9. SITE 162

The Shipboard Scientific Party[1]

SYNOPSIS

Area: West flank of East Pacific Rise between the Clarion and Clipperton fracture zones

Date Occupied: 15-17 March, 1971

Position:
Lat. 14°52.19′N
Long. 140°02.61′W

Water Depth: 4854 meters (corrected)

Penetration: 153 meters

Number of Holes: 1

Number of Cores: 17

Core Recovery: 131.6 meters

Acoustic Basement:
Depth: 0.16 second
Nature: Top of chert horizon
Inferred acoustic velocity in the sedimentary section: 1690 m/sec

Age of Oldest Sediment: Early middle Eocene

Basement: Extrusive basalt

The hole was continuously cored, yielding the following sequence:
0-26 meters – Interbedded nannofossil chalk ooze and subordinate clayey radiolarian ooze and brown clay.
Age: Early Oligocene.
26-63 meters – Clayey radiolarian ooze; upper 10 meters sparsely calcareous.
A brief hiatus may exist in the late Eocene.
Age: Middle Eocene to earliest Oligocene.
63-139 meters – Clayey radiolarian nannofossil chalk ooze with some chalk ooze and brown clayey radiolarian ooze. Several thin beds of chert occur between 130 and 137 meters.
Age: Middle Eocene.
139-144 meters – No core.
144-150 meters – Zeolitic brown clay with a basal foraminiferal nannofossil chalk.
Age: Early middle Eocene.
150-153 meters – Extrusive, strongly altered basalt.

Sedimentation rates are about 23 m/m.y. for the middle Eocene, 3 m/m.y. for the upper Eocene, and 6 m/m.y. for the lower to middle Oligocene. The oldest sediment is from the upper *Globigerina palmerae* or lower *Hantkenina aragonensis* (foraminiferal), *Discoasteroides kuepperi* (nannofossil), and *Theocampe mongolfiere* (radiolarian) zones, giving an estimated age of 49-50 m.y.

REGIONAL SETTING AND OBJECTIVES

DSDP 162 is located due north of DSDP 161 on the lower west flank of the East Pacific Rise about 3900 km west of the crest. It is in the Clarion-Clipperton block, about 80 km south of the Clarion Fracture Zone (Figure 1). The site lies at the extreme northern edge of the zone of thick sediments that parallels the equator in the Pacific (Ewing et al., 1968) and marks the region of high biological productivity. On Legs 5 and 8, a series of holes was drilled across this zone along the 140° meridian to determine the Cenozoic depositional history from the southern zone of low productivity across the equator to the region of slow sedimentation beneath the central North Pacific water mass. This traverse, which was designed to shed light on changes in the zone of high productivity during the Cenozoic and to study postulated temporal changes in the depth of the calcite compensation level (Heath, 1969), failed to penetrate middle Eocene chert at several sites. In addition, the traverse contained several rather large gaps. DSDP 161 and 162 were selected by the Pacific Site Selection Panel to fill these gaps and to obtain a record of early Cenozoic deposition.

The results of Legs 5 and 8 show that the equatorial zone of rapid calcareous sedimentation has been displaced increasingly farther north with increasing age. This displacement probably resulted from a northward migration of the Pacific plate of as much as 30° of latitude since the Late Cretaceous (Francheteau et al., 1970). Furthermore, the data already available show that the carbonate content, width, and sedimentation rates of the deposits of the equatorial zone fluctuated markedly during the Cenozoic (Tracey, Sutton et al., 1971) and support earlier studies suggesting temporal fluctuations of the calcite compensation level.

Additionally, DSDP 162 was intended to determine the nature and age of the volcanic basement, thereby better defining the spreading rate of the west flank of the East Pacific Rise, and to establish whether iron-oxide-rich sediments occur immediately above basement over a large portion of the rise flank (see Chapters 6, 7, and 18, this volume).

TOPOGRAPHIC AND TECTONIC SETTING

The site is located in the same extensive region of abyssal hills as DSDP 159 to 161. The regional strike of small ridges and valleys in the crustal block defined by the Clarion and Clipperton fracture zones appears to be slightly west of north. Near the Clarion Fracture Zone, this structural trend changes to one parallel to the fracture zone

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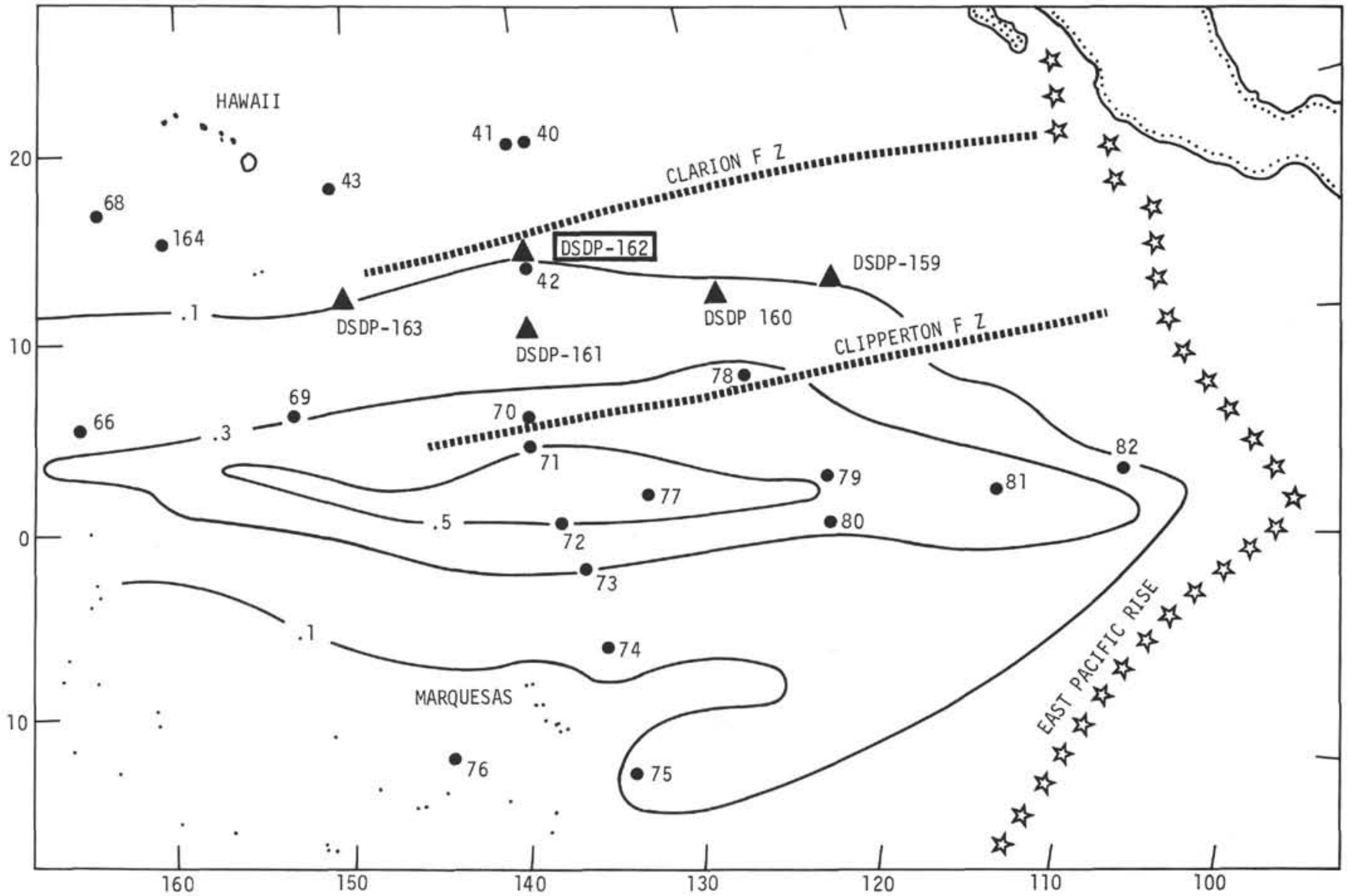

Figure 1. *Location of Leg 16 sites (large triangles) in the eastern equatorial Pacific on the west flank of the East Pacific Rise. Small dots are sites from Legs 5, 8, 9 and 17. Contours indicate sediment thickness above acoustic basement in seconds (approximately equivalent to 800 meters).*

itself. A site survey carried out around DSDP 162 indicates that this site is located in the zone with a northerly structural trend. The local topography (Figures 2 and 3) consists of rather flat-bottomed valleys separated by narrow ridges. The wavelength of the topography is markedly shorter along east-west than along north-south traverses, confirming the northerly structural trend. The valleys are separated from the ridges by small groups of closely spaced normal faults. Differences in elevation between valleys and ridges are between 100 and 200 meters. Compared to DSDP 161, the faulting is less intense and more widely spaced, and the ridges and valleys are wider. Vertical separations on individual faults range from 50-100 meters.

The site is located on a plateau which stands about 200 meters above the abyssal hills of the main portion of the block to the south, and about 400 meters above the block north of the Clarion Fracture Zone (Figure 3). The main Clarion fault scarp which lies about 80 km to the north is quite steep and is bordered at the base by a trough lying below regional depth. A site survey was conducted in the selected area to establish whether it is structurally related to the border area of the fracture zone or to the body of the plate. Had the first alternative been true, it would have been difficult to evaluate the structural position of the site, since the nature of this border zone with its trends apparently parallel to the fracture zone is still very inadequately understood. The results of the site survey are diagrammatically shown in Figure 2. A ridge trending somewhat west of north and with an elevation of approximately 200 meters lies east of the site, located in a small valley with a similar trend. The ridge is broadly triangular in cross section with moderately steep sides. Faulting is evident on the ridge flanks, but it is not clear whether the relief is entirely due to a series of closely spaced faults of small throw. The valley is fairly flat-bottomed and consists of a deeper part on the west separated by a small ridge from a shallower one on the east, in which the site is located. The two parts are separated by a fairly large normal fault or fault complex with a displacement of about 80 meters. This may be the same fault that can be seen on the approach track about 30 km south of the site.

The acoustic basement in the valleys and on the east flank of the main ridge to the east is smooth, level, and most probably sedimentary. It is overlain by a sedimentary section which is rather uniform in thickness over the entire survey region and consists of a lower transparent zone overlain by a thin stratified upper zone The stratified portion is thicker in the lower valley than in the higher one from which it may have been partly removed by erosion. The underlying transparent zone is of uniform thickness

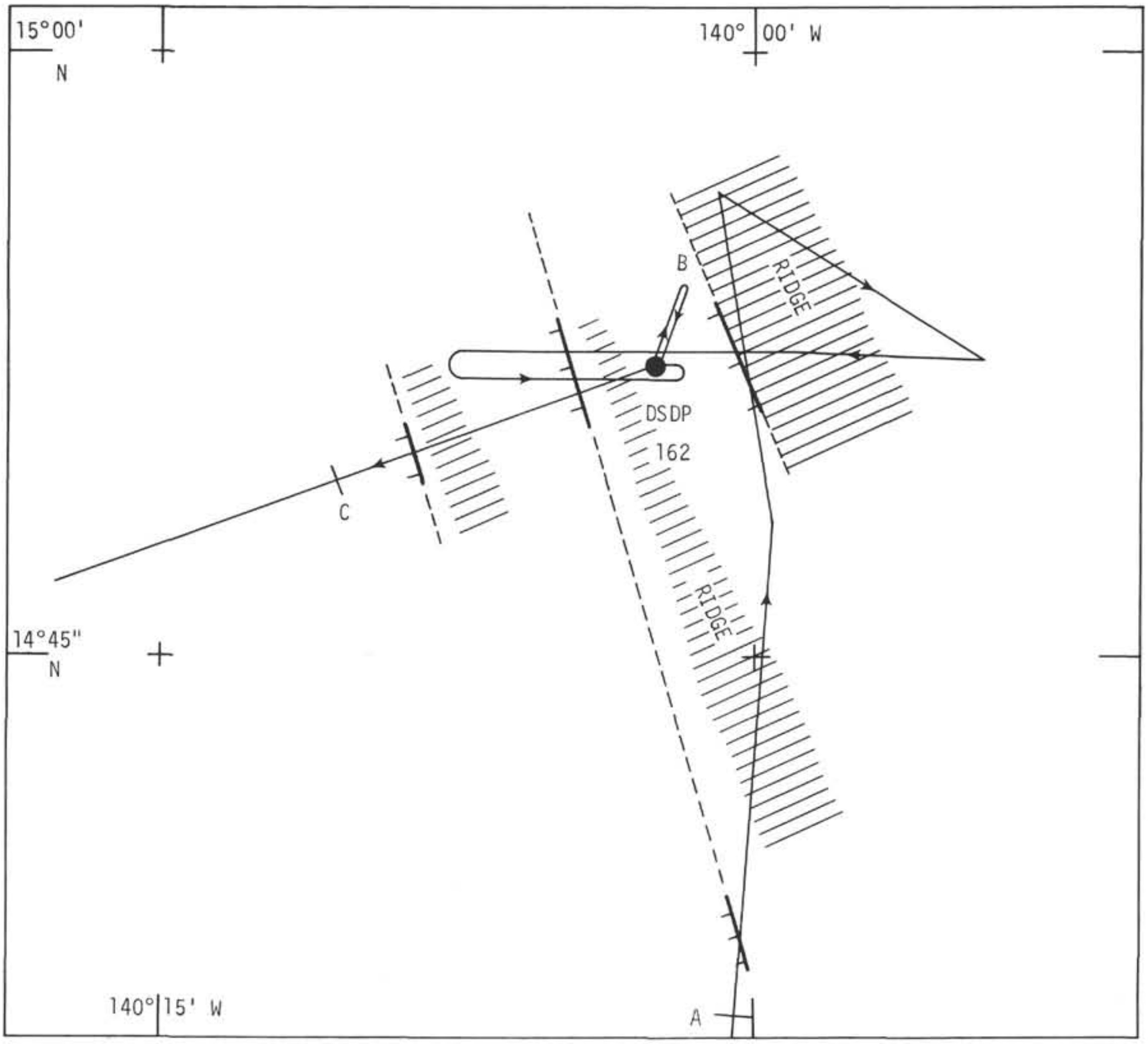

Figure 2. *Site location map. A-162 and B-162-C are locations of profiles of Figure 3. Faults and ridges (shaded) bordering drilled trough are shown.*

(Figure 3). The acoustic basement is a strong reflector. Table 1 shows a comparison of acoustic section and drill data. Correlation of the acoustic basement with the top of the basalt yields an unreasonably high velocity and is rejected.

OPERATIONS

The site survey for DSDP 162 was begun early on March 15 and included a double pass across the selected site. The beacon was dropped at 0845 hours. The hole was cored continuously, using a Smith 10-1/8″ sealed-bearing 3-cone button bit. No problems were encountered until basement, where two hours of coring yielded no core or evidence that core had ever entered the core barrel. After a pass across the beacon, the vessel left the site March 17 at noon. The tungsten insert cone bits apparently solved the problem of penetrating the chert experienced by earlier Pacific legs. Chert was noticeable in the hole, but no difficulty was experienced in penetrating it and coring the intervening layers. A core summary is shown in Table 2.

LITHOLOGY

Most of the sediment cored at DSDP 162 belongs to four lithologic units (Figure 4), which can be arranged in a compositional series ranging from nannofossil chalk ooze (Unit 162-2) to brown, clayey, radiolarian ooze (Unit 162-5). In this spectrum, trends of decreasing nannofossil carbonate and increasing radiolarian silica are accompanied by increasing contents of clay minerals and clay-sized, ferruginous aggregates. Thus, the brown clays which occur in minor amounts at the top of the section (Unit 162-1) and near the base (Unit 162-7) are, in a sense, silica-, clay-, and iron-rich end members of the sequence. Owing to the varying amounts of clay, ferruginous aggregates, and clay-filled radiolarians, each of the major sediment units is characterized by unique, even though subtly different colors. Very minor chert stringers encountered by the drill belong to a seventh lithologic unit (Unit 162-7) and weathered basalt constitutes an eighth (Unit 162-8).

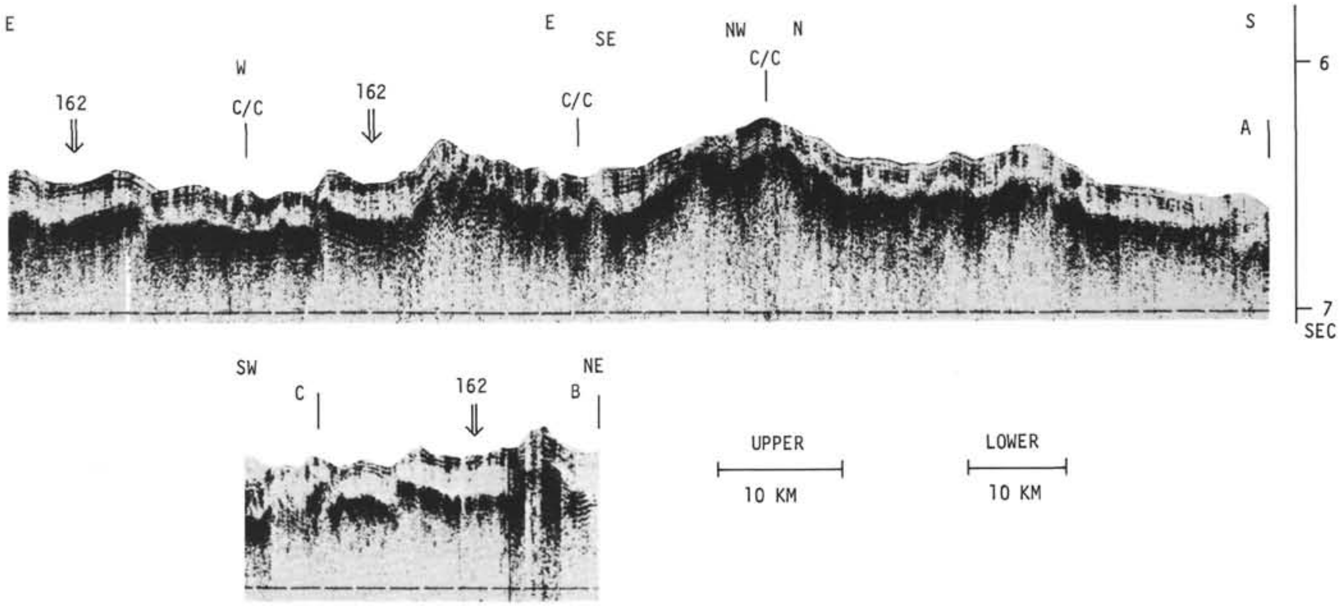

Figure 3. *Acoustic reflection profiles in vicinity of DSDP 162. Depths in seconds two way travel time. Locations on Figure 2. Horizontal scale approximate.*

TABLE 1
Comparison of Acoustic Section and Drill Data, DSDP 162

Reflectors	Depth (sec)	Drilling Results	Velocity (m/sec)
Base upper stratified zone	0.035	27 m base chalk ooze	1540
Acoustic basement	0.16 (0.16)[a]	130 m top chert (153 m top basalt)[a]	1630 (1912)[a]

[a]Correlation not accepted.

Unit 162-1 – Radiolarian zeolitic brown clay containing abundant sponge spicules. Moderate brown, and lesser dusky yellowish brown in color.
Unit 162-2 – Nannofossil chalk ooze with common radiolarians. Grayish orange, and lesser very pale orange in color.
Unit 162-3 – Clayey radiolarian nannofossil marl ooze. Yellow brown to dark yellow brown in color.
Unit 162-4 – Radiolarian nannofossil chalk ooze. Yellow orange and moderate yellow brown in color.
Unit 162-5 – Clayey radiolarian ooze. Moderate brown, lesser dark to dusky brown in color.
Unit 162-6 – Porcellaneous chert. Brownish black, mottled with or laminated in brownish black and dusky yellow brown.
Unit 162-7 – Ferruginous, locally ashy, locally zeolitic brown claystone grading into basal foraminiferal nannofossil marl and nannofossil chalk. Dark to dusky brown in color.
Unit 162-8 – Altered basalt.

The sedimentary column can be divided into four depth intervals, each dominated by one of the foregoing sediment units.

0-26 Meters

The uppermost sequence is made up of slightly mottled nannofossil chalk ooze (Unit 162-2) with minor beds, generally less than one meter thick, and mottles rich enough in radiolarians, clay, and ferruginous aggregates to belong to Units 162-3 or 162-4. Similarly, layers of brown clay (Unit 162-1) form the uppermost 6 cm of the interval and eight other layers scattered through it, as well as two layers at the transition between this interval and the next one. Small manganese nodules up to 3 cm in diameter occur

TABLE 2
Coring Summary, DSDP 162

Core	Depth Below Sea Level (m)	Depth Below Sea Floor (m)	Cored (cm)	Recovered (cm)	Recovered (%)
1	4854-4863	0-9	900	863	95.9
2	4863-4872	0-18	900	875	97.2
3	4872-4881	18-27	900	886	98.4
4	4881-4890	27-36	900	879	97.7
5	4890-4899	36-45	900	826	91.8
6	4899-4908	45-54	900	547	60.8
7	4908-4917	54-63	900	900	100.0
8	4917-4926	63-72	900	887	98.6
9	4926-4835	72-81	900	862	9 .8
10	4935-4944	81-90	900	672	74.7
11	4944-4953	90-99	900	780	86.7
12	4953-4962	99-108	900	885	98.3
13	4962-4971	108-117	900	909	101.0
14	4971-4980	117-126	900	892	99.1
15	4980-4989	126-135	900	894	99.3
16	4989-4998	135-144	900	295	32.8
17	4998-5007	144-153	900	307	34.1

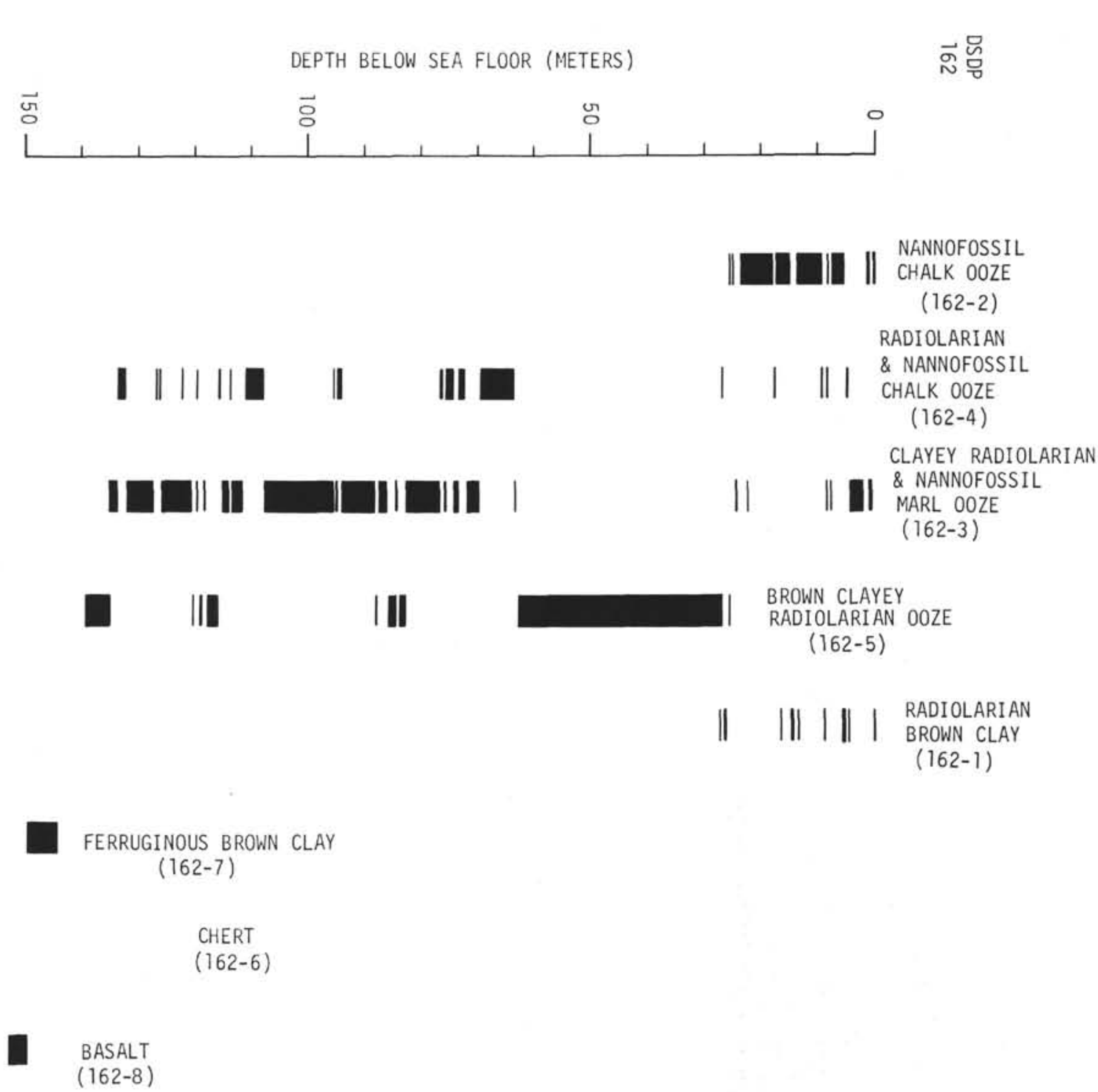

Figure 4. *Sequence of lithologic units of DSDP 162. Explanation in text.*

in several of these clay beds. Acid-treated coarse fractions of the more ferruginous beds reveal sponge spicules in abundances comparable to those of the radiolarians. Diatoms and fish debris are generally present. Clay minerals and clay- or fine silt-sized amorphous ferruginous particles and aggregates are common in the associated chalk ooze as well. Rare grains of light glass and even rarer dark glass or feldspar are observed.

26-63 Meters

This interval is exclusively brown, somewhat zeolitic, clayey radiolarian ooze (Unit 162-5). It is negligibly or very slightly mottled. Rare lumps of nannofossil chalk ooze occur only where the core is significantly disturbed and probably represent cavings from the overlying section. Clay particles and fine-grained amorphous ferruginous aggregates, to which the sediment owes its color, are abundant. Sediments of this interval generally contain small amounts of nannofossils, and sponge spicules are common in acid-treated coarse fractions, which are, however, essentially barren of foraminifera, diatoms, and terrigenous and volcanic detritus.

63-140 Meters

Slightly to moderately mottled clayey radiolarian nannofossil ooze (Unit 162-3) comprises more than 60 per cent of the sediment in this interval. The remaining sediments are closely related types, Units 162-3 and 162-5. Clay and ferruginous aggregates are common to abundant, varying with lithologic type. In addition to abundant radiolarians and nannofossils, diatoms, fish debris, and foraminifera are present in small numbers and amounts, and sponge spicules are slightly more abundant. As in the overlying interval, terrigenous and volcanic debris is virtually missing, although 1-3 cm pieces of gray pumice occur at three places. The basal unit of the interval is a 4-meter layer of fairly well indurated clayey radiolarian ooze or radiolarite.

At a depth of about 130 meters the drilling rate decreased from 0.9 m/minute to 0.5 m/minute. Short-term large fluctuations in torque accompanied this change. Comparable changes at other sites were accompanied by the appearance of chert in cores; at this site the core contained chert only in the core catcher and was moderately disturbed. Chert fragments, obviously cavings, were recovered from the following core as well. On this basis, and despite the lack of chert recovery, chert stringers are judged to occur from 130-135 meters as well as from 135-137 meters where they were actually recovered. The recovered chert is of two types: homogeneous brownish black, and brownish black with dusky brown mottles or laminae, very similar in aspect to the sediments in which they are contained. In this section, the darker chert proved to consist of 70-80 per cent microcrystalline cristobalite with 15-20 per cent brown and yellow-brown ferruginous aggregates identical to the material which colors the overlying and surrounding sediments, and 5-10 per cent fibrous clay aggregates. The rock contains rare fish debris and silicified radiolarian infillings and very rare isolated calcite grains as large as 75-100 microns. Mottles or laminae in the chert are calcite-rich streaks of nannofossil sediment about 1 by 1.25 mm in size. Calcite also occurs as rounded or ovoid, clayey, and silicified patches 0.7-1.2 mm in diameter; these may be fecal pellets. Fish debris particles up to 0.25 mm were also found. In keeping with its light color, ferruginous aggregates constitute only 1-3 per cent of this rock, while 5-10 per cent consists of silicified radiolarian infillings.

144-150 Meters

No cores were recovered in the interval between 139 and 144 meters. Within this gap, a drastic change in sediment character must occur, since from 144-148 meters the sediment is ferruginous zeolitic brown clay, grading downward into foraminiferal nannofossil marl and chalk. The brown clay contains several layers rich in light glass and feldspar fragments.

153 Meters

The core catcher of Core 17 contained about 5 cm of altered brown basalt with calcite-lined vertical fractures. Although no core was recovered in the interval 150-153 meters, the drilling records show an abrupt decrease in drilling rate from 0.5 m/minute to 0.1 m/minute despite increased bit weight, and a reduction in the fluctuating torque which characterized drilling in the overlying beds. Consequently, the contact between sediment and basement is placed at 150 meters. In thin section, the rock is an altered glassy basalt with seriate texture and poorly developed flow structure. The rock contains normally zoned microphenocrysts of plagioclase with cores as calcic as sodic bytownite, and rare augite occurring as sheaflike crystals. The groundmass is clinopyroxene, plagioclase, and opaques with iddingsite alteration products. Plagioclase crystallites in the groundmass commonly have glass-filled cores. Vesicles in the rock are filled with calcite and chlorite; calcite also occurs in veins. On the basis of texture and the lack of evidence for metamorphism and metasomatism in the basal chalk, the basalt is considered extrusive.

GEOCHEMISTRY

Interstitial water samples and shipboard operations for DSDP 162 are listed in Table 3.

TABLE 3
Interstitial Water Samples and Shipboard Observations, DSDP 162

Core	Section	Sampled Interval (cm)	pH	Eh (mv)	Lab. Temp. (°C)	Salinity (‰)	Squeeze Pressure (psi)
1	6	0-8	7.67	131	25.2	34.7	508
2	6	0-9	7.53	138	25.1	34.7	508
3	6	0-9	7.53	138	24.8	35.2	508
4	4	0-6	7.64	145	24.3	34.7	508
5	6	0-8	7.52	157	24.8	35.2	508
6	4	0-8	7.56	170	25.2	35.2	508
7	6	0-8	7.58	161	25.6	35.2	508
8	6	0-8	7.60	146	25.1	35.2	508
9	6	0-8	7.54	163	25.6	35.2	508
10	4	0-8	7.55	164	25.8	35.2	1015
11	5	0-6	7.67	156	25.8	35.2	508
12	5	0-8	7.52	153	25.8	35.2	508
13	6	0-8	7.54	153	25.6	35.2	2436
14	6	0-8	7.52	155	25.9	35.2	1015
15	6	0-8	7.49	152	25.5	35.2	1015
16	2	0-6	7.63	147	25.3	35.2	1015
17	3	0-6	7.35	159	24.8	34.1	2436

BIOSTRATIGRAPHY

At Site DSDP 162, radiolarians and coccoliths indicate a late early Eocene to late early Oligocene section. The presence of some surficial Quaternary at this site is suggested by the occurrence of downward contaminated radiolarians in the early Oligocene of Cores 1 and 2.

Except in Cores 1, 2, and 17, radiolarians are present throughout. In Cores 1 and 2 they are common, but strongly to moderately corroded. Abundant Orosphaerid spines and fragments are present in these sediments.

Coccoliths are present in most of the section. In Cores 1 through 3, and 17, they are abundant. In the intervening radiolarian ooze they are common to rare or, in Cores 5-7 and 16, absent.

The section is mostly barren of foraminifera. Foraminifera were seen in the top of Core 1, lower part of Core 4, and the lower part of Core 15; however, the assemblages are heavily affected by solution and are not age-diagnostic. The only good assemblage was seen in the lower portion of Core 17, where preservation is good and a diverse uppermost lower Eocene fauna transitional between the *Globorotalia palmerae* and *Hantkenina aragonensis* zones occurs.

PHYSICAL PROPERTIES

Numerous subsamples were carefully selected from DSDP 162, complementing standard shipboard techniques, for laboratory determination of sediment mass physical properties. A few vane shear and Swedish Fall Cone penetrometer tests were made in the least disturbed portions of the section. Drilling disturbance was plainly evident throughout much of the sampled sequence. Sound velocity measurements were made on the least disturbed sections and should be fairly representative.

The most striking features of the GRAPE data profiles are the relatively high bulk densities and low porosities in the upper 27 meters relative to the low densities and high porosities found from 27 and 63 meters. Intermediate densities and porosities are observed from 63 to 81 meters with lower bulk densities and higher porosities recorded from 81 to 135 meters.

Bulk Density

GRAPE bulk densities (average per section) range from 1.34 to 1.57 g/cc in the upper 27 meters of nannofossil chalk ooze, but decrease in overall range from 1.17 to 1.26 g/cc in the ferruginous clayey radiolarian ooze (27 to 63 m). In the clayey radiolarian nannofossil marl ooze (63 to 81 m) bulk densities range from 1.32 to 1.34 g/cc, but decrease with depth in the lower marl ooze (81 to 135 m) with values ranging from 1.17 to 1.30 g/cc. Laboratory bulk densities average 1.44 g/cc in the upper 27 meters but decrease, averaging 1.22 g/cc, in the 27 to 63 meter interval. Laboratory densities average 1.26 g/cc in the lowermost interval of 63 to 140 meters.

Porosity

GRAPE porosities of 68 to 81 per cent are found in the upper 27 meters, increasing to 84 and 90 per cent in the underlying interval, 27 to 63 meters. GRAPE porosities of 76 to 78 per cent are recorded in the 63 to 81 meter interval, but increase to 70 to 89 per cent below 81 meters. Laboratory porosities average 73 per cent in the upper 27 meters but increase to 83 per cent from 27 to 63 meters. Below 63 meters to a depth of 140 meters, laboratory porosities average 82 per cent.

Water Content

Water content is highly variable throughout the entire sedimentary sequence. The lowest water contents, averaging 54 per cent and varying from 44 to 67 per cent, are generally found in the upper nannofossil chalk ooze (0 to 27 m). High values, averaging 69 per cent and ranging from 68 to 73 per cent, are associated with the ferruginous clayey radiolarian ooze in the 27 to 63 meter interval. Water contents averaging 66 per cent and ranging from 60 to 71 per cent characterize the lower clayey radiolarian nannofossil marl ooze from 63 to 140 meters.

Grain Density

Grain density is highly variable with depth, but averages 2.61 g/cc in the upper 27 meters. Lower densities are observed below 27 meters averaging 2.29 g/cc to a depth of 63 meters and increasing slightly to an average of 2.31 g/cc from 63 to 140 meters. Average grain densities range from 2.14 to 2.76 g/cc over the entire section.

Sound Velocity

Numerous sonic velocities were determined for the sediment and chert as well as being rerun whenever possible, as a check on the procedure. Although variation in duplicate tests exists, the data appear to be more consistent and reflect a more effective testing technique than used on previous DSDP Leg 16 sites. Average velocities of 1.46 km/sec are low in the upper radiolarian nannofossil ooze, but increase slightly to 1.48 km/sec in the underlying clayey radiolarian ooze and marl ooze. The average velocity for the entire sedimentary column is 1.48 km/sec, excluding the chert which averages 4.47 km/sec. No measurements of basalt were possible due to insufficient sample.

Natural Gamma Radiation

High natural gamma radiation (average value per section) characterized the upper 20 meters of section. Radiation activity decreases significantly below 20 meters despite the slightly higher porosities found here. A somewhat higher activity was found in the ashy zeolitic ferruginous clay below 144 meters.

Shear Strength

A few fall cone penetrometer and vane shear tests were made in the upper 108 meters. Fall cone strengths averaged 91 g/cm^2 in the upper 9 meters and vane shear strengths ranged from 88 to 92 g/cm^2 in the chalk ooze from 9 to 18 meters. Fall cone measurements in the radiolarian ooze at 56 meters average 240 g/cm^2. Fall cone averages range from 224 to 370 g/cm^2 in the marl ooze (72 to 99 m). A high penetrometer strength average of 767 g/cm^2 was recorded in the marl ooze at a depth of 107 to 108 meters.

SUMMARY AND DISCUSSION

The continuously cored section at DSDP Site 162 consists of 150 meters of pelagic, largely biogenic sediment of middle Eocene to middle Oligocene age resting on basalt basement.

The top 26 meters, of Oligocene age, consist of interbedded nannofossil chalk ooze and subordinate brown clayey radiolarian ooze and brown clay with ferromanganese nodules. In general, GRAPE porosities range from 60-70 per cent and the measured acoustic velocities are close to 1.45 km/sec. Natural gamma activity is variable. The sedimentation rate for this unit is about 9 m/m.y. Middle and upper Cenozoic deposits are missing and the surface age is estimated as 30 m.y.

From 26 to 63 meters, the sediment is brown clayey radiolarian ooze of late Eocene and earliest Oligocene age. The upper ten meters are sparsely calcareous. Physically, this sediment differs from the rest of the section in its high porosity (GRAPE values of 85-90%). The absence of the *Thyrsocyrtis tetracantha* (radiolarian) zone could indicate a brief hiatus in the late Eocene. The accumulation rate for the radiolarian ooze section is 3 m/m.y.

From 63 to 140 meters, the section is mainly clayey radiolarian nannofossil marl ooze with lesser chalk ooze and brown clayey radiolarian ooze. The lowest 4 meters consist of indurated clayey radiolarian ooze. This section is of middle Eocene age and, with a sedimentation rate of 23 m/m.y., probably marks the period when DSDP 162 lay beneath the equator. The measured acoustic velocity of 1.48 km/sec is higher than in the overlying beds but still seems unusually low. GRAPE porosities range from 80-85 per cent, with the highest values found in the radiolarian-rich intervals. From 130-139 meters the section contains several thin beds of brownish black chert (cristobalitic porcellanite). This rock has an acoustic velocity of 4.5 km/sec with a variation of 0.1 km/sec and probably forms the acoustic basement. Despite the evidence for diagenetic mobilization of silica, radiolarians and diatoms are abundant in the chert interval.

The lowest sedimentary unit, of early middle Eocene age, occupies the interval 144-150 meters. It is mostly ferruginous zeolitic brown clay, but includes a basal foraminiferal nannofossil chalk about 49 m.y. old. This chalk contains the only good foraminiferal assemblage at the site. The natural gamma activity of the ferruginous clay exceeds that of the overlying chalk. The basal chalk rests on heavily altered brown basalt, which is glassy and contains bytownite and rare augite microphenocrysts. The absence of evidence for metamorphism or metasomatism in the overlying chalk indicates an extrusive origin.

The 1.48 km/sec average of acoustic velocities measured on core samples is much lower than the value of 1.63 km/sec obtained by correlating the reflection record and drilled section at the site. The discrepancy probably results from severe coring disturbance.

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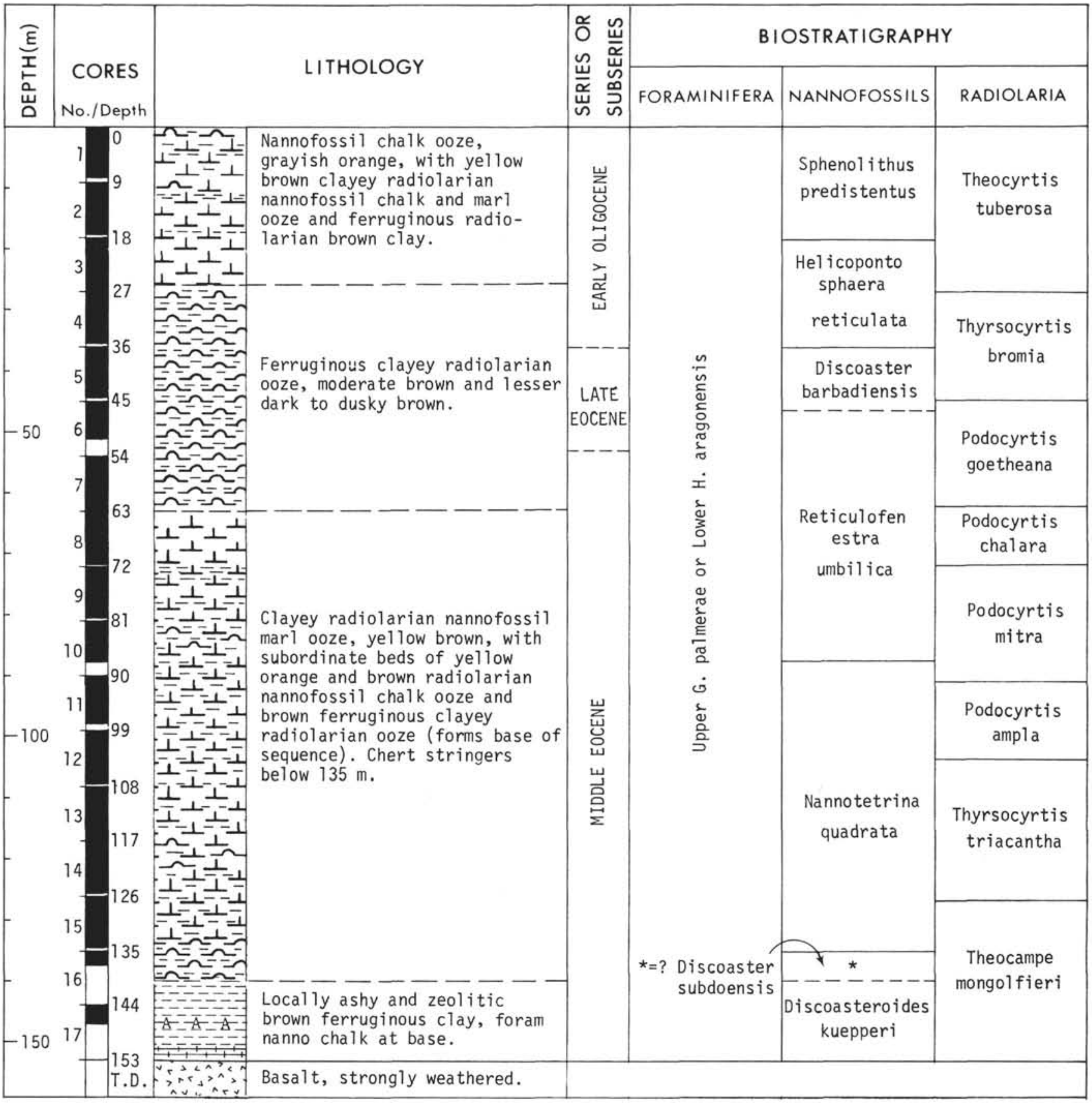
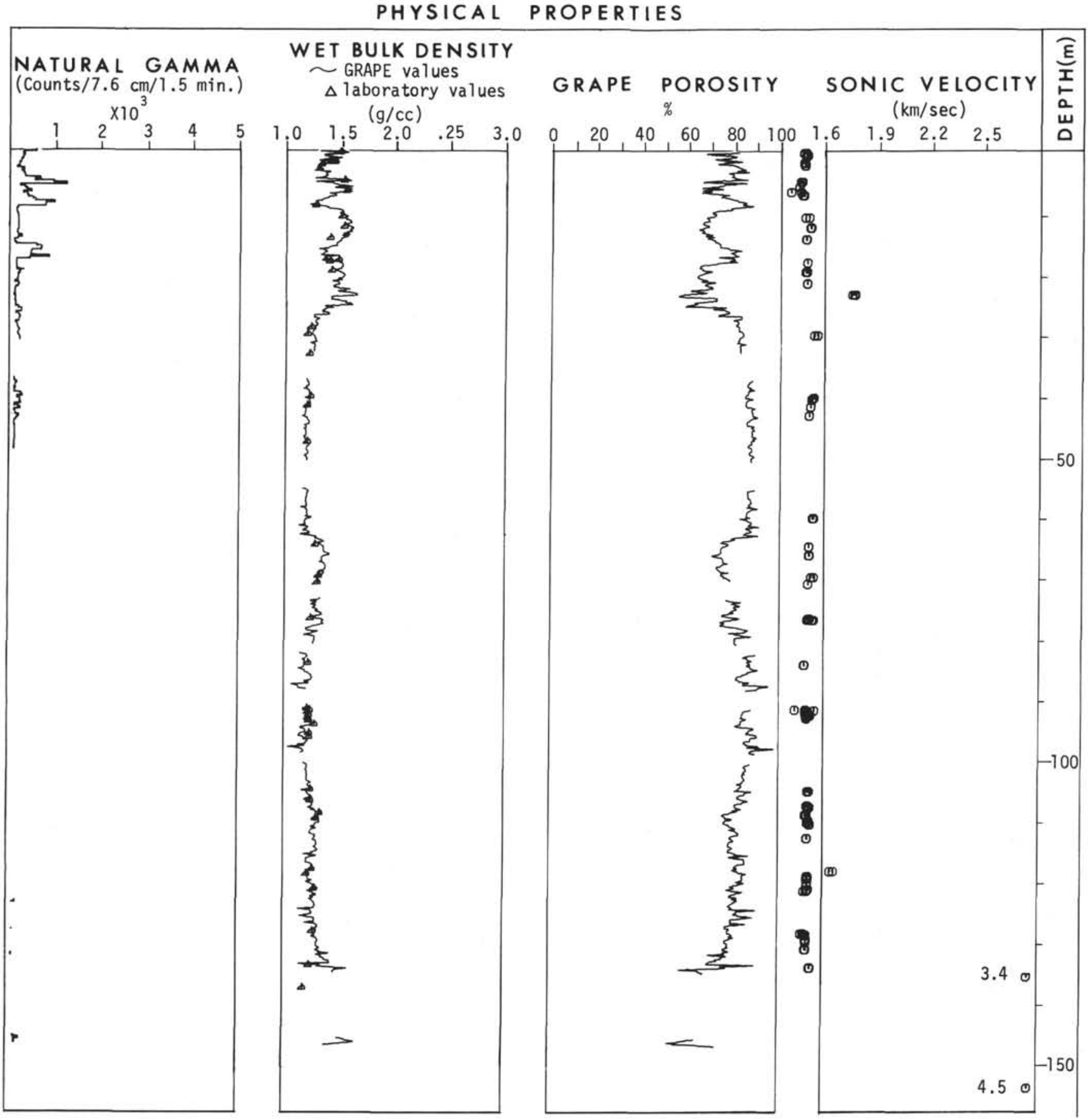


Figure 5. *DSDP 162, graphic hole summary. Vertical scale 1 cm = 10 m (1:1000).*


PHYSICAL PROPERTIES
NATURAL GAMMA
(Counts/7.6 cm/1.5 min.)
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(g/cc)
1.0 1.5 2.0 .25 3.0
GRAPE POROSITY
%
0 20 40 60 80 100
SONIC VELOCITY
(km/sec)
1.6 1.9 2.2 2.5
DEPTH(m)
50
100
150
3.4
4.5

SITE: 162 HOLE: CORE: 1 Cored Interval: 0-9 m

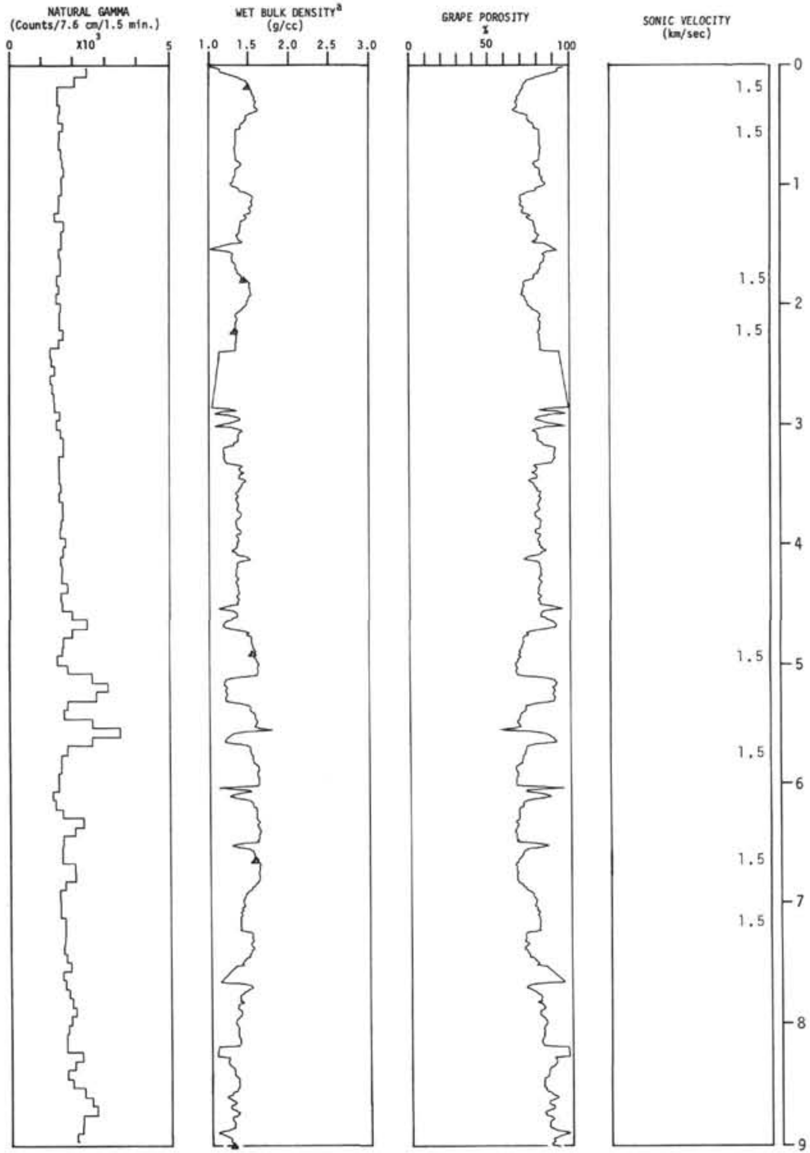
SERIES: LOWER OLIGOCENE

ZONE: Nanno – *Sphenolithus predistentus*; Rad – *Theocyrtis tuberosa*

Depth (Meters)	Section	Microfossil Abund/Pres	Description
0	1	Foram R Pd / R P; Nanno A M / A M; Rad C M	Ferruginous radiolarian brown clay, moderate brown (5YR 3/4), grading down from 6 to 10 cm into: Nannofossil chalk ooze, grayish orange (10YR 7/4), slightly mottled.
			Clayey rad nannofossil marl ooze, yellowish brown (10YR 4/4).
1			Nannofossil chalk ooze, grayish orange (10YR 7/4), grading down into:
			Clayey rad nannofossil marl ooze, yellowish brown (10YR 4/4), slightly mottled.
2	2		Nannofossil chalk ooze, grayish orange (10YR 7/4), grading down into:
			Clayey rad nannofossil marl ooze, yellowish brown (10YR 4/4), slightly mottled.
			VOID
3–4	3	Nanno A M	Disturbed admixture of previous 2 units, radiolarian nannofossil marl ooze dominant, nannofossil chalk ooze subordinate
			1.3 x 0.8 cm dia. manganese nodule at 65 cm.
5	4		Ferruginous radiolarina brown clay, dusky yellowish brown, (10YR 3/3).
			Rad-nanno chalk ooze, yellowish orange (10YR 6/4) at top grading down to very pale orange (10YR 8/3).
			Ferruginous radiolarian brown clay as above (10YR 3/3).
		Nanno R Pd	Nannofossil chalk ooze, grayish orange (10YR 7/3) 3 cm diameter manganese nodule.
6			Ferruginous radiolarian brown clay as above (10YR 3/3). 1 x 1.5 cm manganese nodule
	5		Predominantly nannofossil chalk ooze as above; 3 cm layer of brown clay with 1.6 cm diameter manganese nodule at 4-9 cm; another brown clay layer at 45-50 cm of section 5. Grades down into:
7		Nanno A P / A M	Marly radiolarian nannofossil chalk ooze, yellowish brown (10YR 4/4). Nannoplankton chalk ooze as above.
			Radiolarian nannofossil chalk ooze, locally marly, yellowish brown.
8	6		1 cm manganese nodule interbedded ferruginous radiolarian brown clay and marly radiolarian chalk ooze, colors as above; also a few minor layers of nannofossil chalk ooze; 1.5 cm diameter manganese nodule where indicated.
	CC	Foram C Pd; Nanno C M	

PHYSICAL PROPERTIES

[a]GRAPE values; laboratory values shown by triangles



SITE: 162 HOLE: CORE: 2 Cored Interval: 9-18 m

SERIES: LOWER OLIGOCENE

ZONE: Foram: — ; Nanno: *Sphenolithus predistentus*; Rad: *Theocyrtis tuberosa*

Columns: AGE (SERIES; ZONE: Foram, Nanno, Rad) | DEPTH (Meters) | SECTION | LITHOLOGY | Disturbance | Smear Slide | Paleo. sample | DESCRIPTION | MICROFOSSIL Abund/Pres (Foram, Nanno, Rad); % $CaCO_3$ 0 50 100

Sections: 1, 2, 3, 4, 5, 6, CC (depth 0–9 m). Top of section 1: VOID.

DESCRIPTION

Radiolarian nannofossil chalk ooze, very disturbed, yellowish brown (10YR 4/4 and 10YR 5/4).

Nannofossil chalk ooze, pale orange (10YR 7/2 and 10YR 7/3), slightly mottled: at top, mottles are dominantly radiolarian nannofossil chalk ooze and yellowish brown; in the middle and bottom the mottles are very pale orange (10YR 8/2) and contain fewer Radiolaria and ferruginous aggregates than the main unit.

Radiolarian nannofossil chalk ooze, moderate yellowish brown (10YR 5/4), mottled darker (10YR 4/4).
Nannofossil chalk ooze, grayish orange (10YR 7/3), slight mottling.
Radiolarian nannofossil chalk ooze as above.
Nannofossil chalk ooze, pale yellowish brown (10YR 6/2).
Radiolarian nannofossil chalk ooze as above.
Nannofossil chalk ooze as above.

Radiolarian nannofossil chalk ooze, dark to pale yellowish brown (10YR 4/4 to 10YR 6/4).

2 to 5 cm deformed lumps of radiolarian brown clay, dusky yellowish brown (1oYR 3/3).

Ferruginous radiolarian brown clay, dusky yellow brown.
Disturbed, intermingled nanno and radiolarian nanno chalk oozes.
Radiolarian nannofossil chalk ooze as above.
Nannofossil chalk ooze, grayish orange (10YR 6/4 with minor to YR 7/3); 7 to 10 cm thick interbeds of ferruginous radiolarian brown clay as indicated.

1 x 1.5 cm manganese nodule.

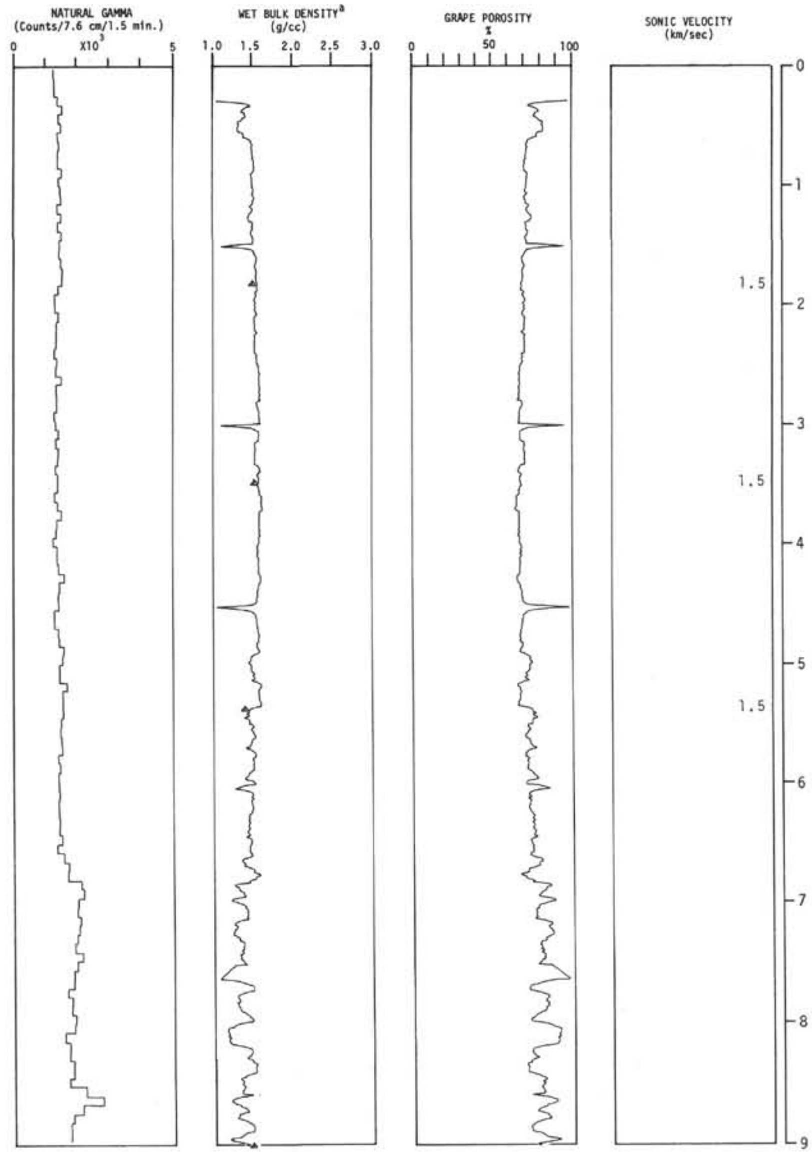
Radiolaria content increases gradationally down the unit, which becomes a radiolarian nannofossil chalk ooze in the lower half.

Microfossil Abund/Pres (Nanno; Rad where given):

Depth (approx.)	Nanno	Rad
Section 3, ~4.3 m	A M	
Section 3, ~4.7 m	A M	
Section 5, ~7 m	A P	
Section 6, ~8.4 m	A M	
CC	A P	C M

PHYSICAL PROPERTIES

[a]GRAPE values; laboratory values shown by triangles

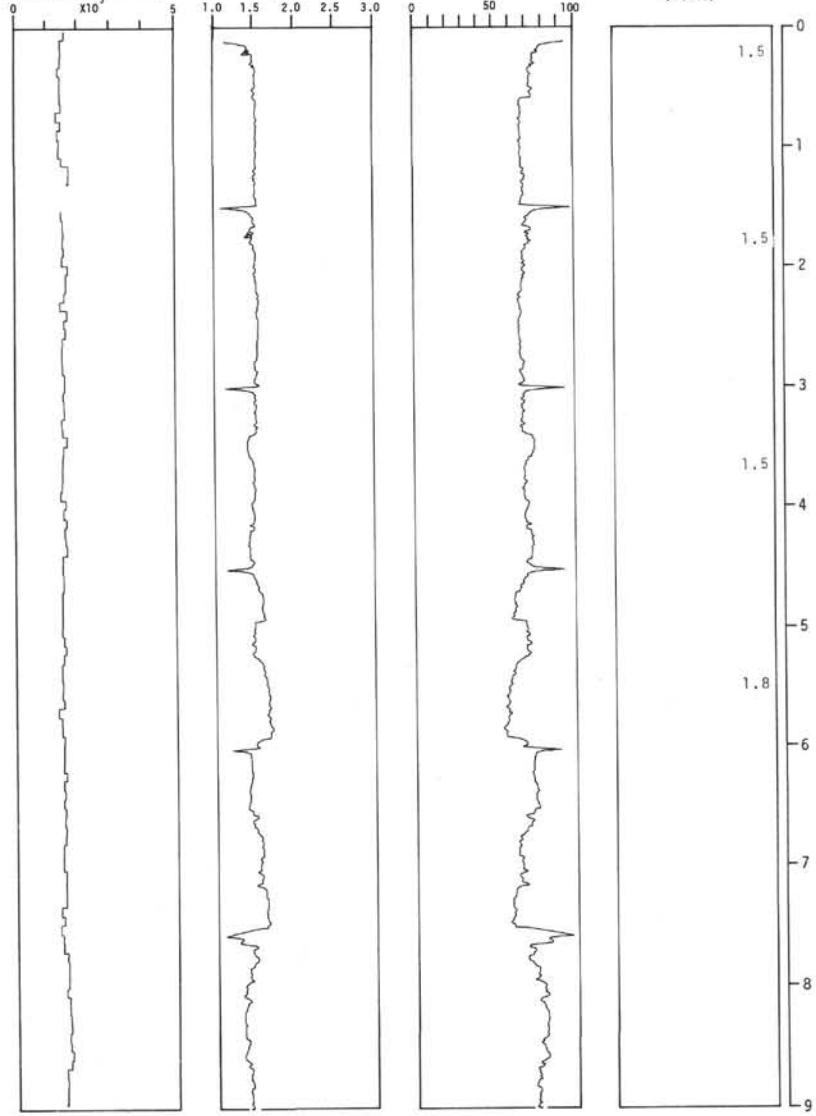


SITE: 162 HOLE: CORE: 3 Cored Interval: 18-27 m

SERIES	AGE ZONE: Foram	AGE ZONE: Nanno	AGE ZONE: Rad	DEPTH (Meters)	SECTION	DESCRIPTION	MICROFOSSIL Abund/Pres: Foram	Nanno	Rad
LOWER OLIGOCENE		*Sphenolithus predistentus*		0–1.5	1	Nannofossil chalk ooze, radiolaria common and locally abundant, predominatly yellowish orange (10YR 6/4, lesser 10YR 5/4); disturbed laminae and slight mottling grayish orange (10YR 7/3), moderate yellow brown (10YR 5/4), and very pale orange (10YR 8/1, 10YR 8/2).		A M	
				1.5–3	2				
		Helicopontosphaera reticulata	*Theocyrtis tuberosa*	3–4.5	3			A P	
				4.5–6	4	Marly radiolarian nannofossil chalk ooze, moderate yellow brown (10YR 4/4 and 10YR 5/4). Nannofossil chalk ooze, grayish orange (10YR 7/4, 10YR 7/3), yellowish orange (10YR 6/4) and moderate yellow brown (10YR 5/4).			
				6–7.5	5	Radiolarian nannofossil marl ooze, moderate yellow brown (10YR 5/4); slight very pale orange (10YR 8/3) and yellowish brown (10YR 6/4) mottling. Nannofossil chalk ooze, predominantly grayish orange (10YR 7/3).		A M	
				7.5–9	6	Ferruginous clayey radiolarian ooze, dusky yellowish brown (10YR 2/3). Disturbed mixture of nannofossil chalk ooze and ferruginous radiolarian brown clay. Ferruginous radiolarian brown clay, dusky yellowish brown (10YR 3/3). Rad nanno chalk ooze, moderate yellow brown (10YR 5/4).			
					CC		R P	A M	A G

PHYSICAL PROPERTIES

[a]GRAPE values; laboratory values shown by triangles



SITE: 162 HOLE: CORE: 4 Cored Interval: 27-36 m

AGE: SERIES	ZONE: Foram	ZONE: Nanno	ZONE: Rad	DEPTH (Meters)	SECTION	LITHOLOGY	Disturbance	Smear Slide	Paleo. sample
LOWER OLIGOCENE		*Helicopontosphaera reticulata*	*Thyrsocyrtis bromia*	0–9	1, 2, 3, 4, 5, 6, CC	Radiolarian ooze; VOID (~6.9–7.2 m, ~8.2–8.7 m)		*	*

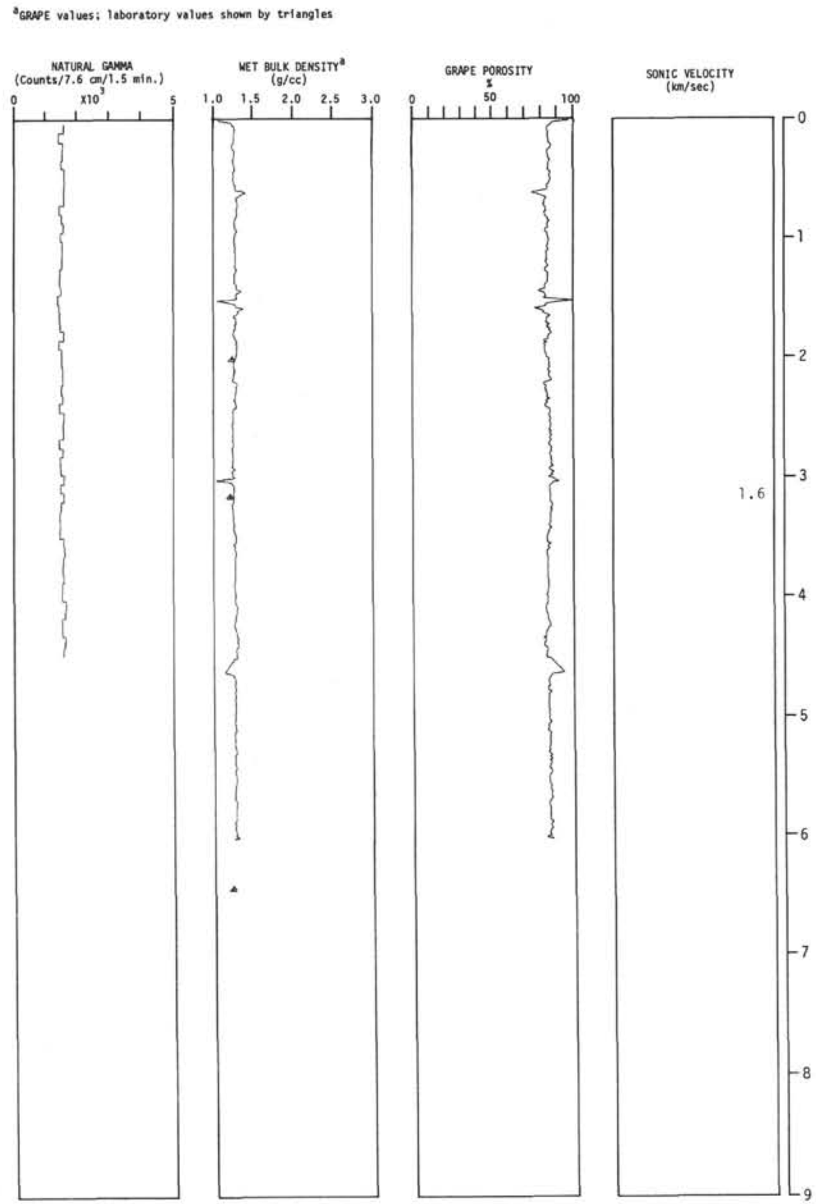
DESCRIPTION

Radiolarian ooze, ferruginous and clayey, predominant color moderate brown (5YR 3/4, lesser 5YR 4/4 and 10YR 2/4 where clay is less. Slightly mottled to unmottled; mottles nannofossil chalk ooze (5YR 7/2, 10YR 8/3) pale or very pale orange. Disturbed nature of core suggests possible drill contamination origin of mottles.

MICROFOSSIL Abund/Pres (Foram, Nanno, Rad; % $CaCO_3$ 0–50–100)

Level	Entries
Section 2 (~1.5 m)	A M
Section 2 (~1.6 m)	A M
Section 3 (~4.1 m)	- - A G
Section 5 (~6.4 m)	R P A G
CC	C F, Pd P, A G

PHYSICAL PROPERTIES

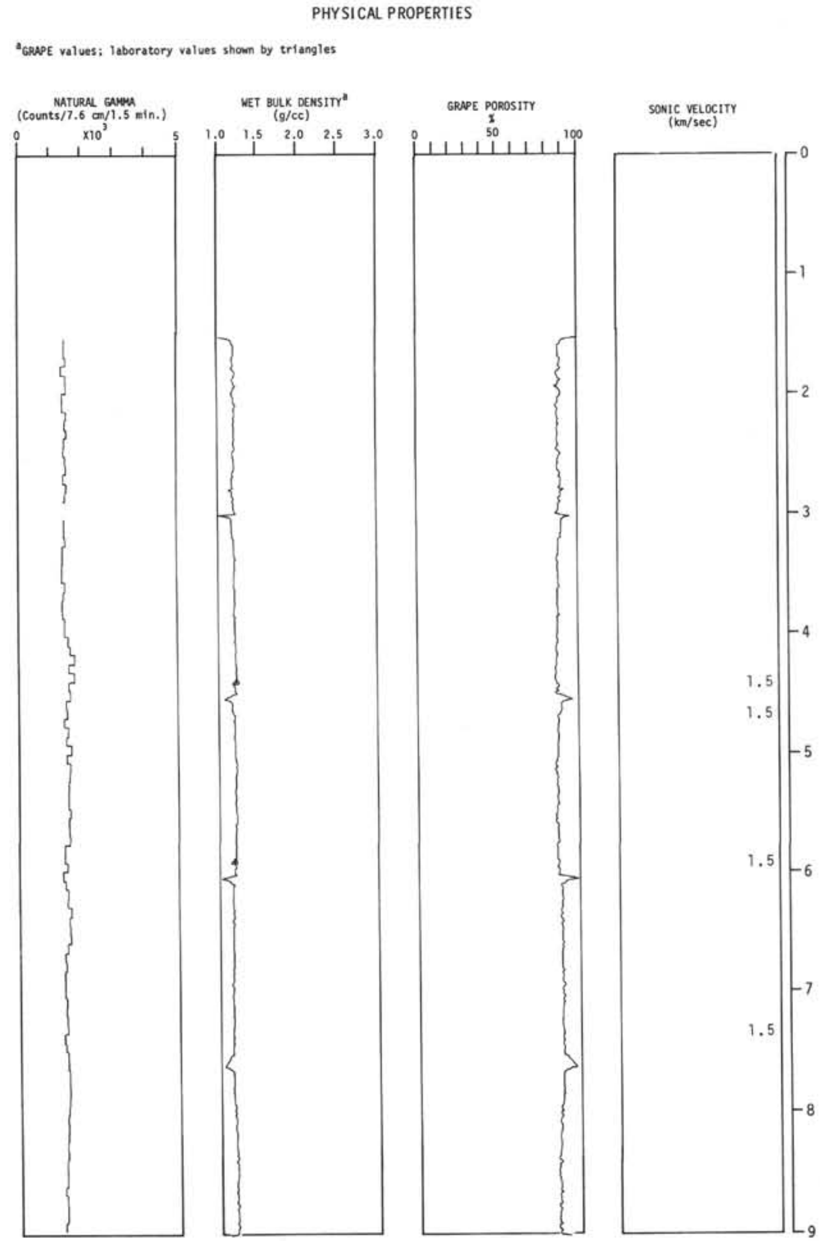


SITE: 162 HOLE: CORE: 5 Cored Interval: 36-45 m

SERIES	AGE / ZONE: Foram	Nanno	Rad	DEPTH (Meters)	SECTION	LITHOLOGY	DESCRIPTION	MICROFOSSIL Abund/Pres: Foram	Nanno	Rad
UPPER EOCENE	—	*Discoaster barbadiensis*	*Thyrsocyrtis bromia*	0–1.5	1	VOID	Radiolarian ooze, ferruginous and clayey, dominant colors dusky yellowish brown (10YR 3/4 and 10YR 2/4); slight mottling.		R P	
				1.5–3	2					
				3–4.5	3				C P	
									- -	
				4.5–6	4					
				6–7.5	5				C Pd	
				7.5–9	6					
					CC				A P	A G

MICROFOSSIL % $CaCO_3$: 0 50 100

PHYSICAL PROPERTIES



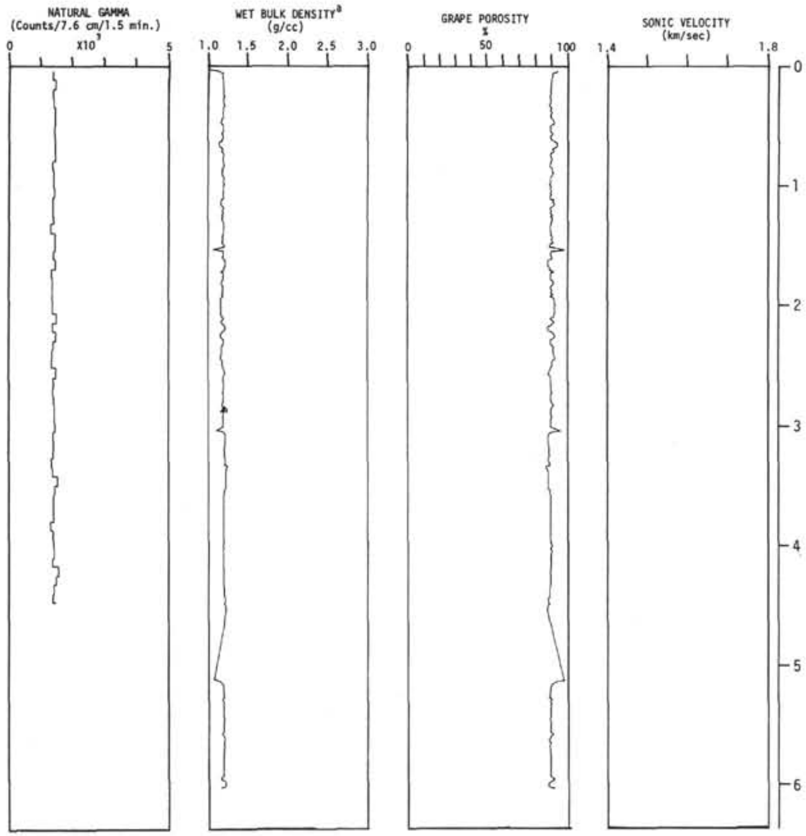
SITE: 162 HOLE: CORE: 6 Cored Interval: 45-54 m

SERIES	ZONE Foram	ZONE Nanno	ZONE Rad	DEPTH (Meters)	SECTION	LITHOLOGY	Disturbance	Smear Slide	Paleo. sample	DESCRIPTION	MICROFOSSIL Abund/Pres Foram	Nanno	Rad
UPPER EOCENE		*Reticulofenestra umbilica*	*Podocyrtis goetheana*	0–1.5	1			*		Radiolarian ooze; ferruginous, clayey; color where undisturbed is dusky yellowish brown (10YR 2/4); where disturbed it is lighter (10YR 3/4 and 10YR 4/4).			
								*	*		-	-	A G
				1.5–3	2				*		A	M	
								*					
				3–4.5	3			*					
									*		-	-	A G
				4.5–6	4	VOID		* * *		Same radiolarian ooze, but color here is moderate to dusky brown (5YR 3/4 and 5YR 2/4).			
					CC				*		C	Pd	A G

% CaCO3: 0 50 100

PHYSICAL PROPERTIES

[a]GRAPE values; laboratory values shown by triangles



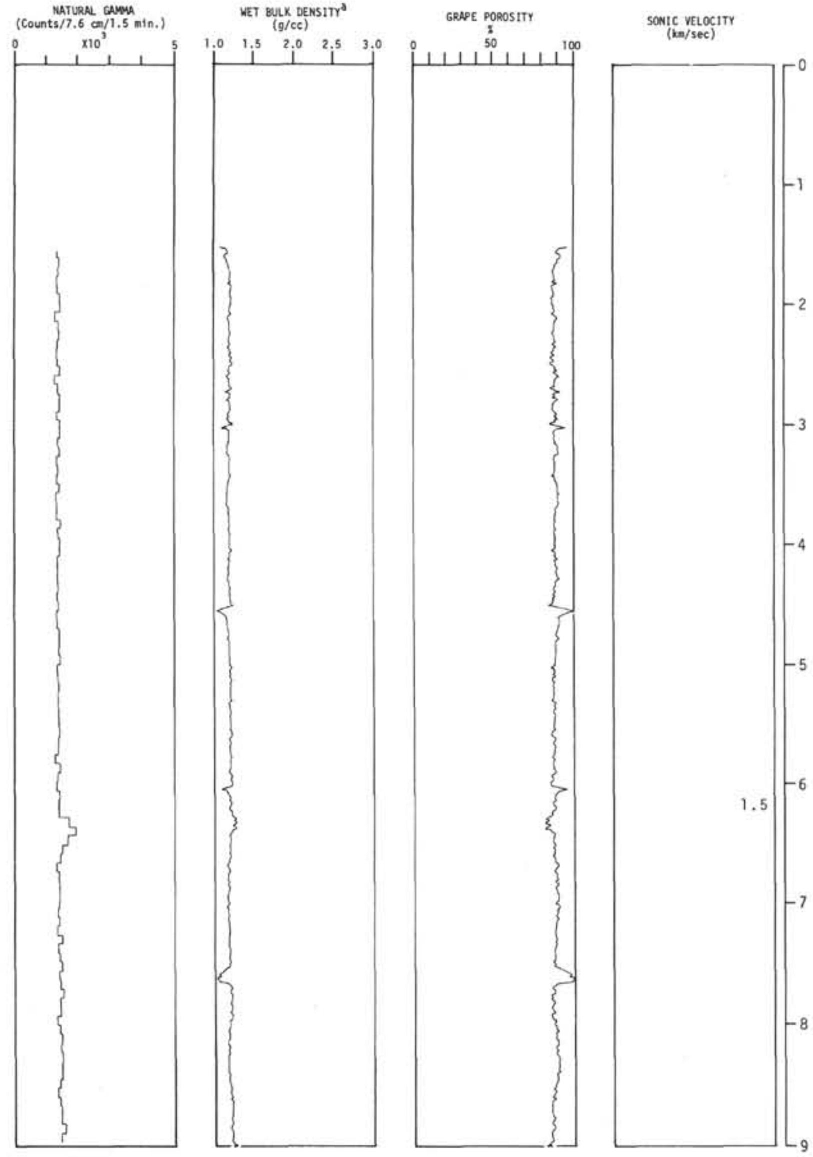
SITE: 162 HOLE: CORE: 7 Cored Interval: 54-63 m

SERIES	AGE ZONE: Foram	AGE ZONE: Nanno	AGE ZONE: Rad	DEPTH (Meters)	SECTION	LITHOLOGY	Disturbance	Smear Slide	Paleo. sample	DESCRIPTION	MICROFOSSIL Abund/Pres: Foram	Nanno	Rad
MIDDLE EOCENE	—	*Reticulofenestra umbilica*	*Podocyrtis goetheana*	0–1.5	1			* *	* *	Radiolarian ooze, ferruginous, clayey, moderate brown (5YR 3/4). Mostly homogenized by drilling. Slightly mottled where undisturbed; mottles moderate yellow brown and yellowish brown (10YR 5/4, 10YR 4/4).	-	-	
				1.5–3	2								
				3–4.5	3				*		-	-	A G
				4.5–6	4			*					
				6–7.5	5			* *	*		-	-	A G
			Podocyrtis chalara	7.5–9	6			*					
					CC				*		-	-	A G

% CaCO3: 0, 50, 100

PHYSICAL PROPERTIES

[a]GRAPE values; laboratory values shown by triangles

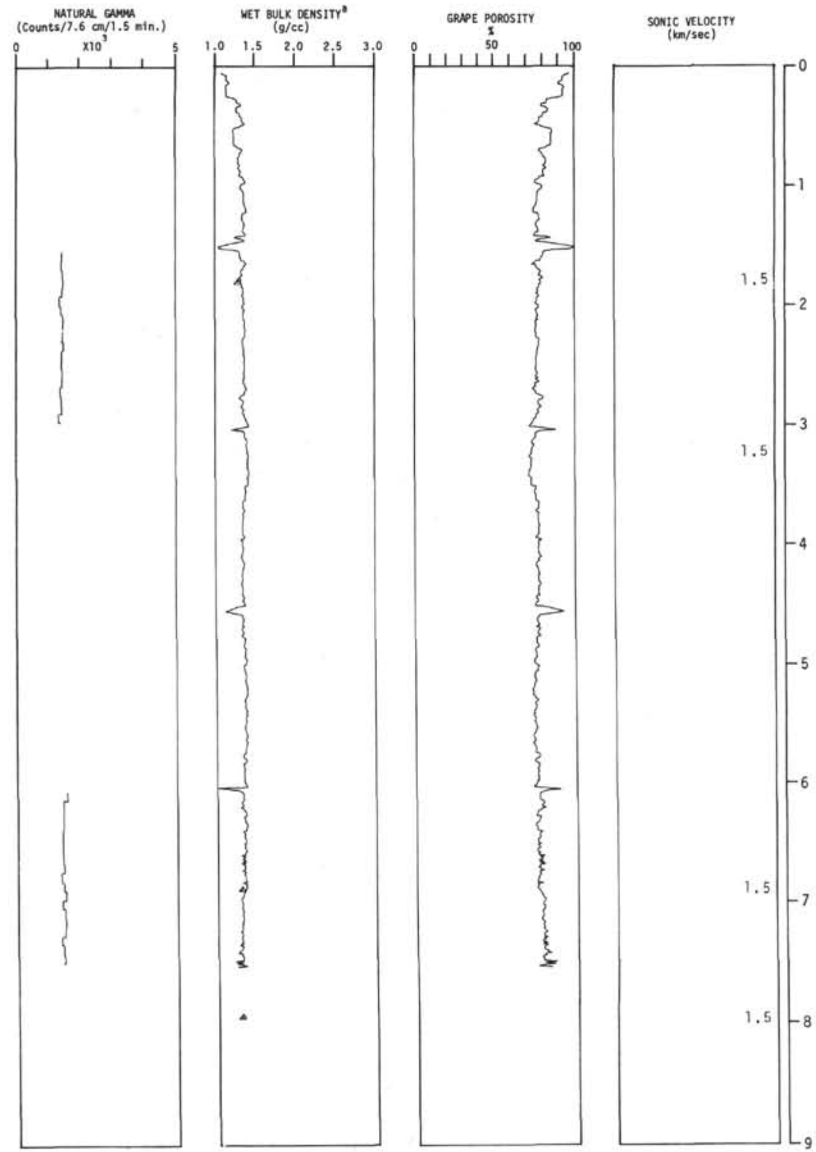


SITE: 162 HOLE: CORE: 8 Cored Interval: 63-72 m

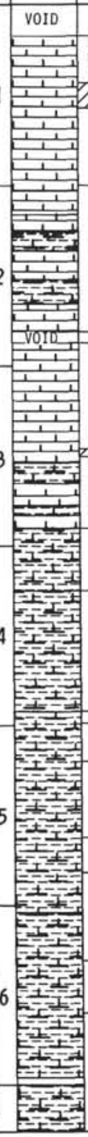
AGE: SERIES	ZONE: Foram	ZONE: Nanno	ZONE: Rad	DEPTH (Meters)	SECTION	LITHOLOGY	DESCRIPTION	MICROFOSSIL Abund/Pres: Foram	Nanno	Rad
MIDDLE EOCENE	—	*Reticulofenestra umbilica*	*Podocyrtis chalara*	0–1.5	1	VOID	Radiolarian nannofossil chalk ooze, moderate yellowish brown (10YR 5/4) and pale yellowish brown (10YR 6/4) or dark yellowish brown (10YR 4/4, 10YR 3/4); moderately mottled with grayish orange (10YR 7/3) nannofossil chalk ooze. Marly layer.		A M	
				1.5–3	2				A M	
				3–4.5	3		0.8 cm diameter manganese nodule.		A M	
				4.5–6	4					
				6–7.5	5		Gradational contact. Clayey radiolarian nannofossil marl ooze, yellowish brown (10Y 4/4); in section 6, disturbed admixture of yellowish brown radiolarian nannofossil chalk ooze. Slight mottling with grayish orange nannofossil chalk ooze.			
				7.5–9	6	VOID			A M	
					CC			—	—	A G

PHYSICAL PROPERTIES

[a]GRAPE values; laboratory values shown by triangles



SITE: 162 HOLE: CORE: 9 Cored Interval: 72-81 m

SERIES	AGE ZONE: Foram	Nanno	Rad	DEPTH (Meters)	SECTION	LITHOLOGY	DESCRIPTION	MICROFOSSIL Abund/Pres: Foram	Nanno	Rad	
MIDDLE EOCENE		*Reticulofenestra umbilica*	*Podocyrtis mitra*	0–9	1–6, CC		See below				
				~4 (Sect. 3)	3			A	M	A	G
				~7 (Sect. 5)	5			A	M	A	
				CC	CC			A	P	A	G

VOID

Radiolarian nannofossil chalk ooze, yellowish orange (10YR 6/4), virtually unmottled.

5 cm thick zone moderate yellow brown.

1 cm thick yellowish brown clayey layer.

Nannofossil chalk ooze, grayish orange (10YR 7/3).

Radiolarian nannofossil chalk ooze, moderate yellow brown (10YR 5/4).
Clayey radiolarian nannofossil marl ooze moderate yellow brown (10YR 5/4).
Radiolarian nannofossil chalk ooze, yellowish orange (10YR 6/4).
Clayey radiolarian nannofossil marl ooze, ferruginous, dark yellowish brown (10YR 3/4).
Radiolarian nannofossil chalk ooze, yellowish orange (10YR 6/4).

VOID

Predominantly radiolarian nannofossil chalk ooze, moderate yellow brown (10YR 5/4); very disturbed; lesser interbedded nannofossil chalk ooze (10YR 8/3) and clayey radiolarian nannofossil marl ooze (10YR 3/4); moderately mottled. 1 cm diameter clay ball at 40 cm.

Clayey radiolarian nannofossil marl ooze, yellowish brown (10YR 4/4), with 0.8 cm diameter manganiferous clay ball.

Nannofossil chalk ooze, grayish orange (10YR 7/3).

Clayey radiolarian nannofossil marl ooze, yellowish brown (10YR 3/4), ferruginous.

Radiolarian nannofossil chalk ooze, moderate yellow brown (10YR 5/4).

Clayey radiolarian nannofossil marl ooze, yellowish brown (10YR 4/4).

Very disturbed interbedded complex, predominantly clayey radiolarian nannofossil marl ooze, moderate yellowish brown (10YR 5/4); lesser radiolarian nanno chalk ooze, marl ooze, and nanno chalk ooze.

0.8 cm diameter manganous clay ball.

Clayey radiolarian nanno marl ooze, yellowish brown (10YR 4/4), ferruginous mottle and mottle of rad nanno chalk ooze.

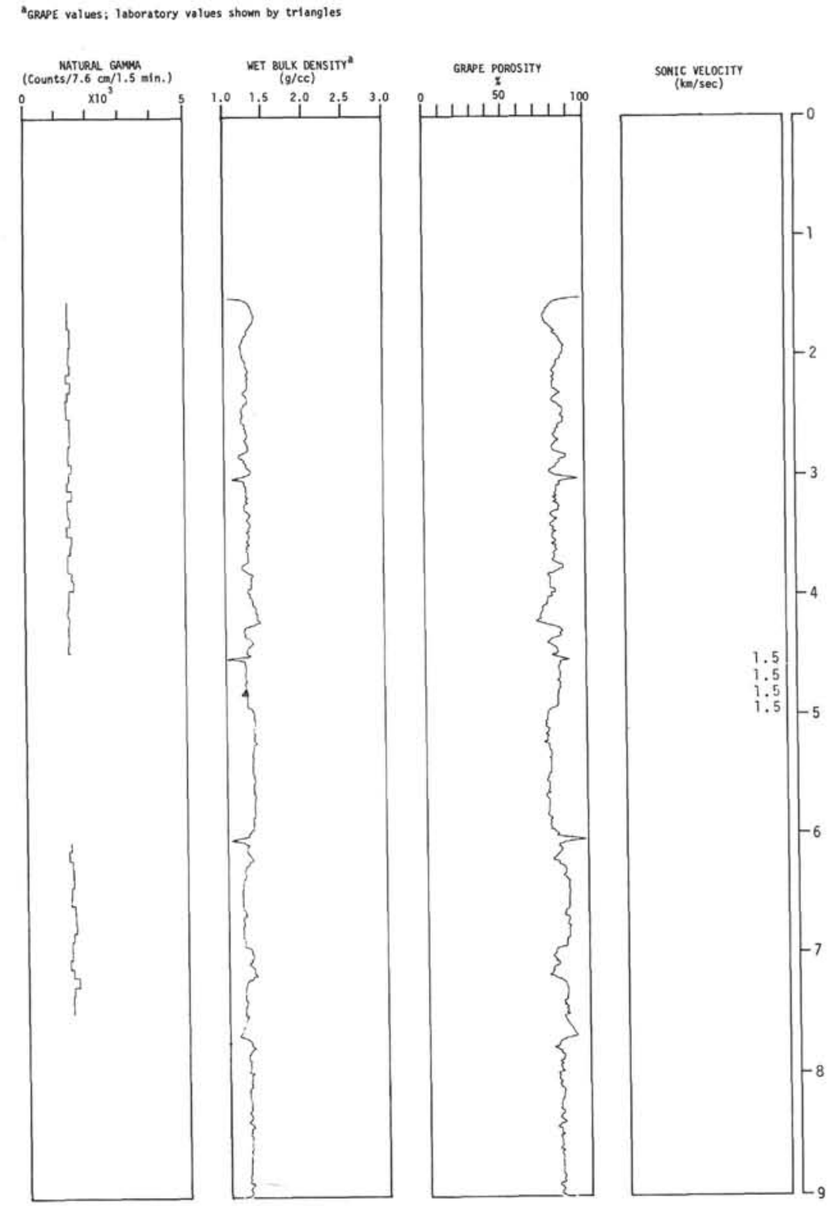
Clayey radiolarian nanno marl ooze, ferruginous, moderate brown (10YR 3/4).

Clayey radiolarian nannofossil marl ooze; mottled admixture of yellowish brown and moderate brown (ferruginous).

Same, predominantly yellowish brown (10YR 4/4).

2 cm diameter gray pumice fragment.
1.5 cm to 0.8 cm diameter pumice fragments in empty end of section.

PHYSICAL PROPERTIES

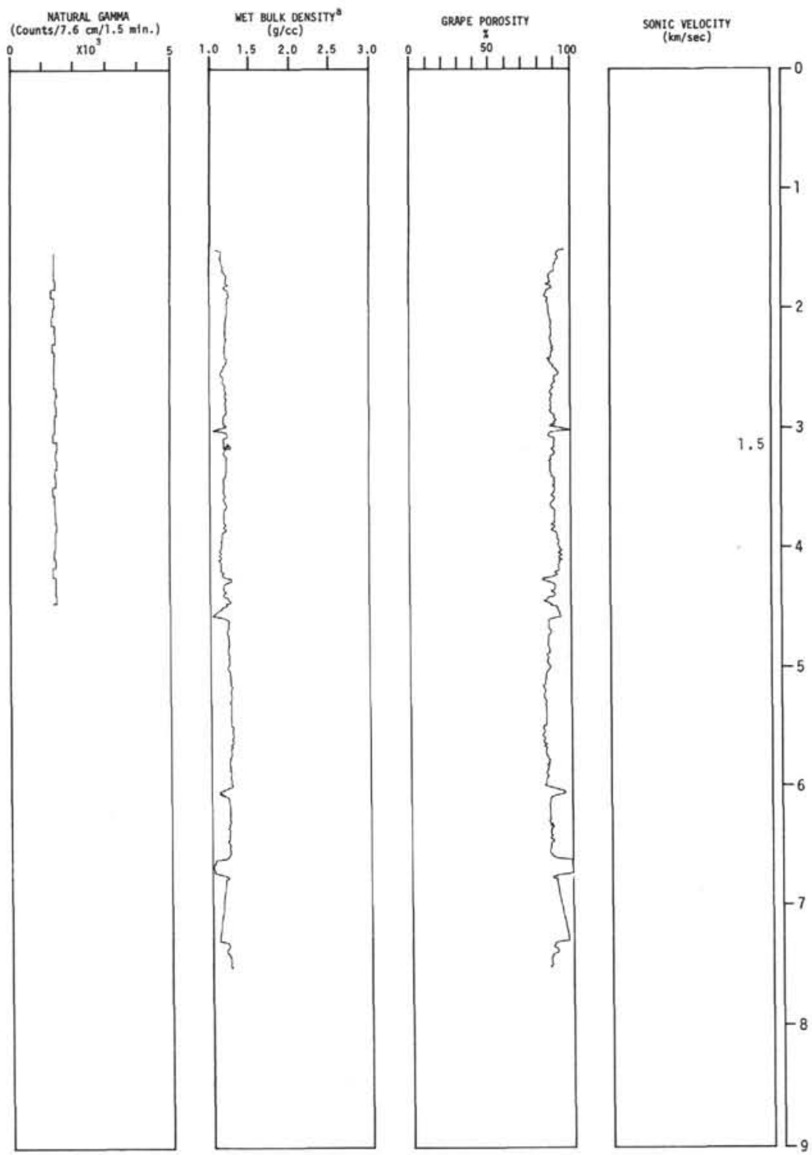


SITE: 162 HOLE: CORE: 10 Cored Interval: 81-90 m

SERIES	AGE / ZONE: Foram	Nanno	Rad	SECTION	LITHOLOGY	DESCRIPTION	MICROFOSSIL Abund/Pres: Foram	Nanno	Rad
MIDDLE EOCENE	—	*Nannotetrina quadrata*	*Podocyrtis mitra*	1	VOID				
				1–2		Clayey radiolarian nannofossil marl ooze, ferruginous, dark yellowish brown (10YR 3/4), with 1.5 x 3 cm lump of nanno chalk ooze.		C M	
								A M	
								A M	
				2		Clayey radiolarian ooze, ferruginous, homogeneous, moderate brown (5YR 3/4).			
				3		Clayey radiolarian nannofossil marl ooze, ferruginous, dark yellowish brown (10YR 3/4).			
				3		Clayey radiolarian ooze, ferruginous, homogeneous.			
				3		Lump of radiolarian nanno marl ooze, dark yellowish brown (10YR 3/4).		A M	
								C P	
				4		Clayey radiolarian nannofossil marl ooze, yellowish brown (10YR 4/4).		C M	
				4		Clayey radiolarian ooze (5YR 3/4).			
				4		Clayey radiolarian nannofossil marl ooze, yellowish brown (10YR 4/4).			
				4–5		Clayey radiolarian ooze, ferruginous, moderate brown (5YR 3/4).			
				5	VOID				
				5		Some clayey radiolarian ooze and nannofossil marl ooze.			
				6	VOID				
				6		Predominantly clayey radiolarian nannofossil marl ooze, yellowish brown (10YR 4/4); minor clayey radiolarian ooze (5YR 3/4); less radiolarian nannofossil chalk ooze (10YR 6/4).			
				CC			C	M	A G

PHYSICAL PROPERTIES

[a]GRAPE values; laboratory values shown by triangles

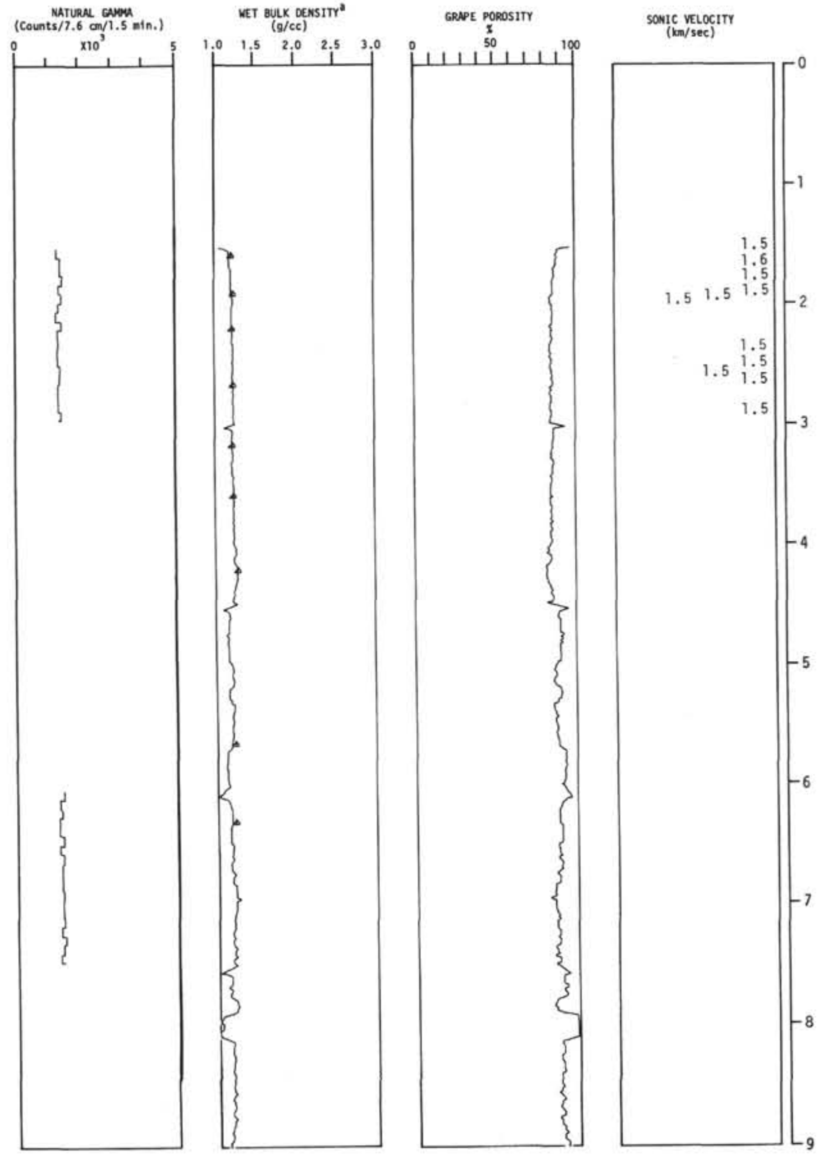


SITE: 162 HOLE: CORE: 11 Cored Interval: 90-99 m

SERIES	Foram	Nanno	Rad	DEPTH (Meters)	SECTION	LITHOLOGY	DESCRIPTION	Foram	Nanno	Rad
MIDDLE EOCENE		*Nannotetrina quadrata*	*Podocyrtis mitra*	0–1.3	1	VOID				
				1.3–2.3	1–2		Clayey radiolarian nannofossil marl ooze, yellowish brown (10YR 4/4), slightly mottled moderate yellow brown (10YR 5/4), dark yellowish brown (10YR 3/4), rarely grayish orange (10YR 7/3).	F	Pd	
			Podocyrtis ampla	4–4.5	3		Radiolarian nannofossil chalk ooze, moderate yellow brown (10YR 5/4), moderately mottled yellowish orange (10YR 6/4) and yellowish brown (10YR 4/4).	C	M	A G
				5–6	4		Clayey radiolarian nanno marl ooze, dark yellowish brown (10YR 3/4). Radiolarian nanno chalk ooze, moderate yellow brown, minor dark yellow brown (10YR 3/4) mottling.			
				6–6.5	4–5		Clayey radiolarian nannofossil marl ooze, dark yellowish brown where more ferruginous, yellowish brown elsewhere; moderately mottled yellowish and grayish orange.			
				7	5		3 cm diameter pumice fragment.	C	P	A G
				7.5–9	6					
					CC			C	P	A G

PHYSICAL PROPERTIES

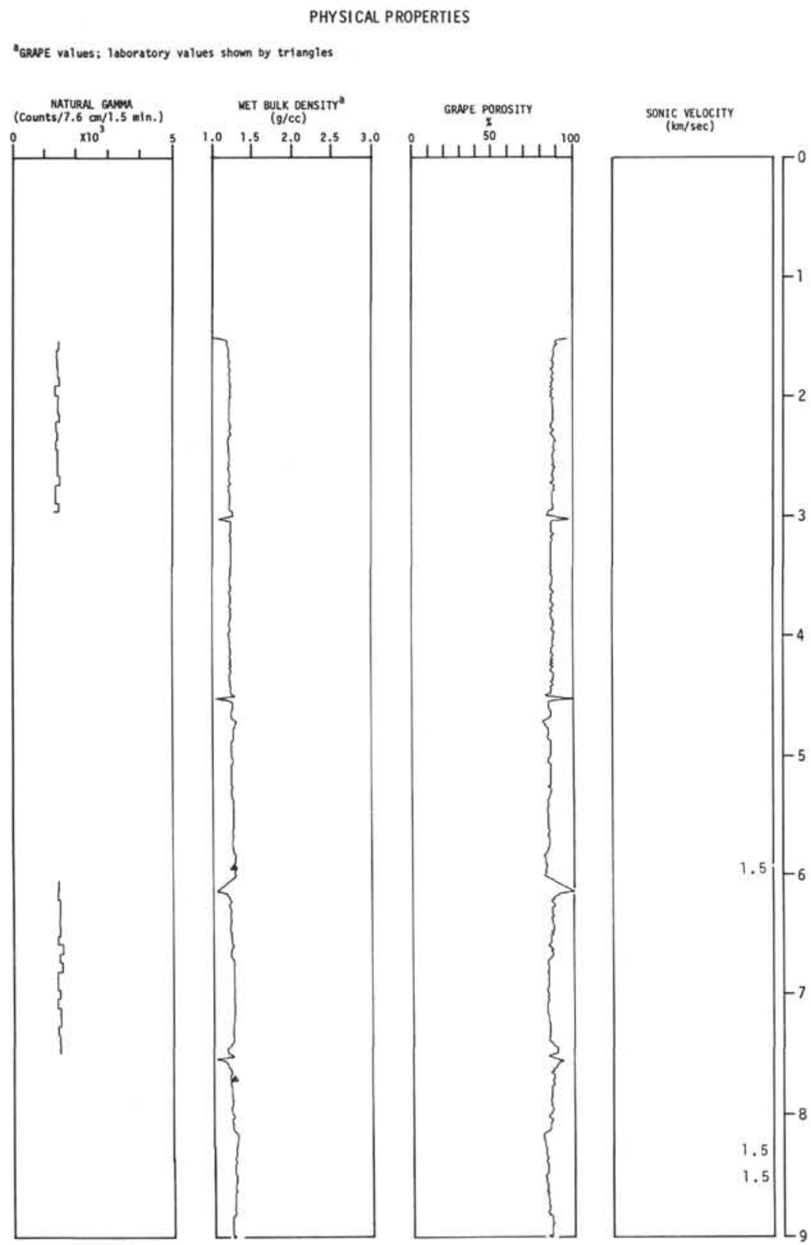
[a]GRAPE values; laboratory values shown by triangles



SITE: 162 HOLE: CORE: 12 Cored Interval: 99-108 m

SERIES	AGE ZONE: Foram	Nanno	Rad	DEPTH (Meters)	SECTION	LITHOLOGY	Disturbance	Smear Slide	Paleo. sample	DESCRIPTION	MICROFOSSIL Abund/Pres: Foram	Nanno	Rad
MIDDLE EOCENE	—	*Nannotetrina quadrata*	*Podocyrtis ampla* / *Thyrsocyrtis triacantha*	0–9	1, 2, 3, 4, 5, 6, CC	VOID (Section 1)		*	*	Clayey radiolarian nannofossil marl ooze, ferruginous; dark yellowish brown (10YR 3/4) with lesser yellow brown (10YR 4/4). Empty; was filled with drill rust and pumice fragments. Clayey radiolarian nannofossil marl ooze, yellow brown (10YR 4/4), with lesser moderate and dark yellow brown (10YR 5/4 and 10YR 3/4); mostly badly homogenized; where less disturbed, slightly mottled.	C / F / C / A	P / P / M / M	A G / A G / A G

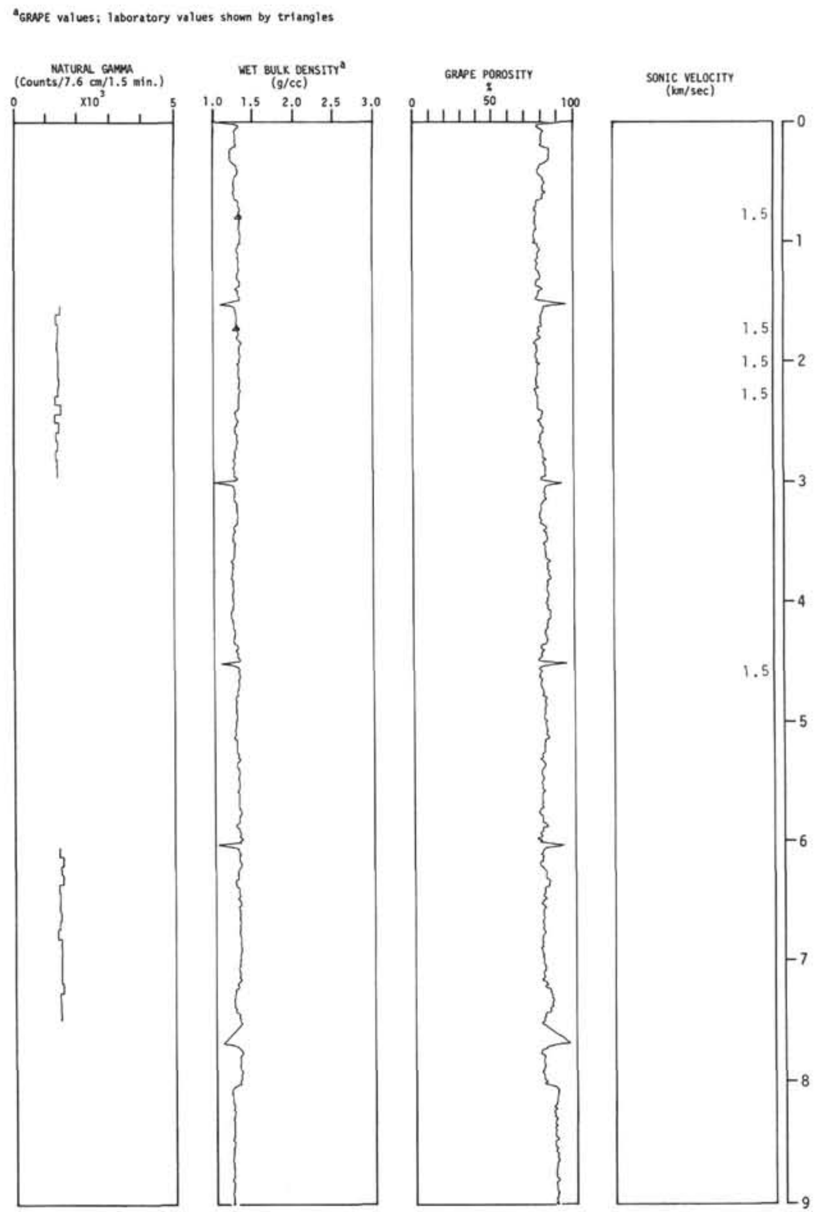
% CaCO3: 0, 50, 100



SITE: 162 HOLE: CORE: 13 Cored Interval: 108-117 m

SERIES	AGE ZONE Foram	Nanno	Rad	DEPTH (Meters)	SECTION	Disturbance / Smear Slide / Paleo. sample	DESCRIPTION	MICROFOSSIL Abund/Pres Foram	Nanno	Rad
MIDDLE EOCENE	—	*Nannotetrina quadrata*	*Thyrsocyrtis triacantha*	0–1.5	1		Radiolarian nannofossil chalk ooze, dominant moderate yellow brown (10Y 5/4) with lesser yellowish orange (10Y 6/4) and minor yellowish brown (10Y 4/4); moderately mottled.			
				1.5–3	2				C Pd	
				3–4.5	3		Clayey radiolarian nannofossil marl ooze, yellowish brown (10YR 4/4); moderately mottled moderate yellowish brown (10YR 5/4); in places dark yellowish brown (10YR 3/4) where ferruginous content is greater.		A M	
				4.5–6	4		Disturbed beds and lumps, 10YR 3/4. Radiolarian nannofossil chalk ooze, moderate yellowish brown (10YR 5/4), with very disturbed yellowish orange (10YR 6/4) and dark yellowish brown (10YR 3/4) interbeds.			
				6–7.5	5		Clayey radiolarian nannofossil marl ooze, dark yellowish brown (10YR 3/4), grading downward to yellowish brown (10YR 4/4) by top of section 5. Minor disturbed 10YR 3/4 lump. Radiolarian nannofossil chalk ooze, moderate yellow brown (10YR 5/4); large lump of ferruginous clayey rad marl ooze near top and 4 mm lamina of same at 20 cm from top of section 6.		A M	
				7.5–9	6		Clayey radiolarian ooze, ferruginous, with very small mod. yellow brown laminae, very disturbed, moderate brown (5YR 3/4).			
					CC				A M	A G

PHYSICAL PROPERTIES

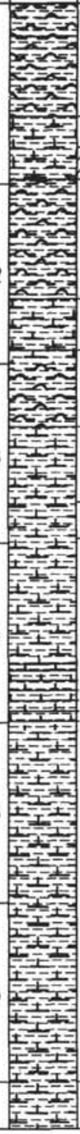


SITE: 162 HOLE: CORE: 14 Cored Interval: 117-126 m

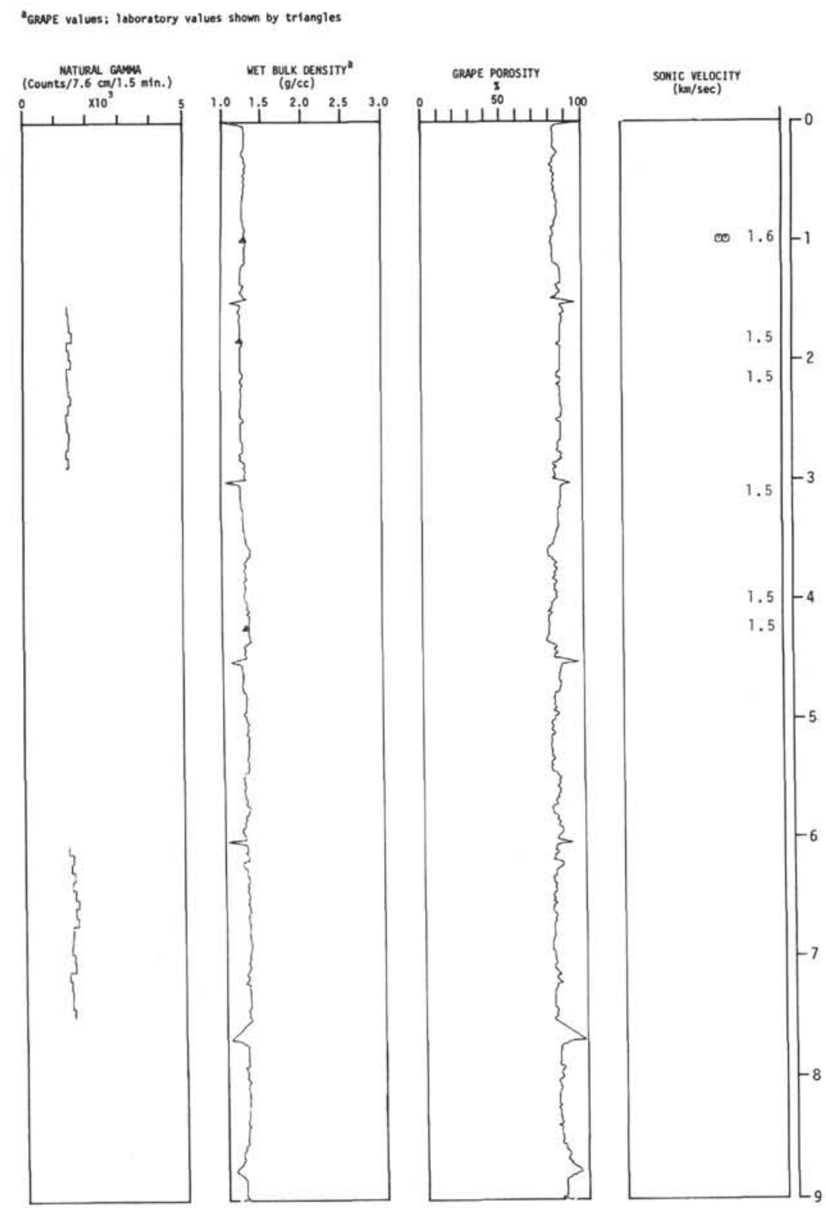
SERIES: MIDDLE EOCENE

AGE / ZONE: Foram: — ; Nanno: *Nannotetrina quadrata*; Rad: *Thyrsocyrtis triacartha*

DEPTH (Meters) / SECTION	DESCRIPTION	MICROFOSSIL Abund/Pres
Section 1	Clayey radiolarian ooze, grayish brown (5YR 3.5/2), ferruginous; intensely mottled dark yellowish brown (10YR 3/2) and pale yellow brown (10YR 6/2). Very badly deformed clayey radiolarian ooze and marly interbeds, dark yellowish brown (10YR 3/2, 10YR 3.5/2), pale yellow brown (10YR 6/2). Top 10 cm contains a dusky brown (10YR 2/2), very ferruginous and possibly manganous layer.	Nanno C P
Section 2	Clayey radiolarian nannofossil marl ooze, yellow brown (10YR 4/4), slightly mottled dusky brown (10YR 2/4) and moderate yellow brown (10YR 5/4). Black nodule or clay ball. Clayey radiolarian ooze, very ferruginous (manganous?), dusky brown (10YR 2/2); slightly mottled moderate yellow brown (10YR 5/4). Clayey radiolarian nannofossil marl ooze, yellow brown (10YR 4/4); one 10 cm lump of clayey rad nanno marl ooze (10YR 5/4), on 15 cm lump of ferrufinous rad ooze (10YR 2/2).	
Section 3	Intricately mottled ferruginous clayey radiolarian nanno marl ooze (10YR 3/4) and radiolarian nanno chalk ooze (10YR 3/4). Clayey radiolarian ooze, very ferruginous (manganous?), dusky brown (10YR 2/2), slightly mottled moderate yellow brown (10YR 5/4). Predominantly clayey radiolarian nannofossil marl ooze, yellowish brown (10Y 4/4); subordinate dark yellow brown (10Y 5/2) and dusky yellow brown (10Y 2/2) ferruginous radiolarian ooze, minor moderate yellow brown (10YR 5/4); where undisturbed, moderately to intensely mottled; however, most homogenized or badly deformed.	Nanno C M; Rad A G
Section 4	Radiolarian nannofossil chalk ooze, moderate yellow brown and yellow brown (10YR 5/4, 10YR 6/4), intensely mottled. Predominantly clayey radiolarian nannofossil marl ooze, yellowish brown (10YR 4/4), intensely mottled where undisturbed; however, much is very deformed and mingles and alternates complexly with radiolarian nanno chalk ooze (10YR 6/4, 10YR 5/4), lesser clayey radiolarian ooze (10YR 2/4).	
Section 5		Nanno C M
Section 6	Two 0.5 cm diameter black manganous(?) lumps.	
CC		Nanno A M



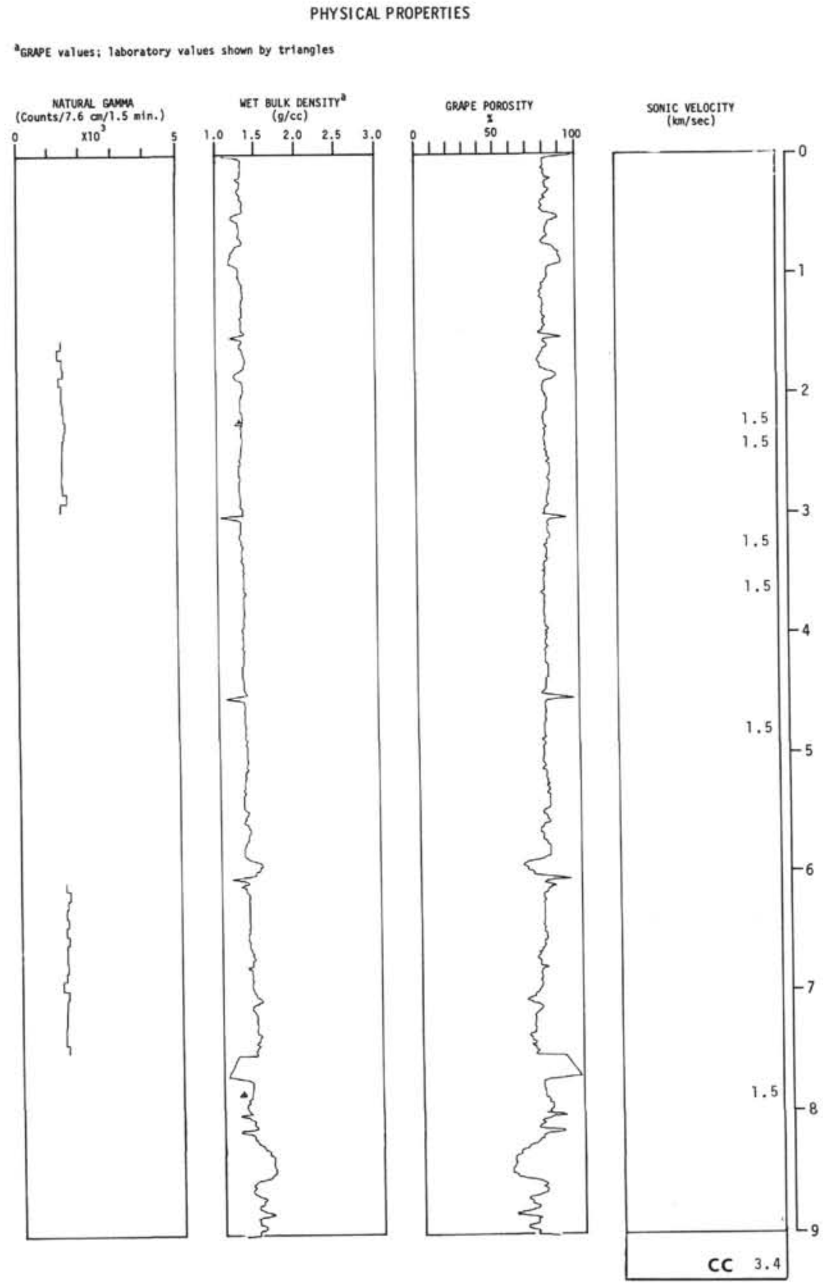
PHYSICAL PROPERTIES



SITE: 162 HOLE: CORE: 15 Cored Interval: 126-135 m

SERIES	AGE / ZONE: Foram	AGE / ZONE: Nanno	AGE / ZONE: Rad	DEPTH (Meters)	SECTION	Smear Slide	Paleo. sample	DESCRIPTION	MICROFOSSIL Abund/Pres (Foram, Nanno, Rad)
MIDDLE EOCENE	—	*Nannotetrina quadrata*	*Theocampe mongolfieri*	0	1		*	Clayey radiolarian nannofossil marl ooze, predominantly yellow brown (10YR 4/4), lesser dark yellowish brown where more ferruginous.	A M A G
				1	1	*	*	Radiolarian nannofossil chalk ooze, yellowish orange (10YR 6/4) and moderate yellow brown (10YR 5/4).	? ?
				2	2	*		Clayey radiolarian nannofossil marl ooze, intensely mottled dark yellowish brown (10YR 3/4), yellowish brown (10YR 4/4), moderate yellow brown (10YR 5/4), and yellowish orange (10YR 6/4); dominant colors as indicated; becoming radiolarian chalk oozes in section 5. 4 black clay balls about 0.5 cm diameter (10YR 4/4).	
				3	3			10YR 5/4.	
				4	3		*	10YR 4/4. 10YR 5/4.	A M A G
					3			10YR 4/4.	
				5	4	*	*	0.5 cm Mu nodule in 10YR 7/3 mottle.	C M
					4	*		10YR 3/4.	
				6	4	*		10YR 5/4. 10YR 4/4. 10YR 5/4.	
					5			10YR 6/4, 10YR 5/4 (verging into rad chalk oozes).	
				7	5		*		A M A G
					6	*		10YR 4/4. 10YR 3/4. 10YR 6/4.	
				8	6	*		10YR 4/4. Small angular chert fragments, 10YR 5/2, 10YR 4/2.	
					6			10YR 4/4 and 10YR 5/4.	
				9	CC		*	8 cm of chert, conchoidal, porcellaneous, brownish black (10YR 2/1); some fragments contain 10YR 5/2 laminae or mottles.	A M A G

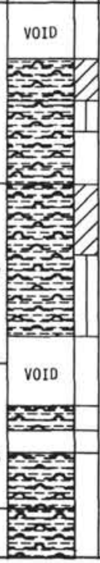
PHYSICAL PROPERTIES



SITE: 162 HOLE: CORE: 16 Cored Interval: 135-144 m

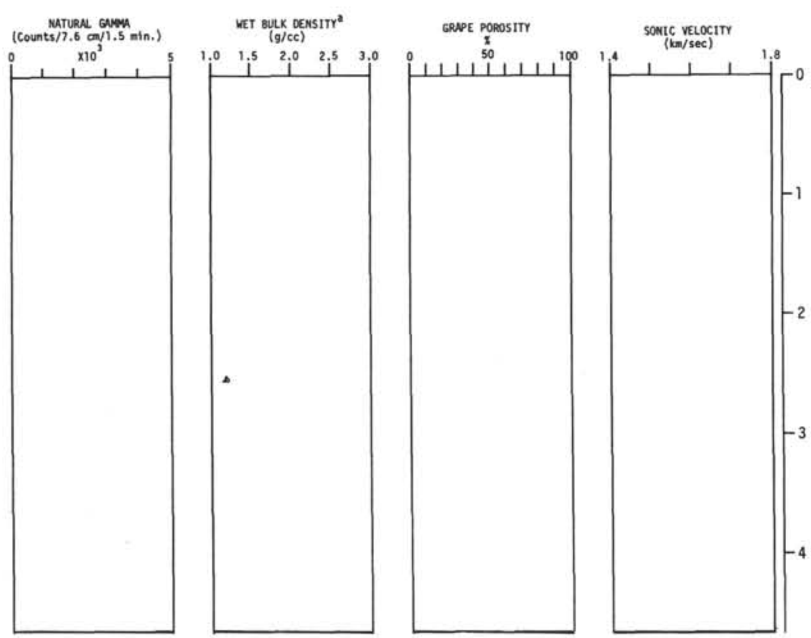
SERIES	AGE ZONE: Foram	Nanno	Rad	DEPTH (Meters)	SECTION	LITHOLOGY	Disturbance	Smear Slide	Paleo. sample	DESCRIPTION	MICROFOSSIL Abund/Pres: Foram	Nanno	Rad
MIDDLE EOCENE	—	? *Discoaster sublodoensis*	*Theocampe mongolfieri*	0–1	1	VOID		* *	**	Clayey radiolarian ooze to radiolarite, (fairly well indurated dusky brown (10YR 2/2), lesser grayish brown (10YR 3/2). Minor admixtures of clayey radiolarian nannofossil marl, yellowish brown (10YR 4/4), yellowish orange (10YR 6/4). 2 x 4 x 4 cm conchoidally angular fragment of black porcellaneous chert. 7 to 20 cm alternations of 10YR 2/2 and 10YR 3/2.	F C	P Pd	A G
				2	2			*	*	Same radiolarian ooze to radiolarite, dusky yellowish brown (10YR 3/2, 10YR 2/2) to grayish brown (5YR 3/2). Fragments of black porcellaneous chert, largest 3 x 4 x 6 cm.	—	—	
				3–4	3	VOID			*	Same radiolarian ooze to radiolarite, dusky brown (5Y 2/2) to brownish black (5Y 2/1). Same, dusky brown (5Y 2/2, 5Y 2/4). 1 cm mottle, yellowish orange.			A G
					CC				* *		—	—	A G

% $CaCO_3$: 0, 50, 100



PHYSICAL PROPERTIES

[a]GRAPE values; laboratory values shown by triangles



SITE: 162 HOLE: CORE: 17 Cored Interval: 144-153 m

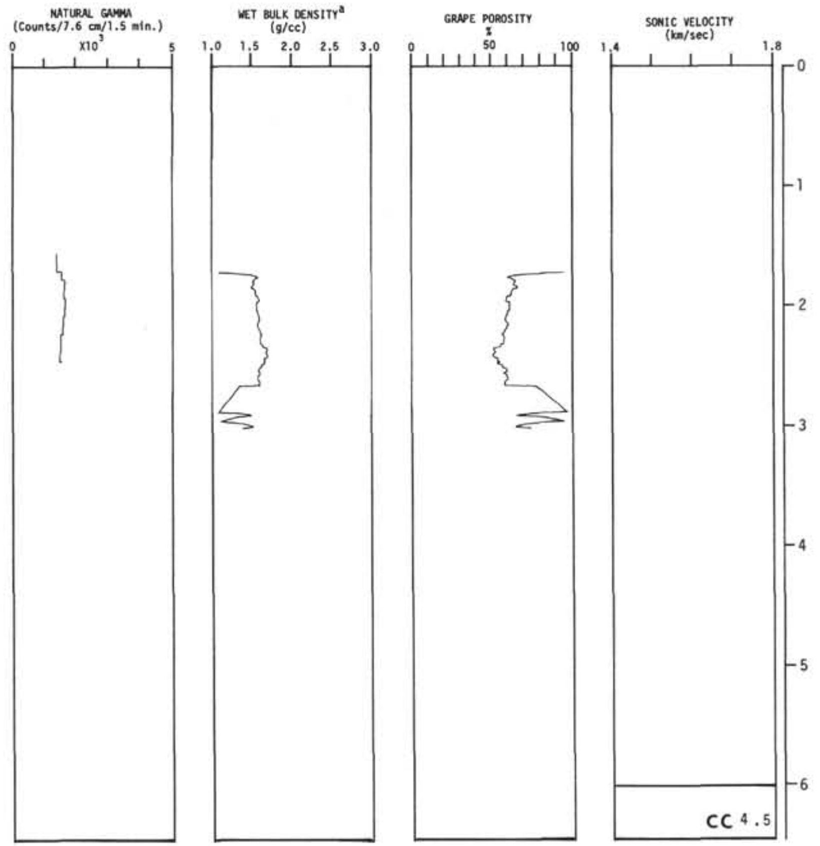
SERIES	AGE / ZONE: Foram	Nanno	Rad	DEPTH (Meters)	SECTION	LITHOLOGY	DESCRIPTION	MICROFOSSIL Abund/Pres: Foram	Nanno	Rad
MIDDLE EOCENE		*Discoasteroides kuepperi*	*Theocampe mongolfieri*	0–1	1		Ferruginous clay, dusky brown (5YR 2/2) contains zeolite at 62 cm, abundant feldspar, dark and light glass in acid-treated coarse fraction from 75-78 cm.			
							Wedge-shaped dark yellowish brown (10YR 3/4) zone with 2 mm thick yellowish orange streak and 5 to 8 mm olive streak of ferruginous clayey nannofossil marl.		C P / A Pd	F M
				1		VOID				
							Ferruginous clay, dark yellowish brown (10YR 4/4) to brownish black (10YR 3/2).		A Md	
						VOID				
				2	2		Ferruginous clay, dark to dusky brown (10YR 4/4, 10YR 3/4, 10YR 3/2).			
							Same, rhythmic graded alternations of 10YR 3/2, 10YR 3/4, 10YR 4/4 in layers several to 15 mm thick.			
							Same, 10YR 4/4, 10YR 3/2, 10YR 3/4, disturbed.		A P	R P
						VOID	Acid-treated coarse fraction contains abundant dark glass and palagonite.			
				3			Same ferruginous clay, disturbed.			
					3	VOID				
				4			Abundant dark glass with lesser palagonite, light glass and feldspar.			R P
				5	4	VOID				
							Mottled clayey nannofossil marl, yellowish and dark yellowish brown (10YR 4/4, 10YR 3/4).		A M / A M	
				6			Ferruginous nannofossil chalk ooze with common foraminifera, yellowish brown (10YR 4/4).		A M	
					CC			A M	A M / A Mc	C M

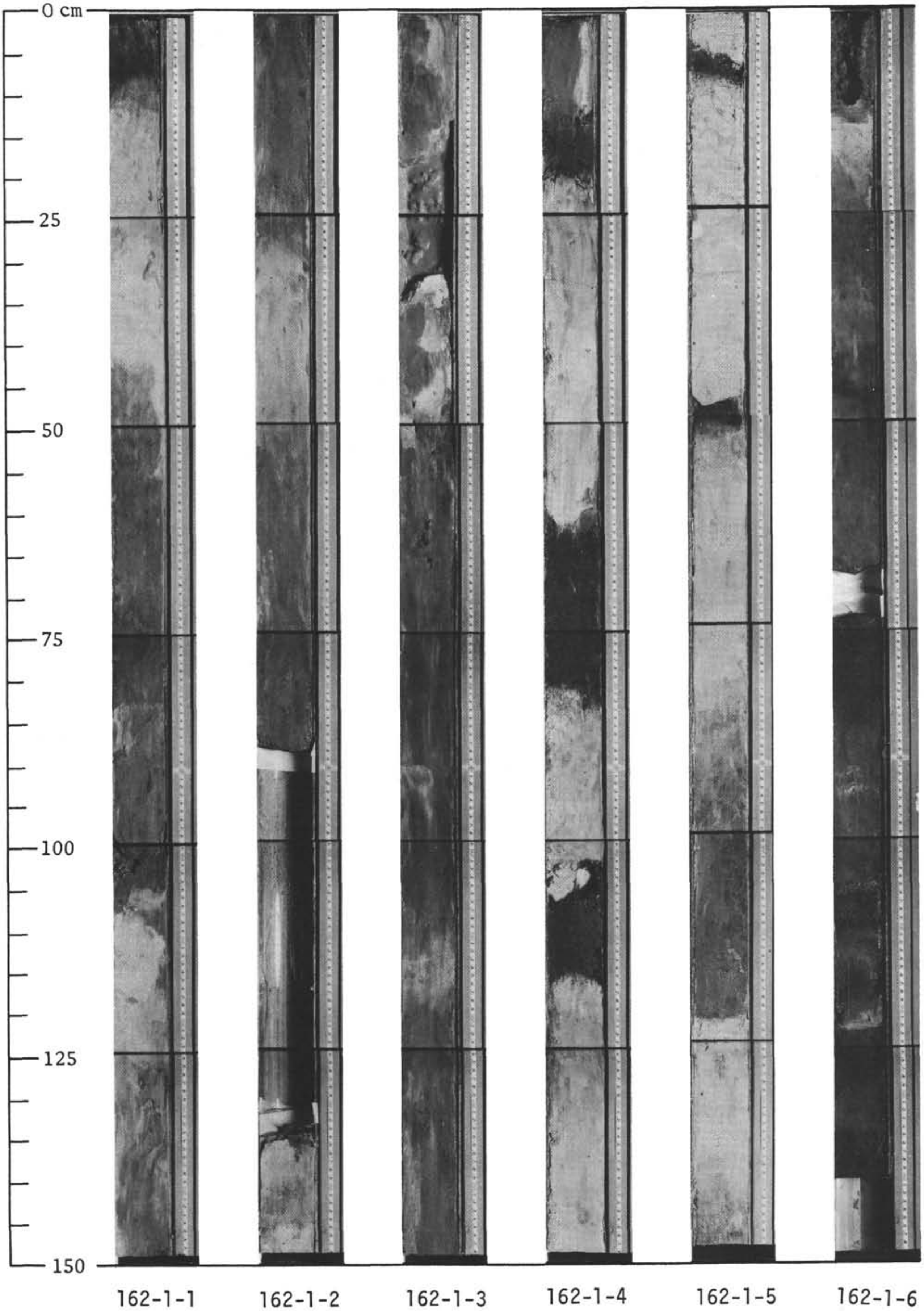
% $CaCO_3$: 0 50 100

Smear Slide: * (2)

PHYSICAL PROPERTIES

[a]GRAPE values; laboratory values shown by triangles

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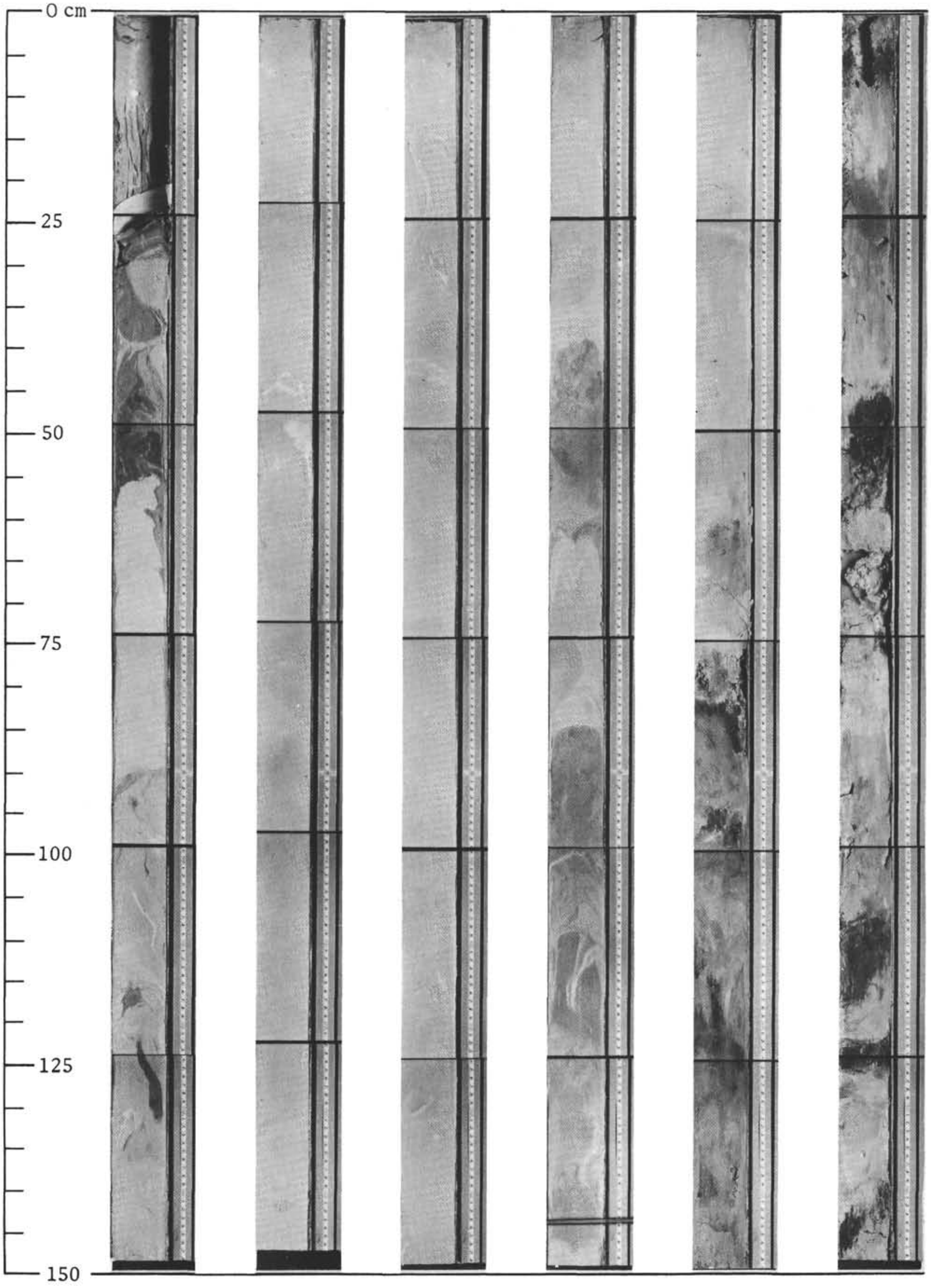
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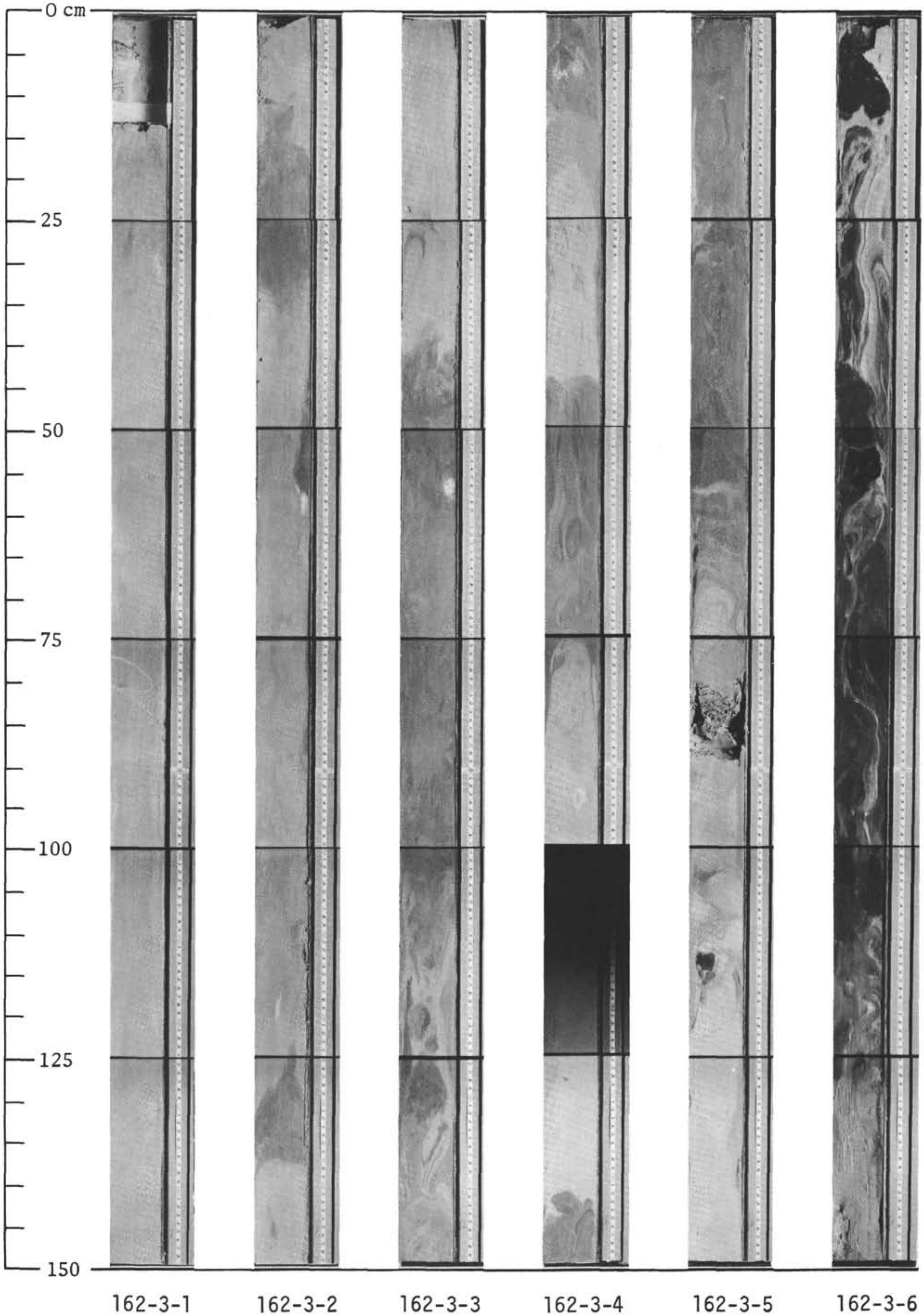
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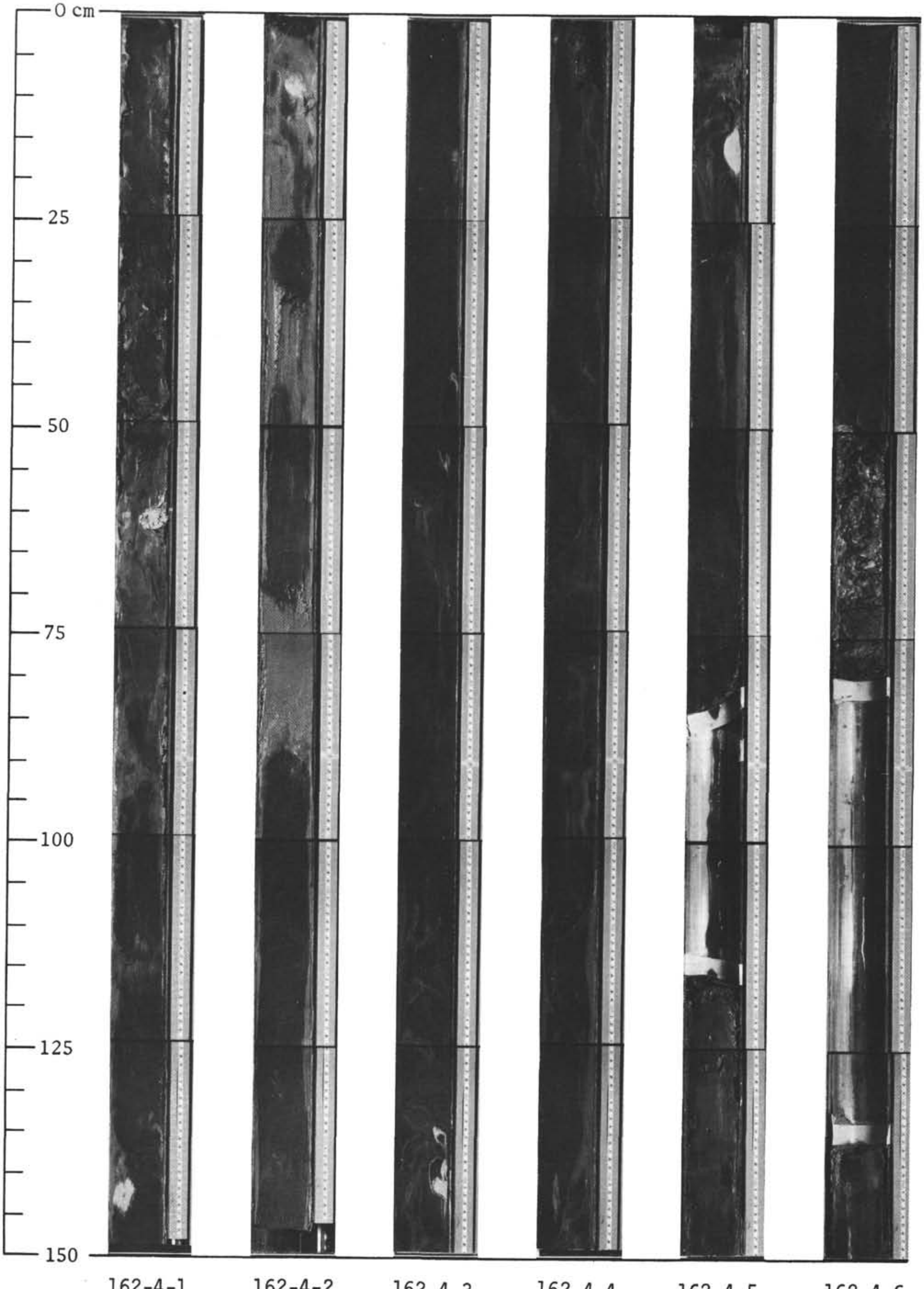
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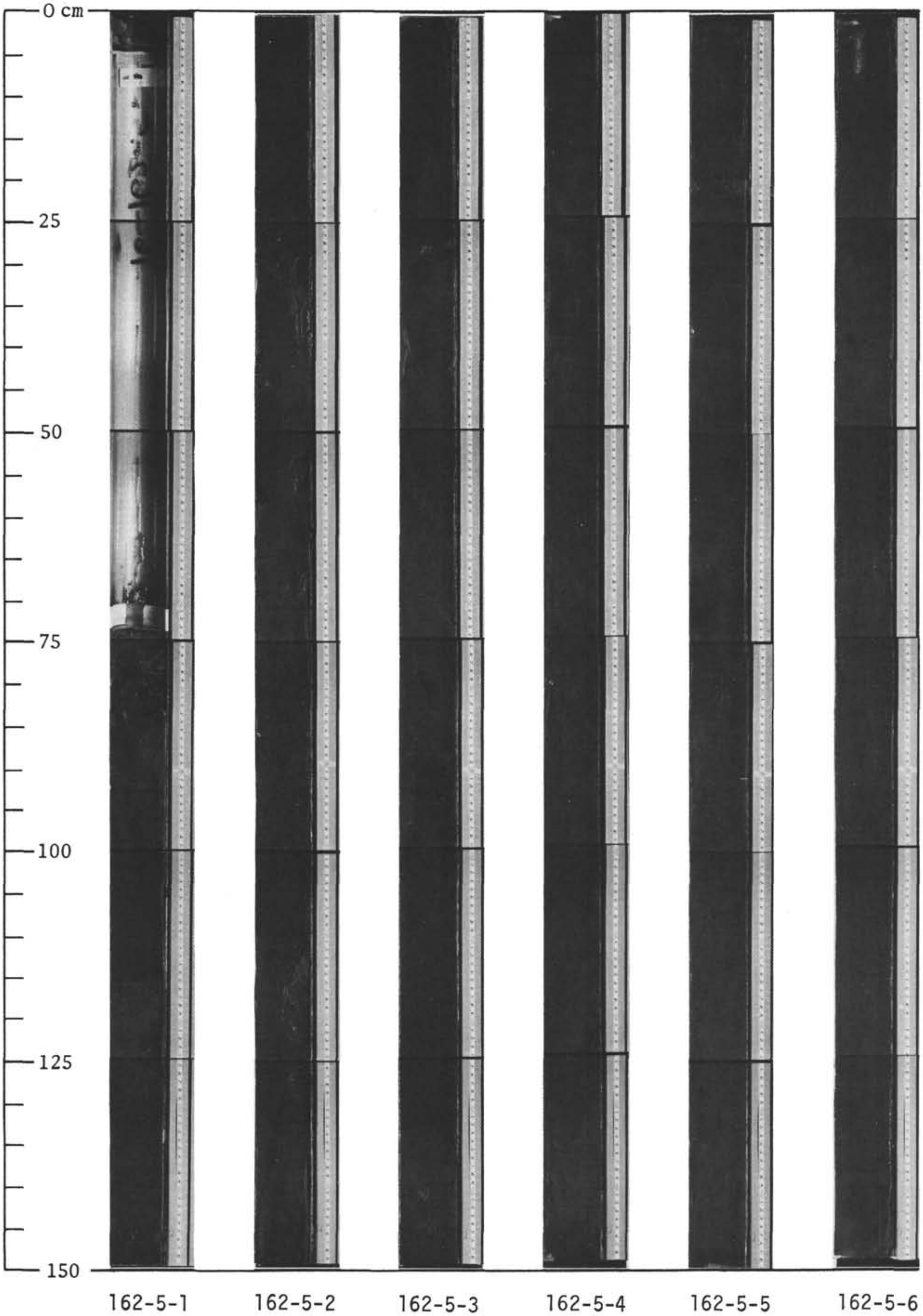
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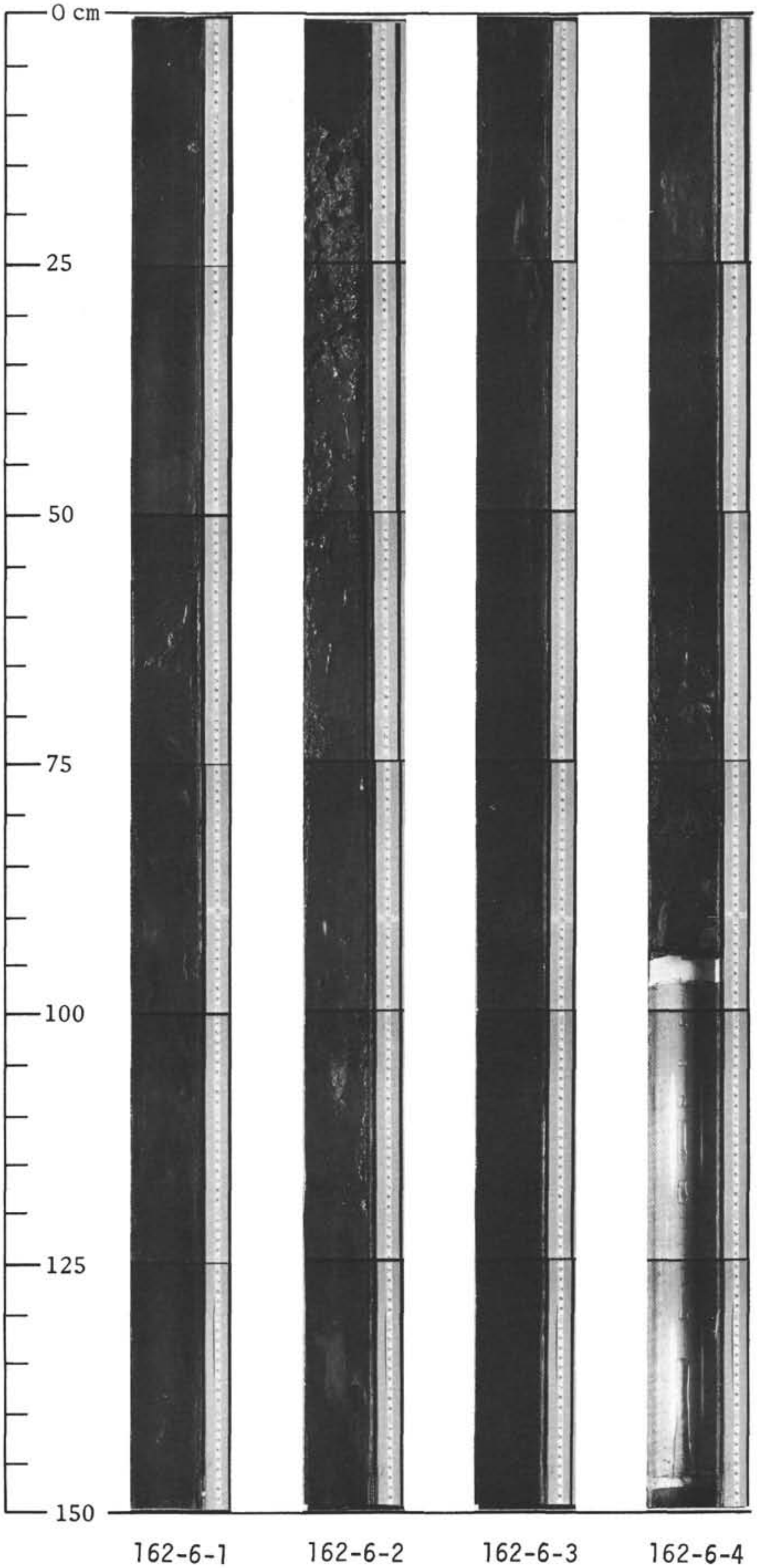
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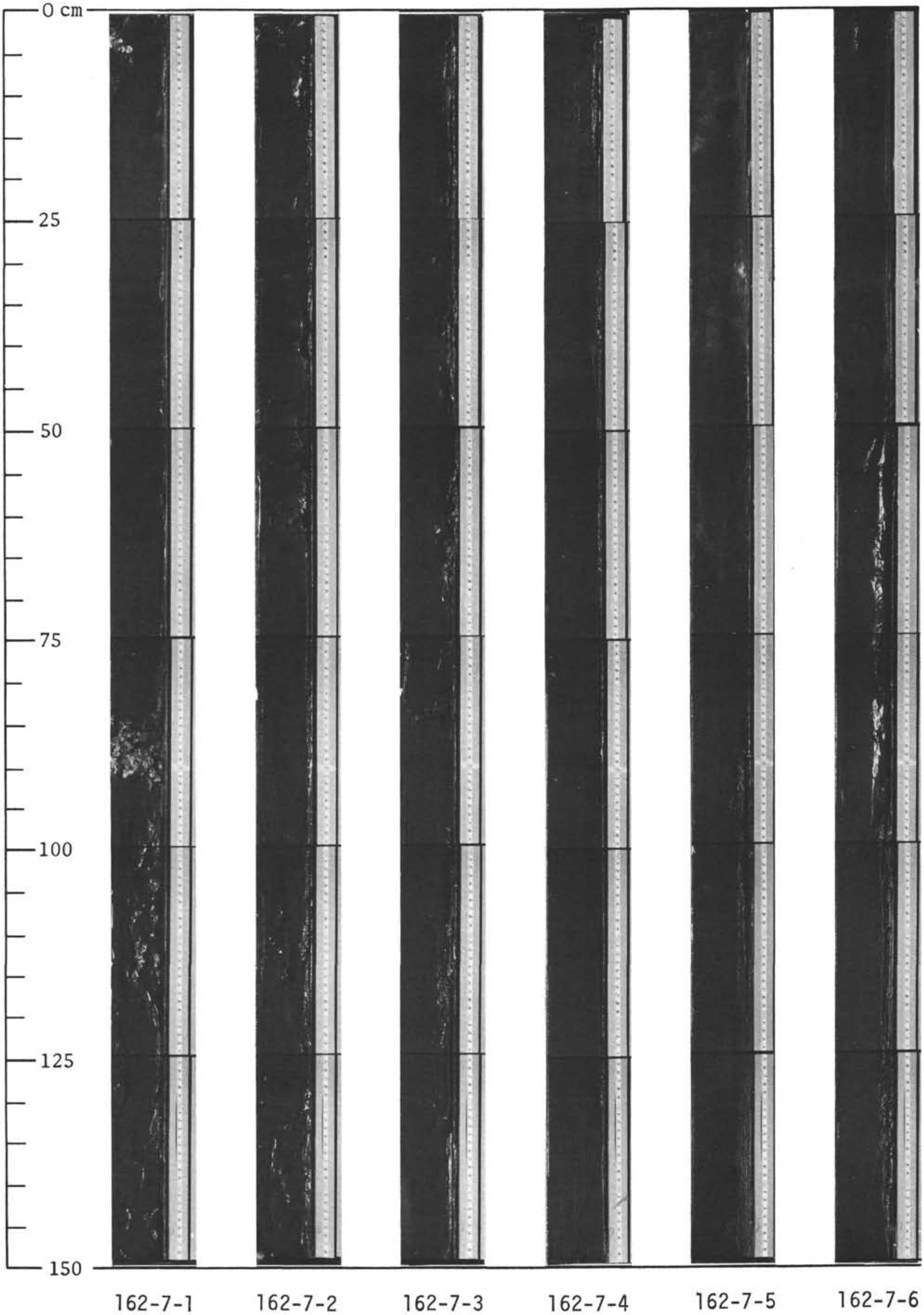
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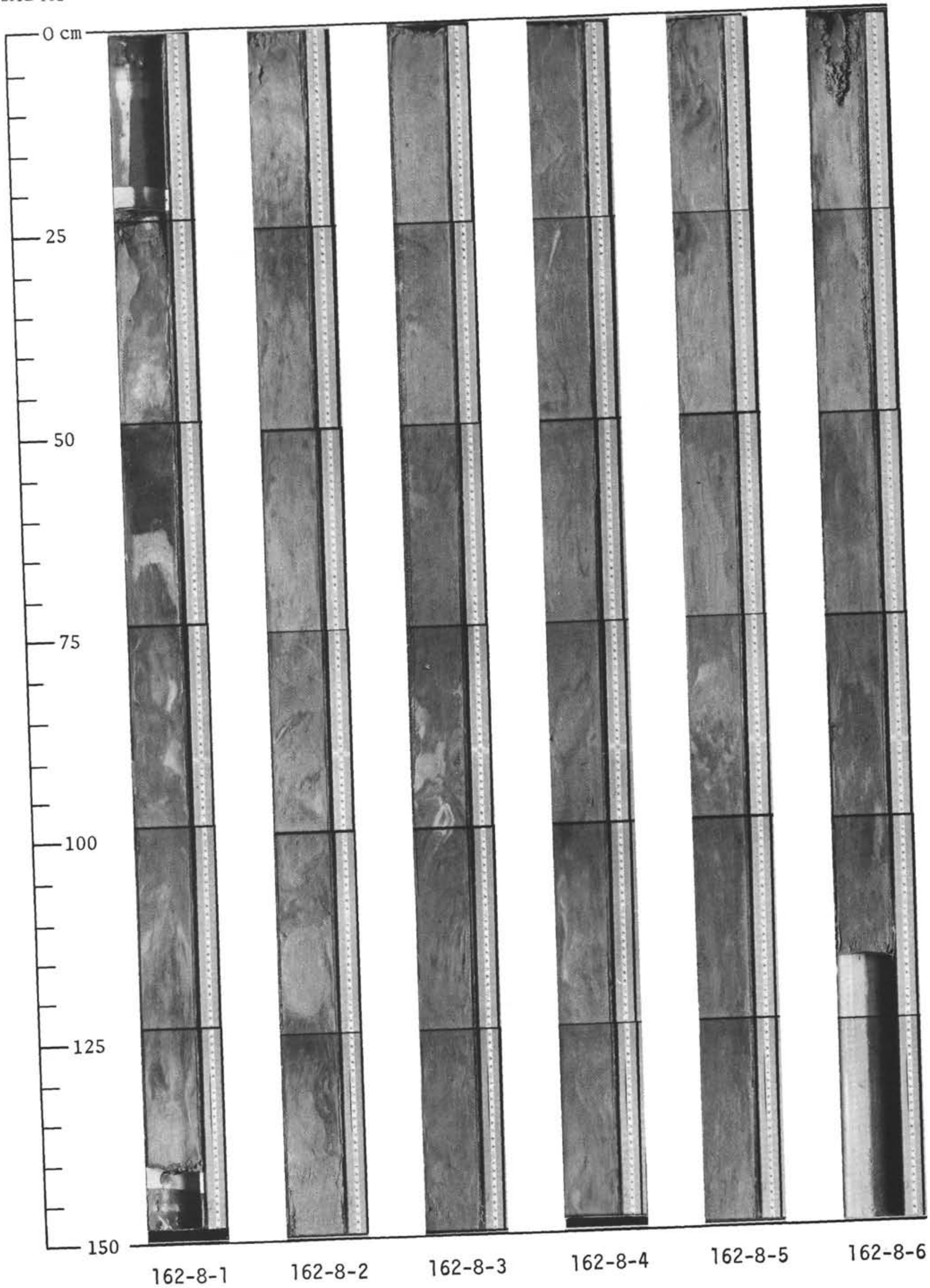
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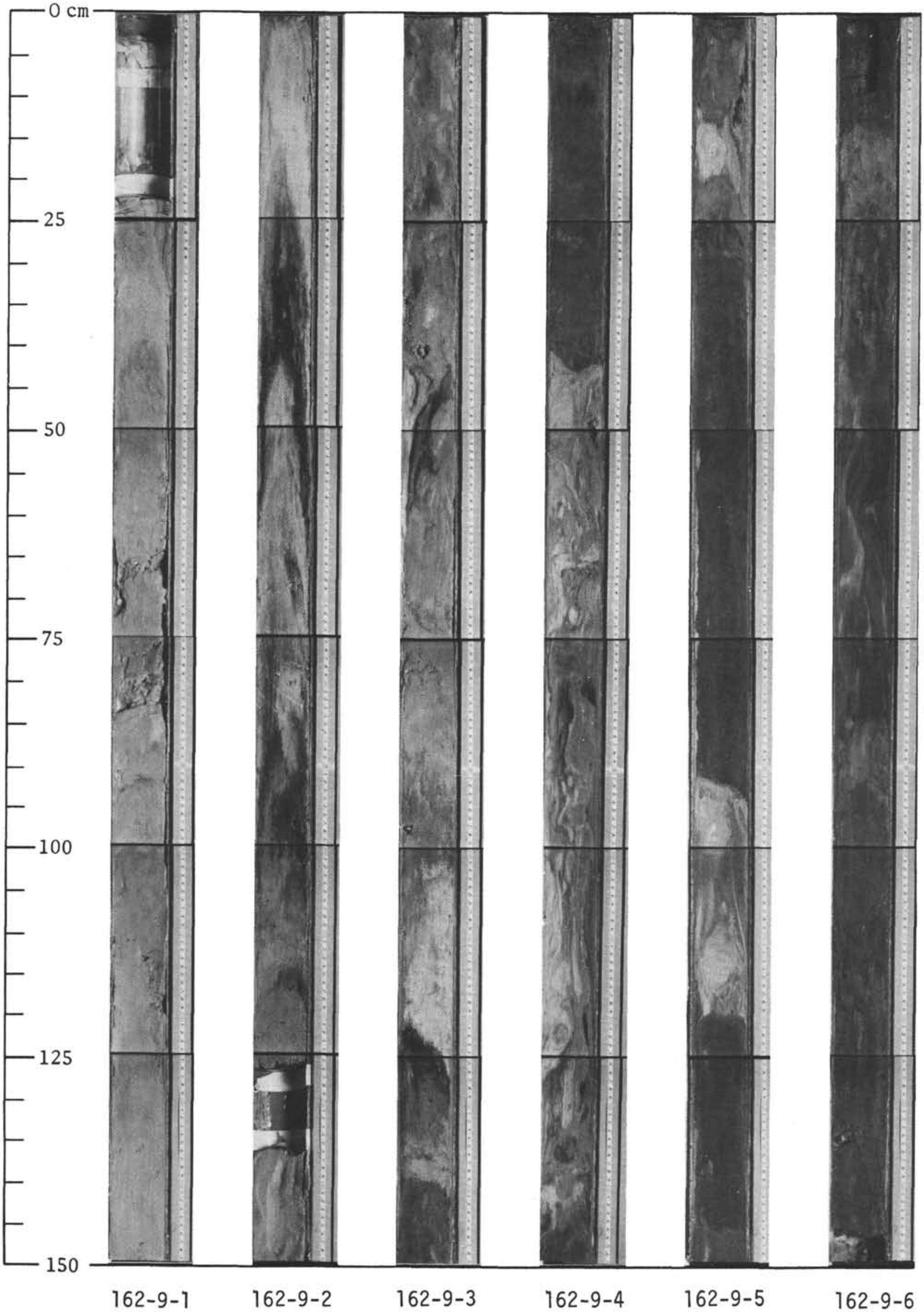
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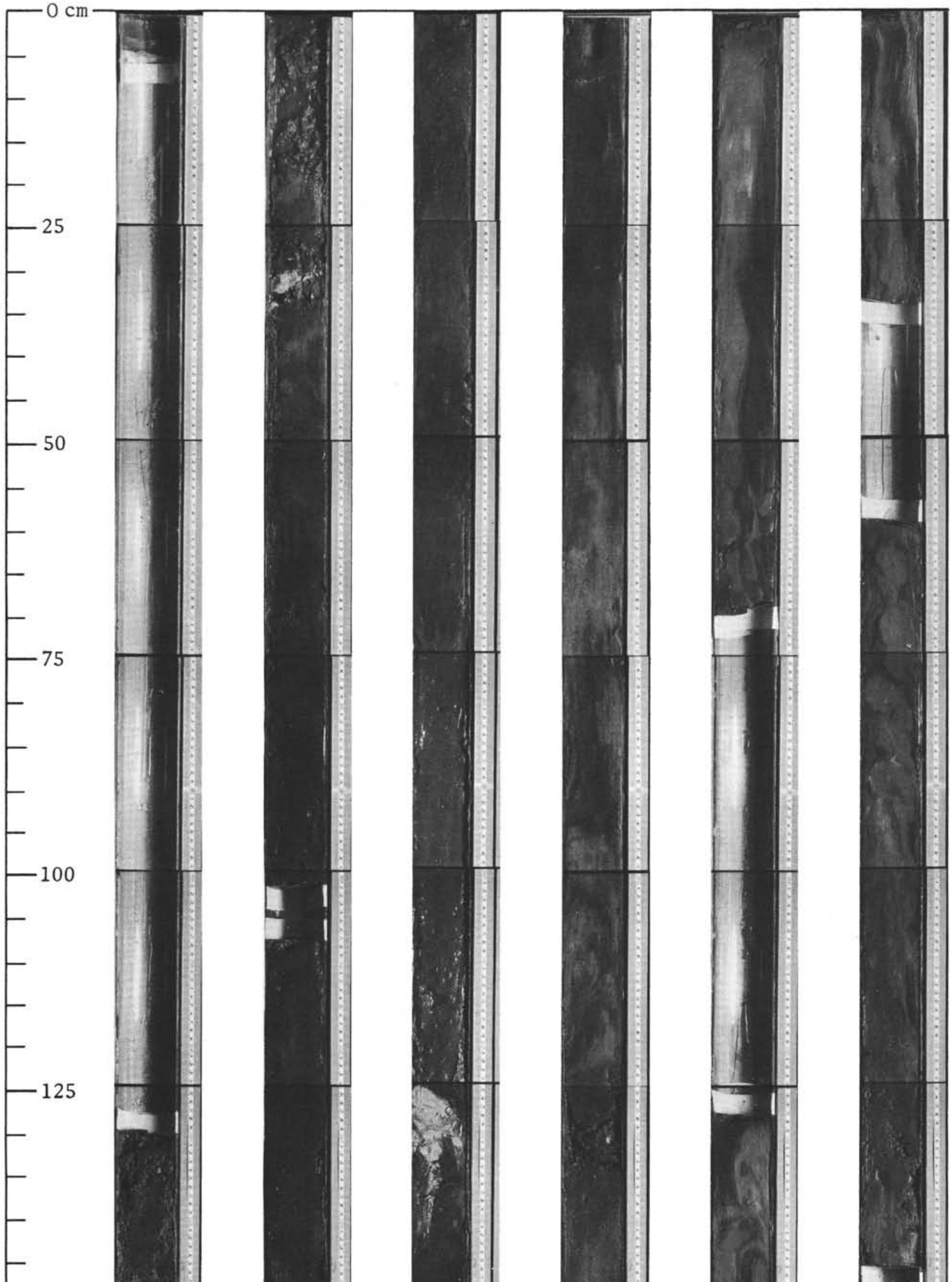
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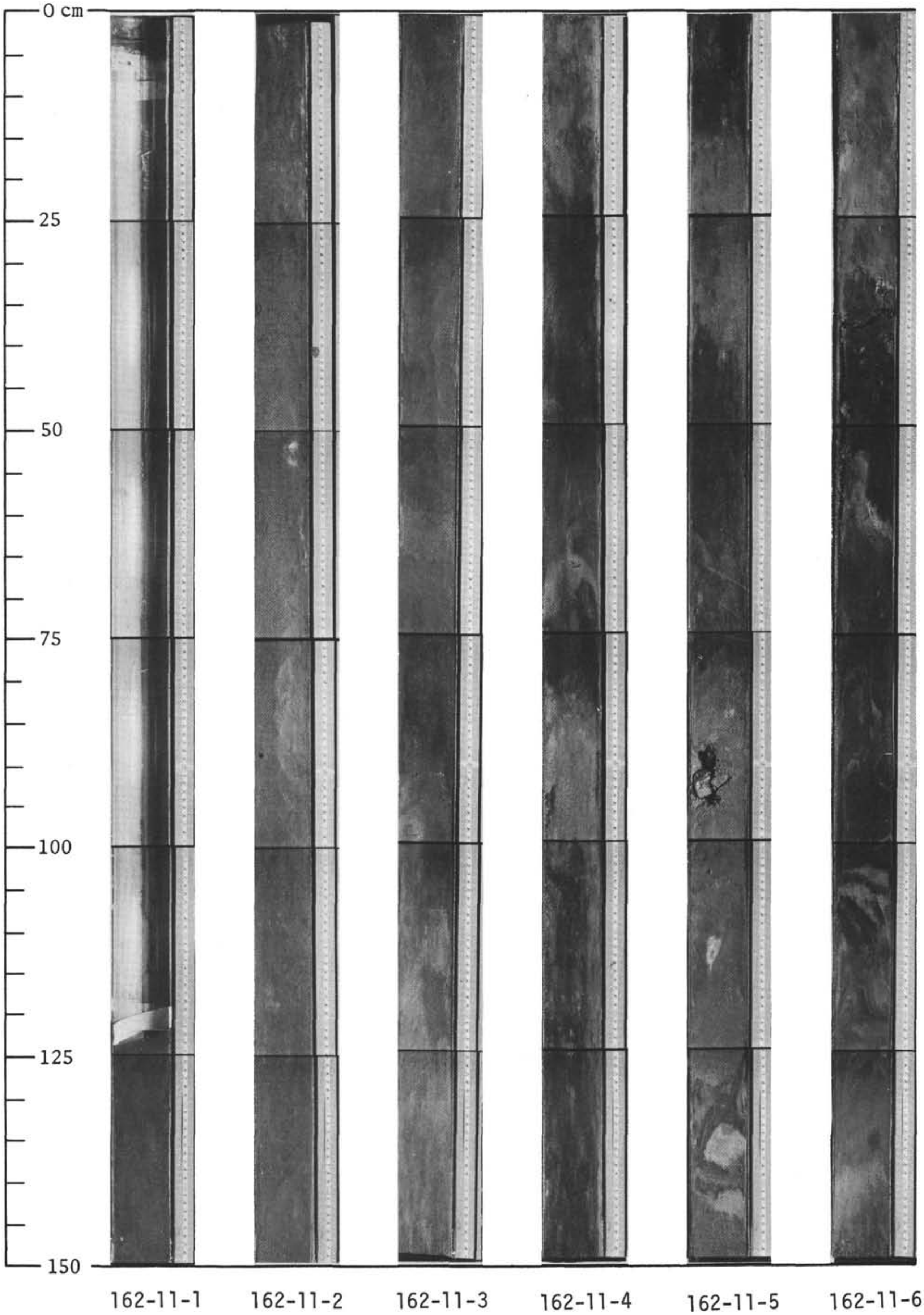
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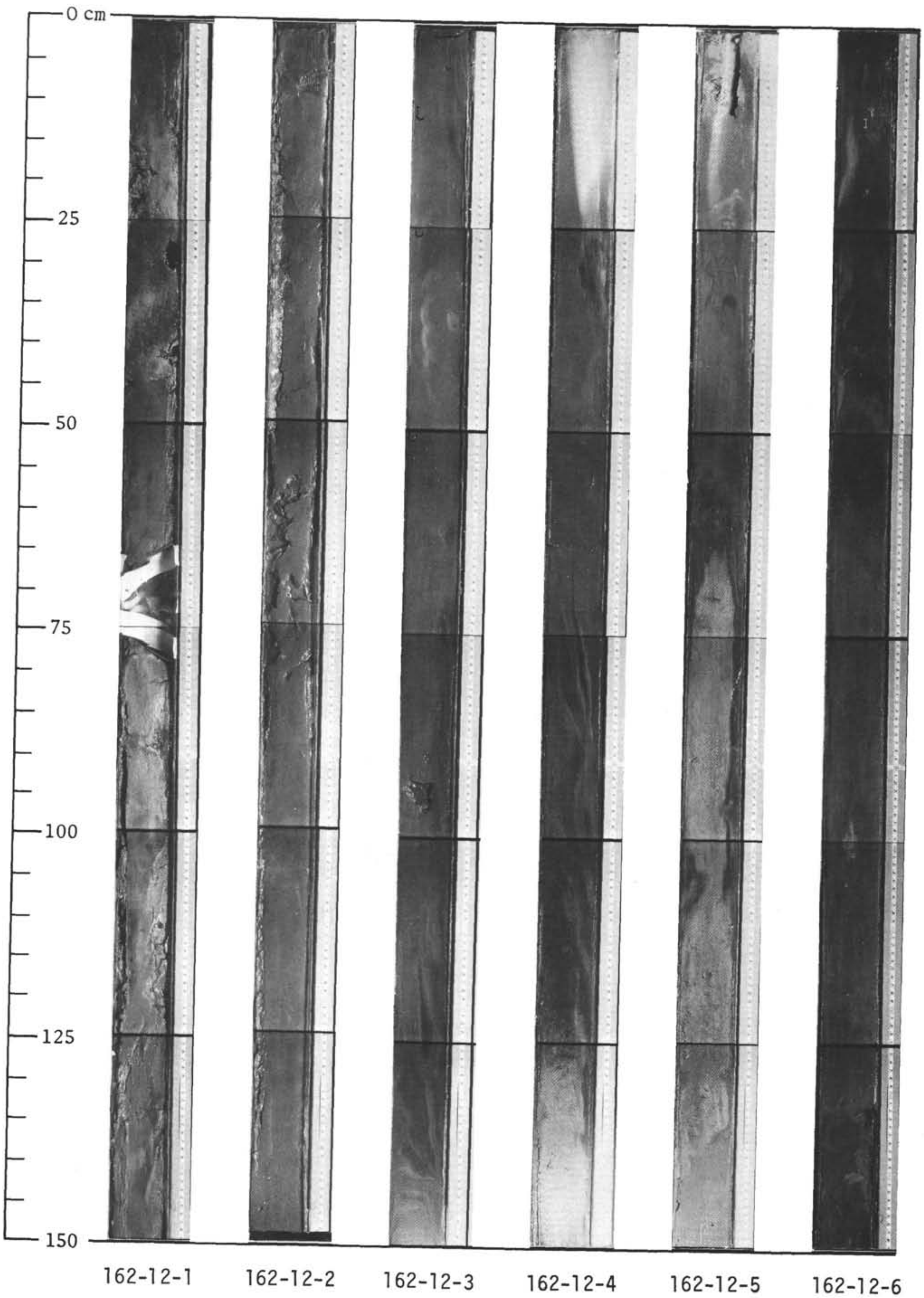
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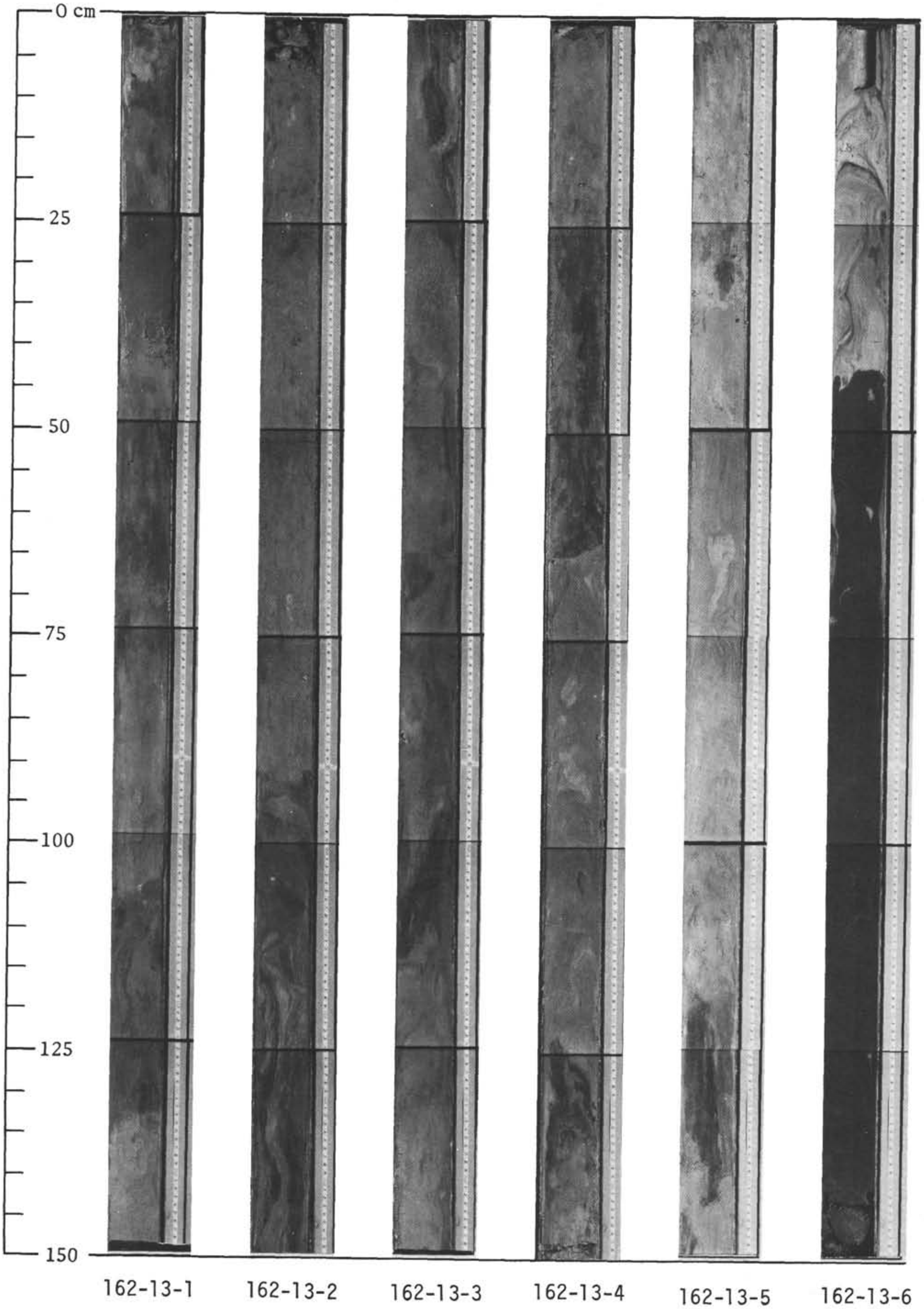
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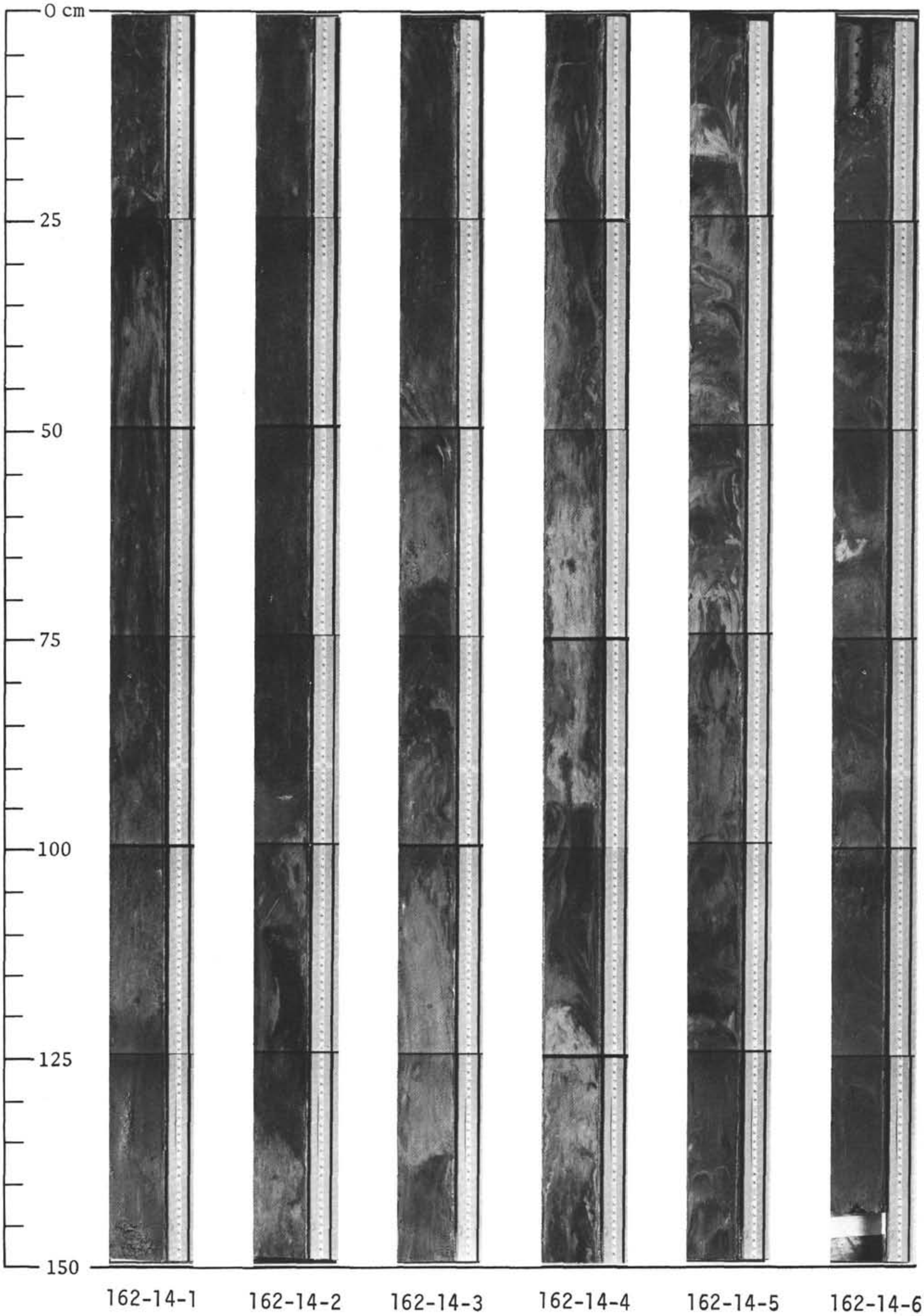
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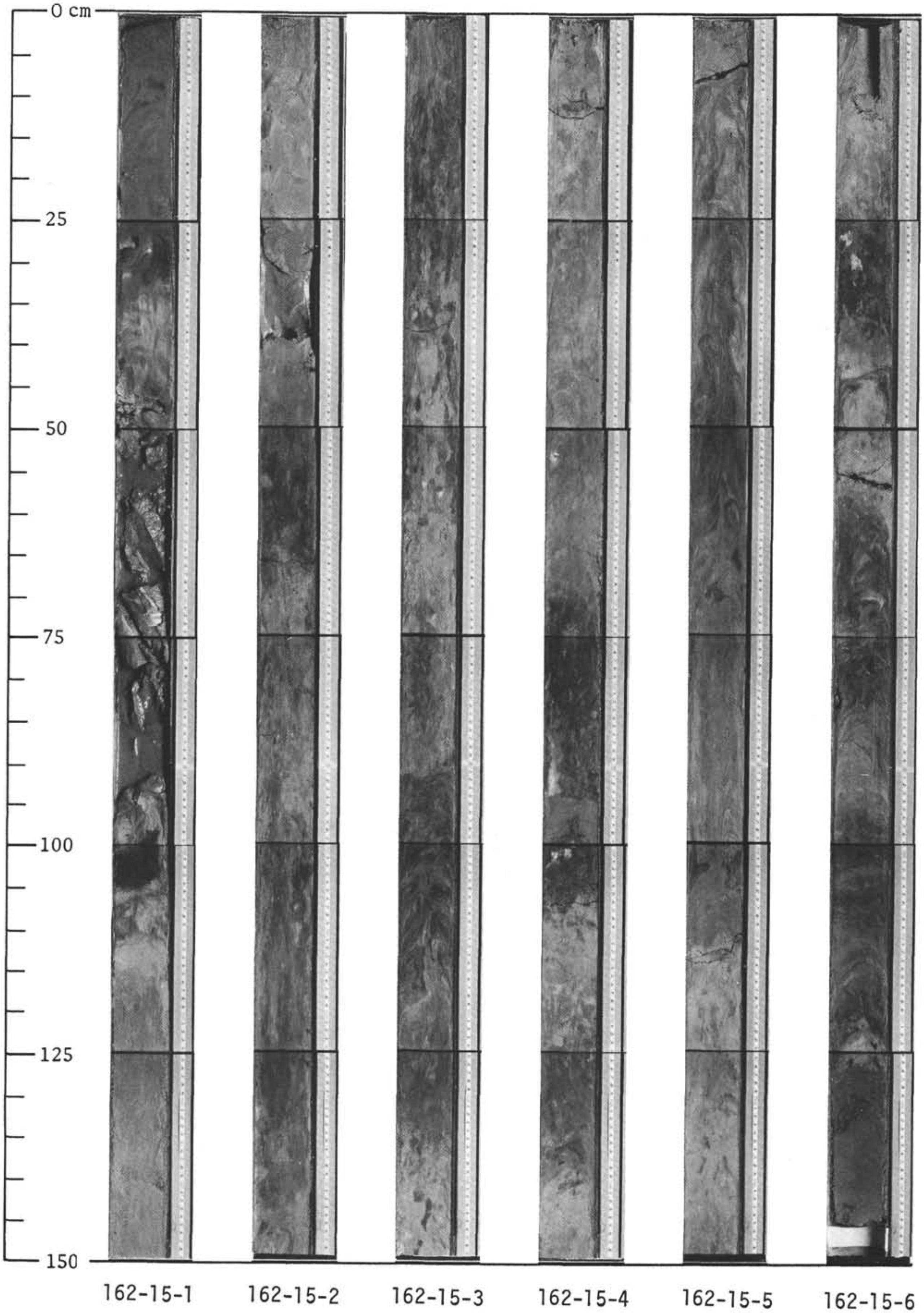
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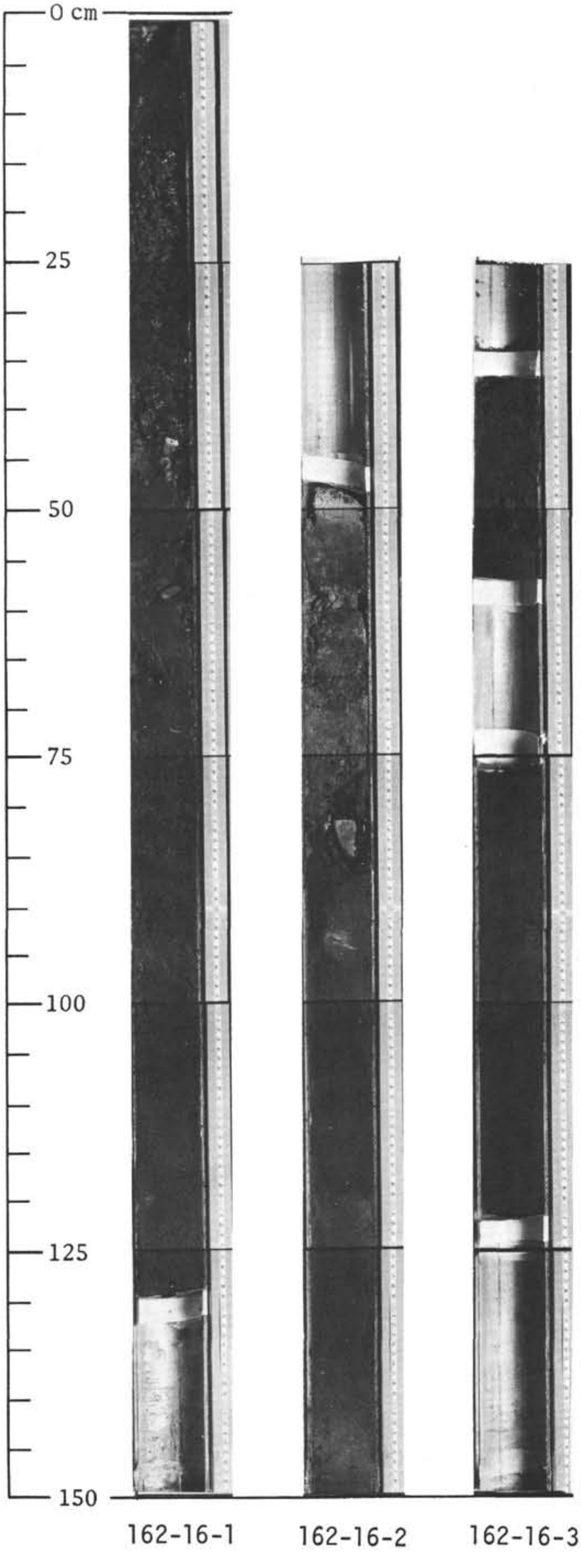
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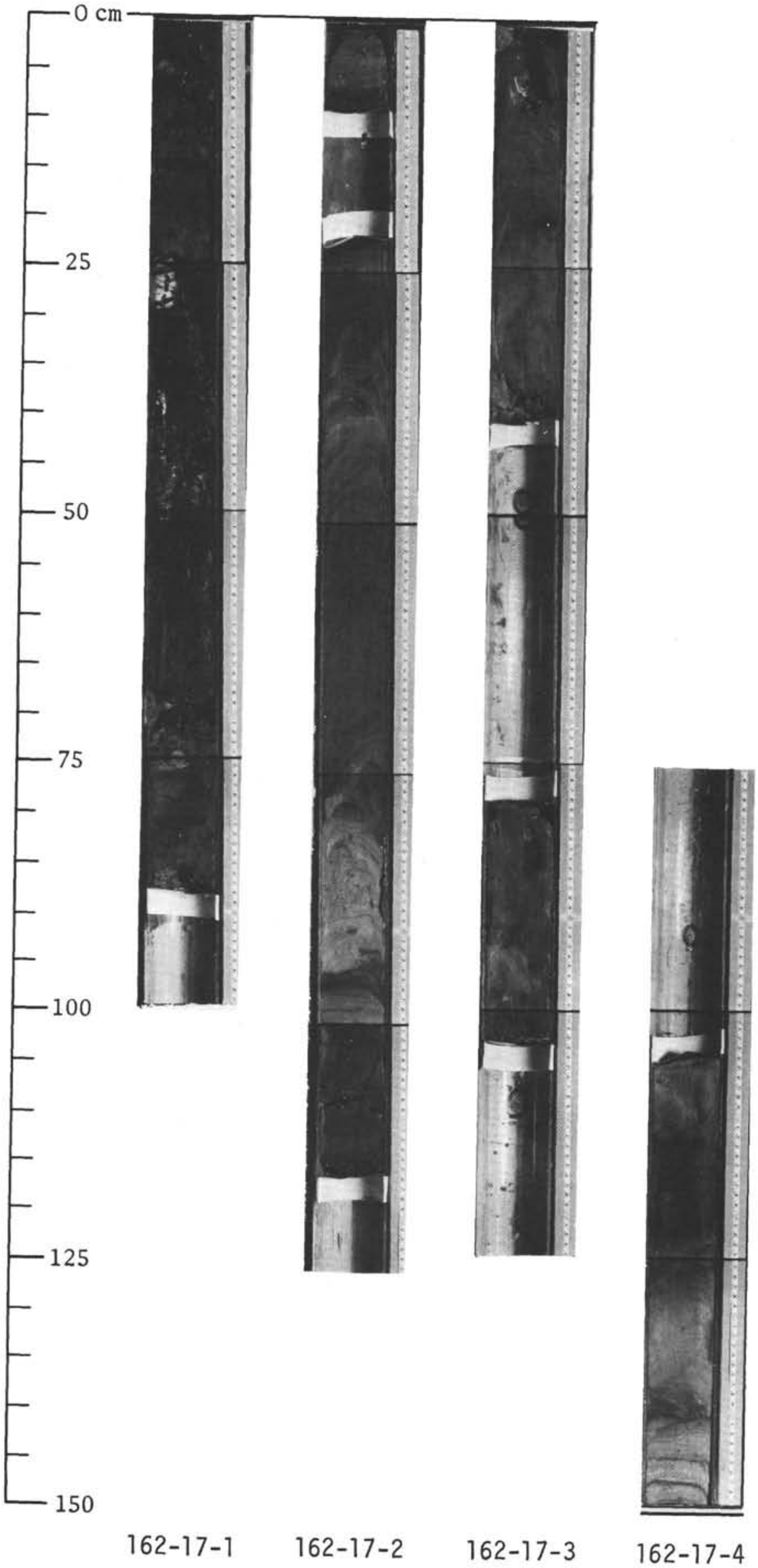
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