11. SITE 615[1]

Shipboard Scientific Party[2]

HOLE 615

Date occupied: 4 October 1983, 1037 LCT

Date departed: 9 October 1983, 1155 LCT

Time on hole: 5 days, 1 hr.

Position: 25°13.3N, 85°59.5′W

Water depth (sea level; corrected m, echo-sounding): 3268

Water depth (rig floor; corrected m, echo-sounding): 3278

Bottom felt (m, drill pipe): 3283.9

Penetration (m): 523.2

Number of cores: 52

Total length of cored section (m): 419.3

Total core recovered (m): 175.29

Core recovery (%): 42

Oldest sediment cored:
Depth sub-bottom (m): 523.2
Nature: Clay with silt
Age: Pleistocene (Ericson Zone W)
Measured velocity (km/s): N/A

Basement: N/A

HOLE 615A

Date occupied: 9 October 1983, 1150 LCT

Date departed: 10 October 1983, 2035 LCT

Time on hole: 1 day, 9 hr.

Position: 25°13.35′N, 85°59.55′W

Water depth (sea level; corrected m, echo-sounding): 3268

Water depth (rig floor; corrected m, echo-sounding): 3278

Bottom felt (m, drill pipe): 3285.9

Penetration (m): 208.5

Number of cores: 17

Total length of cored section (m): 74.5

Total core recovered (m): 51.93

Core recovery (%): 70

Oldest sediment cored:
Depth sub-bottom (m): 208.5
Nature: Mud with silt and sandy silt
Age: Pleistocene (Ericson Zone Y)

Basement: N/A

BACKGROUND AND OBJECTIVES

The Mississippi Fan in the Site 614 and 615 area consists of approximately 1.5 km of Quaternary sediments. Throughout the Pleistocene, large volumes of sediment were delivered to the shelf edge during periods of falling sea level. During times of low sea level, sediment instability and channeling on the shelf created canyons that supplied large volumes of sediment to the deep waters of the Gulf of Mexico, creating deep-sea fan deposits. The buried fan lobes alternate with thick sequences of hemipelagic muds, creating a complex series of interfingering sediment sequences.

The lower fan lobes are relatively thin, rarely exceeding 200 m, and are characterized seismically by parallel reflections and complex interfingering reflections. The channels on the lower fan are rarely wider than 300 m and have relief on the order of 10 to 15 m. Well-developed levees typically flank these channels. Near their terminal ends, the channels become extremely small (<50 m wide and 2–3 m deep) and are poorly defined on the side-scan sonar images. Several morphologic zones, based on side-scan sonar images and sub-bottom profiler records, were mapped in the vicinity of this site.

Holes 615 and 615A were drilled in the lower Mississippi Fan. The site is located 21 km northeast of Site 614 in the outer or distal area of the youngest fan lobe, where it still has a distinct small central channel with broad levees. The channel near this site is about 450 m wide and 10 m deep (crest of levee to bottom of present channel). Within the much wider channel complex (~2 km wide) several more or less linear, subparallel images that are interpreted as abandoned channels can be observed on the 5-km-wide Sea MARC I side-scan sonar records. It is postulated that the main channel, starting at the

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[1] Bouma, A. H., Coleman, J. M., Meyer, A. W., et al., *Init. Repts. DSDP*, 96: Washington (U.S. Govt. Printing Office).

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Mississippi Canyon, continues onto the lower fan. As the main channel decreases in size it probably becomes short lived, resulting in frequent position switching within the channel complex.

The surficial images seen on the Sea MARC I records show a wide variety of features that are difficult to interpret because of the high angle of incidence. Broken subparallel, diamond shaped, and irregular high-reflectivity images on the sonographs may represent surficial mass movement. Semicircular to circular images with a central light-return dot and low elevation are common. These volcanic shapes may represent dewatering structures.

Parallel reflectors are typical on common depth point (CDP) records from this area. On medium-resolution seismic records, such as water gun and air gun (40–80 in.^{3}), an acoustical record with semiparallel reflectors is typical, showing a few rather continuous reflectors as single or multiple lines alternated by zones of broken, less distinct, and typically discontinuous to semitransparent reflector patterns. Indistinct low-angle pinch-outs are not uncommon for this area. The well-developed reflections supposedly represent very fine-grained deposits such as muds and hemipelagic and pelagic sediments, whereas the discontinuous reflectors are more typical of sandy sediments.

High-resolution acoustical profiles, such as 3.5- or 4.5-kHz profiles, show an abundance of information but little penetration and therefore were not used for the overall site selection. However, because air-gun and water-gun records show similar patterns in all directions, the 3.5-kHz profiles were used to pinpoint the final site location to allow correlation attempts over the upper tens of meters between acoustical record characteristics and cores, as well as to identify the lithological characteristics as part of 3.5-kHz seismic stratigraphy. A 3.5-kHz sub-bottom profile run in a east–west direction showed a well-developed levee on the west side with the internal reflectors which revealed the aggradational nature of the sediment accumulation. The eastern side of the channel also has a well-developed levee; however, it is acoustically opaque. Both levees, at a depth equal to that of the bottom of the channel, are underlain by an acoustically transparent zone.

The site was selected near the top of the outer slope of the western levee to insure that levee deposits would be recovered.

We drilled at Site 615 to satisfy the following objectives:

1. To determine the biostratigraphic sequence and age relationships of several succeeding fan lobes that are late Pleistocene in age,
2. To determine the sedimentation rates within each individual fan lobe,
3. To determine the significance and characteristics of the major reflectors that reveal good areal extent,
4. To obtain geochemical characteristics of the sediments and pore fluids as well as their trends with depth,
5. To identify the sediment characteristics and modes of sediment transport within a single fan lobe and to compare those with older buried lobes,
6. To determine the various physical and geotechnical properties of outer fan sediments,
7. To collect samples for studies of provenance and initial diagenesis,
8. To obtain a set of downhole well logs that will be characteristic for outer fan lobes, and
9. To evaluate Mutti's "compensation cycle" concept in several outer fan lobes.

OPERATIONS

Site 614 to Site 615

It was our intention to locate Site 615 immediately northeast of Site 614. Because of extensive preliminary profiling, only the 3.5-kHz echo sounder was used to supplement LORAN C navigation for final site location. At 0458 hr., a 13.5-kHz acoustic beacon was dropped. The approach profile was extended 4.0 km beyond the drop point before the ship returned to the beacon. During this time the beacon's signal was monitored as it fell to the seafloor. The pulse width was noted to be too short for acceptance by the dynamic positioning system (DPS) and the signal rapidly dropped to a low level. Additional precision depth recorder (PDR) profiling was then carried out to locate another drilling location, and a 16-kHz beacon was launched at 0547 hr. As the vessel waited to take station while the second beacon fell through the water column, the original (13.5-kHz) unit began to transmit a strong usable pulse, which obliterated the now very weak 16-kHz signal. Optimistically acknowledging that flexibility is a virtue and that one out of two is not bad, the Global Marine staff switched the DPS back to 13.5-kHz and took station on the nearby original beacon.

The pipe trip began at 0700 hr. on 4 October 1984. At 0750 hr. the 13.5-kHz signal degenerated to a completely unusable level. The 16-kHz beacon was now acquired at a distance of 760 m and the DPS was shifted back to that frequency. It soon became apparent that the 16-kHz pulse was too weak to be heard through the thruster noise and frequent loss of acoustics occurred. With beacons transmitting unusable signals on both operating frequencies, it was necessary to abandon the location and to find an alternate drill site out of acoustic range of the two beacons. The bottom-hole assembly (BHA) was recovered and *Challenger* began profiling at 0900 hr.

A target area was selected about 1.3 km north of the beacons. The towed seismic gear was streamed, since less geophysical information was available for the new location. A new 13.5-kHz beacon was launched at 1037 hr., and an additional 1¼ hr. of surveying was done before the gear was retrieved and final station was taken. The pipe trip commenced at 1245 hr.

Hole 615

With the rig floor PDR depth at 3278 m, the core bit was positioned at 3275 m to insure recovery of the sediment/water interface in the first 9.5-m advanced piston corer (APC) core. The core barrel was recovered with only traces of sediment in the core catcher, indicating that the very soft material had been washed out during retrieval. A second core was "shot" from 2 m deeper and 2.6 m of core was recovered, establishing water depth at 3283.9 m (Table 1).

Continuous APC cores found sand beginning at only 18 m below seafloor, but good penetration and recovery were realized to about 105 m below the seafloor through alternating sand and mud strata. Recovery then dropped sharply, with the APC apparently unable to make significant penetration. At 143 m below the seafloor, the extended core barrel (XCB) system was deployed. Recovery remained low, but representative cores, averaging about 2 m in length, were obtained to about 210 m below the seafloor. Below this depth only traces of sand and clay were generally recovered. Redeployment of the APC resulted in full barrels of flow-in sand or very short cores of hard clay. At about 485 m sub-bottom, an abrupt lithology change to carbonate ooze provided excellent core recovery with the XCB.

Hole conditions had remained good, considering that the penetrated section consisted of over 60% uncemented sand. Up to 5 m of hole fill had been noted between cores, but periodic mud flushes had been fairly effective in cleaning the hole. As the bit (which was not equipped with a float valve) approached 500 m sub-bottom, back pressure could no longer be controlled and shut-in pipe pressures to 400 psi were noted. It was necessary to slug the pipe with weighted mud before core barrels could be dropped against the backflow. Core 615-52 became stuck at the bit and two wireline trips were required to retrieve it. With most of the scientific objectives of the site achieved, coring operations were terminated at 523.2 m sub-bottom for the safety of the drill string.

The lack of core recovery had lent increased importance to the logging program for the delineation of lithologic units. The apparent poor hole conditions made prospects of getting to bottom for open-hole logs look slim. Preparations were therefore made to run a through-pipe formation density/compensated neutron/gamma ray (FDC/CNL/GR) log. The hole was flushed with mud and the pipe was slugged with 30 barrels of 11 lb./gal. mud to counteract the back pressure. One stand of pipe was then set back to allow for cumulative hole fill. By the time the logging sheaves had been rigged and the sonde started down the pipe, shut-in back pressure had increased from 0 to 260 psi and the drill string had become stuck. It was necessary to abort the logging attempt to free the drill pipe. About 35 min. of "working" the pipe was required to free it and the through-pipe logging concept was abandoned.

The hole was then filled with 300 barrels of barite-weighted mud and the bit was pulled to 3330 m below the drill floor. The dual induction/long-spaced sonic/gamma ray (DIT/LSS/GR) tool was then assembled. About 2¼ hr. were spent in tracing an intermittent electrical leak to a connection in the cabling between the winch and recording cabs. The long logging sonde stopped abruptly only a few meters after its lower end had passed through the bit and would go no further. The tool was manipulated with little progress for about ½ hr., but, just before efforts were abandoned, it broke through in-

Table 1. Site 615 coring summary.

Core[a]	Date (Oct. 1983)	Time	Depth from drill floor (m)	Depth below seafloor (m)	Length cored (m)	Length recovered (m)	Amount recovered (%)
Hole 615							
1H	4	2105	3283.9-3286.5	0.0-2.6	2.6	2.57	99
2H	4	2215	3286.5-3296.0	2.6-12.1	9.5	9.41	99
3H	4	2325	3296.0-3304.0	12.1-20.1	8.0	7.83	98
4H	5	0103	3304.0-3308.6	20.1-24.7	4.6	4.52	98
Wash	5		3308.4-3313.5	24.7-29.6	—	—	—
5H	5	0259	3313.5-3323.0	29.6-39.1	9.5	9.04	95
6H	5	0412	3323.0-3332.3	39.1-48.4	9.3	9.13	98
7H	5	0530	3332.3-3341.6	48.4-57.7	9.3	8.10	87
8H	5	0804	3341.6-3344.6	57.7-60.7	3.0	3.00	100
Wash	5		3344.6-3351.1	60.7-67.2	—	—	—
9H	5	0925	3351.1-3355.6	67.2-71.7	4.5	4.59	100
Wash	5		3355.6-3360.1	71.7-76.7	—	—	—
10H	5	1156	3360.1-3370.1	76.7-86.2	9.5	9.29	98
11H	5	1335	3370.1-3378.6	86.2-94.7	8.5	6.75	79
Wash	5		3378.6-3379.6	94.7-95.7	—	—	—
12H	5	1455	3379.6-3389.1	95.7-105.2	9.5	8.84	93
13H	5	1620	3389.1-3393.9	105.2-110.0	4.8	0.89	19
Wash	5		3393.9-3398.6	110.0-114.7	—	—	—
14H	5	1945	3398.6-3398.6	114.7-114.7	—	0.02	—
Wash	5		3398.6-3408.1	114.7-124.2	—	—	—
15H	5	2112	3408.1-3410.0	124.2-126.1	1.9	0.02	1
Wash	5		3410.0-3417.6	126.1-133.7	—	—	—
16H	5	2231	3417.6-3419.9	133.7-136.0	2.3	2.10	91
Wash	5		3419.9-3427.1	136.0-143.2	—	—	—
17X	6	0022	3427.1-3436.6	143.2-152.7	9.5	0.02	<1
18X	6	0210	3436.6-3446.1	152.7-162.2	9.5	1.65	17
19X	6	0317	3446.1-3455.6	162.2-171.7	9.5	1.87	20
20X	6	0435	3455.6-3465.1	171.7-181.2	9.5	1.74	18
21X	6	0549	3465.1-3474.6	181.2-190.7	9.5	1.62	17
22X	6	0704	3474.6-3484.1	190.7-200.2	9.5	9.49	99
23X	6	0815	3484.1-3493.6	200.2-209.7	9.5	3.23	34
24X	6	0920	3493.6-3503.1	209.7-219.2	9.5	0.01	<1
25X	6	1029	3503.1-3512.6	219.2-228.7	9.5	0.17	2
26X	6	1142	3512.6-3522.1	228.7-238.2	9.5	0.01	<1
27X	6	1306	3522.1-3531.6	238.2-247.7	9.5	2.34	24
28X	6	1420	3531.6-3541.1	247.7-257.2	9.5	0.95	10
29H	6	1540	3541.1-3549.1	257.2-265.2	8.0	7.72	97
Wash	6		3549.1-3550.6	265.2-266.7	—	—	—
30H	6	1700	3550.6-3551.6	266.7-267.7	1.0	0.66	66
Wash	6		3551.6-3560.1	267.7-276.2	—	—	—
31X	6	1858	3560.1-3569.6	276.2-285.7	9.5	0.00	0
32X	6	2110	3569.6-3579.1	285.7-295.2	9.5	2.90	31
Wash	6		3579.1-3588.6	295.2-304.7	—	—	—
33X	6	2305	3588.6-3598.1	304.7-314.2	9.5	2.73	29
34X	7	0034	3598.1-3607.6	314.2-323.7	9.5	4.03	42
35X	7	0144	3607.6-3617.1	323.7-333.2	9.5	0.06	1
36X	7	0250	3617.1-3626.6	333.2-342.7	9.5	0.72	8
37X	7	0455	3626.6-3636.1	342.7-352.2	9.5	0.00	0
38X	7	0610	3636.1-3645.6	352.2-361.7	9.5	2.30	24
39X	7	0720	3645.6-3655.1	361.7-371.2	9.5	0.00	0
40X	7	0829	3655.1-3664.6	371.2-380.7	9.5	2.17	23
41X	7	1030	3664.6-3674.1	380.7-390.2	9.5	tr	—
Wash	7		3674.1-3683.6	390.2-399.7	—	—	—
42X	7	1225	3683.6-3693.1	399.7-409.2	9.5	0.72	8
43H	7	1325	3693.1-3702.6	409.2-418.7	9.5	9.00	95
44H	7	1442	3702.6-3704.6	418.7-420.7	2.0	0.30	15
45X	7	1610	3704.6-3712.1	420.7-428.2	7.5	0.05	1
Wash	7		3712.1-3721.6	428.2-437.7	—	—	—
46X	7	1815	3721.6-3731.1	437.7-447.2	9.5	0.45	5
Wash	7		3731.1-3740.6	447.2-456.7	—	—	—
47X	7	2100	3740.6-3750.1	456.7-466.2	9.5	2.36	25
Wash	7		3750.1-3759.6	466.2-475.7	—	—	—
48X	7	2321	3759.6-3769.1	475.7-485.2	9.5	0.04	1
49X	8	0100	3769.1-3779.6	485.2-494.7	9.5	9.40	99
50X	8	0220	3779.6-3788.1	494.7-504.2	9.5	9.54	100
51X	8	0422	3788.1-3797.6	504.2-513.7	9.5	9.28	98
52X	8	0802	3797.6-3807.1	513.7-523.2	9.5	1.66	17
					419.3	175.29	42
Hole 615A							
1H	9	1340	3285.9-3291.5	0.0-5.6	5.6	5.55	99
2H	9	1442	3291.5-3296.8	5.6-10.9	5.3	5.30	100
Wash	9		3296.8-3300.9	10.9-15.0	—	—	—
3H	9	1705	3300.9-3301.4	15.0-15.5	0.5	0.14	28
Wash	9		3301.4-3305.4	15.5-19.5	—	—	—
4H	9	1930	3305.4-3306.7	19.5-20.8	1.3	1.26	97
Wash	9		3306.7-3314.8	20.8-28.9	—	—	—
5H	9	2050	3314.8-3324.1	28.9-38.2	9.3	7.70	83
6H	9	2215	3324.1-3333.4	38.2-47.5	9.3	8.07	87
7H	9	2330	3333.4-3339.4	47.5-53.5	6.0	2.89	48
Wash	9		3339.4-3342.8	53.5-56.9	—	—	—
8H	10	0052	3342.8-3345.8	56.9-59.9	3.0	2.60	87
Wash	10		3345.8-3352.2	59.9-66.3	—	—	—
9H	10	0200	3352.2-3354.7	66.3-68.8	2.5	2.39	96
Wash	10		3354.7-3370.4	68.8-84.5	—	—	—
10H	10	0354	3370.4-3374.9	84.5-89.0	4.5	4.27	95
Wash	10		3374.9-3379.9	89.0-94.0	—	—	—
11H	10	0456	3379.9-3380.9	94.0-95.0	1.0	0.73	73
Wash	10		3380.9-3436.0	95.0-150.1	—	—	—
12H	10	0723	3436.0-3439.6	150.1-153.7	3.6	3.48	97
Wash	10		3439.6-3445.6	153.7-159.7	—	—	—
13H	10	0830	3445.6-3447.6	159.7-161.7	2.0	1.18	59
Wash	10		3447.6-3455.2	161.7-169.3	—	—	—
14H	10	0940	3455.2-3455.7	169.3-169.8	0.5	0.45	90
15H	10	1050	3455.7-3456.7	169.8-170.8	1.0	0.87	87
Wash	10		3456.7-3475.3	170.8-189.4	—	—	—
16X	10	1315	3475.3-3484.9	189.4-199.0	9.6	5.05	53
17X	10	1425	3484.9-3494.9	199.0-208.5	9.5	0.00	0
					74.5	51.93	70

[a] H following number indicates hydraulic piston core, X indicates extended core barrel core.

to open hole. The hole was then found to be absolutely clear as the sonde descended to only 17 m off total depth. A log of excellent quality was recorded for the length of the hole. The upper portion of the logging sonde had already started into the pipe when the lower portion became firmly stuck at the same spot that had given trouble on the down trip. After over 2 hr. of effort, the tool was finally freed by moving the core bit up and down over the logging tool.

When the first sonde had been recovered, two joints of pipe were added to place the bit below the interval of tight hole. The FDC/CNL/GR tool was then deployed, but the run was aborted when a special spectral gamma-ray module malfunctioned. It was replaced by a standard gamma-ray cartridge and adapter. This second logging tool also encountered obstructions in the first 20 m of open hole. It broke through into the obstructions after much effort, and another good logging run was obtained from the same depth as the first run.

With logging operations completed, the sheaves were rigged down and the bit was pulled clear of the seafloor in preparation for respudding.

Hole 615A

Hole 615A was spudded at 1317 hr., 9 October in 3285.9 m of water after the vessel had been offset 18 m to the northeast (Table 1). The hole was drilled to collect cores for geotechnical studies at a later date. Since sand was of little interest for this purpose, coring efforts were concentrated on the more clay-rich intervals. Recovery performance of the APC and XCB systems was consistent with that of the first hole as Hole 615A was drilled and spot cored to total depth of 3494.4 m (208.5 m sub-bottom). The drill string was recovered, and *Glomar Challenger* departed for the next drill site at 2035 hr., 10 October.

SEISMIC STRATIGRAPHY AND ACOUSTIC FACIES

Site 615 is located on the western levee of the main central channel on the lower part of the modern Mississippi fan lobe. The site is within 3 km of the outer edge of the levee. The modern fan lobe at Site 615 is about 200 m thick as defined by a seismic reflection horizon of regional extent (Introductory chapter, this volume). The convex-upward cross-sectional profile across the fan lobe on the lower fan primarily results from the levee relief, which forms the upper 30 to 40 m of the fan sediments. The leveed channel is presently about 10 m deep in this area.

The area of the leveed channel close to its morphological termination was studied in detail during the site survey cruise in December 1982 (see Site 621 chapter, this volume). Figure 1 shows the trackline chart for the detailed survey in the vicinity of Site 615. These data are used to examine the general structure of the lower fan and to determine acoustic facies for the youngest part of the sequence.

Seismic Stratigraphy

Figure 2 shows part of the single-channel seismic reflection profile from Line 62, which passes approximately 1 km south of Site 615. Although numerous, strong flat-lying reflectors are observed in the 800 m illustrated, only six horizons above 500 m exhibit lateral continuity across the detailed survey area on the lower fan. Two of the seismic reflectors (Horizons "20" and "30") occur fanwide (Introductory chapter and Stelting et al., this volume). Horizon "20" marks the base of the convex-upward section that constitutes the modern (most recent) Mississippi fan lobe. Horizon "30" is the strongest and most laterally persistent reflector within the upper 500 m. This regional reflector correlates with the top of a major interstadial period during Wisconsin time (Ericson and Wollin, 1968) at about 0.085 Ma.

Four other reflectors (enhanced in Figure 2) can be traced between Sites 614 and 615 and appear to be continuous throughout much of the area of the detailed survey on the lower fan. These reflectors are subparallel, but subtle wedging of the sections between them (see discussion in Site 614 chapter, this volume) suggests that there was periodic shifting of the channel(s) reaching this part of the fan during deposition of these sequences. Above 350 m, the reflecting surfaces between these major correlatable horizons are shorter and exhibit more local relief. This reflective character generally is indicative of sand sequences; active channeling and scouring in the proximal parts of the depositional area are commonly associated with the sandy sequences.

The topographic relief of the leveed channel is not observed below 30 m at Site 615. Even the shallowest observable reflector at about 15-m depth is nearly horizontal. Thus, the levees appear to be a very late development in the submarine fan sequence at this site.

The results of coring and downhole logging at Site 615 show:

1. The shallowest reflector, at 15 m, corresponds to the first thick (>1 m) sand bed.
2. Horizon "20" appears to mark a major lithologic contact at about 200-m depth between a predominantly muddy section of 15-m thickness that overlies a very sandy 12-m-thick section. This muddy interval probably represents a major, regionwide interval of reduced sand deposition.
3. Horizon "30" is marked by an abrupt change from interbedded silts and clays to a nannofossil ooze. The ooze, which is assigned to the X Zone of Ericson and Wollin (1968), was first recovered in the core catcher of Core 615-48.
4. The other four reflectors of regional extent all correspond to lithologic transitions between dominantly silty/muddy sequences and sand sequences. The sequences between these horizons may thus represent pulses of deposition.
5. Above Horizon "30," the sequence is about 50% sand. The continuity of reflecting horizons is not simply related to the amount of sand present. This suggests

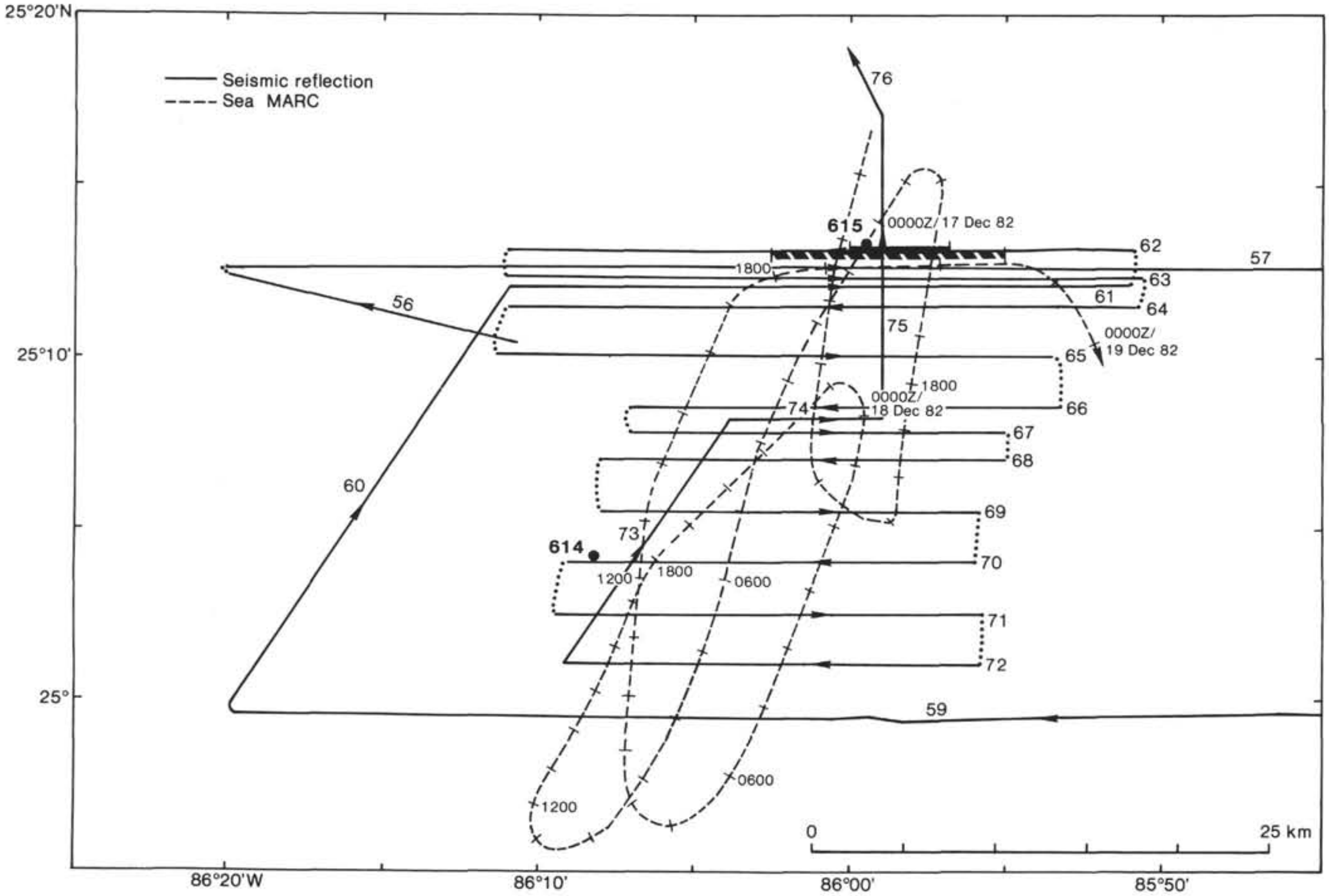

Figure 1. Map showing *Conrad* site survey tracklines and lower fan Sites 614 and 615. Location of Figure 2 indicated by cross-hatching and Figure 3 by heavy line.

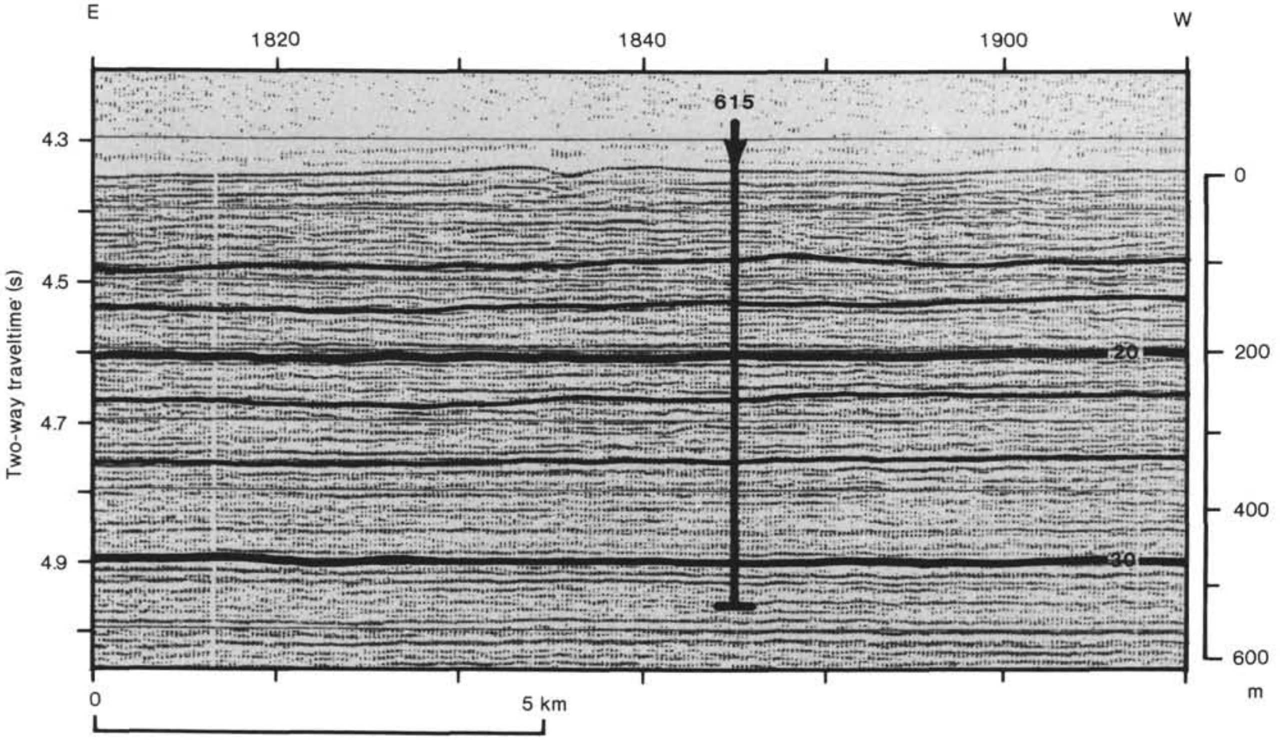

Figure 2. Water-gun seismic reflection profile from Line 62 of site survey cruise that passes 1 km south of Site 615 (see Fig. 1 for location).

that the section above 350 m (and especially above Horizon "20"), where the reflectors are short and with local relief, may have more channel or scour irregularities than the sections between Horizons "20" and "30." This may indicate the entire fan prograded southward during the time following Horizon "30."

Acoustic Facies

The 3.5-kHz shipboard profiles and the 4.5-kHz deep-tow data are used to define at least four separate surficial acoustic facies in the detailed survey area (O'Connell et al., this volume). These acoustic facies are based on the geometry and character of both the seafloor and reflecting horizons to depths of as much as 50 m. At Site 615, multiple, subparallel, relatively continuous reflectors of variable width and strength comprise the levee section (Fig. 3). This acoustic facies is typical of the western channel levee on the lower fan but is distinctly different from the acoustic character of the eastern levee, where there are only a few, short, indistinct sub-bottom reflectors under a prolonged echo from at or near the seafloor.

A very strong, flat-lying diffuse reflector at 20 to 25 ms depth underlies much of the western levee away from the channel floor. It is the deepest reflector recorded under most of the area on the 3.5-kHz records. A reflector of this character is generally thought to indicate sandy units on submarine fans (Damuth, 1978; Normark et al., 1979).

Conclusions

The major results from comparing seismic stratigraphy, acoustic facies, and core samples at Site 615 are

1. Two separate fan lobes were cored at this site; their bases correspond to reflection Horizons "20" and "30."
2. The regional (fanwide) reflection Horizon "30" can be used as a stratigraphic marker to determine sedimentation rates for the late Wisconsin glacial period.
3. 3.5-kHz facies characterizations can be useful in recognizing and mapping sandy sub-bottom horizons in the near seafloor section of modern submarine fans, thus confirming earlier results based on conventional sampling of these surficial sediments by piston cores.

BIOSTRATIGRAPHY AND SEDIMENTATION RATES

Biostratigraphy

The section penetrated in Hole 615 is Quaternary, correlating with the planktonic foraminifer Zone N23 and the calcareous nannofossil Zone NN21. This interval includes the Holocene (Zone Z), late Wisconsin glacial (Zone Y), Wisconsin interstadial (Zone X), and the early Wisconsin glacial (Zone W) of Ericson and Wollin (1968) (Fig. 4).

Zone Y is a displaced sand and mud sequence with reworked Cretaceous foraminifers and radiolarians and predominantly Cretaceous calcareous nannofossils.

Zone X (*Globorotalia flexuosa* Zone) is a warm-water Pleistocene calcareous nannofossil–foraminifer ooze with reworked Pliocene foraminifers and calcareous nannofossils in the upper and middle intervals only.

The X/W boundary was reached in 615-52-1, 118–123 cm. The W Zone is represented by a brown clay with cool-water planktonic foraminifers and reworked Cretaceous nannofossils.

Foraminifers

Foraminifers from Hole 615 are Quaternary, Zone 23 (Blow, 1969). A warm water, high diversity Holocene (Zone Z) planktonic foraminifer ooze occurs in Core 615-1. This fauna contains abundant *Globorotalia menardii* and *G. tumida*, along with bathyal benthic foraminifers *Cibicides wuellerstorfi* and *Melonis pompilioides*.

Zone Y (late Wisconsin glacial) extends from Cores 615-2 through 615-48 and consists of interbedded sands and muds with a very poorly developed foraminiferal fauna. The cool-water planktonic foraminifer *G. inflata* occurs sporadically in low frequencies except in Core

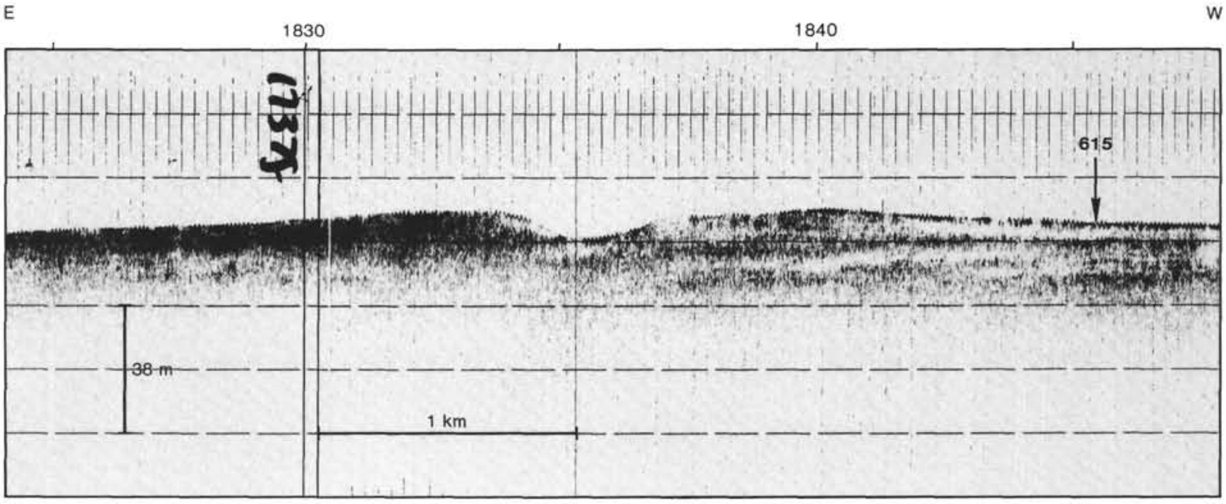

Figure 3. *Conrad* site-survey 3.5-kHz reflection profile from Line 62 (see Fig. 1 for location).

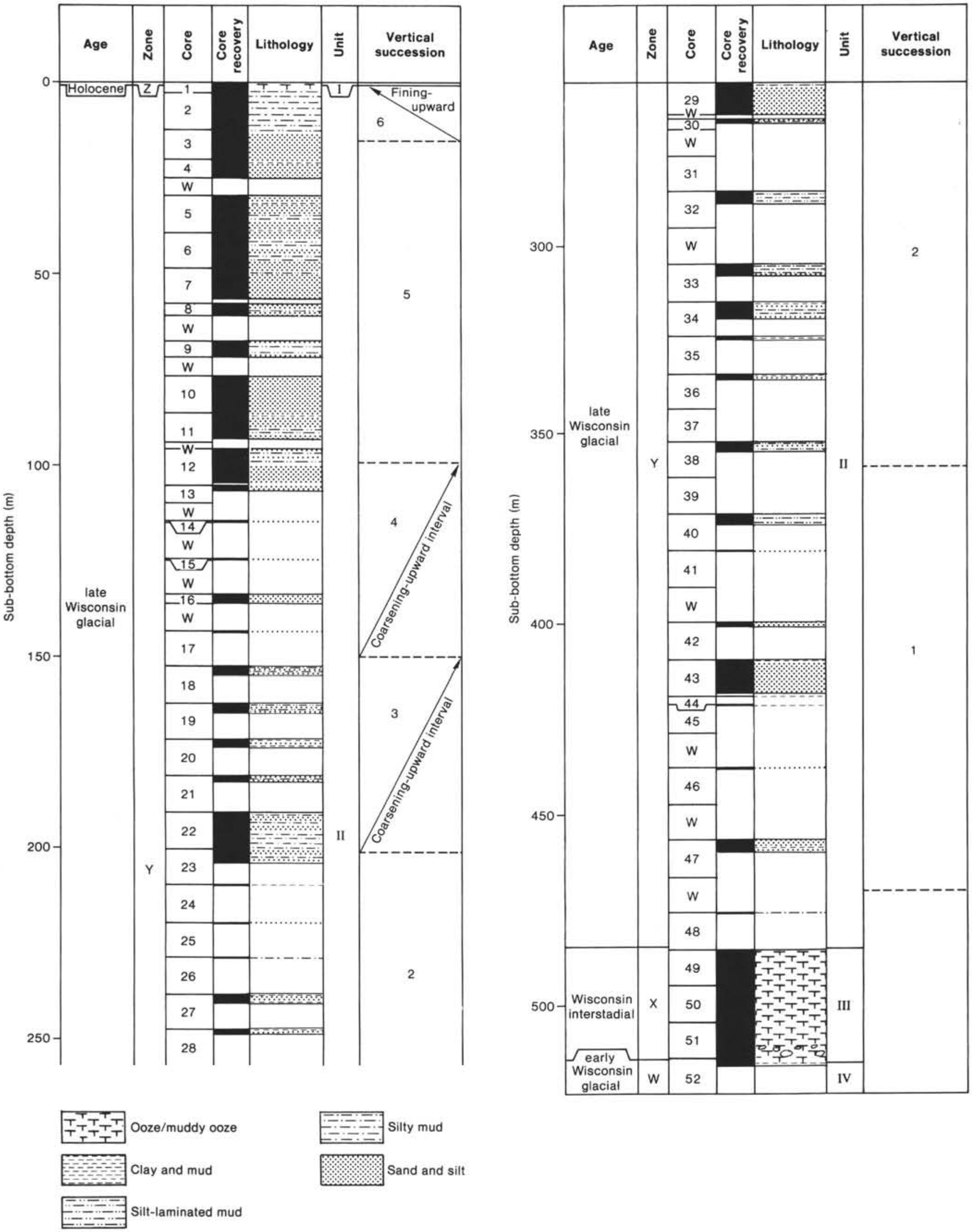

Figure 4. Lithostratigraphic summary of Site 615 showing age, core recovery, graphic lithology, lithologic units, and intervals. W = washed interval.

615-47, where it is common. The occurrence of shallow water (neritic) benthic foraminifers such as *Amphistegina gibbosa, Hanzawaia concentrica, Fursenkoina pontoni, Elphidium* spp., and *Quinqueloculina* spp. suggests that at least some of the Pleistocene sand and mud has been displaced from a neritic environment. The absence of bathyal benthic foraminifers except in Core 615-47, which contains *C. wuellerstorfi*, suggests a rapid sedimentation rate for this zone. Reworked Cretaceous foraminifers and radiolarians occur throughout this interval.

Zone X (warm Wisconsin interstadial) extends from Samples 615-48,CC through 615-52-1, 35-41 cm and is composed of a calcareous foraminifer-nannofossil ooze. The upper interval, Samples 615-48,CC through 615-49,CC, is predominantly a calcareous nannofossil ooze with juvenile planktonic foraminifers and *G. menardii*. The middle interval, Samples 615-49,CC through 615-51,CC, is a foraminifer ooze with *G. flexuosa* (Sample 615-50-4, 35-41 cm) and abundant *G. menardii*. Reworked Pliocene foraminifers such as *G. miocenica, Globoquadrina altispira, Sphaeroidinellopsis seminulina*, and *Globorotalia margaritae* are common throughout this interval, as well as bathyal foraminifers *C. wuellerstorfi* and *M. pompilioides*. Sample 615-51,CC contains gravel-sized chert fragments and calcareous nodules. Calcareous algae (*Lithothamnion*), bryozoans, coral fragments, barnacle plates, and abraded *Amphistegina gibbosa* indicate transport from a neritic environment. The lower interval (top of Section 615-52-1 to Sample 615-52-1, 35-41 cm) contains a warm water Pleistocene foraminifer fauna dominated by *G. menardii* with no reworked Pliocene foraminifers.

Zone W (early Wisconsin glacial) was encountered in Sample 615-52-1, 118-123 cm. The planktonic fauna is represented by dominant *G. inflata* and common *G. truncatulinoides* (dextral).

Calcareous Nannofossils

All samples at Site 615 are interpreted to be in the *Emiliania huxleyi* Zone (NN21) of Martini (1971). The upper 32 cm of Section 615-1-1 consists of a marly foraminifer ooze containing abundant, well-preserved calcareous nannofossils. The floral assemblage within this zone is typical of pelagic Holocene sediments in the Gulf of Mexico. Small coccoliths, tentatively identified as *E. huxleyi*, are dominant.

The interval below this ooze from Section 615-1-1 to Sample 615-48,CC is an interbedded sand-mud sequence in which reworked Cretaceous nannofossils are the major constituent, suggesting a terrigenous source of the deposited material. Only very slight to slight increases in the indigenous Pleistocene flora are encountered in this interval. The most pronounced of these minor increases occurs in Core 615-23 and may be correlative to the increase found in the bottom sample of Hole 614A.

A calcareous foraminifer-nannofossil ooze is encountered from Sample 615-48,CC through Section 615-52-1. This interval appears to grade from a nannofossil ooze in Core 615-49 into a foraminifer-nannofossil ooze in Core 615-51 and is terminated by a gravelly conglomerate in Sample 615-51,CC. Reworked early Pleistocene, Pliocene, Miocene, and Eocene species are common in the flora in this interval, including important biostratigraphic marker species such as *Pseudoemiliania lacunosa, Cyclococcolithina macintyrei, Discoaster brouweri, D. pentaradiatus, Sphenolithus abies, Reticulofenestra pseudoumbilica, D. quinqueramus*, and *D. barbadiensis*.

Within the late Pleistocene flora in this interval, it appears that *Gephyrocapsa* sp. is equal to or dominant over *E. huxleyi*, thus placing this interval below the *E. huxleyi* Acme Zone (Gartner and Emiliani, 1976). This reversal of *G. caribbeanica* and *E. huxleyi* has been shown to occur at 0.085 Ma in tropical and subtropical waters (Thierstein et al., 1977).

Below the conglomerate in Sample 615-51,CC is a pelagic foraminifer ooze containing an abundant, well-preserved late Pleistocene assemblage. Relatively few reworked Pliocene specimens are present in the samples examined in Section 615-52-1.

Sample 615-52,CC consists of a dark brown mud containing few calcareous nannofossils. This interval is again dominated by reworked Cretaceous flora, indicating a return to terrigenous sedimentation.

Sedimentation Rates

The sedimentation rates have been calculated on the basis of three datums. An age of 0.012 Ma is used for the Holocene/Pleistocene boundary (Z/Y zonal boundary), 0.085 Ma for the Y/X zonal boundary, and 0.127 Ma for the X/W zonal boundary (see Explanatory Notes, this volume).

A sedimentation rate of 4.2 cm/1000 yr. is computed for the Holocene Z Zone. This is a minimum rate assuming complete Holocene recovery (Fig. 5).

The Y/X zonal boundary is interpreted to be at the base of the interval drilled in Core 615-48. A sedimentation rate of 663.7 cm/1000 yr. is calculated for the Y Zone.

The warm water interstadial (X Zone) has a sedimentation rate of 71.0 cm/1000 yr. These calculations were based on nondecompacted sediment thicknesses.

LITHOSTRATIGRAPHY

At Site 615 we recognize four lithologic units on the basis of compositional variation in the 523.2 m of section drilled (Table 2, Fig. 4). Core recovery in the upper 100 m (Cores 615-1 through 615-12) was relatively good, averaging 80%, but extremely patchy through the remainder of the section, averaging 22% (Cores 615-13 through 615-52).

Lithologic Unit I: Ooze and Muddy Ooze

This unit occurs in a thin layer at the very top of the section. Only 17 cm of this unit were recovered (Sample 615-1-1, 15-32 cm); staining of the sediment showed that none of the foraminifers were living, indicating that the uppermost surface was not recovered. The sediments comprise a yellowish brown marly calcareous ooze in which planktonic foraminifers are dominant, nannofossils and siliceous organisms form less than 10%, and terrigenous

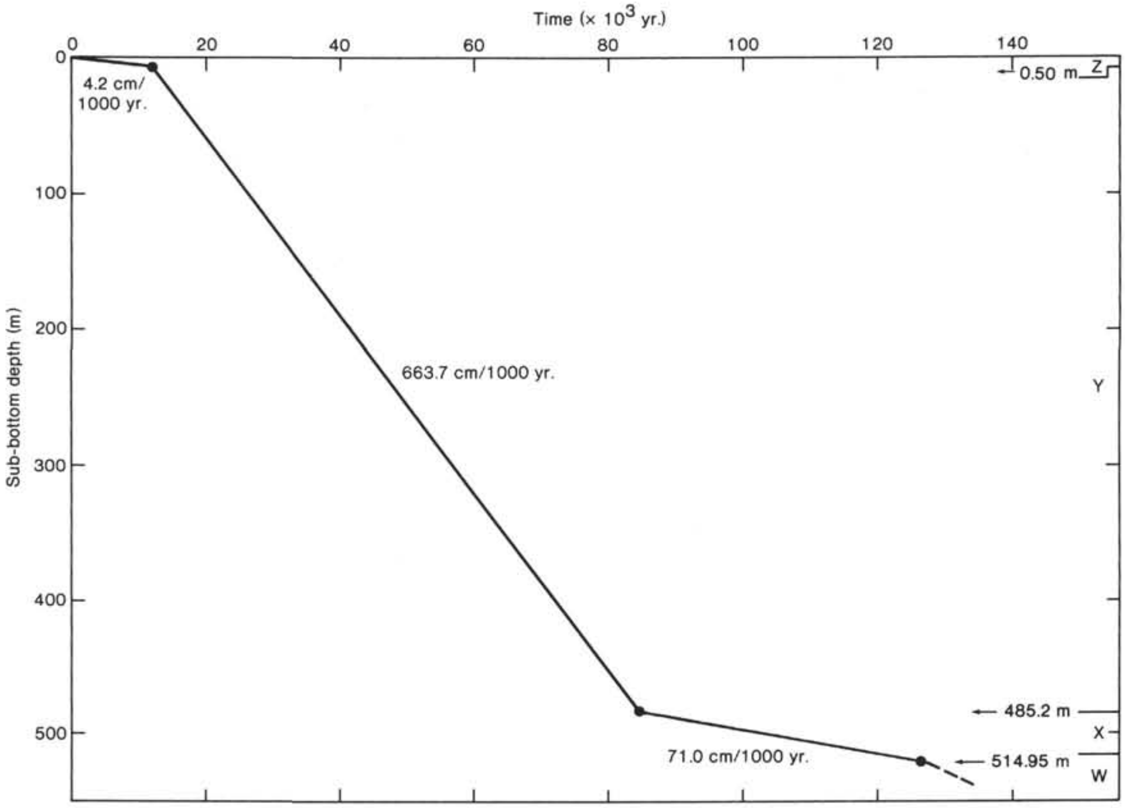

Figure 5. Site 615 sedimentation rates.

Table 2. Lithologic units of Site 615.

Lithologic unit	Sediment	Cored interval	Sub-bottom depth (m)
I	Ooze and muddy ooze	615-1-1, 0–32 cm	0.00–0.32
II	Muds, silts, and sands	615-1-1, 0–32 cm to 615-48,CC	0.32–485.2
III[a]	Nannofossil ooze	615-48,CC to 615-52-1, 125 cm	485.2–514.95
IV	Calcareous mud	615-52-1, 125 cm to 615-52,CC	514.95–523.2

[a] The depth of the top of this unit (485.2 m sub-bottom) was determined by assuming that the nonrecovered material in Core 615-48 consisted of lithologic Unit II mud, silt, and sand. The core catcher sample containing lithologic Unit III nannofossil ooze is therefore placed at the bottom of the cored interval.

material makes up 25 to 35%; it appears homogeneous and is probably thoroughly bioturbated. It passes down through a gradational bioturbated contact into the terrigenous sediments of lithologic Unit II.

Lithologic Unit II: Muds, Silts, and Sands

This unit makes up the major sediment thickness of the drilled section at Site 615 and can be divided into four separate facies (three of which are shown in Fig. 6): (1) sands and silts, (2) silty muds, (3) silt-laminated muds, and (4) clays and muds. There is some gradation between facies, and locally they occur intermixed in disturbed units.

Sand and Silt Facies

Sands and silts make up about 45% of the recovered section in Unit II, and occur in thin to thick beds from less than 10 cm to at least 1.5 m in thickness. The coring of these unconsolidated sands commonly resulted in either core loss by washout or section increase by flow-in, so that we cannot be confident that the thicker (1.5–10 m) sandy intervals recovered represent single beds.

Many of the beds show normal grading. The thicker beds are apparently structureless, whereas most of the thinner sand and silt beds show some internal sedimentary structures. These are commonly organized in partial Bouma sequences with structureless (T_a), parallel (T_b), and cross-laminated divisions (T_c). The bottom contacts are commonly sharp and often somewhat scoured; the upper contacts are either sharp or gradational.

Grain size varies both within and between beds. The maximum size at the base of a few thicker beds ranges up to 5 mm (pebble sized). The mean size is mainly fine to medium sand (150–250 μm) and there is a high proportion of silt. The larger grains are commonly well rounded, spherical or elongate, and highly polished. The thinner beds tend to be better sorted, medium to coarse silt-sized (16–63 μm), with a maximum diameter rarely exceeding 150 μm (fine sand). The finer grains are commonly highly angular and irregular in shape. There are rare medium- to coarse-grained thin sand beds.

The composition is uniformly terrigenous (95–98%), however, there is a distinction between the coarser and finer beds. The coarser beds contain mostly quartz, with secondary occurrences of feldspars, micas, calcite and heavy minerals (especially amphiboles), and accessory glauconite, lithic fragments, and biogenics (2–5% foraminifers, shell debris, and lignite). The finer beds have

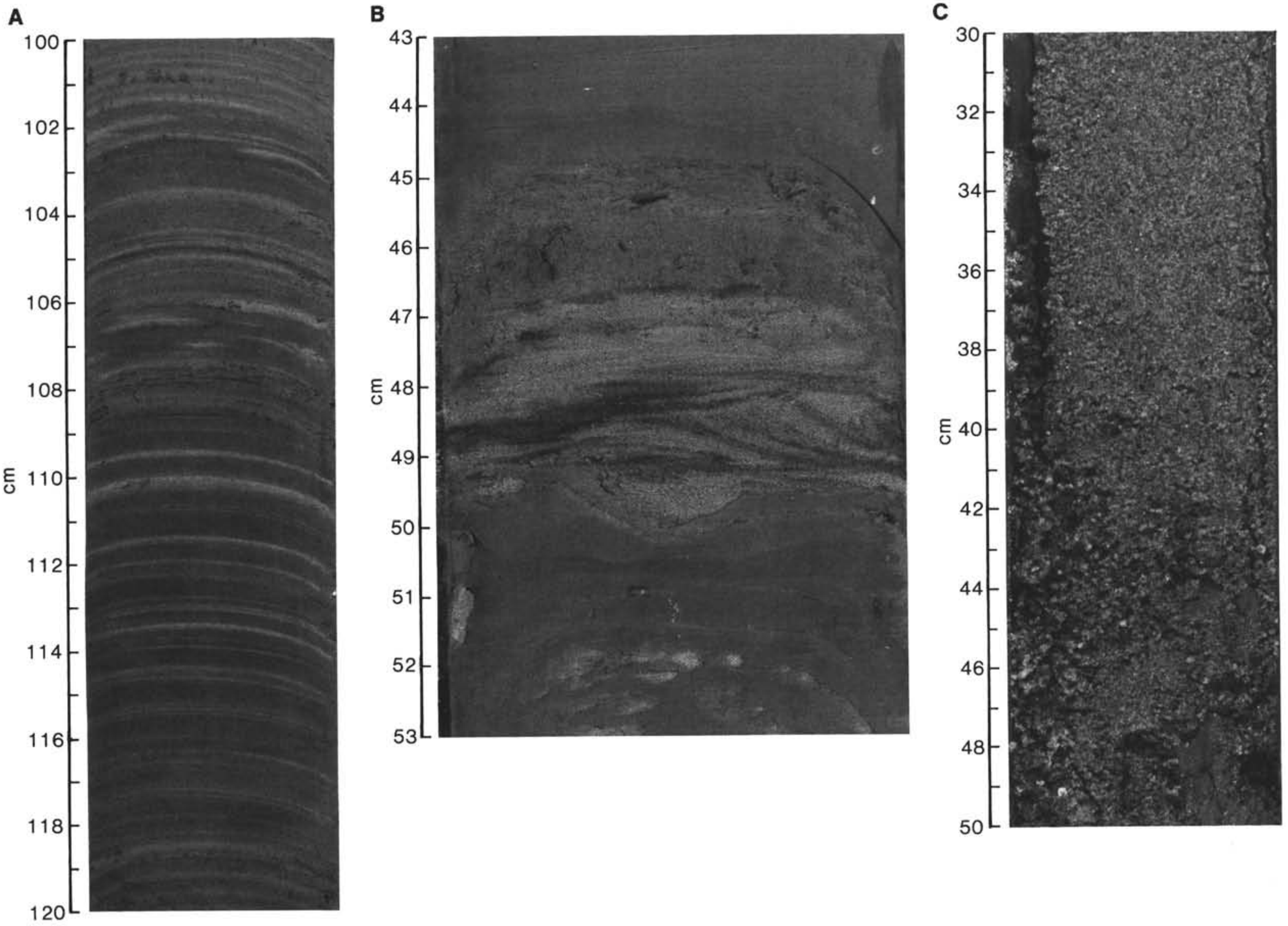

Figure 6. Photographs of characteristic facies of lithologic Unit II. A. Silt-laminated mud (Sample 615-11-3, 100–120 cm). B. Thin silt bed in silty mud, showing normal grading and internal cross-lamination (Sample 615-6-3, 43–53 cm). C. Part of thick graded sand interval (Sample 615-16-2, 30–50 cm).

variable but significant amounts of carbonate in addition to the above mineral suite. In both the coarser- and finer-grained beds, irregular horizons occur that are richer in highly altered minerals and, where graded or laminated, show selective mineral sorting and concentration. Little variation was observed downsection, apart from an increase in authigenic carbonate.

Silty Mud Facies

Dark colored lignite-bearing silty mud intervals occur throughout the section below about 80 m sub-bottom depth; they range in thickness from about 5 to 50 cm and make up approximately 10% of the recovered section in Unit II. There appear to be three main types: (1) structureless with gradational contacts, (2) distinctly bedded, in some cases with poor grading and floating mud clasts, and (3) normally graded beds, in some cases with indistinct layering. The graded beds commonly occur in the middle of 20- to 50-cm-thick units, with a cleaner laminated silt at the base and a finer-grained homogeneous mud at the top.

Texturally, the sediments are silty or sandy silty muds with poor to very poor sorting. Silt, sand, and rare gravel-sized grains are dispersed through a muddy matrix. These grains are predominantly angular or subangular in shape. They are dominantly terrigenous with quartz and clays as the main components, and carbonate silt is present with feldspar, micas, heavy minerals, and lignite as minor but significant components. Many of the grains appear partially altered, and others are coated with iron oxides.

Silt-Laminated Mud Facies

Muddy sections with thin silt laminae and thin-graded laminated silt units occur in thin to thick intervals throughout lithologic Unit II, making up about 40% of the recovered section. These vary from uniform muds with less than 5% silt laminae to muds with up to 50% silt laminae and thin silt layers. Locally, intervals of 5 to 50 cm in thickness show contorted laminae and overturned folds that appear to be of sedimentary origin rather than a result of coring disturbance.

The very thin (<1 mm) silt laminae are difficult to resolve visually. The thicker laminae commonly show internal parallel or cross-lamination and subtle grading. The bases are sharp and commonly scoured; the tops may be sharp or gradational, in some cases with flame-like protrusions into the overlying mud.

Two types of graded laminated units are recognized, each ranging from about 3 to 10 cm in thickness: (1) units that show a regular upward decrease in thickness and grain size of silt laminae, containing up to 10 to 15 laminae per unit and (2) units that pass upward through fine silt laminae into a grayish silty mud and then a reddish clayey mud with a gray-black mottled interval, near but not at the top. The mottled interval is probably bioturbated. Both units commonly have a thin discontinuous silt lamina directly underlying the base of the thickest layer.

The muds and silts are fine-grained (silty or clayey mud, fine silt sized) and dominantly terrigenous in composition, with a small variable proportion of reworked Cretaceous nannofossils, calcite, fine lignitic material, and rare dispersed volcanic ash. Quartz is dominant in the silts; the grains are commonly highly angular.

Clay and Mud Facies

Lithologic Unit II includes intervals of apparently structureless mud of similar composition and texture to the muds of the silt-laminated mud facies. These muds make up about 5% of the section. Some appear completely structureless, but they are more commonly mottled and bioturbated.

Lithologic Unit III: Nannofossil Ooze

The nannofossil oozes of Unit III were encountered abruptly at 485.2 m sub-bottom at the base of Core 615-48, underlying the poorly recovered sections of sand and mud at the base of Unit II. Core recovery was good (98%) throughout the 29-m-thick ooze unit (Sample 615-48,CC through Section 615-52-1).

The light bluish gray to yellowish gray sediments are relatively uniform and structureless. There are subtle grain-size variations within an overall normally graded sequence that extends through the top 28 m of recovered section. Grading is from a thin (10 cm) coarse gravelly layer at the base with chalk and shelf-depth bioclastic debris up to 15 mm in size, through a shelly foraminifer-rich nannofossil ooze and a finer-grained foraminifer-rich nannofossil ooze, to a very fine-grained pure nannofossil ooze in the top several meters. The biogenic material comprises a high percentage of reworked Cretaceous, Pliocene, and Pleistocene forms as well as a contribution of contemporary Pleistocene planktonic forms. Underlying the gravelly material is one meter of very fine grained Pleistocene nannofossil ooze, probably of Wisconsin interstadial age (Ericson X Zone). This grades down at the very bottom of the cored section to a brownish gray more terrigenous mud of Unit IV.

Lithologic Unit IV: Calcareous Mud

The deepest lithologic unit recovered at Site 615 consists of a brownish colored terrigenous mud in Sample 615-52,CC. This mud contains up to 15% calcareous foraminifers and nannofossils that indicate a cooler climate of early Wisconsin age (Ericson W Zone). The sediment is fine-grained and structureless to indistinctly laminated.

Vertical Succession

Relatively good core recovery in the top 100 m of section was complemented with a full suite of wireline logs through the lower 450 m (from 75 m to near the bottom) at Site 615. There is a good correlation between cores and logs, especially in the upper part of the hole, which permits interpretation of the logs in terms of lithology in the intervals with no core recovery (see Constans et al., this volume).

Six major intervals can be identified in Unit II (Fig. 4). These are mainly between 50 and 150 m thick and contain minor sequences, each 2 to 10 m thick. From the base to top, these major intervals are

1. A 110-m-thick sand-dominated interval recovered from about 470 to 360 m sub-bottom with 60 to 65% clean sands separated by thin silt and mud horizons (Cores

615-39 through 615-48). The sands occur in 2- to 10-m-thick sequences that show blocky, funnel- and cone-shaped gamma-log characteristics (Fig. 7).

2. A 160-m-thick sand–mud interval from about 360 to 200 m sub-bottom with 45 to 50% sands that appear less clean and thinner bedded (Cores 615-23 through 615-38). The sands occur in 2- to 10-m-thick minor sequences similar to those described above (blocky, funnel-, and cone-shaped) and also some with a more ragged log characteristic. These minor intervals are separated by equivalent thicknesses of silt and mud.

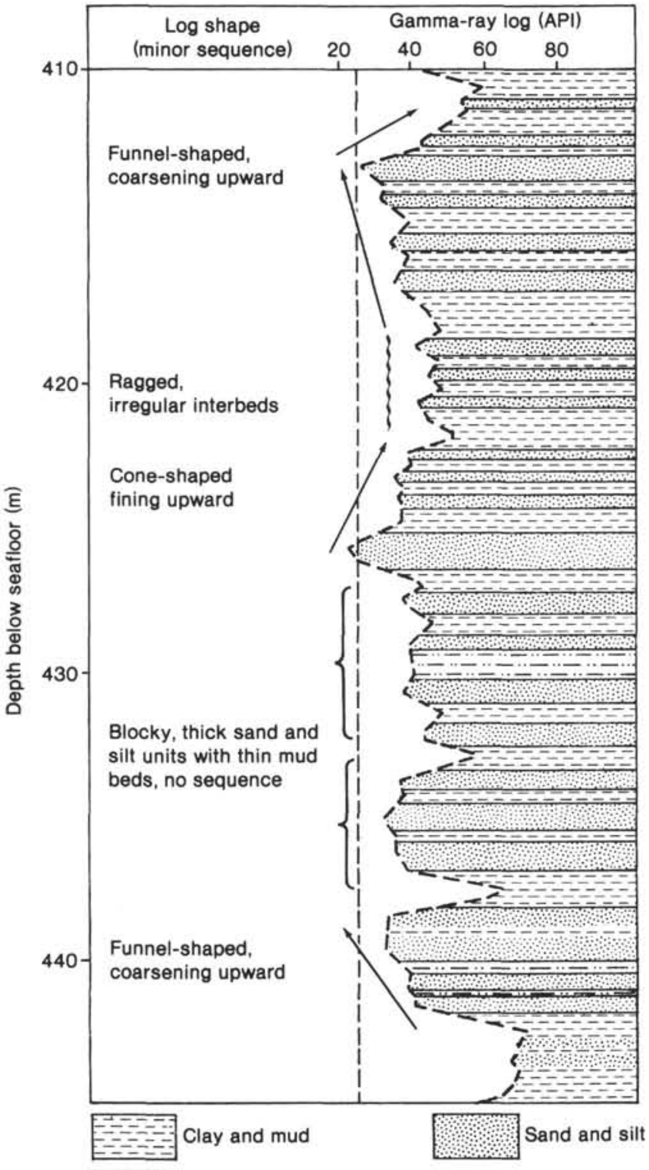

Figure 7. Detail of gamma-ray log and lithologic interpretation in terms of sandy and muddy intervals. The characteristic log patterns and small-scale sequences are shown in the left-hand column. See Coleman et al. (this volume) for further details.

3. A 50-m-thick coarsening-upward sequence from about 200 to 150 m sub-bottom dominated by muds and thin silts in the lower part and with an average of about 25% relatively thin sandy intervals (Cores 615-18 through 615-22). These show a somewhat ragged gamma-log characteristic.

4. A 50-m-thick coarsening-upward sequence from 150 to 99 m sub-bottom (Section 615-12-3 through Core 615-17). This interval is also mud dominated in the lower part, but with a total average of 45 to 50% sand becoming thicker bedded and cleaner upward. Blocky, funnel-, and cone-shaped gamma-log responses are characteristic of the upper sandy interval.

5. An 80-m-thick sand-dominated interval from 99 to 15 m sub-bottom (Sections 615-3-3 through 615-12-2) with 55 to 60% moderately clean sands in 1- to 8-m sequences, separated by silts and muds. The recovered sandy intervals appear to be massive, which may be equivalent to a blocky gamma-log characteristic.

6. A 15-m-thick fining-upward sequence (15 to 0 m sub-bottom) grading from thin sand beds, forming 10 to 15% of the total, through thin silt beds and laminae, to a more homogeneous mud overlain by the marly foraminifer ooze of Unit I.

GEOCHEMISTRY

Organic Geochemistry

The gas content of the upper 475 m of sediment column at Site 615 is very similar to that observed at Site 614, with no obvious gas pockets present. This distribution is believed to be due to the factors outlined in the Site 621 chapter (this volume). Three cores (615-49,-50, and -51) between about 485 and 514 m sub-bottom depth exhibit evidence of degassing. A gas sample collected from Section 615-50-6 has low levels of methane (385 ppm) and carbon dioxide (395 ppm), while ethane and higher hydrocarbons are below the detection limit (about 0.1 ppm). Methane/ethane ratios greater than 2000 indicate a biogenic methane source. Gas samples were not collected from either Core 615-49 or Core 615-51 because of the small amounts of gas present.

The gases observed in Cores 615-49, -50, and -51 occurred in a foraminifer–nannofossil ooze unit that is lithologically different from the sections above and below it (see Lithostratigraphy section). The gases are probably produced by *in situ* microbiological processes. Low levels of microbiological sulfate reduction appear to be occurring in Cores 615-1 through -48, as shown by the lower than seawater values of interstitial sulfate (Defreitas et al., this volume). Below Core 615-49, sulfate decreases to near zero as alkalinity increases as a result of increased microbiological sulfate reduction. The increased microbiological activity could be related either to an increased amount or to more labile sedimentary organic matter in this interval. As sulfate reduction increases, interstitial water sulfate drops to low values and methanogenesis increases in Cores 615-49 to 615-51, where low levels of methane degassing are observed.

Inorganic Geochemistry

The observed inorganic chemistry results are detailed in Ishizuka, Kawahata, et al. (this volume) and can be summarized as follows:

1. The pore water (interstitial water) of the sand samples has a higher salinity than that of the clay samples. The difference between sand and clay samples is about 0.5‰. The salinity of pore water in Cores 615-33 and 615-34 is between 34.5 and 34.0‰ (normal deep-sea water), but the salinity of pore water from Cores 615-40 through 615-52 is between 31 and 32‰.
2. Total alkalinity and pH of sand samples are slightly lower than those of the clay samples.
3. Total alkalinity of pore water in Site 615 shows a value three to six times higher than that in normal deep-sea sediment, but a lower value (1/5-1/2 times) than near Antarctica (Sites 270 and 274) and in the Timor Trough (Site 262), which had generated hydrocarbon gas.
4. A high spike of strontium (25 ppm as compared to normal values of 8-15 ppm) of unknown origin is observed at 488 m.

PHYSICAL PROPERTIES

Wet-bulk density increases from a seafloor value of 1.45 g/cm^3 to 60 m sub-bottom, at which point its value remains between 1.90 and 2.00 g/cm^3 to a depth of 500 m (Fig. 8A). The clays found below 60-m depth have a wet-bulk density similar to that of the sands cored in Hole 615. The scattering of data is due to changes in sediment composition.

Wet water contents of the muds and sands exhibit a large variation over the entire interval cored (Fig. 8B). Above the 60-m level, the wet water content ranges between 53 and 20%. Below 60-m depth, the dry water content (Fig. 8C) of the muds averages about 20 to 25%, which is very close to the water content of the sands present at this site.

Porosity decreases downhole from a high of 70 to 75% to an average value of 45% at levels below 100 m (Fig. 8D).

Undrained shear strength (C_u) increases from a measured value of 5 kPa at the seafloor to 200 kPa at 150-m depth. Below a depth of 200 m, the undrained shear strength varies between 210 and 417 kPa. The measured values of vane-shear strength are plotted against depth in Figure 8E. Figure 9 is a C_u versus σ plot of some representative clays from Site 615. It shows that most of the clays are normally consolidated because the value of C_u/σ is larger than 0.2. It also shows that the clays found deeper within the section are underconsolidated (i.e., C_u/σ values are less than 0.2). Underconsolidation can be caused by rapid rates of sediment accumulation and low permeabilities.

Sonic velocity in the upper 35 m (Fig. 8F) of sediment is less than that in seawater. The lowest velocity recorded was less than 1.450 km/s. The velocities recorded in Figure 8F are for nonsandy sediments. Velocities could not be obtained from the sand section because of drainage and core disturbance.

Sonic velocity increases in the upper 100 m of sediment at an average rate of 2.5 m/s per meter depth. Sediments deeper than 100 m have velocities that vary over a large range, but the increase in velocity is not significant from a depth of 150 m and deeper. The acoustic anisotropy is larger in the deeper sediments; the velocity measured parallel to the bedding has a higher velocity than that measured perpendicular to the bedding (for details see Wetzel, this volume).

SUMMARY AND CONCLUSIONS

Site 615 is located on the lower fan on the western levee of the central channel. We cored to a depth of 523.2 m below the mud line.

The main objectives for drilling a deeper hole on the lower fan were (1) to assess the ages of two succeeding fan lobes, (2) to determine the vertical sediment sequence of a fan lobe, and (3) to compare the sediment sequences with wireline log response.

The section was cored with the advanced piston corer to a depth of 136 m and from there with the extended piston corer to total depth. Four major stratigraphic units were recognized:

I. An upper section of foraminifer ooze comprising the Ericson Zone Z (Holocene).

II. A thick sequence of turbidite facies, of late Wisconsin glacial age (Ericson Zone Y).

III. A 29-m-thick calcareous unit, grading from a thin breccia through a foraminifer–nannofossil ooze into a nannofossil ooze. This unit comprises most of Zone X of Ericson.

IV. A mud forming the top of the Ericson Zone W (early Wisconsin glacial).

The entire cored interval is basically characterized by sediments (sand, clay, carbonate) that originated in shallow water. Benthic foraminifers are normally scarce in lithologic Unit II, however, those present show an outer and middle shelf origin. The carbonates from lithologic Unit III contain, in part, a mixture of pinnacle reef and other shallow-water organisms. A tentative conclusion, based on a few seismic profiles, is that these organisms originated on the central Florida Escarpment/Platform.

The major scientific results are

1. Turbidite deposition is the major type of sediment transport on the lower fan.
2. All terrigenous sediments are derived from inner and middle shelf environments.
3. The fan lobes basically contain only displaced fauna. Planktonic as well as deep-water benthic faunas are scarce, implying, in a geological sense, a nearly continuous deposition of sands and clays during late Wisconsin time.
4. The lower fan is dominated by sand deposition. The youngest fan lobe (199 m thick) contains 82 m of net sand or 41.1%; the older fan lobe (283 m thick) has 184 m of net sand or 65%.
5. Sedimentation rates are 4.2 cm/1000 yr. for Ericson Zone Z, 663.7 cm/1000 yr. for Ericson Zone Y, and 71.0 cm/1000 yr. for Ericson Zone X.

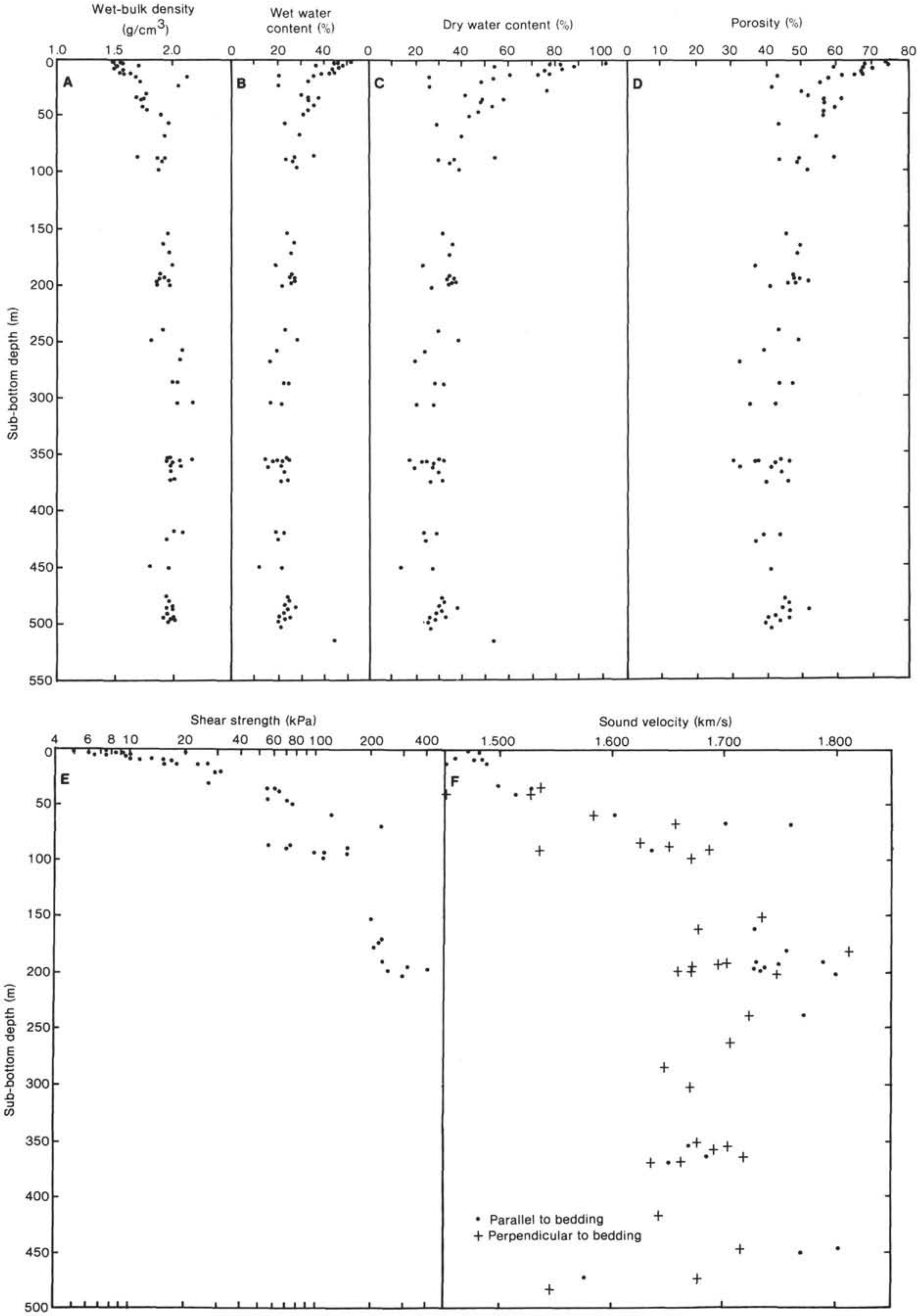

Figure 8. Mass physical properties of Site 615 sediments. A. Wet-bulk density. B. Water content related to weight of wet sediment. C. Water content related to weight of dry sediment. D. Porosity. E. Undrained shear strength. F. Sound velocity.

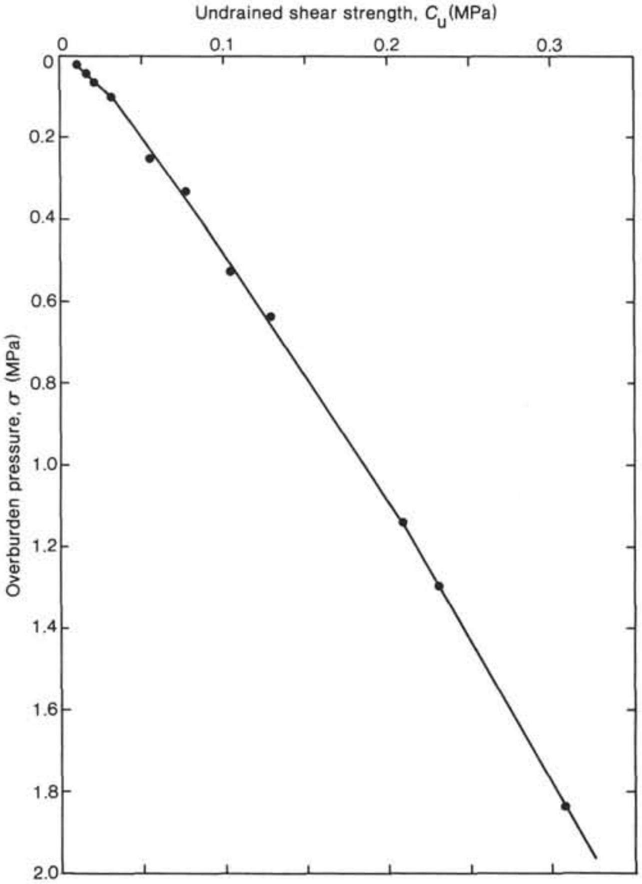

Figure 9. Undrained shear strength (C_u) versus overburden pressure (σ) at Site 615.

6. The wireline logs clearly demonstrate that the nonrecovered core intervals were sandier than estimated from the recovered cores.

7. The nannofossil ooze sequence (Ericson Zone X) was likely emplaced by debris flow deposition, and the source appears to be the central Florida Escarpment/Platform.

8. No gas was encountered in the entire cored section with the exception of a trace of methane in the calcareous debris flow.

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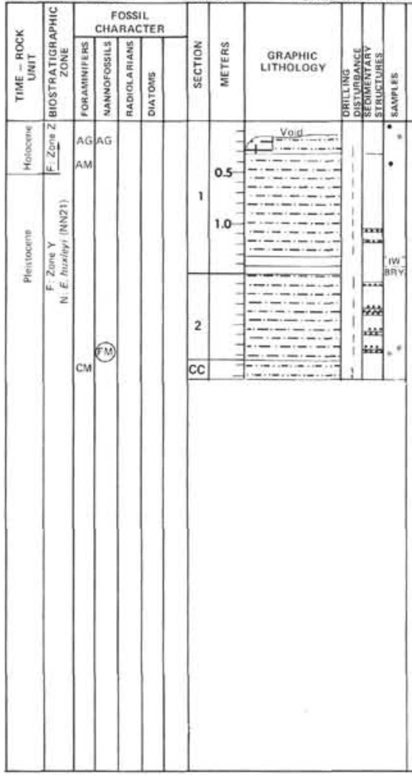
SITE 615 HOLE CORE 1 CORED INTERVAL 3283.9–3286.5 mbsl; 0.0–2.6 mbsf



LITHOLOGIC DESCRIPTION

Section 1, 0–15 cm: void.

Section 1, 15–32 cm: MARLY NANNOFOSSIL-FORAMINIFERAL OOZE. Yellowish brown (10YR 5/4) and thoroughly bioturbated. Separated from the underlying unit by a bioturbated, gradational contact.

Section 1, 32 cm–Core Catcher: SILTY MUD, dark grayish brown (10YR 4/2) grading to dark gray (5Y 4/1) at base of Section 1. The SILTY MUD in Section 2 is color-banded dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2). The color banding may be related to variation in redox conditions(?). The SILTY MUD contains very thin silt laminae that become more frequent downcore. Some of these laminae have clear turbiditic structures, indicating that they are fine-grained turbidites.

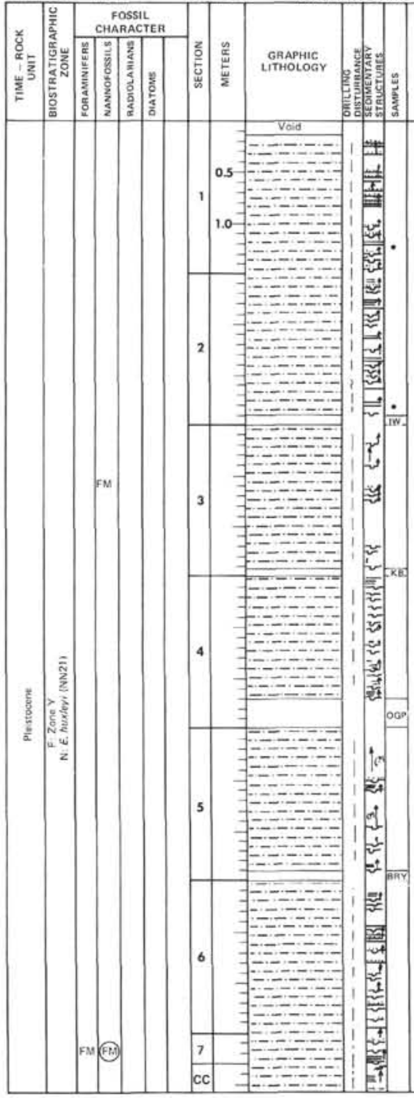
SMEAR SLIDE SUMMARY (%):

	1, 19 D	2, 75 D	2, 80 M
Texture:			
Sand	50	6	—
Silt	30	30	70
Clay	20	70	30
Composition:			
Quartz		—	—
Feldspar		—	—
Mica		—	—
Heavy minerals		—	—
Clay		—	—
Volcanic glass		—	—
Palagonite	50 Total detrital	—	—
Glauconite		—	—
Pyrite		—	—
Micronodules		—	—
Zeolite		—	—
Carbonate unspec.		—	—
Foraminifers	40	—	—
Calc. nannofossils	10	1	1

CARBONATE BOMB DATA:

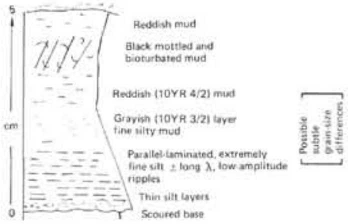
•1, 0–2 cm = 23.0%
1, 44–46 cm = 0.0%

SITE 615 HOLE CORE 2 CORED INTERVAL 3286.5–3296.0 mbsl; 2.6–12.1 mbsf



LITHOLOGIC DESCRIPTION

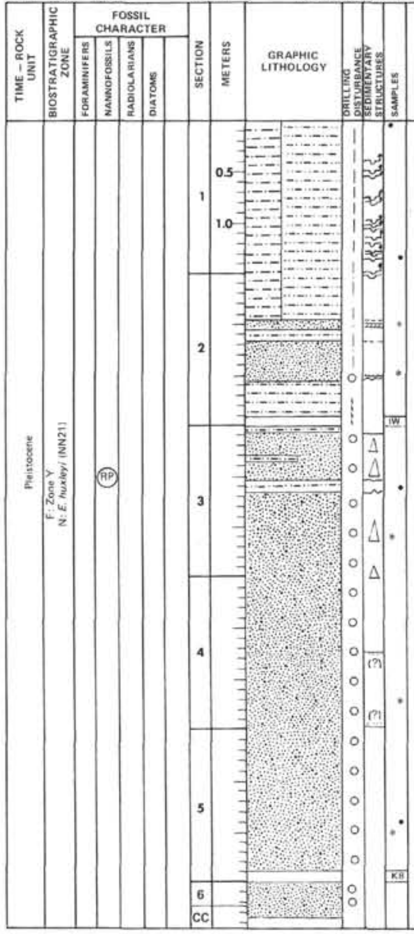
SILTY MUD with thin SILT laminae throughout the core. Dark olive gray to olive gray (10YR 3/2–10YR 4/2) in color. These layers are thin fine-grained turbidites of variable thickness, grain size, and completeness. A typical section through one turbidite is shown below.



CARBONATE BOMB DATA:

•1, 121–123 cm = 0.5%
2, 132–134 cm = 0.5%

SITE 615 HOLE CORE 3 CORED INTERVAL 3296.0–3304.0 mbsl; 12.1–20.1 mbsf



LITHOLOGIC DESCRIPTION

Section 1–2: MUD with SILT laminae and SANDY SILT beds. MUD is dominantly very dark grayish brown (10YR 3/2); SILT and SANDY SILTS are dark grayish brown (10YR 4/2) and homogeneous. Many of the SILT and SAND layers are laminated, normally graded, and have scoured bases.

Section 3–Core Catcher: SAND, dark olive gray (5Y 3.5/2) and slightly soupy. Appear to be fining-upwards sequences within the sand in Section 3.

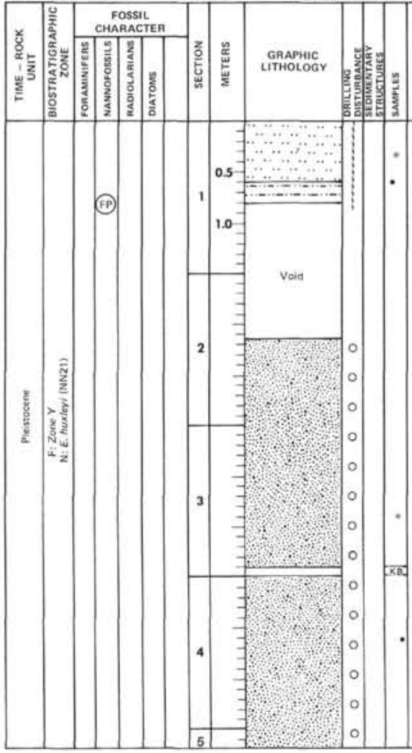
SMEAR SLIDE SUMMARY (%):

	2, 50 D	2, 100 D	3, 110 D	4, 125 D	5, 100 D
Texture:					
Sand	0	85	55	70	60
Silt	65	13	35	20	37
Clay	35	2	10	10	3
Composition:					
Quartz	80	17	22	90	24
Feldspar	1	1	2	5	3
Mica	2	1	1	2	1
Heavy minerals	1	4	2	3	3
Glauconite	1	–	–	–	–
Carbonate unspec.	15	40	35	T	35
Foraminifers	–	–	–	–	T
Calc. nannofossils	–	2	10	–	3
Sponge spicules	–	T	–	–	T
Plant debris	–	5	3	–	1
Altered minerals	–	30	25	–	30

CARBONATE BOMB DATA:

•1, 5–7 cm = 1.0%
1, 136–138 cm = 2.0%
3, 61–63 cm = 0.5%
5, 95–97 cm = 0.0%

SITE 615 HOLE CORE 4 CORED INTERVAL 3304.0–3308.6 mbsl; 20.1–24.7 mbsf



LITHOLOGIC DESCRIPTION

Section 1, 0–59 cm: SILT, very dark gray (10YR 3/1). Original laminae and bedding obliterated by core disturbance.

Section 1, 59–80 cm: MUD, dark gray (5Y 4/1).

Section 1, 80 cm–Section 2, 65 cm: Void.

Section 2, 65 cm–Section 5, 20 cm: SILTY SAND, dark olive gray (5Y 3.5/2), soupy, and homogeneous.

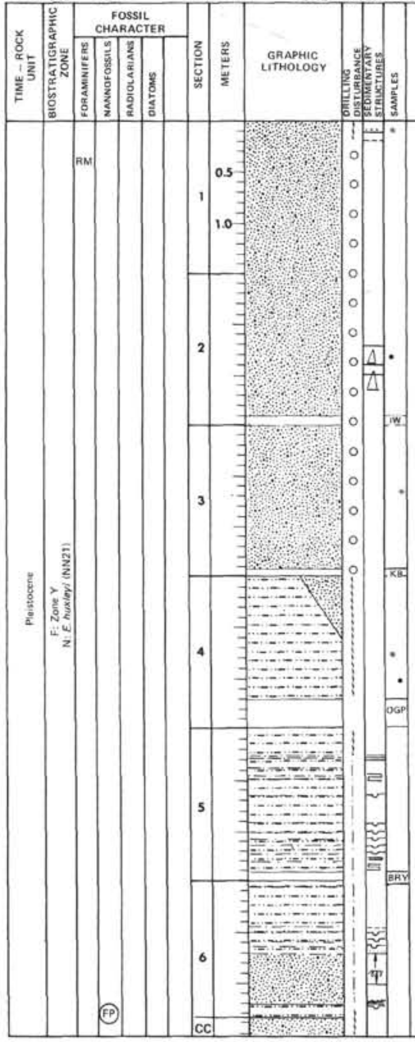
SMEAR SLIDE SUMMARY (%):

	1, 30 D	3, 90 D
Texture:		
Sand	3	75
Silt	87	20
Clay	10	5
Composition:		
Quartz	60	25
Feldspar	4	2
Mica	1	–
Heavy minerals	3	2
Carbonate unspec.	18	40
Foraminifers	1	–
Calc. nannofossils	1	5
Sponge spicules	T	T
Plant debris	–	1
Altered minerals	12	25

CARBONATE BOMB DATA:

•1, 64–66 cm = 1.0%
4, 64–66 cm = 0.0%

SITE 615 HOLE CORE 5 CORED INTERVAL 3313.5–3323.0 mbsl; 29.6–39.1 mbsf



LITHOLOGIC DESCRIPTION

Section 1–3: **SILTY SAND**, olive gray (5Y 4/2–5Y 5/2), moderately well-sorted, and slightly soupy. Section 2 contains several fining-upward turbidite sequences.

Section 4: **MUD**, homogeneous, dark olive gray (5Y 3/2), and highly deformed. Top 60 cm of this section contains interbedded, deformed silty layers.

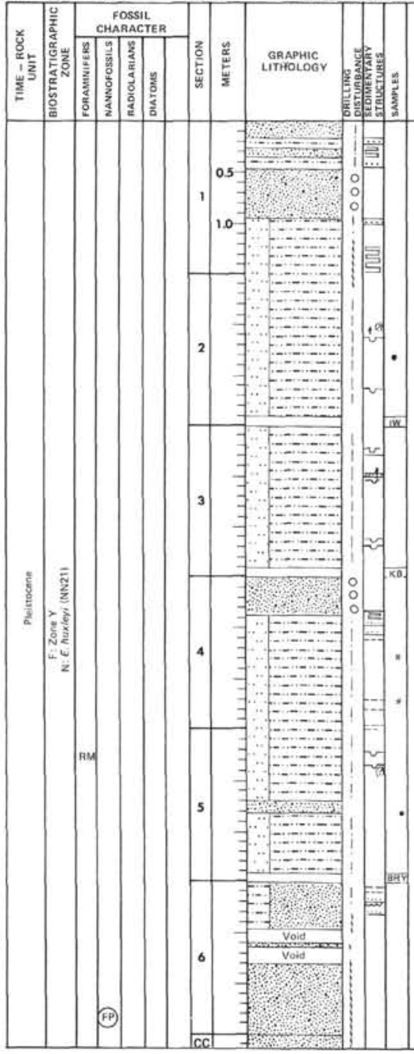
Section 5–6: stiff olive gray (5Y 4/2) **MUD** with gray (5Y 5/1) **SILTY MUD** laminae. These sediments are finely laminated to medium bedded, although mud between silt beds and laminae is structureless. **SILTY SAND** occurs below Section 6, 45 cm, with some graded bedding, and convoluted bedding.

SMEAR SLIDE SUMMARY (%):

	1, 14 D	3, 66 D	4, 80 D
Texture:			
Sand	15	75	0
Silt	50	20	5
Clay	35	5	95
Composition:			
Quartz	50	30	70
Feldspar	1	5	–
Mica	4	–	–
Heavy minerals	3	2	5
Carbonate unspec.	15	39	10
Foraminifers	2	–	–
Calc. nannofossils	20	1	15
Sponge spicules	T	T	T
Plant debris	–	3	T
Altered minerals	5	20	–

CARBONATE BOMB DATA:
•2, 85–87 cm = 2.0%
4, 106–108 cm = 4.5%

SITE 615 HOLE CORE 6 CORED INTERVAL 3323.0–3332.3 mbsl; 39.1–48.4 mbsf



LITHOLOGIC DESCRIPTION

MUD with **SILT** and **MUDDY SILT** laminae and layers and **SILTY SAND** layers.

MUD, olive gray to dark olive gray (5Y 3/2–5Y 4/2), stiff, and often finely laminated.

SILT and **MUDDY SILT** laminae and layers. Black to dark olive gray to olive gray (5Y 2/2–5Y 5/2). Grading, cross bedding, and basal scoured surfaces suggest these **SILTS** and **MUDDY SILTS** are fine-grained turbidites.

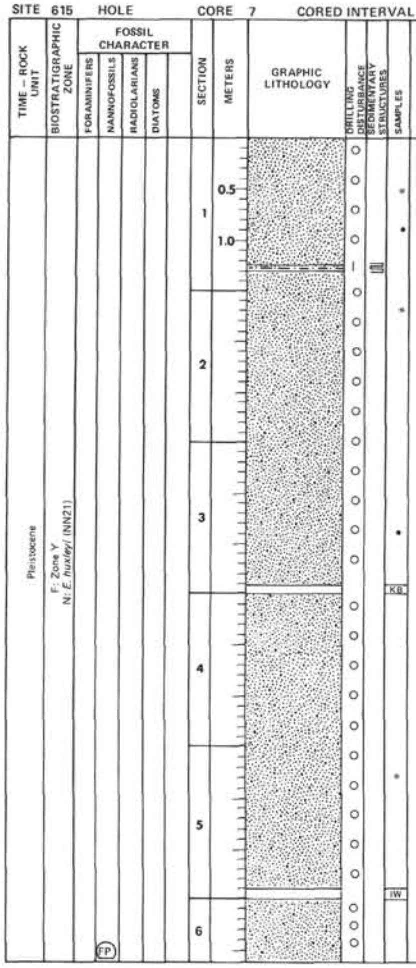
SILTY SAND layers. Massive, poorly to moderately well sorted, dark olive gray to olive gray (5Y 3/2–5Y 4/2) and dark gray (5Y 4/1).

SMEAR SLIDE SUMMARY (%):

	4, 85 D	4, 125 D
Texture:		
Sand	1	1
Silt	92	94
Clay	7	5
Composition:		
Quartz	57	74
Feldspar	3	–
Mica	3	–
Heavy minerals	2	–
Carbonate unspec.	20	5
Foraminifers	1	–
Calc. nannofossils	3	5
Plant debris	1	1
Altered minerals	10	15

CARBONATE BOMB DATA:
•2, 89–91 cm = 4.0%
5, 83–85 cm = 7.0%

SITE 615 HOLE CORE 7 CORED INTERVAL 3332.3–3341.6 mbsl; 48.4–57.7 mbsf



LITHOLOGIC DESCRIPTION

This core consists entirely of dark olive gray (5Y 3/2), slightly soupy, homogeneous SILTY SAND.

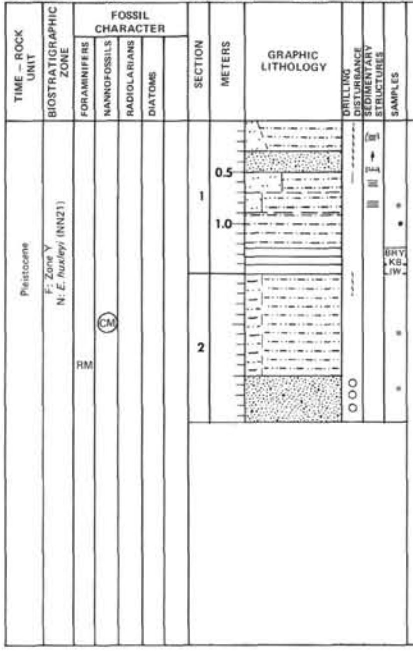
A small interval of laminated SILTY MUD occurs at Section 1, 123–129 cm. The dark laminae are dark olive gray (5Y 3/2); the light are gray (5Y 5/1).

SMEAR SLIDE SUMMARY (%):

	1, 50	2, 20	5, 30
	D	D	D
Texture:			
Sand	30	65	78
Silt	67	30	20
Clay	3	5	2
Composition:			
Quartz	40	82	46
Feldspar	3	10	3
Mica	2	2	2
Heavy minerals	3	1	4
Glauconite	–	T	–
Carbonate unspec.	29	5	25
Foraminifers	–	–	3
Calc. nannofossils	3	–	2
Plant debris	–	–	3
Altered minerals	20	–	12

CARBONATE BOMB DATA:
•1, 90–92 cm = 3.0%
3, 90–92 cm = 0.0%

SITE 615 HOLE CORE 8 CORED INTERVAL 3341.6–3344.6 mbsl; 57.7–60.7 mbsf



LITHOLOGIC DESCRIPTION

Interbedded SILTY SAND (5Y 3/2), SILT-LAMINATED MUD (5Y 3/1, 5Y 5.5/2), and SILTY or SANDY MUD (5Y 4/2–5Y 2/2).

SILTY SAND: homogeneous, lower part completely disturbed.

SILT-LAMINATED MUD: variable frequency of very fine silt laminae, commonly scoured bases and sharp tops.

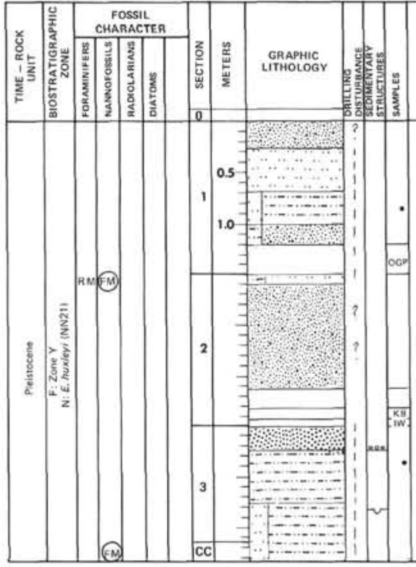
SILTY-SANDY MUD: very poorly sorted, homogeneous, sometimes disturbed structures, positive grading evident in one bed.

SMEAR SLIDE SUMMARY (%):

	1, 86	2, 61	2, 116
	D	D	D
Texture:			
Sand	0	20	60
Silt	95	70	35
Clay	5	10	5
Composition:			
Quartz	66	50	39
Feldspar	1	2	5
Mica	1	2	2
Heavy minerals	1	1	3
Carbonate unspec.	25	30	25
Foraminifers	–	10	15
Calc. nannofossils	3	5	5
Plant debris	1	T	1
Altered minerals	2	–	5

CARBONATE BOMB DATA:
•1, 105–107 cm = 0.0%

SITE 615 HOLE CORE 9 CORED INTERVAL 3351.1–3355.6 mbsl; 67.2–71.7 mbsf

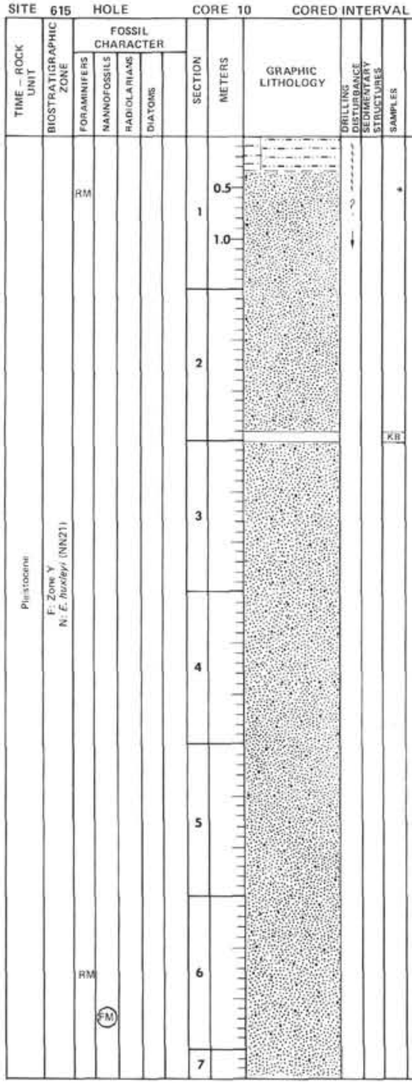


LITHOLOGIC DESCRIPTION

INTERBEDDED SILTY SAND (5Y 3.5/2), SILTY MUD (5Y 3/2) and SILT-LAMINATED MUD (5Y 3/2–5Y 5/2) – same as Core 615-8.

CARBONATE BOMB DATA:
•1, 89–91 cm = 1.5%
3, 40–42 cm = 1.5%

SITE 615 HOLE CORE 10 CORED INTERVAL 3360.6–3370.1 mbsl; 76.7–86.2 mbsf



LITHOLOGIC DESCRIPTION

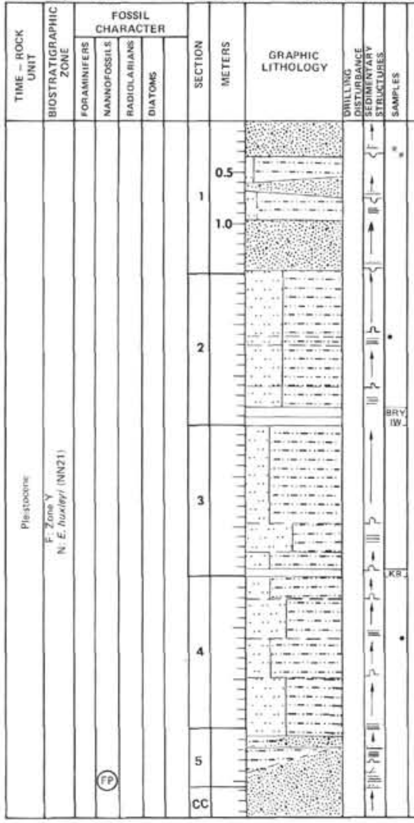
Section 1, 0–32 cm: SILTY MUD (5Y 3.5/1) with pockets and irregular streaks of sand and silt.

Section 1, 32 cm–Section 7: SILTY SAND (5Y 3/2), apparently structureless throughout. Mean size ~250 µm, fine–medium grained, maximum size 800–900 µm, possible positive grading in top 2 meters. Composition: quartz (65%), calcite (10–15%), altered grains (10%), feldspar (5%), heavy minerals (3–5%, amphibole, pyroxene, zircon, epidote, tourmaline), opaques and semi-opaques (3–5%), chert, lignite.

SMEAR SLIDE SUMMARY (%):

	1, 64
	D
Texture:	
Sand	69
Silt	30
Clay	1
Composition:	
Quartz	65
Feldspar	5
Mica	2
Heavy minerals	3
Clay	1
Pyrite/opaques	3
Micronodules	T
Carbonate unspec.	10
Foraminifers	T
Calc. nannofossils	T
Plant debris	1
Altered minerals	10

SITE 615 HOLE CORE 11 CORED INTERVAL 3370.1–3378.6 mbsl; 86.2–94.7 mbsf



LITHOLOGIC DESCRIPTION

Interbedded SILTY SANDS (5Y 3/2), SILT-LAMINATED MUDS (5Y 3.5/1), SLUMPED or CONTORTED LAMINATED MUDS (5Y 3.5/1) and SILTY MUDS (5Y 3.5/2).

SILTY SANDS (near base): thin graded turbidites, with classical turbidite structures; quartz-rich and lignitic; fine–medium grained grading to very fine-grained.

SILT-LAMINATED MUDS: classical fine-grained turbidites; clear to muddy, thick to very thin silt laminae in mud; silts are quartz-carbonate rich, authigenic carbonate more important than up-section.

CONTORTED or SLUMPED INTERVALS: silt-laminated muds (as above) but disturbed with probable slump-like structures.

SILTY MUDS: poorly-sorted "dirty" silty muds without distinct laminae; possible grading through some beds. May be interpreted as fine-grained debris-flow or slurry-flow or slump beds.

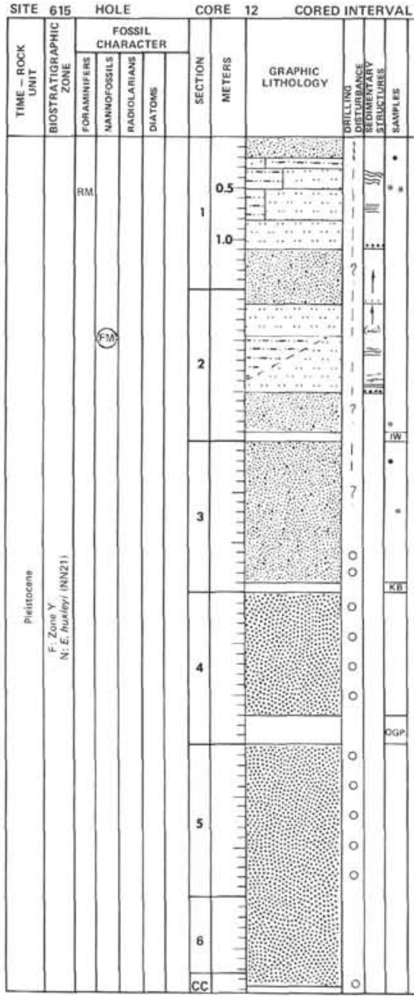
SMEAR SLIDE SUMMARY (%):

	1, 30	1, 35
	D	D
Texture:		
Sand	75	0
Silt	25	40
Clay	0	60
Composition:		
Quartz	60	28
Feldspar	10	T
Mica	2	T
Heavy minerals	8	T
Clay	—	60
Glauconite	T	—
Pyrite	T	—
Carbonate unspec.	15	10
Foraminifers	T	T
Calc. nannofossils	T	2
Plant debris	1	T
Altered minerals	3	—

CARBONATE BOMB DATA:

*2, 64–66 cm = 4.5%
4, 64–66 cm = 5.0%

SITE 615 HOLE CORE 12 CORED INTERVAL 3379.6–3389.1 mbsl; 95.7–105.2 mbsf



LITHOLOGIC DESCRIPTION

Interbedded SILTY SAND (5Y 3/1–5Y 4/1), SILTY MUD (5Y 3/1) and SILT-LAMINATED MUD (mainly 5Y 4.5/1).

SILTY MUD: very poorly sorted, mainly homogeneous or positively graded, but sometimes with disturbed structures, silt lenses and streaks.

SILT-LAMINATED MUDS: classical fine-grained turbidites with associated structures; very closely spaced often and difficult to distinguish individual depositional units.

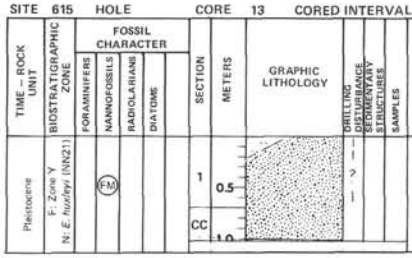
SILTY SAND, structureless, poorly sorted, fine–medium grained; quartz-carbonate rich, mineralogically and texturally immature; probably positive grading in top 1–2 meters of lower sand, and throughout other two sands.

SMEAR SLIDE SUMMARY (%):

	1, 51 D	1, 52 D	2, 137 D	3, 70 D
Texture:				
Sand	T	T	70	45
Silt	35	80	30	52
Clay	65	20	T	3
Composition:				
Quartz	15	40	60	50
Feldspar	3	2	5	30
Mica	1	2	3	1
Heavy minerals	1	3	3	4
Clay	65	20	T	–
Pyrite/opaques	1	2	2	T
Carbonate unspec.	8	30	15	15
Foraminifers	–	–	1	T
Calc. nannofossils	1	T	T	T
Plant debris	T	T	1	–
Altered minerals)	5	1	10	–

CARBONTE BOMB DATA:
•1, 21–23 cm = 6.0%
3, 21–23 cm = 0.0%

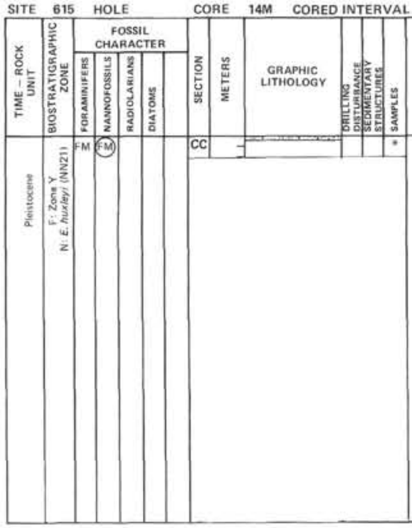
SITE 615 HOLE CORE 13 CORED INTERVAL 3389.1–3393.9 mbsl; 105.2–110.0 mbsf



LITHOLOGIC DESCRIPTION

SILTY SAND, 5Y 3/2, structureless apart from disturbed laminated silt towards the top; fine–medium grained; quartz-rich, lignitic.

SITE 615 HOLE CORE 14M CORED INTERVAL 3398.6 mbsl; 114.7 mbsf



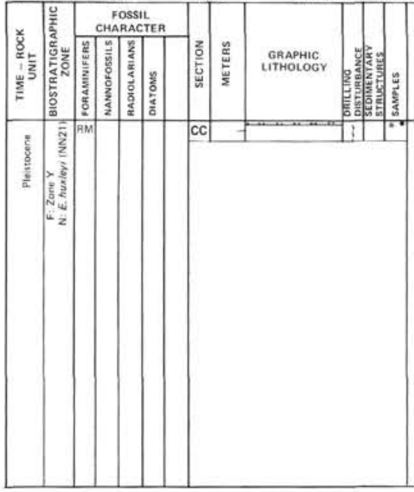
LITHOLOGIC DESCRIPTION

Two cm Core Catcher sample of gravelly muddy silty SAND. Very poorly sorted, Mixed immature composition including rock fragments, biogenics, rounded/polished quartz grains, feldspars, carbonates, micas, heavies, opaques, mica, etc. (from sieved sample).

SMEAR SLIDE SUMMARY (%):

	CC D
Texture:	
Sand	50
Silt	30
Clay	20
Composition:	
Quartz	48
Feldspar	5
Mica	2
Heavy minerals	5
Clay	20
Glauconite	T
Pyrite	T
Carbonate unspec.	15
Foraminifers	1
Plant debris	2
Shell debris	2

SITE 615 HOLE CORE 15 CORED INTERVAL 3408.1–3410.0 mbsl; 124.2–126.1 mbsf



LITHOLOGIC DESCRIPTION

Two cm Core Catcher sample of very firm silty mud–muddy silt; quartz-carbonate rich silt.

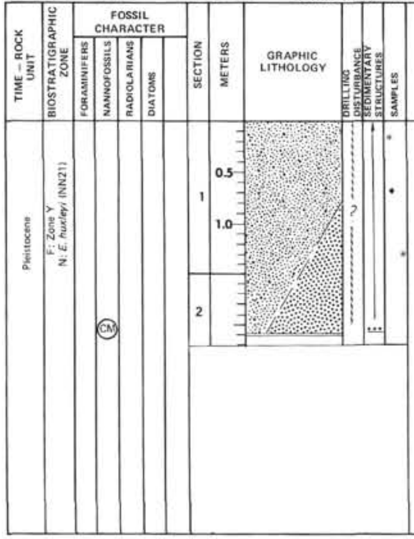
SMEAR SLIDE SUMMARY (%):

	CC
Texture:	
Sand	0
Silt	90
Clay	10
Composition:	
Quartz	54
Feldspar	2
Mica	T
Heavy minerals	3
Clay	10
Glauconite	1
Pyrite	T
Carbonate unspec.	30
Calc. nannofossils	T
Plant debris	T

CARBONATE BOMB DATA:

•CC, 0–2 cm = 11.5%

SITE 615 HOLE CORE 16 CORED INTERVAL 3417.6–3419.9 mbsl; 133.7–136.0 mbsf



LITHOLOGIC DESCRIPTION

SAND grading to SILTY SAND (5Y 3.5/2) (problems with coring, possibly disturbed) coarse sand at base → very fine sand at top; otherwise structureless; composition: quartz, feldspar, calcite, heavy minerals, opaques, forams, lignite; clay ball and clasts near base.

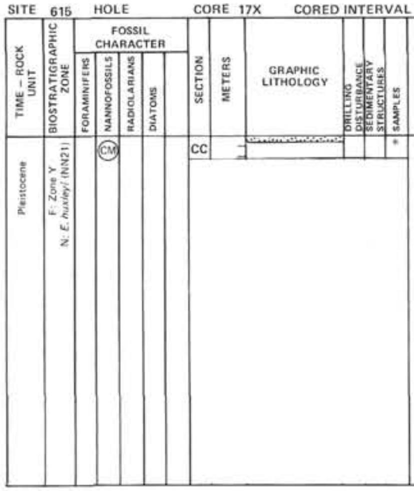
SMEAR SLIDE SUMMARY (%):

	1, 20 D	1, 130 D
Texture:		
Sand	85	85
Silt	15	15
Clay	T	T
Composition:		
Quartz	65	63
Feldspar	6	5
Mica	2	T
Heavy minerals	5	5
Glauconite	T	T
Pyrite/opaques	5	5
Carbonate unspec.	5	10
Foraminifers	1	T
Plant debris	1	2
Altered minerals	10	10

CARBONATE BOMB DATA:

• 1, 70–72 cm = 1.0%

SITE 615 HOLE CORE 17X CORED INTERVAL 3427.1–3436.6 mbsl; 143.2–152.7 mbsf



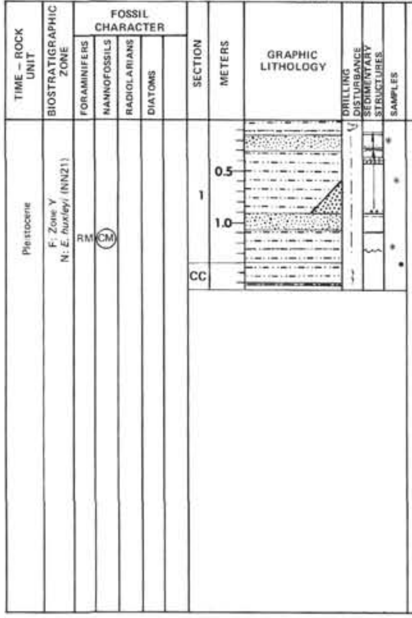
LITHOLOGIC DESCRIPTION

Core consisted of only 4 cm of medium-grained SAND in the Core Catcher. Maximum grain size ~ 1000 μm; mean μ300 μm. The SAND is poorly sorted and consists of quartz and authigenic calcite (replaces forams) + minor shell fragments. Overall color is dark olive gray (5Y 3/2).

SMEAR SLIDE SUMMARY (%):

	CC D
Texture:	
Sand	87
Silt	10
Clay	3
Composition:	
Quartz	25
Feldspar	2
Mica	2
Heavy minerals	3
Carbonate unspec.	60
Calc. nannofossils	1
Sponge spicules	T
Plant debris	2
Altered minerals	5

SITE 615 HOLE CORE 18X CORED INTERVAL 3436.6–3446.1 mbsl; 152.7–162.2 mbsf



LITHOLOGIC DESCRIPTION

MUD and SILTY MUD with 2 SILTY SAND beds.

MUD and SILTY MUD is dominantly dark olive black (5Y 2/2) and commonly includes silty sand blebs. SILTY MUD at 25–90 cm has indistinct very thin beds grading to MUD above 70 cm. These very thin beds – thick laminae are absent in the MUD section. There are two crossbedded silt laminae at 32–33 cm and 37 cm.

SILTY SAND beds are very dark gray (5Y 3/1), poorly sorted, quartz-carbonate rich, and probably graded.

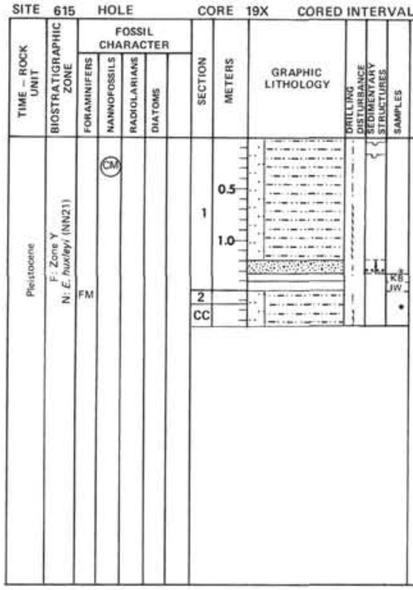
SMEAR SLIDE SUMMARY (%):

	1, 20 D	1, 60 D	1, 125 D
Texture:			
Sand	70	0	T
Silt	20	5	15
Clay	10	95	85
Composition:			
Quartz	18	2	9
Feldspar	5	1	T
Mica	1	T	1
Heavy minerals	1	1	1
Clay	–	85	75
Carbonate unspec.	40	–	8
Calc. nannofossils	10	10	5
Plant debris	3	1	1
Altered minerals	25	–	–

CARBONATE BOMB DATA:

•CC, 7–9 cm = 0.5%

SITE 615 HOLE CORE 19X CORED INTERVAL 3446.1–3455.6 mbsl; 162.2–171.7 mbsf



LITHOLOGIC DESCRIPTION

SILT-LAMINATED MUD (mainly dark olive gray [5Y 3/2]) and SILTY SAND (also 5Y 3/2).

SILT-LAMINATED MUDS include a few thin organic-rich layers and blebs (black [2.5Y 2/N2]). Interval from 68–120 cm is very deformed by drilling.

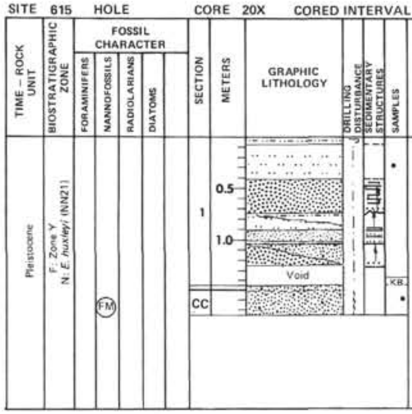
SILTY SAND at Section 1, 120–130 cm is graded from fine sand to very fine sand.

SMEAR SLIDE SUMMARY (%):

	1, 130
	D
Texture:	
Sand	0
Silt	10
Clay	90
Composition:	
Quartz	3
Feldspar	3
Mica	1
Heavy minerals	2
Clay	80
Foraminifers	T
Calc. nannofossils	10
Plant debris	1

CARBONATE BOMB DATA:
•CC, 6–8 cm = 1.5%

SITE 615 HOLE CORE 20X CORED INTERVAL 3455.6–3465.1 mbsl; 171.7–181.2 mbsf



LITHOLOGIC DESCRIPTION

Interbedded MUD, SILT, and SILTY SAND.

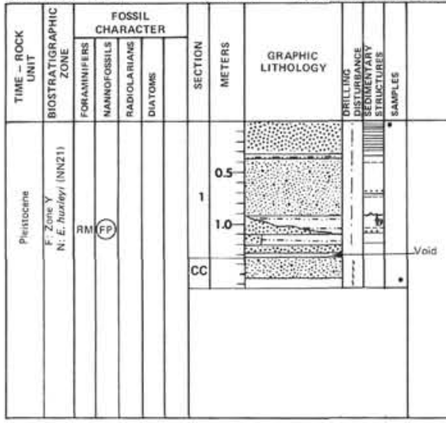
MUDS are olive gray to black (5Y 4/2–5Y 2/2) and homogeneous.

SILTS are dark olive gray to black (5Y 3/2–5Y 2/2) and organic-rich. The organic-rich SILT at Section 1, 77–90 cm grades up section to MUD.

SILTY SANDS are dark olive gray (5Y 3/2–5Y 3.5/2), fine- to medium-graded, thickly-laminated to thinly-bedded, and normally-graded.

CARBONATE BOMB DATA:
•1, 30–32 cm = 0.5%
CC, 18–20 cm = 0.0%

SITE 615 HOLE CORE 21X CORED INTERVAL 3465.1–3474.6 mbsl; 181.2–190.7 mbsf



LITHOLOGIC DESCRIPTION

Interbedded SAND, SILT-LAMINATED MUD, and SILTY MUD.

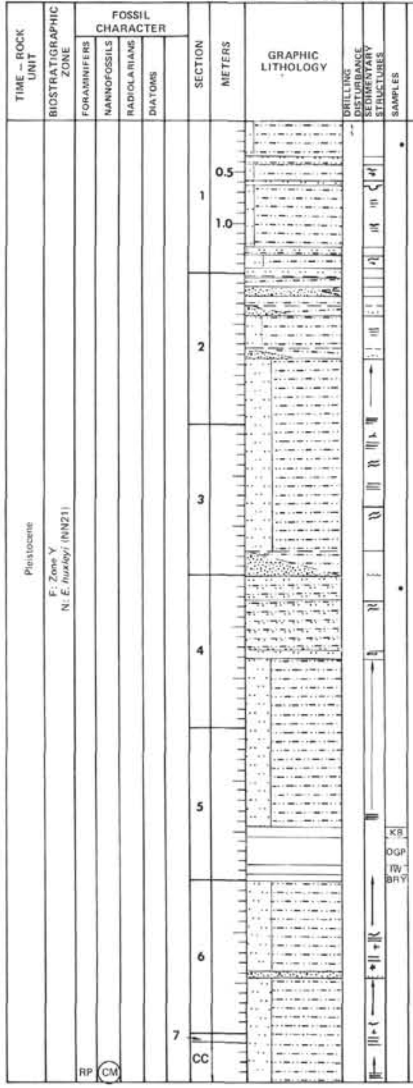
SAND: Fine- to medium-grained, very thin bedded or homogeneous, very dark gray to olive gray (5Y 3/1–5Y 3/2). One sand depositional unit from 35–90 cm with a scoured base; sand appears massive, but may be thinnly laminated about 62 cm and graded above 41 cm.

SILT-LAMINATED MUD at 32–35 cm, dark olive gray (5Y 3/2). Six thin laminae.

SILTY MUD, dark olive gray (5Y 3/2). Much of this seems to be remolded, deformed, and incorporated with MUD and SAND.

CARBONATE BOMB DATA:
•1, 5–7 cm = 0.0%
CC, 25–27 cm = 5.0%

SITE 615 HOLE CORE 22X CORED INTERVAL 3474.6–3484.1 mbsl; 190.7–200.2 mbsf



LITHOLOGIC DESCRIPTION

SILTY MUD (5Y 2/2) dominant throughout core with variable numbers and thicknesses of thin SILT laminae (5Y 4/1) and thin graded beds of darker (7.5YR 2.5/0) SILTY MUD with lignitic material common.

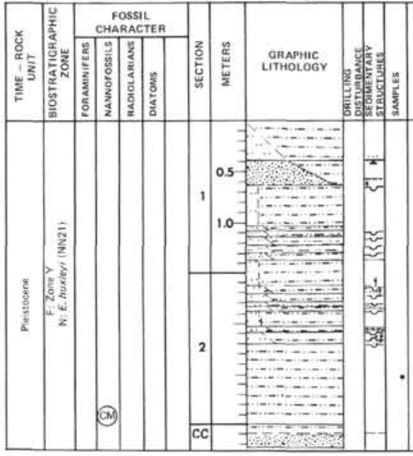
SILTY MUD: terrigenous, trace nannos.

SILT LAMINAE: thin, sometimes with fine-grained turbidite structures.

DARK SILTY MUD: commonly graded beds 5–15 cm thick, turbidites, poorly-sorted and lignite-rich.

CARBONATE BOMB DATA:
• 1, 26–28 cm = 0.5%
4, 18–20 cm = 0.5%

SITE 615 HOLE CORE 23X CORED INTERVAL 3484.1–3493.6 mbsl; 200.2–209.7 mbsf



LITHOLOGIC DESCRIPTION

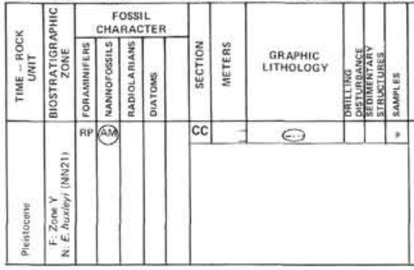
SILTY MUD (5Y 3/2) with thin graded SILT laminae and beds (5Y 7/1) and thicker graded darker (lignite-rich) SILTY SAND and SILTY MUD beds towards top and base of core.

SILT LAYERS with typical fine-grained turbidite structures including scoured/loaded sharp bases, cross-lamination, parallel lamination and positive grading.

SILTY MUD in bottom half of Section 2 is finer grained and apparently structureless.

CARBONATE BOMB DATA:
•2, 108–110 cm = 2.0%

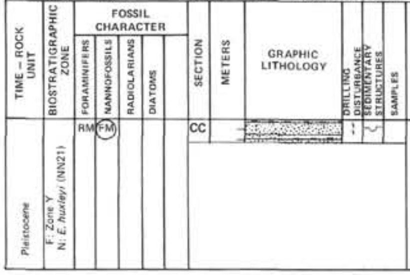
SITE 615 HOLE CORE 24X CORED INTERVAL 3493.6–3503.1 mbsl; 209.7–219.2 mbsf



LITHOLOGIC DESCRIPTION

This core recovered only one small (4 cm x 3 cm x 1 cm) bleb of dark olive gray (5Y 3/2) MUD.

SITE 615 HOLE CORE 25X CORED INTERVAL 3503.1–3512.6 mbsl; 219.2–228.7 mbsf



LITHOLOGIC DESCRIPTION

MUD and SILTY SAND were recovered in the Core Catcher; the rest of the core was empty.

MUD, dark olive gray (5Y 3/2) with olive gray (5Y 4/2) SILTY SAND blebs.

SILTY SAND, dark olive gray (5Y 3/2), poorly-sorted, fine- to medium-grained.

SITE 615 HOLE CORE 26X CORED INTERVAL 3512.6–3522.1 mbsl; 228.7–238.2 mbsf

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FOSSIL CHARACTER FORAMINIFERS	FOSSIL CHARACTER NANNOFOSSILS	FOSSIL CHARACTER RADIOLARIANS	FOSSIL CHARACTER DIATOMS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	SAMPLES
Pleistocene	F: Zone Y N: *E. huxleyi* (NN21)	FM	ⓒCM			CC			○		*

LITHOLOGIC DESCRIPTION

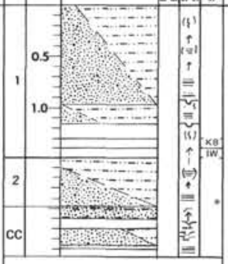
About 4 cm disturbed soupy sediment in Core Catcher: SILTY MUD, quartz/carbonate-rich silt fraction; and some nannos and calcareous needles.

SMEAR SLIDE SUMMARY (%):

	CC D
Texture:	
Sand	–
Silt	35
Clay	65
Composition:	
Quartz	20
Feldspar	T
Mica	T
Heavy minerals	T
Clay	65
Pyrite	T
Carbonate unspec.	10
Foraminifers	T
Plant debris	T

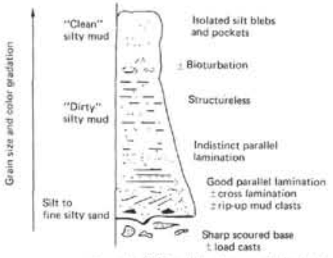
SITE 615 HOLE CORE 27X CORED INTERVAL 3522.1–3531.6 mbsl; 238.2–247.7 mbsf

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FOSSIL CHARACTER FORAMINIFERS	FOSSIL CHARACTER NANNOFOSSILS	FOSSIL CHARACTER RADIOLARIANS	FOSSIL CHARACTER DIATOMS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	SAMPLES
Pleistocene	F: Zone Y N: *E. huxleyi* (NN21)	RM	CM			1 2 CC					KB IW *



LITHOLOGIC DESCRIPTION

Interbedded MUDS, SILTY MUDS, and SILTY SANDS (5Y 5/2 ——→ 5Y 3.5/2) arranged in FOUR organized turbidites as below:



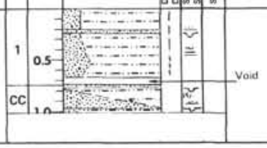
Some thin SILT turbidites between thicker beds.

SMEAR SLIDE SUMMARY (%):

	2, 44 D
Texture:	
Sand	40
Silt	55
Clay	5
Composition:	
Quartz	50
Feldspar	5
Mica	3
Heavy minerals	5
Clay	5
Glauconite	T
Pyrite	T
Carbonate unspec.	30
Foraminifers	T
Calc. nannofossils	1
Plant debris	1

SITE 615 HOLE CORE 28X CORED INTERVAL 3531.6–3541.1 mbsl; 247.7–257.2 mbsf

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FOSSIL CHARACTER FORAMINIFERS	FOSSIL CHARACTER NANNOFOSSILS	FOSSIL CHARACTER RADIOLARIANS	FOSSIL CHARACTER DIATOMS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	SAMPLES
Pleistocene	F: Zone Y N: *E. huxleyi* (NN21)	FM	FM			1 CC					

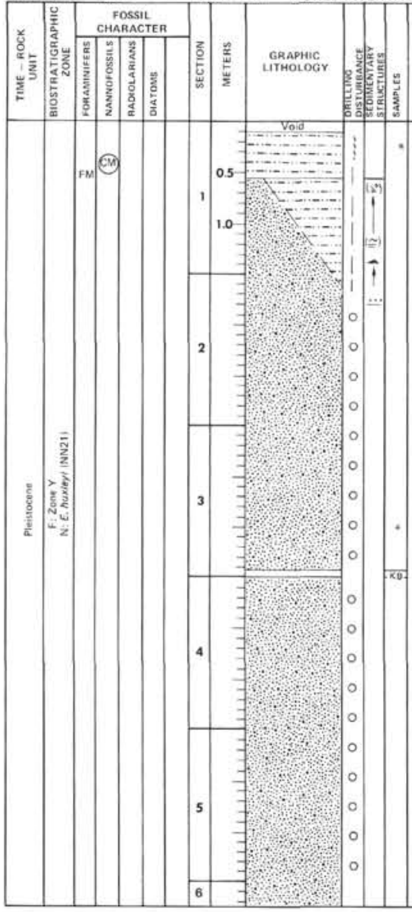


LITHOLOGIC DESCRIPTION

Interbedded MUD (5Y 3.5/2), SILTY SAND (5Y 4/2–5Y 5/2) and SILTY MUD (5Y 3.5/2) with indication of turbidite structures – but whole of first section disturbed.

Core Catcher has clear 15 cm thick turbidite.

SITE 615 HOLE CORE 29H CORED INTERVAL 3541.1–3549.1 mbsl; 257.2–265.2 mbsf



LITHOLOGIC DESCRIPTION

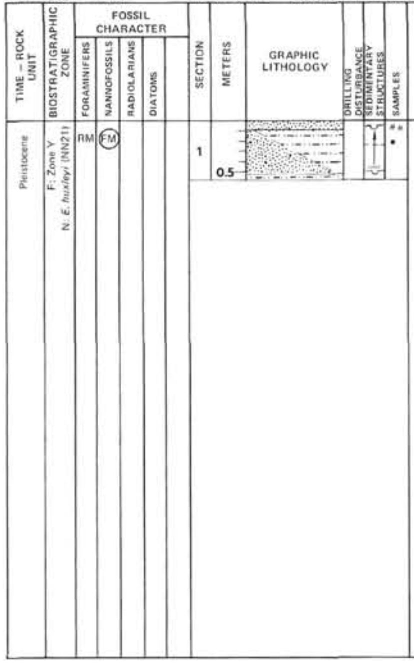
SILTY MUD (5Y 3.5/2) with irregular silt pockets overlying SILTY MUD (5Y 4/1.5) with coarser silt and sand grading down into SILTY SAND (5Y 4/2).

Top 2 m can be interpreted as a single turbidite with relatively sharp contact between sandy-silty part and overlying mud. Complete 8 m core shows possible subtle positive grading – but lower 6 m is probably flow-in.

SMEAR SLIDE SUMMARY (%):

	1, 26	3, 100
	D	D
Texture:		
Sand	0	60
Silt	30	40
Clay	70	0
Composition:		
Quartz	16	68
Feldspar	1	8
Mica	T	2
Heavy minerals	T	5
Clay	70	–
Glauconite	–	T
Pyrite	T	T
Carbonate unspec.	10	15
Foraminifers	T	–
Calc. nannofossils	2	T
Plant debris	1	2

SITE 615 HOLE CORE 30H CORED INTERVAL 3550.6–3551.6 mbsl; 266.7–267.7 mbsf



LITHOLOGIC DESCRIPTION

SILTY SAND (5Y 3/2) representing base of turbidite overlying SILTY MUD (5Y 2.5/2) grading down into SILTY SAND (5Y 3/2). Thin SILTY MUD at base.

Middle part of core is probably a 40 cm thick turbidite with clear positive grading.

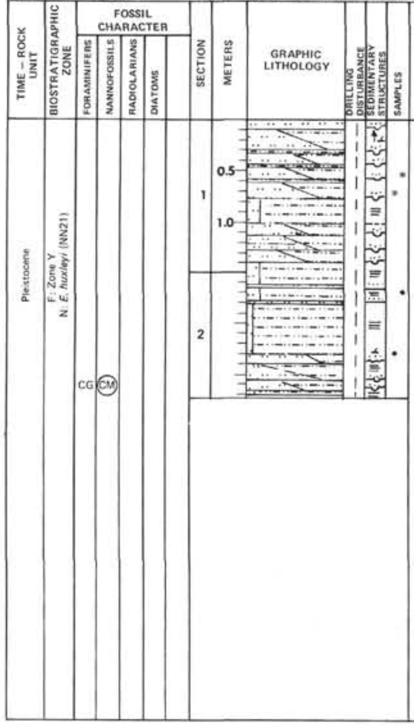
SMEAR SLIDE SUMMARY (%):

	1, 7	1, 9
	D	D
Texture:		
Sand	15	1
Silt	60	40
Clay	25	59
Composition:		
Quartz	55	20
Feldspar	5	3
Mica	1	2
Heavy minerals	2	3
Clay	25	59
Glauconite	–	T
Pyrite	T	T
Micronodules	–	T
Carbonate unspec.	10	12
Foraminifers	T	T
Calc. nannofossils	T	T
Plant debris	1	1
Altered minerals	1	–

CARBONATE BOMB DATA:
•1, 29–31 cm = 4.5%

Note: Core 31X, 3560.1–3569.6 mbsl; 276.2–285.7 mbsf: no recovery.

SITE 615 HOLE CORE 32X CORED INTERVAL 3569.6–3579.1 mbsl; 285.7–295.2 mbsf



LITHOLOGIC DESCRIPTION

SILTY MUD (5Y 3.5/1) with variable frequency and thickness of thin SILT laminae (5Y 4.5/2) and thicker SILT and darker SILTY MUD beds (5Y 4/2).

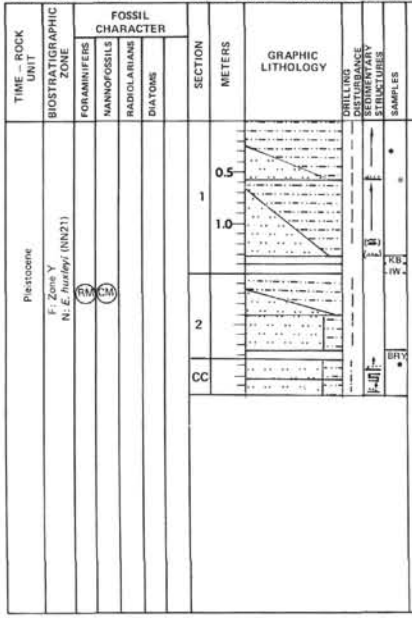
- Silt laminae can be very thin and structures barely distinguishable.
- Silt beds and dark silty-mud beds are positively graded and with a range of turbidite structures. At least two types of turbidites apparent:
  (a) fine, clean, well-sorted and well laminated silt turbidites; and
  (b) "dirty" coarser, poorly sorted, less well structured and commonly lignitic silty mud turbidites.

SMEAR SLIDE SUMMARY (%):

	1, 56	1, 72
	D	D
Texture:		
Sand	0	60
Silt	35	35
Clay	65	5
Composition:		
Quartz	10	53
Feldspar	2	12
Mica	T	3
Heavy minerals	2	5
Clay	65	5
Glauconite	–	T
Pyrite	T	T
Micronodules	T	–
Carbonate unspec.	8	10
Foraminifers	T	T
Calc. nannofossils	1	T
Plant debris	2	2
Altered minerals	10	10

CARBONATE BOMB DATA:
•2, 22–24 cm = 6.5%
2, 80–82 cm = 4.0%

SITE 615 HOLE CORE 33X CORED INTERVAL 3588.6–3598.1 mbsl; 304.7–314.2 mbsf



LITHOLOGIC DESCRIPTION

SILTY MUD, dark olive gray (5Y 3/2–5Y 3.5/2) and subtle color variations.

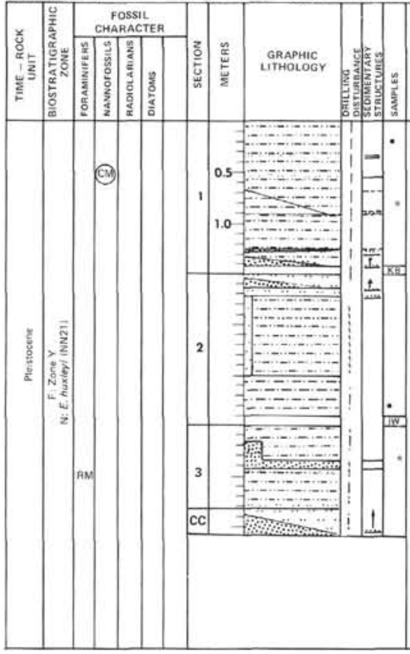
- Core consists of several thick "dirty" disorganized silty MUD turbidite-like layers as shown. These layers are rich in dispersed lignite, regularly layered with slight compositional variations, and positively graded from more-silty SILTY MUD to MUD. Lower turbidite in Section 1 looks somewhat like a debrite.

SMEAR SLIDE SUMMARY (%):

	1, 64
	D
Texture:	
Sand	0
Silt	26
Clay	74
Composition:	
Quartz	13
Feldspar	1
Mica	1
Heavy minerals	T
Clay	74
Pyrite	T
Micronodules	T
Carbonate unspec.	10
Calc. nannofossils	1
Plant debris	T

CARBONATE BOMB DATA:
•1, 33–35 cm = 8.0%
CC, 1–3 cm = 5.0%

SITE 615 HOLE CORE 34X CORED INTERVAL 3598.1–3607.6 mbsl; 314.2–323.7 mbsf



LITHOLOGIC DESCRIPTION

Interbedded MUDS, SILTY MUDS, and SANDS.

SANDS are olive gray to olive (5Y 4/2–5Y 4/3), fine- to coarse-grained, and graded (except for sand in Section 3, which is homogeneous).

SILTY MUDS are very dark grayish brown (10YR 3/2) and organic-rich.

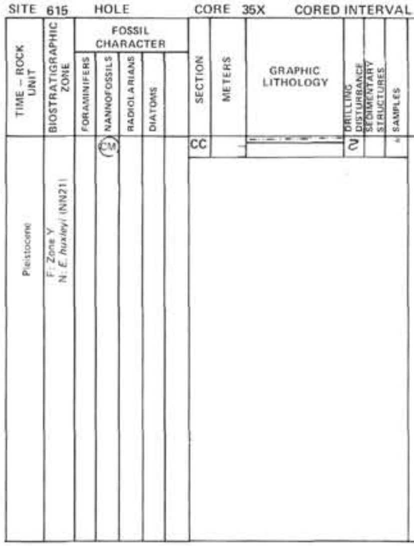
MUDS are dark olive gray to black (5Y 3/2–5Y 2/2). Homogeneous with occasional medium laminae of gray (5Y 5/1) silt and silt and sand blebs and occasional wood fragments. Silt and sand blebs may be due to drilling disturbance; regularly spaced "laminae" in muds may be drilling shear planes.

SMEAR SLIDE SUMMARY (%):

	1, 82	3, 35
	D	D
Texture:		
Sand	25	55
Silt	45	35
Clay	30	10
Composition:		
Quartz	55	74
Feldspar	T	T
Heavy minerals	T	1
Glauconite	–	T
Carbonate unspec.	45	25
Calc. nannofossils	T	–

CARBONATE BOMB DATA:
•1, 20–22 cm = 5.5%
2, 134–136 cm = 0.5%

SITE 615 HOLE CORE 35X CORED INTERVAL 3602.6–3617.1 mbsl; 323.7–333.2 mbsf



LITHOLOGIC DESCRIPTION

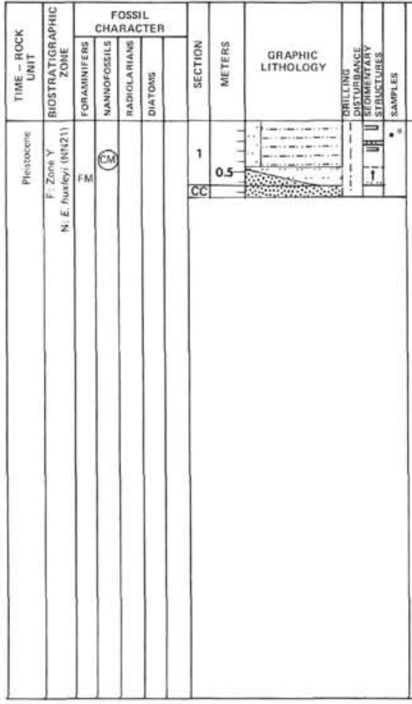
MUD, dark olive gray (5Y 3/2), homogeneous, and very deformed.

Recovered MUD in Core Catcher only; rest of core is empty.

SMEAR SLIDE SUMMARY (%):

	CC
	D
Texture:	
Sand	1
Silt	35
Clay	64
Composition:	
Quartz	14
Feldspar	T
Mica	1
Heavy minerals	2
Clay	64
Volcanic glass	5
Pyrite	T
Micronodules	T
Zeolite	T
Carbonate unspec.	14
Calc. nannofossils	T
Plant debris	T

SITE 615 HOLE CORE 36X CORED INTERVAL 3617.1–3626.6 mbsl; 333.2–342.7 mbsf



LITHOLOGIC DESCRIPTION

MUD with SILT layers. SAND.

MUD is dark olive gray (5Y 2.5/2). Includes SILT layers and blebs: dark gray (5Y 4/1) with structures preserved in coarser-grained/thicker beds.

SAND is dark olive gray (5Y 3/2) and medium-fine grained. SAND in Section 1 is normally-graded.

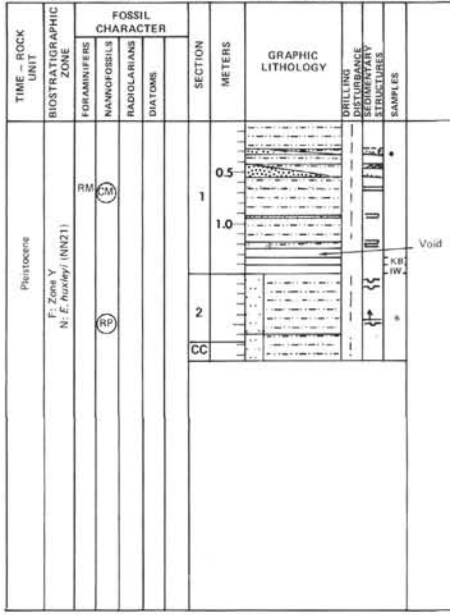
SMEAR SLIDE SUMMARY (%):

	1, 12
	D
Texture:	
Sand	0
Silt	25
Clay	75
Composition:	
Quartz	9
Feldspar	1
Mica	T
Heavy minerals	T
Clay	75
Palagonite	T
Pyrite	T
Micronodules	T
Zeolite	T
Carbonate unspec.	8
Foraminifers	T
Calc. nannofossils	T
Plant debris	T
Other	5

CARBONATE BOMB DATA:
• 1, 15–17 cm = 6.5%

Note: Core 37X, 3626.6–3636.1 mbsl; 342.7–352.2 mbsf: no recovery.

SITE 615 HOLE CORE 38X CORED INTERVAL 3636.1–3645.6 mbsl; 352.2–361.7 mbsf



LITHOLOGIC DESCRIPTION

MUD with SILT and SAND laminae.

MUD is dark olive gray (5Y 3/2); SILTS are olive gray (5Y 5/2) and SANDS are gray (5Y 5/1). Some of the thicker sand beds are graded and contain intercalated organic-rich laminations.

SMEAR SLIDE SUMMARY (%):

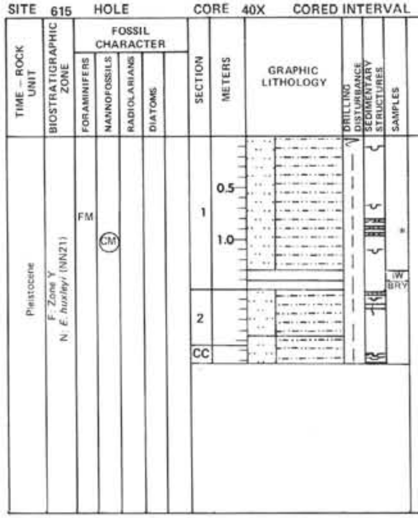
	2, 47
	D
Texture:	
Sand	15
Silt	50
Clay	35
Composition:	
Quartz	32
Feldspar	5
Mica	2
Heavy minerals	3
Clay	35
Pyrite	T
Micronodules	T
Carbonate unspec.	15
Calc. nannofossils	T
Plant debris	1
Altered minerals	7

CARBONATE BOMB DATA:

• 1, 36–38 cm = 5.0%

Note: Core 39X, 3645.6–3655.1 mbsl; 361.7–371.2 mbsf no recovery.

SITE 615 HOLE CORE 40X CORED INTERVAL 3655.1–3664.6 mbsl; 371.2–380.7 mbsf



LITHOLOGIC DESCRIPTION

MUD with SILT layers and blebs.

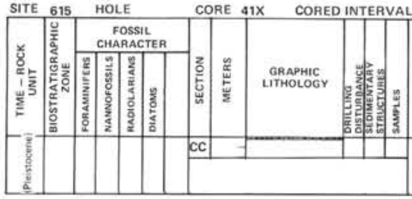
MUD is dark olive gray (5Y 3/2), organic-rich, and slightly silty.

SILT layers and blebs range from black to light olive gray (5Y 2/2–5Y 7/2). The thicker silt layers have scoured lower surfaces and cross-laminations.

SMEAR SLIDE SUMMARY (%):

	1, 94
Texture:	
Sand	0
Silt	99
Clay	1
Composition:	
Quartz	62
Mica	1
Heavy minerals	1
Carbonate unspec.	30
Foraminifers	5
Calc. nannofossils	1
Sponge spicules	T

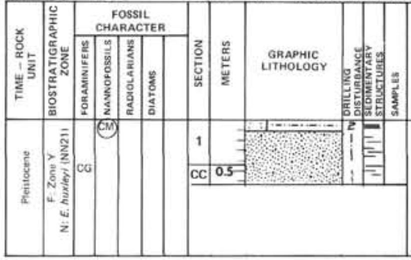
SITE 615 HOLE CORE 41X CORED INTERVAL 3664.6–3674.1 mbsl; 380.7–390.2 mbsf



LITHOLOGIC DESCRIPTION

Core Catcher contained one handful of medium-grained SAND. Rest of core was EMPTY.

SITE 615 HOLE CORE 42X CORED INTERVAL 3683.6–3693.1 mbsl; 399.7–409.2 mbsf



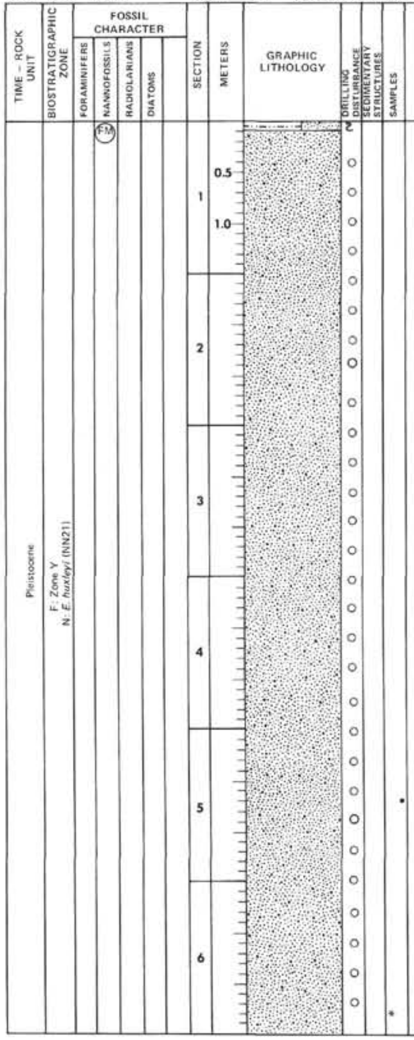
LITHOLOGIC DESCRIPTION

SANDY SILT and MUD with sand laminae.

SANDY SILT is dark gray to olive gray (5Y 4/1–5Y 4/2.5) and indistinctly laminated.

MUD (Section 1, 0–8 cm) is dark olive gray (5Y 3/2) and contains thin silt layers 1–4 mm thick.

SITE 615 HOLE CORE 43H CORED INTERVAL 3693.1–3702.6 mbsl; 409.2–418.7 mbsf



LITHOLOGIC DESCRIPTION

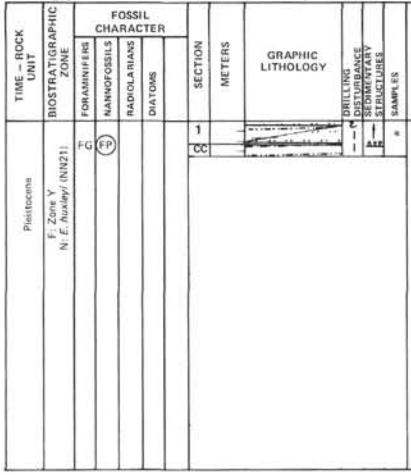
Disturbed muddy top over a full core barrel of soupy silty sand or sandy silt, highly disturbed by flow-in.

SMEAR SLIDE SUMMARY (%):

	6, 130
	D
Texture:	
Sand	15
Silt	80
Clay	5
Composition:	
Quartz	57
Feldspar	25
Mica	T
Heavy minerals	8
Clay	5
Carbonate unspec.	5
Calc. nannofossils	T

CARBONATE BOMB DATA:
*5, 70–72 cm = 0.0%

SITE 615 HOLE CORE 44H CORED INTERVAL 3702.6–3704.6 mbsl; 418.7–420.7 mbsf



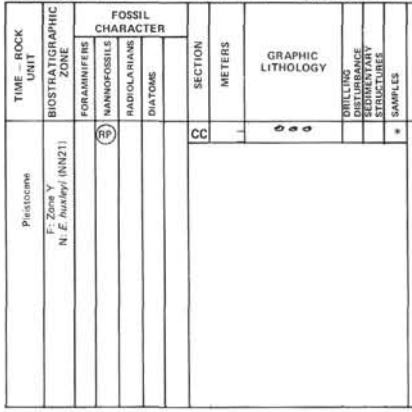
LITHOLOGIC DESCRIPTION

MUD, dark olive gray (5Y 3.5/1–5Y 3/2) with silt blebs and laminae. Section 1, 6–20 cm is a graded, "dirty" silty mud turbidite.

SMEAR SLIDE SUMMARY (%):

	1, 17
	D
Texture:	
Sand	5
Silt	50
Clay	45
Composition:	
Quartz	25
Feldspar	6
Mica	T
Heavy minerals	T
Clay	45
Pyrite	T
Carbonate unspec.	20
Calc. nannofossils	T
Plant debris (lignite)	1
Altered minerals	3

SITE 615 HOLE CORE 45X CORED INTERVAL 3704.6–3712.1 mbsl; 420.7–428.2 mbsf



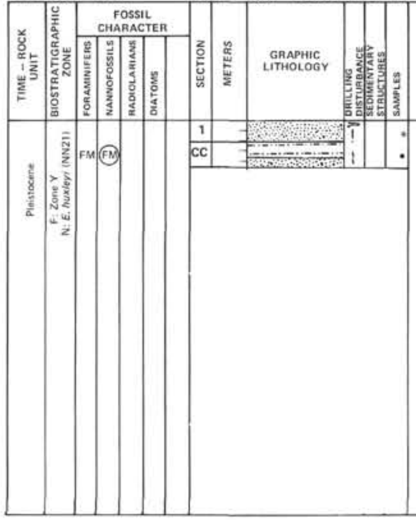
LITHOLOGIC DESCRIPTION

Recovered a couple balls of MUD from the Core Catcher. Rest of core is empty.

SMEAR SLIDE SUMMARY (%):

	CC
	D
Texture:	
Sand	25
Silt	45
Clay	30
Composition:	
Quartz	42
Feldspar	14
Mica	T
Heavy minerals	3
Clay	30
Carbonate unspec.	20
Plant debris	1

SITE 615 HOLE CORE 46X CORED INTERVAL 3721.6–3731.1 mbsl; 437.7–447.2 mbsf



LITHOLOGIC DESCRIPTION

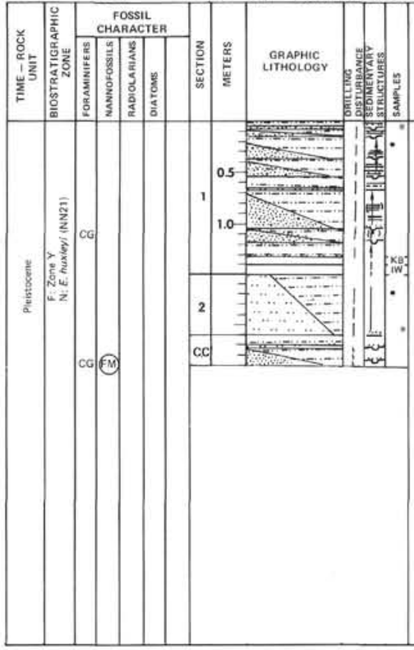
SANDY SILT, dark olive gray (5Y 3/2–5Y 3.5/2). Includes clay chips and indistinct laminae of organic-rich (black) silty mud.

SMEAR SLIDE SUMMARY (%):

	1, 18
	D
Texture:	
Sand	25
Silt	70
Clay	5
Composition:	
Quartz	50
Feldspar	15
Mica	1
Heavy minerals	2
Clay	5
Volcanic glass	T
Carbonate unspec.	25
Foraminifers	T
Calc. nannofossils	T
Plant debris	2

CARBONATE BOMB DATA:
•CC, 18 cm = 0.5%

SITE 615 HOLE CORE 47X CORED INTERVAL 3740.6–3750.1 mbsl; 456.7–466.2 mbsf



LITHOLOGIC DESCRIPTION

SAND, SILT, and SILTY SAND turbidites interbedded with SILTY MUD and MUD layers.

SAND, SILT, and SILTY SAND turbidites are of variable thickness as shown in "Sedimentary Structures" column. Olive gray (5Y 4/2), graded, poorly-sorted, and locally crossbedded.

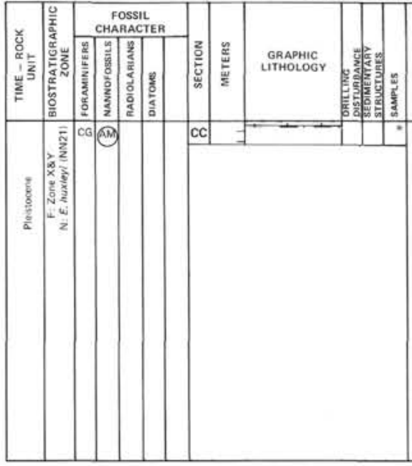
SILTY MUD and MUD interbeds are thin, dark olive gray (5Y 3/2–5Y 3.5/2), and contain tiny blebs of lignite and silt.

SMEAR SLIDE SUMMARY (%):

	1, 4	2, 57
	D	D
Texture:		
Sand	85	25
Silt	15	70
Clay	0	5
Composition:		
Quartz	70	50
Feldspar	20	16
Heavy minerals	3	5
Clay	–	5
Volcanic glass	T	T
Glauconite	T	–
Pyrite/opaques	7	4
Carbonate unspec.	–	20
Foraminifers	–	T
Calc. nannofossils	–	T
Plant debris	–	T

CARBONATE BOMB DATA:
•1, 24–26 cm = 0.0%
2, 24–26 cm = 4.0%

SITE 615 HOLE CORE 48X CORED INTERVAL 3759.6–3769.1 mbsl; 475.7–485.2 mbsf



LITHOLOGIC DESCRIPTION

Four cm Core Catcher sample only.

0–2 cm: SILTY MUD, dark olive gray (5Y 3.5/2), "dirty", and lignitic. Deposited during Ericson Zone Y.

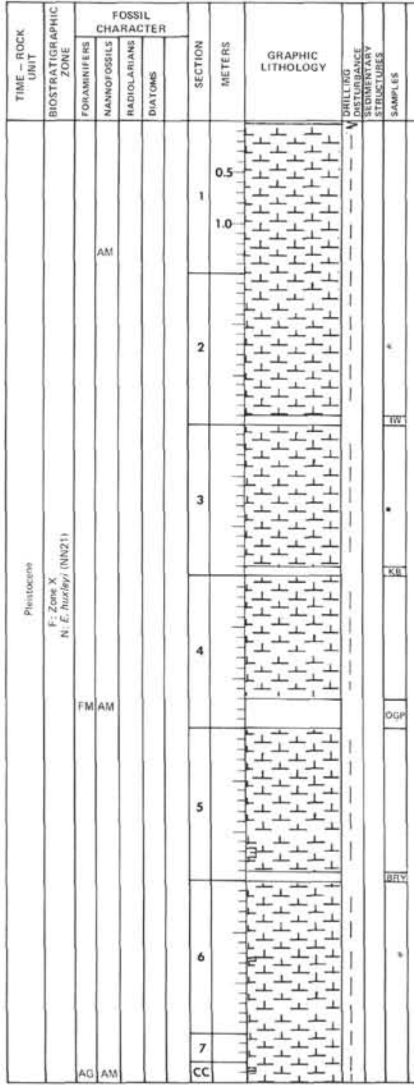
2–4 cm: NANNOFOSSIL OOZE, light greenish gray (5GY 7/1). Deposited during Ericson Zone X.

Shipboard scientsts interpret the nannofossil ooze recovered in the Core Catcher to have come from the base of the cored interval, contiguous with the nannofossil ooze recovered in Core 49 below. The top of the calcareous ooze therefore occurs at ~485.2 mbsf (see site chapter for details).

SMEAR SLIDE SUMMARY (%):

	CC, 3		
Texture:			
Sand	T	Pyrite/opaques	T
Silt	10	Carbonate unspec.	10
Clay	90	Foraminifers	T
Composition:		Calc. nannofossils	90
Quartz	T	Sponge spicules	T

SITE 615 HOLE CORE 49X CORED INTERVAL 3769.1–3778.6 mbsl; 485.2–494.7 mbsf



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE, gray (5Y 6/1) and very homogeneous with tiny dark greenish gray (5GY 4/1) silt blebs at Section 5, 115–123 cm; Section 6, 72–75 cm; and Core Catcher, 5–7 cm.

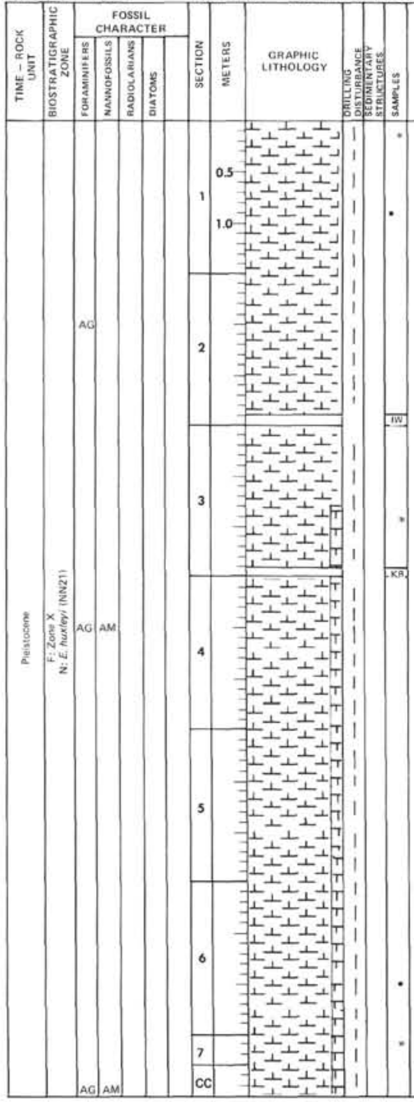
SMEAR SLIDE SUMMARY (%):

	2, 70	6, 75
	D	M
Texture:		
Sand	0	0
Silt	10	70
Clay	90	30
Composition:		
Quartz	–	2
Mica	–	T
Clay	–	46
Micronodules	–	1
Carbonate unspec.	5	15
Foraminifers	T	1
Calc. nannofossils	95	5
Sponge spicules	–	T
Altered minerals	–	30

CARBONATE BOMB DATA:

•3, 87–89 cm = 81.0%

SITE 615 HOLE CORE 50X CORED INTERVAL 3778.6–3788.1 mbsl; 494.7–504.2 mbsf



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE becoming FORAM NANNOFOSSIL OOZE below Section 3, 80 cm. Gray (5Y 6/1) and fairly homogeneous. Includes little blebs of foram-rich ooze and silt. Dispersed organic material and coarse shell fragments more common below Section 6, 75 cm (especially Section 6, 95–105 cm).

SMEAR SLIDE SUMMARY (%):

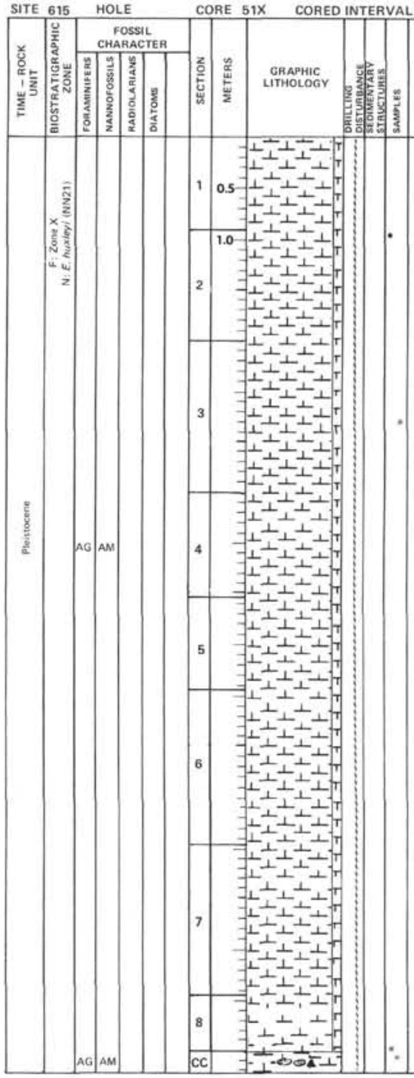
	1, 15	3, 95	7, 10
	D	D	D
Texture:			
Sand	T	10	4
Silt	10	25	22
Clay	90	65	74
Composition:			
Quartz	T	T	T
Pyrite	–	T	–
Micronodules	T	T	T
Carbonate unspec.	15	20	20
Foraminifers	1	15	10
Calc. nannofossils	84	65	70
Sponge spicules	T	T	T
Lithics	–	T	–

CARBONATE BOMB DATA:

•1, 91–93 cm = 76.0%

6, 100–102 cm = 73.0%

SITE 615 HOLE CORE 51X CORED INTERVAL 3788.1–3797.6 mbsl; 504.2–513.7 mbsf



LITHOLOGIC DESCRIPTION

FORAM NANNOFOSSIL OOZE, gray (5Y 5.5/1) and homogeneous.

Note: this core had to be heated, beaten, and extruded out of the core barrel. As a result, the sediment is quite deformed and the sections are not cut to standard 150 cm lengths – section numbers and lengths are indicated in "Section" column.

Core Catcher contains NANNOFOSSIL OOZE with clasts of red clay, green clay, chert, and white nannofossil ooze.

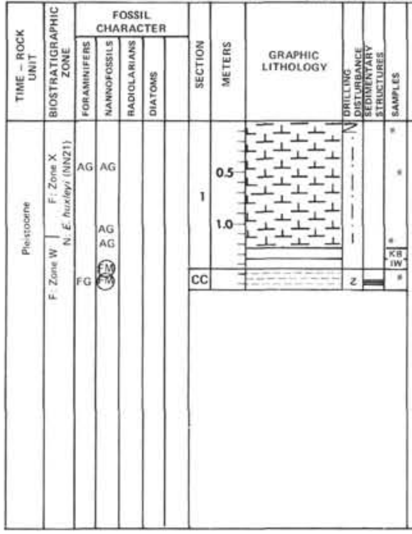
SMEAR SLIDE SUMMARY (%):

	3, 80	CC, 1	CC
	D	D	M
Texture:			
Sand	0	1	0
Silt	35	9	0
Clay	65	90	100
Composition:			
Mica	T	T	–
Pyrite	–	–	T
Carbonate unspec.	15	2	T
Foraminifers	10	3	–
Calc. nannofossils	75	95	100

CARBONATE BOMB DATA:

*2, 9–11 cm = 61.0%

SITE 615 HOLE CORE 52X CORED INTERVAL 3797.6–3807.1 mbsl; 513.7–523.2 mbsf



LITHOLOGIC DESCRIPTION

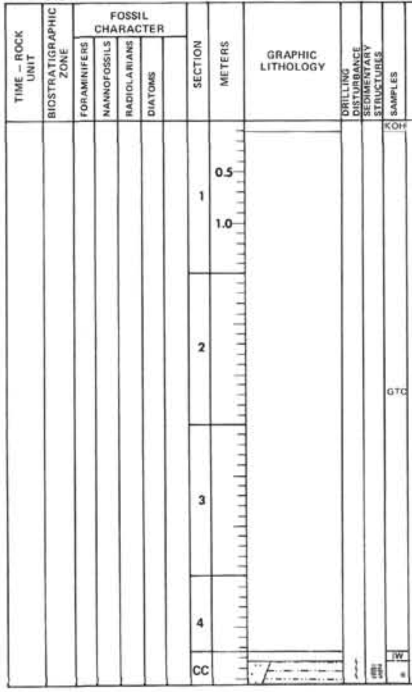
Section 1: NANNOFOSSIL OOZE, color grades downsection from light gray (10YR 7/1; 0–30 cm) to light brownish gray (2.5Y 6/2–10YR 6/2; 30–115 cm) to dark grayish brown (10YR 4/2; 115–124 cm).

Core Catcher: CLAY. Dark olive gray (10YR 3/2) with faint, wavy, discontinuous laminae.

SMEAR SLIDE SUMMARY (%):

	1, 10	1, 50	1, 123	CC, 10
	D	D	D	D
Texture:				
Sand	T	1	0	0
Silt	20	10	10	5
Clay	80	89	90	95
Composition:				
Quartz	T	–	–	–
Mica	T	T	T	–
Heavy minerals	–	–	T	–
Clay	–	–	–	90
Pyrite	T	–	–	–
Carbonate unspec.	–	–	2	10
Foraminifers	2	5	2	–
Calc. nannofossils	98	95	96	–
Sponge spicules	–	T	–	–
Bryozoan	–	T	–	–

SITE 615 HOLE A CORE 1H CORED INTERVAL 3285.9–3291.5 mbsl; 0.0–5.6 mbsf



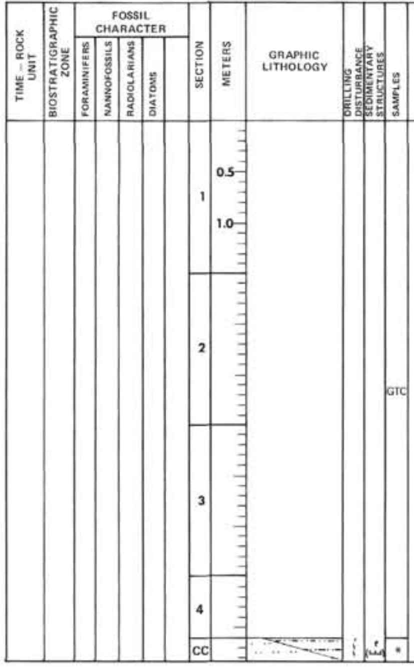
LITHOLOGIC DESCRIPTION

Core Catcher consists of very deformed, dark grayish brown (10YR 4/2) MUD with discontinuous, thin silt laminae. Silt laminae are very dark grayish brown (2.5Y 3/2).

SMEAR SLIDE SUMMARY (%):

	CC, 28 D
Texture:	
Sand	0
Silt	30
Clay	70
Composition:	
Quartz	5
Mica	T
Heavy minerals	5
Clay	70
Palagonite	T
Carbonate unspec.	15
Calc. nannofossils	5
Diatoms	T
Plant debris	T

SITE 615 HOLE A CORE 2H CORED INTERVAL 3291.5–3296.8 mbsl; 5.6–10.9 mbsf



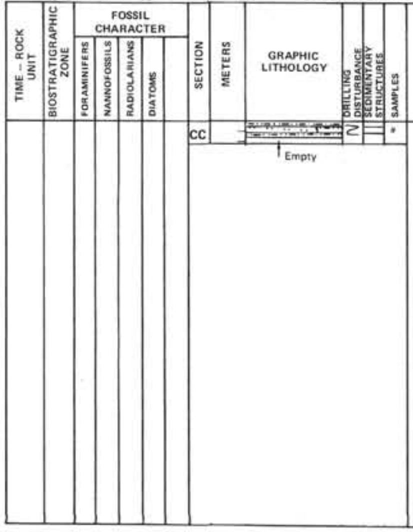
LITHOLOGIC DESCRIPTION

Core Catcher consists of very dark olive gray (5Y 3.5/2) SILT grading upsection to SILTY MUD.

SMEAR SLIDE SUMMARY (%):

	CC, 15 D
Texture:	
Sand	10
Silt	80
Clay	10
Composition:	
Quartz	63
Feldspar	5
Mica	2
Heavy minerals	5
Clay	5
Pyrite	T
Micronodules	T
Carbonate unspec.	10
Calc. nannofossils	T
Plant debris	T
Altered minerals	10

SITE 615 HOLE A CORE 3H CORED INTERVAL 3300.9–3301.4 mbsl; 15.0–15.5 mbsf



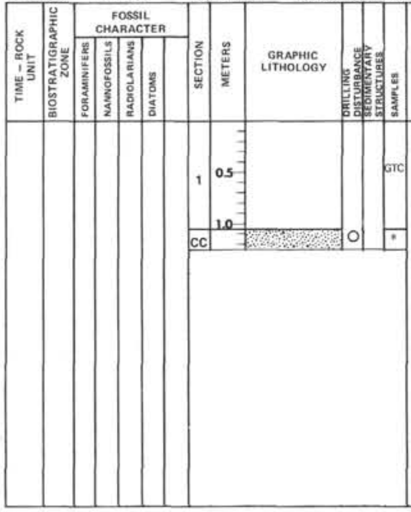
LITHOLOGIC DESCRIPTION

Core Catcher consists of dark olive gray (5Y 3/2–5Y 3.5/2) MUD with a layer of dark olive gray (5Y 3.5/2) SILTY MUD inbetween. SILTY MUD is very poorly sorted, "dirty", and contains a lot of lignite and woody material.

SMEAR SLIDE SUMMARY (%):

	CC, 10 D
Texture:	
Sand	20
Silt	50
Clay	30
Composition:	
Quartz	30
Feldspar	5
Mica	3
Heavy minerals	3
Clay	30
Glauconite	T
Pyrite	T
Micronodules	T
Carbonate unspec.	15
Foraminifers	T
Calc. nannofossils	T
Plant debris (+ woody)	4
Altered minerals	10

SITE 615 HOLE A CORE 4H CORED INTERVAL 3305.4–3306.7 mbsl; 19.5–20.8 mbsf



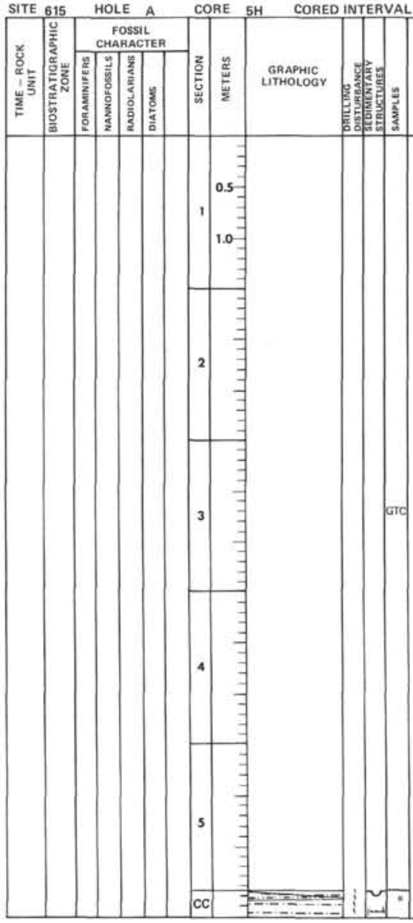
LITHOLOGIC DESCRIPTION

Core Catcher consists of dark olive gray (5Y 3/2), structureless, slightly soupy, very poorly sorted SILTY SAND.

SMEAR SLIDE SUMMARY (%):

	CC, 10 D
Texture:	
Sand	60
Silt	35
Clay	5
Composition:	
Quartz	55
Feldspar	3
Mica	2
Clay	5
Glauconite	T
Pyrite	T
Carbonate unspec.	15
Foraminifers	T
Calc. nannofossils	T
Plant debris	T
Altered minerals and rock fragments	20

SITE 615 HOLE A CORE 5H CORED INTERVAL 3314.8–3324.1 mbsl; 28.9–38.2 mbsf



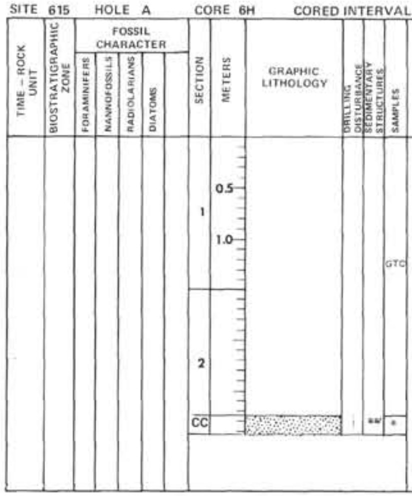
LITHOLOGIC DESCRIPTION

Core Catcher consists of interbedded SILTS and SILT-LAMINATED MUDS, dark olive gray (5Y 3/2).

SMEAR SLIDE SUMMARY (%):

	CC, 10 D
Texture:	
Sand	0
Silt	25
Clay	75
Composition:	
Quartz	9
Feldspar	T
Mica	T
Heavy minerals	T
Clay	75
Palagonite	T
Pyrite	T
Micronodules	T
Carbonate unspec.	13
Calc. nannofossils	3
Plant debris	T

SITE 615 HOLE A CORE 6H CORED INTERVAL 3324.1–3333.4 mbsl; 38.2–47.5 mbsf



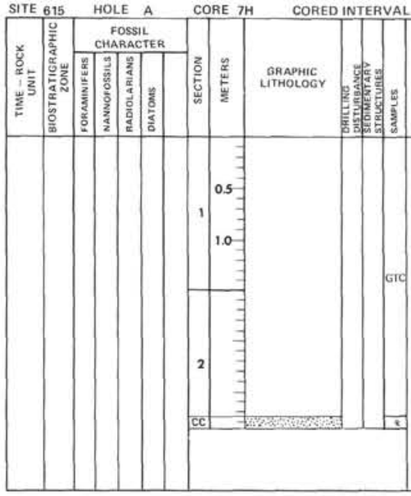
LITHOLOGIC DESCRIPTION

Core Catcher consists of dark olive gray (5Y 3/2), "dirty" SILTY SAND. An indistinct, black (5Y 2.5/2) lignite and plant-rich layer occurs at Core Catcher, 6 cm.

SMEAR SLIDE SUMMARY (%):

	CC, 9
	D
Texture:	
Sand	55
Silt	40
Clay	5
Composition:	
Quartz	50
Feldspar	8
Mica	2
Heavy minerals	5
Clay	5
Carbonate unspec.	15
Foraminifers	T
Calc. nannofossils	T
Plant debris	T
Altered minerals	15

SITE 615 HOLE A CORE 7H CORED INTERVAL 3333.4–3339.4 mbsl; 47.5–53.5 mbsf



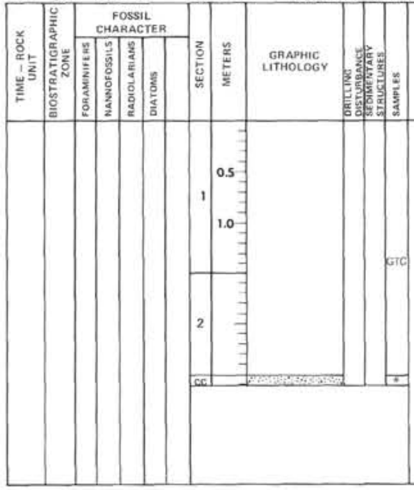
LITHOLOGIC DESCRIPTION

Core Catcher consists of olive gray (5Y 4/2), structureless, slightly soupy, very poorly sorted SILTY SAND.

SMEAR SLIDE SUMMARY (%):

	CC, 9
	D
Texture:	
Sand	60
Silt	30
Clay	10
Composition:	
Quartz	60
Feldspar	2
Mica	T
Heavy minerals	T
Clay	10
Pyrite/opaques	T
Carbonate unspec.	13
Foraminifers	T
Calc. nannofossils	T
Plant debris	T
Altered minerals	15

SITE 615 HOLE A CORE 8H CORED INTERVAL 3342.8–3345.8 mbsl; 56.9–59.9 mbsf



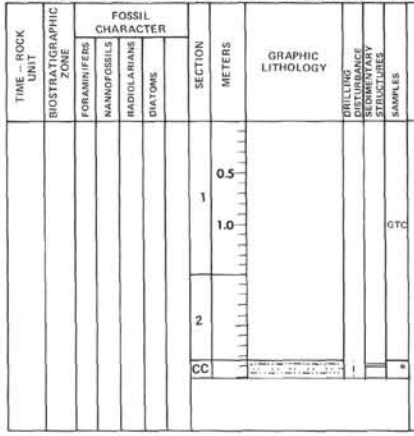
LITHOLOGIC DESCRIPTION

Core Catcher consists of olive gray (5Y 4/2) structureless, slightly soupy, very poorly sorted SILTY SAND.

SMEAR SLIDE SUMMARY (%):

	CC, 5
	D
Texture:	
Sand	70
Silt	25
Clay	5
Composition:	
Quartz	65
Feldspar	2
Mica	1
Heavy minerals	1
Clay	5
Glauconite	T
Pyrite/opaques	1
Carbonate unspec.	15
Foraminifers	T
Calc. nannofossils	T
Plant debris	T
Altered minerals	10

SITE 615 HOLE A CORE 9H CORED INTERVAL 3352.2–3354.7 mbsl; 66.3–68.8 mbsf



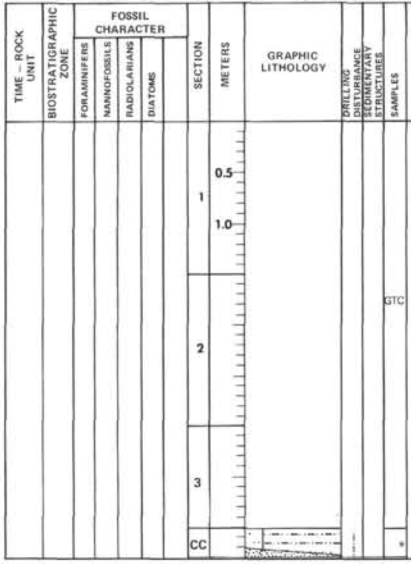
LITHOLOGIC DESCRIPTION

Core Catcher consists of dark olive gray (5Y 3/2) homogeneous MUD with two thin SILT laminae.

SMEAR SLIDE SUMMARY (%):

	CC, 12
	D
Texture:	
Sand	0
Silt	15
Clay	85
Composition:	
Quartz	5
Feldspar	T
Heavy minerals	2
Clay	80
Palagonite	T
Pyrite/opaques	T
Carbonate unspec.	8
Calc. nannofossils	5
Plant debris	T

SITE 615 HOLE A CORE 10H CORED INTERVAL 3370.4–3374.9 mbsl; 84.5–89.0 mbsf



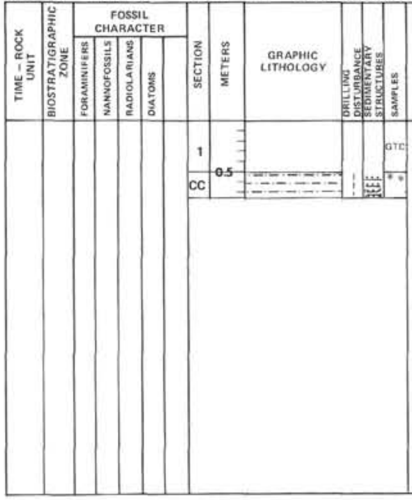
LITHOLOGIC DESCRIPTION

Core Catcher consists of MUD with thin, indistinct SILTY MUD laminae (Core Catcher, 0–11 cm) overlying an indistinctly graded, "dirty" layer of SANDY SILT (Core Catcher, 11–20 cm). All dark olive gray (5Y 3/2).

SMEAR SLIDE SUMMARY (%):

	CC, 18 D
Texture:	
Sand	40
Silt	50
Clay	10
Composition:	
Quartz	55
Feldspar	1
Mica	T
Heavy minerals	1
Clay	10
Volcanic glass	1
Palagonite	T
Pyrite/opaques	5
Carbonate unspec.	15
Calc. nannofossils	T
Plant debris	T
Altered minerals	12

SITE 615 HOLE A CORE 11H CORED INTERVAL 3379.9–3380.0 mbsl; 94.0–95.0 mbsf



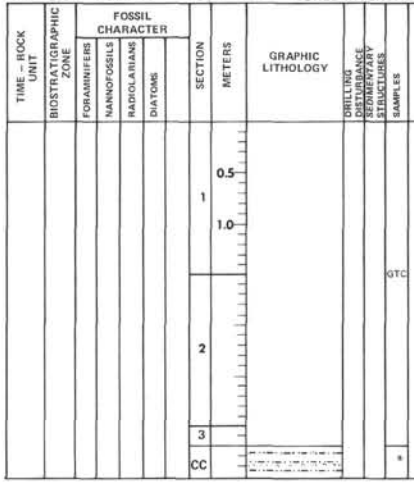
LITHOLOGIC DESCRIPTION

Core Catcher consists of very dark grayish brown (2.5Y 3/2), 3–5 cm thick, graded, "dirty" silty mud turbidite layers.

SMEAR SLIDE SUMMARY (%):

	CC, 3 D	CC, 7 D
Texture:		
Sand	2	0
Silt	60	20
Clay	38	80
Composition:		
Quartz	50	40
Feldspar	2	2
Mica	5	10
Heavy minerals	2	1
Clay	20	28
Palagonite	1	1
Pyrite/opaques	3	1
Carbonate unspec.	15	15
Foraminifers	–	T
Calc. nannofossils	–	2
Diatoms	T	–
Plant debris	2	T

SITE 615 HOLE A CORE 12H CORED INTERVAL 3436.0–3439.6 mbsl; 150.1–153.7 mbsf



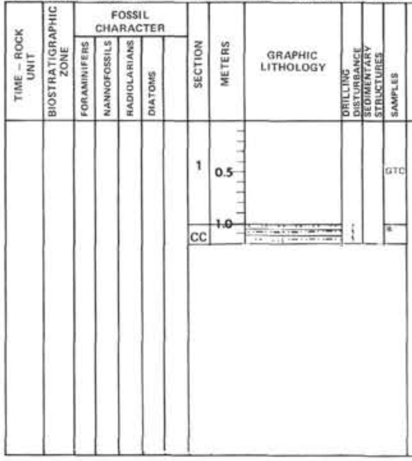
LITHOLOGIC DESCRIPTION

Core Catcher consists of dark olive gray (5Y 3/2), homogeneous MUD with gray (5Y 5/1–5Y 6/1) laminae and blebs.

SMEAR SLIDE SUMMARY (%):

	CC, 18 D
Texture:	
Sand	0
Silt	30
Clay	70
Composition:	
Quartz	20
Feldspar	T
Heavy minerals	1
Clay	60
Pyrite/opaques	2
Carbonate unspec.	15
Calc. nannofossils	2
Plant debris	T

SITE 615 HOLE A CORE 13H CORED INTERVAL 3445.6–3447.6 mbsl; 159.7–161.7 mbsf



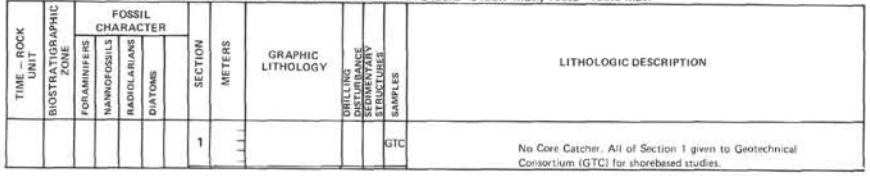
LITHOLOGIC DESCRIPTION

Core Catcher consists of very deformed dark olive gray (5Y 3/2) SILT and MUD. SILT is "dirty" (lignite- and mica-rich).

SMEAR SLIDE SUMMARY (%):

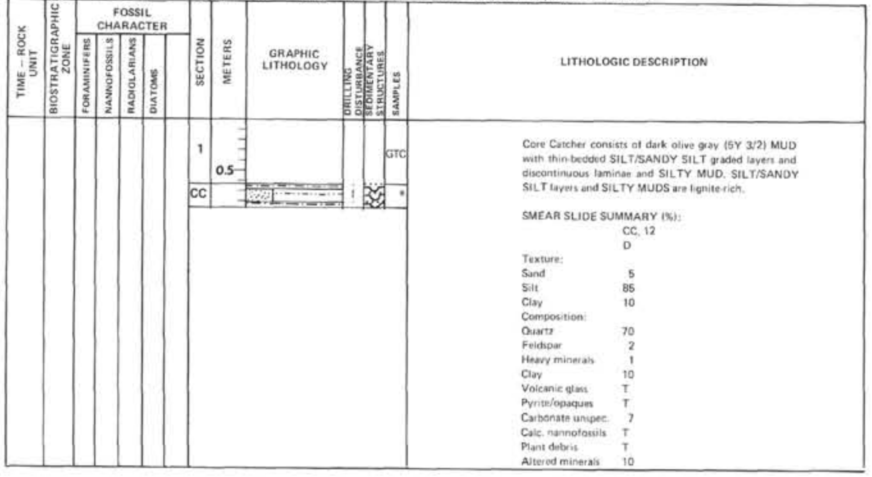
	CC, 3 D
Texture:	
Sand	10
Silt	60
Clay	30
Composition:	
Quartz	55
Feldspar	3
Mica	T
Heavy minerals	3
Clay	30
Pyrite/opaques	1
Carbonate unspec.	5
Calc. nannofossils	T
Plant debris	T
Altered minerals	3

SITE 615 HOLE A CORE 14H CORED INTERVAL 3455.2–3455.7 mbsl; 169.3–169.8 mbsf



No Core Catcher. All of Section 1 given to Geotechnical Consortium (GTC) for shorebased studies.

SITE 615 HOLE A CORE 15H CORED INTERVAL 3455.7–3456.7 mbsl; 169.8–170.8 mbsf

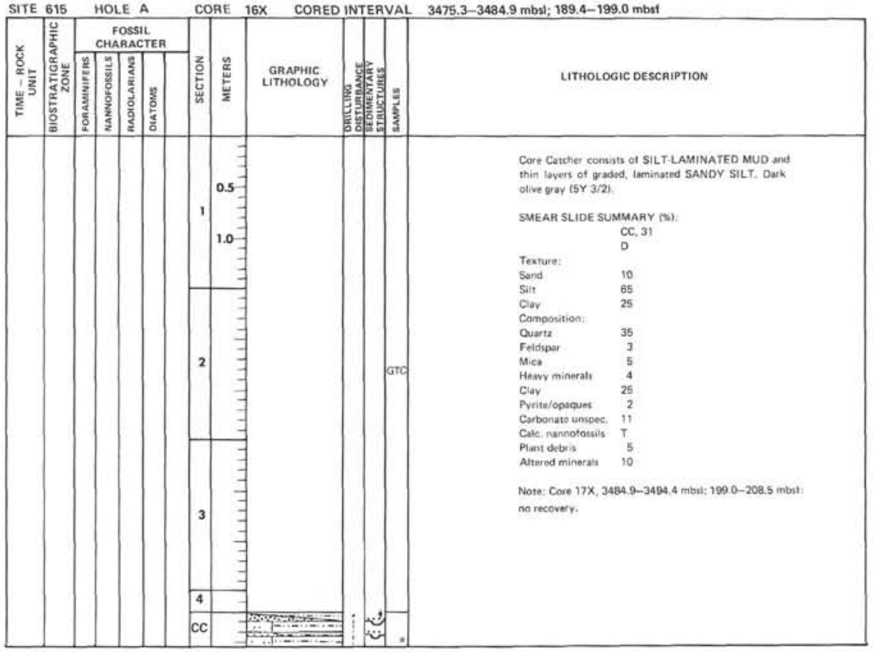


Core Catcher consists of dark olive gray (5Y 3/2) MUD with thin-bedded SILT/SANDY SILT graded layers and discontinuous laminae and SILTY MUD. SILT/SANDY SILT layers and SILTY MUDS are lignite-rich.

SMEAR SLIDE SUMMARY (%):

	CC, 12 D
Texture:	
Sand	5
Silt	85
Clay	10
Composition:	
Quartz	70
Feldspar	2
Heavy minerals	1
Clay	10
Volcanic glass	T
Pyrite/opaques	T
Carbonate unspec.	7
Calc. nannofossils	T
Plant debris	T
Altered minerals	10

SITE 615 HOLE A CORE 16X CORED INTERVAL 3475.3–3484.9 mbsl; 189.4–199.0 mbsf

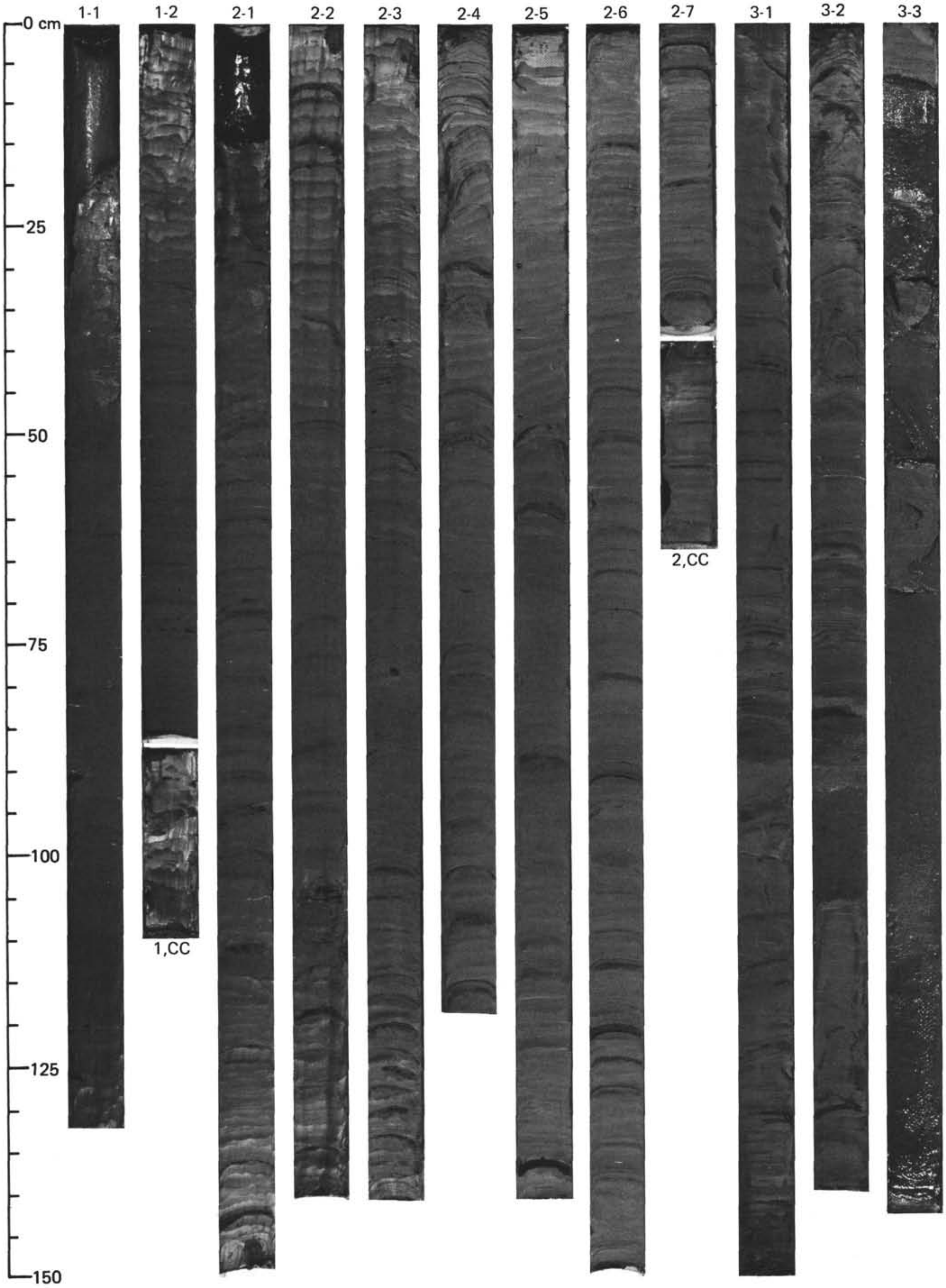


Core Catcher consists of SILT-LAMINATED MUD and thin layers of graded, laminated SANDY SILT. Dark olive gray (5Y 3/2).

SMEAR SLIDE SUMMARY (%):

	CC, 31 D
Texture:	
Sand	10
Silt	65
Clay	25
Composition:	
Quartz	35
Feldspar	3
Mica	5
Heavy minerals	4
Clay	25
Pyrite/opaques	2
Carbonate unspec.	11
Calc. nannofossils	T
Plant debris	5
Altered minerals	10

Note: Core 17X, 3484.9–3494.4 mbsl; 199.0–208.5 mbsf: no recovery.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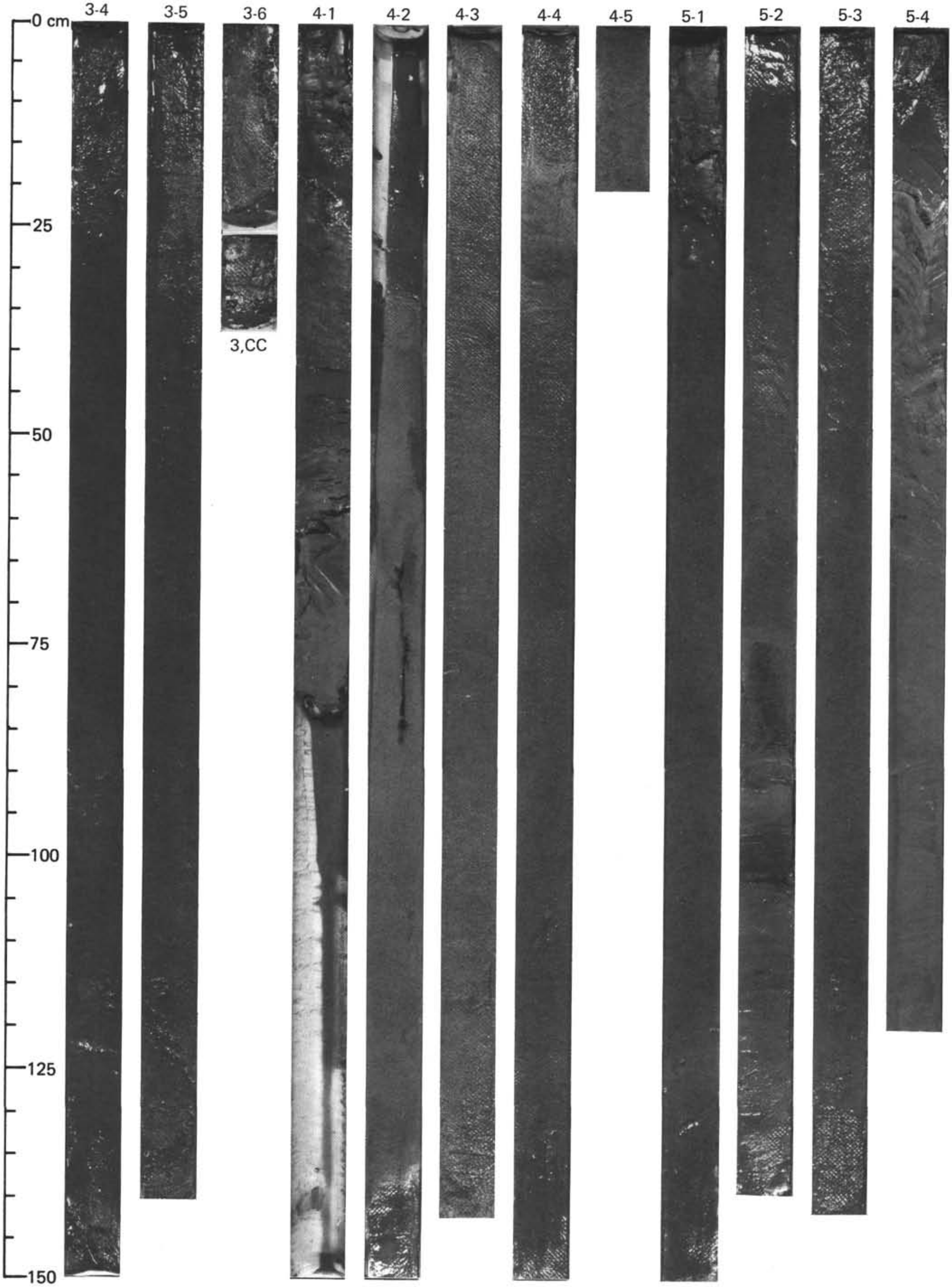

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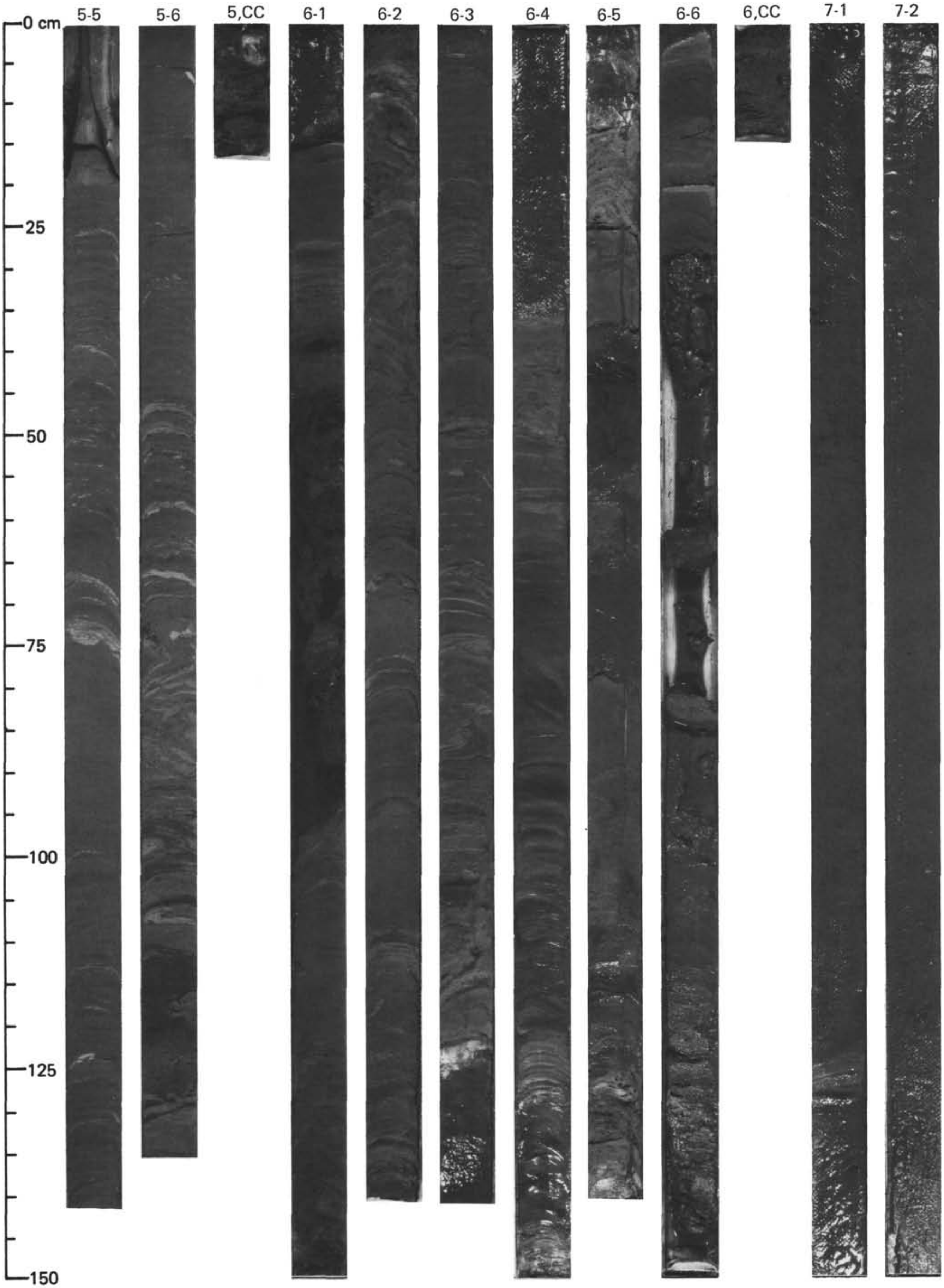
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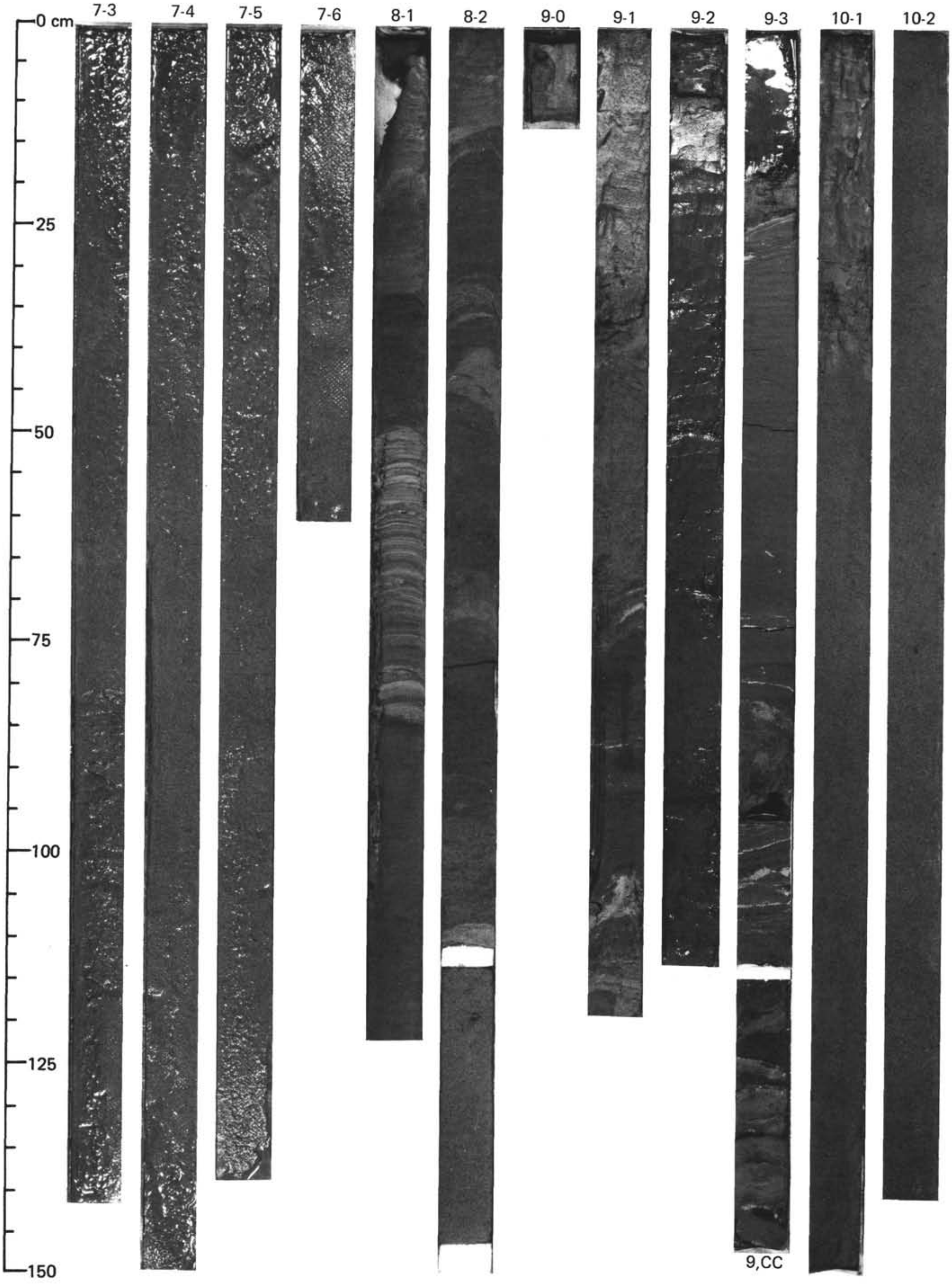
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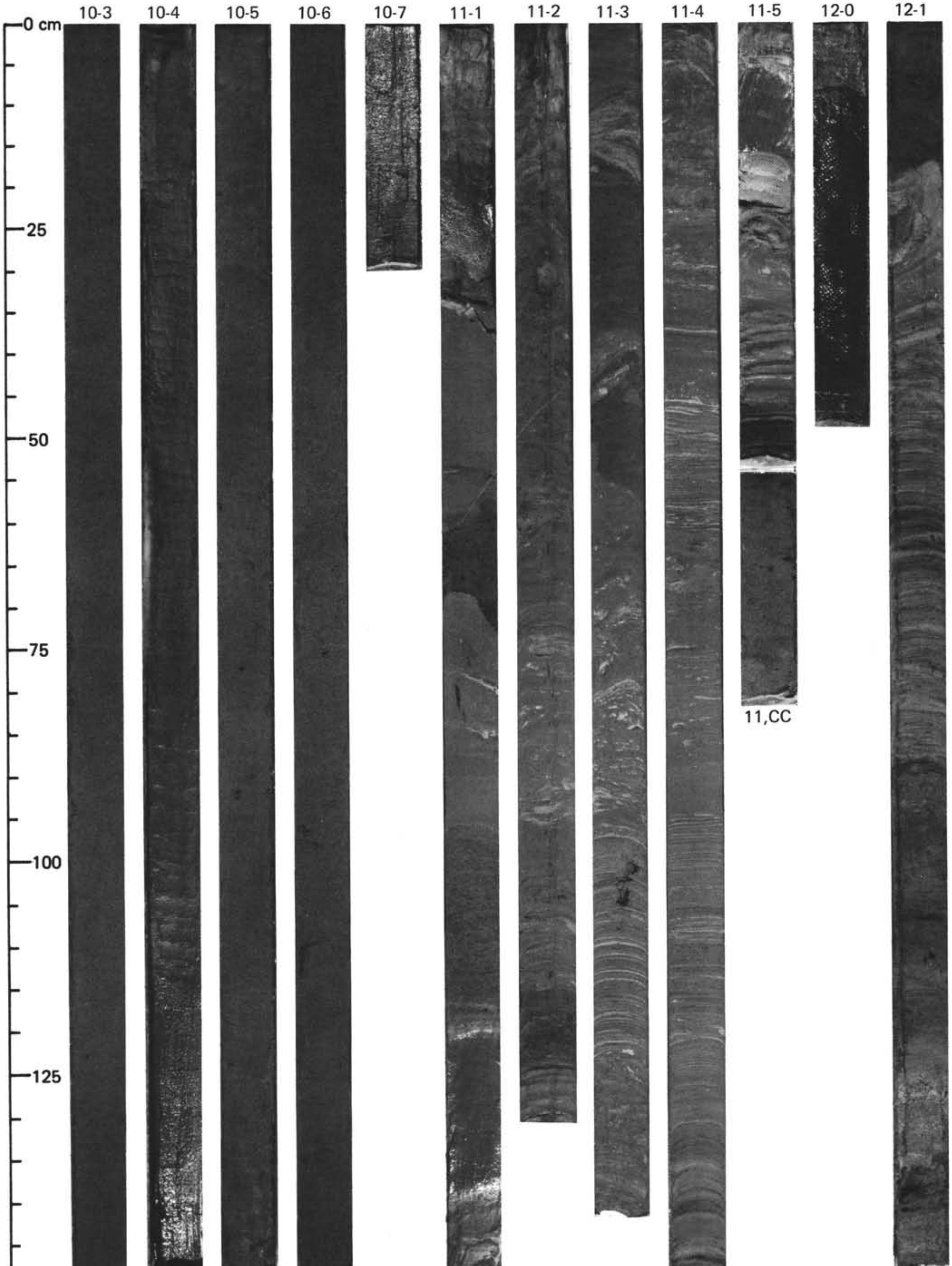
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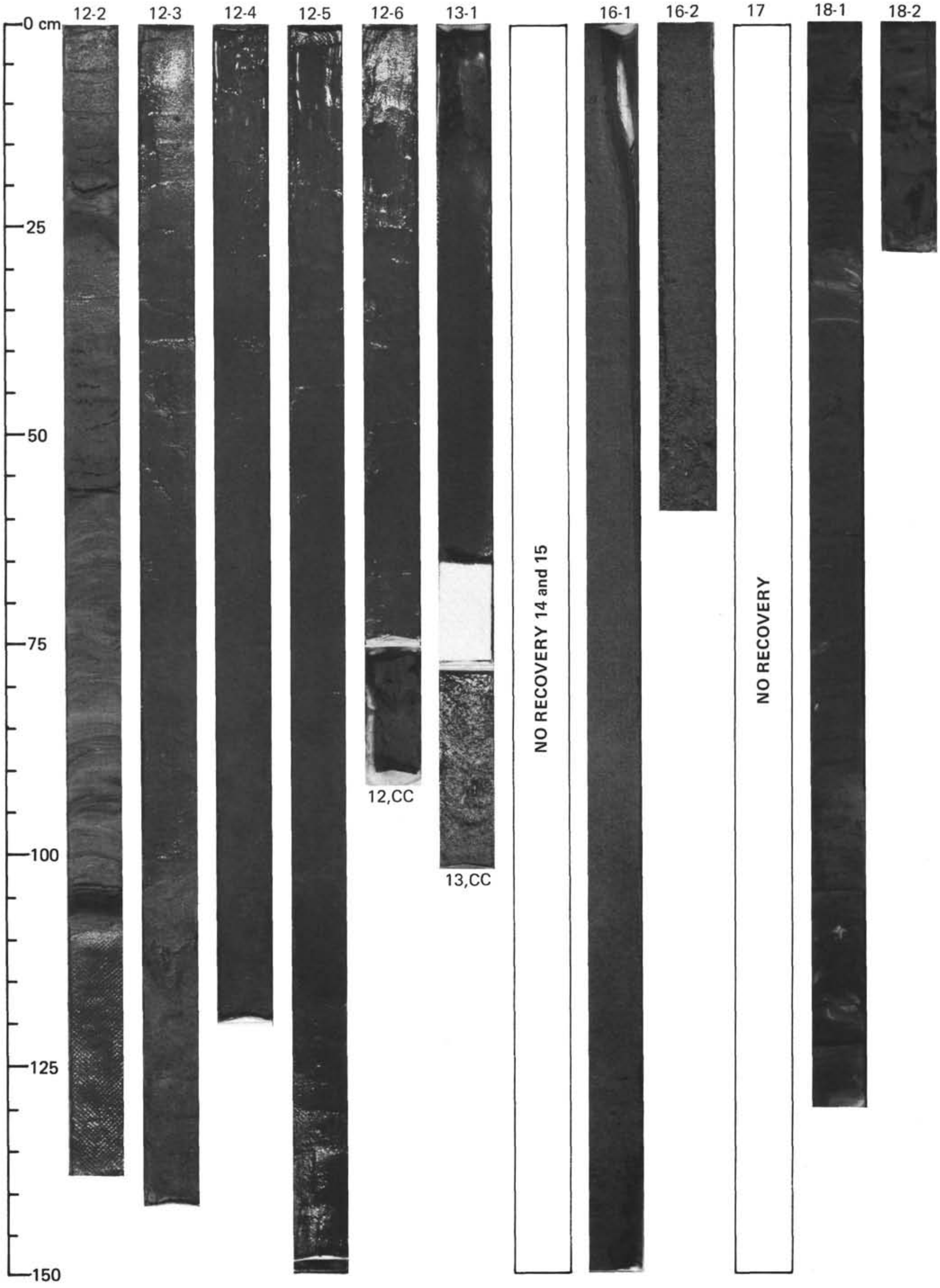
12-2
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17
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12,CC
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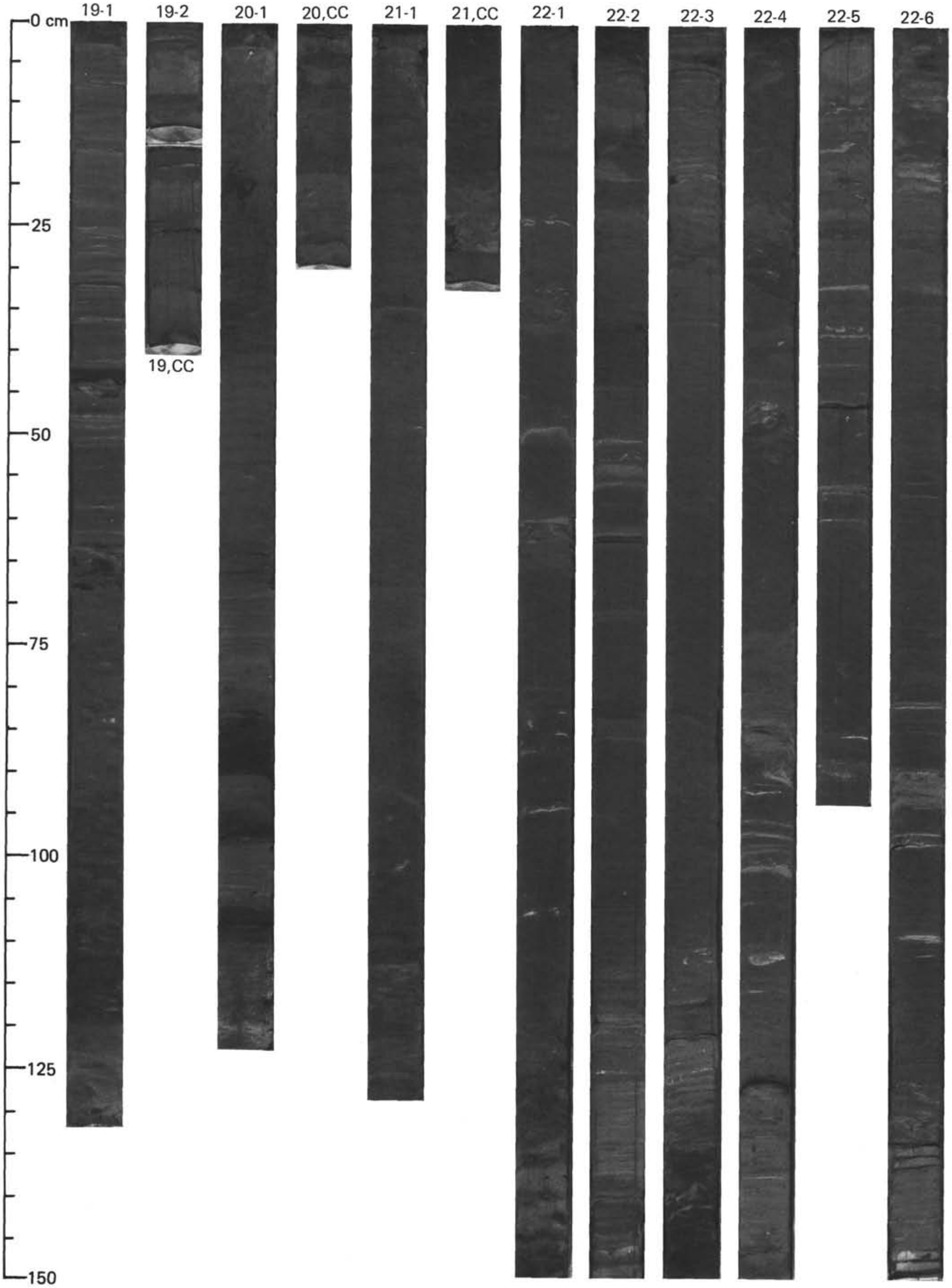
NO RECOVERY 14 and 15
NO RECOVERY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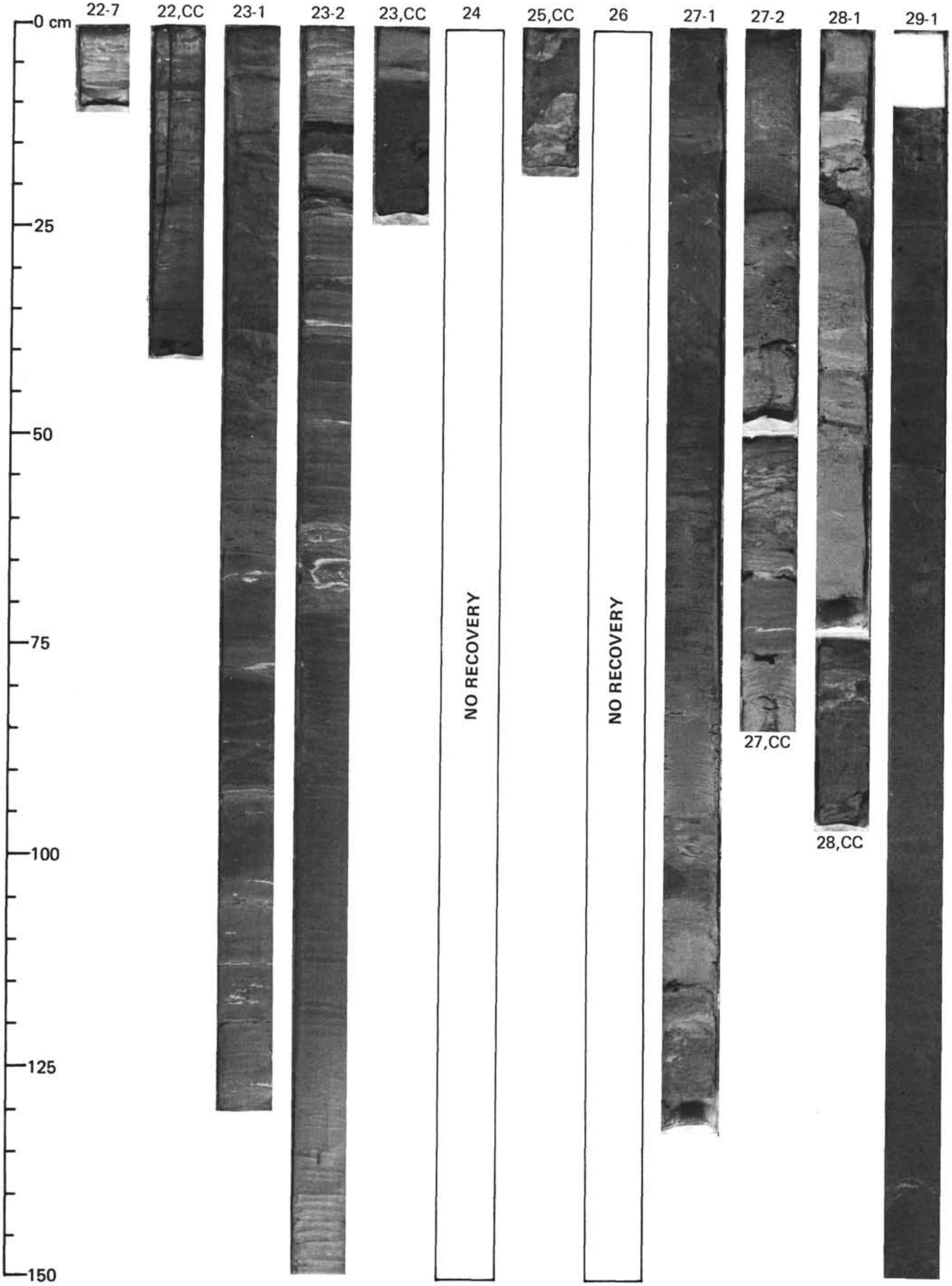
22-6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22-7
22,CC
23-1
23-2
23,CC
24
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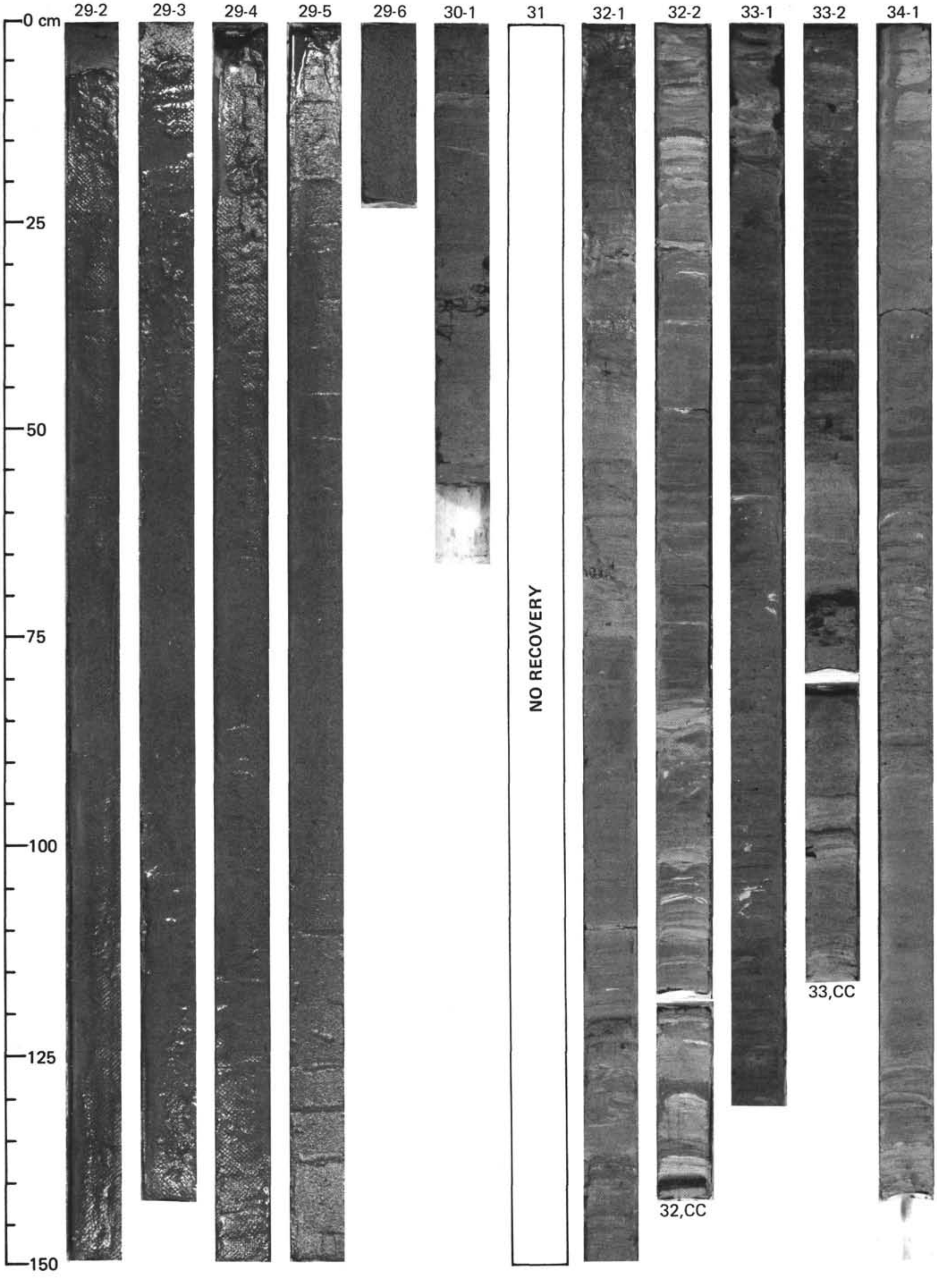
25,CC
26
NO RECOVERY
27-1
27-2
27,CC
28-1
28,CC
29-1


29-2
29-3
29-4
29-5
29-6
30-1
31
32-1
32-2
33-1
33-2
34-1
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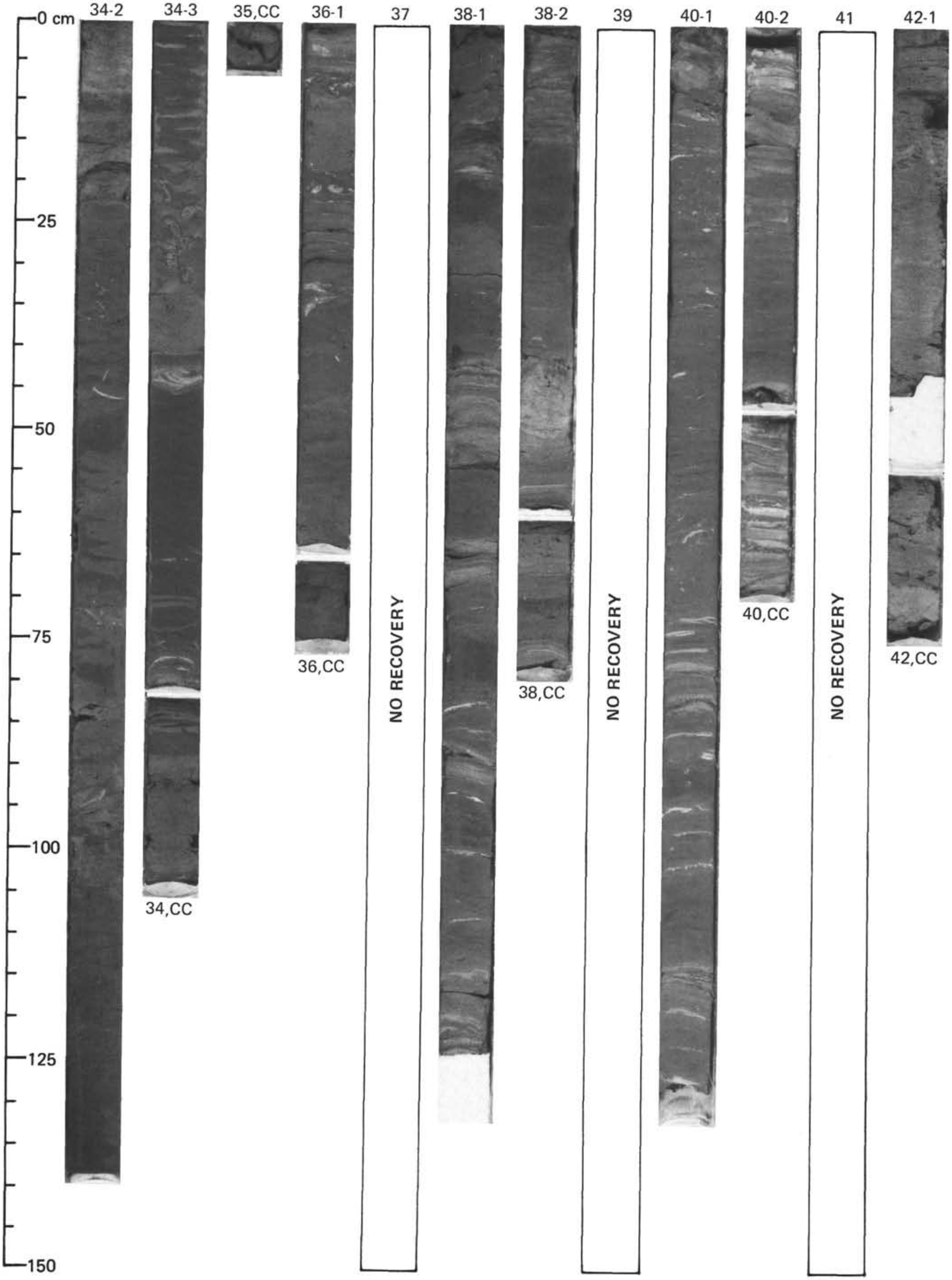
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34-2
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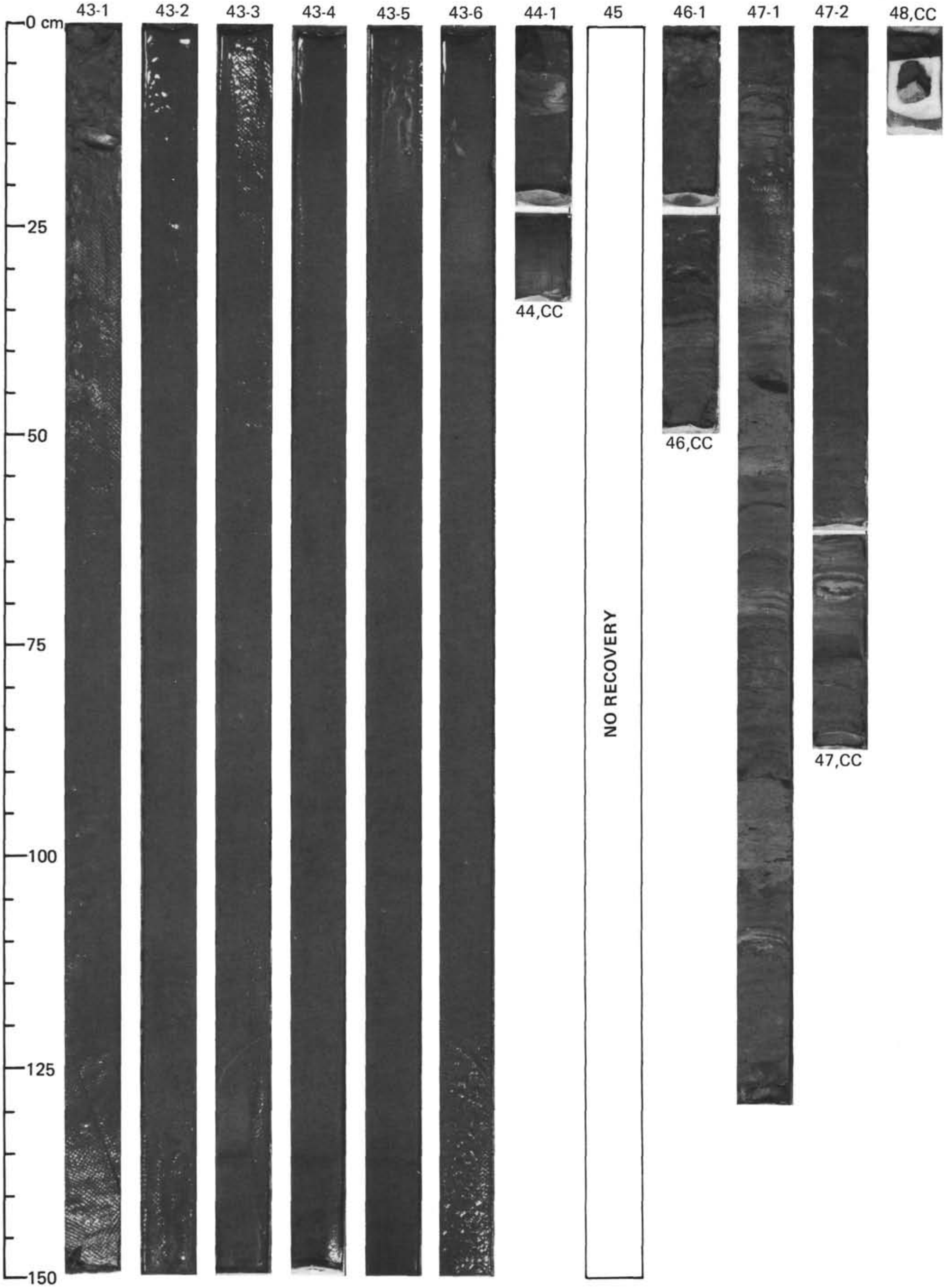
35,CC
36-1
36,CC
37
NO RECOVERY
38-1
38-2
38,CC
39
NO RECOVERY
40-1
40-2
40,CC
41
NO RECOVERY
42-1
42,CC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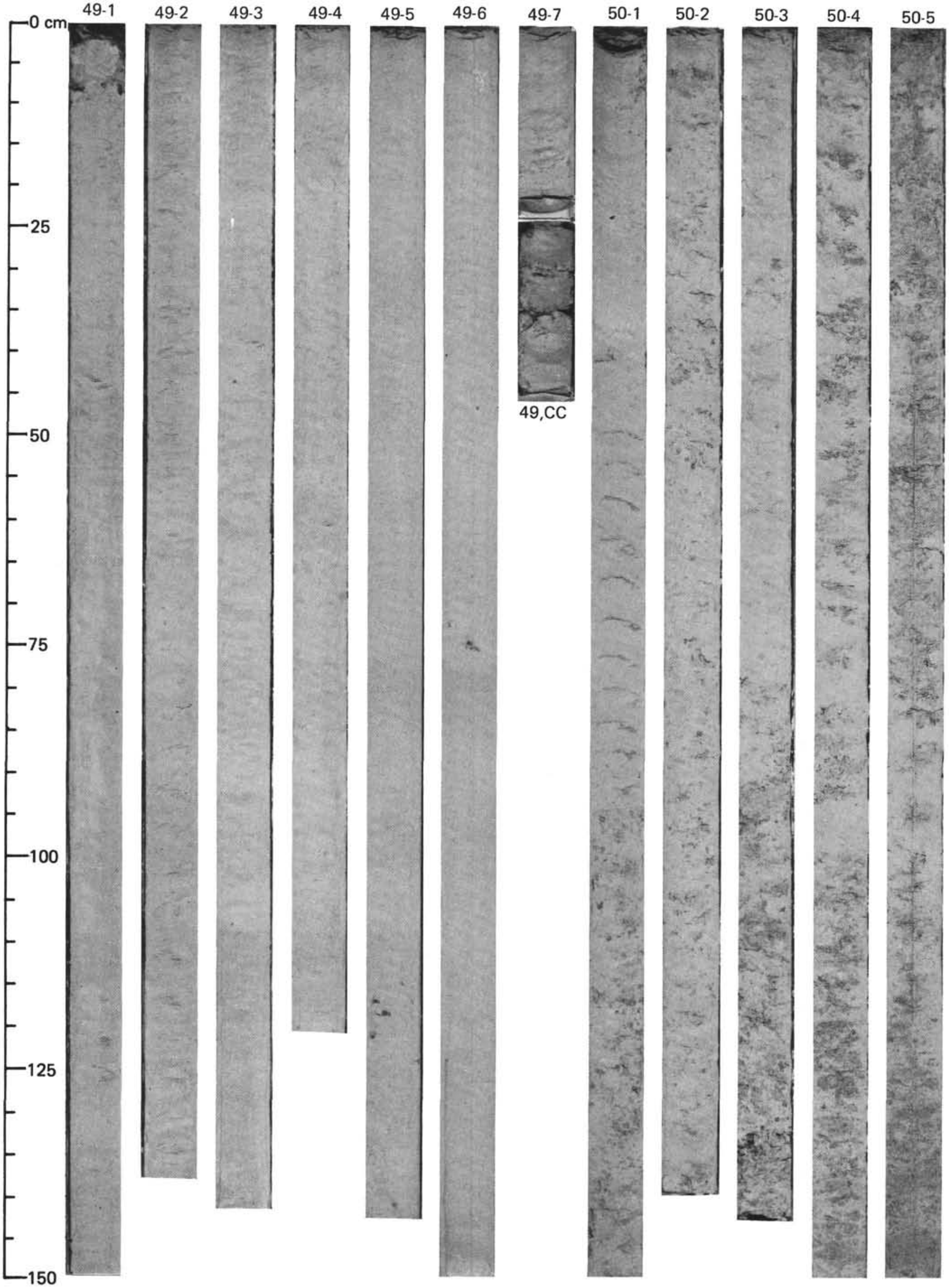
43-1
43-2
43-3
43-4
43-5
43-6
44-1
44,CC
45
NO RECOVERY
46-1
46,CC
47-1
47-2
47,CC
48,CC


49-1
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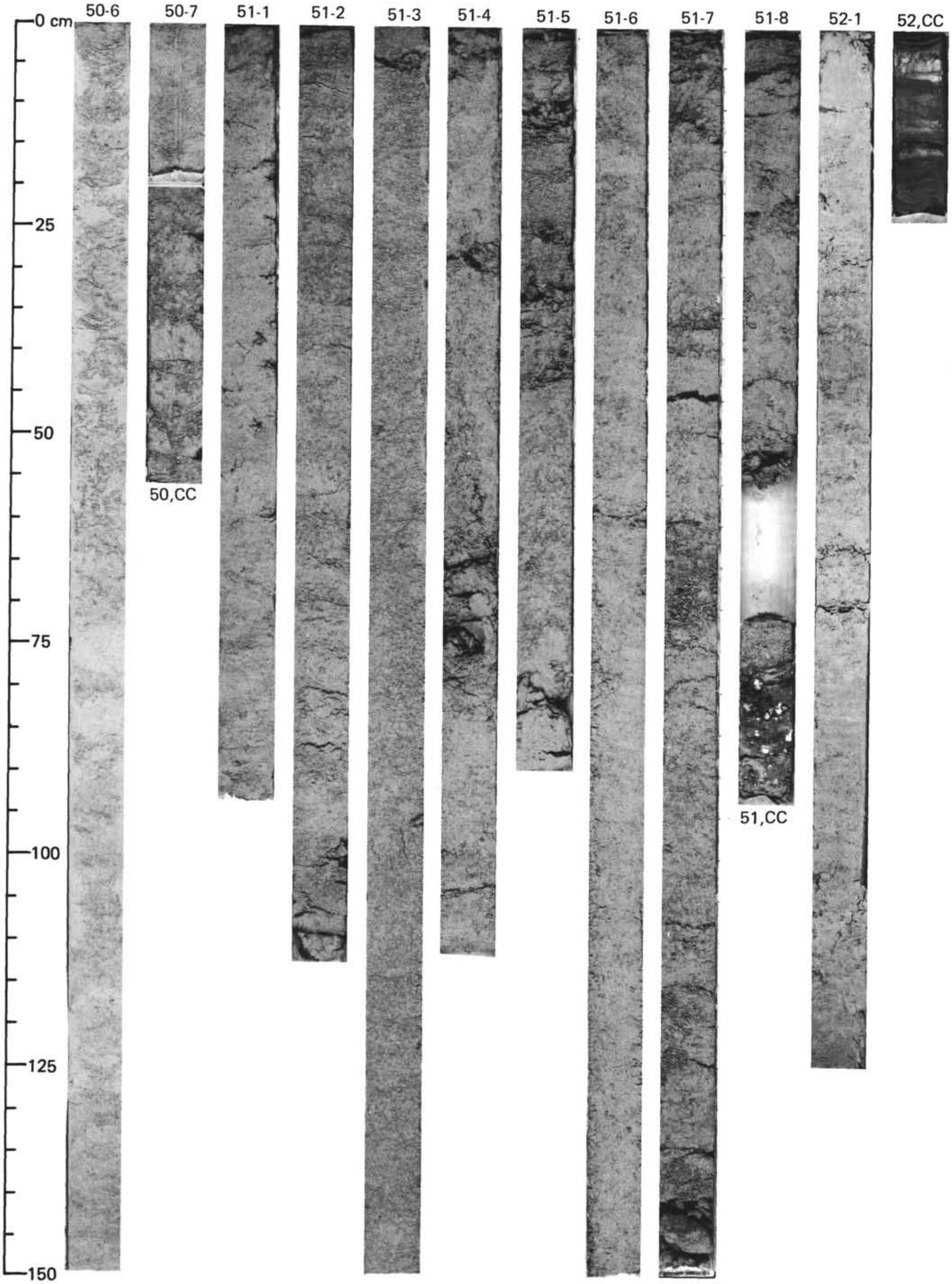
49,CC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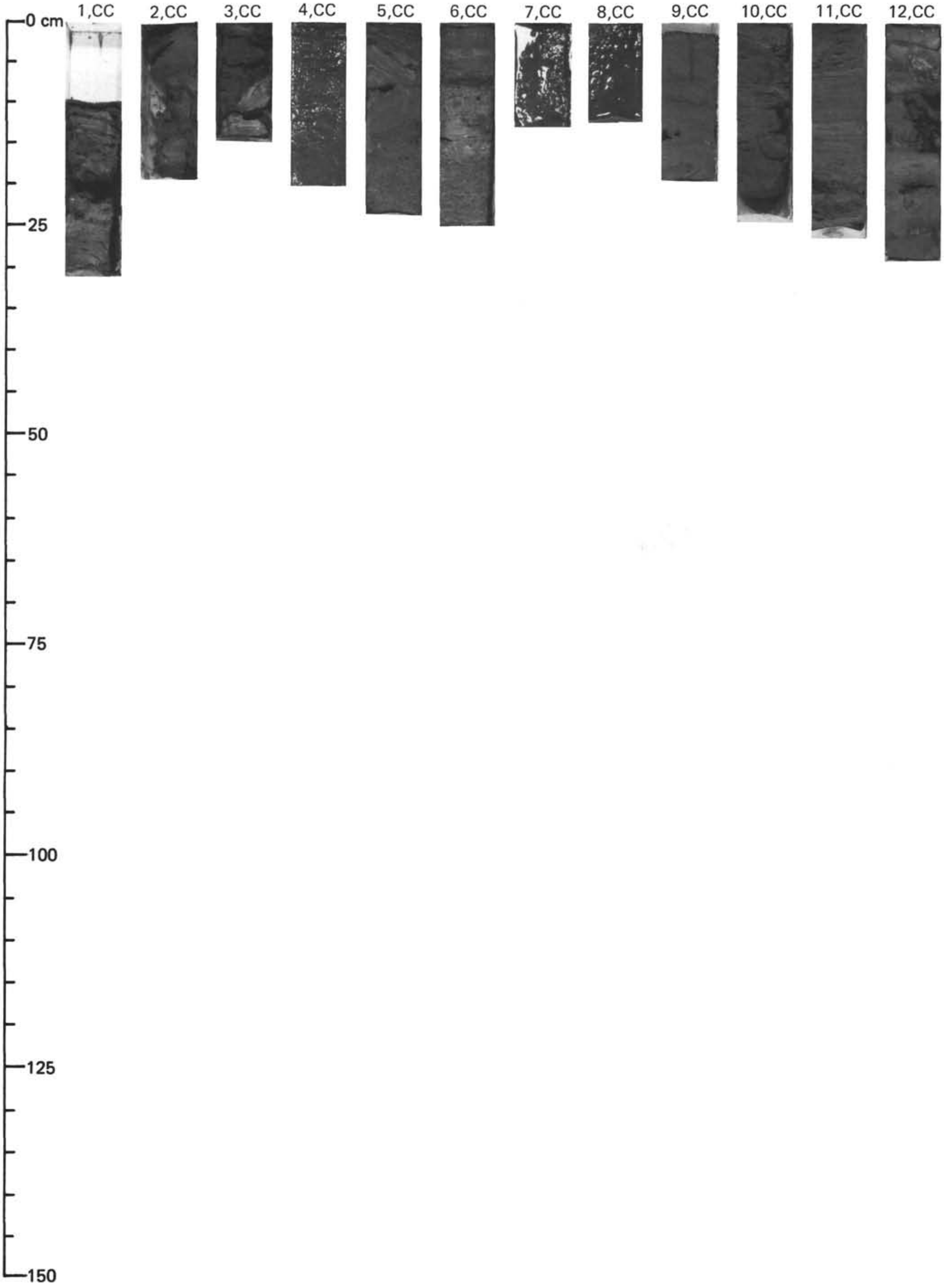
51,CC
52-1
52,CC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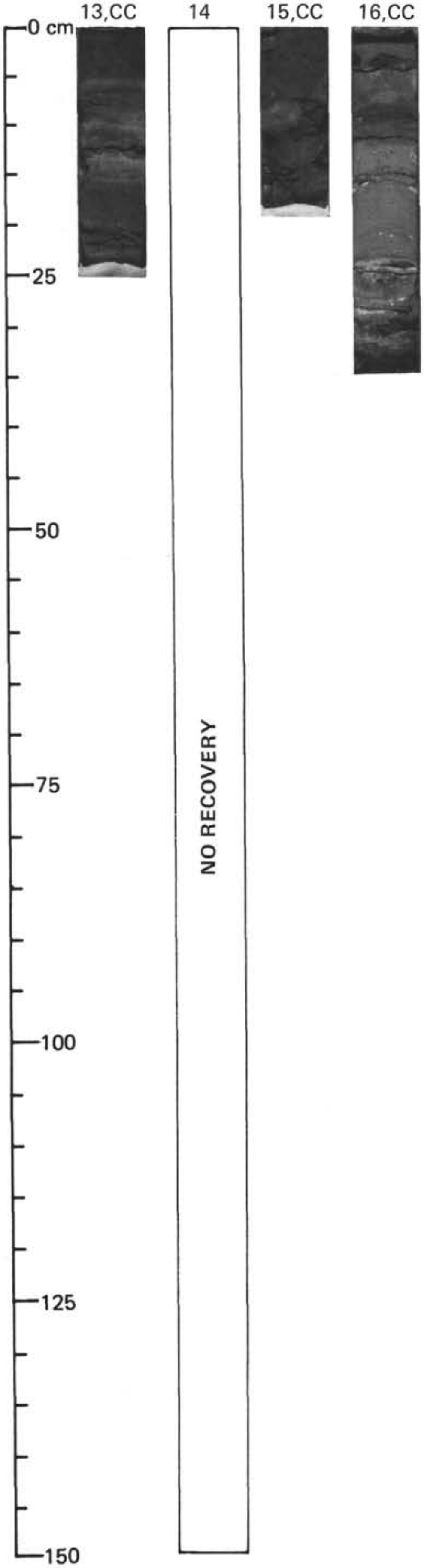
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