4. SITE 69

Shipboard Scientific Party[1]

SITE DATA

Occupied: October 17-20.

Position: Latitude 6° 00.0'N.
Longitude 152° 51.93'W.

Water Depth: 4978 meters.

Total Depth: 230 meters, ending in middle Eocene chert.

Holes Drilled: Two holes.

Cores Taken: Twenty-one cores (8 in Hole 69, 13 in 69A). Cored 0 to 32 meters, 52 to 162 meters, 187 to 196 meters, 214 to 231 meters.

RESULTS

An almost complete stratigraphic section was cored from middle Miocene to middle Eocene, consisting of three lithologic units:

1) Upper radiolarian ooze and bedded siliceous and calcareous ooze 0 to 32 meters of middle and early Miocene age; 32 to 50 meters was not cored.
2) Calcareous nannofossil ooze, 50 to 144 meters, of early Miocene and Oligocene age.
3) Lower radiolarian ooze, 144 to 227 meters, of upper and middle Eocene age.

Hard chert beds below 227 meters were penetrated to 231 meters, but were not recovered.

The contact between Oligocene nannofossil ooze and Eocene radiolarian ooze was very sharp.

BACKGROUND

Site 69 is located about 350 miles northeast of Christmas Island of the Line Islands, in the crustal block between the Clarion and Clipperton Fracture Zones, about 200 miles north of the Clipperton. Since some time was gained at Site 68, where drilling was terminated in a shallow chert horizon, Site 69 was chosen as an additional site to provide lateral control for the N-S section across the equatorial Pacific belt of high productivity and thick sediments. This N-S section was the main objective of Leg 8. Site 69 provides stratigraphic information between the near-equatorial holes drilled to the west during Leg 7 (Sites 62 through 66) and our line of holes and the E-W section drilled across the East Pacific Rise during Leg 9.

There was no SCAN survey for this site and all site information is derived from the observations on the *Challenger*. Topography in the vicinity of the site is moderate with occasional seamounts; one, about 10 miles south of the site, reaching 900 meters in height. The site is located in a gentle northwest plunging depression, or trough, about 3 miles SW of a 180-meter seamount.

Reflection horizons within the sediment are concordant with the sea floor; acoustic basement is also concordant in general, but not in detail (Figure 1 and Figure 12, Chapter 2). Total 'thickness' to acoustic basement in the area varies between 0.25 and 0.35 seconds, thinning to zero near the seamounts. At the site, prominent reflectors are at 0.020, 0.050, 0.190 and 0.305 seconds; the second and third reflectors are correlated with the top and bottom of the Marquesas Oceanic Formation and the fourth with the indurated Eocene sediments near the bottom of the drilled section (Figures 6, 7 and 8, Chapter 2).

A topographic map of the vicinity of Site 69, airgun records, and further site information are given in Chapter 25.

OPERATIONS

The first hole at Site 69 was drilled as an exploratory hole, and bottomed in chert at 231 meters after taking seven cores. About 60 meters of the section were cored, and 46 meters recovered.

Hole 69A was drilled about 30 meters from the original site in order to recover some of the intervals not cored in the first hole. Thirteen cores were taken totaling 106 meters, and 93 meters were recovered.

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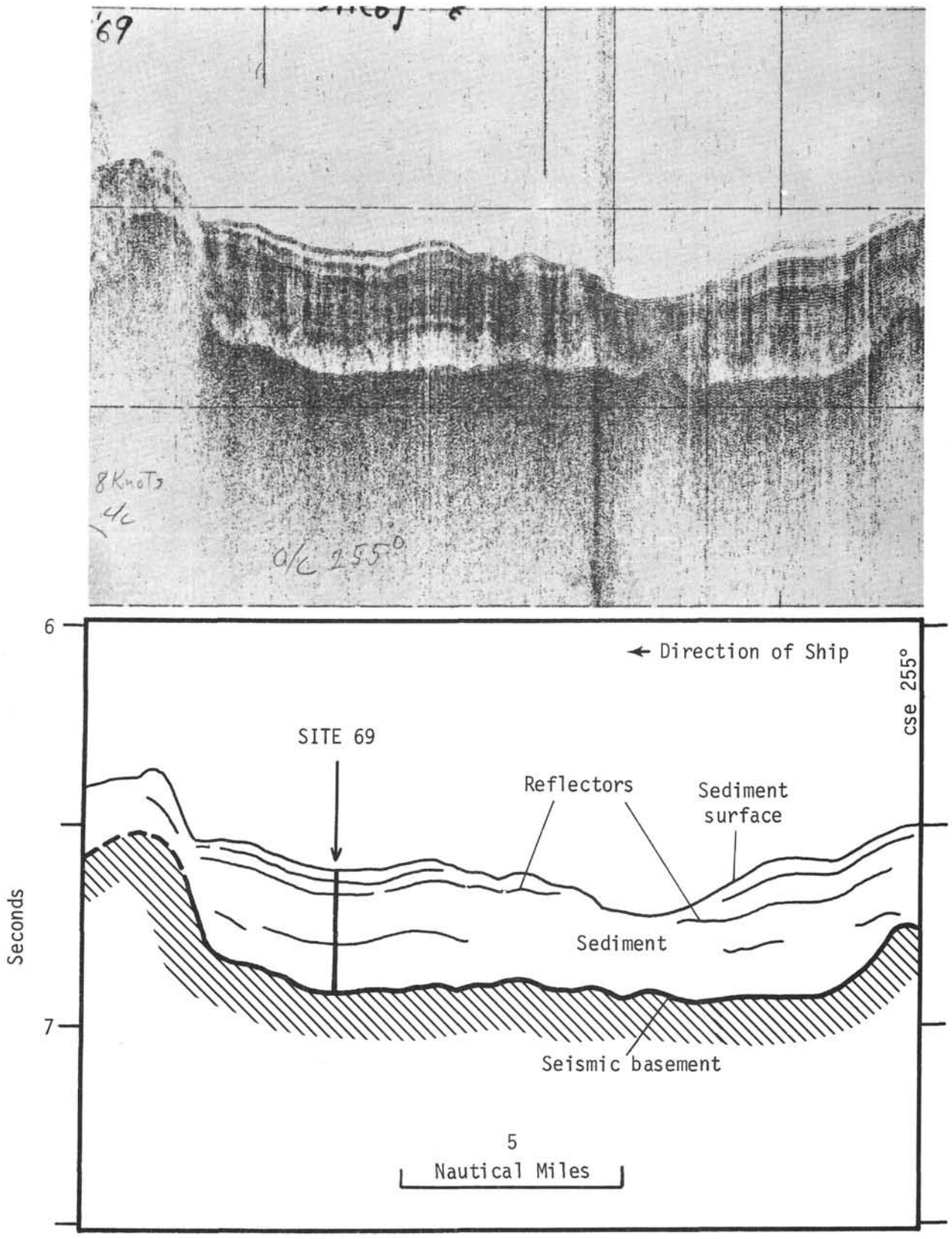


Figure 1. *Airgun record across Site 69 and interpretation.*

TABLE 1
Summary of Coring at Site 69

	Core No.	Interval Below Seafloor (meters)	Cored (m)	Recovered (m)	Comments
Hole 69	1	0-9	9.1	9.1	Washed down 2.9 m
	2	14-23	9.1	9.1	
	3	23-32	9.1	9.1	Drilled 19.5 m
	4	52-61	9.1	9.1	Drilled 55.2 m
	5	117-126	9.1	9.1	Drilled 61.0 m
	6	187-196	9.1	0.0	Drilled 31.7 m
	7	227-228	1.2	0.0	Hard layer 69.2 m
	8	228-231	3.0	0.3	Total depth 231 m in chert
Total			59.1	46.4	79% recovery
Hole 69A	1	61-70	9.1		Drilled 61.3 m
	2	70-79	9.1	9.1	
	3	79-88	9.1	7.0	
	4	88-98	9.1	9.1	
	5	98-107	9.1	9.1	
	6	107-116	9.1	9.1	Drilled 36.6 m
	7	126-135	9.1	4.6	Core liner collapsed
	8	135-144	9.1	7.9	
	9	144-153	9.1	7.9	
	10	153-162	9.1	9.1	Drilled 51.8 m
	11	214-223	9.1	9.1	
	12	223-229	6.7	2.1	
	13	229-230	0.9	0.0	Total depth 231 m in chert
Total			108.3	82.6	76% recovery
Total 69 + 69A			165.0	129.0	77% recovery

Total coring at the site amounted to 177 meters of which 139 meters (70 per cent) were recovered.

An attempt to run the Welex drill pipe logging device failed, as the tool became stuck in a drill pipe joint.

LITHOLOGY AND STRATIGRAPHY

Core recovery at Site 69 was good, and the cores display a sedimentary sequence from the middle Miocene to the middle Eocene. However, some cores were badly disturbed by drilling, mainly those containing lower Oligocene nannofossil ooze.

Three sedimentary formations are present at Site 69: The Clipperton Formation (0 to 35 meters), the Marquesas Formation (35 to 144 meters), and the Line Islands Formation (144 to 231 meters).

Clipperton Oceanic Formation

The Clipperton Oceanic Formation is made up of two lithologic units at Site 69. The upper unit consists of radiolarian ooze and extends from the sea floor to a depth of 19.6 meters. The ooze is dark yellowish brown to yellowish gray, moderately mottled with very pale brown. The texture is somewhat porous or "bready." Radiolaria are the dominant constituent

with rare diatoms. The calcium carbonate content is zero. The radiolarian ooze unit is middle Miocene in age. The contact with the lower cyclic unit is sharp and corresponds to the top of the uppermost carbonate-rich bed.

The lower unit of the Clipperton Oceanic Formation at Site 69 consists of alternating calcareous (radiolarian-nannofossil) and siliceous (radiolarian) oozes from 19.6 to 32 meters. The two lithologies in this cyclic unit are separated by sharp contacts marked by color changes. The calcareous beds are generally very pale orange and are composed predominantly of calcareous nannoplankton (60 to 70 per cent) and Radiolaria (30 to 40 per cent). Siliceous beds composed mainly of Radiolaria make up most of the cyclic unit and are dark yellowish brown. In general within the cyclic unit, the darker brown the color, the lower the carbonate content. The basal contact of the cyclic unit was not cored and lies somewhere in the 32 to 52 meter interval. It is tentatively placed at 35 meters. The cyclic unit of the Clipperton Oceanic Formation is middle and early Miocene in age.

Marquesas Oceanic Formation

This formation is composed of nannofossil ooze with variable proportions of Radiolaria. Calcium carbonate content generally ranges from 60 to 95 per cent. The central part of the unit—of upper Oligocene age—is a rather high-carbonate nannofossil ooze, whereas the top and the bottom portions are more siliceous. Coccolithophorids and discoasters are the dominant fossils. The siliceous fraction is composed of Radiolaria and diatoms. As in the oozes of the Clipperton, the diatoms are proportionately rare but are relatively more abundant in the more siliceous top and bottom sections.

The color is white to very pale orange, pale brown and light gray. The top and the base of the formation display darker hues, generally yellowish brown.

Bedding occurs throughout the whole unit. Contacts are sharp between beds of different colors or of slightly different physical properties. Generally the lighter colored beds are richer in calcareous fossils. The texture is firm to stiff in beds rich in Radiolaria, and in contrast is softer and more plastic in the nannofossil oozes. Moderate mottling is noted from the top to the base of the formation.

The contact between the Marquesas Oceanic Formation and the underlying Line Islands Oceanic Formation is a sharp disconformity corresponding to the Oligocene-Eocene boundary. The last core which was recovered from the Marquesas, Core 8, is an Oligocene radiolarian-nannofossil ooze whereas Core 9, drilled immediately below, is a noncalcareous upper Eocene radiolarian ooze.

Line Islands Oceanic Formation

The upper part of the Line Islands Oceanic Formation is composed of radiolarian ooze. The sediment consists almost wholly of Radiolaria and radiolarian debris. Diatoms, although more abundant than in the overlying calcareous Oligocene oozes, are rare. The calcium carbonate content is zero. The color is dark, grading from yellowish to dark brown. The ooze is moderately mottled in orange. Plastic beds with smooth texture alternate with firmer and more porous beds which show a "bready" texture on freshly cut sections.

At 227 meters the core bit hit a hard layer of chert of which one piece was recovered. The chert is dark brown and has a conchoidal fracture. Subsequent coring penetrated an estimated four meters of chert and soft layers, of which only small chert chips were recovered. These lowermost layers are of middle Eocene age.

PHYSICAL PROPERTIES

Porosities range between about 60 and 90 per cent and sonic velocities range between about 1.50 and 1.55 km/sec. Except for a few anomalously low measurements the relationship between velocity and porosity is as expected for siliceous and calcareous ooze mixed in varying proportions (Figure 2). At this site most of the sediments fall near the two extremes of high and low calcium carbonate ($CaCO_3$). Grain-matrix density averages near 2.0 g/cm^3 and 2.6 g/cm^3 (with a great deal of scatter) for siliceous and calcareous portions, respectively.

The most striking change in physical properties within the unconsolidated sediments occurs across the Marquesas-Line Islands boundary at a depth of 144 meters where the sediment changes from highly calcareous to highly siliceous ooze. This boundary also correlates with a prominent subbottom reflector. Above the boundary the measured sonic velocities are lower than that for sea water. If the laboratory measurements are representative of *in situ* values, they indicate the existence of a low-velocity channel within the sediments to a depth of 144 meters (Figure 7, Chapter 2).

Velocity and density of one piece of Eocene chert are reported in Chapter 2.

Results of grain-size and carbon-carbonate analyses are tabulated in Appendices II and III, respectively.

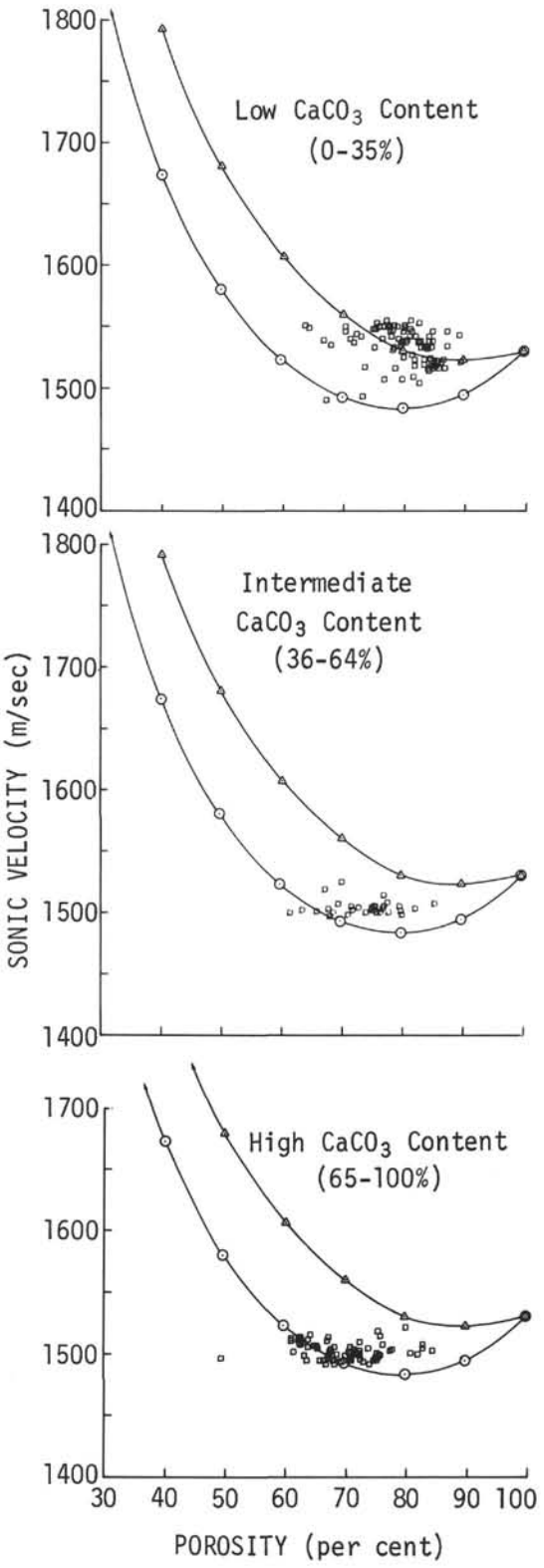


Figure 2. *Sonic velocity versus porosity of unlithified sediments from Site 69 for three ranges of calcium carbonate content. Theoretical curves are based on the equation of Wood (1941). Upper curve, grain-matrix density 2.2 g/cm^3, appropriate for siliceous ooze. Lower curve, grain-matrix density 2.65 g/cm^3, appropriate for calcareous ooze.*

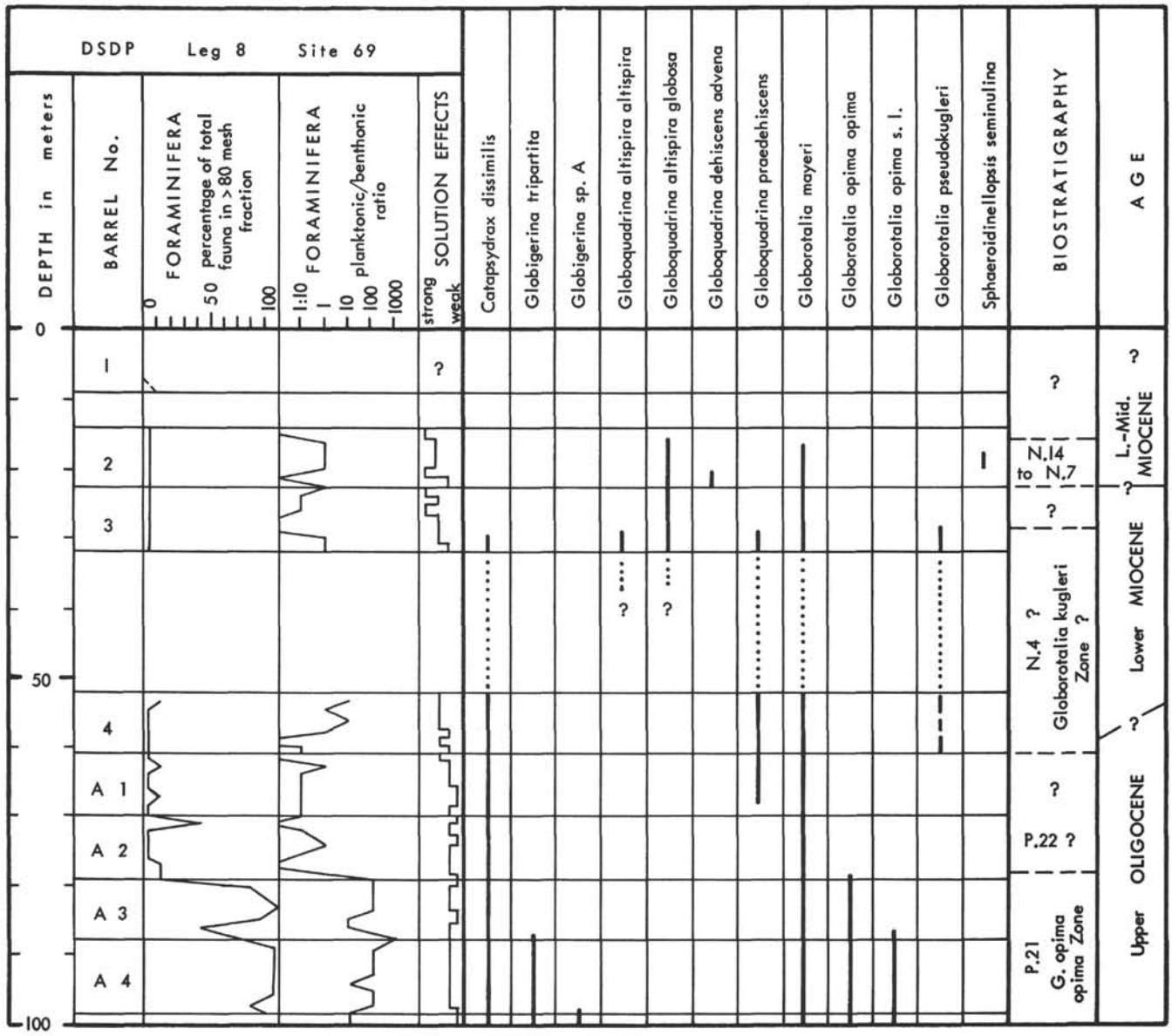


Figure 3. *Foraminifera of Site 69. Frequency distribution, ranges of important species, and biostratigraphy.*

PALEONTOLOGY

Foraminifera

Hole 69 reached a depth of 231 meters. Eight spot cores were cut, but only the first six had significant recovery. In Hole 69A, the uncored intervals of Hole 69 were sampled as far as it was necessary to get a complete record of the Oligocene. This procedure resulted in the somewhat complicated sequence of core numbers shown on Figure 3. Of the thirteen cores taken in Hole 69A, twelve were suitable for paleontological sampling.

The faunas at Site 69 are mainly siliceous. Only an interval of about 25 meters in the Oligocene (*Globorotalia opima opima* Zone or P. 21) had microfaunas which consisted of up to 50 per cent foraminifera. Even in the most calcareous samples, the small species (*Cassigerinella chipolensis, Chiloguembelina* spp. and the *Globigerina ciperoensis* group) are absent altogether. The Oligocene is the only part of the section where specific zones could be distinguished with reasonable confidence.

The faunas of Site 69 contain a relatively large percentage of benthonic foraminifera (see the

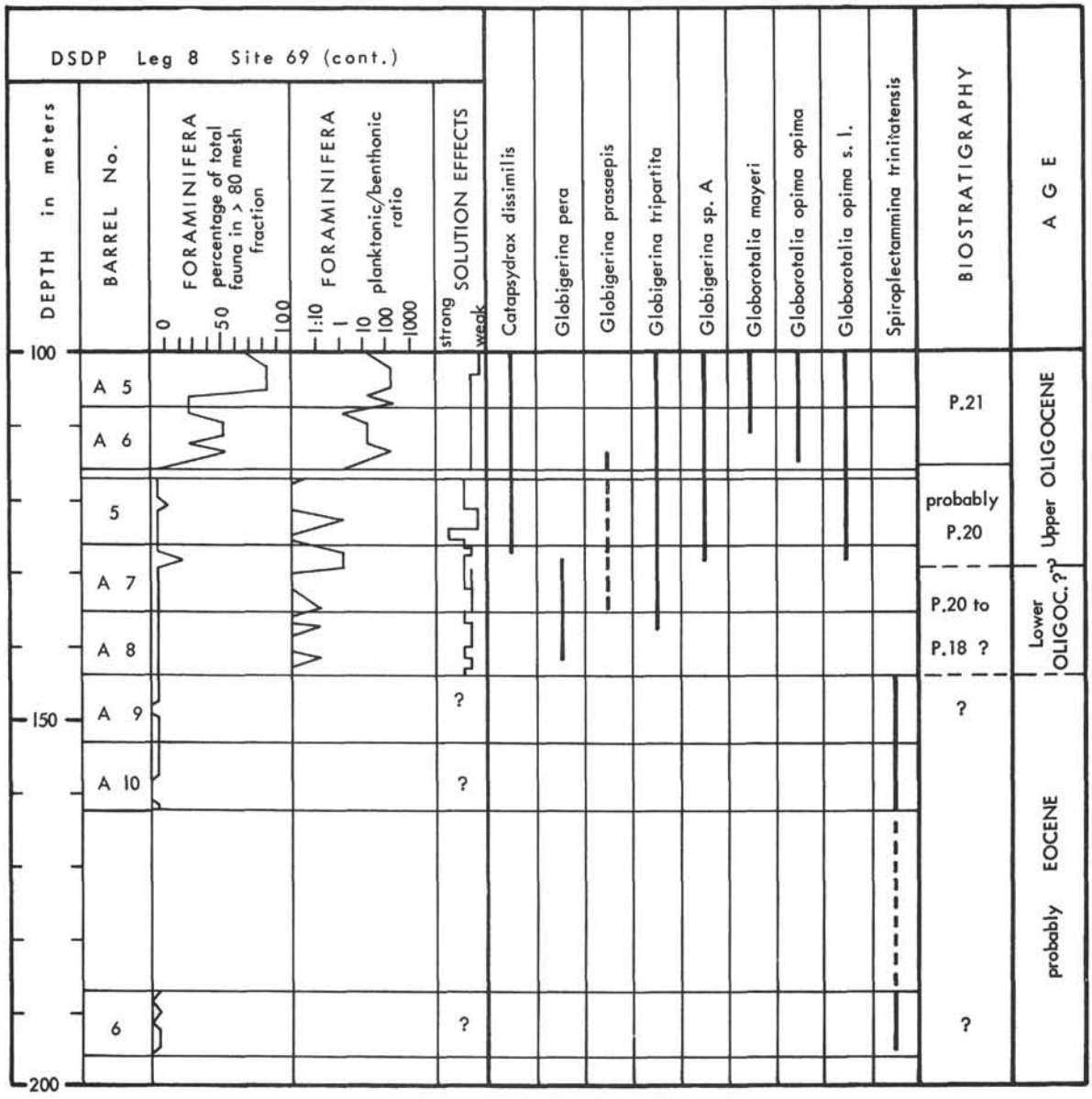


Figure 3. *Continued.*

planktonic/benthonic ratio curve on Figure 3). In the Oligocene and Lower Miocene, the most conspicuous forms belong to the genera *Eggerella, Vulvulina, Chrysalogonium, Stilostomella Cibicides, Globocassidulina, Gyroidina, Laticarinina* and *Pullenia.* In the Eocene, the foraminifera are exclusively agglutinated forms. The resemblance of these faunas to those of the Oceanic Formation of Barbados (West Indies) has already been pointed out.

The faunas of the upper part of Holes 69 and 69A are predominantly or exclusively siliceous. Planktonic foraminifera occur most abundantly in Core 69-2 (Section 3 to core catcher), at a depth of 17 to 23 meters below the sea floor. They are scarce and include *Globoquadrina dehiscens advena, Globorotalia mayeri* and *Sphaeroidinellopsis seminulina,* which indicate an age between N. 7 and N. 14.

In Section 69-3-5 (depth 29 meters) the highest *Catapsydrax dissimilis* was found, associated with *Globoquadrina praedehiscens.* A few small globorotalias, which are probably *G. pseudokugleri*, occur from this depth down to the bottom of Core 69-4 (61 meters) and suggest that this interval might be the *Globorotalia kugleri* Zone (N. 4). In this case the next two Cores, 69A-1 and 69A-2 would essentially represent the *Globigerina ciperoensis ciperoensis* Zone

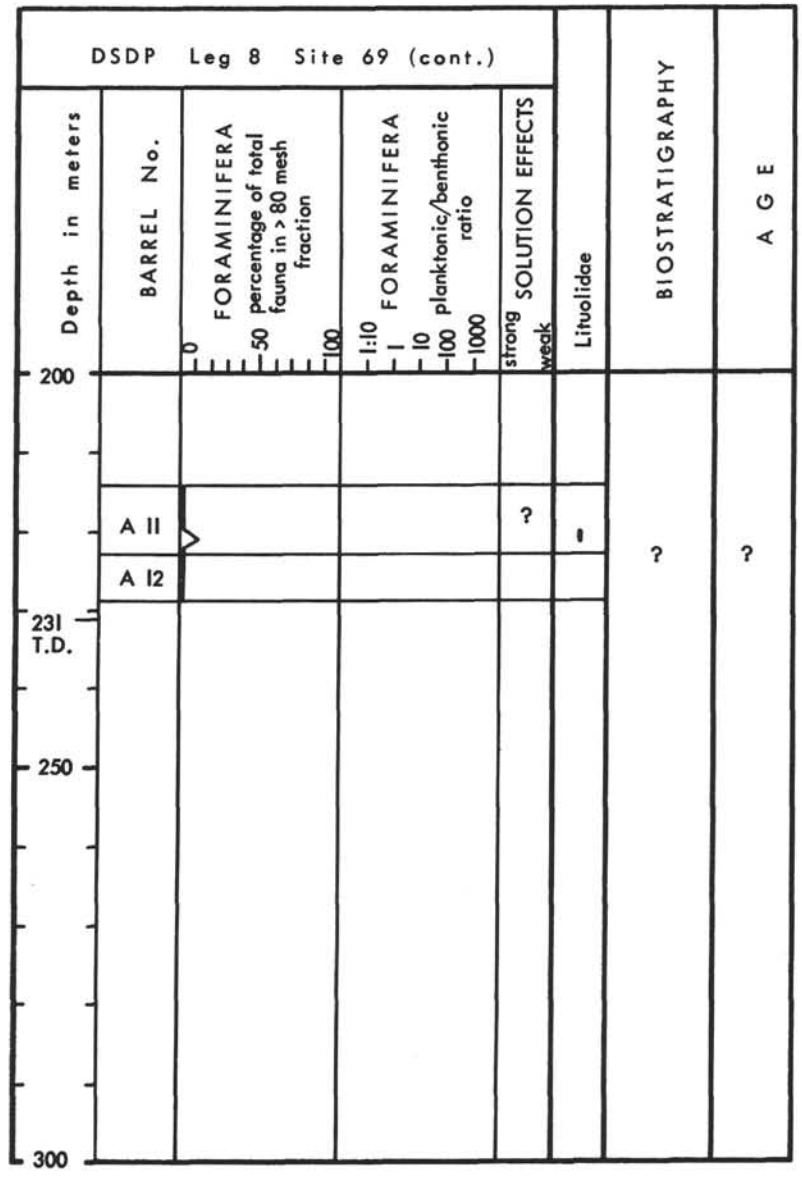


Figure 3. *Continued.*

(P. 22). The *Globorotalia opima opima* Zone (P. 21) can be identified from the core catcher sample of Core 69A-2 down to 69A-6-6 (79 to 116 meters). As expected, the lowest occurrence of *Globorotalia mayeri* is found in this Zone, in Section 69A-6-3. Smaller specimens of *Globorotalia opima* s.l. occur along with occasional *Globigerina prasaepis* below 116 meters, down to 69A-7-2. Below this, the faunas remain similar, but become successively poorer to the bottom of Core 69A-8 (144 meters). The interval from 116 to 144 meters might include the *Globigerina ampliapertura* Zone (P. 20) and possibly some slightly older beds. From the top of Core 69A-9 (144 meters) to total depth, the samples contain abundant Radiolaria together with rare agglutinated foraminifera. Among these, *Spiroplectammina trinitatensis* is probably of some stratigraphic importance, since it is a common form in the Eocene of the Caribbean area.

Calcareous Nannoplankton and Silicoflagellates

With the exception of the upper 10 meters or so, calcareous nannoplankton occur down to about 140 meters. Below this depth, the calcareous fossils have been dissolved. Thirty-one species were identified in the lower Miocene to lower Oligocene section (Table 2). In the lower Oligocene, discoasters are the predominant fossil. The stratigraphic ranges of calcareous nannoplankton are shown in Figure 4.

TABLE 2
Calcareous Nannoplankton and Silicoflagellate Occurrences in Holes 69 and 69A

Species	Occurrences (Hole/Core Nos.)
Calcareous Nannoplankton	
Coccolithus bisectus (Hay, Mohler and Wade) as figured by Bramlette and Wilcoxon	69/5; 69A/2-8
Cyclococcolithus formosus Kamptner	69A/7-8
C. neogammation Bramlette and Wilcoxon	69A/5-3; 69A/1-5; 69A/7-8
Discoaster adamanteus Bramlette and Wilcoxon	69/2-4; 69A/1-8
D. argutus Hay	69/2
D. brouweri Tan Sin Hok	69/2
D. calcaris Gartner	69/3
D. challengeri Bramlette and Riedel	69/3
D. deflandrei Bramlette and Riedel	69/2-5; 69A/1-8
D. dilatus Hay	69/2
D. druggii Bramlette and Wilcoxon	69/3
D. exilis Martini and Bramlette	69/2-3
D. extensus Hay	69/2
D. kugleri Martini and Bramlette	69/2-3
D. lautus Hay	69/2-4; 69A/1-4
D. perplexus Bramlette and Riedel	69/3
D. tani nodifer Bramlette and Riedel	69/5; 69A/6-8
D. tani ornatus Bramlette and Wilcoxon	69A/6
D. tani tani Bramlette and Riedel	69/5; 69A/5-6
D. variabilis Martini and Bramlette	69/2-3
Helicopontosphaera compacta Bramlette and Wilcoxon	69/5?; 69/6
Reticulofenestra umbilica (Levin) Martini and Ritzkowski	69A/7-8
Sphenolithus belemnos Bramlette and Wilcoxon	69A/1
S. ciperoensis Bramlette and Wilcoxon	69A/1-3
S. distentus (Martini) Bramlette and Wilcoxon	69A/3-5
S. heteromorphus Deflandre	?
S. moriformis (Bronnimann and Stradner) Bramlette and Wilcoxon	69/3-5; 69A/1-8
S. predistentus Bramlette and Wilcoxon	69/5; 69A/3-8
S. pseudoradians Bramlette and Wilcoxon	69A/6
Triquetrorhabdulus carinatus Martini	69/4-5; 69A/1-3
T. rugosus Bramlette and Wilcoxon	69/2
Silicoflagellates	
Corbisema tricantha (Ehrenberg) Hanna	69A/9
Dictyocha fibula Ehrenberg	69/1-2
Distephanus speculum (Ehrenberg) Haeckel	69/4
D. speculum brevispinus (Gemeinhardt) Frenguelli	69/1

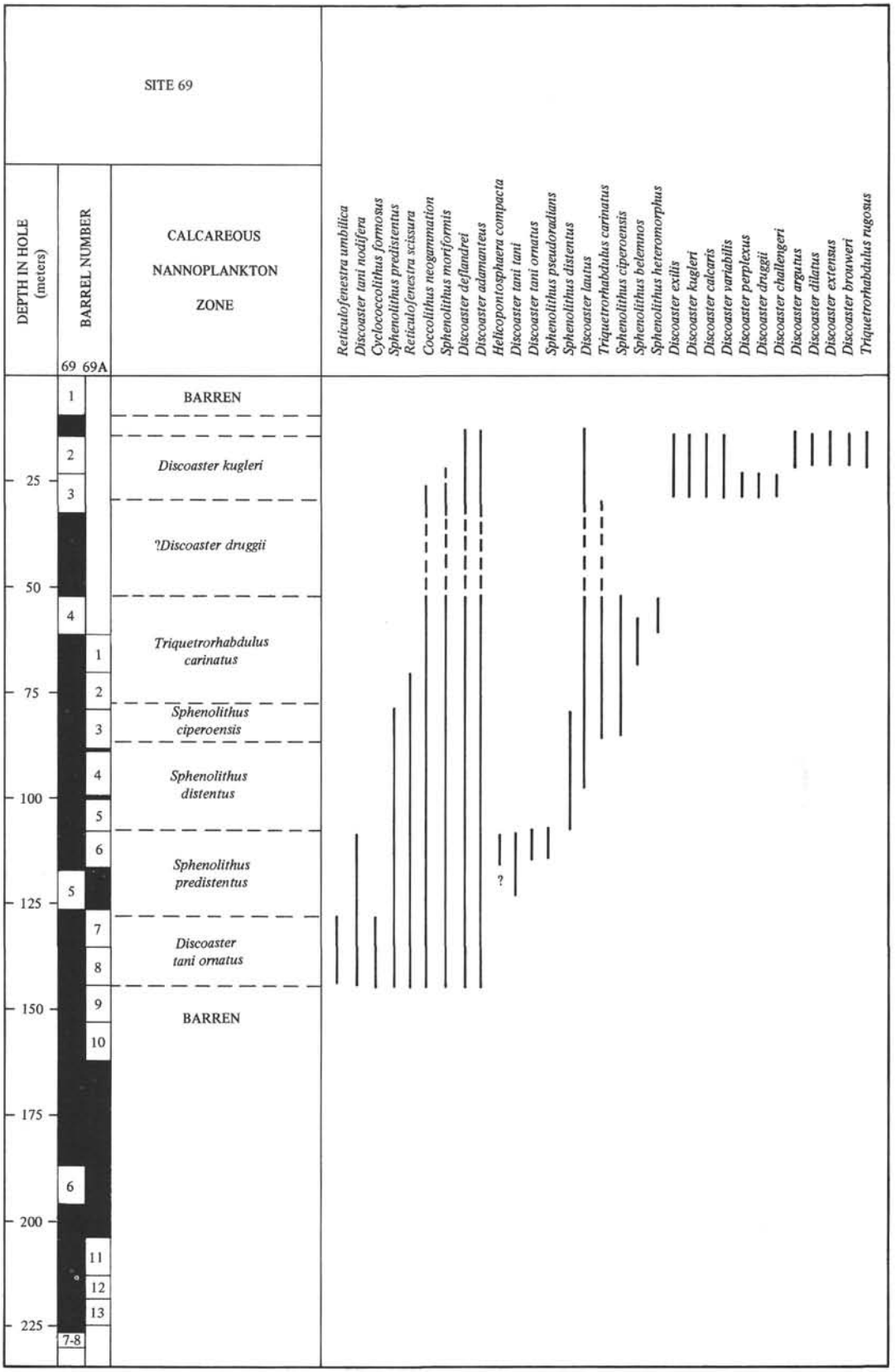


Figure 4. *Calcareous nannoplankton of Site 69. Distribution and biostratigraphy.*

Silicoflagellates are common in the middle Miocene sediments but are virtually absent below about 30 meters. *Dictyocha tricantha* is present in the upper Eocene.

The following calcareous nannoplankton zones were recognized at Site 69:

Hole 69	
Core 1-1 to 1-CC:	Barren
Core 2-1 to 3-4:	*Discoaster kugleri* Zone
Core 3-5 to 3-CC:	*Discoaster druggii* Zone?
Core 4-1 to 4-CC:	*Triquetrorhabdulus carinatus* Zone
Core 5-1 to 5-CC:	*Sphenolithus predistentus* Zone
Core 6-6 to 6-CC:	Barren
Hole 69A	
Core 1-1 to 2-4:	*Triquetrorhabdulus carinatus* Zone
Core 2-5 to 3-5:	*Sphenolithus ciperoensis* Zone
Core 3-6 to 5-CC:	*Sphenolithus distentus* Zone
Core 6-1 to 7-1:	*Sphenolithus predistentus* Zone
Core 7-2 to 8-CC:	*Discoaster tani ornatus* Zone
Core 9-1 to 11-CC:	Barren, with younger contamination
Core 12-1:	Barren, with younger contamination

Radiolaria

The first core (69-1), taken at the sea floor, contains sediments from the uppermost Middle Miocene. From this point down to the Upper Eocene a fairly continuous section was cored. The Lower Miocene-Oligocene section is very thick and contains about 50 meters of section which has not been previously zoned with Radiolaria. A zonation of this interval is proposed in the summary section on Radiolaria. The radiolarian ooze above the chert that terminated Hole 69A was from the lower part of the Middle Eocene.

Radiolaria are numerous and moderately well preserved throughout the section cored. Some solution of the tests is evident in samples from Cores 69-4 (Lower Miocene), 69A-6, 69-5 (the lower part of the Upper Oligocene). Reworking and mixing were frequently encountered in the upper 100 meters of the section and were most common in the noncalcareous part of the section (Cores 69-1, 69A-9, 69A-10) and in Core 69-4. Diatoms are particularly abundant in the Lower Oligocene and uppermost Eocene part of the section.

REFERENCE

Berggren, W. A., 1969. Cenozoic chronostratigraphy, planktonic foraminiferal zonation and the radiometric time scale. *Nature.* **224**, 1072.

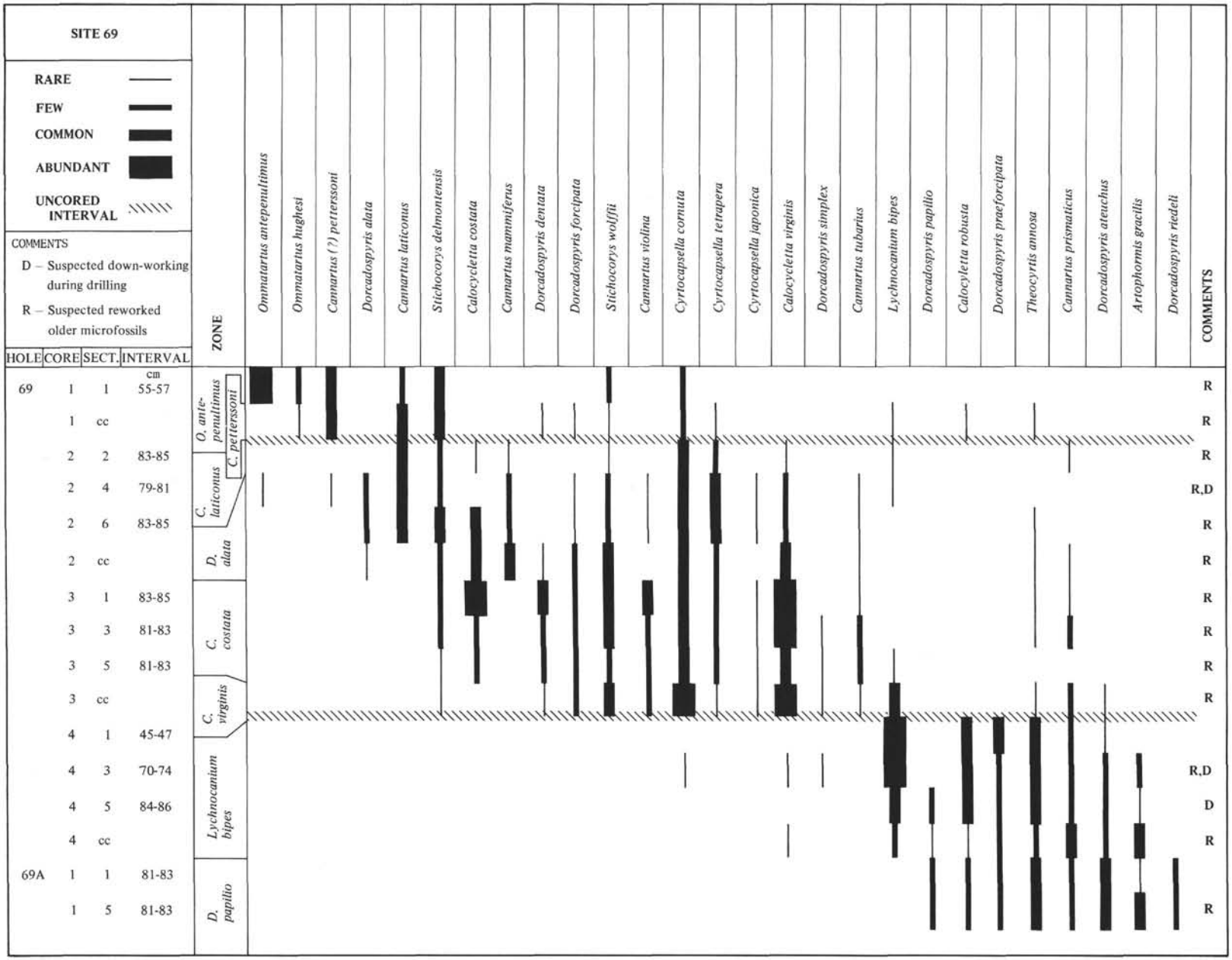
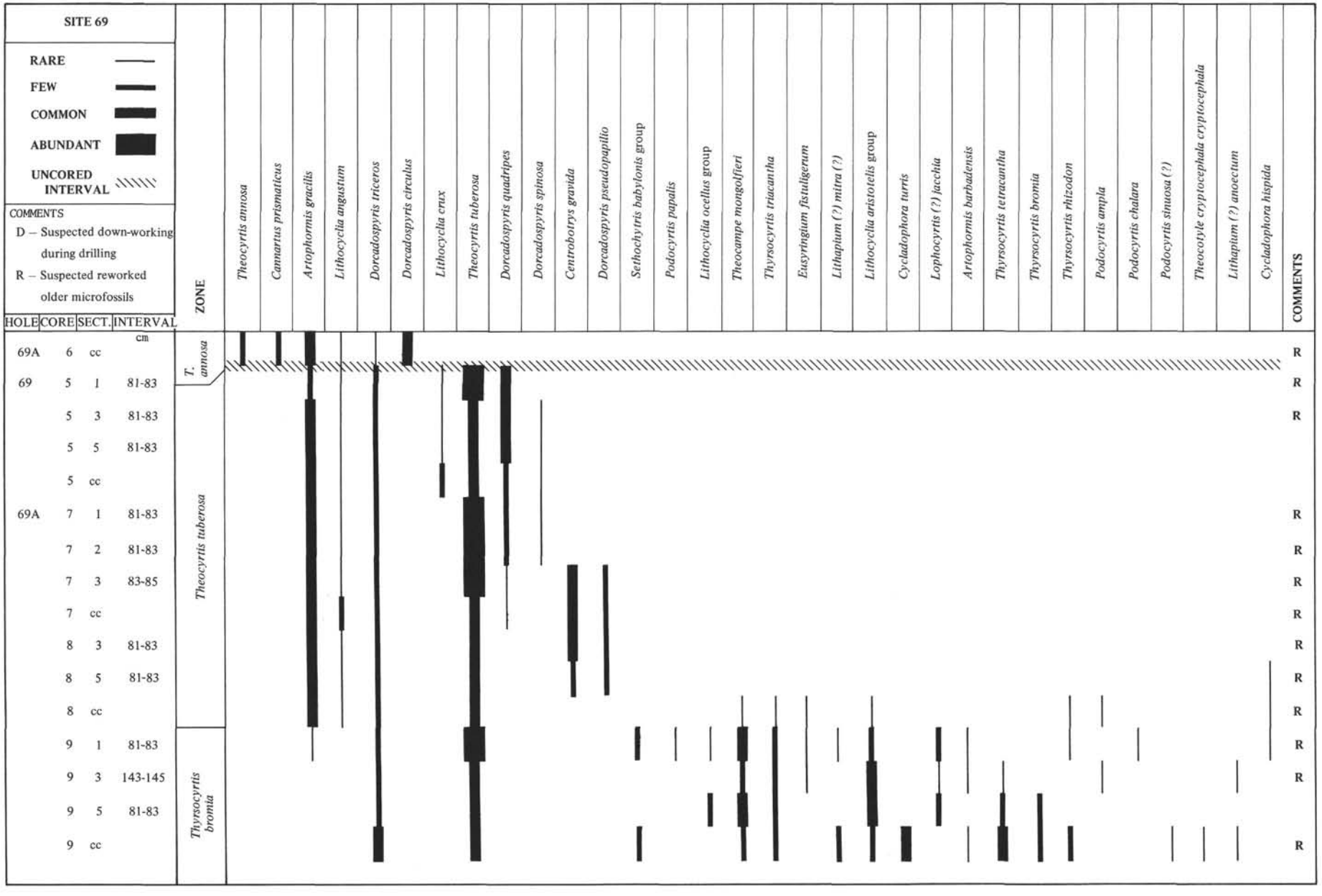


Figure 5. *Radiolaria at Site 69. Frequency, distribution and biostratigraphy.*



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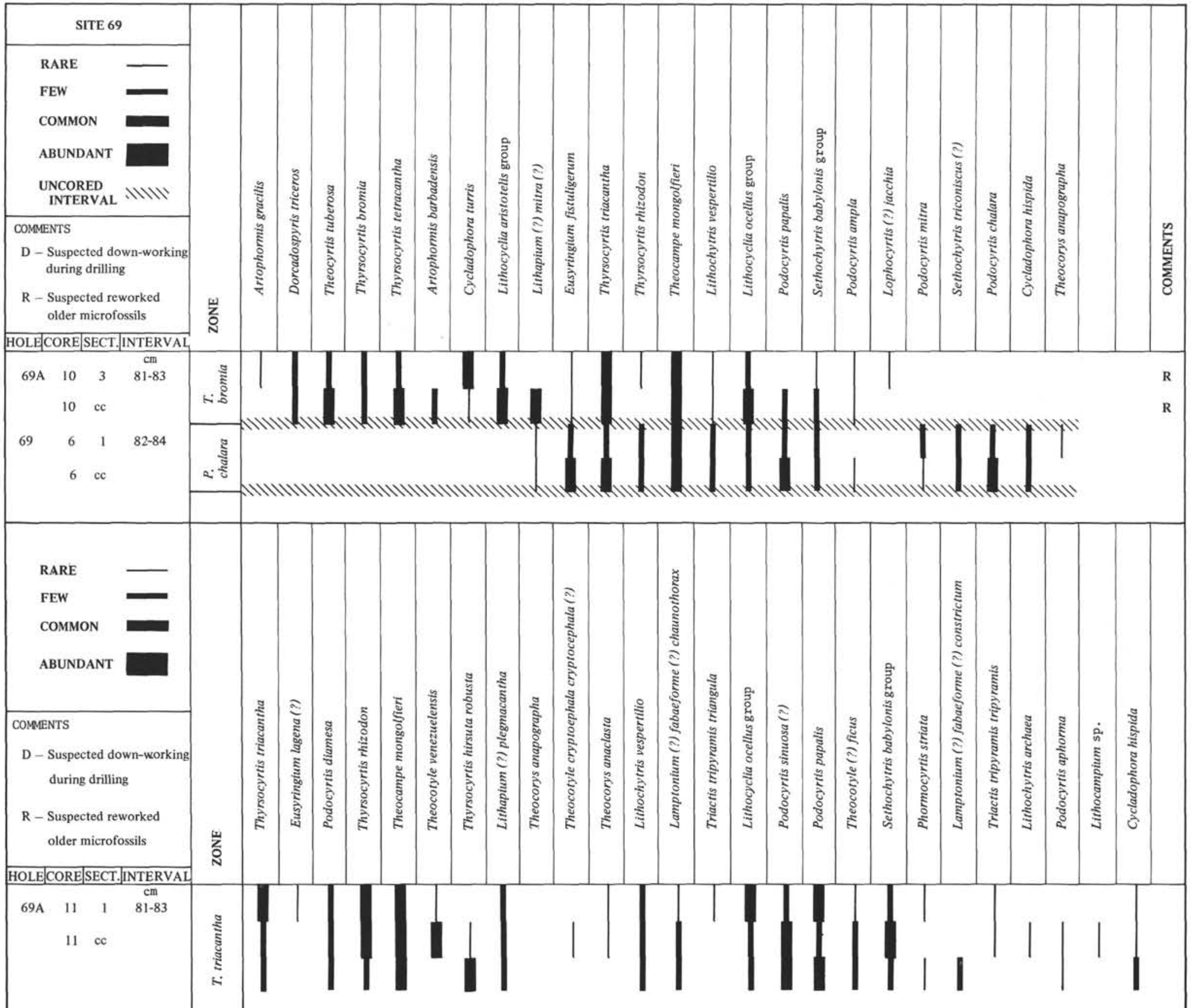

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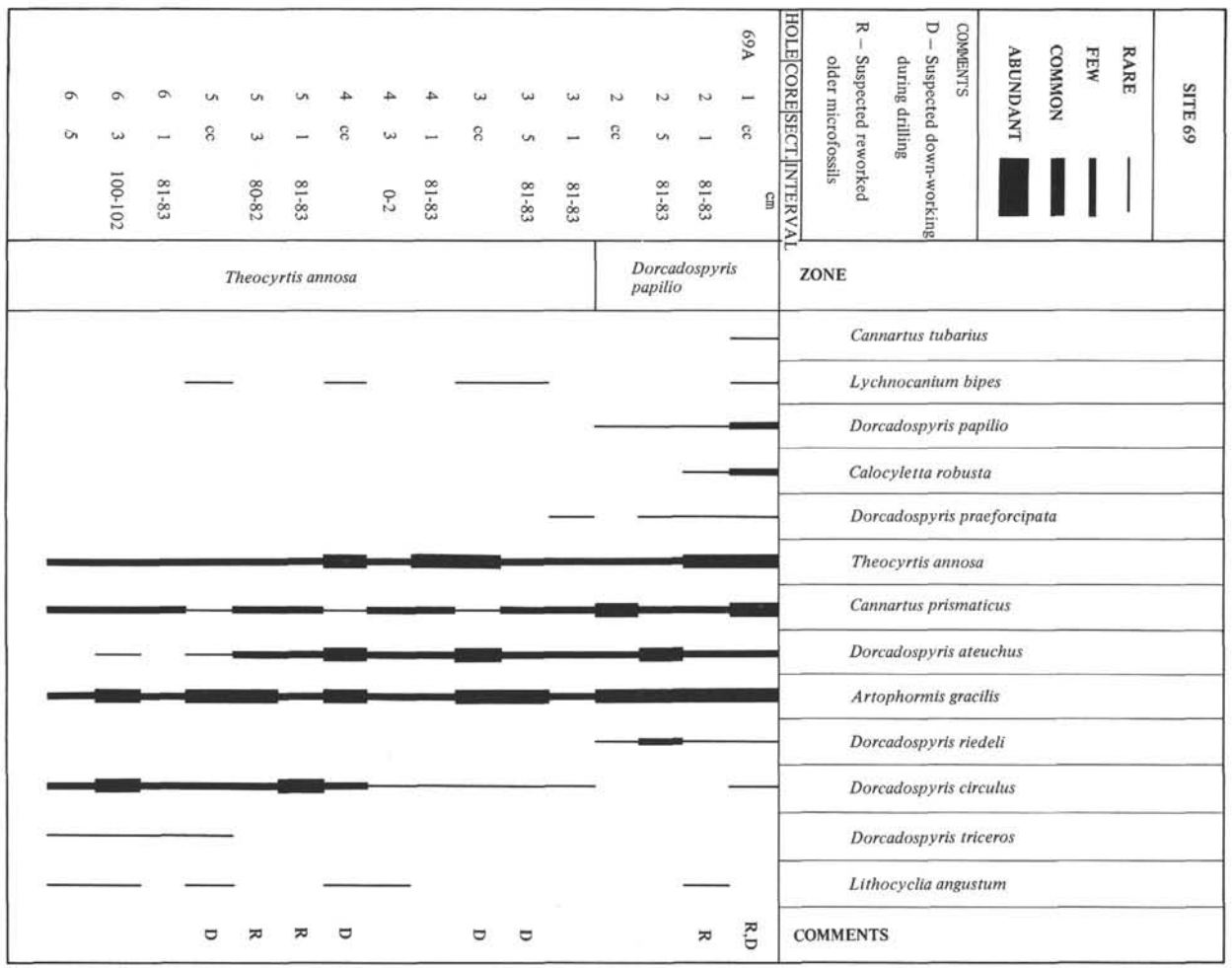

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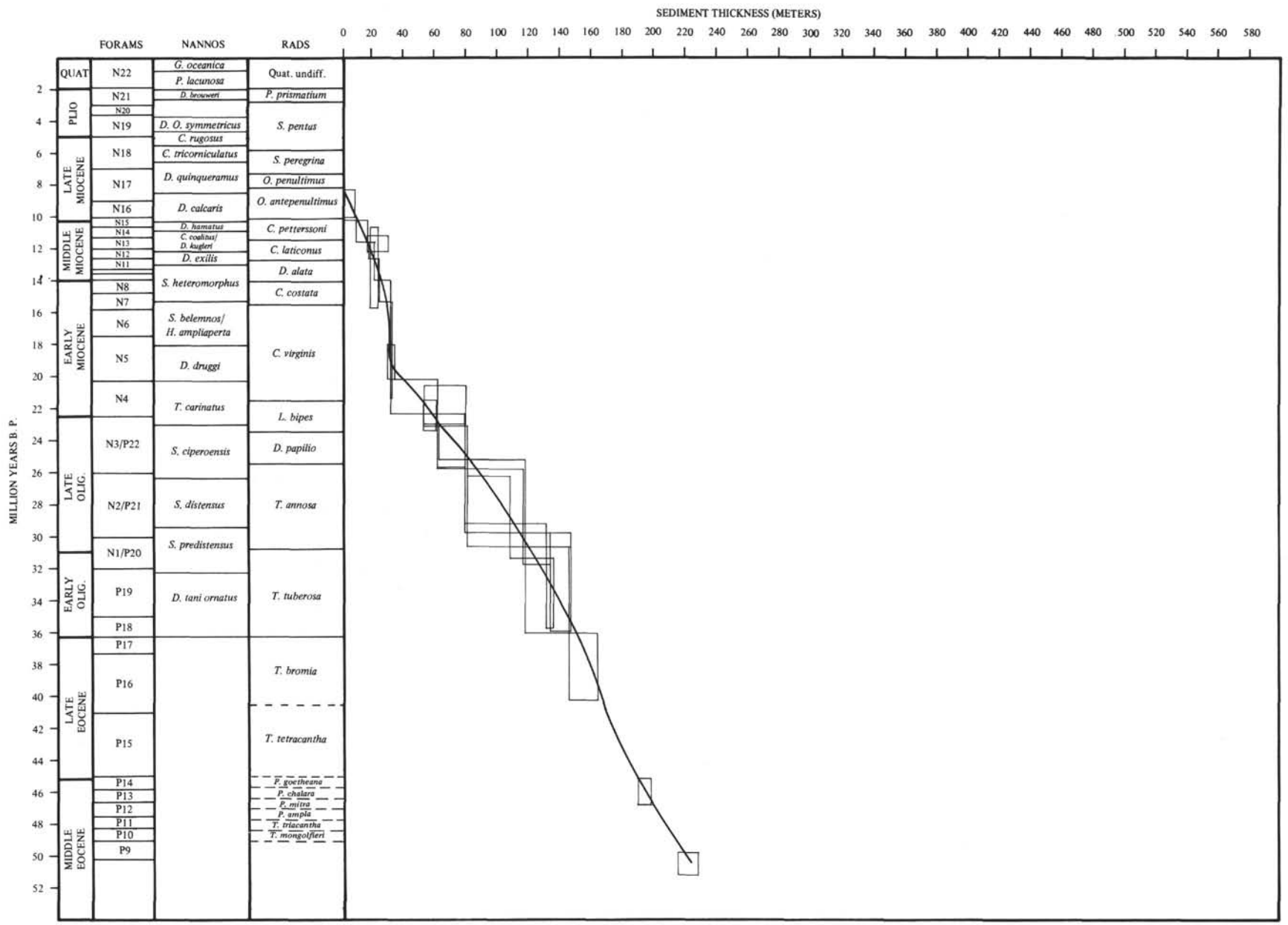
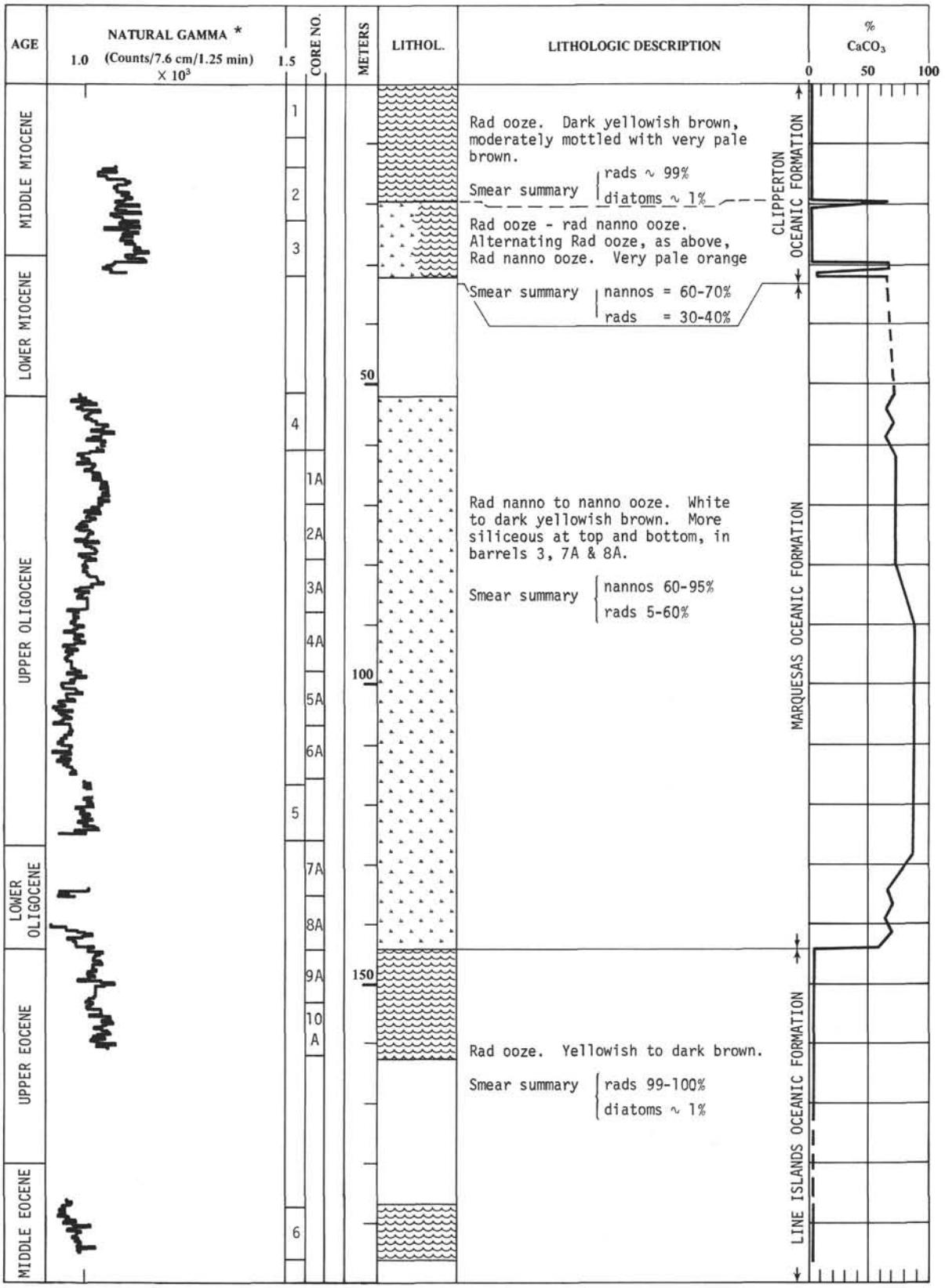
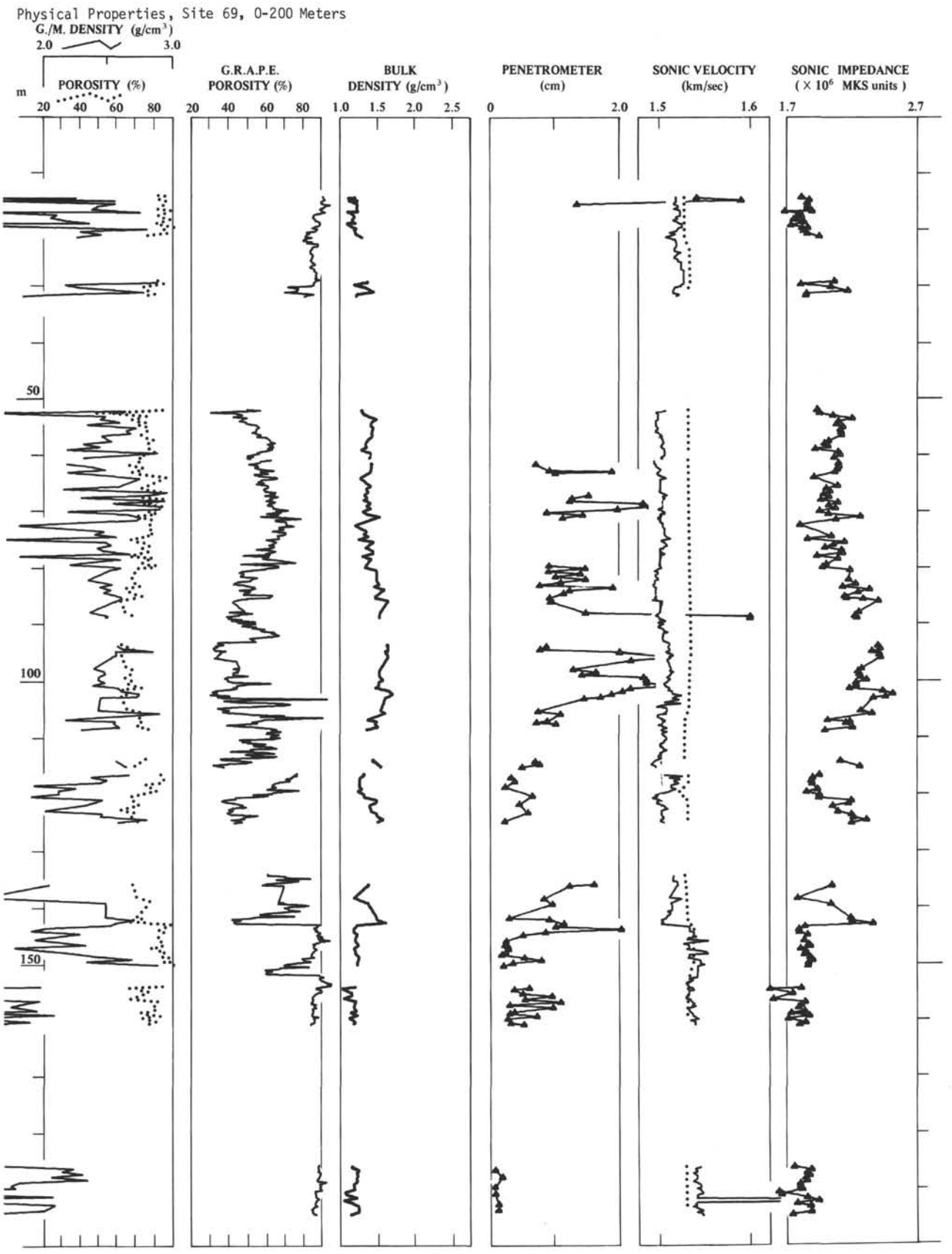
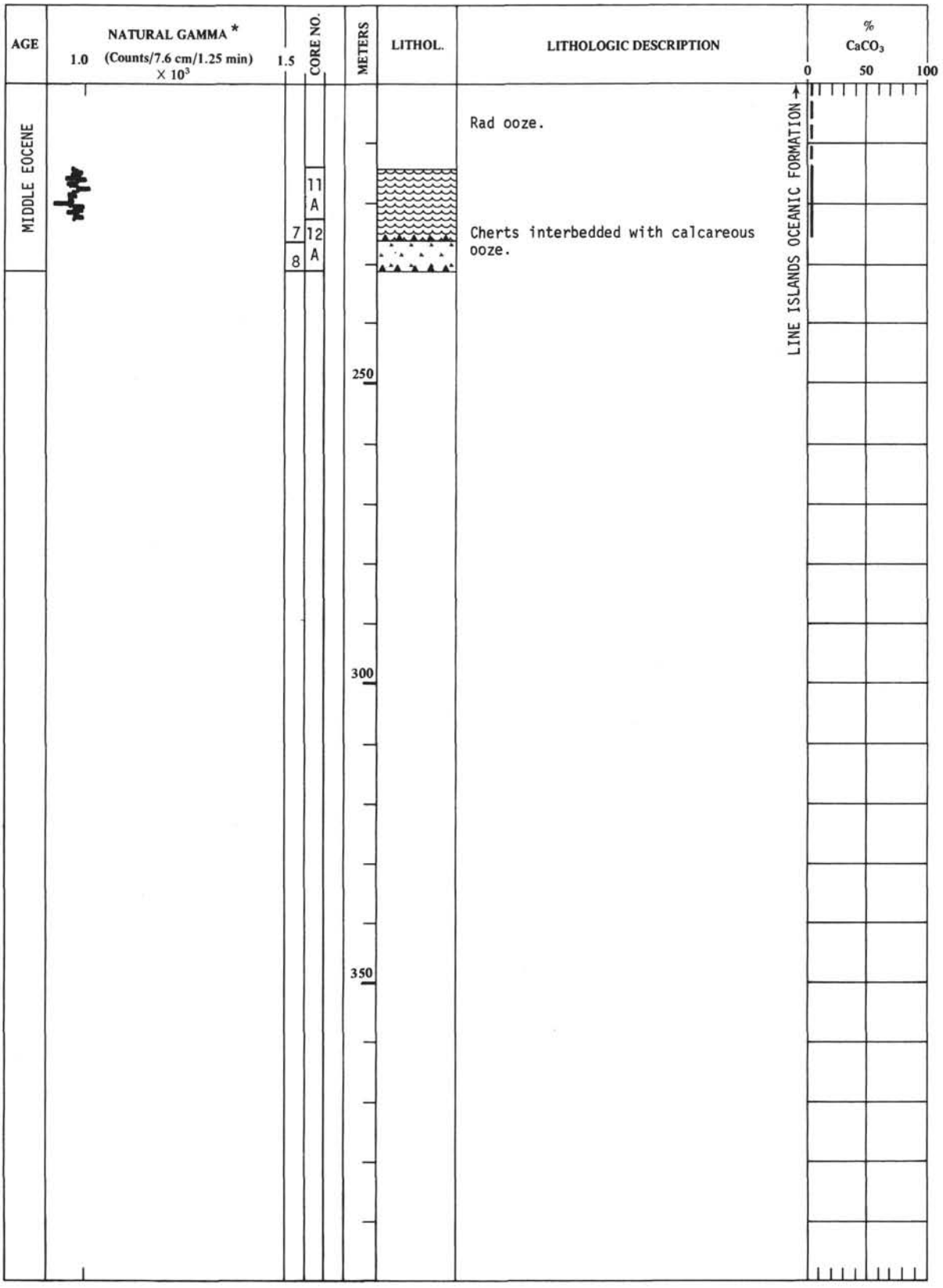


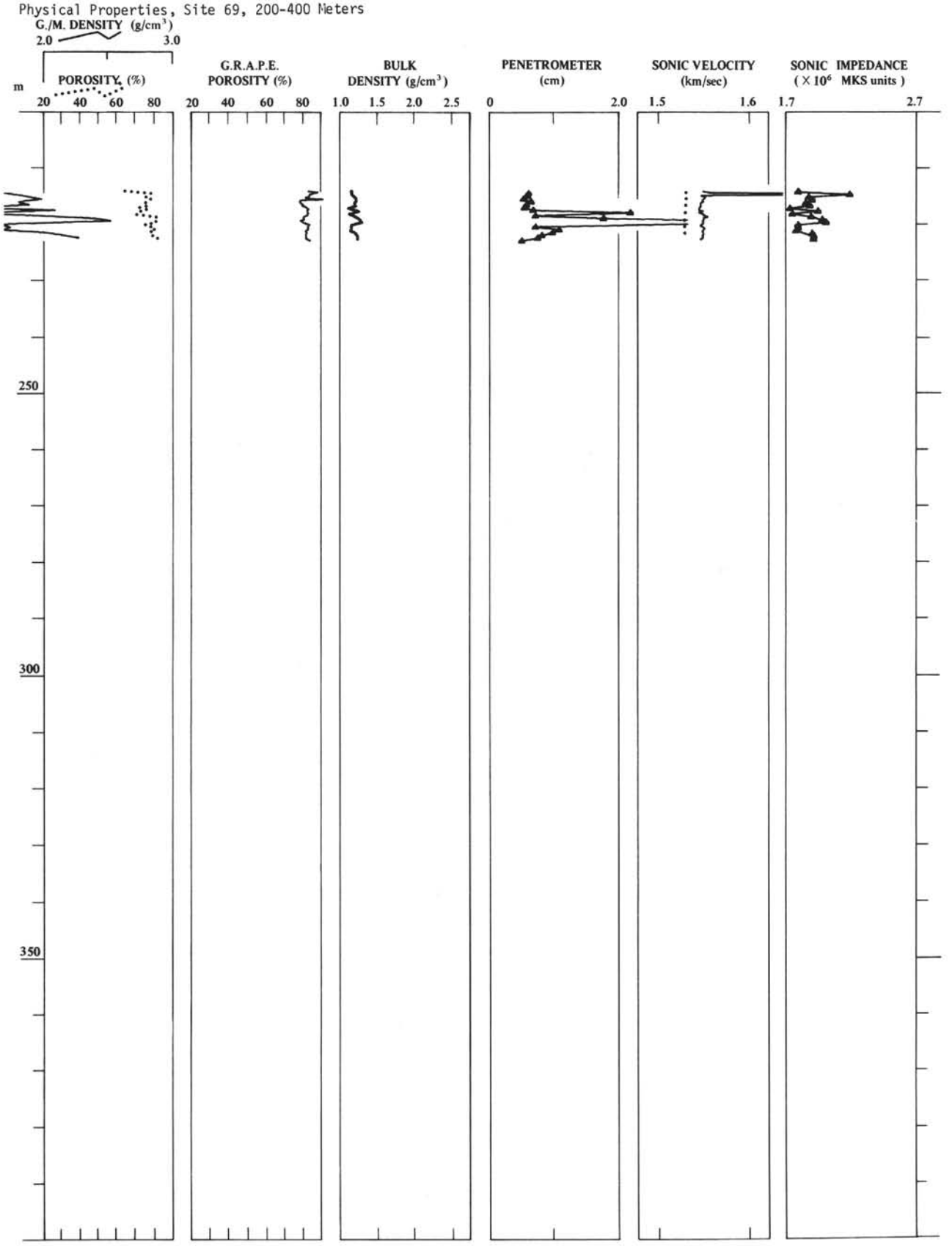
Figure 6. *Age versus depth at Site 69, based on the biostratigraphic zonations of the foraminifera, calcareous nannoplankton and Radiolaria. Ages based on the time scale of Berggren (1969).*


AGE
NATURAL GAMMA *
1.0 (Counts/7.6 cm/1.25 min) 1.5
× 10³
CORE NO.
METERS
LITHOL.
LITHOLOGIC DESCRIPTION
% CaCO₃
0 50 100
MIDDLE MIOCENE
LOWER MIOCENE
UPPER OLIGOCENE
LOWER OLIGOCENE
UPPER EOCENE
MIDDLE EOCENE
1
2
3
4
5
6
1A
2A
3A
4A
5A
6A
7A
8A
9A
10 A
50
100
150
Rad ooze. Dark yellowish brown, moderately mottled with very pale brown.
Smear summary
rads ~ 99%
diatoms ~ 1%
Rad ooze - rad nanno ooze. Alternating Rad ooze, as above, Rad nanno ooze. Very pale orange
Smear summary
nannos = 60-70%
rads = 30-40%
Rad nanno to nanno ooze. White to dark yellowish brown. More siliceous at top and bottom, in barrels 3, 7A & 8A.
Smear summary
nannos 60-95%
rads 5-60%
Rad ooze. Yellowish to dark brown.
Smear summary
rads 99-100%
diatoms ~ 1%
CLIPPERTON OCEANIC FORMATION
MARQUESAS OCEANIC FORMATION
LINE ISLANDS OCEANIC FORMATION

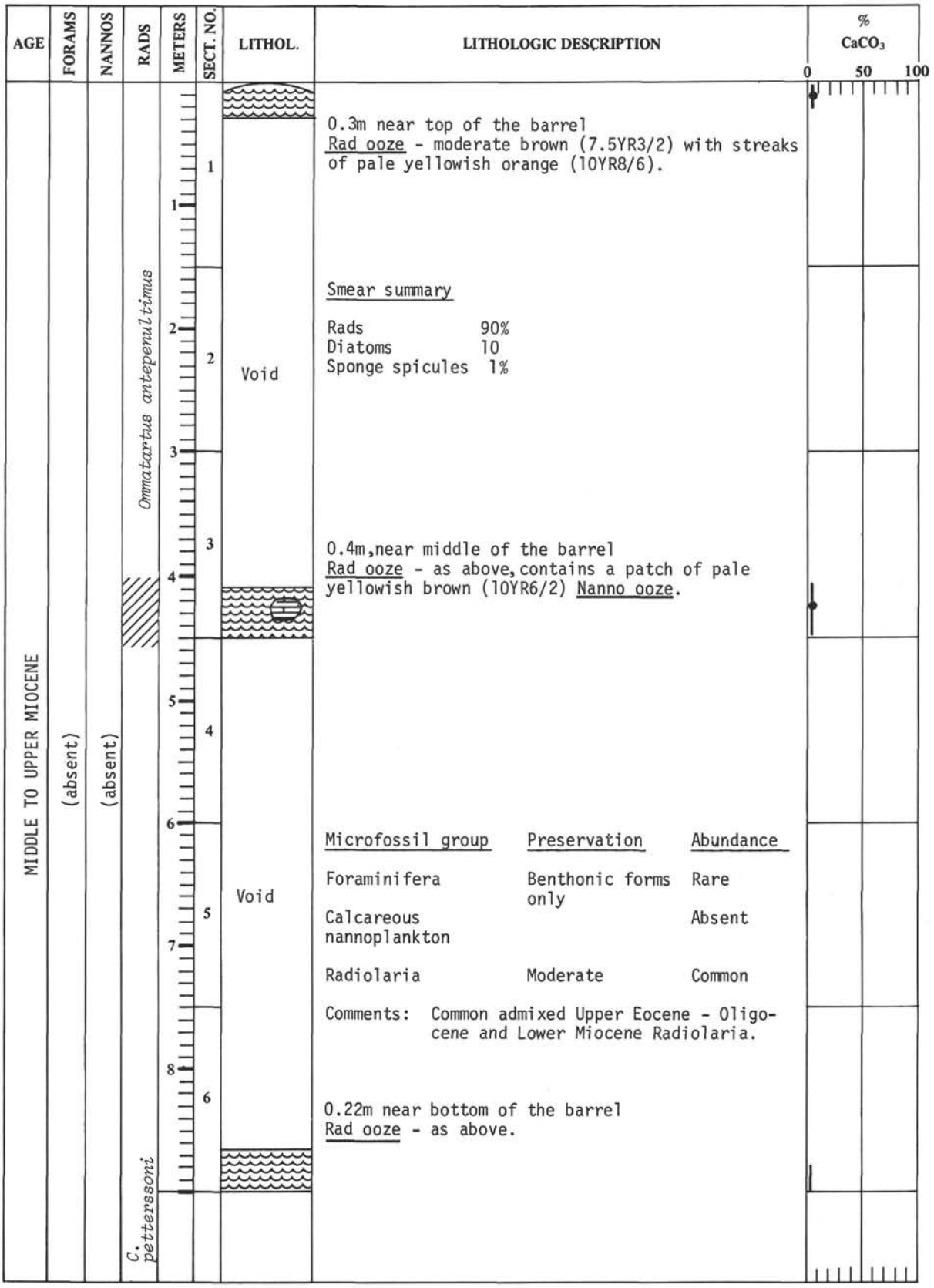

Physical Properties, Site 69, 0-200 Meters
G./M. DENSITY (g/cm³)
2.0
3.0
m
POROSITY (%)
20 40 60 80
G.R.A.P.E. POROSITY (%)
20 40 60 80
BULK DENSITY (g/cm³)
1.0 1.5 2.0 2.5
PENETROMETER (cm)
0 2.0
SONIC VELOCITY (km/sec)
1.5 1.6
SONIC IMPEDANCE (× 10⁶ MKS units)
1.7 2.7
50
100
150


AGE
NATURAL GAMMA *
1.0 (Counts/7.6 cm/1.25 min) × 10³
1.5
CORE NO.
METERS
LITHOL.
LITHOLOGIC DESCRIPTION
% CaCO₃
0
50
100
MIDDLE EOCENE
LINE ISLANDS OCEANIC FORMATION
Rad ooze.
Cherts interbedded with calcareous ooze.
7
8
11 A
12 A
250
300
350

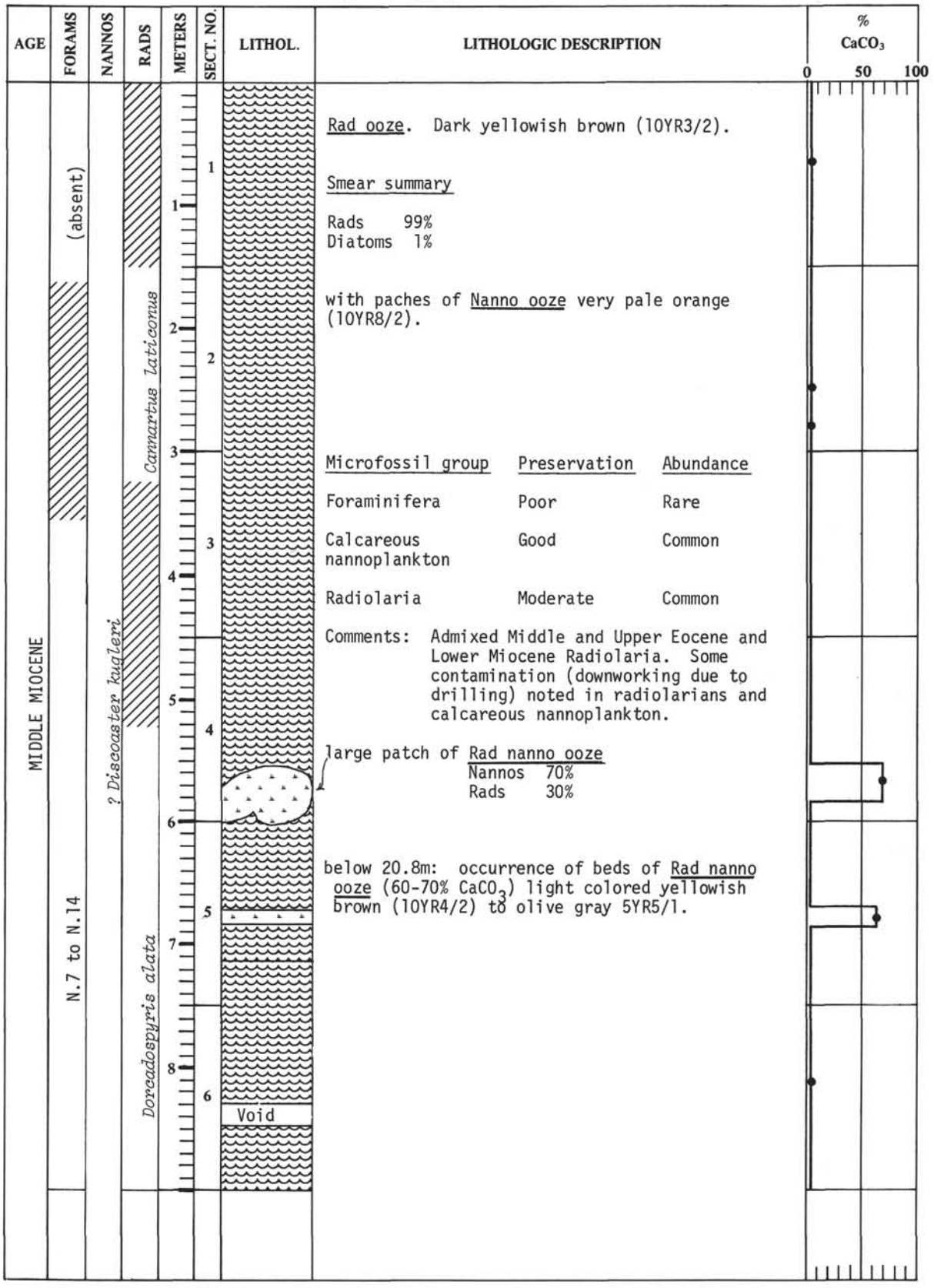
Physical Properties, Site 69, 200-400 Meters



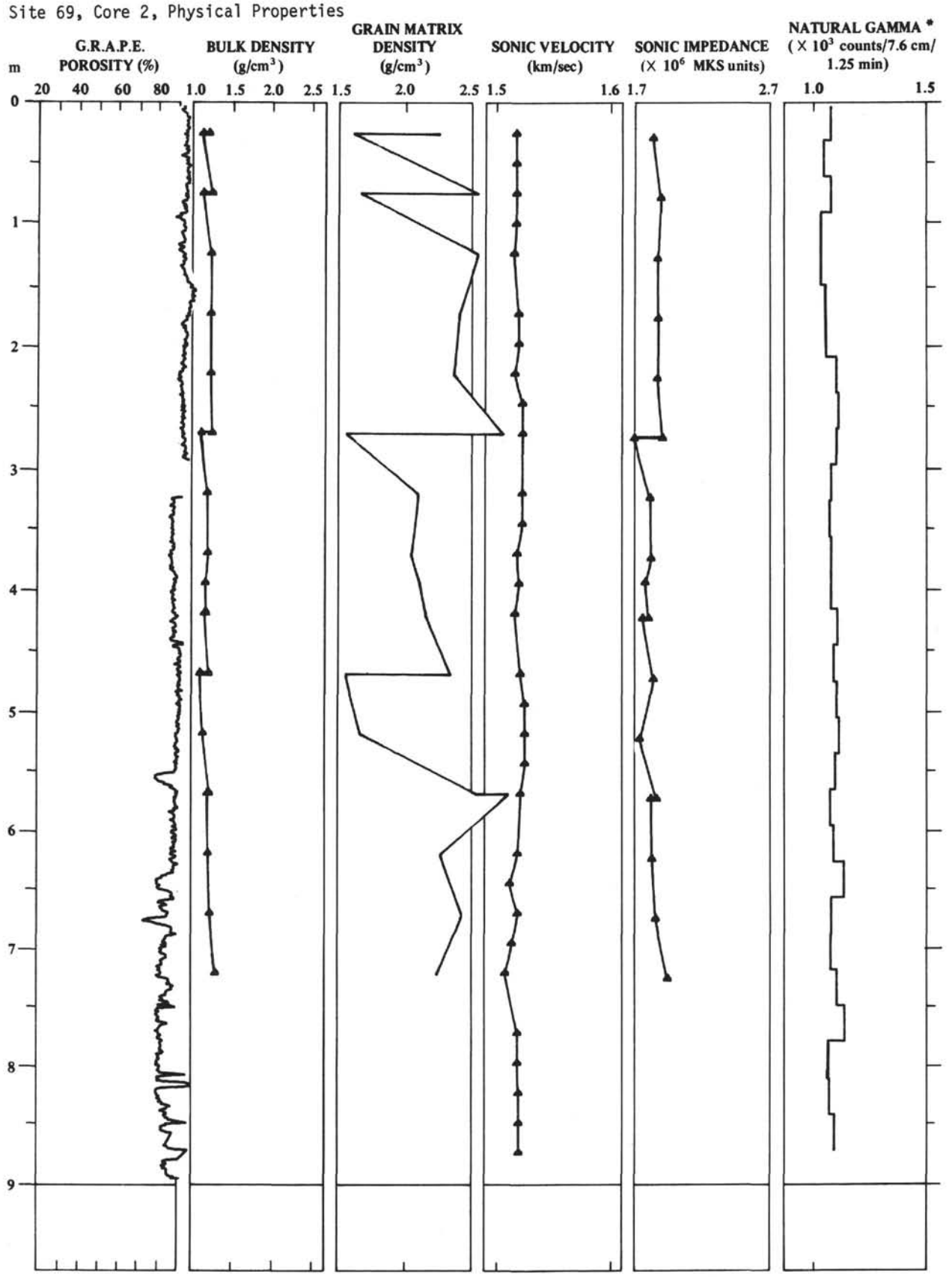
SITE 69 Core 1 Cored interval: 0-9 m



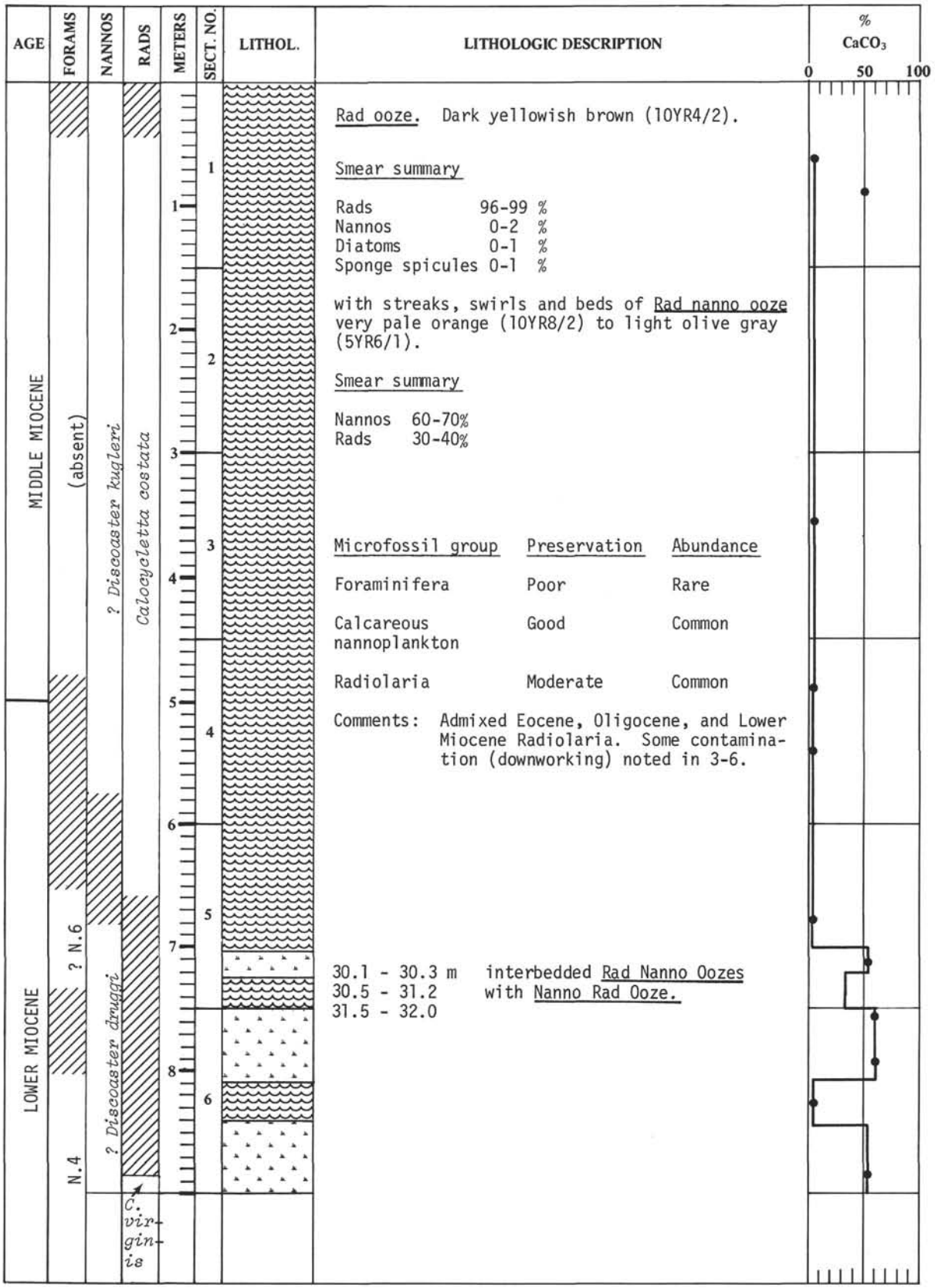
SITE 69 Core 2 Cored interval: 14-23 m



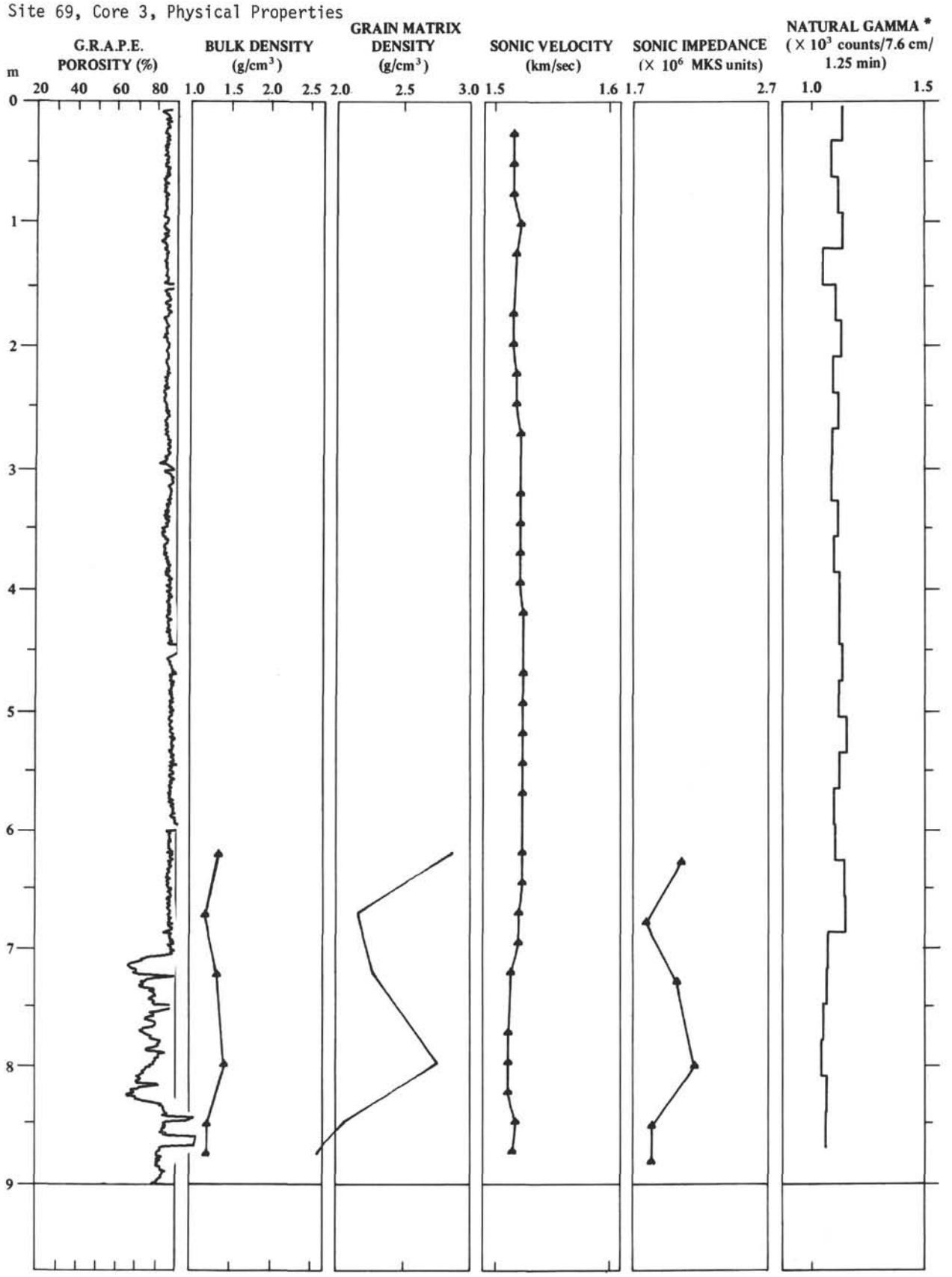
Site 69, Core 2, Physical Properties



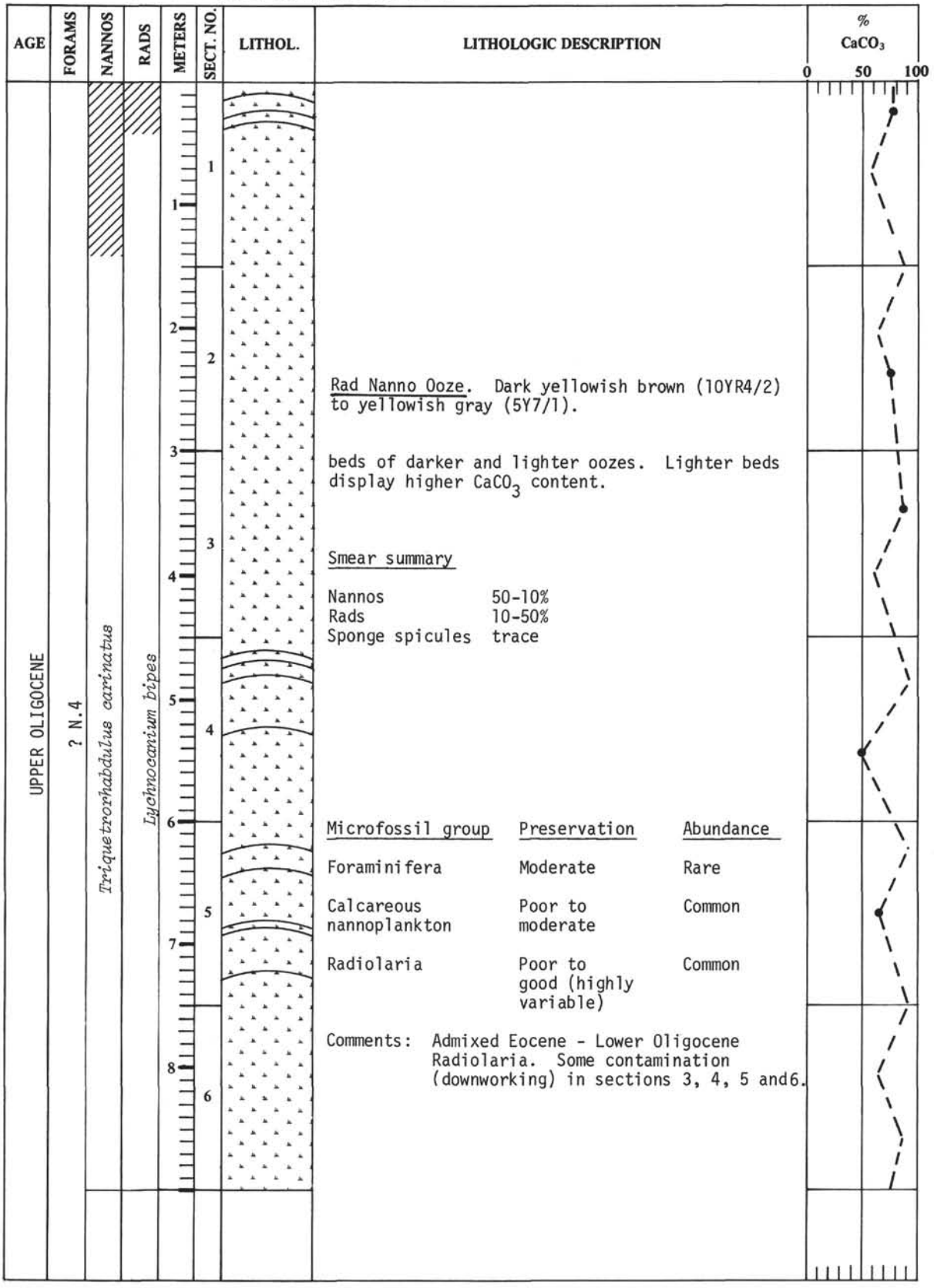
SITE 69 Core 3 Cored interval: 23-32 m



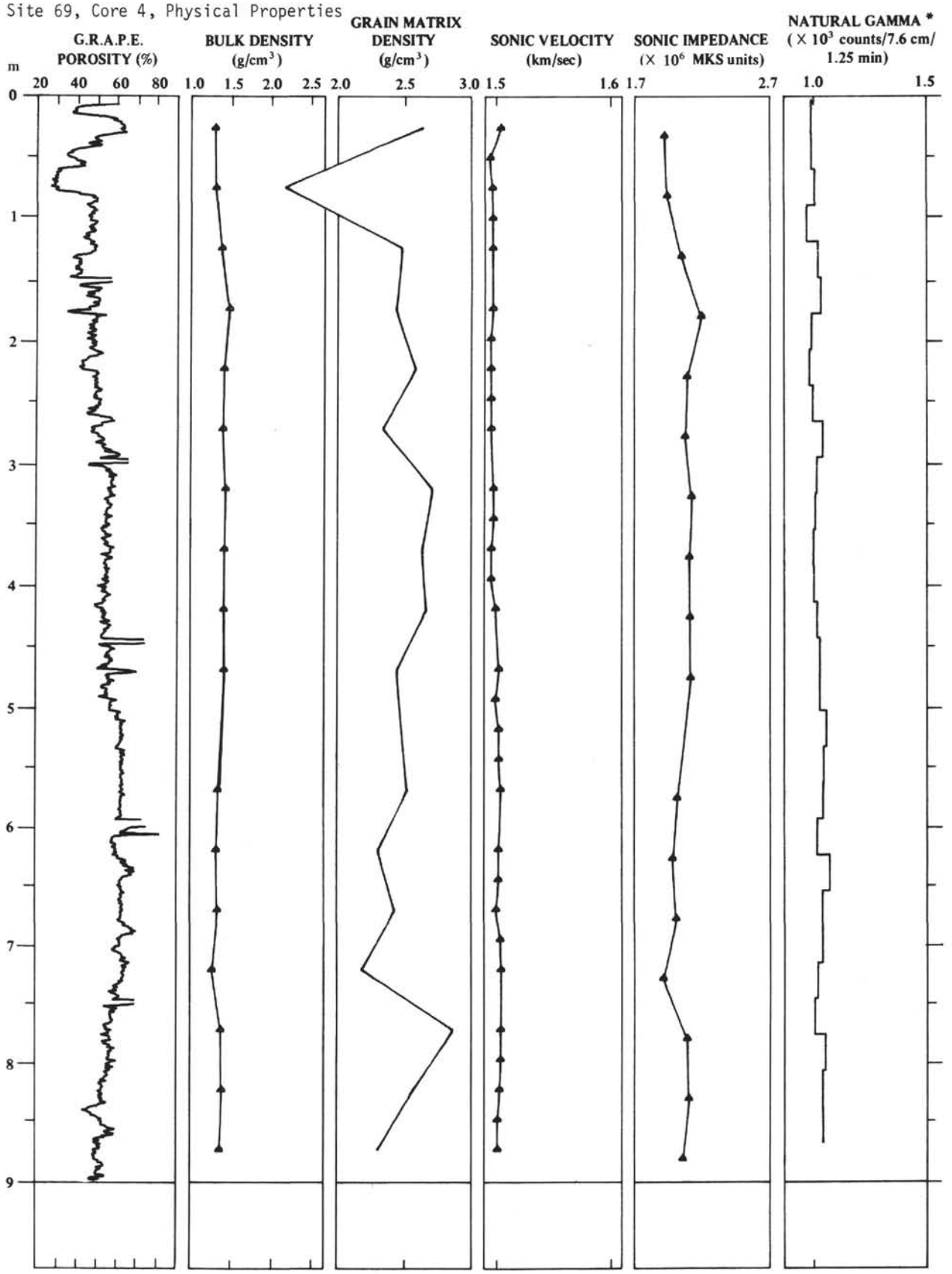
Site 69, Core 3, Physical Properties



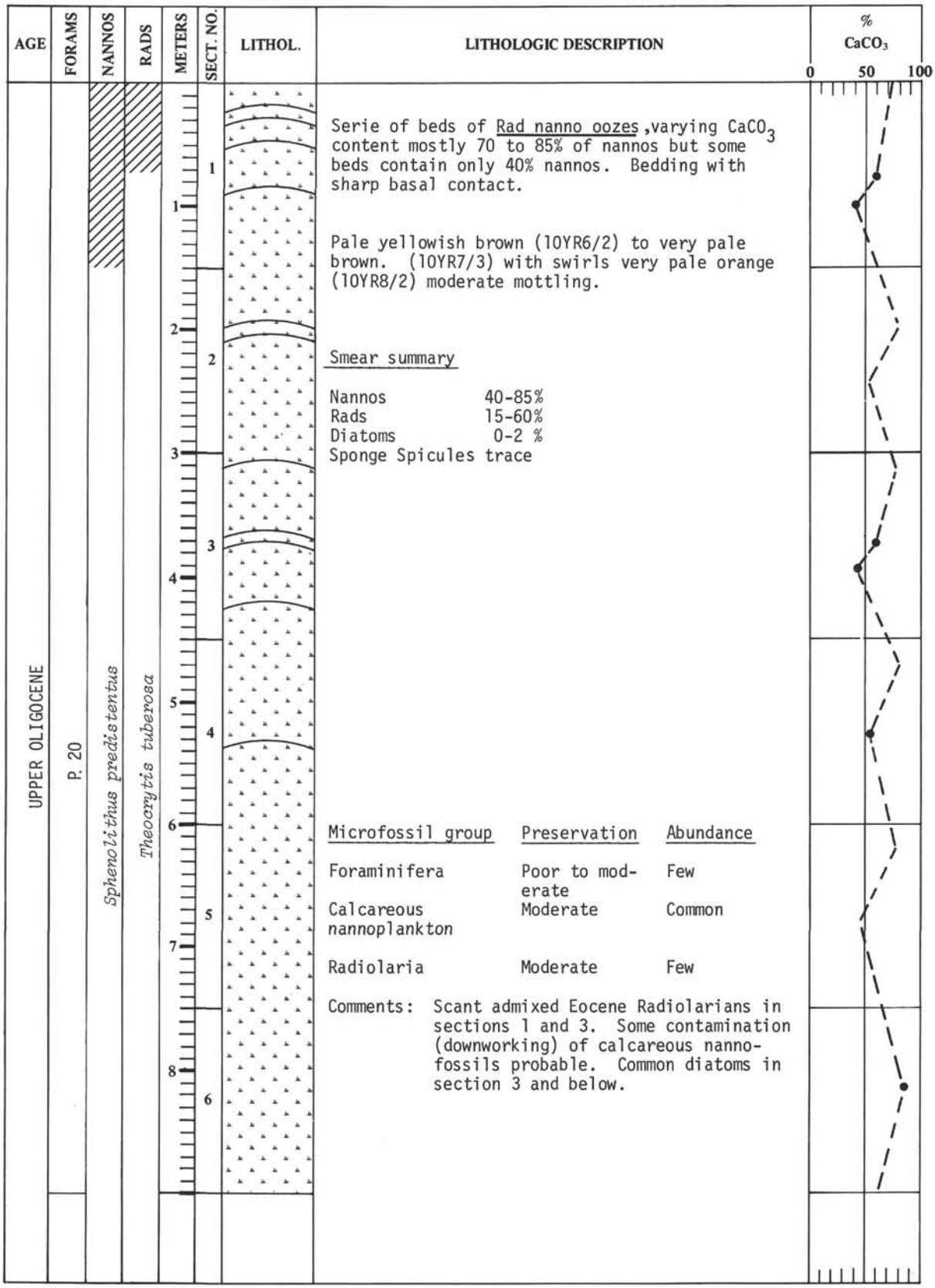
SITE 69 Core 4 Cored interval: 52-61 m



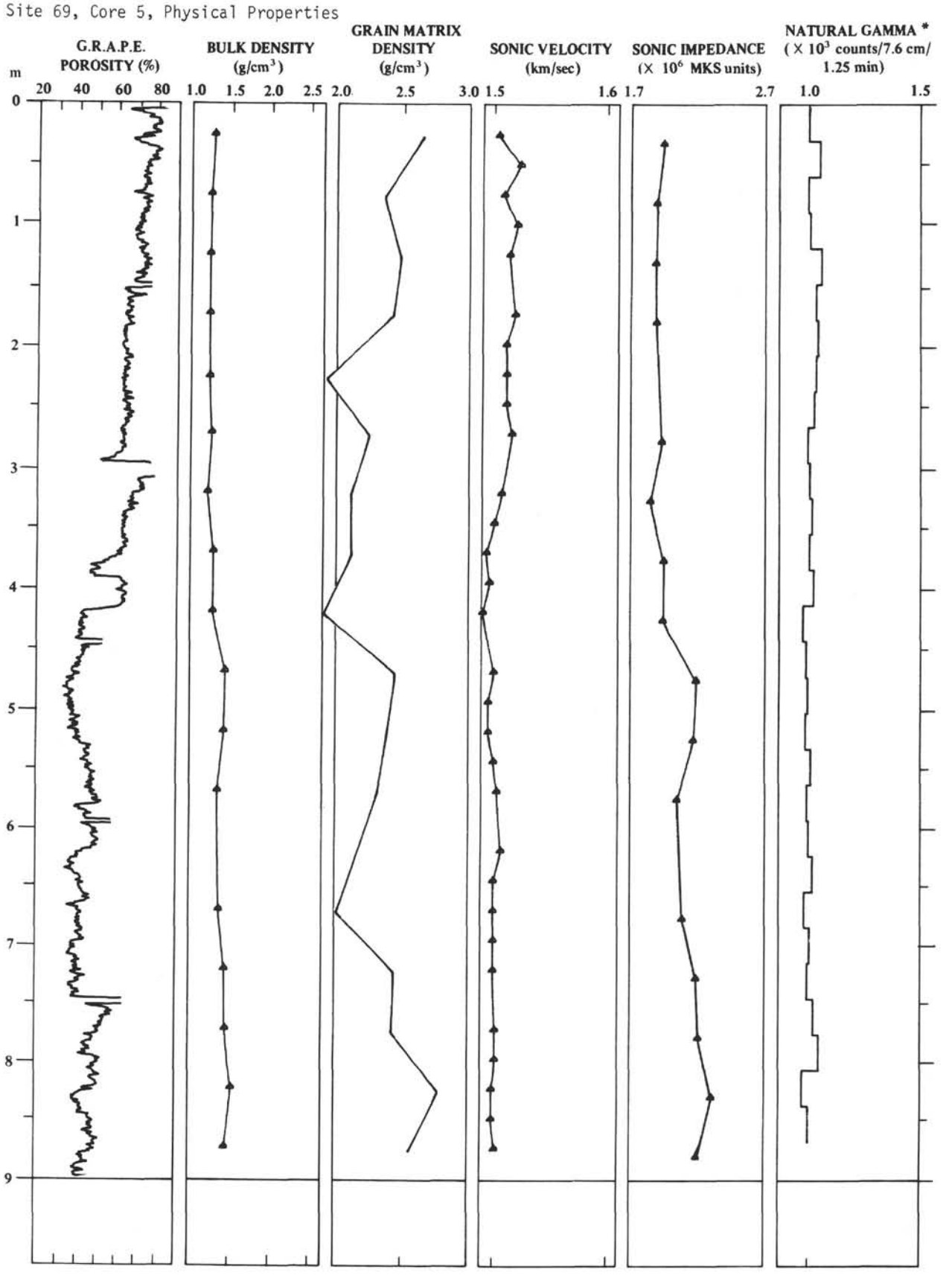
Site 69, Core 4, Physical Properties



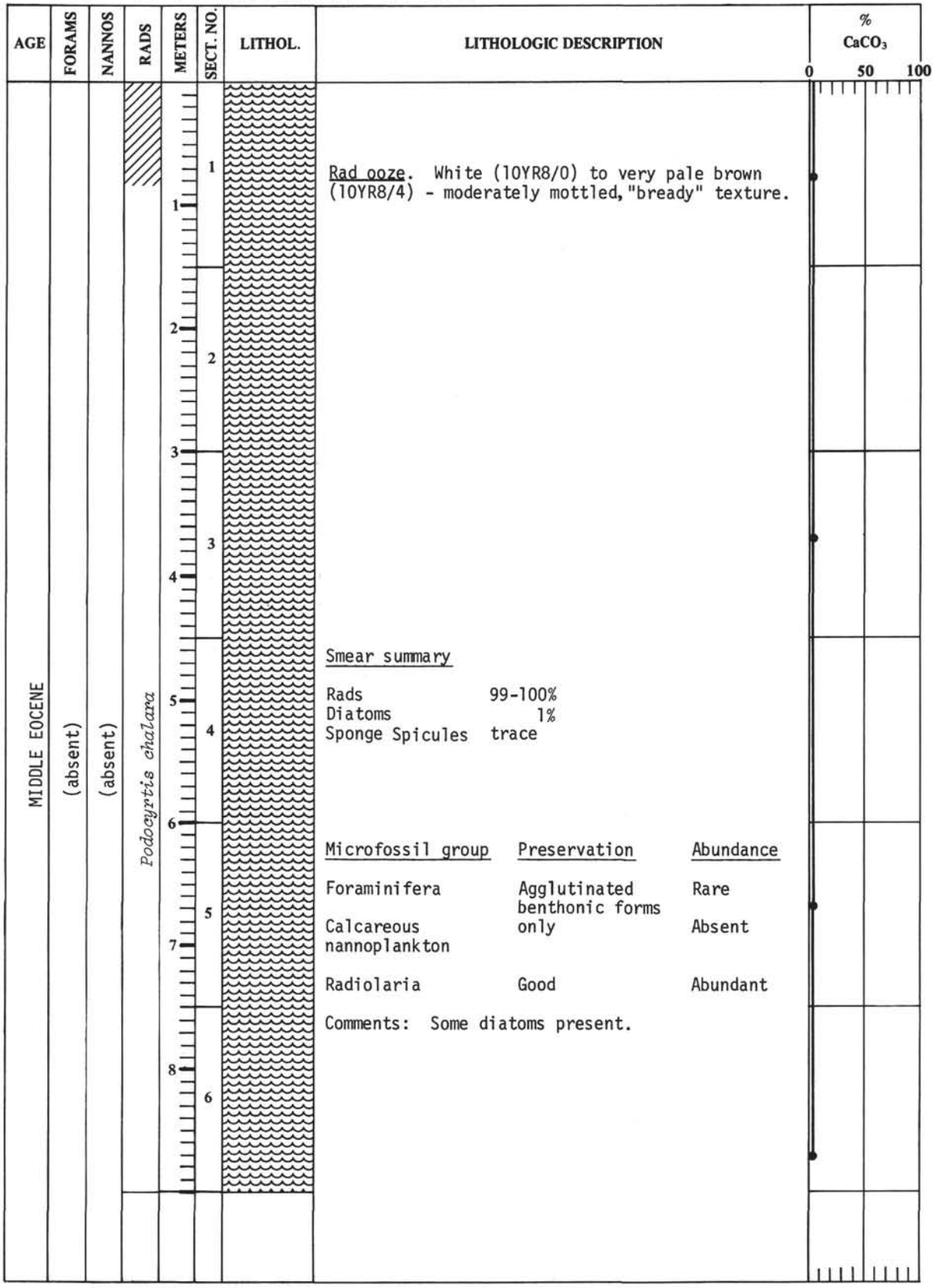
SITE 69 Core 5 Cored interval: 117-126 m



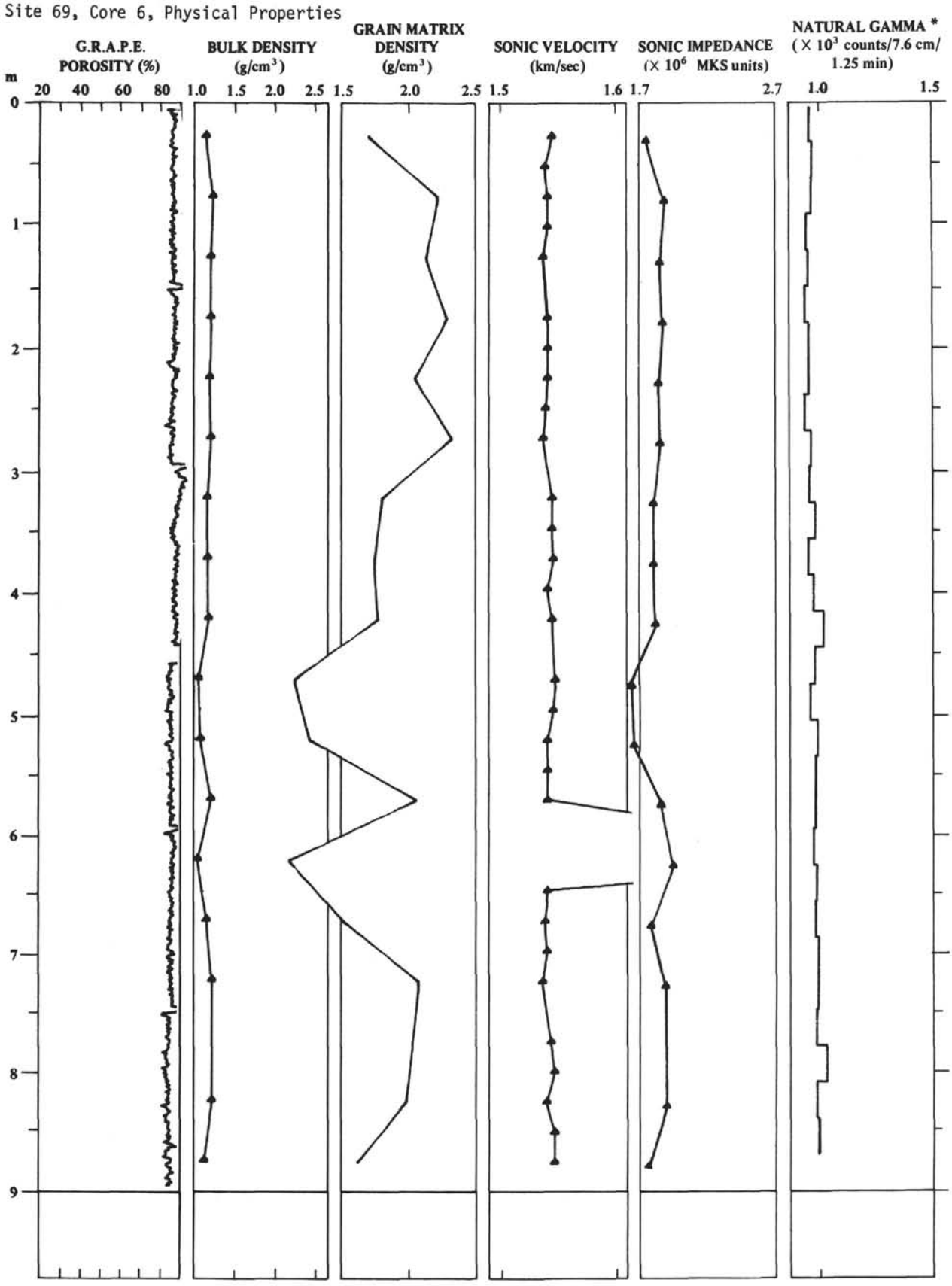
Site 69, Core 5, Physical Properties



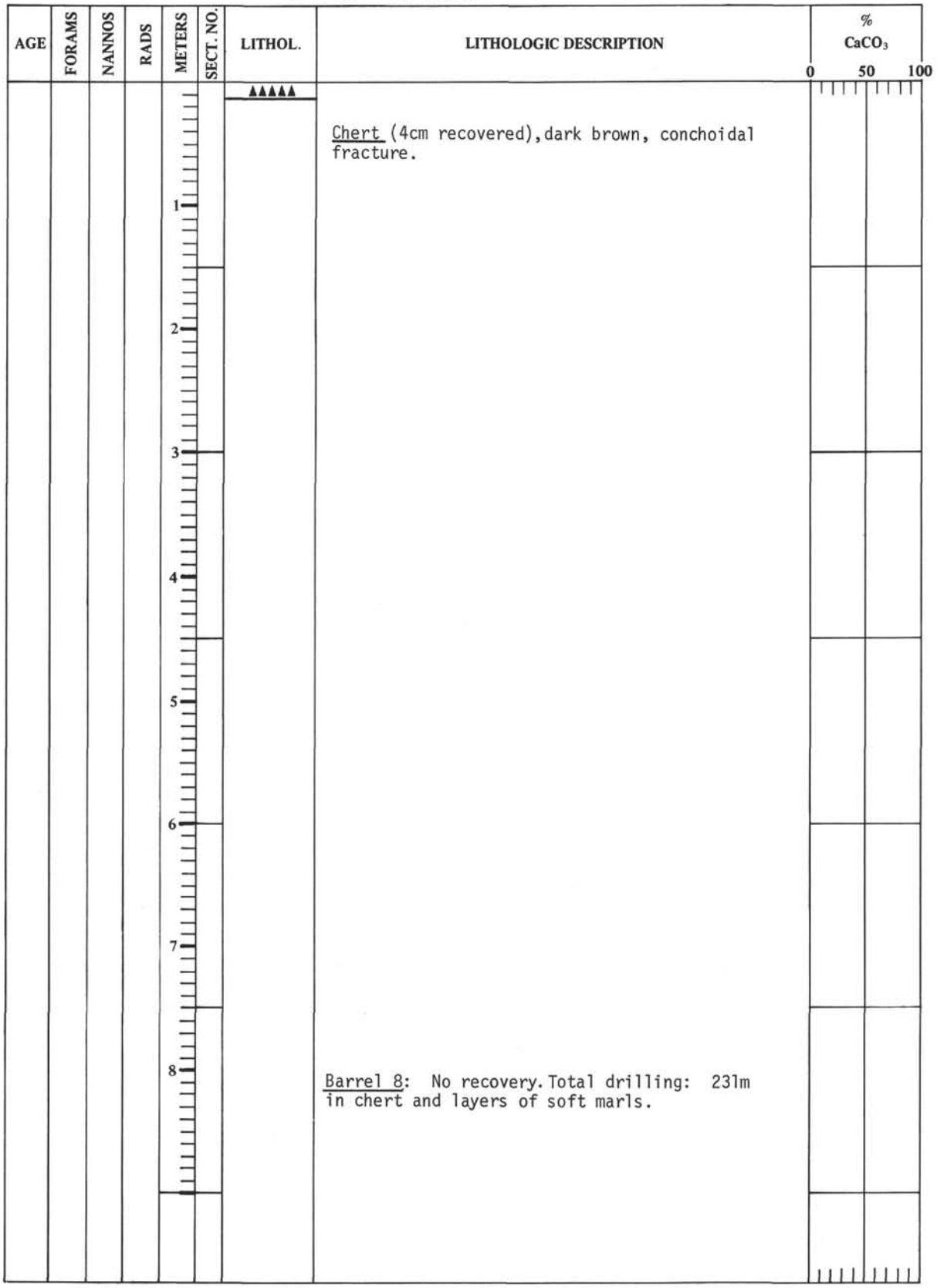
SITE 69 Core 6 Cored interval: 187-196 m



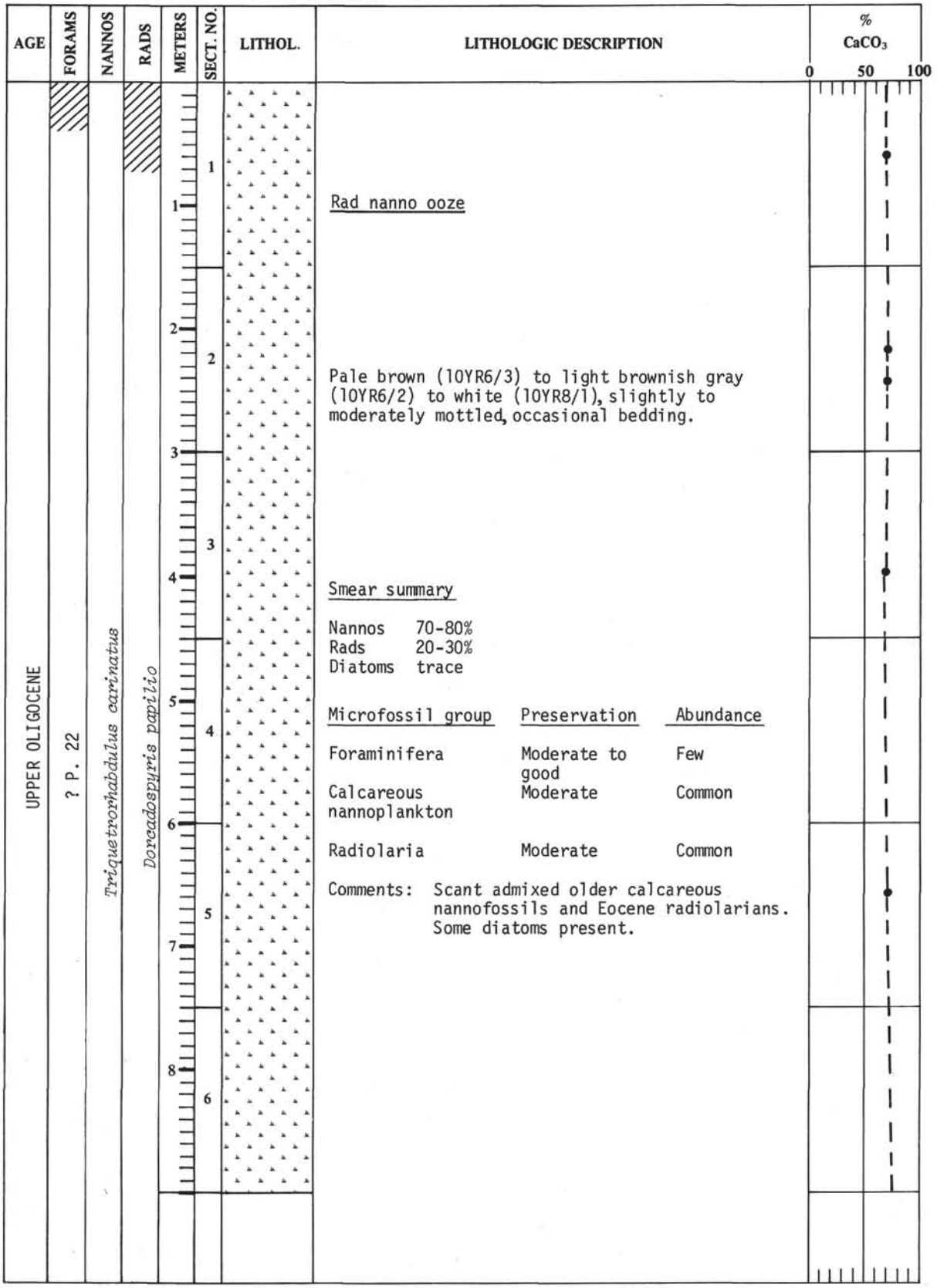
Site 69, Core 6, Physical Properties



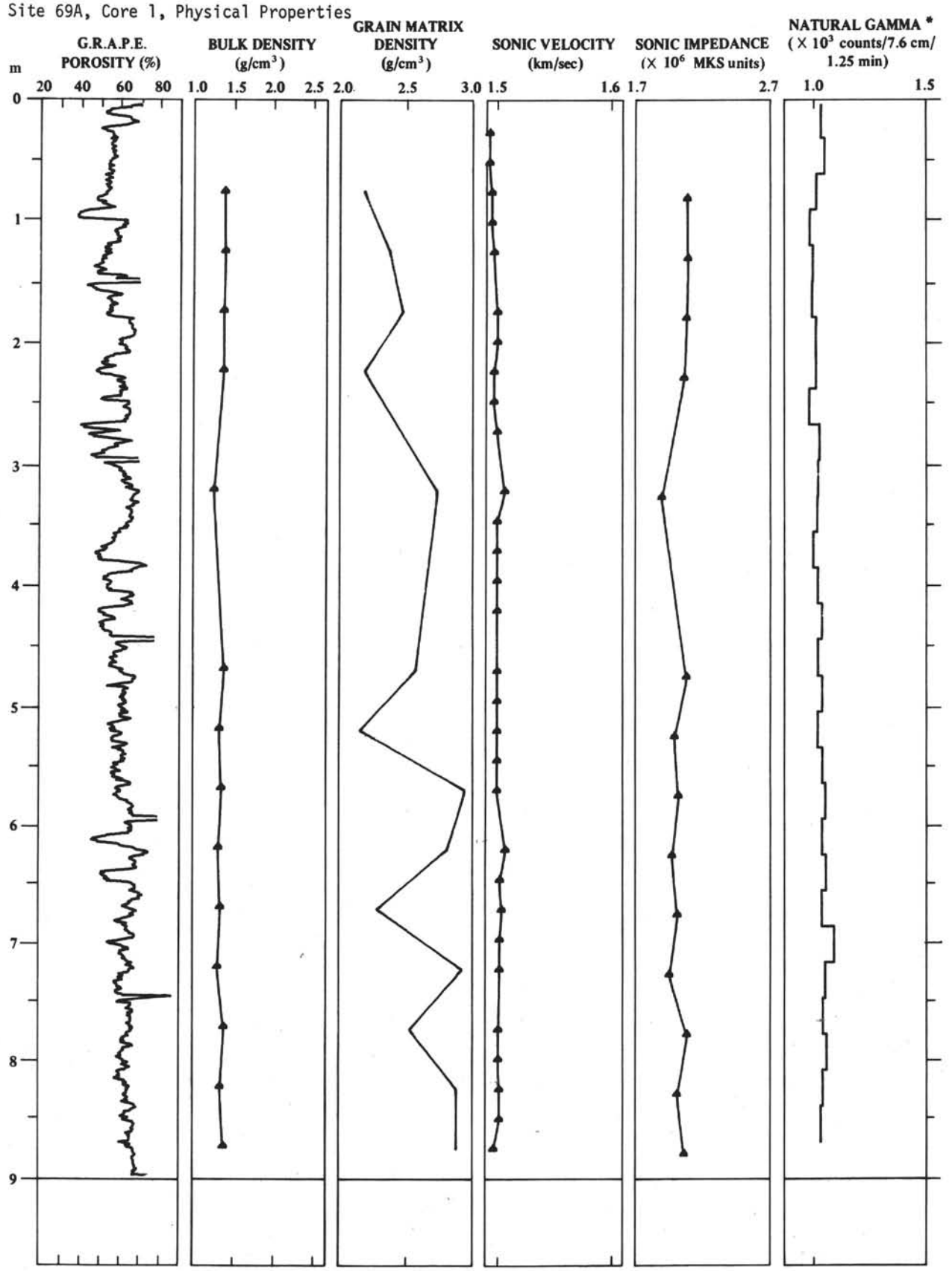
SITE 69 Core 7 Cored interval: 227-228 m



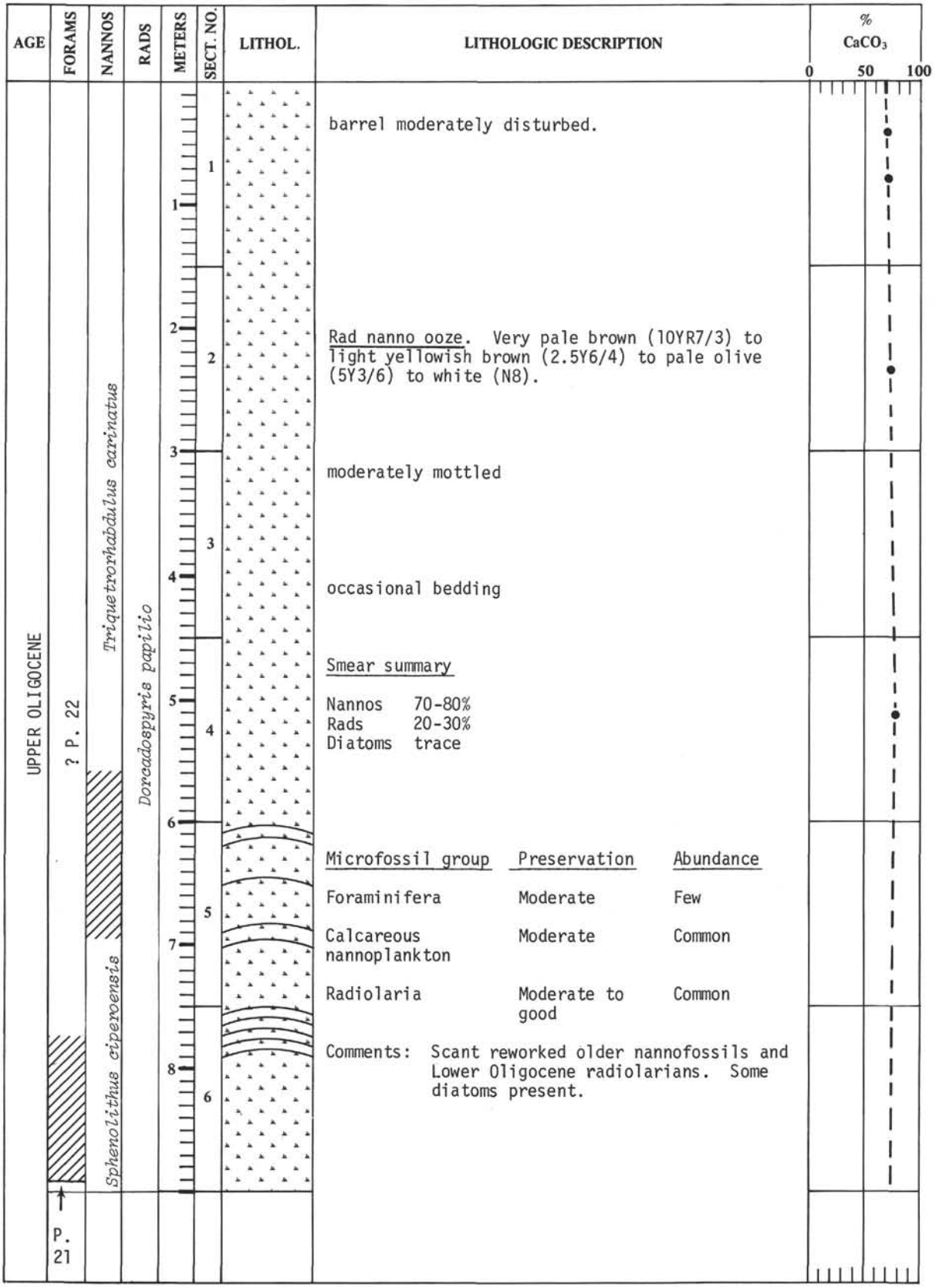
SITE 69A Core 1A Cored interval: 61-70 m



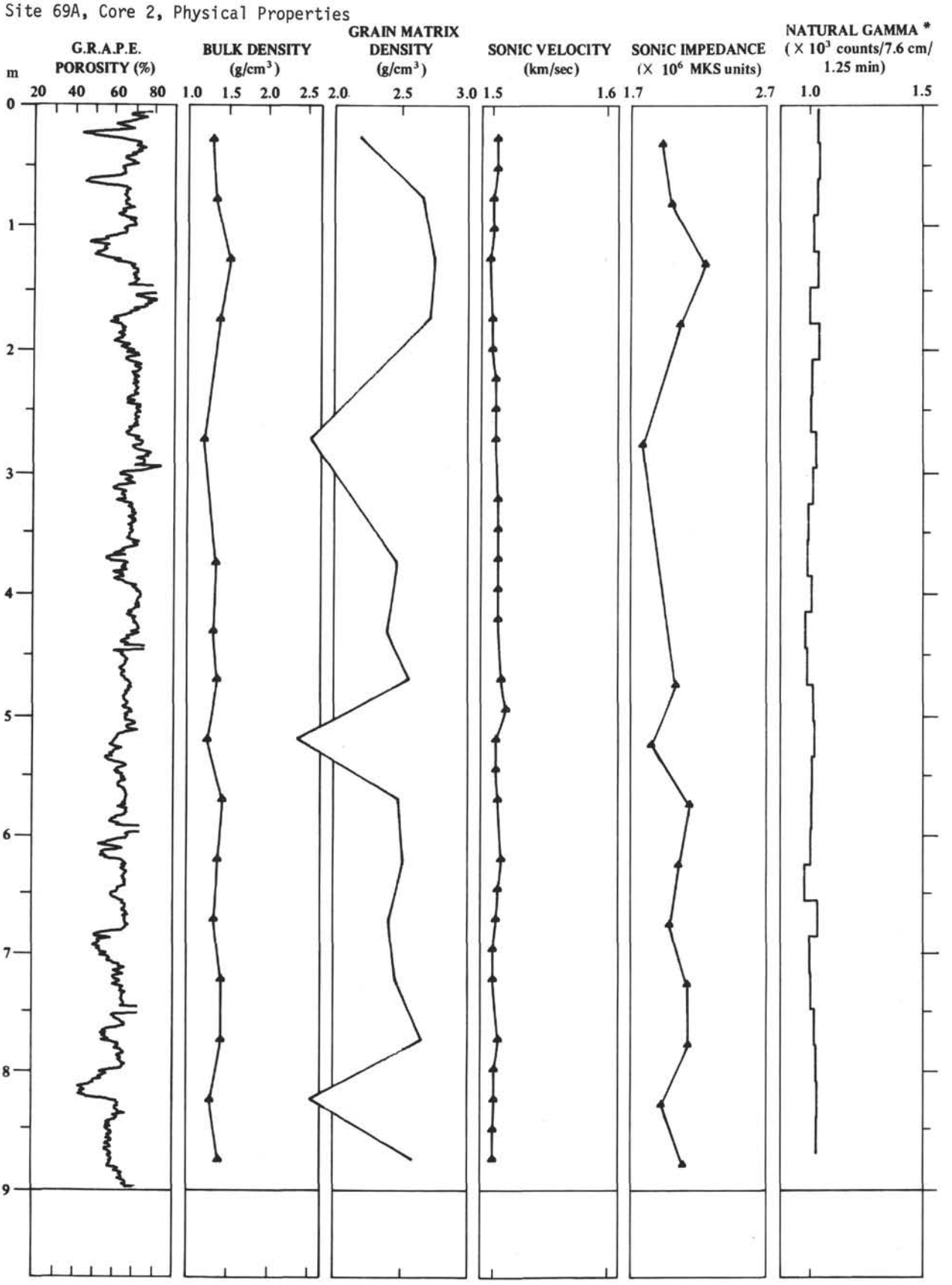
Site 69A, Core 1, Physical Properties



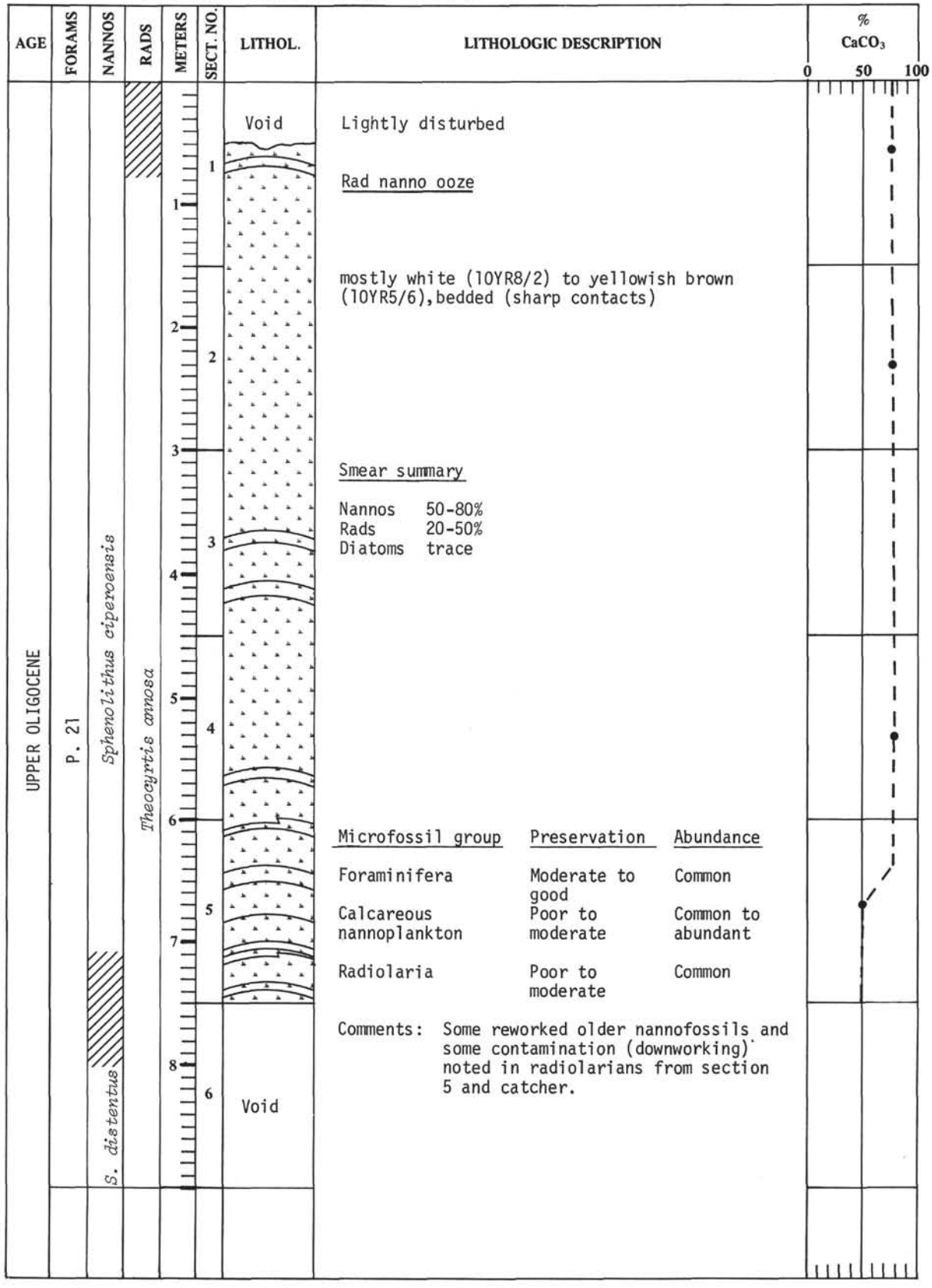
SITE 69A Core 2A Cored interval: 70-79 m



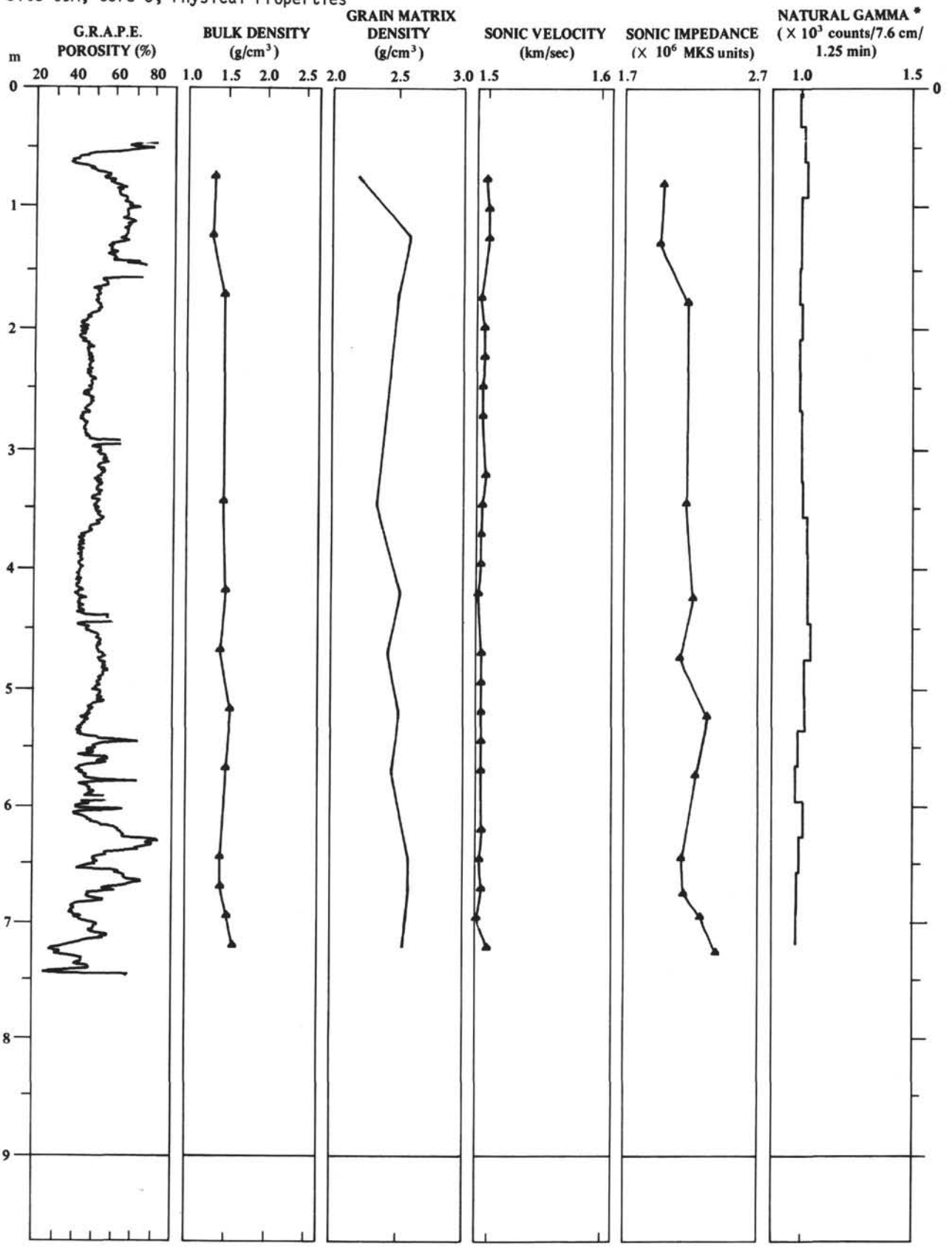
Site 69A, Core 2, Physical Properties



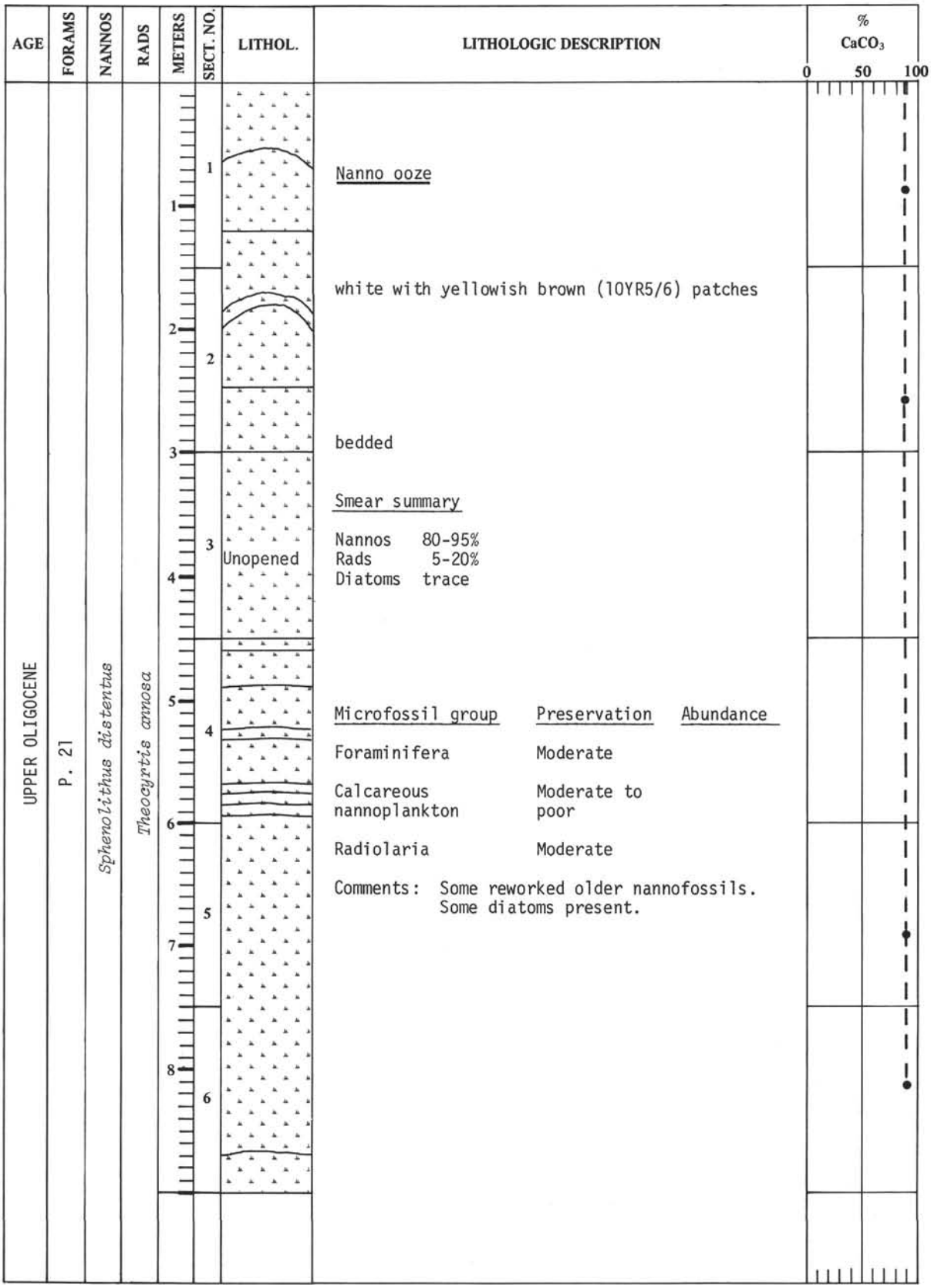
SITE 69A Core 3A Cored interval: 79-88 m



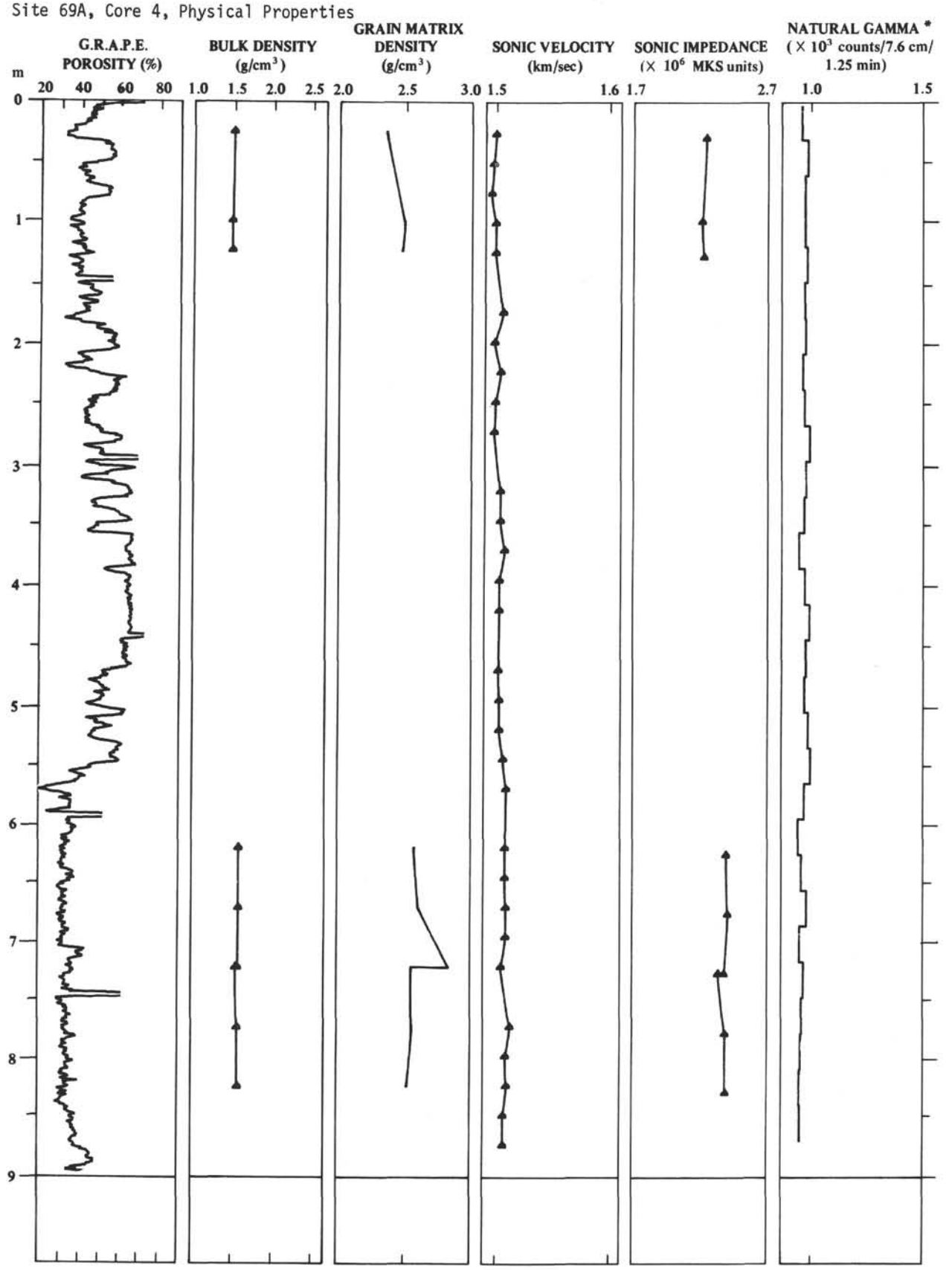
Site 69A, Core 3, Physical Properties



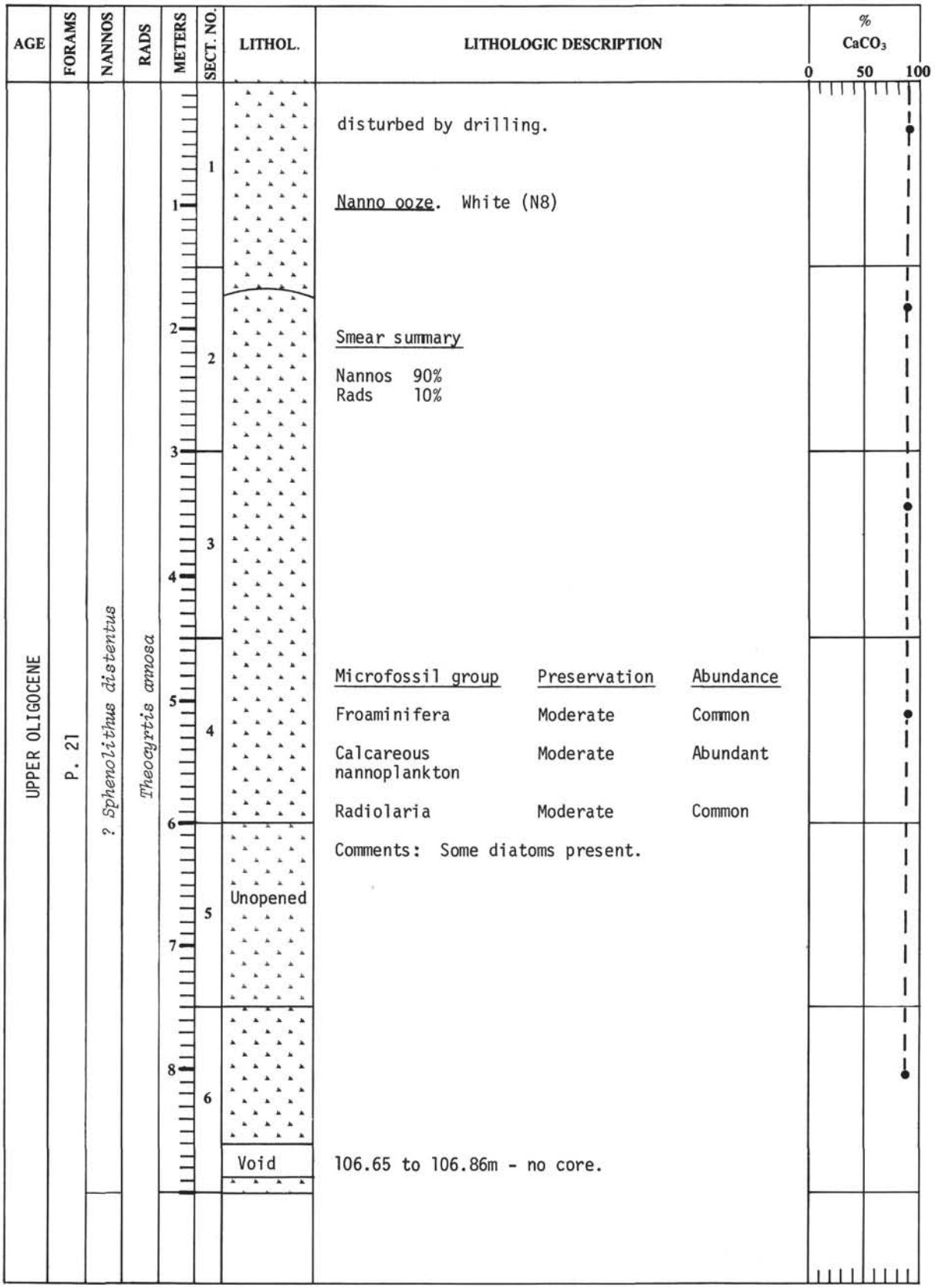
SITE 69A Core 4A Cored interval: 89-98 m



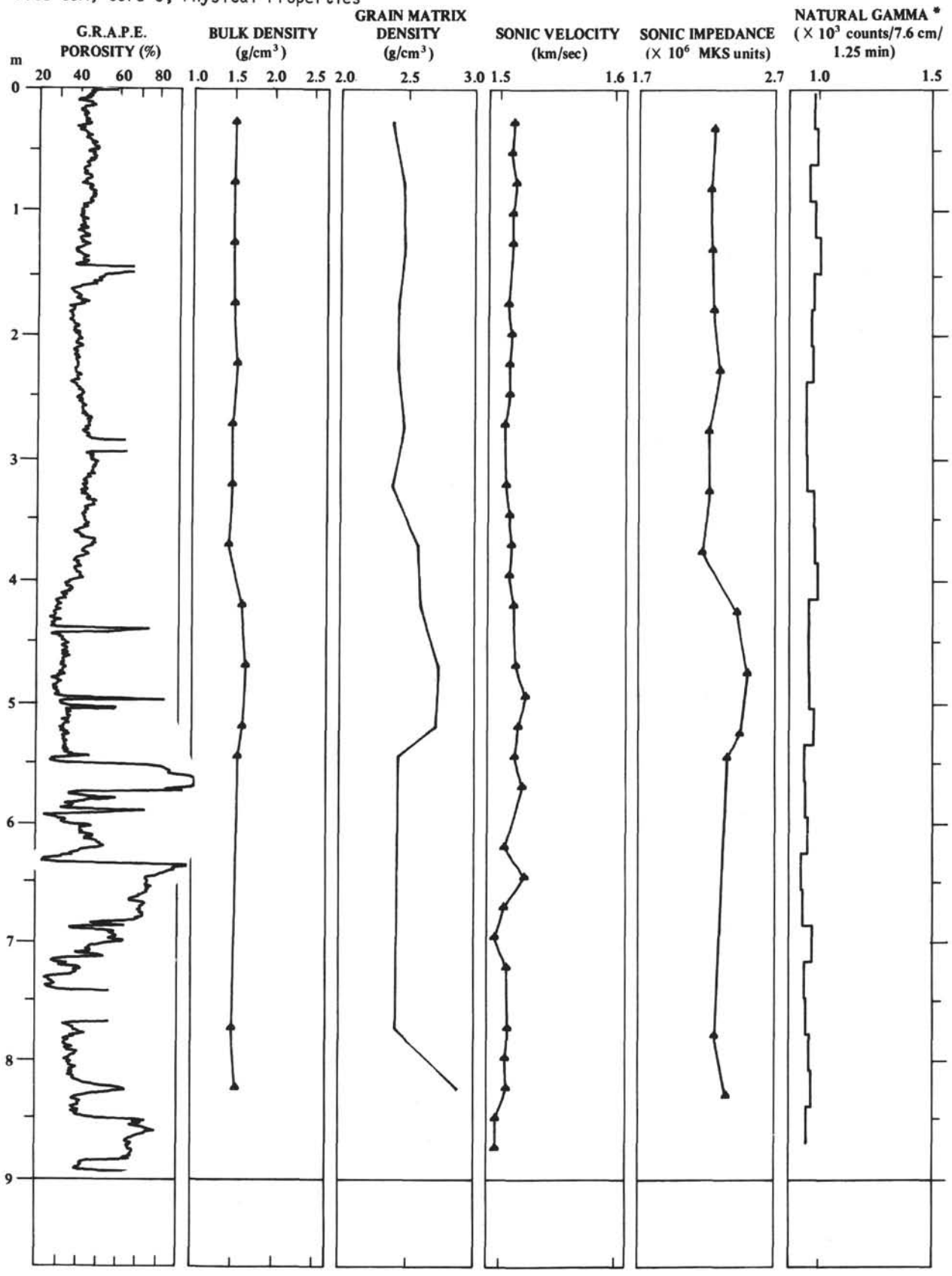
Site 69A, Core 4, Physical Properties



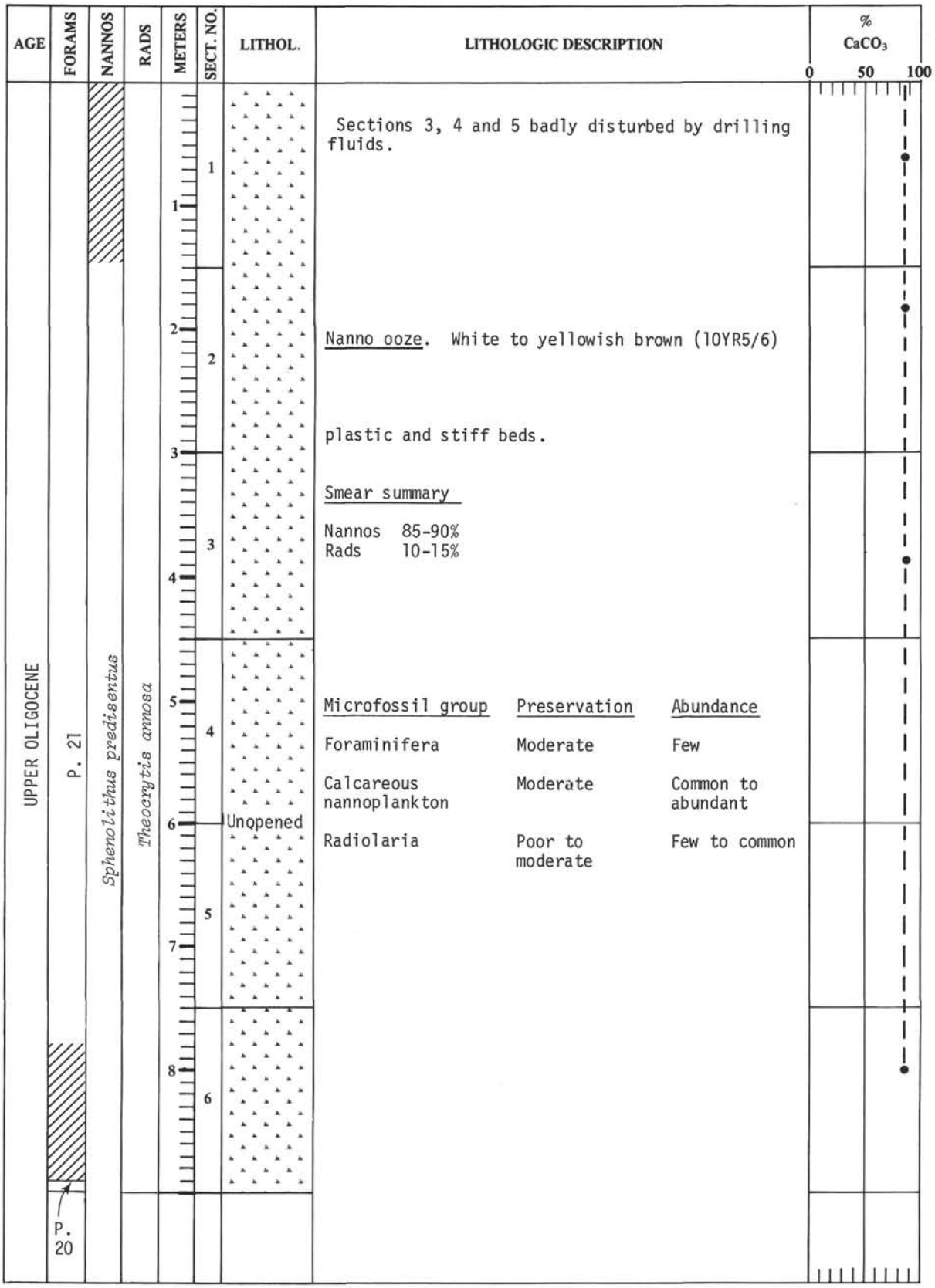
SITE 69A Core 5A Cored interval: 98-107 m



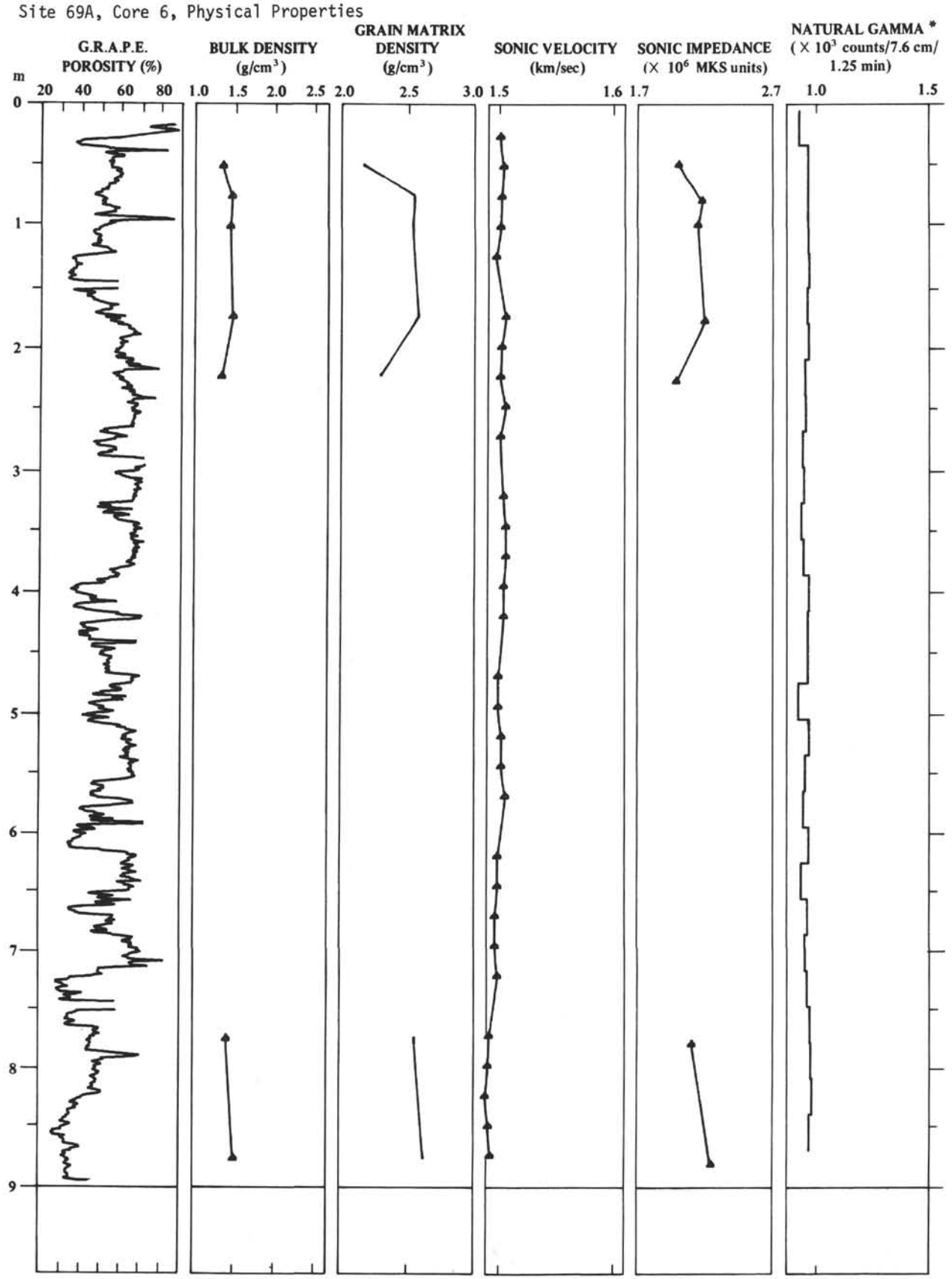
Site 69A, Core 5, Physical Properties



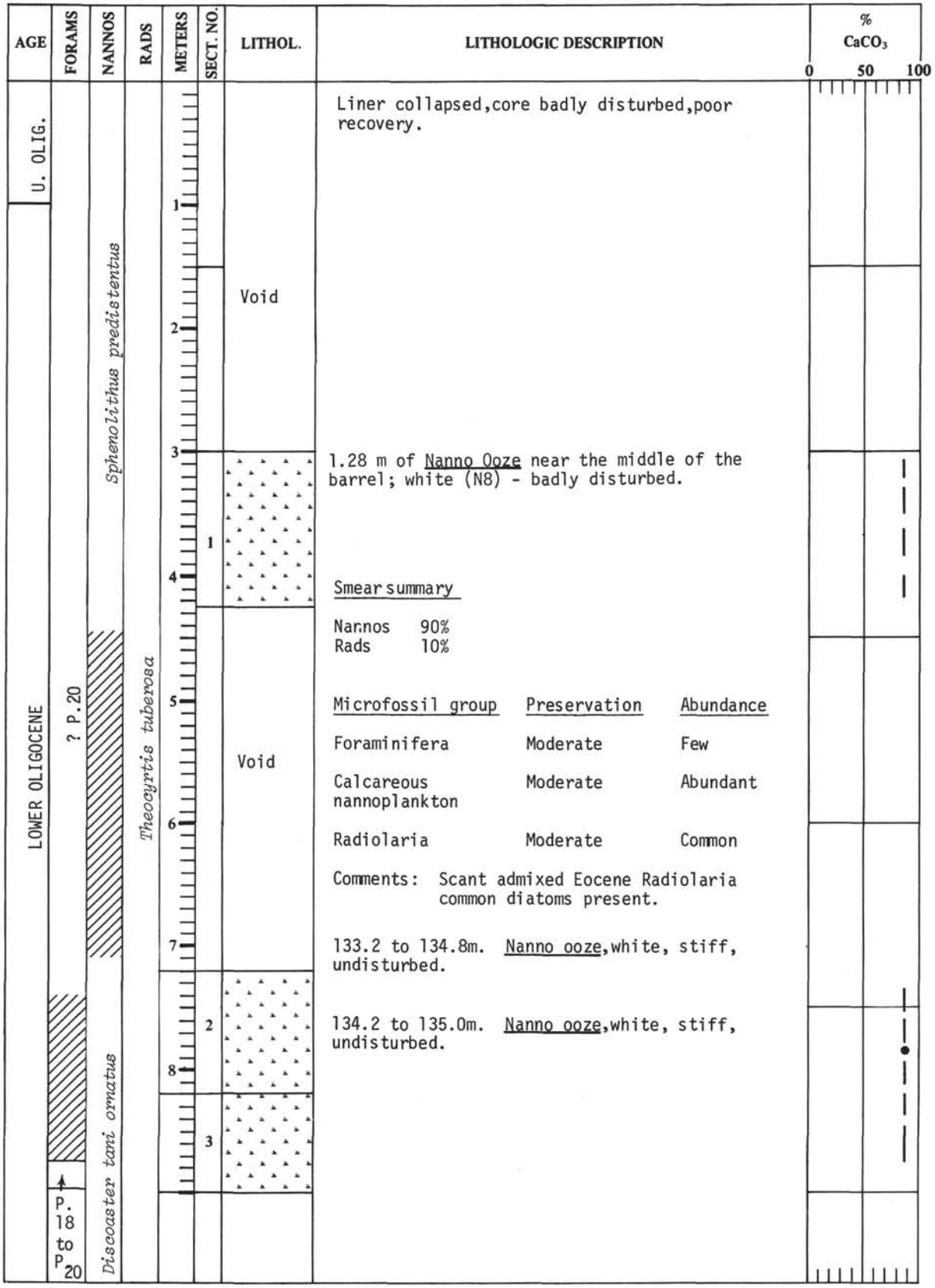
SITE 69A Core 6A Cored interval: 107-116 m



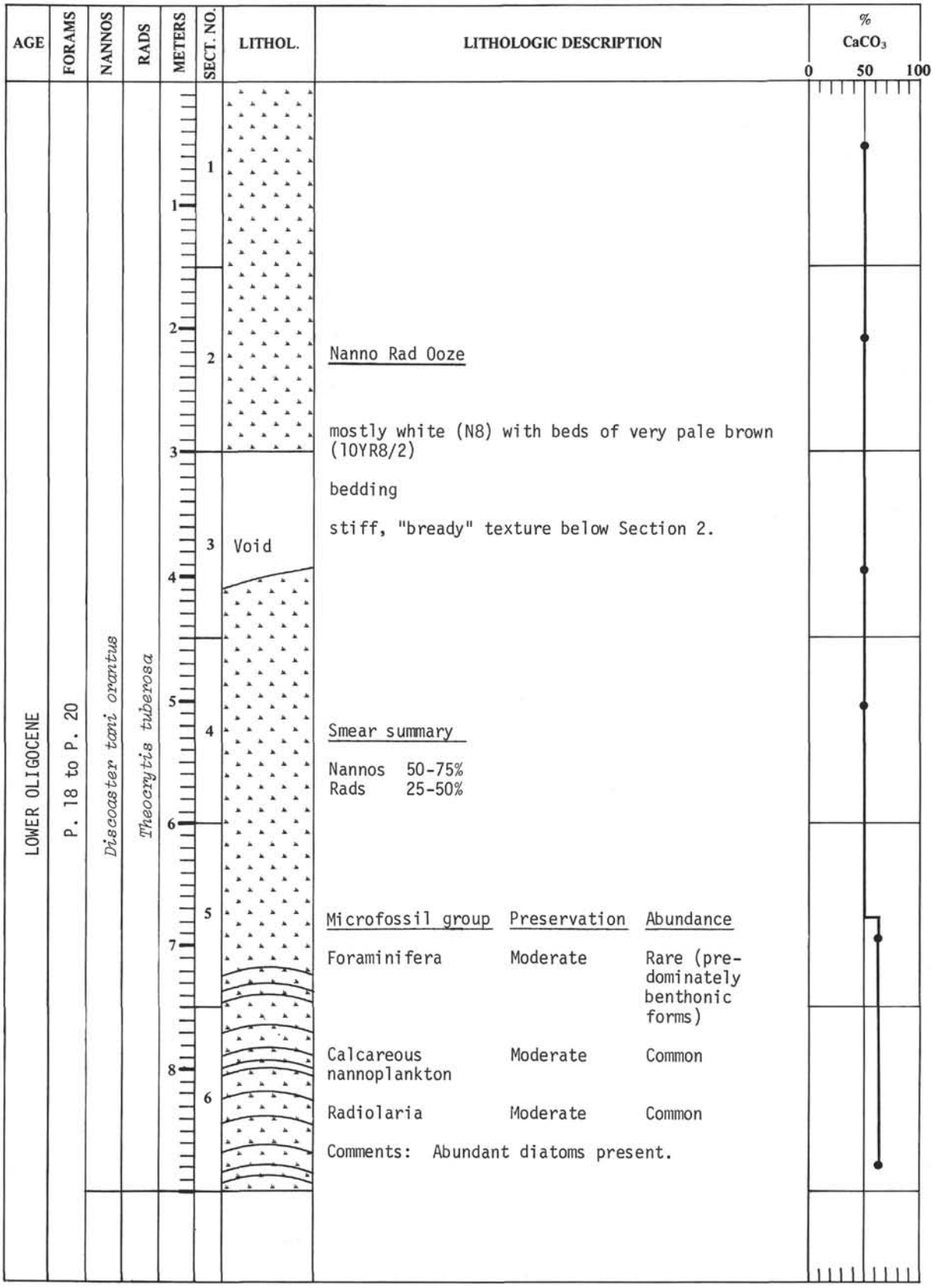
Site 69A, Core 6, Physical Properties



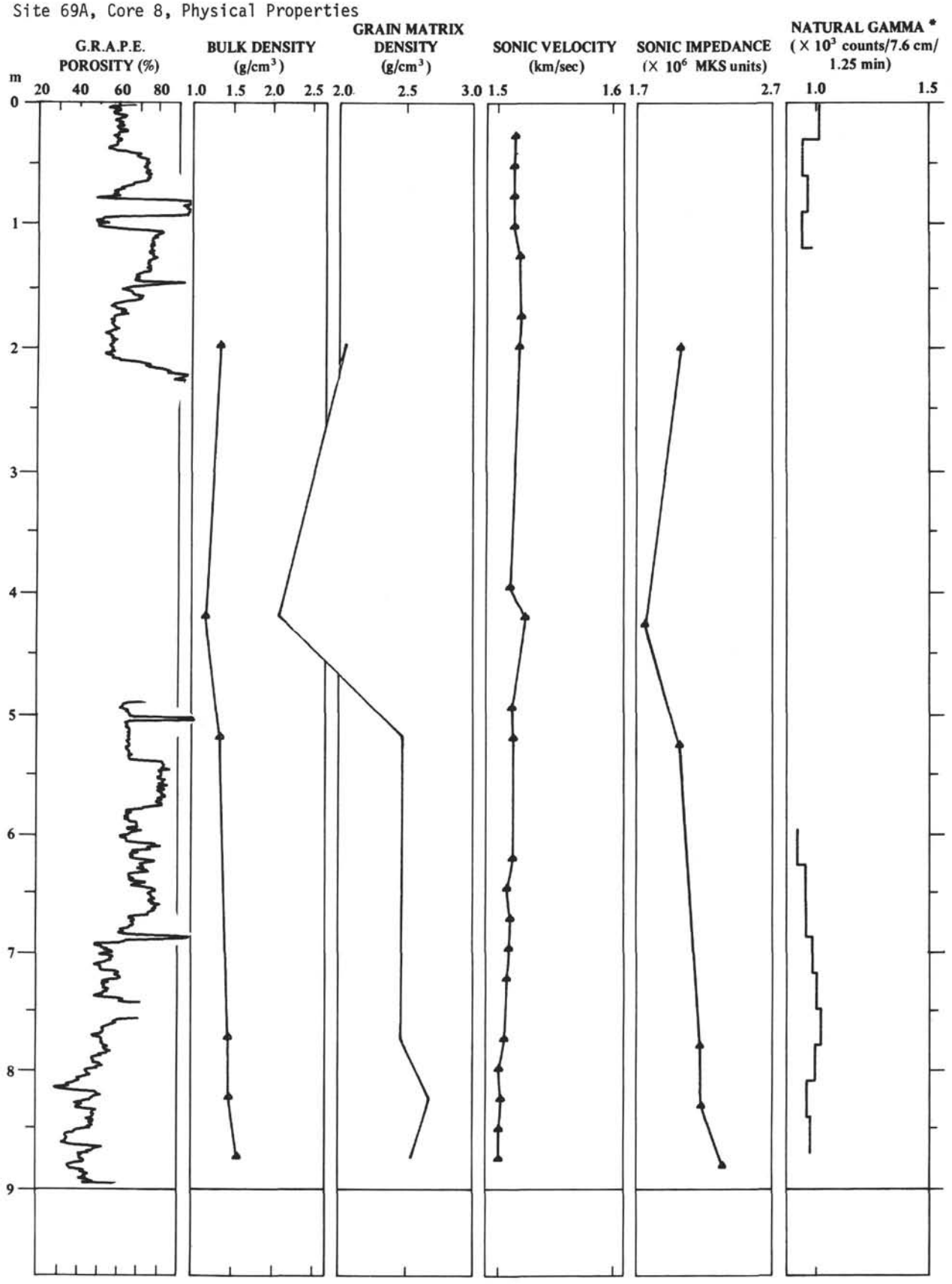
SITE 69A Core 7A Cored interval: 126-135 m



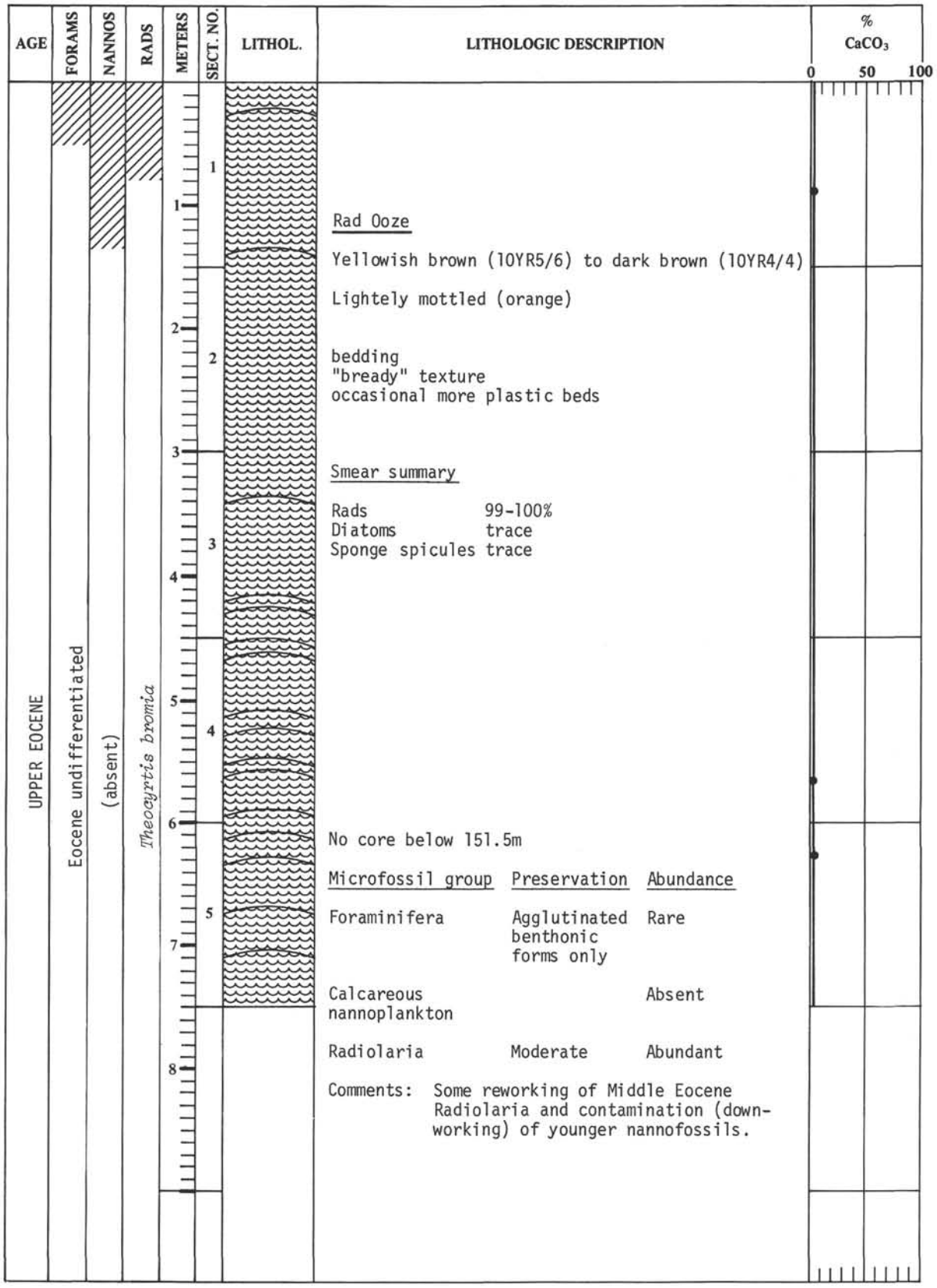
SITE 69A Core 8A Cored interval: 135-144 m



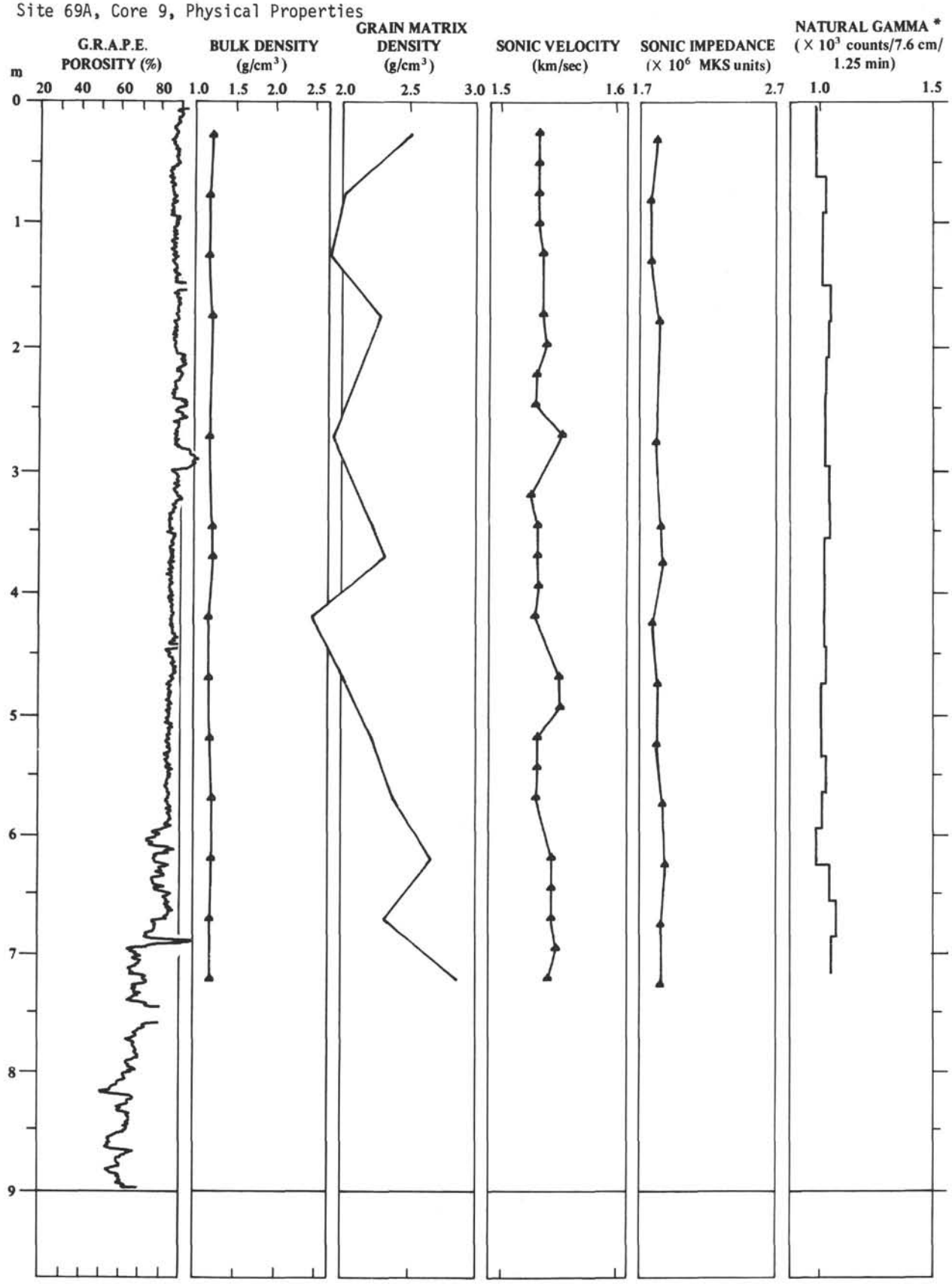
Site 69A, Core 8, Physical Properties



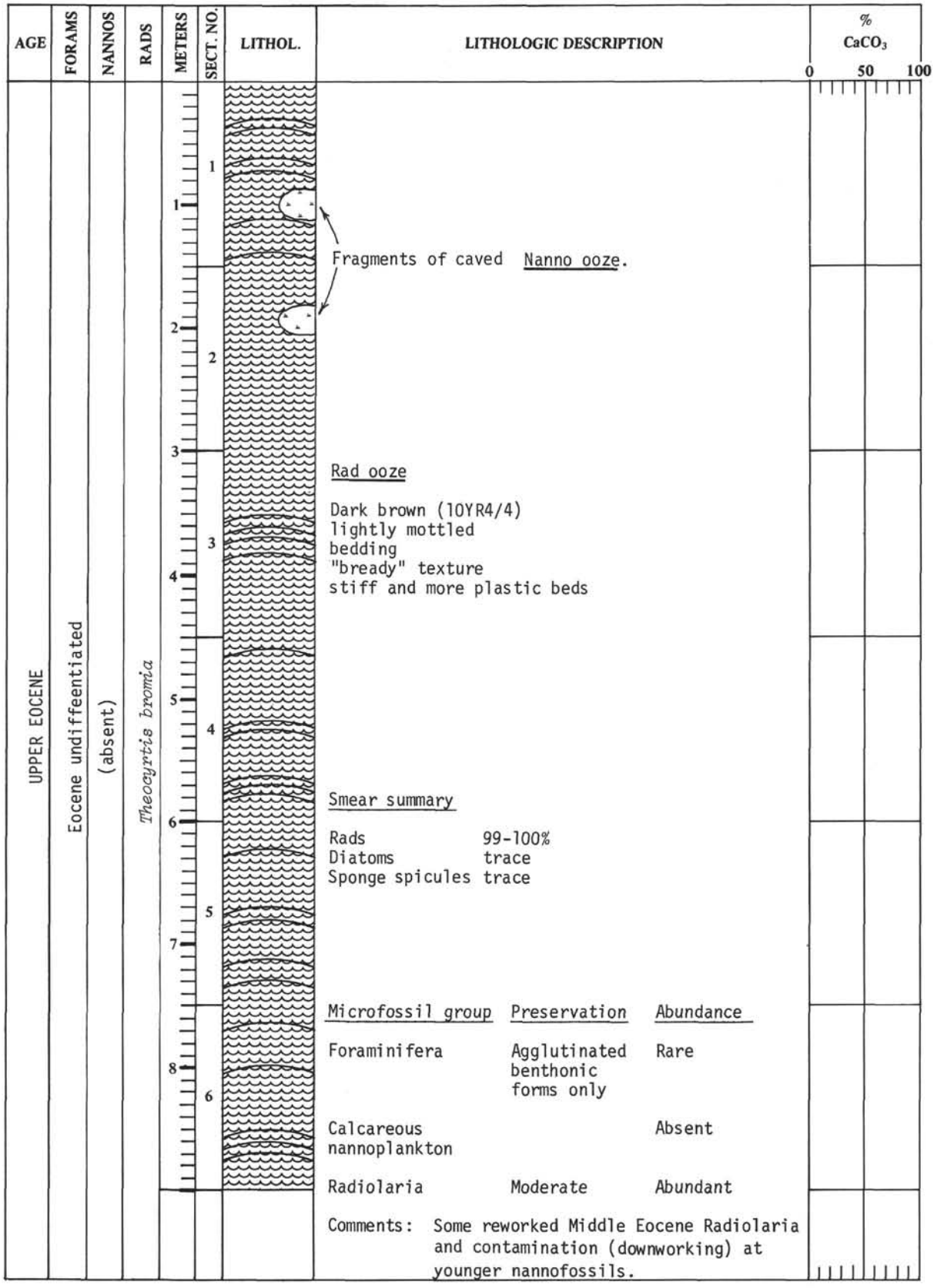
SITE 69A Core 9A Cored interval: 144-153 m



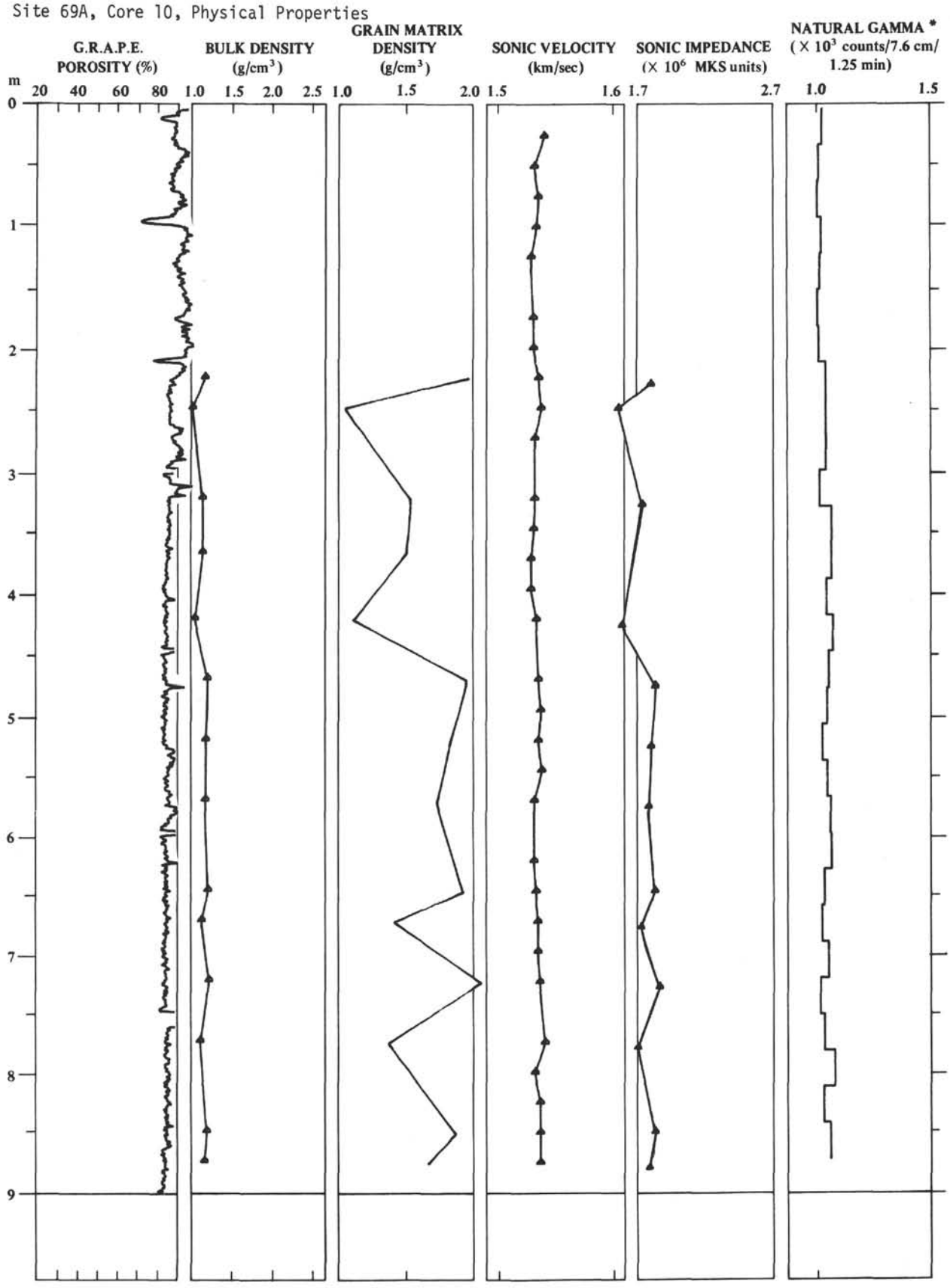
Site 69A, Core 9, Physical Properties



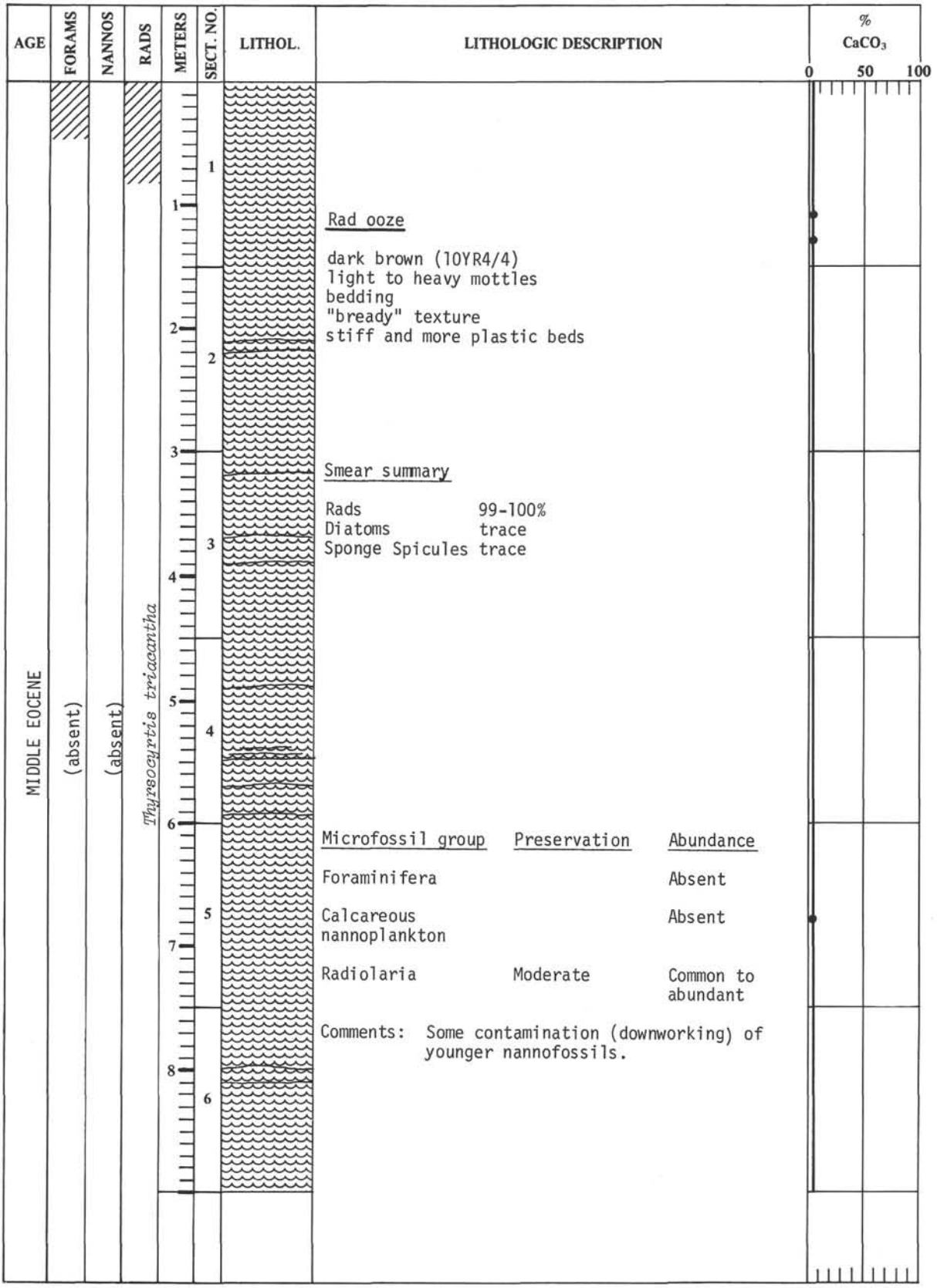
SITE 69A Core 10A Cored interval: 153-162 m



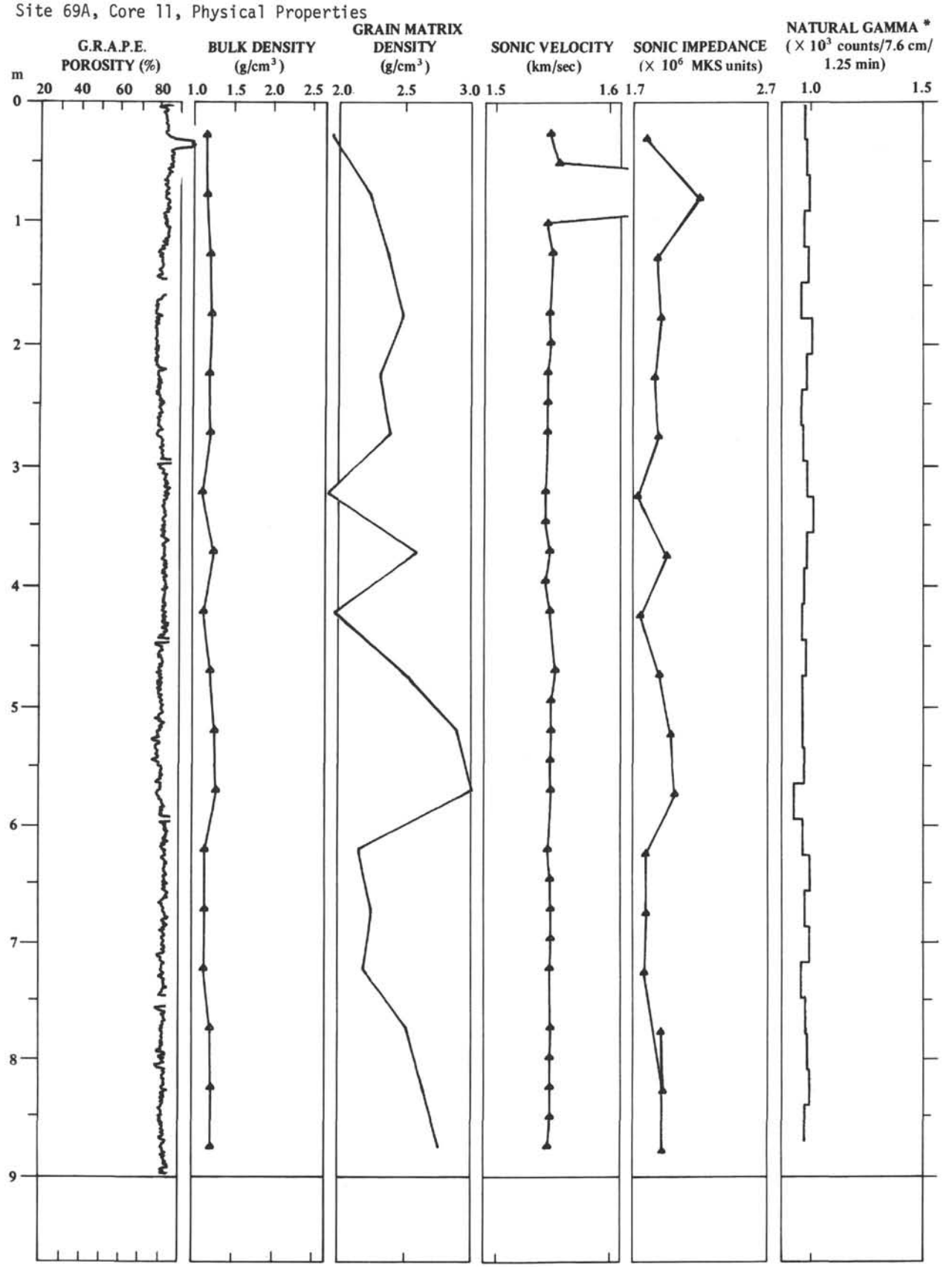
Site 69A, Core 10, Physical Properties



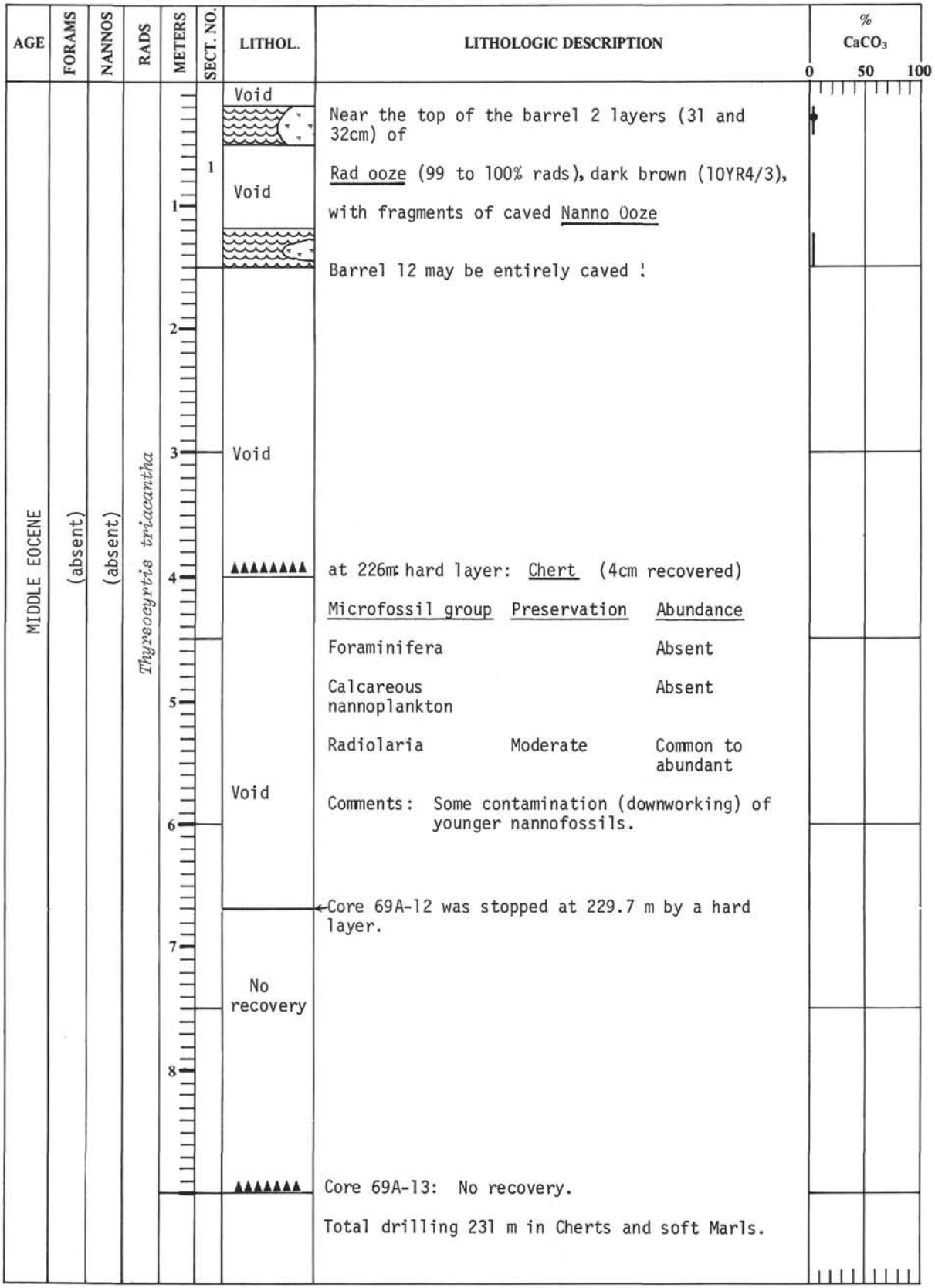
SITE 69A Core 11A Cored interval: 214-223 m

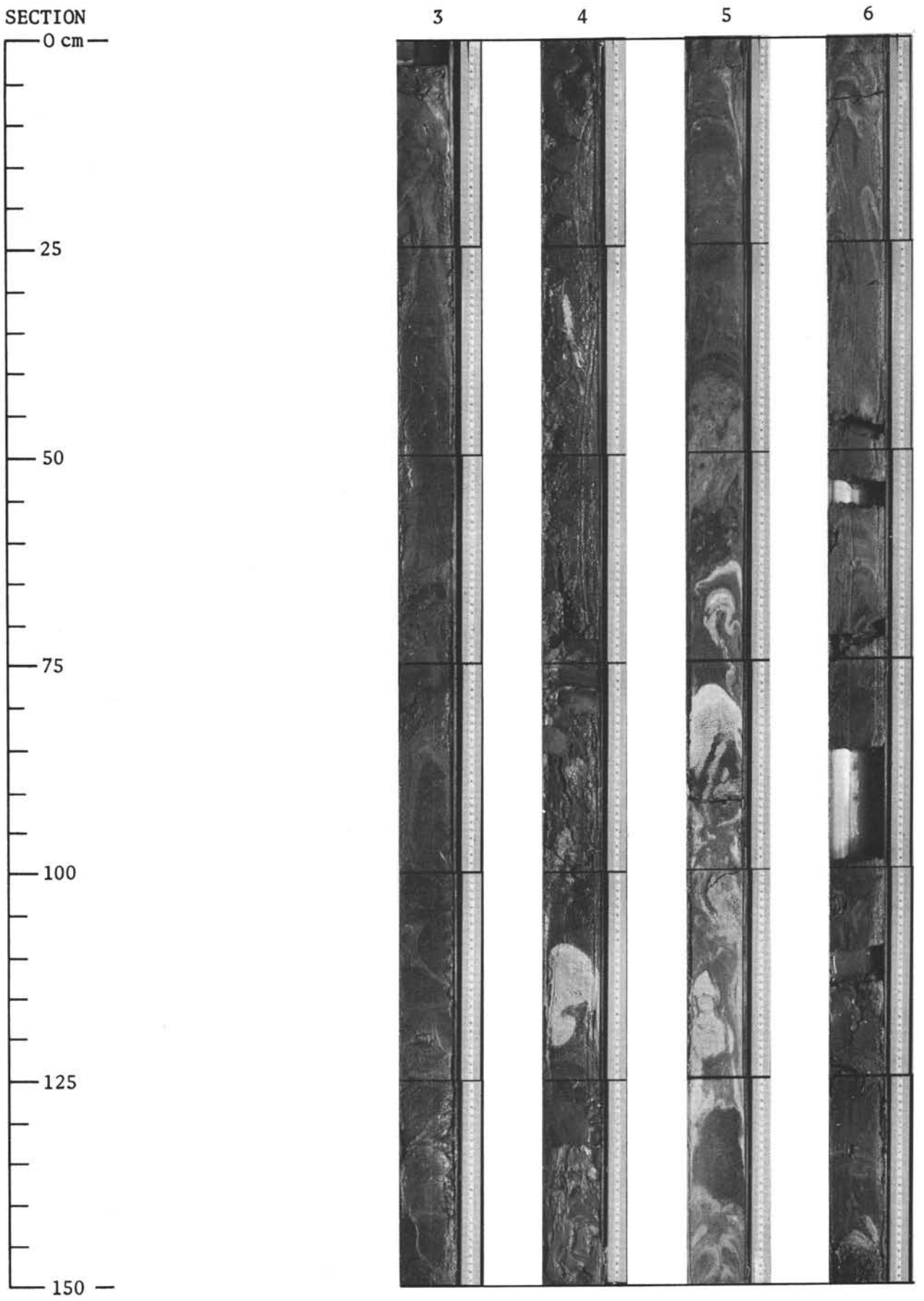


Site 69A, Core 11, Physical Properties

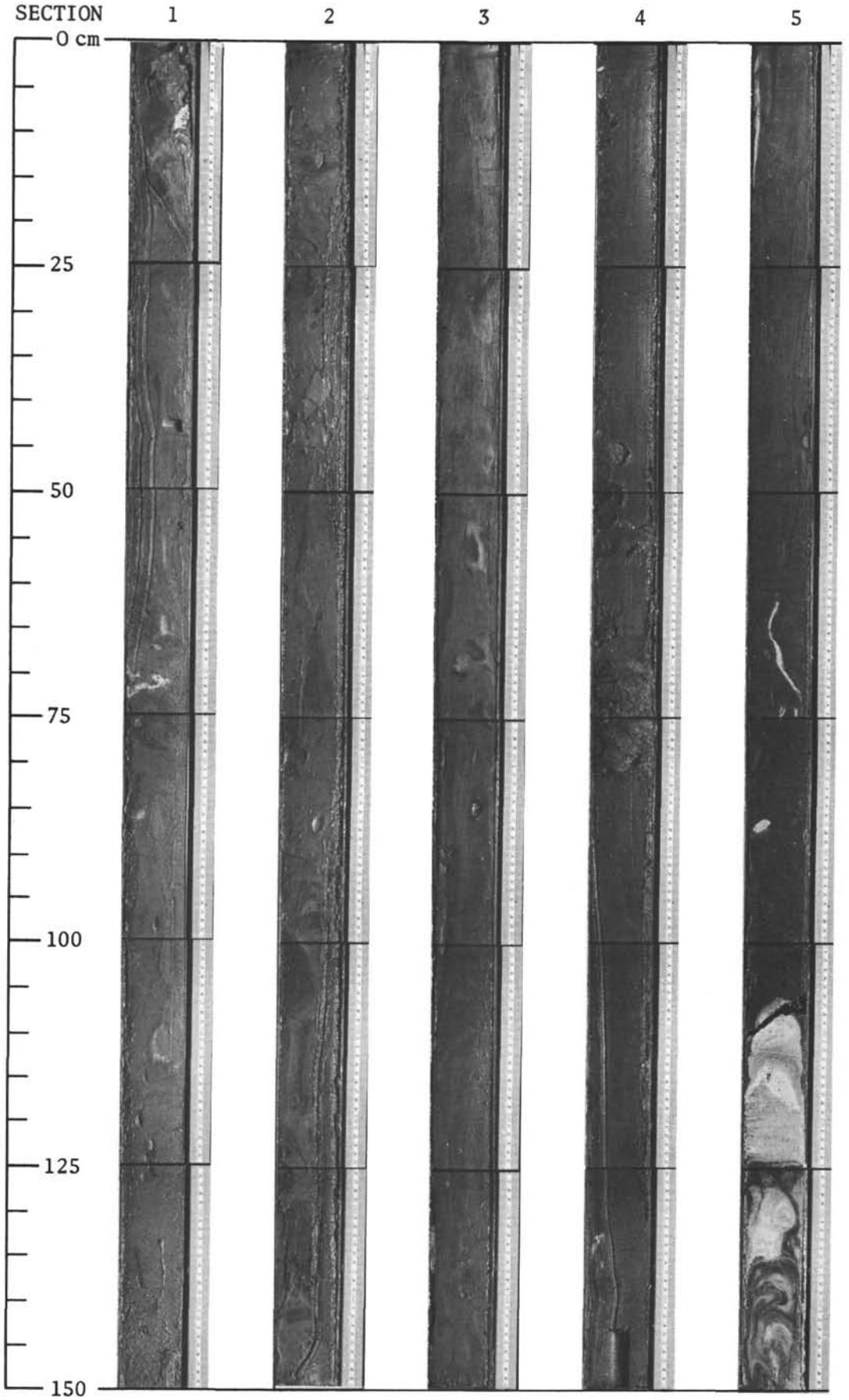


SITE 69A Core 12A (223-229.7 m) and 13A (229.7-231 m)

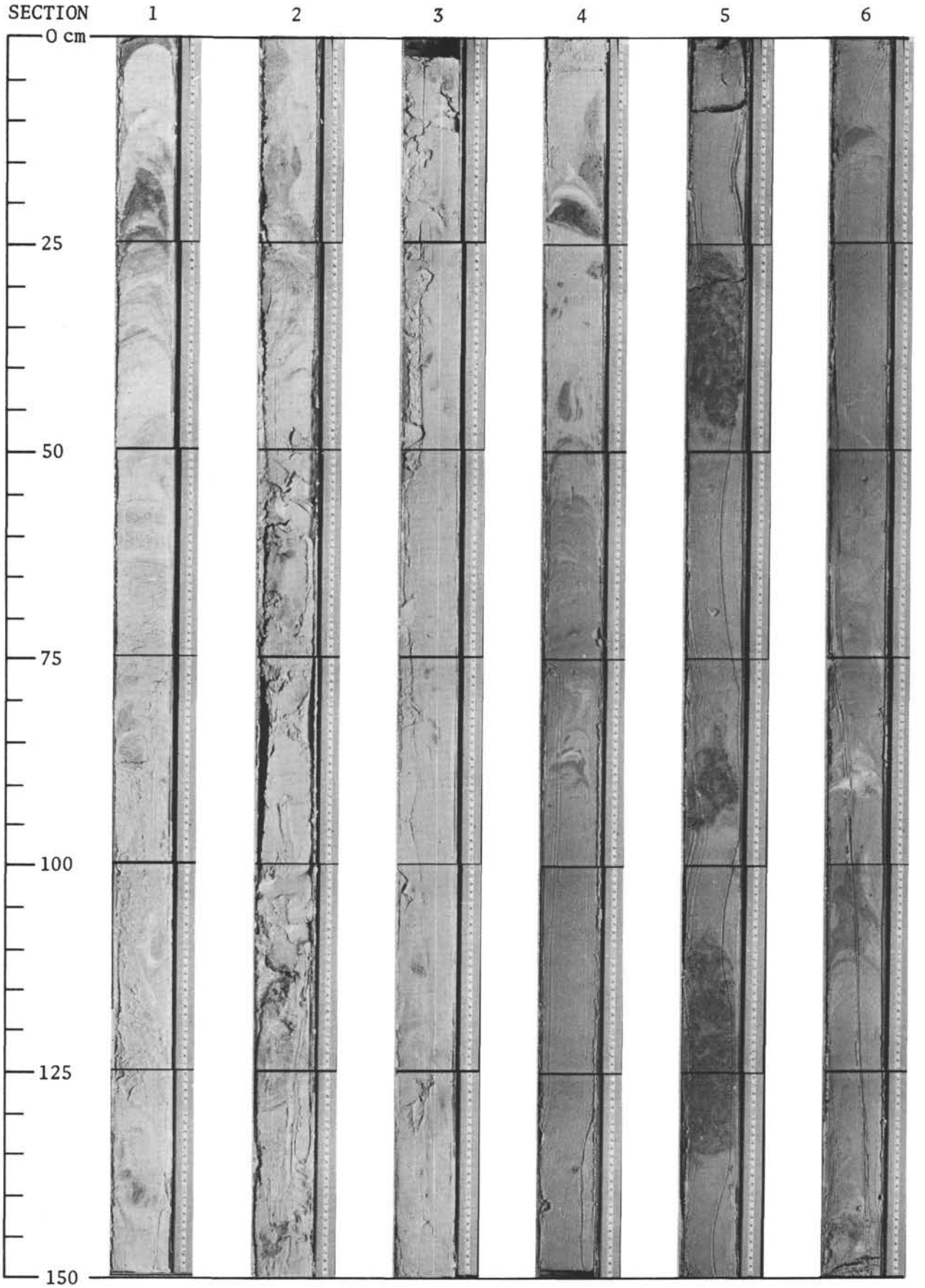




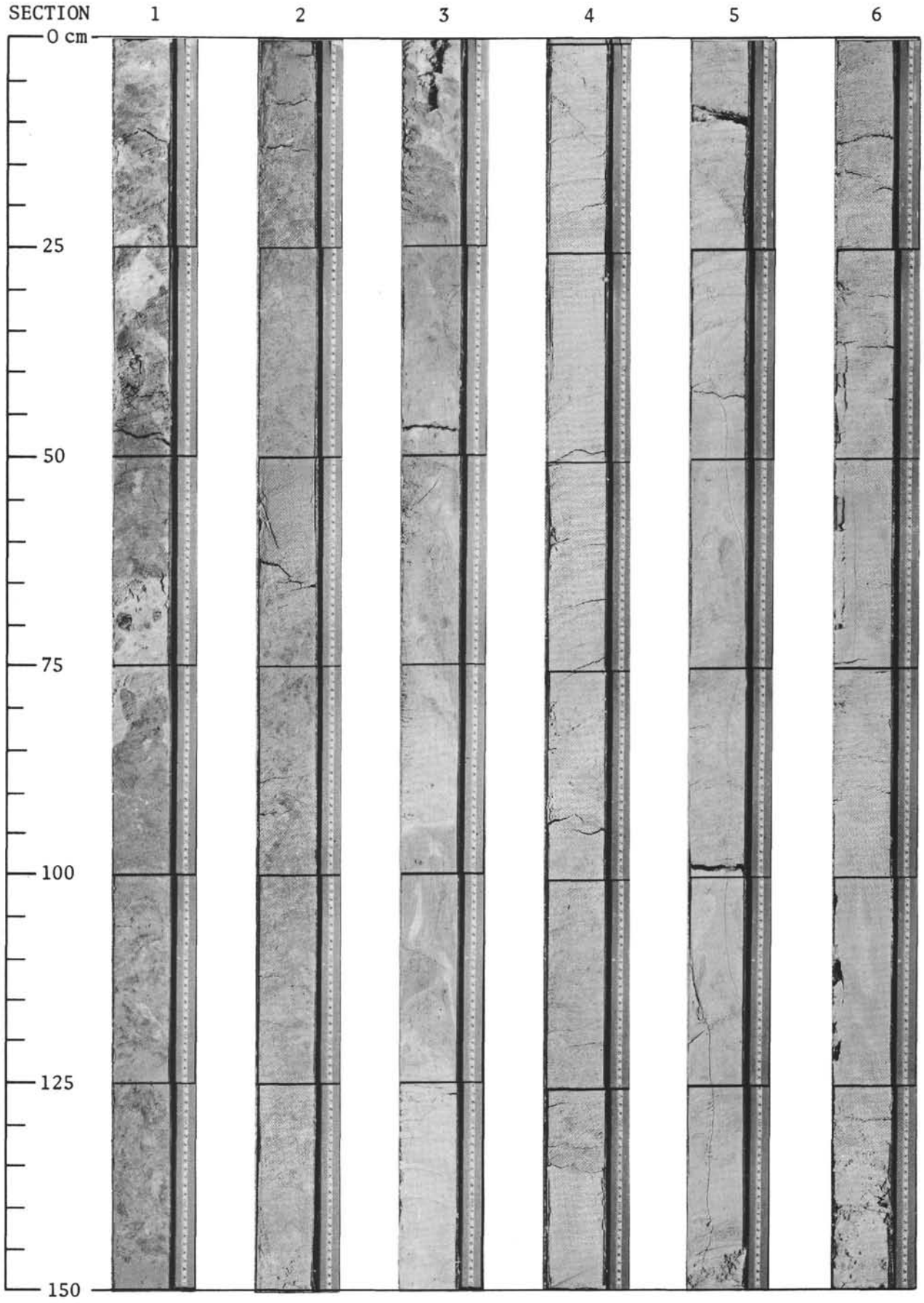
Site 69, Core 2, Sections 3-6.



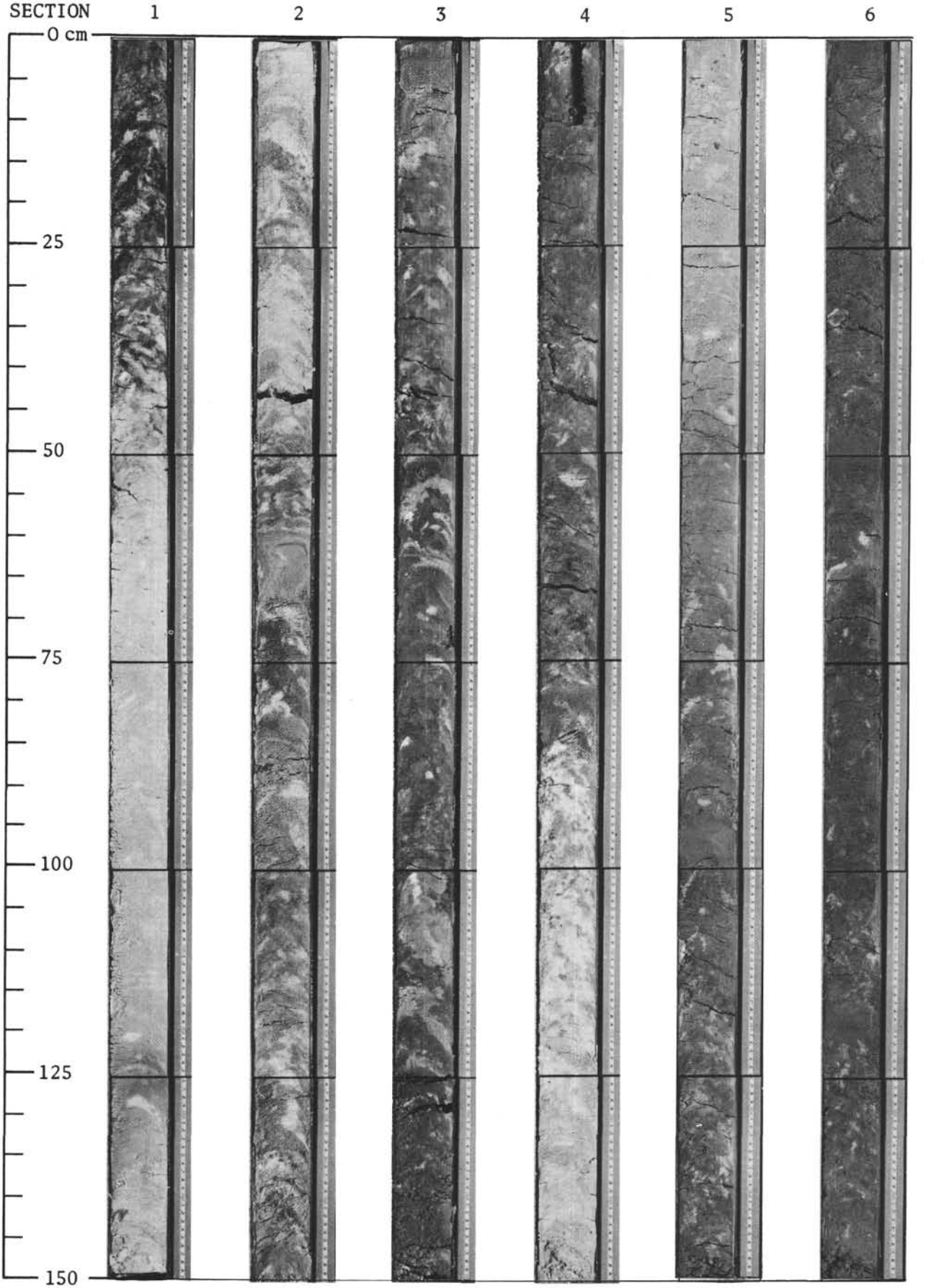
Site 69, Core 3, Sections 1-5.



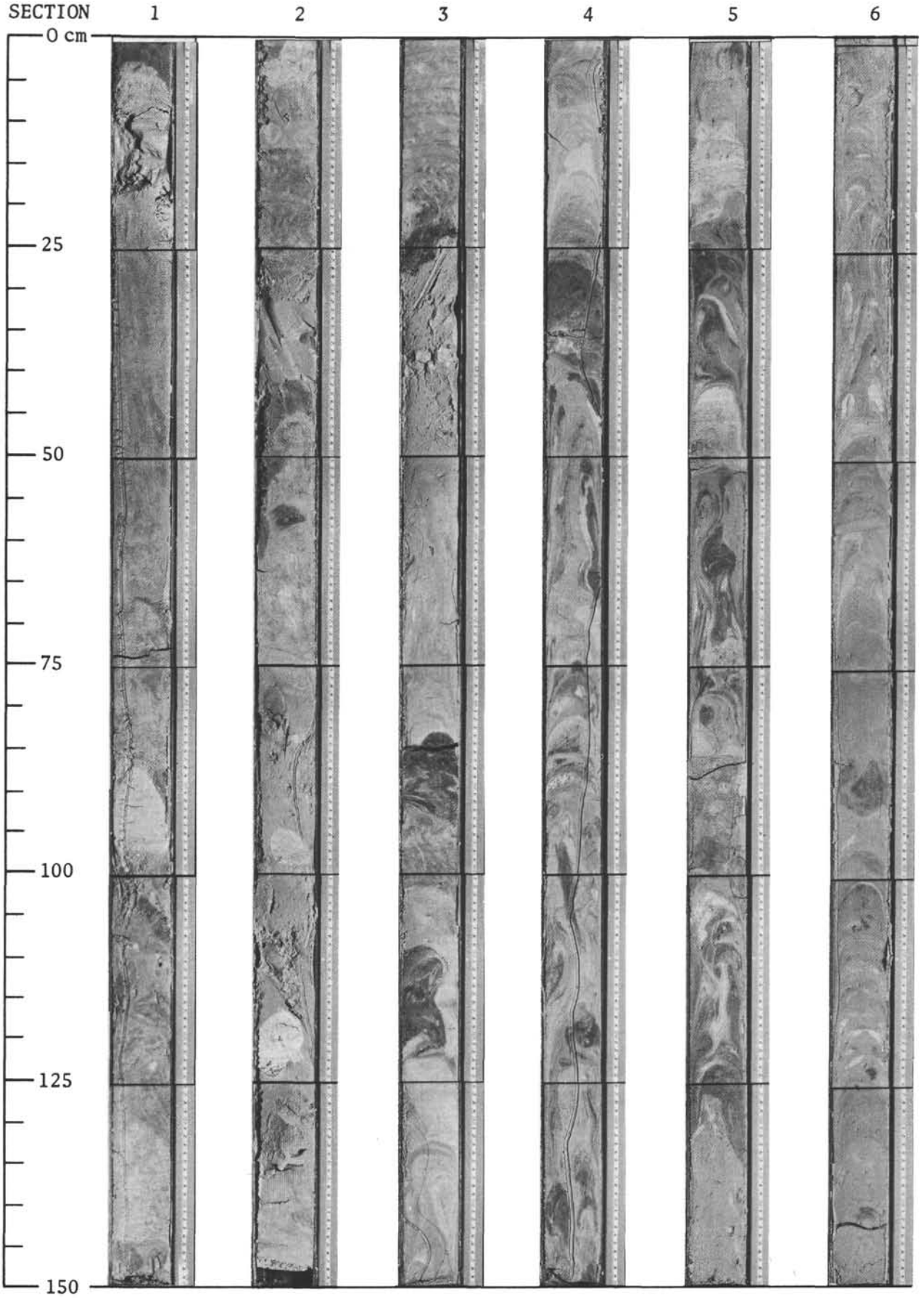
Site 69, Core 4, Sections 1-6.



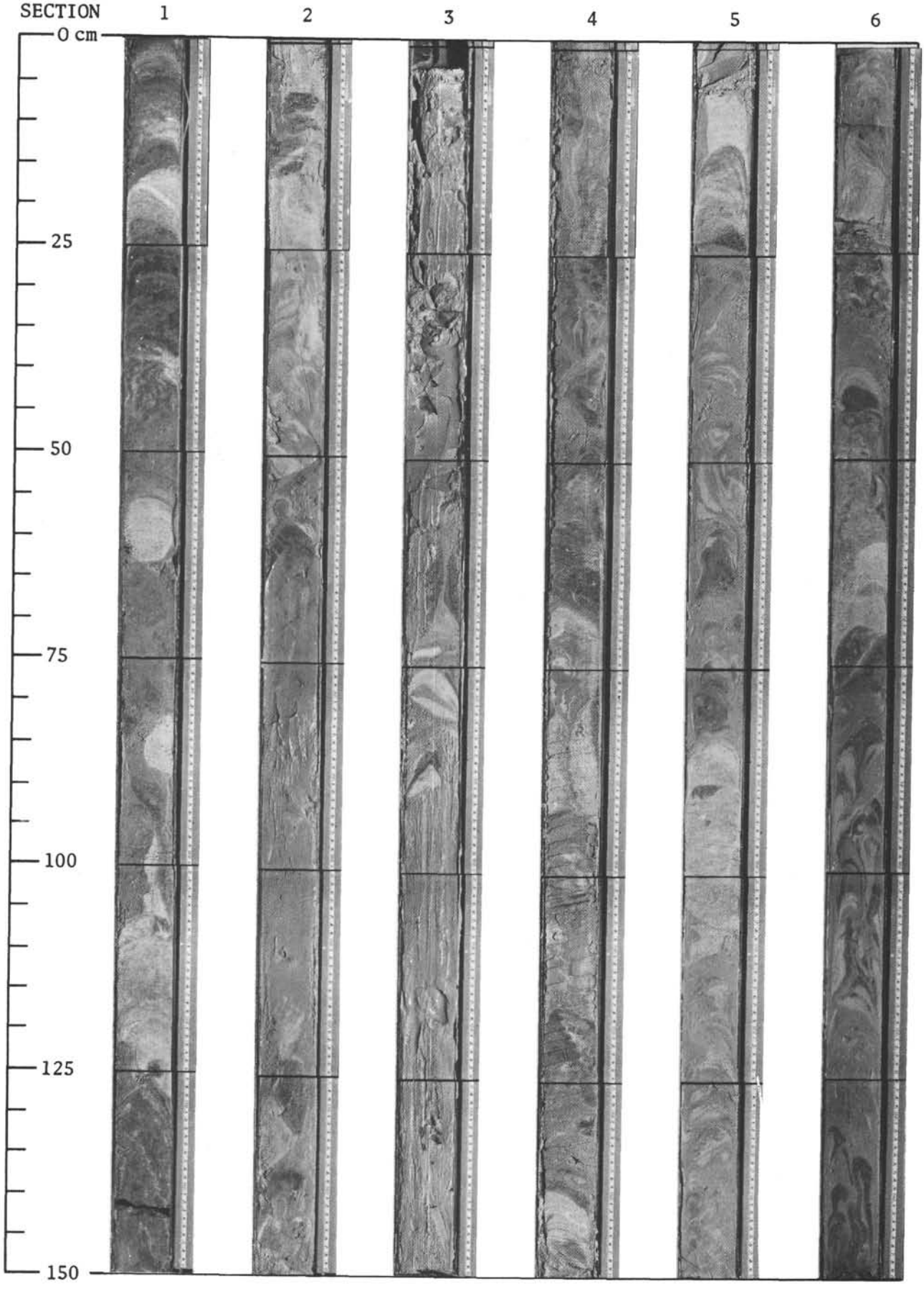
Site 69, Core 5, Sections 1-6.



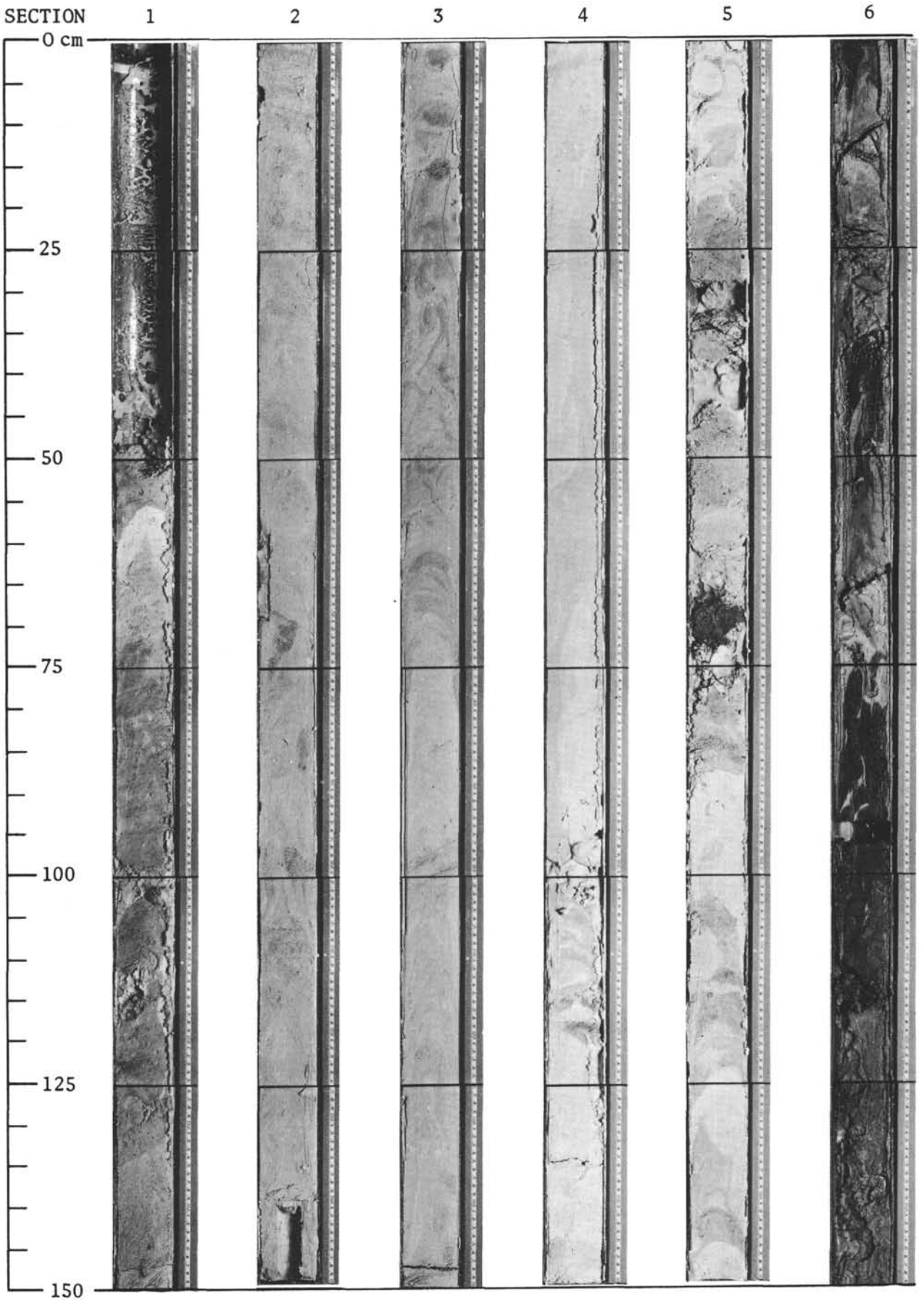
Site 69, Core 6, Sections 1-6.



Site 69A, Core 1, Sections 1-6.

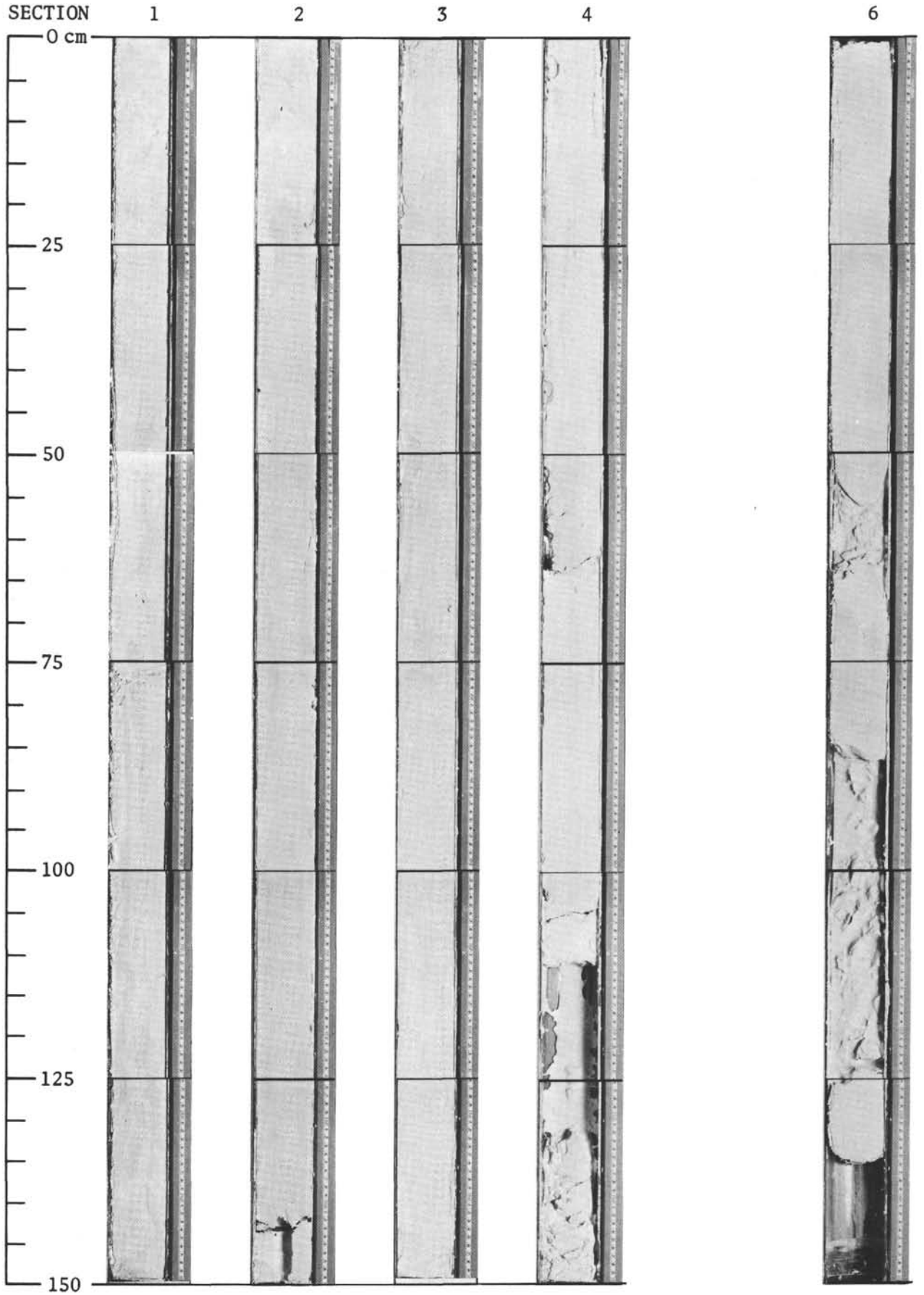


Site 69A, Core 2, Sections 1-6.

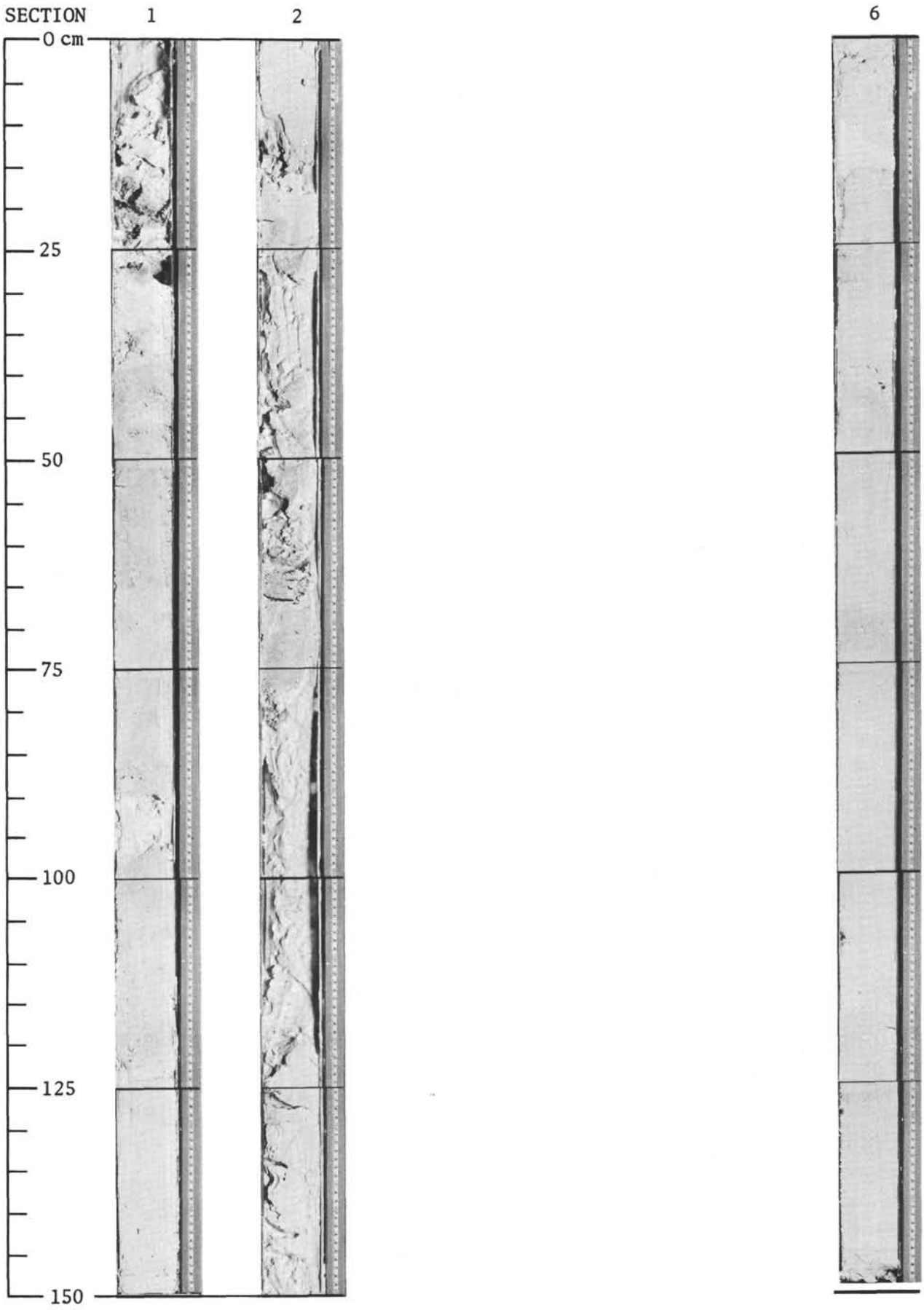


Site 69A, Core 3, Sections 1-6.

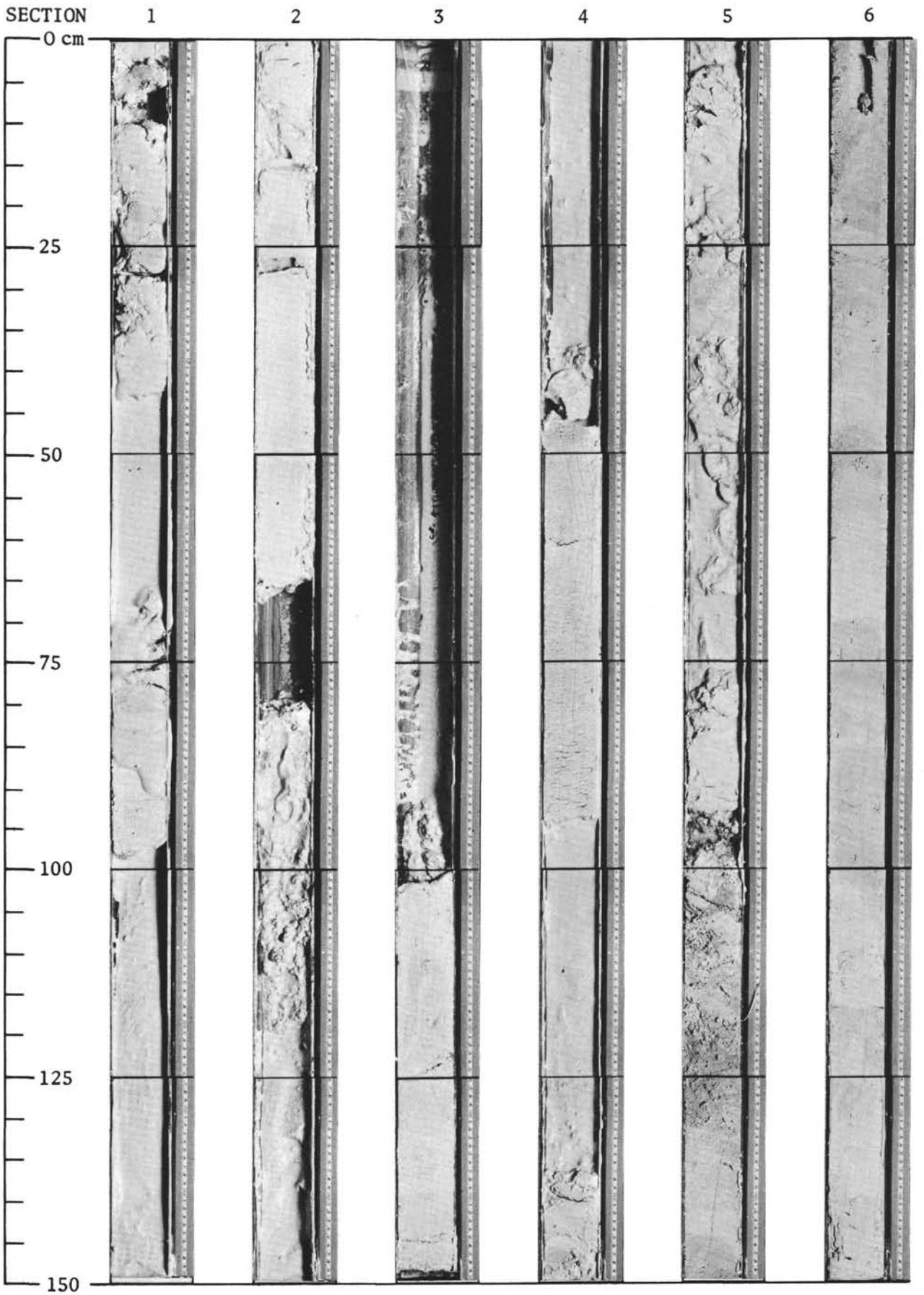
Site 69A, Core 4, Sections 1, 2, 5, 6.



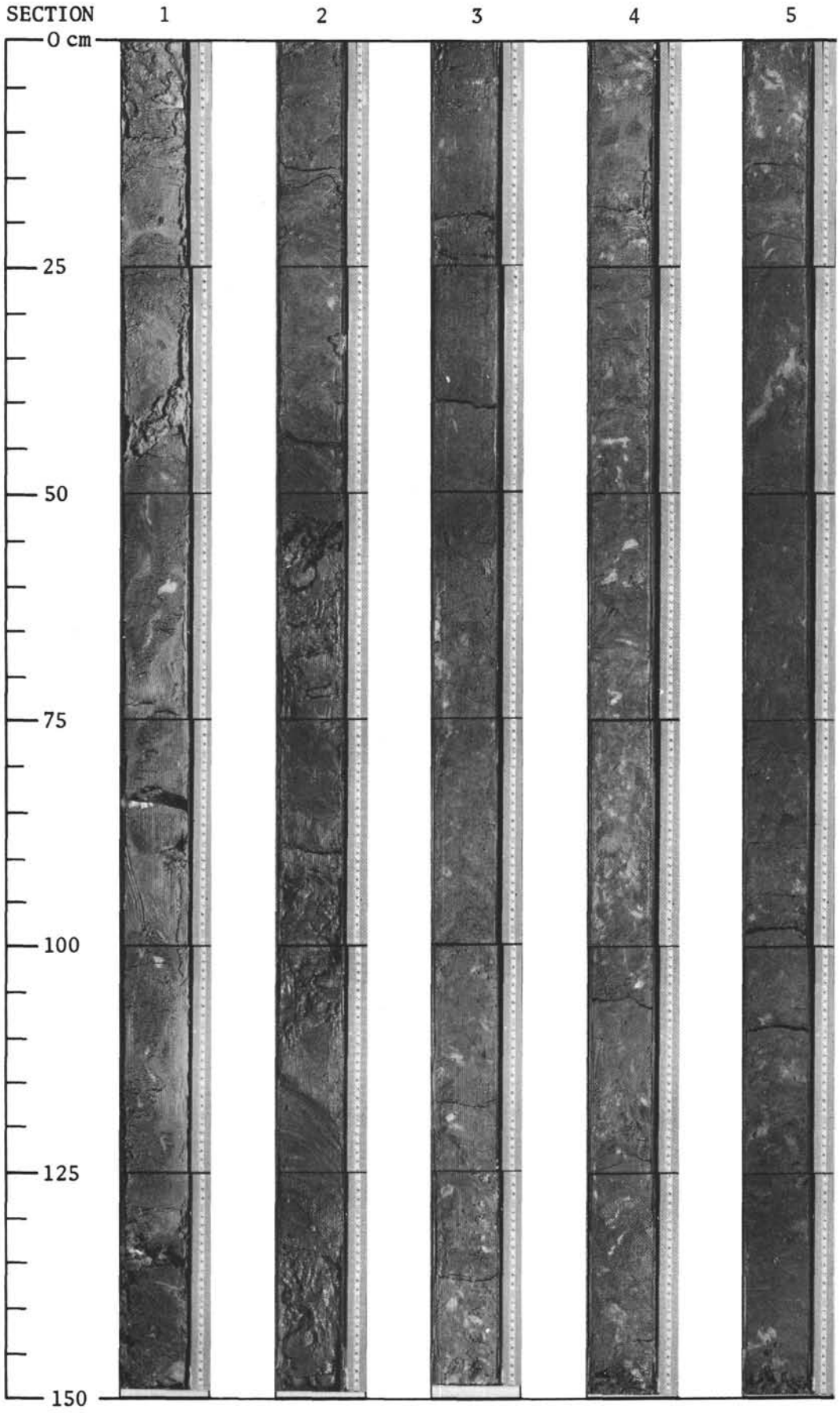
Site 69A, Core 5, Sections 1-4, 6.



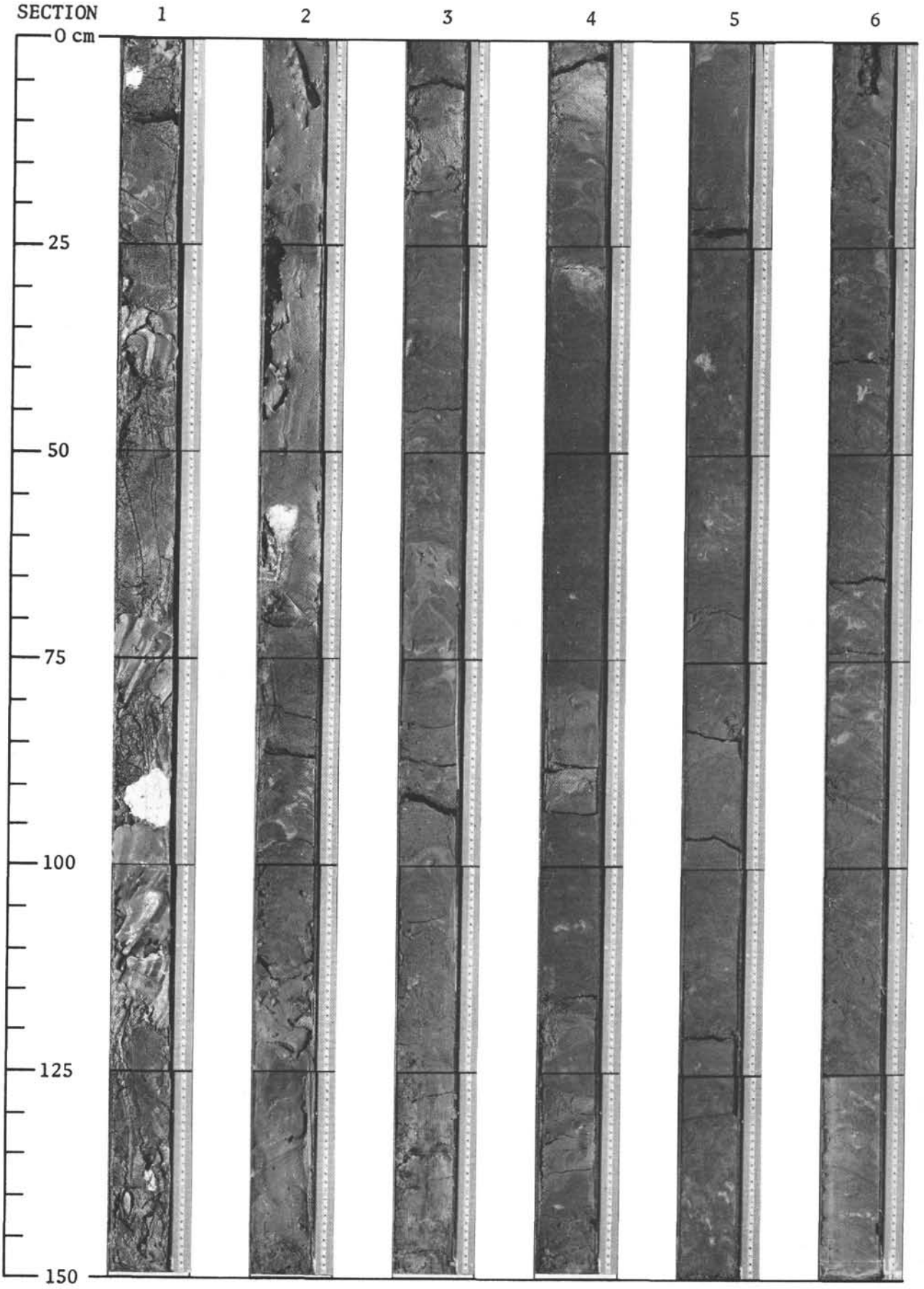
Site 69A, Core 6, Sections 1, 2, 6.



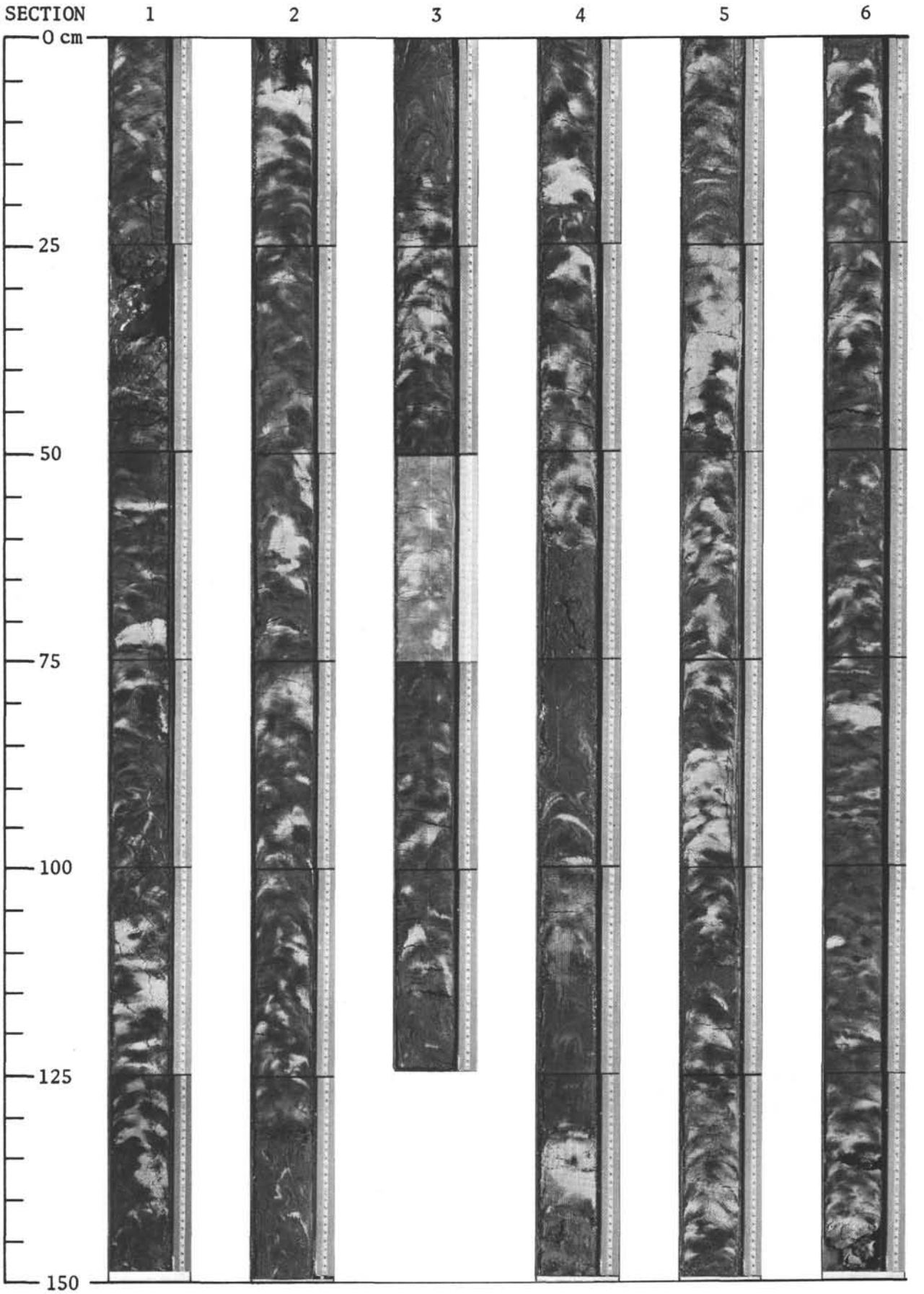
Site 69A. Core 8, Sections 1-6.



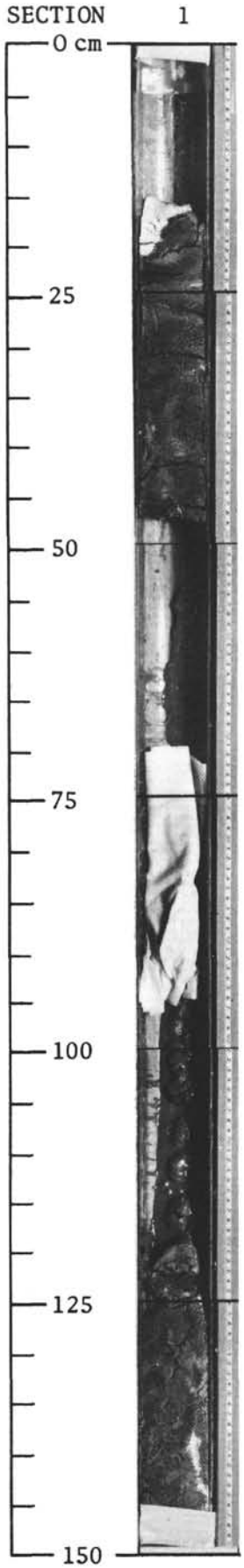
Site 69A, Core 9, Sections 1-5.



Site 69A, Core 10, Sections 1-6.



Site 69A, Core 11, Sections 1-6.



Site 69A, Core 12, Section 1.