7. SITE 289

The Shipboard Scientific Party[1]

SITE DATA

Date Occupied: 31 May 1973 (1630)

Date Departed: 8 June 1973 (1130)

Time on Site: 187 hours

Position:
Latitude: 00°29.92′S
Longitude: 158°30.69′E

Water Depth (from sea level): 2206 meters (echo sounding)

Bottom Felt At: 2224 meters (drill pipe)

Penetration: 1271 meters

Number of Holes: 1

Number of Cores: 133

Total Length of Cored Section: 1271 meters

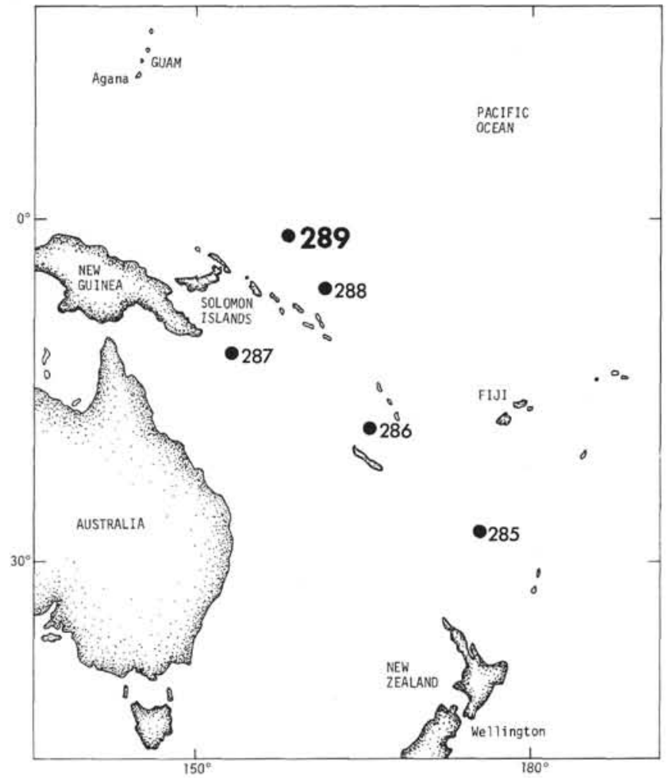
Total Core Recovered: 712.6 meters

Percentage of Core Recovery: 56%

Oldest Sediment Cored:
Depth below sea floor: 1262.5 meters
Nature: Limestone and altered ash
Age: Aptian

Basement:
Depth below sea floor: 1262.5 meters (drilled)
Nature: Basalt

Principal Results: Extrusive basalt, pre-early Aptian (1271-1262 m); Early Cretaceous (Aptian) to late Eocene Radiolaria-bearing limestone, siliceous limestone nanno-foram chalk, nodular chert, and tuff (1262-969 m); late Eocene to Pleistocene nanno-foram ooze and chalk (969-0 m). At Site 289 on the northern part of the Ontong-Java Plateau the Pleistocene to early Oligocene sequence is continuous and contains a diverse microflora and microfauna with good to excellent preservation. Very minor chert was detected in the early Miocene with the major appearance in middle Eocene accompanied by the loss of Radiolaria from the sediments. Less chert was observed at this site than at Site 288. Plateau elevation has been relatively constant above the foram solution depth, with the exception of a deeper interval in the Campanian as seen also at Site 288. At least six substantial stratigraphic breaks are present in the section. These occur between Rupelian (lower Oligocene) and Bartonian; Lutetian (middle Eocene) and Ypresian: Ypresian and Thanetian (upper Paleocene); Thanetian and Danian (lower Paleocene); lower Danian and Maestrichtian; and Aptian and Campanian. The Eocene/Oligocene break is similar to that reported in the Tasman and Coral seas.



BACKGROUND AND OBJECTIVES

The Ontong-Java Plateau has a very thick and, so far as was known, continuous sequence of biogenic sediments that extends back to at least the middle Eocene (Site 64) (Winterer, Riedel, et al., 1971). The principal objective was to core the section continuously to provide a standard section for the tropical biostratigraphy and to extend the sequence down below the chert as far as possible. In the vicinity of Site 289 (160 km north of Site 64) the basement reflector is about 0.1 sec below the chert reflector. In view of the result of drilling at Site 288, where the acoustic basement was

[1]James E. Andrews, University of Hawaii, Honolulu, Hawaii (Co-chief scientist); Gordon Packham, University of Sydney, N.S.W., Australia (Co-chief scientist); James V. Eade, New Zealand Oceanographic Institute, Wellington, New Zealand; Brian K. Holdsworth, The University of Keele, Staffordshire, England; David L. Jones, U.S. Geological Survey, Menlo Park, California; George deVries Klein, University of Illinois, Champaign-Urbana, Illinois; Loren W. Kroenke, University of Hawaii, Honolulu, Hawaii; Tsunemasa Saito, Lamont-Doherty Geological Observatory, Palisades, New York; Samir Shafik, University of Adelaide, Adelaide, South Australia; Douglas B. Stoeser, University of Oregon, Eugene, Oregon (now at Cambridge Astrophysical Observatory, Cambridge, Mass.); Gerrit J. van der Lingen, New Zealand Geological Survey, Christchurch, New Zealand.

found to be limestones and cherts at least Aptian in age at the base, it was important that the acoustic basement should be penetrated at Site 289.

Apart from the nature of the basement at Site 288 other data relevant to the determination of this basement are:

1) The acoustic basement on the plateau shows only little evidence of layering;

2) The magnetic anomalies are of low amplitude;

3) On the track to Site 288 from the Solomon Islands the anomalies appear to trend at 060°T.

This trend of the magnetic anomalies, if correct, differs slightly from the 80°T trend of the Mesozoic Phoenix anomalies (Larson and Chase, 1972) to the east, and the Ontong-Java anomaly amplitude is more subdued. The smaller amplitude might be due to the anomalies originating on the Ontong-Java Plateau in an equatorial region or the anomalies being damped by lava flows. Since the anomalies in the vicinity of Site 288 are also of low amplitude, there is no obvious reason why the acoustic basement should be different from that at Site 289. If the increasing age of the Phoenix anomalies to the north is correct and the same rate of spreading applies, the basement at Site 289 should be 15 m.y. older than at Site 288, i.e., greater than 121 m.y. (assuming no fracture zones intervene). The limestone sequence below the top of the acoustic basement should be about 60 meters thicker than at Site 288. The lack of seismic penetration of basement may be attributable to the strong return of energy from the chert horizon and the top of the acoustic basement.

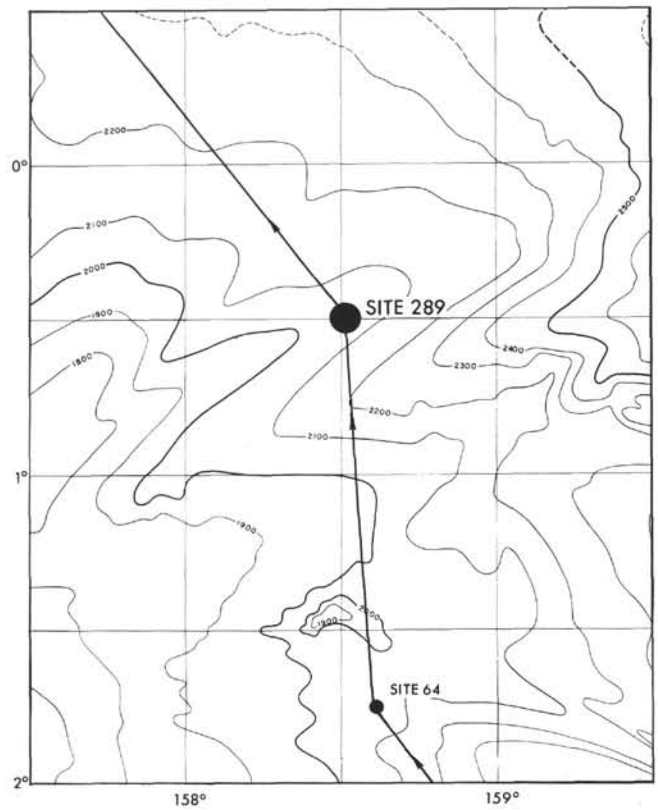


Figure 1. *Location of Site 289 (Leg 30) and Site 64 (Leg 7) on the Ontong-Java Plateau. Contour in hundreds of meters. (Bathymetric map form Kroenke, 1972.)*

OPERATIONS

The track from Site 288 to Site 289 was arranged to cross Site 64 and approach the proposed location on a course of 000° (Figure 1). This provided a degree of correlation between sites and a control for expected stratigraphy at Site 289. The approach profile is shown in Figure 2.

The beacon was dropped underway at 1632, 31 May 1973. Because of the extreme regularity of the plateau, this was accomplished without the usual initial crossing of the site. Because of excellent performance at Site 167 a four-cone sealed bearing bit with chisel teeth was chosen, and results were more than satisfactory. Between 0055, 1 June and 2345, 7 June a total of 133 cores were cut in a program of continuous cor ing to a depth of 1271 meters subbottom. Recovery averaged 56% for the entire section, decreasing downward from 100% in the upper section of the hole as intercalated more lithified zones were encountered. Recovery in hard limestones near the base of the hole was also poor due to the unusual style of bit failure. Normally, bearing failure occurs first and results in undersized cores. In this case the ends of the cones, which cut the core to size, were worn back before the bearings failed, with the result that cores were cut oversize and would jam in the throat of the core barrel. A final basalt section was found jammed in the throat of the bit on pulling the string.

Coring results are summarized in Table 1. It was interesting to note in experimenting with the extended inner barrel that the contact between two cored intervals was sampled (see Figure 3). The extended inner barrel achieved greater recovery, but the cores were highly fractured (apparently due to wandering at the base of the hole), and the volume of samples returned was small compared to standard cores and hindered sampling programs.

An on-site sonobuoy was shot (Figure 4: see also Correlation of Reflection Profiles with Drilling Results section). The site was departed at 1130, 8 June 1973.

LITHOLOGY

Site 289, on the Ontong-Java Plateau, was drilled in a water depth of 2224 meters and cored continuously to 1271 meters. One hundred thirty-three cores were obtained and a total of 712.6 meters of sediments and igneous rocks was recovered (708.6 m of sediment; 4.1 m of igneous rock).

The cored sequence is divided into three units. The sedimentary section ranges in age from Pleistocene to Lower Cretaceous (Aptian). The basal igneous unit consists of a single basalt flow predating the sedimentary succession (Figures 5 and 25). The composition of the sediments as determined from smear slides is given in Appendix A and plotted in Figure 6.

The units are (in descending order):

Unit 1 (0.969.0 m): Nanno-foram ooze, interbedded nanno-foram ooze and nanno-foram chalk. Pleistocene to late Eocene.

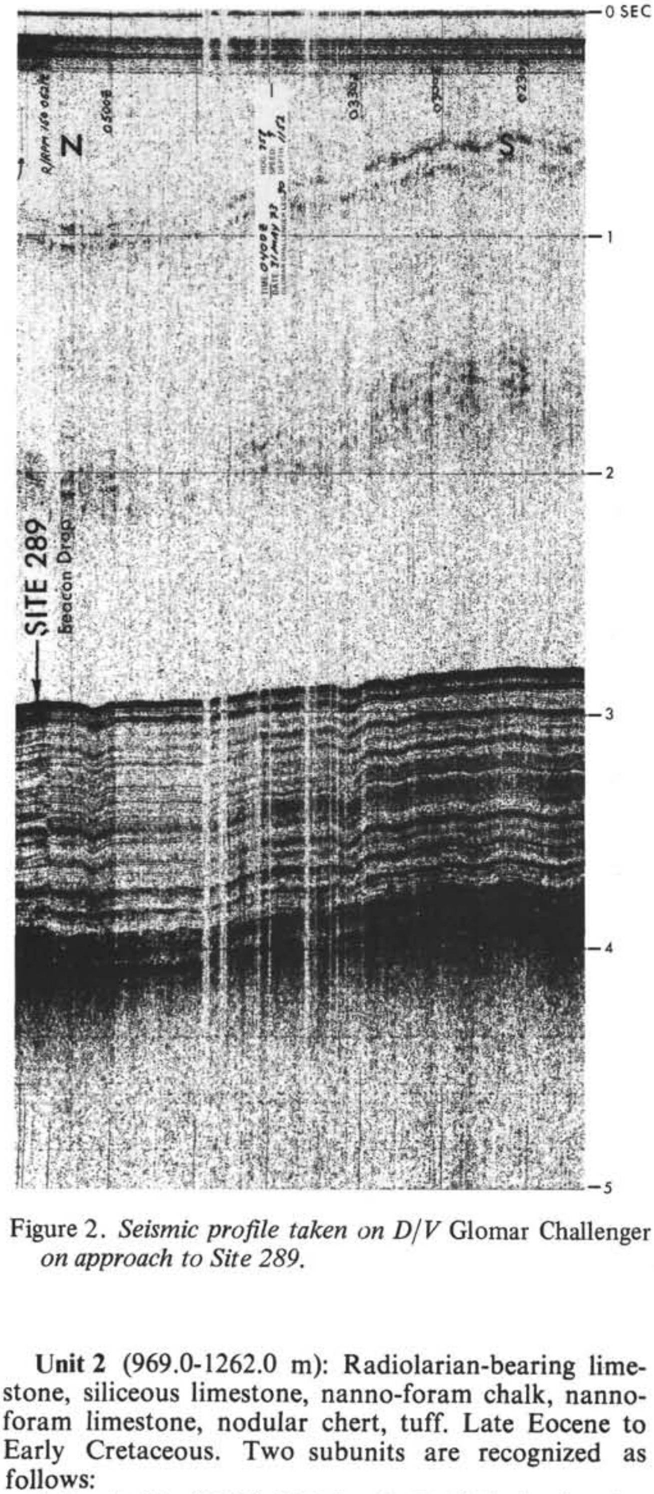


Figure 2. *Seismic profile taken on D/V* Glomar Challenger *on approach to Site 289.*

Unit 2 (969.0-1262.0 m): Radiolarian-bearing limestone, siliceous limestone, nanno-foram chalk, nanno-foram limestone, nodular chert, tuff. Late Eocene to Early Cretaceous. Two subunits are recognized as follows:

Subunit 2A (969.0-1231.0 m). Radiolarian-bearing limestone, siliceous limestone, nanno-foram chalk, nanno-foram limestone, nodular chert. Late Eocene to Late Cretaceous.

Subunit 2B (1231.0-1262.0 m). Limestone and tuff. Late Cretaceous to Early Cretaceous.

Unit 3 (1262.0-1271.0 m). Early Cretaceous, early Aptian.

Unit 1: Nanno-foram Ooze and Interbedded Nanno-foram Ooze and Nanno-foram Chalk

Unit 1, recovered from Cores 289-1 through 289-102, consists of a 969.0-meter thick succession of nanno-foram ooze and interbedded nanno-foram chalk. Highly disturbed soft ooze occurs from the core top to 250 meters below the mudline, whereas interbedded semilithified chalk and both disturbed, soft and undisturbed, stiff ooze occur from 350.0 to 969.0 meters below the mudline.

The ooze and chalk are characterized by the same colors and mineral and biogenic components. White is the dominant color and light gray is subordinate. Accessory colors include black (mostly as spots or in parallel laminae), greenish-white, greenish-gray, yellowish-gray, and medium gray. Trace quantities of pale purple are confined to parallel laminae in the upper part of the interbedded ooze and chalk sequence. Reexamination of core sections 52 days after departure from Site 289 disclosed the alteration of tints of greenish-gray, pale purple, and medium gray to white and yellowish-gray.

Foraminifera and nannofossils are dominant and together comprise up to 99% of the total components present. Accessory components include Radiolaria and micarb; trace quantities of feldspar, pyrite, volcanic glass, opaque minerals, heavy minerals, sponge spicules, and silicoflagellates occur (Appendix A). Texturally, the oozes are silty clays and clayey silts with the foraminifera and Radiolaria comprising the sand and silt sizes, whereas the nannofossils comprise the clay sizes (see Appendix B). Shipboard insoluble residue analysis (Figure 7) and shore-based calcium-carbonate determinations show Unit 1 carbonate sediments to contain in excess of 90% calcium carbonate with the exception of 289-55, CC, where only 87.5% $CaCO_3$ was recorded This lower $CaCO_3$ content at Sample 289-55, CC coincides with a higher Radiolaria content (Appendix A). The remainder of the insoluble residues consists of volcanic glass, a finding in agreement with X-ray determination of the amorphous content of the carbonates (Zemmels, this volume).

Accessory quantities of light to medium gray chert nodules of fine pebble size were observed in Cores 289-32, 289-33, and 289-102.

Hydrogen sulfide gas occurs in some of the ooze in Cores 289-7 through 289-28. It occurs mostly in ooze which contains swirled mixtures of white, black, yellowish-gray, and medium gray, but is absent from white chalk and white ooze. Black spots and both yellowish-gray and medium gray layers containing pyrite are associated with the H_2S-bearing sediment. Smear-slide petrography disclosed the association of both gas bubbles (possibly H_2S) and pyrite within chambers of foraminifera tests (Figure 8).

Sedimentary structures were observed in the lower and better indurated oozes and chalks. They include parallel laminae, color bands up to 3 cm thick, flaser bedding, lenticular bedding, and wavy bedding.

TABLE 1
Coring Summary, Site 289

Core	Date (June 1973)	Time	Depth From Drill Floor (m)	Depth Below Sea Floor (m)	Length Cored (m)	Length Recovered (m)	Recovery (%)
1	1	0055	2224.0-2233.5	0.0-9.5	9.5	9.0	100
2	1	0140	2233.5-2243.0	9.5-19.0	9.5	9.0	95
3	1	0220	2243.0-2252.5	19.0-28.5	9.5	9.5	100
4	1	0305	2252.5-2262.0	28.5-38.0	9.5	9.0	95
5	1	0345	2262.0-2271.5	38.0-47.5	9.5	9.0	95
6	1	0425	2271.5-2281.0	47.5-57.0	9.5	8.6	91
7	1	0510	2281.0-2290.5	57.0-66.5	9.5	9.0	95
8	1	0550	2290.5-2300.0	66.5-76.0	9.5	9.5	100
9	1	0635	2300.0-2309.5	76.0-85.5	9.5	9.4	99
10	1	0725	2309.5-2319.0	85.5-95.0	9.5	7.2	76
11	1	0815	2319.0-2328.5	95.0-104.5	9.5	7.2	76
12	1	0905	2328.5-2338.0	104.5-114.0	9.5	8.0	84
13	1	0950	2338.0-2347.5	114.0-123.5	9.5	5.0	53
14	1	1035	2347.5-2357.0	123.5-133.0	9.5	9.4	99
15	1	1125	2357.0-2366.5	133.0-142.5	9.5	5.7	60
16	1	1225	2336.5-2376.0	142.5-152.0	9.5	9.1	96
17	1	1315	2376.0-2385.5	152.0-161.5	9.5	8.9	94
18	1	1405	2385.5-2395.0	161.5-171.0	9.5	6.9	73
19	1	1455	2395.0-2404.5	171.0-180.5	9.5	5.6	58
20	1	1540	2404.5-2414.0	180.5-190.0	9.5	9.2	97
21	1	1635	2414.0-2423.5	190.0-199.5	9.5	2.9	31
22	1	1730	2423.5-2433.0	199.5-209.0	9.5	4.8	51
23	1	1825	2433.0-2442.5	209.0-218.5	9.5	9.0	95
24	1	1920	2442.5-2452.0	218.5-228.0	9.5	8.6	91
25	1	2020	2452.0-2461.5	228.0-237.5	9.5	6.9	72
26	1	2105	2461.5-2471.0	237.5-247.0	9.5	9.5	100
27	1	2155	2471.0-2480.5	247.0-256.5	9.5	8.7	92
28	1	2245	2480.5-2490.0	256.5-226.0	9.5	9.5	100
29	1	2340	2490.0-2499.5	266.0-275.5	9.5	4.6	48
30	2	0025	2499.5-2509.0	275.5-285.0	9.5	4.1	43
31	2	0115	2509.0-2518.5	285.0-294.5	9.5	8.6	91
32	2	0205	2518.5-2528.0	294.5-304.0	9.5	7.3	77
33	2	0255	2528.0-2537.5	304.0-313.5	9.5	9.2	97
34	2	0350	2537.5-2547.0	313.5-323.0	9.5	9.0	95
35	2	0445	2547.0-2556.5	323.0-332.5	9.5	5.2	55
36	2	0545	2556.5-2566.0	332.5-342.0	9.5	9.4	99
37	2	0635	2566.0-2575.5	342.0-351.5	9.5	9.5	100
38	2	0730	2575.5-2585.0	351.5-361.0	9.5	9.5	100
39	2	0820	2585.0-2594.5	361.0-370.5	9.5	9.5	100
40	2	0920	2594.5-2604.0	370.5-380.0	9.5	9.4	99
41	2	1005	2604.0-2613.5	380.0-389.5	9.5	2.8	29
42	2	1100	2613.5-2623.0	389.5-399.0	9.5	9.5	100
43	2	1205	2623.0-2632.5	399.0-408.5	9.5	9.5	100
44	2	1310	2632.5-2642.0	408.5-418.0	9.5	9.4	99
45	2	1410	2642.0-2651.5	418.0-427.5	9.5	9.4	99
46	2	1510	2651.5-2661.0	427.5-437.0	9.5	2.4	25
47	2	1605	2661.0-2670.5	437.0-446.5	9.5	8.9	94
48	2	1700	2670.5-2680.0	446.5-456.0	9.5	9.7	102
49	2	1755	2680.0-2689.5	456.0-465.5	9.5	9.5	100
50	2	1910	2689.5-2699.0	465.5-475.0	9.5	9.7	102
51	2	2020	2699.0-2708.5	475.0-484.5	9.5	8.7	92
52	2	2150	2708.5-2718.0	484.5-494.0	9.5	9.6	101
53	2	2255	2718.0-2727.5	494.0-503.5	9.5	4.9	52
54	3	0000	2727.5-2737.0	503.5-513.0	9.5	5.2	55
55	3	0105	2737.0-2746.5	513.0-522.5	9.5	9.5	100
56	3	0200	2746.5-2756.0	522.5-532.0	9.5	5.8	61
57	3	0325	2756.0-2765.5	532.0-541.5	9.5	9.1	96
58	3	0420	2765.5-2775.0	541.5-551.0	9.5	9.8	103
59	3	0505	2775.0-2784.5	551.0-560.5	9.5	2.8	29
60	3	0600	2784.5-2794.0	560.5-570.0	9.5	8.3	87
61	3	0655	2794.0-2803.5	570.0-579.5	9.5	9.6	101
62	3	0755	2803.5-2813.0	579.5-589.0	9.5	3.1	33
63	3	0840	2813.0-2822.5	589.0-598.5	9.5	2.9	31
64	3	0930	2822.5-2832.0	598.5-608.0	9.5	3.6	38
65	3	1020	2832.0-2841.5	608.0-617.5	9.5	4.1	43
66	3	1145	2841.5-2851.0	617.5-627.0	9.5	4.5	47

TABLE 1 – *Continued*

Core	Date (June 1973)	Time	Depth From Drill Floor (m)	Depth Below Sea Floor (m)	Length Cored (m)	Length Recovered (m)	Recovery (%)
67	3	1250	2851.0-2860.5	627.0-636.5	9.5	9.6	101
68	3	1350	2860.5-2870.0	636.5-646.0	9.5	7.9	83
69	3	1540	2870.0-2879.5	646.0-655.5	9.5	7.5	79
70	3	1640	2879.5-2889.0	655.5-665.0	9.5	9.6	101
71	3	1745	2889.0-2898.5	665.0-674.5	9.5	7.6	80
72	3	1900	2898.5-2908.0	674.5-684.0	9.5	8.4	88
73	3	2005	2908.0-2917.5	684.0-693.5	9.5	7.1	75
74	3	2110	2917.5-2927.0	693.5-703.0	9.5	9.5	100
75	3	2220	2927.0-2936.5	703.0-712.5	9.5	5.0	53
76	3	2345	2936.5-2946.0	712.5-722.0	9.5	6.3	66
77	4	0055	2946.0-2955.5	722.0-731.5	9.5	1.6	17
78	4	0200	2955.5-2965.0	731.5-741.0	9.5	4.3	45
79	4	0305	2965.0-2974.5	741.0-750.5	9.5	3.9	41
80	4	0410	2974.5-2984.0	750.5-760.0	9.5	4.8	51
81	4	0510	2984.0-2993.5	760.0-769.5	9.5	1.8	19
82	4	0620	2993.5-3003.0	769.5-779.0	9.5	4.6	48
83	4	0720	3003.0-3012.5	779.0-788.5	9.5	1.9	20
84	4	0815	3012.5-3022.0	788.5-798.0	9.5	2.2	23
85	4	0930	3022.0-3031.5	798.0-807.5	9.5	1.5	16
86	4	1035	3031.5-3041.0	807.5-817.0	9.5	7.7	81
87	4	1155	3041.0-3050.5	817.0-826.5	9.5	1.8	19
88	4	1310	3050.5-3060.0	826.5-836.0	9.5	3.3	35
89	4	1420	3060.0-3069.5	836.0-845.5	9.5	6.2	65
90	4	1530	3069.5-3079.0	845.5-855.0	9.5	3.7	39
91	4	1650	3079.0-3088.5	855.0-864.5	9.5	7.0	74
92	4	1800	3088.5-3098.0	864.5-874.0	9.5	1.2	13
93	4	1905	3098.0-3107.5	874.0-883.5	9.5	5.4	57
94	4	2015	3107.5-3117.0	883.5-893.0	9.5	4.8	51
95	4	2130	3117.0-3126.5	893.0-902.5	9.5	1.8	19
96	4	2255	3126.5-3136.0	902.5-912.0	9.5	0.6	6
97	5	0015	3136.0-3145.5	912.0-921.5	9.5	4.0	42
98	5	0130	3145.5-3155.0	921.5-931.0	9.5	3.6	38
99	5	0300	3155.0-3164.5	931.0-940.5	9.5	7.6	80
100	5	0425	3164.5-3174.0	940.5-950.0	9.5	1.6	17
101	5	0540	3174.0-3183.5	950.0-959.5	9.5	2.8	29
102	5	0705	3183.5-3193.0	959.5-969.0	9.5	0.9	9
103	5	0805	3193.0-3202.5	969.0-978.5	9.5	1.5	16
104	5	0910	3202.5-3212.0	978.5-988.0	9.5	0.1	1
105	5	1010	3212.0-3221.5	988.0-997.5	9.5	0.1	1
106	5	1130	3221.5-3231.0	997.5-1007.0	9.5	7.3	77
107	5	1330	3231.0-3240.5	1007.0-1016.5	9.5	2.2	23
108	5	1450	3240.5-3250.0	1016.5-1026.0	9.5	1.4	15
109	5	1600	3250.0-3259.5	1026.0-1035.5	9.5	0.4	4
110	5	1730	3259.5-3269.0	1035.5-1045.0	9.5	0.6	6
111	5	1930	3269.0-3278.5	1045.0-1054.5	9.5	4.0	42
112	5	2145	3278.5-3288.0	1054.5-1064.0	9.5	0.2	2
113	6	0025	3288.0-3297.5	1064.0-1073.5	9.5	0.5	5
114	6	0305	3297.5-3307.0	1073.5-1083.0	9.5	0.3	3
115	6	0600	3307.0-3316.5	1083.0-1092.5	9.5	1.3	14
116	6	0800	3316.5-3326.0	1092.5-1102.0	9.5	0.4	4
117	6	1000	3326.0-3335.5	1102.0-1111.5	9.5	0.1	1
118	6	1140	3335.5-3345.0	1111.5-1121.0	9.5	1.0	11
119	6	1400	3345.0-3354.5	1121.0-1130.5	9.5	0.3	3
120	6	1625	3354.5-3360.0	1130.5-1136.0	5.5	1.1	20
121	6	2110	3360.0-3369.5	1136.0-1145.5	9.5	2.4	25
122	6	2345	3369.5-3379.0	1145.5-1155.0	9.5	2.0	21
123	7	0115	3379.0-3388.5	1155.0-1164.5	9.5	1.2	13
124	7	0235	3388.5-3398.0	1164.5-1174.0	9.5	1.8	19
125	7	0400	3398.0-3407.5	1174.0-1183.5	9.5	0.6	6
126	7	0525	3407.5-3417.0	1183.5-1193.0	9.5	0.2	2
127	7	0700	3417.0-3426.5	1193.0-1202.5	9.5	0.2	2
128	7	0825	3426.5-3436.0	1202.5-1212.0	9.5	0.5	5
129	7	1010	3436.0-3445.5	1212.0-1221.5	9.5	0.4	6
130	7	1130	3445.5-3455.0	1221.5-1231.0	9.5	<0.1	1
131	7	1555	3455.0-3483.5	1231.0-1259.5	28.5	4.5	16
132	7	1925	3483.5-3493.0	1259.5-1269.0	9.5	4.7	49
133	7	2315	3493.0-3495.0	1269.0-1271.0	2.0	0.4	20
Total					1271.0	712.6	56

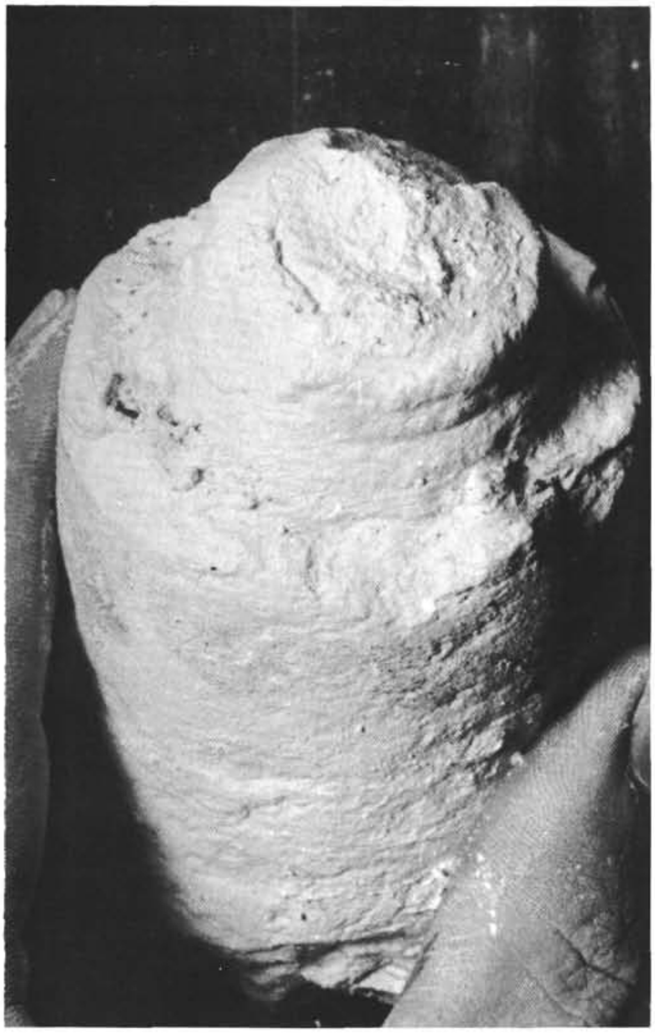


Figure 3. *Junction between Cores 289-91 and 92 from top of Core 289-92. The upper core was taken using an extended innerbarrel and the lower one as taken using a conventional core barrel.*

Biogenic structures include small horizontal and vertical burrows, including *Zoophycos* (Cores 289-63 to 65).

Foraminifera in Unit 1 are extremely well preserved (see Paleontology) and show no evidence of either solution or reworking by bottom currents. The environment of deposition of Unit 1 is oceanic, middle bathyal, and above the foram solution depth. Biogenic productivity was high during deposition of Unit 1.

Bottom current velocities were sufficiently high to generate current ripples (preserved only as wavy beds). However, flaser drapes over the ripples indicate these currents to be characterized by an alternation of bedload and suspension deposition. Tidal currents are characterized by such an alternation. Oceanic bottom currents with both a tidal velocity and directional fluctuation have been observed in water depths of 2000 to 2500 meters by Lonsdale et al., (1972a, b). Perhaps similar current systems operated at Site 289 during deposition of Unit 1 to produce flaser, lenticular, and wavy bedding. Alternatively, periodic storm activity

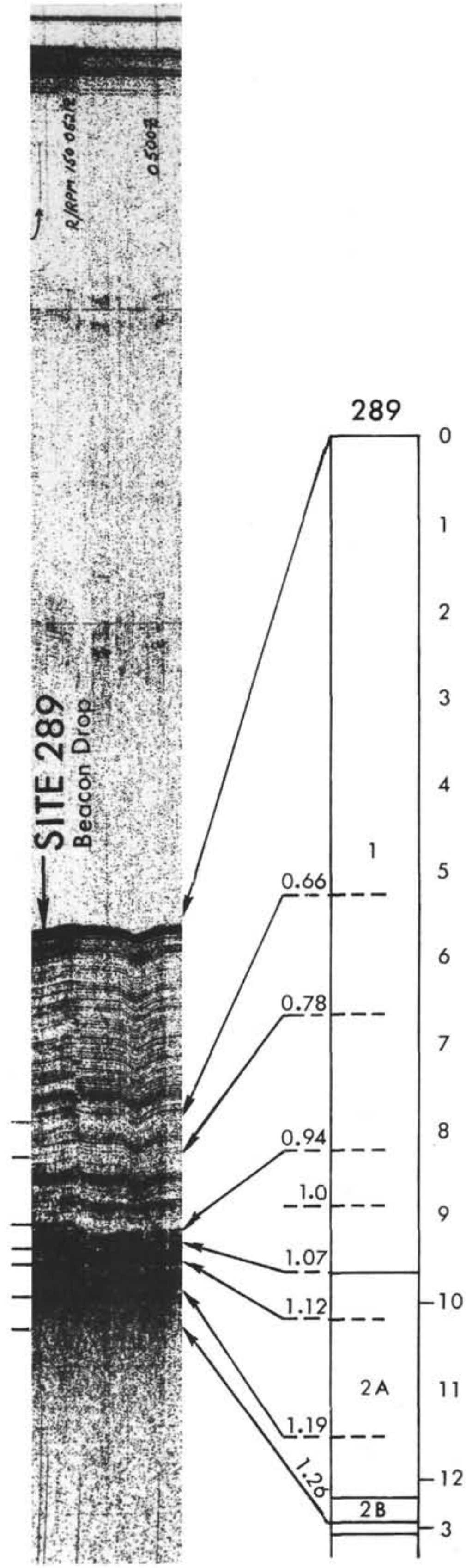


Figure 4. *Part of seismic profile shown in Figure 1 with column showing correlation of reflectors with lithologic units.*

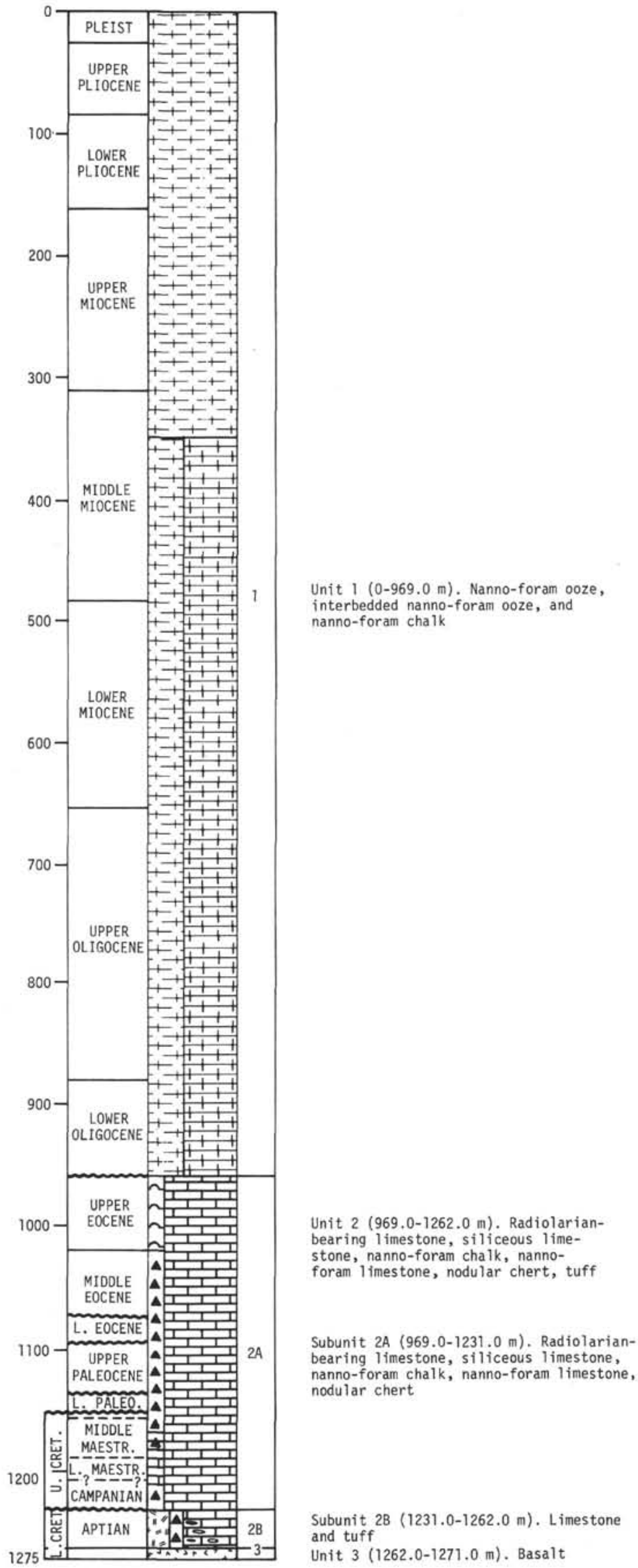


Figure 5. *Stratigraphic column, Site 289.*

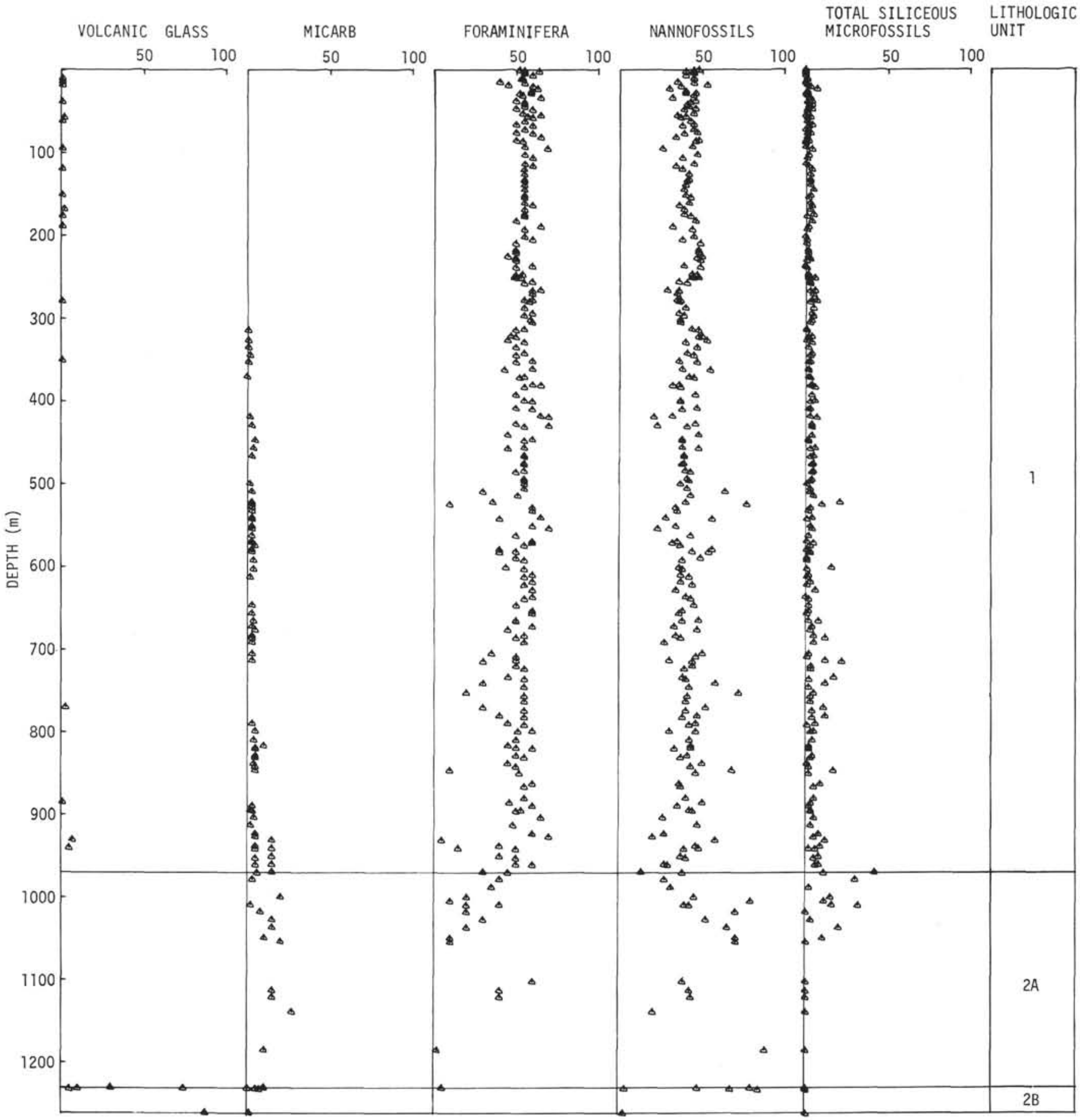


Figure 6. *Sediment composition as determined in smear slides, Site 289.*

may produce such flaser beds (McCave, 1970) although proof of effective bed shear by storms at depths of 2000 to 2500 meters is lacking.

Although an Eocene-Oligocene hiatus is recognized between Cores 289-101 and 102, no lithologic change was observed on either side of the biostratigraphic discontinuity.

Unit 2: Chalk, Ooze, Limestone, Radiolarian-bearing Limestone, Chert Nodules, Tuff

Unit 2, recovered from Cores 289-103 through 289-132, consists of a 293.0-meter thick succession of soft, disturbed nanno ooze, and semilithified nanno chalk, and nanno-foram limestones, nanno limestones, radiolarian-bearing limestones, siliceous limestones, nodular cherts, and tuff. Unit 2 is separated from Unit 1 by the appearance of radiolarian-bearing limestone in Core 289-103; these grade downward into siliceous limestones interbedded with nodular cherts. Unit 2 is divided further into two subunits according to the presence of tuff layers and volcanic glass and zeolites within the limestones.

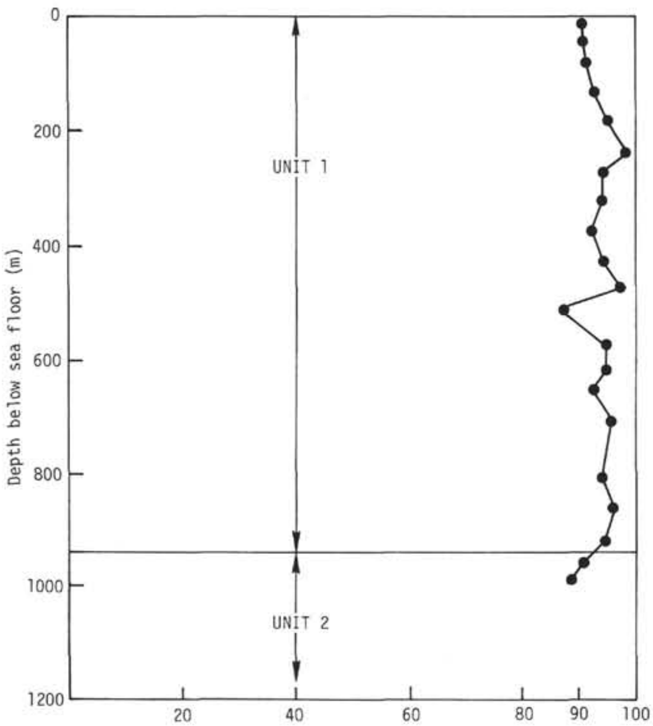


Figure 7. *Percent calcium carbonate determined from shipboard insoluble residue analysis, Site 289.*

Subunit 2A

Subunit 2A, recovered from Cores 289-103 through 289-130, consists of 262 meters of interbedded nanno-foram ooze, nanno-foram chalk, nanno-foram limestones, radiolarian-rich and radiolarian-bearing limestones, and nodular chert. The carbonate rocks are white, very light gray, light gray, and medium gray. Olive-gray, black, and greenish-gray components occur in accessory quantities, usually as parallel, flaser, or wavy beds. The principal components are foraminifera, nannofossils (Figure 9) and Radiolaria (these only from 969.0 to 1025.5 m). Accessory components include micarb and sponge spicules; trace quantities of pyrite, volcanic glass and feldspar occur (Appendix A). Shipboard insoluble residue determinations (Figure 7) show Subunit 2A carbonate rocks to contain about 85% calcium carbonate, a figure in agreement with the radiolarian content (Appendix A). A radiolarian-rich horizon at Sample 289-110, 1-134 contains only 51% calcium carbonate.

Sedimentary structures in Subunit 2A include parallel laminae, flaser bedding, wavy bedding, and lenticular bedding. These laminae and bedding types differ from those in lighter colored limestones by dark olive-gray, black and greenish-gray laminae. Most of the darker laminae contain predominant zeolite and altered volcanic ash. X-ray analysis (Zemmels, this volume) indicates these dark layers to contain significant quantities of sepiolite and palygorskite and pyrite, accessory quantities of mica, montmorillonite, and chlorite, and trace quantities of potassium-feldspar and quartz. The flaser bedding is continuous and bifurcated in contrast to similar-appearing features in bioturbated zones in these

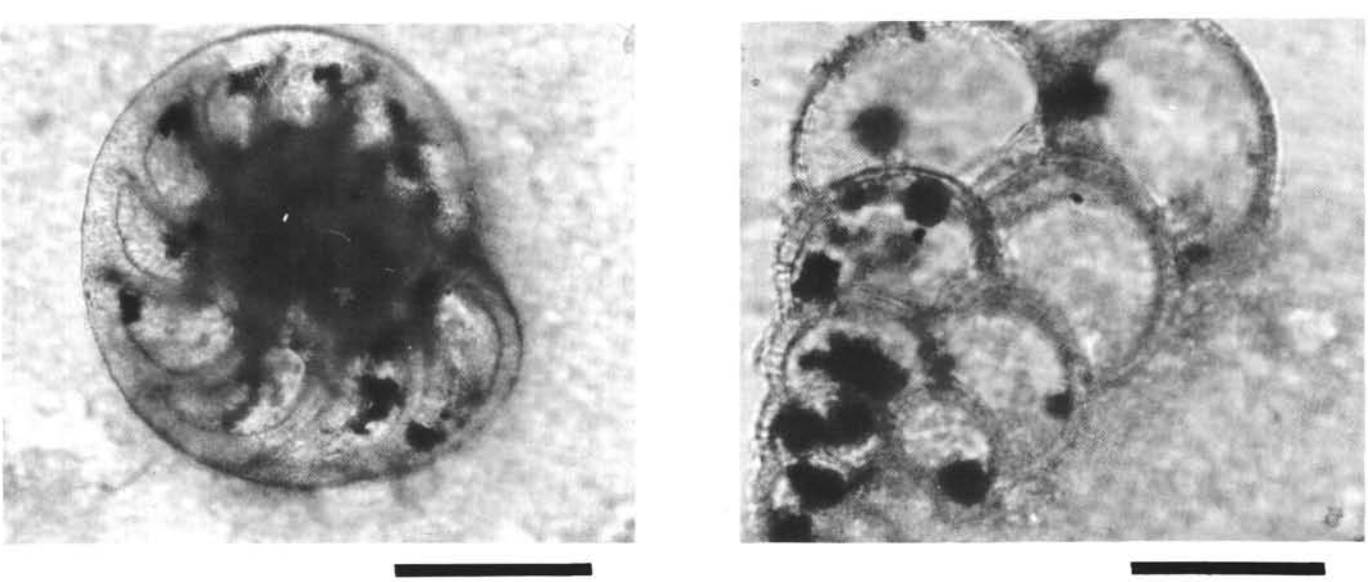


Figure 8. *(a) Photomicrograph of smear slide 289-25-5, 88 cm showing pyrite partially filling chambers of foraminifera test. Nanno-foram ooze, Unit 1, Site 289. Scale bar is 0.25 mm long. (b) Photomicrograph, same smear slide showing pyrite partially filling chambers of foraminiferal test with a geopel fabric. Nanno-foram ooze, Unit 1, Site 289. Scale bar is 0.25 mm long.*

cores, which are disrupted and lack bifurcation. The continuous flaser beds drape lenticular zones; such flaser drapes are absent in bioturbated horizontal burrow zones cross-sections of which may be mistaken for lenticular bedding.

Stylolites are common to Subunit 2A, particularly in the lower half. These stylolites are developed along ash layers and appear to be associated with dissolved foraminifera (see Paleontology section).

Bioturbation is extremely common to this unit and consists mostly of horizontal traces and vertical burrows, ranging in diameter from 2 mm to 1 cm.

Chert nodules of varying size characterize Subunit 2A. They are medium light gray, medium gray, medium grayish-blue, medium dark gray, light gray, and red. These nodules interfinger with enclosing limestone beds and complex patterns of intergrowths were observed. Some intervals resemble "graphic" intergrowths of quartz and feldspar common to pegmatitic granites (Figure 10). Chert also occurs commonly as a secondary pore-fill in tests of foraminifera (Figures 11, 12, 13). X-ray analysis (Zemmels, this volume) shows the chert to contain cristobalite in one sample (289-111-1, 128). The chert is clearly of replacement origin; an origin and replacement sequence as reported by Heath (1973), Heath and Moberly (1971), and Greenwood (1973) is duplicated at Site 289.

Faunal components in Subunit 2A include foraminifera, nannofossils, and Radiolaria. The foraminifera are recrystallized (see Paleontology section) in Cores 289-108 through 289-127; foraminifera in Cores 289-128 through 289-130 show evidence of solution.

Hiatuses are found (see Paleontology section) at the base of Cores 289-113, 289-115, 289-120-1, and 289-122-1. Lithologic changes occur only at the base of Core 289-115. Above that hiatus, white and gray siliceous limestones with flaser and lenticular bedding and bioturbation are interbedded with grayish-blue, gray, and

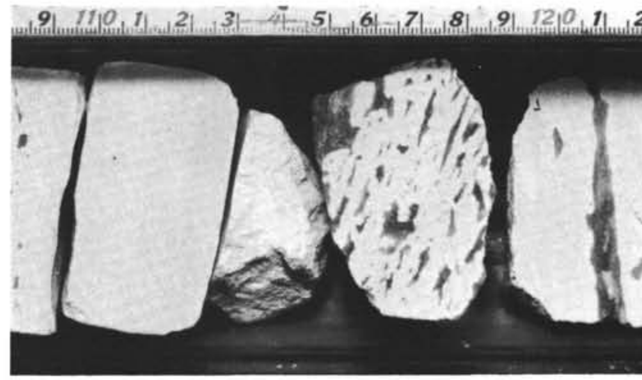


Figure 10. *Graphic replacement intergrowth of chert in limestone, 289-115-1, Unit 2A, Site 289.*

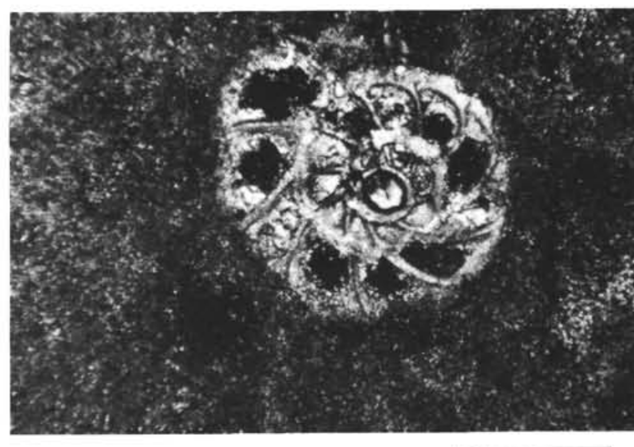


Figure 11. *Chert pore-filling in foraminifera test set in micritic matrix of nanno-fossils in nanno-foram limestone. 289-108-1, 51 cm, Unit 2A, Site 289. Crossed nicols; scale bar is 0.25 mm long.*

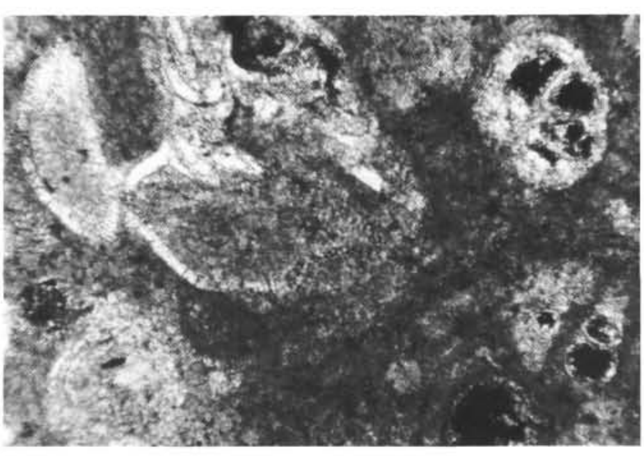


Figure 9. *Photomicrograph of nanno-foram limestone (sand and silt size) and "micritic" matrix of nannofossils, Unit 2A, Site 289. Polarized light; scale bar is 0.25 mm long.*

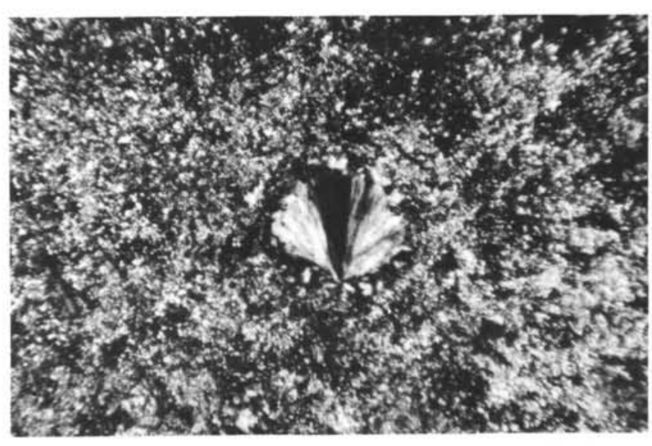


Figure 12. *Chalcedonic pore-filling of foraminifera test in microcrystalline chert nodule, 289-1-8-1, 94 cm, Unit 2A, Site 289. Crossed nicols, scale bar is 0.25 mm long.*

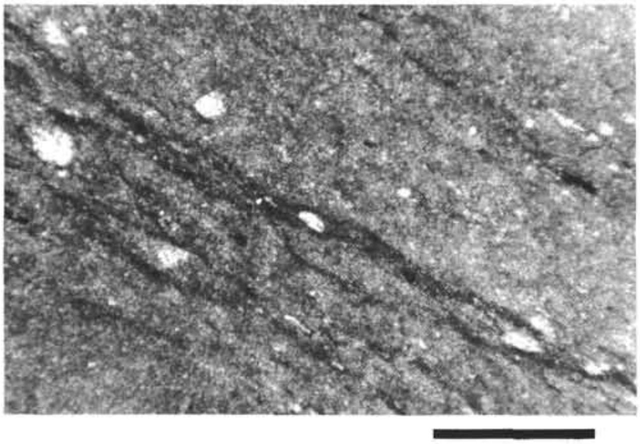


Figure 13. *Chalcedonic and chert pore-filling of foraminiferal tests in nanno-foram limestone. Bimodal size distribution of sand-sized and silt-sized foraminiferal tests set in "micritic matrix" of nannofossils. 289-110-1, 134 cm. Unit 2A, Site 289. Crossed nicols; scale bar is 0.25 mm long.*

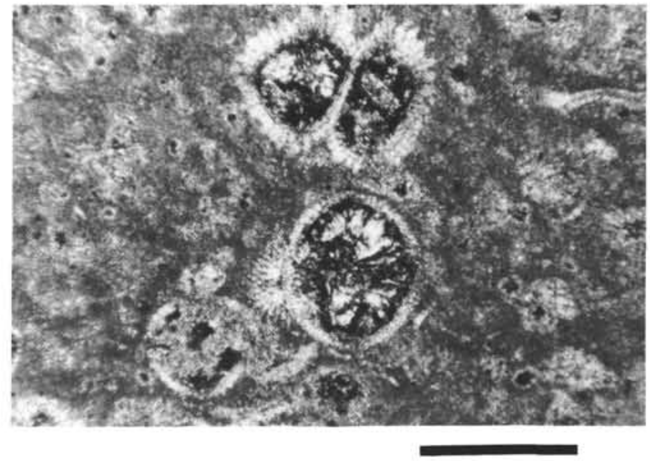


Figure 14. *Nanno limestone containing fragments of potassium feldspar and zeolitic clay laminae organized as flaser bedding and clay drapes (darker laminae). 289-131-107, Unit 2B, Site 289. Crossed nicols, scale bar is 0.25 mm long.*

olive-gray chert, whereas below that hiatus bioturbated white limestones with light gray cherts occur. No lithologic change was observed on either side of the other paraconformities in Subunit 2A.

Most of Subunit 2A was deposited in middle bathyal depths. Deposition occurred in a zone of high biological productivity above the foram solution depth. However, in the basal part of the unit deposition fluctuated above and below the foram solution depth, but above the nanno solution depth in Cores 289-128 through 289-131. Periodically, volcanic ash laminae were deposited by bottom currents. Bottom current conditions appear similar to those prevailing during deposition of Unit 1.

Subunit 2B

This unit, recovered from Cores 289-131 and 289-132, consists of 31 meters of ash-bearing and ash-rich limestones interbedded with nodular chert and vitric tuff. The limestones are white, pinkish-gray, orange brown, light olive-gray, and medium gray. Deeper colors are associated with an increase in volcaniclastic components (Appendix A). The limestone becomes yellowish-brown at the base where it is in contact with the basal vitric tuff bed.

The major components in these limestones are nannofossils, fresh and altered volcanic glass, micarb and zeolite. Accessory components include sponge spicules, heavy minerals, and feldspar; trace amounts of pyrite and opaque minerals occur.

These limestones exhibit flaser and lenticular bedding (Figure 14), intense mottling, and bioturbation (Figure 15).

Chert nodules of replacement origin are brownish-black, and dark reddish-brown. They contain limestone blebs, and also interfinger with the enclosing limestone.

Vitric tuffs occur as thin laminae as flaser beds in limestones, and also as two distinct beds in Sections 289-131-1 and 289-131-2. These tuffs are grayish-brown, with associated blebs of reddish-brown. A third thin tuff consisting of chloritic altered glass is medium green and occurs approximately 5 cm above the base of Subunit 2B. Bioturbation is extremely common in the uppermost tuff layer (Figure 15). The major mineral components are fresh, chloritic and iron-rich glass, zeolites feldspar, attapulgite, palygorskite, opaque minerals, and heavy minerals. Traces of micarb and nannofossils occur. X-ray diffraction (Zemmels, this volume) disclosed the occurrence of significant amounts of palygorskite and quartz, with accessory potassium feldspar and mica in Sample 289-131-1, 106. A separate X-ray analysis of Sample 289-131-1, 107 completed at the clay mineralogy laboratory of the Illinois Geological Survey indicates that attapulgite is also a major constituent in the vitric tuffs. The other ash layers contain significant quantities of potassium feldspar, and montmorillonite (Zemmels, this volume). Palygorskite and montmorillonite dominate the less than two micron grain-size fraction in all ashes and tuffs (Zemmels, this volume).

Foraminifera in Cores 289-131 and 289-132 occur in accessory quantities and are well preserved.

A major hiatus is reported in Core 131-1 (Figure 15) within the uppermost vitric tuff bed (see Paleontology section).

Subunit 2B was deposited under bathyal conditions about the foram solution depth. Carbonate deposition was interrupted periodically by small amounts of altered volcanic ash transported by bottom currents and by volcanic eruptions which blanketed the site with thicker ash beds, now preserved as vitric tuff. These ash beds may represent the terminal phase of basaltic volcanism represented by Unit 3. Bottom currents, with a superimposed tidal component, or periodic storms, reworked most of the sediment, accounting for the wavy bedding and flaser bedding, as in Unit 1.

Unit 3: Basalt

Fresh basalt was encountered at 1262.0 meters below the mudline, and of the 9.2 meters of basalt cored, 4.1

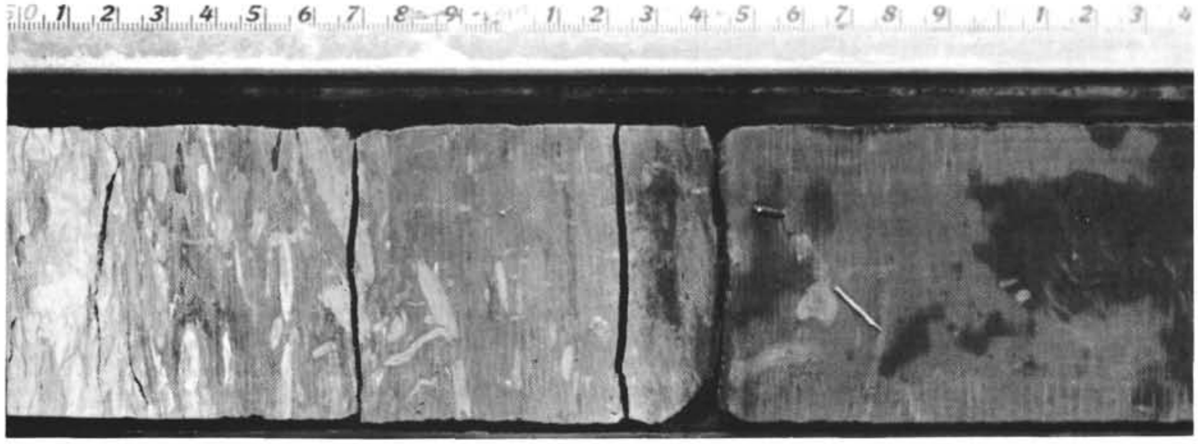


Figure 15. *Bioturbated nanno limestone in contact with uppermost vitric tuff (also bioturbated). Contact falls at 63 cm. Uppermost tuff contains 30 m.y. hiatus between Albian to mid-Campanian. 289-131-1, Unit 2B, Site 289.*

meters were recovered. The basalt core is in two segments, an upper 3.7 meters and a lower 0.4 meters which are separated by an empty zone of 3.5 meters (Figure 16). The lower basalt appears to be identical with the upper one. The basalt is immediately overlain by a sequence of intercalated limestones and vitric tuffs. The contact with the overlying sediments was not recovered, but the material immediately above the top piece of basalt is a grayish-brown tuff which contains well-preserved nannofossils.

The basalt has a chill zone 10 cm thick. The chill zone changes downwards from a well-developed variolitic texture at the top to an intergranular texture at the bottom. The lava of the top few centimeters was quenched before only a small proportion of the plagioclase was able to crystallize. The chill zone shows small altered phenocrysts of approximately 2% plagioclase and less than 1% olivine. The plagioclase has been replaced by calcite and an unidentified negative, low birefringent mineral with a 2V of approximately 20°. The olivine phenocrysts are replaced by iddingsite and chlorite. The groundmass consists of hollow plagioclase, variolitic quench pyroxene, dendritic quench magnetite, and glass which is extensively chloritized.

The basalt unit consists of alternating coarser intergranular and finer variolitic zones. The intergranular zones show an average grain size of less than 0.3 mm and are composed of acicular plagioclase largely without the hollow habit, and pyroxenes which generally occur as sheaf-like bundles. The intergranular basalt contains approximately equal amounts of plagioclase and pyroxene, approximately 5% magnetite, and a few percent chlorite. The finer variolitic zones show well-developed hollow acicular plagioclase, fine variolitic pyroxene, small dispersed euhedral magnetite, and interstitial brown glass.

Small plagioclase phenocrysts (An70 ±5), usually less than 1 mm, are present throughout the basalt in amounts less than 2%. Altered olivine phenocrysts, less than 1-1/2 mm, are unevenly dispersed throughout and

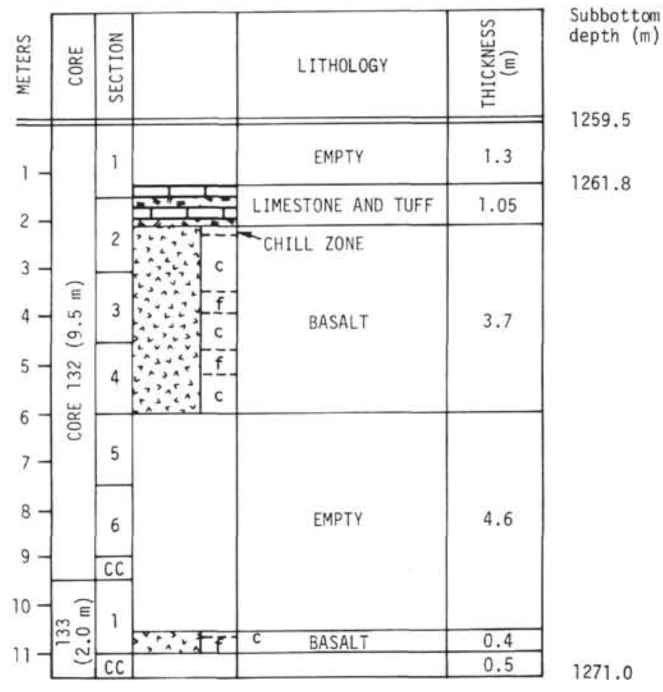


Figure 16. *Summary of lithologic relations in Cores 289-132 and 133. In the basalt column "C" indicates the coarser basalt with an intergranular texture and "f" indicates the finer variolitic basalt.*

constitute less than 1% of the unit. Vesicles, less than 2 mm in diameter are sporadically present throughout the basalt, but never exceed about 1% of the rock. Indistinct to distinct thin horizontal flow laminae are present in many parts of the basalt, but appear to be better developed in the intergranular zones.

Veins up to 1-1/2 cm are abundant, particularly in the basalt of Sections 2 and 3 in Core 132. The vein materials consist of various proportions of chlorite, calcite, rare pyrite, and a yellowish-brown material which is probably siliceous (opaline or jasperoid). Two irregular cavities associated with calcite-chlorite veins contained quartz and calcite crystals.

The basalt probably represents a single flow based on the lack of baking of the overlying sediment and tuff, the textures, and the flow structures which occur throughout the unit. Sufficient petrographic data are not available to adequately classify the basalt, in particular because the pyroxene is too fine grained to allow detection of pigeonite. However, chemical data indicate that the composition is similar to mid-ocean ridge tholeiites (see Stoeser, this volume).

Sequence of Events, Northern Part, Ontong-Java Plateau

Volcanic Phase

Tholeiitic plateau basaltic lava flow was extruded at Site 289 prior to or during Aptian time.

Early Cretaceous

Deposition of volcanic ash and biogenic sediment began during late Aptian time. Following basalt extrusion, deposition of vitric tuff occurred, followed by biogenic sedimentation above the foram solution depth. Biogenic sedimentation continued with minor quantities of volcanic sediment being supplied to the site. A second phase of tuff deposition occurred, followed by a period of nondeposition or erosion. This period ranged from Albian to middle Campanian time.

Late Cretaceous-Paleocene

Biogenic sedimentation resumed during Campanian time below the foram solution depth. Deepening of the foram solution depth or shallowing of the site permitted continued biogenic sedimentation to occur during the Maestrichtian above the foram solution depth. During latest Maestrichtian and earliest Paleocene time a second period of nondeposition or erosion occurred followed by another episode of biogenic sedimentation above the foram solution depth during the late Paleocene. Chert diagenesis postdates the Late CretaceousPaleocene biogenic sedimentation. A third period of nondeposition or erosion occurred during latest Danian and Thanetian time (of the Paleocene) followed by a resumption of carbonate sedimentation for a short interval. This sedimentation was followed by a fourth period of nondeposition and erosion during the latest Paleocene which lasted into the early Eocene.

Eocene

A short period of continued biogenic sedimentation above the foram solution depth occurred during the early Eocene followed by a fifth period of nondeposition or erosion. Biogenic sedimentation above the foram solution depth occurred continuously during the middle and late Eocene. A minor period of higher productivity of Radiolaria occurred during the entire Eocene. Chert diagenesis postdates Eocene sedimentation. A sixth period of nondeposition or erosion occurred at the end of Eocene time and lasted into the earliest Oligocene.

Oligocene-Quaternary

From the beginning of the early Oligocene until the Quaternary, continuous biogenic sedimentation of foraminifera and nannofossils above the foram solution depth has occurred in the northern part of the Ontong-Java Plateau.

GEOCHEMICAL MEASUREMENTS

Table 2 and Figure 17 present *p*H, alkalinity, and salinity data for Site 289. The sequence was sampled every 50 meters down to 1000 meters, that is down to the late Eocene. Recovery below that level was poor and only one sample was taken from the Late Cretaceous (1167.5 m). The *p*H remains almost constant at very close to 7 throughout the entire sample interval. The salinity however, remains at normal seawater salinity to 300 meters subbottom depth, then starts to rise slowly as the sediment becomes more lithified. A major excursion to 40.2‰ was recorded in late Eocene rad and micarb-rich foram-nanno chalk. The alkalinity trend is a more complex one, it increases from the sea floor downward to a depth of 300 meters, then decreases progressively with depth as the salinity increases. The sharp increase in salinity at 1000 meters is not marked by a corresponding excursion in the alkalinity value.

PHYSICAL PROPERTIES

Sample cubes were taken routinely from each section of Cores 289-1 through 289-27 for determination of physical properties. Because of the continuous coring of Site 289 and the excessive time needed to obtain and process cubes for velocity measurements and syringe samples or chips for porosity-density determinations, alternate or even-numbered sections were sampled from Core 289-27 through Core 289-132. Both horizontal and vertical) velocity of the sediment cubes were measured and both density and porosity were determined, as in earlier sites, either from a syringe sample proximal to the cube or, in the more indurated sediment, from a sediment chip adjacent to the cube. The results are presented in Figure 18 with acoustic impedance, sonic velocity, wet-bulk density, and grain density shown versus subbottom depth. Bulk density ranges between 1.5 and 2.6 g/cc, and porosity ranges between 75% and almost 5% at Site 289. Bulk density increases and porosity decreases with depth rather uniformly and with only minor fluctuation down to about 1000 meters subbottom. Changes in these physical properties in this interval probably reflect the degree of induration and diagenetic changes within the column. The most severe changes and largest fluctuations in bulk density and porosity occur below 1000 meters and perhaps correlate with the first appearance of a significant amount of quartz and cristobalite in the limestone matrix. Grain density which averages about 2.7 g/cc down to a depth of about 900 meters decreases to a minimum at 1037 meters subbottom perhaps due to decrease in permeability similar to that described and discussed for Site 288. Below 1037 meters the grain density returns to that observed in the upper part of the column (approximately 2.7 g/cc).

Velocities measured in the shipboard laboratory, on samples selected purposely to avoid drilling disturbances, remained below 1.7 km/sec to a depth of over 400 meters subbottom. Only minor fluctuations were observed within this interval, with excursions in velocity invariably less than 0.1 km/sec. In view of the velocity

TABLE 2
Summary of Shipboard Geochemical Measurements, Site 289

Sample (Interval in cm)	Depth Below Sea Floor (m)	Lab Temp (°C)	pH Punch-in/ Flow-through	Alka-linity (meq/kg)	Salinity (°/oo)
Surface seawater			8.37/8.35	2.34	35.2
1-5, 144-150	7.44-7.50	22.0	7.33/7.33	3.22	35.2
5-5, 144-150	45.44-45.50	21.8	7.17/7.18	4.39	35.2
10-4, 144-150	91.44-91.50	21.8	7.10/7.15	4.78	35.2
15-3, 144-150	137.44-137.50	21.8	7.04/7.07	5.07	35.2
20-5, 144-150	188.44-188.50	22.1	7.02/6.96	5.17	35.2
25-3, 144-150	232.44-232.50	22.0	7.07/6.99	5.17	35.2
30-3, 0-6	278.50-278.56	22.2	6.98/6.94	5.27	35.2
35-3, 144-150	327.44-327.50	22.2	7.03/7.01	4.68	35.5
40-5, 144-150	378.44-378.50	22.5	– /7.03	4.29	35.5
45-3, 144-150	422.94-423.00	21.9	6.95/6.96	4.98	35.8
50-5, 144-150	473.44-473.50	21.5	6.91/6.92	4.78	35.8
55-5, 144-150	520.94-521.00	21.8	6.91/6.93	4.59	36.0
60-5, 144-150	567.94-568.00	22.0	6.94/7.02	3.80	36.0
65-2, 144-150	610.94-611.00	22.0	– /7.16	2.73	36.3
70-5, 144-150	633.44-633.50	22.0	6.88/6.95	3.71	36.3
75-3, 144-150	707.44-707.50	21.6	6.92/7.02	3.12	36.3
80-3, 144-150	754.94-755.00	21.6	7.11/7.10	2.93	36.3
86-5, 144-150	814.94-815.00	21.7	7.11/7.28	2.34	36.3
91-3, 144-150	859.44-859.50	21.8	– /7.36	1.85	36.4
99-4, 144-150[a]	936.94-937.00	21.8	– /7.42	1.46	36.3
99-4, 144-150[b]	936.94-937.00	21.8	– /7.56	1.37	36.6
106-4, 144-150	1003.44-1003.50	22.4	– /7.35	1.46	40.2
124-2, 144-150	1167.44-1167.50	22.4	– /7.04	1.68	36.6

[a]Soft sediment.
[b]Hard sediment.

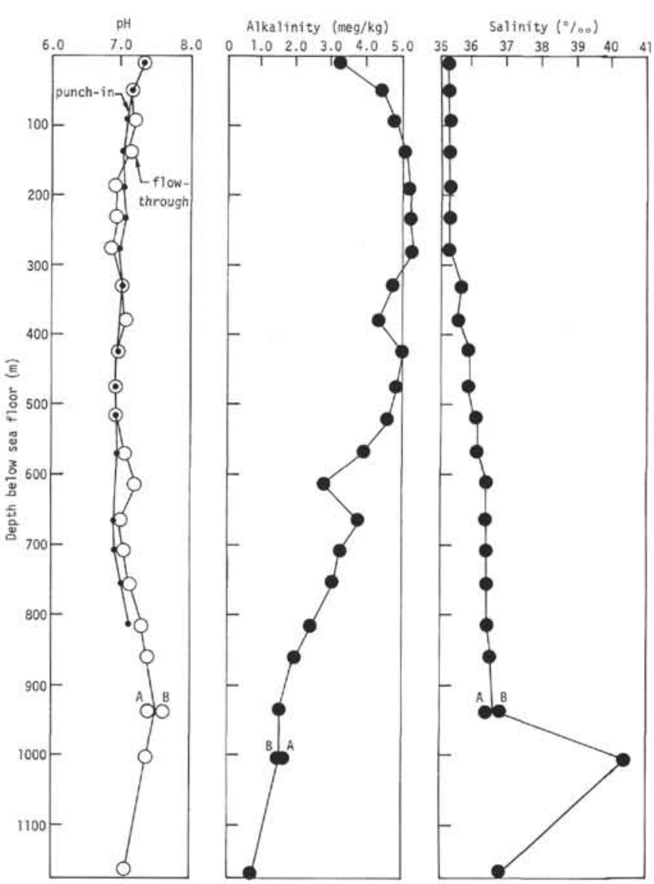


Figure 17. *Graphic summary of geochemical data taken at Site 289.*

gradients seen at earlier sites, previous experience in extrapolating drilling depths from reflection profiles, and earlier velocity determinations from sonobuoy and wide-angle reflection-refraction profiling nearby, the low velocity gradients encountered in the upper 400 meters of Site 289 were surprising, if not unexpected. These were confirmed, however, through later analysis of sonobuoy wide-angle reflection profile taken during drilling of Site 289.

In the interval, 400 to 550 meters subbottom, average velocity increases from about 1.7 km/sec to about 1.9 km/sec. Within this interval, velocity fluctuation increases markedly with excursions exceeding 0.1 km/sec. Below 550 meters, excursions of more than 0.3 km/sec commonly occur and the curve is more oscillatory (Figure 18). In general the velocity continues to increase, reaching an average of approximately 2.3 km/sec immediately above the chert sequence at about 1015 meters subbottom (Core 289-108). The maximum velocity measured in the siliceous limestones above the basalt at Site 289 is over 4.5 km/sec at about 1143 meters subbottom (Core 289-121-2).

Vertical versus horizontal velocity anisotropy develops for short intervals in the sedimentary column above 600 meters only to repeatedly disappear and reappear. Below 600 meters it becomes pronounced and increases with depth in the hole. The anisotropy seems to be established more abruptly and at a much greater depth in the column at Site 289 than that observed at earlier sites.

Sonic velocity of basalt was also measured at Site 289. Basalt samples were taken wherever possible from regions of Core 132, which were devoid of cracks and vugs. As was done at previous sites, the basalt was again measured in two mutually perpendicular transverse directions (across the diameter of the core). The average of each pair of measurements is shown plotted in Figure 19. Velocity ranged from 4.75 km/sec to 5.85 km/sec with changes in velocity correlating with variations in texture. Near the top of the basalt, the first sample measured (Core 132-2) is low (4.75 km/sec). The remainder of the core measured below this point ranges about 5.5 km/sec in the seven samples from Core 132, Sections 3 and 4.

This tight grouping of velocity values shown in Figure 19 is in excellent agreement with sonobuoy results reported by Hussong (1972) across the Ontong-Java Plateau and further supports the contention that the basalt cored at Site 289 originated as a single flow.

CORRELATION OF SEISMIC REFLECTION PROFILE WITH DRILLING RESULTS

Site 289 is on the broad surface of the plateau, and reflector depth varies only slightly in the vicinity of the site. The velocity depth curve in Figure 18 was visually smoothed and average vertical interval velocities selected between what appeared to be significant changes in acoustic impedance. These data were then correlated with reflections observed in the profile across the site (Figures 2 and 4). The results are shown in Table 3 and Figure 4. Table 3 shows a qualitative measure of reflectivity and correlatability based on intensity and continuity of the recorded signal on the profile.

The reflector at 1.07 sec correlates with the top of Unit 2, the first appearance of cherts in the section. The 1.26-sec reflector correlates with the top of the basalt at 1249.8 meters, although this reflector cannot be traced with confidence for any distance along the profile. Note that it is difficult to trace these reflectors to Site 288, but as seen in the stratigraphy, Unit 2 is much thicker at Site 288 and the reflector depth to its top is 0.5 sec versus 1.07 sec at Site 289. The thickening of the section occurs entirely on the plateau margin, increasing with depth from the slope break.

PALEONTOLOGY

The primary objective, to obtain a geologic record of planktonic microfossil sedimentation at an equatorial latitude as complete as possible, was successfully met by coring continuously most of the sedimentary sequence present at Site 289 in a single hole. The lower part of the sedimentary sequence at this site was unfortunately punctuated by several substantial stratigraphic hiatuses.

The 132 sedimentary cores recovered represent a sequence that includes a continuous sedimentary column from Pleistocene to lower Oligocene and a broken column from Upper Eocene to Aptian (Lower Cretaceous).

The Pleistocene to Oligocene cores generally contain a diverse microflora and microfauna with excellent to good state of preservation. The downhole change from a primarily biogenous ooze sequence to a largely limestone sequence bearing strings of chert is accompanied by a reduction in the microfossil contents and deterioration of fossil preservation. This trend continues from Eocene to Cretaceous except near the base of the sequence, where surprisingly well-preserved and diverse Aptian calcareous nannofossils and planktonic foraminifera are encountered. In particular, following the appearance of chert in Core 108 (middle Eocene), Radiolaria rapidly disappear from the sequence and the forms remaining are largely recrystallized.

A combination of biostratigraphic criteria utilizing planktonic foraminifera, calcareous nannofossils, and Radiolaria is used to establish the stratigraphic framework of the recovered sequence (Figure 20). The result for the foraminifera is summarized in Figure 21 by adopting the time-stratigraphic framework of Berggren (1972) for the Cenozoic and of Casey (1964) for the Cretaceous. Because of the consistent occurrence of all three microfossil groups in the upper Eocene through Pleistocene sediments, a high-resolution biostratigraphic control can be achieved for the interval in the future. This report is, however, largely based on the results of examining core-catcher samples. Below the upper Eocene, a combined effect of dissolution of Radiolaria throughout the lower sequence, dissolution of foraminifera in the Campanian and lower Maestrichtian sections, and poor preservation of calcareous nannofossils in the Maestrichtian and some horizons within the Aptian permits utilization of only one or two microfossil groups and will allow a less precise control than that expected for the upper Eocene-Pleistocene sequence. Wherever established, age determinations based on the three microfossil groups are in close agreement except for the positioning of the Pleistocene/Pliocene boundary. This boundary, based on calcareous nannofossils, falls between Cores 289-4 and -5 judged by the last appearance of discoasters in Core 5 and the incoming of *Gephyrocapsa* in Core 4. The foraminiferal boundary occurs between Cores 3 and 4, being the level of the first evolutionary incoming of *G. truncatulinoides* associated with a major left-to-right coiling change in the genus *Pulleniatina*, criteria observed at the Pliocene/Pleistocene boundary of paleomagnetically dated cores from the eastern Equatorial Pacific (Hays et al., 1969).

At least five substantial stratigraphic breaks are detected in the Paleogene sequence at this site, all the Paleogene stage boundaries but one (between Bartonian [upper Eocene] and Lutetian [middle Eocene]) being separated by discontinuities. These breaks occur between: Rupelian (lower Oligocene) and Bartonian; Lutetian and Ypresian (lower Eocene); Ypresian and Thanetian (upper Paleocene); Thanetian and Danian (lower Paleocene); and the lower Danian and middle Maestrichtian (Upper Cretaceous). One additional discontinuity separating the Aptian (Lower Cretaceous) from the Campanian (Upper Cretaceous) is assumed, although the nature and extent of this stratigraphic hiatus is difficult to ascertain due to an extended interval of continuous drilling and coring of 28.5 meters, but with retrieval of core in a single barrel. This 28.5-meter interval, however, seems too short to accommodate all the intervening Cretaceous stages between the Campanian and Aptian, most of which have been encountered at the previous nearby Site 288 as a thick sequence of

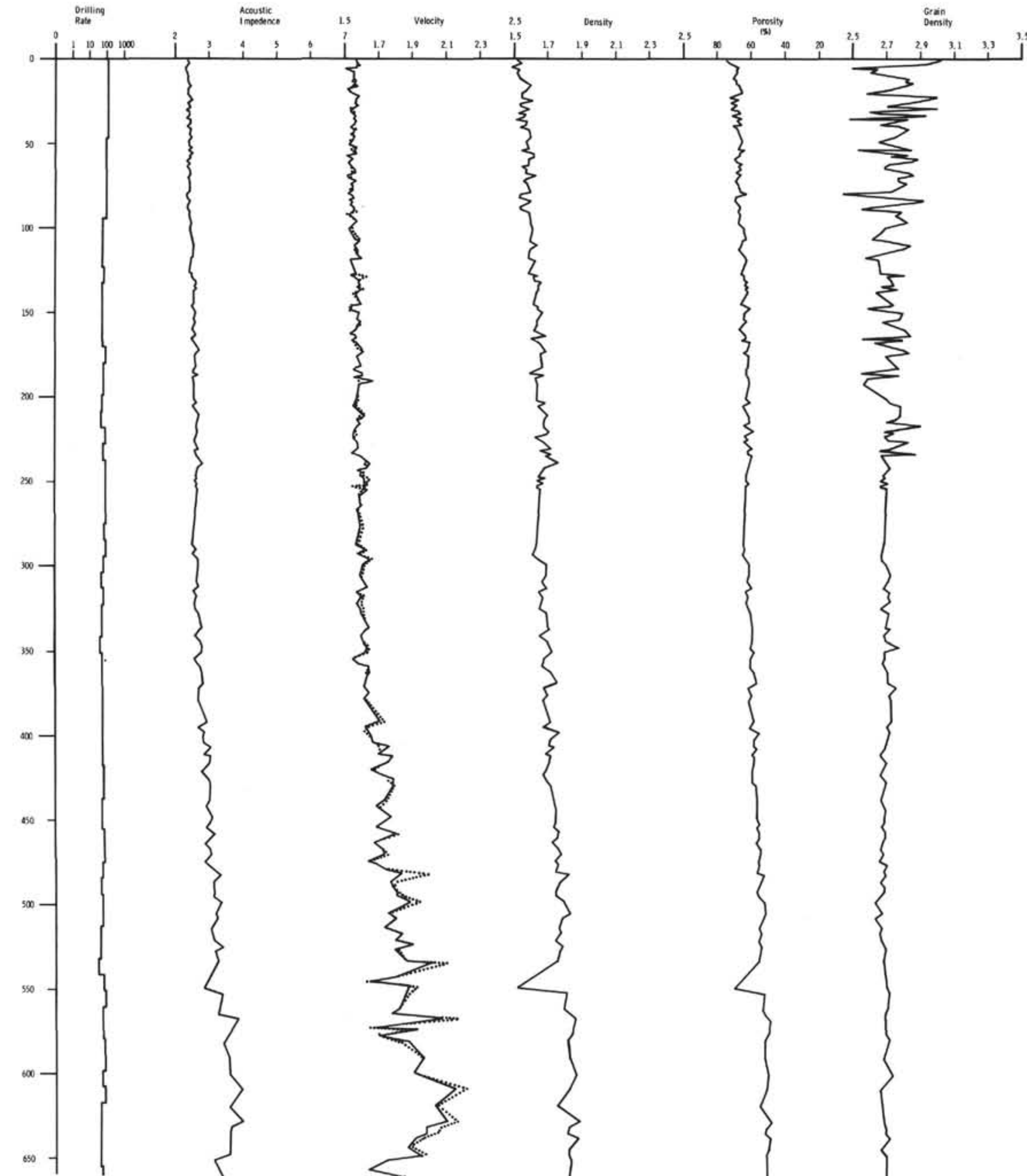


Figure 18. *Graphic summary of shipboard physical property measurements. Horizontal acoustic velocity is shown as a dotted line; vertical velocity as a solid line.*

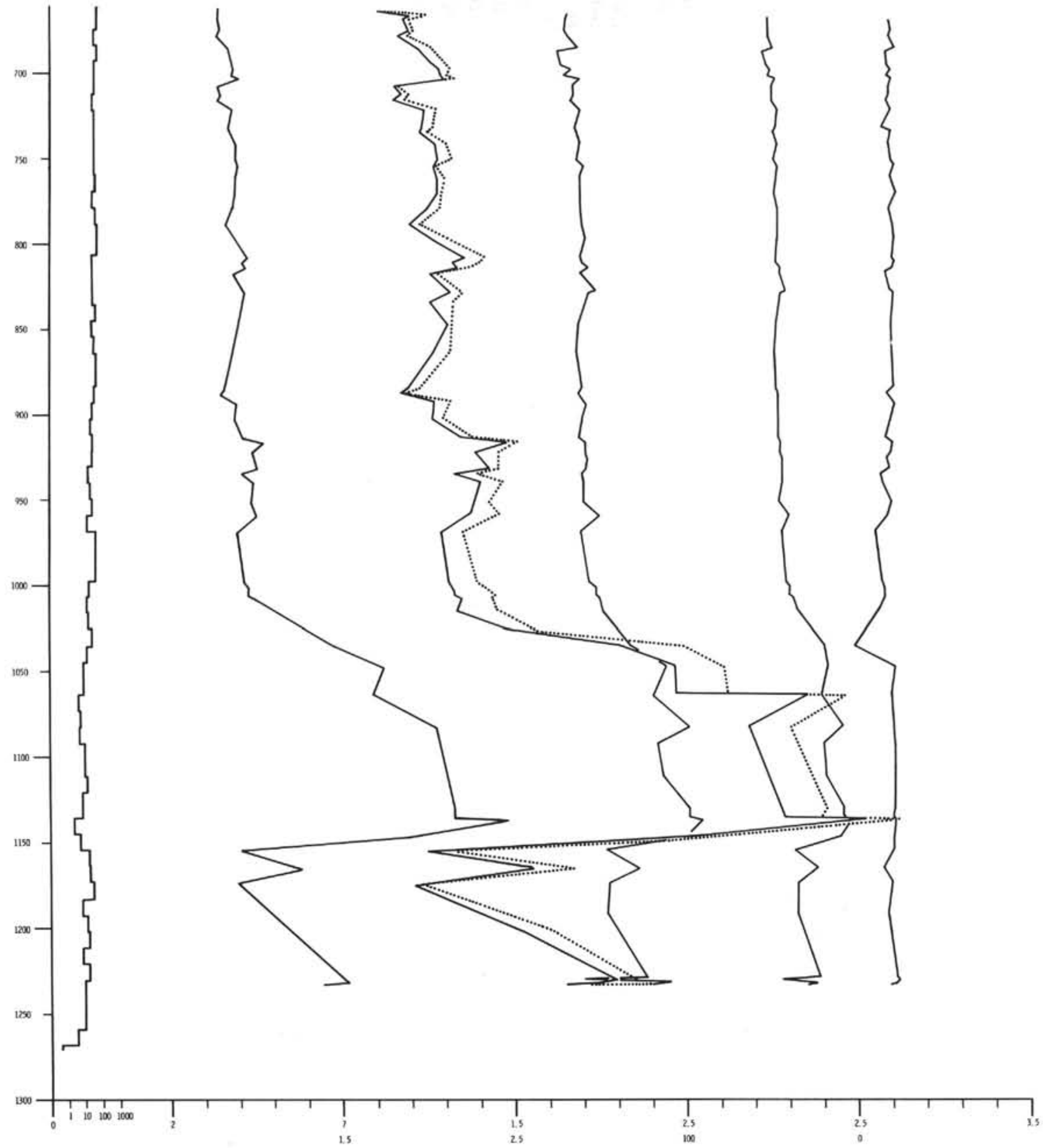


Figure 18. *(Continued).*

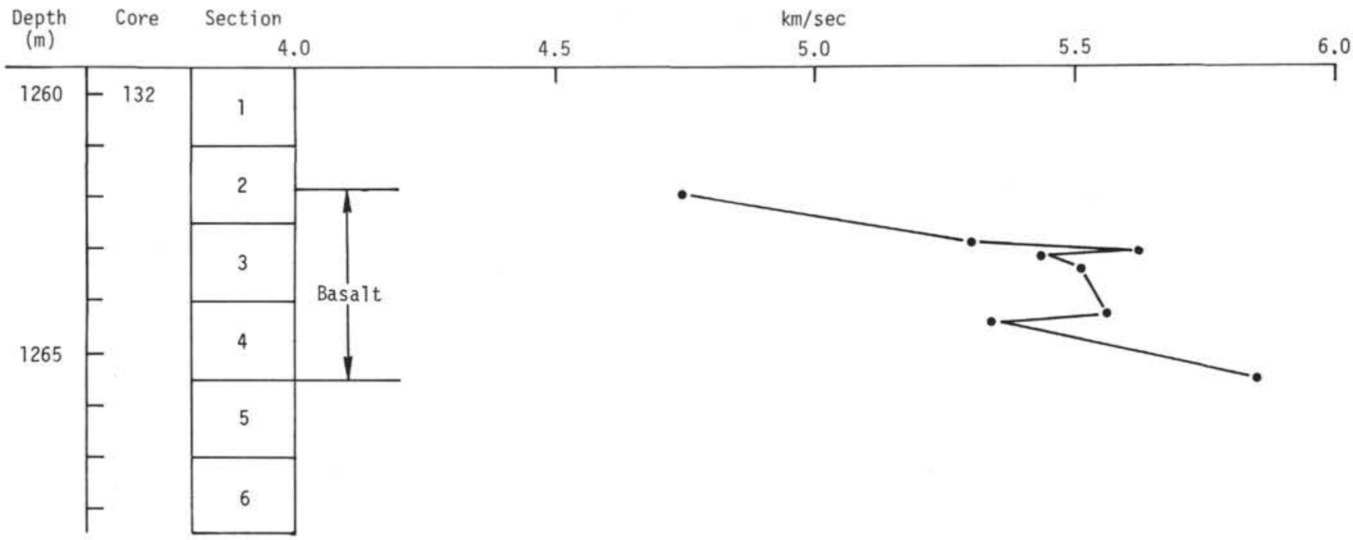


Figure 19. *Acoustic velocities measured in Unit 3 (basalt) at Site 289.*

TABLE 3
Correlation of Seismic Reflectors, Site 289

Reflector Intensity	Correlatability	Δt (sec)	(m/sec)	z (m)
s	c	0.0	1550	0.0
vw	bc	0.18	1580	139.5
m	bc	0.48	1750	376.5
m	c	0.66	1950	534.0
m	c	0.78	1970	670.5
s	bc	0.84	2050	729.6
s	c	0.94	1970	832.1
s	c	1.00	2200	891.0
m	c	1.07	2150	968.6
m	c	1.12	4000	1022.4
w	c	1.19	2500	1162.4
w	bc	1.26	Basalt	1249.8

Note: s = strong; m = moderate; w = weak; vw = very weak; c = correlatable; bc = barely correlatable.

limestone with chert. In addition, the Radiolaria sequence suggests a marked condensation of the radiolarian faunal sequence in the upper Eocene.

It is interesting to note that disconformities occurring underneath the Rupelian (lower Oligocene) and Thanetian (upper Paleocene) at this site were also encountered in similar stratigraphic positions at the previous site, 288, located at the northeastern edge of the Ontong-Java Plateau. Thus, it is probable that some of the stratigraphic hiatuses encountered at this site are of considerable magnitude extending over vast distances in the western Equatorial Pacific region. A widespread unconformity centered in the lower Oligocene, with upper Oligocene sediments overlying upper Eocene, has been reported by Kennett et al. (1972) in the neighboring region of the Tasman Sea-Coral Sea areas. The timing of this unconformity is surprisingly similar to that of the lower Oligocene/upper Eocene discontinuity encountered over the Ontong-Java Plateau at Sites 288 and 289.

In spite of the tropical location of Site 289 and the excellent preservation of foraminifera, several diagnostic species of the planktonic foraminiferal zones widely in use today are conspicuously missing or occur only in greatly reduced numbers in the Oligocene-Recent sequence. Conspicuously absent are all the species belonging to the genus *Praeorbulina* (important group for delineating boundaries in the mid-Miocene sequence) and those species occurring in unusual scarcity are *Globigerina nepenthes* Todd (marker species for the Zone N14 and the top of the Cochiti Geomagnetic Event of early Pliocene) and species of the genus *Sphaeroidinellopsis* (marker for the N12/N13 zonal boundary and the top of the Mammoth Geomagnetic Event of late Pliocene). On the other hand, Oligocene-Pleistocene faunas are dominated throughout the sequence by species of the genus *Globoquadrina.* Such faunal characteristics may suggest planktonic foraminiferal assemblages living within a narrow belt along the Equator.

A similar absence of a number of diagnostic calcareous nannofossils used for the Neogene zonal scheme is also noted at this site. *Discoaster tamalis* and the cosmopolitan *Ceratolithus tricorniculatus* are virtually absent in the Pliocene sediments. *C. tricorniculatus* is a species generally used for delineating the lower/upper Pliocene boundary. Furthermore, *Helicopontosphaera ampliapertura,* whose extinction level marks the zonal boundary between NN4 and NN5 is absent in the lower Miocene sediment. All of these zonal species appear elsewhere in the Pacific within their proper stratigraphic intervals.

Foraminifera

Planktonic foraminifera are present in all the cores recovered from this site except in Cores 128 through 130

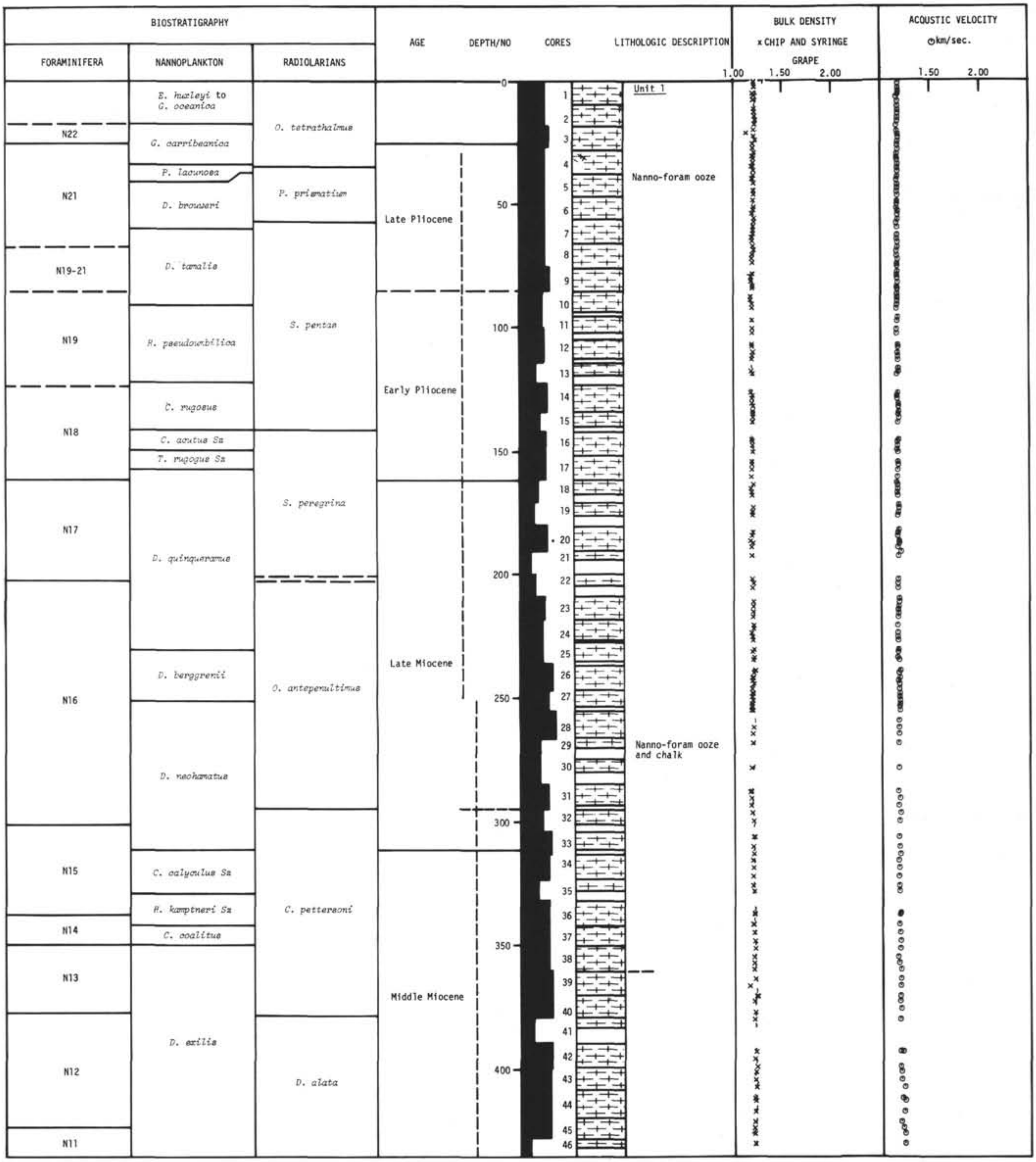


Figure 20. *Composite biostratigraphy, lithology, and physical properties, Site 289.*

Cenozoic and of Casey (1964) for the Cretaceous are adopted for the construction of the table.

Foraminifera investigations reveal that a continuous sequence of Pleistocene through lower Oligocene exists at this site underlain by a broken sequence of upper from the lower part of the sequence. The distribution of biostratigraphically significant planktonic foraminiferal species and the standard foraminiferal zones recognized at this site are summarized in Figure 21. The time-stratigraphic framework of Berggren (1972) for the

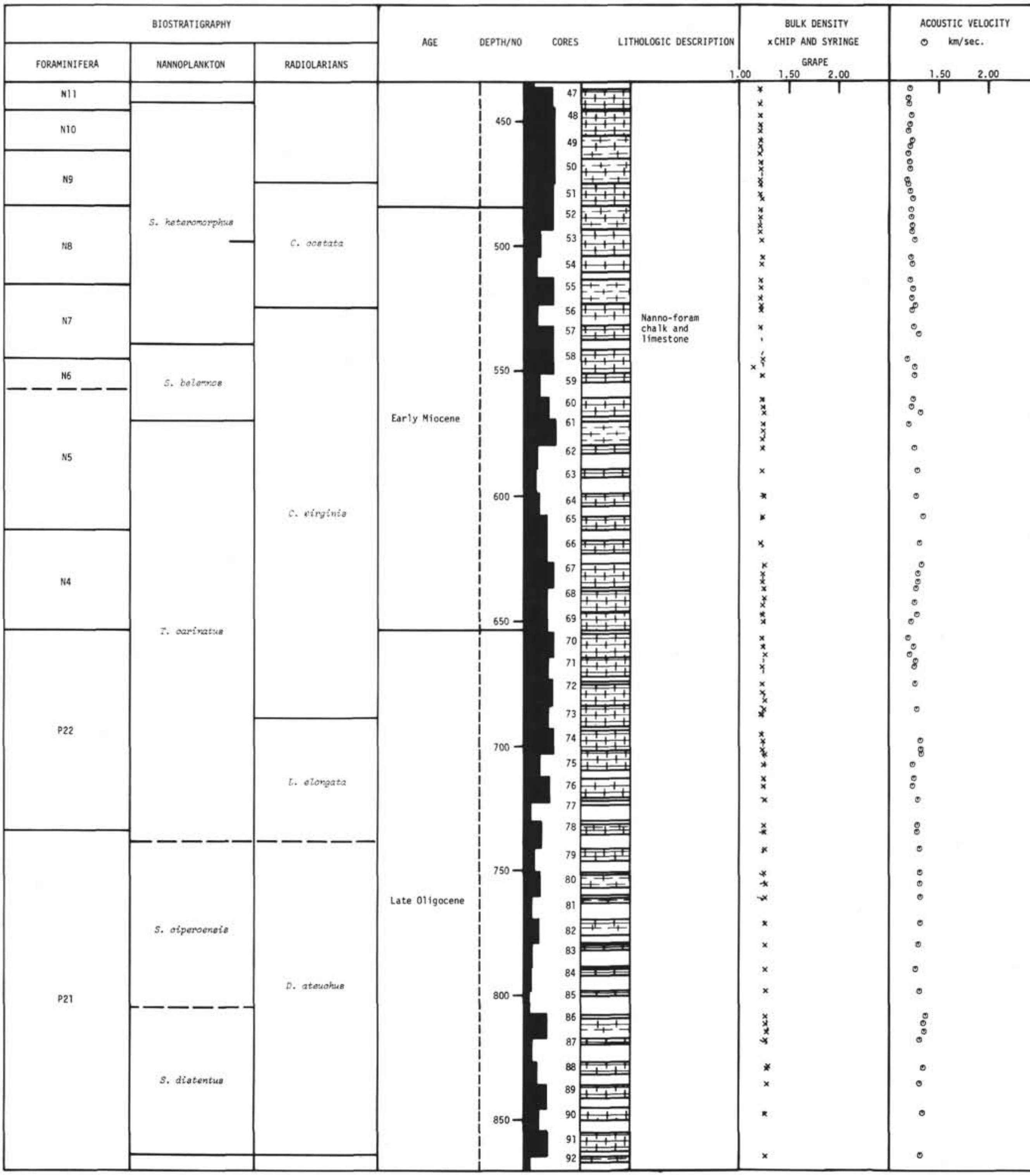


Figure 20. *(Continued).*

Eocene to Aptian. Well-preserved foraminifera occur in great abundance in the continuous Pleistocene-Oligocene sequence of Cores 289-1 through 289-101. No apparent reworked faunas nor evidence of marked foraminiferal solution are detected in this interval. Most of the zonally diagnostic species recorded by Blow (1969) are present at this site and occur in successions similar to those established by him, thus enabling rather precise application of Blow's zonal scheme to the continuously cored sequence. Furthermore, the availability

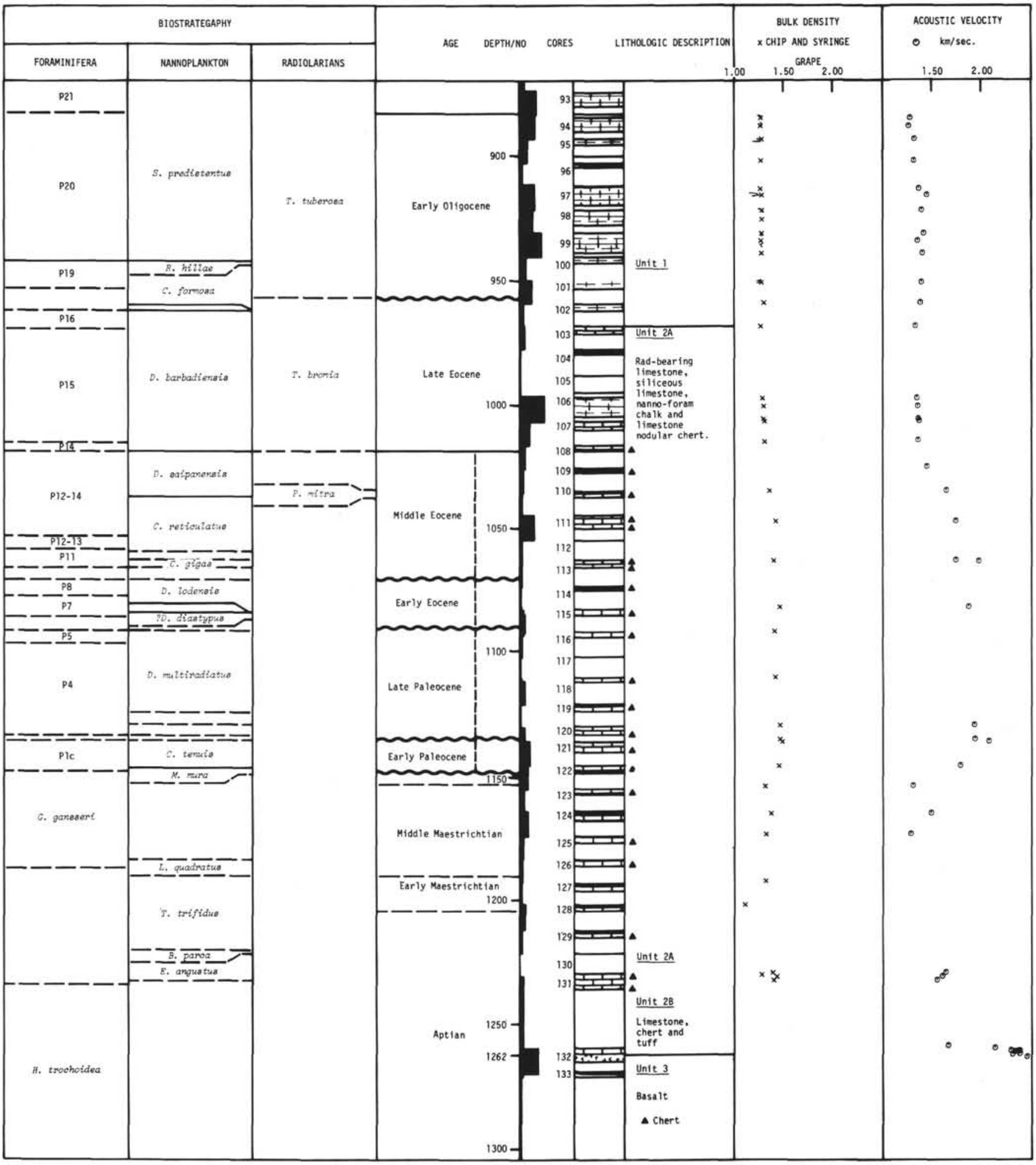


Figure 20. *(Continued).*

of a continuous record of sedimentation in an apparently stable depositional environment above the carbonate compensation depth should provide a means of assessing the duration of each planktonic foraminiferal zone. The duration of these zones has been fixed only approximately on the basis of a few radiometrically dated zones dispersed through the sequence.

The post-Miocene sequence at this site can also be correlated rather precisely with the paleomagnetically dated deep-sea sequence from the eastern Equatorial Pacific (Hays et al., 1969; Saito et al., 1975). Such a correlation indicates an approximate time span represented by each of the upper 16 cores to be on the order of 300,000 years.

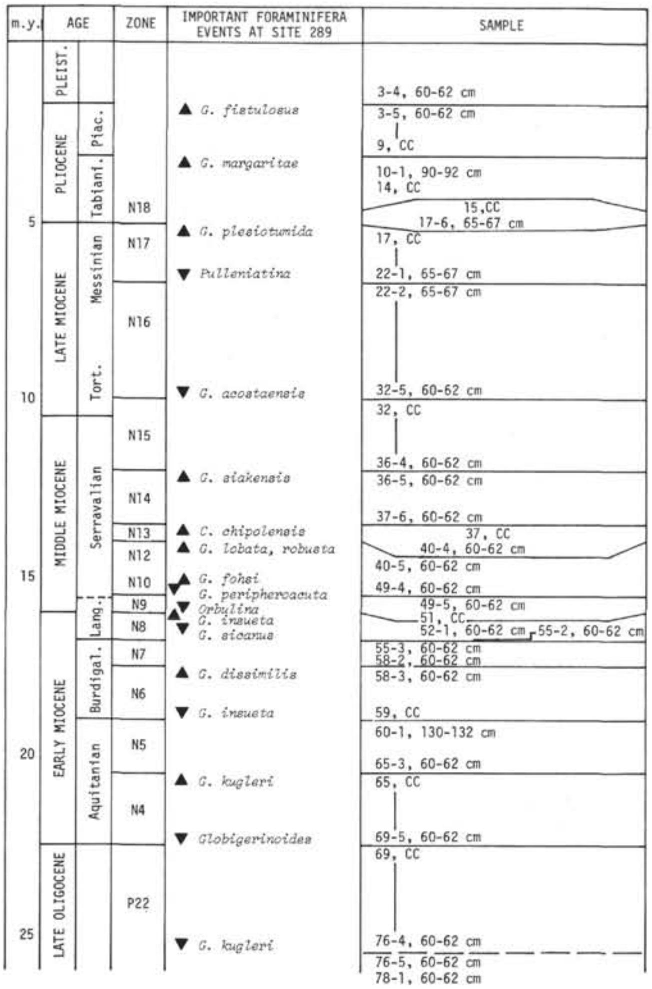


Figure 21. *Important foraminiferal events at Site 289.*

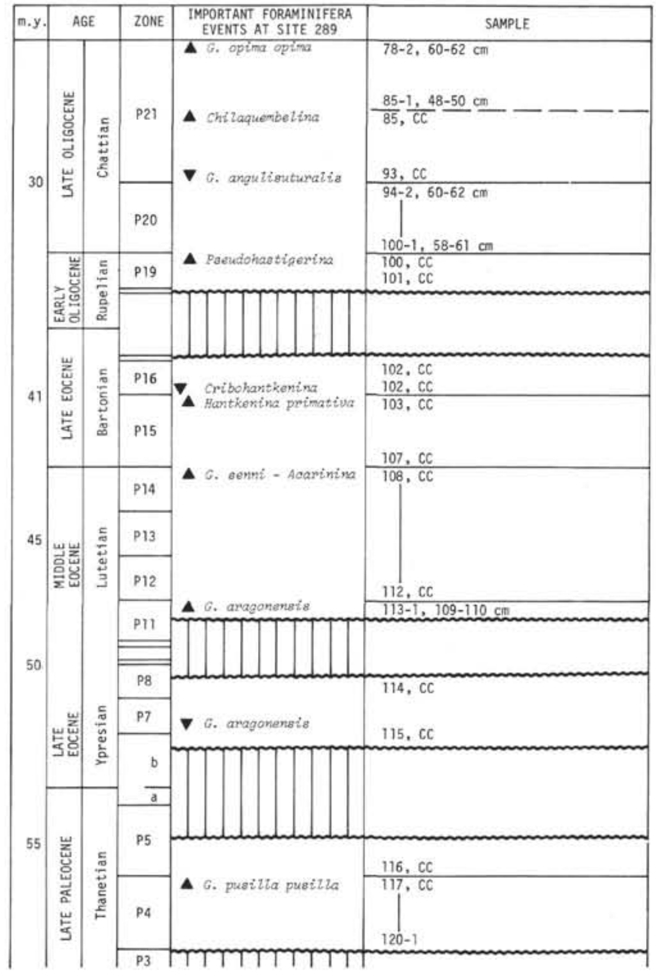


Figure 21. *(Continued).*

The downhole transition from a primarily nonlithified biogenous ooze sequence to a largely limestone sequence bearing strings of chert is nearly coincident with the discontinuity separating the upper, continuous column of the Pleistocene-Oligocene from the lower, hiatus-laden column of upper Eocene-Aptian. Some indications of lithification occur as high as Core 289-59 where processed foraminifera assemblages still include many specimens encrusted with sediment particles. Concomitant with the increasing lithification of sediments below the Oligocene/Eocene discontinuity, preservation of foraminifera deteriorates drastically and foraminifera become totally recrystallized. The poor preservation of foraminifera and several disconformities within the lower column make it difficult to establish the precise zonal subdivision of the upper Eocene-Aptian sequence. However, surprisingly well-preserved foraminifera are found within the lower sequence in Cores 125 and 126 (both middle Maestrichtian age) and in Cores 131 and 132 (both late Aptian age).

The Tertiary/Cretaceous boundary at this site is apparently a discontinuity involving a considerable time span, in which the latest Maestrichtian fauna characterized by *Abathomphalus mayaroensis* (Bolli) and the earliest Danian fauna typified by *Globigerina eugubina* Luterbacher and Premoli-Silva are missing. This discontinuity occurs in the seemingly continuous limestone sequence of Core 289-122 between 5-7 cm and 133-135 cm depth. Its exact position has yet to be determined, but no obvious lithological change which might suggest the stratigraphic hiatus occurs within this interval.

As was also observed at the previous site, 288, the lower Maestrichtian-upper Campanian sequence (Cores 128-130) at this site is devoid of planktonic foraminifera. A similar interpretation of the deposition depth of these sediments can be made, indicating a sedimentation depth close to or below the carbonate compensation depth but above the calcareous nannoflora solution depth.

The stratigraphic relationship between Aptian and Campanian sediments is very likely to be disconformable but whether sediments representing any other Cretaceous stage exist between the two at this site cannot be determined with the available data. The maximum possible interval of 28.5 meters allowable in this core between the Campanian and Aptian sediments seems too short to accommodate any substantial part of

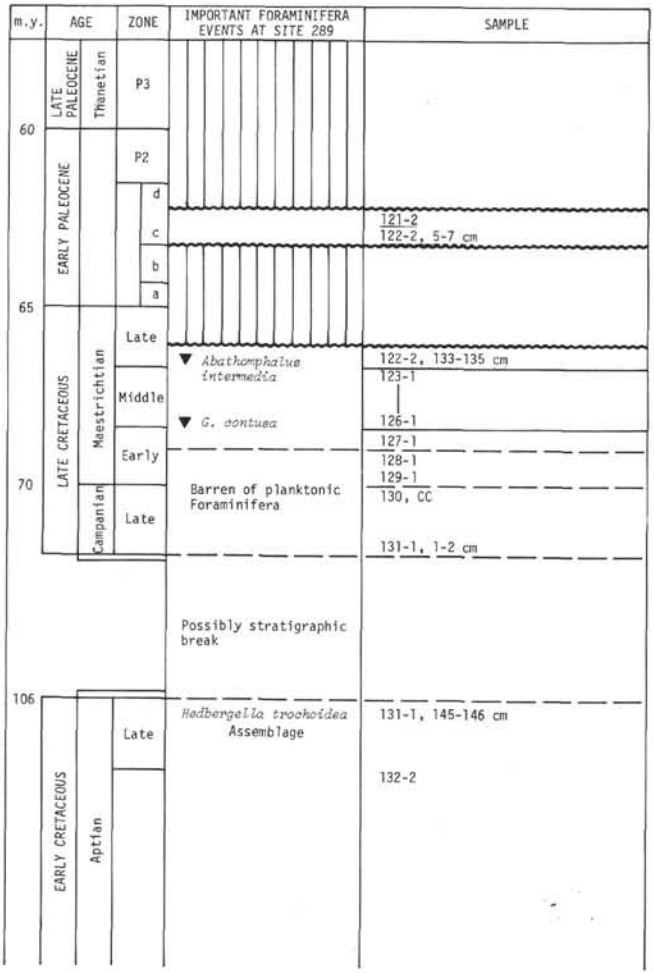


Figure 21. *(Continued).*

other Cretaceous stages. The Aptian fauna includes abundant planktonic species and is interpreted as having been deposited above the calcium carbonate compensation depth.

Calcareous Nannofossils

The sequence ranges in age from Early Cretaceous to Quaternary. Nannofossils are abundant through most of the section. Preservation is excellent in the upper part of the section, but deteriorates gradually, with a parallel decrease in abundance, from the lower Miocene downwards. The Oligocene-Quaternary part of the sequence is complete insofar as its nannofossil zones are all present and well developed. In contrast, the Lower Cretaceous-Eocene section is broken and several hiatuses are recognized.

The nannostratigraphy of this site is dealt with in more detail by Shafik (this volume). Figure 22 is a summary of the biostratigraphy as deduced from the study of the nannofossils.

Radiolaria

Radiolaria assemblages adequate for biostratigraphic purposes were found in all of the upper 110 continuous cores recovered at this site, with the exception of Core

Series or Subseries		Nannofossil Zones/Subzones		Site 289 Samples
HOLOCENE PLEISTOCENE		*Emiliania huxleyi-Gephyrocapsa oceanica*		1-1, 30-31 cm 2-6, 30-31 cm
		Gephyrocapsa caribbeanica		2, CC 4-3, 110-111 cm
		Pseudoemiliania lacunosa		4-4, 30-31 cm 4-6, 30-31 cm
PLIOCENE	Upper	*Discoaster brouwerii*		4, CC 7-2, 35-36 cm
		"Discoaster" pentaradiatus		7-2, 120-121 cm 7-6, 30-31 cm
		Discoaster tamalis		7, CC 10-3, 30-31 cm
	Lower	*Reticulofenestra pseudoumbilica*		10-4, 30-31 cm 13, CC
		Ceratolithus rugosus		14-1, 30-31 cm 15, CC
		Ceratolithus tricorniculatus	*Ceratolithus acutus*	16-1, 120-121 cm 16-4, 30-31 cm
MIOCENE	Upper		*Triquetrorhabdulus rugosus*	16-5, 30-31 cm 17-3, 120-121 cm
		Discoaster quinqueramus		17-4, 120-121 cm 25-1, 120-121 cm
		Discoaster berggrenii		25-2, 120-121 cm 27-3, 120-121 cm
		Discoaster neohamatus		27-4, 30-31 cm 33-4, 120-121 cm
	Middle	*Discoaster hamatus*	*Catinaster calyculus*	33-5, 30-31 cm 35-4, 120-121 cm
			Helicopontosphaera kamptneri	35, CC 36, CC
		Catinaster coalitus		37-1, 30-31 cm 37-6, 35-36 cm
		Discoaster exilis		37-6, 120-121 47-4, 30-31 cm
		Sphenolithus heteromorphus	Upper	47-5, 30-31 cm 53-3, 120-121 cm
	Lower		Lower	53-4, 120-121 cm 57, CC
		Sphenolithus belemnos		58-1, 30-31 cm 60, CC
		Triquetrorhabdulus carinatus	*Discoaster druggii*	61-1, 30-31 cm
			Discoaster deflandrei	
OLIGOCENE			*Cyclicargolithus abisectus*	78, CC
		Sphenolithus ciperoensis		79-1, 60-61 cm 85, CC
		Sphenolithus distentus		86-2, 120-121 cm 91, CC
		Sphenolithus predistentus		92-1, 120-121 cm 100-1, 50-51 cm
		Reticulofenestra hillae		100-1, 122-123 cm 100, CC
		Cyclococcolithina formosa		101-1, 65-66 cm 102-1, 112-113 cm
EOCENE	Upper	*Discoaster barbadiensis*	Upper	102, CC 104, CC
			Lower	105, CC 108-1, 74-75 cm
	Middle	*Discoaster saipanensis*		108, CC 110-1, 107-108 cm
		Cyclicargolithus reticulatus		110, CC 112, CC
		Reticulofenestra umbilica		
		Chiasmolithus gigas		113-1, 117-118 cm
		Nannotetrina fulgens		
		Discoaster sublodoensis	*Rhabdosphaera inflata*	
	Lower		*Discoasteroides kuepperi*	
		Discoaster lodoensis		114-1, 148-150 cm 115-1, 55-56 cm
		Tribrachiatus orthostylus		- - - - - - - -
		Discoaster diastypus		?115, CC

Figure 22. *Nannofossil biostratigraphy at Site 289.*

Series or Subseries	Nannofossil Zones/Subzones	Site 289 Samples
PALEOCENE	*Discoaster multiradiatus*	116-1, 140-143 cm 119, CC
	Discoaster nobilis	
	Discoaster mohleri	120-1, 80-81 cm 120-1, 148-150 cm
	Heliolithus kleinpellii	120, CC
	Fasciculithus tympaniformis	
	Cyclococcolithina robusta	121-1, 125-126 cm 121-2, 62-63 cm
	Cruciplacolithus tenuis	122-1 (top)
MAESTRICHTIAN	*Micula mura*	122, CC
	Lithraphidites quadratus	126-1, 135-136 cm 126 (bottom)
	Tetralithus trifidus	127-1, 131-132 cm 129, CC
CAMPANIAN	*Broinsonia parca*	130, CC
	Eiffellithus augustus	131-1, 1-2 cm 131-1, 30-31 cm
SANTONIAN	*Gartnerago obliquum*	
CONIACIAN	*Marthasterites furcatus*	
TURONIAN	*Micula decussata*	
ALBIAN	*Eiffellithus turriseiffeli*	
	APTIAN	131-1, 149-150 cm 132-2, 68-70 cm

Figure 22. *(Continued).*

289-109 which proved totally barren. Below Section 289-110-1 only traces on extremely poorly preserved Radiolaria were encountered at a few Cretaceous levels, apart from a rich *T. bromia* Zone assemblage downworked in a drilling sand of Sample 289-112, CC.

Throughout this succession Radiolaria are preserved in gray to white nanno-foram oozes, chalks, and limestones. Down to Sample 289-107, CC abundance of Radiolaria, though subject to fluctuation, is high. Peak abundance is probably in Cores 289-103 and 289-104, the longest section showing consistently relatively low return per sample is Cores 289-1 through 289-14. With very few marked exceptions, preservation and diversity of assemblages are good. A slightly more detailed discussion of abundance, preservation, and diversity of radiolarians is included in Holdsworth and Harker (this volume).

Between Samples 289-107, CC and 289-108-1, 72-75 cm there occurs a drastic change, taking place within a depth interval which is at maximum 14 meters, at minimum 0.72 meter, but most probably only slightly more than 6.0 meters. Radiolarians become very scarce and show corrosion and darkening. In Section 289-110-1 only fragmentary, robust species have survived and Core 289-109 revealed no evidence of radiolarians. Change in abundance, preservation, and diversity coincides rather closely with a sharp increase in the degree of chertification of rock recovered.

Zonal Allocation

Some difficulties were encountered in placing zone boundaries (see Holdsworth, this volume, for details.) Final allocations may be summarized:

O. tetrathalmus Zone: 289-1-4, 70-72 through 4-4, 70-72
P. prismatium Zone: 289-4, CC through 6, CC
S. pentas Zone: 289-7-3, 70-72 through 15, CC
S. peregrina Zone: 289-16-4, 70-75 through 22-3, 70-75
O. penultimus Zone: Not recognizable
O. antepenultimus Zone: 289-22, CC through 31, CC
C. petterssoni Zone: 289-32-3, 70-75 through 40-5, 70-75
D. alata Zone: 289-40, CC through 50, CC
C. costata Zone: 289-51-3, 70-75 through 56-2, 70-75
C. virginis Zone: 289-56, CC through 73-3, 70-75
L. elongata Zone: 289-73, CC through 78, CC
D. ateuchus Zone: 289-79-1, 70-75 through 91, CC
T. tuberosa Zone: 289-92-1, 125-130 through 101, CC
T. bromia Zone: 289-102-1, 91-95 through 108-1, 72-75
P. goetheana Zone: Not recognizable in material recovered
P. chalara Zone: Not recognizable in material recovered
P. mitra Zone: 289-110-1, 106-108

For tabulation of Radiolaria, see Holdsworth (this volume).

SEDIMENTATION RATES

The excellent foraminiferal age determinations in the Cenozoic at this site have made it possible to draw up an accurate sediment accumulation column. Saito has used the thickness of the Miocene foraminiferal zones to modify the time scale devised by Berggren (1972), assuming a roughly uniform rate of sedimentation.

In Figure 23 the sediment accumulation curve has been drawn using the scale of Vincent (1974). The sharp increase in gradient in the early middle Miocene and the lower gradient in the later early Miocene is almost certainly an indication that the 14 m.y. early/middle Miocene boundary is too young. The 16 m.y. boundary suggested by Saito is more acceptable.

The sedimentation rates are given in Table 4, calculated on the basis of an initial 70% porosity. Sufficient age points to give a reliable curve are available in the intervals from the early Oligocene to the present, the mid to late Eocene and the Campanian-Maestrichtian.

From the early Oligocene to Pleistocene, the depositional rate fluctuates between a high of 67 m/m.y. in the late Oligocene to 15 m/m.y. for the Pleistocene. Using Saito's modified Miocene scale, most of the rates fall between 30 and 50 m/m.y. without exhibiting any clear overall trend that might be associated with latitudinal motion of the Ontong-Java Plateau.

The middle to late Eocene rate of deposition is a little over 30 m/m.y. and is hence on the low side of the range of later rates. The Campanian-Maestrichtian rate (23 m/m.y.) is less than that of the Eocene, but is about half

TABLE 4
Sedimentation Rates, Site 289

Unit	Depth (m)	Thickness (m)	Porosity (%)	Thickness Corrected to 70% Porosity	Age (m.y.)	Duration (m.y.)	Sedimentation Rate (m/m.y.) Observed Thickness	Thickness Corrected to 70% Porosity
I	0-25-5	25.5	69	26	0-1.75	1.75	15	15
	25.5-85.5	60	68	64	1.75-3.0	1.25	48	51
	85.5-161	75.5	64	91	3.0-5.0	2	38	46
	161-317	156	62	198	5-10.5	5.5	28	36
					5-11.0	6	26	33
	317-421.5	104.5	61	136	10.5-16[a]	5.5	29	41
	421.3-484	62.5	56	92	11.0-14	3.0	56	72
	484-655	171	53	268	16-22.5[a]	6.5	26	41
					14-22.5	8.5	20	32
	655-702	47	52	75	22.5-24.7	2.2	21	34
	702-885	183	48	354	24.7-30	5.3	35	67
	885-955	70	46	126	30-32.5	2.5	28	50
I-2A	955-1015	60	41	118	40.0-43.0	3.0	20	40
	1015-1070	55	21	145	43.0-48	5.0	11	29
	1070-1090	20	11	59	(51.3-52.7)	(1.4)	(14)	(42)
	1090-1135	45	18	123	(55.5-58)	(2.5)	(18)	(49)
	1135-1148	13	11	39	(62.7-63.5)	(0.8)	(16)	(49)
	1148-1250	102	30	238	65.5-76	10.5	10	23
2B	1250-1262	12	20[b]	32	(107-108)	(1)	(12)	(32)

Note: Values in parentheses are based on an assumed gradient of the sediment accumulation curve.

[a]Revised Miocene time scale of Saito (unpublished data).

[b]Estimated value.

of that found at Site 288 for the same interval. This suggests that undetected breaks in sedimentation may exist in the Late Cretaceous at this site.

SUMMARY AND CONCLUSIONS

Summary

Site 289 was located on the north central portion of the Ontong-Java Plateau to sample a presumably continuous biostratigraphic sequence. Continuous coring resulted in recovery of 56% of the section to a depth of 1271 meters subbottom (basalt was encountered at 1262 m). The section proved to be complete in the Neogene and incomplete in the Paleogene.

The section consists of:

Unit 1 (0-969 m): Pleistocene to late Eocene nanno-foram ooze and chalk.

Unit 2 (969-1262 m): Late Eocene to Early Cretaceous Radiolaria-bearing limestone, siliceous limestone, nanno-foram chalk, nodular chert, and tuff.

Unit 3 (1262-1271 m): Basalt (pre-early Aptian).

The continuous Pleistocene to early Oligocene sediments contain a diverse microflora and microfauna with excellent to good preservation. Material in the deeper limestone sequences is more poorly preserved, save for the surprisingly diverse and well-preserved Aptian.

At least six substantial stratigraphic breaks are present in the section. These occur between Rupelian (lower Oligocene) and Bartonian; Lutetian (middle Eocene) and Ypresian; Ypresian and Thanetian (upper Paleocene); Thanetian and Danian (lower Paleocene); lower Danian and Maestrichtian; and late Aptian and Campanian. The Eocene/Oligocene break is similar to that reported by Kennett et al. (1972) in the Tasman and Coral seas.

Very minor chert was detected in the lower Miocene with the major appearance in late Eocene accompanied by the loss of Radiolaria from the sediments. Less chert was observed at this site than at Site 288.

The sequence of events recognized at Site 289 began during or prior to early Aptian time with the extrusion of tholeiitic basaltic lava flows. Following basalt extrusion, deposition of vitric tuff occurred, followed by biogenic sedimentation above the foram solution depth. A period of nondeposition or erosion followed from late Aptian into Campanian.

Biogenic sedimentation during Campanian time was below the foram solution depth, but fluctuations in depth of the plateau (or of the foram solution depth) permitted continued biogenic sedimentation to occur during the Maestrichtian above the foram solution depth. During latest Maestrichtian and earliest Paleocene time, a second period of nonaccumulation occurred. Biogenic sedimentation above the foram solution depth continued during the late Paleocene. A third period of nonaccumulation occurred during the latest Paleocene, and persisted into the early Eocene.

A short period of continued biogenic sedimentation above foram solution depth occurred during the early Eocene followed by a fourth hiatus. Biogenic sedimentation above the foram solution depth occurred continuously during the middle and late Eocene. A minor period of higher productivity of Radiolaria occurred

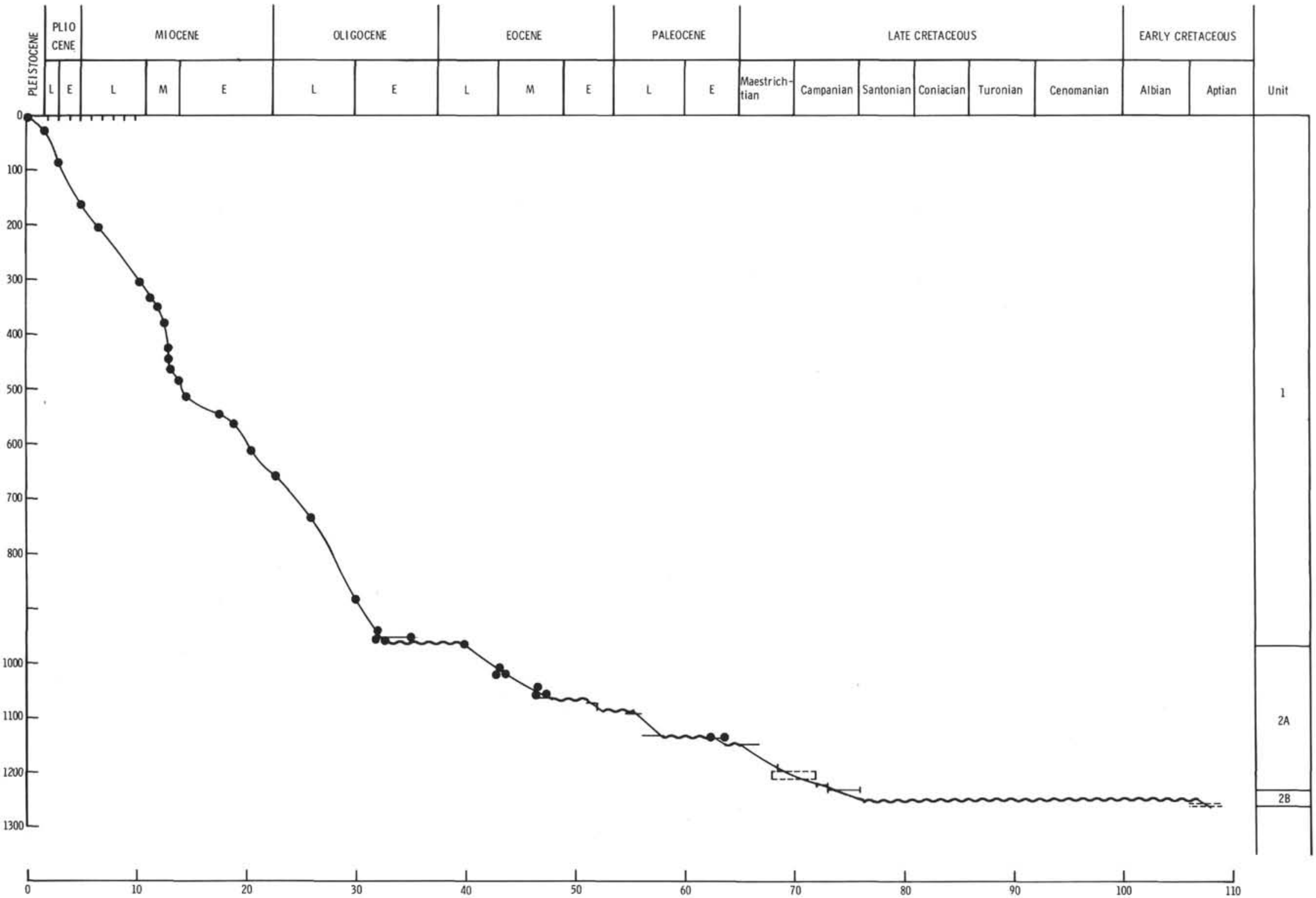


Figure 23. *Sedimentation accumulation curve for Site 289 based on foraminiferal age determinations for the Cenozoic and foraminiferal and nannofossil determinations for the Cretaceous. (Time scale from Vincent, 1974; van Hinte, 1972.)*

during the entire late Eocene. A fifth period of nonaccumulation occurred at the end of Eocene time and persisted into the earliest Oligocene (the Eocene/Oligocene regional unconformity of Leg 21).

From the beginning of the early Oligocene until the Holocene, continuous biogenic sedimentation of foraminifera and nannofossils above the foram solution depth has occurred on the northern part of the Ontong-Java Plateau.

The Early Cretaceous age for Site 288 fits well at the western end of the original Phoenix spreading center based on magnetic trend of Larson and Chase (1972). The age at Site 289 requires a fracture zone between Sites 288 and 289 which appears to have been crossed very near Site 288.

Comparison of Site 289 With Sites 64 and 288

The stratigraphic sequences and sedimentary features at Site 289 show close similarities to those at Sites 64 and 288. Some major differences occur, probably because Sites 289 and 64 (160 km south of Site 289) are on the Ontong-Java Plateau and have been so located for most of their histories), whereas Site 288 is 550 km to the southeast of Site 289 at the western end of the Stewart Basin on the southeastern flank of the Ontong-Java Plateau. At all three sites biogenic ooze comprises almost all of the sediment. Ash is reported as a minor constituent throughout the column at both Sites 288 and 289. Breaks in the sedimentary record occur at both sites, but are more marked at Site 288 where the presence of derived faunas together with the included hiatuses, may be the result of the site's position on the flank of the plateau.

Unit 1, as defined at Site 289, can be traced to Sites 64 and 288, although it is considerably thinner at Site 288 (Figure 24) due largely to the less complete Neogene sequence. This thinning is accompanied by the occurrence of chert-bearing younger limestones at Site 288, and thus Unit 2 is thicker than at Site 289 (Figure 24). The overall volume of chert at Site 288 appears to be far greater than at Site 289.

Two other differences are present in Unit 1 at these three sites. H_2S gas occurs at Site 289, whereas an unidentified gas with a "sweet-smelling" odor (Winterer, Riedel, el al., 1971, p. 552) occurs at Site 64. No gas was observed at Site 288. The foraminifera content at Site 289 appears to be greater than at Sites 64 and 288.

Unit 2, as defined at Site 289, is traceable to Sites 64 (where only the uppermost 20 meters was recovered) and 288. The thickness of Unit 2 at Site 288 is twice that at 289 because of the greater thickness of the Upper Cretaceous section. The basal subunit of mixed volcanic ash, vitric siltstone and carbonates is considerably thicker at Site 288 in spite of there being five breaks in the depositional record. At Site 289, five major stratigraphic discontinuities were also observed in Unit 2 (Figure 25) (see also Paleontology Section). The vitric

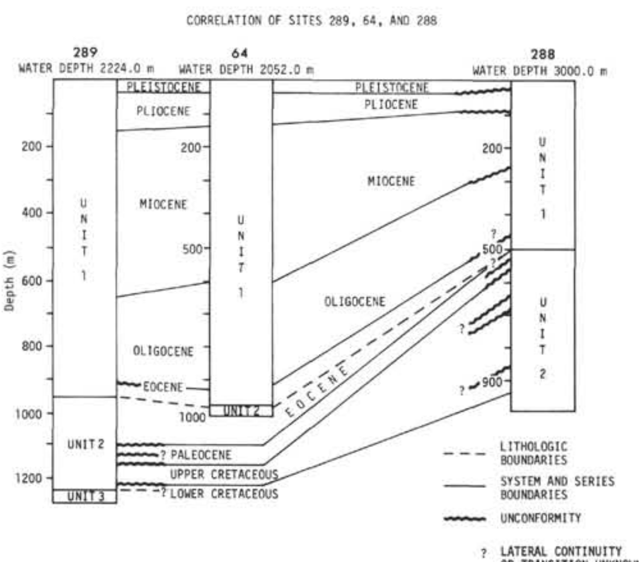


Figure 24. *Correlation of Sites 289, 64, 288.*

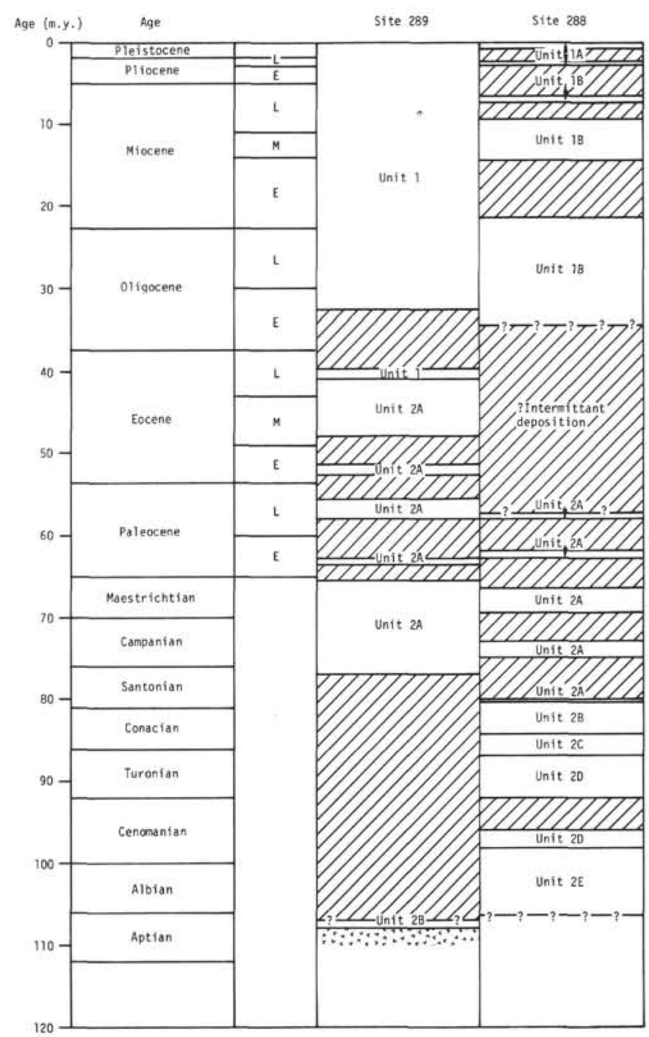


Figure 25. *Time-stratigraphic correlation of Sites 289 and 288. (Time scale after Berggren, 1972; van Hinte, 1972.)*

siltstone-carbonate rhythmic sequences observed at Site 288 in Turonian sediments are absent at Site 289 (Turonian rocks are not represented). Large chert nodules occur in rocks older than Oligocene at all three sites, although scattered chert fragments of fine pebble size occur in the Miocene at Site 289 and 288. Whether this chert diagenesis should be a function of progressive burial and depth-controlled remobilization of silica, or whether other factors are more significant at Sites 289, 64, and 288 remains open.

Although close physical similarity exists among the recovered sediments at all three sites, sharp differences in the thicknesses of major time-stratigraphic units occur (Figure 24). The section of Upper Cretaceous sediments is thicker at Site 288 by a five-fold factor than at Site 289 where a long Upper Cretaceous hiatus in deposition occurred. The Paleocene is represented at both sites by nearly equally thick sections; an upper Paleocene hiatus being common to both sites also. The Eocene at Site 288 may be present in a recovery gap but would be thin; it was partly recovered at Site 64, and is represented incompletely at Site 289 where three hiatuses occur. The Oligocene section reaches its maximum thickness at Site 64, and thins slightly towards Sites 289 and 288. The Miocene thickens progressively when traced from Sites 288 to 64 to 289.The Pliocene thickens gradually in the same direction; the Pleistocene appears to be uniformly thick over all three sites, but only part of the Pleistocene is represented at Site 288.

REFERENCES

Berggren, W.A., 1972. A Cenozoic time-scale—some implications for regional geology and paleobiogeography: Lethaia, v. 5, p. 195-215.

Blow, W.H., 1969. Late middle Eocene to Recent planktonic foraminiferal biostratigraphy. *In* Bronnimann, P. and Renz, H.H. (Eds.), Plankt. Microfossils 1st Internatl. Conf. Proc.: Leiden, Netherlands (Brill): v. 1, p. 199-421.

Casey, R., 1964. The Cretaceous period. *In* Harland, W.B., Smith, A.G., and Wilcock, B. (Eds.), The Phanerozoic Time Scale: Geol. Soc. London, Quart. J., v. 120S, p. 193-202.

Greenwood, R., 1973. Cristobalite: its relationship to chert formation in selected samples from the Deep Sea Drilling Project: J. Sediment. Petrol., v. 43, p. 700-708.

Hays, J.D., Saito, T., Opdyke, N.P., and Burckle, L.H., 1969. Pliocene-Pleistocene sediments of the equatorial Pacific: their paleomagnetic, biostratigraphic and climatic record: Geol. Soc. Am. Bull., v. 80, p. 1481.

Heath, G.R., 1973. Cherts from the eastern Pacific, Leg 16, Deep Sea Drilling Project. *In* Van Andel, T.H., Heath, G.R., et al., Initial Reports of the Deep Sea Drilling Project, Volume 16: Washington (U.S. Government Printing Office), p. 609-614.

Heath, G.R. and Moberly, R., 1971. Cherts from the western Pacific, Leg 7, Deep Sea Drilling Project. *In* Winterer, E.L., Riedel, W.R., et al., Initial Reports of the Deep Sea Drilling Project, Volume 7: Washington (U.S. Government Printing Office), p. 991-1007.

Hussong, D.M., 1972. Complex structure of the South Fiji Basin as shown by ASPER refraction data (abstract): Geol. Soc. Am. Abstracts with Programs, v. 4, p. 175.

Kennett, J.P., Burns, R.E., Andrews, T.E., Churkin, M., Davies, T.A., Dumitrica, P., Edwards, A.R., Galehouse, J.S., Packham, G.H., and van der Lingen, G.J., 1972. Australia-Antarctic continental drift, paleocirculation changes and Oligocene deep sea erosion: Nature Phys Sci., v. 289, p. 51.

Kroenke, L.W., 1972. Geology of the Ontong-Java Plateau, Hawaii Institute of Geophysics Pub. HIG-72-5, 119p.

Larson, R.F. and Chase, C.G., 1972. Late Mesozoic evolution of the western Pacific Ocean: Geol. Soc. Am. Bull., v. 83, p. 3627.

Lonsdale, P., Malfait, B.T., and Spiess, F.N., 1972a. Abyssal sand waves on the Carnegie Ridge: Geol. Soc. Am. Abstract with Programs, v. 4, p. 579-580.

Lonsdale, P., Normark, W.R., and Newman, W.A., 1972b. Sedimentation and erosion on Horizon Guyot: Geol. Soc. Am. Bull., v. 83, p. 289-316.

McCave, I.N., 1970. Deposition of fine-grained suspended sediment from tidal currents: J. Geophys. Res., v. 75, p. 4151-4159.

Saito, T., Burckle, L.H., and Hays, J.D., 1975. Late Miocene to Pleistocene biostratigraphy of equatorial Pacific sediments. *In* Saito, T. and Burckle, L.H. (Eds.), Late Neogene Epoch Boundaries (24th International Geological Congress, Montreal, 1972, Sump. 109). Am. Mus. Nat. Hist., Micropal. Press, Spec. Publ. no. 1, p. 226-237.

Van Hinte, J.E., 1972. The Cretaceous time-scale and planktonic foraminiferal zones: Ned. Akad. Wetensch. Proc. Ser B., v. 75, p. 61-68.

Vincent, E., 1974. Cenozoic planktonic biostratigraphy and paleooceanography of the western Indian Ocean. *In* Fisher, R.L., Bunce, E.T., et al., Initial Reports of the Deep Sea Drilling Project, Volume 24: Washington (U.S. Government Printing Office), p. 1111-1150.

Winterer, E.L., Riedel, W.R., et al., 1971. Initial Reports of the Deep Sea Drilling Project, Volume 7: Washington (U.S. Government Printing Office).

APPENDIX A
Smear-Slide Determination, Site 289 (values in percent)

Sample (Interval in cm)	Depth (m)	Feldspar	Heavy minerals	Mica	Volc. glass	Pyrite + Opaques	Micronodules	Zeolite	Micarb	Calcareous spicules	Forams	Nannos	Radiolaria	Sponge spicules	Diatoms	Silicoflag.	Lithologic Unit
1-1, 75	0.75	tr									55	45	tr	tr			
1-2, 32	1.82	1								tr	64	40					
1-3, 3	3.03	tr									55	45					
1-3, 75	3.75										55	45			tr	tr	
1-5, 75	6.75	tr									60	40	tr			tr	
1, CC	9.10										52	48					
2-1, 75	10.25										54	45	1			tr	
2-1, 120	10.70				1						53	45		tr		1	
2-4, 76	14.76				1	24					40	35	tr			tr	
2-5, 47	15.97	tr									55	45	tr			tr	
2, CC	18.60				1						45	53	1			tr	
3-1, 75	20.05										60	37	2	tr	tr	1	
3-3, 75	23.05	tr									63	30	5			2	
3-5, 75	26.05				tr	tr					59	40	1			tr	
3-6, 123	28.03	tr		tr							59	40	1	tr	tr		
3, CC	28.40	tr				2					52	46				tr	
4-2, 92	30.92	tr									54	45	1	tr	tr	tr	
4-4, 75	33.75				tr						65	32	2	1	tr	tr	
4, CC	37.60					tr					50	46	2	tr	tr	2	
5-1, 120	39.20	1			1	tr				tr	55	43	tr	tr		1	
5-3, 75	41.75				tr	tr					55	41	2	2	tr	tr	
5-5, 62	44.62					1					55	42	1	tr	tr	1	
5, CC	47.10				tr						50	46	2	1	tr	1	
6-1, 93	48.43	tr			tr						60	39	1	tr	tr	tr	
6-3, 75	55.30				tr	tr					65	35	tr	tr		tr	
6-4, 75	52.75	tr									54	45	1	tr		tr	
6, CC	56.60	tr			tr						57	40	2	1	tr	tr	
7-1, 75	57.75	tr	tr		2						60	37	1	tr	tr	tr	
7-4, 75	56.25	tr			1	tr					55	43	1	tr		tr	
7, CC	66.10				tr	1					50	45	2	2		tr	
8-1, 75	67.75				tr	tr					60	38	1	tr		1	1
8-4, 75	72.25	tr			tr						55	45	tr	tr		tr	
8, CC	76.10	tr				tr					50	47	1	1	tr	1	
9-1, 72	77.12	tr			tr						60	39	1	tr		tr	
9-4, 75	81.65	tr			tr	tr					65	34	1	tr	tr	tr	
9, CC	85.50				tr	tr				tr	50	48	1	tr	tr	1	
10-1, 85	86.35				tr						54	46	tr	tr		tr	
10-2, 10	87.10					100											
10, CC	93.10	tr				tr					55	44	tr	tr		tr	
11-1, 75	95.75	tr			1						69	26	2	2	tr	tr	
11, CC	102.60					1					55	47		1		1	
12-2, 75	106.75	1									60	38		tr		1	
12, CC	113.60					tr	tr				55	45	tr	tr		tr	
13-2, 75	116.25	4			tr						60	34	2	tr			
13, CC	120.10				1	1					55	38	1	1	1	2	
14-2, 75	126.05	tr									55	42	1	2	tr	tr	
14, CC	132.90	tr				tr					55	42	2	1	tr	tr	
15-1, 100	134.00	1									55	41	2	1	tr	tr	
15, CC	139.10	1									55	40	2			1	
16-2, 75	144.85	1				tr					55	39	3	1	tr	1	
16, CC	151.70				1	1					55	40	1	1		1	
17-2, 75	154.25	tr			tr	tr					55	43	1	1			
17, CC	161.10	tr				tr					55	42	2	1		tr	
18-2, 75	163.75	tr			tr	tr					60	36	3	1	tr	tr	
18, CC	169.10	1	tr		2						55	39	3				
19-3, 75	174.75	1									55	39	3	1		1	
19, CC	171.10				1	tr					55	43	1	tr		tr	
20-2, 75	182.85				tr						50	46	3	1	tr	tr	
20, CC	189.70				1	tr					65	32	2	tr		tr	
21, CC	193.10	tr									55	44	1	tr		tr	
22-2, 75	201.75	tr			tr		tr				55	45	tr	tr			

APPENDIX A – *Continued*

Sample (Interval in cm)	Depth (m)	Feldspar	Heavy minerals	Mica	Volc. glass	Pyrite + Opaques	Micronodules	Zeolite	Micarb	Calcareous spicules	Forams	Nannos	Radiolaria	Sponge spicules	Diatoms	Silicoflag.	Lithologic Unit
22, CC	205.60	1									60	38	1				
23-1, 90	209.90	tr									50	49	1	tr		tr	
23, CC	218.10	tr									50	48	2	tr			
24-2, 75	220.75	tr									50	48	1	1			
24-5, 88	225.38	tr				3					45	50	1	1			
24, CC	227.60										50	47	3	tr		tr	
25-2, 75	330.25	tr			tr						50	49	1	tr			
25, CC	237.10	1			tr						60	39	tr	tr			
26-1, 75	238.65										50	49	1	tr			
26, CC	247.00	tr									54	44	1	1		tr	
27-1, 100	248.00	tr			tr						50	47	1	1			
27-3, 75	250.75	tr									49	48	1	2			
27-3, 76	250.76	tr			tr						50	44	3	3			
27-3, 76	250.76					tr					53	45	1	1			
27, CC	256.10	1									60	36	2	1	tr	tr	
28-1, 75	257.65	tr				1					55	41	2	1		tr	
28, CC	266.00										65	29	5	1	tr	tr	
29-1, 75	266.75	1									60	36	2			1	
29, CC	270.60	tr									60	35	4	1	tr	tr	
30-2, 75	277.75	tr			tr						60	35	3	1	1	tr	
30-2, 128	278.25	tr				1					55	37	5	1		1	
30, CC	280.10	tr			1	2					58	36	2	1	tr	tr	
31-2, 75	287.25	tr				tr					55	40	3	1		1	
31, CC	249.10				tr						60	36	3	1	tr	tr	
32-2, 75	296.75	1									55	39	3	1	tr	1	
32, CC	302.10	tr									59	37	4	tr	tr	tr	
33-1, 75	304.85										60	37	2	1			
33, CC	313.20					tr					55	44	tr	1			
34-1, 75	314.25								1		50	48	1	tr			
34-6, 75	321.75				tr	tr					47	50	3	1			
34, CC	322.60	tr									50	48	2	tr			1
35-3, 62	326.62								1		45	53	1	tr			
35, CC	329.10	1									55	40	2	1	tr	1	
36-2, 75	335.05								1		50	47	2	tr			
36, CC	341.90					tr					55	41	2	1	tr	1	
37-2, 75	346.65				tr				2		50	45	3	tr			
37, CC	351.50	tr			1						60	36	1	1		1	
38-1, 75	352.75								1		50	47	1	1			
38, CC	361.10					tr					60	38	1	1			
39-1, 75	362.25	tr									43	55	2	tr		tr	
39, CC	370.60	tr					1				55	42	1	1		tr	
40-1, 75	371.65	tr									52	45	2	1			
40, CC	380.00	tr									60	36	3	1		tr	
41-1, 90	380.90	tr				tr					65	32	2	1	tr	tr	
41, CC	383.10	tr				1					55	37	4	1	1	1	
42-2, 75	392.25	tr									50	46	2	2	tr	tr	
42, CC	399.10	1									55	37	5	1	1	tr	
43-1, 75	400.15	tr									60	37	2	1		tr	
43, CC	408.50										50	47	1	2			
44-1, 75	409.55	tr									60	38	2	tr	tr	tr	
44, CC	417.90	tr									65	32	3	tr			
45-1, 75	419.05								2		70	21	5	2	tr		
45, CC	427.40	tr			tr	tr	tr				50	46	1	3			
46-2. 75	429.75								3		70	23	3	1			
46, CC	430.60	tr			tr						55	41	2	2			
47-3, 75	440.75								3		45	48	3	1			
47, CC	446.10	tr			tr	tr					60	38	1	1			
48-1, 75	447.75								5		55	38	1	1			
48, CC	456.10									1	55	38	4	1		1	
49-1, 75					tr				4		45	48	3	tr			
49, CC	465.50					1					55	39	3	1	tr	1	

APPENDIX A – *Continued*

Sample (Interval in cm)	Depth (m)	Feldspar	Heavy minerals	Mica	Volc. glass	Pyrite + Opaques	Micronodules	Zeolite	Micarb	Calcareous spicules	Forams	Nannos	Radiolaria	Sponge spicules	Diatoms	Silicoflag.	Lithologic Unit
50-1, 75	466.75								3		55	39	3				
50, CC	475.10										55	39	4	1		tr	
51-1, 90	475.90										55	38	2	1	1	1	
51, CC	484.10										55	40	3	1		1	
52-1, 75	485.75										50	43	3		3	1	
52, CC	496.10	tr									55	41	3	1			
53-2, 75	406.25	tr									55	42	2			1	
53, CC	500.10					3	2		2		55	37	1	tr			
54-2, 75	505.75	tr								1	55	41	2	1	tr	tr	
54, CC	509.60				tr				3		30	64	3	tr			
55-1, 75	514.15									1	51	43	3	1		1	
55, CC	522.50								3		36	40	20	1			
56-2, 75	524.75				tr				3		10	77	10				
56, CC	528.60								3		60	34	3	tr			
57-1, 80	532.90				tr				3		60	35	2				
57, CC	541.20				tr				3		65	28	3	1			
58-1, 75	542.75								3		40	56	1				
58, CC	551.10				tr				3		60	34	3	tr			
59, CC	554.10				tr	tr			3		70	23	3	1			
60-2, 75	562.75	tr							3	1	50	43	2				
60, CC	569.60				tr				3	1	60	35	1				
61-1, 75	571.25								3		60	32	5	tr			
61-3, 105	574.55					tr			5		55	37	3	tr			
61, CC	579.60					tr			3		40	56	1	tr			
62-2, 75	581.75								3		50	44	3				
62, CC	582.60				tr						40	54	3	tr			
63-1, 80	589.80	tr				tr					50	49	1	tr			
63, CC	592.10								4	2	55	38	1	tr			
64-2, 100	601.00	1				1				2	44	36	15	1		tr	
64, CC	603.10					tr			4	2	55	38	1				
65-2, 62	610.12					tr				1	60	37	2	tr			1
65, CC	612.60				tr	tr			2		55	42	1	tr			
66-1, 75	618.25	tr									60	37	2	1			
66, CC	622.10	tr									55	44	1	tr			
67-1, 75	628.25	tr									60	34	6	tr	tr		
67, CC	636.60				tr						60	40	tr	tr			
68-2, 75	638.75	tr								tr	55	43	2	tr			
69-1, 82	646.82								3		50	45	2				
69, CC	653.60	tr				tr					60	38	2	tr		tr	
70-1, 75	656.75								3		60	36	1				
70, CC	665.10	tr			tr						50	48	1	1			
71-1, 75	665.75								4		50	38	8				
71, CC	672.60				tr				3		60	33	3	1			
72-2, 75	676.75								5		45	47	3				
72, CC	683.60								3	3	55	34	5				
73-2, 75	686.25								3	8	50	37	11	1			
73, CC	691.60								3	10	55	27	5				
75-2, 75	705.25								3	10	35	50	2	tr			
75, CC	709.10	tr								3	50	46				1	
76-1, 75	713.25								3	5	50	30	11			1	
76-2, 75	714.75	tr								3	30	44	20	1		1	
76, CC	720.10									3	50	44	1	1		1	
77, CC	723.60	1								2	55	39	1	1		1	
78-2, 75	733.75	tr								5	45	38	15	1		1	
78, CC	736.10	tr								3	55	40	1	1			
79-1, 10	741.10										30	58	10	1		1	
79, CC	745.60	tr								1	55	42	tr	2		tr	
80-2, 80	752.80									3	20	72	4	1			
80, CC	756.60	1				tr					55	41	1	1		1	
81, CC	763.10	1				1					55	40	1	1		1	
82-1, 75	770.25				3	2				2	30	52	10	1			

APPENDIX A – *Continued*

Sample (Interval in cm)	Depth (m)	Feldspar	Heavy minerals	Mica	Volc. glass	Pyrite + Opaques	Micronodules	Zeolite	Micarb	Calcareous spicules	Forams	Nannos	Radiolaria	Sponge spicules	Diatoms	Silicoflag.	Lithologic Unit
82, CC	774.10	tr								1	55	40	2	1		1	
83-1, 140	780.40	tr			tr	tr				1	40	47	10	1		1	
83, CC	782.10	tr				1				1	55	38	2	1		1	
84-1, 110	789.60								3		45	46	5	1			
84, CC	781.60	1				1					55	42	tr	1			
85-1, 75	798.75					tr			5		60	30	5				
85, CC	799.60					tr					51	46	2	1			
86-2, 75	809.75								4		50	42	3	1			
86, CC	816.60								10		45	43	2				
87-2, 75	819.25								5		50	43	2	tr			
87, CC	820.10					tr			5		60	33	2				
88-2, 75	828.75					tr			5		50	41	3	1			
88, CC	831.10					tr			5		55	37	3	tr			
89-2, 76	838.26	tr							4		45	50	tr	1			
89, CC	842.10								5		50	43	2	tr			
90-1, 100	846.50	tr							5		10	68	15	2			
90, CC	850.10										52	46	2	tr			
91, CC	862.60	1			tr						60	36	8	1			
92, CC	866.10					3					55	37	4	1			1
93, CC	880.10	tr				tr					55	40	3	2			
94-2, 77	885.77				1	tr					46	50	3				
94. CC	889.60								3		60	35	1	1			
95-2, 75	895.25	tr				tr			2		53	42	3	tr			
95, CC	896.10								3		50	44	2	1			
96, CC	904.10								4		65	26	5				
97-1, 11-	913.10	tr							2		48	47	3	tr			
98-2, 75	923.75								5		60	27	8				
98, CC	927.60								5		70	20	5				
99-1, 72	931.72	tr			7	3			15		5	58	10	2			
99, CC	938.60								5		40	46	8	1			
100-1, 104	941.54				5	tr			15		15	48		2			
100, CC	942.10				tr				5		50	39	5	1			
101-1, 87	950.87	tr				tr			15		40	37	8				
101, CC	953.10								5		50	40	4	1			
102-1, 100	960.50					tr			15		50	27	8	tr			
102, CC	961.10								5		60	29	5	1			
103-1, 80	969.80								15		30	13	40	2			
103, CC	970.60								6		45	38	11				
104, CC	978.60								3		40	27	30				
105, CC	988.10									2	35	31		2	tr		
106-2, 103	1000.03								20		20	45	15				
106, CC	1005.10										10	79	10	1			
107-2, 75	1009.25	3			tr				2		40	39	15	1			
107, CC	1010.10	tr									20	42	30	1		1	
108, CC	1018.10	tr							8		20	70					
109, CC	1027.60								15		30	52	3				2A
110, CC	1037.10					tr			15		20	45	20				
111, CC	1049.60					tr			10		10	70	10				
112, CC	1054.60								20		10	70					
117, CC	1102.10	1				tr					60	38					
118, CC	1113.10	3							15		40	42					
119, CC	1121.10	2							15		40	43					
121-2, 84	1138.34				tr	3		50	27			20					
126-1, 140	1184.90					tr			10		2	88					
131-1, 5	1231.05					1		5	10		5	79					
131-1, 48	1231.48	2	3		30	1		7	10			47					
131-1, 100	1232.06	3	5		74	10		5				3					
131-2, 12	1232.62	2	1		10			10	5			67					2B
131-2, 76	1233.26				5	1		3	7			84					
132-2, 50	1262.50		3		71	5	2	15				3	1				
132-2, 76	1262.76	5			87	5			1			2					

Site 289 Hole Core 1 Cored Interval: 0.0-9.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
PLEISTOCENE		Emiliana huxleyi - Gephyrocapsa oceanica	Ommatartas tetrathalmus	F R N	A F A	e- g- g-	0, 1, 2, 3, 4, 5, 6, Core Catcher	0.5, 1.0		3	*	

N7 - light gray

NANNO-FORAM OOZE, light gray; soft.

SS 1-75
55% F Tr% Fsp Tr% S
44% N Tr% R

X-ray 1-73
18% Amor 82% Cryst
99% Calc 1% Quar

$CaCO_3$ 1-90 (89)

Grain Size 1-100 (22.0, 34.8, 43.2)

N6, swirled with N7 and 2.5Y 2.5/0

NANNO-FORAM OOZE, medium light gray; soft.

N8, 5Y 8/2 swirled, with scattered N1 spots

SS 2-32
64% F 1% Fsp
40% N Tr% Calc S.

5G 5/1, W9, N8, 5Y 8/1 swirled with N1 spots

NANNO-FORAM OOZE, medium-greenish gray, swirled with white, very light gray, and yellowish gray, with black spots; soft.

SS 3-75
55% F Tr% D Tr% Fish D.
45% N Tr% SI

NANNO-FORAM OOZE, yellowish gray, light greenish gray, and very light gray, with black spots; soft.

SS 5-75
60% F Tr% Fsp Tr% SI
40% N Tr% R

NANNO-FORAM OOZE, very light gray; soft.

N8

SS CC
52% F
48% N

Site 289 Hole Core 2 Cored Interval: 9.5-19.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
PLEISTOCENE	N22	Emiliana huxleyi-Gephyrocapsa oceanica; Gephyrocapsa caribbeanica	Ommatartus tetrathalmus	N; F R N	A F A	e- g- g-	0, 1, 2, 3, 4, 5, 6, Core Catcher	0.5, 1.0		3	*	

5G 5/1, N9, N8, 5Y 8/1, N1

NANNO-FORAM OOZE, yellowish gray, light greenish gray, and very light gray with black spots; soft.

N9, swirled with N1 and 5Y 8/1

SS 1-75
54% F 1% R
45% N Tr% SI

PYRITE-RICH NANNO FORAM OOZE (black spot); soft.

SS 4-76
40% F 24% Py Tr% R
35% N 1% Gl Tr% SI

NANNO-FORAM OOZE, yellowish gray, light greenish gray, and very light gray with black spots; soft.

SS 5-47
55% F Tr% Fsp Tr% SI
45% N Tr% R

FORAM-NANNO OOZE, very light gray; soft.

N8

SS CC
53% N 1% Gl Tr% SI
45% F 1% R

Explanatory notes in Chapter 2

Site 289 Hole Core 3 Cored Interval: 19.0-28.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
PLEISTOCENE	N22	Gephyrocapsa caribbeanica	Ommatartus tetrathalmus				0				N9, N1, and 5Y 8/1 — FORAM-NANNO OOZE
							1	0.5, 1.0	3	*	N9, N1, and 5Y 8/1, 5G 5/1 — NANNO-FORAM OOZE, yellowish gray, light greenish gray, and very light gray, with black spots; soft. H_2S gas abundant. SS 1-75: 60% F, 37% N, 2% R, 1% SI, Tr% D, Tr% S
							2				
	N22			F	A	e-	3			*	RAD BEARING NANNO-FORAM OOZE, yellowish gray, light greenish gray, and very light gray with black spots; soft. SS 3-75: 63% F, 30% N, 5% R, 2% SI, Tr% Fsp
	N22			F	A	e-	4				
LATE PLIOCENE				F	A	e-	5			*	NANNO-FORAM OOZE, yellowish gray, light greenish gray, very light gray, and black spots; soft. SS 5-75: 59% F, 40% N, 1% R, Tr% Gl, Tr% Opaq, Tr% SI
							6			*	$CaCO_3$ 6-80 (90). NANNO-FORAM OOZE, very light gray; soft.
	N21			F / R / N	A / F / A	e- / g- / g-	Core Catcher			*	N8 — SS CC: 52% F, 46% N, 2% Opaq, Tr% Fsp, Tr% SI

Site 289 Hole Core 4 Cored Interval: 28.5-38.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
LATE PLIOCENE		Gephyrocapsa caribbeanica	Ommatartus tetrathalmus				0					
							1	0.5, 1.0	Empty	3		N8; N9, 5Y 8/1, N1, 5G 8/1 swirled
							2				*	NANNO-FORAM OOZE, white, yellowish gray, light greenish gray, black spots; soft. SS 2-92: 54% F, 45% N, 1% R, Tr% Fsp, Tr% D, Tr% S, Tr% SI
				N		-	3					$CaCO_3$ 3-119 (91); Grain Size 3-125 (9.4, 30.9, 59.7)
				N / R		- / -	4				*	NANNO-FORAM OOZE, white, yellowish gray, light greenish gray, black spots; soft. SS 4-75: 65% F, 32% N, 2% R, 1% S, Tr% Gl, Tr% D, Tr% SI
		Pseudoemiliania lacunosa	Pterocanium prismatium	N		-	5					5B 9/1 (bluish white), 5G 8/1, N1, 5Y 8/1 swirled
		Discoaster brouweri (C. macintyrei Subzone)					6					NANNO-FORAM OOZE, very light gray; soft.
	N21			F / R / N	A / F / A	e- / g- / g-	Core Catcher				*	N8 — SS CC: 50% F, 46% N, 2% R, 2% SI, Tr% Opaq, Tr% D, Tr% S

Explanatory notes in Chapter 2

Site 289 Hole Core 5 Cored Interval: 38.0-47.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
LATE PLIOCENE	N21	Discoaster brouweri	Pterocanium prismatium	N	A	g-	0, 1	0.5, 1.0		3	*	5B 9/1, 5G 8/1, N1 swirled 5Y 8/1 + 5G 6/1
												NANNO-FORAM OOZE, white, yellowish gray, greenish gray, black spots; soupy to soft. SS 1-120: 55% F, 43% N, 1% Fsp, 1% Gl, 1% SI, Tr% Py, Tr% R, Tr% S, Tr% Calc S.
							2					pyrite abundant
				N	A	g-	3				*	NANNO-FORAM OOZE, colors as above; soft. SS 3-75: 55% F, 41% N, 2% R, 2% S, Tr% Gl, Tr% Opaq, Tr% D, Tr% SI
							4					5Y 7/3 (pale yellow) N8 N1 5G 6/1 swirled
							5				*	NANNO-FORAM OOZE, pale yellow, very light gray, greenish gray, with black spots; soft. SS 5-62: 55% F, 42% N, 1% Py, 1% R, 1% SI, Tr% D, Tr% S
							6					N9
				F R N	A F A	g- g- g-	Core Catcher				*	N8. NANNO-FORAM OOZE, very light gray; soft. SS CC: 50% F, 46% N, 2% R, 1% S, 1% SI, Tr% Gl, Tr% D

Site 289 Hole Core 6 Cored Interval: 47.5-57.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
LATE PLIOCENE	N21	Discoaster brouweri	Pterocanium prismatium				0, 1	0.5, 1.0	Empty	3	*	N9 5Y 8/1 5B 9/1 5G 8/1 swirled. NANNO-FORAM OOZE, white, yellowish gray, bluish white, light greenish gray; soft. SS 1-93: 60% F, 39% N, 1% R, Tr% Fsp, Tr% Gl, Tr% D, Tr% S, Tr% SI. $CaCO_3$ 1-89 (90). Grain Size 1-93 (8.3, 27.1, 64.6)
							2					+N1 >5G 8/1
							3				*	NANNO-FORAM OOZE, white, yellowish gray, bluish white, light greenish gray; soft. SS 3-75: 65% F, 35% N, Tr% Gl, Tr% Opaq, Tr% R, Tr% S, Tr% SI. H_2S abundant
							4				*	NANNO-FORAM OOZE, colors as above; soft. SS 4-75: 54% F, 45% N, 1% R, Tr% Fsp, Tr% S, Tr% SI
							5					H_2S
							6					NANNO-FORAM OOZE, very light gray; soft. SS CC: 57% F, 40% N, 2% R, 1% S, Tr% Fsp, Tr% Gl, Tr% D, Tr% SI
				F R N	A F A	e- g- m-	Core Catcher				*	N8

Explanatory notes in Chapter 2

Site 289 Hole Core 7 Cored Interval: 57.0-66.5 m

AGE | FORAMS / NANNOS / RADS | FOSSIL CHARACTER (FOSSIL, ABUND., PRES.) | SECTION | METERS | LITHOLOGY | DEFORMATION | LITHO.SAMPLE | LITHOLOGIC DESCRIPTION

Age: LATE PLIOCENE

Zones: Forams: N21; Nannos: Discoaster brouweri, Discoaster pentaradiatus, Discoaster tamalis; Rads: Spongaster pentas

Section	Fossil	Abund.	Pres.
0			
1			
2	N		–
2	N	A	g–
3	R		–
4			
5	N	A	g–
6	N		–
Core Catcher	F	A	e
	R	F	g
	N	A	g

Meters: 0.5, 1.0

Litho. sample: Section 1 (*, 3); Section 4 (*); Core Catcher (*)

N9, 5Y 8/1,
5B 9/1
5G8/1
N1

H_2S

NANNO-FORAM OOZE, white, yellowish gray, bluish white, light greenish gray, black spots; soft.

H_2S

SS 1-75

60% F	1% R	Tr% D
37% N	Tr% Fsp	Tr% S
1% Gl	Tr% HM	Tr% SI

H_2S (Section 2)

H_2S (Section 3)

NANNO-FORAM OOZE, colors as above; soft.

SS 4-75

55% F	1% Gl	Tr% Fsp	Tr% S
43% N	1% R	Tr% Opaq	Tr% SI

H_2S (Section 5)

H_2S (Section 6)

NANNO-FORAM OOZE, very light gray; soft.

SS CC

50% F	2% R	1% Opaq	Tr% SI
45% N	2% S	Tr% Gl	

N8

Site 289 Hole Core 8 Cored Interval: 66.5-76.0 m

AGE | FORAMS / NANNOS / RADS | FOSSIL CHARACTER (FOSSIL, ABUND., PRES.) | SECTION | METERS | LITHOLOGY | DEFORMATION | LITHO.SAMPLE | LITHOLOGIC DESCRIPTION

Age: LATE PLIOCENE

Zones: Forams: N19-N21; Nannos: Discoaster tamalis; Rads: Spongaster pentas

Section	Fossil	Abund.	Pres.
Core Catcher	F	A	e–
	N	A	m–

Meters: 0.5, 1.0

Deformation: 3 (Section 1)

Litho. sample: Section 1 (*); Core Catcher (*)

FORAM-NANNO OOZE, soft/stiff. Color as below and above.

N9, 5Y 8/1,
5B 9/1, 5G 8/1,
N1

NANNO-FORAM OOZE, white, yellowish gray, bluish white, light greenish gray, black spots; soft.

H_2S

SS 1-75

60% F	1% R	Tr% Gl	Tr% S
38% N	1% SI	Tr% Opaq	

Grain Size 1-50 (7.8, 33.0, 59.2)

$CaCO_3$ 1-55 (91)

H_2S

X-ray 1-60

12% Amor	88% Cryst	100% Calc

H_2S (Section 3)

H_2S

NANNO-FORAM OOZE, color as above; stiff.

SS 4-75

55% F	Tr% Fsp	Tr% R	Tr% SI
45% N	Tr% Gl	Tr% S	

H_2S (Section 5)

N8
5GY 8/1 (light greenish gray)

5Y 8/1

H_2S, strong smell

NANNO-FORAM OOZE, very light gray; soft/stiff.

SS CC

50% F	1% R	1% SI	Tr% Opaq
47% N	1% S	Tr% Fsp	Tr% D

N8

Explanatory notes in Chapter 2

Site 289 Hole Core 9 Cored Interval: 76.0-85.5 m

AGE	FORAMS / NANNOS / RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
					0					5Y 8/1, 5GY 8/1, N1, N9 NANNO-FORAM OOZE, stiff. H_2S.
LATE PLIOCENE	N19-N21 / Discoaster tamalis / Spongaster pentas				1	0.5, 1.0		3	*	5Y 8/1, 5GY 8/1, N1, N9 swirled. H_2S. NANNO-FORAM OOZE, yellowish gray, light greenish gray, black, white, stiff (minor soupy). SS 1-72: 60% F, 39% N, 1% R, Tr% Fsp, Tr% Gl, Tr% S, Tr% SI
					2					H_2S
					3			3		
					4				*	H_2S. NANNO-FORAM OOZE, color as above, stiff. SS 4-75: 65% F, 34% N, 1% R, 1% S, Tr% Fsp, Tr% Gl, Tr% Opaq, Tr% D, Tr% SI
					5					H_2S
		F / R / N	A / F / A	e- / g- / m-	Core Catcher				*	H_2S. N8. NANNO-FORAM OOZE, very light gray; soft/stiff. SS CC: 50% F, 48% N, 1% R, 1% SI, Tr% Gl, Tr% Opaq, Tr% Calc S., Tr% D, Tr% S

Site 289 Hole Core 10 Cored Interval: 85.5-95.0 m

AGE	FORAMS / NANNOS / RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
					0					
EARLY PLIOCENE	N19 / Discoaster tamalis / Reticulofenestra pseudoumbilica / Spongaster pentas	F	A	e-	1	0.5, 1.0	Empty	3	* *	5Y 8/1, 5GY 8/1, N1, N9, N8 swirled. H_2S. NANNO-FORAM OOZE, yellowish gray, light greenish gray, black, light gray, white; stiff. SS 1-85: 54% F, 46% N, Tr% Gl, Tr% R, Tr% S, Tr% SI
		F	A	e-	2					H_2S. Black spot = pyrite spheres and clay-size particles. SS 2-9.5
		N		-	3					H_2S. $CaCO_3$ 3-70 (93). Grain Size 3-80 (12.2, 36.7, 51.1)
		N		-	4					H_2S
		N	A	m-	5					H_2S. NANNO-FORAM OOZE, very light gray; stiff. SS CC: 55% F, 44% N, 1% Opaq, Tr% Fsp, Tr% R, Tr% S, Tr% SI
		F / R / N	A / F / A	e- / f- / m-	Core Catcher				*	N8

Explanatory notes in Chapter 2

Site 289 Hole Core 11 Cored Interval: 95.0-104.5 m

AGE: EARLY PLIOCENE

FORAMS: N19 | NANNOS: Reticulofenestra pseudoumbilica | RADS: Spongaster pentas

FOSSIL CHARACTER (Core Catcher): F A g- ; R F p- ; N A m-

SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
0					
1	0.5–1.0		3	*	5Y 8/1, 5GY 8/1, N1, N8, N9 swirled; H_2S
2					
3		Empty			H_2S
4			2, 3, 2, 5		H_2S
5			3		H_2S
Core Catcher				*	N8

NANNO-FORAM OOZE, yellowish gray, light greenish gray, black, light gray, white; stiff.

SS 1-75
69% F 2% R 1% Gl Tr% D
26% N 2% S Tr% Fsp Tr% SI

NANNO-FORAM OOZE, very light gray; stiff.

SS CC
47% N 1% Py 1% SI
35% F 1% S

Site 289 Hole Core 12 Cored Interval: 104.5-114.0 m

AGE: EARLY PLIOCENE

FORAMS: N19 | NANNOS: Reticulofenestra pseudoumbilica | RADS: Spongaster pentas

FOSSIL CHARACTER (Core Catcher): F A g- ; R F g- ; N A g-

SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
0					
1	0.5–1.0	Empty	3		N9, minor 5Y 8/1, 5GY 6/1 few black spots - N1 swirled
2				*	
3					H S
4					H S
5					
6					N9, 5Y 8/1, 5GY 8/1, N1 swirled
Core Catcher				*	N8

NANNO-FORAM OOZE, white with minor yellowish gray and greenish gray; soft.

SS 2-75
60% F 1% SI Tr% S
38% N 1% Fsp

$CaCO_3$ 2-70 (94)

Grain Size 2-89 (12.1, 34.5, 53.4)

NANNO-FORAM OOZE, very light gray, soft/stiff.

SS CC
55% F Tr% Opaq Tr% R Tr% SI
45% N Tr% M Tr% S

Explanatory notes in Chapter 2

Site 289 Hole Core 13 Cored Interval: 114.0-123.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
							0					
EARLY PLIOCENE	N19	Reticulofenestra pseudoumbilica	Spongaster pentas				1	0.5, 1.0	Empty	3		N9 5Y 8/1 5GY 8/1 N1 swirled
							2				*	FELDSPAR BEARING NANNO-FORAM OOZE, white, yellowish gray, greenish gray, with black spots; soft/stiff. SS 2-75 60% F 4% Fsp Tr% Gl 34% N 2% R Tr% S
							3					
							4					NANNO-FORAM OOZE, very light gray; soft. SS CC 55% F 2% SI 1% Py 1% R 38% N 1% Gl 1% D 1% S
				F N	A A	e- m-	Core Catcher				*	N8

Site 289 Hole Core 14 Cored Interval: 123.5-133.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
							0			3		NANNO-FORAM OOZE
EARLY PLIOCENE	N18	Ceratolithus rugosus	Spongaster pentas	N		-	1	0.5, 1.0		3		N9
							2				*	N9 N1 5Y 8/1 5GY 8/1 swirled H_2S NANNO-FORAM OOZE, white, yellowish gray, greenish gray, black spots; soft/soupy. SS 2-75 55% F 2% S Tr% Fsp Tr% SI 42% N 1% R Tr% D Grain Size 2-10 (4.0, 32.1, 63.9) $CaCO_3$ 2-13 (94)
							3					H_2S - stiff
							4					H_2S
							5					H_2S
							6					H_2S NANNO-FORAM OOZE, very light gray, stiff. SS CC 55% F 2% R Tr% Fsp Tr% D 42% N 1% S Tr% Opaq Tr% SI
				F N	A A	g- m-	Core Catcher				*	N8

Explanatory notes in Chapter 2

Site 289 Hole Core 15 Cored Interval: 133.0-142.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
							0					
EARLY PLIOCENE	N18	Ceratolithus rugosas	Spongaster pentas				1	0.5 1.0	Empty	3	*	N9, 5Y 8/1 swirled — NANNO-FORAM OOZE, white and yellowish gray; soft. SS 1-100: 55% F, 2% R, 1% S, Tr% SI; 41% N, 1% Fsp, Tr% D
							2					
							3					H_2S
							4					NANNO-FORAM OOZE, very light gray; soft. SS CC: 40% N, 2% R, 1% Py; 35% F, 1% Fsp, 1% SI
				F R N	A C A	g- g- m-	Core Catcher				*	N8

Site 289 Hole Core 16 Cored Interval: 142.5-152.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
							0					
EARLY PLIOCENE	N18	Ceratolithus acutus Szone					1	0.5 1.0		3		N9, 5Y 8/1 swirled — NANNO-FORAM OOZE N9, N1, 5GY 8/1, 5Y 8/1 swirled
							2				*	RAD BEARING NANNO-FORAM OOZE, yellowish gray, white, greenish gray, with black spots; stiff. SS 2-75: 55% F, 3% R, 1% S, Tr% Py; 39% N, 1% Fsp, 1% SI, Tr% D. $CaCO_3$ 2-20 (95). Grain Size 2-40 (8.3, 36.6, 55.1). X-ray 2-40: 10% Amor, 90% Cryst, 100% Calc
							3					H_2S
				N R		- -	4					
		Triquetrorhabdulus rugosus Szone	Stichocorys peregrina	N		-	5					H_2S
							6					H_2S — NANNO-FORAM OOZE, very light gray; stiff. SS CC: 55% F, 1% Gl, 1% R, 1% SI; 40% N, 1% Py, 1% S
				F R N	A A A	g- g- m-	Core Catcher				*	N8

Explanatory notes in Chapter 2

Site 289 Hole Core 17 Cored Interval: 152.0-161.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
							0					
EARLY PLIOCENE	N18	Triquetrorhabdulus rugosus Subzone	Stichocorys peregrina	F	C	g-	1	0.5, 1.0		3		N9; 5Y 8/1 swirled
				N		-	2				*	N9 swirled; 5Y 8/1; N1; 5GY 8/1
				N		-	3					H_2S
							4					
	N18			F	A	g-	5		Empty	4/3, 3		N9, with N1 - spots, soft and soupy; H_2S
	N18	Discoaster quinqueramus		F	A	g-	6					N9, N1 (spots); 5Y 8/1, 5GY 8/1 swirled; H_2S
LATE MIOCENE	N17			F, R, N	A, A, A	g-, g-, m-	Core Catcher				*	N8

NANNO-FORAM OOZE, white, yellowish gray, light greenish gray, black spots; stiff.

SS 2-75

55% F	1% R	Tr% Fsp	Tr% Py
43% N	1% S	Tr% Gl	

NANNO-FORAM OOZE, very light gray; stiff.

SS CC

55% F	2% R	Tr% Fsp	Tr% SI
42% N	1% S	Tr% Opaq	

Site 289 Hole Core 18 Cored Interval: 161.5-171.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
							0					
LATE MIOCENE		Discoaster quinqueramus	Stichocorys peregrina				1	0.5, 1.0	Empty	3		N9; N9, 5Y 8/1; N1 swirled; H_2S
							2				*	+5GY 8/1; H_2S
							3					H_2S
							4					H_2S
							5					H_2S
	N17			F, R, N	A, A, A	f-, g-, m-	Core Catcher				*	N8

RAD BEARING NANNO-FORAM OOZE, white, yellowish gray, greenish gray, with black spots; stiff.

SS 2-75

60% F	1% S	Tr% Py
36% N	Tr% Fsp	Tr% D
3% R	Tr% Gl	Tr% SI

$CaCO_3$ 2-35 (95)

Grain Size 2-40 (8.5, 35.0, 56.5)

RAD BEARING NANNO-FORAM OOZE, very light gray; stiff.

SS CC

55% F	3% R	1% Fsp
39% N	2% Gl	Tr% HM

Explanatory notes in Chapter 2

Site 289 Hole Core 19 Cored Interval: 171.0-180.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
							0					
LATE MIOCENE	N17	Discoaster quinqueramus	Stichocorys peregrina				1	0.5, 1.0	Empty	3		N9, 5Y 8/1, N1, 5GY 8/1 swirled; H_2S
							2					H_2S
							3				*	H_2S RAD BEARING NANNO-FORAM OOZE, white, yellowish gray, greenish gray, with black spots; stiff. SS 3-75: 55% F, 39% N, 3% R, 1% Fsp, 1% S, 1% SI
							4					H_2S NANNO-FORAM OOZE, very light gray; stiff. SS CC: 55% F, 43% N, 1% Gl, 1% Opaq, 1% R, Tr% S, Tr% SI
				F / R / N	A / F / A	g- / m- / g-	Core Catcher				*	N8

Site 289 Hole Core 20 Cored Interval: 180.5-190.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
							0					
LATE MIOCENE	N17	Discoaster quinqueramus	Stichocorys peregrina				1	0.5, 1.0		3		N9 NANNO-FORAM OOZE, soft. N9, N1, 5Y 8/1 swirled, stiff H_2S
							2				*	RAD BEARING NANNO FORAM OOZE, white, black spots, yellowish gray; stiff. SS 2-75: 50% F, 46% N, 3% R, 1% S, Tr% Gl, Tr% D, Tr% SI. H_2S $CaCO_3$ 2-53 (96). Grain Size 2-56 (7.8, 24.1, 68.1). X-ray 2-60: 7% Amor, 93% Cryst, 100% Calc
							3					H_2S
							4					H_2S
							5					H_2S
							6					H_2S NANNO-FORAM OOZE, very light gray; stiff. SS CC: 65% F, 32% N, 2% R, 1% Gl, Tr% Py, Tr% S, Tr% SI
				F / R / N	A / F / A	e- / m- / f-	Core Catcher				*	N8

Explanatory notes in Chapter 2

Site 289 Hole Core 21 Cored Interval: 190.0-199.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
							0		Empty			
LATE MIOCENE	N17	Discoaster quinqueramus	Stichocorys peregrina				1	0.5, 1.0		3		N9, N1 5Y 8/1 swirled; H_2S
							2					H_2S
				F R N	A F A	e- m- m-	Core Catcher				*	N8

NANNO-FORAM OOZE, very light gray; stiff.

SS CC
55% F 1% R Tr% S
44% N Tr% Fsp Tr% SI

Site 289 Hole Core 22 Cored Interval: 199.5-209.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
							0					
LATE MIOCENE	N17		Stichocorys peregrina	F	A	g-	1	0.5, 1.0	Empty	3		N9, N1 5Y 8/1 swirled
	N16			F	A	g-	2				*	H_2S
				R		-	3					H_2S
			Ommatartus antepenultimus*				4					H_2S
	N16	Discoaster quinqueramus	Ommatartus antepenultimus	F R N	A F A	e- p- m-	Core Catcher				*	N8

NANNO-FORAM OOZE, white, yellowish gray, with black spots; stiff.

SS 2-75
55% F Tr% Fsp Tr% Nod Tr% S
45% N Tr% Gl Tr% R

$CaCO_3$ 2-122 (96)

Grain Size 2-122 (9.2, 38.6, 52.2)

NANNO-FORAM OOZE, very light gray; stiff.

SS CC
60% F 1% Fsp
38% N 1% R

*(O. penultimus zone not recognizable)

Site 289 Hole Core 23 Cored Interval: 209.0-218.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
							0		Empty			
LATE MIOCENE			Ommatartus antepenultimus				1	0.5, 1.0		4/3, 3	*	← disturbed NANNO FORAM OOZE; N9
							2			3		
							3			3		
							4			3		
							5			3		
		Discoaster quinqueramus					6					
	N16			F R N	A F A	e- g- m-	Core Catcher				*	N9

NANNO-FORAM OOZE, white, with swirls of yellow gray (5Y 8/1) and black (N1); stiff. H_2S smell in all sections.

SS 1-90
50% F 1% R Tr% SI
49% N Tr% S Tr% Fsp

NANNO-FORAM OOZE, white.

SS CC
50% F 2% R Tr% Fsp
48% N Tr% S

Explanatory notes in Chapter 2

Site 289 Hole Core 24 Cored Interval: 218.5-228.0 m

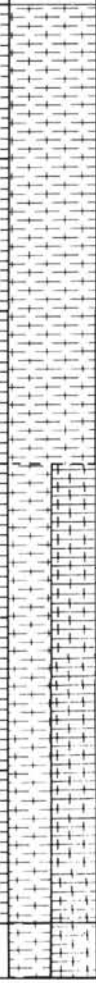
AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE		LITHOLOGIC DESCRIPTION
							0						
LATE MIOCENE	N16	Discoaster quinqueramus	Ommatartus antepenultimus				1	0.5 – 1.0	Empty	3		N9	NANNO-FORAM OOZE, white; soft to soupy.
							2			3	*	N9	NANNO-FORAM OOZE, white, with swirl of yellowish gray (5Y 8/1) and black spots (N1), stiff (soft in Section 3); H_2S smell throughout, but weak in Sections 2 and 6. SS 2-75: 50% F, 48% N, 1% R, 1% S, Tr% Fsp $CaCO_3$ 2-23 (96) Grain Size 2-26 (5.5, 24.6, 69.9)
							3			3			
							4			3			
							5			3	*		PYRITE-BEARING FORAM-NANNO OOZE, black spot. SS 5-88 (black spot): 50% N, 45% F, 3% Py, 1% R, 1% S, Tr% Fsp More white (N9) in Section 6.
							6			3			RAD BEARING NANNO-FORAM OOZE, white. SS CC: 50% F, 47% N, 3% R, Tr% S, Tr% Sl
				F R N	A A A	e- g- m-	Core Catcher				*	N9	

Site 289 Hole Core 25 Cored Interval: 228.0-237.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE		LITHOLOGIC DESCRIPTION
							0						
LATE MIOCENE	N16	Discoaster quinqueramus / (Discoaster berggreni Subzone)	Ommatartus antepenultimus	N		-	1	0.5 – 1.0	Empty	3		N9	NANNO-FORAM OOZE, mainly white, with only locally swirls of light yellow gray (5Y 8/1) and some black spots (N1); stiff in Sections 1, 3, and 4, soft in Section 2. H_2S smell varies in strength, but less than former cores. Very weak in Section 4. SS 2-75: 50% F, 49% N, 1% R, Tr% Gl, Tr% Fsp, Tr% S
				N		-	2			3	*		
							3			3			
							4			3			
							5			3			Yellow gray colors have disappeared in Section 5.
				F R N	A A A	e- g- m-	Core Catcher					N9	NANNO-FORAM OOZE, white. SS CC: 60% F, 39% N, 1% Fsp, Tr% Gl, Tr% R, Tr% S

Explanatory notes in Chapter 2

Site 289 Hole Core 26 Cored Interval: 237.5-247.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
LATE MIOCENE	N16	Discoaster berggrenii	Ommatartus antepenultimus	F / R / N	A / A / C	g / g / m	0, 1, 2, 3, 4, 5, 6, Core Catcher	0.5, 1.0		3; 1, 3, 1, 3, 1; 3; 3; 1, 3; 1/3; 1/3	* (Sec. 1); * (CC)	see below

N9 — NANNO-FORAM OOZE, white.

N9 — NANNO-FORAM OOZE, white with black spots (N1). Color swirls; stiff.

SS 1-75
50% F — 1% R
49% N — Tr% S

Section 2: soft and stiff with semilithified lumps. Mottled (both physical and bio-turbated). At 2/145 a burrow cuts lamination.

Section 3: stiff, lithology stays the same.

$CaCO_3$ 3-56 (95)
Grain Size 3-58 (7.0, 42.0, 50.9)

Section 4: stiff with semilithified lumps.

NANNO-FORAM OOZE/CHALK

← burrow at 110

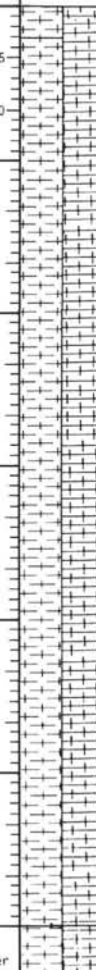
Section 5: stiff and semilithified.

Section 6: same lithology.

NANNO-FORAM OOZE, white.

SS CC
54% F — 1% R — Tr% SI
44% N — 1% S

Site 289 Hole Core 27 Cored Interval: 247.0-256.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
LATE MIOCENE	N16	Discoaster berggrenii; Discoaster neohamatus	Ommatartus antepenultimus	N, N; R / N	A / A	g / m	0, 1, 2, 3, 4, 5, 6, Core Catcher	0.5, 1.0		4; 1/3; 1/3; 1/3; 1/3; 1/3; 1/3	* (Sec. 1); ** (Sec. 3); * (CC)	see below

N9 — NANNO-FORAM OOZE, white with black spots; soupy in Section 1. Color swirls.

SS 1-100
50% F — 2% S — Tr% Fsp
47% N — 1% R — Tr% Gl(?)

Section 2: stiff and semilithified.

Section 3: stiff and semilithified, swirled.

NANNO-FORAM OOZE, white (N9) with black (N1) spots.

SS 3-75
49% F — 2% S — Tr% Fsp
48% N — 1% R

RAD AND SPONGE SPICULE BEARING NANNO-FORAM OOZE, yellowish gray (5Y 8/1) spot.

SS 3-76
50% F — 3% R — Tr% Fsp
44% N — 3% S — Tr% Gl

Section 4: stiff and semilithified, color swirls.

Section 5: stiff and semilithified, color swirls.

Section 6: stiff and semilithified, white (N9) swirled with yellowish gray (5Y 8/1) and 5GY 8/1 also with black (N1) spots.

N9 — NANNO-FORAM OOZE; white.

SS CC
60% F — 2% R — 1% Fsp — Tr% SI
36% N — 1% S — Tr% D

Explanatory notes in Chapter 2

Site 289 Hole Core 28 Cored Interval: 256.5-266.0 m

AGE | FORAMS / NANNOS / RADS | FOSSIL CHARACTER: FOSSIL, ABUND., PRES. | SECTION | METERS | LITHOLOGY | DEFORMATION | LITHO. SAMPLE | LITHOLOGIC DESCRIPTION

AGE: LATE MIOCENE

FORAMS: N16

NANNOS: Discoaster neohamatus

RADS: Ommatartus antepenultimus

Sections: 0, 1, 2, 3, 4, 5, 6, Core Catcher

Meters: 0.5, 1.0

Deformation: 1/3 (Sections 1–6)

Core Catcher fossil character: F R N – A A A – e g g

NANNO-FORAM OOZE/CHALK

NANNO-FORAM OOZE, white.

SS 1-75			
55% F	2% R	1% Py	Tr% SI
41% N	1% S	Tr% Fsp	

N9 (white) with swirls of 5Y 8/1 (yellowish gray)

also N1 (black) spots

Stiff and semilithified.

$CaCO_3$ 3-63 (95)

Grain Size 3-66 (11.7, 29.8, 58.5)

H_2S

X-ray 3-70		
9% Amor	91% Cyrst	100% Calc

Color as above but also with swirls of 5GY 8/1 (light greenish gray)

- faint parallel laminae 5-135/140
- parallel (color) laminae 6-19
- parallel (color) laminae 6-81/88
  parallel (color) laminae 6-136/142

RAD BEARING NANNO-FORAM OOZE, white.

N9

SS CC		
65% F	5% R	Tr% D
29% N	1% S	Tr% SI

Site 289 Hole Core 29 Cored Interval: 266.0-275.5 m

AGE | FORAMS / NANNOS / RADS | FOSSIL CHARACTER: FOSSIL, ABUND., PRES. | SECTION | METERS | LITHOLOGY | DEFORMATION | LITHO. SAMPLE | LITHOLOGIC DESCRIPTION

AGE: LATE MIOCENE

FORAMS: N16

NANNOS: Discoaster neohamatus

RADS: Ommatartus antepenultimus

Sections: 0, 1, 2, 3, Core Catcher

Meters: 0.5, 1.0

Deformation: 1/3, 1, 3, 1, 1/0

Core Catcher fossil character: F R N – A A A – e- g- m-

NANNO-FORAM OOZE/CHALK

N9

NANNO-FORAM OOZE, white, stiff and semi-lithified.

SS 1-75		
60% F	2% R	1% Fsp
36% N	1% SI	

Parallel banding/laminae. White (N9) with swirls of 5Y 8/1 (yellowish gray) and 5GY 8/1 (light greenish gray) also black spots (N1).

N8

White (N8) with 5Y 8/1, 5GY 8/1 and N1 as above. Also swirls of pale purple (5RP 7/2). Parallel laminae.

Section 3: thin parallel laminae of greenish gray and pale purple alternate with medium/thick (2 cm) beds of white.

RAD BEARING NANNO-FORAM OOZE, white.

N9

SS CC			
60% F	4% R	Tr% D	Tr% SI
35% N	1% S	Tr% Fsp	

Explanatory notes in Chapter 2

Site 289 Hole Core 30 Cored Interval: 275.5-285.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
LATE MIOCENE	N16	Discoaster neohamatus	Ommatartus antepenultimus				0					
							1	0.5, 1.0	Empty	4/3, 3, 0		N9 (white); N9 + parallel laminae
							2			1/3, 1/2	*, *	
							3			3, 0, 3, 0		N9; N9 and color swirled; N9; N9 and color swirled
				F R N	A A A	e- g- g-	Core Catcher				*	N9

NANNO-FORAM OOZE/CHALK

soft
white, black, pale purple - swirled

stiff

White, light greenish gray (5G 8/1), pale purple (5RP 7/2) - swirled.

RAD BEARING NANNO-FORAM OOZE, white, stiff and semilithified.

SS 2-75			
60% F	3% R	1% S	Tr% Gl
35% N	1% D	Tr% Fsp	Tr% SI

RAD BEARING NANNO-FORAM OOZE, from pale purple laminae.

SS 2-128			
55% F	5% R	1% S	Tr% Fsp
37% N	1% Py	1% SI	

CaCO$_3$ 3-108 (93)

Grain Size 3-110 (8.8, 47.0, 44.2)

NANNO-FORAM OOZE, white.

SS CC		
58% F	2% Py	Tr% Fsp
36% N	1% S	Tr% D
2% R	1% Gl	Tr% SI

Site 289 Hole Core 31 Cored Interval: 285.0-294.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
LATE MIOCENE	N16	Discoaster neohamatus	Ommatartus antepenultimus				0					
							1	0.5, 1.0	Empty	3, 1/2		N9 with N1 spots; 5G 8/1, 5RP 7/2
							2			0/2	75 *	H$_2$S
							3			0/2		
							4			0/2		
							5			0/2		
							6			0/2		
				F R N	A A C	e- g- m-	Core Catcher				*	N9

NANNO-FORAM OOZE/CHALK, white, stiff-semilithified.

swirls at 1/90, 1/110 parallel laminae (of green and pale purple)

also 5Y 8/1 (yellowish gray) swirls

RAD BEARING NANNO OOZE, white.

SS 2-75			
55% F	3% R	1% SI	Tr% Py
40% N	1% S	Tr% Fsp	

+ parallel laminae

+ parallel laminae

+ parallel laminae

+ parallel laminae

+ parallel laminae

+ parallel laminae

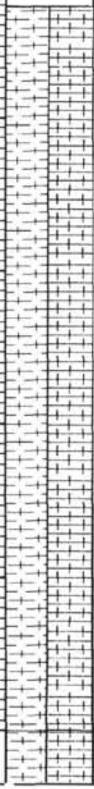
+ parallel laminae
+ parallel laminae
+ parallel laminae
+ parallel laminae
+ parallel laminae
+ parallel laminae
+ parallel laminae
+ parallel laminae
+ parallel laminae
+ parallel laminae

RAD BEARING NANNO-FORAM OOZE, white.

SS CC			
60% F	3% R	Tr% Gl	Tr% SI
36% N	1% S	Tr% D	

Explanatory notes in Chapter 2

Site 289 Hole Core 32 Cored Interval: 294.5-304.0 m

AGE	ZONE		FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0		Empty			
LATE MIOCENE	N16	Cannartus petterssoni	F R	A	e-	1	0.5, 1.0		3		N9 (N1, 5G 8/1, 5Y 8/1, 5RP 7/2 swirls) NANNO-FORAM OOZE/chalk, soft.
						2			0/2	75 *	RAD BEARING NANNO-FORAM CHALK, white with swirls of light greenish gray, yellowish gray, pale purple and black. Stiff-semi lithified. Parallel laminae at: 1/104,120; 2/24,50,120; 3/3-5, 36, 92, 110; 4/30, 85; and 5/28, 130-132. SS 2-75: 55% F, 39% N, 3% R, 1% Fsp, 1% S, 1% SI, Tr% D
						3			0/2		$CaCO_3$ 3-64 (93); Grain Size 3-66 (11.4, 46.5, 42.1); CHERT granule, medium gray (N6) at 3/100-102.
						4			0/2		
	N16 / N15	Discoaster neohamatus	F	A	e-	5			0/2		RAD BEARING NANNO-FORAM OOZE, white.
			F R N	A A A	e- g- m-	Core Catcher				*	N9. SS CC: 59% F, 37% N, 4% R, Tr% Fsp, Tr% D, Tr% S, Tr% SI

Site 289 Hole Core 33 Cored Interval: 304.0-313.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
							0					
LATE MIOCENE		Discoaster neohamatus	Cannartus petterssoni				1	0.5, 1.0		0/1	75 *	N9, N1, 5Y 8/1, 5GY 8/1, 5RP 7/2. NANNO-FORAM OOZE, white (N9), black spots (N1), yellowish gray (5Y 8/1), light greenish gray (5GY 8/1), and pale purple (5RP 7/2); stiff/semilithified; most of section is white, black occurs only in spots, light greenish gray and pale purple occurs as thin (1-2 mm) laminae, separated by medium thick (1-3 cm) bands of white, yellowish gray occurs as mottles. Parallel laminae at 1/60, 1/70, 1/110, and 1/140. SS 1-75 (nanno-foram ooze): 60% F, 37% N, 2% R, 1% S
							2			0/1		parallel laminae at 2/90
							3			0/1		parallel laminae at 3/130
				N		-	4			0/1		
		Catinaster calyculus Szone		N		-	5			0/1		parallel laminae at 5/92-95, 5/140-150; chert granules at 5/75-77, 5/87
							6			0/1		parallel laminae at 6/85-93, 6/104-106, 6/130. NANNO-FORAM OOZE, white.
MIDDLE MIOCENE	N15			F R N	A A A	e- m- m-	Core Catcher				*	White (N9). SS CC: 55% F, 44% N, 1% S, Tr% R, Tr% Py

Explanatory notes in Chapter 2

Site 289 Hole Core 34 Cored Interval: 313.5-323.0 m

AGE: MIDDLE MIOCENE

FORAMS: N15

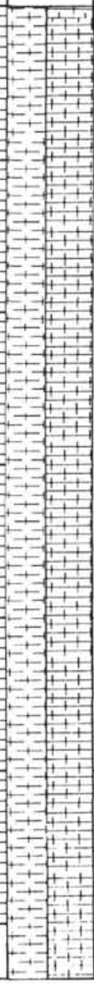
NANNOS: Catinaster calyculus Szone

RADS: Cannartus petterssoni

FOSSIL CHARACTER (Core Catcher): FOSSIL F / R / N; ABUND. A / A / A; PRES. e- / g- / m-

Sections: 0, 1, 2, 3, 4, 5, 6, Core Catcher

METERS: 0.5, 1.0



SECTION	DEFORMATION	LITHO. SAMPLE	COLORS	LITHOLOGIC DESCRIPTION
1	0/1	75 *	N9, N1 5GY 8/1 5Y 8/1 5RP 7/2	NANNO-FORAM OOZE, white (N9), black spots (N1), yellowish gray (5Y 8/1), light greenish gray (5GY 8/1), pale purple (5RP 7/2); stiff/semilithified; most of section is white, black occurs only in spots, light greenish gray and pale purple occur as thin (1-2 mm) laminae, separated by medium thick (1-3 cm) bands of white, yellowish gray occurs as mottles; parallel laminae at 1/20, 1/50, 1/63, and 1/78. SS 1-75 50% F 1% M Tr% S 48% N 1% R
2	0/1			parallel laminae at 2/38-43
3	0/1			parallel laminae at 3/40-43, 3/60-62, 3/80-83, 3/101-104 $CaCO_3$ 3-59 (94) Grain Size 3-60 (3.8, 57.7, 38.6)
4	0/1			yellowish gray (5Y 8/1) mottles
5	0/1			white (N9), black (N1) spots scattered
6	0/1, 2, 0, 2, 0, 2, 0/1	75 *		parallel laminae at 6/40-47, 6/72-77 RAD BEARING FORAM-NANNO OOZE SS 6-75 50% N 3% R Tr% Gl 47% F 1% S Tr% Py
Core Catcher		*	White (N9)	NANNO-FORAM OOZE, white. SS CC 50% F 2% R Tr% S 48% N Tr% Fsp

Site 289 Hole Core 35 Cored Interval: 323.0-332.5 m

AGE: MIDDLE MIOCENE

FORAMS: N15

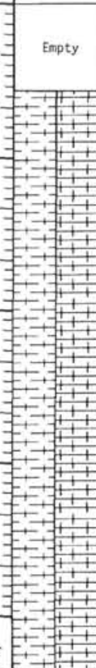
NANNOS: Catinaster calyculus Szone •

RADS: Cannartus petterssoni; N

FOSSIL CHARACTER (Core Catcher): FOSSIL F / R / N; ABUND. A / A / A; PRES. e- / g- / m-

Sections: 0, 1, 2, 3, 4, Core Catcher

METERS: 0.5, 1.0



SECTION	DEFORMATION	LITHO. SAMPLE	COLORS	LITHOLOGIC DESCRIPTION
1	2, 0		N9 N1 5Y 8/1 5GY 8/1 5RP 7/2	FORAM-NANNO OOZE, white (N9), black spots (N1), yellowish gray (5Y 8/1), light greenish gray (5GY 8/1), pale purple (5RP 7/2). Semilithified, most of section is white, black occurs only in spots, light gray and pale purple occur as thin (1-2 mm) laminae, separated by medium thick (1-3 cm) bands of white, yellowish gray occurs as mottles. parallel laminae 1/87-1/90
2	0/1		N9	parallel laminae 2/105
3	0/1	62 *		FORAM-NANNO OOZE, white (N9) only, Section 3; no parallel laminae; stiff/semilithified. SS 3-62 53% N 1% M Tr% S 45% F 1% R
4	0/1			colors same as Sections 1 and 2 parallel laminae 4/57-59, 4/110
Core Catcher		*	White (N9)	NANNO-FORAM OOZE, white. SS CC 55% F 2% R 1% S Tr% D 40% N 1% Fsp 1% SI

Explanatory notes in Chapter 2

• Helicopontosphaera kamptneri

Site 289 Hole Core 36 Cored Interval: 332.5-342.0 m

AGE: MIDDLE MIOCENE

FORAMS: N15 / N14 (Core Catcher: N14)

NANNOS: Helicopontosphaera kamptneri Subzone

RADS: Cannartus petterssoni

Section	Fossil	Abund.	Pres.	Deformation	Litho. Sample	Color	Lithologic Description
0							NANNO-FORAM OOZE, white (N9), as above and below.
1				1, 2, 1		N9, N1	NANNO-FORAM OOZE, white (N9), black (N1) spots; no laminae; stiff.
2	F	A	e-	0, 2, 0, 2, 0, 2, 0, 1	75 *	N9	Same as in Section 1. NANNO-FORAM OOZE, white; stiff/semi-lithified. SS 2-75: 50% F, 47% N, 2% R, 1% M, Tr% S
3				1/2, 0/1			Same as in Section 2. $CaCO_3$ 3-63 (94). Grain Size 3-66 (6.1, 50.4, 43.5). X-ray 3-70: 7% Amor, 93% Cryst, 100% Calc
4	F	A	e-	0, 0/1			Section 4: white (N9), black (N1) spots, greenish gray (5GY 8/1) and pale purple (5RP 7/2) in parallel laminae; semi-lithified/stiff; parallel laminae at 4/80, 4/90, and 4/100.
5	F	A	e-	1, 0, 1, 0, 1, 0/1			Section 5: white (N9) only; no parallel laminae.
6				1, 0/1, 1			Section 6: 6/0-100, like Section 5; 6/100-150, white (N9), black (N1) spots, greenish gray (5G 6/1) parallel laminae, very light gray (N8) band, parallel laminae at 6/104.
Core Catcher	F / R / N	A / A / A	e- / g- / f-		*	White (N9)	NANNO-FORAM OOZE, white. SS CC: 55% F, 41% N, 2% R, 1% S, 1% Sl, Tr% Py, Tr% D

Meters: 0.5, 1.0

Site 289 Hole Core 37 Cored Interval: 342.0-351.5 m

AGE: MIDDLE MIOCENE

FORAMS: N14 / N13

NANNOS: Catinaster coalitus / Discoaster exilis

RADS: Cannartus petterssoni

Section	Fossil	Abund.	Pres.	Deformation	Litho. Sample	Color	Lithologic Description
0							NANNO-FORAM OOZE, white (N9), as above and below.
1				1		N9, N7, N8; 5G 6/1; 5RP 7/2	NANNO-FORAM OOZE, white (N9), soft/semilithified.
2				0, 0/1	75 *	N9	Section 2: white (N9), black (N1) spots, light gray (N8) in bands (2-4 cm thick), greenish gray (5G 6/1) and pale purple (5RP 7/2) in parallel laminae; semi-lithified/soft; light gray banding at 2/23-34. RAD BEARING NANNO-FORAM OOZE, white. SS 2-75: 50% F, 45% N, 3% R, 2% M, Tr% Gl, Tr% S. parallel laminae at 2/10-18, 2/58, 2/97-100, 2/119-124, 2/130, and 2/142
3				2, 0, 2, 0, 2, 0, 2			Section 3: same as Section 2; parallel laminae at 3/30-32.
4				1, 0, 1, 0, 1, 0, 1, 0, 1			Section 4: white (N9), black (N1) spots; no laminae.
5	F	A	e-	1, 0, 1			Section 5: like Section 4.
6	N / F / N	A	e-	0, 1, 0, 1, 0, 1, 0			Section 6: white (N9), black (N1) spots, greenish gray (5G 6/1) and light gray (N7) parallel laminae at 6/30-34 and 6/140-142; stiff/semilithified.
Core Catcher	F / R / N	A / A / C	e- / g- / m-		*	White (N9)	NANNO-FORAM OOZE, white. SS CC: 60% F, 36% N, 1% Gl, 1% R, 1% S, 1% Sl, Tr% Fsp

Meters: 0.5, 1.0

Explanatory notes in Chapter 2

Site 289 Hole Core 38 Cored Interval: 351.5-361.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
							0					NANNO-FORAM OOZE, white (N9).
MIDDLE MIOCENE			Cannartus petterssoni				1	0.5 1.0		0 0/1 1 0/1 0/1	*	N9 N1 N7 5G 6/1 — NANNO-FORAM OOZE/CHALK, white (N9), black (N1) spots, greenish gray (5G 6/1) and light gray (N7) parallel laminae. NANNO-FORAM OOZE, white. SS 1-75: 50% F, 47% N, 1% M, 1% R, 1% S. Stiff/semilithified, parallel laminae at 1/4, 1/9, 1/14-27, 1/44-46, 1/75-77, and 1/92-94.
							2			1 0 1 0 1 0 1 0		Section 2: white (N9), black (N1) spots; semilithified/soft; no laminae. N9
							3			1 0 1 0 1 0 1 0 1		Section 3: like Section 1, parallel laminae at 3/72, 3/78; gray bands at 3/99. CaCO3 3-62 (93). Grain Size 3-67 (7.8, 45.9, 46.3)
							4			1/0		N9 + N1 spots — semilithified/stiff
							5			1/0		+5G 6/1 in parallel laminae at 5/144, 147
							6					parallel laminae at 6/104. NANNO-FORAM OOZE, white.
	N13	Discoaster exilis		F R N	A A A	e- g- f-	Core Catcher					White (N9) — SS CC: 60% F, 38% N, 1% R, 1% S, Tr% Py

Site 289 Hole Core 39 Cored Interval: 361.0-370.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
							0					
MIDDLE MIOCENE		Cannartus petterssoni					1	0.5 1.0		0/1		N9, N1 spots, 5G 6/1 in parallel laminae — FORAM-NANNO OOZE, white with black spots and greenish gray in parallel laminae; semilithified/stiff. SS 1-75: 55% N, 47% F, 2% R, Tr% Fsp, Tr% S, Tr% SI
							2			0/1		Parallel laminations at: Section 1-76 to 82; Section 2-33 to 40, 119 to 122, 130; Section 3-29, 58 to 60, 82; Section 4-72 to 78, 114 to 116; Section 5-13, 33 to 35; Section 6-39, 65
							3			0/1		
							4			0/1		semilithified/soft
							5			0/1		semilithified/stiff
							6			0/1		NANNO-FORAM OOZE, white; semilithified/stiff.
	N13	Discoaster exilis		F R N	A A A	f- g- m-	Core Catcher				*	N9 — SS CC: 55% F, 42% N, 1% Nod, 1% R, 1% S, Tr% Fsp, Tr% SI

Explanatory notes in Chapter 2

Site 289 Hole Core 40 Cored Interval: 370.5-380.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	DEFORMATION	LITHO. SAMPLE
							0			
MIDDLE MIOCENE	N13						1	0.5, 1.0	0/1	*
							2		0/1	
				F	A	g-	3		0/1	
			Cannartus petterssoni	F	A	g-	4		0/1	
	N12			F R	A	g-	5		0/1	
							6		0/1	
	N12	Discoaster exilis	Dorcadospyris alata	F R N	A A A	g- g- m-	Core Catcher			*

LITHOLOGIC DESCRIPTION

N9
N1 spots
5G 6/1 in parallel laminae

NANNO-FORAM OOZE/CHALK

NANNO-FORAM OOZE, white, black spots, greenish gray in parallel laminae; semilithified/soft.

SS 1-75

52% F	2% R	Tr% Fsp
45% N	1% S	

semilithified/stiff

semilithified/soft

$CaCO_3$ 3-52 (94)

Grain Size 3-56 (8.3, 52.5, 39.1)

X-ray 3-60
10% Amor 90% Cryst 100% Calc

Parallel laminations at:
Section 1-9 to 14, 31 to 34, 68 to 72, 128 to 129
Section 2-13, 31 to 36, 109, 141 to 144
Section 3-23 to 27
Section 4-24 to 26, 60 to 64, 91 to 95
Section 5-10 to 15

semilithified

N9
N1 spots

semilithified/soft

RAD BEARING NANNO-FORAM OOZE, white; semilithified.

N9

SS CC

60% F	3% R	Tr% Fsp
36% N	1% S	Tr% SI

Site 289 Hole Core 41 Cored Interval: 380.0-389.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	DEFORMATION	LITHO. SAMPLE
							0			
MIDDLE MIOCENE	N12	Discoaster exilis	Dorcadospyris alata				1	0.5, 1.0	0	*
							2		0/1, 0	
				F R N	A A C	e g m	Core Catcher			*

LITHOLOGIC DESCRIPTION

N9
N1 spots
5G 6/1
5RP 6/2 (pale purple) in parallel laminae

NANNO-FORAM CHALK

NANNO-FORAM CHALK, white, with black spots; greenish gray and pale purple in parallel laminations; semilithified.

SS 1-90

65% F	2% R	Tr% Fsp	Tr% D
32% N	1% S	Tr% Py	Tr% SI

Parallel laminations at:
Section 1-55 to 56, 70 to 82
Section 2-1 to 5, 28, 85 to 92, 106 to 108, 133 to 138

RAD BEARING NANNO-FORAM CHALK, white; semilithified.

N9

SS CC

55% F	4% R	1% D	1% SI
37% N	1% Py	1% S	Tr% Fsp

Explanatory notes in Chapter 2

Site 289 Hole Core 42 Cored Interval: 389.5-399.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE MIOCENE	N12	Discoaster exilis	Dorcadospyris alata	F R N	A A C	e g m	0, 1, 2, 3, 4, 5, 6, Core Catcher	0.5, 1.0		0/1 (sections 1–6)	* (section 2), * (core catcher)	see below

N9 NANNO-FORAM OOZE/CHALK
N1 spots
5G 6/1
5RP 6/2 in parallel laminae

semilithified/soft

semilithified/stiff

NANNO-FORAM OOZE, white, black spots, greenish gray and pale purple in parallel laminae; semilithified/stiff.

SS 2-75
50% F 2% R Tr% Fsp Tr% SI
46% N 2% S Tr% D

Parallel laminations at:
Section 1-10 to 14, 40 to 50, 64 to 66, 125 to 134
Section 2-2 to 5
Section 3-71 to 76
Section 4-65 to 67, 103
Section 5-40 to 56, 77 to 83
Section 6-10 to 14, 36 to 42, 50 to 56, 144 to 148

$CaCO_3$ 4-67 (93)
Grain Size 4-90 (15.3, 44.3, 40.5)

RAD BEARING NANNO-FORAM OOZE, white; semilithified/stiff.

SS CC
55% F 5% R 1% D Tr% SI
37% N 1% Fsp 1% S

N9

Site 289 Hole Core 43 Cored Interval: 399.0-408.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE MIOCENE	N12	Discoaster exilis	Dorcadospyris alata	F N	A A	g m	0, 1, 2, 3, 4, 5, 6, Core Catcher	0.5, 1.0		0/1 (sections 1–6)	* (section 1), * (core catcher)	see below

N9 NANNO-FORAM OOZE/CHALK

N9, N1 spots NANNO-FORAM OOZE/CHALK
5G 6/1
5RP 6/2 in parallel laminae

NANNO-FORAM OOZE, white, black spots, greenish gray and pale purple in parallel laminae; semilithified/stiff.

SS 1-75
60% F 2% R Tr% Fsp
37% N 1% S Tr% SI

Parallel laminae at:
Section 1-52 to 60, 75 to 82, 96 to 101, 113 to 121
Section 2-111 to 114, 144 to 146
Section 3-146 to 148
Section 4-35
Section 5-109
Section 6-33 to 35, 98 to 102, 121 to 123, 144 to 149

NANNO-FORAM OOZE, white; semilithified/stiff.

SS CC
50% F 2% S
47% N 1% R

N9

Explanatory notes in Chapter 2

Site 289 Hole Core 44 Cored Interval: 408.5-418.0 m

AGE	ZONE: FORAMS	ZONE: NANNOS	ZONE: RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE MIOCENE	N12	Discoaster exilis	Dorcadospyris alata	F	A	g	0–6	0.5, 1.0		0/1, 0/1, 0, 0/1, 0/1, 3, 0, 3, 0, 3, 0	*	
				N	A	f	Core Catcher				*	

N9 — NANNO-FORAM OOZE/CHALK
5Y 8/1 blebs

NANNO-FORAM CHALK, white, with yellowish gray blebs; semilithified/stiff.

SS 1-75
60% F — 2% R — Tr% D — Tr% Sl
38% N — Tr% Fsp — Tr% S

N9
N1 spots
5G 6/1
5RP 7/2 laminae

Parallel laminae at:
Section 2-34 to 36, 48, 109
Section 3-42 to 43
Section 4-10 to 12, 18 to 20, 26 to 29, 49 to 51

N7 bands

+ 5Y 8/1 blebs

CaCO$_3$ 3-17 (91)
Grain Size 3-20 (22.0, 43.6, 34.4)

N9 — soft

semilithified at 62-68

RAD BEARING NANNO-FORAM OOZE, white; semilithified/soft.

SS CC
65% F — 3% R — Tr% S
32% N — Tr% Fsp

Site 289 Hole Core 45 Cored Interval: 418.0-427.5 m

AGE	ZONE: FORAMS	ZONE: NANNOS	ZONE: RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE MIOCENE	N12 / N11	Discoaster exilis	Dorcadospyris alata	F	A	e	0–6	0.5, 1.0		1, 0, 0/1, 0, 1, 0, 1, 0, 1, 0/1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0/1, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1	*	
	N11			F	A	e						
				N	C	f	Core Catcher				*	

N9 white — NANNO-FORAM OOZE/CHALK

N9 white — NANNO-FORAM OOZE/CHALK
N1 spots, black
5G 6/1 parallel laminae, greenish gray

RAD BEARING NANNO-RICH NANNO OOZE, white.

SS 1-75
70% F — 5% R — 2% S
21% N — 2% M — Tr% D

Semilithified/stiff, parallel laminae at:
Section 1-52 to 57, 60 to 63, 76, 90 to 97, 130
Section 2-2 to 5, 73 to 77, 98 to 103

N9
N1 spots
N1 layers

semilithified

semilithified/stiff
N1 laminae Section 4-52 to 100

N1 laminae Section 5-107 and 121 to 127

SPONGE SPICULE BEARING NANNO-FORAM OOZE, white.

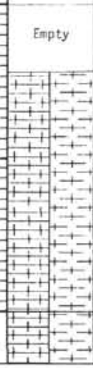
N9

SS CC
50% F — 3% S — Tr% Fsp — Tr% Py
46% N — 1% R — Tr% Gl — Tr% Nod

Explanatory notes in Chapter 2

Site 289 Hole Core 46 Cored Interval: 427.5-437.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE MIOCENE	N11	Discoaster exilis	Dorcadospyris alata	F	A	e	0, 1, 2	0.5, 1.0	Empty	3, 0, 1, 0/1/0, 1, 0, 0/1, 0	*	see below
	N11			F R N	A A A	e g f	Core Catcher				*	



NANNO-FORAM OOZE

N9 white — NANNO-FORAM OOZE, soft.

N9 — NANNO-FORAM CHALK/OOZE, semilithified/stiff.
N1 black spots
5G 6/1 gray-green laminae at Section 1-134

N9 white — semilithified/stiff
5G 6/1 greenish-gray laminae at Section 2-48, 67 to 69, 89 to 105

MICARB AND RAD BEARING NANNO-RICH FORAM CHALK/OOZE, white.

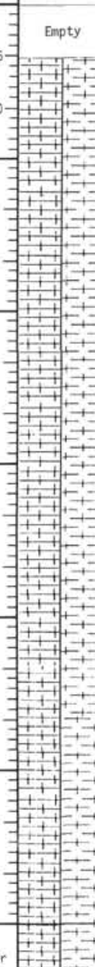
<u>SS 2-75</u>
70% F 3% M 1% S
23% N 3% R

N9 white — NANNO-FORAM OOZE, white.

<u>SS CC</u>
55% F 2% R Tr% Fsp
41% N 2% S Tr% Gl

Site 289 Hole Core 47 Cored Interval: 437.0-446.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE MIOCENE	N11	Discoaster exilis; Sphenolithus heteromorphus	Dorcadospyris alata	N, N, F	A	g	0, 1, 2, 3, 4, 5, 6	0.5, 1.0	Empty	0, 1, 0, 1, 0, 1, 0, 1, 0, 1/0, 1, 1/0	*	see below
				F R N	A A A	e g m	Core Catcher				*	



N9 white — NANNO-FORAM CHALK/OOZE, stiff/semilithified

5G 6/1 greenish-gray laminae at Section 1-141 to 147

As above plus 5Y 8/1 yellowish-gray blebs.

greenish-gray laminae at Section 2-39, 80, 107

black laminae at Section 2-130

N9 — greenish-gray laminae at Section 3-10 to 15, 40-62, 140-142, and 148

<u>$CaCO_3$ 3-27</u> (92)

<u>Grain Size 3-30</u> (20.1, 35.7, 44.3)

MICARB AND RAD BEARING FORAM-NANNO OOZE, white.

<u>SS 3-75</u>
48% N 3% M 1% S
45% F 3% R

* granule of pyrite, cylindrical, possible tube filling of organic organism, ~.5 x .2 x .2 cm

parallel laminae at Section 4-2 to 3, 110 to 111, 120 to 135

parallel laminae at Section 5-15, 50, 89 to 92, 120, 140

parallel laminae at Section 6-20 to 22, 43 to 45, 59 to 61, 80 to 82

N9 — NANNO-FORAM OOZE, white.

<u>SS CC</u>
60% F 1% R Tr% Fsp Tr% Py
38% N 1% S Tr% Gl

Explanatory notes in Chapter 2

Site 289 Hole Core 48 Cored Interval: 446.5-456.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	DEFORMATION	LITHO. SAMPLE
MIDDLE MIOCENE	N10	Sphenolithus heteromorphus	Dorcadospyris alata	F	A	g	1	0.5, 1.0	1/0	*
							2			
							3		2/0	
							4			
							5		1/0	
							6			
	N10			F	A	f	Core Catcher			*
				N	A	m				

LITHOLOGIC DESCRIPTION

NANNO-FORAM CHALK/OOZE

N9 white
5Y 8/1 sparse yellowish-gray blebs
5G 6/1 greenish-gray laminae at Section 1-35, 115

MICARB-BEARING NANNO FORAM CHALK, white.

SS 1-75

55% F	5% M	1% S
38% N	1% R	

semilithified/stiff

parallel laminae at Section 2-100 to 102, 126

N9 white
N1 black spots semilithified/stiff

$CaCO_3$ 3-43 (95)

Grain Size 3-46 (17.7, 31.3, 50.9)

X-ray 3-50
7% Amor 93% Cryst 100% Calc

parallel laminae at Section 4-51, 74 to 76

NANNO-FORAM CHALK, white.

SS CC

55% F	4% R	1% SI
38% N	1% S	1% Calc S.

N9

Site 289 Hole Core 49 Cored Interval: 456.0-465.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	DEFORMATION	LITHO. SAMPLE
MIDDLE MIOCENE	N10	Sphenolithus heteromorphus	Dorcadospyris alata	F	A	g	1	0.5, 1.0	1/0	*
							2			
							3		0	
	N10			F	A	g	4		1	
	N9			F	A	g	5			
							6		0/1	
	N9			F	A	g	Core Catcher			*
				N	A	m				

LITHOLOGIC DESCRIPTION

FORAM-NANNO CHALK/OOZE

N9 white
N1 black spots and parallel laminae
5RP 7/2 pale purple parallel laminae
5G 6/1 greenish-gray parallel laminae

MICARB AND RAD BEARING FORAM-NANNO CHALK, white.

SS 1-75

48% N	4% M	Tr% Gl
45% F	3% R	Tr% S

semilithified/stiff
parallel laminae at:
Section 1-5, 40 to 66, 75, 95
Section 2-7 to 11, 84 to 86, 130 to 161
Section 3-25, 33 to 41, 107 to 109

Chalk

semilithified

parallel laminae at Section 4-4 to 6, 30 to 52, 127 to 128

ooze

chalk/ooze

semilithified/stiff
parallel laminae Section 5-77 to 79

soft/semilithified

NANNO-FORAM CHALK, white.

SS CC

55% F	3% R	1% SI
39% N	1% S	Tr% D

N9

Explanatory notes in Chapter 2

Site 289 Hole Core 50 Cored Interval: 465.5-475.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE MIOCENE	N9	Sphenolithus heteromorphus	Dorcadospyris alata				0					N9 white — NANNO-FORAM OOZE/CHALK
							1	0.5, 1.0		0/1	*	N9 white, N8 light gray, N1 black — NANNO-FORAM CHALK/OOZE all in parallel laminae, semilithified 0-30 N9 white — MICARB AND RAD BEARING NANNO-FORAM OOZE, white; semilithified/stiff. SS 1-75: 55% F, 39% N, 3% M, 3% R
							2					N9 N1 black streaks, spots and laminae at: Section 2-44 to 46, 52 to 54; Section 3-90 to 92, 100 to 103, 106 to 107, 110 to 112, 120 to 125, 130 to 138
							3					N9 $CaCO_3$ 3-67 (95) Grain Size 3-70 (13.8, 41.6, 44.6)
							4			0/1		N9
							5					N9
							6					N9 white, N8 light gray in parallel laminae at Section 6-30 to 52, 124 to 125; N1 black spots
				F	A	f						NANNO-FORAM CHALK, white.
				N	A	m	Core Catcher				*	N9 — SS CC: 55% F, 39% N, 4% R, 1% Fsp, 1% S, Tr% SI

Site 289 Hole Core 51 Cored Interval: 475.0-484.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE MIOCENE	N9	Sphenolithus heteromorphus	Calocycletta costata				0					
							1	0.5, 1.0	Empty	1/0	*	N9, N1 spots — NANNO FORAM CHALK, white (N9); semilithified. SS 1-90: 55% F, 38% N, 2% R, 1% Fsp, 1% Gl, 1% D, 1% S, 1% SI
				F	A	e	2			0		Black (N1) streaks, spots and parallel laminae at: Section 1-40 to 64, 98 to 101; Section 2-122 to 125, 133 to 139; Section 5-92 to 100
				R			3			0		
				F	A	e	4			0		
				F	A	e	5			0/1		NANNO-FORAM CHALK/OOZE, white; semilithified/stiff.
							6					N9, 5GY 8/1, N8 — White (N9) with light greenish gray (5GY 8/1) and light gray (N8) parallel laminae at Section 6-3 to 5, 141 to 144.
				F	A	g						RAD BEARING NANNO-FORAM CHALK, white.
				N	C	m	Core Catcher				*	N9 — SS CC: 55% F, 40% N, 3% R, 1% S, 1% SI

Explanatory notes in Chapter 2

Site 289 Hole Core 52 Cored Interval: 484.5-494.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
EARLY MIOCENE	N8	Sphenolithus heteromorphus	Calocycletta costata	F	A	g	1	0.5, 1.0		0/1	*
							0				
							2			0/1	
							3			0/1	
							4			0/1	
							5			0/1	
							6			0/1	
	N8			F	A	f	Core Catcher				*
				N	C	f					

LITHOLOGIC DESCRIPTION

N9 — NANNO-FORAM CHALK, white.

N9, N1 — NANNO-FORAM CHALK/OOZE

DIATOM AND RAD BEARING NANNO-FORAM CHALK, white with black streaks and spots.

SS 1-75
50% F 3% D 1% SI
43% N 3% R

semilithified/stiff

parallel laminae (light greenish gray) at Section 1-4 to 8

Spots, streaks and laminae (black) at:
Section 1-31, 98
Section 3-147 to 150
Section 4-27

$CaCO_3$ 3-128 (95)

Grain Size 3-131 (18.9, 46.4, 34.7)

X-ray 3-135
9% Amor 91% Cryst 100% Calc

RAD BEARING NANNO-FORAM CHALK, white.

N9

SS CC
55% F 3% R Tr% Fsp
41% N 1% S

Site 289 Hole Core 53 Cored Interval: 494.0-503.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
EARLY MIOCENE		Sphenolithus heteromorphus					0				
							1	0.5, 1.0	Empty	1	
							2				*
		Sphenolithus heteromorphus	Calocycletta costata	N			3		Void	5	
										1	
				N			4			4	
										0	
	N8	Sphenolithus		F	A	g	Core Catcher				*
				N	C	f					

LITHOLOGIC DESCRIPTION

NANNO-FORAM CHALK/OOZE

N9 (N8, N1 laminae)

NANNO-FORAM OOZE, white with black (N1) streaks and parallel laminae.

SS 2-75
55% F 2% R Tr% Fsp
42% N 1% SI

semilithified/stiff (Sections 1 and 2)
semilithified/soft (Sections 3 and 4)

N9 (5GY 8/1 laminae)

+ small burrow? (4/60)

Parallel laminae at:
Section 1-127 to 130, 141 to 144
Section 2-19, 48 (black)
Section 3-117 (black)
Section 4-55 to 60, 76 to 78, 139 to 150 (light greenish gray)

PYRITE BEARING NANNO-FORAM CHALK, white.

N9

SS CC
55% F 3% Py 2% M Tr% S
37% N 2% Fe-O 1% R

Explanatory notes in Chapter 2

Site 289 Hole Core 54 Cored Interval: 503.5-513.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
EARLY MIOCENE	N8	Sphenolithus heteromorphus	Calocycletta costata				0					
							1	0.5, 1.0	Empty	2/3, 0, 4		NANNO-FORAM CHALK/OOZE; N9 (N1 spots and streaks)
							2			0/1	*	NANNO-FORAM CHALK, white with black spots and streaks; semilithified/soft. SS 2-75: 55% F, 41% N, 2% R, 1% S, 1% Calc S., Tr% Fsp, Tr% D, Tr% Sl
							3		Void	5, 0/4		$CaCO_3$ 3-100 (93). Parallel laminae at: Section 1-134 to 145; Section 3-107 to 112, 124 to 131 (black). Oval banding (black) at Section 3-115.
							4			0/1		RAD AND MICARB BEARING FORAM-NANNO OOZE, white.
				N	C	m	Core Catcher				*	N9. SS CC: 64% N, 30% F, 3% M, 3% R, Tr% Gl, Tr% S

Site 289 Hole Core 55 Cored Interval: 513.0-522.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
EARLY MIOCENE	N8 / N7	Sphenolithus heteromorphus	Calocycletta costata				0					
							1	0.5, 1.0		0/1	*	N9. NANNO-FORAM CHALK/OOZE. RAD BEARING NANNO-FORAM OOZE, white; semilithified/stiff. SS 1-75: 51% F, 43% N, 3% R, 1% S, 1% Sl, 1% Calc S.
				F	A	g	2			0/1		N9
				F	A	g	3			0/1		N9
							4			0/1		5G 9/1 greenish white in Section 4
							5			0/1	·	5G 9/1
							6			0/1		5G 9/1
	N7			F	A	f	Core Catcher					MICARB BEARING, RAD RICH FORAM-NANNO CHALK, white.
				N	A	f					*	N9. SS CC: 40% N, 36% F, 20% R, 3% M, 1% S

Explanatory notes in Chapter 2

Site 289 Hole Core 56 Cored Interval: 522.5-532.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
EARLY MIOCENE	N7	Sphenolithus heteromorphus	Calocycletta costata; Calocycletta virginis	R; N	A	f	0, 1 (0.5, 1.0), 2, 3, 4, Core Catcher		Void	5; 1/0; 0/1	* ; *	see below

N8 very light gray chalk ooze — NANNO CHALK

N9 white

N8

N1 black spots, N1 and 5G 6/1 black and greenish gray laminae.

RAD AND FORAM BEARING NANNO CHALK, white; semilithified/stiff.

N9

SS 2-75
77% N 10% R Tr% Gl
10% F 3% M

Grain Size 3-66 (5.7, 64.7, 29.6)

$CaCO_3$ 3-83 (94)

Parallel laminae at:
Section 2-111 to 113, 120 to 126
Section 3-3 to 7, 21 to 23
Section 4-26 to 27 (5G 6/1),
69 to 72 (5G 6/1)

MICARB AND RAD BEARING NANNO-FORAM CHALK, white.

N9

SS CC
60% F 3% M Tr% S
34% N 3% R

Site 289 Hole Core 57 Cored Interval: 532.0-541.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
EARLY MIOCENE	N7	Sphenolithus heteromorphus	Calocycletta virginis	F; N	A; A	f; f	0, 1 (0.5, 1.0), 2, 3, 4, 5, 6, Core Catcher			4/0; 1/0; 0	* ; *	see below

NANNO-FORAM CHALK

N9 chalk/ooze

MICARB BEARING NANNO-FORAM CHALK, white; semilithified/stiff.

SS 1-80
60% F 3% M Tr% Gl
35% N 2% R

N8 chalk/ooze, very light gray, with N1 black spots

N1 black parallel laminae at Section 2/22, 2/103

chalk

N9+ chalk, white, semilithified/stiff

MICARB AND RAD BEARING NANNO-FORAM CHALK, white.

SS CC
65% F 3% M 1% S
28% N 3% R Tr% Gl

Explanatory notes in Chapter 2

Site 289 Hole Core 58 Cored Interval: 541.5-551.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
EARLY MIOCENE	N7 / N6 / N6	Calocycletta virginis / Sphenolithus belemnos		N			0					N9 white NANNO-FORAM CHALK FORAM-NANNO CHALK
							1	0.5, 1.0			*	N9 chalk/ooze, white, glack spots Section 1-7 to 14 MICARB-BEARING FORAM-NANNO CHALK, white; semilithified/stiff. SS 1-75: 56% N, 40% F, 3% M, 1% R
				F	A	g	2					semilithified/soft
				F	A	g	3			0		semilithified stiff CaCO3 3-86 (94) Grain Size 3-90 (7.3, 57.0, 35.7) N9
							4					
							5					
				F	A	g	6					N1 black spots at Section 6-22 to 30 RAD AND MICARB BEARING NANNO-FORAM CHALK, white.
				F / N	A / C	g / m	Core Catcher				*	SS CC: 60% F, 34% N, 3% M, 3% R, Tr% Gl, Tr% S

Site 289 Hole Core 59 Cored Interval: 551.0-560.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
EARLY MIOCENE	N6	Sphenolithus belemnos / Calocycletta virginis					0					
							1	0.5, 1.0	Void	5		NANNO-FORAM CHALK, white; semilithified. N9 white N1 black parallel laminae at Section 1-41 to 43, 71 to 72 Burrow fills at: Section 1-40, 50, 80; Section 2-80 to 85 Zoophycos at Section 2-67
							2			0		black spots, Section 2 light gray band at Section 2-113 RAD AND MICARB BEARING NANNO-RICH FORAM CHALK, white.
				N	A	m	Core Catcher				*	N9 white SS CC: 70% F, 23% N, 3% M, 3% R, 1% S, Tr% Gl, Tr% Py

Explanatory notes in Chapter 2

Site 289 Hole Core 60 Cored Interval: 560.5-570.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
EARLY MIOCENE	N5	Calocycletta virginis					0					
							1	0.5 / 1.0	Void	3		NANNO-FORAM CHALK N9 white
				F	C	f						
				F	C	f	2				*	N8 chalk, light gray N1 black spots at Section 2-39 to 44, 95 MICARB BEARING NANNO-FORAM CHALK, white; semilitified/soft. SS 2-75: 50% F, 43% N, 3% M, 2% R, 1% Calc S., Tr% Fsp X-ray 2-80: 9% Amor, 91% Cryst, 100% Calc
							3					N8 chalk/ooze, light gray N1 black parallel laminae at Section 3-28 black streaks slight mottling semilithified/stiff $CaCO_3$ 3-73 (95) Grain Size 3-76 (11.1, 51.5, 37.4)
							4			0		N8 chalk, light gray semilithified/stiff
							5					
		Sphenolithus belemnos					6			0/1		N9 chalk/ooze, white semilithified/stiff 5G 6/1 greenish gray N1 black parallel laminae at Section 6-0 to 6, 34 to 37 MICARB BEARING NANNO-FORAM CHALK, white. SS CC: 60% F, 35% N, 3% M, 1% R, 1% Calc S., Tr% Gl
	N5			F	A	f						
				N	C	m	Core Catcher				*	N9 white

Site 289 Hole Core 61 Cored Interval: 570.0-579.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
EARLY MIOCENE			Calocycletta virginis				0					N9 white NANNO-FORAM CHALK
				N		-	1	0.5 / 1.0			*	NANNO-FORAM CHALK N9+ chalk/ooze, white N1 black streaks burrow at Section 1-63 MICARB AND RAD BEARING NANNO-FORAM CHALK, white; semilithified/stiff. SS 1-75: 60% F, 32% N, 5% R, 3% M, Tr% S N9 chalk/ooze, white
							2					
							3				*	N8 chalk/ooze, very light gray MICARB AND RAD BEARING NANNO-FORAM CHALK, white, semilithified/stiff. SS 3-105 (green laminae): 55% F, 37% N, 5% M, 3% R, Tr% Py, Tr% S 5G 6/1 greenish-gray parallel laminae at Section 3-104 to 105 N1 black laminae at Section 3-102 N1 black spots (Section 3 only)
							4			0		N9 chalk/ooze, white
		Triquetrorhabdulus carinatus					5					parallel laminae at Section 5-117 to 119 N8 very light gray chalk/ooze N1 black spots 5G 6/1 greenish-gray spots, semilithified/stiff N1 black parallel laminae at Section 6-4
							6					MICARB-BEARING FORAM-NANNO CHALK, white. SS CC: 56% N, 40% F, 3% M, 1% R, Tr% Py, Tr% S
	N5			N	A	m	Core Catcher				*	N9 white

Explanatory notes in Chapter 2

Site 289 Hole Core 62 Cored Interval: 579.5-589.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
EARLY MIOCENE	N5	Triquetrorhabdulus carinatus	Calocycletta virginis	F N	A C	g f	0, 1, 2, Core Catcher	0.5, 1.0		3, 0, 4, 0	*, *

LITHOLOGIC DESCRIPTION

N9 NANNO-FORAM CHALK
N1 black streaks
5G 6/1

soft

semilithified/stiff

MICARB BEARING NANNO-FORAM CHALK, white, with black streaks and greenish gray laminae; soft/semilithified.

SS 2-75
50% F 3% M
44% N 3% R

$CaCO_3$ 2-52 (96)

Grain Size 2-55 (9.9, 41.2, 49.0)

Parallel laminae at:
Section 1-148 to 150
Section 2-34 to 36 (black), 117 to 136 (greenish gray)

N9 RAD BEARING FORAM-NANNO CHALK, white; semilithified/stiff.

SS CC
54% N 3% M Tr% Gl
40% F 3% R Tr% S

Site 289 Hole Core 63 Cored Interval: 589.0-598.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
EARLY MIOCENE	N5	Triquetrorhabdulus carinatus	Calocycletta virginis	N	C	f	0, 1, 2, Core Catcher	0.5, 1.0		0, 4, 0, 4	*, *

LITHOLOGIC DESCRIPTION

N9 white
5G 6/1 parallel laminae
N1

NANNO-FORAM CHALK, white, with greenish gray and black parallel laminae; semilithified.

SS 1-80
50% F 1% R Tr% Py
49% N Tr% Fsp Tr% S

Zoophycos at Section 1-66, and 75; mottled and burrowed at Section 1-47 to 55.

burrowed at Section 2-7 to 15

Parallel laminae at:
Section 1-20 to 47 (greenish-gray), 60 to 70 (greenish-gray), 95 to 120 (greenish-gray and black)
Section 2-throughout (greenish-gray and black)

N9 MICARB BEARING NANNO-FORAM CHALK, white; semilithified.

SS CC
55% F 4% M 1% R
38% N 2% Calc S. Tr% S

Site 289 Hole Core 64 Cored Interval: 598.5-608.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
EARLY MIOCENE	N5	Triquetrorhabdulus carinatus	Calocycletta virginis Zone	F N	A C	g f	0, 1, 2, 3, Core Catcher	0.5, 1.0	Void	4, 1, 4/0	*, *

LITHOLOGIC DESCRIPTION

N9, N1 (spots), 5G 6/1 (parallel laminae)
slight mottling
N8

Burrows at Section 2-18; zoophycos at Section 2-99.

RAD-RICH NANNO-FORAM CHALK, white, light gray, greenish-gray; semilithified.

SS 2-100
44% F 15% R 1% Fsp 1% S
36% N 2% Calc S. 1% Py Tr% SI

Intensely burrowed at Section 2-50 to 56 and 96 to 100. Parallel laminae at Section 2-133 to 143 ("pin stripe").

Burrows at Section 3-45 and 115.

X-ray 3-55
7% Amor 93% Cryst 100% Calc

$CaCO_3$ 3-58 (95)

MICARB BEARING NANNO-FORAM CHALK, white; semilithified.

N9

SS CC
55% F 4% M 1% R
38% N 2% Calc S. Tr% Py

Site 289 Hole Core 65 Cored Interval: 608.0-617.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
EARLY MIOCENE	N5 N4	Triquetrorhabdulus carinatus N5	Calocycletta virginis Zone	F F N	A A C	g g f	0, 1, 2, 3, Core Catcher	0.5, 1.0	Void	0, 0/4	*, *CC

LITHOLOGIC DESCRIPTION

N9, N8, 5G 6/1
N1 semilithified

burrowed at Section 1-128 and 142

NANNO-FORAM CHALK, white, light gray, black spots, and greenish gray laminae; semilithified.

SS 2-62
60% F 2% R Tr% Py
37% N 1% Calc S. Tr% S

mottled at Section 3-10

Parallel laminae at:
Section 1-80 thru 125
Section 2-0 thru 50
Section 3-30

burrows at Section 3-97 and 111 (zoophycos)

NANNO-FORAM CHALK, white.

N9

SS CC
55% F 2% M Tr% Gl Tr% SI
42% N 1% R Tr% Py

Explanatory notes in Chapter 2

Site 288 Hole Core 66 Cored Interval: 617.5-627.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
							0		Void			
EARLY MIOCENE	N4	Triquetrorhabdulus carinatus	Calocycletta virginis				1	0.5 1.0		0/4	*	N9, N8, 5G 6/1, N1
							2			0		
							3			0/4		
				N	C	f	Core Catcher				*	N9

mottled at Section 1-53, and 128 to 132

NANNO-FORAM CHALK, white, light gray, black spots, greenish-gray laminae; semilithified/stiff.

SS 1-75
60% F 2% R Tr% Fsp
37% N 1% S

mottled at Section 2-20 to 27 and 125 to 145

Parallel laminae at:
Section 1-29 thru 38
Section 2-121 to 125
Section 3-0 to 5, 29 to 31, 49 to 52

$CaCO_3$ 3-104 (93)
Grain Size 3-104 (17.2, 44.5, 38.3)

intensely mottled at Section 3-95 to 105

NANNO-FORAM CHALK, white; semilithified

SS CC
55% F 1% R Tr% S
44% N Tr% Fsp

Site 289 Hole Core 67 Cored Interval: 627.0-636.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
							0					N9 NANNO-FORAM OOZE
EARLY MIOCENE	N4	Triquetrorhabdulus carinatus; Calocycletta virginis Zone					1	0.5 1.0		0	*	N9+ NANNO-FORAM CHALK/OOZE
							2					
							3					
							4					
							5			0		
							6					
				F	A	g	Core Catcher					
				N	A	f					*	

RAD-BEARING NANNO FORAM OOZE, white; semilithified/soft.

SS 1-75
60% F 6% R Tr% D
34% N Tr% Fsp Tr% S

Mottled at Section 2-1 to 5.

semilithified/stiff

Parallel laminae at Section 4-55 to 58, greenish gray (5G 6/1).

Mottled and burrowed at Section 6-76 to 78 and 113 to 118.

NANNO-FORAM CHALK, white; semilithified/stiff.

SS CC
60% F Tr% Gl Tr% S
40% N Tr% R

Explanatory notes in Chapter 2

Site 289 Hole Core 68 Cored Interval: 636.5-646.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
EARLY MIOCENE	N4	Triquetrorhabdulus carinatus	Calocycletta virginis Zone				0					
							1	0.5, 1.0	Void			
										3		N9 NANNO-FORAM OOZE; soft.
							2				*	+N1 black spots NANNO-FORAM CHALK, white, with black spots; semilithified/stiff. SS 2-75: 55% F, 43% N, 2% R, Tr% Fsp, Tr% S, Tr% Calc S. Mottling at Section 2-76 to 82.
							3			0		$CaCO_3$ 3-62 (96); Grain Size 3-65 (10.7, 43.7, 45.6). Parallel laminae at: Section 2-27, 48, 86, 92, 97 (greenish gray); Section 6-101
							4			0		
							5			0		
							6					N9, 5G 6/1, N1 black spots. Mottling at Section 6-102 to 110. NANNO-FORAM CHALK, white; semilithified/stiff. SS CC: 55% F, 43% N, 1% Fsp, 1% R, Tr% S
				F / N	A / C	p / f	Core Catcher				*	N9

Site 289 Hole Core 69 Cored Interval: 646.0-655.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
EARLY MIOCENE			Calocycletta virginis Zone				0					
							1	0.5, 1.0	Void	5, 0, 4, 0	*	FORAM-NANNO CHALK/OOZE. N9 chalk/ooze, white; 5G 8/1 light greenish gray. MICARB-BEARING NANNO-FORAM CHALK, white; semilithified/stiff; mottling (bioturbation). N1 black spots. SS 1-82: 50% F, 45% N, 3% M, 2% R. Parallel laminae at: Section 1-31 to 33, 60 to 62, 70 to 72, 65-90, 105 to 106
							2			4, 0, 4		Parallel laminae at: Section 2-12 to 20, 100 to 106, 130 to 150 (sparse); Section 3-15, 80 to 84, 108, 138
							3					
							4			0		semilithified/stiff. N9 chalk/ooze, white; N1 black spots
	N4	Triquetrorhabdulus carinatus		F	A	g	5					NANNO-FORAM CHAK, white; semilithified. SS CC: 60% F, 38% N, 2% R, Tr% Fsp, Tr% Py, Tr% S, Tr% SI
LATE OLIGOCENE	P22			F / N	A / C	f / f	Core Catcher				*	N9

Explanatory notes in Chapter 2

Site 289 Hole Core 70 Cored Interval: 655.5-665.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
LATE OLIGOCENE	P22	Triquetrorhabdulus carinatus	Calocycletta virginis Zone				0					N9 white NANNO-FORAM CHALK
							1	0.5, 1.0			*	NANNO-FORAM CHALK/OOZE N9 white MICARB-BEARING NANNO-FORAM CHALK, white, semilithified/stiff. SS 1-75 60% F 3% M 36% N 1% R
							2					N9
							3					N1 black spots at Section 3-50 to 53 $CaCO_3$ 3-55 (95) Grain Size 3-60 (11.9, 45.3, 42.8)
							4			0		
							5					N9 chalk/ooze, white N8 very light gray 5G 6/1 greenish-gray N1 black spots Parallel laminae at Section 5-68 to 70. mottle/bioturbated semilithified/stiff
							6					N9 chalk/ooze, white N1 black spots NANNO-FORAM OOZE, white.
				F / N	A / C	f / f	Core Catcher				*	N9 SS CC 50% F 1% R Tr% Fsp 48% N 1% S Tr% Gl

Site 289 Hole Core 71 Cored Interval: 665.0-674.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
LATE OLIGOCENE	P22	Triquetrorhabdulus carinatus	Calocycletta virginis Zone				0					
							1	0.5, 1.0			*	NANNO-FORAM CHALK/OOZE N9 chalk/ooze, white N1 black spots N1 black parallel laminae throughout 5G 6/1 greenish gray MICARB and RAD BEARING NANNO-FORAM CHALK, white; semilithified/stiff. SS 1-75 50% F 8% R 38% N 4% M
							2					
							3			0		semilithified/stiff N9+ chalk/ooze, white
							4					N9 chalk/ooze, white
							5			4, 0, 4, 0		6G 6/1 greenish gray Parallel laminae at Section 5-101, 112. RAD AND MICARB BEARING NANNO-FORAM CHALK, white.
				F / N	A / A	f / m	Core Catcher				*	N9 SS CC 60% F 3% M 1% S 33% N 3% R Tr% Gl

Explanatory notes in Chapter 2

Site 289 Hole Core 72 Cored Interval: 674.5-684.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
LATE OLIGOCENE	P22	Triquetrorhabdulus carinatus	Calocycletta virginis Zone				0					
							1	0.5, 1.0	Void	5, 3, 0		
							2			4	*	
							3					
							4			0		
							5					
							6					
				F	A	f						
				N	C	f	Core Catcher				*	

FORAM NANNO CHALK/OOZE

N9+ chalk/ooze, white

semilithified/soft

N9 chalk/ooze, white

RAD AND MICARB BEARING FORAM-NANNO CHALK, white; semilithified/stiff.

SS 2-75
47% N 5% M
45% F 3% R

$CaCO_3$ 3-71 (93)

Grain Size 3-75 (7.9, 48.5, 43.6)

X-ray 3-80
11% Amor 89% Cryst 100% Calc

MICARB, CALCAREOUS SPICULE AND RAD BEARING NANNO-FORAM CHALK.

SS CC
55% F 5% R 3% Calc S.
34% N 3% M Tr% Fish D.

Site 289 Hole Core 73 Cored Interval: 684.0-693.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
LATE OLIGOCENE	P22	Triquetrorhabdulus carinatus	Calocycletta virginis Zone / Lychnaconoma elongata Zone				0					
							1	0.5, 1.0	Void	5, 0, 4		
							2				*	
							3			0		
							4					
							5					
				F	A	f						
				N	C	f	Core Catcher				*	

NANNO-FORAM CHALK/OOZE

N9 chalk, white

N8 very light gray

5Y 8/1 yellowish-gray mottles/bioturbation

Flaser bedding at Section 1-73 to 76.

parallel laminae
semilithified/stiff

Lenticular(?) and flaser bedding with mottles at Section 2-25 to 33.

MICARB AND CALCAREOUS SPICULE BEARING NANNO-FORAM OOZE, white; semilithified/stiff.

SS 2-75
50% F 11% R 3% M
37% N 8% Calc S. 1% S

N9 chalk/ooze, white semilithified/stiff

N9 chalk, white semilithified/lithified
5G 6/1 greenish-gray Parallel laminae at Section 5-120 to 130.

N9 MICARB, RAD AND CALCAREOUS SPICULE BEARING NANNO-FORAM CHALK, white.

SS CC
55% F 10% Calc S. 3% M
27% N 5% R

Explanatory notes in Chapter 2

Site 289 Hole Core 74 Cored Interval: 693.5-703.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
LATE OLIGOCENE	P22	Triquetrorhabdulus carinatus	Lychnaconoma elongata Zone				0					N9 white NANNO-FORAM CHALK
							1	0.5, 1.0			*	NANNO-FORAM CHALK/OOZE N9 to 5G 9/1 white to greenish-white chalk/ooze, semi-lithified/soft MICARB-CALCAREOUS SPICULE BEARING, RAD RICH, NANNO-FORAM CHALK, white; semilithified/stiff. SS 1-75 50% F 11% R 3% M 30% N 5% Calc S. 1% S
							2					N9
							3					$CaCO_3$ 3-37 (92) Grain Size 3-41 (17.1, 46.9, 36.1) N7 medium light gray chert fragments at Section 3-107 and 119.
							4			0		
							5					
							6					
				F N	A C	f f	Core Catcher					NO CORE CATCHER

Site 289 Hole Core 75 Cored Interval: 703.0-712.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
LATE OLIGOCENE	P22	Triquetrorhabdulus carinatus	Lychnaconoma elongata Zone				0					
							1	0.5, 1.0	Void	5		FORAM-NANNO CHALK/OOZE N9 chalk, white semilithified, flaser bedding N8 very light gray 5G 6/1 greenish-gray
							2				*	Parallel laminae at Section 2-15 to 22. Mottles, bioturbation especially at Section 2-60, 53 to 54. N9 chalk/ooze, white Lenticular bedding at Section 2-54 to 55, wavy bedding. MICARB AND CALCAREOUS SPICULE BEARING FORAM-NANNO CHALK, white; semilithified/stiff. SS 2-75 50% N 10% Calc S. 2% R 35% F 3% M Tr% S
							3			0		
							4					Parallel laminae at: Section 4-98, 134, 146 N9 chalk/ooze, white N1 black spots at Section 4-110 to 125 5G 6/1 greenish-gray
				F N	A C	f f	Core Catcher				*	N9 white CALCAREOUS SPICULE BEARING NANNO-FORAM OOZE, white. SS CC 50% F 3% Calc S. Tr% Fsp 46% N 1% SI

Explanatory notes in Chapter 2

Site 289 Hole Core 76 Cored Interval: 712.5-722.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
							0					
LATE OLIGOCENE	P22	Triquetrorhabdulus carinatus	Lychnaconoma elongata Zone				1	0.5, 1.0	Empty	3		RAD RICH FORAM-NANNO CHALK/OOZE N9 (N1 spots) CALCAREOUS SPICULE BEARING RAD RICH FORAM-NANNO OOZE, white with black spots; semilithified/stiff.
							2			0	*	SS 2-75 44% N 20% R 1% Py 1% SI 30% F 3% Calc S. 1% S Tr% Fsp
							3			0		CaCO$_3$ 3-79 (93) Grain Size 3-82 (5.2, 44.3, 50.3) X-ray 3-85 9% Amor 91% Cryst. 100% Calc Bioturbated at: Section 3-13 to 18, 33 to 39 Section 5-93 to 95, 122 to 128 (very light gray-N8)
				F	A	f	4			0		
				F	A	f	5					CALCAREOUS SPICULE BEARING NANNO-FORAM CHALK, white; semilithified.
				F N	A C	f f	Core Catcher				*	N9 SS CC 50% F 3% Calc S. 1% S 44% N 1% R 1% SI

Site 289 Hole Core 77 Cored Interval: 722.0-731.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
							0					
LATE OLIGOCENE	P22	Triquetrorhabdulus carinatus	Lychnaconoma elongata Zone				1	0.5, 1.0		0 0		N9 (N8) bioturbation NANNO-FORAM CHALK/OOZE, white with very light gray zones where bioturbation, lenticular bedding and parallel laminae are present; semilithified/stiff. Lenticular bedding at Section 1-35 to 38. Parallel laminae at Section 1-140 to 146 (N8, N9). Wavy bedding.
				F N	C C	f f	Core Catcher				*	N9 NANNO-FORAM CHALK, white; semilithified. SS CC 55% F 2% Calc S. 1% R 1% SI 39% N 1% Fsp 1% S

Site 289 Hole Core 78 Cored Interval: 731.5-741.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
							0					
LATE OLIGOCENE	P22	Triquetrorhabdulus carinatus	Lychnaconoma elongata Zone	F	A	f	1	0.5, 1.0		3		N9 (N8) RAD RICH NANNO-FORAM CHALK/OOZE
	P21			F	A	f	2			0	*	CALCAREOUS SPICULE BEARING RAD RICH NANNO-FORAM OOZE, white with very light gray and greenish gray laminae, semi-lithified-stiff. SS 2-75 45% F 15% R 1% S Tr% Fsp 38% N 5% Calc S. 1% SI Parallel laminae at: Section 1-138 (N8) Section 2-19, 54 (N8) Section 3-142 to 150 (5G 6/1)
							3			0		Bioturbation at: Section 2-35 to 42 Section 3-126 to 139 (N8) CaCO$_3$ 3-77 (93) Grain Size 3-80 (5.7, 48.9, 45.5) N9 (5G 6/1)
	P21			F N	C C	f f	Core Catcher				*	N9 CALCAREOUS SPICULE BEARING NANNO-FORAM CHALK, white; semilithified. SS CC 55% F 3% Calc S. 1% S 40% N 1% R Tr% Fsp

Site 289 Hole Core 79 Cored Interval: 741.0-750.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
							0					
LATE OLIGOCENE	P21	Sphenolithus ciperoensis / T. carinatus	Dorcadospyris ateuchus				1	0.5, 1.0	Empty	0	*	RAD RICH FORAM-NANNO CHALK/OOZE N9 (N7, 5G 6/1) bioturbation RAD RICH FORAM-NANNO CHALK, white with very light gray, grayish green and light gray laminated and bioturbated zones; semi-lithified-stiff. SS 1-110 58% N 10% R 30% F 1% S
							2			0		bioturbation Parallel laminae at: Section 1-120 to 131 (5G 6/1) Section 2-95 to 104 Bioturbation at: Section 2-4 to 12, 14 to 25, 60 to 70 Section 3-110 to 117, 135 to 140
							3		Void	5 0/3 0/1		NANNO-FORAM CHALK, white; semilithified. bioturbation (N1 spots) SS CC 55% F 2% S Tr% Fsp Tr% SI 42% N 1% Calc S. Tr% R
				F N	C C	f f	Core Catcher				*	N9

Explanatory notes in Chapter 2

Site 289 Hole Core 80 Cored Interval: 750.5-760.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE		LITHOLOGIC DESCRIPTION
LATE OLIGOCENE	P21	Sphenolithus ciperoensis	Dorcadospyris ateuchus				0						
							1	0.5, 1.0	Empty				
							2			0, 4, 0, 4, 0	*	N9 (N7, N8)	
							3						
							4						
				F / N	C / C	f / f	Core Catcher				*	N9	

RAD RICH FORAM-NANNO CHALK/OOZE

Parallel laminations at:
Section 2-101 to 106
Section 4-89 to 90, 121

Bioturbation at:
Section 2-0 to 80
Section 3-50 to 53, 102 to 106
Section 4-105 to 147

CALCAREOUS SPICULE, RAD BEARING FORAM RICH NANNO CHALK, white with light gray and very light gray bioturbation and laminated zones; stiff-semilithified.

SS 2-80
72% N 4% R 1% S
20% F 3% Calc S.

$CaCO_3$ 3-80 (94)

Grain Size 3-83 (5.7, 45.4, 48.8)

X-ray 3-90
11% Amor 89% Cryst 100% Calc

NANNO-FORAM CHALK, white; semilithified.

SS CC
55% F 1% R 1% SI Tr% Py
41% N 1% S 1% Fsp

Site 289 Hole Core 81 Cored Interval: 760.0-769.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE		LITHOLOGIC DESCRIPTION
LATE OLIGOCENE	P21	Sphenolithus ciperoensis	Dorcadospyris ateuchus				0						
							1	0.5, 1.0	Empty				
							2			0, 4, 0, 1-4, 0, 4, 0, 4, 0		N9	
				F / N	C / C	f / f	Core Catcher				*	N9	

NANNO-FORAM CHALK/OOZE, white; semilithified-stiff.

Bioturbation and parallel lamination throughout.

NANNO-FORAM CHALK, white; semilithified.

SS CC
55% F 1% Fsp 1% R 1% SI
40% N 1% Py 1% S

Site 289 Hole Core 82 Cored Interval: 769.5-779.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE		LITHOLOGIC DESCRIPTION
LATE OLIGOCENE	P21	Sphenolithus ciperoensis	Dorcadospyris ateuchus				0						
							1	0.5, 1.0	Empty	0	*	N9 (N7)	
							2						
							3					--- (N8)	
				F / N	C / C	f / f	Core Catcher				*	N9	

FORAM-NANNO CHALK/OOZE

VOLCANIC GLASS AND RAD BEARING FORAM-NANNO CHALK, white and very light gray; semilithified/stiff.

SS 1-75
52% N 10% R 2% Calc S. 1% Py
30% F 3% Gl 1% Opaq 1% S

$CaCO_3$ 3-47 (92)

Grain Size 3-50 (6.7, 43.7, 49.7)

Bioturbation at:
Section 1-throughout
Section 2-5 to 11, 90
Section 3-80 to 84, 140 to 148 (N8)

NANNO-FORAM CHALK, white; semilithified.

SS CC
55% F 2% R 1% SI Tr% Fsp
40% N 1% S 1% Calc S.

Site 289 Hole Core 83 Cored Interval: 779.0-788.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE		LITHOLOGIC DESCRIPTION
LATE OLIGOCENE	P21	Sphenolithus ciperoensis	Dorcadospyris ateuchus				0						
							1	0.5, 1.0	Empty	0	*	N9 (N8)	
							2			0			
				F / N	C / C	f / f	Core Catcher				*	N9	

RAD BEARING FORAM-NANNO CHALK, white and very light gray; semilithified.

SS 1-140
47% N 1% S Tr% Fsp
40% F 1% SI Tr% Gl
10% R 1% Calc S. Tr% Py

Bioturbated throughout.
Parallel laminations at Section 1-138 to 140.
Lenticular and flaser bedding and wavy bedding at Section 2-10 to 13.

NANNO-FORAM CHALK, white; semilithified.

SS CC
55% F 2% R 1% Py 1% Calc S.
38% N 2% SI 1% S Tr% Fsp

Explanatory notes in Chapter 2

Site 289 Hole Core 84 Cored Interval: 788.5-798.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
							0					
LATE OLIGOCENE	P21	Sphenolithus ciperoensis	Dorcadospyris ateuchus				1	0.5 / 1.0	Empty	0, 4, 0, 4, 0	*	FORAM-NANNO CHALK
							2		Void	5, 0, 4, 0, 4, 0, 4		
				F / N	C / A	f / m	Core Catcher				*	

FORAM-NANNO CHALK

N9 chalk, white with N7/N8 light gray

MICARB AND RAD BEARING FORAM NANNO CHALK, white; semilithified, bioturbated throughout.

SS 1-110
46% N 5% R 1% S
45% F 3% M

X-ray 2-20
14% Amor 86% Cryst 100% Calc

$CaCO_3$ 2-23 (93)

Parallel laminae at Section 2-50 to 57, 82 to 86.
Flaser bedding at Section 2-110 to 113.
Lenticular bedding at Section 2-110 to 113.
Wavy bedding at Section 2-110 to 113.

N9 NANNO-FORAM CHALK, white.

SS CC
55% F 1% Fsp 1% S
42% N 1% Py Tr% R

Site 289 Hole Core 85 Cored Interval: 798.0-807.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
							0					
LATE OLIGOCENE	P21	Sphenolithus ciperoensis	Dorcadospyris ateuchus	F	C	f	1	0.5 / 1.0			*	NANNO-FORAM CHALK
				F / N	C / C	f / f	Core Catcher				*	

NANNO-FORAM CHALK

N9 chalk, white with N7/N8 light gray

MICARB AND RAD BEARING NANNO-FORAM CHALK, white; semilithified.

SS 1-75
60% F 5% M Tr% Py
30% N 5% R

Parallel laminae at Section 1-16 to 30, 116, rest is bioturbated with intense mottling at Section 1-90 to 100.

N9 NANNO-FORAM CHALK, white.

SS CC
51% F 2% R Tr% Py
46% N 1% S

Site 289 Hole Core 86 Cored Interval: 807.5-817.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
							0					
LATE OLIGOCENE			Dorcadospyris ateuchus				1	0.5 / 1.0	Empty			NANNO-FORAM CHALK/OOZE
							2			0, 4, 0, 4, 0	*	
							3			4, 0, 4		
							4					
							5			0		
							6					
	P21	Sphenolithus distentus		F / N	A / C	g / f	Core Catcher				*	

NANNO-FORAM CHALK/OOZE

N9 ooze/chalk, soft, white

N9 chalk/ooze, white and N8 light gray and N5 medium gray bioturbate

RAD AND MICARB BEARING NANNO-FORAM CHALK, white; semilithified/stiff.

SS 2-75
50% F 4% M 1% S
42% N 3% R

Semilithified/stiff.
Bioturbate at Section 2-24 to 31, 64 to 69.
Parallel laminae at Section 2-2 to 10.

$CaCO_3$ 3-67 (96)

N9+ chalk/ooze, white

Grain Size 3-70 (4.2, 47.3, 48.6)

N5 medium gray biotrubation mottling at:
Section 4-52 to 54, 89 to 91
Section 5-110

N9 chalk/ooze, white semilithified/stiff

MICARB BEARING NANNO-FORAM CHALK.

SS CC
45% F 10% M
43% N 2% R

Explanatory notes in Chapter 2

Site 289 Hole Core 87 Cored Interval: 817.0-826.5 m

AGE: LATE OLIGOCENE

ZONE: FORAMS: P21; NANNOS: Sphenolithus distentus; RADS: Dorcadospyris ateuchus

FOSSIL CHARACTER (Core Catcher): F – C – f; N – C – f

SECTION 0; SECTION 1: Empty (0.5, 1.0 m); SECTION 2; Core Catcher

DEFORMATION: 0, 4, 0, 4, 0

LITHO. SAMPLE: * (Section 2), * (Core Catcher)

LITHOLOGIC DESCRIPTION

NANNO-FORAM CHALK

N9 white chalk — Flaser and 5G 6/1 greenish-gray, lenticular bedding at Section 2-28 to 33,

5G 6/1 — wavy bedding at Section 2-28 to 33.

MICARB BEARING NANNO-FORAM CHALK, white; lithified/semilithified.

SS 2-75

50% F	5% M	Tr% S
43% N	2% R	

N9 white — MICARB BEARING NANNO-FORAM CHALK, white.

SS CC

60% F	5% M	Tr% Py
33% N	2% R	

Site 289 Hole Core 88 Cored Interval: 826.5-836.0 m

AGE: LATE OLIGOCENE

ZONE: FORAMS: P21; NANNOS: Sphenolithus distentus; RADS: Dorcadospyris ateuchus

FOSSIL CHARACTER (Core Catcher): F – C – f; N – C – f

SECTION 0; SECTION 1: Empty (0.5, 1.0 m); SECTION 2; SECTION 3; Core Catcher

DEFORMATION: 0, 4, 4 0 4, 0 4, 4 0, 0, 3, 0, 4, 0, 4, 0, 0=4, 4, 0

LITHO. SAMPLE: * (Section 2)

LITHOLOGIC DESCRIPTION

NANNO-FORAM CHALK

N9 chalk, white with N7 light gray

X-ray 2-40

6% Amor	94% Cryst	100% Calc

RAD AND MICARB BEARING NANNO-FORAM CHALK, white; semilithified, bioturbated.

SS 2-75

50% F	5% M	1% S
41% N	3% R	Tr% Py

N6 medium light gray in lenticular and flaser bedded zones at Section 2-45 to 50, bioturbation at Section 2-29 to 41, 66 to 71.

Bioturbated and parallel laminae throughout Section 3. 2 mm (N6) medium gray chert fragments at Section 3-26.

$CaCO_3$ 3-38 (96)

$CaCO_3$ 3-63 (96)

N9 white — MICARB AND RAD BEARING NANNO-FORAM CHALK, white.

SS CC

55% F	5% M	Tr% Py
37% N	3% R	Tr% S

Site 289 Hole Core 89 Cored Interval: 836.0-845.5 m

AGE: LATE OLIGOCENE

ZONE: FORAMS: P21; NANNOS: Sphenolithus distentus; RADS: Dorcadospyris ateuchus

FOSSIL CHARACTER (Core Catcher): F – A – f; N – C – m

SECTION 0; SECTION 1 (0.5, 1.0 m); SECTION 2; SECTION 3; SECTION 4; Core Catcher

DEFORMATION: 3/4 (Section 1), 4/0/3 (Sections 2–3), 3/4 (Section 4)

LITHO. SAMPLE: * (Section 2), * (Core Catcher)

LITHOLOGIC DESCRIPTION

FORAM-NANNO CHALK

N9 chalk/ooze, white

Parallel laminae at Section 1-61 to 63.

MICARB BEARING FORAM-NANNO CHALK, white; semilithified/stiff/soft.

SS 2-76

50% N	4% M	Tr% Fsp
45% F	1% S	Tr% R

(core shattered after sampling with punch corer)

MICARB BEARING NANNO-FORAM CHALK, white.

N9 white

SS CC

50% F	5% M	Tr% S
43% N	2% R	

Explanatory notes in Chapter 2

Site 289 Hole Core 90 Cored Interval: 845.5-855.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
							0					
LATE OLIGOCENE	P21	Sphenolithus distentus	Dorcadospyris ateuchus				1	0.5 1.0	Empty	4 0	*	
							2			0		
							3			4 0		
				N	C	f	Core Catcher				*	

N9 chalk/ooze, white — NANNO CHALK/OOZE

MICARB AND FORAM BEARING, RAD RICH NANNO CHALK, from dark gray laminae.

SS 1-10U

68% N	10% F	2% S
15% R	5% M	Tr% Py

N5 medium gray — Parallel laminae at:
Section 1-107 to 111, 145
Section 2-throughout
Section 3-50 to 52, 59 to 61
Wavy-flaser-lenticular bedding at:
Section 2-96, 135 to 137
Section 3-26 to 31, 135 to 140
Bioturbated at:
Section 1-126 to 138, 146 to 154
Section 2-throughout
Section 3-32 to 48, 120 to 136, 134 to 150

$CaCO_3$ 3-60 (90)

Grain Size 3-64 (4.8, 44.7, 50.6)

N9 white — NANNO-FORAM CHALK, white.

SS CC

52% F	2% R
46% N	Tr% S

Site 289 Hole Core 91 Cored Interval: 855.0-864.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
							0					
LATE OLIGOCENE	P21	Sphenolithus distentus	Dorcadospyris ateuchus				1	0.5 1.0	Empty			
							2					
							3			4/3/0		
							4					
							5					
				F N R	C C	f f —	Core Catcher					

N9 white — NANNO-FORAM CHALK/OOZE, white; semi-lithified/stiff/soft.

(core shattered by punch corer)

N9 white — RAD BEARING NANNO-FORAM CHALK, white.

SS CC

60% F	3% R	1% S
36% N	1% Fsp	Tr% Gl

Explanatory notes in Chapter 2

Site 289 Hole Core 92 Cored Interval: 864.5-874.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
LATE OLIGOCENE	P21	Sphenolithus predistentus	Theocyrtis tuberosa	N R	— —		0 1	0.5 1.0	Empty	0 4/0 0		N9 N6 medium gray — NANNO-FORAM CHALK/OOZE, white; semilithified/stiff. Parallel laminae at Section 1-49 to 52, 58 to 60
				F N	C C	f f	Core Catcher					N9 white — PYRITE AND RAD BEARING NANNO-FORAM CHALK, white. SS CC 55% F 4% R 1% S 37% N 3% Py

Site 289 Hole Core 93 Cored Interval: 874.0-883.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
LATE OLIGOCENE	P21	Sphenolithus predistentus	Theocyrtis tuberosa				0 1 2 3 4	0.5 1.0	Empty	4/3/0		N9 — NANNO-FORAM CHALK/OOZE, white; semilithified/stiff/soft. (core shattered by punch corer)
				F N	C C	f f	Core Catcher				*	N9 white — RAD BEARING NANNO-FORAM OOZE, white. SS CC 55% F 3% R Tr% Fsp 40% N 2% S Tr% Py

Site 289 Hole Core 94 Cored Interval: 883.5-893.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
EARLY OLIGOCENE	P20	Sphenolithus predistentus	Theocyrtis tuberosa	F	C	f	0 1 2 3 4	0.5 1.0	Empty	0/4	*	Parallel laminae at: Section 1-128 to 132; Section 2-20 to 29, 34, 44, 54, 63, 70, 82, 121 CHALK/OOZE N9 N6 5G 6/1 in parallel laminae at Section 1-128 to 132 Bioturbated at Section 1-136 to 140; semilithified/stiff. RAD BEARING FORAM-NANNO CHALK, white, with black and greenish gray laminae; semilithified/stiff. SS 2-77 50% N 3% R Tr% Py 46% F 1% Gl Bioturbated at Section 2-126 to 133. $CaCO_3$ 3-70 (96) X-ray 3-80 (dark gray) 30% Amor 93% Calc 1% Pyri 70% Cryst 6% Plag Lenticular bedding at Section 3-58 to 62. Flaser bedding at Section 3-80 to 82. N9 N7 bioturbated N6 in parallel laminae Bioturbation at Section 4-20 to 30, 40 to 50, 80 to 85, 120 to 125, 145 to 150. MICARB-BEARING NANNO-FORAM CHALK, white; semilithified.
	P20	Sphenolithus predistentus		F N	C C	f f	Core Catcher				*	N9 — SS CC 60% F 3% M 1% S 35% N 1% R

Explanatory notes in Chapter 2

Site 289 Hole Core 95 Cored Interval: 893.0-902.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE
							0				
EARLY OLIGOCENE	P20	Sphenolithus predistentus	Theocyrtis tuberosa				1	0.5, 1.0	Empty		
							2			0/4	*
				F N	C C	f f	Core Catcher				*

LITHOLOGIC DESCRIPTION

Section 2 bioturbation throughout.

N9
N4 in bioturbation at Section 1-145 to 150
N2
N8 Flaser(?) bedding at Section 2-21 to 36
N5

RAD BEARING NANNO-FORAM CHALK, white, with gray laminae and bioturbated zones; semilithified/stiff.

SS 2-75
53% F 3% R Tr% Fsp Tr% S
42% N 2% M Tr% Py

N9 MICARB BEARING NANNO-FORAM CHALK, white, semilithified/stiff.

SS CC
50% F 3% M 1% S
44% N 2% R

Site 289 Hole Core 96 Cored Interval: 902.5-912.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE
							0				
EARLY OLIGOCENE	P20	Sphenolithus predistentus	Theocyrtis tuberosa				1	0.5, 1.0	Empty	0	
				F N	R C	P P	Core Catcher				*

LITHOLOGIC DESCRIPTION

FORAM-NANNO CHALK, very light gray.

$CaCO_3$ 1-101 (93)

N8, N7, N5

Bioturbated with flaser(?) bedding; semilithified.

N9 MICARB AND RAD BEARING NANNO-FORAM CHALK, white; semilithified.

SS CC
65% F 5% R
26% N 4% M

Site 289 Hole Core 97 Cored Interval: 912.0-921.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE
							0				
EARLY OLIGOCENE	P20	Sphenolithus predistentus	Theocyrtis tuberosa				1	0.5, 1.0	Empty	0/4	*
							2		Void	0/4	
							3		Void	0/4	
				F	C	p	4				

LITHOLOGIC DESCRIPTION

NANNO-FORAM CHALK

N9,
N8, N6

Bioturbated throughout.

RAD BEARING NANNO-FORAM CHALK, white, with medium to very light gray; semilithified; bioturbated.

SS 1-101
48% F 3% R Tr% Fsp
47% N 2% M Tr% S

N9,
N8 bioturbated

N1 black area with rings around black spot

X-ray 3-77 (greenish gray)
36% Amor 96% Calc 1% Mont
64% Cryst 3% Plag

N9 (5G 6/1 band at Section 3-74
N8

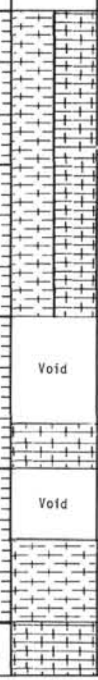
Bioturbated throughout.

+N4 flaser(?) beds

Explanatory notes in Chapter 2

Site 289 Hole Core 98 Cored Interval: 921.5-931.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
EARLY OLIGOCENE	P20	Sphenolithus predistentus	Theocyrtis tuberosa	R F N	A C C	g f m	0				
							1	0.5 1.0		4/3	
							2			0 4 0 4 0	*
							3		Void	5 0	
							4		Void	5 0	
							Core Catcher				*



N9 — NANNO-FORAM CHALK/OOZE, white; soft; (disturbed by drilling?).

N9 chalk/ooze, white — semilithified/soft
N8 very light gray
N6 medium gray

MICARB AND RAD BEARING NANNO-FORAM CHALK, white.

SS 2-75
60% F — 8% R
27% N — 5% M

Bioturbation at:
Section 1-140 to 150
Section 2-1 to 5, 24 to 70, 108 to 114
Section 3-105 to 112, 125 to 131

X-ray 3-127
15% Amor — 86% Cryst — 100% Calc

Grain Size 3-131 (3.0, 45.5, 51.5)

$CaCO_3$ 3-135 (91)

Section 3 semilithified/stiff.

N8 ooze, semilithified, very light gray

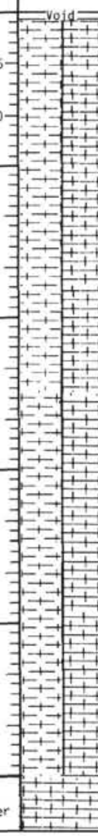
N7 ooze, light gray

N9/N7 white/light gray — MICARB AND RAD BEARING NANNO-FORAM CHALK, white.

SS CC
70% F — 5% M
20% N — 5% R

Site 289 Hole Core 99 Cored Interval: 931.0-940.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
EARLY OLIGOCENE	P20	Sphenolithus predistentus	Theocyrtis tuberosa Zone	R F N	F c c	m f f	0				
							1	0.5 1.0	Void	5 0 4	*
							2				
							3			0	
							4				
							5				
							Core Catcher				*



N9
N8
N6

FORAM-NANNO CHALK/OOZE, white, very light gray, medium gray; semilithified/stiff, abundant bioturbation.

PYRITE, VOLCANIC GLASS, FORAM AND RAD BEARING, MICARB RICH, NANNO CHALK, from gray laminae.

SS 1-72
58% N — 5% Gl — 2% Fe-O — Tr% G
15% M — 5% F — 2% S
10% R — 3% Py — Tr% Fsp

N7 light gray
N5 medium gray

semilithified/stiff

abundant bioturbation

N9 white chalk ooze
N7 light gray
N5 medium gray

semilithified/stiff

$CaCO_3$ 5-87 (90)

Grain Size 5-90 (1.3, 43.4, 55.3)

N9 white — MICARB AND RAD BEARING FORAM-NANNO CHALK, white.

SS CC
46% N — 8% R — 1% S
40% F — 5% M

Explanatory notes in Chapter 2

Site 289 Hole Core 100 Cored Interval: 940.5-950.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	DEFORMATION	LITHO. SAMPLE
EARLY OLIGOCENE	P20 — P19	Reticulofenestra hillae / Sphenolithus predistentus	Theocyrtis tuberosa	N / F / N	A	— / f / —	0, 1	0.5, 1.0	3, 0, 4, 0, 4, 4/0, 0	*
				R / N	A / C	g / f	Core Catcher			*

N9
N8/N5

NANNO-FORAM CHALK/OOZE, white chalk/ooze, very light gray to medium gray; semi-lithified/stiff, abundant bioturbation.

VOLCANIC GLASS BEARING, MICARB FORAM AND RAD RICH NANNO CHALK, from gray laminae.

SS 1-104
48% N 15% F 5% Gl Tr% Py
15% M 15% R 2% S

N9 white

MICARB AND RAD BEARING NANNO-FORAM CHALK, white.

SS CC
50% F 5% M 1% S
39% N 5% R Tr% Gl

Site 289 Hole Core 101 Cored Interval: 950.0-959.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	DEFORMATION	LITHO. SAMPLE
EARLY OLIGOCENE	P19	Cyclococcolithina formosa	Theocyrtis tuberosa	N		—	0, 1 (Empty)	0.5, 1.0	3, 0, 3, 0, 4, 0, 4/0, 0, 4/0	*
							2		4, 4/0, 0, 4/0	
				R / F / N	A / C / C	m / f / f	Core Catcher			*

N9
N8

NANNO-FORAM CHALK/OOZE, white and very light gray.

RAD BEARING, MICARB RICH, NANNO-FORAM CHALK, white and very light gray, semi-lithified/stiff/soft; bioturbated.

SS 1-87
40% F 15% M Tr% Gl
37% N 8% R Tr% Py

X-ray 1-83 (dark gray ash)
34% Amor 66% Cryst 100% Calc

N6 medium gray bands at Section 1-83 to 84, and Section 2-25 to 32.

RAD AND MICARB BEARING, NANNO-FORAM CHALK, white to very light gray.

N9/N8

SS CC
50% F 5% M 1% S
40% N 4% R

Site 289 Hole Core 102 Cored Interval: 959.5-969.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	DEFORMATION	LITHO. SAMPLE
LATE EOCENE	P16	Cyclococcolithina formosa / Discoaster barbadiensis +	Thyrsocyrtis bromia Zone	R / N		—	0, 1 (Empty)	0.5, 1.0	0	*
				R / F / N	A / R / C	g / f / p	Core Catcher			*

N9
N8

NANNO-FORAM CHALK, white and very light gray.

RAD BEARING MICARB RICH NANNO-FORAM CHALK, white and very light gray, bioturbated.

SS 1-100
50% F 15% M Tr% Py
27% N 8% R Tr% S

$CaCO_3$ 1-93 (93)

X-ray 1-93
10% Amor 90% Cryst 100% Calc

N6 medium light gray bands at Section 1-118 to 120, 136.

N9 white

MICARB AND RAD BEARING NANNO-FORAM CHALK, white.

SS CC
60% F 5% M 1% S
29% N 5% R

Site 289 Hole Core 103 Cored Interval: 969.0-978.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	DEFORMATION	LITHO. SAMPLE
LATE EOCENE	P15	Discoaster barbadiensis	Thyrsocyrtis bromia	N	C	f	0, 1 (Empty)	0.5, 1.0		*
				R / F / N	A / C / C	g / f / f	Core Catcher			*

N9

FORAM RAD CHALK

NANNO AND MICARB RICH FORAM RAD CHALK, white; semilithified; bioturbated.

SS 1-80
40% R 15% M 2% S
30% F 13% N

N7 light gray laminae at Section 1-107, 123.

N9 white

MICARB BEARING, RAD RICH, NANNO-FORAM CHALK, white.

SS CC
45% F 11% R
38% N 6% M

Site 289 Hole Core 104 Cored Interval: 978.5-988.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	DEFORMATION	LITHO. SAMPLE
LATE EOCENE	P15	Discoaster barbadiensis	Thyrsocyrtis bromia				0, 1 (Empty)	0.5, 1.0		
				R / F / N	A / R / C	g / p / f	Core Catcher			*

N9

FORAM CHALK, white; semilithified/lithified.

N9 white

NANNO RAD FORAM CHALK, white.

SS CC
40% F 27% N
30% R 3% M

Explanatory notes in Chapter 2

Site 289 Hole Core 105 Cored Interval: 988.0-997.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	LITHOLOGIC DESCRIPTION
LATE EOCENE	P15	Discoaster barbadiensis	Thyrsocyrtis bromia	R N	A C	g m	Core Catcher	N8 — Core catcher only. RAD NANNO-FORAM CHALK, very light gray. SS CC: 35% F, 31% N, 30% R, 2% S, 2% Calc S., Tr% D, Tr% Fsp

Site 289 Hole Core 106 Cored Interval: 997.5-1007.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	DEFORMATION	LITHOLOGIC DESCRIPTION
LATE EOCENE	P15	Discoaster barbadiensis	Thyrsocyrtis bromia				1	3, 0, 4	N9 — FORAM-NANNO CHALK/OOZE, white; semi-lithified/stiff.
							2	Void 5, 4, 0, 4, 0	RAD AND MICARB RICH FORAM-NANNO CHALK, white. SS 2-105: 45% N, 20% M, 20% F, 15% R
							3	Void 5, 0, 4, 0, Void 5	CaCO₃ 3-103 (92); Grain Size 3-106 (0.9, 41.9, 57.2); X-ray 3-110: 9% Amor, 91% Cryst, 100% Calc
							4	0, 4, 0, 4	
							5	0	
				R F N	A C C	g f f	Core Catcher		N9 — FORAM AND RAD BEARING NANNO CHALK, white. SS CC: 79% N, 10% F, 10% R, 1% S

Site 289 Hole Core 107 Cored Interval: 1007.0-1016.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	DEFORMATION	LITHOLOGIC DESCRIPTION
LATE EOCENE	P15	Discoaster barbadiensis	Thyrsocyrtis bromia				1	Empty; 0, 4	N9, N7
							2	0	Chert (N5) — FELDSPAR BEARING RAD RICH NANNO-FORAM LIMESTONE, white and light gray; lithified. SS 2-75: 50% F, 39% N, 15% R, 3% Fsp, 2% M, 1% S, Tr% Gl, Tr% Py. Flaser bedding(?) at Section 2-72 to 74, 100 to 105. CHERT, dark gray, at Section 2-20.
				R F N	A R C	g f m	Core Catcher		N9 — FORAM RAD NANNO OOZE, white; stiff. SS CC: 42% N, 30% R, 26% F, 1% S, 1% Sl, Tr% Fsp

Site 289 Hole Core 108 Cored Interval: 1016.5-1026.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	LITHOLOGIC DESCRIPTION
MIDDLE EOCENE	P14	Discoaster barbadiensis / Discoaster saipanensis	Thyrsocyrtis bromia Zone	R N		— —	1 (Empty at top)	CaCO₃ 1-65 (95). N9, N7 — RAD RICH NANNO-FORAM LIMESTONE, white and light gray; lithified. Wavy and lenticular bedding at Section 1-46 to 47, 50 to 51. Chert — Flaser bedding(?) at Section 1-74. Chert — CHERT medium light gray (N7) at Section 1-21, 92 to 94, 106 to 108, 109 to 111, 130 to 131, 141 to 142.
				R F N	— R C	— p p	Core Catcher	N9, N4 Chert — MICARB BEARING FORAM RICH NANNO CHALK, white, interbedded with chert. SS CC: 70% N, 20% F, 8% M, 2% Carb(?), Tr% Fsp

Explanatory notes in Chapter 2

Site 289 Hole Core 109 Cored Interval: 1026.0-1035.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
							0					
MIDDLE EOCENE	P12-P14	Discoaster saipanensis	?	R	—	—	1	0.5, 1.0	Empty			
				R	—	—						N9, N3 FORAM NANNO LIMESTONE, white limestone, dark gray chert. CHERT at Section 1-145, 147 Lithified.
				R F N	— R C	— P P	Core Catcher				*	

N9 RAD BEARING MICARB RICH FORAM-NANNO LIMESTONE, white.

N5 Chert, medium gray

SS CC
52% N 15% M
30% F(?) 3% R

Site 289 Hole Core 110 Cored Interval: 1035.5-1045.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
							0					
MIDDLE EOCENE	P12-P14	Cyclicargolithus reticulatus / Discoaster saipanensis	Podocyrtis mitra Zone				1	0.5, 1.0	Empty			
				N R F	R	— P						N9, N7, N5 RAD RICH NANNO LIMESTONE, white; lithified, partly siliceous.
			?	R N	T F	P P	Core Catcher				*	

N8 lenticular bedding at Section 1-115, parallel laminae at Section 1-116.

X-ray 1-128
23% Amor 71% Calc 16% Cris 1% Bari
77% Cryst 5% Quar 6% Trid

$CaCO_3$ 1-134 (51)

SILICEOUS LIMESTONE, light gray (N7), lenticular bedded at Section 1-137.

CHERT, medium gray, nodular.

Chert at Section 1-92 to 104, 108, 111 to 113.

N9 MICARB FORAM AND RAD RICH NANNO LIMESTONE, white.

SS CC
45% N 20% R(?) Tr% Py
20% F(?) 15% M

Site 289 Hole Core 111 Cored Interval: 1045.5-1054.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
							0					
MIDDLE EOCENE	P12-P14	Cyclicargolithus reticua reticulatus	No Radiolaria Zones recognizable in this or lower cores. Radiolaria absent.				1	0.5, 1.0	Empty	0		N9, N3, N5 NANNO LIMESTONE, white (N9); lithified; bioturbated, flaser bedding.
									Void			
							2			0		
							3			0		
				F N	R F	P P	Core Catcher				* CC	N9

CHERT, dark gray (N3) at:
Section 1-62 yo 65, 143 to 144, 149 to 150
Section 2-88 to 90
Section 3-18 to 19, 27 to 29, 70 to 72, 75 to 76, 105 to 107, 112 to 113, 120 to 121, 140 to 144

Stylolites (N5) at:
Section 2-72, 136 to 137
Section 3-42 to 44, 46

MICARB-FORAM-RAD-BEARING NANNO LIMESTONE, white (N9).

SS CC
70% N 10% R Tr% Py
10% F 10% M

Site 289 Hole Core 112 Cored Interval: 1054.5-1064.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
							0					
MIDDLE EOCENE	P12 or P13	Cyclicargolithus reticulatus	(T. bromia) downhole contamination	R F N	A R F	g p p	Core Catcher				*	N5 CHERT, medium gray (N5), fragmented by drilling. N9 LIMESTONE, white (N9).

SS CC
70% N 10% F
20% M Tr% R

Explanatory notes in Chapter 2

Site 289 Hole Core 113 Cored Interval: 1064.0-1073.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
							0					
MIDDLE EOCENE	P11	Chiasmolithus gigas		F N	R C	p p	1	0.5 1.0	Empty			N9 NANNO-FORAM LIMESTONE, white (N9); lithified, bioturbated. N6 CHERT, medium light gray (N6) with limestone inclusions. X-ray 1-116 3% Amor 97% Cryst 100% Calc

Site 289 Hole Core 114 Cored Interval: 1073.5-1083.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
							0					
LOWER EOCENE	P8	Discoaster lodoensis		N F	R R	p p	1	0.5 1.0	Empty	0		CHERT, dark gray, light gray, medium gray, interdigitates with limestone, limestone blebs. LIMESTONE, white (N9), bioturbated. N3, N7, N5 N9

Site 289 Hole Core 115 Cored Interval: 1083.0-1092.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
							0					
EARLY EOCENE	P7	? Discoaster diastypus Discoaster lodoensis		N N F	 F C	— p p	1	0.5 1.0				5PB 5/2, N5, N4, 5Y 4/1 CHERT, medium grayish blue, medium gray, medium dark gray, olive gray, cuts across bedding, interfingers with limestone. N9, N8, N6 LIMESTONE, siliceous, white, very light gray, medium gray, bioturbated. Flaser bedded(?) at Section 1-77 to 81 Lenticular bedded(?) Section 1-102 to 106 Wavy bedding Section 1-138 to 140

Site 289 Hole Core 116 Cored Interval: 1092.5-1102.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
							0					
LATE PALEOCENE	P5	Discoaster multiradiatus		F N	R F	p p	1	0.5 1.0				LIMESTONE, white (N9), bioturbated. N9 N7 CHERT, light gray (N7).

Site 289 Hole Core 117 Cored Interval: 1102.0-1111.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
							0					
LATE PALEOCENE	P4	Discoaster multiradiatus		F N	R F	p p	Core Catcher				*	5YR 2/1, 5YR 4/1 CHERT, brownish gray, brownish black. N9 NANNO-FORAM LIMESTONE, white. SS CC 60% F 1% M Tr% Pyr 38% N 1% Fsp

Site 289 Hole Core 118 Cored Interval: 1111.5-1121.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
							0					
LATE PALEOCENE	P4	Discoaster multiradiatus					1	0.5 1.0				CHERT, medium light gray (N6). LIMESTONE, white (N9), bioturbated. X-ray 1-85 3% Amor 97% Cryst 100% Calc N9 $CaCO_3$ 1-106 (100) N6
				N	C	m	Core Catcher				* CC	N9 FELDSPAR-BEARING, MICARB-RICH FORAM-NANNO LIMESTONE, white. SS CC 42% N 15% M 40% F 3% Fsp

Explanatory notes in Chapter 2

Site 289 Hole Core 119 Cored Interval: 1121.0-1130.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE		LITHOLOGIC DESCRIPTION
							0						
LATE PALEOCENE	P4	Discoaster multiradiatus		F N	C C	p p	Core Catcher				*	N9	MICARB-RICH, FORAM-NANNO LIMESTONE, white (N9). SS CC 43% N 15% M 40% F 2% Fsp

Site 289 Hole Core 120 Cored Interval: 1130.5-1136.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE		LITHOLOGIC DESCRIPTION
							0						
LATE PALEOCENE	P4	Discoaster mohleri Heliolithus kleinpellii		N N F	— C R	 f p	1	0.5 1.0				N9 N4 N6 N3	LIMESTONE, white (N9), bioturbated. CHERT, medium dark gray, medium light gray, dark gray, nodular with limestone blebs.
							Core Catcher					N9 10YR 6/6	LIMESTONE, white. CHERT, brownish yellow.

Site 289 Hole Core 121 Cored Interval: 1136.0-1145.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE		LITHOLOGIC DESCRIPTION
							0						
EARLY PALEOCENE	F16	Cyclococcolithina tobusta		N		—	1	0.5 1.0	Empty			N9 N7	Stylolites at Section 1-113. Bioturbated. LIMESTONE, white, light gray, wavy, flaser and lenticular bedding at Section 2-78 to 93, 101 to 125, 130 to to 138. CHERT, dark brown (7.5YR 3/2) at Section 2-92, 98, 126. PYRITE-BEARING, NANNO-RICH, MICARB-ZEOLITE, olive gray (5Y 4/1); occur in thin laminae at Section 2-84 and 133.
				N F	C C	f p	2				*		SS 2-84 50% Z 27% M Tr% Gl 20% N 3% Py X-ray 2-84 (Zeolitite) 48% Amor 1% Quar 4% Mont 52% Cryst 2% K-Spar 15% Clin 56% Calc 2% Chlo 21% Sepi

Site 289 Hole Core 122 Cored Interval: 1145.5-1155.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE		LITHOLOGIC DESCRIPTION
							0						
EARLY PALEOCENE		C. tenuis					1	0.5 1.0	Empty			N8 N7 N4	LIMESTONE, very light gray, light gray, also medium dark gray specks, wavy, flaser and lenticular bedding at Section 1-128 to 134, and Section 2-30 to 35. (NB - flaser and lenticular bedding best displayed where limestone and zeolitite are interbedded). Stylolites at Section 2-63. Bioturbated, with greenish gray (5G 6/1) burrow walls. Zoophycos at Section 2-110.
? LATE MAASTRICHTIAN	P16	Micula mura		N F F F N	R R C R	p p p p	2						LIMESTONE, SILICEOUS, light olive gray (5Y 6/1) at Section 2-23 to 25. Bioturbated at Section 2-30 to 32. CHERT, red (10R 4/6). ZEOLITITE, olive gray (5Y 2/1) at Section 2-99 and 128.

Site 289 Hole Core 123 Cored Interval: 1155.0-1164.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE		LITHOLOGIC DESCRIPTION
							0						
M. MAASTRICHTIAN	G. gansseri Zone			F N	C C	f f	1	0.5 1.0	Empty	0		N9	LIMESTONE; white; bioturbated; stylolites at Section 1 29 and 101. CHERT, red (10R 4/6) at Section 1-55 to 60.

Site 289 Hole Core 124 Cored Interval: 1164.5-1174.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE		LITHOLOGIC DESCRIPTION
							0						
MID. MAASTRICHTIAN	Globotruncana gansseri Zone						1	0.5 1.0	Empty				
				F N	A C	p f	2			0		N9	LIMESTONE, SILICEOUS, white; bioturbated; stylolites at Section 2-67. CaCO3 2-149 (99)

Explanatory notes in Chapter 2

Site 289 Hole Core 125 Cored Interval: 1174.0-1183.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
							0					
MIDDLE MAASTRICHTIAN	G. gannsseri Zone			F	A	f	1	0.5 – 1.0	Empty	0		N9 LIMESTONE, SILICEOUS; white; bioturbated. CHERT, red (10R 4/6) at Section 1-146 to 150.

Site 289 Hole Core 126 Cored Interval: 1183.5-1193.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
							0					
MIDDLE MAASTRICHTIAN	G. gansseri Zone	Lithraphidites quadratus		F N	C C	f m	1	0.5 – 1.0	Empty	0 3	*	N9 LIMESTONE; white. N9 MICARB BEARING NANNO OOZE, white; a soft to stiff interval. SS 1-140 88% N 2% F 10% M Tr% Py

Site 289 Hole Core 127 Cored Interval: 1193.0-1202.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
							0					
EARLY MAASTRICHTIAN		Tetralithus trifidus		F N	R C	p m	1	0.5 – 1.0	Empty			N9 LIMESTONE (Chalky); white and pink gray (5YR 8/1); bioturbated. X-ray 1-144 to 146 2% Amor 98% Cryst 100% Calc

Site 289 Hole Core 128 Cored Interval: 1202.5-1212.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
							0					
EARLY MAASTRICHTIAN		Tetralithus trifidus		F	—	—	1	0.5 – 1.0	Empty	0		N9 LIMESTONE (Chalky) white and pink gray (5YR 8/1); bioturbated.

Site 289 Hole Core 129 Cored Interval: 1212.0-1221.5 m

AGE	FORAMS	NANNOS	RADS	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
							0					
LATE CAMPANIAN OR EARLY MAASTRICHTIAN?		Tetralithus trifidus		F N	— C	— m	1	0.5 – 1.0	Empty			N9 LIMESTONE; white; bioturbated. CHERT, red (10R 4/6) at Section 1-140. N9 LIMESTONE, white.

Site 289 Hole Core 130 Cored Interval: 1221.5-1231.0 m

AGE	FORAMS	NANNOS	RADS	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
							0					$CaCO_3$ 1-0 (99)
LATE CAMPANIAN		Broinsonia parca		F N	— C	— m	Core Catcher					N9 LIMESTONE (Chalky); white; and CHERT (variegated); red (10R 4/3) and dark brown (7.5YR 4/4). X-ray CC 39% Amor 7% Quar 1% Chlo 61% Cryst 4% K-Spar 1% Mont 48% Calc 5% Mica 35% Paly

Explanatory notes in Chapter 2

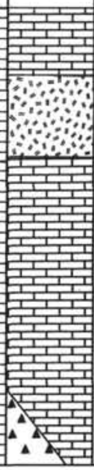
Site 289 Hole Core 131 Cored Interval: 1231.0-1259.5 m

AGE: CAMPANIAN; APTIAN; APTIAN — NANNOS: E. augustus ? — FORAMS: Hedbergella trochoidea

FOSSIL CHARACTER (FOSSIL / ABUND. / PRES.): F T p; N C m — F T p; N R p; F R f — F C f; N C m; F C f

SECTION: 0, 1, 2, 3 — METERS: 0.5, 1.0

LITHOLOGY



LITHOLOGIC DESCRIPTION

5YR 7/4
5YR 5/4

LIMESTONE, white, pinkish gray, orange brown, reddish brown, (colors gradational). Wavy flaser bedding at Section 1-20 to 29; bioturbated.

5YR 3/2

ZEOLITE-FORAM-MICARB-BEARING, NANNO LIMESTONE, white, pinkish gray; biotrubated.

SS 1-5
79% N 5% Z 1% Py
10% M 5% F

5Y 6/1
N4 •
7.5YR 8/2
10YR 8/2

HEAVY MINERAL, ZEOLITE-MICARB-BEARING, GLASS-SHARD-RICH NANNO LIMESTONE, reddish brown; bioturbated.

SS 1-48
47% N 10% M 3% HM 1% Py
30% Gl 7% Z 2% Fsp

NANNO-FELSPAR-HEAVY MINERAL-ZEOLITE-OPAQUE MINERAL-BEARING, GLASS-SHARD TUFF, grayish brown, with blebs of reddish brown; bioturbated.

SS 1-106
74% Gl 5% HM 3% Fsp
10% Opaq 5% Z 3% N

X-ray 1-106
34% Amor 6% K-Spar 2% Mont
66% Cryst 5% Mica 75% Paly
11% Quar 1% Chlo

SPONGE SPICULE-MICARB-GLASS-SHARD-ZEOLITE-BEARING NANNO LIMESTONE, light olive gray, medium dark gray, pinkish white, white, wavy, flaser and lenticular bedding; bioturbated; silicified at some intervals.

SS 2-12
67% N 10% Z 5% S 1% HM
10% Gl 5% M 2% Fsp

ZEOLITE-GLASS-SHARD-MICARB-BEARING, NANNO LIMESTONE, light olive gray, medium dark gray, pinkish white, white, wavy, flaser and lenticular-bedded; bioturbated.

SS 2-76
84% N 5% Gl 1% Opaq M.
7% M 3% Z

CHERT, brownish black (5YR 2/1), dark reddish brown (5YR 3/4), with limestone blebs at Section 2-40, 65, 80 to 83, 85, 112 to 125, and 125.

X-ray 2-105-107
15% Amor 90% Calc 4% Paly 3% Bari
85% Cryst 2% Mont 2% Clin

X-ray CC
2% Amor 98% Cryst 100% Calc

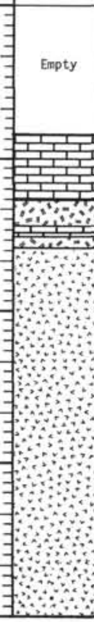
Site 289 Hole Core 132 Cored Interval: 1259.5-1269.0 m

AGE: APTIAN

FOSSIL CHARACTER (FOSSIL / ABUND. / PRES.): F C p; N C m

SECTION: 0, 1, 2, 3, 4 — METERS: 0.5, 1.0

LITHOLOGY



LITHOLOGIC DESCRIPTION

LIMESTONE, light olive gray, medium dark gray, pinish white, white, wavy, flaser and lenticular bedding, bioturbated, basal part - yellowish brown.

HEAVY MINERAL-NANNO-OPAQUE MINERAL-BEARING, ZEOLITE RICH, GLASS SHARD TUFF, grayish brown.

5Y 6/1
N4
7.5YR 8/2
10YR 8/2
10YR 6/4
5YR 3/2
10YR 6/4
5YR 3/2

SS 2-50
71% Gl 5% Opaq M. 3% N
15% Z 3% HM 1% R

X-ray 2-50
52% Amor 9% Quar 3% Mica
48% Cryst 60% K-Spar 29% Mont

LIMESTONE, yellowish brown.

FELDSPAR-OPAQUE MINERAL-BEARING GLASS SHARD TUFF, grayish brown.

SS 2-76
87% Gl 5% Opaq 1% M
5% Fsp 2% N

X-ray 2-75
69% Amor 7% Quar 9% Mica
31% Cryst 42% K-Spar 43% Mont

X-ray 2-87
1% Amor 95% Calc 1% Mica
99% Cryst 4% Quar

BASALT

N6/N4, dry, medium light gray to medium dark gray
5Y 4/1/5GY 4/1, wet, olive-gray to dark greenish gray

The top 10 cm is a chill zone, grading downwards from a fine variolitic texture to an intergranular texture. The groundmass consists of hollow plagioclase, variolitic pyroxene, quench magnetite, and chloritized glass.

The basalt consists of two alternating textural types which grade into one another:
(1) coarser intergranular texture: Section 2-92 to 150, Section 3-0 to 48 and 78 to 150, Section 4-0 to 12 and 65 to 150
(2) fine variolitic texture: Section 3-48 to 78, Section 4-12 to 65.

The intergranular basalt contains approximately equal amounts of plagioclase and pyroxene, ∼5% magnetite, and a few percent chlorite.

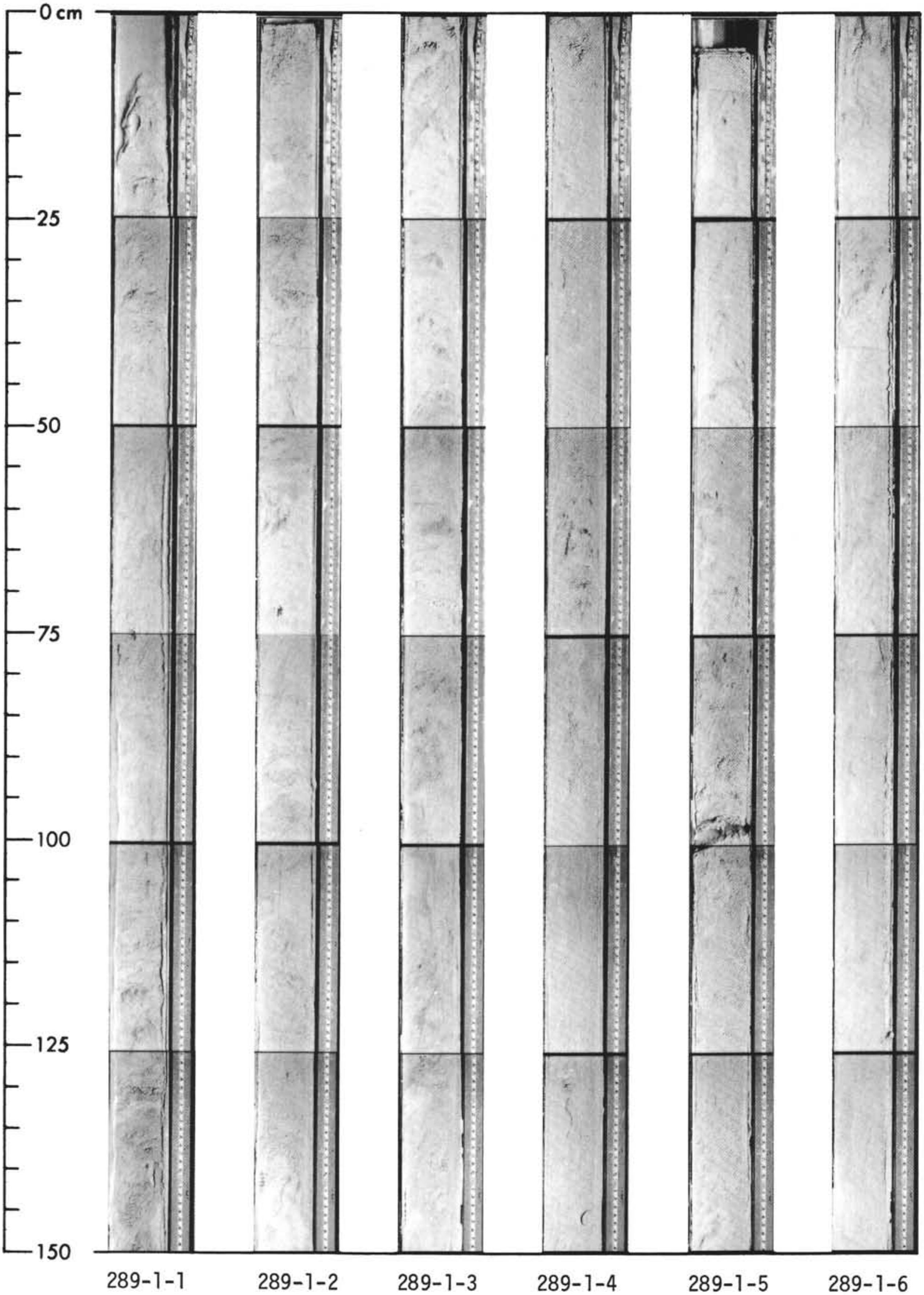
Veins <1½ cm common in Sections 2 and 3, chlorite, calcite, quartz and 10YR 5/4 yellowish brown unidentified material (opaline or jasperoid?), vesicles <2 mm throughout, <1% volcanic. Indistinct to distinct thin flow laminae common throughout.

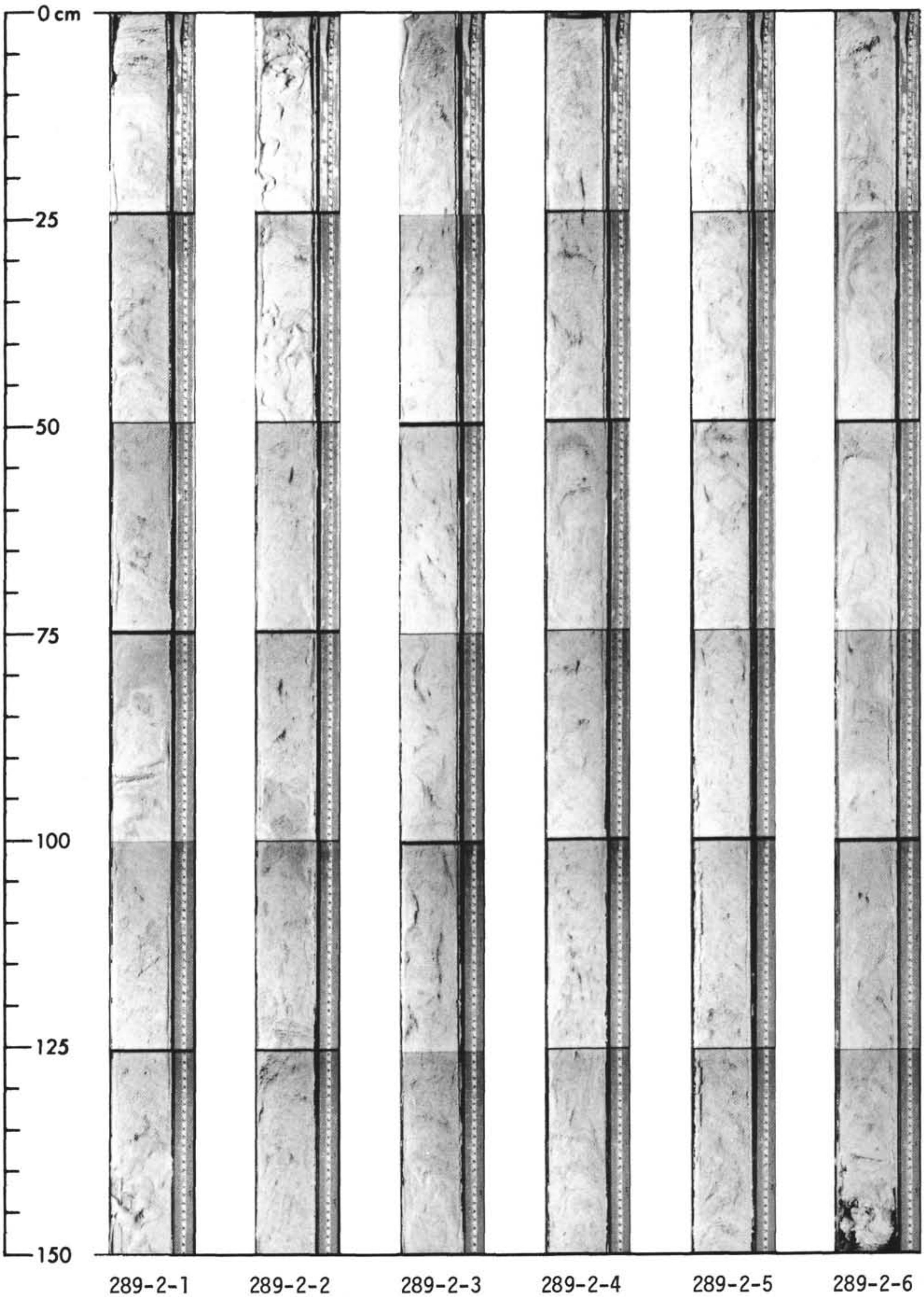
Explanatory notes in Chapter 2

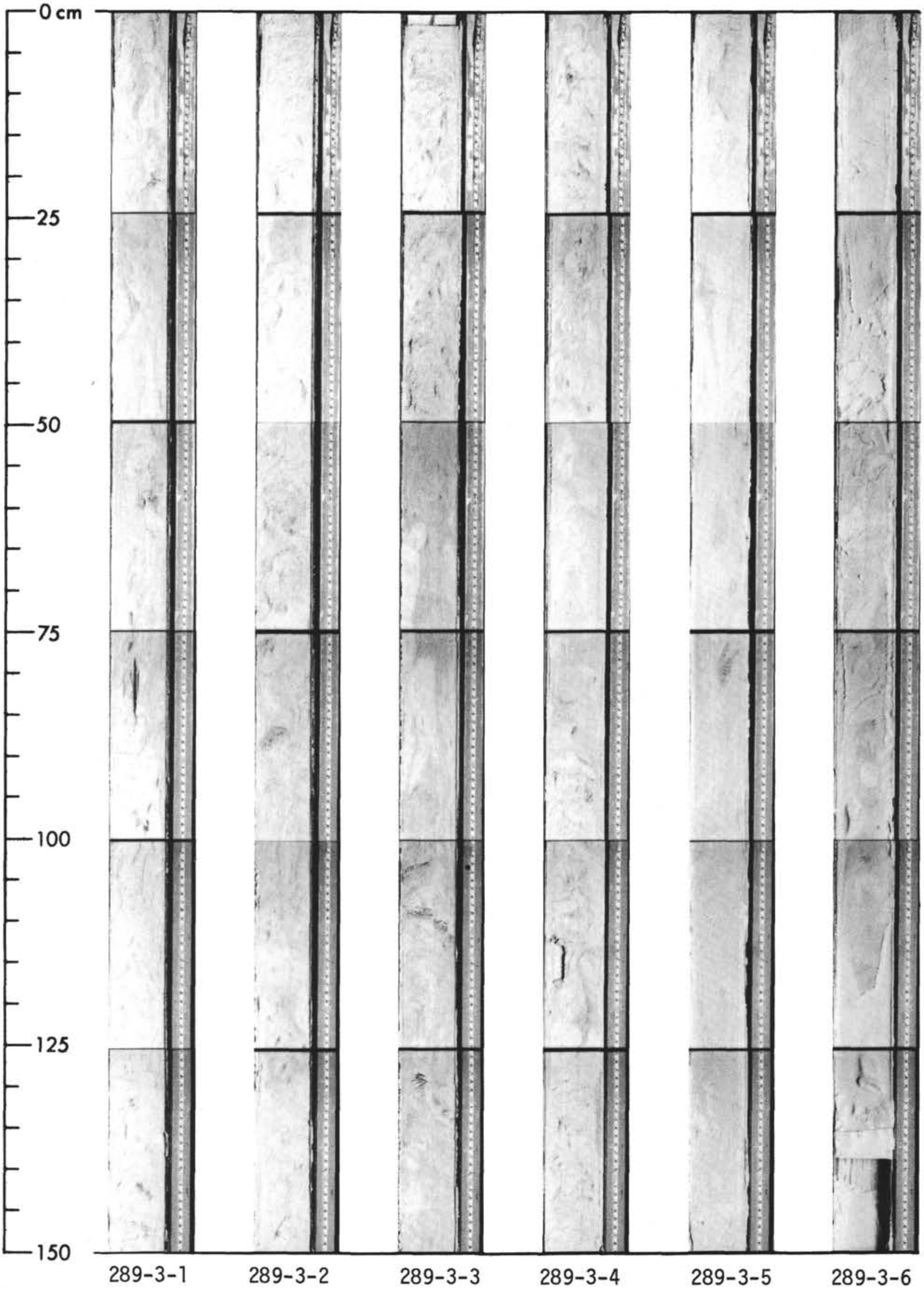
Site 289 Hole Core 133 Cored Interval: 1269.0-1271.0 m

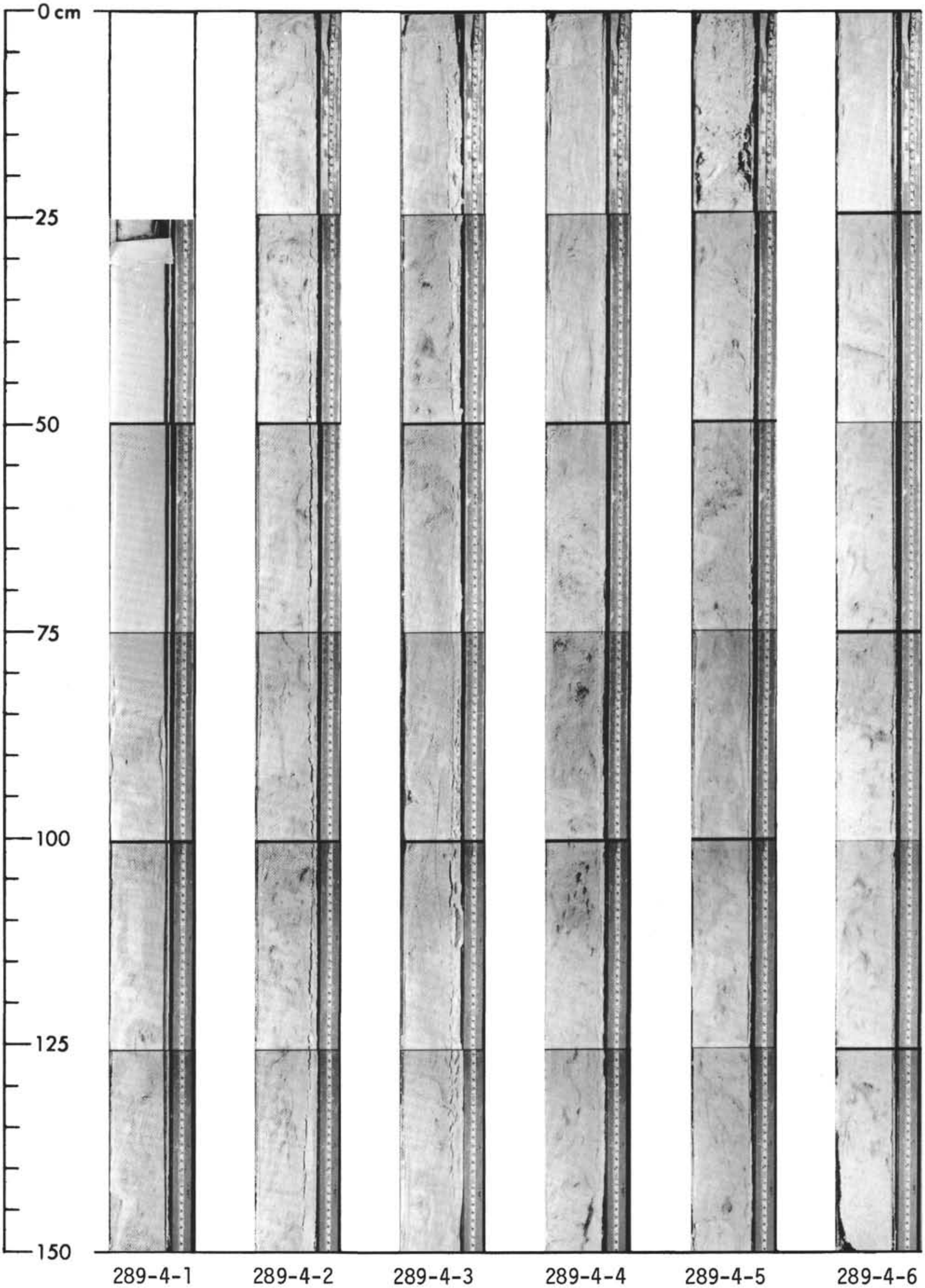
AGE	FORAMS	NANNOS	RADS	FOSSIL CHARACTER: FOSSIL	FOSSIL CHARACTER: ABUND.	FOSSIL CHARACTER: PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
							0					
							1	0.5 1.0	Empty			BASALT Like basalte of Core 132, intergranular texture Section 1-107 to 118, varolitic texture at Section 1-118 to 150.

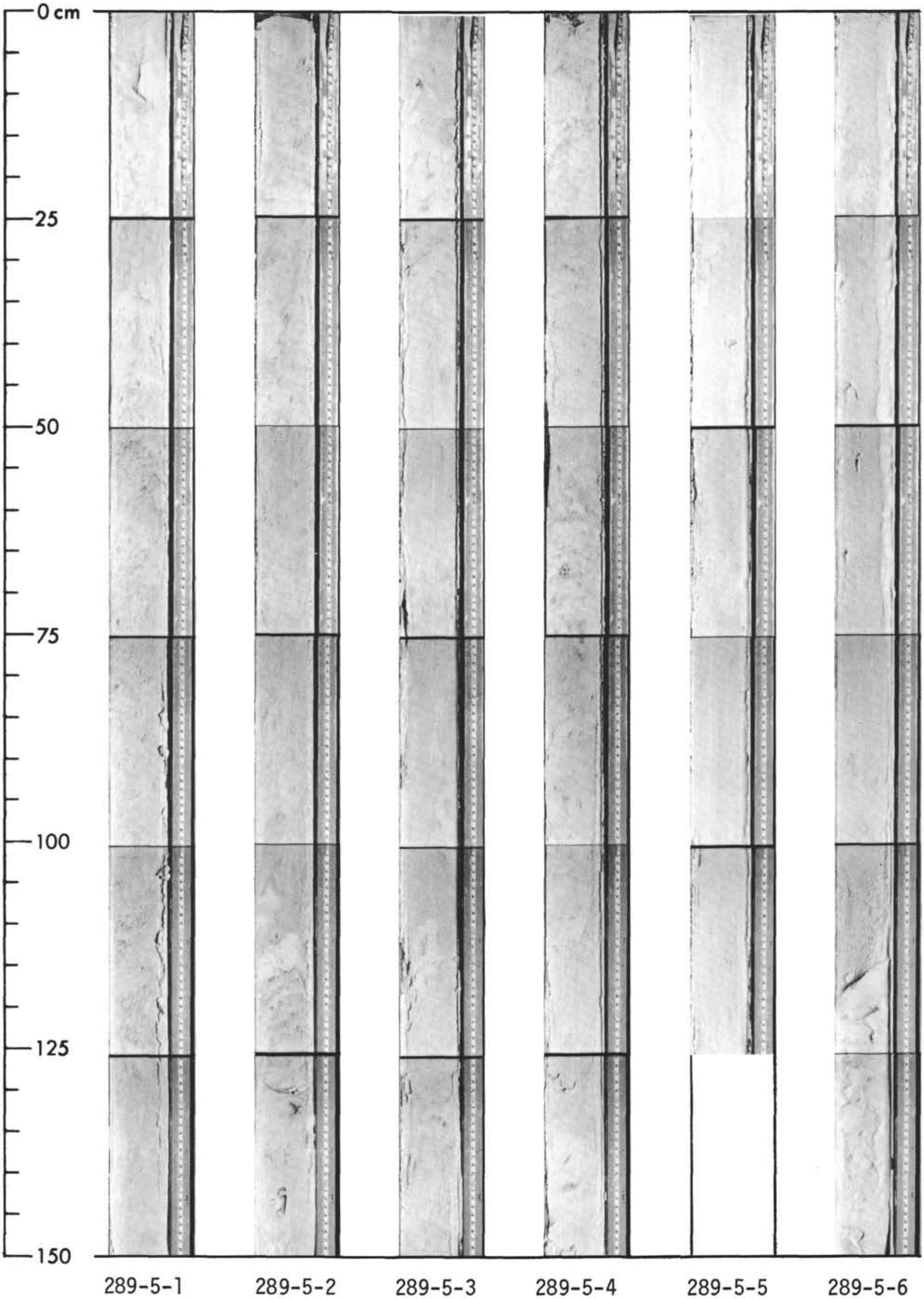
Explanatory notes in Chapter 2

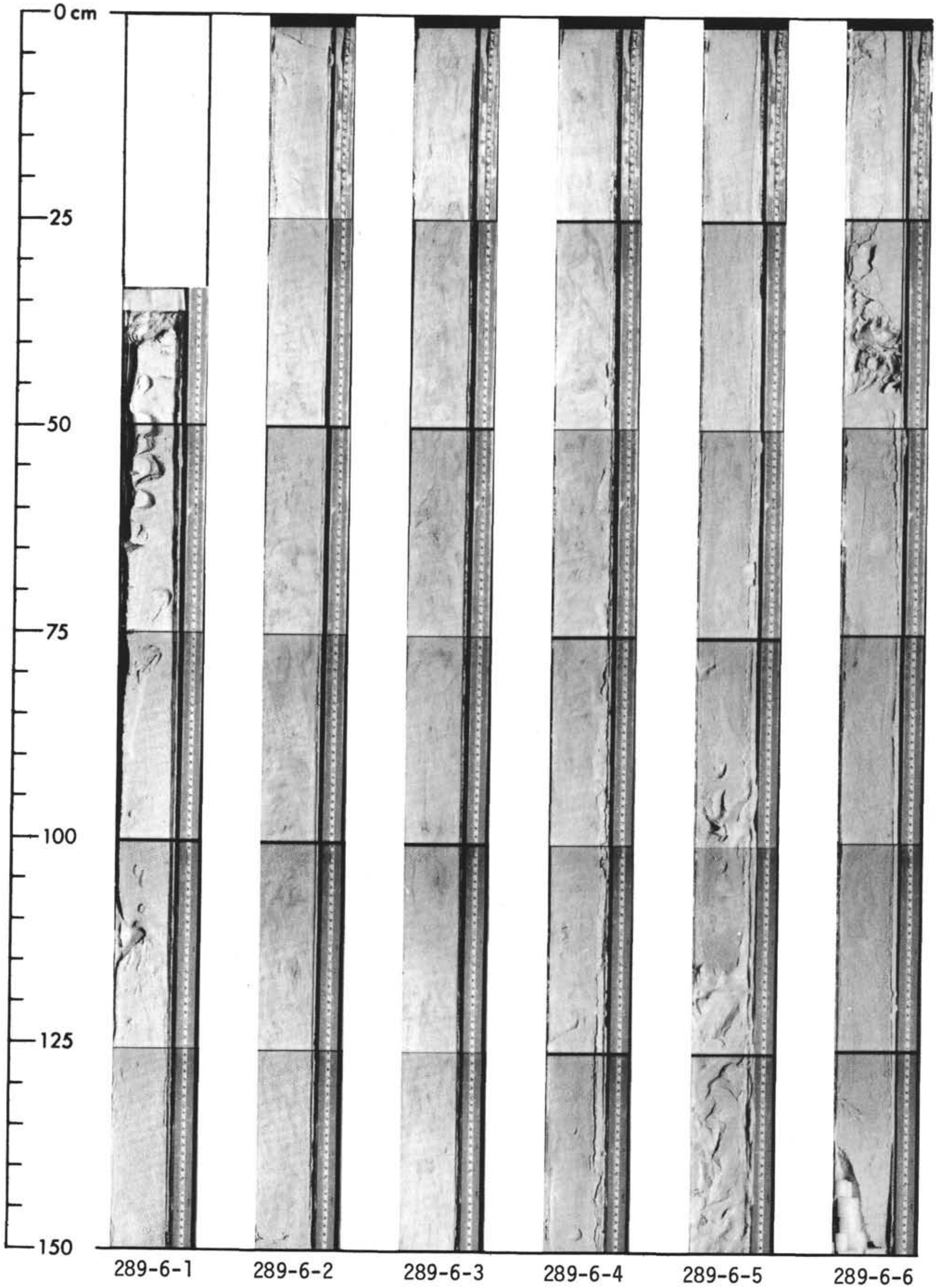

0 cm
25
50
75
100
125
150
289-1-1
289-1-2
289-1-3
289-1-4
289-1-5
289-1-6

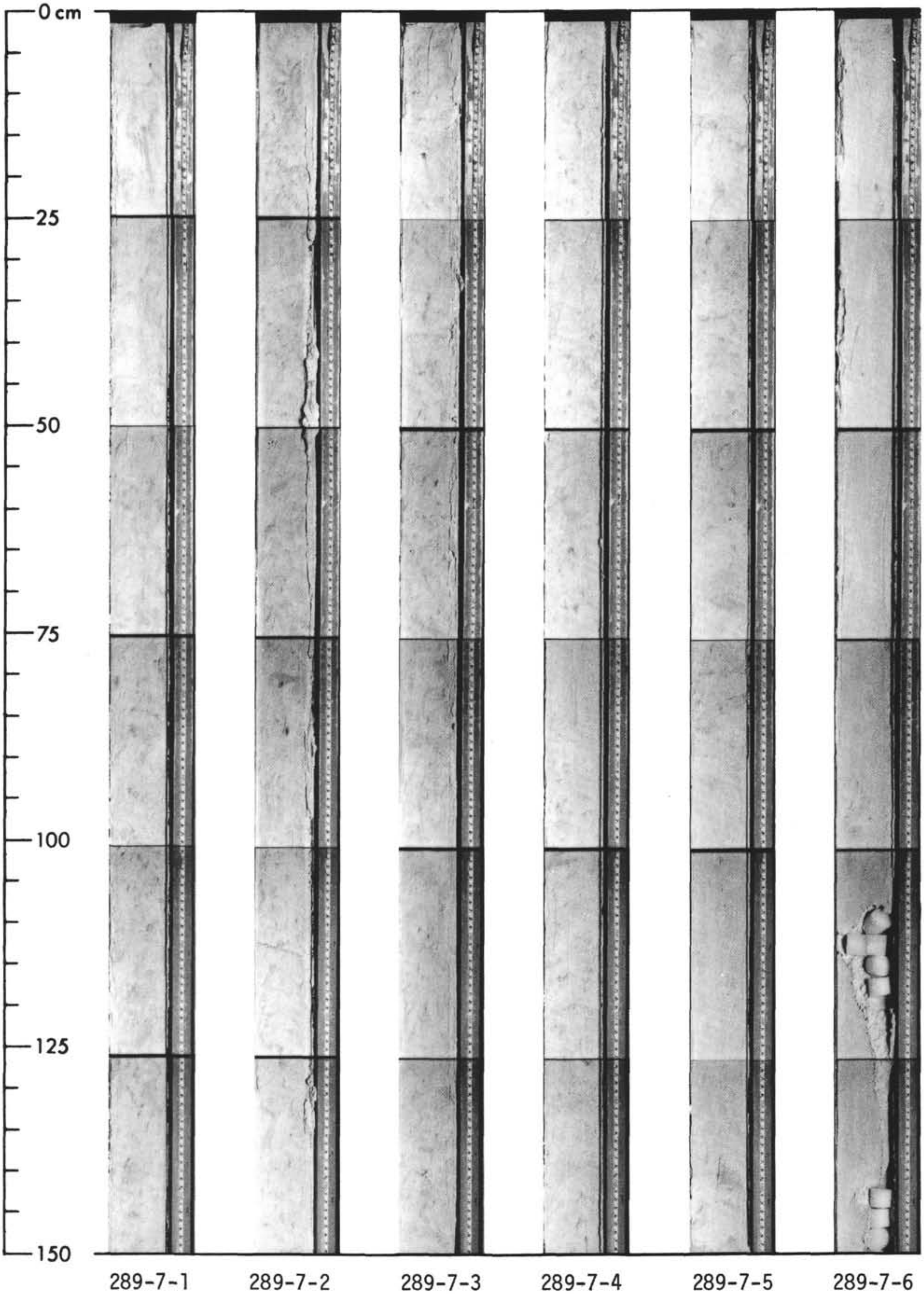

0 cm
25
50
75
100
125
150
289-2-1
289-2-2
289-2-3
289-2-4
289-2-5
289-2-6

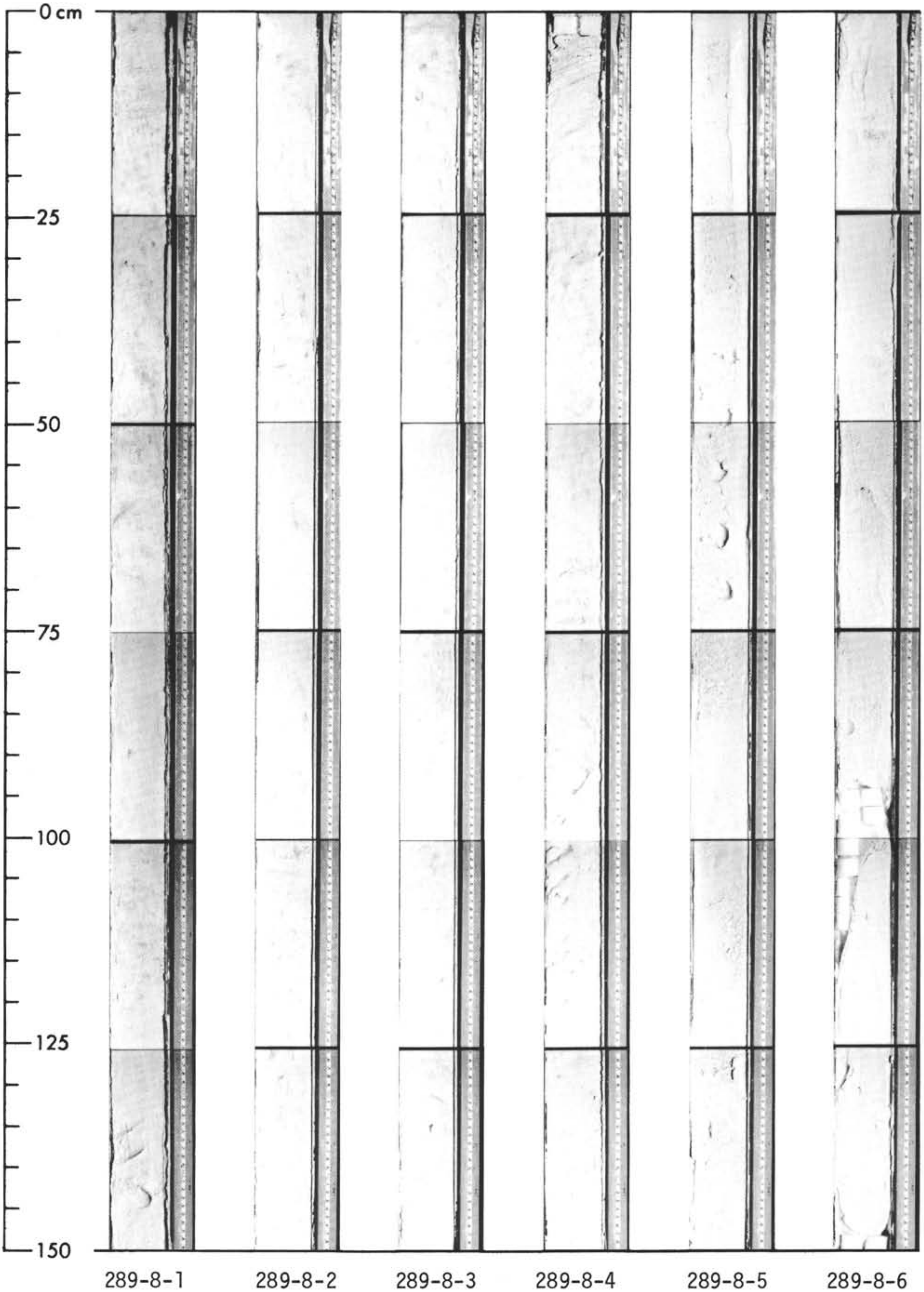

0 cm
25
50
75
100
125
150
289-3-1
289-3-2
289-3-3
289-3-4
289-3-5
289-3-6

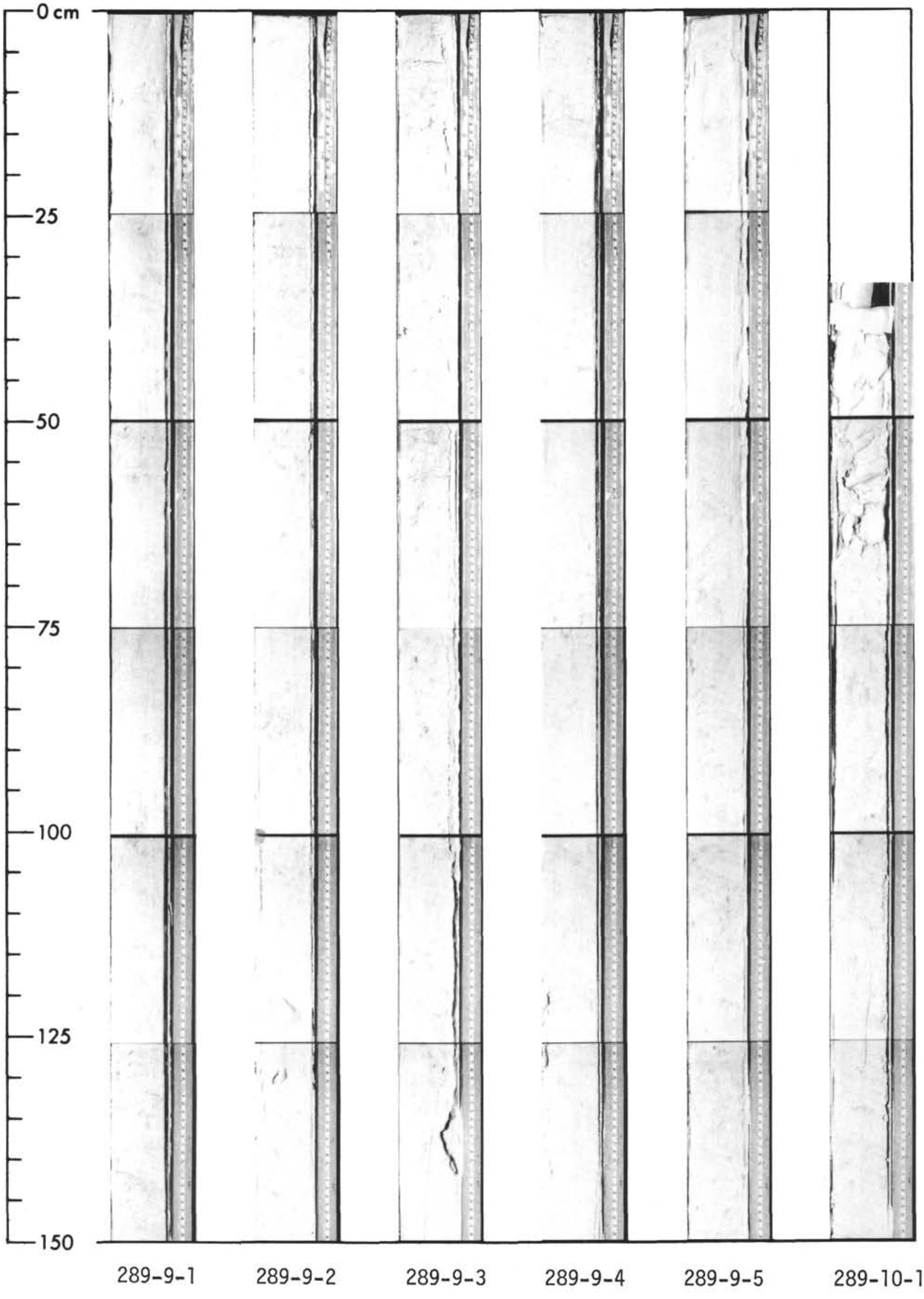

0 cm
25
50
75
100
125
150
289-4-1
289-4-2
289-4-3
289-4-4
289-4-5
289-4-6

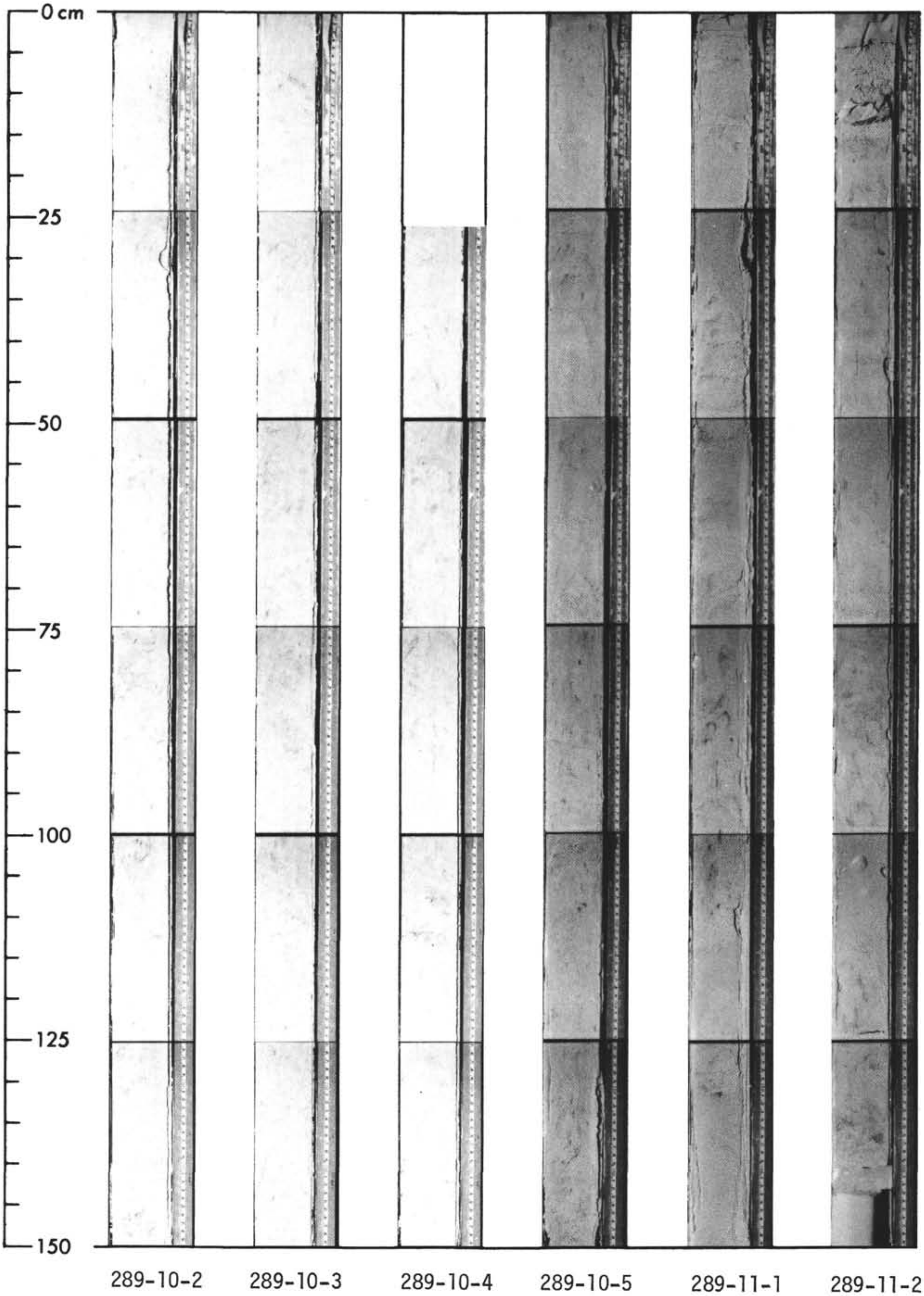

0 cm
25
50
75
100
125
150
289-5-1
289-5-2
289-5-3
289-5-4
289-5-5
289-5-6

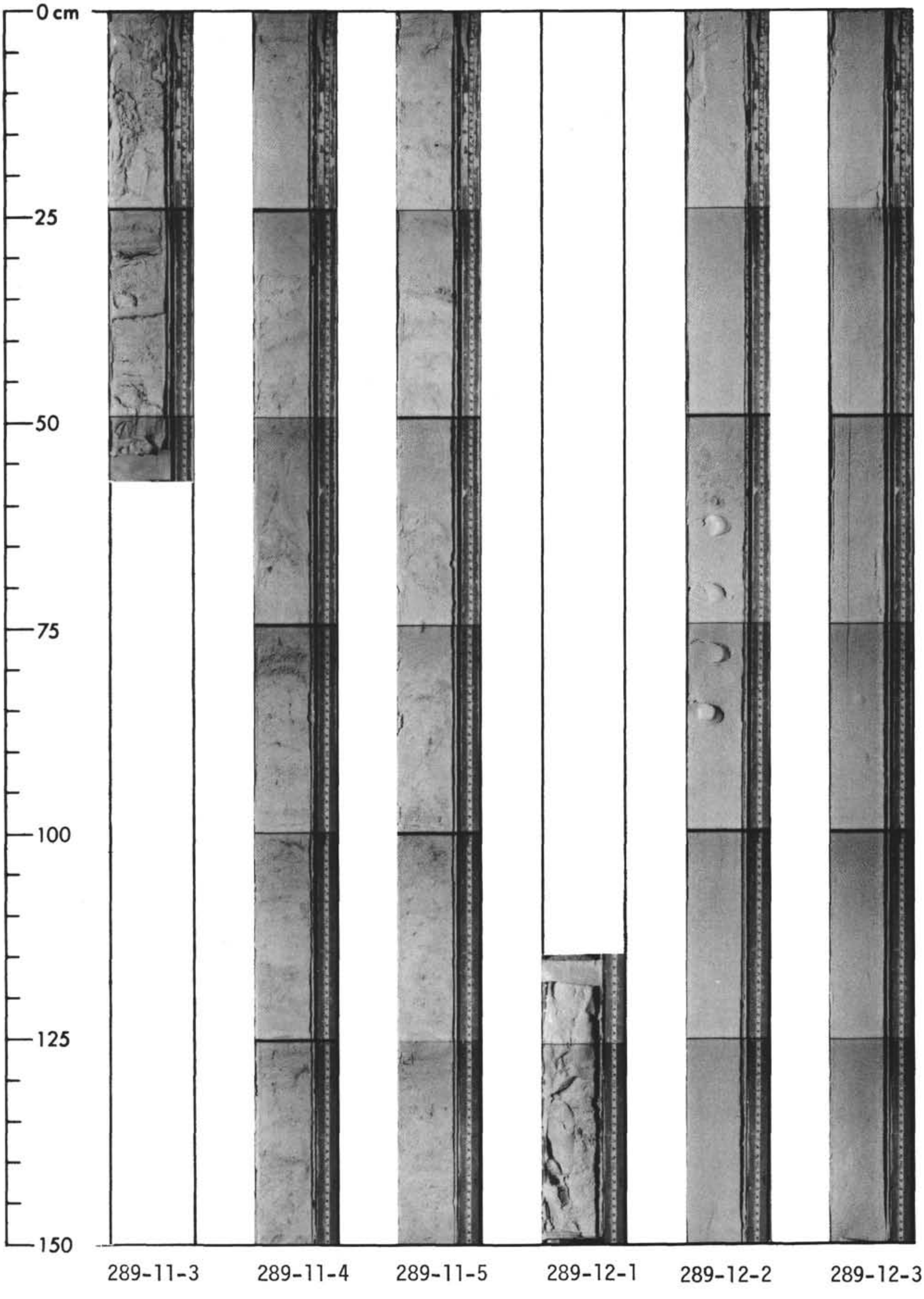

0 cm
25
50
75
100
125
150
289-6-1
289-6-2
289-6-3
289-6-4
289-6-5
289-6-6

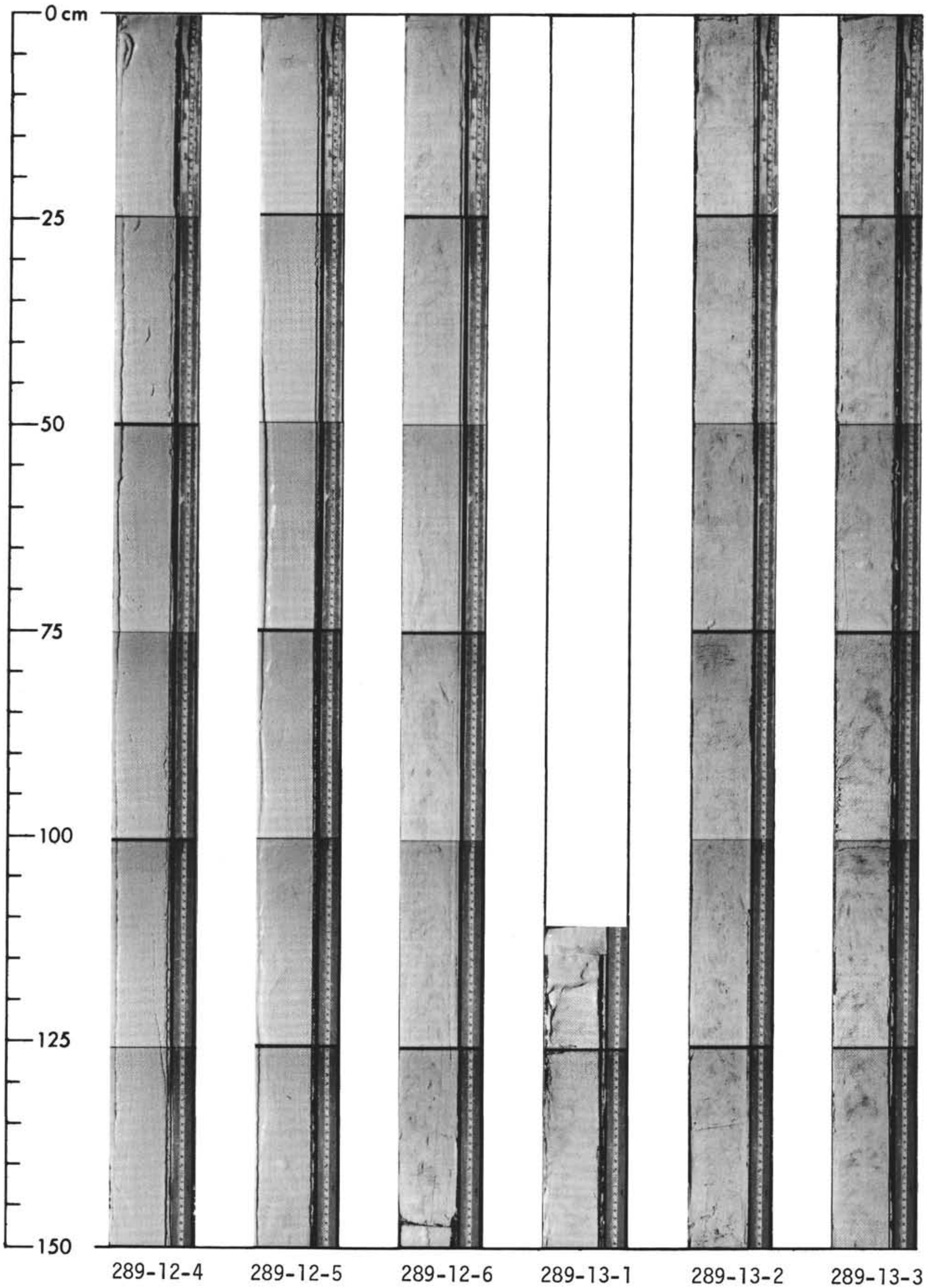

0 cm
25
50
75
100
125
150
289-7-1
289-7-2
289-7-3
289-7-4
289-7-5
289-7-6

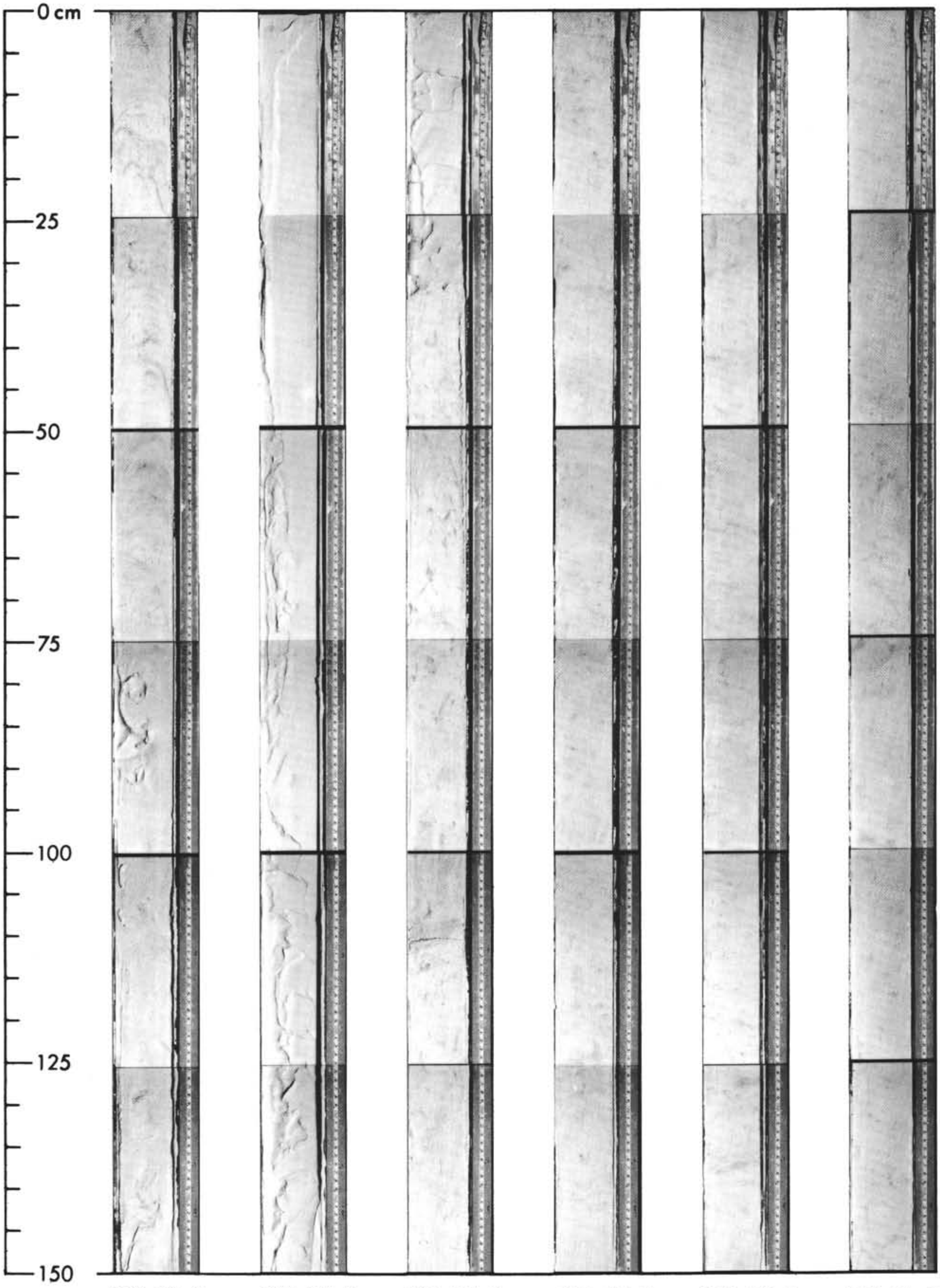

0 cm
25
50
75
100
125
150
289-8-1
289-8-2
289-8-3
289-8-4
289-8-5
289-8-6

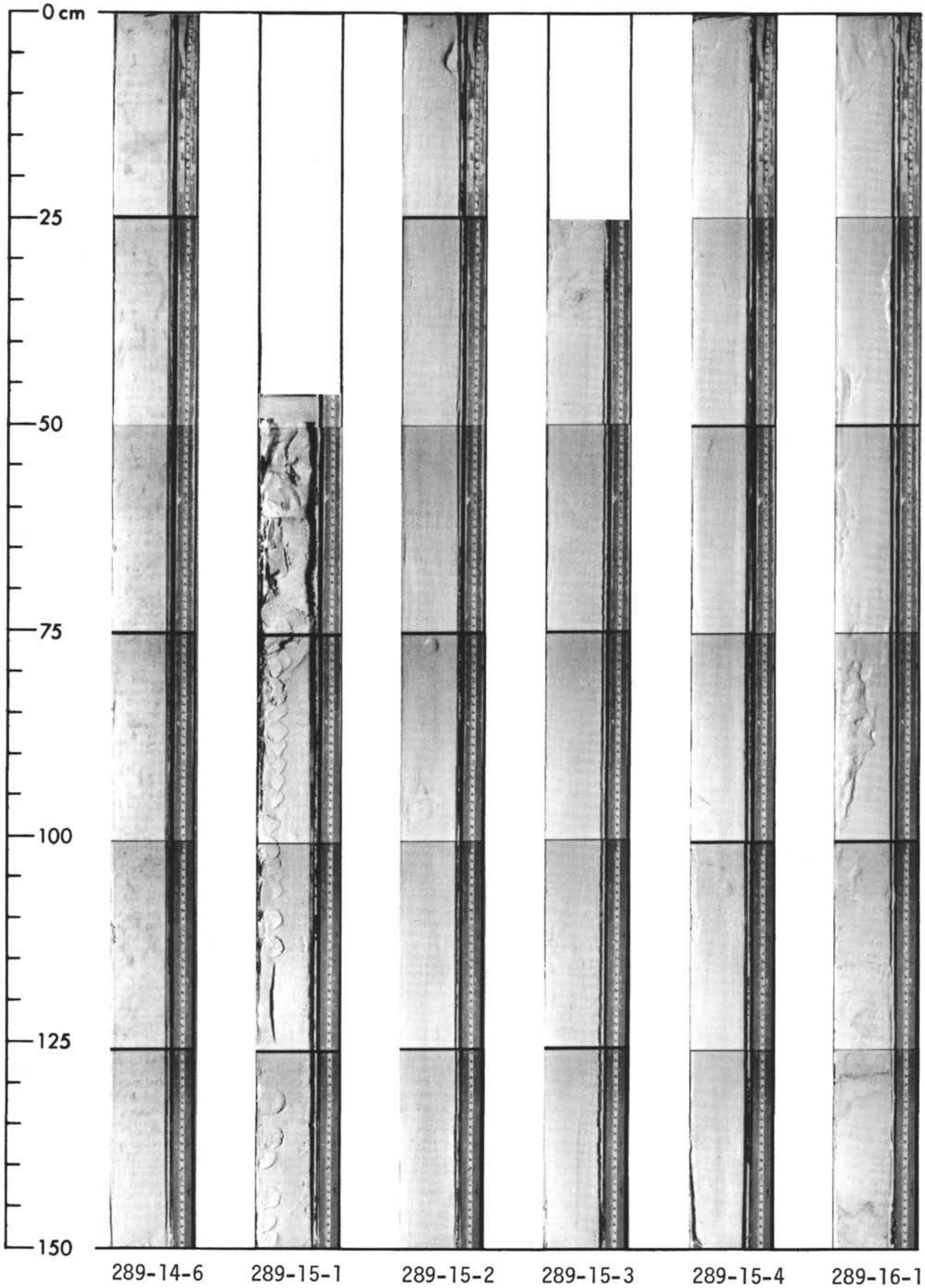

0 cm
25
50
75
100
125
150
289-9-1
289-9-2
289-9-3
289-9-4
289-9-5
289-10-1

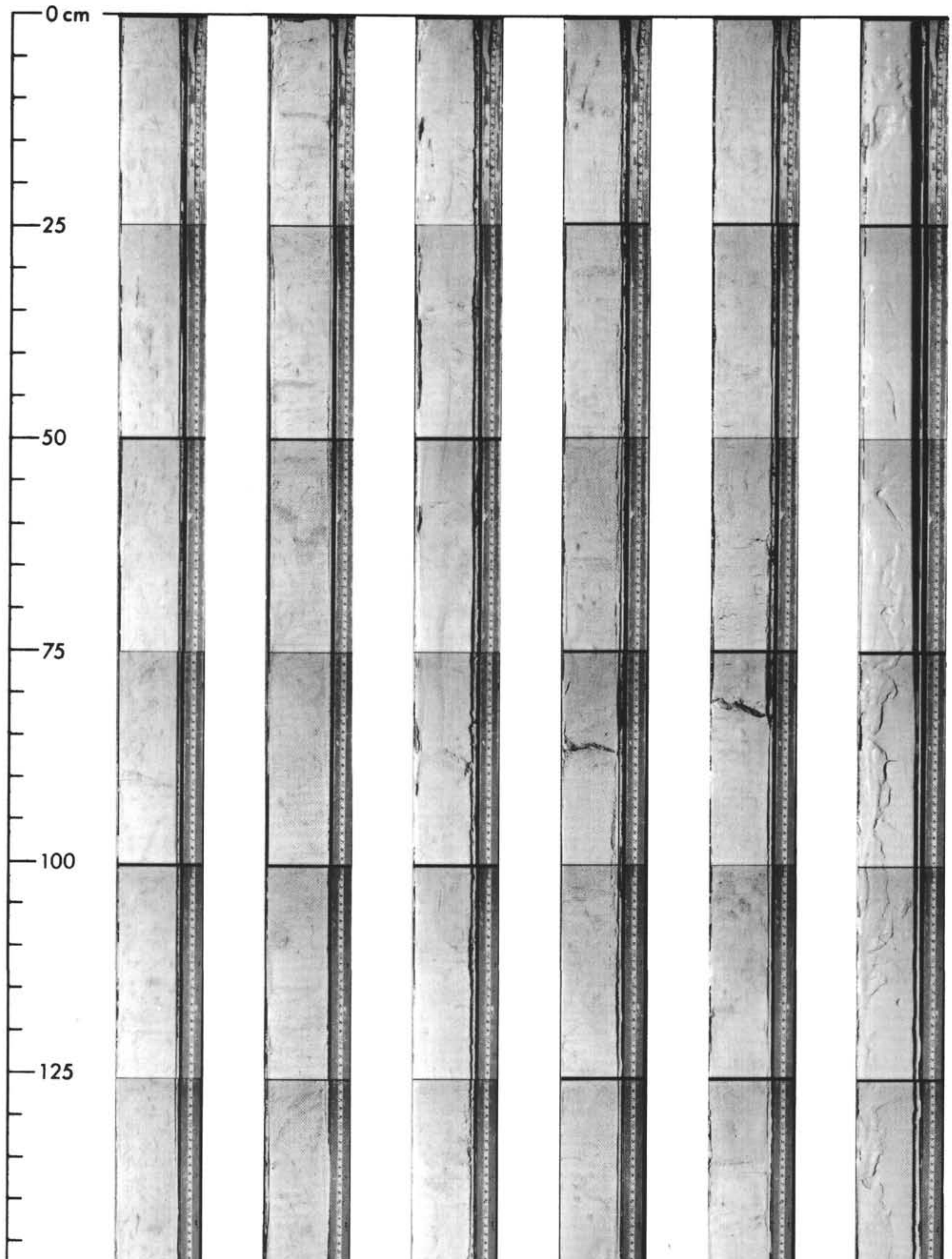

0 cm
25
50
75
100
125
150
289-10-2
289-10-3
289-10-4
289-10-5
289-11-1
289-11-2

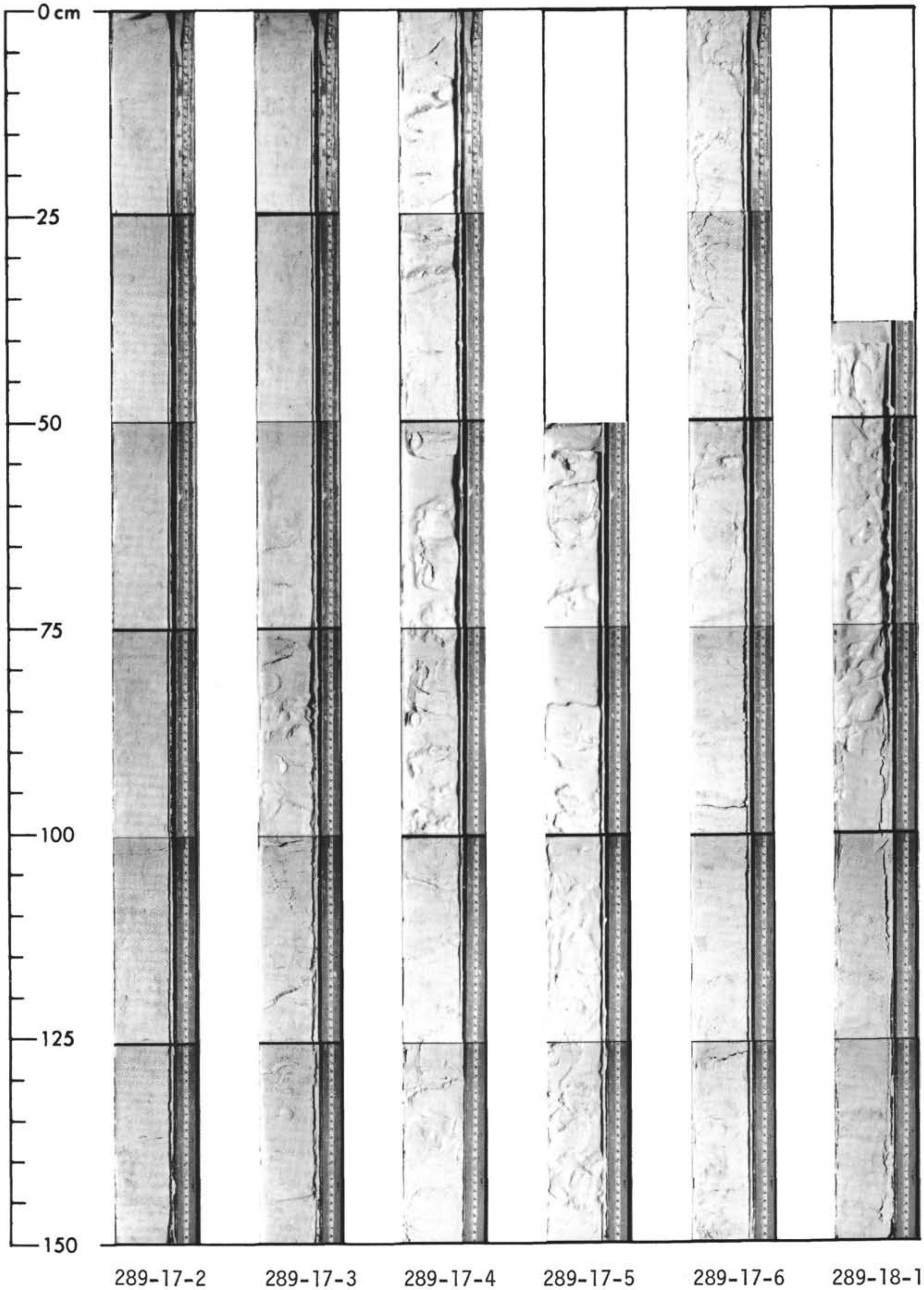

0 cm
25
50
75
100
125
150
289-11-3
289-11-4
289-11-5
289-12-1
289-12-2
289-12-3

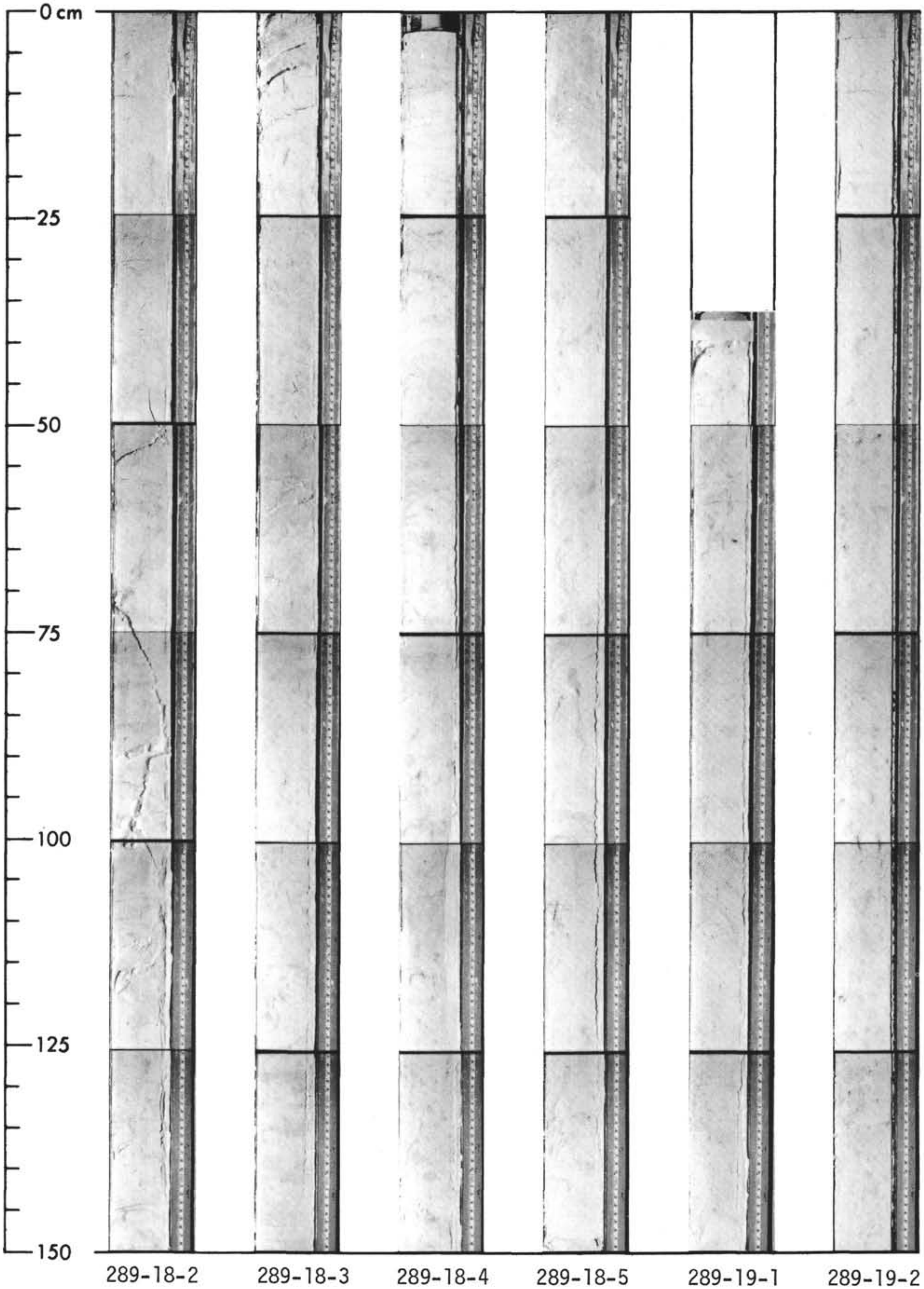

0 cm
25
50
75
100
125
150
289-12-4
289-12-5
289-12-6
289-13-1
289-13-2
289-13-3

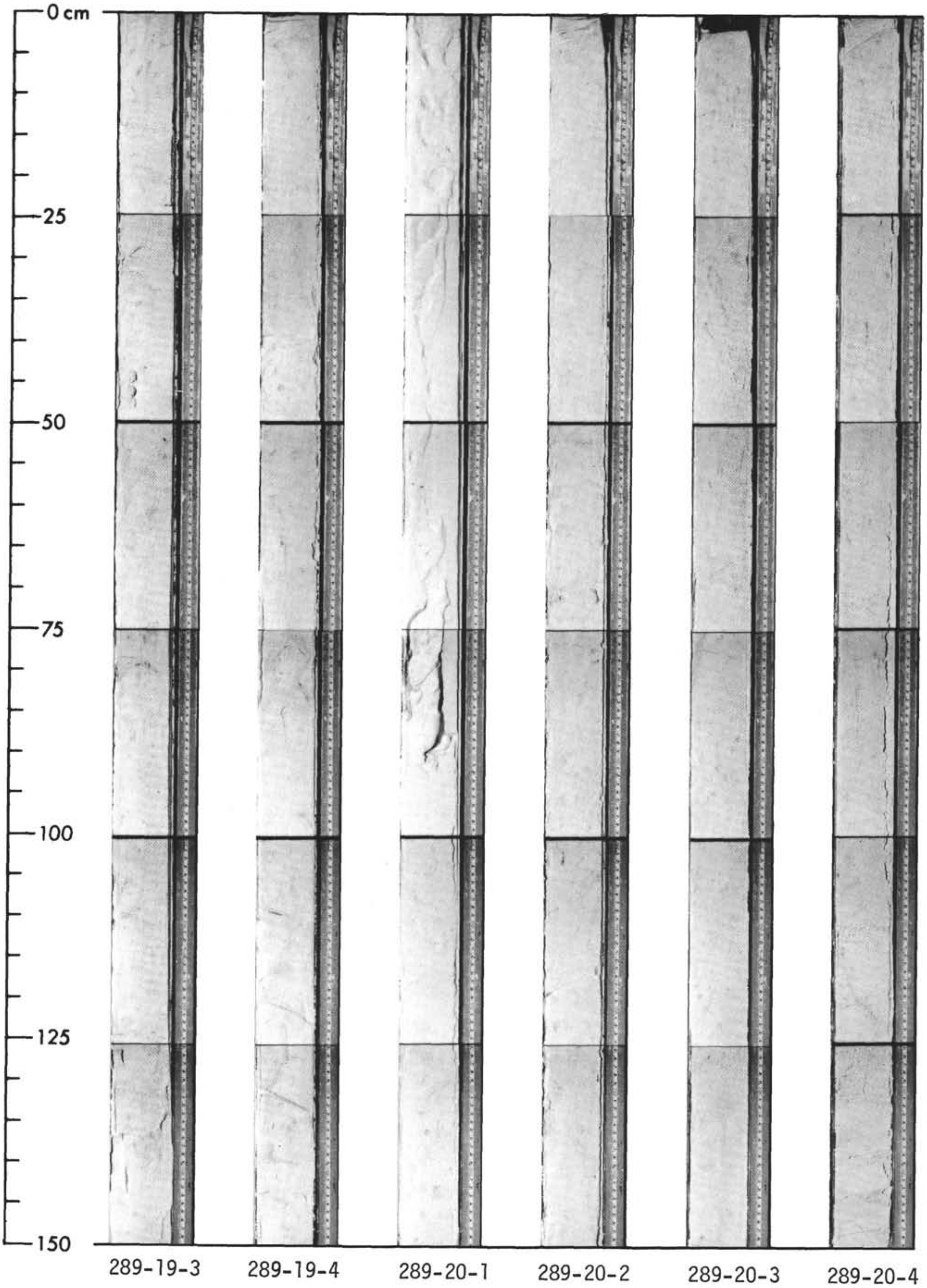

0 cm
25
50
75
100
125
150
289-13-4
289-14-1
289-14-2
289-14-3
289-14-4
289-14-5

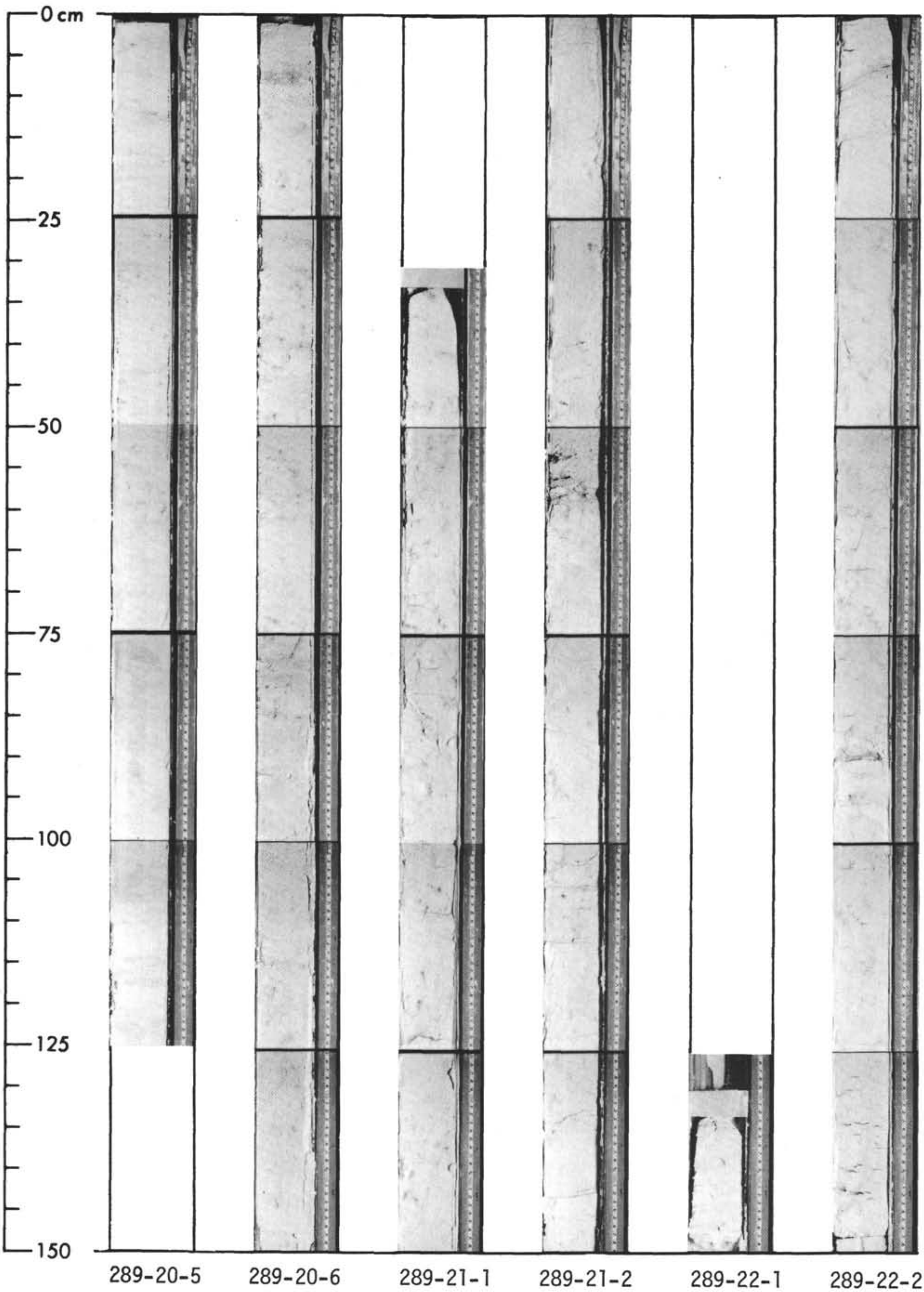

0 cm
25
50
75
100
125
150
289-14-6
289-15-1
289-15-2
289-15-3
289-15-4
289-16-1

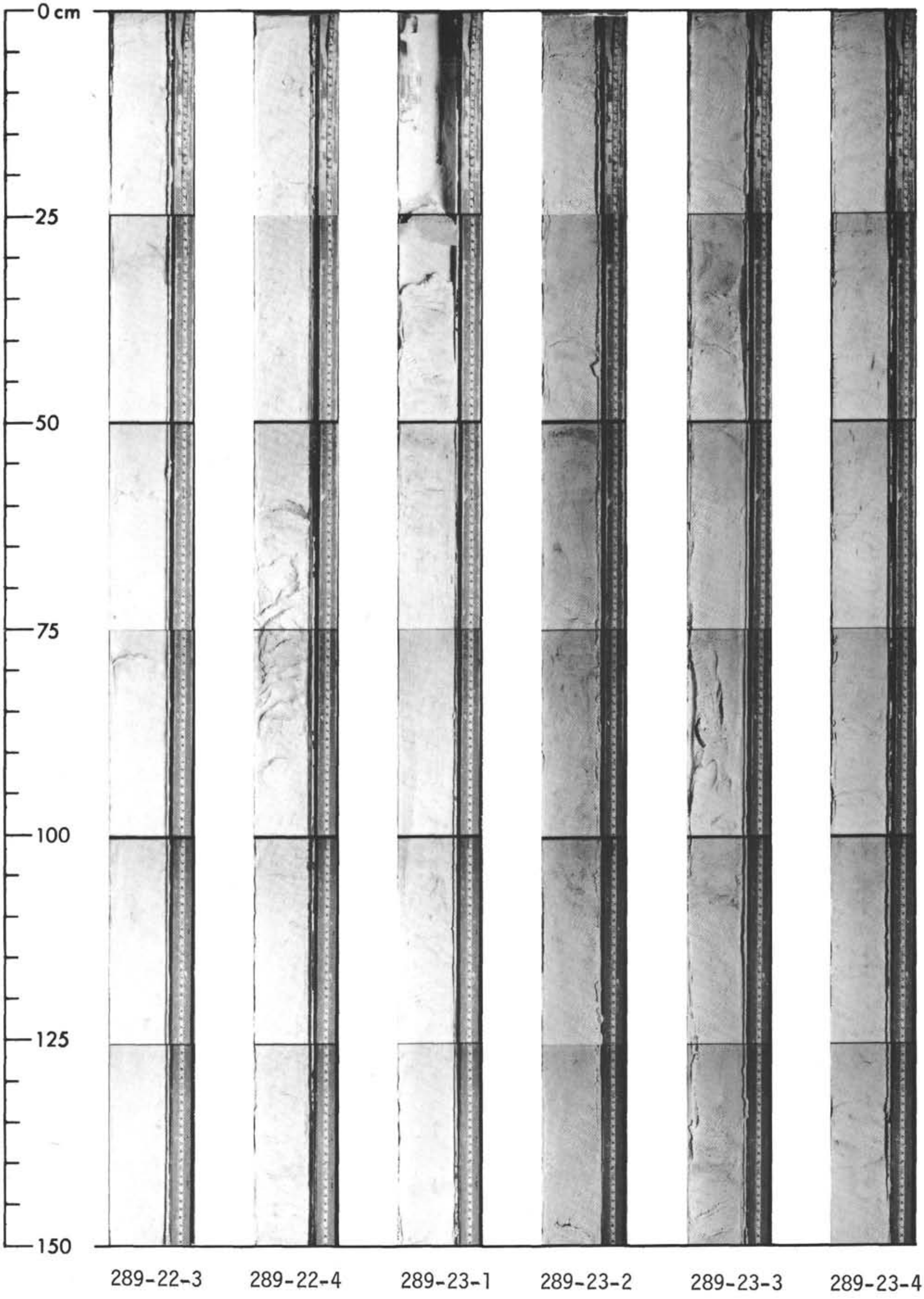

0 cm
25
50
75
100
125
150
289-16-2
289-16-3
289-16-4
289-16-5
289-16-6
289-17-1

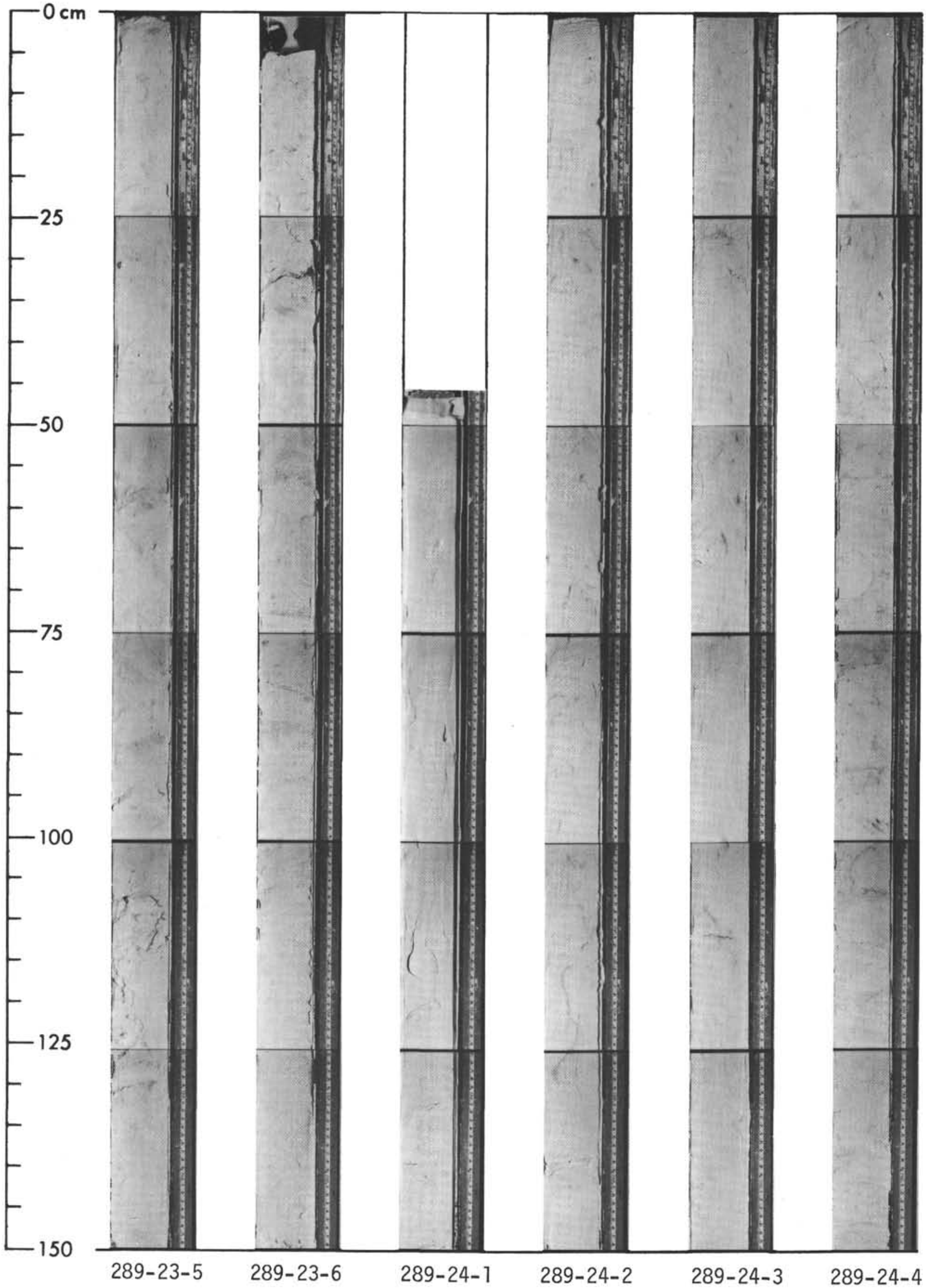

0 cm
25
50
75
100
125
150
289-17-2
289-17-3
289-17-4
289-17-5
289-17-6
289-18-1

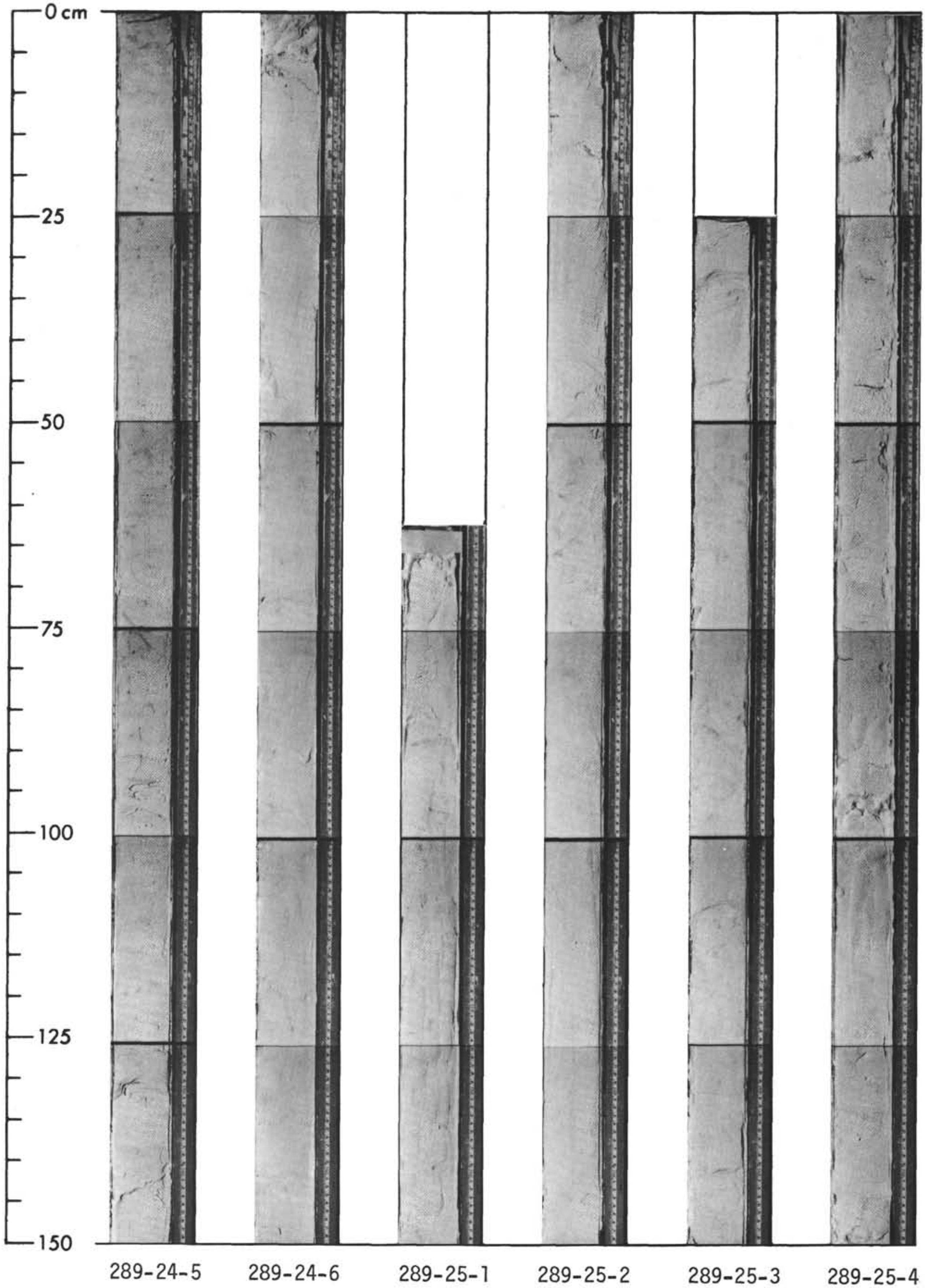

0 cm
25
50
75
100
125
150
289-18-2
289-18-3
289-18-4
289-18-5
289-19-1
289-19-2

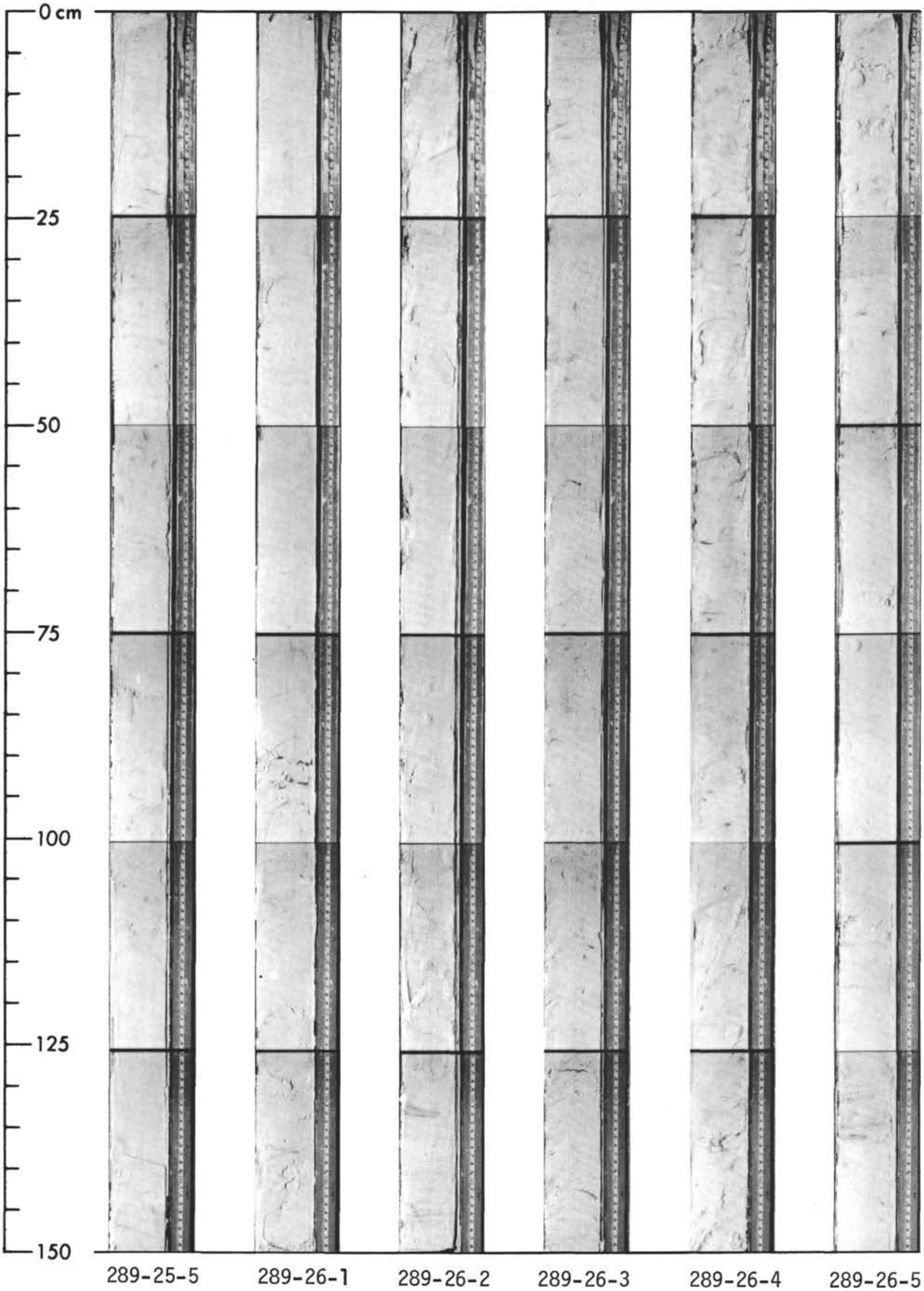

0 cm
25
50
75
100
125
150
289-19-3
289-19-4
289-20-1
289-20-2
289-20-3
289-20-4

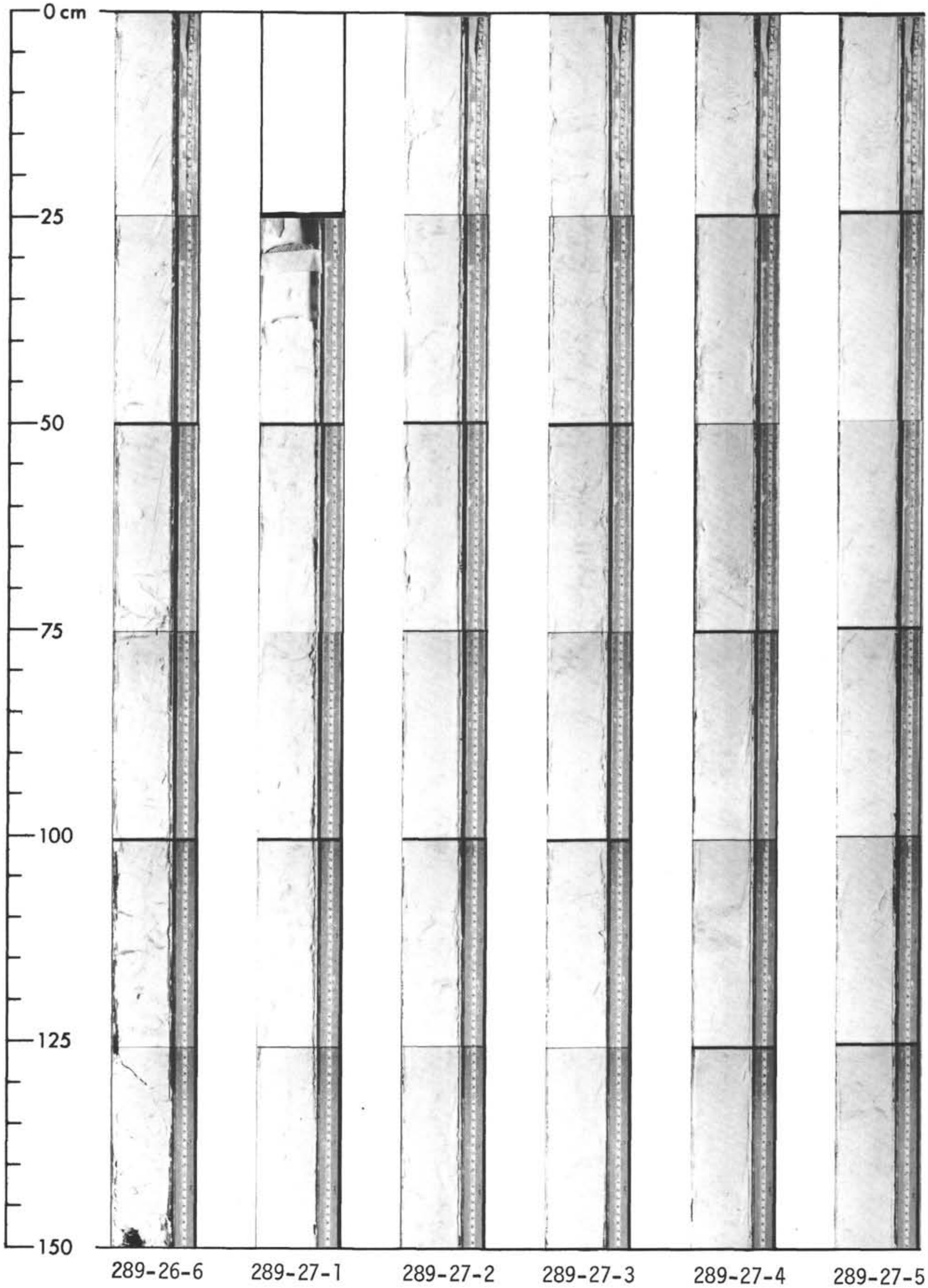

0 cm
25
50
75
100
125
150
289-20-5
289-20-6
289-21-1
289-21-2
289-22-1
289-22-2

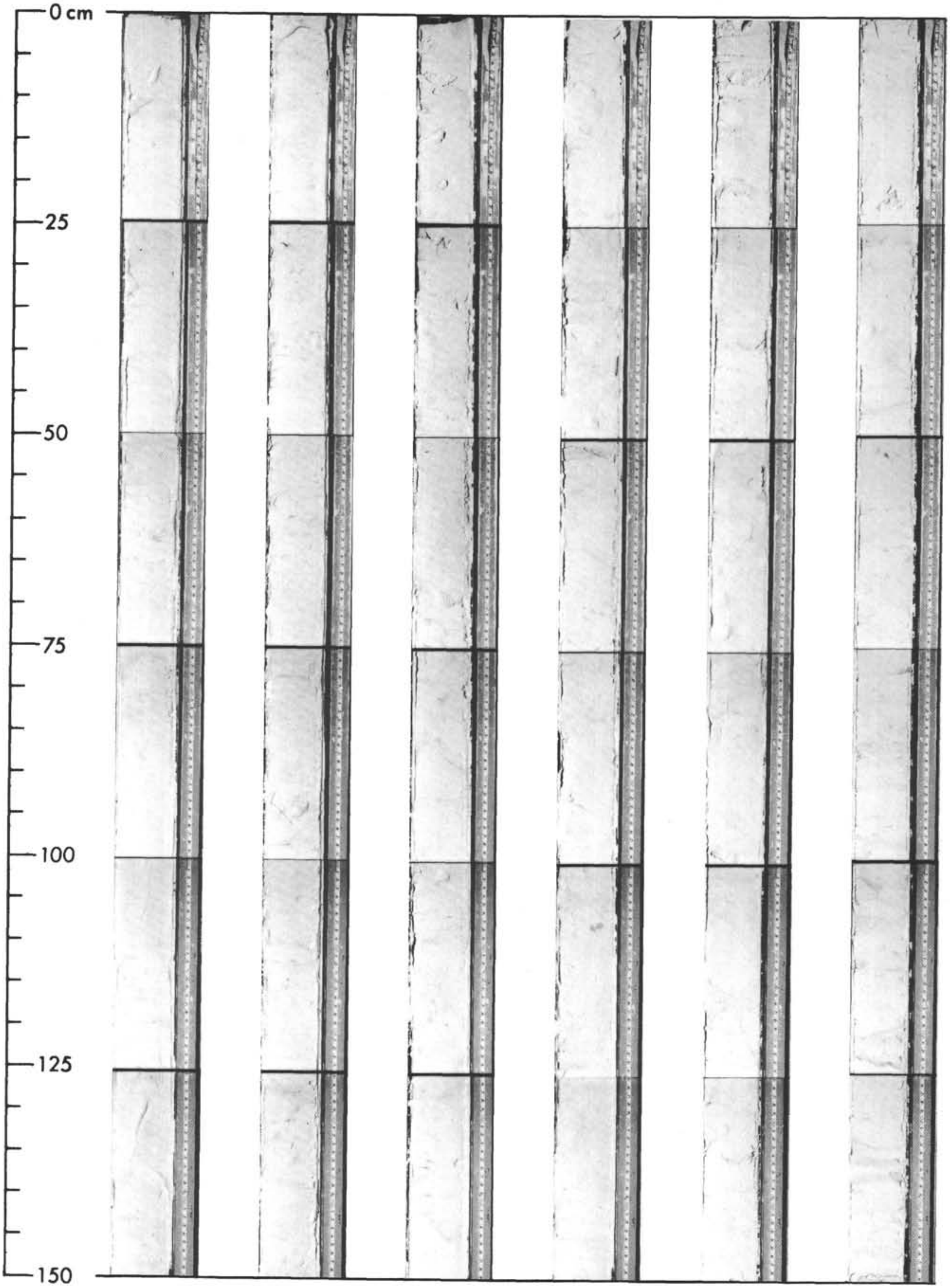

0 cm
25
50
75
100
125
150
289-22-3
289-22-4
289-23-1
289-23-2
289-23-3
289-23-4


0 cm
25
50
75
100
125
150
289-23-5
289-23-6
289-24-1
289-24-2
289-24-3
289-24-4

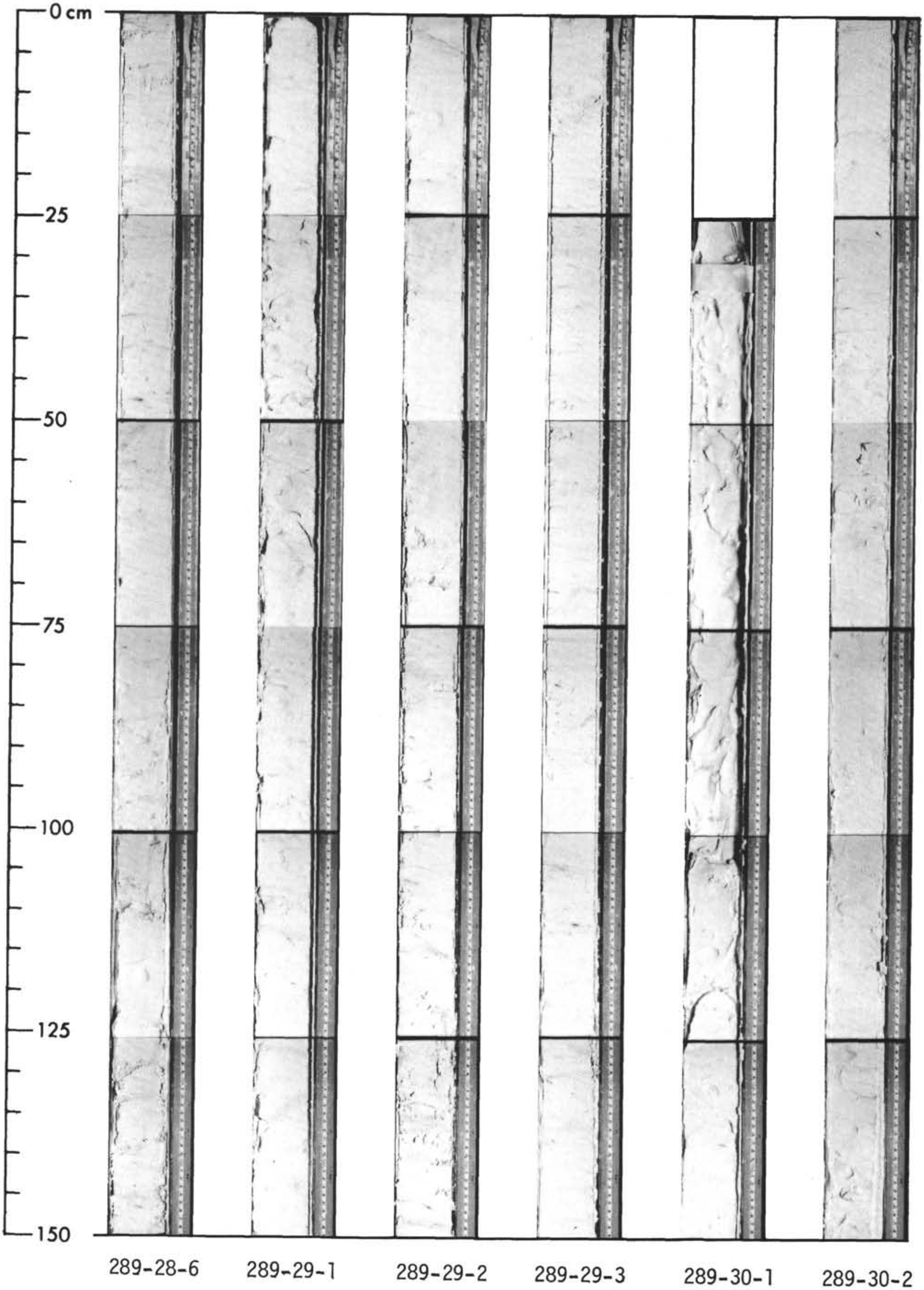

0 cm
25
50
75
100
125
150
289-24-5
289-24-6
289-25-1
289-25-2
289-25-3
289-25-4

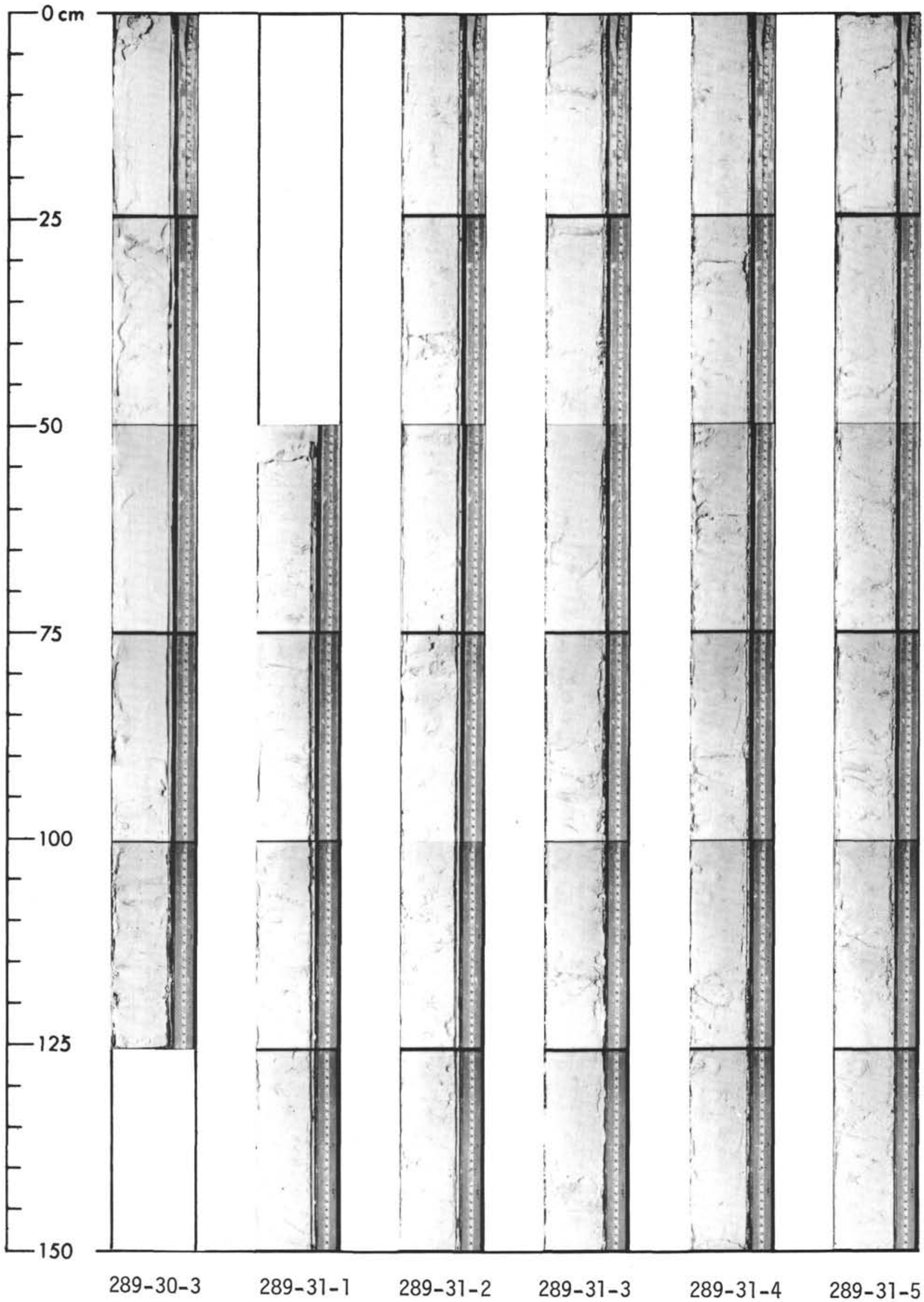

0 cm
25
50
75
100
125
150
289-25-5
289-26-1
289-26-2
289-26-3
289-26-4
289-26-5

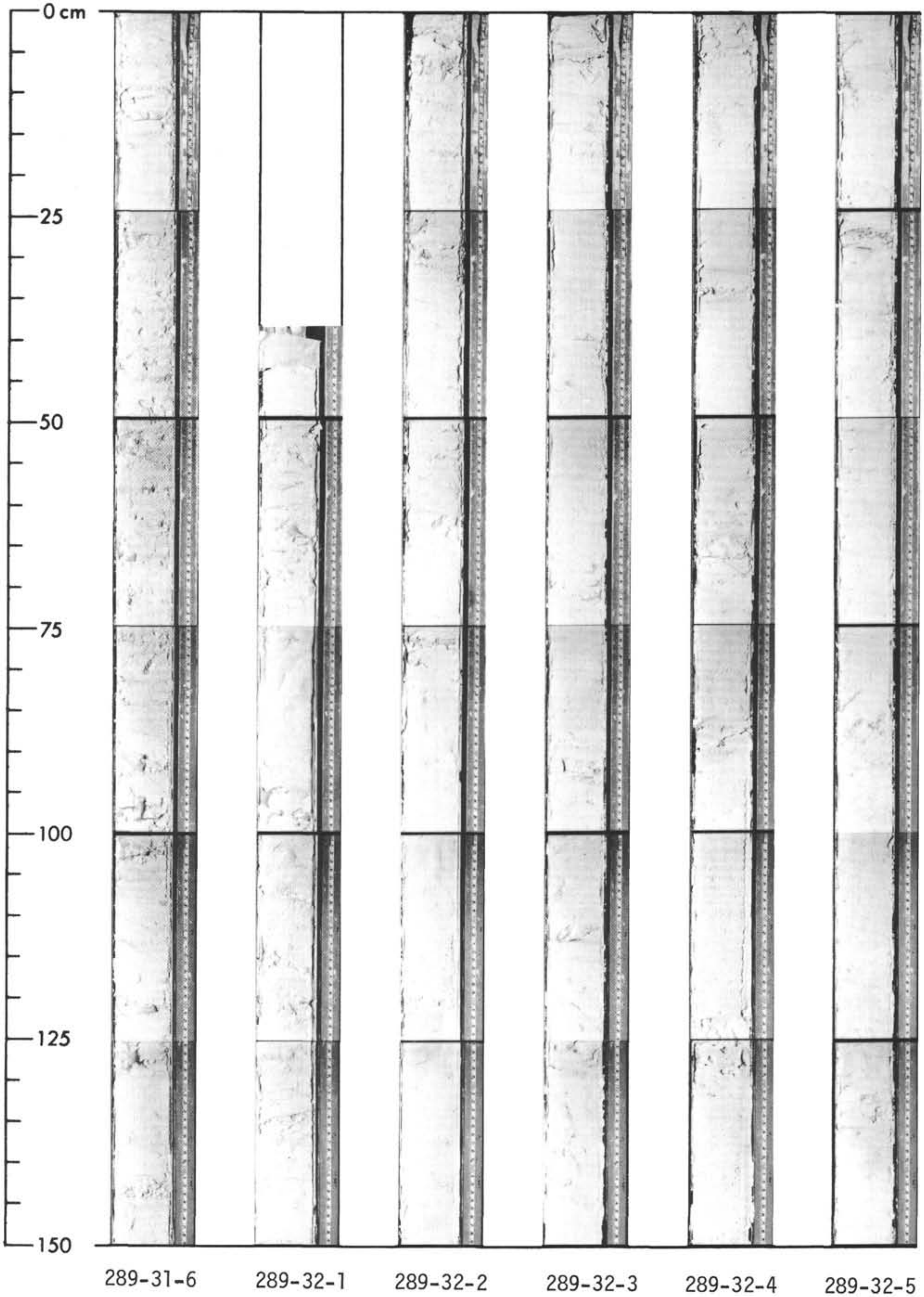

0 cm
25
50
75
100
125
150
289-26-6
289-27-1
289-27-2
289-27-3
289-27-4
289-27-5

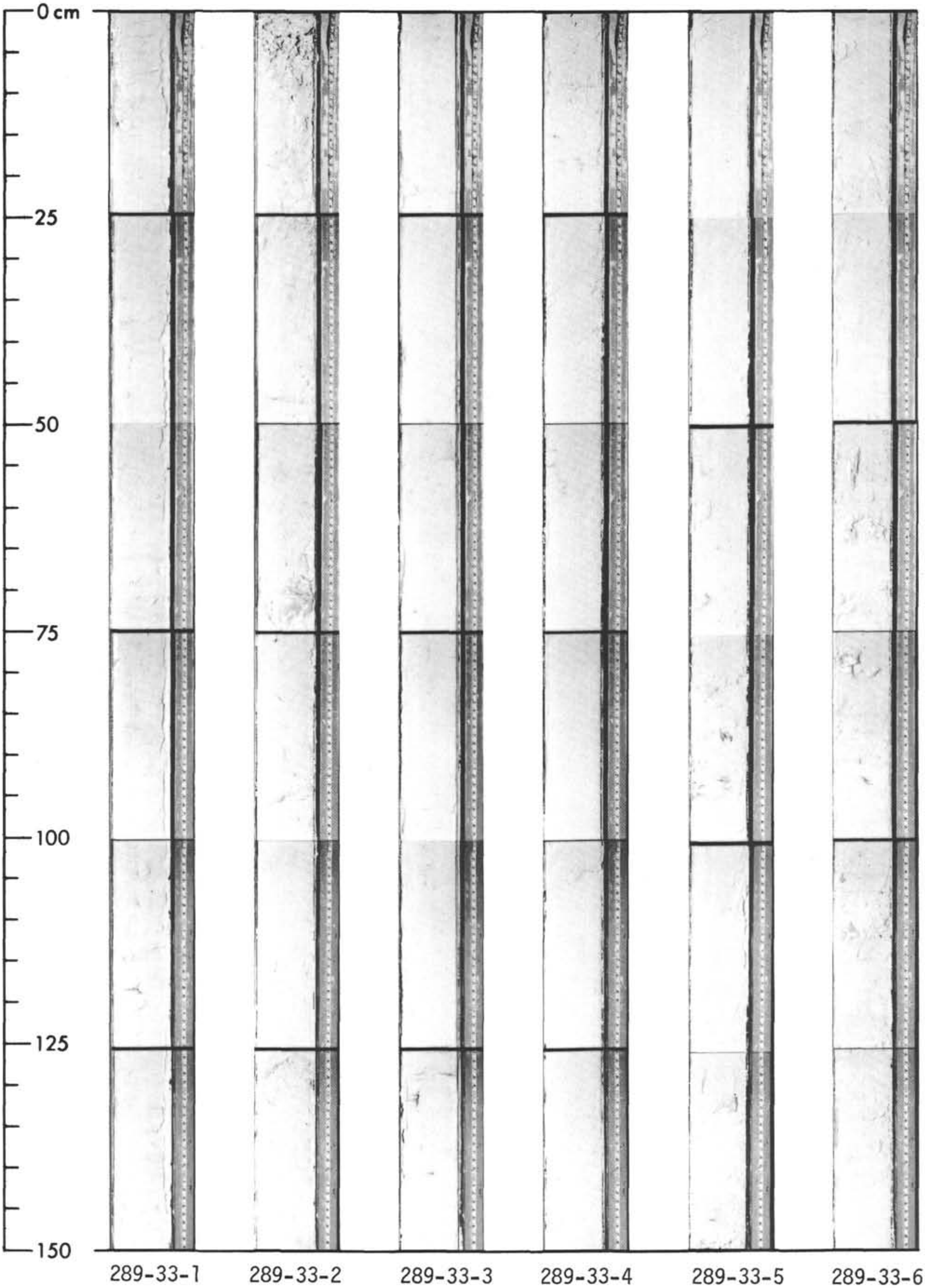


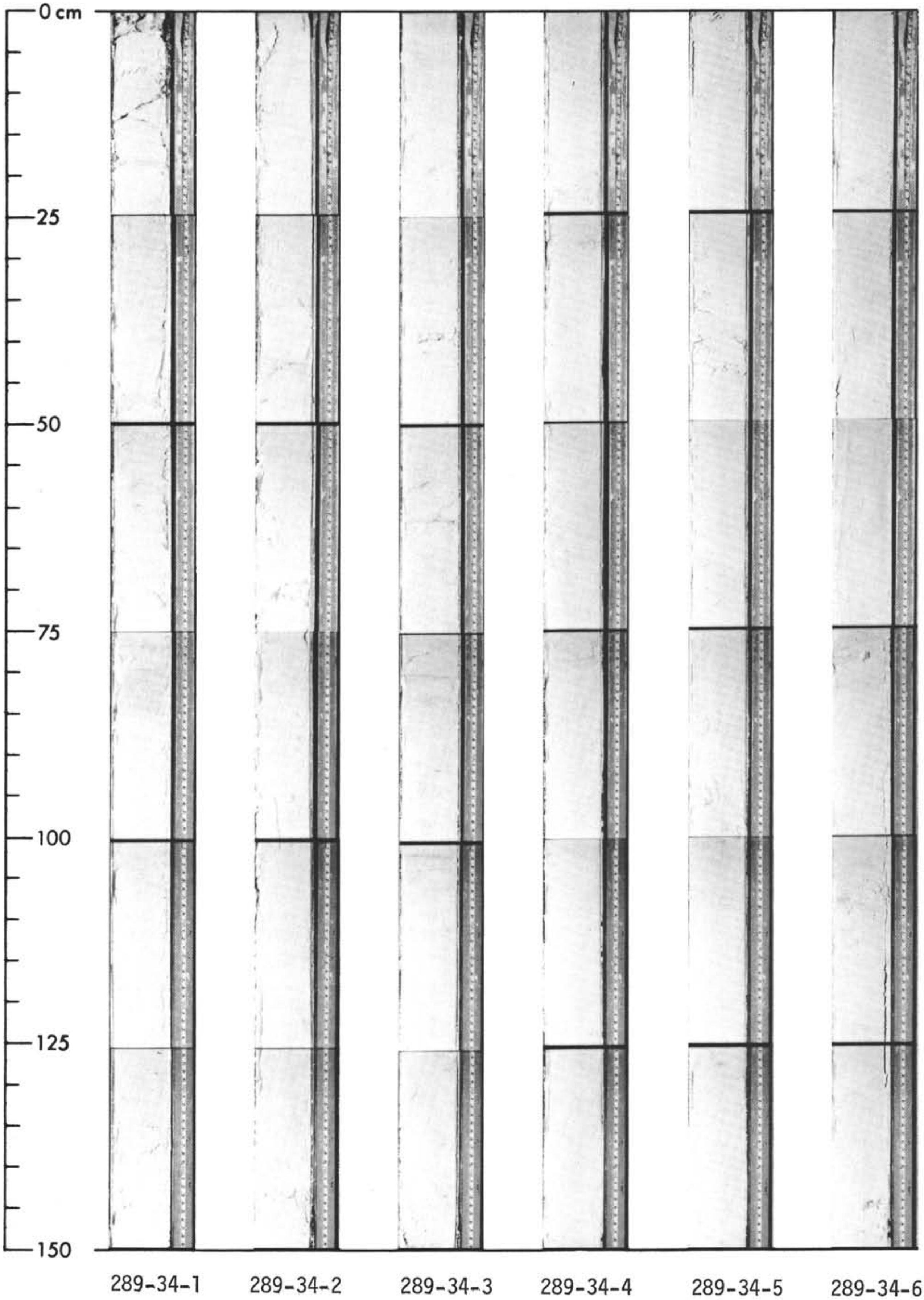
289-27-6 289-28-1 289-28-2 289-28-3 289-28-4 289-28-5

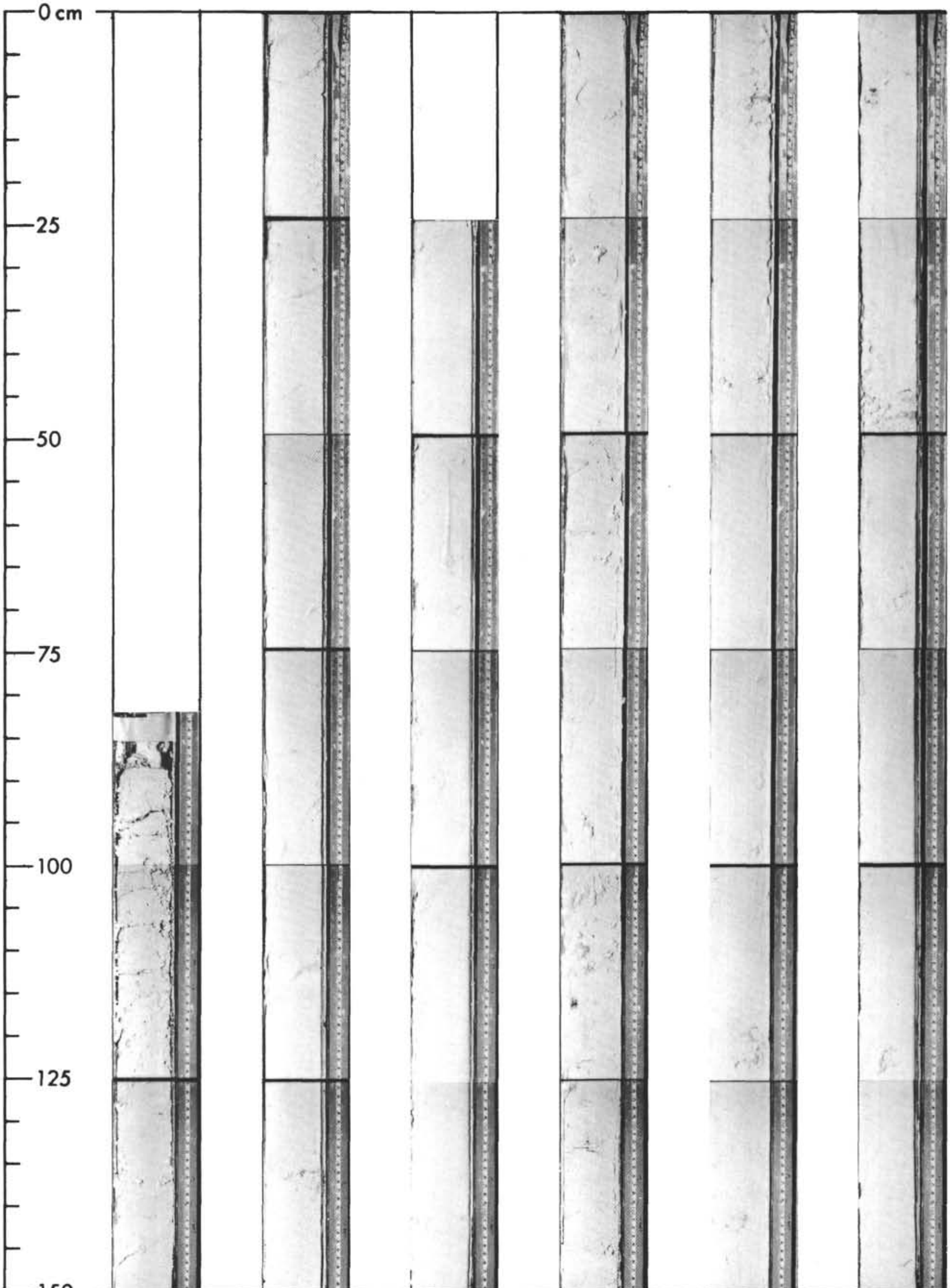

0 cm
25
50
75
100
125
150
289-28-6
289-29-1
289-29-2
289-29-3
289-30-1
289-30-2


0 cm
25
50
75
100
125
150
289-30-3
289-31-1
289-31-2
289-31-3
289-31-4
289-31-5

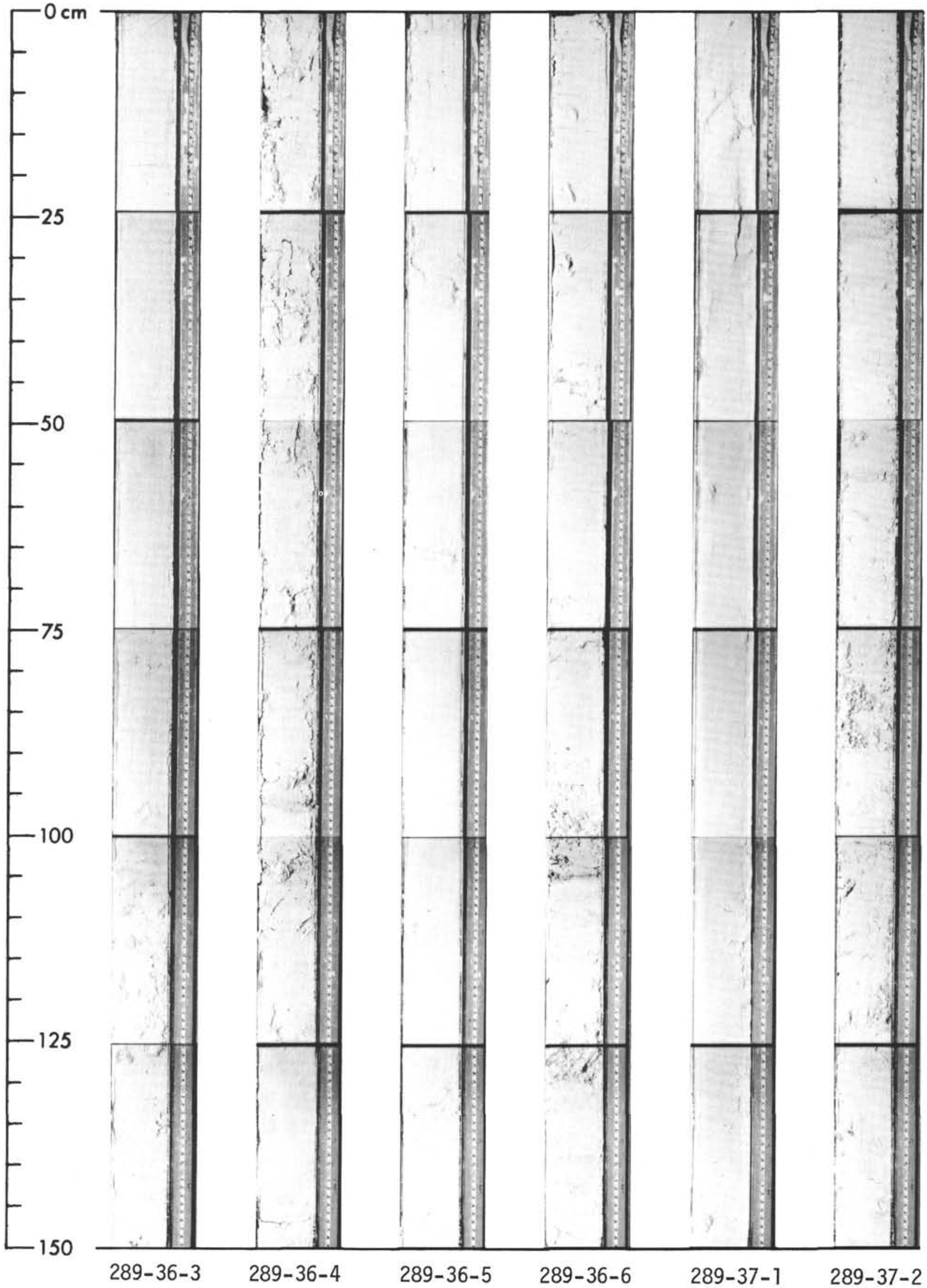

0 cm
25
50
75
100
125
150
289-31-6
289-32-1
289-32-2
289-32-3
289-32-4
289-32-5

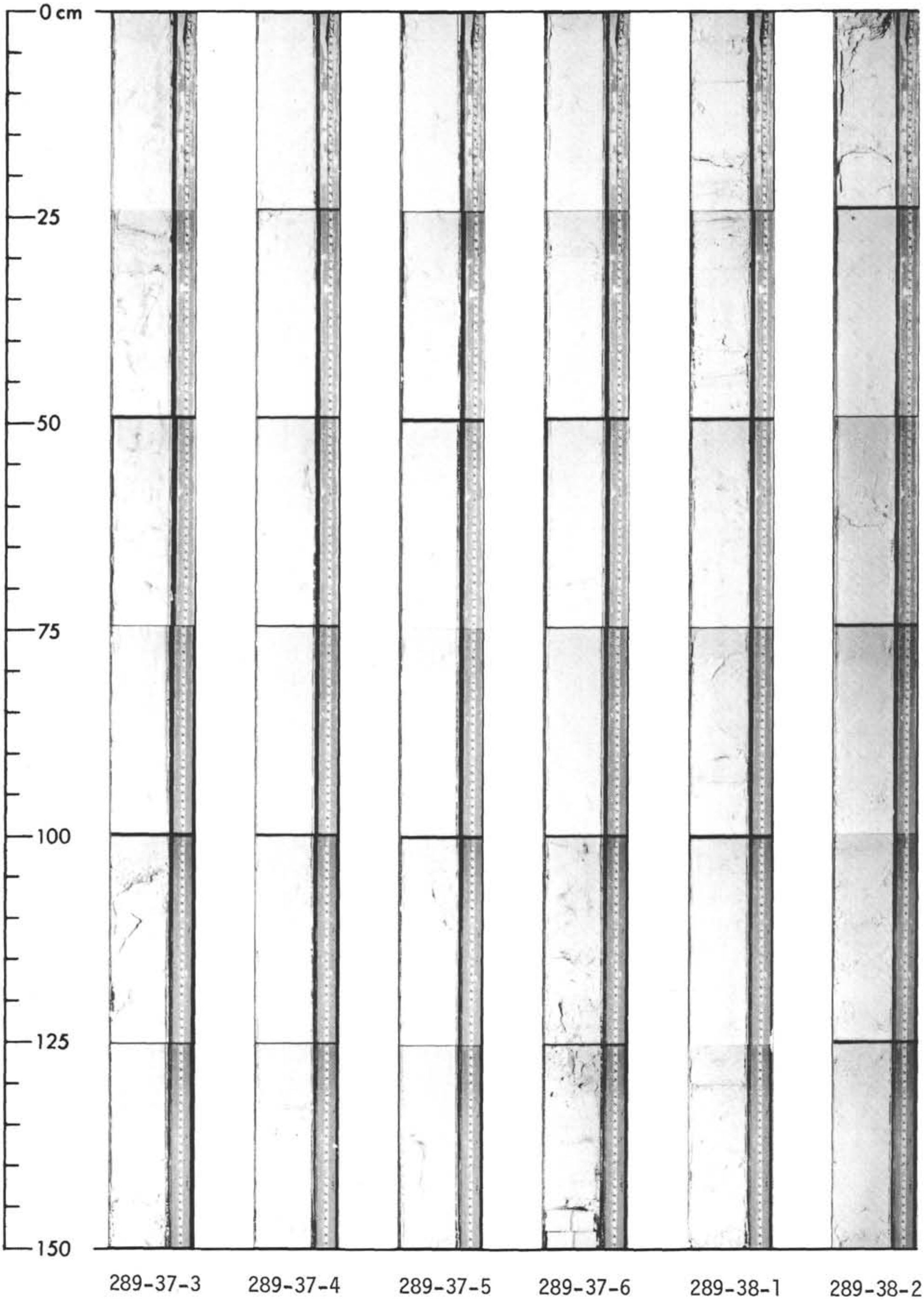

0 cm
25
50
75
100
125
150
289-33-1
289-33-2
289-33-3
289-33-4
289-33-5
289-33-6

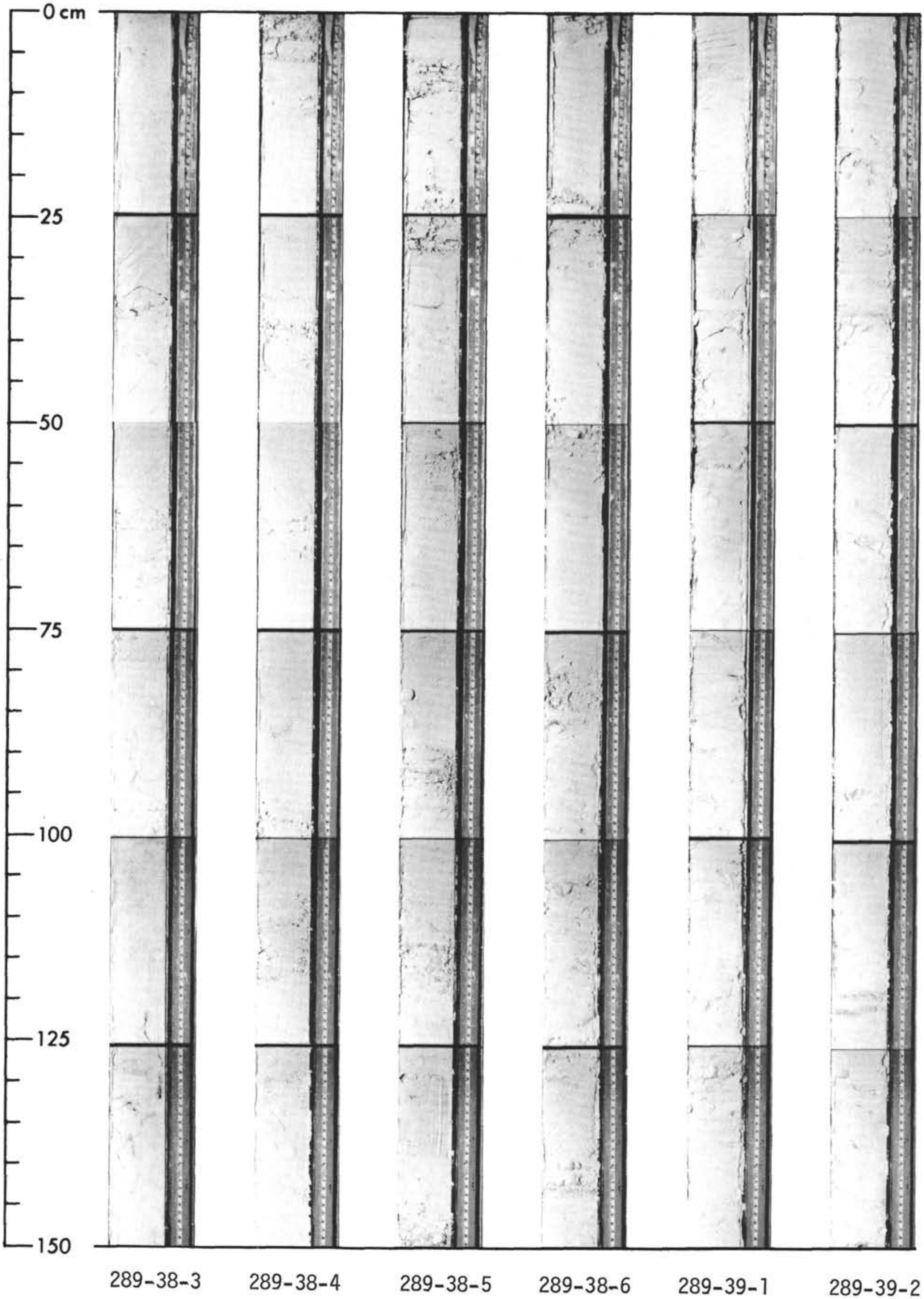

0 cm
25
50
75
100
125
150
289-34-1
289-34-2
289-34-3
289-34-4
289-34-5
289-34-6

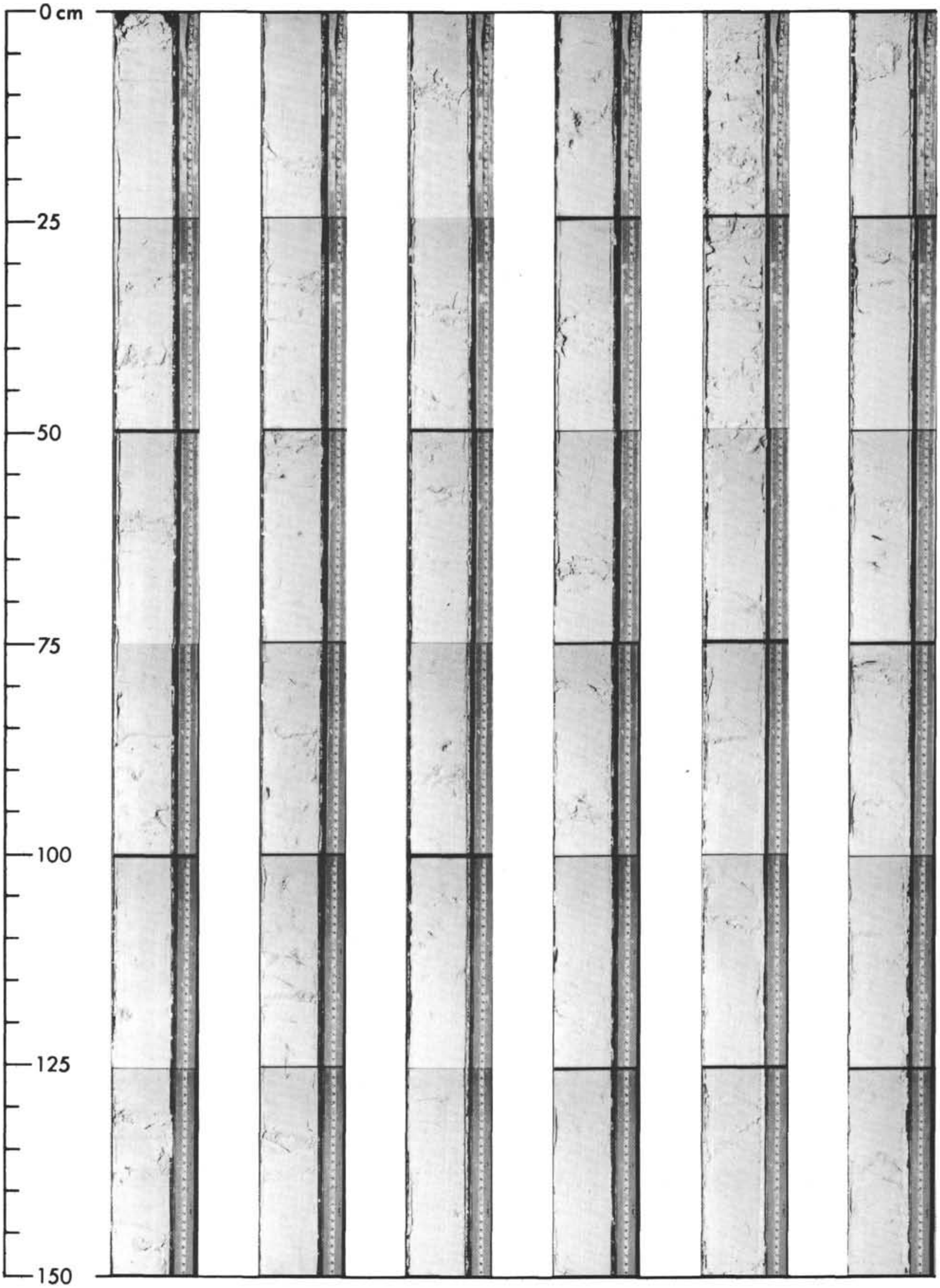


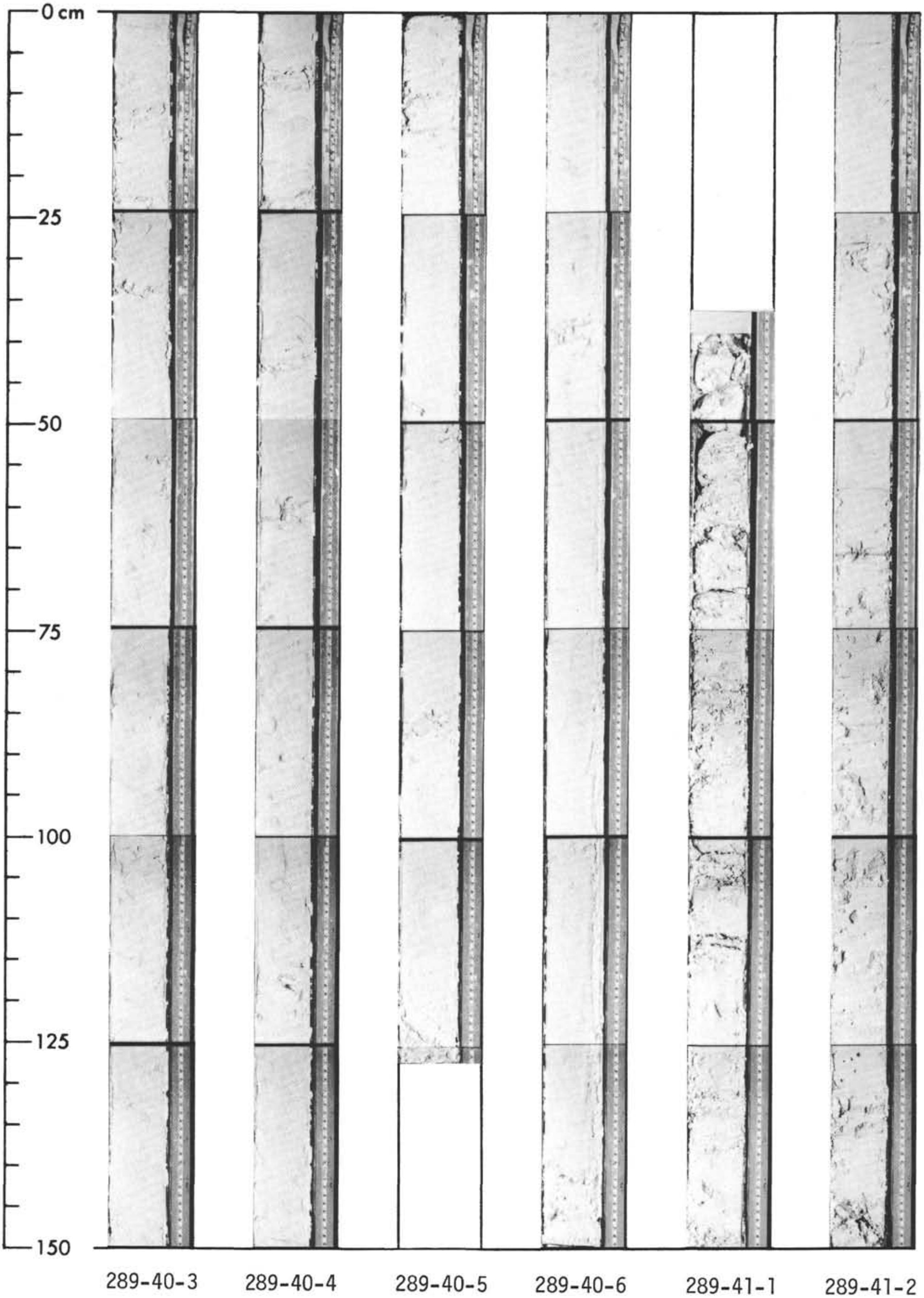
289-35-1 289-35-2 289-35-3 289-35-4 289-36-1 289-36-2

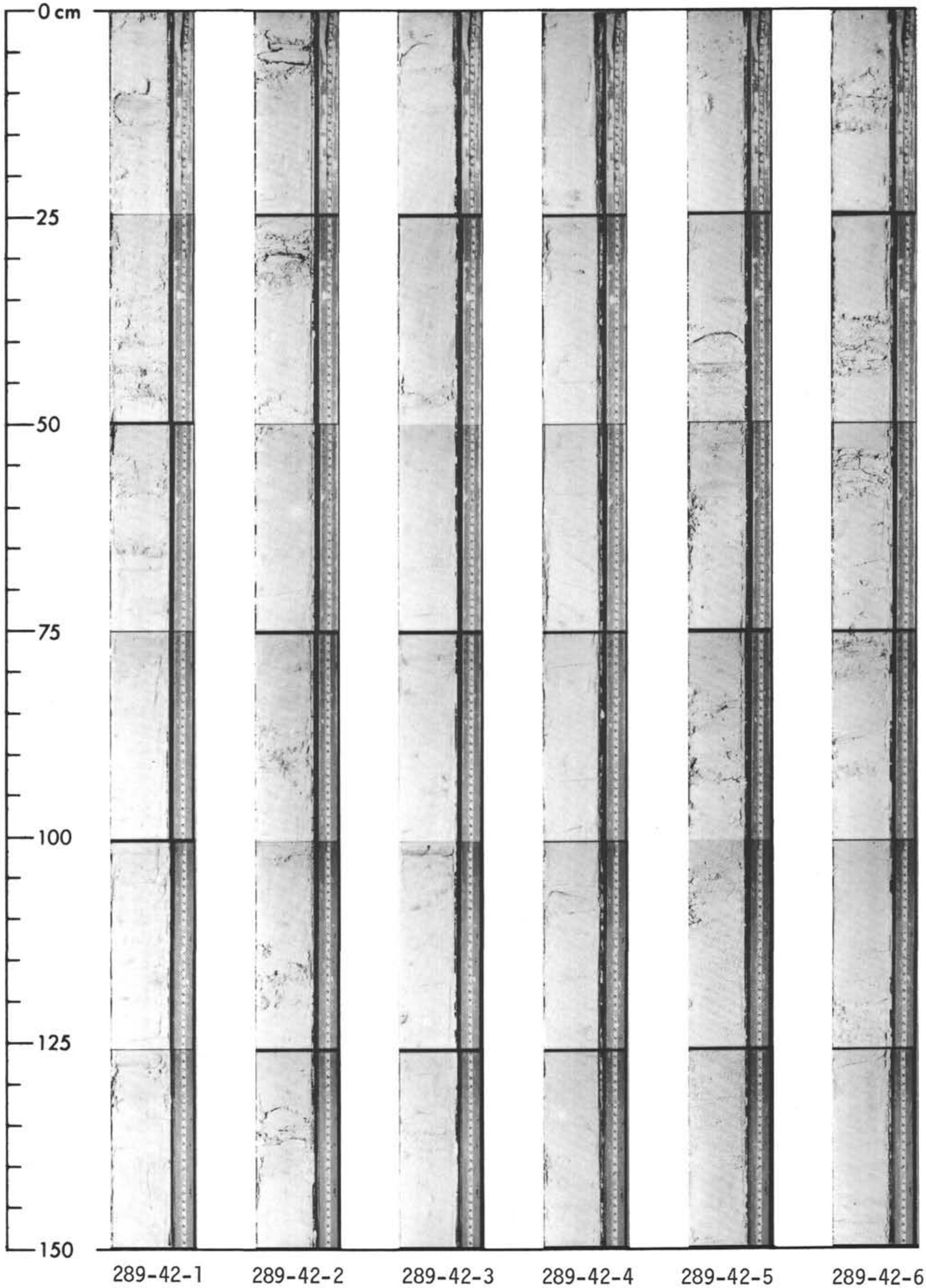

0 cm
25
50
75
100
125
150
289-36-3
289-36-4
289-36-5
289-36-6
289-37-1
289-37-2

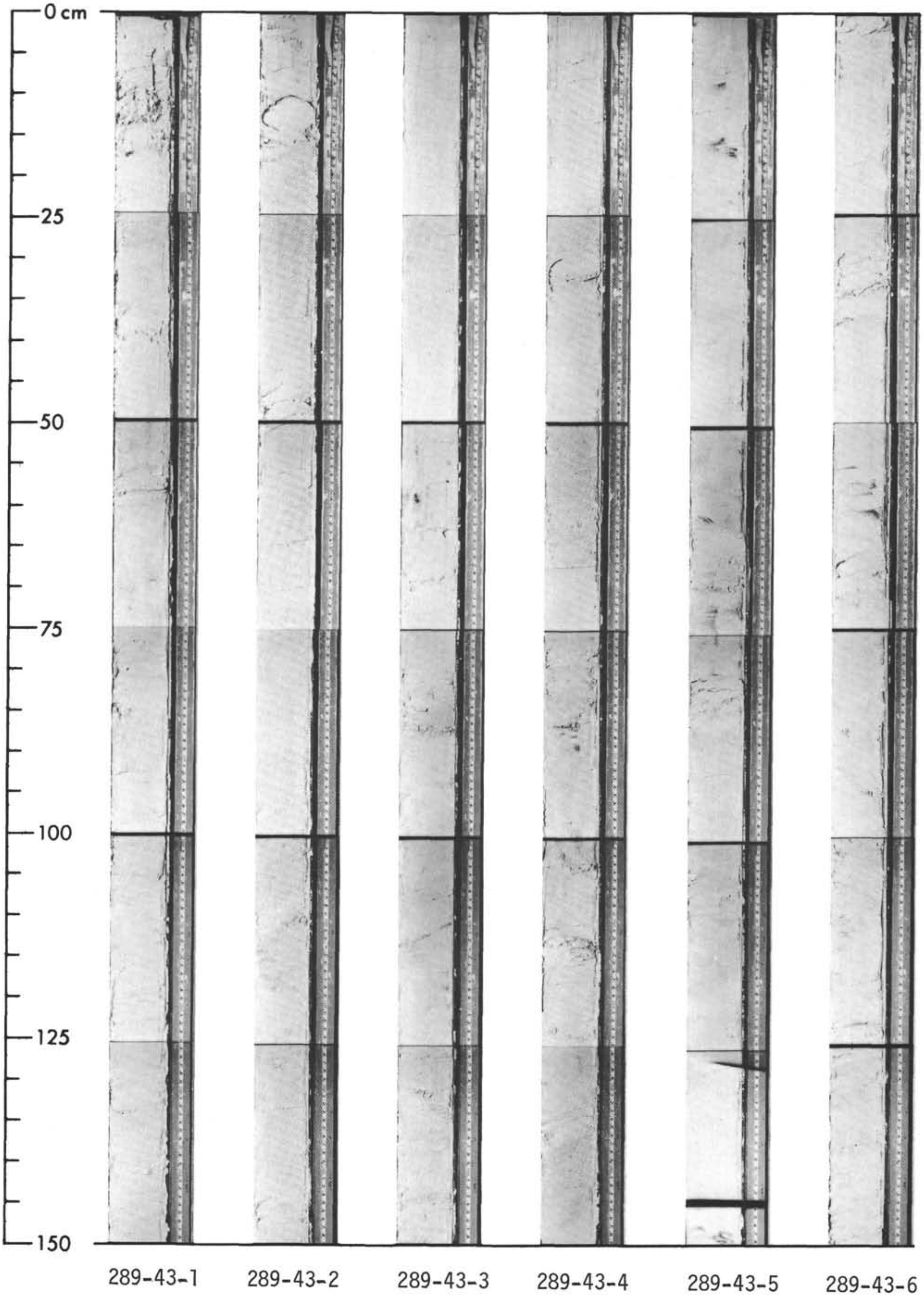

0 cm
25
50
75
100
125
150
289-37-3
289-37-4
289-37-5
289-37-6
289-38-1
289-38-2

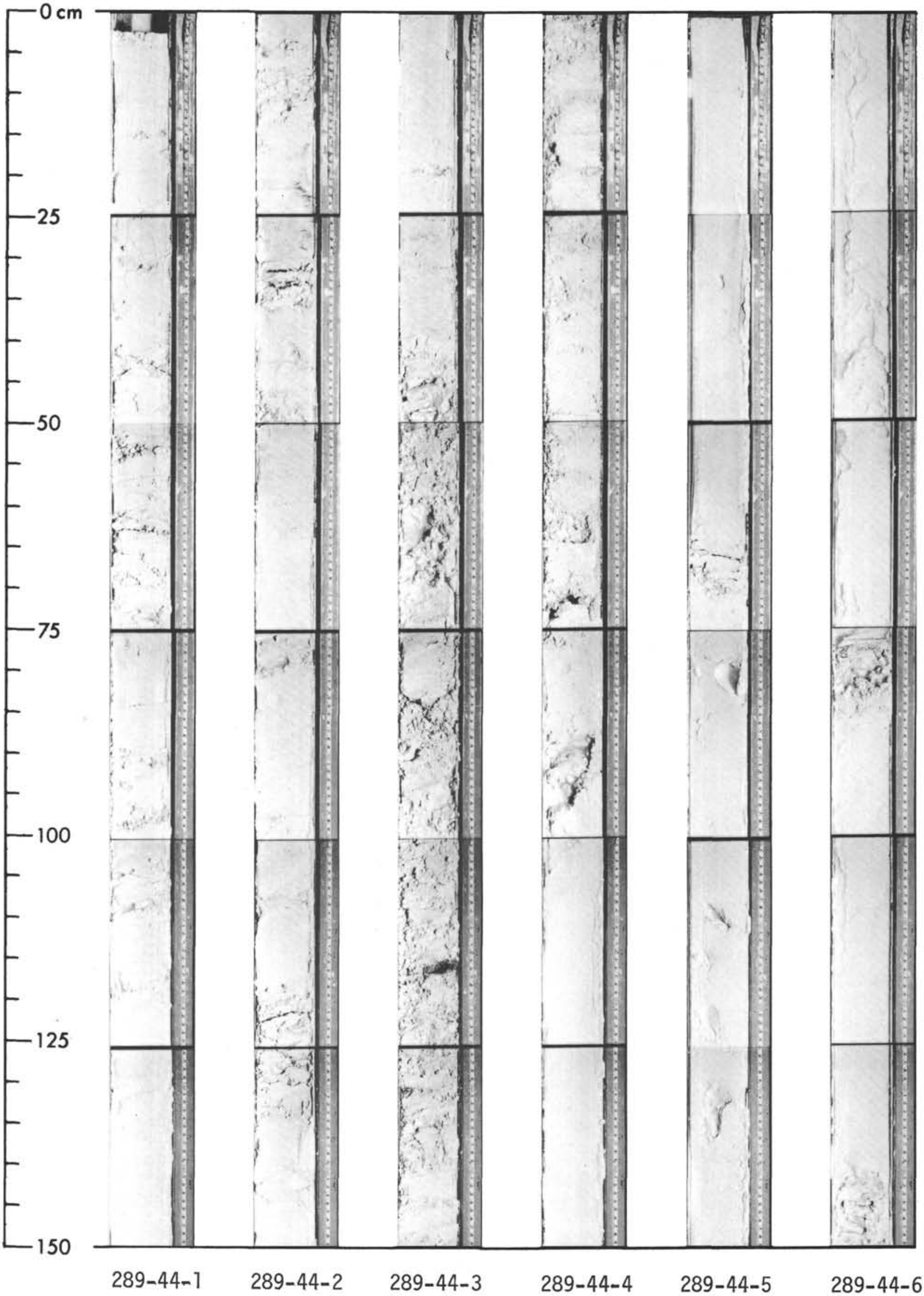

0 cm
25
50
75
100
125
150
289-38-3
289-38-4
289-38-5
289-38-6
289-39-1
289-39-2

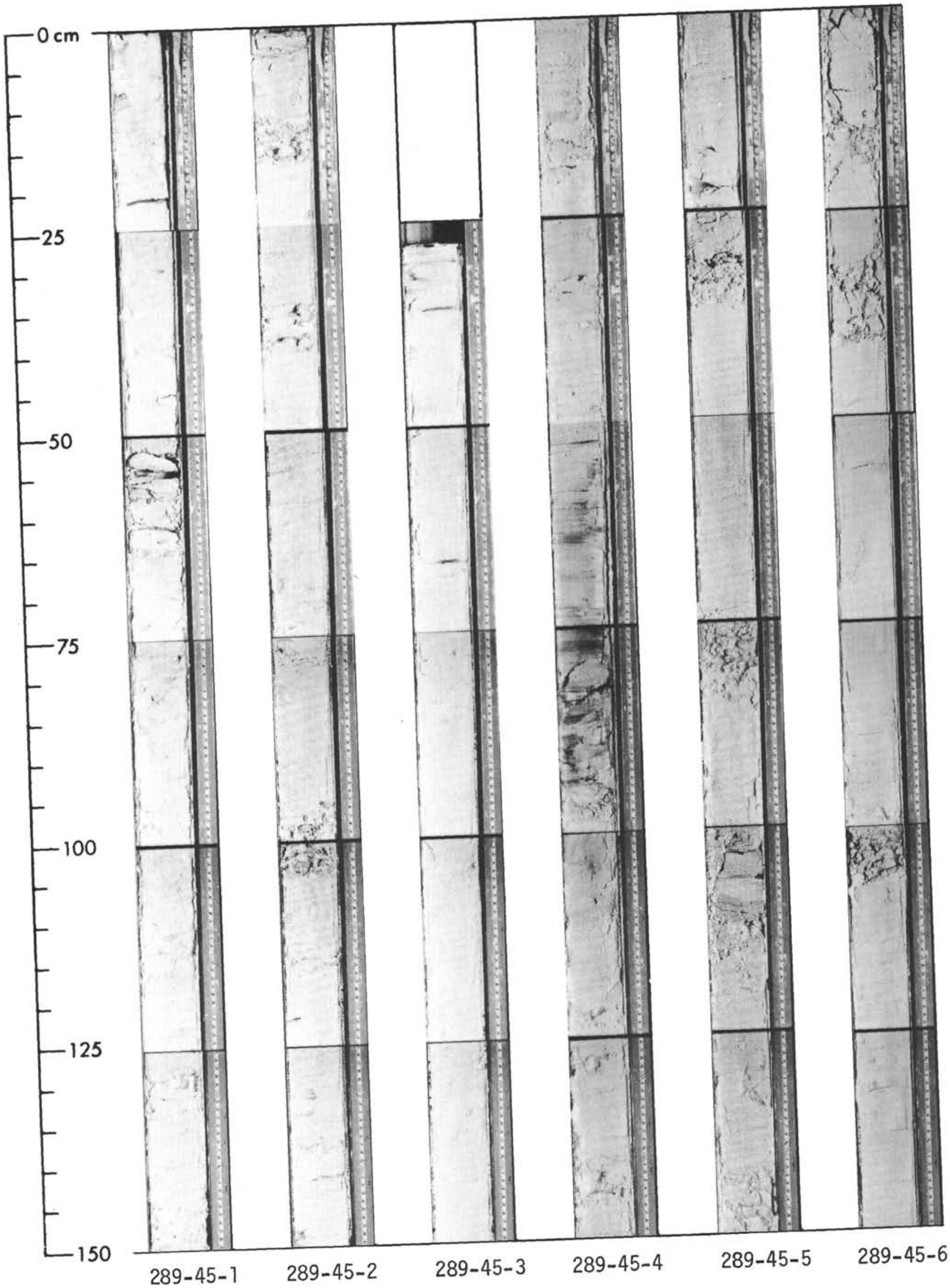

0 cm
25
50
75
100
125
150
289-39-3
289-39-4
289-39-5
289-39-6
289-40-1
289-40-2

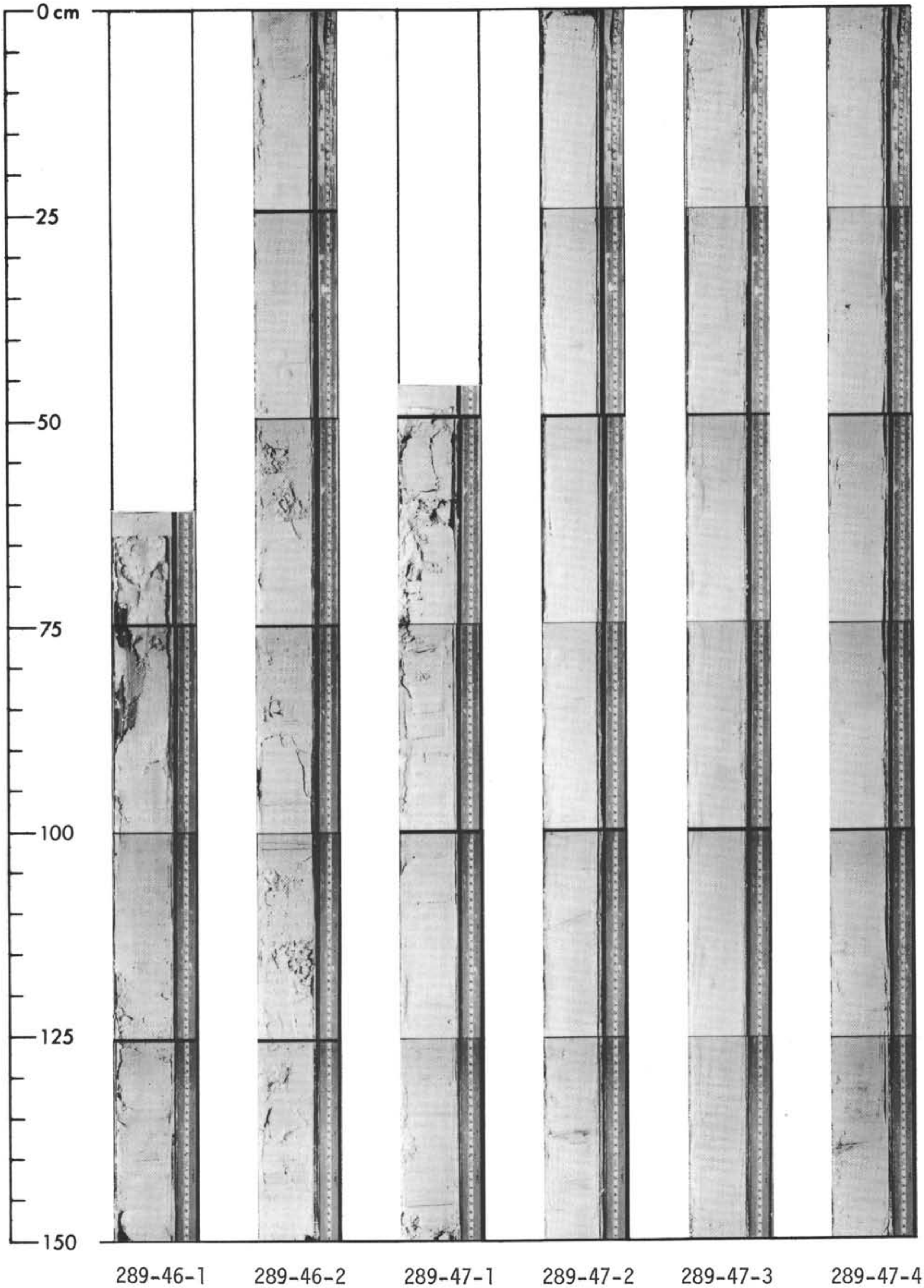

0 cm
25
50
75
100
125
150
289-40-3
289-40-4
289-40-5
289-40-6
289-41-1
289-41-2

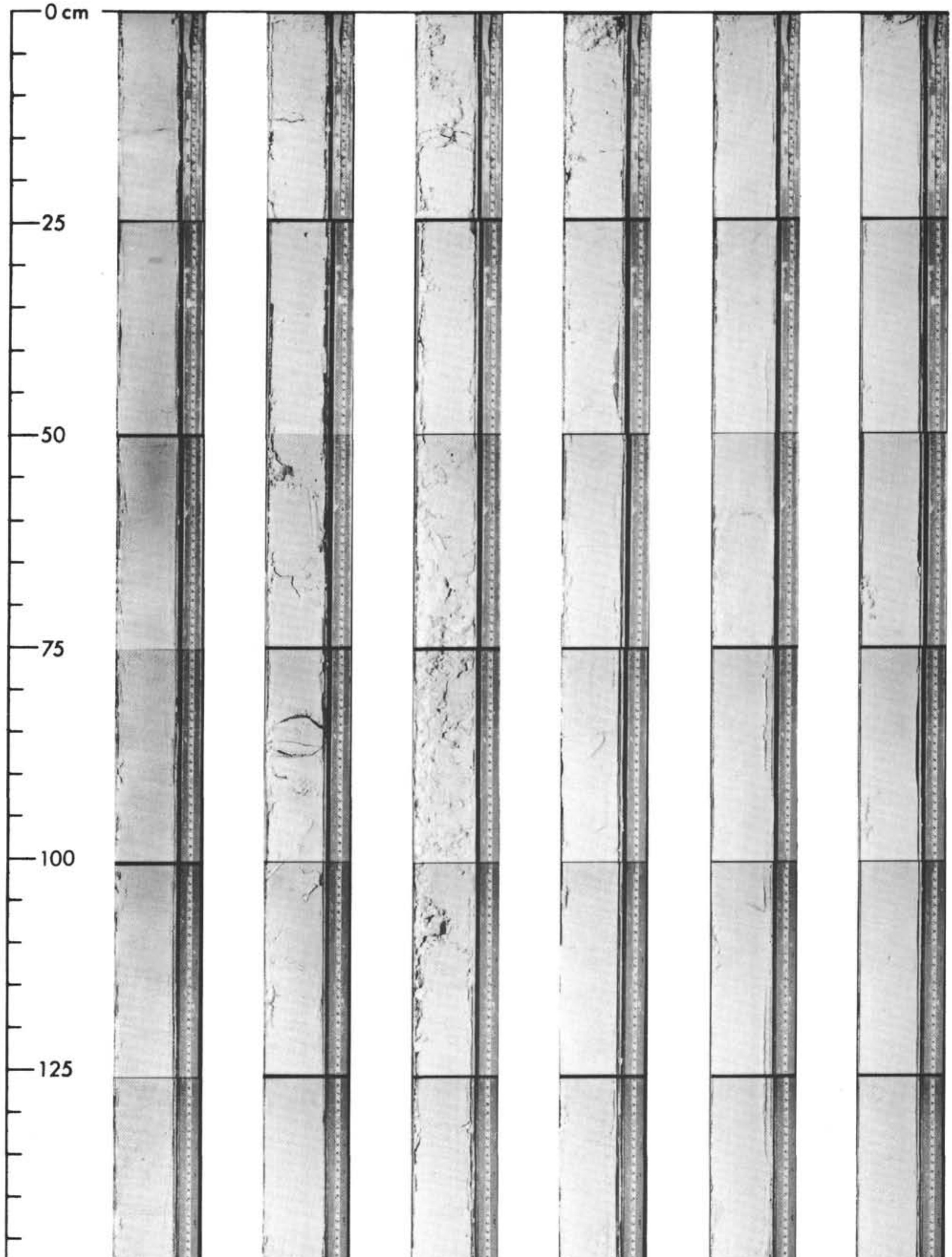

0 cm
25
50
75
100
125
150
289-42-1
289-42-2
289-42-3
289-42-4
289-42-5
289-42-6

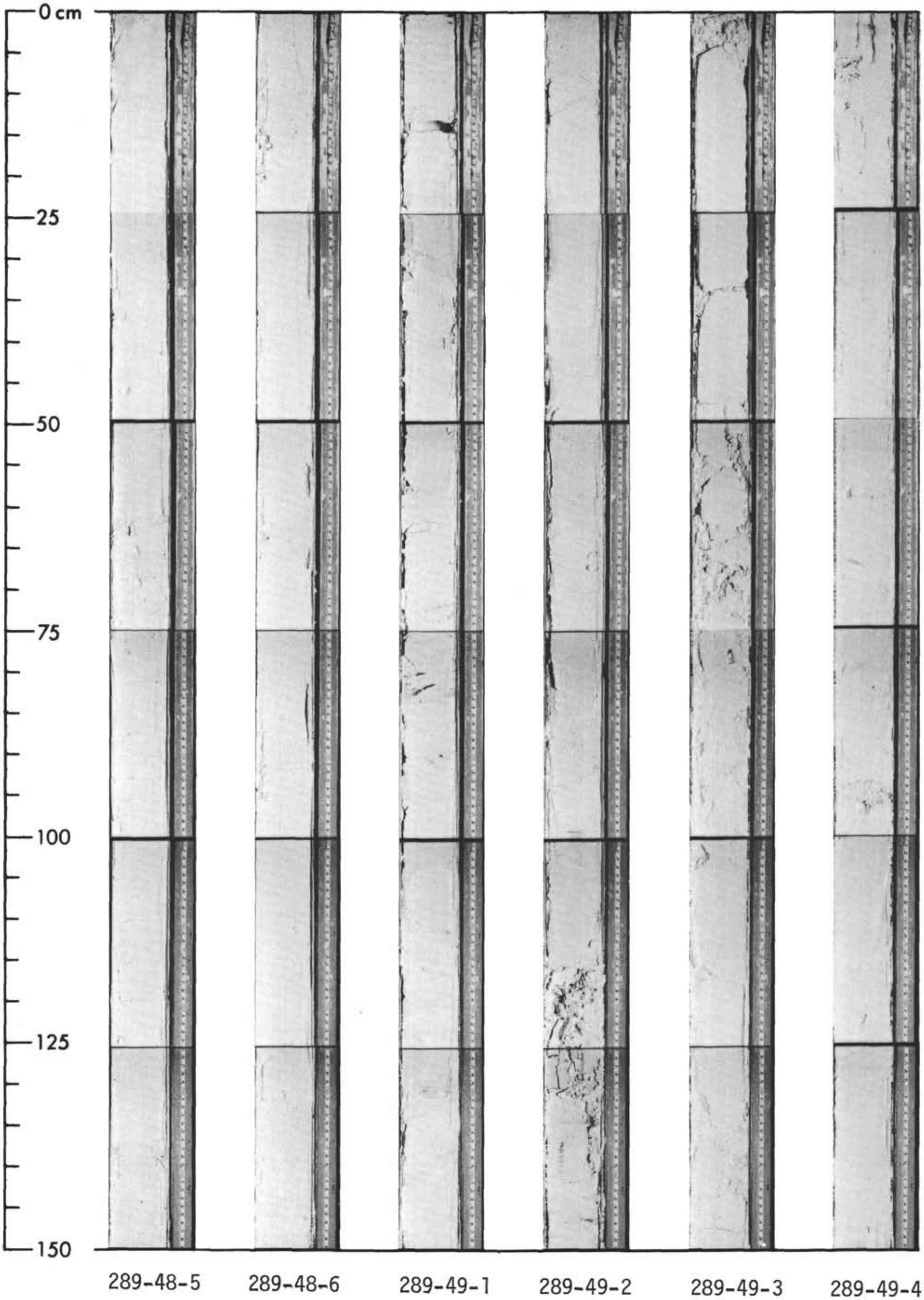

0 cm
25
50
75
100
125
150
289-43-1
289-43-2
289-43-3
289-43-4
289-43-5
289-43-6

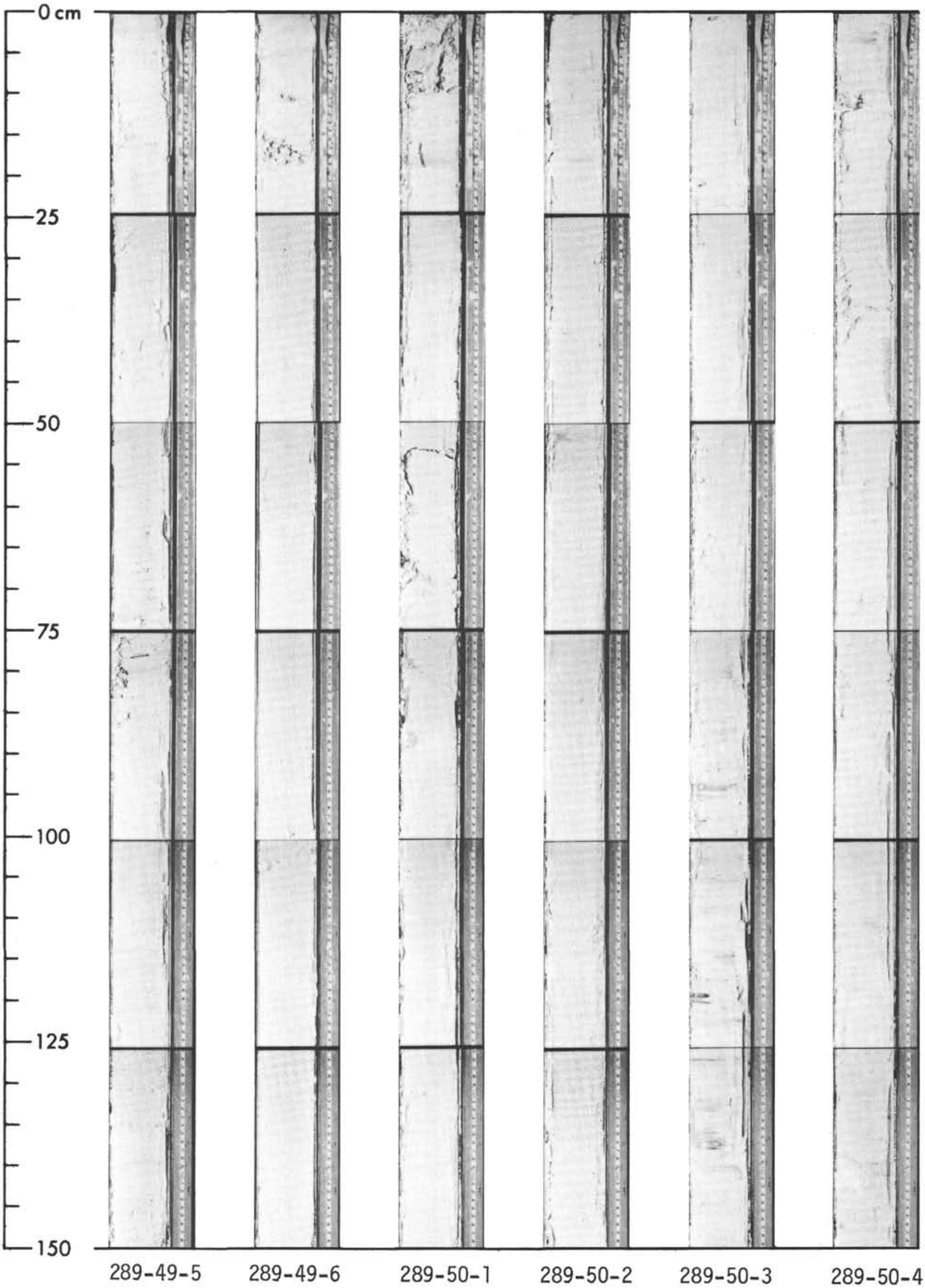

0 cm
25
50
75
100
125
150
289-44-1
289-44-2
289-44-3
289-44-4
289-44-5
289-44-6

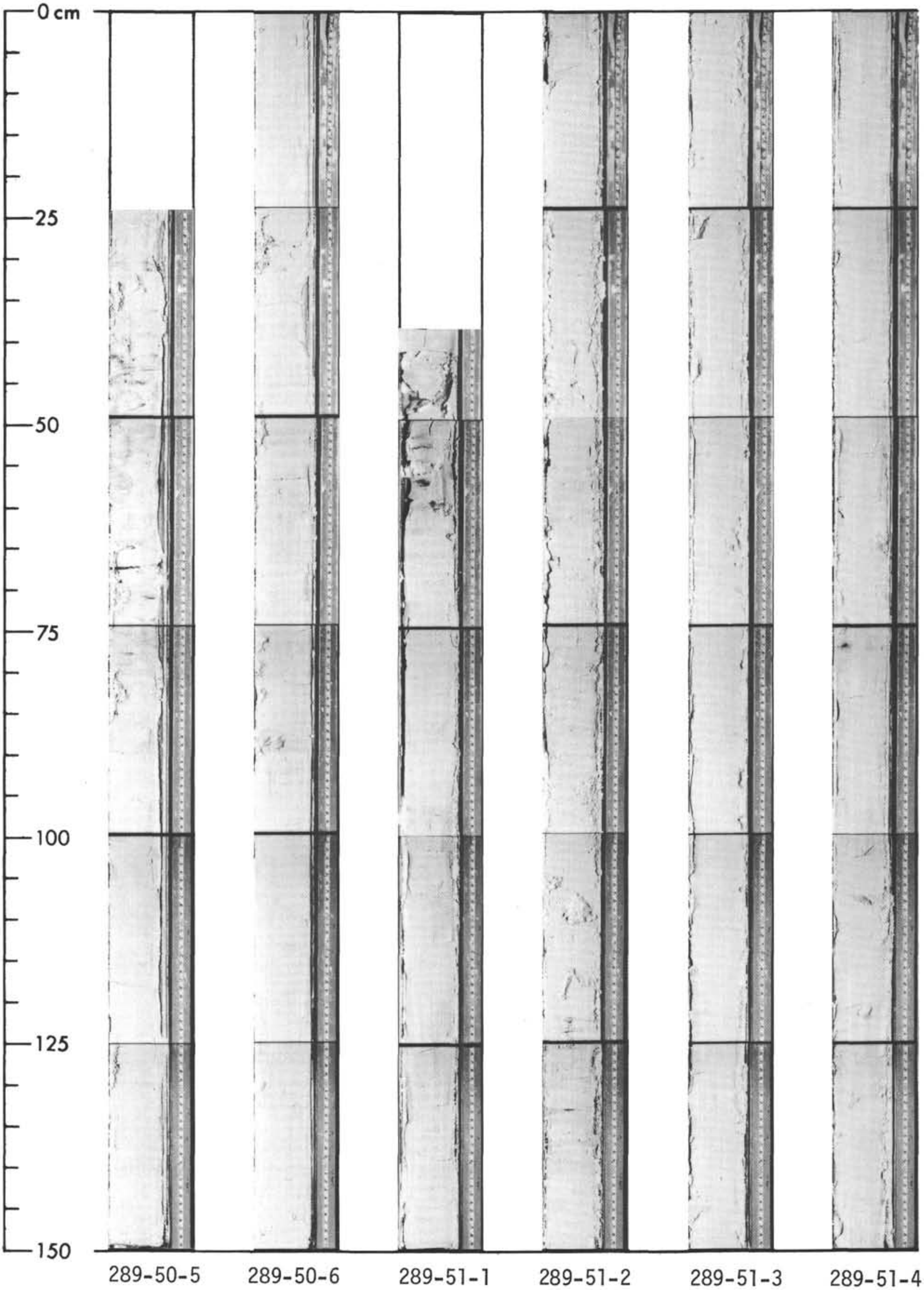

0 cm
25
50
75
100
125
150
289-45-1
289-45-2
289-45-3
289-45-4
289-45-5
289-45-6

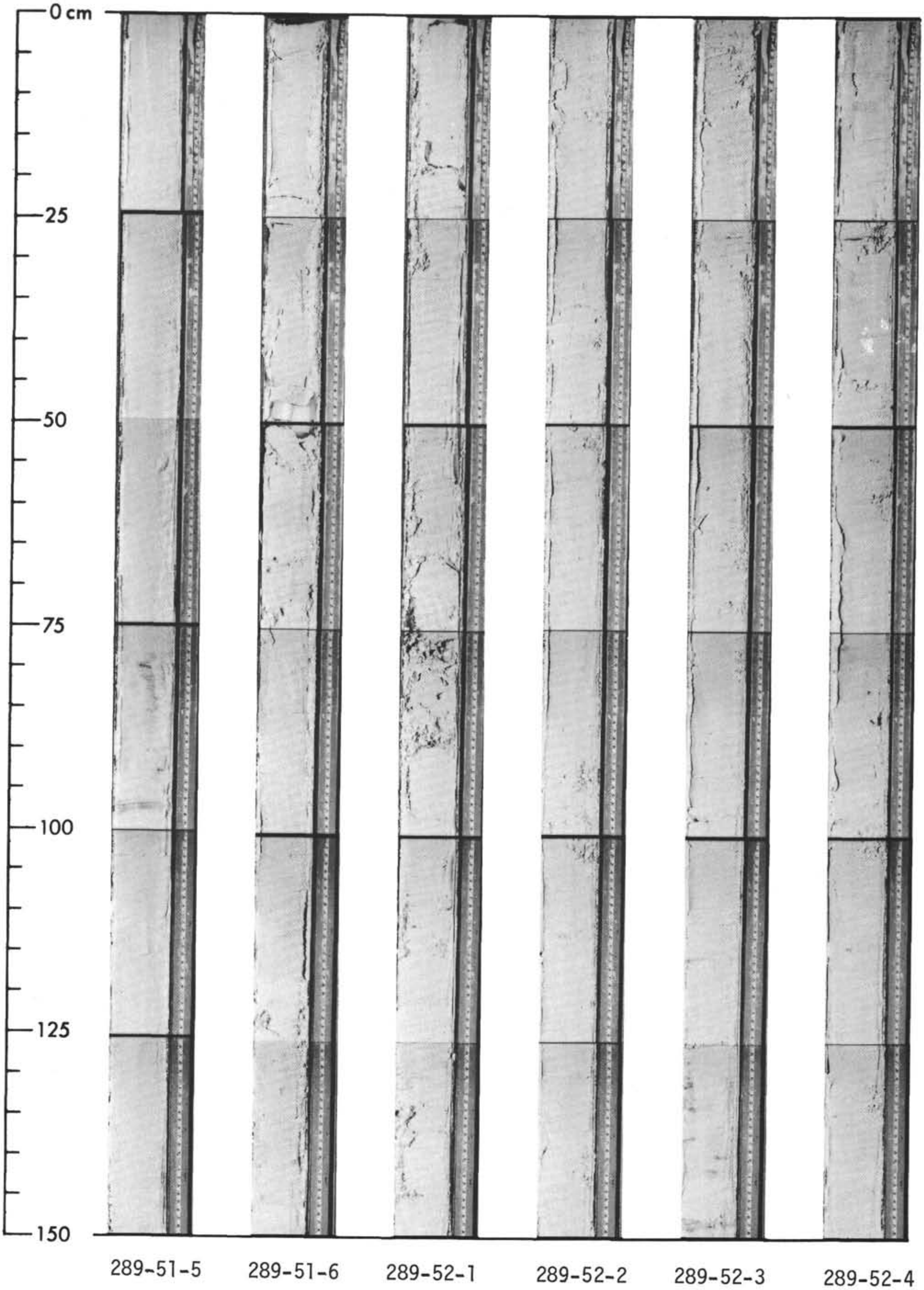

0 cm
25
50
75
100
125
150
289-46-1
289-46-2
289-47-1
289-47-2
289-47-3
289-47-4

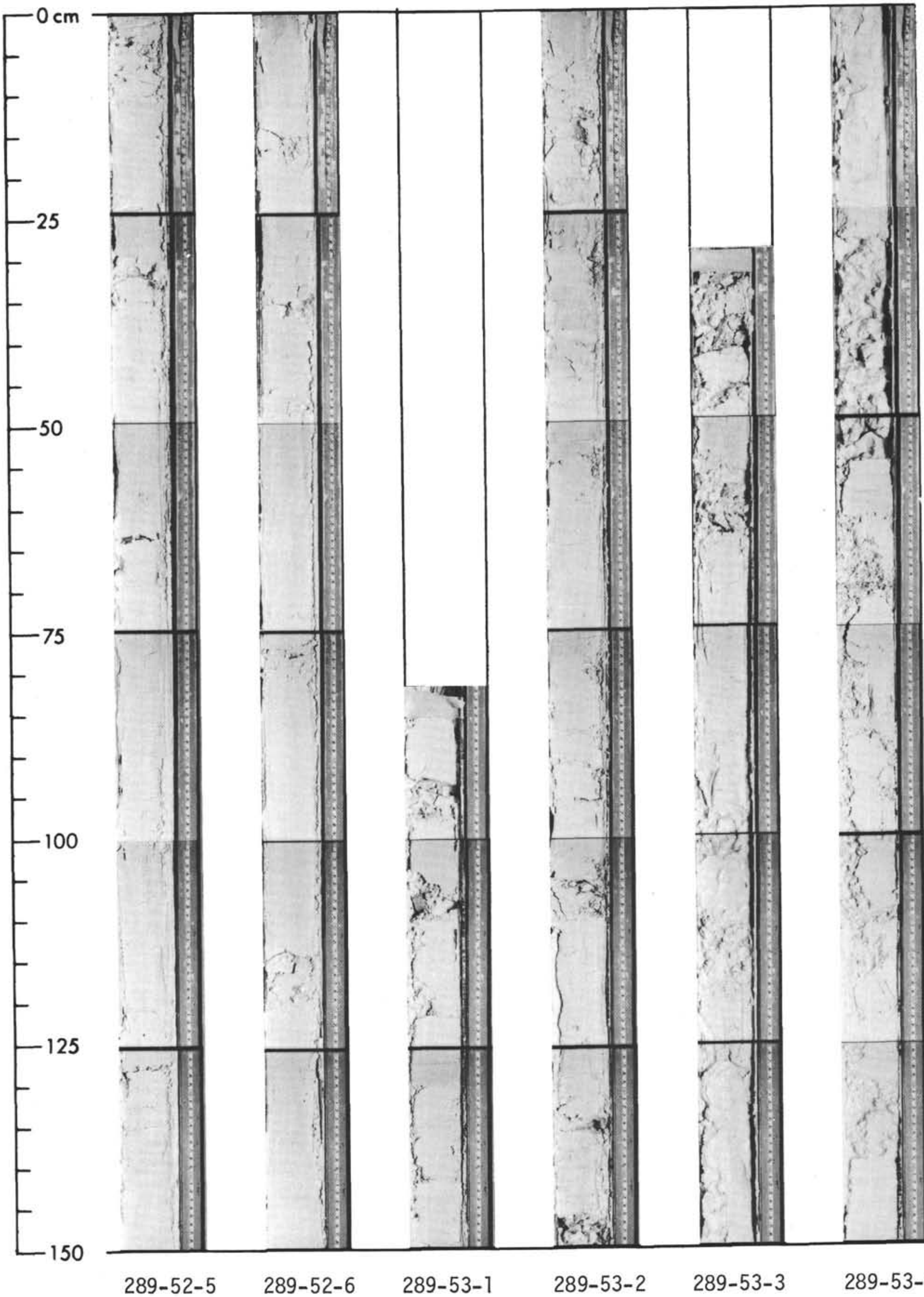

0 cm
25
50
75
100
125
150
289-47-5
289-47-6
289-48-1
289-48-2
289-48-3
289-48-4

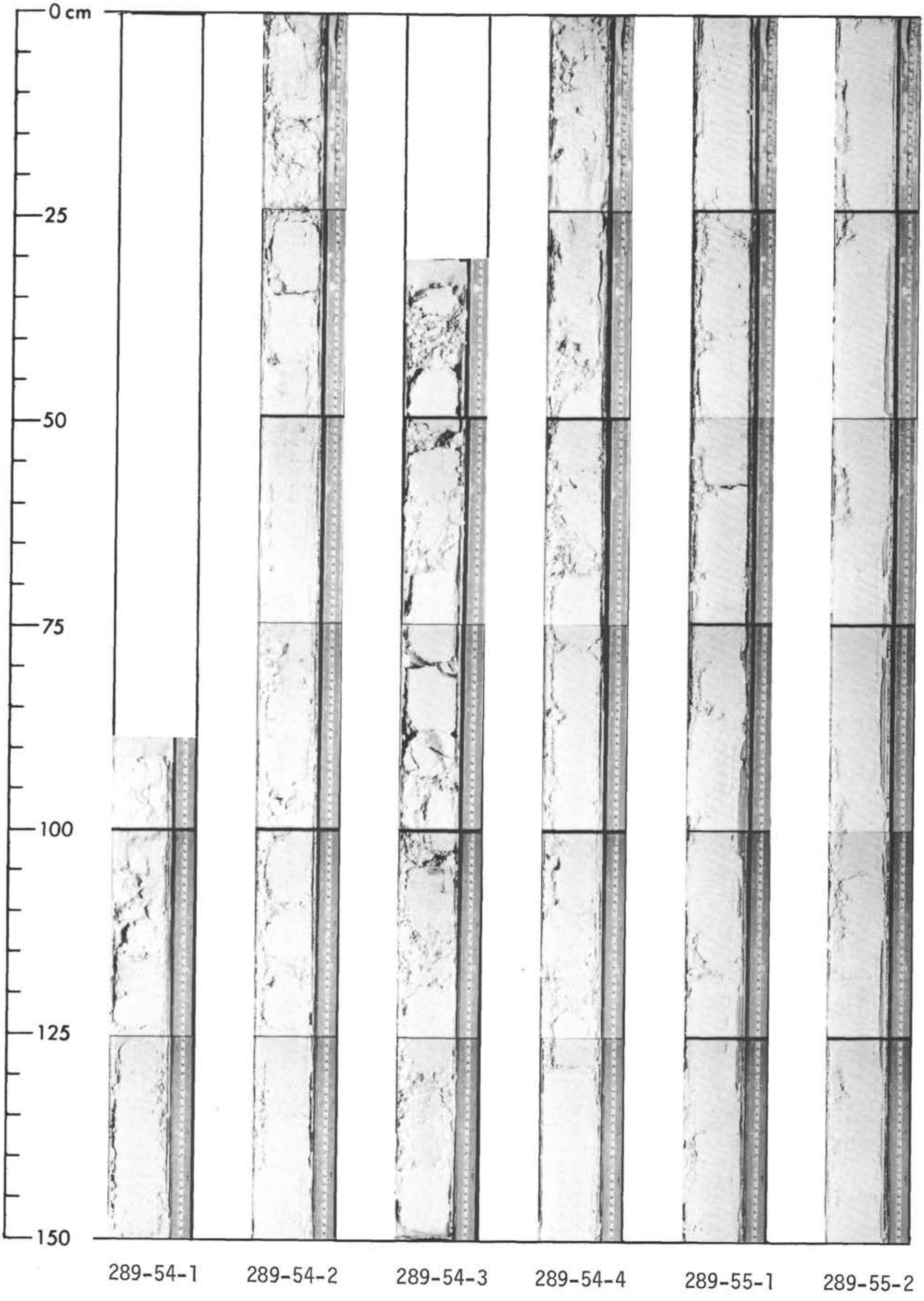

0 cm
25
50
75
100
125
150
289-48-5
289-48-6
289-49-1
289-49-2
289-49-3
289-49-4

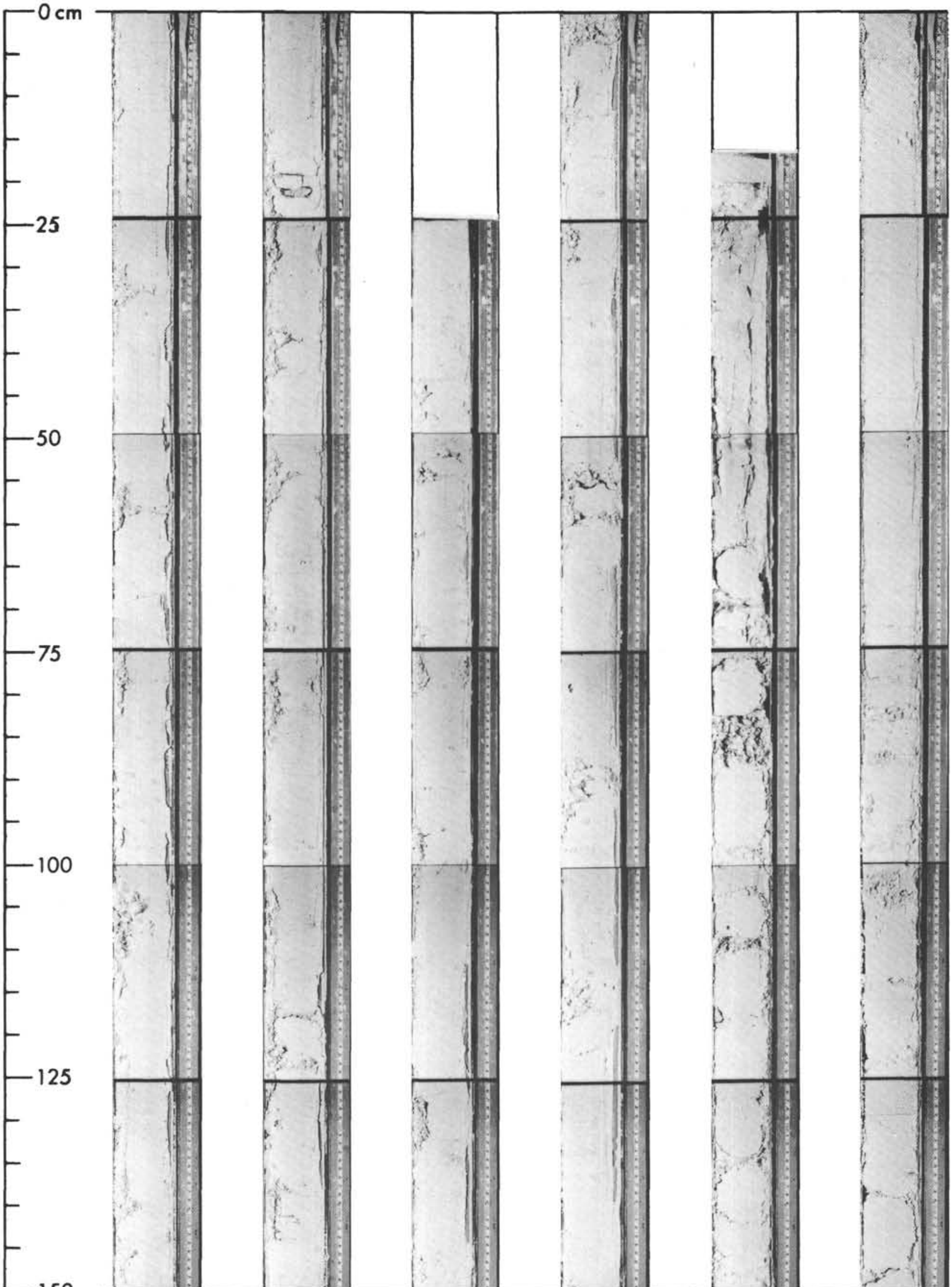

0 cm
25
50
75
100
125
150
289-49-5
289-49-6
289-50-1
289-50-2
289-50-3
289-50-4


0 cm
25
50
75
100
125
150
289-50-5
289-50-6
289-51-1
289-51-2
289-51-3
289-51-4

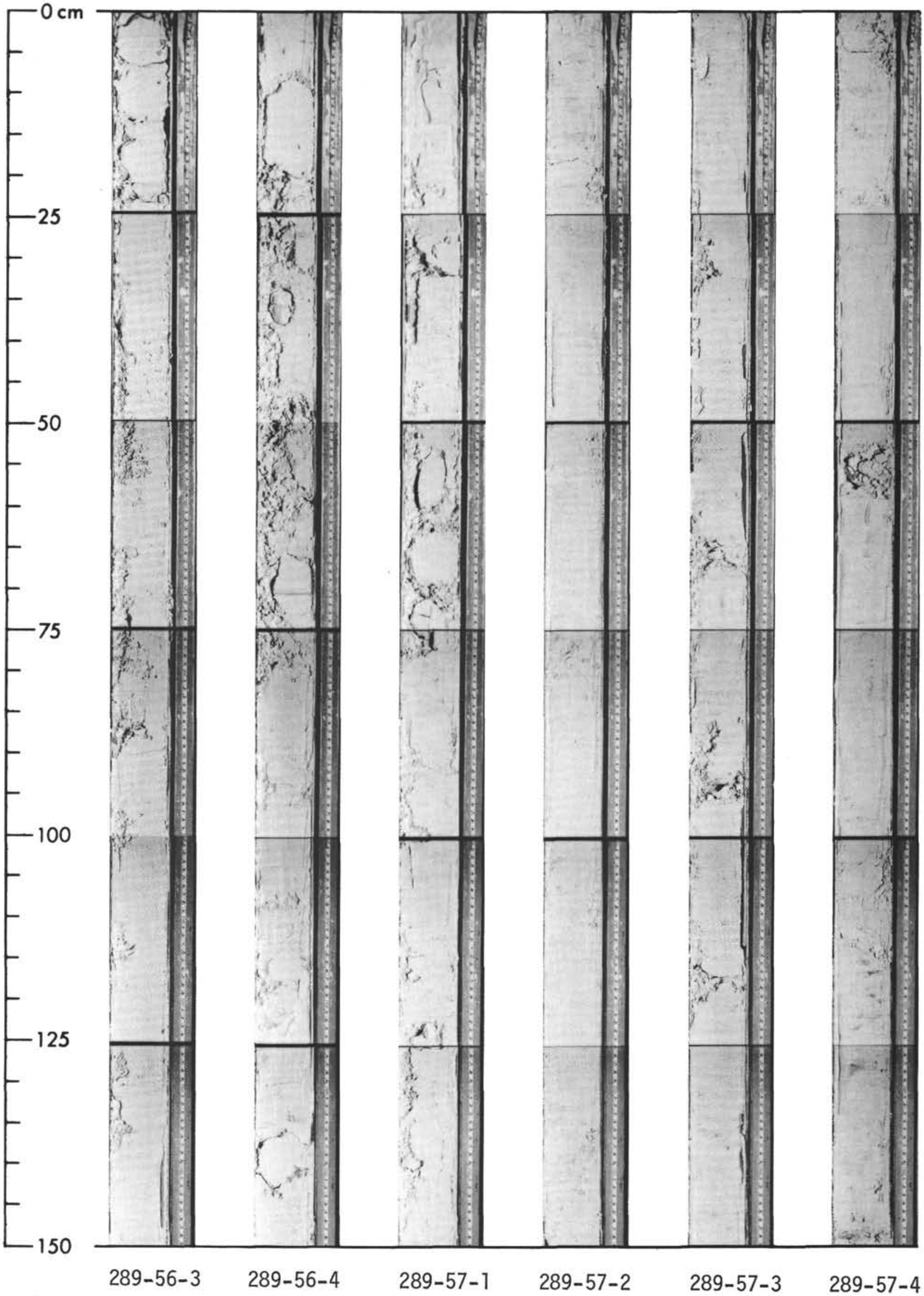

0 cm
25
50
75
100
125
150
289-51-5
289-51-6
289-52-1
289-52-2
289-52-3
289-52-4

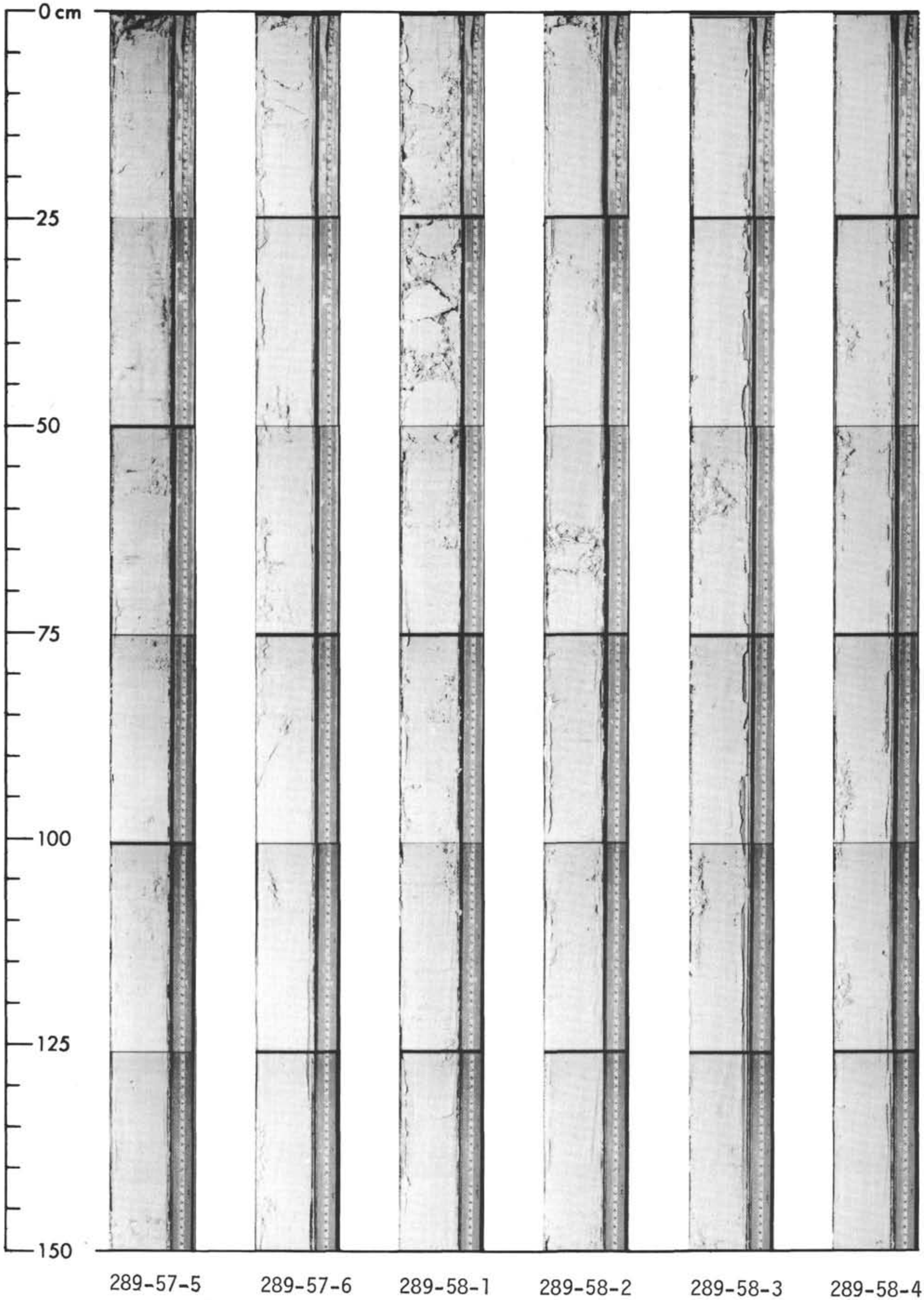

0 cm
25
50
75
100
125
150
289-52-5
289-52-6
289-53-1
289-53-2
289-53-3
289-53-4

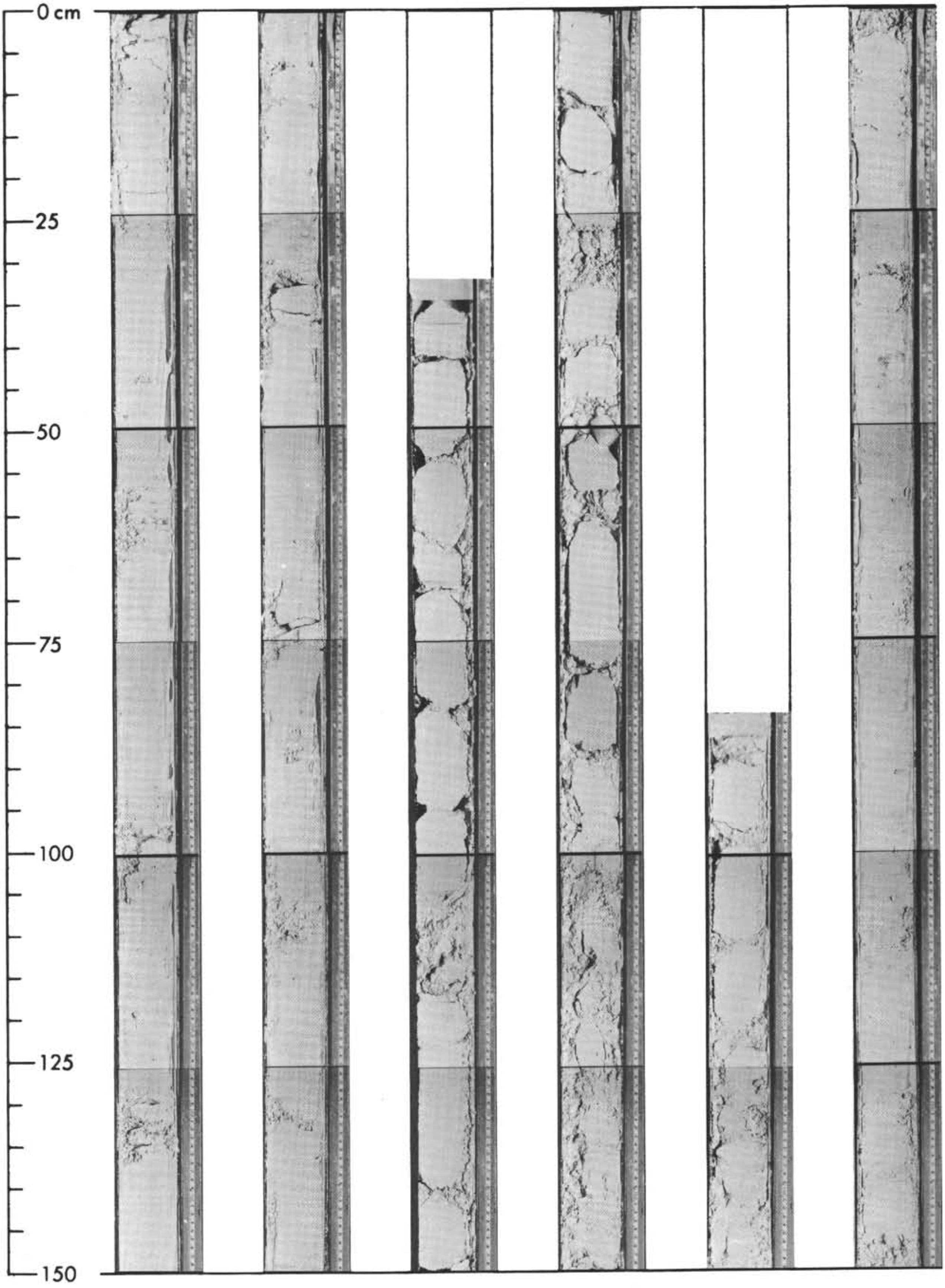

0 cm
25
50
75
100
125
150
289-54-1
289-54-2
289-54-3
289-54-4
289-55-1
289-55-2

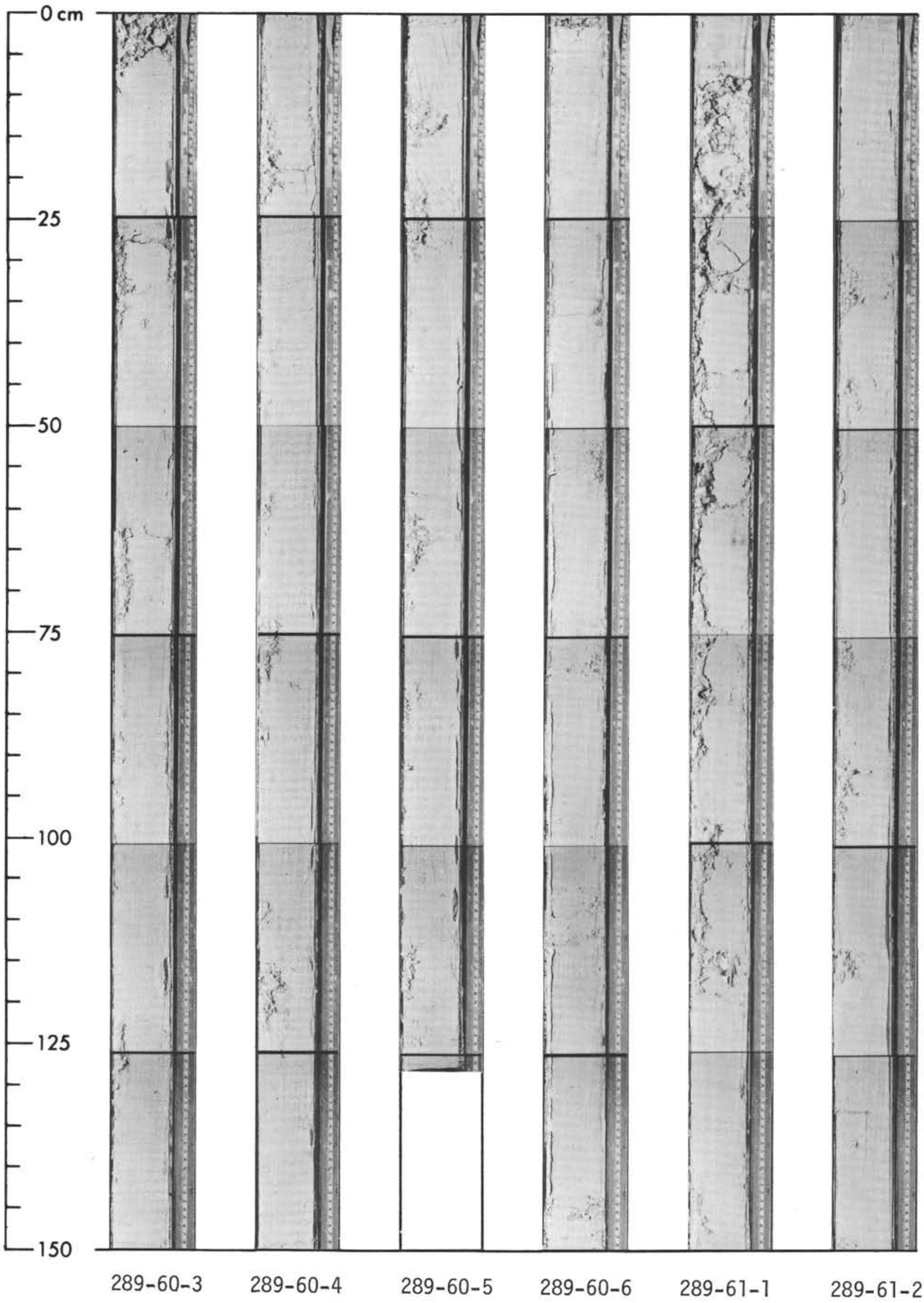


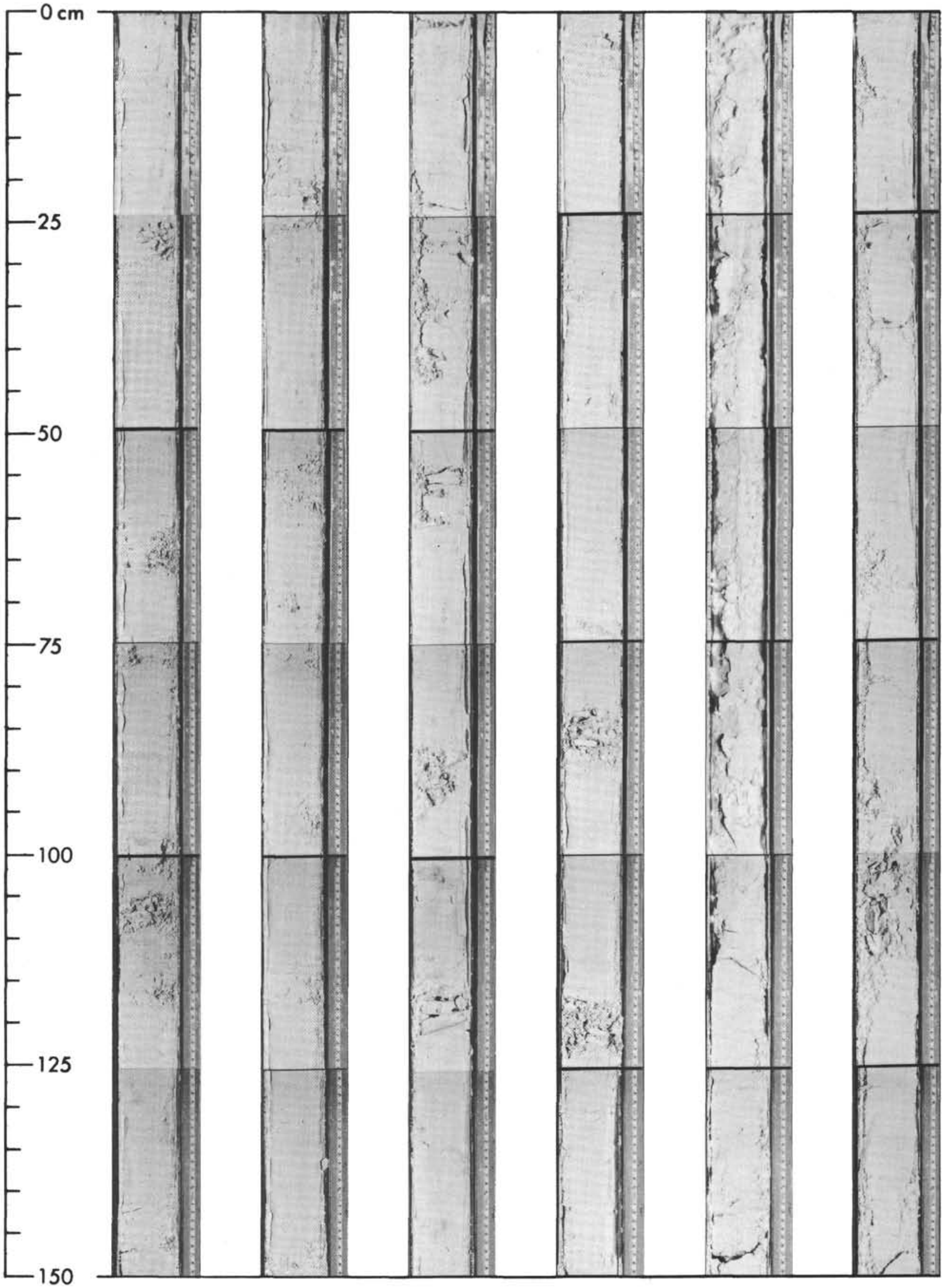
289-55-3 289-55-4 289-55-5 289-55-6 289-56-1 289-56-2

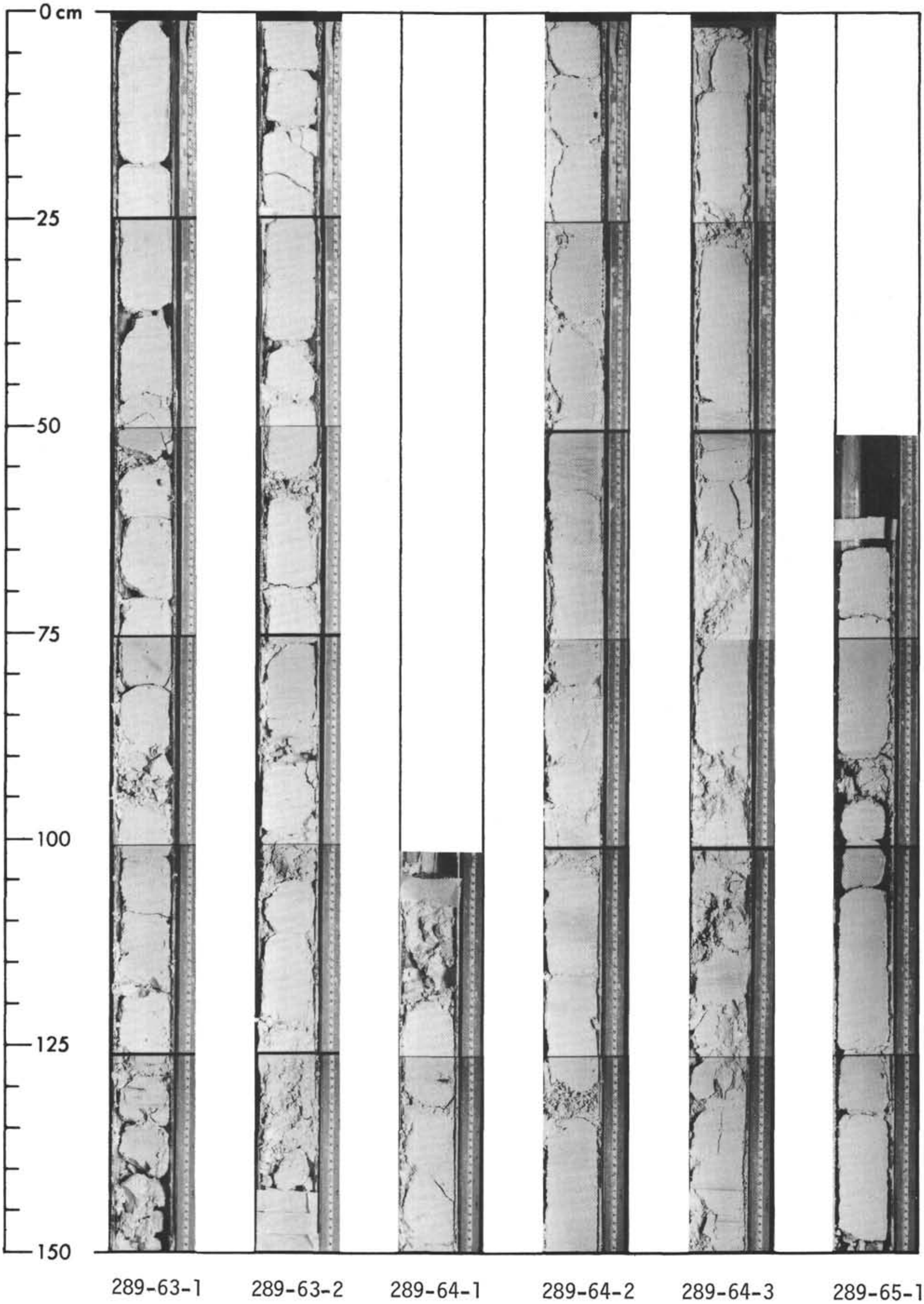

0 cm
25
50
75
100
125
150
289-56-3
289-56-4
289-57-1
289-57-2
289-57-3
289-57-4

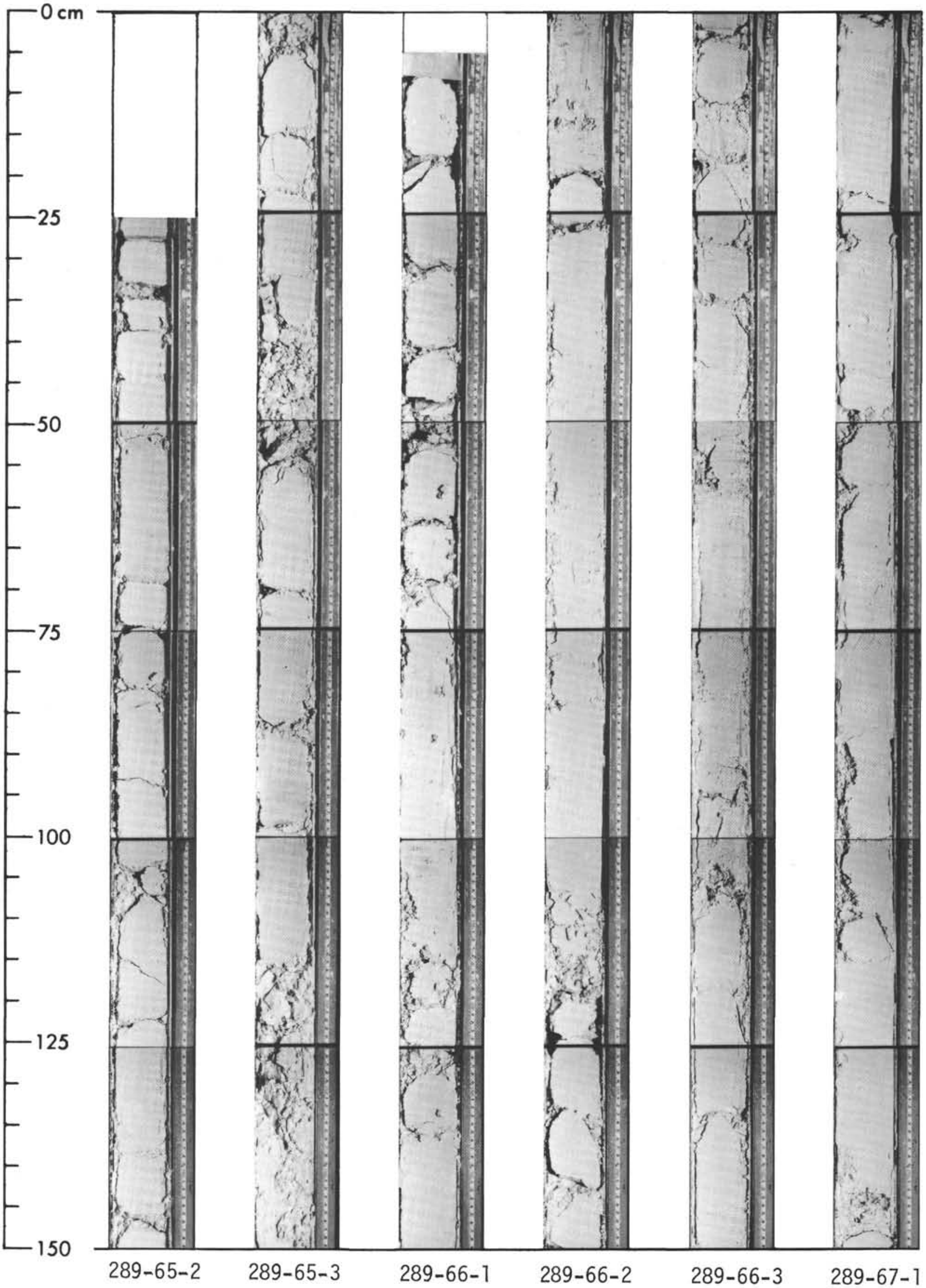

0 cm
25
50
75
100
125
150
289-57-5
289-57-6
289-58-1
289-58-2
289-58-3
289-58-4

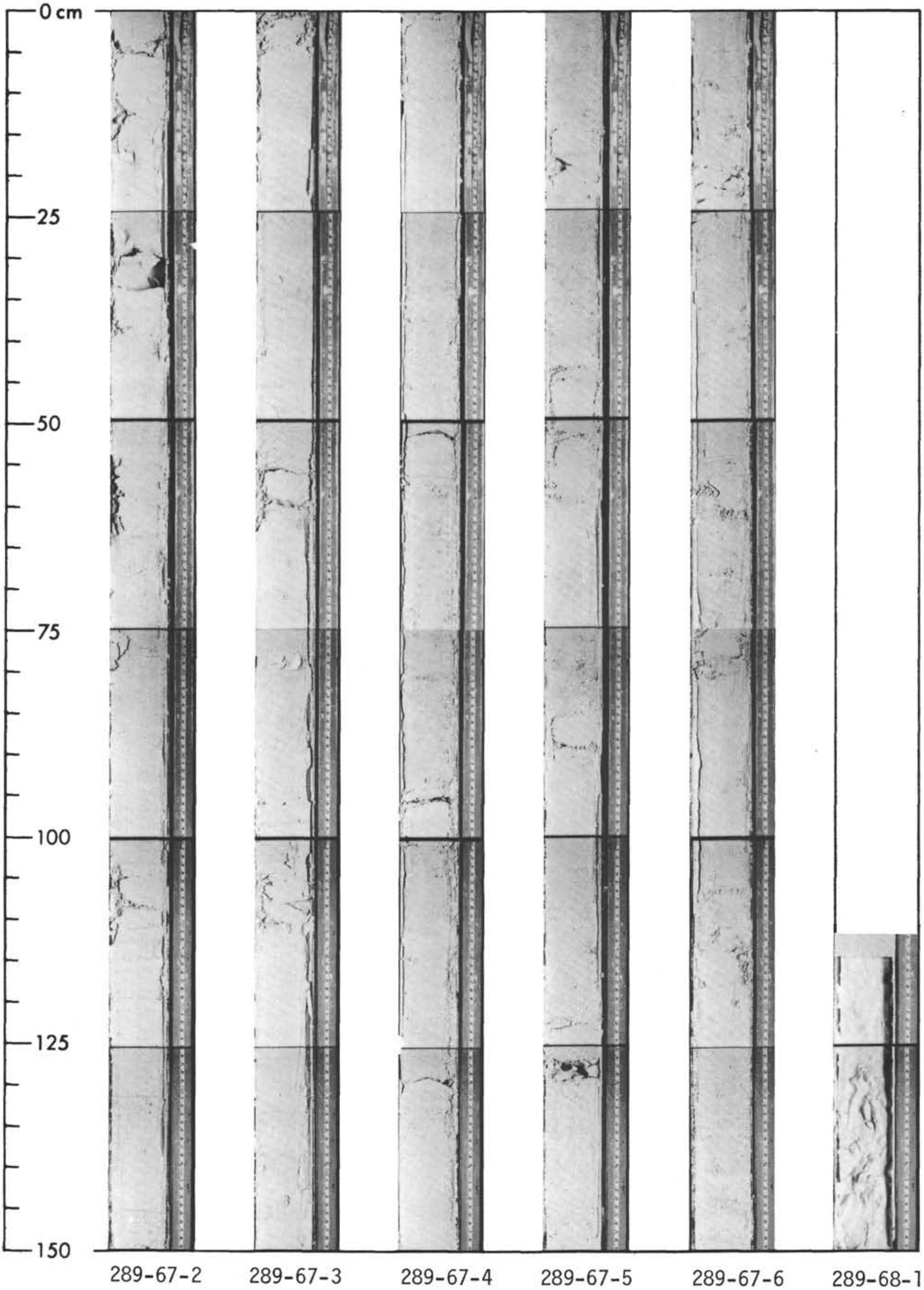

0 cm
25
50
75
100
125
150
289-58-5
289-58-6
289-59-1
289-59-2
289-60-1
289-60-2

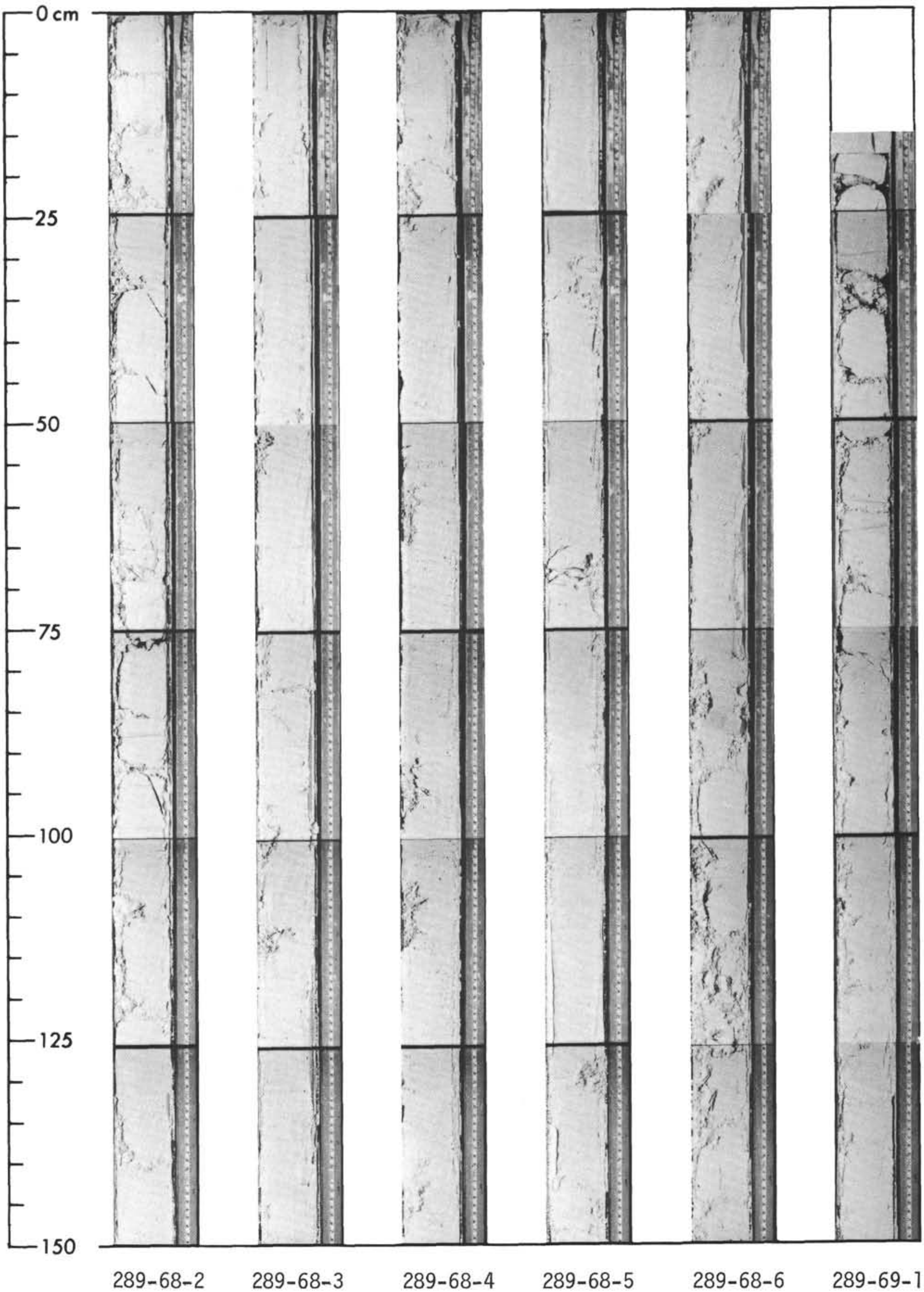

0 cm
25
50
75
100
125
150
289-60-3
289-60-4
289-60-5
289-60-6
289-61-1
289-61-2

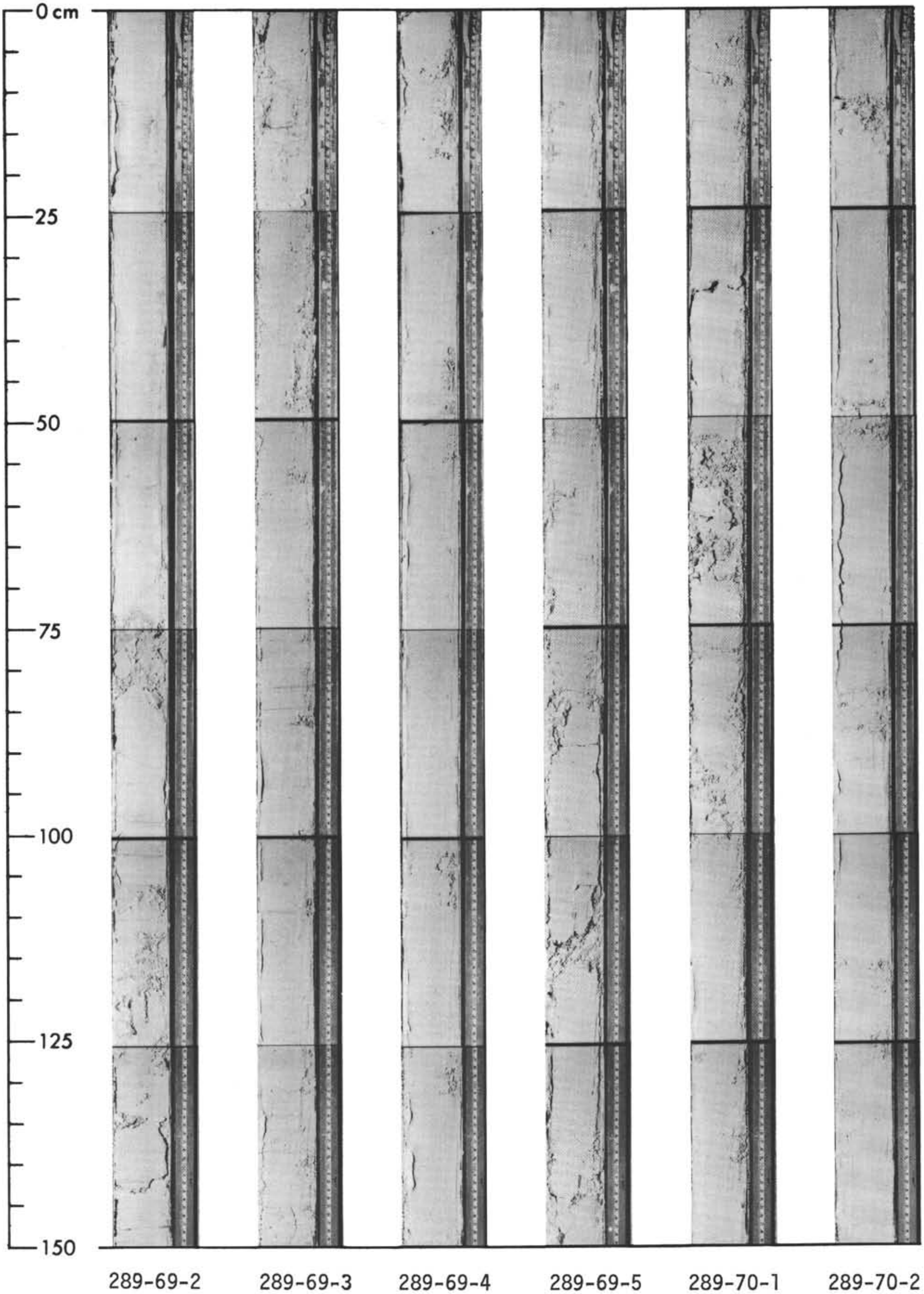

0 cm
25
50
75
100
125
150
289-61-3
289-61-4
289-61-5
289-61-6
289-62-1
289-62-2

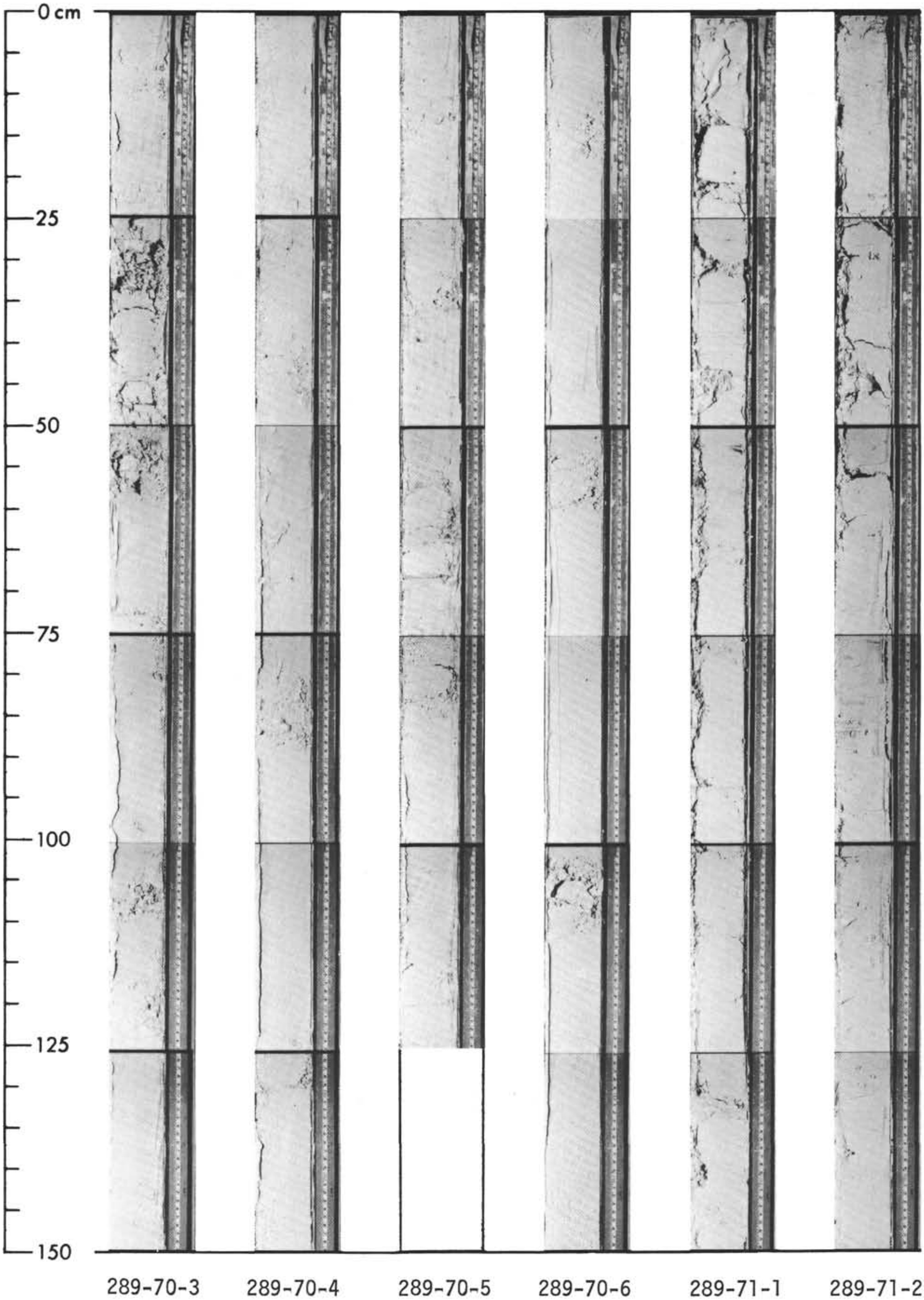

0 cm
25
50
75
100
125
150
289-63-1
289-63-2
289-64-1
289-64-2
289-64-3
289-65-1

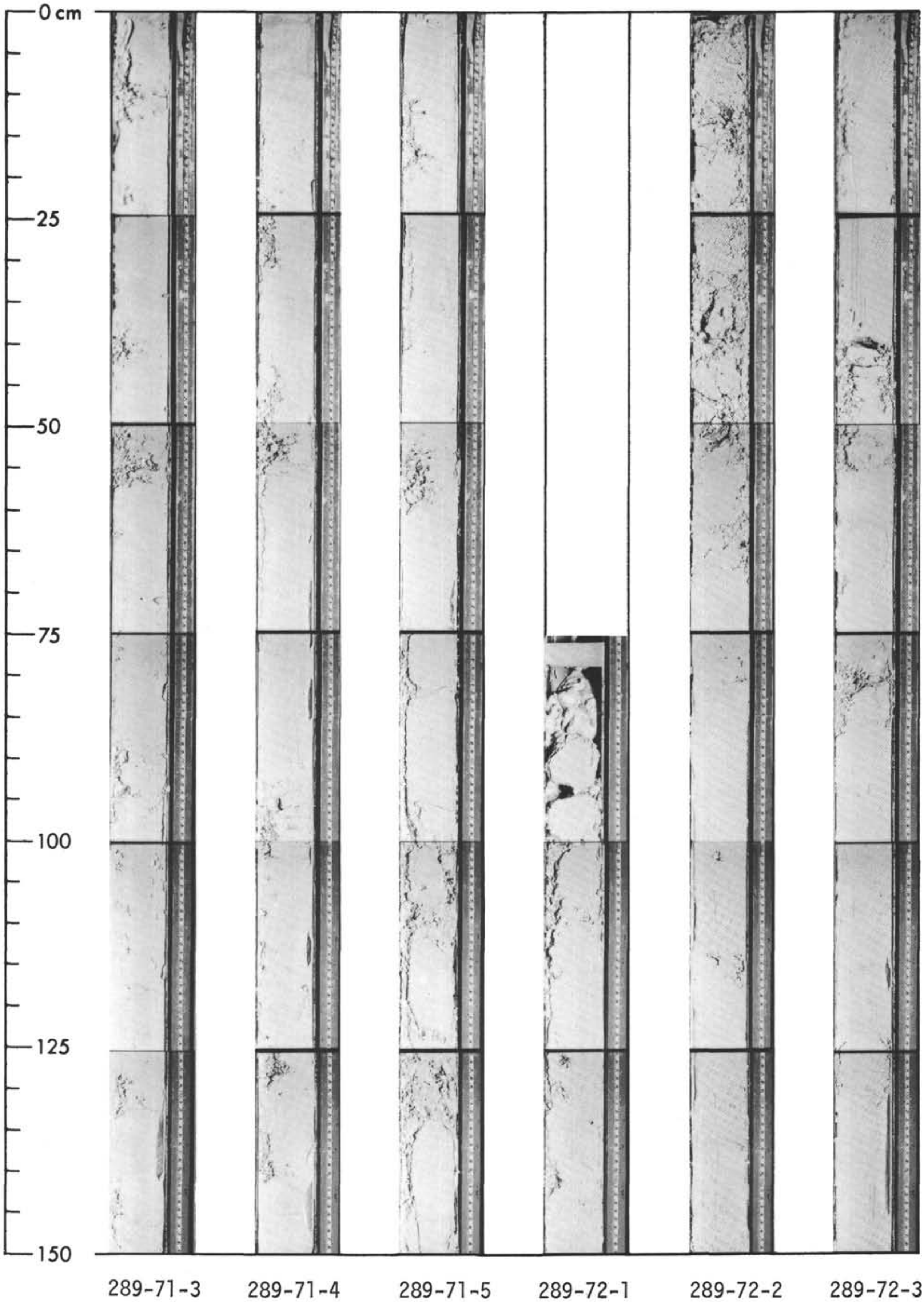

0 cm
25
50
75
100
125
150
289-65-2
289-65-3
289-66-1
289-66-2
289-66-3
289-67-1

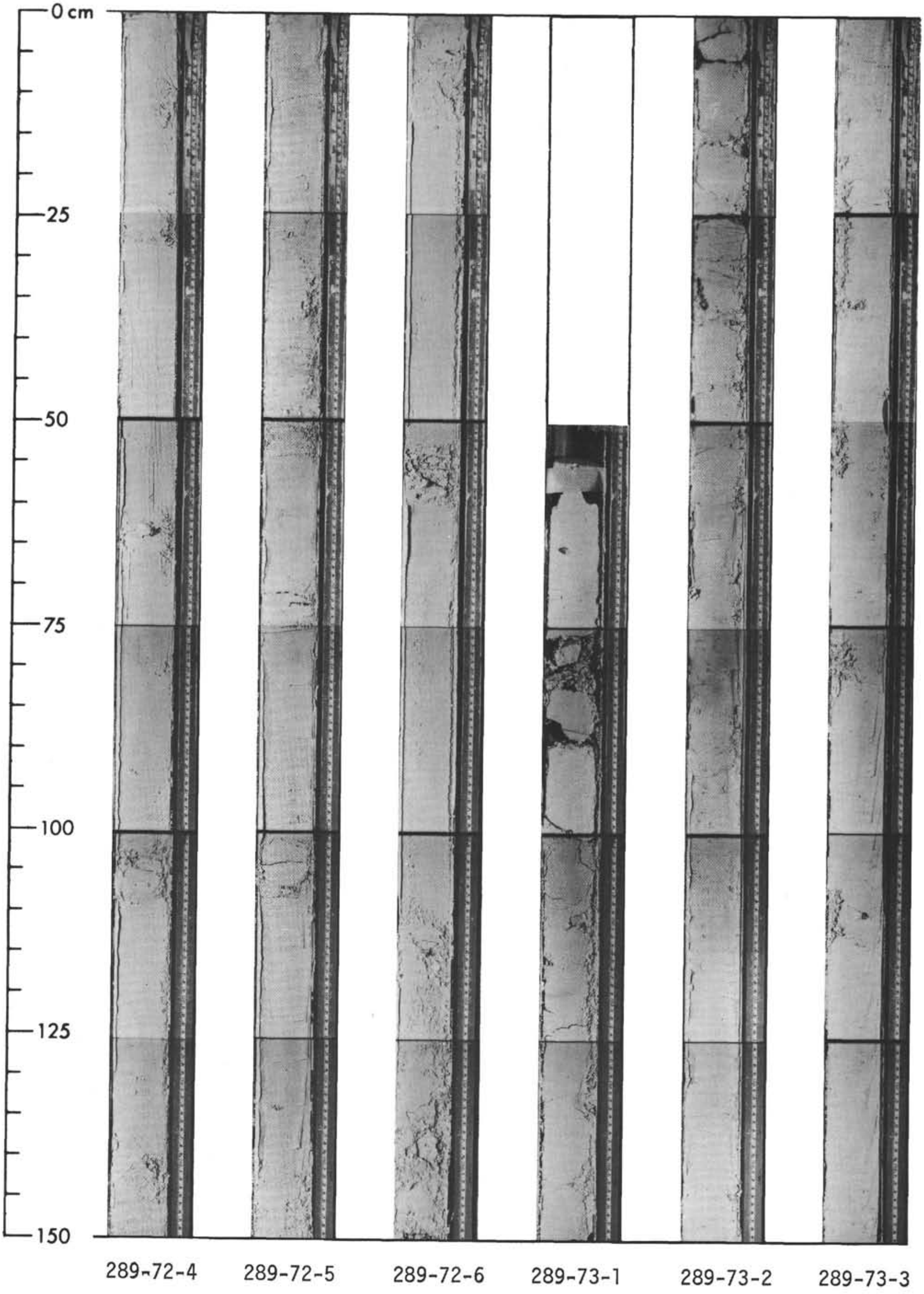

0 cm
25
50
75
100
125
150
289-67-2
289-67-3
289-67-4
289-67-5
289-67-6
289-68-1

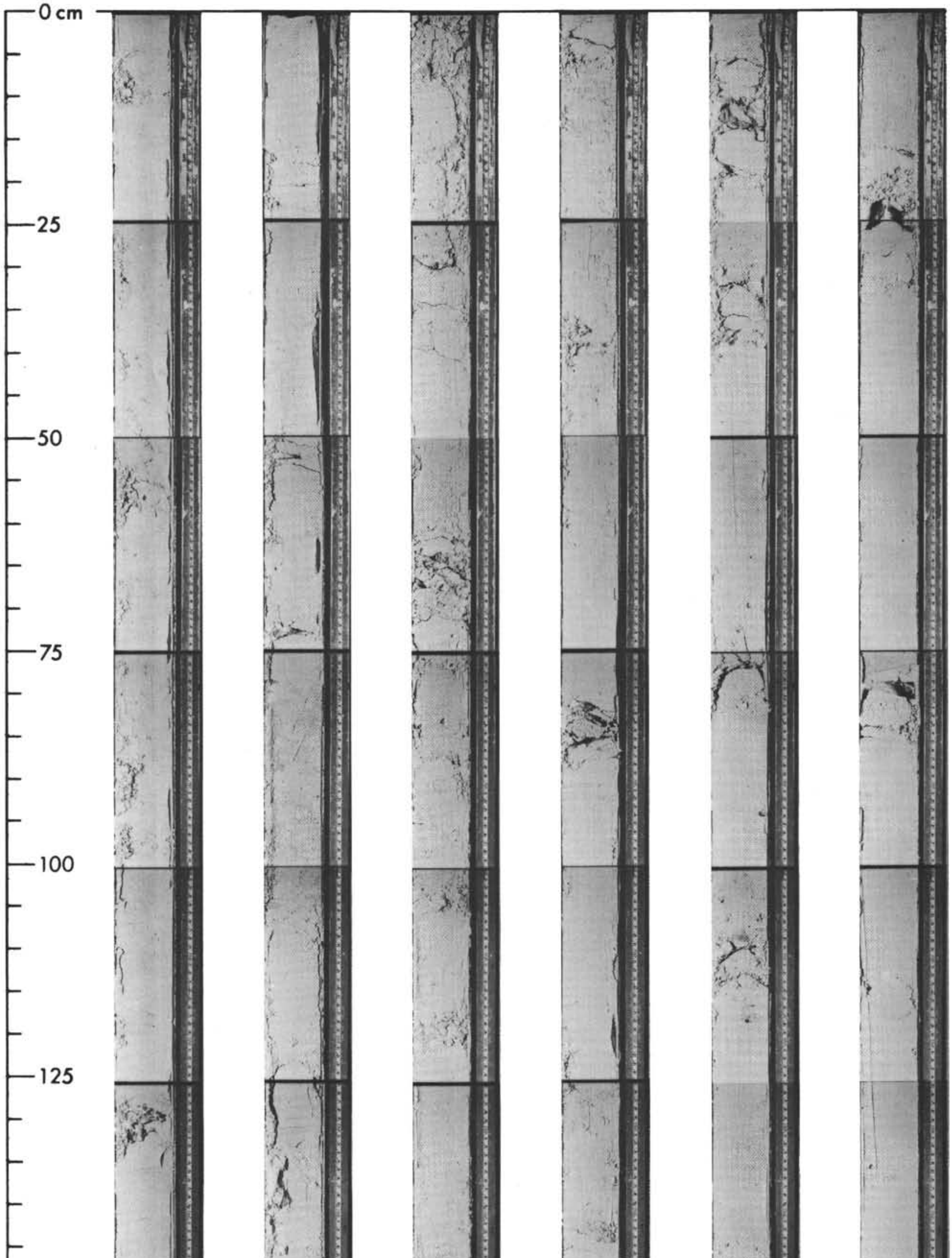

0 cm
25
50
75
100
125
150
289-68-2
289-68-3
289-68-4
289-68-5
289-68-6
289-69-1

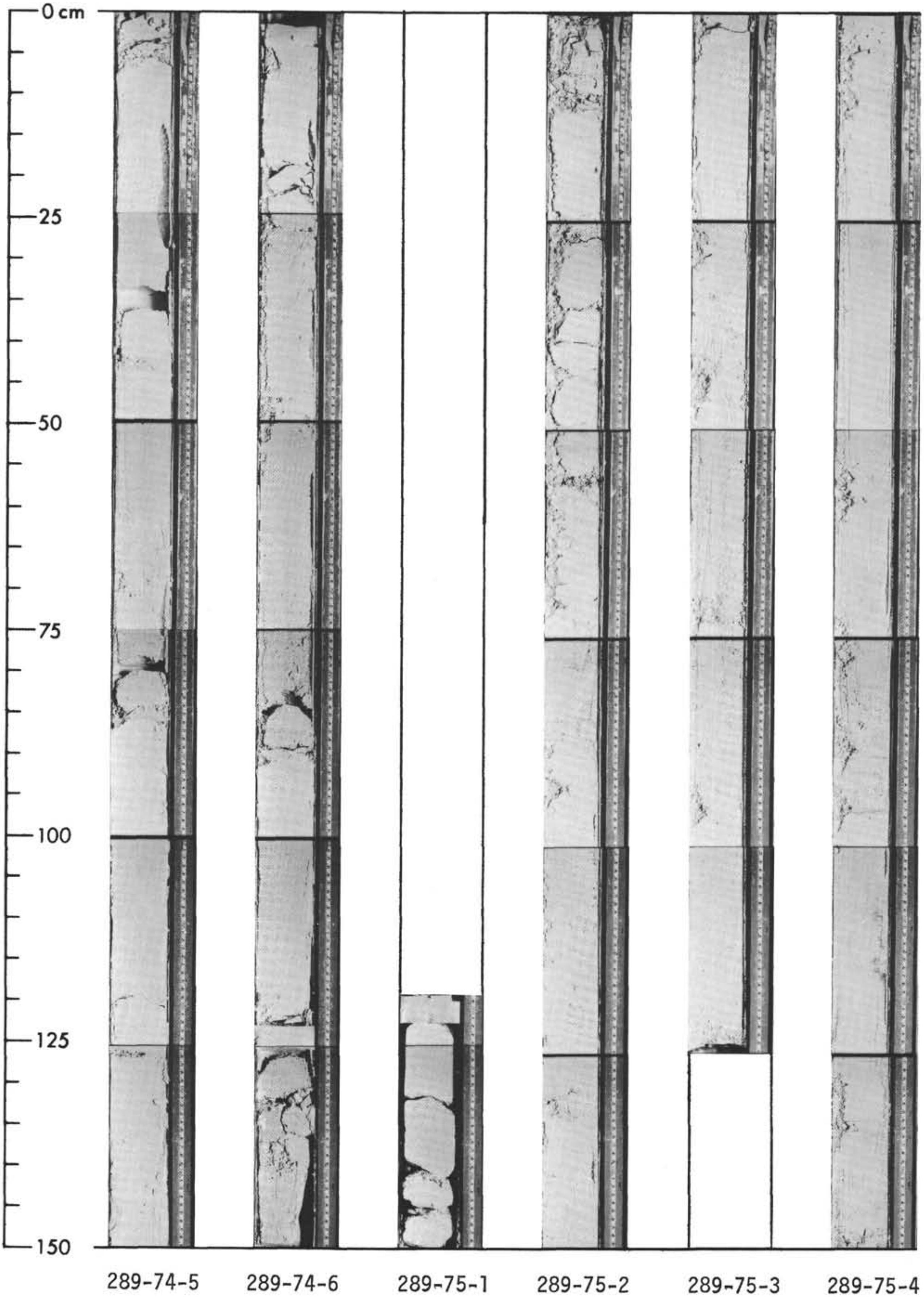

0 cm
25
50
75
100
125
150
289-69-2
289-69-3
289-69-4
289-69-5
289-70-1
289-70-2

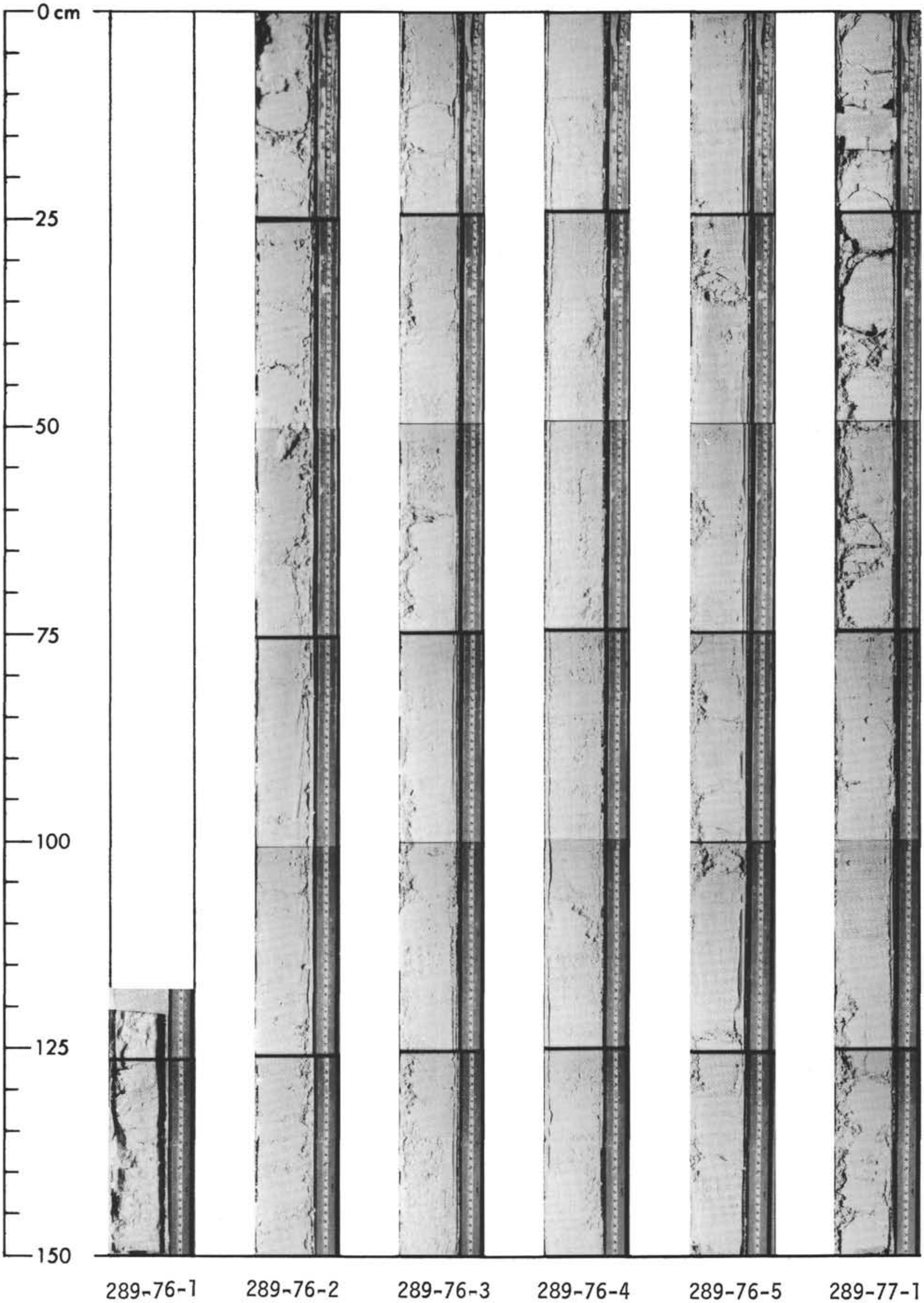

0 cm
25
50
75
100
125
150
289-70-3
289-70-4
289-70-5
289-70-6
289-71-1
289-71-2

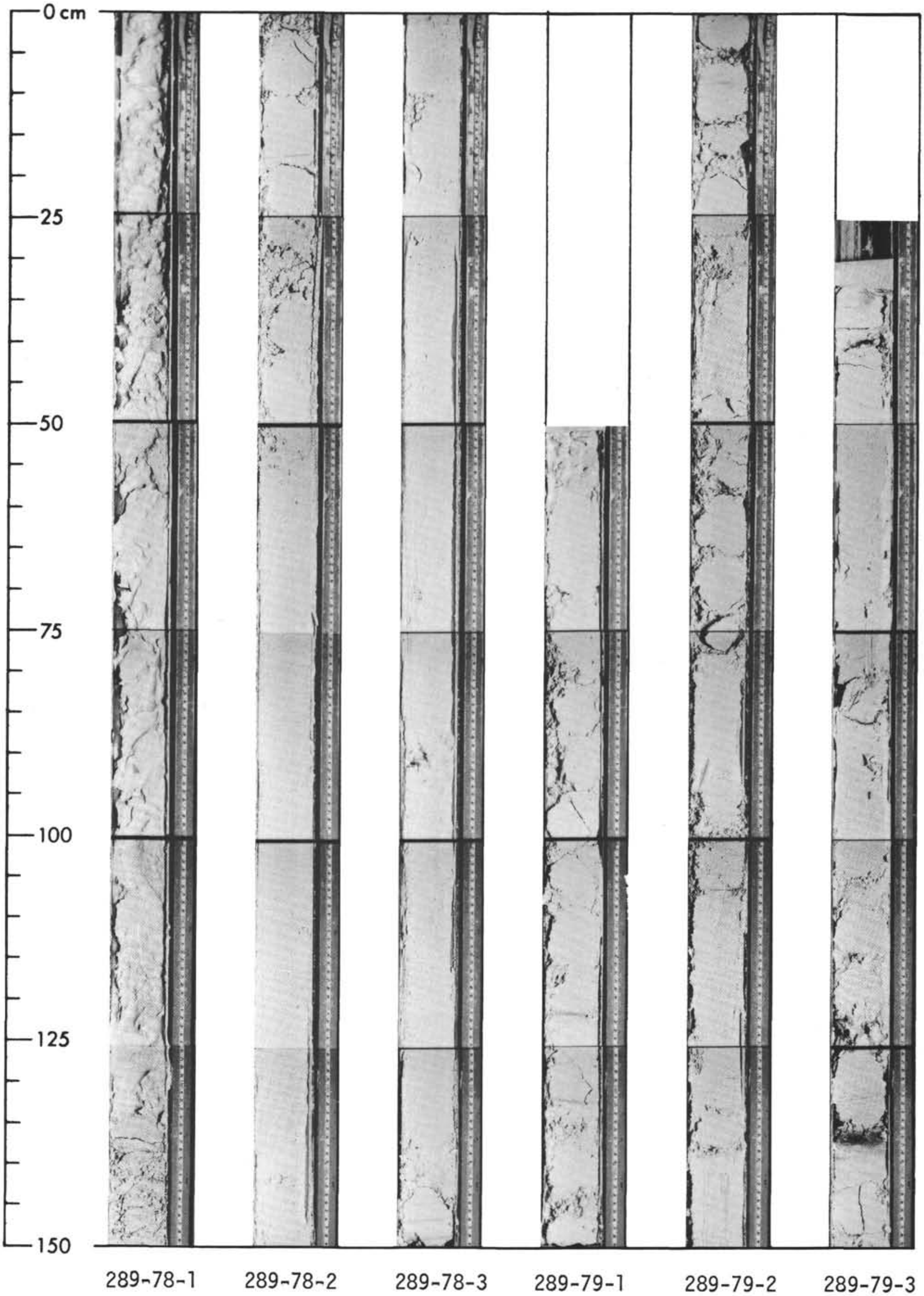

0 cm
25
50
75
100
125
150
289-71-3
289-71-4
289-71-5
289-72-1
289-72-2
289-72-3

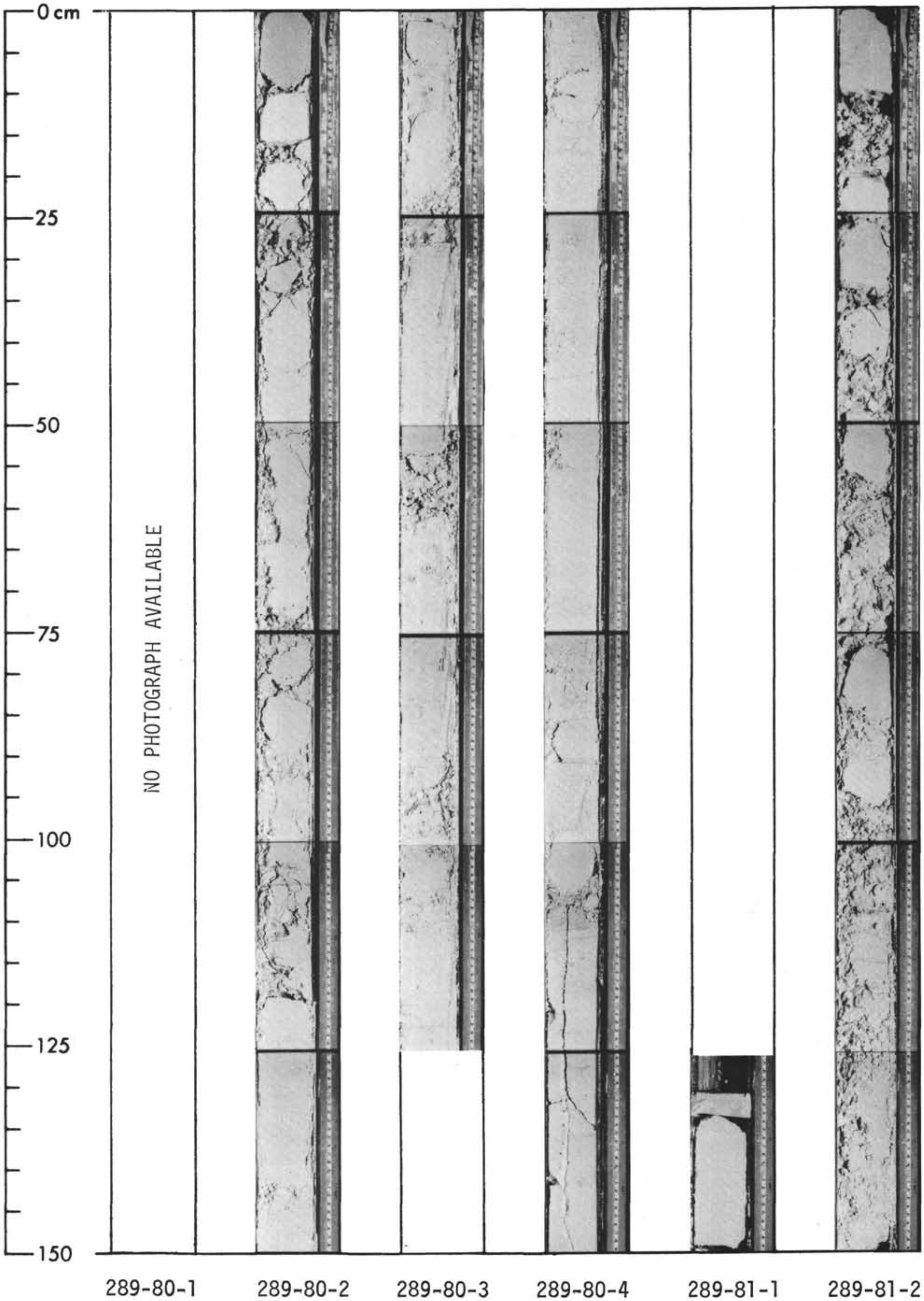

0 cm
25
50
75
100
125
150
289-72-4
289-72-5
289-72-6
289-73-1
289-73-2
289-73-3

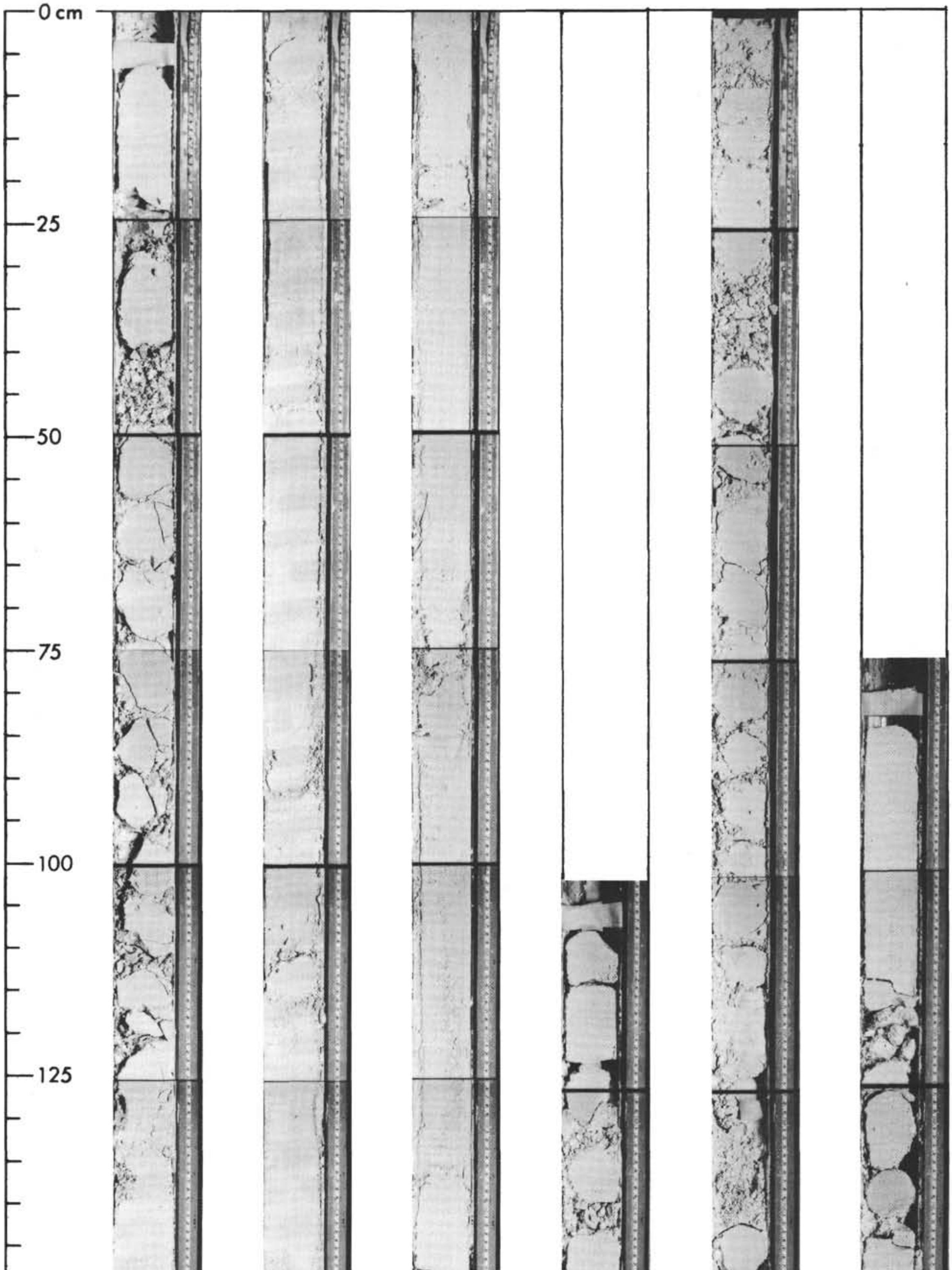

0 cm
25
50
75
100
125
150
289-73-4
289-73-5
289-74-1
289-74-2
289-74-3
289-74-4

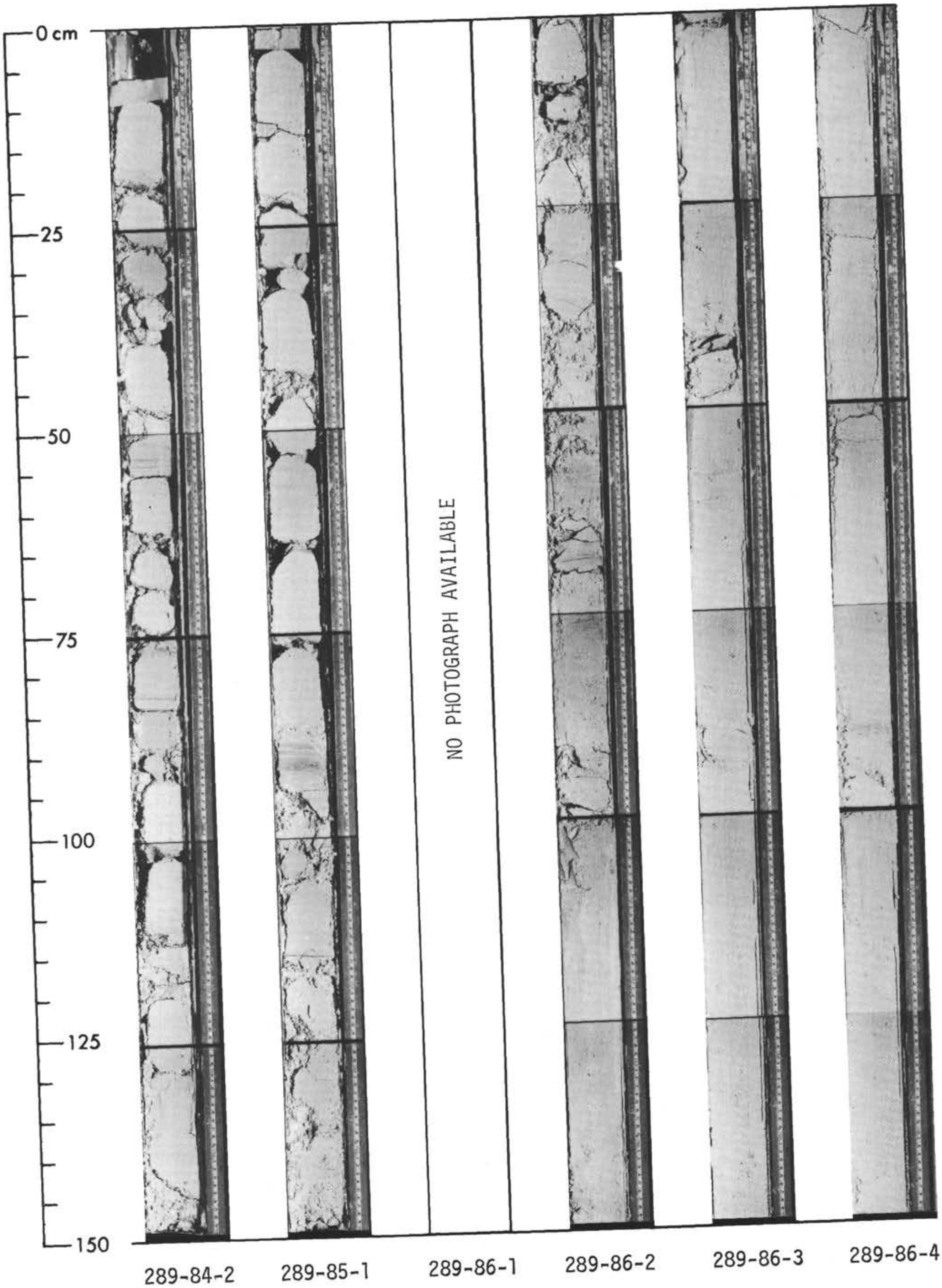

0 cm
25
50
75
100
125
150
289-74-5
289-74-6
289-75-1
289-75-2
289-75-3
289-75-4

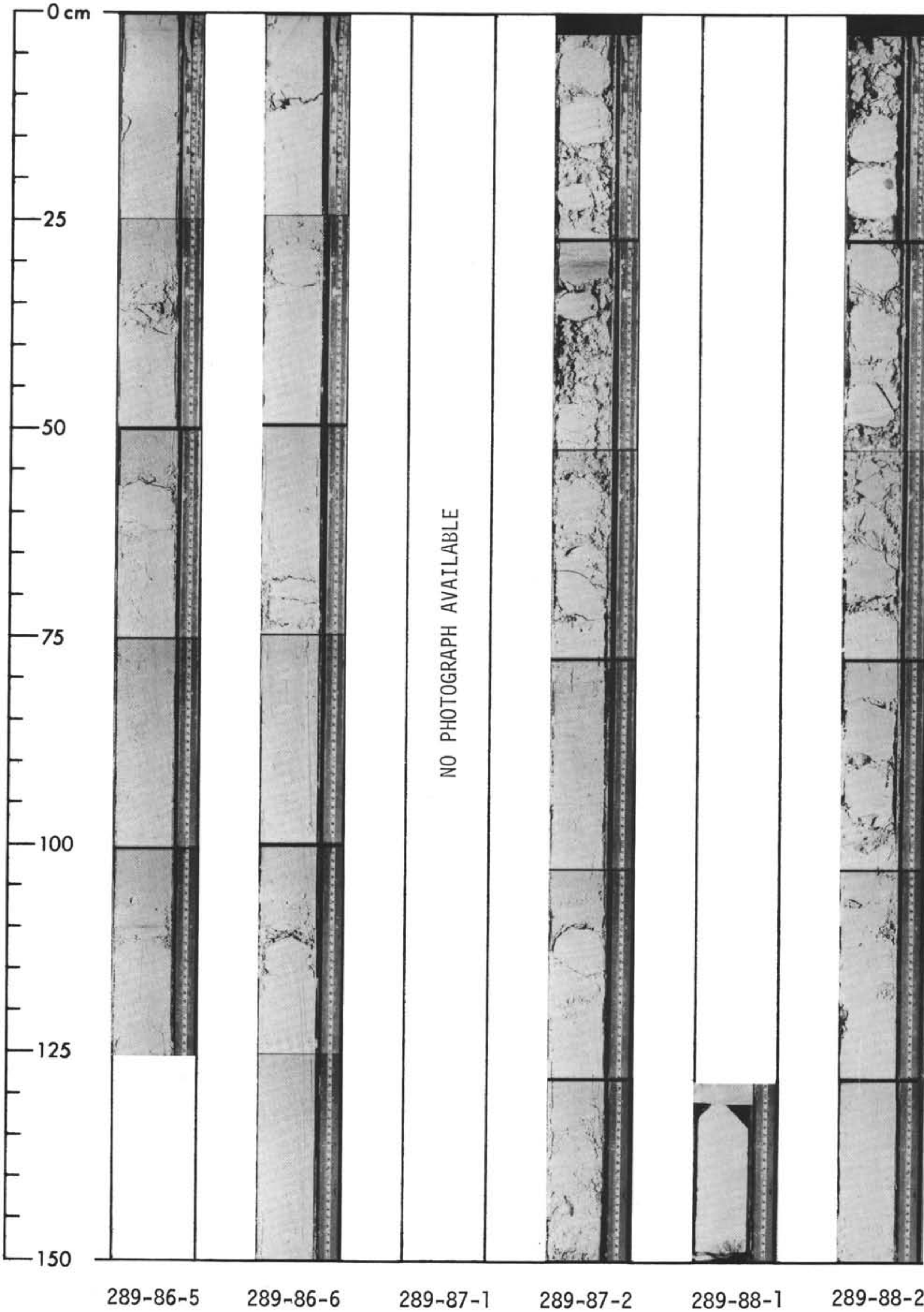

0 cm
25
50
75
100
125
150
289-76-1
289-76-2
289-76-3
289-76-4
289-76-5
289-77-1

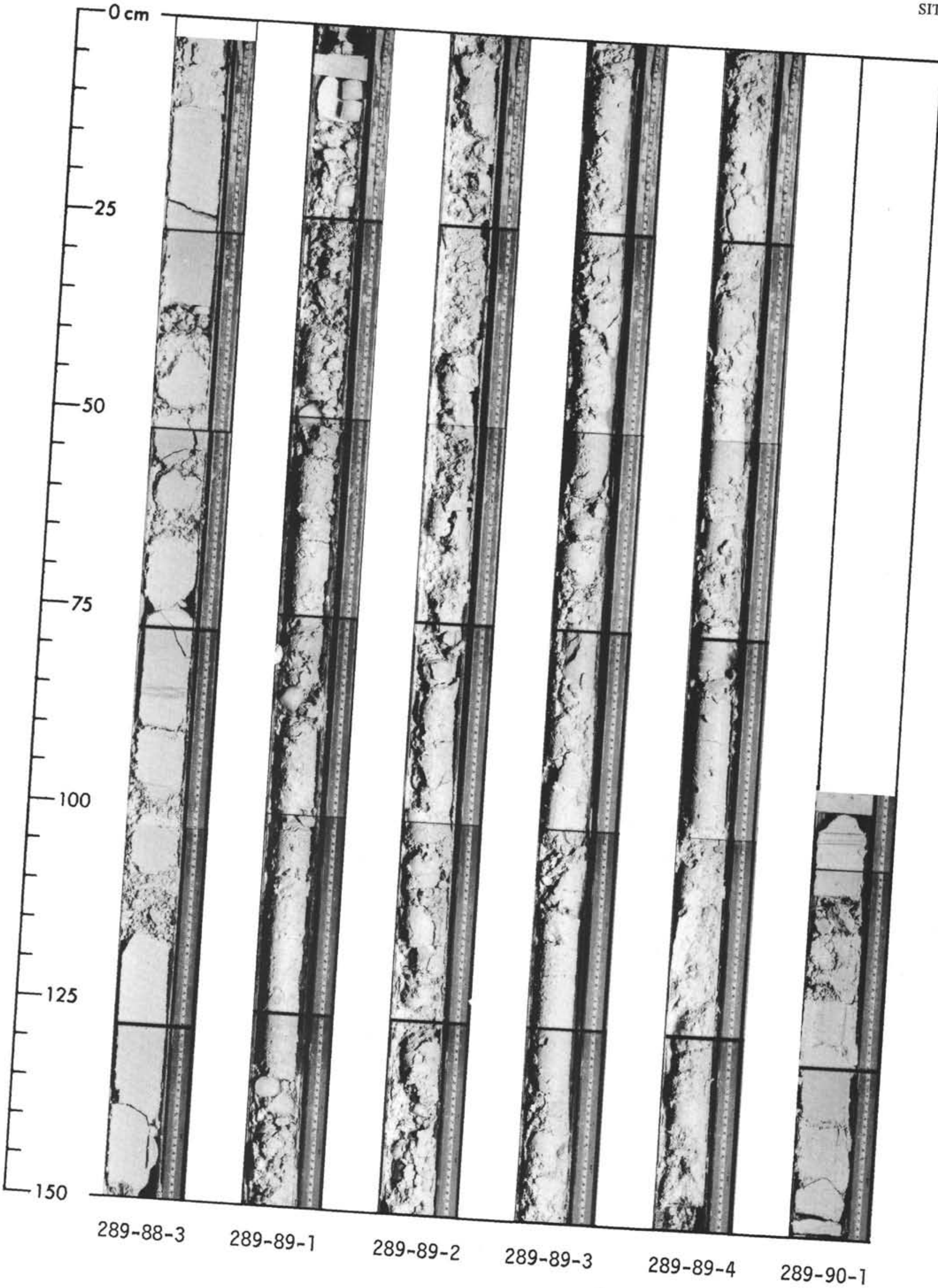

0 cm
25
50
75
100
125
150
289-78-1
289-78-2
289-78-3
289-79-1
289-79-2
289-79-3

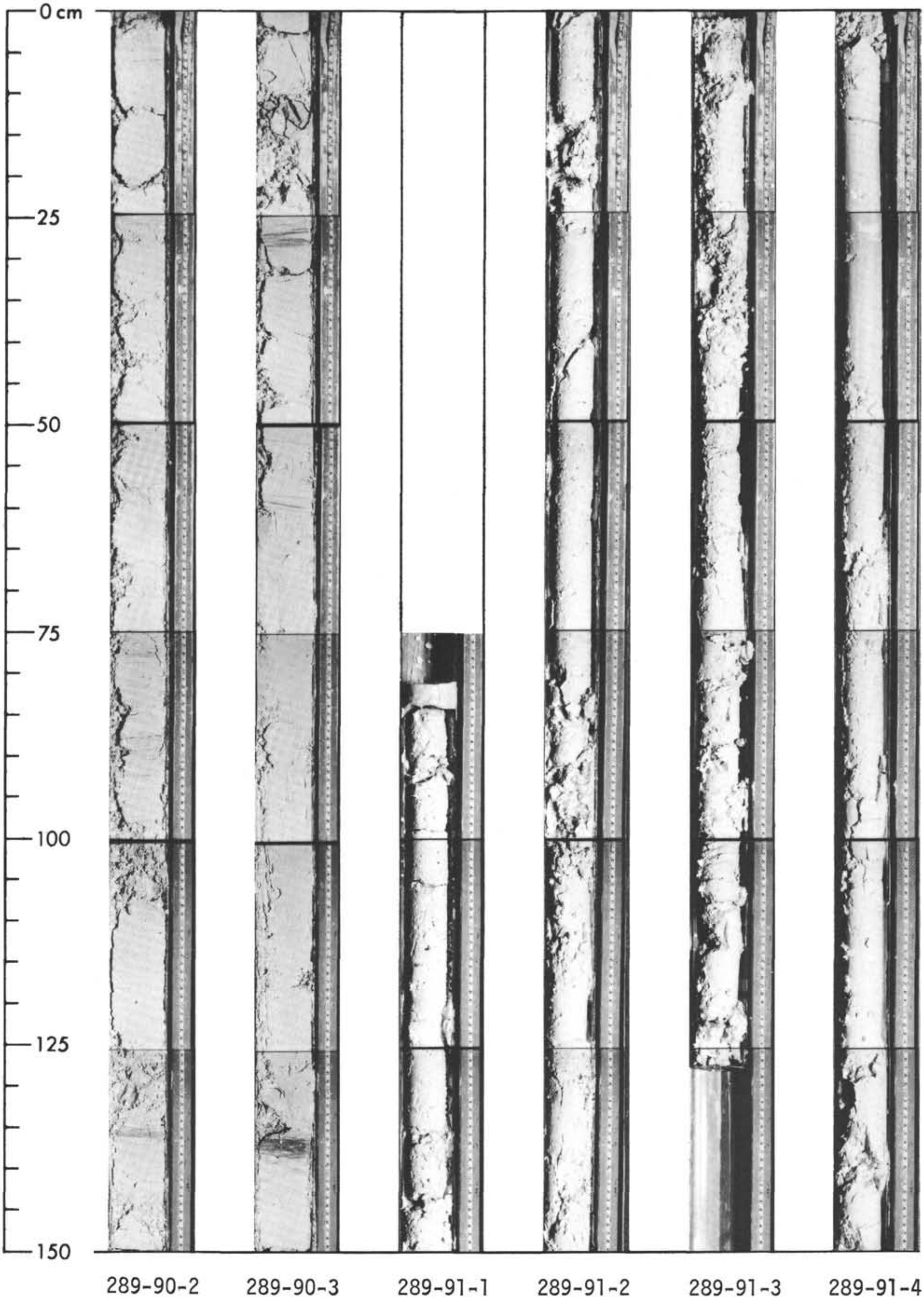

0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
289-80-1
289-80-2
289-80-3
289-80-4
289-81-1
289-81-2

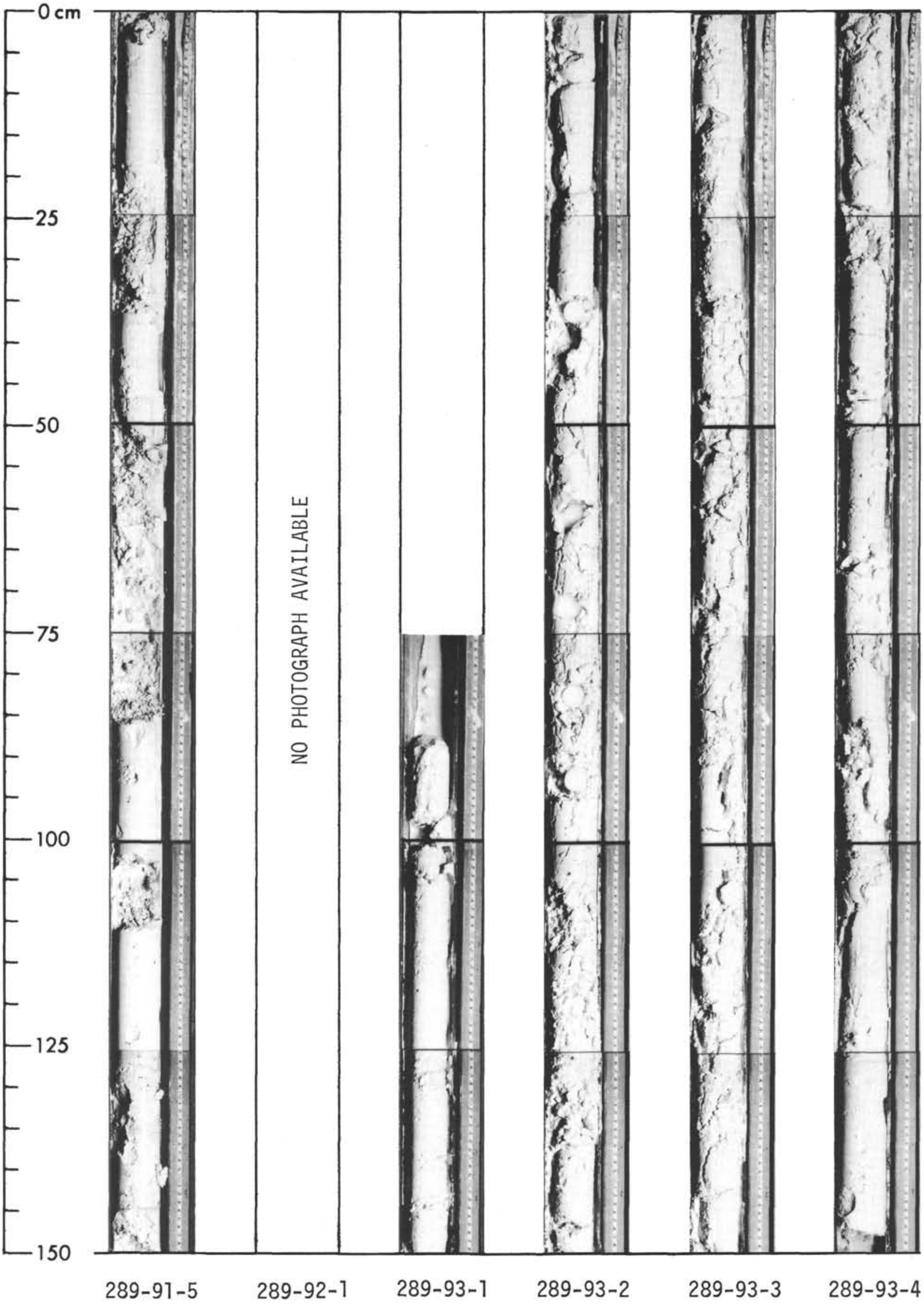

0 cm
25
50
75
100
125
150
289-82-1
289-82-2
289-82-3
289-83-1
289-83-2
289-84-1

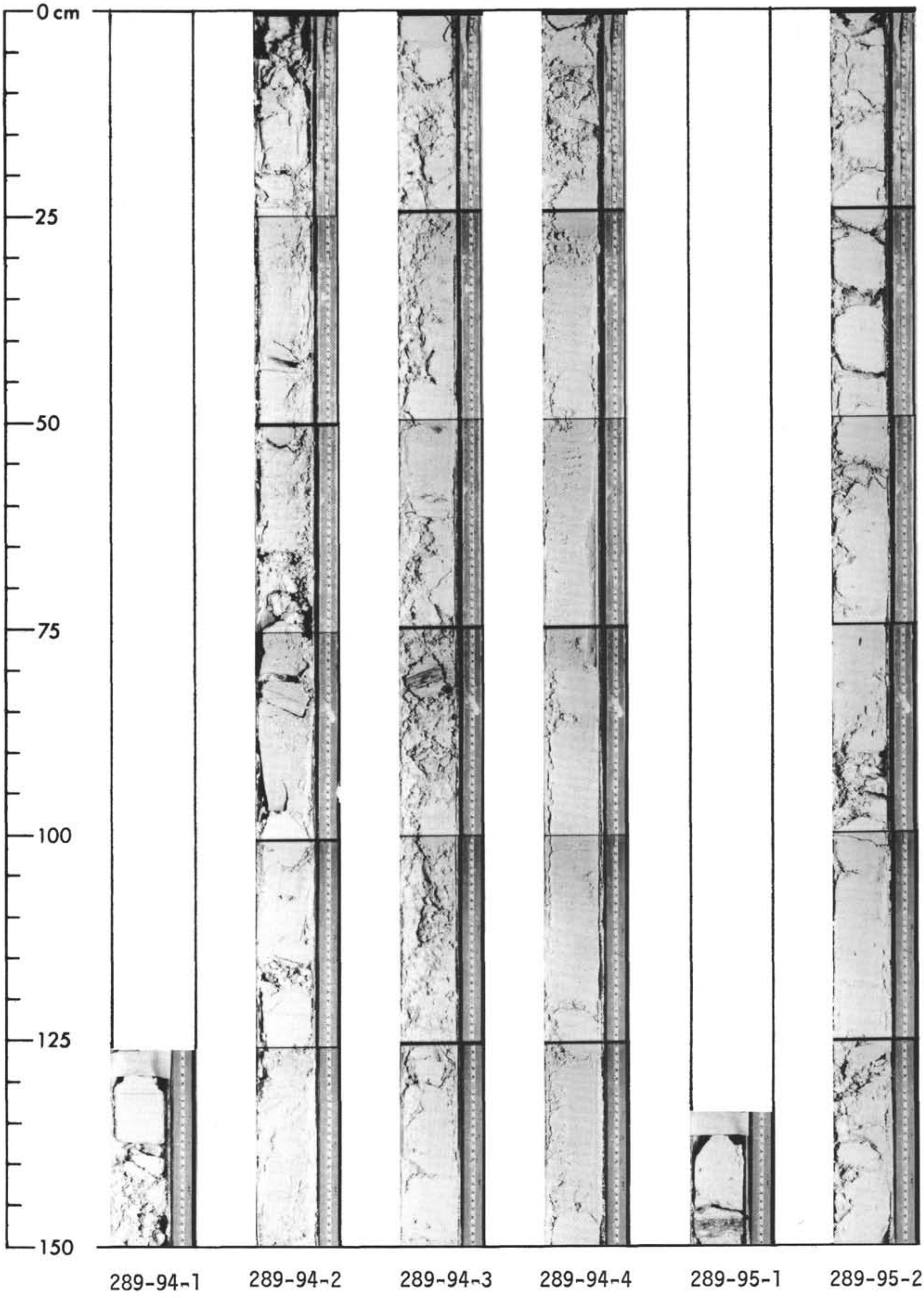

0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
289-84-2
289-85-1
289-86-1
289-86-2
289-86-3
289-86-4

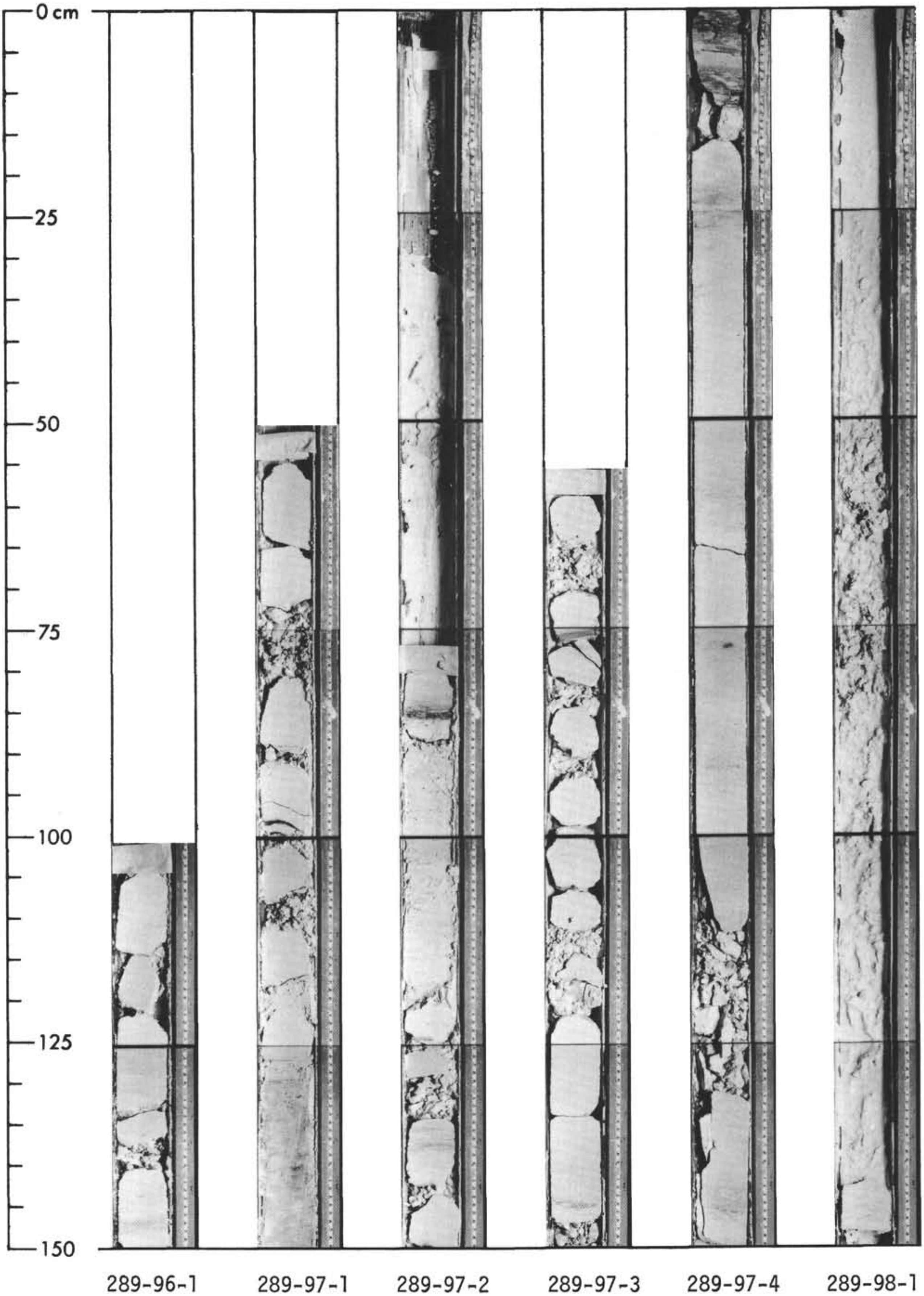

0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
289-86-5
289-86-6
289-87-1
289-87-2
289-88-1
289-88-2


0 cm
25
50
75
100
125
150
289-88-3
289-89-1
289-89-2
289-89-3
289-89-4
289-90-1

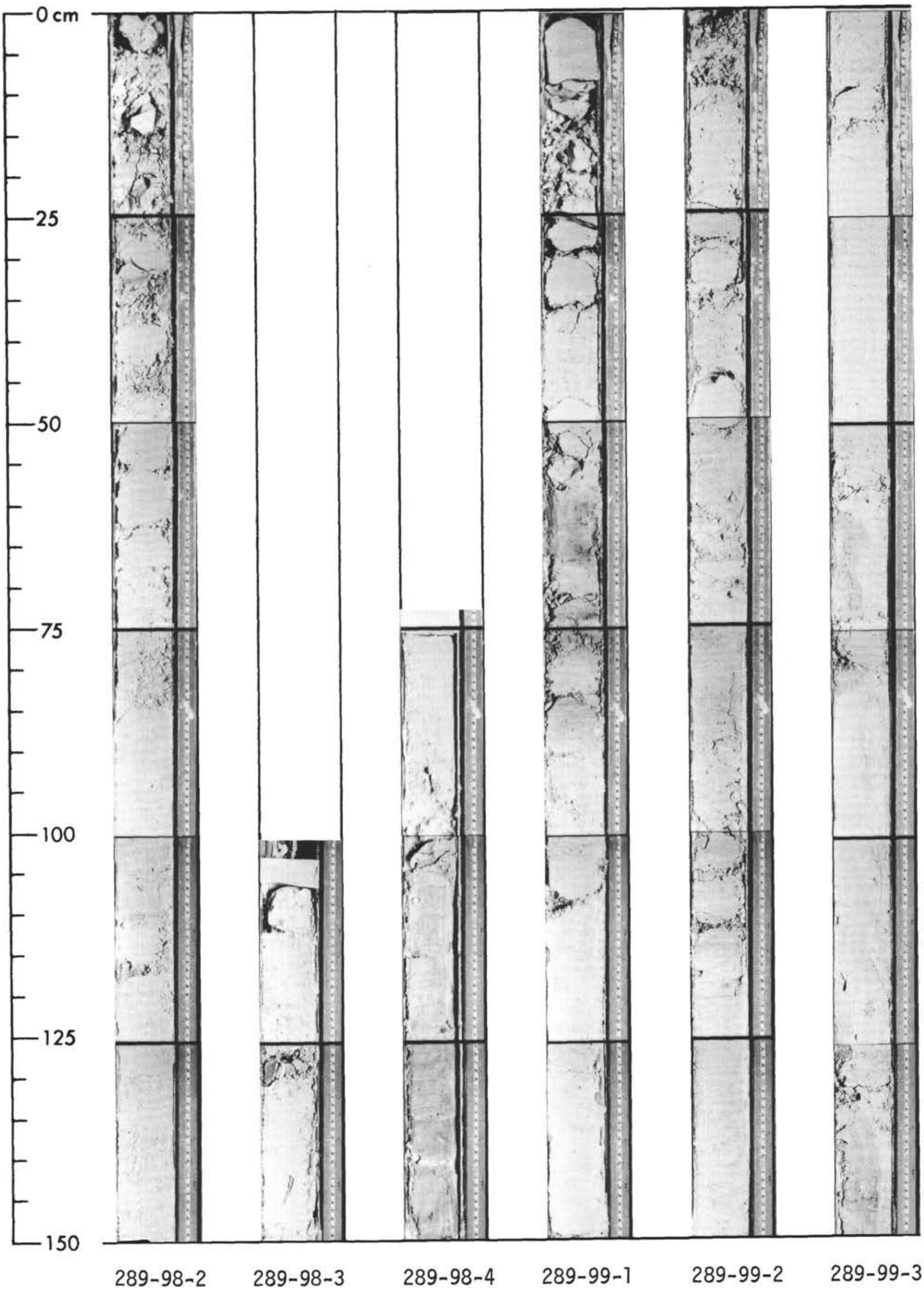

0 cm
25
50
75
100
125
150
289-90-2
289-90-3
289-91-1
289-91-2
289-91-3
289-91-4

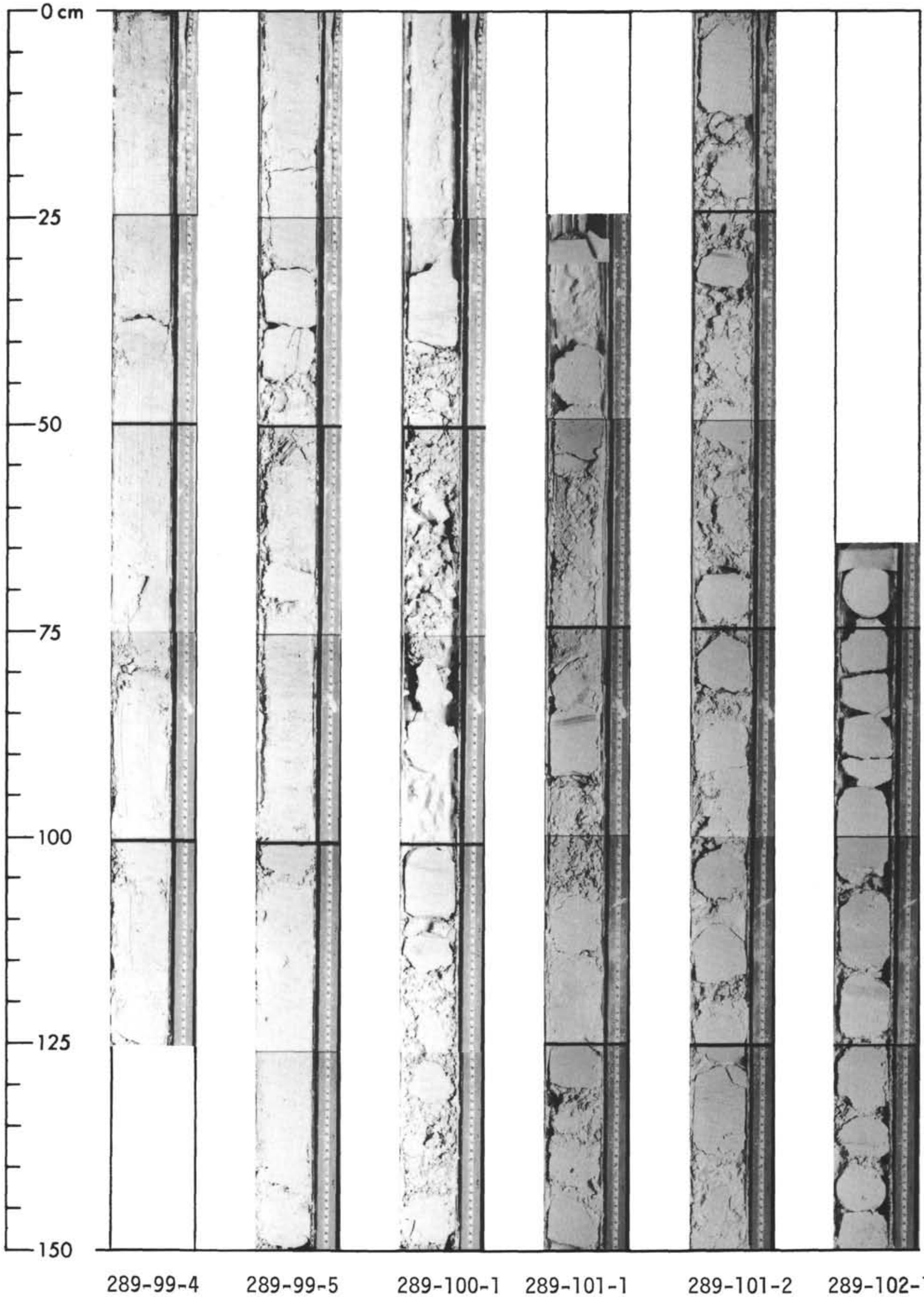

0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
289-91-5
289-92-1
289-93-1
289-93-2
289-93-3
289-93-4

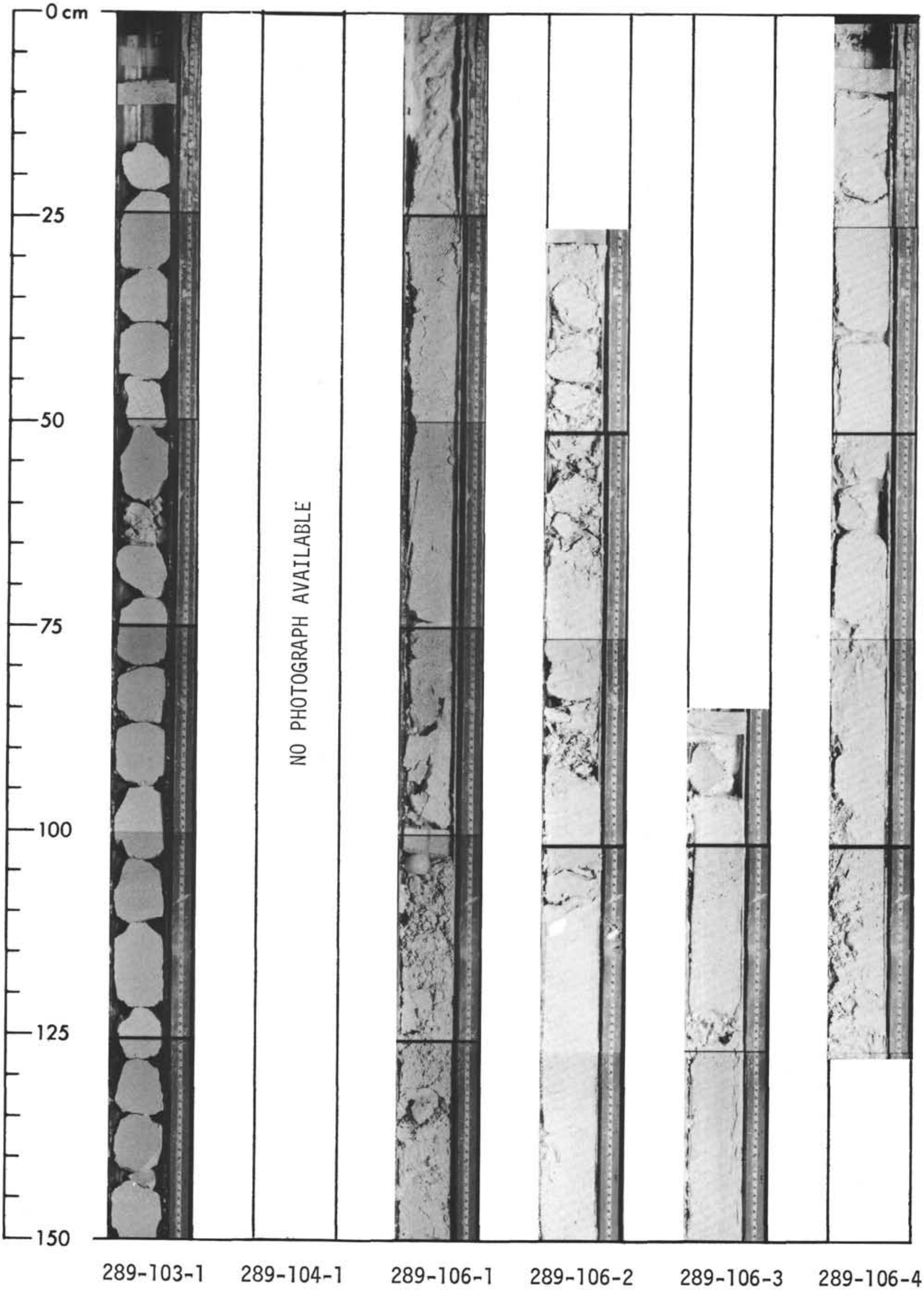

0 cm
25
50
75
100
125
150
289-94-1
289-94-2
289-94-3
289-94-4
289-95-1
289-95-2

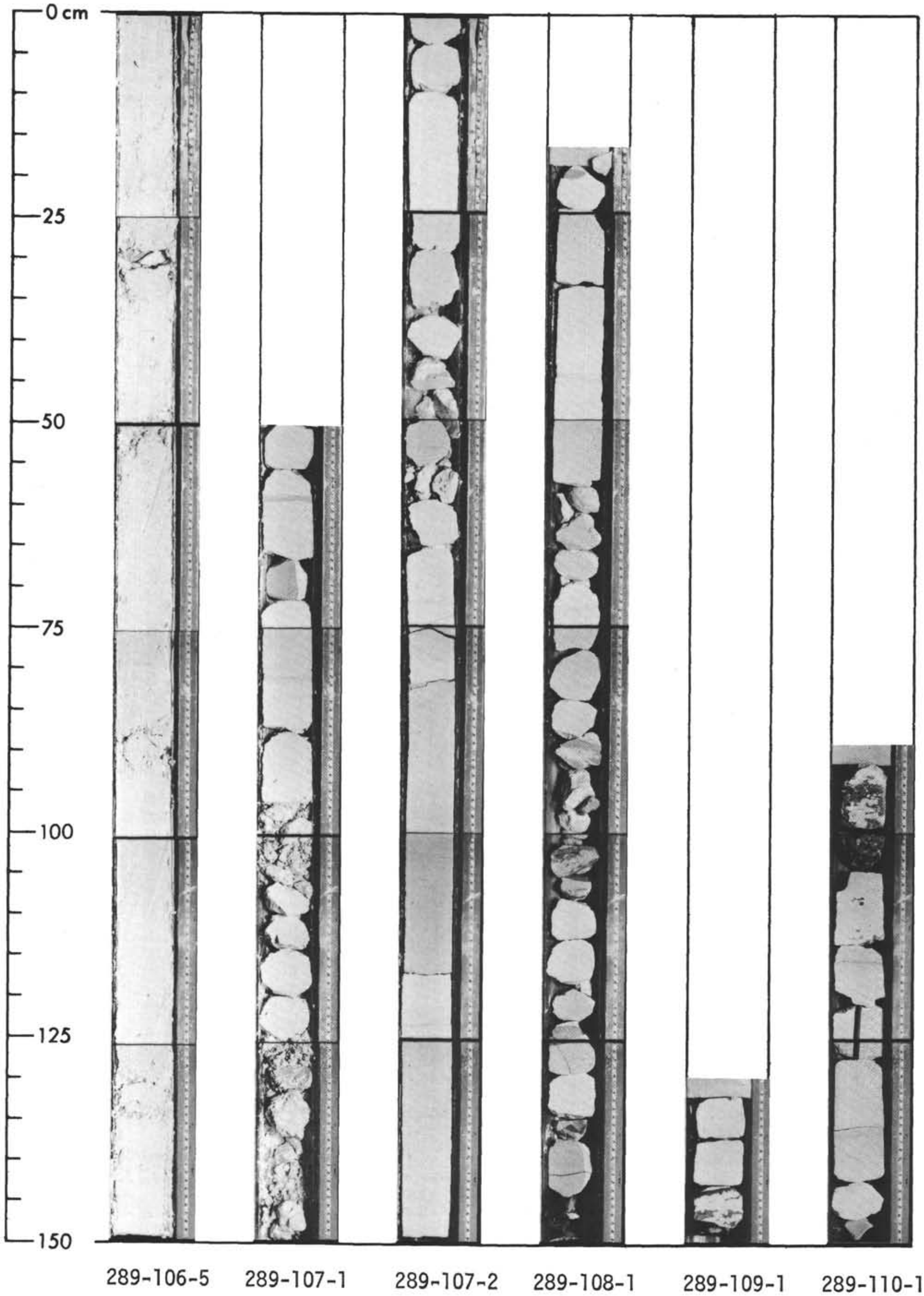


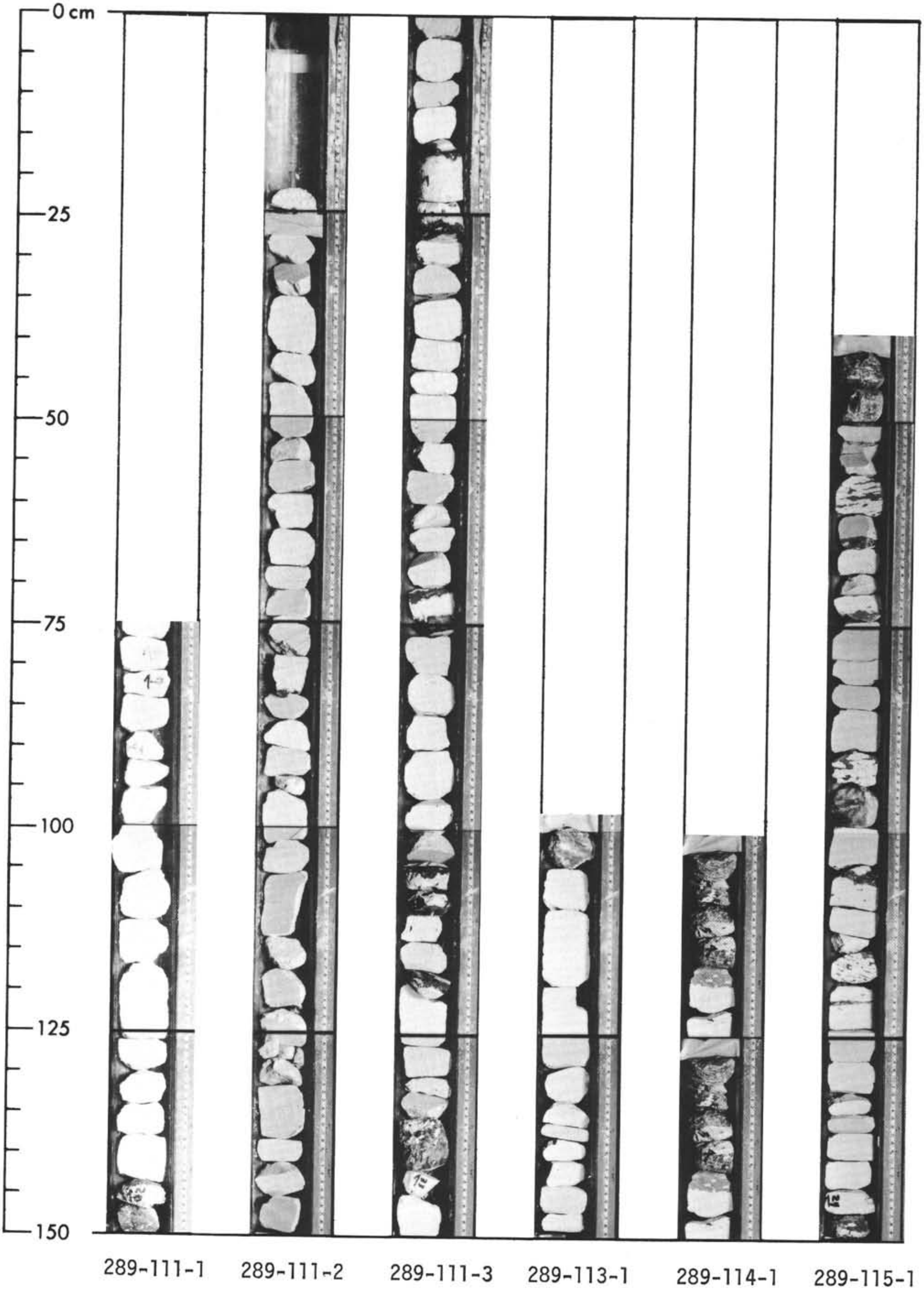
0 cm
25
50
75
100
125
150
289-96-1
289-97-1
289-97-2
289-97-3
289-97-4
289-98-1

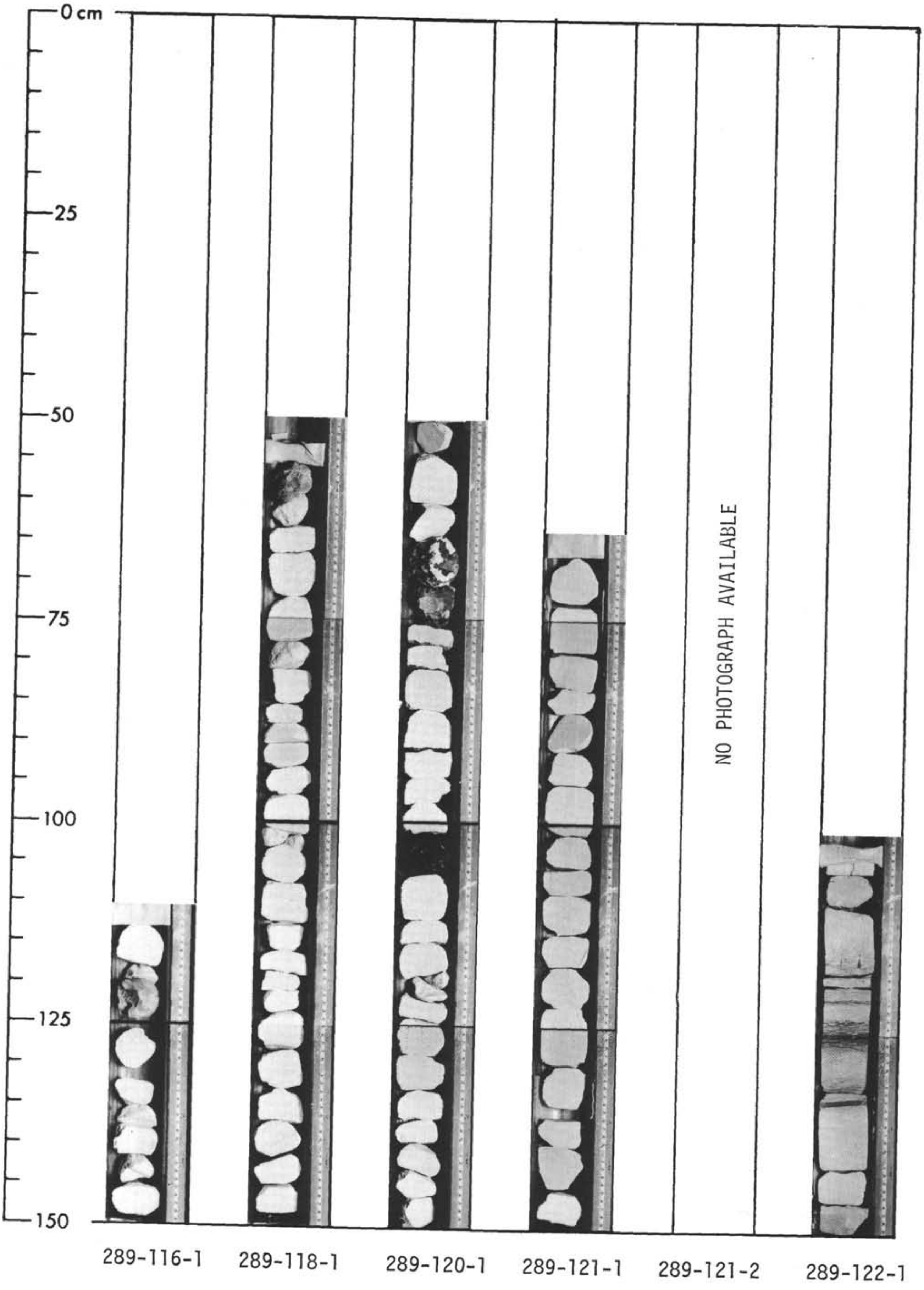

0 cm
25
50
75
100
125
150
289-98-2
289-98-3
289-98-4
289-99-1
289-99-2
289-99-3

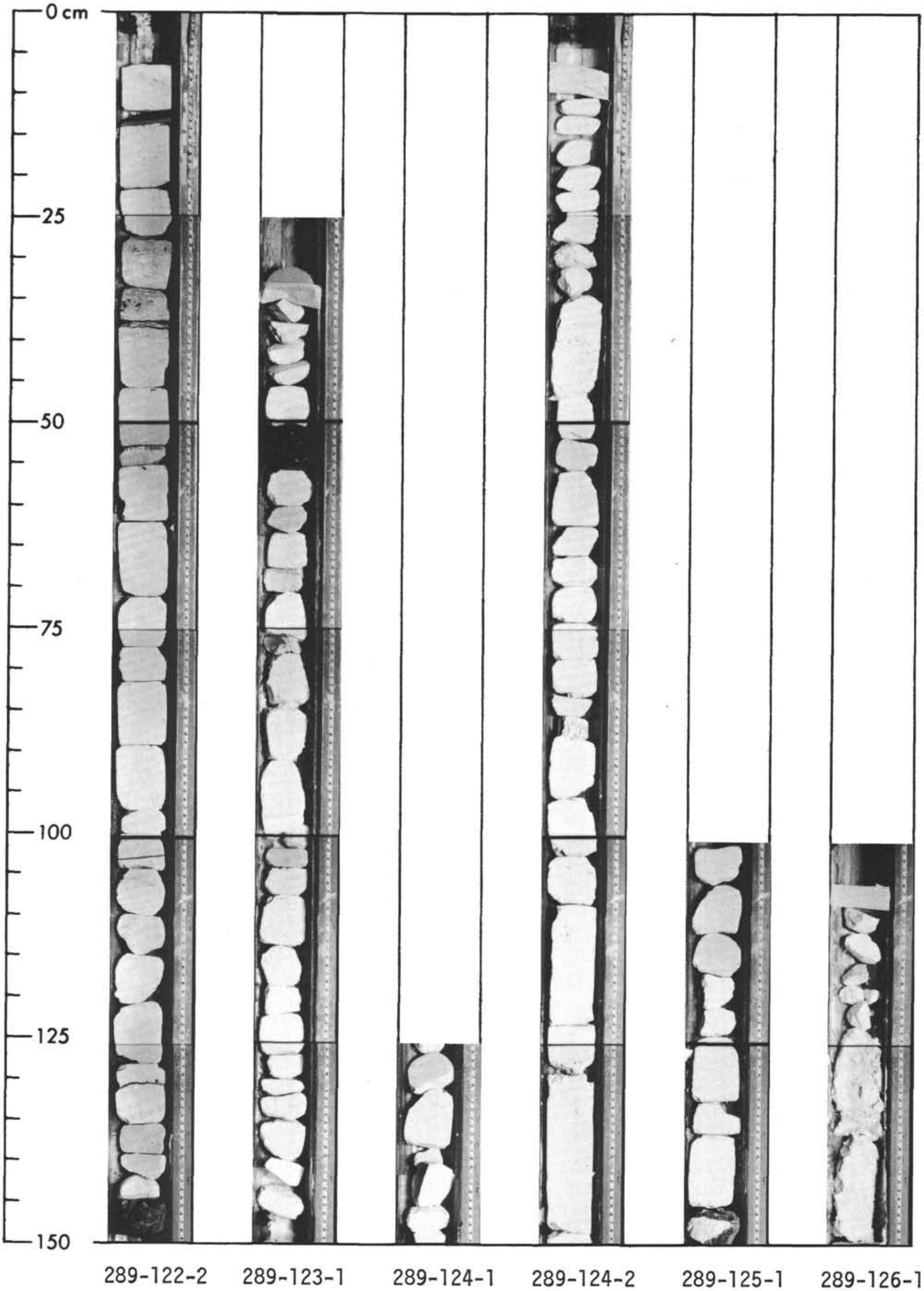

0 cm
25
50
75
100
125
150
289-99-4
289-99-5
289-100-1
289-101-1
289-101-2
289-102-1

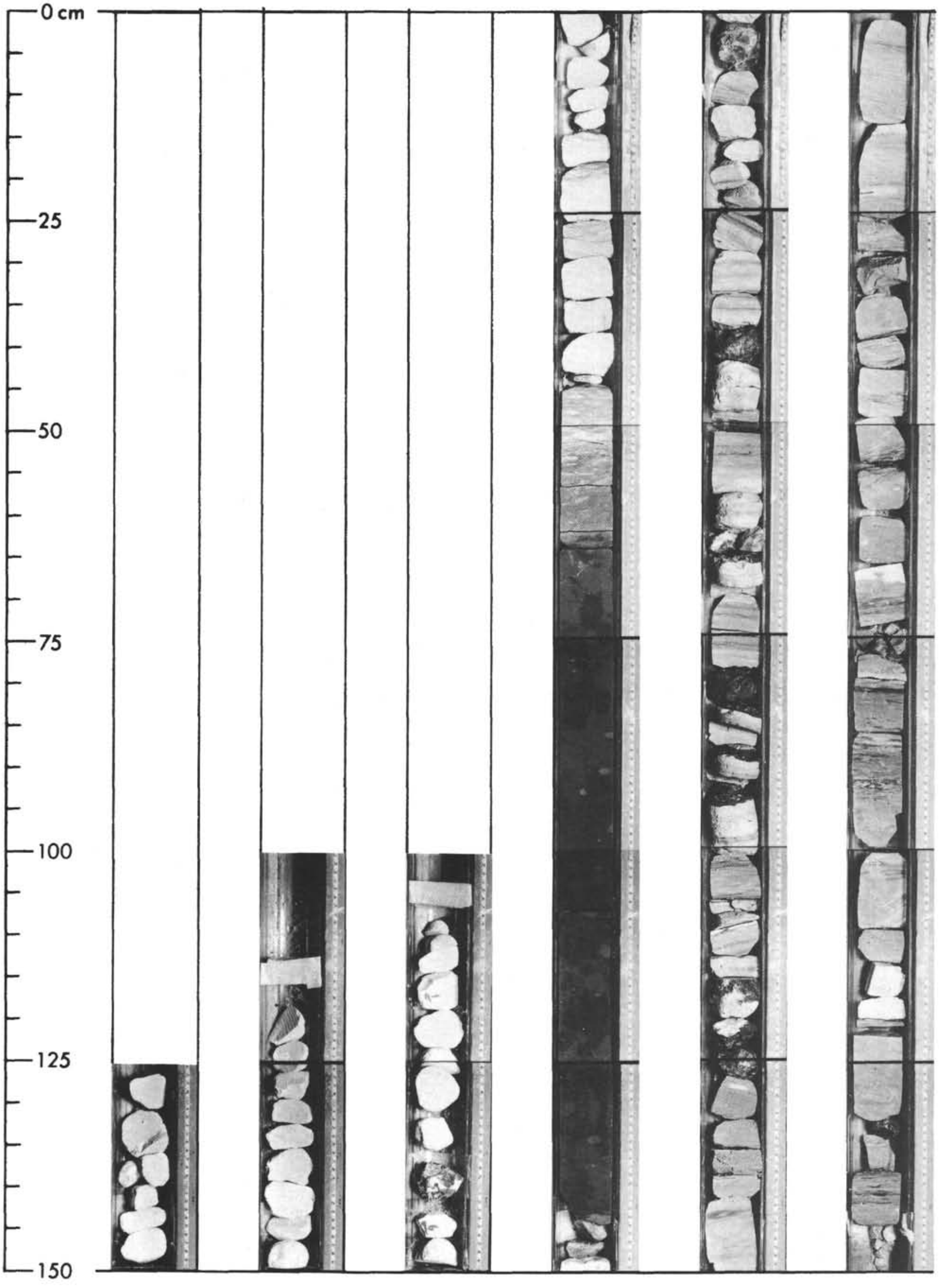

0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
289-103-1
289-104-1
289-106-1
289-106-2
289-106-3
289-106-4

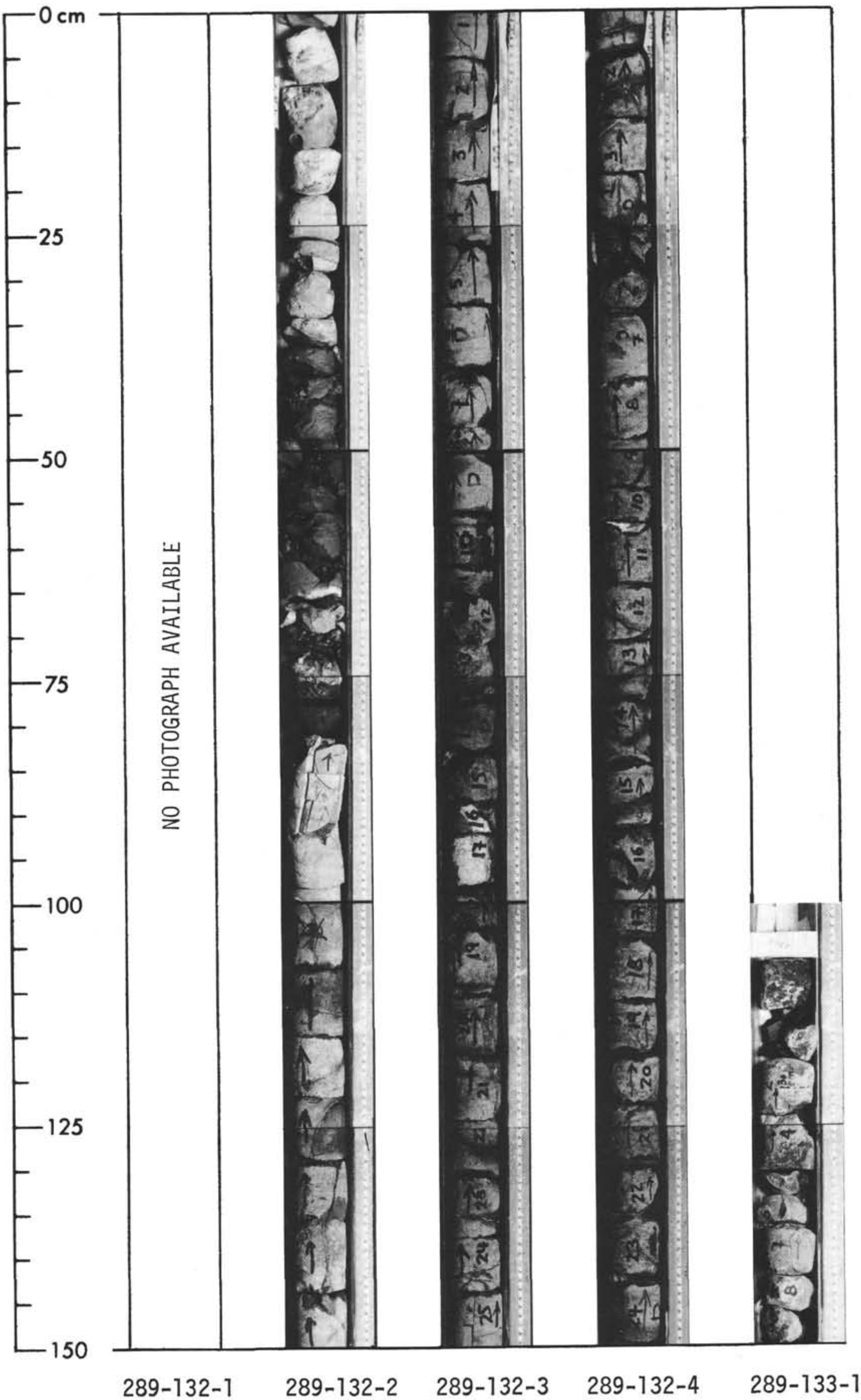

0 cm
25
50
75
100
125
150
289-106-5
289-107-1
289-107-2
289-108-1
289-109-1
289-110-1


0 cm
25
50
75
100
125
150
289-111-1
289-111-2
289-111-3
289-113-1
289-114-1
289-115-1


0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
289-116-1
289-118-1
289-120-1
289-121-1
289-121-2
289-122-1


0 cm
25
50
75
100
125
150
289-122-2
289-123-1
289-124-1
289-124-2
289-125-1
289-126-1


0 cm
25
50
75
100
125
150
289-127-1
289-128-1
289-129-1
289-131-1
289-131-2
289-131-3


0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
289-132-1
289-132-2
289-132-3
289-132-4
289-133-1