2. SITE 525[1]

Shipboard Scientific Party[2]

HOLE 525[3]

Date occupied: 10 June 1980

Date departed: 10 June 1980

Time on hole: 10 hr., 30 min.

Position: 29°04.24′S, 02°59.12′E

Water depth (sea level; corrected m, echo-sounding): 2467

Water depth (rig floor; corrected m, echo-sounding): 2477

Bottom felt (m, drill pipe): 2478.9

Penetration (m): 3.6

Number of cores: 1

Total length of cored section (m): 3.6

Total core recovered (m): 3.6

Core recovery (%): 100

Oldest sediment cored:
Depth sub-bottom (m): 3.6
Nature: Foraminifer-nannofossil ooze
Age: Pleistocene
Measured velocity (km/s): 1.62

HOLE 525A[4]

Date occupied: 10 June 1980

Date departed: 15 June 1980

Time on hole: 4 days, 22 hr., 15 min.

Position: 29°04.24′S, 02°59.12′E

Water depth (sea level; corrected m, echo-sounding): 2467

Water depth (rig floor; corrected m, echo-sounding): 2477

Bottom felt (m, drill pipe): 2478.9

Penetration (m): 678.1

Number of cores: 63

Total length of cored section (m): 555.1

Total core recovered (m): 406.7

Core recovery (%): 73

Oldest sediment cored:
Depth sub-bottom (m): 649.6
Nature: Volcanic calcareous claystone
Age: Early Maestrichtian
Measured velocity (km/s): 2.39–2.55

Basement:
Depth sub-bottom (m): 678.1, top of basement complex 574.6
Nature: Basalt and interlayered sediment
Velocity range (km/s): 3.35–4.78

HOLE 525B

Date occupied: 15 June 1980

Date departed: 19 June 1980

Time on hole: 3 days, 8 hrs., 15 min.

Position: 29°04.24′S, 02°59.12′E

Water depth (sea level; corrected m, echo-sounding): 2467

Water depth (rig floor; corrected m, echo-sounding): 2477

Bottom felt (m, drill pipe): 2478.9

Penetration (m): 285.6

Number of cores: 53

Total length of cored section (m): 227.0

Total core recovered (m): 181.7

Core recovery (%): 80

Oldest sediment cored:
Depth sub-bottom (m): 285.6
Nature: Foraminifer-nannofossil ooze
Age: Middle Eocene
Measured velocity (km/s): 1.68

Principal results:

1. A complete sedimentary section from seafloor to 574 meters sub-bottom was recovered, with all sediments rich to moderately rich in biogenic carbonate. The upper 209 m and the interval between 268 and 286 m sub-bottom, spanning the Oligocene/Eocene contact, was recovered with the HPC.

2. There is a marked hiatus within the carbonate section, so that upper Oligocene sediments directly overlie middle Eocene sediments.

3. Accumulation rates reached a distinct maximum in the lower Pliocene and perhaps again in the upper middle Miocene. The accumulation rate of benthic foraminifers also shows a peak in the lower Pliocene. Although recovery was sometimes spotty, the effects of dissolution appear small in most of the recovered Neogene section.

4. The proportion of planktonic foraminifers in the sediments increases markedly in the lower Pliocene.

5. Although a rather complete middle Eocene through Maestrichtian section was recovered, dissolution and calcite overgrowths hamper biostratigraphic interpretation.

6. Paleomagnetic studies yielded a good record for the early Paleocene through Maestrichtian (Anomalies 28–32), and accumu-

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[1] Moore, T. C., Jr., Rabinowitz, P. D., et al., *Init. Repts. DSDP*, 74: Washington (U.S. Govt. Printing Office).

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[3] Principal results follow Hole 525B data.

[4] See Hole 525B for Principal results.

lation rate plots based on the age of these anomalies indicate a sharp decrease at the Cretaceous/Tertiary boundary.

7. Paleomagnetic studies of the HPC cores (in Hole 525B) show that the magnetic signal of the Pliocene to mid-Miocene oozes was not measurable even with a cryogenic magnetometer. The early to mid-Miocene oozes have a higher remanence, but samples were magnetically unstable owing to viscous contamination.

8. The recovered basement complex of 103 m has an age of early Maestrichtian (70 m.y.), in agreement with seafloor magnetic anomalies and the magnetic measurements made on the sediments.

9. The basalts are aphyric with a subophitic texture and a rather uniform petrography. The nature of the basement seems to eliminate the possibility of the Walvis Ridge being a continental fragment.

10. Sediments near basement show clear evidence of gravity flows and contain shallow-water fossils. The depth of basement at Anomaly 32 time is estimated to be within a few hundred meters of sea level; this agrees with estimates based on the crustal cooling (backtracking) technique.

BACKGROUND AND OBJECTIVES

Geologic and Oceanographic Setting

The planned Site SAII-1 was drilled at Site 525. It is located near the broad, relatively flat crest of a NNW-SSE-trending block in the Walvis Ridge (Fig. 1) and is the shoalest site of a transect extending down the northwestern flank of this block into the Angola Basin. Reflection records of *Vema* and *Thomas B. Davie* (Fig. 1) show the presence of 0.6 s of sediments (approximately 540 m) conformably overlying a relatively flat acoustic basement. Studies of the crustal magnetic anomalies in this region and further predrilling site surveys indicate that the basement age at this site should be approximately 70 m.y. (Anomaly 32 time, late Maestrichtian–early Campanian) (Rabinowitz and Simpson, 1979). Dredge hauls from the latest CNEXO cruises in 1979 (Needham, personal communication, 1979) and results from Site 524 (Leg 73) nearby also suggest a Late Cretaceous age for basement.

Surface circulation in the eastern South Atlantic is dominated by the highly productive eastern boundary current (Benguela Current). The Walvis Ridge transect of sites lies just outside the main flow of this current, beneath the less productive waters of the subtropical gyre.

Bottom water flow into the Angola Basin is topographically controlled. It is bounded to the south by the Walvis Ridge, to the west by the Mid-Atlantic Ridge, to the east by the African continent, and to the north by the Sierra Leone Rise. Deep-water flow into the basin enters near the equator through the Romanche Fracture Zone and passes southward through the Guinea Basin into the Angola Basin. Flow from the Cape Basin into the Angola Basin may also pass through the Walvis Passage near the southwestern end of the Walvis Ridge (36°S, 7°W; Connery and Ewing, 1974). The relatively shallow sills (near 4200 m) of these passages block most of the flow of Antarctic Bottom Water and permit the entry of waters derived from the North Atlantic. These North Atlantic Deep Waters are chemically very "young" (i.e., rich in oxygen and relatively noncorrosive with respect to calcite). As a result, both the calcite compensation depth (CCD) and lysocline are 500 to 1000 m deeper in the Angola Basin than in the Brazil Basin to the west of the Mid-Atlantic Ridge, and silica preservation is generally poor except in regions of divergence and upwelling.

Scientific Objectives

The scientific objectives of this site are an integral part of the transect as a whole. They focus on three main topics: (1) the history of bottom waters in the eastern South Atlantic (as indicated by changes in benthic faunas and calcite preservation); (2) the development of detailed biostratigraphies and magnetic stratigraphies in the geologic section; and (3) the plate tectonic evolution of the Walvis Ridge (by determining the age and the petrologic and chemical character of basement rocks and the subsidence history of the sediments).

Site 525 is one of the shallowest sites to be drilled on Leg 74 and contains the thickest sedimentary section. Thus it is of particular importance to the stratigraphic studies and to the studies of deep-water history. The Angola Basin has been drilled on DSDP Legs 3, 40, and 73, but these sites were located on relatively young crust in rugged topography or on older crust close to shore where calcite dissolution increases and the CCD shoals markedly. Sections recovered from them indicate marked changes in carbonate preservation and, presumably, in deep-water chemistry and circulation. The Walvis Ridge transect, and Site 525 in particular, provides an opportunity to sample a well-preserved pelagic section in a setting which is both topographically and sedimentologically uncomplicated. This site is located at a depth of about 2500 m and thus is now at the average depth of most spreading centers. The depth versus time backtracking curve (assuming normal crustal cooling and subsidence) provides an estimate of the paleodepth history of this site and indicates that at the time of crustal formation (~70 Ma) the site location was only a few hundred meters below sea level. Thus the sediments at this location provide a history of that part of the water column for which paleoceanographic reconstructions are most difficult: the region between the mixed layer of the near-surface waters and the level equivalent to the usual depths of spreading centers (about 2500 m). Results from Legs 3 and 73 indicate marked shoaling of the CCD in the mid-Miocene and Eocene. This site, together with others in the transect, provide critical data on carbonate preservation and accumulation in shallower water depths during these intervals.

The good carbonate preservation, combined with the use of the hydraulic piston corer (HPC), should provide excellent sections for paleoceanographic, paleoclimatic, and stratigraphic studies.

OPERATIONS

Glomar Challenger departed Cape Town, South Africa on 06 June 1980 at 1512 hr. The ship's track en route to Site 525 (SAII-1) on the Walvis Ridge traversed the Mesozoic sequence of magnetic anomalies and the Cretaceous magnetic quiet zone in the Cape Basin. Continuous seismic profiles, magnetic anomalies, and bathymetry were collected. The track was planned so as

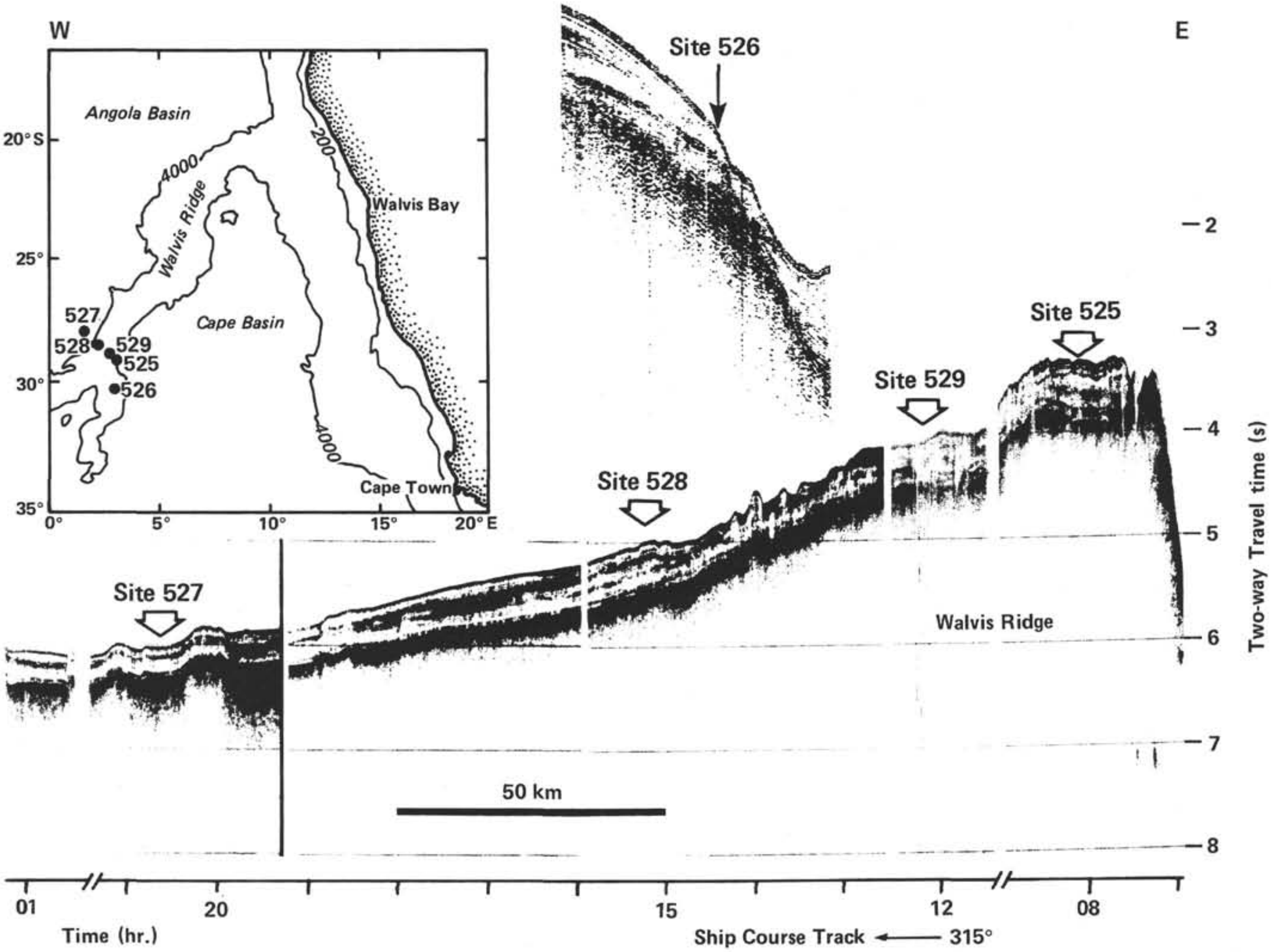

Figure 1. Index and location map for Site 525 and reflection profile record of *Vema* and *T. Davie*, showing 0.6 s of sediment overlying flat acoustic basement at Site 525.

not to duplicate other geophysical traverses in the region.

A geophysical site survey was conducted prior to Leg 74 by *Thomas B. Davie* of the University of Cape Town. Other geological/geophysical ships' tracks in the vicinity which were of importance in the site selection included those of *Vema* (L-DGO) and *Atlantis II* (WHOI). A predrilling survey by *Challenger* in the site area was not necessary.

Glomar Challenger approached Site 525 (SAII-1) from the east-southeast on a course of 290° and speed of 7 kn. The beacon was dropped at 0942 hr., 10 June 1980, based on a depth of 2464 m and a sediment thickness of 0.6 s (two-way reflection time) observed on seismic reflection profiles aboard *Challenger* and its correlation to the predrilling site surveys. We continued on this course for 2 n.m. in order to obtain a *Challenger* seismic reflection profile across the site. At 1000 hr. we reversed course to approach the site and commenced pulling the towed geophysical gear. At 1115 hr. we were on Site 525, latitude 29°04.24′S, longitude 02°59.12′E. Figure 2 shows the ship's track for the approach on site.

At Site 525, we planned a downhole heat flow experiment, hydraulic piston coring (HPC), rotary coring through the remaining sediment section and into basement, and logging of the hole. We also planned a number of engineering tests relating to the pressure core barrel (PCB) and drill bit motion indicator (DBMI). The latter tests required a drill bit size on the drill string which was not compatible with the HPC. In order to properly evaluate the PCB and do the DBMI tests, we were thus compelled to trip the entire drill string prior to hydraulic piston coring.

Three holes were drilled at Site 525. The depth from the drill floor to the seafloor was the same for each of the holes—2478.9 m.

Hole 525

Only one core was obtained, with 3.6 m penetration beneath the seafloor. The purpose of this hole was to establish the mud line and follow with a downhole heat flow experiment (see Table 1). Following the heat flow experiment, the pipe was lifted to the mud line, offset, and drilling commenced at Hole 525A.

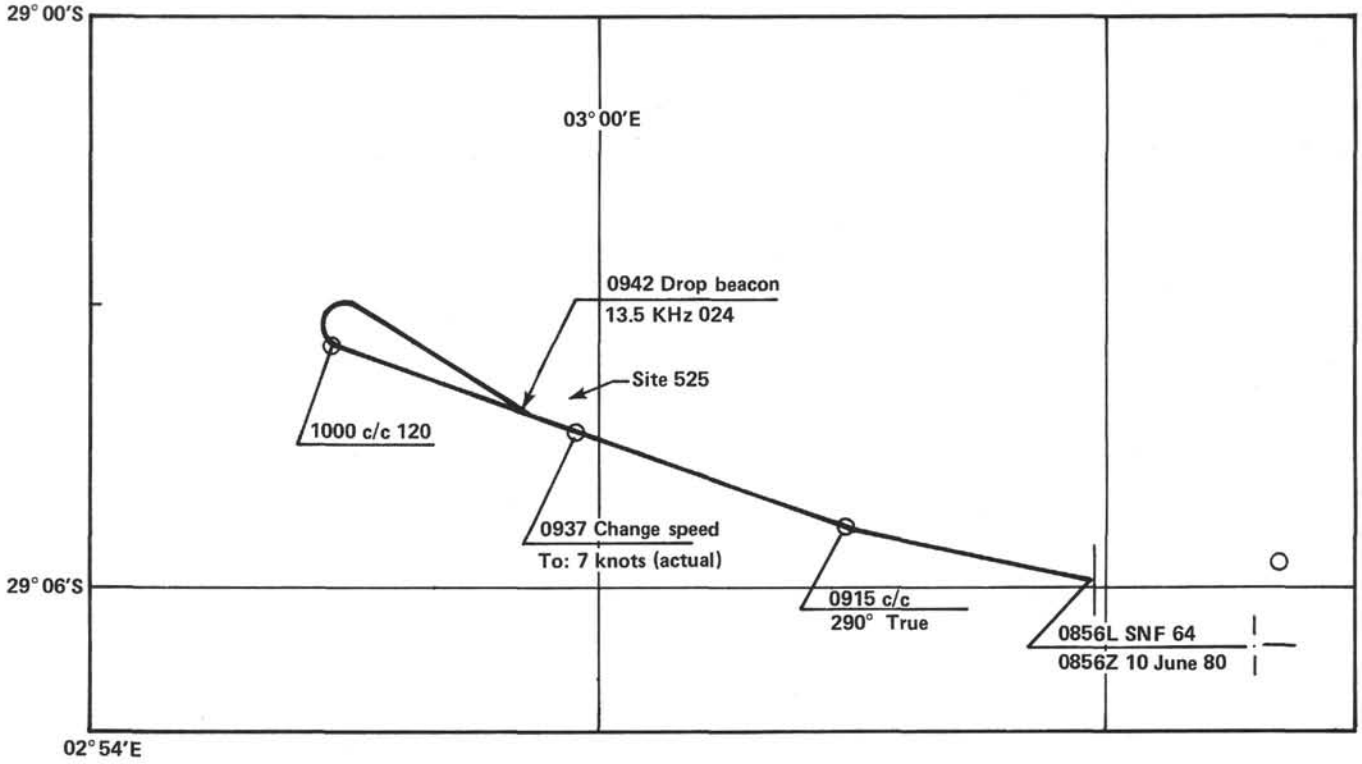

Figure 2. Ship's track for the approach to Site 525.

Hole 525A

We obtained 63 cores from this hole, with a total penetration of 678.1 m below the seafloor (see Table 1). We spot-cored the first 6 cores down to 165.1 m sub-bottom and continuously cored from 165.1 m (the interval above this was later to be piston-cored continuously) to 678.1 m sub-bottom. A basement rock complex (basalt plus sediment) was first encountered in Core 53, at 574.6 m. We thus cored 447.6 m of sediment (409.5 m continuously from Core 7 at 165.1 m sub-bottom) and 103.5 m of the basement complex with a combined recovery rate of 73%. The recovery rate of the sediments was 74%; the recovery rate of the basement complex was 55%.

After completion of rotary drilling, we attempted to log the hole. The drill bit did not release, and we were thus forced to abort the logging program. The drill string was lifted and prepared for piston coring in Hole 525B.

Numerous PCB and DBMI tests were taken on this station. The results of these tests are given in the operations manager's report.

Hole 525B

We hydraulic-piston-cored 53 cores for a total cored length of 227.0 m. The recovery rate was 80% (see Table 1).

We continuously cored from the mud line at 2478.9 m (Core 1) to 2688.3 m (Core 49), a total of 209.4 m. Ship operational constraints (we had to take a sick man into port) forced us to end the hole early. We thus washed down 58.6 m to 268 m sub-bottom and cored another 17.6 m (4 cores) with the express purposes of recovering a continuous sequence of sediments on either side of the Oligocene–Eocene hiatus and of evaluating our ability to use the HPC at greater sub-bottom depths. The hiatus was observed only in Hole 525A, and the continuous sequence was successfully cored here.

After completion of Hole 525B, the drill was retrieved and the *Challenger* departed for Walvis Bay to disembark the patient. We deployed a beacon upon departure from Site 525 in order to keep open the option to return to the site for further piston coring. A sonobuoy was deployed over Site 525 en route to Walvis Bay. The geophysical information gained on the ship's track into Walvis Bay should yield important information relating to Site 525.

SEDIMENT LITHOLOGY

Lithologic Classification of Sediments

We used the standard DSDP sediment classification system adopted by the JOIDES panel on Sedimentary Petrology and Physical Properties (see Explanatory Notes in the introduction to this volume). The classification is descriptive and divisions between sediment types somewhat arbitrary. Any modifications in this classification are discussed in the text.

Sediments and Lithostratigraphy

The sediments recovered at Site 525 are of three major types. Unit I, the majority of sediment, is divided into two subunits: Subunit IA, nannofossil and fora-

Table 1. Coring summary, Site 525.

Core No.	Date (June 1980)	Time	Depth from Drill Floor (m) Top Bottom	Depth below Seafloor (m) Top Bottom	Length Cored (m)	Length Recovered (m)	Recovery (%)
Hole 525							
1	10	1836	2478.9–2482.5	0.0–3.6	3.6	3.6	100
Hole 525A							
1	10	2342	2478.9–2482.5	0.0–3.6	3.6	3.5	97
2	11	0048	2482.5–2488.5	3.6–9.6	6.0	0.3	5
3	11	0315	2520.5–2530.0	41.6–51.1	9.5	2.9	31
4	11	0445	2530.0–2536.0	51.1–57.1	6.0	1.5	25
5	11	0717	2568.0–2577.5	89.1–98.6	9.5	7.6	80
6	11	0907	2577.5–2585.0	98.6–106.1	7.5	8.0	100+
7	11	1156	2644.0–2653.5	165.1–174.6	9.5	4.4	46
8	11	1302	2653.5–2663.0	174.6–184.1	9.5	9.7	100+
9	11	1411	2663.0–2672.5	184.1–193.6	9.5	8.6	91
10	11	1512	2672.5–2682.0	193.6–203.1	9.5	9.7	100+
11	11	1612	2682.0–2691.5	203.1–212.6	9.5	8.8	93
12	11	1710	2691.5–2701.0	212.6–222.1	9.5	7.1	75
13	11	1809	2701.0–2710.5	222.1–231.6	9.5	9.8	100+
14	11	1916	2710.5–2720.0	231.6–241.1	9.5	9.7	100+
15	11	2017	2720.0–2729.5	241.1–250.6	9.5	9.8	100+
16	11	2120	2729.5–2739.0	250.6–260.1	9.5	9.7	100+
17	11	2300	2739.0–2746.5	260.1–267.6	7.5	2.3	31
18	12	0006	2746.5–2748.5	267.6–269.6	2.0	4.9	100+
19	12	0123	2748.5–2758.0	269.6–279.1	9.5	7.9	83
20	12	0223	2758.0–2767.5	279.1–288.6	9.5	6.7	71
21	12	0321	2767.5–2777.0	288.6–298.1	9.5	8.4	88
22	12	0422	2777.0–2786.5	298.1–307.6	9.5	7.9	83
23	12	0533	2786.5–2796.0	307.6–317.1	9.5	9.8	100+
24	12	0630	2796.0–2805.5	317.1–326.6	9.5	9.7	100+
25	12	0732	2805.5–2815.0	326.6–336.1	9.5	7.4	78
26	12	0832	2815.0–2824.5	336.1–345.6	9.5	4.2	44
27	12	0955	2824.5–2830.5	345.6–351.6	6.0	0.1	2
28	12	1059	2830.5–2834.0	351.6–355.1	3.5	4.3	100+
29	12	1156	2834.0–2843.5	355.1–364.6	9.5	6.7	71
30	12	1258	2843.5–2853.0	364.6–374.1	9.5	8.2	86
31	12	1355	2853.0–2862.5	374.1–383.6	9.5	8.7	92
32	12	1505	2862.5–2872.0	383.6–393.1	9.5	9.8	100+
33	12	1620	2872.0–2878.0	393.1–399.1	6.0	0.0	0
34	12	1745	2878.0–2881.5	399.1–402.6	3.5	0.1	3
35	12	1908	2881.5–2891.0	402.6–412.1	9.5	9.8	100+
36	12	2036	2891.0–2900.5	412.1–421.6	9.5	3.6	38
37	12	2215	2900.5–2910.0	421.6–431.1	9.5	1.9	20
38	12	2341	2910.0–2919.5	431.1–440.6	9.5	5.0	53
39	13	0119	2919.5–2929.0	440.6–450.1	9.5	10.0	100+
40	13	0315	2929.0–2938.5	450.1–459.6	9.5	7.8	82
41	13	0504	2938.5–2948.0	459.6–469.1	9.5	9.8	100+
42	13	0735	2948.0–2957.5	469.1–478.6	9.5	9.5	100
43	13	0927	2957.5–2967.0	478.6–488.1	9.5	9.5	100
44	13	1125	2967.0–2976.5	488.1–497.6	9.5	9.8	100+
45	13	1315	2976.5–2986.0	497.6–507.1	9.5	7.5	79
46	13	1534	2986.0–2995.5	507.1–516.6	9.5	8.8	93
47	13	1741	2995.5–3005.0	516.6–526.1	9.5	6.6	69
48	13	1910	3005.0–3014.5	526.1–535.6	9.5	5.1	54
49	13	2045	3014.5–3024.0	535.6–545.1	9.5	4.6	48
50	13	2214	3024.0–3033.5	545.1–554.6	9.5	9.2	97
51	13	2340	3033.5–3043.0	554.6–564.1	9.5	8.3	87
52	14	0109	3043.0–3052.5	564.1–573.6	9.5	4.3	45
53	14	0237	3052.5–3062.0	573.6–583.1	9.5	4.0	42
54	14	0415	3062.0–3071.5	583.1–592.6	9.5	2.9	31
55	14	0650	3071.5–3081.0	592.6–602.1	9.5	2.9	31
56	14	0925	3081.0–3090.5	602.1–611.6	9.5	8.1	85
57	14	1145	3090.5–3100.0	611.6–621.1	9.5	8.6	91
58	14	1430	3100.0–3109.5	621.1–630.6	9.5	6.7	71
59	14	1712	3109.5–3119.0	630.6–640.1	9.5	7.5	79
60	14	2020	3119.0–3128.5	640.1–649.6	9.5	9.5	100
61	14	2308	3128.5–3138.0	649.6–659.1	9.5	2.4	25
62	15	0225	3138.0–3147.5	659.1–668.6	9.5	2.2	23
63	15	0548	3147.5–3157.0	668.6–678.1	9.5	2.6	27
				Totals	555.1	406.7	73
Hole 525B							
1	16	0630	2478.9–2482.4	0.0–3.5	3.5	4.5	100+
2	16	0740	2482.4–2486.8	3.5–7.9	4.4	4.5	100+
3	16	0833	2486.8–2491.2	7.9–12.3	4.4	4.1	93
4	16	0940	2491.2–2495.6	12.3–16.7	4.4	4.1	93
5	16	1120	2495.6–2500.0	16.7–21.1	4.4	3.1	70
6	16	1220	2500.0–2504.4	21.1–25.5	4.4	3.5	80
7	16	1340	2504.4–2508.8	25.5–29.9	4.4	4.1	93
8	16	1445	2508.8–2513.2	29.9–34.3	4.4	3.7	86
9	16	1540	2513.2–2517.6	34.3–38.7	4.4	4.3	98
10	16	1646	2517.6–2522.0	38.7–43.1	4.4	4.3	98
11	16	1753	2522.0–2526.4	43.1–47.5	4.4	4.0	91
12	16	1900	2526.4–2530.8	47.5–51.9	4.4	0.8	18
13	16	2031	2530.8–2535.2	51.9–56.3	4.4	4.5	100+
14	16	2136	2535.2–2539.6	56.3–60.7	4.4	4.2	95
15	16	2250	2539.6–2544.0	60.7–65.1	4.4	2.8	64
16	17	0100	2544.0–2548.4	65.1–69.5	4.4	4.5	100+
17	17	0215	2548.4–2552.8	69.5–73.9	4.4	4.3	98
18	17	0320	2552.8–2557.2	73.9–78.3	4.4	1.9	43
19	17	0430	2557.2–2561.6	78.3–82.7	4.4	4.2	95
20	17	0535	2561.6–2566.0	82.7–87.1	4.4	0.3	7
21	17	0632	2566.0–2570.4	87.1–91.5	4.4	1.0	23
22	17	0744	2570.4–2573.9	91.5–95.0	3.5	3.6	100+
23	17	0855	2573.9–2578.3	95.0–99.4	4.4	4.5	100+
24	17	1000	2578.3–2582.7	99.4–103.8	4.4	4.2	95
25	17	1055	2582.7–2587.1	103.8–108.2	4.4	2.8	64
26	17	1145	2587.1–2591.5	108.2–112.6	4.4	4.5	100+
27	17	1245	2591.5–2595.9	112.6–117.0	4.4	4.5	100+
28	17	1345	2595.9–2600.3	117.0–121.4	4.4	0.4	9
29	17	1446	2600.3–2604.7	121.4–125.8	4.4	3.4	77
30	17	1615	2604.7–2609.1	125.8–130.2	4.4	4.5	100+
31	17	1654	2609.1–2613.5	130.2–134.6	4.4	4.9	100+
32	17	1800	2613.5–2617.9	134.6–139.0	4.4	3.9	89
33	17	1917	2617.9–2622.3	139.0–143.4	4.4	4.5	100+
34	17	2020	2622.3–2626.7	143.4–147.8	4.4	3.3	75
35	17	2120	2626.7–2631.1	147.8–152.2	4.4	2.8	64
36	17	2228	2631.1–2635.5	152.2–156.6	4.4	4.2	95
37	17	2336	2635.5–2639.9	156.6–161.0	4.4	4.0	91
38	18	0415	2639.9–2644.3	161.0–165.4	4.4	4.0	91
39	18	0620	2644.3–2648.7	165.4–169.8	4.4	4.6	100+
40	18	0725	2648.7–2648.7	169.8–169.8	0.0	0.0	0
41	18	0831	2648.7–2653.1	169.8–174.2	4.4	1.4	32
42	18	0930	2653.1–2657.5	174.2–178.6	4.4	1.7	39
43	18	1017	2657.5–2661.9	178.6–183.0	4.4	3.9	89
44	18	1120	2661.9–2666.3	183.0–187.4	4.4	0.2	5
45	18	1225	2666.3–2670.7	187.4–191.8	4.4	4.7	100+
46	18	1324	2670.7–2675.1	191.8–196.2	4.4	4.5	100+
47	18	1423	2675.1–2679.5	196.2–200.6	4.4	4.9	100+
48	18	1530	2679.5–2683.9	200.6–205.0	4.4	4.5	100+
49	18	1635	2683.9–2688.3	205.0–209.4	4.4	4.8	100+
50	18	1840	2746.9–2751.3	268.0–272.4	4.4	1.3	30
51	18	2010	2751.3–2755.7	272.4–276.8	4.4	2.8	64
52	18	2125	2755.7–2760.1	276.8–281.2	4.4	1.9	43
53	18	2240	2760.1–2764.5	281.2–285.6	4.4	3.8	86
				Totals	227.0	181.7	80

Note: Heat flow experiment followed establishment of mudline. Heatflow measurements at 2476.5, 2481.0, 2500.0, 2519.0, 2538.0, and 2547.5 m.

minifer nannofossil ooze, and Subunit IB, nannofossil and foraminifer nannofossil ooze and chalk. Unit II consists of cyclic sediments, which are interpreted as being turbidity current and small-scale or low-velocity slump deposits. The sediments are calcareous, with high amounts of noncarbonate material (mostly volcanogenic). Rock names range from conglomerates to claystones to limestones and indurated chalks. (The term *indurated* is used to designate chalk that is compacted and hardened but has not been lithified.) Unit III consists of basement complex sedimentary rocks. They are calcareous and volcanogenic in composition and include claystones, cherts, and volcanic fragments. Each unit is discussed in conjunction with the lithostratigraphic summary that is presented in Figure 3.

Nannofossil and Foraminifer–Nannofossil Ooze (Subunit IA)

The sediments recovered from the seafloor down to Core 19 in Hole 525A and through Core 51 in Hole 525B are predominantly nannofossil and foraminifer–nannofossil oozes. They are mostly white (N9) to bluish white (5B9/1) in the upper portions and gradually grade into a very pale orange (10YR8/2) to pinkish gray (5YR8/1) toward the bottom. Preservation of primary and secondary sedimentary structures is poor. The only exceptions are Cores 1 and 2 of 525B, in which well-preserved halo burrows are found. The rest of the cores

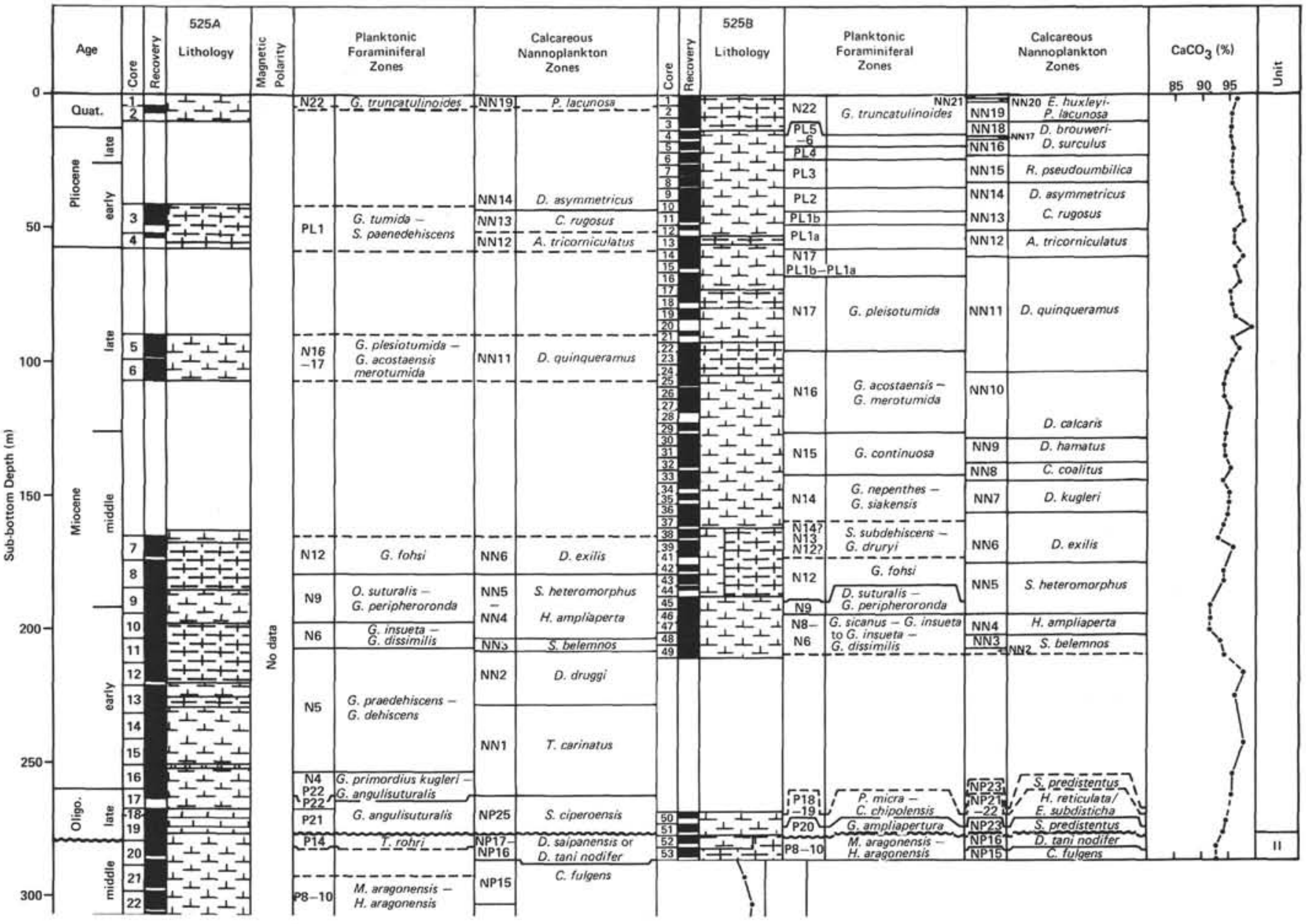

Figure 3. Lithostratigraphic and biostratigraphic summary for Site 525.

are very homogeneous in physical appearance. Calcium carbonate content in this biogenic ooze averages over 95%.

It is interesting to note that a color change is associated with the base of this subunit/biogenic ooze. This color change coincides with the late Oligocene–middle Eocene hiatus (see section on biostratigraphy). The colors are given in the following.

Nannofossil and Foraminifer-Nannofossil Ooze and Chalk (Subunit IB)

Nannofossil ooze and chalk are dominant from Core 19 to approximately Core 40 (Hole 525A). At the upper boundary a pinkish gray (5YR8/1) to very light gray (N8) dominates. The color gradually changes to a predominantly yellowish gray (5Y8/1). Because of the high drilling disturbance, sedimentary structures are not preserved in the ooze layers or in most of the chalks. In Cores 37–39, there is mottling with traces of burrowing. *Planolites, Chondrites, Zoophycos*, and halo burrows are present. The abundance of chalk layers increases toward the bottom. Chert fragments are present in Cores 35 and 36. These deposits probably form as a result of fluids rich in silica that migrate into a pocket or void, with eventual mineral crystallization. $CaCO_3$ content averages well over 95% down to Core 30. Below, the $CaCO_3$ content decreases fairly rapidly to approximately 80% at the base of Lithologic Subunit IB.

The base of the ooze/chalk interval is marked by a color change, a dramatic decrease in calcium carbonate content, and a change in sedimentation pattern from entirely pelagic to cyclic in nature.

Again the lithostratigraphy coincides approximately with the biostratigraphy. The Cretaceous/Tertiary boundary is pinpointed at the top of Core 40, Section 2 (Fig. 4). This agrees with the change in sedimentation patterns. A thin, brownish red layer near the top of this section contains Paleocene microfauna. It is crumbly and more friable than the overlying and underlying chalks. Included in the underlying Late Cretaceous chalk is an intraclast containing Paleocene microfauna. It is possible that this thin layer represents a lithologic unconformity in which the dominant mode of sedimentation changed from submarine erosion and current deposition to a more pelagic regime.

Cyclic Sediments (Unit II)

A pattern of cyclic sedimentation on a scale of 10 cm to 1 m begins approximately at Core 39 and continues to basement. A transitional zone of indurated chalks that are light olive gray (5Y6/1) to yellow gray (5Y8/1) is present to Core 42. Interbedded with these transitional

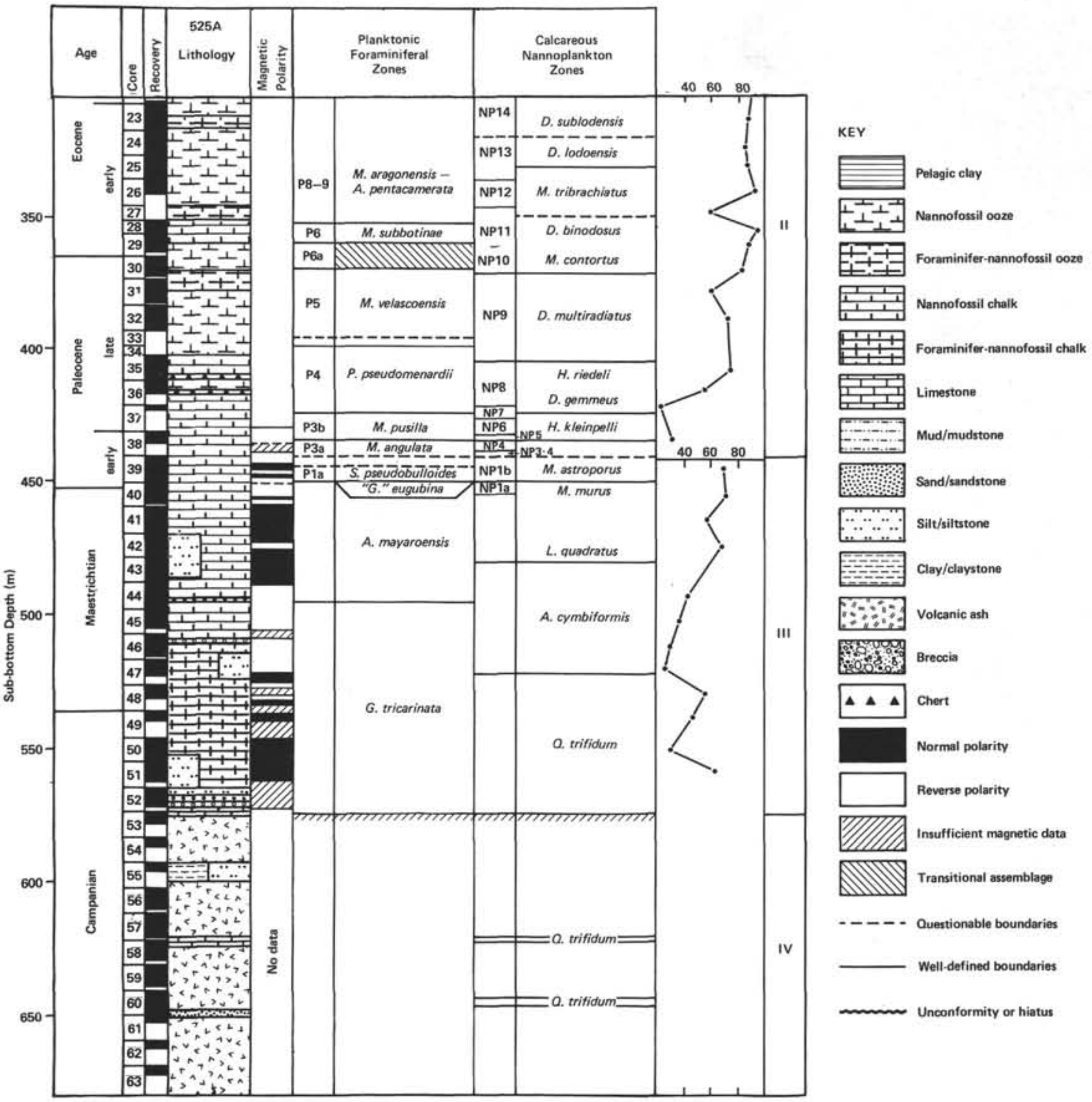

Figure 3. (Continued).

nannofossil chalks are vague, fine-grained silts and included fragments that suggest periodic pulses of minor current activity or distal deposits of slumps or turbidity currents. Biogenic sedimentary structures (*Zoophycos*, halo burrows, *Planolites*) are abundant. The calcium carbonate content in the chalks is less than 80%.

Below this transitional chalk zone (Hole 525A, Cores 42–51) the cyclic sedimentation pattern is more pronounced. Alternating beds of chalk, calcareous siltstone and sandstones, and marly limestones are present and persist throughout the interval. Colors are dominantly greenish gray (5GY6/1) in the coarser-grained layers and light gray (N7) to light olive gray (5Y6/1) in the finer-grained chalk and marly limestones. Calcium carbonate content averages between 40 and 50%. Volcanic rock fragments, palagonite, acidic(?) glass, and quartz are the major noncalcareous components identified in smear slides. X-ray diffraction (XRD) analyses done onboard identify smectites, K-feldspar, and plagioclase as additional acid-insoluble minerals (see XRD section, this chapter). Biogenic mottling is extensive, with beautifully preserved *Zoophycos* (Fig. 5), *Planolites*, and *Chondrites* burrows. Large *Inoceramus* fragments are interspersed in the cores. Some small *Inoceramus* shell beds in the coarser-grained units and rounded intraclasts indicate that currents and winnowing processes were active at the depositional site.

The first three and one-half sections of Core 52, Hole 525A contain a well-preserved turbidite sequence. It is a fining-upward sequence beginning with cobbly, pebbly conglomerates at the base and grading to conglomerates, sandstones, siltstones, and highly mottled calcareous mudstones at the top. Minor fluctuations in current intensity and/or directions are well documented. Included fragments are rounded, with varied mineralogy. The bottom of the turbidite is marked by a sharp contact with underlying marine marly limestones.

The remainder of Core 52, down to basement (basalt) in Core 53, contains a multicolored limestone, dominantly in shades of gray to grayish red (10R4/2). The

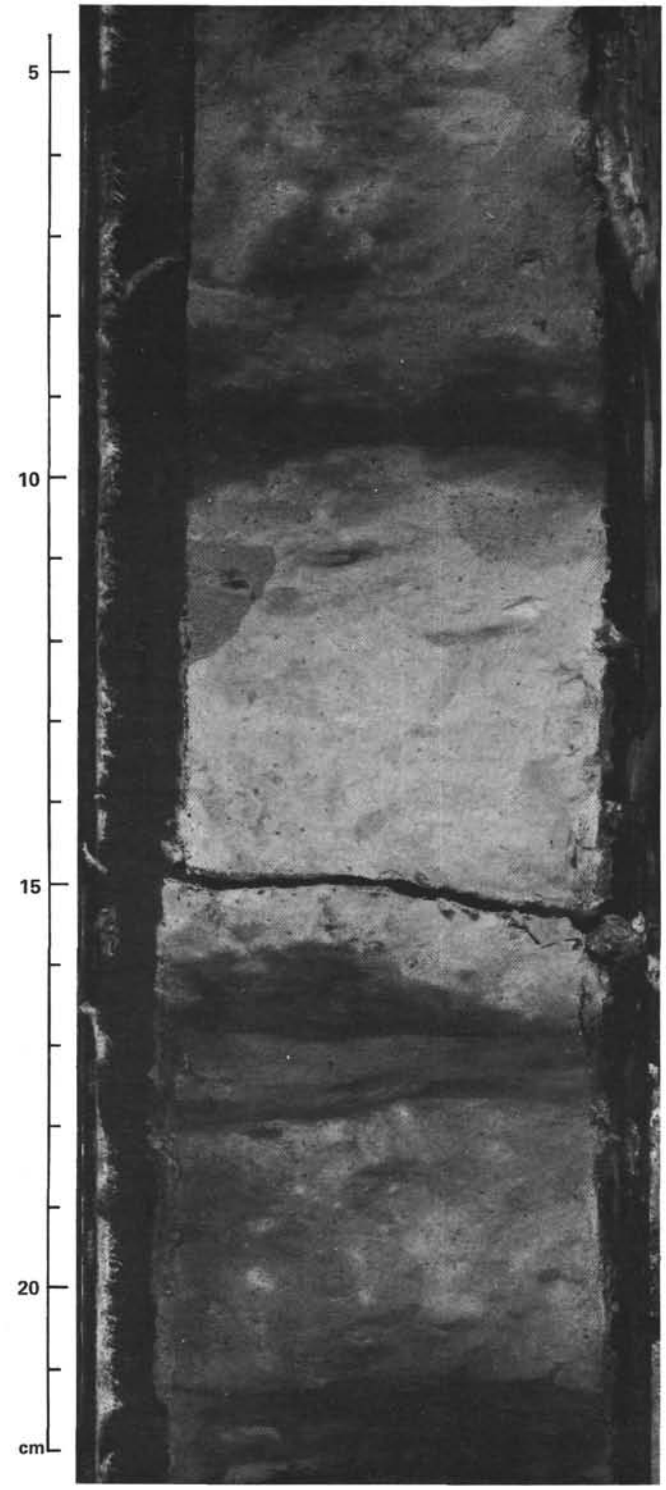

Figure 4. Cretaceous/Tertiary boundary in Sample 525A-40-2, 5-20 cm.

mottled, marly limestone grades into a noncalcareous mudstone that in turn lies immediately above a chert layer. The bottom of the chert is in direct contact with the basement complex.

Basement Complex Sedimentary Rocks (Unit III)

Interbedded between the basement basalts are fine-grained, marly limestones, noncalcareous mudstones, cherts, and volcanogenic sediments. They range in thickness from approximately 0.02 to 2.0 m and are multicolored, varying from greenish gray (5G4/1) to black, to grayish red purple (5RP4/2). The calcareous sediments are bioturbated (e.g., *Zoophycos, Planolites*), contain *Inoceramus* shell fragments, and show grading from fine-grained sand to silts. Chert fragments are found in restricted areas within the sediments. The noncalcareous mudstones and claystones appear to be of volcanogenic origin. High amounts of volcanic glass, rock fragments, and palagonite are identified.

These interlayered basalts and sediments probably represent a series of flows with sediments accumulating during nonvolcanic periods. The highly altered and baked appearance of the sediments near some of the basalt/sediment contacts may be due to heat from the basalt itself or to seawater-basement interactions.

INORGANIC GEOCHEMISTRY—INTERSTITIAL WATER STUDIES

The results of the interstitial water studies for Holes 525A and 525B are shown in Figures 6 and 7 and tabulated in Tables 2 and 3.

No correlation exists between lithostratigraphic units or color changes and pore water chemistry.

There is a gradual increase in chlorinity and salinity with depth at Site 525. The values obtained here are similar to those obtained during Leg 40 by Sotelo and Gieskes (1978) in a region farther west, near the African coastline. They suggested that the increases at Sites 361 and 362 were due to the migration of dissolved ions in pore fluids from salt deposits near the coast rather than to diagenetic reactions and ion exchange. If similar increases at Site 525 result from the same processes, then either the dissolved ions have migrated much farther (Site 525 is ~1000 km from the present-day Angolan salt deposits), or salt deposits were once closer to the location of Site 525 on the Walvis Ridge and gave rise to relatively high salinities in the pore waters (the Brazil salt was probably less than 500 km from Site 525 in the Late Cretaceous). Another possibility is that sediment-basement interactions have increased the total dissolved ion concentration and chloride content in pore waters.

Calcium and magnesium show an approximately one-to-one inverse relationship with increasing depth (i.e., Ca increases and Mg decreases). This relationship has been reported elsewhere (e.g., Manheim and Sayles, 1974) and is typical of areas of biogenic ooze with low sedimentation rates (less than 3 cm/1000 yr.). The inverse relationship suggests that Ca is dissolved from the calcareous organisms and enriched in the pore waters while the Mg is depleted in pore waters as more Mg-bearing carbonates are precipitated.

pH and alkalinity are fairly constant, with a very slight increase and decrease at the bottom, respectively. This change, however, may be within the range of analytical error.

X-RAY DIFFRACTION ANALYSIS

XRD analysis was done on 19 samples from Site 525, using a Rigaku Miniflex X-ray diffractometer. Samples were scanned from 50°2θ to 3°2θ at a speed of 2.4°2θ/

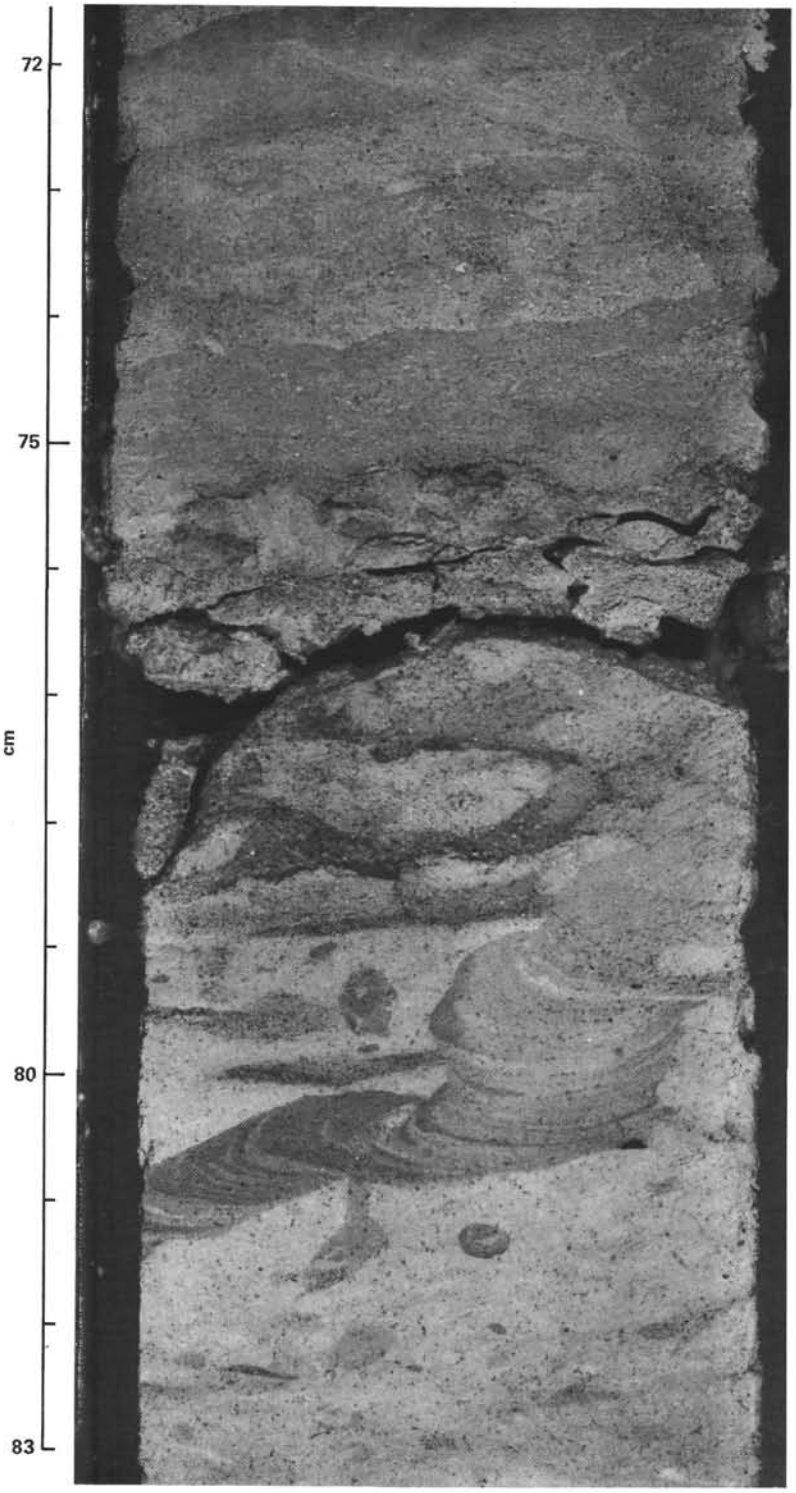

Figure 5. An example of the extensive biogenic mottling in the sediments. Note the well-preserved *Zoophycos* burrow at 80 cm (Sample 525A-41-4, 72-83 cm).

min., using CuKα radiation generated at 30 kv and 10 mA. Traces were available within 25 min. and supplemented visual core description and smear slide analyses. No semiquantitative analysis was attempted because of the differences in slide preparation and orientation.

The results are summarized in Table 4. Calcite is the most abundant mineral in almost all the major lithologies, and aragonite is found only in the first section of the first core. The presence of halite peaks in the traces is due to the evaporation of the interstitial waters during

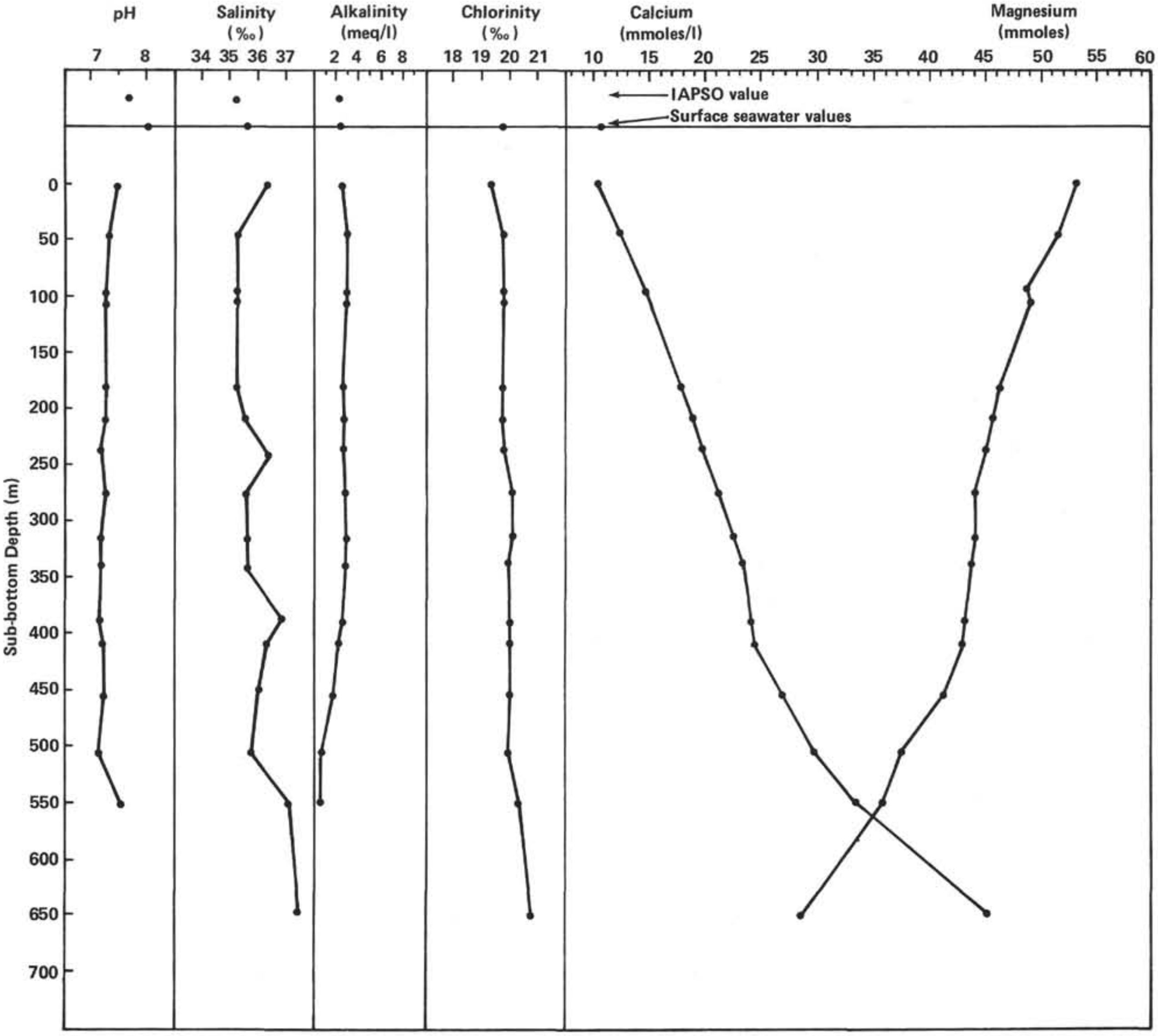

Figure 6. Summary of shipboard inorganic geochemistry pore water study, Hole 525A.

slide preparation. In many samples (particularly Cores 9-13 in Hole 525A) a small peak is noted at about 26.5° 2θ. This is interpreted as the illite 003 and/or the quartz 101 peaks; the latter is more likely, since the illite 001 peak is absent.

The samples from Cores 39 to 47 were generally taken from coarser-grained, silty beds within the chalk, and XRD analysis shows the probable importance of volcanogenic detritus in the formation of these layers. K-feldspars, and particularly anorthoclase, are important components in the samples. Montmorillonite was identified by a shift of its basal plane reflection from 13 Å to 17 Å upon glycolation and was probably derived by alteration of volcanic ash. Minor plagioclase is present in Core 46.

BIOSTRATIGRAPHIC SUMMARY

At Site 525 three holes—525, 525A, and 525B—were drilled. Hole 525 contained one core of Pleistocene age. Hole 525A was rotary-cored discontinuously from the lower Pleistocene to the upper Oligocene, then continuously cored from the upper Oligocene down to basement, of early Maestrichtian age. Hole 525B, using the HPC, continuously cored sediments from early Pleistocene to early Miocene in age and, after washing through most of the lower Miocene, cored across the interval where upper Oligocene overlies middle Eocene sediments.

Nannofossils and planktonic and benthic foraminifers were studied from all cores containing sediments. Biostratigraphic zonation of the Neogene (Fig. 3) is based on the time scales and zonations of Vincent (1977) and Martini (1971); of the Paleogene, on the time scales and zonations of Hardenbol and Berggren (1978) and Martini (1971); and of the Cretaceous, on the time scales and zonations of Thierstein (1976) and Sliter (unpublished).

Results of study of all core catcher samples are shown in the biostratigraphic summary diagram (Fig. 3).

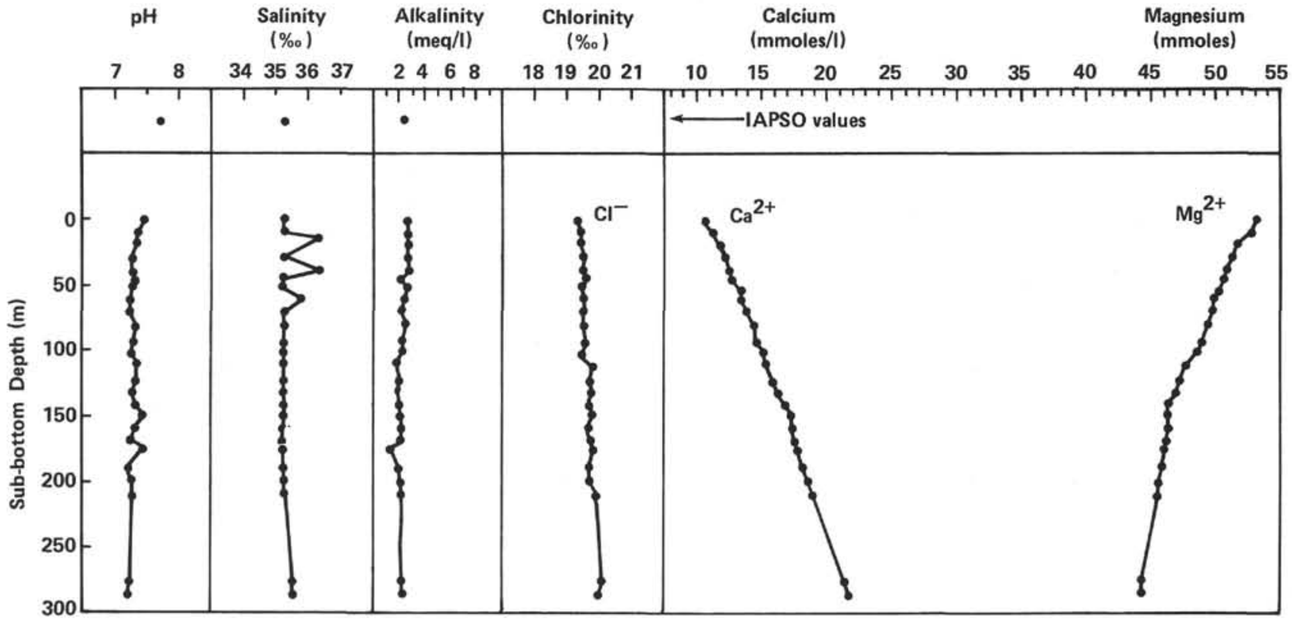

Figure 7. Summary of shipboard inorganic geochemistry pore water study, Hole 525B.

Table 2. Summary of shipboard pore water study, Hole 525A.

Sample No.	DSDP Sample (interval in cm)	Sub-bottom Depth (m)	pH	Alkalinity (meq/l)	Salinity (‰)	Calcium (mmoles/l)	Magnesium (mmoles/l)	Chlorinity (‰)
	IAPSO		7.70	2.409	35.2	—	—	—
	SSW		8.072	2.310	35.5	10.74	55.10	19.79
1	1-1, 144–146	1.44–1.50	7.485	2.467	36.3	10.32	53.00	19.34
2	3-2, 140–150	44.50–44.60	7.303	2.810	35.2	12.34	51.66	19.75
3	5-4, 140–150	95.00–95.10	7.288	2.381	35.2	14.65	48.88	19.70
4	6-4, 140–150	104.50–104.60	7.269	2.303	35.2	14.98	48.90	19.75
5	8-5, 140–150	182.00–182.10	7.249	2.164	35.2	17.64	46.33	19.65
6	11-5, 135–150	210.45–210.60	7.245	2.071	35.5	18.79	45.84	19.73
7	14-5, 135–150	238.95–239.10	7.196	2.123	36.3	19.75	45.06	19.89
8	19-3, 135–150	273.95–274.10	7.264	2.184	35.5	21.16	44.13	20.09
9	23-5, 135–150	314.95–315.40	7.162	2.213	35.5	22.44	44.58	20.08
10	26-2, 135–150	338.95–339.10	7.170	2.052	35.5	23.20	43.75	19.89
11	32-4, 135–150	389.45–389.60	7.155	1.864	36.8	24.07	43.30	20.01
12	35-6, 135–150	411.45–411.60	7.211	1.624	36.3	24.42	43.13	20.02
13	40-5, 140–150	456.00–456.10	7.217	1.274	36.0	27.01	41.23	20.06
14	45-5, 140–150	505.00–505.10	7.155	0.168	35.8	29.74	37.22	19.99
15	50-5, 140–150	552.50–552.60	7.502	0.274	37.1	33.48	35.86	20.33
16	60-5, 135–150	647.45–647.60	—	—	37.4	45.17	28.79	20.76

Note: Sample 16 analyzed with first meter of Hole 525B.

Calcareous Nannoplankton

Calcareous nannoplankton were identified at Site 525. Sediments from Holes 525, 525A, and 525B contained abundant nannofossils. The preservation, however, fluctuated from moderate to poor as a consequence of dissolution, fragmentation, and overgrowth. Graphic representations of nannoplankton biostratigraphy and zonal identification of these three holes are given in Figure 3. The zonation scheme applied in this chapter follows that of Martini (1971) for the Tertiary and Quaternary and that of Thierstein (1976) for the Cretaceous.

Hole 525

Only one core was taken from Hole 525. The core catcher sample from 3.6 m contains common *Pseudoemiliania lacunosa, Gephyrocapsa oceanica* or *G. caribbeanica, Emiliania ovata, Helicosphaera carteri, Cyclococcolithus leptoporus*, and small *Gephyrocapsa*, with rare *Ceratolithus rugosus*. This assemblage indicates the *P. lacunosa* Zone (NN19) of the early Pleistocene.

Hole 525A

Hole 525A was drilled with conventional rotary coring. Sediments were not continuously cored above 165.1 m. The depth of this hole reaches 678.1 m (Sample 525A-63,CC). Basalt was encountered in Core 53 at a depth of 574.6 m. The oldest sediments above and sandwiched within the basalt are early Maestrichtian (*Tetralithus trifidus* Zone) in age.

A continuous Cretaceous–Tertiary sequence was recovered in Core 40; however, there is a major hiatus from upper Oligocene to middle Eocene in Core 19.

Pleistocene (0–3.6 m)

Quaternary sediments were recognized only in Core 1 of this hole. The core catcher sample, which contains common *Pseudoemiliania lacunosa, Gephyrocapsa oceanica* or *G. caribbeanica*, and *Emiliania ovata*, is as-

Table 3. Summary of shipboard pore water study, Hole 525B.

Sample No.	DSDP Sample (interval in cm)	Sub-bottom Depth (m)	pH	Alkalinity (meq/l)	Salinity (‰)	Calcium (mmoles/l)	Magnesium (mmoles/l)	Chlorinity (‰)
	IAPSO		7.719	2.285	35.2	—	—	—
17	1-1, 140–150	1.40–1.50	7.436	2.613	35.2	10.47	53.12	19.31
18	3-1, 140–150	9.30–9.40	7.356	2.707	35.2	11.36	52.89	19.46
19	5-2, 133–143	18.03–18.13	7.345	2.641	36.3	11.64	51.56	19.44
20	7-2, 140–150	28.40–28.50	7.272	2.640	35.2	12.16	51.40	19.56
21	9-3, 111–121	38.41–38.51	7.285	2.611	36.3	12.45	50.84	19.46
22	11-2, 140–150	46.00–46.10	7.306	2.230	35.2	12.77	50.76	19.56
23	13-2, 140–150	53.80–53.90	7.272	2.505	35.2	13.23	50.29	19.49
24	15-1, 140–150	62.10–62.20	7.248	2.365	35.8	13.27	49.83	19.49
25	17-1, 140–150	71.00–71.10	7.235	2.229	35.2	13.70	49.71	19.51
26	19-2, 140–150	81.20–81.30	7.352	2.678	35.2	14.36	49.28	19.46
27	22-2, 140–150	94.40–94.50	7.284	2.180	35.2	14.50	48.84	19.56
28	24-2, 140–150	102.20–102.30	7.226	2.174	35.2	15.06	48.59	19.46
29	26-2, 140–150	111.00–111.10	7.354	1.921	35.2	15.29	47.88	19.75
30	29-2, 140–150	124.20–124.30	7.345	1.974	35.2	15.88	47.15	19.61
31	31-2, 140–150	133.00–133.10	7.297	2.000	35.2	16.04	46.95	19.75
32	33-2, 140–150	141.90–142.00	7.315	2.011	35.2	16.66	46.48	19.73
33	35-1, 140–150	149.20–149.30	7.455	2.124	35.2	17.11	46.48	19.77
34	37-2, 140–150	159.90–160.00	7.337	2.231	35.2	17.26	46.44	19.70
35	39-2, 140–150	168.30–168.40	7.267	2.012	35.2	17.51	146.26	19.73
36	42-1, 140–150	174.60–174.70	7.477	1.382[a]	35.2	17.71	46.11	19.77
37	45-3, 140–150	190.80–190.90	7.224	1.989	35.2	18.05	45.77	19.73
38	47-3, 140–150	200.60–200.70	7.280	2.030	35.2	18.62	45.62	19.71
39	49-3, 140–150	209.40–209.50	7.280	2.093	35.2	19.00	45.53	19.80
40	51-1, 140–150	273.80–273.90	7.237	2.088	35.5	21.36	44.25	20.09
41	53-2, 140–150	284.10–284.20	7.217	2.090	35.5	21.66	44.31	19.99

[a] Bad induration.

Table 4. X-ray diffraction analysis, Site 525.

Sample (level, interval in cm)	Dominant/Minor Lithology	Minerals Identified
525-1-1, 140	D	Calcite, halite
525A-1-1, 50–52	D	Calcite, aragonite, halite
525A-2-6, 149–150	D	Calcite, illite/quartz
525A-7-5, 15–16	D	Calcite
525A-8-7, 2	D	Calcite, halite
525A-9-4, 25	D	Calcite, halite, illite/quartz
525A-10-1, 30	D	Calcite, halite, illite/quartz
525A-11-1, 50	D	Calcite, halite, illite/quartz
525A-12-1, 50	D	Calcite, halite, illite/quartz
525A-13-4, 50	D	Calcite, halite, illite/quartz
525A-14-4, 61	D	Calcite, illite/quartz
525A-26-3, 69	D	Calcite
525A-29-4, 81–82	D	Calcite, halite, anorthoclase
525A-32-6, 112	D	Calcite
525A-39-4, 56	M	Na-montmorillonite, K-feldspars
525A-43-4, 0–2	M	Calcite, illite/quartz, K-feldspars
525A-46-4, 100	M	K-feldspar (anorthoclase), plagioclase, montmorillonite
525A-47-2, 58–60	M	Anorthoclase
525B-23-1, 147	D	Calcite, halite, illite/quartz

signed to the *P. lacunosa* Zone (NN19). This assemblage suggests the upper part of the lower Pleistocene, because it contains abundant small *Gephyrocapsa* yet without *Helicosphaera sellii* and *Cyclococcolithus macintyrei*.

Pliocene (43.1–51.1 m)

No sample was investigated for Core 2. The lower Pliocene (*Discoaster asymmetricus* Zone) was found in Sample 525A-3-1, 150 cm only. The determination is based on the presence of *Amaurolithus primus, A. delicatus, Discoaster asymmetricus*, and rare *Ceratolithus rugosus* in this sample. Sample 525A-3,CC contains common *Amaurolithus primus* and *A. delicatus*. The absence of *Discoaster quinqueramus* and *Ceratolithus rugosus*, however, indicates the *A. tricorniculatus* Zone (NN12). No sample was investigated for Core 4.

Miocene (95.1–? m)

Sample 525A-5,CC, containing *Reticulofenestra pseudoumbilica, Sphenolithus abies, Discoaster brouweri, D. surculus, D. pentaradiatus*, and *Amaurolithus primus*, is assigned to the upper Miocene *D. quinqueramus* Zone (NN11). *Amaurolithus delicatus* is absent in this sample.

In Core 6, the co-occurrence of *D. calcaris, D. neohamatus, D. surculus,* and *D. pentaradiatus*, together with *D. variabilis*, indicates the upper Miocene (*Discoaster quinqueramus–D. calcaris* zonal interval). *Discoaster quinqueramus*, however, does not occur in this interval.

Core 7, which contains *Cyclicargolithus floridanus, D.* cf. *deflandrei, Coronocyclus nitescens*, and *Coccolithus pelagicus*, is attributed to the *D. exilis* Zone (NN6). Owing to the strong overgrowth of the discoaster species, the presence of *D. exilis* and *D. kugleri* (index fossil for Zone NN7) is difficult to detect in this interval.

Sediments from Cores 8, 9, and from Sample 525A-10-3, 150 cm contain *Cyclicargolithus floridanus, D. deflandrei, Coronocyclus nitescens, R.* cf. *pseudoumbilica, Coccolithus pelagicus*, and *S. heteromorphus*. The assemblage indicates the *S. heteromorphus* (NN5) to the *Helicosphaera ampliaperta* (NN4) zonal interval. Owing to differential dissolution or environmental exclusion, *H. ampliaperta* was not present in this hole. Therefore it is difficult to discriminate between Zones NN5 and NN4. The top of the lower Miocene (i.e., the top of NN4) is therefore roughly put at Sample 525A-9,CC.

Lower Miocene sediments were recovered from the Core 10 core catcher to the Core 15 core catcher. They contain abundant, yet poorly to moderately preserved, nannofossils. In the Core 10 core catcher the co-occurrence of *S. heteromorphus* and *Sphenolithus belemnos* suggests the upper part of the *Sphenolithus belemnos* Zone (NN3). The interval from Sample 525A-11,CC through 525A-15,CC contains no typical index fossils for the lower Miocene. This thick interval can be roughly assigned from NN2 to NN1.

Miocene–Oligocene (260.1 m)

The core catcher of Core 16 contains abundant *Cyclicargolithus floridanus, Reticulofenestra* spp., *Discoaster* cf. *deflandrei*, and very rare *Dictyococcites bisectus*, without *Sphenolithus ciperoensis*, an assemblage characteristic of the transition from the Miocene to the Oligocene period.

Oligocene (267.6–278.21 m)

The span from Sample 525A-17,CC to 525A-19-6, 111 cm contains typical *Sphenolithus ciperoensis. Sphenolithus ciperoensis* is common in Sample 525A-19-6, 111 cm, which suggests that this core is still within the *S. ciperoensis* Zone (NP25). Very rare *S. distentus, S. predistentus* (forms with strong overgrowth), and *Reticulofenestra umbilica* were found in Samples 525A-18,CC and 525A-19-6, 111 cm. They were possibly reworked from lower Oligocene and upper Eocene sediments. A hiatus immediately below this interval supports this supposition.

Eocene (278.9–371.35 m)

A hiatus was observed from Samples 525A-19-6, 111 cm to 525A-19-7, 20 cm. The entire lower Oligocene and upper Eocene are missing at this site. The time gap is roughly 14 m.y.

An upper middle Eocene assemblage was recognized in Samples 525A-19-7, 20 cm and 525A-19,CC. *Reticulofenestra umbilica, Sphenolithus radians, S. pseudoradians, Chiasmolithus grandis, Helicosphaera compactus, Discoaster saipanensis, S. furcatolithoides, Bramletteius serraculoides, Triquetrorhabdulus inversus, D. barbadiensis*, and *Cyclococcolithus formosus* were all found in this interval. This assemblage indicates the *D. saipanensis* (NP17) to *D. tani nodifer* (NP16) zonal interval. The core catcher of Core 20 contains rare *Chiphragmalithus fulgens*, without *R. umbilica*. This indicates the *C. fulgens* Zone (NP15). Core catchers of Cores 21, 22, and 23 contain *D. lodoensis, D. sublodoensis, D. barbadiensis, T. inversus, Zygrhablithus bijugatus* (short form), *Cyclococcolithus gammation*, and *Coccolithus eopelagicus*, which suggest the *D. sublodoensis* Zone (NP14) or part of the *Chiphragmalithus fulgens* Zone (NP15).

The core catcher of core 24 has essentially the same assemblage as in the last three cores. It does not, however, contain *T. inversus* and probably belongs to the *D. lodoensis* Zone (NP13). The middle/lower Eocene boundary at Site 525 is difficult to detect because *D. sublodoensis*, whose first occurrence defines the base of NP14 (i.e., the base of the middle Eocene), extends down and overlaps the ranges of *Marthasterites tribrachiatus*. The middle/lower Eocene boundary at this site is therefore tentatively placed in Core 24, based on the first occurrence of *Triquetrorhabdulus inversus*.

Marthasterites tribrachiatus was first encountered in Sample 525A-25,CC, which indicates the *M. tribrachiatus* Zone (NP12). Sample 525A-26,CC has essentially the same assemblage as 525A-25,CC, with an abundant and well-diversified flora and many giant specimens.

Calcareous nannofossils from Samples 525A-27,CC, 28,CC, and 29,CC are different from those in the previous two cores. Discoasters decline in number, and large nannofossil specimens disappear. Also, in this interval the preservation of nannofossils deteriorates suddenly. *Toweius craticulus* and *T. eminens* first appear in Sample 525A-28,CC, and *S. anarrhopus* first occurs in 525A-27,CC. The entire interval from Sample 525A-27, CC to 525A-29,CC can be assigned to the *D. binodosus* (NP11)–*M. contortus* (NP10) zonal interval of the lower Eocene. Species characteristic of this interval are *M. tribrachiatus, D. gemmeus, D. diastypus, D. salisburgensis, Toweius craticulus, T. eminens, Chiasmolithus bidens, C. consuetus*, and *S. anarrhopus*. A special sample, 525A-30-5, 75 cm (a thin layer of brown shale), surprisingly contains moderately to well-preserved nannofossils. The assemblage is composed of *M. tribrachiatus* (long-armed type), *D. binodosus, D. diastypus, D. multiradiatus*, and *C. consuetus*, which indicate basal Eocene (NP10–NP11).

Paleocene (374.1–451.71 m)

Coccoliths and discoasters from the Paleocene sequence in Hole 525A are few to abundant and poorly to moderately preserved. The interval from Sample 525A-30,CC through 525A-34,CC contains common *Discoaster multiradiatus*, which is an index species of Zone NP9. Other important species found in this interval are *Fasciculithus* spp., *Toweius eminens, T. craticulus, Chiasmolithus bidens, Coccolithus pelagicus, D. lenticularis, D. gemmeus*, and *Ellipsolithus macellus*. The absence of *D. multiradiatus* and the presence of *Heliolithus* cf. *riedeli* place Sample 525A-35,CC in either the *D. gemmeus* Zone (NP7) or the *Heliolithus riedeli* Zone (NP8). The co-occurrence of *Discoaster gemmeus* and *H. kleinpelli*, on the other hand, assigns 525A-36,CC to the *D. gemmeus* Zone (NP7). In Sample 525A-37,CC, *D. gemmeus* is not present. The assemblage is dominated by *C. pelagicus, T. eminens, F.* spp., *Sphenolithus moriformis*, and *Cyclococcolithus robustus*. The rare presence of *H. kleinpelli*, however, limits this core catcher sample to the *H. kleinpelli* Zone (NP6).

The poorly preserved calcareous nannofossil assemblage in Sample 525A-38,CC is dominated by *Coccolithus pelagicus* (= *C. cavus*), with common *Cruciplacolithus tenuis* and rare *Markalius astroporus, Princius* cf. *bisulcus, Zygodiscus sigmoides*, and *Chiasmolithus* sp. Typical *C. danicus* was not found in this core. Because of the absence of *F. tympaniformis*, this core is assigned to either the *C. danicus* (NP3) or the *E. macellus* (NP4) zonal interval.

The calcareous nannofossils in Sample 525A-39,CC are rare to few. The assemblage is dominated by *Thoracosphaera* spp. Accompanying rare species are *Z. sigmoides, Markalius astroporus, M. panis*, and *Biantholithus sparsus*. Fragments of *Braarudosphaera bigelowii* are common, but there were no complete specimens of this species. This assemblage is typical of the *M. astroporus* Zone (NP1). Reworked Cretaceous species in this core catcher sample are relatively rare.

Cretaceous/Tertiary Boundary (451.71 m)

The Cretaceous/Tertiary boundary in Hole 525A was recovered in Section 2 of Core 40. Closely spaced samples from this section were processed and investigated. The relative locations of these samples are shown in Figure 4 (see also Fig. 2 in Manivit, this volume). Samples 525A-40-2, 7 cm (light brown), 525A-40-2, 9 cm (brown), and 525A-40-2, 11 cm (light green) contain common *Thoracosphaera* spp., rare *Markalius astroporus, M. panis, Zygodiscus sigmoides*, and *Biantholithus sparsus*. Calcareous nannofossils in these slides are few to common with poor to moderate preservation. Reworked Cretaceous species are rare to few. This assemblage is typical for the basal Tertiary *M. astroporus* Zone (NP1).

Samples 525A-40-2, 22 cm (light brown), 525A-40-2, 64 cm, and 525A-40-2, 140 cm, on the other hand, contain an abundant and poorly preserved Cretaceous nannofossil assemblage. *Arkhangelskiella cymbiformis, Micula staurophora, Cribrosphaera ehrenbergi, Watznaueria barnesae, Microrhabdulus decoratus, Eiffellithus turriseiffeli, Cylindralithus gallicus*, and *Lithraphidites quadratus* are common, and *Micula murus, Thoracosphaera* spp., *M. astroporus*, and *Z. sigmoides* are rare in these slides. The presence of *M. murus* indicates that this interval belongs to the *M. murus* Zone of the uppermost Cretaceous. There appears to be no stratigraphic discontinuity across the Cretaceous–Tertiary in Hole 525A.

Samples 525A-40-2, 11.5 cm (pale green), 525A-40-2, 15 cm (light brown), and 525A-40-2, 17 cm (pale brown), however, contain a curious assemblage. The nannofossil preservation is extremely bad, so that most species are fragmented. Rare *M. astroporus* and *M. panis* were found mixed with rare to common Cretaceous forms in this interval. Many calcite particles in these slides look like isolated elements of *Braarudosphaera bigelowii;* however, very rare complete specimens of *B. bigelowii* were observed. If these calcite particles are indeed elements of *B. bigelowii*, the Cretaceous/Tertiary boundary should then be put somewhere between Samples 525A-40-2, 11 cm and 525A-40-2, 22 cm. Tentatively, the Cretaceous/Tertiary contact in this hole is placed between Samples 525A-40-2, 11 cm and 525A-40-2, 11.5 cm, because it corresponds to a minor lithological (color) change.

Maestrichtian (453.0–516.6 m)

Sample 525A-40,CC is assigned to the *Micula mura* Zone of the uppermost Cretaceous. This is based on the co-occurrence of *M. murus, Markalius astroporus*, and *Lithraphidites quadratus*. Sample 525A-41,CC contains rare *Nephrolithus frequens*, without *Micula murus*. It probably belongs to the *M. mura/L. quadratus* zonal interval or to Perch-Nielsen's (1977) *Nephrolithus frequens* Zone. Sample 525A-42,CC contains *L. quadratus*, without *N. frequens* and is attributed to the *L. quadratus* Zone. The *Arkhangelskiella cymbiformis* Zone is indicated in Samples 525A-43,CC and 525A-45, CC. The top of this zone is defined by the first occurrence of *L. quadratus* and the base by the last occurrence of *Quadrum trifidum*. In Sample 525A-46,CC, *Broinsonia parca* and *Reinhardtites levis* appear. This sample does not contain *Q. trifidum* and therefore belongs to the lower part of the *Arkhangelskiella cymbiformis* Zone.

Maestrichtian–Campanian (526.1–573.6, 574.5, 623.73–624.9 m)

Samples 525A-47,CC through 525A-52,CC are within the *Quadrum trifidum* Zone, because *Q. trifidum*, though not common, occurs consistently. Basalt was encountered in Section 1 of Core 53. The two layers of sediments sandwiched within the basalts encountered in Samples 525A-58,CC and 525A-60,CC still belong to the *Q. trifidum* Zone. Because the Maestrichtian/Campanian boundary is within the *Q. trifidum* Zone, it is difficult to judge whether the basal sediments of this site reach the upper Campanian or are still within the lower Maestrichtian.

Hole 525B

Hole 525B was drilled with the HPC. Nannofossils are present in all cores. Preservation of fossil coccoliths is in general moderate. Discoasters, however, show strong overgrowth from 31,CC downward.

Quaternary (0–7.9 m)

Quaternary sediments were recovered in Samples 525B-1,CC and 525B-2,CC. Sample 525B-1,CC is dominated by small *Gephyrocapsa* with some *Helicosphaera carteri, Cyclococcolithus leptoporus*, and *Pseudoemiliania lacunosa*. According to Gartner (1977), this assemblage belongs to the small *Gephyrocapsa* acme interval, middle part of the *P. lacunosa* Zone (NN19). Sample 525B-2,CC contains *G. caribbeanica, P. lacunosa, H.* cf. *sellii*, and *Ceratolithus rugosus*. This assemblage suggests the lower part of the *P. lacunosa* Zone (NN19).

Pliocene (12.3–56.3 m)

The presence of *Gephyrocapsa* cf. *caribbeanica* in Sample 525B-3,CC suggests a Pleistocene age. However, since *Discoaster brouweri* together with common *Coccolithus* cf. *doronicoides* and *Emiliania ovata* cooccur, it is assigned to the *D. brouweri* Zone (NN18) of the upper Pliocene. Samples 525B-4,CC and 525B-5,CC are within the *D. surculus* Zone (NN16) of the upper Pliocene, because they contain *D. surculus, D. pentaradiatus, D. brouweri, D. asymmetricus*, and *Pseudoemiliania lacunosa. Reticulofenestra pseudoumbilica* is also present in these two cores, but in insignificant numbers.

Samples 525B-6,CC and 525B-7,CC are assigned to the *R. pseudoumbilica* Zone (NN15) of the lower Pliocene, based on an abundance of *R. pseudoumbilica* together with *P.* cf. *lacunosa* but without *Amaurolithus* sp. The co-occurrence of *A. delicatus, Ceratolithus rugosus, D. asymmetricus*, and *Sphenolithus abies* in Samples 525B-8,CC and 525B-9,CC then indicates the *D. asymmetricus* Zone (NN14). Samples 525B-10,CC and 525B-11,CC probably belong to the *C. rugosus* Zone (NN13), based on the presence of *C. rugosus* together with diverse *Discoaster* species. *Discoaster asymmetricus* declines in number in these two cores. However, very rare *D.* cf. *asymmetricus* do occur. The common appearance of *Amaurolithus delicatus* and *A. primus* without *D. quinqueramus* and *C. rugosus* in Samples 525B-12,CC and 525B-13,CC indicates the *A. tricorniculatus* Zone (NN12) of the lower Pliocene.

Miocene (60.7–209.4 m)

Samples 525B-14,CC through 525B-22,CC contain common *Discoaster* species, such as *D. brouweri, D. surculus, D. pentaradiatus, D. decorus, D. variabilis,* and *D. intercalaris*. Very rare *D. berggrenii* or *D. quinqueramus* together with common *Amaurolithus delicatus* and *A. primus* in this interval indicate the upper Miocene *D. quinqueramus* Zone (NN11). The lowest sample that contains *Amaurolithus* species is 525B-22, CC. Samples 525B-23,CC through 525B-29,CC belong to the lower part of the upper Miocene (NN11–NN10). The first *D. neohamatus* was encountered in Sample 525B-23,CC; Samples 525B-24,CC through 525B-26,CC contain common *D. loeblichii*, and Samples 525B-24, CC through 525B-28,CC contain common to abundant *Minylitha convallis*. The latter species, according to Bukry (1973), occurs in the *D. neohamatus* Zone and the lower part of his *D. quinqueramus* Zone (i.e., lower part of upper Miocene).

The middle Miocene was first encountered in Sample 525B-30,CC, which contains *D. hamatus* and *Catinaster calyculus* and belongs to the *D. hamatus* Zone (NN9). The preservation of discoaster species suddenly becomes poor from Sample 525B-31,CC downward, most specimens being overgrown. The age determination of core samples is therefore difficult. Sample 525B-32,CC, which contains *D. bellus* and *C. calyculus*, and Core 33, which contains *C. calyculus*, probably belong to the *D. hamatus* (NN9) or to the *C. coalitus* (NN8) zonal interval. Sample 525B-33,CC contains both *C. calyculus* and *C.* cf. *coalitus* and is assigned to the *C. coalitus* Zone (NN8). Samples 525B-34,CC through 525B-36,CC contain abundant *Coccolithus pelagicus* and huge *Reticulofenestra* species with common overgrown *D. variabilis* or *D. exilis* and are attributed to Zones NN6 to NN8. *Discoaster kugleri* is difficult to identify in these core samples. The exact boundaries of the *D. kugleri* Zone (NN7) are therefore difficult to define.

The abundant occurrence of *Cyclicargolithus floridanus* with rare *Helicosphaera* cf. *euphratis* and without *Sphenolithus heteromorphus* in Samples 525B-37,CC through 525B-41,CC strongly indicates the *D. exilis* Zone (NN6) of the middle Miocene. Except for Sample 525B-44,CC, 525B-42,CC through 525B-47,CC contain common *S. heteromorphus* and belong to the *S. heteromorphus* (NN5)–*H. ampliaperta* (NN4) zonal interval. Sample 525B-44,CC is a mixed assemblage of early Pliocene to late Miocene with middle Miocene. The boundary between Zones NN5 and NN4 (i.e., the boundary between the middle and lower Miocene) is difficult to determine because of the absence of the index species *H. ampliaperta* in this hole.

Sample 525B-48,CC contains common *S. belemnos without S. heteromorphus* and is assigned to the *S. belemnos* Zone (NN3). In Sample 525B-49,CC, *S. belemnos* is not present. Its age therefore could be attributed to NN3 or to the *D. druggi* Zone (NN2), based on the common occurrence of *D. deflandrei* and *D.* cf. *druggi*.

Oligocene–Eocene Hiatus (276.8–281.2 m)

The Oligocene–Eocene hiatus was drilled in this hole and occurred between Samples 525B-51,CC and 525B-52,CC. The calcareous nannofossil assemblages from immediately above and below the contact are of different ages from those in Hole 525A. The top of cores 50 and Sample 525B-51,CC contain *Sphenolithus distentus, S. predistentus, S. pseudoradians, S. moriformis, Dictyococcites bisectus, Zygrhablithus bijugatus*, and *Cyclicargolithus floridanus*, which suggest the *S. predistentus* Zone (NP23) of the upper or middle Oligocene. Samples 525B-50-1, 50 cm, 525B-50-1, 70 cm, and 525B-50,CC, on the contrary, contain a lower Oligocene assemblage, including *Reticulofenestra umbilica, Cyclococcolithus formosus, Discoaster* cf. *tani, Bramletteius serraculoides, Hayella situliformis, S. pseudoradians, Dictyococcites bisectus*, and *Z. bijugatus*. Because no *Discoaster saipanensis* and *D. barbadiensis* were found in these samples, they are assigned to the *Helicosphaera reticulata* (NP22)–*Ericsonia*? *subdisticha* (NP21) zonal interval of the lower Oligocene. Obviously, these lower Oligocene sediments are reworked into an upper Oligocene horizon.

Sample 525B-51,CC contains *R. umbilica, C. formosus, Triquetrorhabdulus inversus, D. saipanensis, D. barbadiensis, Chiasmolithus* cf. *titus, Z. bijugatus, S. radians, S. furcatolithoides, Chiasmolithus grandis*, and *Coccolithus pelagicus*. The assemblage suggests the *D. tani nodifer* Zone (NP16) of the middle Eocene. In Sample 525B-53,CC there is a substantial change in the nannoplankton assemblage. Large specimens of *Reticulofenestra umbilica* disappear, and common *Chipragmalithus fulgens* and *C. cristatus* appear. The last core catcher sample of Hole 525B therefore reaches the *C. fulgens* Zone (NP15) of the middle Eocene.

Foraminifers

Planktonic and benthic foraminifers were recovered in all cores containing sediment at Site 525. Foraminifers ranged in age from Pleistocene to early Maestrichtian at Hole 525A and from Pleistocene to middle Eocene in Hole 525B. Planktonic foraminifers were moderately to well preserved through the Neogene, moderately to poorly preserved in the Paleogene, and generally poorly preserved in the Maestrichtian.

Planktonic foraminiferal faunas are characteristic of temperate water masses, although incursions of more subtropical species occurred in the Pliocene and middle to late Miocene. Larger numbers of boreal species are present in sediments of early Miocene and late Oligocene age. Paleocene faunas contain elements typical of middle latitudes, but Cretaceous faunas are too poorly preserved to interpret biogeographically.

Benthic foraminiferal faunas are diverse and generally well preserved throughout the Neogene, although the amount of fragmentation is surprising for this age. Paleogene faunas are less diverse, and solution-resistant species often dominate the assemblages. Late Maestrichtian faunas, interpreted as representing slope depths, are often dominated by solution-resistant forms. Early Maestrichtian faunas are included in an *Inoceramus* ooze and intercalated within the basalt at the bottom of Hole 525B. Such microfossil and large invertebrate fossil faunas are typical of the mixing that occurs on the slope.

Neogene

Planktonic Foraminifers

Pleistocene–Pliocene

Pleistocene faunas were found in Samples from Hole 525B, Cores 1 and 2, and from Hole 525A, Core 1. The *Globorotalia crassaformis* group is well represented here, so that the subzones developed by Bolli and Premoli Silva (1975) and used by Pflaumann and Krasheninnikov (1978, 1979) will be applicable here. Preservation is excellent, and faunas include pink-pigmented *Globigerina rubescens*, judged by most workers to be the most solution-sensitive species.

Pliocene faunas were found from Cores 525B-4 to 525B-13 and in Core 525A-3. Again preservation is excellent, and in general the faunas are quite rich, although faunal variations through the Pliocene are suggestive of quite major climatic fluctuation. Zones PL5-6 through PL1a are present in Hole 525B; only Zone PL1c was recognized in Hole 525A.

Upper Miocene (Hole 525A, Cores 4–6; Hole 525B, Cores 14–26)

Owing to the low abundance and sporadic occurrence of upper Miocene index fossils of the *Globorotalia tumida* and *Neogloboquadrina acostaensis* lineages, subdivision of the upper Miocene is very approximate.

The Miocene/Pliocene boundary was tentatively located between Samples 525B-15,CC and 525B-16,CC within Berggren's (1973) Zone Pl1a, on the basis of the presence of left-coiling *G. margaritae*.

Uppermost Miocene Zone N17 (Cores 525B-14–525B-16) is identified on the basis of rare specimens of *N. acostaensis* and *G.* cf. *plesiotumida. Globorotalia margaritae, G. scitula*, and *G. conoidea* occur commonly, whereas the Miocene/Pliocene boundary index species, *Globoquadrina dehiscens*, is absent throughout the zone. *Orbulina bilobata* and *Globigerinoides mitra* occur frequently in this zone. Globorotalids appear to be concentrated in Sample 525B-16,CC, possibly as a result of increased carbonate dissolution.

The transition from Zones N17 to N16 is located in Hole 525A, Cores 4–6 and in Section 525B-17-2. *Neogloboquadrina acostaensis* is very rare; no *G. plesiotumida* is present, but various middle Miocene globorotalids increase in abundance. Occasionally in Zone N16 *Globigerinoides ruber, G. sacculifer* and *Globorotalia menardii*, in increasing abundance, suggest warmer surface water conditions. In Sample 525B-25,CC, together with the frequent occurrence of these subtropical species, *Globigerina nepenthes* increases markedly in size, several other species develop bullae, and *G. falconensis* develops supplementary apertures on the spiral side. The sudden occurrence of *Globoquadrina dehiscens* accompanied by increased abundances of other globoquadrinids suggests a change in surface water productivity in older samples at this zone.

The transition from Zone N16 to N15 is identified in Hole 525B, Core 26. *Neogloboquadrina acostaensis* is not present; *Globorotalia merotumida* decreases in size and abundance, and *N. continuosa* occurs more frequently.

Middle Miocene (Cores 525B-28–525B-40; 525A-7)

According to Vincent (1977), the boundary between the upper and middle Miocene lies within planktonic foraminiferal Zone N15. In Hole 525B, Zones N15 and N14 are recognized before a hiatus to Zones N11–N10 in Core 37. Since the *Globorotalia fohsi* lineage was not represented, zonal assignation is only tentative. Counts of fragments in the coarse fraction indicate increased dissolution through this interval.

Lower Miocene (Hole 525B, Cores 39–49; Hole 525A, Cores 10–17)

Hole 525B, Cores 39–45, and Hole 525A, Cores 8–10, contain fossils of the uppermost lower Miocene Zone N9, including *Sphaeroidinellopsis seminulina, Orbulina suturalis, Turborotalia peripheroronda, Globorotalia miozea* at the top, with the addition of *Streptochilus* sp. and *G. praemenardii* in the lower core catchers.

Lower Miocene Zones N4–N9 are tentatively identified in Hole 525B, Cores 45–47, on the basis of rare small orbulinids including *O. suturalis, O. glomerosa*, and *Praeorbulina transitoria*, as well as *T. peripheroronda, Globigerinoides diminutus*, and the *Globigerina woodi* group. No *Globigerinatella insueta* is present.

Zone N5 (Hole 525A, Cores 11–15; Hole 525B, Cores 48–49) is recognized by the presence of *Catapsydrax unicavus, Globigerinoides trilobus, T. peripheroronda, Globoquadrina dehiscens* and the *Globigerina woodi* group. Several of the New Zealand globigerinids and turborotalids first occur in this zone. No other lower Miocene sediment was found in Hole 525B.

In Hole 525A, an extended Zone N5 occurs in Cores 12 to Sample 525A-15,CC. Index fossils include *Globoquadrina dehiscens, G. praedehiscens, C. unicavus*, and *C. dissimilis. Globoquadrinids and Catapsydrax* spp. occur frequently, whereas the turborotalids and *Globigerina woodi* group are markedly less abundant than in overlying cores. An unidentified spiney globoquadrinid that occurs in this zone was found also at Site 357 on the Rio Grande Rise and may be a useful paleoceanographic indicator.

In Hole 525A high abundance of large globigerinids and globoquadrinids begins in Core 16, which is tentatively called the Oligocene/Miocene transition (Zone N4–P22). *G. ciperoensis* and *Globigerinoides primordius* are not present.

Benthic Foraminifers. Benthic foraminifers comprise less than 1% of all Miocene foraminiferal faunas. Nevertheless they are diverse and well represented in every sample. One noteworthy feature of these faunas is the persistence of "old" species—e.g., forms like *Globocassidulina subglobosa, Osangularia mexicana, Pullenia bulloides, P. quinqueloba, Oridorsalis umbonifera, Nuttalides umbonifera*, which evolved in the early Tertiary.

Most upper Miocene samples are dominated by *Pyrgo* spp. and other miliolids, including *Sigonoillopsis schlumbergeri* and *Spirillina*. In the topmost sample of Hole 525B, *Uvigerina hispida* dominates the benthic faunas. This *Uvigerina* dominance may be equivalent to that recorded by Vincent et al. (1980) in the Indian Ocean at the top of the Miocene. Throughout upper Miocene Zones N17–N16, the miliolids occur in abundance but become rare below the base of Zone N16. It is not certain whether these high Mg calcite miliolids decrease because of ecologic changes or because of dissolution in the sediment.

Globocassidulina subglobosa, Planulina renzi, and *U.* ex. gr. *peregrina* dominate at different levels below the miliolid disappearance. Other common species include *Stilostomella abyssorum, Bulimina aculeata, Anomalina pompilioides, U. spinulosa, U. auberiana*, and *Valvulina haeringensis*.

There is no apparent change in benthics across the lower to middle Miocene interval (Zones N9–N12), during which the Antarctic Ice Sheet is presumed to have formed (Shackleton and Kennett, 1975).

The lower Miocene *Uvigerina* peak recognized by Lutze (1978) at Site 369 was not found in our samples, but may be located with further study.

Paleogene

Paleogene sediments were recovered by continuous rotary coring in Core 16 through Section 40-2, 6 cm, in Hole 525A and in Cores 50–53 in Hole 525B.

Hiatuses were encountered in the section from the upper Oligocene to the middle Eocene, from the lower Eocene Zones P7 to P6, and in the basal Paleocene from Zones P1b through P2. In Hole 525B, the Oligocene section is complicated by reworking of lower Oligocene sediments into the upper Oligocene section above the hiatus.

Preservation throughout the Paleogene was extremely variable. Oligocene faunas are generally well preserved despite some fragmentation of both planktonic and benthic foraminifera in the larger size fractions. Sediments are poorly preserved in the middle Eocene but moderately well preserved in the lower Eocene. Paleocene sediments are moderately well preserved down to the Cretaceous/Tertiary contact, where most of the planktonic foraminifers are fragmented and the benthic foraminifers are concentrated.

Oligocene (Hole 525A, Cores 17–18 and 50–51)

Upper Oligocene Zone P22 was recognized in place in Hole 525A by the overlap of *Turborotalia kugleri, Globoquadrina praedehiscens, Globigerina angulisuturalis*, and various typically Oligocene species that do range into the lower Miocene. The absence of the solution-susceptible *G. ouachitaensis–G. ciperoensis* groups and the abundance of the large species *Globoquadrina venezuelana* and *Globigerina tripartita* indicate dissolution through this interval.

Lower Oligocene sediments in Hole 525B, Core 48, were indicated by the presence of *G. ampliapertura, Pseudohastigerina micra*, and *Chiloguembelina cubensis*. The zonation of nannofossils in the upper levels of this core and in the top of Core 49 below demonstrate that this lower Oligocene material was reworked into the upper Oligocene. A few Eocene fossils were also found in the reworked sediments.

Middle–Lower Eocene (Hole 525A, Cores 19–31,CC; Hole 525B, Cores 52–53)

Following a hiatus of nearly 14 m.y., middle Eocene sediments of Zone P14 occur in Hole 525A, Core 19. The presence of *Turborotalia cerroazulensis, T. cocoaensis*, and *Globigerinatheka subconglobata*, but the absence of *G. semiinvoluta* and *Orbulinoides beckmani* characterize this interval. The nominate taxon, *Truncarotalites rohri*, could not be found. Globigerinathekids and globigerinids dominate the faunas.

Faunas in all middle Eocene zones below this level are very poorly preserved; only a few dissolution-resistant species, *Morozovella spinulosa, Acarinina densa*, and *Globorotalia senni*, are preserved. The only index species identified, *M. aragonensis*, allowed us to locate Hole 525A, Cores 20 to 24, and Hole 525B, Cores 52 to 53, in the P9 to P10 zonal interval. Zone P7–P8 interval was located in Cores 26–27 of Hole 525A. Benthic foraminifers, frequently found, included *Nuttalides truempyi, Bulimina jarvisi, Osangularia mexicana*, and *Oridorsalis umbonifera*.

Improved preservation in Hole 525A, Cores 28–31, allowed recognition of the lower part of lower Eocene Zone P6, based on the co-occurrence of *Morozovella subbotinae, M. velascoensis*, and *Pseudohastigerina micra. Morozovella marginodentata* is particularly common in these faunas, although acarininids and globigerinids dominate the fauna. Benthic foraminifers are rare and small in size.

Paleocene (Samples 525A-29,CC to 525A-40-2, 6 cm)

The Paleocene/Eocene boundary interval is located in Core 32 on the basis of the overlap between *Morozovella subbotinae* and *M. velascoensis* and the apparent absence of *Pseudohastigerina micra*. The disappearance of the benthic *Gavelinella beccariiformis* is the best criterion for recognizing this boundary here.

Faunas of upper Paleocene Zone P5 (Cores 33–36) consist predominantly of globigerinids and small, round-edged acarininids. Morozovellids are represented by *M.*

velascoensis, M. marginodentata, M. acuta, and rare *M. aequa. Nuttalides truempyi* is the most common of the benthics, which increase in overall abundance lower in this zone.

In Zone P4, located in Core 36, the moderately well preserved faunas include the nominate taxon *Planorotalites pseudomenardii*, which is small and delicate, *M. velascoensis, Chiloguembelina midwayensis*, and *Acarinina* cf. *nitida*. Acarininids and globigerinids dominate the faunas; *Chiloguembelina* spp. are very rare.

The Core 37 core catcher contains fossils from Zone P3b, including *M. pusilla pusilla, M. velascoensis*, and *A. primitiva*, but no *M. conicotruncata*. Zone P3a was located in 38-CC by the presence of the nominate taxa. The overlap of *M. uncinata* and *M. angulata* occurs in the basal portion of Zone P3a.

Benthic foraminiferal faunas are dominated by *N. truempyi* and the buliminids, but several fragments of large agglutinants were found. Benthic genera increase in size, but not diversity below this level and through the lower Paleocene.

Cretaceous

Transition Tertiary to Cretaceous (Samples 525A-39,CC to 525A-40-2, 6 cm)

The span from Section 39,CC to 525A-40-2, 6 cm contains mixed faunas from lowermost Paleocene Zones P1a, b, and "*Globigerina*" *eugubina*, as well as from the uppermost Maestrichtian. Fossils from P1b (formerly P1a of Berggren, 1972) dominate the faunas in Section 39,CC, but most of the foraminifers are fragmented. The "*G.*" *eugubina* Zone fauna dominates the sample at 40-2, 6 cm; however, fossils from both P1b and the Cretaceous were also found in this sample. The foraminifers occur in a matrix of clay, quartz, volcanic glass, glauconite, and other unidentified mineral particles. Owing to dissolution of the planktonic foraminifers, benthic species are enriched and particularly abundant. Most common species include *Gavalinella beccariiformis*, presumed the most solution-resistant; *Nuttalides truempyi; Anomalinoides aragonensis; Osangularia mexicana;* and large fragments of *Chrysalogonium* sp.

Evidence from the nannofossils locates the actual Cretaceous/Tertiary boundary around Sample 525A-40-2, 11 cm; no hiatus is inferred despite mixing of the sediments and the presence of allochthonous sediments.

Maestrichtian (Samples 525A-40-2 to 525A-60,CC)

The uppermost Maestrichtian *Abathomphalus mayaroensis* Zone is located in Section 525A-40-2 through Core 525A-49, on the basis of abundant *Globotruncana contusa, Racemiguembelina fructicosa*, and *A. mayaroensis*. These five species are concentrated by dissolution in all samples. Glass and mineral fragments are scattered throughout these samples. Only the most resistant benthic foraminifers occur consistently. *Nuttalides truempyi* is absent, and lagenids and buliminids occur only sporadically.

The lower Maestrichtian *G. tricarinata* Zone fauna occurs in Cores 45 to 49 in loose sediment, in Cores 50 to 52 within an *Inoceramus* ooze, and in 53 to 60 as sediment intercalated in basalt. All faunas are very poorly preserved, particularly within the basalt. The few resistant foraminifers include the planktonic *G. tricarinata, G. fornicata, Pseudotextularia elegans, Heterohelix globulosa*, and *Gublerina* sp. Radiolarians are found in Samples 45,CC, 46,CC, and 50,CC.

At the top of the lower Maestrichtian section, the benthic faunas are typical of upper slope depths. Faunas include bathyal and shelf benthic species of *Lenticulina, Marginulina, Palmula*, and *Nodosaria*, fragments of very large benthic species, and large amounts of mollusks and bryozoans at the bottom of the section, at the top of and within the basalts, suggesting that shelf debris was emplaced by gravity flows throughout most of the lower Maestrichtian section.

Summary

Foraminifers and nannofossils occur in all sediment samples of Pleistocene to Maestrichtian age in Hole 525A and of Pleistocene to middle Eocene age in Hole 525B. Only Maestrichtian radiolarians occur in sediments at the bottom of Hole 525A. Investigation primarily of core samples from these holes revealed the following:

1) In general, the nannofossils are only moderately well preserved, but preservation of foraminifers is generally good. In the Neogene sequence, nannofossil preservation is moderate. Counts of foraminiferal fragments indicate little dissolution except at one level in the uppermost Miocene just below the Miocene/Pliocene boundary and in sediments above the apparent hiatus in the middle Miocene. Most dissolution in the Neogene is considered to have occurred within the sediments, since both the planktonic and benthic foraminifers are fragmented and since the benthic forms always comprise less than 1% of coarse-fraction faunas. Paleogene nannofossils are moderately to poorly preserved. Both foraminifers and nannofossils are particularly badly preserved in the middle to lower Eocene, and many species are presumed eliminated by dissolution. Preservation of both groups is poor across the Cretaceous/Tertiary boundary; most planktonic foraminifers are preserved only as fragments, and benthic foraminifers are enriched. Foraminiferal and nannofossil preservation is poor through the Maestrichtian, but particularly so in the sediments intercalated within the basalt in the bottom cores of Hole 525A.

2) Dissolution removal of species or intense overgrowth, particularly of the discoasters, renders nannofossil zonation particularly difficult in the middle Miocene, and lower Miocene floras lack index fossils.

3) Most foraminiferal index species are lacking throughout the Neogene section, presumably because of ecologic exclusion. In the Eocene, index species are presumed lost because of dissolution and recrystallization of the planktonic forms, which are particularly intense in the middle Eocene. Paleocene and Maestrichtian faunas, despite dissolution, are amenable to zonation owing to the wide geographic ranges of Paleocene species and the fact than many Maestrichtian index species are solution-resistant.

4) The composite section from all three holes contained a nearly complete Neogene sequence, the upper Oligocene, middle through lower Eocene; a nearly complete Paleocene, including the Cretaceous/Tertiary boundary; and a possibly complete Maestrichtian. Missing foraminiferal zones include those at the top of the Pleistocene, N10–N12 of the middle Miocene, the lower Oligocene through the upper Eocene, and a small portion (Zones P1c–P2) of the lower Paleocene.

5) Planktonic foraminiferal faunas throughout the sequence are characteristic of temperate water masses; in the Pliocene, subtropical elements occasionally become more abundant. The lack of various globoquadrinids and members of the *Turborotalia acostaensis* lineage in the upper Miocene and Pliocene suggests location in a low productivity region. The relatively large number of boreal Neogene planktonic foraminifers attests to the connection with the Indian Ocean and higher latitude regions throughout the Paleogene and Neogene. Incursion of some forms typical for the Indian Ocean into the South Atlantic underscores this connection and may be useful in identifying times of water mass boundary fluctuations.

6) The discoaster:*Chiasmolithus* ratio of Bukry (1973) is high at Site 525, suggesting warm conditions in the middle to lower Eocene above Core 525A-27 (Zone NP12). In these floras, nannofossils are diverse and many giant specimens occur. Conditions are significantly cooler in underlying Zone NP11, as indicated by the abrupt decline in numbers of discoasters and the large nannofossils. The appearance of the cooler flora is surprising, as the lower Eocene is considered by most authors to be the warmest interval in the Tertiary.

7) Benthic foraminifers comprise less than 1% of the foraminiferal faunas except in sediments above the Cretaceous/Tertiary boundary, where they are concentrated by dissolution. Neogene benthic faunas are diverse and dominated by the miliolids, with subsidiary amounts of *Planulina wuellerstorfi* and *Globocassidulina subglobosa*. Benthic foraminifers are surprisingly fragmented in these faunas. Paleogene benthic faunas are less diverse and dominated by *G. subglobosa* in the Oligocene through Eocene but by *Nuttalides truempyi* and *G. beccariformis* in the Paleocene. In Paleocene Zone P3a, there is a decrease in the size of most benthic species, which then remain smaller through the course of the Paleocene. This change is size is interpreted to represent either a deepening of the site or a downslope movement of larger benthic faunas during the temperature maximum of the Paleocene. Maestrichtian benthic faunas are dominated by *G. beccariiformis* at the top of the section, but by the gyroidinids lower in the Maestrichtian. Such faunas are considered indicative of slope depths. Shallower depths are indicated in the lower levels of the lower Maestrichtian by the abundance of the mollusk *Inoceramus;* of benthic shelf species of the genera *Palmula, Marginulina, Lenticulina*, and *Nodosaria;* and of large amounts of invertebrate fossil debris, including some bryozoans. The lowest samples from Hole 525A, both at the top of and within the basalt, are interpreted to represent slope depths; shelf depth sediments were emplaced by gravity flows throughout the lowermost Maestrichtian.

SEDIMENT ACCUMULATION RATES

One of the objectives of the present leg is to compare the accumulation rate of various sedimentary components at different water depths under what we assume to be similar rates of input. The time scales used are discussed in the Introduction. We have chosen to break Figures 8A and 8B into segments from 0 to 3.0 m.y., 3.0 to 4.4 m.y., and 4.4 to 10.5 m.y. Rates in Figure 9 present average accumulation. Figure 9 also indicates the accumulation rate (cm/10^3 y.) estimated for each segment.

Figure 8A shows data for Hole 525A (for clarity we have ignored the data in the time range covered by Fig. 8B). A single rate has been estimated for the early Miocene, chosen to cross the line derived in Figure 8 at 13.5 m.y. It is at present not clear whether or not the section is absolutely continuous in the early–mid-Miocene.

There is almost certainly a hiatus in accumulation covering the late Eocene and much of the Oligocene. We have modeled the remainder of the Eocene and much of the Paleocene with a single rate. Magnetic data (this volume) provide estimates for the early Paleocene and for the Late Cretaceous. Again, the rates estimated are shown at the lower part of Figure 8A. Over the time intervals as defined, the estimates probably are good to about ±20%. However, two comments should be made. First, the data in Figure 8A cannot be satisfied without invoking accumulation rate changes by a factor of two, yet the general impression is of long-term consistency of sedimentation (aside from the hiatus). The points chosen to define the intervals over which accumulation rate is estimated are chosen because we hope to be able to correlate them accurately with other sites. They are not necessarily good estimates of the times at which sedimentation rate changed.

From the gravimetric data (see physical properties chapter, this volume), we have estimated the average weight of dry sediment per cubic centimeter wet sediment [(wet-bulk density, g/cm^3) × (100 − % wet-water content) ÷ 100]. This enables us to estimate the accumulation rate, g/cm^2/10^3 y. Figure 9A shows the accumulation rate for Hole 525B in cm/10^3 y., and Figure 9B shows the data converted by g/cm^2/10^3 y. The figures are almost indistinguishable.

We have also made a preliminary estimate of the accumulation rate of foraminifers (taken as that part of the sediment retained by a 63-μm sieve). The sediment was weighed wet—it was not allowed to dry out at all—and then washed on a sieve. The fraction retained was dried and weighed. The accumulation rate of foraminifers is estimated as [(accumulation, cm/10^3 y.) × (wet-bulk density, g/cm^3) × (weight dry foraminifers per gram wet sediment)]. This is shown in the lower part of Figure 9D.

The accumulation rate for $CaCO_3$ is obtained easily from the foregoing data combined with the weight percent $CaCO_3$ and is shown as the total in Figure 9D. By subtraction, the portion of this carbonate not repre-

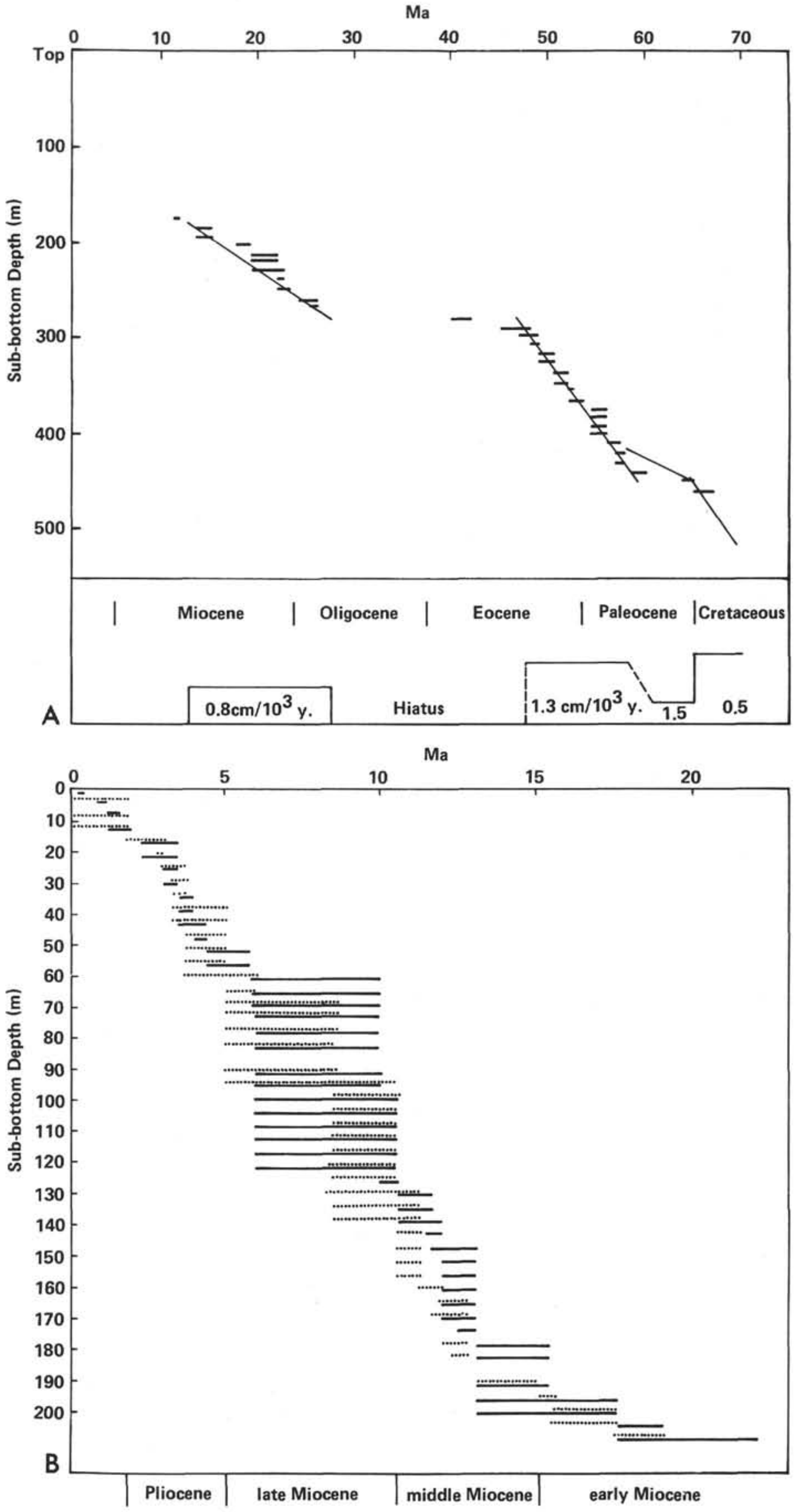

Figure 8. Age-depth plot for (A) Hole 525A (combined nannofossils and foraminifers) and (B) Hole 525B (Horizontal lines represent ranges in ages determined by nannofossils [solid line] and foraminifers [dashed line]).

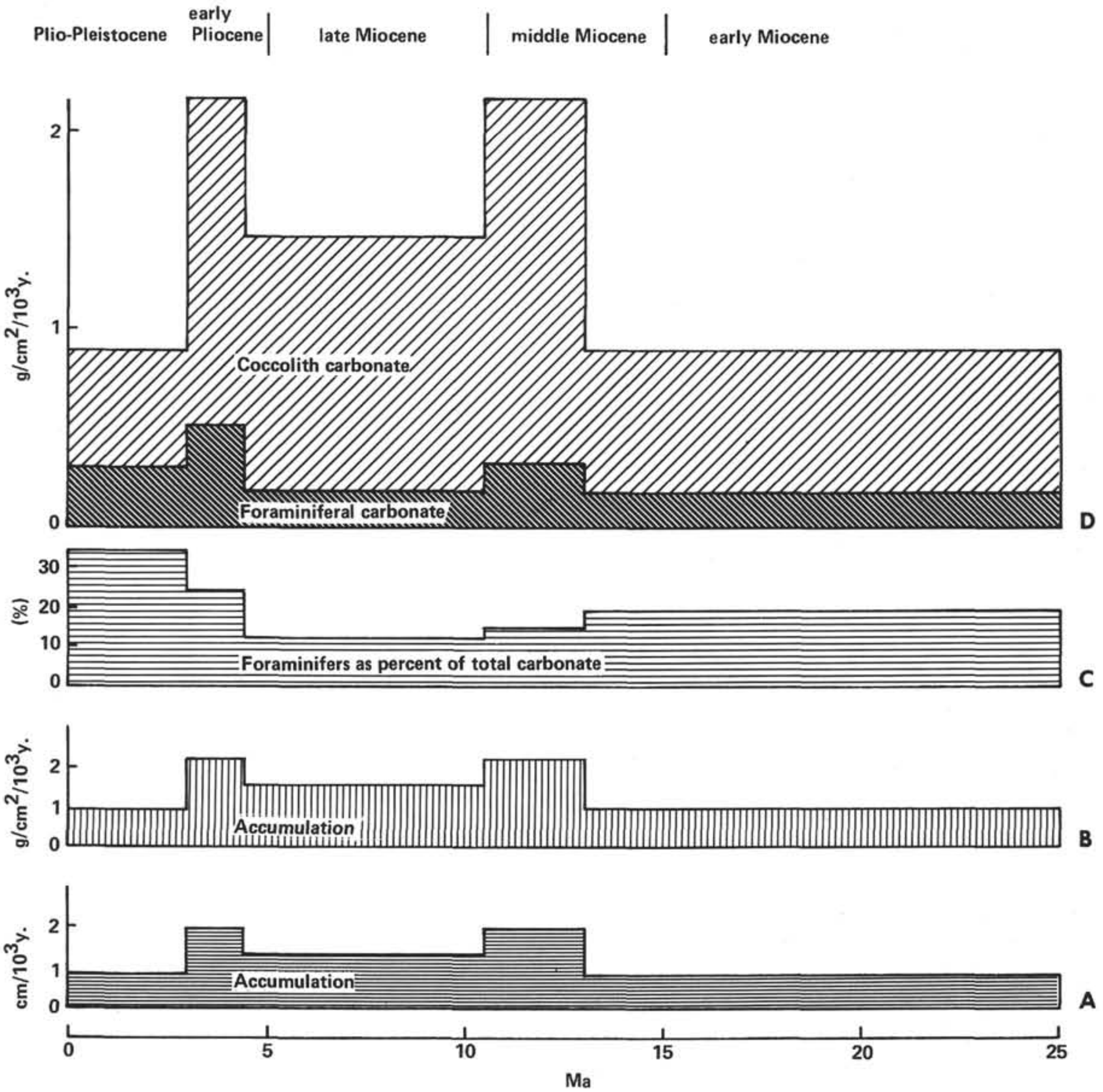

Figure 9. Estimates and comparison of accumulation rates in g/cm²/10³ y. to cm/10³ y. for Hole 525B and foraminifers and coccolith accumulation rates.

sented by foraminifers is taken to be coccoliths. Figure 9C shows the ratio of the two carbonate components.

The foraminiferal component varies considerably on a short scale as well as over the broad intervals depicted in Figure 9. The measurement is often used as an index of seafloor dissolution; however, it is not yet clear whether this would be appropriate here or whether the variations are primarily an indication of variations in the production ratio of foraminifers to coccoliths.

IGNEOUS PETROLOGY

Introduction

Basement drilling on Leg 74 was designed to address various questions concerning the nature and origin of the aseismic Walvis Ridge. The classic interpretation of this feature (and its counterpart in the southwestern Atlantic, the Rio Grande Rise) has been that it represents a hot spot track formed during opening of the South Atlantic. The hot spot would be presently located somewhere in the vicinity of the island of Tristan da Cunha. Although alkalic basaltic material had also previously been dredged from the vicinity of the ridge, a volcanic origin for the ridge as a whole could not be assumed. Its origin as a passive margin consisting of continental basement was not beyond the bounds of possibility. An alternative hypothesis holds that the Walvis Ridge consists of a series of segments alternately parallel to the paleoridge axis and transform fault directions. The Leg 74 transect was located on a segment whose direction of elongation suggested formation parallel to the ridge axis.

If basement was found to be volcanic, then the following could be determined:

1) Age—the age of basaltic extrusives (or intrusives) could range between that of adjacent ocean crust and recent time.

2) Environment of extrusion—subaerial or subaqueous, depending on ridge subsidence history.

3) Primary chemistry—tholeiitic or alkalic affinities resembling those of either normal mid-ocean ridge basalts or ocean island or continental rift basalts.

4) Degree of alteration—possible radical extent of basalt alteration.

Procedures

Procedures used in pursuit of these determinations are those established on previous legs:

1) Age of basement, as given by the age of oldest sediments overlying basalt and compared with the age of nearest ocean basin magnetic anomalies.

2) Environment of extrusion by macroscopic examination of basalt morphology.

3) Primary chemistry—shipboard petrographic study, to be followed by shore-based geochemical study of the major and trace element and isotopic character of freshest basalts.

4) Degree of alteration by macro- and microscopic study of the nature and extent of basalt alteration. The revised ICD alteration terminology espoused in the Leg 73 Hole Summaries has been utilized.

Summary

Hole 525A was drilled on the crest of the Walvis Ridge and reached basaltic basement at a sub-bottom depth of 575 meters. Drilling in basalt was terminated at 678 m sub-bottom depth, corresponding to a thickness of 103 m. The sampled portion of the basement complex consists of basalt pillows and flows with minor intercalated sediments at depths of 593, 596, 625, and 647 m. Of 55 m of material recovered (average recovery rate of 53%), 50 m were basalt. The intercalated sediments form the basis for subdivision of the basalt pile into five units. A stratigraphic column indicating this subdivision, together with lithology and details of recovery, is presented in Figure 10.

Unit 1 is approximately 21 m thick and immediately underlies chert at the base of the sediment pile. It consists of a fine- to medium-grained aphyric basalt. It is light green gray in color and moderately to badly altered. The coarser basalts have subophitic textures. The recovery rate of 30–40% and the degree of alteration preclude strict definition of the size and nature of cooling unit(s), but very fine grained upper and lower margins and medium-grained interior(s) indicate flow(s). Unit 1 is separated from Unit 2 by an 80+-cm-thick claystone layer of volcaniclastic origin. Unit 2 is perhaps 4 or 5 m thick and identical in appearance to Unit 1. At its base there is another 10+-cm-thick volcaniclastic claystone layer.

Unit 3 is approximately 22 m thick and consists of highly vesicular fine- to coarse-grained aphyric to sparsely plagioclase and clinopyroxene phyric basalt. The basalt is medium gray, has a subophitic texture, and is slightly to moderately altered with vesicles generally filled by carbonate. Although the upper margin was not recovered, the lowest meter of this unit shows a progressive decrease in grain size to an aphanitic base. This might represent a single cooling unit. Unit 3 is immediately underlain by a 1.6-m-thick calcareous mudstone layer bearing shallow-water faunal debris.

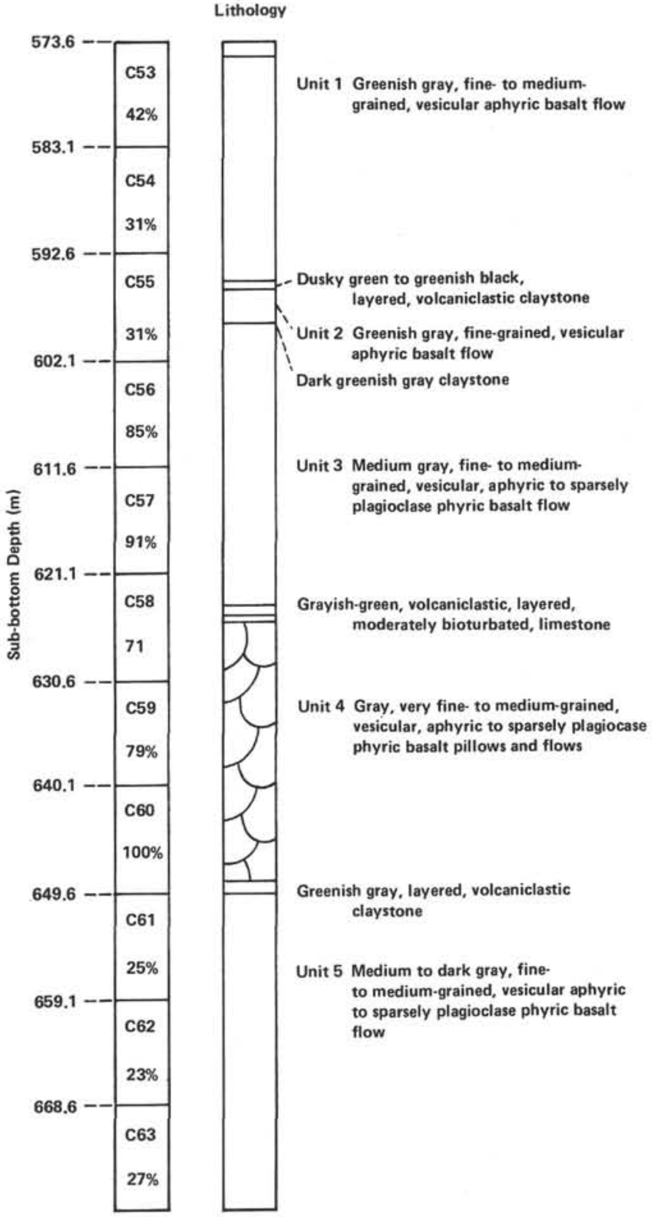

Figure 10. Lithostratigraphic summary of basement complex at Hole 525A.

Unit 4 is approximately 20 m thick and comprises a distinct pillow basalt sequence. The basalt is medium gray, moderately vesicular and aphyric to sparsely plagioclase and clinopyroxene phyric. Textures are dominantly subophitic. Alteration consists of carbonate filling of vesicles and voids and partial replacement of pillow margins by carbonate and green smectite. A minimum of 25 pillows and/or thin flows are distinguishable. These vary from 10 cm to 4.3 m in preserved thickness within three cores (58–60), with recoveries of 71, 79, and 100%. The details of this subdivision into cooling units are listed in Table 5. The majority of the chilled margins of these cooling units have reasonably fresh glass rinds. Pillow structures are indicated by the location of some of these glassy chilled margins down the sides of oriented pieces. Below a 30-cm-thick basal pillow, the unit rests on a 2.8-m-thick volcaniclastic claystone.

Hole 525A was terminated 28 m into Unit 5, 7 m of which were recovered. The unit consists of probable flows of dark gray moderately vesicular glassy and fine-grained basalt, grading into medium- to coarse-grained sparsely plagioclase phyric basalt with subophitic textures and few vesicles. The latter comprises the macroscopically freshest basalt recovered in this hole.

The basalt sequence just described is interpreted as the upper portion of Walvis Ridge basement. The biostratigraphic age of the oldest sediment overlying the basalt pile (see biostratigraphy section), and the intercalated mudstone is lowermost Maestrichtian (approximately 70 m.y. old). This is in excellent agreement with the 70-m.y. age of basement derived by magnetic anomaly correlation with Hole 525, on the edge of Anomaly 32. Based on the occurrence of glassy chilled margins, we consider the environment of basalt extrusion to be definitely subaqueous for Units 4 and 5 and probably subaqueous for Units 1, 2, and 3. No evidence of sediment baking at upper basalt margins, indicative of sill intrusion, has been detected.

Table 5. Stratigraphic position and preserved thickness of pillows and flows in Unit 4 of basalt pile (upper margin) in Hole 525A.

Core/Section (level in cm)	Thickness (cm)
58-3, 105	46
58-4, 18	22
58-4, 40	78
58-4, 108	100
58-5, 72	135
59-1, 28	24
59-1, 52	64
59-1, 116	72
59-2, 42	24
59-2, 66	32
59-2, 98	146
59-3, 96	20
59-3, 116	66
59-4, 36	22
59-4, 58	30
59-4, 88	78
59-5, 28	32
59-5, 60	52
59-5, 112	16
59-5, 128	28
59-6, 8	34
59-6, 42	8+
60-1, 0	72
60-1, 72	72
60-1, 144	30
60-2, 30	420
60-5, 24	28

Of prime interest is the question of whether these are tholeiitic or alkali basalts. Distinguishing these two compositional types on the basis of petrography is difficult. The available observational data are entirely consistent with a tholeiitic compositional character for the sequence of recovered basalts. None of the few mineralogical characteristics often associated with alkali basalts (presence of pleochroic titan–augite, alkali feldspar, abundant apatite) were detected. An unequivocal distinction cannot, however, be drawn without shore-based determination of major and trace element chemistry.

Petrography

Basalt petrography is very uniform, with aphyric to sparsely plagioclase and clinopyroxene phyric basalt with subophitic texture predominating. Plagioclase is the most abundant mineral, forming between 50 and 60% of the basalt. It forms laths with average sizes ranging from 0.3 × 0.02 mm to 0.8 × 0.15 mm. Its morphology shows the most variation in the pillows and flows of Unit 4. Both plumose and skeletal forms are observed in several of the cooling units. One of the units has phenocrysts (1.5 × 0.2 mm) that show excellent polysynthetic twinning. Twin extinction angle measurements, using the Michel-Levy method, suggest an approximate plagioclase composition of labradorite (An_{60}). At the base of Unit 4 a few large xenocrysts (1.5 × 1 mm) with partially resorbed margins are observed. Plagioclase has undergone minimal alteration.

Clinopyroxene is the second most abundant mineral, forming between 35 and 45% of the rock. It assumes both subhedral and anhedral shapes, varying in average size from 0.02 × 0.02 mm to 0.2 × 0.2 mm. It has a slightly greenish tinge, lacks pleochroism, and has a moderate extinction angle (approx. 30°). Pyroxene from a Unit 5 glassy margin is identified as augite. The degree of alteration varies from moderate, affecting the grain boundaries only, to extreme, in which the grain has been completely altered to clay minerals.

The presence of olivine in these basalts is suspected but has yet to be confirmed. Olivine is known to be readily susceptible to alteration. Since clinopyroxene has generally suffered local alteration, original olivine may well have assumed the guise of clay alteration minerals.

Opaques are present as both primary and secondary phases, forming between 2 and 10% of the groundmass. No attempt has been made to distinguish between magnetite, which is probably dominant, and other opaque minerals. Pyrite is probably also present, given its macroscopic abundance in veins and vesicles. The opaques occur as subhedral and anhedral interstitial forms and as needle-like laths dispersed throughout the groundmass. The needle laths are more abundant in the finer-grained basalts. Opaques frequently form a rim or partial rim around vesicles.

Glass is present in the groundmass matrix of some of the fine-grained basalts and dominates in glassy chilled margins. In the latter, it has an orange brown, nonpleochroic coloration and has undergone local devitrification. When it occurs interstitially within the groundmass, it is usually altered to clay minerals.

Vesicles form between 0 and 30% of the rock. Their rims are usually altered to pale brown, nonpleochroic clay minerals. Fine-grained zeolites (particularly natrolite) occur adjacent to the clay minerals and are often accompanied by a very fine grained, highly birefringent mineral, interpreted to be sericite. When vesicles are filled, the dominant secondary mineral is calcite.

Conclusions

In Hole 525A on the crest of the Walvis Ridge, a 100-m sequence of basalts consisting of pillows and flows, with minor intercalated volcaniclastic sediments, was recovered from Walvis Ridge basement. Their age is identical to that of basaltic ocean crust in the adjacent ocean basins, and their morphology and petrography are consistent with formation at a mid-ocean ridge.

MAGNETICS

Samples were obtained in Cores 525A-38 to 525A-52, in the interval between 20 and 40 cm. Thirteen pilot samples were given detailed alternating field demagnetization treatment, and a cleaning field of 150–250 Oe was selected. Details may be found in the sedimentary paleomagnetism chapter (Chave, this volume). The polarity interpretation is contained in Figure 3. Six normally polarized intervals are recognized and are consistent with Anomalies 28–32, using the time scale of Ness et al. (1980). Basement age is placed at Anomaly 32 time (~70 Ma), consistent with formation contemporaneously with the surrounding ocean basins.

The paleomagnetic samples from the hydraulic piston cores at Site 525, Hole 525B, were measured with the shipboard spinner magnetometer and later on a cryogenic superconducting rock magnetometer at the Woods Hole Oceanographic Institution. The remanence was too weak to measure on the spinner system. The white nannofossil ooze of Pleistocene to late Miocene age was not measurable even with the SRM, with a remanence intensity near 10^{-9} emu. The middle to early Miocene material below the color change to light tan was measurable but proved to possess an unstable remanence. The instability is believed to be caused by a very strong tendency to acquire viscous remanent magnetization. The pattern established in this hole was repeated at the other hydraulic piston core sites, and no usable information was obtained.

PHYSICAL PROPERTIES

The downhole physical properties are shown in Figure 11; for details, see Table 6. The upper part of the sequence (Subunit Ia), composed of calcareous ooze, is relatively uniform not only in lithology but in physical properties, with the exception of the uppermost 20 to 30 m. In this top section, the gravimetrically determined wet bulk density is less than 1.7 g/cm³. The GRAPE-density data, obtained from cores in Hole 525B, are not reliable in this uppermost part of the section. Together with the relatively low bulk density data, the wet water content and porosity values of this section are distinctly higher than in the sequence below (water content >35%; porosity >55%). As a result, shrinkage reaches its highest value in the upper part of the sequence, with maximum values of 7 to 12.7% of volume. The other properties do not show any distinct difference from the deeper sequence. The bulk sequence of Subunit Ia shows only minor trends. Wet-bulk density is about the same throughout the whole section, with slight scatter. The 2-min. count GRAPE-densities are somewhat higher than the gravimetric data. Wet water content shows a slight trend of decreasing water content with increasing depths, and in the lower third of this subunit water content decreases to about 30%. The same trend can be seen in the porosity data; grain density shows no trend and some scatter. No differences between the gravimetric data obtained from rotary-drilled cores and those obtained from HPC cores were found.

Although the scattering of shrinkage is very high because of sampling disturbance and difficulty in measuring the shrunken samples, there is a slight trend in Subunit Ia to lower shrinkage with increasing depth. Vane shear strength and needle penetration both reveal a wide scatter while showing no clear trend. Shear strength is less than 150 g/cm² (=15 kPa). Needle penetration varies between 4 and 15 mm. The sonic velocity and thermal conductivity of the sediments of Subunit Ia do not show any trend and vary around a mean value of about 1.6 km/s and 1.5 W/m °C (≙3.6 mcal/cm °C s), respectively.

In Subunit Ib, the transition zone between oozes and chalks, the trends which were only slight in Subunit Ia become more obvious, thus showing the beginning of distinct diagenesis. Most of the changes occur in the lower third of Subunit Ib, at a depth of about 400 m sub-bottom. The bulk of the gravimetric density samples from this unit were cylindrical samples as in Subunit Ia, but on a few indurated layers bulk pieces samples were taken. Toward the bottom of Subunit Ib wet-bulk density increases sharply. Water content and porosity show a clear decrease, and grain density seems to increase slightly. Shrinkage shows a further decrease in this subunit, with wide scatter.

Although variation of shear strength is very large, it is obvious that it increases considerably with depth. The highest value measured is about 855 g/cm² (=85.5 kPa), and zones of high shear strength coincide with layers of low carbonate content (about 80% $CaCO_3$). The mean shear strength of this subunit is about 230 g/cm² (=23 kPa).

Sonic velocity increases from the top to the bottom of Subunit Ib. Only thermal conductivity does not show distinct change, and its mean value for this subunit is 1.7 W/m °C (≙4.07 mcal/cm °C s).

A main characteristic of Unit II (marly chalks with increasing amount of volcanogenic clastics) is a wide variation of all parameters, especially bulk density, porosity, and sonic velocity. This is due to the varying lithology, as expressed in the wide range of carbonate content in this unit. From this section (and from Unit III below) only bulk samples were taken. The gravi-

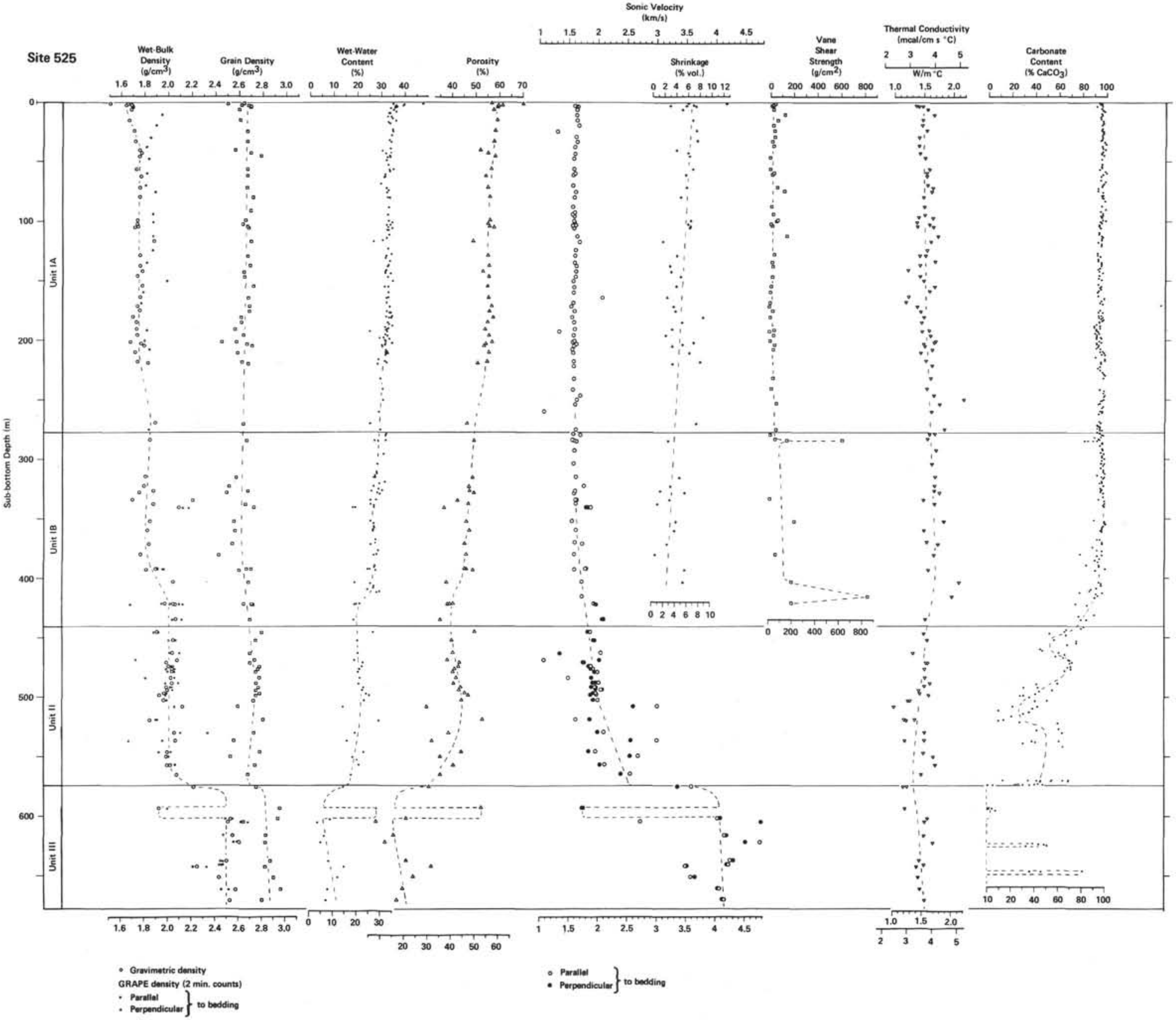

Figure 11. Summary of downhole physical properties, Site 525.

Table 6. Physical properties summary, Site 525.

Sample (interval, level in cm)	Sub-bottom Depth (m approx)	2-Min. Count GRAPE Density (g/cm^2)		Gravimetric Data				Shrinkage (vol.%)	Vane Shear Strength ( ) = remolded (g/cm^2)	Penetrometer (mm) Fall Height 0 cm 1	Sonic Velocity		Acoustic Impedance		Thermal Conductivity (W/m °C)
		∣ to Bedding	⊥	Wet-Bulk Density (g/cm^3)	Approx. Grain Density (g/cm^3)	Salt-Corrected Wet-Water Content (%)	Salt-Corrected Porosity (%)				∣ to Bedding (km/s)	⊥ (km/s)	∣ to Bedding (10^5 g/cm^2 s)	⊥	
Hole 525															
1-2, 52–64	1.1			1.66	2.50	34.9	56.7	6.1		11.5					
1-3, 9–11	3.1			1.70	2.70	35.7	59.4	5.7	31 (15)						
1-3, 39–51	3.4			1.70	2.70	35.6	59.4	7.5	21 (13)	33.8	1.62		2.75		1.41
Hole 525A								12.7	46 (12)	11.9					
								7.0		11.7					1.28
1-1, 128–134	1.3			1.51	2.64	47.6	70.0		21 (1)	12.0	1.65				1.48
1-2, 98–105	2.5			1.64	2.62	38.2	61.2								
1-3, 32–40	3.4					33.6									
3-1, 40–41	42.0					34.3									
3-3, 80–81	45.4			1.76	2.79	33.9	58.2	6.3							
4-1, 89–91	52.0					32.9									
5-2, 140	92.0										1.60				
5-5, 128–132	96.4										1.58				1.42
6-2, 63–64	100.7					34.5									
6-3, 36	102.0									15.5					
6-3, 64–78	102.3			1.74	2.63	32.4	55.2	6.1	11 (11)						1.60
6-3, 104–105	102.6									12.6					
6-3, 144	103.0										1.62		2.81		
6-4, 66	103.7									9.6					
6-4, 125–139	104.4			1.75	2.67	32.8	56.0	6.6	28 (19)	10.2	1.56		2.73		1.67
6-6, 33–35	106.4					32.5									
7-5, 28–38	171.4			1.74	2.69	33.7	57.2	3.7	1	12.4	1.53		2.67		1.40
8-2, 140–141	176.5					33.7									
8-3, 140–141	179					34.8									
8-4, 132–142	180.5			1.70	2.62	34.6	57.4	8.8	7		1.56		2.64		1.52
8-5, 139–140	182.0					33.5									
9-1, 80–88	184.9			1.73	2.62	32.8	55.4	5.2			1.58		2.73		1.48
9-2, 80–82	186.4					33.5									
9-3, 28–30	187.4					35.0									
9-4, 95–97	189.6					33.2									
9-6, 37	192.0									5.4					
9-6, 89–97	192.5					32.8			2	12.3	1.32				1.49
10-3, 84–86	137.5					29.5									
10-4, 73–74	138.8					33.6									
10-5, 74–76	200.3					32.0									
10-5, 138–142	201.0										1.57				1.69
10-6, 73–76	201.8			1.68	2.58	34.8	57.3	7.1							
10-7, 52–63	203.1			1.77	2.67	31.7	54.7	5.2			1.63		2.88		1.51
11-3, 147–148	207.6					32.2									
11-4, 146–147	203.1					32.6									
11-5, 123–128	210.3			1.72	2.59	33.0	55.5	6.4			1.57		2.70		1.46
11-6, 123–124	211.8					32.0									
12-2, 145–146	215.6					28.9									
12-3, 140–147	217.0					31.7					1.58				1.56
12-4, 116–118	218.3			1.74	2.63	32.4	55.2	8.2							
12-5, 96–98	219.6			1.83	2.68	28.7	51.2	3.5							
12-6, 90–94	221.0										1.58				1.66
13-7, 54–56	231.6					29.8			36		1.58				1.63
14-6, 132–144	240.5					30.8			23		1.56				1.57
15-4, 50–54	246.1										1.69				1.69
15-6, 103–112	249.7					30.9					1.63				2.19
16-2, 73	252.8									4.1					
16-2, 114–119	253.3								66	4.05	1.61				1.79
16-6, 110–123	259.3					29.1					1.06				1.65
19-7, 13–30	279.1					32.2			72		1.69				1.62
20-3, 94–106	283.1					32.4			62		1.56				1.59
21-3, 63–68	292.3										1.59				1.73
21-5, 39–40	295.0					31.4									
22-4, 90–100	303.6					28.8					1.59				1.66
23-2, 126–128	310.4					28.4									
23-3, 119–121	311.8					28.5									
23-4, 126–128	313.4					27.7									
23-5, 120–129	314.9					27.2					1.61				1.71
23-5, 142–145	315.0			1.81	2.58	27.9	49.3	4.7							
24-1, 146–148	318.6					31.9									
24-2, 130–132	319.9					29.5									
24-4, 81–88	322.4			1.80	2.52	27.1	47.7	3.3			1.76		3.17		1.70
24-5, 86–88	324.0					29.3									
24-6, 86–88	325.5					30.6									
24-7, 54–63	326.6			1.88	2.68	26.1	48.0	1.6			1.61		3.03		1.70
25-1, 126–136	327.9			1.76	2.50	28.9	49.7	5.7			1.60		2.80		1.79
25-2, 26–28	328.4					29.7									
25-6, 12	334.2										1.63				
25-6, 17–30	334.3			1.70	2.21	25.8	42.7	3.1	17		1.62	2.76			1.51
25-7, 20–22	335.8					28.1									
26-1, 136–145	337.5			1.88	2.66	25.9	47.5	1.1			1.63	3.06			1.70
26-2, 124–126	338.8					27.2									
26-3, 76–78	339.9					27.4									
26-4, 11–13	340.3	2.13	2.18	2.10	2.73	18.1	37.1				1.88	1.83	3.95	3.84	
26-4, 12–14	340.3					19.2									
28-1, 52–58	352.2			1.85	2.56	25.8	46.5	4.2	218		1.56		2.88		1.86
28-2, 52–55	353.6					27.0									
29-1, 88–90	356.0					27.1									
29-2, 76–78	357.4					27.4									
29-3, 76–78	358.9					26.7									
29-4, 21–25	359.8										1.62				1.53
29-4, 40–42	360.0			1.83	2.57	26.7	47.7	4.0							
30-2, 107–109	367.2					28.0									
30-4, 107–114	370.2					27.6					1.60				1.57
30-5, 74–85	371.4			1.84	2.55	25.6	46.0	2.8			1.73		3.18		1.76
31-2, 82–84	376.4					28.8									
31-4, 123–125	379.8					28.2									
31-5, 3–18	380.2			1.77	2.43	27.0	46.7	0.7	57		1.58		2.80		1.70
32-4, 114–116	389.2					27.6									
32-5, 60–62	390.2					27.5									
32-6, 110–112	392.2	1.97	1.36	1.91	2.67	24.7	46.0				1.80	1.82	3.43	3.48	

Table 6. (Continued).

Sample (interval, level in cm)	Sub-bottom Depth (m approx)	2-Min. Count GRAPE Density (g/cm^2)		Gravimetric Data				Shrinkage (vol.%)	Vane Shear Strength ( ) = remolded (g/cm^2)	Penetrometer (mm) Fall Height		Sonic Velocity		Acoustic Impedance		Thermal Conductivity (W/m °C)
		∥ to Bedding	⊥	Wet-Bulk Density (g/cm^3)	Approx. Grain Density (g/cm^3)	Salt-Corrected Wet-Water Content (%)	Salt-Corrected Porosity (%)			0 cm	1	∥ to Bedding (km/s)	⊥ (km/s)	∥ to Bedding (10^5 g/cm^2 s)	⊥	
Hole 525A (Continued)																
32-6, 111–113	392.2			1.90	2.71	25.5	47.8									
32-7, 46–60	393.1			1.82	2.61	27.9	49.6	5.8		3.8		1.61		2.92		1.60
35-1, 106–118	403.7			2.05	2.69	19.0	38.1	5.5	193 (11)	3.75		1.73		3.54		2.13
35-2, 66–69	404.3					25.8										
35-3, 116–118	406.8					27.1										
35-4, 108–110	408.2					27.0										
35-5, 85–87	409.5					24.6										
35-6, 85–87	411.0					29.5										
35-7, 83–85	412.1					28.4										
36-4, 18–23	415.7								855 (169)	3.85		1.74				2.01
37-1, 24–26	421.8	1.95	2.14	1.98	2.65	21.3	41.1					1.93	1.93	3.82	3.83	
37-1, 30–34	421.9	2.02	2.10	2.05	2.72	19.9	39.7					1.97	1.97	4.04	4.05	
37-1, 49–54	422.1	1.69	2.13	2.07	2.73	19.2	38.7		197			1.99	1.96	4.12	4.06	
38-3, 88–92	435.0	2.04	2.12	2.07	2.70	18.6	35.6					2.10	2.08	4.34	4.30	1.56
39-4, 62–65	445.7	1.88	1.92	1.91	2.80	26.9	50.1					1.87	1.82	3.58	3.48	
39-5, 32–38	447.0															1.53
40-2, 79–100	452.6	2.01	2.07	2.05	2.75	20.2	40.3					1.92	1.91	3.95	4.06	1.59
41-3, 61–68	463.2	2.03	2.10	2.04	2.70	20.6	41.0					2.05	1.36	4.18	2.77	1.35
42-1, 23–25	469.3	1.73	2.08	2.08	2.74	19.1	38.7					1.08	2.03	2.25	4.22	
42-2, 56–67	471.2	2.00	2.00	1.99	2.70	22.5	43.9					1.77	1.74	3.53	3.47	1.57
42-4, 102–106	474.6	2.05	2.03	2.01	2.78	22.1	43.5					1.89	1.85	3.79	3.71	
42-6, 14–23	476.8	1.99	2.06	2.04	2.77	21.0	41.8					1.92	1.89	3.91	3.85	1.54
43-1, 35–38	479.0	2.00	2.06	2.04	2.75	20.5	41.0					2.00	1.95	4.07	3.98	
43-4, 81–90	484.0	1.81	2.06	2.03	2.78	21.3	42.3					1.50	1.89	3.04	3.84	1.55
44-1, 46–58	488.6	1.98	2.09	2.04	2.75	20.7	41.3					2.02	1.95	4.13	3.96	1.64
44-3, 99–103	492.1	2.02	2.04	1.99	2.77	22.7	44.2					1.95	1.89	3.89	3.76	1.54
44-5, 40–51	494.6	1.99	2.04	2.00	2.75	22.3	43.5					2.07	1.96	4.14	3.92	1.45
44-7, 9–18	497.2	1.99	1.99	1.97	2.78	23.9	45.9					1.97	1.91	3.87	3.76	1.46
45-1, 127–138	498.9	1.92	1.98	1.93	2.75	25.1	47.3					1.99	1.88	3.83	3.63	1.51
45-4, 62–74	503.3	1.98	1.99	1.97	2.73	23.3	44.7					2.00	1.93	3.94	3.80	1.29
46-1, 137–150	508.5	2.06	2.12	2.13	2.60	14.4	29.9					3.11	2.60	6.63	5.54	1.02
47-2, 121–131	519.4	1.91	1.90	1.85	2.81	29.5	53.4					1.62	1.87	2.99	3.45	1.29
48-3, 110–115	530.2	2.34	2.11	2.06	2.73	19.5	39.1					2.10	2.00	4.33	4.11	1.55
49-1, 131–150	537.0	1.96	1.67	2.07	2.56	15.9	32.1					3.01	2.56	6.22	5.29	1.38
50-1, 130–143	546.5	1.93	2.03	2.00	2.78	22.9	44.7					1.97	1.84	3.94	3.69	1.53
50-4, 50–64	550.2	1.98	2.01	1.99	2.53	18.4	35.7					2.69	2.55	5.35	5.08	1.69
51-2, 115–123	557.3	2.07	2.07	2.03	2.74	20.9	41.3					2.11	2.03	4.29	4.12	1.73
52-1, 140–150	565.6			2.08	2.68	17.6	35.9					2.55	2.39	5.31	4.98	1.49
53-2, 74–82	575.9	2.21	2.23	2.22	2.75	14.3	30.9					3.59	3.35	7.96	7.43	1.21
55-1, 118–127	593.8	2.00	1.93	1.93	2.95	28.2	53.0					1.75	1.72	3.38	3.32	1.21
56-1, 31–39	602.4	2.49	2.35	2.53	2.94	8.6	21.3					4.03	4.08	10.20	10.33	1.59
56-2, 140–150	605.0	2.64	2.68	2.51	2.64	3.4	8.3					2.72	4.78	6.82	12.0	1.55
57-4, 49–58	616.6	2.47	2.55	2.55	2.83	6.3	15.6					4.14	4.19	10.56	10.68	1.53
58-1, 99–111	622.1	2.58	2.59	2.61	2.83	4.8	12.1					4.77	4.51	12.44	11.76	1.69
59-5, 113–123	637.8	2.45	2.47	2.50	2.87	8.3	20.1					4.26	4.31	10.64	10.77	1.45
60-1, 105–112	641.2	2.47	2.46									4.22	4.22	10.31	10.30	1.53
60-2, 108–114	642.7	2.26	2.33	2.25	2.83	14.6	32.1					3.48	3.52	7.84	7.91	1.40
61-2, 27–33	651.4	2.19	2.31	2.44	2.90	10.2	24.3					3.58	3.66	8.72	8.92	1.43
62-2, 56–62	661.2	2.46	2.52	2.58	2.96	7.8	19.7					4.07	4.06	10.49	10.49	1.46
63-2, 71–79	670.9	2.54	2.52	2.53	2.80	7.0	17.2					4.14	4.11	10.47	10.40	1.54
Hole 525B																
1-1, 125–127	1.3					39.8										
1-2, 114–130	2.7			1.69	2.68	36.1	59.6	3.0	31			1.59		3.12		1.37
1-3, 125–128	3.5					36.6										
2-1, 128–130	4.8					33.9										
2-2, 124–143	6.3			1.69	2.60	34.9	57.6	5.1	39	5.88	7.63	1.63		3.19		1.57
2-3, 128–130	7.8					36.1										
3-1, 134–137	9.2					33.1										
3-1, 134–137	9.2					33.2										
3-2, 116–148	10.7	1.95							130	5.55	5.95	1.63		3.17		1.67
3-3, 91–93	11.8					34.2										
3-3, 134–136	12.3					32.6										
4-1, 135–137	13.7					34.6										
4-2, 23	14.0									5.55	5.2					
4-2, 117–138	15.1			1.67	2.61	36.1	59.0	6.9	69	5.5	8.0	1.63		2.72		1.48
4-3, 135–138	16.4					32.9										
5-1, 94–96	17.6					33.6										
5-2, 42	18.6									8.65	8.65					
5-2, 98	19.2								34							
5-2, 118–128	19.4	1.90										1.66		3.15		1.47
6-1, 146–149	22.6					34.7										
6-2, 20	22.9									4.1	5.65					
6-2, 106	23.7									4.65	5.05					
6-2, 139–149	24.0			1.71	2.67	34.8	58.1	7.5	40			1.29		2.21		1.55
7-2, 60–63	27.6					34.1										
7-3, 4	28.5									7.05	9.1					
7-3, 60–70	29.1	1.85							47	8.85	8.85	1.61		2.97		1.42
8-1, 145–148	31.4					33.4										
8-2, 141–148	32.9			1.72	2.67	34.2	57.5	7.6	23	7.3	8.0	1.62		2.79		
9-2, 3	35.8									8.45	12.0					
9-2, 41–45	36.2															1.41
9-2, 81–101	36.7								30	7.75	7.7					
9-2, 125–148	37.2	1.82										1.59		2.89		
9-3, 107–109	38.4					33.8										
10-2, 89–91	40.1			1.76	2.57	30.3	52.1	4.1								
10-3, 102–111	42.8			1.78	2.70	31.9	55.2	6.1				1.59		2.83		1.44
11-1, 136–139	44.5					33.7										
11-2, 126–129	45.9					32.6										
11-3, 20–22	46.3								13	10.6	9.05					
11-3, 82–91	47.0	1.84										1.58		2.90		1.53
12-1, 65–66	48.2					32.1										
13-3, 76	55.7									8.25	9.55					
13-3, 101–108	55.9					35.0						1.57		2.71		
13-3, 118–129	56.1			1.73	2.67	33.5	56.7	7.0	6	7.25	7.85					1.70
14-1, 115–117	57.5					33.6										

Table 6. (Continued).

Sample (interval, level in cm)	Sub-bottom Depth (m approx)	2-Min. Count GRAPE Density (g/cm²)		Gravimetric Data					Vane Shear Strength ( ) = remolded (g/cm²)	Penetrometer (mm) Fall Height		Sonic Velocity		Acoustic Impedance		Thermal Conductivity (W/m °C)
		∥ to Bedding	⊥ to Bedding	Wet-Bulk Density (g/cm³)	Approx. Grain Density (g/cm³)	Salt-Corrected Wet-Water Content (%)	Salt-Corrected Porosity (%)	Shrinkage (vol.%)		0 cm	1	∥ to Bedding (km/s)	⊥ to Bedding (km/s)	∥ to Bedding (10⁵ g/cm² s)	⊥ to Bedding (10⁵ g/cm² s)	
Hole 525B (Continued)																
14-3, 13–24	59.5	1.82							45	6.7	10.45	1.60		2.90		1.56
14-3, 73–80	60.1					31.5				6.4	6.55					
15-2, 20–34	62.0			1.77	2.67	31.5	54.4	5.7	31	5.4	7.45	1.58		2.79		1.56
15-2, 42–44	62.1					31.4										
16-2, 120–122	67.8					29.9										
16-3, 113–128	69.3	1.81										1.56		2.82		1.57
17-2, 57–69	71.6			1.76	2.67	32.1	55.1	5.9	68	4.85	6.65					1.66
17-2, 124	72.2									6.0	6.75					
17-3, 68–69	73.2					32.9										
18-1, 96–123	75.0	1.89							132	4.9	5.7	1.60		3.03		1.64
18-1, 128–130	75.2					32.3										
19-2, 95–119	79.4			1.76	2.72	32.6	56.2	4.9				1.58		2.78		1.50
19-2, 103–105	79.3					33.7										
21-1, 55–68	87.7					33.1			19	7.35	9.45	1.56				1.52
22-2, 84–99	93.9	1.87				32.6			31	5.7	8.0	1.55		2.90		
22-2, 128–132	94.3															1.52
23-2, 20–43	96.8									7.1	6.55					1.66
23-2, 141–149	99.0			1.74	2.65	33.7	56.1	6.6	73	5.5	5.55	1.58		2.75		
24-1, 41–45	99.8								68	4.65	4.05					
24-1, 125–136	100.7	1.87										1.60		2.98		1.39
24-2, 132–135	102.2					33.8										
25-1, 38–42	104.2															1.40
25-1, 140–148	105.2			1.72	2.68	34.4	57.8	6.4				1.58		2.71		
25-2, 75–78	106.1					33.0										
26-2, 127–180	111.0					33.3										
26-3, 57	111.8									7.25	10.1					
26-3, 104–130	112.4	1.87							146			1.63		3.05		1.75
27-1, 127–130	113.9					32.1										
27-2, 127–130	115.4					30.7										
27-3, 66	116.3									5.3	5.4					
27-3, 120–130	116.8			1.88	2.70	26.7	49.0	1.8				1.66		3.13		1.63
29-1, 105–108	122.5					32.9										
29-2, 114–124	124.1	1.87										1.61		3.01		1.57
30-1, 144–147	127.2					34.3										
30-2, 63–84	128.0								41	7.8	7.95					
30-2, 137–147	128.7			1.76	2.67	32.2	55.2	4.3				1.60		2.81		1.49
30-3, 132–135	130.2					31.8										
31-2, 137–140	133.1					33.5										
31-3, 30–52	133.6									6.7	7.1					1.70
31-3, 128–141	134.5	1.82							24	6.1	8.5	1.59		2.90		
32-1, 135–138	136.0					33.1										
32-2, 39–43	136.5									5.3	6.05					1.44
32-2, 136–148	137.5			1.76	2.69	32.6	55.9	3.0	33	6.45	6.4	1.62		2.86		
32-3, 71–73	138.2			1.78	2.64	30.7	53.2	3.3								
33-1, 146–148	140.5					32.0										
33-2, 30–33	140.8															1.24
33-2, 75	141.3									6.4	6.4					
33-2, 131–139	141.9	1.78										1.61		2.87		
33-3, 136–139	142.4					31.7										
34-1, 125–128	144.7					33.9										
34-2, 139–149	146.3			1.74	2.64	32.8	55.6	4.9	31	6.3	6.6	1.60		2.78		1.45
35-2, 60–83	149.9	1.99				34.8				8.2	8.7	1.56		3.11		1.52
36-2, 66–73	154.4			1.78	2.72	31.7	55.1	4.2	25	5.8	6.3					
36-2, 81–90	154.6					33.1				5.85	6.55					
36-2, 131–135	155.0											1.58				1.70
37-2, 22–27	158.3															1.62
37-2, 81	158.9									6.75	8.8					
37-2, 104–136	159.2	1.79							15	6.5	7.65	1.58		2.83		
37-2, 103–136	159.2					33.2										
38-2, 128–130	163.8					33.1										
38-2, 139–148	163.9			1.76	2.68	32.5	55.6	2.5		7.4	7.7	2.07		3.63		1.25
39-2, 36	167.3									9.9	8.3					
39-2, 112–114	868.0					32.4										
39-2, 118–128	168.1	1.77							15	7.9	7.0	1.57		2.78		1.21
42-1, 115–128	175.3			1.76	2.69	32.4	55.7	4.1	37	6.5	10.1	1.60		2.81		1.46
42-2, 60–62	176.3					34.2										
43-1, 143–146	180.0					32.3										
45-1, 131–134	188.7					31.8										
45-2, 145–148	190.4					32.6										
45-3, 28–46	190.7			1.73	2.57	32.1	54.2	3.5		4.6	5.4					
45-3, 126–135	191.7	1.82							50	5.4	6.7	1.60		2.91		1.61
46-1, 146–149	192.3					25.2										
46-2, 146–149	194.8					31.9										
46-3, 21	195.0									6.9	6.4					
46-3, 99–126	195.9			1.74	2.64	32.8	55.7	2.4	41	4.5	5.55	1.57		2.73		1.63
47-1, 146–149	197.7					31.1										
47-2, 146–149	199.2					31.6										
47-3, 17	199.4									8.0	9.7					
47-3, 99–108	200.2	1.80							10	9.7	11.35	1.60		2.87		
47-3, 132–136	200.5															1.72
48-1, 146–149	202.1					32.0										
48-2, 146–149	203.6					30.4										
48-3, 18–22	203.8								50	9.0	7.7					
48-3, 122–133	204.9			1.80	2.71	30.6	53.7	3.5				1.59		2.86		1.53
49-2, 25	206.8									6.0	7.9					
49-2, 123–140	207.8	1.84							39	6.5	7.2	1.56		2.86		1.66
49-3, 136–140	209.4					32.2										
49-4, 95–98	210.5					32.4										
50-1, 115–118	269.2			1.89	2.64	25.3	46.6	7.7								
51-2, 8	274.0									5.45	6.8					
51-2, 77–101	274.7	1.84							63	10.4	8.6	1.61		2.96		1.87
51-2, 77–101	274.7					29.9										
53-2, 102–105	283.7								630	1.0	1.65	1.68				
53-2, 118–128	283.9			1.85	2.67	27.5	49.7	2.9	162	2.35	3.05	1.60		2.95		
53-2, 129–131	284.0					29.1										

metric data do not show any trend in this unit, with the exception of the lower part. Below a sub-bottom depth of about 550 m, water content and porosity tend to decrease, and wet-bulk density increases. Sonic velocity increases considerably throughout Unit II, with a wide scatter. Sound velocity measured vertically is somewhat lower in most cases than in the horizontal direction. Thermal conductivity is somewhat lower than in the unit above, and there may be a slight trend of decreasing conductivity with depth.

Unit III, the basement unit composed of basalts with interbedded sedimentary layers, has different physical properties than the overlying sediment. Scatter is very high in this unit owing to the widely varying alteration of the basalts (see Table 7). Only a single sediment sample was tested. It revealed a water content and porosity that were distinctly higher and a bulk density that was lower than in the sediments of Unit II. Sonic velocity was about the same as in the upper part of Unit II. Grain density and thermal conductivity do not differ significantly from the values found in the basalts.

DOWNHOLE INSTRUMENTS

Heat Flow

A heat flow experiment was run in Hole 525 using the Uyeda heat flow probe. Five measurements were obtained in the top 75 m of sediment by washing down and measuring at 10–20 m intervals. An extremely low gradient near 0.01°C/m was observed, and the scatter in the data is large enough to make a meaningful heat flow value unobtainable.

Careful instrument checks were made after recovery to determine both calibration and timing of the tool. Both proved to be within tolerances. The measured bottom water temperature was 6.25°C, which is quite high for the North Atlantic Deep Water at the site and suggests that the surface water pumped down for washing contaminated the temperature results, in spite of 12-min. equilibration times at each measurement. Another potential explanation lies in disturbance of the sediment by washing. The nannofossil oozes in the hole were very difficult to penetrate by washing, and high pressures were used.

Logging

After three attempts, the drill bit failed to release following the rotary coring in Hole 525A. Therefore logging was not attempted at this site.

Table 7. Physical properties summary for the basement complex, Site 525.

	Basalt (mean of 11 samples)	Sediment (Sample 525A-51-1, 118–127 cm)
Wet-bulk density (gravimetric)	2.47 g/cm^3	1.93 g/cm^3
Wet-water content	8.5%	28.2%
Porosity	20.2%	53.0%
Approximate grain density	2.84 g/cm^3	2.95 g/cm^3
Sonic velocity: horizontal	3.91 km/s	1.75 km/s
vertical	4.07 km/s	1.72 km/s
Thermal conductivity	1.47 W/m °C (=3.51 mcal/cm°C·s)	1.21 W/m °C (=2.80 mcal/cm°C s)

SUMMARY AND CONCLUSIONS

Site 525 is on crust of Magnetic Anomaly 32 age (early Maestrichtian–late Campanian) and located on a broad flat crest of a NNW–SSE-trending block on the Walvis Ridge. It is the shoalest site of a transect across the Walvis Ridge into the Angola Basin. Three holes were drilled which give a complete section from the seafloor through the sedimentary layers (574 m sub-bottom) and 103 m into the basement complex.

Hole 525: One core was obtained, with 3.6 m recovery, to establish the mud line. A downhole heat flow experiment, with inconclusive results, followed the coring.

Hole 525A: We obtained 63 rotary cores from this hole, with a total penetration of 678.1 m below seafloor and a recovery of 73%. A basement rock complex was first encountered at 574.6 m sub-bottom and continuously cored for 103.5 m. Several unsuccessful PCB and DBMI tests were run on this hole. Logging was unsuccessful as a result of failure of the drill bit to release.

Hole 525B: We hydraulic-piston-cored 53 cores for a total core length of 231 m and recovery of 79%. The major geological and geophysical results are given in the following paragraphs.

Lithology: Sediment

Three major sedimentary lithologic units are observed. One of these units is within the basaltic basement complex.

Unit I is the largest sedimentary unit (452 m thick). It consists of a very homogeneous nannofossil and foraminifer–nannofossil ooze and/or chalk. The calcium carbonate content is greater than 90% throughout, except for a small drop next to the base of the unit. No primary or secondary structures are observed in this unit. Its division into two subunits is based on the occurrence of chalks.

Subunit IA is entirely white to pinkish white nannofossil and foraminifer–nannofossil ooze, the base of which coincides with a color change and a major biostratigraphic hiatus between upper Oligocene and mid-Eocene at 270 m sub-bottom.

Subunit IB consists of alternating beds of nannofossil and foraminifer–nannofossil oozes and chalks with chalks increasing in abundance with depth. The unit terminates near the well-recovered Cretaceous/Tertiary boundary at 452 m sub-bottom. Chert fragments are observed near the base of the unit.

Unit II sediments extend from the Cretaceous/Tertiary boundary at 452 m sub-bottom to the top of the basement complex at 574 m sub-bottom. The sediments are cyclic in nature and composed of nannofossil marly chalks and limestones and siltstones/sandstones of turbidite and/or slump origin. The thickness of the cyclic units are of the order of 1 to 2 m except for a spectacular turbidite sequence of about 6 m near the base of the unit. Below this turbidite sequence is an approximately 3-m sequence of highly altered, baked, or lithified limestones to noncalcareous sediments with a small amount of chert(?) which overlie basement. The calcium carbonate content is generally less than 50%. High amounts of volcanogenic clastic material are also identified in smear slides. K-feldspar (anorthoclase), smectite, and minor amounts of plagioclase and illite were identified by the X-ray diffraction technique. Well-preserved primary and secondary sedimentary structures are present throughout the unit. In particular, graded and inverse graded bedding, parallel laminations, and beautifully preserved *Zoophycus, Planolites*, and halo burrows abound. Large *Inoceramus* sp. mollusk shells are found throughout the unit.

Unit III consists of four sedimentary interbeds within the basaltic basement complex. They are at 593, 596, 625, and 647 m sub-bottom and are 0.2 to 3.0 m thick. They consist of bioturbated marly limestone and volcanogenic sediments (smectite, palagonite, volcanic glass, and igneous rock fragments). Chert fragments are also observed. The carbonate content ranges from 0 to 50%. Fossils recovered from one of these layers are the same age as those observed at the base of Unit II (early Maestrichtian).

Lithology: Basalt

We drilled 103 m of basement complex, with an average recovery of 53%. Five basaltic units are identified. The four intercalated sedimentary layers (Unit III) form the basis for the subdivision of the basalt. The basalts are mainly aphyric, subophitic in texture, and in general vesicular, with carbonate in the vesicles. Calcite veins are abundant throughout most cores. The basalt petrography is very uniform. Plagioclase, the most abundant mineral, forms about 50 to 60% of the groundmass; clinopyroxene forms about 35 to 45%. Olivine is not found. It may be highly altered and present in the form of clay alteration minerals. We will have to await the results of shore-based chemical studies to determine whether these are alkali or tholeiite basalts.

The following are the five basalt units:

Unit 1 is a 21-m-thick, green gray, fine- to medium-grained, highly altered vesicular aphyric basalt.

Unit 2 is 4.5 m thick and similar to Unit 1.

Unit 3 is a 22-m-thick, medium gray, moderately altered, vesicular, fine- to coarse-grained, aphyric to sparsely plagioclase and clinopyroxene phyric basalt.

Unit 4 is a 20-m-thick, medium gray, moderately vesicular, aphyric to sparsely plagioclase–clinopyroxene phyric basalt. This unit comprises a distinct pillow sequence consisting of a minimum of 25 pillows and/or thin flows with fresh glass rinds on their outer surface.

Unit 5 is a 7-m-thick, dark gray, moderately vesicular glassy and fine-grained basalt grading into medium- to coarse-grained sparsely plagioclase phyric basalt with few vesicles. The unit comprises macroscopically the freshest basalt recovered.

Relationship between Lithology and Seismic Reflection Profile

The seismic stratigraphy is shown in Figure 12. The basal, very smooth, dark reflector (see *Vema* record) is interpreted as acoustic basement and coincides with the top of the basaltic basement complex. The top of the prominent reflector observed about 0.1 s above basement is probably related to the top of Unit II (Cretaceous/Tertiary boundary) and to the change from nannofossil and foraminifer–nannofossil oozes and chalk to the cyclical, patterned, nannofossil marly chalks and siltstone/sandstones. Higher in the section (about 0.3 s above basement), a rather prominent seismic reflector is observed which may relate to the Subunit IA–IB boundary (late Oligocene–mid-Eocene hiatus) and occurrence of nannofossil and foraminifer–nannofossil chalks.

Physical Properties

In sediment Subunit IA there are no very obvious and persistent trends in the physical properties, although the relatively high porosity in the upper 20 to 30 m of Hole 525B may be associated with the high foraminifer:coccolith ratio. The results from hydraulic piston coring and rotary coring are very similar. There are some trends in Subunit IB suggestive of the beginning of diagenesis, in agreement with the observed lithology. In Unit II, the trends of decreasing water content and porosity observed in Subunit IB continue. In general, in Unit II there is a very wide scattering of physical properties caused by the varying lithology and drilling disturbance. The physical properties in the basement complex are obviously much different than the overlying sediments in having much higher bulk density and sonic velocities and much lower water content and porosity.

Paleomagnetics

The Pleistocene to middle Miocene natural remanence is, in general, low (below the shipboard instrument noise level) and hence was analyzed in a shore-based laboratory with a cryogenic magnetometer. The lower to middle Miocene sediments were magnetically unstable and their paleomagnetic stratigraphy consequently unobtainable.

The paleomagnetic stratigraphy is very well defined from 420 m sub-bottom (Core 36, upper Paleocene) to the basement complex at 574 m sub-bottom. Anomalies 28 to 32 are easily recognized. The results are consistent with the Walvis Ridge crust being formed at this site during Magnetic Anomaly 32 time, as inferred from surface ship magnetometer measurements.

Sedimentation and Accumulation Rates

The sedimentation rates vary between about 10 m/m.y. and 20 m/m.y. with the exceptions of a major hiatus between the late Oligocene and middle Eocene and a marked slowdown (to about 0.5 cm/10^3 y.) between the middle Paleocene and the Cretaceous/Tertiary boundary. There is a marked increase in sedimentation rates for the time span prior to the Cretaceous/Tertiary boundary (>1.5 cm/10^3 y.) The magnitude of the increase depends on whether the age of basement is early Maestrichtian or late Campanian.

Accumulation rates were calculated (g/cm^2/10^3 y.) for Plio–Pleistocene to early Miocene. They show a similar trend to the sedimentation rates for this interval. The ratio of the foraminifer carbonate to coccolith carbonate accumulation rates varies considerably. It is not clear whether this represents an index of dissolution, or

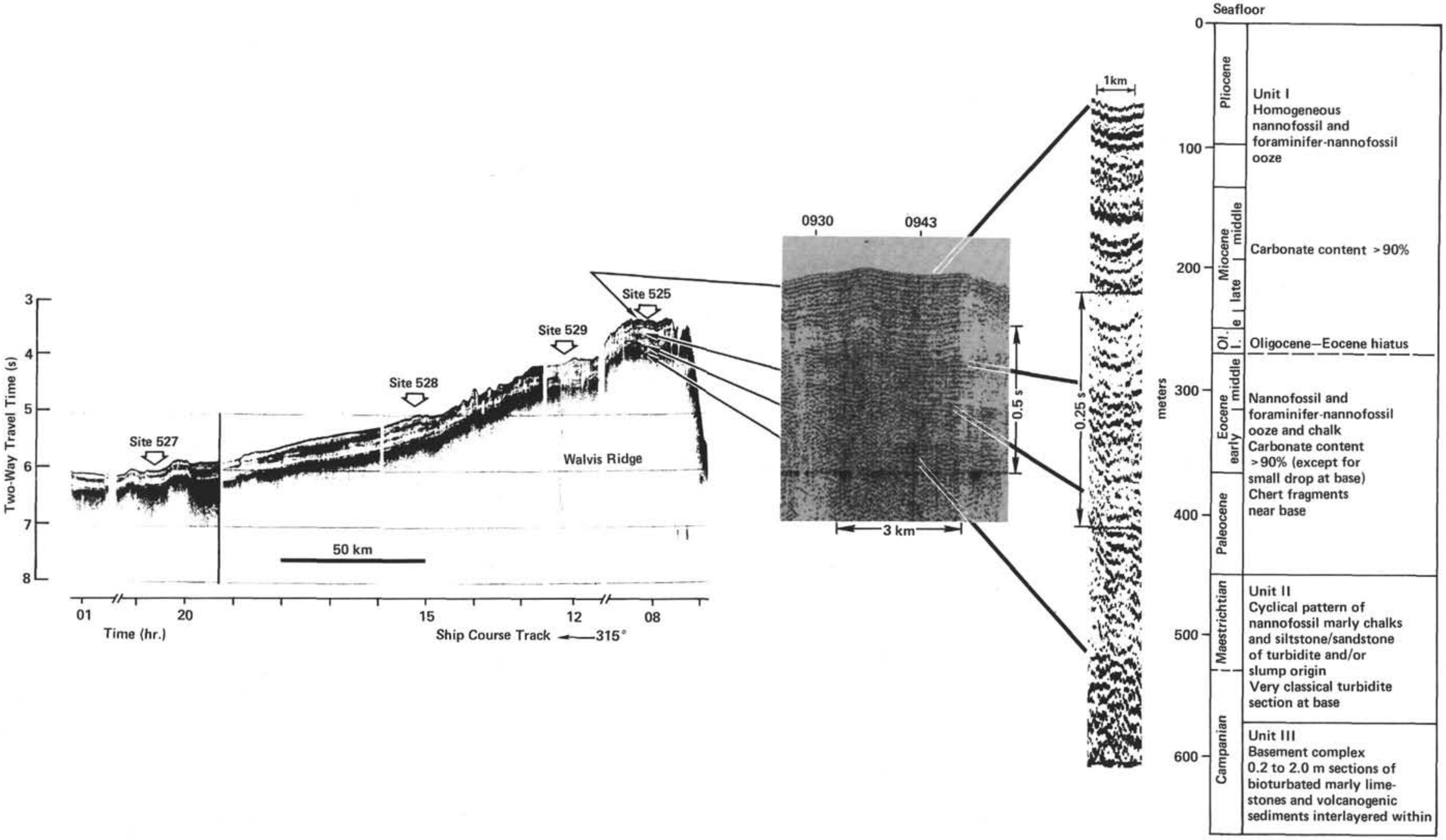

Figure 12. Correlaton between seismic records and lithostratigraphy, Site 525.

production, or an evolutionary change in the ratio of foraminifers to coccoliths.

Biostratigraphy and History of the Walvis Ridge

The age of the crust (early Maestrichtian), as determined from the identification of fossils within the sediments above basement as well as from the paleomagnetic measurements, is in agreement with the surface ship magnetic anomaly identifications and thus suggests that the part of the Walvis Ridge under study was formed at a mid-ocean ridge spreading center. Further, the initial extrusion of ocean crust here was probably near sea level and subsequently subsided to its present depth of 3054 m below sea level. Benthic foraminifers and associated fragments of mollusks and bryozoans, together with highly vesicular pillow basalts, suggest that the final outpourings of lava at this site occurred within a few hundred meters water depth.

Sediments rich in volcaniclastic material as well as in biogenic debris covered the basement complex rather quickly, as evidenced by sedimentological indications of gravity flows, by the moderately high average sedimentation rates (>15 m/m.y. compared to an average of about 10 m/m.y. for the remainder of the section), and by the fact that sediments within the basalt and for 54 m overlying the basalt come from the same biostratigraphic zone. The CCD was quite shallow throughout the world ocean during the Late Cretaceous and early Paleogene; however, the rather poor preservation of carbonate microfossils in the lower part of the section appears somewhat anomalous, considering the relatively shallow paleodepth of this site (approx. 1000–1500 m). This lack of good carbonate preservation may be diagenetic or may have resulted from a regional shoaling of the CCD associated with the very shallow Walvis Ridge that existed at that time—a shoaling comparable to that near continental margins and regions of high productivity in the modern ocean. The preservation of the calcareous fossils shows both effects. Recrystallization and calcite overgrowth affect the microfossils of the lower middle Eocene (below Zone P14) and lower Eocene, but preservation improves somewhat in the late Paleocene. Dissolution in the early Paleocene (below Zone P3) again decreases the preservation, but below this interval, in the Maestrichtian, cementation and alteration of biogenic calcites cause the poor preservation of the microfossils. The general sedimentary character of the early Paleogene and Late Cretaceous sediments suggests a marked decrease in the degree of carbonate preservation with age. Although carbonate content commonly exceeds 80 to 90% in this interval and is usually greater than 50%, fragmentation, diagenetic alteration, and calcite overgrowths hinder biostratigraphic interpretation.

Further complicating interpretation in this zone of poor preservation is the presence of an interval of very slow accumulation rate spanning the Cretaceous/Tertiary boundary. Although all the appropriate biostratigraphic zones and magnetic events have been identified at the boundary, sharp color changes and a distinct brown layer near the boundary may indicate that a small portion is missing from the sedimentary record.

There is a possibility of several small hiatuses in the section cored at Site 525 (e.g., the missing foraminiferal Zones Plc to P2 in the lower Paleocene and N10 to N12 in the middle Miocene); however, the most marked change in accumulation at this site is the 14-m.y. hiatus spanning the middle Eocene (P14, NP23–25) and upper Oligocene (P22, NP16–17). Some carbonate dissolution appears to be associated with this hiatus; however, carbonate concentrations remain at 90% or greater on either side of it. This, together with the increase in degree of lithification below the hiatus and reworked older microfossils in the overlying upper Oligocene section, suggests erosional removal of much of the Oligocene section. The part of the section that has been removed includes the intervals in which *Braarudosphaera* chalks and oozes are commonly found in sediments of the South Atlantic.

Neogene sediment accumulation rates vary between approximately 8 and 20 m/m.y. For a central gyre region which is rather distant from zones of intense upwelling, changes in accumulation rates by a factor of two are highly significant. The upper Oligocene through lower middle Miocene shows low average accumulation rates (8 m/m.y.). These rates increase to 20 m/m.y. in the latter half of the middle Miocene and then decrease again in the upper Miocene to about 13 m/m.y. In the lower Pliocene, the accumulation rate again reaches nearly 20 m/m.y. before decreasing again in the upper Pliocene to Quaternary. These changes in accumulation rate do not appear to show a simple relationship to indices of preservation. Increased fragmentation of foraminiferal tests is noted just prior to the mid-Miocene and early Pliocene peaks in sediment accumulation; however, preservation of the calcareous fossils in the rest of the section appears to be affected mainly by fragmentation and overgrowths occurring within the sediment. Overgrowths on the calcareous nannofossils are prevalent below the upper part of the middle Miocene.

Subtle changes in the color of the carbonate sediments, on the other hand, do appear to bear some relationship to accumulation rates. The lower Pliocene peak in accumulation rate seems to match the zone of bluish gray carbonates within sediment Subunit IA. The lower rates of the upper Miocene are typified by homogeneous, very white carbonates, and the second Neogene peak in accumulation in the middle Miocene is associated with alternating white, very pale orange, and pinkish gray zones of carbonate.

The proportion of foraminifers (by weight) making up the Neogene sediments reaches a minimum in the upper Miocene before climbing to a distinct maximum in the Plio–Pleistocene. It is not clear whether this large increase in the proportion of foraminifers over the last 3 to 5 m.y. indicates an evolutionary change or a change in ecologic response. It does not appear to match changes in other indicators of the degree of preservation of the carbonate debris.

The planktonic assemblages throughout the section are characteristic of temperate water masses. A careful analysis of the relative importance of the subtropical and boreal assemblages could reveal details of oceanographic fluctuations over the early Paleogene and Neogene.

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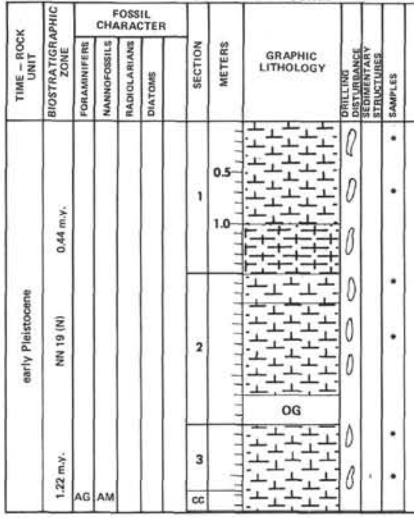
SITE 525 HOLE CORE 1 CORED INTERVAL 0.0–3.6 m



LITHOLOGIC DESCRIPTION

N9

5YR 8/1

N9 & N8

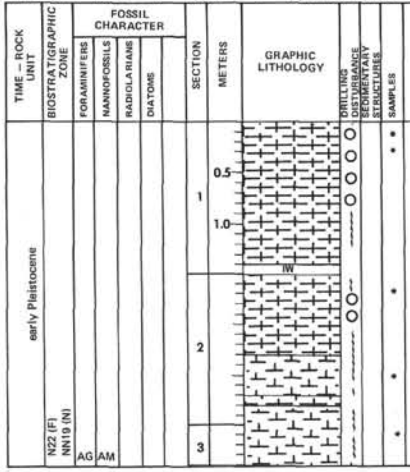
NANNOFOSSIL OOZE

Core 1 contains a white (N9) to very light gray (N8) soft nannofossil ooze. Drilling disturbance is severe and has left no sedimentary structures. A foraminifer nannofossil ooze occurs from 94–130 cm in Section 1. It is pinkish gray (5YR 8/1) in color. Core-Catcher: foraminiferal nannofossil ooze.

SMEAR SLIDE SUMMARY:

	1-5	1-70	2-5	3-51
	D	D	D	D
Composition:				
Feldspar	–	–	–	TR
Clay	TR	–	TR	TR
Carbonate unspecified	2	5	2	2
Foraminifers	3	25	3	3
Calcareous nannofossils	95	70	95	95
Diatoms	–	–	TR	TR

SITE 525 HOLE A CORE 1 CORED INTERVAL 0.0–3.6 m



LITHOLOGIC DESCRIPTION

5YR 8/1

N9

5YR 8/1

N9

FORAMINIFER NANNOFOSSIL OOZE

A highly disturbed to soupy pinkish gray (5YR 8/1) foraminifer nannofossil ooze is present. This ooze alternates to some extent with a nannofossil ooze which is white (N9). No sedimentary or biogenic structures are observed.

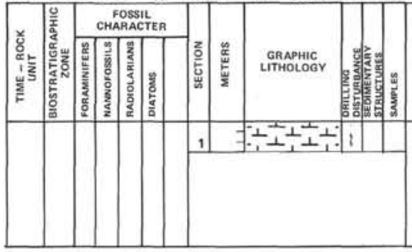
SMEAR SLIDE SUMMARY:

	1-12	1-37	2-19	2-109	3-19
	D	D	D	D	D
Composition:					
Foraminifers	50	40	60	5	5
Calcareous nannofossils	45	60	40	95	95
Pteropods	5	–	–	–	–
Calcareous dinoflagellates	5	TR	–	–	–

ORGANIC CARBON AND CARBONATE:

	1-61	2-61	3-21
Organic carbon	–	–	–
Carbonate	95	96	96

SITE 525 HOLE A CORE 2 CORED INTERVAL 3.6–9.6 m

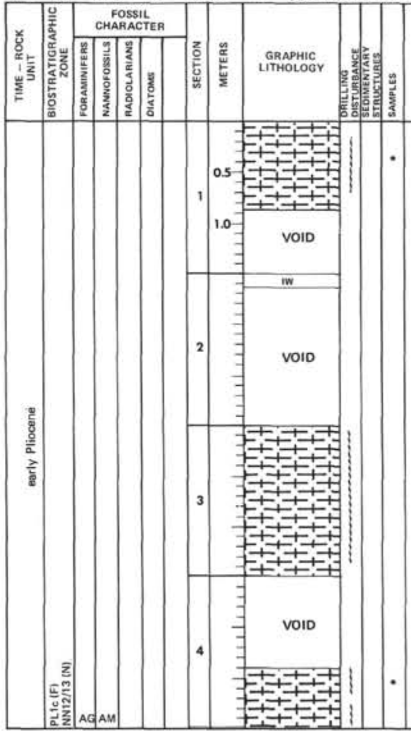


LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

A highly disturbed white (N9) to pinkish gray nannofossil ooze is present. This is a pressure core barrel sample which did not work. The core (30 cm) is taken over a 6 meter interval and is not representative of any specific position within the interval.

SITE 525 HOLE A CORE 3 CORED INTERVAL 41.6–51.1 m



LITHOLOGIC DESCRIPTION

FORAMINIFER NANNOFOSSIL OOZE

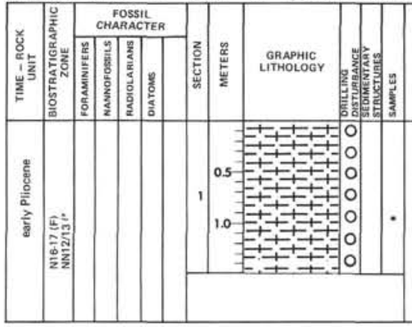
A white (N9) homogeneous foraminifer nannofossil ooze. The sediment is highly disturbed due to fracturing of the core barrel during drilling.

SMEAR SLIDE SUMMARY:

	1-40	4-103
	D	D
Composition:		
Foraminifers	35	10
Calcareous nannofossils	60	85
Calcareous discoasters	5	5

Information on core description sheets, for ALL sites, represents field notes taken aboard ship under time pressure. Some of this information has been refined in accord with post-cruise findings, but production schedules prohibit definitive correlation of these sheets with subsequent findings. Thus the reader should be alerted to the occasional ambiguity or discrepancy.

SITE 525 HOLE A CORE 4 CORED INTERVAL 51.1–57.1 m



LITHOLOGIC DESCRIPTION

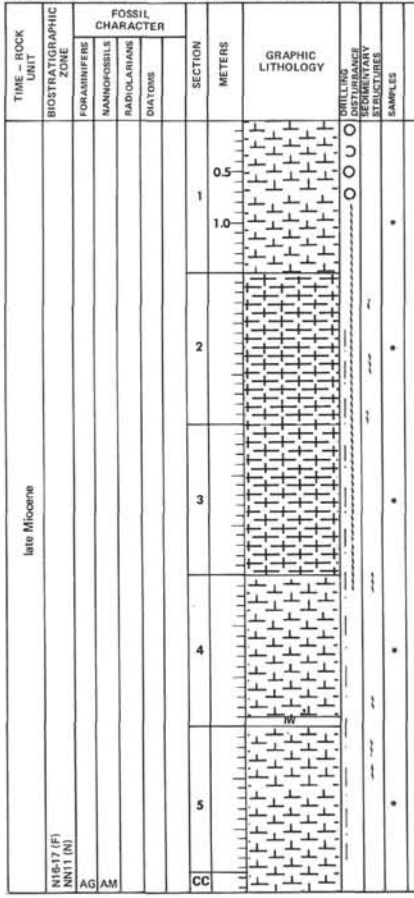
FORAMINIFER NANNOFOSSIL OOZE

A highly disturbed, soupy, homogeneous, wisite (N9), foraminifera nannofossil ooze was recovered.

SMEAR SLIDE SUMMARY:

	1-90 D
Composition:	
Foraminifers	10
Calcareous nannofossils	80
Discoasters	10

SITE 525 HOLE A CORE 5 CORED INTERVAL 89.1–98.6 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE TO
FORAMINIFER NANNOFOSSIL OOZE

A white (N9), foraminifer nannofossil ooze to nannofossil ooze is present. Some small dark gray to black blebs (dots) and indistinct layers are observed.

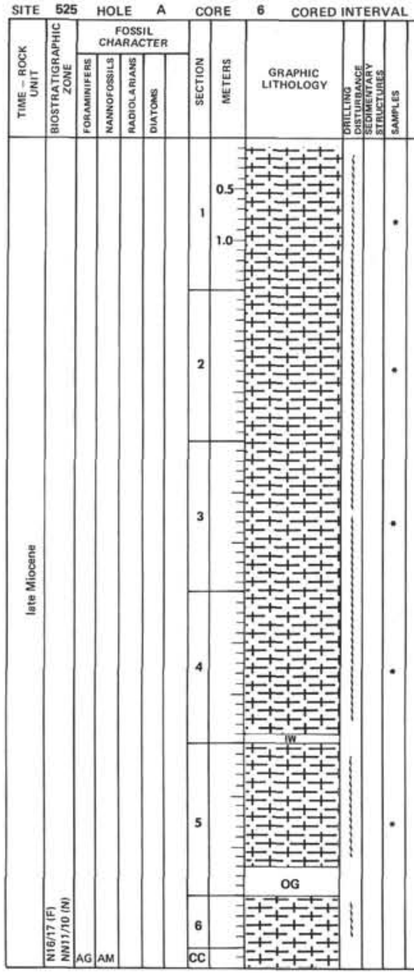
SMEAR SLIDE SUMMARY:

	1-100 D	2-18 D	3-80 D	4-79 D	5-80 D
Composition:					
Carbonate unspecified	–	–	2	–	–
Formainifers	5	10	10	–	5
Calcareous nannofossils	90	85	80	100	90
Discoasters	5	5	5	–	5
Calcareous dinoflagellates	–	–	3	–	–

ORGANIC CARBON AND CARBONATE:

	1-61
Organic carbon	–
Carbonate	99

SITE 525 HOLE A CORE 6 CORED INTERVAL 98.6–106.1 m



LITHOLOGIC DESCRIPTION

N9

FORAMINIFER NANNOFOSSIL OOZE

A white (N9), homogeneous, very disturbed, foraminifer nannofossil ooze was recovered. Small gray wisps and patches were observed and were determined to be grease.

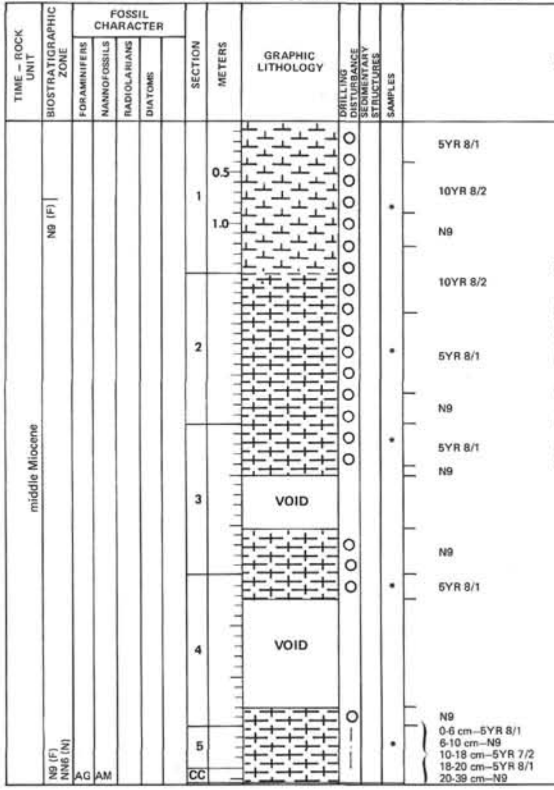
SMEAR SLIDE SUMMARY:

	1-80 D	2-80 D	3-80 D	4-80 D	5-80 D
Composition:					
Foraminifers	5	13	10	10	15
Calcareous nannofossils	90	85	85	90	80
Sponge spicules	–	TR	–	–	–
Discoasters	5	2	3	–	3
Calcareous dinoflagellates	–	–	2	1	2

ORGANIC CARBON AND CARBONATE:

	1-61
Organic carbon	–
Carbonate	99

SITE 525 HOLE A CORE 7 CORED INTERVAL 165.1–174.6 m



LITHOLOGIC DESCRIPTION

FORAMINIFER NANNOFOSSIL OOZE
AND NANNOFOSSIL OOZE

This core contains a predominantly white (N9) to pinkish gray (5YR 8/1) foraminifer nannofossil ooze. Section 5 is only moderately disturbed and shows some color banding.

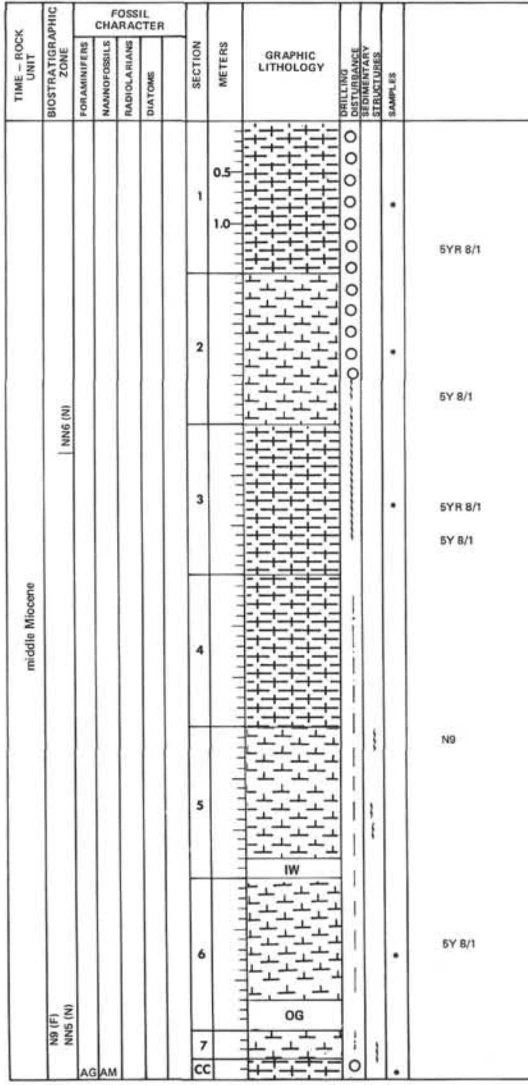
SMEAR SLIDE SUMMARY:

	1-80 D	2-80 D	3-20 D	49 D	5-11 D
Composition:					
Mica	TR	–	–	TR	–
Carbonate unspecified	–	–	TR	TR	TR
Foraminifers	5	10	15	15	10
Calcareous *nannofossils*	95	90	85	85	90
Diatoms	TR	–	TR	–	–

ORGANIC CARBON AND CARBONATE:

	1-85
Organic carbon	–
Carbonate	98

SITE 525 HOLE A CORE 8 CORED INTERVAL 174.6–184.1 m



LITHOLOGIC DESCRIPTION

FORAMINIFER NANNOFOSSIL OOZE
AND NANNOFOSSIL OOZE

A predominantly pinkish gray (5YR 8/1) to yellowish gray (5Y 8/1) soupy to highly deformed foraminifer nannofossil ooze is observed. Mottles resulting from bioturbation are present in Section 5.

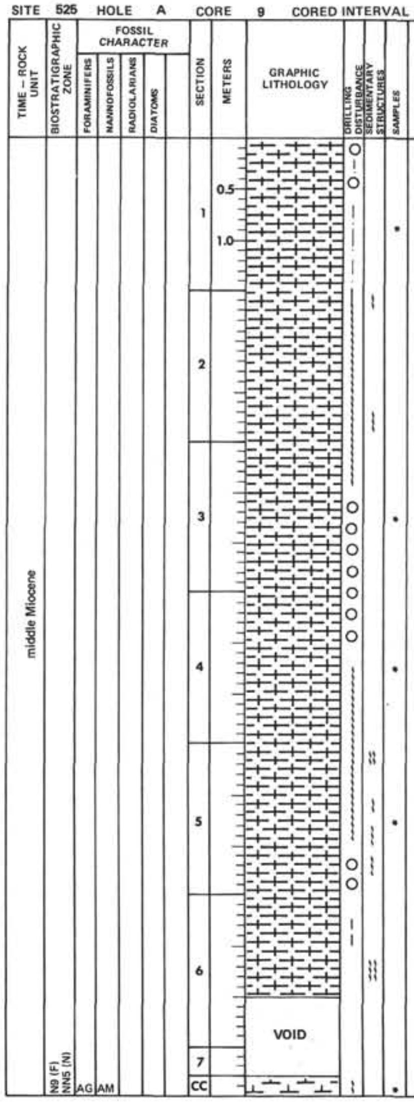
SMEAR SLIDE SUMMARY:

	1-80 D	2-80 D	3-80 D	6-70 D	CC D
Composition:					
Quartz	TR	–	TR	–	–
Mica	TR	TR	–	–	–
Carbonate unspecified	–	1	TR	–	5
Foraminifers	25	25	5	5	20
Calcareous nannofossils	75	75	95	95	75
Diatoms	TR	–	TR	–	–

ORGANIC CARBON AND CARBONATE:

	2-144	3-144	4-144	5-144	6-35
Organic carbon	–	–	–	–	–
Carbonate	97	96	97	96	98

SITE 525 HOLE A CORE 9 CORED INTERVAL 184.1–193.6 m



LITHOLOGIC DESCRIPTION

10YR 8/2

FORAMINIFER NANNOFOSSIL OOZE

This core contains a soupy to highly disturbed, homogeneous very pale orange (10YR 8/2) foraminifer nannofossil ooze. White patches (N9) and greenish gray (5G 4/1) are found throughout the core. These are interpreted to be burrows (halo burrows?).

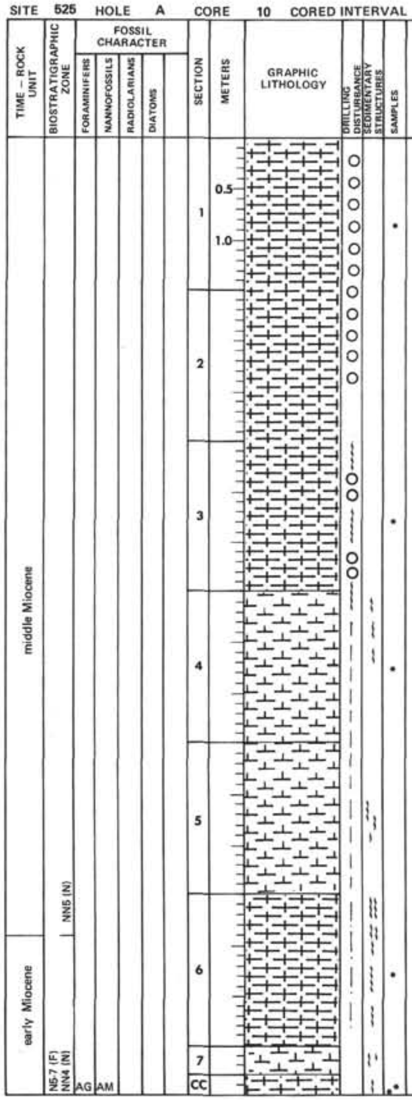
SMEAR SLIDE SUMMARY:

	1-80 D	3-80 D	4-80 D	5-80 D	CC D
Composition:					
Quartz	TR	TR	–	–	–
Feldspar	1	–	TR	TR	–
Mica	–	TR	2	TR	–
Clay	–	2	–	TR	–
Carbonate unspecified	TR	–	–	TR	TR
Foraminifers	30	10	15	10	10
Calcareous nannofossils	69	88	83	90	90
Diatoms	TR	–	–	–	TR

ORGANIC CARBON AND CARBONATE:

	1-70	2-70	3-70	4-70	5-70
Organic carbon	–	–	–	–	–
Carbonate	94	92	95	95	92

SITE 525 HOLE A CORE 10 CORED INTERVAL 193.6–203.1 m



LITHOLOGIC DESCRIPTION

10YR 8/2

FORAMINIFER NANNOFOSSIL AND NANNOFOSSIL OOZE

A very pale orange (10YR 8/2) soupy to slightly deformed foraminifer nannofossil ooze was recovered. Sections 4–6 contain mottles which are interpreted as biogenic in origin. The mottles are of the halo burrow type and are up to 1 cm wide with white (N9) to grayish pink (5R 8/2) centers and dark greenish gray (5GY 4/1) exteriors. They are aligned horizontally to sub-horizontally.

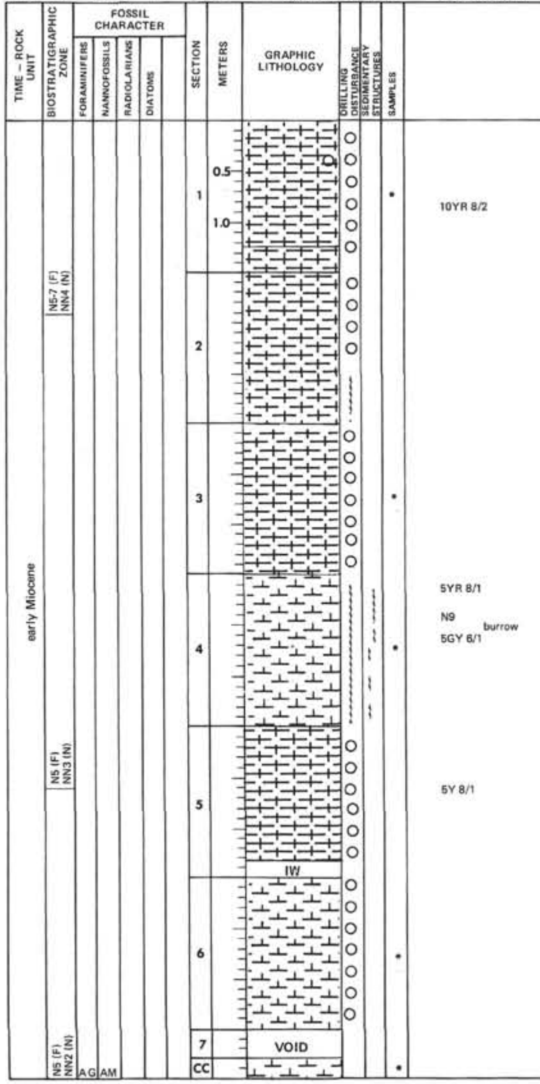
SMEAR SLIDE SUMMARY:

	1-80 D	3-80 D	4-80 D	6-80 D	CC D
Composition:					
Feldspar	TR	TR	–	–	–
Mica	–	TR	TR	–	TR
Clay	TR	–	–	–	–
Carbonate unspecified	–	–	TR	–	–
Foraminifers	10	10	8	15	10
Calcareous nannofosils	90	90	92	85	90
Diatoms	–	TR	–	–	–

ORGANIC CARBON AND CARBONATE:

	1-70	3-70	4-70	5-70	6-70	7-50
Organic carbonate	–	–	–	–	–	–
Carbonate	94	95	96	94	96	92

SITE 525 HOLE A CORE 11 CORED INTERVAL 203.1–212.6 m



LITHOLOGIC DESCRIPTION

FORAMINIFER NANNOFOSSIL AND NANNOFOSSIL OOZE

A very pale orange (10YR 8/2) pinkish gray (5YR 8/1) to yellowish gray (5Y 8/1), highly disturbed and soupy foraminifer nannofossil ooze was recovered. Some possible biogenic mottles are observed in Section 4. The mottles are white (N9) to greenish gray (5GY 6/1) in color.

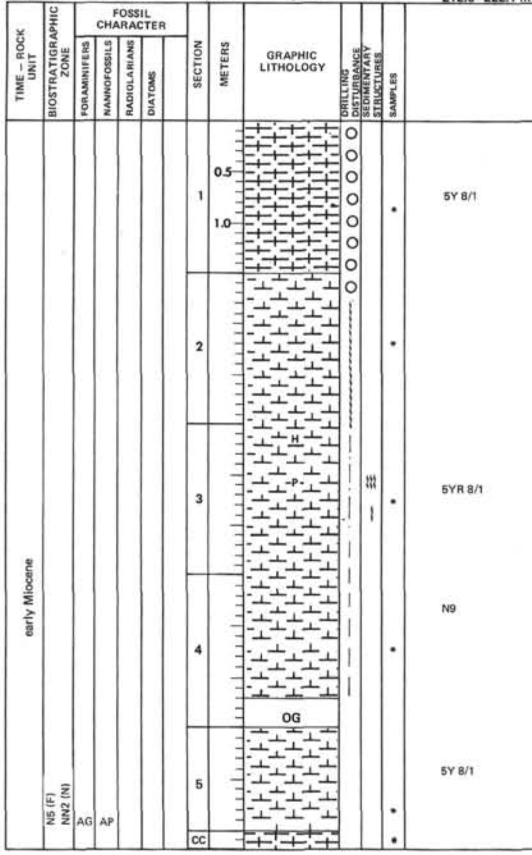
SMEAR SLIDE SUMMARY:

	1-80	3-80	4-80	6-80	CC
	D	D	D	D	D
Composition:					
Feldspar	–	TR	TR	TR	–
Mica	TR	TR	TR	–	–
Clay	–	2	–	TR	–
Carbonate unspecified	TR	–	–	TR	–
Foraminifers	20	18	10	5	5
Calcareous nannofossils	80	80	90	90	95

ORGANIC CARBON AND CARBONATE:

	1-100	2-100	3-100	4-100	5-100	6-100
Organic carbon	–	–	–	–	–	–
Carbonate	92	93	95	97	98	96

SITE 525 HOLE A CORE 12 CORED INTERVAL 212.6–222.1 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE AND FORAMINIFER NANNOFOSSIL OOZE

This core contains a yellowish gray (5Y 8/1) to pinkish gray (5YR 8/1) and white (N9) nannofossil and foraminifera nannofossil ooze. Numerous mottles are present in Section 3, with a wide range in colors. These burrows are of the planolites type. Very few have the halo burrow morphology.

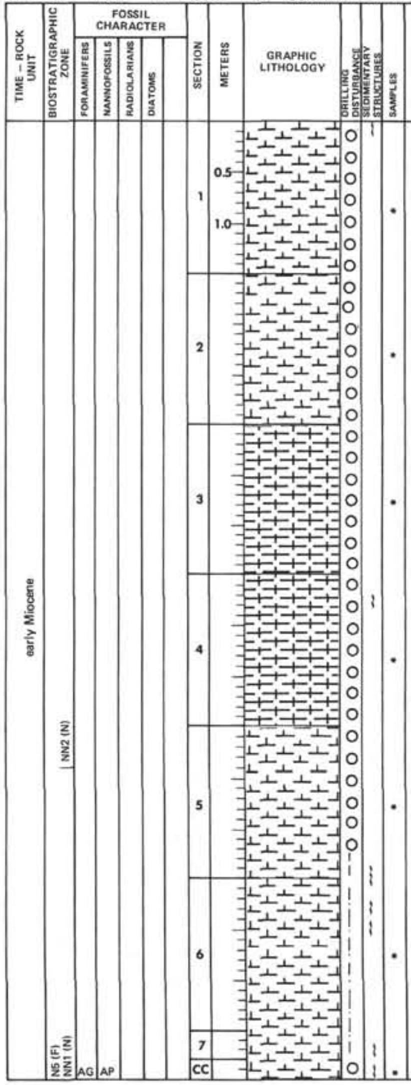
SMEAR SLIDE SUMMARY:

	1-80	3-80	5-80	CC
	D	D	D	D
Composition:				
Feldspar	–	TR	–	TR
Mica	TR	–	–	–
Other clay minerals	–	1	–	–
Carbonate unspecified	TR	–	TR	–
Foraminifers	20	7	5	10
Nannofossils	80	92	95	90

ORGANIC CARBON AND CARBONATE:

	1-10	2-10	3-10	4-10	5-10
Organic carbon	–	–	–	–	–
Carbonate	99	99	99	96	96

SITE 525 HOLE A CORE 13 CORED INTERVAL 221.1–231.6 m



LITHOLOGIC DESCRIPTION

5Y 8/1

5Y6/1

NANNOFOSSIL OOZE AND FORAMINIFER NANNOFOSSIL OOZE

A yellowish gray (5Y 8/1) highly disturbed nannofossil to foraminifer nannofossil ooze is present. Contamination from drill pipe rust is observed. White (N9) patches which may have been burrows are observed in Section 4.

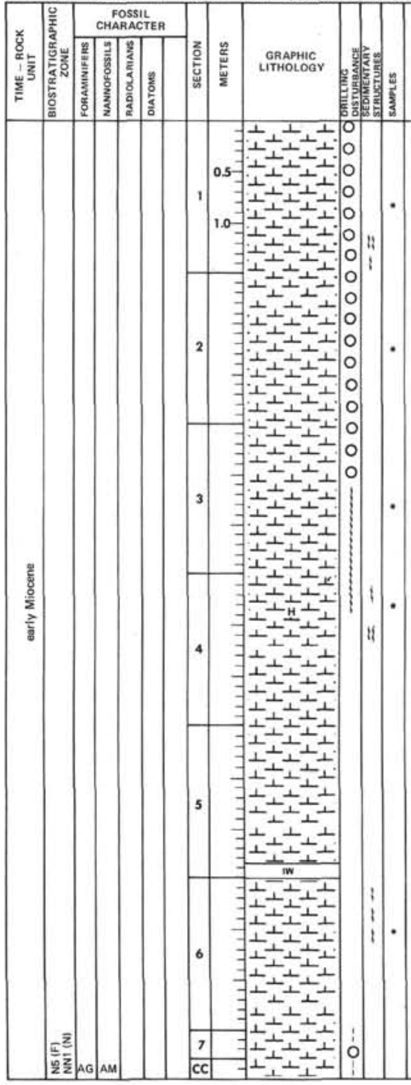
SMEAR SLIDE SUMMARY:

	1-80	3-80	5-80	CC
	D	D	D	D
Composition:				
Feldspar	–	–	TR	–
Mica	TR	–	–	–
Other clay minerals	–	TR	–	–
Foraminifers	5	15	–	3
Nannofossils	95	85	100	97
Diatoms	–	TR	–	–

ORGANIC CARBON AND CARBONATE:

	1-10	2-10	3-10	4-10	5-10	6-10	7-10
Organic carbon	–	–	–	–	–	–	–
Carbonate	95	93	95	97	98	99	98

SITE 525 HOLE A CORE 14 CORED INTERVAL 231.6–241.1 m



LITHOLOGIC DESCRIPTION

5Y 8/1

5Y 8/1
N9

5Y 8/1
N9
5Y 8/1
N9

5Y 8/1
N9

5YR 8/1

NANNOFOSSIL OOZE

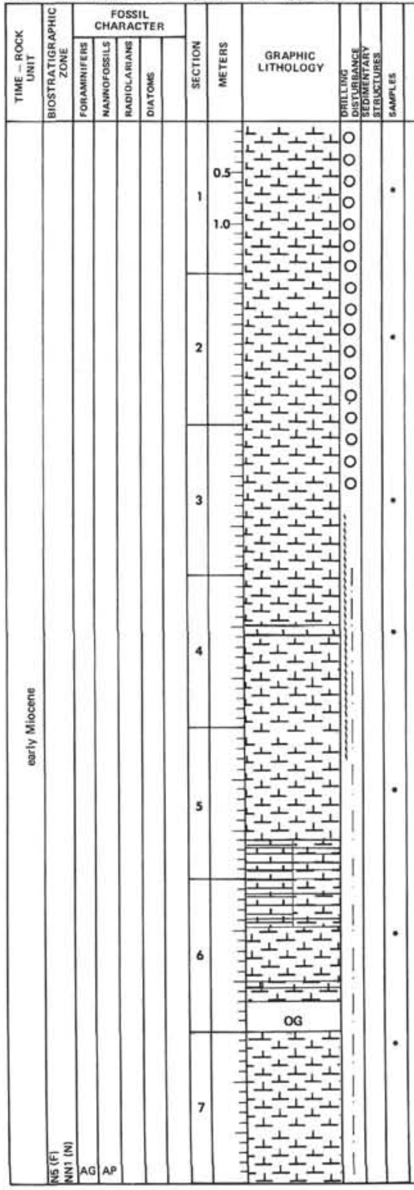
The top half of the core is a soupy to highly disturbed yellowish gray (5Y 8/1) nannofossil ooze.

The bottom half is undisturbed and has a mottled character. Halo burrows are noticed. The mottles are white (N9) in a yellowish gray matrix. In Sections 6 and 7 the colors grade from a white to pinkish gray (5YR 8/1).

SMEAR SLIDE SUMMARY:

	1-80	2-80	3-80	4-26	6-50
	D	D	D	M	D
Composition:					
Foraminifers	2	3	1	1	1
Nannofossils	98	97	99	99	99

SITE 525 HOLE A CORE 15 CORED INTERVAL 241.1–250.6 m



LITHOLOGIC DESCRIPTION

5YR 8/1

NANNOFOSSIL OOZE

A soupy to moderately disturbed, homogeneous, pinkish gray (5YR 8/1) nannofossil ooze interspersed with chalky somewhat lithified lenses or layers is observed.

SMEAR SLIDE SUMMARY:

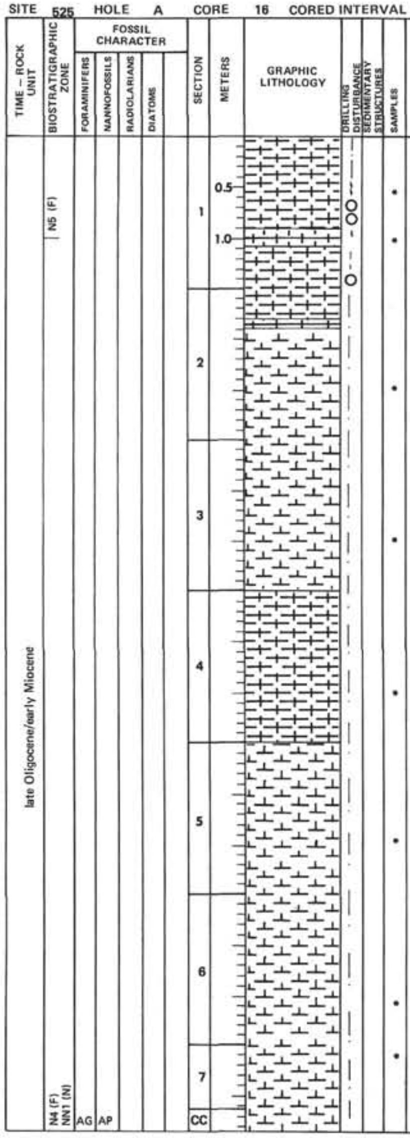
	1-66 D	2-66 D	3-78 D	4-51 D
Composition:				
Foraminifers	8	2	2	2
Calcareous nannofossils	92	98	98	98
(Discoasters)	(25)	(40)	(30)	(12)

	5-58 D	6-56 D	7-8 D
Composition:			
Foraminifers	2	2	1
Calcareous nannofossils	98	98	99
(Discoasters)	(20)	(15)	(10)

ORGANIC CARBON AND CARBONATE:

	1-10	2-10	3-10	4-10	5-10	6-10	7-10
Organic carbon	–	–	–	–	–	–	–
Carbonate	95	99	98	99	98	98	97

SITE 525 HOLE A CORE 16 CORED INTERVAL 241.1–250.6 m



LITHOLOGIC DESCRIPTION

8YR 8/1

FORAMINIFER NANNOFOSSIL OOZE

A pinkish gray (5YR 8/1) moderately to highly deformed foraminifer nannofossil ooze was recovered. Two thin (5–10 cm) foraminifer nannofossil chalk layers were observed in the upper portion of the core. No sedimentary or biogenic structures were observed.

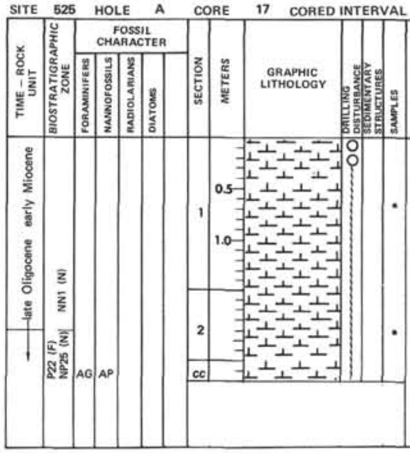
SMEAR SLIDE SUMMARY:

	1-64 D	1-109 M	2-100 D	4-100 D	5-97 D
Composition:					
Foraminifers	10	20	10	40	5
Calcareous nannofossils	90	80	90	90	95

ORGANIC CARBON AND CARBONATE:

	1-10	2-10	3-10	4-10	5-10	6-10	7-10
Organic carbon	–	–	–	–	–	–	–
Carbonate	96	95	94	98	97	95	97

SITE 525 HOLE A CORE 17 CORED INTERVAL 260.1–267.6 m



LITHOLOGIC DESCRIPTION

5YR 8/1

NANNOFOSSIL OOZE

A homogeneous, pinkish gray (5YR 8/1) nannofossil ooze was recovered. It is highly disturbed. No sedimentary or biogenic structures are observed. Rust from the drill pipe was present throughout.

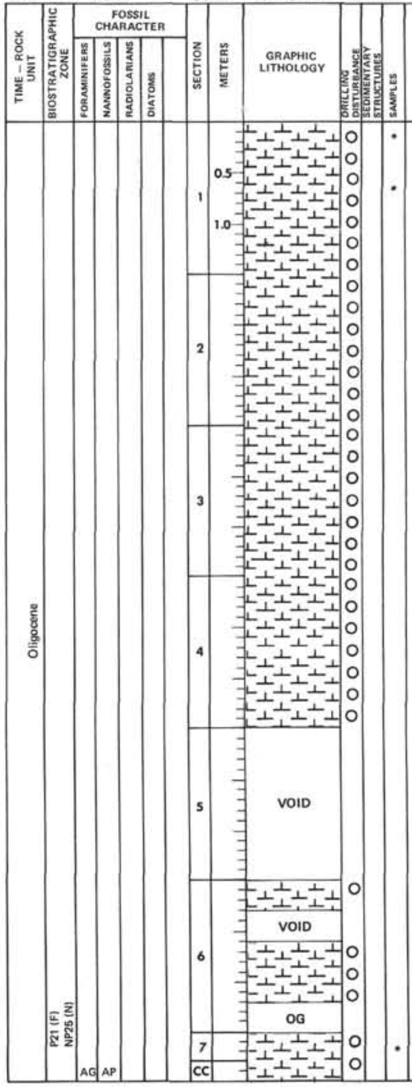
SMEAR SLIDE SUMMARY:

	1-70 D	2-40 D
Composition:		
Foraminifers	5	5
Calcareous nannofossils	95	95

ORGANIC CARBON AND CARBONATE:

	1-10	2-10
Organic carbon	–	–
Carbonate	97	94

SITE 525 HOLE A CORE 18 CORED INTERVAL 267.6–269.6 m



LITHOLOGIC DESCRIPTION

5YR 8/1

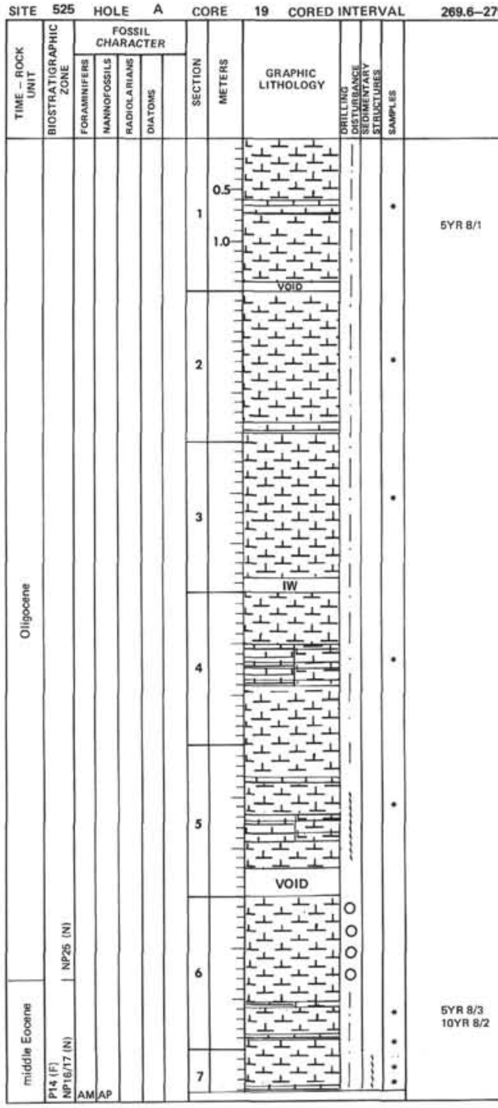
NANNOFOSSIL OOZE

A very soupy, pinkish gray (5YR 8/1) nannofossil ooze was recovered. The core contained lots of drill pipe rust flakes. No sedimentary or biogenic structures (ichnofossils) were observed.

SMEAR SLIDE SUMMARY:

	1-10 D	1-70 D	7-19 D
Composition:			
Foraminifers	5	5	10
Calcareous nannofossils	95	95	90

SITE 525 HOLE A CORE 19 CORED INTERVAL 269.6–279.1 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE/CHALK

A predominantly pinkish gray (5YR 8/1) nannofossil ooze was recovered. Thin chalk layers were interspersed. The sections were moderately disturbed by drilling.

SMEAR SLIDE SUMMARY:

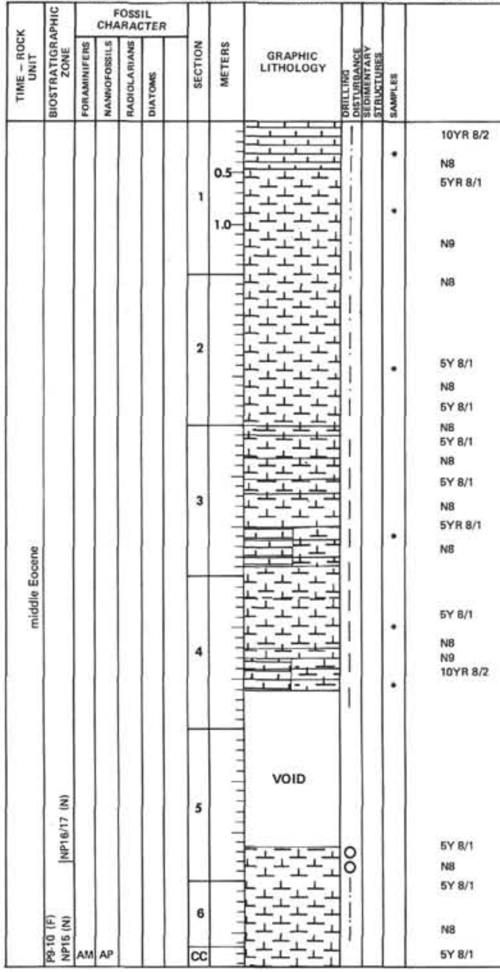
	1-68 D	2-68 D	3-68 D	4-68 D	5-68 D
Composition:					
Foraminifers	5	3	3	10	10
Calcareous nannofossils	92	95	95	90	90
Calcareous dinoflagellates	3	2	2	–	–

	6-13 D	6-145 D	7-18 D	7-32 D
Composition:				
Foraminifers	5	10	2	8
Calcareous nannofossils	95	90	98	90
Calcareous dinoflagellates	TR	–	–	2

ORGANIC CARBON AND CARBONATE:

	1-10	2-10	3-10	4-10	5-10	6-10	7-10
Organic carbon	–	–	–	–	–	–	–
Carbonate	96	93	94	95	97	95	96

SITE 525 HOLE A CORE 20 CORED INTERVAL 279.1–288.6 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE AND CHALK

A multicolored, very light gray (N8), pinkish gray (5YR 8/1) to yellowish gray (5Y 8/1) nannofossil ooze is present. Interbedded with the dominant nannofossil ooze is nannofossil chalk. Bedding which is vague is defined by color changes. The degree of deformation varies from slightly to very deformed. Some areas of light white (N9) to light gray mottles are observed.

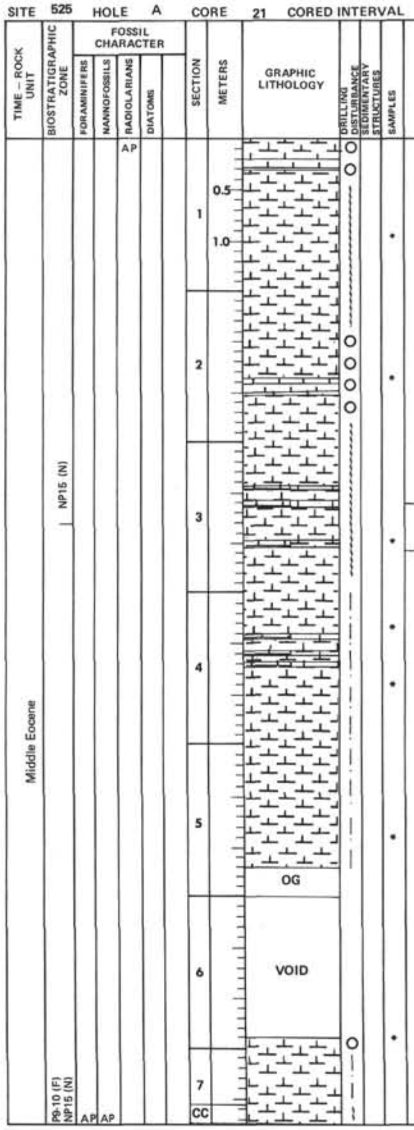
SMEAR SLIDE SUMMARY:

	1-30 D	2-90 D	3-106 D	4-53 D	4-85 D
Composition:					
Foraminifers	TR	1	5	8	5
Calcareous nannofossils	100	99	95	90	95
Calcareous dinoflagellates	–	–	–	2	–

ORGANIC CARBON AND CARBONATE:

	1-90	2-90	3-90	4-90	5-136	6-30
Organic carbon	–	–	–	–	–	–
Carbonate	98	96	95	82	97	97

SITE 525 HOLE A CORE 21 CORED INTERVAL 288.6–298.1 m



LITHOLOGIC DESCRIPTION

5YR 8/1
N9
5YR 8/1
N8
5YR 8/1
N8
N9
5YR 8/1
10YR 8/2

NANNOFOSSIL OOZE

A multicolored very light gray (N8), pinkish gray (5YR 8/1) to very pale orange (10YR 8/2) nannofossil ooze is present. Interspersed are layers of white (N9) lenses and/or layers. Intercalated with the dominant nannofossil ooze are layers of nannofossil chalk of variable thicknesses.

SMEAR SLIDE SUMMARY:

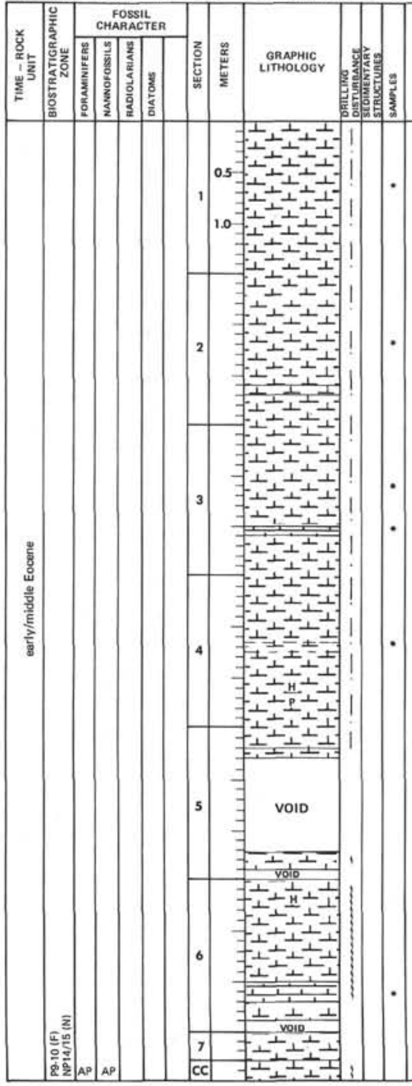
	1-90 D	2-90 D	3-90 D	4-31 D	4-90 D
Composition:					
Foraminifers	–	TR	–	TR	5
Calcareous nannofossils	100	100	100	100	95

	5-90 D	6-149 D
Composition:		
Foraminifers	TR	–
Calcareous nannofossils	100	100

ORGANIC CARBON AND CARBONATE:

	1-34	2-34	3-34	4-34	5-34	7-34
Organic carbon	–	–	–	–	–	–
Carbonate	95	97	97	96	98	97

SITE 525 HOLE A CORE 22 CORED INTERVAL 298.1–307.6 m



LITHOLOGIC DESCRIPTION

N8
N9
5Y 8/1
N8
N7
N8
N9
N8

NANNOFOSSIL OOZE WITH MINOR NANNOFOSSIL CHALK LAYERS

A light gray (N8) to yellowish gray (5Y 8/1) moderately disturbed nannofossil ooze is present. A few circular burrows with dark (N6) exteriors and white (N9) interiors are observed. They are the halo or planolites types burrows. A chalk layer in Section 6 shows excellent small scale circular burrows and included fragments.

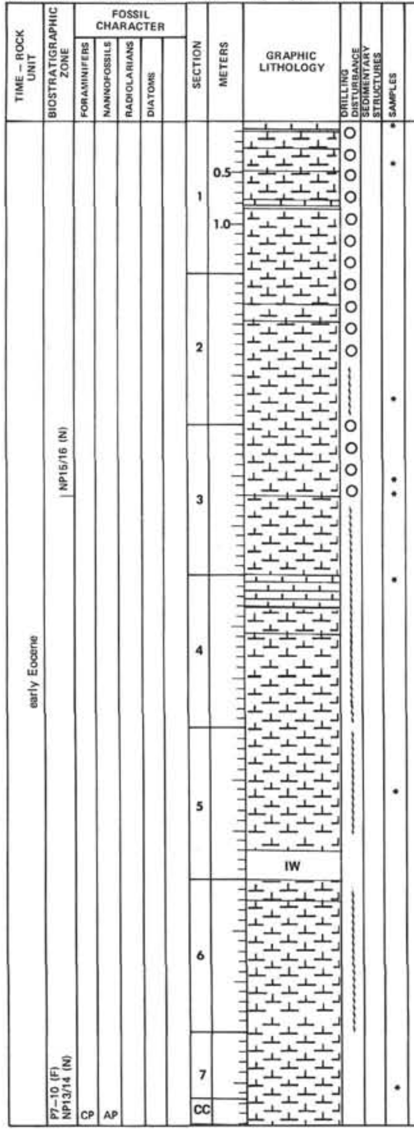
SMEAR SLIDE SUMMARY:

	1-70 D	2-70 D	3-70 D	4-70 D	6-112 D
Composition:					
Foraminifers	5	–	–	–	–
Calcareous nannofossils	95	95	100	95	100
Calcareous dinoflagellates	–	3	TR	5	–

ORGANIC CARBON AND CARBONATE:

	1-13	2-13	3-13	4-13	5-13	6-13
Organic carbon	–	–	–	–	–	–
Carbonate	97	99	97	96	99	98

SITE 525 HOLE A CORE 23 CORED INTERVAL 307.6–317.1 m



LITHOLOGIC DESCRIPTION

N9
5YR 8/1
N9
5YR 8/1
10YR 8/2
5YR 8/1
N9
5YR 8/1
N9
N8
N9
5YR 8/1

NANNOFOSSIL OOZE

A white to pinkish gray highly deformed nannofossil ooze. The nannofossil ooze is intercalated with nannofossil chalk. Layering is faint and is determined by color changes. One distinct brown layer at 9 cm in Section 4 contains FeO spherules.

SMEAR SLIDE SUMMARY:

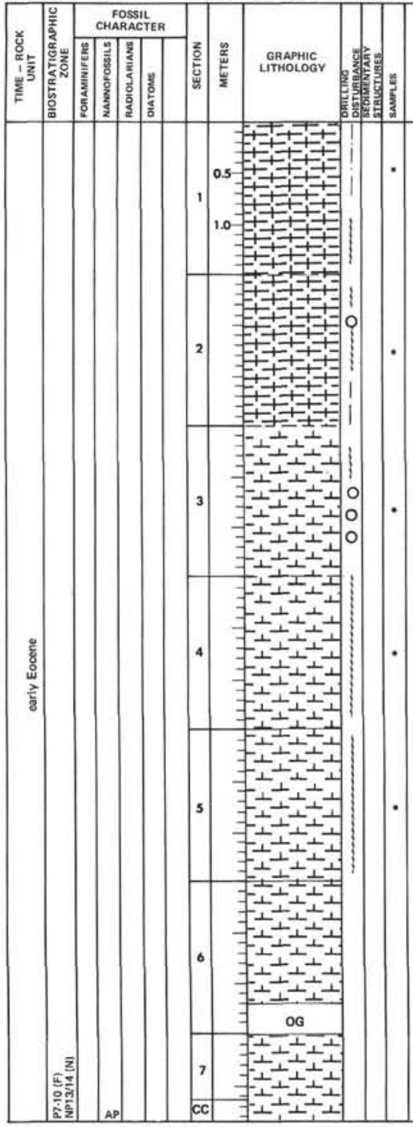
	1-7	1-60	2-120	3-63	3-70
	D	D	D	D	D
Composition:					
Amorphous FeO	–	–	–	20	–
Foraminifers	TR	3	3	–	–
Calcareous nannofossils	100	97	97	80	100

	4-7	5-70	7-64
	D	D	D
Composition:			
Amorphous FeO	5	–	–
Foraminifers	–	–	5
Calcareous nannofossils	95	100	92
Calcareous dinoflagellates	–	–	3

ORGANIC CARBON AND CARBONATE:

	1-12	2-12	3-12	4-12	5-12	6-12	7-12
Organic carbon	–	–	–	–	–	–	–
Carbonate	96	99	98	93	99	97	98

SITE 525 HOLE A CORE 24 CORED INTERVAL 317.1–326.6 m



LITHOLOGIC DESCRIPTION

N8
5YR 8/1
N9
N8
N8
5YR 8/1
N8
5YR 8/1
N8

NANNOFOSSIL OOZE TO FORAMINIFER NANNOFOSSIL OOZE

This core contains a very light gray (N8) to pinkish gray (5YR 8/1) nannofossil to foraminifer nannofossil ooze. Drilling disturbance has obliterated any sedimentary structures which may have existed.

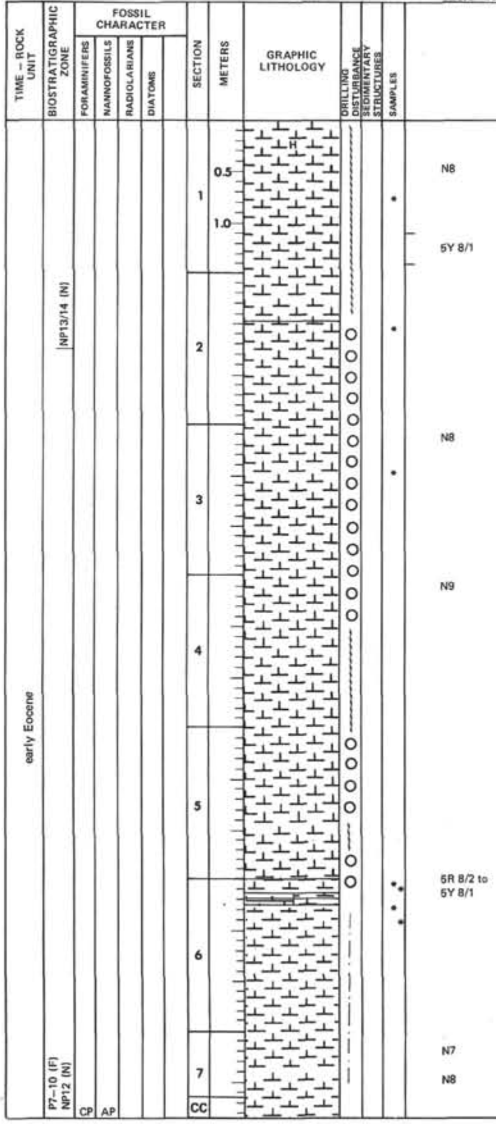
SMEAR SLIDE SUMMARY:

	1-42	2-80	3-80	4-80	5-80
	D	D	D	D	D
Composition:					
Quartz	–	–	–	TR	–
Felspar	–	–	–	1	1
Clay	1	1	1	TR	TR
Volcanic glass	–	1	–	–	–
Zeolites	1	–	–	–	–
Foraminifers	10	10	3	7	3
Calcareous nannofossils	83	89	95	92	96
Diatoms	1	–	1	–	–

ORGANIC CARBON AND CARBONATE:

	1-33	2-33	3-33	4-33	5-33	6-33
Organic carbon	–	–	–	–	–	–
Carbonate	97	97	95	98	96	97

SITE 525 HOLE A CORE 25 CORED INTERVAL 326.6–336.1 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

A variegated highly disturbed nannofossil ooze was cored.

It contains circular and elliptical structures that may be hallow burrows. They have dark (N6) rims and light (N9) interiors. Section 6 shows good layering contacts with the most notable change occurring from 14–18 cm.

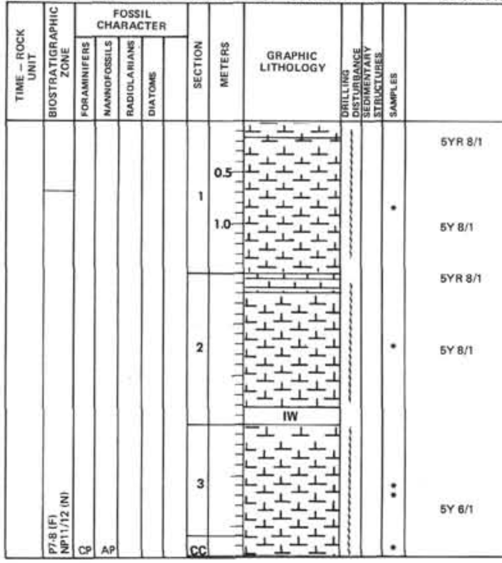
SMEAR SLIDE SUMMARY:

	1-78	2-59	3-47	6-11	6-18
	D	D	D	D	D
Composition:					
Foraminifers	1	2	1	1	–
Calcareous nannofossils	98	98	98	99	100

ORGANIC CARBON AND CARBONATE:

	1-33	2-33	4-33	6-33	7-33
Organic carbon	–	–	–	–	–
Carbonate	96	98	98	94	99

SITE 525 HOLE A CORE 26 CORED INTERVAL 336.1–345.6 m



LITHOLOGIC DESCRIPTION

NANOFOSSIL OOZE

A slightly bioturbated pinkish gray to yellowish gray nannofossil ooze is present. A chalk layer is found at the top of Section 2. In each section the ooze becomes firmer downward section. This may be an artifact of drilling or core handling.

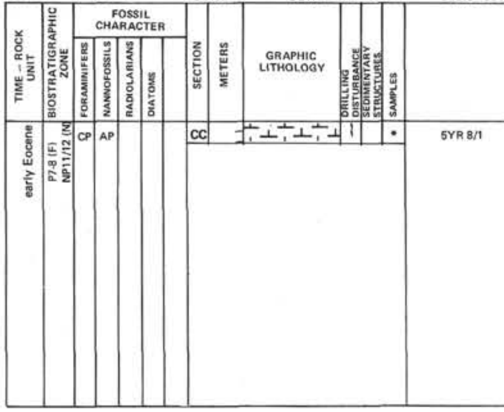
SMEAR SLIDE SUMMARY:

	1-80	2-80	3-69	CC
	D	D	D	D
Composition:				
Feldspar	–	TR	–	1
Clay	TR	–	–	–
Volcanic glass	–	–	–	1
Pyrite	–	–	10	–
Zeolites	1	1	–	–
Foraminifers	1	1	–	–
Calcareous nannofossils	98	98	90	98

ORGANIC CARBON AND CARBONATE:

	1-33	2-33	3-33
Organic carbon	–	–	–
Carbonate	99	98	99

SITE 525 HOLE A CORE 27 CORED INTERVAL 345.6–351.6 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

No core was recovered. The Core-Catcher contained a pinkish gray to light olive gray nannofossil ooze.

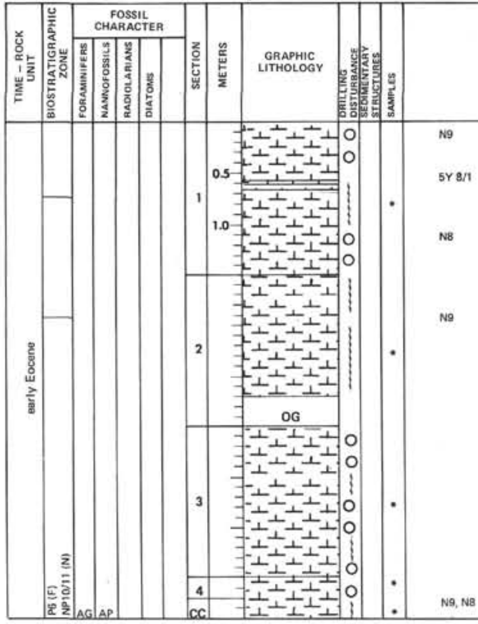
SMEAR SLIDE SUMMARY:

	CC
	D
Composition:	
Feldspar	1
Carbonate unspecified	TR
Calcareous nannofossils	97

ORGANIC CARBON AND CARBONATE:

	CC
Organic carbon	–
Carbonate	90

SITE 525 HOLE A CORE 28 CORED INTERVAL 351.6–355.1 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

A predominantly white (N9) to light gray (N8) soupy to highly disturbed nannofossil ooze was recovered. A chalk layer is present in Section 1.

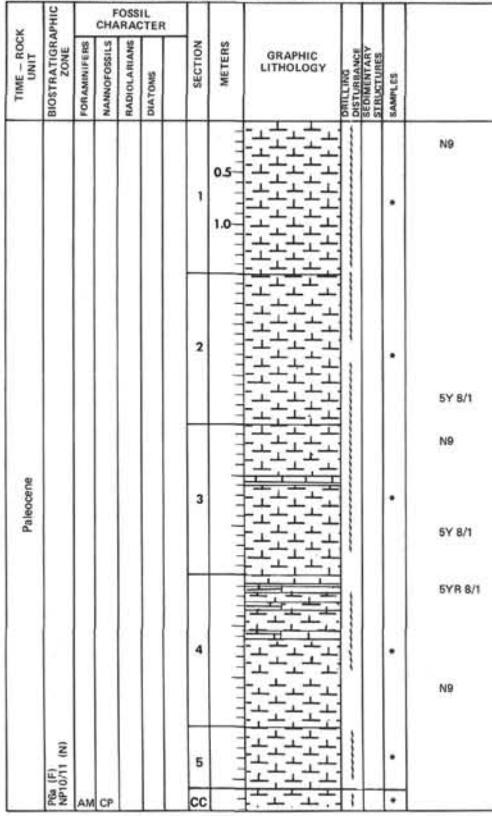
SMEAR SLIDE SUMMARY:

	1-80 D	2-80 D	3-80 D	4-10 D	CC D
Composition:					
Quartz	–	–	TR	–	–
Feldspar	TR	–	2	TR	–
Clay	–	TR	–	TR	–
Palagonite	–	TR	–	–	–
Zeolites	1	1	1	TR	1
Foraminifers	1	2	–	1	1
Calcareous nannofossils	98	97	97	99	98

ORGANIC CARBON AND CARBONATE:

	1-8	2-8	3-8
Organic carbon	–	–	–
Carbonate	99	99	100

SITE 525 HOLE A CORE 29 CORED INTERVAL 355.1–354.5 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE WITH SOME NANNOFOSSIL CHALK LAYERS

This core contains a white (N9) to yellowish gray (5Y 8/1) highly disturbed nannofossil ooze. Nannofossil chalk layers are found interbedded with ooze in Sections 3 and 4.

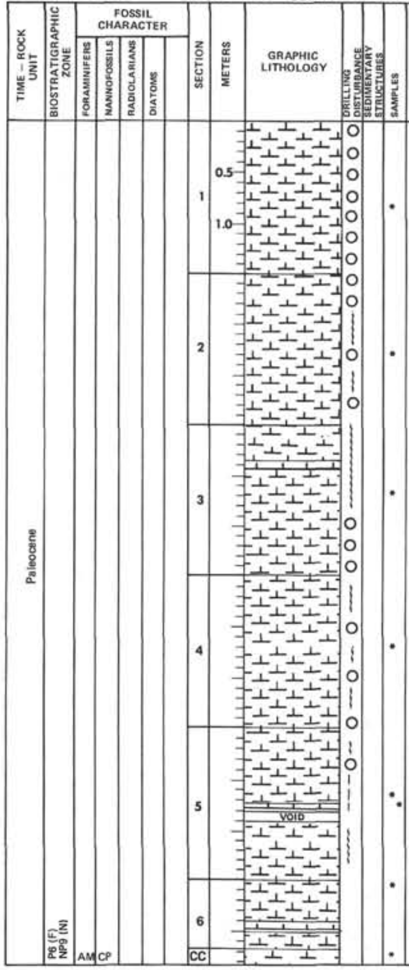
SMEAR SLIDE SUMMARY:

	1-80 D	2-80 D	3-80 D	4-80 D	5-32 D	CC D
Composition:						
Feldspar	TR	–	–	–	–	–
Clay	–	5	–	TR	–	–
Zeolites	1	1	1	TR	TR	TR
Foraminifers	TR	–	TR	TR	TR	TR
Calcareous nannofossils	99	94	99	100	100	100

ORGANIC CARBON AND CARBONATE:

	1-15	2-15	3-15	4-15	5-15
Organic carbon	–	–	–	–	–
Carbonate	98	97	97	96	97

SITE 525 HOLE A CORE 30 CORED INTERVAL 364.6–374.1 m



LITHOLOGIC DESCRIPTION

5YR 8/1

5Y 8/1

5YR 8/1

N9

NANNOFOSSIL OOZE

A pinkish gray (5YR 8/1) to yellowish gray (5Y 8/1) highly disturbed nannofossil ooze was recovered. A few mottles are located throughout the cores but they are too obscure to be classified as biogenic.

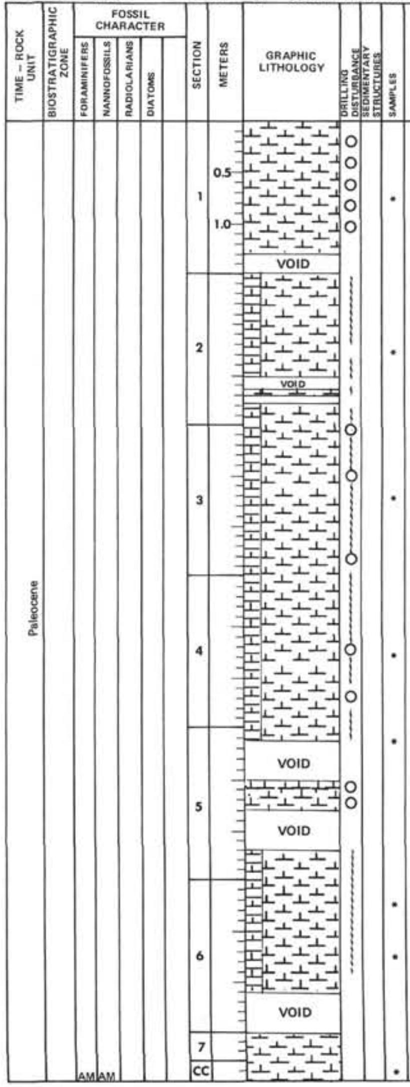
SMEAR SLIDE SUMMARY:

	1-80	2-80	3-80	4-80	5-80	CC
	D	D	D	D	D	D
Composition:						
Feldspar	–	TR	TR	–	–	–
Clay	–	–	–	–	–	10
Pyrite	TR	–	–	–	–	–
Zeolites	2	TR	TR	TR	TR	TR
Foraminifers	1	TR	TR	TR	TR	TR
Calcareous nannofossils	97	100	100	100	90	100
Radiolarians	–	–	–	–	–	TR

ORGANIC CARBON AND CARBONATE:

	2-19	3-19	4-19	5-19	6-19
Organic carbon	–	–	–	–	–
Carbonate	95	93	97	97	98

SITE 525 HOLE A CORE 31 CORED INTERVAL 374.1–383.6 m



LITHOLOGIC DESCRIPTION

N9

VOID

5YR 8/1

N9

N8

INTERLAYERED NANNOFOSSIL OOZE AND NANNOFOSSIL CHALK

This core consists of a white (N9) to pinkish gray (5YR 8/1) highly disturbed sequence of alternating layers of nannofossil chalks and ooze. No sedimentary structures are preserved. At the bottom of Section 3 some pale yellowish brown (10YR 6/2) chert fragments are present.

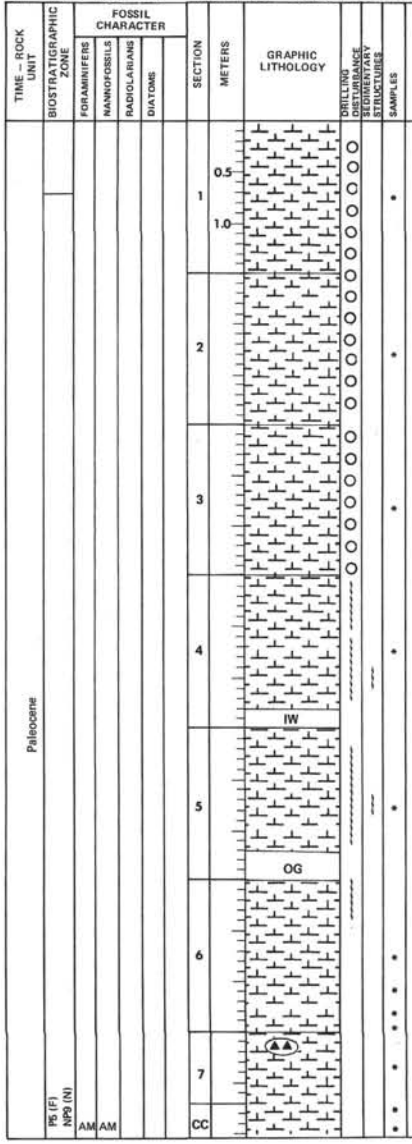
SMEAR SLIDE SUMMARY:

	1-80	2-80	3-80	4-80	5-10	CC
	D	D	D	D	D	D
Composition:						
Quartz	–	TR	–	TR	–	–
Clay	TR	–	–	–	–	–
Volcanic glass	–	TR	–	TR	–	–
Zeolites	TR	–	TR	–	1	1
Carbonate unspecified	–	–	–	TR	–	–
Foraminifers	1	2	2	1	2	1
Calcareous nannofossils	99	98	98	99	92	98
Other	–	–	–	–	–	TR

ORGANIC CARBON AND CARBONATE:

	1-10	2-10	3-10	4-10	5-10	6-10
Organic carbon	–	–	–	–	–	–
Carbonate	89	93	97	78	97	93

SITE 525 HOLE A CORE 32 CORED INTERVAL 383.6–393.1 m



LITHOLOGIC DESCRIPTION

N9

NANNOFOSSIL OOZE

Core 32 contains a white (N9) soupy to highly disturbed nannofossil ooze. No structures are preserved. Chert fragments occur in Sections 2, 3, and 7, and in the Core-Catcher. Section 7 contains a large 3x5 cm chert nodule.

SMEAR SLIDE SUMMARY:

	1-80 D	2-80 D	3-80 D	4-80 D	5-80 D	6-80 D
Composition:						
Feldspar	TR	TR	–	–	–	–
Mica	TR	TR	–	–	–	–
Palagonite	TR	–	–	–	–	TR
Zeolites	1	2	TR	TR	TR	1
Carbonate unspecified	–	–	TR	–	–	–
Foraminifers	TR	2	1	2	TR	TR
Calcareous nannofossils	99	96	99	98	100	99
Dolomite	TR	TR	TR	TR	TR	TR

ORGANIC CARBON AND CARBONATE:

	1-10	2-10	3-10	4-10	5-10	6-10	7-10
Organic carbon	–	–	–	–	–	–	–
Carbonate	95	91	94	84	95	100	92

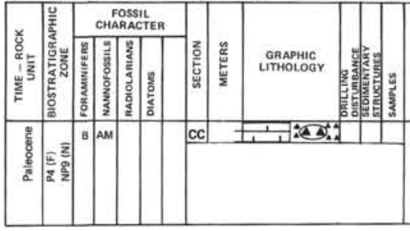
†No sediment was recovered from Core 33.

N7

N9

5Y 6/1

SITE 525 HOLE A CORE 34 CORED INTERVAL 399.1–402.5 m

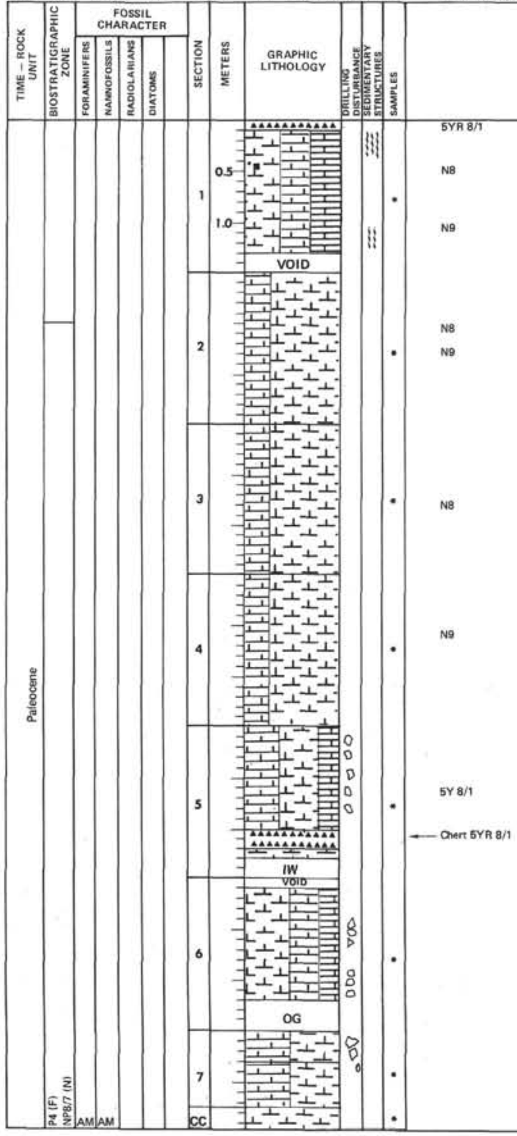


LITHOLOGIC DESCRIPTION

N9

No recovery in Sections 1–7. The Core-Catcher contained a pale yellowish brown (10YR 6/2) chert patch in sharp contact with a white chalk. The dimensions of the chert are 3x1.0x2.5 cm.

SITE 525 HOLE A CORE 35 CORED INTERVAL 402.6–412.1 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE INTERBEDDED WITH NANNOFOSSIL CHALK, LIMESTONE, AND CHERT

This core contains a white (N9) nannofossil chalk which is interbedded with very light gray (N8) nannofossil chalk, yellowish gray (5Y 8/1) limestone and chert which is light olive gray (5Y 6/1) to pinksih gray (5YR 8/1). Each unit is relatively homogeneous with only a few biogenic mottles being observed in Section 1. Sections 5, 6, and 7 have been breciated during drilling.

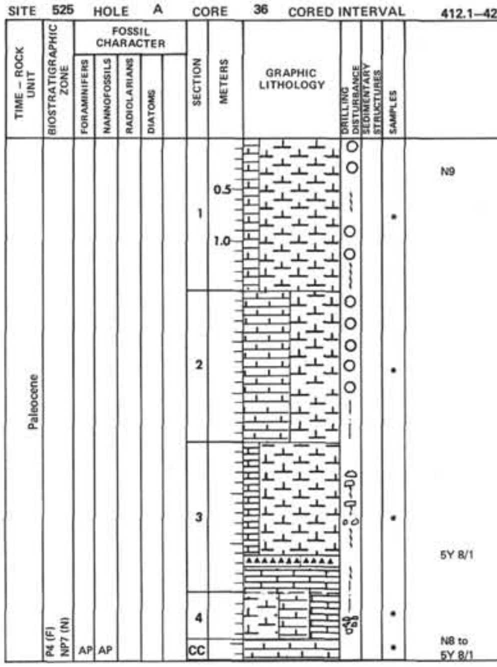
SMEAR SLIDE SUMMARY:

	1-80 D	3-80 D	5-80 D	7-44 D	CC D
Composition:					
Quartz	–	–	TR	–	TR
Feldspar	–	–	TR	–	–
Heavy minerals	–	–	–	TR	–
Clay	5	5	7	10	–
Volcanic glass	–	–	–	TR	–
Zeolites	–	TR	–	TR	TR
Carbonate unspecified	5	–	–	–	–
Foraminifers	–	TR	TR	–	1
Calcareous nannofossils	88	90	86	90	99
Dolomite	2	5	7	–	–

ORGANIC CARBON AND CARBONATE:

	1-13	2-11	3-11	4-11	5-11	6-11	7-11
Organic carbon	–	–	–	–	–	–	–
Carbonate	95	97	97	93	88	87	98

SITE 525 HOLE A CORE 36 CORED INTERVAL 412.1–421.6 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

A moderately to highly disturbed sequence of layered nannofossil ooze, chalk, and chert was recovered. The ooze is predominantly white (N9), with light gray (N8) to yellowish gray (5Y 8/1) limestone, light greenish gray (5GY 8/1) and yellowish gray (5Y 8/1) chalk, and light olive gray (5Y 6/1) to pinkish gray (5YR 8/1) chert fragments. Most of the non-ooze layers are very thin.

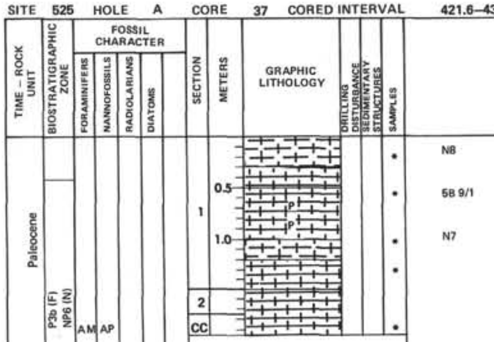
SMEAR SLIDE SUMMARY:

	1-80 D	2-80 D	3-80 D	4-22 D
Composition:				
Quartz	TR	2	–	–
Clay	3	10	25	–
Zeolites	TR	TR	15	–
Foraminifers	–	–	TR	1
Calcareous nannofossils	97	88	55	99
Diatoms	–	–	TR	–
Dolomite	TR	–	–	–

ORGANIC CARBON AND CARBONATE:

	1-10	2-10	3-10	4-9
Organic carbon	–	–	–	–
Carbonate	79	92	94	91

SITE 525 HOLE A CORE 37 CORED INTERVAL 421.6–431.1 m



LITHOLOGIC DESCRIPTION

FORAMINIFER NANNOFOSSIL CHALK

A very light gray (N8) to bluish white nannofossil chalk is present. Flazer type bedding and planolites type burrows are preserved. The burrows and bedding are horizontal. Some pieces have included fragments which may have been beds of chalk separated by ooze layers.

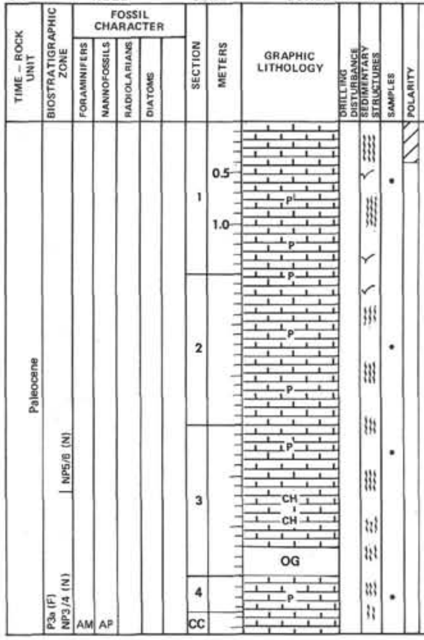
SMEAR SLIDE SUMMARY:

	1-23 D	1-63 D	1-104 D	1-130 D	CC D
Composition:					
Foraminifers	20	20	5	10	20
Calcareous nannofossils	80	80	95	90	80

ORGANIC CARBON AND CARBONATE:

	1-9	2-9
Organic carbon	–	–
Carbonate	75	85

SITE 525 HOLE A CORE 38 CORED INTERVAL 431.1–440.6 m



N8

N7

N8

2.5Y 6/2

N7

LITHOLOGIC DESCRIPTION

NANNOFOSSIL CHALK

This core contains a very light gasy (N8) to light brownish gray nannofossil chalk. Large planolites type burrows and flazer type bedding is observed. Mottling is strong throughout the core.

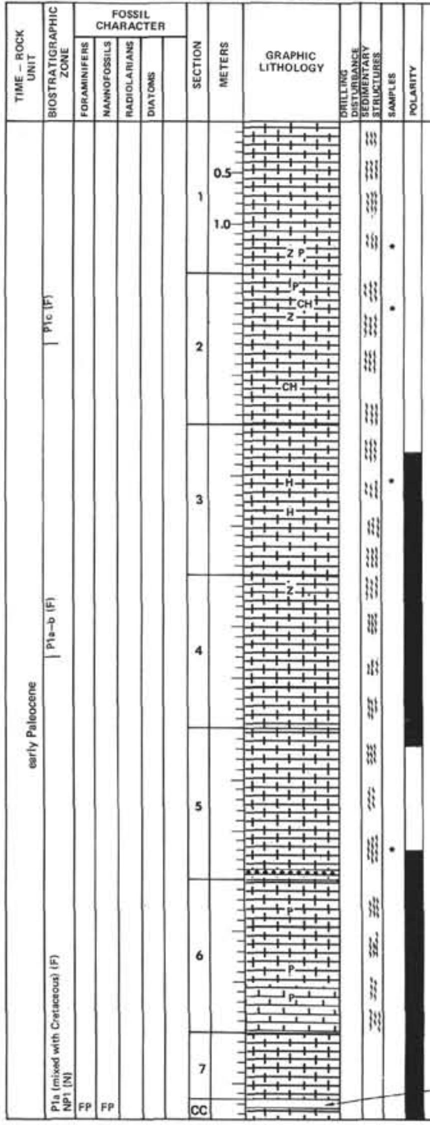
SMEAR SLIDE SUMMARY:

	1-60 D	2-75 D	3-28 D	4-23 D
Composition:				
Amorphous FeO	TR	–	TR	TR
Carbonate unspecified	5	–	–	–
Foraminifers	TR	–	TR	TR
Calcareous nannofossils	95	100	99	99

ORGANIC CARBON AND CARBONATE:

	1-9	2-9	3-9	4-9
Organic carbon	–	–	–	–
Carbonate	91	78	84	80

SITE 525 HOLE A CORE 39 CORED INTERVAL 440.6–450.1 m



5Y 6/1

5Y 8/1

10YR 6/2

5YR 4/4

10YR 6/2

VOID

5YR 3/4

LITHOLOGIC DESCRIPTION

INDURATED FORAMINIFER NANNOFOSSIL CHALK

A multicolored highly bioturbated well preserved predominantly light olive gray (5Y 6/1) to yellowish gray (5Y 8/1) nannofossil chalk. Ichnofossils are present and are beautifully preserved. Non-calcareous green to gray clasts are present in the lower sections (smectites?). Slump structures are not apparent. Some faint traces of cyclic type sedimentation are present.

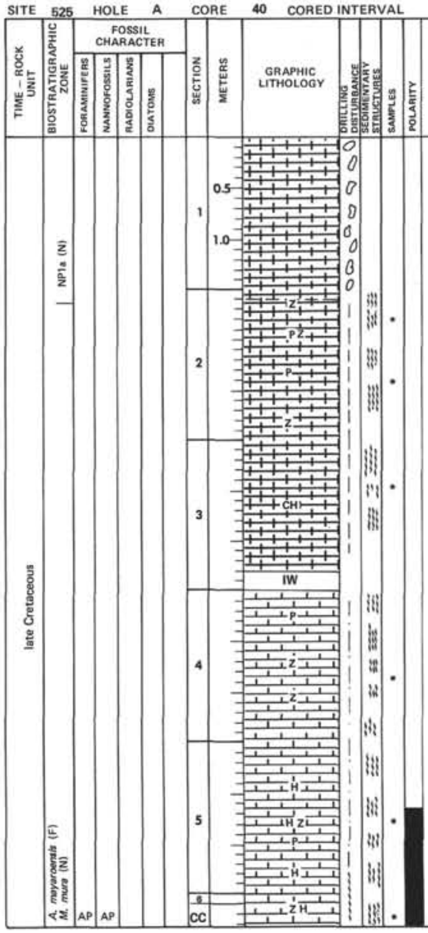
SMEAR SLIDE SUMMARY:

	1-122 D	2-40 D	3-55 D	5-123 D
Composition:				
Foraminifers	10	20	20	10
Calcareous nannofossils	90	80	80	80

ORGANIC CARBON AND CARBONATE:

	1-56	2-48	3-49	4-49	5-61	6-40
Organic carbon	–	–	–	–	–	–
Carbonate	82	80	67	66	53	67

SITE 525 HOLE A CORE 40 CORED INTERVAL 450.1–495.6 m



LITHOLOGIC DESCRIPTION

5YR 8/1

FORAMINIFER NANNOFOSSIL CHALK TO NANNOFOSSIL CHALK

This core contains a multicolored but predominantly pinkish gray (5YR 8/1) and light brown (5YR 6/4) foraminifer *nannofossil* and *nannofossil* chalk. Ichnofossil preservation is excellent. Zoophycus, halo burrows, chondrites, and planolites type burrows are all present.

The Tertiary-Cretaceous boundary is found at the top of Section 2.

5YR 3/4

58 6/1

SMEAR SLIDE SUMMARY:

	2-30	2-95	3-51	4-90	5-87	CC
	D	D	D	D	D	D
Composition:						
Quartz	–	–	–	15	–	10
Carbonate unspecified	–	–	–	–	5	5
Foraminifers	10	10	10	5	–	10
Calcareous nannofossils	90	90	90	80	95	75

ORGANIC CARBON AND CARBONATE:

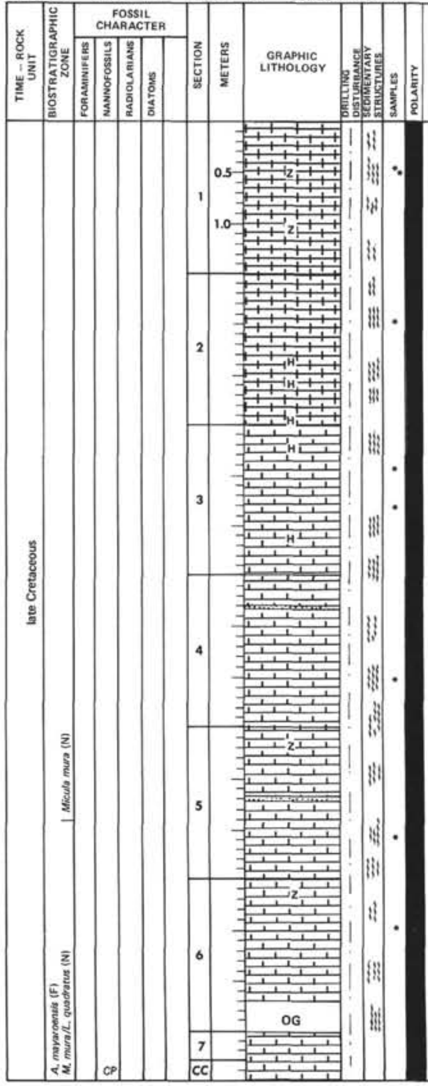
	2-111	3-58	4-52	5-48
Organic carbon	–	–	–	–
Carbonate	57	76	76	68

5YR 8/1

5YR 5/6

5YR 6/4

SITE 525 HOLE A CORE 41 CORED INTERVAL 459.6–469.1 m



LITHOLOGIC DESCRIPTION

5YR 5/6

INDURATED NANNOFOSSIL CHALK AND FORAM-NANNOFOSSIL CHALK

A highly bioturbated (zoophycus pelleted zoophycus, halo burrows) yellowish brown (10YR 6/2) foraminifer *nannofossil chalk is present.*

Coarse-grained material occurs disseminated throughout the core. The coarse-grained material consists of volcanic glass, quartz, large foraminifer and basalt rock fragments.

Patterns of cyclic sedimentation are present with the dark brown layers representing coarser-grained material (non-carbonate fraction) and the finer-grained material being lighter in color. Boundaries are gradational. These repeating cycles may represent small slump deposits, i.e. periods when coarser non-carbonate debris was deposited into a dominantly calcareous environment.

10YR 6/2

5YR 4/4

SMEAR SLIDE SUMMARY:

	1-44	2-55	3-84	4-104	5-110
	D	D	D	D	D
Composition:					
Quartz	10	5	10	1	TR
Volcanic glass	10	5	1	1	15
Foraminifers	20	5	31	3	5
Calcareous nannofossils	60	85	59	95	92

10YR 6/2

ORGANIC CARBON AND CARBONATE:

	1-51	2-38	3-56	4-90	5-48
Organic carbon	–	–	–	–	–
Carbonate	45	47	61	66	58

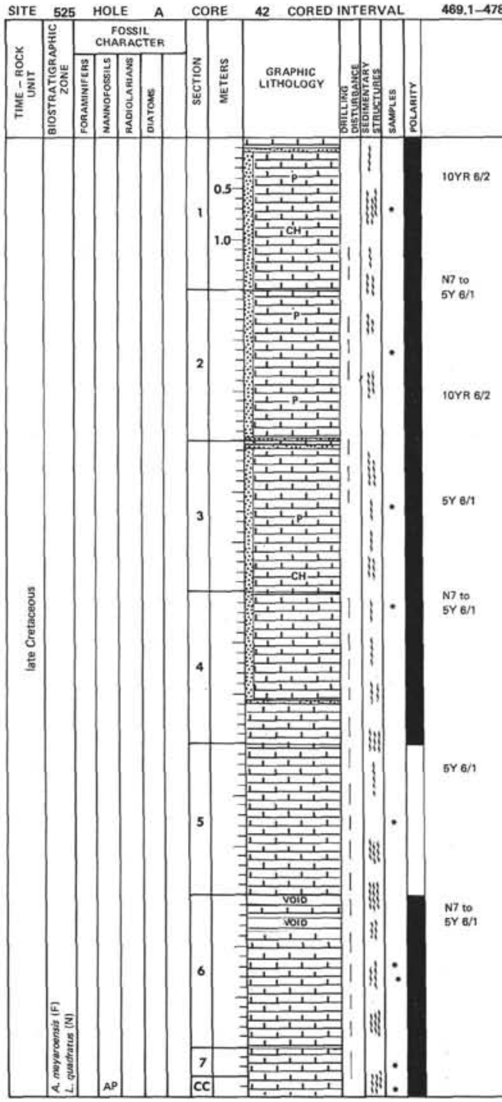
	6-48	7-47
Organic carbon	–	–
Carbonate	65	69

5YR 4/4

5Y 6/1

25 Y 6/2

SITE 525 HOLE A CORE 42 CORED INTERVAL 469.1–478.6 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL CHALK

A light gray (N7) to light olive gray (5Y 6/1) nannofossil chalk interbedded with some greenish gray (5G 6/1) coarse-grained sandy layers (approximately 1 cm) are present. Biogenic sedimentary structures are numerous. A cyclic sedimentation pattern persists and are interpreted to be very small scale slump deposits.

SMEAR SLIDE SUMMARY:

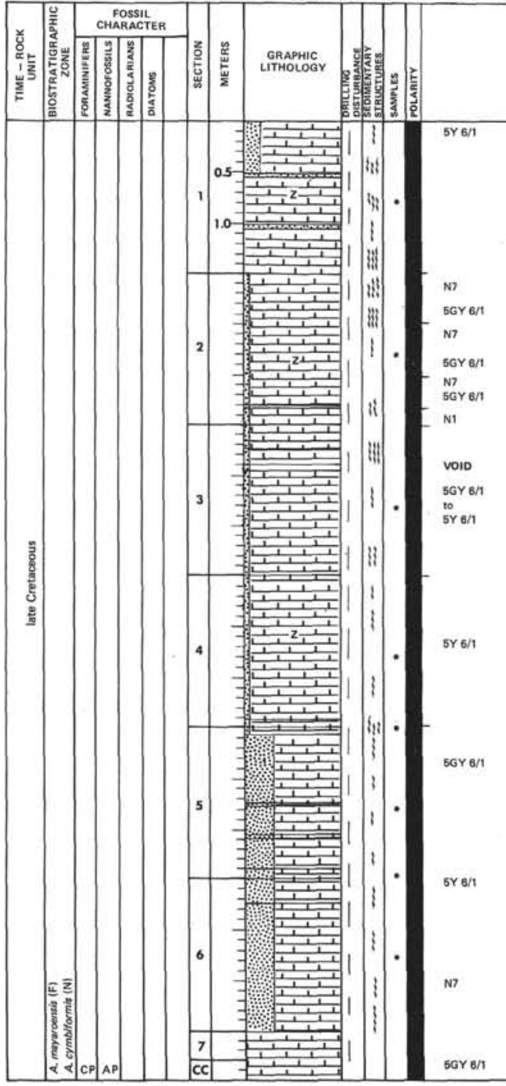
	1-70	2-70	3-70	4-28	5-80
	D	D	D	D	D
Composition:					
Quartz	–	–	–	1	TR
Feldspar	–	–	–	TR	TR
Clay	–	–	–	–	TR
Volcanic glass	–	TR	TR	TR	TR
Palagonite	–	–	–	–	TR
Pyrite	–	–	–	TR	–
Zeolites	–	–	–	1	–
Carbonate unspecified	–	–	–	–	TR
Foraminifers	2	2	1	1	2
Calcareous nannofossils	98	98	99	97	98

ORGANIC CARBON AND CARBONATE:

	1-33	2-7	3-20	4-32	5-32
Organic carbon	–	–	–	–	–
Carbonate	70	72	70	71	68

	6-32	7-15
Organic carbon	–	–
Carbonate	71	66

SITE 525 HOLE A CORE 43 CORED INTERVAL 478.6–488.1 m



LITHOLOGIC DESCRIPTION

INTERBEDDED NANNOFOSSIL CHALK AND SANDSTONE

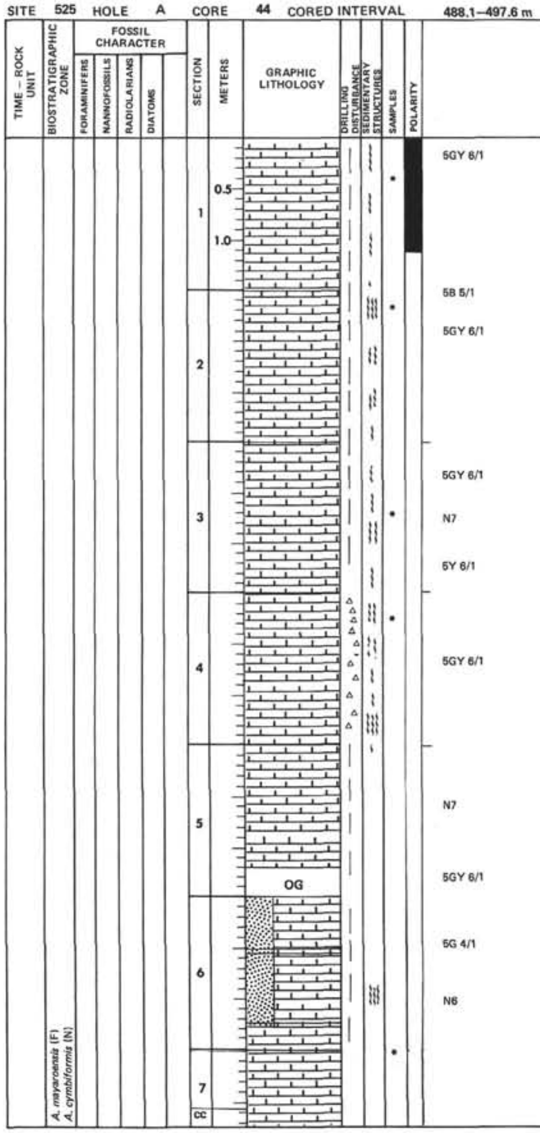
A light olive gray (5Y 6/1) to greenish gray (5GY 6/1) nannofossil chalk is present. Coarse-grained sand/sandstone layers are present and repeat in patterns with the calcareous chalk. These cycles are most noticeable in Sections 1, 2, and 5.

Burrowing is intense with excellent preservation of ichnofossils.

SMEAR SLIDE SUMMARY:

	1-80	2-80	3-80	4-80	6-2
	D	D	D	D	D
Composition:					
Quartz	1	TR	TR	TR	TR
Feldspar	–	TR	TR	TR	TR
Mica	TR	–	–	–	–
Clay	–	2	–	–	–
Volcanic glass	TR	–	1	TR	1
Pyrite	–	–	–	–	10
Carbonate unspecified	–	–	2	1	–
Foraminifers	2	–	2	1	1
Calcareous nannofossils	27	98	95	98	88

SITE 525 HOLE A CORE 44 CORED INTERVAL 488.1–497.6 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL CHALK

A greenish gray (5GY 6/1) indurated, heavily bioturbated nannofossil chalk is present. Light olive gray (5Y 6/1) clayey layers occur in Sections 1 and 2.

Zoophyous and planolite burrows occur frequently and especially in Section 3. Coarse-grained material is present in Sections 6 and 7. Volcanic and zeolitic fragments are identified in smear slides.

A possible fault plane with slickensides is visible in Section 6 (103–107 cm).

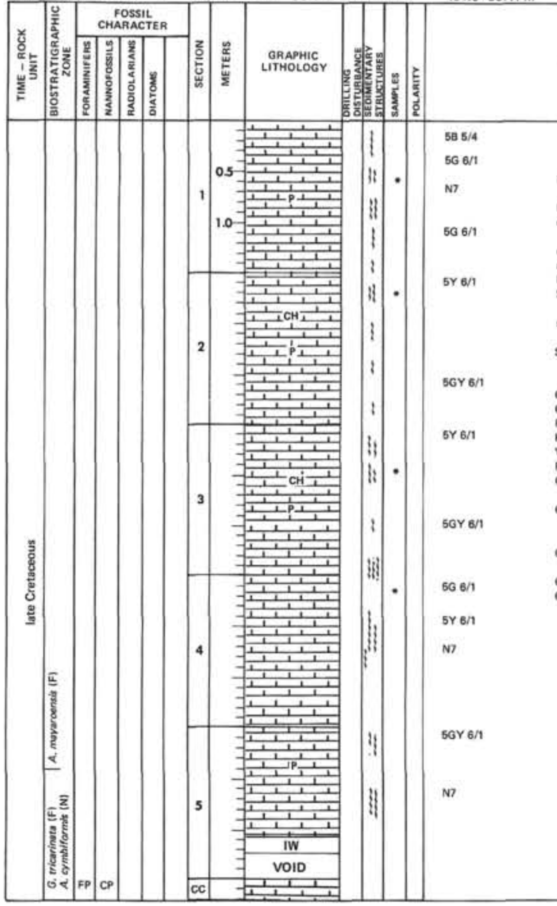
SMEAR SLIDE SUMMARY:

	1-46 D	2-27 D	3-80 D	4-30 D	7-4 D
Composition:					
Quartz	TR	–	–	–	–
Feldspar	TR	TR	–	–	–
Volcanic glass	TR	15	TR	5	9
Zeolites	TR	TR	2	15	5
Foraminifers	–	TR	–	–	–
Calcareous nannofossils	99	85	28	80	92
Fish remains	–	–	–	–	TR

ORGANIC CARBON AND CARBONATE:

	1-5	2-16	3-14	4-14	5-29	6-29
Organic carbon	–	–	–	–	–	–
Carbonate	60	42	31	43	55	44

SITE 525 HOLE A CORE 45 CORED INTERVAL 491.6–507.1 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL CHALK

A greenish gray (5G 6/1), to light olive gray (5Y 6/1) indurated, bioturbated nannofossil chalk was recovered.

Light gray (N7) to light olive gray (5Y 6/1) thin clayey layers (1 cm) occur in Sections 1–4. Trace fossils are abundant in Sections 2, 3, and 5 (chondrites, planolites).

Interspersed throughout the core with the chalk are clayey layers and coarser-grained layers which contain high amounts of non-carbonate sediments. The coarser-grained layers account for as much as 50% of the sediment (e.g. Section 3).

These alternating lithologies are suggestive of small scale slump deposition.

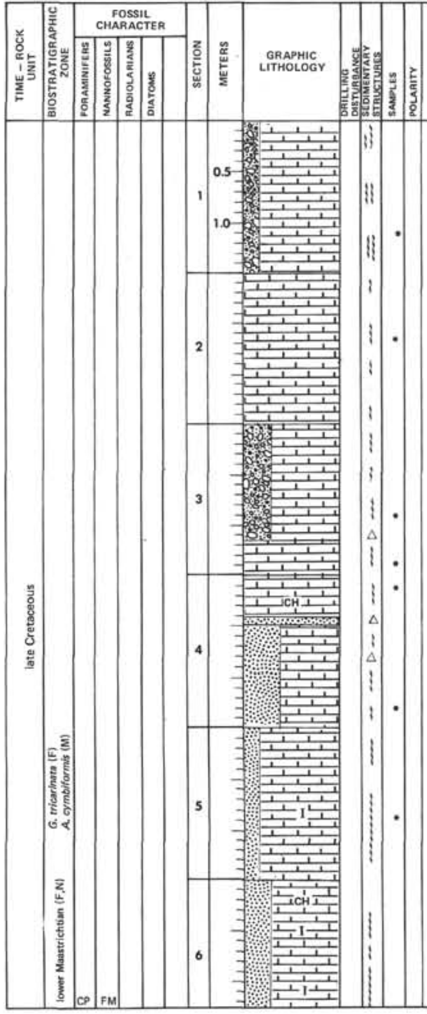
SMEAR SLIDE SUMMARY:

	1-59 D	2-22 D	3-50 D	4-12 D
Composition:				
Quartz	TR	5	1	TR
Feldspar	TR	–	–	–
Heavy minerals	10	50	20	4
Volcanic glass	TR	–	TR	TR
Palagonite	–	10	–	–
Carbonate unspecified	–	10	–	TR
Calcareous nannofossils	98	35	80	96

ORGANIC CARBON AND CARBONATE:

	1-10	2-9	3-5	4-10	5-10
Organic carbon	–	–	–	–	–
Carbonate	31	28	36	41	51

SITE 525 HOLE A CORE 46 CORED INTERVAL 507.1–516.6 m



LITHOLOGIC DESCRIPTION

10Y 4/2
5GY 3/2
10Y 4/2
5GY 3/2
10Y 4/2
5GY 3/2
10Y 4/2

INDURATED NANNOFOSSIL CHALK

A predominantly fine-grained grayish olive (10Y 4/2) to grayish olive green (5GY 3/2) moderately indurated nannofossil chalk is present.

Coarse-grained units are present (lenses, layers, or disseminated grains), through the core, varying from conglomerate to fine sand. Rounded intraclasts are also observed. Lower bedding contacts are sharp. The coarse-grain layer contains *Inoceramus* sp., nannofossil chalk fragments and palagonite. This sedimentation, often cyclic, suggests slumping processes were active at that depositional site.

Biogenic sedimentary structure are abundant. A large marcasite nodule is found in a coarse layer at the top of Section 4.

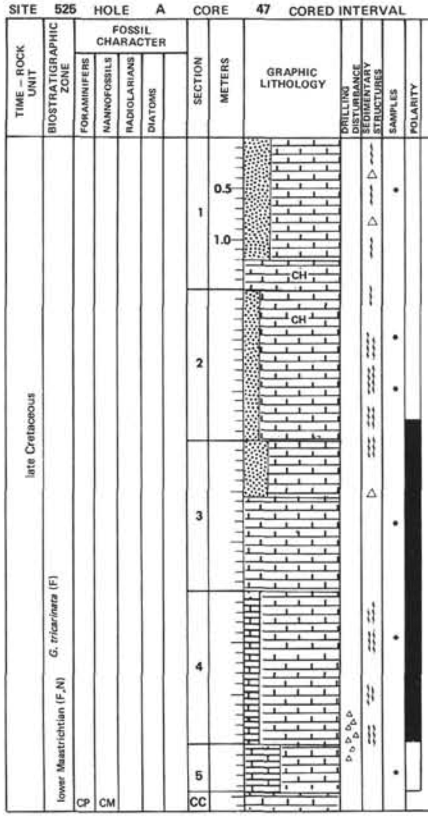
SMEAR SLIDE SUMMARY:

	1-110	2-70	3-94	4-17	5-98
	D	D	D	D	D
Composition:					
Quartz	–	10	TR	5	TR
Volcanic glass	30	10	50	30	5
Palagonite	40	–	50	60	25
Foraminifers	25	15	TR	–	10
Calcareous nannofossils	25	65	TR	25	60

ORGANIC CARBON AND CARBONATE:

	1-12	2-26	3-4	4-17	5-6	6-15
Organic carbon	–	–	–	–	–	–
Carbonate	43	22	39	10	36	31

SITE 525 HOLE A CORE 47 CORED INTERVAL 516.6–526.1 m



LITHOLOGIC DESCRIPTION

10Y 4/2
5GY 3/2
5GY 3/2
5GY 6/1
5B 5/1
5G 6/1

INDURATED NANNOFOSSIL CHALK

This core contains a moderately bioturbated predominantly grayish olive (10Y 4/2) indurated nannofossil chalk. The chalk is intercalated with coarse palagonite rich layers that fine upward. The palagonite also appears throughout the chalk layers. The chalk grades into a limestone at the bottom of the core.

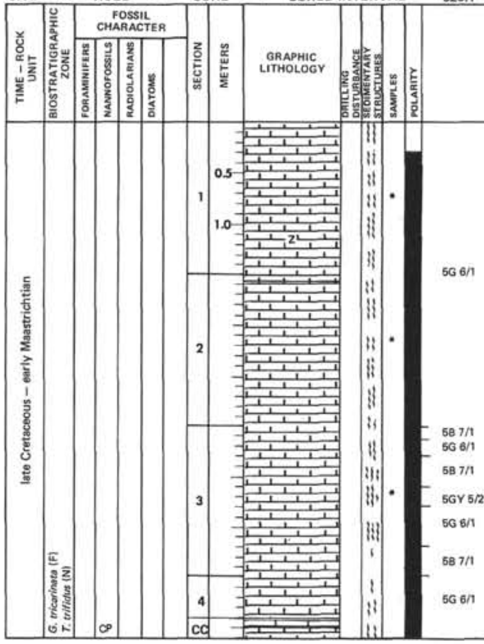
SMEAR SLIDE SUMMARY:

	1-59	2-55	3-90	4-60	5-30
	D	M	D	D	D
Composition:					
Heavy minerals	10	–	–	–	–
Volcanic glass	15	–	10	–	–
Palagonite	–	90	20	40	35
Zeolites	–	–	–	–	TR
Carbonate unspecified	10	–	–	–	12
Foraminifers	–	–	–	TR	3
Calcareous nannofossils	60	10	20	50	50

ORGANIC CARBON AND CARBONATE:

	1-9	2-5	3-42	4-20	5-7
Organic carbon	–	–	–	–	–
Carbonate	21	14	10	28	60

SITE 525 HOLE A CORE 48 CORED INTERVAL 526.1–535.6 m



LITHOLOGIC DESCRIPTION

HIGHLY INDURATED NANNOFOSSIL CHALK

A highly bioturbated indurated greenish gray (5G 6/1) nannofossil chalk was recovered.

Section 3 contains some coarse palagonite rich sediments which are interspersed within the nannofossil chalk.

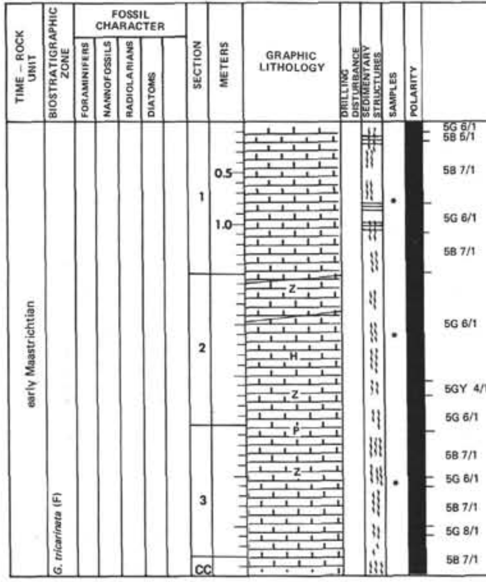
SMEAR SLIDE SUMMARY:

	1-76 D	2-76 D	3-76 D
Composition:			
Carbonate			
unspecified (recrystallized)	50	50	50
Foraminifers	–	–	TR
Calcareous			
nannofossils	50	50	50

ORGANIC CARBON AND CARBONATE:

	1-105	2-48	3-7	4-31
Organic carbon	–	–	–	–
Carbonate	61	42	64	63

SITE 525 HOLE A CORE 49 CORED INTERVAL 535.6–545.1 m



LITHOLOGIC DESCRIPTION

HIGHLY INDURATED NANNOFOSSIL CHALK

This core contains a moderately to highly bioturbated greenish gray (5G 6/1) and light bluish gray (5B 7/1) nannofossil chalk.

An *Inoceramus* shell fragment is present in Section 1. Zoophycus, halo burrows and planolites are the trace fossils present.

Two possible slickensides fault planes are present at the top of Section 2. However, this effect may be produced by drilling.

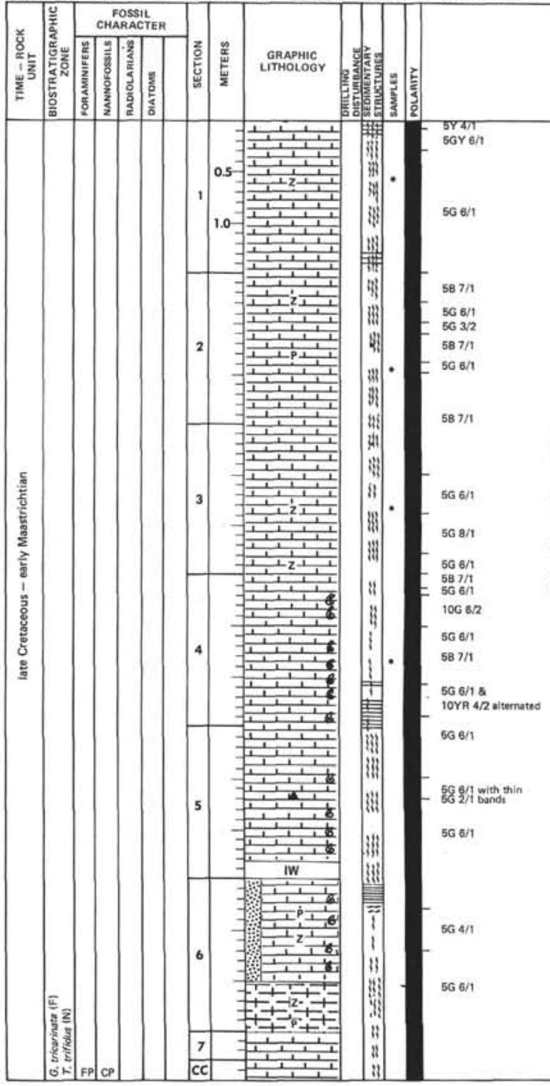
SMEAR SLIDE SUMMARY:

	1-72 D	2-67 D	3-62 D
Composition:			
Volcanic glass	–	1	–
Zeolites	–	1	–
Carbonate			
recrystallized	50	40	50
Calcareous			
nannofossils	50	55	50
Other	–	3	–

ORGANIC CARBON AND CARBONATE:

	1-38	2-38	3-7
Organic carbon	–	–	–
Carbonate	38	61	41

SITE 525 HOLE A CORE 50 CORED INTERVAL 545.1–554.6 m



LITHOLOGIC DESCRIPTION

HIGHLY INDURATED NANNOFOSSIL CHALK

This section contains a predominantly greenish gray (5GY 6/1) highly indurated nannofossil chalk. Due to compaction and lithification stages much of the carbonate in smear slides has recrystallized or has compacted calcite grains extensively.

Bioturbation is intense with excellent trace fossil preservation. The mollusk, *Inoceramus* Sp.? is present, especially in Sections 4–6.

Parallel beds and laminae of both fine- and coarse-grained sediment are present. This along with large shell fragment and non-carbonate interclasts suggest minor current activity.

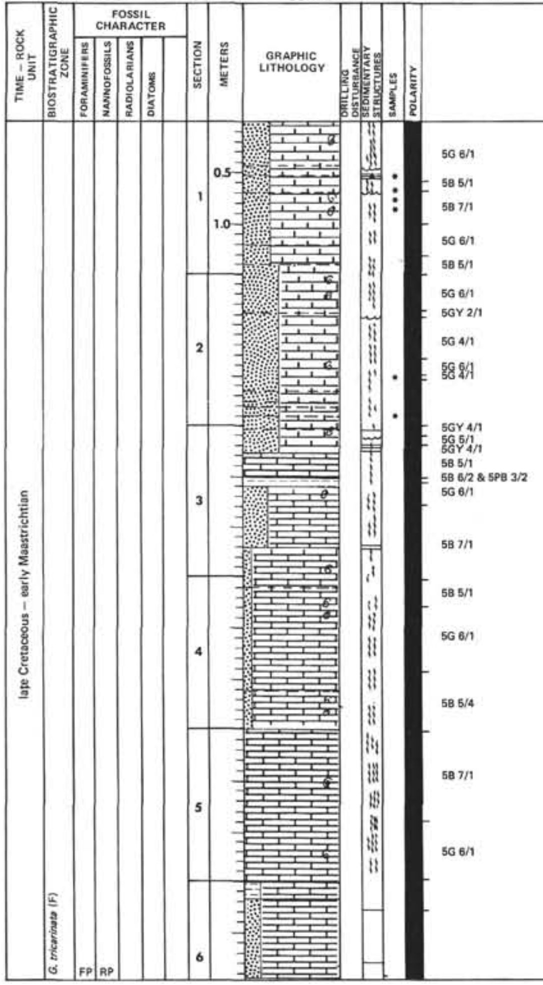
SMEAR SLIDE SUMMARY:

	1-52 D	2-93 D	3-84 D	4-88 D
Composition:				
Feldspar	TR	–	–	–
Volcanic glass	–	5	–	–
Palagonite	–	10	–	–
Carbonate				
recrystallized	45	30	45	45
Foraminifers	5	5	5	5
Calcareous nannofossils	30	50	50	50

ORGANIC CARBON AND CARBONATE:

	3-48
Organic carbon	–
Carbonate	30

SITE 525 HOLE A CORE 51 CORED INTERVAL 554.6–564.1 m



LITHOLOGIC DESCRIPTION

INDURATED NANNOFOSSIL CHALK/LIMESTONE AND CALCAREOUS SANDSTONES AND SILTSTONES

This core is predominantly a greenish gray (5G 6/1), moderately bioturbated, indurated nannofossil chalk and limestone. Calcareous sandstones and siltstones alternate with this major lithology. Scour and fill structures are present. The sandstones and siltstones contain high amounts of volcanic glass and palagonite. Irregular size intraclasts up to cobble size are found interspersed throughout the core. The cyclic sedimentation pattern is interpreted to represent smale scale slumping or turbidity current activity which intermittently deposited coarser-grained material into the deposition site.

Bioturbation has probably obliterated much of the primary sedimentary structures.

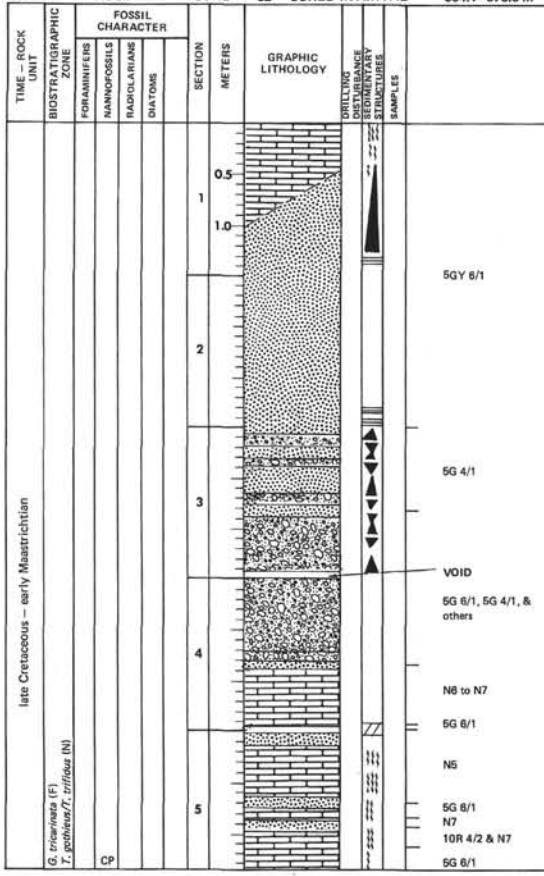
SMEAR SLIDE SUMMARY:

	1-53	1-72	1-85	2-102	2-142
	M	D	D	M	M
Composition:					
Clay	–	–	–	–	100
Volcanic glass	–	–	–	20	–
Palagonite	50	60	–	60	–
Zeolites	25	–	–	20	–
Carbonate unspecified	–	10	40	–	–
Calcareous nannofossils	25	30	60	–	–

ORGANIC CARBON AND CARBONATE:

	5-71
Organic carbon	–
Carbonate	64

SITE 525 HOLE A CORE 52 CORED INTERVAL 564.1–573.6 m



LITHOLOGIC DESCRIPTION

TURBIDITE SEQUENCE – SILTSTONE, SANDSTONE, CONGLOMERATE AND LIMESTONE

The upper 3 and one-half sections of this core contain a spectacular turbidite sequence. From top to bottom the sequence is:

(1) Calcareous mudstones and siltstones which are highly bioturbated;

(2) Siltstones to fine- to medium-grained sandstones;

(3) Medium- to coarse-grained sandstones to calcareous pebbly conglomerates; to

(4) 7.0 cm elia pebbly conglomerates to cobbly pebble conglomerates.

There is a definite major fining upwards sequence, with minor coarsening and fining upwards sequences in Section 3.

The contact at the base of the turbidite is sharp.

Below the turbidite calcareous sandstones and limestones alternate.

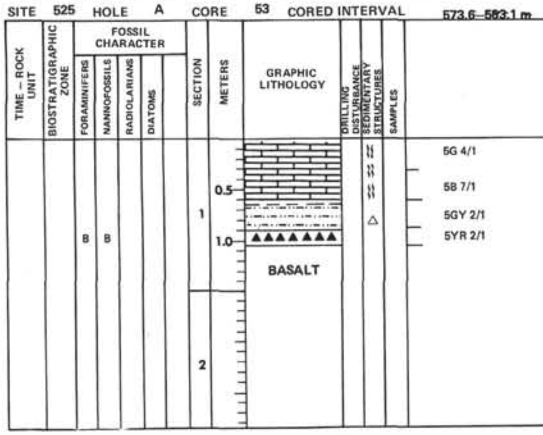
These limestones and sandstones are highly bioturbated and are shades of gray and grayish red (10R 4/2).

ORGANIC CARBON AND CARBONATE:

	4-140	5-13	5-29	5-79
Organic carbon	–	–	–	–
Carbonate	69	13	55	64

	5-128	5-110
Organic carbon	–	–
Carbonate	67	45

SITE 525 HOLE A CORE 53 CORED INTERVAL 573.6–583.1 m



LITHOLOGIC DESCRIPTION

FINE-GRAINED LIMESTONES TO NON-CALCAREOUS MUDSTONE TO CHERT

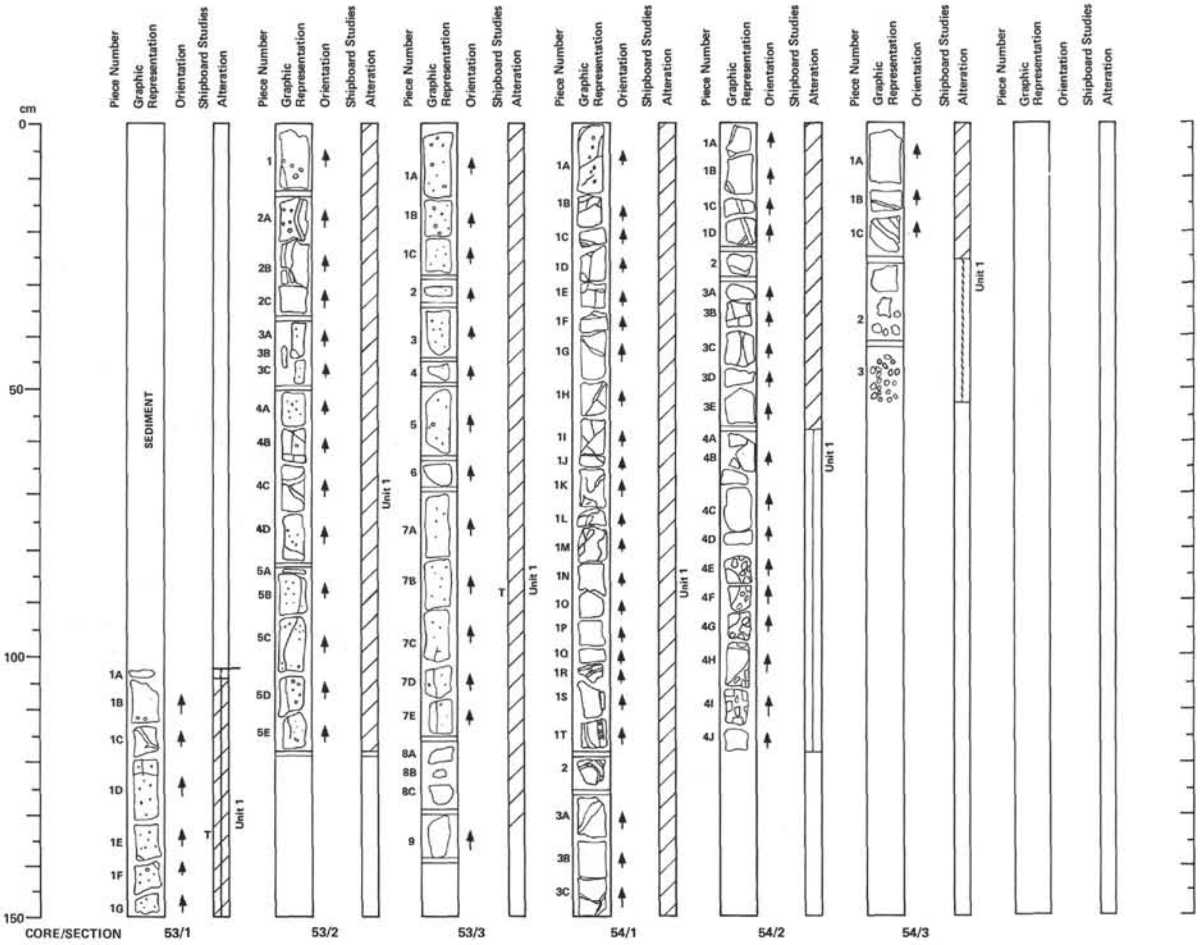
A dark greenish gray (5G 4/1) grading to light bluish gray (5B 7/1) moderately bioturbated fine-grained limestone was recovered. It fines upward.

Below this lithology (55–70 cm) is a transitional zone from a calcareous limestone to a non-calcareous mudstone (greenish black – 5GY 2/1).

The mudstone grades directly into brownish black chert fragments which in turn lie directly over highly altered basalt.

ORGANIC CARBON AND CARBONATE:

	1-2	1-18	1-35	1-54	1-65
Organic carbon	–	–	–	–	–
Carbonate	43	40	47	36	5



74-525A-53 through 55 **Depth: 574.6–593.6 mbsf**

Core 53, Sections 1–3; Core 54, Sections 1–3; and Core 55, Sections 1–3 (Unit 1)

Dominant Lithology: Aphyric basalt.

Macroscopic Description: Sparse (0–5%) vesicular, grayish green, fine- to medium-grained aphyric basalt. Moderately to extensively altered with some parts consisting of a powdery clay-like material. Carbonate minerals (predominantly calcite) fill some of the vesicles, thin fractures, and small veins. Pyrite and other secondary alteration minerals (zeolites and smectites) occur associated with carbonate. Other vesicles are filled with clays.

Thin Section Descriptions:

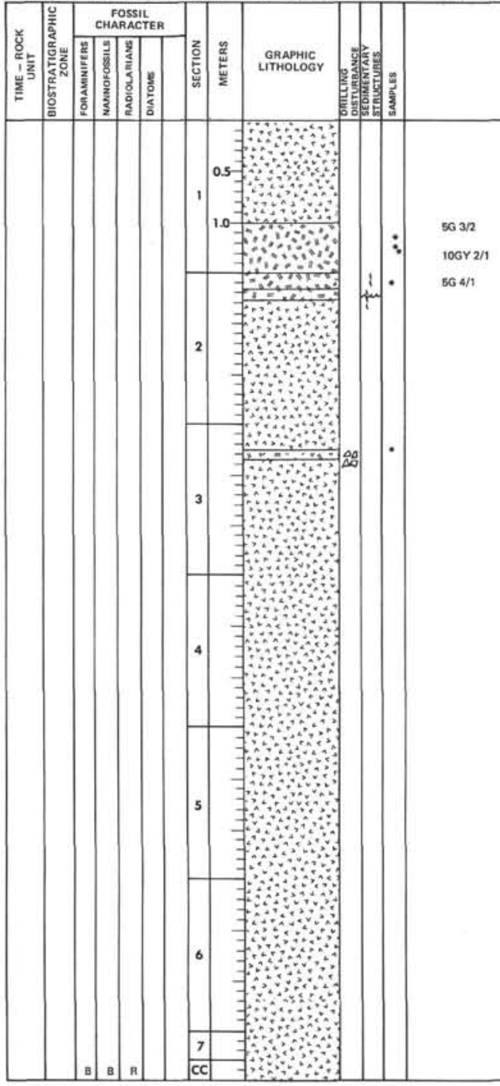
53-1, 132–135 cm (Piece 1E):

Name: Fine-grained, vesicular aphyric basalt.
Texture: Subophitic.
Phenocrysts: None.
Groundmass: Plagioclase, 50%, 0.3x0.02 mm, laths; clinopyroxene, 45%, 0.08x0.05 mm subhedral; magnetite, 5%, 0.04x0.02 mm, irregular and thin laths.
Vesicles: Scattered rounded voids 0.3–1.5 mm in diameter.
Alteration: About 5% groundmass altered to clays. Magnetite, zeolite, and clay minerals rim vesicles.

53-3, 81–84 cm (Piece 7B):

Name: Medium-grained, vesicular aphyric basalt.
Texture: Subophitic.
Phenocrysts: None.
Groundmass: Plagioclase, 55%, 0.5x0.08 mm, stubby laths; clinopyroxene, 40%, 0.2x0.2 mm, subhedral; magnetite, 5%, 0.08x0.04 mm, subhedral.
Vesicles: Rounded, scattered voids (0.1–5.0 mm in diamter).
Alteration: Vesicle rims clinopyroxene. Grain boundaries are altered to clay.

SITE 525 HOLE A CORE 55 CORED INTERVAL 592.6–602.1 m



LITHOLOGIC DESCRIPTION

VOLCANOGENIC SEDIMENTS

The sediments and sedimentary rocks in Core 55 are interbedded with aphyric basalts.

In Section 1 a dusky green (5G 3/2) to greenish black (5GY 2/1) silt-claystone is present. A grayish red purple (5RP 4/2) lamina at 122 cm occurs. The unit is non-calcareous and is extremely altered and contains high amounts of clay minerals and volcanic glass. It appears to be a volcanogenic sediment.

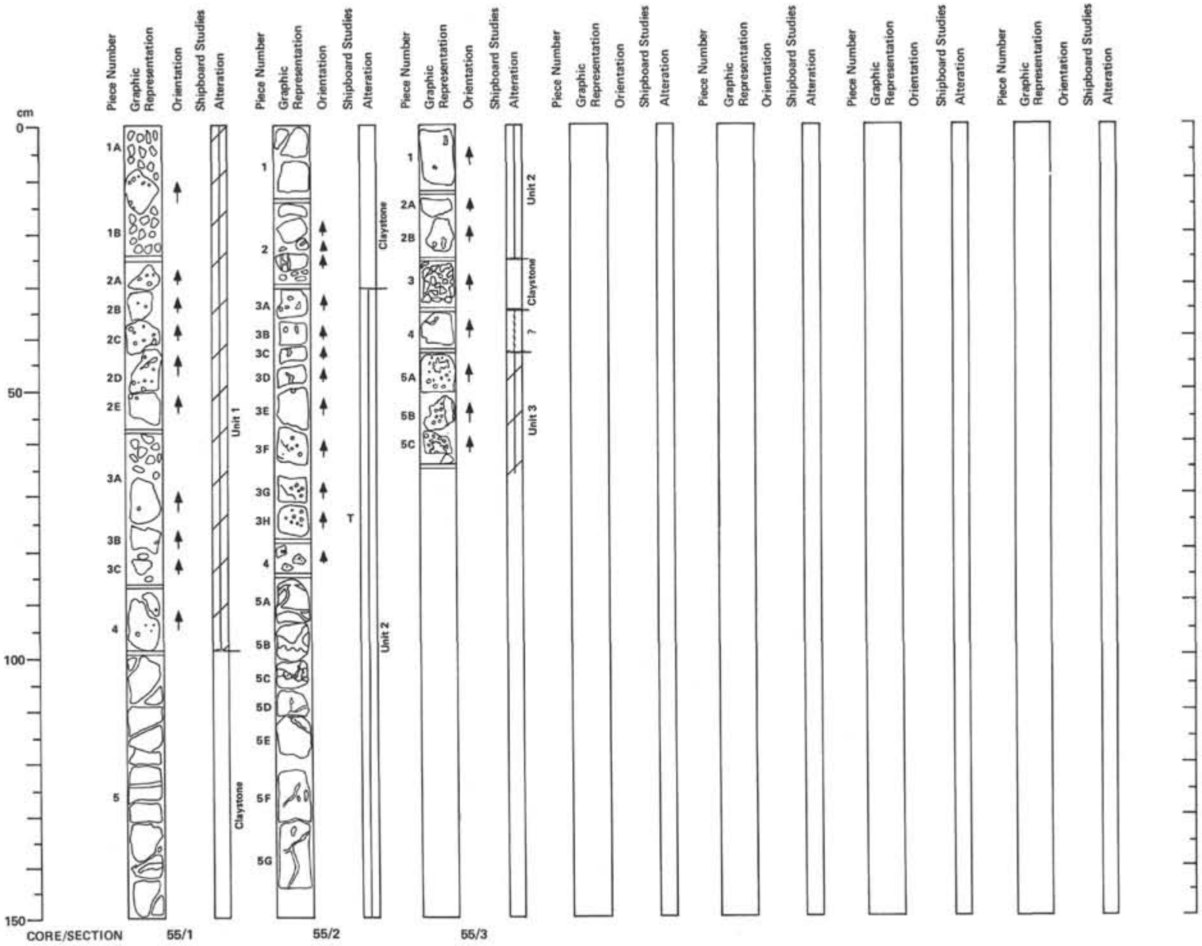
Sections 2 and 3 contain small beds or layers between basalt of dark greenish gray (5G 4/1) to greenish gray (5GY 6/1) claystone and siltstone. Zoophycus burrows are present indicating a period of time in which burrowing in fauna grazed in the sediment. Calcite veins are shot through the mudstones.

SMEAR SLIDE SUMMARY:

	1-117	1-122	1-130	3-28
	D	D	D	D
Texture:				
Sand	–	–	–	–
Silt	33	60	20	50
Clay	67	40	80	50
Composition:				
Feldspar	–	–	2	5
Mica	3	10	–	TR
Heavy minerals	20	20	3	30
Clay	67	40	80	50
Volcanic glass	15	15	15	15
Pyrite	–	15	–	–

ORGANIC CARBON AND CARBONATE:

	1-101	1-126	1-139	3-26
Organic carbon	–	–	–	–
Carbonate	–	–	1	7



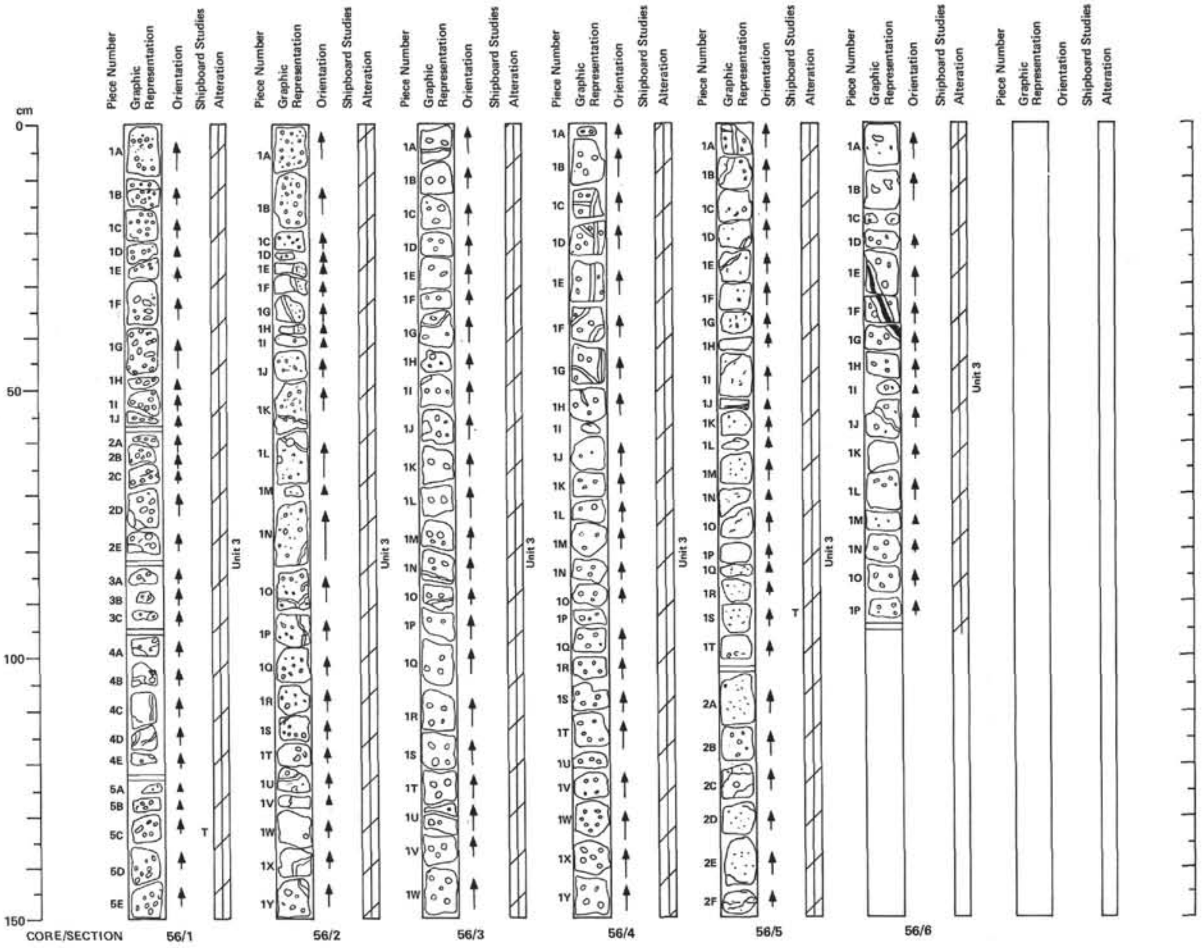
74-525A-55 **Depth: 594.4–595.4 mbsf**

Core 55, Sections 2 and 3 (Unit 2)

Dominant Lithology: Aphyric basalt.

Macroscopic Description: Pale grayish green aphyric basalt. Vesicles are larger and more abundant than Unit 1.

Thin Section Description:
55-2, 72–76 cm (Piece 3H):
Name: Aphyric, medium-grained vesicular basalt.
Texture: Subophitic, with some parts also showing a spinifex texture.
Phenocrysts: None.
Groundmass: Plagioclase laths, 0.4x0.04 mm, 60%; clinopyroxene, anhedral, 0.2x0.1 mm, 38%; and magnetite (and possibly other opaques), 0.04x0.02 mm, laths and subhedral grains, 2%.
Vesicles: 7%.
Alteration: Around vesicles there are magnetite accumulations. Groundmass and clinopyroxene grain boundaries replaced by clay minerals. Vesicles are rimmed with opaques and clay minerals and filled with carbonate, clay, and sparse zeolites.



70-525A-56 through 58 **Depth: 595.6–623.4 mbsf**

Core 56, Sections 1–6; Core 57, Sections 1–6; and Core 58, Sections 1–2 (Unit 3)

Dominant Lithology: Aphyric basalt.

Macroscopic Description: Medium to light gray. Highly aphyric basalt.

Thin Section Descriptions:

56-1, 128–133 cm (Piece 5C):

Name: Medium-grained vesicular, aphyric basalt.

Texture: Subophitic–intersertal.

Phenocrysts: None.

Groundmass: Plagioclase, 58%, 0.5x0.1 mm, stubby laths; clinopyroxene, 35%, 0.06x0.04 mm, anhedral; magnetite, 2%, 0.03x0.03 mm, anhedral; and glass, 5%, with an irregular distribution in the interstices and around vesicles.

Vesicles: Scattered, oval vesicles (1 and 5 mm in diameter) form about 15% of the rock.

Alteration: Vesicles filled with carbonate minerals and smaller amounts of clays and zeolites. Clinopyroxene grain boundaries and glass altered to clay. Some magnetite has spinifex-like texture.

56-5, 94–98 cm (Piece 1S):

Name: Coarse-grained vesicular basalt.

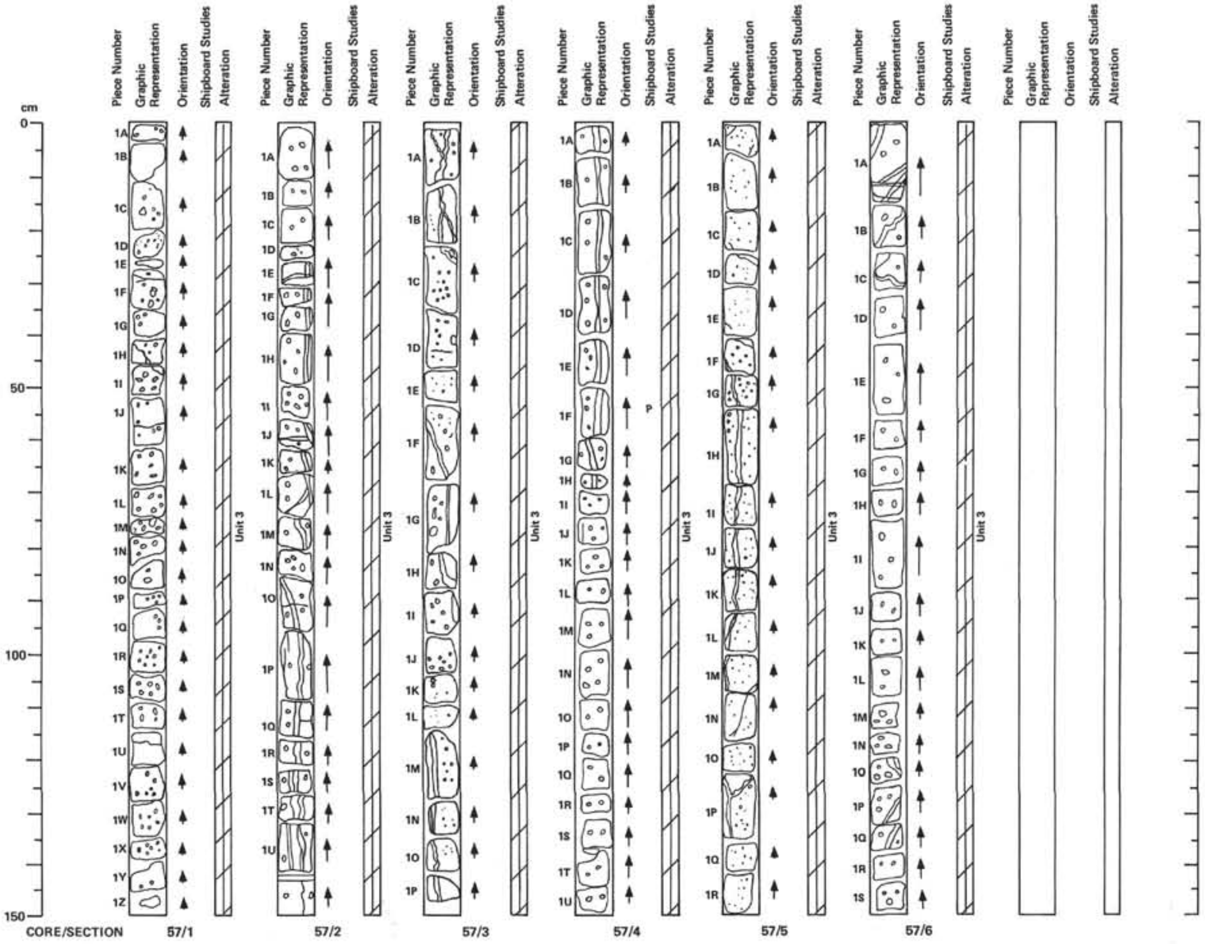
Texture: Subophitic.

Phenocrysts: None.

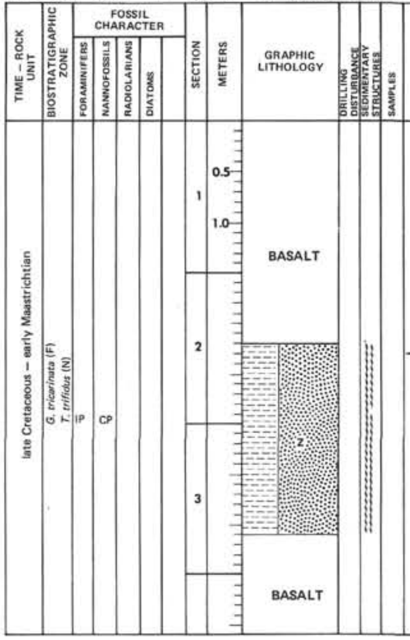
Groundmass: Plagioclase, 55%, 0.8x0.15 mm, laths; clinopyroxene, 43%, 0.2x0.2 mm, subhedral with some sector zoning noted; magnetite, 2%, 0.05x0.05 mm, anhedral.

Vesicles: Scattered arcuate vesicles (1–2 mm in diameter) form about 5% of the rock.

Alteration: Patchy orange brown clay minerals and magnetite around the vesicles.


cm
0
50
100
150
Piece Number
Graphic Representation
Orientation
Shipboard Studies
Alteration
Unit 3
P
CORE/SECTION
57/1
57/2
57/3
57/4
57/5
57/6

SITE 525 HOLE A CORE 58 CORED INTERVAL 602.1–640.1 m



LITHOLOGIC DESCRIPTION

Calcite vein

10G 6/2

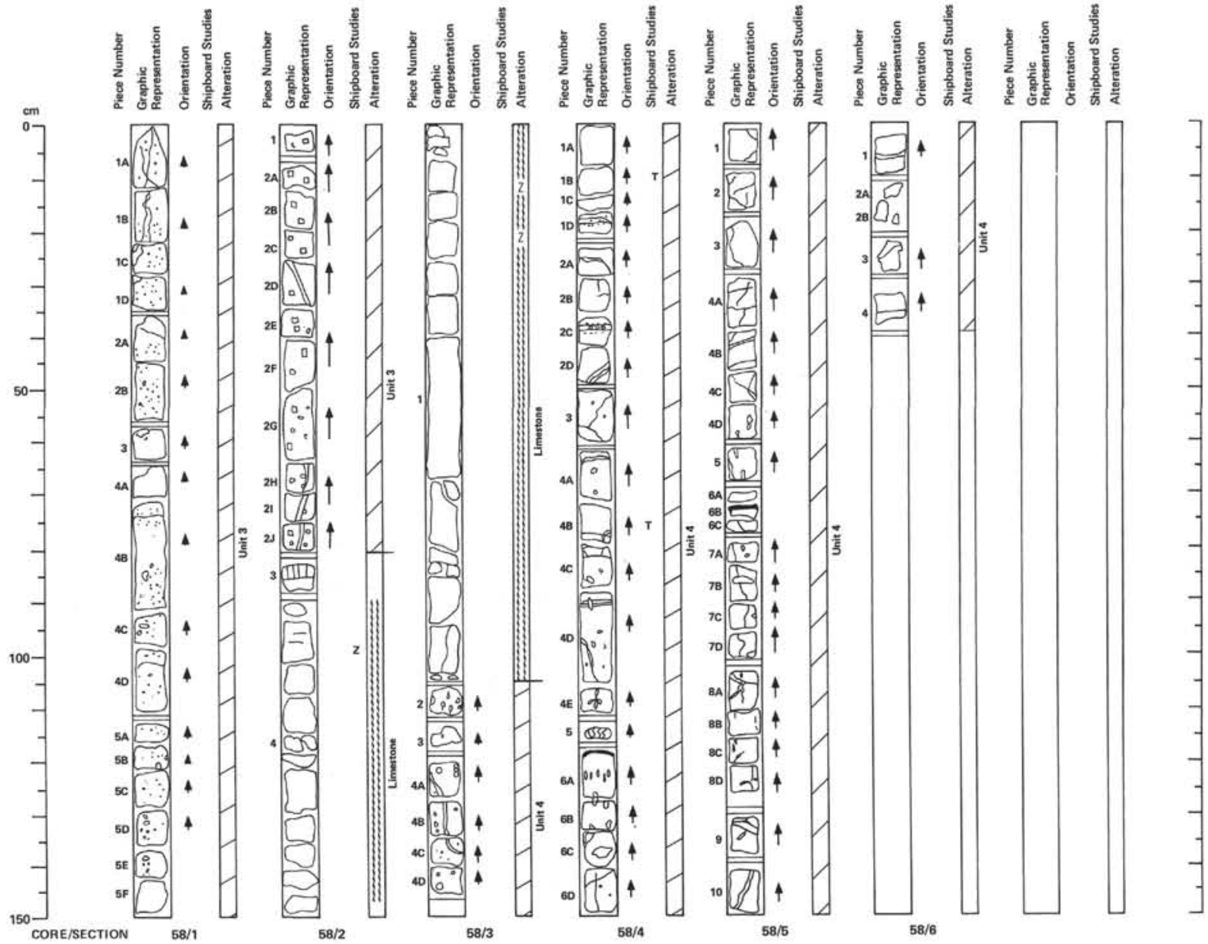
CALCAREOUS SILTSTONE/MUDSTONE

This core contains a highly bioturbated pale green calcareous mudstone to siltstone. Horizontal bedding and laminations are present. Some fine grain sandstones are interbedded with the siltstones and claystones. Burrows are also horizontal. At 22–24 cm in Section 3 a fine sandstone which is graded is in contact with siltstone.

At 108 cm in Section 2 a concentrated sandy shell layer is present.

ORGANIC CARBON AND CARBONATE:

	2-88	2-127	3-1	3-101
Organic carbon	–	–	–	–
Carbonate	39	44	49	33



74-525A-58 through 60 **Depth 625.1–646.8 mbsf**

Core 58, Sections 3–6; Core 59, Sections 1–6; and Core 60, Sections 1–5 (Unit 4)

Dominant Lithology: Aphyric, vesicular basalt.

Macroscopic Description: Medium gray, fine- to medium-grained, vesicular, aphyric pillow basalts and flows.

Thin Section Descriptions:

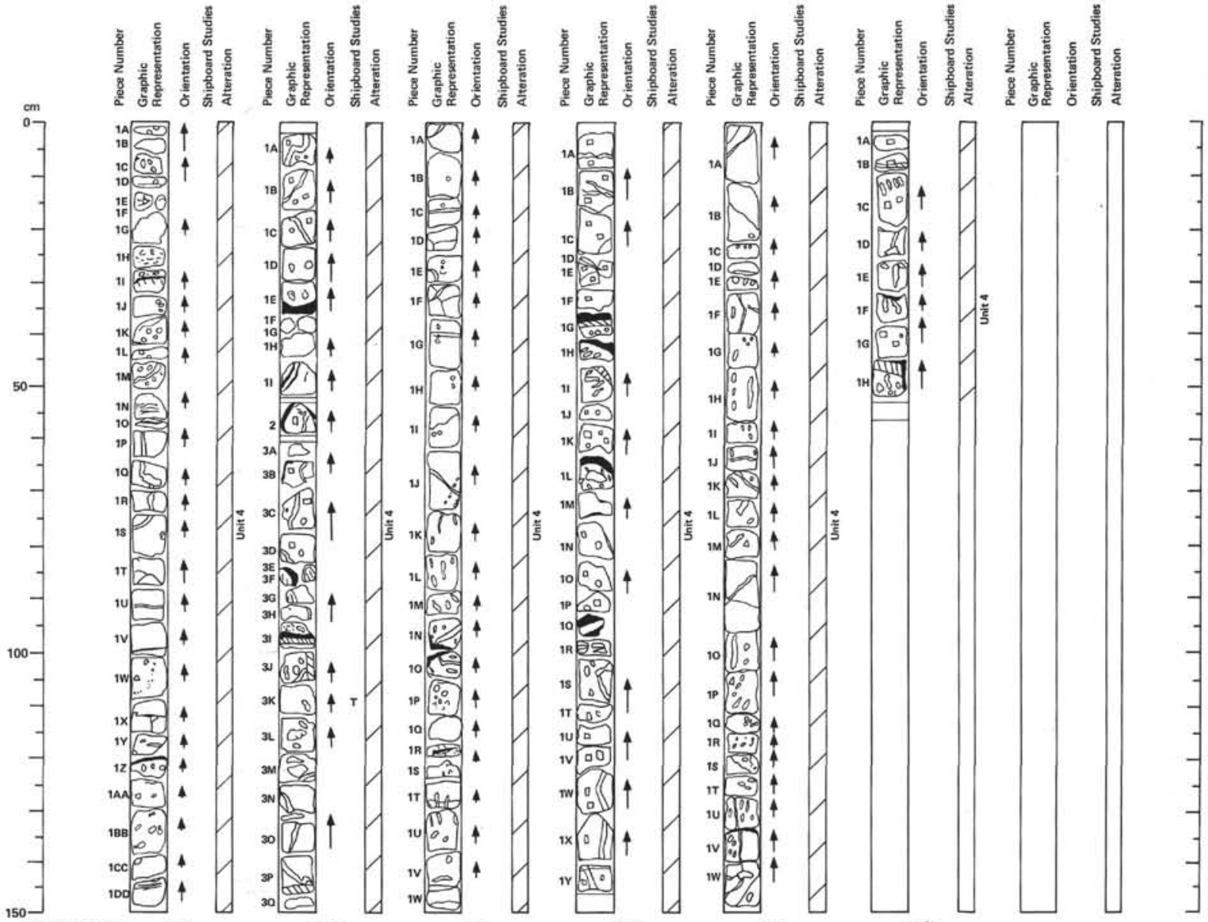
58-4, 10–14 cm (Piece 1B):
Name: Fine-grained, moderately phyric basalt.
Texture: Plumose.
Phenocrysts: Plagioclase, 8%, 1.5x2.0 mm, laths; clinopyroxene, <1%, 0.3x0.3 mm, subhedral.
Groundmass: Plagioclase, 46%, 0.1x0.01 mm, tiny laths; clinopyroxene, 35%.
Vesicles: None.
Alteration: <1% carbonate minerals present in thin vein.

58-4, 74–78 cm (Piece 4B):
Name: Fine-grained, moderately phyric (plagioclase–clinopyroxene) basalt.
Texture: Subophitic.
Phenocrysts: Plagioclase, 28%, 0.1x0.8 mm, laths and skeletal laths; clinopyroxene, 22%, 0.3x0.3 mm, subhedral to anhedral.
Groundmass: Plagioclase (23%) and clinopyroxene (23%).Extensive alteration makes grain size measurements unreliable; magnetite, 4%, 0.1x0.02 mm.
Vesicles: Irregular (0.3–1.5 mm in diameter), carbonate filled, unevenly distributed, ~2% thin section.
Alteration: Groundmass, vesicles, clay rims, and clinopyroxene grain boundaries about 47% altered to clay minerals with minor amounts of magnetite.

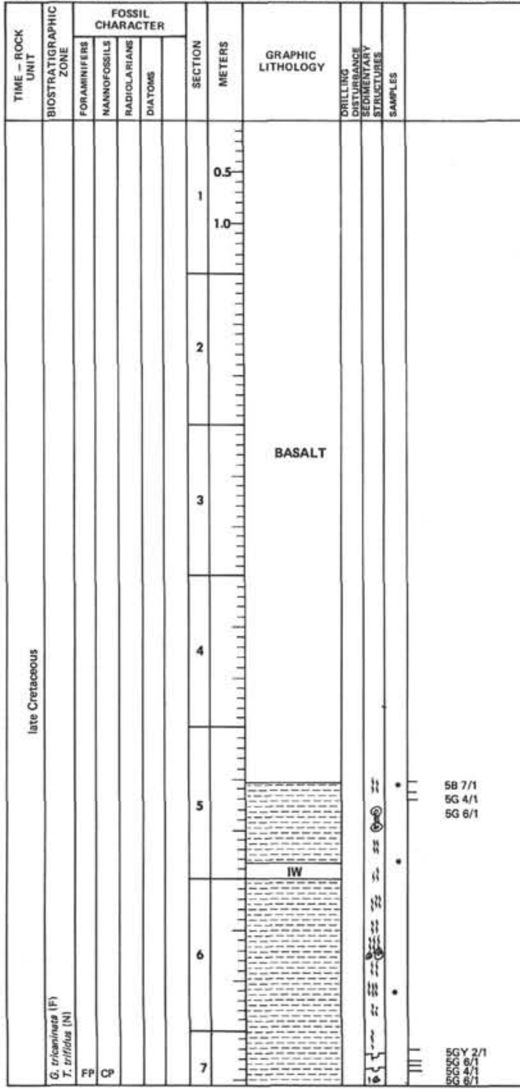
59-2, 102–108 cm (Piece 3K):
Name: Fine- to medium-grained aphyric basalt.
Texture: Subophitic.
Phenocrysts: None.
Groundmass: Plagioclase, 55%, 0.5x0.04 mm, laths with local preferred orientation; clinopyroxene, 45%, 0.2x0.2 mm, subhedral. Fine-grained basalt spheres included in groundmass.
Vesicles: Rounded to elongate (3 mm in diameter), carbonate filled, form ~1% of thin section.
Alteration: About 30% groundmass is altered to clay minerals.

60-2, 127–130 cm (Piece 4N):
Name: Fine-grained, vesicular aphyric basalt.
Texture: Subophitic intersertal.
Phenocrysts: None.
Groundmass: Plagioclase, 50%, 0.2x0.02 mm, laths; clinopyroxene 20%, 0.04x0.04 mm anhedral; glass, 30%, devitrified.
Vesicles: Rounded (0.5–2 mm in diameter), carbonate filled, ~25% of thin section.
Alteration: About 20% alteration to clay minerals.

60-5, 4–8 cm (Piece 1B):
Name: Fine-grained aphyric basalt.
Texture: Subophitic.
Phenocrysts: Plagioclase, <1%, 1.5x1.0 mm, and clinopyroxene, <1%, 0.2x0.2 mm, both xenocrysts with resorbed margins.
Groundmass: Plagioclase, 60%, 0.3x0.04 mm, laths and clinopyroxene, 40%, 0.02x0.02 mm, anhedral.
Vesicles: Rounded (0.5 mm in diameter) carbonate filled, form less than 1% of the rock.
Alteration: Most alteration confined to thin veins with carbonate filling forming about 2% of the thin section area.


Piece Number
Graphic Representation
Orientation
Shipboard Studies
Alteration
cm
0
50
100
150
Unit 4
T
1A 1B 1C 1D 1E 1F 1G 1H 1I 1J 1K 1L 1M 1N 1O 1P 1Q 1R 1S 1T 1U 1V 1W 1X 1Y 1Z 1AA 1BB 1CC 1DD
1A 1B 1C 1D 1E 1F 1G 1H 1I 2 3A 3B 3C 3D 3E 3F 3G 3H 3I 3J 3K 3L 3M 3N 3O 3P 3Q
1A 1B 1C 1D 1E 1F 1G 1H 1I 1J 1K 1L 1M 1N 1O 1P 1Q 1R 1S 1T 1U 1V 1W
1A 1B 1C 1D 1E 1F 1G 1H 1I 1J 1K 1L 1M 1N 1O 1P 1Q 1R 1S 1T 1U 1V 1W 1X 1Y
1A 1B 1C 1D 1E 1F 1G 1H 1I 1J 1K 1L 1M 1N 1O 1P 1Q 1R 1S 1T 1U 1V 1W
1A 1B 1C 1D 1E 1F 1G 1H
CORE/SECTION
59/1
59/2
59/3
59/4
59/5
59/6

SITE 525 HOLE A CORE 60 CORED INTERVAL 640.1–649.6 m



LITHOLOGIC DESCRIPTION

CALCAREOUS CLAYSTONE

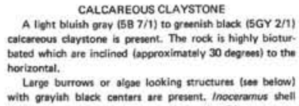
A light bluish gray (5B 7/1) to greenish black (5GY 2/1) calcareous claystone is present. The rock is highly bioturbated which are inclined (approximately 30 degrees) to the horizontal.

Large burrows or algae looking structures (see below) with grayish black centers are present. *Inoceramus* shell debris and small pyrite grains are observed at 74 cm.

This sediment may have been baked by basaltic flows or intrusive sills. It appears highly altered.

A small fault (normal) is reported in Section 5.

Section 5, 74 cm:

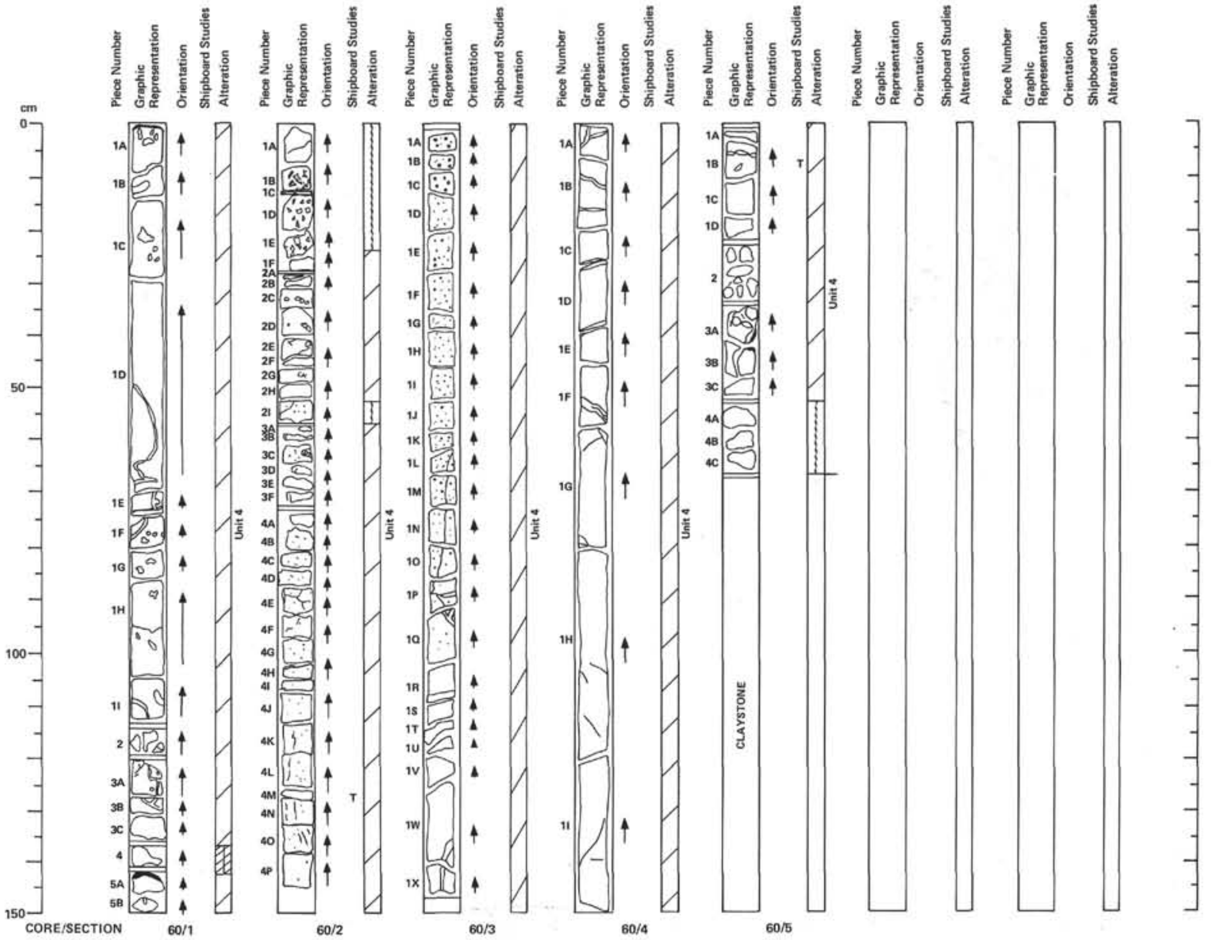


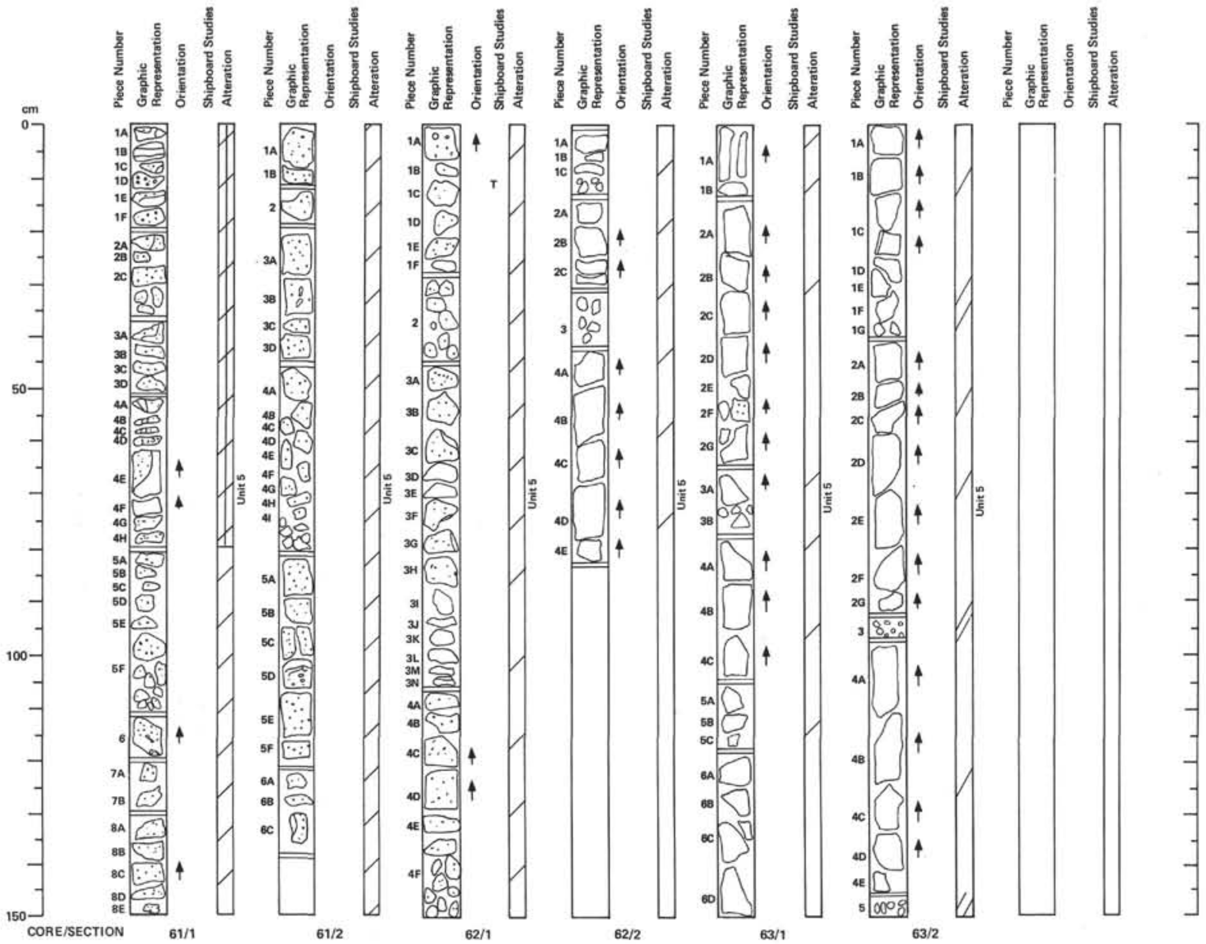
SMEAR SLIDE SUMMARY:

	5-60 D	5-133 M	6-117 D
Texture:			
Sand	3	–	–
Silt	–	–	–
Clay	97	–	–
Composition:			
Feldspar	TR	1	–
Mica	TR	–	–
Heavy minerals	3	–	8
Clay	91	35	80
Volcanic glass	4	–	3
Palagonite	–	–	4
Pyrite	–	50	–
Zeolites	–	10	–
Carbonate unspecified	–	1	–
Calcareous nannofossils	2	3	5

ORGANIC CARBON AND CARBONATE:

	5-60	5-66	5-83
Organic carbon	–	–	–
Carbonate	81	36	46


Piece Number
Graphic Representation
Orientation
Shipboard Studies
Alteration
cm
0
50
100
150
1A
1B
1C
1D
1E
1F
1G
1H
1I
2
3A
3B
3C
4
5A
5B
Unit 4
1A
1B
1C
1D
1E
1F
2A
2B
2C
2D
2E
2F
2G
2H
2I
3A
3B
3C
3D
3E
3F
4A
4B
4C
4D
4E
4F
4G
4H
4I
4J
4K
4L
4M
4N
4O
4P
T
Unit 4
1A
1B
1C
1D
1E
1F
1G
1H
1I
1J
1K
1L
1M
1N
1O
1P
1Q
1R
1S
1T
1U
1V
1W
1X
Unit 4
1A
1B
1C
1D
1E
1F
1G
1H
1I
Unit 4
1A
1B
1C
1D
2
3A
3B
3C
4A
4B
4C
T
Unit 4
CLAYSTONE
CORE/SECTION
60/1
60/2
60/3
60/4
60/5



74-525A-61 through 63 **Depth: 649.6–678.1 mbsf**

Core 61, Sections 1 and 2; Core 62, Sections 1 and 2; and Core 63, Sections 1 and 2 (Unit 5)

Dominant Lithology: Aphyric to sparsely plagioclase phyric basalt.

Macroscopic Description: Dark gray to black, fine-grained, aphyric to sparsely plagioclase phyric flows and pillow basalts. Glass is present at some pillow margins. Carbonate, pyrite, and black clay material filled vesicles abundant in the upper part of the unit, forming 5–20% of rock.

Thin Section Description:

62-1, 10–12 cm (Piece 1C):

Name: Phyric glassy basalt.

Texture: Glassy.

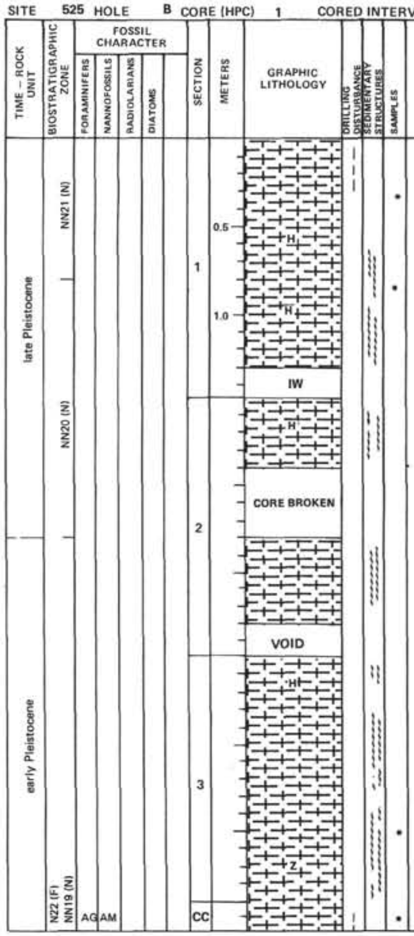
Phenocrysts: Plagioclase, 10%, 0.4x0.04 mm, laths; and clinopyroxene, 2%, 0.2x0.2 mm, subhedral. These are microphenocrysts with augite generally intergrown with plagioclase in glomerophyric intergrowths.

Groundmass: Glass, 88%, orange-brown clay and locally devitrified.

Vesicles: Round, clay filled vesilces (1–5 mm in diameter) form about 20% of the thin section.

Alteration: Local devitrification of glass.

SITE 525 HOLE B CORE (HPC) 1 CORED INTERVAL 0.0–3.5 m



LITHOLOGIC DESCRIPTION

5YR 7/2

N9

5YR 7/2

NANNOFOSSIL FORAMINIFER OOZE

Core 1 contains a nannofossil foraminifer ooze. The color is grayish orange pink (5YR 7/2) to pinkish gray (5YR 8/1). Halo burrows are present throughout the core.

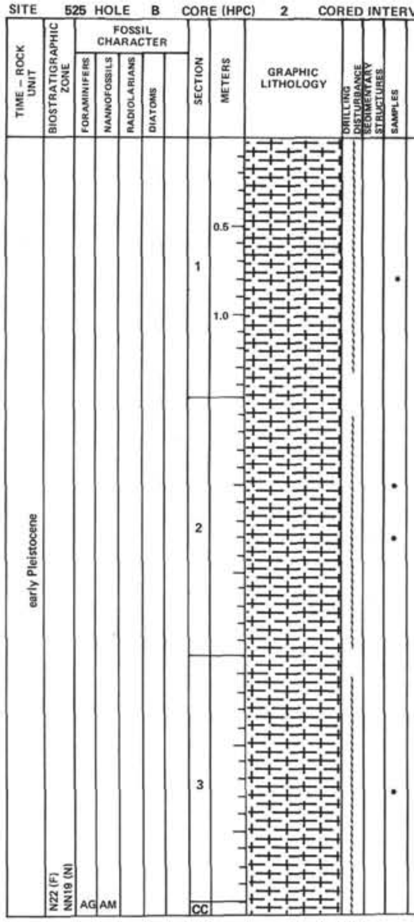
SMEAR SLIDE SUMMARY:

	1-35	2-90	3-100	CC
	D	D	D	D
Composition:				
Quartz	–	–	–	TR
Feldspar	–	–	–	TR
Carbonate unspecified	–	–	–	7
Foraminifers	55	48	60	79
Calcareous nannofossils	40	50	38	20
Calcareous dinoflagellates	5	2	2	–

ORGANIC CARBON AND CARBONATE:

	1-8	2-8	3-8
Organic carbon	–	–	–
Carbonate	94	96	97

SITE 525 HOLE B CORE (HPC) 2 CORED INTERVAL 3.5–7.9 m



LITHOLOGIC DESCRIPTION

N8

N9

N8

N9

NANNOFOSSIL FORAMINIFER OOZE

Core 2 contains a very light gray to white nannofossil foraminifer ooze. The core is very homogeneous with little or no sedimentary or biogenic structures present.

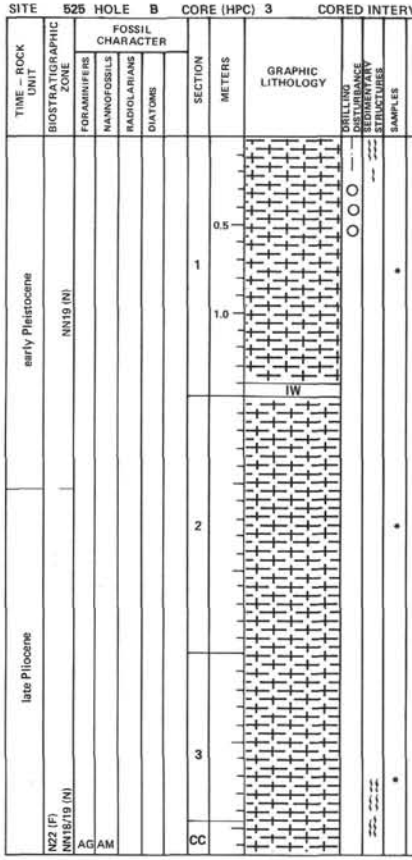
SMEAR SLIDE SUMMARY:

	1-80	2-51	2-80	3-80
	D	M	D	D
Composition:				
Volcanic glass	–	TR	–	–
Foraminifers	60	80	60	50
Calcareous nannofossils	38	20	38	48
Calcareous dinoflagellates	2	–	2	2

ORGANIC CARBON AND CARBONATE:

	1-40	2-40	3-40
Organic carbon	–	–	–
Carbonate	96	96	97

SITE 525 HOLE B CORE (HPC) 3 CORED INTERVAL 7.9–12.3 m



LITHOLOGIC DESCRIPTION

N9

FORAMINIFERAL NANNOFOSSIL OOZE

Core 3 contains a very homogeneous titanium white (N9) foraminiferal nannofossil ooze.

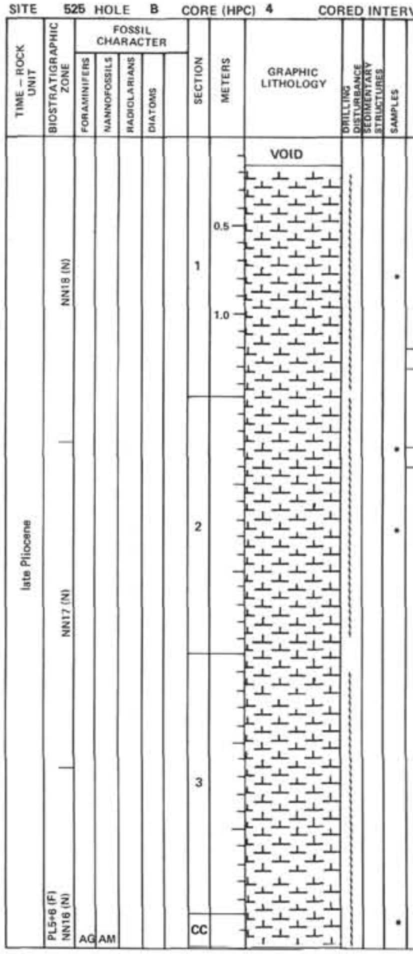
SMEAR SLIDE SUMMARY:

	1-75	2-75	3-75
	D	D	D
Composition:			
Volcanic glass	1	5	3
Foraminifers	35	30	25
Calcareous nannofossils	60	65	72
Fish remains	1	–	–
Dinoflagellates	3	–	–

ORGANIC CARBON AND CARBONATE:

	1-8	2-8	3-8
Organic carbon	–	–	–
Carbonate	96	96	96

SITE 525 HOLE B CORE (HPC) 4 CORED INTERVAL 12.3–16.7 m



LITHOLOGIC DESCRIPTION

N9
5YR 8/1
N9
5YR 8/1
N9
5YR 8/1

NANNOFOSSIL OOZE

Core 4 contains a very homogeneous predominantly white (N9) nannofossil ooze. Small pinkish gray (5YR 8/1) zones are observed in Section 1 (123–135 cm), Section 2 (19–40 cm), Section 3 (74–87 cm), and in the Core-Catcher.

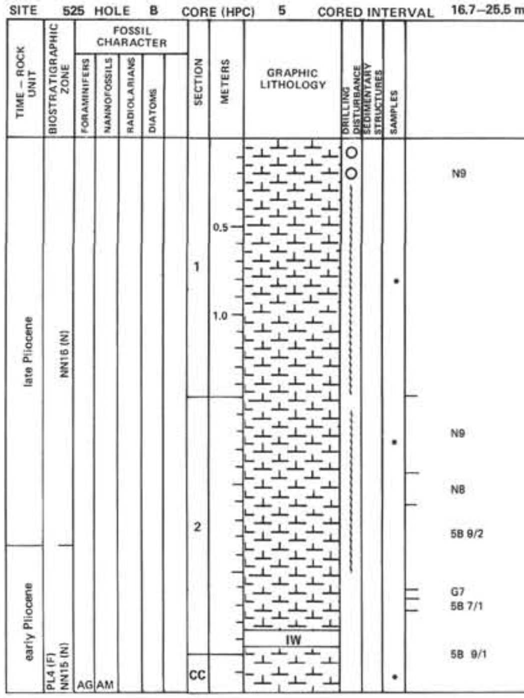
SMEAR SLIDE SUMMARY:

	1-80	2-30	2-80	CC
	D	D	D	D
Composition:				
Quartz	–	–	TR	–
Feldspar	–	TR	–	TR
Mica	–	–	TR	–
Volcanic glass	–	TR	TR	TR
Carbonate unspecified	1	2	TR	–
Foraminifers	3	7	2	5
Calcareous nannofossils	94	91	98	95

ORGANIC CARBON AND CARBONATE:

	1-30	2-30	3-30
Organic carbon	–	–	–
Carbonate	95	95	97

SITE 525 HOLE B CORE (HPC) 5 CORED INTERVAL 16.7–25.5 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

Core 5 contains a very homogeneous nannofossil ooze. In Section 1, the color is white (N9). Color changes are observed in Section 2 and the Core-Catcher from white to very pale orange pink (5YR 8/4), to very light gray (N8) to bluish white (5B 9/1) to light bluish gray (5B 7/1).

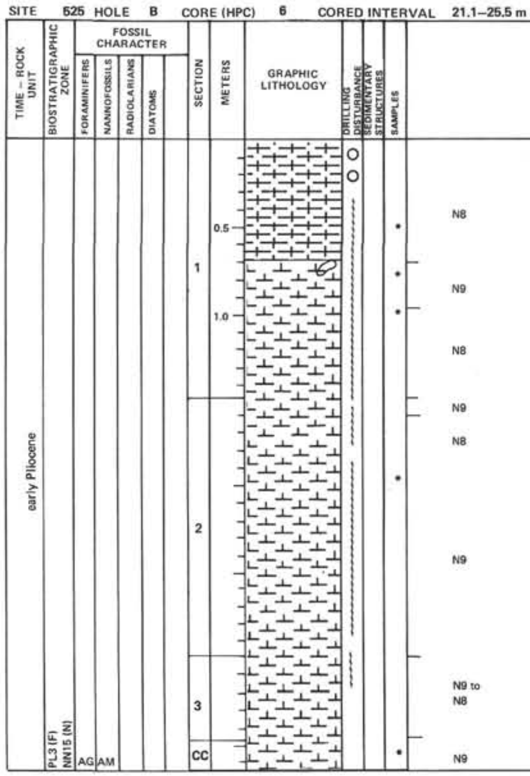
SMEAR SLIDE SUMMARY:

	1-80	2-90	CC-10
	D	D	D
Composition:			
Quartz	TR	–	TR
Feldspar	TR	TR	–
Volcanic glass	TR	–	TR
Carbonate unspecified	TR	1	2
Foraminifers	7	3	5
Calcareous nannofossils	93	96	93
Dolomite	–	TR	–

ORGANIC CARBON AND CARBONATE:

	1-85	2-85
Organic carbon	–	–
Carbonate	97	98

SITE 525 HOLE B CORE (HPC) 6 CORED INTERVAL 21.1–25.5 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

Core 6 contains a very light gray (N8) to white (N9) foraminiferal nannofossil ooze in the first section. Sections 2 and 3 contain a white (N9) nannofossil ooze. Sedimentary structures are not observed.

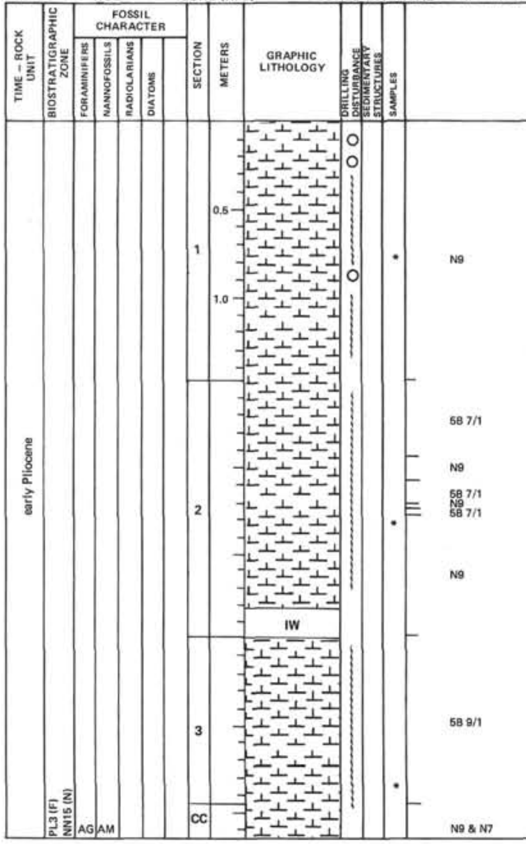
SMEAR SLIDE SUMMARY:

	1-50	1-80	1-100	2-50	CC
	D	D	D	D	D
Composition:					
Quartz	–	–	TR	–	TR
Feldspar	TR	TR	–	–	1
Mica	–	TR	–	–	–
Volcanic glass	TR	–	TR	TR	TR
Carbonate unspecified	1	–	–	1	–
Forminifers	30	7	5	3	3
Calcareous nannofossils	69	93	95	96	96

ORGANIC CARBON AND CARBONATE:

	1-89	2-89	3-25
Organic carbon	–	–	–
Carbonate	96	96	97

SITE 525 HOLE B CORE (HPC) 7 CORED INTERVAL 25.5–29.9 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

Core 7 contains a homogeneous predominantly white (N9) nannofossil ooze. Light bluish gray (5B 7/1) and bluish white (5B 9/1) zones are observed. The presence of discoasters is noted in the Core-Catcher.

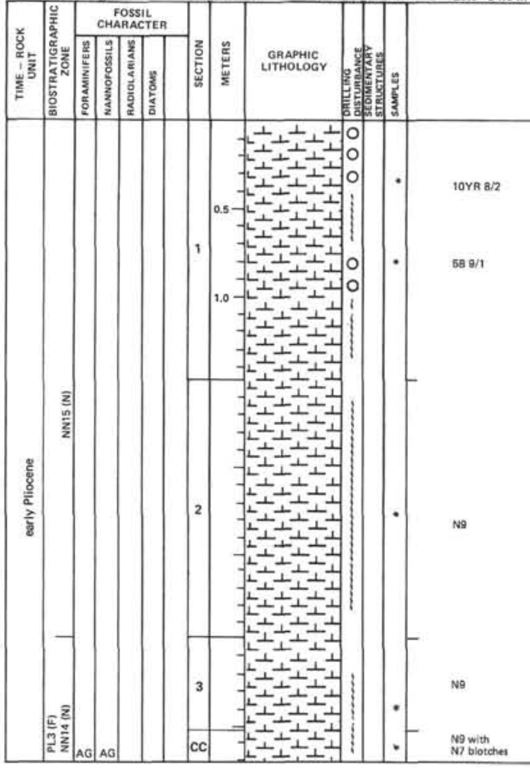
SMEAR SLIDE SUMMARY:

	1-80	2-80	3-80	CC
	D	D	D	D
Composition:				
Quartz	–	–	TR	–
Feldspar	1	TR	–	–
Mica	–	–	–	TR
Volcanic glass	–	–	–	TR
Palagonite	TR	–	–	–
Carbonate unspecified	2	1	1	–
Foraminifers	5	7	4	1
Calcareous nannofossils	92	92	95	75
Pteropod debris	–	–	TR	–
Discoasters	–	–	–	25

ORGANIC CARBON AND CARBONATE:

	1-59	2-59	3-59
Organic carbon	–	–	–
Carbonate	97	96	96

SITE 525 HOLE B CORE (HPC) 8 CORED INTERVAL 29.9–34.3 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

Core 8 contains a very homogeneous white (N9) nannofossil ooze. A large abundance of discoasters (from 10–92%) is observed on smear slides.

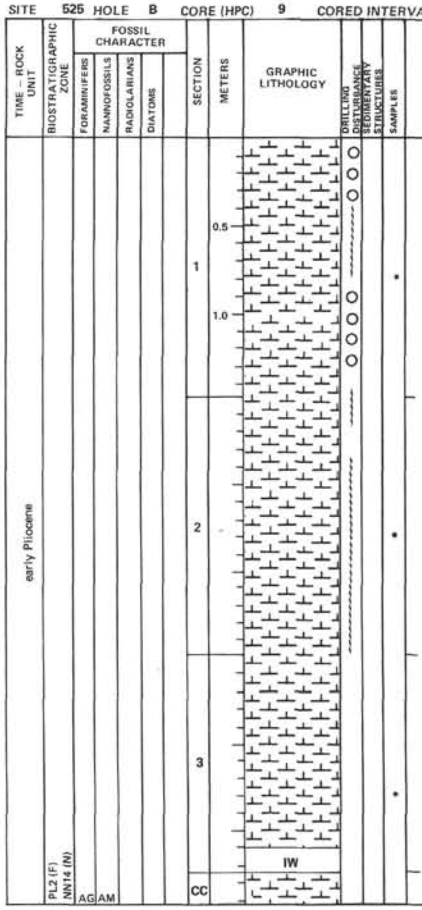
SMEAR SLIDE SUMMARY:

	1-38	1-80	2-80	3-40	CC
	M	D	D	D	D
Composition:					
Quartz	–	–	–	TR	–
Feldspar	TR	–	TR	–	–
Mica	–	–	–	–	TR
Volcanic glass	TR	–	–	–	TR
Palagonite	TR	–	–	–	–
Carbonate unspecified	–	1	1	TR	–
Foraminifers	3	1	–	1	2
Calcareous nannofossils	5	86	10	89	88
Discoasters	92	10	88	10	10

ORGANIC CARBON AND CARBONATE:

	1-105	2-20	3-20
Organic carbon	–	–	–
Carbonate	96	95	98

SITE 525 HOLE B CORE (HPC) 9 CORED INTERVAL 34.3–38.7 m



5B 9/1

N9

5B 9/1

5B 9/1

LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

Core 9 contains a white (N9) to bluish white (5B 9/1) homogeneous nannofossil ooze with an approximate 5% discoaster composition.

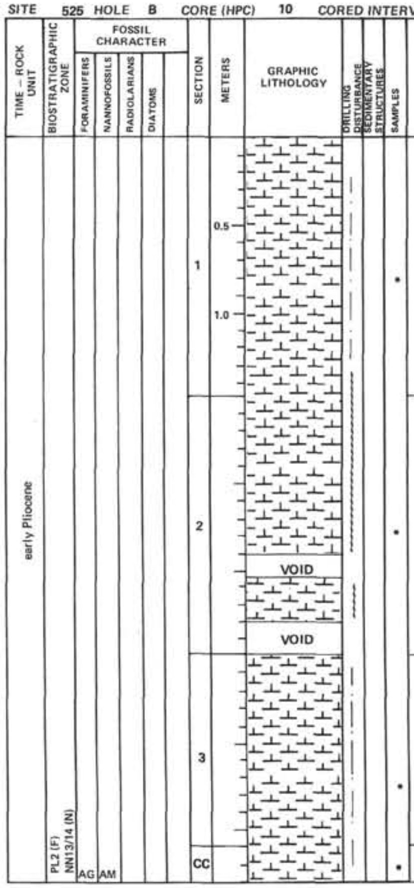
SMEAR SLIDE SUMMARY:

	1-80	2-80	3-80
	D	D	D
Composition:			
Quartz	TR	TR	TR
Feldspar	–	–	TR
Carbonate unspecified	TR	–	1
Foraminifers	1	3	2
Calcareous nannofossils	94	92	92
Discoasters	5	5	5

ORGANIC CARBON AND CARBONATE:

	1-75	2-75	3-75
Organic carbon	–	–	–
Carbonate	99	96	97

SITE 525 HOLE B CORE (HPC) 10 CORED INTERVAL 38.7–43.1 m



N9 with
5B 7/1 layer

5B 9/1

5B 9/1

LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

Core 10 contains a white (N9) to bluish-white (5B 7/1) homogeneous nannofossil ooze. The discoaster composition is approximately 20–30%.

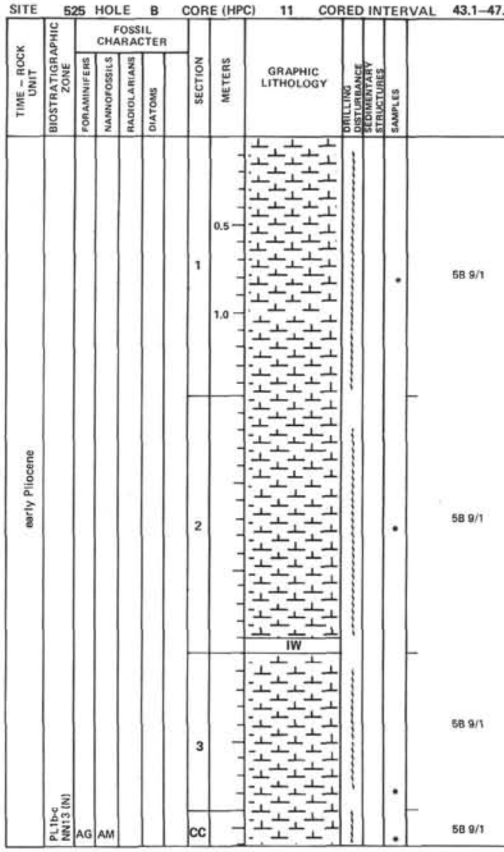
SMEAR SLIDE SUMMARY:

	1-80	2-80	3-80	CC
	D	D	D	D
Composition:				
Quartz	TR	TR	TR	–
Zeolites	–	–	TR	–
Carbonate unspecified	2	TR	TR	–
Foraminifers	4	2	1	2
Calcareous				5
nannofossils	71	73	69	73
Discoasters	20	25	30	10

ORGANIC CARBON AND CARBONATE:

	1-86	2-86	3-86
Organic carbon	–	–	–
Carbonate	99	97	96

SITE 525 HOLE B CORE (HPC) 11 CORED INTERVAL 43.1–47.5 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

Core 11 contains a bluish-white (5B 9/1) homogeneous nannofossil ooze rich in discoasters (approximately 30%).

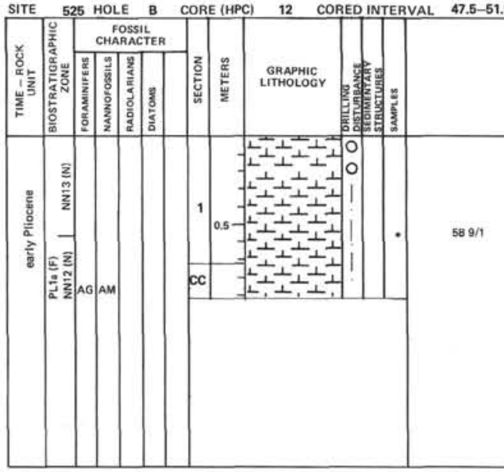
SMEAR SLIDE SUMMARY:

	1-80	2-80	3-80	CC
Composition:				
Quartz	TR	–	TR	TR
Feldspar	–	–	TR	TR
Heavy minerals	TR	–	–	–
Volcanic glass	TR	TR	–	–
Carbonate unspecified	–	TR	–	–
Foraminifers	5	1	1	1
Calcareous nannofossils	65	69	69	79
Discoasters	30	30	30	20

ORGANIC CARBON AND CARBONATE:

	1-7	2-7	3-7
Organic carbon	–	–	–
Carbonate	96	98	97

SITE 525 HOLE B CORE (HPC) 12 CORED INTERVAL 47.5–51.9 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

Core 12 contains a bluish white (5B 9/1) homogeneous nannofossil ooze.

Section 1, 40–60 cm shows very pale orange (10YR 8/2) patches.

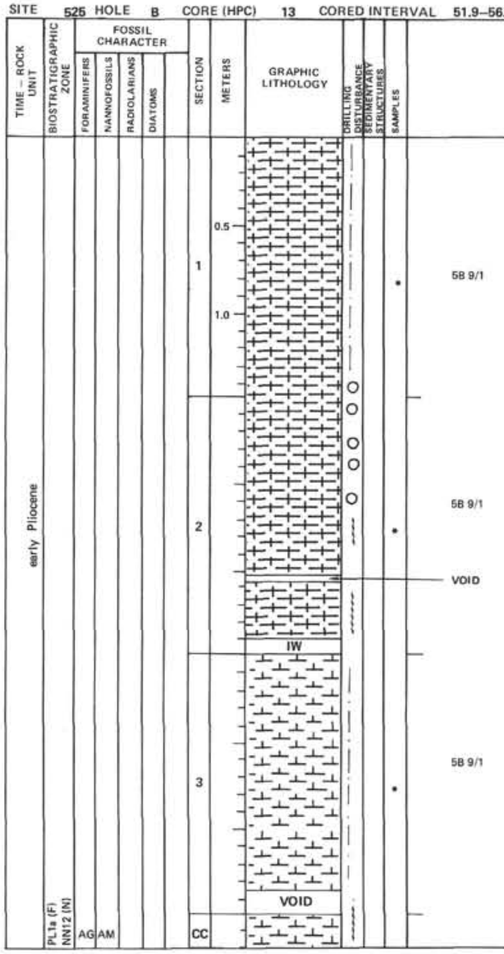
SMEAR SLIDE SUMMARY:

	1-58 D
Composition:	
Volcanic glass	2
Foraminifers	TR
Calcareous nannofossils	88
Discoasters	10

ORGANIC CARBON AND CARBONATE:

	1-7
Organic carbon	–
Carbonate	96

SITE 525 HOLE B CORE (HPC) 13 CORED INTERVAL 51.9–56.3 m



LITHOLOGIC DESCRIPTION

FORAMINIFER NANNOFOSSIL OOZE TO NANNOFOSSIL OOZE

Core 13, Sections 1 and 2 contain a bluish-white (5B 9/1) foraminifer nannofossil ooze.

Section 3 contains a homogeneous bluish-white (5B 9/1) nannofossil ooze.

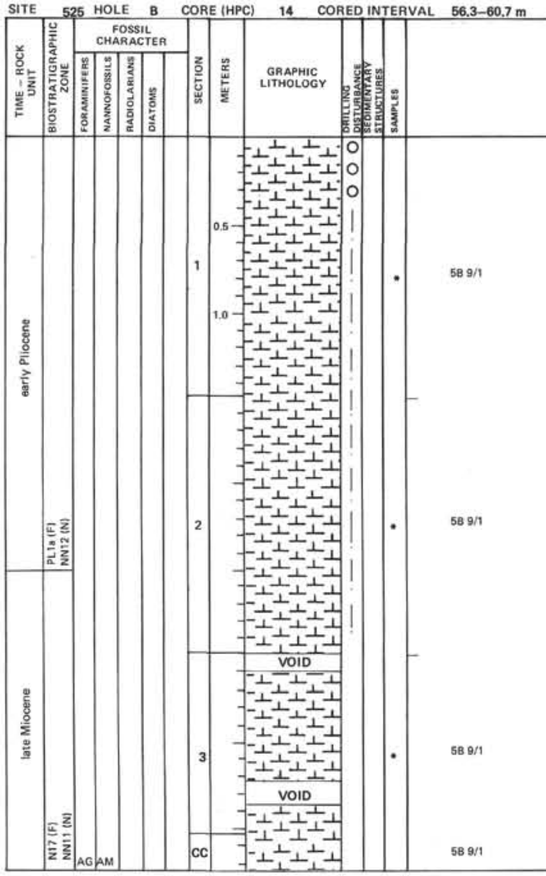
SMEAR SLIDE SUMMARY:

	1-80 D	2-80 D	3-80 D
Composition:			
Mica	–	TR	3
Volcanic glass	5	15	–
Carbonate unspecified	2	–	–
Foraminifers	15	15	TR
Calcareous nannofossils	48	58	87
Diatoms	TR	2	–
Discoasters	30	10	10

ORGANIC CARBON AND CARBONATE:

	1-4	2-4	3-4
Organic carbon	–	–	–
Carbonate	96	96	96

SITE 525 HOLE B CORE (HPC) 14 CORED INTERVAL 56.3–60.7 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

Core 14 contains a bluish-white (5B 9/1) homogeneous nannofossil ooze.

In Section 3, 60–62 cm a bluish-gray (5B 5/1) layer is present.

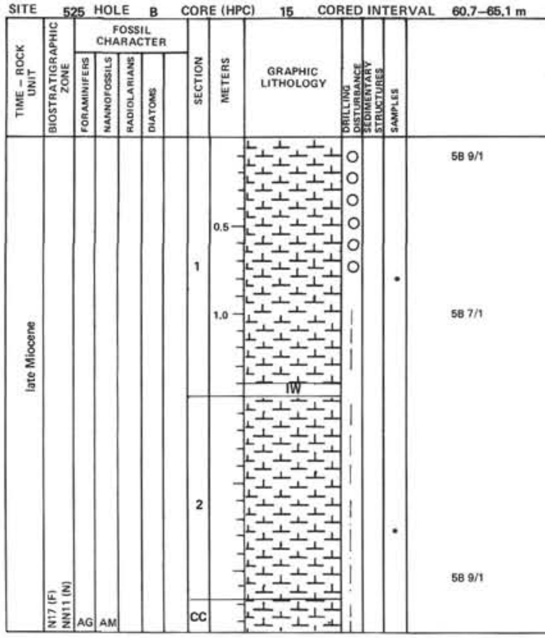
SMEAR SLIDE SUMMARY:

	1-80 D	2-80 D	3-80 D
Composition:			
Feldspar	–	–	TR
Mica	TR	TR	TR
Volcanic glass	3	TR	5
Carbonate unspecified	–	TR	TR
Foraminifers	2	2	7
Calcareous nannofossils	95	83	68
Diatoms	TR	TR	TR
Discoasters	–	15	20

ORGANIC CARBON AND CARBONATE:

	1-4	2-4	3-4
Organic carbon	–	–	–
Carbonate	94	99	100

SITE 525 HOLE B CORE (HPC) 15 CORED INTERVAL 60.7–65.1 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

A bluish white (5B 9/1) to light bluish gray (5B 7/1) nannofossil ooze was recovered. The core is disturbed and shows no sedimentary structures.

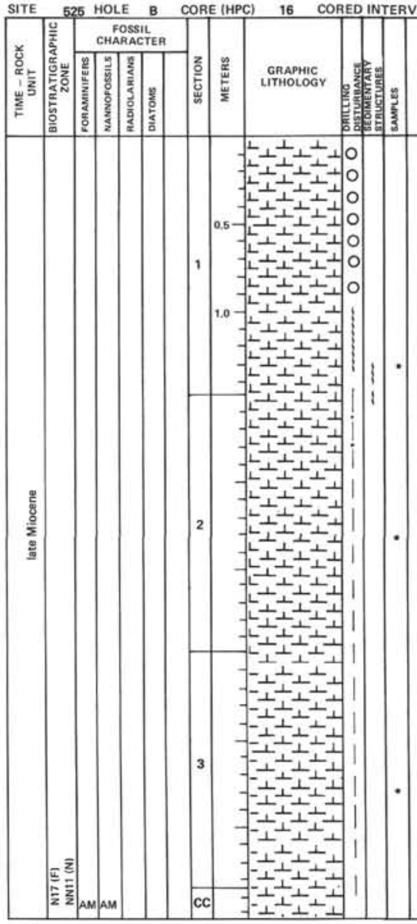
SMEAR SLIDE SUMMARY:

	1-80 D	2-80 D
Composition:		
Foraminifers	TR	5
Calcareous nannofossils	99	95

ORGANIC CARBON AND CARBONATE:

	1-4	2-4
Organic carbon	–	–
Carbonate	97	95

SITE 525 HOLE B CORE (HPC) 16 CORED INTERVAL 65.1–69.5 m



LITHOLOGIC DESCRIPTION

N9

NANNOFOSSIL OOZE

A titanium white (N9), very homogeneous nannofossil ooze was recovered.

The core is soupy to moderately disturbed (Section 1) to slightly disturbed (Sections 2 and 3). The monotonous sediment shows no sediment structures.

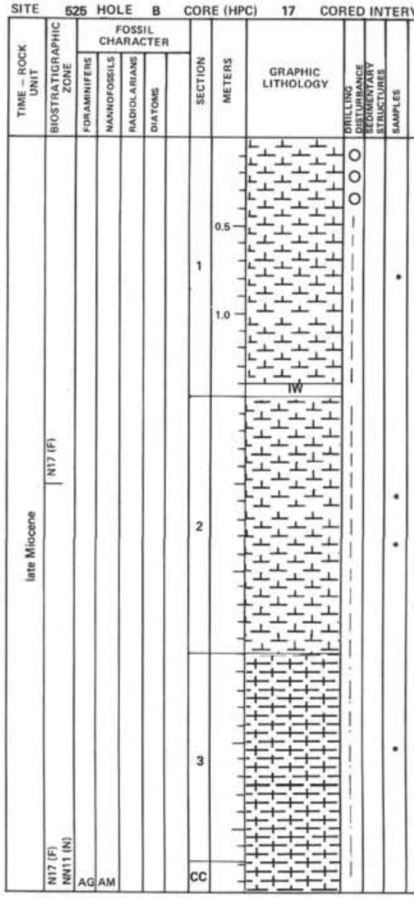
SMEAR SLIDE SUMMARY:

	1-130	2-80	3-80
	D	D	D
Composition:			
Foraminifers	10	5	10
Calcareous nannofossils	90	95	90

ORGANIC CARBON AND CARBONATE:

	1-4	2-4	3-4
Organic carbon	–	–	–
Carbonate	95	99	98

SITE 525 HOLE B CORE (HPC) 17 CORED INTERVAL 69.5–73.9 m



LITHOLOGIC DESCRIPTION

N9

NANNOFOSSIL OOZE

A titanium white (N9), homogeneous, highly to moderately disturbed nannofossil ooze was recovered in Sections 1 and 2.

A 4 cm (89–93 cm, Section 2) layer, pale blue (5PB 7/2) contains some volcanic glass.

FORAM-NANNOFOSSIL OOZE

A titanium white (N9) homogeneous, moderately deformed foram-nannofossil ooze was recovered in Section 3.

Sediment structures are not visible.

SMEAR SLIDE SUMMARY:

	1-80	2-60	2-88	3-60
	D	D	M	D
Composition:				
Volcanic glass	–	–	2	2
Foraminifers	10	10	10	20
Calcareous nannofossils	90	90	88	78

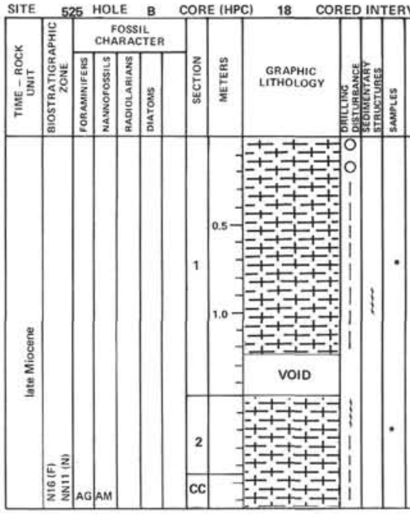
5B 7/2

N9

ORGANIC CARBON AND CARBONATE:

	1-4	2-4	3-4
Organic carbon	–	–	–
Carbonate	97	96	93

SITE 525 HOLE B CORE (HPC) 18 CORED INTERVAL 73.9–78.3 m



LITHOLOGIC DESCRIPTION

N9

FORAMINIFER NANNOFOSSIL OOZE

A homogeneous titanium white (N9) moderately disturbed foraminifer nannofossil ooze is recovered.

A pale blue (5PB 7/2) layer is present at Section 1, 94–95 cm and contains 1–2% volcanic glass&palagonite.

Sediment structures are not to be recognized.

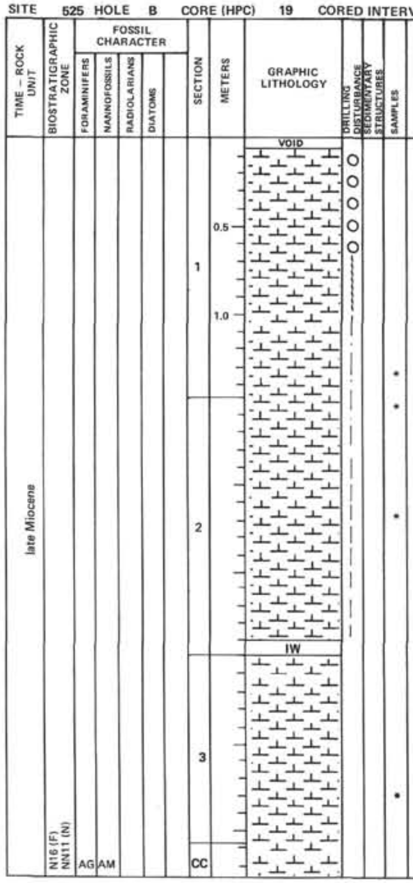
SMEAR SLIDE SUMMARY:

	1-70	2-23
	D	D
Composition:		
Volcanic glass	TR	–
Foraminifers	15	20
Calcareous nannofossils	83	75
Calcareous dinoflagellates	2	5

ORGANIC CARBON AND CARBONATE:

	1-16	2-16	CC-16
Organic carbon	–	–	–
Carbonate	93	97	97

SITE 525 HOLE B CORE (HPC) 19 CORED INTERVAL 78.3–82.7 m



LITHOLOGIC DESCRIPTION

N9

5PB 7/2

N7

N7

N9

NANNOFOSSIL OOZE

A homogeneous predominantly "titanium" white (N9) in some layers pale blue (5PB 7/2) to light gray (N7) nannofossil ooze is recovered. Section 1 is soupy to moderately disturbed and Sections 2 and 3 slight disturbed.

Sediment structures are indicated by slight mottling.

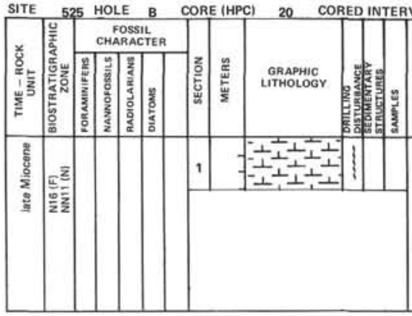
SMEAR SLIDE SUMMARY:

	1-130	2-6	2-70	3-80
	D	M	D	D
Composition:				
Feldspar	–	–	TR	–
Carbonate unspecified	–	–	1	–
Foraminifers	5	1	1	5
Calcareous nannofossils	95	99	99	93
Calcareous dinoflagellates	1	–	–	2

ORGANIC CARBON AND CARBONATE:

	1-11	2-11	3-11
Organic carbon	–	–	–
Carbonate	96	96	97

SITE 525 HOLE B CORE (HPC) 20 CORED INTERVAL 82.7–87.1 m



LITHOLOGIC DESCRIPTION

N9

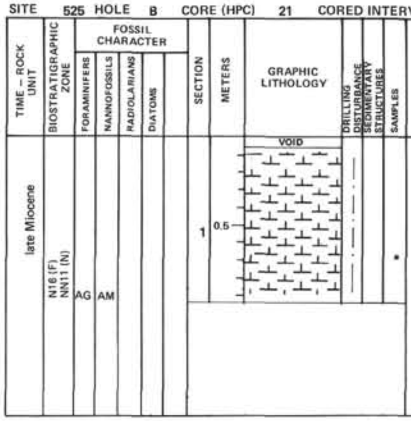
NANNOFOSSIL OOZE

A homogeneous, very deformed, white (N9) nannofossil ooze is recovered.

ORGANIC CARBON AND CARBONATE:

	1-27
Organic carbon	–
Carbonate	99

SITE 525 HOLE B CORE (HPC) 21 CORED INTERVAL 87.1–91.5 m



LITHOLOGIC DESCRIPTION

FORAMINIFER NANNOFOSSIL OOZE

A homogeneous, titanium white (N9) moderately deformed foraminifer nannofossil ooze is recovered.

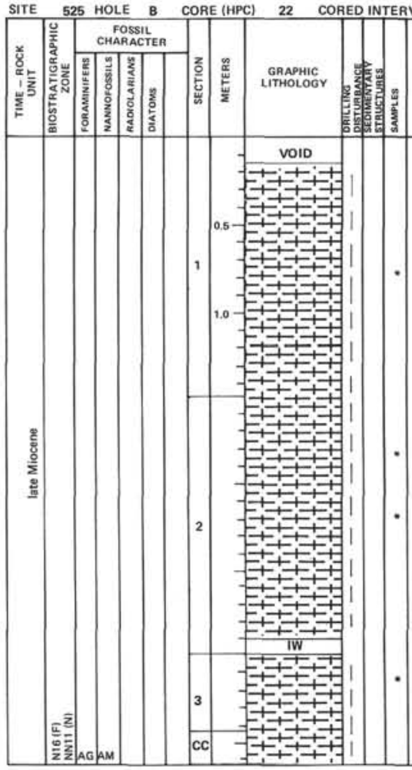
SMEAR SLIDE SUMMARY:

	1-70
	D
Composition:	
Volcanic glass	TR
Foraminifers	25
Calcareous nannofossils	75

ORGANIC CARBON AND CARBONATE:

	1-15
Organic carbon	–
Carbonate	96

SITE 525 HOLE B CORE (HPC) 22 CORED INTERVAL 87.1–91.5 m



LITHOLOGIC DESCRIPTION

FORAMINIFER NANNOFOSSIL OOZE

A white (N9) to bluish white (5B 9/1), homogeneous foraminifer nannofossil ooze is recovered. Deformation is slight to moderate.

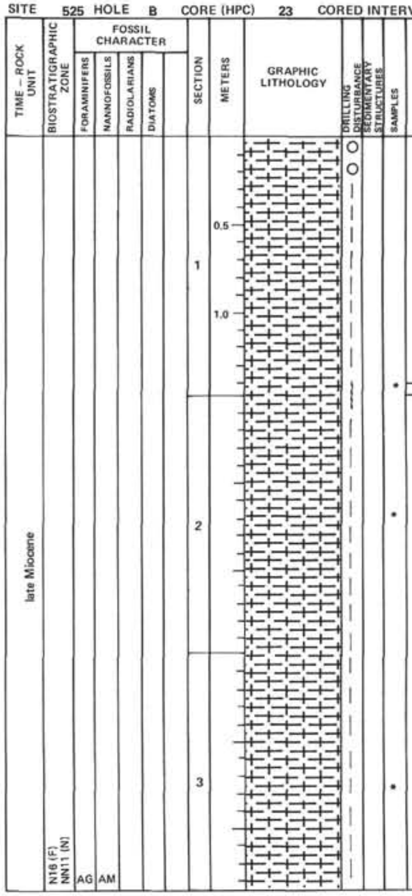
SMEAR SLIDE SUMMARY:

	1-74	2-35	2-70	3-19
	D	M	D	D
Composition:				
Feldspar	–	–	–	TR
Heavy minerals	–	–	–	TR
Volcanic glass	TR	TR	–	TR
Foraminifers	10	20	20	20
Calcareous nannofossils	90	80	80	79

ORGANIC CARBON AND CARBONATE:

	1-16	2-16	3-16
Organic carbon	–	–	–
Carbonate	95	97	97

SITE 525 HOLE B CORE (HPC) 23 CORED INTERVAL 94.9–99.3 m



LITHOLOGIC DESCRIPTION

FORAMINIFER NANNOFOSSIL OOZE

A very homogeneous titanium white (N9) only slightly deformed foraminifer nannofossil ooze is recovered.

Section 1, 145–150 cm contains a dark gray (N3) layer of nannofossil foraminifer ooze probably due to deformation and drilling grease.

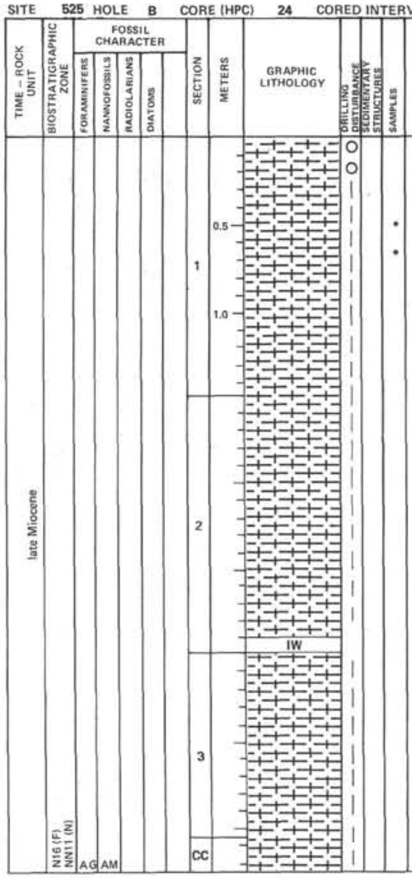
SMEAR SLIDE SUMMARY:

	1-147	2-70	3-80
	M	D	D
Composition:			
Foraminifers	60	15	25
Calcareous nannofossils	40	80	70
Fish remains	–	1	–
Others	–	4	5

ORGANIC CARBON AND CARBONATE:

	1-28	2-28	3-28
Organic carbon	–	–	–
Carbonate	95	96	97

SITE 525 HOLE B CORE (HPC) 24 CORED INTERVAL 99.3–103.7 m



LITHOLOGIC DESCRIPTION

N9

FORAMINIFER NANNOFOSSIL OOZE

A homogeneous titanium white (N9) foraminifer nannofossil ooze is recovered.

Cores are only very slightly deformed.

Sediment structures are not to be recognized.

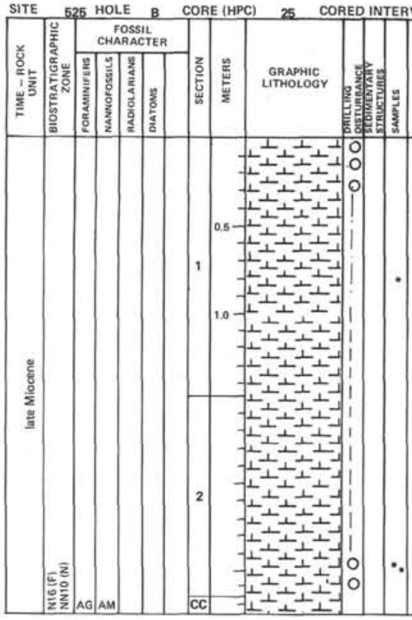
SMEAR SLIDE SUMMARY:

	1-53 M	1-70 D
Composition:		
Foraminifers	50	20
Calcareous nannofossils	50	70
Discoasters	–	10

ORGANIC CARBON AND CARBONATE:

	1-28	2-28	3-28
Organic carbon	–	–	–
Carbonate	95	96	94

SITE 525 HOLE B CORE (HPC) 25 CORED INTERVAL 103.7–108.1 m



LITHOLOGIC DESCRIPTION

5B 9/1

2.5YR 6/0

NANNOFOSSIL OOZE

A bluish white (5B 9/1) to white (N9) homogeneous nannofossil ooze is recovered.

Section 2, 92–102 cm contains a grayish (2.5YR 6/0) layer with a black (N1) band at the bottom probably due to drilling disturbances and contamination by drilling grease.

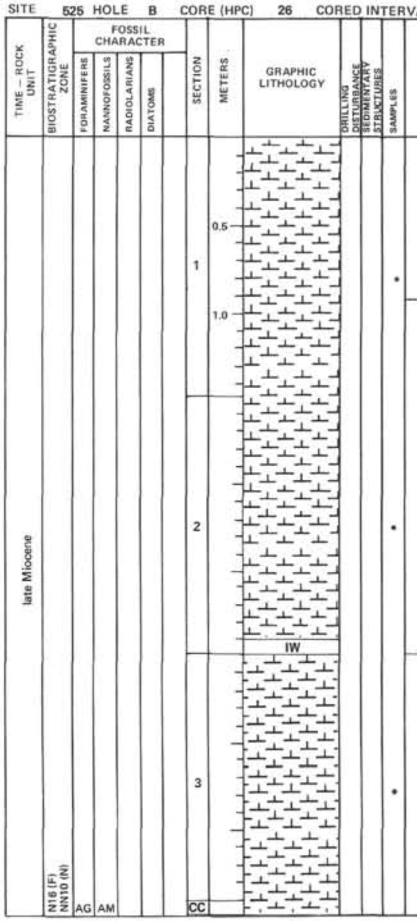
SMEAR SLIDE SUMMARY:

	1-80 D	2-100 M	2-103 M
Composition:			
Quartz	3	TR	TR
Feldspar	TR	TR	TR
Mica	TR	–	–
Volcanic glass	5	4	3
Carbonate unspecified	TR	30	TR
Foraminifers	TR	TR	TR
Calcareous nannofossils	92	66	97

ORGANIC CARBON AND CARBONATE:

	1-28	2-28
Organic carbon	–	–
Carbonate	94	95

SITE 525 HOLE B CORE (HPC) 26 CORED INTERVAL 108.1–112.5 m



LITHOLOGIC DESCRIPTION

N9 + 5Y 8/1

N9

N9 to 5B 9/1

NANNOFOSSIL OOZE

Core 26 contains a white (N9) to bluish white (5B 9/1) homogeneous nannofossil ooze.

Section 1, 0–90 cm is soupy with yellowish gray (5Y 8/1) patches. A higher foram content is probably due to winnowing during coring.

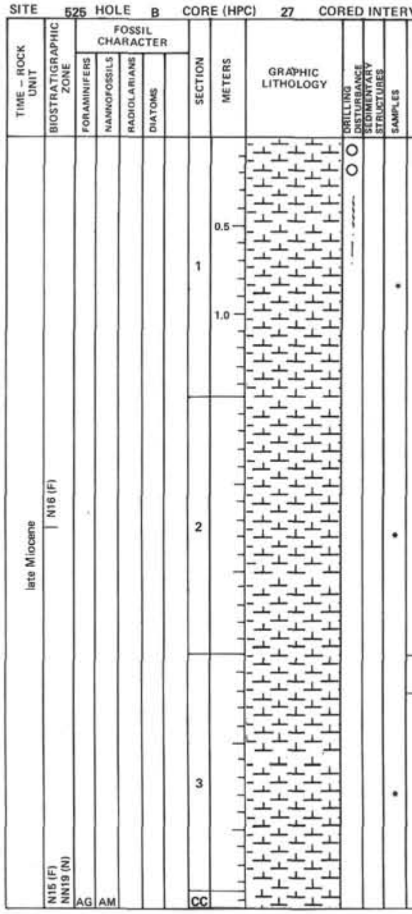
SMEAR SLIDE SUMMARY:

	1-80	2-80	3-80
	D	D	D
Composition:			
Feldspar	TR	–	–
Mica	TR	–	–
Volcanic glass	TR	TR	TR
Foraminifers	20	TR	5
Calcareous nannofossils	80	100	95

ORGANIC CARBON AND CARBONATE:

	1-123	2-123	3-119
Organic carbon	–	–	–
Carbonate	94	94	96

SITE 525 HOLE B CORE (HPC) 27 CORED INTERVAL 112.5–116.9 m



LITHOLOGIC DESCRIPTION

N9

N8

N9

NANNOFOSSIL OOZE

Core 27 contains a soupy (Section 1, 0–30 cm) to undeformed white (N9) to very light gray (N8) homogeneous nannofossil ooze.

Medium dark gray (N4) patches and streaks , probably due to contamination by drilling grease, are present in all sections.

Section 3, 0–30 cm shows some yellowish gray (5Y 8/1) patches.

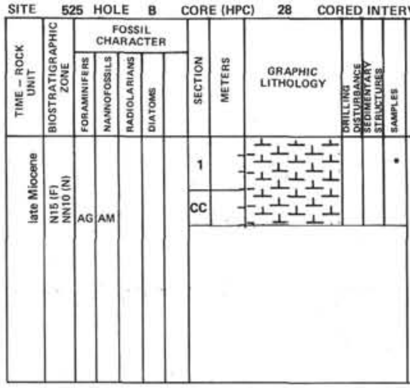
SMEAR SLIDE SUMMARY:

	1-80	2-80	3-80
	D	D	D
Composition:			
Feldspar	TR	–	–
Mica	–	–	TR
Clay	–	–	TR
Volcanic glass	3	TR	TR
Carbonate unspecified	–	–	TR
Foraminifers	5	TR	TR
Calcareous nannofossils	92	100	100

ORGANIC CARBON AND CARBONATE:

	1-56	2-56	3-56
Organic carbon	–	–	–
Carbonate	97	96	96

SITE 525 HOLE B CORE (HPC) 28 CORED INTERVAL 116.9–121.3 m



LITHOLOGIC DESCRIPTION

N9

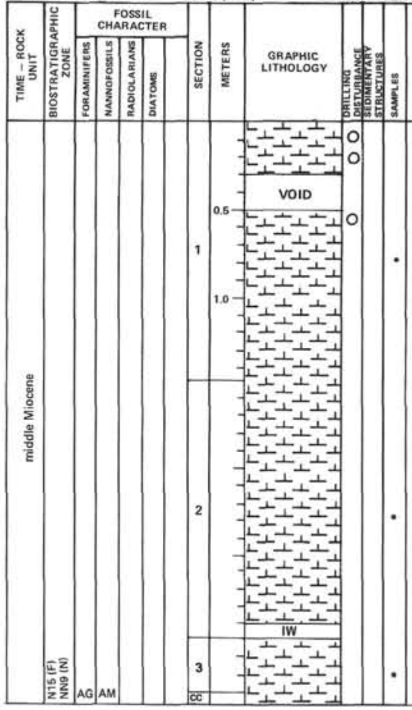
NANNOFOSSIL OOZE

A white (N9) to bluish white (5B 9/1) homogeneous nannofossil ooze with patches of medium light gray (N6) is recovered.

SMEAR SLIDE SUMMARY:

	1-20
	D
Composition:	
Feldspar	TR
Clay	15
Volcanic glass	TR
Foraminifers	TR
Calcareous nannofossils	85

SITE 525 HOLE B CORE (HPC) 29 CORED INTERVAL 121.3–125.7 m



LITHOLOGIC DESCRIPTION

N9

NANNOFOSSIL OOZE

Core 29 contains a white (N9) homogeneous nannofossil ooze. Section 1, 0–65 cm is soupy. Sediment structures are not visible.

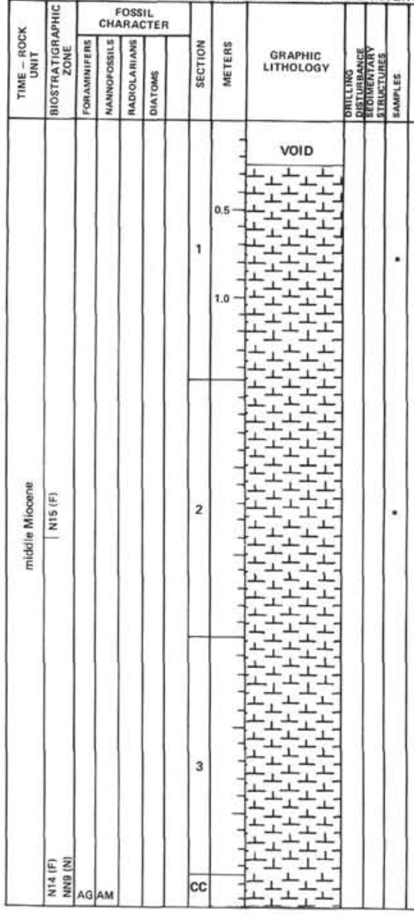
SMEAR SLIDE SUMMARY:

	1-80	2-80	3-20
	D	D	D
Composition:			
Quartz	TR	1	–
Felspar	2	1	TR
Mica	TR	–	–
Clay	10	20	15
Volcanic glass	TR	TR	TR
Carbonate unspecified	–	–	TR
Foraminifers	TR	3	2
Calcareous nannofossils	88	75	83

ORGANIC CARBON AND CARBONATE:

	1-78	2-78	3-28
Organic carbon	–	–	–
Carbonate	93	96	96

SITE 525 HOLE B CORE (HPC) 30 CORED INTERVAL 125.7–130.1 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

Core 30 contains a white (N9) to very light gray (N8) homogeneous nannofossil ooze. Sedimentary structures are not visible.

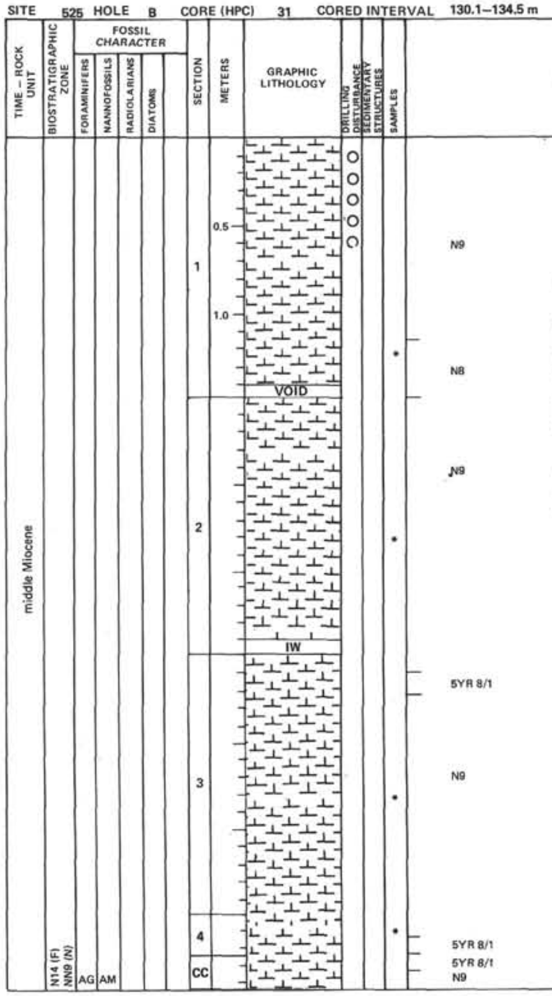
SMEAR SLIDE SUMMARY:

	1-80	2-80
	D	D
Composition:		
Quartz	–	TR
Feldspar	TR	TR
Mica	TR	–
Clay	5	5
Volcanic glass	TR	TR
Foraminfiers	2	2
Calcareous nannofossils	93	93
Diatoms	–	TR

ORGANIC CARBON AND CARBONATE:

	1-95	2-95	3-95
Organic carbon	–	–	–
Carbonate	93	93	95

SITE 525 HOLE B CORE (HPC) 31 CORED INTERVAL 130.1–134.5 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

Core 31 contains a white (N9) homogeneous nannofossil ooze layered by some light gray (N8) or pinkish gray (5YR 8/1) horizon.

Section 1, 0–120 cm is soupy. Sediment structures are not visible.

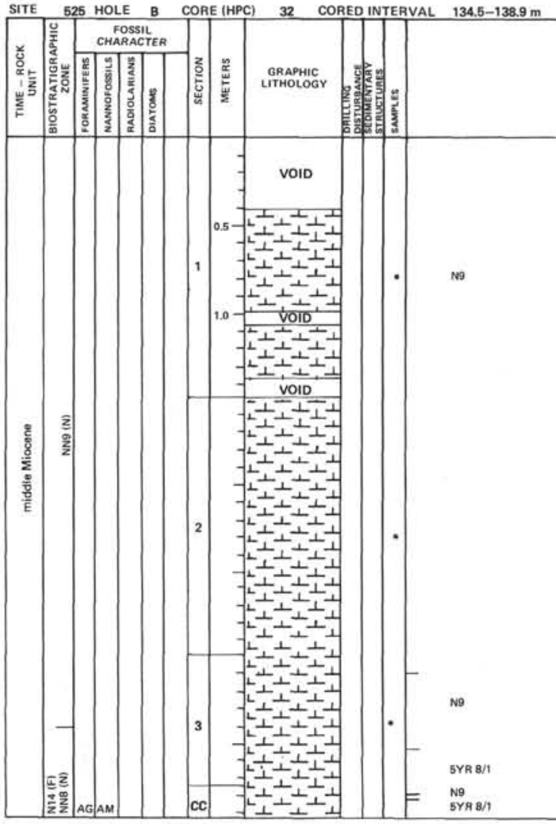
SMEAR SLIDE SUMMARY:

	1-127	2-80	3-80	4-10
	D	D	D	D
Composition:				
Feldspar	TR	TR	TR	–
Mica	TR	TR	TR	–
Clay	10	–	10	–
Volcanic glass	TR	TR	–	TR
Palagonite	–	–	–	10
Foraminifers	2	TR	TR	TR
Calcareous nannofossils	88	100	90	90

ORGANIC CARBON AND CARBONATE:

	2-14	3-14	4-14
Organic carbon	–	–	–
Carbonate	93	93	96

SITE 525 HOLE B CORE (HPC) 32 CORED INTERVAL 134.5–138.9 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

Core 32 contains a white (N9) to grayish pink (5YR 8/1) *nannofossil ooze.*

Sediment structures are not visible.

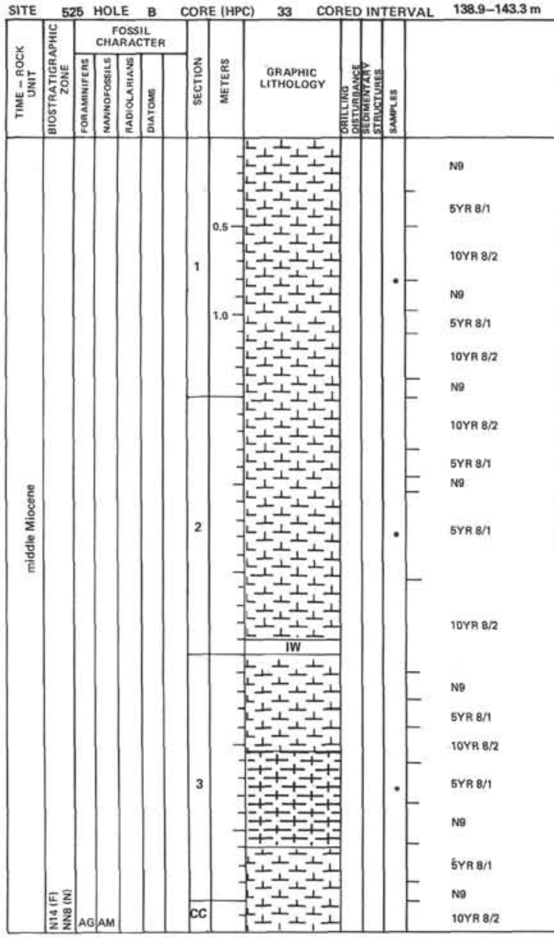
SMEAR SLIDE SUMMARY:

	1-80	2-80	3-40
	D	D	D
Composition:			
Quartz	TR	–	–
Feldspar	TR	–	–
Mica	–	TR	–
Clay	5	7	15
Volcanic glass	2	2	–
Foraminifers	TR	TR	TR
Calcareous *nannofossils*	93	91	85

ORGANIC CARBON AND CARBONATE:

	1-50	2-19	3-4
Organic carbon	–	–	–
Carbonate	96	96	96

SITE 525 HOLE B CORE (HPC) 33 CORED INTERVAL 138.9–143.3 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

Core 33 contains a multicolored (white – N9, pinkish gray – 5YR 8/1, very pale orange – 10YR 8/2) banded homogeneous nannofossil ooze.

Sediment structures are not visible.

Section 3, 55–110 cm is a foraminiferal nannofossil ooze.

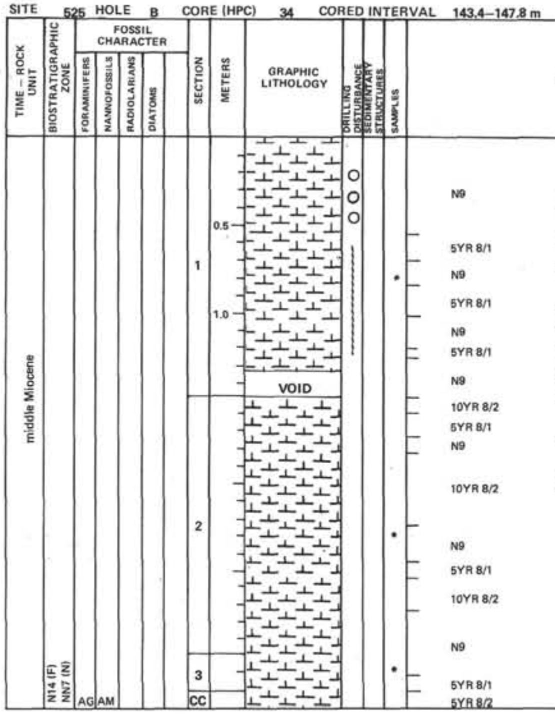
SMEAR SLIDE SUMMARY:

	1-80	2-80	3-80
	D	D	D
Composition:			
Feldspar	TR	–	TR
Clay	2	–	–
Volcanic glass	TR	TR	TR
Carbonate unspecified	–	2	–
Foraminifers	TR	5	15
Calcareous nannofossils	98	93	85

ORGANIC CARBON AND CARBONATE:

	1-29	2-6	3-6
Organic carbon	–	–	–
Carbonate	.95	93	94

SITE 525 HOLE B CORE (HPC) 34 CORED INTERVAL 143.4–147.8 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

Core 34 contains a multicolored (white – N9, pinkish gray – 5YR 8/1, very pale orange – 10YR 8/2) banded homogeneous nannofossil ooze.

Section 1, 0–60 cm is soupy and contains numerous pieces of drill pipe rust.

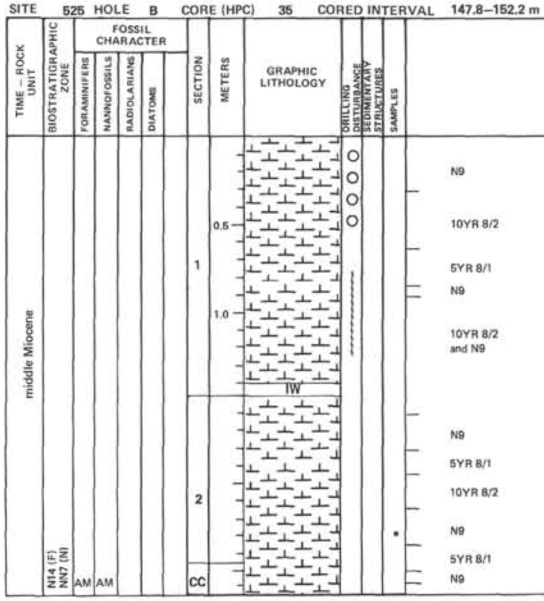
SMEAR SLIDE SUMMARY:

	1-80	2-80	3-10
	D	D	D
Composition:			
Quartz	–	TR	–
Feldspar	TR	–	TR
Clay	–	–	3
Volcanic glass	TR	TR	TR
Foraminifers	2	TR	4
Calcareous nannofossils	98	100	93

ORGANIC CARBON AND CARBONATE:

	1-80	2-80	3-21
Organic carbon	–	–	–
Carbonate	97	94	94

SITE 525 HOLE B CORE (HPC) 35 CORED INTERVAL 147.8–152.2 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

Core 35 contains a multicolored (White – N9, pinkish gray – 5YR 8/1, very pale orange – 10YR 8/2) banded homogeneous nannofossil ooze.

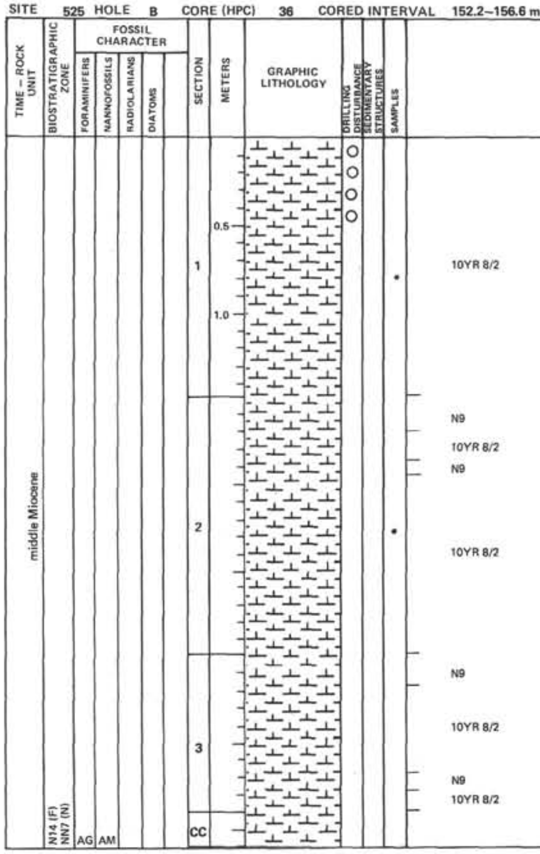
SMEAR SLIDE SUMMARY:

	2-80
	D
Composition:	
Feldspar	TR
Clay	4
Volcanic glass	TR
Foraminifers	2
Calcareous nannofossils	94

ORGANIC CARBON AND CARBONATE:

	1-117	2-5
Organic carbon	–	–
Carbonate	96	95

SITE 525 HOLE B CORE (HPC) 36 CORED INTERVAL 152.2–156.6 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

Core 36 contains a banded white (N9) and very pale orange (10YR 8/2) homogeneous nannofossil ooze.

Section 1, 0–85 cm is soupy and shows white (N9) patches and contains abundant drill pipe debris.

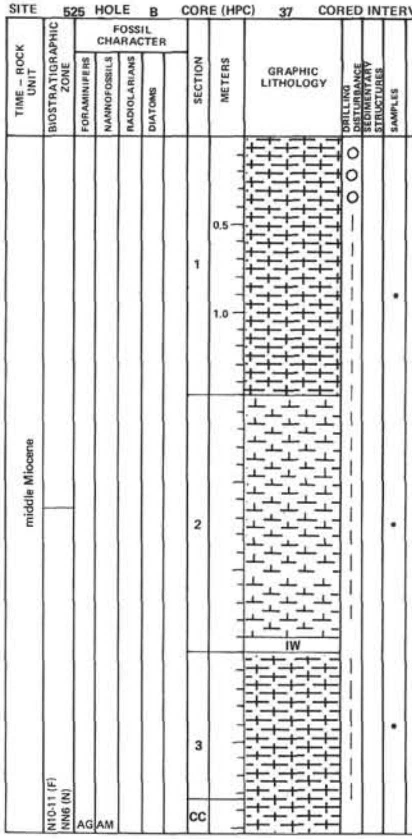
SMEAR SLIDE SUMMARY:

	1-80	2-80
	D	D
Composition:		
Feldspar	TR	–
Heavy minerals	–	10
Carbonate unspecified	–	TR
Foraminifers	–	TR
Calcareous nannofossils	100	90

ORGANIC CARBON AND CARBONATE:

	1-92	2-102	3-10
Organic carbon	–	–	–
Carbonate	93	96	95

SITE 525 HOLE B CORE (HPC) 37 CORED INTERVAL 156.6–160.0 m



LITHOLOGIC DESCRIPTION

10YR 8/2

FORAMINIFER NANNOFOSSIL OOZE
TO NANNOFOSSIL OOZE

In Core 37 a homogeneous very pale orange (10YR 8/2) sequence of foram-nannofossil ooze to nannofossil ooze is recovered.

No sediment structures are recognized.

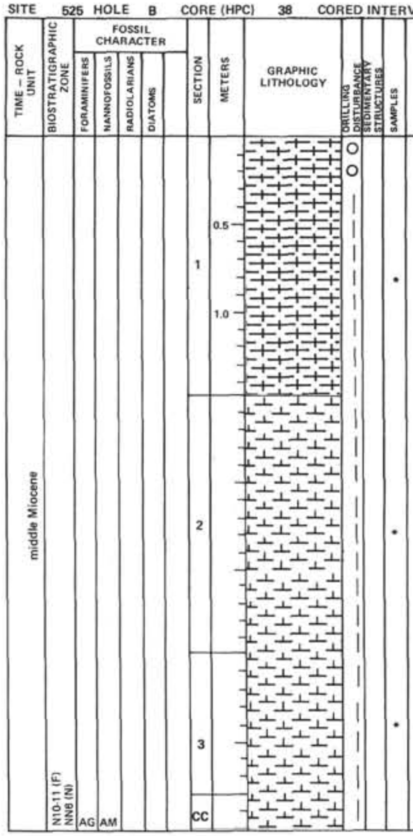
SMEAR SLIDE SUMMARY:

	1-90 D	2-76 D	3-40 D
Composition:			
Volcanic glass	TR	TR	–
Foraminifers	15	5	15
Calcareous nannofossils	85	95	85

ORGANIC CARBON AND CARBONATE:

	1-45	2-5	3-5
Organic carbon	–	–	–
Carbonate	96	94	93

SITE 525 HOLE B CORE (HPC) 38 CORED INTERVAL 161.0–165.4 m



LITHOLOGIC DESCRIPTION

10YR 8/2

NANNOFOSSIL OOZE

In Core 38 a pale orange (10YR 8/2) homogeneous slightly deformed nannofossil ooze was recovered. Areas of high concentrations of forams 10–15 cm are found. No structures are observed.

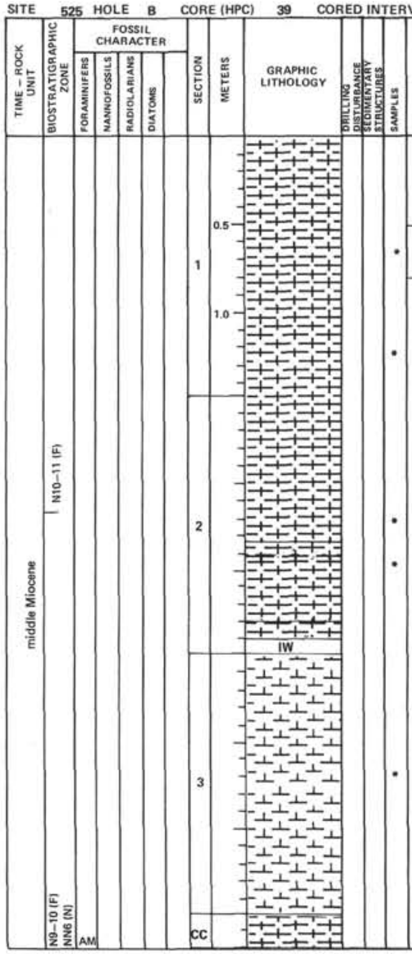
SMEAR SLIDE SUMMARY:

	1-85 D	2-80 D	3-40 D
Composition:			
Foraminifers	12	5	2
Calcareous nannofossils	85	95	98
Calcareous dinoflagellates	3	–	–

ORGANIC CARBON AND CARBONATE:

	2-2
Organic carbon	–
Carbonate	93

SITE 525 HOLE B CORE (HPC) 39 CORED INTERVAL 165.4–169.8 m



LITHOLOGIC DESCRIPTION

N9

2.5Y 8/2

10YR 8/2

FORAM-NANNOFOSSIL OOZE

A homogeneous, very pale orange (10YR 8/2) to white (N9 and 2.5Y 8/2), slightly disturbed foram-nannofossil ooze is recovered in Core 39.

Chalky layers are included at 93–95 and 135–140 cm in Section 2. No sediment structures are to be recognized.

SMEAR SLIDE SUMMARY:

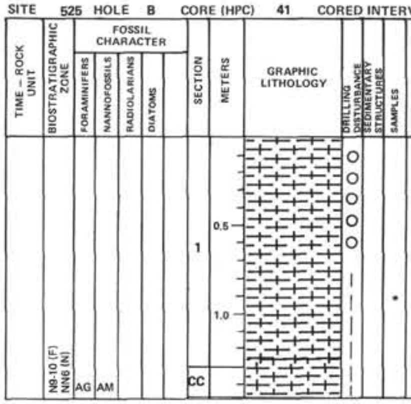
	1-68	1-122	2-70	2-94	3-70
	D	D	D	M	D
Composition:					
Foraminifers	12	20	10	15	5
Calcareous nannofossils	88	80	90	85	95

ORGANIC CARBON AND CARBONATE:

	1-138	2-138	3-139
Organic carbon	–	–	–
Carbonate	96	95	97

NOTE: Core 40, 169.4–169.8 m:
No recocery.

SITE 525 HOLE B CORE (HPC) 41 CORED INTERVAL 169.8–174.2 m



LITHOLOGIC DESCRIPTION

5YR 8/1

FORAMINIFER NANNOFOSSIL OOZE

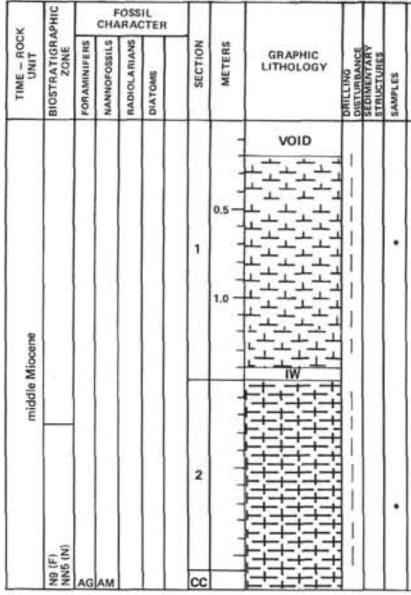
Core 41 contains a highly to slightly disturbed, pinkish gray homogeneous foraminifer nannofossil ooze.

No sedimentary structures are observed.

SMEAR SLIDE SUMMARY:

	1-90
	D
Composition:	
Foraminifers	10
Calcareous nannofossils	90

SITE 525 HOLE B CORE (HPC) 42 CORED INTERVAL 174.2–177.6 m



LITHOLOGIC DESCRIPTION

10YR 8/2

NANNOFOSSIL OOZE

In Core 42 homogeneous, very pale orange (10YR 8/2), slightly to moderately disturbed foram-nannofossil to nannofossil ooze is recovered.

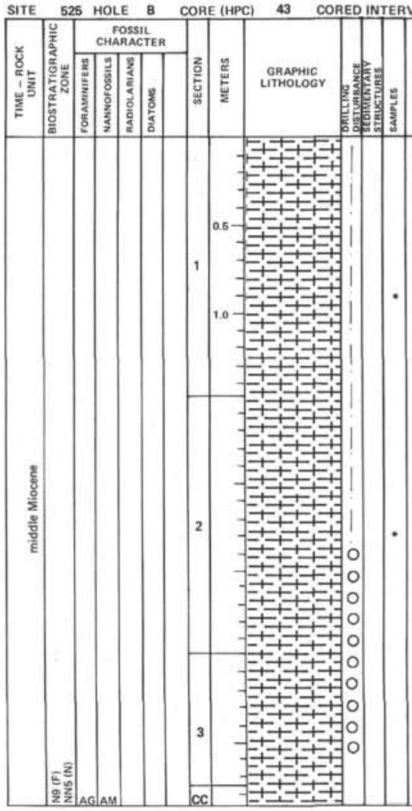
SMEAR SLIDE SUMMARY:

	1-70	2-70
	D	D
Composition:		
Foraminifers	5	10
Calcareous nannofossils	95	90

ORGANIC CARBON AND CARBONATE:

	1-52	2-52
Organic carbon	–	–
Carbonate	95	93

SITE 525 HOLE B CORE (HPC) 43 CORED INTERVAL 178.6–183.0 m



LITHOLOGIC DESCRIPTION

10YR 8/2

FORAMINIFER NANNOFOSSIL OOZE

Core 43 contains a very pale orange (10YR 8/2) homogeneous moderately deformed to soupy foraminifer nannofossil ooze. Sediment structures are not visible.

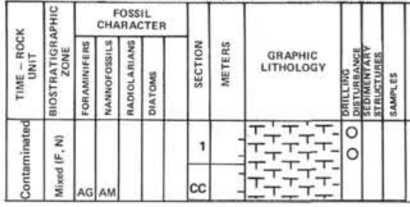
SMEAR SLIDE SUMMARY:

	1-90	2-80
	D	D
Composition:		
Volcanic glass	TR	TR
Foraminifers	15	15
Calcareous nannofossils	85	85

ORGANIC CARBON AND CARBONATE:

	1-40	2-40
Organic carbon	–	–
Carbonate	94	94

SITE 525 HOLE B CORE (HPC) 44 CORED INTERVAL 183.0–187.4 m

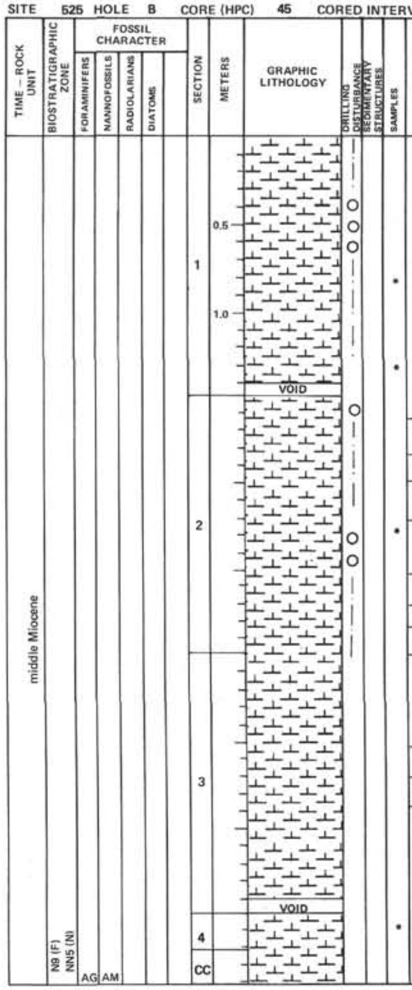


LITHOLOGIC DESCRIPTION

FORAMINIFERAL OOZE

Core 44 contains a pinkish gray (5YR 8/1) foraminiferal ooze mixed with abundant drill pipe debris due to contamination and winnowing by coring.

SITE 525 HOLE B CORE (HPC) 45 CORED INTERVAL 187.4–191.8 m



LITHOLOGIC DESCRIPTION

5YR 8/1
10YR 8/2
5YR 8/1
N9
5YR 8/1
10YR 8/2
5YR 8/1
N9
10YR 8/2
5YR 8/1
19YR 8/2
5YR 8/1
10YR 8/2

NANNOFOSSIL OOZE

Core 45 contains a multicolored (White – N9, pinkish gray – 5YR 8/1, very pale orange – 10YR 8/2) banded nannofossil ooze.

Sections 1 and 2 are moderately disturbed to soupy. Due to homogeneity no sediment structures are visible.

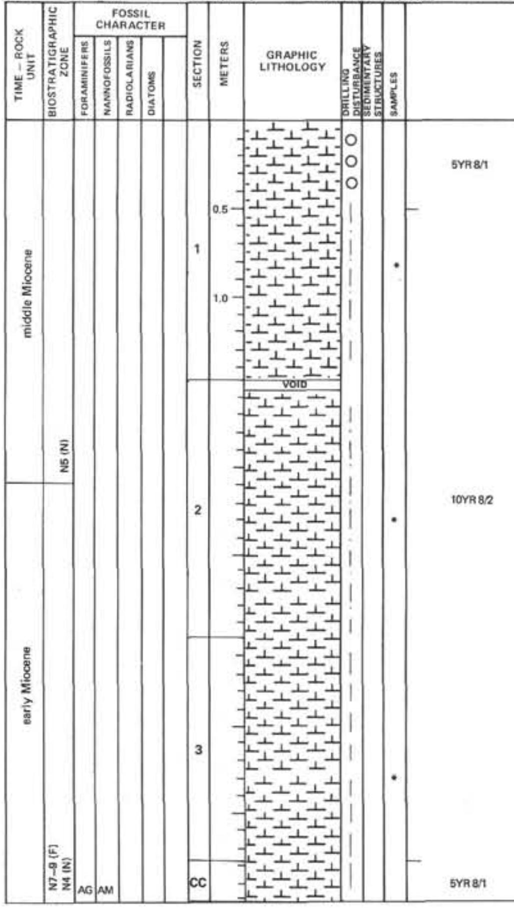
SMEAR SLIDE SUMMARY:

	1-80	2-80	4-10
	D	D	D
Composition:			
Quartz	–	–	TR
Mica	–	TR	–
Clay	TR	TR	20
Palagonite	TR	TR	–
Zeolites	–	–	TR
Carbonate unspecified	TR	–	TR
Foraminifers	–	1	1
Calcareous nannofossils	100	99	79

ORGANIC CARBON AND CARBONATE:

	1-60	2-14	3-14	4-14
Organic carbon	–	–	–	–
Carbonate	90	90	95	92

SITE 525 HOLE B CORE (HPC) 46 CORED INTERVAL 191.8–196.2 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

Core 46 contains a very pale orange (10YR 8/2) homogeneous nannofossil ooze.

Sections 1 and 2 are moderately disturbed to soupy.

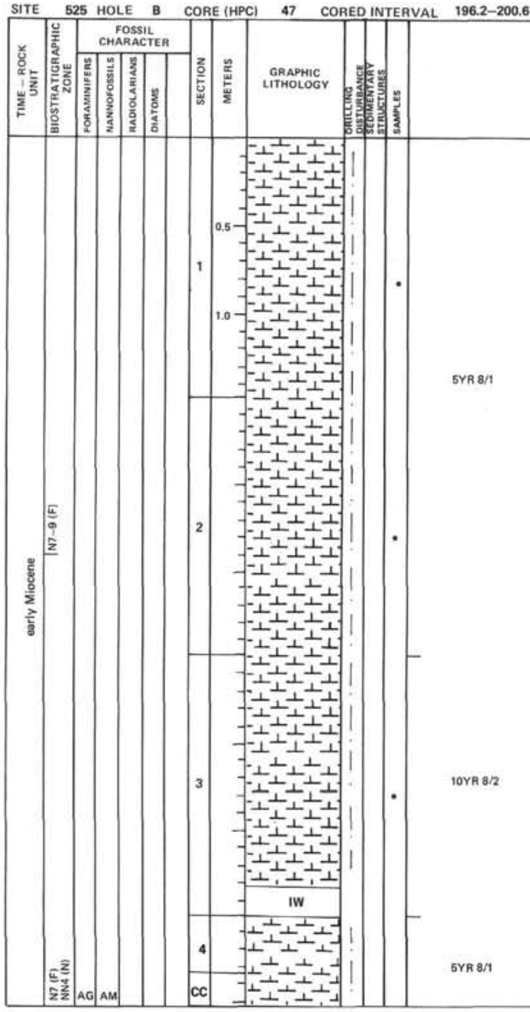
SMEAR SLIDE SUMMARY:

	1-80	2-80	3-80
	D	D	D
Composition:			
Quartz	TR	TR	TR
Feldspar	TR	–	–
Clay	5	TR	5
Volcanic glass	–	TR	TR
Carbonate unspecified	1	–	TR
Foraminifers	1	2	1
Calcareous nannofossils	63	58	64
Discoasters	30	40	30

ORGANIC CARBON AND CARBONATE:

	1-66	2-66	3-66
Organic carbon	–	–	–
Carbonate	93	91	92

SITE 525 HOLE B CORE (HPC) 47 CORED INTERVAL 196.2–200.6 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

Core 47 contains a pinkish gray (5YR 8/1) to very pale orange (10YR 8/2) homogeneous nannofossil ooze with disseminated blotches throughout the core.

Sediment structures are not visible.

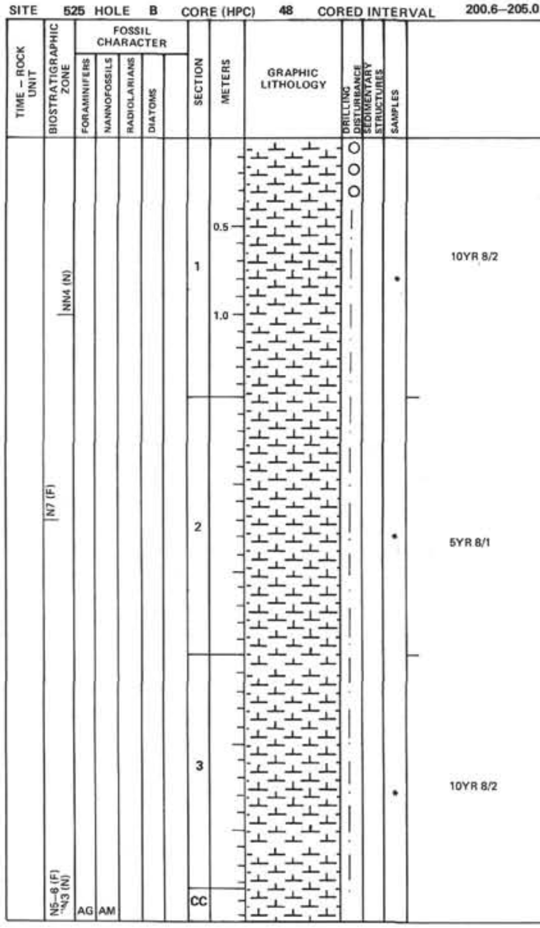
SMEAR SLIDE SUMMARY:

	1-80	2-80	3-80
	D	D	D
Composition:			
Quartz	–	–	TR
Clay	TR	1	TR
Pyrite	–	TR	TR
Carbonate unspecified	–	1	–
Foraminifers	1	2	2
Calcareous nannofossils	99	96	98

ORGANIC CARBON AND CARBONATE:

	1-15	2-5	3-5
Organic carbon	–	–	–
Carbonate	92	92	92

SITE 525 HOLE B CORE (HPC) 48 CORED INTERVAL 200.6–205.0 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

Core 48 contains a pinkish gray (5YR 8/1) to very pale orange (10YR 8/2) homogeneous moderately disturbed nannofossil ooze.

Sediment structures are not visible.

Section 1, 0–45 contains winnowed foraminifers and abundant drill pipe debris.

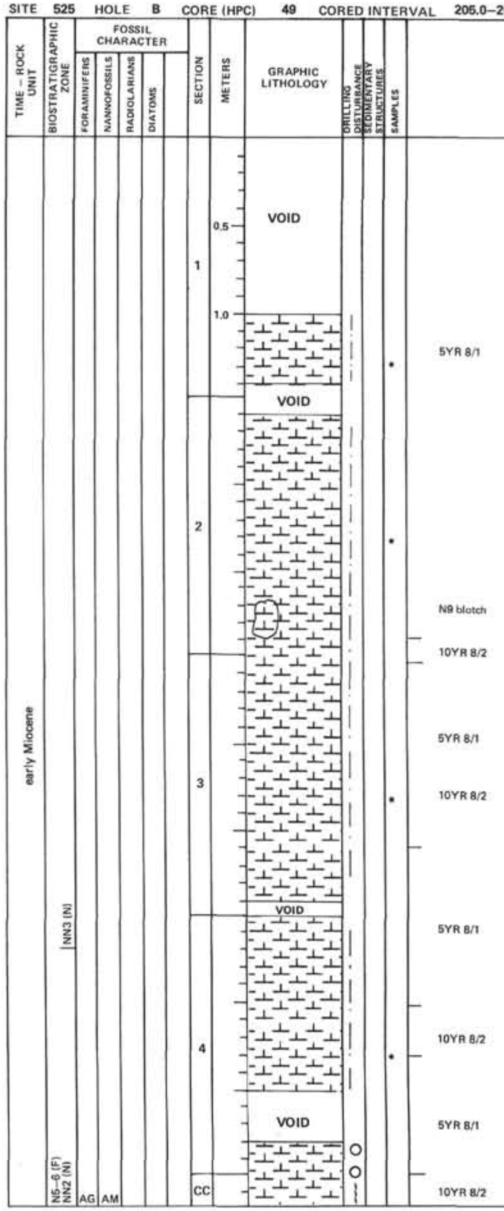
SMEAR SLIDE SUMMARY:

	1-80	2-80	3-80
	D	D	D
Composition:			
Quartz	–	TR	–
Feldspar	TR	TR	–
Volcanic glass	TR	–	–
Palagonite	–	TR	TR
Carbonate unspecified	1	TR	1
Foraminifers	TR	TR	1
Calcareous nannofossils	99	100	98

ORGANIC CARBON AND CARBONATE:

	1-56	2-56	3-56
Organic carbon	–	–	–
Carbonate	95	92	94

SITE 525 HOLE B CORE (HPC) 49 CORED INTERVAL 205.0–209.4 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE

Core 49 contains an alternating sequence of yellowish gray (5YR 8/1) and very pale orange (10YR 8/2) homogeneous nannofossil ooze. The core is moderately disturbed and no sediment structure is visible.

Section 2, 120–125 cm contains a soft white (N9) blotch.

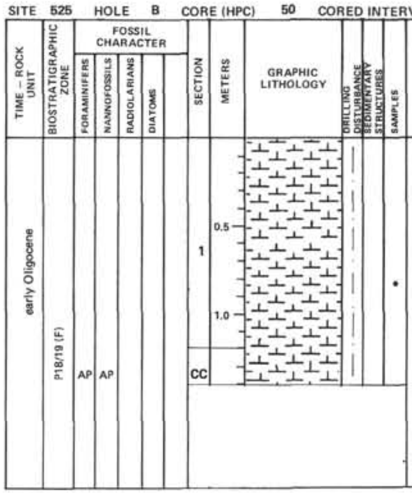
SMEAR SLIDE SUMMARY:

	1-130	2-80	3-80	4-80
	D	D	D	D
Composition:				
Quartz	TR	TR	–	TR
Feldspar	–	–	TR	TR
Volcanic glass	TR	–	TR	–
Palagonite	TR	TR	–	TR
Pyrite	TR	–	–	–
Carbonate unspecified	TR	TR	1	–
Foraminifers	1	2	1	2
Calcareous nannofossils	99	98	98	98

ORGANIC CARBON AND CARBONATE:

	2-5	3-5	4-5
Organic carbon	–	–	–
Carbonate	92	96	95

SITE 525 HOLE B CORE (HPC) 50 CORED INTERVAL 268.0–272.4 m



LITHOLOGIC DESCRIPTION

5R 8/2

NANNOFOSSIL OOZE

Core 50 contains a grayish (5Y 8/2) somewhat mottled grayish orange pink (10R 8/2) nannofossil ooze.

Core is moderately disturbed.

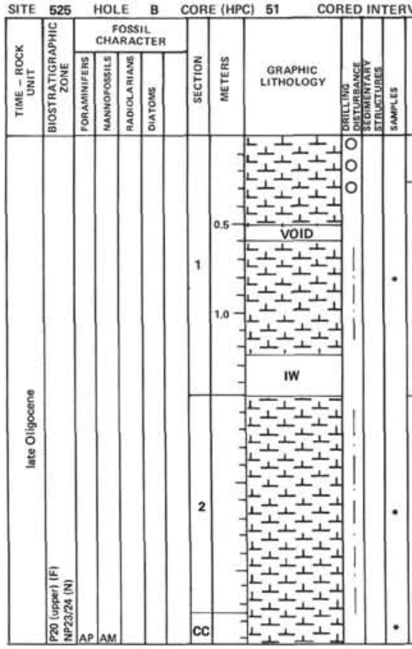
SMEAR SLIDE SUMMARY:

	1-80 D	CC D
Composition:		
Quartz	TR	–
Palagonite	–	TR
Pyrite	–	TR
Carbonate unspecified	TR	TR
Foraminifers	2	TR
Calcareous nannofossils	98	100

ORGANIC CARBON AND CARBONATE:

	1-10
Organic carbon	–
Carbonate	95

SITE 525 HOLE B CORE (HPC) 51 CORED INTERVAL 272.4–276.8 m



LITHOLOGIC DESCRIPTION

5R 8/2

10YR 8/2

5YR 8/1

10R 8/2

NANNOFOSSIL OOZE

Core 51 contains a grayish pink (5R 8/2) to grayish orange pink (10R 8/2) homogeneous nannofossil ooze.

In Section 2 a pinkish gray (5YR 8/1) is passing downwards to grayish orange pink (10R 8/2).

Core is moderately disturbed. No sediment structures are visible.

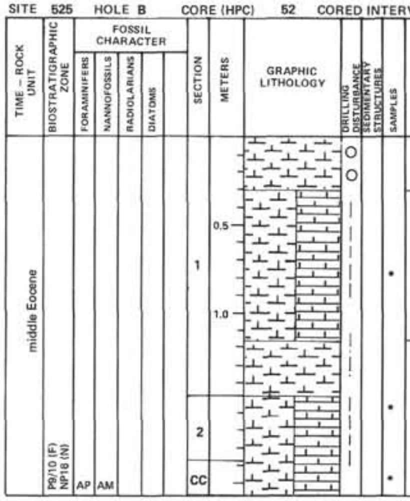
SMEAR SLIDE SUMMARY:

	1-80 D	2-70 D	CC D
Composition:			
Quartz	TR	TR	TR
Volcanic glass	–	–	TR
Palagonite	–	–	TR
Carbonate unspecified	TR	1	1
Foraminifers	1	3	7
Calcareous nannofossils	99	96	92

ORGANIC CARBON AND CARBONATE:

	1-38
Organic carbon	–
Carbonate	95

SITE 525 HOLE B CORE (HPC) 52 CORED INTERVAL 276.8–281.2 m



LITHOLOGIC DESCRIPTION

N9

N8/N9

5YR 8/1

NANNOFOSSIL OOZE AND CHALK

Core 52 contains an alternating sequence of white (N9) to pinkish gray (5YR 8/1) nannofossil ooze and nannofossil chalk.

Core is slightly to moderately disturbed, Section 1, 0–30 cm is soupy. No sediment structures are visible.

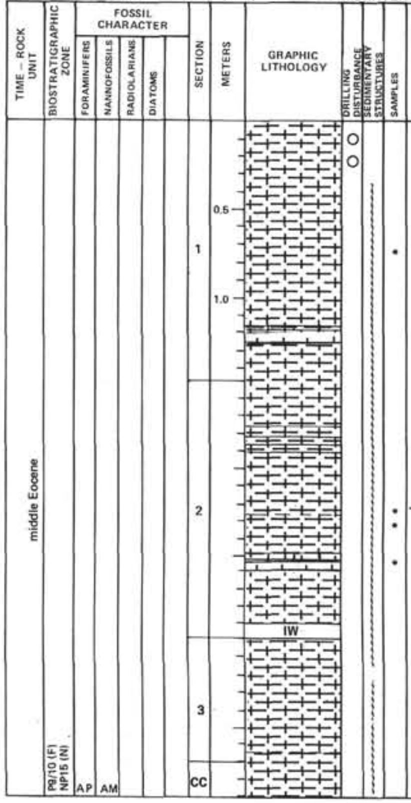
SMEAR SLIDE SUMMARY:

	1-80 D	2-10 D	CC D
Composition:			
Feldspar	TR	TR	TR
Volcanic glass	TR	TR	–
Carbonate unspecified	TR	TR	TR
Foraminifers	1	2	2
Calcareous nannofossils	99	98	98

ORGANIC CARBON AND CARBONATE:

	2-15
Organic carbon	–
Carbonate	93

SITE 525 HOLE B CORE (HPC) 53 CORED INTERVAL 281.2–285.6 m



LITHOLOGIC DESCRIPTION

N9

5YR 8/1

5Y 6/1

5YR 8/1

5Y 2/1

N9

5Y 8/1

N9

Graduational contact N6

5Y 8/1

N6

5YR 8/1

FORAMINIFER NANNOFOSSIL OOZE

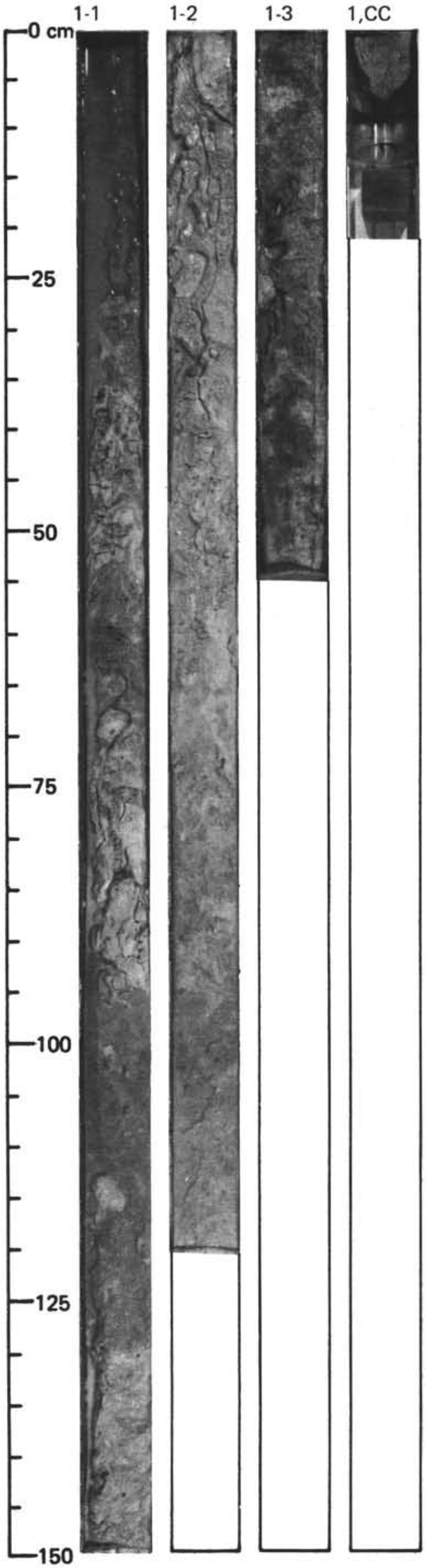
Core 53 contains a slightly bioturbated predominantly yellow gray (5Y 8/1) to pinkish gray (5YR 8/1) foraminifer nannofossil ooze. Biogenic sedimentary structures are unidentifiable. Two chalk layers are present. The alternation of colors may be indicative of a cyclic sedimentation pattern. The yellowish gray layers have a higher percentage of foraminifers than the pinkish gray areas.

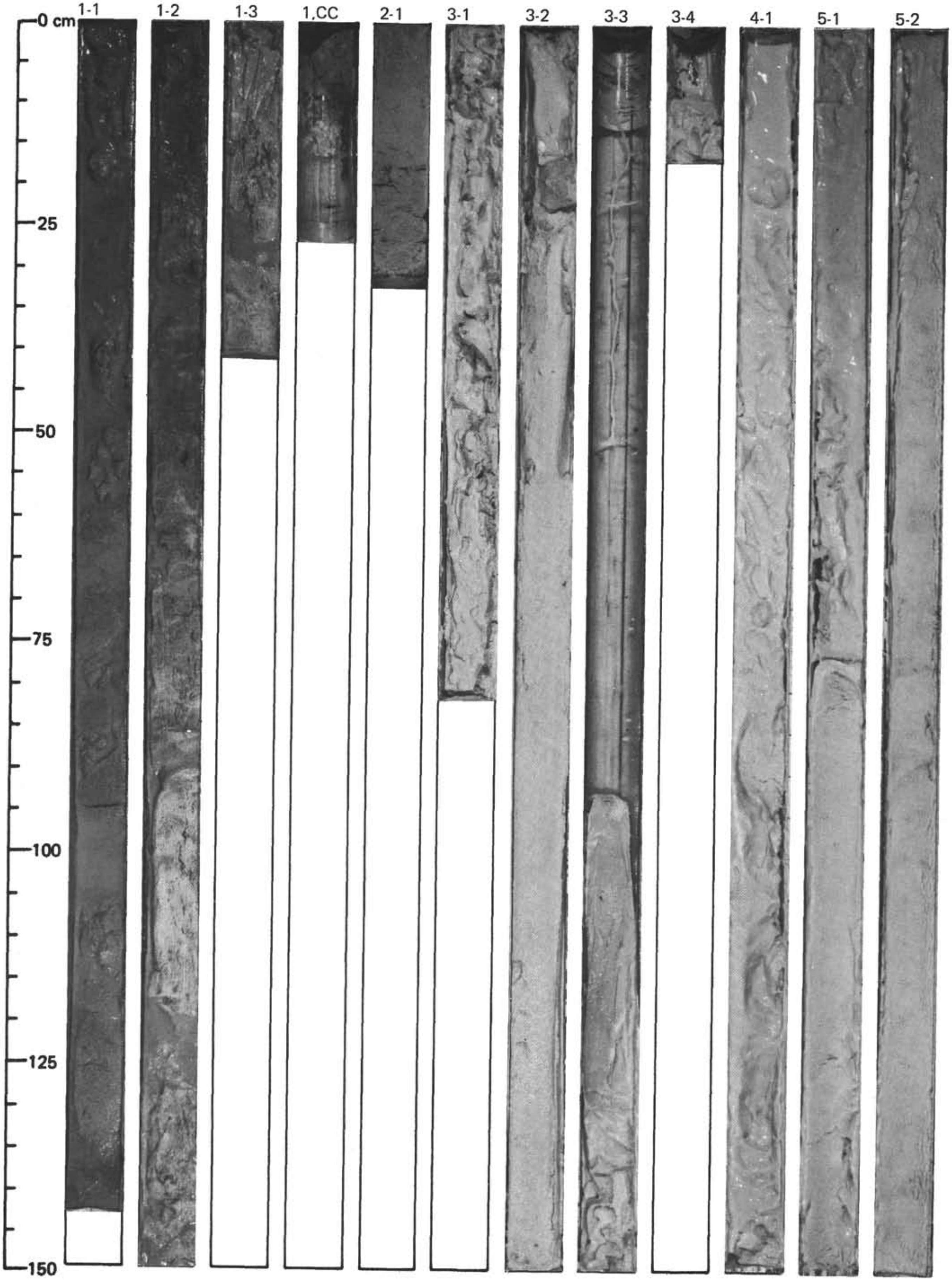
SMEAR SLIDE SUMMARY:

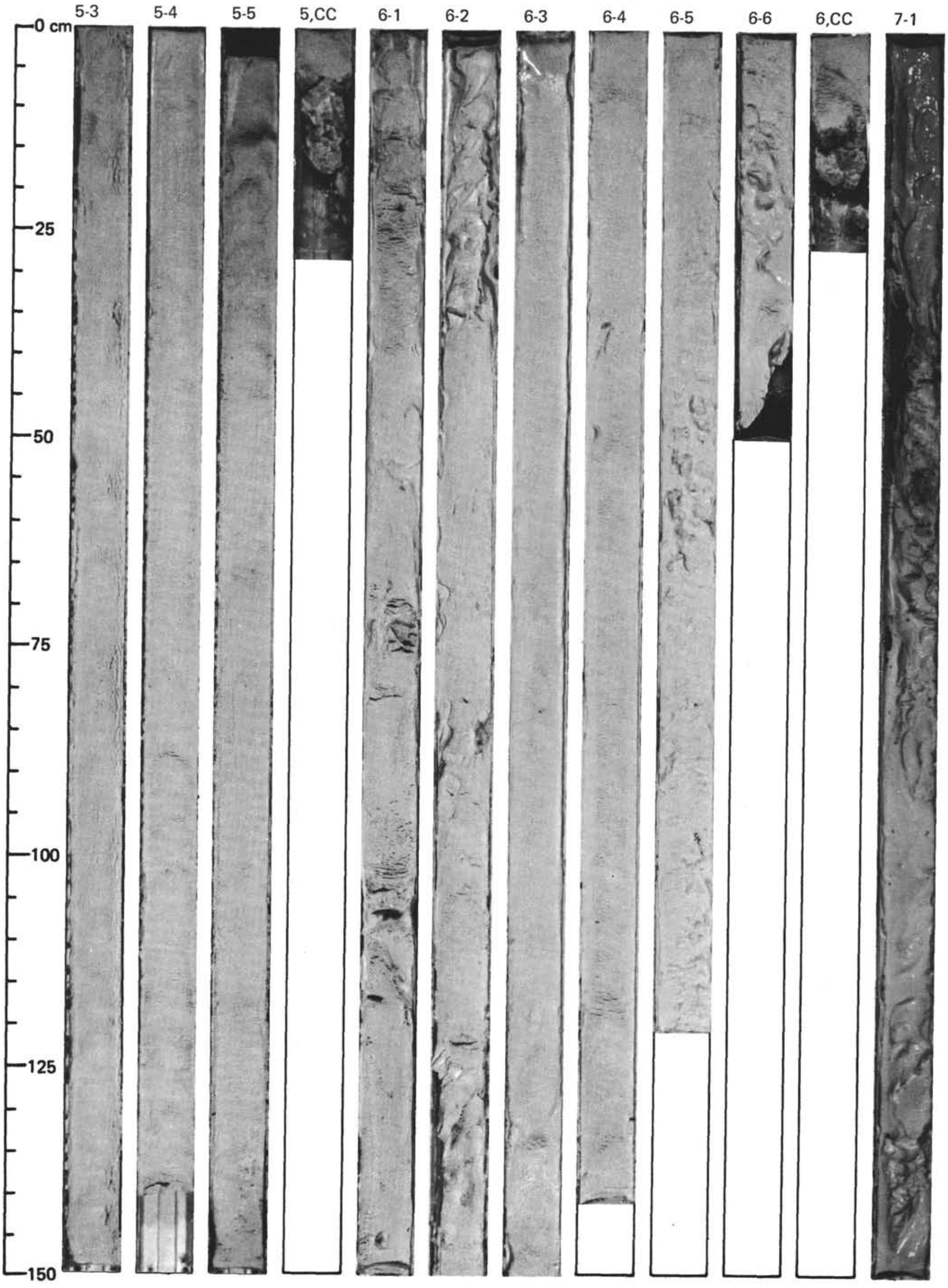
	1-77 D	2-76 D	2-82 D	2-103 D
Composition:				
Volcanic glass	–	–	–	1
Foraminifers	15	20	10	20
Calcareous nannofossils	85	80	90	79
Fish remains	–	–	–	TR

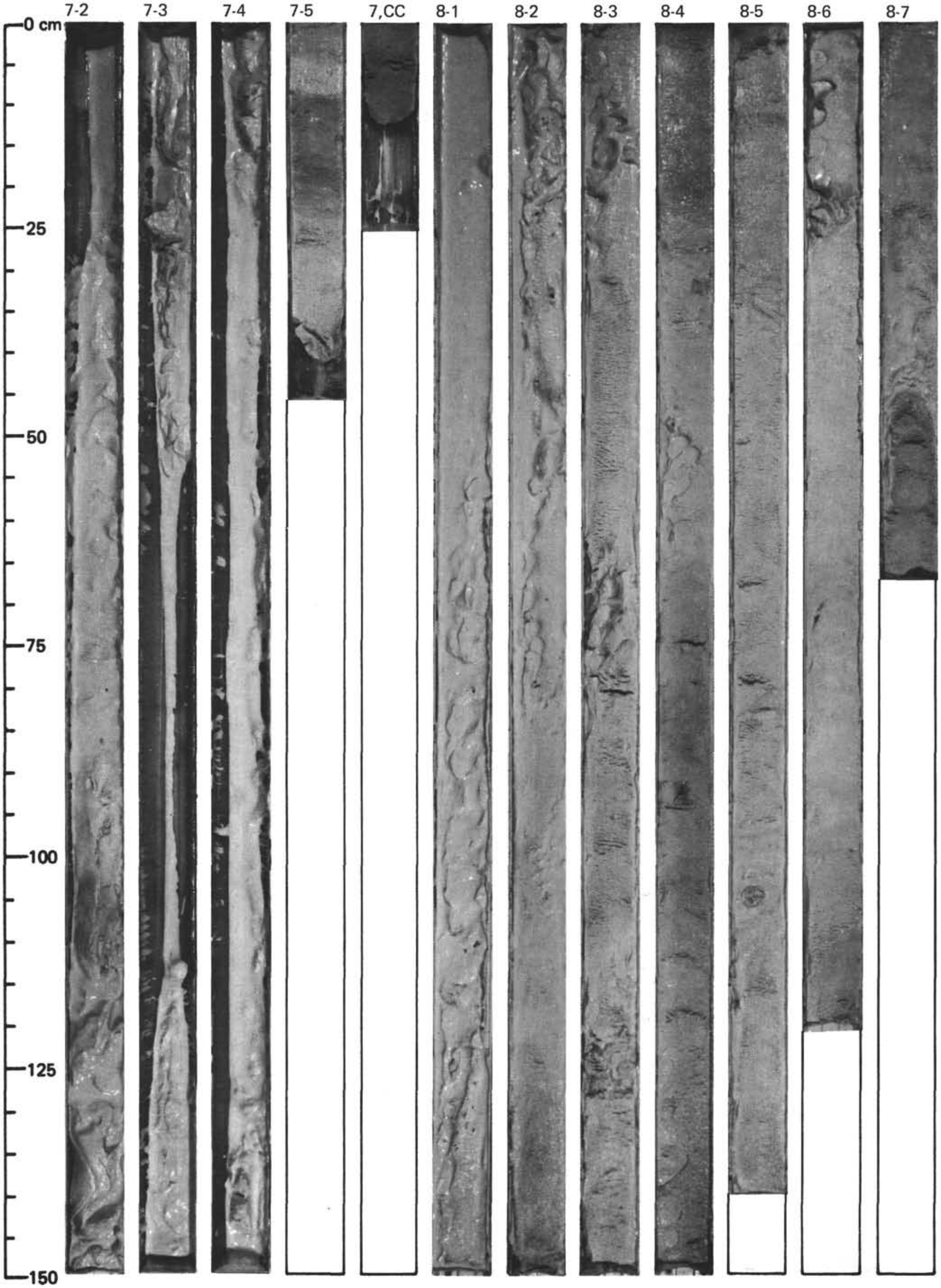
ORGANIC CARBON AND CARBONATE:

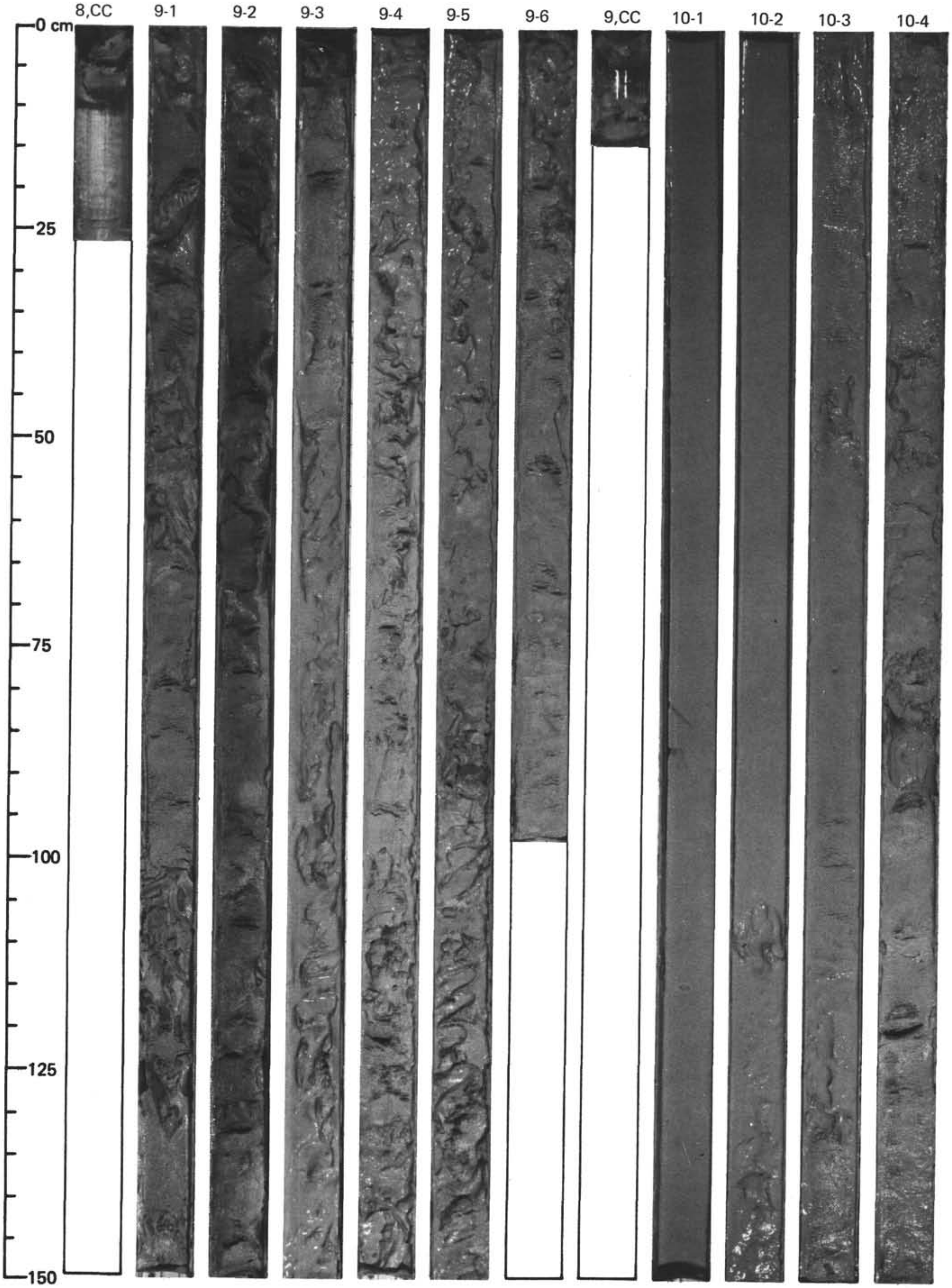
	1-55	2-55	3-55
Organic carbon	–	–	–
Carbonate	91	94	93

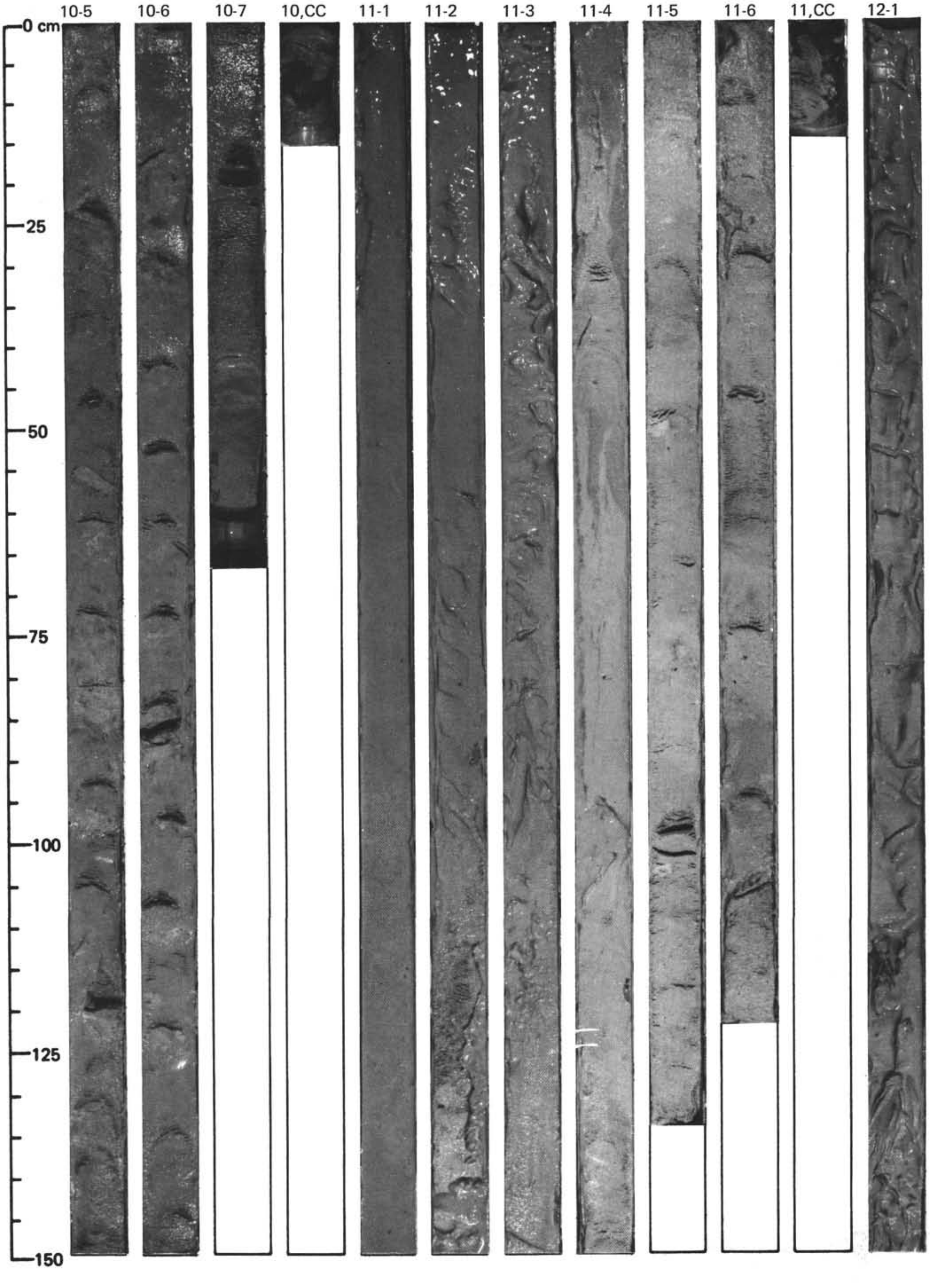

1-1
1-2
1-3
1,CC
0 cm
25
50
75
100
125
150

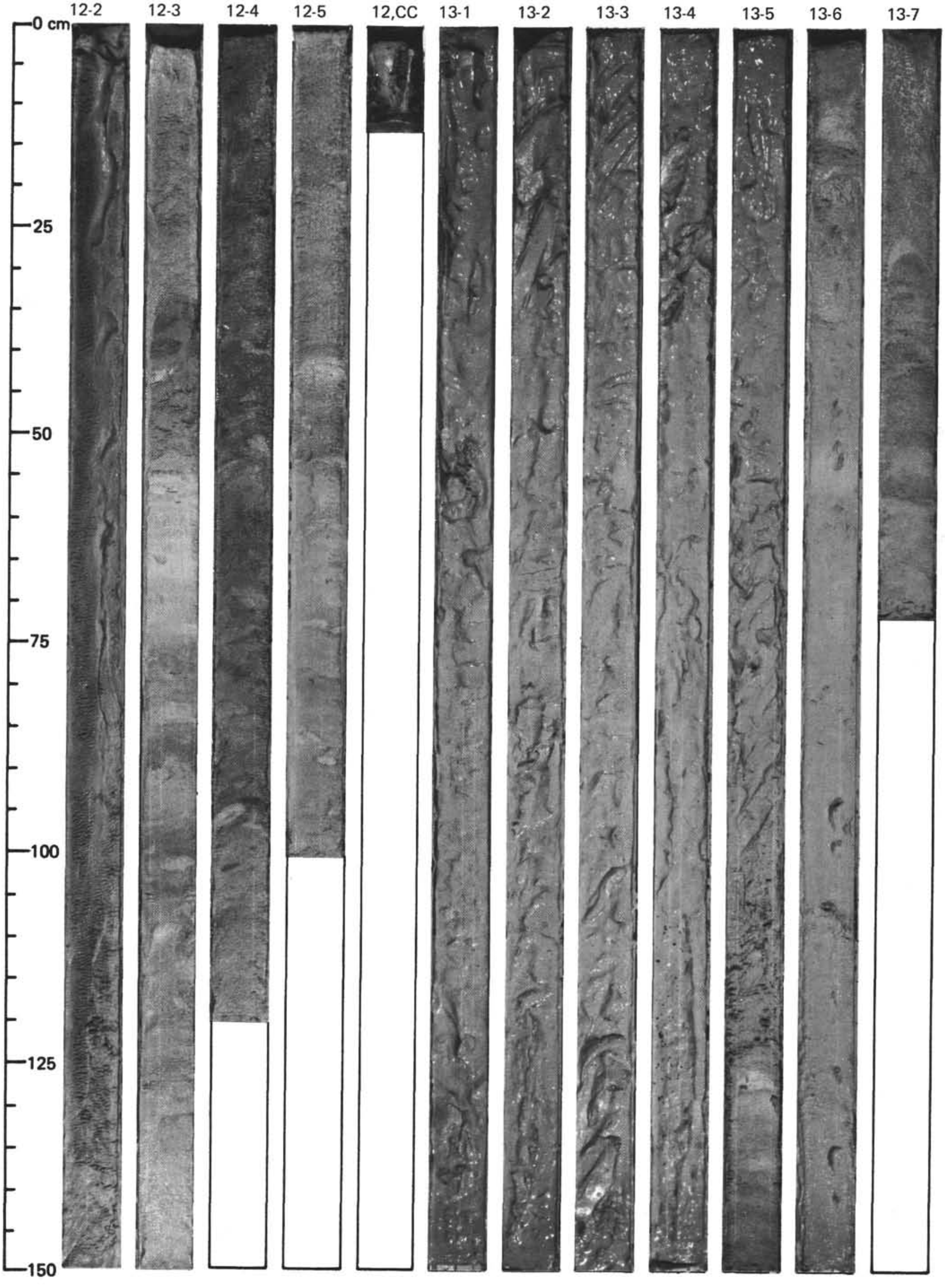

0 cm
25
50
75
100
125
150
1-1
1-2
1-3
1,CC
2-1
3-1
3-2
3-3
3-4
4-1
5-1
5-2

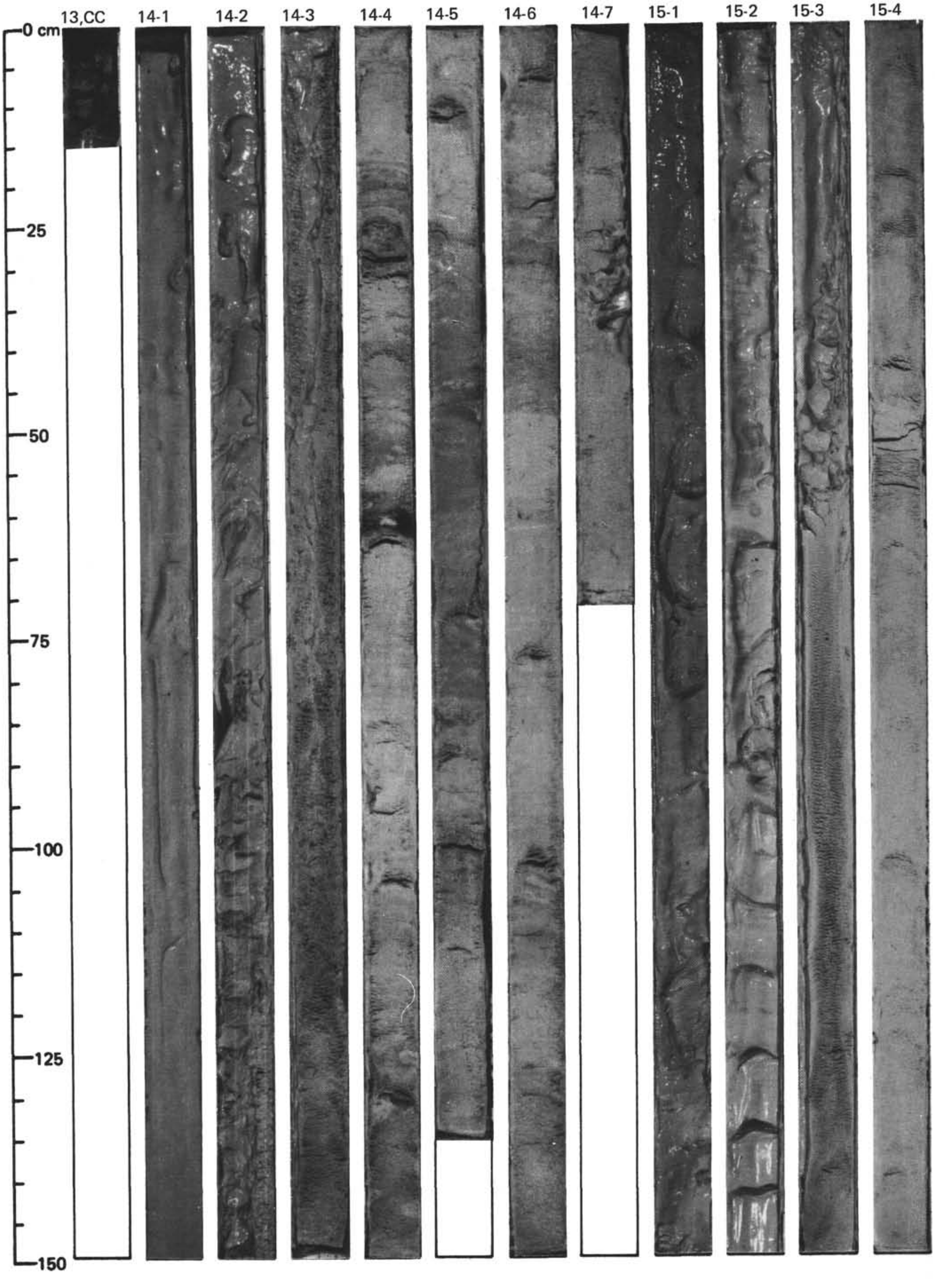

5-3
5-4
5-5
5,CC
6-1
6-2
6-3
6-4
6-5
6-6
6,CC
7-1
0 cm
25
50
75
100
125
150

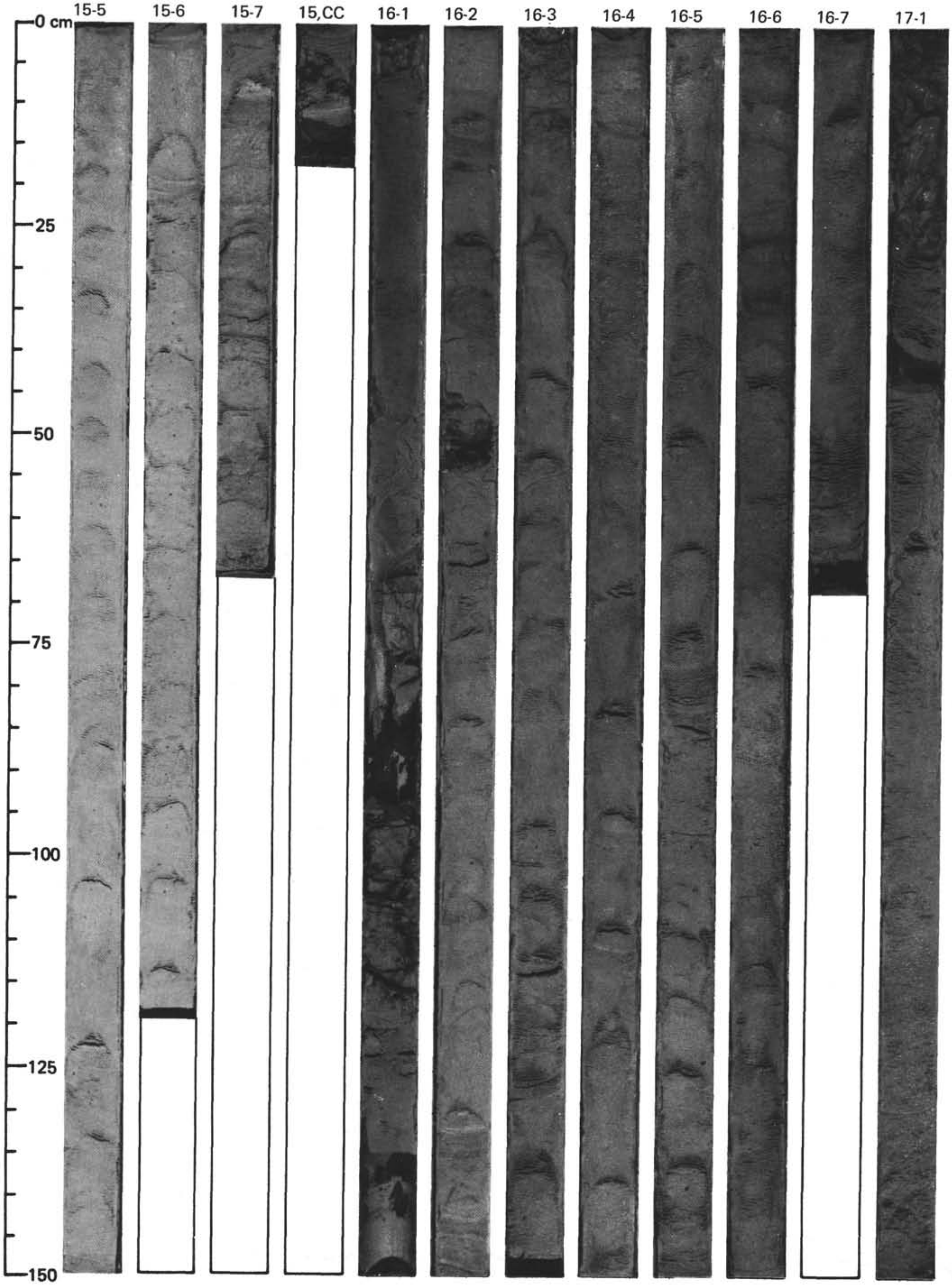

7-2
7-3
7-4
7-5
7,CC
8-1
8-2
8-3
8-4
8-5
8-6
8-7
0 cm
25
50
75
100
125
150

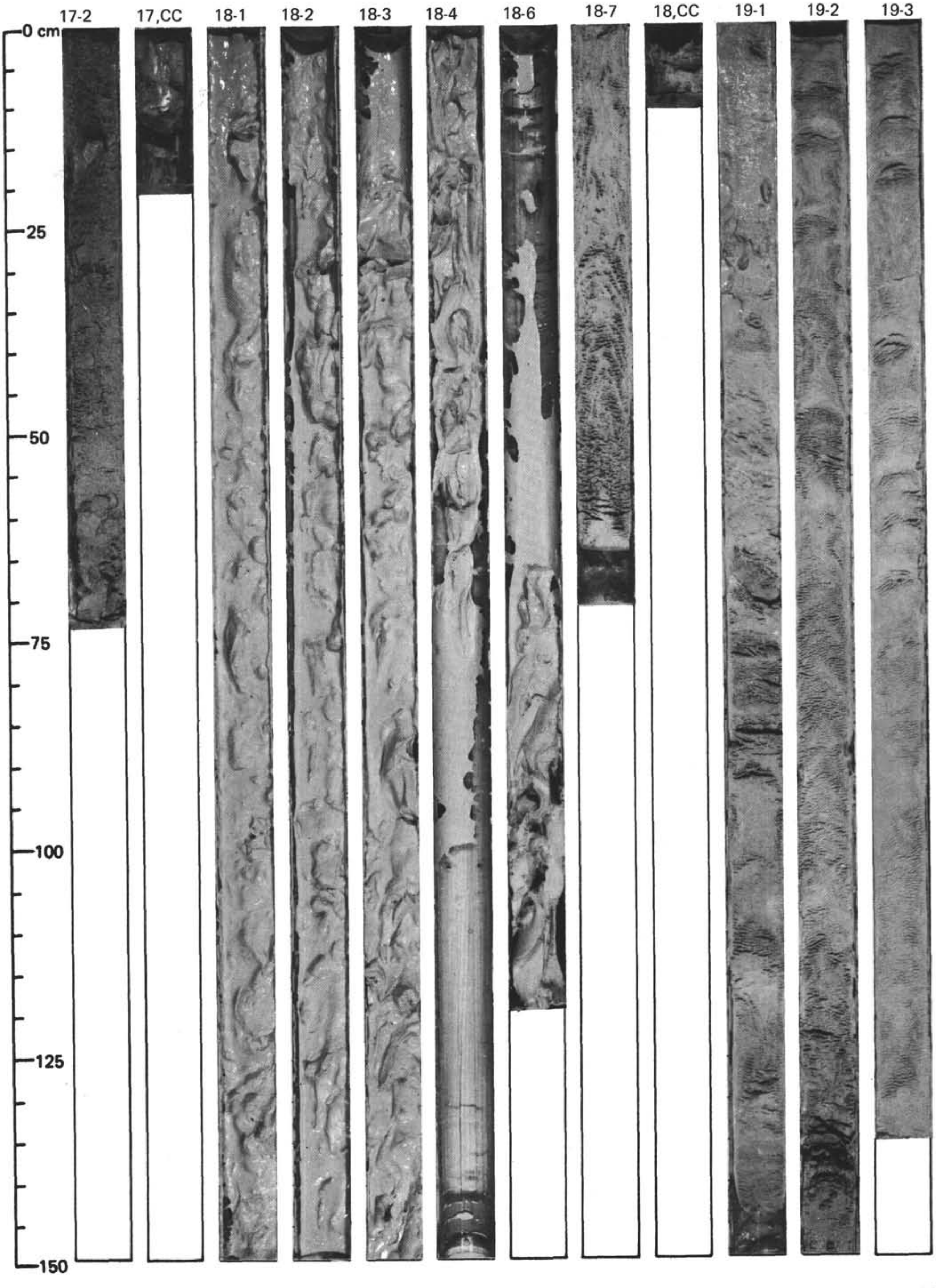

8,CC
9-1
9-2
9-3
9-4
9-5
9-6
9,CC
10-1
10-2
10-3
10-4
0 cm
25
50
75
100
125
150

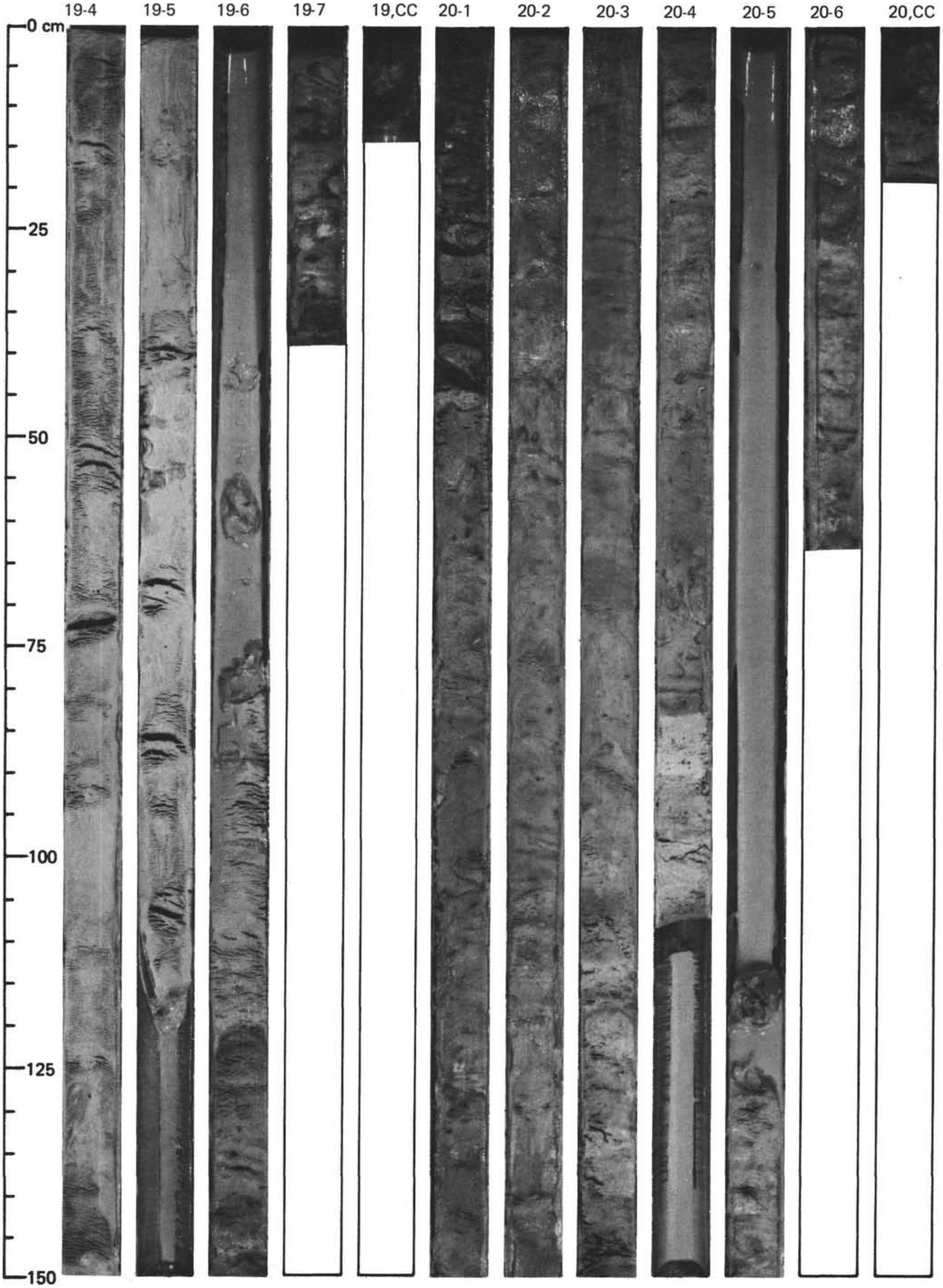

10-5
10-6
10-7
10,CC
11-1
11-2
11-3
11-4
11-5
11-6
11,CC
12-1
0 cm
25
50
75
100
125
150

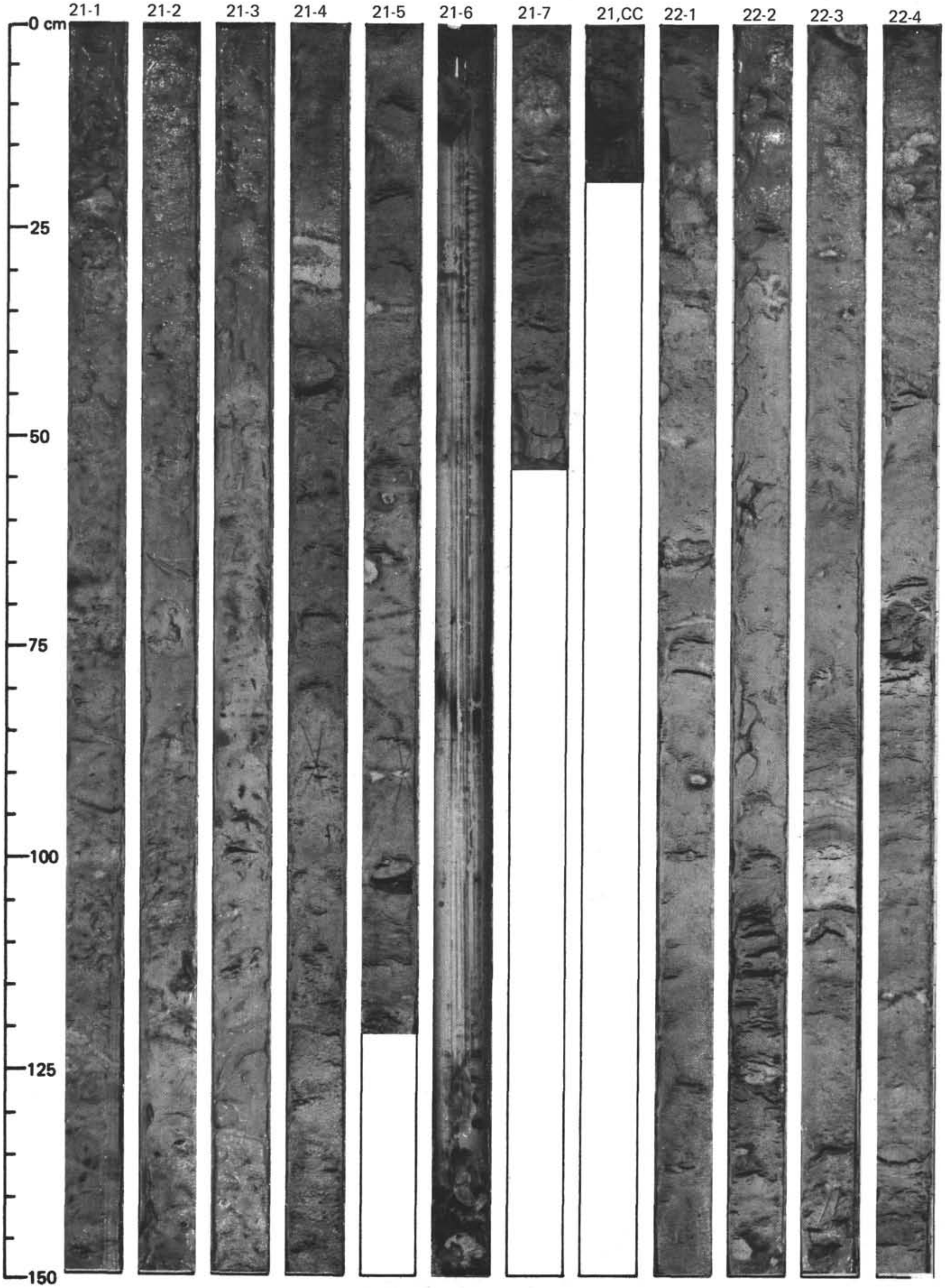

12-2
12-3
12-4
12-5
12,CC
13-1
13-2
13-3
13-4
13-5
13-6
13-7
0 cm
25
50
75
100
125
150

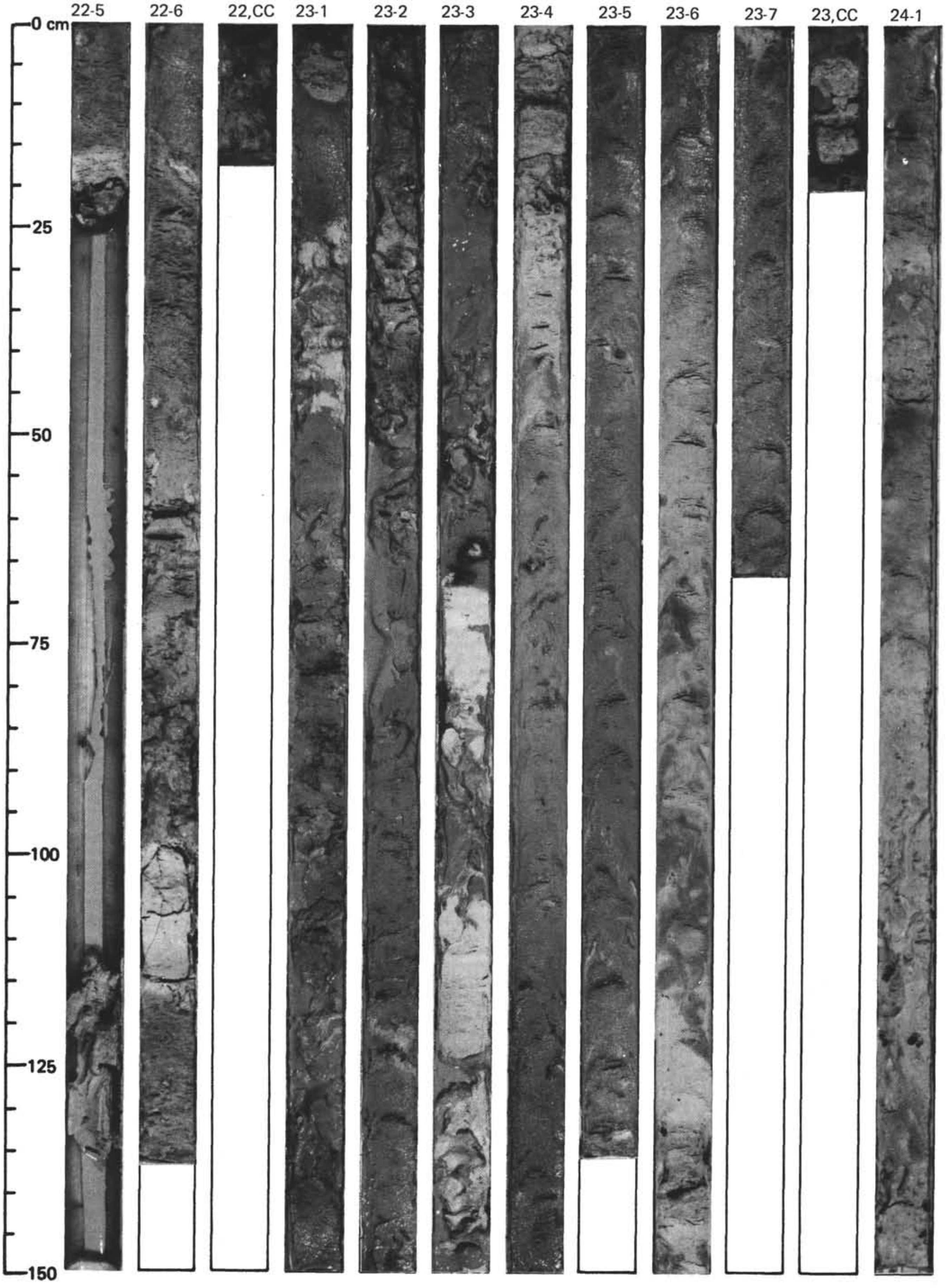

13,CC
14-1
14-2
14-3
14-4
14-5
14-6
14-7
15-1
15-2
15-3
15-4
0 cm
25
50
75
100
125
150

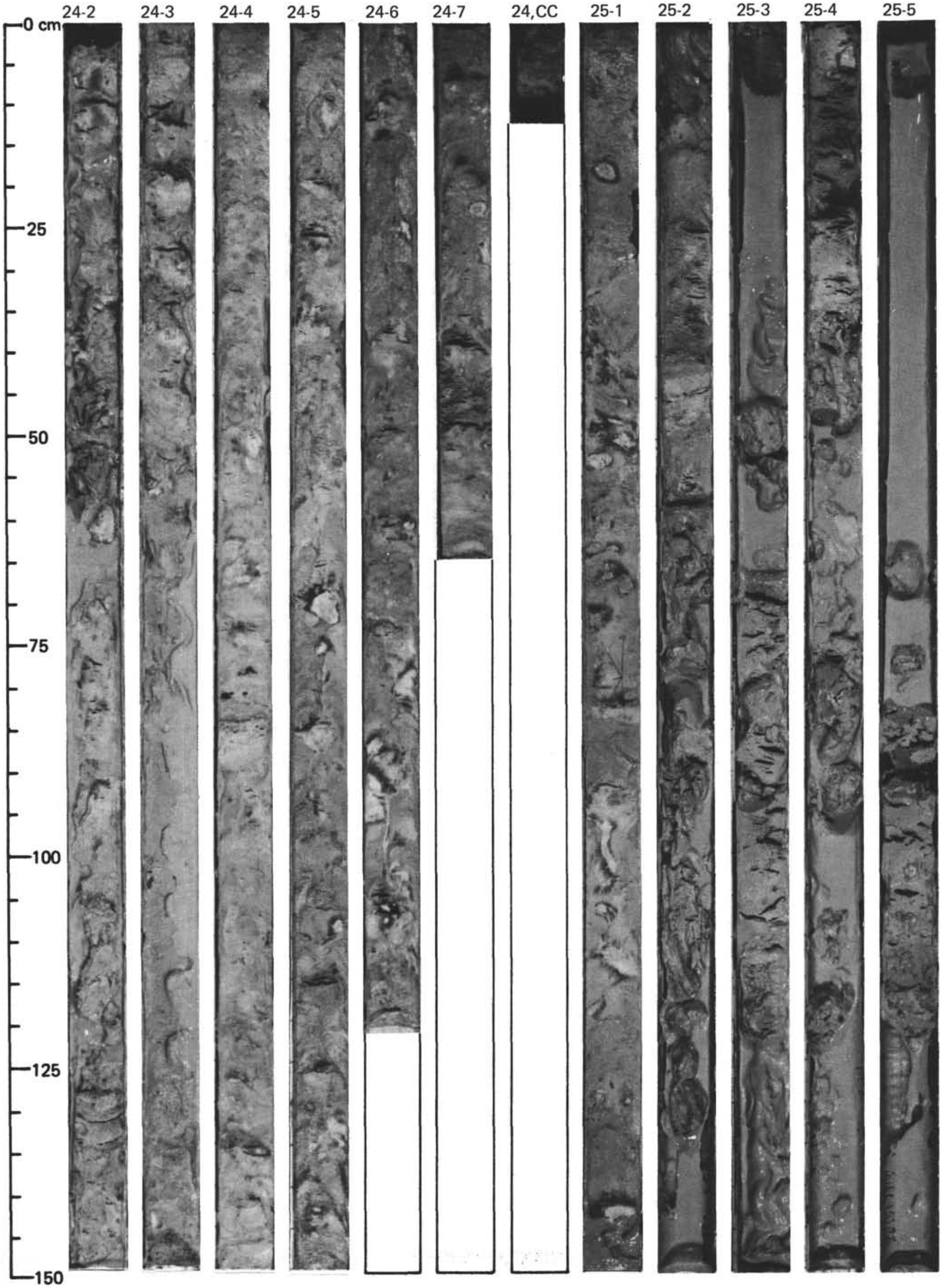

15-5
15-6
15-7
15,CC
16-1
16-2
16-3
16-4
16-5
16-6
16-7
17-1
0 cm
25
50
75
100
125
150

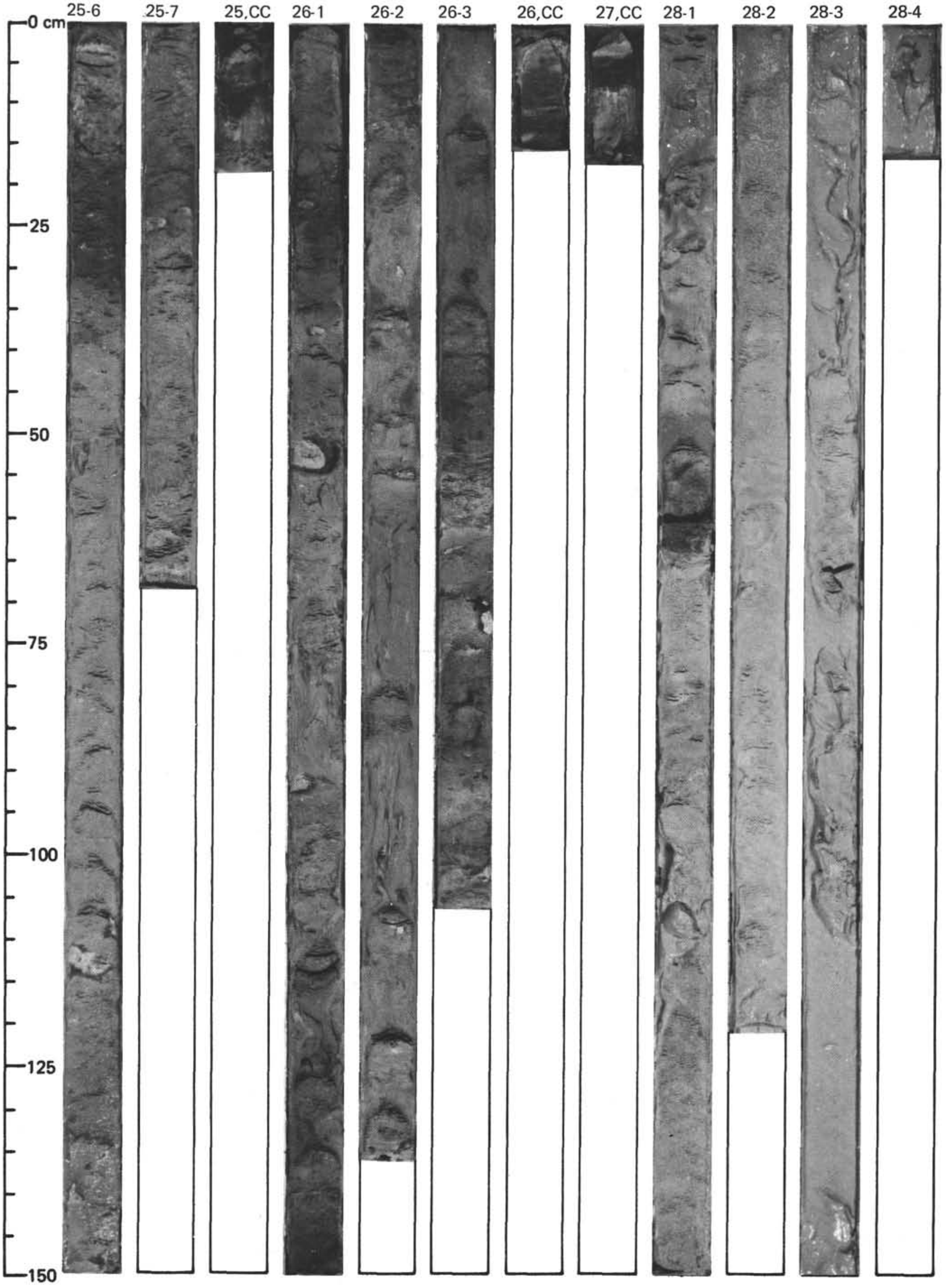

17-2
17,CC
18-1
18-2
18-3
18-4
18-6
18-7
18,CC
19-1
19-2
19-3
0 cm
25
50
75
100
125
150

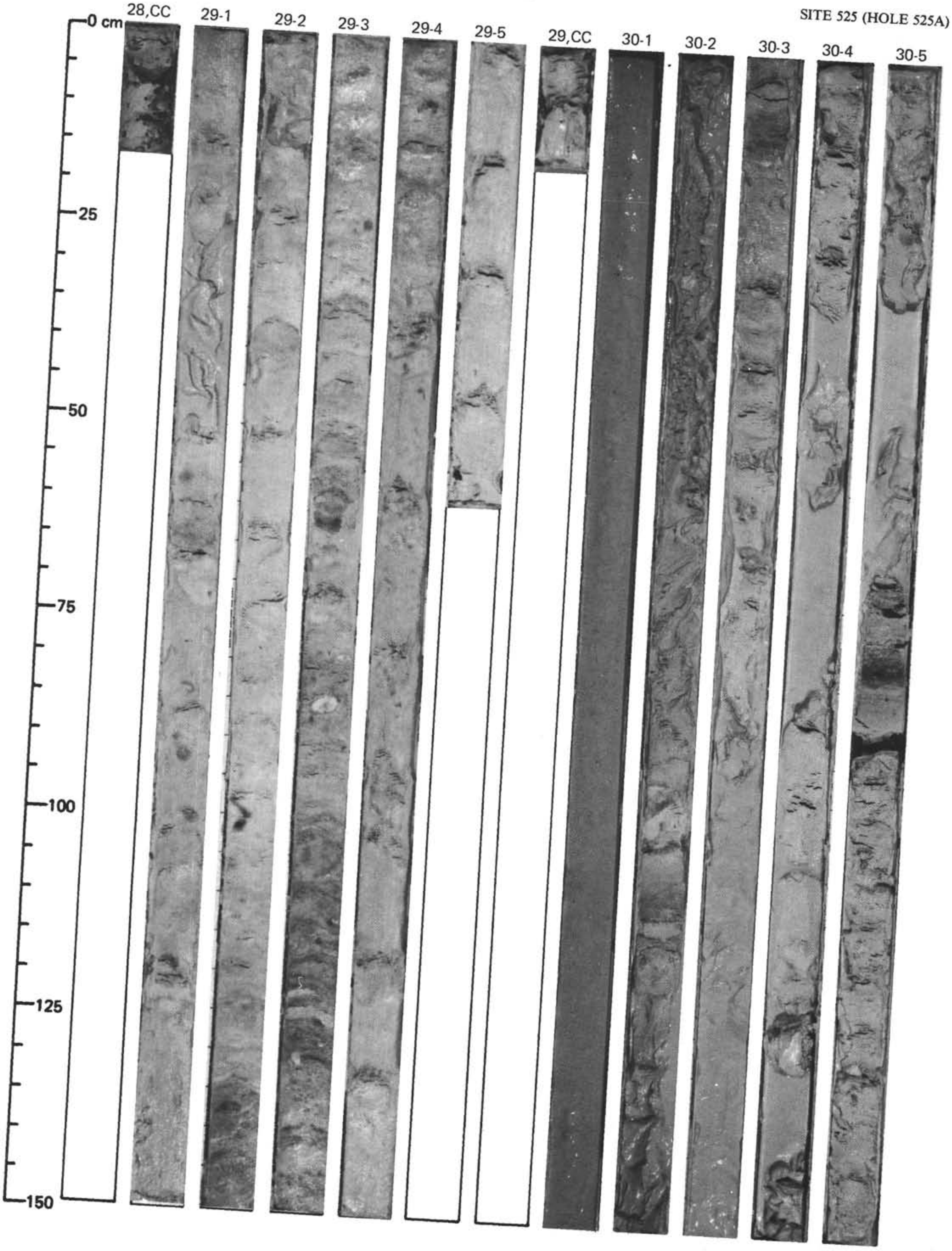

19-4
19-5
19-6
19-7
19,CC
20-1
20-2
20-3
20-4
20-5
20-6
20,CC
0 cm
25
50
75
100
125
150

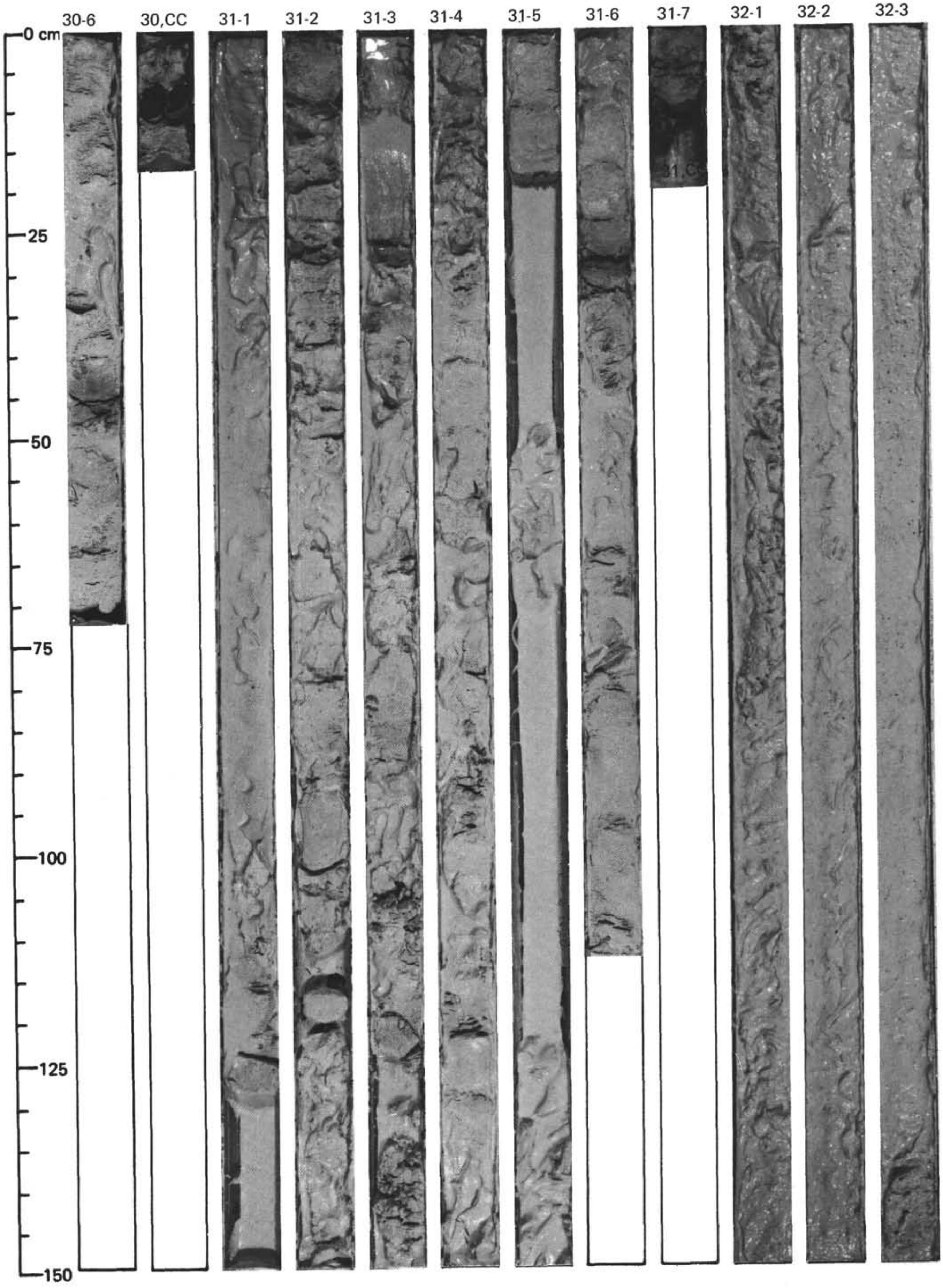

21-1
21-2
21-3
21-4
21-5
21-6
21-7
21,CC
22-1
22-2
22-3
22-4
0 cm
25
50
75
100
125
150

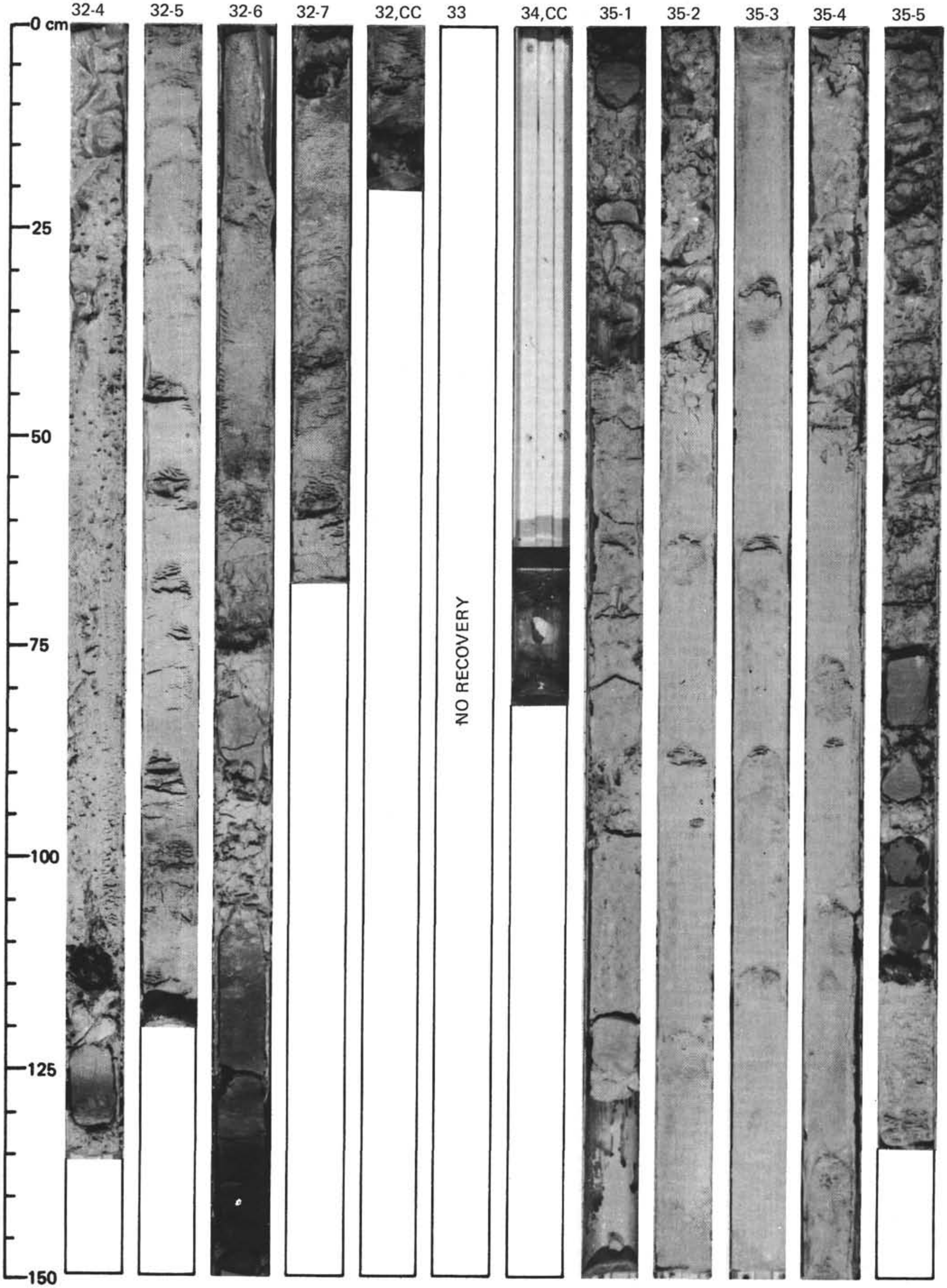

22-5
22-6
22,CC
23-1
23-2
23-3
23-4
23-5
23-6
23-7
23,CC
24-1
0 cm
25
50
75
100
125
150

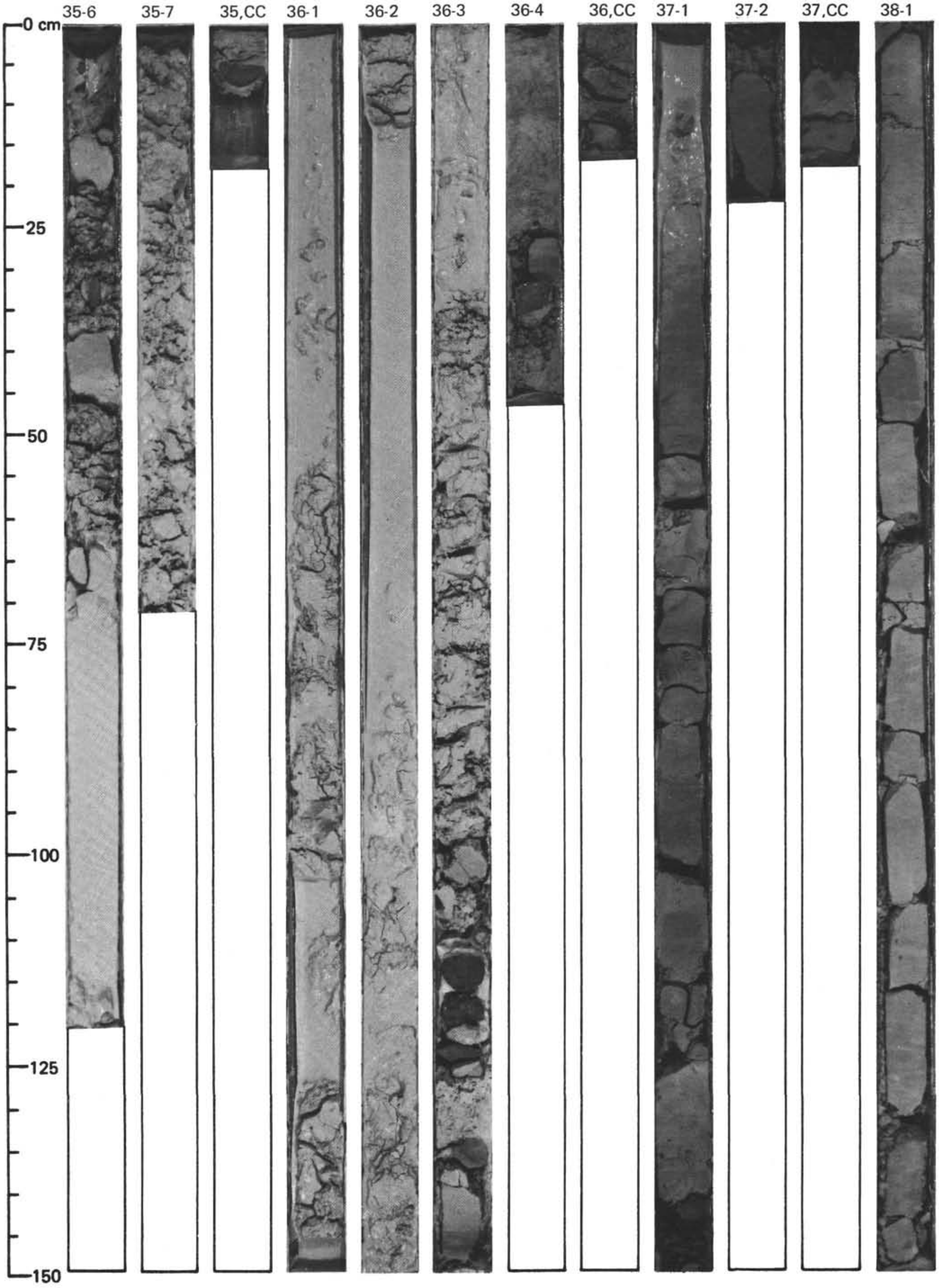

24-2
24-3
24-4
24-5
24-6
24-7
24,CC
25-1
25-2
25-3
25-4
25-5
0 cm
25
50
75
100
125
150

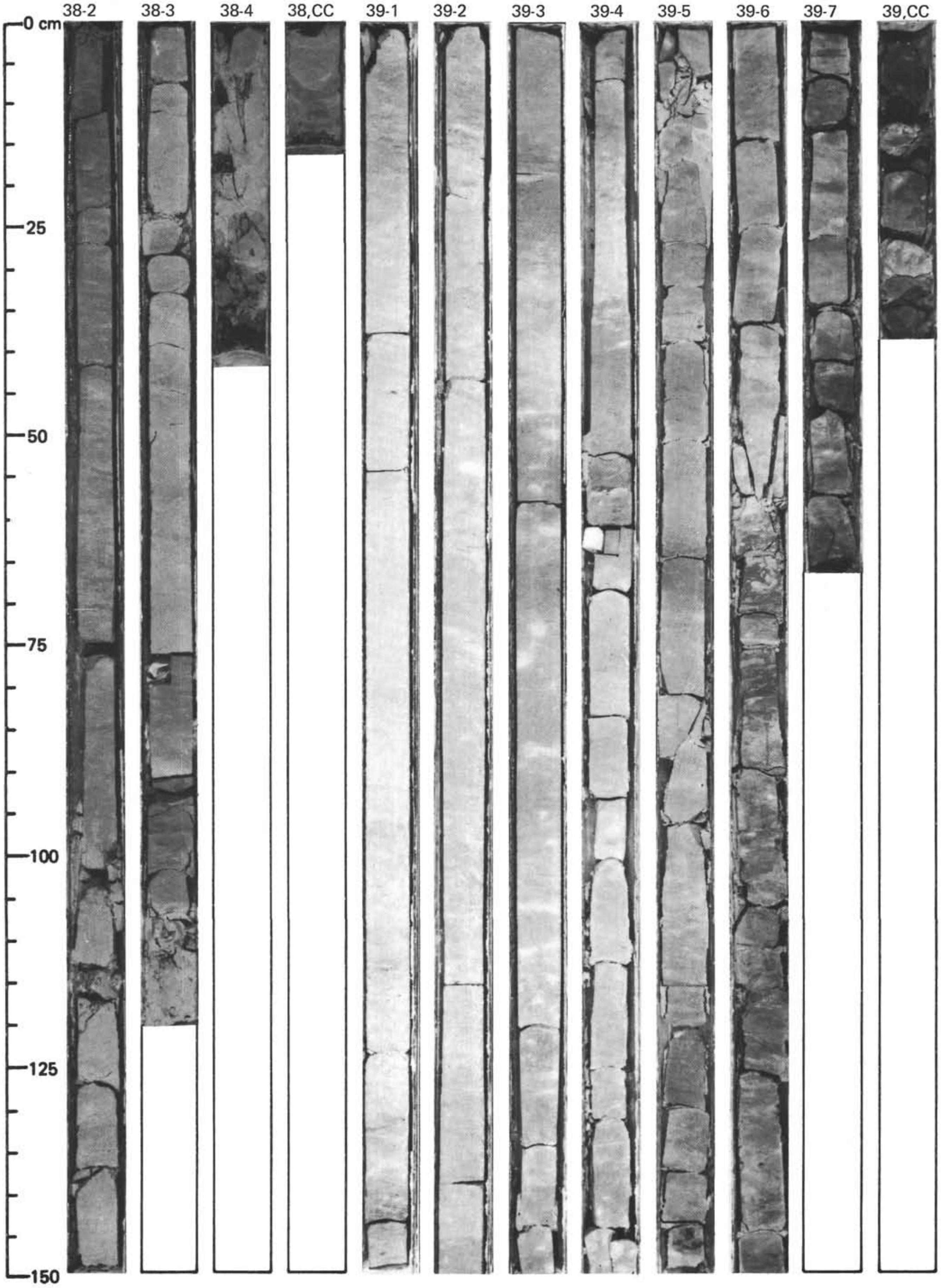

25-6
25-7
25,CC
26-1
26-2
26-3
26,CC
27,CC
28-1
28-2
28-3
28-4
0 cm
25
50
75
100
125
150

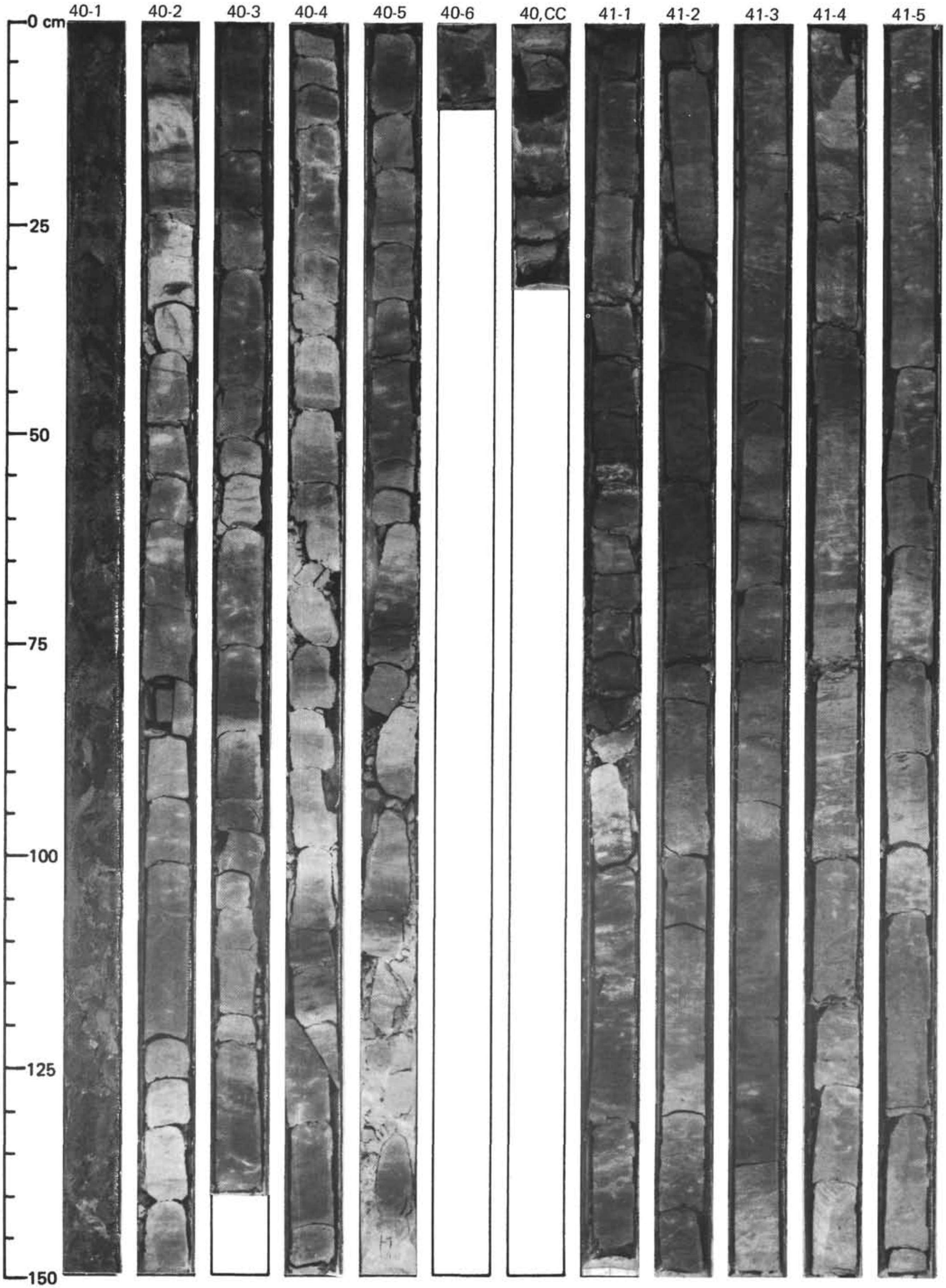

0 cm
25
50
75
100
125
150
28,CC
29-1
29-2
29-3
29-4
29-5
29,CC
30-1
30-2
30-3
30-4
30-5

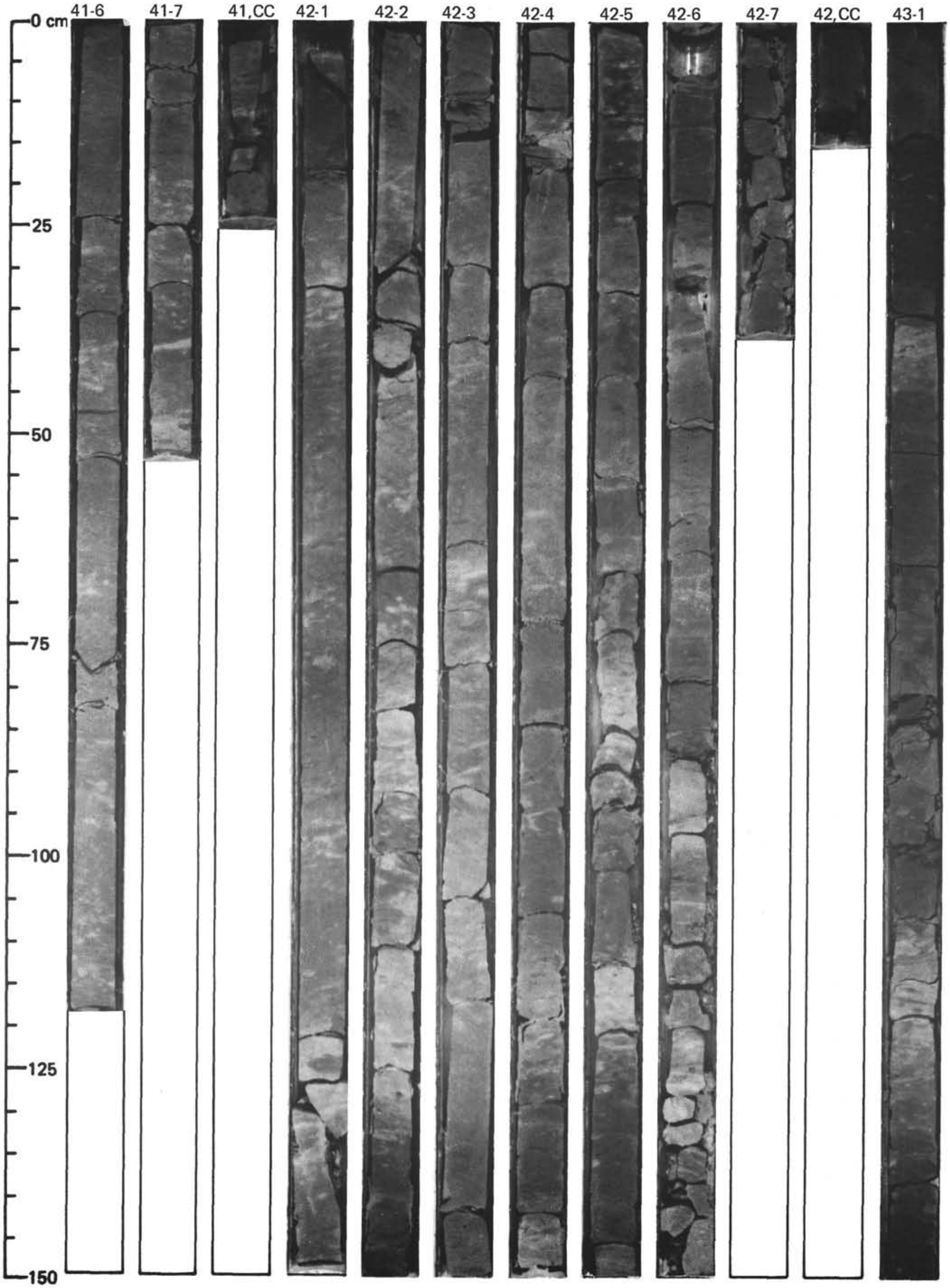

30-6
30,CC
31-1
31-2
31-3
31-4
31-5
31-6
31-7
31,CC
32-1
32-2
32-3
0 cm
25
50
75
100
125
150


32-4
32-5
32-6
32-7
32,CC
33
34,CC
35-1
35-2
35-3
35-4
35-5
0 cm
25
50
75
100
125
150
NO RECOVERY


35-6
35-7
35,CC
36-1
36-2
36-3
36-4
36,CC
37-1
37-2
37,CC
38-1
0 cm
25
50
75
100
125
150


38-2
38-3
38-4
38,CC
39-1
39-2
39-3
39-4
39-5
39-6
39-7
39,CC
0 cm
25
50
75
100
125
150


40-1
40-2
40-3
40-4
40-5
40-6
40,CC
41-1
41-2
41-3
41-4
41-5
0 cm
25
50
75
100
125
150


41-6
41-7
41,CC
42-1
42-2
42-3
42-4
42-5
42-6
42-7
42,CC
43-1
0 cm
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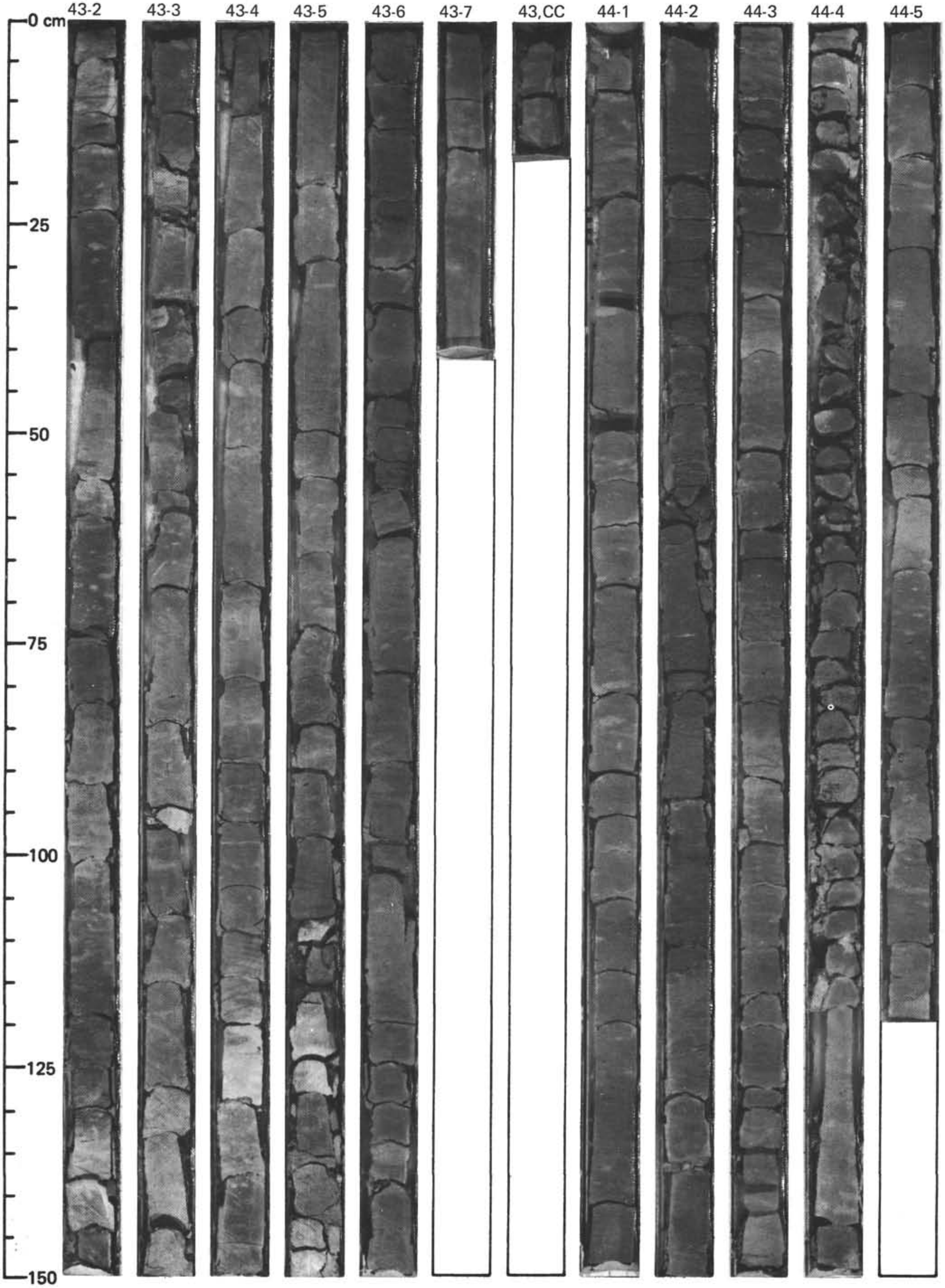
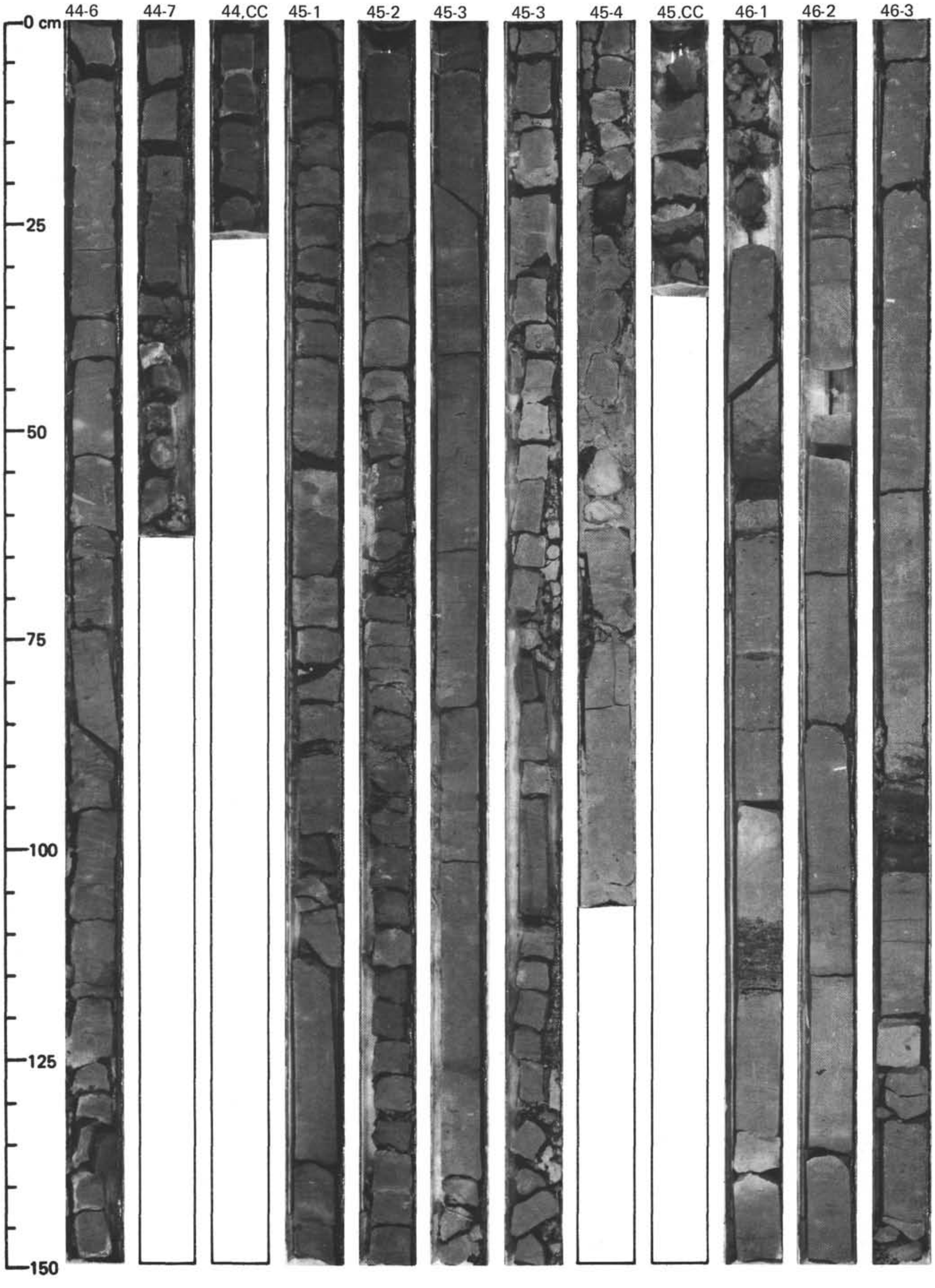
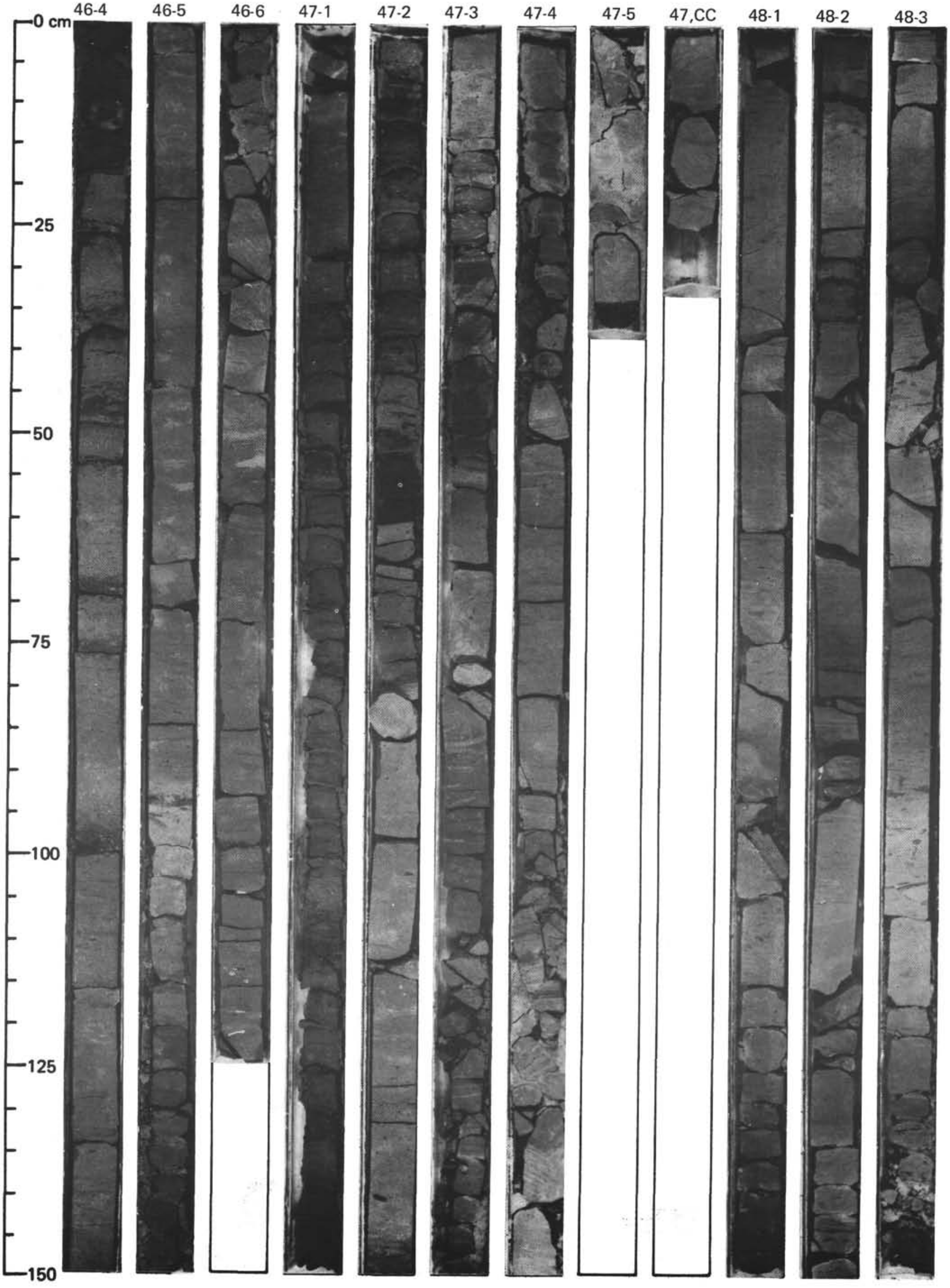
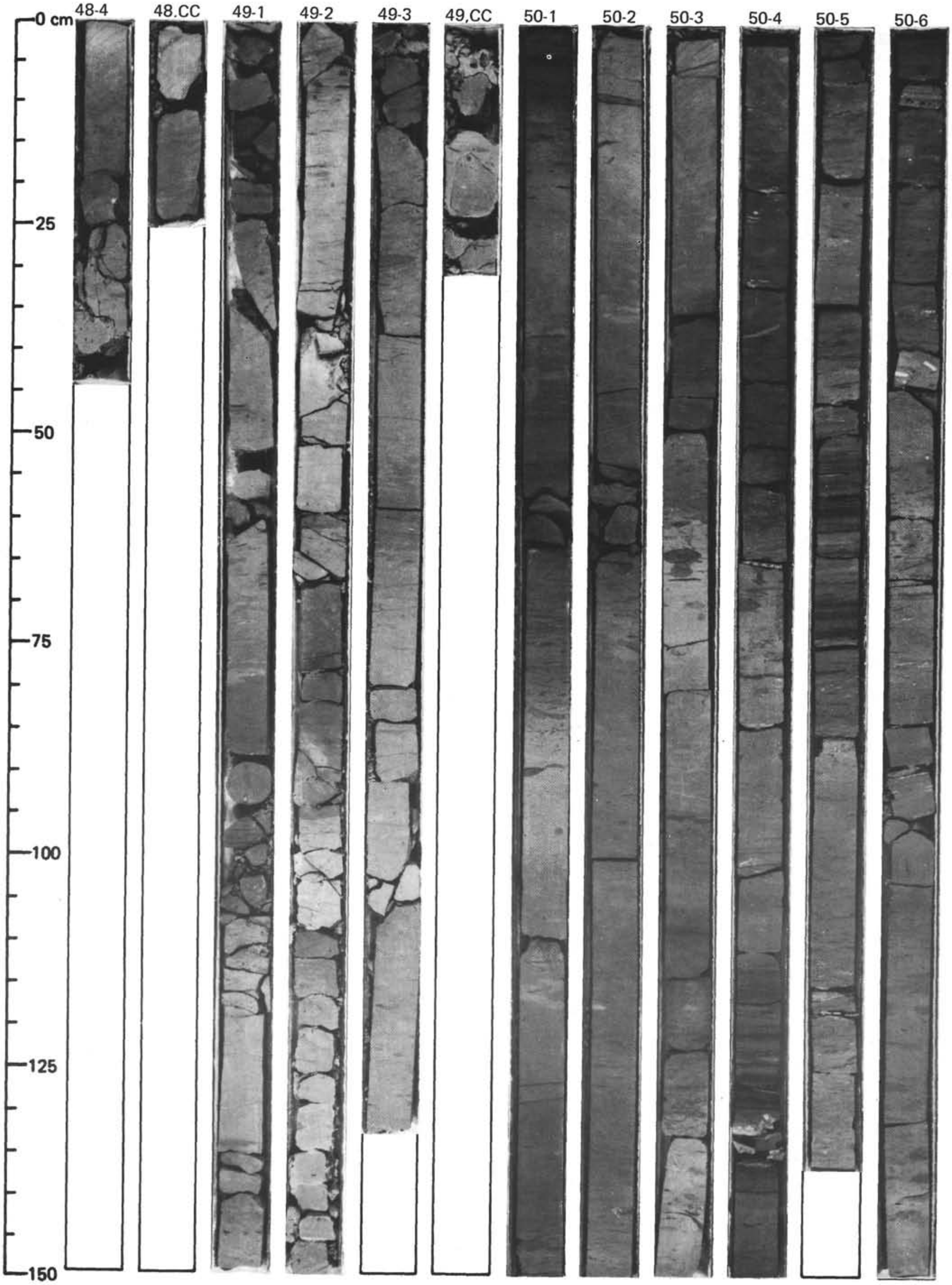
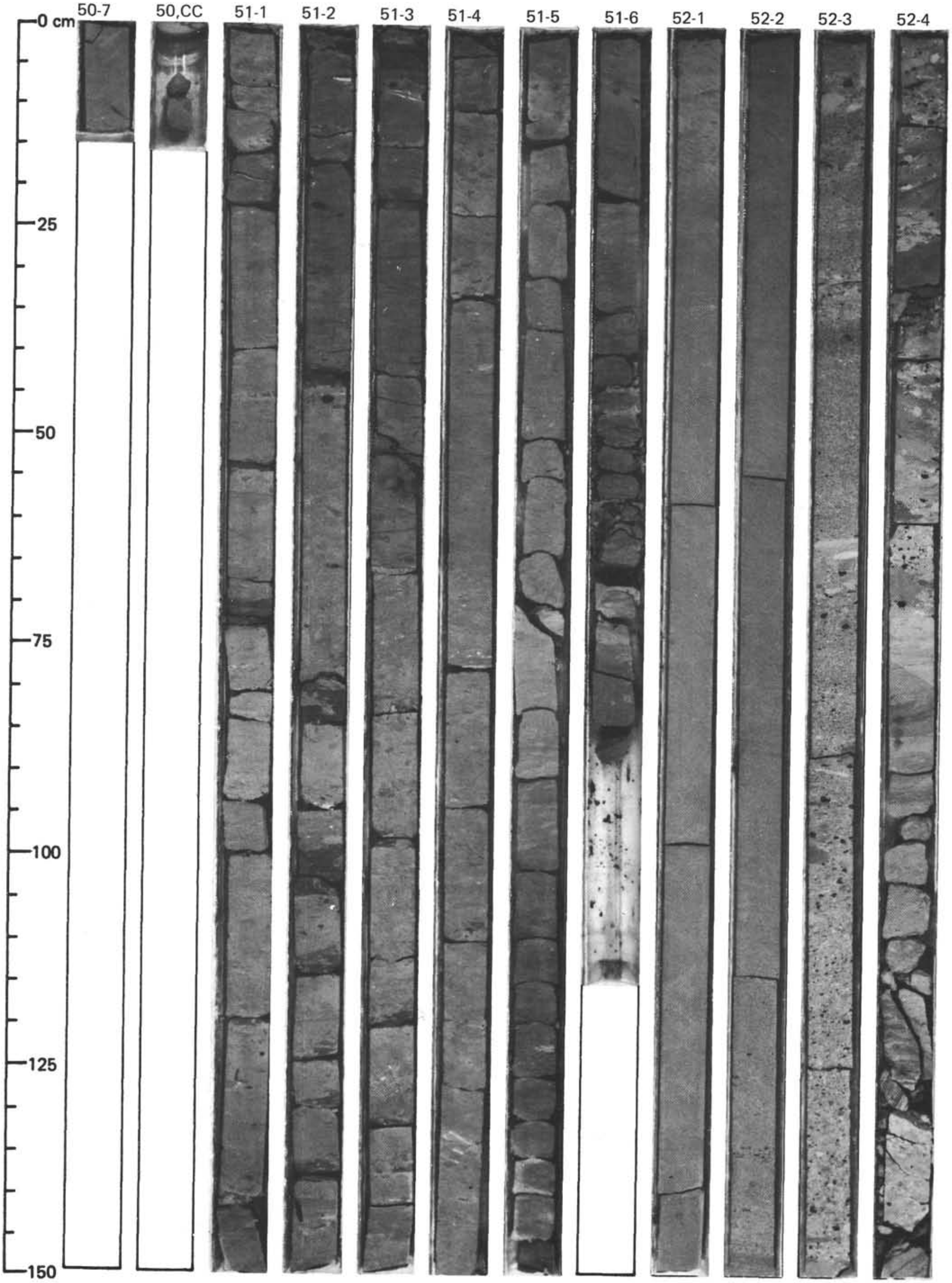
50
75
100
125
150

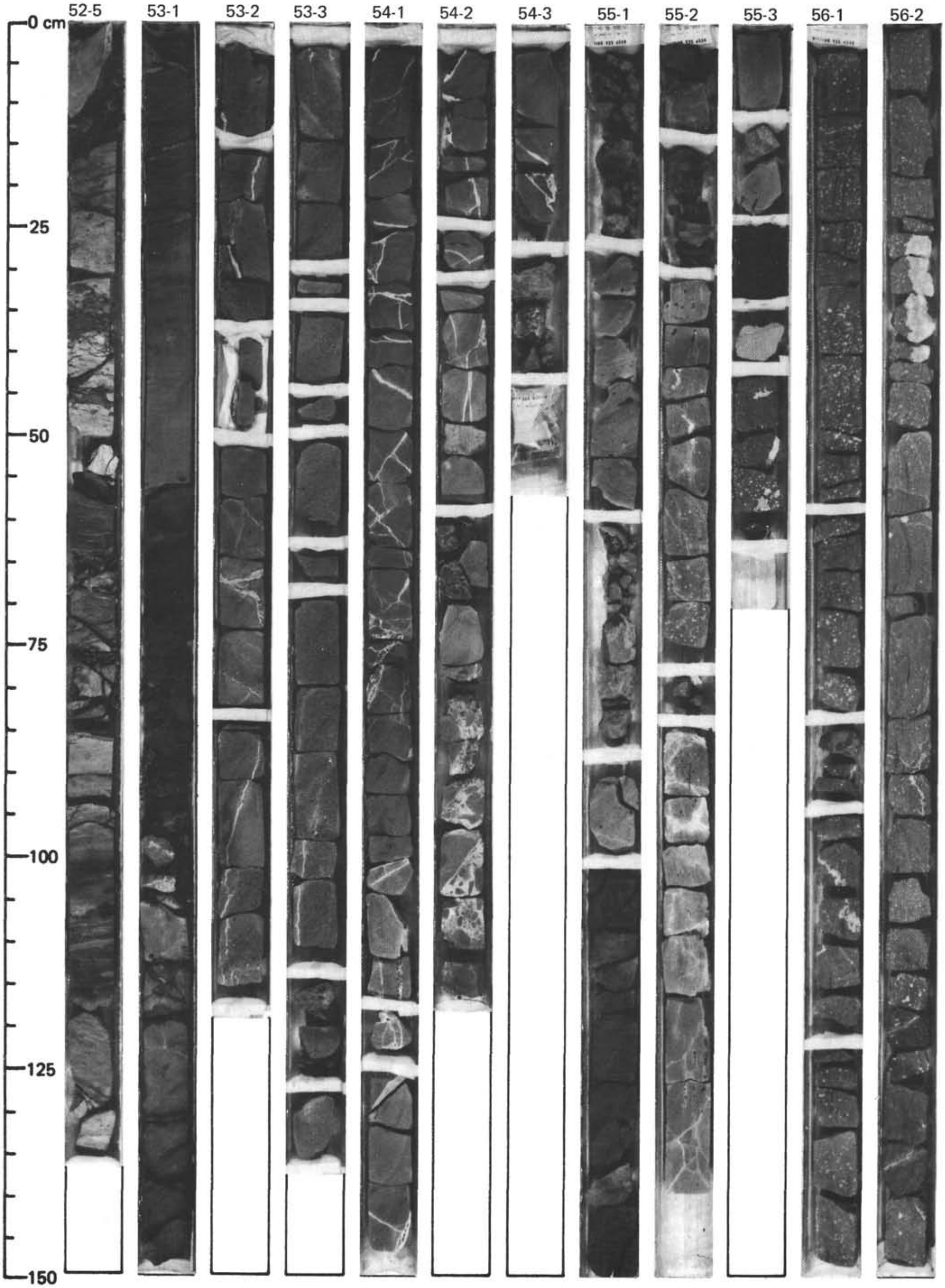

43-2
43-3
43-4
43-5
43-6
43-7
43,CC
44-1
44-2
44-3
44-4
44-5
0 cm
25
50
75
100
125
150

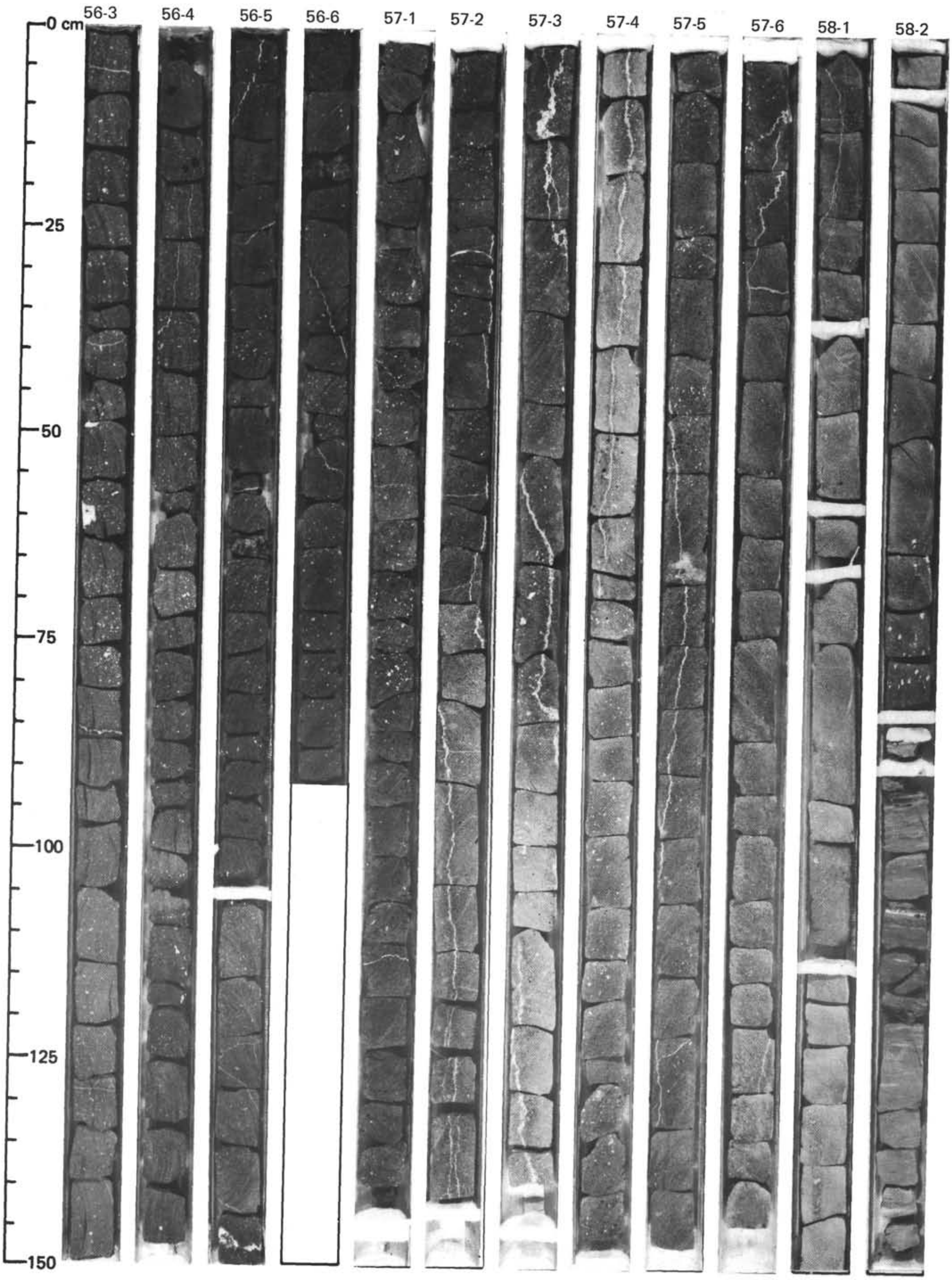

0 cm
25
50
75
100
125
150
44-6
44-7
44,CC
45-1
45-2
45-3
45-3
45-4
45,CC
46-1
46-2
46-3

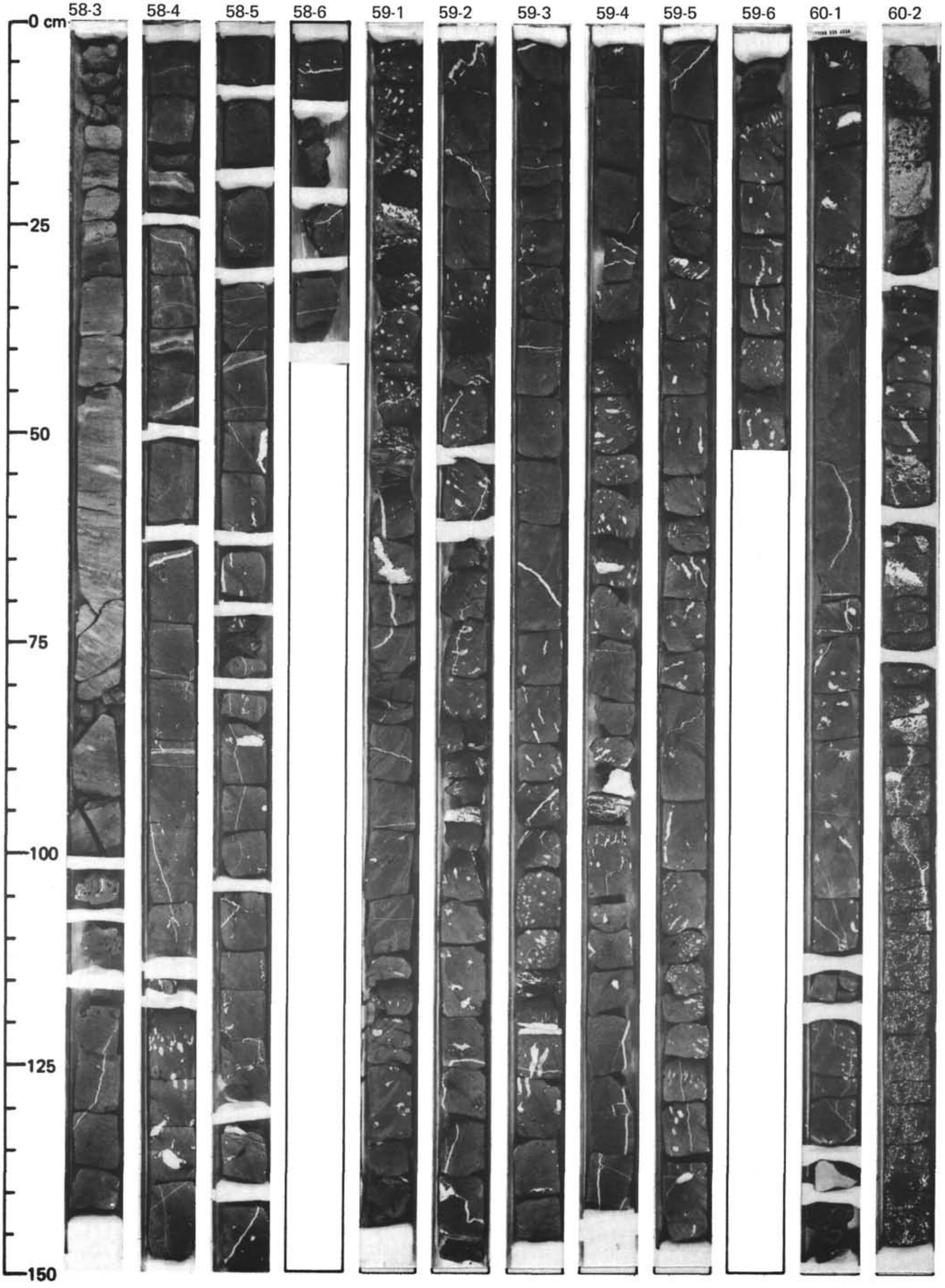

0 cm
25
50
75
100
125
150
46-4
46-5
46-6
47-1
47-2
47-3
47-4
47-5
47,CC
48-1
48-2
48-3


0 cm
25
50
75
100
125
150
48-4
48.CC
49-1
49-2
49-3
49,CC
50-1
50-2
50-3
50-4
50-5
50-6


0 cm
25
50
75
100
125
150
50-7
50,CC
51-1
51-2
51-3
51-4
51-5
51-6
52-1
52-2
52-3
52-4


52-5
53-1
53-2
53-3
54-1
54-2
54-3
55-1
55-2
55-3
56-1
56-2
0 cm
25
50
75
100
125
150


56-3
56-4
56-5
56-6
57-1
57-2
57-3
57-4
57-5
57-6
58-1
58-2
0 cm
25
50
75
100
125
150


0 cm
25
50
75
100
125
150
58-3
58-4
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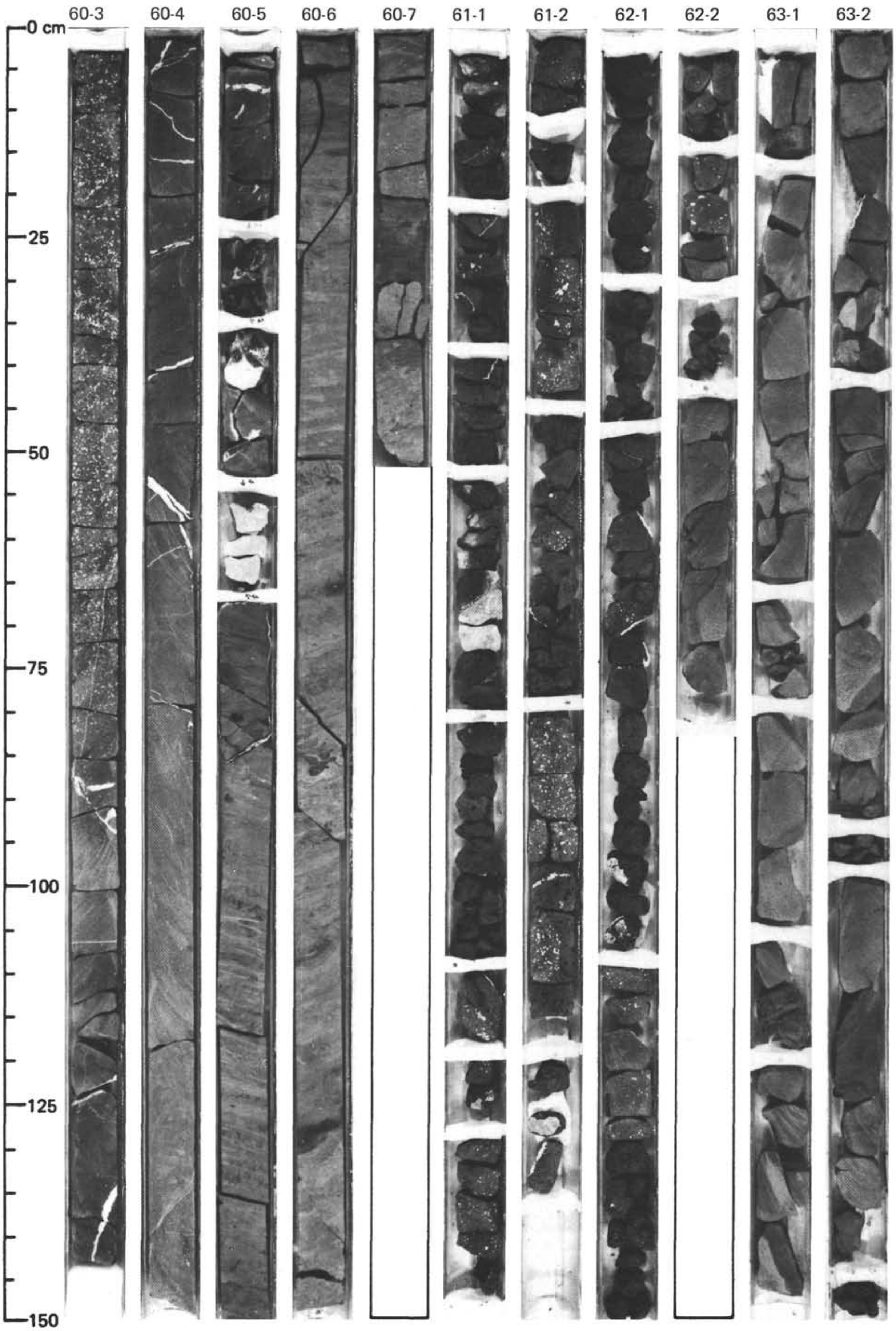
58-6
59-1
59-2
59-3
59-4
59-5
59-6
60-1
60-2


60-3
60-4
60-5
60-6
60-7
61-1
61-2
62-1
62-2
63-1
63-2
0 cm
25
50
75
100
125
150