5. SITES 102-103-104 – BLAKE-BAHAMA OUTER RIDGE (NORTHERN END)

The Shipboard Scientific Party[1]

INTRODUCTION

Geophysicists studying the deep-sea area off the Blake Plateau during the late 1950's concluded that the Blake-Bahama Outer Ridge is a foundered chain of islands and reefs structurally connected to the Cape Fear Arch off the Carolinas, (Hersey *et al.*, 1959). During the early 1960's scientists of the Lamont--Doherty Geological Observatory made continuous seismic reflection profiles over the ridge and showed that it is a vast accumulation of sediments lying on a horizontal reflecting surface (Layer A) which in turn lies above the rough acoustic basement reflector (Ewing and Ewing, 1964). This discovery led to a number of concepts attempting to explain the processes of formation of such huge sediment bodies in the deep sea.

Ewing *et al.* (1966) suggested that much of the material forming the ridge had been eroded from the Blake Plateau by the Gulf Stream. Andrews (1967) suggested that the ridge was formed by an enormous slump from a proximal up-slope position, in this case from the Blake Plateau region.

Heezen and Hollister (1964) and Heezen *et al.* (1966) proposed that the ridge, as well as many other fine-grained sediment bodies in the deep sea, owes its shape and structure to the effects of mud-carrying, contour-following deep currents ("contour currents") associated with deep thermohaline circulation.

Bryan (1970) and Markl *et al.* (1970) combined these concepts, suggesting that interaction of turbid flow from the Blake Plateau with the southward-flowing contour current initiated the development of the ridge which subsequently was enlarged and perhaps somewhat reshaped by further deposition and erosion associated with the contour currents.

The Blake-Bahama Outer Ridge (Figure 1) includes deposits of several shapes and sizes, from dunes a few kilometers long and tens of meters in height, to ridges many hundreds of kilometers long and thousands of meters high (Markl *et al.*, 1970).

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The principal objective of Sites 102, 103 and 104 was to determine the geologic history of the Blake-Bahama Outer Ridge by investigating its structure, composition, rate of growth, and the provenance of constituent sediments.

OPERATIONS

The ship arrived at Site 102 on the crest of the Blake-Bahama Outer Ridge during the late hours of April 30, and drilling was commenced at 1120 hours on May 1. A light-set diamond bit was chosen for this hole. The bottom hole assembly was the same as that used for most of the holes of this leg, consisting mainly of bit and outer core barrel, eight drill collars, and three bumper subs.

The sediment was soft and penetration progressed smoothly for the first three cores. Drill string rotation and pumping were required below a depth of 100 meters, but there was no difficulty in penetration until a depth of about 620 meters was reached. At this depth, which correlates well with the prominent conformable reflector at 0.62 second below bottom in the profiler record (Figure 2a), the sediment became much firmer and drier, and penetration slowed severely. After more than twelve hours drilling in this zone with a penetration rate of only 3 m/hr, the hole was abandoned. There had been some speculation that the bit might have clogged or the seals were blown out of a bumper sub, rather than that the sediment caused difficult penetration; but when the string was recovered no equipment problem was found. Therefore, the sharp decrease in penetration rate must indicate a significant change in lithology at the depth of the prominent seismic reflector at 0.62 second. By comparing the data from this hole and Hole 103 (Figure 2b), it is obvious that the reflector is not a time boundary and, therefore, must result from diagenetic processes.

Most of the cores at this site contained substantial amounts of organic material and were gassy, usually partially extruding themselves from the plastic liners and creating gaps in the remaining sections. Chromatograph measurements indicate that the gas is principally methane with only a small fraction (usually less than 0.5 per cent) of ethane.

Hole 103 was drilled on the southwest flank of the Blake-Bahama Outer Ridge at a location where seismic

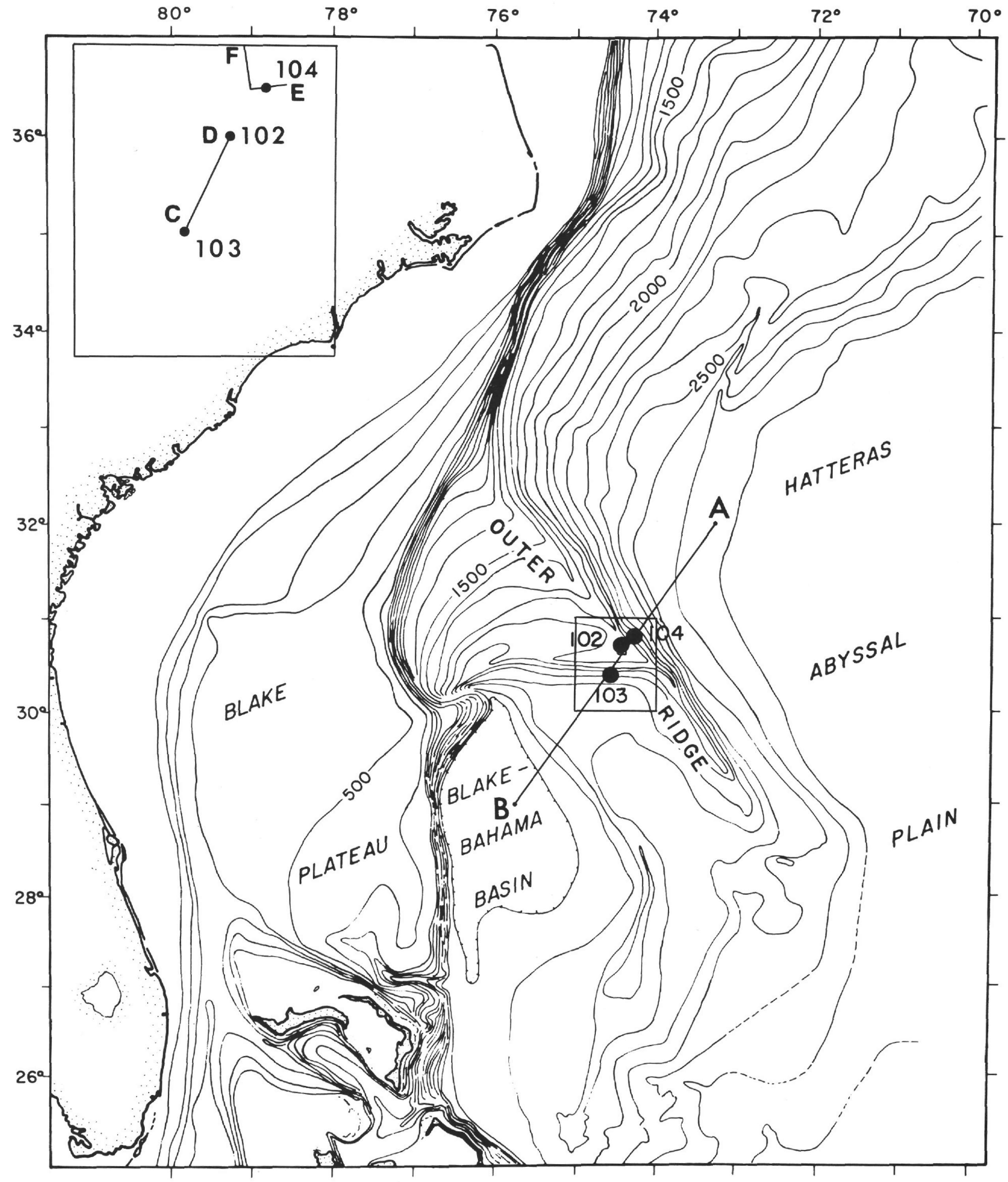


Figure 1. *Bathymetry of the Blake-Bahama Outer Ridge system (after Mankl,* et al, *1970). Track segments locate seismic profiler sections shown in Figures 2a, 2b and 2c.*

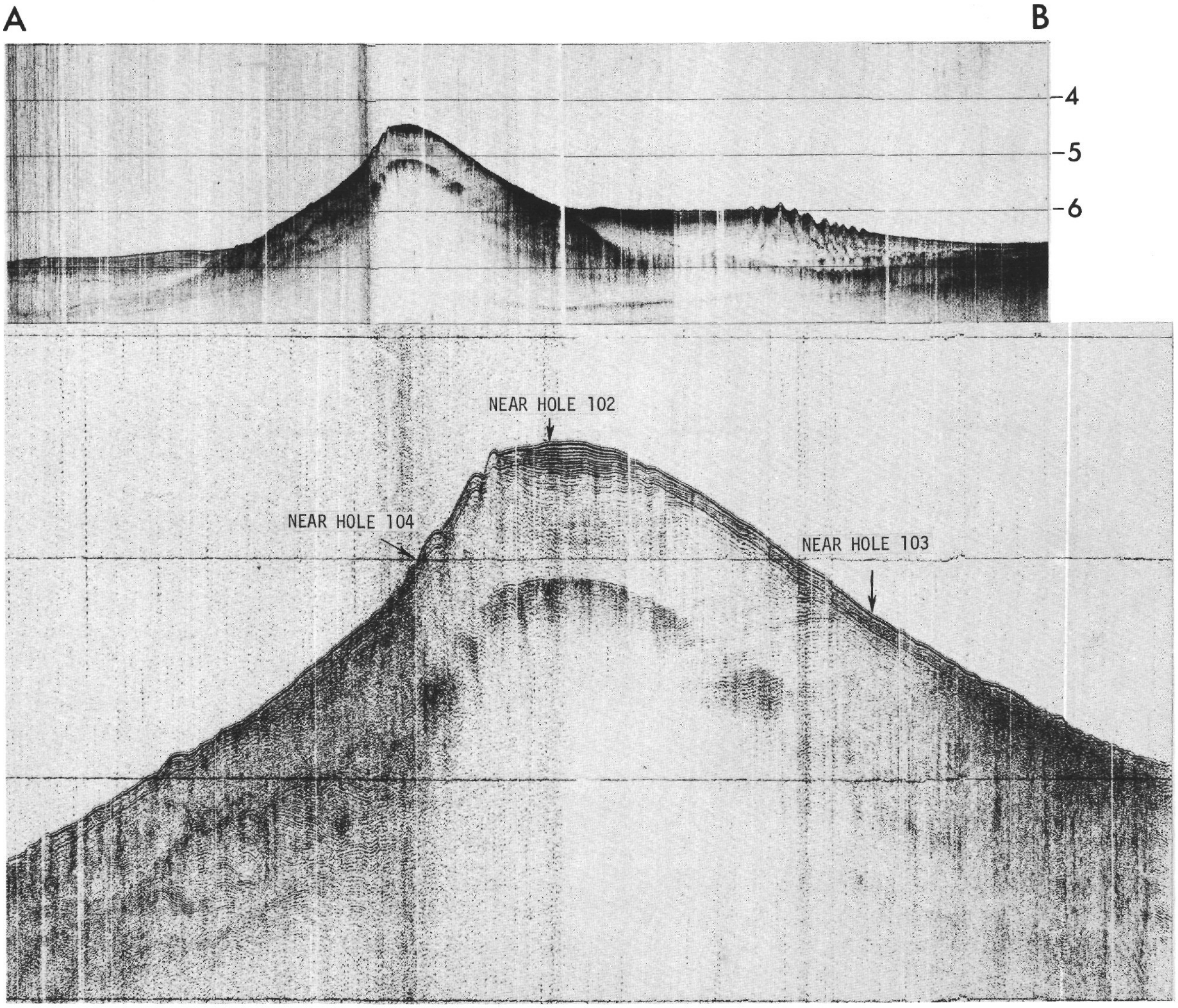


Figure 2a. Vema 21 *Seismic profiler section across the Blake-Bahama Outer Ridge, (crestal region expanded below). See Figure 1 for location.*

profiler data indicated an outcropping of the deeper beds penetrated in Hole 102 (Figure 2b). Drilling commenced at 1400 hours on 5 May, 1970. The second core, taken at a subbottom depth of 40 meters, brought up late Miocene sediment which had not been reached in the crest hole until a depth of more than 500 meters.

After the difficulty experienced at Hole 102 in drilling the firmer sediment with the diamond bit, a drag bit was chosen to drill this hole. It appeared to perform well, and during the drilled interval above the deepest core, penetrated firm clay at a good rate. Unfortunately, after Core 7 was taken the hole began to show signs of serious collapse and had to be abandoned.

The sediment samples were very similar to those at Hole 102, consisting mainly of silty clay with appreciable amounts of organic material. All of the cores contained a substantial amount of gas, consisting primarily of methane with a trace of ethane.

After the collapse of Hole 103, enough time remained for about 36 hours more drilling, and a decision was made to drill a third hole (Hole 104) on the northeast flank of the ridge (Figure 2c) at approximately the same water depth as Hole 103, drilled on the southwest flank. Drilling commenced at 1400 hours on 7 May, 1970, in a water depth of 3821 meters. The 3-cone carbide button roller bit used for Hole 99A was employed again.

After only 3 or 4 meters of penetration, several hard, apparently thin beds were encountered, requiring bit rotation and a substantial amount of weight. The hard material, some of which was recovered in Core 1, appears as a finely laminated calcite "crust" covered with calcite-filled burrow-like structures.

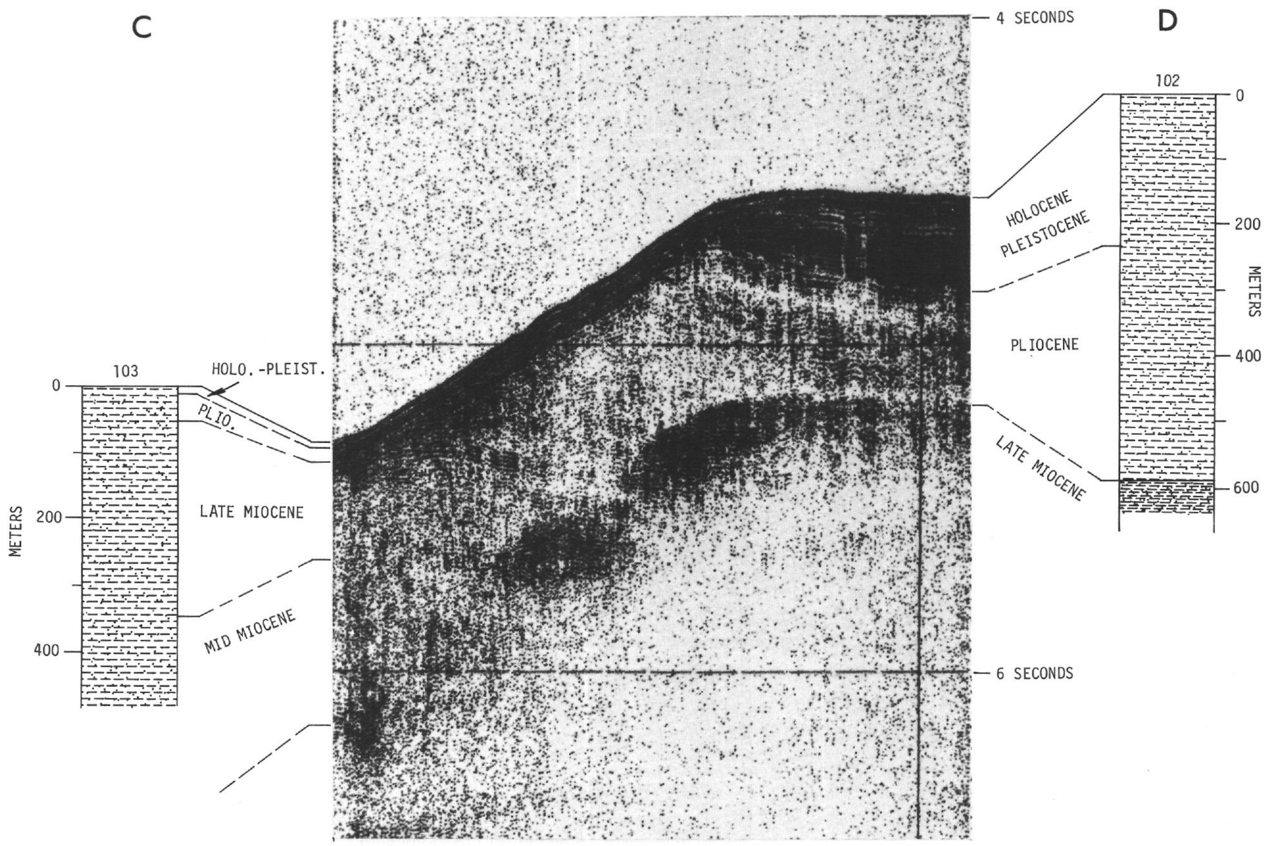


Figure 2b. *Lithology and seismic stratigraphy at Site 102 (right) and Site 103 (left).*

Most of the cored section consisted of hemipelagic silty mud similar to that found in Holes 102 and 103. The deepest core, taken at a depth corresponding to that of the prominent conformable reflector at 0.62 second (Figure 2c) contained approximately 15 centimeters of very hard ankerite. This layer or nodule required several minutes to drill through and was as hard drilling as any of the cherts, limestones, or basalts cored in previous holes during this leg. The material underneath the ankerite appeared to be little different from that above it. Unfortunately, time had run out at this point, and drilling was terminated in order for the ship to make its scheduled arrival at Norfolk.

The situation with respect to gas in the sediments was about the same as at Holes 102 and 103. The chromatograph showed only a trace of ethane. The first three cores of Hole 104 had a strong odor of hydrogen sulfide (H_2S), but this diminished rapidly in the deeper part of the section.

STRATIGRAPHY

Biostratigraphy

Assemblages of abundant calcareous nannoplankton, planktonic foraminifera, dinoflagellates, Radiolaria, and diatoms of Holocene to early middle Miocene age were encountered at these sites. Approximately 600 meters of middle Miocene, 300 meters of late Miocene, 350 meters of Pliocene and 220 meters of Pleistocene sediments are present.

The foraminiferal and nannoplankton assemblages contain the same tropical/subtropical components that have been observed in worldwide equatorial latitudes. They correspond well with the biostratigraphic zones established by Blow (1969), Martini and Worsley (1970), and the nannofossil zonation of Milow used on Leg 9. The composite section of Sites 102, 103 and 104 contains each of Zones N. 23 to N. 10/9 as defined by Blow (1969).

Two major stratigraphic boundaries (according to foraminiferal data) are documented; the Miocene-Pliocene in Core 2 at Site 103, and Pliocene-Pleistocene in Core 8 at Site 102. In addition, three major unconformities are present; one at Site 104 (Core 1), and two at Site 103 (within Core 1).

Pollen grains and spores occur in all the examined samples. Pleistocene grains consist mainly of pine,

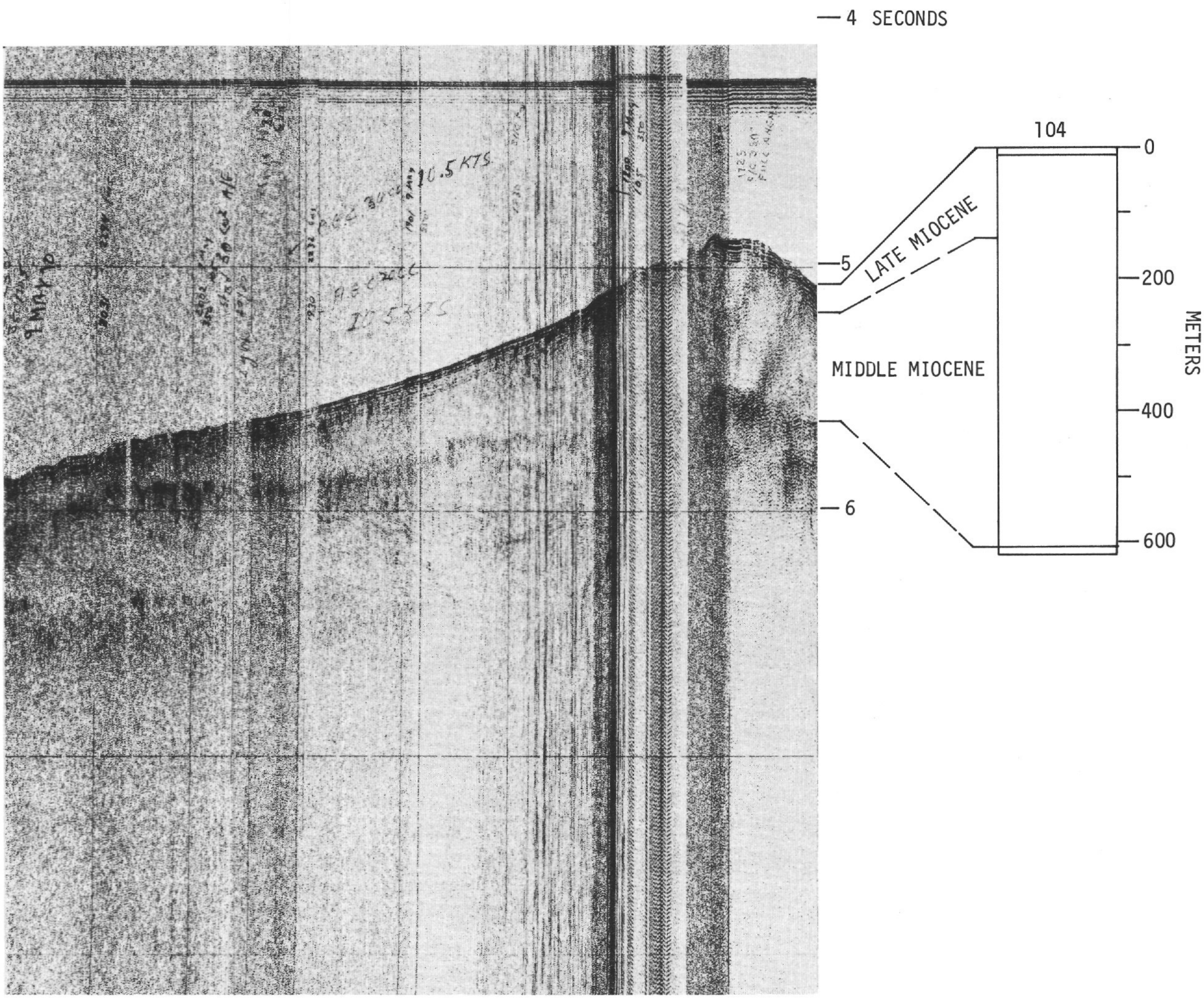


Figure 2c. *Lithology and seismic stratigraphy at Site 104.*

scattered spruce and pteridophyte spores, which suggests transportation from a northerly source. Reworked grains of Cretaceous and Carboniferous ages are also present. In the upper and middle Miocene sediments, the pollen assemblages are more varied, containing appreciable amounts of oak pollen, grasses, sedges, alder and hickory; this suggests either a climate warmer than the Pleistocene in the same northerly direction, or increased stream discharge and marine currents, or change in source area. Reworked grains of Cretaceous age are also more common, some with excellent preservation, which suggests possible contributions from the Atlantic Coastal Plain or deep-sea deposits. The foraminifers offer little evidence with regard to source of sediment, except that some sublittoral forms are usually minor constituents of the foraminiferal assemblages. This indicates displacement from shallow water.

Foraminifera

Refer to the chapter titled "Neogene Foraminiferal Biostratigraphy" for a detailed analysis of the planktonic foraminiferal assemblages at Sites 102, 103 and 104.

Calcareous Nannoplankton

Coring at Site 102 recovered sediment ranging in age from late Miocene to Quaternary. The first core, from 9 meters, contained a typical Pleistocene nannoplankton assemblage. The second core, from 27 meters, is also Pleistocene and represents perhaps a glacial interval judging from the common to abundant concentration of large specimens of *Coccolithus pelagicus*, a species that has a definite cold-water preference in modern oceans. Cores 3 to 8 were likewise assigned to the Quaternary. The core catcher of Core 9 contains a few specimens of *Discoaster brouweri* and thus, was, assigned to the latest Pliocene N. 21 Zone of Blow. Core 10 contains an assemblage indicative of the lower part of N. 21. Core 12 was placed within Zone N. 20. Cores 13, 14 and 15 were assigned to the early Pliocene Zone N. 19, and Core 16 to either very low in Zone N. 19 or possibly to the upper part of Zone N. 18. Cores 17, 18 and 19 were considered to be late Miocene, Zone N. 18.

Coring at Site 103 recovered sediments ranging in age from Holocene at the sea floor to middle Miocene at a depth of 449 meters. Core 1 extends from the surface to a depth of 8 meters, and the bottom of the core contains an early Pliocene assemblage. In superposed sequence, Cores 2 through 7 recovered nannoplankton assemblages of late Miocene in Core 2 to middle Miocene in Core 7. In all but the lower two cores, nannoplankton are present in abundance and are well preserved. Core 6 contains only a few forms, and in Core 7 they are very rare. In these two cores solution effects are commonly observed on the foraminifera.

Cores from Site 104 recovered sediments as young as Quaternary at the top and as old as earliest middle Miocene at a depth of 617 meters. The top of the first core contains a Quaternary assemblage, but the sample from the core catcher was assigned to the late Miocene (probably Zone N. 17 of Blow). The remaining cores (2 through 10) revealed a gradual increase in age through the middle Miocene, terminating in the earliest middle Miocene *Sphenolithus heteromorphus* Zone (N. 9/10).

Dinoflagellates

Dinoflagellate cysts were recovered from all samples examined at Site 102. *Operculodinium centrocarpum* (Deflandre and Cookson), *Tectatodinium pellitum* Wall, and species of *Spiniferites* are common in the Quaternary assemblages of Cores 1 through 6. *Achomosphaera ramulifera* (Deflandre) occurs in the Pliocene cores, in addition to those species found also in the Quaternary. At Site 103, *Hystrichosphaeropsis obscurum* new species was found in the cores of Miocene age. The Miocene cores contain a diversified assemblage of pollen grains, including those assigned to oak, hickory, Compositae and grasses. Reworked grains are scattered through the samples, including those of Cretaceous and Carboniferous ages.

Hystrichosphaeropsis obscurum occurs in the Miocene cores of Site 104. *Pentadinium taeniagerum* Gerlach occurs in Core 10 at Site 104.

Rate of Sediment Accumulation

During late Miocene time, sediment at Site 102 accumulated at a rate of 2.5 cm/1000 yr. and increased to 13.7 cm/1000 yr. during the Pleistocene.

At Site 103 approximately 200 meters of late middle and early late Miocene sediment accumulated at a rate of 19.3 cm/1000 yr., and continued at this rate to the end of the Miocene. Rates through the early and middle Pliocene were about 2.6 cm/1000 yr.

At Site 104 middle Miocene sediments accumulated at a rate (19.5 cm/1000 yr.) similar to that calculated for the late middle and early late Miocene at Site 103. During the remainder of late Miocene time, a considerable drop in sedimentation rate (1.8 cm/1000 yr.) occurred at Site 104. In other words, during the late middle and early late Miocene the rate of accumulation at Site 103 (west flank of ridge) was approximately twice that at Site 104 (east flank of ridge). This suggests perhaps that the greatest amount of sediment was being supplied to the southwestern portion of the ridge during late Miocene time.

Lithology

At Sites 102, 103 and 104—on the crest (3425 meters), southwest flank (3964 meters) and northeast flank (3811 meters), respectively, of the Blake-Bahama Outer Ridge—a total of 1727 meters of dark greenish-gray hemipelagic silty mud was penetrated; 192 meters of this material were recovered in 36 cores. Sediment age ranges from middle Miocene to Holocene. All three sites have in common the late Miocene foraminiferal biostratigraphic Zone N. 17 as well as correlatable sediment types as determined by smear slide analysis. They will be treated together as one sequence representing the uppermost kilometer of ridge crest sediment.

Three main variations in the hemipelagic sediments are distinguished (1) siliceous, calcareous, and heavy mineral-rich Pleistocene sediments deposited at a rate of about 14 cm/1000 yr., (2) non-siliceous, siderite-pyrite-glauconite-rich Pliocene and late Miocene sediments deposited at a rate of about 9 cm/1000 yr., (3) siliceous, noncalcareous, siderite-rich middle Miocene sediments deposited at a rate of about 19 cm/1000 yr.

Pleistocene Sediments (N. 22 - N. 23)

Approximately 220 meters of the Pleistocene was penetrated at Site 102; 72 meters of this were cored and 52 meters were recovered. The accumulation rate of almost 14 cm/1000 yr. is extremely high for a deep-sea environment, which is rarely over 5 cm/1000 yr. Less than 5 meters of the surface cores at Sites 103 and 104 were Pleistocene and, thus, the following discussion deals entirely with material recovered in Cores 1 through 8 at Site 102.

The upper 10 meters of sediment at Site 102 resemble the sediment recovered in piston cores taken on the crest of the Blake-Bahama Outer Ridge by Lamont-Doherty scientists (Heezen *et al.*, 1966). The upper half meter is Holocene yellow-brown and gray, laminated, silty, foraminiferal ooze. Smear slide examinations reveal an abundance of clay minerals, inorganic silt-sized detritus and organic debris, foraminifera and coccoliths, aragonite needles, and a flood of radiolarians, diatoms, and sponge spicules. Siliceous microfossils are almost totally lacking in the underlying Pliocene sediment. The abundant inorganic detrital silt laminae contain abundant heavy minerals.

Below the first few meters, the color becomes dark gray to grayish-brown; black patches of iron sulfide become quite abundant. Methane gas with traces of ethane becomes detectable below about 10 meters below bottom. Below a depth of about 100 meters, a few layers of rose-gray and mottled yellow-green silty clay occur. Siderite, dolomite and aragonite are found sporadically, and burrows are often filled with inorganic light-colored quartz silt.

A few hard, well-indurated crusts of limy mud containing cemented wormlike burrows and burrow-fillings were found at Site 104. Rather large fragments of hard lithographic limestone were found immediately below the crust. The lower limit of the fragments coincides with a major unconformity that separates the early Pleistocene from the late Miocene. Similar crusty surfaces have been found in modern sediments where strong bottom currents scour the sea floor thereby temporarily preventing deposition. It is the absence of Pliocene sediments at Site 104 which indicates recent periods of scouring or nondeposition on the east flank of the Blake-Bahama Outer Ridge.

Pliocene–Late Miocene Sediment (N. 21 - N. 15)

At Sites 102, 103 and 104, a total of 687 meters of Pliocene (N. 18/19 – N 21) to late Miocene (N. 14/15) sediment was penetrated; 83 meters of this was recovered in 18 cores. This late Miocene sediment is very similar to the Pliocene material and thus the two will be treated as one lithologic unit. It is homogeneous, dark greenish-gray, silty hemipelagic mud, occasionally mottled with lighter olive-gray hues.

The distinction between Pleistocene and Pliocene-late Miocene sediments lies in minor mineralogic differences revealed by smear-slide analysis and an abundance of siliceous material. Within the Pleistocene, siderite, pyrite and glauconite make their first consistent appearance. They increase in amount with depth in the section. Many of the burrows are found to be filled with siderite silt. Aragonite needles and heavy minerals, common in the Pleistocene, become rare to absent in the older sediment. In the Pleistocene deposits radiolarians, sponge spicules and diatoms are very abundant, whereas in the Pliocene-late Miocene they are rare.

A significant change in mineralogy and palynology also occurs near the boundary between the late Miocene and middle Miocene. This boundary, penetrated at Sites 103 and 104, was not reached at Site 102 and thus the following discussion is based on smear slides obtained from these two correlatable sites.

Middle Miocene Sediment (N. 14 - N. 9)

A change at the late-middle Miocene boundary is a gradual decrease in abundance of heavy minerals. Foraminiferal tests and nannoplankton are almost totally lacking in smear slides of middle Miocene sediment. However, their decrease has been rather gradual since about middle Pliocene, and may reflect progressive dissolution of carbonate as a function of time and/or depth of burial. At the bottom of the oldest sediment recovered (Core 10, Site 104, Zone N. 10/9), a bed or nodule of ankerite was cored.

Below the middle Miocene-late Miocene boundary an increase in abundance of siliceous organisms occurs. Also, near this boundary an abrupt change in pollen and spore assemblages is noted. Pleistocene and Pliocene sediment contains spruce and fir pollen that appears to have been transported from northerly sources, whereas the middle Miocene sediment contains more temperate forms such as alder, hickory, oak, grasses and sedges that may have been derived from more proximal sources and thus have a more restricted transportational history.

DISCUSSION AND CONCLUSIONS

Cores recovered from these sites can be correlated on the basis of one common biostratigraphic zone (N. 17) as well as on the basis of similar sediment composition. Zone N. 16 is present in Holes 102 and 103. The nature of the sediments and the attitude of reflectors recorded on seismic reflection profiles (Markl *et al.*, 1970) suggest that at least the upper 600 meters of the northern end of the Blake-Bahama Outer Ridge is a large accumulation of rapidly-deposited, hemipelagic, silty carbonaceous clay of Pliocene-Pleistocene age that has been transported to this region from the north by southerly-flowing bottom currents. Erosion has occurred along both flanks of the ridge. The underlying 600 meters of late and middle Miocene hemipelagic sediment recovered at Site 104 appear to have been derived from nearer sources. The upper 150 meters of sediment recovered at Site 102 appears to have been deposited as a conformable lens of Pleistocene hemipelagic silty clay on top of the Pliocene and middle Miocene accumulations.

The western flank of the ridge in the vicinity of Site 103 represents a continuation of the straight, east-west oriented slope running from the vicinity of "Nose" of the Blake Plateau to the ridge crest at approximately

30° 30′ N. The unconformities apparent in the seismic profile near Site 103 must be related to the same processes that have formed this east-west linear slope. The unconformities and disturbed reflectors seen in profiles over the eastern flank of the Blake-Bahama Outer Ridge in the vicinity of Site 104 indicate erosion.

As discussed in a previous chapter, the Tertiary sediments at Site 101 at the southern end of the Blake-Bahama Outer Ridge have been transported from the north by southerly-flowing currents and, subsequently, penecontemporaneously sculpted and shaped by the Western Boundary Undercurrent (Heezen, Hollister and Ruddiman, 1966).

At Hole 102, the drilling-rate graph shows only one important break – that at a depth of 620 meters. In the appropriate region of the seismic record, there is only one reflector that could reasonably correlate with the drilling break; that is, the one at 0.62 second which is conformable to the topography and appears to cut across bedding planes. Such a correlation indicates an average sound velocity of 2.0 km/sec in the upper 600 meters of section. It is possible to divide the section into two layers and compute average velocities of 1.9 and 2.3 km/sec, respectively–as shown in the drilling-rate graph (Figure 3).

Drilling at Hole 103 did not achieve sufficient penetration to permit a velocity determination to be made.

At Hole 104, penetration was made at a uniform rate down to 615 meters where a very hard layer, or nodule, of ankerite was cored. Unfortunately, there was not enough time to drill deeper, so we cannot be certain whether the ankerite was an isolated nodule or part of an ankerite-rich zone. In any case, this drilling break is the only observed event to correlate with the reflector at 0.61 second. The correlation indicates an average sound velocity of 2.16 km/sec for the upper 600 meters, a value rather close to that computed for the section at Hole 102.

A sound velocity greater than 2 km/sec seems to be somewhat high for the hemipelagic mud cored at these sites, particularly when we consider that most of the material contained significant amounts of methane. However, if we assume a lower velocity for this material, we are faced with having to accept the fact that we drilled through the prominent reflector without noticing it and then encountered a significant drilling break underneath the reflector. This may indicate that it is the homogeneous zone beneath the reflector that resisted drilling, and the reflectivity of the zone just above it is due to factors not apparent in the normal examination of the cores.

Alternatively, we can accept the interval velocity of about 2 km/sec as a valid measurement and attribute the rather high velocity to the presence of the methane. Stoll *et al.* (1971) have pointed out that under usual deep sea conditions, the pressure and temperature in the uppermost few hundred meters of sediment are such that methane would exist as a hydrate–an ice-like substance. They further made laboratory measurements in which the speed of sound in water-saturated sand was observed to increase from about 1.7 km/sec to more than 2.5 km/sec after methane had been bubbled through the sample for several hours at 2° to 3° C and 800 to 1000 psi pressure. Although this may account for the abnormal sound velocity, this is not an obvious explanation of the reflector itself. The fact that it is so conformable to the sea floor and cuts across time lines ranging from mid-Miocene to Quaternary suggests that it is caused by a diagenetic process with a short time constant. It seems reasonable to assume that temperature would change much more rapidly than pressure with increasing depth in the sediment, so the diagenesis appears to have a strong tendency to follow an isotherm and, therefore, may be directly or indirectly related to the presence of gas.

REFERENCES

Andrews, J. E., 1967. Blake Outer Ridge; development by gravity tectonics. *Science.* **156**, 642.

Blow, W. H., 1969. Late Middle Eocene to Recent planktonic foraminiferal biostratigraphy: *Proc. First Intern. Conf. Plank. Microfossils.* **1**, 109.

Ewing, M. and Ewing, J. I., 1964. Distribution of oceanic sediments. *In Studies on Oceanography.* Tokyo (Geophysics Institute, Univ. of Tokyo, Japan), 525.

Heezen, B. C. and Hollister, C. D., 1964. Deep sea current evidence from abyssal sediments. *Marine Geol.* **1**, 141.

Heezen, B. C., Hollister, C. D., and Ruddiman, W. F., 1966. Shaping of the continental rise by deep geostrophic contour currents. *Science.* **152**, 502.

Hersey, J. B., Bunce E. T., Wyrick, R. F. and Dietz, F. T., 1959. Geophysical investigation of the continental margin between Cape Henry, Virginia and Jacksonville, Florida. *Bull. Geol. Soc. Am.* **70**, 437.

Markl, R. G., Bryan, G. M. and Ewing, J. I., 1970. Structure of the Blake Bahama Outer Ridge. *J. Geophys. Res.* **75**, 4539.

Martini, E. and Worsley, T., 1970. Standard Neogene calcareous nannoplankton zonation. *Nature.* **225**, 289.

Bryan, G. M., 1970. Hydrodynamic model of the Blake Outer Ridge. *J. Geophys. Res.* **75** (24), 4539.

Ewing, J., Ewing, M. and Leyden, R., 1966. Seismic profiler survey of the Blake Plateau. *Bull. Am. Assoc. Petrol. Geol.* **50** (9), 1948.

Stoll, R. D., Ewing, John and Bryan, G. M., 1971. Anomalous wave velocities in sediments containing gas hydrates. *J. Geophys. Res.* **76**, (8), 2090.

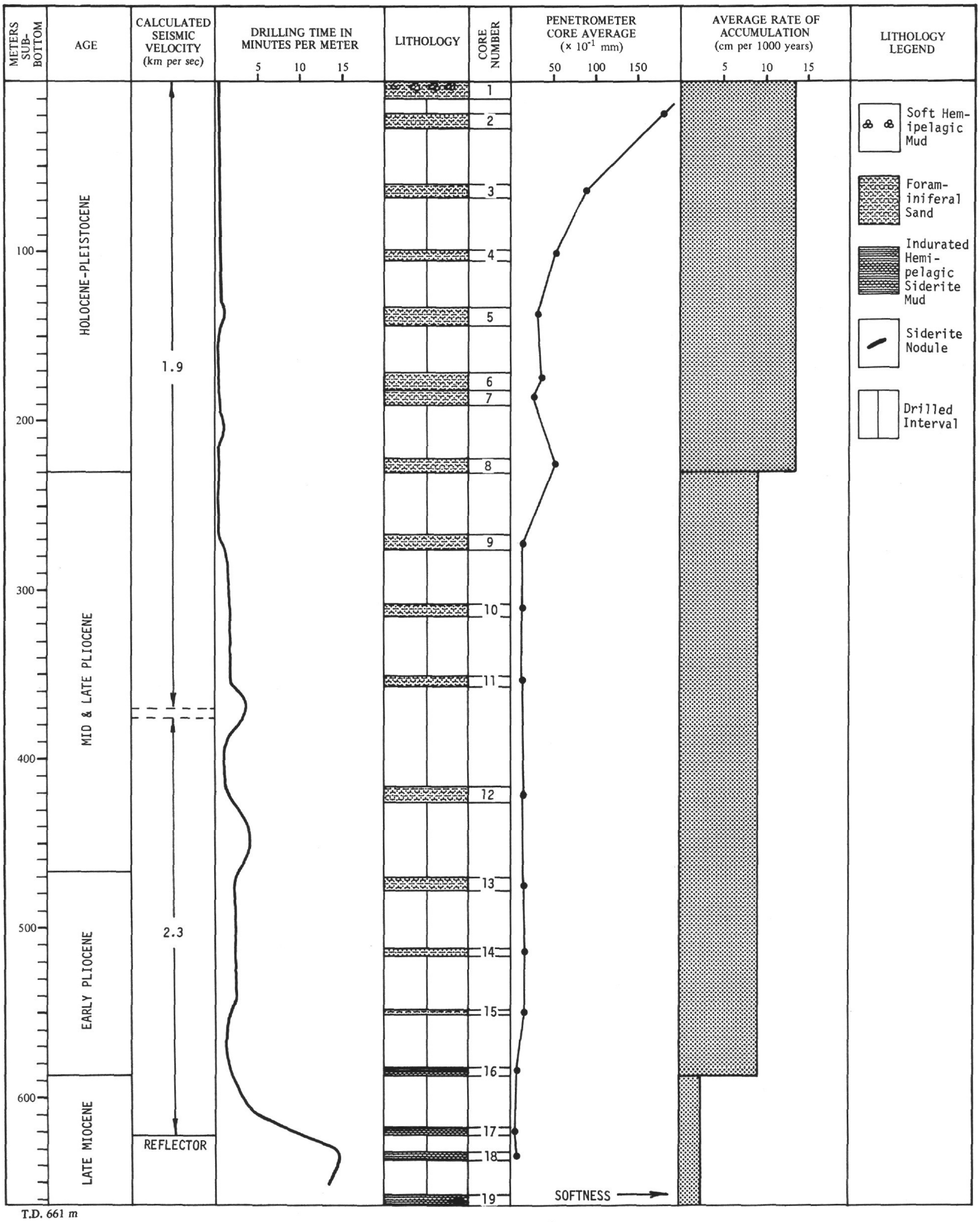


Figure 3a. *Site 102 summary chart*

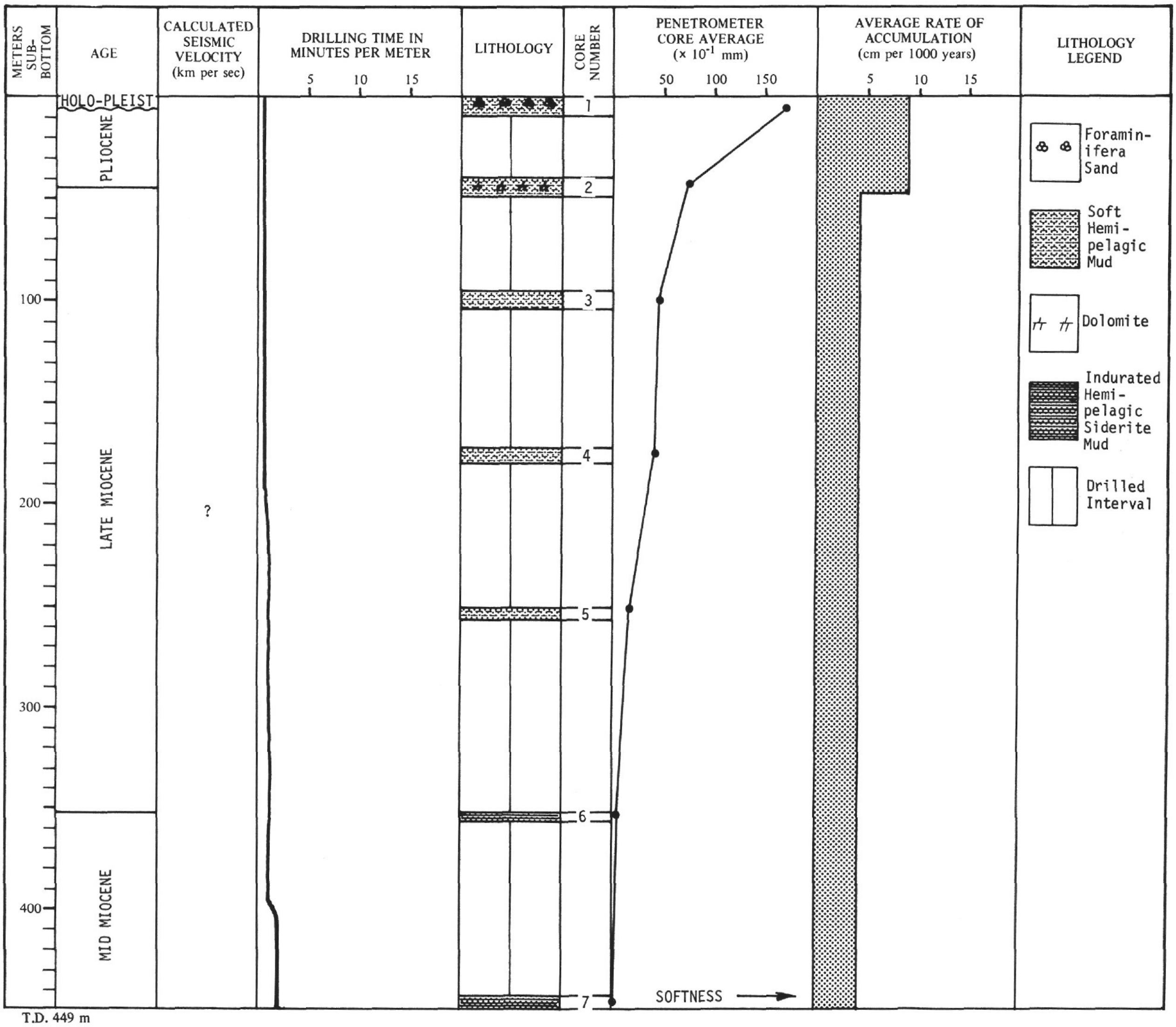


Figure 3b. *Site 103 summary chart*

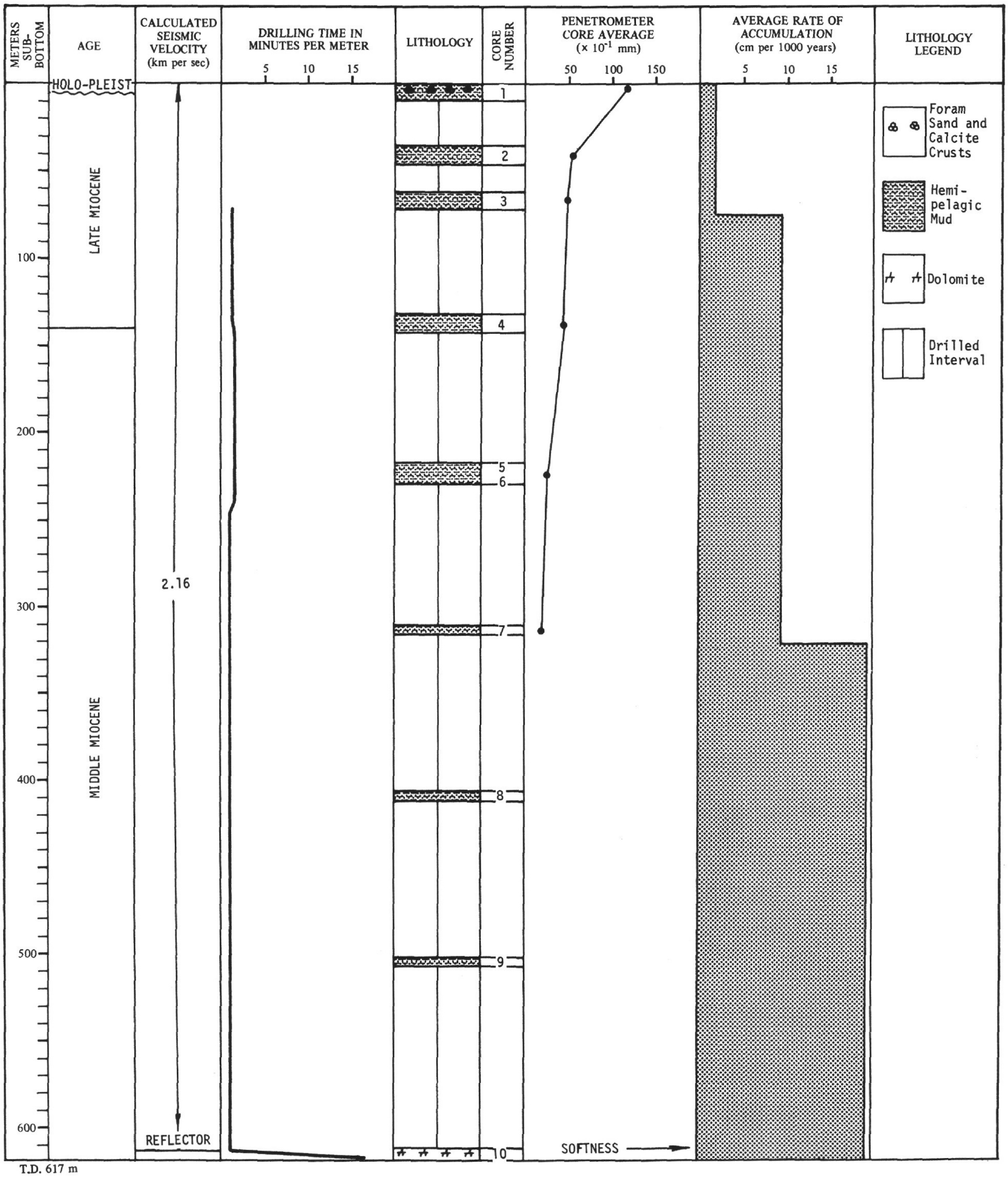


Figure 3c. *Site 104 summary chart*

Hole 102
Latitude: 30°43.93′N.
Longitude: 74°27.14′W.
Water depth: 3426 meters (drill pipe); 3414 meters (PDR)

Core No.	Interval Cored (meters)[a]				Lithology	Age		
	Depth	Amount	Recovery	Subbottom Depth		Foraminifera	Nannoplankton	Dinoflagellates
1	3436-3445	9	9	9	Gray hemipelagic mud	Holooene-Late Pleistocene	← Quaternary →	
(Drilled)	(3445-3454)	(9)		(18)				
2	3454-3463	9	8.7	27	Gray hemipelagic mud	Late Pleistocene	Early Quaternary	Quaternary
(Drilled)	(3463-3494)	(31)		(58)				
3	3494-3503	9	1.7	67	Gray hemipelagic mud	Late Pleistocene	Early Quaternary	Quaternary
(Drilled)	(3503-3532)	(29)		(96)				
4	3532-3541	9	4.3	105	Gray hemipelagic mud	Late Pleistocene	Early Quaternary	Quaternary
(Drilled)	(3541-3569)	(28)		(133)				
5	3569-3578	9	9	142	Gray hemipelagic mud	Late Pleistocene	Early Quaternary	Quaternary
(Drilled)	(3578-3608)	(30)		(172)				
6	3608-3617	9	9	181	Gray hemipelagic mud	Early Pleistocene	Early Quaternary	Quaternary
7	3617-3626	9	9	190	Gray hemipelagic mud	Early Pleistocene	Early Quaternary	Quaternary
(Drilled)	(3626-3655)	(29)		(119)				
8	3655-3664	9	1.8	228	Gray hemipelagic mud	Early Pleistocene-Late Pliocene	Early Quaternary	Quaternary
(Drilled)	(3664-3702)	(38)		(266)				
9	3702-3711	9	9	275	Gray hemipelagic mud	← Late Pliocene →		Pliocene
(Drilled)	(3711-3742)	(31)		(306)				
10	3742-3751	9	9	315	Gray hemipelagic mud	← Late Pliocene →		Pliocene

Figure 4a. *Core Summary table, Site 102.*

Core No.	Interval Cored (meters)[a]				Lithology	Age		
	Depth	Amount	Recovery	Subbottom Depth		Foraminifera	Nannoplankton	Dinoflagellates
(Drilled)	(3751-3789)	(38)		(353)				
11	3789-3793	4	3	357	Gray hemipelagic mud	Late Pliocene	Middle Pliocene	Pliocene
(Drilled)	(3793-3855)	(62)		(419)				
12	3855-3859	4	4.5	423	Gray hemipelagic mud	Late Pliocene	Middle Pliocene	Pliocene
(Drilled)	(3859-3909)	(50)		(473)				
13	3909-3912	3	4.4	476	Gray hemipelagic mud	← Early Pliocene →		Pliocene
(Drilled)	(3912-3948)	(36)		(512)				
14	3948-3949	1	1.4	513	Gray hemipelagic mud	← Early Pliocene →		Pliocene
(Drilled)	(3949-3984)	(35)		(548)				
15	3984-3985	1	1	549	Gray hemipelagic mud	← Early Pliocene →		Pliocene
(Drilled)	(3985-4020)	(35)		(584)				
16	4020-4021	1	0.7	585	Gray hemipelagic mud	Early Pliocene-Late Miocene	Early Pliocene	Pliocene
(Drilled)	(4021-4054)	(33)		(618)				
17	4054-4055	1	1.5	619	Gray hemipelagic mud	← Late Miocene →		Miocene
(Drilled)	(4055-4070)	(15)		(634)				
18	4070-4072	2	3.4	636	Gray hemipelagic mud	← Late Miocene →		Miocene
(Drilled)	(4072-4095)	(23)		(659)				
19	4095-4097	2	1.5	661	Gray hemipelagic mud	← Late Miocene →		Miocene

[a]All intervals are measured by drill pipe from the derrick floor which is 10 meters above water surface.

Figure 4a. *Core Summary table, Site 102* (Cont)

Hole 103

Latitude: 30°27.08′N.

Longitude: 74°34.99′W.

Water depth: 3964 meters (drill pipe); 3992 meters (PDR)

Core No.	Interval Cored (meters)[a]				Lithology	Age		
	Depth	Amount	Recovery	Subbottom Depth		Foraminifera	Nannoplankton	Dinoflagellates
1	3974-3982	8	9	8	Hemipelagic mud	Holocene- Late Pleistocene- Early Pliocene	Early Pliocene	
(Drilled)	(3982-4012)	(30)		(38)				
2	4012-4021	9	9	47	Hemipelagic mud with dolomite-rich layer	Early Pliocene Late Miocene	Late Miocene	
(Drilled)	(4021-4068)	(47)		(94)				
3	4068-4077	9	9	103	Hemipelagic mud	← Late Miocene →		Miocene
(Drilled)	(4077-4144)	(67)		(270)				
4	4144-4153	9	6.8	179	Hemipelagic mud	← Late Miocene →		Miocene
(Drilled)	(4153-4221)	(68)		(247)				
5	4221-4230	9	2.5	256	Hemipelagic mud	← Late Miocene →		Miocene
(Drilled)	(4230-4317)	(87)		(343)				
6	4317-4326	9	1.4	352	Hemipelagic mud	← Late Miocene →		Miocene
(Drilled)	(4326-4414)	(88)		(440)				
7	4414-4423	9	0.25	449	Dark gray shale	Late Miocene	Middle Miocene	

[a]All intervals are measured by drill pipe from the derrick floor which is 10 meters above water surface.

Figure 4b. *Core Summary table, Site 103.*

Hole 104

Latitude: 30°49.65′N.

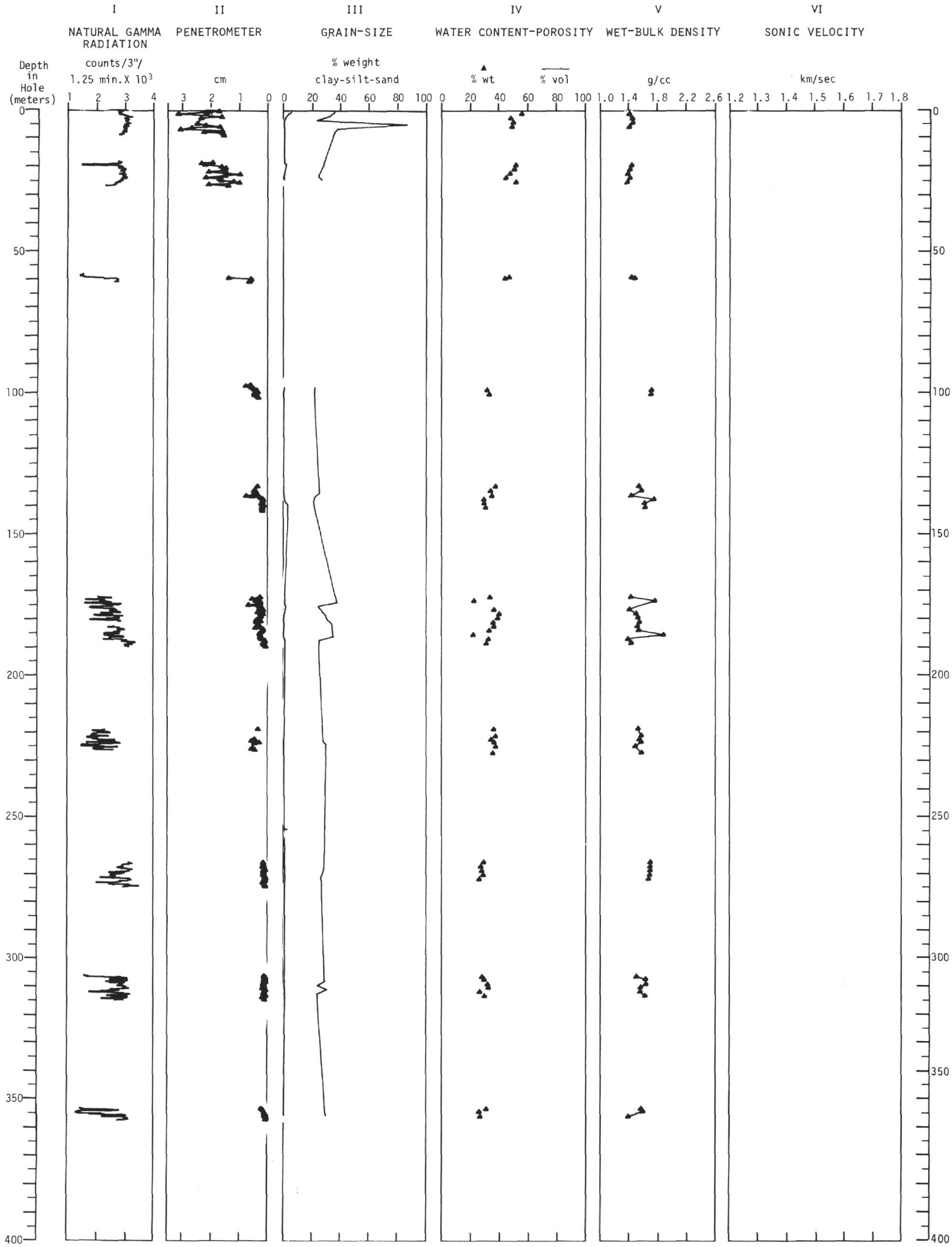
Longitude: 74°19.64′W.

Water depth: 3811 meters (drill pipe); 3833 meters (PDR)

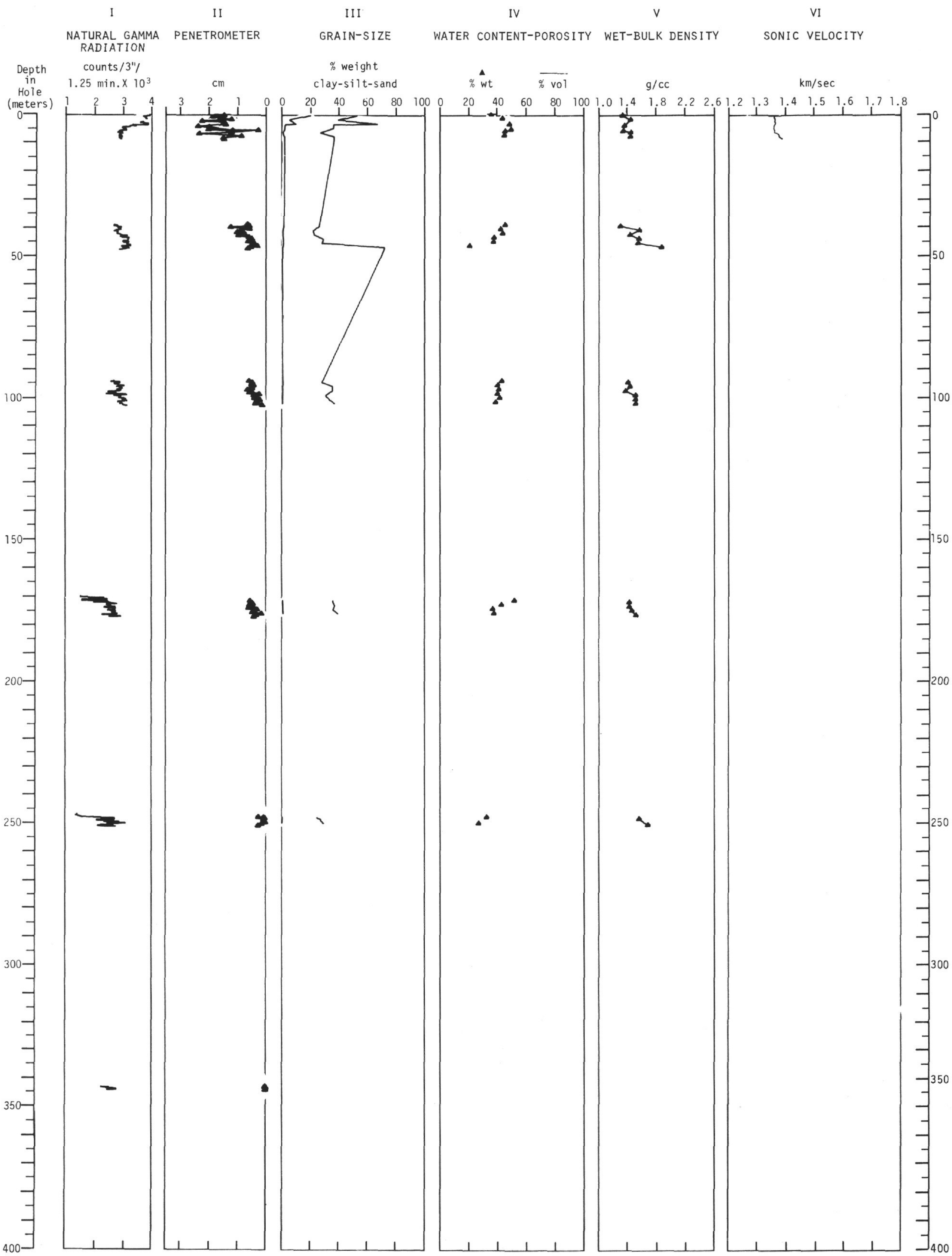
Core No.	Interval Cored (meters)[a]				Lithology	Age		
	Depth	Amount	Recovery	Subbottom Depth		Foraminifera	Nannoplankton	Dinoflagellates
1	3821-3830	9	9	9	Hemipelagic mud worm-burrow crust	Holocene-Pleistocene-Late Miocene	Late Miocene	
(Drilled)	(3830-3857)	(27)		(36)				
2	3857-3866	9	9	45	Hemipelagic mud	← Late Miocene →		Miocene
(Drilled)	(3866-3883)	(17)		(62)				
3	3883-3892	9	9	71	Hemipelagic mud	← Middle Miocene →		Miocene
(Drilled)	(3892-3954)	(62)		(133)				
4	3954-3963	9	9	142	Hemipelagic mud	← Middle Miocene →		Miocene
(Drilled)	(3963-4031)	(68)		210				
5	4031-4040	9	0	219	Hemipelagic mud			
6	4040-4049	9	9	228	Hemipelagic mud	← Middle Miocene →		Miocene
(Drilled)	(4049-4127)	(78)		(306)				
7	4127-4136	9	3.6	315	Hemipelagic mud	← Middle Miocene →		Miocene
(Drilled)	(4136-4222)	(86)		(401)				
8	4222-4231	9	4	410	Hemipelagic mud	← Middle Miocene →		Miocene
(Drilled)	(4231-4316)	(85)		(495)				
9	4316-4325	9	2.5	504	Hemipelagic mud	← Middle Miocene →		Miocene
(Drilled)	(4325-4436)	(111)		(615)				
10	4436-4438	2	1	617	Hemipelagic mud and ankerite layer	← Middle Miocene →		Miocene

[a]All intervals are measured by drill pipe from derrick floor which is 10 meters above water surface.

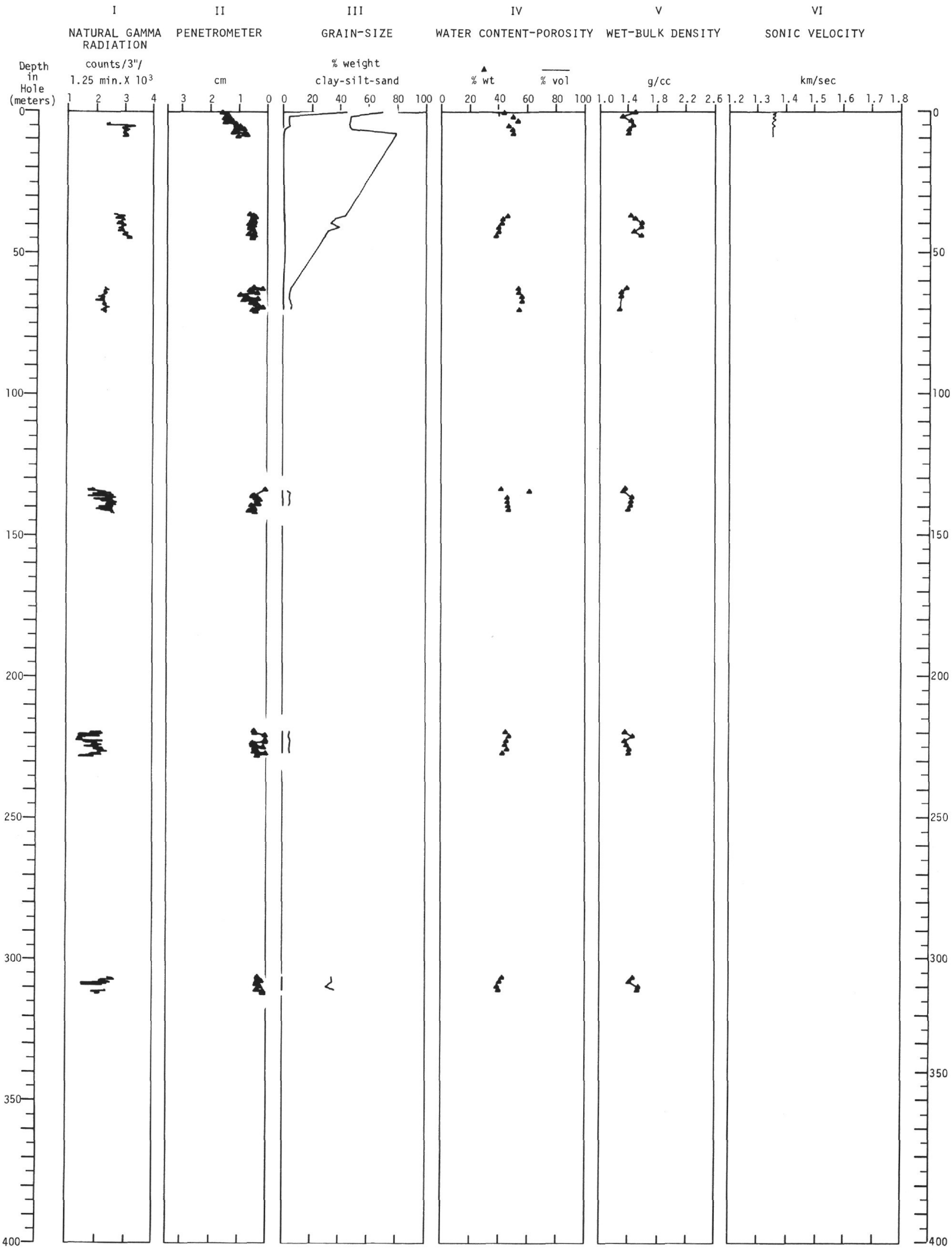
Figure 4c. *Core Summary table, Site 104.*



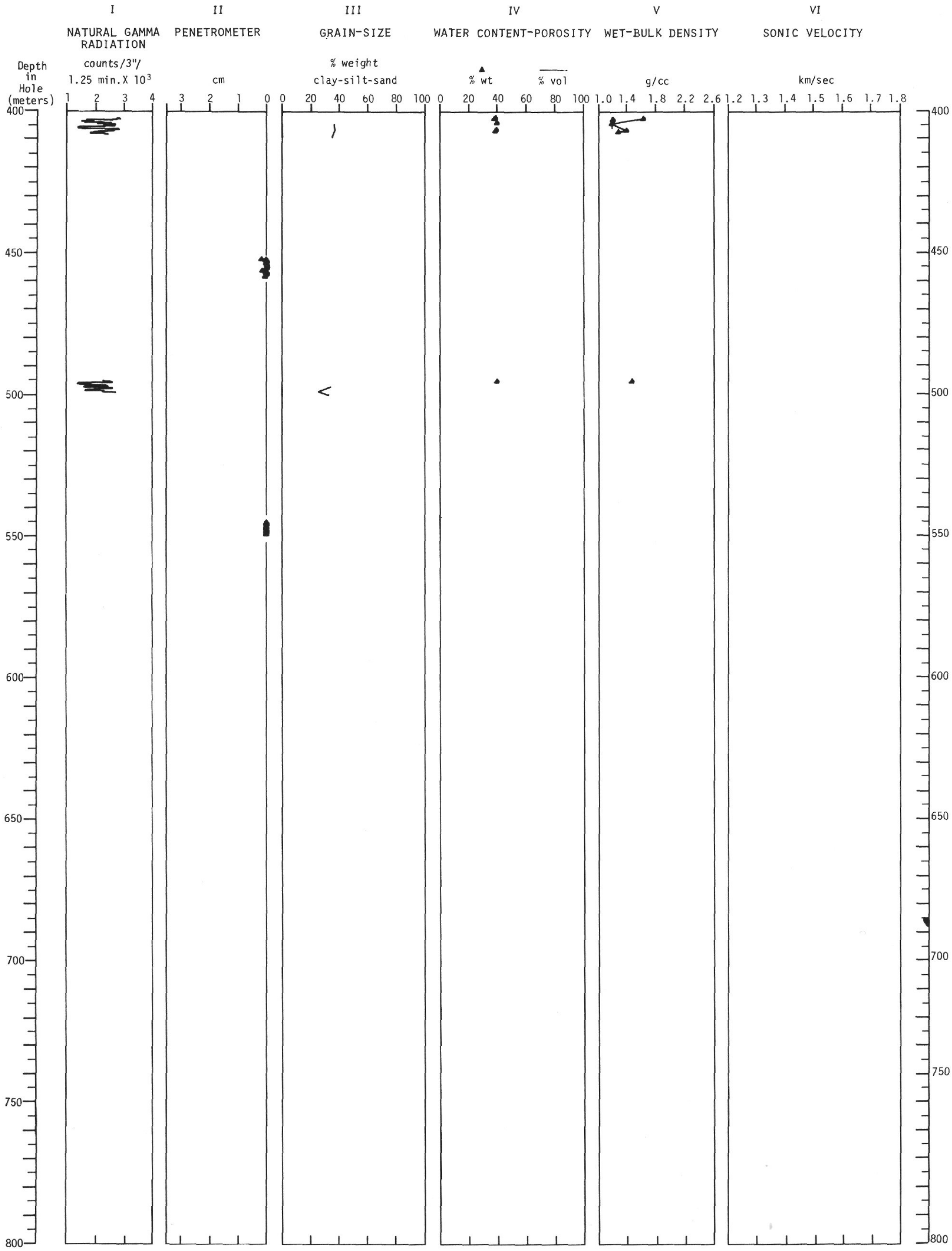
Summary of Physical Properties, Hole 102



Summary of Physical Properties, Hole 103



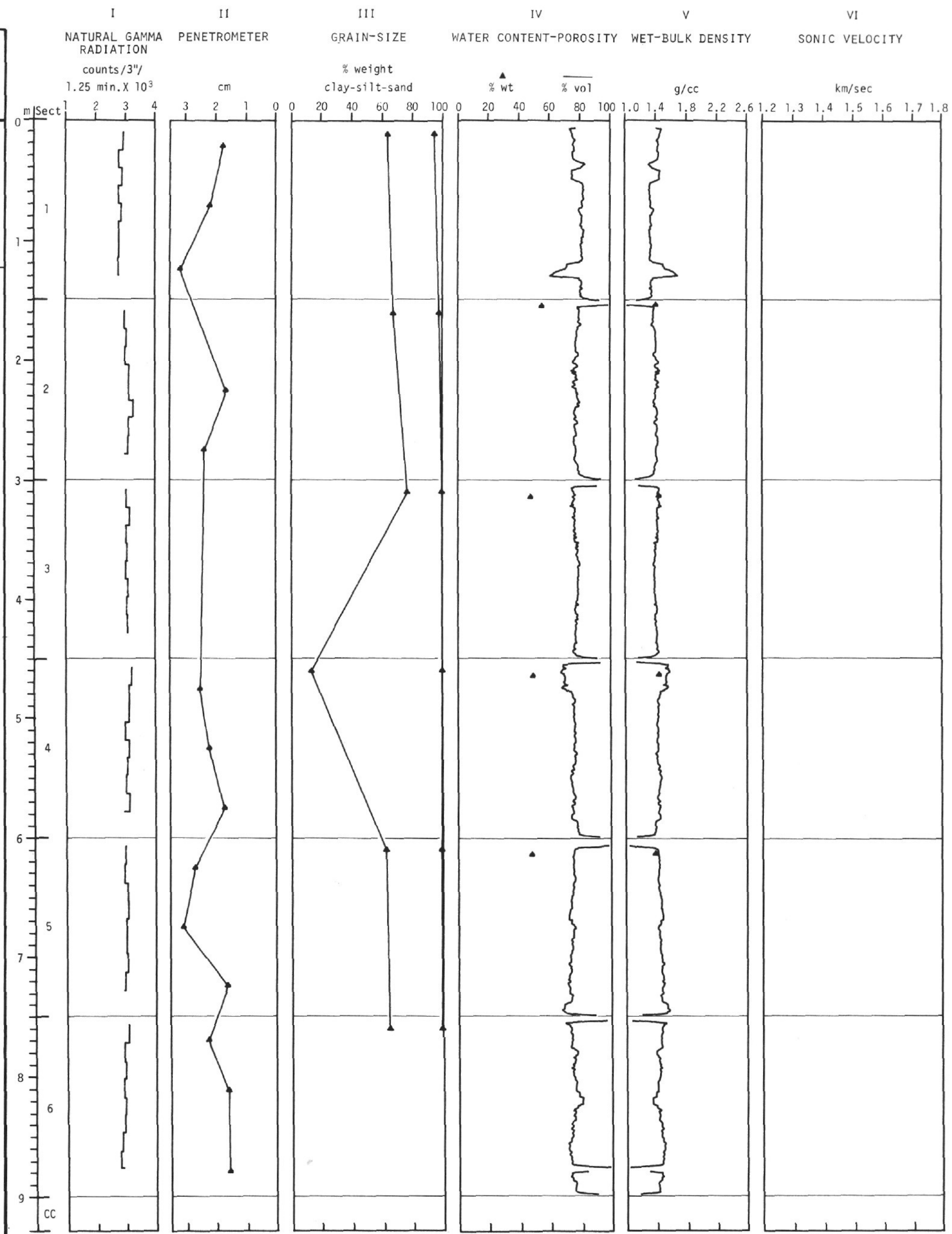
Summary of Physical Properties, Hole 104



Summary of Physical Properties, Hole 104 (Cont'd)

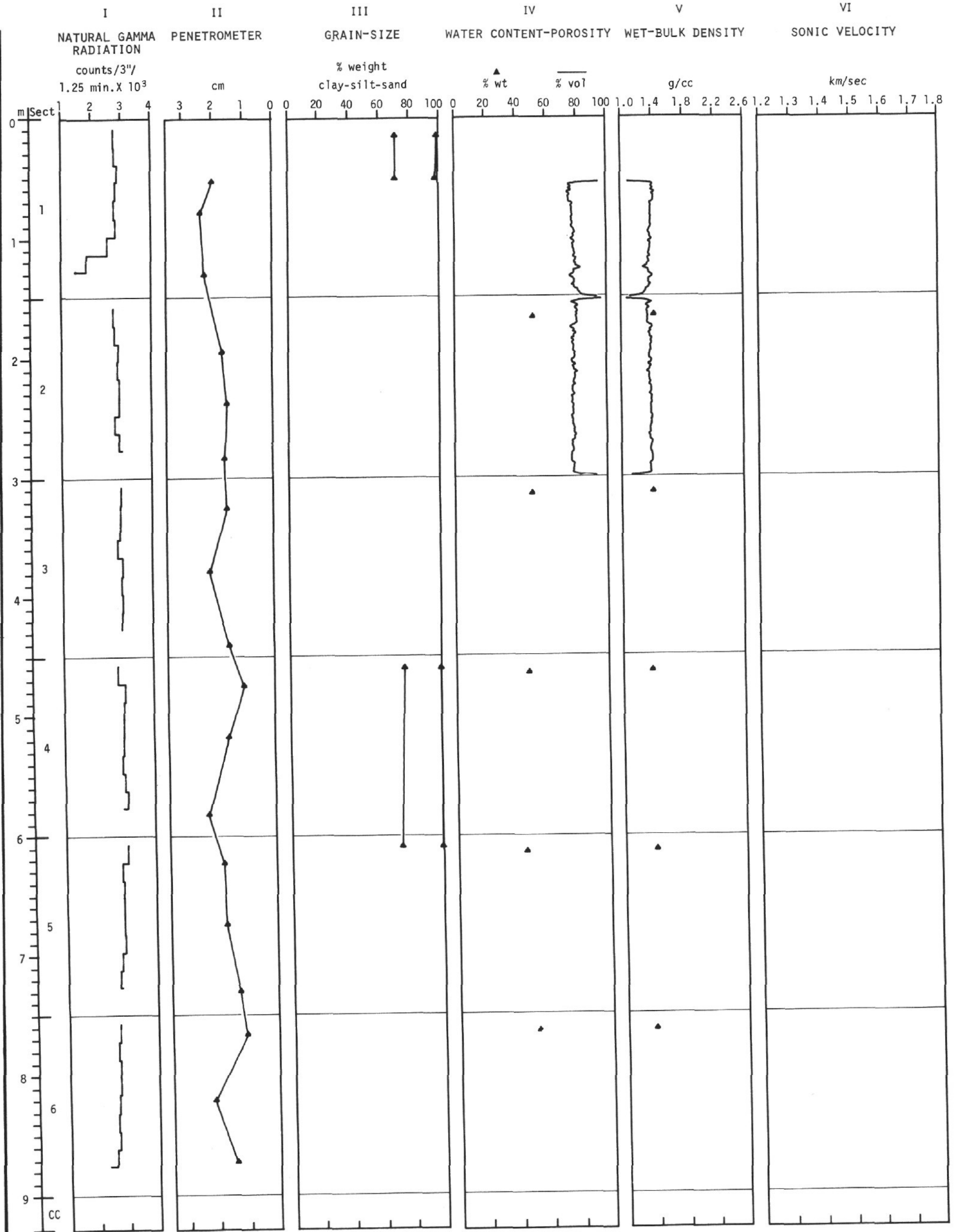
Hole 102, Core 1 (0m to 9m)

AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
HOLOCENE		0–1	1		SS F, SS F, SS, SS	Foram-nannoplankton ooze; very soft, varicolored brown and gray. Clay, quartz, mica, common (2.5Y5/2). Hemipelagic carbonaceous silty clay; soft, plastic, dark gray (10YR4/1).	PLANKTONIC FORAMINIFERS: *Globigerina calida*, *Globorotalia truncatulinoides (sinistral)*, *Globigerina rubescens*, *Globigerinoides tuber f. rosea*, *Globorotalia cultrata*, *Globoquadrina dutertrei*
LATE PLEISTOCENE	*Globigerina calida/Sphaeroidinella excavata* N.23 / *Gephyrocapsa oceanica*	1–9	1, 2, 3, 4, 5, 6, CC		SS F (Sections 2–6); CN (Section 5); F,CN (Section 6); SS (CC)	Increasing abundance of dark (N1) iron sulfide specks and stains. Faint rose-gray colored silty clay. Fragments of detrital carbonate common in Section 2. Occasional faint mottling of lighter (5YR 6/1) material. Clay sized rutile needles common in Section 3. Irregular calcite grains common in Section 4. Bed and clast of firm clay. Rutile needles and fragments of detrital calcite in both Sections 5 and 6. General Comments: - Increasing abundance of diatoms and sponge spicules towards bottom. - Dark iron sulfide specks throughout core. - Increasing abundance of quartz silt and heavy mineral grains towards bottom of core. -Carbonate average 15%	PLANKTONIC FORAMINIFERS: *Globorotalia truncatulinoides (Dextral)*, *Turborotalia inflata*. CALCAREOUS NANNOPLANKTON: *Gephyrocapsa oceanica*, *Umbilicosphaera mirabilis*, *Ceratolithus cristatus*, *Cyclococcolithina leptopora*
			CC		SS	Calcite fragments abundant, rutile needles common.	CORE CATCHER. CALCAREOUS NANNOPLANKTON: *Gephyrocapsa oceanica*, *Ceratolithus cristatus*, *Helicopontosphaera kamptneri*, *Umbilicosphaera mirabilis*.



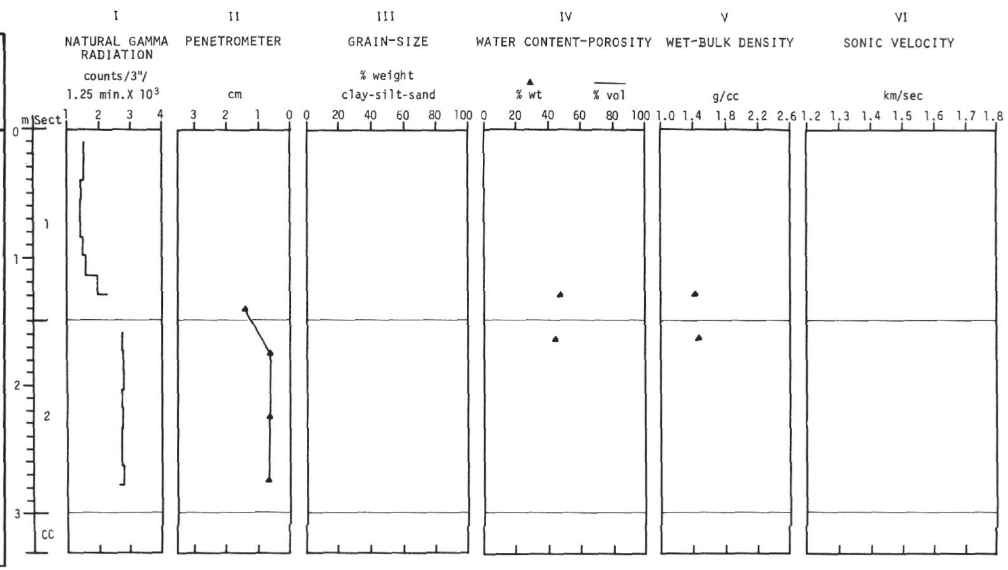
Hole 102, Core 2 (18m to 27m)

AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
LATE PLEISTOCENE	Globigerina calida/Sphaeroidinella excavata N.23 Ellipsoplacolithus lacunosus	0–1.5	1		SS	Hemipelagic carbonaceous silty clay; soft, plastic, dark greenish gray (5G4/1) with mottling of greenish gray (5G6/1) and light olive gray (5Y6/1).	
		1.5–3	2		SS, CN		CALCAREOUS NANNOPLANKTON: *Gephyrocapsa oceanica, Ellipsoplacolithus lacunosus, Ceratolithus cristatus, Syracosphaera pulchra, Cyclococcolithina leptopora*
		3–4.5	3		SS	Heavy minerals common in Sections 2 and 3. Rutile needles common in Sections 3 and 4.	
		4.5–6	4		SS	Radiolarians rare in Sections 4 and 5. Occasional pyrite nodules. General Comments: -Sediment broken into foamy chunks due to gas expansion.	
		6–7.5	5		SS	-Abundant black specks of iron sulfide common throughout. -Abundant radiolarians, diatoms, and sponge spicules. -Common organic matter and calcite fragments throughout. -Increasing amount of sand, nannoplankton and radiolarians towards bottom of core.	
		7.5–9	6		SS	-Carbonate average 10%. Gradual change to greenish gray color (5G6/1).	*CORE CATCHER* PLANKTONIC FORAMINIFERS: *Globorotalia truncatulinoides (sinistral), Turborotalia inflata*
			CC		F, CN, SS		CALCAREOUS NANNOPLANKTON: *Gephyrocapsa oceanica, Ceratolithus cristatus, Rhabdosphaera stylifera, Syracosphaera pulchra, Cyclococcolithina leptopora*



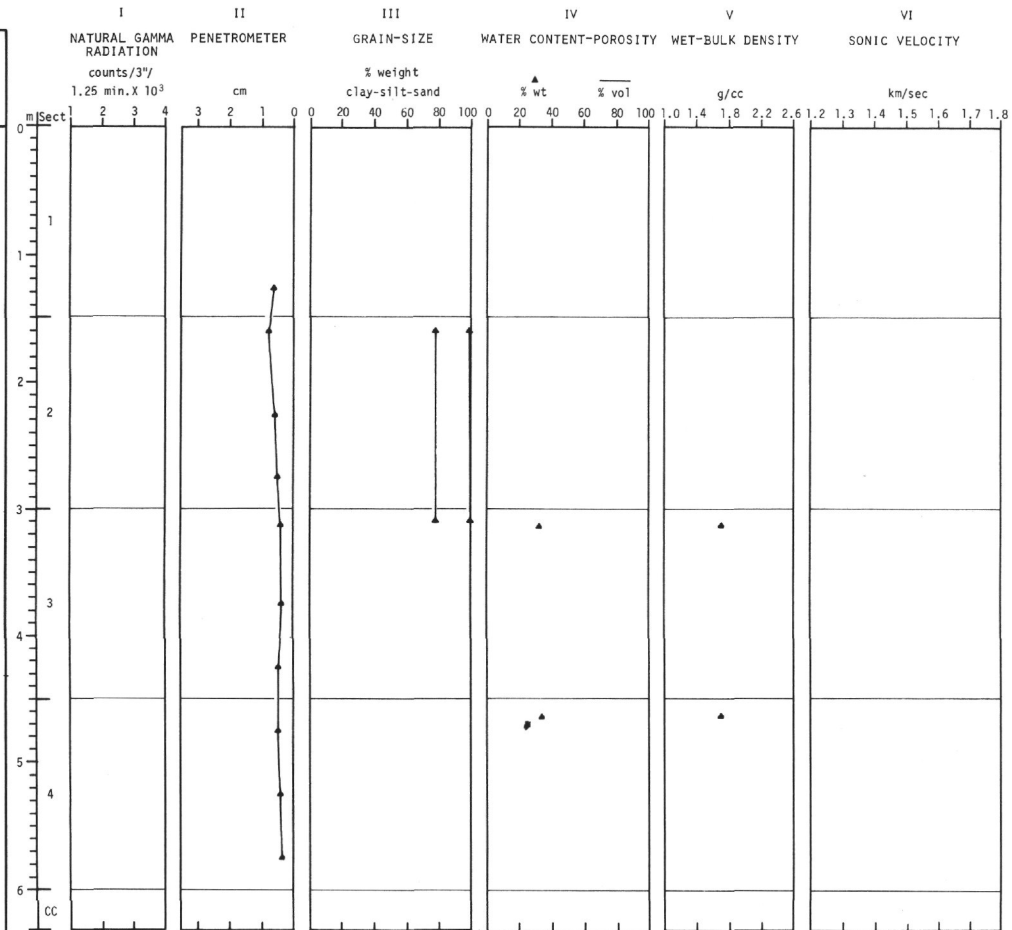
Hole 102, Core 3 (58m to 67m)

AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
LATE PLEISTOCENE	Globigerina calida/Sphaeroidinella excavata N.23 Ellipsoplacolithus lacunosus	1 2 3	1 2 CC		CN SS F,CN SS	<u>Hemipelagic carbonaceous silty clay</u>; soft, plastic, dark greenish gray (5G4/1) slight mottling of lighter shades. General Comments: -Dark specks of iron sulfide common throughout. -Rutile needles common in top of section and rare in core catcher sample. -Fragmental calcite rare in top and common in core catcher sample. -Carbonate average 25%.	CALCAREOUS NANNOPLANKTON: *Gephyrocapsa oceanica, Ceratolithus cristatus, Rhabdosphaera, Stylifera, Helicopontosphaera kamptneri, Syracosphpera pulchra* *CORE CATCHER* PLANKTONIC FORAMINIFERS: *Globorotalia truncatulinoides (sinistral), Turborotalia inflata, Globigerina pachyderma* CALCAREOUS NANNOPLANKTON: *Gephyrocapsa oceanica, Ellipsoplacolithus lacunosus, Syracosphaera pulchra, Ceratolithus cristatus, Cyclococcolithina leptopora*



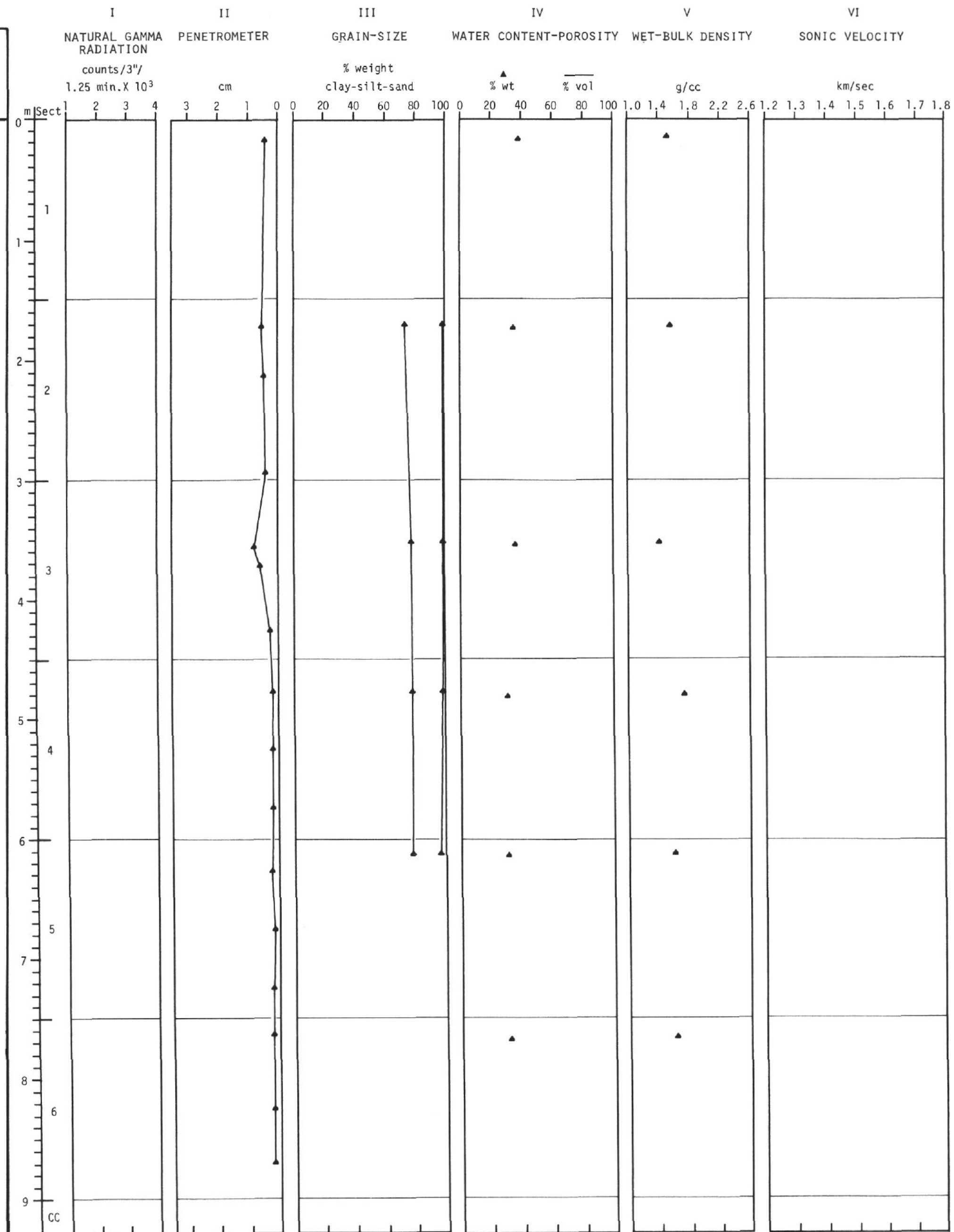
Hole 102, Core 4 (96m to 105m)

AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
EARLY PLEISTOCENE	*Globorotalia truncatulinoides* N.22 *Ellipsoplacolithus lacunosus*	1–7	1, 2, 3, 4, CC		SS, CN (Sect. 2) SS (Sect. 3) SS (Sect. 4) F, CN, SS (CC)	Hemipelagic carbonaceous silty clay; soft, plastic, greenish gray (5G5/1) with intense mottling of light greenish gray (5G7/1). Dark greenish gray (5G 4/1) with mottling of brownish gray (5YR4/1) and greenish gray (5G6/1). Olive gray (5Y4/1) with moderate mottling of dark greenish gray (5GY4/1). General Comments: - Radiolarians, diatoms and sponge spicules rare throughout. - Quartz silt abundant in upper portions of core. - Nannoplankton increase towards bottom of core. - Voids due to gas expansion. - Carbonate average 8%. - Black specks of iron sulfide common throughout core. - Calcite fragments abundant and rutile needles rare throughout.	CALCAREOUS NANNOPLANKTON: *Ellipsoplacolithus lacunosus, Gephyrocapsa oceanica, Syracosphaera pulchra, Rhabdosphaera stylifera, Cyclococcolithina leptopora, Ceratolithus cristatus* *CORE CATCHER* PLANKTONIC FORAMINIFERS: *Globorotalia truncatulinoides (Dextral), Globorotalia cultrata (sinistral), Turborotalia inflata.* CALCAREOUS NANNOPLANKTON: *Gephyrocapsa oceanica, Ellipsoplacolithus lacunosus, Rhabdosphaera stylifera, Ceratolithus cristatus*

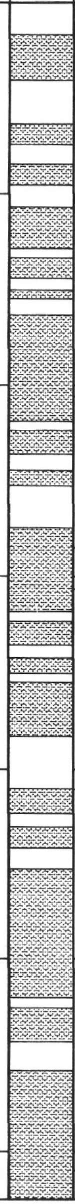


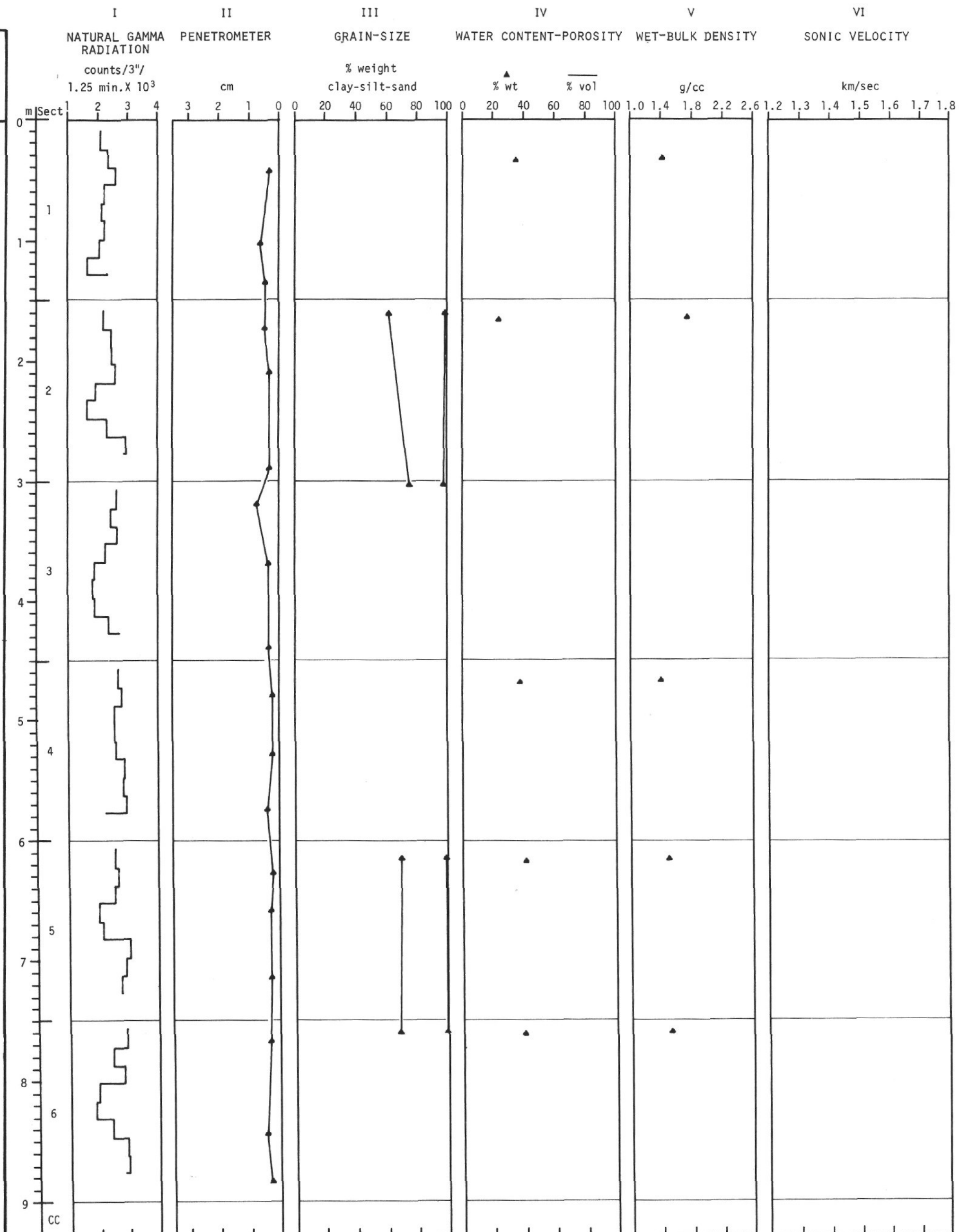
Hole 102, Core 5 (133m to 142m)

AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
EARLY PLEISTOCENE	*Globorotalia truncatulinoides* N.22 *Ellipsoplacolithus lacunosus*	0–9	1, 2, 3, 4, 5, 6, CC		SS; SS; SS; SS, CN; SS; SS; F, CN; SS	Hemipelagic carbonaceous silty clay; soft plastic, greenish gray (5G5/1), slight mottling of olive gray (5Y4/1) and brownish gray (5YR4/1). General Comments: - Clay mineral content decreases towards the lower half of the core. - Foraminifers increase in abundance towards lower part of the core. - Siliceous forms are rare in core. - Core highly distrubed throughout. - Voids due to gas expansion. - Black specks of iron sulfide common. - Calcite fragments generally common, rutile needles generally rare. Glauconite common in Section 2. Pyrite nodule. Pyrite nodules.	CALCAREOUS NANNOPLANKTON: *Ellipsoplacolithus lacunosus, Gephyrocapsa oceanica, Rhabdosphaera stylifera, Discolithina japonica, Cyclococcolithina leptopora* *CORE CATCHER* PLANKTONIC FORAMINIFERS: *Globorotalia conomiozea, Globorotalia cultrata (sinistral), Globorotalia truncatulinoides (Dextral), Turborotalia inflata, Globigerina pachyderma.* CALCAREOUS NANNOPLANKTON: *Ellipsoplacolithus lacunosus, Gephyrocapsa oceanica, Discolithina japonica, Cyclococcolithina leptopora*



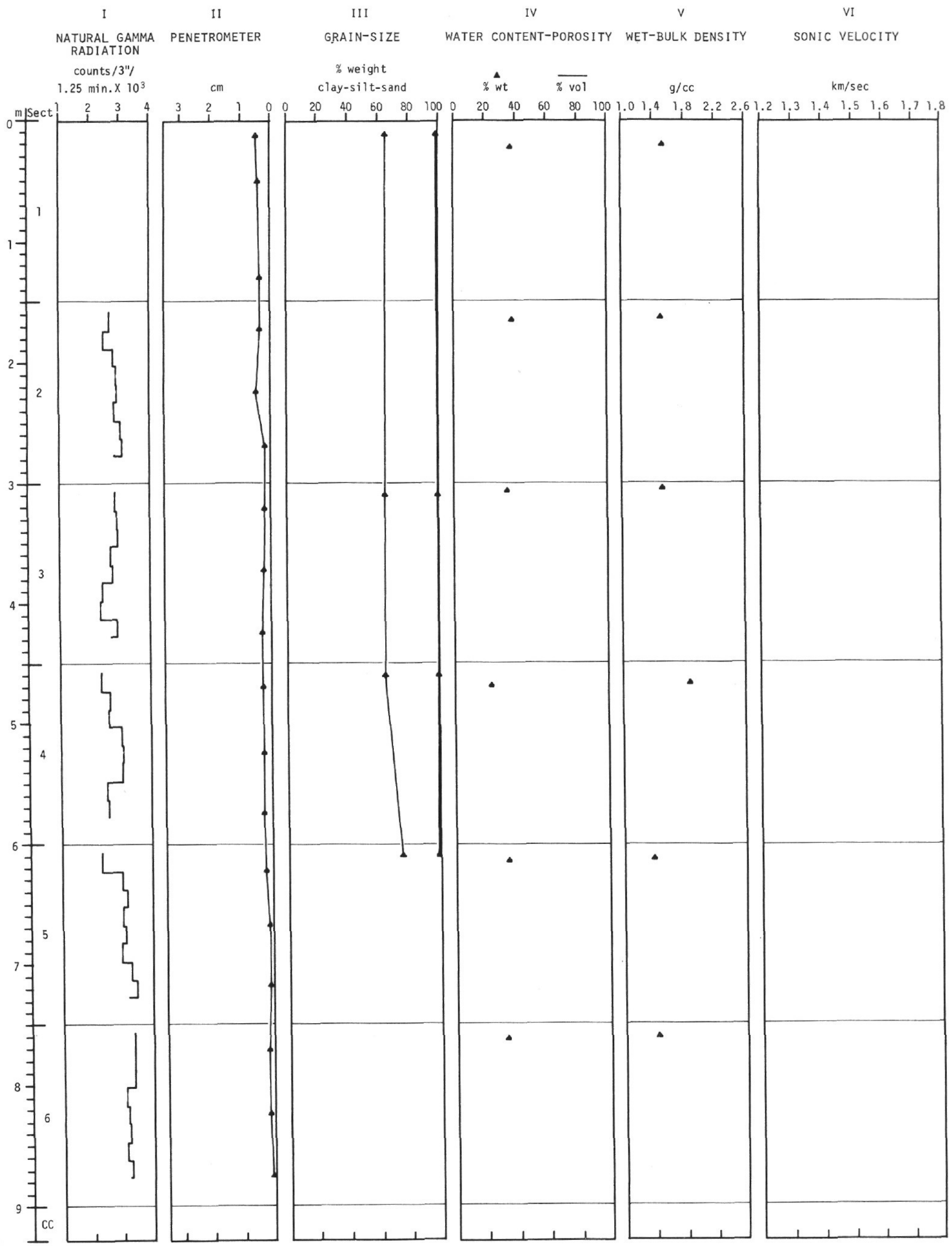
Hole 102, Core 6 (172m to 181m)

AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
EARLY PLEISTOCENE	Globorotalia truncatulinoides N.22; Ellipsoplacolithus lacunosus	0–9	1, 2, 3, 4, 5, 6, CC		SS, SS, SS, CN, SS, SS, SS, F,CN SS	Hemipelagic carbonaceous silty clay; soft, plastic, greenish gray (5G5/1) with mottling of olive gray (5Y4/1). General Comments: -Abundance of voids due to expansion of gas. Sediment occasionally very foamy. -Some very soupy sediment in the void intervals. -Dark (N2) specks of iron sulfide common throughout. -Foraminifers decrease towards bottom of core. -Sponge spicules and diatoms are common throughout core. -Calcite fragments generally common throughout core. -Carbonate average 27%.	CALCAREOUS NANNOPLANKTON: *Ellipsoplacolithus lacunosus, Gephyrocapsa oceanica, Cyclococcolithina leptopora, Rhabdosphaera stylifera, Ceratolithus cristatus* *CORE CATCHER* PLANKTONIC FORAMINIFERS: *Turborotalia tosaensis, Globorotalia truncatulinoides (random), Gl. cultrata (sinistral), Turborotalia inflata.* CALCAREOUS NANNOPLANKTON: *Ellipsoplacolithus lacunosus, Gephyrocapsa oceanica, Ceratolithus cristatus*



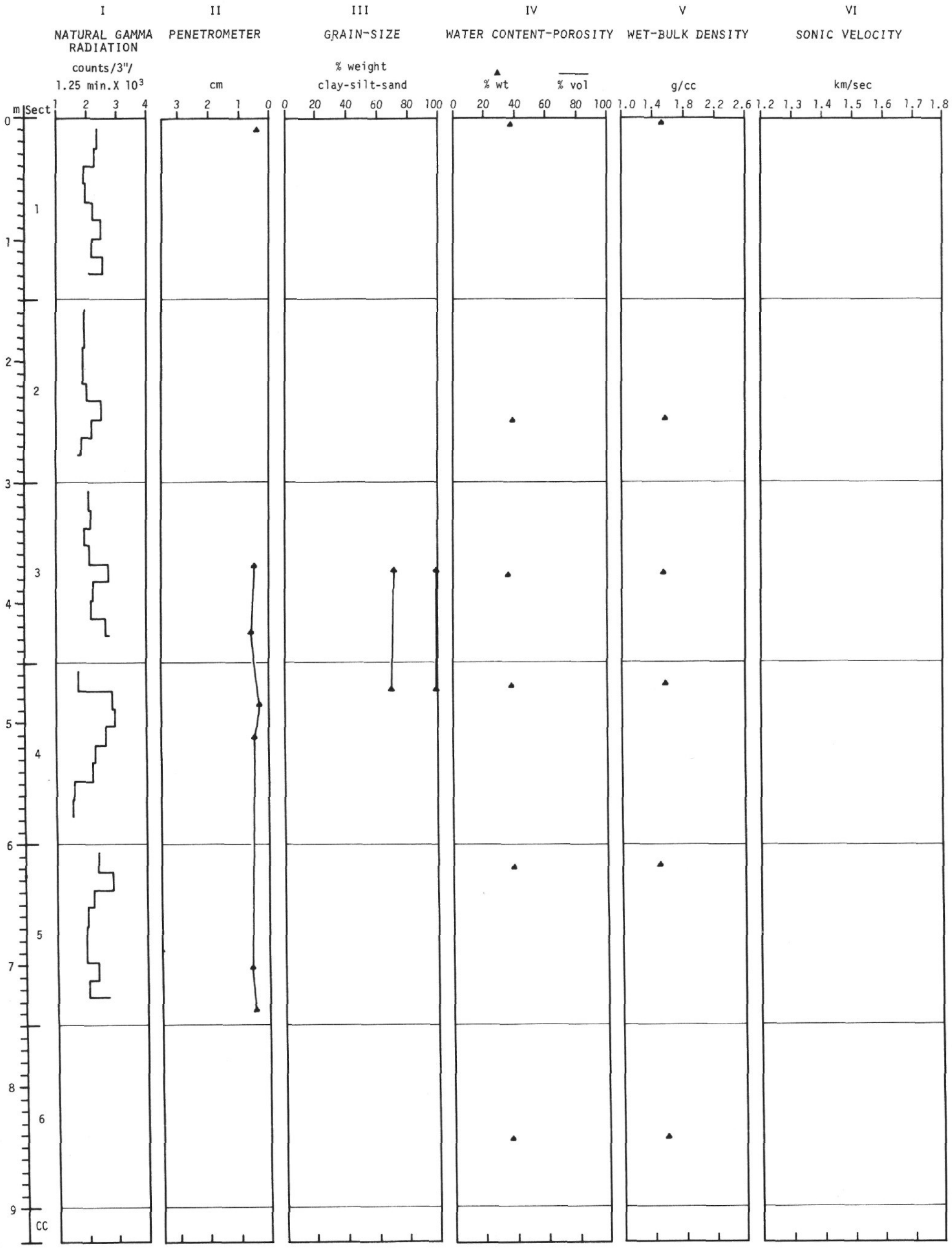
Hole 102, Core 7 (181m to 190m)

AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
EARLY PLEISTOCENE	Globorotalia truncatulinoides N.22 Ellipsoplacolithus lacunosus	0–1.5	1		SS, CN	<u>Hemipelagic carbonaceous silty clay</u>; soft, plastic, dark greenish gray (5G4/1) with faint gray mottling (5GY6/1). General Comments: - Burrow fillings of silt sized quartz and feldspar. - Black specks of iron sulfide throughout.	CALCAREOUS NANNOPLANKTON: *Ellipsoplacolithus lacunosus, Cyclococcolithina leptopora, Discolithina japonica, Ceratolithus cristatus, Rhabdosphaera stylifera*
		1.5–3	2		SS	- Voids due to gas expansion. - First hint of downhole trend towards fewer carbonate fragments in bottom of core (Section 5). - Carbonate average 16%.	
		3–4.5	3		SS	Sediment firmer from top of Section 3 downward Greenish gray (5G 5/1) with mottling of dusky yellow green (5GY 5/2) from top of Section 3 to Section 5.	
		4.5–6	4		SS, SS	Increased quartz silt content in upper part of Section 4 and first (downhole) abundant occurence of siderite in silt layer. Dramatic lack of calcareous and siliceous tests in Section 4.	
		6–7.5	5		SS	Gradual color change to dark greenish gray (5GY4/1 and 5G4/1).	
		7.5–9	6		SS, SS		
		9	CC		F,CN		*CORE CATCHER* PLANKTONIC FORAMINIFERS: *Turborotalia inflata, Turborotalia tosaensis, Globorotalia truncatulinoides (sinistral)* CALCAREOUS NANNOPLANKTON: *Ellipsoplacolithus lacunosus, Ceratolithus cristatus, Cyclococcolithina leptopora, Discolithina japonica, Rhabdosphaera stylifera, Helicopontosphaera kamptneri*



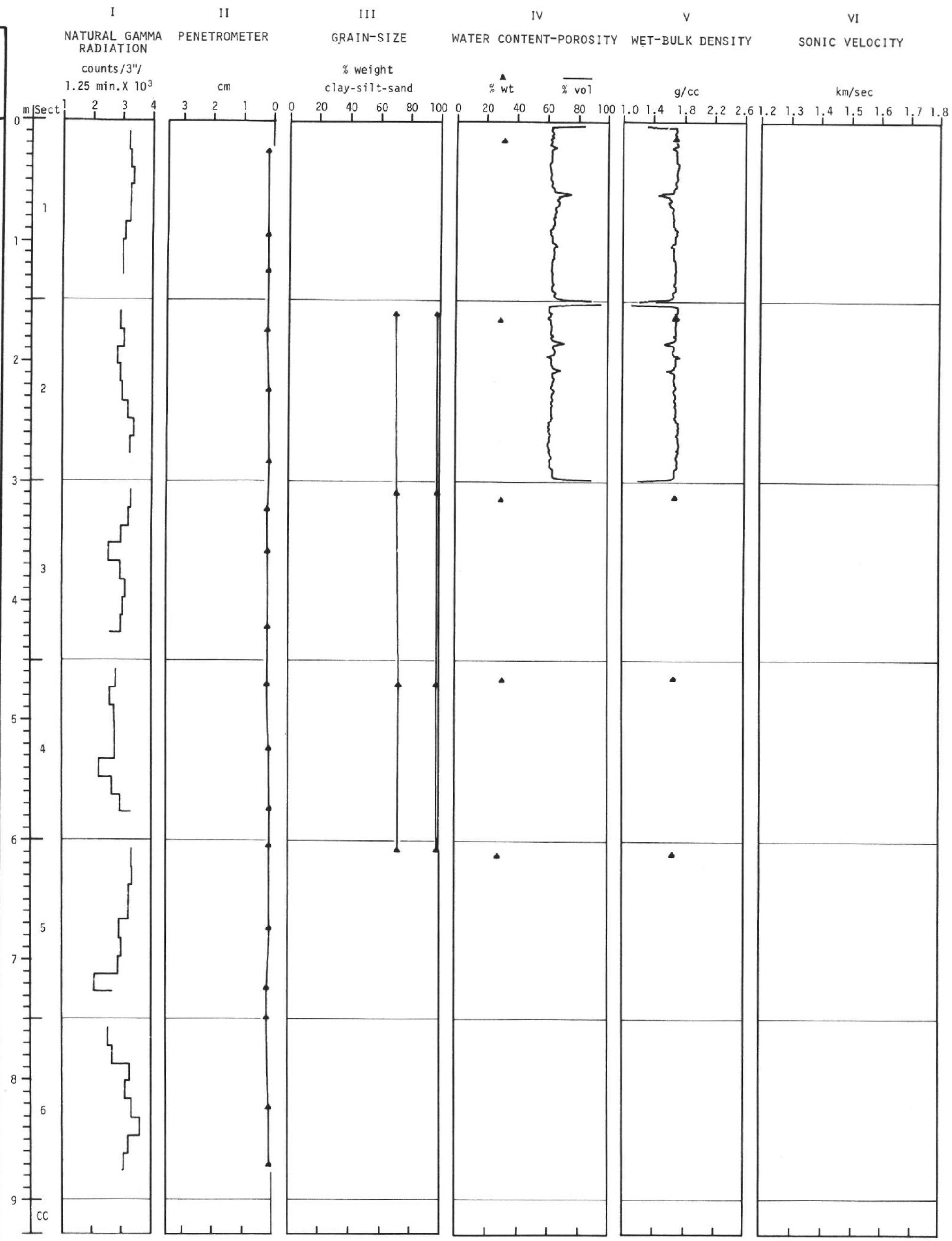
Hole 102, Core 8 (219m to 228m)

AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
EARLY PLEISTOCENE	Globorotalia truncatulinoides N.22; Ellipsoplacolithus lacunosus	0–5	1, 2, 3		SS, F, F, CN, F	Hemipelagic carbonaceous silty clay; soft, plastic, dark greenish gray (5G4/1), foamy nature due to gas. General Comments: -Voids due to gas expansion. -Most of the "void" zones contain very mixed and soupy sediment. -Radiolarians absent from this core to bottom of hole. -Rare calcite fragments and rutile needle. -Carbonate average 15%.	PLANKTONIC FORAMINIFERS: *Globorotalia truncatulinoides (dextral), Turborotalia inflata* CALCAREOUS NANNOPLANKTON: *Gephyrocapsa oceanica, Ellipsoplacolithus lacunosus, Cyclococcolithina leptopora, Ceratolithus cristatus, Rhabdosphaera stylifera*
LATE PLIOCENE	Turborotalia tenuitheca N.21; Ellipsoplacolithus lacunosus	5–9	4, 5, 6, CC		F, F, F, F, F, F,CN, SS		PLANKTONIC FORAMINIFERS: *Turborotalia inflata, T. acostaensis, Globorotalia conomiozea* *CORE CATCHER* CALCAREOUS NANNOPLANKTON: *Gephyrocapsa oceanica, Ellipsoplacolithus lacunosus, Ceratolithus cristatus, Helicopontosphaera kamptneri, Rhabdosphaera stylifera*



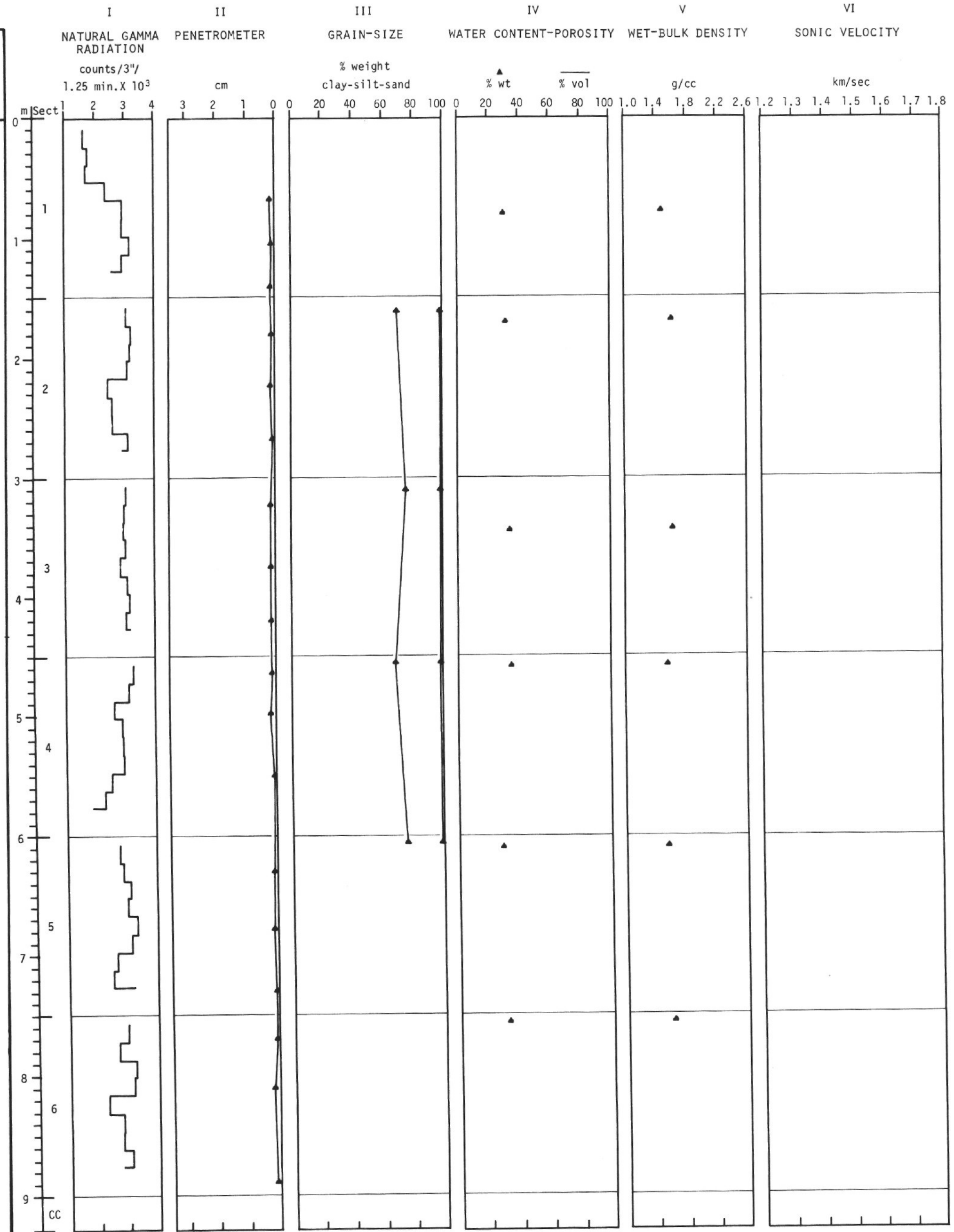
Hole 102, Core 9 (266m to 275m)

AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
LATE PLIOCENE	Turborotalia tenuitheca N.21 Discoaster brouweri	0–9	1, 2, 3, 4, 5, 6, CC		SS F; CN; SS; F SS; F SS; SS; F SS; F; F,D,CN SS	Hemipelagic carbonaceous silty clay; slightly indurated plastic, greenish gray (5G5/1) with mottling of olive gray (5Y4/1). Pyrite nodule. General Comments: -Black specks of iron sulfide common throughout. -Finely bedded nature noticed for first time in the hole. -Voids due to gas expansion. -Silt content and nannoplankton increase toward bottom of core. -Siliceous forms conspicuously absent. -Siderite rhombs rare to common throughout, first consistent occurence. -Carbonate average 26%. Lens of pyrite silt. Pyrite nodule.	CALCAREOUS NANNOPLANKTON: *Ellipsoplacolithus lacunosus, Discoaster brouweri, D. pentaradiatus, Cyclococcolithina leptopora, Helicopontosphaera kamptneri, Ceratolithus cristatus* PLANKTONIC FORAMINIFERS: *Turborotalia inflata, Globorotalia conomiozea, Turborotalia acostaensis, Globigerinoides extremus, Globorotalia limbata, Turborotalia tosaensis* *CORE CATCHER* DINOFLAGELLATES: *Achomosphaera ramulifera* CALCAREOUS NANNOPLANKTON: *Discoaster brouweri, D. pentaradiatus, Cyclococcolithina leptopora, Ellipsoplacolithus lacunosus*



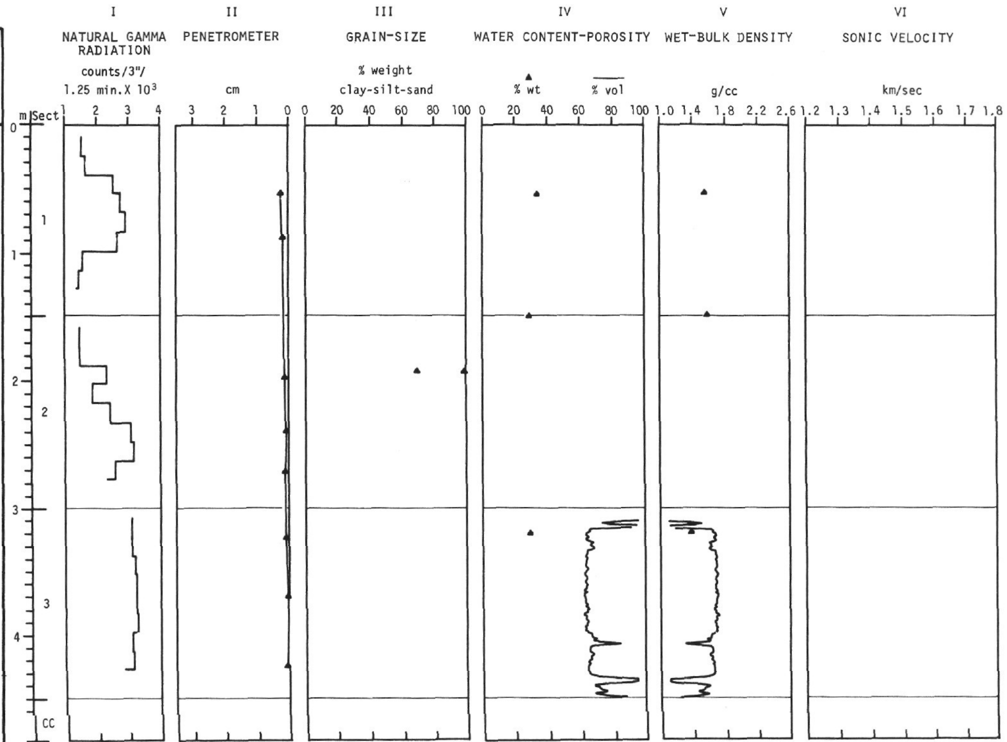
Hole 102, Core 10 (306m to 315m)

AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
LATE PLIOCENE	Turborotalia tenuitheca N.21 / Discoaster brouweri	0–9	1, 2, 3, 4, 5, 6, CC		F; F, SS; CN; SS; SS; SS; SS; F; SS; SS; F,D,CN, SS	Hemipelagic carbonaceous silty clay; firm, plastic, greenish gray (5G5/1). General Comments: -Black specks of iron sulfide throughout. -Voids due to gas expansion. -Entire core has strong odor of mercaptans. -Quartz and feldspar silt increase towards bottom of hole. -Siliceous forms rare throughout. -Siderite rare to abundant. -Carbonate average 14%. Occasional faint mottling of light olive gray (5Y5/2) in Sections 3 thru 5. Occasional worm burrows, siderite abundant in Section 4. Gradual color change to dark greenish gray (5G4/1). White lens of quartz-feldspar silt	CALCAREOUS NANNOPLANKTON: *Ellipsoplacolithus lacunosus,* *Discoaster brouweri,* *D. pentaradiatus,* *Ceratolithus rugosus,* *Cyclococcolithina leptopora* PLANKTONIC FORAMINIFERS: *Globigerinoides extremus,* *Globorotalia miocenica,* *Gl. exilis,* *Gl. conomiozea* *CORE CATCHER* CALCAREOUS NANNOPLANKTON: *Ellipsoplacolithus lacunosus,* *Discoaster brouweri,* *D. pentaradiatus,* *D. asymmetricus,* *Ceratolithus rugosus,* *Cyclococcolithina leptopora*



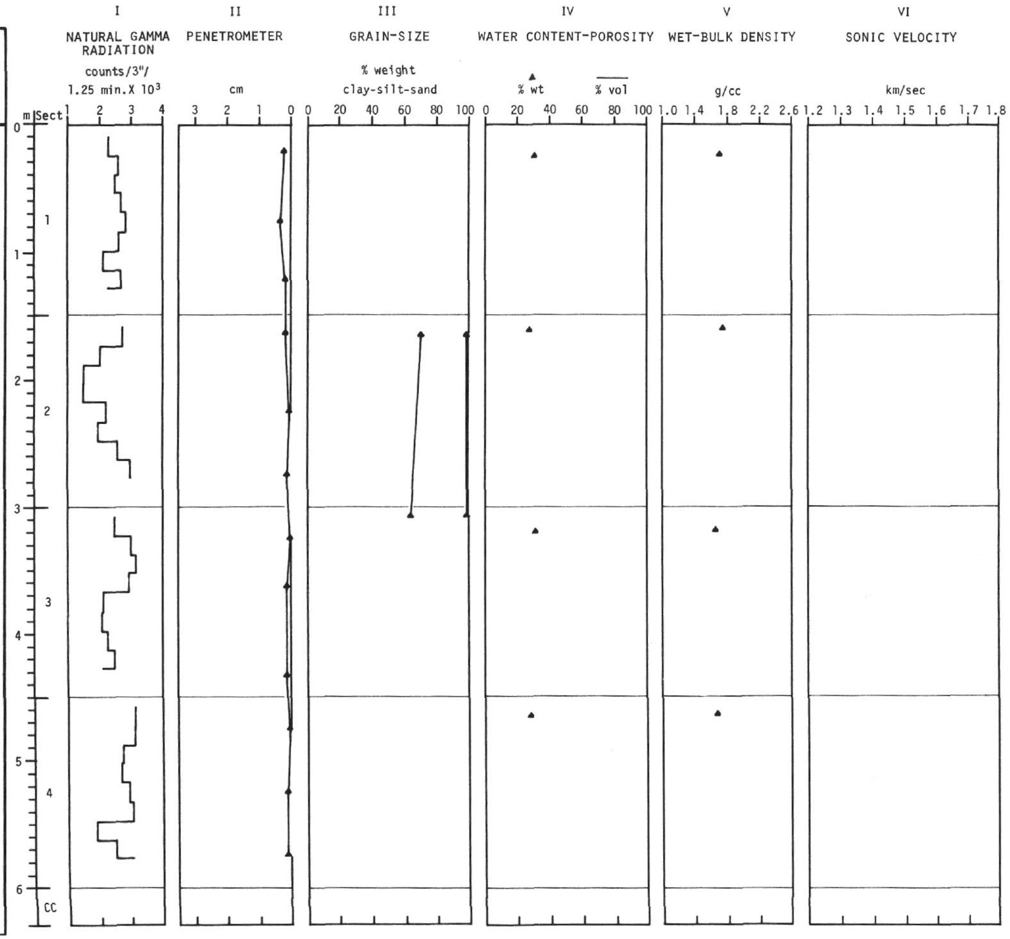
Hole 102, Core 11 (353m to 357m)

AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
LATE PLIOCENE	Turborotalia tenuitheca N.21 Reticulofenestra pseudoumbilica	0–1	1		SS, CN	Hemipelagic carbonaceous silty clay; firm, plastic, dark greenish gray (5G4/1). General Comments: -Siderite common throughout. -White specks and glass rare to common. -Silt, pyrite, foraminifers and sponge spicules increase towards bottom of core. -Unusually abundant sponge spicules. -Voids due to gas expansion. -Carbonate average 18%.	CALCAREOUS NANNOPLANKTON: *Reticulofenestra pseudoumbilica, Ellipsoplacolithus lacunosus, Cyclococcolithina macintyrei, Discoaster brouweri, D. variabilis, D. pentaradiatus, D. asymmetricus, Helicopontosphaera sellii , H. kamptneri*
		2	2		SS		
		3–4	3		F		PLANKTONIC FORAMINIFERS: *Globigerinoides extremus, Globorotalia miocenica, Gl. multicamerata, Gl. exilis, Globoquadrina altispira, Sphaeroidinellopsis subdehiscens, Globoquadrina venezuelana, Globorotalia conomiozea* *CORE CATCHER*
			CC		SS, F, CN		CALCAREOUS NANNOPLANKTON: *Reticulofenestra pseudoumbilica, Discoaster brouweri, D. pentaradiatus, D. asymmetricus, Sphenolithus abies*



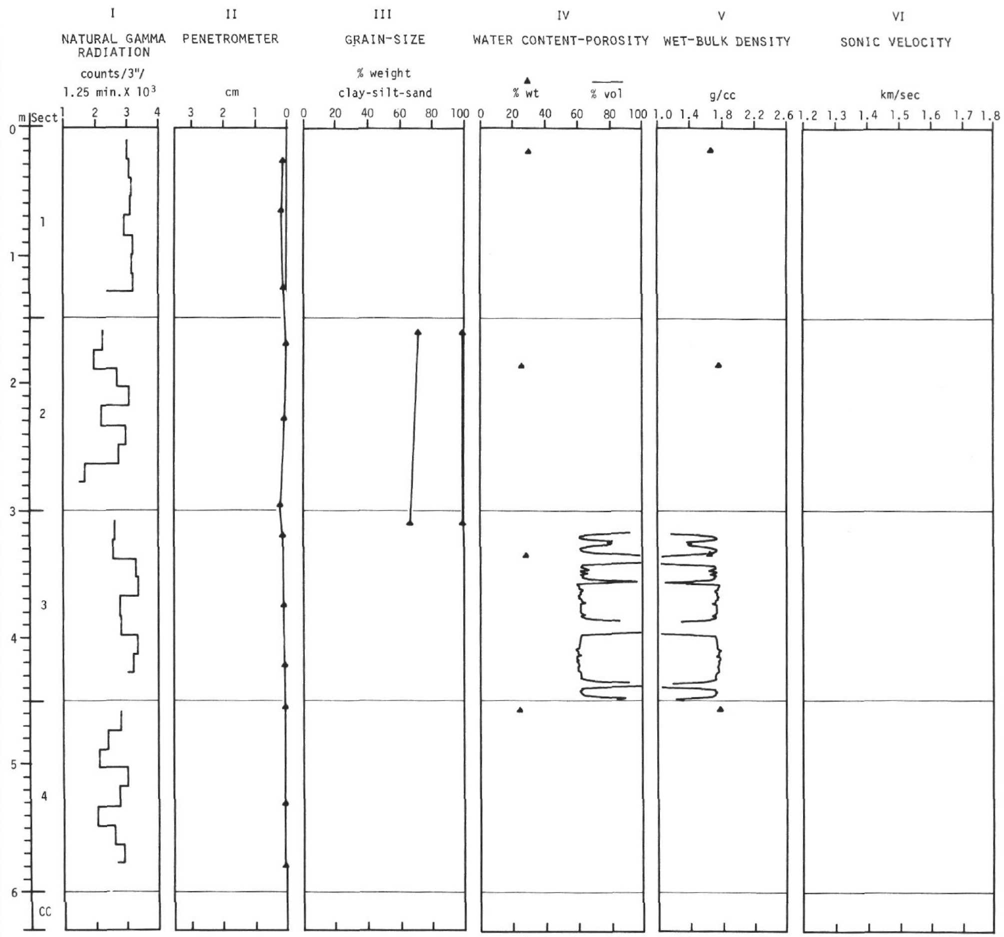
Hole 102, Core 12 (419m to 423m)

AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
LATE PLIOCENE	Turborotalia pseudopima N.20 Reticulofenestra pseudoumbilica	0–6	1, 2, 3, 4, CC		F, SS (Sect. 1); CN, SS (Sect. 2); SS (Sect. 3); F, D, CN, SS (CC)	<u>Hemipelagic carbonaceous silty clay</u>; firm, plastic, dark greenish gray (5G4/1). General Comments: -Voids due to gas expansion. -Siliceous forms absent. -Siderite common throughout. -Calcite fragments common at bottom. -Carbonate average 21%. Silt abundant.	CALCAREOUS NANNOPLANKTON: *Reticulofenestra pseudoumbilica, Sphenolithus abies, Discoaster brouweri, D. pentaradiatus, D. asymmetricus, Helicopontosphaera sellii* PLANKTONIC FORAMINIFERS: *Globigerinoides extremus, Globorotalia miocenica, Gl. multicamerata, Globoquadrina altispira, Gq. venezuelana, Sphaeroidinellopsis subdehiscens, Ss. seminulina Globorotalia crassula* *CORE CATCHER* DINOFLAGELLATES: *Achomosphaera ramulifera* CALCAREOUS NANNOPLANKTON: *Reticulofenestra pseudoumbilica, Discoaster asymmetricus, D. brouweri, D. pentaradiatus, Sphenolithus abies*



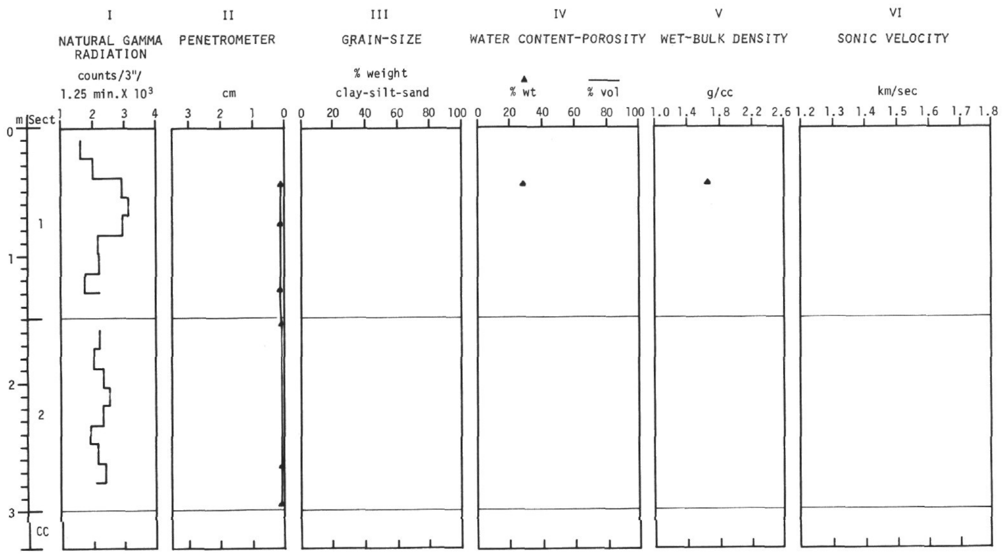
Hole 102, Core 13 (473m to 476m)

AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
EARLY PLIOCENE	Sphaeroidinella dehiscens/Globoquadrina altispira N.19 Discoaster asymmetricus	0–6	1, 2, 3, 4, CC		SS, F (Sect. 1); SS (Sect. 2); SS, F (Sect. 3); CN (Sect. 4); F,D,CN,SS (CC)	<u>Hemipelagic carbonaceous silty clay</u>; slightly indurated, firm dark greenish gray (5G4/1). General Comments: -Voids due to gas expansion. -Siderite common throughout. -Siliceous forms absent. -Carbonate average 16%. Abundant sand and silt grains of heavy minerals, quartz, pyrite and glauconite.	PLANKTONIC FORAMINIFERS: *Globorotalia margaritae, Pulleniatina primalis, Globorotalia cibaoensis, Globoquadrina altispira, Globigerinoides extremus* CALCAREOUS NANNOPLANKTON: *Discoaster asymmetricus, D. surculus, D. pentaradiatus, Sphenolithus abies, Reticulofenestra psedoumbilica, Helicopontosphaera kamptneri, H. sellii* *CORE CATCHER* DINOFLAGELLATES: *Achomosphaera ramulifera* CALCAREOUS NANNOPLANKTON: *Discoaster asymmetricus, D. pentaradiatus, D. surculus, Reticulofenestra pseudoumbilica, Sphenolithus abies, Helicopontosphaera sellii*



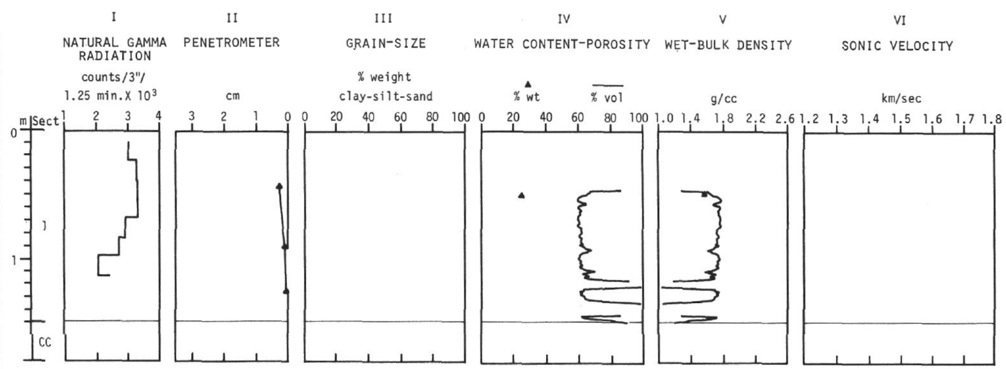
Hole 102, Core 14 (512m to 513m)

AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
EARLY PLIOCENE	*Sphaeroidinella dehiscens/Globoquadrina* / *Discoaster asymmetricus*	1, 2, 3	1, 2, CC		-SS, -CN, -F,D, CN,SS	Hemipelagic carbonaceous silty clay; slightly indurated, firm, dark greenish gray (5G4/1). General Comments: -Voids due to gas expansion. -Siderite common throughout. -Siliceous forms absent. -Carbonate average 19%.	PLANKTONIC FORAMINIFERS: *Globorotalia margaritae, Pulleniatina primalis, Globoquadrina altispira, Globigerinoides extremus, Globorotalia cibaoensis* DINOFLAGELLATES: *Achomosphaera ramulifera* CALCAREOUS NANNOPLANKTON: *Reticulofenestra pseudoumbilica, Discoaster asymmetricus, D. surculus, D. brouweri, Ceratolithus rugosus, Cyclococcolithina macintyrei* CORE CATCHER CALCAREOUS NANNOPLANKTON: *Reticulofenestra pseudoumbilica, Discoaster asymmetricus, D. surculus, D. brouweri, Ceratolithus rugosus, C. tricorniculatus, Cyclococcolithina macintyrei*



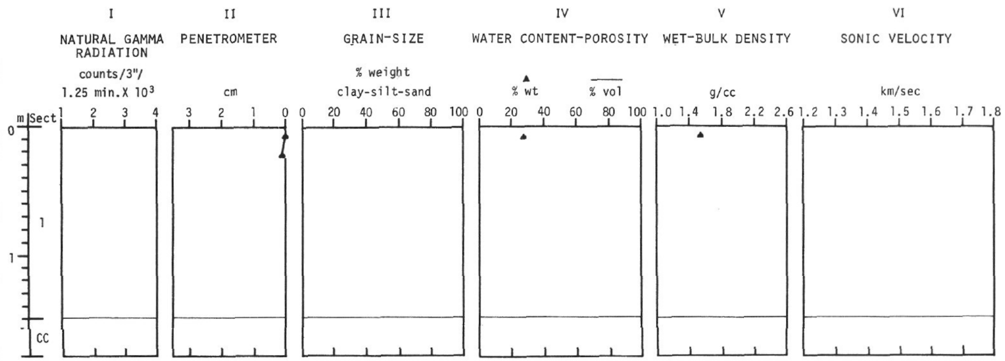
Hole 102, Core 15 (548m to 549m)

AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
EARLY PLIOCENE	*Sphaeroidinella dehiscens/Globoquadrina altispira* N.19 / *Discoaster asymmetricus*	1	1, CC		-CN, -F,D, CN, SS	Hemipelagic carbonaceous silty clay; firm, dark greenish gray (5G4/1) with mottling to grayish olive (10Y4/2). General Comments: -Voids due to gas expansion. -Siderite common. -Carbonate average 20%.	PLANKTONIC FORAMINIFERS: *Globigerina nepenthes, Globorotalia limbata, Gl. margaritae, Globoquadrina altispira, Globigerinoides extremus* CALCAREOUS NANNOPLANKTON: *Discoaster asymmetricus, D. brouweri, D. surculus, D. pentaradiatus, Sphenolithus abies, Ceratolithus rugosus, Reticulofenestra pseudoumbilica* CORE CATCHER DINOFLAGELLATES: *Achomosphaera ramulifera:* CALCAREOUS NANNOPLANKTON: *Discoaster asymmetricus, D. brouweri, D. pentaradiatus, D. surculus, Ceratolithus rugosus, Reticulofenestra pseudoumbilica*



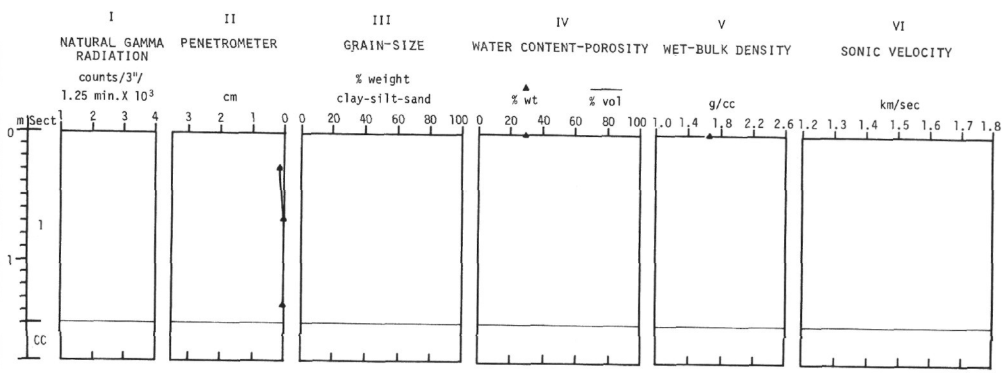
Hole 102, Core 16 (584m to 585m)

AGE	ZONE	DEPTH (m)	SECTION NO.	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
EARLY PLIOCENE / LATE MIOCENE	Globorotalia tumida/Sphaeroidinellopsis paenedehiscens N.18; Discoaster asymmetricus	1	1, CC	F,CN; SS; SS; SS; F,CN; SS	Hemipelagic, carbonaceous, silty clay; indurated, dark greenish gray (5G4/1). General Comments: -Concentrations of quartz and feldspar silt in burrows. -Siderite grains common. -White fluorescent material in core catcher sample. -Carbonate average 14%.	CALCAREOUS NANNOPLANKTON: *Reticulofenestra pseudoumbilica, Sphenolithus abies, Discoaster asymmetricus, D. brouweri, D. surculus, Ceratolithus tricorniculatus* PLANKTONIC FORAMINIFERS: *Globorotalia plesiotumida, Turborotalia multiloba, Globigerina nepenthes, Globorotalia limbata (dextral), Globorotalia margaritae* *CORE CATCHER* PLANKTONIC FORAMINIFERS: *Globorotalia plesiotumida, Gl. merotumida, Gl. lembata (dextral), Gl. margaritae, Turborotalia multiloba, Globigerina nepenthes, Globoquadrina altispira* CALCAREOUS NANNOPLANKTON; *Reticulofenestra pseudoumbilica, Sphenolithus abies, Discoaster asymmetricus, D. exilis, D. brouweri, D. challengeri, Ceratolithus tricorniculatus*



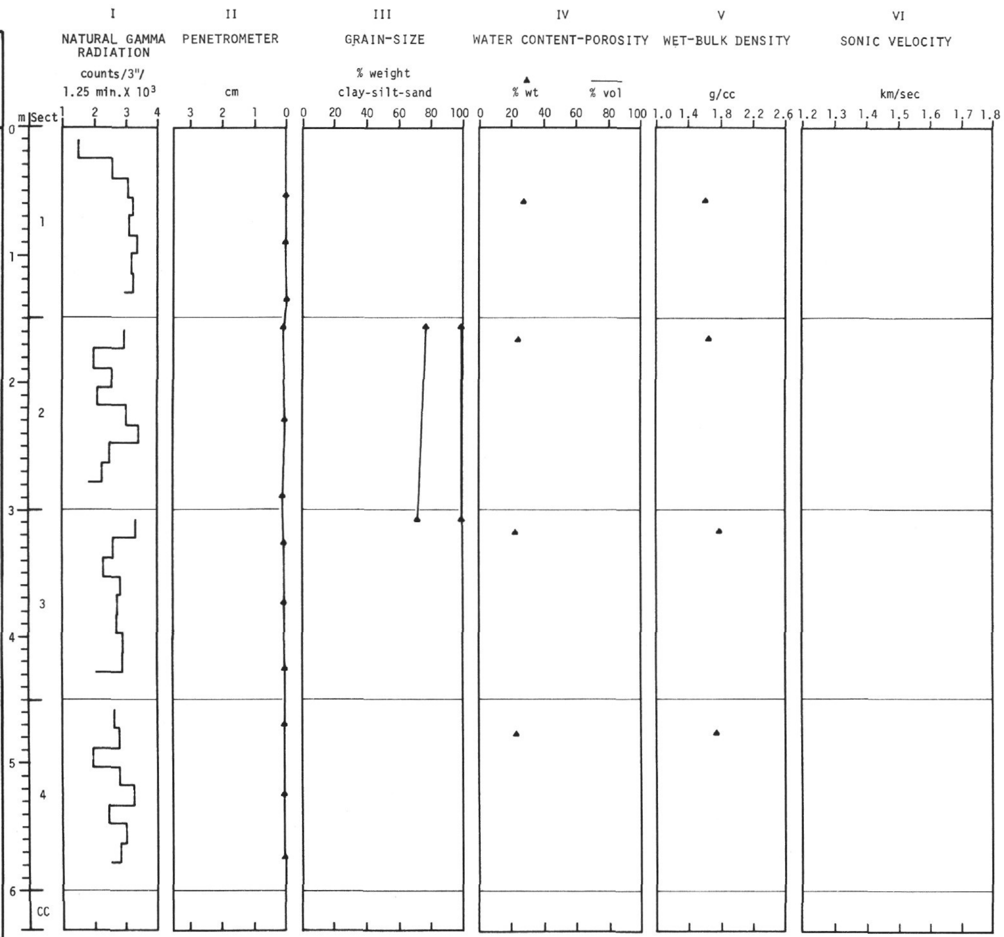
Hole 102, Core 17 (618m to 619m)

AGE	ZONE	DEPTH (m)	SECTION NO.	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
LATE MIOCENE	Globorotalia plesiotumida N.17; Ceratolithus tricorniculatus	1	1, CC	SS; F; SS; F,D, CN, SS	Hemipelagic, carbonaceous silty clay; indurated, dark greenish gray (5G4/1). General Comments: -Sponge spicules and diatoms common; only occurence below core 11. -Abundant pyrite spheres in core catcher. -Siderite rare. -Carbonate average 14%.	PLANKTONIC FORAMINIFERS: *Globigerinoides extremus, Globorotalia margaritae, Gl. limbata (sinistral), Globigerina nepenthes, Turborotalia multiloba* *CORE CATCHER* DINOFLAGELLATES: *Achomosphaera ramulifera* CALCAREOUS NANNOPLANKTON: *Ceratolithus tricorniculatus, Discoaster challengeri, D. exilis, D. variabilis, D. kugleri, D. quinqueramus, Reticulofenestra pseudoumbilica*



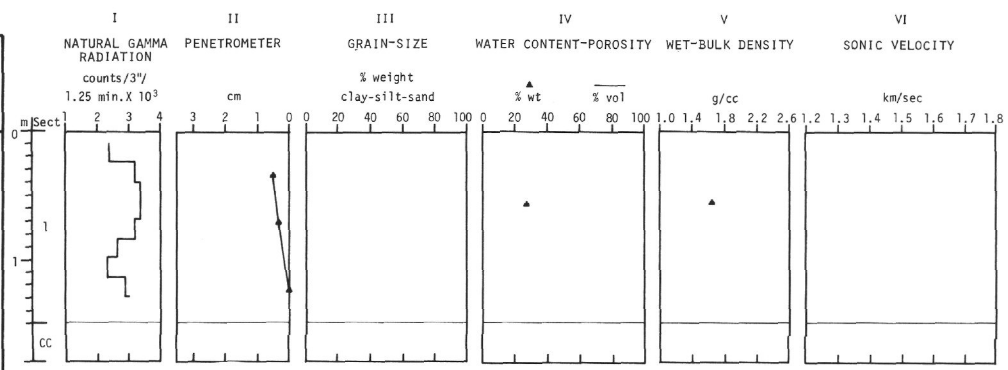
Hole 102, Core 18 (634m to 636m)

AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
LATE MIOCENE	Globorotalia plesiotumida N.17 Ceratolithus tricorniculatus	0–6	1, 2, 3, 4, CC		F, SS, SS, CN, SS, SS SS SS SS SS, F,D,CN,SS	Hemipelagic carbonaceous silty clay; firm, brittle, dark greenish gray (5GY4/1) to greenish black (5G2/1). Thin sand lens of fragments of echinoid spines and siderite rhombs. General Comments: -Most of this core is disturbed by coring operation. Darker beds are highly contorted; lighter speckled beds are relatively undisturbed. -White specks are foram tests and burrow fillings of quartz, feldspar and pyrite grains. -Voids due to gas expansion. -Siderite common throughout. -Carbonate average 11%.	CALCAREOUS NANNOPLANKTON: *Ceratolithus tricorniculatus, Reticulofenestra pseudoumbilica, Discoaster quinqueramus, D. brouweri, D. challengeri, D. varabilis.* PLANKTONIC FORAMINIFERS: *Globigerina nepenthes, Globorotalia miozea, Gl. limbata (sinistral), Gl. cibaoensis, Globigerinoides extremus.* *CORE CATCHER* DINOFLAGELLATES: *Achomosphaera ramulifera* CALCAREOUS NANNOPLANKTON: *Ceratolithus tricorniculatus, Discoaster quinqueramus, D. brouweri, D. challengeri, D. variabilis, Reticulofenestra pseudoumbilica, Sphenolithus abies*



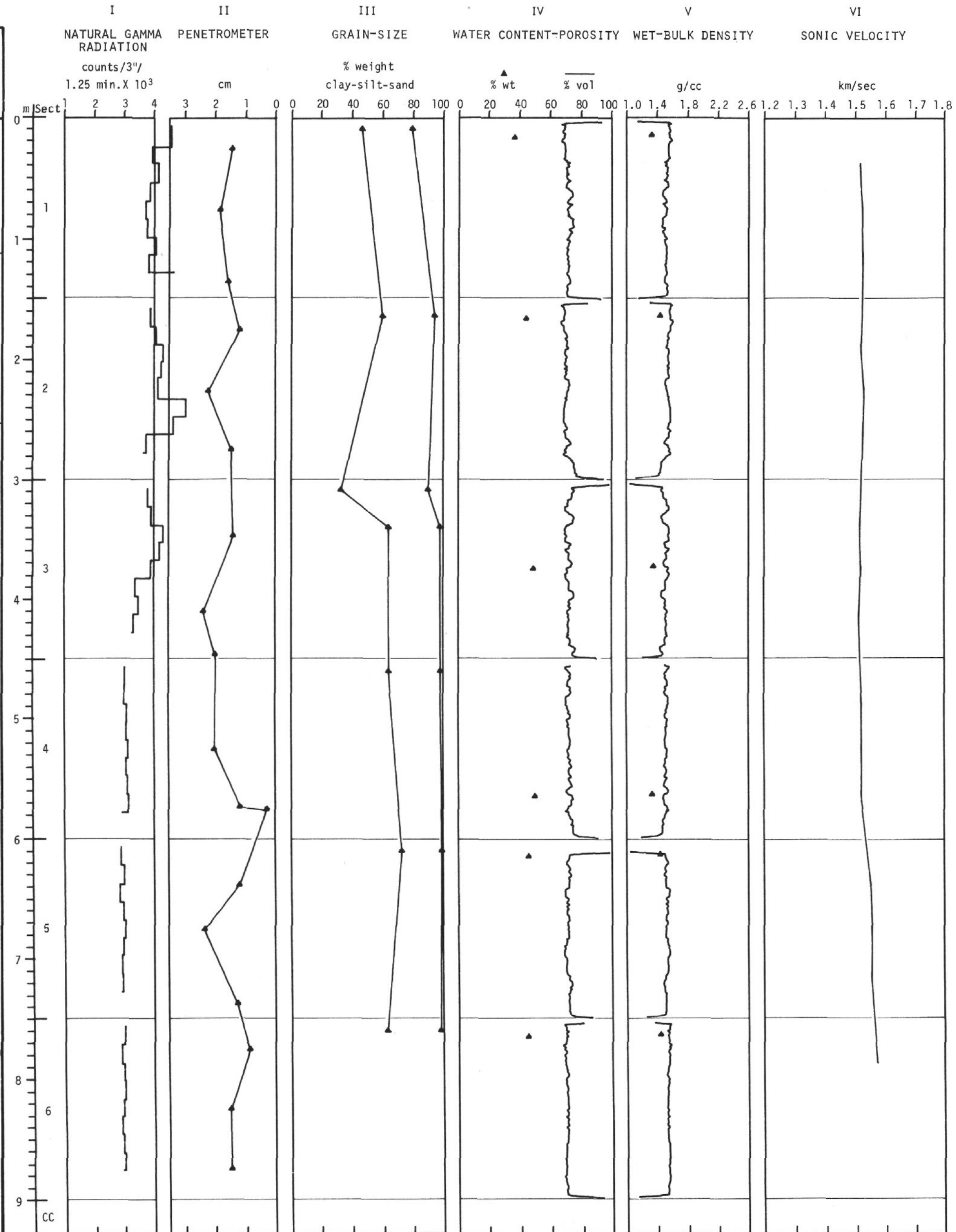
Hole 102, Core 19 (659m to 661m)

AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
LATE MIOCENE	Turborotalia acostaensis/Globorotalia merotumida N.16 Discoaster quinqueramus	1	1		F SS SS	Hemipelagic, carbonaceous, silty clay; firm, brittle, dark greenish gray (5G4/1) to lighter gray (5GY4/1). Flat siderite nodule. General Comments: -Most of this core is disturbed by coring operation. Darker beds are highly contorted; lighter speckled beds are relatively undisturbed. -White specks are foram tests and burrow fillings of quartz, feldspar and pyrite grains. -Voids due to gas expansion. -Siderite common throughout. -Carbonate average 11%.	PLANKTONIC FORAMINIFERS: *Turborotalia acostaensis, Turborotalia continuosa, T. clemenciae, Globorotalia merotumida, Globoquadrina altispira, Globigerina nepenthes, Globorotalia plesiotumida, Sphaeroidinellopsis subdehiscens, Ss. seminulina.* *CORE CATCHER* DINOFLAGELLATES: *Achomosphaera ramulifera* CALCAREOUS NANNOPLANKTON: *Discoaster quinqueramus, D. challengeri, D. kugleri, D. variabilis, Ceratolithus tricorniculatus, Sphenolithus abies*
			CC		D,F, CN, SS		



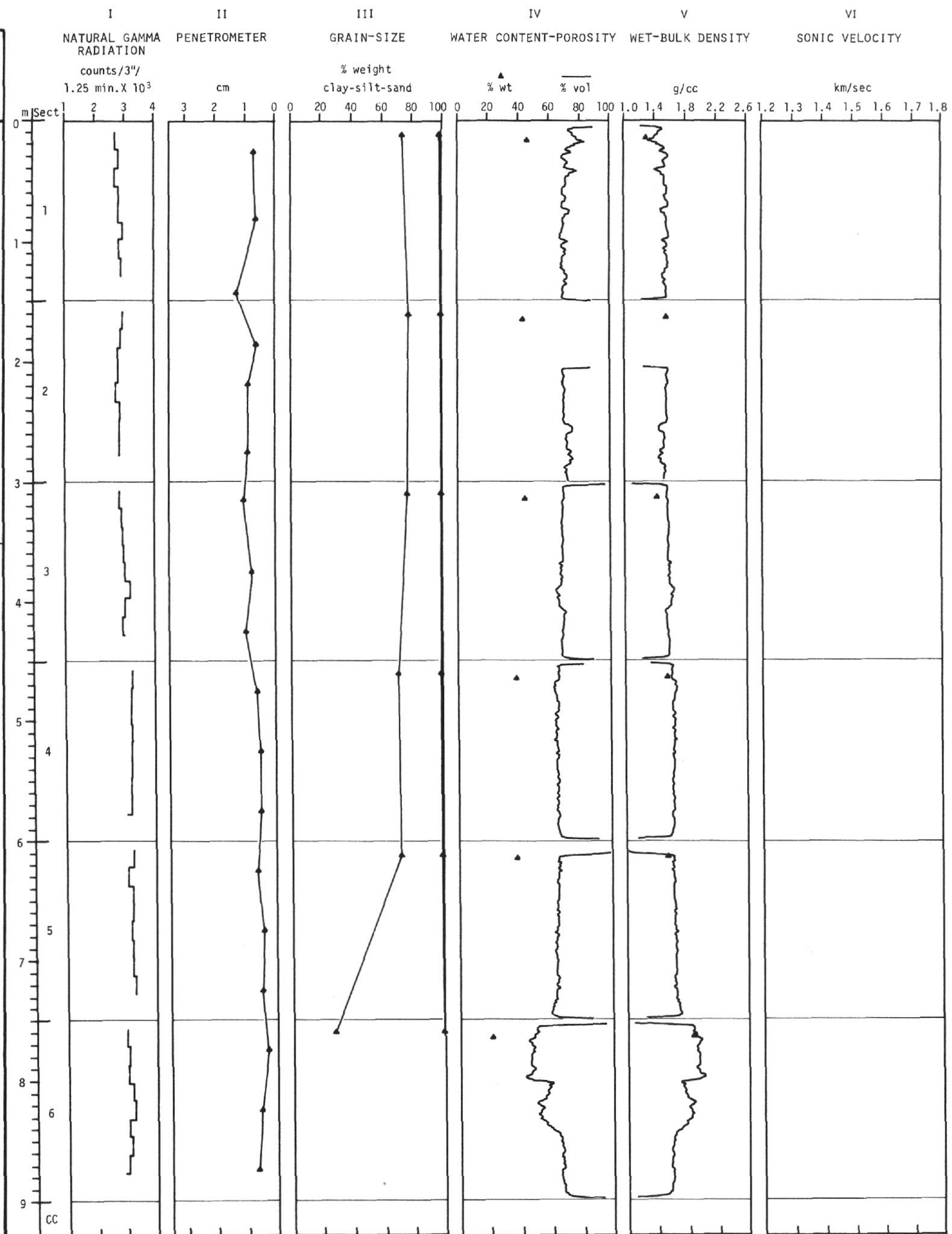
Hole 103, Core 1 (0m to 8m)

AGE	ZONE	DEPTH (m)	SECTION NO.	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
HOLOCENE	Globigerina calida/ Sphaeroidinella excavata N.23	0–1	1	SS,F; SS,F; SS,F; F	Hemipelagic silty and sandy (foraminiferal) carbonaceous clay; soft, varying in color from greenish gray (5G6/1) to dark yellowish orange (10YR5/4). Light brown foram sand (5YR6/6) with heavy minerals.	PLANKTONIC FORAMINIFERS: *Sphaeroidinella excavata, Globorotalia truncatulinoides, Gl. cultrata, Globigerina rubescens, Globigerinoides ruber f. rosea, Turborotalia inflata, Globigerina calida*
EARLY PLEISTOCENE	Globorotalia truncatulinoides N.22	1–2	1, 2	F; SS SS; F; F	Grayish green clay.	PLANKTONIC FORAMINIFERS: *Globorotalia truncatulinoides, Turborotalia inflata, T. tosaensis*
PLIOCENE	Turborotalia pseudopima N.20	3–5	2, 3, 4	F; F SS; F; SS SS; F; F,CN	Color becoming predominantly greenish gray (5G6/1) to olive gray (5Y4/1). Dark iron sulfide specks common below middle of Section 4.	PLANKTONIC FORAMINIFERS: *Turborotalia inflata Sphaeroidinellopsis subdehiscens, Ss. seminulina, Globoquadrina altispira, Globorotalia multicamerata, Globoquadrina venezuelana, Globigerinoides extremus, Globorotalia exilis* CALCAREOUS NANNOPLANKTON: *Ceratolithus Rugosus, C. tricorniculatus, Discoaster asymmetricus, D. Brouweri, D. pentaradiatus, Cyclococcolithina macintyrei, Reticulofenestra pseudoumbilica*
	Ceratolithus rugosus	6–7	5	SS,F; F	General Comments: -Upper 4 meters of core badly deformed. -Foraminifers decrease dramatically below the top of Section 2. -Lighter shade of brown and orange in foram rich layers of Section 2 only. -Quartz silt common throughout. -Carbonate average 22%.	PLANKTONIC FORAMINIFERS: *Globorotalia margaritae Globoquadrina altispira Globigerinoides extremus Globorotalia multicamerata Sphaeroidinellopsis subdehiscens Ss. seminulina* DINOFLAGELLATES: *Achomosphaera ramulifera*
	Sphaeroidinella dehiscens/ Globoquadrina altispira N.19	8–9	6, CC	F; SS,F; F; F,D,CN SS	Quartz and feldspar silt abundant.	CALCAREOUS NANNOPLANKTON: *Discoaster asymmetricus, D. Surculus, D. Brouweri, Ceratolithus rugosus, C. tricorniculatus, Sphenolithus abies, Reticulofenestra pseudoumbilica*



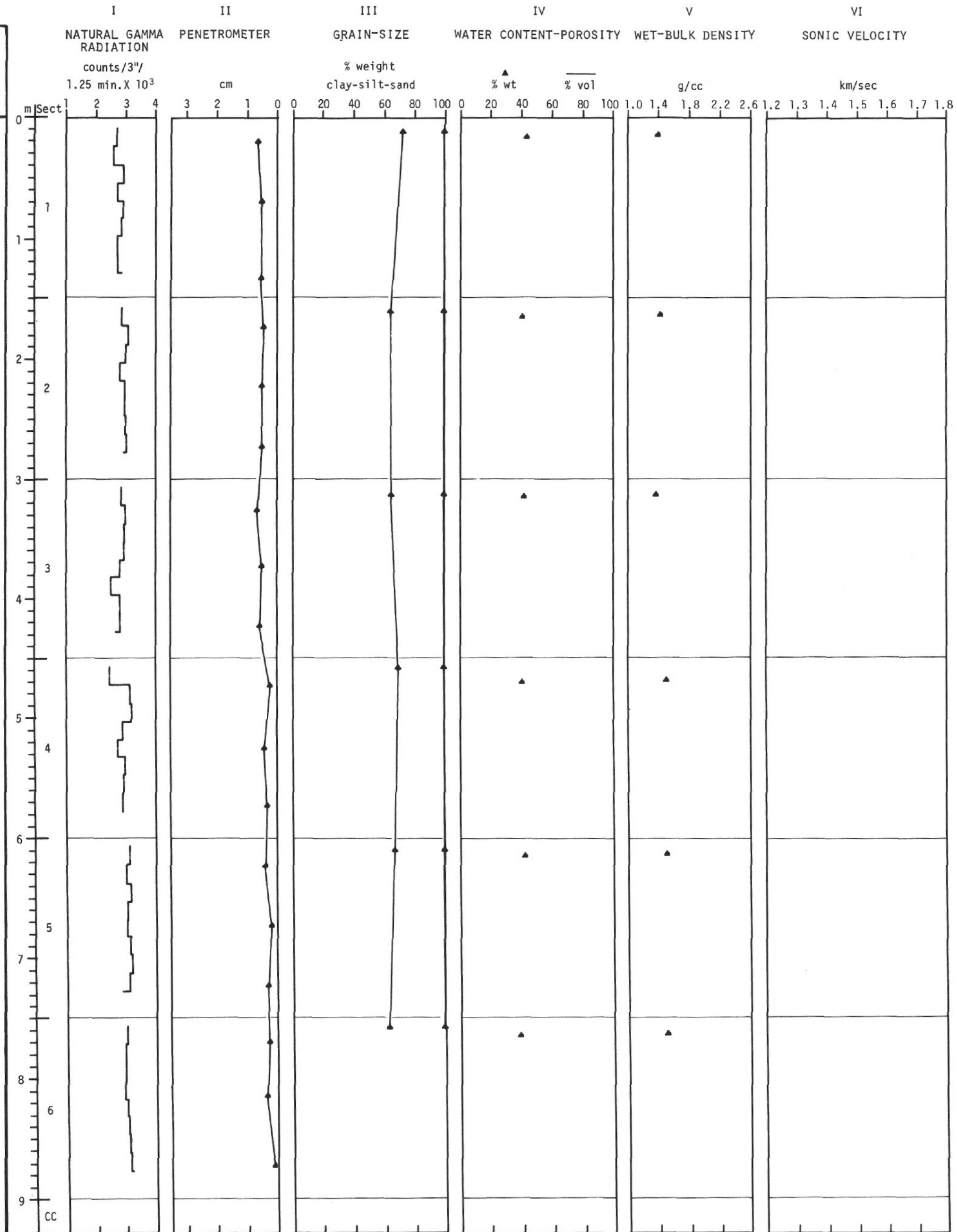
Hole 103, Core 2 (39m to 48m)

AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
EARLY PLIOCENE	Globorotalia tumida/Sphaeroidinellopsis paenedehiscens N.18; Ceratolithus tricorniculatus	0–3	1, 2		SS, F; F,CN	Hemipelagic carbonaceous silty clay; soft, plastic, medium bluish gray (5B5/1) mottled with yellowish gray (5Y8/1) and greenish gray (5GY6/1). General Comments: -Foraminifers rare throughout core. -Core has strong odor of H_2S. -Pyrite common to abundant throughout core. -Only concentration of dolomite in Outer Ridge holes - Section 6. -Carbonate average 20%.	PLANKTONIC FORAMINIFERS: *Globigerina nepenthes, Globorotalia cibaoensis, Turborotalia acostaensis, Globigerinoides mitra, Globorotalia plesiotumida, Sphaeroidinellopsis seminulina, Ss. subdehiscens* CALCAREOUS NANNOPLANKTON: *Discoaster quinqueramus, D. browweri, D. exilis, D. surculus, Reticulofenestra pseudoumbilica, Ceratolithus tricorniculatus, Sphenolithus abies*
LATE MIOCENE		3–9	3, 4, 5, 6, CC		SS; SS; SS; SS, SS, SS, SS, SS, SS, SS, SS; F,D,CN, SS	Small pyrite lined burrows, also quartz and feldspar lined burrows. Dolomite zone begins here and continues to end of core. Dolomite in form of rhombs, very abundant, dispersed in the clay. Color becoming dark greenish gray (5G4/1) and medium bluish gray (5B5/1) with mottling of yellowish gray (5Y8/1) and greenish gray (5GY6/1).	*CORE CATCHER* PLANKTONIC FORAMINIFERS: *Globorotalia merotumida, Globigerinoides mitra, Turborotalia acostaensis, Globigerina nepenthes, Globorotalia margaritae, Globoquadrina altispira* DINOFLAGELLATES: *Achomosphaera ramulifera* CALCAREOUS NANNOPLANKTON: *Ceratolithus tricorniculatus, Discoaster quinqueramus, D. exilis, D. surculus, Sphenolithus abies, Reticulofenestra Pseudoumbilica*



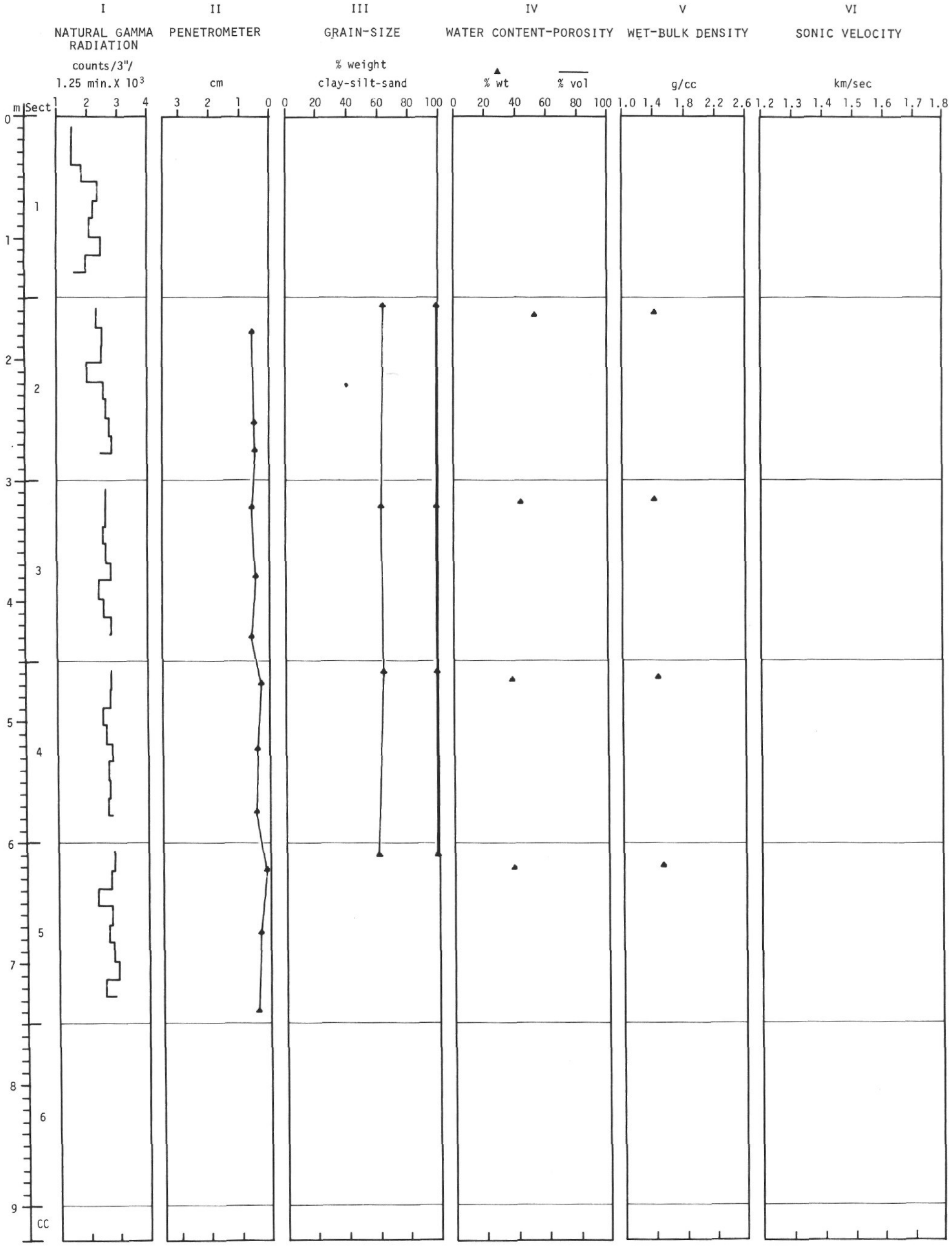
Hole 103, Core 3 (94m to 103m)

AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
LATE MIOCENE	*Globorotalia plesiotumida* N.17 *Ceratolithus tricorniculatus*	0–9	1, 2, 3, 4, 5, 6, CC		F, SS, SS, SS, CN, SS, SS, SS, F SS, D, FD SS	Burrow filled with siderite <u>Hemipelagic, carbonaceous, silty clay</u>; soft, plastic, dark greenish gray (5GY4/1) with mottling of light olive gray (5Y5/2). Dusky yellow siderite lens. General Comments: -Voids due to gas expansion. -First downhole occurrence of siderite in hole 103. -Carbonate average 4%. Siderite lens. Hard calcite/dolomite nodule.	CALCAREOUS NANNOPLANKTON: *Reticulofenestra pseudoumbilica, Cyclococcolithina macintyrei, Discoaster quinqueramus, D. variabilis, D. challengeri, D. exilis, Sphenolithus abies* PLANKTONIC FORAMINIFERS *Globorotalia merotumida, Gl. plesiotumida, Gl. cibaoensis, Globigerina nepenthes, Globoquadrina altispira, Sphaeroidinellopsis subdehiscens, Ss. seminulina* *CORE CATCHER* DINOFLAGELLATES: *Achomosphaera ramulifera, Hystrichosphaeropsis obscurum*



Hole 103, Core 4 (170m to 179m)

AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
LATE MIOCENE	Globorotalia plesiotumida N.17; Discoaster Quinqueramus; Turborotalia acostaensis/ Globorotalia merotumida—N.16	1–7	1, 2, 3, 4, 5, CC		SS, SS, CN, D, SS, SS, SS, F, SS, F, F,D, CN, SS	Hemipelagic, carbonaceous, silty clay; soft, plastic; greenish gray (5GY5/1). General Comments: -Upper 2½ meters very disturbed. -First occurrence of siliceous forms (radiolarians diatoms and sponge spicules) in Hole 103. -Voids due to gas expansion. -Carbonate average 8%. Light olive gray (5Y6/1) siderite silt lens, siderite replacing nannoplankton. Siderite nodule. Siderite silt lens. Siderite silt lens.	CALCAREOUS NANNOPLANKTON: *Discoaster quinqueramus, D. variabilis, D. challengeri, D. kugleri, Sphenolithus abies, Reticulofenestra pseudoumbilica, Helicopontosphaera intermedia* DINOFLAGELLATES: *Hystrichosphaeropsis obscurum, Achomosphaera ramulifera* PLANKTONIC FORAMINIFERS: *Sphaeroidinellopsis seminulina, Globoquadrina altispira, Globigerina nepenthes, Globorotalia miozea* *CORE CATCHER* PLANKTONIC FORAMINIFERS: *Turborotalia acostaensis, T. continuosa, Globorotalia merotumida, Gl. plesiotumida, Globigerina nepenthes, Globoquadrina altispira, Sphaeroidinellopsis subdehiscens, Se. seminulina* DINOFLAGELLATES: *Hystrichosphaeropsis obscurum, Achomosphaera ramulifera* CALCAREOUS NANNOPLANKTON: *Discoaster quinqueramus, D. variabilis, D. challengeri, Reticulofenestra pseudoumbilica, Sphenolithus abies*



Hole 103, Core 5 (247m to 256m)

AGE: LATE MIOCENE

ZONE: Turborotalia continuosa N.15; Discoaster Variabilis (D. exilis subzone)

DEPTH (m): 1, 2, 3, 4

SECTION NO.: 1, 2, 3, CC

SAMPLE INTERVAL: F, D, SS, SS, D, D, SS, F, D, CN, SS

LITHOLOGY

Hemipelagic, carbonaceous, silty clay; firm, plastic, dark greenish gray (5GY4/1) with mottling of light olive gray (5Y5/2).

Dusky yellow lens of siderite.

General Comments:

- Voids due to gas expansion.
- Burrow fillings are principally àragonite.
- Core contains unusually abundant nannoplankton.
- Siderite common.
- Carbonate average 20%.

Dusky yellow lens of siderite.

DIAGNOSTIC FOSSILS

PLANKTONIC FORAMINIFERS:

Globoquadrina globosa,
Gq. dehiscens,
Gq. advena,
Globigerina nepenthes,
Globoquadrina altispira,
Sphaeroidinellopsis subdehiscens,
Ss. seminulina

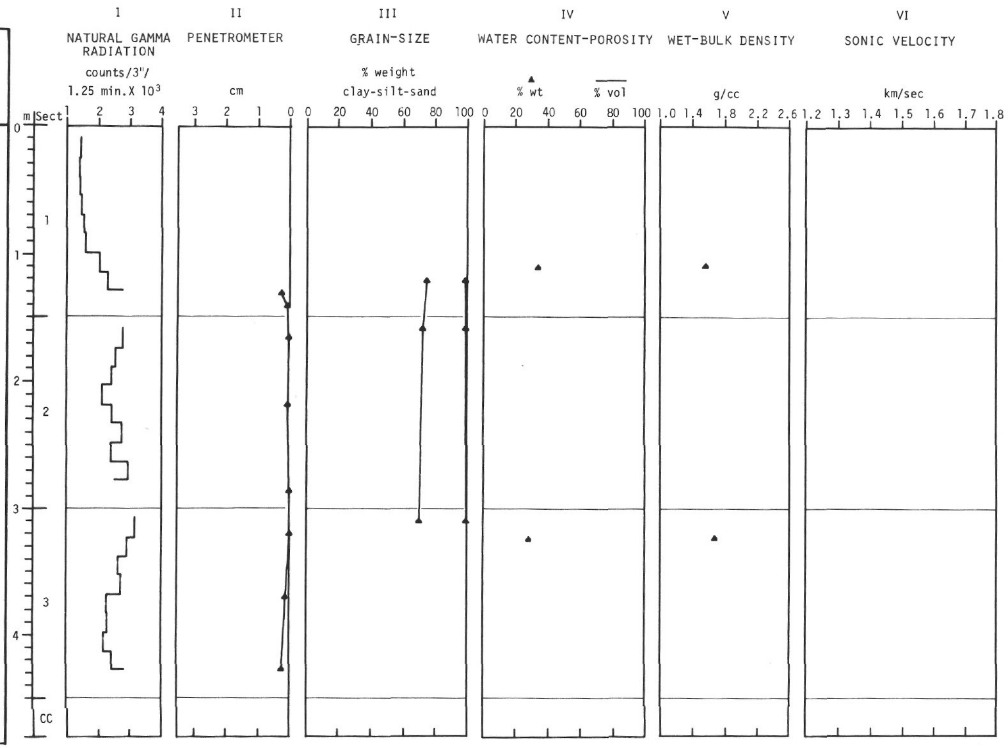
DINOFLAGELLATES:

Hystrichosphaerum obscurum
Achomosphaera ramulifera

CORE CATCHER

CALCAREOUS NANNOPLANKTON

Reticulofenestra pseupoumbilica,
Discoaster exilis,
D. quinqueramus,
D. pentaradiatus,
Sphenolithus abies



Hole 103, Core 6 (343m to 352m)

AGE: MIDDLE - LATE MIOCENE

ZONE: Turborotalia continuosa - Globigerina nepenthes/Turborotalia siakensis N.15-14; Discoaster variabilis

DEPTH (m): 1

SECTION NO.: 1, CC

SAMPLE INTERVAL: F, SS, SS, F, D, SS, F, D, CN

LITHOLOGY

Hemipelagic, carbonaceous, silty clay (claystone); well indurated, grayish olive green (5GY3/2).

General Comments:

- Very well bedded, fissile, crumbly.
- Vertical fractures.
- Abundant spicules and diatoms.
- Dusky yellow lenses of siderite (replacing nannoplankton).
- Carbonate average 12%.

DIAGNOSTIC FOSSILS

PLANKTONIC FORAMINIFERS:

Turborotalia clemenciae,
Globoquadrina dehiscens,
Gq. advena,
Globigerina nepenthes,
Sphaeroidinellopsis subdehiscens,
Ss. seminulina

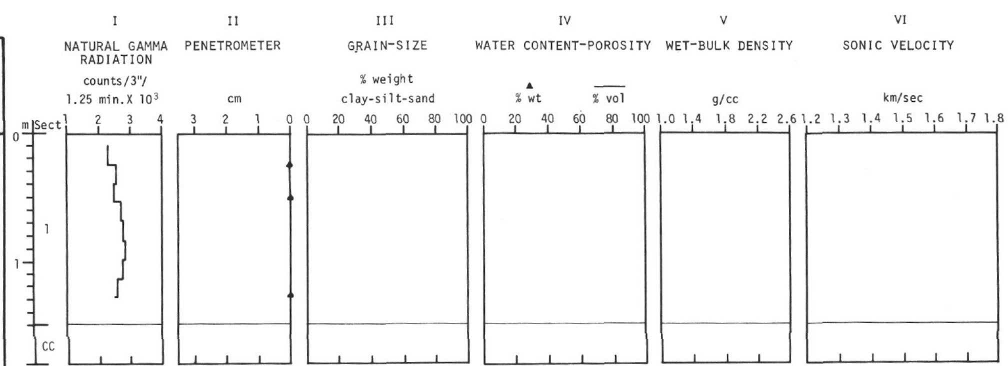
DINOFLAGELLATES:

Hystrichosphaerum obscurum,
Achomosphaera ramulifera

CORE CATCHER

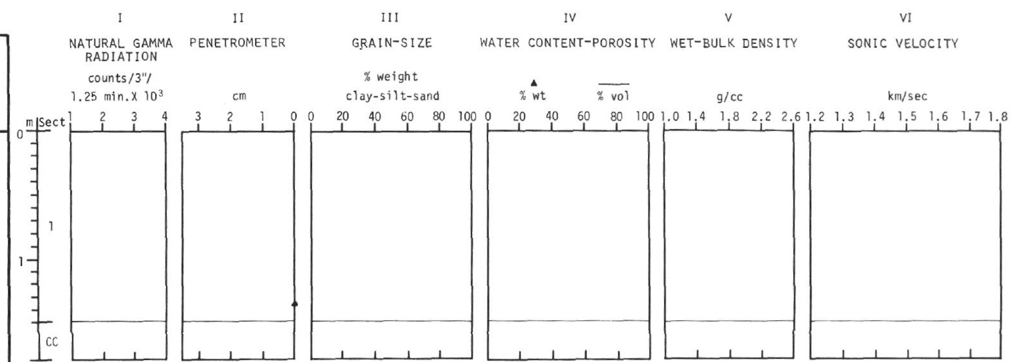
CALCAREOUS NANNOPLANKTON:

Reticulofenestra pseudoumbilica,
Discoaster exilis,
D. variabilis,
D. challengeri,
Catinaster cf.
C. coalitus

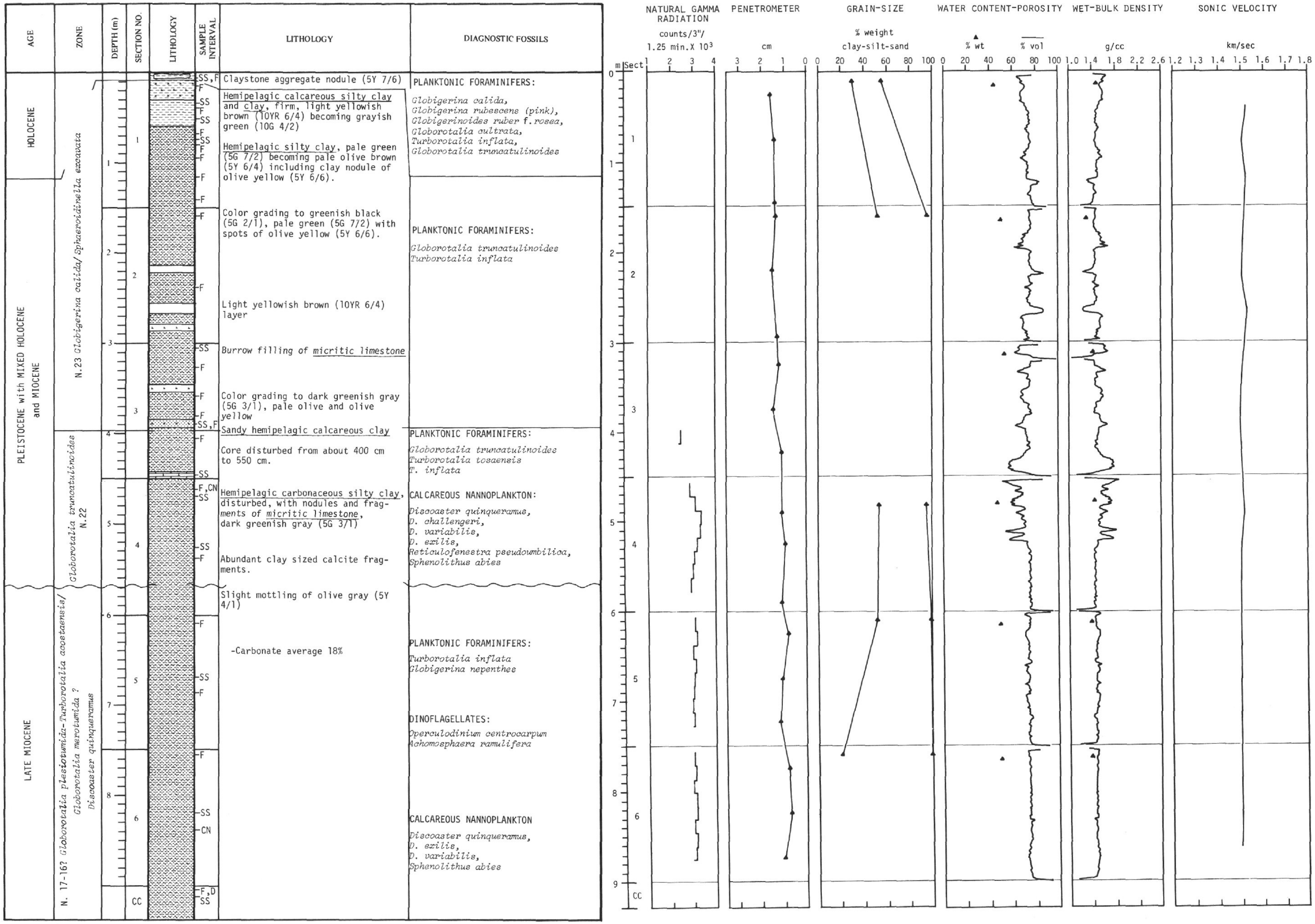


Hole 103, Core 7 (440m to 449m)

AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
MIDDLE MIOCENE		1	1		SS SS D, CN, SS	Hemipelagic, carbonaceous, silty claystone; brittle, dark greenish gray (5GY4/1) with irregular lenses of olive gray (5Y4/1). General comments: -Abundant burrow fillings of pyrite crystals. -Quartz and feldspar abundant. -Siliceous forms common to abundant. -Only a few chunks of brittle, crumbly mud recovered.	CALCAREOUS NANNOPLANKTON: *Reticulofenestra pseudoumbilica, Coccolithus pelagicus, Discoaster variabilis* *CORE CATCHER* DINOFLAGELLATES: *Hystrichosphaeropsis obscurum*

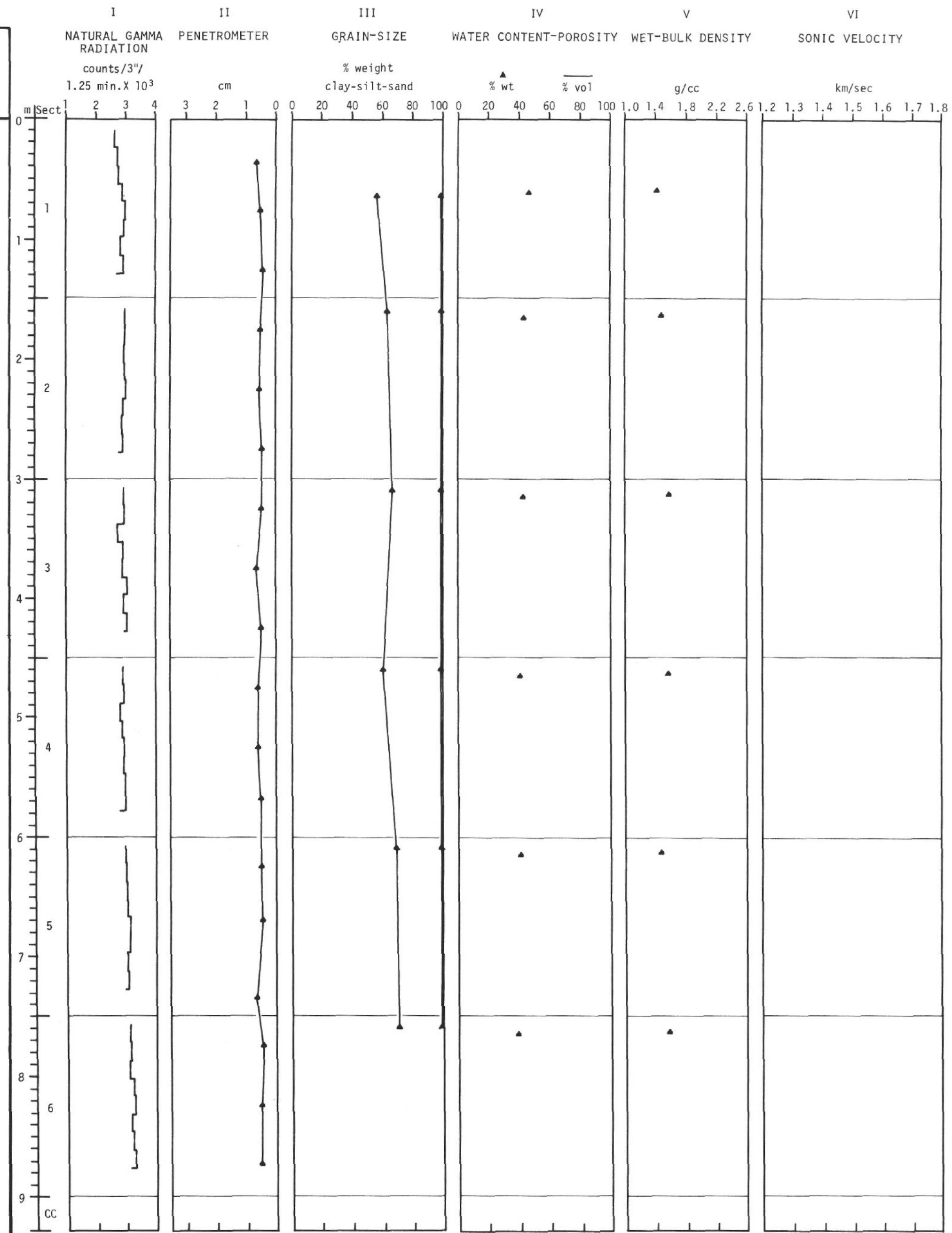


Hole 104, Core 1 (0m to 9m)



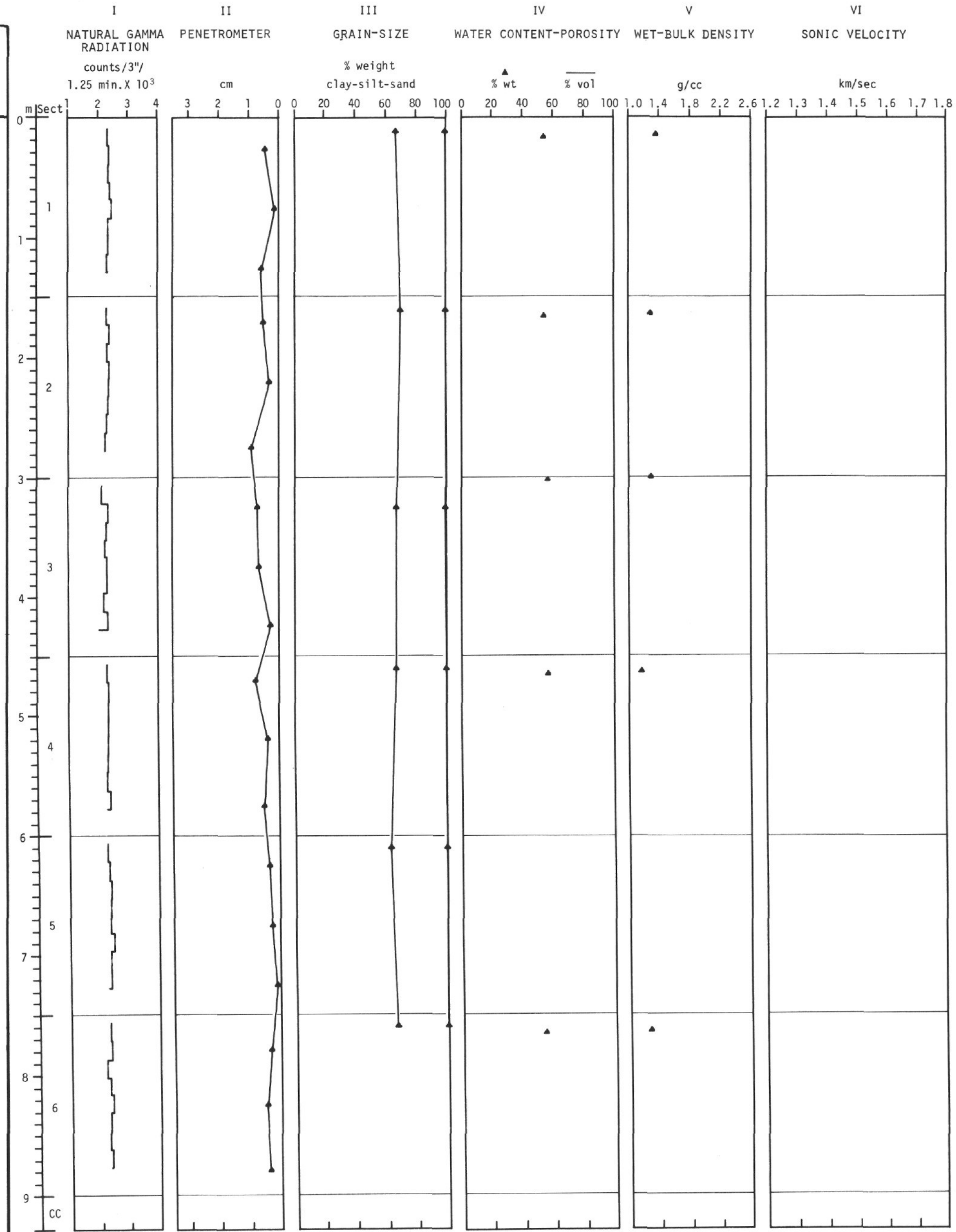
Hole 104, Core 2 (36m to 45m)

AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
LATE MIOCENE	Turborotalia continuosa N.15 Discoaster hamatus	0–1.5	1		SS, F, SS, F	Hemipelagic carbonaceous silty clay; soft, plastic, dark greenish gray (5G4/1) with grayish olive mottling (10Y4/2). General Comments: -Upper 10cm contains fragments of gray lithographic limestone. -Abundant pyrite burrow fillings. -Strong odor of H_2S. -Pyrite common to abundant throughout. -Unusually abundant nannoplankton. -Carbonate average 12%.	PLANKTONIC FORAMINIFERS: *Globigerina nepenthes*, *Globoquadrina dehiscens*, *Gq. advena*, *Sphaeroidinellopsis subdehiscens*, *Ss. seminulina*
		1.5–3	2		SS, CN, D		CALCAREOUS NANNOPLANKTON: *Reticulofenestra pseudoumbilica*, *Sphenolithus abies*, *Discoaster hamatus*, *D. variabilis*, *D. brouweri*, *D. exilis*, *D. quinqueramus* DINOFLAGELLATES: *Hystrichosphaeropsis obscurum*, *Achomosphaera ramulifera*, *A.* cf. *triangulata*
		3–4.5	3		SS		
		4.5–6	4		SS		
		6–7.5	5		SS	Color becoming medium bluish gray (5B5/1) with moderate mottling of light bluish gray (5B7/1).	*CORE CATCHER* PLANKTONIC FORAMINIFERS: *Globigerina nepenthes*, *Globoquadrina dehiscens*, *Globoquadrina advena*, *Sphaeroidinellopsis subdehiscens*, *Ss. advena* CALCAREOUS NANNOPLANKTON: *Discoaster hamatus*, *D. variabilis*, *D. quinqueramus*, *D. exilis*, *Reticulofenestra pseudoumbilica*, *Helicopontosphaera kamptneri*, *Sphenolithus abies* DINOFLAGELLATES: *Hystrichospaeropsis obscurum*, *Achomosphaera ramulifera*
		7.5–9	6		SS		
		9	CC		F, D, CN, SS		



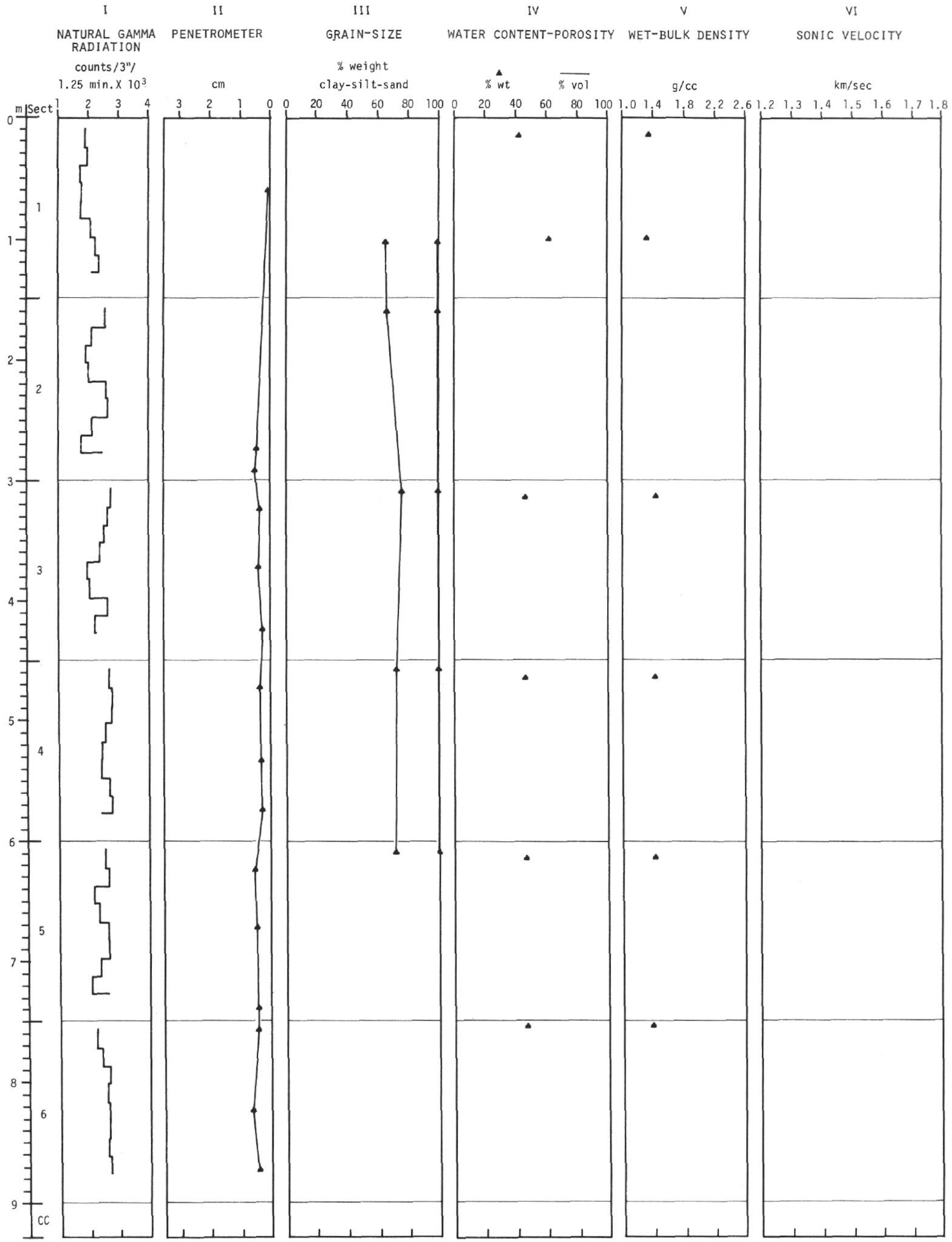
Hole 104, Core 3 (62m to 71m)

AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
MIDDLE MIOCENE	Turborotalia continuosa - Globigerina nepenthes/Turborotalia siakensis N.15-14; Catinaster coalitus	0–9	1, 2, 3, 4, 5, 6, CC		SS, CN, SS, SS, D, SS, SS, SS, F,D,CN SS	Hemipelagic carbonaceous, silty clay; dark greenish gray (5G4/1) with mottling to yellowish olive (5Y6/2) and olive gray (5Y5/1). General Comments: -First occurrence of diatoms and sponge spicules (downhole) in Hole 104. They remain abundant to bottom of hole. -Burrow-like structures with siderite filling. -Carbonate average 11%. Pyrite nodule.	CALCAREOUS NANNOPLANKTON: *Discoaster variabilis, D. exilis, D. challengeri, Catinaster coalitus, Reticulofenestra pseudoumbilica, Sphenolithus abies* DINOFLAGELLATES: *Hystrichosphaeropsis obscurum, Achomosphaera ramulifera* *CORE CATCHER* PLANKTONIC FORAMINIFERS: *Globigerina nepenthes, Globoquadrina dehiscens, Gq. advena, Gq. altispira, Sphaeroidinellopsis subdehiscens, Ss. seminulina* CALCAREOUS NANNOPLANKTON: *Catinaster coalitus, Discoaster variabilis, D. exilis, D. challengeri, Sphenolithus abies,* ***Helicopontosphaera kamptneri,*** DINOFLAGELLATES: *Hystrichosphaeropsis obscurum, Achomosphaera ramulifera*



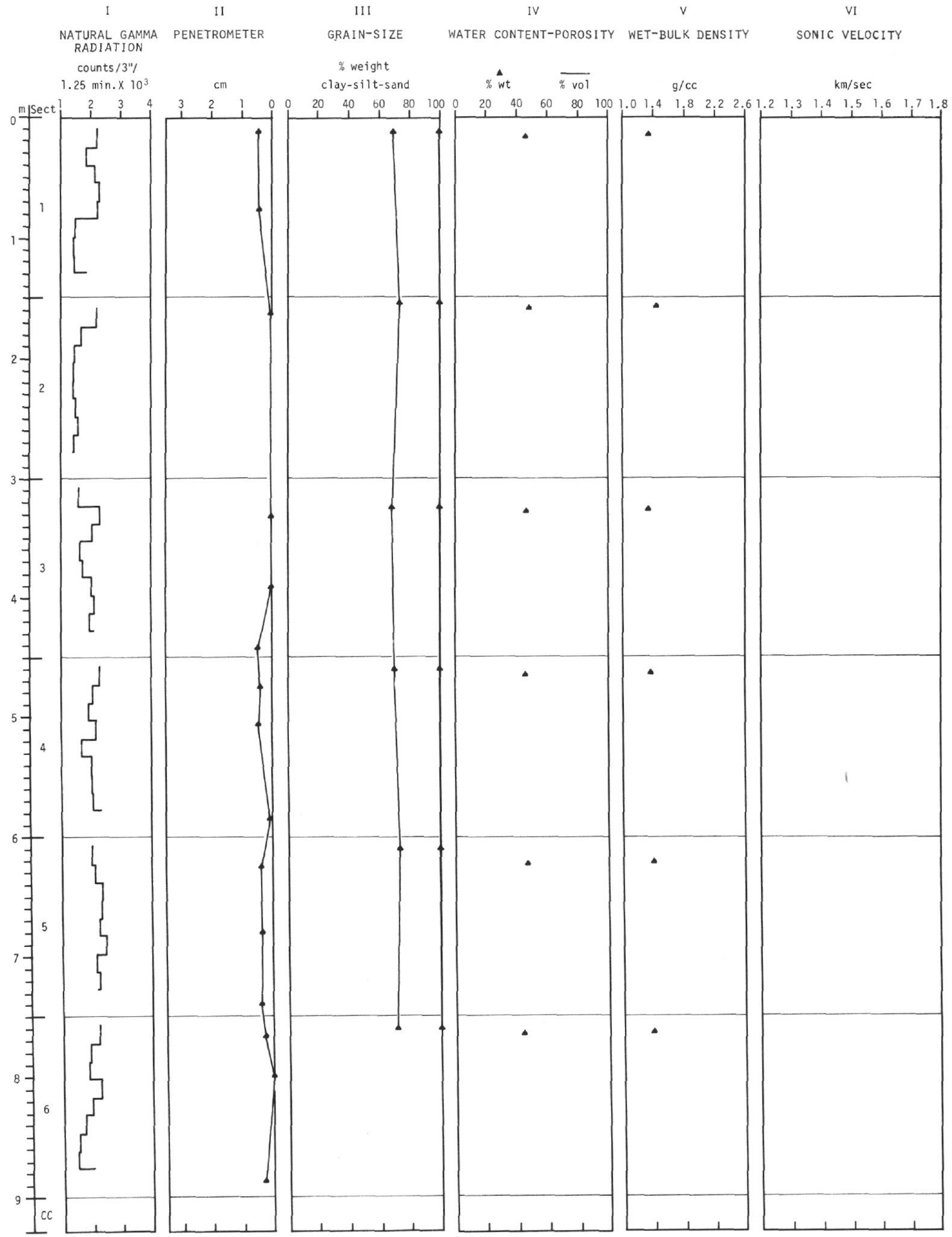
Hole 104, Core 4 (133m to 142m)

AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
MIDDLE MIOCENE	*Turborotalia continuosa* - *Globigerina nepenthes*/*Turborotalia siakensis* N.15-14 *Discoaster kugleri*	0–9	1, 2, 3, 4, 5, 6, CC		SS, SS, SS, CN, SS, SS, SS, SS, F,D,CN SS	<u>Hemipelagic carbonaceous silty clay</u>; soft, greenish gray (5G5/1) with dusky yellow mottling (5Y6/4). General Comments: -Upper 3 meters badly deformed. -Voids due to gas expansion. -Abundant 5cm thick layers of indurated clay - due to coring. -Siderite common to abundant in yellow material. -Abundant diatoms and sponge spicules. -Carbonate average 7%. Abundant diatoms in soft material.	CALCAREOUS NANNOPLANKTON: *Discoaster bollii*, *D. kugleri*, *D. variabilis*, *Reticulofenestra pseudoumbilica*, *Sphenolithus abies*, *Helicopontosphaera kamptneri*, *CORE CATCHER* PLANKTONIC FORAMINIFERS: *Globoquadrina advena*, *Sphaeroidinellopsis seminulina*, *Ss. subdehiscens*, DINOFLAGELLATES: *Hystrichosphaeropsis obscurum*, *Achomosphaera ramulifera* CALCAREOUS NANNOPLANKTON: *Discoaster kugleri*, *D. bollii*, *D. variabilis*, *Coccolithus eopelagicus*, *Reticulofenestra pseudoumbilica*, *Sphenolithus abies*



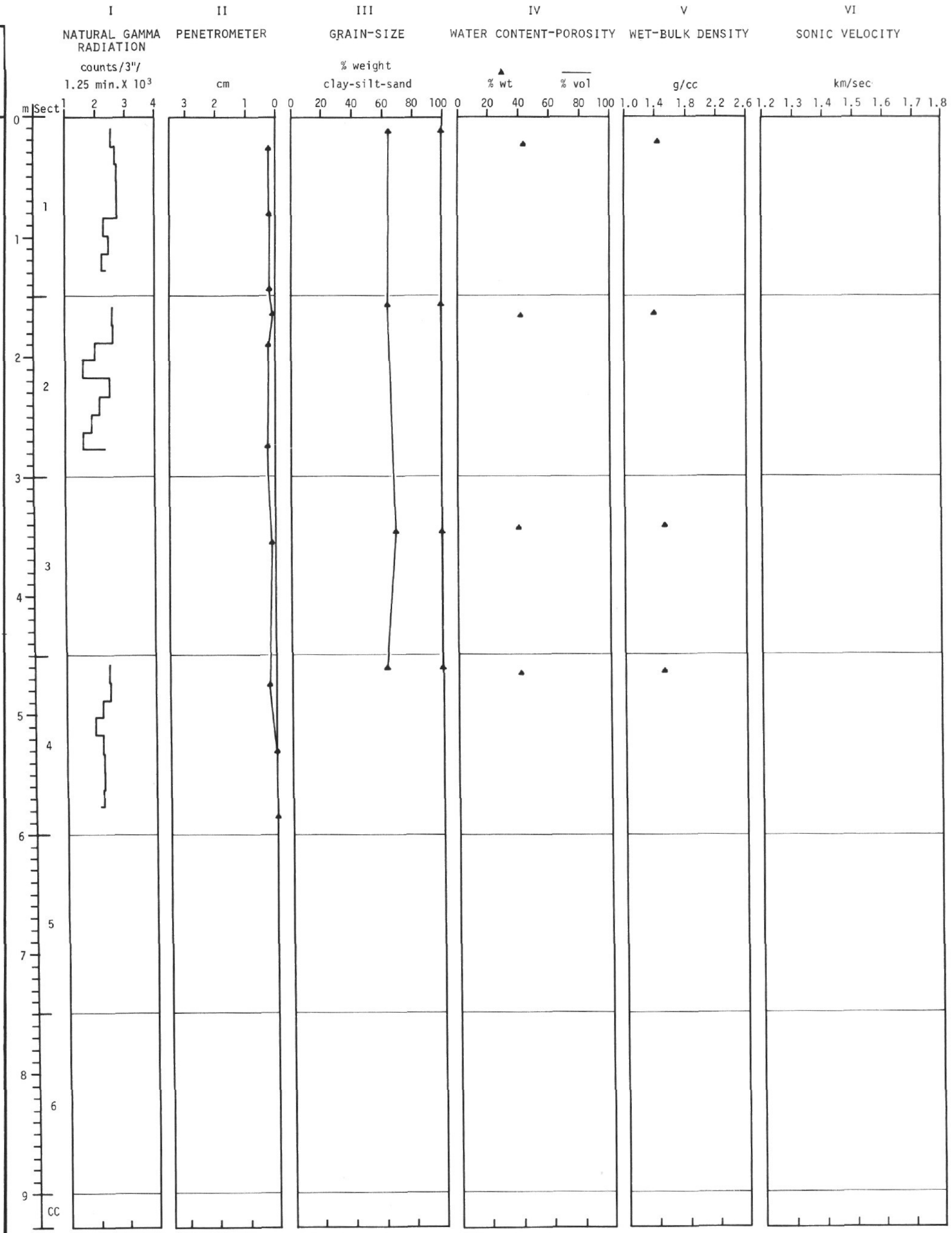
Hole 104, Core 6 (219m to 228m) (no recovery at Core 5)

AGE	ZONE	DEPTH (m)	SECTION NO	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
MIDDLE MIOCENE	Sphaeroidinellopsis subdehiscens/Globigerina druryi N.13 Discoaster kugleri	0–9	1, 2, 3, 4, 5, 6, CC		F, SS, CN, SS, SS, SS, SS, F,D,CN SS	Hemipelagic, carbonaceous, silty clay; plastic, grayish olive (10Y4/2). General Comments: -Frequent layers of relatively indurated clay interbedded throughout core - due to coring. -Voids due to gas expansion. -Diatoms and sponge spicules common to abundant throughout. -Carbonate average 14%. Lenses of yellowish gray (5Y7/2) sandy clay.	PLANKTONIC FORAMINIFERS: *Globigerinoides subquadratus, Turborotalia siakensis* CALCAREOUS NANNOPLANKTON: *Discoaster kugleri, D. bollii, D. exilis, Coccolithus eopelagicus, Helicopontosphaera kamptneri, Reticulofenestra pseudoumbilica, Sphenolithus abies* CORE CATCHER PLANKTONIC FORAMINIFERS: *Sphaeroidinellopsis subdehiscens, Ss. seminulina, Globigerinoides subquadratus, Turborotalia siakensis, Globoquadrina altispira* CALCAREOUS NANNOPLANKTON: *Discoaster kugleri, D. exilis, D. bollii, Sphenolithus abies, Reticulofenestra pseudoumbilica, Helicopontosphaera kamptneri* DINOFLAGELLATES: *Hystrichosphaeropsis obscurum*



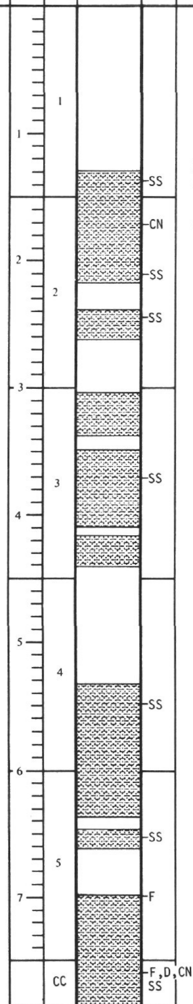
Hole 104, Core 7 (306m to 315m)

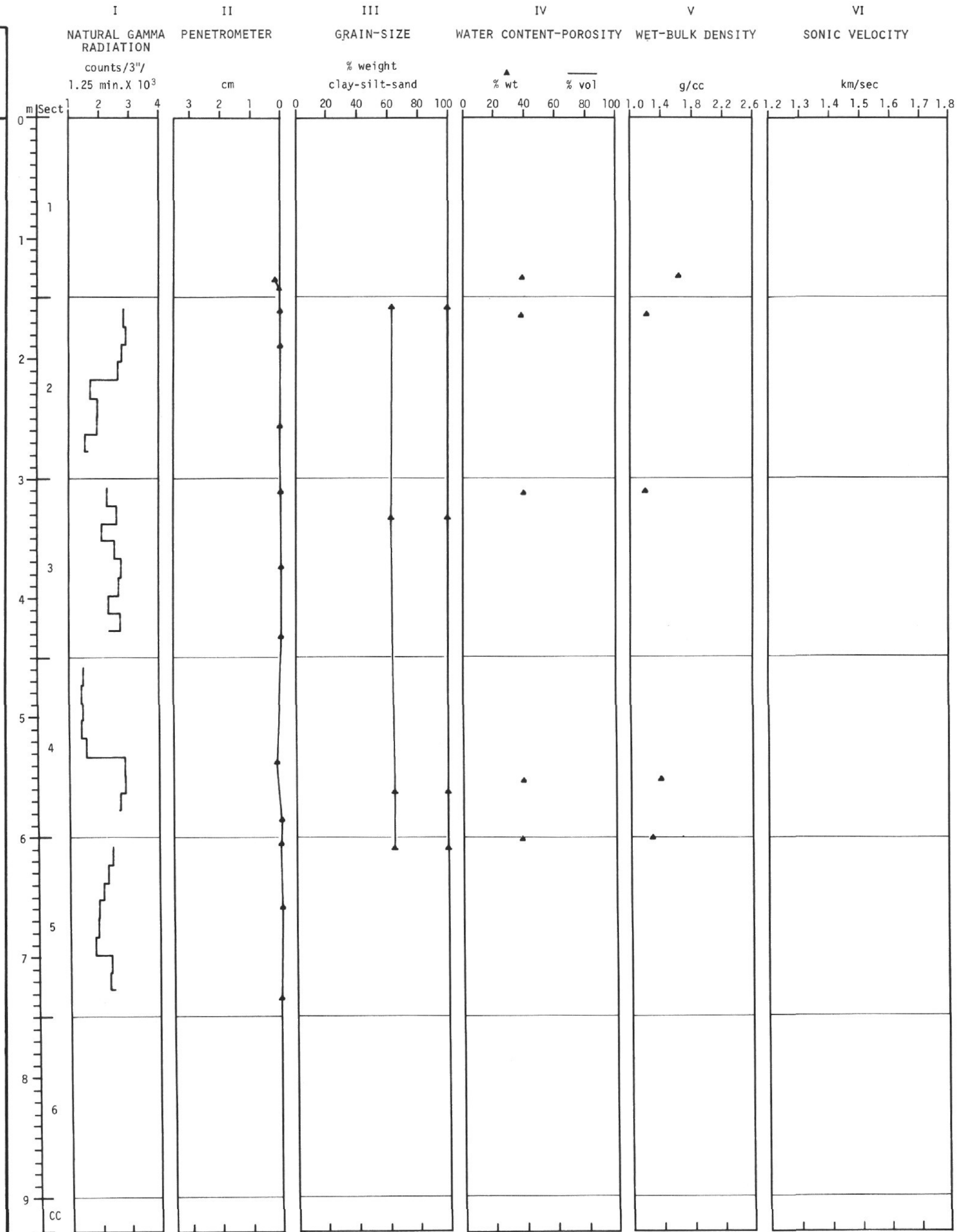
AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
MIDDLE MIOCENE	N.13 Sphaeroidinellopsis subdehiscens/ Gobigerina-druryi; N.12 Globorotalia fohsi; Discoaster exilis	0–6	1, 2, 3, 4, CC		SS, F, CN, SS, SS, F,D, CN,SS	<u>Hemipelagic, carbonaceous, silty clay</u>; plastic, grayish olive (10Y4/2). General Comments: - Abundant layers of relatively indurated layers interbedded throughout core - due to coring. - Voids due to gas expansion. - Concentrations of white quartz and feldspar silt in burrows. - Diatoms and sponge spicules abundant. - Siderite present throughout. - Carbonate average 20%.	PLANKTONIC FORAMINIFERS: *Globoquadrina advena, Sphaeroidinella subdehiscens, Turborotalia siakensis* CALCAREOUS NANNOPLANKTON: *Discoaster exilis, D. bollii, D. variabilis, D.* aff.*D. deflandrei, Coccolithus eopelagicus, Sphenolithus abies, Reticulofenestra pseudoumbilica, Helicopontosphaera kamptneri* *CORE CATCHER* PLANKTONIC FORAMINIFERS: *Globoquadrina dehiscens, Gq. advena, Sphaeroidinellopsis seminulina, Globigerinoides subquadratus, Turborotalia siakensis, Turborotalia peripheroranda, Gl. lobata, Gl. robusta, Gl. praemenardii* DINOFLAGELLATES: *Hystrichosphaeropsis obscurum, Achomosphaera ramulifera* CALCAREOUS NANNOPLANKTON: *Discoaster exilis, D. bollii, D. variabilis, Coccolithus eopelagicus, Helicopontosphaera kamptneri, Sphenolithus abies*



Hole 104, Core 8 (401m to 410m)

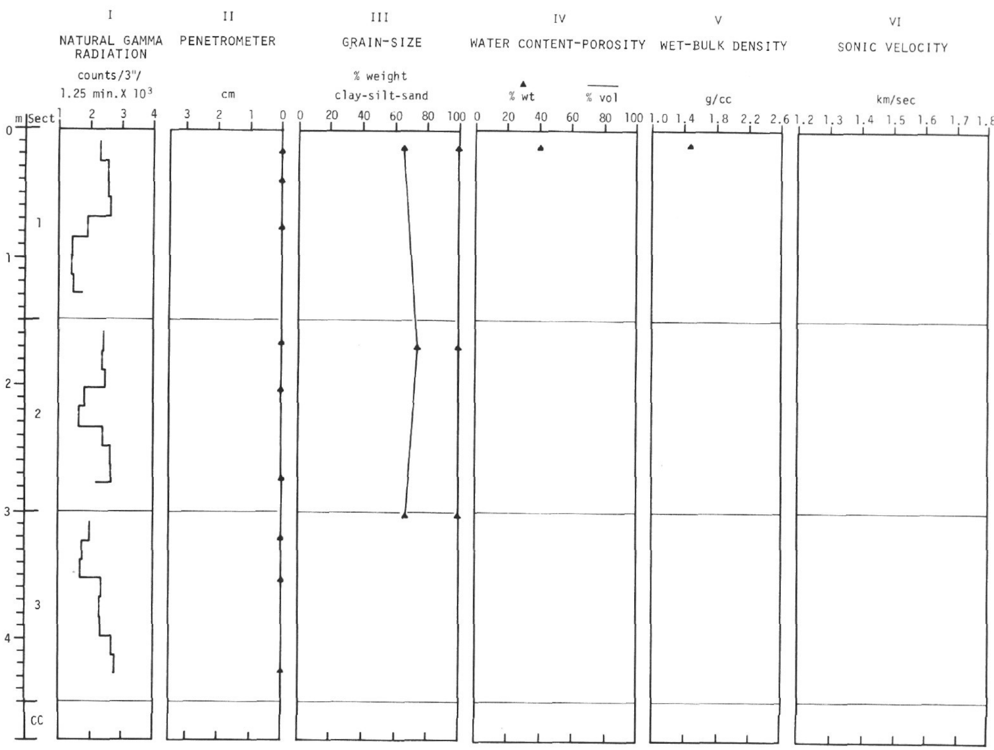
AGE	ZONE	LITHOLOGY	DIAGNOSTIC FOSSILS
MIDDLE MIOCENE	*Turborotalia praefohsi* N.11 *Discoaster exilis*	Hemipelagic, carbonaceous, silty clay, firm, grayish olive (10Y4/2). General Comments: -Voids due to gas expansion. -Alternate firm and plastic layering due to coring operation. -Vertical fracturing in harder layers. -Diatoms and sponge spicules abundant. -Carbonate average 20%.	CALCAREOUS NANNOPLANKTON: *Discoaster exilis,* *D. bollii,* *D. variabilis,* *Coccolithus eopelagicus,* *Sphenolithus abies,* *Helicopontosphaera kamptneri.* *CORE CATCHER* DINOFLAGELLATES: *Hystrichosphaeropsis obscurum* *Achomosphaera ramulifera* PLANKTONIC FORAMINIFERS: *Turborotalia praefohsi* *T. peripheroacuta* *T. continuosa* *T. mayeri* *T. siakensis* *Globorotalia praemenardii,* *Gl. lobata,* *Sphaeroidinellopsis seminulina* *Globoquadrina advena,* *Gq. dehiscens* CALCAREOUS NANNOPLANKTON: *Discoaster exilis,* *D. variabilis,* *D. bollii,* *Helicopontosphaera kamptneri,* *Coccolithus eopelagicus.*





Hole 104, Core 9 (395m to 504m)

AGE	ZONE	DEPTH (m)	SECTION NO	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
MIDDLE MIOCENE	Orbulina suturalis/Turborotalia peripheroranda? N.9 ? Discoaster exilis	1, 2, 3, 4	1, 2, 3, CC		SS, SS, SS, SS, F, CN, F,D, CN, SS	Hemipelagic carbonaceous silty clay, firm, dry, grayish olive (10Y4/2). General comments: -Voids due to gas expansion. -Thin, lensy bedding apparent. -Diatoms and sponge spicules abundant. -Carbonate average 20%.	PLANKTONIC FORAMINIFERS: *Globoquadrina altispira* CALCAREOUS NANNOPLANKTON: *Coccolithus eopelagicus, Discoaster exilis, D. bollii, D. variabilis, Sphenolithus abies, Reticulofenestra pseudoumbilica, Helicopontosphaera kamptneri* PLANKTONIC FORAMINIFERS: *Globigerinoides subquadratus* DINOFLAGELLATES: *Hystrichosphaeropsis obscurum, Achomosphaera ramulifera* CALCAREOUS NANNOPLANKTON: *Discoaster exilis, D. bollii, D. variabilis, Helicopontosphaera kamptneri, Sphenolithus abies, Coccolithus eopelagicus*



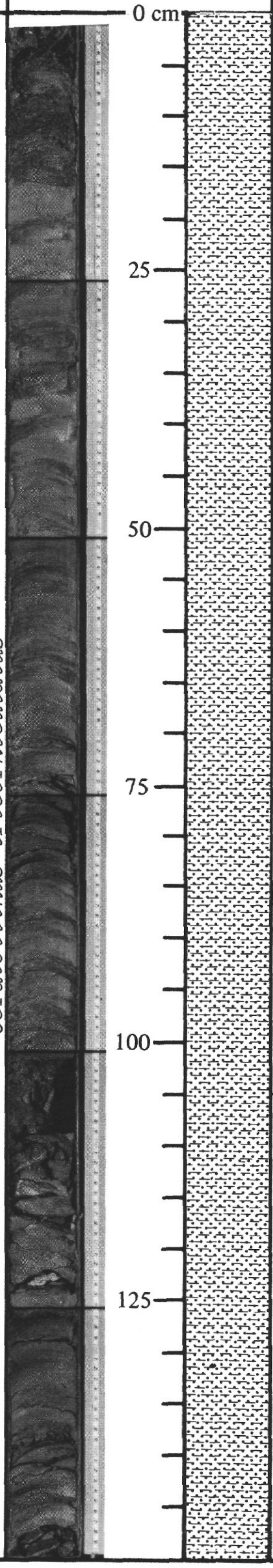
Hole 104, Core 10 (615m to 617m)

AGE	ZONE	DEPTH (m)	SECTION NO.	LITHOLOGY	SAMPLE INTERVAL	LITHOLOGY	DIAGNOSTIC FOSSILS
MIDDLE MIOCENE	? Orbulina suturalis/ Turborotalia peripheroronda? Sphenolithus heteromorphus	1	1, CC		SS, D,CN, SS, D, F,D, CN, SS	Ankerite, very hard. Hemipelagic silty claystone; greenish gray (5GY5/1), gassy. General Comments: -Bedding disturbed by abundant burrows. -Diatoms and sponge spicules - abundant. -Radiolarians - common.	PLANKTONIC FORAMINIFERS: *Orbulina suturalis, Turborotalia peripheroronda, T. siakensis, Globoquadrina altispira, Gq. dehiscens* DINOFLAGELLATES: *Pentadinium taeniagerum, Chiropteridium* sp. A *Achomosphaera ramulifera, Svalbardella* sp., *Spiniferites* sp. A CALCAREOUS NANNOPLANKTON: *Sphenolithus heteromorphus, Helicopontosphaera kamptneri, Discoaster exilis, D. bollii, Cyclococcolithina neogammation, Reticulofenestra pseudoumbilica*

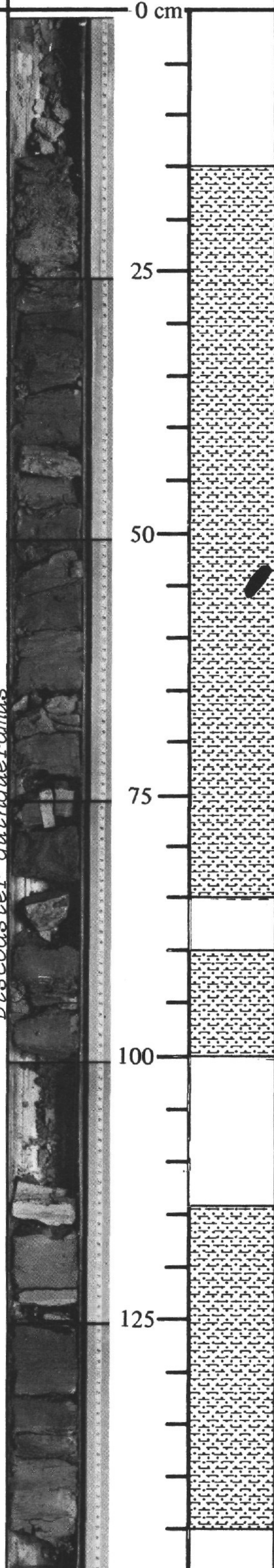
Hole 102, Core 11, Sect. 3

AGE	ZONE	LITHOLOGY	SAMP. INT	LITHOLOGY	DIAGNOSTIC FOSSILS
LATE PLIOCENE	*Turborotalia tenuitheca* N.21 *Reticulofenestra pseudoumbilica*	 0 cm, 25, 50, 75, 100, 125	CN F	<u>Hemipelagic carbonaceous silty clay</u>; dark greenish gray (5G 4/1), moderately indurated but plastic. Siderite, sponge spicules, clay minerals abundant. Quartz, pyrite, plant debris common. Diatoms, mica, glass and glauconite rare. Light colored specks are siderite concentrations. Voids due to gas expansion.	CALCAREOUS NANNOPLANKTON: *Discoaster brouweri*, *D. pentaradiatus*, *D. asymmetricus*, *Reticulofenestra pseudoumbilica*, *Cyclococcolithina macintyrei*, *Helicopontosphaera sellii* PLANKTONIC FORAMINIFERS: *Globigerinoides extremus*, *Globorotalia miocenica*, *Gl. multicamerata*, *Globoquadrina altispira*, *Gq. venezuelana*

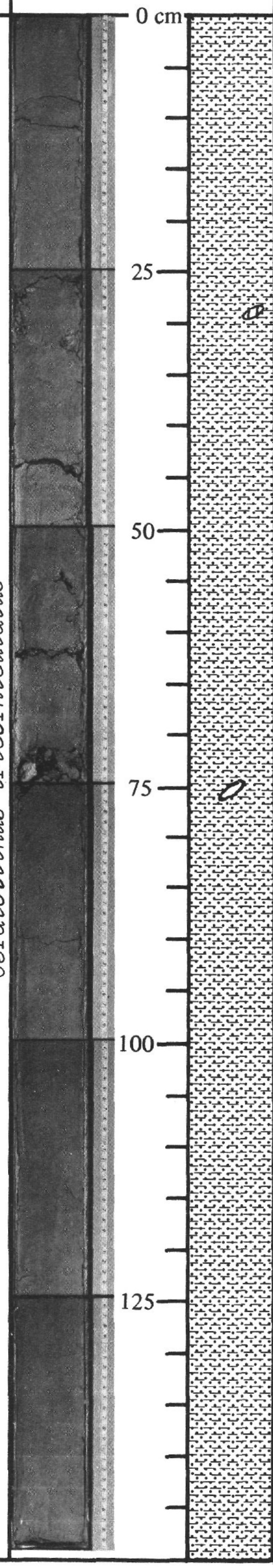
Hole 102, Core 17, Sect. 1

AGE	ZONE	LITHOLOGY	SAMP. INT	LITHOLOGY	DIAGNOSTIC FOSSILS
LATE MIOCENE	*Globorotalia plesiotumida* N.17 *Ceratolithus tricorniculatus*		SS (0 cm) CN, F (~85 cm) SS (~105 cm)	Hemipelagic, siliceous, silty clay; dark greenish gray (5G 4/1), indurated. Clay minerals abundant. Radiolarians, plant debris, quartz, mica glauconite rare. Nannoplankton, calcite fragments, diatoms, sponge spicules and pyrite common. Clay minerals abundant, nannoplankton, diatoms, sponge spicules, plant debris, pyrite common. Calcite fragments, siderite quartz, glauconite rare. Pyrite spheres and clay minerals abundant. Diatoms, sponge spicules, common. Nannoplankton, quartz, mica, dolomite rhombs, rare.	CALCAREOUS NANNOPLANKTON: *Ceratolithus tricorniculatus*, *Discoaster quinqueramus*, *D. exilis*, *D. challengeri*, *Reticulofenestra pseudoumbilica*, *Sphenolithus abies*. PLANKTONIC FORAMINIFERS: *Globoquadrina altispira*, *Sphaeroidinellopsis seminulina*, *Globorotalia margaritae*, *Globigerina nepenthes*

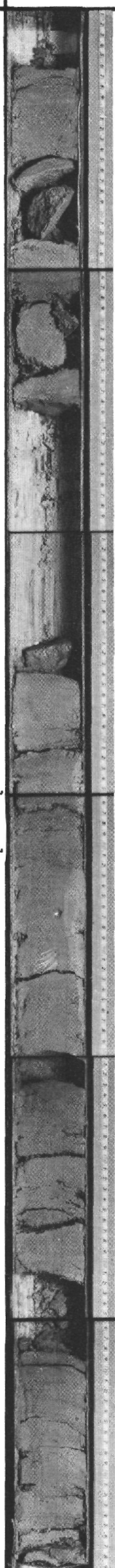
Hole 102, Core 19, Sect. 1

AGE	ZONE	LITHOLOGY	SAMP. INT	LITHOLOGY	DIAGNOSTIC FOSSILS
LATE MIOCENE	*Turborotalia acostaensis*/*Globorotalia merotumida* N.16 *Discoaster quinqueramus*		F CN	<u>Hempelagic silty carbon-aceous clay</u>, varying between dark greenish gray (5G 4/1) and light greenish gray (5GY 4/1). Light beds are relatively undisturbed - dark layers reveal distortion caused by coring operation. Voids are due to gas expansion. Siderite nodule. White specks are concentrations of foraminifers or quartz and feldspar silt. Pyrite occurs as framboidal grains in burrow fillings. Clay minerals dominant. Quartz, plant debris, and nannoplankton are common. Foraminifers rare.	PLANKTONIC FORAMINIFERS: *Globorotalia miozea*, *Globigerina nepenthes*, *Globorotalia merotumida*, *Turborotalia continuosa*, *Turborotalia clemenciae* CALCAREOUS NANNOPLANKTON: *Reticulofenestra pseudoumbilica*, *Discoaster quinqueramus*, *D. kugleri*, *D. exilis*, *Ceratolithus tricorniculatus*, *Helicopontosphaera kamptneri*

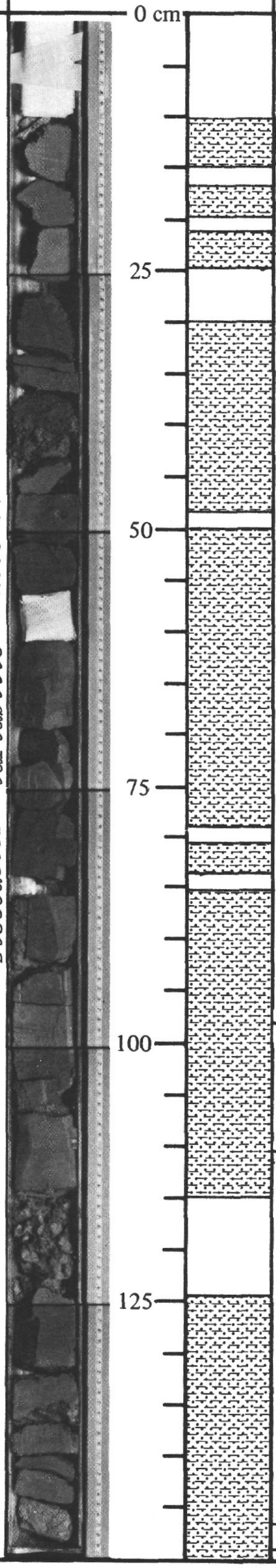
Hole 103, Core 3, Section 6

AGE	ZONE	LITHOLOGY	SAMP. INT	LITHOLOGY	DIAGNOSTIC FOSSILS
LATE MIOCENE	*Globorotalia plesiotumida* *Ceratolithus tricorniculatus*		SS (75 cm) CN F D (100 cm)	Hemipelagic silty carbonaceous clay, dark greenish gray (5GY 4/1) mottled with light olive gray (5Y 5/2), soft, plastic Lens of siderite. Clay minerals and quartz silt abundant. Plant debris abundant. Foraminifera & nannoplankton rare. Dolomite nodule.	CALCAREOUS NANNOPLANKTON: *Discoaster challengeri, D. variabilis, D. quinqueramus, D. brouwer, Sphenolithus abies, Reticulofenestra pseudoumbilica* PLANKTONIC FORAMINIFERS: *Globorotalia plesiotumida Gl. cibaoensis, Globigerina nepenthes* DINOFLAGELLATES: *Achomosphaera ramulifera*

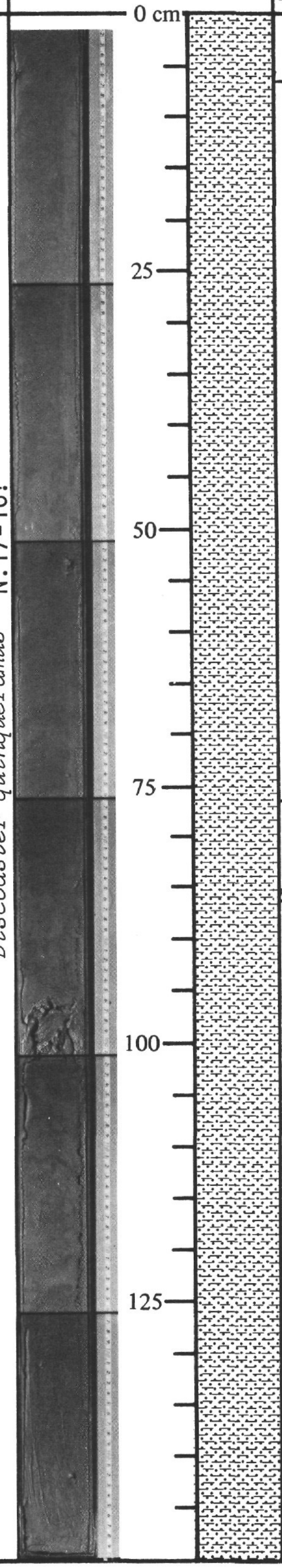
Hole 103, Core 5, Section 2

AGE	ZONE	LITHOLOGY	SAMP. INT	LITHOLOGY	DIAGNOSTIC FOSSILS
LATE MIOCENE	L *Turborotalia continuosa* *Discoaster quinqueramus* N.15	 0 cm, 25, 50, 75, 100, 125	SS (75 cm), N, SS, D	<u>Hemipelagic silty carbonaceous clay</u>; dark greenish gray (5GY 4/1) mottled with light olive gray (5Y 5/2) firm, plastic. Burrow (?) fillings composed of aragonite. Voids due to gas expansion. Clay minerals and nannoplankton abundant. Plant debris and pyrite common. Dolomite and foraminifers rare.	CALCAREOUS NANNOPLANKTON: *Discoaster variabilis, D. exilis, D. bollii, D. hamatus, D. quinqueramus, Sphenolithus abies, Reticulofenestra pseudoumbilica.* DINOFLAGELLATES: *Hystrichosphaeropsis obscurum, Achomosphaera ramulifera*

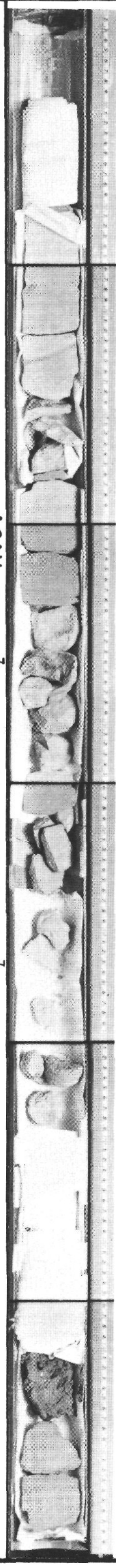
Hole 103, Core 6, Section 1

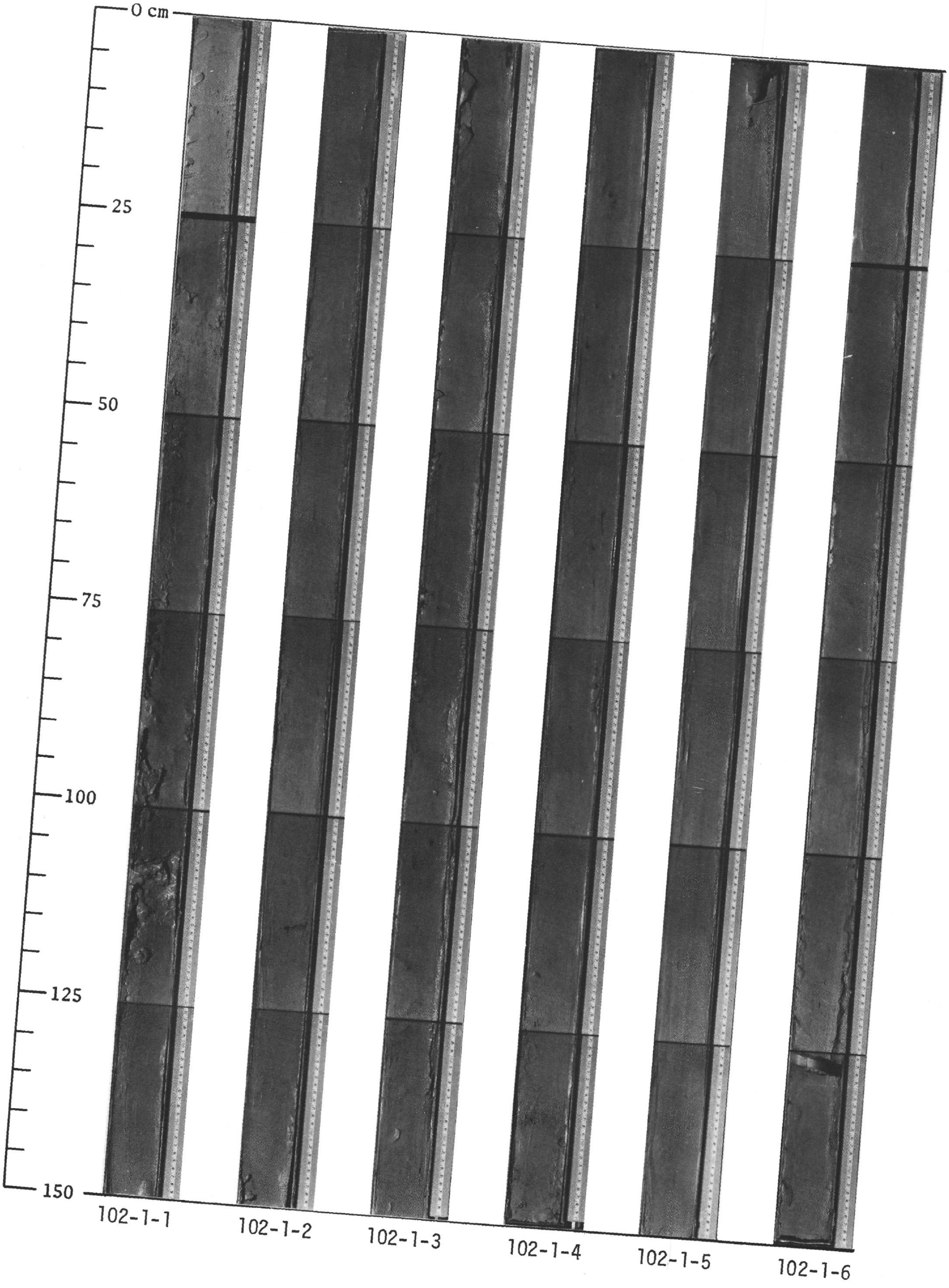
AGE	ZONE	LITHOLOGY	SAMP. INT	LITHOLOGY	DIAGNOSTIC FOSSILS
LATE MIOCENE	*Turborotalia continuosa* *Globigerina nepenthes*/*Turborotalia siakensis* N.15-14 *Discoaster variabilis*		CN, F, SS, F, D, SS, SS	Hemipelagic carbonaceous silty clay, grayish olive olive green (5GY 3/2) with lenses of dusky yellow. Evenly bedded. Sediment is very crumbly and fractured. Clay minerals abundant. Quartz, diatoms, sponge spicules, plant debris common. White lenses are predominantly siderite replacing nannoplankton.	CALCAREOUS NANNOPLANKTON: *Discoaster variabilis*, *D. exilis*, *D. challengeri*, *Helicopontosphaera itamptneri*, *Reticulofenestra pseudoumbilica*, *Scyphosphaera amphora* PLANKTONIC FORAMINIFERS: *Globoquadrina dehiscens*, *Globigerina nepenthes* PLANKTONIC FORAMINIFERS: *Globigerina nepenthes*, *Globoquadrina advena* DINOFLAGELLATES *Hystrichosphaeropsis obscurum*, *Achomosphaera ramulifera*

Hole 104, Core 1, Section 6

AGE	ZONE	LITHOLOGY	SAMP. INT	LITHOLOGY	DIAGNOSTIC FOSSILS
LATE MIOCENE	*Globorotalia plesiotumida* *Turborotalia acostaensis*/*Floborotalia merotumida* ? *Discoaster quinqueramus* N.17-16?		F (top) SS (75 cm) CN F, D (bottom)	Hemipelagic silty carbonaceous clay, dark greenish gray (5G 4/1) to olive gray (5Y 4/1), soft and plastic. Clay minerals abundant. Quartz, feldspar and organic matter common.	PLANKTONIC FORAMINIFERS: *Turborotalia inflata* CALCAREOUS NANNOPLANKTON: *Discoaster quinqueramus*, *D. exilis*, *D. variabilis*, *Sphenolithus abies* DINOFLAGELLATES: *Operculodinium centracarpum*, *Achomosphaera ramulifera* PLANKTONIC FORAMINIFERS: *Turborotalia inflata*, *Globigerina nepenthes*

Hole 104, Core 10, Section 1

AGE	ZONE	LITHOLOGY	SAMP. INT	LITHOLOGY	DIAGNOSTIC FOSSILS
MIDDLE MIOCENE	*Orbulina suturalis/Turborotalia peripheroronda* ? *Sphenolithus heteromorphus* N.9?	 0 cm, 25, 50, 75, 100, 125	SS	Ankeritic limestone, greenish gray (5GY 5/1)	
			CN D SS	Hemipelagic, siliceous, silty mudstone. Clay minerals, diatoms, sponge spicules abundant. Siderite, radiolarians	CALCAREOUS NANNOPLANKTON: *Sphenolithus heteromorphus, Discoaster bollii, D. exilis Cyclococcolithina neogammation, Coccolithus eopelagicus, Helicopontosphaera kamptneri* DINOFLAGELLATES: *Achomosphaera ramulifera, Svalbardella* sp. *Hystrichosphaeropsis obscurum*
			D	Irregular bedding throughout.	
			SS F, D, N		CALCAREOUS NANNOPLANKTON: *Sphenolithus heteromorphus, Helicopontosphaera kamptneri Discoaster exilis, D. bollii, Cyclococcolithina neogammation, Reticulofenestra pseudoumbilica* DINOFLAGELLATES: *Achomosphaera ramulitera, Svalbardella* sp., *Spiniferites* sp. A PLANKTONIC FORAMINIFERS: *Orbulina suturalis, Turborotalia siakensis, T. peripheroronda, Globoquadrina dehiscens*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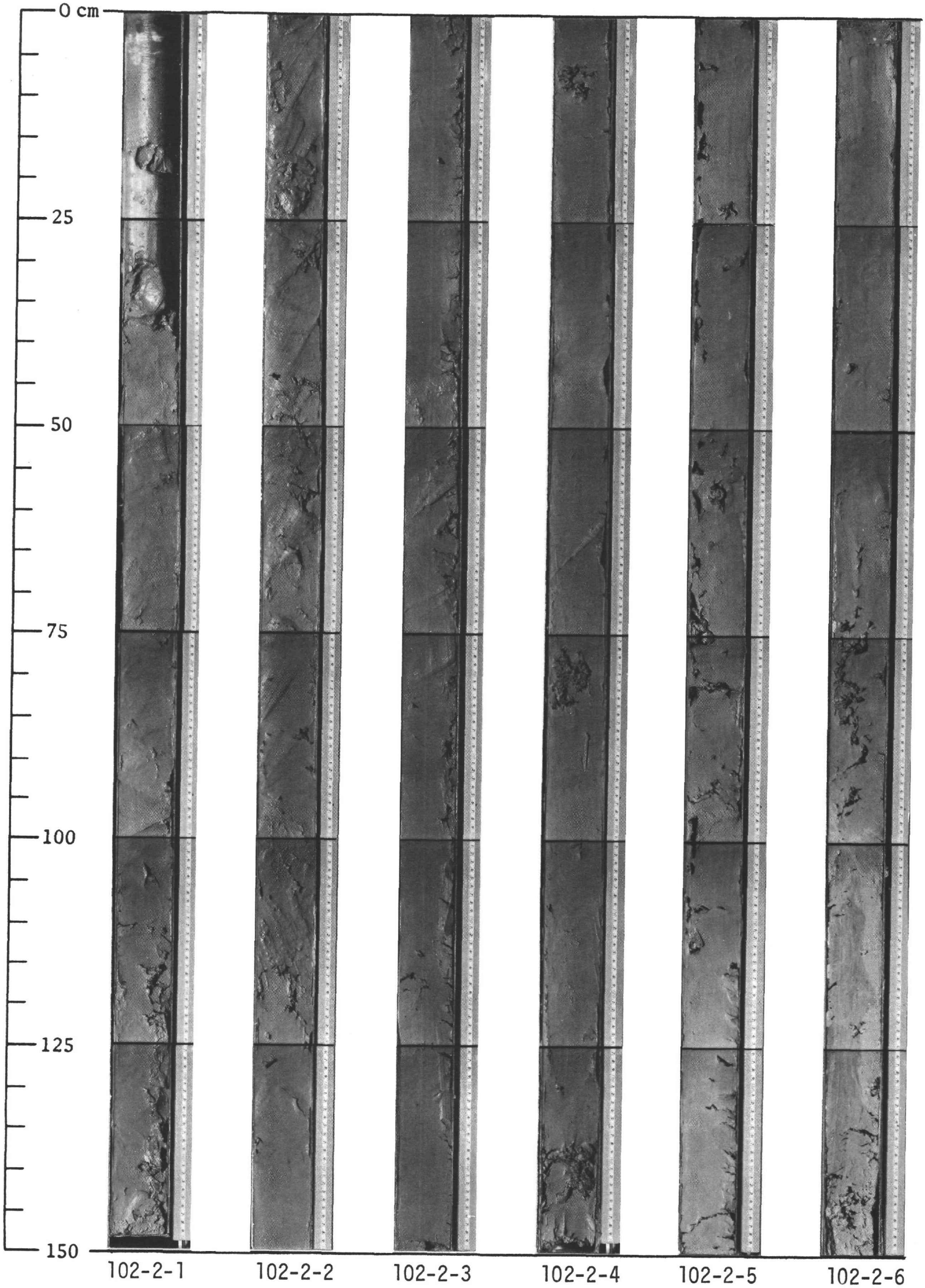
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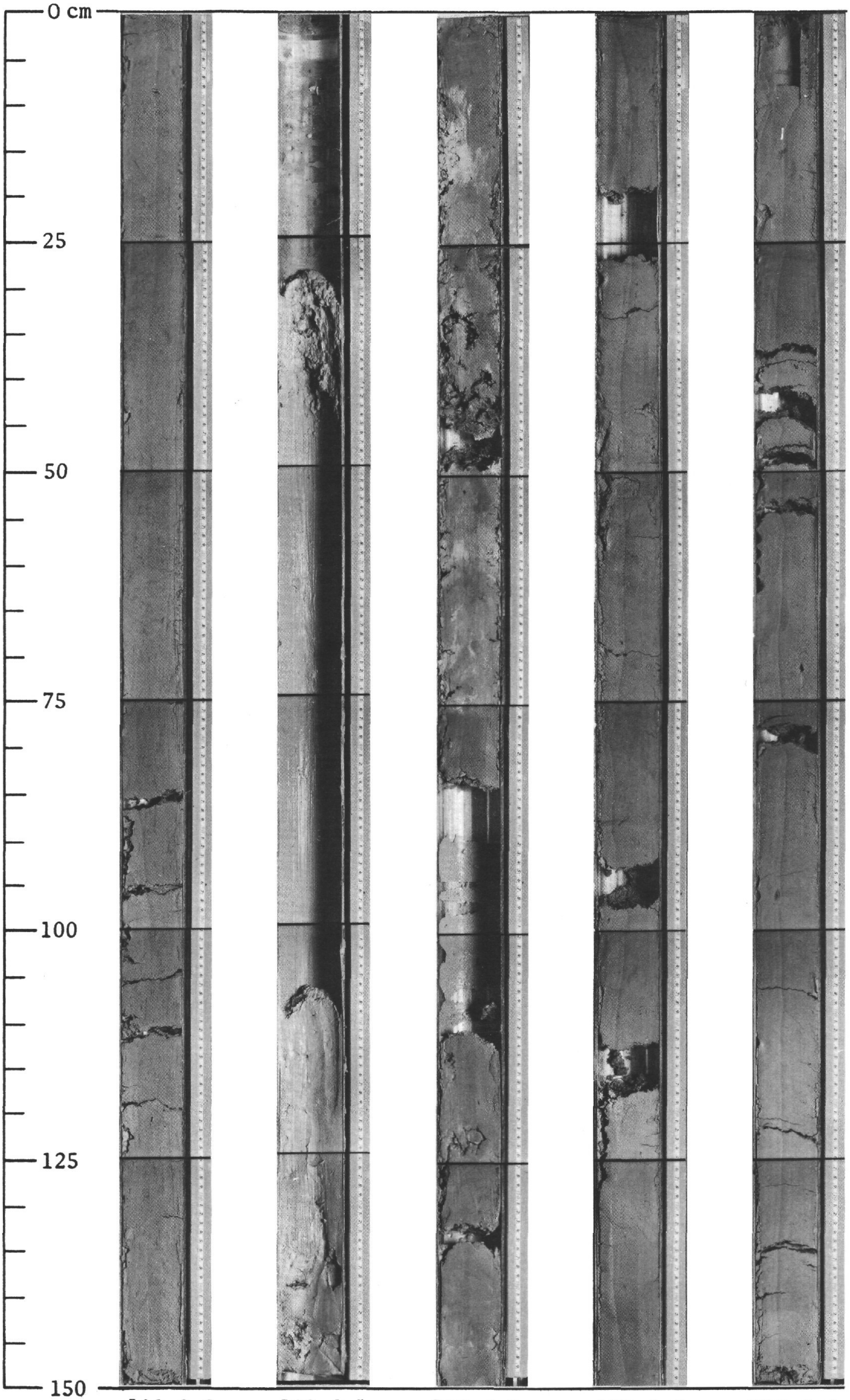
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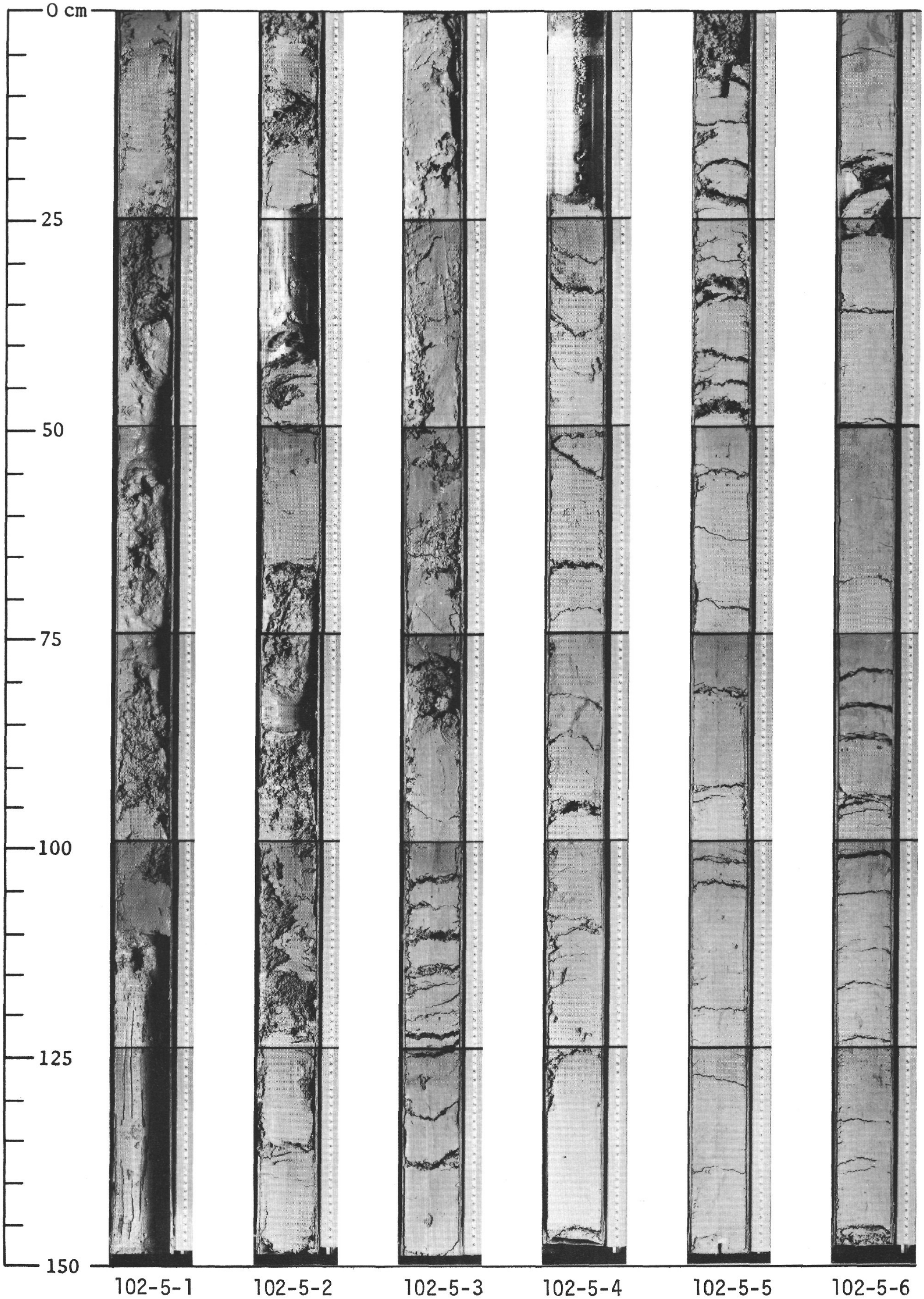

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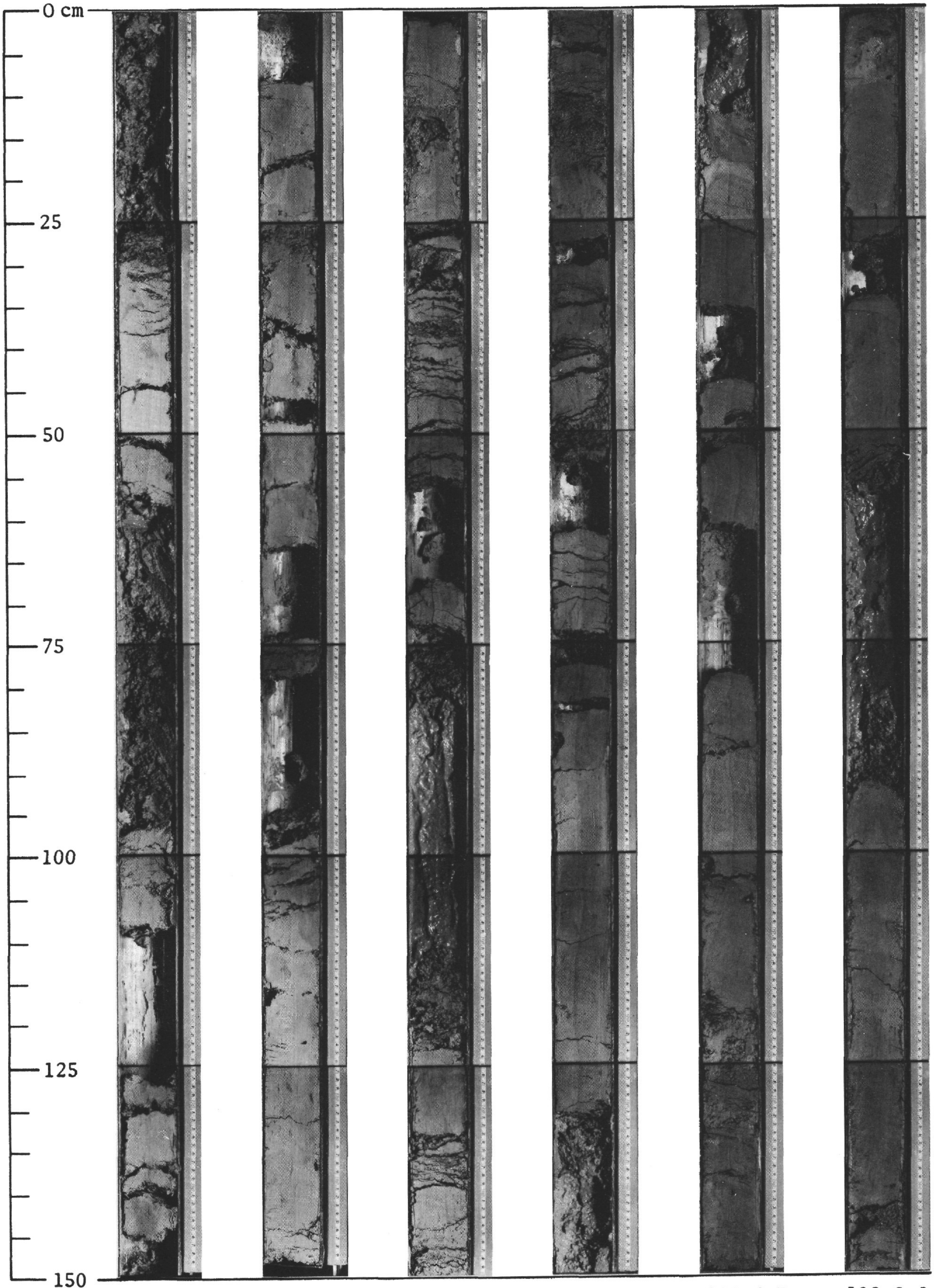
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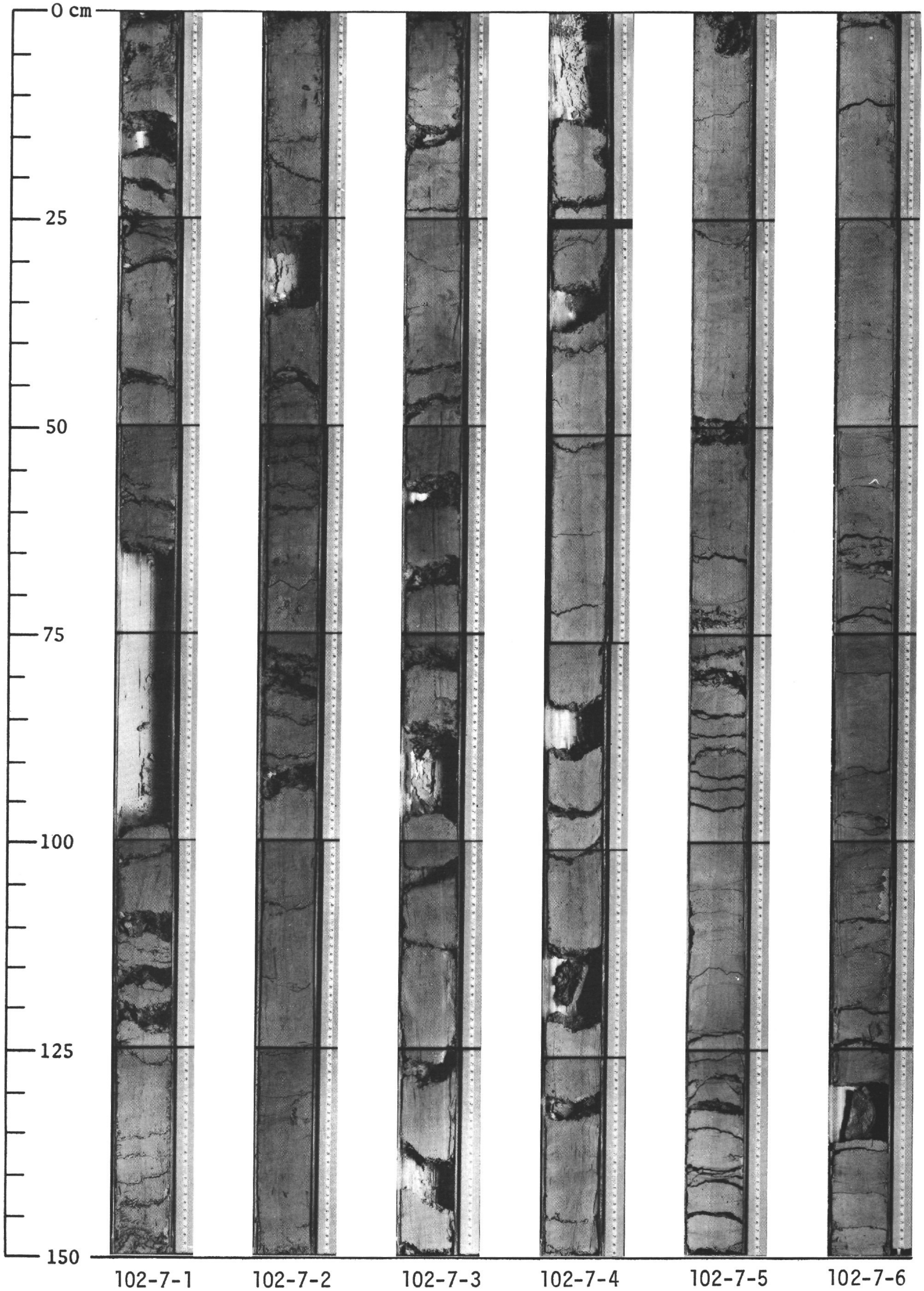
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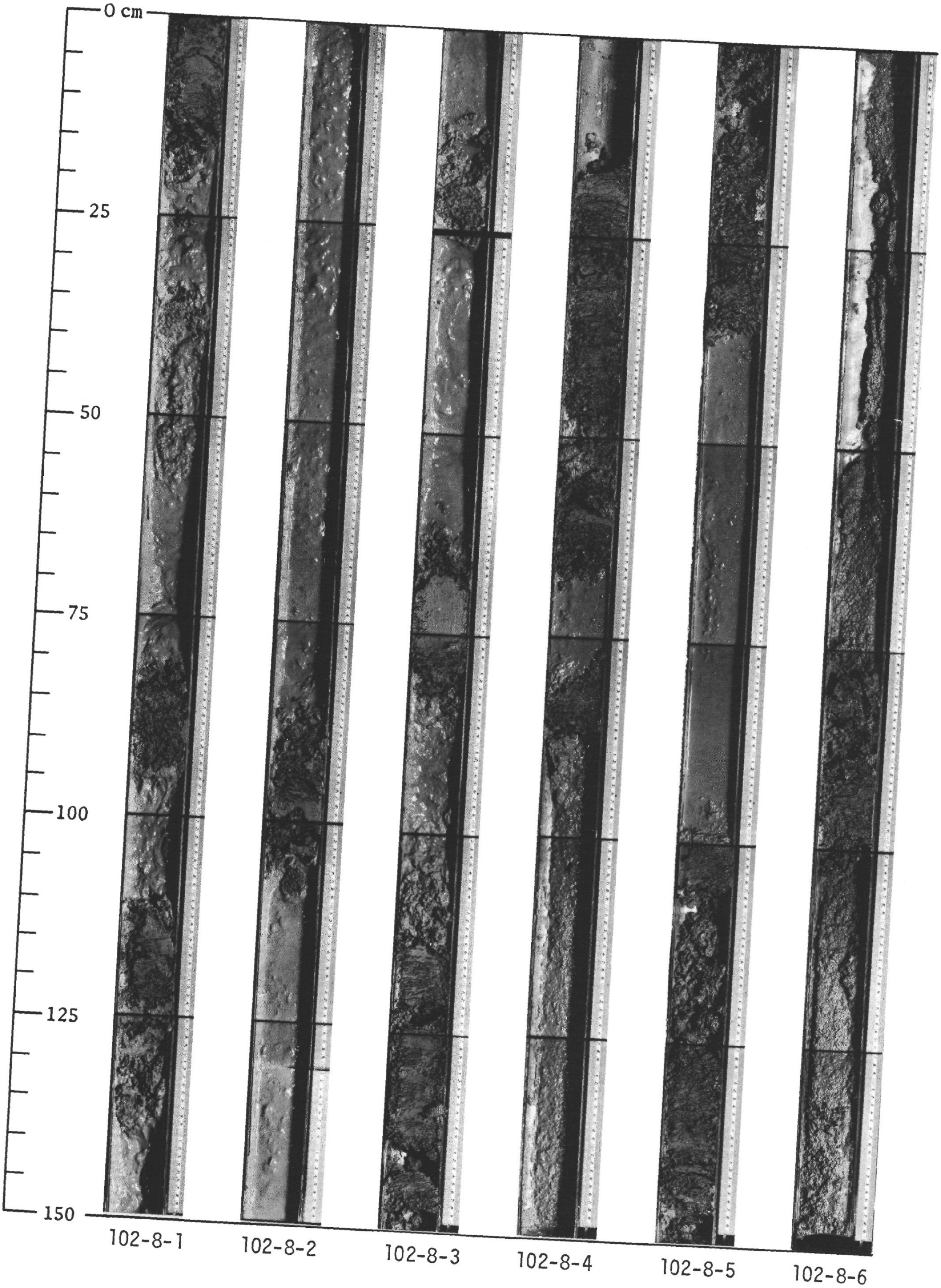
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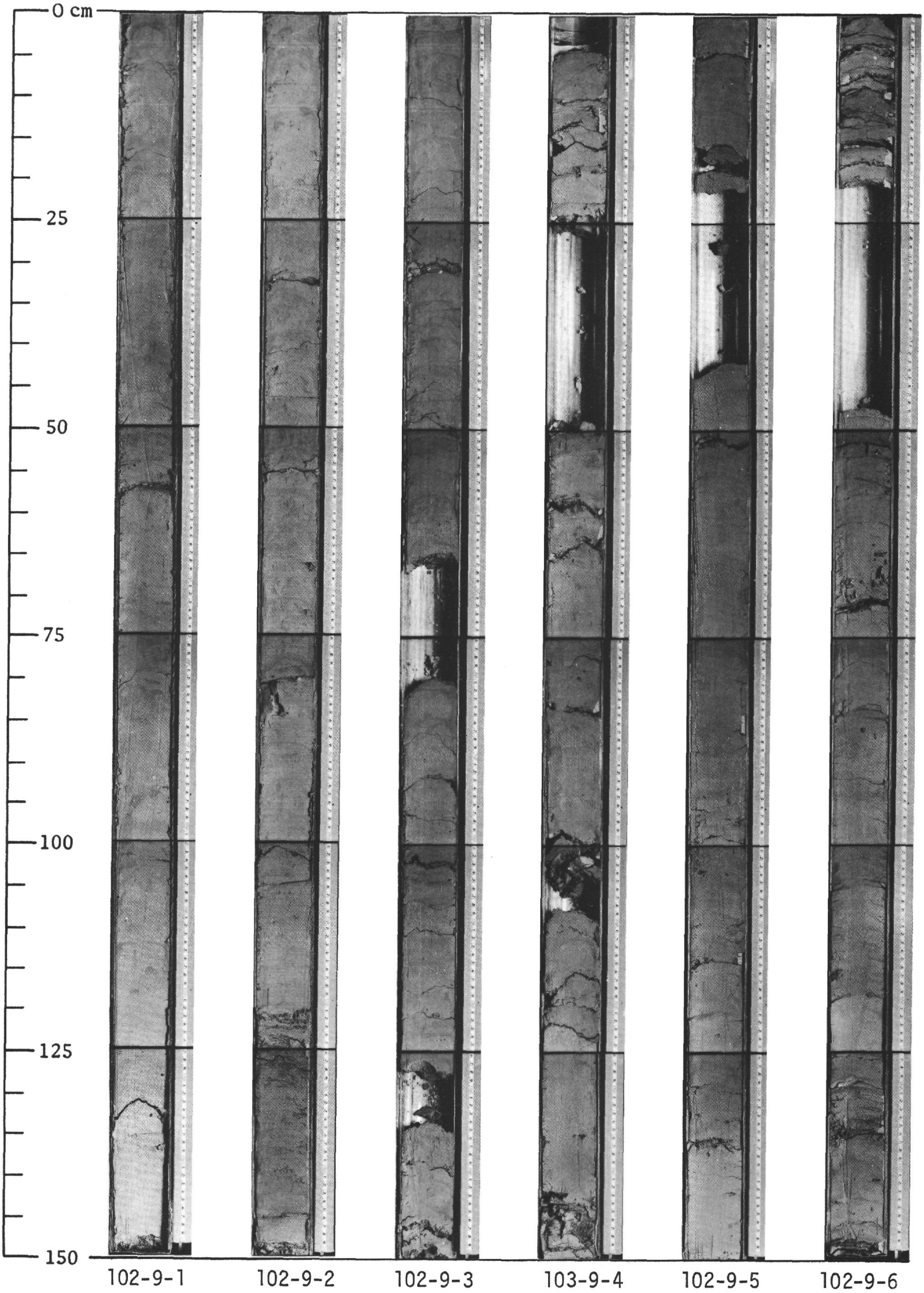
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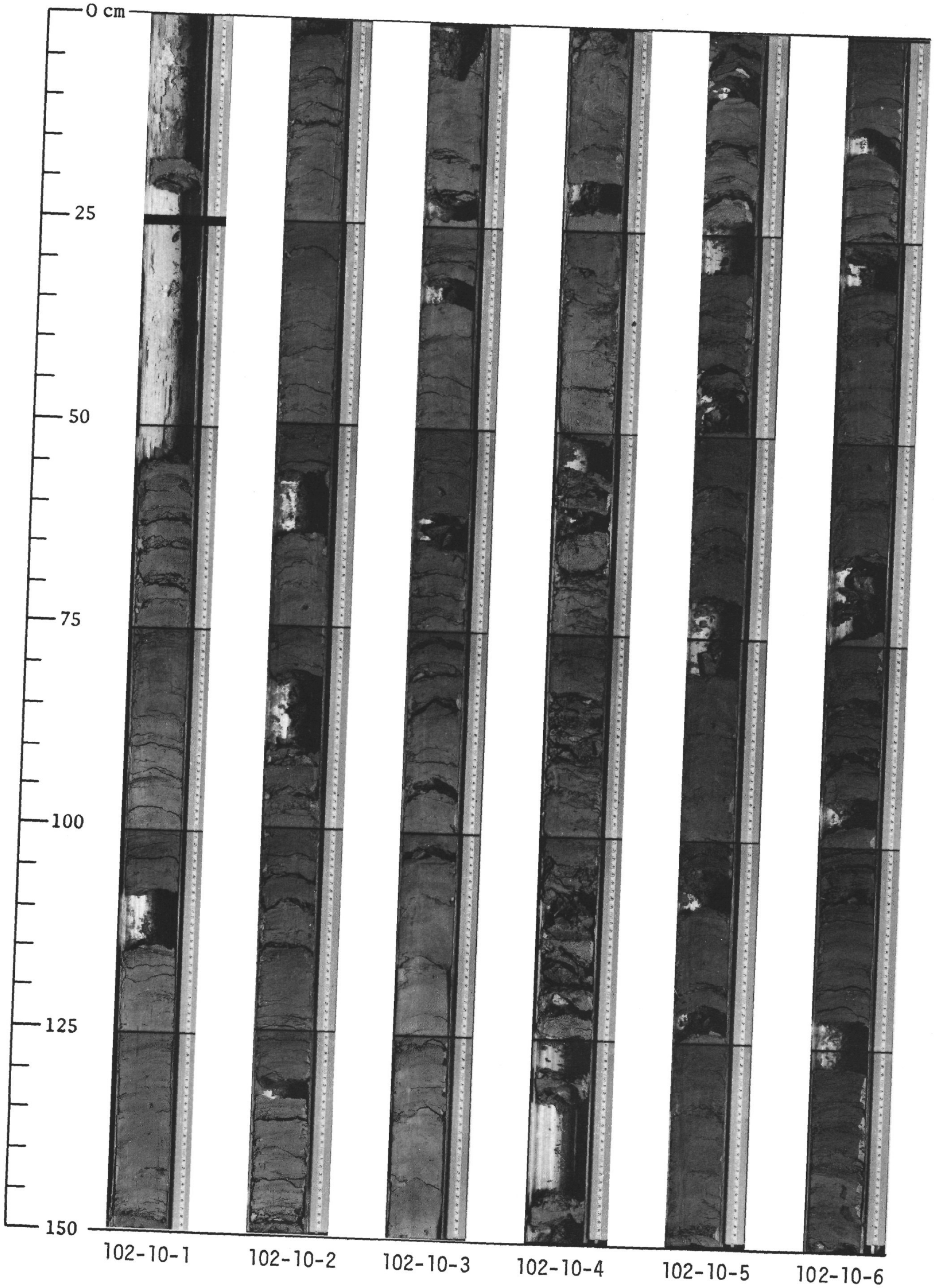
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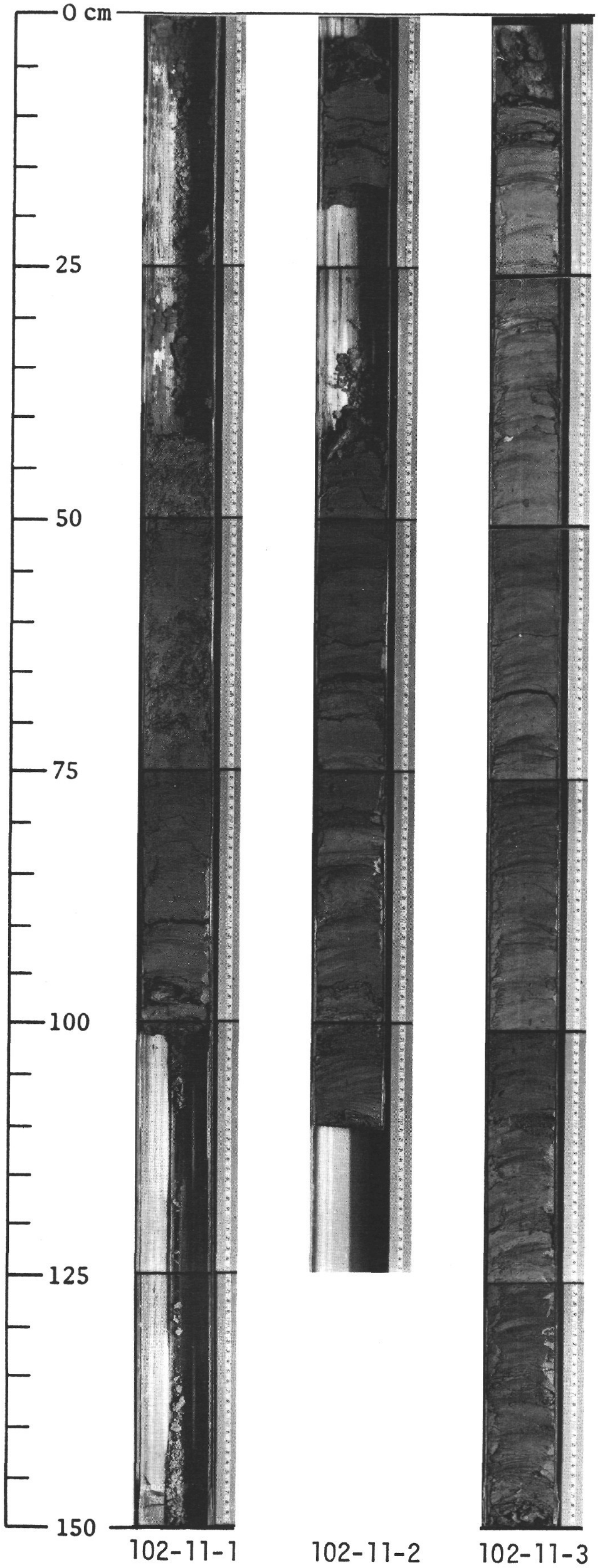
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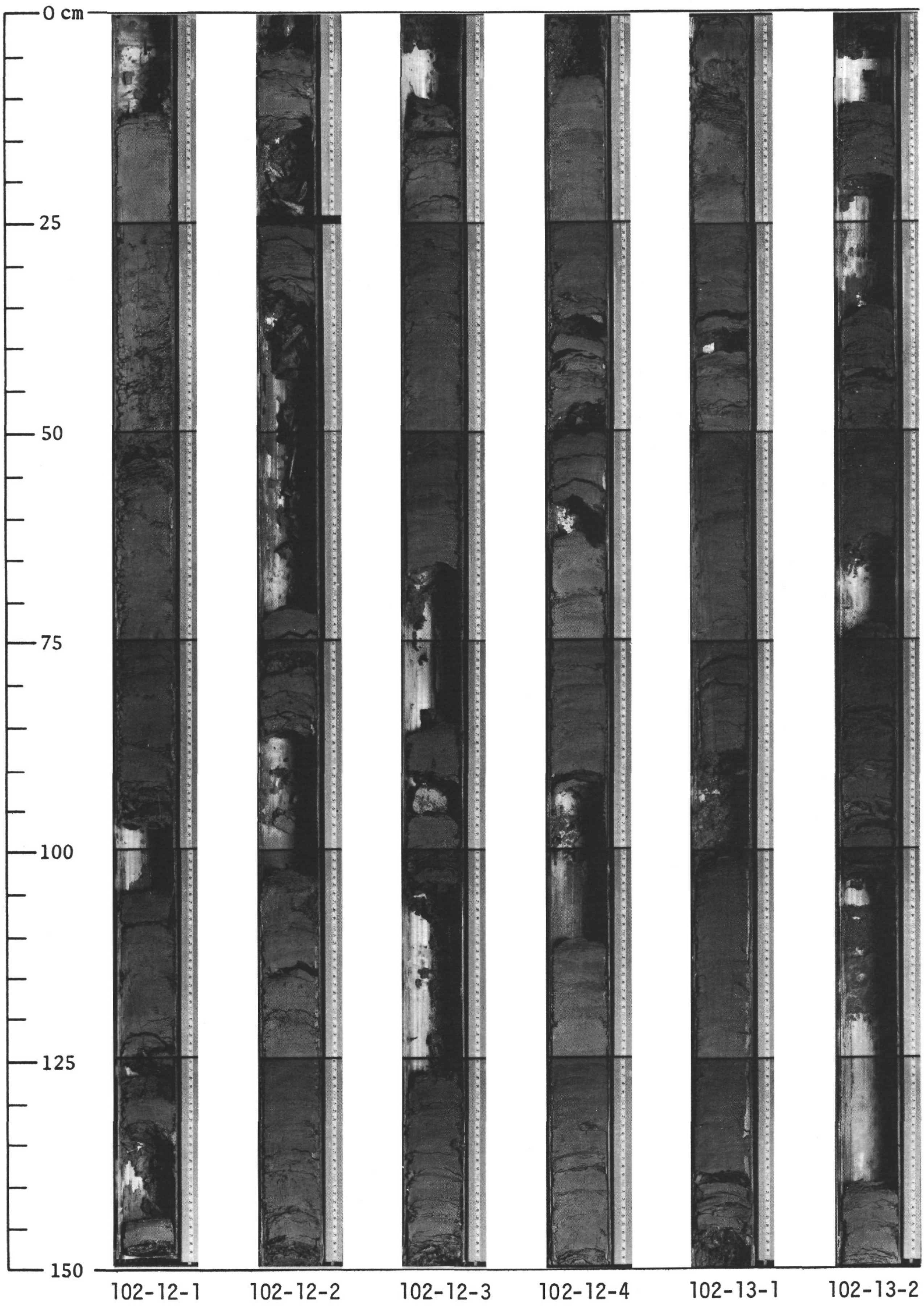
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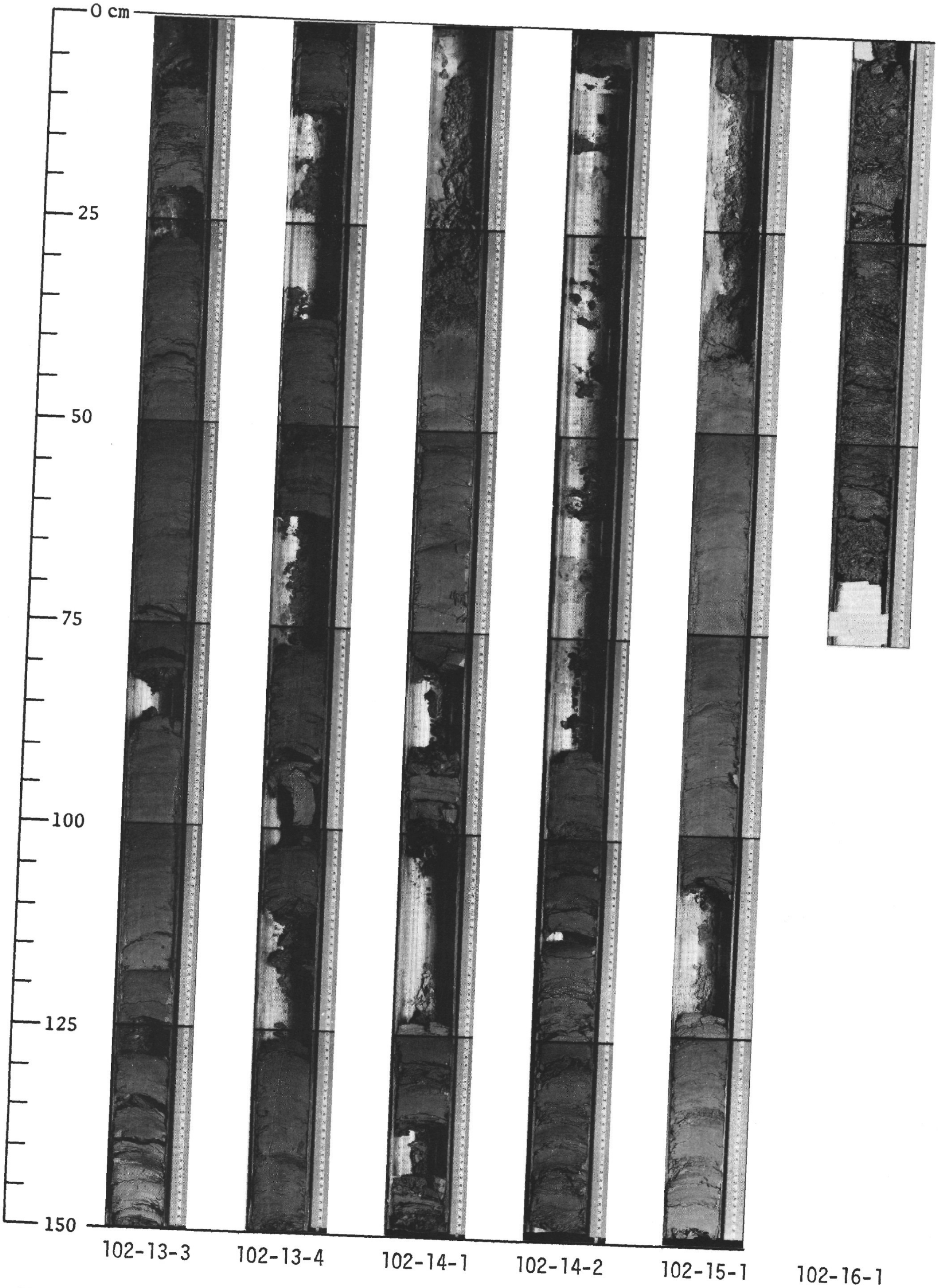
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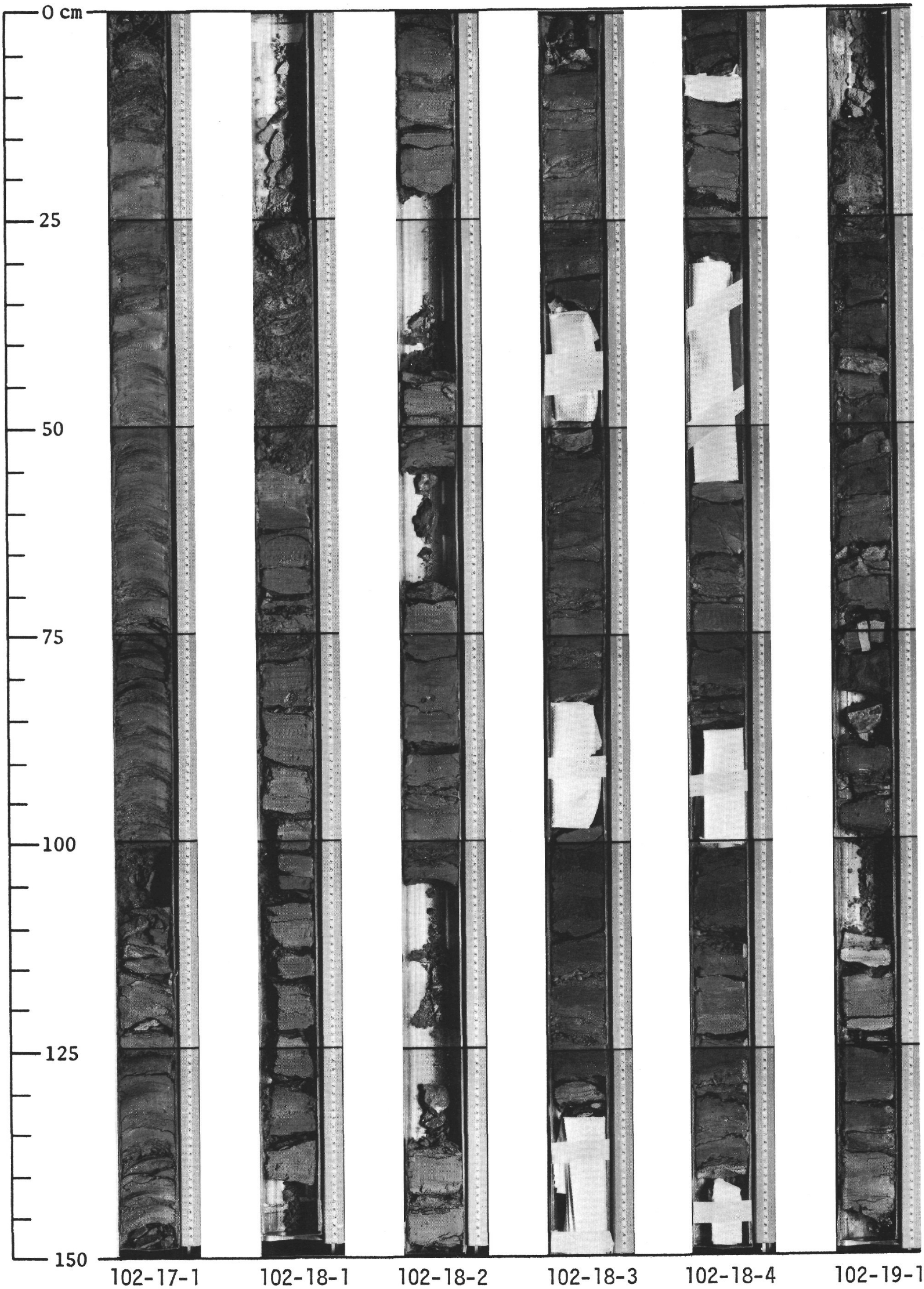

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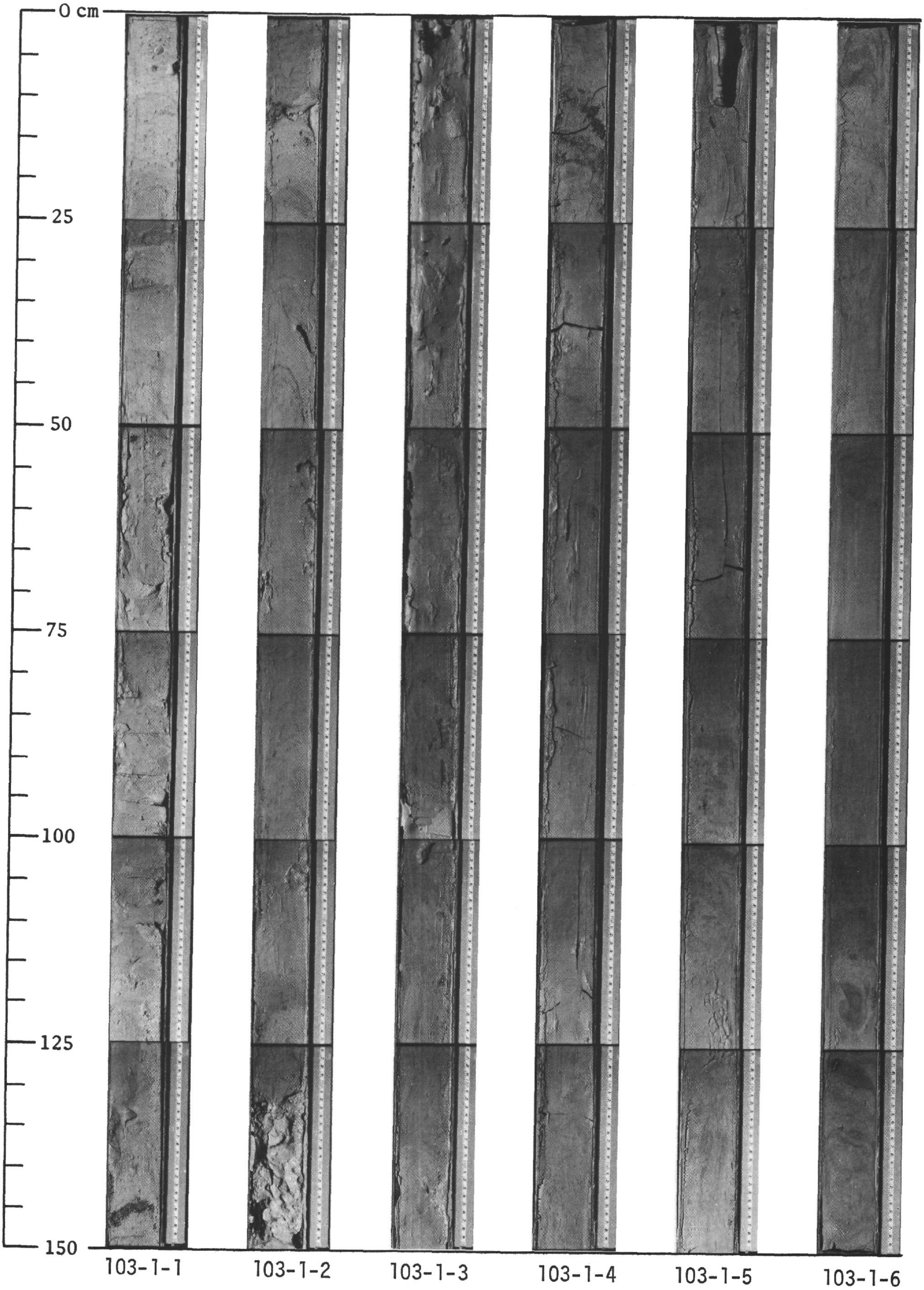

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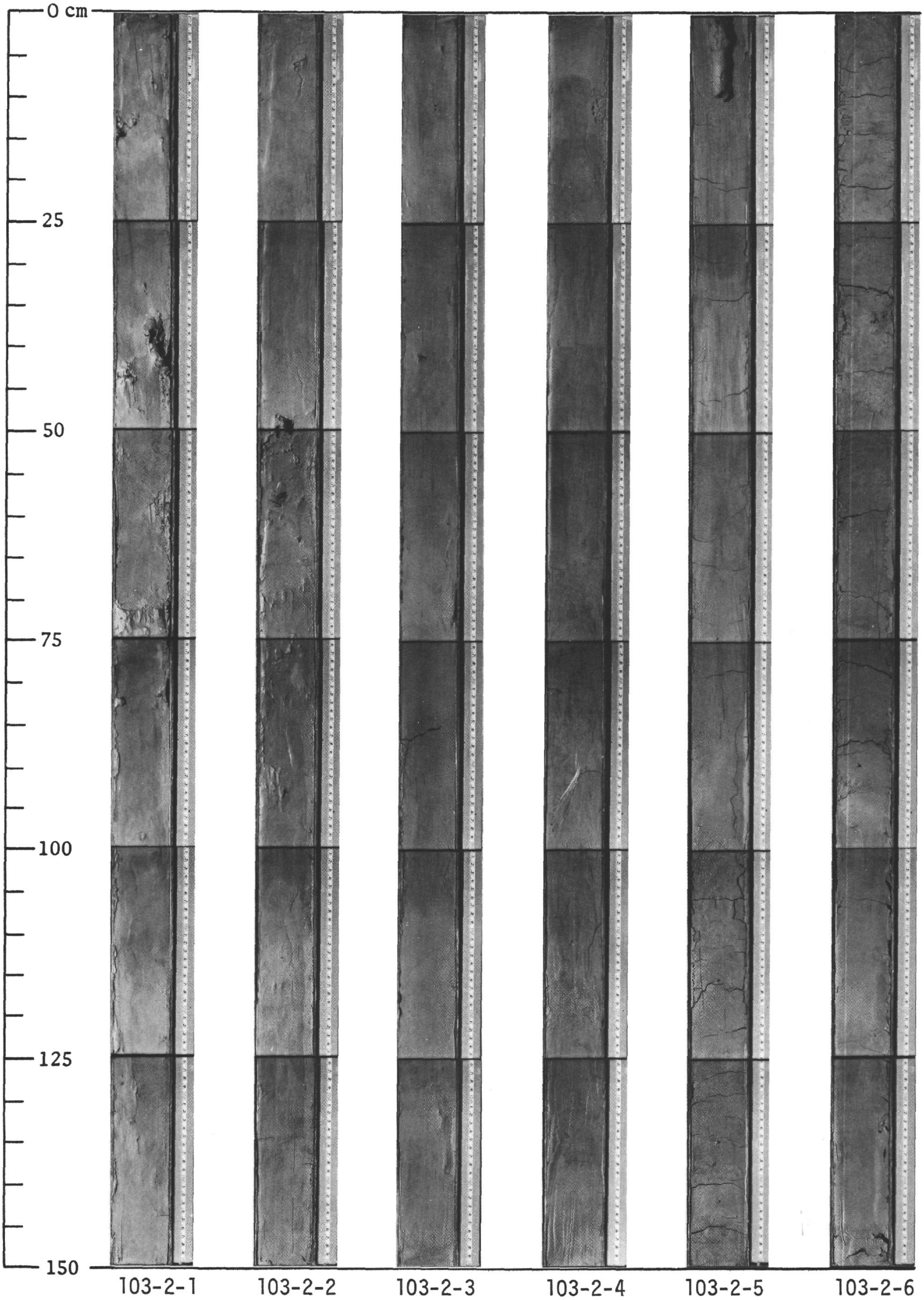
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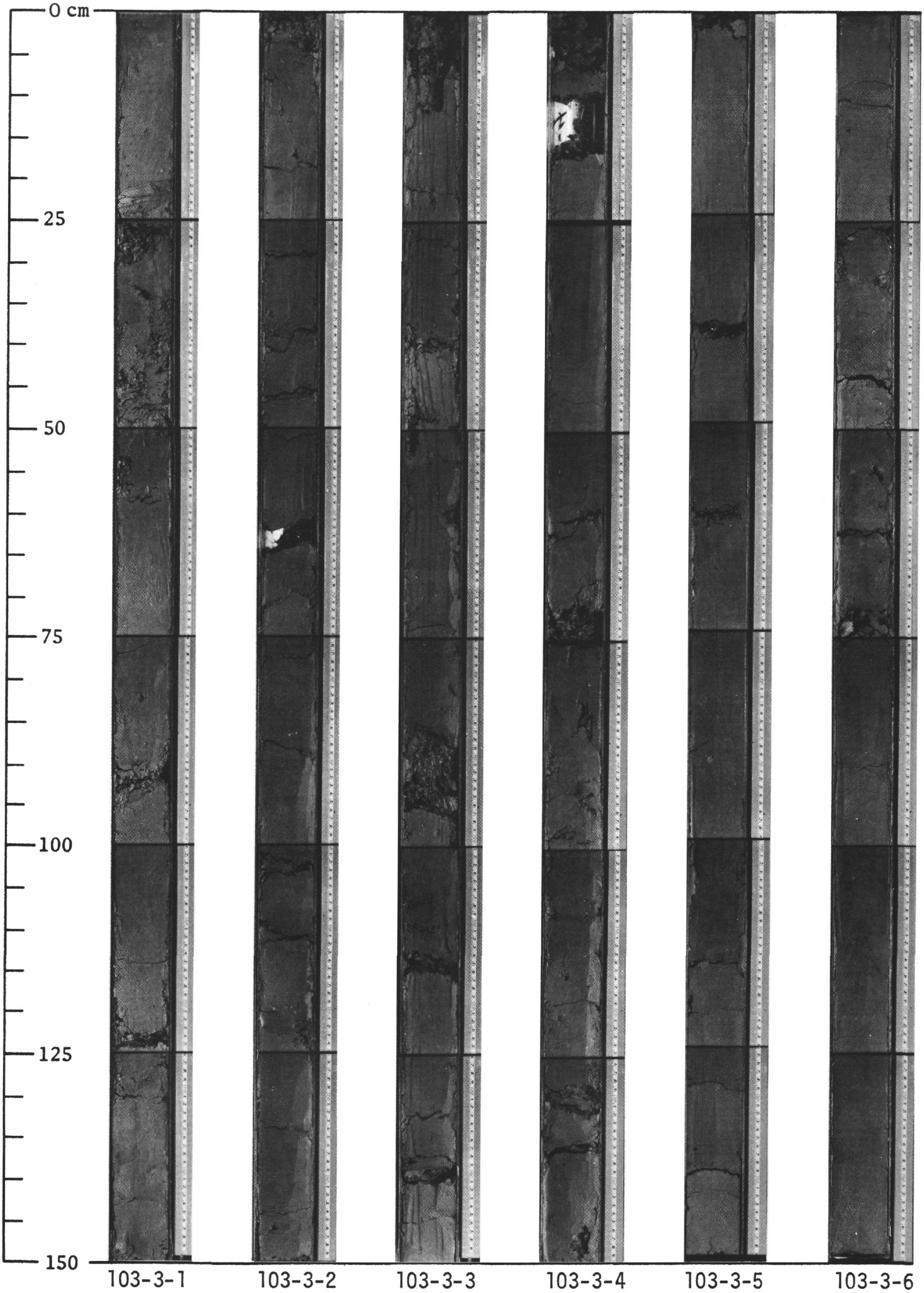
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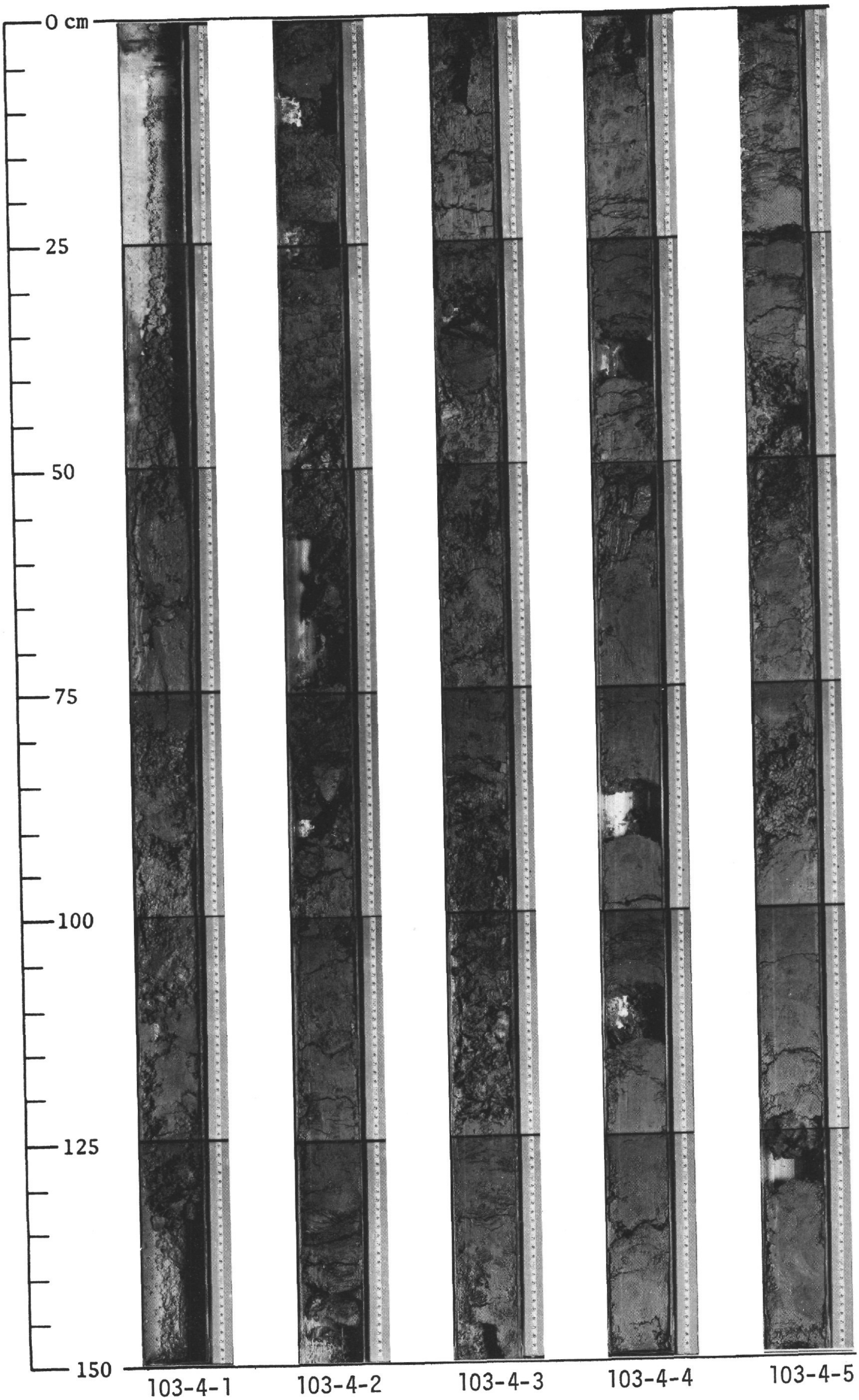

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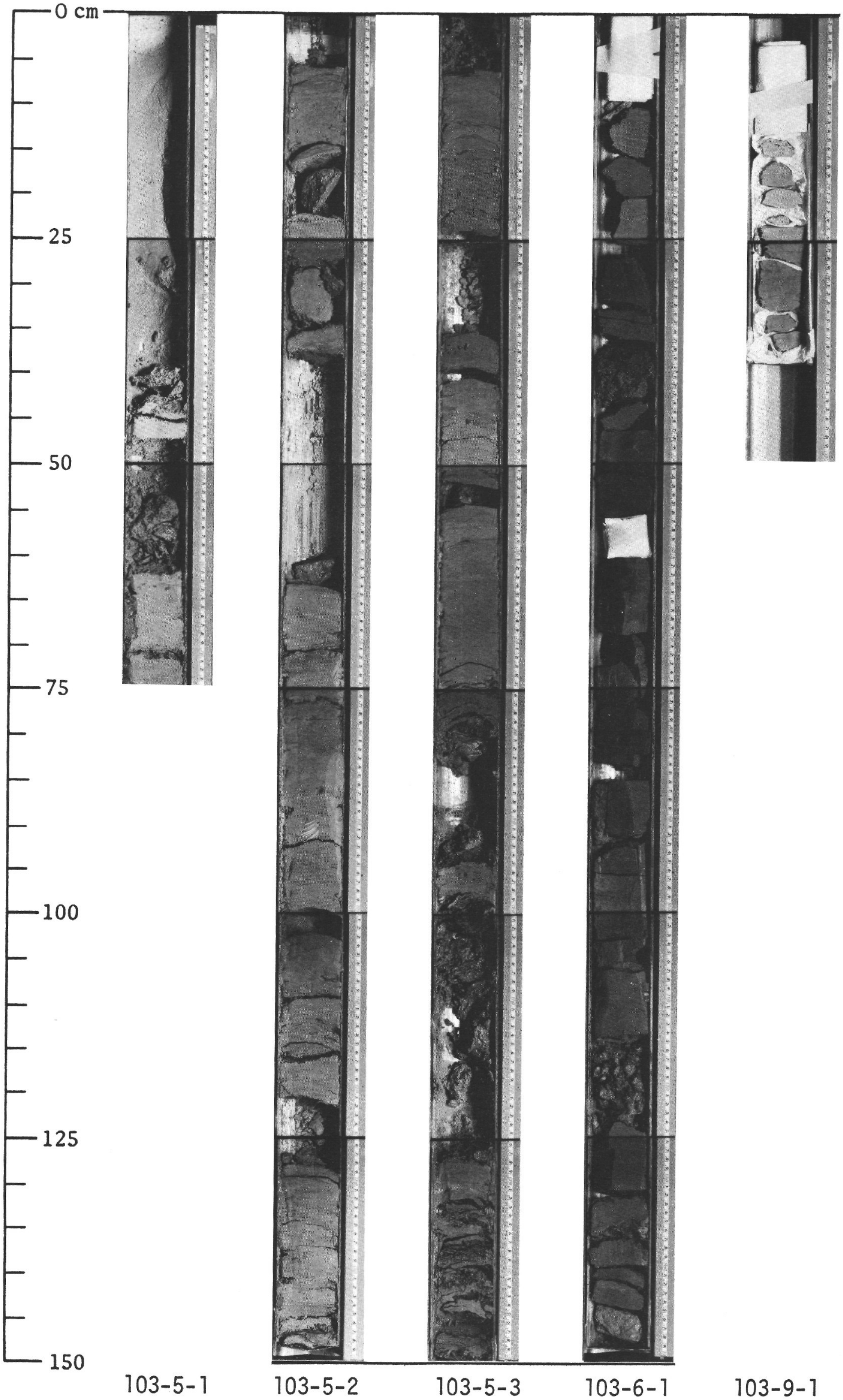
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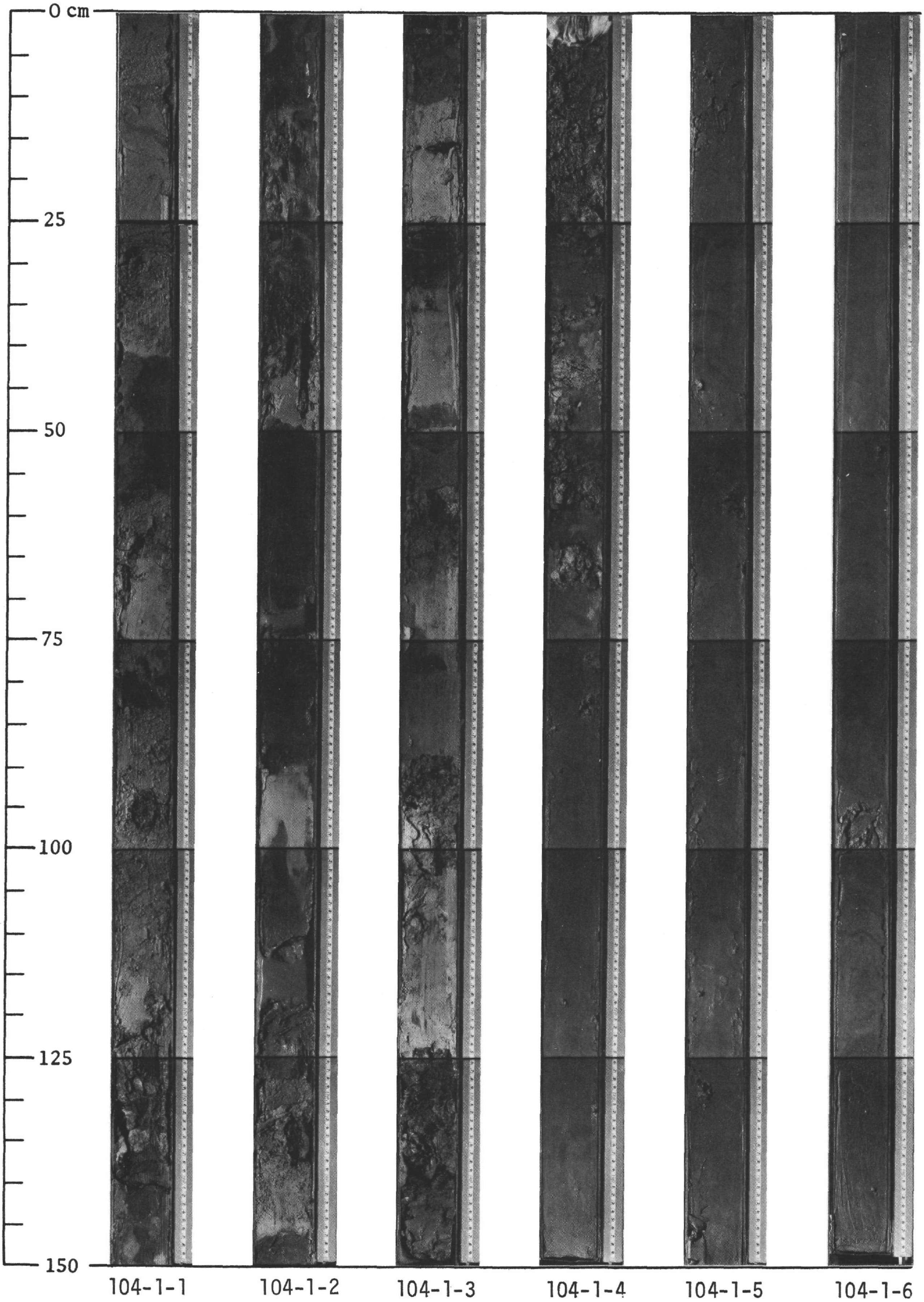
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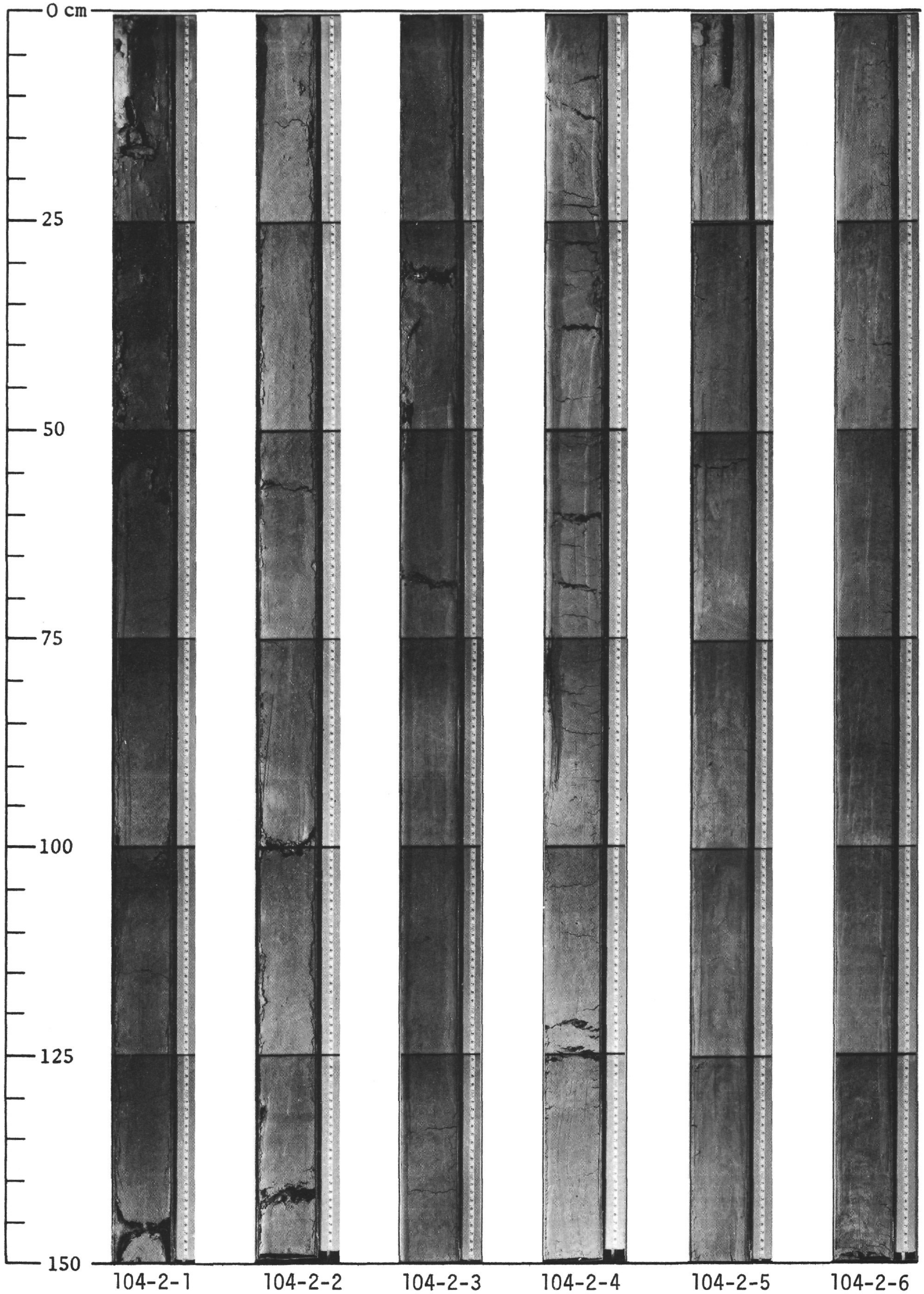
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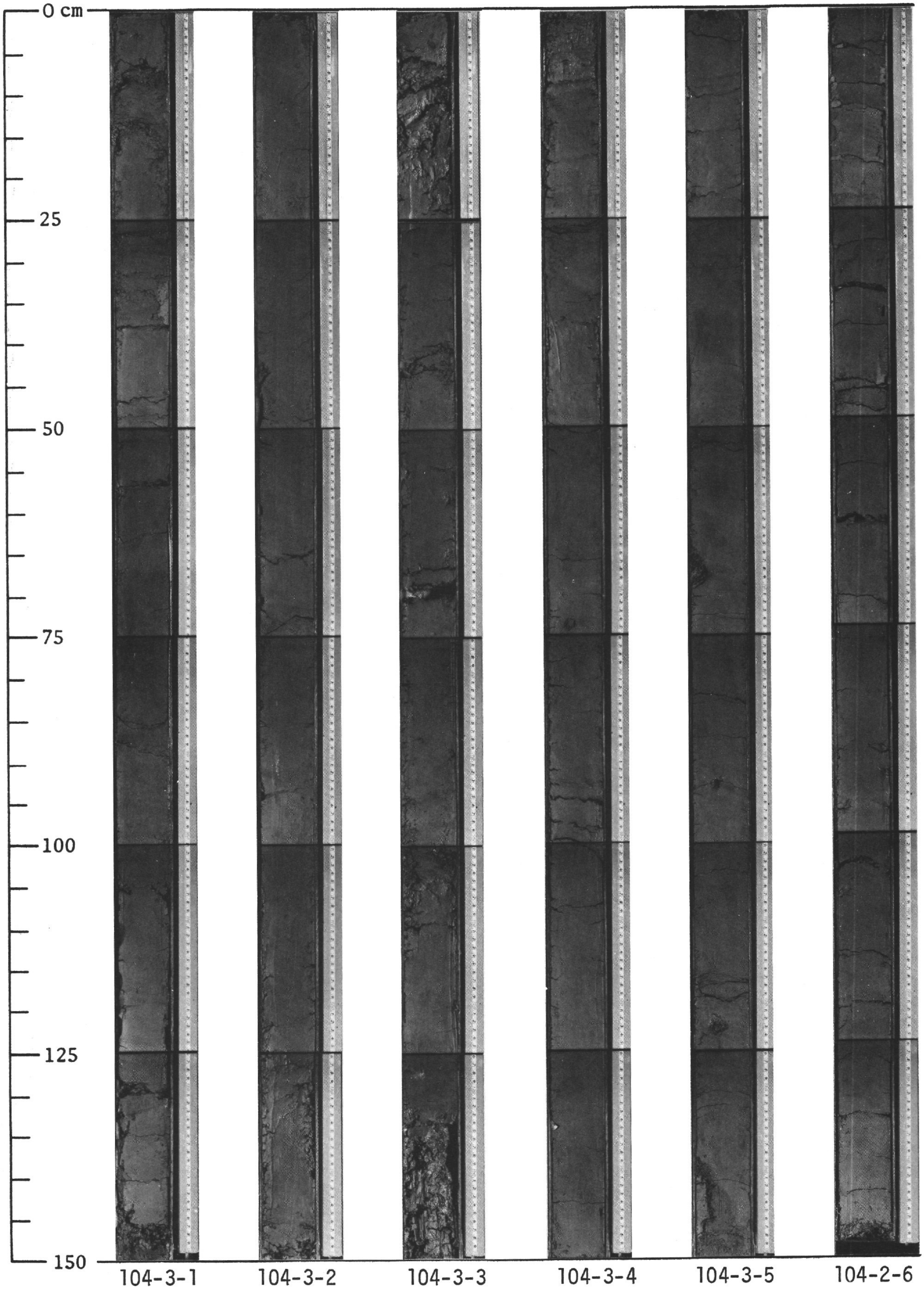
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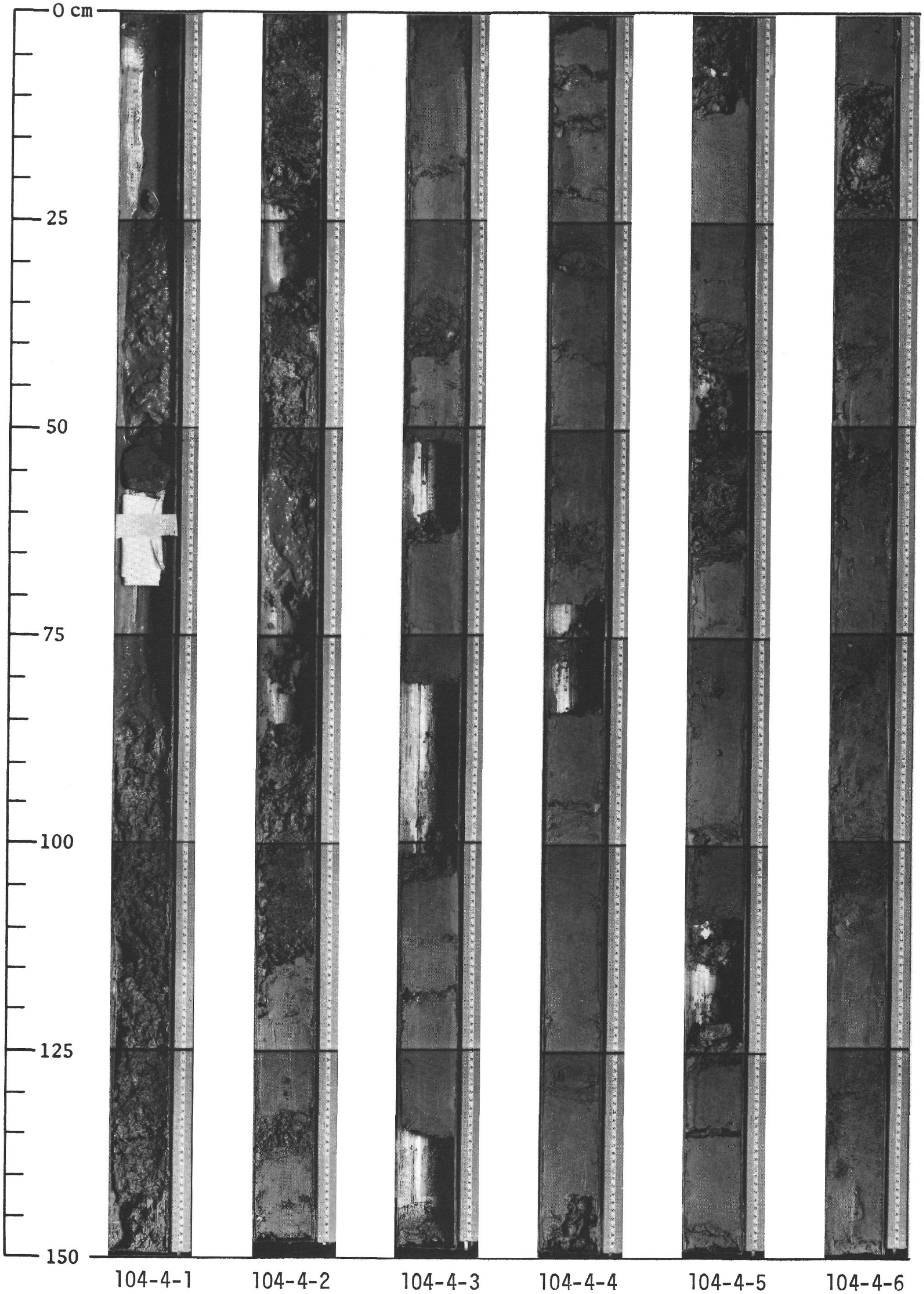
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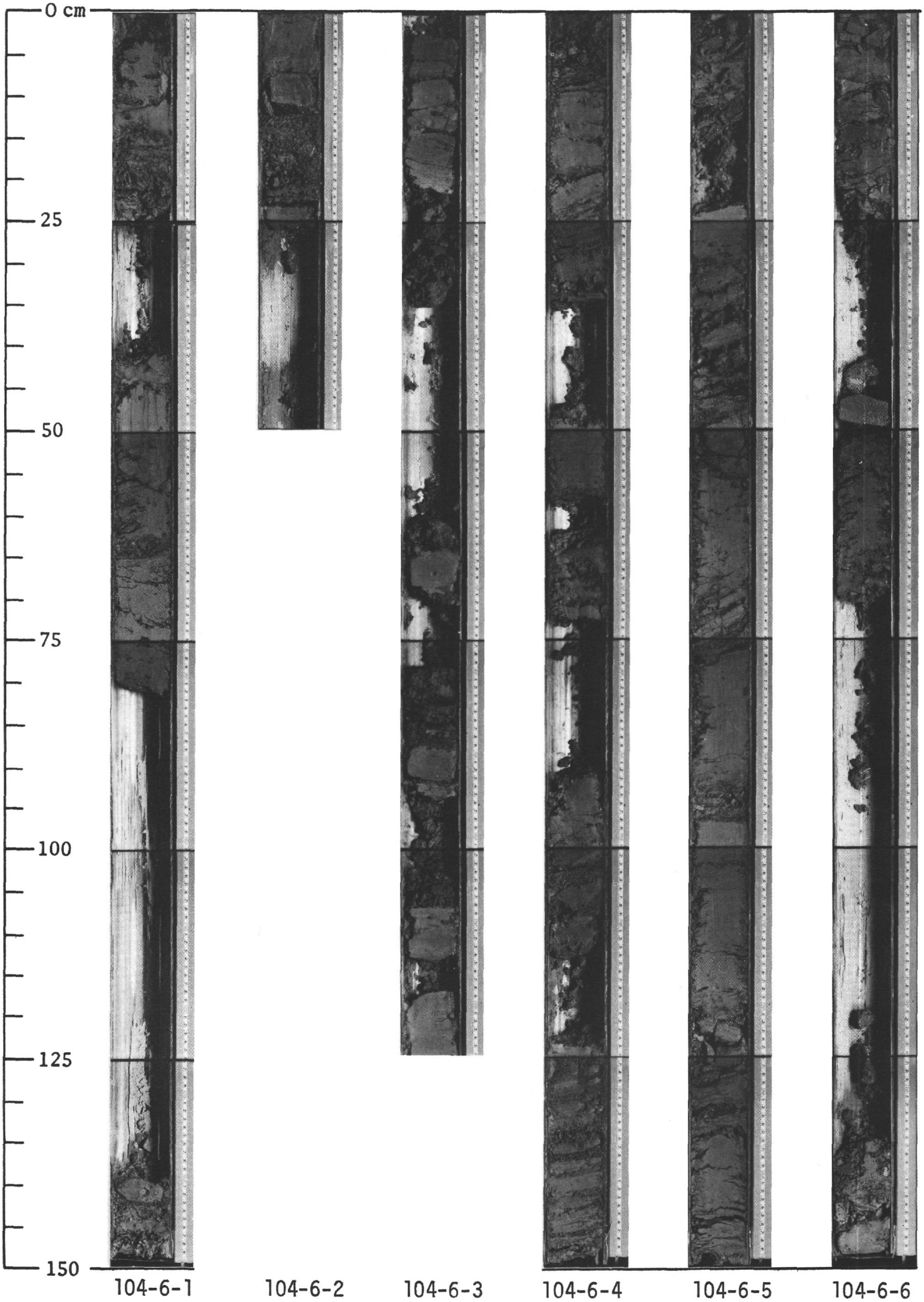

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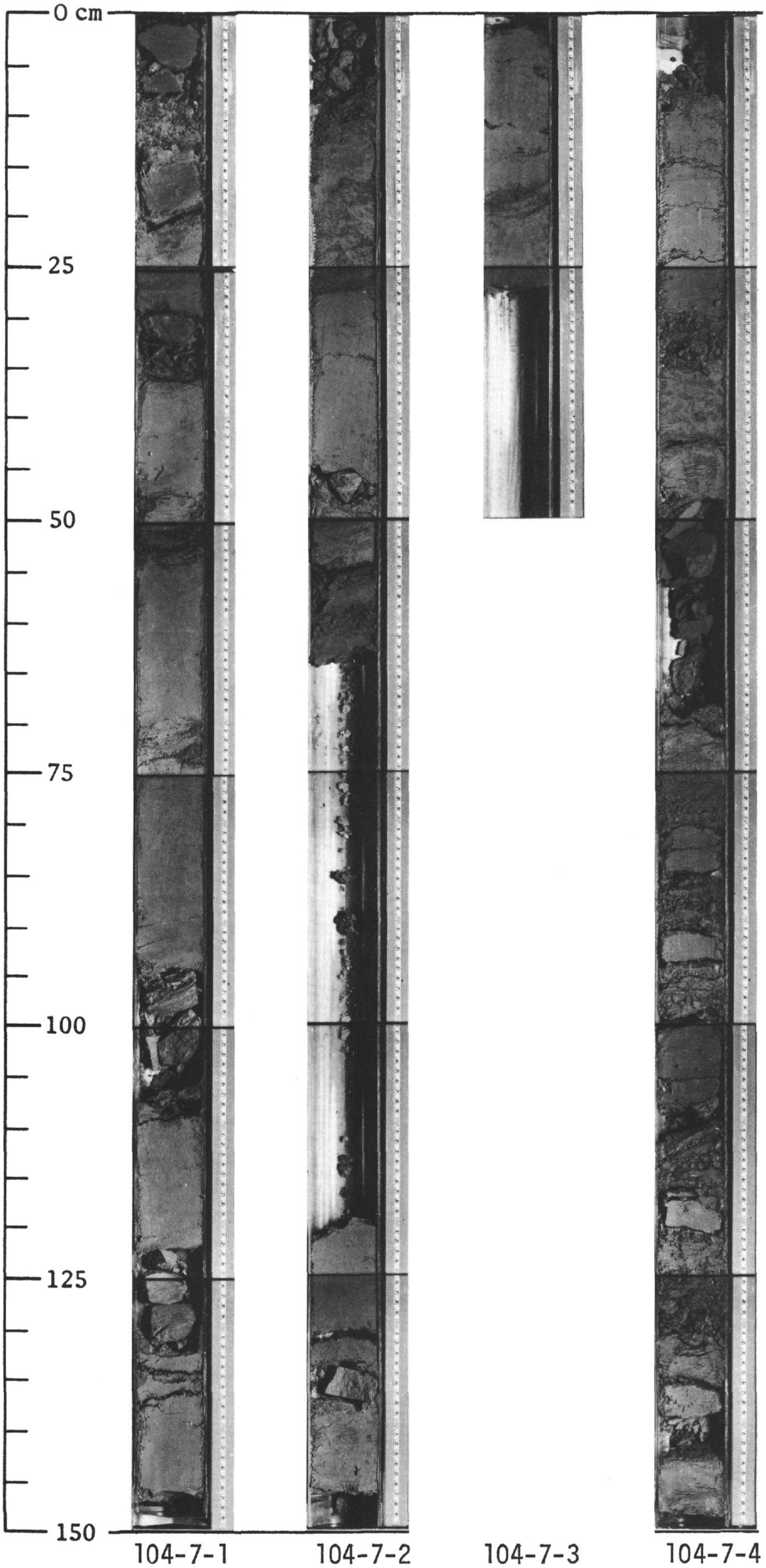
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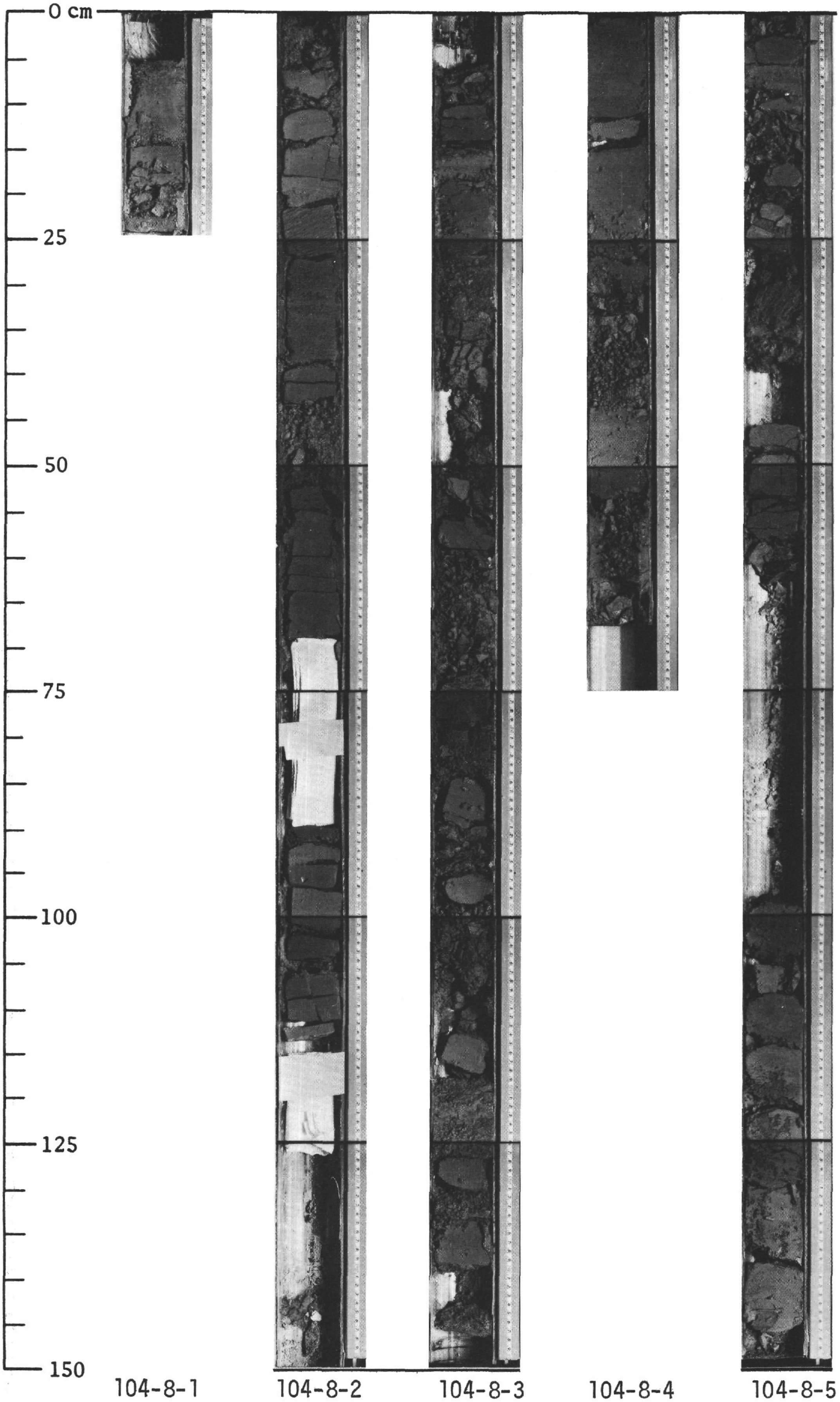
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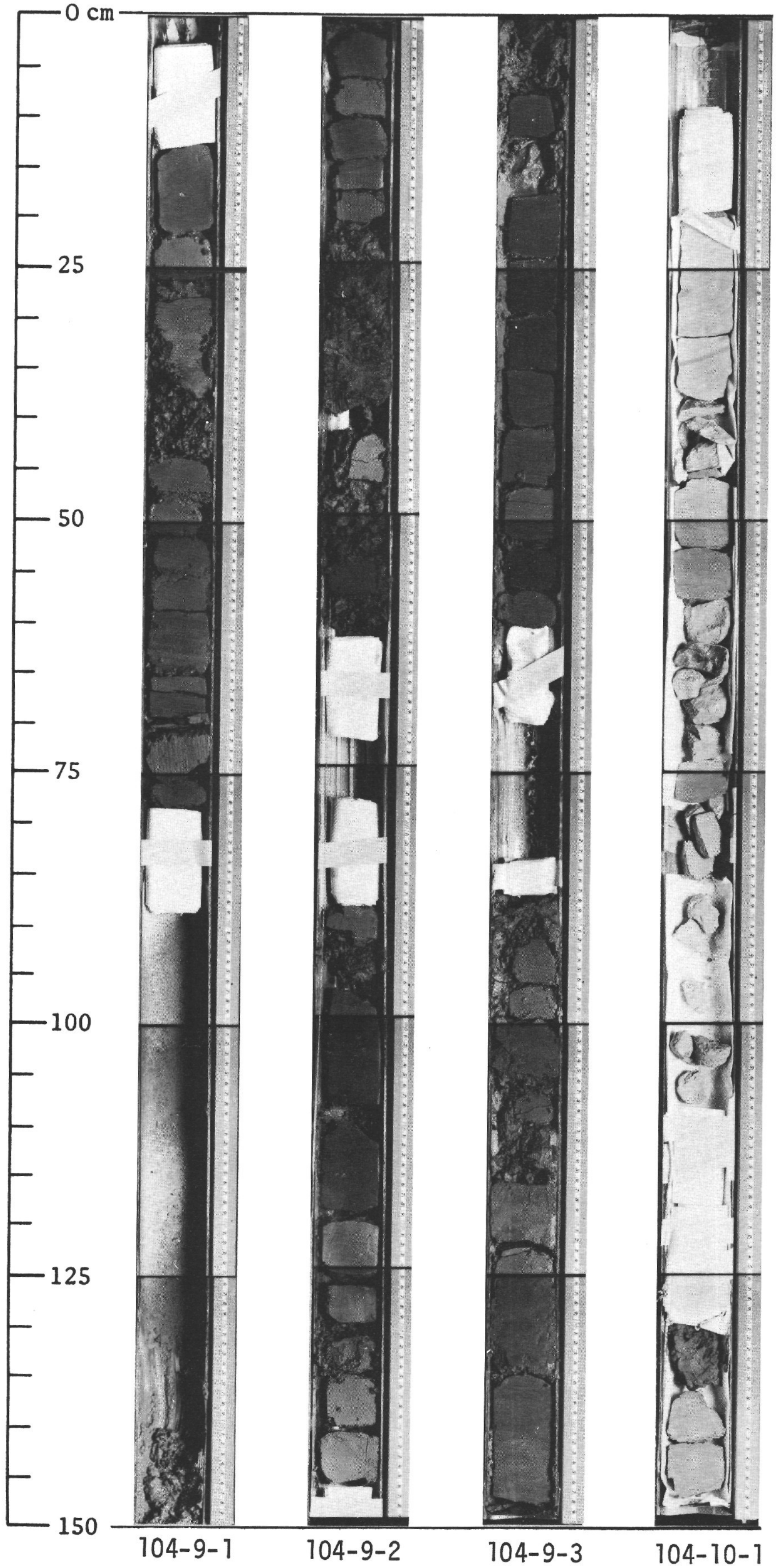
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