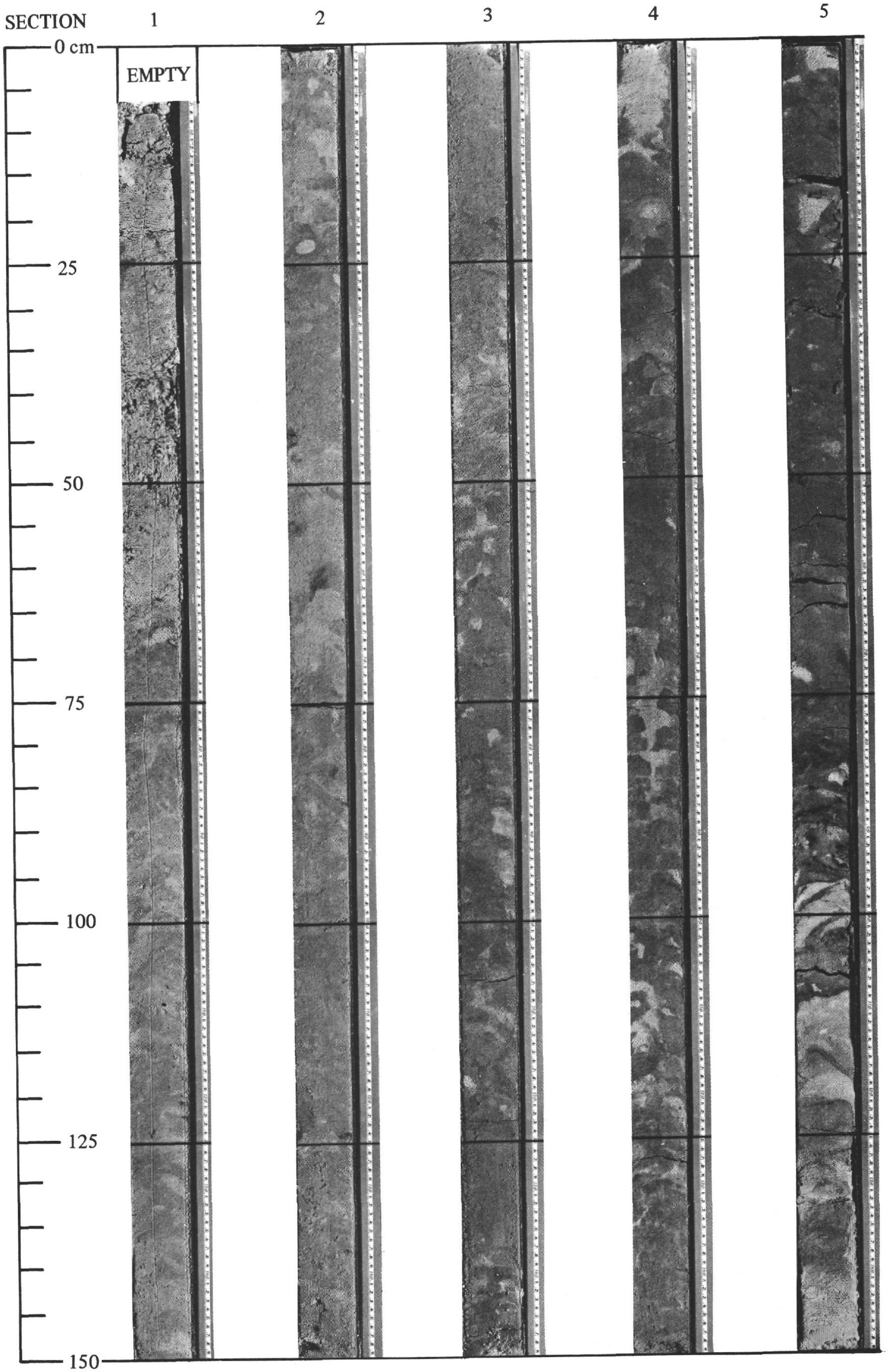

Plate 5. *Core 10, Hole 29.*

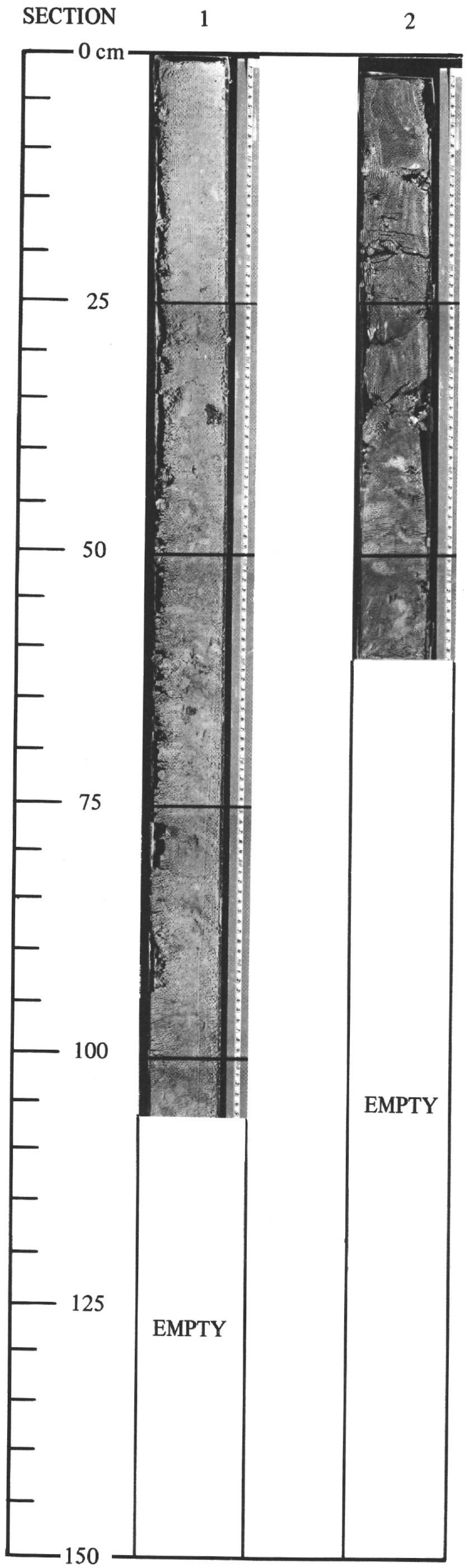

Plate 6. *Core 11, Hole 29.*

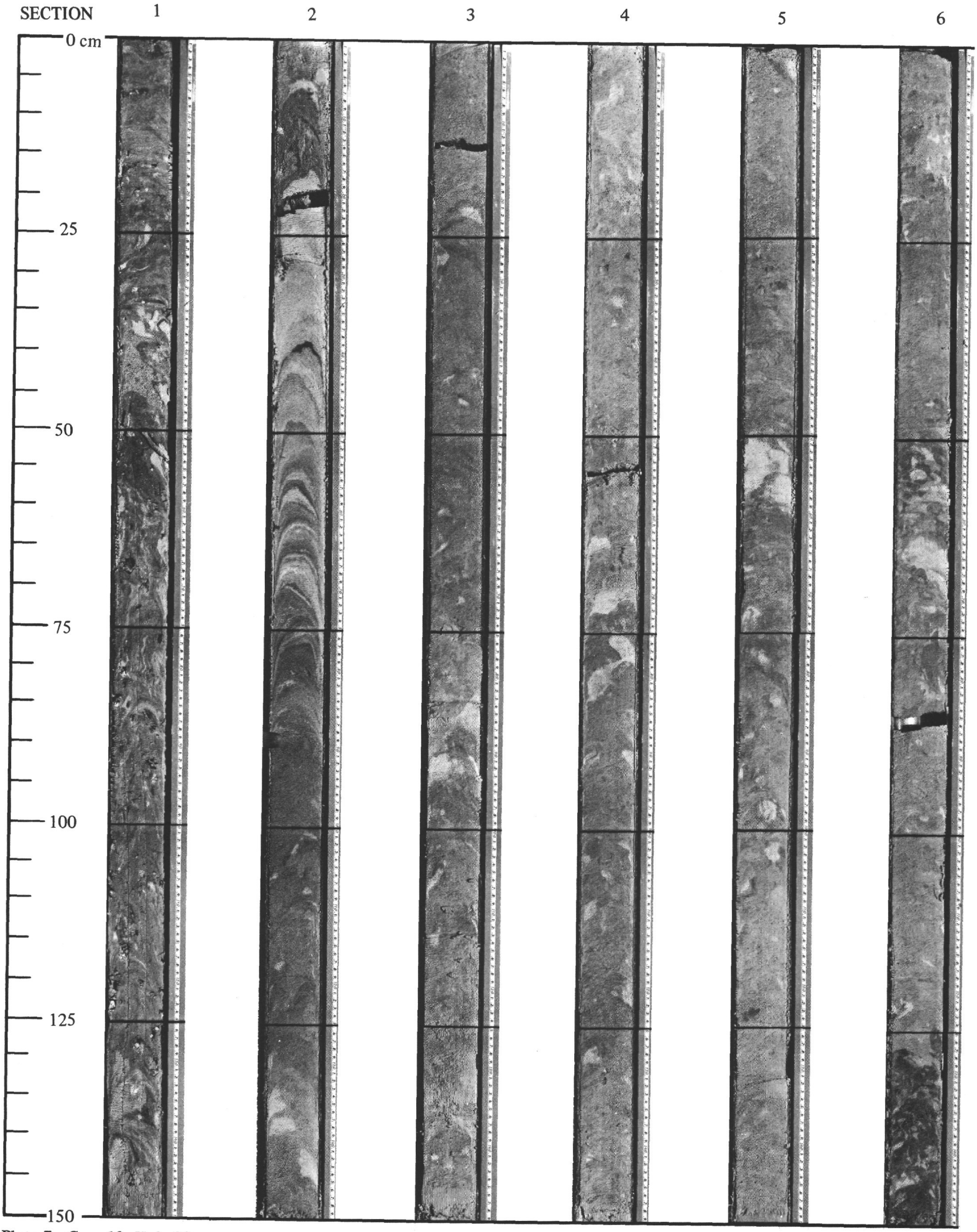

Plate 7. *Core 12, Hole 29.*

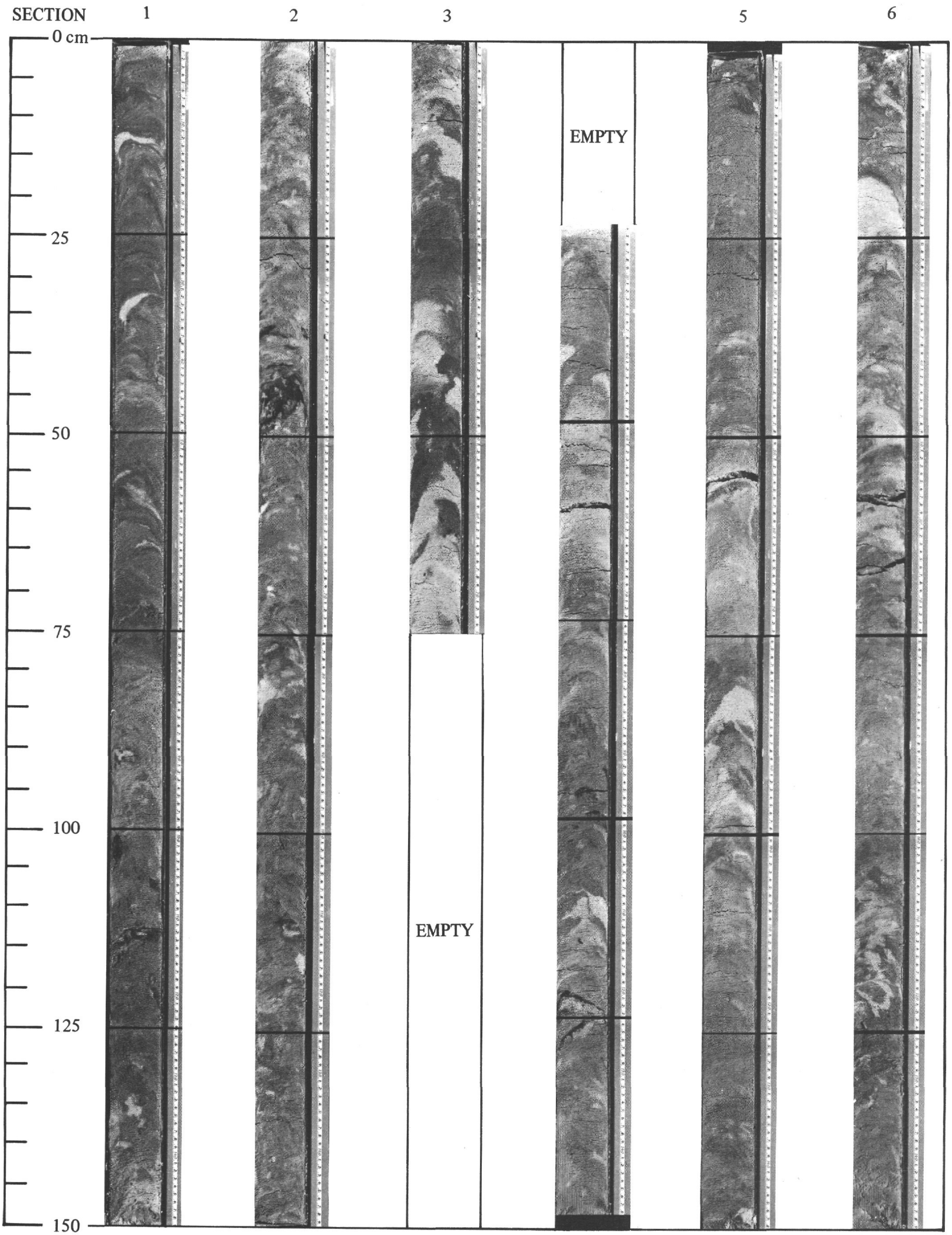

Plate 8. *Core 14, Hole 29.*

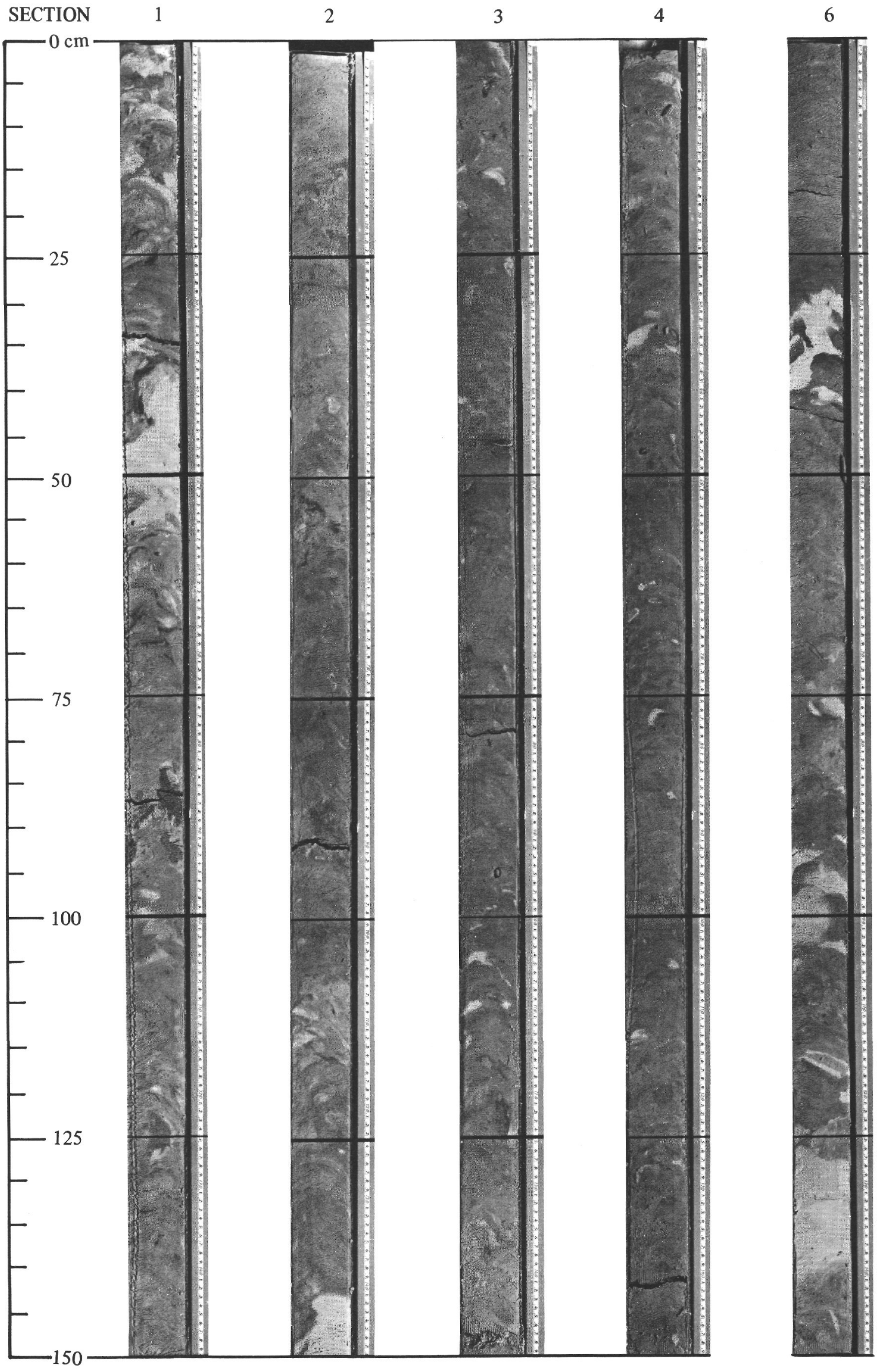

Plate 9. *Core 15, Hole 29.*

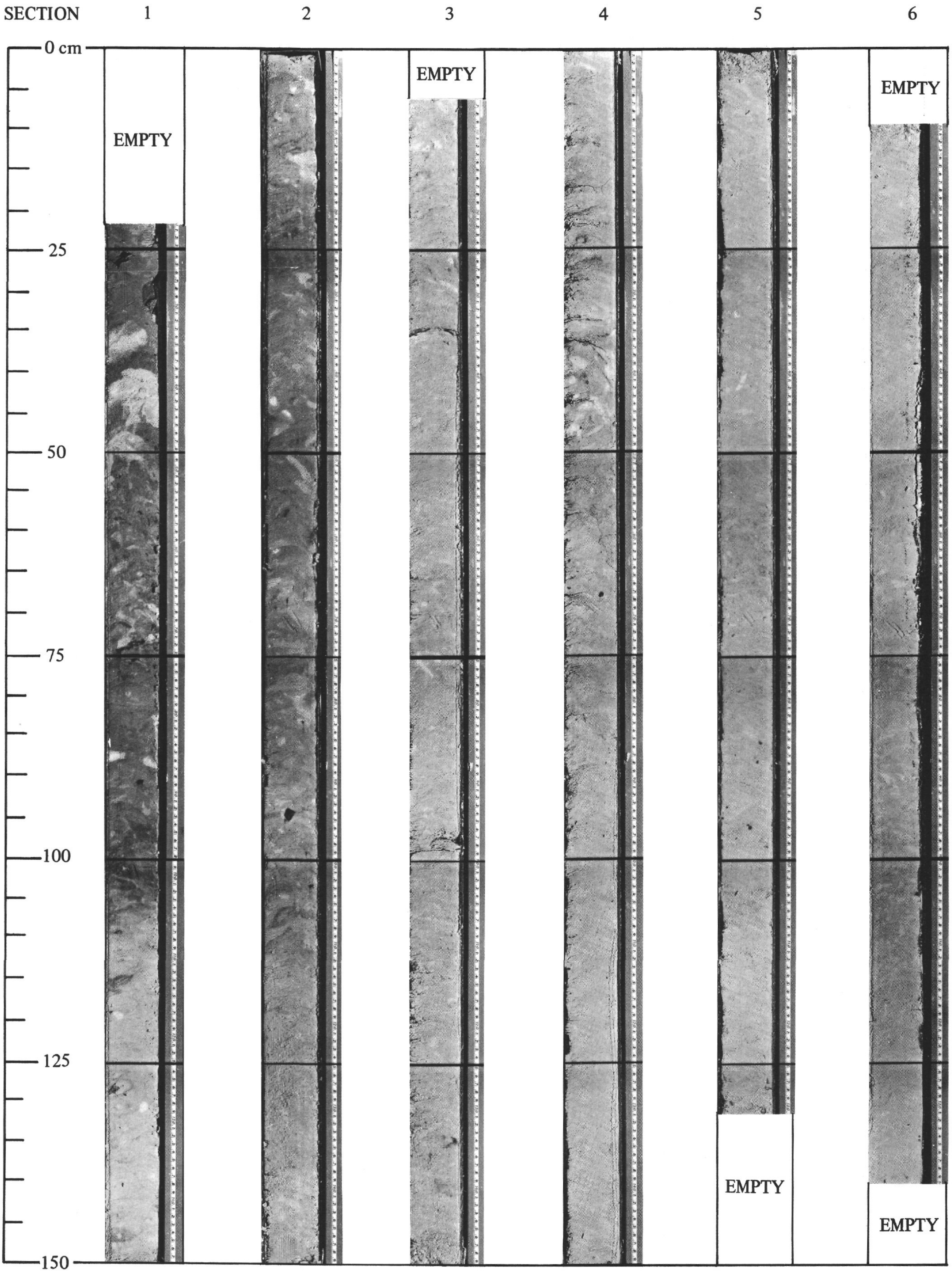

Plate 10. *Core 16, Hole 29.*

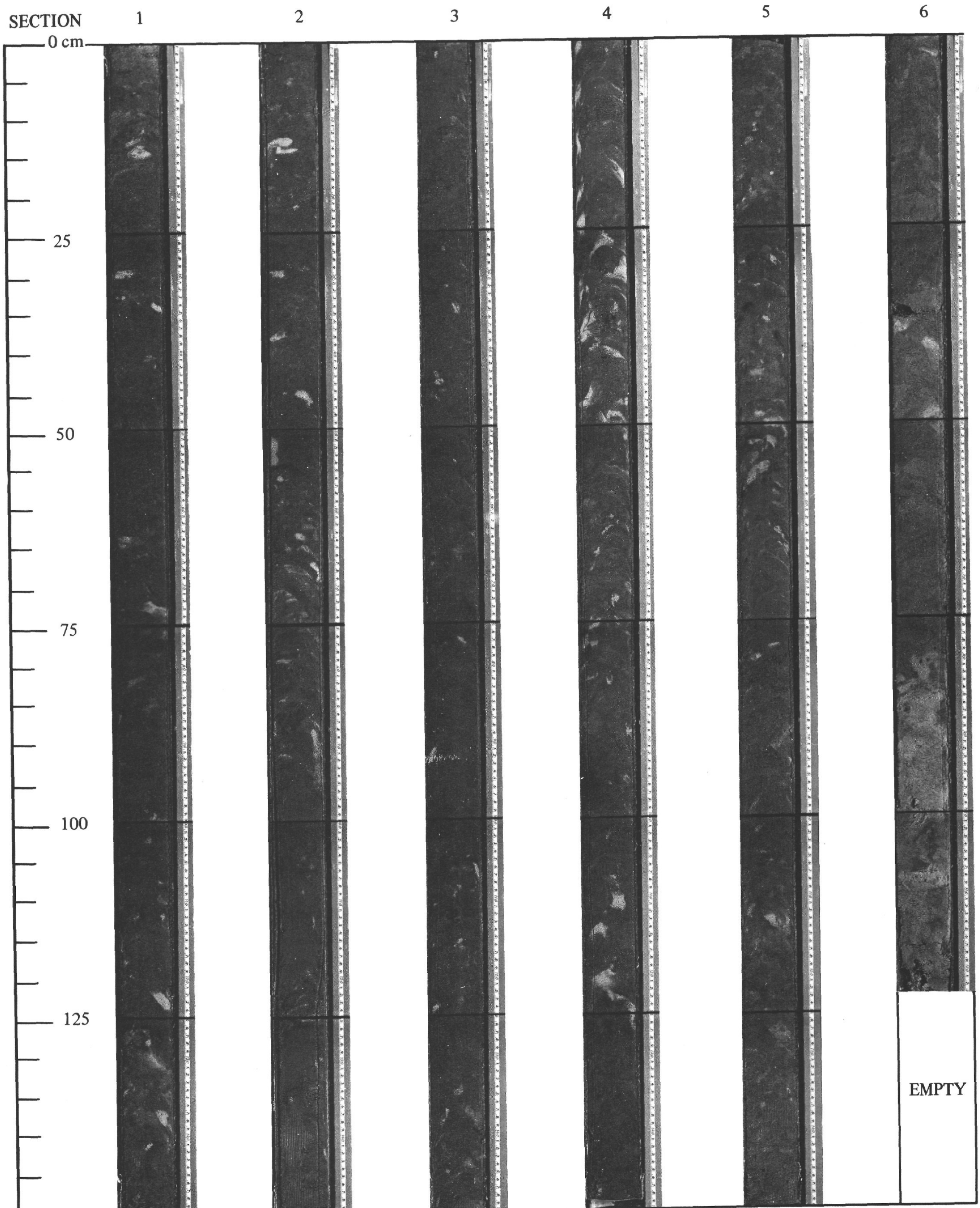

Plate 11. *Core 17, Hole 29.*

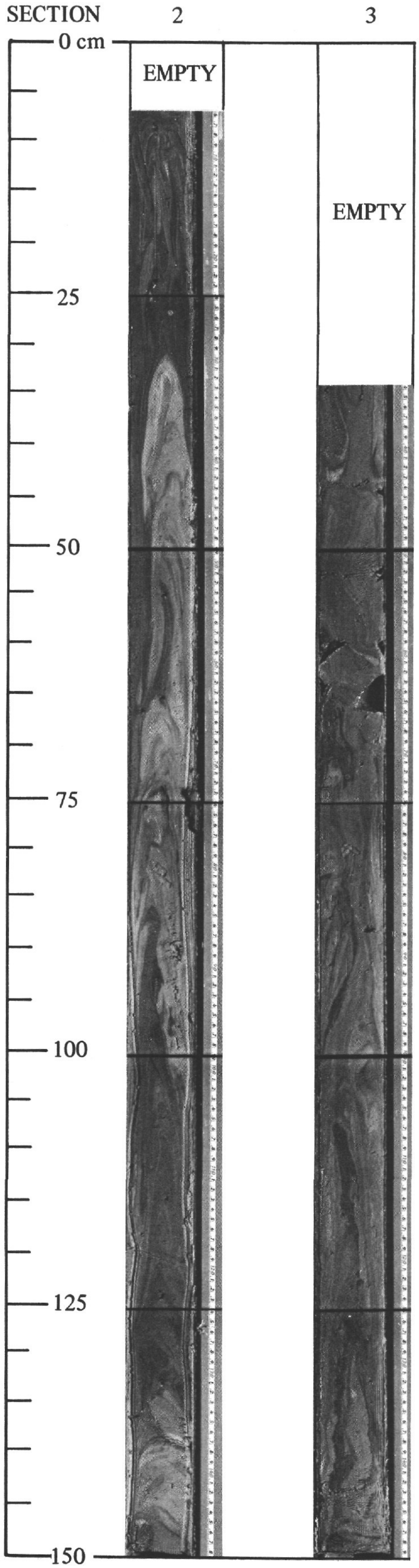

Plate 12. *Core 18, Hole 29.*

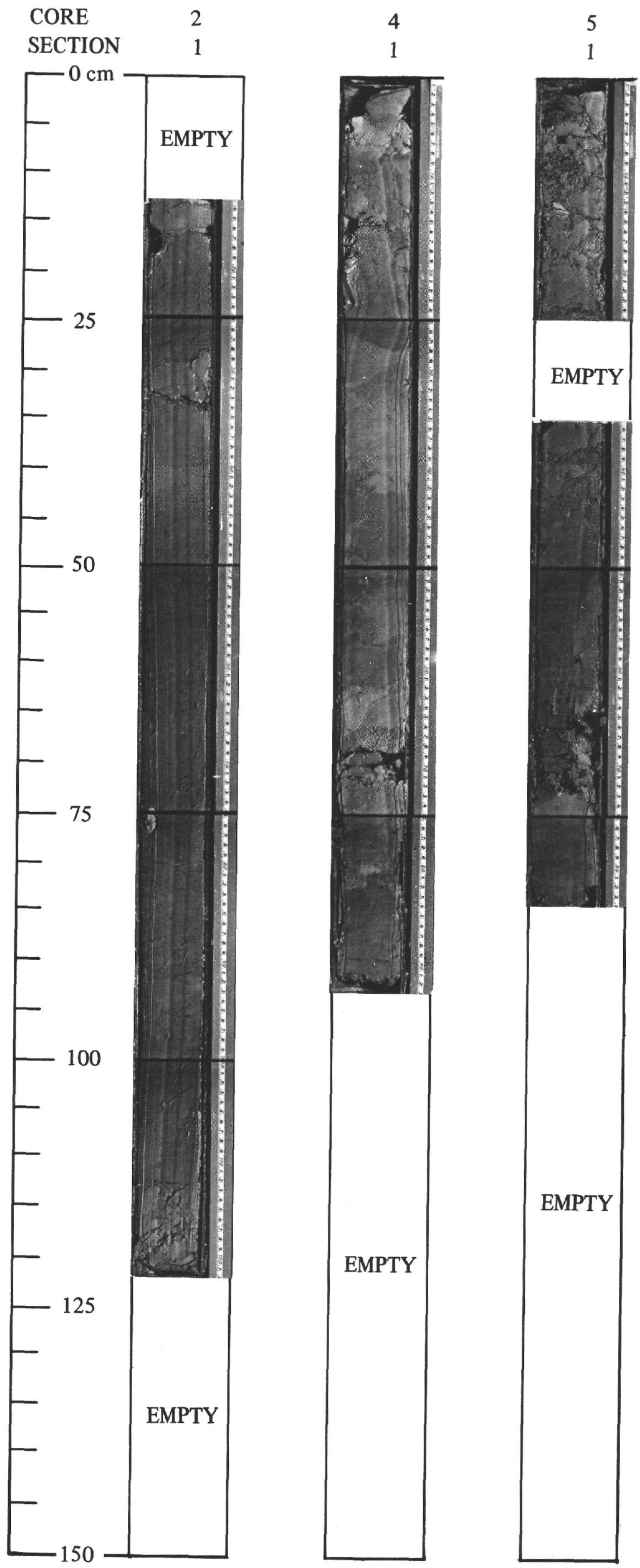

Plate 13. *Core 2, 3, and 5, Hole 29A.*

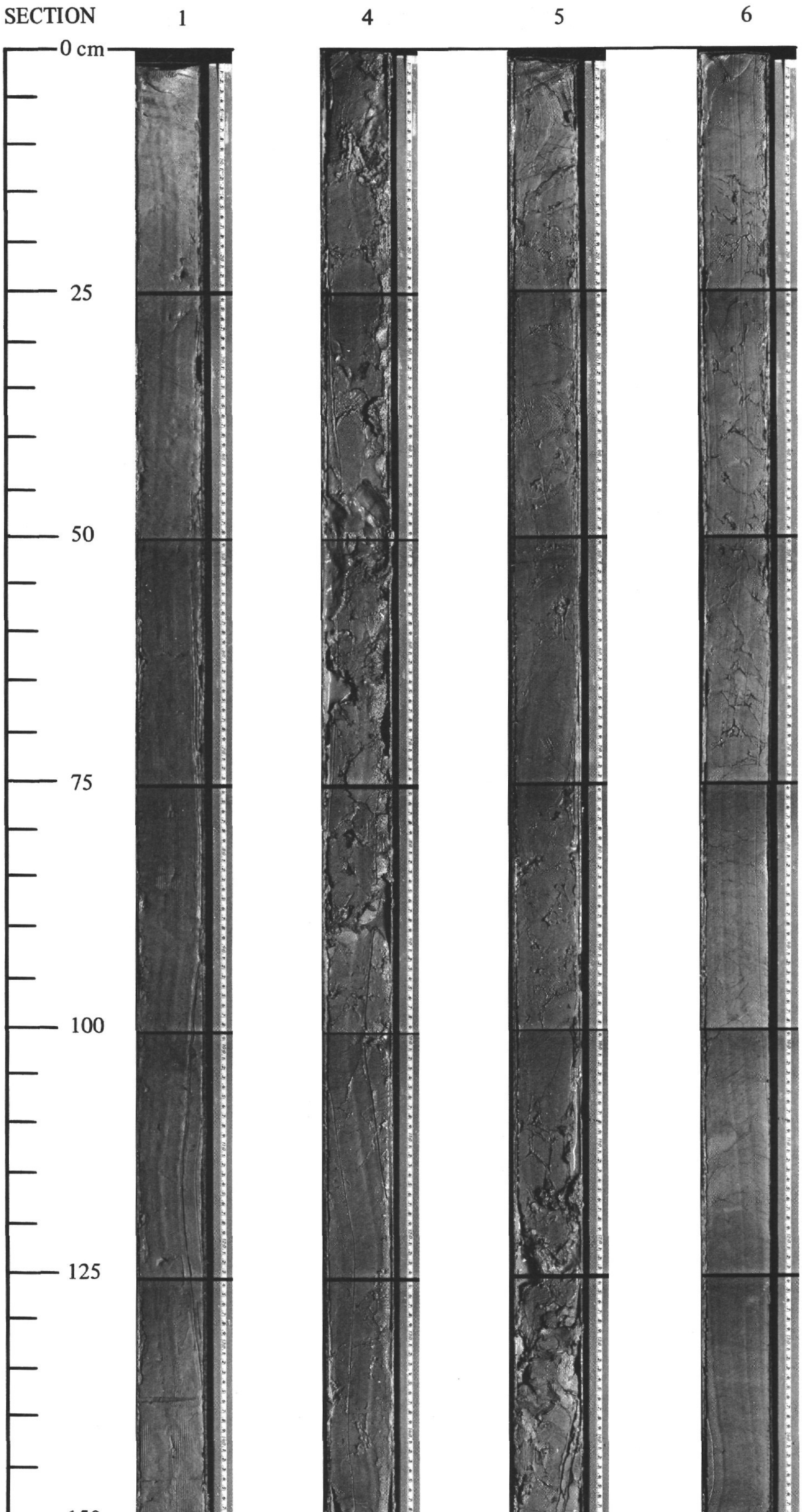

Plate 14. *Core 1, Hole 29B.*

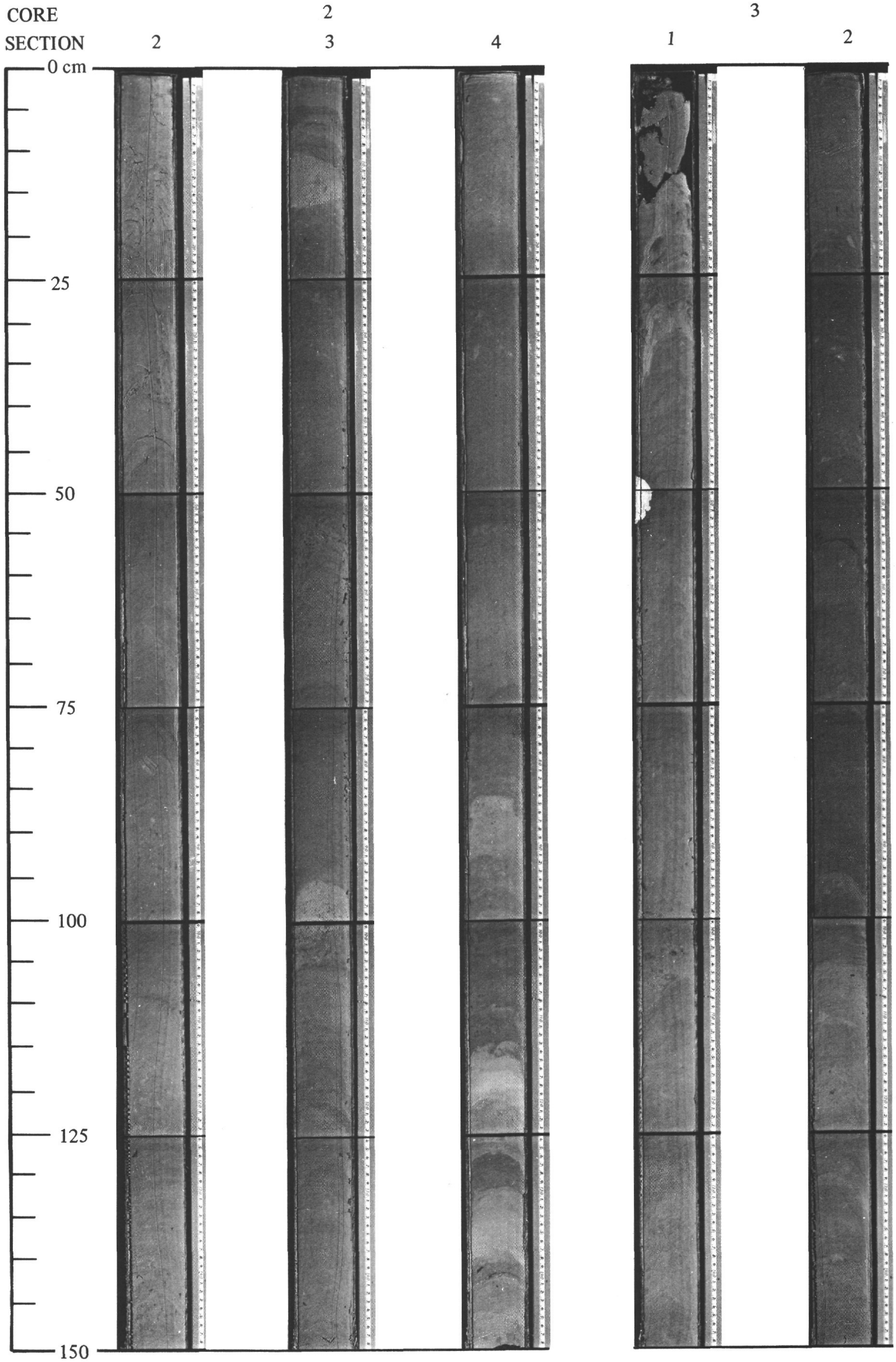

Plate 15. *Cores 2 and 3, Hole 29B.*

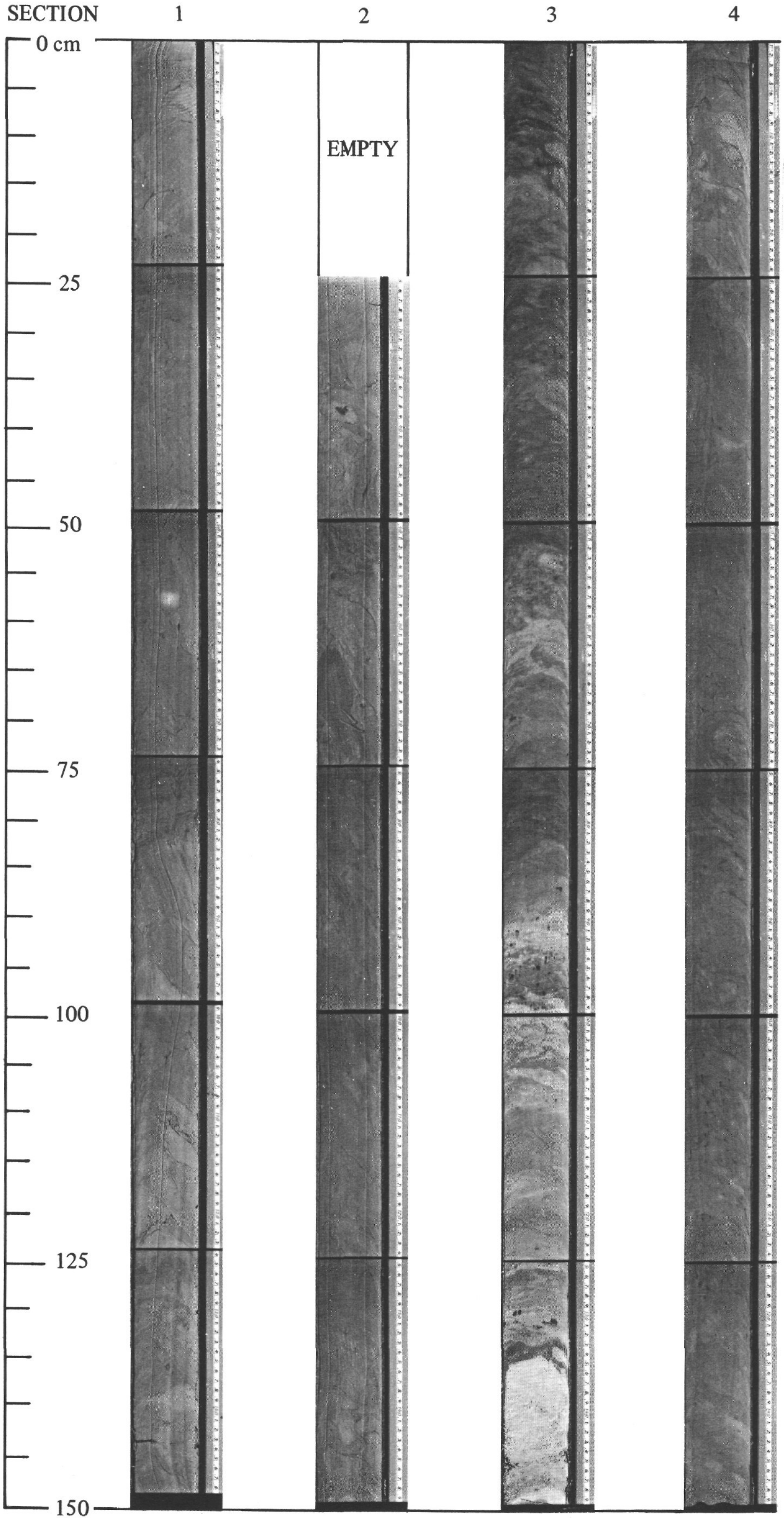

Plate 16. *Core 4, Hole 29B.*

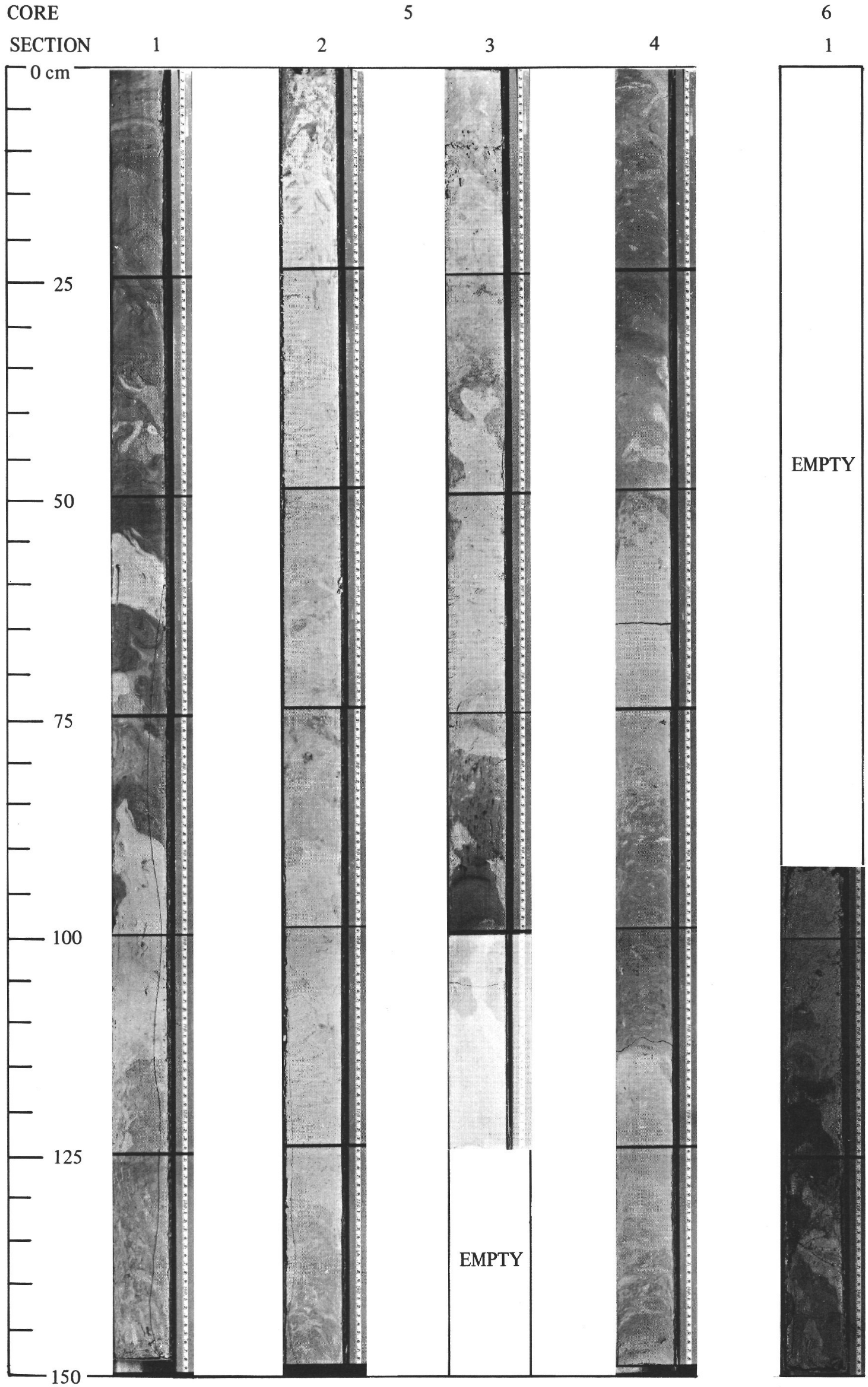

Plate 17. *Cores 5 and 6, Hole 29B.*

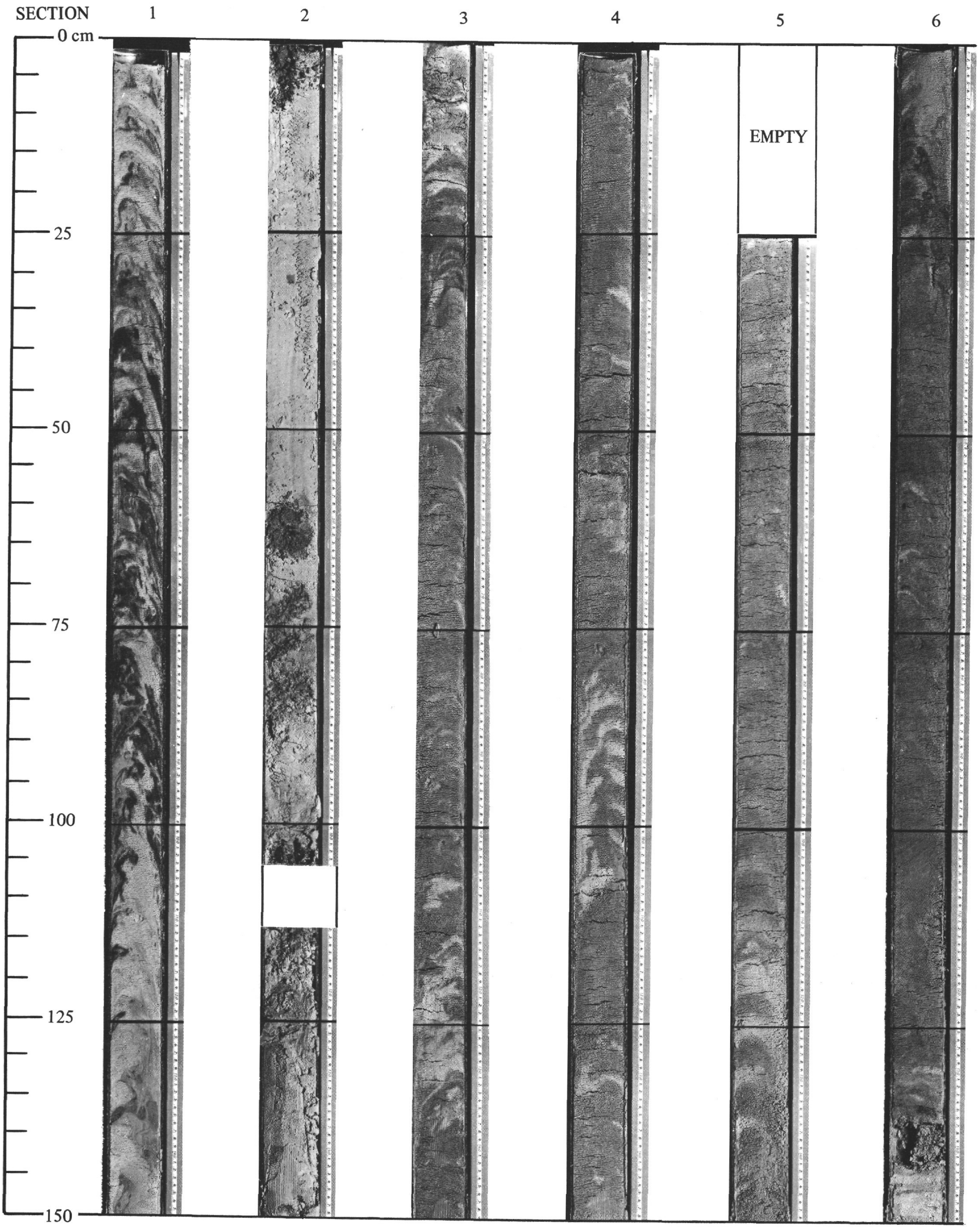

Plate 18. *Core 8, Hole 29B.*

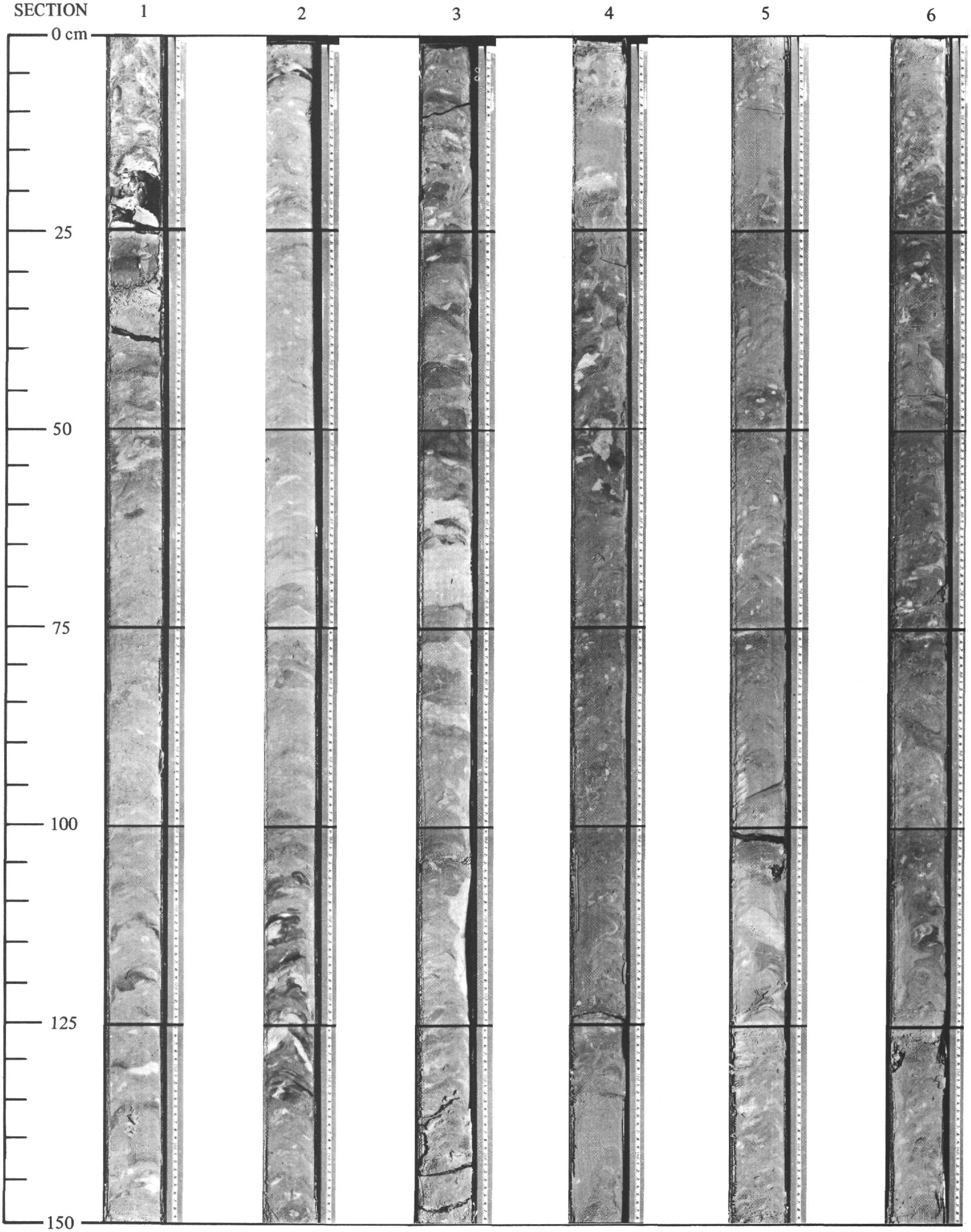

Plate 19. *Core 9, Hole 29B.*

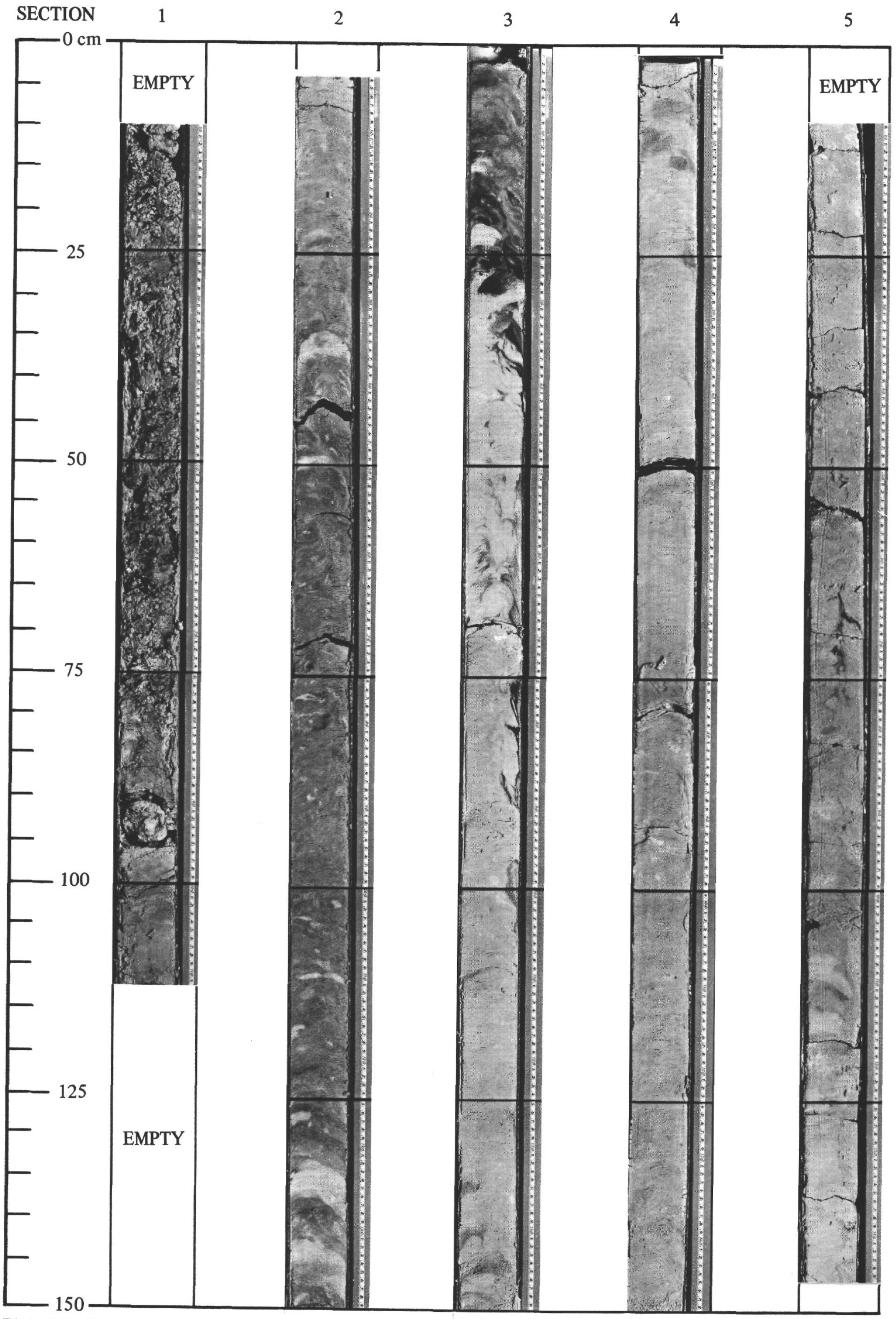

Plate 20. *Core 10, Hole 29B.*

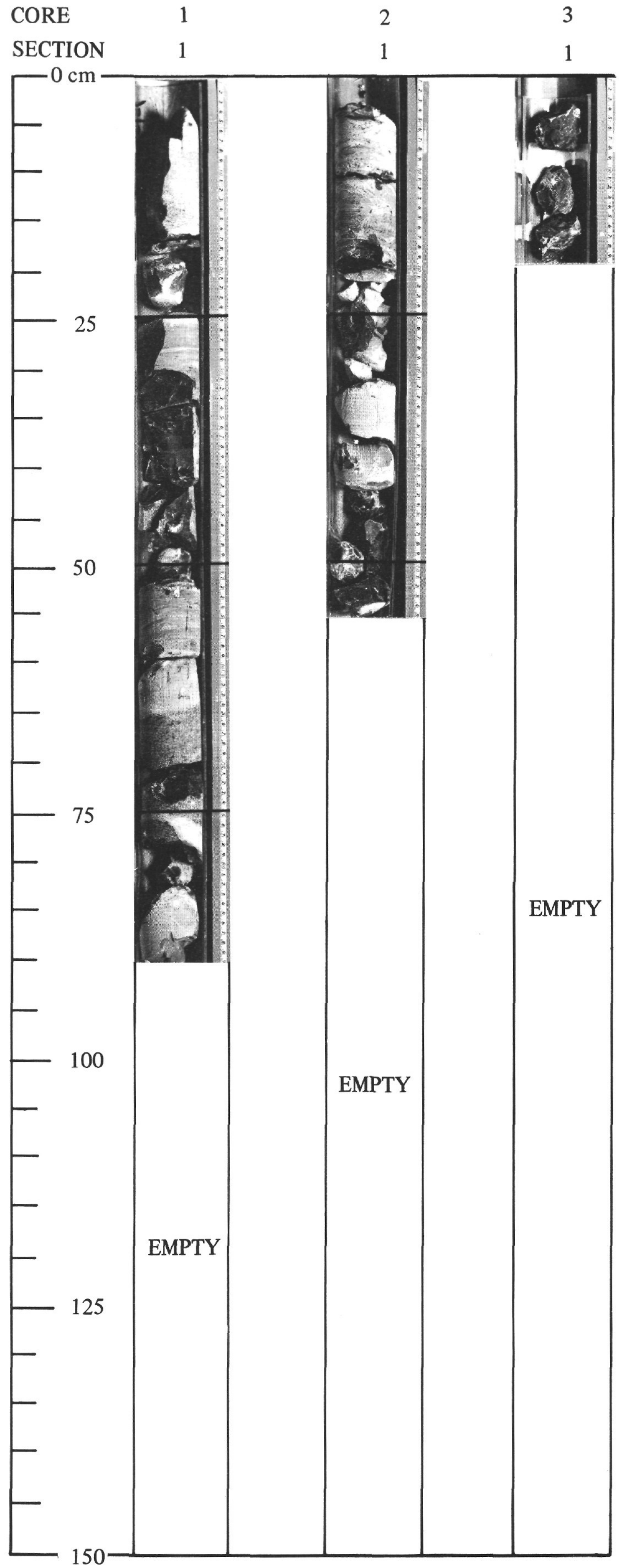

Plate 21. *Cores 1, 2, and 3, Hole 29C.*

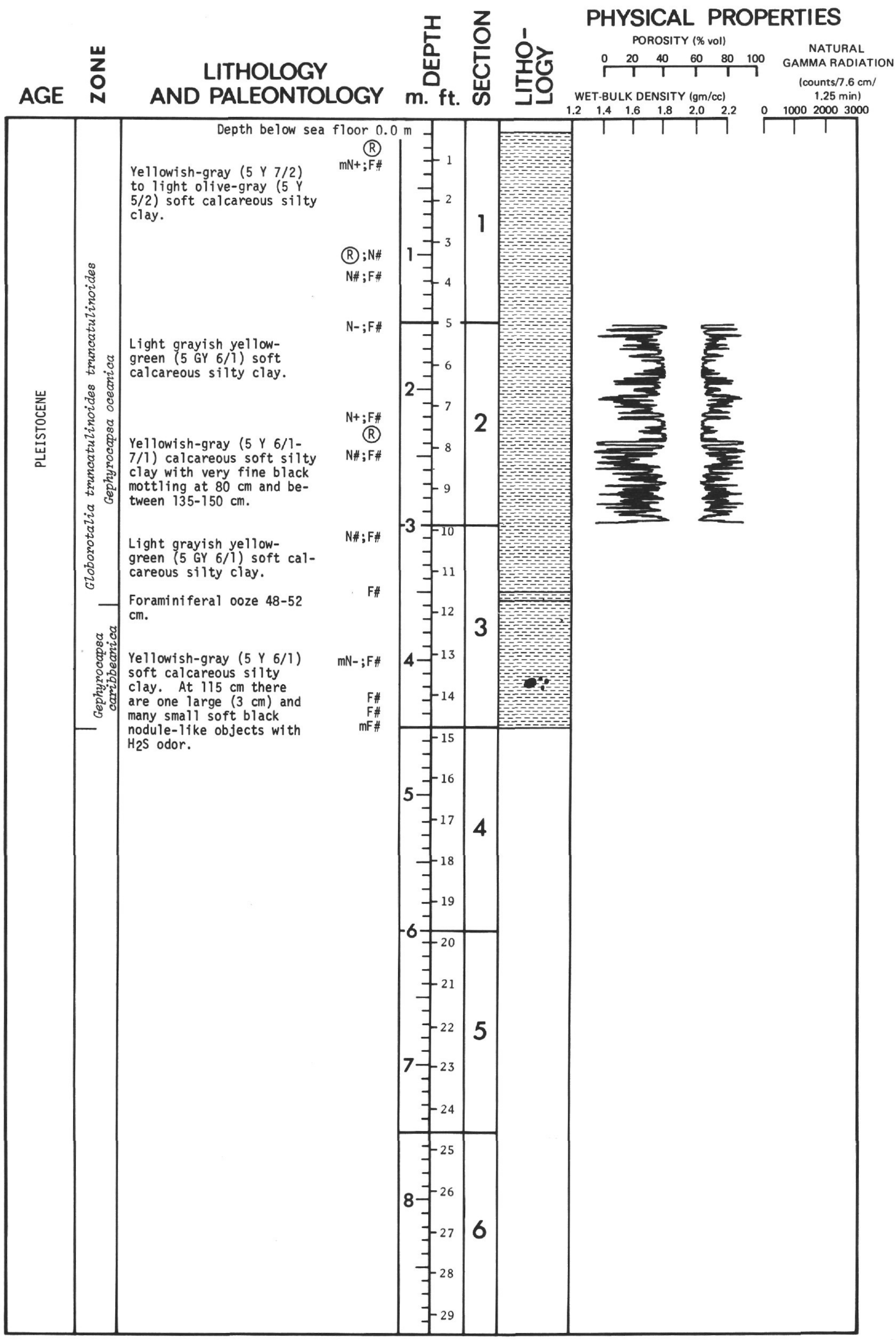

Figure 6. *Core 1, Hole 29.*

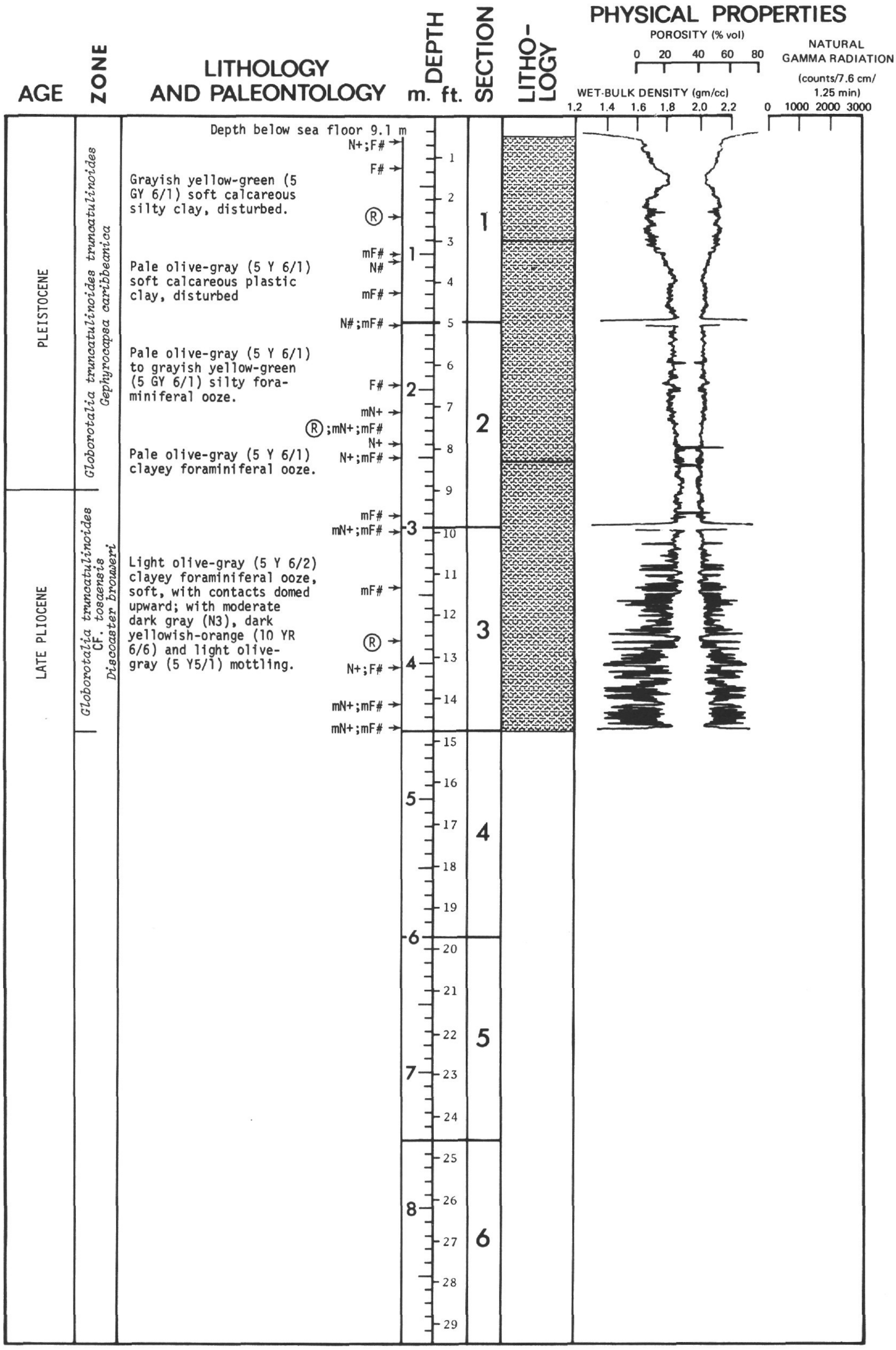

Figure 7. *Core 2, Hole 29.*

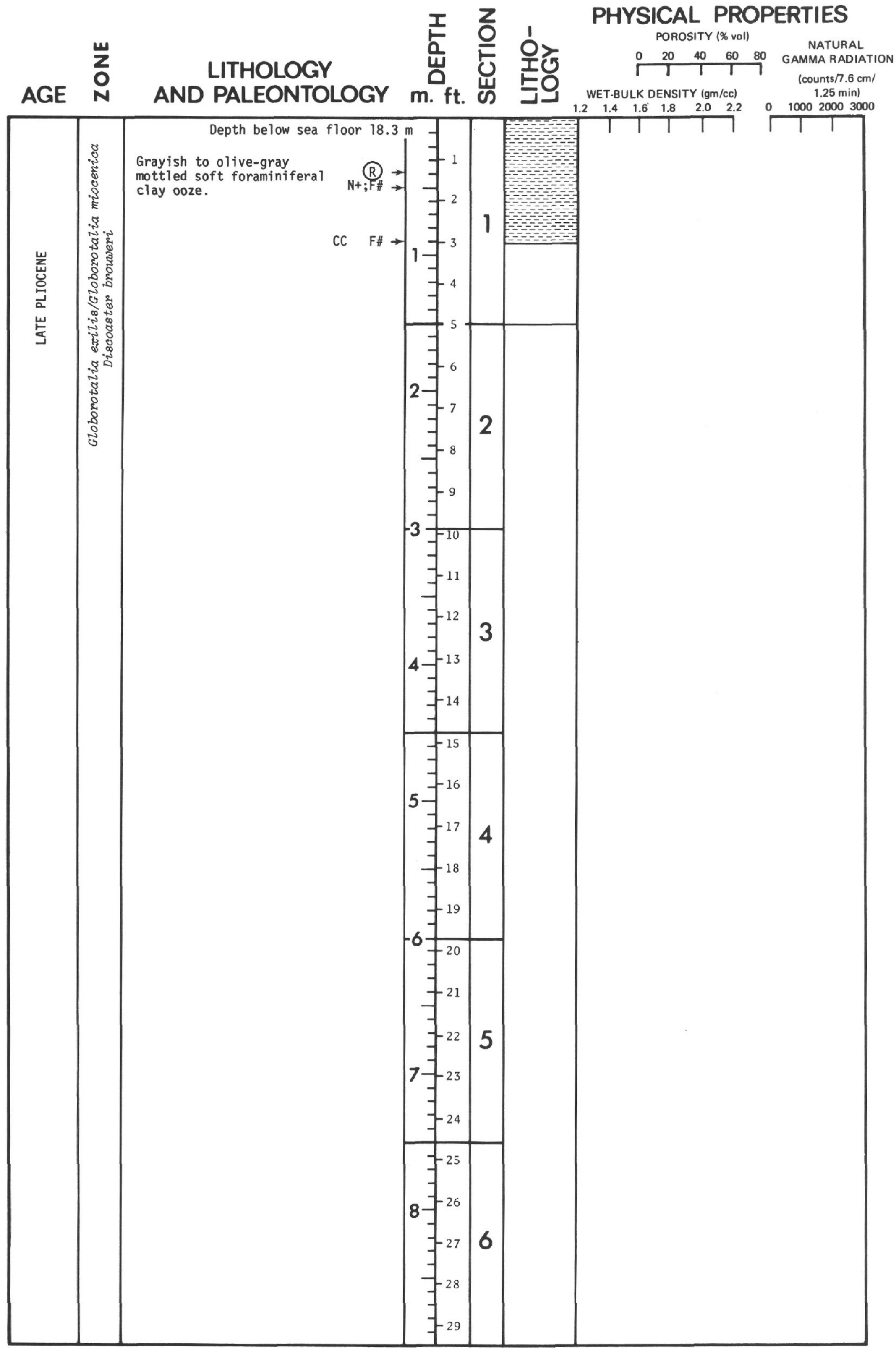

Figure 8. *Core 3, Hole 29.*

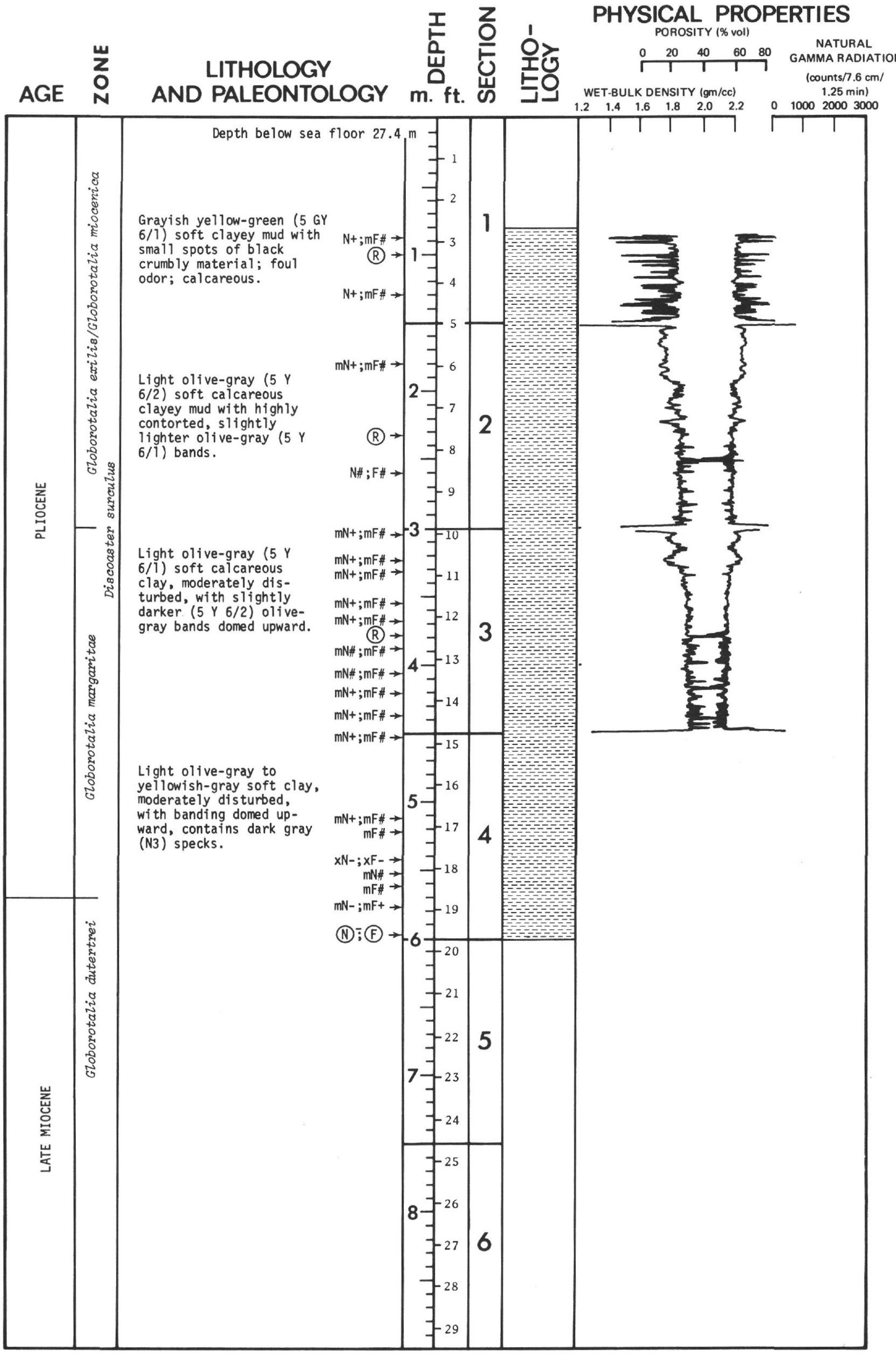

Figure 9. *Core 8, Hole 29.*

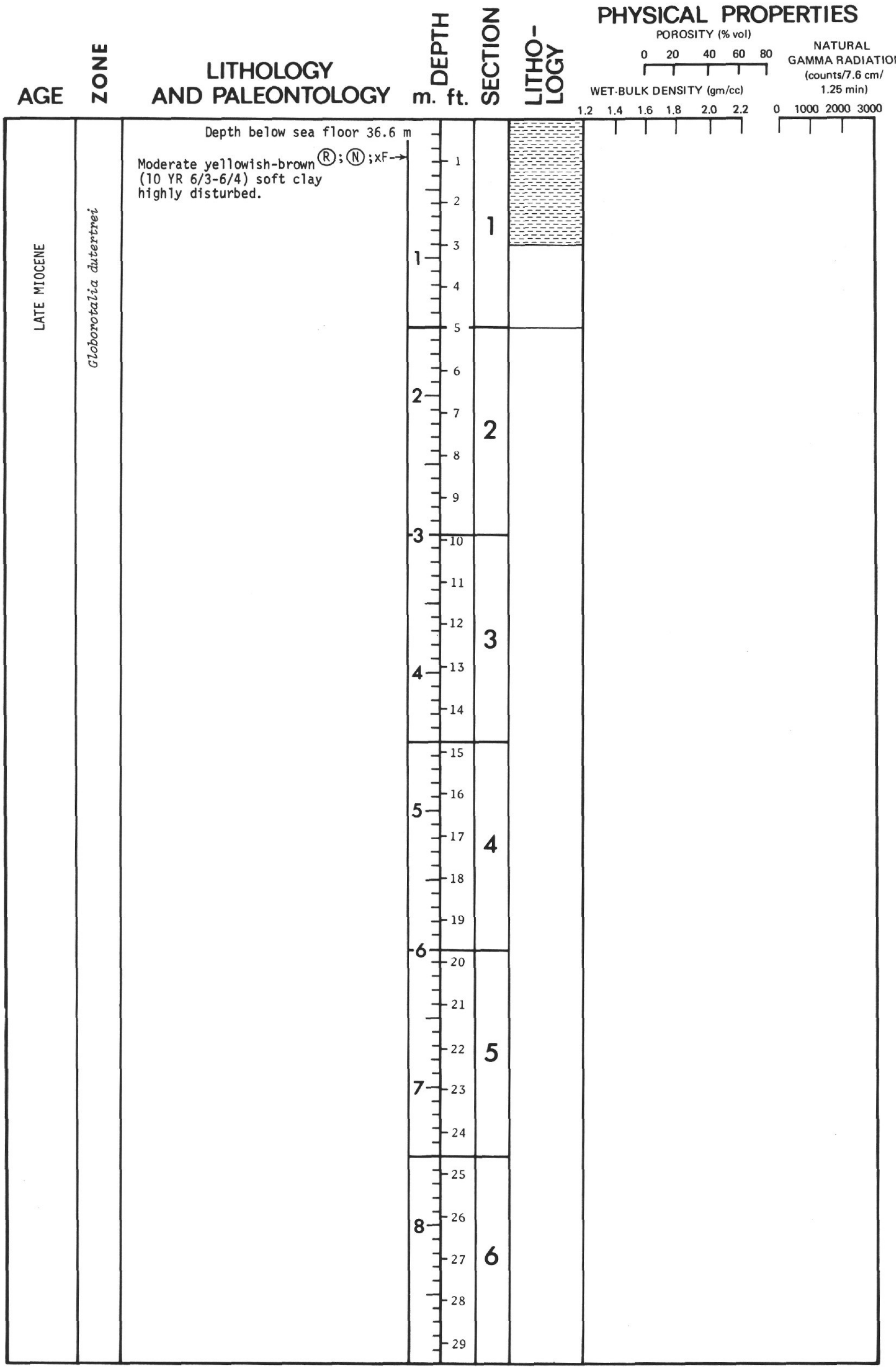

Figure 10. *Core 5, Hole 29.*

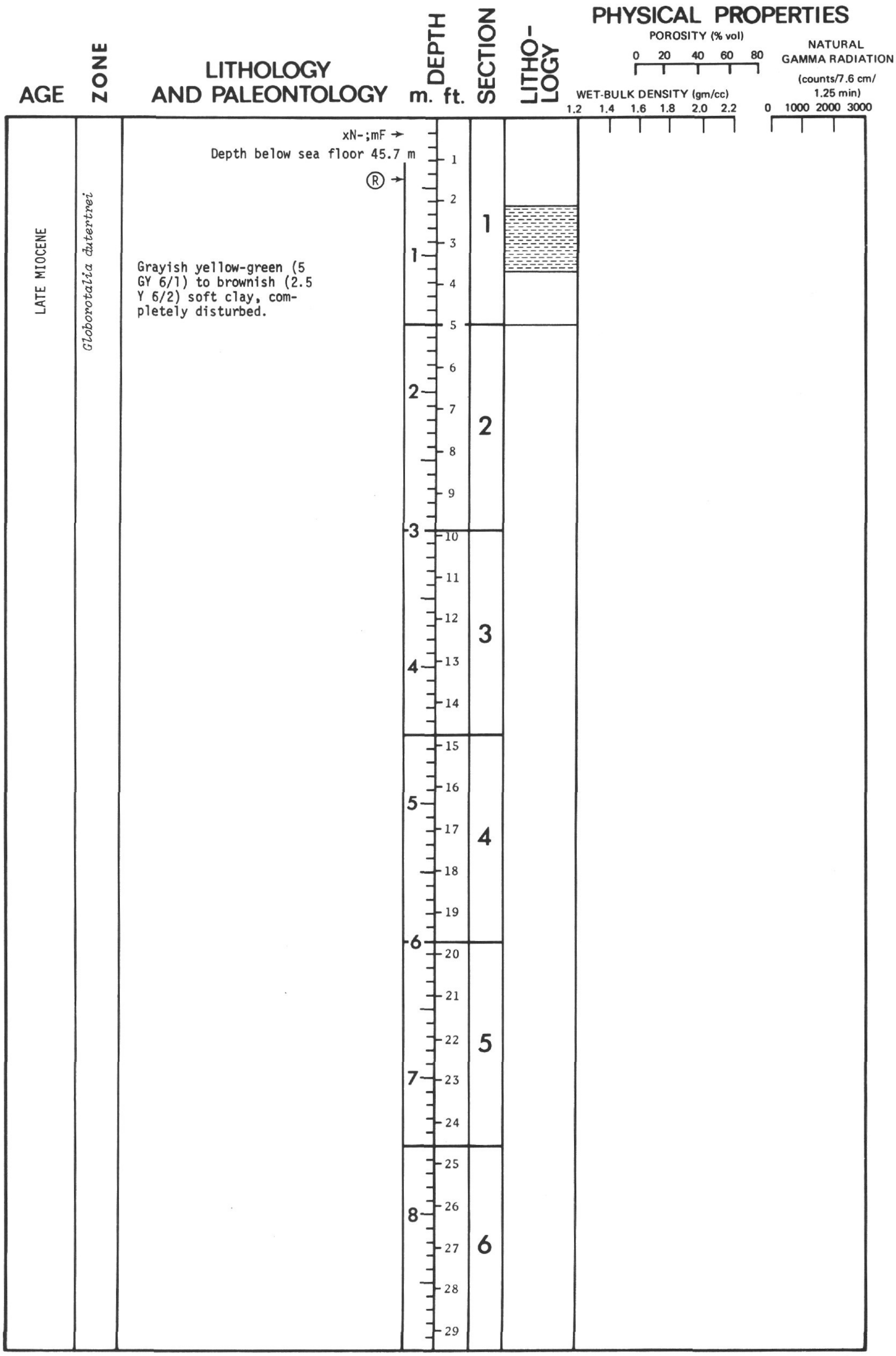

Figure 11. *Core 6, Hole 29.*

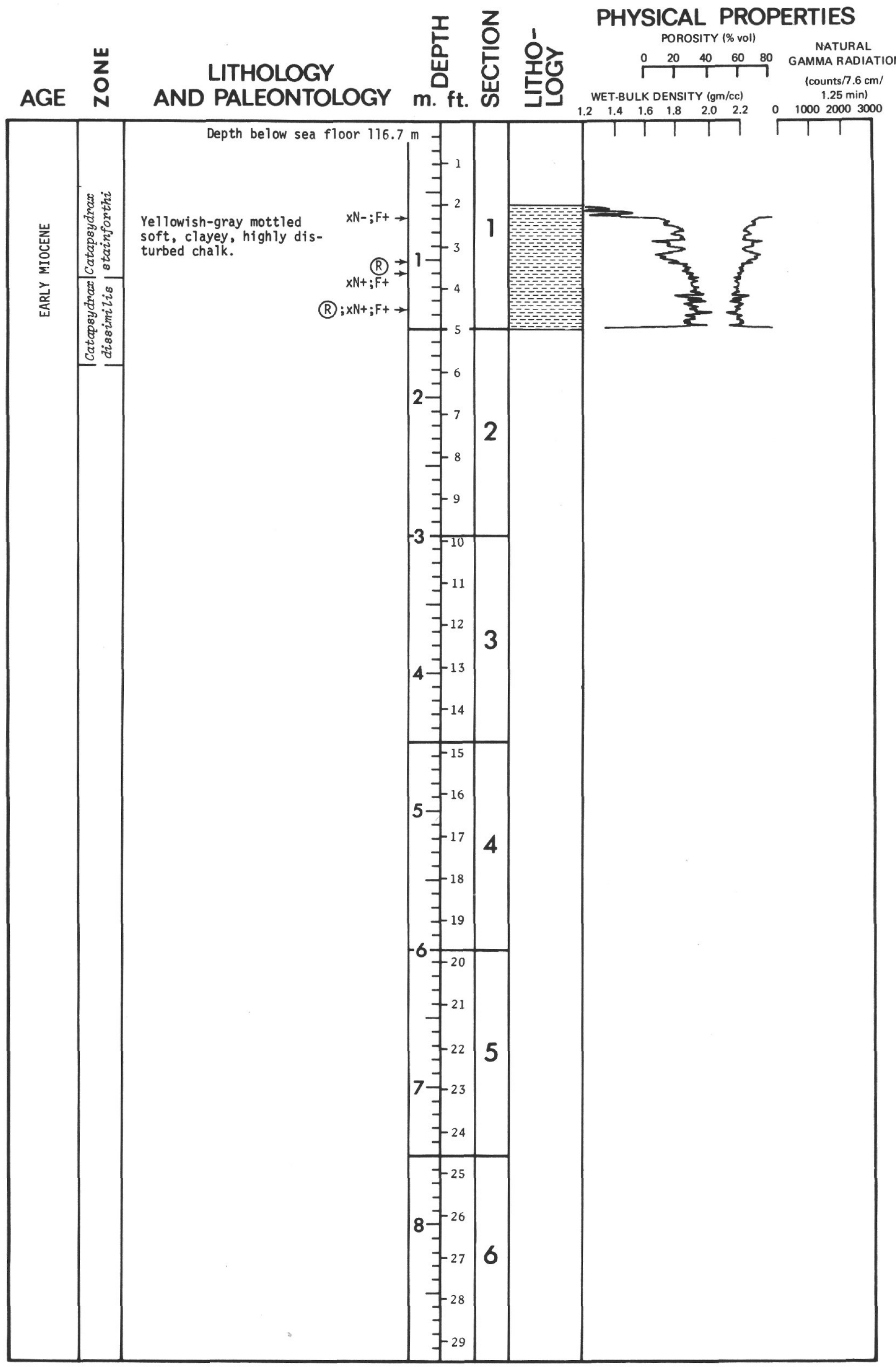

Figure 12. *Core 7, Hole 29.*

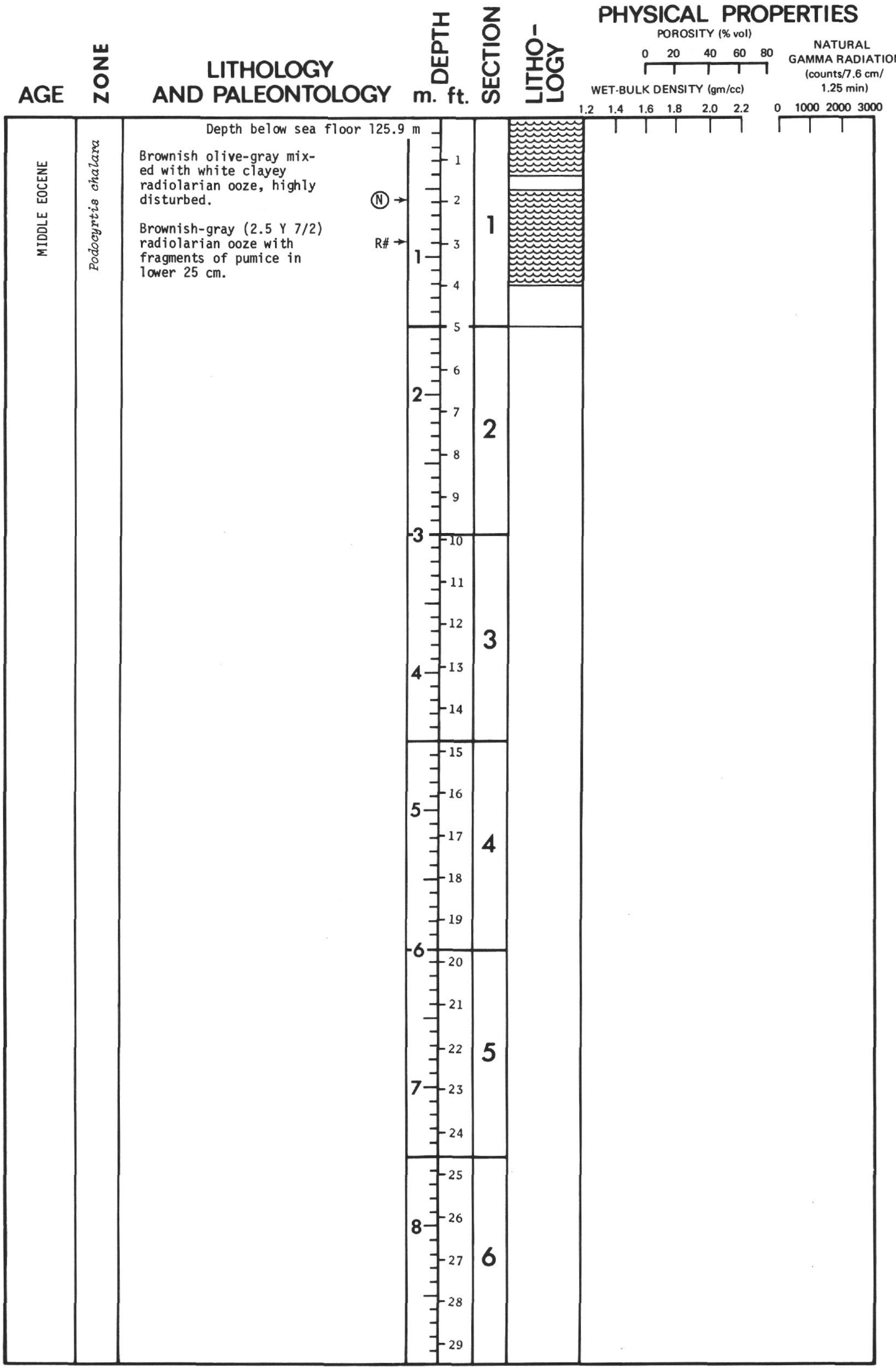

Figure 13. *Core 8, Hole 29.*

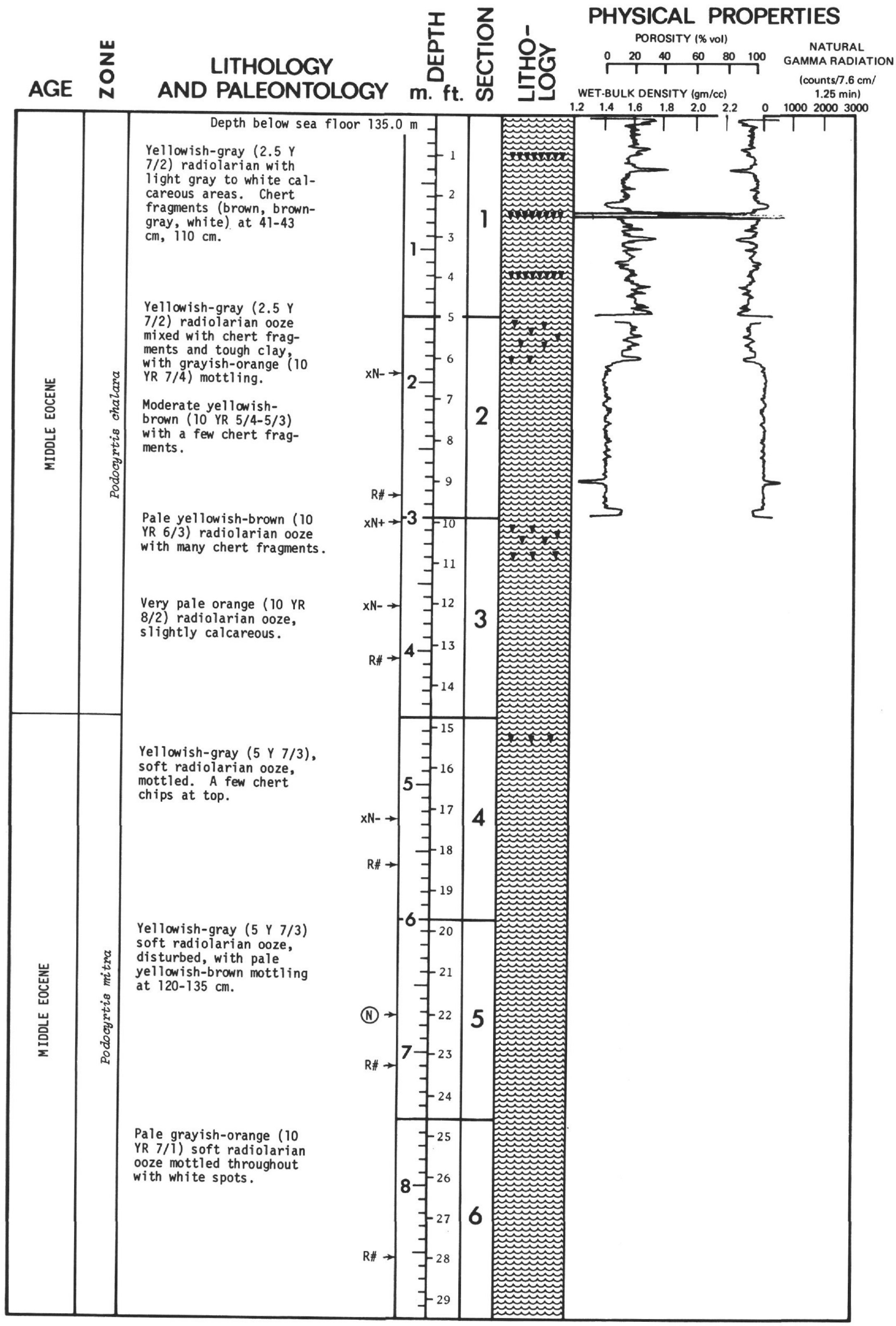

Figure 14. *Core 9, Hole 29.*

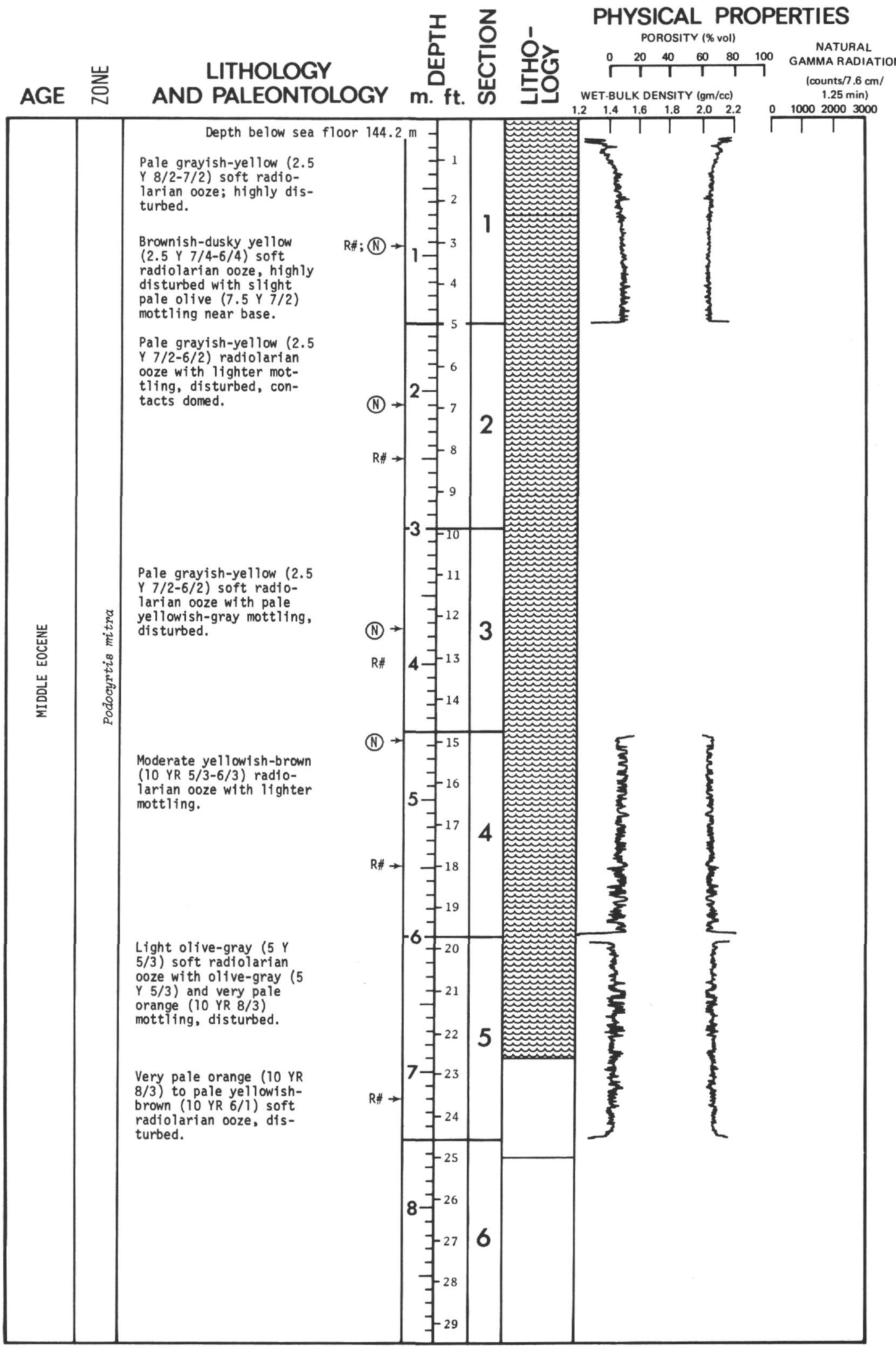

Figure 15. *Core 10, Hole 29.*

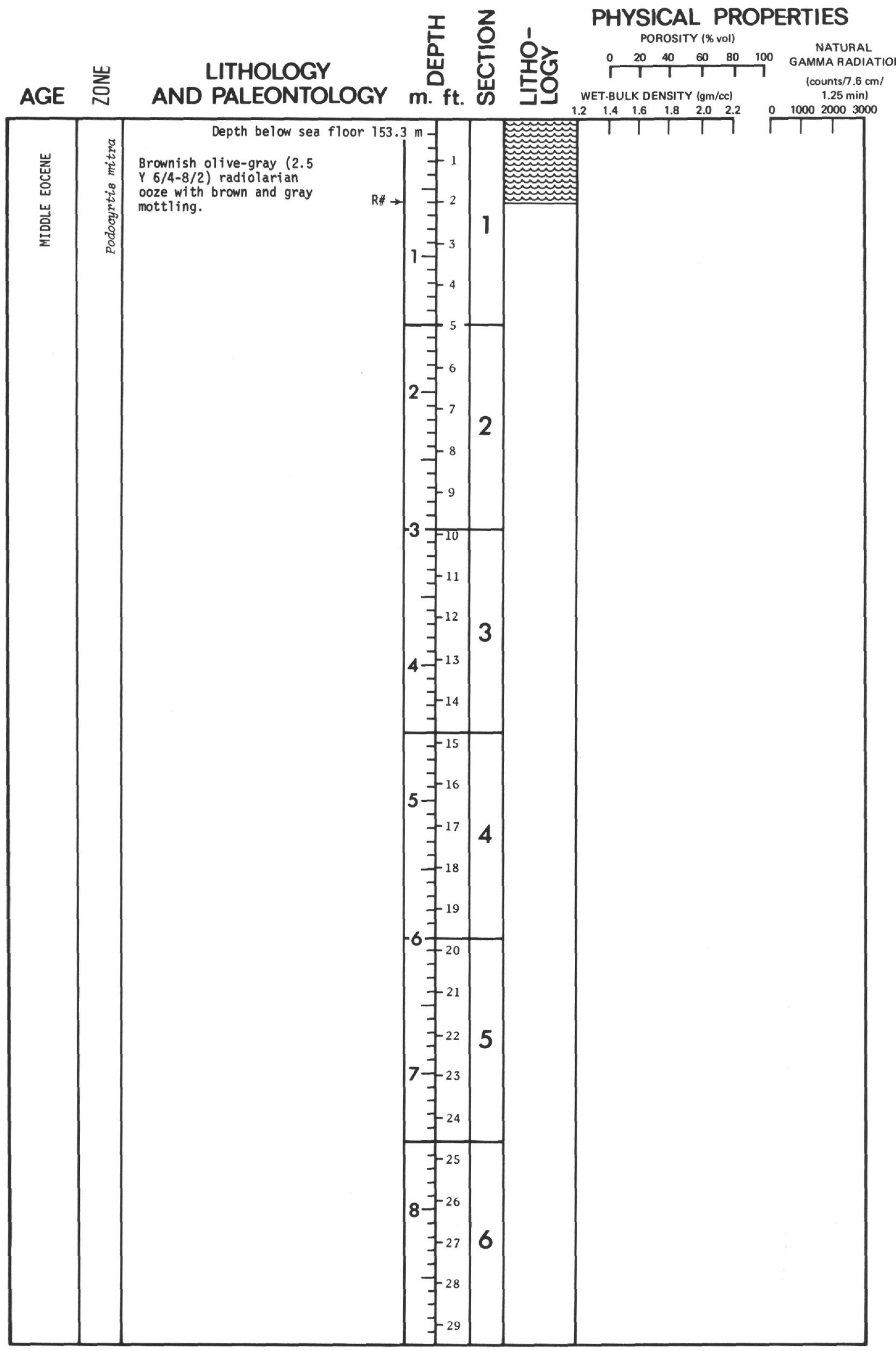

Figure 16. *Core 11, Hole 29.*

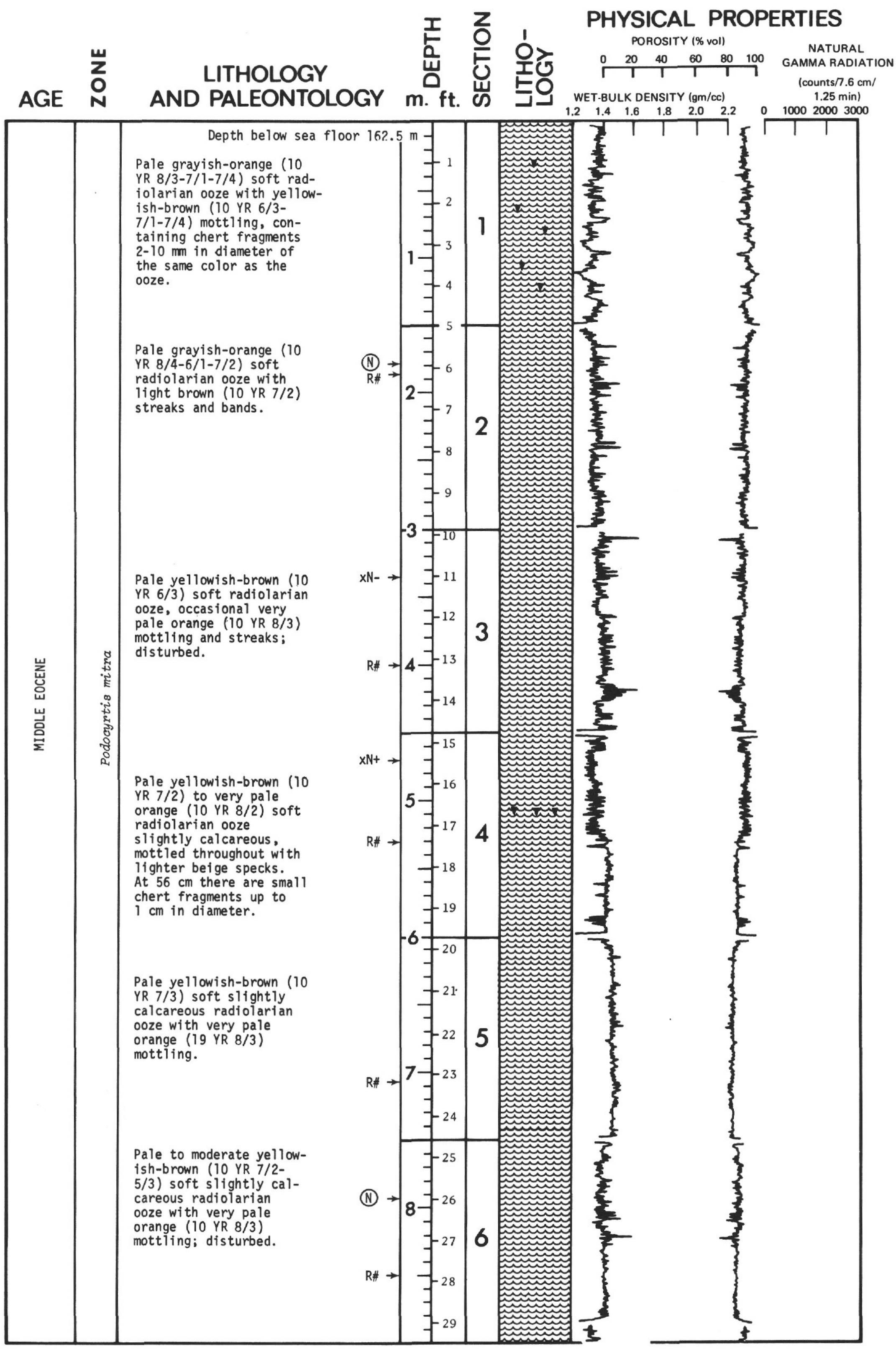

Figure 17. *Core 12, Hole 29.*

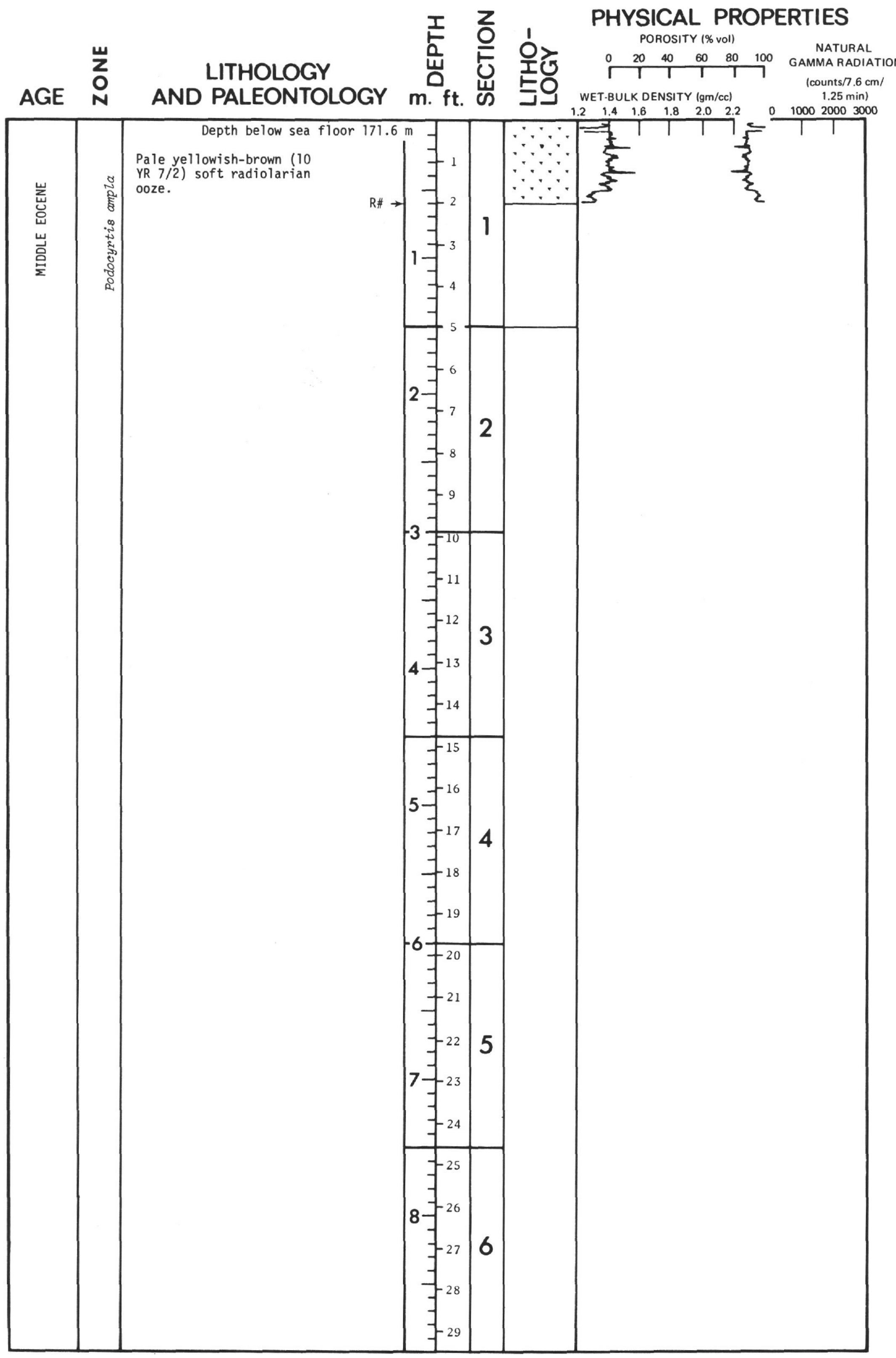

Figure 18. *Core 13, Hole 29.*

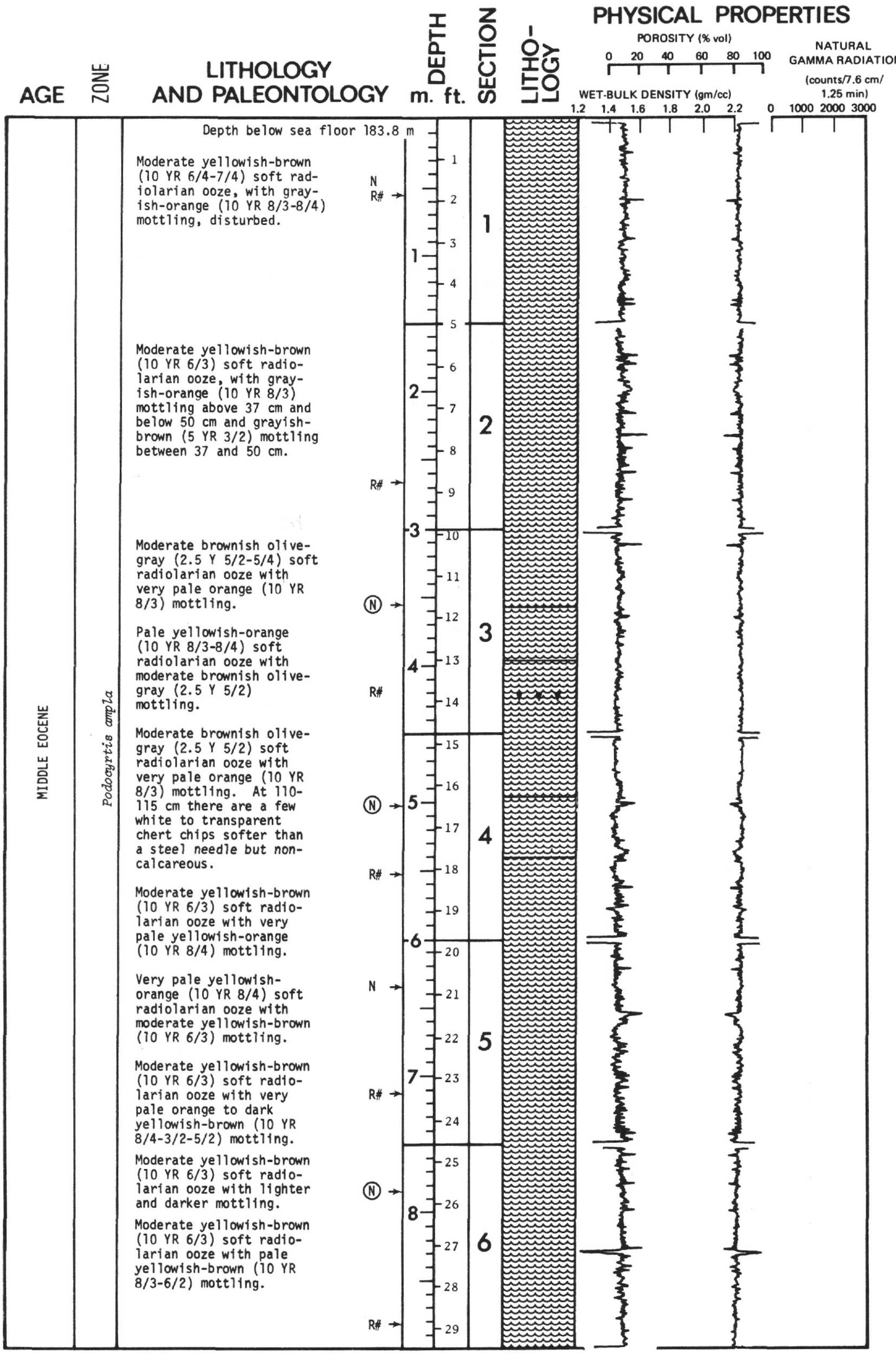

Figure 19. *Core 14, Hole 29.*

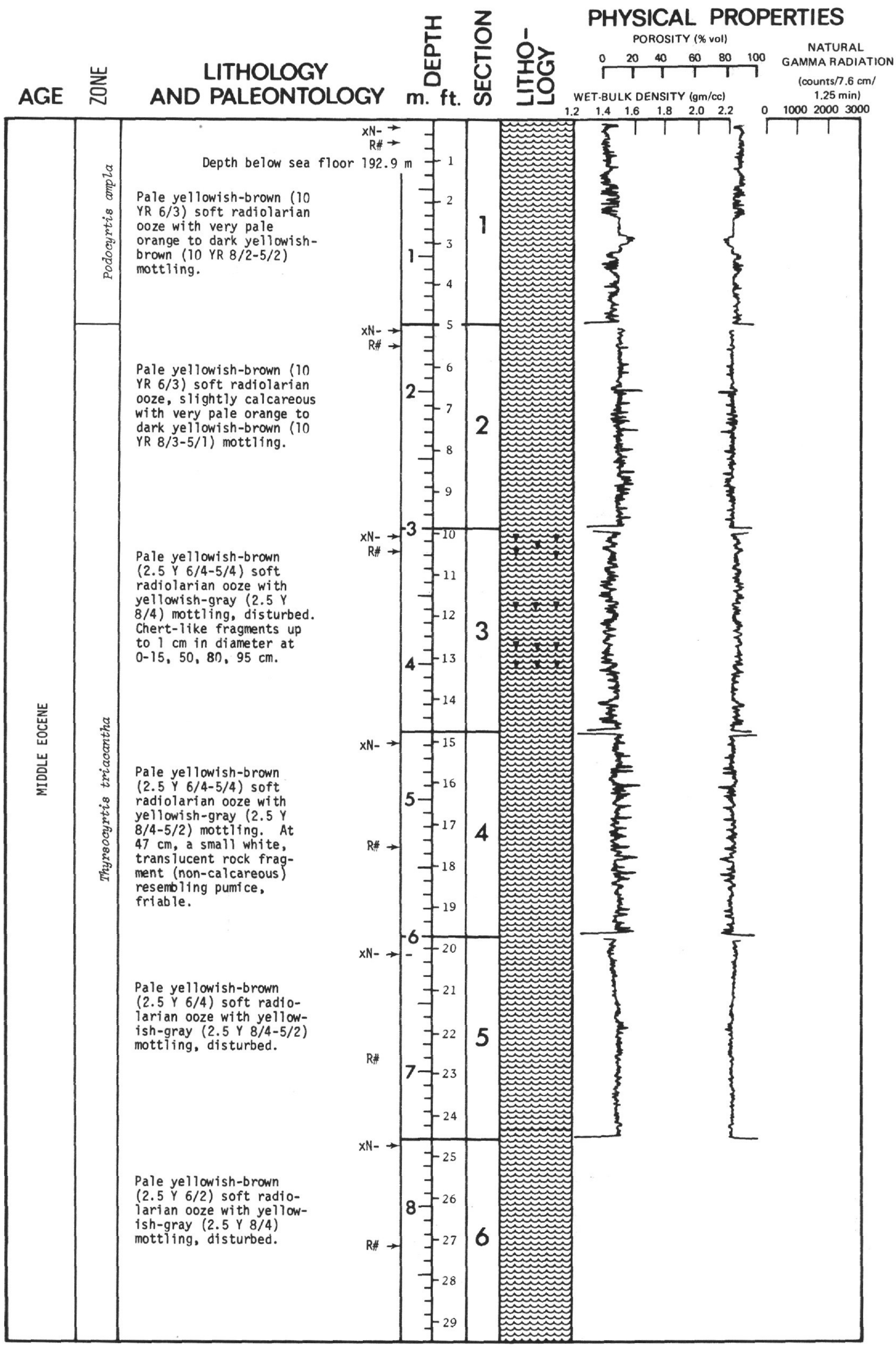

Figure 20. *Core 15, Hole 29.*

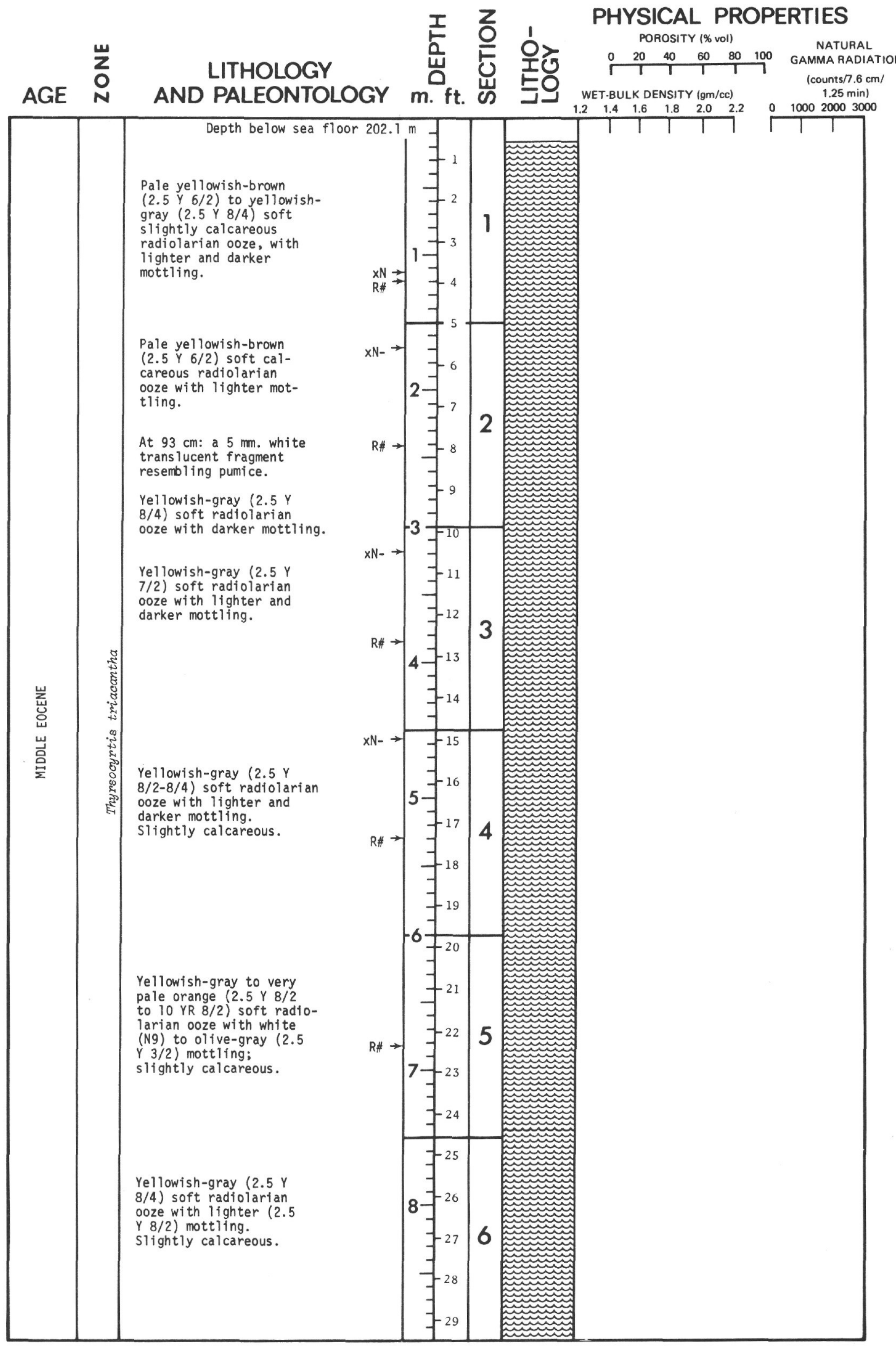

Figure 21. *Core 16, Hole 29.*

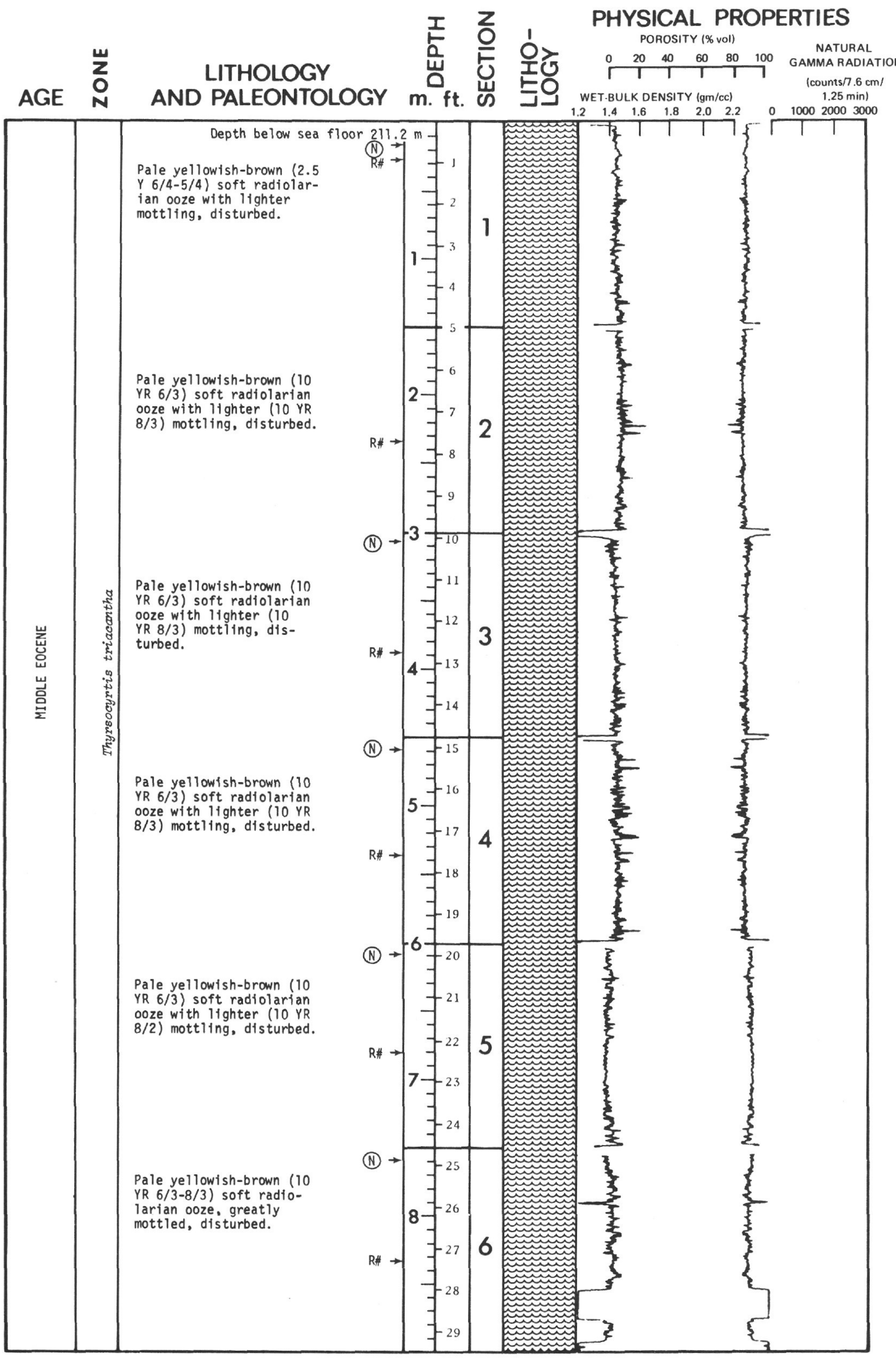

Figure 22. *Core 17, Hole 29.*

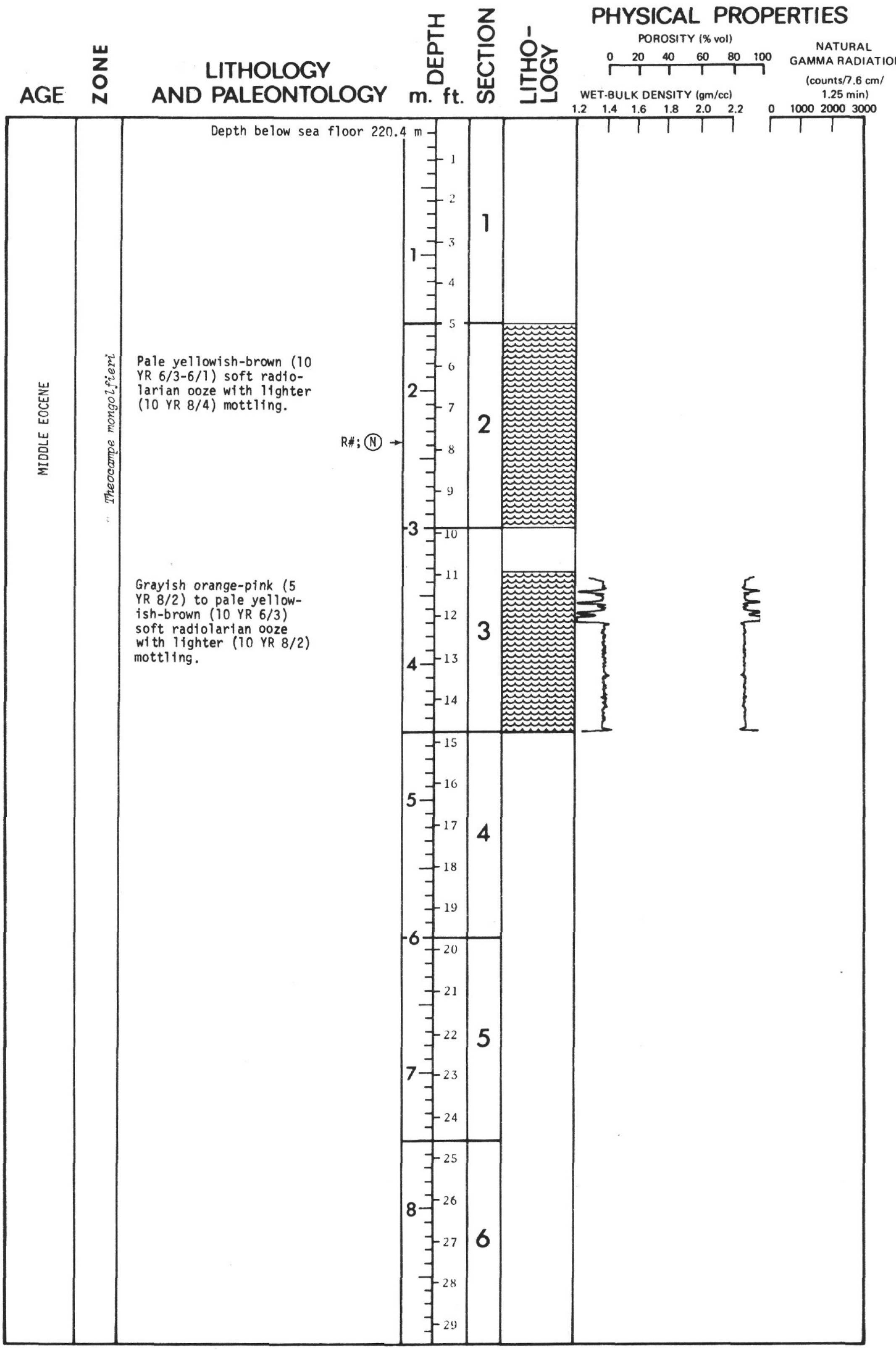

Figure 23. *Core 18, Hole 29.*

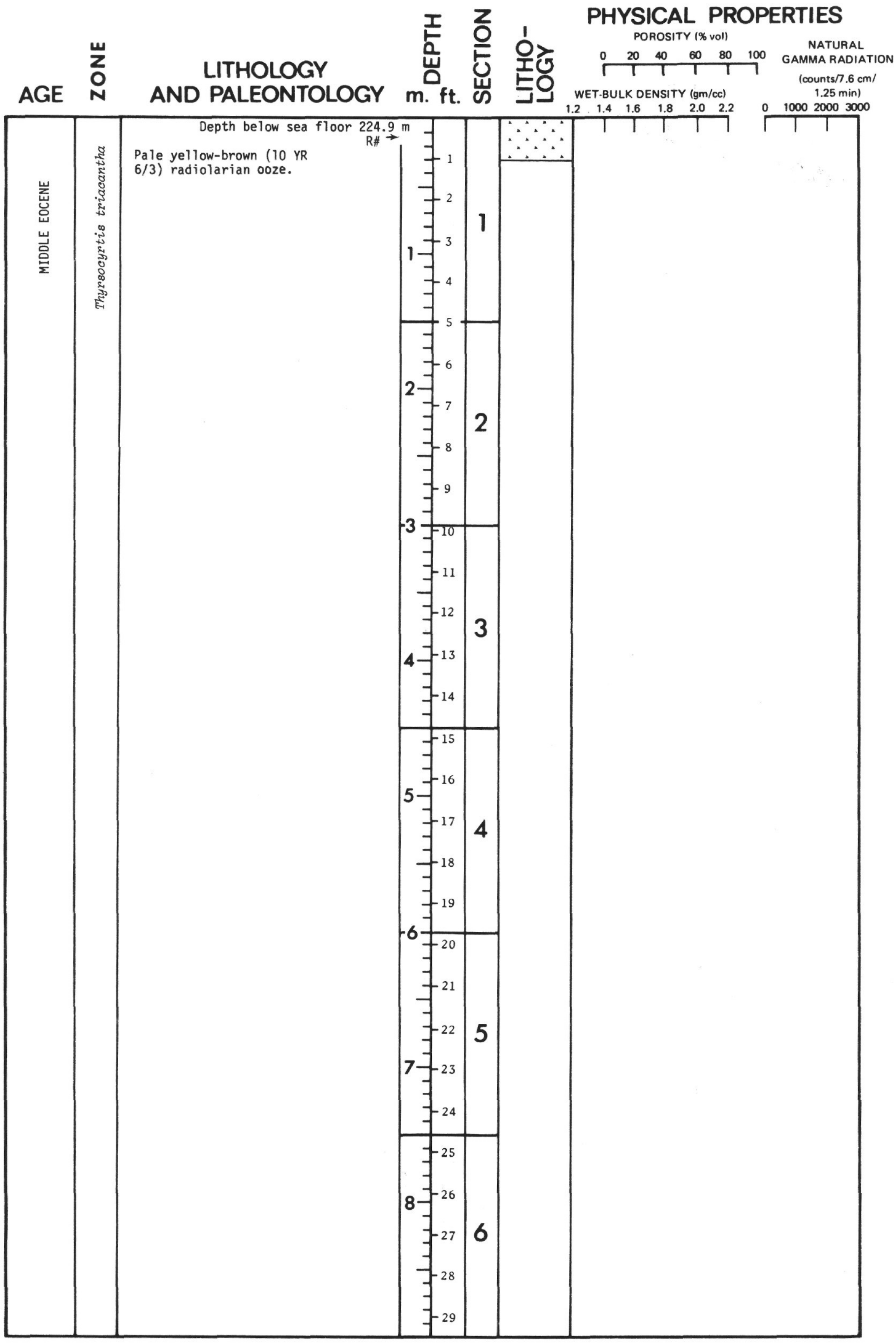

Figure 24. *Core 19, Hole 29.*

NO CORE RECOVERED

Figure 25. *Core 1, Hole 29A.*

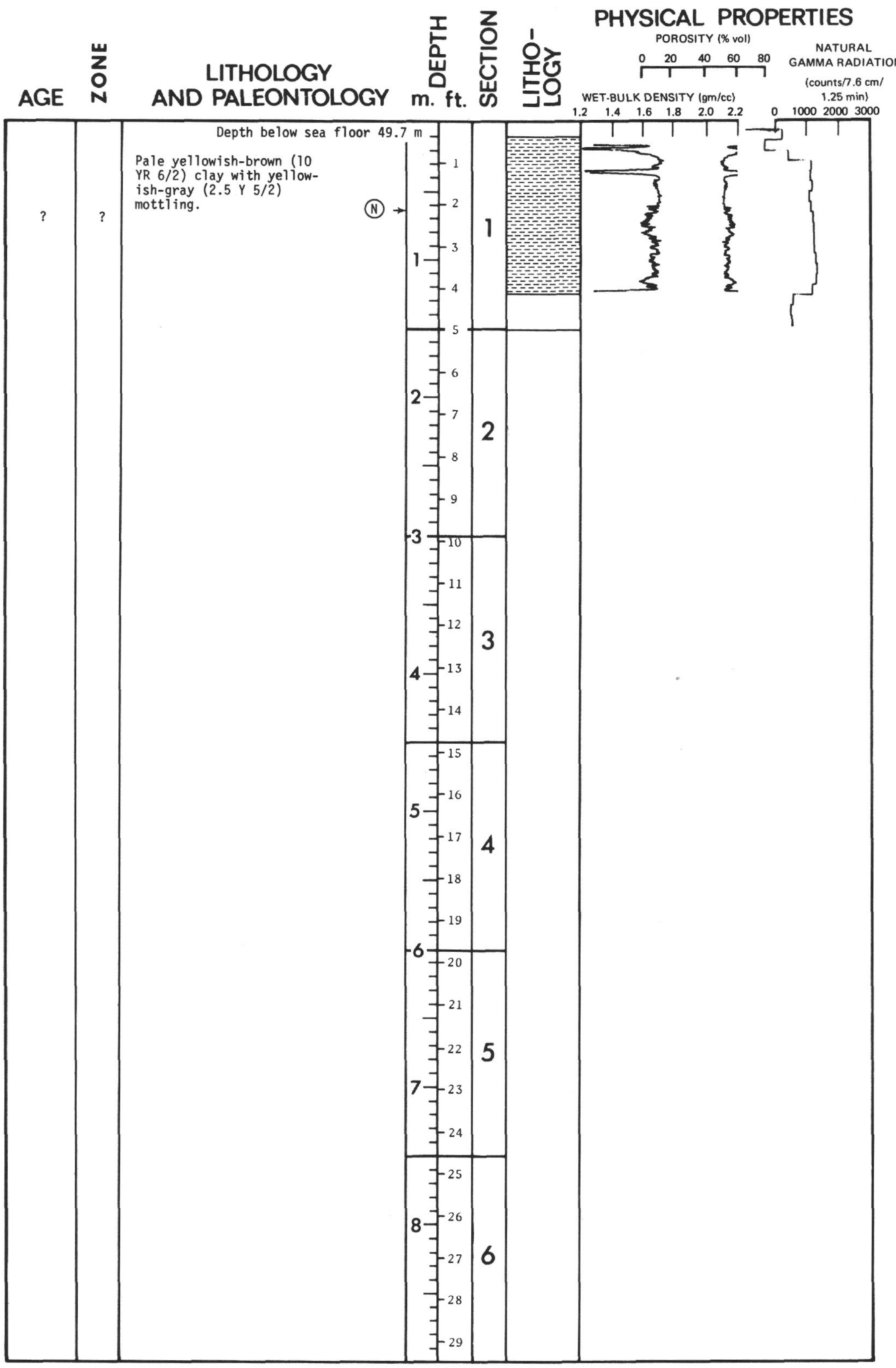

Figure 26. *Core 2, Hole 29A.*

NO CORE RECOVERED

Figure 27. *Core 3, Hole 29A.*

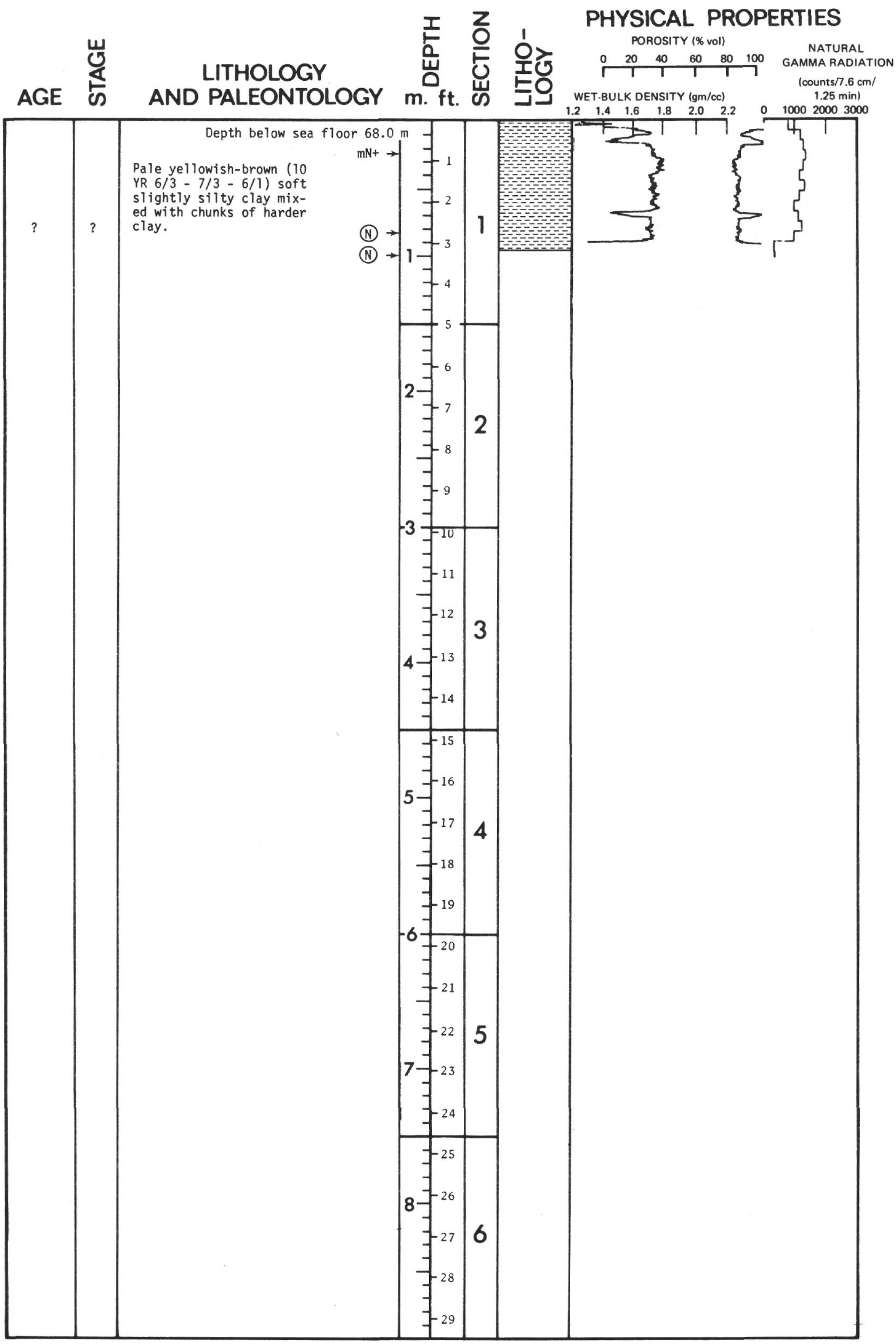

Figure 28. *Core 4, Hole 29A.*

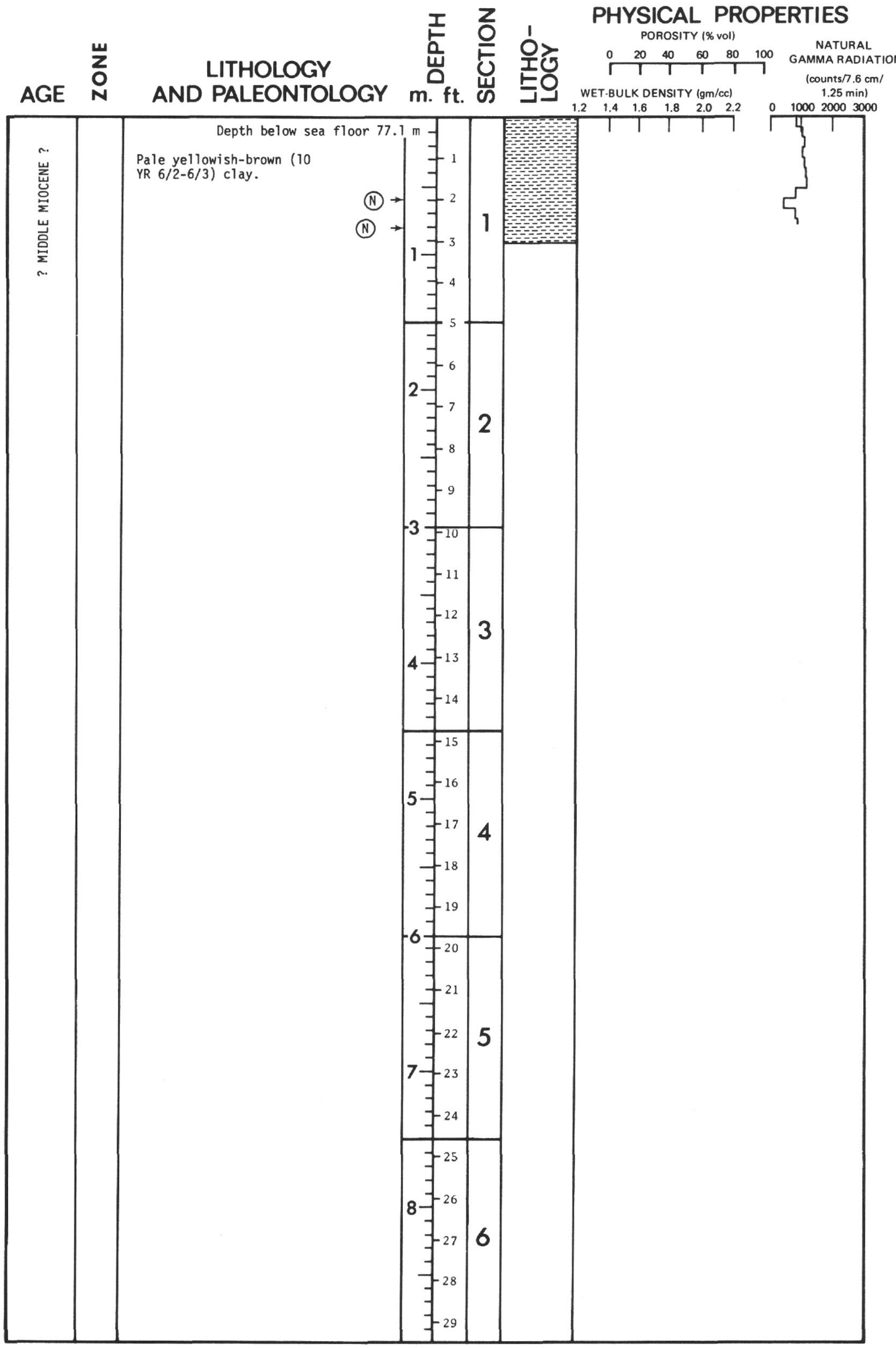

Figure 29. *Core 5, Hole 29A.*

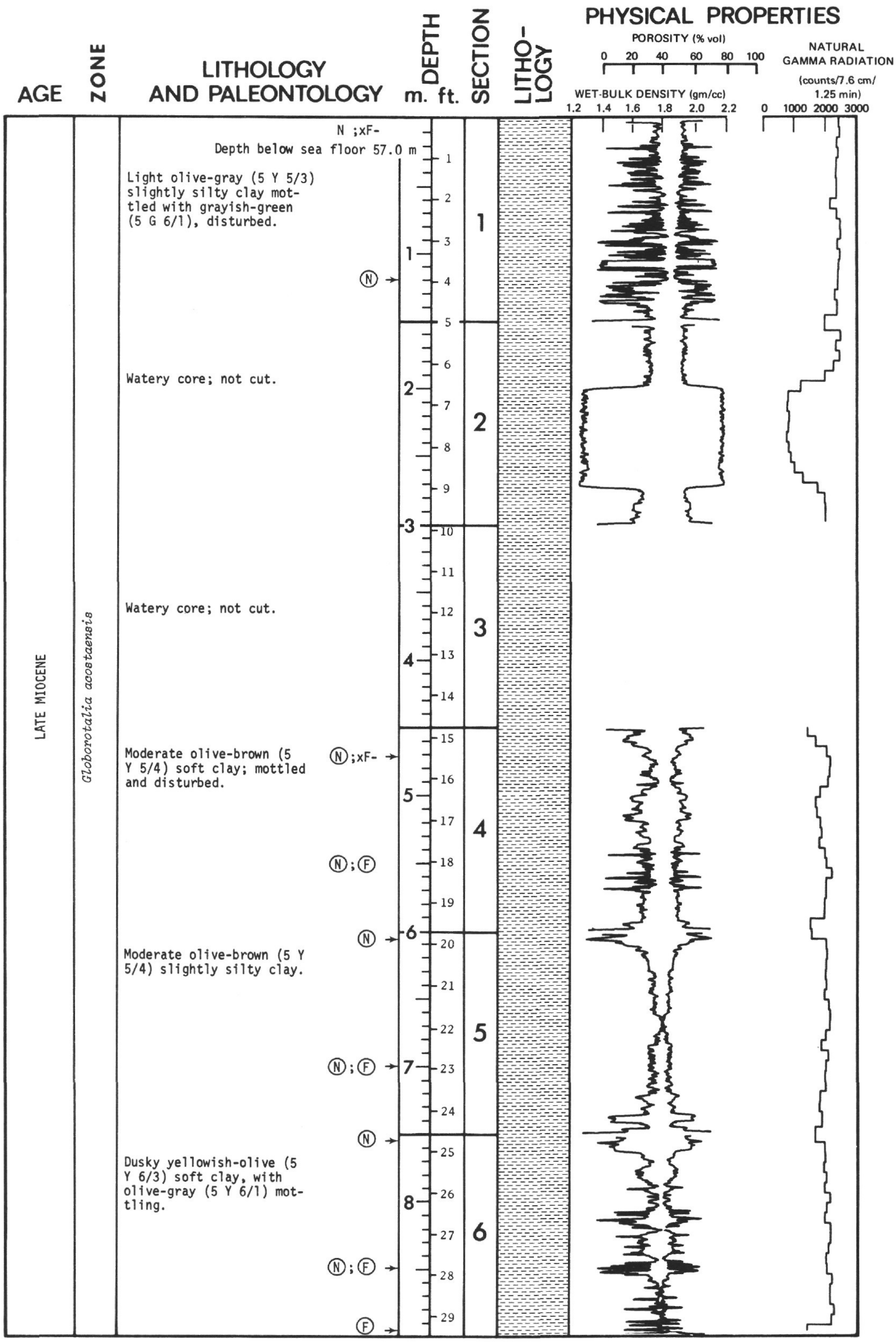

Figure 30. *Core 1, Hole 29B.*

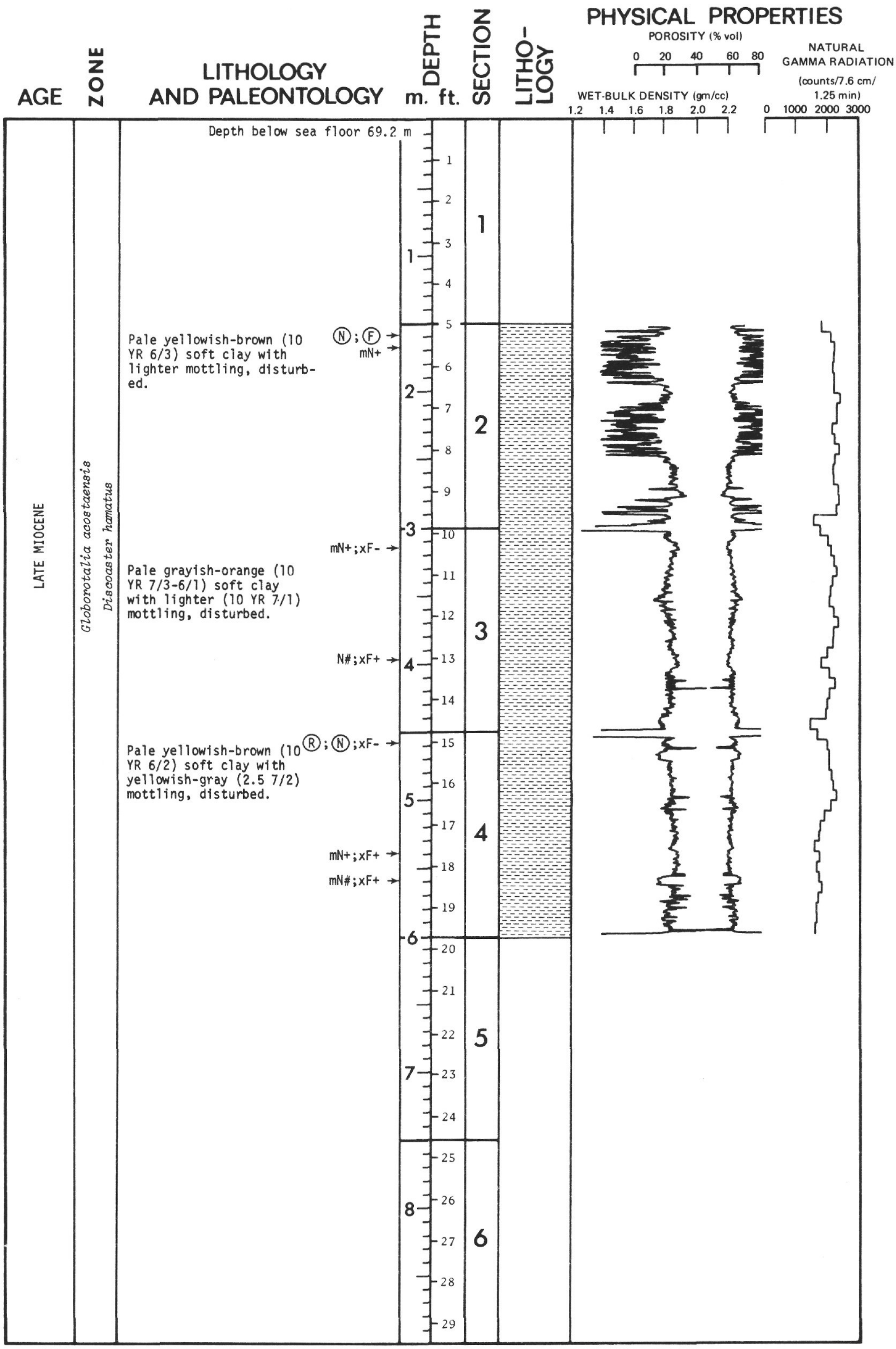

Figure 31. *Core 2, Hole 29B.*

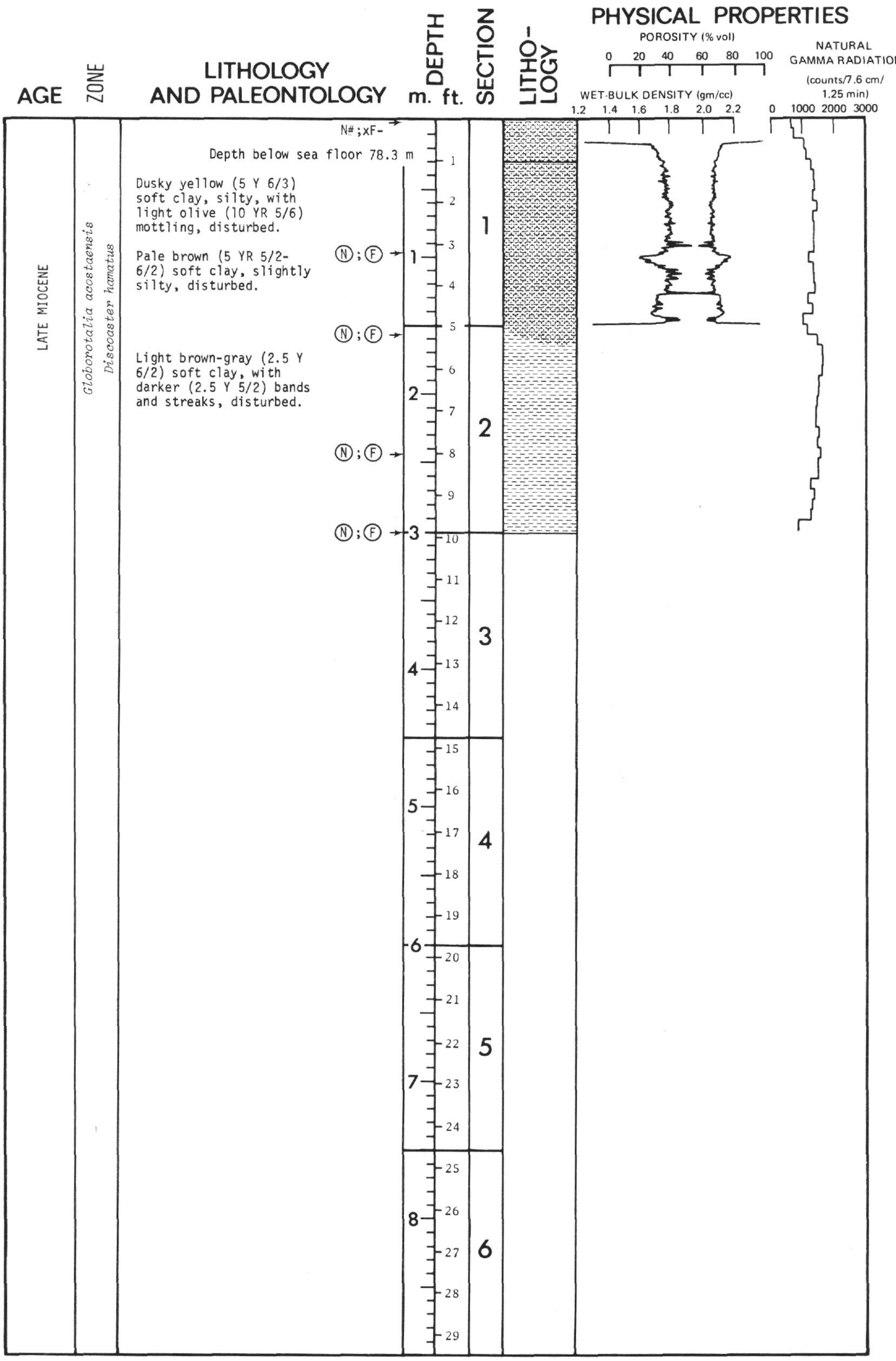

Figure 32. *Core 3, Hole 29B.*

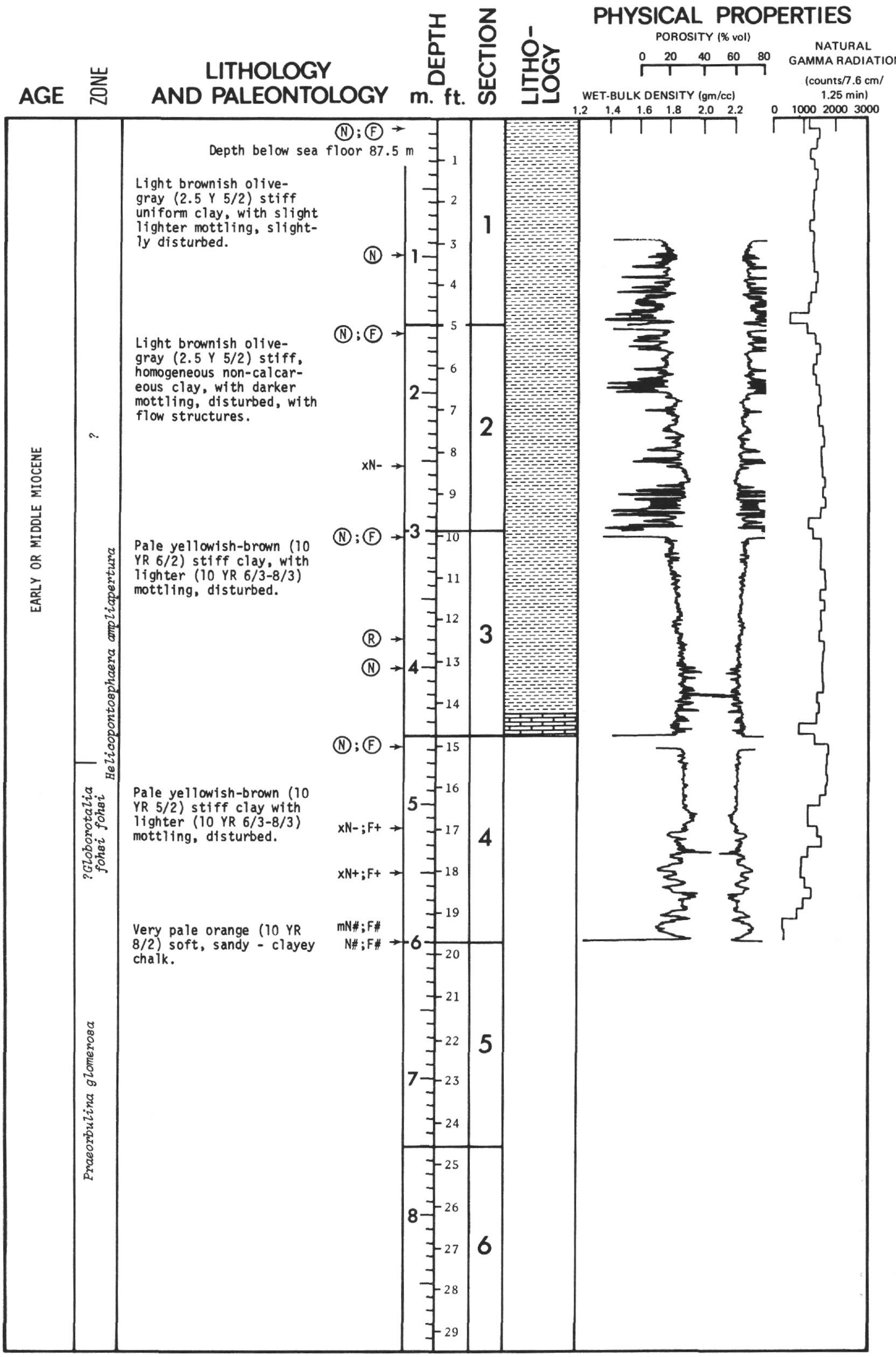

Figure 33. *Core 4, Hole 29B.*

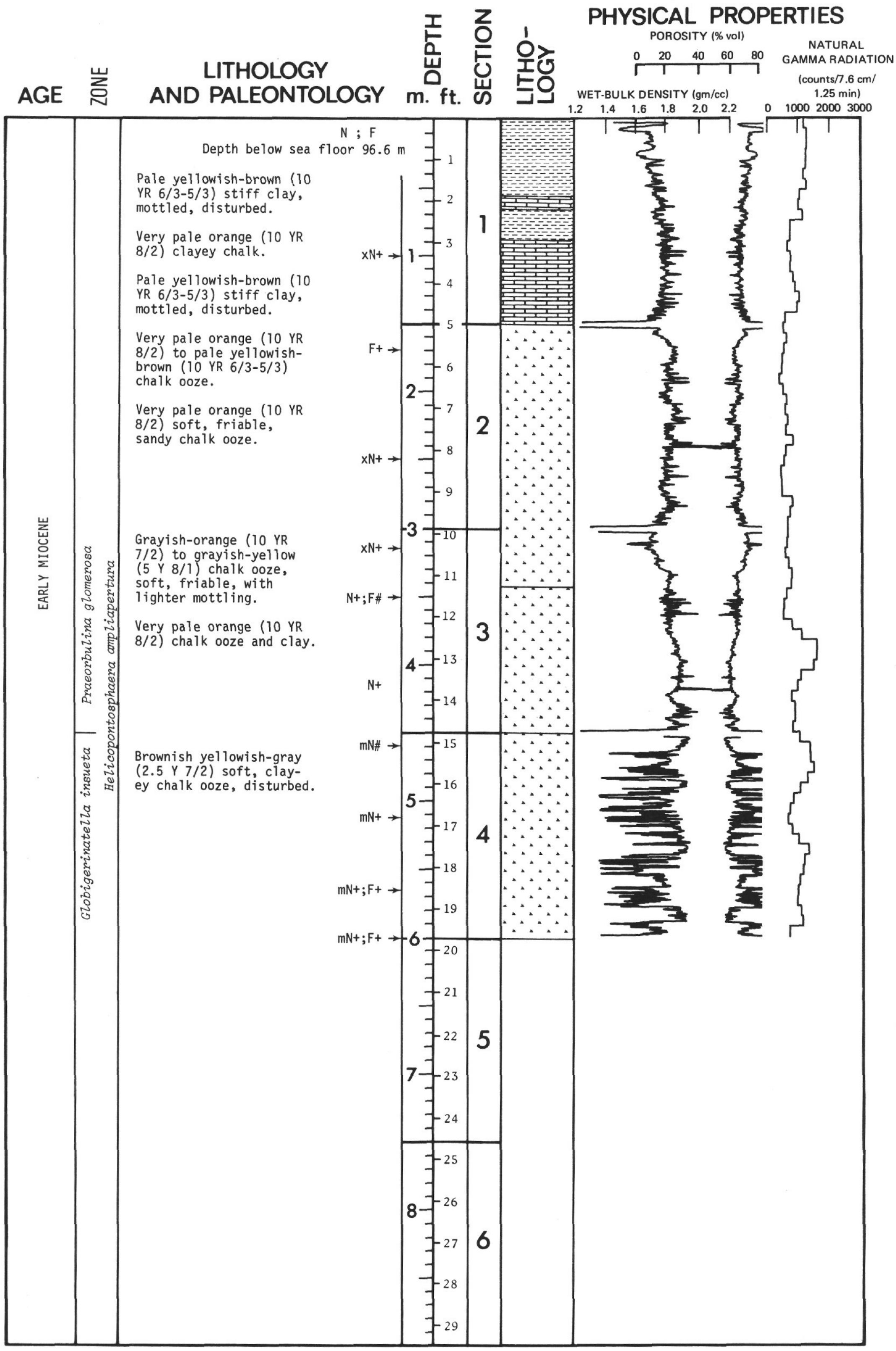

Figure 34. *Core 5, Hole 29B.*

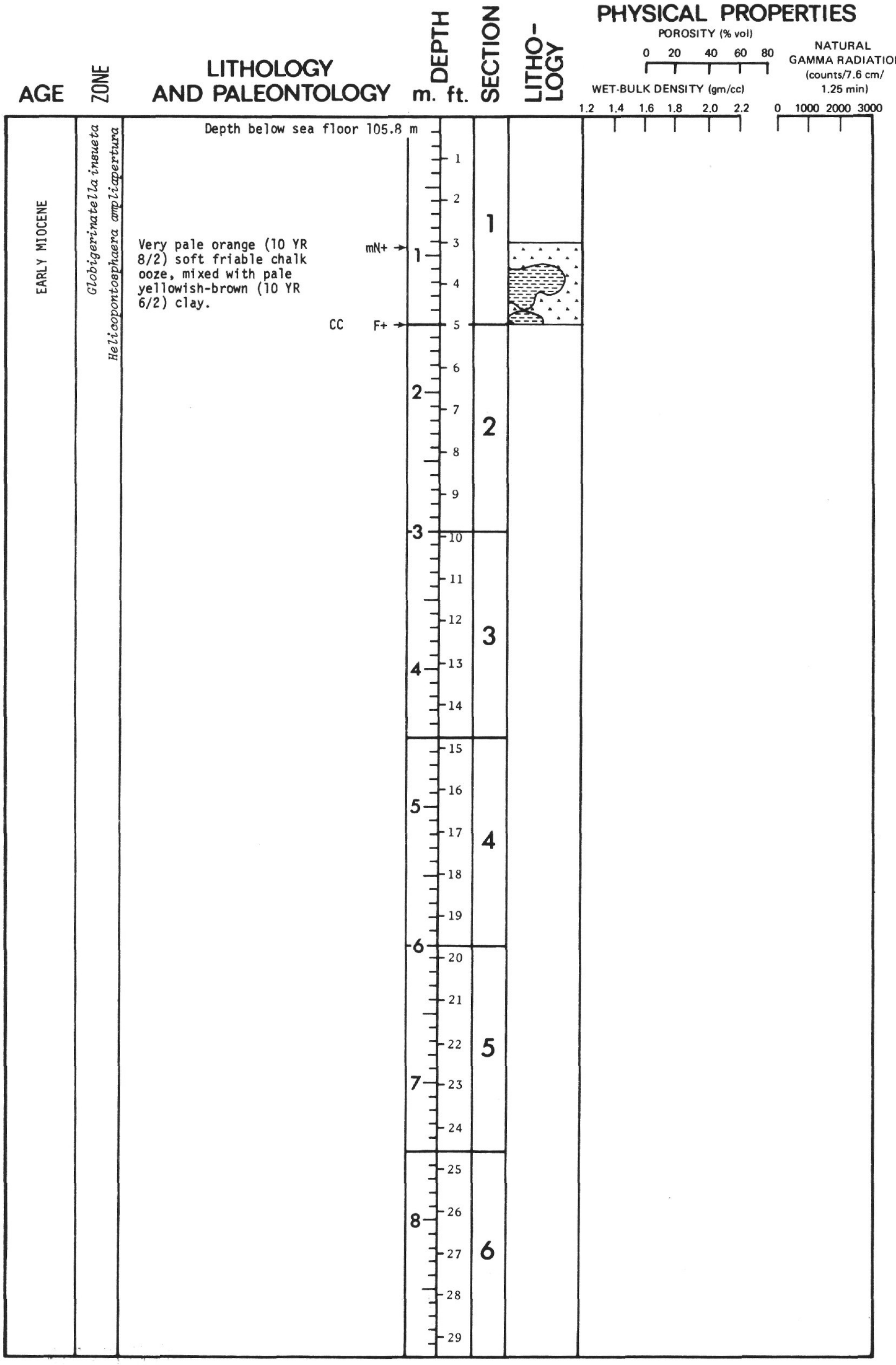

Figure 35. *Core 6, Hole 29B.*

AGE	ZONE	LITHOLOGY AND PALEONTOLOGY	DEPTH m. ft.	SECTION	LITHOLOGY	PHYSICAL PROPERTIES POROSITY (% vol) 0 20 40 60 80; WET-BULK DENSITY (gm/cc) 1.2 1.4 1.6 1.8 2.0 2.2; NATURAL GAMMA RADIATION (counts/7.6 cm/1.25 min) 0 1000 2000 3000
?	?	Clay Ⓝ;Ⓕ Depth below sea floor 121.9 m		1		
				2		
				3		
				4		
				5		
				6		

Figure 36. *Core 7, Hole 29B.*

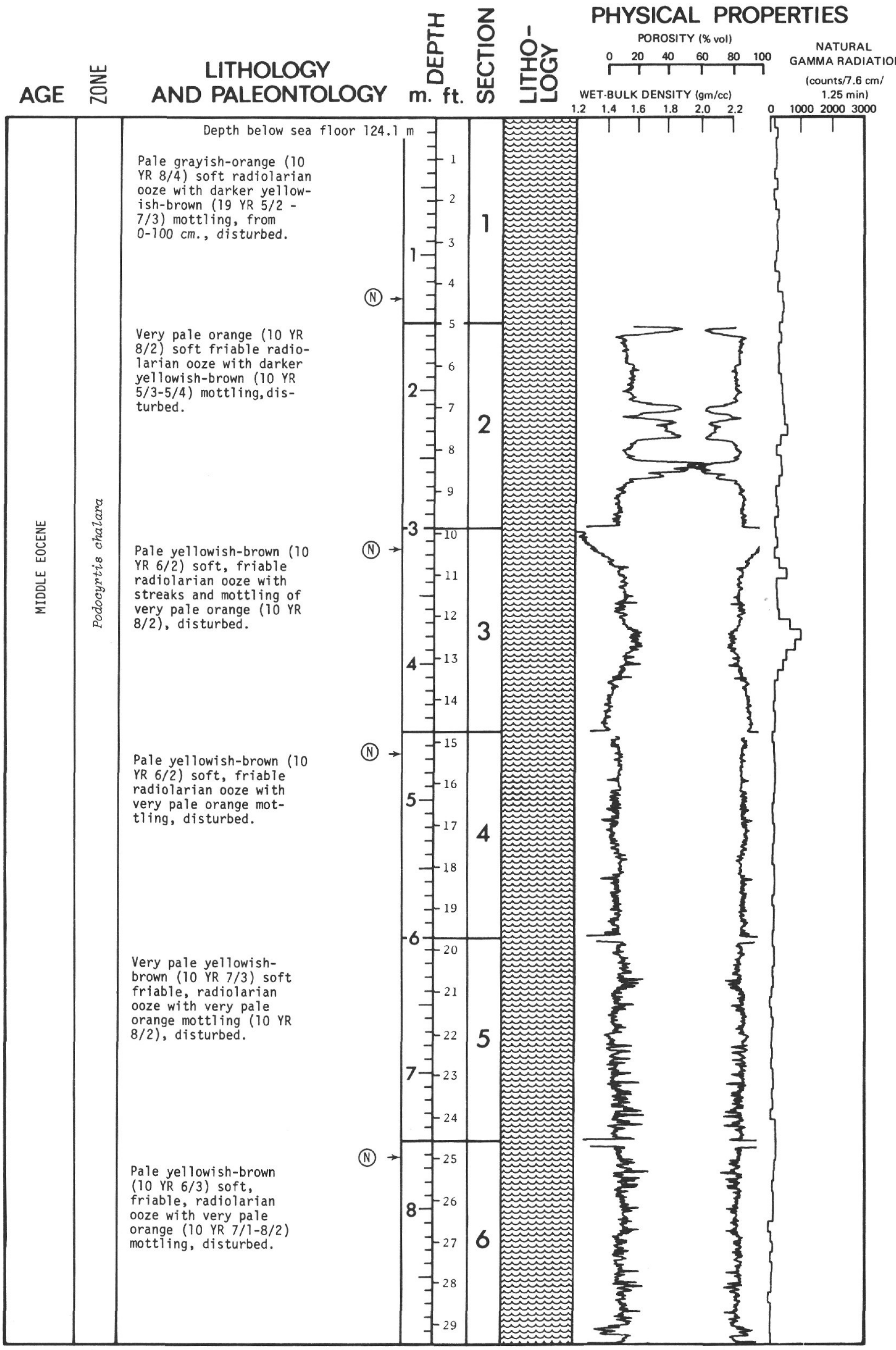

Figure 37. *Core 8, Hole 29B.*

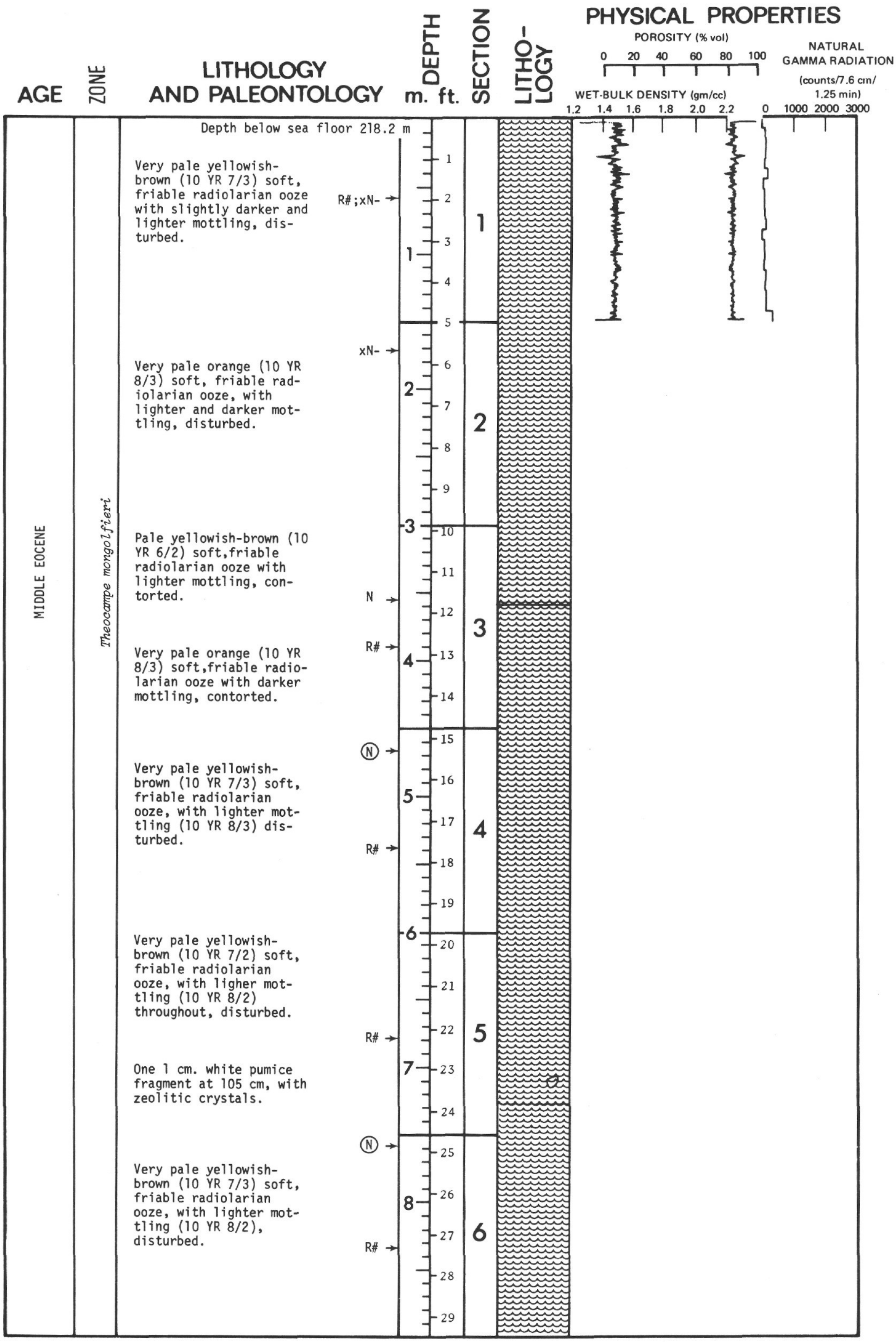

Figure 38. *Core 9, Hole 29B.*

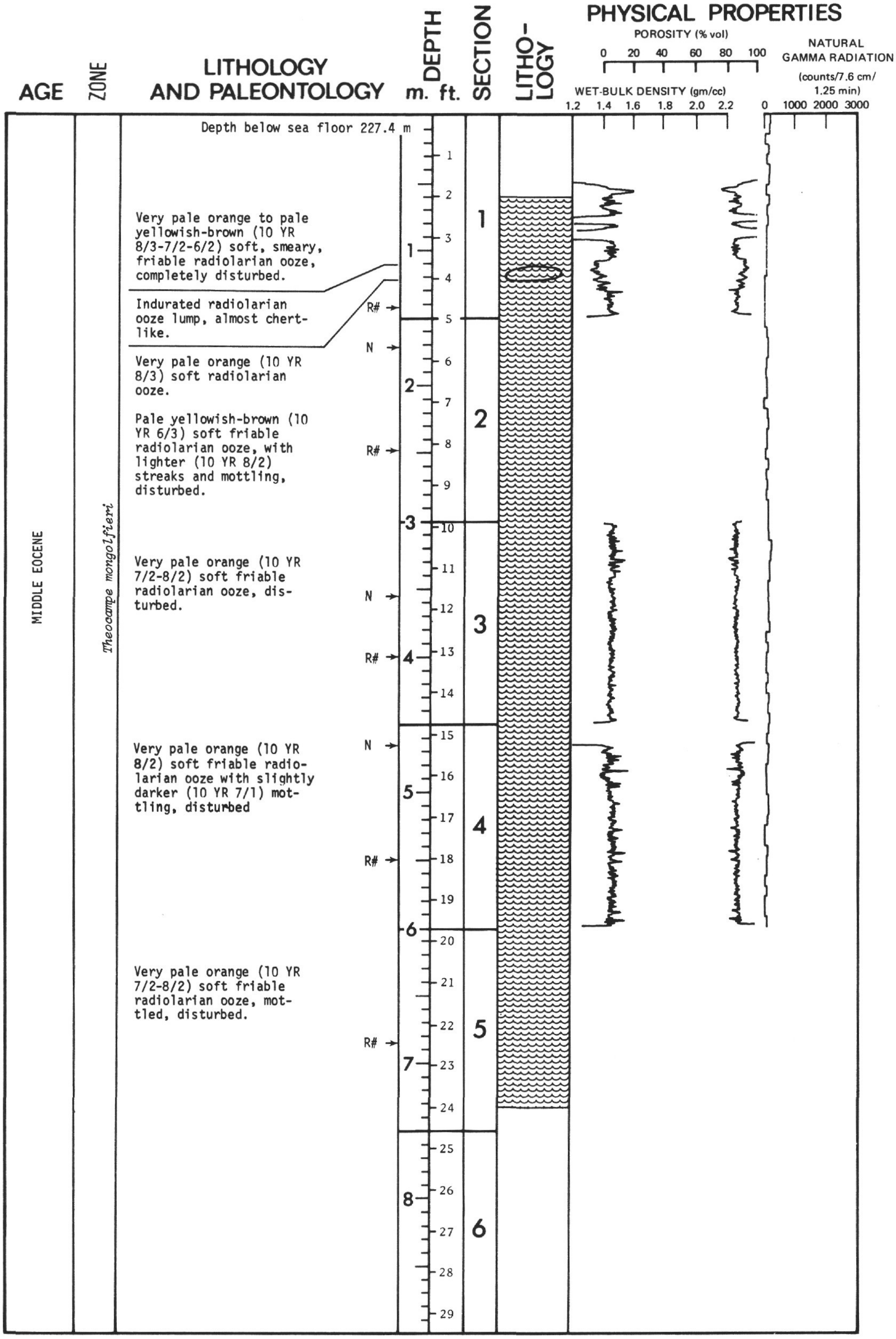

Figure 39. *Core 10, Hole 29B.*

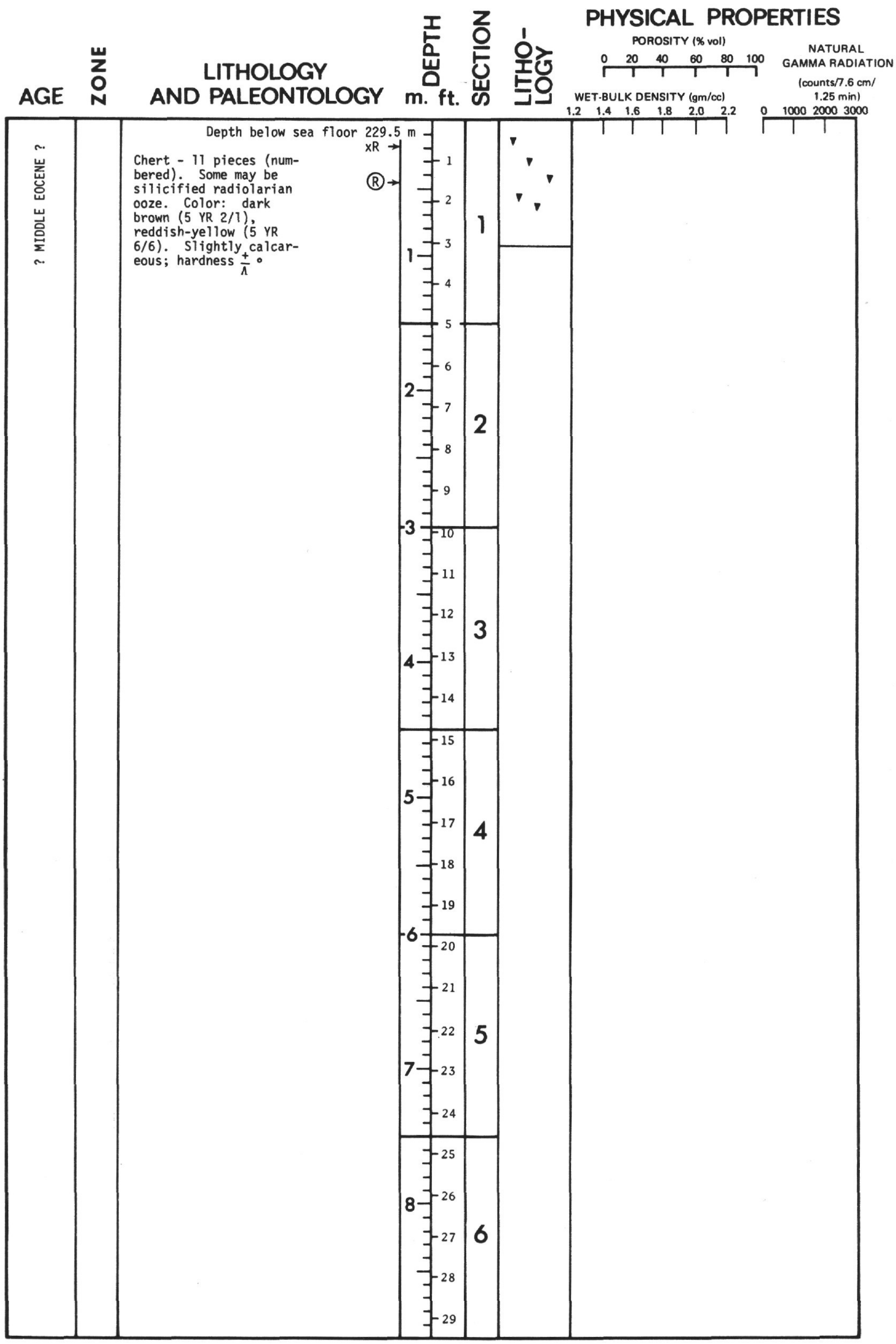

Figure 40. *Core 1, Hole 29C.*

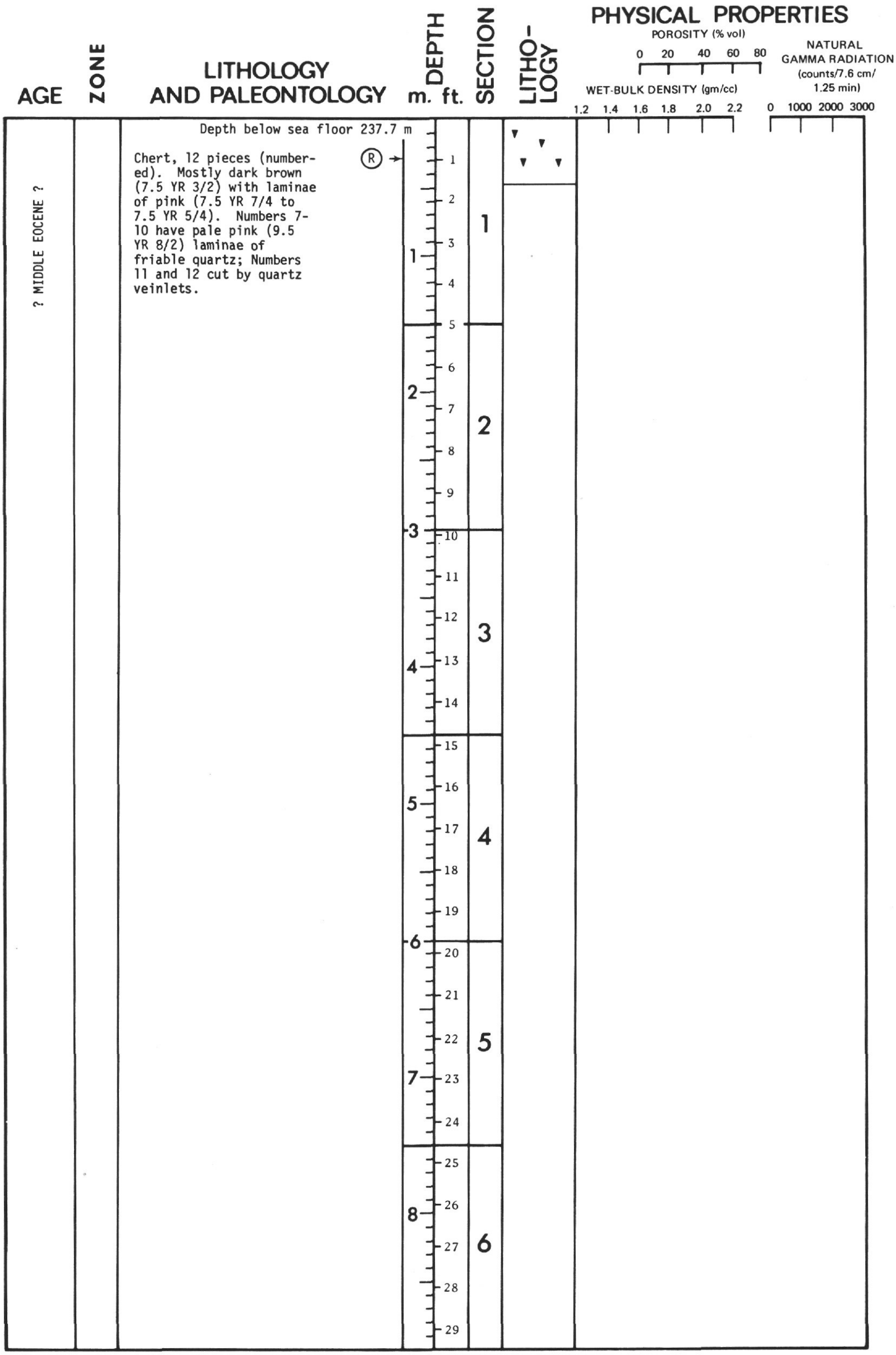

Figure 41. *Core 2, Hole 29C.*

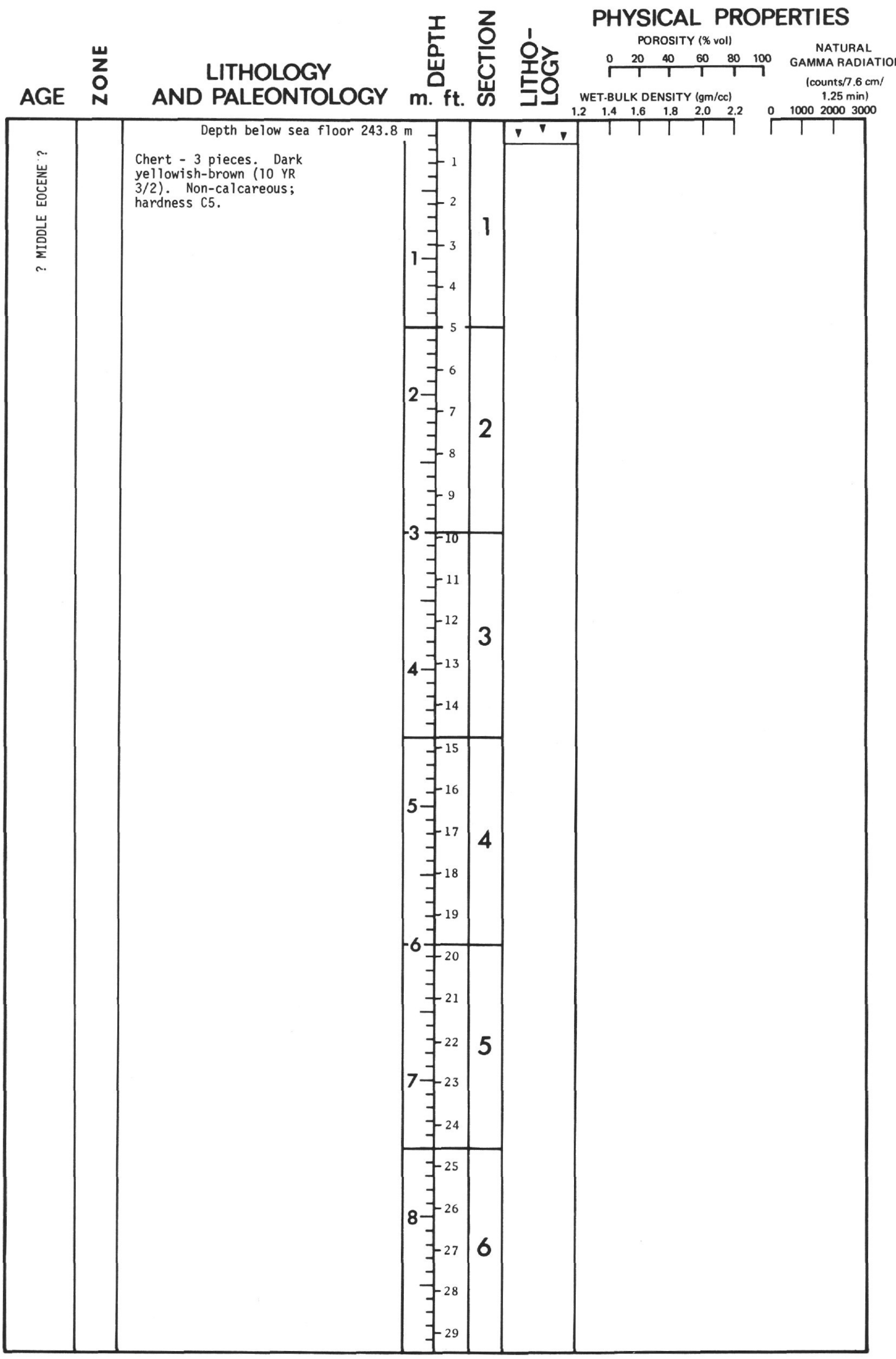

Figure 42. *Core 3, Hole 29C.*