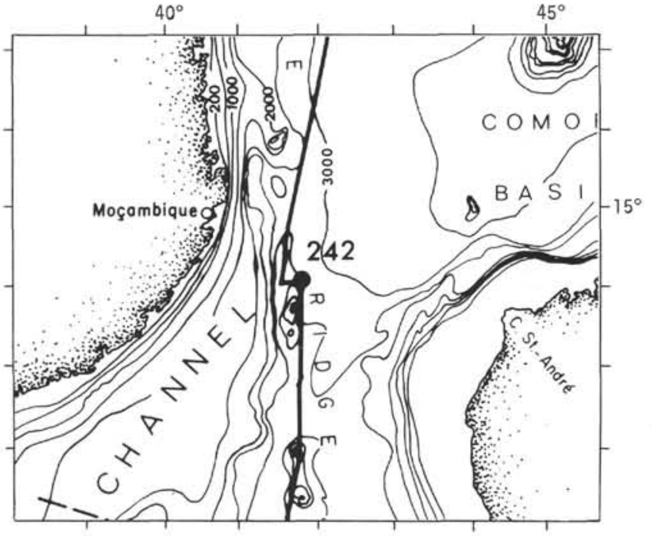
5. SITE 242

The Shipboard Scientific Party[1]

SITE DATA



Location: Mozambique Channel (Davie Ridge)

Position: 15°50.65′S, 41°49.23′E

Water Depth: 2275 meters

Total Penetration: 676 meters

Cores: 19 cores (134 m cut, 103.1 m recovered)

Deepest Unit Recovered: Early late Eocene brown nanno chalk

BACKGROUND AND OBJECTIVES

Long before, and since development of the sea floor spreading hypothesis and of modern plate tectonic concepts, a variety of predrift paleopositions and subsequent movements has been proposed for Madagascar. Most of the authors concerned have displayed their unfamiliarity with (or have found it convenient to disregard) the significance of both the similarities and differences between the structure and geological history of eastern Africa and western Madagascar, which have been summarized by Dixey (1960) and Flores (1970). An important factor contributing to the confusion is the almost complete lack of published data on the bathymetry, crustal structure, and stratigraphy of the Mozambique Channel between Mozambique and Madagascar.

Flores (1970) has published a concise account of the Phanerozoic geology of Mozambique and western Madagascar, based upon his personal familiarity with both areas and access to data from deep boreholes. He summarizes the overall similarities of Karroo and Cretaceous stratigraphy in both areas but is careful to emphasize the time and space distribution of continental/marine facies transitions. In both southeastern Africa and western Madagascar, continental lacustrine, with perhaps occasional marine conditions of sedimentation, were prevalent during the Permo-Carboniferous and Triassic Periods. This gave way during the Jurassic to widespread volcanism in the west with contemporaneous marine sedimentation in the east (Madagascar), south (Agulhas Bank), and in coastal Kenya (Dixey, 1960). According to Flores (1970), during the Cretaceous, the marine facies of western Madagascar changed to continental, culminating in volcanic activity during the middle Cretaceous (Turonian to Santonian/ Campanian). By contrast, the present wide Mozambique coastal plain was an area of marine sedimentation throughout the Cretaceous, becoming continental in the west. Upper Cretaceous and Tertiary marine sediments are found on both sides of the Mozambique Channel, with Late Cretaceous intrusives and late Tertiary to Quaternary volcanic activity chiefly in Madagascar and in the Mozambique Channel (Figure 1).

The general morphological features of the Mozambique Channel are shown in Figure 1, which is partly based upon an unpublished compilation of bathymetric data by Langseth, Heezen, and Ewing. To the south, lies the 4500-5000-meter-deep abyssal plain in the Mozambique Basin which is bounded on the west and east, respectively, by the Mozambique and Madagascar ridges and becomes progressively shallower northward into the Mozambique Channel. The adjacent continental slopes of Africa and Madagascar are steeply inclined down to the average depth of about 3000 meters in the channel. The floor of this channel is deeply incised by the Zambesi Canyon and several tributary canyons from Madagascar, which effectively act as channels for the transport and dispersion of terrigenous sediment into the northern Mozambique Basin.

The Mozambique Channel is divided into two distinct basin compartments by the asymmetric (steep to the west) and weakly seismic Davie Ridge, which follows the 42°E meridian southward until it disappears as a positive morphological feature near 19°S where its trend is continued southward by the lower Zambesi Canyon. Both

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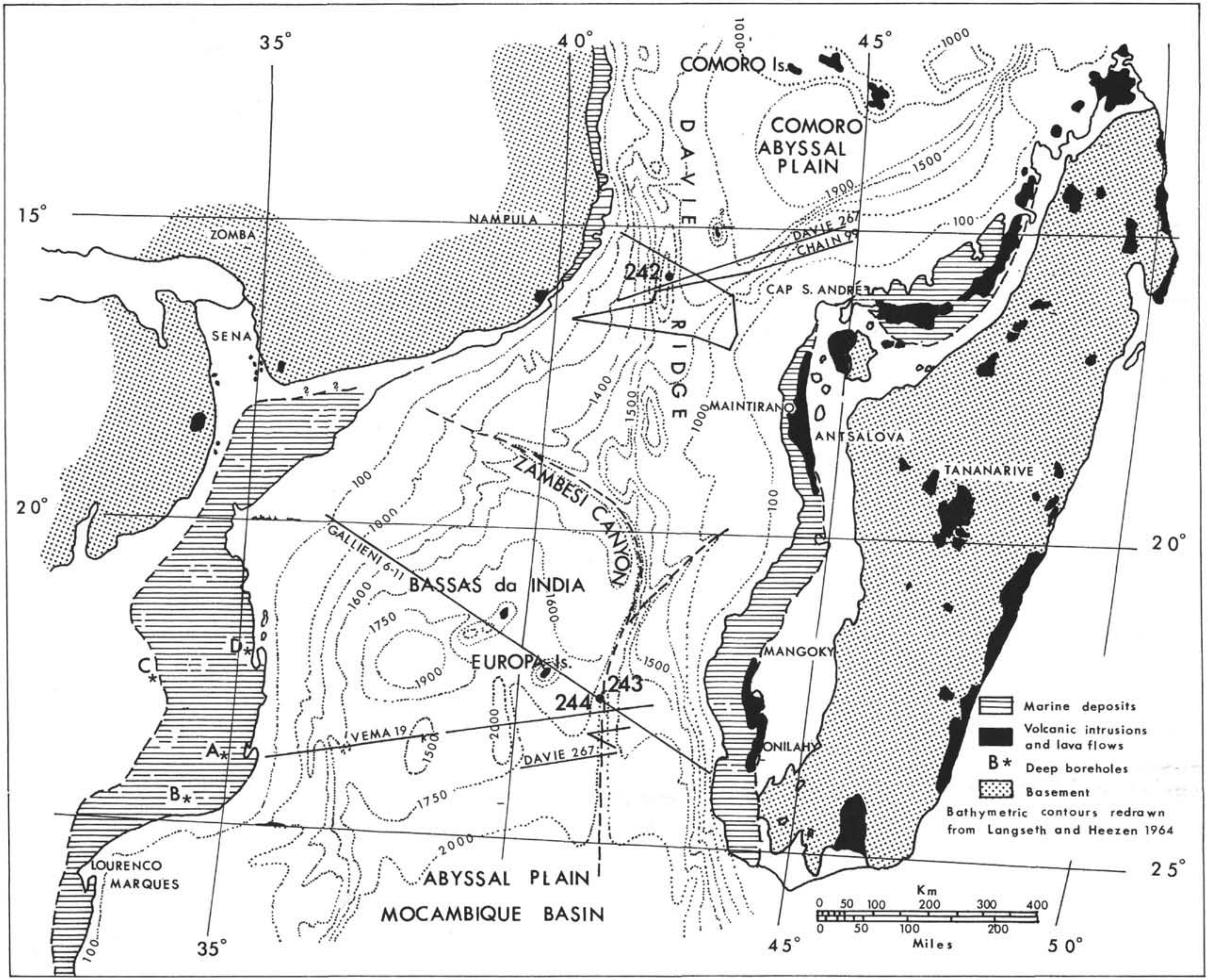

Figure 1. *Map of the Mozambique Channel (slightly modified after Flores, 1970) showing the location of Site 242 and of the seismic reflection profiles in Figures 2 and 3.*

features, each in its own way, act as effective barriers to the transport of terrigenous sediment across the channel. West of the Zambesi Canyon and the volcanic islands of Europa and Bassas da India lies the Europa Basin and abyssal plain (3500 m), which is underlain by stratified sediments more than 1 sec DT (double way time) thick. Between the Davie Ridge and northwestern Madagascar, extending northward to the volcanic Comoro Islands (which mark the southern boundary of the Somali Basin), lies the Comoro Abyssal Plain (3500 m), which is similarly underlain by stratified sediments more than 1 sec DT thick. A series of airborne magnetic profiles flown east-west across the Mozambique Channel and northern Mozambique Basin has been published by Green (1972). Except over volcanic islands, the magnetic anomalies over the channel between 10°S and 22°S (Europa Island) are below 100γ, with wavelengths between 15 and 60 km. These contrast with the much greater amplitude and reduced wavelength of the anomalies over the Mozambique Basin between 25°S and 30°S.

Reconstructions of Gondwanaland have variously placed Madagascar in three possible positions at the end of the Paleozoic before the commencement of drift:

1) Adjacent to the coast of East Africa, off Somalia, Kenya and Tanzania, followed by drift to the south and slightly east. This reconstruction is favored by du Toit, 1937; Fisher, Engel, and Hilde, 1968 (who deduce that it was 20° north of its present position during the Permian and that it has occupied its present position relative to Africa since the Cretaceous); Dietz and Holden, 1970; McElhinny, 1970; Smith and Hallam, 1970; Heirtzler and Burroughs, 1971 (who believe that the southward movement began since the early Cenozoic, 42-65 m.y. ago, and still continues at a rate of 2.9 cm/yr); and Sowerbutts, 1972 (who suggests the initiation of breakup during the Cretaceous).

2) Adjacent to the pre-Cretaceous continental margin of Mozambique or Natal, with subsequent drift to the north and east. This paleoposition is advocated by Wellington, 1954, 1955; Flores, 1970 (commencement of drift during Early Jurassic, cessation during mid-Cretaceous-Turonian); Wright and McCurry, 1970; Heirtzler, 1971 (movement sometime since the Cretaceous); and Green, 1972 (who believes that Madagascar separated from the Natal margin by east-west spreading about the Mozambique Ridge from the Late Triassic until Late Cretaceous/early Tertiary, and that possible continued northward movement relative to Africa is indicated by present-day seismic activity of the Davie Ridge).

3) Present position relative to Africa has been maintained since the Paleozoic at least. This reflects the conclusion of Dixey, 1956, 1960 (who proposed Late Carboniferous subsidence of the Mozambique Channel area resulting in the formation of a "geosyncline" and deposition of the Karroo sequence with up to 14 km of sedimentary rocks); Pepper and Everhart, 1963; Holmes, 1965; Flower and Strong, 1969; and Tarling, 1971.

Each of the above reconstructions has implications relating to the crustal composition and structure beneath the Mozambique Channel:

1) Movement of Madagascar southward along a transform fault structure implies, according to Heirtzler and Burroughs (1971), that basement on the east side of the Davie Ridge should be representative of the Madagascar plate, and the stratigraphic section should be similar to that of eastern Kenya and Somalia.

2) Movement of Madagascar eastward away from Africa implies the presence of oceanic or thinned continental crust beneath the Mozambique Channel.

3) If no lateral movement of Madagascar relative to Africa has taken place since the Paleozoic, the channel should be underlain by a succession of terrestrial and shallow-marine sediments and volcanics transitional between the stratigraphic sections found in east southern Africa and western Madagascar.

One of the major objectives of Leg 25 of the Deep Sea Drilling Project was to provide essential data which would assist in the solution of this enigmatic problem and, with this end in view, two sites located in the Mozambique Channel were selected for drilling on the basis of available data and our present meager understanding of the structure and stratigraphy of this region.

Numerous traverses across the Davie Ridge in the northwestern Mozambique Channel between 10°S and 19°S are available from *Chain* Cruise 99 in 1970 (Heirtzler and Burroughs, 1971) and *Thomas B. Davie* Cruise 267 in 1971 (Simpson, in preparation). Figure 1 shows only those tracks which pass near the proposed site.

The Davie Ridge trends north-south along the 41°30'E meridian close to, and parallel with, the linear stretch of the African coast near Cape Delgado (10°S), continuing southward as a positive morphological feature at least as far as 19°S from where its strike direction is continued by the lower reaches of the Zambesi Canyon in the southeastern Mozambique Channel.

Most, but not all, traverses across the ridge show it to be strongly asymmetric with a single steep scarp facing west (see Figures 2 and 3). Shallow-focus earthquake epicenters are located near and slightly to the west of the ridge, and the wavelength of associated low-amplitude ($<200\gamma$) magnetic anomalies indicate deep burial of magnetic basement. A thick sequence of turbidite sediments derived from Africa is banked up against the base of the steep western scarp. On the eastern side of the sediment-free ridge crest, the regionally smooth acoustic ridge basement shows local relief and some prominent buried seamounts and is covered by sediments of increasing thickness (more than 2 sec DT) beneath the Comoro Abyssal Plain (Figure 3). Regional seismic profiler traverses indicate that the sediments comprise an upper stratified layer at least 1.5 sec DT thick believed to be derived from Madagascar, overlying a basal layer of acoustically transparent (probably pelagic) sediment up to 0.5 sec DT thick which is exposed on the sea floor along the lower and middle eastern flank of the Davie Ridge (Figures 2 and 3).

Heirtzler and Burroughs (1971) have suggested that the Davie Ridge is a strike-slip (transform) fault structure along which the island of Madagascar was displaced southward since the Cretaceous from its paleoposition adjacent to equatorial East Africa, in which case, according to these authors, the east flank of the Davie Ridge should be Precambrian basement and the overlying sediments should

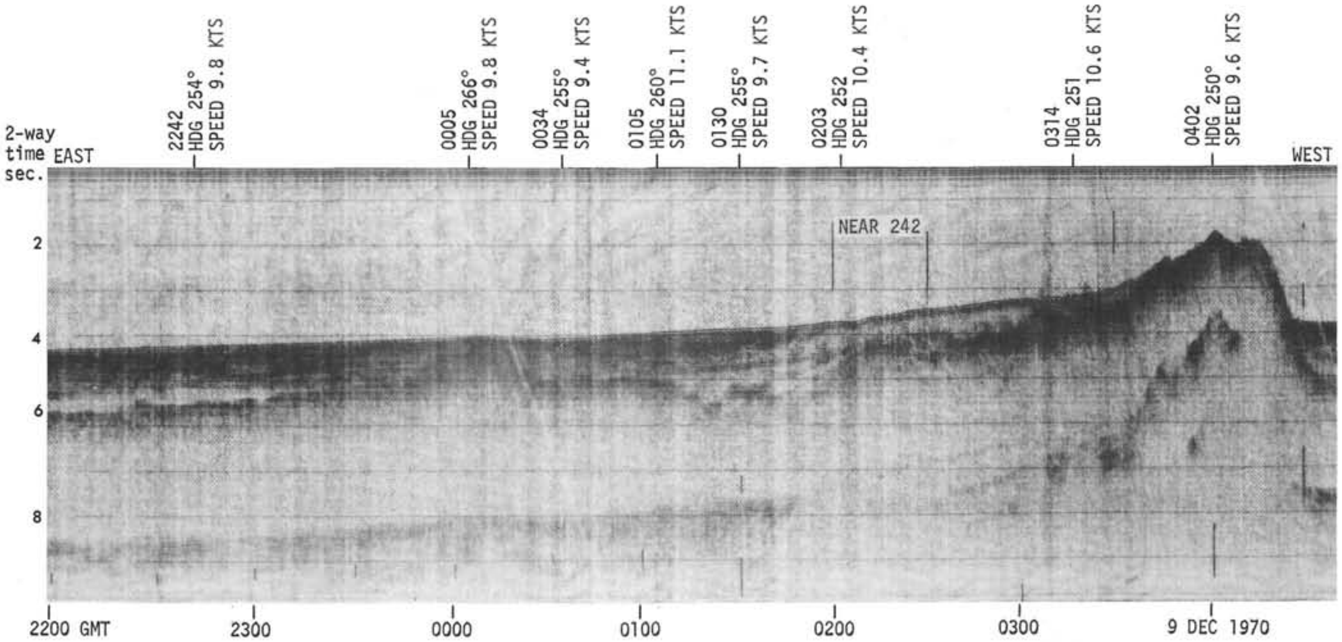

Figure 2. Chain *99 seismic reflection profile across the Davie Ridge near Site 242 (location shown in Figure 1). Reproduced by courtesy of Woods Hole Oceanographic Institution.*

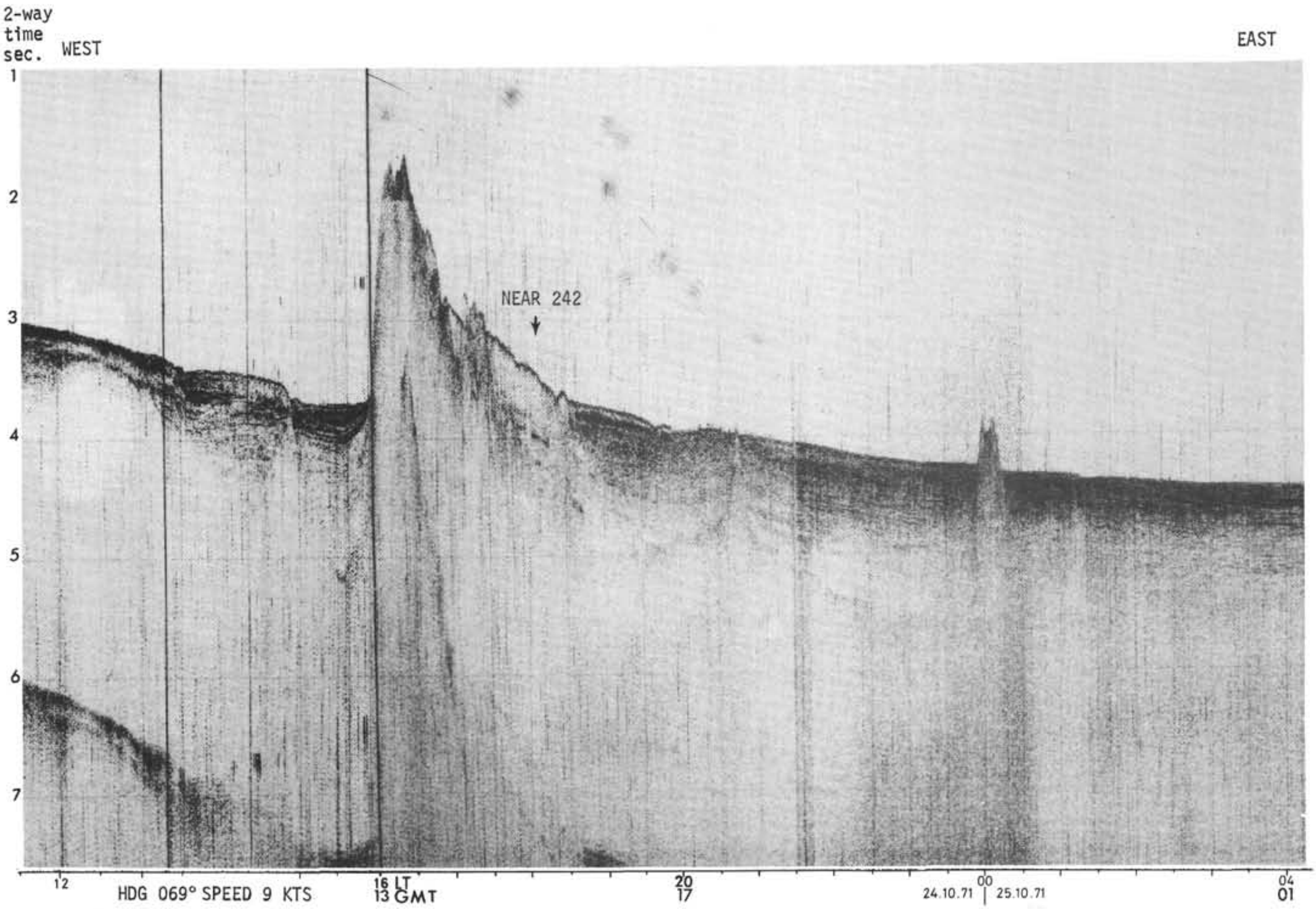

Figure 3. Thomas B. Davie *267 seismic reflection profile across the Davie Ridge near Site 242 (location shown in Figure 1). Unpublished data provided by E. S. W. Simpson.*

correspond with the coastal stratigraphic sequence found in Kenya and Somalia (Dixey, 1960).

Site 242 is located on the eastern flank of the Davie Ridge, where acoustic basement is covered by about 0.5 sec DT of transparent sediment. The objectives of drilling at this site were (a) to determine the composition and age of the ridge basement, (b) to sample and date the acoustically transparent (presumably pelagic) sediment cover and establish a midlatitude faunal succession for the western Indian Ocean, and (c) to provide possible clues to the paleoposition and movement of Madagascar.

SURVEY DATA AND OPERATIONS

Glomar Challenger departed from Site 241 at 1430 hours LT (local time) (1130 GMT) on 18 July 1972 and after 4 days and 8 hours of steaming southward across the southern Somali Basin and northern Mozambique Channel, reached a point at 15°56′S, 41°33′E, about 20 miles due west of the proposed Site 242 (15°56′S, 41°55′E). At 2220 LT (1920 GMT) on 22 July 1972, *Glomar Challenger* changed course and Site 242 was approached along a course of about 090°. At 2329 LT (2029 GMT) the speed was reduced to 6 knots to improve the quality of the airgun records and the course was slightly corrected to 089°. At about 0133 LT (2233 GMT) on 23 July 1972, *Glomar Challenger* reversed course to 290°. At 0242 LT (2342 GMT), a suitable location was reached, according to the airgun seismic reflection records, and the 16.0-kHz beacon was dropped under way above the identified site. Immediately after the airguns, hydrophones, and magnetometer had been brought onboard, the ship returned to the beacon to take up station (Figure 4).

The *Glomar Challenger* seismic reflection profile was run very close to the track of *Chain*, Cruise 99, 1970 (Figures 1 and 2) and *T. B. Davie*, Cruise 267, 1971 (Figures 1 and 3). All the seismic reflection profiles obtained in the near-site area show the same characteristics. At Site 242, the seismic acoustic basement, upon which only the transparent sediment sequence rests, is at 0.75 sec DT (Figure 5).

The main site objective was to sample the acoustic basement of the ridge, which was expected at a depth of

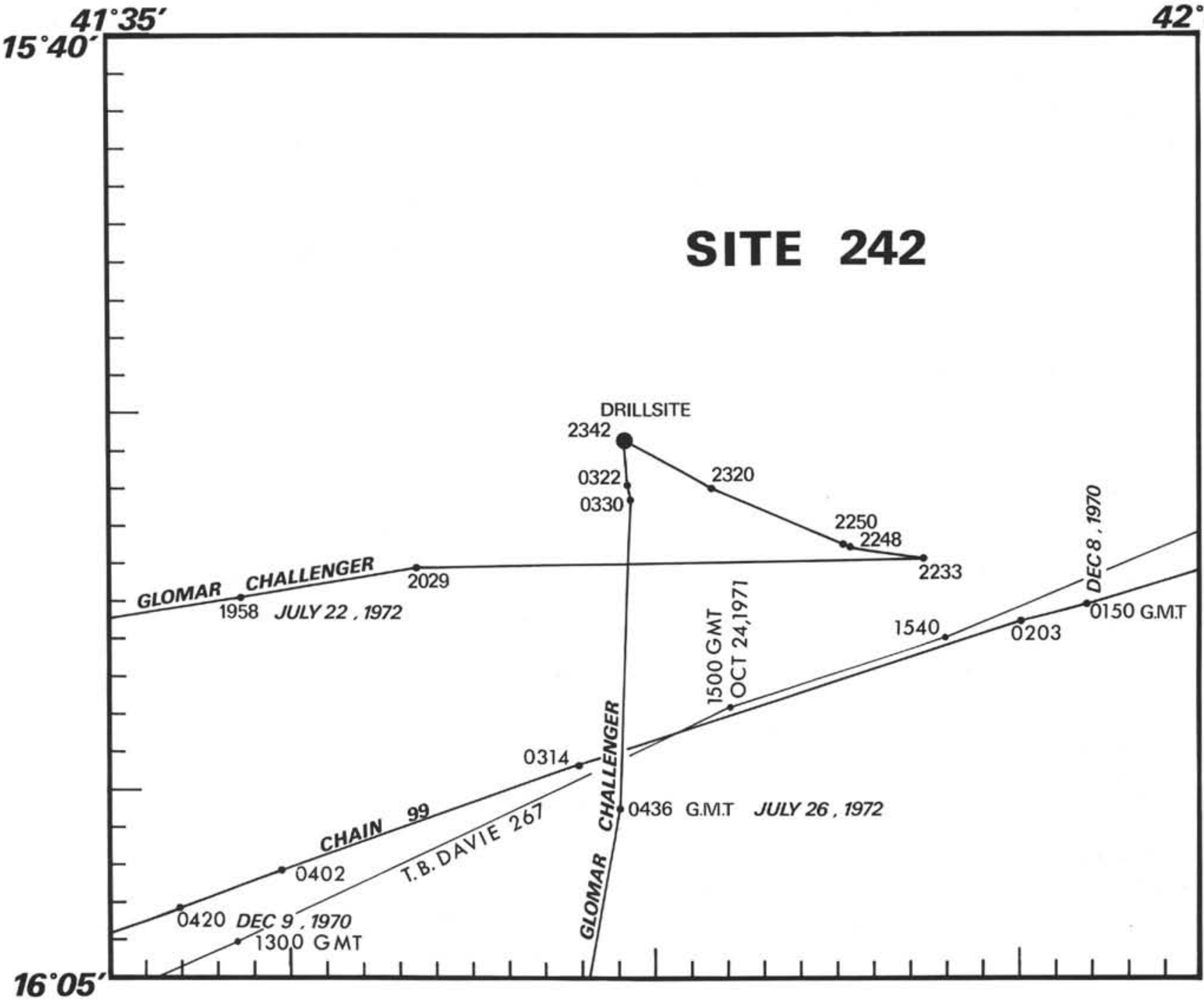

Figure 4. *Details of the* Glomar Challenger *site approach.*

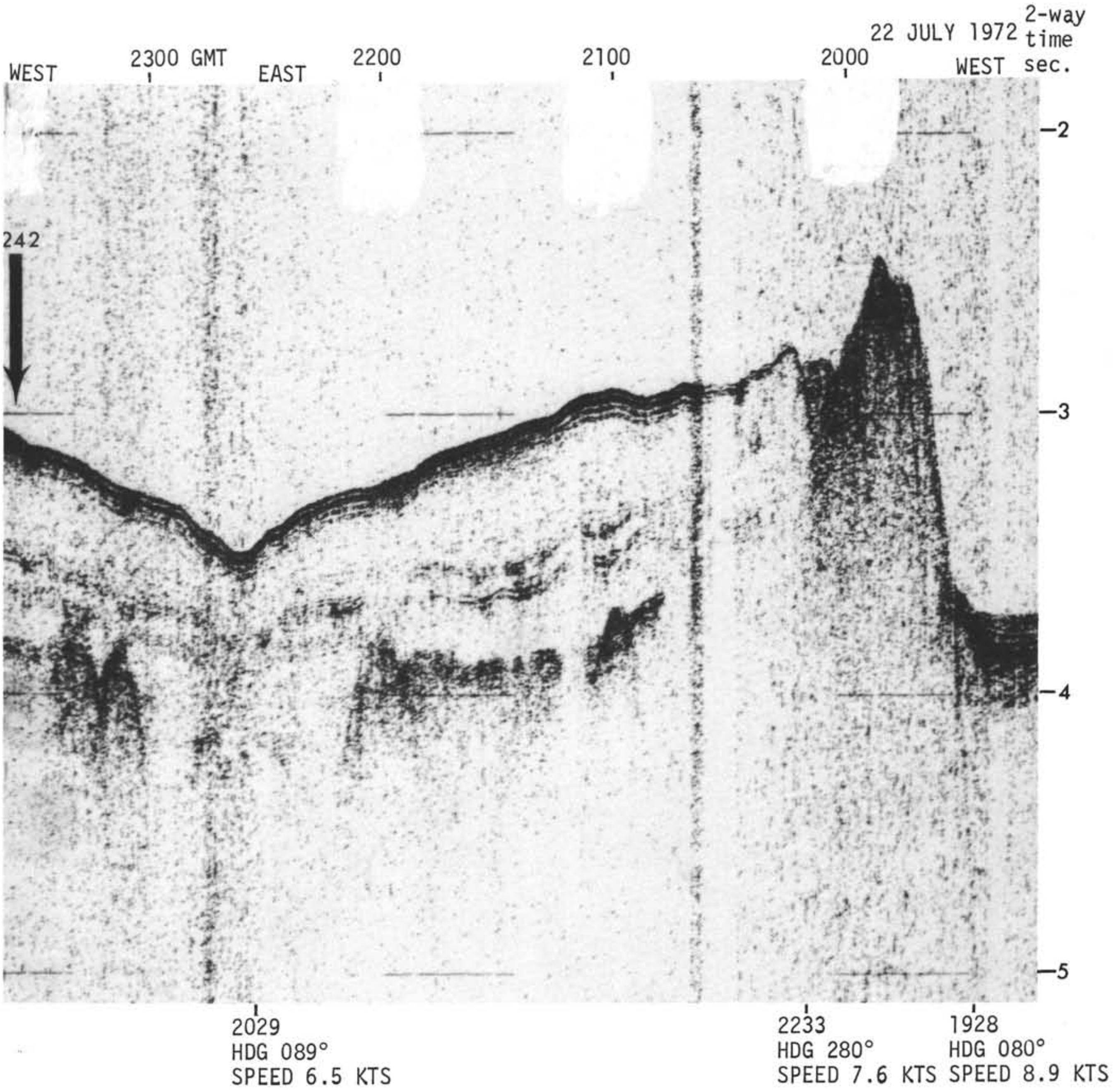

Figure 5. Glomar Challenger *seismic reflection profile on approach to Site 242.*

about 600 to 700 meters. Consequently, a program of intermittent coring was planned: one core every 50 meters between 0 and 600 meters and continuous coring below 600 meters. The objectives apparently being completed, and the penetration rate becoming extremely low, it was decided, on both scientific and technical grounds, to stop drilling and coring at a depth of 676 meters (Table 1). From the measured velocities at different depths, it can be assumed that the 0.75 sec DT acoustic basement horizon was reached and sampled.

Drilling and coring at this site started at 1015 (LT) on 23 July 1972 and ended at 2210 (LT) on 25 July 1972. Nineteen cores were cut. The total cored section is 134 meters and the total core recovered is 103.1 meters. The rates of drilling and coring decreased very sharply at a depth of about 400 meters and was only a few meters per hour at a depth of about 600 meters. For the last core, cut between 673 and 676 meters, the rate of penetration was as low as 1.5 meters per hour. After completion of drilling and coring, the four-cone bit appeared to be in very good condition but was balled with very stiff clay. The type of formation, mainly nanno ooze chalk, encountered at this site may explain the extremely slow penetration rate. After Core 3 at 141 meters and Core 6 at 317 meters, heat flow measurements were successfully conducted. Two inclinometer tests were made in this hole, the first at 141

TABLE 1
Coring Summary, Site 242

Core	Depth Below Sea Floor (m)	Cored (m)	Recovered (m)	Recovery (%)
1	0-4	4	4.7	100
2	52-61	9	5.8	64
3	128-137	9	9.0	100
4	147-156	9	8.8	98
5	233-242	9	5.4	60
6	308-317	9	3.6	40
7	403-412	9	9.5	100
8	479-488	9	6.8	76
9	555-564	9	9.5	100
10	602-611	9	9.5	100
11	611-620	9	0	0
12	623-631	8	4.4	55
13	631-640	9	9.5	100
14	640-649	9	5.7	63
15	649-653	4	4.4	100
16	653-658	5	1.1	22
17	668-669	1	1.0	100
18	672-673	1	1.2	100
19	673-676	3	3.2	100
Total		134	103.1	77

Note: Echo sounding depth (to drill floor) = 2285 meters; drill pipe length to bottom = 2287 meters.

meters and the second at 631 meters; the readings indicate that the hole was 2° off the vertical.

At 1615 (LT) on 23 July 1972, unreliable signals from the 16-kHz beacon made it necessary to drop a 13.5-kHz beacon, which landed at a distance of 800 feet from the original 16-kHz beacon. Operations were continued satisfactorily with this offset.

Glomar Challenger departed from Site 242 at 0430 LT (0130 GMT) on 26 July 1972 in a northeast direction at a speed of about 6 knots while the airguns, hydrophones, and magnetometer were streamed. At a distance of about 1.5 miles from the beacon, the ship changed course to 260° so as to pass over the beacon. At 0505 LT (0205 GMT), the beacon was passed. At 0518 LT (0218 GMT), the course was altered to 045°; then at 0539 LT (0239 GMT), to 180°, and the beacon was passed a second time at right angles to the preceding track at 0610 LT (0310 GMT). This survey was planned to check the position of the beacon and to clarify the relief of the acoustic basement observed at 0.75 sec DT on the airgun records. The two crossings showed that basement follows more or less the bottom topography and confirmed the originally determined thickness of 0.75 sec DT for the overlying sediments. At 0630 LT (0330 GMT), the speed was increased to maximum and the ship steamed south in the direction of Site 243.

LITHOLOGY

Introduction

Site 242 penetrated 676 meters of sediment below a sea bottom depth of 2275 meters. The interval penetrated represents an apparently uninterrupted sedimentary record from Holocene to late Eocene time. Because of the remarkable similarity of the sediments throughout the entire cored interval, the lithologic subdivisions assigned are somewhat arbitrary and are based more upon changes of color and induration than of composition. A subdivision into three lithologic units is given in Table 2. A stratigraphic column is presented in Figure 6.

Description of Lithologic Units

Unit I: Gray Foram-Rich and Foram-Bearing Nanno Ooze (Cores 1 to 5)

With the exception of the brown topmost meter, Unit I is characterized by a greenish gray color. It is essentially a nanno ooze with the amount of calcareous nannofossils constituting between 50 and 70 percent. Foraminifera may comprise as much as 20 percent of the upper half of Unit I, but in general their amount is much reduced (5%-10%) in the lower half. Abundant black spots and streaks of pyrite are characteristic. Core catcher samples analyzed for insoluble residue indicate that clays comprise between 30 and 40 percent of the sediment and that much of this clay is montmorillonite. These clays do not occur in uniform amounts throughout all sections of each core; instead, clay occurs more abundantly in local, thin (2-5 cm) layers which are recognized by being stiffer than intervening regions of the core.

Lesser constituents of Unit I include fine silt-sized detrital grains of quartz, potash and plagioclase feldspar, the heavy minerals zircon, hornblende, sphene, and hypersthene, pyrite, kaolinite, and glauconite. These constituents occur mostly in trace amounts but may constitute up to 2 percent. Although pyrite is not volumetrically important, it nevertheless causes noticeable black coloration locally throughout the unit, especially where it is concentrated in burrow casts. Minor glauconite occurs in two laminae in Sections 3 and 4 of Core 1. Locally, in the lower half of Unit I are burrows which are filled with silt-sized authigenic carbonate (micarb). An especially good example is Core 4, Section 3, at 30 cm.

Unit I is extremely soft, except for the thin, local clay-rich stiff layers and was moderately to intensely deformed by coring. Nevertheless, subtle bedding is locally evident as is bioturbate structure. Unit I ranges in age from Holocene to late Miocene.

TABLE 2
Lithologic Units, Site 242

Depth (m)	Lithologic Units	Thickness (m)
	I Gray foram-bearing to foram-rich clayey nanno ooze	237
237	II Gray foram-bearing clayey nanno chalk	183
420	III Brown clayey nanno chalk	256
676		

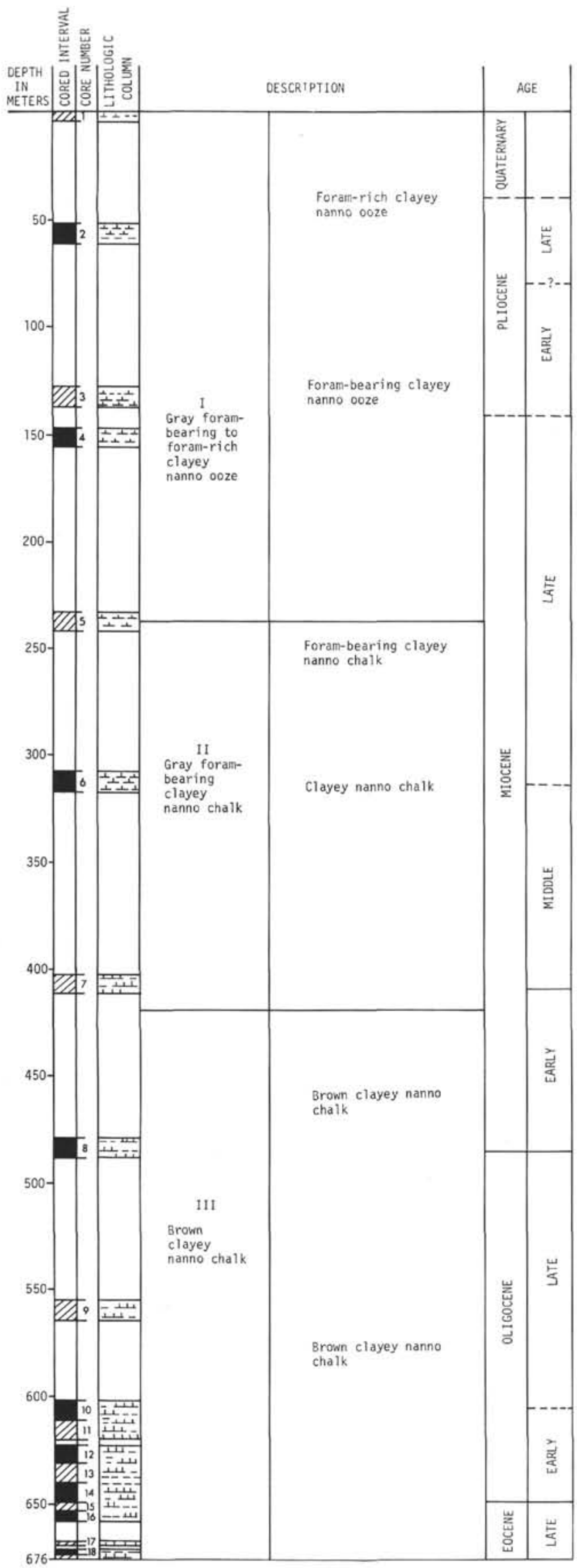

Figure 6. *Stratigraphic column; Site 242. Dashed lines indicate uncertain boundaries.*

Unit II: Gray Foram-Bearing Clayey Nanno Chalk (Cores 6-7)

Core 5, Section 4, marks the top of semilithified sediments at Site 242 and for this reason is designated as the top of Unit II. This core section and all subsequent lower ones had to be split by a band saw, and they are, therefore, designated as chalks rather than oozes. Analysis of core catcher samples reveals that the insoluble residue content, which is mostly clay, increases significantly at the top of this unit and locally comprises as much as 50 percent (by weight). Otherwise, there seems to be no significant difference in composition from Unit I, and only the sharp compactional boundary is a practical basis for subdivision.

Greenish-gray hues characterize Unit II, and the relative amounts of nannofossils remain as in Unit I. Foraminifera decrease in abundance. Black pyritic streaks are numerous—many of which are directly related to burrows. Trace amounts of quartz, feldspar, mica, and heavy minerals occur as very fine silt.

Unit III: Brown Clayey Nanno Chalk (Cores 8 to 19)

The division between Units II and III is based on a striking color change from predominantly green hues to brown ones and was arbitrarily selected at 420 meters (between Cores 7 and 8), although it could actually occur anywhere within the 67-meter washed interval between these cores. While greens and greenish grays predominate in the overlying sediments, Unit III is distinguished by browns and yellowish browns mottled and locally interbedded with greenish grays.

Calcareous nannofossils are the dominant constituents of Unit III, comprising from 45 to 60 percent. The unit is lithified sufficiently to warrant designation as a chalk. Insoluble residue from core catcher samples, as well as smear slide examinations, indicate that an appreciable amount of clay is present throughout and reaches nearly 60 percent in the core catcher of Core 9. As in the above units, clay content is not uniform throughout but is locally richer in layers which are generally better lithified than intervening ones. There is locally present in burrows a manganese-rich nanno chalk in which opaque authigenic manganese oxide either coats foraminifera tests or is finely disseminated as a matrix. Small-scale lenticular bedding exhibiting cut-and-fill structure occurs in Core 10, Section 5. Bioturbate structures, mostly burrows, occur sporadically throughout Unit III and are commonly accompanied by green reduction spots having black (manganese?) nuclei. The core catcher of Core 17 and Core 18 are noticeably rich in carbonate fragments (micarb) of unknown origin. Trace constituents include silt-sized quartz, feldspar, carbonate rhombs, and heavy minerals. X-ray analysis reveals the presence of mica (probably illite clay) as well as palygorskite. Unit III ranges in age from early Miocene to early late Eocene.

Discussion

The dominance of calcareous nannofossils plus the paucity of terrigenous detritus at Site 242 indicate that this site has been within a region of pelagic sedimentation at least since late Eocene time, which attests to the tectonic stability of the region for the past 40 million years.

Additional demonstration of this tectonic quiescense is the apparent lack of any major stratigraphic breaks in the sediment as this hole contains one of the most complete Tertiary sediment records encountered on Leg 25. The average sediment accumulation rate for the section penetrated is approximately 20 m/m.y., a relatively high figure for pelagic sediments. However, Site 242 is located only 15 degrees of latitude south of the equator, and such a thick accumulation of relatively homogeneous biogenic sediments is probably due to the high biologic productivity characteristic of equatorial waters. Additionally, the bottom at this site has probably been above the CCD throughout the entire time span of pelagic sedimentation.

The site is situated in the lee of Davie Ridge, which would act as a barrier against terrigenous materials that may have been shed from the African continent. This may explain the paucity of land-derived detritus in the sediments. Such detritus that may have been shed from Madagascar has been deposited in deeper water between the Davie Ridge and Madagascar and thus did not reach Site 242. The minor amounts of silt-sized detrital minerals (quartz, feldspar, zircon, hornblende, sphene, and hypersthene) present in several smear slides probably represent the distal edge of turbidites derived from Madagascar, the bulk of which underlie the Comoro Abyssal Plain to the northeast. Relatively weak bottom currents should be capable of transporting such fine sediments.

A study of the insoluble residue from each core catcher was made in order to check the accuracy of shipboard smear slide descriptions–especially the estimation of clay content. The results reveal two anomalous regions in this hole. A very clear abrupt increase in clay content coincides with the division between Units I and II–a division selected on the basis of a change from soft, unconsolidated sediments to hard, semilithified ones. It thus seems apparent that lithification of pelagic sediments is directly related to the content of clay minerals and is probably a result of compaction with loss of interstitial water. The second anomalous region at Site 242 occurs at approximately 570 meters, where the average amount of insoluble residue decreases significantly and in addition exhibits a cyclic or oscillatory pattern. In the interval between 570 meters and the bottom of the hole, three distinct cycles of increasing and decreasing clay content are obvious. It is probably significant, but is as yet unexplained, that this cyclic nature occurs in Oligocene sediments which were found at Site 242 but which are conspicuously absent at most other sites drilled in the southwestern Indian Ocean.

The abrupt color change separating Unit II from Unit III is interpreted to reflect the oxidation state of iron in the clay fraction with the greens and grayish greens suggesting reducing conditions as contrasted with the browns and reddish browns. Whether these colors are indicative of primary depositional conditions or of post-depositional diagenetic changes is indeterminable.

The strongly bioturbate condition of much of the sediment at Site 242 attests to the presence of abundant bottom dwellers. Such mud feeding benthos generally flourish where low energy and low turbidity exists; thus, the bottom conditions at this site have probably been about the same throughout much of Tertiary time.

PHYSICAL PROPERTIES

The bulk density values determined from the GRAPE device are higher than those obtained from the syringe sample and section weight methods except for the last syringe sample value at about 309 meters in Core 6. This is the first and only syringe sample bulk density measured in the semilithified sediments of lithology Unit II. The bulk densities in Units I increases with depth. Below 237 meters (top of Unit II) the reliability of the GRAPE data is uncertain because of the variability in core diameter. Nevertheless, it also suggests an increase of bulk density with depth. From Cores 12 to 19 (623-676 m) the cores, and therefore the data also, are more closely spaced. Within this depth interval, the bulk density ranges between 1.85 and 2.08 g/cm^3. When considered with other physical properties, these changes become important. Sonic velocities increase systematically to a depth of about 636 meters. From that depth to about 669 meters, the velocities decrease to a value of 2.12 km/sec. Below 669 meters, there is a sharp increase again to 2.33 km/sec.

The curve for acoustic impedance data appears as an amplified version of the bulk densities plot with the increase of sonic velocity with depth reflected as a divergence of the bulk density and acoustic impedance curves with depth. Sharp variations of acoustic impedance between 623-676 meters are clearly seen.

In general, the thermal conductivity increases with depth, and the water content and porosity decrease with depth. At about 610 meters, in Core 10, the thermal conductivity has a strong positive anomaly. There is also a provisional suggestion of a more rapid decrease in water content below Core 14 (649 m). One other possible anomaly of thermal conductivity is at the top of Core 6 (308 m). Here a low value of about 2.27 mcal/cm sec °C was measured but is considered less reliable because of the limited time interval of the test. Two other values in the same core section measured 2.63 and 2.65 mcal/cm sec °C.

In summary, one very reliable depth interval for anomalous physical property values was determined between 623-676 meters and almost surely represents a seismic reflection zone even though there is no apparent correlation with lithology.

BIOSTRATIGRAPHY

Calcareous Nannoplankton

At Site 242, a complete sequence from Quaternary to the late Eocene was penetrated (Figure 7). The nannoplankton in these sediments are generally very abundant and well preserved.

Quaternary

Core 1 samples contain abundant nannoplankton and include the upper part of the Quaternary, the *Emiliania huxleyi* Zone (NN21) and the *Gephyrocapsa oceanica* Zone (NN20). The identification of *Emiliania huxleyi* in the light microscope is difficult and not always certain. Typical species of these zones are: *Gephyrocapsa oceanica,*

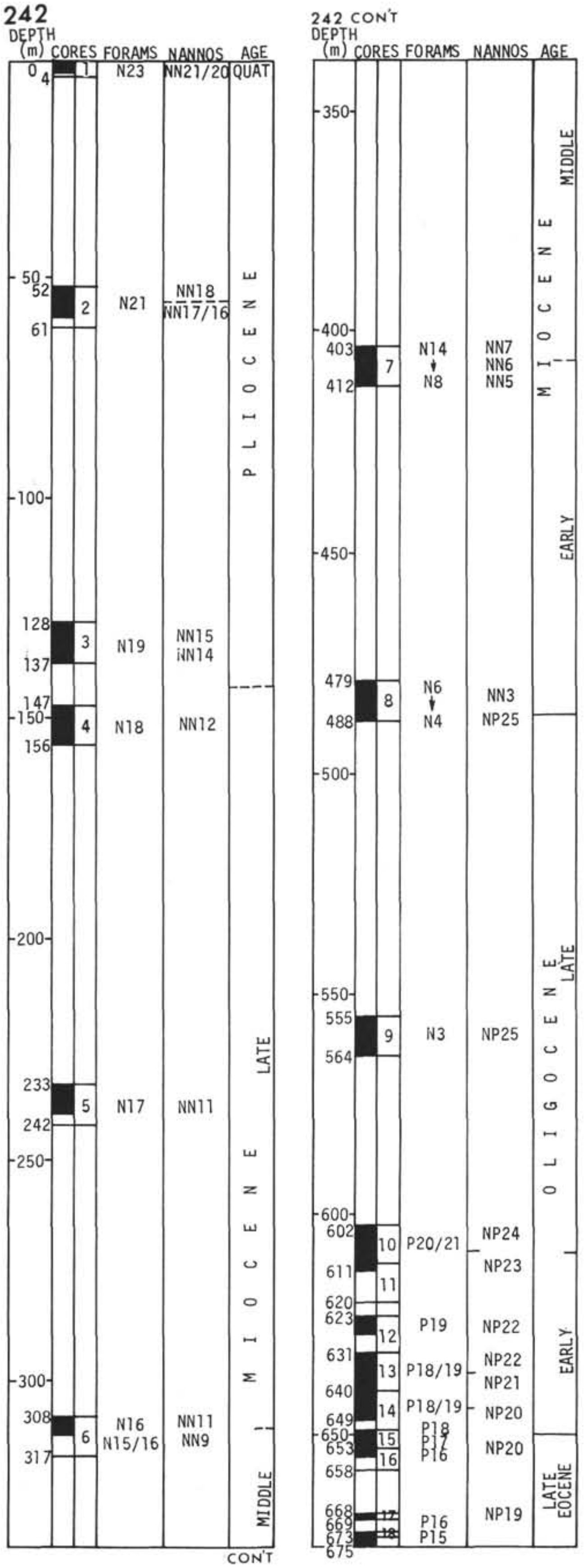

Figure 7. *Biostratigraphic column for Site 242.*

Umbilicosphaera mirabilis, Scapholithus fossilis, Syracosphaera pulchra, and *Ceratolithus cristatus. Pseudoemiliania lacunosa* was not observed.

Neogene

The uppermost part of Core 2 seems to belong to the *Discoaster brouweri* Zone (NN18). The boundary between this zone and the following *Discoaster pentaradiatus* Zone (NN17) is not very distinct because *Discoaster pentaradiatus* was found only in a few specimens. The first appearance of this species was observed in Sample 2-1, 78 cm.

The boundary between the *Discoaster pentaradiatus* Zone and the *Discoaster surculus* Zone (NN16) lies in Sample 2-4 with the last occurrence of *Discoaster surculus.*

Core 3 is very rich in nannoplankton which have very good preservation. It belongs to the *Reticulofenestra pseudoumbilica* Zone (NN15) with *Reticulofenestra pseudoumbilica, Ceratolithus rugosus,* and *Discoaster asymmetricus* (3-1 to 3-4) and *Discoaster asymmetricus* Zone (NN14) from Sample 3-4, 54 cm to Sample 3, CC.

The late Miocene, *Ceratolithus tricorniculatus* Zone (NN12) was identified in Core 4. In addition to the well-known form of *Ceratolithus tricorniculatus,* a bizarre form of this species was observed which has the horn extended into a rod. Further on, *Scyphosphaera globolata* was found. The core catcher of Core 4 is very rich in species of the genus *Scyphosphaera.* They seem to be most abundant in the uppermost part of the Miocene. The *Discoaster quinqueramus* Zone (NN11) was identified in Core 5 to Core 6, Section 3, 150 cm. The most frequently occurring species are: *Discoaster quinqueramus, Discoaster brouweri,* and *Discoaster neohamatus,* in the lower part of this zone; *Discoaster challengeri, Triquetrorhabdulus rugosus, Discoaster surculus,* and *Ceratolithus tricorniculatus,* in the upper part of the zone. The samples are very rich in calcareous nannoplankton which show very good preservation.

Catinaster coalitus was observed very frequently in the core catcher of Core 6. *Catinaster calyculus, Discoaster exilis* and *Discoaster hamatus* are not abundant. These species indicate the *Discoaster hamatus* Zone (NN9).

In Core 7, Section 1 to Core 7, Section 2, 148 cm, *Discoaster kugleri* occurs, thereby indicating the *Discoaster kugleri* Zone (NN7). Samples 7-3, 100 cm to 7-4, 50 cm belong to the *Discoaster exilis* Zone (NN6).

The *Sphenolithus heteromorphus* Zone (NN5) was identified in Samples 7-4, 128 cm to 8-1, 90 cm with *Sphenolithus heteromorphus, Coronocyclus nitescens, Helicopontosphaera kamptneri,* and a few species of *Discoaster exilis.* The *Helicopontosphaera ampliaperta* Zone (NN4) was not observed. This species seems to be missing in this region.

Samples 8-2, 50 cm to 8-4, 140 cm are without *Sphenolithus heteromorphus* and *Triquetrorhabdulus carinatus* but with *Sphenolithus belemnos,* indicating the *Sphenolithus belemnos* Zone (NN3).

Paleogene

The boundary Paleogene/Neogene lies within Core 8, Section 5. The lower part of Cores 8 and 9 belong to the *Sphenolithus ciperoensis* Zone (NP25) of the late Oligocene with *Sphenolithus ciperoensis, Helicopontosphaera recta, Helicopontosphaera euphratis, Triquetrorhabdulus carinatus, Coccolithus abisectus, Discoaster deflandrei,* and *Helicopontosphaera obliqua.* These samples are very abundant in nannoplankton.

The *Sphenolithus distentus* Zone (NP24) is determined by the first occurrence of *Sphenolithus ciperoensis.* This zone includes the samples of Core 10, Section 1 to Core 10, Section 5, 40 cm. Typical for this zone are *Helicopontosphaera recta, Coccolithus abisectus, Sphenolithus ciperoensis,* and *Sphenolithus distentus.*

Sample 10-5, 120 cm and the core catcher of Core 11 belong to the *Sphenolithus predistentus* Zone (NP23) with *Sphenolithus predistentus, Sphenolithus distentus, Helicopontosphaera compacta, Dictyococcites dictyodus,* and *Cyclococcolithus floridanus.* The *Helicopontosphaera reticulata* Zone (NP22) includes Core 12 and the upper part of Core 13, Section 2. The nannoplankton assemblage consists of *Helicopontosphaera reticulata, Dictyococcites dictyodus, Reticulofenestra umbilica*, and a few species of *Ericsonia subdisticha.*

The *Ericsonia subdisticha* Zone (NP21) was observed in the interval of 13-3, 100 cm to 14-3, 100 cm with *Cyclococcolithus formosus, Helicopontosphaera compacta, Discoaster tani nodifer, Sphenolithus predistentus,* and *Reticulofenestra umbilica.*

The late Eocene, *Sphenolithus pseudoradians* Zone (NP20) was determined in the interval 14-4, 100 cm to Core 16, with *Sphenolithus pseudoradians, Helicopontosphaera compacta, Discoaster tani nodifer, Discoaster barbadiensis, Discoaster saipanensis, Cyclococcolithus formosus,* and a few specimens of *Isthmolithus recurvus.* The boundary between the Eocene and Oligocene, which is indicated by the extinction of *Discoaster saipanensis,* is not very distinct, because in the uppermost part of the Eocene this species was very rare.

Cores 27, 28, and 29 probably belong to the *Isthmolithus recurvus* Zone (NP19). The samples are rich in *Cribrocentrum reticulatum, Discoaster tani nodifer, Discoaster barbadiensis, Reticulofenestra umbilica,* and *Cyclococcolithus formosus.*

Foraminifera

Quaternary, Neogene, and Oligocene

An exceptionally well developed Quaternary and Neogene pelagic sedimentary sequence is represented at Site 242. Although the thickness of the biostratigraphic zones is very great, there were only a few examples of displaced material of older age or from lesser water depths; i.e., nearly all benthonic foraminifera are deep-water forms.

Core 1 seems to be entirely of Holocene age. The tropical foraminiferal assemblages are very rich in species and specimens. All those species which are believed to be typical for the Holocene can be observed in the samples of this core. These are: *Globigerina bulloides calida, Beella digitata,* and *Globigerinella adamsi.* The *Globorotalia truncatulinoides* of this core are very large and sharply keeled.

It is somewhat difficult to decide by means of the foraminifera whether the sediments of Core 2 are of early Pleistocene or late Pliocene age. There are no typical *Globorotalia tosaensis,* only somewhat smaller, less sharply keeled *Globorotalia truncatulinoides* in the upper part of the core. In the lower part, *G. truncatulinoides* is replaced by *G. tosaensis.* Since members of the *Globorotalia cultrata* group, and even partly of the *Globorotalia tumida* group, are chiefly right coiling in the samples of Core 2, whereas they are generally left coiling in the Holocene and Pleistocene, a late Pliocene age is assumed for Core 2. This age is confirmed by the nannoplankton; the samples have many discoasters. Therefore, the boundary between the Quaternary and Tertiary is drawn just above Core 2.

The faunas of Core 3 are of early Plicoene age with, among others, *Globigerina apertura, Globigerina nepenthes,* very few *Globorotalia margaritae, Globoquadrina altispira altispira, Pulleniatina obliquiloculata praecursor,* and *Sphaeroidinellopsis subdehiscens.*

Core 4 with *Globorotalia tumida plesiotumida,* together with nontypical *Globorotalia merotumida,* a few *Globorotalia tumida tumida,* and a foraminiferal association very similar to that of Core 3 is thus of late late Miocene age, Zone N.18 of Blow.

Beginning with Core 3, the amount of foraminifera in the samples diminishes, owing only partly to incipient dissolution of the more fragile specimens. However, many fragile species still are represented.

In Core 5 and deeper cores, the planktonic foraminifera are partly dissolved. The amount of dissolution varies from sample to sample. Grain-size fraction $>177\mu$ of Sample 5-4, 50 cm contains about 50 percent *Sphaeroidinellopsis subdehiscens,* and that of the core catcher of Core 6, also of late Miocene age, 50 percent of *Globigerina nepenthes.* Nevertheless, there are enough characteristic species left to date the samples, e.g., *Globorotalia tumida plesiotumida, Globorotalia merotumida, Globigerinoides obliquus obliquus, Globigerinoides obliquus extremus, Globigerina nepenthes, Globoquadrina altispira altispira, Globoquadrina altispira globosa, Globoquadrina dehiscens,* but no more *Globorotalia tumida* and *Sphaeroidinellopsis subdehiscens paenedehiscens.* Core 6 contains a typical fauna of the early late Miocene (Blow Zone N.16); *Globorotalia crassaformis* group and *Pulleniatina* spp. are missing.

Core 7 shows an astonishingly condensed sequence of middle Miocene age with relatively well preserved foraminifera. The uppermost part of the core belongs in Blow Zone N.14 of the middle middle Miocene with *Globigerina nepenthes* together with *Globorotalia mayeri,* while in Section 6, *Globorotalia fohsi fohsi, Globorotalia fohsi barisanensis,* and other species typical of the early middle Miocene (N.10) can be observed. In the core catcher sample, one specimen of *Globigerinatella insueta* was found, which together with *Praeorbulina* spp. and *Globigerinoides sicanus* would possibly point to the uppermost early Miocene (N.8). Thus, the equivalent of at least 2×10^6 years (according to Berggren, 1972) can be found in this 9-meter core. There is no sign of a hiatus within this core.

In Core 8 near the top, the lower part of Blow Zone N.6 has been found. Very few foraminifera occur below this sample, indicating stronger calcium carbonate dissolution. The foraminiferal associations do not contradict an early Miocene (N.5) age with *Globigerina binaiensis, Globigerina venezuelana, Globigerinita dissimilis s.l., Globoquadrina* *altispira altispira,* and *Globorotalia mayeri.* The lower part of the core contains small faunas in which the presence of a high percentage of *Globorotalia kugleri*, together with a foraminiferal association quite similar to the ones above, strongly points to an earliest early Miocene (N.4) age. In Core 8, the first foraminifera affected by increased pressure can be observed. Although the flattening may be the result of drilling pressure, the Oligocene cores contain flat foraminifera together with recrystallized ones which show clearly that the flattening is a diagenetic process.

There is a continuous succession from the Miocene, through the entire Oligocene and into the Eocene; this being the only hole where a complete Oligocene section was observed during Leg 25. Preservation of the foraminifera is fairly good, but there apparently are some deviations from the schemes of Blow (1969) and Berggren (1972). One of these is the extinction datum of *Pseudohastigerina,* which occurs almost simultaneous with that of *Chiloguembelina.* The Oligocene section needs some detailed study which could not be done during the preparation of this initial report because of the lack of time. Therefore, only the approximate agreement between the nannoplankton zonation and the foraminiferal zonation has been checked.

The uppermost part of Core 9 still contains some *Globorotalia kugleri* together with Oligocene species, thereby indicating that this part of the core is from the Miocene-Oligocene transition area. The lower part of Core 9 has a true Oligocene foraminiferal fauna with *Globigerina binaiensis, G. sellii,* and *G. angulisuturalis*, giving a P.22 age according to Blow (1969). Section 1 of Core 10 seems to belong to the P.21 Zone because *Chiloguembelina* and *Pseudohastigerina* are missing. From Section 2 of Core 10 downward in the hole, the latter two genera are represented with continuously increasing numbers. Together with *Globorotalia opima* and several longer ranging Oligocene species, a middle Oligocene age is given to Core 10. Early Oligocene is represented in Cores 12 to 14 with several large, thick species of *Globigerina* such as *G. sellii, G. tapuriensis,* and *G. praesaepis,* and several species of *Globigerinita*, among them forms very similar to the *G. martini scandretti* mentioned by Blow (1969), together again with *Pseudohastigerina* and *Chiloguembelina* species. These foraminiferal faunas do not contain very characteristic species, but the communities found do not contradict the zonation with nannoplankton which here is surely more reliable than the foraminiferal zonation.

Eocene

The lower part of this hole gives an interesting profile of the late Eocene and the transition to the Oligocene. According to the foraminifers, this transition is found in Core 15. The pelagic assemblages are mostly rich and diversified and are generally well preserved. However, the shells of the larger species are often flattened or partially destroyed on one face. The benthonic assemblages are considerably less rich than the planktonic ones, although they are still relatively profuse, and they correspond to a rather shallow exotic influx into a bathyal environment, probably from the lower slope.

It is to be noted that in this section, faunas are described from older to younger. Beginning with the base, the position in the late Eocene, in its bottom zone, i.e., P.15 or *Globigerinatheka semiinvoluta* Zone, a rich planktonic assemblage occurs. Level 242-19-3, 100-102 cm, the oldest examined (not counting the core catcher, in which an identical assemblage was found), will be taken as an example. A list contains the following:

Globigerina gr. *eocaena* Gümbel, 1870
Globigerina corpulenta Subbotina, 1953
Globigerina c.f. *jacksonensis* Bandy, 1949
Globigerina praeturritilina Blow and Banner, 1962
Globigerina pseudoampliapertura Blow and Banner, 1962
Globigerina (Subbotina) angiporoides Hornibrook, 1965
Globigerinita cf. *africana* Blow and Banner, 1962
Globigerinita globiformis Blow and Banner, 1962
Globigerinita pera (Todd, 1957)
Globigerinatheka lindiensis Blow and Banner, 1962
Globigerinatheka semiinvoluta (Keijzer, 1945)
Globorotalia (Turborotalia) cerroazulensis (Cole, 1928)
Globorotalia (Turborotalia) gemma Jenkins, 1966
Globorotalia (Globorotalia) spinulosa Cushman, 1927
Globorotalia cf. *Truncorotaloides topilensis* (Cushman, 1925)
Hantkenina primitiva Cushman and Jarvis, 1929

The fine fraction of the washed residue contains abundant *Chilogümbelina* and *Pseudohastigerina.*

There is considerable reworking, apparently fed by levels from the early Eocene and the bottom of the middle Eocene. We find, in particular:

Globorotalia (Morozovella) aragonensis Nuttall, 1930
Globorotalia (Morozovella) crater Finlay, 1939
Globorotalia (Morozovella) formosa Bolli, 1957
Globorotalia (Morozovella) subbotinae Morozova, 1939
Globorotalia (Acarinina) spinuloinflata Bandy, 1949

Such displaced assemblages are found, often in extreme abundance, throughout a large portion of the sediment column up to Core 16. Above this, we also find some, but they are much more disseminated.

Cores 19 and 18 reveal an extremely homogeneous pelagic assemblage. The following should be added to the species mentioned above:

Globigerinita martini Blow and Banner, 1962
G. martini scandretti Blow and Banner, 1962
Hantkenina alabamensis Cushman, 1925.

As in the subsequent cores, the fact that *Hantkeninae* are extremely rare here can be mentioned.

The most constant and most characteristic group in Core 19, after the *Hantkenina,* is made up of *Globigerinatheka semiinvoluta* (Keijzer, 1945) and *Globigerinatheka lindiensis* Blow and Banner, 1962. The tests are mostly small and not greatly "evolved". There are few additional openings in the former, and few "bullae" in the latter. In Core 18, only *G. semiinvoluta* persists in the form of occasional specimens which, for the most part, are not very typical.

At the same time, the *Turborotalia cerroazulensis* group is evolving and contains intermediate forms with *Globorotalia (Turborotalia) cocoaensis* Cushman, 1928. This species is present in a typical manner beginning with the bottom of Core 17. Hence, the boundary between Zones P.15 (*Globigerinatheka semiinvoluta* Zone) and P.16 (*Cribrohantkenina inflata* Zone) can be situated between Cores 18 and 17.

Samples examined:
242-19, CC
242-19-3, 100-102 cm
242-19-3, 50-52 cm
242-19-3, 10-12 cm
242-19-2, 100-102 cm
242-19-2, 50-52 cm
242-19-1, undetermined
242-18, CC
242-18-1, 130-132 cm
242-18-1, 64-66 cm

Cores 17 and 16 are located in Zone P.16 (*Cribrohantkenina inflata* Zone). The assemblage as a whole is similar to the preceding one except for the guide forms (*G. mexicana*, *G. lindiensis*, and *G. cerroazulensis*) which have disappeared. Also found are:

Globorotalia (Turborotalia) cocoaensis Cushman, 1928
Turborotalia increbescens (Bandy, 1949)
Chilogümbelina martini (Pijpers, 1933)
Pseudohastigerina barbadoensis Blow, 1969
Hantkenina aff. *H. brevispina* Cushman, 1925

On the other hand, the guide form *Cribrohantkenina inflata* was not found.

Samples examined:
242-17, CC
242-17-1, 95-97 cm
242-17-1, 50-52 cm
242-16, CC
242-16-1, 80-82 cm
242-16-1, 10-12 cm

Core 15, first of all, shows levels which are located at the top of the late Eocene. They probably correspond to Zone P.17 (*G. gortanii-G. centralis* Zone). For example, the following were found in the core catcher:

Hantkenina aff. *brevispina* Cushman, 1925
H. alabamensis Cushman, 1924
Globorotalia (Turborotalia) cocoaensis Cushman, 1928
G. (T.) cocoaensis cunialensis Toumarkine and Bolli, 1970
Globigerina ampliapertura Bolli, 1957
Globigerina gortanii Borsetti, 1959

In Sample 242-15-3, 100-102 cm, *Hantkenina* are still present while the *Globorotalia* from the *cocoaensis* group have disappeared.

The boundary between the Eocene and Oligocene can conventionally be located between Samples 242-15-1, 30-32 cm, and 242-15-1, 100-102 cm, i.e., between Zones P.17 and P.18 (*G. tapuriensis* Zone). The *Hantkeninas* and the *Globorotalias* of the *cocoaensis* group have disappeared. At the same time various species either appear or become more abundant, including:

Globorotalia (Turborotalia) increbescens (Bandy, 1949)
Globigerina ampliapertura Bolli, 1957
Globorotalia (Turborotalia) nana (Bolli, 1957)
Globigerina officinalis Subbotina, 1953
Globoquadrina yeguaensis (Weinz. and Applin, 1929)–*G. galavisi* (Bermúdez, 1961)
G. tapuriensis Blow and Banner, 1962

There are some specimens which show the transition to *G. sellii* Borsetti, 1959. The *Globigerina eocaena* (Gümbel, 1870)–*G. corpulenta* Subbotina, 1953 group continues to be well represented. On the other hand, *G. gortanii* Borsetti, 1959 is sparse.

Samples examined:
242-15, CC
242-15-3, 100-102 cm
242-15-3, 50-52 cm
242-15-2, 100-102 cm
242-15-2, 50-52 cm
242-15-1, 100-102 cm

Only a partial inventory of the benthonic assemblage, which was found to abound mainly in the lower two cores, was possible. Its composition is the one normally found at such levels, and it appears to correspond to the depths of the lower slope at least, with an exogenic influx from the neritic realm or from the upper slope. The following were found:

Eggerella sp.
Dorothia sp.
Lagena sp.
Bulimina cf. *pachecoensis* Smith, 1957
Bulimina jarvisi Cushman and Parker, 1936
Bulimina cf. *jugosa* Cushman and Parker, 1936 or *forticosta* Finlay, 1940
Uvigerina gr. *spinicostata* Cushman and Jarvis, 1929
Pullenia alazanensis Cushman, 1927
Pullenia eocaenica Cushman and Siegfus, 1939
Pleurostomella gr. *alternans* Schwager, 1866–*hantkeni* Andreae, 1884
Nonion pulleniformis Chalilov, 1956
Gyroidina cf. *depressaeformis* Bykova, 1953
Gyroidina perampla Cushman and Stainforth, 1945
Anomalina cf. *perthensis* Parr, 1938
Cibicides gr. *grimsdalei* Nuttall, 1930
Cibicides gr. *perlucidus* Nuttall, 1932
Eponides gr. *umbonatus* (Reuss)
Nuttalides trumpyi (Nuttall, 1930)
Siphonodosaria nuttalli Cushman and Jarvis, 1934

BIOSTRATIGRAPHIC SUMMARY

In Site 242, a complete sequence of Quaternary to upper Eocene sediments occurs. The sediments are hemipelagic and pelagic in origin and rich in calcareous microfossils. Although the thickness of biostratigraphic zones within the Neogene is very great, there are only a few signs of displaced material of older age or from lesser water depth; nearly all benthonic foraminifera are deep-water forms deposited in water deeper than 2000 meters. The Quaternary has a sedimentation rate of ~25 m/m.y. This is unusually low considering the position of the hole and leaves some open questions as to whether the conditions of sedimentation changed during the youngest history at this site (which is situated on the Davie Ridge) or whether the coring technique introduced an error. These questions cannot be answered without additional, and continuous, coring.

The Pliocene sequence of about 100 meters is underlain by about 350 meters of Miocene sediments. The sedimentation rate for the late Miocene to late Pliocene is very high, about 57 m/m.y., while it is only about 13 m/m.y. for the late Oligocene to late Miocene. The original sedimentation rate curve, which allows for more than one sample from each core, shows several steps (see Explanatory Remarks, Chapter 1) which probably are not real but have their origin in the possible errors discussed by T. C. Moore (1972). To get a more realistic picture, these steps were graphically eliminated in the combined sedimentation rate diagram for Leg 25 (see Lithologic Summary, this volume). The planktonic foraminifera of the late Miocene are slightly dissolved while the nannoplankton show good preservation. Planktonic foraminifera and/or nannoplankton enable us to recognize the conventional late Eocene and Oligocene zonations along the profile;

nevertheless, there are minor discrepancies with regard to the Eocene/Oligocene boundary according to foraminifera and nannoplankton age determinations. It must be emphasized that reworked materials from lower to middle Eocene deposits occur. A sedimentation rate of about 6 m/m.y. can be estimated for the upper Eocene to upper Oligocene sequence.

CORRELATION OF REFLECTION PROFILES AND LITHOLOGIES

Characteristics of the airgun reflection profile run by *Glomar Challenger* in the near-site area are quite comparable to the data obtained by *Chain* in 1970 and *T. B. Davie* in 1971. The north-south ridge appears as a single steep scarp facing west, with a slope of about 27°. To the east, the sequence consists of a seismic acoustic basement on the ridge crest, descending to a depth of 1.5 sec to 2.0 sec DT beneath the Comoro Abyssal Plain. The overlying sediments are strongly stratified in the east, becoming acoustically transparent and thinning westwards in the direction of the ridge. At Site 242, the acoustic basement upon which the transparent layer rests is at 0.75 sec DT. Two minor reflectors above acoustic basement are visible on the records, the first at 0.39 sec DT and the second less distinct at about 0.54 sec DT (Figure 5).

At Site 242, drilling and coring penetrated 676 meters of sediments below the sea floor. The sediments are remarkably similar in composition throughout the whole section, and the lithologic divisions are more or less related to changes in color and compaction. Therefore, correlation of seismic reflectors with lithologies is difficult.

The compositional homogeneity of the sedimentary section enabled us to calculate a mean sonic velocity with confidence for each core from the measured values. The mean velocities increase progressively from about 150 meters down to 635 meters, where the velocity decreases sharply and significantly by about 5 percent until 668 meters and increases again very clearly below this level (Figure 8). The acoustic impedance curve shows similar but less clear variations at the same depths (the scattering of the data probably is due to the uncertainty of density determinations). The thermal conductivity increases progressively with depth and also shows a very strong positive anomaly at about 610 meters.

The two minor reflectors which are seen at about 0.39 sec DT and 0.54 sec DT on the pre-site survey records (Figure 5), and which appear much less pronounced on the records obtained when leaving the site (Figure 8), cannot be correlated with any clear lithologic or other changes. The reflector at 0.54 sec DT could correspond to the interface of Units II and III, but this is probably fortuitous since the boundary between these two units was arbitrarily selected at 420 meters according to a striking color change.

The clear acoustic basement reflector at 0.75 sec DT cannot be correlated with any lithologic change but may correspond to the sharp changes in physical properties observed at about 635/668 meters. If this correlation is true, then the interval velocity between the sea floor and the acoustic basement reflector at 0.75 sec DT is 1.74 ± 0.05 km/sec. The mean measured velocity between 0 and 650 meters is 1.71 km/sec; consequently, it can be assumed that the observed acoustic basement reflector has been sampled and does not correspond to any obvious lithologic or stratigraphic change but only to sharp variations in physical properties.

Figure 8 shows the correlation which can be established between the reflection profile, the stratigraphic section, and the measured sonic velocity.

SUMMARY AND CONCLUSIONS

Site 242 is located at a water depth of 2275 meters on the eastern flank of Davie Ridge in the northern Mozambique Channel. The single hole penetrated 676 meters of Quaternary to upper Eocene sediments. A summary of the scientific data is shown on Figure 9.

The *Glomar Challenger* airgun seismic reflection profile (Figure 5) is similar in all essential respects to those obtained by *Chain* 99 in 1970 (Figure 2) and by *Thomas B. Davie* 267 in 1971 (Figure 3), showing (at the site) an acoustically transparent sediment layer 0.75 sec DT thick (with two minor internal reflectors) resting upon acoustic ridge basement. The main objectives of drilling this hole were (a) to sample, identify, and date the acoustic ridge basement reflector in an attempt to determine whether the north-south Davie Ridge can be interpreted as a strike-slip fault indicating the drift direction and path of Madagascar relative to Africa, and (b) to systematically sample the acoustically transparent, presumably pelagic sediment cover in sufficient detail to establish a midlatitude biostratigraphic succession for the western Indian Ocean.

Drilling Results

The hole was cored at approximately 60-meter intervals to 600 meters. This was followed by nearly continuous coring below that level to the total depth of 676 meters in order to ensure that both the sediments immediately overlying the basement acoustic reflector and the reflector itself were adequately sampled. From the measured sonic velocities at different depths, it can be assumed that the acoustic basement reflector occurs in the 635-668 meters depth interval. At a depth of 676 meters, the hole was abandoned on scientific and, mainly, technical grounds since the objectives had been completed and penetration had become extremely slow (about 1.5 m/hr) due to clayballing of the bit.

The entire 676-meter section penetrated consists of dominantly biogenic sediments of remarkably similar composition which grade in age apparently without break from Holocene to early late Eocene and physically from greenish-gray ooze and chalk to brown compacted chalk. No very distinct lithologic boundaries exist between the three units into which the section has been arbitrarily subdivided. The boundary between Units I and II is marked by an abrupt physical change from soft ooze to semilithified chalk. Calcareous nannofossils are the dominant component (50%-70%) in all samples examined, and most of the biostratigraphic nannoplankton zones could be identified without difficulty. Foraminifera comprise up to 20 percent in Unit I (Holocene to late Miocene) and diminish in amount down the section, but are never entirely absent. Clay minerals comprise 30-40 percent of the sediment, tending to occur in thin (2-5 cm) layers.

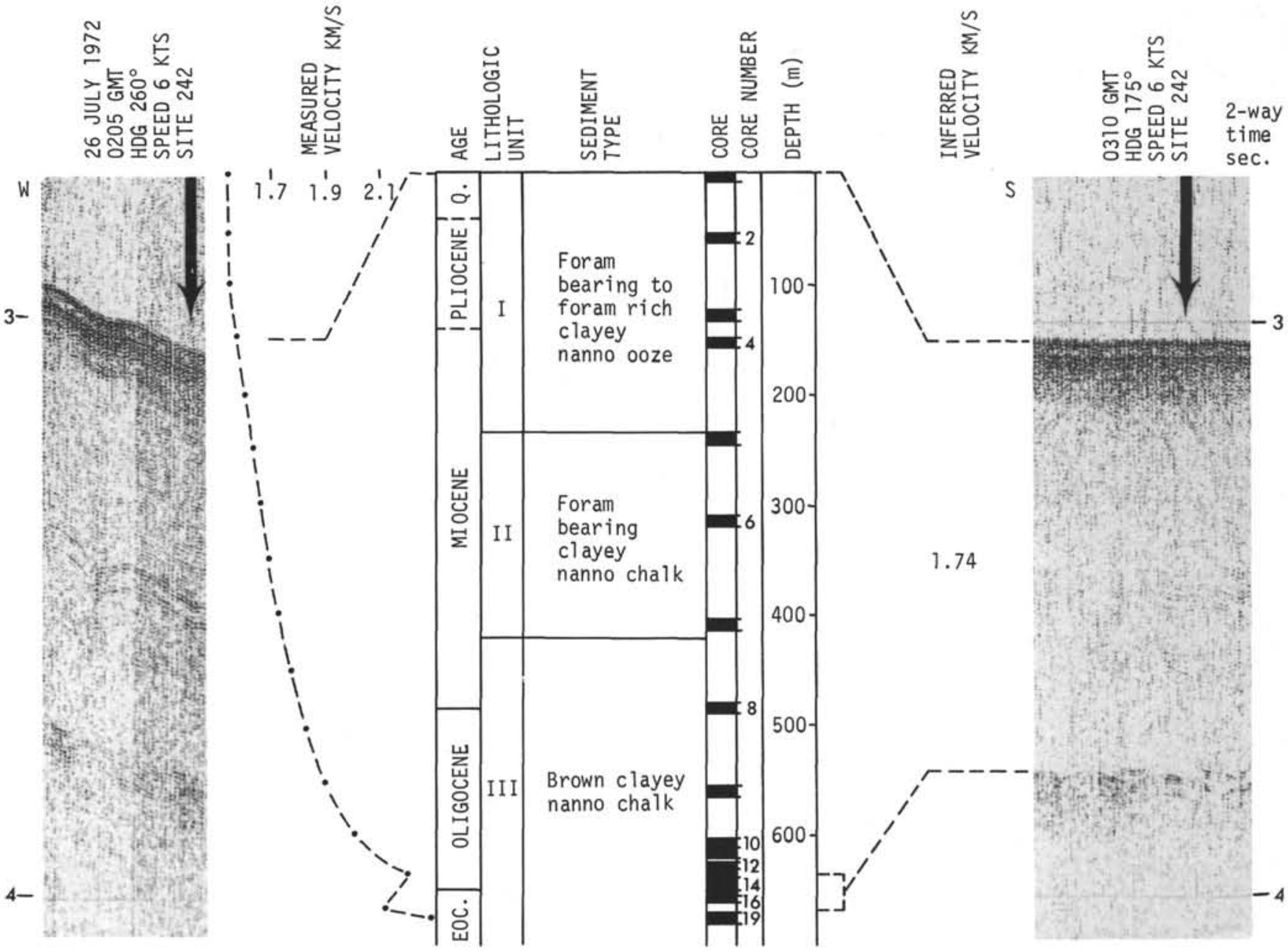

Figure 8. *Correlation of seismic reflection profile with lithology and physical properties.*

Lesser constituents include fine (silt-size) detrital quartz and feldspar accompanied by trace amounts of zircon, hornblende, pyroxene, and sphene. Pyritized burrow casts are commonly visible in most cores; burrows in the lowest, brown nanno chalk of Unit III are often accompanied by manganese enrichment or green reduction spots surrounding black manganese nuclei. Minor glauconite occurs in two very thin layers in the sea floor punch-core.

An exceptionally well developed Quaternary and Neogene pelagic foraminiferal sequence is represented at Site 242, and the tropical assemblages are very rich in species and specimens. Progressive partial dissolution is evident below 200 meters, but in every core even fragile species of foraminifera have survived and enough characteristic species are always present for purposes of dating. The relative increase of deep-water benthonic foraminifera in the middle and late Oligocene part of the brown lithologic Unit III is probably due to greater ease of dissolution of the planktonic forms. Lower down, however, in the lower Oligocene and upper Eocene sediments, pelagic forms predominate and the infrequent benthonics are largely derived from a shelf environment and, hence, have been transported. It should be noted that all three subdivisions of the Oligocene (about 130 m thick) are represented.

Sedimentation rates are listed in Figure 9, showing a high rate (30-37 m/m.y.) for the Pliocene and late Miocene, and variation between 6 and 23 m/m.y. for the older part of the section cored.

Measured physical properties show fairly regular variation with increasing depth down to 600 meters, below which sharp, somewhat erratic changes are evident. Heat flow measurements were made at depths of 141 meters and 317 meters, with a mean result of 0.70μ cal/cm^2 sec. This compares well with a value of 0.72μ cal/cm^2 sec obtained in the same vicinity by von Herzen and Langseth (1965), but it is anomalously low compared with other values obtained in the Mozambique Channel in particular, and the Indian Ocean in general, for which Langseth and Taylor (1967) adopted a preferred average value of 1.32 ± 0.38μ cal/cm^2 sec.

The *Glomar Challenger* seismic reflection profiles (Figures 5 and 8) show a distinct acoustic basement reflector (which was traced eastwards from the crest of the Davie Ridge) at about 0.75 sec DT and two minor intermediate reflectors at about 0.39 sec DT and 0.54 sec DT. The compositional homogeneity of the sedimentary section permitted a confident calculation of mean sonic velocity for each core from measured valued. Using velocity values obtained by integration of the mean measured

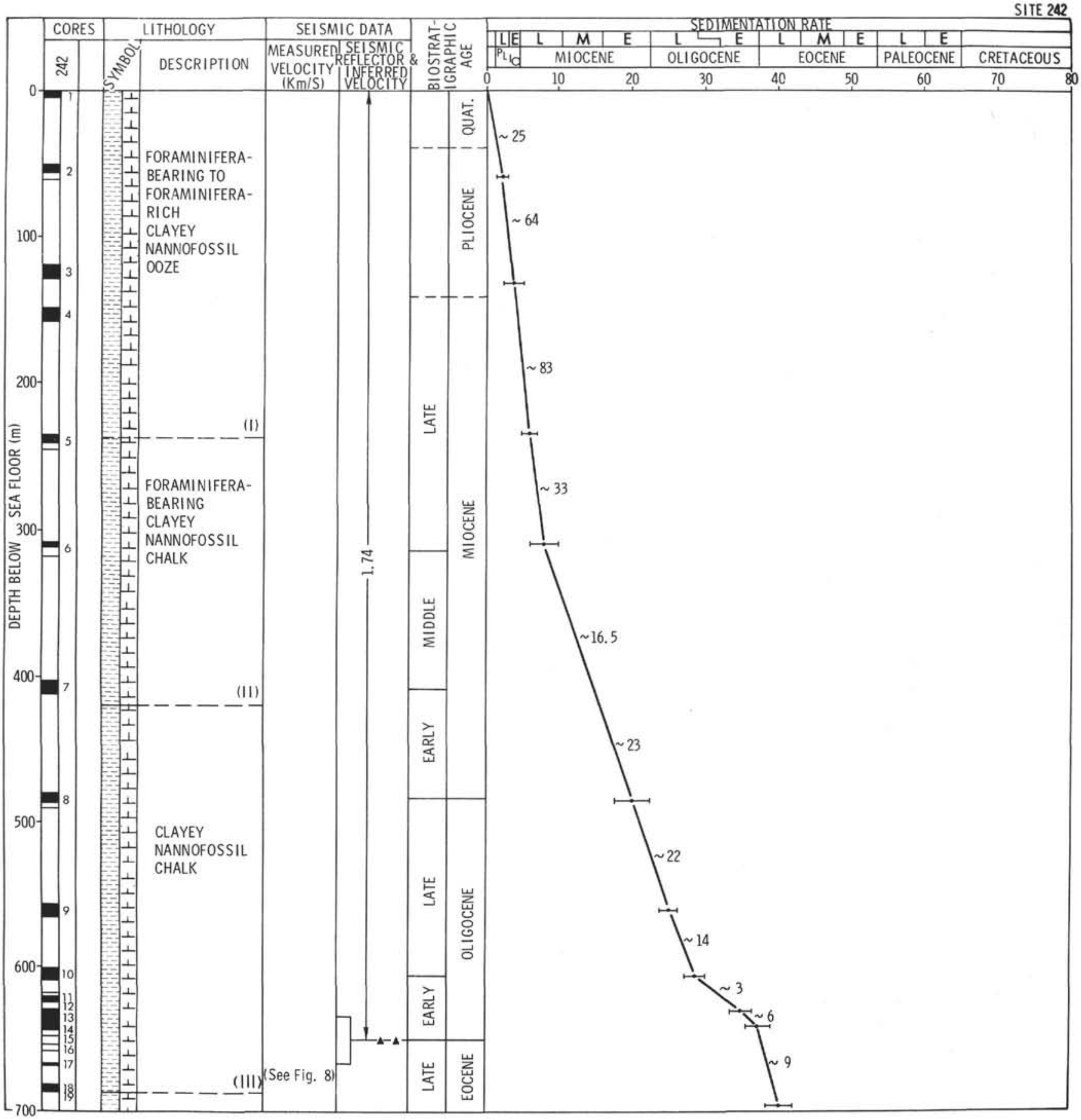

Figure 9. *Summary diagram, Site 242.*

velocity curve, the calculated depth for the acoustic basement reflector is 641 meters. None of the reflectors corresponds with any lithologic change, but the clear acoustic basement reflector could correspond with sharp changes in physical properties observed at about 635/668 meters.

Regional Interpretation and Speculation

There can be no possibility of doubt that the clear acoustic basement reflector at 0.75 sec DT (inferred depth 637/668 m) was penetrated by the 676-meter-deep hole, and there is little doubt that it can be traced seismically to, and identified as, the basement material which forms the apparently sediment-free crest of the Davie Ridge. It is surprising that this reflector does not correspond to crystalline basement as expected but can be identified as hard compact clay-bearing nanno chalk. This result is, however, in accord with the lack of significant magnetic anomalies associated with the Ridge. The proposed nature, origin, and significance of the Davie Ridge in relation to the drift of Madagascar relative to Africa (Heirtzler and Burroughs, 1971) can be neither supported nor rejected outright by the evidence now available, but the probability of their interpretation is not thereby enhanced. Indeed, there is no reason to suppose that the Davie Ridge is not the result of still-active vertical tectonic movements probably related to the East African rift valley system.

The presence of fine (silt-sized) detrital quartz, feldspar, and accessory heavy minerals in the dominantly biogenic sequence strongly suggests that the eastern flank of the Davie Ridge is located in the distal zone of the Comoro Abyssal Plain turbidite depositional area and that this has been so since the early late Eocene. Seismic reflection profiles across the Comoro Abyssal Plain indicate that the present source of supply is Madagascar without any reason to suppose that such has not been the case since the formation of the Comoro Basin and no doubt also the contiguous south Somali Basin.

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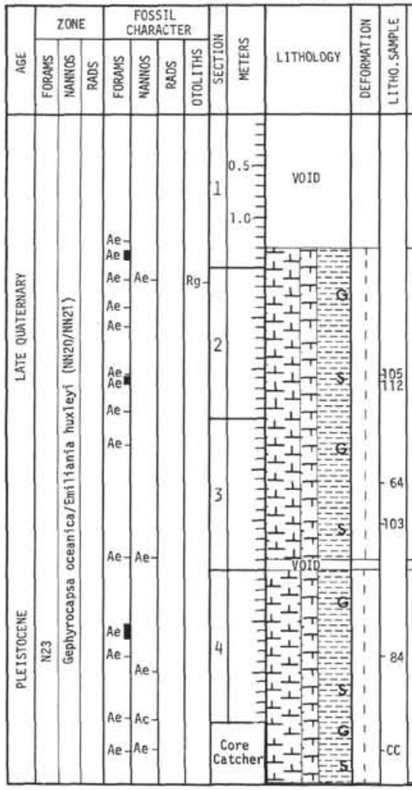
Site 242 Hole Core 1 Cored Interval: 0-4 m



LITHOLOGIC DESCRIPTION

Core is soft and deformed throughout. Colors are dark yellow brown (10YR5/4) and light olive gray (5Y6/1).

FORAM-RICH CLAYEY NANNO OOZE
Smears 2-105, 2-112
Composition

calc. nannos	53%	qtz. & feld.	2%
det. clay	30%	sp. spic.	Tr.
forams	10%	heavies	Tr.
micarb.	5%	rads.	Tr.
		glauconite	Tr.

Note: pyrite streaks throughout below 2-110 cm.

10YR5/4

Distinct color change to light olive gray.

5Y6/1

Carbon-Carbonate
2-79 (8.0-0.2-64)
4-74 (7.9-0.2-64)

← Glauconite

CaCO$_3$ Content		Wt. % forams (>100μ)	
1-130	37%	CC	10%
2-50	64%		
3-130	57%		
CC	61%		

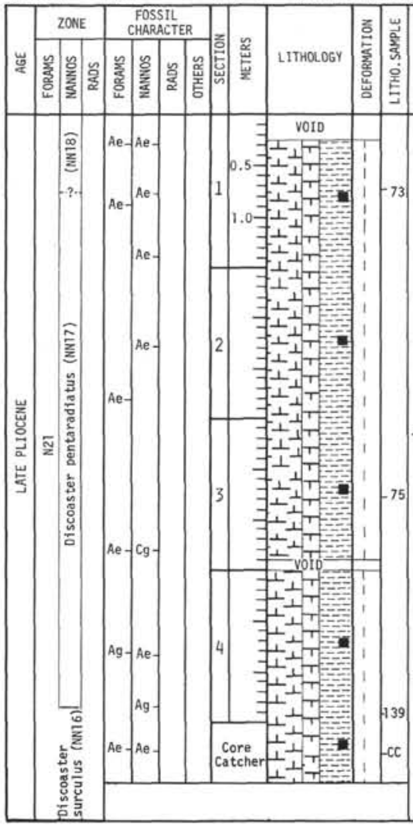
Insoluble residue from 1-130 includes:

det. clay	60%
qtz. & feld. (silt sized)	20%
sp. spic.	15%
heavies & opaques	5%

← Glauconite

Explanatory notes in chapter 1

Site 242 Hole Core 2 Cored Interval: 52-61 m



LITHOLOGIC DESCRIPTION

Core is soft and deformed. Color is mainly green gray (5GY6/1).

Pyrite-rich streak

FORAM-RICH CLAYEY NANNO OOZE
Smears 3-75, 4-139
Composition

calc. nannos	55%	qtz. & feld.	1%
det. clay	28%	pyrite	Tr.
forams	16%	heavies	Tr.

Abundant streaks of pyrite-rich clayey nanno ooze throughout.

Carbon-Carbonate
1-75 (7.3-0.2-60)
4-80 (6.6-0.2-54)

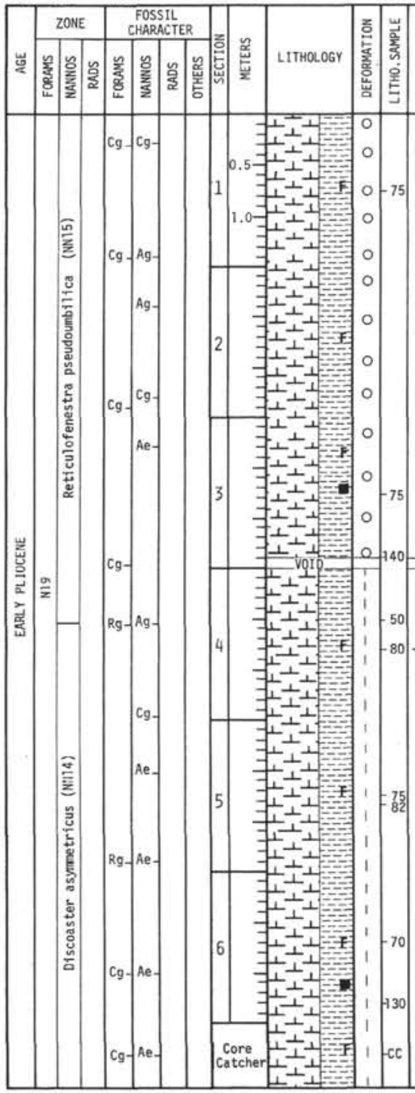
← 3-15 cm pyrite burrow cast

5GY6/1
green gray

CaCO$_3$ Content		Wt. % forams (>100μ)	
2-51	55%	CC	5%
CC	51%		

← pyrite burrow cast

Site 242 Hole Core 3 Cored Interval: 128-137 m



LITHOLOGIC DESCRIPTION

Core is greatly deformed to a drilling breccia in Sections 1-3, soft and moderately deformed in Sections 4-6. Colors are light olive gray (5Y6/1) and green gray (5GY6/1).

FORAM-BEARING CLAYEY NANNO OOZE
Smears 1-75, 3-75

Composition

calc. nannos	65%
det. clay	30%
forams	5%
opaques	Tr.
micarb.	Tr.

5Y6/1 to 5GY6/1

FORAM-BEARING CLAYEY NANNO OOZE light olive gray (5Y6/1); as above but with very minor clay occurring in 1-2 cm thick beds. Clay beds are stiff; rest are soft.

Carbon-Carbonate
3-80 (8.0-0.2-65)

CaCO$_3$ Content		Wt. % forams (>100μ)	
3-100	59%	CC	3%
CC	54%		

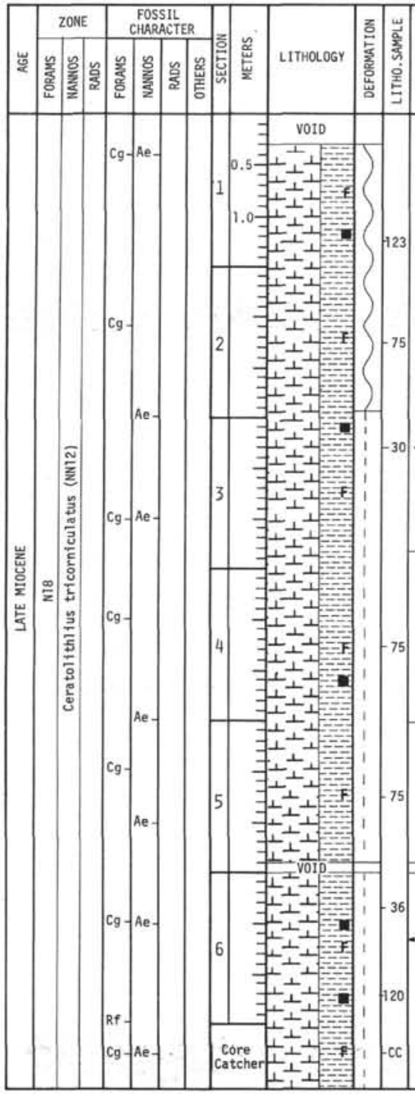
Core becomes more clay-rich here

X-ray 6-130

calc.	A	k-feld.	T
qtz.	P	plag.	T
mica	P	kaol.	T

80 ← Minor Lith: Nanno-rich Detrital Foram-rich Carbonate Silt. Text. 90% silt; 10% clay.

Site 242 Hole Core 04 Cored Interval: 147-156 m



LITHOLOGIC DESCRIPTION

Core is soft and deformed in Sections 1 and 2, and becomes stiffer in Sections 3-6. Colors are mainly green gray (5GY6/1) and light olive gray (5Y6/1) with abundant black pyrite streaks.

FORAM-BEARING CLAYEY NANNO OOZE
Smears 2-75, 3-30, 5-75

Composition

calc. nannos	60%	opaques	Tr.
det. clay	30%	chlor.	Tr.
forams	10%	micarb.	Tr.

Benthonic forams from deep basin, 2000-3000 meters.

30 ← 3-30 cm carbonate-filled burrow

FORAM-BEARING CLAYEY NANNO OOZE
Smear 4-75

green gray 5GY6/1

Composition

calc. nannos	50%	qtz. & feld.	1%
det. clay	43%	opaques	1%
forams	5%		

light olive gray 5Y6/1

Carbon-Carbonate
6-30 (7.5-0.1-61)

CaCO$_3$ Content		Wt. % forams (>100μ)	
6-20	64%	CC	0.4%
CC	58%		

X-ray 3-89

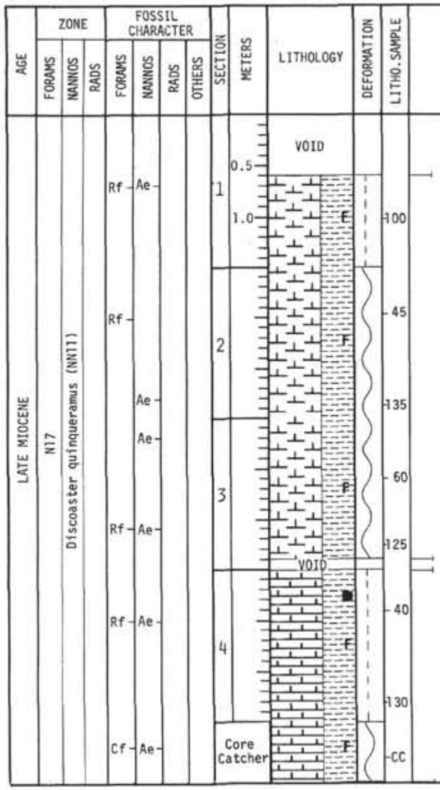
calc.	A
qtz.	P
k-feld.	T
plag.	T
kaol.	T
mica	T

green gray 5GY6/1

← 6-68 cm pyrite burrow casts

Explanatory notes in chapter 1

Site 242 Hole Core 5 Cored Interval: 233-242 m



LITHOLOGIC DESCRIPTION

Core is soft and deformed in Sections 1-3, and becomes very stiff in Section 4. Colors are light olive gray (5Y6/1) and green gray (5GY6/1).

FORAM-BEARING CLAYEY NANNO OOZE
Smears 1-100, 2-45, 2-135

Composition

calc. nannos	60%	qtz. & feld.	3%
det. clay	30%	opaques	1%
forams	5%	micarb.	1%
		chlor.	Tr.

Change at base of Section 3 from foram-bearing clayey nanno ooze to foram-bearing clayey nanno chalk.

Note: Section 4 much stiffer than Sections 1-3.

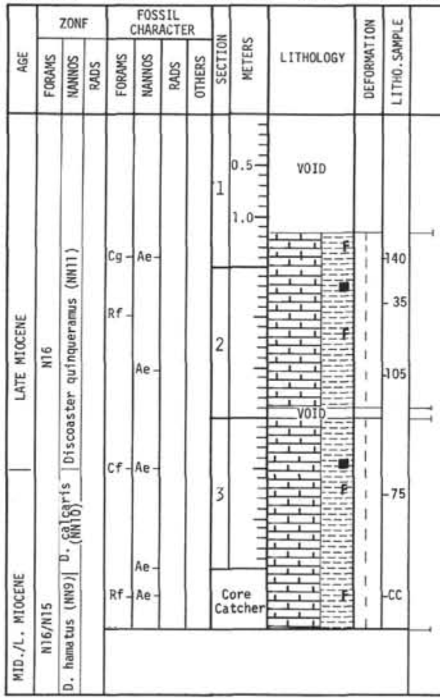
Carbon-Carbonate
1-99 (8.1-0.2-66)

CaCO$_3$ Content		Wt. % forams (>100μ)	
CC	63%	CC	0.7%

X-ray 3-125 (bulk)		X-ray 3-125 (<2μ)	
calc.	A	mont.	A
qtz.	T	mica	A
k-feld.	T	paly.	P
plag.	T	qtz.	P
kaol.	T		
mica	T		
mont.	T		

4-32 cm pyrite burrow cast

Site 242 Hole Core 06 Cored Interval: 308-317 m



LITHOLOGIC DESCRIPTION

5GY6/1
to
5GY5/1

Core is stiff, semi-lithified and slightly deformed. Color varies from greenish gray (5GY6/1 to 5GY5/1) in subtle interbedding, with black pyritic streaks throughout. Lithology very similar throughout except for minor variations in forams and clay minerals content.

FORAM-BEARING CLAYEY NANNO CHALK
Smears 2-35, 2-105, 3-75

Composition

calc. nannos	50%	micarb.	5%
det. clay	35%	qtz. & feld.	2%
forams	7%	opaques	1%

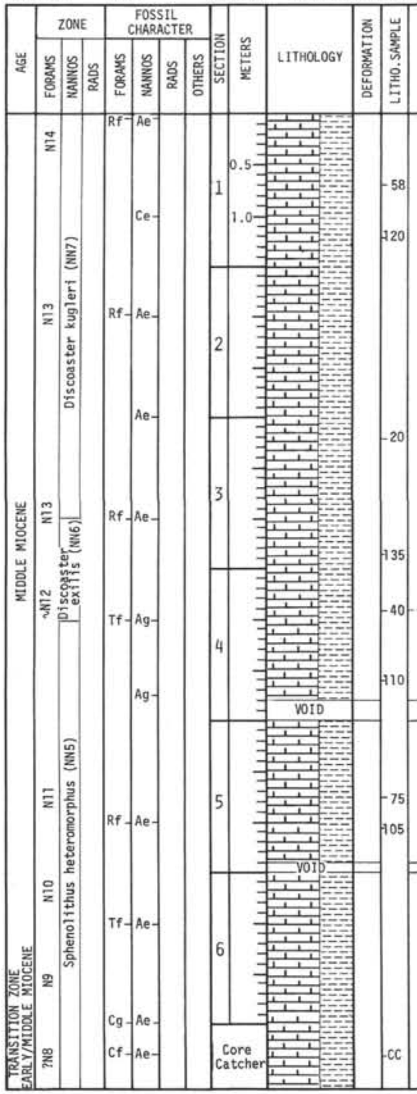
Carbon-Carbonate
3-75 (7.7-0.1-63)

CaCO$_3$ Content		Wt. % forams (>100μ)	
CC	44%	CC	0.5%

X-ray 2-120 (bulk)		X-ray 2-120 (<2μ)	
calc.	A	mont.	A
qtz.	T	kaol.	P
kaol.	T	paly.	P
mica	T	mica	P
mont.	T	qtz.	T
		pyrite	T

Explanatory notes in chapter 1

Site 242 Hole Core 07 Cored Interval: 403-412 m



LITHOLOGIC DESCRIPTION

Core is stiff, semi-lithified and only slightly deformed. Colors are gray olive (10Y4/2) with some mottling (burrow?) of gray olive (10Y5/2). Only slightly broken by cutting process. Probable burrows in all sections.

10Y4/2

CLAYEY NANNO CHALK
Smears 4-40, 5-105
Composition

calc. nannos	50%	qtz. & feld.	2%
det. clay	44%	micarb.	2%
forams	2%	opaques	1%
		heavies	Tr.

Grain Size
6-65 (1-26-73) silty clay

Carbon-Carbonate
1-58 (5.5-0.1-45)
5-52 (6.2-0.1-50)

Several burrowed zones in Section 3.

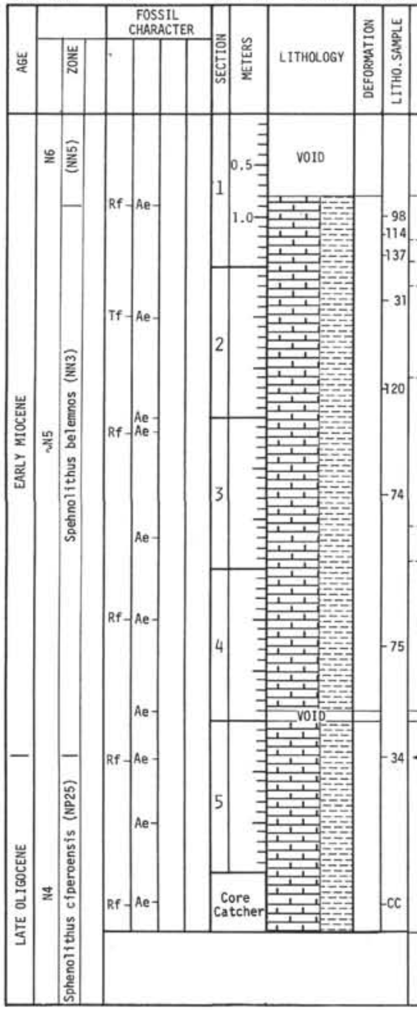
CaCO Content		Wt. % forams (100)	
CC	51%	CC	0.2%

10Y4/2

10Y5/2

X-ray 5-49 (bulk)		X-ray 5-49 (<2μ)	
calc.	A	mont.	A
k-feld.	P	kaol.	P
mica	P	mica	P
qtz.	T	paly.	P
plag.	T	qtz.	P
mont.	T		
paly.	T		

Site 242 Hole Core 08 Cored Interval: 479-488 m



LITHOLOGIC DESCRIPTION

Core is stiff; slightly deformed by drilling, but broken by sawing. Colors are moderate brown (5YR4/4 to 5YR3/4) mottled and interbedded with gray olive (10Y4/2). Numerous filled burrows throughout produces mottled colors; locally, foram-bearing or very clay-rich.

10Y4/2

5YR4/4

10Y4/2

5YR4/4

CLAYEY NANNO CHALK
Smear 3-74
Composition

calc. nannos	50%	micarb.	3%
det. clay	41%	opaques	2%
forams	2%	heavies	Tr.
qtz. & feld.	2%		

Minor lithology at Section 5, 34 cm.

10Y4/2 and 5YR4/4

MANGANESE/CLAYEY CARBONATE CHALK
Composition

micarb.	30%	carb. rhombs	5%
manganese(?)	25%	qtz. and feld.	5%
det. clay	25%	heavies	Tr.
calc. nannos	10%		

Grain Size
1-107 (0-24-76) clay

5GY5/1

Carbon-Carbonate
1-106 (3.7-0.1-30)

$CaCO_3$ Content		Wt. % forams (<2μ)	
CC	38%	CC	0.04%

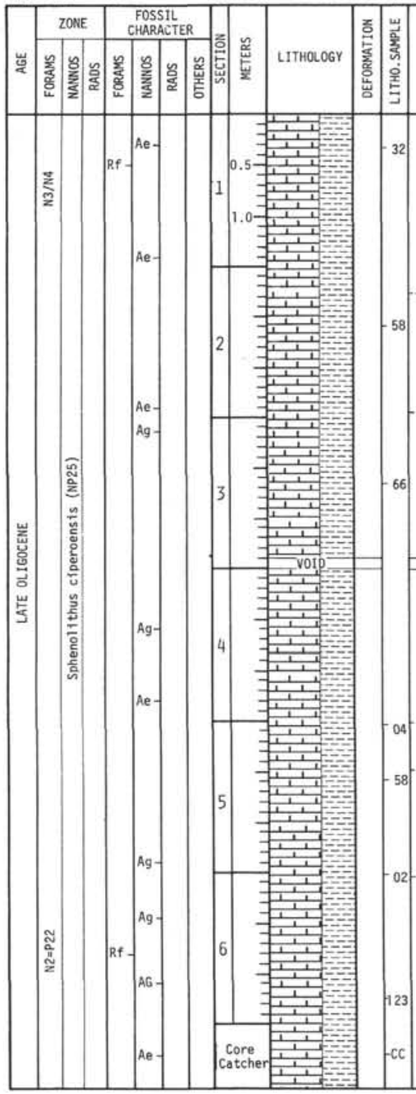
5YR3/4 to 5YR4/4 and 10Y4/2

X-ray 1-108 (bulk)		X-ray 1-108 (<2μ)	
calc.	A	mont.	A
qtz.	P	kaol.	P
k-feld.	P	mica	P
mica	P	paly.	P
paly.	P	qtz.	P
plag.	T	k-feld.	T
mont.	T		

34 ← conspicuous bedding plane with black MnO_2 coating on carbonate fragments.

Explanatory notes in chapter 1

Site 242 Hole Core 09 Cored Interval: 555-564 m



LITHOLOGIC DESCRIPTION

Core is broken by shipboard sawing; sedimentary structures mostly undeformed. Gray and brown CLAYEY NANNO CHALK. Color alternates between yellow brown (10YR4/2 to 10YR6/2) and green gray (5GY4/1 to 5GY6/1). Core is stiff to semi-lithified throughout with bedding preserved. Numberous burrows indicated by reduction spots-mostly green gray (5GY5/1) with some black centers.

10YR5/2

5G6/1 to
5G4/1

well developed burrows at 80-90 cm

CLAYEY NANNO CHALK
Smear 2-58
<u>Composition</u>

calc. nannos	50%	qtz. & feld.	4%
det. clay	40%	opaques	1%
micarb.	5%	heavies	Tr.

Burrow zones are common throughout the core.

<u>Carbon-Carbonate</u>
1-68 (6.1-0.1-50)
4-85 (7.8-0.1-64)

10YR6/2
to
10YR4/2

CaCO$_3$ Content		Wt. % forams (>100μ)	
CC	51%	CC	0.01%

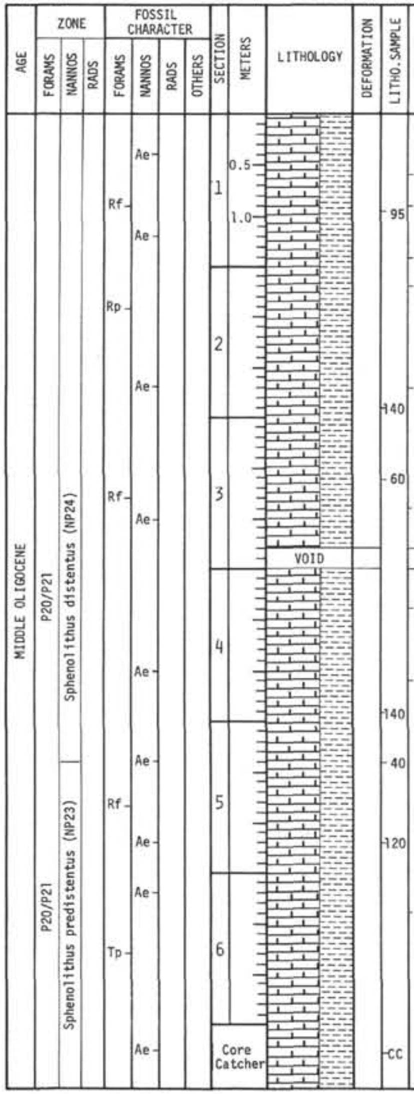
X-ray 3-99 (bulk)		X-ray 3-99 (<2μ)	
calc.	A	mont.	A
qtz.	T	paly.	P
plag.	T	kaol.	P
kaol.	T	mica	P
mica	T	qtz.	P
mont.	T	k-feld.	T

5Y5/1

10YR4/2

5GY5/1

Site 242 Hole Core 10 Cored Interval: 602-611 m



LITHOLOGIC DESCRIPTION

10YR5/2
5GY6/1
green gray
10YR5/2

Core is broken by cutting process; sedimentary structures are not deformed. Colors are dark yellow brown (10YR4/2 and 10YR5/2), dark green gray (5G4/1 and 5GY4/1), and green gray (5GY5/1 and 5GY6/1).

CLAYEY NANNO CHALK
Smears 3-60, 5-40
<u>Composition</u>

calc. nannos	60%	qtz. & feld.	2%
det. clay	30%	opaques	1%
micarb.	6%	forams	1%

5G4/1 dark
green gray
10YR5/2
dark
yellow
brown to
pale
yellow
brown
5GY4/1
to
5GY5/1
green gray

Alternating hues of brown and green throughout; burrow mottling throughout-more intense locally; color changes are gradational and generally intermixed.

<u>Carbon-Carbonate</u>
1-29 (5.7-0.1-46)
4-33 (5.4-0.1-44)

X-ray 1-28 (bulk)		X-ray 5-102 (bulk)	
calc.	A	calc.	A
mica	P	qtz.	P
mont.	P	k-feld.	P
qtz.	T	mica	P
k-feld.	T	mont.	P
plag.	T	plag.	T
kaol.	T	kaol.	T

10YR4/2
dark yellow
brown

5GY4/1
dark green
gray

10YR4/2
dark yellow
brown

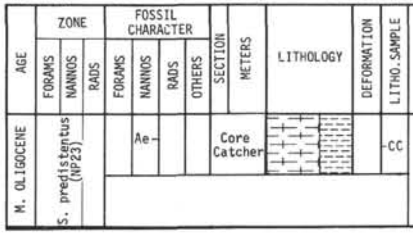
Section 5, 110 to 130 cm: irregular lenticular bedding with cut-and-fill.

5GY5/1
green gray

Insol. res. in CC is 39% by weight, mostly clay minerals.

Explanatory notes in chapter 1

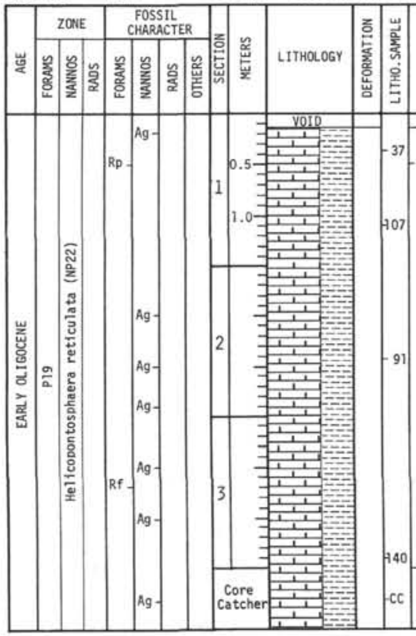
Site 242 Hole Core 11 Cored Interval: 611-620 m



LITHOLOGIC DESCRIPTION

CLAYEY NANNO CHALK
$CaCO_3$ Content in CC is 51%

Site 242 Hole Core 12 Cored Interval: 623-631 m



LITHOLOGIC DESCRIPTION

5GY5/1 green gray

10YR4/2 dark yellow brown

Core is stiff and semi-lithified. Colors are dark yellow brown (10YR4/2), green gray (5GY5/1), and olive gray (5Y4/1). Burrow mottling throughout core, particularly evident at Section 1, 37 cm.

CLAYEY NANNO CHALK
Smears 1-107, 3-140
Composition

calc. nannos	50%	qtz. & feld.	2%
det. clay	40%	forams	2%
micarb.	5%	opaques	1%
		carb. rhombs	Tr.

88-92 cm slightly disrupted bedding.

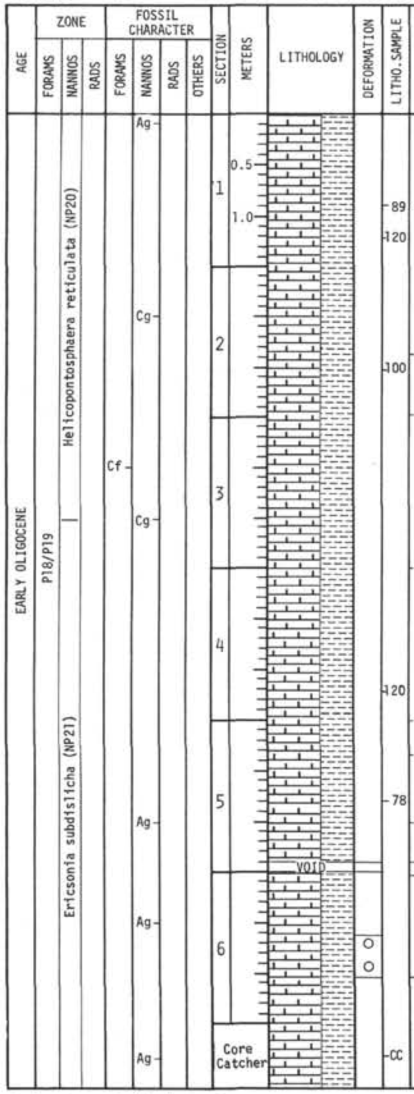
Forams are mostly benthonic.

Carbon-Carbonate
1-15 (6.2-0.2-50)

10YR4/2

5Y4/1 olive gray

Site 242 Hole Core 13 Cored Interval: 631-640 m



LITHOLOGIC DESCRIPTION

Core is stiff and semi-lithified. Color varies in gradational alternations between 10YR4/2 dark yellow brown and 5GY6/1 green gray with local zones of 5Y6/1 light olive gray. Numerous mottles due to burrowing-some are rich in manganese oxide (black). Locally contains as much as 5% forams.

← 10YR4/2 dark yellow brown

Burrow filling at 1-89: manganese(?) nanno chalk

5Y6/1 light olive gray

CLAYEY NANNO CHALK
Smears 1-120, 5-78
Composition

calc. nannos	60%	opaques	2%
det. clay	32%	qtz. & feld.	2%
micarb.	4%	chlor.	Tr.
forams	Tr.	vol. gls.	Tr.

10YR4/2 dark yellow brown and 5GY6/1 green gray interbedded

Carbon-Carbonate
1-79 (6.5-0.1-53)
3-74 (6.3-0.1-52)
6-54 (6.5-0.1-53)

5GY6/1 green gray to 5Y4/1 olive gray

$CaCO_3$ Content
CC 58%

5GY6/1 green gray

10YR4/2 dark yellow brown

5Y6/1 light olive gray

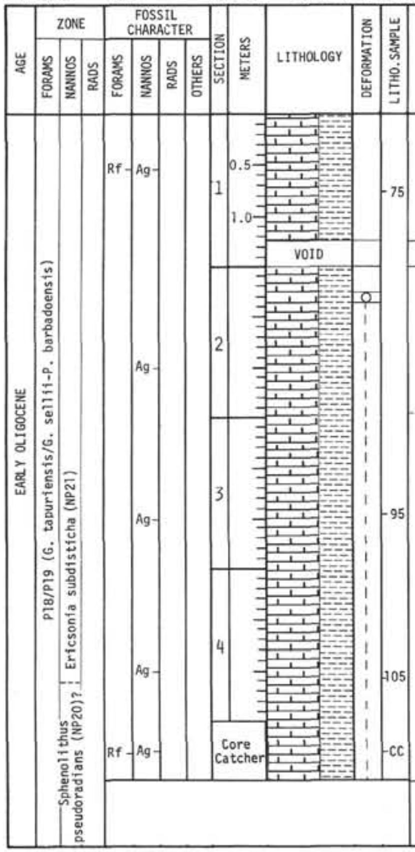
10YR6/2 dark yellow brown

X-ray 1-77 (bulk)		X-ray 1-77 (<2μ)	
calc.	A	mont.	A
k-feld.	P	mica	P
mica	P	kaol.	P
qtz.	T	qtz.	P
plag.	T	k-feld.	T
kaol.	T	plag.	T
mont.	T		

5Y6/1

Explanatory notes in chapter 1

Site 242 Hole Core 14 Cored Interval: 640-649 m



LITHOLOGIC DESCRIPTION

green gray (5GY6/1) and 10YR4/2 interbedded

Core is stiff and semilithified. Colors are green gray (5GY6/1), dark green gray (5GY4/1), olive gray (5Y4/1) and dark yellow brown (10YR4/2). Streaks of opaques (manganese oxide?) scattered throughout the core.

olive gray (5Y4/1)

CLAYEY NANNO CHALK
Smears 1-75, 3-95

Composition

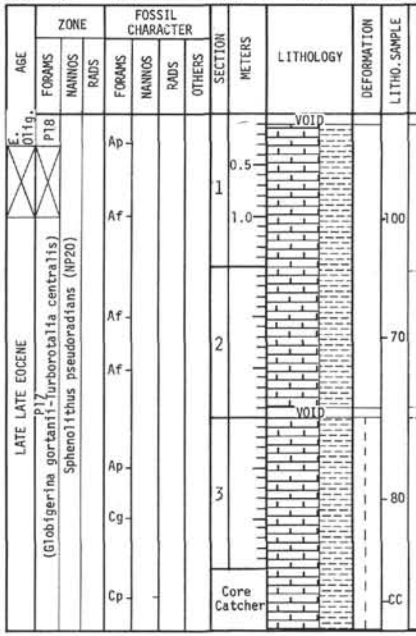
calc. nannos	60%	qtz. & feld.	2%
det. clay	30%	opaques	2%
micarb.	6%		

Carbon-Carbonate
1-63 (6.7-0.1-55)
4-68 (6.9-0.1-56)

$CaCO_3$ Content
CC 58%

5GY6/1 to 5GY4/1

Site 242 Hole Core 15 Cored Interval: 649-653 m



LITHOLOGIC DESCRIPTION

Core is stiff and mostly undeformed except in Section 3. Colors are generally yellow brown (10YR6/2 to 10YR4/2) with interbedding and mottles of (5Y6/1) light olive gray and (5GY6/1) dark green gray. Burrow mottling with streaks of manganese in burrows.

5Y6/1 light olive gray

large burrow Section 1, 112 to 115 cm

CLAYEY NANNO CHALK
Smear 1-100, 2-70

Composition

calc. nannos	60%	qtz. & feld.	2%
det. clay	32%	opaques	1%
micarb.	4%	chlor.	1%
		vol. gls.	Tr.

10YR6/2 pale yellow brown to 10YR4/2 dark yellow brown

Carbon-Carbonate
1-79 (6.3-0.1-51)

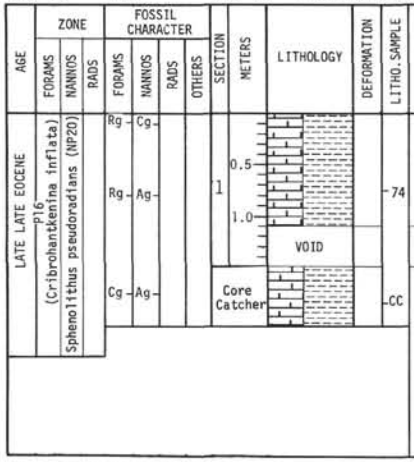
$CaCO_3$ Content
CC 49%

5YR4/4 moderate brown

5GY6/1 dark green gray

bed with MnO_2 streaks at Section 3, 91 cm

Site 242 Hole Core 16 Cored Interval: 653-658 m



LITHOLOGIC DESCRIPTION

Color is moderate brown (5YR4/4) with local burrow mottling of light olive gray (5Y6/1).

5YR4/4

NANNO CLAYSTONE
Smears 1-74, CC

Composition

calc. nannos	40%	qtz. & feld.	2%
det. clay	53%	vol. gls.	1%
micarb.	3%	opaques	1%

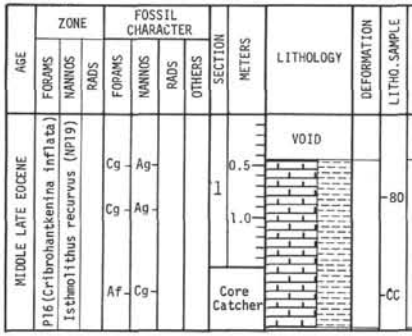
Carbon-Carbonate
1-101 (3.7-0.1-30)

$CaCO_3$ Content
CC 39%

X-ray 1-92 (bulk)		X-ray 1-92 (<2μ)	
calc.	A	paly.	P
k-feld.	P	mont.	P
mica	P	mica	P
paly.	P	kaol.	P
qtz.	T	qtz.	P
plag.	T	k-feld.	P
kaol.	T	plag.	T
chlor.	T	chlor.	T
mont.	T		

Explanatory notes in chapter 1

Site 242 Hole Core 17 Cored Interval: 668-669 m



LITHOLOGIC DESCRIPTION

Core is stiff and semilithified. Colors are green gray (5GY5/1) with small amount of moderate brown (5YR4/4) near top.

5GY5/1

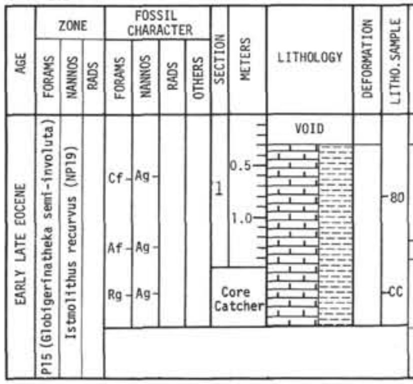
CLAYEY NANNO CHALK
Smears 1-80, CC

Composition

calc. nannos	50%	qtz. & feld.	2%
det. clay	37%	opaques	1%
micarb.	10%	vol. gls.	Tr.

Carbon-Carbonate
1-82 (6.9-0.1-57)

Site 242 Hole Core 18 Cored Interval: 672-673 m



LITHOLOGIC DESCRIPTION

Core is semilithified and broken by coring and splitting processes.
Thin, wavy bedding at 60 cm.

5YR4/4
moderate
brown

CLAYEY NANNO CHALK
Smears 1-80, CC

Composition

calc. nannos	45%	qtz. & feld.	2%
det. clay	42%	opaques	1%
micarb.	10%	vol. gls.	Tr.

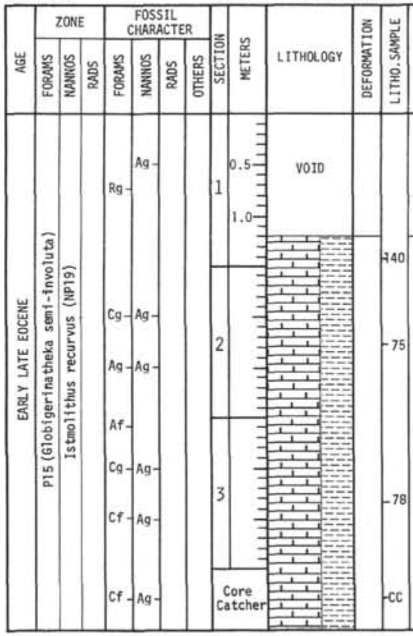
5G4/1 dark
green gray

5YR4/4
moderate
brown

Carbon-Carbonate
1-52 (5.7-0.1-47)

May be alternating clayey nanno chalk and nanno claystone beds.

Site 242 Hole Core 19 Cored Interval: 673-676 m



LITHOLOGIC DESCRIPTION

Core is semilithified and broken. Generally (5YR4/4) moderate brown mottled and in part interbedded with (5GY6/1) green gray.

CLAYEY NANNO CHALK
Smears 1-140, 2-75

Composition

calc. nannos	45%	qtz. & feld.	3%
det. clay	40%	opaques	2%
micarb.	10%	vol. gls.	Tr.
		heavies	Tr.

Grain Size
3-136 (1-35-64) silty clay

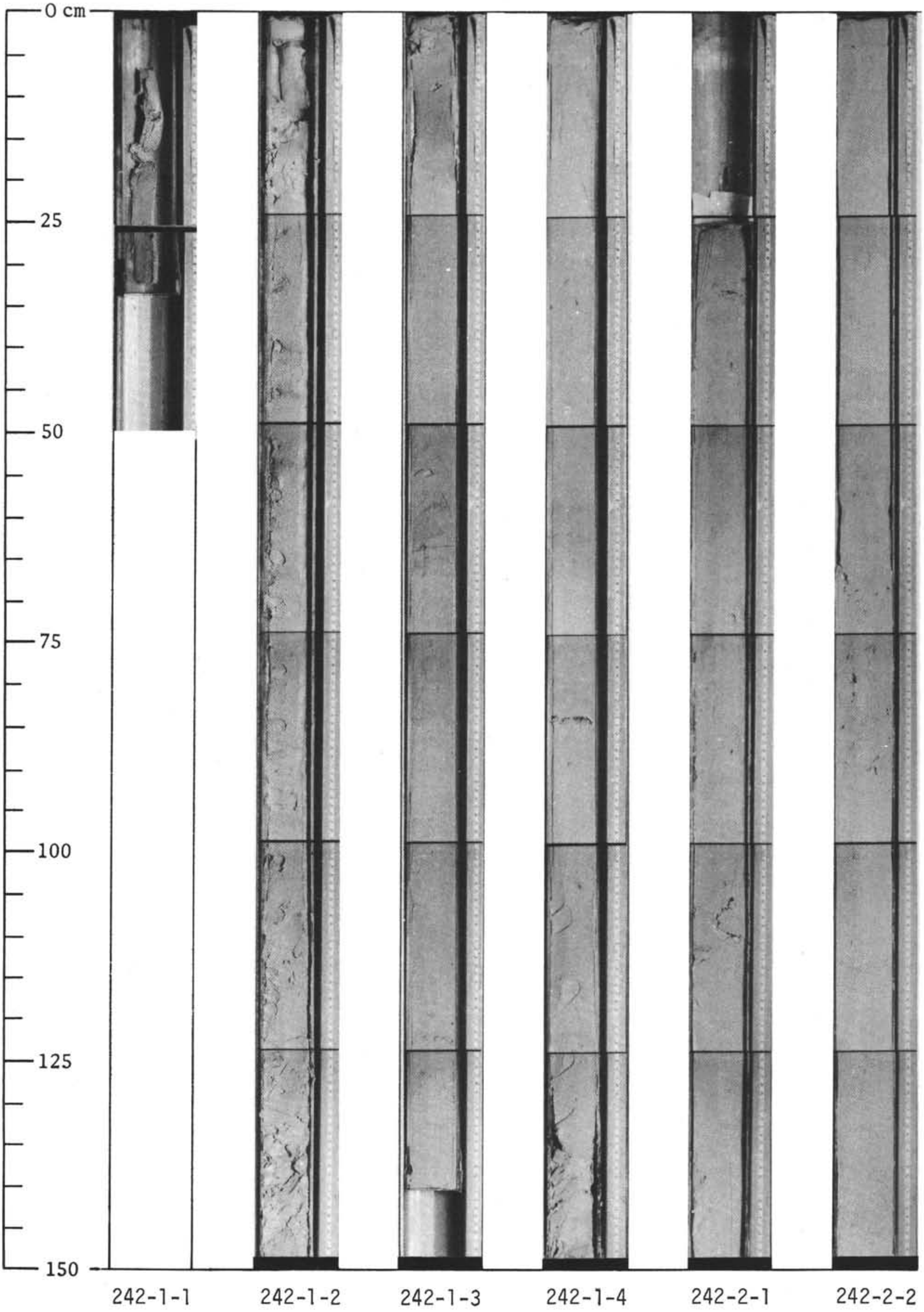
moderate
brown 5YR4/4
and
5GY6/1 green
gray

Carbon-Carbonate
1-138 (5.8-0.1-47)
2-36 (4.3-0.1-35)

X-ray 2-47 (bulk)

calc.	A
k-feld.	P
mica	P
paly.	P
qtz.	T
plag.	T
kaol.	T
chlor.	T
mont.	T

Explanatory notes in chapter 1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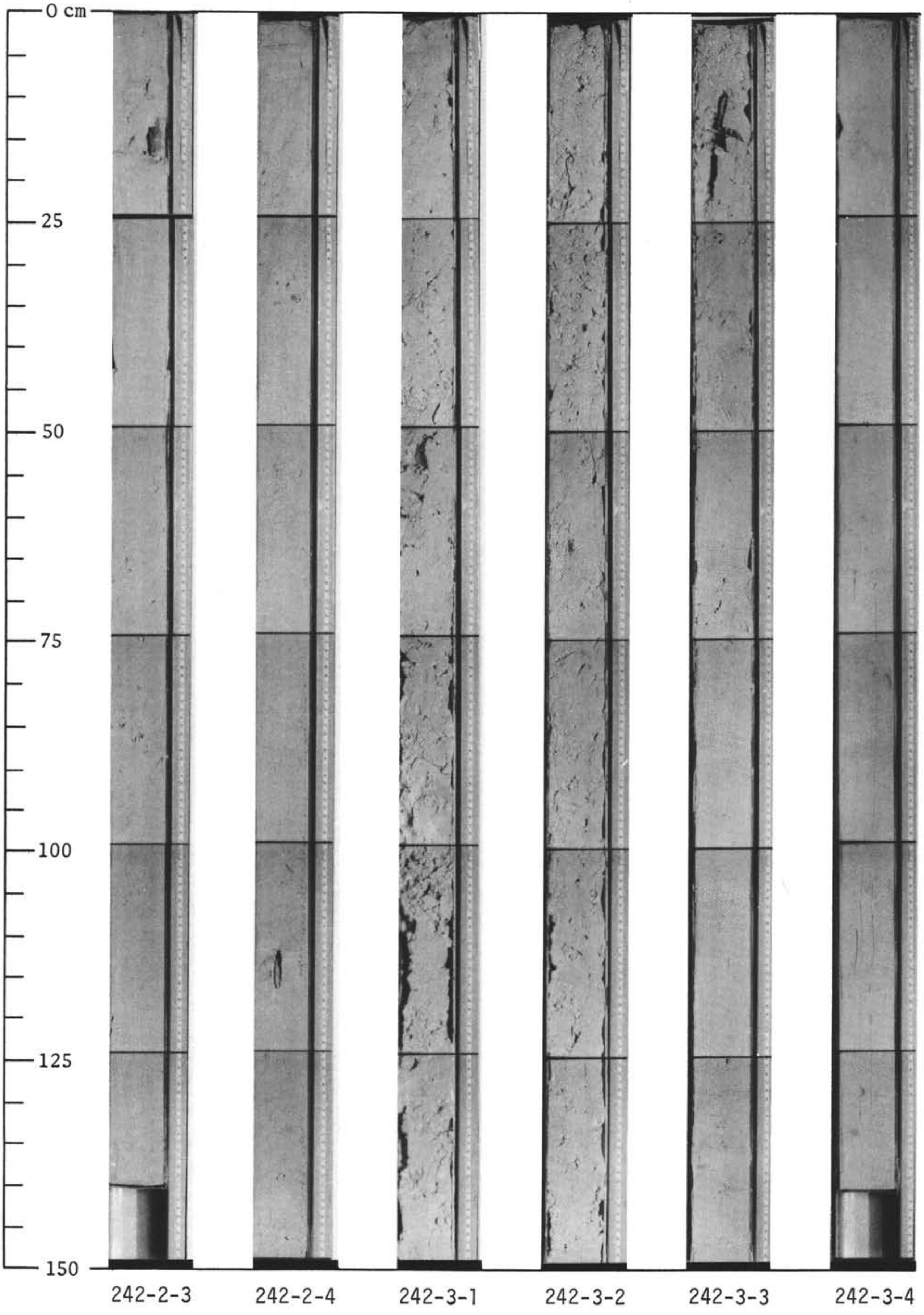
242-1-2
242-1-3
242-1-4
242-2-1
242-2-2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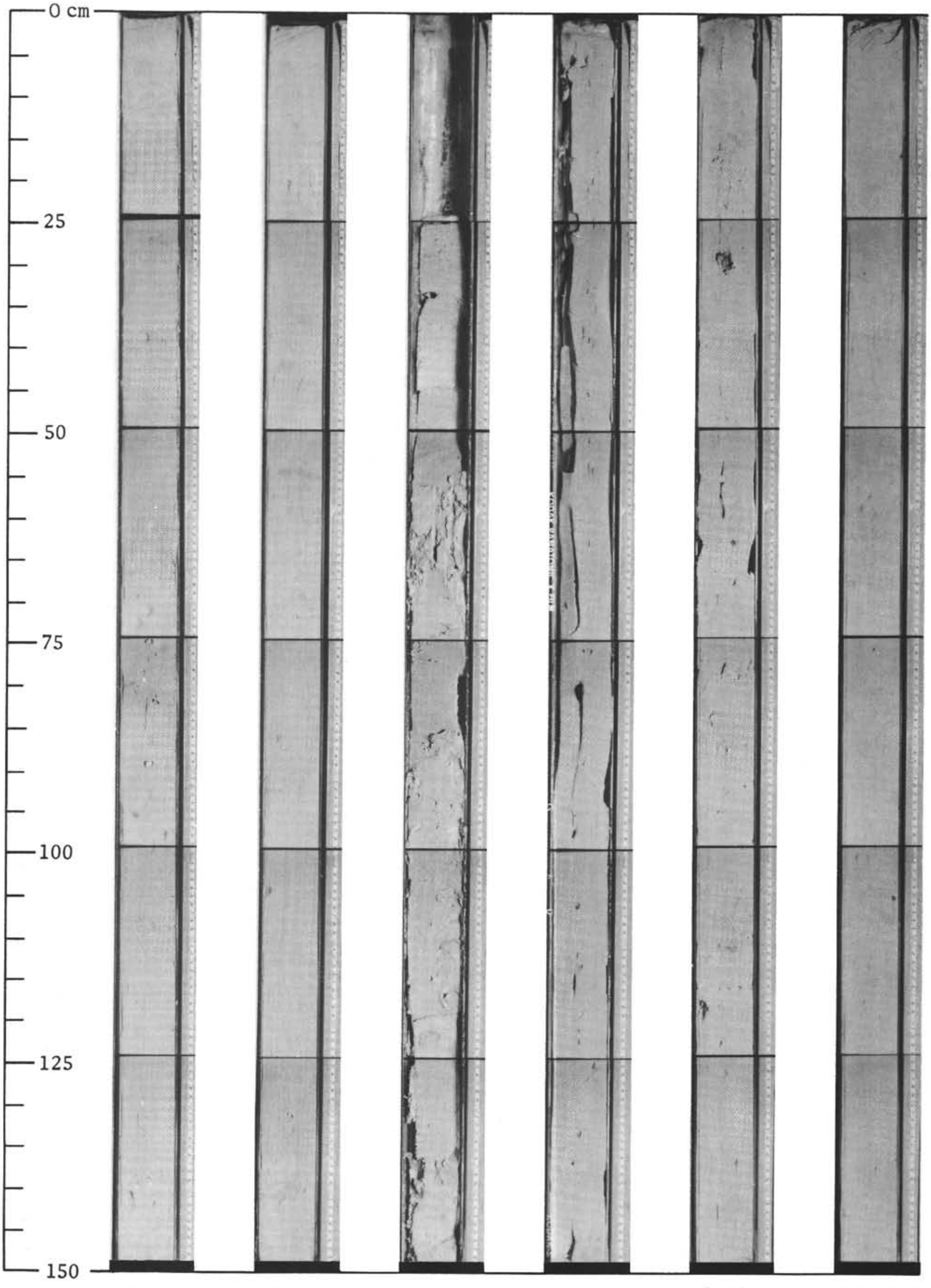
242-2-4
242-3-1
242-3-2
242-3-3
242-3-4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242-4-1
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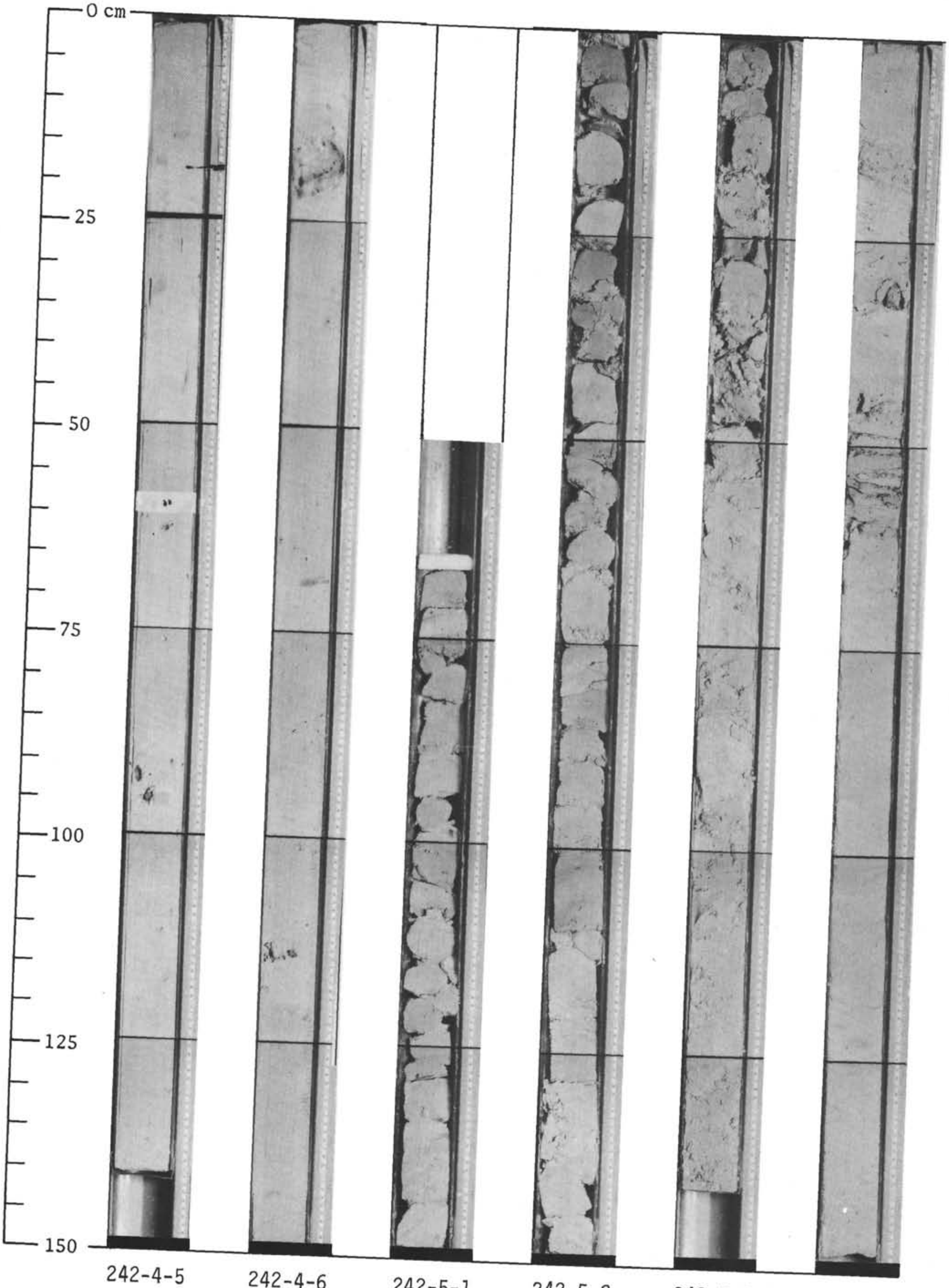
242-4-3
242-4-4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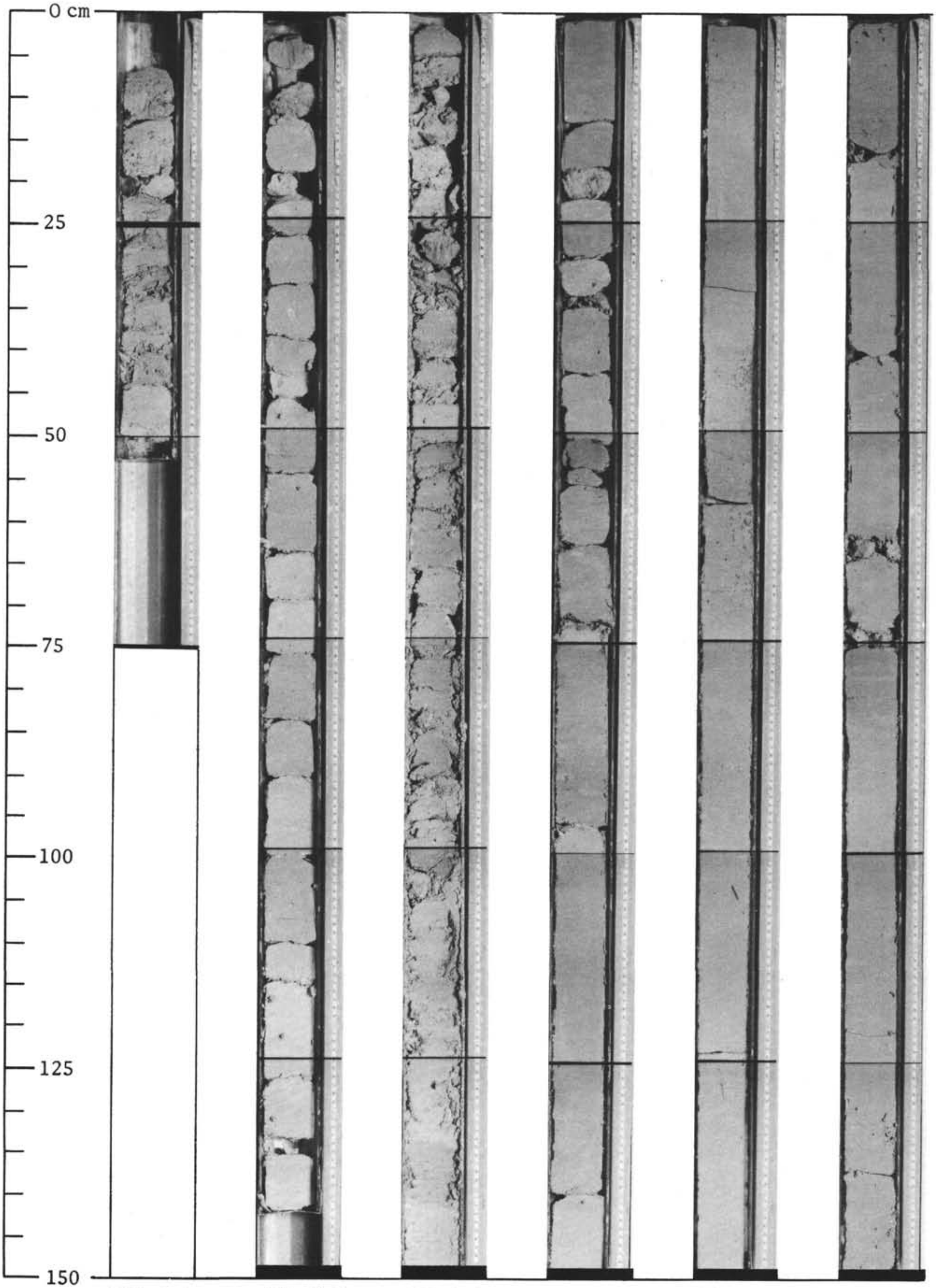
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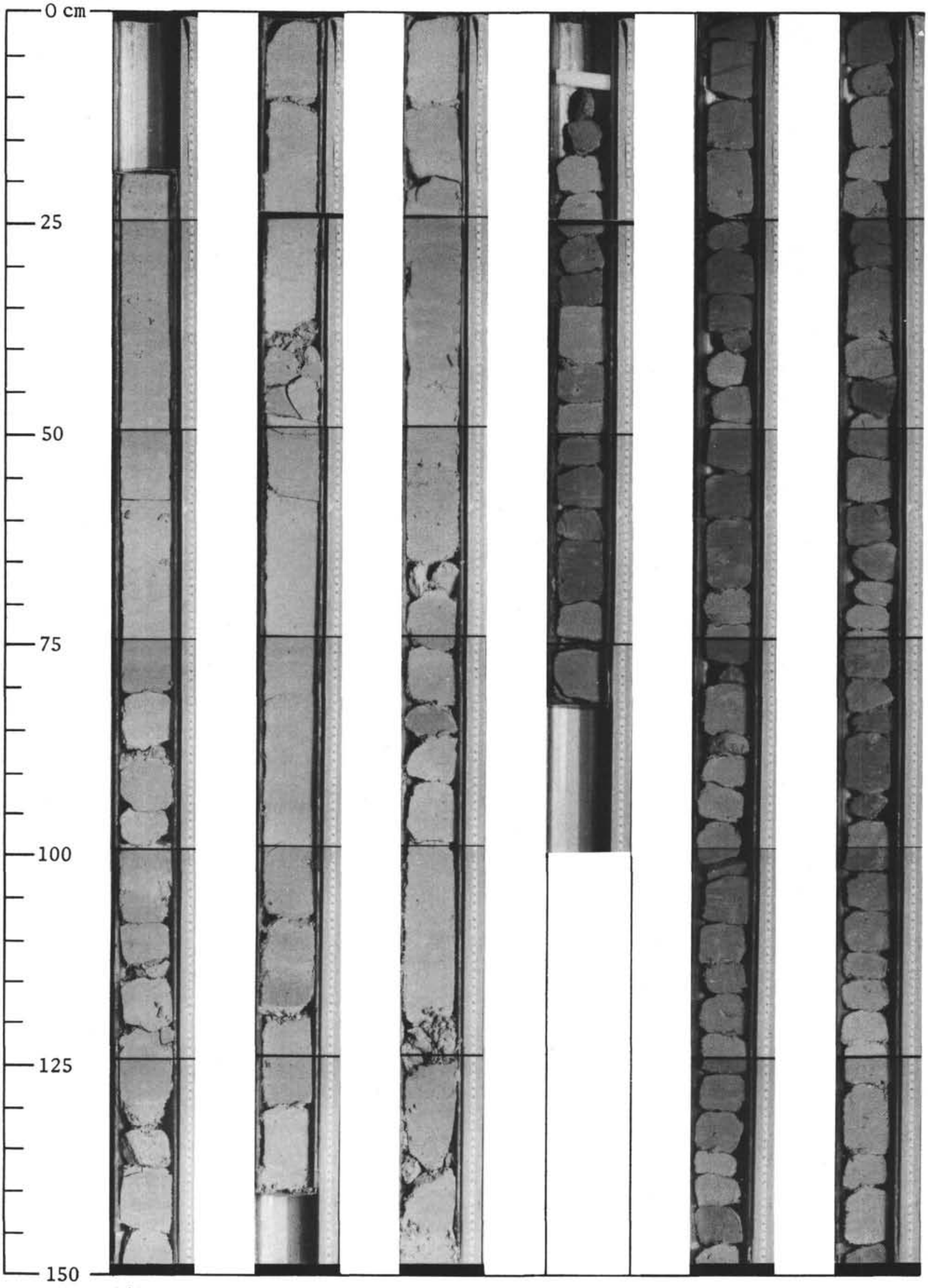
242-7-3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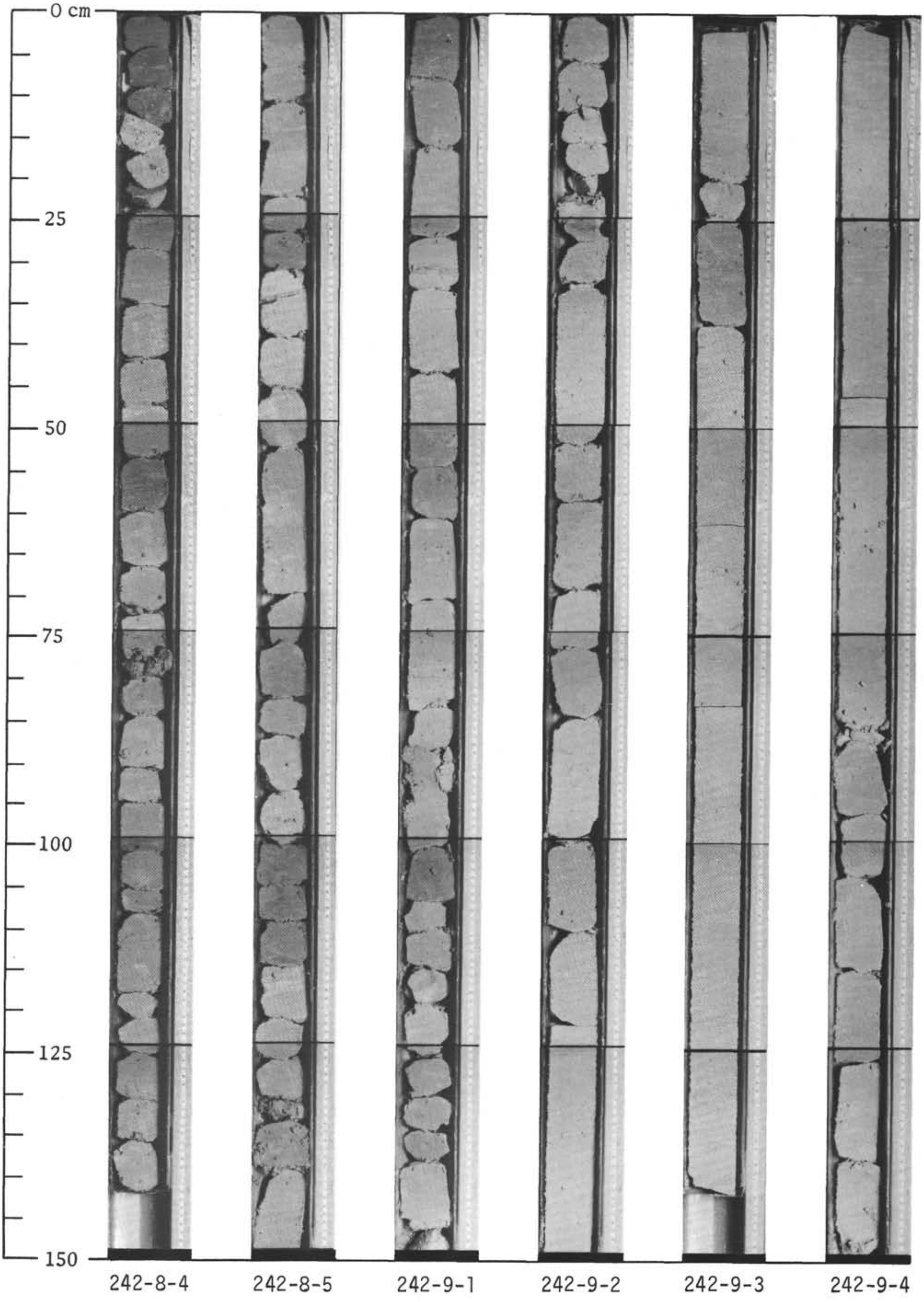
242-7-6
242-8-1
242-8-2
242-8-3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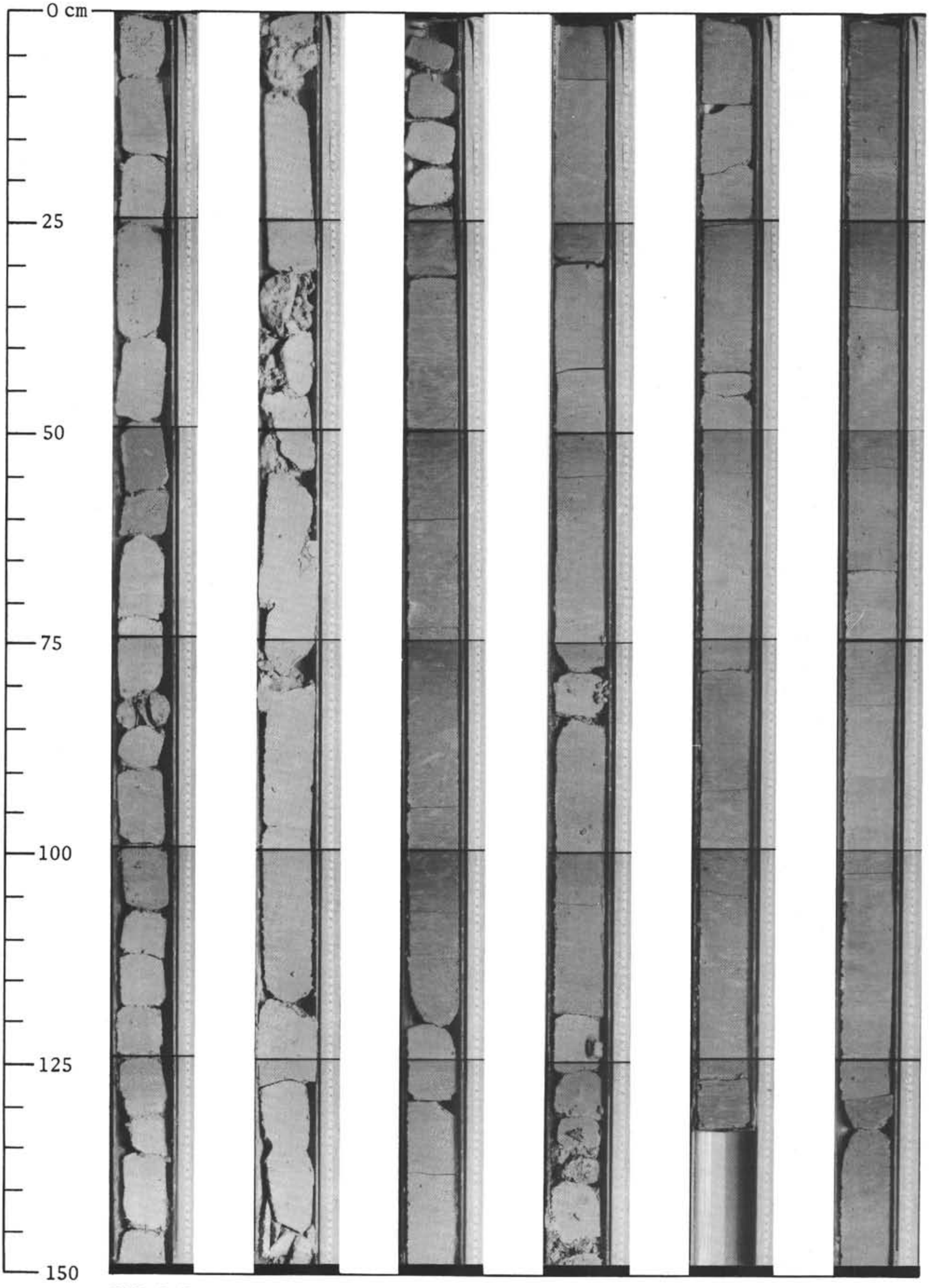
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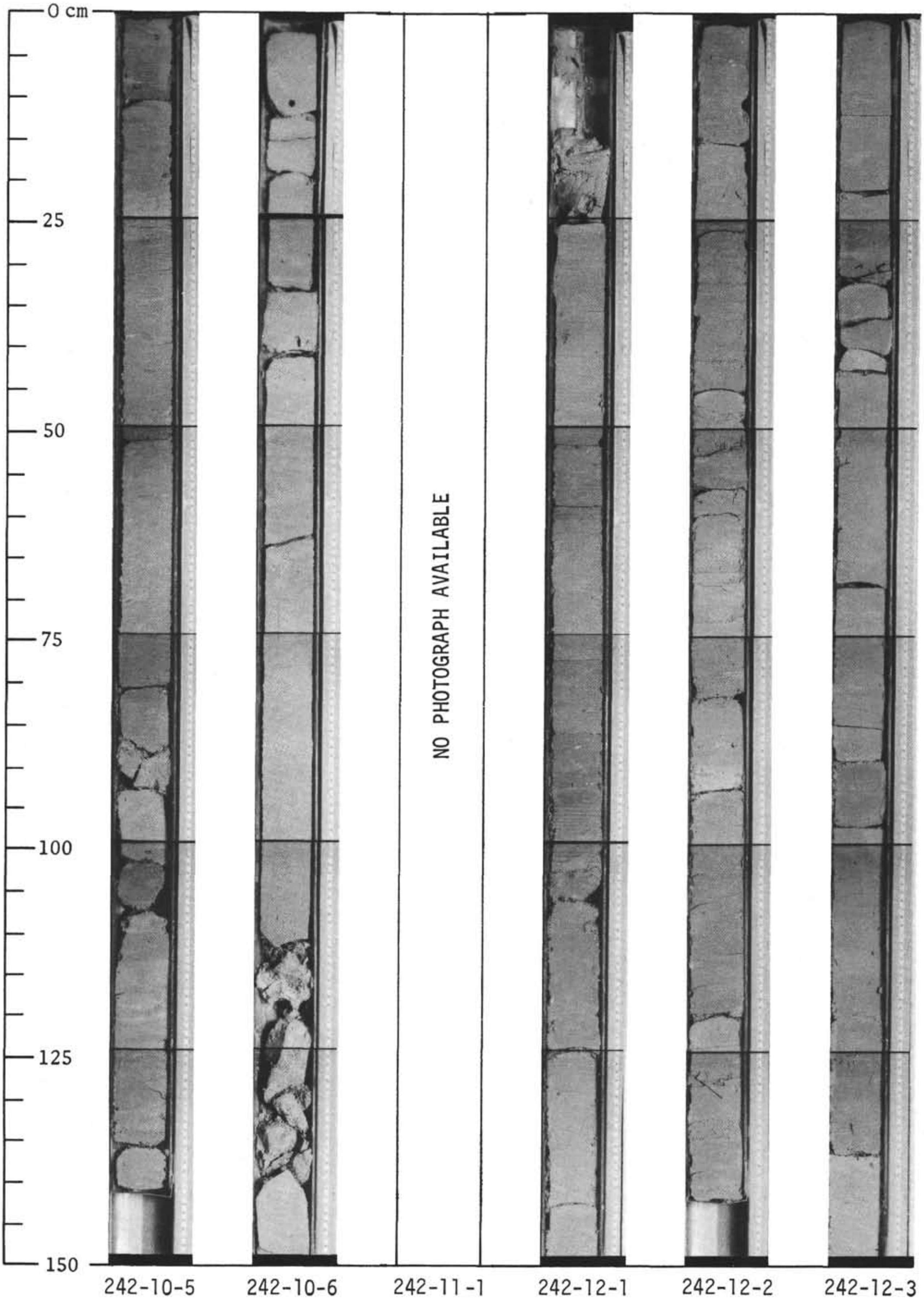
242-10-2
242-10-3
242-10-4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242-11-1
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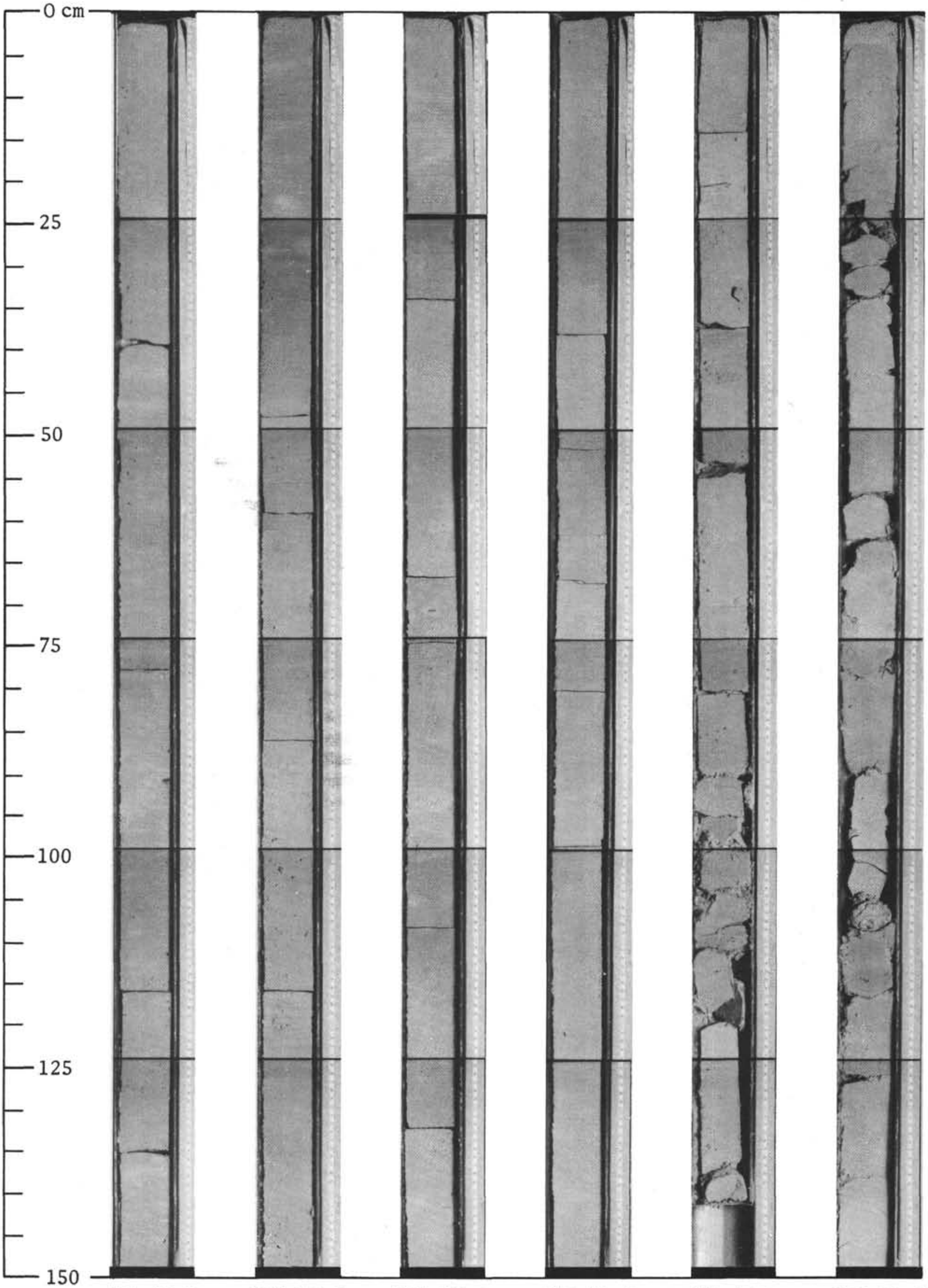
242-12-3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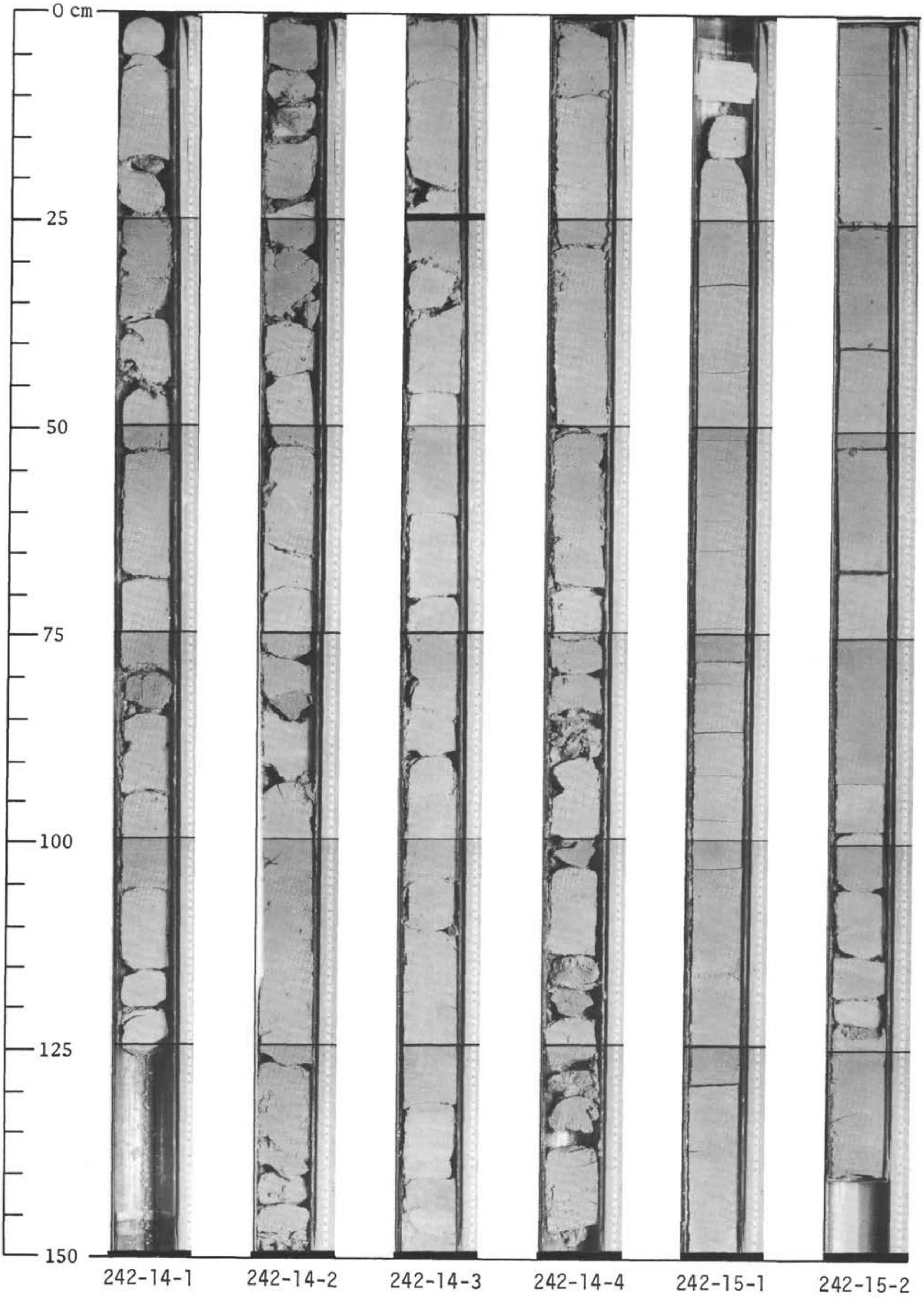
242-13-6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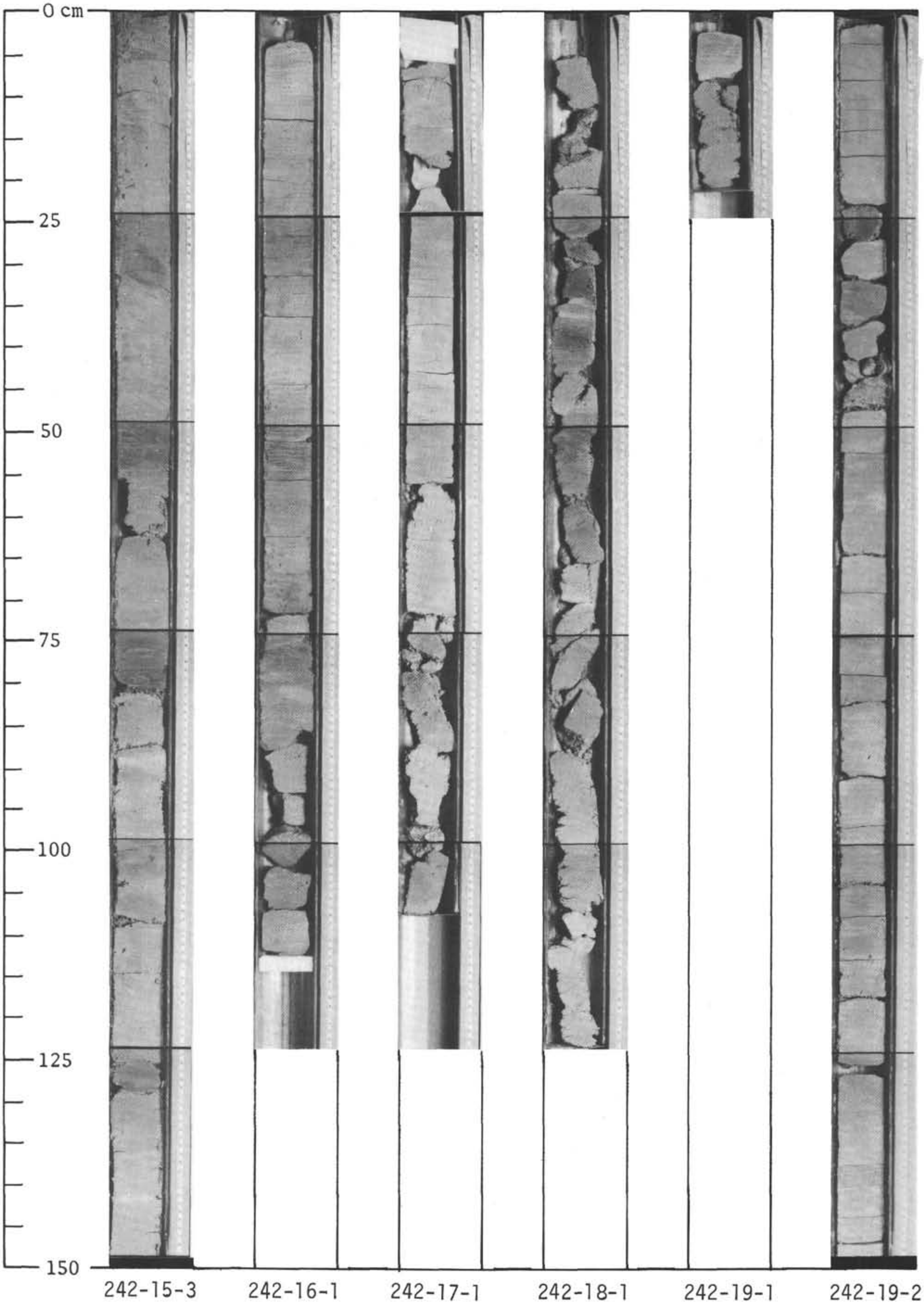
242-15-2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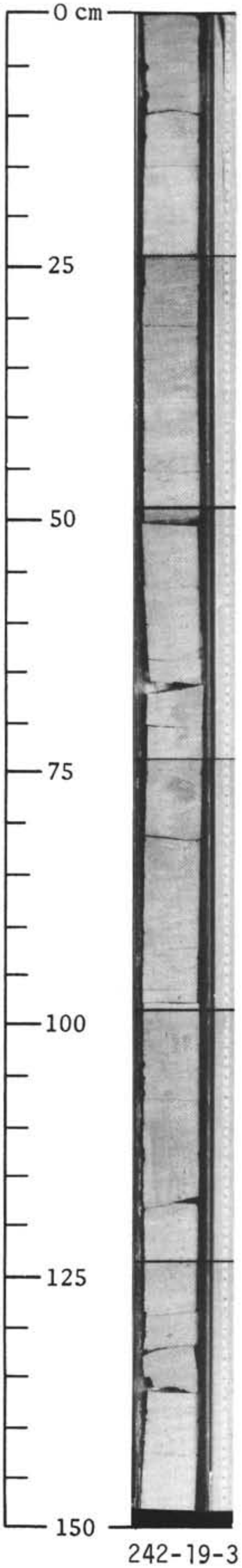
242-19-2



242-19-3