7. SITE 17

The Shipboard Scientific Party[1]

SURVEY DATA AND SITE BACKGROUND

This site was selected to be in the vicinity of Magnetic Anomaly 13 on the east side of the Mid-Atlantic Ridge, although the magnetic anomaly pattern is uncertain in this area. This correlation may be subject to change with further study of the magnetic patterns. Three holes were drilled and cored over a negative magnetic anomaly.

The site was not surveyed before the drilling ship arrived on station, so that a preliminary box survey, approximately 25 kilometers E-W by 10 kilometers N-S, was made by *Glomar Challenger.* The final site (28° 02.74'S, 6° 36.15'W, Holes 17 and 17A) proved to be slightly south of the box survey. The topography at the site consists mainly of small hills 10 to 200 meters (32 to 656 feet) high (Figure 1). Occasional small (1 kilometer wide) flat valleys interrupt the pattern of small hills, and these are the foci of sediment accumulations. Holes 17 and 17A are located at the base of one of the larger hills, and Hole 17B is displaced about 300 meters (984 feet) to the west of these towards the center of a small basin. The water depth for Holes 17 and 17A is 4266 meters (13,992 feet) corrected (2264 fathoms, uncorrected) or 4277 meters (14,029 feet) corrected (2270 fathoms, uncorrected), depending on whether the first or second of the two reflectors is chosen. The length of drill pipe at bottom contact indicated that the deeper sounding was closer to the depth beneath the ship. Water depth at Hole 17B is nearly 100 meters (328 feet) greater.

Sediment thicknesses around the site range from 0 to 0.3 second reflection time between bottom and "basement" reflector, with the thickest accumulations generally (but not always) at the lower elevations. The air-gun record deteriorated during the latter part of the preliminary survey, causing some uncertainty in selecting a site without an excessive sediment thickness. Over the site, the sediment accumulation above basement reflector (Figure 2) is apparently represented by about 0.18 second reflection time below bottom, compared to about 0.2 to 0.25 second on the hill to the east and beneath the central part of the valley to the west. The drilling results, however, indicate that the hard layer encountered at the bottom of all three holes on this site is not as deep as indicated by this strong reflector. The topography, sediment thickness, and magnetic anomaly patterns all showed a distinct N-S lineation.

OPERATIONS

Positioning

The beacon was dropped at Site 17 at 2150 hours on 30 December, 1968. After the beacon reached bottom, the ship was placed in automatic and there were no problems of position keeping. At noon on 1 January, 1969, it was decided to move the hole in a direction of 240° to a distance of about 240 to 300 meters (787 to 984 feet). An offset of 300 meters (984 feet) to the west and 60 meters (196 feet) to the south was placed in the computer and the ship was centered on this location with no difficulty. During the day, large and variable currents were encountered which required shifting occasionally to semi-automatic positioning. The wind and current directions were often at a 90° angle to each other. At times the ship would reach the edge of the major lobe of the beacon and it would be necessary to shift into manual to maintain position.

Drilling

The only drilling break of consequence in Hole 17 occurred at 1900 hours on 31 December, when the bit struck a hard layer at a depth of 92.7 meters (304 feet), which could neither be penetrated nor cored. This layer was resistant enough to stall the drilling pipe. Since the hole had been washed in the previous 14 meters (46 feet), it was decided to pull the pipe back to the sea floor and start a new hole (17A) in order to collect a sample directly over the hard layer. Hole 17A was located, essentially, at the same spot as Hole 17. However, the hard layer was not encountered at 92.7 meters (304 feet) as in Hole 17, but at a depth of 102.5 meters (336 feet). Again, the layer could not be drilled or cored, although small fragments of basalt were recovered from the sediment core immediately in contact with the layer.

Because of the sharp slope of this hard layer, the position of the ship was offset by about 300 meters

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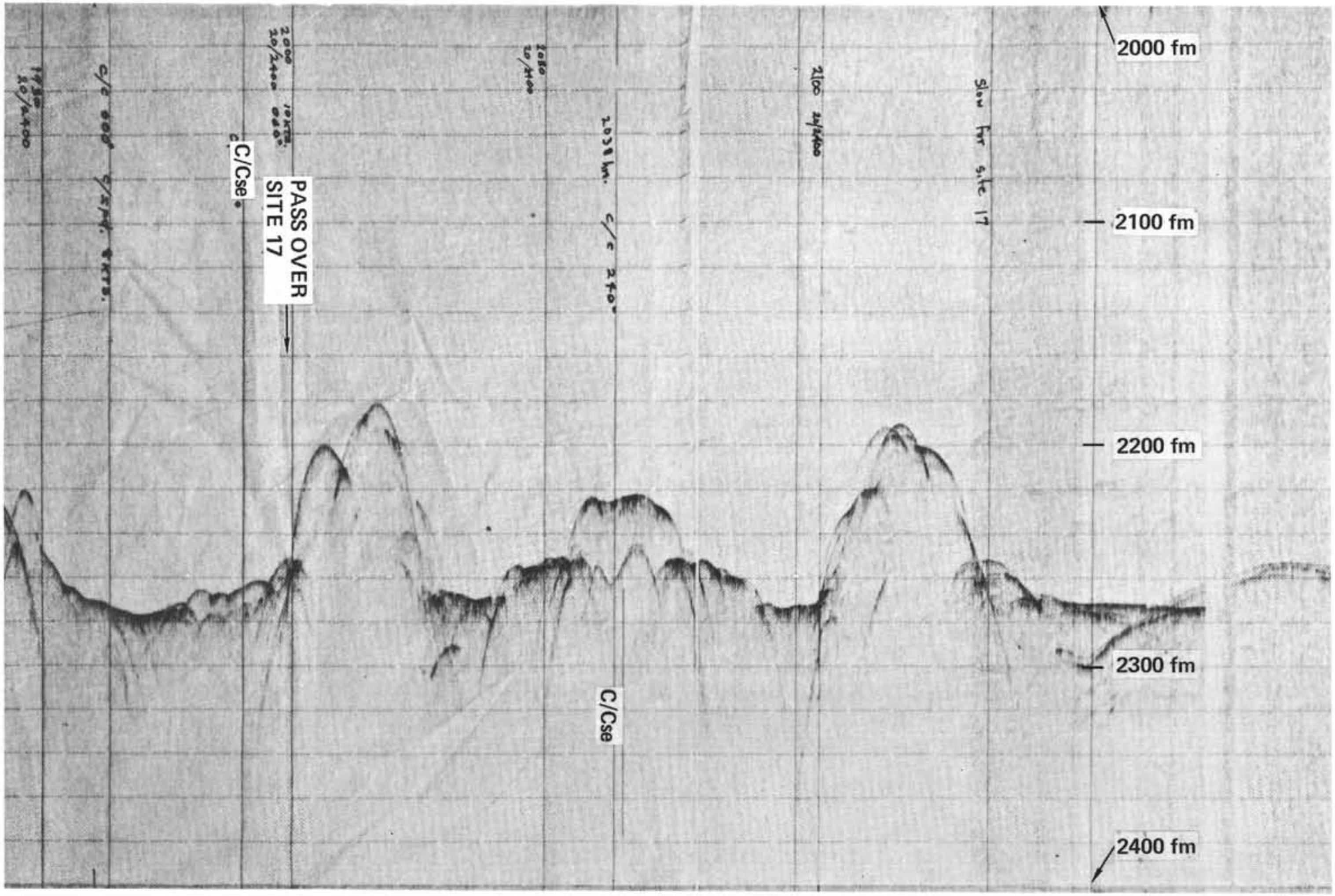


Figure 1. *Precision depth recording in the vicinity of Site 17.*

TABLE 1
Summary of Coring at Site 17

Core No.	Date/Time		Interval Cored (m below sea floor)	Core Retrieved (m)	Remarks
17-1	12-31-68	1200	0-9.2	9.0	–
17-2		1350	19.2-28.4	9.0	–
17-3		1615	47.6-56.8	9.0	–
17-4		1830	76.3-85.4	9.0	–
17-5		2100	92.7-92.7	0.0	No penetration.
17A-1	1-1-69	0030	28.4-37.5	9.0	–
17A-2		0230	37.5-46.7	9.0	–
17A-3		0530	85.4-94.6	9.0	–
17A-4		0820	94.6-102.5	7.9	Small fragments of basalt at bottom of core.
17B-1	1-1-69	1315	86.6-95.7	8.7	–
17B-2		1500	95.7-104.9	9.0	–
17B-3		1700	104.9-114.0	9.0	–
17B-4		1900	114.0-123.2	8.8	Pieces of basalt at bottom.
17B-5		2300	124.1-127.4	0.0	No recovery.
	Total			106.4	

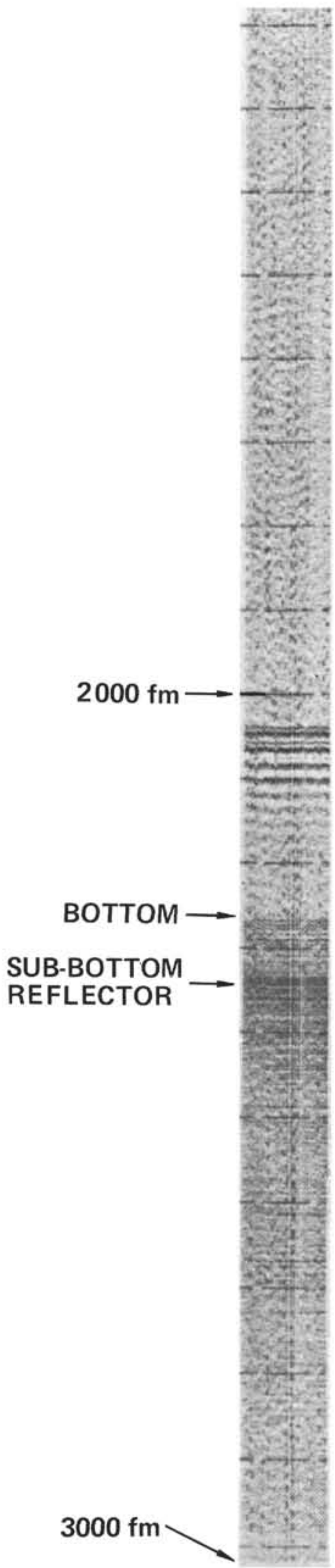


Figure 2. *Continuous seismic profiler record on station at Site 17.*

(984 feet) in the hope that the hard layer might be avoided. Thus, Hole 17B was drilled in 4359 meters (13,297 feet) of water–slightly greater than the other two holes at this site. At this new location the hard layer was struck at 124 meters (407 feet), where very small fragments of vesicular basalt were recovered.

It should be noted that a very good profiler record at this site gave a strong reflector at 0.18 second (reflection time), which was interpreted as basement. This particularly good record led to the consideration that the hard layer encountered at a markedly shallower depth might not be basement, but an intermediate layer. Therefore, although the bottom of each of these holes has been in basalt, it has been referred to as a hard layer rather than basement. A more detailed examination of the geophysical parameters in the area will permit resolution of this uncertainty.

Coring

A total of fourteen cores were attempted in three separate holes at Site 17. A summary of these is presented in Table 1. The distribution of these cores was such that the total section of sediments, with the exception of the interval from 9 to 19 meters (30 to 62 feet), was sampled. On the average, the cores took 2.5 hours each to collect. Because of the nature of the sloping structure, duplicate sections were retrieved of some of the lower sections. Again, there was a high return on the sampling, where 107.8 meters (354 feet) out of 109.2 meters (358 feet) were obtained, yielding a 98.7 per cent recovery. The roller bit used in this hole proved to be unsuccessful in sampling basalt. No significant basalt samples were collected and the bit came back with two rollers missing and the third severely damaged.

PALEONTOLOGY

Three holes were drilled at Site 17: Hole 17, Hole 17A and Hole 17B. The stratigraphic relationships of these holes are shown in Figure 3. Pleistocene, Lower Pliocene, Lower Miocene and Upper Oligocene sediments were recovered from four out of the five cores in Hole 17. Core 5 was an attempt to core basalt, but no basalt was recovered because no penetration was attained. Coring was discontinuous throughout the hole from 0 to 92.7 meters (0 to 304 feet). The four cores of Hole 17A recovered Lower Miocene and Upper Oligocene sediments. Small fragments of basalt were found in the bottom of Core 4 mixed with the sediments. Coring was purposely discontinuous in this hole because the stratigraphic sequence had been partially established in Hole 17. Two Lower Miocene cores were taken from 28.4 to 37.5 meters (93 to 123 feet) and two from the Upper Oligocene immediately above the basalt, from 85.4 to 102.5 meters (281 to 336 feet). Only Upper Oligocene sediments

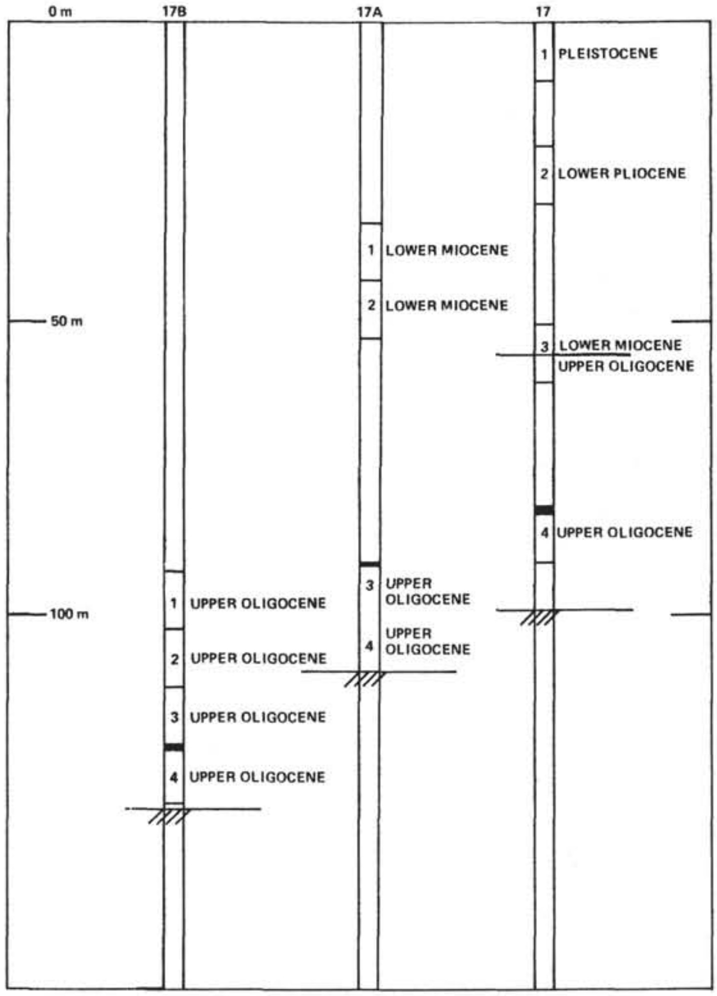


Figure 3. *Stratigraphic relationships between Holes 17, 17A and 17B.*

were recovered from four out of the five cores in Hole 17B. Core 5, from 124.1 to 127.4 meters (407 to 418 feet), was an attempt to core the basalt. Although no core was recovered, small pieces of basalt were found in the bottom of Core 4, from 114.1 to 123.2 meters (374 to 404 feet). Coring was practically continuous from 86.6 to 127.4 meters (284 to 418 feet). This was done in order to insure coring of the sediments immediately overlying the basalt and determine their age. The stratigraphic sequence in the upper part of the hole–0 to 86.6 meters (0 to 284 feet)–had been established in Holes 17 and 17A.

Two stratigraphic boundaries were cored at Site 17, namely the Aquitanian/Burdigalian boundary of the Lower Miocene in Core 1 of Hole 17A and the Oligocene/Miocene boundary in Core 3 of Hole 17. Time limitations aboard the ship, the soupy nature of many of the sediments cored and the repetition of some stratigraphic intervals in different holes resulted in some of the cores not being slabbed and sampled in detail for geologic and paleontologic studies.

One of the purposes in drilling at this site was to test the hypothesis of sea-floor spreading and the interpretation of linear magnetic anomalies. Although the hole was located on a negative magnetic anomaly, the lack of definitive survey data around this site does not permit the identification of this particular anomaly in terms of the Heirtzler *et al.* (1968) scheme. The age of the oldest sediments above the basalt is Late Oligocene (Chattian), and the sediments represent the *Globigerina ampliapertura* Zone of Bolli (1957c) and the *Sphenolithus predistentus* Zone of Bramlette and Wilcoxon (1967). According to Chapter 2, Figure 3, these zones can be correlated with a radiometric age of about 33 million years. The age of the basement rock has been estimated independently to be about 32 million years B.P. by assuming a constant rate of spreading of the ocean floor of 2 cm/yr over the distance between this site and the axis of the Mid-Atlantic

Ridge. The 2 cm/yr of spreading rate in this area is compatible with the drilling data from the western flank of the Ridge. Therefore, the age derived from the paleontological data is in close agreement with the data obtained from the sea-floor spreading hypothesis.

As previously discussed for Sites 15 and 16, the lower Pliocene and Pleistocene planktonic foraminiferal faunas are not those typical of tropical waters. On the other hand, lower Miocene and upper Oligocene faunas are similar to those described from tropical regions. The calcareous nannoplankton floras contain species reported from tropical areas throughout most of the stratigraphic sequence, except possibly for the Pleistocene which was not studied in detail.

The sediments of most of the cores from Holes 17, 17A and 17B consist predominantly of the plates of calcareous nannoplankton with varying amounts of planktonic foraminiferal tests and minor amounts of opaque minerals and zeolites. An exception is Core 2 of Hole 17, which contains 20 to 50 per cent diatoms. The variations from lithologic unit to unit are discussed in the section on Stratigraphy.

In Hole 17, the sediments of Core 1, from 0 to 9.2 meters (0 to 30 feet), are Pleistocene in age based on the planktonic foraminifera and calcareous nannoplankton. The fauna in various samples consists of: *Globorotalia inflata, G. crassaformis, G. truncatulinoides,* left coiling *G. menardii,* right coiling *Pulleniatina obliquiloculata* and right coiling *P. finalis* Banner and Blow. The floras include: *Helicopontosphaera kamptneri Gephyrocapsa oceanica, Cyclococcolithus leptoporus* and *Ceratolithus cristatus.*

The Early Pliocene (Zanclian) age of Core 2, from 19.2 to 28.4 meters (63 to 94 feet), of Hole 17 is based on the planktonic foraminifera and the calcareous nannoplankton. Moderate numbers of Radiolaria were found in association with common to abundant frustules of diatom, *Ethmodiscus rex* (Rattray), in this core. Although the radiolarian fauna is not greatly diversified, it exemplifies a late-early or near mid-Pliocene radiolarian assemblage consisting of: *Eucyrtidium elongatum peregrinum* Riedel, *Penartus tetrathalmus* Haeckel, *Pterocanium* cf. *prismatium* Riedel (Rare), *P. trilobum* Haeckel (Rare) and *Lamprocyclas maritalis* Haeckel. Characteristic planktonic foraminiferal species are: *Globorotalia margaritae, G. multicamerata, Globoquadrina altispira* and *Globigerinoides obliquus.* The calcareous nannoplankton species present are: *Discoaster brouweri, D. pentaradiatus, D. surculus, Ceratolithus tricorniculatus, C. rugosus* (Rare) and *Reticulofenestra pseudoumbilica.*

In Hole 17, the Oligocene/Miocene boundary is located in Core 3, from 47.6 to 56.8 meters (156 to 186 feet), based on the planktonic foraminifera. The boundary is placed arbitrarily in the middle of the core between Sections 3 and 4 because only two samples, one from the top and one from the core catcher of Section 4, were studied. The planktonic species from the upper sample consist of *Globorotalia kugleri, G. peripheroronda, Globigerinita dissimilis, G. stainforthi* and *Globoquadrina praedehiscens* which suggest their correlation with the upper part of the *Globorotalia kugleri* Zone of an Early Miocene (Aquitanian) age. The fauna from the core catcher sample is characteristic of the *Globigerina ciperoensis* Zone of Bolli (1957c), and it includes *Globigerina ciperoensis* Bolli, *G. angulisuturalis* and *Globorotalia opima nana.* The occurrence of *Cyclococcolithus neogammation, Coccolithus* aff. *bisectus* and *Discoaster deflandrei* in the upper sample indicates its correlation with the lower part of the *Triquetrorhabdulus carinatus* Zone of Bramlette and Wilcoxon (1967). The occurrence of *Coccolithus bisectus* and *Sphenolithus ciperoensis* in association with the forms mentioned above in the core catcher sample assigns it to the *Sphenolithus ciperoensis* Zone of Bramlette and Wilcoxon (1967).

Core 4, from 76.3 to 85.4 meters (250 to 270 feet), of Hole 17 is placed in the Upper Oligocene (Chattian) based on the planktonic foraminifera and calcareous nannoplankton. This core is assigned to the *Globigerina ampliapertura* Zone of Blow (1969) because this interval lies immediately below the level of the first geologic appearance of *Globigerina angulisuturalis* and includes species such as *Chiloguembelina cubensis, Globorotalia opima nana, G. postcretacea* and *Globoquadrina praedehiscens* in the top of the core. The core catcher sample contained a more diverse fauna representing the same zone. As in the case of Core 3, only two samples were studied because this core was not slabbed or sampled in detail. The sample from the top of the core is the *Braarudosphaera rosa* Chalk which has been discussed in Core 4 of Hole 14 (see Chapter 4, Paleontology). This chalk is also found in Sites 19, 20 and 22, and Holes 17A and 17B. The flora from this core is more diverse than that found in Hole 14, and consists of complete specimens of *Braarudosphaera rosa* with floods of its isolated fragments, *Coccolithus bisectus, C. eopelagicus, Cyclococcolithus neogammation* and *Discoaster deflandrei.* This flora is not too diagnostic of an age since many characteristic species are absent. However, the flora in the core catcher sample contains species characteristic of the *Sphenolithus predistentus* Zone of Bramlette and Wilcoxon (1967), such as, *Sphenolithus predistentus, S. distentus* and *Discoaster tani* s.l. The *Sphenolithus distentus* Zone of Bramlette and Wilcoxon (1967) may be present in this core, but the section was not studied in detail.

In Hole 17A, the Aquitanian/Burdigalian boundary of the Lower Miocene is placed in Section 5 of Core 1, from 28.4 to 37.5 meters (93 to 123 feet), between samples from 7 to 9 centimeters and 100 to 102 centimeters depth based on the planktonic foraminifera. The lower sample is marked by the first appearance of *Globigerinita dissimilis* and *G. stainforthi*, which are the diagnostic species of the *Globigerinita stainforthi* Zone. The upper sample consists of *Globoquadrina dehiscens dehiscens, G. dehiscens advena, Globigerinoides trilobus, G. subquadratus* Bronniman, *Globigerina woodi* and *G. opima continuosa* and is correlated with the *Globigerinatella insueta/Globigerinoides trilobus* Zone of Blow (1959). The calcareous nannoplankton species represent the *Helicopontosphaera ampliaperta* Zone of Bramlette and Wilcoxon (1967). Diagnostic species present are: *Cyclococcolithus neogammation, Sphenolithus heteromorphus, Discoaster deflandrei* and *D. challengeri.* Several samples in this core contain younger Neogene floral and faunal contaminants from uphole. The sample from 16 to 18 centimeters of Section 1 contains a much younger Neogene flora associated with one characteristic of the *Helicopontosphaera ampliaperta* Zone. The sample from the core catcher contains a fauna typical of the *Globigerinoides sicanus/ Globigerinatella insueta* Zone of Blow (1959).

Core 2, from 37.5 to 46.7 meters (123 to 153 feet), of Hole 17A is Aquitanian (Early Miocene) in age based on the planktonic foraminifera. Two of the zones proposed by Bolli (1957) are present in this core, namely the *Globorotalia kugleri* and the younger *Globigerinita dissimilis* Zones. The boundary between the two occurs in the middle of Section 5 between the samples from 2 to 4 centimeters and from 100 to 102 centimeters depth. The first occurrence of the zonal index species *Globorotalia kugleri* is in the lower sample. The calcareous nannoplankton represent the *Sphenolithus ciperoensis* and the lower part of the *Triquetrorhabdulus carinatus* Zones of Bramlette and Wilcoxon (1967). Species present throughout the core are *Coccolithus* aff. *bisectus, Cyclococcolithus neogammation* and *Discoaster deflandrei.* The contact between these two calcareous nannoplankton zones is placed between Sections 5 and 6 based upon the first appearance of *Coccolithus bisectus* and *Sphenolithus ciperoensis* in the sample from 19 to 21 centimeters depth of Section 6.

The sediments in Core 3, from 85.4 to 94.6 meters (270 to 311 feet) in Hole 17A are Late Oligocene (Chattian) in age based on the planktonic foraminifera and the calcareous nannoplankton. This core was not studied in detail because the same stratigraphic interval is probably represented in Core 4 of Hole 17B. The planktonic foraminifera present in the two samples studied are: *Chiloguembelina cubensis, Globorotalia opima nana, G. opima opima. Globigerina sellii, G. tripartita* Koch and *Globigerina angulisuturalis,* and represent the *Globorotalia opima opima* Zone of Bolli (1957). The flora from the upper part of Section 1 contains *Sphenolithus distentus, S. predistentus, Coccolithus bisectus, C.* aff. *bisectus, Cyclococcolithus neogammation* and *Discoaster deflandrei,* and it represents the *Sphenolithus distentus* Zone of Bramlette and Wilcoxon (1967). Two samples, one from the lower part of Section 6 and the other from the core catcher, contain a similar flora, but without *Coccolithus* aff. *bisectus* and with rare specimens of *Discoaster tani* s.l. This lower flora probably represents the *Sphenolithus predistentus* Zone of Bramlette and Wilcoxon (1967). This contact between these two zones is arbitrarily placed between Sections 3 and 4. A sample from the top of this core contains the *Braarudosphaera rosa* Chalk. It contains a flora similar to that reported from Core 4 of Hole 17.

Core 4 from 94.6 to 102.5 meters (311 to 336 feet), of Hole 17A is also Late Oligocene (Chattian) in age based on planktonic foraminifera and the calcareous nannoplankton. The flora and fauna throughout the core are similar to that mentioned for the lower part of Core 3 of Hole 17A, except that the planktonic foraminifer *Globigerina ampliapertura* and the calcareous nannoplankton species *Helicopontosphaera compacta* (Bramlette and Wilcoxon) are present, and *Discoaster tani* s.l. is abundant. This interval is correlated with *Globigerina ampliapertura* Zone of Blow (1969) and the *Sphenolithus predistentus* Zone of Bramlette and Wilcoxon (1967).

In Hole 17B, Core 1, from 86.6 to 95.7 meters (284 to 314 feet), Core 2, from 95.7 to 104.9 meters (314 to 344 feet), Core 3, from 104.9 to 114 meters (344 to 374 feet) and Core 4, from 114 to 123.2 meters (374 to 404 feet), are Late Oligocene (Chattian) in age based on the planktonic foraminifera and calcareous nannoplankton. The planktonic foraminifera in Core 1 represent the *Globigerina ciperoensis* Zone of Bolli (1957c), and the flora, the *Sphenolithus ciperoensis* Zone of Bramlette and Wilcoxon (1967). The fauna is characterized by *Globigerina sellii, G. yeguaensis* and *G. corpulenta* throughout the core with *G. ciperoensis* first occurring in the core catcher. The flora consists of *Coccolithus bisectus, C.* aff. *bisectus, Cyclococcolithus neogammation, Sphenolithus ciperoensis* and *Discoaster deflandrei.* Core 2 contains the same flora; however, the fauna is changed. The contact between the *Globorotalia opima opima* and *Globigerina ciperoensis* Zones of Bolli (1957c), occurs between samples at 27 to 29 centimeters of Section 1 and from 7 to 9 centimeters of Section 3 based on the first appearance of *Globorotalia opima opima* in the lower sample. Core 3 includes the boundary between the *Globigerina ampliapertura* and *Globorotalia opima opima* Zones, which is placed between the samples from 34 to 36 centimeters of Section 1 and 102 to 104 centimeters of Section 2 on the basis of the first geologic appearance of *G. angulisuturalis* in the upper sample. The calcareous nannoplankton in Core 3 are those typical of the *Sphenolithus distentus* Zone of

Bramlette and Wilcoxon (1967). At the top of Core 4, the *Braarudosphaera rosa* Chalk occurs which contains a flora similar to those previously mentioned in Core 4 of Hole 17 and in Core 3 of Hole 17A. The planktonic foraminifera from this core are characteristic of the *Globigerina ampliapertura* Zone of Blow (1969). Except for the uppermost part of Section 1, most of the core represents the *Sphenolithus predistentus* calcareous nannoplankton Zone of Bramlette and Wilcoxon (1967) based on the occurrence of *Coccolithus bisectus, Cyclococcolithus neogammation, Discoaster deflandrei, D. tani* s.l., *Sphenolithus distentus* and *S. predistentus.* The flora in the sample from 34 to 36 centimeters depth of Section 1 lacks *Discoaster tani,* and suggests its correlation with the *Sphenolithus distentus* Zone of Bramlette and Wilcoxon (1967).

STRATIGRAPHY

Three holes were drilled at Site 17 (Holes 17, 17A and 17B). Stratigraphic correlation between the holes posed no problems, as they were spaced less than 350 meters (1149 feet) apart. Five lithologic units were recognized, and they are applicable to all three holes.

The five units here can be correlated with those at adjacent sites to constitute the following formations:

3-17-1-1	Albatross Ooze	Foraminiferal nannofossil chalk ooze.
3-17-2-1	Blake Ooze	Nannofossil chalk oozes with diatomaceous member.
3-17A-1-1	Endeavor Ooze	Zeolitic nannofossil chalk and marl oozes.
3-17A-2-4	Fram Ooze	Nannofossil chalk ooze with *Braarudosphaera* Chalk member.
3-17B-4-4	Grampus Ooze	Foraminiferal nannofossil chalk ooze.

The Albatross Ooze here consists of the usual very pale brown foraminiferal nannofossil chalk oozes. The identifiable foraminifera content ranges from 10 to 25 per cent, although the sand-size fraction of the oozes varies from 14 to 33 per cent. Clays account largely for the non-carbonate impurities in these oozes; some diatoms have also been identified.

The underlying Unit 3-17-2-1 includes mainly white chalk oozes, which consist almost exclusively of nannofossils, with traces of foraminifera and the diatom *Ethmodiscus rex.* However, the lower part of the unit includes some diatom-rich layers. Examined in detail, the section 3-17-2-5 was found to include 6 layers of cyclic sedimentation. Each cycle consists of a dark gray diatomaceous ooze at the base and a white nannofossil chalk ooze at the top. These cyclic layers range from 20 to 30 centimeters and represent a periodic influx of siliceous planktons at an interval of about every 50 thousand years. The dark gray layers include, besides nannofossils, some 50 per cent siliceous fossils, mainly the diatom *Ethmodiscus rex;* some radiolarians are also present. The chalk oozes at the top of each cycle consist mainly of nannofossils. A slight increase in the foraminifera content in these oozes was noted, as the sand-fraction increased from less than 1 per cent to about 5 per cent in the last two sections of 3-17-2.

The Unit 3-17-2-1 occupies a stratigraphic position, and is lithologically similar to the Blake Ooze of adjacent sites, except for the presence of siliceous planktons. The authors have, therefore, designated this unit a part of the Blake Ooze. They recognized, however, the presence of the above-mentioned diatomaceous intercalations, and recommend a Subunit 3-17-2-5 to designate the 1.5-meter (5-foot) interval. Thus, this subunit constitutes an unnamed diatomaceous member of the Blake Ooze Formation.

The Unit 3-17A-1-1, Lower Miocene, representing the Endeavor Ooze, underlies the Pliocene Blake Ooze disconformably. The Challenger Ooze and Discovery Clay at Site 15 are absent here. This unit consists of brown zeolitic nannofossil chalk and marl oozes. Dark yellowish-brown interbeds, 20 to 70 centimeters thick, are common in the top. The lower half is mainly yellowish-brown with a few very pale brown intercalations near the transitional lower contact. Non-carbonate constituents, which are mainly zeolites (up to 10 per cent), hematitic aggregates and clays, decrease from 45 per cent near the top to about 15 per cent at the base, corresponding to changes in color. Foraminifera are practically absent, so that the sand-fraction constitutes less than 1 per cent of these deposits.

The Fram Ooze is represented by the nannofossil chalk oozes of the Unit 3-17A-2-4 here. These very pale brown and light yellowish-brown sediments consist of nannofossils, and the uniform lithology is characteristic of the Fram Ooze. In thin sections, traces of foraminifera and a few percentages of zeolitic and hematitic impurities were observed, but not in such quantities as suggested by the grain-size (average 3.5 per cent) and by the non-carbonate content (average 15 per cent).

The remarkable thin layer of the white crystalline chalk, consisting exclusively of *Braarudosphaera* pentelets, first observed at Site 14, was again found at Site 17, and in all three holes. This layer was broken during the drilling of the first two holes, so that small chalk chips were found scattered throughout Cores 17-4-1 and 17A-4-1. However, a 7-centimeter thick crystalline chalk layer was observed in Core 17B-4-2

TABLE 2
Stratigraphy Site 17

Age	Cored Interval (m)	Formation Name	Probable Interval (m)	Probable Thickness (m)	Description
Pleistocene	(0-9)	Albatross Ooze 3-17-1-1	15	15	Very pale brown to white foraminiferal nannofossil chalk oozes. 5 to 20 per cent foraminifera.
Lower Pliocene	(19-28)	Blake Ooze 3-17-2-1	15.0-28.4	13.4	Very pale brown to white nannofossil chalk oozes, with less than 1 per cent foraminifera. Diatom rich layers containing 20 to 50 per cent diatoms in the lower part (3-17-2-5 Subunit).
Lower Miocene	28.4-43.5 (47.6-56.8)	Endeavor Ooze 3-17A-1-1	28.4-43.5	15.1	Light yellow brown to dark brown zeolitic nannofossil chalk and marl oozes. Up to 8 per cent zeolite.
Lower Miocene–Upper Oligocene	43.5-46.7 (76.3-85.4) 85.4-102.5 (86.6-120.0)	Fram Ooze 3-17A-2-4 with *Braarudosphaera* Chalk	43.5-98 ?	54.5	Very pale brown to light yellow brown nannofossil chalk oozes. The *Braarudosphaera* Chalk is again the white chalk composed solely of the plates and fragments of the nannofossil *Braarudosphaera rosa* (3-17B-4-2 Subunit).
Upper Oligocene	98-102 (120.0-123.2)	Grampus Ooze 3-17B-4-4	98?-102	4	Light yellow brown foraminiferal nannofossil chalk ooze. 10 to 15 per cent foraminifera.
?	120 (86)	Basement 3-17B-5-1	102	?	Basalt glass with plagioclase phenocrysts.

at the 95 to 102 centimeter interval. The authors have denoted this remarkable bed as the *Braarudosphaera* Chalk, which is middle Oligocene in age everywhere in the South Atlantic.

Several foraminifera-rich horizons were found near the base of the sedimentary sequence in Hole 17B (17B-4-6). Since those layers include 10 to 15 per cent identifiable foraminifera, in contrast to the uniform nannofossil sediments typical of the Fram Ooze, it was decided that they belong to a separate unit (Unit 3-17B-4). These light yellowish-brown foraminiferal oozes are lithologically similar to the Unit 3-14-6-1 (Chapter 4, Stratigraphy), and together they constitute a part of the Grampus Ooze Formation.

A hard basalt layer was reached in all three holes. Chips of basalts were found in 3-17-5-core catcher and in 3-17A-4-core catcher. They consist of plagioclase phenocrysts in a glassy matrix. Three holes were drilled, because this basalt was encountered at a considerably shallower depth than that suggested by the air-gun record. On the other hand the authors found no positive indication that this basalt is not a basement.

Due to a lack of time, the authors omitted the processing of some sections which duplicated the stratigraphy at other holes and left the problem of detailed local stratigraphy to future workers. Nevertheless, they noted a remarkable local facies variation. The total sediment thickness increased 32 meters (106 feet), or some 35 per cent, in a horizontal distance of 300 meters (984 feet). Such drastic variations are related to local topography, as to be demonstrated again during the coring at Site 20. Not so clear is the cause of the thickness difference between the *Braarudosphaera* Chalk and the basement as shown below:

	Hole 17 (m)	Hole 17A (m)	Hole 17B (m)
Depth of *Braarudosphaera* Chalk	76.0	86.0	117
Depth of basalt	92.7	102.5	124
Sediment thickness below *Braarudosphaera* Chalk	15.7	15.5	7

The fact that the deposit older than the chalk is thinnest in the hole with the thickest total-sediment section could be explained by two alternatives: either the basalt is a sill which cut slightly across the bedding plane, or the bottom slope has been reversed since the Oligocene time. A study of the duplicate sections may resolve this problem.

The formational boundaries were drawn on the basis of the data presented below:

Base of Albatross Ooze	At 15 m (Hole 17)	Mid-point of uncored interval.
Base of Blake Ooze	At 28.4 m (Hole 17A)	Disconformity.
Base of Endeavor Ooze.	At 46 m (Hole 17A)	Color change described in text.
Base of Fram Ooze	At 120 m (Hole 17B) or At 98 m? (Hole 17A)	Top of foraminifera-rich horizon described in text.

The stratigraphy at Site 17 is summarized in Table 2. The cited cored intervals, probable formational intervals and probable formational thicknesses refer to those in Hole 17A. Cored intervals in Holes 17 and 17B are also given, but in parentheses. The stratigraphic classification and description are based upon a study of cores from all three holes.

The sedimentation rates at Hole 17A are:

Albatross Ooze	15.0 m/3 m.y. or 0.50 cm/t.y.
Blake Ooze	13.4 m/3 m.y. or 0.45 cm/t.y.?
Endeavor Ooze	15.1 m/5 m.y. or 0.30 cm/t.y.
Fram Ooze	54.5 m/7 m.y. or 0.75 cm/t.y.
Grampus Ooze	4.0 m/?

The rates for the Albatross and Blake Oozes are considerably slower than those at the Ridge crest sites (Sites 15 and 16). The rates for the Endeavor and the Fram Oozes are comparable to those at Site 14 on the outer side of the Ridge, but at a similar distance.

PHYSICAL PROPERTIES

Natural Gamma Radiation

Natural gamma radiation at Site 17, from the Albatross Ooze, Blake Ooze, Endeavor Ooze, Fram Ooze, and Grampus Ooze had counts from zero to 1100, with an average of 275 counts per 1.25 minutes per 7.6-centimeter core segment (Figures 4A-6A and 7A-20A). The higher counts, up to 1100, were associated with the lower Miocene-Oligocene nannofossil chalk ooze, which contained zeolite minerals (Endeavor Ooze).

Porosity, Wet-Bulk Density, and Water Content

Porosities, water contents and wet-bulk densities at Holes 17, 17A and 17B ranged from 43 to 82 (?) per cent, 28 to 47 per cent and 1.36 (?) g/cc to 2.01 g/cc, averaging 58 per cent, 37 per cent, and 1.73 g/cc (Figures 4A-6A and 7A-20A). The *Braarudosphaera* Chalk had wet-bulk densities as great as 2.00 g/cc and porosities as low as 43 per cent at Site 17 (barrel 4, sections 1 and 2). High densities at Hole 17 Cores 1 and 2 were recorded for about 200 centimeters on GRAPE unit. This chalk member was also detected on the GRAPE charts at Holes 17A and 17B. In general, porosities appeared to decrease irregularly from about 63 per cent with increasing depth through the Albatross Ooze, Blake Ooze, Endeavor Ooze, the Fram Ooze, and Grampus Ooze (in the first 80 meters). Wet-bulk densities and sound velocities, in general, vary inversely with porosity. Coring disturbances of this sediment prevent these values from being precisely representative of *in situ* conditions.

Sediment Sound Velocity

Sound velocities ranged from 1.50 to 1.65 km/sec, averaging about 1.54 km/sec (Figures 4A-6A and 7A-20A). Higher velocities of 1.58 to 1.65 km/sec appear to correlate with the *Braarudosphaera* Chalk Zone at Holes 17, 17A and 17B. The averaged "core barrel" sound velocities increased through the Albatross Ooze, Blake Ooze, Endeavor Ooze and Fram Ooze, with increasing depth, and were inversely correlated to porosities, and directly correlated to wet-bulk densities. The Grampus Ooze sound velocity average was slightly less than the Fram Ooze.

Penetrometer

At Holes 17, 17A and 17B, the meager number of penetrometer measurements registered from 73×10^{-1} millimeters to complete penetration (Figures 4A-6A and 7A-20A). The unpenetrated sections averaged 135×10^{-1} millimeters. The *Braarudosphaera* Chalk Zone section in Hole 17B was completely penetrated, although other sections of the same core averaged 153, and ranged from 74 to 196 mm $\times 10^{-1}$ These values are not particularly high when compared to the Hole 17 and 17A overall penetrometer values; however, at Hole 17B the other cores were completely penetrated. These values are not necessarily representative of *in situ* conditions since these cores were disturbed.

Thermal Conductivity

At Site 17, thermal conductivities varied from about 2.7 to 3.1×10^{-3} cal/°C cm sec. There was a small increase with depths in the upper 40 meters. From 40 m. to 80 m. conductivity was relatively constant at about 3.0×10^{-3} cal/°C cm sec. The highest value at 3.1×10^{-3} cal/°C cm sec. was measured at a depth of about 90 m. in the hole.

Interstitial Water Salinity

Interstitial water samples were not collected at Site 17.

REFERENCES

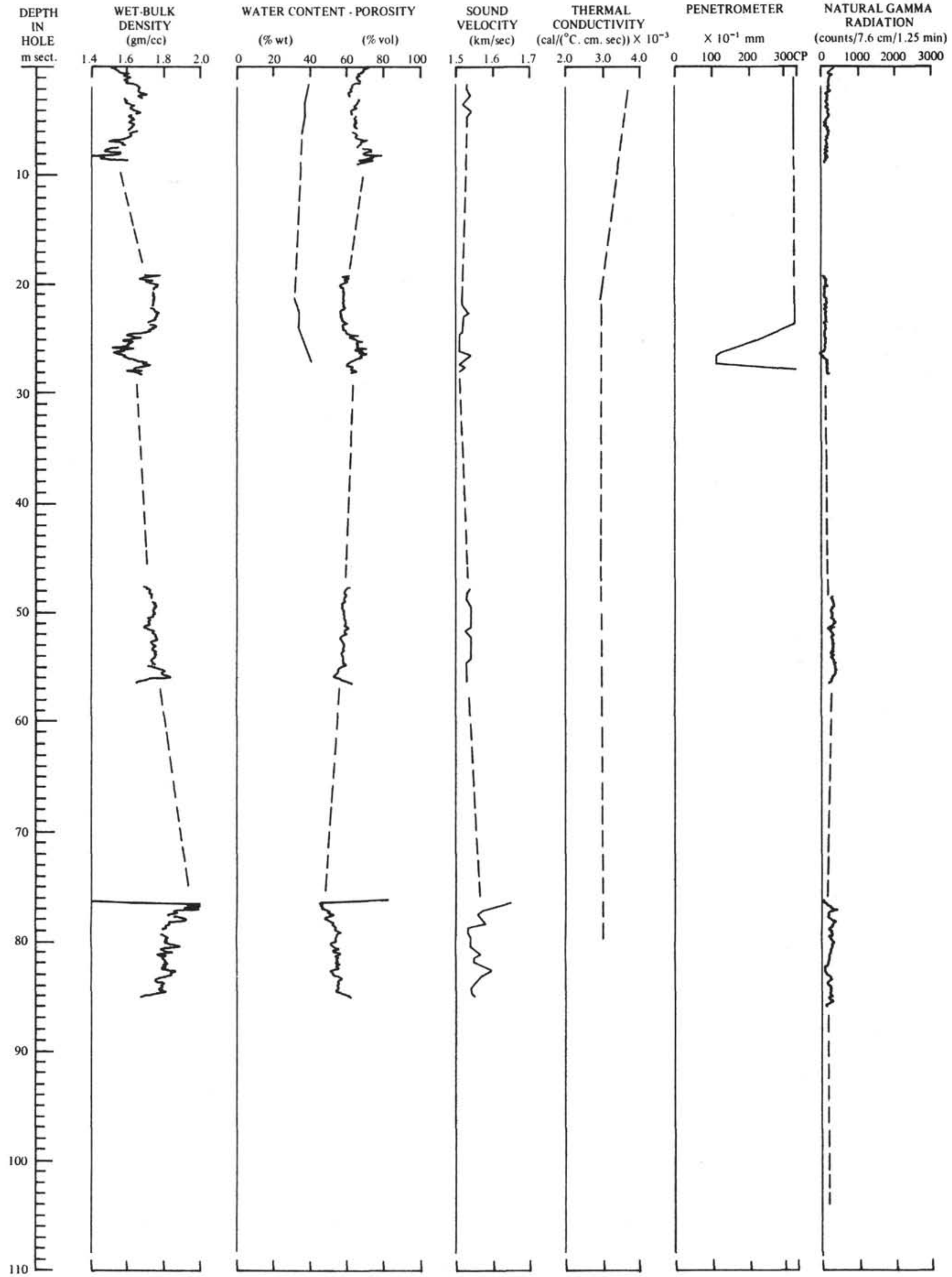
See consolidated list at the end of Chapter 13.

THE CORES RECOVERED FROM SITE 17

The following pages present a graphic summary of the results of drilling and coring at Site 17.

The first illustrations show a summary of the physical properties of the cores, the positions of the cores and cored intervals and some notes on the lithology and ages of the cores recovered from the holes.

Following this summary are more detailed displays of the individual cores recovered from Site 17. These two-page displays show the physical properties of the cores, the age assignments made on the basis of paleontology, a graphic representation of the lithology of the cores, some notes on the lithology, and notes regarding the diagnostic fossil species present. Symbols have been used for graphic display of lithology to give a general impression only, rather than a detailed representation, and these are supplemented by the lithology notes. For this reason, a detailed kay has not been prepared. Interspersed among the core descriptions are photographs of the cores, where photographs are available. In general, every attempt has been made to locate photographs of the cores adjacent to, or as close as practicable to, the relevant Core Summaries. Where sections of core are of special interest, detailed Section Summaries are inserted.

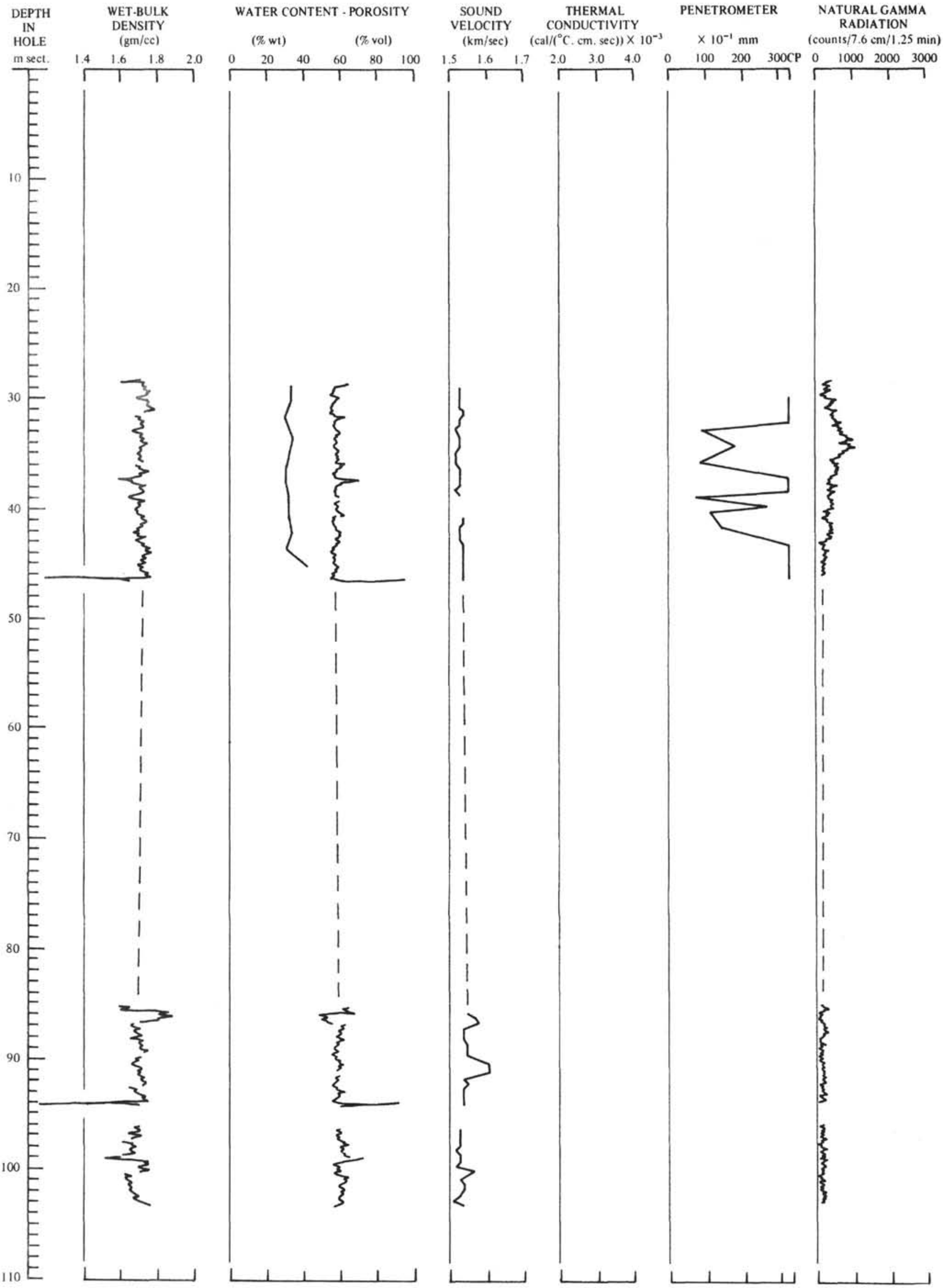


*"0" = laboratory atmospheric background count of 1550.

Figure 4A. *Summary of the Physical Properties of the cores recovered from Hole 17.*

DEPTH	CR.	CI.	FORMATION	LITHOLOGY	AGE
0	1		Albatross Ooze 3-17/1/1	Very pale brown to white foraminiferal nannofossil chalk oozes, 10-25% Foraminifera.	PLEISTOCENE
	2		Blake Ooze 3-17/2/1 with 3-17/2/5 diatomaceous subunit	White nannofossil chalk oozes, with 1.5 m. thick subunit of 6 interbeds of diatomaeous nannofossil oozes.	LOWER PLIOCENE Zanclian
				- DISCONFORMITY -	
			Endeavor Ooze 3-17A/1/1	Not cored in this hole.	LOWER MIOCENE Burdigalian
50	3		Fram Ooze 3-17A/2/4	Core not split.	LOWER MIOCENE Aquitanian
	4		with *Braarudosphaera* Marker 3-17B/4/2	White chalk chips in 17/4/1. Core split only in part.	UPPER OLIGOCENE Chattian Bormidian
			? ? ?		
	5		Basement	Basalt	
100					

Figure 4B. *Summary of the Cores from Hole 17. (Depth in meters below sea bed; C.R. = core recovered; C.I. = cored interval.)*

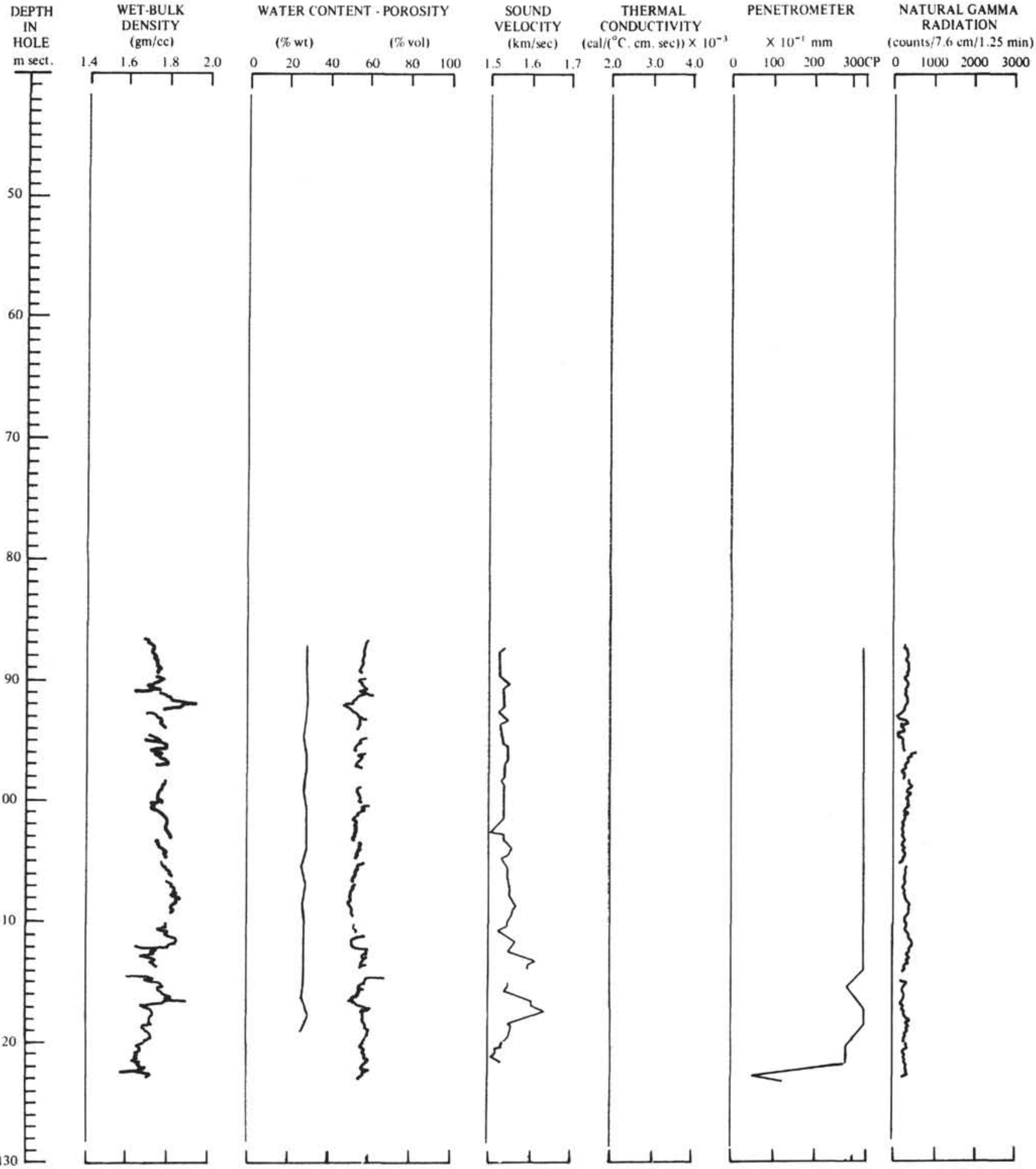


*"0" = laboratory atmospheric background count of 1550.

Figure 5A. *Summary of the Physical Properties of the core recovered from Hole 17A.*

DEPTH	CR.	CI.	FORMATION	LITHOLOGY	AGE
0			Albatross Ooze 3-17/1/1	Not cored in this hole.	PLEISTOCENE
			Blake Ooze 3-17/2/1	Not cored in this hole.	LOWER PLIOCENE Zanclian
				DISCONFORMITY	
1			Endeavor Ooze 3-17A/1/1	Light yellow to dark brown nannofossil chalk and marl oozes, zeolitic, hematitic.	LOWER MIOCENE Burdigalian
2					LOWER MIOCENE Aquitanian
50			Fram Ooze 3-17A/2/4	Very pale to light yellow brown nannofossil chalk oozes, very uniform.	
3			with *Braarudosphaera* Marker 3-17B/4/2	Core split only in part. White friable chalk chips in 17A/4/1.	UPPER OLIGOCENE Chattian Bormidian
4					
100			? ? ?	Core not split.	
			Basement	Basalt	

Figure 5B. *Summary of the Cores from Hole 17A.(Depth in meters below sea bed; C. R. = core recovered; C. I. = cored interval.)*



*"0" = laboratory atmospheric background count of 1550.

Figure 6A. *Summary of the Physical Properties of the cores recovered from Hole 17B.*

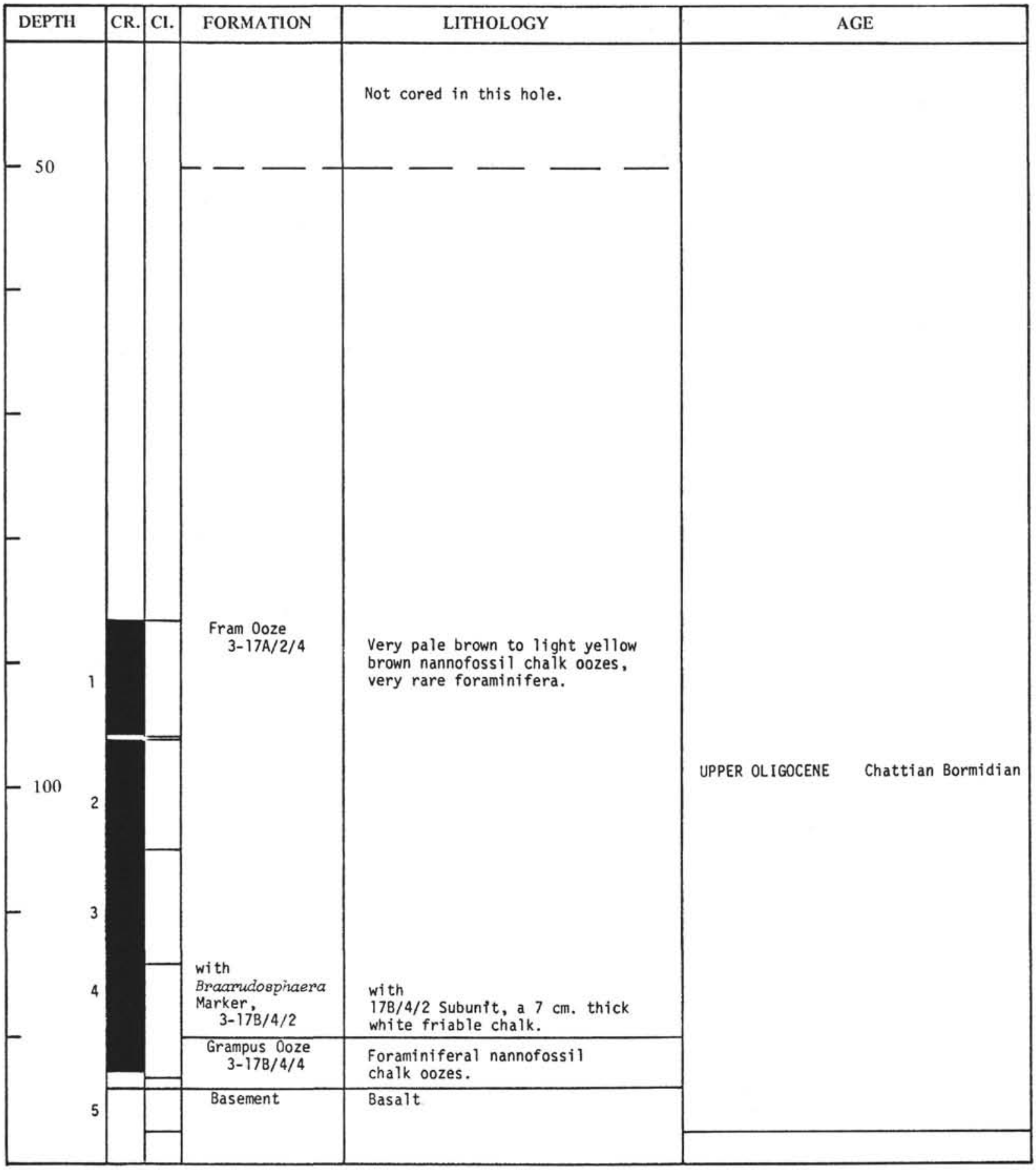
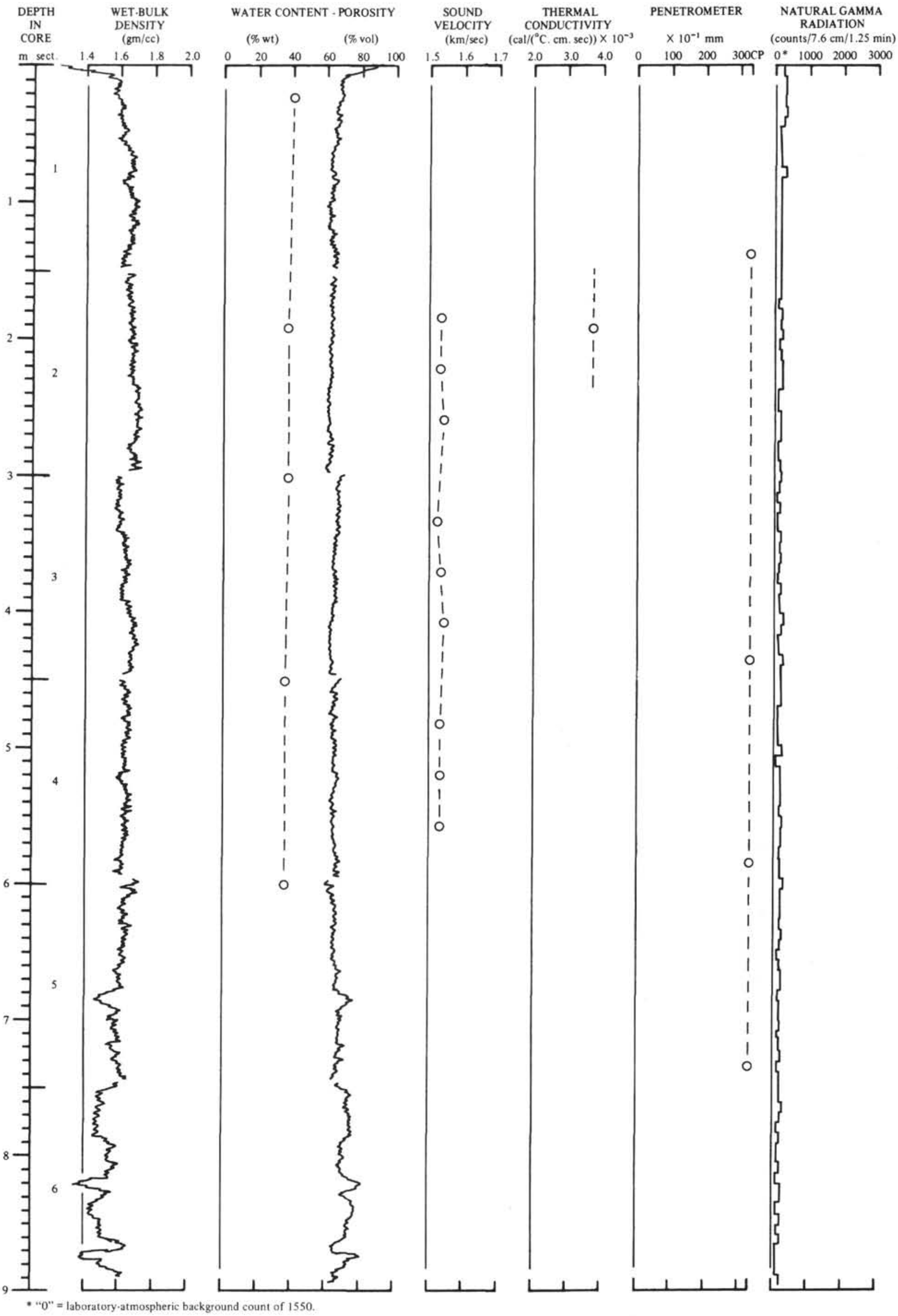


Figure 6B. *Summary of the Cores from Hole 17B. (Depth in meters below sea bed; C.R. = core recovered;*



* "0" = laboratory-atmospheric background count of 1550.

Figure 7A. *Physical properties of Core 1, Hole 17.*

AGE	STAGE	DEPTH (METERS)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
PLEISTOCENE		0–1	1		FN	(Core disturbed, Soupy)	Planktonic foraminifera: *Pulleniatina obliquiloculata* (R), *P. finalis* (R), *Globorotalia inflata*, *G. truncatulinoides*, *G. crassaformis*, *G. scitula* (R), *Globigerina digitata*, *Globigerinoides ruber*, *G. sacculifer*, *Sphaeroidinella dehiscens*. Calcareous nannoplankton: *Helicopontosphaera kamptneri*, *Ceratolithus cristatus*, *Gephyrocapsa oceanica*, *Cyclococcolithus leptoporus*, *Rhabdosphaera* sp.
		2	2				
		3–4	3			ALBATROSS OOZE	
		5	4			White to very pale brown (10YR8/1-8/3), foram-nannofossil chalk ooze. 10-20% forams	
		6–7	5		F, N		Flora and fauna similar to above.
		8	6		NOT OPENED		Core catcher: Flora similar to above. Planktonic foraminifera: *Globorotalia menardii* (L), *G. hirsuta*, *G. inflata*, *G. truncatulinoides*, *G. tumida*, *Globigerina digitata*, *Globigerinoides sacculifer*, *G. conglobatus*, *Candeina nitida*, *Sphaeroidinella dehiscens*.

Figure 7B. *Core 1, Hole 17.*

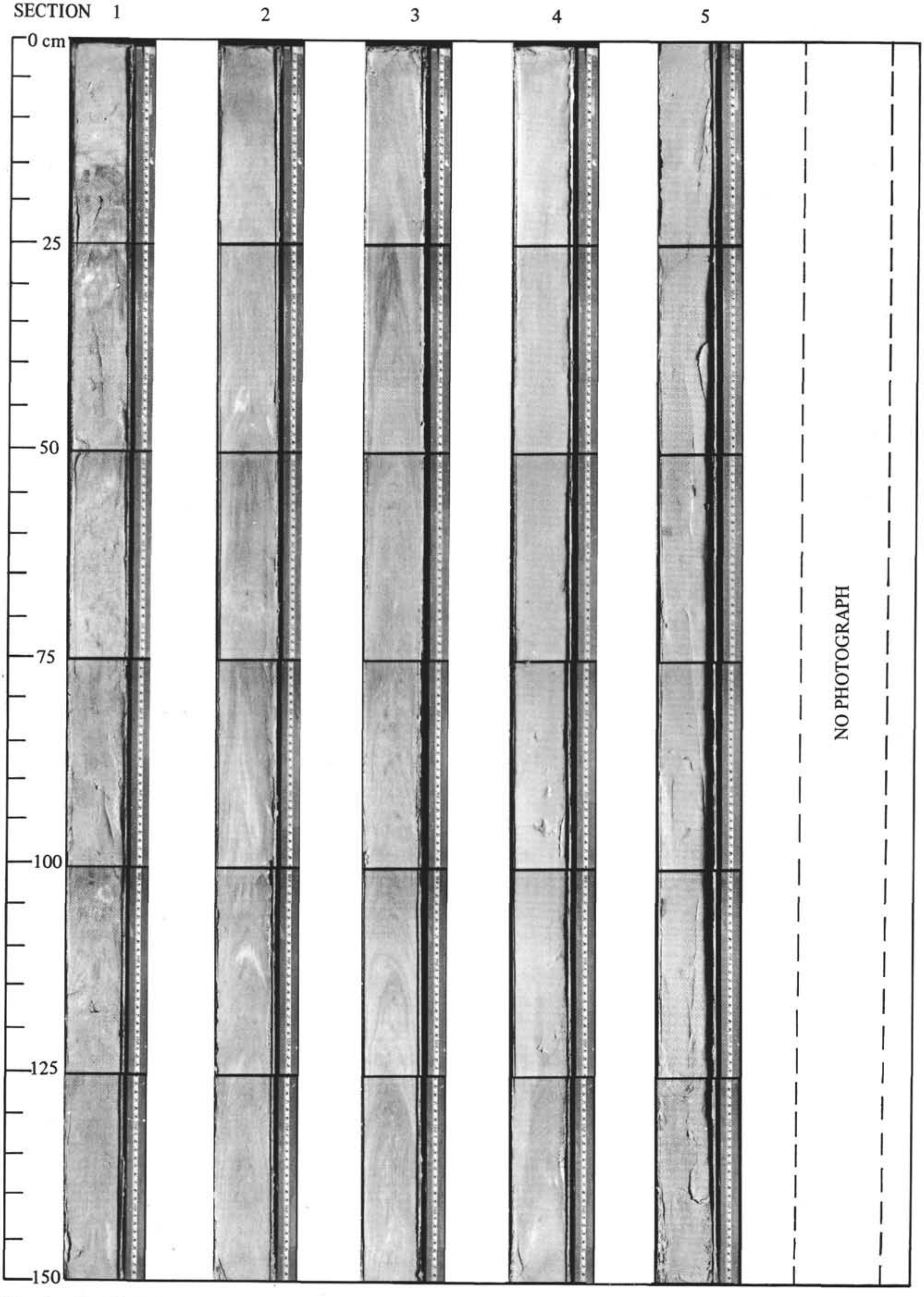


Plate 1. *Core 1, Hole 17.*

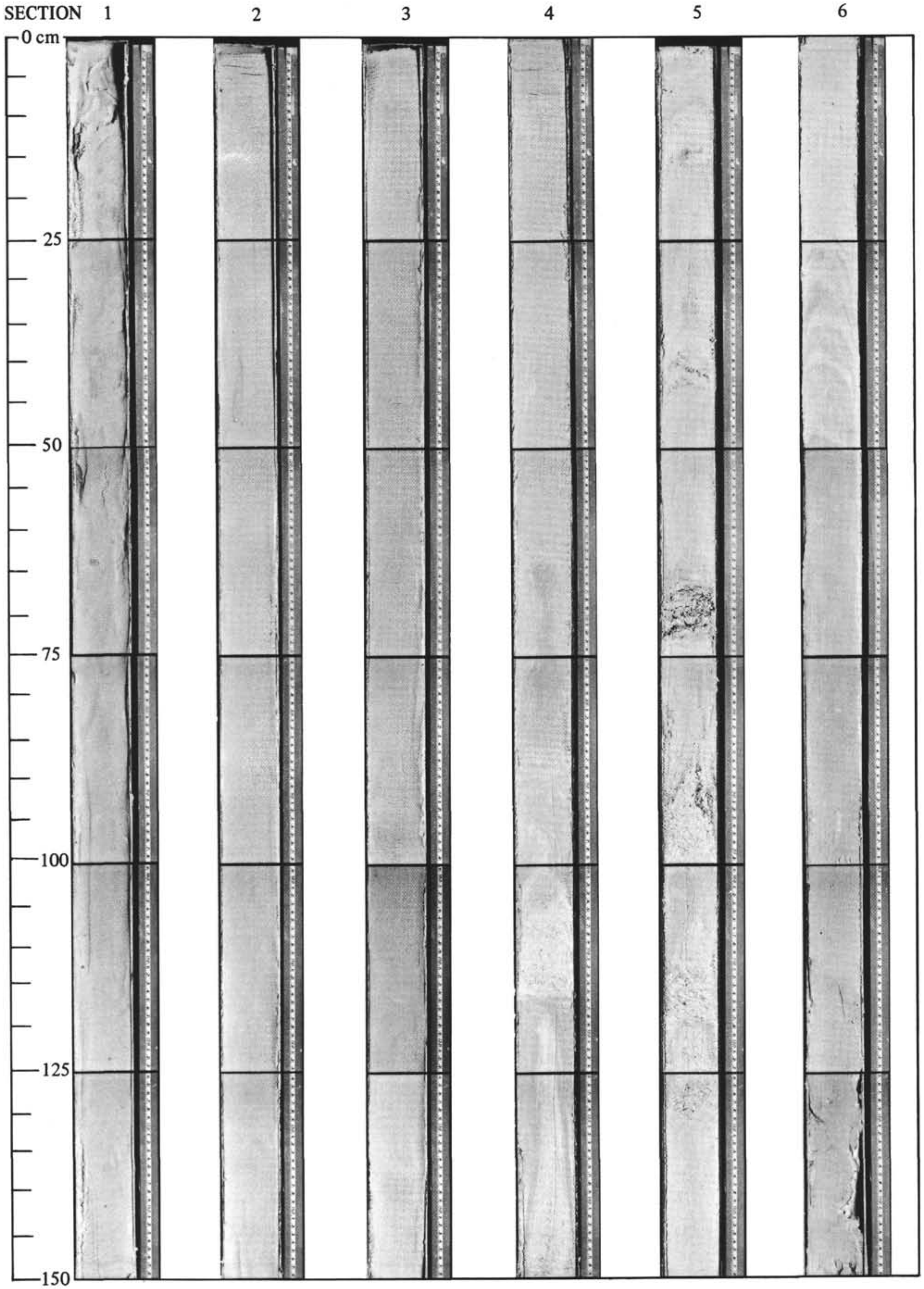
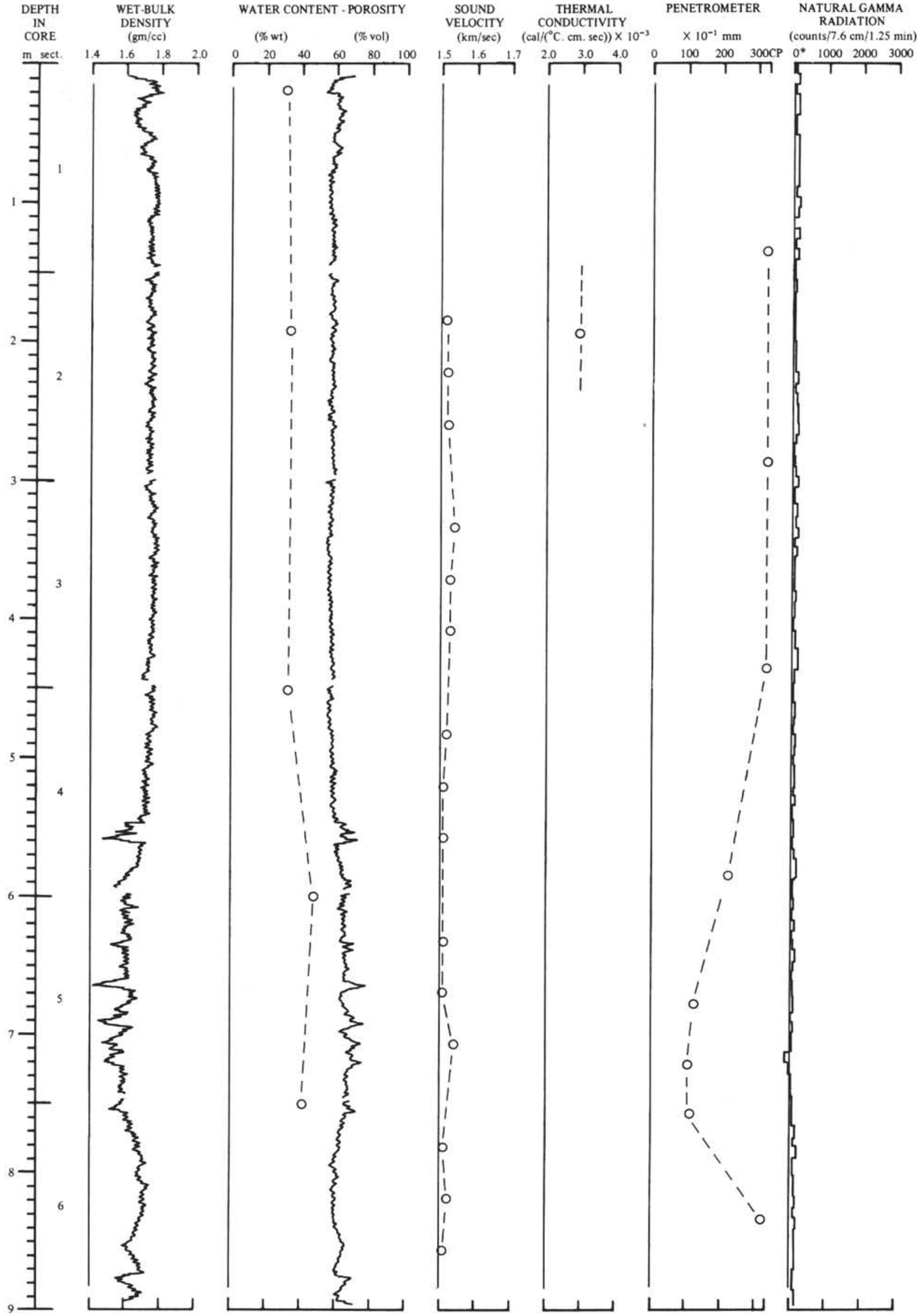


Plate 2. *Core 2, Hole 17.*



* "0" = laboratory-atmospheric background count of 1550.

Figure 8A. *Physical properties of Core 2, Hole 17.*

AGE	STAGE	DEPTH (METERS)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
LOWER PLIOCENE	ZANCLIAN	1	1		FN N	(Core disturbed)	For flora and fauna descriptions see Section Sheet.
		2	2		R N		Radiolaria: *Eucyrtidium elogatum peregrinum*, *Penartas tetrathalamus*, *Pterocanium* cf. *prismatium*, *P. trilobum*, *Lamprocyclas maritalis*. Calcareous nannoplankton: *Discoaster brouweri*, *D. pentaradiatus*, *D. surculus*, *Ceratolithus tricorniculatus*, *C. rugosus* (rare), *Reticulofenestra pseudoumbilica*, *Helicopontosphaera kamptneri*, *Cyclococcolithus leptoporus*, *Coccolithus pelagicus*.
		3 4	3		R FN	BLAKE OOZE White to very pale brown (10YR8/1-3) nannofossil chalk ooze. 1% forams.	Flora and fauna similar to above. Planktonic foraminifera: *Globoquadrina altispira*, *Globorotalia margaritae*, *G. crassaformis*, *G. conoidea*, *G. conomiozea*, *G. inflata*, *Globigerinoides obliquus*, *Candeina nitida*, *Sphaeroidinellopsis seminulina*.
		5	4		R N		Flora and faunas similar to above.
		6 7	5		R FN	See Section Summary Interlayers of dark gray (10YR4/1) diatom ooze: 40-50% diatom 50-60% nannofossil.	Flora and faunas similar to above.
		8	6		R FN		Flora and fauna similar to above. Planktonic foraminifera: Fauna similar to above. First appearance of *Globigerina nepenthes*. Core catcher: Flora and faunas similar to above.

Figure 8B. *Core 2, Hole 17.*

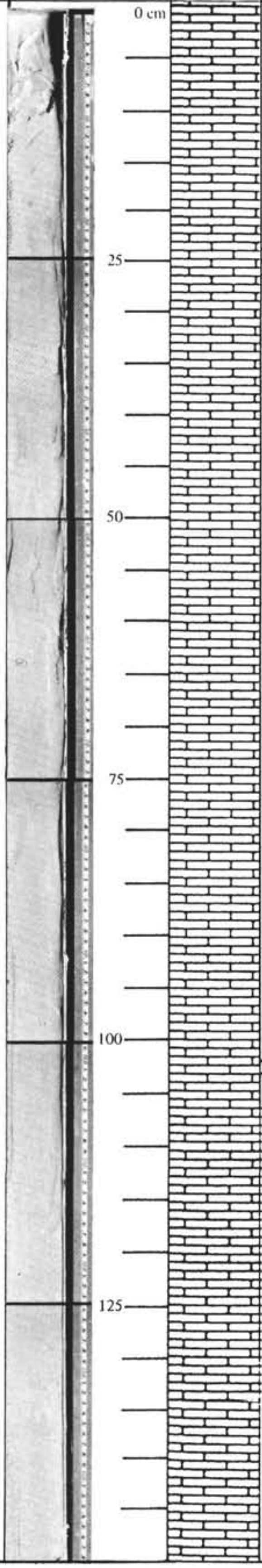
AGE	STAGE	LITHOLOGY	SAMP. INT.	LITHOLOGY	DIAGNOSTIC FOSSILS
LOWER PLIOCENE	ZANCLIAN		R FN N	Fm. BLAKE OOZE Nannofossil chalk ooze. 1% foram white to very pale brown (10YR8/1-8/3) Core highly disturbed, very soupy.	Radiolaria: *Eucyrtidium elongatum peregrinum, Penartus tetrathalmus, Pterocanium* cf. *prismatium, P. trilobum, Lamprocyclas maritalis.* Planktonic foraminifera: *Globorotalia margaritae, G. multicamerata* (R), *G. crassaformis, G. conomiozea, G. conoidea, G. inflata, Globoquadrina altispira, Globigerinoides obliquus, Sphaeroidinellopsis seminulina.* Calcareous nannoplankton: *Discoaster brouweri, D. pentaradiatus, D. surculus, Ceratolithus tricorniculatus, C. rugosus* (Rare), *Reticulofenestra pseudoumbilica, Sphenolithus abies, Helicopontosphaera kamptneri, Cyclococcolithus leptoporus.*

Figure 9. *Summary of Section 1, Core 2, Hole 17.*

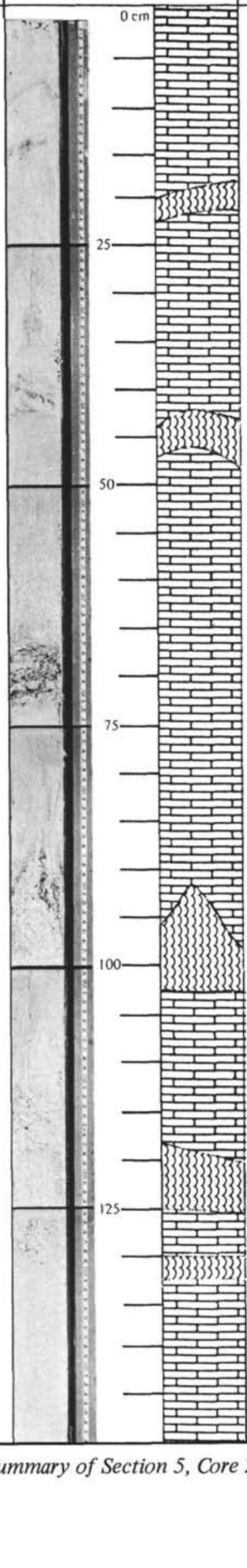
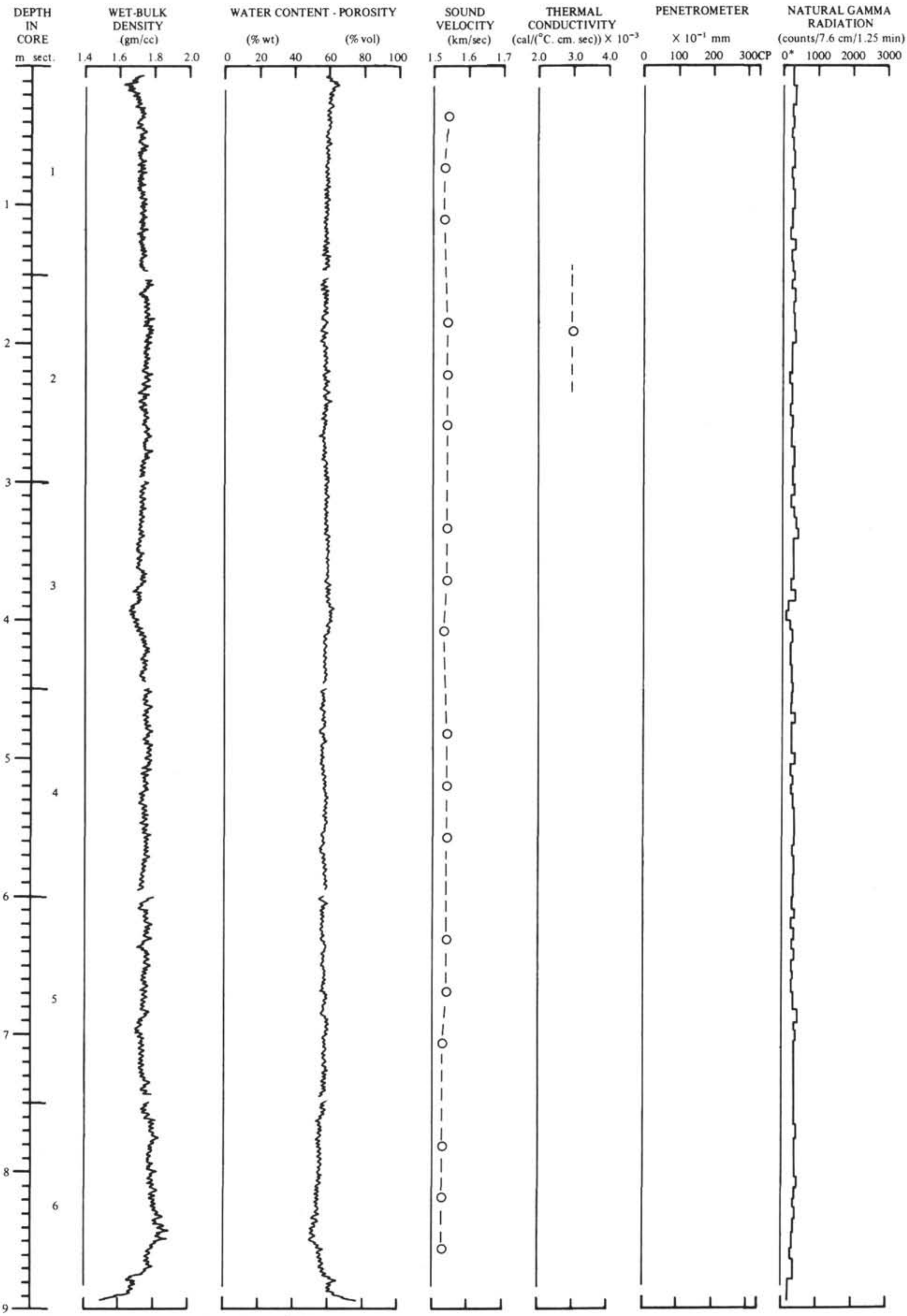
AGE	STAGE	LITHOLOGY	SAMP. INT	LITHOLOGY	DIAGNOSTIC FOSSILS
LOWER PLIOCENE	ZANCLIAN			Fm. BLAKE OOZE Nannofossil chalk ooze (white, 10YR8/1) interbedded with dark gray diatom ooze (10YR4/1) 40-50% diatoms 50-60% nannofossil Core slightly disturbed.	Flora and faunas: See core summary sheet.

Figure 10. *Summary of Section 5, Core 2, Hole 17.*

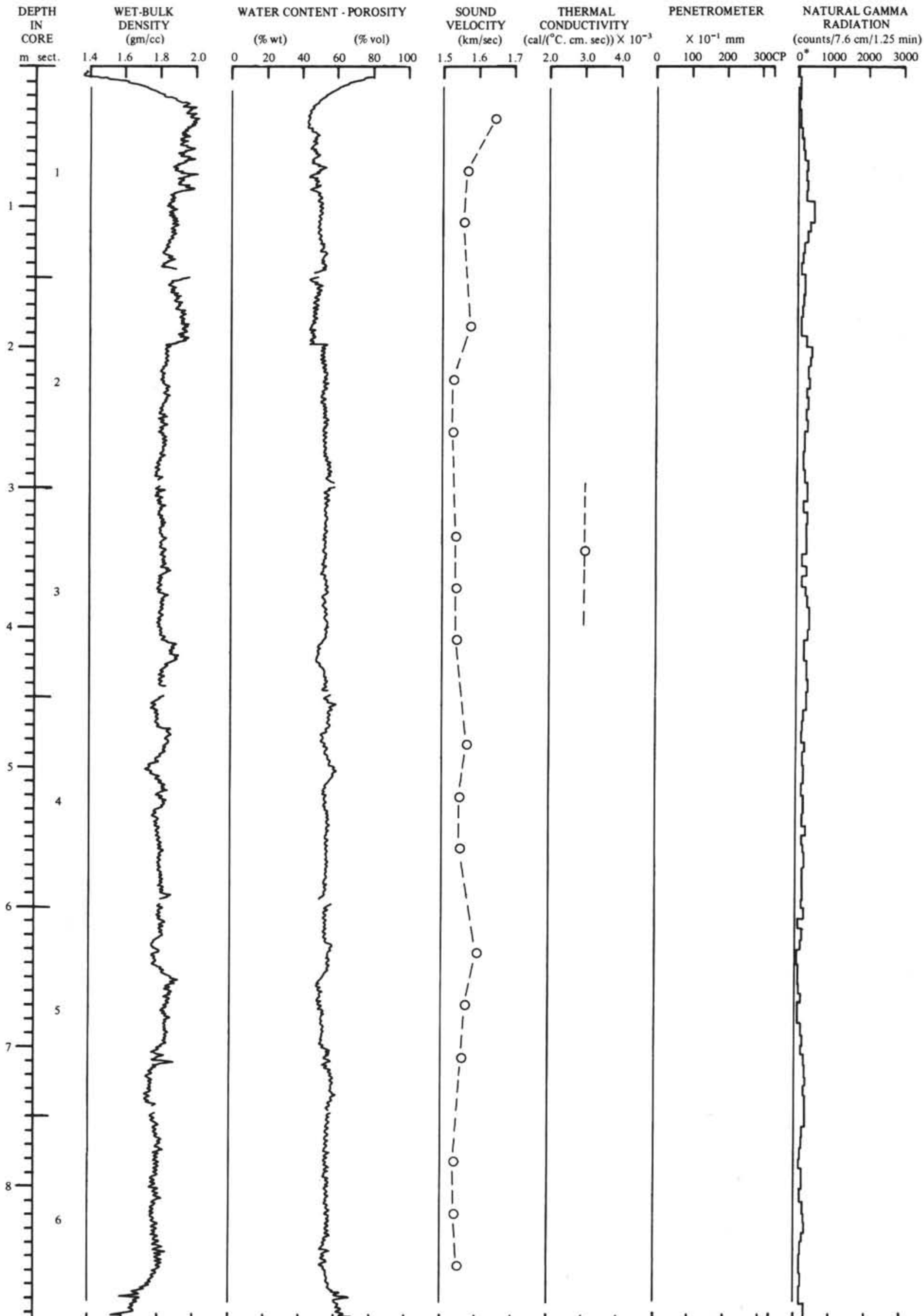


* "0" = laboratory-atmospheric background count of 1550.

Figure 11A. *Physical properties of Core 3, Hole 17.*

AGE (STAGE)	ZONE	DEPTH (METERS)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
LOWER MIOCENE (AQUITANIAN)	*Globorotalia kugleri*; *Triquetrorhabdulus carinatus*	1	1		FN; NOT OPENED		Planktonic foraminifera: *Globorotalia kugleri*, *G. peripheroronda*, *Globigerinita dissimilis*, *G. stainforthi*, *Globoquadrina rohri*, *G. praedehiscens*, *Globorotaloides suteri*. Calcareous nannoplankton: *Cyclococcolithus neogammation*, *Coccolithus* aff. *bisectus*, *C. pelagicus*, *C. eopelagicus*, *Discoaster deflandrei*.
		2	2		NOT OPENED		
		3, 4	3		NOT OPENED	FRAM OOZE Light yellow brown (10YR7/4) nannofossil chalk ooze. 1-8% zeolite and hematite Core not split- Stratigraphic duplicate of Hole 17A, Core 1 Sections 3 through 6 and Hole 17A, Core 2.	
?	? ?						
UPPER OLIGOCENE (CHATTIAN-BORMIDIAN)	*Globigerina ciperoensis*; *Sphenolithus ciperoensis*	5	4		NOT OPENED		
		6, 7	5		NOT OPENED		
		8	6		NOT OPENED		Core catcher: Planktonic foraminifera: *Globigerina ciperoensis*, *G. angulisuturalis*, *G. yeguaensis*, *Globorotalia opima opima* (rare), *G. siakensis*, *Globoquadrina rohri*, *G. tripartita*, *Globigerinita dissimilis*, *G. unicava*. Calcareous nannoplankton: *Coccolithus bisectus*, *C.* aff. *bisectus*, *C. pelagicus*, *C. eopelagicus*, *Sphenolithus ciperoensis*, *Helicopontosphaera truncata*.

Figure 11B. *Core 3, Hole 17.*



* "0" = laboratory-atmospheric background count of 1550.

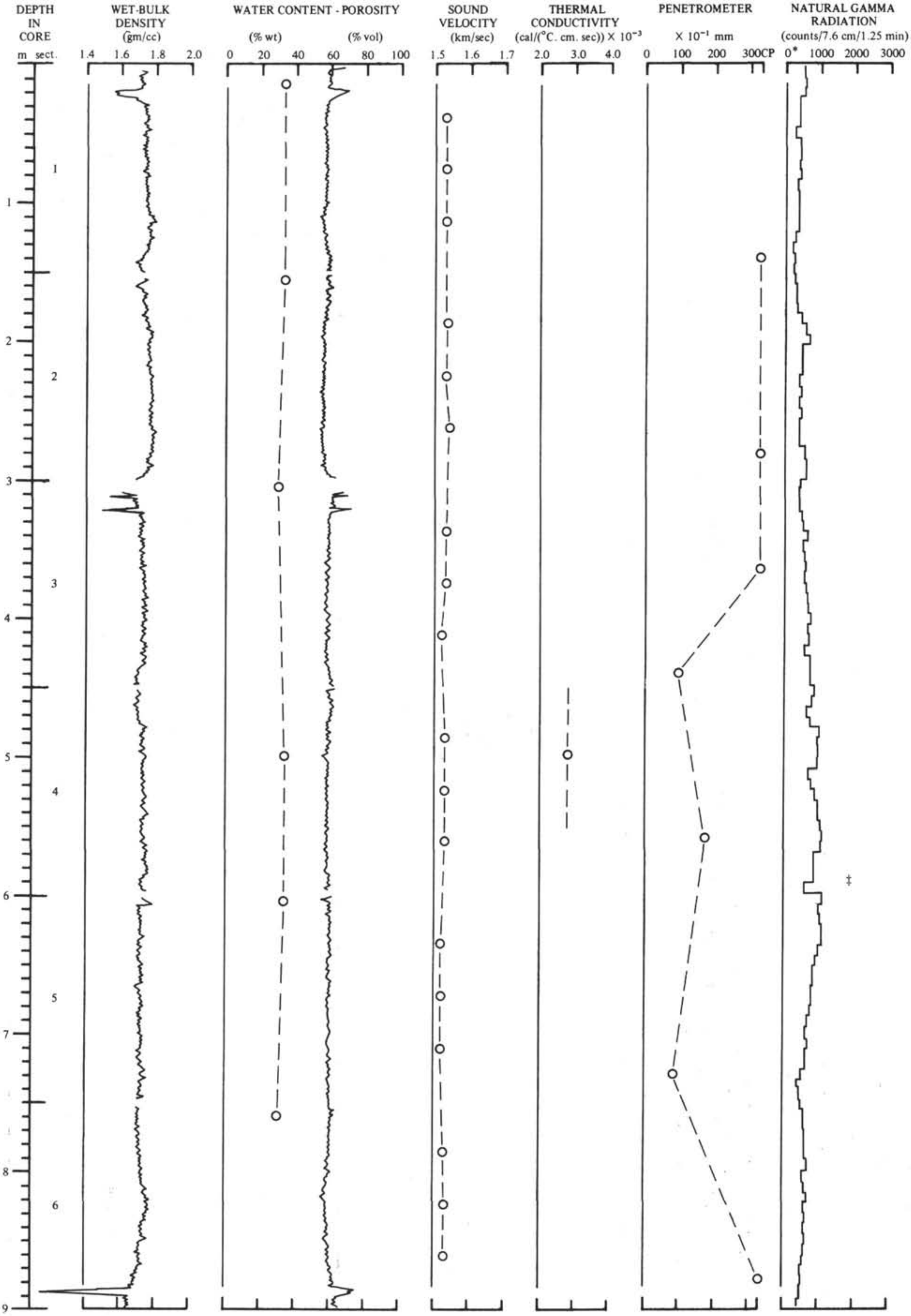
Figure 12A. *Physical properties of Core 4, Hole 17.*

AGE (STAGE)	ZONE	DEPTH (METERS)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
UPPER OLIGOCENE (CHATTIAN)	*Globigerina ampliapertura* / *Sphenolithus predistentus* **	0–1.5	1		FN; NOT OPENED	FRAM OOZE Light yellow brown nannofossil chalk ooze. Fragments of *Braarudosphaerid* chalk in section 1 (Maxwell Marker).	Planktonic foraminifera: *Chiloguembelina cubensis, Globorotalia opima nana, G. postcretacea, Globoquadrina praedehiscens.* Calcareous nannoplankton:* *Braarudosphaera rosa* (complete and floods of isolated fragments), *Coccolithus bisectus, C. pelagicus, C. eopelagicus, Cyclococcolithus negammation, Discoaster deflandrei.*
		1.5–3	2		NOT OPENED		
		3–4.5	3		NOT OPENED		
		4.5–6	4		NOT OPENED		
		6–7.5	5		NOT OPENED		
		7.5–9	6		NOT OPENED		Core catcher: Planktonic foraminifera: *Chiloguembelina cubensis; Globorotalia clemenciae, G. opima nana, G. postcretacea, Globorotaloides suteri, Globigerina yeguaensis, Globoquadrina tripartita, G. venezuelana, Globigerinita dissimilis, G. unicava.* Calcareous nannoplankton: *Cyclococcolithus neogammation, Coccolithus bisectus, C. eopelagicus, C. pelagicus, Sphenolithus distentus, S. predistentus, Discoaster tani* (s.l.).

* This sample is a sample of *Braarudosphaera* Chalk.

**The *Sphenolithus distentus* zone may also be present in this core.

Figure 12B. *Core 4, Hole 17.*



* "0" = laboratory-atmospheric background count of 1550.

‡ Radiation counts at the ends of 1.5 m sections are low because the volume of sediment being scanned is reduced.

Figure 13A. *Core 1, Hole 17A.*

AGE (STAGE)	ZONE	DEPTH (METERS)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
LOWER MIOCENE (BURDIGALIAN)	*Globigerinatella insueta*/*Globigerinoides trilobus*; *Helicopontosphaera ampliaperta*	0–1.5	1		FN; N	(Core slightly disturbed)	Sample 16-18 cm: Planktonic foraminifera:* *Globigerina nepenthes, Globorotalia conomiozea, G. conoidea, G. crassaformis, G. crassaformis oceanica, Globigerinoides gomitulus, Sphaeroidinellopsis seminulina.* Calcareous nannoplankton:** *Cyclococcolithus neogammation, Sphenolithus heteromorphus, Coccolithus pelagicus, Discoaster deflandrei, D. challengeri.* Sample 100-102 cm: Flora similar to above.
		1.5–3	2		FN	ENDEAVOR OOZE Light yellow brown (10YR6/4), zeolitic nannofossil chalk ooze. Tr. hematite Tr. foram 1-8% zeolite	Flora similar to above. Planktonic foraminifera: *Globoquadrina dehiscens advena, G. dehiscens dehiscens, G. altispira, Globorotalia praemenardii, G. praescitula, G. miozea.*
		3–4.5	3		FN		Flora and fauna similar to above.
		4.5–6	4		FN	Dark yellow brown (10YR4.5/4). 1-8% zeolite 1-5% hematite and opaques	Flora similar to above. Planktonic foraminifera: *Globigerinoides sicanus, G. trilobus, Globorotalia praemenardii,* **Chiphragmalithus** *G. praescitula, Globoquadrina dehiscens dehiscens, G. dehiscens advena, Sphaeroidinellopsis seminulina.*
(AQUITANIAN)	*Globigerinita stainforthi*	6–7.5	5		F; FN		Sample 7-9cm: Planktonic foraminifera: *Globiquadrina dehiscens dehiscens, G. dehiscens advena, Globigerinoides trilobus, G. subquadratus, Globigerina woodi, G. praebulloides, Globorotalia opima continuosa.* Sample 100-102 cm: Flora similar to above. Planktonic foraminifera: *Globigerinita dissimilis, G. stainforthi, Sphaeroidinellopsis seminulina, Globigerinoides subquadratus, G. trilobus.*
		7.5–9	6		FN		Flora and fauna similar to above. Core catcher: Flora similar to above. Planktonic foraminifera: ** *Globigerinoides sicanus, Globorotalia miozea, G. zealandica, Sphaeroidinellopsis seminulina, Globigerina druryi.*

* This sample consists of younger Neogene planktonic foraminifera contaminants from uphole.

** This sample contains younger Neogene floral contaminants from uphole.

Figure 13B. *Core 1, Hole 17A.*

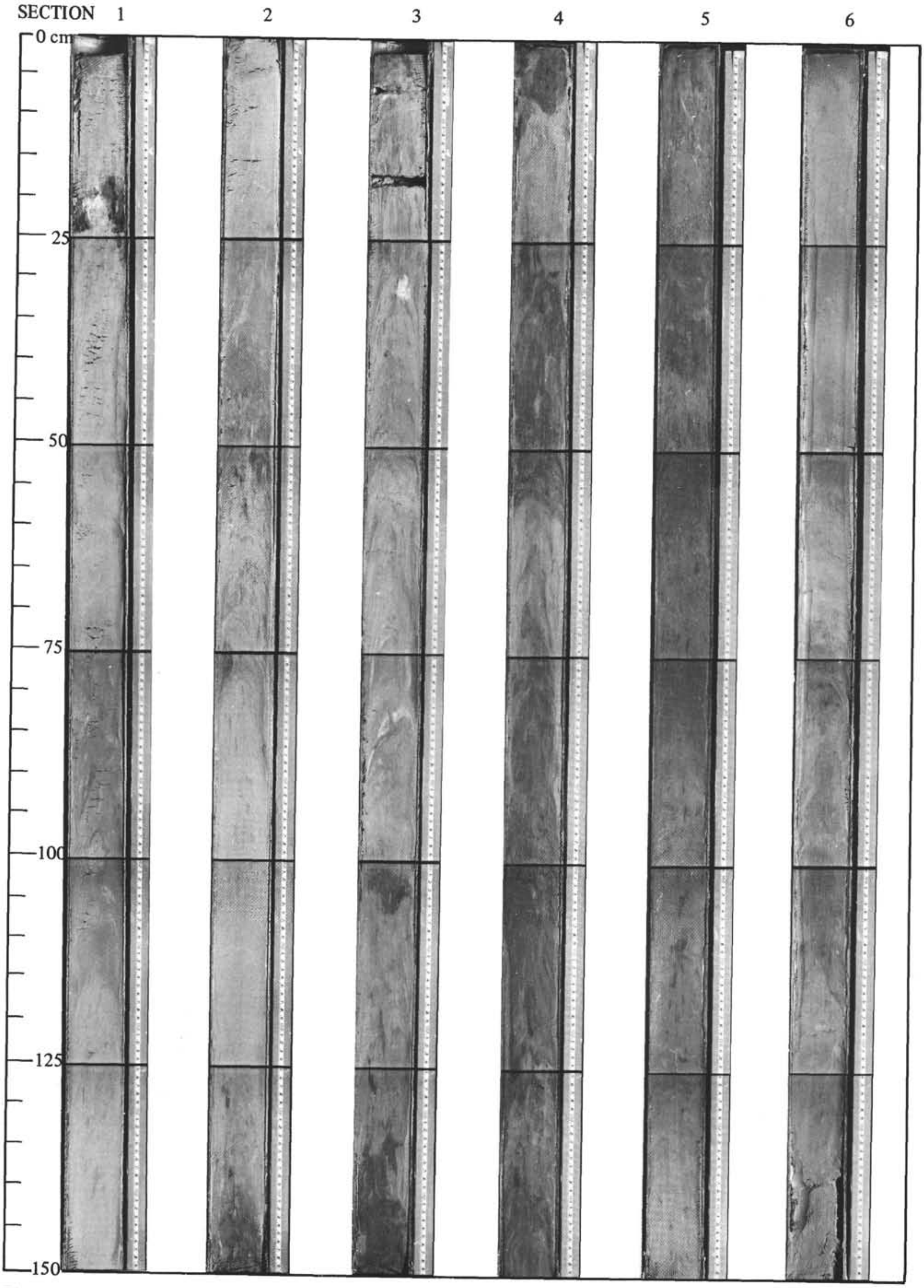


Plate 3. *Core 1, Hole 17A.*

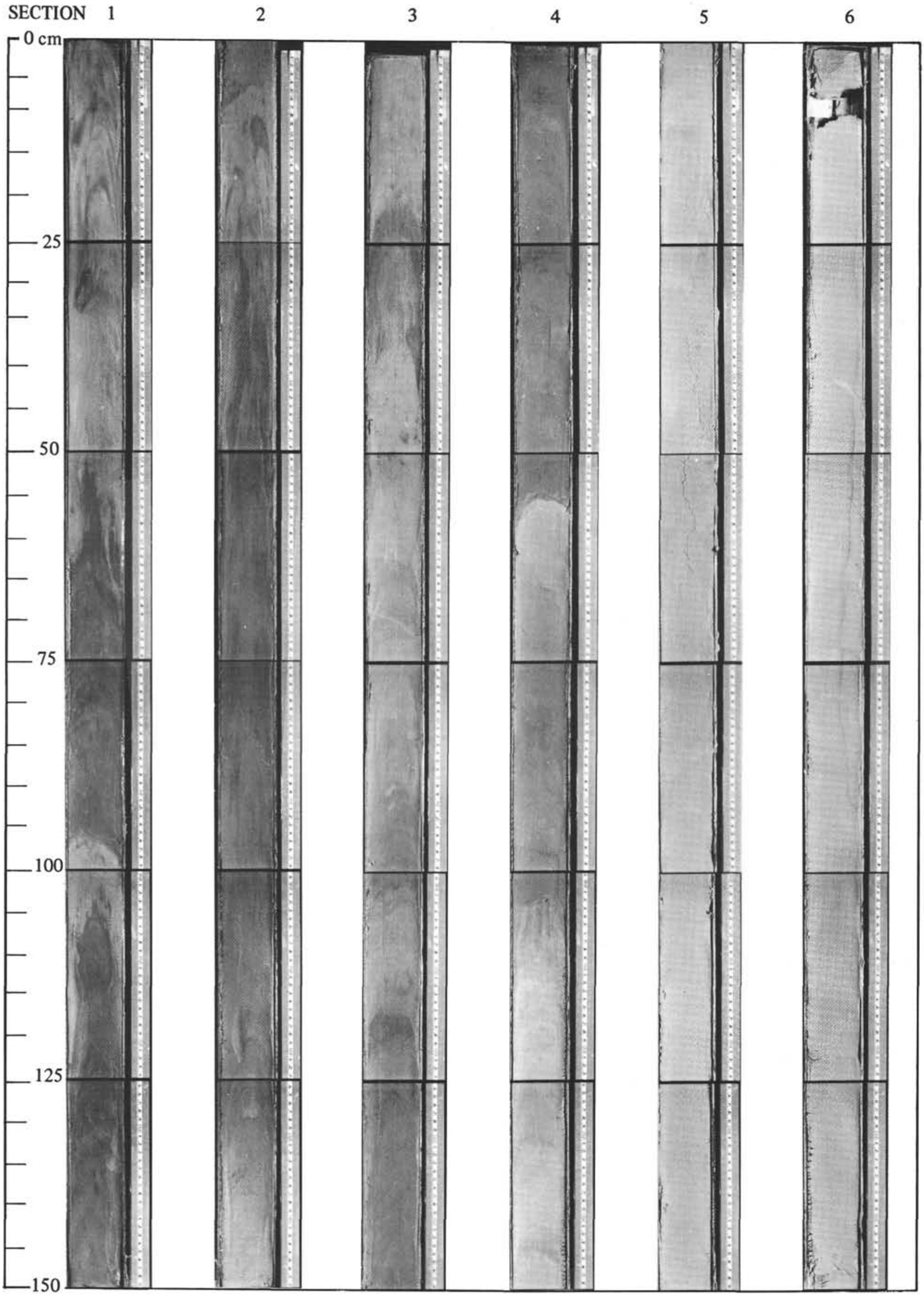
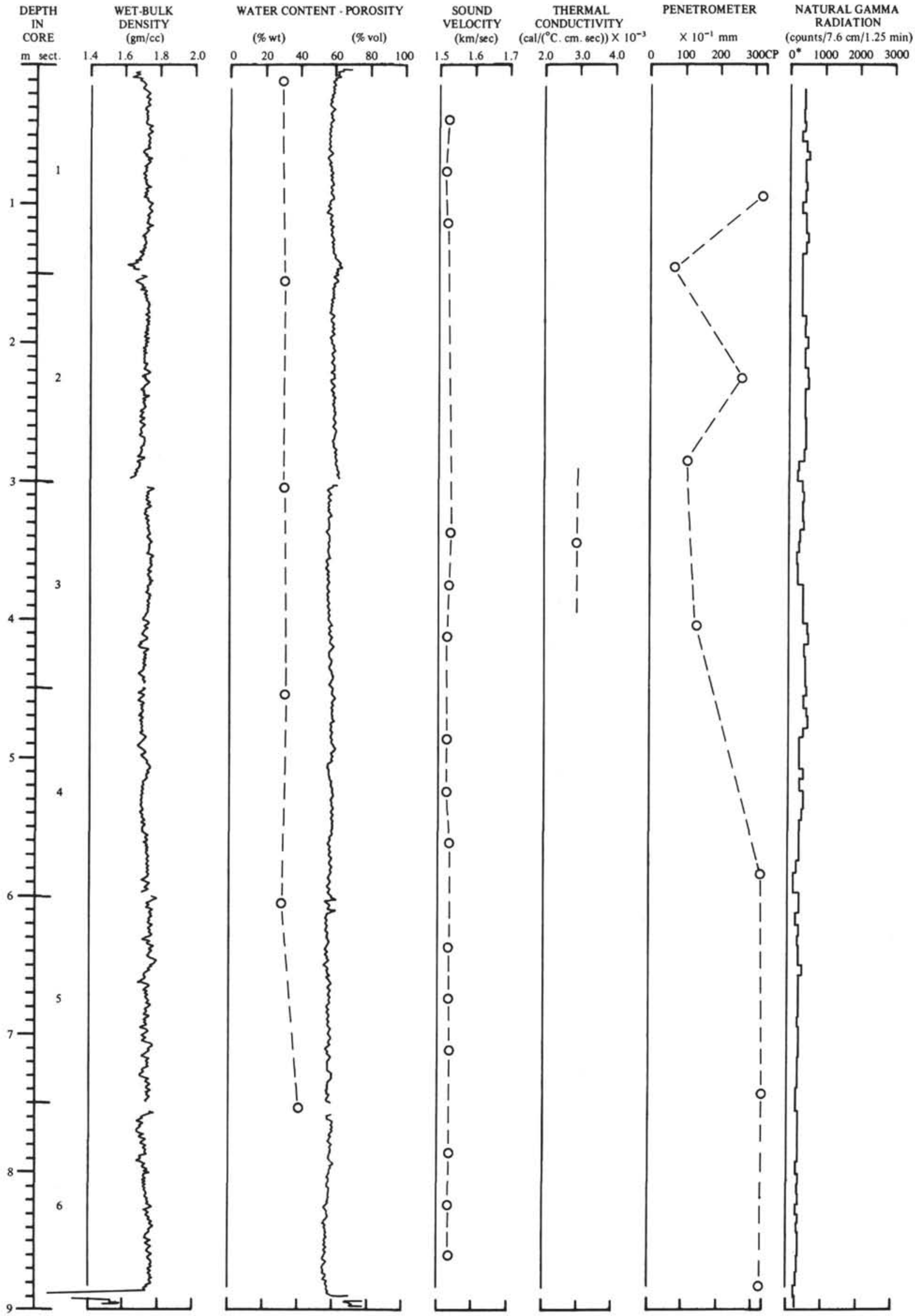


Plate 4. *Core 2, Hole 17A.*



* "0" = laboratory-atmospheric background count of 1550.

Figure 14A. *Physical properties of Core 2, Hole 17A.*

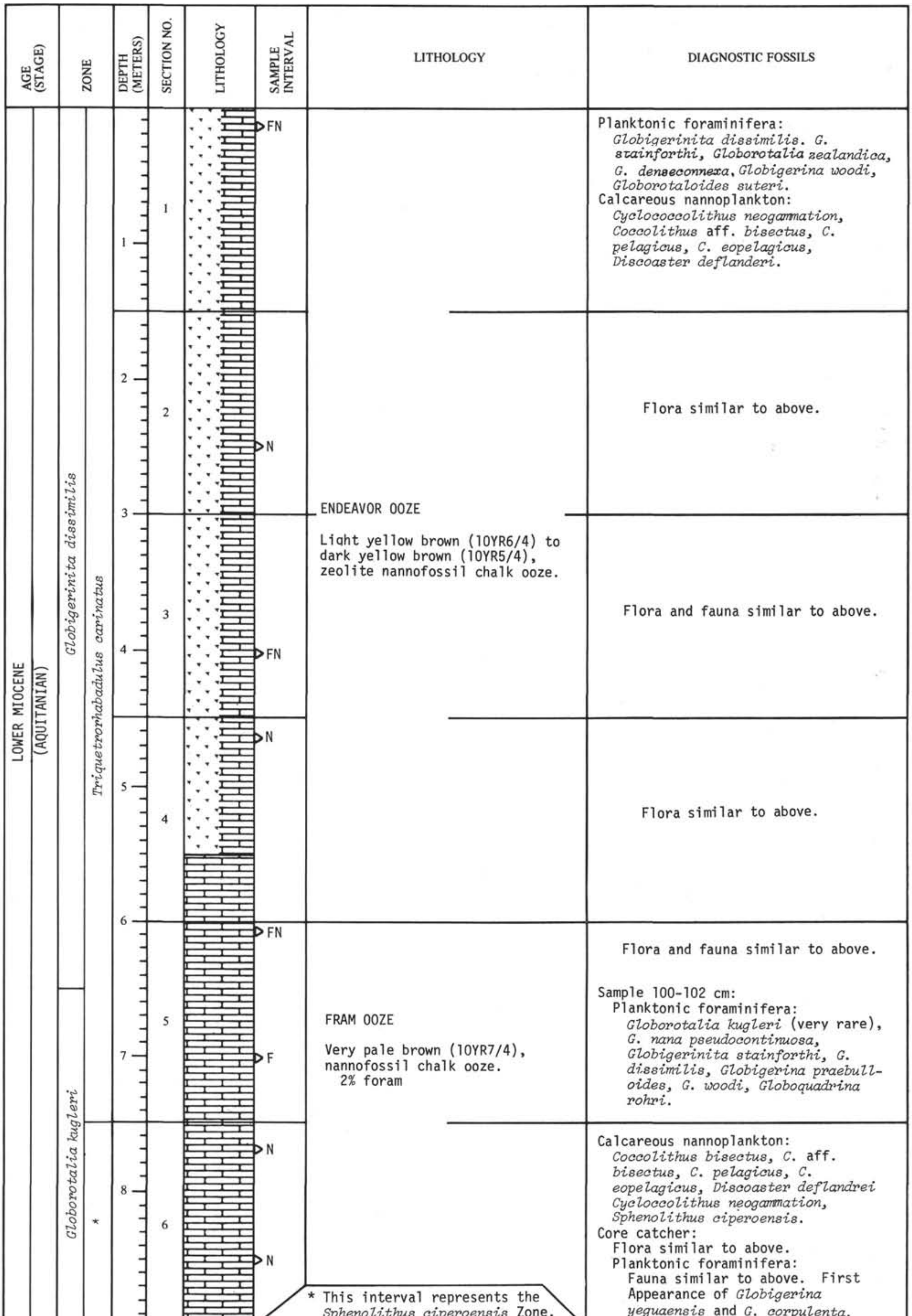
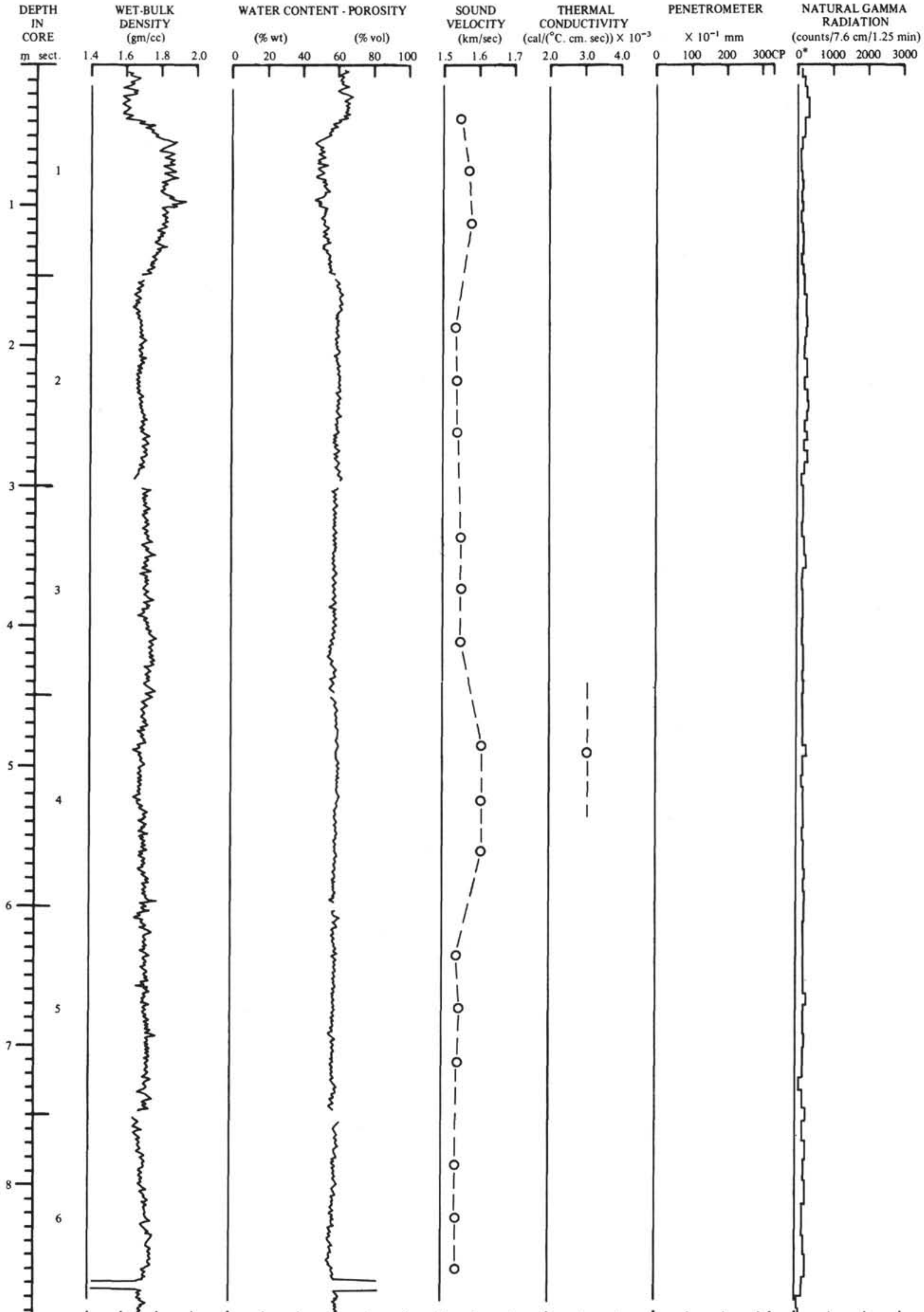


Figure 14B. *Core 2, Hole 17A.*



* "0" = laboratory-atmospheric background count of 1550.

Figure 15A. *Physical properties of Core 3, Hole 17A.*

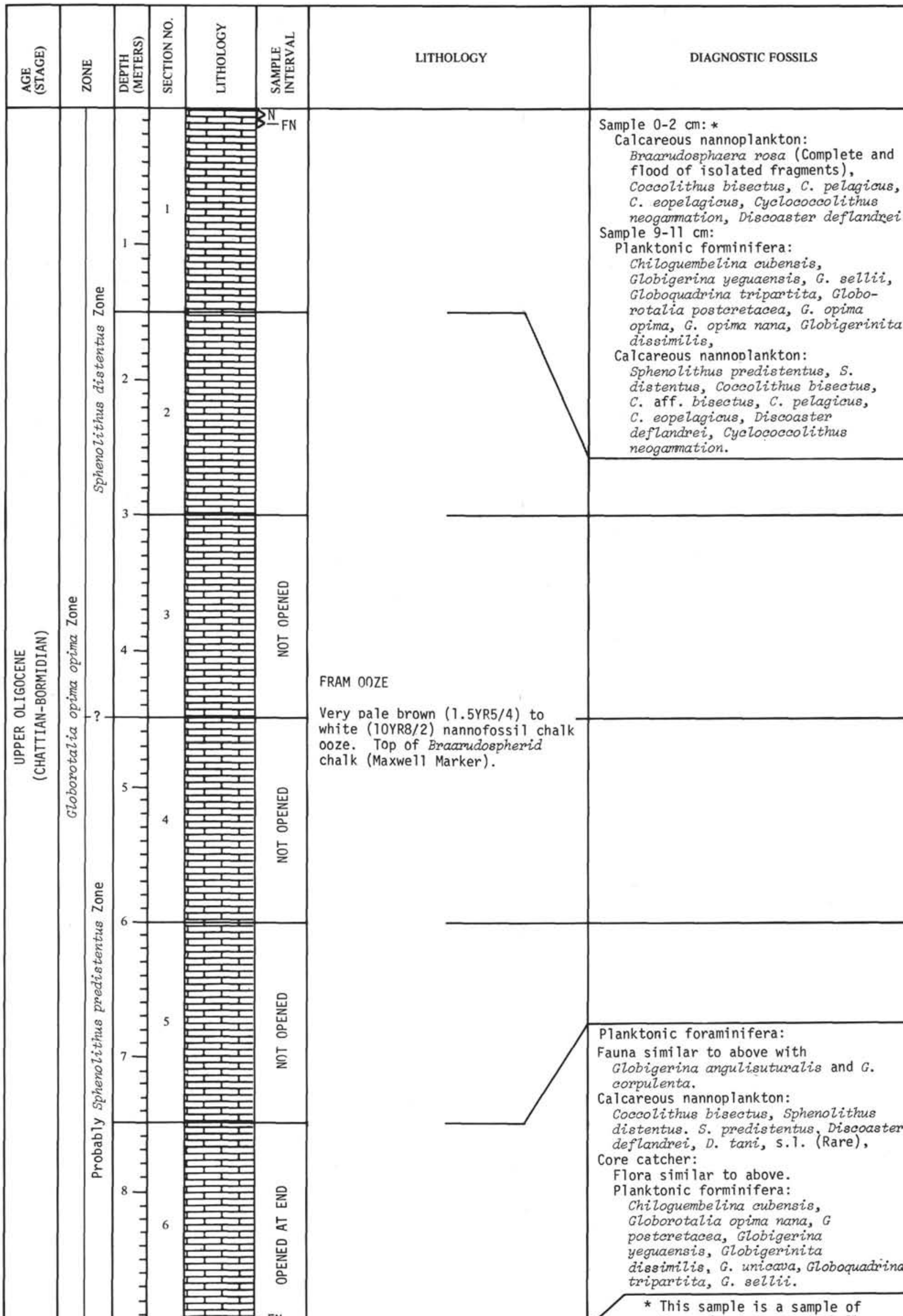


Figure 15B. *Core 3, Hole 17A.*

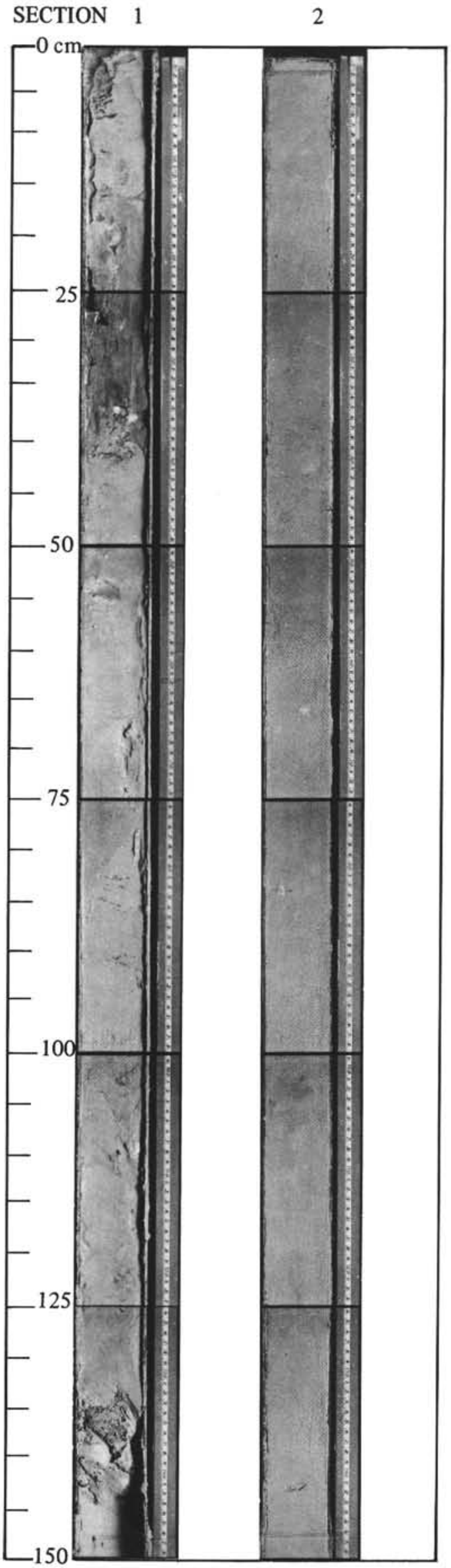


Plate 5. *Core 3, Hole 17A.*

SECTION 6

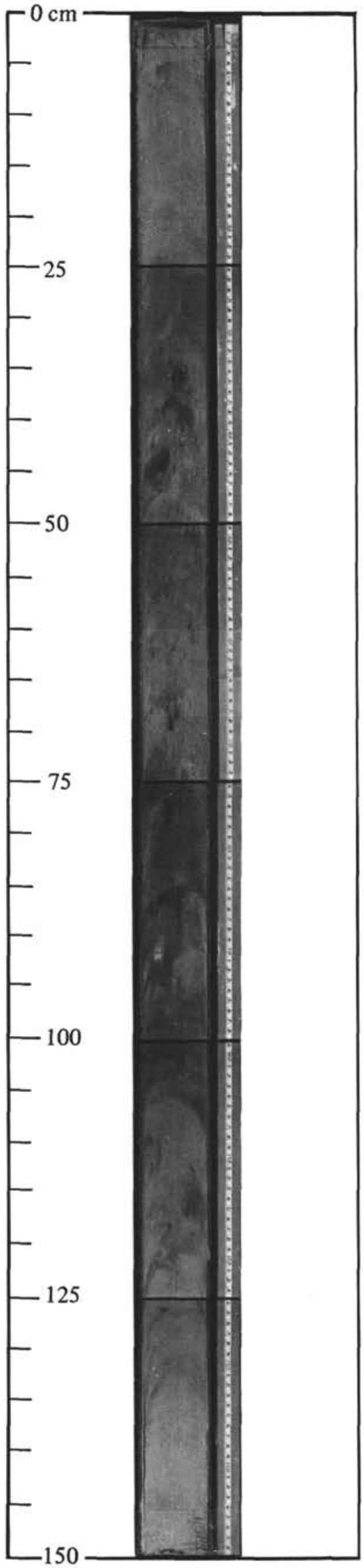
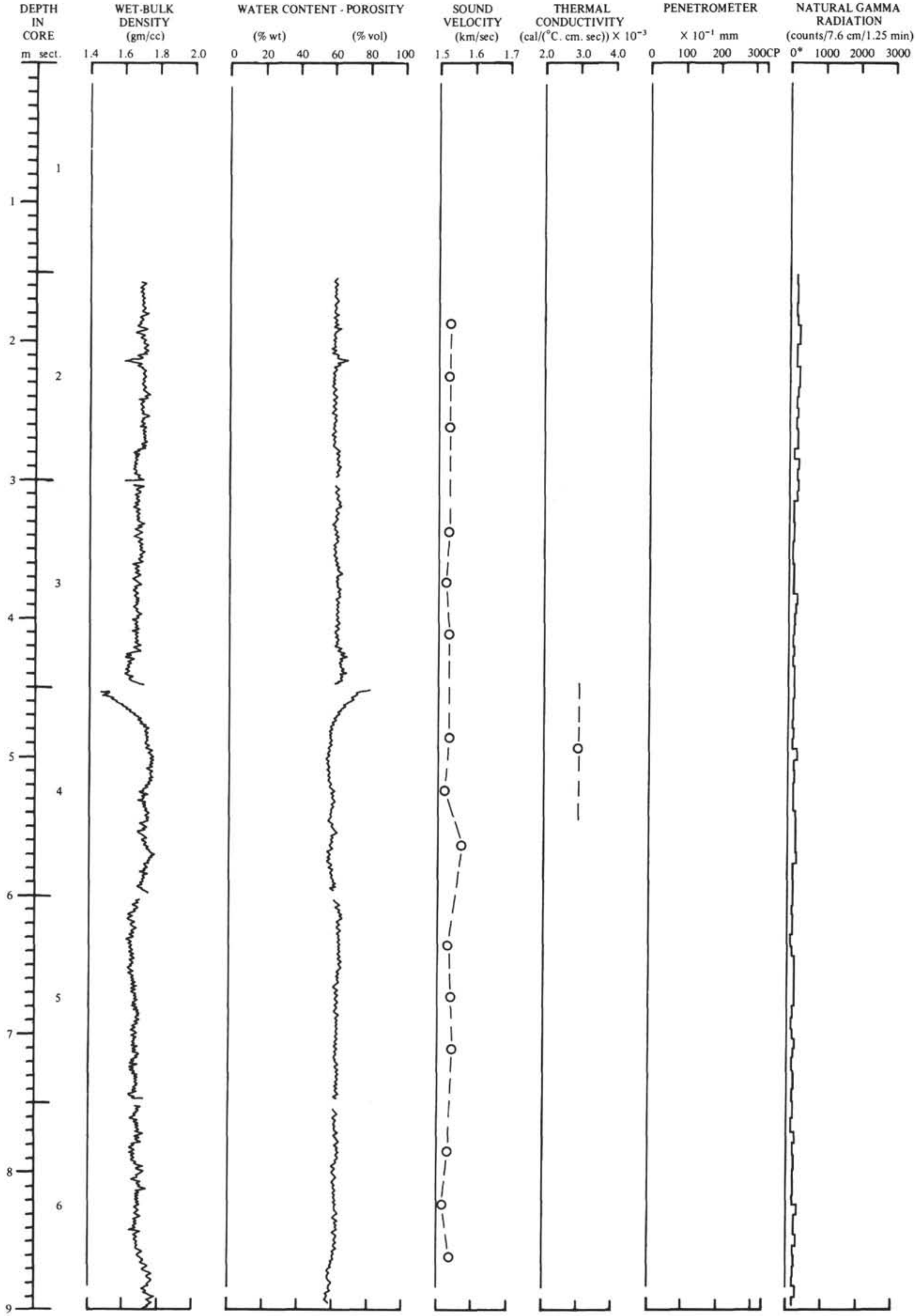


Plate 6. *Core 4, Hole 17A.*



* "0" = laboratory-atmospheric background count of 1550.

Figure 16A. *Physical properties of Core 4, Hole 17A.*

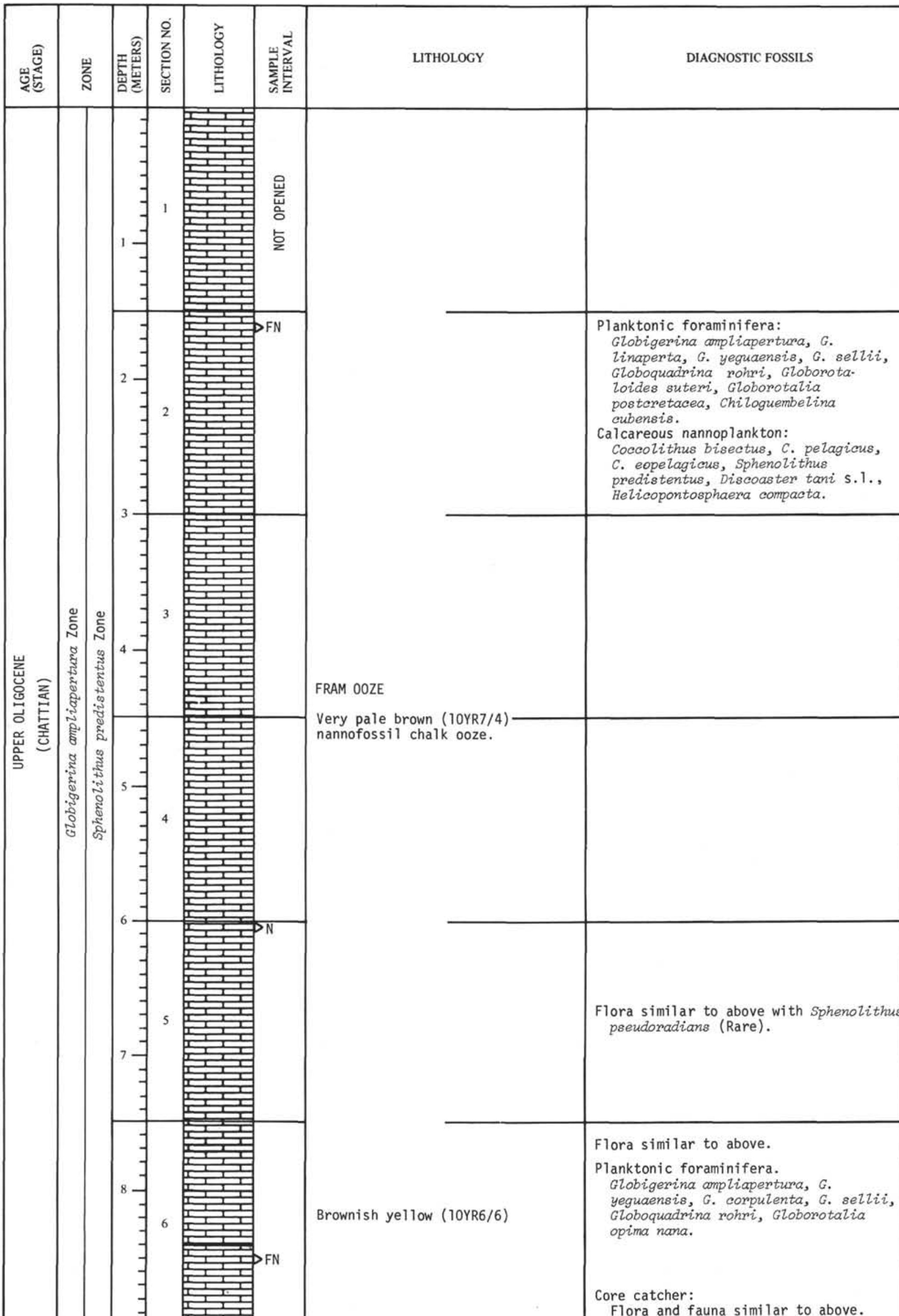
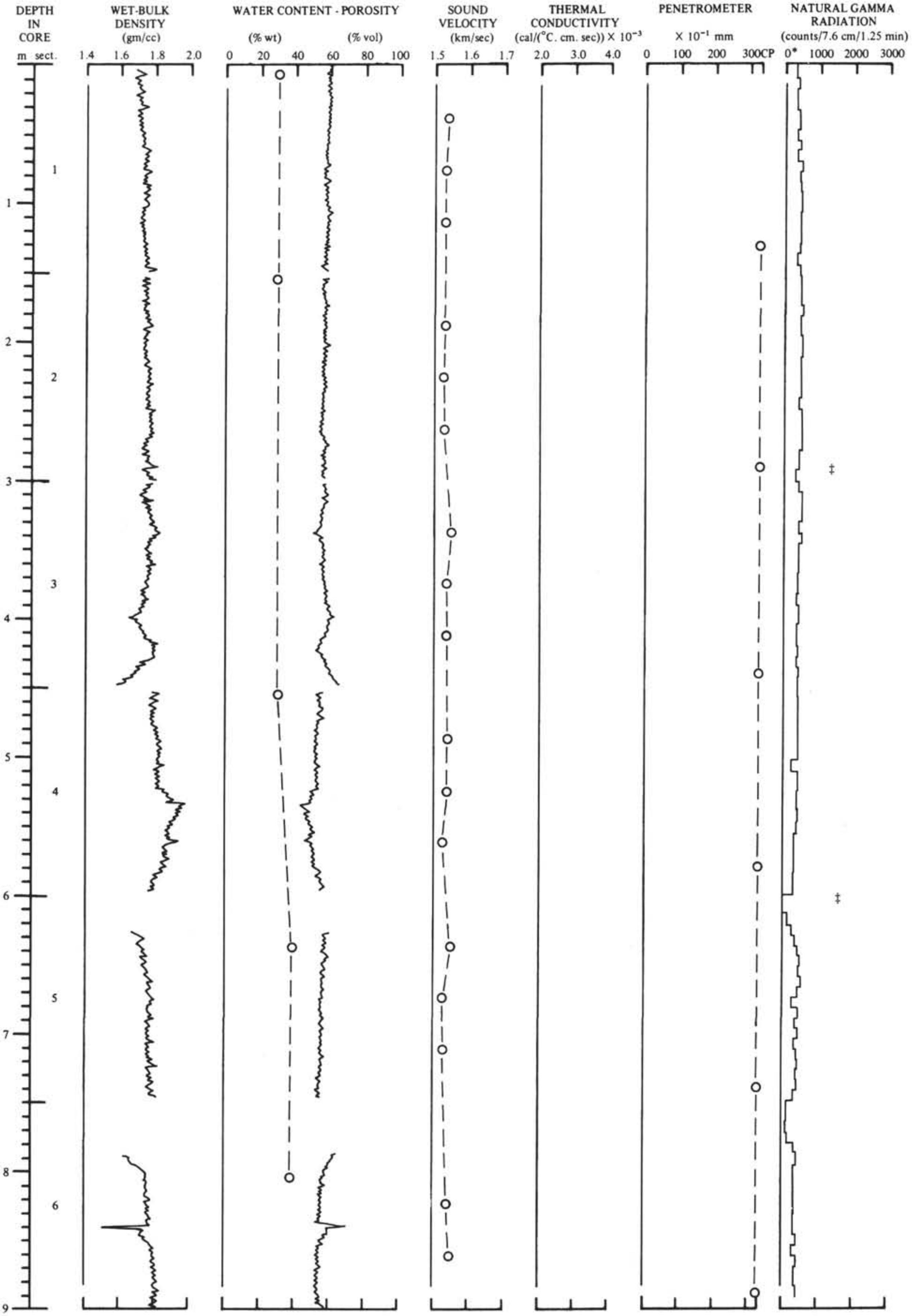


Figure 16B. *Core 4, Hole 17A.*



* "0" = laboratory-atmospheric background count of 1550.
‡ Radiation counts at the ends of 1.5 m sections are low because the volume of sediment being scanned is reduced.

Figure 17A. *Physical properties of Core 1, Hole 17B.*

AGE (STAGE)	ZONE	DEPTH (METERS)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
UPPER OLIGOCENE (CHATTIAN-BORMIDIAN)	*Globigerina ciperoensis* Zone; *Sphenolithus ciperoensis* Zone	1	1		FN		Planktonic foraminifera: *Globorotalia denseconnexa, Globrigerina yeguaensis, G. corpulenta, G. sellii, Globigerinita dissimilis.* Calcareous nannoplankton: *Coccolithus bisectus, C.* aff. *bisectus, Cyclococcolithus neogammation, C. pelagicus, C. eopelagicus, Discoaster deflandrei, Sphenolithus ciperoensis.*
		2	2		FN		Flora similar to above. Planktonic foraminifera: Fauna similar to above with *Globoquadrina rohri, Globigerinita stainforthi, G. unicava, Globigerina angulisuturalis, Globorotalia postcretacea.*
		3, 4	3		F, N	FRAM OOZE Light yellow brown (10YR6/4) to very pale brown (10YR7/4) nannofossil chalk ooze. 0-1% foram	Fauna similar to above.
		5	4		N		Flora similar to above.
		6, 7	5		F, F, N		Flora similar to above. Fauna similar to above with *Globigerina angustiumblicata* and *Globorotalia opima continuosa.*
		8	6		F, FN		Flora and fauna similar to above. Core catcher: Flora similar to above. Planktonic foraminifera: *Globigerina ciperoensis, G. angulisuturalis, G. sellii, Globoquadrina rohri, G. venezuelana, G. tripartita.*

* Most planktonic foraminifera tests are broken in this sample.

Figure 17B. *Core 1, Hole 17B.*

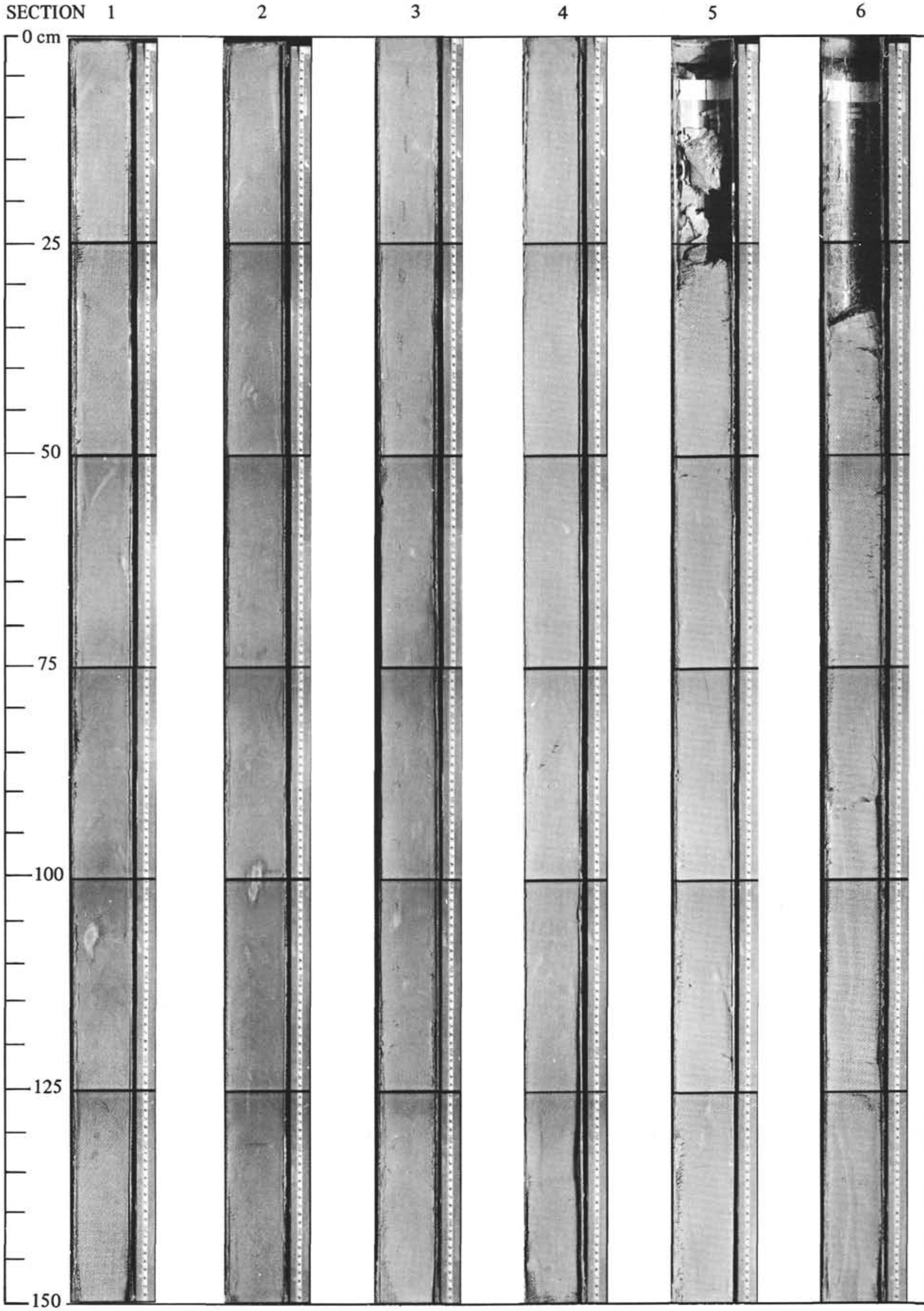


Plate 7. *Core 1, Hole 17B.*

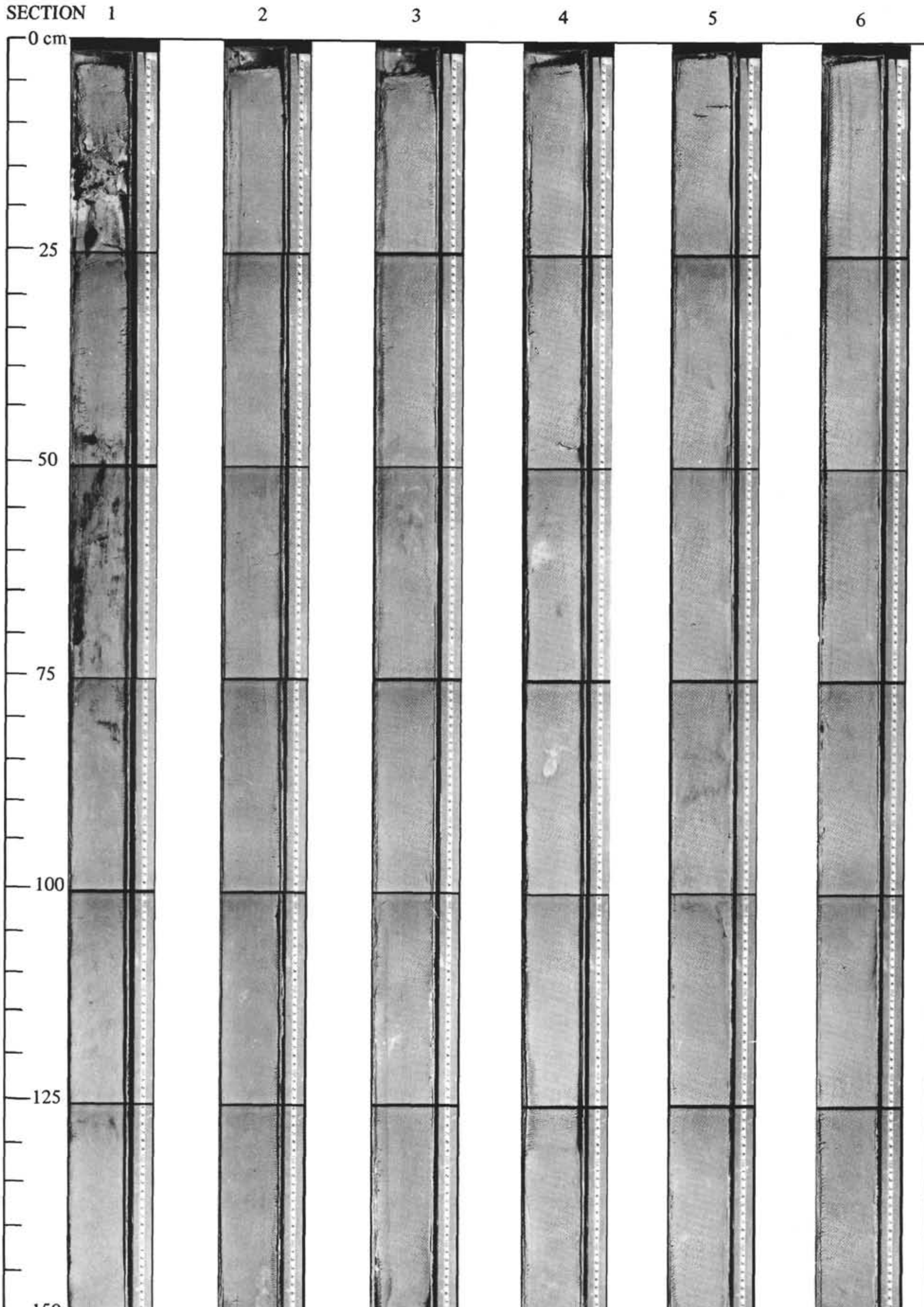
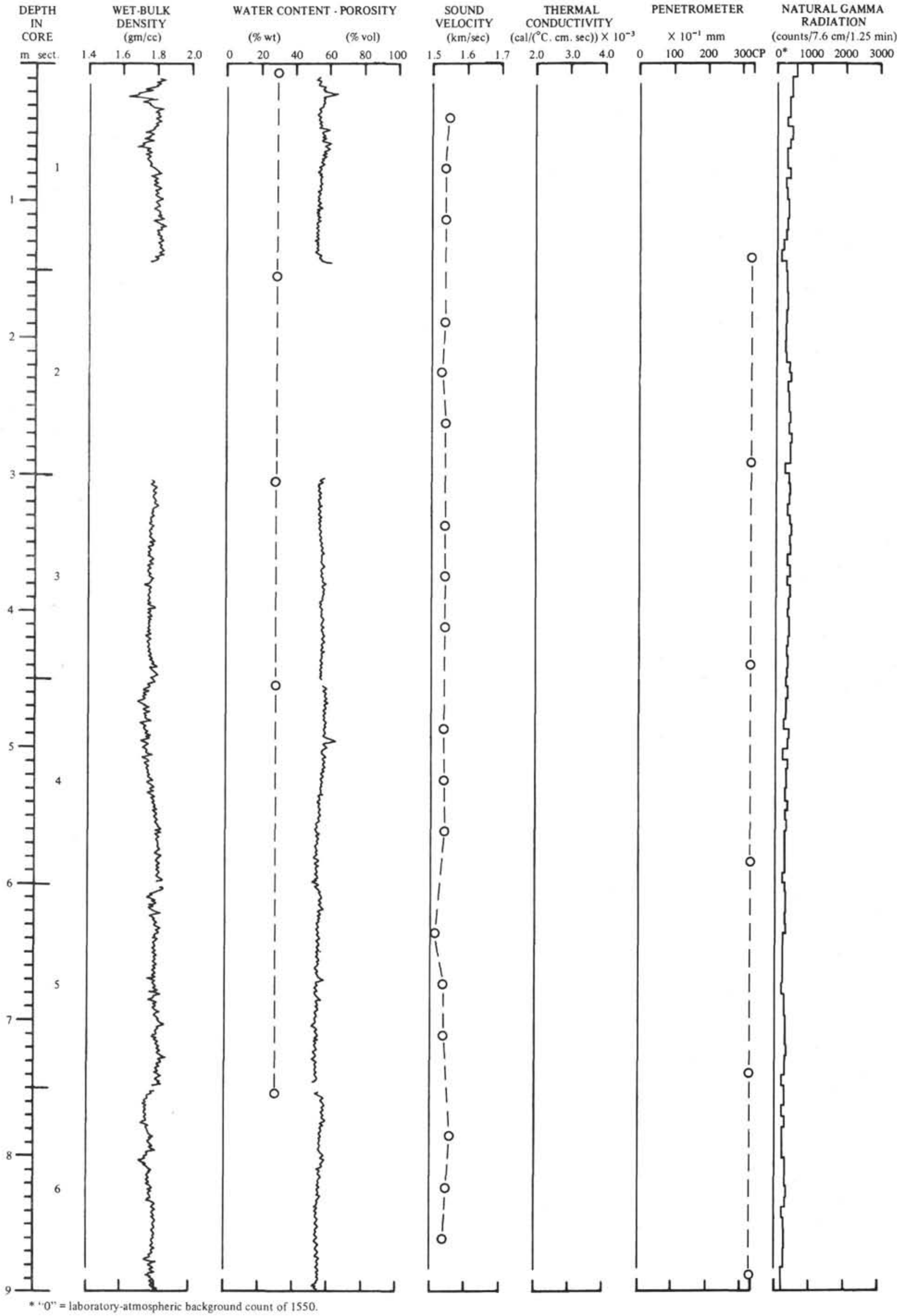


Plate 8. *Core 2, Hole 17B.*

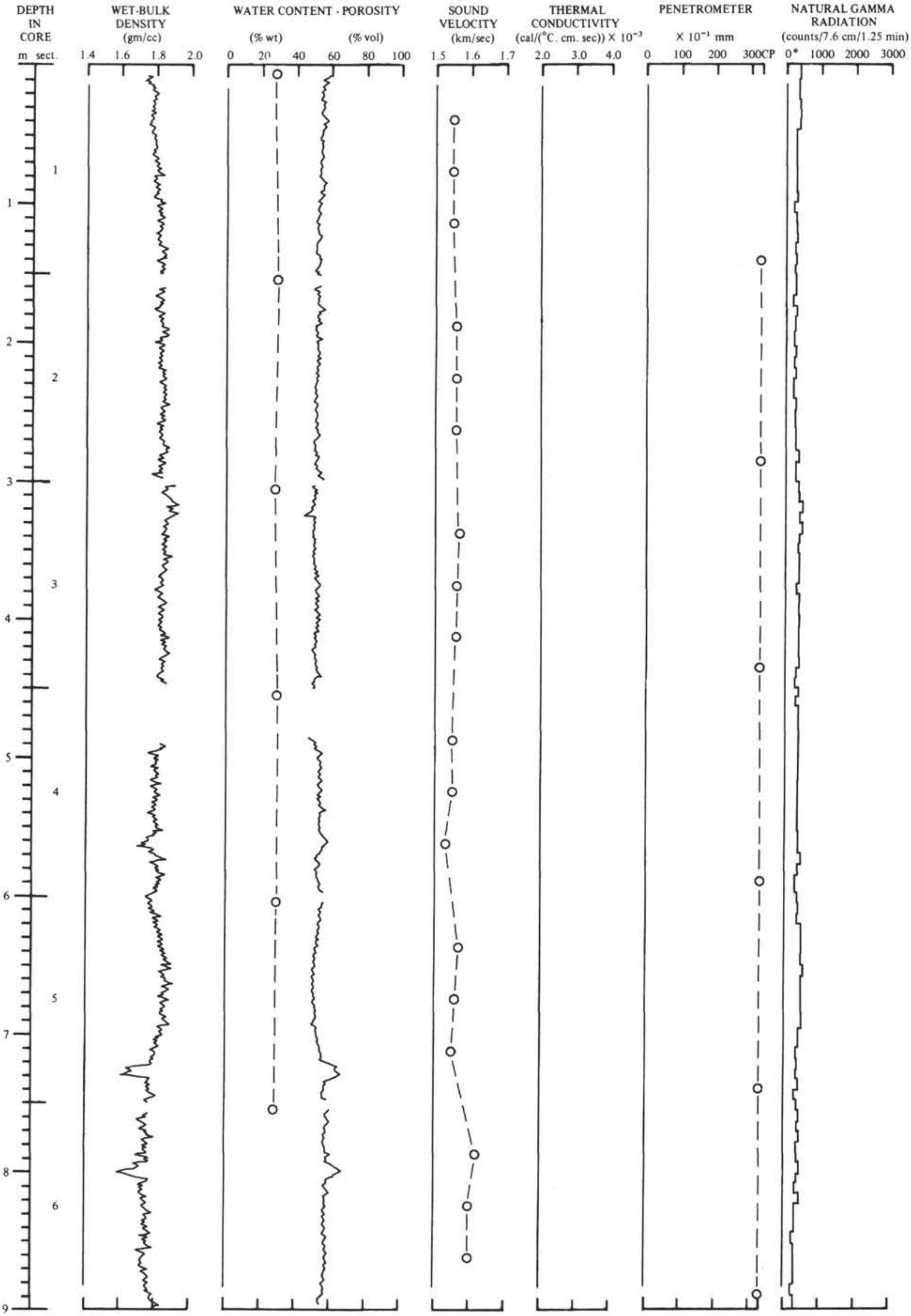


* "0" = laboratory-atmospheric background count of 1550.

Figure 18A. *Physical properties of Core 2, Hole 17B.*

AGE (STAGE)	ZONE	DEPTH (METERS)	SECTION NO.	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
UPPER OLIGOCENE (CHATTIAN-BORMIDIAN)	*Globigerina ciperoensis* Zone; *Sphenolithus ciperoensis* Zone	0–1.5	1	FN	45-80 cm. reworked younger seds. as dark and light mottles; core disturbance?	Planktonic foraminifera: *Globigerina senilis, G. corpulenta, Globoquadrina rohri, Globorotalia opima nana, Globorotaloides variabilis.* Calcareous nannoplankton: *Cyclococcolithus neogammation, Coccolithus bisectus, C.* aff. *bisectus, C. pelagicus, C. eopelagicus, Sphenolithus ciperoensis, Discoaster deflandrei.*
	Globigerina ciperoensis Zone / *Globorotalia opima opima* Zone; *Sphenolithus ciperoensis* Zone	1.5–3	2	N		Flora similar to above.
	Globorotalia opima opima Zone; *Sphenolithus ciperoensis* Zone	3–4.5	3	FN	FRAM OOZE Light yellow brown (10YR6/4) to very pale brown (10YR7/4) nannofossil chalk ooze. 0-1% foram	Flora similar to above. Fauna similar to above. First appearance of *Globorotalia opima opima.*
		4.5–6	4	FN		Flora and fauna similar to above.
		6–7.5	5	N		Flora similar to above.
		7.5–9	6	F, N		Flora and fauna similar to above. Core catcher: Flora and fauna similar to above.

Figure 18B. *Core 2, Hole 17B.*



* "0" = laboratory-atmospheric background count of 1550.

Figure 19A. *Physical properties of Core 3, Hole 17B.*

AGE (STAGE)	ZONE	DEPTH (METERS)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
UPPER OLIGOCENE (CHATTIAN-BORMIDIAN)	*Globorotalia opima opima* Zone; *Sphenolithus distentus* Zone	1	1		FN	(Core disturbed)	Planktonic foraminifera: *Globorotalia opima opima, G. opima nana, G. postcretacea, G. clemenciae, Globigerinita dissimilis, Globoquadrina rohri, Globigerina yeguaensis G. corpulenta, G. sellii.* Calcareous nannoplankton: *Coccolithus bisectus, C.* aff. *bisectus, C. pelagicus, C. eopelagicus, Cyclococcolithus neogammation, Sphenolithus predistentus, S. distentus, Discoaster deflandrei.*
		2	2				
		3, 4	3		F, N	FRAM OOZE	Fauna similar to above. Flora similar to above.
	Globigerina ampliapertura Zone	5	4		F, N	Light yellow brown (10YR6/4) nannofossil chalk ooze. 0-5% foram	Fauna similar to above. First appearance of *Chiloguembelina cubensis*. Flora similar to above.
		6, 7	5				
		8	6		FN		Flora similar to above. Fauna similar to above. First appearance of *Globorotalia insolita*. Core catcher: Flora and fauna similar to above.

Figure 19B. *Core 3, Hole 17B.*

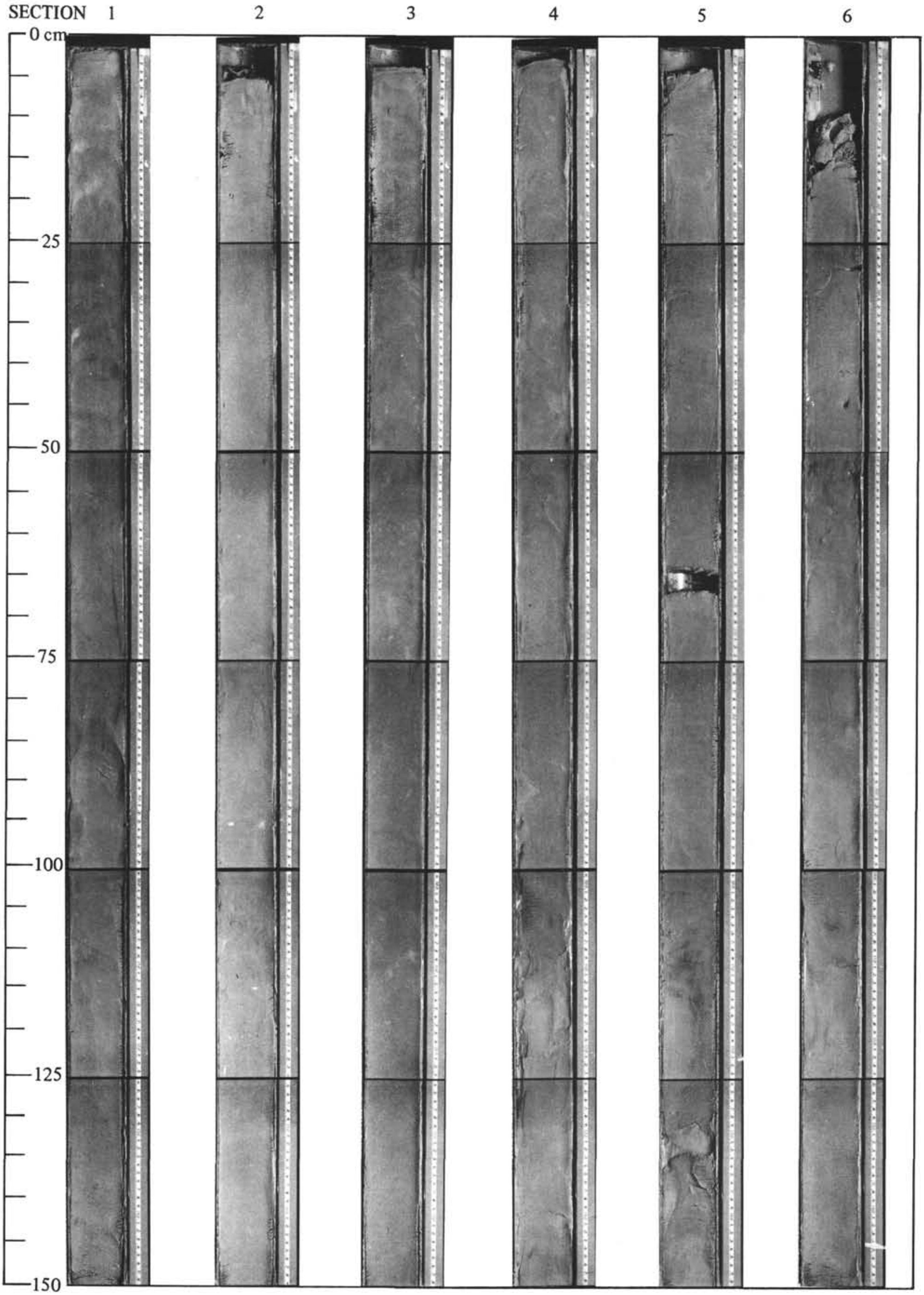


Plate 9. *Core 3, Hole 17B.*

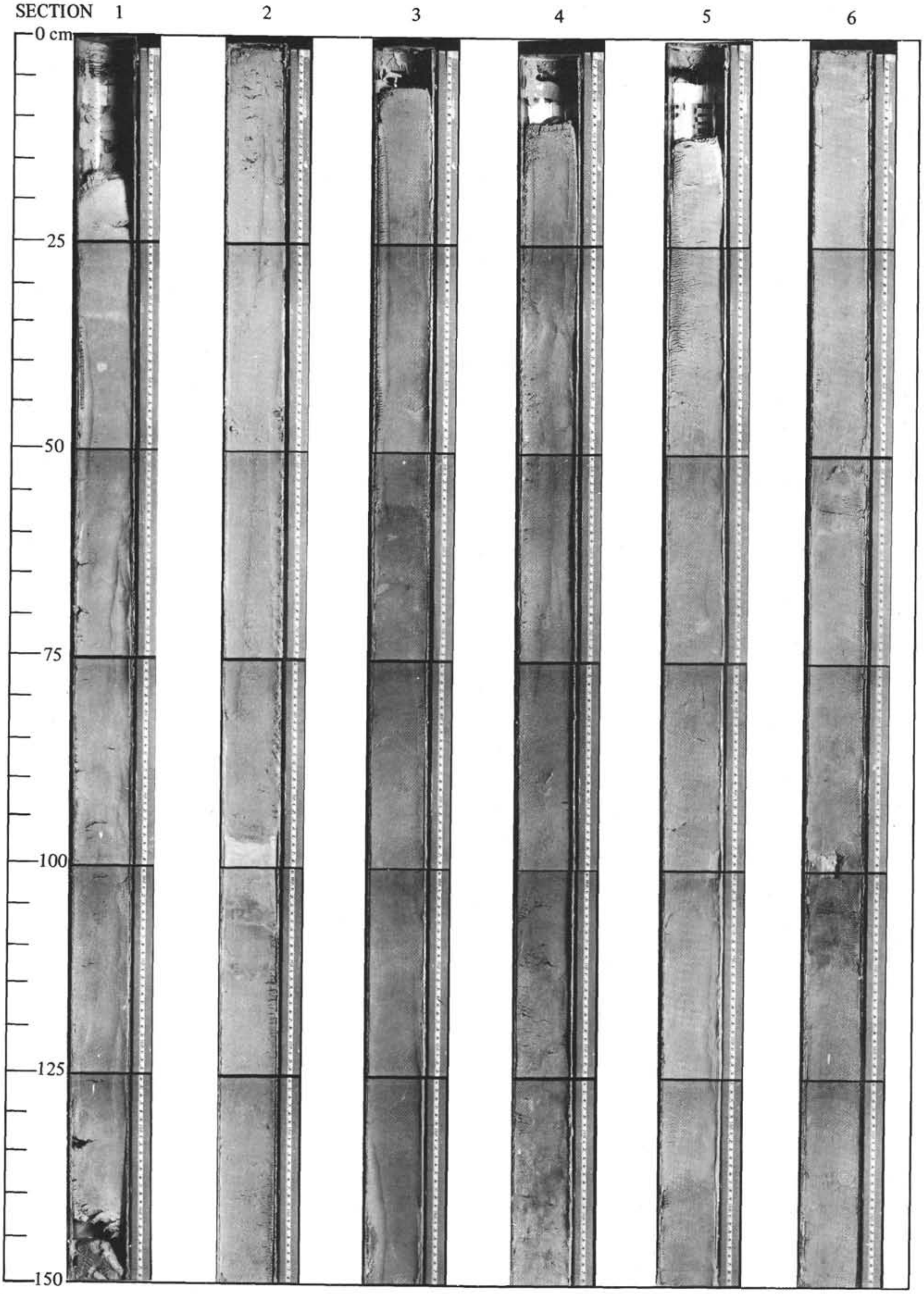


Plate 10. *Core 4, Hole 17B.*

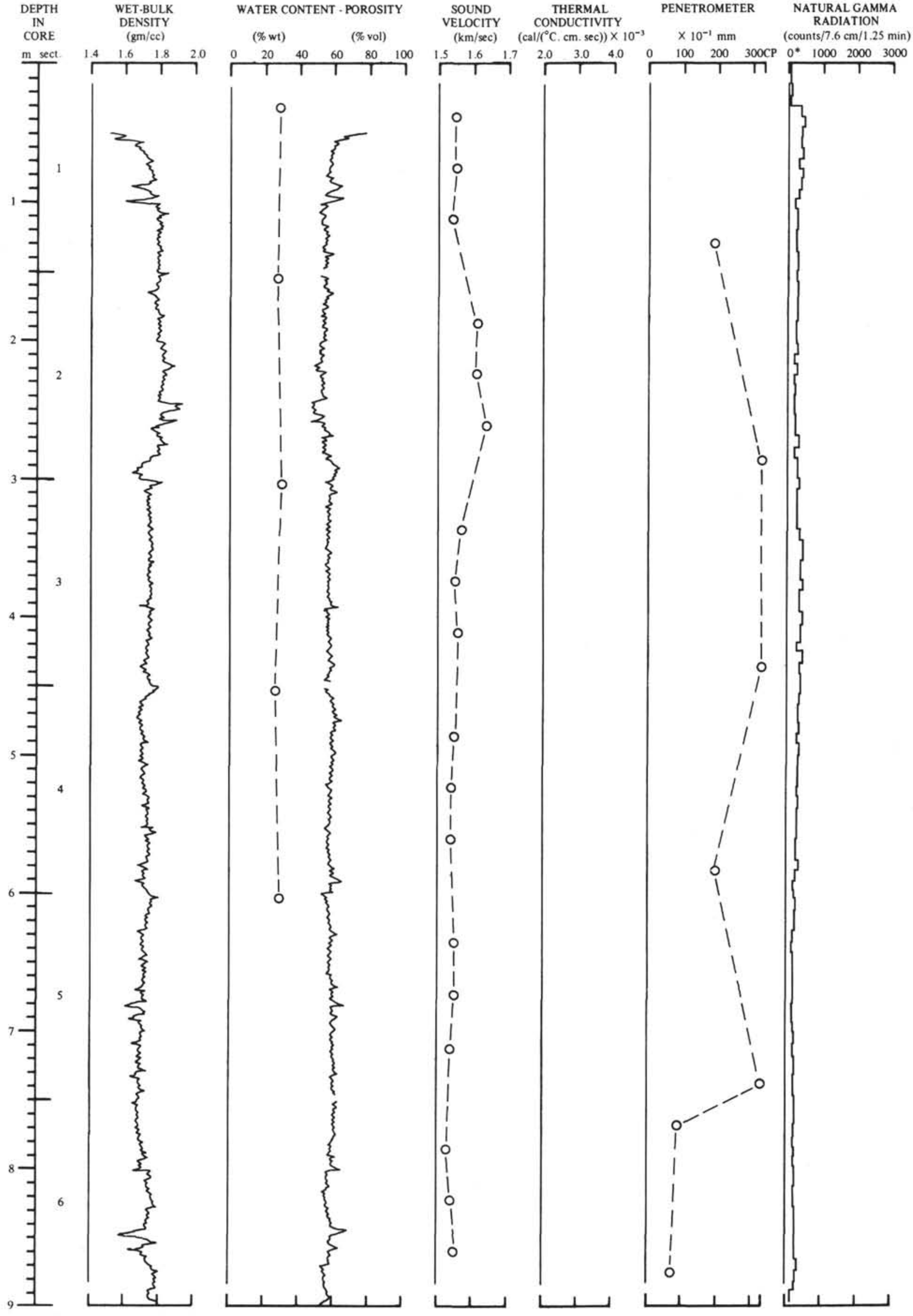


Figure 20A. *Physical properties of Core 4, Hole 17A.*

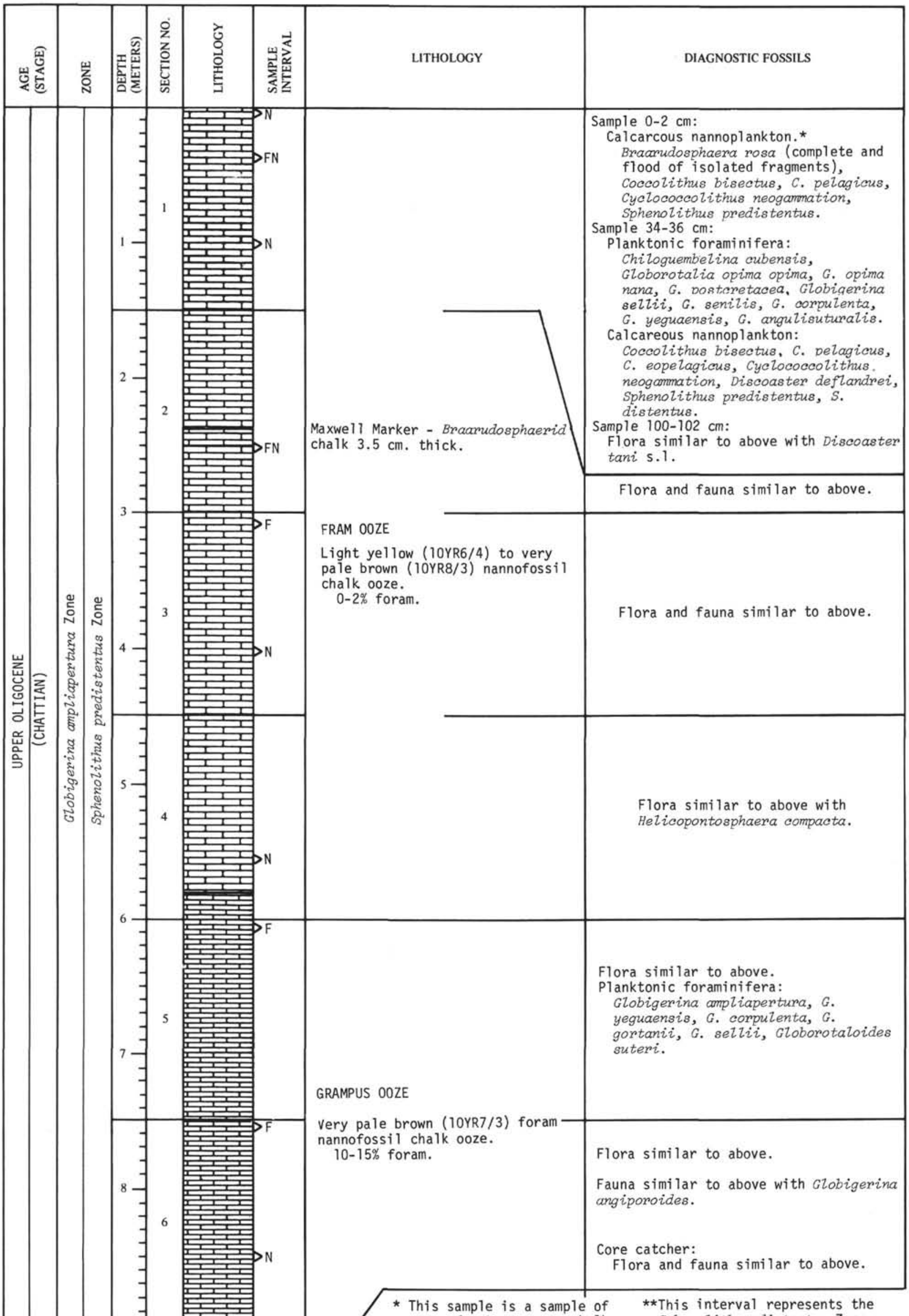


Figure 20B. *Core 4, Hole 17A.*