2. SITE 264

The Shipboard Scientific Party[1]

SITE DATA

Date Occupied: 22 December, 1972

Date Departed: 24 December, 1972

Position: 34°58.13′S; 112°02.68′E

Water Depth: 2876 corrected meters (echo sounding)

Water Depth (adopted): 2873 meters (drill pipe from rig floor)

Total Penetration: 215.5 meters

Number of Cores: 19

Total Section Cored: 180.5 meters

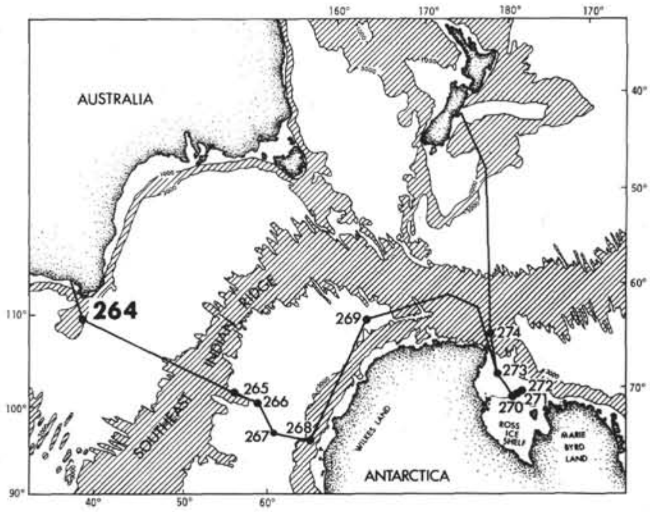
Total Section Recovered: 98.4 meters

Percentage Core Recovery: 55%

Oldest Sediment Cored:
Depth below sea floor: 170.7 meters
Lithology: Conglomerate
Age: Santonian or older

Basement:
Depth below sea floor: 0.20 sec (reflection time)
Depth below sea floor: ≥171 meters (drilled)
Average velocity to basement: ≤1.71 km/sec
Lithology: Volcaniclastic rocks

Principal Results: A thin Neogene and a well-developed Paleogene sequence of carbonate oozes and chalks, with some chert, was cored at this site. The oldest material taken, beneath Cenomanian/Santonian chalks, was Cenomanian or pre-Cenomanian volcaniclastic conglomerate, but yielded poor recovery. The inferred average velocity of the carbonate sediments of 1.71 km/sec is consistent with the interpretation that the top of the volcaniclastic conglomerate corresponds to the strong acoustic basement reflector. The question of the continental versus oceanic nature of true crystalline basement remains unresolved. The unconformities recorded here span the following intervals: (1) upper Miocene-upper Eocene, (2) lower Eocene-mid Paleocene, (3) mid Paleocene-?/Santonian. The Eocene section cored at Site 264 has no known counterpart in the onshore Perth Basin or in DSDP sites east of the Ninetyeast Ridge. A cool subtropical deep-water environment prevailed (with some fluctuations) at this site from at least Late Cretaceous to Present.



BACKGROUND AND OBJECTIVES

The objectives at Site 264 were threefold: (1) To complement the biostratigraphic results obtained at Site 26-258, especially the Early Cretaceous portion of the section. (2) To sample acoustic basement to determine its "continental" versus "oceanic" nature. (3) To test components of the drawworks and drilling rig repaired in Fremantle at a site near port.

Background Information

Site 264 is located near the southern edge of the Naturaliste Plateau (Figure 1), about 125 km southwest of Site 26-258. The water depth at Site 264 is approximately 2900 meters, and 300 to 400 meters of sediment overlie acoustic basement. Seismic reflection profiles from *Eltanin* 45 show an acoustically transparent sediment cover much thinner than the cover present at Site 26-258 where several internal reflectors are also recorded. The acoustic basement is defined by a strong, rough reflecting surface that appears to be continuous with the surface that defines the steep southern escarpment of the Naturaliste Plateau (Figure 2).

Because of the relatively thin sediment cover at Site 264 and the pinching out of prominent reflectors as one proceeds toward Site 264 from Site 258, it was anticipated that a significant portion of the section deposited at Site 258 is missing at Site 264.

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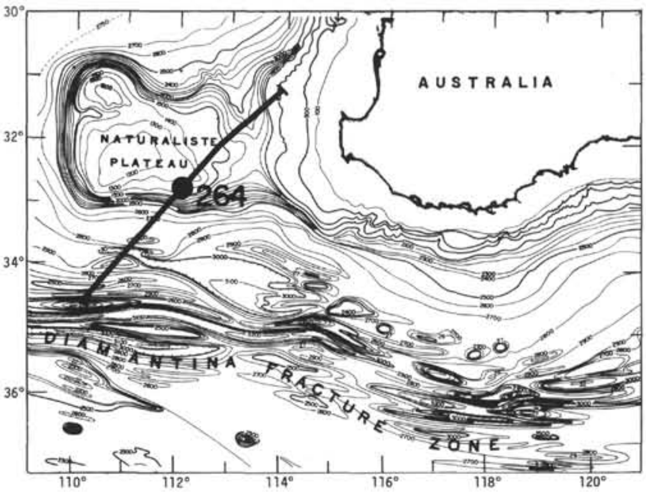

Figure 1. *Location of Site 264 and bathymetry. Contours in fathoms (corrected). Solid line shows location of* Eltanin *52 seismic profile shown in Figure 2.*

A major sedimentary hiatus (from about 80 m.y. to 10 m.y.) was recorded at Site 258. The coring program at Site 264 was initially designed to investigate the presence of a similar hiatus, or others; to collect closely spaced samples in that part of the section older than Cenomanian; and to sample acoustic basement. A recent study by Markl (1974) provides a complete review of the geological and geophysical setting of the Naturaliste Plateau.

OPERATIONS

The location of Site 264 was selected preliminarily on the basis of a northeast-southwest *Eltanin* 45 crossing of the south flank of the Naturaliste Plateau. Approach to the area was made at 170 rpm (the EM log was down) along nearly the same track as that of *Eltanin.* The site was chosen on the basis of the profiler record, which showed 0.20 sec of sediments (two-way travel time) over a high in the acoustic basement. The ship continued past the site on course 220° at slow ahead until the towed gear was retrieved, then reversed course and returned to the selected site using the PDR trace as a guide for dropping beacon.

During the first day of drilling, deployment of a drifting sonobuoy was made impossible because the ship's heading into wind, sea, and swell from the southwest put her stern-first to a one-knot current. The wind and sea shifted to the northeast during the second day, the ship's heading was altered, and a sonobuoy record was obtained. The apparent reflecting horizons below acoustic basement could be caused by side echoes or internal multiples as well as real subbasement layering.

On departure from the site, the underway gear was streamed on a heading of due west. Then following a jog to the north, the ship made another crossing of the site on a heading of 145° and passed about 0.8 miles to the southwest of the beacon.

Summary of coring at Site 264 is shown in Table 1.

LITHOLOGY

At Site 264 the first hole penetrated 171 meters of pelagic carbonate sediment and 35 meters of underlying volcanics. Hole 264A was drilled at the same location; to 158.5 meters, and cored over two 19-meter intervals in order to recover important uncored intervals in Hole 264. Three sedimentary and one volcanic unit are described in Table 2.

Unit 1

Unit 1 is a soft, pinkish-gray, foram nanno ooze. The percentage of foraminifera, as indicated by the percentage "sand," ranges from 20% to 50% in the upper 27 meters, but is only 9% to 14% in the lower 4 meters. Carbonate content ranges from 92% to 95%. Sponge spicules are present in trace amounts to about 3%. The sediments appear structureless throughout, except for subtle mottles about 1 cm across in the upper part of the unit. Severe deformation is evident in about a third of the core, mostly in the lower part of the unit.

Angular quartz grains and pale brown equant glass fragments up to 100μ across are present in trace amounts through most of the unit, but both quartz and glass comprise 2% in the interval from 12 to 18 meters subbottom. The glass is basaltic (n = 1.57).

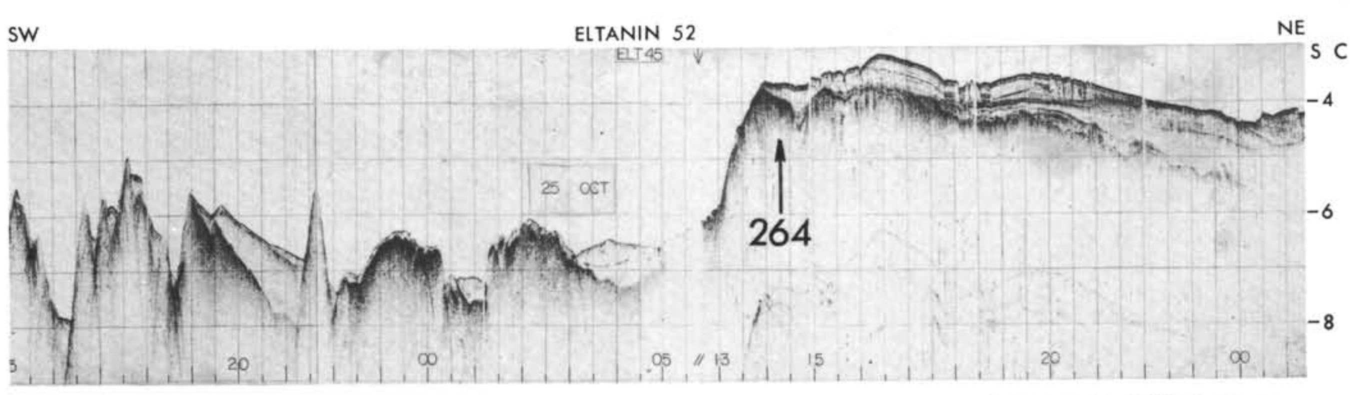

Figure 2. Eltanin *52 acoustic reflection profile in vicinity of Site 264. Vertical scale in seconds of two-way reflection time. Location of profile shown in Figure 1.*

TABLE 1
Coring Summary, Site 264

Core	Date (Dec. 1972)	Time	Depth From Drill Floor (m)	Depth Below Sea Floor (m)	Cored (m)	Recovered (m)	Recovery (%)
Hole 264							
1	22	1255	2883.0-2892.5	0.0-9.5	9.5	8.3	87
2	22	1410	2908.5-2918.0	25.5-35.0	9.5	9.0	90
3	22	1518	2937.0-2946.5	54.0-63.5	9.5	9.5	100
4	22	1628	2947.5-2956.0	63.5-73.0	9.5	9.4	99
5	22	1735	2956.0-2965.5	73.0-82.5	9.5	6.3	66
6	22	1846	2965.5-2975.0	82.5-92.0	9.5	4.9	52
7	22	2001	2975.0-2984.5	92.0-101.5	9.5	5.1	53
8	22	2111	2984.5-2994.0	101.5-111.0	9.5	5.2	53
9	22	2224	3013.0-3022.5	130.0-139.5	9.5	2.2	23
10	22	2344	3041.5-3051.0	158.5-168.0	9.5	3.3	35
11	23	0108	3051.0-3060.5	168.0-177.5	9.5	2.0	21
12	23	0320	3060.5-3070.0	177.5-187.0	9.5	frag	–
13	23	0500	3070.0-3079.5	187.0-196.5	9.5	frag	–
14	23	0700	3079.5-3089.0	196.5-206.0	9.5	1 frag	–
15	23	0933	3089.0-3098.5	206.0-215.5	9.5	1 frag	–
Hole 264A							
1A	23	1155	2891.5-2901.0	8.5-18.0	9.5	9.0	95
2A	23	1252	2901.0-2910.5	18.0-27.5	9.5	8.0	84
3A	23	1530	3022.5-3032.0	139.5-149.0	9.5	8.9	94
4A	23	1635	3032.0-3041.5	149.0-158.5	9.5	7.3	77
Total					180.5	98.4	55

TABLE 2
Lithologic Units, Site 264

Unit	Lithology	Subbottom Depth (m)	Unit Thickness (m)	Age
1	Foram nanno ooze	0-31	31	Late Miocene to Recent
2	Nanno ooze to nanno chalk	31-163	132	Early to late Eocene
3	Clay-rich nanno chalk	163-171	8	Late Cretaceous (Santonian?)
4	Altered volcaniclastic rocks	171-206	35+	Late Cretaceous or older

Unit 2

Unit 2 consists almost entirely of coccoliths, with trace amounts of forams and sponge spicules. The carbonate percentage ranges from 82% to 93%. The noncalcareous fraction is dominated by finely divided clay, some acicular crystals about 10μ long, and a few grains, up to about 20μ, of angular quartz. The X-ray mineralogy (Zemmels, this volume) shows that the clay is largely montmorillonite and that the acicular crystals are probably clinoptilolite, presumably from alteration of volcanic glass. In the lower 3 meters, however, the clay content increases to 15%.

The upper 61 meters of Unit 2 is stiff, white nanno ooze. The upper contact is sharp, and subcircular mottles, up to 2 cm across, interpreted as burrows, are scattered through the upper 30 cm. This upper portion is structurally featureless, although the consistency of the ooze varies considerably, probably as a result of variable deformation during coring. The lower 71 meters of Unit 2 consists of bluish-white nanno chalk. Light gray chert (nodules or fragments up to 6 cm across) occurs at intervals of about 1 to 2 meters through the unit. Purplish-black streaks a few millimeters wide are scattered through the core, most of which show signs of brecciation from drilling. The presence in Core 8, Section 3 of an ovoid structure 8 mm across with three or four fine concentric purplish laminae suggests that the purplish-black streaks have come from similar small concretionary structures in the chalk.

Unit 3

The upper contact of Unit 3 is sharp, is marked by a greenish-gray film, and appears to record an unconformity. The unit comprises yellowish-gray nanno chalk with from 10% to 30% clay and trace amounts of sponge spicules and forams. In the upper part of the unit the clay is in the form of equant plates 1μ to 10μ across, in contrast to the acicular and cryptocrystalline habits of clay in the overlying units. In the lower part, which is separated from the upper by 4 meters of lost core, the acicular and cryptocrystalline clays return. A sample from a dusky yellow patch at 162.9 meters just below the unconformity is carbonate free and consists largely of clinoptilolite (52%) and apatite (25%) with minor barite and palygorskite. A more typical sample, from 169.7 meters, is 98% carbonate, though the noncarbonate fraction is dominated by alteration products of glass, palygorskite (41%), and clinoptilolite (14%), the remainder being largely montmorillonite.

Unit 4

Unit 4 consists of comparatively hard volcaniclastic and possible volcanic flow or pyroclastic rocks that apparently lie unconformably beneath nanno chalk of Unit 3. The unit is poorly sampled through a drilled interval of about 38 meters, which extends to the base of the hole. Except in the lowest recovered part of Core 11, samples from this unit chiefly are broken and abraded fragments from core catchers of Cores 12 through 15. In addition, Core 13 contained eight rounded fragments up to about 6 cm across.

The varied lithologies of the samples, as well as unevenness of drilling rates, indicate a high degree of heterogeneity in the sequence. Lithologies of some clasts are repeated in different parts of the drilled section, and systematic vertical changes are not apparent. Volcanic conglomerate, seen in the lower 30 cm of the recovered part of Core 11, apparently caps Unit 4 and was recovered also from the core catcher of Core 14. The conglomerates are composed of subrounded pebbles of andesite and vitrophyre up to 6 cm long in a matrix of coarse sand, in part possibly tuffaceous and cemented by sparry calcite. Nearby, matrix-free fragments of albitized holocrystalline andesitic rock and altered rhyolitic vitrophyre may be parts of large clasts but conceivably represent, respectively, hypabyssal intrusive and volcanic units. It is not clear whether fragments of andesite and vitrophyre from the remainder of the hole represent large clasts within a volcanogenic sedimentary rock, or lithic fragments in a pyroclastic rock. One or two volcanic flows may also be represented.

Most rocks of Unit 4 are strongly altered, possibly due to physical and chemical interactions with seawater during their formation. Albitized andesites predominate among the samples, with lesser amounts of fresher andesite and of apparently more siliceous vitrophyre. Little-altered primary labradorite (An_{50-65}) is rare in the andesites, the original plagioclase being replaced in part or completely by albite and oligoclase. Fresh crystals show weak normal zoning to rims of andesine (An_{40-50}). Altered crystals exhibit irregular patchy zoning and commonly are saussuritized and clouded by numerous tiny inclusions. Primary mafic minerals, even in rocks with fresh feldspars, are completely altered to a variety of secondary products including iron oxides, chlorite, and green to brownish amphiboles and micas. Two of the 17 thin sections showed well-formed pseudomorphs after olivine or pyroxene. Relict textures suggest that originally they were intersertal or intergranular. Rare vesicles are filled by quartz, partly spherulitic chalcedony, and lesser chlorite. Some vesicles record as many as five distinct phases of deposition. Red to gray vitrophyres, devitrified and otherwise altered, occur as obvious clasts in volcanic conglomerate from Core 11 and from the core catcher of Core 14, and as individual fragments without matrix in Core 13 and its core catcher. Some vitrophyres have vitroclastic and perlitic structures.

Chemical and petrologic study of the volcanic rocks has shown that the composition of the crystalline rocks is largely andesitic and that the vitrophyres range from andesite to rhyolite. The study concludes that the source terrane was probably an island arc or continental margin orogenic belt not unlike that of southern Asia.

PHYSICAL PROPERTIES

General

Bulk-density determinations using the GRAPE technique and sonic-velocity measurements were made on selected sections of nearly all cores obtained. Several porosity and additional bulk-density measurements were obtained from syringe samples. These data points have been plotted (Figure 6). With the exception of perturbations associated with the stratigraphic contact in Core 2 which are discussed below, the following general observations seem to hold. Porosity remains relatively constant at about 57% to 88% down to 100 meters. Bulk density gradually increases from somewhat less than 1.70 g/cc near the surface to just over 1.80 g/cc at 150 meters. In the depth range from 60 to 100 meters, the bulk densities obtained from GRAPE appear to be 0.2 to 0.3 g/cc less than nearby syringe values. Sonic velocities of the sediment hold relatively constant between 1.51 and 1.55 km/sec near 170 meters subbottom at the base of the sediments.

Measurements Across an Unconformity

A sharp stratigraphic contact was found about 75 cm down in Section 4 of Core 2, at 31 meters subbottom. Above the contact is upper Miocene foram nanno ooze, while below is upper Eocene foram-free nanno ooze which shows considerable mottling in the 30 cm just below the contact. The changes in physical properties across this boundary are illustrated in Figure 3. Downward, porosity and water content increase while bulk density and sonic velocity decrease. While these changes are internally consistent, they are difficult to explain physically without additional information. The most obvious changes in sediment character, i.e., the difference in ages and the presence of forams above the contact and their absence below, would most reasonably lead one to expect a decrease in porosity in going down through the contact.

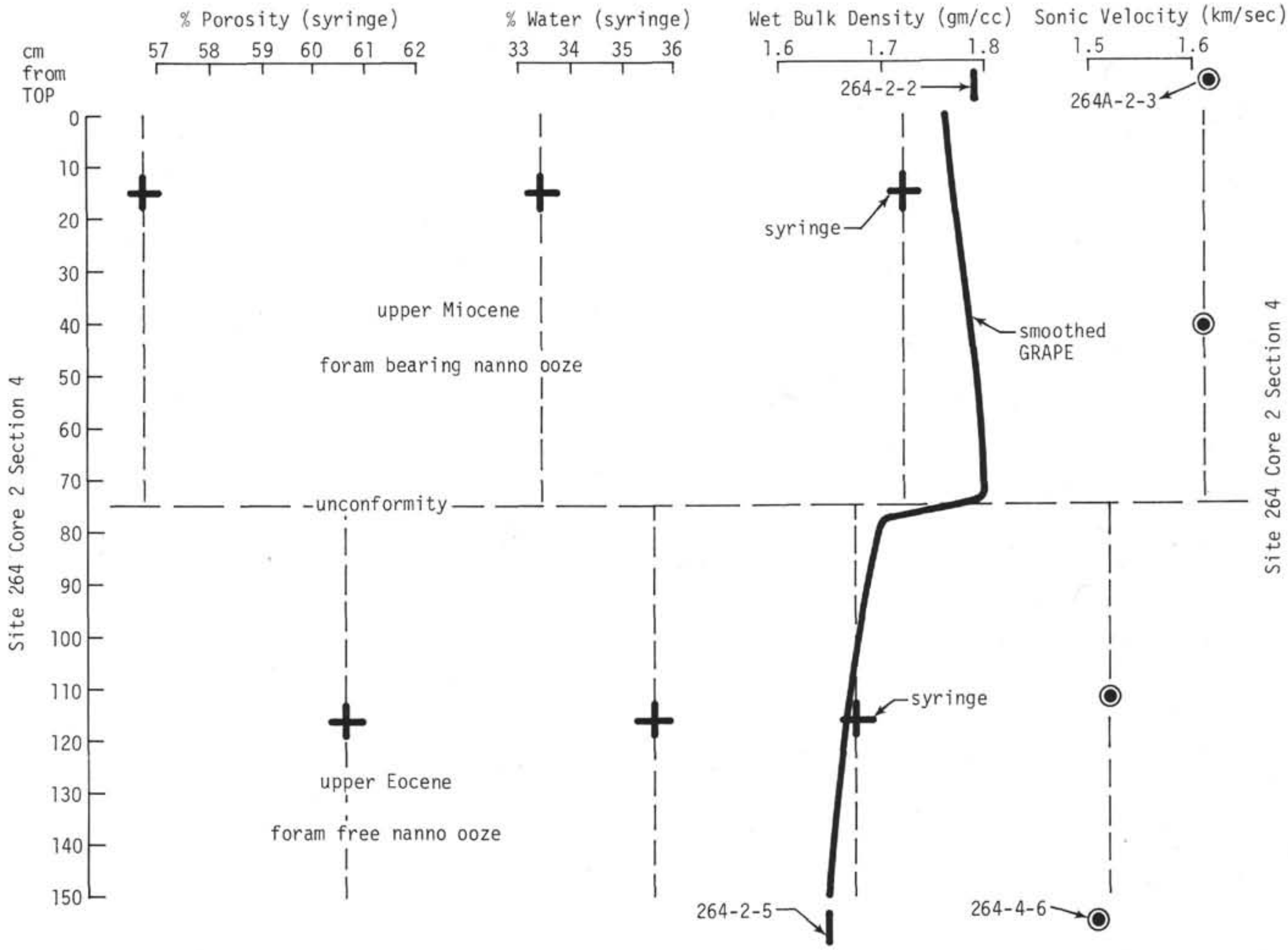

Figure 3. *Change in porosity, water content, wet bulk density, and sonic velocity across the Eocene/upper Miocene unconformity in Section 4 of Core 2.*

Hard-rock Samples

The following sonic-velocity measurements were obtained on rock samples.

7-1, 65	Chert	3.85 km/sec (avg. of 2 measurements)
11-2, 135/140	Conglomerate (top piece)	4.65 km/sec
	Conglomerate (large piece)	3.98 km/sec (avg. of 2 measurements)
11, CC	Altered basalt	3.97 km/sec (av. of 2 measurements)
12, CC	Altered basalt	3.93 km/sec
13, CC (#1)	Altered basalt	4.57 km/sec (sm dim parallel to cut face)
		4.34 km/sec (lge dim parallel to cut face)
		4.61 km/sec (perpendicular to cut face)
(#2)	Altered basalt	4.47 km/sec (perpendicular to cut face)
15, CC	Altered basalt with veinlet	5.02 km/sec (perpendicular to cut face)
		4.95 km/sec (sm dim parallel to cut face)
	Altered basalt without veinlet	4.68 km/sec (perpendicular to cut face)

BIOSTRATIGRAPHIC SUMMARY

Foraminifera

Neogene

The Neogene sediments at Site 264 consist of 30.8 meters of Pliocene and Pleistocene foram-bearing nanno ooze which disconformably overlies Eocene nanno ooze. Foraminifera are abundant throughout this interval and are well preserved, except in the basal few meters where severe corrosion is evidenced by abundant test fragments, limited diversity, and a dominance of large, thick-walled specimens.

The section down to the disconformity is apparently complete and accords well with the distribution of

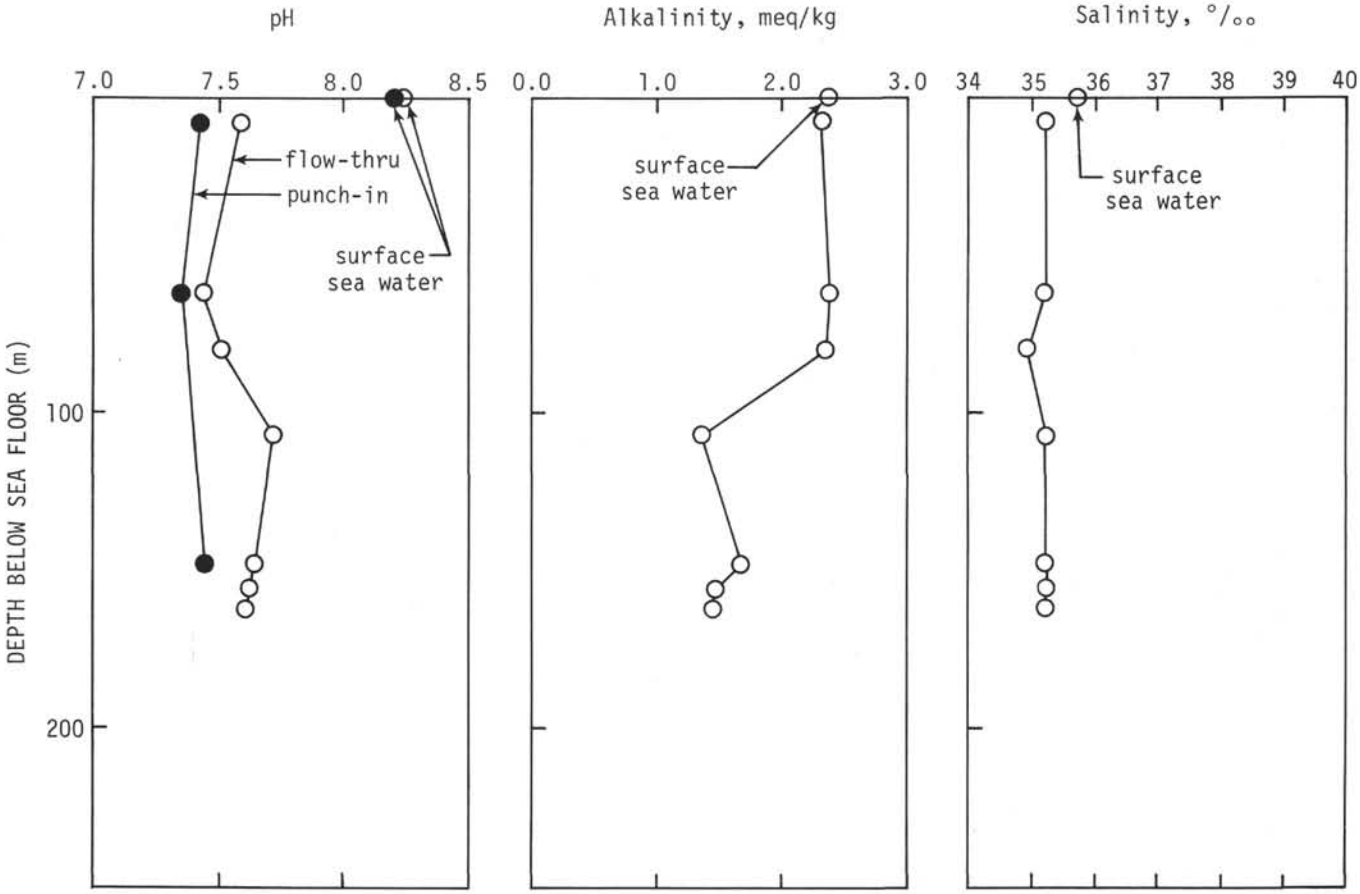

Figure 4. *Shipboard measurements of* pH, *alkalinity, and salinity of interstitial waters at Site 264.*

foraminifera in the New Zealand late Tertiary and with the zonation and local stages for this area. Two zones were recognized: the *Globorotalia miozea sphericomiozea* Zone of the upper Miocene Kapitean stage, and the *Globorotalia inflata* Zone, a broad interval covering the Pliocene and Pleistocene (Opoitian to Hawera stages). A finer subdivision of this interval was not attempted. The Pliocene-Pleistocene boundary was determined by a major change in faunal character between Cores 2A and 1A that includes (a) disappearance of *Globorotalia limbata* (last occurrence in Section 2 of Core 2A), *Globigerinoides extremus*, and *Globorotalia triangula* Theyer; and (b) the appearance of common *Globorotalia truncatulinoides* in Core 1A in contrast to its absence below.

The faunas throughout have a mid-latitude aspect, being dominated by members of the *G. miozea-sphericomiozea-inflata* and *G. crassaformis s.l.* lineages. Above its first occurrence in the lower Pliocene, *G. inflata* is the dominant element of all faunas examined. Although tropical forms such as *G. menardii* and *Pulleniatina* were occasionally seen, they never occur as more than one or several specimens per sample examined.

Globorotalia miozea conoidea ranges to the top of the Kapitean stage, and *Globorotalia conomiozea* was seen in the basal 2 meters of this interval. *G. miozea sphericomiozea* ranges into the lower part of the *Globorotalia inflata* Zone, where it is abundant, along with an entire series of morphologically transitional specimens to *G. puncticulata* (= *G. inflata* auct.) and *Globorotalia triangula*. Such an evolutionary sequence had been proposed by McInness (1965) and is well developed at Site 264. *Globorotalia crassaformis* first occurs in the lower Pliocene; in this section, it appears to evolve from a form figured by Blow (1969) as *G. subscitula* Conato. Two biostratigraphically significant taxa, used in lower latitude zonations, occur at Site 264—*Globoquadrina altispira* and *Sphaeroidinella seminulina*. Both disappear simultaneously in the lower part of the *G. inflata* Zone at this site. *Globigerina nepenthes*, which in low-latitude sequences ranges to the mid-Pliocene, disappears at the base of the *G. inflata* Zone. *Globorotalia margaritae* is very rare and was seen only in the *G. miozea sphericomiozea* Zone. One right-coiling specimen of *Pulleniatina primalis* was seen in the lower *G. inflata* Zone.

Paleogene

The boundary between the late Miocene and late Eocene is well defined in Section 4 of Core 2 at a depth of 76 cm.

Late Eocene foraminifera are confined to the lower part of Core 2. Planktonic taxa dominate and include *Chiloguembelina cubensis* (first upward appearance), *Globanomalina micra*, *Globigerina linaperta*, *Globorotaloides turgida*, and *Globigerapsis index*. This fauna closely resembles those of the New Zealand Arnold Series. The fact that *Pseudogloboquadrina primitiva* is present lower in this section but absent in this interval suggests a post-Bortonian age, probably correlating with the late Eocene Kaiatan stage. The environment is interpreted as deep, warm temperate water.

Abundant and well-preserved mid Eocene faunas are present in core catchers of Cores 3-9 and slightly lower in Core 3A, as well as in Sample 4A-2, 123-125 cm. Pelagic taxa again dominate, significant taxa including *Globigerina triloculinoides*, *Pseudogloboquadrina primitiva*, *Globanomalina micra*, *Globorotaloides turgida*, *Globigerapsis index*, and *Globigerina linaperta*. This interval correlates with the New Zealand Porangan and Bortonian stages (mid Eocene), with the presence of *Globigerapsis index* in the interval between core catchers of Cores 3 and 6 also indicating a correlation with the latter stage. Benthonic taxa constitute a minor part of the fauna with species of *Pleurostomella*, *Pullenia*, *Aragonia*, *Stilostomella*, *Nuttallides* and *Bulimina* present and ostracodes and fish teeth also noted. The change in lithology observed between core catchers of Cores 6 and 7 coincides with the entry of *Globigerapsis index* at the Porangan-Bortonian stage boundary. A slight hiatus might be present at this level. Environmental conditions are regarded as similar to those prevailing in the late Eocene, i.e., deep open water and warm temperate.

A thin succession of early Eocene is present between Samples 4A-4, 123-125 cm and 10-3, 132-139 cm. Planktonic taxa present include *Globigerina triloculinoides*, *Pseudogloboquadrina primitiva*, *Globorotalia australiformis*, *Globorotalia crater*, *Globorotaloides turgida*, *Globigerina higginsi*, and *Globanomalina micra*. Dominant benthonic taxa include species of *Siphotextularia*, *Pullenia*, *Vulvulina*, *Cibicides*, *Stilostomella*, *Bulimina*, *Pleurostomella*, and *Gyroidinoides*. The presence of *Globorotalia crater* (probably a senior synonym of *G. formosa* and *G. aragonensis*) allows confident correlation with the *G. crater* Zone (early Eocene) and Mangaorapan and Heretaungan stages (both early Eocene) of New Zealand. This interval is also correlated with the *G. formosa* and *G. aragonensis* zones of Trinidad. Open water pelagic conditions are again indicated.

A sharp color change in Core 10-3, at 40 cm, marks the boundary between the early Eocene and mid Paleocene.

Mid Paleocene faunas are dominated by planktonic taxa, including the following taxa: *Globorotalia pusilla*, *G. uncinata*, *G. angulata*, *G. pseudomenardii*, *G. pseudobulloides*, *G. chapmani*, *G. mckannai*, and *Globigerina triloculinoides*. This interval is correlated with the *G. pusilla-angulata* Zone and *G. pseudomenardii* Zone of Trinidad and with part of the *G. triloculinoides* Zone of New Zealand. The presence of *Gaudryina whangaia* and *Clavulina anglica* indicates a correlation with the New Zealand Teurian stage. This interval is an approximate correlative of the Kings Park Shale, Perth, Western Australia. Contamination from the underlying Cretaceous is indicated by the presence of *Heterohelix reussi*, *Globigerinelloides asperus*, and *Rotalipora evoluta*. The higher proportion of benthonic taxa, along with the reworking noted above, suggests that the early Eocene was shallower than the middle and late Eocene. Deep open water conditions persisted.

Cretaceous

Cretaceous faunas are confined to Core 11, down to Sample 11-2, 110 cm. At this level the almost entirely pelagic Cretaceous sediment rests abruptly on indurated conglomerate. The fauna is dominated by well-preserved tests of *Heterohelix reussi*, *Globigerinelloides asperus*, *Hedbergella planispira*, *H. delrioensis*, and *Schackoina multispinata*. *Marginotruncana coronata* and *Globotruncana linneiana* are present in very small numbers. *Rugoglobigerina* was not observed. Benthonic taxa include species of *Marssonella*, *Lenticulina*, *Dentalina*, *Frondicularia*, *Pullenia*, *Gyroidinoides*, and *Globorotalites*. This mixed assemblage appears to be made up of elements having a total range of Cenomanian to Campanian. From the available taxa, it seems certain that pelagic conditions persisted nearly through the Upper Cretaceous. No tests of Albian *Ticinella* or *Hedbergella washitensis* were recovered so it seems reasonable to suggest that the underlying conglomerate is Albian or older. Alternatively, in view of the highly contaminated Cretaceous faunas encountered here, it is possible that the conglomerate and volcanic rocks might be incorporated within a Cretaceous slumpmass.

Nannofossils

The sediments recovered from this site range in age from Recent to Cretaceous. Sediments in Cores 1-10 contain moderate to abundant nannofossils with moderate to good preservation. In contrast, however, the chalks in Core 11 contain poorly preserved nannofossils, with a large amount of background fragmented nannofossil debris.

At Site 264 the upper sediments provided a relatively short Pleistocene-upper Miocene section (Cores 1, 1A, 2A, and 2). Species commonly present in this part of the section include: *Emiliania huxleyi*, *Gephyrocapsa oceanica*, a small *Gephyrocapsa* species; *Cyclococcolithus leptoporus*, *Gephyrocapsa oceanica*, *Helicopontosphaera sellii*, *Pseudoemiliania lacunosa*, *Cyclococcolithina macintyrei*, *Discoaster brouweri*, *D. pentaradiatus*, *D. surculus*, *Reticulofenestra pseudoumbilica*, *Discoaster asymmetricus*, *D. challengeri*, *D. variabilis*, *Ceratolithus rugosus*, *C. tricorniculatus*, *Sphenolithus abies*, *Ceratolithus primus*, and *C. amplificus*. The distribution of the nannofossil species gives the following subdivision of this upper section. Pleistocene: Sample 1-1, 77 cm to Sample 2A-3, 120 cm (Zones NN21-NN19); Upper Pliocene: Sample 2A-5, 125 cm to Sample 2A-6, 75 cm (Zones NN18-NN16); Lower Pliocene and Upper Miocene: Sample 2A-6, 75 cm to Sample 2-4, 76 cm (Zones NN15-NN12).

Between Samples 2-4, 76 cm and 2-4, 120 cm is an unconformity, clearly identifiable by changes in lithology, color, and time gap. The sediments below the unconformity (Samples 2-4, 120 cm to 10-3, 40 cm) range from upper Miocene to upper Eocene. The underlying Eocene section is extremely thick (Core 2 to Core 10) and ranges in age from upper Eocene to lower Eocene, with a particularly long middle Eocene component. The lower part of the Eocene section ends in a lower Eocene-middle Paleocene unconformity in Core 10.

Species present in the Eocene section include: *Reticulofenestra umbilica*, *Chiastomolithus grandis*, *Coccolithus eopelagicus*, *Chiastomolithus expansus*, *Cyclolithella samodurovi*, *Markalius inversus*, *Cyclococcolithina formosa*, *Thoracosphaera deflandrei*, *Zygolithus dubius*, *Chiastomolithus solitus*, *Nannotetrina quadrata*, *Chiphragmolithus cristatus*, *Lanternithus minutus*, *Sphenolithus pseudoradians*, *Chiastomolithus oamaruensis*, *Discoaster saipanensis*, *D. tani*, *D. barbadiensis*, *D. bifax*, *Helicopontosphaera reticulata*, *Sphenolithus moriformis*, *Zygrhabdolithus bijugatus*, *Reticulofenestra dictyoda*, *Discoaster sublodoensis*, *Sphenolithus spinniger*, *Helicopontosphaera* sp., *Discoaster robustus*, *Reticulofenestra hillae*, *Helicopontosphaera lophata*, *Chiastomolithus bidens*, *Cyclococcolithus inversus*, *Chiastomolithus gigas*, *Discoaster mirus*, *Sphenolithus radians*, *Discoaster nodifer*, *D. wemmelensis*, *Chiphragmolithus* spp., *Discoaster strictus*, *Nannotetrina pappi*, *Sphenolithus furcatolithoides*, small *Sphenolithus* spp., *Discoaster lodoensis*, *D. septemradiatus*, *D. nonradiatus*, *D. kuepperi*, and *Marthasterites tribrachiatus*.

The distribution of these species allows the Eocene section to be subdivided as follows: upper to upper middle Eocene: Sample 2-4, 120 cm to Sample 3-3, 40 cm (*D. saipanensis* and *D. tani* zones) (Zones NP17-NP18); middle Eocene: Sample 3-4, 40 cm to Sample 10-2, 24 cm (*N. quadrata* and *D. sublodoensis* zones); lower Eocene: Sample 10-2, 60 cm to Sample 10-3, 143 cm (*D. lodoensis* and *M. tribrachiatus* zones).

Between Sample 10-3, 143 cm and Sample 10-3, 145 cm there is a hiatus. This hiatus appears to be well defined by a lithologic and color change, but is not as well defined faunally. The lowest recognizable white Eocene sediment is in the *D. lodoensis* Zone (NP13). Below this, within a transitional zone of mixed lithology between the white Eocene and lower greenish Paleocene sediments, are a number of small pockets of sediment rich in *Marthasterites tribrachiatus*. Within the same transitional zone are pockets of sediment containing only a very few nannofossils. The lower part of Core 10 can all be placed in the middle Paleocene (lower *Heliolithus kleinpelli* Zone NP6 and upper *Fasciculithus tympaniformis* Zone NP5). However, these same sediments also contain a small amount of reworked Cretaceous nannofossils. The lower zones of the Paleocene are not present, and as this part of the section was not recovered, it cannot be determined whether the Paleocene rests unconformably on the Cretaceous sediments below.

The chalk section in Core 11 is Upper Cretaceous in age. The youngest diagnostic nannofossils found in these sediments were *Kamptnerius magnificus* and *Micula staurophora* indicating a Campanian/Santonian age.

Radiolaria

Low quantities of moderately preserved Eocene Radiolaria are present between Core 2, Section 5 and Sample 3, CC. Radiolaria are absent or occur only in trace amounts throughout the remainder of the cores.

The stratigraphic zonation of the sediments containing Radiolaria is difficult to determine, because low-latitude index species are absent. However, on the basis of overall occurrences of several species (*Lychnocanoma amphitrite*, *Eusyringium fistuligerum*, *Lithochytris vespertilio*, *Theocampe amphora*, *Calocyclas hispida*, *Theocampe urceolus*, *Lophocyrtis biaurita*, *Lychnocanoma babylonis*, and *Phormocyrtis striata striata*), it appears that from Sample 3, CC to Core 2, Section 5 the sediments are within the interval from the *Podocyrtis mitra* Zone to *Thyrsocyrtis bromia* Zone (upper middle Eocene to upper Eocene).

Diatoms

Core-catcher samples were investigated for this site with all but Sample 2, CC being barren. The diatoms recovered were poorly preserved and extremely low in number. The diatoms identified in 2, CC are; *Melosira sulcata*, *Stephanopyxis turris*, *Triceratiumpartitum*?, *Arachnoidiscus ehrenbergii*, *Hemiaulus polymorphus*.

Silicoflagellates

All calcareous nanno ooze sediments recovered at this site were barren of silicoflagellates except sediments in Sample 2, CC. Silicoflagellates were very rare in 2, CC with only four to five specimens counted per slide. The silicoflagellates identified were as follows: *Naviculopsis biapiculata*, *Naviculopsis constricta*, *Corbisema archangelskianna*, and *Mesocena oamaruensis* var. *quadrangula*. These species can occur concurrently in either the late Oligocene or the late Eocene; however, a late Eocene date is favored on the basis of biostratigraphic evidence from other microfossil groups.

Palynology

Eleven samples from the carbonate sequence at Site 264 were macerated and acid-insoluble residues examined; 10 samples were selected from the Eocene sequence, 1 from the Late Cretaceous basal interval. All, however, proved virtually barren—only in Sample 10-3, 125-127 cm were rare spinose acritarchs observed. The lack of palynomorphs is possibly due to oxidation during deposition, or else to extreme dilution of organic-walled microplankton by calcareous skeletons.

SUMMARY AND CONCLUSIONS

Site 264 is located in 2873 meters of water just north of the southern flank of the Naturaliste Plateau and about 180 km west of Cape Leeuwin. Seismic profiles from *Eltanin* 45 and the site survey reveal a broad structural depression containing up to about 600 meters of acoustically transparent sediments and apparently isolated from the 1-km-thick Naturaliste sedimentary sequence. The site was positioned on the south flank of this depression in an effort to obtain sediments older than the Lower Cretaceous glauconitic silts sampled at Site 258 (Leg 27) and to determine whether the basement rocks are of oceanic or continental affinity.

The sedimentary column at Site 264 consists of 171 meters of calcareous oozes, foram-bearing at the top but made up predominantly of calcareous nannofossils (Figure 5). Unconformities detected by gaps in biostratigraphic zonation, separate (1) Miocene and

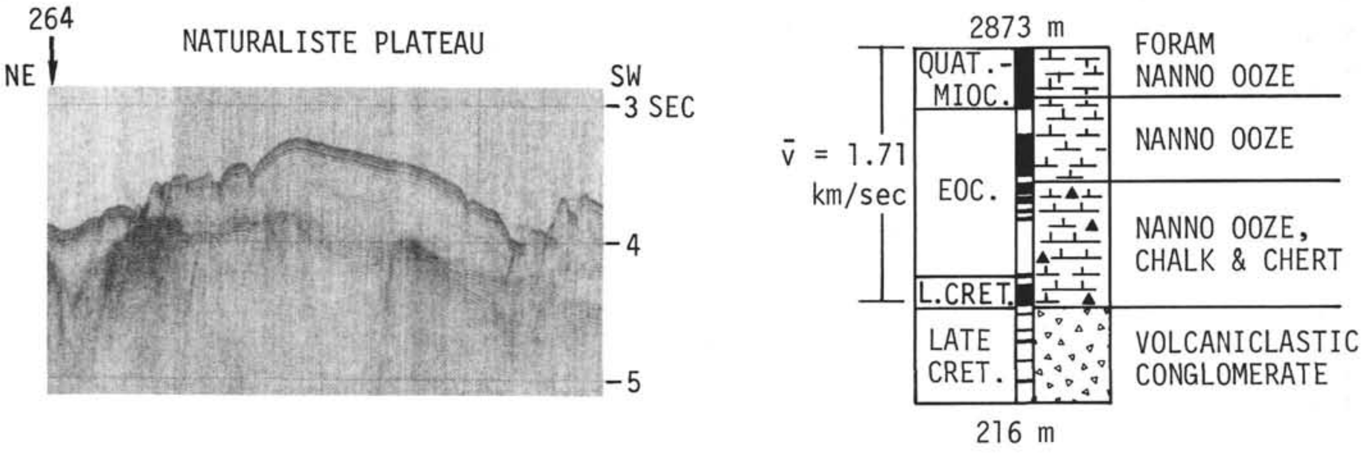

Figure 5. *Comparison of* Glomar Challenger *seismic profile on approach to Site 264 and the drilled section. The strong reflector at about 0.2 sec below the sea floor probably corresponds to the top of the volcaniclastic conglomerate.*

younger strata from an Eocene sequence, (2) Eocene from middle Paleocene, and, probably, (3) Paleocene from Late Cretaceous (Campanian-Santonian).

The volcaniclastic sequence at the base of the hole probably does not represent oceanic basement (layer 2) in view of its clastic character and its range of intermediate to basic composition. Rather, the volcanic sequence may be a basal or near-basal continental sequence deposited in a small depression in a volcanic terrane. Submergence of the basin to moderately great depths had occurred by Santonian time, probably by the Albian as at Sites 255 and 258. Accumulation of calcareous oozes began by Early Late Cretaceous and has continued, perhaps intermittently, until the present. Erosion, probably by bottom currents in the latest Cretaceous and earliest Cenozoic, stripped off much of the Cretaceous sediment and some of the debris was incorporated in the mid Paleocene sediments.

The depression drilled at Site 264 probably had a Late Cretaceous/Cenozoic history similar to that of both the northeastern part of Naturaliste Plateau proper, as seen at Site 258, and of Broken Ridge, as indicated by Site 255 (Leg 26). However, Site 264 is unique for this region in that it contains Santonian or older volcanic conglomerate suggesting Mesozoic coastal volcanism, and in that a well-developed section of Eocene carbonates is preserved, suggesting that Paleogene erosion patterns in the region were erratic.

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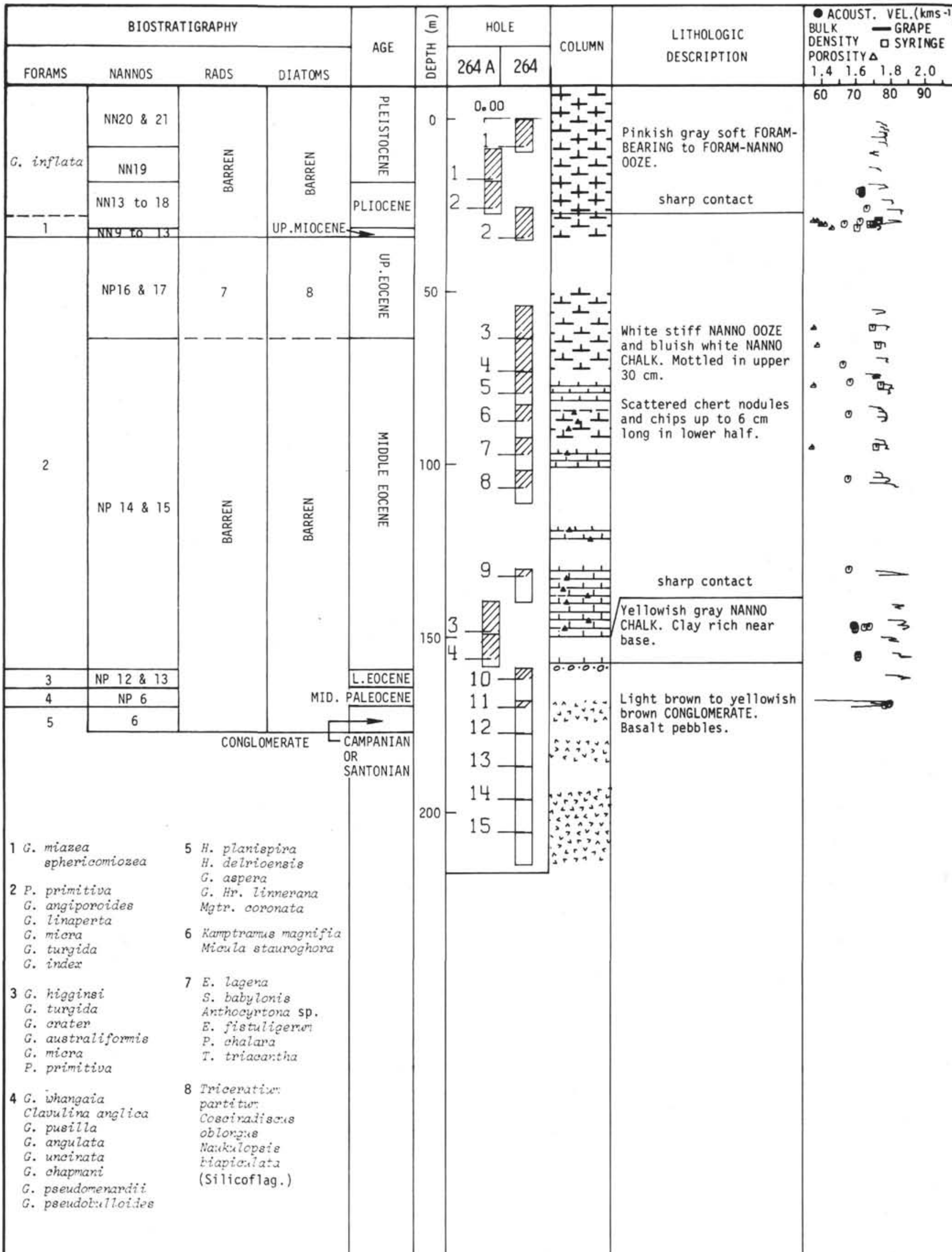


Figure 6. *Graphic hole summary, Site 264.*

Site 264 Hole Core 1 Cored Interval: 0-9.5 m

AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
PLEISTOCENE	NN21/20	N	A	G	1	0.5, 1.0	VOID		*	Pinkish gray (5YR 8/1), soft FORAM-RICH NANNO OOZE; indistinct moderate mottling in patches about 1 cm across due to slight changes in color density and grayness.
	Emiliania huxleyi & Gephyrocapsa	N	A	G	2				GZ,CC *	Pinkish gray (5YR 8/1), soft, coherent FORAM NANNO OOZE; indistinct moderate mottling throughout. Sec. 2 (125 cm): 60% nannos, 40% forams, 2% sponge spicules
	Globorotalia inflata	F / N	A / A	G / G	3				**	
	Pseudoemiliana lacunosa NN19	N	C	M	4					
		N	A	G	5					
		N	C	M	6				*	
		N / F	A / A	G / G	Core Catcher				*	

Site 264 Hole Core 2 Cored Interval: 25.5-35 m

AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
UPPER MIOCENE	Globorotalia inflata D. surculus NN16	F / N	C / A	P / G	1	0.5, 1.0			* GZ,CC GZ,CC	
	Globorotalia miozea sphericomiozea NN13	F / N	C / A	P / G	2				*	Pinkish gray (5YR 8/1) soft, plastic FORAM-BEARING NANNO OOZE. Becomes foram-rich 30 cm above the contact in Sec. 4 (76 cm). Sec. 2 (14 cm): 90% nannos (mostly coccoliths, a few discoasters), 8% forams, 2% sponge spicules up to 200 microns long
	NN11	F / N	C / A	P / G	3				*	
		F	F	P	4				*	Contact sharp but dragged down up to 30 cm at edge of core.
UPPER EOCENE	Discoaster saipanensis NP16	N	A	G					* *	White (N9) stiff NANNO OOZE. Very pale orange (10YR 8/2) mottles (?burrows) up to 2 cm across scattered through and fading out at the base of the 30-cm interval below the contact. Sec. 6 (5 cm): 99% nannos (coccoliths), TR sponge spicules, TR rad fragments
		N	A	G	5				GZ,CC	
		N	A	G	6				*	
		F / N	A / A	G / G	Core Catcher				*	

Explanatory notes in Chapter 1

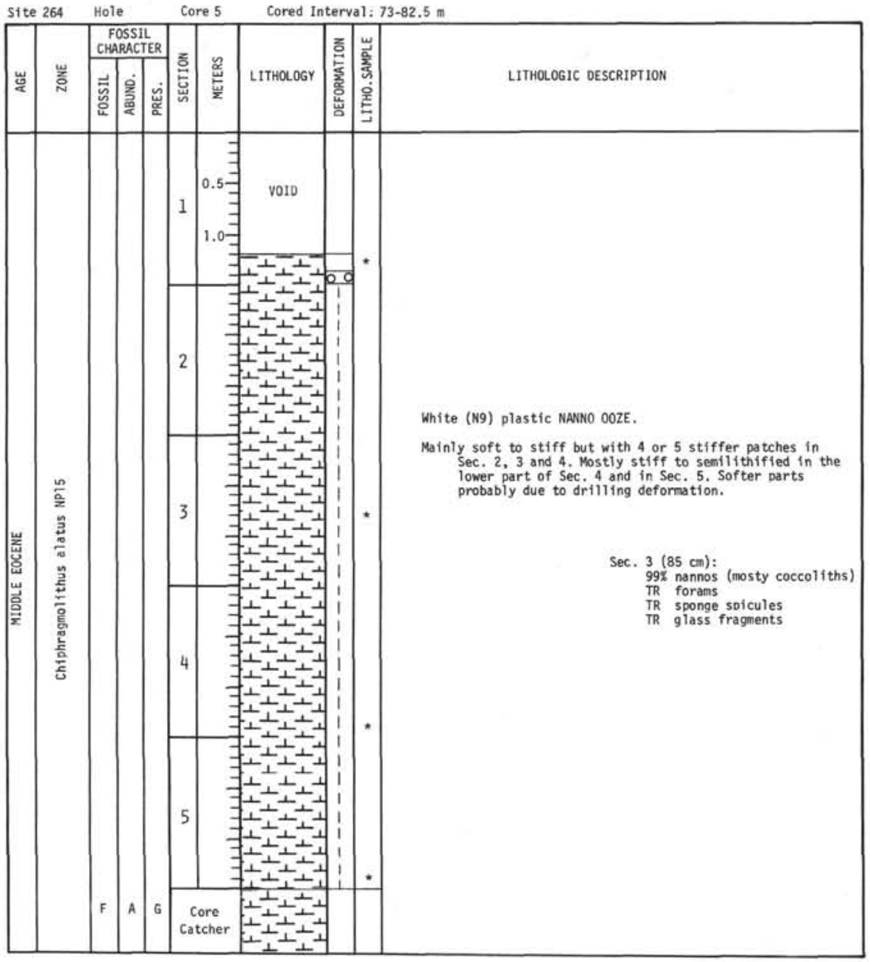
Site 264 Hole Core 3 Cored Interval: 54-63.5 m

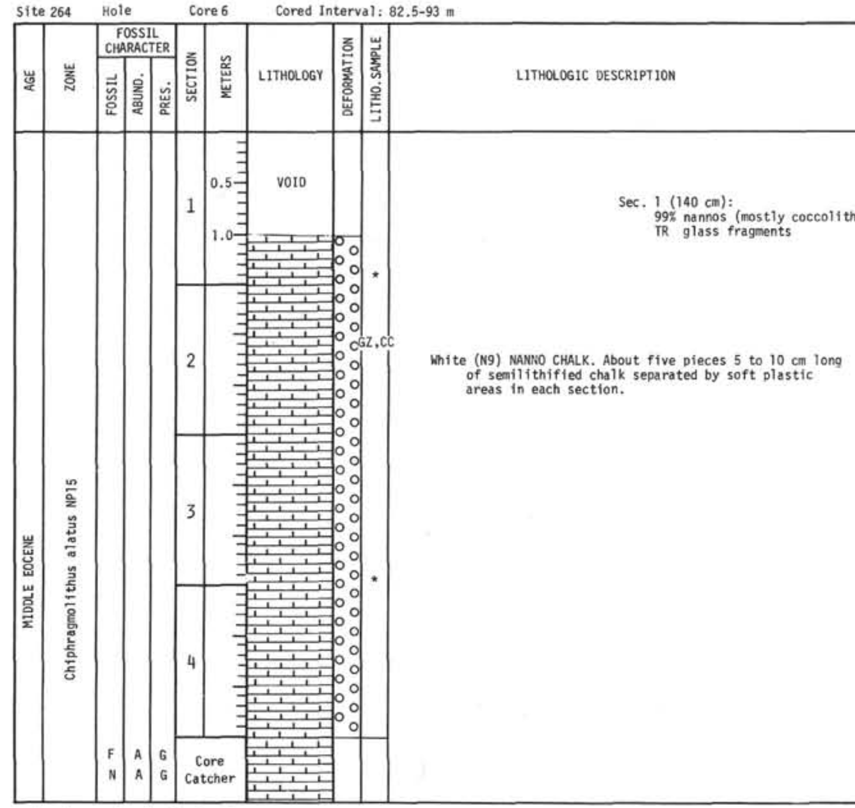
AGE	ZONE	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
UPPER EOCENE	NP16				1	0.5, 1.0			GZ,CC	White, stiff, uniform NANNO OOZE.
										Light gray discontinuous laminae in Sec. 2 from 86 to 89 cm.
					2				*	
					3					White (N9), stiff NANNO OOZE. Slightly plastic beds 10 to 20 cm thick alternate with more plastic beds 5 to 10 cm thick.
					4				*	
					5				*	Sec. 5 (57 cm): 99% nannos (mainly coccoliths - a few discoasters) TR forams TR glass fragments
										"Vertical bedding" in Sec. 6, 54-150 cm.
					6					
		F / N	A / A	G / G	Core Catcher				*	

Site 264 Hole Core 4 Cored Interval: 63.5-73 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE EOCENE	Chiphragmolithus alatus NP15				1	0.5, 1.0				
					2				**	White (N9) stiff plastic NANNO OOZE. Stiff core is slightly sheared and alternates with softer intervals that are probably much more highly deformed.
					3				GZ,CC GZ,CC	
					4				*	Sec. 4 (92 cm): 99% nannos (mostly coccoliths - a few discoasters) TR forams TR sponge spicules
									*	Several thin conchoidal flakes up to 2 cm across of chert from 91 to 108 cm in Sec. 4.
					5				GZ,CC	
					6					
		F / N	A / A	G / G	Core Catcher					

Explanatory notes in Chapter 1





Explanatory notes in Chapter 1

Site 264 Hole Core 7 Cored Interval: 92-101.5 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE EOCENE	NP15	F N	A A	G G	1, 2, 3, 4, Core Catcher	0.5, 1.0	VOID		*, *, GZ,CC	See below

White NANNO OOZE with flakes of light bluish gray (5B 7/1) chert.

Sec. 1 (57 cm):
99% nannos (mostly coccoliths)
1% clay
TR glass fragments

Sec. 2 (46 cm):
99% nannos (mostly coccoliths)
TR forams
TR sponge spicules
TR clay

Bluish white (5B 9/1) NANNO OOZE. Streaks of very dusky purple (5P 2/2) a few millimeters wide every 5 to 15 cm.

Flakes and nodules of light bluish gray (5B 7/1) chert range up to 6 cm across.

Scattered stiff patches about 5 cm across and intervening soft areas suggest brecciation during drilling.

Site 264 Hole Core 8 Cored Interval: 101.5-111 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE EOCENE	NP15	F N	A A	G G	1, 2, 3, 4, Core Catcher	0.5, 1.0	VOID		*, XM, GZ,CC, *	See below

Light gray chert fragment 3 cm across in Sec. 1 (100 cm).

Bluish white (5B 9/1) semilithified NANNO CHALK. Streaks of 1 or 2 mm wide of purplish black (5P 2/1) common in Section 1 and grade down into larger but more sparsely distributed patches.

Ovoid concretionary structure 0.5 x 0.8 cm with 3 or 4 fine concentric purplish black bands. Brecciated during drilling and with scattered soft patches.

Sec. 2 (110 cm):
98% nannos (coccoliths with subordinate discoasters)
2% clay

Bulk X-ray (105.1 m):

Amorph.	- 0%
Ident.	-100%
Calc.	- 97.6%
Quar.	- 0.3%
Mont.	- 1.6%
Clin.	- 0.5%

Site 264 Hole Core 9 Cored Interval: 130-139.5 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE EOCENE	Chiphragmolithus alatus NP15 Discoaster lodoensis NP14	F N	A A	G G	1, 2, Core Catcher	0.5, 1.0	VOID		*, GZ,CC, *	See below

Bluish white (5B 9/1) semilithified NANNO CHALK. Core brecciated (pieces up to 15 cm long) but no indication that chert nodules have been dragged far. Greenish gray (5GY 6/1) subequant chert nodules 3 to 5 cm across in Sec. 2 (49, 92, and 120 cm). Color boundary at margin is sharp but fractures cut right across it.

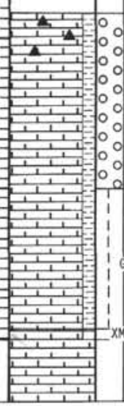
Sec. 2 (135 cm):
99% nannos
TR clay
TR glass fragments

White semilithified NANNO CHALK. Very light gray chert fragment 2 cm across.

Explanatory notes in Chapter 1

Site 264 Hole Core 10 Cored Interval: 158.5-168 m

AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
LOWER EOCENE	NP14	F N	A A	G G	1	0.5 1.0	VOID		*
					2				CC GZ * XM
	NP13	F N	A C	G M	3				XM * GZ,CC
MIDDLE PALEOCENE	NP12 NP6 plus reworked Cretaceous	F N	A C	G M	Core Catcher				XM,GZ,CC



LITHOLOGIC DESCRIPTION

Light bluish gray (5B 7/1) chert nodules 4 to 6 cm long in Sec. 1 (128 and 147 cm) and Sec. 2 (3 cm).

White semilithified CLAY-RICH NANNO CHALK. Drilling breccia includes core up to 30 cm long. A yellowish gray sludge surrounds the fragments. Clay content increases from ~5% in Sec. 1 (142 cm) to 20% in Sec. 3 (136 cm).

Bulk X-ray (161.1 m):
Amorph. - 0%
Ident. -100%
Calc. - 98.2%
Quar. - 0.4%
Clin. - 1.4%

Bulk X-ray (161.8 m):
Amorph. - 0%
Ident. -100%
Calc. - 98.5%
Quar. - 0.4%
Clin. - 1.1%

Bulk X-ray (162.9 m):
Amorph. - 2.3%
Ident. - 97.7%
Quar. - 3.6%
Mica - 5.7%
Paly. - 6.1%
Clin. - 51.8%
Apat. - 25.3%
Bari. - 7.6%

Sec. 3 (32 cm):
85% nannos
15% clay
TR forams
TR glass

Contact sharp and marked by dark greenish gray (5G 4/1) film.

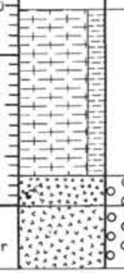
Yellowish gray (5Y 8/1) semilithified CLAY-RICH NANNO CHALK with dusky yellow patch (5Y 6/4).

Sec. 3 (142 cm):
85% nannos (mostly coccoliths with λ discoasters)
15% clay
TR forams, sponge spicules

White semilithified NANNO CHALK with pale greenish cast.

Site 264 Hole Core 11 Cored Interval: 168-177.5 m

AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
CAMPANIAN OR SANTONIAN	plus Cretaceous reworking	F N	A F	G P	1	0.5 1.0	VOID		* * XM GZ,CC
		F N	A F	G P	2				*
?	?				Core Catcher				



LITHOLOGIC DESCRIPTION

Yellowish gray (5Y 8/1) semilithified CLAY-RICH NANNO CHALK. A few light-colored laminae both horizontal and complexly deformed at time of deposition. Laminae have lower clay content and higher glass fragment and foram content than the dominant yellowish gray lithology.

cf: Sec. 1. (126 cm) white Sec. 1 (127 cm) yellowish gray

	Sec. 1 (126 cm) white	Sec. 1 (127 cm) yellowish gray
nannos	70%	70%
clay	10%	30%
forams	20%	0%
glass	2%	TR

Light brown (5YR 6/4-5/6) to yellowish brown (10YR 5/4-4/2) BASALT CONGLOMERATE. Two pebbles and three conglomerate fragments recovered, all heavily iron stained. Pebbles mostly 0.3 to 1.5 cm but up to 6 cm long and subrounded. Larger pebbles are altered and albitised fine-grained crystalline basalt; smaller pebbles are microbreccia or Fe-rich devitrified glass. Matrix is coarse sand. Sparry calcite forms a film around the larger pebbles and cements the sand matrix.

Thin sections:
Sec. 2 (127 cm): Albitised gabbro pebble
Sec. 2 (140 cm): Altered andesitic vitrophyre
Sec. 2 (142 cm): Calcite-cemented basalt conglomerate

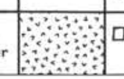
Core catcher sample about 7 cm long, of iron-stained and chloritised crystal-rich fine-grained basalt (An_{60-65}) with zoning to An_{40} common. Original mafics entirely altered to chlorite and Fe oxides.

Thin section:
11-2-CC

Bulk X-ray (169.7 m):
Amorph. - 0%
Ident. -100%
Calc. - 98.0%
Quar. - 0.2%
Clin. - 1.3%
Bari. - 0.5%

Site 264 Hole Core 12 Cored Interval: 177.5-187 m

AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
?	?				Core Catcher			□	



LITHOLOGIC DESCRIPTION

One piece 8 cm long of heavily limonitised, dark yellowish brown (10YR 4/4), dense, fine-grained basalt. Specimen has marks indicating that it was drilled in two directions.

NOTE: High and variable coring speed suggests that lithologies represented by cores 12 through 15 are soft and inhomogeneous, such as sediment with interbedded volcanic conglomerate and basalt pillows.

Explanatory notes in Chapter 1

Site 264 Hole Core 13 Cored Interval: 187-196.5 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
					1	0.5 1.0	VOID			
?	?				Core Catcher					Eight fragments from 2 to 6 cm across of medium gray to greenish gray, fine-grained, crystalline to aphanitic volcanic rocks. Four have plagioclase phenocrysts (mainly albite) and five have scattered quartz- and chlorite-filled amygdales. Thin sections: Core 13, Sec. 1, Piece #1: Altered andesitic (An_{30-35}) vitrophyre #2: Albitised fine-grained basalt #4: Albitised dacitic vitrophyre #5: Albitised amygdaloidal basalt #6: Silicified andesitic vitrophyre Note: These fragments may have rolled out into the tube from the core catcher after the barrel came on deck. Note: High and variable coring speed suggests that lithologies represented by cores 12 through 15 are soft and inhomogeneous, such as sediment with inter-bedded volcanic conglomerate and basalt pillows. Nine fragments 2 to 6 cm across of yellowish gray (5Y 8/1) and light to dark greenish gray (5Y 8/1-4/1) fine-grained and aphanitic volcanic rocks. Thin sections: Core 13, CC, Piece #1: Chloritised fine-grained basalt #2: Altered basaltic vitrophyre #3: Albitised fine-grained basalt #4: Albitised fine-grained basalt #6: Ferruginous andesitic vitrophyre #7: Albitised fine-grained basalt

Site 264 Hole Core 14 Cored Interval: 196.5-206 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
?	?				Core Catcher					One fragment 7 cm long of moderately sorted conglomerate with subrounded to rounded pebbles up to 4 cm across. The sandy, tuffaceous matrix is held together by calcite and chlorite cement. Pebbles are altered basaltic vitrophyre. Thin section: 14-CC Note: High and variable coring speed suggests that lithologies represented by cores 12 through 15 are soft and inhomogeneous, such as sediment with inter-bedded volcanic conglomerate and basalt pillows.

Site 264 Hole Core 15 Cored Interval: 206-215.5 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
?	?				Core Catcher					One piece 6 x 6 x 6 cm of olive gray to dark greenish gray (5Y-5GY 4/1) dense, fine-grained, albitised basalt. Thin section: 15-CC Note: High and variable coring speed suggests that lithologies represented by cores 12 through 15 are soft and inhomogeneous, such as sediment with inter-bedded volcanic conglomerate and basalt pillows.

Explanatory notes in Chapter 1

Site 264 Hole A Core 1 Cored Interval: 8.5-18 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
PLEISTOCENE	Globorotalia inflata; Pseudoemiliano lacunosa NN19				1	0.5, 1.0			* *	Pinkish gray (5YR 8/1) soft but coherent FORAM-RICH NANNO OOZE. Soupy in places near top and bottom of core. Fine light gray and white mottles in places up to 3 cm across scattered throughout.
					2					
		F	A	G	3				*	Sec. 3 (139 cm): 80% nannos, 15% forams, 5% glass fragments (10-40 microns)
					4					
					5				GZ,CC	Sec. 5 (142 cm): 65% nannos, 25% forams, 4% sponge spicules, 2% quartz, 2% glass fragments (n=1.57)
					6				*	
		N	A	G	Core Catcher					
		F	A	G					*	

Site 264 Hole Core 2 Cored Interval: 18-27.5 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
PLIOCENE	Globorotalia inflata	F	A	G	1	0.5, 1.0	VOID		*	Grayish pink (5R 9/1) soft (and in some areas soupy) FORAM-NANNO OOZE. 'Vertical bedding' in Sec. 3, 4, and 5.
		F	A	G	2					
		F	A	G	3					
		F	A	G	4					
		F	A	G	5				*	
	Discoaster surculus NN16	F	A	G	6				*	Sec. 6 (53 cm): 70% nannos, 30% forams, TR sponge spicules, TR ferruginous specks, TR glass fragments
		N	A	G	Core Catcher				*	CC: Fewer forams but 2% glass fragments

Explanatory notes in Chapter 1

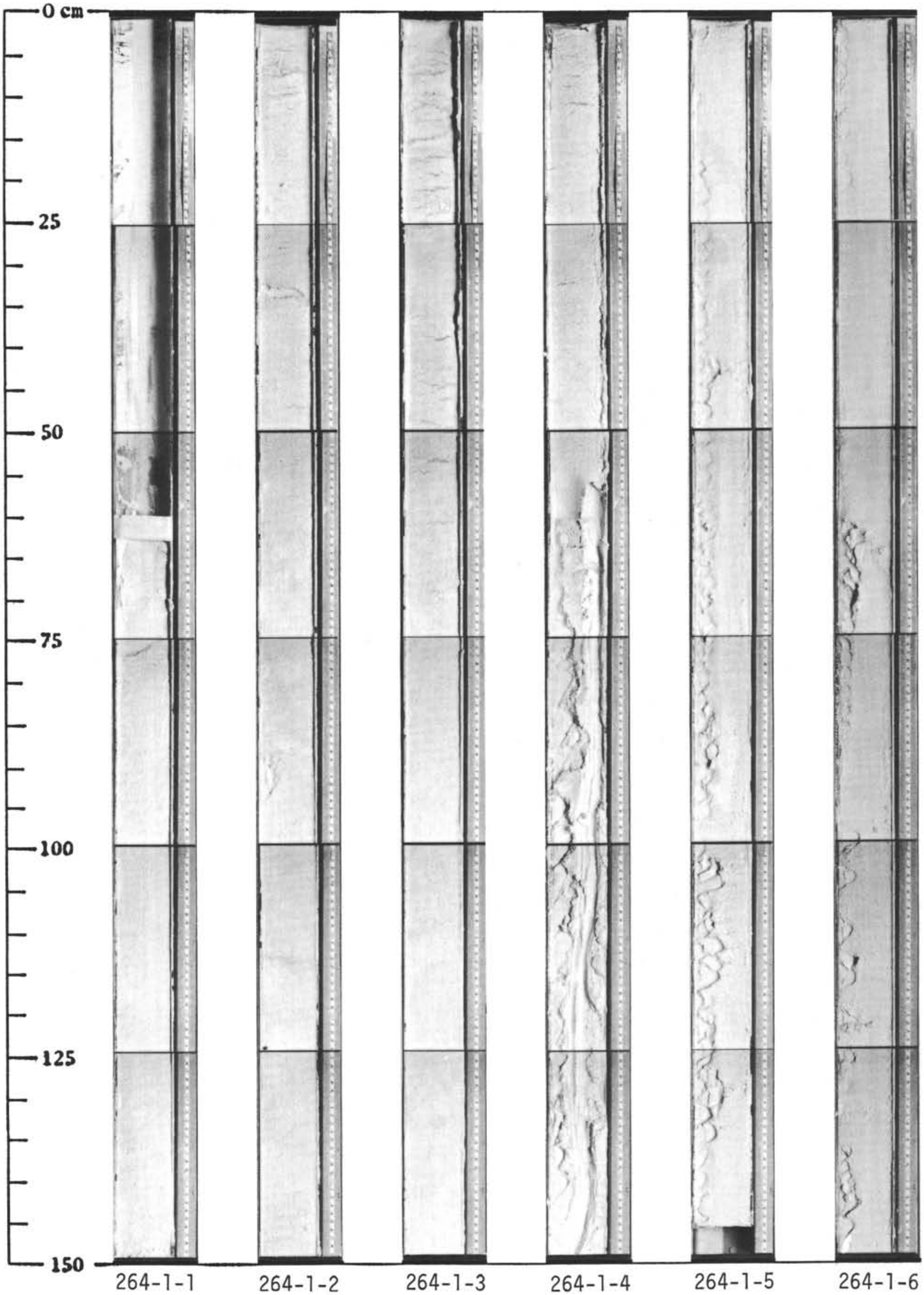
Site 264 Hole A Core 3 Cored Interval: 139.5-149 m

AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE EOCENE	Chiphragmolithus alatus NP15				1	0.5, 1.0	VOID		*	
					2					
					3				GZ,CC *	Bluish white (5B 9/1) semilithified NANNO CHALK. Mainly as drilling breccia with 4 to 6 semilithified fragments of core width and from 3 to 14 cm long in each section, except for 26-51 cm in Sec. 1, which is undisturbed. A few purplish black (5P 2/1) streaky patches 2 or 3 mm across in Sec. 2. Light gray chert fragments 2 to 4 cm across in Sec. 2 (100 cm), Sec. 4 (102 cm), Sec. 6 (147 cm), and in the core catcher. Sec. 3 (102 cm): 95% nannos, 2% clay, TR forams, TR glass fragments, TR ferruginous specks
					4					
					5					
					6				*	
		N / F	A / A	G / G	Core Catcher					

Site 264 Hole A Core 4 Cored Interval: 149-158.5 m

AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE EOCENE					1	0.5, 1.0	VOID			Bluish white (5B 9/1) semilithified NANNO CHALK. Brecciated by drilling in Sec. 1 and 2; almost homogenized in Sec. 3 and 4. Light gray chert nodules and fragments.
		F	A	G	2				*	
					3					
EARLY EOCENE		F	A	G	4					
					5				GZ,CC *	A few faint horizontal laminae and small light gray patchy smears in Sec. 5. Sec. 5 (100 cm): 99% nannos, TR forams, TR clay, TR glass fragments
					Core Catcher				**	CC: 95% nannos, TR forams, TR glass fragments, 4% clay

Explanatory notes in Chapter 1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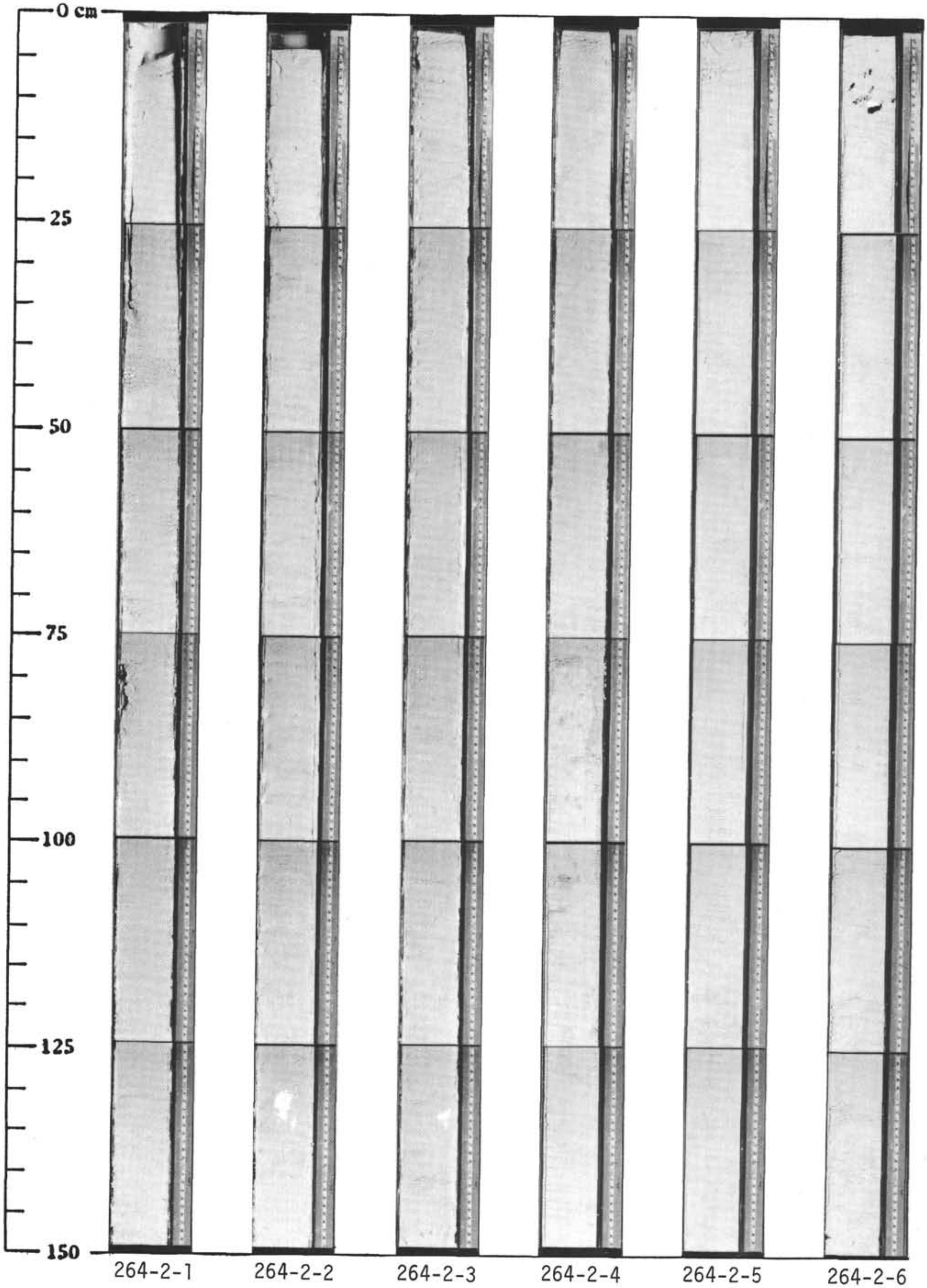
264-1-5
264-1-6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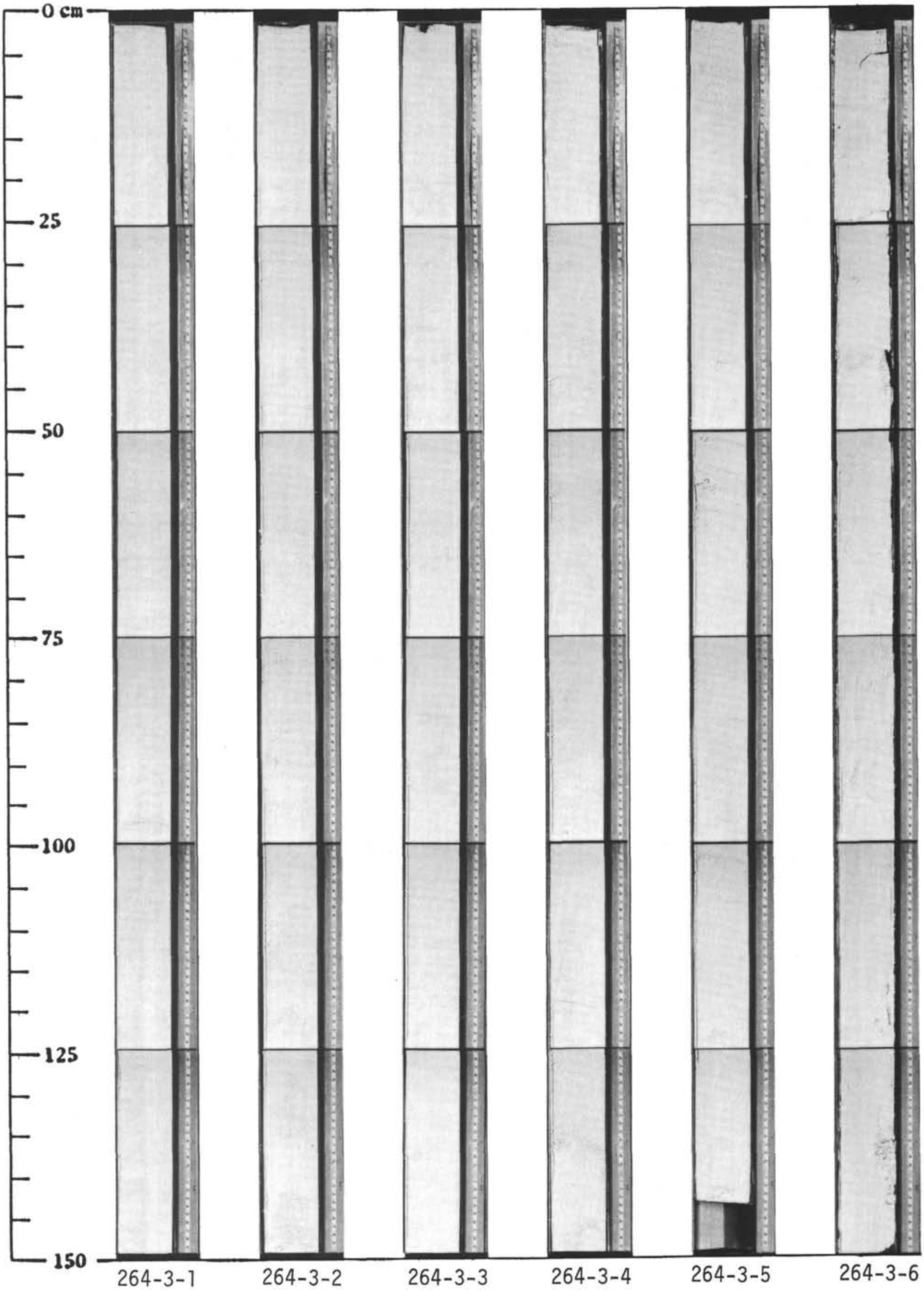
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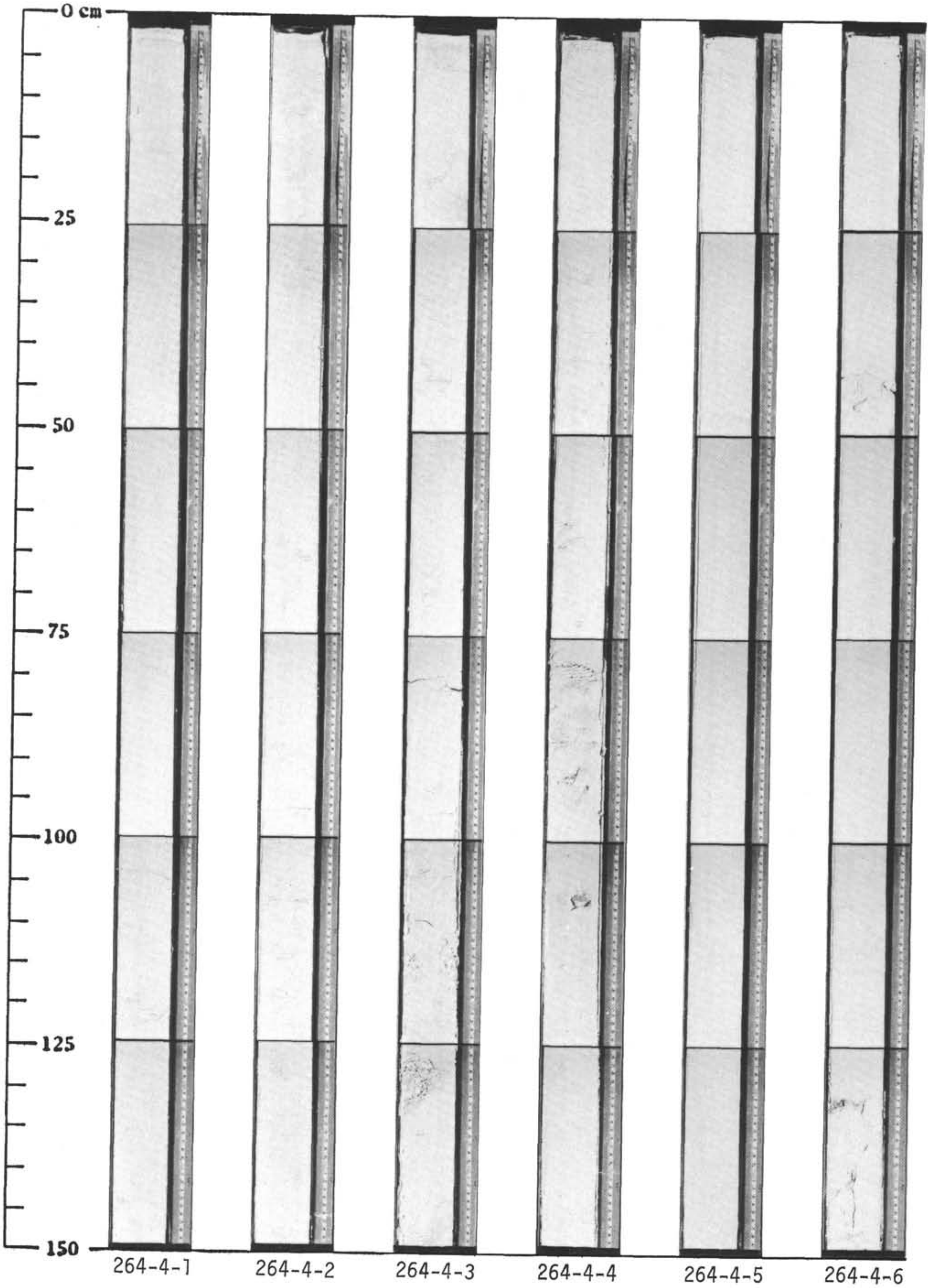
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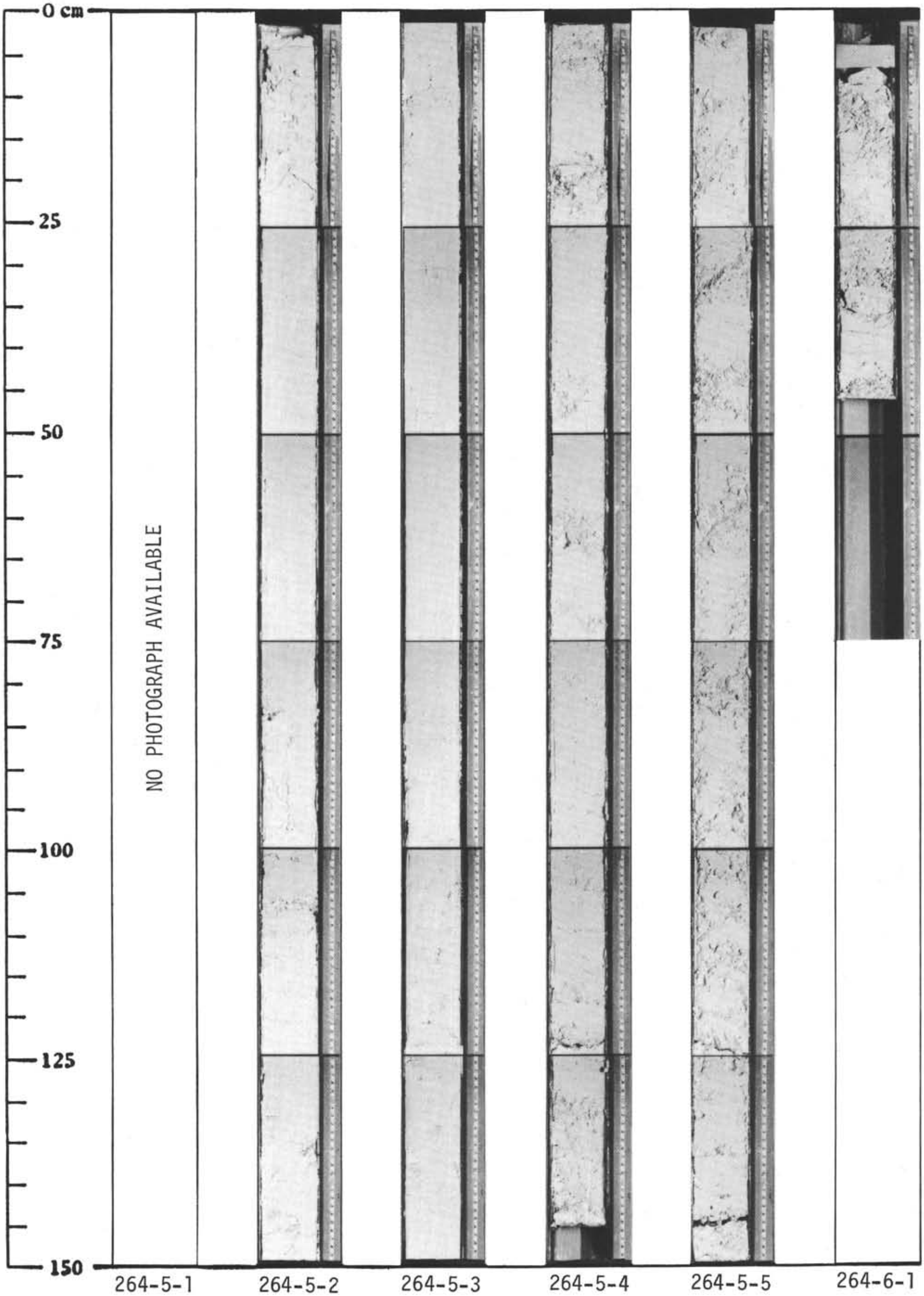
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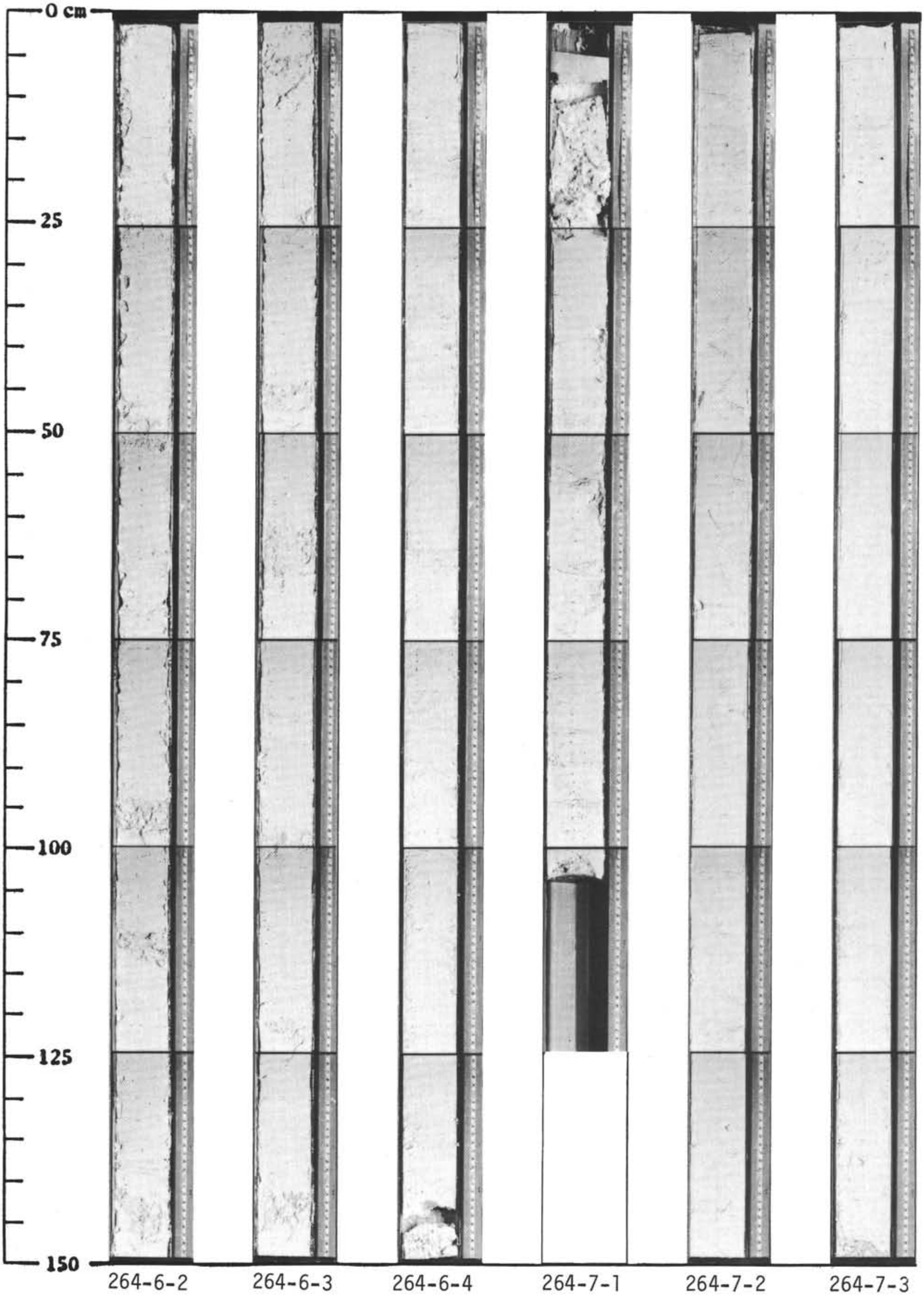
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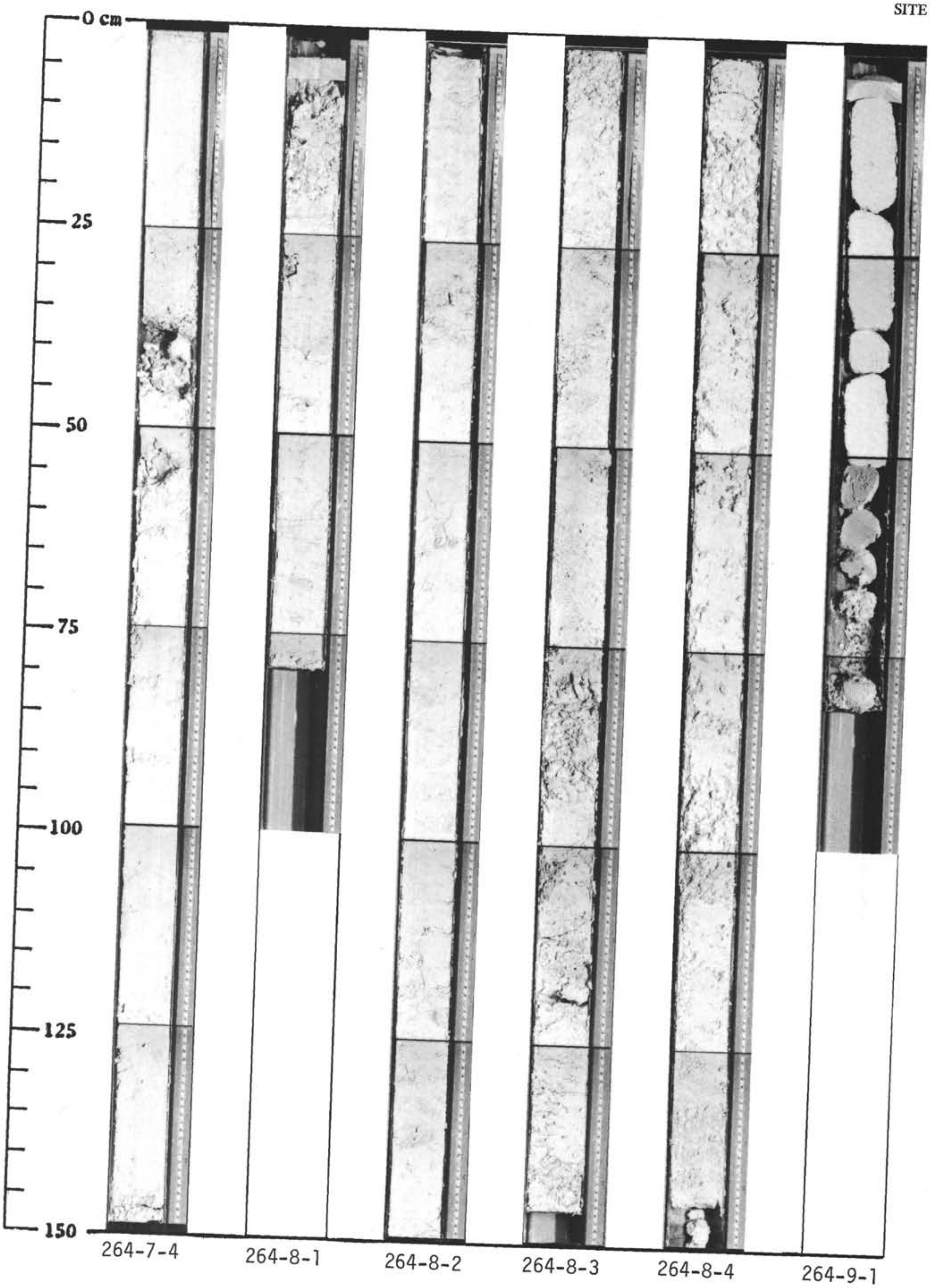
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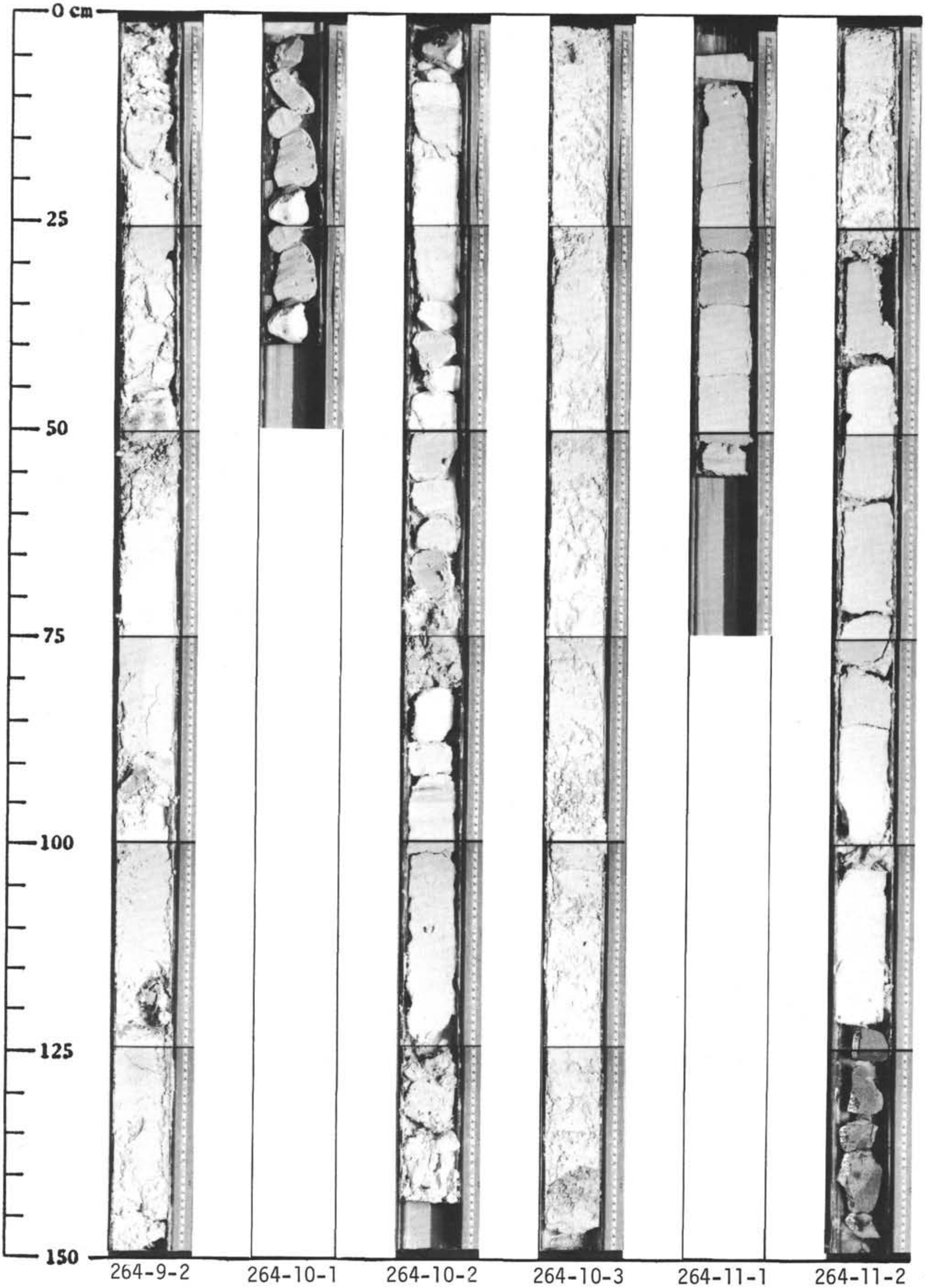
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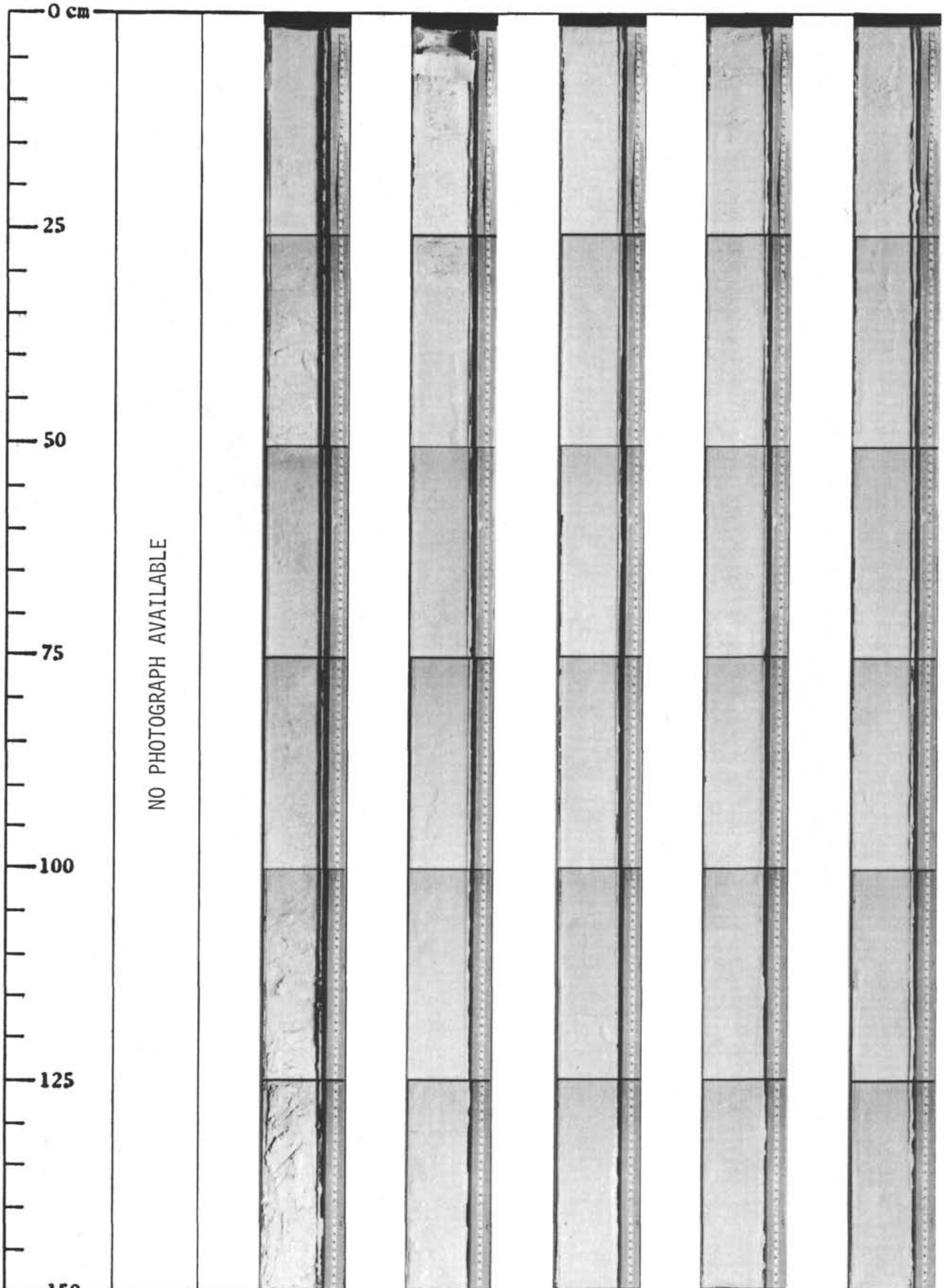

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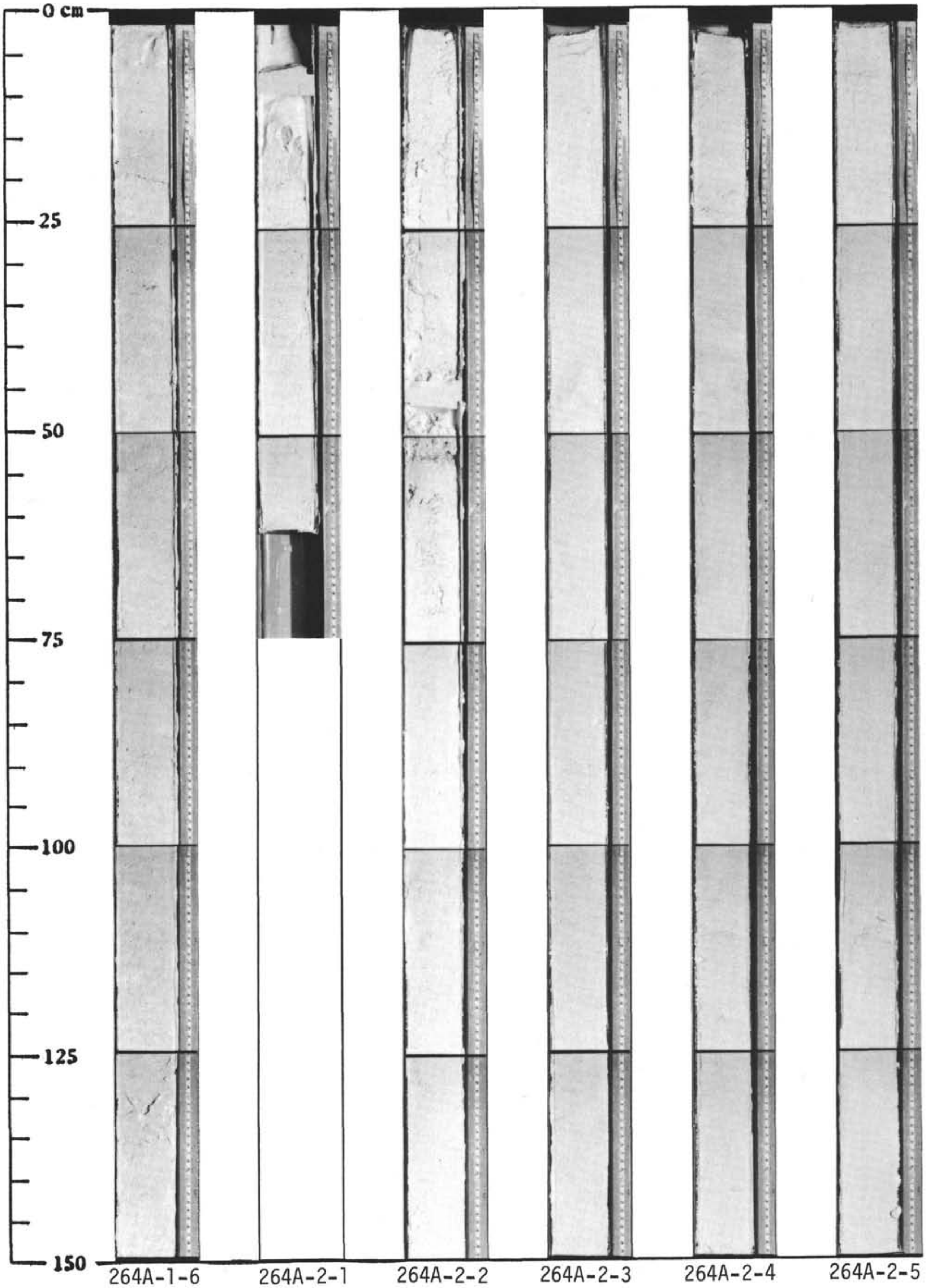
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264A-2-1
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264A-2-3
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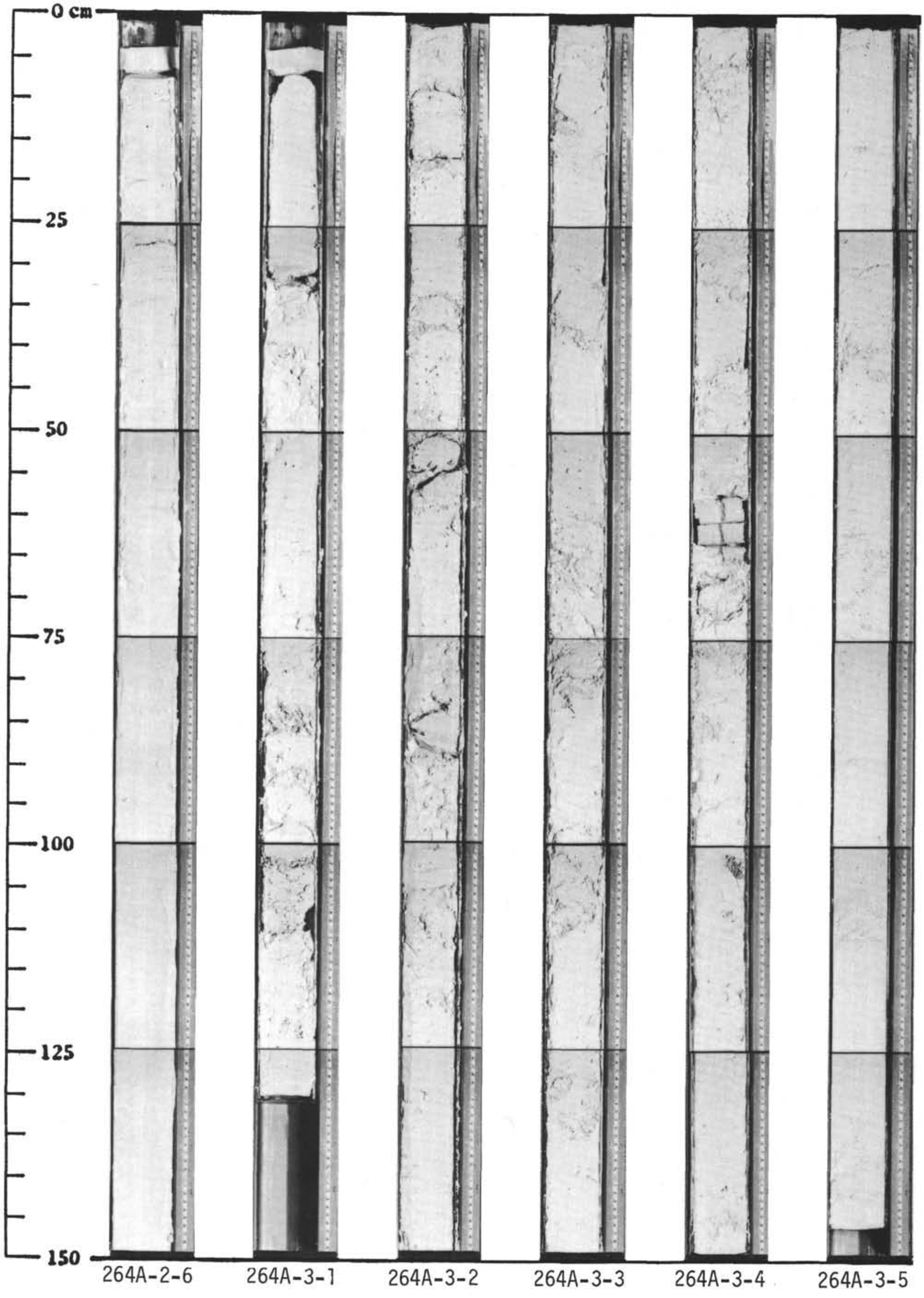
264A-2-5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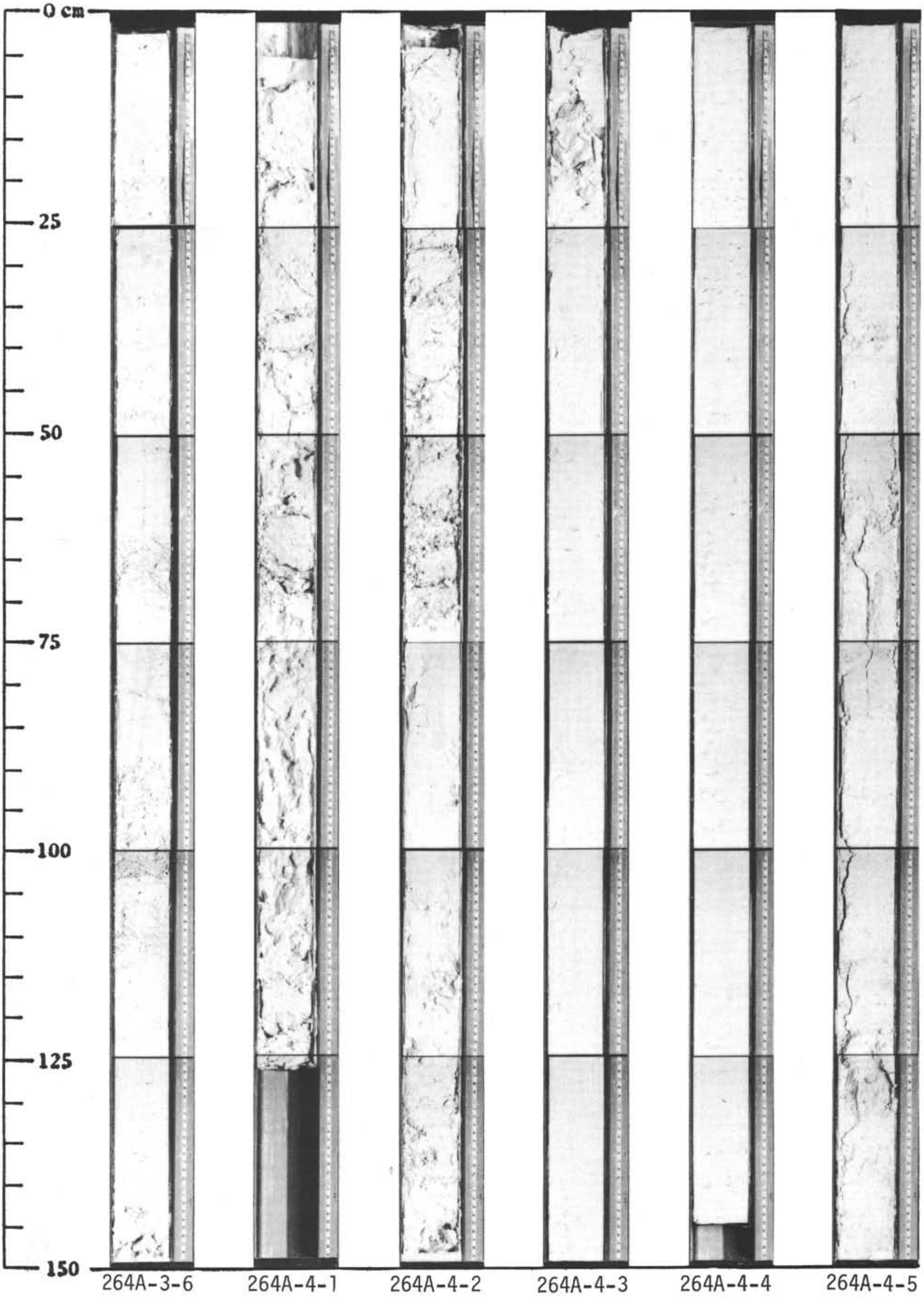
264A-3-3
264A-3-4
264A-3-5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264A-4-2
264A-4-3
264A-4-4
264A-4-5