7. SITE 254

The Shipboard Scientific Party[1]

With Additional Contributions From
H. J. Oertli, SPNA, Centre de Recherches, Pau, France
and
Peter Jung, Naturhistorisches Museum, Basel, Switzerland

SITE DATA

Locality: South end of Ninetyeast Ridge

Position:
lat 30°58.15′S
long 87°53.72′E

Dates Occupied: 7-9 October 1972

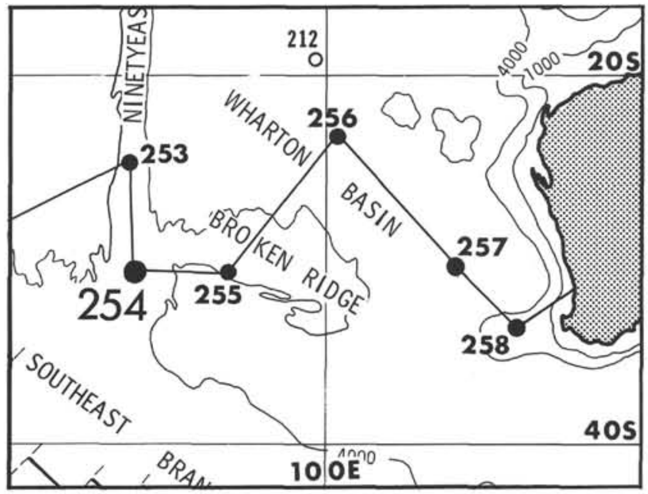
Water Depth: 1253 meters

Penetration: 343.5 meters

Number of Cores: 38

Oldest Datable Sediment Cored:
Depth (subbottom): 167.0-176.5 meters (Core 20)
Nature: Foraminifera-rich ooze
Age: Oligocene

Basement:
Depth encountered (subbottom): 301 meters
Nature: Olivine basalt
Penetration: 42.5 meters



Principal Results: Reworked microfossils were a major problem in determining the stratigraphy at this site. Overlying the basalt are 91.5 meters of black, gray, and yellow-brown sandy and silty sand and pebble conglomerates with fragments of macrofossils, littoral foraminifera, and ostracods. Above this 209.5 meters of foraminifera-rich coccolith ooze. The upper 167 meters are well dated and range through the Neogene. Core 20 (167.0-176.5 m) is Oligocene in age. Below this ages become indeterminate.

BACKGROUND AND OBJECTIVES

Site 254 is located in 1253 meters of water near the southern end of Ninetyeast Ridge. This location is also south of the apparent intersection of Broken Ridge and Ninetyeast Ridge (Figure 1). The objectives at this site were similar to those at Site 253: to determine the age and nature of basement. An important observation is that Ninetyeast Ridge extends south of Broken Ridge. For this to be true the Ninetyeast Ridge must have been a leaky or subductive transform between the ancient Australian and Indian plates and continued as such until these two plates healed together (Falvey, 1972). A pure transform could not have caused uplift or created relief on this scale. If it behaved as a leaky transform, then it would be younger than the adjacent ocean crust, and its youngest age would give the date that the Australian and Indian plates welded together.

Because the Ninetyeast Ridge is shallow, a rather complete calcareous fauna can be retrieved from an extremely wide latitudinal span (30°S to 10°N).

The seismic profile approaching the site (Figure 2) shows that it is located on a broad high plateau which slopes away to the north and south. An east-west *Eltanin* line shows also that the plateau slopes to the east and west; therefore the site is on a fairly isolated high. About

[1]Thomas A. Davies, Scripps Institution of Oceanography, La Jolla, California; Bruce P. Luyendyk, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts (now at University of California at Santa Barbara); Kelvin S. Rodolfo, University of Illinois at Chicago Circle, Chicago, Illinois; D. R. C. Kempe, British Museum (Natural History), London, United Kingdom; Barrie C. McKelvey, The University of New England, Armidale, N. S. W., Australia; Rosanne D. Leidy, Harvard University, Cambridge, Massachusetts; George J. Horvath, The Florida State University, Tallahassee, Florida (now at State of Florida Department of Pollution Control, Tallahassee, Florida); Roy D. Hyndman, Dalhousie University, Halifax, Nova Scotia, Canada; Hans R. Thierstein, Geologisches Institut, Zurich, Switzerland; (now at Lamont-Doherty Geological Observatory, Palisades, New York); Rene C. Herb, University of Berne, Berne, Switzerland; Esteban Boltovskoy, Museo Argentino de Ciencias Naturales, Buenos Aires, Argentina; Patricia Doyle, Scripps Institution of Oceanography, La Jolla, California.

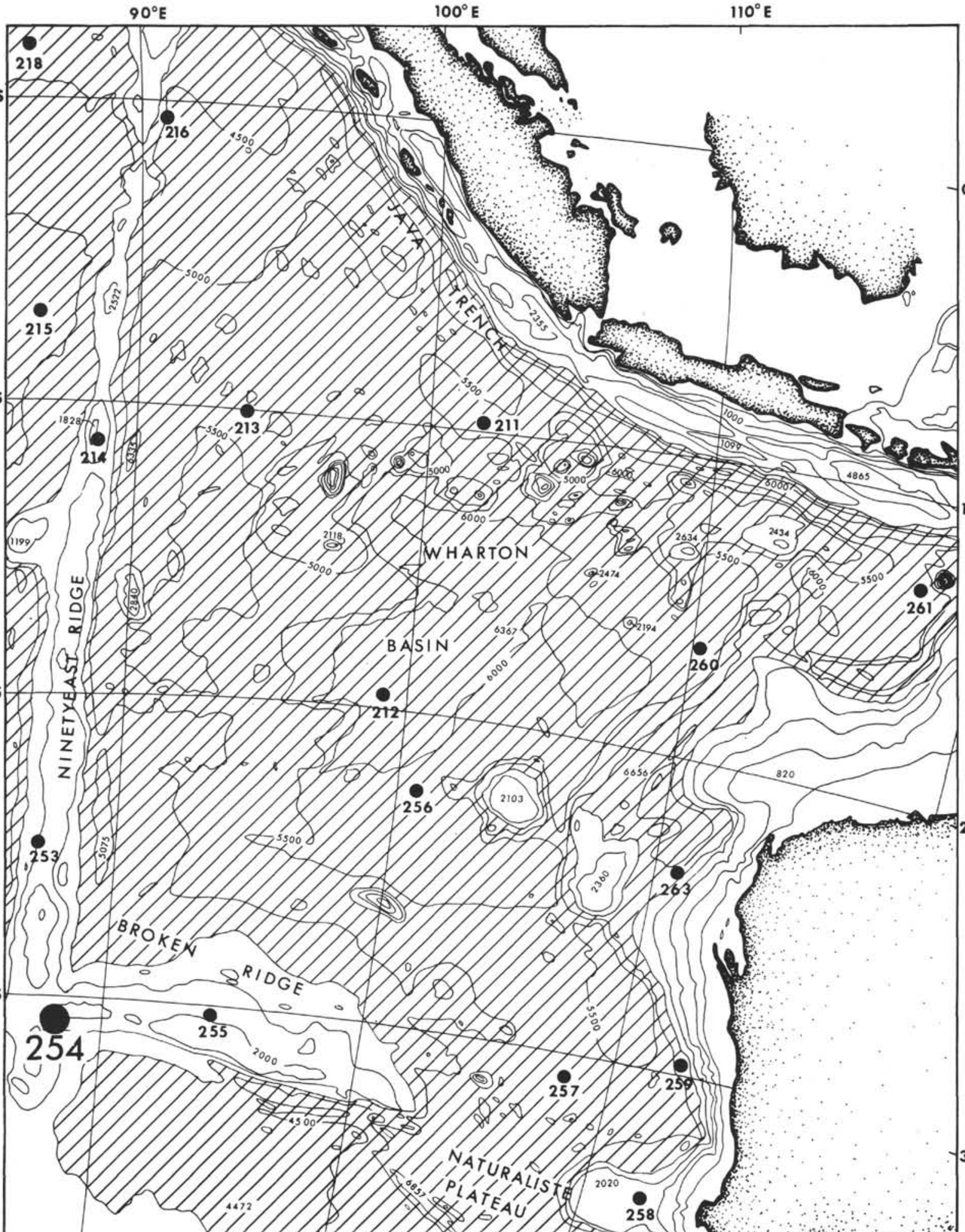


Figure 1. *Base chart and localitv of Site 254. Sites from DSDP Legs 22 and 27 are also shown. (Adapted from the Russian bathymetric chart of the Indian Ocean.)*

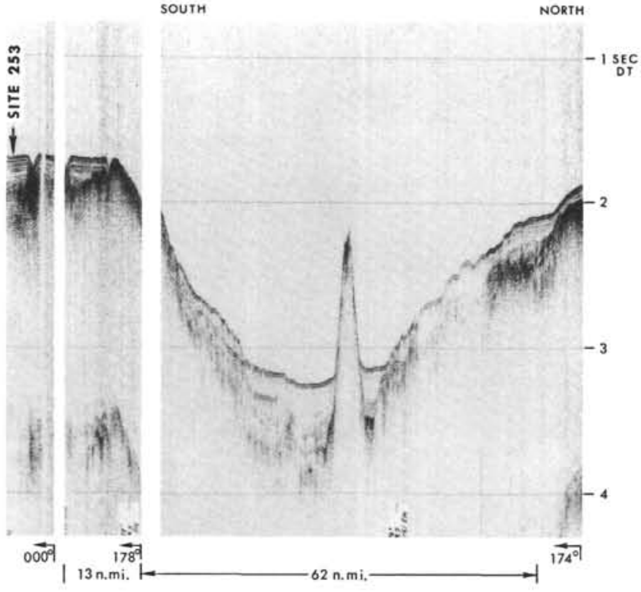


Figure 2. *Seismic reflection profile onto Site 254 taken from D/V* Glomar Challenger.

0.17 sec DT of sediment overlies a very strong intermediate reflector which is conformable to the sediment surface. Below this reflector, between 0.3 and 0.5 sec DT, there is a weak and diffuse return with much relief that appears to be oceanic basement. This deeper reflection is often better seen in multiples.

OPERATIONS

Glomar Challenger approached Site 254 from the north, passed over the site, then turned onto a reciprocal course to return over the selected location. Since the water depth was quite shallow and selection of the precise location was critical, we decided to take a chance on dropping an untested beacon underway, because there had not been an opportunity to presoak a beacon at the last site. The beacon was dropped while underway at 5 knots in 668 fathoms (uncorrected) 1253 meters (corrected) of water at 1138, 7 October. Bottom was reached at 1545, and Core 1 was brought aboard at 1620. After this, continuous coring proceeded until the hole was terminated at 1106, 9 October with the recovery of Core 38. Vital statistics for the cores cut at Site 254 are given in Table 1. Recovery was disappointingly low below 110 meters despite our trying all possible combinations of bit weight, pump pressure, and rotating speed. Otherwise operations proceeded smoothly and uneventfully.

Four good temperature measurements were made with the heat-flow instrument.

Positioning throughout operations at this site was excellent, being aided by virtually perfect weather conditions (very little wind and only gentle swells), so that the largest excursion from the hole was only 30.48 meters, this occurring during a change of heading. Most of the time excursions were much less than this.

After recovering Core 38 the drill pipe was pulled and we got underway for Site 255 at 1448, 9 October. No pre- or postsite surveys were run since we felt that given the very limited time available for such activities, we could not add significantly to the already available *Eltanin*-48 data and the data obtained on approach.

LITHOLOGY

At Site 254, 329 meters of section were drilled and continuously cored. Recovery was 150.5 meters or 45.7%. The succession consists of three contrasting types of lithologies: an upper sequence of biogenic ooze, an intermediate sequence of volcanic-derived silty sandstone and mudstone, and a basement of olivine basalt.

Five lithostratigraphic units are recognized. Four of these are within the biogenic and clastic sedimentary succession which conformably overlies the olivine basalt (Table 2).

Unit 1

Very pale orange coccolith foram ooze makes up the youngest 11.5 meters of the sequence. The sediment is extremely pure, containing only trace amounts of terrigenous quartz, mica, and clay. Typically the ooze is composed of 65% foraminifera and 35% coccoliths. With a decrease in the amount of foraminifera, the sediments pass gradationally down into the underlying coccolith ooze of Unit 2.

Unit 2

The nannoplankton ooze of Unit 2 is divided into four subunits distinguished from each other by the varying amounts of foraminifera, coccoliths, and microcrystalline calcite present.

Subunit 2a has foram-rich coccolith ooze varying only slightly in color, from light gray and pinkish-gray to very pale orange. Indeed, one of the most striking features of the unit is its homogeneity of color and texture. Very slight color mottling does occur at 25, 27.5, and 35 meters and faint lamination is developed between 69 and 71 meters; but these are the only textural features observed. The ratio of coccoliths to foraminifera varies but averages about 5:1. Discoasters are present everywhere in trace amounts of 1% or 2% at most. The distribution of microcrystalline calcite appears to be irregular. About 10% is present at 43 meters and this increases to 30% at 53 meters before decreasing to only trace amounts at 57 meters. At 126 meters microcrystalline calcite again forms approximately 10% of the sediment.

Subunit 2b is poorly sampled and poorly defined stratigraphically, recovery being limited to two core catchers. The thickness of 11 meters is a maximum estimate and may be considerably less in reality. The nature of the transition with Subunit 2a is not known.

The sediments of Subunit 2b are foram-rich micarb ooze and foram micarb ooze. Petrographically the subunit contrasts with Subunit 2a in that foraminifera clearly predominate over coccoliths in a ratio of 2:1. It is probable that the microcrystalline calcite represents a diagenetic modification of formerly abundant coccoliths.

Subunit 2c has very pale orange and grayish-orange ooze and does not differ appreciably from Subunit 2a. The transition with Subunit 2b is rapid, apparently occurring between Cores 16 and 17 at 138.5 meters. The

TABLE 1
Cores Cut at Site 254

Core	Date (Oct. 1972)	Time	Depth from Drill Floor (m)	Depth Below Sea Floor (m)	Length Cored (m)	Length Recovered (m)	Recovery (%)
1	7	1620	1263.0-1268.5	0 -5.5	5.5	3.2	58
2	7	1658	1268.5-1278.0	5.5-15.0	9.5	9.5	100
3	7	1738	1278.0-1287.5	15.0-24.5	9.5	9.5	100
4	7	1818	1287.5-1297.0	24.5-34.0	9.5	9.0	95
5	7	1857	1297.0-1306.5	34.0-43.5	9.5	9.1	96
6	7	1940	1306.5-1316.0	43.5-53.0	9.5	9.2	97
7	7	2018	1316.0-1325.5	53.0-62.5	9.5	9.5	100
8	7	2057	1325.5-1335.0	62.5-72.0	9.5	9.3	98
9	7	2135	1335.0-1344.5	72.0-81.5	9.5	3.3	35
10	7	2220	1344.5-1354.0	81.5-91.0	9.5	9.0	95
11	7	2253	1354.0-1363.5	91.0-100.5	9.5	8.3	87
12	7	2338	1363.5-1373.0	100.5-110.0	9.5	6.0	63
13	8	0030	1373.0-1382.5	110.0-119.5	9.5	CC	0
14	8	0132	1382.5-1390.5	119.5-127.5	8.0	CC	0
15	8	0220	1390.5-1400.0	127.5-137.0	9.5	CC	0
16	8	0312	1400.0-1401.5	137.0-138.5	1.5	CC	0
17	8	0350	1401.5-1411.0	138.5-148.0	9.5	1.0	11
18	8	0430	1411.0-1420.5	148.0-157.5	9.5	8.0	84
19	8	0606	1420.5-1430.0	157.5-167.0	9.5	9.5	100
20	8	0645	1430.0-1439.5	167.0-176.5	9.5	9.2	97
Drilled			1439.5-1449.0	176.5-186.0			
21	8	0850	1449.0-1458.5	186.0-195.5	9.5	CC	0
22	8	0956	1458.5-1463.0	195.5-200.0	4.5	CC	0
23	8	1055	1463.0-1472.5	200.0-109.5	9.5	CC	0
24	8	1153	1472.5-1482.0	209.5-219.0	9.5	0.7	7
25	8	1248	1482.0-1491.5	219.0-228.5	9.5	9.0	95
26	8	1341	1491.5-1501.0	228.5-238.0	9.5	0.5	5
27	8	1430	1501.0-1510.5	238.0-247.5	9.5	3.5	37
28	8	1523	1510.5-1520.0	247.5-257.0	9.5	0.3	3
29	8	1613	1520.0-1529.5	257.0-266.5	9.5	0.5	5
30	8	1717	1529.5-1539.0	266.5-276.0	9.5	1.3	14
31	8	1920	1539.0-1548.5	276.0-285.5	9.5	0.6	6
32	8	2015	1548.5-1558.0	285.5-295.0	9.5	0.7	7
Drilled			1558.0-1563.0	295.0-300.0			
33	8	2221	1563.0-1572.5	300.0-309.5	9.5	1.2	13
34	9	0100	1572.5-1573.0	309.5-310.0	0.5	0.2	4
35	9	0525	1573.0-1578.0	310.0-315.0	5.0	4.1	82
36	9	0801	1578.0-1587.5	315.0-324.5	9.5	4.4	46
37	9	0930	1587.5-1597.0	324.5-334.0	9.5	CC	0
38	9	1106	1597.0-1606.5	334.0-343.5	9.5	1.2	13
Total					329.0	150.8	45.7

one petrographic difference noted is the presence of trace amounts of zeolite.

Subunit 2d has dark yellowish-orange, moderate orange-pink, or light brown foram-rich micarb coccolith ooze and has as accessory components trace amounts of zeolites and opaque ferruginous oxides. The amount of microcrystalline calcite increases irregularly from 26% to 90% near the base of the unit (approximately 76 m). Unlike the micarb ooze of Subunit 2b, throughout Subunit 2d coccoliths predominate over foraminifera by a ratio of at least 2:1.

Unit 3

Stratigraphically this unit of micarb ooze and chalk is not well defined, recovery being limited to three core catchers.[2] The basal contact with the underlying clastic sediments of Unit 4 can be confidently positioned at 209.5 meters.

Microcrystalline calcite forms more than 92% of the sediment with foraminifera ranging up to a few percent and recognizable coccoliths present only in trace amounts. Authigenic zeolite is also present in trace proportions. The dark yellowish-brown and grayish-

[2]The thickness of 33 meters is a maximum estimate. Included are 9.5 meters between 176.5 and 186 meters where no recovery was attempted.

TABLE 2
Lithologic Summary, Site 254

Unit/ Subunit	Core	Depth Below Sea Floor (m)	Thickness (m)	Description
1	1-2	0-11.5	11.5	Very pale orange coccolith foram ooze
2a	2-14	11.5-127.5	116	Light gray, pinkist-gray, and very pale orange foram-rich coccolith ooze
2b	15-16	127.5-138.5	11 max	Very pale orange and grayish-orange foram-rich micarb ooze and foram micarb ooze
2c	17-19	138.5-167.0	28.5	Very pale orange and grayish-orange foram-rich coccolith ooze
2d	20	167.0-176.5	9.5	Dark yellowish-orange and moderate orange-pink foram-rich micarb coccolith ooze.
3	21-23	176.5-209.5	33.0	Dark yellowish-brown and grayist-orange foram-bearing micarb ooze; Dark yellowish-orange micarb ooze
4	24-33	209.5-301.0	91.5	Olive-black, olive-gray, and dark yellowish-brown sandy and silty clays and fine-grained silty sands; some pebble conglomerates; fragmented macrofossil debris
5	33-38	301.0-343.5[a]	42.5	Fine to medium-grained massive, amygdaloidal and breciated olivine basalts

[a]Total depth.

orange coloration of this unit reflects the presence of opaque and translucent ferruginous oxides. Between 200 and 209.5 meters the degree of consolidation is such that the term chalk may be applied.

Unit 4

Unit 4 is at least 91.5 meters thick and consists largely of olive-green and olive-black poorly sorted silty clay and fine sandstone. Equally poorly sorted fine conglomerates with abundant muddy matrices (i.e., diamictites) are a much subordinate lithology forming less than 2% of the recovered core. The most noticeable feature of the whole unit is the poor sorting, with scattered detrital granules (2-4 mm) and occasional small volcanic pebbles being widely distributed.

Typically thin-walled macrofossil debris is common in the top part of the unit, between 209.5 and 247.5 meters. At some horizons the fossils are well preserved, whereas at others they are comminuted and reduced to carbonate prisms. Well-preserved valves show no preferred depositional orientation. Areas of extensive bioturbation and scattered 10-mm-wide solitary burrows are also common down to 247.5 meters. These organic features have destroyed much of the original depositional features. However, some lamination is preserved. Intraformational brecciation is not uncommon with angular fossiliferous fragments ranging up to 6 cm developed at some horizons (e.g., 224 and 241 m).

Below 247.5 meters no macrofossil debris was observed, and diffuse sulphide mottles and a few pyrite nodules up to 1 cm in diameter are distributed throughout this lower part of the core.

Thin bands (5-8 cm) of poorly sorted pebble (up to 10 cm) conglomerates often with dispersed frameworks were especially well developed at 230 and 267 meters. The fine-grained matrices form up to 50% of these sediments. The subrounded to angular pebbles are relatively well sorted and consist of formerly glassy or very fine-grained porphyritic volcanics. Some are vesicular. The majority of the pebbles are dark gray and of basaltic aspect. The remainder are of similar composition, but display much color and textural variation.

All the sediments of Unit 4 reflect a basaltic provenance. Grains of green or nearly colorless, partially altered volcanic glass are present in all slides. Much of the clay mineral aggregates appears to be altering from largely vitric grains, or from volcanic ash. In some slides the grains of altered glass form up to 60%. Amorphous and partially translucent ferruginous aggregates are interpreted as iron-rich fragments of volcanic glass. However, no definite shards were observed. Crystalline magmatic material is virtually absent, being restricted to trace amounts of plagioclase feldspar.

By far the most common mineral is montmorillonite. No calcite is present, as it is in the corresponding unit at Site 253, the second most abundant mineral being the zeolite phillipsite. The remainder of the sediment is reported as comprising pyrite (ca 17%), accompanied by small amounts or traces of glauconite, kaolinite, clinoptilolite, analcite, erionite, adularia, anatase, ilmenite, magnetite, and goethite. Pyrite occurs as framboids and as amorphous aggregates, but it is surprising that it reaches nearly 30% of the 20% crystalline material in Core 27. Adularia represents authigenic alkali feldspar for the only time recorded on Leg 26; deep-sea sediments may be too young for much adularia to have crystallized. The zeolite erionite, usually found in ash and tuff, is reported from this hole only on Leg 26; it was first recorded from DSDP cores from Leg 6, in large amounts in a volcanic ash sequence from the Mariana Trench (Pimm et al., 1971, p. 1242.).

Between 266 meters and the base of the unit at 301 meters, recovery is extremely poor. However, the sediments become increasingly ferruginous. As well as pyrite nodules, lensoidal laminae of earthy opaque oxides are present. From 277 meters approximately half a meter of relatively coarse-grained porphyritic fresh basalt was recovered. Its temporal relationship to the sediments is not known.

Unit 5

The contact between the basement basalts and the sediments of Unit 4 is conformable. At the contact, the highly weathered basalt is overlain by weathered ferruginous silty clay and fine sandstone of basaltic provenance. These sediments contain very weathered fragments of the immediately underlying basalt.

In hand specimen three contrasting types of highly altered basalt can be recognized. From 301 to 314.3 meters the basalt is relatively coarse porphyritic rocks with feldspars up to 3 mm. Some interstitial glass is present. The thin basalt recovered at 277 meters from Unit 4 is of this variety. Finer-grained amygdaloidal basalt extends from 314.3 to 334 meters. Some nonamygdaloidal horizons are present in this interval. Below 334 meters down to the bottom of the hole at 343 meters, the basalt is nonamygdaloidal, fine-grained, autobrecciated rocks containing abundant basaltic xenoliths.

Examination of the drilling record indicates the thin basalt recovered in Unit 4 at 277 meters to be about 2 meters thick. The drilling record also shows considerable hardness variation within the two intervals interpreted as amygdaloidal and brecciated basalts.

Petrography

1) Coarse ophitic basalt: Plagioclase laths, up to 1.8 mm, are ophitically enclosed in large neutral-colored pyroxenes, up to 1.2 mm (2.0 mm) with $2V\gamma$ ca 45°-50°. Very dark green palagonitic glass occupies the interstitial spaces between the ophitic areas, grading into cavities filled with radial fibers of the same green material. Most of the iron ore is indistinguishable from the glassy areas, but there are some ilmenite bars (up to 0.5 mm) and grains. There are scattered interstitial pools of calcite. A very few completely iddingsitized crystals of olivine (ca 0.5 mm) are present in the lowest section examined.

2) Amygdaloidal basalt: This porphyritic olivine basalt has a hyaloophitic texture. Abundant olivine forms large phenocrystic crystals (up to 0.5 mm) and many smaller ones. The larger olivines are altered to very well-developed pleochroic greenish-brown iddingsite, highly birefringent, and showing the characteristic lamellar structure. Laths of sodic labradorite, slightly saussuritized, reach 0.7 mm in length, and the interstitial material consists of ragged, neutral-colored grains of pyroxene, glass, and iron oxide. The frequent amygdales are filled with green spherulitic ?bowlingite or chlorite, or calcite; some have both, in which case the calcite always occupies the center.

3) Autobrecciated basalt: Autobrecciated, amygdaloidal olivine basalt at the base of the sequence shows flow banding and swirling in thin section. The fine-grained basalt is rich in olivine, with many small shapeless crystals and a few larger (up to 0.5 mm) ones, totally altered to deep-red iddingsite; the larger crystals are lighter colored, lamellar, and birefringent. The groundmass is granular, containing plagioclase laths, pyroxene, and ilmenite rods, all reaching a maximum of some 0.1 mm, and some glass. Irregular-shaped amygdales are filled with greenish chlorite or bowlingite. Where boundaries of the brecciated fragments can be observed, the latter are always of a type of basalt practically identical with the host.

Less obviously brecciated basalt at 334.6 meters is free of olivine. Here, small plagioclase laths, well-shaped grains and grain strings of pyroxene, and bars of ilmenite, again all reaching about 1 mm, form the bulk of the rock. They are cut by green stringers, linked to cavities, filled with chlorite or bowlingite.

The most altered rock, which occurs in the lowest level of basalt drilled (the autobrecciated basalt, Core 38), is composed of some two-thirds montmorillonite, accompanied by pyroxene, amphibole, feldspar, and quartz.

Discussion

The clastic sediments of Unit 4 indicate the weathering and erosion of a basaltic terrain adjacent to and composed of the same type of volcanic rocks as those of Unit 5. There is no proven contemporaneous pyroclastic contribution to Unit 4. The poor sorting and lack of traction current features indicate rapid deposition in quiet water. The rapid deposition is further substantiated by the intraformational breccias pointing to contemporaneous instability of the sedimentary pile. The abundance of pyrite below 247.5 meters and the restriction of macrofossils to strata above this horizon suggest either shallowing or else decrease in the depositional rate. The comminuted state of much of the macrofossil debris and the random orientation of the better-preserved valves, when considered with the overall poor sorting and presence of diamictites, does suggest some redeposition.

During the biogenic deposition of Units 1, 2, and 3, there was no basaltic or continental terrigenous sediment contribution.

The micarb ooze and chalk of Units 1, 2, and 3 are most probably a diagenetic modification of normal coccolith oozes. In spite of their present petrographic contrast with the foram and coccolith oozes, these micarb-bearing oozes need reflect no real change within the domain of sedimentation.

TABLE 3
Modes of the Basalts, Site 254

	Very Coarse Ophitic Basalt (277.5 m)	Nonamygdaloidal Ophitic Basalt (318.8 m)	Amygdaloidal Olivine Basalt (315.6 m)	Autobrecciated Olivine Basalt (334.6 m)	Autobrecciated Basalt (335.1 m)
Olivine	–	2	10	20	–
Plagioclase	43	31	45		17
Pyroxene	25	35	17		30
Iron oxide	3	2	20	72	18
Glass	25	30			35
Calcite	4	–	–	–	–
Amygdales	–	–	8	8	–

SHIPBOARD GEOCHEMICAL MEASUREMENTS

Routine analyses for salinity, *p*H, and alkalinity were conducted on interstitial water samples squeezed from seven sediment samples taken at depths in the hole from 13 to 268 meters below the sea floor. In addition, *p*H was measured on the uppermost four samples of unsqueezed sediment by the punch-in method, before the core recoveries became too stiff for the electrodes. The sampling and analytical techniques are described in the report on Site 250, and the results for Site 254 are summarized in Table 4 and are presented in graphical form in Figure 3.

Results

Salinity

No obviously meaningful salinity trends were observed at this site. The shallowest sample, from 13 meters below the sea floor, yielded interstitial water with a salinity of 35.2‰, slightly higher than the regional near-bottom values of 34.4‰-34.5‰ reported by Wyrtki (1971). Values fluctuate narrowly in the range 34.9‰ -35.2‰ to a depth of 155.5 meters, which lies well above the base of the coccolith ooze sequence. The three remaining deeper values do not appear significant; in particular, the site's minimum salinity of 33.3‰ from a depth of 200 meters was the only sample taken from a core catcher and therefore the most likely to have suffered contamination.

pH

Punch-in and flow-through *p*H values agree fairly well, the punch-in values being consistently higher than flow-through values by 0.04-0.1 *p*H unit. Flow-through values increase irregularly downward from 7.31 at 13 meters to 7.70 at 228.5 meters. The deepest *p*H value, at 268 meters, was maximal for the hole: 8.29.

Alkalinity

Alkalinity shows a general inverse relationship with *p*H, decreasing downward from 2.40 meq/kg at depths of 13 and 60.5 meters to 1.32 at a depth of 268 meters below the sea floor.

PHYSICAL PROPERTIES

The physical properties measured at Site 254 were bulk density, porosity, sonic velocity, and thermal conductivity. The methods are described in the Explanatory Notes (Chapter 2). The results are shown in the hole summary diagram.

Density, Porosity, and Water Content

The densities in this hole are very uniform with an average of 1.70 g/cc. There is no systematic difference among the syringe, GRAPE, and section-weight methods such as was observed at Site 253. The average water content in the sediments is 35% and the porosity 60%; both decrease slowly with depth.

Acoustic Velocity and Acoustic Impedance

The acoustic velocities are uniform in the upper carbonate ooze section (1.6 km/sec), increase slightly at about 150 meters, where there is small change in composition and increased consolidation, and increase markedly below 210 meters in the volcanic sediments. Velocities parallel to the bedding were systematically

TABLE 4
Summary of Shipboard Geochemical Measurements, Site 254

Sample (Interval in cm)	Depth Below Sea Floor (m)	Lab Temp. (°C)	*p*H Punch-in/Flow-through	Alkalinity (meq/kg)	Salinity (‰)
(Reference seawater)			8.31/8.21	2.40	35.8
2-5, 144-150	12.94-13.00	22.1	7.41/7.31	2.40	35.2
7-5, 144-150	60.44-60.50	22.0	7.45/7.41	2.40	34.9
12-3, 144-150	104.94-105.00	21.3	7.63/7.56	2.35	35.1
18-5, 140-150	155.40-155.50	21.8	7.56/7.47	2.20	35.0
22, CC	200.00	22.2	/7.55[a]	2.00	33.3
25-6, 140-146	228.40-228.46	22.1	/7.70[a]	1.47	35.5
30-1, 143-150	267.93-268.00	22.6	/8.29[a]	1.32	34.6

[a]Too stiff to measure punch-in.

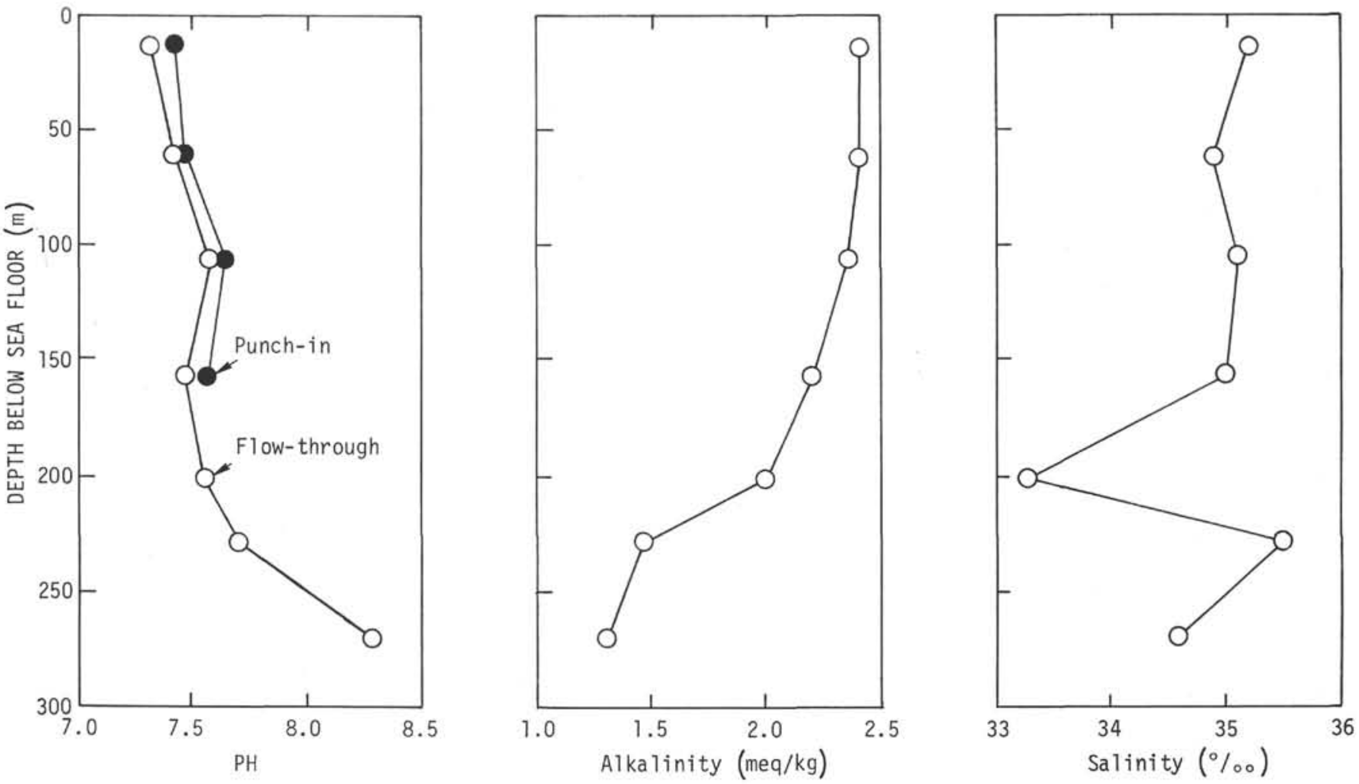


Figure 3. *Graphic summary of geochemical measurements taken at Site 254.*

higher than those measured perpendicular. The mean velocity for seven measurements in basalt was 4.75 km/sec.

The acoustic impedance increases by 30% to 40% between the carbonate oozes and the underlying volcanic sediments which should give a good seismic reflection. There is an acoustic impedance contrast of a factor of 3 or 4 at the basalt basement.

CORRELATION OF SEISMIC PROFILE WITH DRILLING RESULTS

An on-site seismic profile was run with an SSQ41 sonobuoy and the 30in.[3] airgun (Figure 4). This profile showed three prominent reflections and several subordinate ones. Prominent ones are at 0, 0.195, and 0.375 sec DT subbottom. Other reflections can be seen at 0.175, 0.25, 0.31, and 0.35 sec DT. As with Site 253, there is no prominent "basement" return but rather a weak and diffuse return below the strong reflector at about 0.195 sec DT.

A correlation between lithologic contrasts, impedance contrasts, and reflection times is shown in Table 5. Correlation between these parameters can be considered quite good if it is accepted that the average velocity in the ooze sequence is closer to 2.0 km/sec rather than the measured acoustic velocity of 1.6-1.7 km/sec (see Physical Properties section). This is the same problem with the velocity structure as became evident at Site 253.

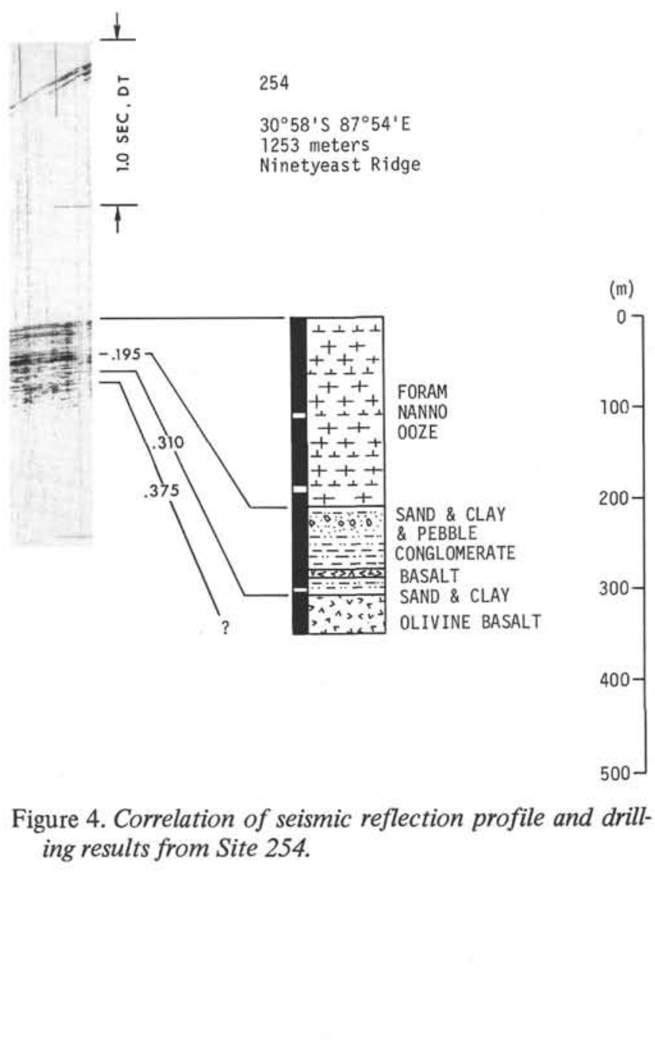


Figure 4. *Correlation of seismic reflection profile and drilling results from Site 254.*

TABLE 5
Reflection Times and Depths of Lithologic Impedance Contrasts, Site 254

Reflection Time (msec DT)	Depth of Lithologic Contrast, (m)	Depth of Impedance Contrast, (m)	Average Velocity (km/sec)
175	176	?	2.01
195	209.5	209.5	2.14
250	–	230	1.84
310	301	301	1.94
350			
375			

The major lithologic contrasts are at 209.5 and 301 meters and are the contacts between ooze-volcaniclastic and volcaniclastic-basalt flows. The upper contact produces a very strong reflection which agrees with its strong impedance contrast. As with Site 253 transmission and absorption losses in the volcaniclastic sequence may explain the very weak reflection from basement. The basalt flow sequence at 301 meters does not give as strong a reflection as the reflection at 0.375 sec DT. This last reflection probably marks a more closely spaced flow sequence or less-weathered basalt flows and therefore could be thought of as the true oceanic basement. However, we would not suspect that the time-stratigraphic gap between the sequence at 301 meters and this deeper "basement" is very great.

PALEONTOLOGY

Biostratigraphic Summary

A more or less continuous sequence of foraminiferal and nannofossil zones could be recognized in the Neogene part of the section at this site, between 0 and 167 meters. The succession of foraminiferal zones seems to be uninterrupted in the upper Miocene-Recent interval, but in the lower and middle Miocene no detailed zonation could be established. The liquified character of a great part of the core material may account for some of the difficulties in separating biozones. Oligocene foraminiferal assemblages occur throughout Core 20.

A shallow-water assemblage of bryozoans and benthonic foraminifera was found in Core 21, and some benthonic foraminifera occur in Core 22, among them a species which so far has been found only in the middle and upper Eocene.

The volcanic-derived sediment in the lower part of the section is characterized by a restricted assemblage of few foraminifera, and ostracods, as well as small and fragile pelecypods and gastropods. The age of this sequence is open to discussion. Ostracod assemblages are of a rather endemic character, but generally point to an Eocene rather than Oligocene age. The molluscs, on the other hand, indicate Oligocene or Miocene, and pollen analyses give a Miocene or younger age (Kemp, this volume, Chapter 34). The age of this unit is tentatively given here as upper Eocene or lower Oligocene.

Foraminifera

Neogene: A more or less continuous Neogene sequence was recognized at this site by means of planktonic foraminifera, but in many cases it has not been possible to differentiate individual biozones. Fifteen samples in the Miocene section appear to be contaminated, fortunately with Quaternary specimens. Foraminiferal tests were well preserved throughout all the cores.

The Quaternary sequence is only 5.5 meters thick. The foraminiferal assemblages in it are typical of the temperate zone. *Globorotalia inflata s.l.* is the dominant species; *G. menardii s.l.* is found only as isolated tests. The uppermost sample, taken at a depth of 40-42 meters below the sea bed, contains rare specimens of *Globorotalia tosaensis* and does not show any Recent indicators. This proves that the whole sequence is Pleistocene. If Recent is present it is represented by a thin layer not thicker than 40 cm.

The underlying sediments are Pliocene in age. Their age is well documented on the basis of planktonic foraminifera. The Quaternary/Pliocene boundary was located by means of the relationship between *Globorotalia truncatulinoides* and *G. tosaensis* and by the presence of *G. crotonensis* below the boundary. The Pliocene was apparently colder; no specimens of *Globorotalia menardii s.l.* were recorded.

The Pliocene sequence was divided into three parts. In the upper Pliocene (2 m) *Globorotalia crotonensis* is the characteristic species. In the middle Pliocene sequence (7.5 m) the extinction of *Globoquadrina venezuelana* and *Sphaeroidinella seminulina* is recorded in the uppermost part. The lower Pliocene has a thickness of 9.5 meters. Its upper limit is given by the extinction of *Globorotalia margaritae* (last occurrence at 15.42 m).

The Miocene/Pliocene boundary was located using foraminiferal criteria. In the lowermost Pliocene *Globorotalia inflata s.l.* and *G. crassaformis* were recorded frequently. In the uppermost Miocene only isolated specimens of these species were found. As at other sites, the first occurrence of *Globorotalia crassaformis* was recorded at Site 254 a little earlier than *G. inflata s.l.*

The Miocene sequence (142.5 m) is much thicker than the Pliocene. It was also divided into three parts. The extinction of *Globigerinita unicava, Globigerinopsis aguasayensis* and, somewhat lower, of *Globigerinoides sicanus* and *Globorotalia* aff. *limbata* were used, tentatively, as the main criteria to locate the upper part of the middle Miocene.

The faunal differences between middle and lower Miocene are well illustrated on the range charts in Chapter 30. The extinction of such typical lower Miocene species as *Globigerinita dissimilis dissimilis, G. dissimilis ciperoensis, Globigerina euapertura,* and some others are characteristic features of the termination of that epoch.

A great number of quite small unidentifiable planktonic foraminifera were observed in practically all the

Miocene samples. Sometimes these specimens were more numerous than those which could be identified.

An interesting relationship was observed between the number of specimens of *Globorotalia inflata s.l., G. crassaformis,* and *G. miozea conoidea.* From lower Pliocene downward the first two species decrease numerically whereas *Globorotalia miozea conoidea* increases. In the Miocene deposits *Globorotalia inflata* and *G. crassaformis* are not found, and *G. miozea conoidea* is widely distributed and numerous. It appears that this one species is replaced by *Globorotalia inflata* and *G. crassaformis* in the more recent deposits.

Paleogene: Middle to upper Oligocene planktonic assemblages occur throughout Core 20. *Globorotalia opima opima* has been found associated with rare *Globigerina angulisuturalis.* An increasing number of benthonic foraminifera, among them *Victoriella conoidea* (Rutten), *Carpenteria balaniformis* Gray, and *Rupertina stabilis* (Wallich) indicate shallower conditions than during the Miocene to recent interval. *Victoriella conoidea* is an index form for the Oligocene with some occurrences in the uppermost Eocene and lowermost Miocene (Glaessner and Wade, 1959).

Cores 21 and 22 contain only rare planktonic foraminifera. Most benthonic foraminifera are poorly preserved. The predominance of *Amphistegina* indicates a shallow-water environment. *Stomatorbina torrei* (Cushman and Bermudez), also occurring in these levels, has so far been found only in Eocene, mostly upper Eocene, deposits and would therefore indicate such an age for this level. It must be pointed out, however, that the preservation of this species is rather poor, and its actual stratigraphic range may not yet be completely known.

The volcanic-derived sediments of Cores 25 to 29 contain a well-preserved, but very restricted shallow-water and nearshore foraminiferal assemblage of the genera *Elphidium, Quinqueloculina, Miliammina,* and *Baggina.* None of these forms are biostratigraphically distinctive and no age can therefore be derived from them.

No foraminifera occur below Core 29.

As a whole, this Paleogene sequence shows a very distinct transition from marine shallow-water and nearshore conditions at the base towards an open marine-type of environment at the end of the Oligocene.

Calcareous Nannoplankton

Stratigraphy: A possibly continuous sequence of lower Miocene to Quaternary nannoplankton assemblages was encountered in the uppermost 170 meters of the calcareous oozes (Cores 1-20). Cores 24 to 33 were barren of nannofossils. Since all pre-Quaternary assemblages showed signs of strong overgrowth, zonal assignment could be based only on a very restricted number of species and therefore remains tentative. The highly liquefied condition of the cores, combined with the foram-sand lithology might have resulted in the mixing of sediment within the cores. Reworked middle to upper Eocene coccoliths were found in Cores 18 through 20. Sample 16, CC and Core 12 (middle Miocene) are contaminated with upper Miocene to Pliocene nannofossils.

Preservation: All pre-Quaternary assemblages are overgrown.

Paleoecology: Rare *Braarudosphaera bigelowi* are found in Cores 17 through 20 indicating a nearshore or shallow-water environment in the lower Miocene. The ecologic conditions during the middle and upper Miocene and the Pliocene were subtropical as at Site 253.

Ostracods[3]

Cores 25 to 28 commonly contain ostracod assemblages. According to Oertli seven species are present. The assemblages are different from any known from adjacent areas (New Zealand, India, Africa, Middle East) and seem to be rather endemic and of shallow-water type. Specific determinations could not be attempted, but in its general aspect the fauna suggests an Eocene or Oligocene age. Due to its endemic character, however, the possibility of its occurrence as a relict assemblage in slightly younger sediments cannot be excluded.

Molluscs[4]

General

The mollusc material from Site 254 is poorly preserved (very fragile) and individual forms are often represented by a single fragment only. It has therefore not been possible to give any specific identifications.

Faunal list

Sample 24, CC:	*Paphia* sp.
	Pecten (Amussiopecten?)
	Pectinids indet. (2 ssp.)
	Smaragdiine
Sample 25-1, 46 cm:	Naticid indet.
Sample 25-5, 125 cm:	Cardiid indet.
	Crassatella sp.
Sample 26, CC:	*Dentalium* sp.
	Nucula (Lamellinucula) sp.
	Glycymeris (Glycymeris) sp.
	Brachidontes ? sp.
	Tellina sp.
	Tellinid indet.
	Naticid indet.
	small Cerithid close to *Bittium*

[3]Contribution by H. J. Oertli, SPNA, Centre de Recherches, Pau, France.

[4]Contribution by Peter Jung, Naturhistorisches Museum, Basel, Switzerland.

Sample 27, CC:	*Brachidontes* sp.
	Naticid indet.
Sample 28, CC:	Pholadid indet.
	Turbinid ?
	Naticid indet.

Ecology

Little can be said about the ecological conditions under which these faunules lived except that they are composed of tropical shallow-water forms. Genera such as *Dentalium* and *Nucula* are known to be able to live at greater depths (several hundred meters), but the majority are restricted to shallow water.

Age

The faunules as a whole do not compare at all with the known faunas from southern India, Sumatra, or Java. None of the genera or subgenera represented are diagnostic as to age. Among the genera and subgenera cited above, *Amussiopecten* has the shortest range (upper Oligocene to upper Miocene), but its identification is doubtful.

Although there is no definite evidence, the faunules seem to be of pre-Miocene age. With the possible exception of *Crassatella* sp. there are no forms which would clearly point to an Eocene age. For the time being it seems best, therefore, to consider these faunules as mid-Tertiary.

SEDIMENTATION RATES

The Oligocene-Miocene boundary is fairly well established at 167 meters subbottom, which gives an accumulation rate of 7.4 m/m.y. for the Neogene. The age of the sediments below Core 20 is still open to discussion, so any estimate of the sedimentation rate would be of little value. Judging from the nature of the sediments and the spread of ages suggested, however, it seems reasonable to assume that the rate of accumulation of the lower 133 meters of the section at Site 254 was significantly higher than for the upper part of the sequence.

SUMMARY AND CONCLUSIONS

Summary of Results

Site 254 is located in 1253 meters of water near the southern end of Ninetyeast Ridge. The site is located south of the apparent intersection of Broken Ridge and Ninetyeast Ridge. The seismic profile shows that the site lies on an isolated broad, high plateau. About 0.195 sec DT of sediment overlies a very strong intermediate reflector which is conformable with the sediment surface. Below this reflector, at 0.3-0.5 sec DT, is a weak and diffuse reflection with high relief that appears to be oceanic basement. Site 254 was drilled and cored through 301.0 meters of sediments and 42.5 meters of basalt flows to a total penetration of 343.5 meters; 329.0 meters of section (38 cores) were cored and 150.5 meters recovered, including 6.8 meters of basalt.

The sedimentary section can be divided into four lithostratigraphic units overlying the basalt flows sequence. The upper three of these form a sequence of biogenous oozes, and the fourth is a sequence of volcanic-derived silty sandstones and mudstones. The prominent seismic reflections correspond to the boundaries between the biogenous and volcanic sediments and between the volcanics and the underlying basalts.

Unit 1 is a very pale orange foram ooze making up the uppermost 11.5 meters of the sequence. The sediment is extremely pure, containing only trace amounts of terrigenous quartz, micas, and clays. The nannoplankton oozes of Unit 2, 165 meters thick, are divided into four subunits distinguished from each other by the varying amounts of foraminifera, coccoliths, and microcrystalline calcite present. Unit 3 is not well defined since recovery was limited to three core catchers. However, the base of the unit can be positioned confidently at 209.5 meters giving a maximum possible thickness for the unit of 33 meters. Microcrystalline calcite forms more than 92% of the sediment which is sufficiently consolidated in the lower part of the unit to be termed a chalk.

Unit 4, the volcanically derived sequence, is at least 91.5 meters thick and consists largely of poorly sorted silty clays and fine sandstones. Equally poorly sorted fine conglomerates with abundant muddy matrices are a much subordinate lithology. The most noticeable feature of the whole unit is the poor sorting, with scattered detrital granules and occasional volcanic pebbles widely distributed. Thin-walled macrofossil debris is common in the top part of the unit but absent below 247.5 meters. All the sediments of Unit 4 reflect a basaltic provenance. Partially altered volcanic glass, and ferruginous aggregates are common. No definite shards were observed, however, and crystalline igneous material is virtually absent.

The contact between the sediments and the basement basalts is conformable. At the contact the highly weathered basalt is overlain by ferruginous silty clays and fine sandstones containing weathered fragments of the underlying basalt. Three types of basalt can be recognized: an upper coarse porphyritic type, underlain by amygdaloidal basalt, underlain by nonamygdaloidal, fine-grained autobrecciated rocks with abundant basalt xenoliths.

From a paleontological point of view, Site 254 is confusing. Many intervals are barren of fossils, and those which are not contain mixed faunas. Matters are further complicated by the fact that the reworked fauna is generally in an excellent state of preservation. Core 1 is considered to be Quaternary, Cores 2 and 3 Pliocene, and Cores 4 through 19 Miocene in age. Core 20 contained an Oligocene assemblage which is possibly reworked. All of the benthonic foraminifera found in the calcareous sediments (Cores 1-19) suggest a water depth essentially the same as that of the present.

The volcanic sediments contained a distinctly littoral assemblage with two species of *Elphidium, Quinqueloculina,* a number of ostracod species (with and without ornamentation of the test), well-preserved but extremely fragile pelecypods and small gastropods. A precise age determination based on foraminifera is not possible, however, due to the lack of index forms. Samples 19 through 24, CC did not contain any microfossils and perhaps represent subaerial sediments.

The nannofloras are also mixed. All cores down to Core 19 contain rare to common Quaternary nannofossils, which are distinctly less overgrown than the older Miocene nannofossils. Whether all Miocene and Pliocene nannofossils are reworked into downwards-impoverished Quaternary assemblages or Pliocene and Miocene strata have been contaminated with Quaternary forms during drilling and coring cannot be definitely determined.

Three downhole temperature measurements were attempted at this site. A best estimate of the mean heat flow at this site is 1.25 $\pm 0.15\ \mu cal/cm^2/sec$. This value agrees well with the heat flow of 1.22 at Site 253 and 1.25 at Site 214 (Leg 22) on the Ninetyeast Ridge to the North.

Preliminary Conclusions

The clastic sediments of Unit 4 indicate weathering and erosion of a basaltic terrain adjacent to and composed of the same type of volcanic rocks as those found at the base of the section. There is no proven contemporaneous pyroclastic contribution to Unit 4. The poor sorting and lack of traction-current features indicate rapid deposition in quiet water, and the faunas suggest a shallow-water littoral or lagoonal type of environment. The rapid deposition is further substantiated by the intraformational breccias, which indicate contemporaneous instability of the sedimentary pile. The abundance of pyrite below 247.5 meters and the restriction of macrofossils to strata above this horizon suggest either shoaling or decrease in the depositional rate. The comminuted state of much of the macrofossils debris and the random orientation of the better preserved valves, when considered with the overall poor sorting and presence of diamicites, do suggest some redeposition.

During the deposition of the calcareous sediments (Units 1, 2, and 3), there was no basaltic or continental terrigenous sediment contribution, and all of the faunal evidence suggests an environment essentially similar to that of the present.

The micarb ooze and chalk are most probably a diagenetic modification of normal coccolith oozes. In spite of their present petrographic contrast with the foram and coccolith oozes, these micarb-bearing oozes need not reflect any real change within the domain of sedimentation.

Without further study it is impossible to develop any time scale for the events summarized above, although the calcareous sediments are probably no older than Miocene.

Combining Leg 26 and Leg 22 DSDP results from the Ninetyeast Ridge, the following facts emerge:

1) The age of the basal sediment immediately overlying the basalt becomes progressively older northwards, from late Eocene or Oligocene at Site 254 to older than Campanian at Site 217.

2) Leg 22 sites are the same age as the crust to the west; Site 253 may be the same age as this crust, but Site 254 is indeterminate in this regard.

3) The nature of the basal sediments varies from site to site. Sites 214 and 254 have littoral or lagoonal volcanoclastic sediments, Site 253 a great thickness of pyroclastic material, and Site 216 tuffaceous limestone.

4) Each site shows systematic deepening through time from littoral or shallow-water environments to the present depths. The ridge was thus formed as a shallow feature; it is not oceanic crust which has been pushed up to its present position. The implications of these facts for the origin of the Ninetyeast Ridge are discussed in a later section of this volume (Chapter 36).

REFERENCES

Falvey, D. A., 1972. Sea floor spreading in the Wharton Basin (northeast Indian Ocean) and the breakup of eastern Gondwanaland: Australian Petrol. Explor. Assoc. J., v. 12, p. 86-88.

Glaessner, M. F. and Wade, M., 1959. Revision of the foraminiferal family Victoriellidae: Micropaleontology, v. 5, p. 193.

Pimm, A. C., Garrison, R. E., and Boyce, R. E., 1971. Sedimentology synthesis: lithology, chemistry and physical properties of sediments in the northwestern Pacific Ocean. *In* Fischer, A. G., Heezen, B. C., et al., Initial Reports of the Deep Sea Drilling Project, Volume 6: Washington (U.S. Government Printing Office), p. 1131.

Wyrtki, K., 1971. Oceanographic Atlas of the International Indian Ocean Expedition: Washington (U.S. Government Printing Office).

APPENDIX A
Grain-Size Determinations for Site 254

Core Section Top of Interval (cm)	Subbottom Depth (m)	Sand (%)	Silt (%)	Clay (%)	Classification
1-2, 90	2.4	83.9	10.3	5.8	Sand
2-5, 90	12.4	49.5	28.0	22.5	Sand-silt-clay
3-2, 90	17.4	34.6	36.1	29.3	Sand-silt-clay
3-5, 90	21.9	32.5	33.1	34.4	Sand-silt-clay
4-2, 90	26.9	42.1	32.5	25.6	Sand-silt-clay
4-5, 90	31.4	40.9	30.8	28.3	Sand-silt-clay
5-2, 90	36.4	48.3	32.5	19.2	Silty sand
5-5, 90	40.9	40.2	38.9	21.0	Sand-silt-clay
6-2, 90	43.9	43.0	31.8	25.1	Sand-silt-clay
6-5, 90	50.4	46.7	35.4	17.9	Silty sand
7-2, 90	55.4	18.3	52.2	29.4	Clayey silt
7-5, 90	59.9	26.9	49.2	23.9	Sand-silt-clay
8-2, 90	64.9	27.8	44.9	27.3	Sand-silt-clay
8-5, 90	69.4	31.4	47.8	20.7	Sand-silt-clay
9-2, 90	74.4	29.6	45.1	25.3	Sand-silt-clay
10-2, 90	83.9	38.5	41.0	20.5	Sand-silt-clay
10-5, 90	88.4	36.7	44.4	18.9	Sandy silt
11-2, 90	93.4	37.1	40.1	22.8	Sand-silt-clay
11-5, 90	97.9	35.0	42.1	22.8	Sand-silt-clay
12-1, 90	101.4	50.1	29.7	20.1	Sand-silt-clay
17-1, 110	139.6	82.7	8.6	8.7	Sand
18-2, 90	150.4	41.0	35.5	23.4	Sand-silt-clay
18-5, 90	154.9	52.4	33.4	14.2	Silty sand
19-2, 90	159.9	36.0	41.0	23.0	Sand-silt-clay
19-5, 90	164.4	39.0	35.8	25.2	Sand-silt-clay
20-2, 109	169.6	40.1	37.1	22.8	Sand-silt-clay
20-5, 90	173.9	56.5	30.9	12.6	Silty sand
24-1, 90	210.4	27.4	28.7	43.9	Sand-silt-clay
25-3, 93	222.9	15.8	52.0	32.2	Clayey silt
25-5, 90	225.9	22.2	43.1	34.7	Sand-silt-clay
26-1, 132	229.8	3.4	38.6	57.9	Silty clay
27-1, 121	239.2	9.6	39.8	50.7	Silty clay
27-3, 90	241.9	12.5	42.9	44.5	Silty clay
29-1, 120	253.2	5.7	29.3	64.9	Silty clay
30-1, 90	267.4	5.0	30.9	64.1	Silty clay
32-1, 130	286.8	14.1	56.6	29.3	Clayey silt

APPENDIX B
Carbon-Carbonate Determinations for Site 254

Core Section Top of Interval (cm)	Subbottom Depth (m)	Total Carbon (%)	Organic Carbon (%)	$CaCO_3$ (%)
1-2, 88.0	2.38	10.8	0.1	90
2-2, 88.0	7.88	11.6	0.1	96
2-5, 88.0	12.38	11.7	0.1	97
3-2, 88.0	17.38	1.2	0.0	9
3-5, 88.0	21.88	11.8	0.1	98
4-2, 88.0	26.88	12.0	0.1	99
4-5, 88.0	31.38	11.8	0.1	98
5-2, 88.0	36.38	11.5	0.1	95
5-5, 88.0	40.88	11.6	0.1	96
6-2, 88.0	45.88	11.7	0.0	97
6-5, 88.0	50.38	11.6	0.1	96
7-2, 88.0	55.38	11.7	0.1	97
7-5, 88.0	59.88	11.8	0.1	98
8-2, 88.0	64.88	11.7	0.1	97
8-5, 88.0	69.38	11.5	0.1	95
9-2, 88.0	74.38	10.2	0.1	84
10-2, 88.0	83.88	11.7	0.1	97
10-5, 88.0	88.38	11.7	0.1	97
11-2, 88.0	93.38	11.6	0.0	96
11-5, 88.0	97.88	11.6	0.0	96
12-1, 88.0	101.38	11.2	0.1	93
17-1, 109.0	139.59	10.8	0.1	89
18-2, 88.0	150.38	11.1	0.1	92
18-5, 88.0	154.88	10.8	0.0	90
19-2, 88.0	159.88	11.8	0.0	98
19-5, 88.0	164.38	11.5	0.1	95
20-2, 108.0	169.58	7.4	0.1	61
20-5, 88.0	173.88	11.2	0.1	93
24-1, 88.0	210.38	1.1	0.4	6
25-3, 92.0	222.92	0.9	0.7	2
25-5, 88.0	225.88	1.1	0.7	3
26-1, 137.0	229.87	0.3	0.4	0
27-1, 120.0	239.20	1.4	1.3	1
27-3, 92.0	241.92	1.0	0.6	3
29-1, 119.0	258.19	3.4	1.6	15
30-1, 89.0	267.39	4.4	3.0	12
32-1, 129.0	286.79	0.1	0.2	0

APPENDIX C
X-Ray Analyses for Site 254

Core	Cored Interval Below Sea Floor (m)	Sample Depth Below Sea Floor (m)	Diff.	Amor.	Calc.	U–10[a]	U–11[b]	Quar.	Kaol.	Mica	Mont.	Clin.	Phil.	Anal.	Pyri.	Erio.	Gyps.	U–12[c]	Hali.	Magn.	Anat.	Goet.	U–6[d]
Bulk Samples																							
2	5.5-15.0	7.9	45.9	15.5	100.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		12.4	47.9	18.5	100.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
4	24.5-34.0	26.9	46.8	16.9	100.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
7	53.0-62.5	59.9	47.0	17.2	100.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
10	81.5-91.0	87.6	45.9	15.5	100.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
18	148.0-157.5	154.9	51.2	23.7	97.6	–	–	–	–	–	–	–	2.4	–	–	–	–	–	–	–	–	–	–
20	167.0-176.5	169.0	50.7	22.9	100.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		169.8	74.7	60.4	87.7	T	T	–	–	–	4.1	–	6.8	–	–	–	–	–	–	1.4	–	–	–
24	209.5-219.0	210.6	85.5	77.3	–	P	T	–	–	–	66.6	–	20.5	–	8.3	–	–	–	–	3.4	1.2	–	–
25	219.0-228.5	225.7	83.5	74.3	–	P	P	–	–	–	45.1	–	32.7	3.0	19.2	–	–	P	–	–	–	–	–
27	238.0-247.5	242.2	86.7	79.2	–	P	P	–	3.7	–	46.7	4.9	16.9	–	27.8	–	–	P	–	–	–	–	–
30	266.5-276.0	267.7	89.4	83.4	–	–	–	–	–	–	95.5	–	–	–	–	–	–	T	4.5	–	–	–	–
2-20μ Fraction																							
18	148.0-157.5	154.9	73.7	58.9	–	P	P	–	–	–	–	–	92.2	1.3	–	–	–	–	–	6.5	–	–	–
20	167.0-176.5	169.0	83.7	74.5	–	P	A	–	–	–	23.6	–	27.6	36.4	1.9	–	–	–	–	10.5	–	–	–
		169.8	83.4	74.1	–	P	P	–	–	–	20.9	–	68.0	3.0	–	–	–	–	–	8.2	–	–	–
24	209.5-219.0	210.6	79.7	68.3	–	A	P	–	–	–	60.2	–	5.2	–	28.2	–	–	–	–	4.9	1.4	–	–
25	219.0-228.5	225.7	71.5	55.5	–	P	P	–	–	–	24.6	–	20.1	5.8	33.1	16.5	–	T	–	–	–	–	–
27	238.0-247.5	242.2	73.3	58.3	–	P	P	–	–	–	14.1	21.3	27.2	–	37.4	–	–	P	–	–	–	–	–
30	266.5-276.0	267.7	79.0	67.1	–	–	–	–	–	–	100.0	–	–	–	–	–	–	A	–	–	–	T	–
<2μ Fraction																							
2	5.5-15.0	7.9	97.8	96.6	–	–	–	15.3	–	28.0	35.9	–	–	–	–	–	10.4	–	10.4	–	–	–	–
		12.4	97.7	96.4	–	–	–	3.4	–	4.1	87.8	–	–	–	–	–	1.2	–	3.5	–	–	–	–
4	24.5-34.0	26.9	98.0	96.9	–	–	–	5.9	–	12.4	77.2	–	–	–	–	–	3.2	–	1.3	–	–	–	–
7	53.0-62.5	59.9	98.9	98.3	–	–	–	34.9	–	–	33.6	–	–	–	–	–	7.0	–	24.6	–	–	–	–
10	81.5-91.0	87.6	98.7	98.0	–	–	–	25.7	–	35.2	28.6	–	–	–	–	–	5.3	–	5.3	–	–	–	–
18	148.0-157.5	154.9	95.0	92.1	–	A	P	–	–	16.6	47.5	–	17.1	–	–	–	1.8	–	11.3	5.8	–	–	–
20	167.0-176.5	169.0	95.4	92.8	–	–	–	–	–	–	81.1	–	–	3.7	–	–	5.0	–	–	10.2	–	–	–
		169.8	91.8	87.3	–	P	P	–	–	–	56.7	–	–	–	–	–	–	–	23.1	20.1	–	–	–
24	209.5-219.0	210.6	86.7	79.2	–	–	–	–	–	–	85.7	–	–	–	1.6	–	–	–	11.2	–	1.4	–	–
25	219.0-228.5	225.7	85.1	76.8	–	–	–	–	–	–	87.5	–	–	–	5.2	–	–	–	7.3	–	–	–	–
27	238.0-247.5	242.2	87.6	80.6	–	P	P	–	5.4	–	55.1	2.9	2.9	–	16.4	–	–	–	17.3	–	–	–	–
30	266.5-276.0	267.7	82.0	71.9	–	–	–	–	–	–	62.2	–	–	–	–	–	–	–	37.8	–	–	P	A

[a]Peaks at 3.23Å and 2.145Å among others. This mineral's peaks closely match those of anorthoclase (JCPDS 9-478). A = abundant; P = present; T = trace.
[b]Peaks at 3.30Å, 3.76Å, and 2.982Å among others. This mineral's peaks closely match those of adularia (JCPDS 19-931). A = abundant; P = present; T = trace.
[c]Peaks at 2.743Å, 2.538Å, and 1.719Å among others. This mineral is ilmenite (JCPDS 3-781). A = abundant; P = present; T = trace.
[d]Narrow peaks at 9.60Å and 2.418Å.

Site 254 Hole Core 1 Cored Interval: 0.0-5.5 m

AGE	FORAMS ZONE	NANNOS ZONE	FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS., ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
QUATERNARY	N22-N23	NN20					1	0.5, 1.0	VOID			
			AG	0			2				* HO, CC GZ *XM	10YR 8/2
			AG	0	AG							
			AG	0			3				*, KE	
			AG	0								
			AG	0		B	Core Catcher					

Very pale orange COCCOLITH FORAMINIFERAL OOZE.

TEXTURE: Sand 84%
Silt 10%
Clay 6%

BIOGENIC CONSTITUENTS:

Foraminifera 65%
Coccoliths 35%

MINOR CONSTITUENTS:

Quartz: trace amounts
Mica: trace amounts
Detrital Clay: ubiquitous trace amounts

Total Carbon: 10.8%
Organic Carbon: 0.1%
Calcium Carbonate: 90%

CONSOLIDATION: Soft.

Explanatory notes in chapter 2

Site 254 Hole Core 2 Cored Interval: 5.5-15.0 m

AGE	FORAMS ZONE	NANNOS ZONE	FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS., ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
UPPER PLIOCENE	N20	NN16	AG	0		B	1	0.5, 1.0			*	N8, 10YR 8/2
			AG	0								
			AG	0			2				CC GZ *XM	N8 interval; [small patch 10YR 7/4]; N8
					AGO							
LOWER PLIOCENE	N19		AG	0			3				*	
			AG	0								
			AG	0			4				*	
			AG	0								
			AG	0			5				*CC GZ XM, KE	
			AG	0	AGO							
			AG	0		B	6				*	
			AG	0					VOID			
			AG	0	AGO		Core Catcher					

Above Section 2, 100 cm:

Same very pale orange COCCOLITH FORAMINIFERAL OOZE as Core 1.

Below Section 2, 100 cm:

Very light gray FORAM-RICH COCCOLITH OOZE.

TEXTURE: Sand 50%
Silt 28%
Clay 22%

BIOGENIC CONSTITUENTS:

Coccoliths: 73-78%
Foraminifera: 22-25%
Discoasters: Tr- 2%

MINOR CONSTITUENTS:

Ubiquitous very minor traces of detrital clay.

Total Carbon: 11.6-11.7%
Organic Carbon: 0.1%
Calcium Carbonate: 96-97%

CONSOLIDATION: Soft.

Explanatory notes in chapter 2

Site 254 Hole Core 3 Cored Interval: 15.0-24.5 m

AGE	ZONE: FORAMS	ZONE: NANNOS	FOSSIL CHARACTER: FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS. ETC.	SECTION	METERS	LITHO. SAMPLE
LOWER PLIOCENE	N19	NN14	AG	0			1	0.5	*
			AG	0		B		1.0	
			AG	0			2		* CC GZ
			AG	0					
			AG	0			3		*
			AG	0					
			AG	0			4		*
			AG	0					
			AG	0			5		CC GZ *XM KE HO
			AG	0			6		
			AG	0					*
			AG	0	AGO		Core Catcher		

N8

Very light gray FORAM-RICH COCCOLITH OOZE.

Note: Deforamtion difficult to establish because of homogeneity.

TEXTURE: Sand 32-35%
Silt 33-36%
Clay 29-34%

BIOGENIC CONSTITUENTS:

Coccoliths: 75-85% (average 80%)
Foraminifera: 15-25% (average 20%)
Discoasters: traces (1 smear slide, 1%)

MINOR CONSTITUENTS: Ubiquitous very minor traces of detrital clay.

Total Carbon: 11.8%
Organic Carbon: 0.1%
Calcium Carbonate: 98%

CONSOLIDATION: Soft.

N8 (Core Catcher)

Explanatory notes in chapter 2

Site 254 Hole Core 4 Cored Interval: 24.5-34.0 m

AGE	ZONE: FORAMS	ZONE: NANNOS	FOSSIL CHARACTER: FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS. ETC.	SECTION	METERS	LITHO. SAMPLE
UPPER MIOCENE	N18	NN11	AG	0		B	1	0.5	
			AG	0				1.0	*
			AG	0			2		
			AG	0	AGO				CC GZ
	N16-N17		AG	0			3		* *
			AG	0					*
			AG	0			4		*
			AG	0					
			AG	0			5		
			AG	0	AGO				CC GZ *XM KE
			AG	0		B	6		
			AG	0					
			AG	0	AMO		Core Catcher		

N8 with very faint slight 5YR 8/1 mottles or patches

N8

very faint 5YR 8/1 mottles

Very light gray FORAM-RICH COCCOLITH OOZE, slightly and very faintly mottled very pale orange in Section 1.

TEXTURE: Sand 41-42%
Silt 31-32%
Clay 26-28%

BIOGENIC CONSTITUENTS:

Coccoliths: 74-80%
Foraminifera: 20-25%
Discoasters: Traces (1% in 1 smear slide)

MINOR CONSTITUENTS: Ubiquitous very minor traces of detrital clay.

Total Carbon: 11.8-12.0%
Organic Carbon: 0.1%
Calcium Carbonate: 98-99%

CONSOLIDATION: Soft.

N8 (Core Catcher)

Explanatory notes in chapter 2

Site 254 Hole Core 5 Cored Interval: 34.0-43.5 m

AGE	FORAMS ZONE	NANNOS ZONE	SECTION	FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS., ETC.	LITHO. SAMPLE
UPPER MIOCENE	N16-N17	NN9	1	AG	0		B	*
				AG	0			* HO
			2	AG	0			* CC GZ
				AG	0	AMO		
MIDDLE MIOCENE	N13-N15		3	AG	0			*
				AG	0			
			4	AG	0			
				AG	0			*
			5	AG	0			* CC GZ XM
				AG	0	CMO		
			6	AG	0		B	*
				AG	0			
			Core Catcher	AG	0	CMO		

Remarks (beside the lithology column, top to bottom): N8; 5YR 8/1 band; N8; 2 cm 5YR 8/1; 5YR 8/1; 1 cm 5YR 8/1; [micarb-rich below this level]; very slight color change; N8 (Core Catcher).

LITHOLOGIC DESCRIPTION

Very light gray FORAM-RICH COCCOLITH OOZE: micarb rich below Section 5; with minor pinkish gray banding in the upper 165 cm of the core.

TEXTURE: Sand 40-48%
Silt 32-39%
Clay 19-21%

BIOGENIC CONSTITUENTS:

Coccoliths: 70-85%
Foraminifera: 15-25%
Discoasters: Traces in every smear slide

MINOR CONSTITUENTS:

10% micarb in Section 6 (broken nannos)
Ubiquitous very minor traces of detrital clay.

Total Carbon: 11.5-11.6%
Organic Carbon: 0.1%
Calcium Carbonate: 95-96%

CONSOLIDATION: Soft.

Explanatory notes in chapter 2

Site 254 Hole Core 6 Cored Interval: 43.5-53.0 m

AGE	FORAMS ZONE	NANNOS ZONE	SECTION	FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS., ETC.	LITHO. SAMPLE
MIDDLE MIOCENE	N13-N15	NN9	1	AG	0		B	*
				AG	0			
			2	AG	0			* CC GZ
				AG	0	CMO		*
			3	AG	0			
				AG	0			*
			4	AG	0			*
				AG	0			
			5	AG	0			CC GZ XM
				AG	0	AMO		* KE
			6	AG	0		B	*
				AG	0			
			Core Catcher	AG	0	AMO		

Remarks (beside the lithology column, top to bottom): 5YR 8/1 with 20% N9 patches; 5YR 8/1 zone; N8 to 5YR 8/1; Abundant drill pipe rust; 5YR 8/1; 5YR 8/1 (Core Catcher).

LITHOLOGIC DESCRIPTION

Pinkish-gray MICARB AND FORAM RICH COCCOLITH OOZE. White patches in the upper part of the core are probably due to drilling deformation.

TEXTURE:

Sand 43% in upper part; 47% in lower part
Silt 32% in Sections 1 & 2; rest 35%
Clay 25% in upper part; 18% in lower part

BIOGENIC CONSTITUENTS:

Coccoliths: 75% decreasing downward to 58%
Foraminifera: 15% in upper half of the core; decreasing to 12% in lower half
Discoasters: Ubiquitous traces

MINOR CONSTITUENTS:

Micarb, increasing from 10% in Section 1 to 30% in lower half of the core
Ubiquitous very minor traces of detrital clay

Total Carbon: 11.6-11.7%
Organic Carbon: 0.0-0.1%
Calcium Carbonate: 96-97%

CONSOLIDATION: Soft.

Explanatory notes in chapter 2

Site 254 Hole Core 7 Cored Interval: 53.0-62.5 m

AGE: MIDDLE MIOCENE — FORAMS ZONE: N13-N15 — NANNOS ZONE: NN9; NN6-NN9

SECTION	FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS., ETC.	LITHO. SAMPLE
1	AG	0		B	5YR 8/1
1	AG	0			* ←[30% micarb]
2	AG	0			
2	AG	0	AMO		CC GZ * ←[5% micarb]
3	AG	0			
3	AG	0			* [no micarb]
4	AG	0			
4	AG	0			*
5	AG	0			CC GZ * XM KE
5	AG	0	AMO		
6	AG	0		B	*
6	AG	0			
Core Catcher	AG	0	AMO		5YR 8/1

LITHOLOGIC DESCRIPTION

Pinkish gray FORAM-RICH COCCOLITH OOZE; also micarb-rich in Section 1. The downward decrease in micarb is not reflected in any textural or color change seen visually.

TEXTURE:

1. Upper part of core:

Sand 18%
Silt 52%
Clay 29%

2. Lower part of core:

Sand 21%
Silt 49%
Clay 29%

BIOGENIC CONSTITUENTS:

Coccoliths: (Section 1) 58%; rest of core 83-88%
Foraminifera: 12-15%
Discoasters: Ubiquitous traces

MINOR CONSTITUENTS:

Ubiquitous very minor traces of detrital clay
Micarb: Section 1, 30%; Section 2, 5%

(Lower Part)
Total Carbon: 11.7-11.8%
Organic Carbon: 0.1%
Calcium Carbonate: 97-98%

CONSOLIDATION: Soft, but lower half of the core shows slight stiffening.

Explanatory notes in chapter 2

Site 254 Hole Core 8 Cored Interval: 62.5-72.0 m

AGE: MIDDLE MIOCENE — FORAMS ZONE: N13-N15 — NANNOS ZONE: NN6-NN9

SECTION	FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS., ETC.	LITHO. SAMPLE
1	AG	0		B	5YR 8/1
1	AG	0			*
2	AG	0			*
2	AG	0	AMO		CC GZ
3	AG	0			
3	AG	0			* ; * ←[deeper shade of 5YR 8/1] ; *
4	AG	0-1			
4	AG	0-1			* ; 5YR 8/1 & N8
5	AG	0-1			* XM KE } N8 layer
5	AG	0-1	AMO		* ← layer ; * HO 5YR 8/1 & N9
6	AG	0-1		B	
6	AG	0-1			
Core Catcher	AG	0-1	AMO		

LITHOLOGIC DESCRIPTION

FORAM-RICH COCCOLITH OOZE; predominantly pinkish-gray, but with minor very light gray and white shades and layers in the lowest two sections.

TEXTURE: Sand 28-31%
Silt 45-48%
Clay 21-27%

BIOGENIC CONSTITUENTS:

Coccoliths 88-92% (average 80%)
Foraminifera: 10-15% (average 12%)
Discoasters: Ubiquitous traces

MINOR CONSTITUENTS:

Ubiquitous very minor traces of detrital clay
Rare traces of authigenic carbonate

Total Carbon: 11.5-11.7%
Organic Carbon: 0.1%
Calcium Carbonate: 95-97%

CONSOLIDATION: Slightly stiff.

Explanatory notes in chapter 2

Site 254 Hole Core 9 Cored Interval: 72.0-81.5 m

AGE	FORAMS ZONE	NANNOS ZONE	FOSSIL CHARACTER: FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS., ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE MIOCENE	N13-N15		AG	0-1		B	1	0.5 / 1.0	VOID		*	5YR 8/1 ←[slightly darker patch]
			AG	0-1	AMO		2				* CC GZ / KE	
	N9-N12	NN6-NN9	AG	0-1			3				*	very faint banding
			AG	0-1								
			AG	0-1	AMO		Core Catcher					

Pinkish gray FORAM-RICH COCCOLITH OOZE. Approximately 0.5% to 1% of the foraminifera are stained orange.

TEXTURE: Sand 30%
Silt 45%
Clay 25%

BIOGENIC CONSTITUENTS:

Coccoliths: 88%
Foraminifera: 12%
Discoasters: Ubiquitous traces

MINOR CONSTITUENTS: Ubiquitous very minor traces of detrital clay

Total Carbon: 10.2%
Organic Carbon: 0.1%
Calcium Carbonate: 84%

CONSOLIDATION: Slightly stiff.

Explanatory notes in chapter 2

Site 254 Hole Core 10 Cored Interval: 81.5-91.0 m

AGE	FORAMS ZONE	NANNOS ZONE	FOSSIL CHARACTER: FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS., ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE MIOCENE	N9-N12	NN6-NN9	AG	0-1			1	0.5 / 1.0			*	5YR 8/2
			AG	0-1		B						
			AG	0-1			2				* CC GZ	
			AG	0-1	AMO							
			AG	0-1			3				*	
			AG	0-1								
			AG	0-1			4				*	
			AG	0-1							XM	
			AG	0-1			5				*	
			AG	0-1	AMO						CC GZ / KE	
			AG	0-1		B	6				*	
			AG	0-1								
			AG	0-1	AMO		Core Catcher					

Pinkish gray FORAM-RICH COCCOLITH OOZE, micarb-bearing. As in Core 9, 1% of the foraminifers are stained orange.

TEXTURE: Sand 37-38%
Silt 41-44%
Clay 19-20%

BIOGENIC CONSTITUENTS:

Coccoliths: 83-88%
Foraminifera: 12-15%
Discoasters: Ubiquitous traces

MINOR CONSTITUENTS: Ubiquitous traces of detrital clay

0-5% (average 2%) micarb

Total Carbon: 11.7%
Organic Carbon: 0.1%
Calcium Carbonate: 97%

CONSOLIDATION: "Semi-stiff"

Explanatory notes in chapter 2

Site 254 Hole Core 11 Cored Interval: 91.0-100.5 m

AGE	FORAMS ZONE	NANNOS ZONE	FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS. ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE		LITHOLOGIC DESCRIPTION
MIDDLE MIOCENE	N9-N12	NN6-NN9	AG	0-1			1	0.5 / 1.0	VOID		*	5YR 8/1	FORAM-RICH COCCOLITH OOZE, mostly pinkish-gray but grading downward to very pale orange in the lowest part of Section 6. Orange-stained foraminifera are abundant in the washed top of the core but elsewhere are less abundant than in Core 10.
			AG	0-1		B	2				CC *GZ		TEXTURE: Sand 35-37%, Silt 40-42%, Clay 23%
			AG	0-1	AMO								BIOGENIC CONSTITUENTS: Coccoliths: 80-89%; Foraminifera: 8-20%; Discoasters: Ubiquitous trace amounts
			AG	0-1			3						MINOR CONSTITUENTS: Ubiquitous, very minor traces of detrital clay; Micarb, traces to 3%
			AG	0-1							*		Total Carbon: 11.6%; Organic Carbon: 0.0%; Calcium Carbonate: 96%
			AG	0-1			4				*		CONSOLIDATION: "Semi-stiff"
			AG	0-1									
			AG	0-1			5				* CC GZ *	←brown spot	
			AG	0-1	AMO								
			AG	0-1		B	6				HO XM KE *	10YR 8/2	
			AG	0-1									
			AG	0-1	AMO		Core Catcher						

Explanatory notes in chapter 2

Site 254 Hole Core 12 Cored Interval: 100.5-110.0 m

AGE	FORAMS ZONE	NANNOS ZONE	FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS. ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE		LITHOLOGIC DESCRIPTION
MIDDLE MIOCENE	N9-N12 (contaminated; Quaternary specimens)	NN6-NN9 (+NN11, contaminated)	AG	0-1		B	1	0.5 / 1.0			* CC GZ *	5YR 8/1 with N8 patches	FORAM-RICH COCCOLITH OOZE, mostly pinkish gray except for basal 170 cm, which is very pale orange. Micarb-bearing. Note: Sections 1, 2 and 3 are very badly contaminated by drilling-pipe rust.
			AG	0-1	AMO								TEXTURE: Sand 50%, Silt 30%, Clay 20%
			AG	0-1			2						BIOGENIC CONSTITUENTS: Coccoliths: 65-77%, increasing with depth; Foraminifera: 20-30%, decreasing with depth; Discoasters: Ubiquitous traces
			AG	0-1	AMO								MINOR CONSTITUENTS: Ubiquitous traces of detrital clay; 3-5% silt-size micarb
			AG	0-1	AMO		3						Total Carbon: 11.2%; Organic Carbon: 0.1%; Calcium Carbonate: 93%
			AG	0-1							*	10YR 8/2	CONSOLIDATION: "Semi-stiff".
			AG	0-1		B	4				KE		
			AG	0-1							*	←3 cm patch of 10YR 8/6	
		NN5	AG	0-1	AMO		Core Catcher						

Explanatory notes in chapter 2

Site 254 Hole Core 13 Cored Interval: 110.0-119.5 m

AGE	FORAMS ZONE	NANNOS ZONE	FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS. ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE		LITHOLOGIC DESCRIPTION
MIDDLE MIOCENE	N9-N12 (contaminated; Quaternary specimens)		AG	0-1			Core Catcher				*	N9	RECOVERY: Core catcher only. White FORAM-RICH COCCOLITH OOZE. TEXTURE: Sand 10%, Silt 5%, Clay 85% (Smear Slide). BIOGENOUS CONSTITUENTS: Coccoliths: 90%; Foraminifera: 10%; Discoasters: Trace amount. MINOR CONSTITUENTS: Trace of detrital clay

Explanatory notes in chapter 2

Site 254 Hole Core 14 Cored Interval: 119.5-126.5 m

AGE	FORAMS ZONE	NANNOS ZONE	FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS., ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
MIDDLE MIOCENE	N9-N12 (contaminated; Quaternary specimens)	NN5	AG	0	AMO			Core Catcher			*

10YR 8/2

RECOVERY: Core catcher only.

Very pale orange, micarb-bearing FORAM-RICH COCCOLITH OOZE.

TEXTURE: Sand 15%
Silt 5%
Clay 80%
(Smear Slide)

BIOGENOUS CONSTITUENTS:

Coccoliths: 75%
Foraminifera: 15%
Discoasters: Trace amount

MINOR CONSTITUENTS:

10% micarb
Trace of detrital clay

Explanatory notes in chapter 2

Site 254 Hole Core 15 Cored Interval: 126.5-137.0 m

AGE	FORAMS ZONE	NANNOS ZONE	FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS., ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
LOWER MIOCENE	N8	NN3	AG	0-1	AMO			Core Catcher			*

10YR 8/2

RECOVERY: Core catcher only.

Very pale orange coccolith-bearing FORAM-RICH MICARB OOZE.

TEXTURE: Sand 20%
Silt 10%
Clay 70%
(Smear Slide)

Micarb content: 70%

FOSSIL CONTENT:

Foraminifers: 20%
Coccoliths: 10%

MINOR CONSTITUENT: Trace of detrital clay

Explanatory notes in chapter 2

Site 254 Hole Core 16 Cored Interval: 137.0-138.5 m

AGE	FORAMS ZONE	NANNOS ZONE	FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS., ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
LOWER MIOCENE	N8 (contaminated Quaternary)	NN3 (+ contaminated Pliocene)	AG	0-1	AMO			Core Catcher			

10YR 7/4

RECOVERY: Core catcher only.

Grayish-orange feldspar and nannoplankton bearing FORAMINIFERAL MICARB OOZE.

62% micarb
30% forams
5% coccoliths

TEXTURE: Sand 30%
Silt 5%
Clay 65%
(Smear Slide)

CONSOLIDATION: Soft (disturbed).

Explanatory notes in chapter 2

Site 254 Hole Core 17 Cored Interval: 138.5-148.0 m

AGE	FORAMS ZONE	NANNOS ZONE	FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS., ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
LOWER MIOCENE	N8 --- N4-N7	NN1-NN3	AG/M AG/M	0-1 0-1	AMO AMO	B	1 Core Catcher	0.5 1.0	VOID		* CC GZ *

10YR 8/2
10YR 7/4
5YR 8/1
10YR 8/2

Very pale orange, grayish orange and pinkish gray micarb-bearing FORAM-RICH COCCOLITH OOZE.

TEXTURE: Sand 83%
Silt 9%
Clay 9%

BIOGENIC CONSTITUENTS:

Coccoliths: 76-81%
Foraminifera: 15-20%
Discoasters: 1%

MINOR CONSTITUENTS: Ubiquitous trace amounts of detrital clay; rare trace of heavy minerals.

Total Carbon: 10.8%
Organic Carbon: 0.1%
Calcium Carbonate: 89%

CONSOLIDATION: "Semi-stiff"; stiff at 131-133 cm.

Explanatory notes in chapter 2

Site 254 Hole Core 18 Cored Interval: 148.0-157.5 m

AGE	FORAMS ZONE	NANNOS ZONE	FOSSIL CHARACTER: FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS., ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
LOWER MIOCENE	N4-N7	NN1-NN3	AG/M	0-1	AMO	B	1	0.5, 1.0	VOID			10YR 8/2
			AG/M	0-1			2				* CC GZ * *	5YR 8/1 w/ 10YR 6/2 mottles; 10YR 7/4 [semi-lithified lump]; 10YR 8/2 w/ 10YR 7/4 mottles; 10YR 8/4 w/ slight 10YR 8/2 mottles
			AG/M	0-1	AMO		3				* *	10YR 8/2 w/ 5YR 6/2 mottles; 5YR 8/4; 10YR 8/4
			AG/M	0-1			4				*	N8 & 5YR 6/4 mottles; 10YR 8/2
			AG/M	0-1			5		VOID		HO * CC GZ XM KE	5YR 8/1
			AG/M	0-1	AMO							
			AG/M	0-1		?	6					10YR 7/4
			AG/M	0-1	AMO		Core Catcher					

Very pale orange, lesser moderate orange pink and grayish orange micarb-bearing FORAM-RICH COCCOLITH OOZE, slightly to moderately mottled with pale yellow brown, grayish orange, gray and light brown colors.

TEXTURE: Sand 41-52%
Silt 33-36%
Clay 14-23%

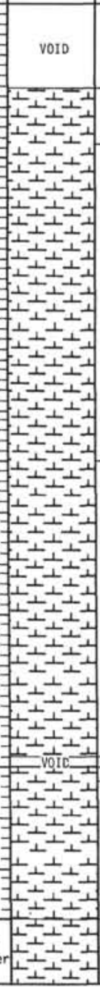
BIOGENIC CONSTITUENTS:

Coccoliths: 71-88%
Foraminifera: 10-25%
Discoasters: Ubiquitous traces
One occurrence of echinoid spine.

MINOR CONSTITUENTS:

Micarb: 0.5 to 2.5%
Detrital clay: Ubiquitous traces
One occurrence of amorphous ferruginous aggregates
Zeolite: 0.5 to 2.5%

Total Carbon: 10.8-11.1%
Organic Carbon: 0.0-0.1%
Calcium Carbonate: 90-92%



Explanatory notes in chapter 2

Site 254 Hole Core 19 Cored Interval: 157.5-167.0 m

AGE	FORAMS ZONE	NANNOS ZONE	FOSSIL CHARACTER: FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS., ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
LOWER MIOCENE	N4-N7	NN1-NN3	AG/M	0-1		?	1	0.5, 1.0			* *	10YR 8/2; Thin 10YR 5/4 patch
			AG/M	0-1								
			AG/M	0-1	AMO		2				CC GZ	
			AG/M	0-1								
			AG/M	0-1			3				*	
			AG/M	0-1								
			AG/M	0-1			4				*	
			AG/M	0-1								
			AG/M	0-1	AMO		5				CC GZ *	
			AG/M	0-1		?						
			AG/M	0-1	AMO		6				KE HO	5YR 8/1; 10YR 8/2
			AG/M	0-1	AMO		Core Catcher					

Very pale orange and very minor pinkish gray FORAM-RICH COCCOLITH OOZE.

TEXTURE: Sand 36-39%
Silt 36-41%
Clay 23-25%

BIOGENIC CONSTITUENTS:

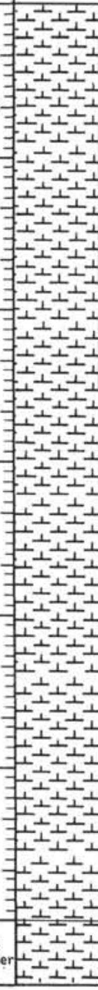
Coccoliths: 75-85%
Foraminifera: 15-25%
Discoasters: Ubiquitous traces
One occurrence of an echinoid spine
Few coarse shell fragments

MINOR CONSTITUENTS:

Detrital clay: Ubiquitous traces
Micarb: Trace amounts; (1 smear slide w/ 3%)
Zeolite: Ubiquitous trace amounts

Total Carbon: 11.5-11.8%
Organic Carbon: 0.0-0.1%
Calcium Carbonate: 95-98%

CONSOLIDATION: "Semi-stiff".



Explanatory notes in chapter 2

Site 254 Hole Core 20 Cored Interval: 167.0-176.5 m

AGE	FORAMS ZONE	NANNOS ZONE	FOSSIL CHARACTER: FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS., ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
OLIGOCENE	P21	?	AG	0	AMO		1	0.5, 1.0				10YR 6/6
			AG	0		B						
			AG	0			2				XM	
			AG	0							CC *GZ XM *	5YR 5/6 Fragments of 5YR 4/4 mudstone; 10YR 8/2
			AG	0			3				*	←3 cm 5Y 4/4 fragment
			AG	0								
			AG	0			4					←2 cm 5Y 4/4 lump
			AG	0								
							5				CC GZ *	5YR 8/4
						B	6					
			AG								* HO KE	10YR 7/4
			CG		CMO	B	Core Catcher					

Dark yellowish orange, moderate orange-pink and minor light brown FORAM-RICH MICARB-COCCOLITH OOZE; locally, iron and zeolite-bearing or coccolith and foram bearing MICARB OOZE. Micarb content increases irregularly toward the base of the core, ranging between 26 and 52%, attaining 90% in 1 smear slide.

TEXTURE: Sand 40-56%
Silt 31-37%
Clay 13-23%

BIOGENIC CONSTITUENTS:

Coccoliths: 38-60%
Foraminifera: 8-20%
One noted occurrence of fish debris

MINOR CONSTITUENTS:

The fragments of moderate brown (5YR 4/4) mudstone are concentrations of amorphous ferruginous clay-sized aggregates, which also occurs in amounts ranging from traces to 5% throughout, being more concentrated in the darker intervals.

Zeolite: Traces to 3%.
Mica: One occurrence (trace) noted.

Total Carbon: 7.4-11.2%
Organic Carbon: 0.1%
Calcium Carbonate: 61-93%

CONSOLIDATION: Stiff to semi-lithified.

Explanatory notes in chapter 2

Site 254 Hole Core 21 Cored Interval: 186.0-195.5 m

AGE	FORAMS ZONE	NANNOS ZONE	FOSSIL CHARACTER: FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS., ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
?	?		R P-M		B	B	Core Catcher			*		10YR 6/6

RECOVERY: Core catcher only.

Dark yellowish brown foram-bearing MICARB OOZE. Micarb content: 92%.

TEXTURE: Sand 10%
Silt 10%
Clay 80%
(Smear Slide)

BIOGENIC CONSTITUENTS: 5% forams, trace of coccoliths, 2% echinoid spines

MINOR CONSTITUENTS: 1% amorphous ferruginous aggregates, trace of zeolite.

CONSOLIDATION: Stiff to semi-lithified.

Explanatory notes in chapter 2

Site 254 Hole Core 22 Cored Interval: 195.5-200.0 m

AGE	FORAMS ZONE	NANNOS ZONE	FOSSIL CHARACTER: FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS., ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
?	?	?	R P-M		RPO		Core Catcher				*	10YR 7/4

RECOVERY: Core catcher only.

Grayish orange ferruginous, foram-bearing MICARB OOZE. Micarb content is 97%.

TEXTURE: Sand 10%
Silt 10%
Clay 80%
(Smear Slide)

BIOGENIC CONSTITUENTS: 2% forams, traces of coccoliths.

MINOR CONSTITUTENTS: 1% amorphous ferruginous aggregates, traces of zeolite.

CONSOLIDATION: Stiff.

Explanatory notes in chapter 2

Site 254 Hole Core 23 Cored Interval: 200.0-209.5 m

AGE	FORAMS ZONE	NANNOS ZONE	FOSSIL CHARACTER: FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS., ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
?	?		B		B		Core Catcher				*	10YR 6/6

RECOVERY: Core catcher only.

Dark yellowish orange, iron and zeolite-bearing MICARB CHALK.

Micarb content: 92%.

TEXTURE: Sand 5%
Silt 10%
Clay 85%
(Smear Slide)

BIOGENIC CONSTITUENTS:

2% forams, traces of coccoliths

MINOR CONSTITUENTS:

5% ferruginous aggregates, 1% zeolite

CONSOLIDATION: Semi-lithified.

Explanatory notes in chapter 2

Site 254 Hole Core 24 Cored Interval: 209.5-219.0 m

AGE	FORAMS ZONE	NANNOS ZONE	FOSSIL CHARACTER: FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS., ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE TERTIARY	?		RM		B		1	0.5, 1.0	VOID		CC GZ HO KE XM	5Y 2/1 mudstone texture; sandy with few clasts up to 0.5 cm
			RM		RPO		Core Catcher					

Olive black MUDSTONE and SANDSTONE derived from basic vitric volcanic rocks.

TEXTURE: Sand 27%
Silt 29%
Clay 44%

COMPOSITION:

92% clay alteration products from glass
5% amorphous ferruginous aggregates
2% mica
1% authigenic zeolite

Total Carbon: 1.1%
Organic Carbon: 0.4%
Calcium Carbonate: 6%

CONSOLIDATION: Semi-lithified.

5YR 2/1 Silty clay derived from basalt
Pelecypods, Gastropods

Explanatory notes in chapter 2

Site 254 Hole Core 25 Cored Interval: 219.0-228.5 m

AGE	FORAMS ZONE	NANNOS ZONE	FOSSIL CHARACTER: FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS., ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE TERTIARY	?		FM				1	0.5, 1.0			KE HO *	5Y 2/1 clay text., abund. shell (Gastropod, Pelecypod) fragments of coarse sand-size, 1-2%
			FM			?	2				*	N1 clay texture 25% shell fragments, few 2-4 mm blue-green and black granules-coarse sand
			FM				3		VOID		CC *GZ	N1 fine sand 2% shells & shell frags; N1 coarse (to 8 cm) clasts
			FM				4				*	Fine sands; 5Y 2/1 med-fine sand, 5% shells and shell fragments; bioturbated; scattered angular lithic pebbles to 8 mm; large intraformational fossil-bearing fragments
			FM				5				XM CC GZ * KE	←Pelecypods
			FM				6		VOID		MY	5Y 2/1 Basalt-derived silty clay
			FG		B		Core Catcher					

Olive black SANDY MUDSTONES and poorly sorted FINE-GRAINED SANDSTONES, all of basaltic provenance The sandstones contain scattered basic volcanic pebbles. Fragmental fossil debris throughout.

COMPOSITION AND TEXTURE

A. Mudstones:

Texture: Sand 16%
Silt 52%
Clay 32%

Composition:
90% clay (possibly alteration products from volcanic glass)
5% amorphous ferruginous aggregates
2% mica
1- 2% colorless volcanic glass
1- 2% zeolite

B. Sandstones:

Texture: Sand 22%
Silt 43%
Clay 35%

Composition (Smear Slide):

66-78% clay (possibly alteration products from vitric and lithic basalt fragments)
10% amorphous ferruginous aggregates
1-10% colorless volcanic glass
1- 2% mica
1- 2% glauconite
2-12% zeolite
Localized concentrations of up to 2% framboidal pyrite

Total Carbon: 0.9-1.1%
Organic Carbon: 0.7%
Calcium Carbonate: 2-3%

CONSOLIDATION: Semi-lithified.

Explanatory notes in chapter 2

Site 254 Hole Core 26 Cored Interval: 228.5-238.0 m

AGE	FORAMS ZONE	NANNOS ZONE	FOSSIL CHARACTER: FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS. ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE TERTIARY	?		FM				1	0.5, 1.0	VOID		MY *KE GZ CC HO	5Y 4/1
			FG		B		Core Catcher					5Y 2/1 Olive black basalt-derived silty clay Pelecypods, Gastropods

Olive gray FINE DIAMICTITE or PEBBLE CONGLOMERATE of fine-grained basic provenance.

COMPOSITION (Smear Slide):
78% clay (basalt alteration products)
10% amorphous ferruginous aggregates
5% colorless volcanic glass
2% glauconite
2% pyrite framboids
2% zeolite
1% mica
Trace serpentine

TEXTURE (matrix): Sand 3%, Silt 39%, Clay 58%

Total Carbon: 0.3%
Organic Carbon: 0.4%
Calcium Carbonate: 0.0%

CONSOLIDATION: Semi-lithified.

Explanatory notes in chapter 2

Site 254 Hole Core 27 Cored Interval: 238.0-247.5 m

AGE	FORAMS ZONE	NANNOS ZONE	FOSSIL CHARACTER: FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS. ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE TERTIARY							1	0.5, 1.0	VOID	▲▼	*CC GZ	N2 brecciated mudstones; few rounded green-blue fine-grained volcanic pebbles
											*	Mudstones; 2-10 cm laminations
							2					Fossilif. silty mudstone; bio-turbated; large-diameter burrows; intraformational frags. up to 6 cm fine-med. sand; 2% shell frags., scattered granules and pebbles fine grained volcanics
							3			▲	*GZ CC KE XM MY HO	
			RP		B		Core Catcher					5Y 2/1 Olive black basalt-derived silty clay with Pelecypods, Gastropods

Black and olive black pebbly and sandy MUDSTONES and SANDSTONES derived from basalticprovenance. Extensive bioturbation and intra-formational deformation.

COMPOSITION (Smear Slide):
68-77% clay
5-10% amorphous ferruginous aggregates
5- 8% pyrite framboids
3- 5% volcanic glass
2% zeolite
1- 2% mica
1- 2% glauconite

N.B.: Smear slide in Section 3, of representative material, assays 60% volcanic glass, 40% clay

TEXTURE: Sand 10-12%, Silt 40-43%, Clay 44-51%

Total Carbon: 1.0-1.4%
Organic Carbon: 0.6-1.3%
Calcium Carbonate: 1-3%

CONSOLIDATION: Semi-lithified.

Explanatory notes in chapter 2

Site 254 Hole Core 28 Cored Interval: 247.5-257.0 m

AGE	FORAMS ZONE	NANNOS ZONE	FOSSIL CHARACTER: FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS. ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE TERTIARY	?						1	0.5, 1.0	VOID		*KE	5Y 2/1
			FG		B		Core Catcher					

Olive black basalt-derived SILTY CLAY containing traces of broken fossil fragments.

COMPOSITION (Smear Slide):
82-92% clay (basalt alteration products)
1- 5% amorphous ferruginous aggregates
2- 3% volcanic glass
3- 5% framboidal pyrite
1- 2% mica
1- 2% zeolite
Tr- 1% glauconite
Tr coccoliths

CONSOLIDATION: Semi-lithified.

Pelecypods, Gastropods

Explanatory notes in chapter 2

Site 254 Hole Core 29 Cored Interval: 257.0-266.5 m

AGE	FORAMS ZONE	NANNOS ZONE	FOSSIL CHARACTER: FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS. ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
?	?						1	0.5, 1.0	VOID		KE *CC GZ	5Y 2/1 ← [1 cm pyrite nodule]
			B		B		Core Catcher					

Olive black poorly sorted SILTY CLAY derived from basaltic provenance, slightly mottled, with scattered, deformed 2-3 mm bands of coarse sand and no apparent fossil debris. Contains a 1 cm diameter pyrite nodule.

COMPOSITION (Smear Slide):
92% clay
3% pyrite framboids
2% volcanic glass
1% mica
1% zeolite
1% amorphous ferruginous aggregates

TEXTURE: Sand 6%, Silt 29%, Clay 65%

Total Carbon: 3.4%
Organic Carbon: 1.6%
Calcium Carbonate: 15%

CONSOLIDATION: Semi-lithified.

Explanatory notes in chapter 2

Site 254 Hole Core 30 Cored Interval: 266.5-276.0 m

AGE	FORAMS ZONE	NANNOS	FOSSIL CHARACTER: FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS., ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
?	?		B		B		1	0.5, 1.0	VOID; VOID		CC GZ HO XM KE	
							Core Catcher					

N2 deformed, admixed mudstone

[1 x 2 cm pyrite nodule] Dark black mudstone with lensoidal laminae of earthy opaque oxides; upper part coarse sand and lithic granules.

Very poorly sorted coarse sands & fine cgl.; abund. muddy matrix; pebbles up to 1.5 cm.

Slightly laminated sandy mudstone; pebbles up to 1 cm.

5GY 2/1 [greenish black] drilling breccia with 1 blue inclusion.

Black SILTY CLAY AND CLAYEY SANDS derived from basaltic provenance; detailed above.

COMPOSITION (Smear Slide):

60-75% clay
15-40% amorphous ferruginous aggregates
Traces of zeolite

The blue inclusion near the base of the core is pure volcanic glass.

TEXTURE: Sand 5%
Silt 31%
Clay 64%

Total Carbon: 4.4%
Organic Carbon: 3.0%
Calcium Carbonate: 12%

CONSOLIDATION: Semi-lithified.

5B 5/1 Medium bluish gray basalt-derived silty clay

Explanatory notes in chapter 2

Site 254 Hole Core 31 Cored Interval: 276.0-285.5 m

AGE	FORAMS ZONE	NANNOS	FOSSIL CHARACTER: FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS., ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
?	?		B		B		1	0.5, 1.0	VOID			
							Core Catcher					

Medium-grained altered BASALT.

[1 carbonate vein; 2 cm finer veined cognate xenolith]

5Y 2/1 Olive black basalt-derived silty clay

Explanatory notes in chapter 2

Site 254 Hole Core 32 Cored Interval: 285.5-295.0 m

AGE	FORAMS ZONE	NANNOS	FOSSIL CHARACTER: FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS., ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
?	?		B		B		1	0.5, 1.0	VOID		KE CC *GZ	10YR 4/2
							Core Catcher					5Y 3/2

Dark yellowish brown basalt-derived CLAYEY SILT containing no macrofossils. Core catcher is completely weathered olive gray basalt-derived SAND.

COMPOSITION (Smear Slide):

79% ferruginous oxides
20% clay
1% green volcanic glass

TEXTURE: Sand 14%
Silt 57%
Clay 29%

Total Carbon: 0.1%
Organic Carbon: 0.2%
Calcium Carbonate: 0%

CONSOLIDATION: Uncertain; disaggregated by drilling.

Explanatory notes in chapter 2

Site 254 Hole Core 33 Cored Interval: 300.0-309.5 m

AGE	FORAMS ZONE	NANNOS	FOSSIL CHARACTER: FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS., ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
?	?						1	0.5, 1.0	VOID		KE	

5YR 3/4 moderate brown FERRUGINOUS SILTY CLAY, derived from basaltic provenance

Very weathered basalt, gradational from above, and into

Weathered hemicrystalline porphyritic basalt

Explanatory notes in chapter 2

Site 254 Hole Core 34 Cored Interval: 309.5-310.0 m

AGE	FORAMS ZONE	NANNOS	FOSSIL CHARACTER: FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS., ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
?			B		B		Core Catcher				*TS	N2

RECOVERY: Core catcher only.

Dark, hemicrystalline PORPHYRITIC BASALT.

Explanatory notes in chapter 2

Site 254 Hole Core 35 Cored Interval: 310.0-315.0 m

AGE	FORAMS ZONE	NANNOS	FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS. ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION	
							1	0.5, 1.0	VOID		*TS	5Y 2/1 fine-grained, grading to medium-grained	Dark BASALT, varying texturally from fine-grained through medium-grained to amygdaloidal as indicated.
							2						
							3						
							Core Catcher					Fine-grained, amygdaloidal with calcite in amygdules	
												N2 Amygdaloidal; amygdules up to 1 cm	

Explanatory notes in chapter 2

Site 254 Hole Core 36 Cored Interval: 315.0-324.5 m

AGE	FORAMS ZONE	NANNOS	FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS. ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION	
							1	0.5, 1.0	VOID		*TS	N2 amygdaloidal (1.5 cm amygdules) Calcite fills amygdules. [gradational] Few amygdules	Dark BASALT; fine-grained and amygdaloidal or medium-grained, varying texturally as indicated.
							2						
							3				*TS	Medium-grained, no amygdules; feldspar laths up to 3 mm	
							Core Catcher					N2, fine-grained, amygdaloidal and 5Y 2/1; weathered vesicular basalt	

Explanatory notes in chapter 2

Site 254 Hole Core 37 Cored Interval: 324.5-334.0 m

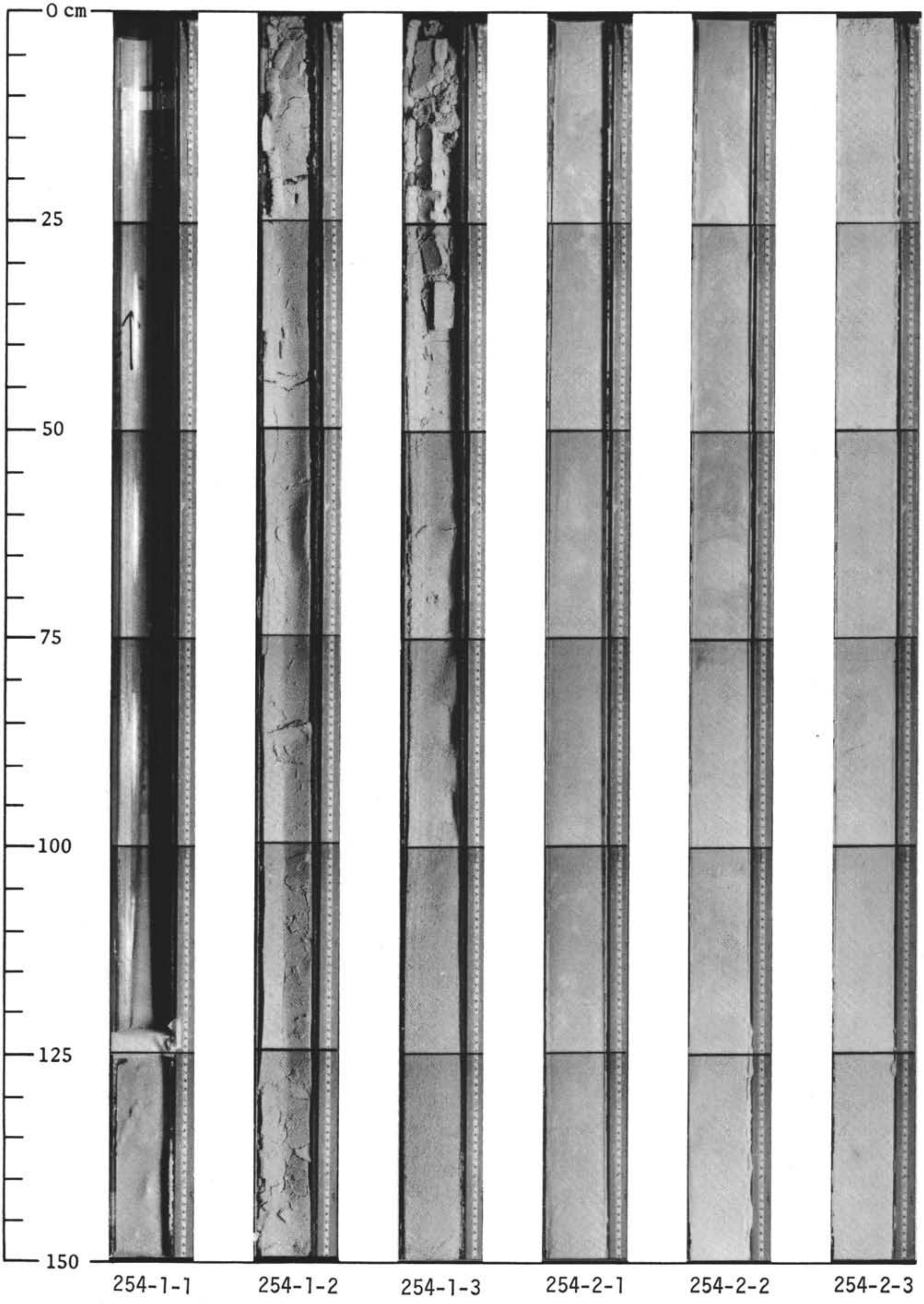
AGE	FORAMS ZONE	NANNOS	FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS. ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION	
					B		Core Catcher					5YR 2/1	RECOVERY: Core catcher only. Brownish black weathered VESICULAR BASALT.

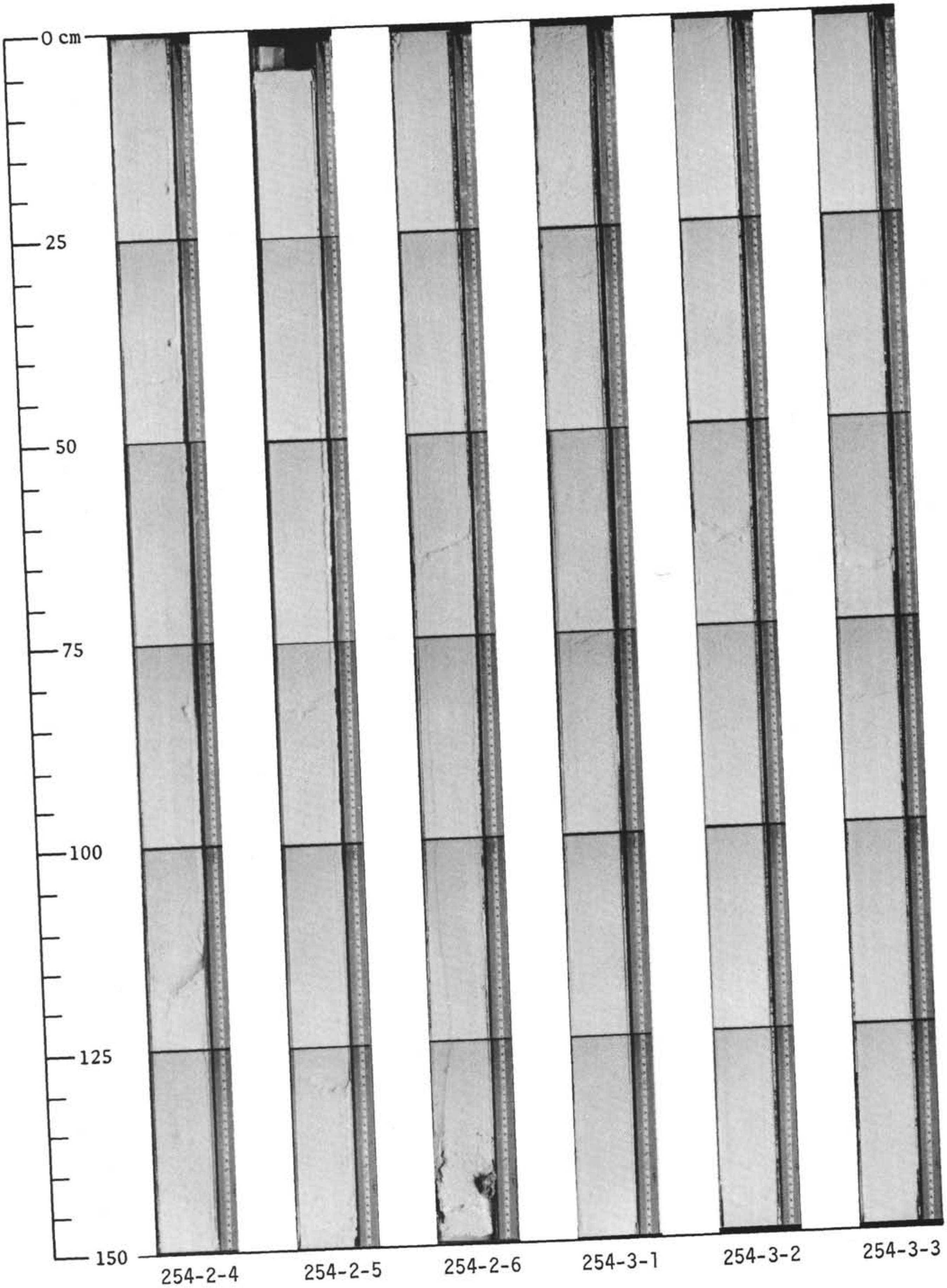
Explanatory notes in chapter 2

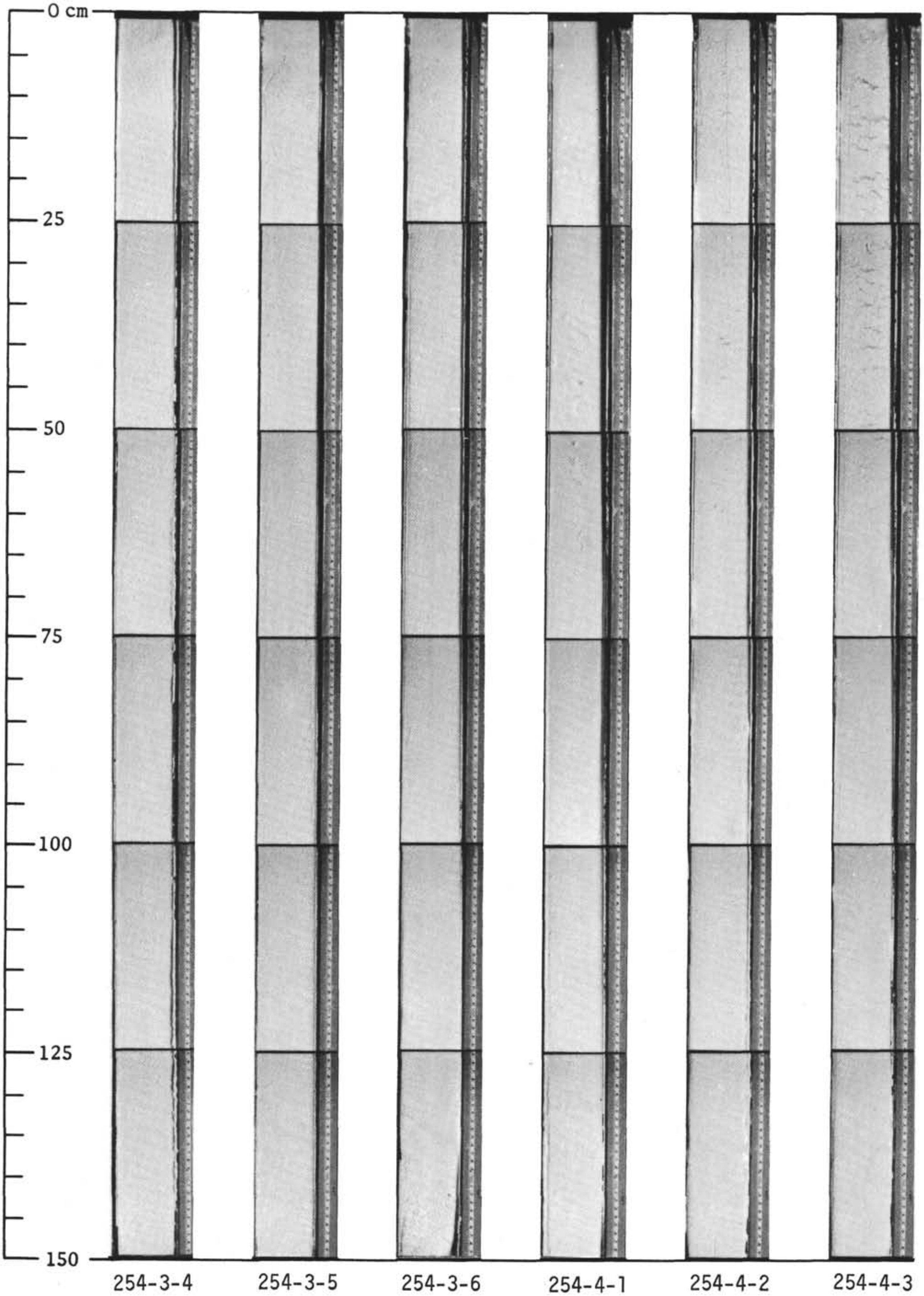
Site 254 Hole Core 38 Cored Interval: 334.0-343.5 m

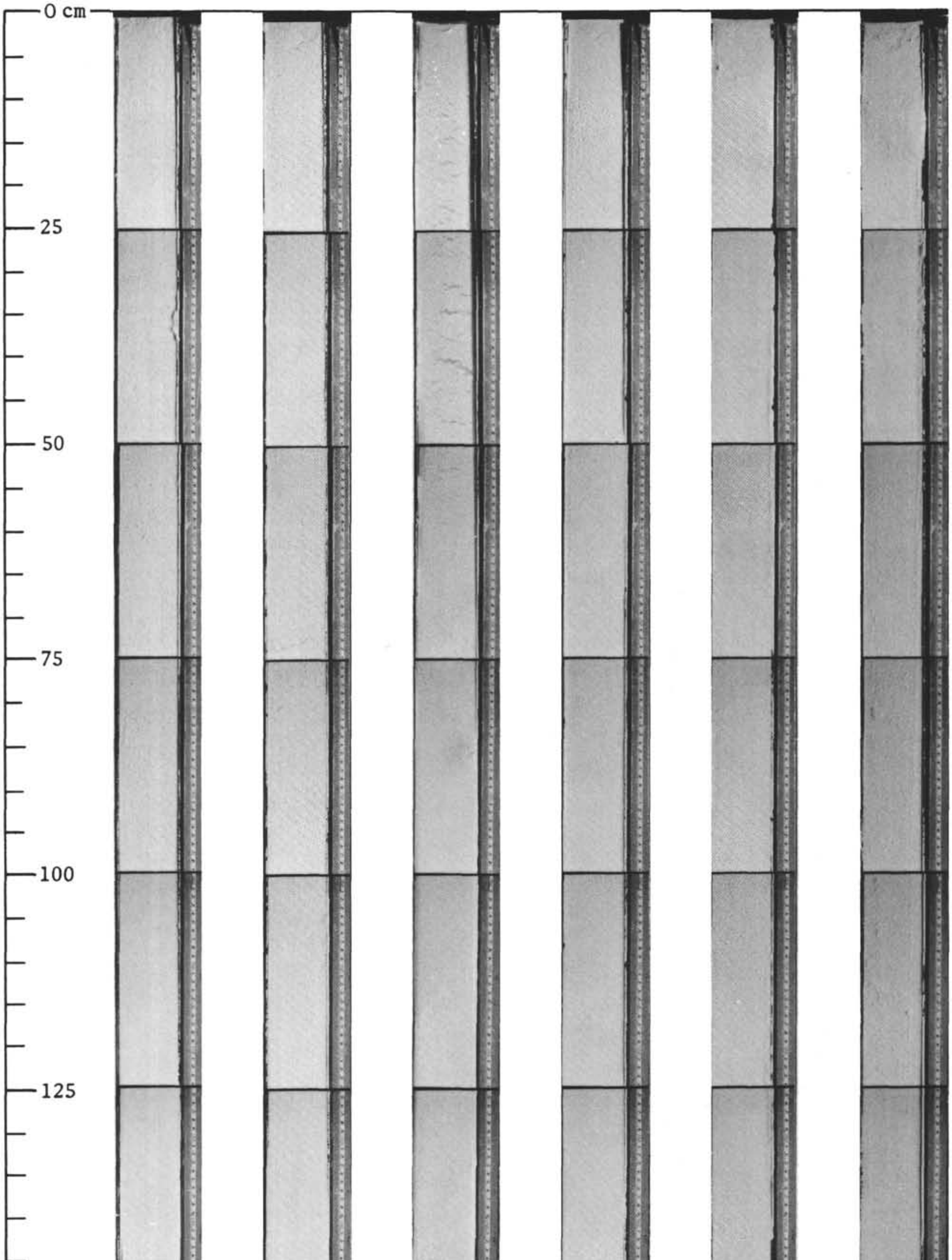
AGE	FORAMS ZONE	NANNOS	FORAMS	DISSOL. EFFECTS	NANNOS	SILICEOUS FOSS. ETC.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION	
							1	0.5, 1.0			*TS, *TS	Brecciated, fine-grained / Massive, with xenoliths / Brecciated, fine-grained, dark	BASALT, fine-grained and brecciated or massive and containing xenoliths as indicated.
					B		Core Catcher					Coarse basalt breccia of various basalt lithologies; fragments up to 3 cm; carbonate cement.	

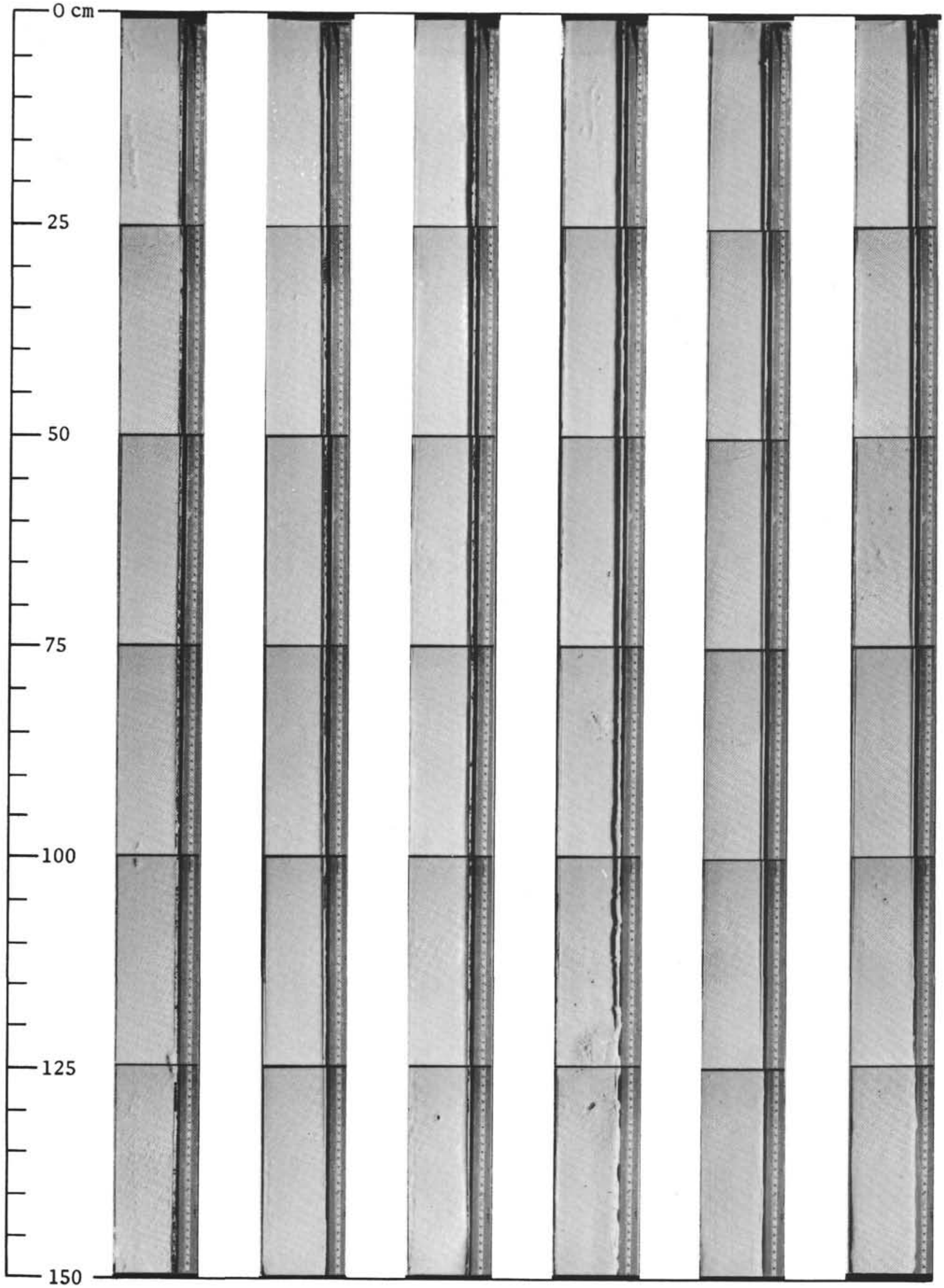
Explanatory notes in Chapter 2

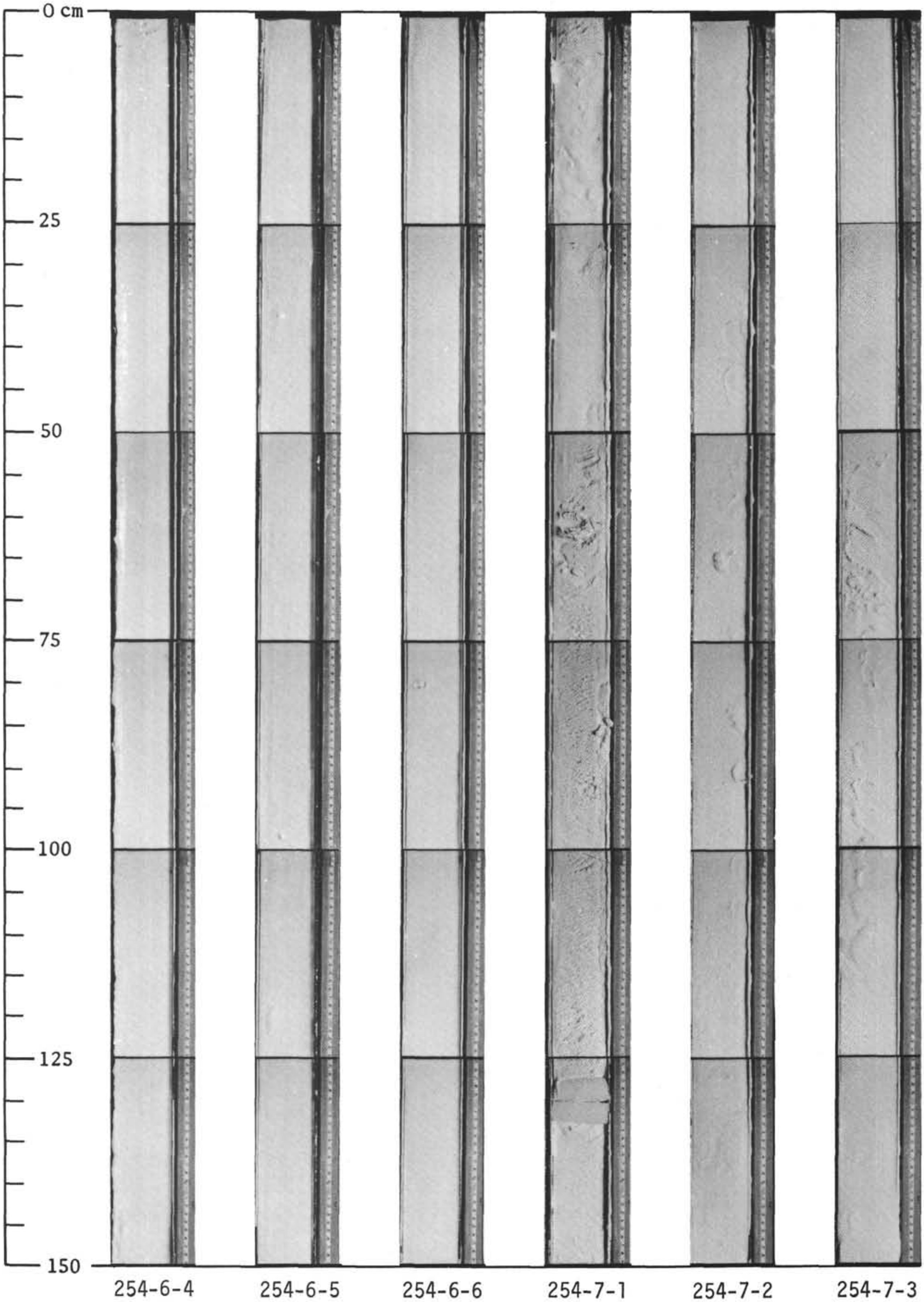

0 cm
25
50
75
100
125
150
254-1-1
254-1-2
254-1-3
254-2-1
254-2-2
254-2-3

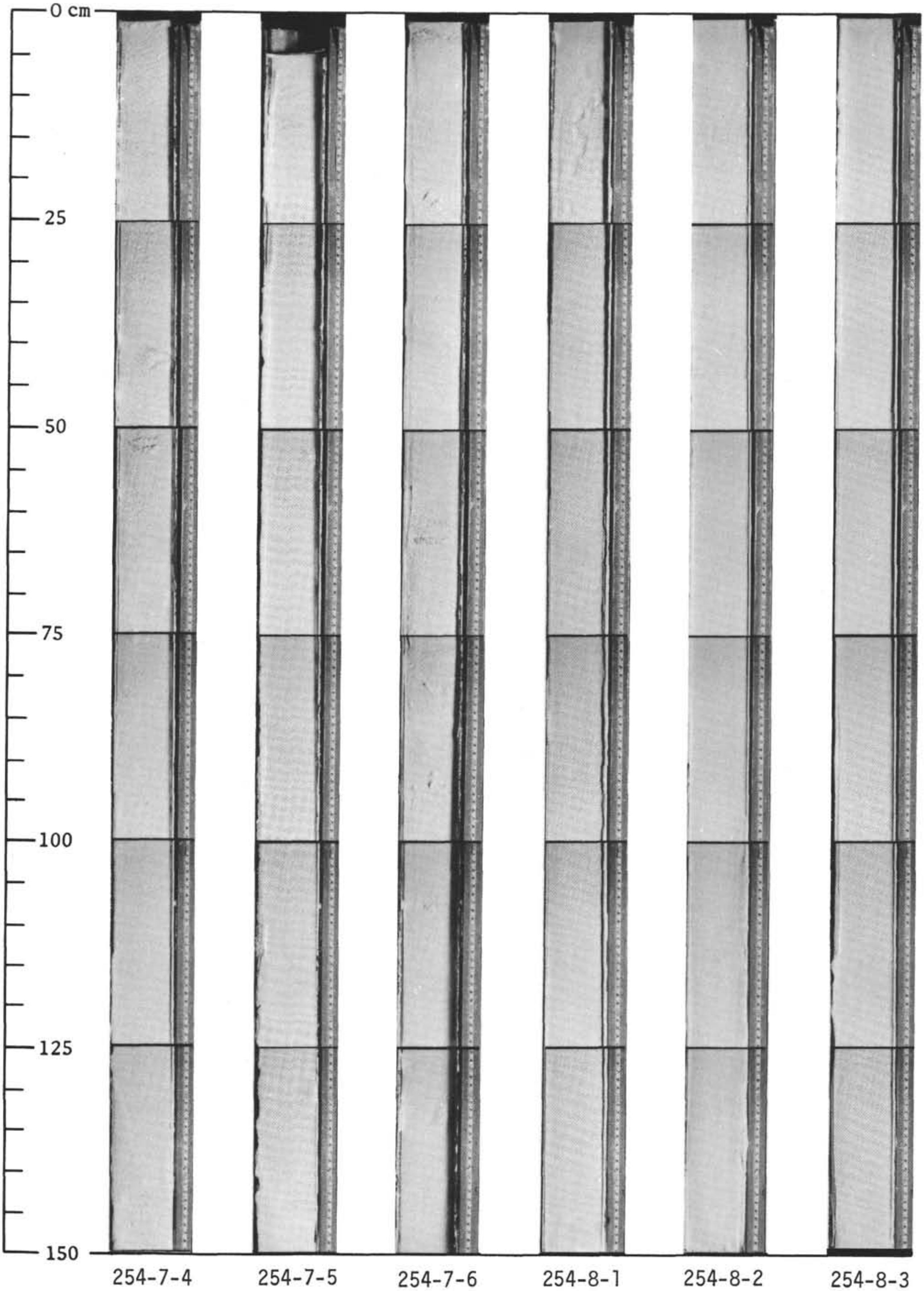

0 cm
25
50
75
100
125
150
254-2-4
254-2-5
254-2-6
254-3-1
254-3-2
254-3-3

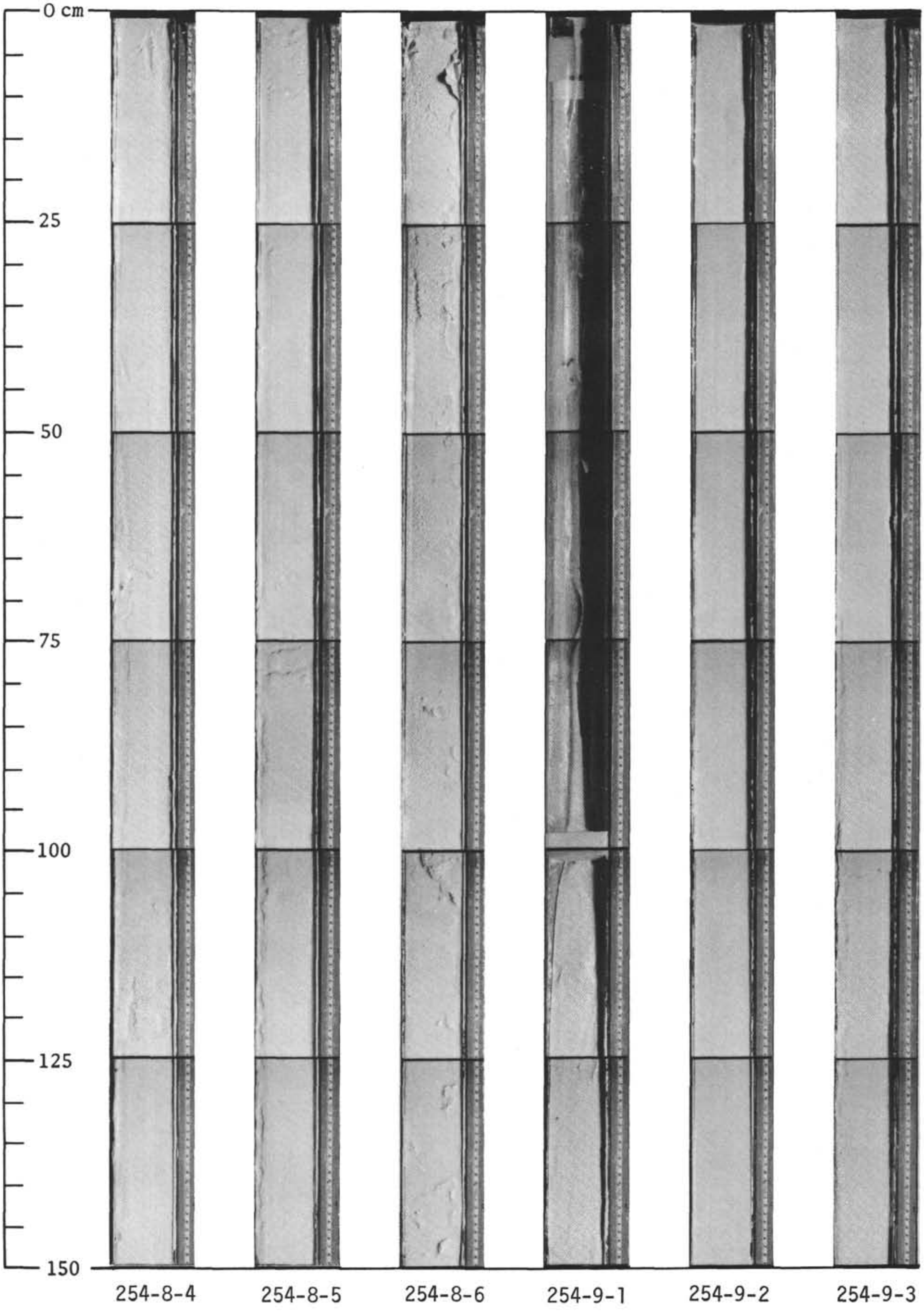

0 cm
25
50
75
100
125
150
254-3-4
254-3-5
254-3-6
254-4-1
254-4-2
254-4-3

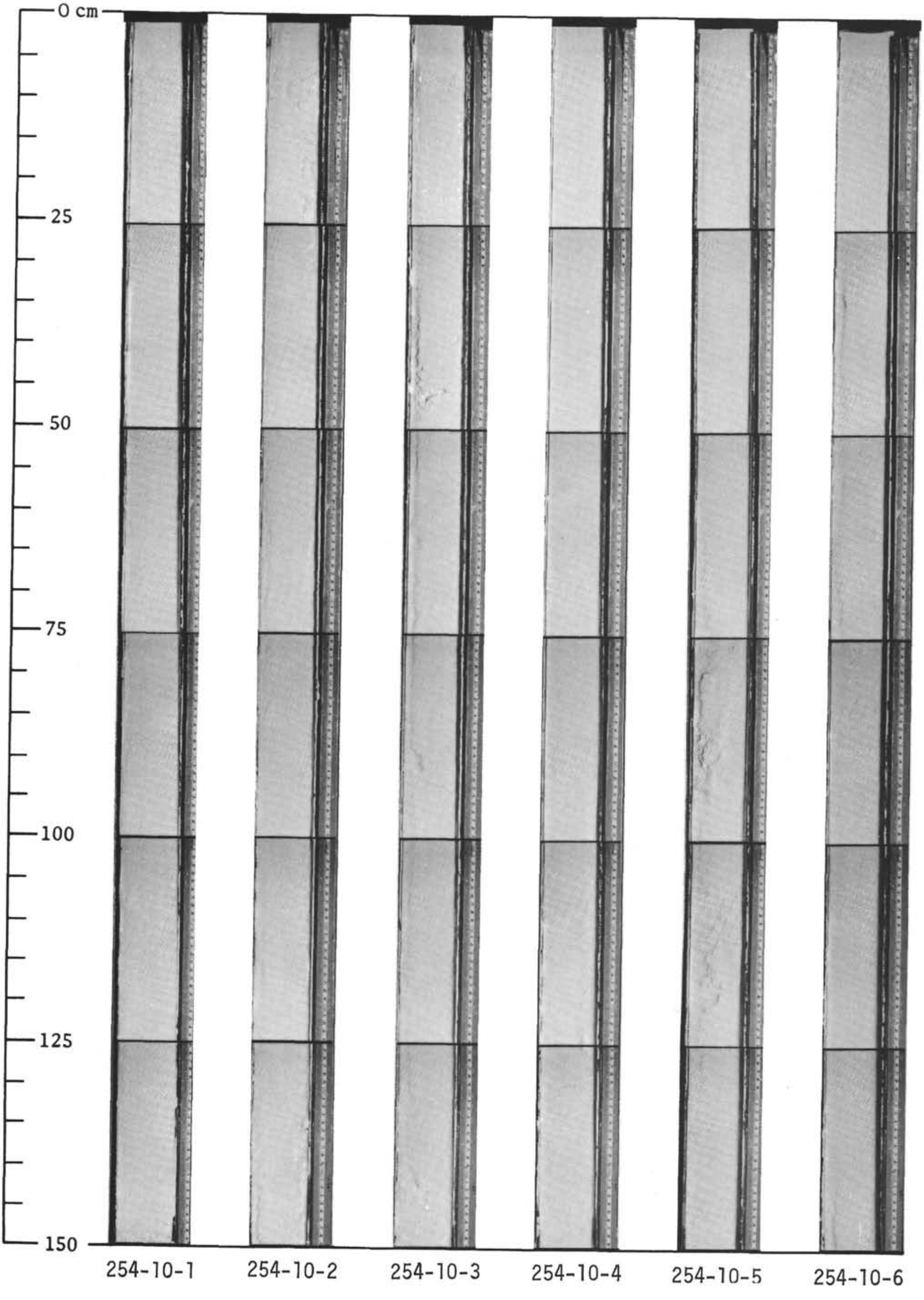

0 cm
25
50
75
100
125
150
254-4-4
254-4-5
254-4-6
254-5-1
254-5-2
254-5-3

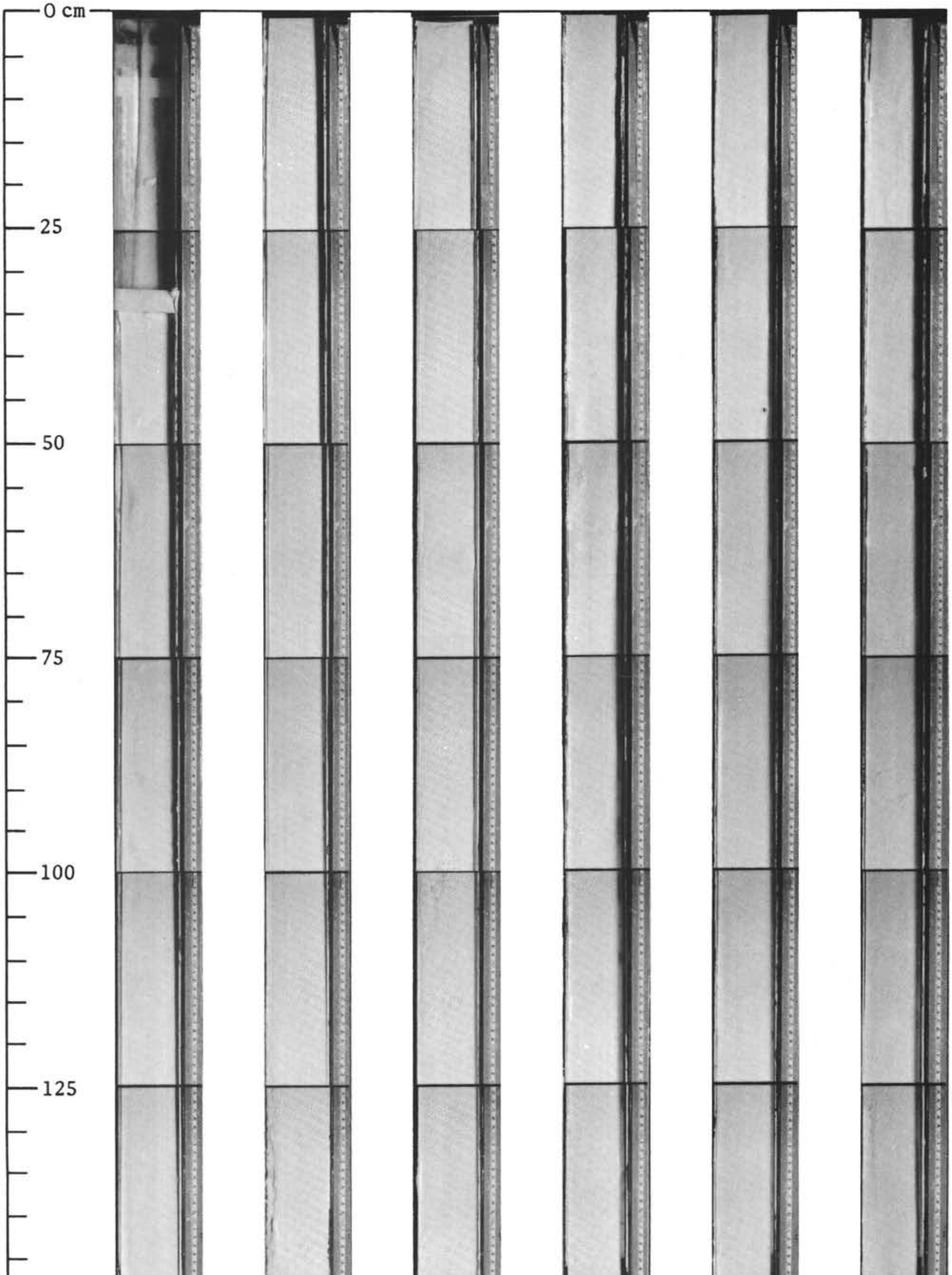

0 cm
25
50
75
100
125
150
254-5-4
254-5-5
254-5-6
254-6-1
254-6-2
254-6-3

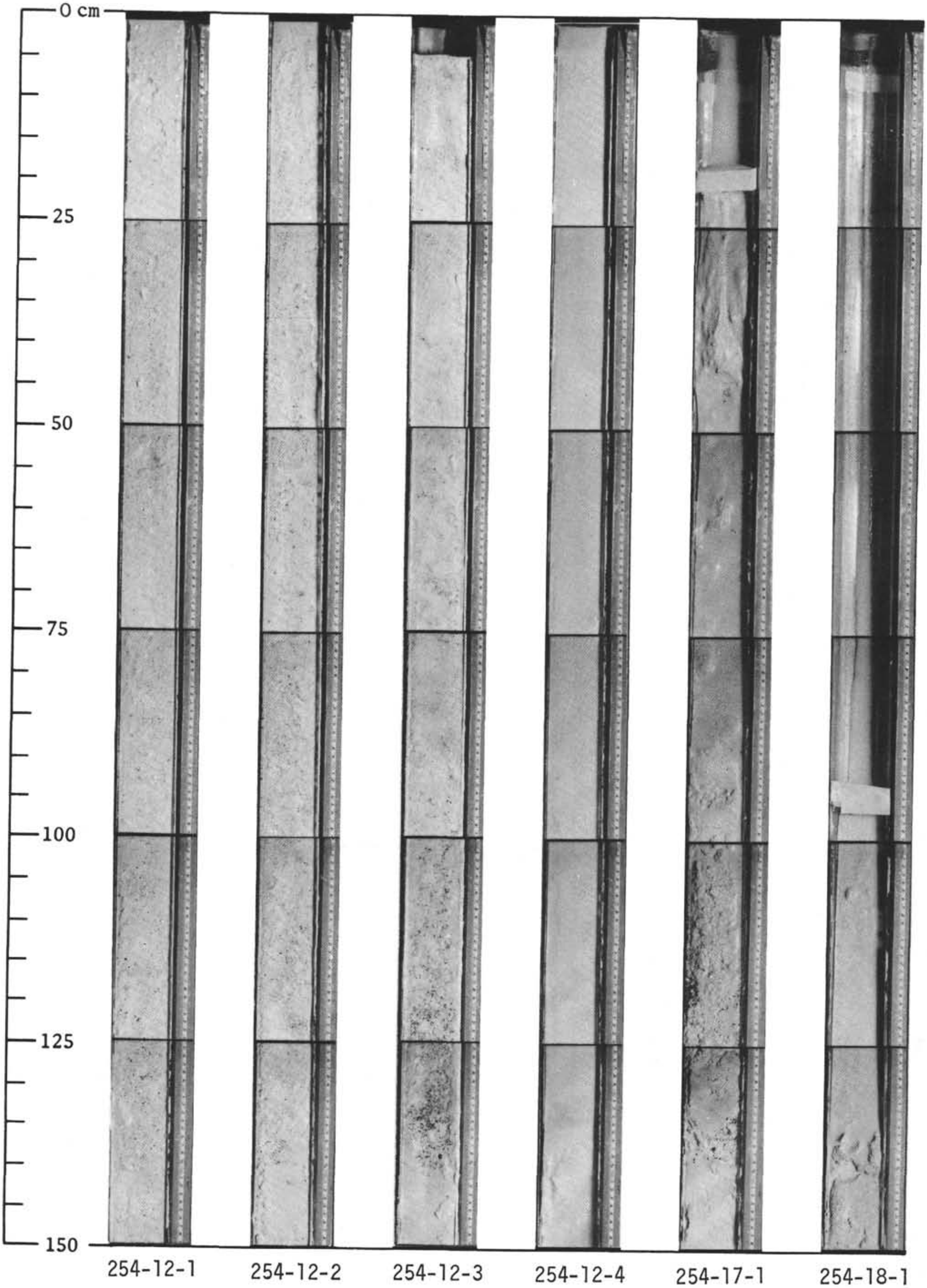

0 cm
25
50
75
100
125
150
254-6-4
254-6-5
254-6-6
254-7-1
254-7-2
254-7-3

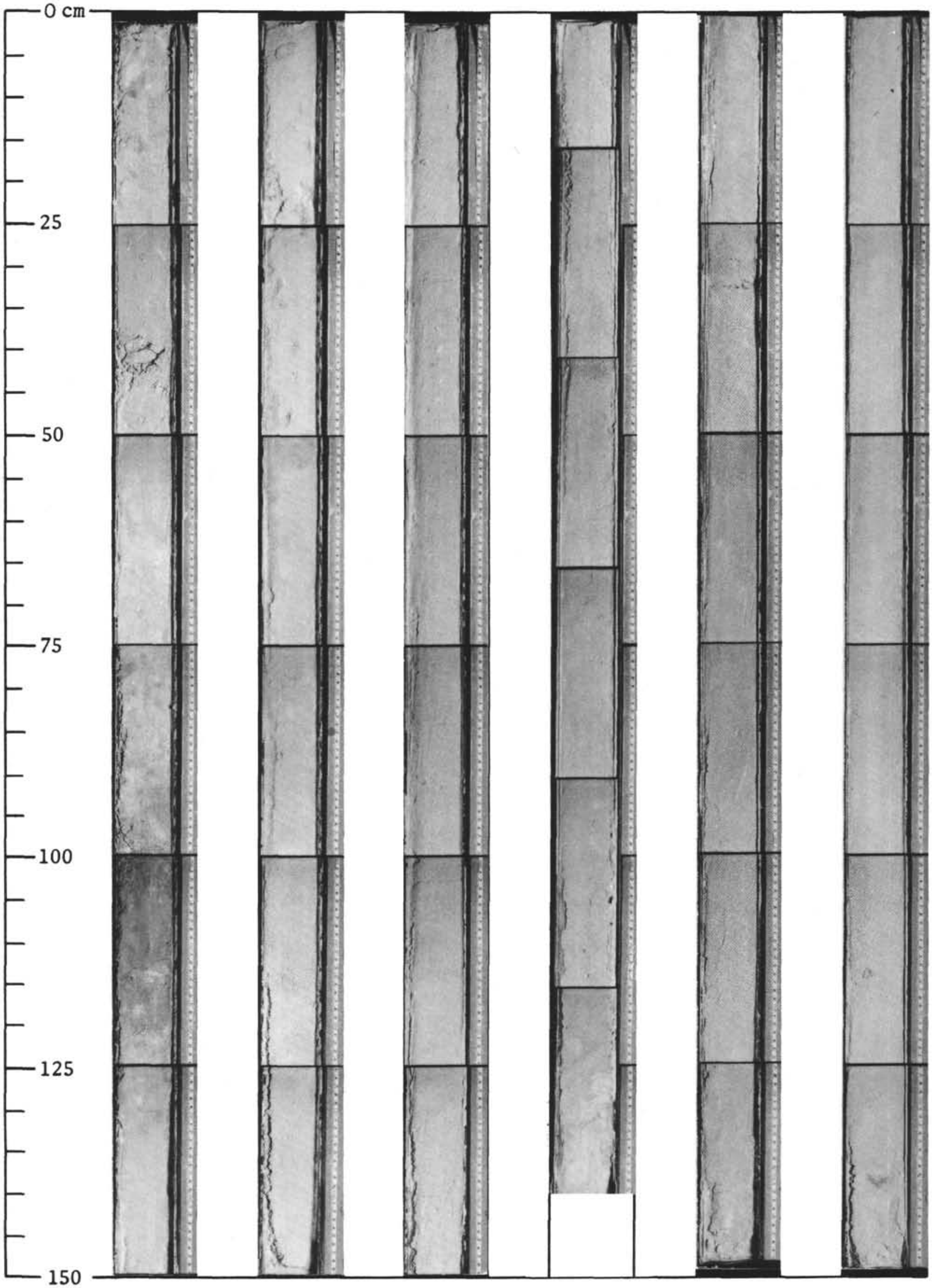

0 cm
25
50
75
100
125
150
254-7-4
254-7-5
254-7-6
254-8-1
254-8-2
254-8-3

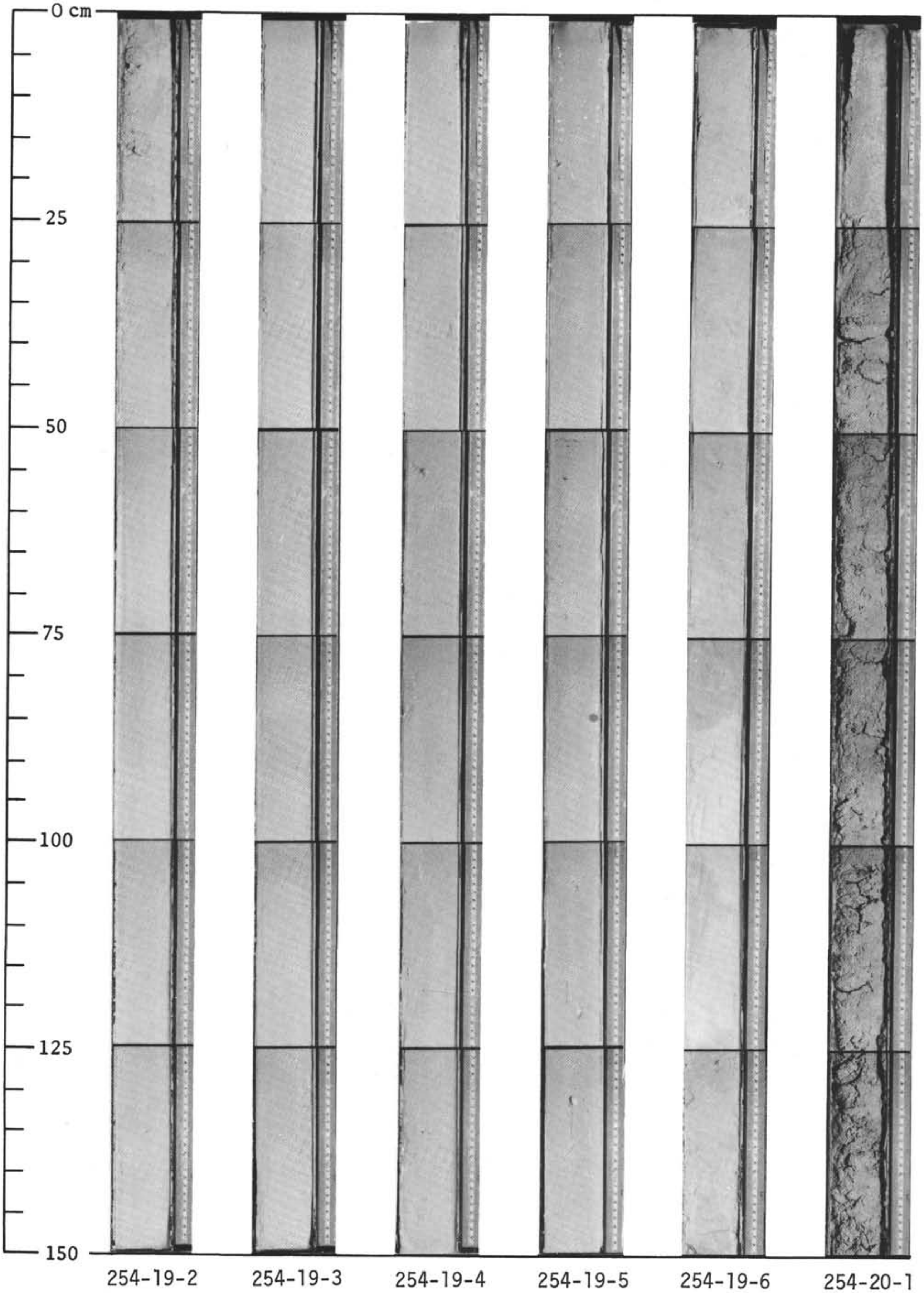

0 cm
25
50
75
100
125
150
254-8-4
254-8-5
254-8-6
254-9-1
254-9-2
254-9-3

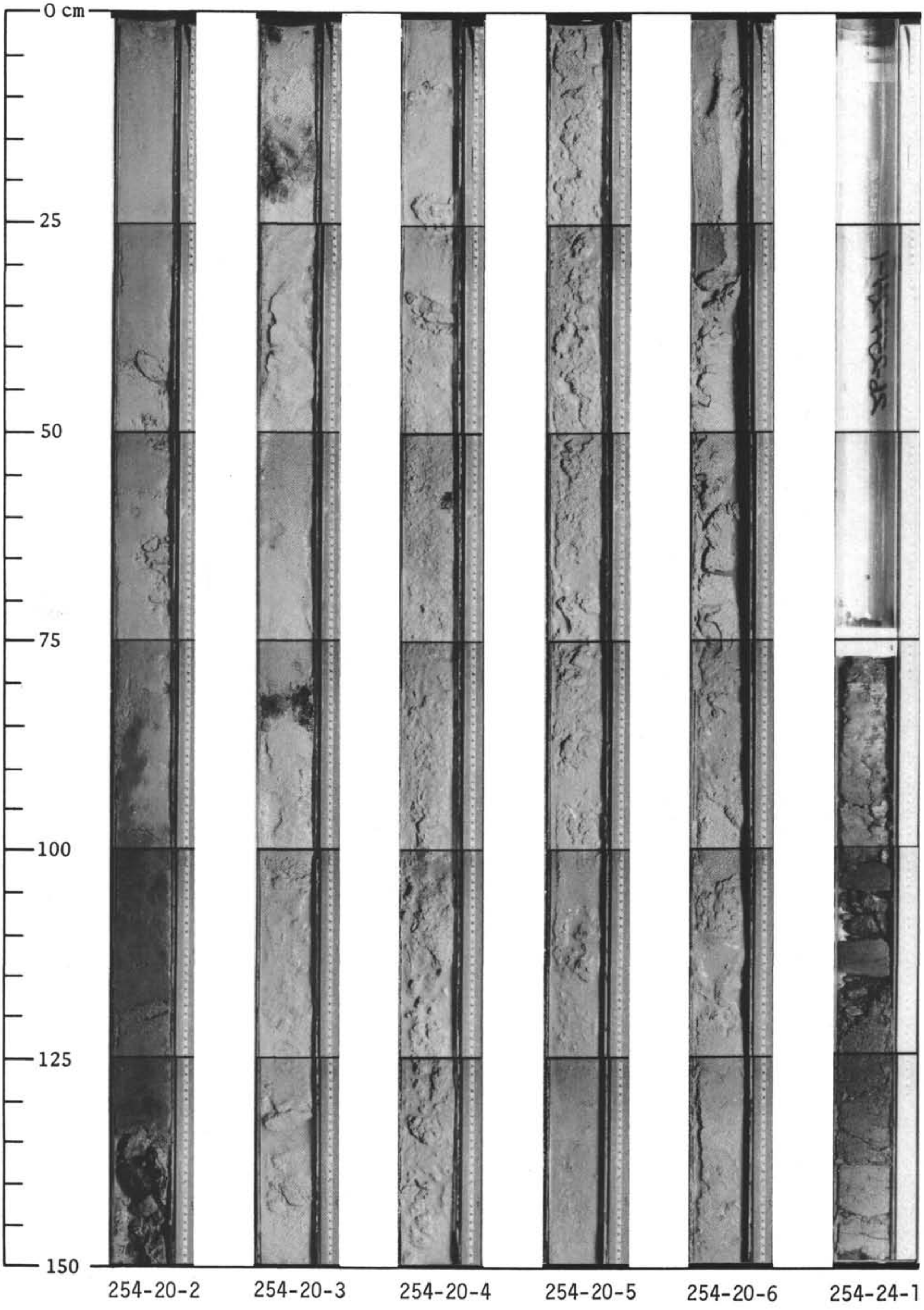

0 cm
25
50
75
100
125
150
254-10-1
254-10-2
254-10-3
254-10-4
254-10-5
254-10-6

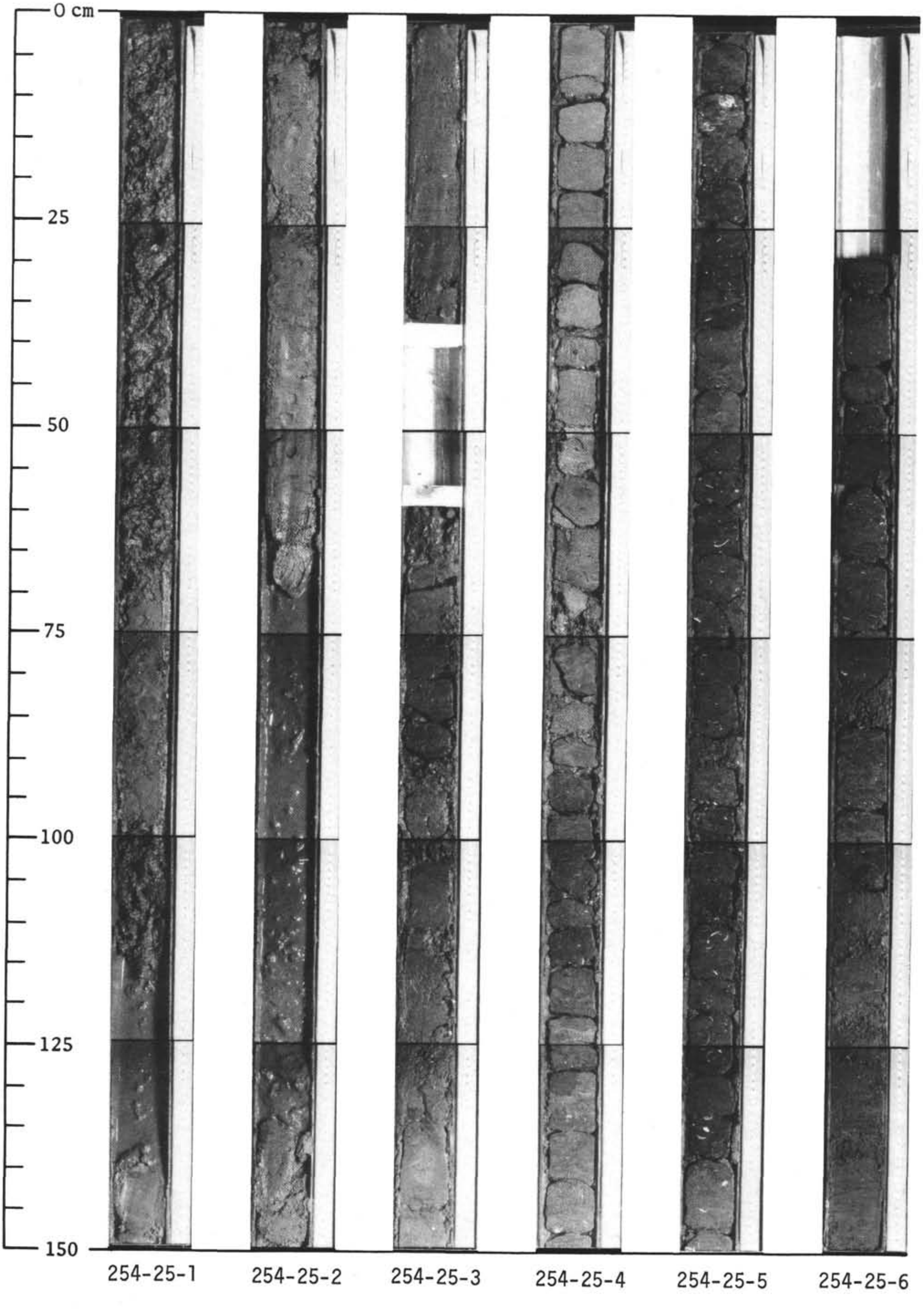

0 cm
25
50
75
100
125
150
254-11-1
254-11-2
254-11-3
254-11-4
254-11-5
254-11-6

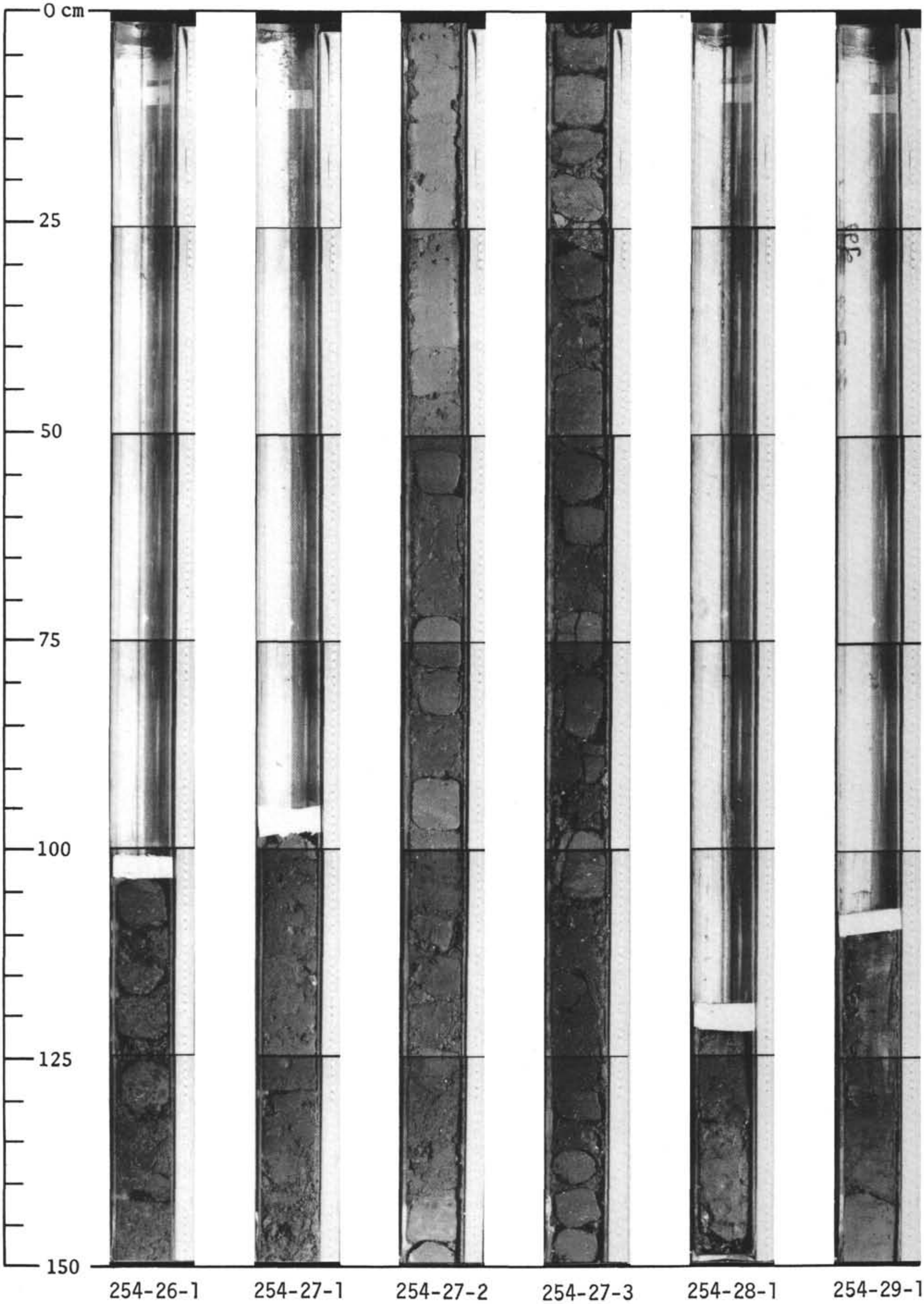

0 cm
25
50
75
100
125
150
254-12-1
254-12-2
254-12-3
254-12-4
254-17-1
254-18-1

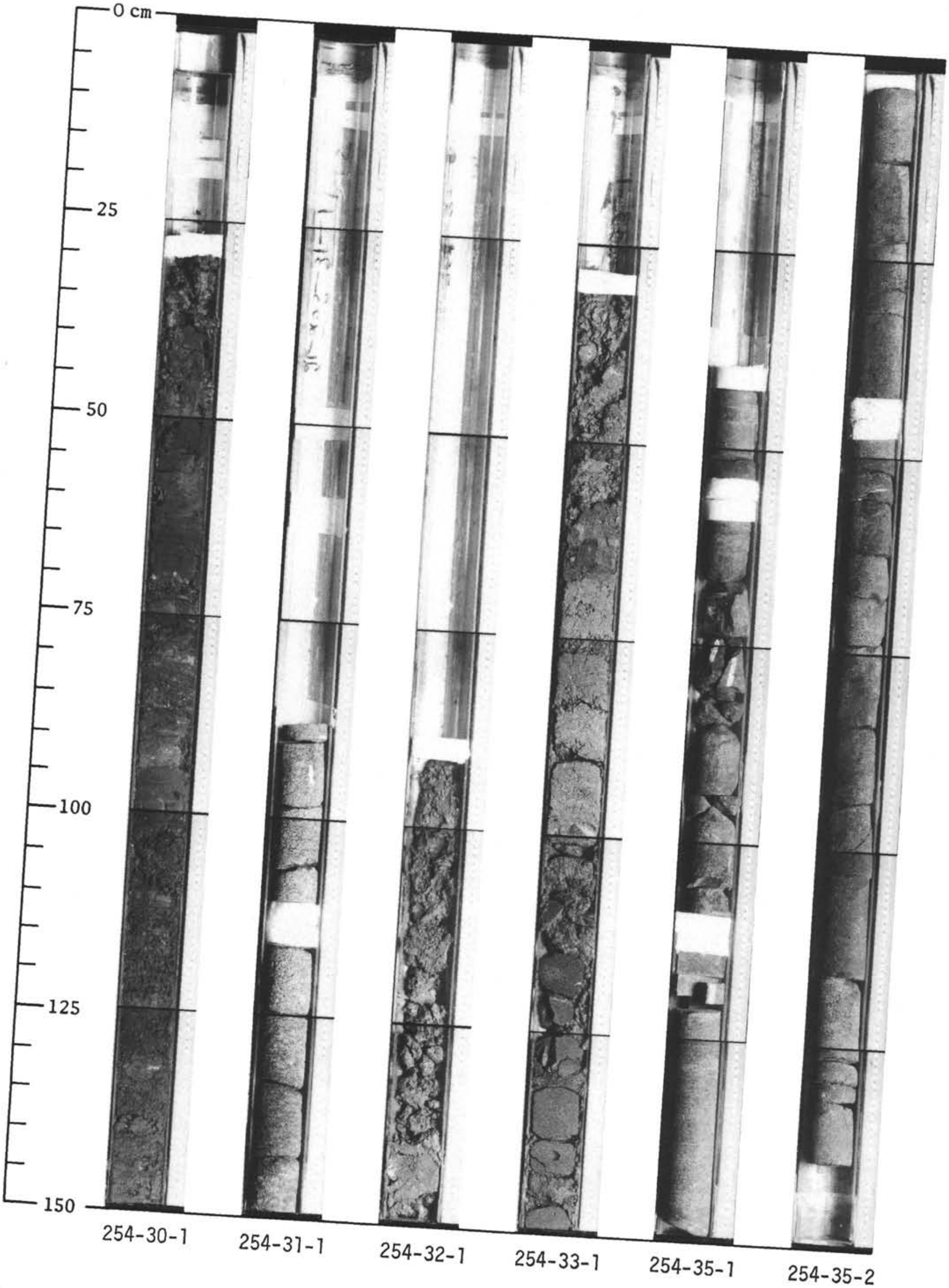

0 cm
25
50
75
100
125
150
254-18-2
254-18-3
254-18-4
254-18-5
254-18-6
254-19-1

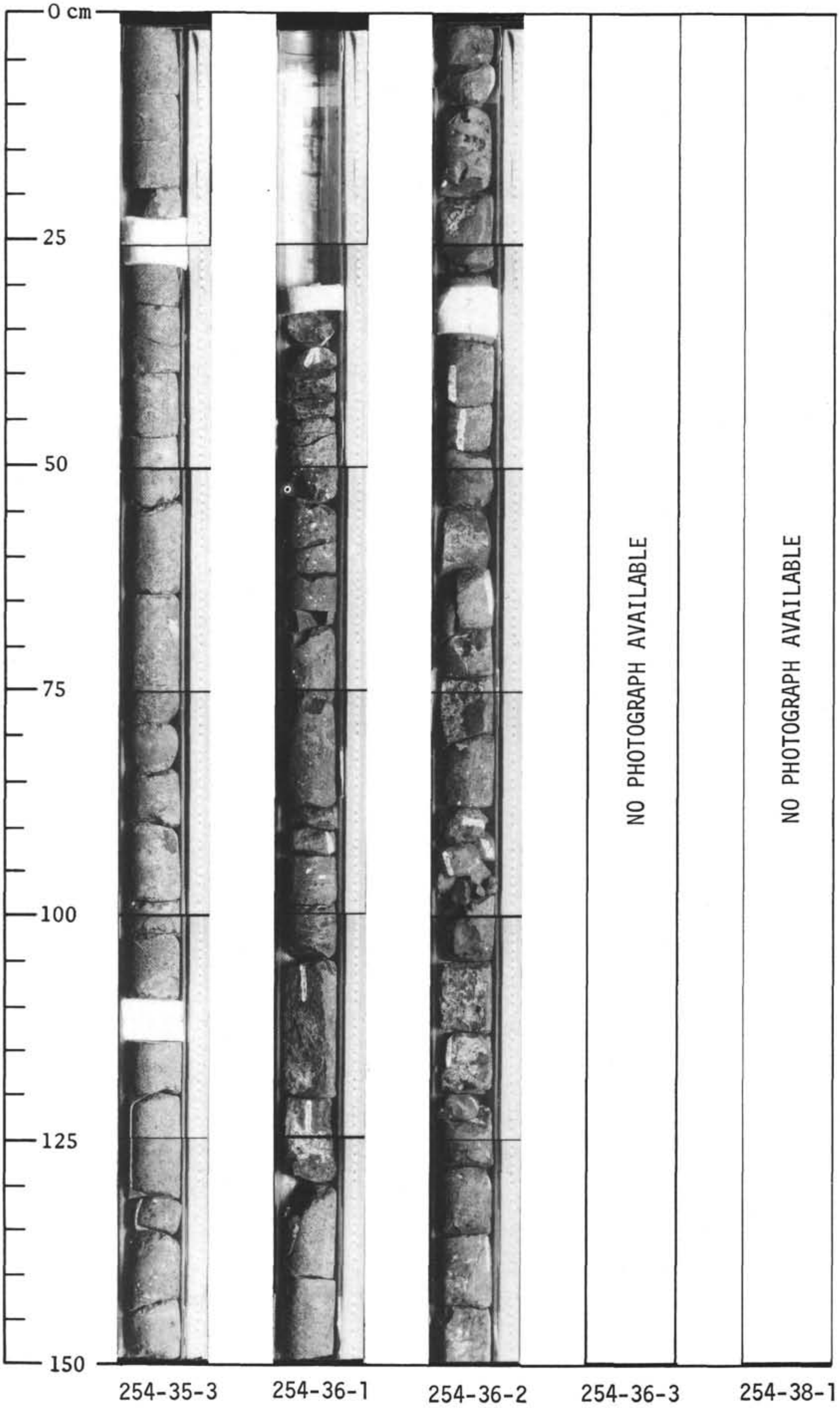

0 cm
25
50
75
100
125
150
254-19-2
254-19-3
254-19-4
254-19-5
254-19-6
254-20-1


0 cm
25
50
75
100
125
150
254-20-2
254-20-3
254-20-4
254-20-5
254-20-6
254-24-1

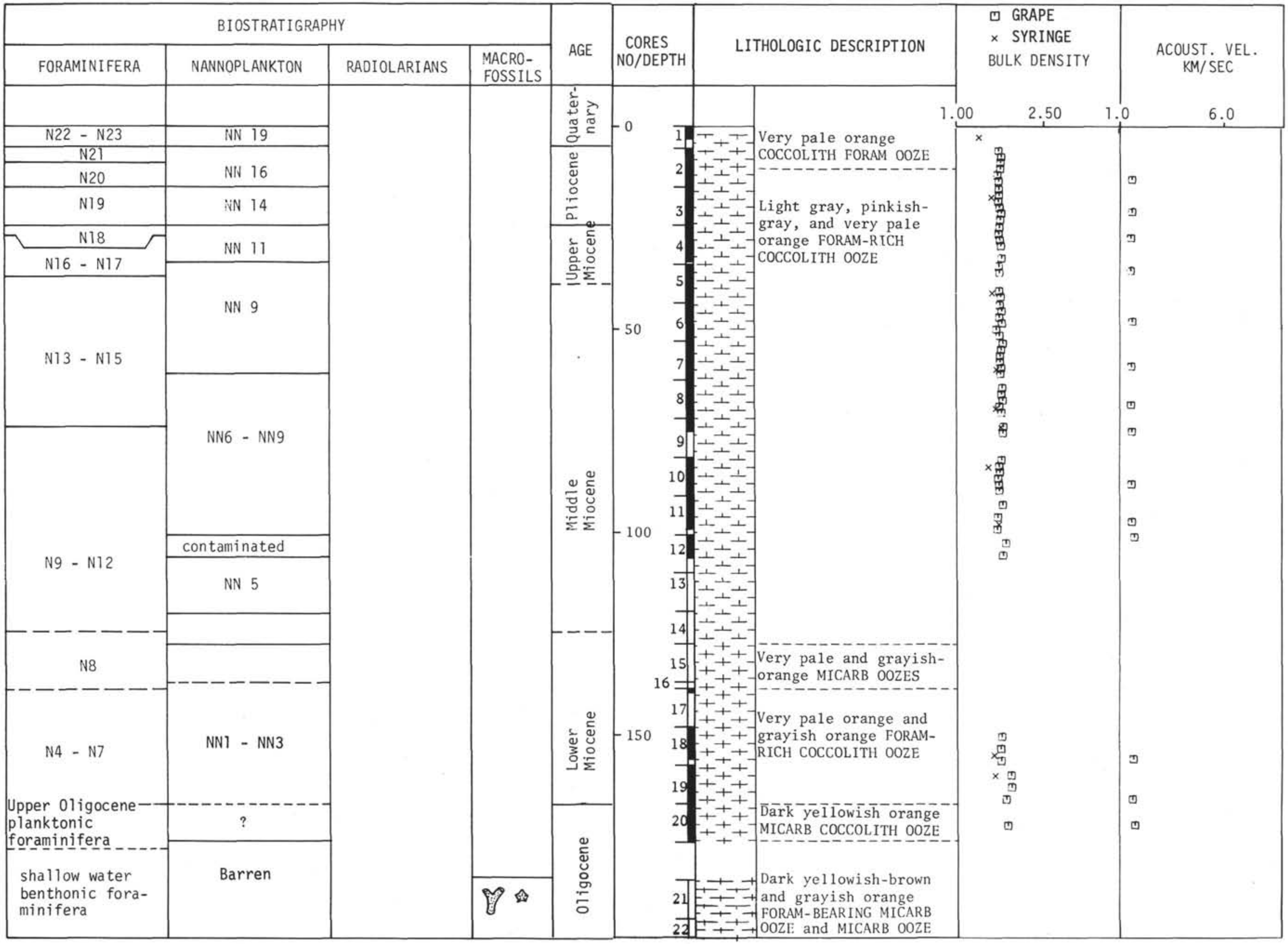

0 cm
25
50
75
100
125
150
254-25-1
254-25-2
254-25-3
254-25-4
254-25-5
254-25-6


0 cm
25
50
75
100
125
150
254-26-1
254-27-1
254-27-2
254-27-3
254-28-1
254-29-1


0 cm
25
50
75
100
125
150
254-30-1
254-31-1
254-32-1
254-33-1
254-35-1
254-35-2


0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
NO PHOTOGRAPH AVAILABLE
254-35-3
254-36-1
254-36-2
254-36-3
254-38-1

SUMMARY OF DRILLING RESULTS: SITE 254/0 - 200 m



SUMMARY OF DRILLING RESULTS: SITE 254/200 - 400 m

BIOSTRATIGRAPHY				AGE	CORES NO/DEPTH	LITHOLOGIC DESCRIPTION
FORAMINIFERA	NANNOPLANKTON	RADIOLARIANS	MACRO-FOSSILS			
Barren	Barren ↓			Upper Eocene or Lower Oligocene	200 — 23	
Few benthonic foraminifera					24, 25	[macrofossil debris] Olive black, olive gray and dark yellowish brown basalt-derived SANDY and SILTY CLAYS and fine-grained SILTY SANDS with lesser PEBBLE CONGLOMERATES.
Few shallow water benthonic foraminifera (Elphidium, Quinqueloculina)					26, 27, 250 — 28	Abundant macrofossil debris above 247 m; pyritiferous below 247 m; ferruginous at base.
Barren					29, 30, 31, 32	[55 cm. of medium-grained fresh BASALT; upper and lower contacts not seen] At base, sands & clays grade into weathered
					300 — 33, 34, 35, 36, 37, 38	OLIVINE BASALT, fine to medium grained and massive, or amygdaloidal.
					350