5. SITE 445, DAITO RIDGE, DEEP SEA DRILLING PROJECT LEG 58

The Shipboard Scientific Party[1]

HOLE 445

Date occupied: January 11, 1978

Date departed: January 17, 1978

Time on hole: 6 days

Position (latitude; longitude): 25°31.36′N; 133°12.49′E

Water depth (sea level; corrected m, echo sounding): 3377

Water depth (rig floor; corrected m, echo sounding): 3387

Bottom felt (m, drill pipe): 3382

Penetration (m): 892.0

Number of cores: 94

Total length of cored section (m): 892.0

Total core recovered (m): 619.52

Core recovery (%): 69

Oldest Sediment Cored:
  Depth sub-bottom (m): 892.0
  Nature: conglomeratic sandstone
  Age: early middle Eocene
  Measured velocity (km/s): 3.6

Basement:
  Depth sub-bottom (m): not reached

Principal Results: Site 445 is in a small basin in the Daito Ridge, northwest Philippine Sea. Sediments range in age from middle Eocene to Pleistocene, and the cored interval is 892 meters thick. A hiatus in sedimentation occurred during early Oligocene. Occurrence of *Nummulites boninensis* is limited to resedimented debris-flow conglomerate beds. The carbonate sediments, mudstones, sandstones, and conglomerates are dominantly resedimented by slumping, debris flows, and turbidity currents. Shipboard analysis of paleomagnetic inclination of samples indicates that Site 445 migrated from an equatorial latitude to its present position over the last 50 m.y.

BACKGROUND AND OBJECTIVES

Background

The marginal basins of the western Pacific owe their origin to a variety of processes, and deep drilling during Leg 58 focused on three sites in the Shikoku Basin to test several models for the spreading origin of that basin. Previous Leg 58 results (Sites 442, 443, and 444) indicated that three modes of spreading were possible in the Shikoku Basin: symmetrical spreading, single-limb spreading, and asymmetrical spreading.

The second part of Leg 58 deals with the triangular northwest portion of the north Philippine Sea immediately around the remnant arcs of the Daito Ridge and Basin province. This region has been of considerable interest to several workers, and prior study included deep drilling in the adjoining Kyushu–Palau Ridge at Site 296 (Karig, Ingle, et al., 1975), structural analysis of the basin (Karig, 1975; Hilde et al., 1977; Watts et al., 1977; Mizuno et al., 1975, 1979), and dredging (Mizuno et al., 1975, 1979; Shiki et al., 1976). Magnetic lineations were identified south of the Daito Ridge and Basin area (Louden, 1976; Watts et al., 1977), but none have been identified in the area itself. From this, it has been inferred that the Daito Ridge and Basin region is very old, and that in fact this portion of the northwest Philippine Sea incorporates older crust trapped behind the remnant arc of the Daito Ridge and Oki–Daito Ridge (Karig, 1975; Hilde et al., 1977; Watts et al., 1977; Mizuno et al., 1975, 1979). The trapping mechanism should show similarities with the hypothetical origin of the Bering Sea (Cooper et al., 1976).

Dredge hauls from the Daito Ridge and Basin region, the Oki–Daito Ridge (immediately south), and the Amami Plateau (immediately to the north) indicate that the geology of the region is extremely variable. Greenschist, hornblende schist, and serpentine have been collected from the Daito Ridge, indicating some regional metamorphism (Mizuno et al., 1975; Shiki et al., 1976). Igneous rocks recovered from the Daito Ridge include andesite and diorite of island-arc origin. Dredge hauls from the Oki–Daito Ridge recovered basalt; andesite, granodiorite, and basalt were recovered from the Amami Plateau.

Perhaps the most interesting discovery from dredging is limestone samples containing *Nummulites boninensis,*

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a larger foraminifer of shallow-water origin. These Eocene samples (Konda et al., 1977) were obtained from these ridges and the Amami Plateau from water depths ranging from 1160 to 2340 meters. This fossil suggests either that the entire area was uplifted during Eocene time and subsequently subsided (Mizuno et al., 1975, 1979), or that the fossils were resedimented from coastal areas into deeper environments. If uplift had occurred, followed by subsequent subsidence, then the Daito Ridge and Basin area represents a remnant arc whose uplift was tied to deep-seated igneous and metamorphic activity or to trench tectonics early in its history (Mizuno et al., 1975).

Site 445 was located in a small sediment pond on the southern side of the Daito Ridge, along a seismic profile surveyed by the R/V *Kaiyo-Maru* (IPOD–Japan, 1977), shown in Figure 1. The seismic-reflection profile obtained by the D/V *Glomar Challenger* is shown in Figure 2.

Objectives

The primary objectives for drilling at Site 445 were fivefold. Of prime importance was to determine the age of the oldest sediment and of the basement to determine in turn whether this portion of the northern Philippine Sea incorporates old crust trapped behind a remnant arc. A second objective was to determine the nature of the basement and to elucidate its crustal history. A third objective at this site was to determine by sedimentology and paleoecology the nature of the subsidence history of the northwest Philippine Sea. Fourth, climatic changes at the site, presumably due to its supposed northward drift, were to be determined by paleontology and paleomagnetism.

The location of Site 445 near the Kuroshio Current provides a unique opportunity to understand its circulation history. That history can be elucidated from sedimentology and paleontology of samples from Site 445; this was the fifth major objective.

OPERATIONS

Drilling operations at Site 444 terminated on 9 January 1978. At 0300 hours seismic gear was streamed, and at 0400 hours the *Challenger* was under way to Site 445 on a course of 236°.

Weather and sea conditions deteriorated late in the evening of 9 January and through the early hours of 10 January. Accordingly, at 1130 hours, 10 January, winds up to 40 mph and extremely high seas necessitated slowing the ship's speed to 140 rpm in order to better ride out the storm. Seismic gear was also retrieved. Storm conditions prevailed until 0400 hours, 11 January, when the ship's speed was increased to 190 rpm and seismic gear was streamed. The *Challenger* headed for Site 445 on a course of 202°.

At 1600 hours, 11 January, a 16-kHz beacon was dropped, marking Site 445 (Figure 3). Water depth at the site was later established as 3382 meters by drill-pipe measurement. The seismic gear was retrieved; at 1714 hours the *Challenger* established an auto-mode positioning over the beacon, and RIH was started. Spud-in for Hole 445 was at 0217 hours, 12 January. Core 1, 8.5 meters of nannofossil ooze, was recovered at 0304 hours, 12 January.

A program of continuous coring was followed, the time interval (on deck) between cores being about one hour (Table 1). The sediment nature was consistent and permitted exceptionally high core recoveries (in some cases exceeding 100 per cent; Table 1).

On 16 January, weather predictions showed that a frontal system with accompanying high winds and seas was headed for the site area. Conditions were moderate through the 16th and into early hours of 17 January. However, at 0830 hours, conditions affecting positioning were severe enough to force abandonment of Hole 445. Accordingly, POOH began, and at 1530 hours, the *Challenger* was under way to Site 446 on a course of 206° (Figure 3).

In all, 94 cores were taken, with a total sub-bottom penetration of 892 meters. The length recovered was 619.52 meters, or 69 per cent (Table 1).

SEDIMENT LITHOLOGY

A single-bit hole was drilled at Site 445 by continuous coring. It penetrated a total of 892 meters of sediments of middle-Eocene to Quaternary age and recovered 94 cores, 619.52 meters in total length.

Sediments are dominantly redeposited biogenic components for the late Eocene to the Quaternary, and dominantly redeposited terrigenous components for the middle Eocene. Five lithologic units were distinguished, based on the biogenic components (units I–IV) and terrigenous components (unit V). Some of the units are divided into sub-units on the basis of dominant color (unit I), abundance of siliceous biogenic components (unit II), and abundance of calcareous biogenic components and sediment texture (unit V). These units and sub-units are conformable, except for an early-Oligocene or late-Eocene hiatus between units II and III, discerned from micropaleontological data. Figure 4 shows the stratigraphy at Site 445, and Figure 5 shows the vertical distribution of some lithologic components.

Unit I

Unit I is predominantly soft to firm nannofossil ooze and foraminifer–nannofossil ooze, with some associated nannofossil–foraminifer ooze, volcanic ash layers, and scattered volcanic ash. Sediments are variously colored, predominantly from gray to brown. Vertical distribution of the dominant colors allows further subdivision into two sub-units.

Sub-Unit Ia

This sub-unit consists largely of soft to firm nannofossil ooze and interbedded foraminifer-nannofossil ooze, which are locally clayey or vitric and are associated with nannofossil–foraminifer ooze. Dominant colors of these sediments are light gray and pale brown.

The upper interval consists of interbedded nannofossil ooze and foraminifer–nannofossil ooze, whereas the remaining interval is predominantly nannofossil ooze

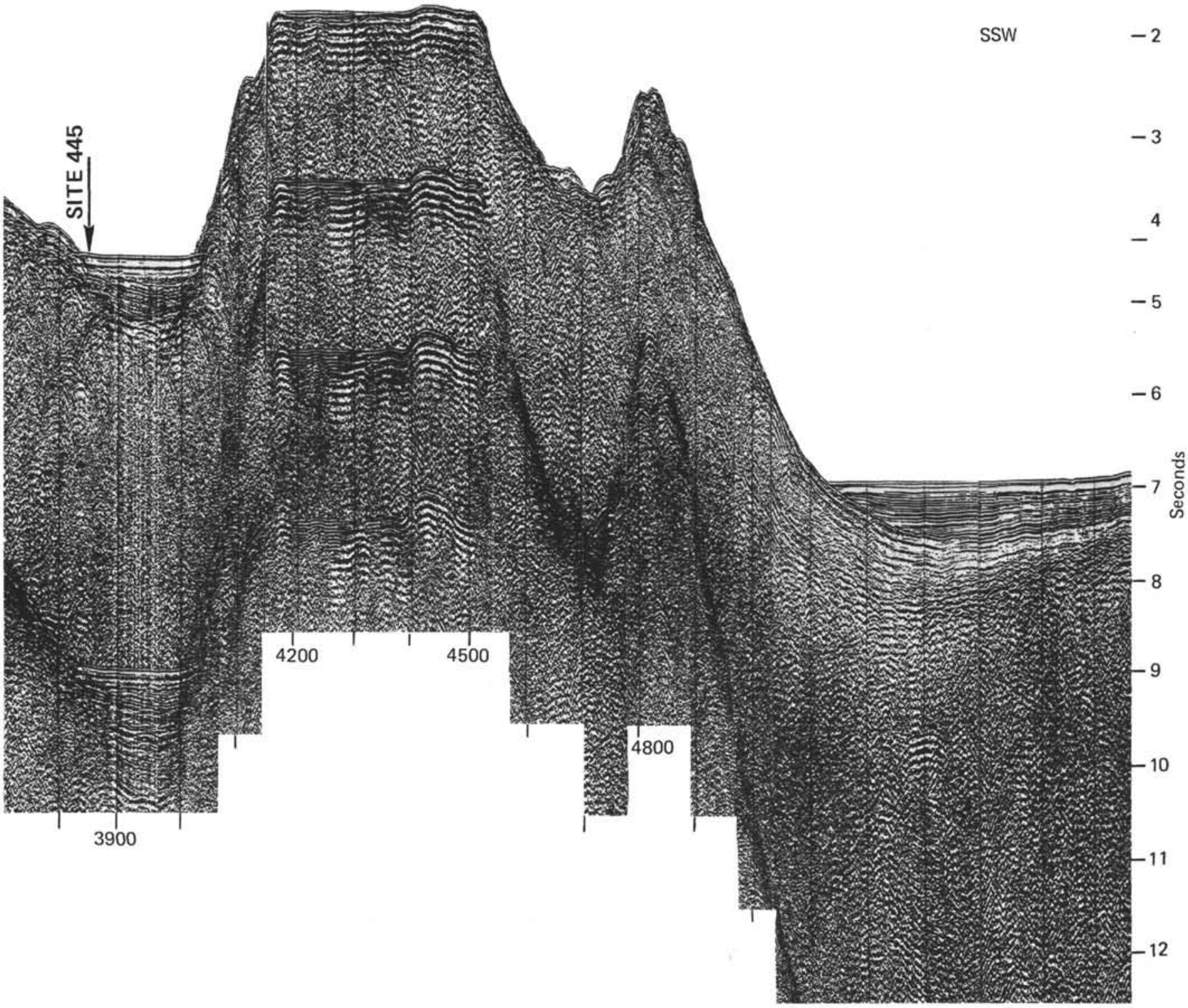


Figure 1. *Seismic-reflection profile through Daito Ridge by R/V* Kaiyo-Maru.

with subordinate amounts of foraminifer-nannofossil ooze. The sediments are mostly of silty clay texture (nannofossil ooze) to sandy mud texture (foraminifer-nannofossil ooze). A graded sequence identifiable to the partial Bouma sequence T(d,e) is observed in Core 3-3.

Sub-Unit Ib

This sub-unit is distinguished from sub-unit Ia by sediment color; it consists dominantly of firm, light-gray to white nannofossil ooze, associated with interbeds of foraminifer-nannofossil ooze of various thicknesses.

Foraminifer-nannofossil ooze is dominant in the upper part (Core 10). Nannofossil ooze locally passes to darker-colored, clayey nannofossil ooze which contains clay (15-20% of total).

Coarse-tail graded bedding 5 to 10 cm thick is commonly found in color-band alternations in the middle part of the sub-unit. It starts from very fine sand- to silt-sized nannofossil-foraminifer ooze or foraminifer ooze with parallel laminae just above a sharp contact, which fines upward to silty-clay-sized nannofossil ooze. It may be identified to the partial Bouma sequence T(d,e). In general, bioturbation is slight to moderate in the middle to lower part. Medium- to coarse-grained calcareous sand occurs only at the lowest part of this sub-unit. Containing about 60 per cent rock fragments, it rests just above the scoured bottom (the lowest boundary of sub-unit Ib) with a 10-cm-thick graded bed and passes upward to nannofossil ooze. This represents another type of graded sequence, equivalent to T(a,b,e).

Unit II

Unit II sediments are stiffer than those of Unit I. The dominant lithology is a gray, brown, or pink, very firm nannofossil chalk, with varying amounts of siliceous, clayey, and volcanic components. Mudstone occurs locally. It tends to be concentrated at the middle part of

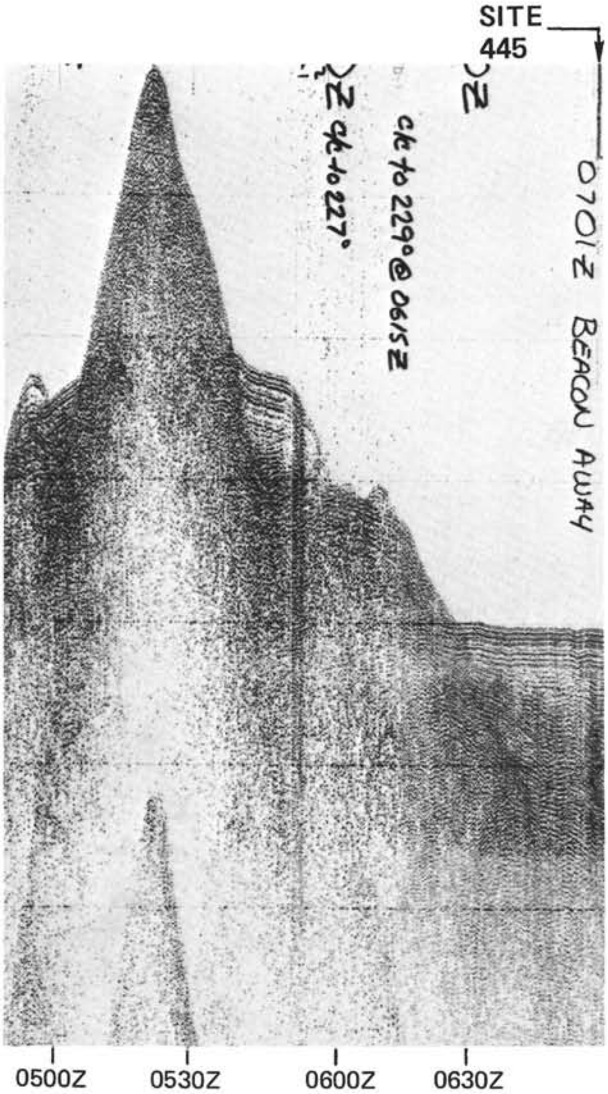


Figure 2. Glomar Challenger *seismic-reflection profile approaching Site 445. See Figure 3 for location.*

this unit (sub-unit IIb and the upper part of sub-unit IIc). Bioturbation is very common and intense. Calcareous nannofossils occur abundantly throughout the unit. The abundance of siliceous fossils, mostly radiolarians and sponge spicules, varies, and this makes it possible to subdivide the thick sequence of unit II into four sub-units. In sub-units IIa and IIc, siliceous fossils are nearly absent, whereas in sub-units IIb and IId they range from several per cent to around 10 per cent or more.

A distinctive aspect of unit II is the extensive occurrence of various sedimentary structures, such as graded sequences and bioturbation, locally associated with slump structures and microfaults.

The graded sequences are coarse-tail and mostly consist of resedimented calcareous biogenic components accompanied by accessory amounts of terrigenous coarse-grained materials at the basal interval, and in some cases by a thin layer of pelagic clay in the upper interval. They include the typical Bouma sequence T(a–e) and partial Bouma sequences T(c–e), T(d,e).

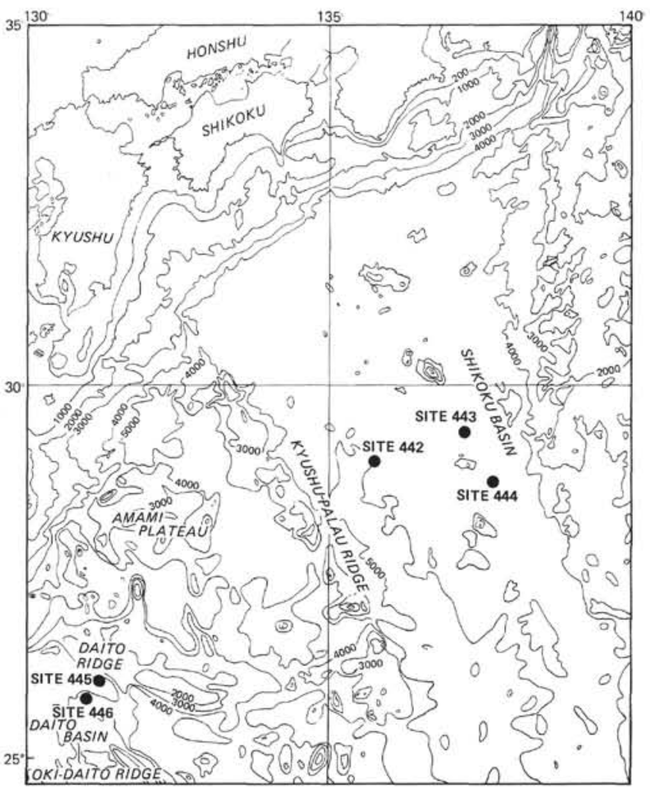


Figure 3. *Site location map.*

Occurrence of T(a–e) is restricted to the upper part of sub-unit IIa and the lower part of sub-unit IIc, and it mostly overlies, with sharp, scoured contact, the underlying sediments, which are associated with slump structures. It is usually 35 to 60 cm thick, with rare cases more than 5 meters thick.

Interval a consists of foraminifer chalk or calcareous chalk with lithic fragments and reworked fossils; it is coarse- to very coarse-sand size at the base and medium- to fine-sand texture at the top. In some cases it is partially replaced by calcareous sand with detrital grains of several tens per cent. This interval gradually passes upward to interval b, parallel laminated nannofossil-foraminifer chalk of fine-grained-sand size. This passes upward to interval c, foraminifer-nannofossil chalk (very fine-grained-sand to muddy-sand texture) with micro-cross-laminae and (or) convolute lamination. Above this, interval d is parallel laminated foraminifer-nannofossil chalk (sandy-mud to silty-clay texture). Interval e is a thick, faintly laminated or non-laminated nannofossil chalk and (or) clayey nannofossil chalk (silty-clay to clay size) with a clay content of clayey materials from a trace to 15 per cent of the total. This interval tends to be slightly bioturbated in the lower part, and moderately to intensely bioturbated in the upper part. Clayey nannofossil chalk is in some cases replaced by nannofossil mudstone.

T(d,e) is very common throughout unit II. The thickness of each bed is usually several tens of centimeters, but often decreases to around 20 cm or increases to more than 4 meters.

TABLE 1
Site 445 Coring Summary

Cores	Date (Jan., 1978)	Time	Depth From Drill Floor (m) Top Bottom	Depth Below Sea Floor (m) Top Bottom	Length Cored (m)	Recovery (m)	Recovery (%)
445-1	12	0304	3382.0-3390.5	0.0-8.5	8.5	8.50	100
2	12	0408	3390.5-3400.0	8.5-18.0	9.5	6.10	64
3	12	0505	3400.0-3409.5	18.0-27.5	9.5	9.61	101
4	12	0610	3409.5-3419.0	27.5-37.0	9.5	9.50	100
5	12	0706	3419.0-3428.5	37.0-46.5	9.5	3.61	38
6	12	0805	3428.5-3438.0	46.5-56.0	9.5	8.62	91
7	12	0906	3438.0-3447.5	56.0-65.5	9.5	9.10	96
8	12	1000	3447.5-3457.0	65.5-75.0	9.5	8.27	87
9	12	1057	3457.0-3466.5	75.0-84.5	9.5	0.38	4
10	12	1155	3466.5-3476.0	84.5-94.0	9.5	7.90	83
11	12	1309	3476.0-3485.5	94.0-103.5	9.5	6.55	69
12	12	1412	3485.5-3495.0	103.5-113.0	9.5	6.00	63
13	12	1513	3495.0-3504.5	113.0-122.5	9.5	6.10	64
14	12	1615	3504.5-3514.0	122.5-132.0	9.5	1.95	21
15	12	1717	3514.0-3523.5	132.0-141.5	9.5	2.40	25
16	12	1817	3523.5-3533.0	141.5-151.0	9.5	5.34	56
17	12	1922	3533.0-3542.5	151.0-160.5	9.5	2.27	24
18	12	2020	3542.5-3552.0	160.5-170.0	9.5	6.66	70
19	12	2120	3552.0-3561.5	170.0-179.5	9.5	5.54	58
20	12	2230	3561.5-3571.0	179.5-189.0	9.5	3.46	36
21	12	2335	3571.0-3580.5	189.0-198.5	9.5	3.22	34
22	13	0047	3580.5-3590.0	198.5-208.0	9.5	1.76	19
23	13	0147	3590.0-3599.5	208.0-219.5	9.5	5.11	54
24	13	0247	3599.0-3609.0	217.5-227.0	9.5	7.11	75
25	13	0349	3609.0-3618.5	227.0-236.5	9.5	8.50	89
26	13	0446	3618.5-3628.0	236.5-246.0	9.5	8.61	91
27	13	0546	3628.0-3637.5	246.0-255.5	9.5	8.34	88
28	13	0644	3637.5-3647.0	255.5-265.0	9.5	7.60	80
29	13	0815	3647.0-3656.5	265.0-274.5	9.5	5.58	59
30	13	0915	3656.5-3666.0	274.5-284.0	9.5	6.98	73
31	13	1021	3666.0-3675.5	284.0-293.5	9.5	9.60	101
32	13	1116	3675.5-3685.0	293.5-303.0	9.5	3.77	40
33	13	1220	3685.0-3694.5	303.0-312.5	9.5	6.95	73
34	13	1318	3694.5-3704.0	312.5-322.0	9.5	7.45	78
35	13	1420	3704.0-3713.5	322.0-331.5	9.5	5.60	59
36	13	1521	3713.5-3723.0	331.5-341.0	9.5	7.52	79
37	13	1620	3723.0-3732.5	341.0-350.5	9.5	7.65	81
38	13	1735	3732.5-3742.0	350.5-360.0	9.5	8.15	86
39	13	1838	3742.0-3751.5	360.0-369.5	9.5	5.71	60
40	13	1953	3751.5-3761.0	369.5-379.0	9.5	4.37	46
41	13	2059	3761.0-3770.5	379.0-388.5	9.5	8.32	88
42	13	2215	3770.5-3780.0	388.5-398.0	9.5	8.25	87
43	13	2330	3780.0-3789.5	398.0-407.5	9.5	6.20	65
44	14	0048	3789.5-3799.0	407.5-417.0	9.5	6.17	65
45	14	0154	3799.0-3808.5	417.0-426.5	9.5	6.96	73
46	14	0305	3808.5-3818.0	426.5-436.0	9.5	9.06	95
47	14	0415	3818.0-3827.5	436.0-445.5	9.5	8.46	89
48	14	0529	3827.5-3837.0	445.5-455.0	9.5	8.51	90
49	14	0646	3837.0-3846.5	455.0-464.5	9.5	7.24	76
50	14	0802	3846.5-3856.0	464.5-474.0	9.5	3.15	33
51	14	0920	3856.0-3865.5	474.0-483.5	9.5	5.48	58
52	14	1117	3865.5-3875.0	483.5-493.0	9.5	7.02	74
53	14	1240	3875.0-3884.5	493.0-502.5	9.5	7.10	75
54	14	1358	3884.5-3894.0	502.5-512.0	9.5	9.74	103
55	14	1522	3894.0-3903.5	512.0-521.5	9.5	9.96	105
56	14	1643	3903.5-3913.0	521.5-531.0	9.5	7.27	74
57	14	1816	3913.0-3922.5	531.0-540.5	9.5	9.56	101
58	14	2013	3922.5-3932.0	540.5-550.0	9.5	8.01	84
59	14	2127	3932.0-3941.5	550.0-559.5	9.5	9.69	102
60	14	2238	3941.5-3951.0	559.5-569.0	9.5	5.14	54
61	14	2347	3951.0-3960.5	569.0-578.5	9.5	9.67	102
62	15	0059	3960.5-3970.0	578.5-588.0	9.5	9.69	102
63	15	0206	3970.0-3979.5	588.0-597.5	9.5	5.98	63
64	15	0314	3979.5-3989.0	597.5-607.0	9.5	9.59	101
65	15	0432	3989.0-3998.5	607.0-616.5	9.5	3.82	40
66	15	0541	3998.5-4008.0	616.5-626.0	9.5	6.42	68
67	15	0826	4008.0-4017.5	626.0-635.5	9.5	1.27	13
68	15	1046	4017.5-4027.0	635.5-645.0	9.5	2.25	24
69	15	1242	4027.0-4036.5	645.0-654.5	9.5	5.47	58
70	15	1417	4036.5-4046.0	654.5-664.0	9.5	1.78	19
71	15	1547	4046.0-4055.5	664.0-673.5	9.5	5.31	56
72	15	1720	4055.5-4065.0	673.5-683.0	9.5	2.05	22
73	15	1846	4065.0-4074.5	683.0-692.5	9.5	4.47	47
74	15	2021	4074.5-4084.0	692.5-702.0	9.5	7.46	79
75	15	2159	4084.0-4093.5	702.0-711.5	9.5	9.00	95
76	15	2333	4093.5-4103.0	711.5-721.0	9.5	7.71	81
77	16	0121	4103.0-4112.5	721.0-730.5	9.5	7.33	77
78	16	0311	4112.5-4122.0	730.5-740.0	9.5	8.47	89
79	16	0446	4122.0-4131.5	740.0-749.5	9.5	9.87	104
80	16	0606	4131.5-4141.0	749.5-759.0	9.5	8.35	88
81	16	0730	4141.0-4150.5	759.0-768.5	9.5	8.32	88
82	16	0903	4150.5-4160.0	768.5-778.0	9.5	6.63	70
83	16	1029	4160.0-4169.5	778.0-787.5	9.5	7.33	77
84	16	1206	4169.5-4179.0	787.5-797.0	9.5	4.50	47
85	16	1348	4179.0-4188.5	797.0-806.5	9.5	6.50	68
86	16	1517	4188.5-4198.0	806.5-816.0	9.5	5.63	59
87	16	1643	4198.0-4207.5	816.0-825.5	9.5	8.36	88
88	16	1816	4207.5-4217.0	825.5-835.0	9.5	8.07	85
89	16	2018	4217.0-4226.5	835.0-844.5	9.5	9.74	103
90	16	2153	4226.5-4235.0	844.5-854.0	9.5	4.42	47
91	17	0013	4235.0-4245.5	854.0-863.5	9.5	7.15	75
92	17	0308	4245.5-4255.0	863.5-873.0	9.5	4.55	48
93	17	0608	4255.0-4261.5	873.0-882.5	9.5	6.43	68
94	17	0807	4261.5-4274.0	882.5-892.0	9.5	7.20	76
				Totals	892.0	619.52	69

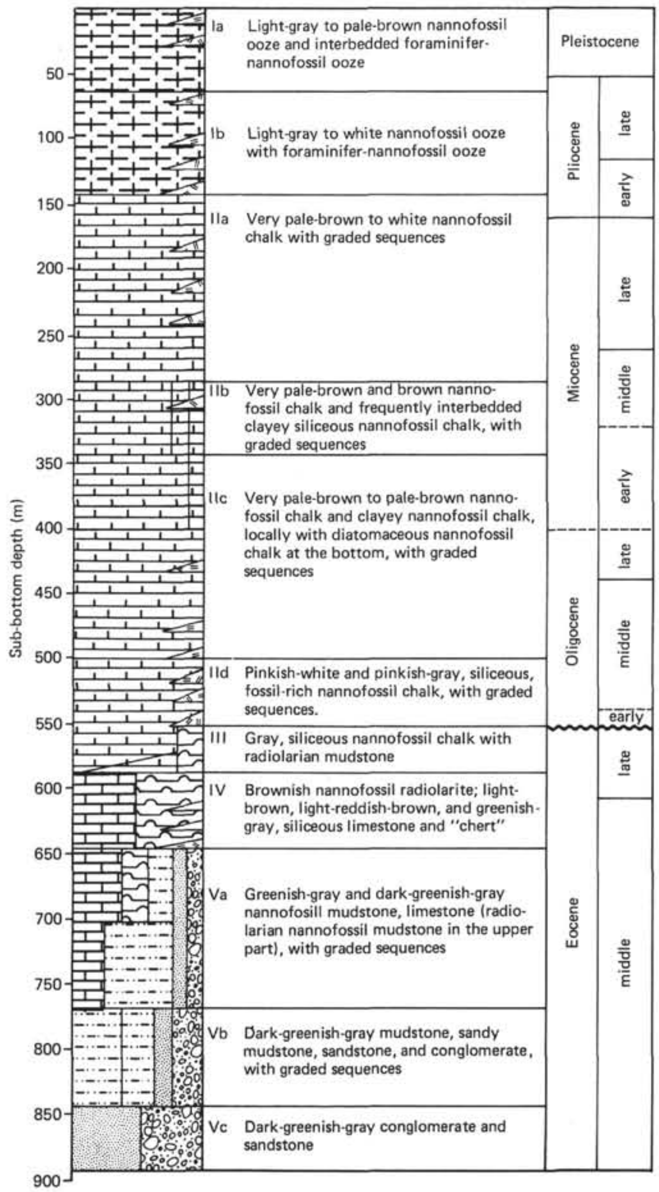


Figure 4. *Stratigraphic summary, Site 445.*

T(c–e) and T(a,b,e) are very scarce. The former is found in the lowest part of sub-unit IIb, sub-unit IIc, and sub-unit IId, and the latter is restricted to sub-unit IIa and sub-unit IIb.

T(b–e) is only observed in sub-unit IId.

Through all the types of sequences, the intervals a, b, and c generally include tests of shallow-water benthic foraminifers, and the a in the T(a–e) sequence contains many lithic fragments of very coarse-grained-sand to granule size, including clasts of muddy sediments formed earlier.

Slump structures occur in some intervals of unit II. They are concentrated in the middle to upper part of sub-unit IIa and in the upper and lower parts of sub-unit IIc. They are represented by slump folds extending vertically through an interval of 2 to 4 meters in most cases, and also by slump blocks of smaller magnitude. Some of them are accompanied by the typical Bouma

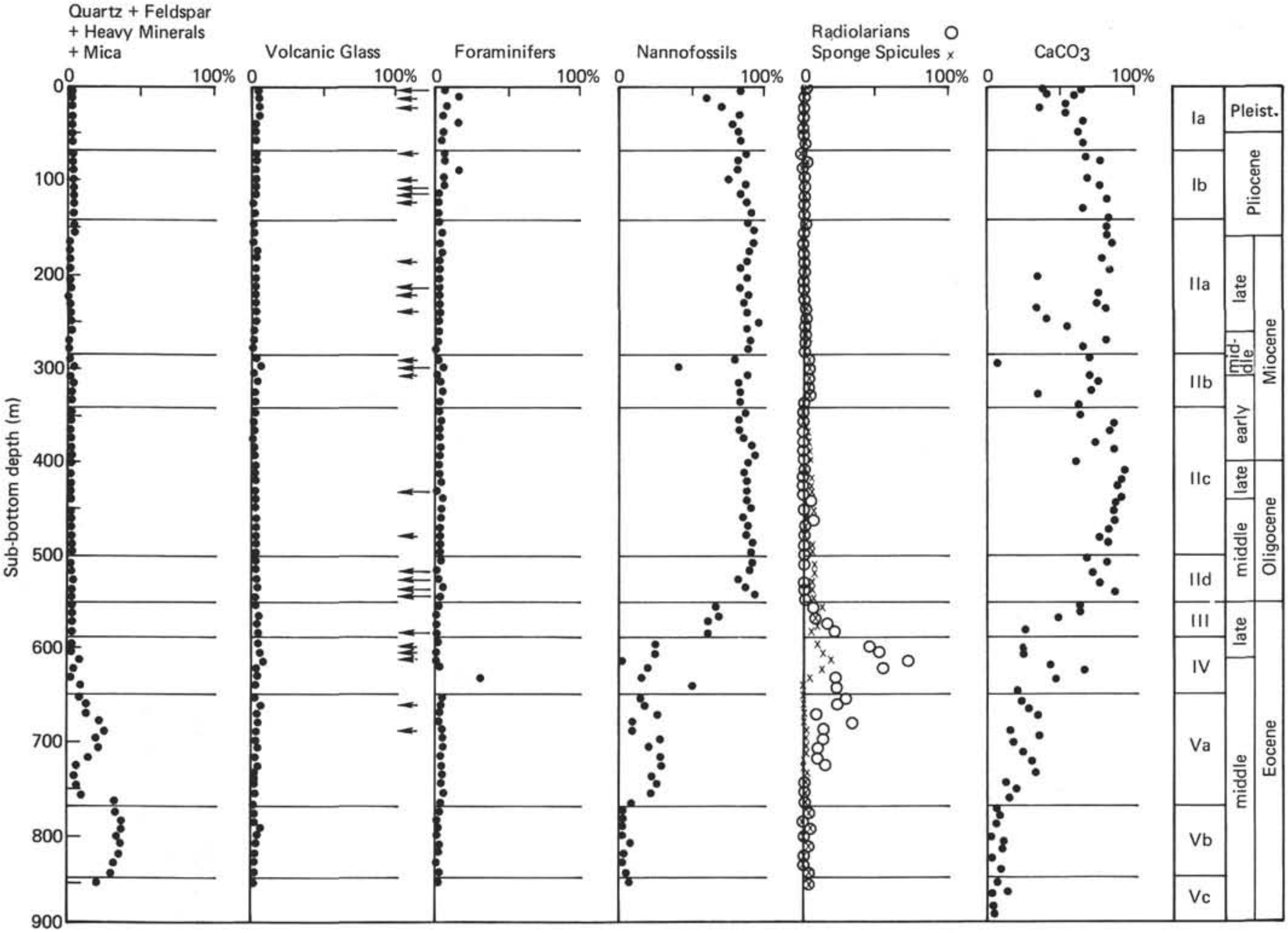


Figure 5. *Composition of dominant lithology, Site 445, determined by smear-slide observation, with $CaCO_3$ data from shore-based analysis. Plotted are average values of the components of dominant lithology in each core. Arrows in the volcanic glass column indicate the interbedded ashy layers as a minor lithology: long arrows, volcanic ash or tuff interbeds; short arrows, vitric interbeds.*

sequence T(a–e) and are definitely eroded, as shown by scoured, sharp basal contacts.

These sedimentary structures suggest that the larger part of unit II was resedimented by turbidity currents.

Sub-Unit IIa

This sub-unit consists mostly of nannofossil chalk. Clayey nannofossil chalk, marly nannofossil chalk, nannofossil mudstone, vitric nannofossil chalk, and nannofossil tuff occur as thin interbeds. Nannofossil–foraminifer chalk and foraminifer–nannofossil chalk occur as very thin layers in the basal coarse-tail graded sequence. Dominant color of sediment is very pale brown to white.

Volcanic-glass shards are generally absent, but they range from 30 to 60 per cent. Siliceous fossils are very rare.

Graded sequences with bioturbation are common. Slump structures occur through the upper half of this sub-unit.

Sub-Unit IIb

This sub-unit consists dominantly of nannofossil chalk, with varying amounts of clayey, siliceous, and volcanic components. Nannofossil chalk is frequently interbedded with clayey nannofossil chalk and nannofossil mudstone. The dominant color of the sediments is the same as in sub-unit IIa.

Bioturbation is generally intense in the upper part of interval e; this tends to relate to increasing clay content, which produces color-bands.

Sub-Unit IIc

This sub-unit is similar to sub-unit IIb. It consists mainly of nannofossil chalk, with frequent interbeds of clayey nannofossil chalk, nannofossil mudstone, and foraminifer–nannofossil chalk. Generally, clayey components are abundant in the upper part of this sub-unit, and silty claystone only occurs in the uppermost part.

The sediments are dominantly very pale brown, pale brown, and brown. Color changes frequently form color-band alternations, mostly varying with the amount of clayey component, particularly in the upper part of the sub-unit.

Graded sequences, with associated bioturbation, are extensively developed. The thickness of the beds ranges from 50 to 450 cm, mostly 80 to 100 cm.

The middle to upper part of the sub-unit often includes thin beds of another type. They are usually 30 to 40 cm thick and rest upon a sharp contact; they consist of very dark-colored nannofossil mudstone, passing upward to lighter-colored nannofossil chalk, either with or without a basal silty layer.

Slump structures occur in the upper part and the lower part.

Sub-Unit IId

This sub-unit is dominantly nannofossil chalk, with varying proportions of clayey, siliceous, and volcanic components. The dominant color is pinkish white and pinkish gray to light gray and gray.

Volcanic ash is rather common throughout this sub-unit, both as interbeds and as an admixture.

Sedimentary structures are largely represented by graded bedding, intense bioturbation, and wavy lamination. In the upper half of the sub-unit, thick beds are intensely bioturbated. The intense bioturbation very likely obliterates the bedding which might have existed. The dark-colored (black to dark-gray), tuffaceous sediments, either clayey or non-clayey, have a unique sedimentary structure in the lower part of the sub-unit. They rest on nannofossil chalk with a sharp boundary and pass upward to nannofossil chalk, and the structure is very similar to that of the middle to upper part of sub-unit IIc. Dish structures are observed in Core 57-7.

Unit III

Unit III consists dominantly of siliceous nannofossil chalk with less than 10 per cent clay, radiolarians from 4 to 25 per cent, and sponge spicules 3 to 15 per cent (combined radiolarians and sponge spicules about 30 per cent maximum). The sediment is dominantly pinkish gray and light gray to gray.

Sedimentary structures are dominated by extensively developed parallel and wavy laminations (very thin-bedded siliceous nannofossil chalk) and by intense bioturbation. Micro-faults are found in Core 61-3.

Unit IV

Unit IV is essentially characterized by frequent occurrence of radiolarians and well-indurated rocks such as siliceous limestone and "chert."

The middle to upper part is largely composed of radiolarite, with interbeds of more-calcareous, clayey, or ashy layers. Dominant color is olive gray to light brown to light yellowish brown. Siliceous fossils form 60 to 80 per cent of the total in the radiolarite, of which two thirds to four fifths consists of radiolarians and the remainder of sponge spicules.

Bioturbation is moderate to intense and extensive. Graded sequences are very poor, represented rarely by some intervals similar to T(d,e). Instead, sandy to silty, very thin layers (a few millimeters) are thin bedded, without definite upper and lower boundaries.

In the middle part of this unit (Cores 64 and 65), are interbedded thin layers (10 to 20 centimeters thick) of "chert", siliceous limestone, and siliceous marly limestone.

Core recovery for the lower part of Unit IV (Cores 67 and 68) is not good. The lower part is composed largely of interbedded limestone and chert, very hard and massive to parallel thin-laminated. Color is very variable: light reddish brown, to very dark grayish brown, olive gray, greenish gray, and dark greenish gray. Visual discrimination of siliceous limestone and chert is very difficult.

A thin interbed of greenish gray graded sandstone (about 10 centimeters thick) is present in Core 68-1. It begins as a coarse grained sandstone just above a sharp basal contact (Core 68-1, 95 cm), and passes upward to faintly laminated to massive sandy limestone and well-laminated nanno limestone, successively. The sandstone contains many reworked foraminiferal tests of *Asterocyclina* cf. *penuria, Operculinoides* sp., and smaller type foraminifers of benthic and planktonic forms.

Unit V

Unit V is essentially characterized by abundant terrigenous components, in contrast to the overlying units. Although siliceous and calcareous biogenic components are present in considerable amount in the upper part, they decrease downward; on the contrary, terrigenous components of various grain size gradually increase and become coarser downward, and the lower part consists only of conglomerate and sandstone. This makes it possible to subdivide this unit into three sub-units.

The dominant lithology of unit V is mudstone, sandy mudstone and limestone (sub-units Va and Vb) and conglomeratic sandstone (sub-units Va to Vc), greenish gray to dark greenish gray in color.

The lithological suite of mudstone, sandy mudstone, and limestone shows very thin-bedded or laminated sedimentary structure in general. Different-sized grains, very fine sand to silt and mud, repeatedly occur in laminae of 1 to 2 cm. Also, the extensive occurrence of thin-bedded T(d,e) sequences characterizes this lithologic suite. Small-scale slump folds are rarely developed, and microconvolutions and microfaults are common features.

Conglomeratic sandstone is developed throughout unit V. It occurs in sub-units Va and Vb as interbeds, thickness ranging from about 5 to 120 cm. On the other hand, it makes massive, very thick beds in sub-unit Vc, which has little finer sediment.

Conglomerate is of debris flow origin and consists of variously sized clasts and calcareous fossil tests, mainly of larger foraminifers, with sandy grains and small amounts of muddy matrix of nannofossil-rich mudstone (Figure 6).

Most clasts are chaotically arranged, but tend to fine upward from pebble and granule size to granule and very coarse-sand size. Clasts are relatively larger in sub-unit Vc, attaining diameters up to 15 cm. Clasts and

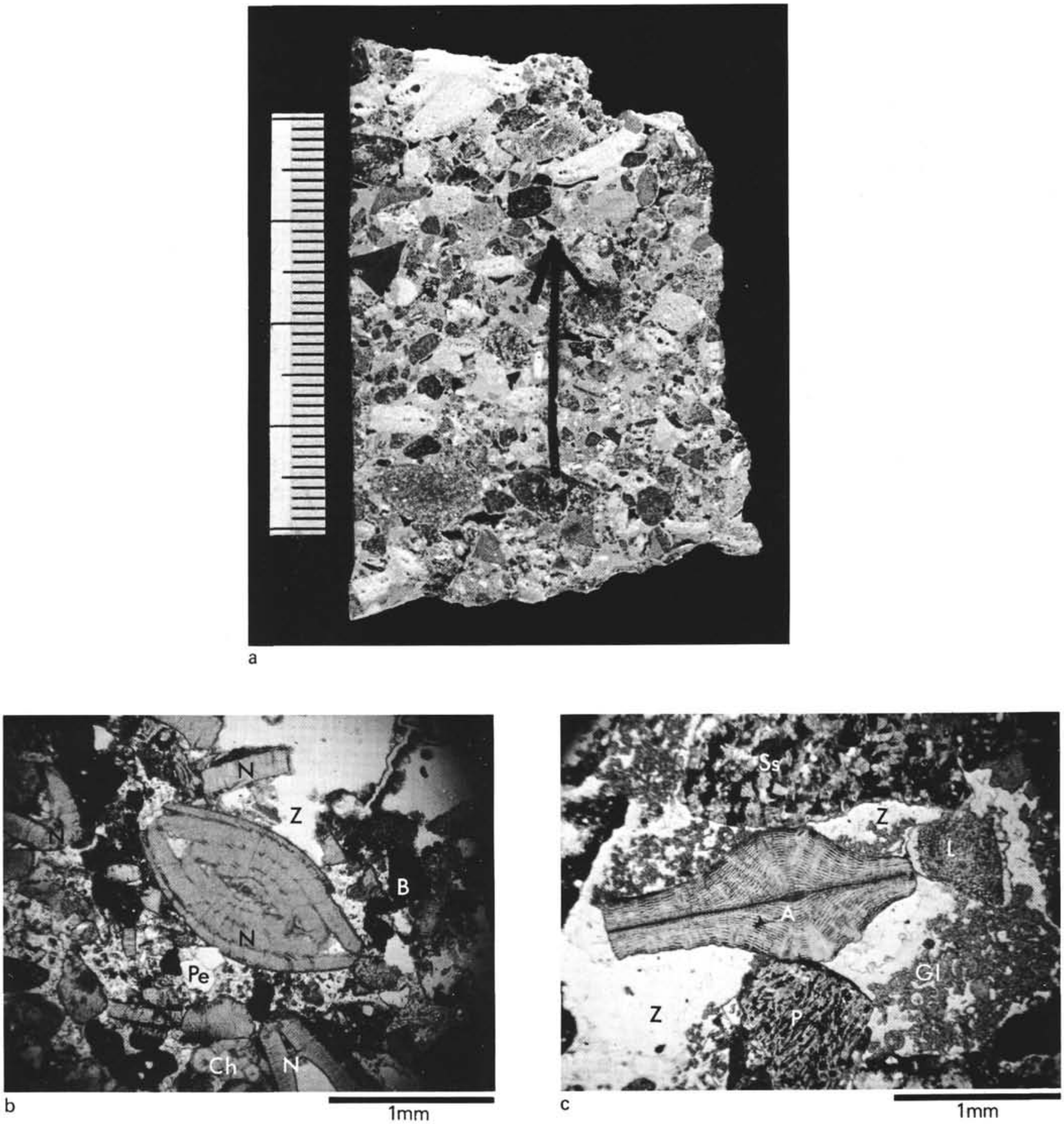


Figure 6. A. *Photograph of slice sample of* Nummulites-*bearing conglomerate (Core 69-2, 64–68 cm; sub-unit Va). White spots are* Nummulites *tests, and dark spots are largely basalt and other igneous rocks.* B. Nummulites-*bearing conglomerate, showing tests of megalospheric form of* Nummulites boninensis *Hanzawa (Core 74-3, 59–61 cm, sub-unit Va). Besides* Nummulites boninensis *tests (N), fragments of basalt (B) and plagioclase (Pl), and highly altered, chloritized volcanic clasts with oolitic structure (Ch) are scattered in cementation materials of zeolite (Z), shown by white fills. Lower nicol only.* C. Nummulites-*bearing conglomerate, showing tests of* Asterocyclina *sp. cf.* A. penuria *Cole (Core 69-2, 8–12 cm; sub-unit Va).* Asterocyclina *sp. cf.* A. penuria *(A), clasts of sandstone (Ss), basalt (B), and limestone (L), and fragmental grains of glauconitic nannofossil clay or tuff (Gl) are filled with zeolite (Z) shown by white color. Lower nicol only.*

sand grains have various colors of green, brown, red, white, and black, and are variously shaped, angular to rounded. Under the microscope, the following rocks and minerals were distinguished: plagioclase phyric basalt (dominant), aphyric basalt (common), microdolerite (common), hornblende schist (rare), chert, sandstone, limestone, plagioclase (common), green hornblende (common), titaniferous augite (common), brown hornblende (rare), augite (common), olivine pseudomorphs (rare), chromian spinel (picotite) (common), epidote (rare). Heavy minerals (Sato, this volume) in conglomerate and sandstone include common hornblende and augite of volcanic origin, some minerals of schists, such as bluish-green amphibole and epidote, and chromite, which may have been derived from ultrabasic rock.

Calcareous fossil tests are megalospheric and microspheric forms of *Nummulites boninensis* (very abundant), *Asterocyclina* sp. cf. *A. penuria,* and *Operculinoides* sp., besides fragments of bryozoan and *Ostrea.* Microspheric forms of *N. boninensis* attain diameters of about 3 cm, but most of the tests are broken. *Nummulites* and *Asterocyclina* are identical with those reported from sea bottoms of the Oki–Daito Ridge, the Daito Ridge, and the Amami Plateau at depths of 1500 to 2300 meters by Mizuno and Konda (1977) and Mizuno et al. (1977).

Both lithologic suites locally develop the perfect Bouma sequence, T(a–e): in Core 71-1, conglomeratic sandstone forms the base of interval a and gradually passes upward to interval b, consisting of parallel-laminated sandstone, the interval c consisting of very fine-grained sandstone with microconvolution, and the interval d of nannofossil limestone with weak parallel lamination. This sequence ends in the uppermost interval e, composed of massive, muddy nannofossil limestone (71-1, 19–89 cm).

A primary sedimentary structure common to both lithologic suites in unit V is inclined bedding. In most cores and sections, beds dip at 5 to 10° or more. The direction of dip frequently changes from core to core and (or) from section to section. This structure may have resulted from frequent resedimentation by large-scale submarine slumping or sliding.

Sub-Unit Va

This sub-unit is dominantly thin-bedded and laminated, greenish-gray to dark-greenish-gray nannofossil mudstone, sandy mudstone, and nannofossil limestone, with interbeds of conglomerate and sandstone. In the upper part, mudstone, sandy mudstone, and limestone are often rich in partly dissolved radiolarians. Volcanic glass is usually present in amounts up to 3 per cent, but very locally reaches more than 10 per cent in the upper part.

Conglomerate and sandstone interbeds containing larger foraminifers are distributed throughout, but beds more than 50 cm thick occur in the middle to upper part (Cores 69–78).

Sub-Unit Vb

This sub-unit consists of dark-greenish-gray sandy mudstone, mudstone, and conglomerate. The general sedimentary features of sandy mudstone and mudstone are very similar to those of sub-unit Va, except for a general increase of sandy particles in mudstone. They are devoid of siliceous fossils and relatively poor in calcareous fossils. Conglomerate occurs as interbeds of 10 to 70 cm in the upper part and the lowest part.

Sub-Unit Vc

This sub-unit is exclusively dark-greenish-gray conglomerate, sandstone, and muddy sandstone. The upper part (Cores 90–92) consists of alternating conglomerate, sandstone, and muddy sandstone, whereas the lower part (Cores 93–94) consists of thick beds of conglomerate with larger clasts (up to 15 cm in diameter) and irregularly interbedded, ill-sorted sandstone. They show slump structures throughout.

ORGANIC GEOCHEMISTRY

Organic-carbon and nitrogen contents were measured for 74 sediment samples. Results of the analyses are reported elsewhere (Waples and Sloan, this volume) and are plotted in Figure 7. In the upper part of the section (0–525 m sub-bottom depth), where virtually all the samples are pelagic (biogeneous carbonate represents more than 80% of the sediment), the organic-carbon and nitrogen profiles are very similar to those reported for Sites 442, 443, and 444 for hemipelagic sediments. Organic-carbon and nitrogen values decrease steadily from the sediment water interface (0.27 and 0.38%, respectively) to a depth of about 100 meters, below which they remain constant at about 0.06 and 0.015 per cent, respectively, throughout the pelagic-sediment interval.

Below 600 meters, the regularity of the organic-carbon profile is broken by anomalously high contents in many sediments. Most of the sediments from 600 to 885 meters are silty (–25% silt-size particles) or sandy (©15% sand-size particles), and represent reworked sediments deposited during episodes of slumping and (or) turbid flow (Figure 8). It is likely, therefore, that the organic debris contained in these sediments is also reworked.

Benthic foraminifers throughout this interval indicate that the original depositional environment was relatively shallow, conditions favoring the input of relatively greater amounts of terrigenous organic debris.

The C/N ratios for the silty material also support a terrestrial origin for much of the organic material. As grain size increases toward silt, there is a dramatic increase in the C/N ratio. Because terrestrial plants generally are much depleted in nitrogen compared to aquatic organisms, the organic material in the silt fraction probably is terrestrial. The C/N ratios of the sandy samples were about the same as for clays. This indicates

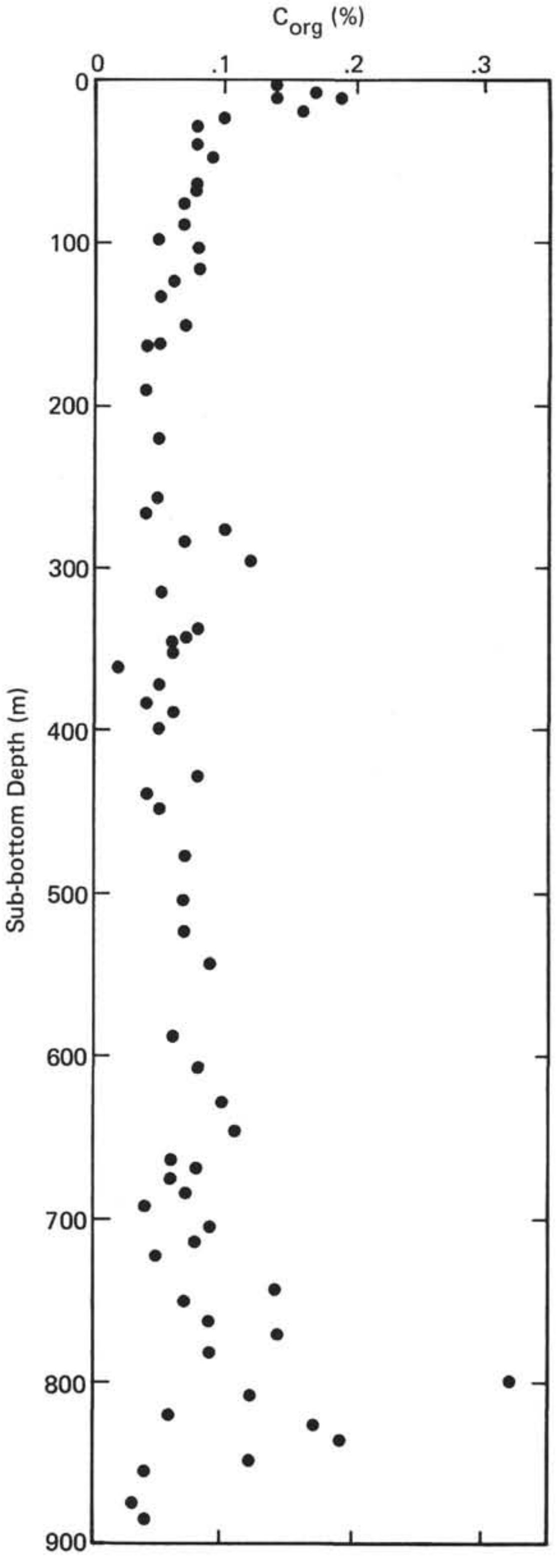


Figure 7. *Per cent organic carbon versus depth (all sediments), Site 445.*

that the sands did not bring much organic material with them; the small quantities of organic matter associated with these sediments are probably adsorbed on the clay-sized particles.

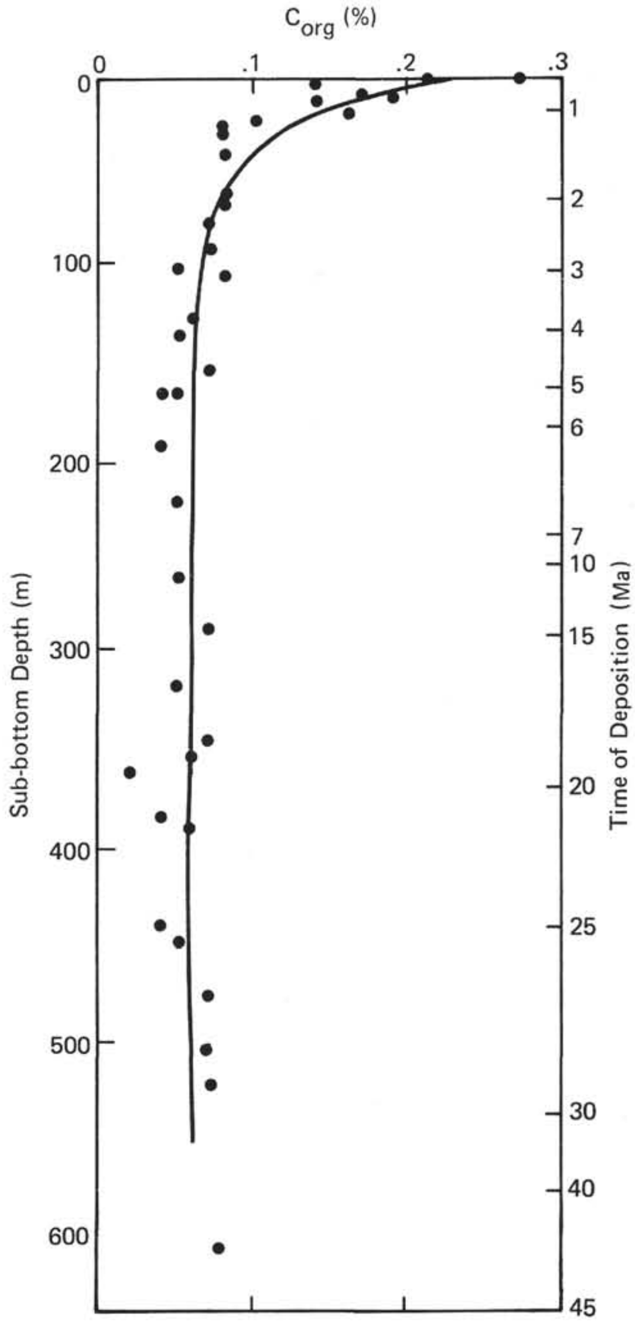


Figure 8. *Per cent organic carbon versus depth (pelagic sediments), Site 445.*

INORGANIC GEOCHEMISTRY

From Hole 445, 14 samples were taken for interstitial-water studies. The data are presented in Table 2 and on Figure 9.

*p*H

*p*H averages 7.46, which is lower than the values for the IAPSO and surface-sea-water standards. *p*H varies somewhat down-hole, but does illustrate a trend to increase from the surface down to 296.5 meters, and from

TABLE 2
Summary of Shipboard Geochemical Data for Hole 445

Sample (interval in cm)	Sample Number	Sub-Bottom Depth (m)	pH	Alkalinity (meq/kg)	Salinity (⁰/oo)	Ca^{++} (mmol/l)	Mg^{++} (mmol/l)	Cl^- (⁰/oo)
	IAPSO		7.99	2.39	35.2	10.55	53.99	19.375
	SSW		8.32	2.41	35.2	10.48	53.29	19.444
445-1-4, 144–150	28	5.94–6.00	7.57	3.05	35.2	11.20	51.45	19.547
6-5, 144–150	29	53.94–54.00	7.36	3.33	35.5	15.83	43.40	19.822
11-4, 144–150	30	99.94–100.00	7.54	1.66	35.5	17.05	38.75	19.856
17-1, 140–150	31	152.40–152.50	7.21	0.87	35.2	20.58	33.09	19.925
22-1, 144–150	32	199.94–200.00	7.40	1.80	35.2	22.93	32.34	19.822
27-4, 140–150	33	251.90–252.00	7.38	1.76	36.3	25.46	30.22	19.959
32-2, 140–150	34	296.40–296.50	7.42	1.50	35.2	26.90	29.31	20.200
37-4, 140–150	35	346.90–347.00	7.18	1.70	34.6	27.86	29.59	19.512
42-5, 90–100	36	395.40–395.50	7.32	1.58	35.5	30.74	25.83	19.993
47-4, 90–100	37	441.40–441.50	7.37	1.31	36.3	35.53	21.51	20.062
52-4, 90–100	38	488.90–489.00	7.58	1.40	36.3	37.54	21.21	20.200
62-4, 140–150	39	584.40–584.50	7.63	0.68	36.3	39.56	21.91	20.097
65-2, 90–100	40	609.40–609.50	7.44	1.39	36.3	41.79	21.45	20.371
80-4, 90–100	41	754.90–755.00	8.08	0.36	36.3	45.84	26.14	20.406

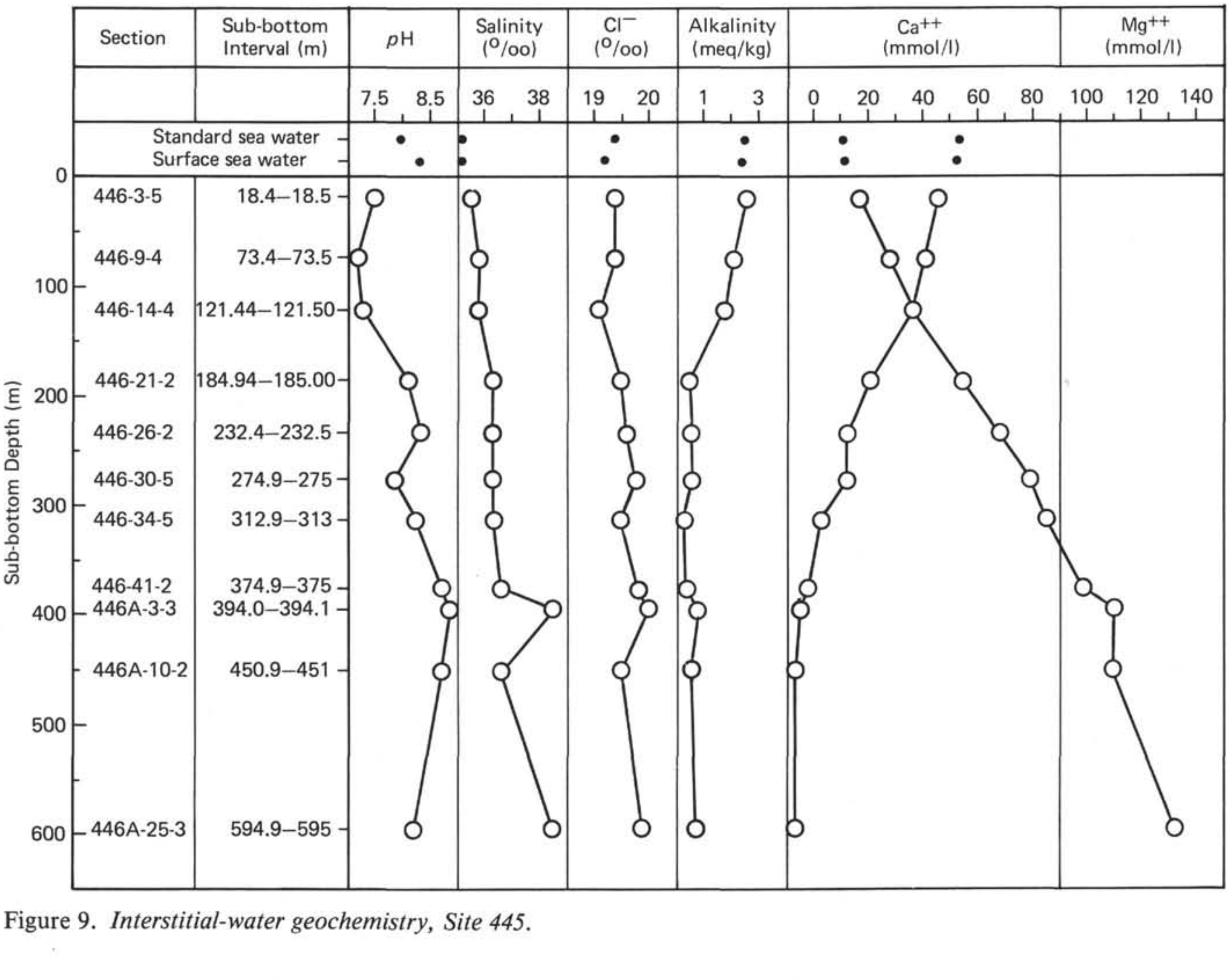


Figure 9. *Interstitial-water geochemistry, Site 445.*

346.9 to 755 meters. The separation of these two trends approximates the boundary between sub-units IIb and IIc.

Alkalinity

Alkalinity averages 1.6 meq/kg, lower than values for the two standards. Alkalinity shows little variation down-hole, except for a fairly steady decrease in values with increasing depth.

Salinity and Chlorinity

Salinity averages 35.7 per mill, and chlorinity 19.96 per mill, both averaging higher than the IAPSO and surface-sea-water standards. Both parameters increase with increasing depth, and, as expected, the trends of the two parameters correlate.

Ca^{++} and Mg^{++}

Ca^{++} averages 24.5 mmol/l, higher than the standard values of 10.55 and 10.48. Mg^{++} averages 30.44 mmol/l, which is lower than the standard values o 53.99 and 53.29.

Ca^{++} illustrates a definite trend of increasing with depth, whereas Mg^{++} generally decreases with depth. The crossover for the two trends occurs in Core 37 (346.9–347.0 m), which marks the sub-unit IIb/IIc boundary of very pale-brown and pale-brown, clayey nannofossil chalks; siliceous marly chalk; and white pinkish-gray and very pale-brown, clayey nannofossil chalks and nannofossil chalks.

The decrease of Mg^{++} with depth is interrupted in Core 52, below which Mg^{++} values show a slight tendency to increase.

BIOSTRATIGRAPHY

Quaternary to middle-Eocene sediments were recovered at Site 445 (Table 3). This site, at a water depth of 3377 meters, is bordered by ridges in three directions with heights of 1000 to 2000 meters. This topographic feature created continuous and heavy reworking throughout the entire sequence.

Because the sedimentary basin is well above the CCD, calcareous microfossils are abundant. The preservation of foraminifers and calcareous nannofossils proves that this site has been well above the CCD from the middle Eocene to the present. Although the history of subsidence is not indicated by present paleontological data, further study of benthic foraminifers may provide this information.

All paleontological evidence indicates a strong influence of tropical water during the middle Miocene and afterward. The relatively rare tropical nannofossils of the early Miocene and Oligocene periods may indicate slight cooling from the early Oligocene to the early Miocene at this site; also, foraminifers are smaller, and microforaminifers dominate the fauna in the same sequence.

The Pliocene/Pleistocene boundary was identified in Core 6 by foraminifers and nannofossils. Although a well-preserved modern radiolarian fauna was observed in Cores 1 and 2, radiolarians were not preserved in lower cores until the middle Miocene.

Foraminifers and nannofossils are abundant and well preserved in the Pliocene. Both the floral and faunal assemblages indicate Core 16 as the Miocene/Pliocene boundary.

Cores 17 to 28 represent the late Miocene and the middle and late early Miocene was recovered in Cores 29 to 35. The first overgrowth of nannofossils is in the upper Miocene. The sediment became too hard for quick examination of foraminifer assemblages in the lower cores, except for sporadic soft layers. Therefore, the age determination almost exclusively relied upon nannofossils in the early Miocene and older sediments.

The Oligocene/Miocene boundary was identified in Core 41. The middle and late Oligocene was represented by Cores 41 to 57, whereas the entire early Oligocene and the early middle Oligocene, representing at least 8 m.y., are represented by less than 15 meters of sediment. Therefore, a hiatus is suspected in the late Eocene to early middle Oligocene.

In the Oligocene and Eocene, which are mainly turbidite deposits, reworked fossils such as *Nummulites*, "larger" foraminifers, bryozoans, echinoid spines, and fragments of mollusks are common.

The abrupt appearance of a late-Eocene nannofossil assemblage was observed at Core 59-3. The top of the Eocene may be missing at this site. Radiolarians are abundant but not well preserved in Cores 63 to 65, and absent below Core 65.

Cores 66 through 89 represent the later middle Eocene. Both foraminifers and nannofossils confirm the age of the lower portion of this sequence as middle middle Eocene (47–48 m.y.).

Foraminifers

Continuous coring at Site 445 provided a foraminifer sequence from Neogene (N.23) through Paleogene (P.11/P.10; middle Eocene), suitable for biostratigraphic and environmental study.

In general, the foraminifers are abundant in the Pleistocene and Pliocene and decrease in number, size, and diversity from the Miocene to middle Eocene. They show no dissolution.

Although deposition is estimated to have been well above the CCD throughout the section encountered at this site, for some time spans foraminifers are rare or absent, and in some sections represented only by juveniles and microforaminifers. Therefore, fluctuating climate may have controlled this situation.

Only core-catcher samples were used for shipboard study, because rocks from the lower Miocene downward were so lithified (by foraminifer-study standards) that processing the material was time consuming.

Table 3 is a summary of the zonation of Hole 445.

In Cores 1 through 5, planktonic and benthic foraminifers are abundant and well preserved; they indicate a Pleistocene age and deposition well above the CCD.

Cores 6 through 15 are Pliocene, and again the condition of the entire foraminifer fauna indicates that deposition was above the CCD. In Core 16, the Pliocene/Miocene (N.18; ~5 m.y.) boundary was detected; because this is defined by evolutionary appearances and concurrent ranges, precise definition must await study of the section samples. Cores 17 to 41 are Miocene. Throughout this interval, normal-sized foraminifers are very rare, and the index species used for the very short middle-Miocene zonation recognized in other parts of the world (i.e., Caribbean) were not seen.

Although the foraminifers are mostly in the microforaminifer size range, occasional normal-sized benthic forms indicate an open-sea (≥500 meters) environment.

Fossils extracted from the indurated Oligocene are tiny and moderately well preserved. Based on the nannofossils, the Oligocene is estimated to range from within Core 41 to Core 59, Section 4. The Oligocene identified foraminifer zones are within Core 49 through Core 57, approximately 26.5 to 36+ m.y. In Cores 52 and 53-4, 68–70 cm, *Nummulites*, one of the "larger" foraminifers, was recovered from a greenish fragmented sandstone. Core 53 also contained other shallow-water foraminifers, such as *Baculogypsina, Gypsina, Sphaerogypsina,* and *Rupertina.* In the rubble, Eocene planktonic forms were also found, which indicate reworking in this section. The washed residue of 57,CC is ash, but it contained many planktonic foraminifers of Eocene (?) age, encrusted with ash.

In Core 76, from 711.5 to 721 meters, the mid-Eocene species *Globorotalia spinulosa* was encountered. This sample is dated approximately 44.5 to 45 m.y. Cores 79, 80, and 85 are also middle Eocene. The tentative foraminifer zonation shown in Table 3 indicates that sediments as old as 48 to 49 m.y. were penetrated in this hole.

Both the megalospheric and microspheric generations of *Nummulites* occur in abundance in many of the Eocene cores from Core 60 downward. These may be related to the species *Nummulites boninensis*, described by Hanzawa in 1947 and recognized by Mizuno and Konda (1977) in dredge hauls near Daito and Oki-Daito Islands. The rocks in which these *Nummulites* occur also contain other shallow-water elements such as the benthic genus *Amphistegina* s.l. and fragments of bryozoans, pelecypods, echinoid spines and *Ostrea.* The fauna is undoubtedly reworked. However, the unbroken condition of the tests of the foraminifers may indicate a short distance of transport, therefore suggesting that this site is close to the source.

Nannofossils

Upper-Pleistocene to middle-Eocene nannofossils occur at this site. Nannofossils are abundant in all cores except the middle-Eocene sequence, in which they are sporadic. Because of heavy and continuous reworking, however, dating of cores was difficult in some intervals. All reworked specimens observed at this site represent a few zones prior to the time of redeposition, with a maximum time difference of several million years. Nannofossils are well preserved in the upper sequence (upper Miocene and above); only slight etching, without any sign of overgrowth, is recognized. Slight etching and moderate to heavy overgrowth, on the other hand, prevail in the lower cores. Recrystallization of nannofossils is strongest in the Oligocene and becomes relatively weak in the middle-Eocene turbidites. The age identification of cores is summarized in Table 3.

Pleistocene

Sections 1 to 5 of Core 1 belong to the *Emiliania huxleyi* Zone, whereas Section 1,CC contains an assemblage of the *Ceratolithus cristatus* Subzone. Reworked fossils are mostly Pliocene to early Pleistocene forms, but much older species, such as *Cyclicargolithus floridanus,* are also observed. Sections 2-2 to 3-5 belong to the *Pseudoemiliania lacunosa* Subzone, and a subtropical assemblage of the *Crenalithus doronicoides* Zone occurs in Section 4-1 to 6-3. The Pliocene/Pleistocene boundary was identified in Section 6-4.

Pliocene

Section 6-5 to 12-4 belong to the late Pliocene (*Discoaster brouweri* Zone). The disappearance of *Discoaster surculus* identifies the base of the *D. surculus* Subzone at Section 9,CC. Heavy reworking prevents subdivision of this sequence. The early-Pliocene cores, however, are recognized at subzone levels. Core 13 belongs to the *Discoaster asymmetricus* Subzone, whereas Cores 14 and 15 represent the *Sphenolithus neoabies* Subzone. The *Coratolithus rugosus* Subzone is identified in Sections 16-2 to 16-4. The *C. acutus* Zone occurs in Cores 16,CC to 18-2, and the Miocene/Pliocene boundary lies within this interval.

Miocene

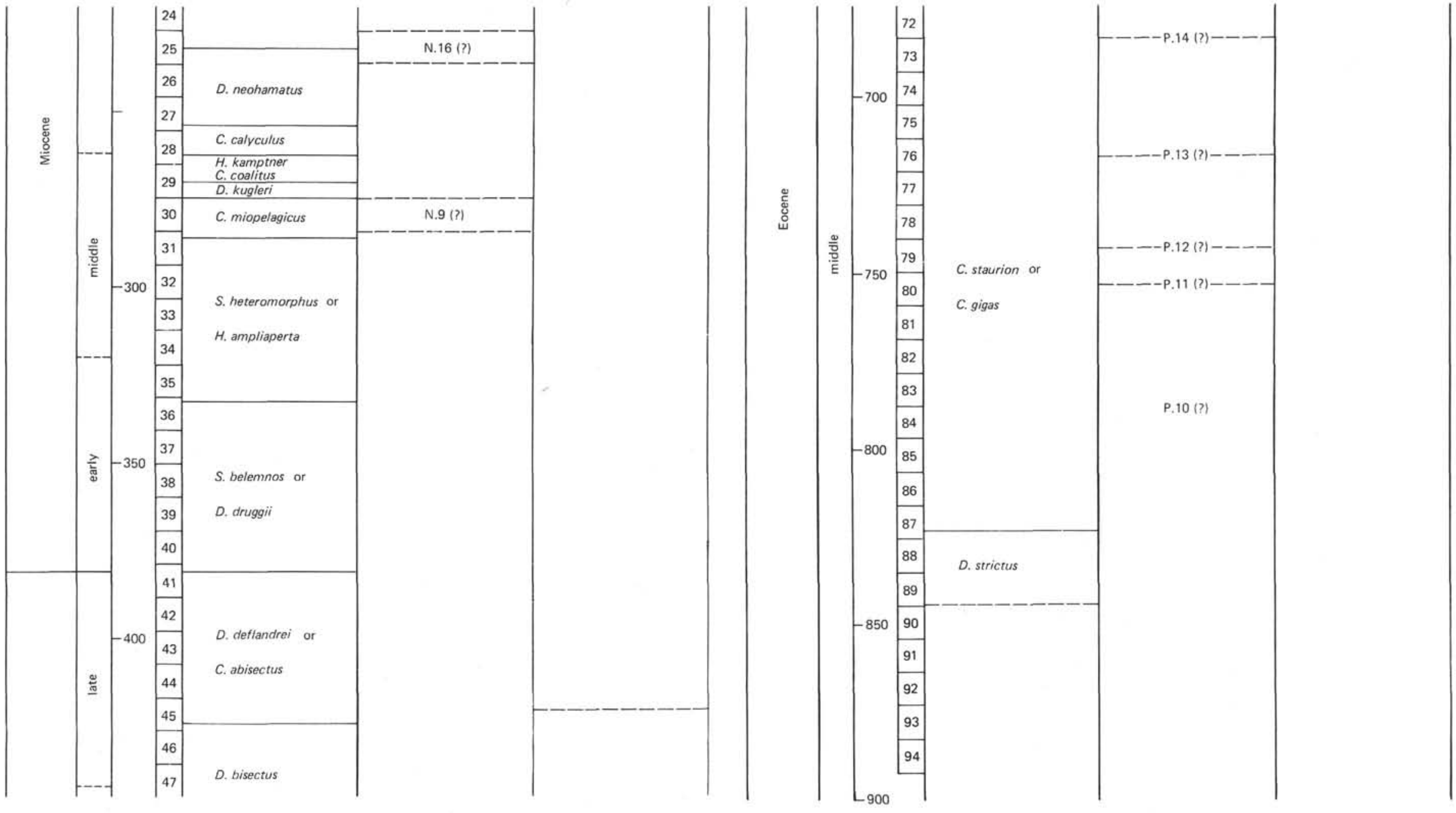
Miocene assemblages of abundant nannofossils occur in Cores 18-4 through 41-1. Section 18-4 belongs to the late late Miocene (*Triquetrorhabdulus rugosus* Subzone). Cores 18,CC to 25-3 belong to the *Discoaster quinqueramus* Zone, and the first occurrence of *Amaurolithus primus* identifies the base of the *A. primus* Subzone in Section 22-2. The preservation of nannofossils is good until Core 23; it becomes mostly moderately good in the Miocene sequence. The *Discoaster neohamatus* Zone occurs in Cores 25-5 to 27-5, and Cores 27,CC to 28-4 belong to the *Catinaster calyculus* Subzone. Because *Discoaster hamatus* occurs only sporadically, the base of the *Helicosphaera carter* Subzone is not clear. The base of the *Catynaster coalitus* Zone is recognized in Section 29-4 by only the occurrence of *Discoaster kugleri* in 29,CC. Cores 30-2 to 31-1 belong to the *Coccolithus miopelagicus* Subzone of early middle Miocene. Cores 31-3 to 35,CC represent the *Helicosphaera ampliaperata* Zone or the *Sphenolithus heteromorphus* Zone. The sporadic and rare occurrence of *H. ampliaperata* and reworking hampers identification of the boundary between these two zones. Similarly, the absence of *Sphenolithus belemnos* prevents division of the early-Miocene cores between sections 36-2 and 41-1. These cores belong to the *Discoaster druggi* Subzone or *S. belemnos* Zone.

TABLE 3
Biostratigraphic Zones, Site 445

Age		Depth (m) and Core No. 445		Nannofossil Zones and Subzones	Foraminifer Zones	Radiolarian Zones
Pleistocene			1	*E. huxleyi*	N.23	*L. haysi*
				C. cristatus		
			2	*P. lacunosa*		
			3			
			4	*C. doronicoides*	N.22	
			5			
		50	6			
Pliocene	late		7	*C. macintyeri*	N.21	
			8			
			9			
			10	*D. surculus* or *D. tamalis*		
		100	11			
			12			
	early		13	*D. asymmetricus*	N.19 (?)	
			14	*S. neoabies*		
			15			
			16	*C. rugosus*	N.18 (?)	
		150	17	*C. acutus* *T. rugosus*		
	late		18			
			19	*A. primus*	N.17 (?)	
			20			
			21			
		200	22	*D. berggrenii (?)*		
			23			

TABLE 3 – *Continued*

Age		Depth (m) and Core No. 445		Nannofossil Zones and Subzones	Foraminifer Zones	Radiolarian Zones
Oligocene	middle	450	48	*C. floridanus*		
			49		N.3/P.22 (?)	
			50			
			51			
			52	*S. distentus*		
		500	53		N.2/P.21 (?)	
			54			
			55			
			56		P.17/P.18 (?)	
			57			
	early		58	*S. predistentus* *H. reticulata*		
	late	550	59	*I. recurvus*		
			60			
			61	*C. oamaruensis*		
			62			
			63	*D. saipanensis*		
		600	64			
			65	*D. bifax*		
			66			
			67			
			68			
		650	69			
			70			
			71			


Miocene
middle
early
late
300
350
400
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
D. neohamatus
C. calyculus
H. kamptner
C. coalitus
D. kugleri
C. miopelagicus
S. heteromorphus or
H. ampliaperta
S. belemnos or
D. druggii
D. deflandrei or
C. abisectus
D. bisectus
N.16 (?)
N.9 (?)
Eocene
middle
700
750
800
850
900
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
C. staurion or
C. gigas
D. strictus
P.14 (?)
P.13 (?)
P.12 (?)
P.11 (?)
P.10 (?)

Oligocene

Cores 41-3 to 45-3 are assignable to the latest Oligocene or the earliest Miocene (*Cyclicargotithus abisectus* Subzone or *Discoaster deflandrei* Subzone). Cores 45,CC to 52-1 belong to the *Sphenolithus ciperoensis* Zone, and Section 47-3 represents the base of the *Dictyococcites bisectus* Subzone. Although rare, the consistent occurrence of *Sphenolithus distentus* identifies Cores 52-3 to 57,CC with the *S. distentus* Zone.

An assemblage of the early early to early middle Oligocene (*Helicosphaera reticulata* and *Sphenolithus predistentus* Zones) occurs in Cores 58-2 to 59-3. Because of heavy reworking, detailed age identification is impossible for this interval. Considering the length of time (8 m.y.) represented by this short sequence of sediment, a hiatus is suspected. The sudden increase of *Reticulofenestra umbilica* and *Discoaster saipanensis* below Sections 58-2 and 59-4 respectively suggests hiatuses at the top and at the base of this sequence. Although rare, *Isthmolithus recurvus* occurs consistently through this sequence and in the uppermost Eocene cores. This species is seldom preserved in low-latitude area, whereas it is common in high-latitude areas (Bukry, 1975). At nearby Sites 290, 291 and 292, this species was not observed. The cause of the sporadic occurrence of this species at this site is not clear at present.

Eocene

The first occurrence of *I. recurvus* in Section 60,CC identifies the base of the upper-Eocene *I. recurvus* Subzone. Although *Chiasmolithus oamaruensis* does not occur at this site, extinction of *C. grandis* indicates the base of the *C. oamaruensis* Subzone in Section 63-1. Cores 63-3 to 65-1 and 66-1 to 71-4 belong to the *D. saipanensis* and *Discoaster bifax* Subzones, respectively. Below Core 65, hitherto ubiquitous nannofossils are scarce and sporadic. The *Chiasmolithus gigas* and *Coccolithus staurion* Subzones of the middle middle Eocene are identified in Cores 72-1 to 87-2. The turbidites of Cores 88 and 89 contain a moderately well-preserved assemblage of the *Discoaster strictus* Subzone (47.0–48.0 m.y.). The oldest reworked fossils found in these cores are *Discoaster lodoensis* and *D. sublodoensis*. Both species are considered to have become extinct about 48.0 Ma. Cores 90 and 91 contain a few poorly preserved nannofossils; the assemblage does not justify age identification, and Cores 92 to 94 are barren of nannofossils.

Radiolarians

Radiolarians are sporadic at Site 445. Only Cores 1 and 2 had well-preserved and abundant radiolarians. Radiolarians in any abundance are again encountered only in Cores 63 through 65, but they are not well preserved.

Cores 1 and 2 are Pleistocene to Holocene and contain species which are still living in today's seas (*Spongaster tetras, Euchitonia furcata,* and *Ommatartus tetrathalamus*). Cores 3 through 30 are barren, and Cores 31 through 34 have a few middle-Miocene species, with slight lower-Miocene reworking. Many cores from 35 to 58 are barren, but some contain abundant unidentified fragments of radiolarian spines and lattices.

Below the chert, the sediments are coarse-grained (sandy mudstones grading into conglomerates), and radiolarians are not preserved in this type of sedimentary regime. The moderately well-preserved radiolarians in Cores 63 through 65 contain species of the Eocene and Oligocene genera *Eusyringium, Podocyrtis, Dorcadospyris,* and *Theocyrtis.* No radiolarian zone can be assigned to Core 63, but Cores 64 and 65 belong to the late Eocene (*Podocyrtis chalara* Zone). There are no radiolarians preserved below Core 65.

SEDIMENTATION RATE

An age–depth plot is shown in Figure 10. The ages of the sediment were obtained using the time-scales of Berggren (1972), Berggren and Van Couvering (1974), and Bukry (1975), and the modified Miocene time scale of Saito (1977). Table 4 shows sediment accumulation rates calculated for each stratigraphic unit.

The sediment accumulation rates show a systemic change down-hole. They are moderate to moderately high for the Pleistocene and Pliocene foraminifer-nannofossil oozes of unit I, and moderate for the Oligocene and Miocene chalks of unit II. The rates are lowest 9.3 during the early Oligocene and late Eocene, during deposition of the radiolarites and chert of unit III; they increase drastically in sandstones, conglomerates, and mudstones of unit V (early late and middle Eocene). The sediment accumulation rate curve shows remarkable similarity to the trend of the accumulation rate curve for Site 286 in the Hebrides Basin (Andrews, Packham, et al., 1975), in particular, and both Sites 285 and 286 in general (Klein, 1975). There, the high rates of accumulation were characteristic of debris-flow conglomerates and turbidite sandstones; the lowest rates were characteristic of biogenic, pelagic carbonate oozes, and intermediate and moderate rates were characteristic of resedimented nannofossil oozes.

The explanation for the sediment accumulation rate pattern at Site 286 is the same for Site 445. The highest rates of sediment accumulation are for the turbidite sandstones and the pebble to granule gravel conglomerates of slump and debris-flow origin of unit V. The lowest rates are characteristic of the unit IV radiolarites and cherts. Intermediate values are characteristic of units I, II, and III, where evidence of resedimentation by subaqueous gravity processes is common. That evidence includes preserved slump blocks, folds and faults, and graded foraminifer sands organized into partial Bouma sequences [T(a,b,e)] produced by turbidity currents. The slight increase in sediment accumulation rates for the Pleistocene oozes may well reflect higher productivity of the Kuroshio Current, detected at Sites 296 and 297 by Karig, Ingle, et al. (1975).

PALEOMAGNETISM

Site 445 is a single-bit hole with about 900-meter penetration into the sediment cover. The topmost 200

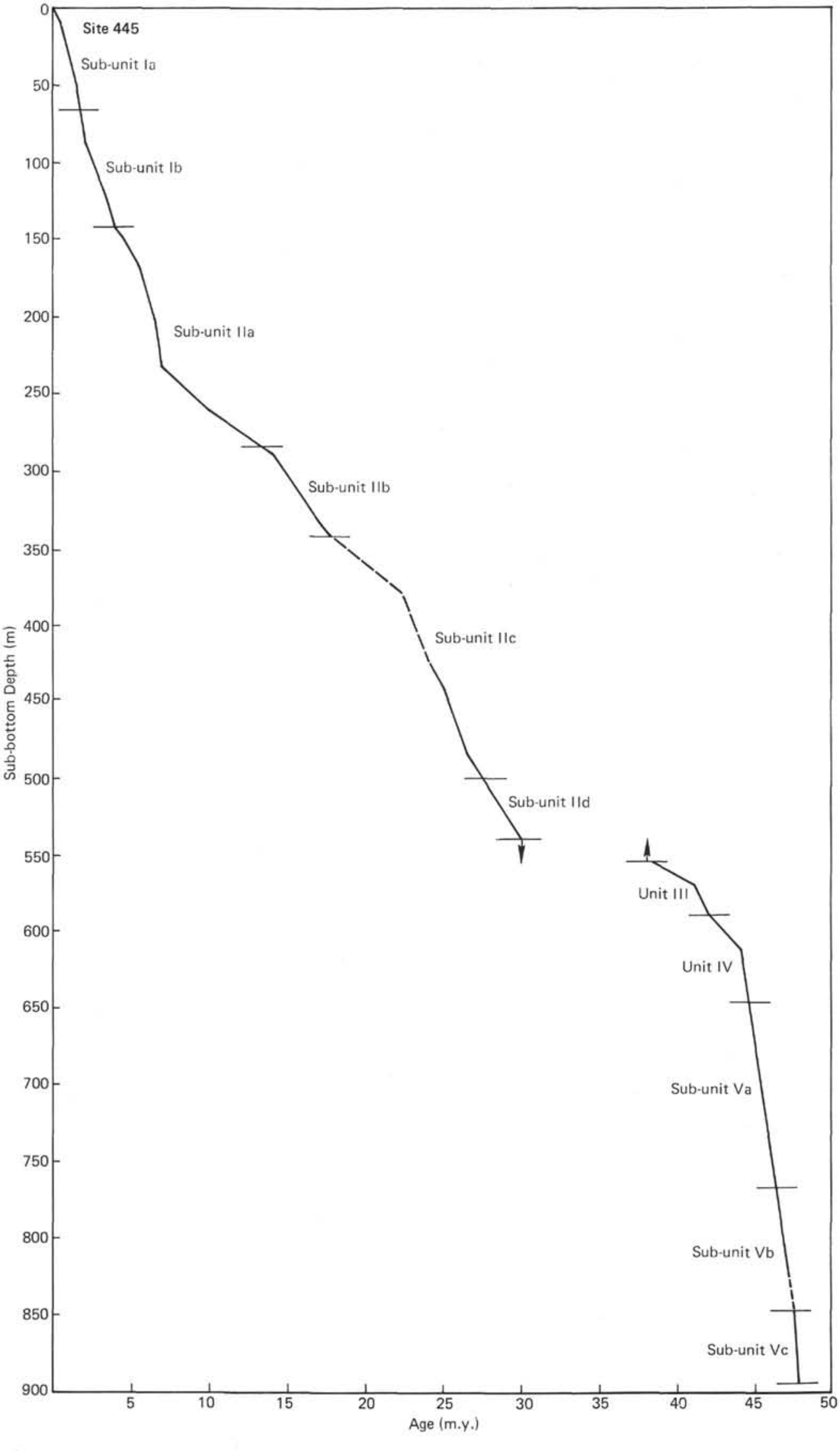


Figure 10. *Sediment accumulation rate curve for Site 445, based on biostratigraphic age determinations.*

TABLE 4
Sedimentation Rates, Site 445

Unit	Depth (m)	Interval Thickness (m)	Sedimentation Rate (m/m.y.)
Ia	0.0–65.5	65.5	36.9
Ib	65.5–141.8	76.3	34.7
IIa	141.8–284.0	142.2	16.0
IIb	284.0–341.0	57.0	13.9
IIc	341.0–502.5	161.5	16.5
IId	502.5–551.7	49.2	18.9
III	551.7–588.9	37.2	9.3
IV	588.9–645.0	56.1	22.4
Va	645.0–768.5	123.5	72.6
Vb	768.5–844.5	76.0	95.0
Vc	844.5–892.0	47.5	237.5

meters consists of relatively soft sediments. In the other part, the sediments are lithified and mechanically stable. Paleomagnetism samples were taken on an average of 1.5 meters in the recovered cores. Three hundred and twelve of them were used for NRM and AF-demagnetized NRM measurements. Changes in NRM during AF treatment are significantly different from sample to sample, as shown in Figure 11. Because stepwise AF demagnetization for all of the samples was impossible within a limited time schedule, the AF demagnetization was carried out in a 150-oe AF, decreasing to zero at a constant rate. Measuring and AF demagnetizing techniques are described in the Site 442 report. On account of a large number of samples available at this site, a rigorous examination of paleomagnetism stability was applied to distinguish paleomagnetically reliable samples. Examination was according to the following criteria: (1) intensity ratio of AF-demagnetized remanent magnetization to the initial NRM falls between 2 and 1/2; (2) angular shift of NRM during AF demagnetization is less than 5 degrees; (3) the Koenigsberger ratio is larger than 10.

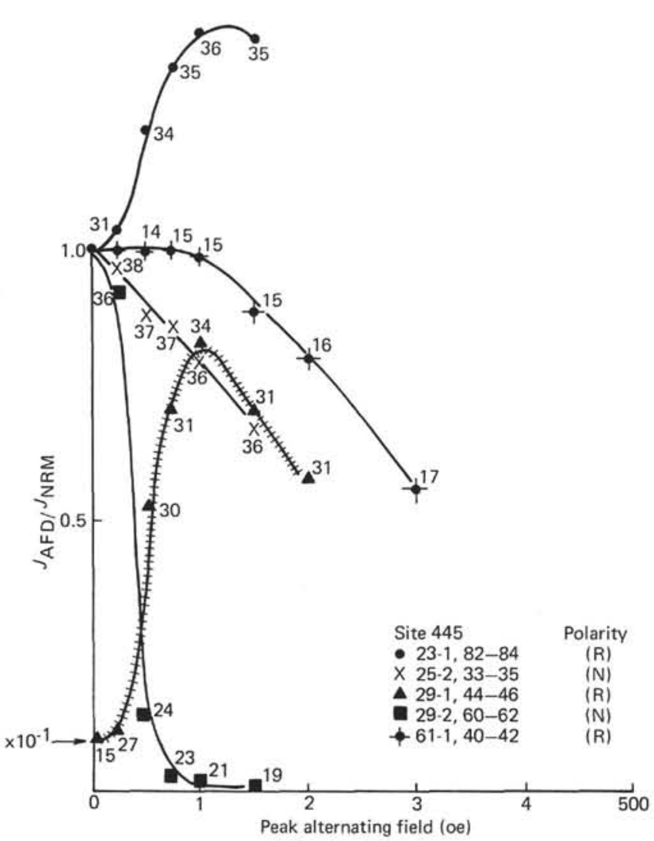


Figure 11. *Change in sediment NRM intensity during AF demagnetization. Rounded numbers attached to each point represent absolute inclination values obtained after AF demagnetization.*

Ninety-five samples of 312 were retained for further analyses. All the data on sample positions and measurements of remanent magnetization are listed in Table 5. Normal and reversed sequences of cores are diagrammatically shown in Figure 12. In the last part of Figure 12, Cores 68 through 90, the polarity column is left blank for two reasons. One, in the lowermost 200 meters of the sediment cover NRM inclination becomes smaller, and therefore the polarity change of the geomagnetic field cannot be determined through NRM inclination values alone. Two, this layer consists mostly of mudstones, and only a small portion of the recovered cores were found useful. In Figure 13A, absolute inclinations of AF-demagnetized stable NRM are plotted against sub-bottom depth. In Figure 13B, original NRM intensity values (mean for every 10 meters) are plotted against sub-bottom depth. AF-demagnetized absolute NRM inclination values are divided into four groups for 200-meter sub-bottom intervals, and statistical treatment was applied. Results are listed in Table 6. Latitude of the Daito Ridge is calculated upon the assumption that the mean virtual pole position is exactly equal to the present geographical pole position throughout the last 45 m.y.

Table 6 also includes the latitude of Site 445 in the past. The results are plotted in Figure 14. The position of the Shikoku Basin deduced from the NRM inclination data at Sites 442 through 444 is also shown in the figure for comparison. It seems likely that the scatter of data is significantly dependent on the mechanical strength of the sediment. Statistical analysis leads us to a tentative evaluation of a minimum distance of migration of the Daito Ridge during the last 45 m.y. Supposing that the ridge was situated at 5 degrees north latitude, due south of the present location, and that it continuously drifted northward to reach the present position, the distance of movement is about 2000 km (4.4 cm/yr). The other implication of Figure 13b is a high incidence of subaerial eruptions at this locality during the probable Eocene, represented by a thick mudstone layer in the bottom 200 meters of the hole. It is likely that the mudstone contains ferromagnetic minerals (probably titanomagnetite) more abundant by one order of magnitude than in the other sediments. AF demagnetization mode shows that the ferromagnetic particles are fine-grained, just as in the chilled margin of an oceanic basalt. This is possible when a tremendous amount of fine-grained materials falls to form a thick tuff layer. Actually, some of the tuffs and welded tuffs on land show a

TABLE 5
Paleomagnetism Measurements of Sedimentary Cores from Site 445[a]

Sample (interval in cm)	Sub-bottom Depth (m)	J_{NRM} (10^{-5} gauss)	Susceptibility (10^{-5} gauss/oe)	Inclination		Polarity
				NRM	AFD	
445-2-1, 86–88*	9.37	1.97	0.23	26.7	31.9	+
2-2, 116–118*	11.17	1.98	0.17	38.4	37.5	+
2-3, 114–116*	12.65	2.44	0.07	10.5	10.5	+
3-1, 15–17	18.16	0.27	0.11	–4.6	–1.4	–
3-2, 100–102	20.51	1.86	0.24	50.0	51.3	+
3-3, 76–78*	21.77	2.74	0.16	43.6	44.4	+
3-4, 57–59*	23.08	0.88	0.10	–31.1	–29.7	–
3-5, 21–23	24.22	0.68	0.21	–28.7	–28.5	–
3-6, 109–111*	26.60	1.14	0.17	–9.4	–14.9	–
4-1, 14–16*	27.65	2.06	0.22	22.6	25.1	+
4-4, 40–42	32.41	0.23	0.14	–45.5	–56.5	–
4-5, 52–54	34.03	0.46	0.19	–1.7	–22.2	
4-6, 21–23	35.22	0.82	0.19	–19.0	–9.2	–
5-1, 93–95	37.94	0.94	0.22	–46.4	–45.1	–
5-2, 137–139	39.88	1.01	0.22	72.6	39.4	+
5-3, 11–13	40.12	0.99	0.25	–16.6	–23.5	–
6-1, 38–40	46.89	0.28	0.19	–20.8	–40.6	–
6-2, 137–139	49.36	0.46	0.17	74.3	30.5	+
6-3, 115–117	50.66	1.01	0.24	–1.8	–18.3	–
6-4, 86–88	51.87	0.13	0.24	–0.8	–29.2	–
6-5, 71–73	53.22	2.26	0.48	30.1	21.8	+
6-6, 79–81	54.80	1.21	0.31	16.1	4.2	+
7-6, 88–90	64.39	1.03	0.25	36.4	28.3	+
8-1, 138–140	66.89	0.57	0.26	–15.2	–15.6	
8-2, 138–140	68.39	1.10	0.26	36.7	41.0	+
8-3, 138–140	69.89	0.05	0.25	45.3	60.4	+
8-4, 138–140	71.39	0.28	0.33	–50.1	–49.6	–
8-5, 138–140	72.89	0.51	0.29	59.0	–23.2	+/–
10-5, 144–146	91.95	1.27	0.32	55.6	51.1	+
11-2, 69–71	96.20	1.13	0.33	24.3	23.9	+
11-3, 80–82	97.81	0.11	0.33	–65.0	–80.2	–
11-4	<100	0.30	0.37	–31.1	–46.4	–
11-5	>100	0.73	0.36	–7.0	–11.6	–
12-1, 95–97	104.46	0.93	0.21	52.0	53.6	+
12-2, 95–97*	105.96	1.05	0.21	–82.6	–83.5	–
12-3, 95–97*	107.46	2.37	0.40	29.4	31.0	+
12-4, 95–97	108.96	0.76	0.26	31.7	29.7	+
13-1, 72–74	113.73	0.23	0.25	34.5	35.2	+
13-2, 72–74	115.23	0.049	0.34	37.6	–34.5	+/–
13-3, 72–74	116.73	0.51	0.23	43.2	47.5	+
13-4, 72–74	118.23	0.078	0.29	–40.0	–66.8	–
14-1, 58–60	123.09	0.010	0.16	–68.4	–50.8	–
15-1, 20–22	132.21	0.028	0.21	–17.6	–37.2	–
15-2, 20–22	133.71	1.39	0.31	–51.1	–49.8	–
16-1, 45–47	141.96	0.10	0.15	48.0	31.6	+
16-2, 45–47	143.46	0.79	0.23	22.8	13.0	+
16-3, 45–47	144.96	0.88	0.17	43.2	49.6	+
17-2, 24–26	152.75	0.40	0.16	73.6	69.7	+
18-1, 99–101	161.50	0.25	0.19	–0.0	–40.7	–
18-5, 21–23	166.72	1.31	0.17	42.2	24.0	+
19-2, 05–07	171.56	1.33	0.17	21.8	11.9	+
19-3, 05–07	173.06	0.44	0.17	21.9	–30.6	+/–
20-1, 100–102	180.49	0.35	0.18	50.8	–13.3	+/–
20-2, 100–102	181.99	0.16	0.17	30.7	–83.9	+/–
21-1, 134–136	190.35	0.19	0.19	–6.3	–38.6	–
21-2, 62–64	191.13	0.21	0.19	28.0	–73.5	+/–
22-1, 92–94	199.43	0.091	0.20	43.0	–3.5	+/–
22-2, 13–15	200.14	0.006	0.09	–9.8	–10.4	–
23-1, 82–84*	208.83	1.17	0.23	–35.1	–34.5	–
23-2, 68–70*	210.19	1.89	0.36	–52.6	–51.1	–
23-3, 103–105	212.04	0.64	0.26	44.4	41.8	+
24-1, 22–24	217.73	0.80	0.27	–40.9	–35.5	–
24-2, 16–18	219.17	1.73	0.26	51.2	43.8	+
24-3, 57–59	221.08	0.29	0.38	39.1	–20.1	+/–
24-4, 130–132	223.31	0.63	0.34	42.9	–18.2	+/–
24-5, 29–31	223.80	0.97	0.32	50.4	–2.3	+/–
25-1, 145–147	228.46	1.65	0.31	–42.0	–33.7	–
25-2, 33–35*	228.09	4.19	0.38	36.8	35.7	+
25-3, 97–99*	230.98	2.11	0.31	31.9	30.1	+
25-4, 111–113	228.87	0.14	0.42	–30.5	–40.3	–
445-25-5, 127–129	234.28	0.45	0.42	–20.6	–36.9	–
25-6, 59–61*	235.10	1.67	0.33	–23.6	–29.3	–
26-1, 139–141*	237.90	3.40	0.39	37.2	41.9	+
26-2, 140–142	239.41	1.72	0.40	33.7	32.6	+
26-3, 144–146	240.95	1.74	0.39	29.1	16.2	+
26-4, 145–147	242.46	0.47	0.27	–8.2	–33.1	–
26-5, 140–142	243.91	1.48	0.38	34.2	36.9	+
26-5, 60–62	243.11	0.46	0.31	17.1	74.7	+
27-1, 81–83*	247.57	3.96	0.50	35.0	31.2	+
27-2, 59–61*	248.10	1.71	0.31	–28.4	–29.5	–
27-3, 54–56	249.55	1.56	0.44	2.8	–17.7	+/–
27-4, 35–37	250.86	1.40	0.48	35.0	4.7	+
27-5, 50–52*	252.51	3.57	0.46	35.7	34.2	+
27-6, 41–43	253.92	0.48	0.19	10.5	–52.4	+/–
28-1, 128–130*	256.79	2.34	0.33	36.0	35.2	+
28-2, 106–108*	258.07	3.47	0.33	35.4	34.7	+
28-3, 147–149	259.98	0.03	0.27	37.6	35.0	+
28-4, 100–102*	261.01	3.19	0.50	34.2	32.1	+
28-5, 118–120	262.69	0.45	0.45	–3.0	–26.1	–
29-1, 44–46	265.45	0.11	0.40	–14.8	–31.2	–
29-2, 60–62	267.11	1.01	0.36	39.2	18.8	+
29.3, 55–57	268.56	0.98	0.40	28.4	7.9	+
29-4, 8–10	269.59	0.19	0.32	17.4	–9.3	+/–
30-1, 42–44*	274.93	2.13	0.43	38.0	31.2	+
30-4, 32–34	279.33	0.01	0.29	–57.3	–53.7	–
31-1, 22–24	284.23	1.98	0.44	37.3	31.9	+
31-4, 140–142	289.91	0.02	0.29	26.4	14.1	+
31-5, 136–138*	291.37	3.52	0.39	28.4	28.3	+
32-1, 16–18	293.67	2.07	0.34	27.7	10.2	+
33-2, 65–67	305.16	0.15	0.33	9.2	–4.5	+/–
33-3, 18–20*	306.19	1.93	0.34	–8.2	–13.0	–
33-5, 61–63*	309.62	2.20	0.27	26.9	23.7	+
34-2, 37–39	314.38	0.33	0.37	9.2	–21.6	+/–
34-4, 30–32	317.31	0.22	0.38	8.9	–39.1	+/–
34-5, 24–26	318.75	0.87	0.32	–32.4	–35.7	–
35-1, 12–14	322.13	4.86	0.44	27.0	19.2	+
35-2, 78–80	324.29	1.18	0.44	1.3	–14.3	+/–
35-3, 78–80	325.79	0.64	0.27	35.3	3.9	+
36-1, 85–87	332.36	1.41	0.47	–9.7	–30.1	–
36-2, 66–68	333.67	1.43	0.48	36.5	35.2	+
37-1, 144–146	342.45	0.75	0.36	62.2	6.7	+
37-2, 68–70	343.19	1.09	0.42	31.4	33.7	+
37-4, 23–25	345.74	0.012	0.71	38.2	21.3	+
38-1, 37–39	350.88	0.56	0.40	46.0	8.3	+
38-2, 37–39	352.38	0.26	0.40	74.2	–5.1	+/–
38-3, 39–41	353.90	0.90	0.30	39.1	50.9	+
38-4, 39–41	355.40	0.76	0.43	38.5	13.2	+
38-5, 70–72	357.21	1.03	0.32	35.7	37.3	+
39-1, 94–96	360.95	0.03	0.32	23.1	–33.3	+/–
39-3, 94–96	363.95	0.91	0.28	27.4	35.7	+
40-2, 146–148	372.47	0.001	0.32	50.8	49.8	+
40-3, 14–16	372.65	1.17	0.44	34.5	38.2	+
41-1, 60–62	379.61	0.83	0.37	25.6	33.8	+
41-2, 79–81	381.30	0.68	1.81	27.0	28.1	+
41-3, 117–119	380.93	0.00	0.31	–18.7	–27.4	–
41-4, 126–128*	384.77	1.62	0.36	34.6	28.5	+
41-5, 129–131	386.30	0.13	0.29	29.8	25.2	+
41-6, 33–35	386.84	0.28	0.24	37.3	28.5	+
42-1, 98–100	389.49	0.01	0.29	19.2	23.5	+
42-3, 44–46	391.95	0.39	0.21	–6.3	–32.0	+
42-4, 104–106	394.05	0.012	0.47	26.8	15.1	+
42-5, 75–77	395.26	1.34	0.42	55.7	66.0	+
42-6, 22–24	396.23	0.43	0.27	–10.0	–14.4	–
43-1, 23–25	398.24	0.28	0.40	39.9	35.7	+
43-2, 100–102	400.49	0.35	0.32	37.4	42.7	+
43-3, 66–68	401.67	0.74	0.34	15.5	5.0	+
44-1, 90–92	408.41	0.78	0.34	43.0	42.2	+
44-2, 63–65	408.89	1.54	0.52	35.6	21.6	+
44-3, 130–132	411.79	1.72	0.43	18.7	11.0	+
44-4, 05–07	412.06	0.76	0.39	26.9	26.9	+

TABLE 5 – *Continued*

Sample (interval in cm)	Sub-bottom Depth (m)	J_{NRM} (10^{-5} gauss)	Susceptibility (10^{-5} gauss/oe)	Inclination		Polarity
				NRM	AFD	
445-45-1, 13–15	417.14	0.79	0.32	-4.7	-20.9	+
45-2, 73–75	419.24	0.38	0.31	-11.0	-20.8	-
45-3, 31–33	420.32	0.73	0.37	3.0	-15.2	+/-
45-4, 06–08	421.57	0.93	0.40	55.6	53.4	
45-5, 66–68	423.67	1.31	0.45	-12.0	-19.5	-
46-1, 28–30*	426.79	1.73	0.28	34.8	35.3	+
46-2, 28–30*	428.29	2.85	0.44	24.2	23.6	+
46-3, 28–30*	429.79	3.38	0.56	23.6	21.2	+
46-4, 28–30*	431.29	6.52	0.57	30.0	29.3	+
46-5, 28–30	432.79	2.13	0.58	-80.4	-77.3	-
46-6, 28–30*	434.29	10.7	1.25	-2.9	-7.6	-
47-1, 73–75*	436.74	2.82	0.53	-19.1	-22.0	-
47-2, 73–75*	438.24	5.46	0.81	-18.2	-21.5	-
47-3, 73–75*	439.74	2.41	0.47	34.8	28.5	+
47-4, 73–75*	441.24	3.96	0.47	29.4	28.4	+
47-5, 73–75*	442.74	8.88	0.73	28.3	28.3	+
47-6, 73–75*	444.24	5.33	0.45	12.9	7.7	+
48-1, 26–28*	445.77	3.55	0.44	22.8	20.9	+
48-2, 26–28	447.27	1.93	0.40	7.4	1.5	+
48-3, 26–28*	448.77	3.52	0.52	24.2	23.2	+
48-4, 26–28	450.27	1.91	0.36	29.7	20.1	+
49-1, ?	455.75+?	1.77	0.40	35.5	30.6	+
49-2, 54–56*	457.05	5.34	0.40	27.0	26.3	+
49-3, 54–56	458.55	1.85	0.52	26.7	18.8	+
49-4, 54–56*	460.05	4.56	0.45	25.4	26.1	+
49-5, 54–56	461.55	1.68	0.44	27.9	22.9	+
50-1, 38–40	464.89	1.95	0.49	22.2	15.8	+
50-2, 38–40	466.39	1.55	0.40	-26.6	-30.9	-
51-1, 77–79	474.78	4.03	0.98	44.2	41.3	+
51-3, 108–110	478.09	0.16	0.44	11.8	-1.0	+/-
52-2, 86–88	485.87	2.33	0.42	5.2	-3.0	+/-
52-4, 64–66	488.65	1.77	0.69	20.2	12.9	+
53-1, 37–39	493.38	0.84	0.61	14.9	0.8	+
53-2, 37–39	494.89	1.12	0.46	38.0	34.6	+
53-3, 37–39	496.38	1.63	0.52	40.7	38.3	+
53-5, 23–25	499.24	3.38	1.21	38.2	39.7	+
53-5, 37–39*	499.38	2.30	0.50	-14.9	-19.6	-
54-1, 38–40*	502.89	4.22	0.69	-5.0	-10.6	-
54-2, 38–40*	504.39	2.43	0.39	32.3	30.0	+
54-3, 38–40*	505.89	3.67	0.54	4.4	-1.3	+/-
54-4, 38–40	507.39	1.91	0.55	-16.8	-29.7	-
54-5, 38–40	508.89	0.71	0.51	24.5	3.2	+
54-6, 38–40	510.39	0.16	0.38	36.2	14.7	+
55-1, 38–40	512.39	1.18	0.55	11.5	16.2	+
55-2, 38–40	513.89	1.71	0.54	-7.6	-15.5	-
55-3, 38–40	515.39	0.04	0.35	64.0	-18.2	+/-
55-4, 38–40	516.85	2.96	1.08	18.5	-0.6	+/-
55-5, 43–45*	518.44	5.60	0.54	-14.9	-18.2	-
55-6, 43–45	519.94	0.69	0.68	24.4	-7.5	+/-
56-1, 33–35*	521.84	3.31	0.57	-8.5	-13.5	-
56-2, 33–35*	523.34	8.58	1.21	-14.3	-18.7	-
56-3, 33–35*	524.84	6.49	0.88	-19.4	-22.0	-
56-4, 33–35*	526.34	5.28	1.00	-8.5	-14.4	-
56-5, 33–35	527.84	1.25	0.74	-2.1	-19.9	-
57-1, 73–75	531.74	0.64	0.31	4.1	3.7	+
57-2, 74–76*	533.27	2.10	0.48	34.0	33.7	+
57-3, 73–75*	534.74	6.48	0.64	25.1	24.2	+
57-4, 74–76	536.25	2.07	0.54	29.4	25.5	+
57-5, 73–75	537.74	1.16	0.32	23.0	17.9	+
58-1, 103–105	541.54	2.17	0.52	31.7	33.0	+
58-2, 23–25*	542.24	1.91	0.45	29.7	33.8	+
58-3, 110–112	544.61	0.92	0.35	-4.1	-10.6	-
58-4, 146–148	546.47	1.28	0.48	-7.5	-11.9	-
58-5, 93–95	547.44	1.61	0.55	-12.3	-18.2	-
59-1, 72–74	550.73	2.02	0.55	2.6	-3.2	+/-
59-2, 83–85	552.34	2.89	0.51	10.4	2.7	+
59-3, 26–28*	553.27	9.06	0.68	-25.9	-27.8	-
59-4, 145–147*	555.96	6.50	0.71	-12.1	-14.9	-
59-5, 06–08*	556.07	6.35	0.61	-4.1	-8.4	-
59-6, 28–30*	557.79	10.88	1.00	17.6	17.0	+

TABLE 5 – *Continued*

Sample (interval in cm)	Sub-bottom Depth (m)	J_{NRM} (10^{-5} gauss)	Susceptibility (10^{-5} gauss/oe)	Inclination		Polarity
				NRM	AFD	
445-60-1, 41–43	559.92	0.05	0.78	-15.0	-18.2	-
60-2, 127–129	562.29	0.57	0.64	15.8	2.5	+
60-3, 49–51*	563.00	5.07	0.87	4.6	1.4	+
60-4, 13–15	564.14	2.22	0.81	24.5	13.9	+
61-1, 40–42*	569.41	5.70	0.95	-14.6	-15.4	-
61-2, 109–111*	571.58	8.17	0.81	16.9	16.7	+
61-3, 76–78*	572.77	10.94	0.93	20.1	20.1	+
61-4, 140–142*	574.91	6.97	0.83	19.3	19.1	+
61-5, 136–138*	576.37	5.14	0.65	20.1	17.8	+
61-6, 34–36*	576.85	7.84	0.87	22.4	22.0	+
61-7, 37–39	578.38	1.87	0.81	-2.1	-12.5	-
62-1, 143–145	579.94	1.70	0.65	9.7	-1.5	+/-
62-2, 44–46	580.45	0.88	0.56	0.4	-10.9	+/-
62-3, 143–145	582.94	2.76	0.75	29.6	26.8	+
62-4, 130–132*	584.31	7.43	1.16	29.4	29.5	+
62-5, 130–132*	585.81	5.29	0.84	22.8	20.8	+
62-6, 63–65*	586.64	9.58	0.19	31.4	31.9	+
63-1, 22–24	588.23	0.53	0.56	59.9	63.6	+
63-2, 127–129	590.78	3.29	0.74	33.7	32.0	+
63-3, 22–24	591.23	1.70	0.59	26.7	27.2	+
63-4, 116–118	593.67	1.14	0.55	22.0	17.9	+
64-1, 04–06	597.55	3.11	0.81	21.5	19.0	+
64-2, 18–20	599.19	1.68	0.52	-1.1	-3.9	-
64-3, 18–20	600.69	1.40	0.57	19.4	17.2	+
64-4, 18–20*	602.19	4.39	0.64	18.2	14.5	+
64-5, 18–20*	603.69	3.81	0.64	16.4	14.7	+
64-6, 05–07*	605.06	3.84	0.68	12.3	13.4	+
64-7, 05–07	606.56	3.16	0.78	17.2	14.9	+
65-1, 42–44	607.43	2.18	0.69	19.7	18.4	+
65-2, 42–44	608.93	0.88	0.61	34.3	–	(+)
65-3, 42–44	610.43	2.46	0.73	15.4	12.4	+
66-1, 16–18*	616.67	5.85	0.65	-13.5	-15.6	-
66-2, 16–18*	618.17	5.69	0.81	-1.0	-3.4	-
66-3, 16–18	619.67	3.16	0.88	11.0	3.6	+
66-4, 16–18*	621.17	3.95	0.55	-9.6	-11.5	-
66-5, 16–18	622.67	2.34	0.55	13.5	8.6	+
67-1, 19–21*	626.20	7.08	0.81	16.3	15.5	+
68-1, 78–80	636.29	2.39	2.05	19.5	24.0	+
68-2, 41–43	637.42	1.12	1.41	31.7	22.6	+
69-1, 24–26	645.25	1.55	0.78	2.9	2.8	+
69-2, 100–102*	647.51	18.99	2.47	-1.4	-1.7	-
69-4, 52–54	650.03	4.24	0.43	0.1	-4.2	+/-
70-2, 07–09*	656.08	27.65	1.60	7.0	6.6	
71-1, 38–40	664.39	3.84	1.31	-18.5	-16.5	
71-2, 06–08	665.57	14.34	2.46	6.4	7.6	
71-3, 38–40*	667.39	15.55	2.29	6.0	4.9	
71-4, 13–15	668.64	11.65	3.37	-36.2	-38.4	
72-1, 43–45	673.94	14.65	3.10	2.5	2.3	
72-2, 43–45	675.44	4.12	3.46	-33.2	-36.3	
73-1, 84–86	683.85	11.09	6.53	-2.7	16.0	
73-2, 84–86	685.35	11.77	5.13	16.0	18.4	
73-3, 84–86	686.85	4.32	6.12	9.2	34.1	
74-2, 46–48*	694.47	28.93	2.42	7.5	6.8	
74-4, 46–48*	697.47	19.11	2.68	5.0	4.8	
74-5, 46–48*	698.97	18.77	2.66	9.3	10.9	
75-1, 39–41*	702.40	30.88	2.26	-10.1	-11.8	
75-2, 39–41*	703.90	13.40	2.32	-2.8	-2.0	
75-3, 120–122	706.21	4.73	1.71	42.6	22.3	
75-4, 43–45	706.94	2.60	1.73	31.9	–	
75-5, 43–45	708.44	2.66	3.20	25.0	27.8	
76-1, 87–89*	712.38	19.52	2.49	11.6	8.1	
76-3, 106–108*	715.57	20.42	2.78	3.9	2.7	
76-4, 109–111*	717.10	32.21	2.20	17.9	17.7	
76-5, 20–22	717.71	13.40	3.46	-12.6	-15.0	
77-1, 139–141	722.40	14.05	3.13	-7.7	-3.0	
77-2, 38–40*	722.89	24.10	4.02	5.8	4.1	
77-3, 139–141	725.40	6.04	2.84	44.5	37.5	
77-4, 144–146	726.95	32.84	2.77	-0.1	-2.6	
77-5, 92–94	727.93	21.89	2.83	-24.5	-18.8	
78-1, 84–86	731.35	14.41	2.65	2.4	-2.1	

TABLE 5 – *Continued*

Sample (interval in cm)	Sub-bottom Depth (m)	J_{NRM} (10^{-5} gauss)	Susceptibility (10^{-5} gauss/oe)	Inclination		Polarity
				NRM	AFD	
445-78-2, 60–62*	732.61	26.23	2.69	5.5	3.8	
78-3, 20–22*	733.71	24.49	2.99	3.5	0.9	
78-4, 25–27*	735.26	25.55	2.39	-5.3	-6.3	
78-5, 112–114	737.63	7.84	3.54	-33.8	-23.9	
79-2, 130–132*	742.81	23.43	1.81	3.2	1.4	
79-3, 52–54	743.53	19.26	3.07	-13.0	-1.6	
79-4, 54–56*	745.05	27.00	2.81	-3.4	-6.0	
79-5, 51–53*	746.52	25.49	3.39	-25.4	-27.2	
80-1, 135–137	750.86	13.14	3.70	-8.9	-13.7	
80-2, 138–140	752.39	15.38	4.45	-9.8	-13.4	
80-3, 138–140	753.89	16.10	4.19	-10.5	-10.1	
80-5, 140–142	756.89	4.23	5.76	6.3	–	
81-1, 56–58	759.57	28.79	4.12	-18.7	-20.6	
81-3, 56–58	762.57	20.12	4.29	28.8	-16.6	
81-5, 56–58	765.58	11.79	5.10	-1.9	–	
82-1, 70–72	769.19	19.59	4.97	-21.9	–	
82-3, 70–72	772.21	7.48	6.23	-26.6	–	
83-1, 76–78	778.77	23.01	4.94	-2.9	-4.4	
83-3, 76–78	781.77	10.87	6.52	48.4	–	
83-5, 76–78	784.77	9.93	4.67	-24.6	–	
84-1, 100–102	788.51	17.09	4.37	9.8	–	
84-3, 100–102	791.51	18.38	4.59	3.3	–	
85-3, 97–99	800.98	7.44	4.41	-31.1	–	
85-4, 94–96*	802.45	32.57	5.52	10.3	11.9	
86-2, 56–58	808.57	7.99	2.61	11.1	–	
86-4, 56–58	811.57	14.17	5.97	13.8	–	
87-4, 40–42	820.91	7.03	4.86	19.9	–	
87-6, 40–42	823.91	17.48	3.68	59.1	–	
88-3, 58–60	829.09	13.37	3.46	18.5	–	
88-4, 58–60	830.59	14.83	3.67	8.6	–	
89-4, 89–91	840.40	9.89	4.60	23.6	–	
89-6, 64–66*	843.15	43.88	2.59	14.1	12.7	

[a] J_{NRM} is the intensity of NRM given in 10^{-5} gauss/cm^3; AFD is obtained by peak alternating demagnetizing field of 150 oe, decreasing to zero at a constant rate of 20 milligauss/cycle; polarity shows whether the inclination of NRM is positive (+) or negative (–); an asterisk at the sample number denotes good reliability for the sample.

highly stable and strong NRM similar to this mudstone (for example, lapilli tuff at Oshima, Japan, and welded tuff of Aso volcano, Kyushu, Japan).

In addition a fine, continuous record of polarity reversal was found. Between 142 and 551 meters, the sedimentary cores consist mainly of milky-colored nannofossil chalk. This part of the sediment was consolidated and was easily drilled, with a lesser number of fractures within each 9-meter core. Routine measurement in minicores every 1.5 meters showed that between Cores 45 and 47 there are more than two reversals. It is interesting to note that these cores cover only about 1 m.y. (24–25 Ma).

After rechecking the magnetic stability of NRM, it appears that the reversal would not have taken place due to a secondary effect, but must have recorded a real reversal of the geomagnetic field (at least the direction of a local magnetic field).

PHYSICAL PROPERTIES

Site 445 sediments and sedimentary rocks vary considerably in composition, texture, porosity, and water content. This variability is directly reflected in physical properties (Table 7).

Figure 15 shows the variation of sonic velocity and wet-bulk density with depth for Hole 445. Velocities range from about 1.5 to 1.6 km/s in sub-units Ia, Ib, and IIa, and systematically increase from 1.7 to 2.6 km/s within sub-units IIb and IIc. Velocities decrease near the base of sub-unit IIc, and generally continue to decrease through units IId and III. This decrease may be related to the decrease of calcium carbonate relative to silica in unit III. Unit IV is characterized by high and relatively variable sonic velocities. This is caused by the interlayering of various lithologies, including chert, radiolarite, mudstone, and conglomerate. The mudstones of unit V show monotonous velocities somewhat above 2 km/s and lower than those of the overlying unit. Velocities again increase in the conglomerates and sandstones of unit VI. Wet-bulk density follows the same pattern with respect to depth as sonic velocity (Figure 15).

There are several features of note in the velocity-depth profile presented in Figure 15. First, a clear velocity gradient distinguishes the upper 450 meters of the velocity column. Velocity gradients such as this will not necessarily be evident in marine reflection and refraction data and, if present, will tend to cause overestimation of layer thickness. Second, there are two distinctive low-velocity layers within the sediment column at Site 445. One occurs between the base of unit IIc and the top of unit IV. Unit V comprises the second velocity inversion. The presence of low-velocity layers will also lead to miscalculation of layer thicknesses using marine seismic data.

The variation of thermal conductivity with depth (Figure 16) is the same as the variations of sonic velocity and wet-bulk density (Figure 15). Conductivity increases with depth in units I, IIa, IIb, and IIc. This trend is similar to that observed by Hyndman et al. (1974) for Leg 26 sediments. The increase in conductivity with depth is directly related to the decreasing water content of the nannofossil oozes and chalks. This inverse relationship is shown in Figure 17 for sediments in Cores 1 through 58. The decrease of conductivity with increasing water content conforms to the general relationship established by Ratcliffe (1960). Site 445 data for carbonates, however, plot consistently above Ratcliffe's empirically determined curve (Figure 17).

Conductivity values decrease from a maximum in sub-unit IIc to a minimum in unit III. The decrease reflects the down-hole decrease in the amount of calcite, a mineral with a high thermal conductivity. Conductivities increase to an average of 3.2 mcal/cm-°C-s below unit III, and remain nearly constant for the mudstones, sandstones, and conglomerates of the lower portion of the recovered sedimentary section.

In general, conductivities for Site 445 sediments are higher than those reported for the clay-dominated lithologies of Sites 442, 443, and 444. This difference is caused by the generally higher thermal conductivity of the calcite-bearing lithologies of Site 445 and the generally lower water content of the carbonates. Bimodal distributions of thermal conductivities for oceanic sedi-

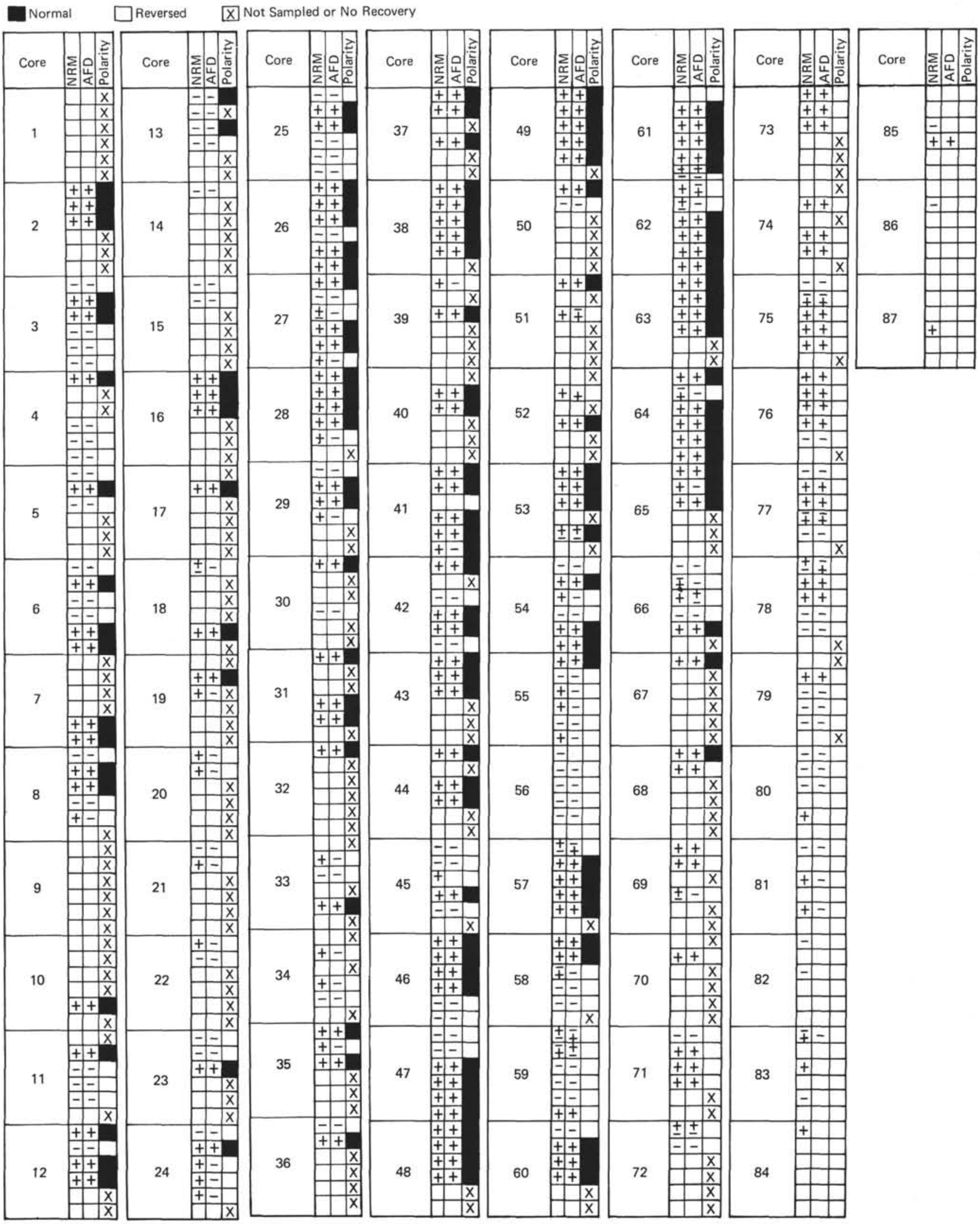


Figure 12. *Results listed in Table 5 illustrated in descending order of cores and sections. Lowermost part of the polarity column is left blank because of poor resolution of NRM inclinations (see text).*

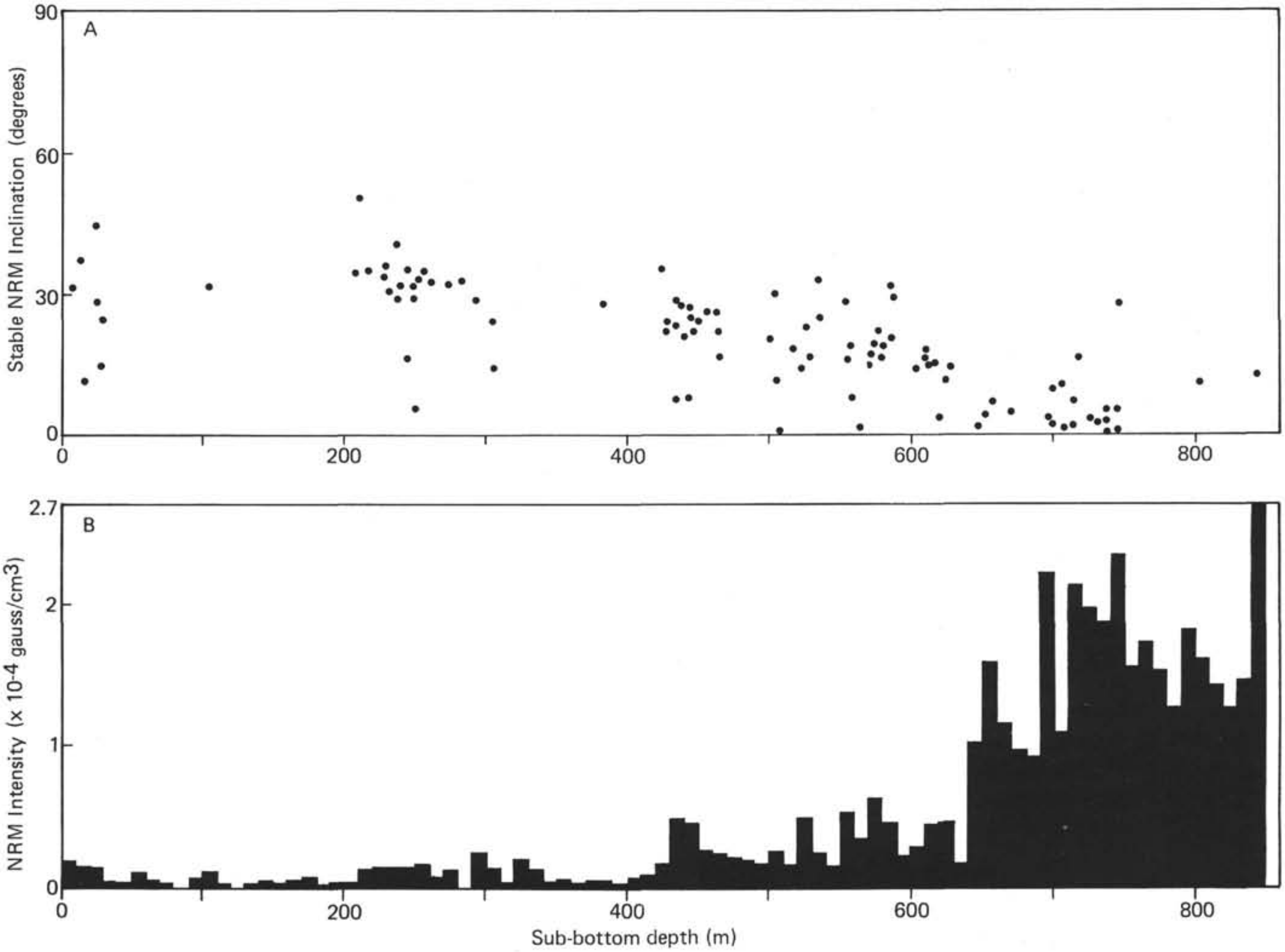


Figure 13. *Paleomagnetism parameters plotted against sub-bottom depth.* A. *Absolute value of inclination of stable NRM of sediments.* B. *NRM intensity values averaged for every 10 meters.*

TABLE 6
Statistical Treatment of Absolute Values of NRM Inclination[a]

Sub-bottom Depth (m)	0–200	200–400	400–600	600
Number of Reliable Samples	9	18	41	27
Mean Inclination (degrees)	34.3	32.1	20.8	8.9(?)[b]
Standard Deviation	21.2	7.6	8.3	6.3
Expected Latitude (degrees)	$18.8^{+17.2}_{-7.0}$	$17.4^{+5.3}_{-5.0}$	$10.8^{+4.3}_{-4.5}$	$4.5^{+2.6}_{-3.3}$

[a] Expected latitude values are deduced from the mean of NRM inclinations.
[b] Poor resolution power of inclination at lower latitude.

ments (e.g., Erickson, 1973; Marshall and Erickson, 1974; Hyndman et al., 1974) apparently are created by these fundamental differences between lithologies dominated by clay minerals and carbonate minerals.

Shear strength ranges from 0.0 to 3.0 dynes/cm^2; two measurements exceed this range. The nearly constant shear strength below 40 meters (Figure 18) reflects the constant lithology of the nannofossil ooze. Because of the lithologic differences between Site 445 and Sites 442, 443, and 444, the previously reported variations of shear strength with depth are not in evidence at Site 445.

CORRELATION OF GEOPHYSICAL DATA WITH DRILLING RESULTS

Site 445 is 1 nautical mile northwest of shot point 3960 of line 3-2, multichannel seismic reflection profile of S/V *Kaiyo-Maru* (Figure 19). The uppermost layer, with a two-way normal time thickness of 0.4 seconds, is semi-transparent, and the underlying 0.3-second section is moderately stratified. Below this, two discrete, sharp reflectors can be observed at 0.68 seconds and 0.72 seconds, respectively.

Lithology and sonic velocity of the recovered cores can be correlated with these acoustic reflectors as follows:

1. The uppermost, semi-transparent layer corresponds to nannofossil ooze and the upper portion of nannofossil chalk sections lying above a sub-bottom depth of 360 meters, at which sonic velocity increases from 1.6 to 1.8 km/s to 2.0 km/s.

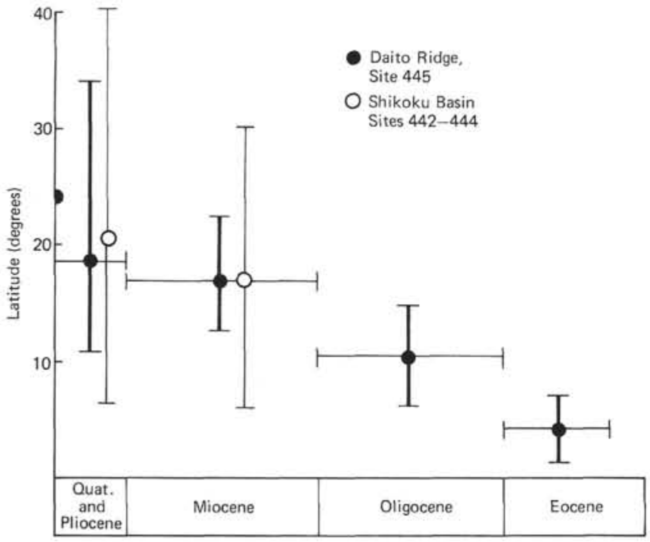


Figure 14. *Latitude of Site 445 in the geological past. Solid circles are calculated and plotted from mean values of the absolute NRM inclination, as listed in Table 6. Horizontal bars show time spans for which inclination values are averaged. Vertical bars show probable errors corresponding to the standard deviations of NRM inclination in Table 6, asymmetrical around the expected geographic latitude. Open circles are plots for Sites 442 through 444 (mixed), for comparison. A solid semicircle on the left of the figure indicates the present latitude.*

2. There are a few levels at which the sonic velocity sharply increases and then gradually decreases downhole; this is possibly associated with increase in clay content in chalk. The stratified structure of the lower sediment sections seen in the acoustic record is due to such a repetition of composition in chalk downhole.

3. Occurrence of chert and radiolarite, which show high sonic velocity of 3.0 km/s, is indicated by the sharp reflector observed at 0.68 seconds.

4. Conglomerate occurring at the hole bottom shows sonic velocity higher than 3.0 km/s. The boundary between the conglomerate and the overlying mudstone (V_p = 2.1) probably marks the discrete reflector at 0.72 seconds.

5. Lithified basement is not clearly recognized in the seismic profile. An indistinct reflector at 0.91 seconds is likely the basement. If the average velocity of the overlying layers is assumed to be 2.1 km/s, the sub-bottom depth of basement is 956 meters below the mudline.

Sonobuoy site-survey measurements show that a 310-meter-thick layer (V_p = 1.85) overlies a 240-meter-thick layer (V_p = 2.11) and a 890-meter-thick layer (V_p = 3.9), underlain by the basement with V_p = 5.7. Thickness and sonic velocity of the upper two layers are roughly consistent with those of the recovered cores. Sonic velocity of the underlying layer, in contrast, seems to be overestimated; thus thickness of the layer is likewise overestimated. If the interval velocity is assumed to be 2.5 km/s, the layer apparently becomes as thin as 580 meters, consistent with the depth of basement estimated by other methods. Sonobuoy data may be less precise here because of rough basement topography.

SUMMARY AND CONCLUSIONS

Summary

The stratigraphic section at Site 445 consists of six sedimentary units. Some of these units have been subdivided further on the basis of biogenic content, color, and minor compositional changes.

The total penetration at Site 445 was 892.0 meters, and the entire section was sedimentary. Acoustic basement was not reached, but may not be very far below the depth of maximum penetration.

The preservation of foraminifers and nannofossils was excellent in samples recovered from Pleistocene, Pliocene, and upper-Miocene rocks. This fauna is tropical. However, in the early Miocene and late Oligocene, the foraminifer and nannofossil species represent colder water. The Eocene fauna is tropical. The depth of deposition was well above the CCD from the late Eocene onward, and probably above the lysocline from latest Eocene to the present (Figure 20). The depth of deposition during the middle Eocene was most likely at or slightly below the CCD, apparently following the general Pacific CCD curve of van Andel et al. (1975).

Discontinuities in floral associations in the middle to early Oligocene chalks of unit IVd suggest that a hiatus may occur between Cores 57-5 and 59-4, encompassing a major part of the early and middle Oligocene. The discontinuity consists of an abrupt occurrence of well-developed late-Eocene assemblages below Core 59-5, whereas no Eocene assemblage exists in the overlying sediment. A similar discrepancy was also observed in cores between 57-4 and 57-5, where an early-Oligocene assemblage directly underlies an assemblage of the late middle Oligocene. Because this sequence is heavily reworked, the paleontological evidence indicates a hiatus lasting at least 8 m.y.

Sedimentation at Site 445 was mainly resedimentation of biogenic pelagic oozes by turbidity currents and slumping, and of terrigenous and volcaniclastic sands and conglomerates by turbidity currents, fluidized-sediment flow, debris flow, and slumping. Evidence for resedimentation by turbidity currents includes graded terrigenous and volcaniclastic foraminifer sands; graded sequences, T(a,b,e); and sharp scours. Most of the graded beds contain fossils reworked from shallower water depths. The interbedded pelagic sediments contain deeper-water fossils. Evidence for fluidized-sediment flow is found in conglomerate deposits organized into a framework conglomerate with a fabric. Many of these conglomerates contain specimens of the large shallow-water foraminifer *Nummulites*; these platy tests and other platy clasts define the fabric of such conglomerates. Evidence for deposition by debris flow consists again is found in conglomerates, but such conglomerates are supported by a mudstone or muddy-sandstone matrix, and the gravel-sized clasts display a dispersed fabric. Much of the sequence, particularly the sandstones, conglomerates, and mudstones, and chalks and

TABLE 7
Summary of Physical Properties of Sediments, Site 445

Sample (interval in cm)	Lithology	Sonic Velocity (km/s)	Thermal Conductivity (mcal/cm-s-°C)	Shear Strength ($\times 10^{-5}$ dynes/cm^2)	Wet-Bulk Density (g/cm^3)	Porosity (%)	Water Content (%)
445-1-2, 125–128	nannofossil ooze	–	–	0.05	–	–	–
1-3, 96–99	”	–	–	0.00	–	–	–
1-4, 83–86	”	–	–	0.38	–	–	–
1-4, 144–150	”	–	–	–	1.54	69.43	46.09
1-5, 71–73	”	–	–	0.10	1.58	70.62	45.78
1-6, 77–90	”	–	2.542	0.10	–	–	–
2-1, 90–92	”	–	–	0.02	1.52	72.85	49.08
2-2, 110–112	”	–	–	1.34	–	–	–
2-3, 136–138	”	–	–	2.11	–	–	–
2-4, 110–112	”	–	–	0.67	–	–	–
3-1, 120–122	”	–	–	0.96	–	–	–
3-2, 120–122	”	–	–	1.24	–	–	–
3-3, 69–71	”	–	–	0.62	–	–	–
3-4, 69–71	”	–	–	1.24	–	–	–
3-5, 30–32	”	–	–	1.72	1.60	67.16	42.92
3-6, 120–122	”	–	–	0.86	–	–	–
3-7, 20–22	”	–	–	2.49	–	–	–
4-1, 20–22	”	–	–	1.15	–	–	–
4-2, 110–112	”	–	–	0.10	–	–	–
4-4, 44–46	”	–	–	0.86	–	–	–
4-5, 42–52	”	1.568	2.811	0.77	1.54	59.71	39.67
4-6, 44–46	”	–	–	0.48	–	–	–
6-5, 144–150	”	–	–	–	1.63	63.41	39.75
6-6, 64–74	”	1.527	2.878	2.39	1.68	65.51	39.83
7-5, 90–100	”	1.509	2.867	2.39	1.63	65.32	41.03
8-3, 79–81	”	–	–	1.39	–	–	–
8-5, 110–120	”	1.517	2.875	2.49	1.58	68.41	44.39
8-5, 110–120	”	1.508*	–	–	–	–	–
10-5, 130–140	”	1.592	2.917	4.98	1.66	62.22	38.40
11-4, 87–89	”	–	–	1.53	–	–	–
11-4, 90–100	”	1.553	3.222	6.70	1.74	67.28	39.70
11-4, 144–150	”	–	–	–	1.70	62.79	37.93
12-2, 40–50	”	1.618	2.875	–	1.76	79.98	46.45
13-3, 62–72	”	1.571	2.742	–	1.60	68.14	43.73
14-1, 122–132	”	1.490	2.878	3.26	1.55	68.68	45.39
15-1, 126–136	”	1.535	2.900	–	1.72	64.26	38.21
16-2, 84–94	”	1.552	3.306	–	1.60	57.38	36.76
17-1, 40–50	”	1.577	3.411	–	1.72	61.20	36.56
17-1, 140–150	”	–	–	–	1.76	57.48	33.40
18-3, 69–79	”	1.579	–	–	1.70	53.84	32.44
18-4, 136–146	nannofossil chalk	1.552	–	–	1.70	61.34	36.95
20-2, 87–97	”	1.533	3.167	2.68	1.75	62.99	36.91
21-1, 62–72	”	1.550	3.389	–	–	–	–
22-1, 144–150	”	–	–	–	1.66	52.70	32.51
22-1, 144–150	”	–	–	–	1.78	54.32	31.30
22-2, 62–75	”	1.554	3.294	–	–	–	–
23-1, 70–71	”	–	–	–	1.62	61.49	38.98
23-2, 35–45	”	1.543	3.028	–	–	–	–
24-2, 78–79	”	–	–	–	1.79	55.07	31.49
24-3, 124–134	”	1.659	3.422	–	–	–	–
25-1, 24–25	”	–	–	–	1.77	53.20	30.86
25-2, 47–57	”	1.604	2.933	–	–	–	–
26-3, 102–103	”	–	–	–	1.74	56.32	33.24
27-4, 140–150	”	–	–	–	1.68	66.20	40.37
28-2, 5–15	”	1.600	2.781	–	1.68	64.87	39.66
29-4, 94–104	”	1.712	3.067	–	1.84	55.05	30.72
30-3, 14–29	”	1.657	3.236	–	1.72	57.38	34.25
31-1, 85–95	”	–	3.097	–	–	–	–
31-4, 110–121	”	1.663	3.394	–	1.75	53.46	31.36
32-1, 48–58	”	1.807	2.892	–	1.50	69.50	47.56
32-1, 72–82	”	1.736	3.983	–	1.67	59.28	36.36
32-2, 140–150	”	–	–	–	1.65	62.66	38.93

TABLE 7 – *Continued*

Sample (interval in cm)	Lithology	Sonic Velocity (km/s)	Thermal Conductivity (mcal/cm-s-°C)	Shear Strength ($\times 10^{-5}$ dynes/cm^2)	Wet-Bulk Density (g/cm^3)	Porosity (%)	Water Content (%)
445-33-2, 50–60	"	1.733	3.467	–	–	–	–
34-2, 37–40	"	1.799	–	–	–	–	–
34-2, 46–56	"	–	–	–	1.79	54.32	31.13
34-2, 58–59	nannofossil chalk	–	–	–	1.76	55.49	32.36
35-2, 78–81	"	1.716	–	–	–	–	–
35-2, 83–93	"	–	3.511	–	1.79	57.14	32.62
36-2, 66–76	"	1.705	3.364	–	1.73	63.09	37.32
36-2, 114–124	"	–	2.903	–	–	–	–
37-2, 68–78	"	1.730	3.700	–	1.91	50.11	26.95
37-4, 23–33	"	1.865	3.389	–	1.95	53.13	27.92
37-4, 140–150	mudstone	–	–	–	1.73	60.90	36.04
38-3, 39–49	nannofossil chalk	1.802	4.111	–	1.96	51.32	26.80
39-1, 9–19	"	–	3.969	–	–	–	–
39-1, 94–97	"	1.892	–	–	1.94	58.69	30.94
40-2, 146–150	"	1.929	4.414	–	2.06	40.91	20.32
41-6, 33–43	"	1.999	4.081	–	2.11	41.57	20.18
42-4, 104–114	"	1.780	3.236	–	1.91	54.25	29.11
42-5, 90–100	"	–	–	–	1.79	55.33	31.68
43-2, 100–103	"	2.018	–	–	2.21	43.26	20.09
44-3, 130–133	"	1.958	–	–	2.23	46.06	21.18
45-3, 31–34	"	2.143	–	–	2.33	47.78	21.00
46-3, 28–30	"	–	–	–	1.91	44.09	23.67
46-4, 28–31	"	1.996	–	–	2.05	49.71	24.86
47-3, 73–76	"	1.937	–	–	2.13	47.76	22.92
47-4, 90–100	"	–	–	–	2.01	44.75	22.75
48-2, 26–36	"	2.524	5.144	–	2.14	41.56	19.89
49-3, 54–64	"	2.252	4.511	–	2.31	48.61	21.56
50-1, 38–48	"	2.358	4.492	–	2.26	47.08	21.36
51-3, 108–118	"	2.086	3.728	–	1.86	45.30	24.97
52-2, 86–96	"	2.275	4.997	–	1.99	36.65	18.84
52-2, 90–100	"	–	–	–	1.90	48.42	26.17
53-2, 34–44	"	2.111	4.094	–	1.92	47.10	25.12
54-2, 38–48	"	2.110	4.178	–	1.93	42.36	22.47
55-3, 38–48	"	2.065	4.228	–	1.95	46.89	24.59
56-3, 33–43	"	2.081	3.928	–	1.92	48.98	26.12
57-3, 73–83	"	2.124	3.381	–	1.76	53.45	31.04
58-1, 103–106	"	2.376	–	–	–	–	–
58-2, 23–33	"	2.407	5.036	–	–	–	–
59-4, 139–149	"	1.988	3.386	–	1.85	47.45	26.25
60-1, 38–48	"	2.106	2.878	–	1.92	47.80	25.45
61-3, 67–69	"	1.848	2.569	–	1.59	59.31	38.30
62-2, 44–47	"	1.948	–	–	1.77	55.33	32.02
62-2, 143–150	"	–	2.422	–	–	–	–
62-2, 140–150	"	–	–	–	1.75	56.95	33.38
63-2, 127–140	"	1.884	2.486	–	1.64	59.79	37.35
64-3, 18–28	"	1.823	2.594	–	1.61	59.06	37.51
65-1, 42–52	"	1.773	2.464	–	1.55	66.27	43.83
65-2, 90–100	radiolarite	–	–	–	1.46	66.24	46.60
65-3, 42–52	radiolarian ooze	1.736	2.575	–	1.46	61.04	42.92
65-3, 92–95	chert	2.160	–	–	–	–	–
66-2, 16–26	radiolarite	1.839	2.906	–	1.68	63.00	38.44
67-1, 19–22	mudstone	3.321	–	–	2.33	24.73	10.89
68-1, 78–88	siltstone	2.329	3.450	–	2.08	43.11	21.26
68-2, 41–51	"	2.538	2.989	–	2.10	37.52	18.26
69-1, 24–26	mudstone	–	–	–	2.19	32.86	15.37
69-2, 100–103	"	2.088	–	–	2.02	44.86	22.75
69-3, 28–38	sandstone	3.030	3.142	–	2.22	36.53	16.84
70-2, 7–17	claystone	2.065	3.275	–	2.78	47.18	24.78
71-1, 38–45	mudstone	2.537	3.375	–	1.93	41.21	21.92
72-1, 43–46	"	2.265	–	–	2.08	39.66	19.54
73-1, 80–83	"	2.078	–	–	2.01	42.52	21.68
73-3, 84–94	sandstone	2.061	6.531	–	1.96	42.87	22.39
74-2, 46–49	mudstone	2.244	–	–	2.01	40.16	20.42

TABLE 7 – *Continued*

Sample (interval in cm)	Lithology	Sonic Velocity (km/s)	Thermal Conductivity (mcal/cm-s-°C)	Shear Strength ($\times 10^{-5}$ dynes/cm^2)	Wet-Bulk Density (g/cm^3)	Porosity (%)	Water Content (%)
445-75-2, 39–42	mudstone	2.152	–	–	2.03	38.72	19.59
75-5, 43–53	"	2.182	3.156	–	1.93	42.72	22.66
76-3, 106–116	"	2.282	3.211	–	2.11	36.75	17.82
77-1, 137–147	"	2.257	3.436	–	2.09	36.64	17.99
78-4, 25–35	"	2.067	3.194	–	2.06	48.48	24.14
79-2, 125–135	"	2.049	3.236	–	2.01	47.47	24.25
80-1, 135–145	"	2.037	3.231	–	1.96	47.25	24.68
80-4, 90–100	"	–	–	–	1.95	47.57	24.95
81-3, 56–66	"	1.994	3.033	–	2.03	56.91	29.69
82-1, 70–80	"	2.045	3.142	–	1.97	46.40	24.10
83-3, 76–79	"	2.062	–	–	1.97	45.99	23.91
84-1, 100–110	"	2.058	3.250	–	1.97	47.71	24.80
85-3, 97–107	"	2.110	3.239	–	2.03	42.35	21.38
86-2, 56–59	"	2.076	–	–	1.97	45.76	23.75
87-4, 40–50	siltstone	2.162	3.328	–	2.04	40.66	20.43
88-3, 58–68	mudstone	2.305	2.719	–	2.04	43.94	22.10
89-3, 75–85	"	2.092	3.158	–	2.02	44.46	22.59
90-1, 25–35	sandstone	2.949	4.428	–	2.18	32.06	15.05
91-2, 50–66	"	2.561	3.089	–	2.07	33.41	16.51
92-3, 95–105	"	3.192	2.783	–	2.32	28.44	12.55
93-3, 90–100	conglomerate	3.246	3.558	–	2.30	26.64	11.85
94-2, 96–106	"	3.059	3.597	–	2.31	26.30	11.68

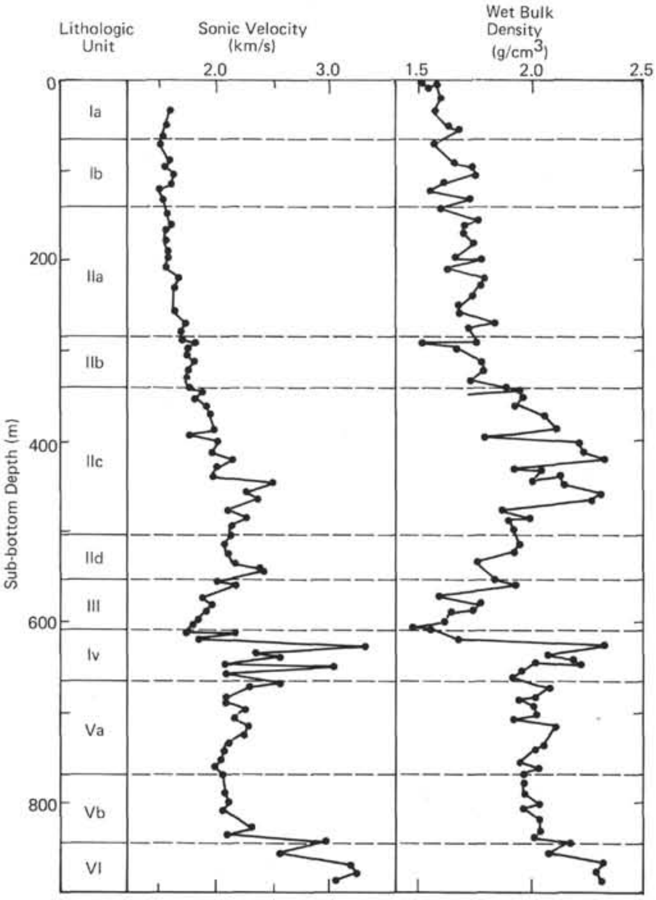


Figure 15. *Sonic velocity and wet-bulk density versus depth for Site 445 sediments.*

limestones of units II, V, and VI, show features clearly indicative of slumping, including rotation of large blocks (some as thick as 5 m), microfaults, pull-apart fractures, and well-developed slump folds. Slumping of sediments involved both the chalks and the volcaniclastic sandstones. This style of sedimentation has been observed before both in the South Fiji and New Hebrides marginal basins (Klein, 1975a,b), and off the Line Islands in the central Pacific (Cook et al., 1976).

The rates of sediment accumulation reflect this style of sedimentation. Rates are very low for the purely pelagic intervals, and moderate for the resedimented biogenic pelagic carbonates. Rates of sediment accumulation are very high for the sandstones and conglomerates of unit V. This pattern of sedimentation rates (an early history of rapid sedimentation, and then a decrease with time) is identical to a similar change in sediment accumulation rates reported by Andrews, Packham, et al. (1975) from the New Hebrides Basin (Site 286), and from the South Fiji Basin (Site 285).

The volume of sediment deposited by resedimentation processes is high, perhaps as much as 70 per cent for unit V, and perhaps as much as 80 per cent for the upper carbonate units. (See White et al., this volume.)

Organic-carbon content decreases exponentially to a depth of about 100 meters, below which it remains constant throughout the pelagic sequence. In the deepest part of the section, organic-carbon content increases again, probably reflecting the contribution of resedimented terrigenous organic material carried in the debris flows.

The observed decrease in organic carbon with sediment age and depth in these pelagic sediments is analogous to the trends observed in the hemipelagic sediments

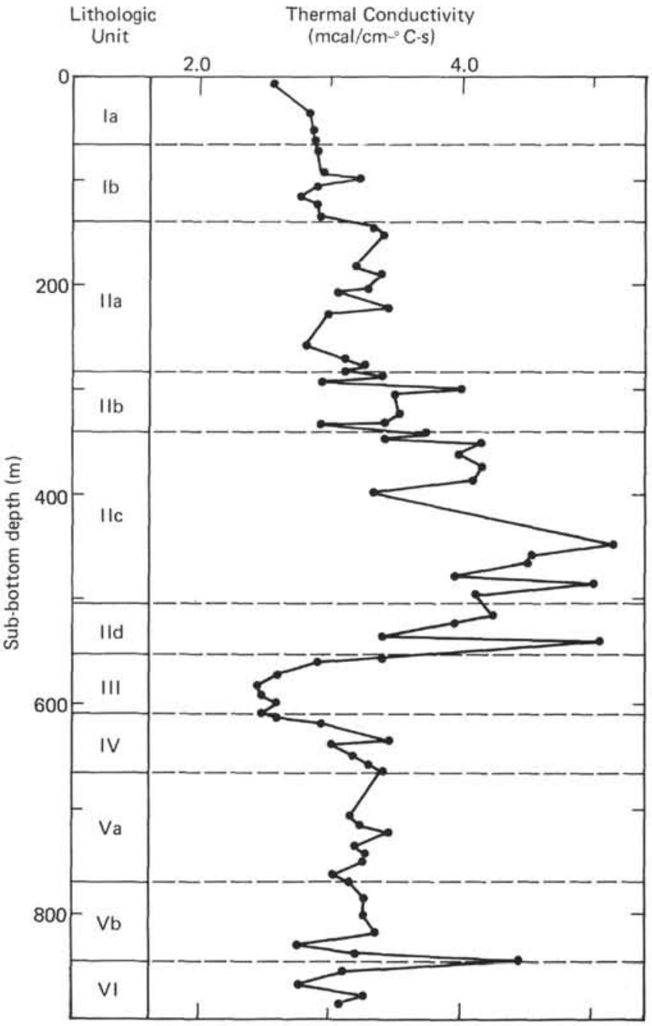


Figure 16. *Thermal conductivity versus depth for Site 445 sediments.*

at Sites 442, 443, and 444. Approximately equal lengths of time (about 4 m.y) are required for the degradation process to be completed in the pelagic and hemipelagic environments. Both the initial and final organic-carbon contents are only about half of those in the relatively pure hemipelagic clays at Sites 442 and 443; the explanation for this probably lies in the absence of organic matter adsorbed on clay surfaces at Site 445.

The *p*H of the sediments averages 7.46, alkalinity averages 1.6 meq/kg, salinity averages 35.7 per mill, and chlorinity averages 19.96 per mill.

Table 8 summarizes average physical properties of the sediments recovered at Site 445. Sonic velocity increases in the older units with depth, and from this a minimum elevation of the sediment/basement boundary was estimated at approximately 950 meters sub-bottom.

Paleomagnetism measurements of sediment samples recovered at Site 445 show that there is a systematic change in magnetic inclination with depth. The change indicates that Site 445 has drifted in a net northerly

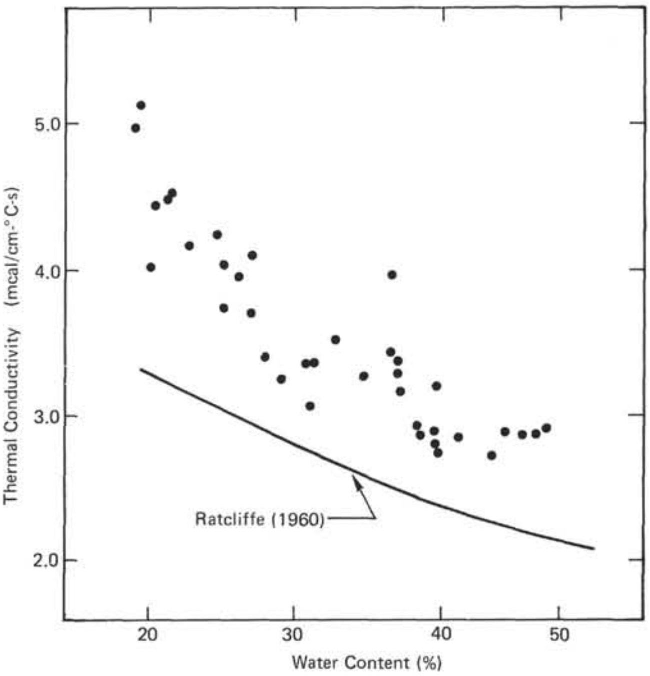


Figure 17. *Relationship between thermal conductivity and water content for nannofossil oozes and chalks in Cores 1 through 58, Site 445. Also shown is the relationship for deep-ocean sediments established by Ratcliffe (1960).*

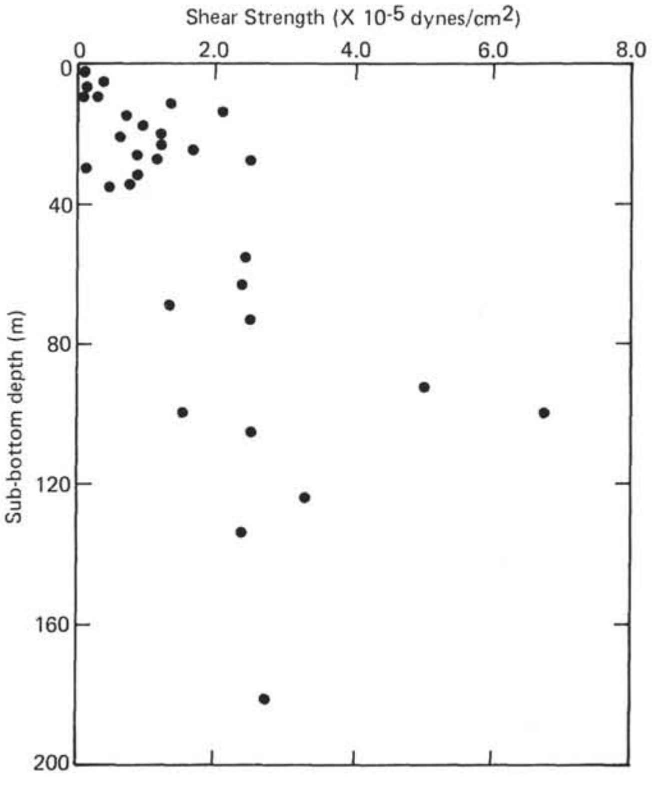


Figure 18. *Shear strength versus depth for Site 445 sediments.*

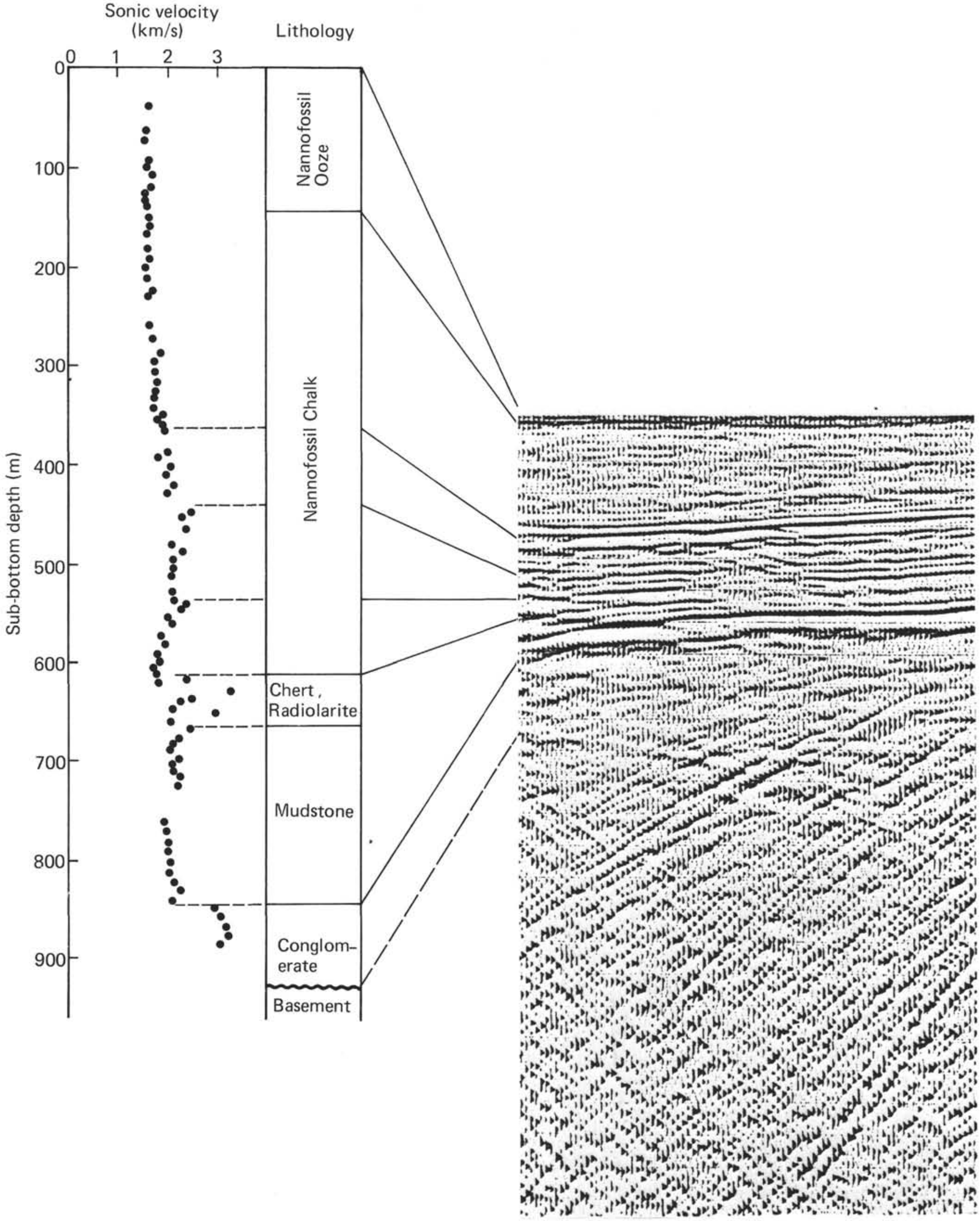


Figure 19. *Site 445 stratigraphic section and corresponding seismic profile of R/V* Kaiyo-Maru.

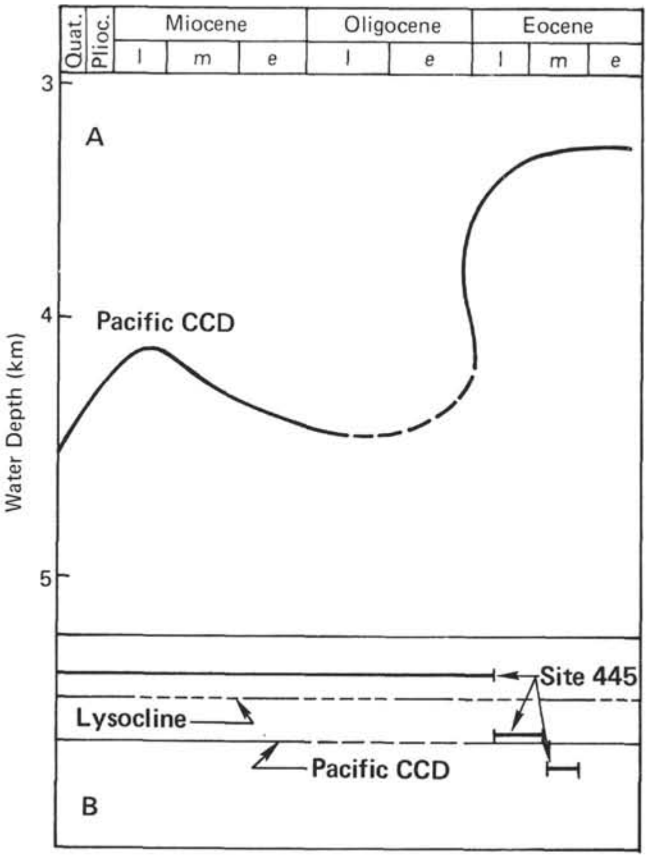


Figure 20. A. *General curve showing estimated water depth of CCD in Pacific Ocean (after van Andel et al., 1975, p. 47, fig. 29).* B. *Relative depth of deposition at Site 445 compared to CCD curve for Pacific Ocean.*

TABLE 8
Average Values and Ranges of Sonic Velocity, Shear Strength, and Thermal Conductivity for Sediments, Site 445

	Sonic Velocity (km/s)	Shear Strength ($\times 10^5$ dynes/cm^2)	Thermal Conductivity (mcal/cm-s-°C)
Average	2.007	1.60	3.421
Range	1.490–3.321	0.0–6.70	2.422–6.531

direction over the last 47 m.y. At 47 Ma, Site 445 was close to the equator; it has migrated nearly 2000 km to its present position at an average rate of 4.4 cm/yr. These data are in agreement with results obtained by Louden (1976, 1977) in the West Philippine Basin. Intensity of natural remanent magnetization is greater in deeper parts, which appear to contain higher amounts of volcanogenic magnetite.

Conclusions

Our findings permit us to draw the following conclusions about the geological history of Site 445:

1. Although we did not reach acoustic basement, the systematic increase in sonic velocity with depth suggests that basement may occur not far below our maximum depth of penetration.

2. The depositional surface at Site 445 was well above the CCD during most of its depositional history.

3. The dominant motif of sedimentation at Site 445 was one of resedimentation of pelagic biogenic sediment, terrigenous sediment, and volcaniclastic sediment by turbidity currents, slump processes, fluidized-sediment flows, and debris flows.

4. The occurrence of *Nummulites* in debris flow and fluidized-sediment-flow conglomerates indicates clearly that it and associated shallow-water bivalves, bryozoans, and gastropods were emplaced by resedimentation processes from shallower water. This origin for *Nummulities* is significant to consideration of dredge recovery of *Nummulities*-bearing rocks from the Amami Plateau and the Daito Ridge (Mizuno et al., 1975). The combined evidence from dredge sampling and our drilling indicates that the Daito Ridge, at present nearly 1300 meters below sea level, probably subsided no more than 1200 meters between Eocene time and the present.

5. Paleomagnetism data indicate that Site 445 and the surrounding Daito Ridge were around the equator at 47 Ma. Since then, northward drift averaging 4.4 cm/yr has occurred.

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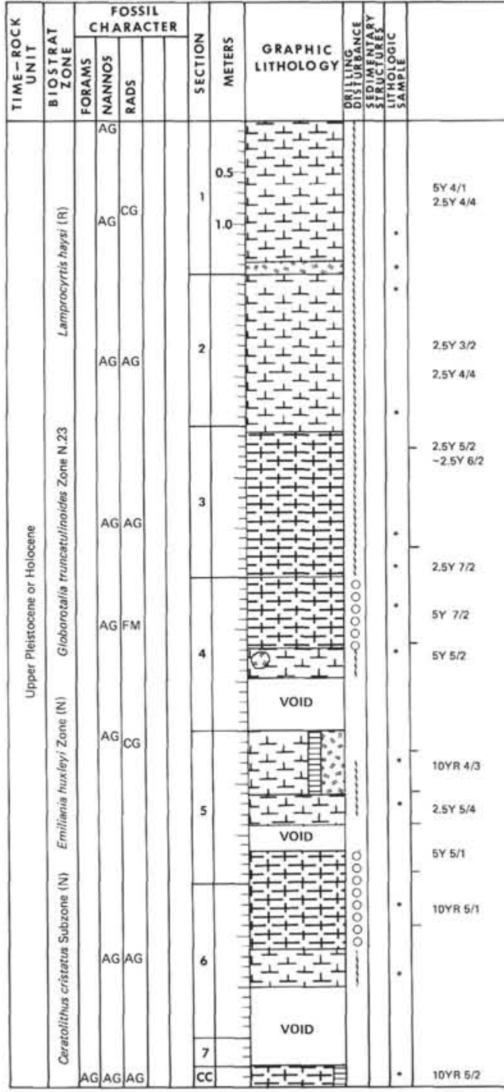
SITE 445 HOLE CORE 1 CORED INTERVAL: 0.0-8.5 m



LITHOLOGIC DESCRIPTION

Dominant Lithology:
Foraminifera-Nannofossil and Nannofossil-Foraminifera Ooze, gray — grayish brown — brown, partly clayey and vitric.

Minor Lithologies Include:
Brown volcanic ash.
Sediment is highly disturbed and no original structures.

SMEARS:
1-115, 2-20, 2-140, 4-75, 5-75, 6-90 (Nannofossil Ooze)

Clay minerals	5%	Nannofossils	70-87%
Volcanic glass	0- 7%	Diatoms	0- 1%
Foraminifers	2-10%	Radiolarians	1- 4%

3-110, 6-25 (Foraminifera-Nannofossil Ooze)

Clay minerals	5- 9%	Nannofossils	59%
Volcanic glass	1- 3%	Diatoms	0-TR%
Foraminifers	15-20%		

CC (Clayey Foraminifera-Nannofossil Ooze)

Clay minerals	15%	Diatoms	TR
Foraminifers	15%	Radiolarians	2%
Nannofossils	65%		

5-32 (Clayey Vitric Nannofossil Ooze)

Sand	40%	Clay minerals	20%
Silt	10%	Volcanic glass	30%
Clay	50%	Foraminifers	<10%
		Nannofossils	41%
		Diatoms	1%
		Sponge spicules	3%

3-140, 4-30 (Nannofossil-Foraminifera Ooze)

Clay minerals	5%	Nannofossils	18-45%
Volcanic glass	1- 5%	Diatoms	0- 1%
Foraminifers	50-60%	Radiolarians	0- 1%

1-140 (Volcanic Ash)

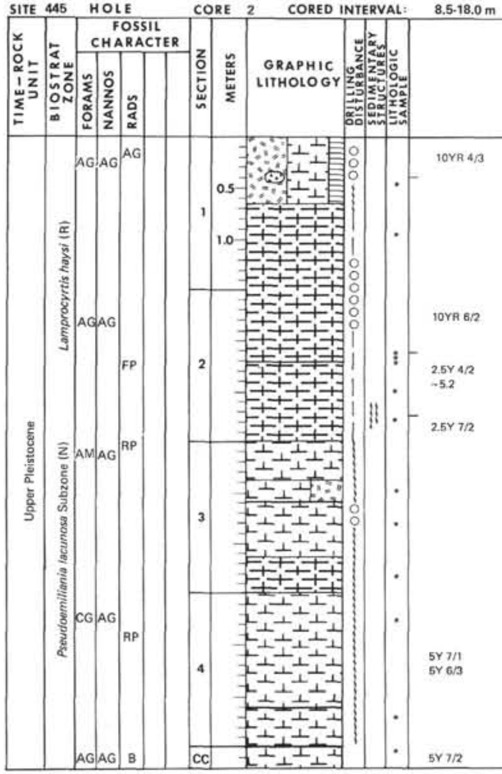
Sand	65%	Clay minerals	<10%
Silt	20%	Volcanic glass	7%
Clay	15%	Foraminifers	2%
		Nannofossils	5%
		Sponge spicules	TR

GRAIN SIZE:
1-46 (1.5, 37.8, 60.6)
3-106 (5.5, 42.4, 52.1)

CARBON-CARBONATE:
1-55 (4.7, 0.3, 37)
3-109 (7.8, 0.1, 64)

CARBONATE BOMB:
2-121 (52.2)

SITE 445 HOLE CORE 2 CORED INTERVAL: 8.5-18.0 m



LITHOLOGIC DESCRIPTION

Dominant Lithology:
Foraminifera-Nannofossil Ooze and Nannofossil Ooze, brown, grayish brown, gray, partly clayey and vitric. Sediments are highly disturbed, with no sedimentary structures.

SMEARS:
1-100, 2-70, 2-74, 2-80, 2-110, 4-125 (Foraminifera-Nannofossil Ooze)

Clay minerals	TR- 5%	Nannofossils	53-75%
Volcanic glass	TR- 3%	Radiolarians	TR- 2%
Foraminifers	10-20%	Sponge spicules	TR- 1%

2-130, 3-85, 3-135, 4-30, CC (Nannofossil Ooze)

Clay minerals	TR- 5%	Nannofossils	68-85%
Volcanic glass	TR- 7%	Radiolarians	TR- 1%
Foraminifers	5-10%	Sponge spicules	TR- 1%

3-50 (Vitric Nannofossil Ooze)

Sand	37%	Clay minerals	5%
Silt	13%	Volcanic glass	30%
Clay	50%	Foraminifers	7%
		Nannofossils	60%
		Radiolarians	1%
		Sponge spicules	1%

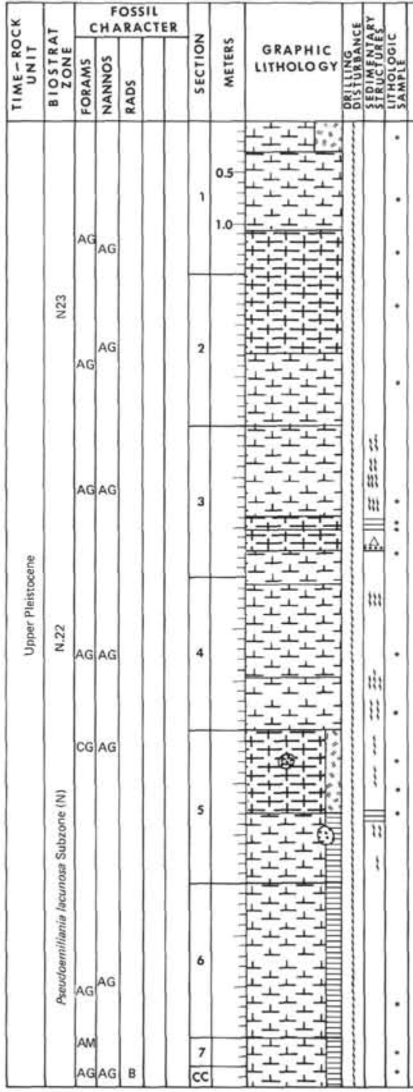
1-50 (Clayey Vitric Nannofossil Ooze)

Sand	15%	Clay minerals	TR
Silt	51%	Volcanic glass	38%
Clay	34%	Foraminifers	7%
		Nannofossils	26%
		Diatoms	TR
		Radiolarians	2%
		Sponge spicules	1%

GRAIN SIZE:
1-50 (13.9, 50.9, 35.2)
3-136 (0.8, 22.8, 76.4)

CARBON-CARBONATE:
1-63 (4.8, 0.2, 38)
3-132 (7.2, 0.1, 59)

SITE 445 HOLE CORE 3 CORED INTERVAL: 18.0-27.5 m



5Y 6/1
5Y 7/1

10YR 6/2

10YR 6/2
~6/1

10YR 7/2
~7/1

10YR 6/2

10YR7/1

LITHOLOGIC DESCRIPTION

Dominant Lithology:
Foraminifera-Nannofossil Ooze, Nannofossil Ooze, with Nannofossil-Foraminifera Ooze, partly vitric. Lower part of the core is clayey (up to 15%). Colors are light gray, light brownish gray, light olive gray, light brown. The sediments are firm to stiff.
Sedimentary structures:
Parallel bedding obvious even in intensely disturbed sediments. Intense to moderate bioturbation in Sections 3 and 4.Graded bed fining upward in Section 3, 102-117 cm: sand-sized at base grading upward into silt then white clay.

SMEARS:
1-75, 2-110, 3-75, 3-130, 4-75, 4-130, 6-120 (Nannofossil Ooze)

Clay minerals	TR- 5%	Nannofossils	68-70%
Volcanic glass	TR- 5%	Radiolarians	TR- 1%
Foraminifers	5-10%	Sponge spicules	0- 1%

1-130, 2-39, 3-95, 3-115 (Foraminifera-Nannofossil Ooze)

Clay minerals	5%	Nannofossils	55-71%
Volcanic glass	TR- 2%	Radiolarians	0-TR%
Foraminifers	15%	Sponge spicules	TR

5-105, 5-135, 7-10, CC (Clayey Nannofossil Ooze)

Sand	2- 5%	Clay minerals	10-15%
Silt	8-15%	Volcanic glass	TR- 2%
Clay	80-90%	Foraminifers	3- 7%
		Nannofossils	65-68%
		Radiolarians	0-TR%
		Sponge spicules	0- 1%

3-115 (Nannofossil-Foraminifera Ooze)

Clay minerals	TR	Carbonate unspecified	19%
Foraminifers	50%	Nannofossils	30%

1-20 (Vitric Nannofossil Ooze)

Sand	40%	Clay minerals	5%
Silt	20%	Volcanic glass	30%
Clay	40%	Foraminifers	5%
		Nannofossils	60%
		Radiolarians	TR
		Sponge spicules	1%

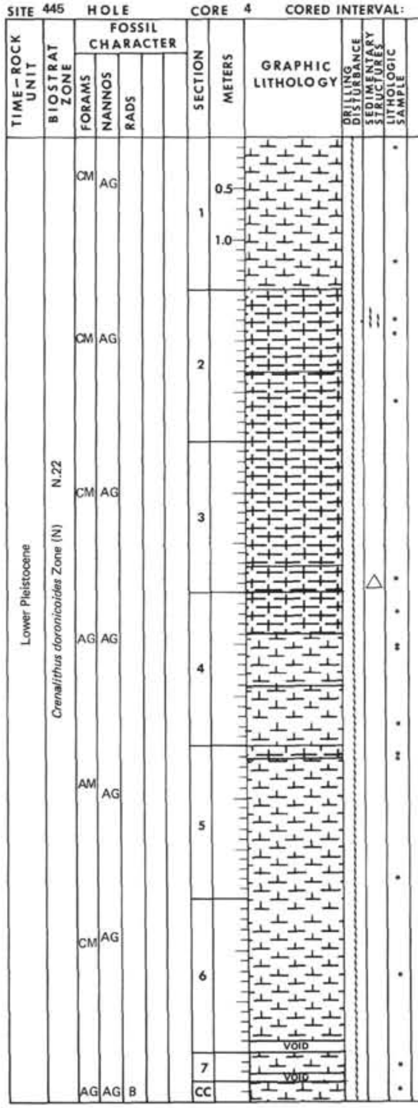
5-30 (Vitric Foraminifera-Nannofossil Ooze)

Sand	<10%	Clay minerals	<10%
Silt	>45%	Volcanic glass	15%
Clay	>40%	Foraminifers	15%
		Nannofossils	50%
		Sponge spicules	1%

GRAIN SIZE:
1-75 (1.7, 35.1, 63.2)
3-81 (1.6, 31.2, 67.3)
5-46 (6.4, 49.9, 43.7)

CARBON-CARBONATE:
1-78 (5.1, 0.1, 42)
3-84 (6.4, 0.1, 52)
5-49 (3.2, 0.1, 26)

SITE 445 HOLE CORE 4 CORED INTERVAL: 27.5-37.0 m



10YR 5/3

10YR 8/3

10YR 5/3,
10YR 8/3

10YR 6/3

10YR 7/3

10YR 7/3,
10YR 6/2

10YR 8/4

10YR 8/1
~8/4

10YR 6/2

LITHOLOGIC DESCRIPTION

Dominant Lithology:
Nannofossil-Foraminifera Ooze (upper sections) and **Nannofossil Ooze** (lower sections). Colors are light brown, brownish gray, brown. Volcanic glass rare. Sediments are soft to firm. Color mottling. Sedimentary structures not present except for bioturbation.

SMEARS:
1-15, 1-125, 4-55, 4-130, 5-17, 5-130, 6-75, 7-25, CC (Nannofossil Ooze)

Clay minerals	0- 8%	Nannofossils	71-90%
Volcanic glass	0- 3%	Sponge spicules	0- 1%
Foraminifers	1-10%		

2-38, 2-45, 2-115, 3-135, 4-20 (Foraminifera-Nannofossil Ooze)

Clay minerals	TR- 5%	Nannofossils	60-83%
Volcanic glass	TR- 3%	Sponge spicules	0-TR%
Foraminifers	10-25%		

5-10 (Nannofossil-Foraminifera Ooze)

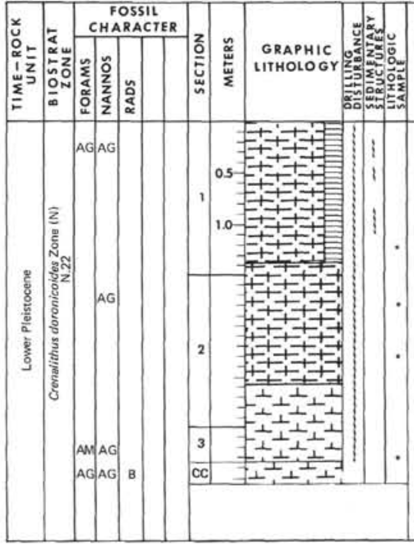
Clay minerals	0%	Nannofossils	45%
Volcanic glass	5%	Radiolarians	TR
Foraminifers	50%		

GRAIN SIZE:
1-20 (1.2, 36.2, 62.6)
3-67 (2.7, 36.1, 61.2)
5-56 (0.0, 34.9, 65.0)

CARBONATE BOMB:
4-59 (58.5)

CARBON-CARBONATE:
1-23 (4.1, 0.1, 33)
3-71 (6.4, 0.1, 53)
5-59 (8.2, 1.0, 60)

SITE 445 HOLE CORE 5 CORED INTERVAL: 37.0-46.5 m



LITHOLOGIC DESCRIPTION

10YR 6/3

Dominant Lithology: Foraminifera-Nannofossil Ooze and Nannofossil Ooze (partly clayey), pale brown, soft. Volcanic glass 1-3%.
Sedimentary structures: bioturbation and mottling.

SMEARS:
2-30 (Foraminifera-Nannofossil Ooze)

Clay minerals	5%
Foraminifers	15%
Nannofossils	87%

2-135, 3-32, CC (*Nannofossil Ooze*)

Clay minerals	5%	Nannofossils	74-89%
Volcanic glass	1- 2%	Radiolarians	0- 1%
Foraminifers	2-10%	Sponge spicules	0- 1%

1-125 (*Clayey Foraminifera-Nannofossil Ooze*)

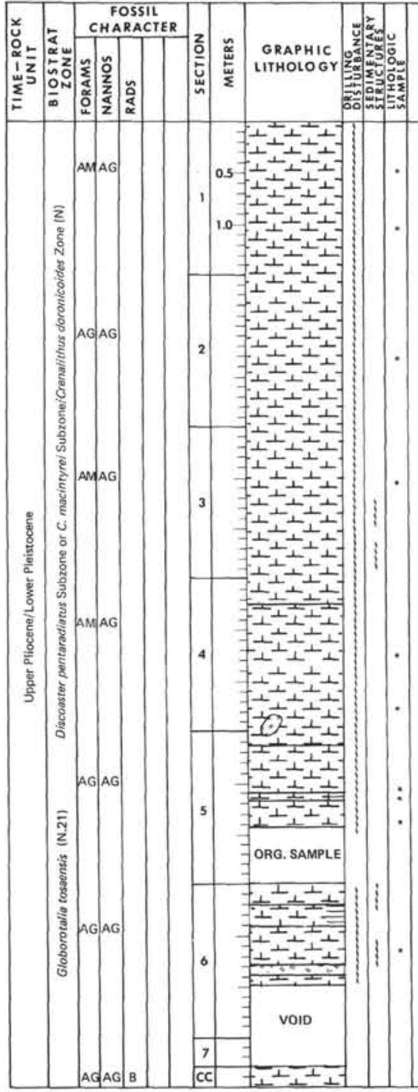
Sand	3%	Clay minerals	15%
Silt	12%	Foraminifers	15%
Clay	85%	Nannofossils	53%

GRAIN SIZE:
1-2 (2.7, 36.0, 61.2)
3-2 (9.9, 31.6, 58.6)

CARBONATE BOMB:
2-36 (54)

CARBON-CARBONATE:
1-5 (6.8, 0.1, 56)
3-5 (8.2, 0.7, 63)

SITE 445 HOLE CORE 6 CORED INTERVAL: 46.5-56.0 m



LITHOLOGIC DESCRIPTION

10YR 8/2,
10YR 6/3

10YR 6/3

10YR 8/2,
10YR 6/3

10YR 8/2

10YR 6/2,
10YR 7/3

10YR 5/2

10YR 8/3

10YR 7/4

Dominant Lithology: Nannofossil Ooze partly passing to grayish brown **Clayey Nannofossil Ooze** in Sections 5 and 6. Pale brown to white; pelagic clay generally < 10% volcanic glass 0-5%. Sediments are very soft to firm in Sections 5, 6, and 7.

Minor Lithology: Ash, 1 bed noted at Section 6, 84 cm.

Sedimentary structures: biotrubation mild to intense, color mottling. Relics of parallel bedding.

SMEARS:
1-50, 1-105, 2-85, 3-110, 4-75, 4-130, 5-60, 5-90, 6-65, CC (Nannofossil Ooze)

Clay minerals	2- 5%	Nannofossils	71-90%
Volcanic glass	0- 5%	Sponge spicules	0-TR%
Foraminifers	1- 9%		

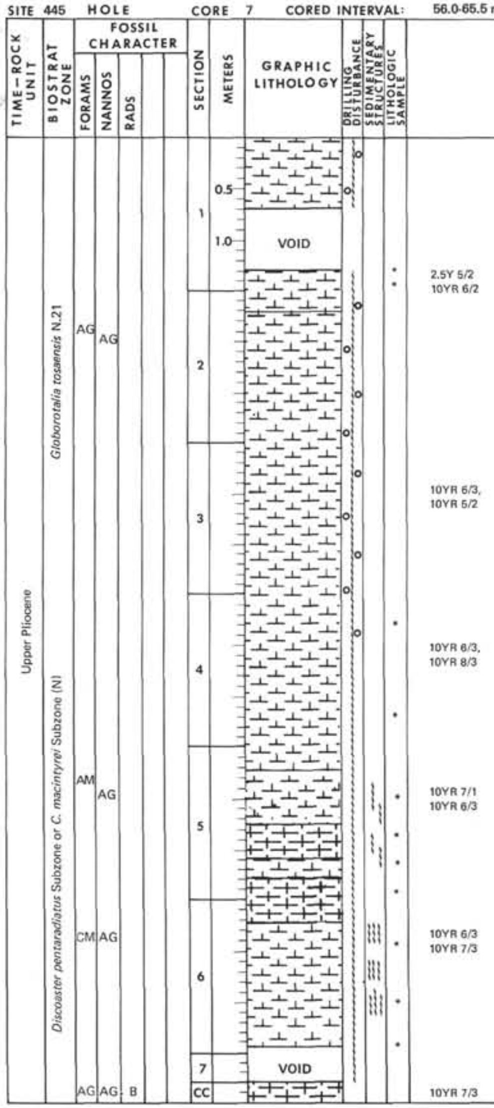
5-66 (Clayey Nannofossil Ooze)

Sand	9%	Clay minerals	30%
Silt	18%	Volcanic glass	1%
Clay	73%	Foraminifers	4%
		Nannofossils	56%

GRAIN SIZE:
1-25 (3.9, 33.4, 62.7)
3-25 (3.6, 25.3, 71.1)
5-25 (5.1, 31.1, 63.9)

CARBON-CARBONATE:
1-28 (8.4, 0.9, 63)
3-28 (8.4, 0.1, 70)
5-28 (7.2, 0.1, 59)

SITE 445 HOLE CORE 7 CORED INTERVAL: 56.0-65.5 m



LITHOLOGIC DESCRIPTION

Dominant Lithology:
Nannofossil Ooze and Foraminifera-Nannofossil Ooze, olive gray, gray, pale olive, pale yellow, <10% pelagic clay, volcanic glass 0-4%. Sediments are very soft to soupy; soft to firm in Sections 5 and 6.
Sedimentary structures: bioturbation intense in Section 6. Mottling extensive evidence of bioturbation.

SMEARS:
1-31, 1-143, 4-32, 4-120, 5-50, 5-116, 6-45, 6-100, 6-140 (Nannofossil Ooze)

Clay minerals	TR-10%	Foraminifers	2-10%
Volcanic glass	0- 3%	Nannofossils	75-92%

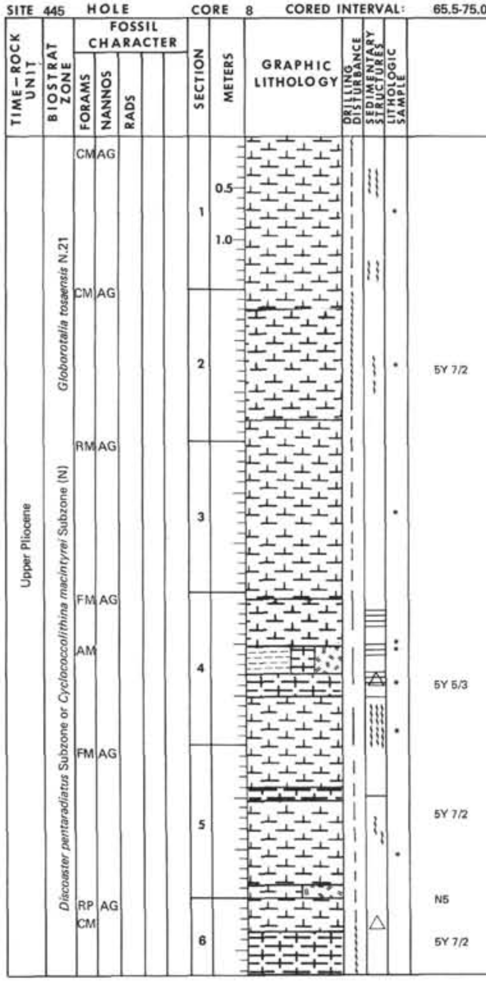
5-90, 5-147, CC (Foraminifera-Nannofossil Ooze)

Clay minerals	TR- 5%	Foraminifers	15%
Volcanic glass	2- 4%	Nannofossils	74-76%

GRAIN SIZE:
5-60 (2.6, 27.0, 70.5)

CARBON-CARBONATE:
5-64 (7.8, 0.1, 64)

SITE 445 HOLE CORE 8 CORED INTERVAL: 65.5-75.0 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: Nannofossil Ooze, light gray (5Y 7/2). Volcanic glass 0-4%. Sediments are firm.

Minor Lithologies: Ashy Ooze with interbeds of gray or green **Nannofossil-Foraminifera Ooze and Vitric Calcareous Mud.**

Sedimentary structures:
Bioturbation mild to intense, parallel laminae – black. Graded bed = massive, sandy textured zone composed of foraminifers and nannofossils fining upward to fine zone with black parallel laminae. Sandy–silty–ooze in 45 cm. Sequence with sharp basal contact with underlying intensely bioturbated zone in Section 5. Sandy–silty–clayey textured sequence, Section 6.

SMEARS:
1-75, 2-75, 3-75, 4-54, 4-190, 5-110 (Nannofossil Ooze)

Clay minerals	TR- 5%	Foraminifers	2-10%
Volcanic glass	TR- 4%	Nannofossils	80-93%

4-90, 6-50 (Nannofossil-Foraminifera Ooze)

Clay minerals	TR- 3%	Foraminifers	66-68%
Volcanic glass	TR- 1%	Nannofossils	20%

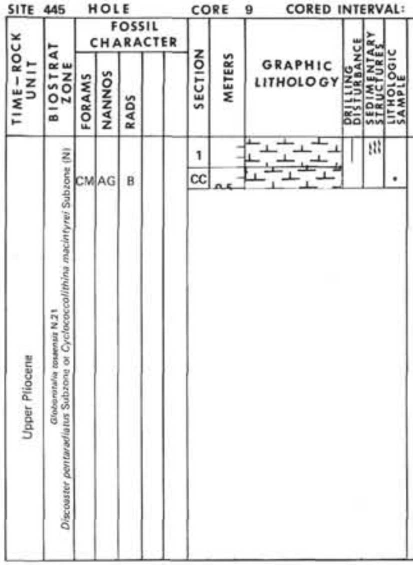
4-58 (Vitric Calcareous Sandy Mud)

Sand	40%	Clay minerals	5%
Silt	40%	Quartz, Feldspar	20%
Clay	20%	Opaque minerals	10%
		Volcanic glass	27%
		Foraminifers	20%
		Nannofossils	15%

GRAIN SIZE:
1-90 (1.0, 25.9, 73.1)
3-90 (0.0, 29.0, 70.9)
5-90 (0.2, 27.4, 72.4)

CARBON-CARBONATE:
1-95 (8.0, 0.1, 66)
3-95 (8.1, 0.1, 67)
5-95 (7.9, 0.1, 65)

SITE 445 HOLE CORE 9 CORED INTERVAL: 75.0-84.5 m



LITHOLOGIC DESCRIPTION

5Y 7/2

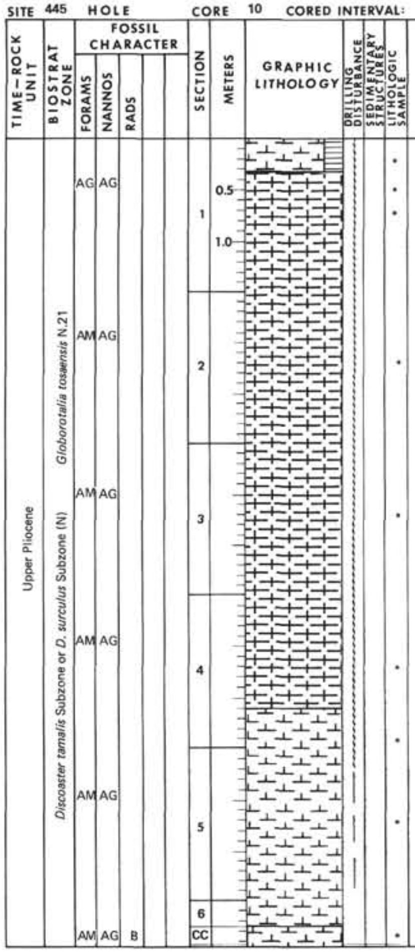
Dominant Lithology: Nannofossil Ooze, light gray with intense bioturbation.

SMEARS:

CC (Nannofossil Ooze)

Clay minerals	5%	Foraminifers	7%
Volcanic glass	2%	Nannofossils	80%

SITE 445 HOLE CORE 10 CORED INTERVAL: 84.5-94.0 m



LITHOLOGIC DESCRIPTION

5Y 5/3

Dominant Lithology: Foraminifera-Nannofossil Ooze and Nannofossil Ooze, light gray to white. Volcanic glass 1-2%. Sediments are soft to firm.

Minor Lithology: Clayey Nannofossil Ooze (Section 1) olive color with 20% clay.

Sedimentary structures: mottling.

5Y 7/2,
5Y 8/2

SMEARS:

1-54, 1-75, 2-75, 3-75, 4-75 (Foraminifera-Nannofossil Ooze)

Clay minerals	5- 8%	Foraminifers	10-18%
Volcanic glass	TR- 2%	Nannofossils	71-87%

4-147, 5-75, CC (Nannofossil Ooze)

Clay minerals	TR- 9%	Nannofossils	64-83%
Volcanic glass	1- 2%	Quartz, Feldspar (4-147)	9%
Foraminifers	5-10%	Opaque minerals (4-147)	10%

1-20 (Clayey Nannofossil Ooze)

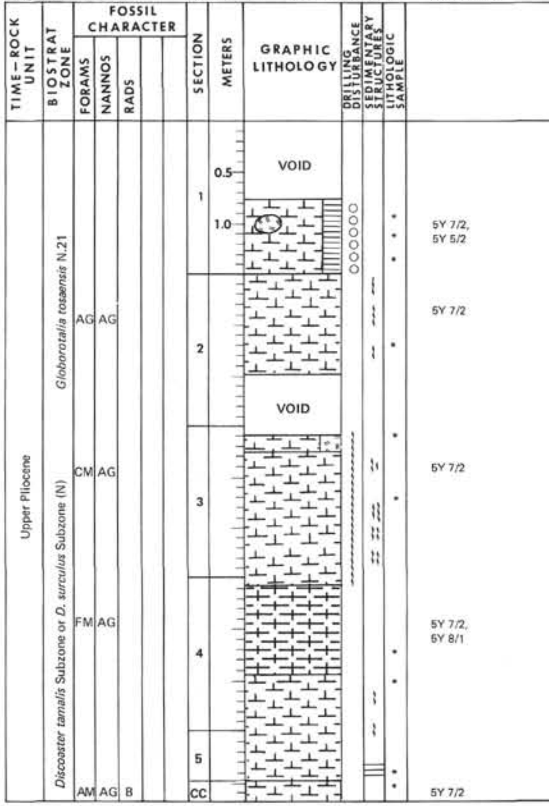
Sand	2%	Clay minerals	20%
Silt	10%	Volcanic glass	1%
Clay	88%	Foraminifers	2%
		Nannofossils	71%

GRAIN SIZE:
1-57 (2.8, 30.9, 66.3)
3-57 (3.3, 31.6, 65.1)
5-57 (3.2, 33.0, 63.9)

CARBON-CARBONATE:
1-61 (9.2, 0.1, 76)
3-61 (9.1, 0.1, 76)

5Y 7/2,
5Y 8/1-2

SITE 445 **HOLE** **CORE** 11 **CORED INTERVAL:** 94.0-103.5 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: Nannofossil Ooze and minor amounts of **Foraminifera-Nannofossil Ooze,** light gray to white with olive gray. Minor amounts of clay and volcanic glass. Sediments are soupy to firm.

Minor Lithologies: Vitric Nannofossil Ooze and Clayey Nannofossil Ooze.

Sedimentary structures: bioturbation (mild to intense), mottling with olive gray, parallel laminae white and light gray.

SMEARS:

1-116, 2-75, 3-75, 4-100, 5-41, CC (Nannofossil Ooze)

Clay minerals	5-10%	Foraminifers	1- 8%
Volcanic glass	TR- 5%	Nannofossils	62-85%

4-75 (Foraminifera-Nannofossil Ooze)

Clay minerals	9%	Foraminifers	15%
Volcanic glass	2%	Nannofossils	69%

1-96, 3-10 (Vitric Nannofossil Ooze)

Sand	5-25%	Clay minerals	5- 9%
Silt	15-20%	Volcanic glass	13-18%
Clay	55-80%	Foraminifers	3- 4%
		Nannofossils	62-74%

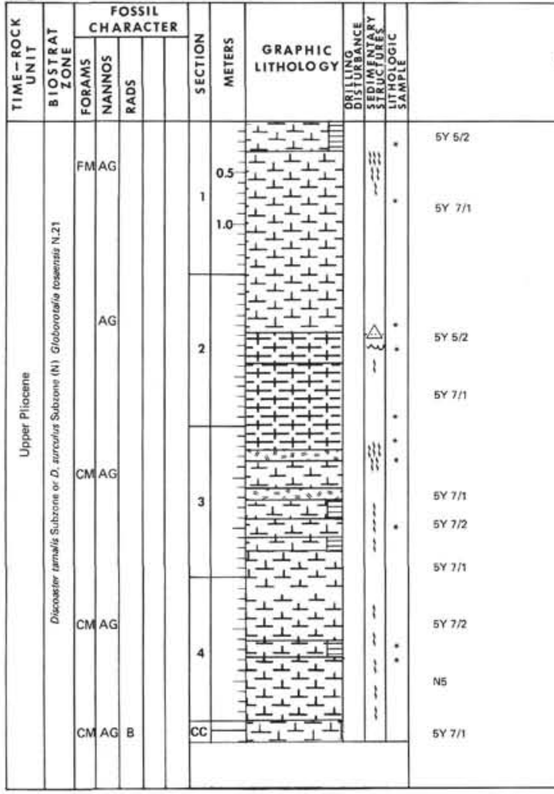
1-137 (Clayey Nannofossil Ooze)

Sand	1%	Clay minerals	25%
Silt	10%	Volcanic glass	1%
Clay	89%	Foraminifers	1%
		Nannofossils	82%

GRAIN SIZE:
2-62 (3.6, 28.7, 67.7)
4-62 (4.8, 31.9, 63.3)

CARBON-CARBONATE:
2-66 (8.6, 0.1, 79)
4-66 (8.1, 0.1, 67)

SITE 445 **HOLE** **CORE** 12 **CORED INTERVAL:** 103.5-113.0 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: Nannofossil Ooze and lesser amounts of **Clayey Nannofossil Ooze,** associated with **Foraminifera-Nannofossil Ooze.** Alternating olive gray (clayey nannofossil ooze) and light gray (nannofossil ooze and foraminifera-nannofossil ooze); gray at base, clay <20% and glass 1-3%. Sediments are firm to very firm.

Minor Lithologies: Nannofossil-Foraminifera Ooze, Volcanic Ash in Section 3.
2 and 3.

Sedimentary structures: bioturbation: mild to intense graded bed; scoured basal content; fining upward. NOTE: beds thinner, less massive than in higher cores.

SMEARS:

1-80, 2-50, 3-100, 4-80, CC (Nannofossil Ooze)

Clay minerals	7- 9%	Foraminifers	TR-10%
Volcanic glass	TR- 3%	Nannofossils	81-92%

1-21, 4-70 (Clayey Nannofossil Ooze)

Sand	1%	Clay minerals	20%
Silt	9%	Volcanic glass	0-TR%
Clay	90%	Foraminifers	1- 2%
		Nannofossils	69-76%

2-140 (Foraminifera-Nannofossil Ooze)

Clay minerals	7%	Foraminifers	12%
Volcanic glass	4%	Nannofossils	73%

2-74, 3-16 (Nannofossil-Foraminifera Ooze)

Clay minerals	4- 5%	Nannofossils	15-20%
Volcanic glass	2- 3%	Carbonate	
Foraminifers	30-62%	unspecified	15-43%

3-33 (Volcanic Ash)

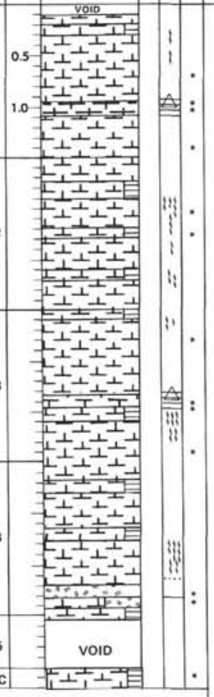
Sand	15%	Volcanic glass	67%
Silt	70%	Foraminifers	1%
Clay	15%	Nannofossils	6%
		Quartz, Feldspar	20%

GRAIN SIZE:
1-54 (0.3, 24.5, 75.2)
3-54 (0.6, 29.2, 70.2)

CARBON-CARBONATE:
1-58 (8.4, 0.1, 69)
3-58 (7.9, 0.1, 65)

SITE 445 HOLE CORE 13 CORED INTERVAL: 113.0-122.5 m

TIME–ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	SECTION
Lower Pliocene	N.21	RP	AG		1
	Globorotalia margaritae Zone N.19		AG		2
	Discoaster asymmetricus Subzone (N)	CM	AG		3
			AG		4
					5
		CM	AG	B	CC



5Y 5/2
5Y 7/1
5Y 5/2
5Y 7/1
5Y 5/2
5Y 7/1
5Y 7/1
5Y 7/1
5Y 7/1
5Y 7/1
5Y 7/2
5Y 7/2
5Y 7/2

LITHOLOGIC DESCRIPTION

Dominant Lithology: Nannofossil Ooze and interbedded **Clayey Nannofossil Ooze** partly **Vitric Nannofossil Ooze** and olive gray **Clayey Nannofossil Ooze,** gray – light gray, rare volcanic glass. Sediments are firm to very firm.

Minor Lithology: Foraminifer Ooze, Nannofossil-Foraminifera Ooze and Calcareous Ooze at a base of a graded bed.
Nannofossil Ash in Section 4, dark olive gray.

Sedimentary structures: bioturbation, parallel laminae with graded beds with coarse sand-sized foraminifers grading up to silt size to calcareous ooze. Color change light to dark upward.

SMEARS:

1-74, 1-139, 2-59, 3-30, 3-140 (Nannofossil Ooze)

Clay minerals	0-10%	Foraminifers	TR- 3%
Volcanic glass	0- 4%	Nannofossils	74-88%

2-78, 3-100, CC (Clayey Nannofossil Ooze)

Sand	TR- 4%	Clay minerals	15%
Silt	12-20%	Volcanic glass	1- 5%
Clay	80-87%	Foraminifers	2%
		Nannofossils	71-79%

4-140 (Clayey Vitric Nannofossil Ooze)

Sand	10%	Clay minerals	15%
Silt	15%	Volcanic glass	15%
Clay	75%	Foraminifers	2%
		Nannofossils	57%

4-130 (Nannofossil Ash)

Sand	70%	Clay minerals	5%
Silt	20%	Volcanic glass	72%
Clay	10%	Foraminifers	3%
		Nannofossils	10%

1-100 (Nannofossil-Foraminifera Ooze)

Foraminifers	78%
Nannofossils	15%

3-95 (Foraminifera Ooze)

Foraminifers	80%
Nannofossils	<10%

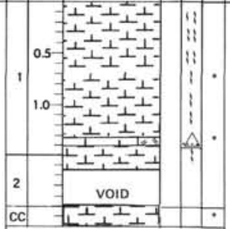
4-107 (Calcareous Ooze)

Clay minerals	2%	Carbonate unspecified	36%
Foraminifers	15%	Rock fragments	30%
Nannofossils	10%		

GRAIN SIZE:	CARBON-CARBONATE:
1-48 (0.0, 27.2, 72.8)	1-52 (9.2, 0.1, 76)
3-47 (0.0, 31.9, 68.1)	3-52 (9.0, 0.1, 74)

SITE 445 HOLE CORE 14 CORED INTERVAL: 122.5-132.0 m

TIME–ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	SECTION
Lower Pliocene	*Sphenolithus neoabies* Subzone (N) Forams N.19	FM	AG		1
					2
		FM	AG	B	CC



5Y 7/1
?
5Y 7/1

LITHOLOGIC DESCRIPTION

Dominant Lithology: Nannofossil Ooze, light gray with olive gray mottling. Sediments are very firm.

Minor Lithology: Vitric Nannofossil Ooze at base of graded bed (Section 1).

Sedimentary structures: bioturbation, mottling load casts at base of graded(?) ashy nannofossil ooze.

SMEARS:

1-75, CC (Nannofossil Ooze)

Clay minerals	5- 8%	Nannofossils	87-91%
Foraminifers	1- 2%		

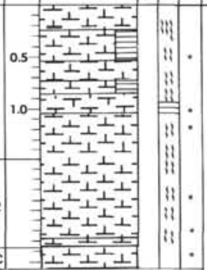
1-139 (Vitric Nannofossil Ooze)

Sand	15%	Clay minerals	7%
Silt	20%	Volcanic glass	30%
Clay	65%	Foraminifers	2%
		Nannofossils	56%

GRAIN SIZE:	CARBON-CARBONATE:
1-78 (0.1, 27.8, 72.2)	1-82 (9.7, 0.1, 81)

SITE 445 HOLE CORE 15 CORED INTERVAL: 132.0-141.5 m

TIME–ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	SECTION
Lower Pliocene	*Sphenolithus neoabies* Subzone (N) N.19 *Globorotalia margaritae*	FM	AG		1
		CG	AG		2
		FM	AG	B	CC



5Y 7/1,
5Y 7/2
5Y 7/1

LITHOLOGIC DESCRIPTION

Dominant Lithology: Nannofossil Ooze and interbedded **Clayey Nannofossil Ooze,** light gray. Alternating beds of light gray (5Y 7/1) **Nannofossil Ooze** and light gray (5Y 7/2) **Clayey Nannofossil Ooze,** have ~10% pelagic clay. Glass very rare. Sediments are very firm.

Minor Lithology: Clayey Nannofossil Ooze, Foraminifera Ooze in parallel laminae at base of bed (Section 1).

Sedimentary structures: moderately intense bioturbation. Parallel lamination of foraminifera ooze above sharp contact (Section 1, 104 cm). Chondrites.

SMEARS:

1-120, 2-35, 2-70, CC (Nannofossil Ooze)

Clay minerals	7-10%	Foraminifers	TR- 1%
Volcanic glass	0- 1%	Nannofossils	87-90%

1-50 (Clayey Nannofossil Ooze)

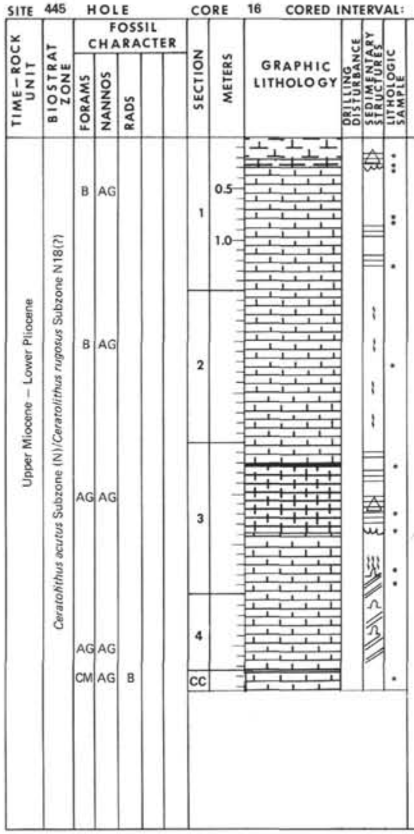
Sand	1%	Clay minerals	12%
Silt	6%	Foraminifers	1%
Clay	93%	Nannofossils	85%

1-104 (Nannofossil-Foraminifera Ooze)

Foraminifers	70%	Carbonate unspecified	10%
Nannofossils	15%		

GRAIN SIZE:	CARBON-CARBONATE:
1-63 (0.6, 30.0, 69.4)	1-67 (8.1, 0.1, 67)

SITE 445 **HOLE** **CORE** 16 **CORED INTERVAL:** 141.5-151.0 m



LITHOLOGIC DESCRIPTION

5Y 7.5/1

5Y 7/1,
5Y 7.5/1

5Y 7.5/1,
5Y 7/1

Dominant Lithology: Nannofossil Chalk, light gray with minor amounts of clay. 0-33 cm – firm nannofossil ooze, light gray associated with nannofossil-foraminifera ooze and calcareous sand at base of graded bed (30 and 32 cm). Very firm (change from ooze to chalk at 33 cm).

Minor Lithology: Nannofossil-Foraminifera Chalk and Sandy Foraminifera-Nannofossil Chalk at lower part of graded bed (Section 3).

Sedimentary structures: parallel laminae-grayish green. Bioturbation. Slump structures and inclined bedding Sections 3 and 4. Graded bed with sharp scoured basal contact: dark gray; abundant sand-sized grains; foraminifers, sediment clasts – dark gray, black, green. Contorted bedding in slump.

SMEARS:

1-10 (Nannofossil Ooze) and 1-80, 1-88, 1-127, 2-75, 3-70, 3-129, 3-140, CC (Nannofossil Chalk)

Clay minerals	0- 8%	Foraminifers	1- 5%
Volcanic glass	0- 1%	Nannofossils	85-91%

1-30 (Nannofossil-Foraminifera Ooze) and 3-29 (Nannofossil-Foraminifera Chalk)

Clay minerals	0%	Foraminifers	60-80%
Volcanic glass	TR- 5%	Nannofossils	12-23%

3-86 (Sandy Foraminifera-Nannofossil Chalk)

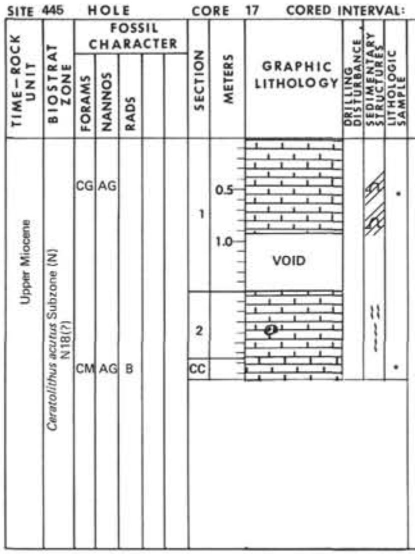
Sand	50%	Clay minerals	2%
Silt	25%	Foraminifers	10%
Clay	25%	Nannofossils	67%
		Volcanic glass	4%
		Opaque minerals	5%
		Rock fragments	10%

1-32 (Calcareous Sand)

Sand	85%	Carbonate	
Silt	10%	unspecified	10%
Clay	5%	Foraminifers	15%
		Nannofossils	8%
		Rock fragments	60%

GRAIN SIZE:	**CARBON-CARBONATE:**
1-76 (0.0, 28.1, 71.9)	1-80 (10.1, 0.0, 84)
3-76 (35.8, 38.3, 25.9)	3-80 (11.0, 0.1, 91)

SITE 445 **HOLE** **CORE** 17 **CORED INTERVAL:** 151.0-160.5 m



LITHOLOGIC DESCRIPTION

5Y 7.5/1

Dominant Lithology: Nannofossil Chalk, light gray with white. No glass, but some lapilli (Section 2). Little clay. Sediments are very, very firm - hard.

Sedimentary structures: bioturbation, slump structures, inclined bedding.

SMEARS:

1-58 (light), 1-58 (dark), CC (Nannofossil Chalk)

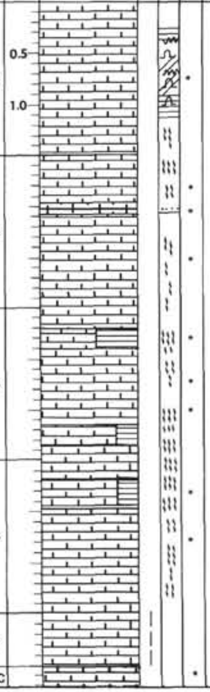
Clay minerals	TR- 5%	Nannofossils	90-93%
Foraminifers	4- 5%		

GRAIN SIZE:
1-10 (0.8, 27.5, 71.7)

CARBON-CARBONATE:
1-74 (10.1, 0.1, 83)

SITE 445 **HOLE** **CORE** 18 **CORED INTERVAL:** 160.5-170.0 m

TIME-ROCK UNIT	BIOSTRAT ZONE	SECTION	FOSSIL CHARACTER FORAMS	NANNOS	RADS
Upper Miocene	N18 — *Amaurolithus primus* Subzone (N)/*Triquetrorhabdulus rugosus* Subzone *Ceratolithus acutus* Subzone (N)	1	AG	AG	
		2	CG	AG	
		3	CG	AG	
		4	FG	AG	
		5	RP	AG	
		CC	FM	AG	RF



LITHOLOGIC DESCRIPTION

5Y 7.5/1
5Y 7.5/1, 7/1
5Y 5/2
5Y 7/1
5Y 7/1, 7.5/1
5Y 5/2
5Y 7.5/1
5Y 7/2
5Y 5/3
10YR 7/3
10YR 7/3
10YR 7/3

Dominant Lithology: Nannofossil Chalk and interbedded olive gray **Clayey Nannofossil Chalk.** Light gray to white. Very firm — hard sediments.

Minor Lithology: Nannofossil Foraminifera Chalk at base of bed (Section 2).

Sedimentary structures: slump structures with contorted and inclined bedding in Section 1. Mild to intense bioturbation. Chondrites and *Zoophycus*. Fining upward beds. Color change to very pale brown in Section 4.

SMEARS:
1-75, 2-30, 2-100, 3-75, 3-100, 4-130, CC (Nannofossil Chalk)

Clay minerals	TR-10%	Nannofossils	85-96%
Foraminifers	TR- 4%		

4-36 (Clayey Nannofossil Chalk)

Sand	0%	Clay minerals	15%
Silt	10%	Nannofossils	80%
Clay	90%		

2-56 (Nannofossil-Foraminifera Chalk)

Foraminifers	59%	Carbonate unspecified	20%
Nannofossil	20%		

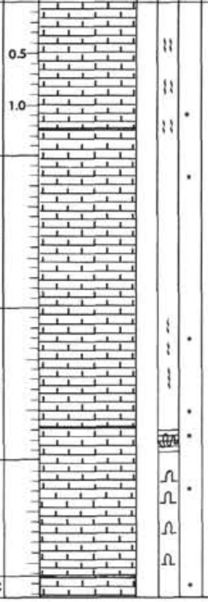
GRAIN SIZE:
1-43 (1.9, 30.3, 67.9)
3-43 (0.1, 31.5, 68.4)

CARBONATE BOMB:
3-77 (88)

CARBON-CARBONATE:
1-40 (8.7, 0.1, 80)
3-40 (7.3, 0.1, 61)
5-40 (9.3, 0.0, 77)

SITE 445 **HOLE** **CORE** 19 **CORED INTERVAL:** 170.0-179.5 m

TIME-ROCK UNIT	BIOSTRAT ZONE	SECTION	FOSSIL CHARACTER FORAMS	NANNOS	RADS
Upper Miocene	N17(?) *Amaurolithus primus* Subzone (N))	1	CG	AG	
		2	CM	AG	
		3	FM	AG	
		4			
		CC	CM	AG	FP



LITHOLOGIC DESCRIPTION

10YR 6/2, 10YR 7/3
10YR 7/3, 7/2
10YR 7/3, ~8/3, ~8/2
10YR 7/3, ~8/3, ~8/2

Dominant Lithology: Nannofossil Chalk.
Predominantly very pale brown.

Sedimentary structures:
bioturbation — mild. Long massive section in Section 2 with no sedimentary structures but faint mottling to intense mottling with abundant deformation and contorted bedding Section 3. Parallel laminae contorted. Slump structures in Section 4.

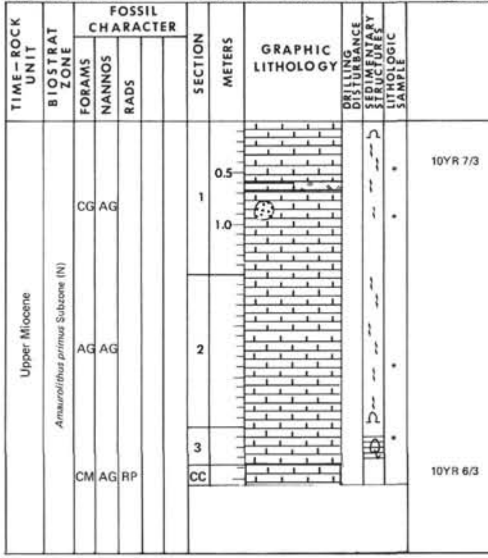
SMEARS:
1-107, 2-25, 3-35, 3-105, 3-129, 4-30, CC (Nannofossil Chalk)

Clay minerals	5-10%	Nannofossils	85-92%
Volcanic glass	TR- 4%	Sponge spicules	0-TR%
Foraminifers	TR-10%		

GRAIN SIZE:
1-100 (2.1, 38.2, 59.8)
3-100 (0.7, 31.7, 67.6)

CARBON-CARBONATE:
1-105 (10.2, 0.0, 85)
3-105 (10.3, 0.0, 86)

SITE 445 HOLE CORE 20 CORED INTERVAL: 179.5-189.0 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: Nannofossil Chalk, very pale brown with minor amounts of pelagic clay. Volcanic glass 0-2% with an increase in ash zones.

Minor Lithology: Vitric Nannofossil Chalk (Section 1) pale brown.

Sedimentary structures: slump structures – contorted and inclined bedding. Bioturbation.

SMEARS:
1-90, 2-90, 3-15, CC (Nannofossil Chalk)

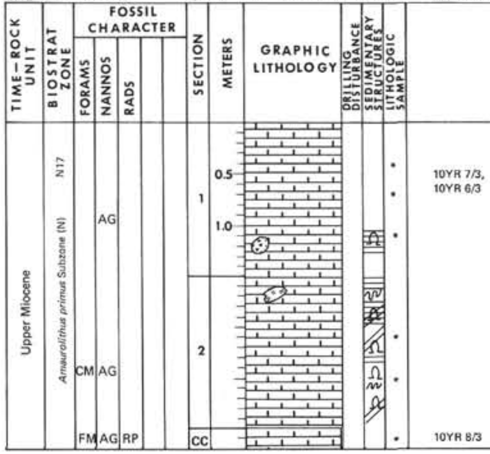
Clay minerals	TR- 5%	Nannofossils	81-91%
Volcanic glass	0- 2%	Sponge spicules	0- 1%
Foraminifers	1- 5%		

1-56 (Vitric Nannofossil Chalk)

Sand	50%	Clay minerals	< 5%
Silt	20%	Quartz, Feldspar	7%
Clay	30%	Volcanic glass	32%
		Foraminifers	5%
		Nannofossils	55%
		Sponge spicules	TR

GRAIN SIZE:	CARBON-CARBONATE:
1-24 (1.5, 33.5, 65.0)	1-29 (9.5, 0.0, 79)
3-24 (3.9, 39.4, 56.7)	3-29 (9.5, 0.0, 78)

SITE 445 HOLE CORE 21 CORED INTERVAL: 189.0-198.5 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: Nannofossil Chalk, pale brown to very pale brown (alternation).

Sedimentary structures: parallel laminae. Intensive slumping, contorted bedding.

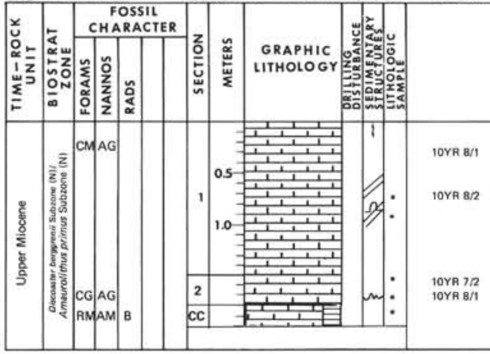
SMEARS:
1-48, 1-75, 1-100, 2-65, 2-100, CC (Nannofossil Chalk)

Clay minerals	TR-10%	Nannofossils	80-85%
Volcanic glass	TR- 5%	Sponge spicules	TR- 1%
Foraminifers	2- 5%		

GRAIN SIZE:
1-60 (1.6, 33.1, 65.3)

CARBON-CARBONATE:
1-64 (9.1, 0.0, 75)

SITE 445 HOLE CORE 22 CORED INTERVAL: 198.5-208.0 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: Nannofossil Chalk, white to light gray (alternating), 0-1% volcanic glass.

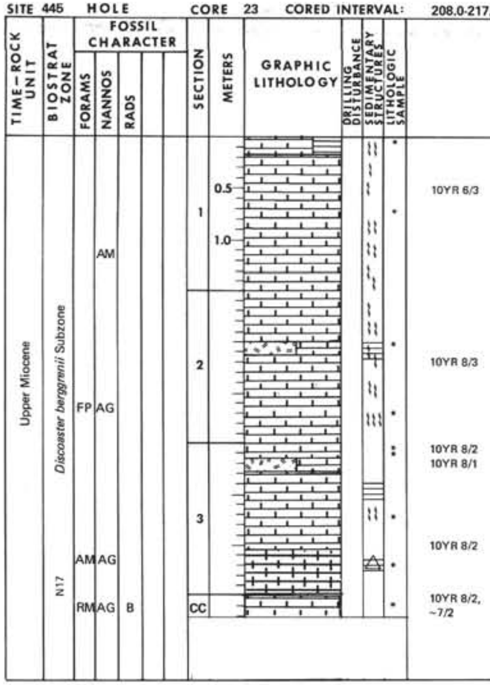
Sedimentary structures: parallel laminae, slump structures.

SMEARS:
1-75, 1-95, 2-10, 2-29, CC (Nannofossil Chalk)

Clay minerals	TR-10%	Nannofossils	81-93%
Volcanic glass	0- 1%	Sponge spicules	0-TR%
Foraminifers	0- 3%		

GRAIN SIZE:
1-39 (1.0, 27.8, 71.3)

SITE 445 HOLE CORE 23 CORED INTERVAL: 208.0-217.5 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: Nannofossil Chalk associated with **Nannofossil Marly Chalk** at top of core. Pale brown, very pale brown, and white, light gray lower.

Minor Lithology: Nannofossil Tuff (Sections 2 and 3), brown; dark lamination. **Nannofossil-Foraminifera Chalk** (Section 3).

Sedimentary structures: parallel laminations in beds with sharp basal contacts. Ash beds laminated. Graded beds; laminae. Bioturbation.

SMEARS:
1-75, 2-120, 3-10, 3-75, CC (Nannofossil Chalk)

Clay minerals	TR- 5%	Foraminifers	0- 3%
Volcanic glass	0- 2%	Nannofossil	71-90%

1-2 (Nannofossil Marly Chalk)

Sand	10%	Clay minerals	30%
Silt	20%	Volcanic glass	<10%
Clay	20-30%	Nannofossils	48%
		Sponge spicules	1%

2-56, 3-15 (Nannofossil Tuff)

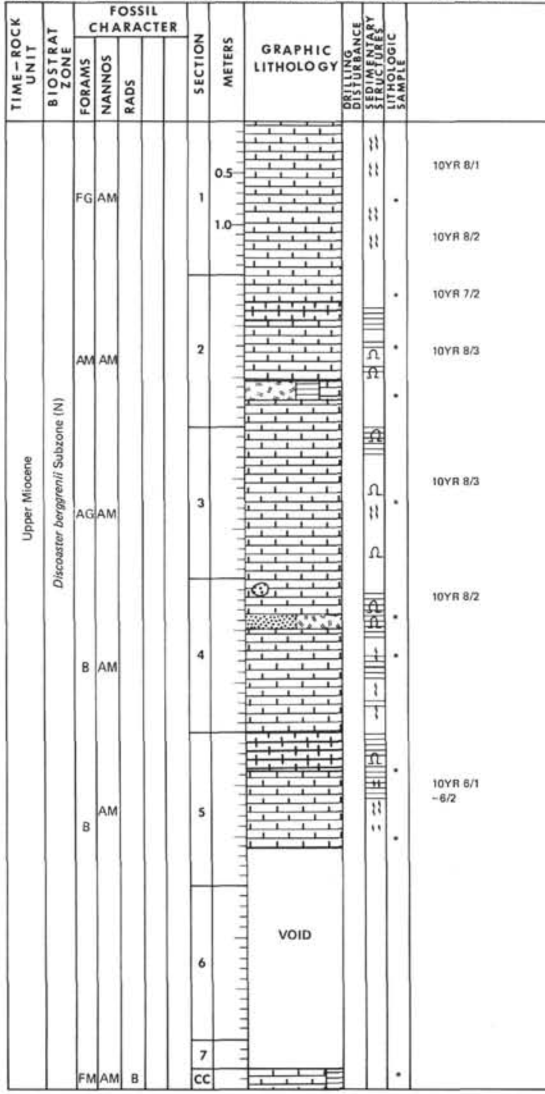
Sand	50-60%	Clay minerals	5-10%
Silt	20%	Volcanic glass	52-55%
Clay	20-30%	Foraminifers	0- 1%
		Nannofossils	29-30%

3-120 (Nannofossil-Foraminifera Chalk)

Clay minerals	5%	Nannofossils	34%
Foraminifers	50%		

GRAIN SIZE:	CARBON-CARBONATE:
1-29 (0.9, 40.0, 59.2)	1-33 (4.2, 0.1, 34)
3-29 (0.6, 28.1, 71.3)	3-33 (8.9, 0.1, 74)

SITE 445 HOLE CORE 24 CORED INTERVAL: 217.0-236.5 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: Nannofossil Chalk, white, light gray, very pale brown, pale brown. Glass only in ashy zones – darker mottling.

Minor Lithologies: Clayey Nannofossil Tuff (dark grayish brown) (Section 2).
Tuffaceous sandstone (Section 4)
Nannofossil-foreminifera Chalk (Section 2)
Foraminifera-Nannofossil Chalk (Section 5)
Clayey Nannofossil Chalk (CC)

Sedimentary structures: extensive, intense slumping, inclined and contorted beds. Parallel laminae. Moderate bioturbation – bioturbated beds are darker color.

SMEARS:
1-75, 2-20, 2-70, 3-75, 4-75, 5-100 (Nannofossil Chalk)

Clay minerals	5%	Nannofossils	86-90%
Volcanic glass	TR- 1%	Sponge spicules	0-TR%
Foraminifers	1- 5%		

CC (Clayey Nannofossil Chalk)

Sand	0%	Clay minerals	20%
Silt	5%	Volcanic glass	1%
Clay	95%	Foraminifers	TR
		Nannofossils	75%
		Sponge spicules	TR

2-40 (Nannofossil-Foraminifera Chalk)

Clay minerals	5%	Foraminifers	35%
Volcanic glass	7%	Nannofossils	15%
Carbonate unspecified	30%		

5-35 (Foraminifera-Nannofossil Chalk)

Clay minerals	5%	Nannofossil	37%
Carbonate unspecified	30%	Sponge spicules	1%
Foraminifers	25%		

4-40 (Tuffaceous Sandstone)

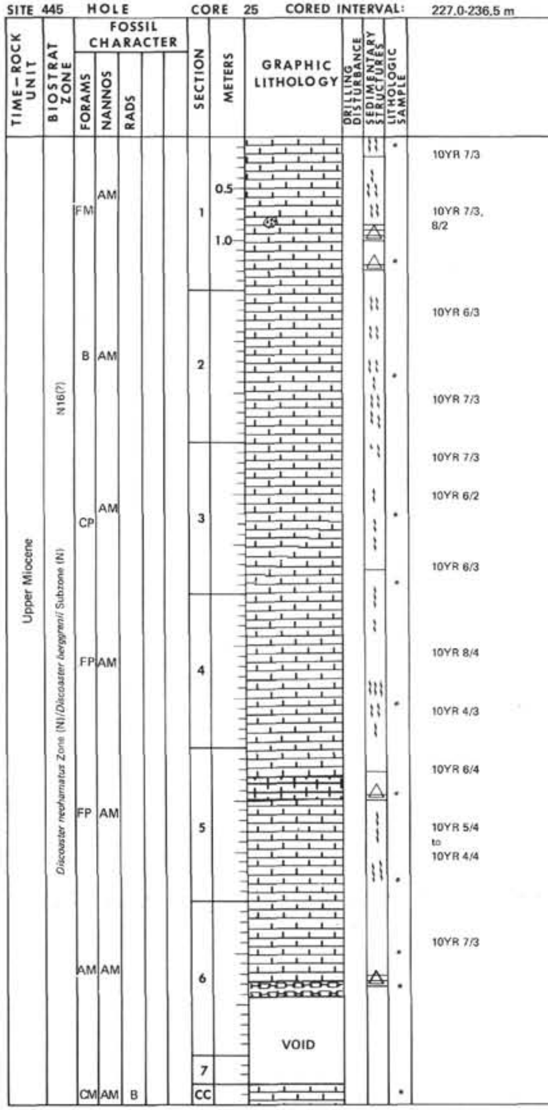
Sand	70%	Clay minrals	5%
Silt	10%	Altered volcanic glass	30%
Clay	20%	Quartz, Feldspar	40%
		Foraminfiers	<10%
		Nannofossils	5%
		Sponge spicules	TR

2-122 (Clayey Nannofossil Tuff)

Sand	50%	Clay minerals	10%
Silt	20%	Volcanic glass	48%
Clay	30%	Quartz, Feldspar	5%
		Carbonate unspecified	5%
		Foraminifers	2%
		Nannofossils	25%

GRAIN SIZE:	CARBON-CARBONATE:
1-39 (0.2, 21.6, 78.2)	1-42 (9.4, 0.1, 78)
3-38 (4.2, 46.9, 48.9)	3-42 (9.1, 0.0, 75)
5-44 (0.9, 40.3, 58.9)	5-42 (6.8, 0.1, 56)

SITE 445 HOLE CORE 25 CORED INTERVAL: 227.0-236.5 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: Nannofossil Chalk, pale brown and white to Section 4; then brown. Volcanic glass 0-1% with laminae of dark color (ash?).

Minor Lithologies: Foraminifera-Nannofossil Chalk (Section 5) and **Nannofossil-Foraminifera Chalk** (Section 6), both at lower part of graded bed.

Sedimentary structures:
Graded beds – coarse foraminifers (and ash?) in graded laminae (dark colored).
Bioturbation mild to intense. *Zoophycos* cycles of alternating pale brown, (very slight bioturbated with light yellowish brown (intensely bioturbated).

SMEARS:
1-10, 1-120, 2-85, 3-75, 3-140, 4-115, 5-130, 6-50, CC (Nannofossil Chalk)

Sand	0%	Clay minerals	< 5-10%
Silt	0- 5%	Volcanic glass	0- 1%
Clay	95-100%	Foraminifers	TR- 7%
		Nannofossils	80-91%
		Sponge spicules	0-TR%

5-52 (Foraminifera-Nannofossil Chalk)

Sand	0%	Clay minerals	5%
Silt	5%	Foraminifers	30%
Clay	95%	Nannofossils	56%

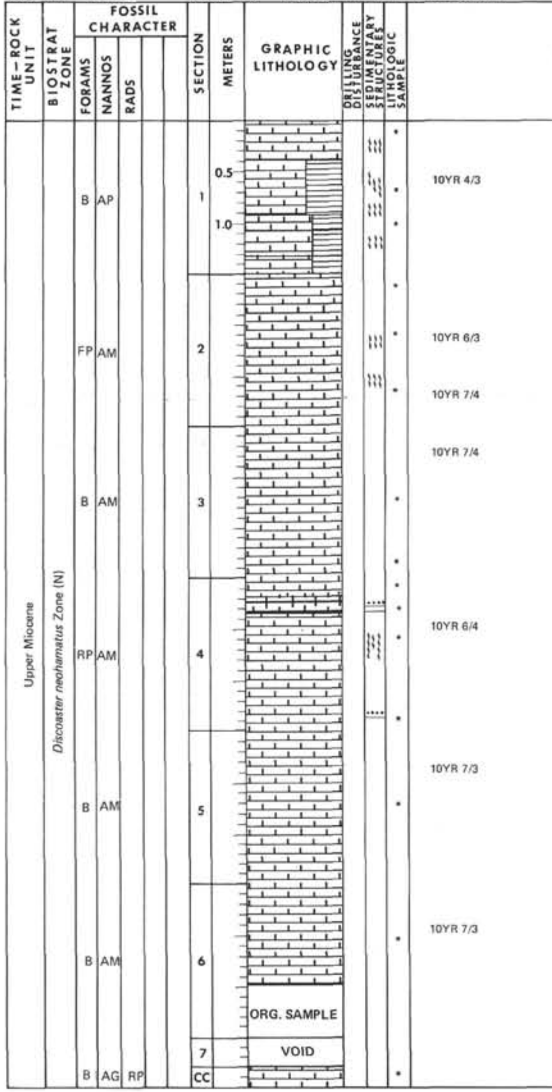
6-87 (Nannofossil-Foraminifera Chalk)

Sand	40%	Clay minerals	5%
Silt	40%	Carbonate unspecified	30%
Clay	20%	Foraminifers	50%
		Nannofossils	18%

GRAIN SIZE:
1-44 (0.3, 29.9, 69.8)
3-44 (1.2, 32.8, 66.0)
5-44 (0.4, 53.9, 45.7)

CARBON-CARBONATE:
1-41 (5.1, 0.1, 42)
3-41 (8.9, 0.1, 74)
5-41 (7.3, 0.1, 60)

SITE 445 HOLE CORE 26 CORED INTERVAL: 236.5-246.0 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: Nannofossil Chalk, pale brown to very pale brown, volcanic glass 0-3% except in ashy layers, passing to **Nannofossil Marly Chalk**, dark brown (Section 1). Section 5, 80-82 cm and Section 6, 80-82 cm and CC – common micro-forams
Minor Lithology: Vitric Nannofossil Chalk (Section 1), light yellowish brown, ⩾30% ash (gritty). **Foraminifera-Nannofossil Chalk** at base of bed (Section 4).

Sedimentary structures: Intense to zero bioturbation; absent in lower half. Possible graded beds; gritty zones with ash at base of fining-upward sequence. Mottling.

SMEARS:
1-10, 2-10, 2-60, 2-125, 3-75, 3-132, 4-10, 4-60, 4-148, 5-75, 6-50, CC (Nannofossil Chalk)

Clay minerals	TR- 5%	Nannofossils	80-92%
Volcanic glass	0- 3%	Sponge spicules	0- 1%
Foraminifers	0- 8%		

1-70 (Nannofossil Marly Chalk)

Sand	5%	Clay minerals	40%
Silt	25%	Volcanic glass	1%
Clay	70%	Nannofossils	48%
		Diatoms	TR
		Radiolarians	TR
		Sponge spicules	TR

4-30 (Foraminifera-Nannofossil Chalk)

Clay minerals	0%	Carbonate unspecified	20%
Volcanic glass	TR	Radiolarians	TR
Foraminifers	30%	Sponge spicules	TR
Nannofossils	44%		

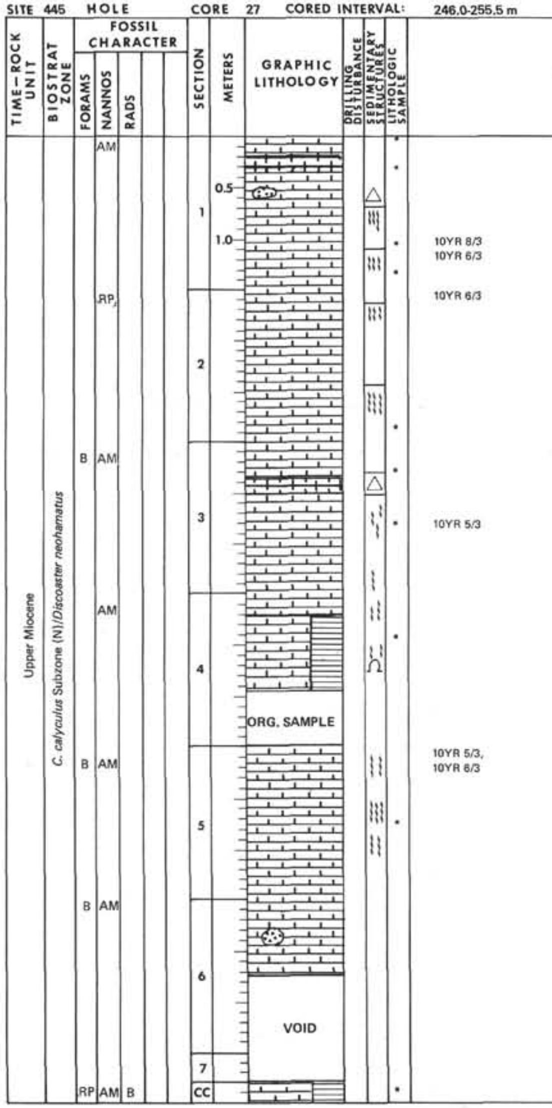
1-100 (Vitric Nannofossil Chalk)

Sand	30%	Clay minerals	5%
Silt	20%	Volcanic glass	30%
Clay	50%	Nannofossils	60%

GRAIN SIZE:
1-51 (0.2, 32.9, 66.8)
3-51 (0.0, 73.9, 26.1)
6-51 (0.0, 45.2, 54.8)

CARBON-CARBONATE:
1-44 (3.7, 0.1, 30)
3-44 (9.5, 0.1, 79)
6-44 (9.3, 0.0, 77)

SITE 445 HOLE CORE 27 CORED INTERVAL: 246.0-255.5 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: Nannofossil Chalk and interbedded **Clayey Nannofossil Chalk**, pale brown to very pale brown; grades upward in cycles to brown.

Minor Lithology: Foraminifera-Nannofossil Chalk at basal part of graded bed.

Sedimentary structures: Intense bioturbation at top of light-upward-to-dark cycles. Graded beds – contain coarse particles at base = 1 mm – fining upward. Unit may be >20 cm thick. Soft sediment deformation – slumping. Mottling.

SMEARS:
1-4, 1-100, 1-137, 2-130, 3-25, 3-50, 3-80, 5-75 (Nannofossil Chalk)

Clay minerals	0- 5%	Nannofossils	89-99%
Volcanic glass	0- 1%	Sponge spicules	0-TR%
Foraminifers	0- 8%		

4-45, CC (Clayey Nannofossil Chalk)

Sand	0-TR%	Clay minerals	15%
Silt	2- 3%	Foraminifers	0- 1%
Clay	97-98%	Nannofossils	79-81%

1-30, 3-50 (Foraminifera-Nannofossil Chalk)

Clay minerals	0-TR%	Nannofossils	59-80%
Volcanic glass	0- 1%	Sponge spicules	TR- 2%
Foraminifers	15-40%		

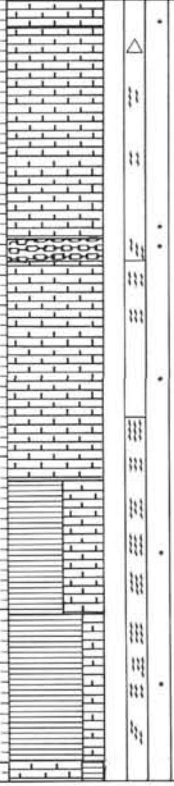
GRAIN SIZE:
1-120 (1.2, 34.6, 64.2)
3-120 (0.1, 30.7, 69.2)

CARBON-CARBONATE:
1-124 (6.8, 0.1, 56)
3-124 (4.9, 0.1, 40)

SITE 445 HOLE CORE 28 CORED INTERVAL: 255.5-265.0 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	SECTION	METERS
Upper Miocene	*Helicosphaera carteri* Subzone (N)/*Catynaster calyculus* Subzone (N)	B	AM		1	0.5 1.0
		B	AG		2	
		RP FP	AM		3	
			AM		4	
Middle Miocene		B	AM		5	
					CC	

GRAPHIC LITHOLOGY / DRILLING DISTURBANCE / SEDIMENTARY STRUCTURES / LITHOLOGIC SAMPLE



10YR 5/3
10YR 8/3
10YR 6/4
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10YR 6/3
10YR 6/3,
10YR 5/3,
10YR 4/3
10YR 5/3
10Y 4/3,
3/3

LITHOLOGIC DESCRIPTION

Dominant Lithology:
(1) **Nannofossil Chalk**, colors in cycles, grading upward from pale brown to very pale brown. Cycles darker in lower part, from dark brown grading up to brown to pale brown: locally passing to **Clayey Nannofossil Chalk** (CC).

(2) **Nannofossil Mudstone** (Sections 4 and 5), dark brown to pale brown, darkens toward base, clay up to 70%.

Minor Lithology: Foraminifera-Nannofossil Chalk above base of bed, Section 2.

Sedimentary structures: Intense mottling, graded beds in cycles and subcycles [e.g. clay-ooze to ooze in large cycle; smaller ones within]. Sharp base. Intense bioturbation. Parallel laminae (faint).

SMEARS:
1-21, 2-75, 3-75 (Nannofossil Chalk)

Clay minerals	5-10%	Nannofossils	82-88%
Volcanic glass	TR- 1%	Sponge spicules	TR- 2%
Foraminifers	TR- 5%		

CC (Clayey Nannofossil Chalk)

Sand	0%	Clay minerals	20%
Silt	5%	Volcanic glass	1%
Clay	95%	Foraminifers	2%
		Nannofossils	71%

4-95, 5-75 (Nannofossil Mudstone)

Sand	0- 2%	Clay minerals	52-70%
Silt	5- 9%	Volcanic glass	1%
Clay	91-93%	Nannofossils	25-40%
		Sponge spicules	1%

2-93 (Foraminifera-Nannofossil Chalk)

Clay minerals	<10%	Nannofossils	41%
Volcanic glass	2%	Carbonate	
Foraminifers	20%	unspecified	26%

GRAIN SIZE:
1-114 (0.1, 28.0, 71.8)

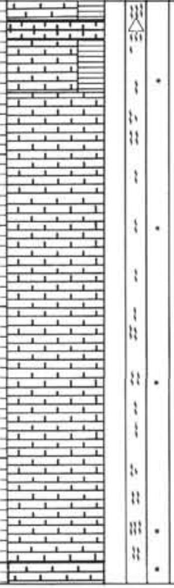
CARBONATE BOMB:
1-40 (69)
5-12 (11.5)

CARBON-CARBONATE:
1-120 (5.5, 0.1, 45)

SITE 445 HOLE CORE 29 CORED INTERVAL: 265.0-274.5 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	SECTION	METERS
Middle Miocene	*Discoaster kugleri* Subzone (N)/*Catynaster coalitus* Zone or *Helicosphaera kamptneri* Subzone (N)		AM		1	0.5 1.0
		RP	AM		2	
			AM		3	
		FP	AM		4	
		RM	AP	B	CC	

GRAPHIC LITHOLOGY / DRILLING DISTURBANCE / SEDIMENTARY STRUCTURES / LITHOLOGIC SAMPLE



10YR 5/3
~7/3
10YR 6/3
10YR 5/3
10YR 5/3

LITHOLOGIC DESCRIPTION

Dominant Lithology: Nannofossil Chalk, brown to pale brown to very pale brown. Volcanic glass – trace; locally passing to **Clayey Nannofossil Chalk** (Section 1).

Minor Lithology: Foraminifera Chalk.

Sedimentary structures: bioturbation mild to intense. Possible graded beds – coarse bed of foraminifera-chalk at base of Section 1, 25-43 cm. Mottled. Parallel laminae (faint).

SMEARS:
2-75, 3-75, 4-75, CC (Nannofossil Chalk)

Clay minerals	< 10%	Nannofossils	84-89%
Volcanic glass	0-TR%	Sponge spicules	TR
Foraminifers	0- 1%		

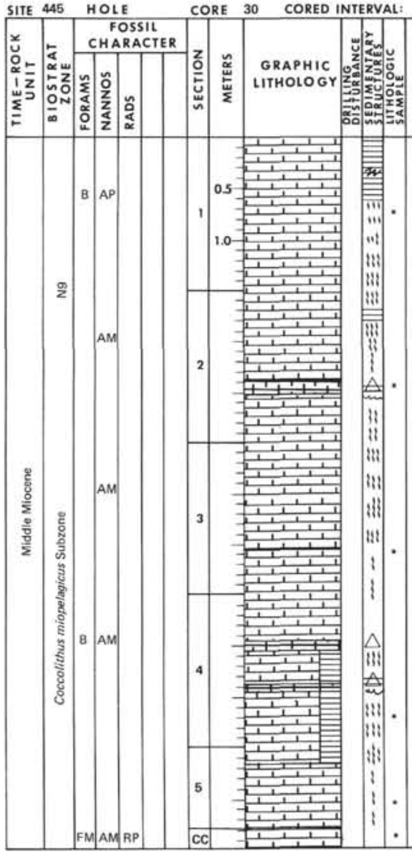
1-75 (Clayey Nannofossil Chalk)

Sand	TR	Clay minerals	20%
Silt	9%	Nannofossils	75%
Clay	91%	Radiolarians	TR
		Sponge spicules	TR

GRAIN SIZE:
3-52 (0.5, 33.3, 66.2)

CARBON-CARBONATE:
2-47 (7.0, 0.1, 57)

SITE 445 HOLE CORE 30 CORED INTERVAL: 274.5-284.0 m



10YR 4/4
10YR 6/3
10YR 7/3
10YR 7/3
10YR 5/4
10YR 5/3
10YR 8/2
10YR 5/3
10YR 6/3

LITHOLOGIC DESCRIPTION

Dominant Lithology: Nannofossil Chalk and interbedded **Clayey Nannofossil Chalk**, brown to pale brown and very pale brown darkening upward. Traces of volcanic glass.
Clayey Nannofossil Chalk in Sections 4 and 5.

Minor Lithology: Nannofossil-Foraminifera Chalk at base of each graded bed. A black and white **Sandy-Textured Layer** 2-5 cm thick, with black lithic fragments (e.g. at Section 4, 53 cm and 80% sand-size with 60% foraminifers [including benthics]).

Sedimentary structures: Intense bioturbation, *Zoophycos*, mottling, graded beds of foramifera calcarenite sharp scoured contact at base. Bioturbation most intense beneath sharp contact, in darkest sediments of cycle. Parallel laminae.

SMEARS:

1-75, 3-110, 5-55 (Nannofossil Chalk)

Clay minerals	< 5-10%	Nannofossils	83-90%
Volcanic glass	0-TR%	Radiolarians	0-TR%
Foraminifers	0- 1%	Sponge spicules	1%

4-120, CC (Clayey Nannofossil Chalk)

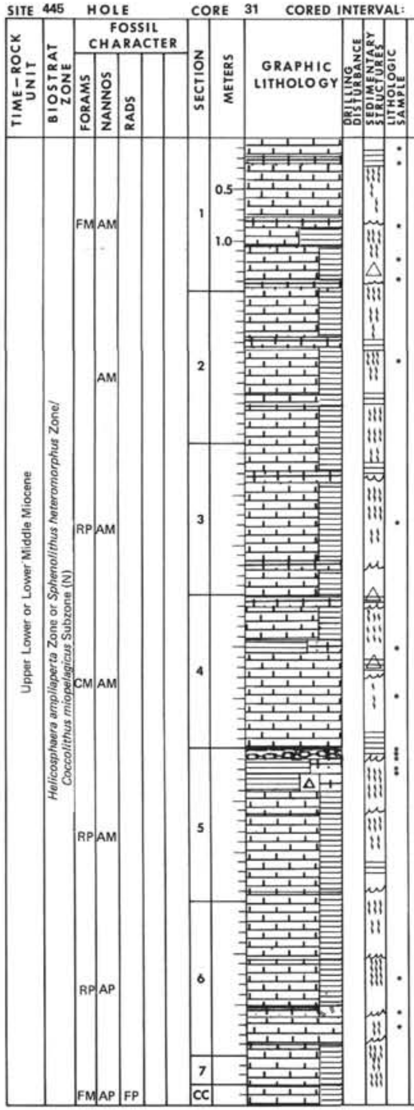
Sand	0- 1%	Clay minrals	10-15%
Silt	0- 8%	Volcanic glass	TR
Clay	92-98%	Foraminifers	0- 1%
		Nannofossils	80-86%
		Radiolarians	0- 1%
		Sponge spicules	0- 1%

2-95, 4-54 (Nannofossil-Foraminifera Chalk)

Clay minerals	TR- 5%	Carbonate	
Foraminifers	47-60%	unspecified	20%
Nannofossils	15-20%	Sponge spicules	1%

CARBON-CARBONATE:
1-130 (6.7, 0.1, 56)
3-130 (9.2, 0.0, 76)

SITE 445 HOLE CORE 31 CORED INTERVAL: 184.0-293.5 m



10YR 5/3
10YR 5/3
10YR 7/3
10YR 8/2
10YR 5/3
10YR 8/3
10YR 3/4

LITHOLOGIC DESCRIPTION

Dominant Lithology: Clayey Nannofossil Chalk and lesser amounts of **Nannofossil-Foraminifera Chalk, Calcareous Chalk** and **Vitric Foraminifera-Nannofossil Chalk**. Brown to pale brown, to very pale brown, to white in downward sequence in each cycle with sharp basal contact. Minor glass, clay to 15%.

Minor Lithology: Clayey Nannofossil Chalk (Section 5) locally passing to lighter colored **Nannofossil Chalk** (Sections 1 and 4) or darker colored **Nannofossil Mudstone, Silcieous Calcareous Mudstone** (Sections 4 and 5) foraminifera-bearing chalks occupying lower-basal parallel laminated part of each graded unit.

Sedimentary structures: bioturbation intense, parallel laminae, graded beds – white sand at base over sharp scoured contact; very pale brown to brown upward.

SMEARS:

1-12, 1-121, 4-100, 6-128 (Nannofossil Chalk)

Clay minerals	5-10%	Nannofossils	87-89%
Volcanic glass	0-TR%	Sponge spicules	0- 1%
Foraminifers	2%		

1-90, 2-70, 3-80, 6-98 (Clayey Nannofossil Chalk)

Sand	1- 8%	Clay minerals	10-20%
Silt	9-15%	Volcanic glass	0- 8%
Clay	80-90%	Foraminifers	0- 2%
		Nannofossils	61-80%
		Radiolarians	0- 3%
		Sponge spicules	0- 3%

1-28, 1-140 (Nannofossil-Foraminifera Chalk)

Clay minerals	TR- 2%	Nannofossils	13-25%
Volcanic glass	0- 2%	Radiolarians	0- 1%
Foraminifers	57-58%	Sponge spicules	0- 1%

4-50, 5-28 (Siliceous Calcareous Mudstone)

Sand	8%	Clay minerals	50-68%
Silt	16-20%	Volcanic glass	5-10%
Clay	72-76%	Nannofossils	8- 9%
		Radiolarians	5- 8%
		Sponge spicules	5- 9%

5-2 (Calcareous Chalk)

Clay minerals	8%	Nannofossils	25%
Volcanic glass	3%	Diatoms	1%
Carbonate		Radiolarians	3%
unspecified	30%	Sponge spicules	3%
Foraminifers	23%		

5-22 (Nannofossil Mudstone)

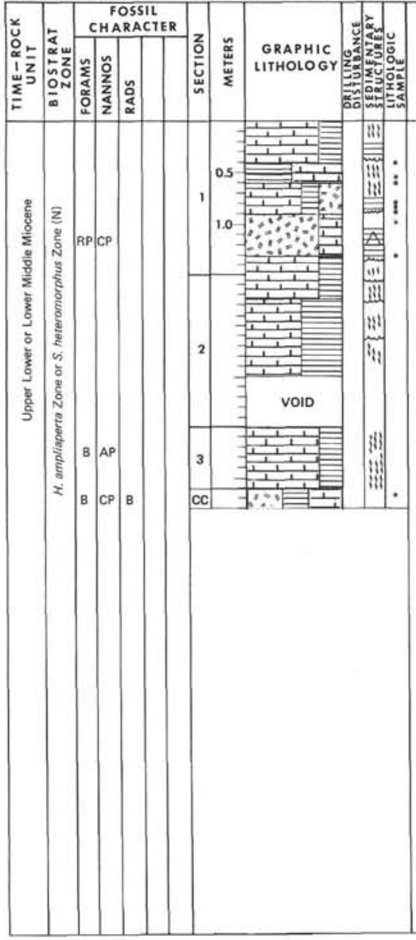
Sand	10%	Clay minerals	37%
Silt	10%	Volcanic glass	3%
Clay	80%	Foraminifers	2%
		Nannofossil	15%
		Radiolarians	3%
		Sponge spicules	3%

6-112 (Vitric Foraminifera-Nannofossil Chalk)

Sand	4%	Clay minerals	7%
Silt	10%	Volcanic glass	20%
Clay	36%	Foraminifers	16%
		Nannofossils	35%
		Radiolarians	3%
		Sponge spicules	1%

CARBON-CARBONATE:
1-66 (6.9, 0.0, 57)
3-66 (8.5, 0.1, 70)
5-66 (6.1, 0.2, 49)

SITE 445 HOLE CORE 32 CORED INTERVAL: 293.5-303.0 m



LITHOLOGIC DESCRIPTION

10YR 6/3
10YR 6/3
10YR 5/3
10YR 4/1
10YR 3/4
10YR 3/4

Dominant Lithology: Clayey Nannofossil Chalk and Nannofossil Marly Chalk, locally vitric. Brown to pale brown to very pale brown; + white.

Minor Lithologies: Nannofossil Tuff, Radiolarian Nannofossil Tuff with a muddy sand texture constituting a parallel laminated graded bed in Section 1.

Sedimentary structures: parallel laminations, intense mottling and bioturbation, graded beds – silts or coarse sand at base. Fining upward cycle repeated many times. Lower part of cycle is white sandy-silty bed on scoured contact.

SMEARS:

1-42, 1-53 (Nannofossil Marly Chalk)

Sand	10%	Clay minerals	33-51%
Silt	12%	Volcanic glass	5- 6%
Clay	78%	Nannofossils	36-47%
		Radiolarians	2- 5%
		Sponge spicules	2- 3%

1-84 (Nannofossil Chalk)

Clay minerals	8%	Nannofossils	72%
Volcanic glass	2%	Radiolarians	3%
Foraminifers	4%	Sponge spicules	5%

1-68 (Vitric Clayey Nannofossil Chalk)

Sand	12%	Clay minerals	12%
Silt	13%	Volcanic glass	10%
Clay	75%	Nannofossils	64%
		Radiolarians	5%
		Sponge spicules	4%

1-89 (Radiolarian Nannofossil Tuff)

Sand	50%	Volcanic glass	50%
Silt	25%	Foraminifers	3%
Clay	25%	Nannofossils	26%
		Radiolarians	10%
		Sponge spicules	2%

1-91, 1-102, 1-134 (Nannofossil Tuff)

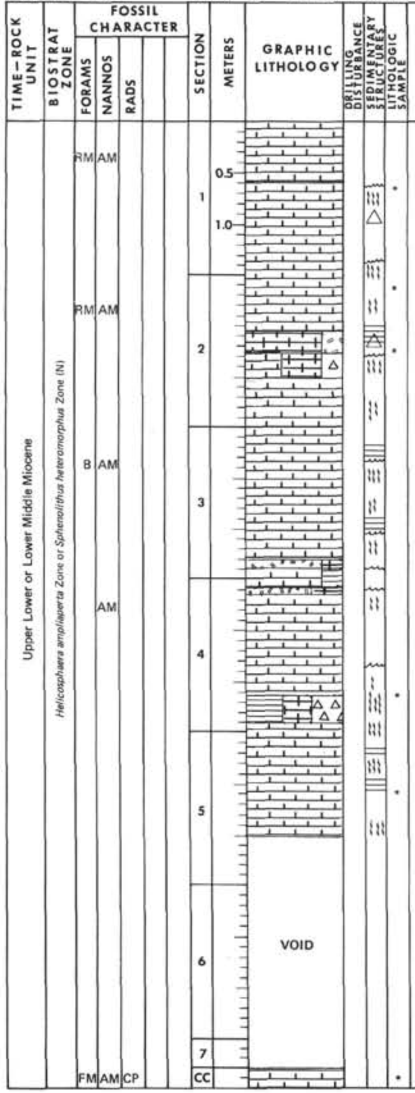
Sand	70%	Clay minerals	5%
Silt	15%	Volcanic glass	60-75%
Clay	15%	Foraminifers	1- 2%
		Nannofossils	10-17%
		Radiolarians	TR- 5%
		Sponge spicules	0- 1%

CALCIUM-CARBONATE:
2-76 (1.2, 0.8, 8)

CC (Clayey Nannofossil Tuff)

Sand	30%	Clay minerals	15%
Silt	40%	Volcanic glass	55%
Clay	30%	Nannofossils	16%
		Sponge spicules	2%

SITE 445 HOLE CORE 33 CORED INTERVAL: 293.5-303.0 m



LITHOLOGIC DESCRIPTION

10YR 7/3
10YR 4/3
10YR 4/3
10YR 7/3
10YR 4/3
10YR 4/3
10YR 7/2
10YR 8/2
10YR 8/2
10YR 4/3

Dominant Lithology: Clayey Nannofossil Chalk dark brown, pale brown to light gray; locally replaced by **Nannofossil Siliceous Mudstone** (Section 4, possibly middle of Section 2).

Minor Lithology: Vitric Foraminifera-Nannofossil Chalk with a sandy mud texture (siliceous remains – rich?) white; at base of fining up sequence, as at Section 3, 77 cm.

Sedimentary structures: graded beds, parallel laminae, scour, biotrubation (dark brown zones mostly bioturbated).

SMEARS:

1-65, 2-15, 5-60, CC (Nannofossil Chalk)

Clay minerals	5-10%	Radiolarians	1- 3%
Volcanic glass	TR- 1%	Sponge spicules	1- 2%
Nannofossils	84-88%		

2-77 (Vitric Foraminifera-Nannofossil Chalk)

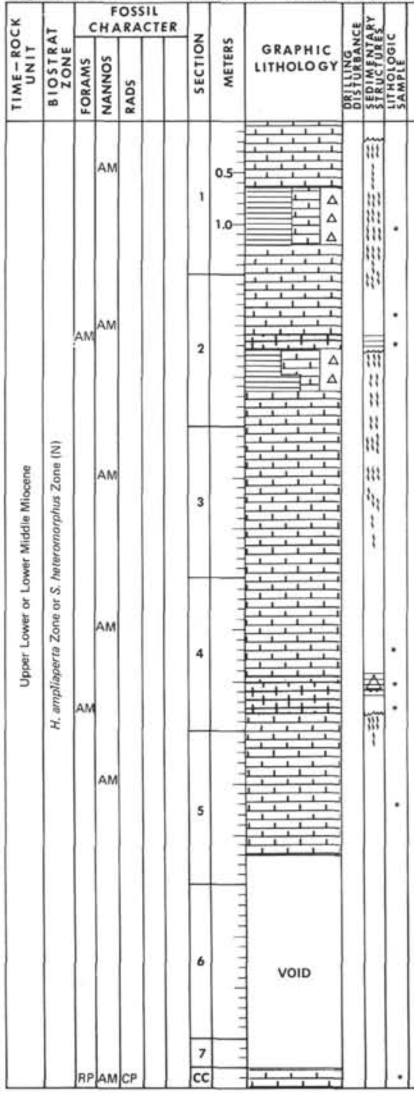
Sand	34%	Clay minerals	5%
Silt	40%	Volcanic glass	14%
Clay	26%	Foraminifers	15%
		Nannofossils	40%
		Radiolarians	2%
		Diatoms	2%
		Sponge spicules	3%

4-114 (Nannofossil Siliceous Mudstone)

Sand	15%	Clay minerals	41%
Silt	10%	Volcanic glass	2%
Clay	75%	Foraminifers	1%
		Nannofossils	21%
		Radiolarians	10%
		Sponge spicules	15%
		Organic material	10%

CARBON-CARBONATE:
1-89 (7.2, 0.0, 59)
3-89 (8.4, 0.1, 70)

SITE 445 HOLE CORE 34 CORED INTERVAL: 312.5-322.0 m



10YR 6/3 to 7/3
10YR 3/4
10YR 6/3 to 7/3
10YR 3/4
10YR 3/4
10YR 6/3 to 7/3
10YR 3/4
10YR 6/3 to 7/3
10YR 6/3 to 7/3

LITHOLOGIC DESCRIPTION

Dominant Lithology:
Sections 1 and 2: Alternating pale brown to very pale brown **Nannofossil Chalk** and dark yellowish brown to very pale brown **Siliceous Nannofossil Mudstone.**
Sections 3 thru 5 and CC: pale brown to very pale brown **Nannofossil Chalk.**
Section 2, 70-72 cm, Section 4, 110-112 cm – microforams
Minor Lithology:
Foraminifera-Nannofossil Chalk with muddy sand texture, parallel laminated, with lithic fragments, at basal to lower part of graded beds (Sections 2, 4).

Sedimentary structures: graded beds with calcarenite at base (white). Bioturbation, scour, a massive bed with no structures at Sections 3, 82 cm. Parallel lamination.

SMEARS:

2-43, 4-75, 5-75, CC (Nannofossil Chalk)

Clay minerals	< 5%	Diatoms	0- 1%
Volcanic glass	1- 3%	Radiolarians	1- 3%
Foraminifers	1- 3%	Sponge spicules	1- 2%
Nannofossils	77-84%		

1-108 (Siliceous Nannofossil Mudstone)

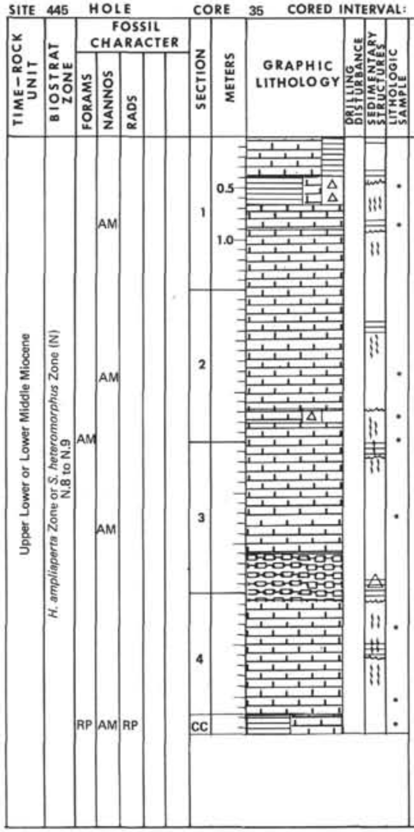
Sand	12%	Clay minerals	47%
Silt	18%	Volcanic glass	1%
Clay	70%	Foraminifers	1%
		Nannofossils	19%
		Diatoms	TR
		Radiolarians	12%
		Sponge spicules	9%
		Organic material	9%

2-75, 4-107, 4-128 (Foraminifera-Nannofossil Chalk)

Clay minerals	0- 4%	Diatoms	0- 1%
Volcanic glass	1- 5%	Radiolarians	1- 5%
Foraminifers	15-30%	Sponge spicules	1- 2%
Nannofossils	36-62%		

CARBON-CARBONATE:
1-140 (9.0, 0.0, 75)
3-140 (8.7, 0.0, 72)

SITE 445 HOLE CORE 35 CORED INTERVAL: 322.0-331.5 m



10YR 6/3 to 7/2
10YR 5/3
10YR 8/2
10YR 7/3
10YR 6/3 to 7/2
10YR 6/3 to 7/2
10YR 6/3 to 7/2
10YR 6/3

LITHOLOGIC DESCRIPTION

Dominant Lithology:
Nannofossil Chalk pale brown, very pale brown, light gray, white; locally passing the darker colored brown **Siliceous Nannofossil Chalk** (Section 2). **Nannofossil Mudstone** (CC), or **Siliceous-Calcareous Mudstone** (Section 1).

Minor Lithology:
Calcareous Chalk – Calcareous Sandstone at lower – basal part of graded unit (Section 3) (by visual observation).

Sedimentary structures: parallel laminae, graded beds with very fine sand to coarse sand at base, scour, sharp contacts.

SMEARS:

1-85, 2-85, 2-148, 3-85, 4-35, 4-102 (Nannofossil Chalk)

Clay minerals	5-10%	Diatoms	0- 2%
Volcanic glass	TR- 2%	Radiolarians	1- 4%
Foraminifers	1- 5%	Sponge spicules	1- 3%
Nannofossils	76-81%		

2-125 (Siliceous Nannofossil Chalk)

Clay minerals	<10%	Diatoms	2%
Volcanic glass	1%	Radiolarians	9%
Foraminifers	3%	Sponge spicules	2%
Nannofossils	67%		

CC (Nannofossil Mudstone)

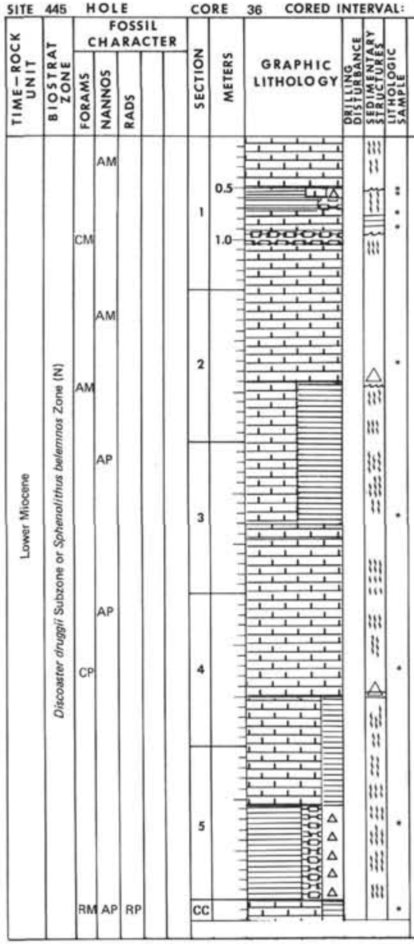
Sand	5%	Clay minerals	50%
Silt	13%	Volcanic glass	1%
Clay	82%	Nannofossils	38%
		Radiolarians	2%
		Sponge spicules	5%

1-51 (Siliceous-Calcareous Mudstone)

Sand	15%	Clay minerals	46%
Silt	15%	Volcanic glass	2%
Clay	70%	Foraminifers	2%
		Nannofossils	10%
		Diatoms	1%
		Radiolarians	12%
		Sponge spicules	1%
		Organic material	5%

CARBON-CARBONATE:
1-88 (8.8, 0.0, 73)
3-88 (9.0, 0.0, 75)

SITE 445 HOLE CORE 36 CORED INTERVAL: 331.5-341.0 m



LITHOLOGIC DESCRIPTION

10YR 6/3

10YR 6/3 to 7/2

10YR 6/3

10YR 6/3 to 7/2

10YR 4/3 to 6/3

10YR 6/3 to 4/3

10YR 6/3

10YR 4/3

Dominant Lithology: Alternating **Nannofossil Chalk and Clayey Nannofossil Chalk**, pale brown to very pale brown to light gray. Clay 4-22%; volcanic glass 0-5%.

Minor Lithology:
(1) Calcareous Mudstone (Section 5, 52-150 cm), pale brown, 72% clay.
(2) Siliceous Nannofossil Mudstone (Section 1), reddish yellow, dark brown.
(3) Calcareous Chalk with muddy sand to sandy mud texture at base of sequences.

Sedimentary structures: bioturbation, parallel laminae, graded beds, soft sedimentary deformation = microfault, weak stratification in the more massive layers in mid-cycle.

SMEARS:

1-75, 2-75, 4-75 (Nannofossil Chalk)

Clay minerals	< 10%	Diatoms	TR- 2%
Foraminifers	1- 3%	Radiolarians	0-TR%
Nannofossils	77-83%	Sponge spicules	1- 2%

3-75, CC (Clayey Nannofossil Chalk)

Sand	2- 4%	Clay minerals	15-22%
Silt	8-17%	Foraminifers	1%
Clay	79-90%	Nannofossils	64-77%
		Diatoms	0- 1%
		Radiolarians	0- 3%
		Sponge spicules	1- 2%

1-57, 5-75 (Calcareous Mudstone)

Sand	3%	Clay minerals	72-77%
Silt	9%	Foraminifers	0- 1%
Clay	90%	Nannofossils	5- 8%
		Carbonate unspecified	5- 7%
		Diatoms	1%
		Radiolarians	3- 4%
		Sponge spicules	2- 4%

1-54 (Siliceous Nannofossil Mudstone)

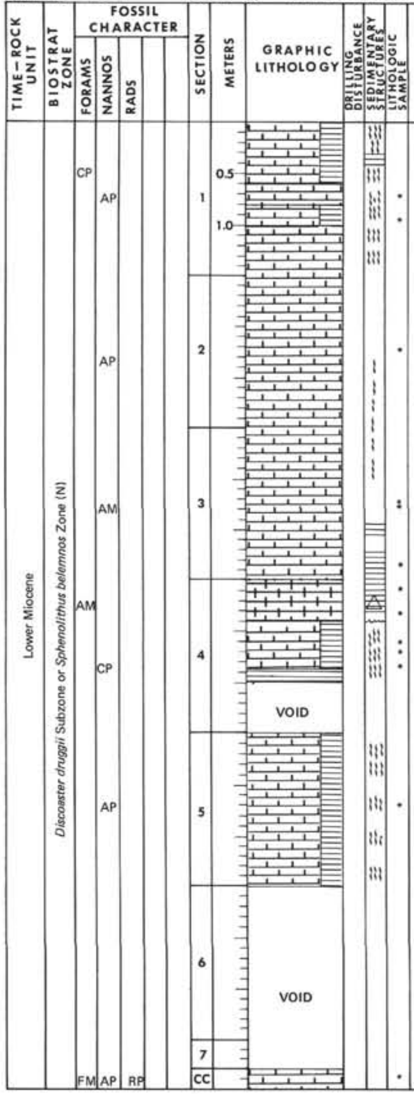
Sand	4%	Clay minerals	65%
Silt	15%	Nannofossils	10%
Clay	81%	Diatoms	2%
		Radiolarians	4%
		Sponge spicules	4%

1-91 (Calcareous Chalk)

Clay minerals	4%	Foraminifers	10%
Volcanic glass	5%	Nannofossils	19%
Carbonate unspecified	37%	Radiolarians	8%

CARBON-CARBONATE:
1-39 (4.4, 0.1, 36)

SITE 445 HOLE CORE 37 CORED INTERVAL: 341.0-350.5 m



LITHOLOGIC DESCRIPTION

10YR 4/3

10YR 6/3

10YR 6/3 to 7/2

10YR 6/3 to 7/2

Color change

7.5YR 7/4

7.5YR 7/4

7.5YR 6/3 to 7/2

Dominant Lithology: (very hard) **Nannofossil Chalk** and less amounts of **Clayey Nannofossil Chalk.** Brown, dark brown – pale to very pale brown. Clay materials more dominant in Sections 4 and 5. Silty claystone interbed, pink (Section 4).

Sedimentary structures: parallel laminae, closely spaced. Graded beds. Horizontal layering of burrows. Bioturbation.

Minor Lithology: Foraminifera-Nannofossil Chalk, parallel laminae, with sandy-mud texture at lower part of graded bed (Section 4).

SMEARS:

1-75, 2-75, 3-71, 3-133, CC (Nannofossil Chalk)

Clay minerals	5- 9%	Radiolarians	0- 1%
Foraminifers	0- 3%	Diatoms	0-TR%
Nannofossil	81-87%	Sponge spicules	0- 2%

1-99, 4-61, 4-73, 5-75 (Clayey Nannofossil Chalk)

Sand	2%	Clay minerals	15-25%
Silt	7-10%	Foraminifers	0- 2%
Clay	88-90%	Nannofossils	65-78%
		Diatoms	0-TR%
		Radiolarians	0- 1%
		Sponge spicules	0- 2%

4-10, 4-36 (Foraminifera-Nannofossil Chalk)

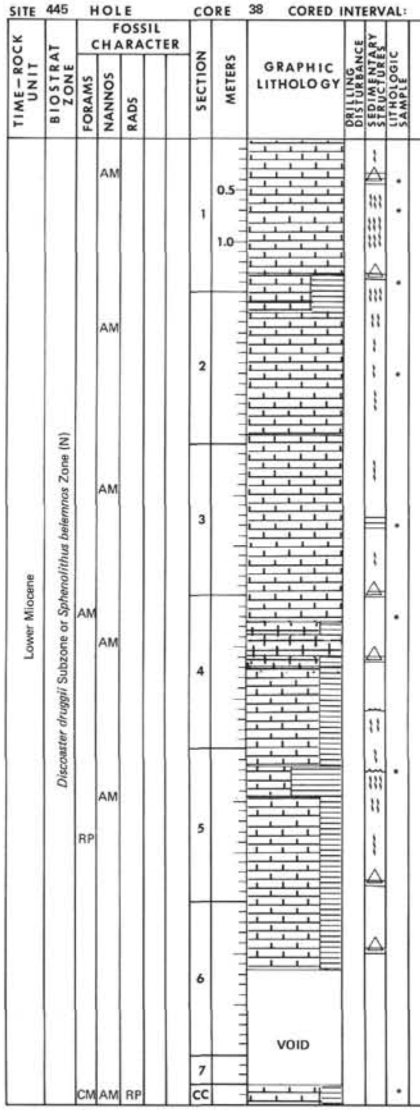
Clay minerals	6-10%	Foraminifers	10%
Carbonate unspecified	10-15%	Nannofossils	61-68%
		Diatoms	0-TR%

4-85 (Silty Claystone)

Sand	2%	Clay minerals	78%
Silt	16%	Nannofossils	7%
Clay	82%		

CARBON-CARBONATE:
1-90 (7.3, 0.0, 60)

SITE 445 HOLE CORE 38 CORED INTERVAL: 350.5-360.0 m



10YR 4/4

10YR 7/3 to 5/3

10YR 8/2 to 7/3

10YR 7/3 to 6/6 to 8/3

10YR 5/3 to 8/3

10YR 7/3

LITHOLOGIC DESCRIPTION

Dominant Lithology: Nannofossil Chalk (Section 3), very pale brown to very light gray and **Clayey Nannofossil Chalk** (Sections 4, 5, and CC)

Minor Lithology: Nannofossil Mudstone interbed in **Clayey Nannofossil Chalk** (Section 5); **Clayey Foraminifera-Nannofossil Chalk** at lower (basal) part of graded beds.

Sedimentary structures: Bioturbation, parallel laminae, graded beds with white calcarenite at base? Long sections of massive structureless mudstone between turbidite sequences. Slumped – contorted bedding. Wavy laminations below.

SMEARS:

1-42, 1-76, 2-80, 3-80 (Nannofossil Chalk)

Clay minerals	< 10%	Diatoms	TR- 1%
Foraminifers	0- 7%	Sponge spicules	TR- 1%
Nannofossils	75-86%		

1-145, CC (Clayey Nannofossil Chalk)

Sand	0- 1%	Clay minerals	12-15%
Silt	5- 7%	Nannofossils	80-83%
Clay	93-95%	Diatoms	0-TR%
		Sponge spicules	0- 2%

5-20 (Nannofossil Mudstone)

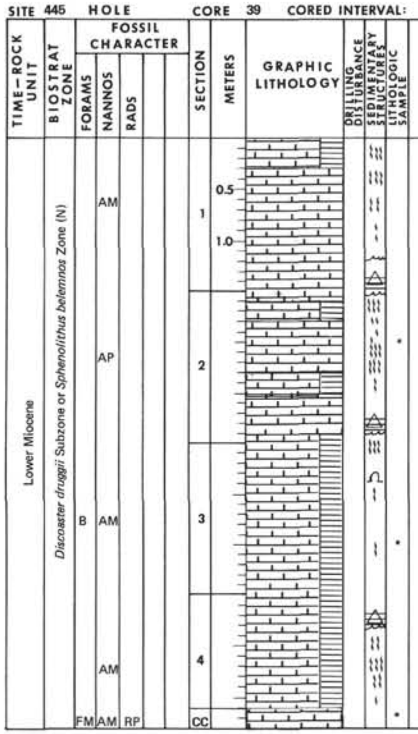
Sand	0%	Clay minerals	49%
Silt	5%	Nannofossils	37%
Clay	95%	Sponge spicules	2%

4-25 (Clayey Foraminifera-Nannofossil Chalk)

Sand	15%	Clay minerals	15%
Silt	25%	Foraminifers	15%
Clay	60%	Nannofossils	61%
		Diatoms	1%
		Sponge spicules	1%

CARBON-CARBONATE:
1-77 (7.5, 0.0, 62)

SITE 445 HOLE CORE 39 CORED INTERVAL: 360.0-369.5 m



10YR 8/3 to 7/3 to 6/3

10YR 5/3 to 8/3

10YR 7/3

10YR 8/3

10YR 6/3 to 7/3

LITHOLOGIC DESCRIPTION

Dominant Lithology: alternating very pale brown **Nannofossil Chalk** and brown **Clayey Nannofossil Chalk**. Sections 1 and 2 dominated by **Nannofossil Chalk**, Sections 3 and 4 by **Clayey Nannofossil Chalk**.

Sedimentary structures: graded beds, bioturbation, parallel laminae, wavy beds over graded bed laminae. Slump structure – inclined and disturbed bedding. Soft sediment deformation.

SMEARS:

2-50, CC (Nannofossil Chalk)

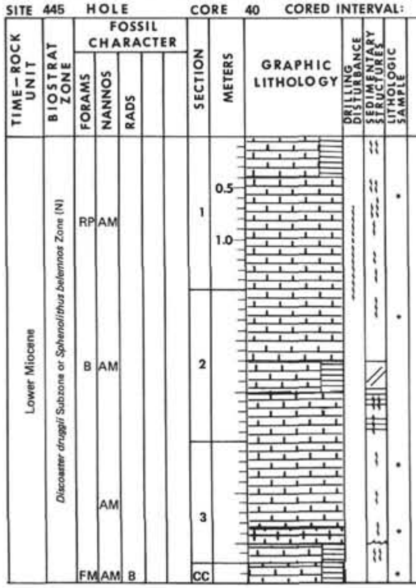
Clay minerals	5-10%	Nannofossils	82-88%
Foraminifers	1- 2%	Sponge spicules	0- 2%

3-100 (Clayey Nannofossil Chalk)

Sand	0%	Clay minerals	20%
Silt	0%	Foraminifers	1%
Clay	100%	Nannofossils	75%
		Sponge spicules	2%

CARBON-CARBONATE:
1-82 (10.1, 0.1, 84)

SITE 445 HOLE CORE 40 CORED INTERVAL: 369.5-379.0 m



10YR 6/3

10YR 6/3

10YR 5/3 to 6/3

10YR 6/6

5YR 8/2

10YR 7/1

LITHOLOGIC DESCRIPTION

Dominant Lithology: Nannofossil Chalk and Clayey Nannofossil Chalk, very pale brown to brown, reddish yellow streak; plus pinkish white.

Minor Lithologies:
Foraminifera-Nannofossil Chalk (Section 3) at base of bed.

Sedimentary structures: parallel bedding, extremely contorted and inclined bedding Section 2, 50 cm = slump structures.

SMEARS:

1-60, 2-30, 3-20, CC (Nannofossil Chalk)

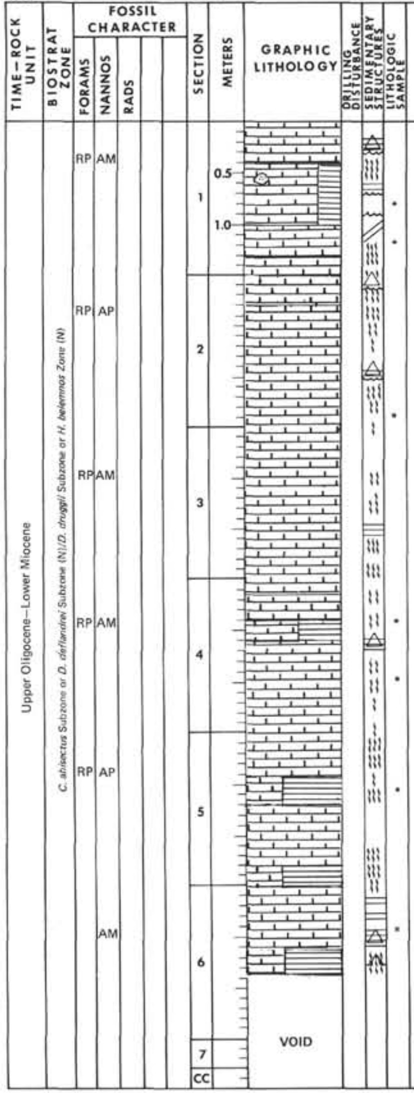
Clay minerals	< 5-10%	Nannofossils	83-86%
Foraminifers	0- 5%	Sponge spicules	1- 2%

3-10 (Foraminifera-Nannofossil Chalk)

Clay minerals	< 5%	Diatoms	TR
Foraminifers	10%	Sponge spicules	TR
Nannofossils	77%		

CARBON-CARBONATE:
2-63 (9.6, 0.1, 86)
3-79 (9.7, 0.0, 81)

SITE 445 HOLE CORE 41 CORED INTERVAL: 379.0-388.5 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: Nannofossil Chalk; light gray to pale brown.

Minor Lithology; interbedded darker colored layers of **Clayey Nannofossil Chalk and Nannofossil Mudstone;** light gray to dark gray.

Sedimentary structures: graded beds, bioturbation, parallel laminae at the lower interval of each graded unit. Slump structure at Section 6, 60 to 82 cm, cut by the base of graded bed.

SMEARS:

1-120, 2-140, 3-120, 4-40, 6-40 (Nannofossil Chalk)

Clay minerals	TR-10%	Nannofossils	85-91%
Foraminifers	TR- 5%	Sponge spicules	TR- 2%

1-80, 5-55 (Clayey Nannofossil Chalk)

Sand	5%	Clay minerals	25%
Silt	5%	Volcanic glass	1- 2%
Clay	90%	Foraminifers	0- 5%
		Nannofossils	56-61%
		Radiolarians	0- 2%
		Sponge spicules	1%

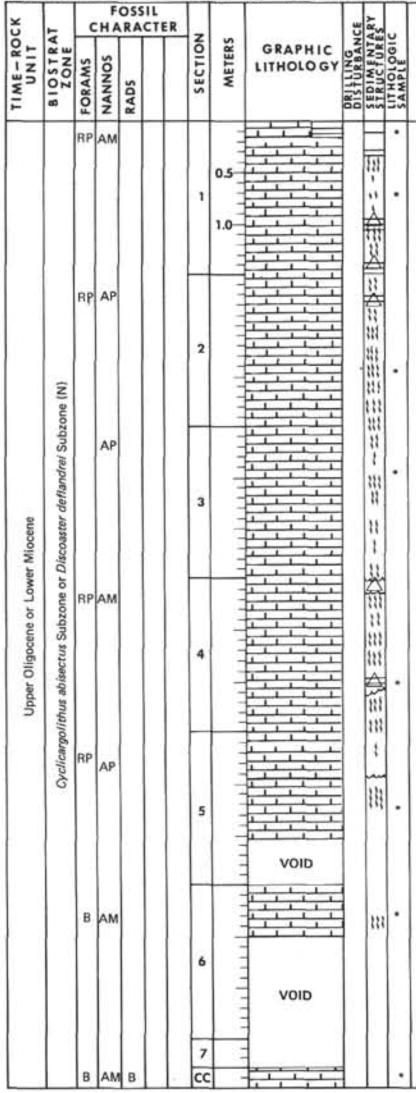
4-50 (Nannofossil Mudstone)

Sand	5%	Clay minerals	40%
Silt	5%	Volcanic glass	3%
Clay	90%	Nannofossils	42%
		Quartz, Feldspar	5%
		Opaque minerals	5%

CARBON-CARBONATE:

1-44 (9.4, 0.0, 78)
3-44 (8.8, 0.8, 73)
5-44 (9.0, 0.0, 74)

SITE 445 HOLE CORE 42 CORED INTERVAL: 388.5-398.0 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: nearly exclusively **Nannofossil Chalk;** light gray, very pale brown to pale brown, partly pinkish gray (5YR 7/2).

Sedimentary structures: extensive bioturbation, graded beds with basal parallel-laminated layer.

Minor Lithology: Clayey Nannofossil Chalk at top of core.

SMEARS:

1-75, 2-97, 3-45, 4-100, 5-75, 6-30, CC (Nannofossil Chalk)

Clay minerals	TR-10%	Nannofossils	83-97%
Volcanic glass	0- 1%	Sponge spicules	1- 3%
Foraminifers	0- 2%		

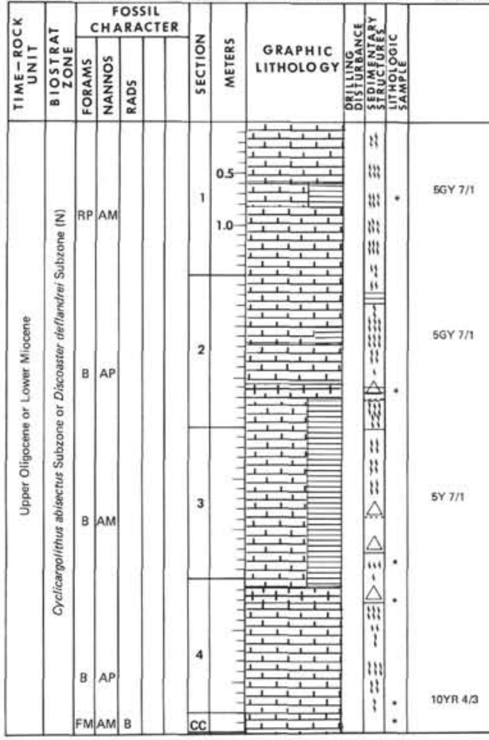
1-10 (Clayey Nannofossil Chalk)

Sand	5%	Clay minerals	20%
Silt	5%	Volcanic glass	2%
Clay	90%	Foraminifers	2%
		Nannofossils	71%
		Sponge spicules	1%

CARBON-CARBONATE:

1-23 (10.5, 0.1, 87)
3-30 (10.1, 0.0, 84)
5-38 (5.1, 0.0, 42)

SITE 445 HOLE CORE 43 CORED INTERVAL: 398.0-407.5 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: Nannofossil Chalk, light greenish gray (5GY 7/1) to light gray (5Y 7/1), associated with pale brown (10YR 4/3) at lower interval of Section 4.

Minor Lithologies: Clayey Nannofossil Chalk, black colored interbeds in **Nannofossil Chalk** sequence (Sections 1 and 2) with 25% or more(?) clay minerals. **Foraminifera-Nannofossil Chalk,** occurs at basal coarser intervals of recognized graded sequences, with 10-15% foraminifers.

Sedimentary structures: graded beds, parallel laminae, extensive bioturbation.

SMEARS:

2-90, 3-130, 4-120, CC (Nannofossil Chalk)

Clay minerals	<5-10%	Nannofossils	83-89%
Volcanic glass	0- 1%	Radiolarians	0- 2%
Foraminifers	0- 1%	Sponge spciules	TR- 1%

1-75 (Clayey Nannofossil Chalk)

Sand	0%	Clay minerals	25%
Silt	5%	Volcanic glass	1%
Clay	95%	Nannofossils	67%
		Radiolarians	1%
		Sponge spicules	3%

2-115 (Foraminifera-Nannofossil Chalk)

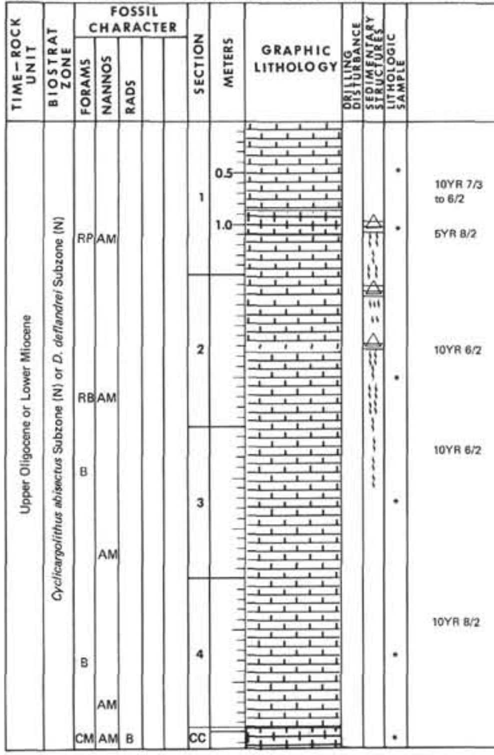
Clay minerals	< 5%	Nannofossils	47%
Volcanic glass	2%	Sponge spicules	1%
Foraminifers	40%	Quartz, Feldspar	5%

4-20 (Foraminifera-Nannofossil Chalk)

Clay minerals	<10%	Nannofossils	62%
Volcanic glass	1%	Radiolarians	5%
Foraminifers	>10%	Sponge spicules	3%

CARBON-CARBONATE:
1-85 (9.4, 0.0, 78)
3-85 (7.2, 0.0, 59)

SITE 445 HOLE CORE 44 CORED INTERVAL: 407.5-417.0 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: Nannofossil Chalk, very pale brown to light brownish gray, with <5-10% clay and 0-1% volcanic glass.

Minor Lithology: Foraminifera-Nannofossil Chalk, whitish pink, with 10-20% foraminifers, at the basal *part of graded sequence (Section 1, 105-110 cm)* and Core-Catcher.

Sedimentary structures: graded beds and parallel laminae at the basal part of graded sequence. Bioturbation at Section 1, 110 cm and Section 3, 60 cm.

SMEARS:

1-50, 2-100, 3-75, 4-75 (Nannofossil Chalk)

Clay minerals	<5-10%	Nannofossils	79-88%
Volcanic glass	0- 1%	Sponge spicules	1- 3%
Foraminifers	0- 3%		

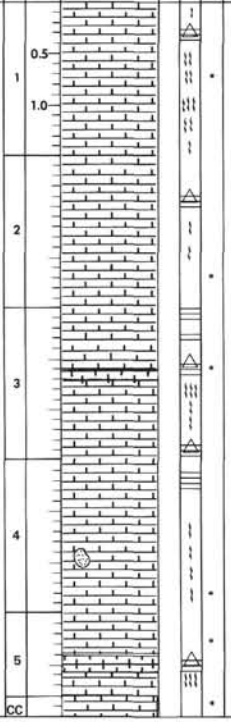
1-105, CC (Foraminifera-Nannofossil Chalk)

Clay minerals	<5-10%	Nannofossils	63-70%
Foraminifers	10-20%	Sponge spicules	1- 4%

CARBON-CARBONATE:
1-121 (10.6, 0.0, 88)
3-121 (11.1, 0.0, 92)

SITE 445 **HOLE** **CORE** 45 **CORED INTERVAL:** 417.0-426.5 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	SECTION
Upper Oligocene or Lower Miocene	*Dictyococcites bisectus* Subzone/*C. abisectus* Subzone or *D. deflandrei* Subzone (N)		AM		1
		B	AM		2
		FM	AM		3
		RP	AM		4
		RM			5
		B	AM	CM	CC



5YR 7/1

5YR 8/2

7.5YR 8/2

7.5YR 7/2

7.5YR 7/2

10YR 8/3

LITHOLOGIC DESCRIPTION

Dominant Lithology: Nannofossil Chalk, dominantly pinkish gray (7.5YR 8/2), locally pinkish white (7.5 YR 8/2, 5YR 8/2), with <5-10% clay and 0-2% volcanic glass.

Minor Lithology: Foraminifera-Nannofossil Chalk, at the base of graded bed in Section 3, 65-70 cm and Section 5.

Sedimentary structures: graded beds and parallel laminae. Bioturbation mild to general.

SMEARS:

1-75, 2-120, 4-130, 5-30, CC (Nannofossil Chalk)

Clay minerals	<5-10%	Nannofossils	79-89%
Volcanic glass	0- 2%	Sponge spicules	1- 3%
Foraminifers	0- 5%		

3-65 (Foraminifera-Nannofossil Chalk)

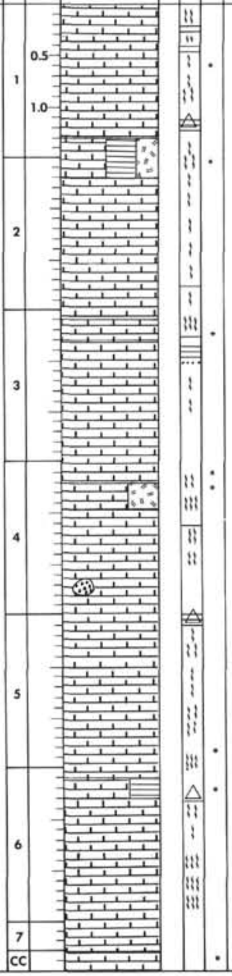
Clay minerals	< 5%	Nannofossils	48%
Foraminifers	35%	Sponge spicules	5%

CARBON-CARBONATE:

1-124 (10.9, 0.0, 91)
3-124 (11.0, 0.0, 92)
3-39 (10.7, 0.0, 89)

SITE 445 **HOLE** **CORE** 46 **CORED INTERVAL:** 426.5-436.0 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	SECTION
Upper Oligocene	*Dictyococcites bisectus* Subzone (N)	RP	AM		1
		RP	AM		2
		RP	AM		3
		RP	AM		4
		RP	AM		5
		B			6
					7
		FM	AM	RP	CC



10YR 8/3 to 7/2

10YR 8/2

10YR 8/2, 10YR 7/1

10YR 8/1 to 8/2

10YR 8/2 to 10YR 7/2

5YR 8/2

10YR 8/2

LITHOLOGIC DESCRIPTION

Dominant Lithology: mainly white to light gray **Nannofossil Chalk,** with <5-10% clay and 0-3% volcanic glass.

Minor Lithologies: Vitric Nannofossil Marly Chalk, at the uppermost interval of graded beds (Sections 1 and 2) **Nannofossil Tuff** (Section 4).

Sedimentary structures: graded beds and parallel laminae. Bioturbation generally mild.

SMEARS:

1-60, 3-25, 4-10, 5-135 CC (Nannofossil Chalk)

Clay minerals	<5-10%	Nannofossils	83-88%
Volcanic glass	0- 3%	Sponge spicules	1- 2%

6-25 (Clayey Nannofossil Chalk)

Sand	10%	Clay minerals	15%
Silt	15%	Volcanic glass	<10%
Clay	75%	Nannofossils	67%
		Sponge spicules	2%

2-7 (Vitric Nannofossil Marly Chalk)

Sand	5%	Clay minerals	15%
Silt	5%	Opaque minerals	10%
Clay	95%	Volcanic glass	15%
		Nannofossils	46%
		Sponge spicules	1%

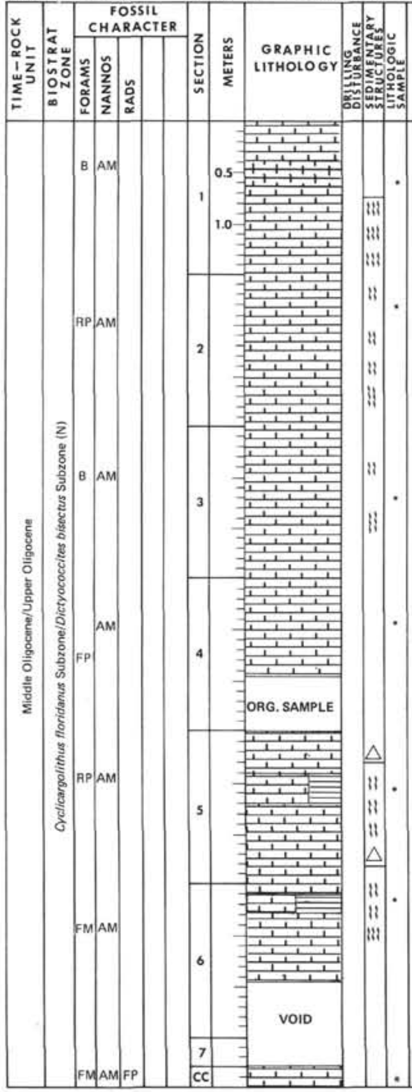
4-26 (Nannofossil Tuff)

Sand	50%	Clay minerals	<10%
Silt	20%	Volcanic glass	50%
Clay	30%	Nannofossils	30%
		Sponge spicules	2%

CARBON-CARBONATE:

2-98 (10.9, 0.0, 90)

SITE 445 HOLE CORE 47 CORED INTERVAL: 436.0-445.5 m



LITHOLOGIC DESCRIPTION

10YR 8/2
10YR 4/1
10YR 8/2
10YR 8/2

Dominant Lithology: Nannofossil Chalk, with white (10YR 8/2), no structures except for bioturbation.
Clayey Nannofossil Chalk, as interbeds in **Nannofossil Chalk** (Section 5).

Minor Lithologies: Foraminifera-Nannofossil Chalk (Section 1) and **Nannofossil Mudstone** (Section 6).

Sedimentary structures: generally massive, with extensive bioturbation.

SMEARS:
2-35, 3-75, 4-45, CC (Nannofossil Chalk)

Clay minerals	<5- 8%	Radiolarians	0- 5%
Foraminifers	2- 5%	Sponge spicules	1- 2%
Nannofossils	85-88%		

1-60 (Foraminifera-Nannofossil Chalk)

Clay minerals	<5%	Nannofossils	61%
Volcanic glass	3%	Sponge spicules	1%
Foraminifers	15%		

5-55 (Clayey Nannofossil Chalk)

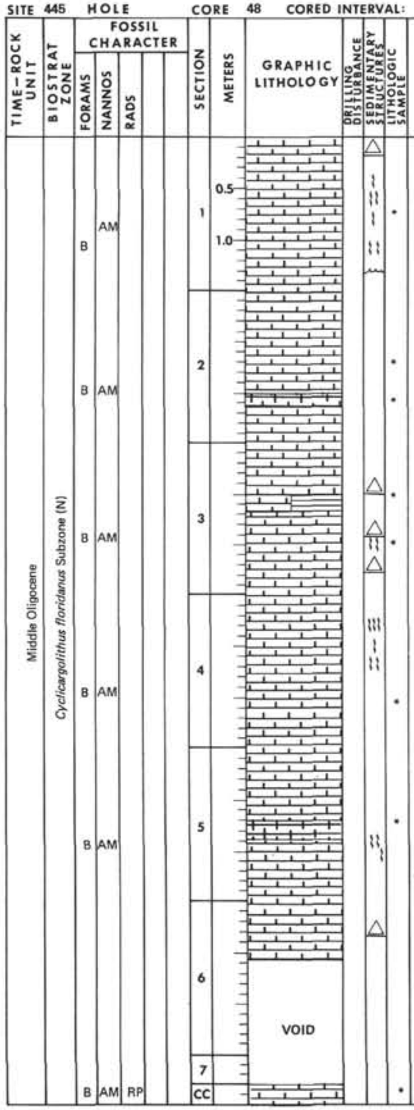
Sand	7%	Clay minerals	15%
Silt	7%	Volcanic glass	2%
Clay	86%	Foraminifers	2%
		Nannofossils	71%
		Radiolarians	TR
		Sponge spicules	2%

6-17 (Nannofossil Mudstone)

Sand	13%	Clay minerals	37%
Silt	30%	Opaque minerals	15%
Clay	60%	Volcanic glass	5%
		Foraminifers	5%
		Nannofossils	17%
		Diatoms	1%
		Radiolarians	2%
		Sponge spicules	1%

CARBON-CARBONATE:
2-44 (10.7, 0.0, 89)

SITE 445 HOLE CORE 48 CORED INTERVAL: 445.5-455.0 m



LITHOLOGIC DESCRIPTION

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

Dominant Ltihology: Nannofossil Chalk, white, faintly laminated.

Minor Lithologies: Interbeded **Nannofossil Marly Chalk,** layer (Section 3), **Foraminifera-Nannofossil Chalk** (Section 2) and **Nannofossil-Foraminifera Chalk** (Section 5).

Sedimentary structures: graded beds; faint lamination; bioturbation rather mild.

SMEARS:
1-75, 2-70, 3-100, 4-10, CC (Nannofossil Chalk)

Clay minerals	TR- 7%	Nannofossils	83-94%
Volcanic glass	0- 1%	Sponge spicules	1- 3%
Foraminifers	1- 5%		

2-107 (Foraminifera-Nannofossli Chalk)

Clay minerals	TR	Nannofossils	62%
Volcanic glass	4%	Sponge spicules	1%
Foraminifers	15%		

3-52 (Nannofossil Mudstone)

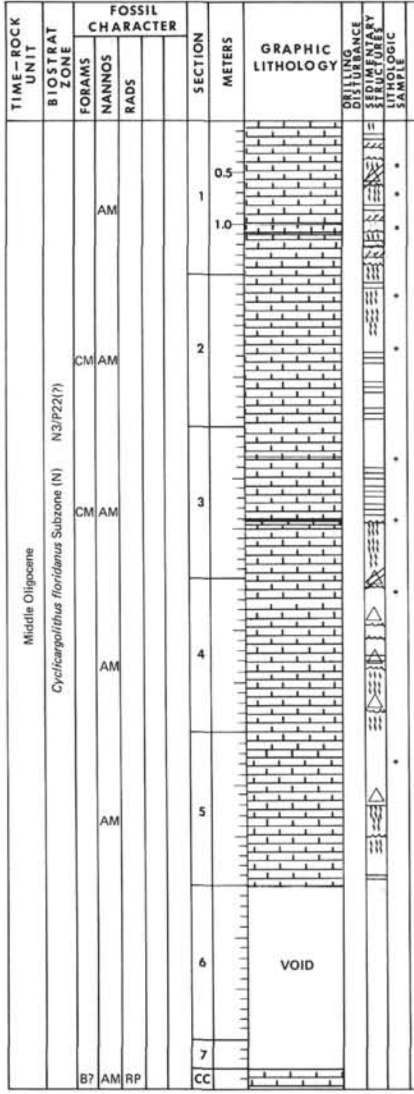
Sand	5%	Clay minerals	50%
Silt	10%	Opaque minerals	5%
Clay	85%	Voclanic glass	1%
		Foraminifers	2%
		Nannofossils	27%
		Radiolarians	1%
		Sponge spicules	4%

5-73 (Nannofossil-Foraminifera Chalk)

Clay minerals	8%	Nannofossils	25%
Foraminifers	51%	Sponge spicules	2%

CARBON-CARBONATE:
1-114 (10.5, 0.0, 87)

SITE 445 HOLE CORE 49 CORED INTERVAL: 455.0-464.5 m



LITHOLOGIC DESCRIPTION

10YR 8/1 to 7/1

10YR 7/1

10YR 8/1

10YR 8/1

10YR 7/1

10YR 7/1

10YR 8/1

10YR 8/1

Dominant Lithology: white (10YR 8/1) **Nannofossil Chalk** with 0-1% volcanic glass.

Minor Lithology: Nannofossil-Foraminifera Chalk, at basal part of some graded beds.

Sedimentary structures: graded beds, parallel laminations and bioturbations. A graded unit; 15 cm to 150 cm thick (largely 40 to 50 cm thick), consisting of the lowest parallel-laminated and/or micro-cross-laminated silty to sandy layer, the little bioturbated middle light colored layer, and the intensely bioturbated dark colored layer.

SMEARS:

1-49, 1-75, 2-28, 2-75, 2-120, 3-30, 4-12, 5-30, 5-125 (Nannofossil Chalk)

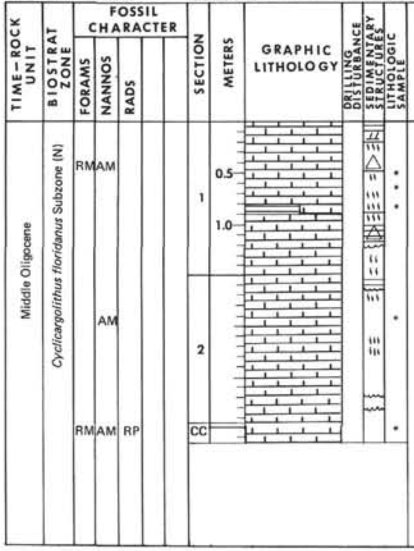
Clay minerals	TR- 5%	Diatoms	0- 2%
Volcanic glass	0- 1%	Radiolarians	0- 5%
Foraminiers	0- 5%	Sponge spicules	1- 3%
Nannofossils	75-90%		

1-106, 3-90 (Nannofossil-Foraminifera Chalk)

Clay minerals	TR- 3%	Nannofossils	18-51%
Volcanic glass	0- 1%	Radiolarians	1- 2%
Foraminifers	30-40%	Sponge spicules	1%

CARBON-CARBONATE:
1-110 (10.7, 0.0, 89)

SITE 445 HOLE CORE 50 CORED INTERVAL: 464.5-474.0 m



LITHOLOGIC DESCRIPTION

10YR 8/1

N4

10YR 8/1

10YR 8/1

10YR 7/1

Dominant Lithology: Nannofossil Chalk, w' 'te (10YR 8/1).

Minor Lithology: dark gray (N4) **Nar .ossil Mudstone** interbed at the interval " .oion 1, 80-91 cm (the basal part of thir' ,raded unit from top of core).

Sedimentary structures: graded beds with lower parallel- or micro-cross-laminated layer, slightly or little bioturbated middle layer, and intensely bioturbated upper layer.

SMEARS:

1-55, 1-67, 2-49, CC (Nannofossil Chalk)

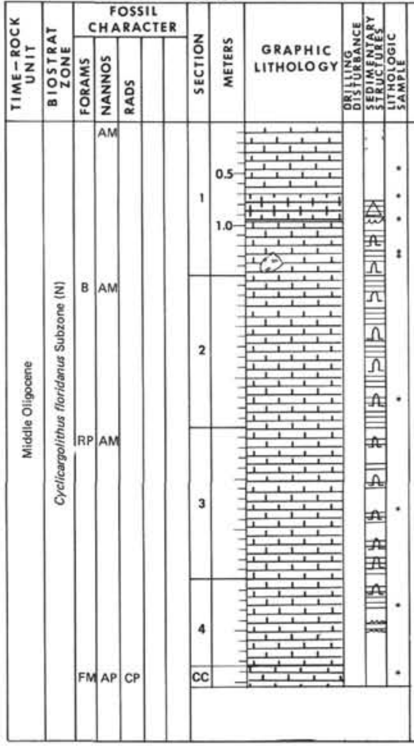
Clay minerals	TR- 9%	Radiolarians	0- 2%
Volcanic glass	0- 1%	Sponge spicules	0- 3%
Foraminifers	0- 4%	Diatoms	0- 2%
Nannofossils	82-90%		

1-87 (Nannofossil Mudstone)

Sand	25%	Quartz, Feldspar	18%
Silt	50%	Clay minerals	33%
Clay	25%	Opaque minerals	5%
		Volcanic glass	5%
		Nannofossils	23%
		Sponge spicules	1%

CARBON-CARBONATE:
1-36 (10.1, 0.0, 84)

SITE 445 HOLE CORE 51 CORED INTERVAL: 474.0-483.5 m



LITHOLOGIC DESCRIPTION

10YR 7/1

10YR 8/1

10YR 8/1

10YR 8/1

10YR 8/1

10YR 8/1

Dominant Lithology: Nannofossil Chalk, white (10YR 8/1), with 0-1% volcanic glass; with frequently interbedded thin layers of **Sandy Mudstone,** gray (10YR 5/1).

Minor Lithology: light gray (5Y 7/2) **Nannofossil-Foraminifera Chalk** (very coarse sand to very fine sand texture) at Section 1, 70-98 cm, occurring as basal facies of a graded bed. This bed overlies a slump fold block at Section 1, 98 cm and Section 4, 50 cm with sharp contact.

Sedimentary structures: graded bed; Section 1, 70-98 cm, with parallel lamination and micro-convolution. Slump fold; Section 1, 98 cm to Section 4, 50 cm, probably representing a part of large scale slumping bed, with minor folding and slump ball of gray sandy mudstone.

SMEARS:

1-45, 1-135, 2-120, 3-80, 4-27, CC (Nannofossil Chalk)

Clay minerals	TR- 5%	Nannofossils	82-93%
Volcanic glass	TR- 1%	Radiolarians	0- 1%
Foraminifers	0- 3%	Sponge spicules	TR- 2%

1-73, 1-97 (Nannofossil-Foraminifera Chalk)

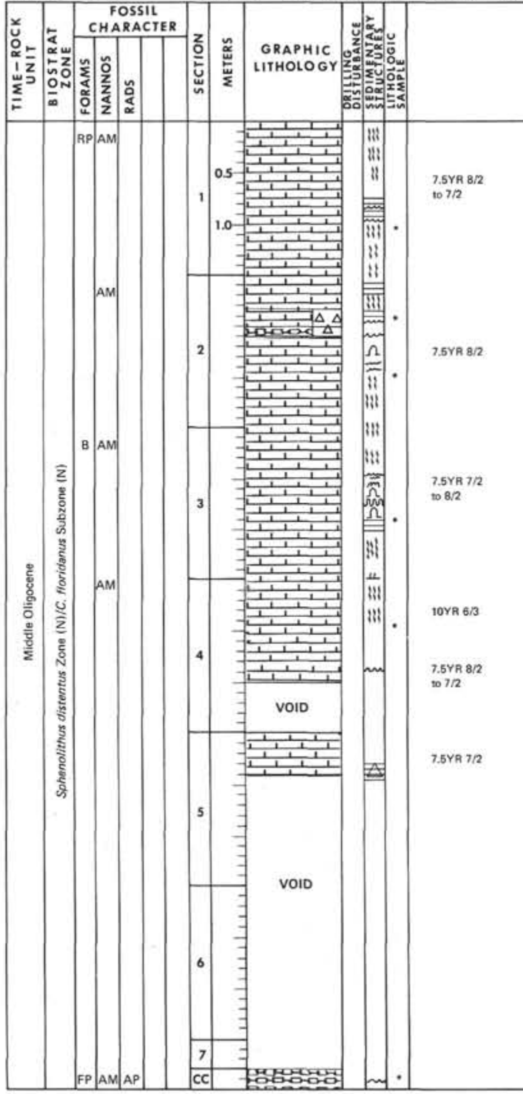
Clay minerals	0-TR%	Foraminifers	30%
Quartz, Feldspar	5%	Nannofossils	20-30%
Volcanic glass	0- 1%	Radiolarians	0- 2%
Carbonate unspecified	19-36%	Sponge spicules	2- 5%

1-130 (Vitric Nannofossil Marly Chalk)

Sand	30%	Quartz, Feldspar	25%
Silt	50%	Clay minerals	TR
Clay	20%	Volcanic glass	15%
		Foraminifers	5%
		Nannofossils	37%
		Radiolarians	2%
		Sponge spicules	1%

CARBON-CARBONATE:
1-33 (9.6, 0.0, 79)

SITE 445 HOLE CORE 52 CORED INTERVAL: 483.5-493.0 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: pinkish white (7.5YR 8/2) to pinkish gray (7.5YR 7/2) **Nannofossil Chalk.**

Minor Lithology: Pinkish white **Siliceous Nannofossil Chalk** (coarse grained, with black lithic fragments) layer at lower part of a graded bed (Section 2, 40-60 cm), associated with basal **Calcareous Chalk** (visual observation).

Sedimentary structures: graded beds with parallel lamination and bioturbation. Bioturbation intense and extensive through entire core. Slumping structure with slump ball and contorted bedding, at around Section 2, 70 cm and Section 3, 70-80 cm.

SMEARS:

1-100, 2-100, 3-91, 4-50 (Nannofossil Chalk)

Clay minerals	TR- 5%	Radiolarians	TR
Foraminifers	0- 2%	Sponge spicules	0- 2%
Nannofossils	85-94%		

2-40 (Siliceous Nannofossil Chalk)

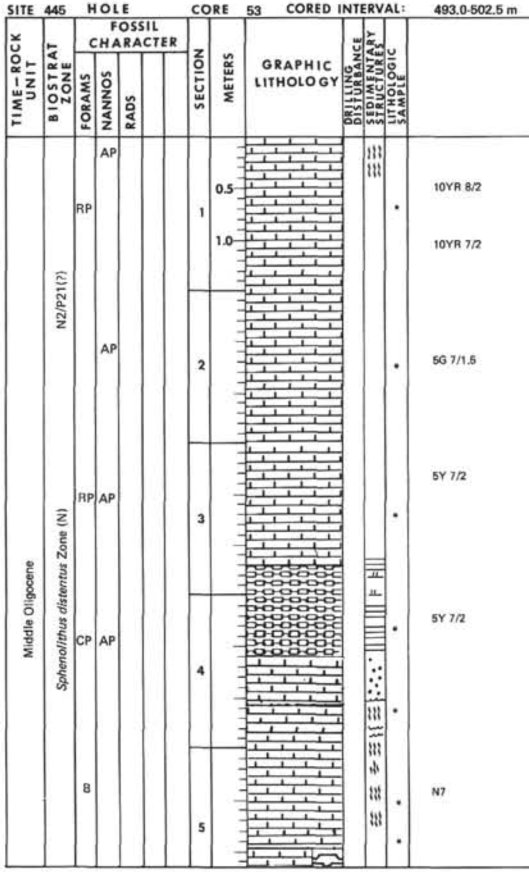
Quartz, Feldspar	9%	Nannofossils	57%
Clay minerals	<10%	Diatoms	4%
Volcanic glass	2%	Radiolarians	3%
Foraminifers	4%	Sponge spicules	5%

CC (Calcareous Chalk)

Quartz, Feldspar	15%	Foraminifers	20%
Clay	<5%	Nannofossils	10%
Volcanic glass	8%	Diatoms	1%
Carbonate unspecified	30%	Radiolarians	6%

CARBON-CARBONATE:
1-22 (9.1, 0.0, 75)

SITE 445 HOLE CORE 53 CORED INTERVAL: 493.0-502.5 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: **Nannofossil Chalk**, pinkish gray (10YR 8/2) to light gray (5Y 7/2).

Minor Lithologies: **Calcareous Chalk** at Section 4 gradually passing upwards to **Nannofossil Chalk;** including many lithic angular pebbles and granules. **Diatomaceous Nannofossil Chalk** (Section 5), parallel laminated, showing interbedded light gray (dominant) white (minor) and grayish green (minor) color attenuation (thin).

SMEARS:

1-75, 2-75, 3-75, 4-113, 5-95 (Nannofossil Chalk)

Clay minerals	<5%	Nannofossils	85-93%
Volcanic glass	0- 2%	Radiolarians	0- 6%
Foraminfiers	0- 5%	Sponge spicules	0- 2%

4-35 (Calcareous Chalk)

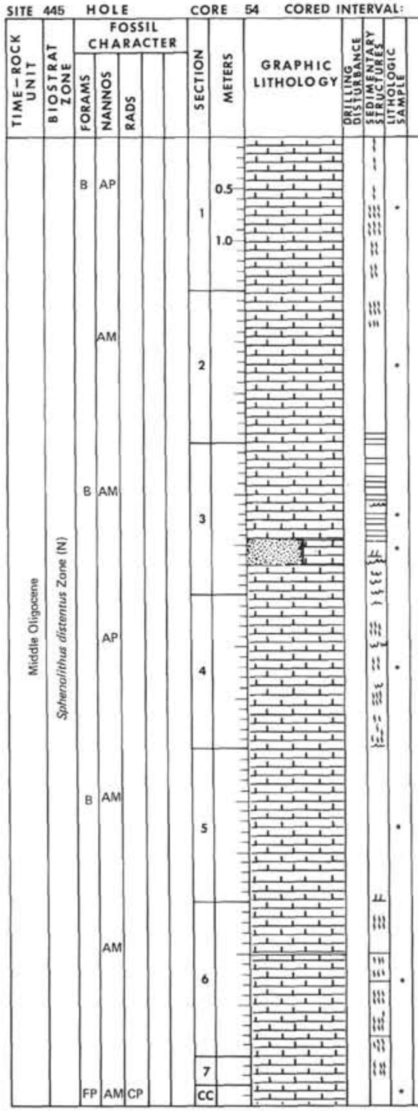
Clay minerals	<5%	Foraminifers	15%
Volcanic glass	2%	Nannofossils	8%
Carbonate unspecified	55%		

5-95 (Diatomaceous Nannofossil Chalk)

Clay minerals	<5%	Diatoms	20%
Volcanic glass	4%	Radiolarians	3%
Nannofossils	67%	Sponge spicules	5%

CARBON-CARBONATE:
1-70 (9.7, 0.0, 81)

SITE 445 HOLE CORE 54 CORED INTERVAL: 502.5-512.0 m



LITHOLOGIC DESCRIPTION

5Y 7/1

10R 8/1

7.5YR 8/3

7.5YR 7/2

7.5YR 8/2

5Y 8/2
to 7/2

5Y 7/2
to 8/2

7.5Y 8/2

7.5Y 8/2,
7/2

7.5Y 8/2

Dominant Lithology: Nannofossil Chalk, with dominant color of pinkish white (7.5YR 8/2) to pinkish gray (7.5YR 7/2) and white (5Y 8/2) to light gray (5Y 7/2).

Minor Lithologies: Calcareous Silty Sandstone, at base of parallel-laminated and micro-cross-laminated **Nannofossil Chalk** sequence (Section 3, 103-118 cm).

Sedimentary structures: No definite graded beds; parallel laminations, wavy laminations, and micro-cross-laminations; bioturbation locally intense.

SMEARS:
1-70, 2-75, 3-75, 4-75, 5-75, 6-75, CC (Nannofossil Chalk)

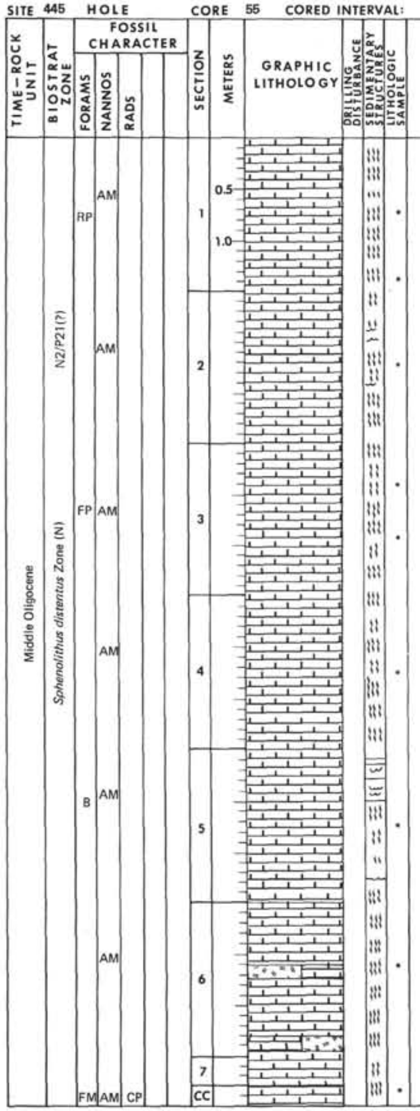
Clay minerals	TR- 5%	Diatoms	0- 2%
Foraminifers	0- 5%	Sponge spicules	1- 5%
Nannofossils	78-96%		

3-108 (Calcareous Silty Sandstone)

Sand	55%	Quartz, Feldspar	28%
Silt	40%	Clay minerals	4%
Clay	5%	Opaque minerals	15%
		Carbonate unspecified	20%
		Foraminifers	10%
		Nannofossils	5%

CARBON-CARBONATE:
1-61 (7.8, 0.0, 65)

SITE 445 HOLE CORE 55 CORED INTERVAL: 512.0-521.5 m



LITHOLOGIC DESCRIPTION

7.5YR 8/2
7.5YR 7/2

7.5YR 7/2

7.5Y 7/2
7.5YR 8/2

7.5YR 7/2
7.5YR 8/2

7.5YR 7/2
7.5YR 8/2

Dominant Lithology: intensely and extensely bioturbated **Nannofossil Chalk;** pinkish white (7.5YR 8/2) to pinkish gray (7.5YR 7/2); generally rich in siliceous remains.

Minor Lithologies: Vitric Nannofossil Chalk at Section 6 and **Nannofossil Tuff** at Section 6. Nannofossil tuff occurs as dark gray (10YR 5/1) thin, several layers of 1-10 cm thickness with definite bottom boundary throughout the section.

Sedimentary structures: except for some parts, it is very difficult to discriminate original stratification from nearly horizontal structure (wavy lamination-like); possibly resulting from intense bioturbation.

SMEARS:
1-75, 1-140, 2-75, 3-41, 3-95, 4-75, 5-75, CC (Nannofossil Chalk)

Clay minerals	TR- 5%	Diatoms	2- 8%
Volcanic glass	0- 1%	Radiolarians	0- 5%
Foraminifers	0- 1%	Sponge spicules	1- 5%
Nannofossils	70-95%		

6-134 (Vitric Nannofossil Chalk)

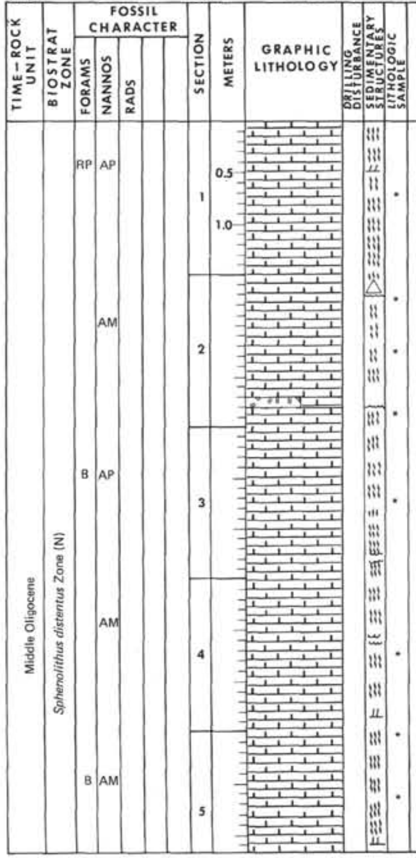
Sand	5%	Volcanic glass	<10%
Silt	60%	Nannofossils	60%
Clay	35%	Diatoms	2%
		Opaque minerals	8%

6-63 (Nannofossil Tuff)

Sand	5%	Clay minerals	3%
Silt	65%	Opaque minerals	5%
Clay	30%	Volcanic glass	54%
		Nannofossils	25%
		Diatoms	2%

CARBON-CARBONATE:
1-74 (9.6, 0.0, 80)

SITE 445 HOLE CORE 56 CORED INTERVAL: 521.5-531.0 m



7.5YR 8/2 to 7/2

7.5YR 7/2

7.5YR N4

7.5YR 7/2

7.5YR 7/2-8/2

10YR 7/1

LITHOLOGIC DESCRIPTION

Dominant Lithology: pinkish white (7.5YR 8/2) to pinkish gray (7.5YR 7/2) **Nannofossil Chalk.**

Minor Lithology: gray (7.5YR N6) **Nannofossil Tuff** interbed at Section 2, 122-132 cm.

Sedimentary structures: graded bed rarely occurs. Bioturbation* intensely developed, possibly resulting in destroying of original stratification.

*Including Chondrites, *Zoophycos*, rind burrows, and others.

SMEARS:
1-75, 2-25, 2-75, 3-75, 4-75, 5-9, 5-60 (Nannofossil Chalk)

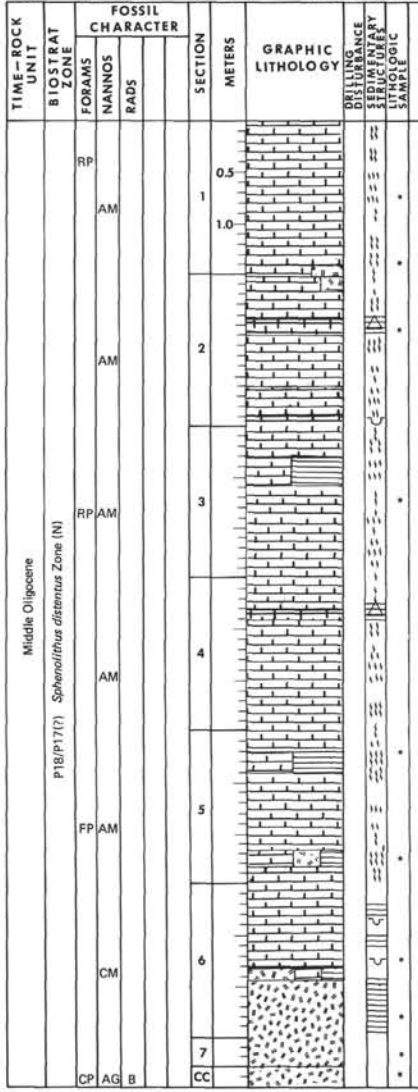
Clay minerals	TR- 5%	Nannofossils	61-92%
Opaque minerals	0-18%	Diatoms	2- 6%
Volcanic glass	0- 3%	Sponge spicules	1- 3%
Foraminiers	0- 2%	Radiolarians	0- 1%

2-132 (Nannofossil Tuff)

Sand	6%	Clay minerals	2%
Silt	74%	Volcanic glass	60%
Clay	20%	Foraminifers	1%
		Nannofossils	20%
		Diatoms	2%
		Sponge spicules	1%

CARBON-CARBONATE:
1-66 (8.5, 0.0, 70)

SITE 445 HOLE CORE 57 CORED INTERVAL: 531.0-540.5 m



5Y 7/1, 5Y 6/1

5Y 7/1, 5Y 5/1

5Y 7/1 to 5Y 6/1 to 5Y 5/1

5Y 5/1 to 4/1

5Y 7/1 to 5Y 5/1

5Y 7/1 to 5Y 4/1

LITHOLOGIC DESCRIPTION

Dominant Lithology: alternating light gray (5Y 7/1) **Nannofossil Chalk** and less amount of darker colored gray (5Y 5/1, N5) layers consisting of **Nannofossil Mudstone, Clayey Vitric Nannofossil Chalk, Nannofossil Tuff, etc.**
Tuffaceous layers are concentrated in Sections 5, 6, and CC.

Minor Lithology: Nannofossil-Foraminifera Chalk occurs at basal part of graded beds.

Sedimentary structures: bioturbation; intensity is episodic from mild to intense, but extensive. Graded beds occur at interval of about 3 meters.

SMEARS:
1-25, 3-75, 4-75 (Nannofossil Chalk)

Clay minerals	TR- 5%	Nannofossils	85-90%
Foraminifers	1- 5%	Sponge spicules	1%

1-140 (Vitric Nannofossil Chalk)

Sand	40%	Clay minerals	<5%
Silt	20%	Volcanic glass	25%
Clay	40%	Nannofossils	60%
		Sponge spicules	1%

2-55 (Nannofossil-Foraminifera Chalk)

Clay minerals	<5%	Nannofossils	35%
Foraminifers	40%	Sponge spicules	1%

5-20 (Nannofossil Mudstone)

Sand	15%	Quartz, Feldspar	10%
Silt	5%	Clay minerals	25%
Clay	80%	Opaque minerals	10%
		Volcanic glass	3%
		Nannofossils	39%

5-125 (Clayey Vitric Nannofossil Chalk)

Sand	40%	Clay minerals	15%
Silt	20%	Volcanic glass	30%
Clay	40%	Nannofossils	49%
		Diatoms	1%
		Sponge spicules	2%

6-85 (Clayey Nannofossil Tuff)

Sand	60%	Clay minerals	15%	Nannofossils	3%
Silt	20%	Volcanic glass	50%	Foraminifers	24%
Clay	20%				

6-135, 7-20 (Nannofossil Tuff)

Sand	40-70%	Clay minerals	< 5%	Foraminifers	3%
Silt	10-20%	Volcanic glass	64-65%	Nannofossils	20%
Clay	20-40%				

CC (Tuff)

Sand	93%	Volcanic glass	93%
Silt	3%	Foraminifers	3%
Clay	4%	Nannofossils	4%

CARBON-CARBONATE:
1-93 (9.2, 0.1, 76)

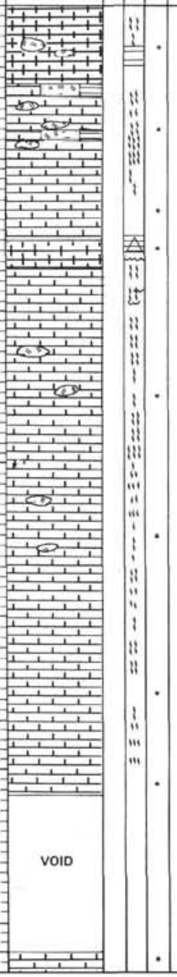
SITE 445 HOLE CORE 58 CORED INTERVAL: 540.5-550.0 m

TIME-ROCK UNIT: Lower or Lower Middle Oligocene

BIOSTRAT ZONE: *Helicosphaera reticulata* Zone or *Sphenolithus predistentus* Zone (N)

FOSSIL CHARACTER: FORAMS	NANNOS	RADS	SECTION
	AM		1
RP			
	AM		2
B?	AM		3
	AM		4
	AM		
RP			5
			6
			7
FP	AM	FP	CC

METERS 0.5 1.0



5Y 5/1 to 4/1

5Y 5/1

5Y 7/1 to 5Y 5/1

5Y 6/1 to 5/1

5Y 7/1

LITHOLOGIC DESCRIPTION

Dominant Lithology: Nannofossil Chalk with light gray (5Y 7/1) to gray (5Y 5/1) color, locally passing to **Foraminifera-Nannofossil Chalk** (Section 1); generally rich in volcanic ash grains throughout the core.

Minor Lithologies: Vitric Nannofossil Chalk interbeds and **Foraminifera-Nannofossil Marly Chalk.** The latter occurs at the basal part of graded bed (Section 2, 90-100 cm).

Sedimentary structures: graded bed is seen in Section 2. Most part of **Clayey Nannofossil Chalk** is intensely to mildly bioturbated and without original stratification.

Other structures: fault at Section 3, 75-80 cm, dipping about 45°

SMEARS:

2-50, 3-85, 4-75, 5-75, 6-15, CC (Nannofossil Chalk)

Clay minerals	0- 5%	Nannofossils	85-95%
VOlcanic glass	0- 2%	Diatoms	0- 5%
Foraminifera	1- 5%	Sponge spicules	0- 4%

1-42, 2-90 (Foraminifera-Nannofossil Chalk)

Clay minerals	0-TR%	Foraminifers	15-25%
Volcanic glass	1- 2%	Nannofossils	60-80%

1-125 (Vitric Nannofossil Marly Chalk)

Sand	30%	Clay minerals	20%
Silt	20%	Volcanic glass	30%
Clay	5%	Foraminifers	2%
		Nannofossils	31%

CARBON-CARBONATE:
2-55 (10.5, 0.0, 87)

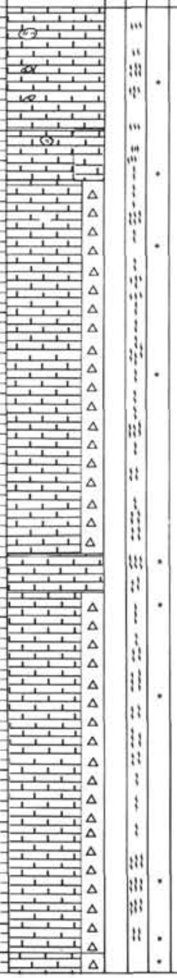
SITE 445 HOLE CORE 59 CORED INTERVAL: 550.0-559.5 m

TIME-ROCK UNIT: Lower or Lower Middle Oligocene; Upper Eocene

BIOSTRAT ZONE: *Thyrsocyrtis bromia* (R) P.17 Foraminifera Zone/*H. reticulata* Zone or *S. predistentus* Zone (N) P.18 Foraminifera Zone; *Isthmolithus recurvus* Subzone (N)

FOSSIL CHARACTER: FORAMS	NANNOS	RADS	SECTION
RP	AP		1
	AM		2
B	AP		3
	AP		4
	AP		5
	AP		6
			7
B	AP	CP	CC

METERS 0.5 1.0



5Y 7/1 to 5/1

7.5YR 7/3 to 6/2

7.5YR 7/2 to 4/2

7.5YR 6/1 to 7/1

7.5YR 7/2 to 4/2

10YR 6/2 to 7/2

LITHOLOGIC DESCRIPTION

Dominant Lithology: Section 1, 0 cm to Section 2, 20 cm **Nannofossil Chalk** (light gray – 5Y 7/1 to gray – 5Y 5/1). Section 2, 20 cm to CC **Siliceous Nannofossil Chalk** (pinkish gray – 7.5YR 7/2 to 6/2). Color change from 5Y series to 7.5YR series is gradual.

Minor Lithology: Clayey Nannofossil Chalk at Section 4, 95 cm.

Sedimentary structures: extensive to intense to mild bioturbation. Faint parallel laminations throughout the entire core.

SMEARS:

2-15, 2-85, 3-60, 4-140, 5-75, 6-110, 7-20, CC (Siliceous Nannofossil Chalk)

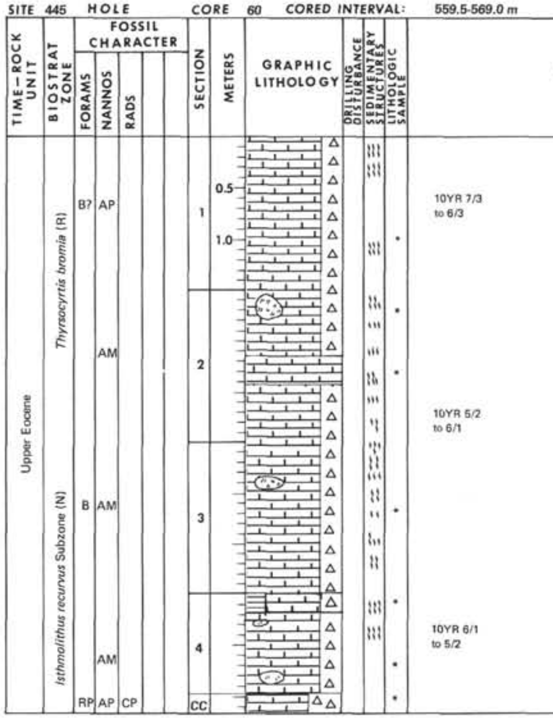
Sand	3-15%	Clay minerals	<5-10%
Silt	7-30%	Volcanic glass	1- 9%
Clay	60-86%	Nannofossils	54-75%
		Radiolarians	5- 8%
		Sponge spicules	3-15%

1-75, 4-95 (Nannofossil Chalk)

Sand	3- 4%	Clay minerals	<5%
Silt	12-16%	Volcanic glass	1- 3%
Clay	80-85%	Nannofossils	84-88%
		Radiolarians	TR
		Sponge spicules	2%

CARBON-CARBONATE:
2-17 (7.4, 0.0, 61)

SITE 445 HOLE CORE 60 CORED INTERVAL: 559.5-569.0 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: mottled pale brown (10YR 7/3, 10YR 6/3), light gray (10YR 7/2, 10YR 6/1) and dark grayish brown (10YR 5/2), hard **Siliceous Nannofossil Chalk**, with streaks or thin interbeds of **Radiolarian Nannofossil Mudstone** (Section 4).

Sedimentary structures: bioturbation throughout, slight to intense. Faint laminations (parallel) well developed throughout.

SMEARS:

1-100, 2-20, 3-70, 4-70, CC (Siliceous Nannofossil Chalk)

Clay minerals	< 5-10%	Radiolarians	4-10%
Volcanic glass	3- 5%	Sponge spicules	5-12%
Nannofossils	57-74%		

2-80 (Nannofossil Chalk)

Clay minerals	0%	Radiolarians	1%
Nannofossils	83%	Sponge spicules	5%

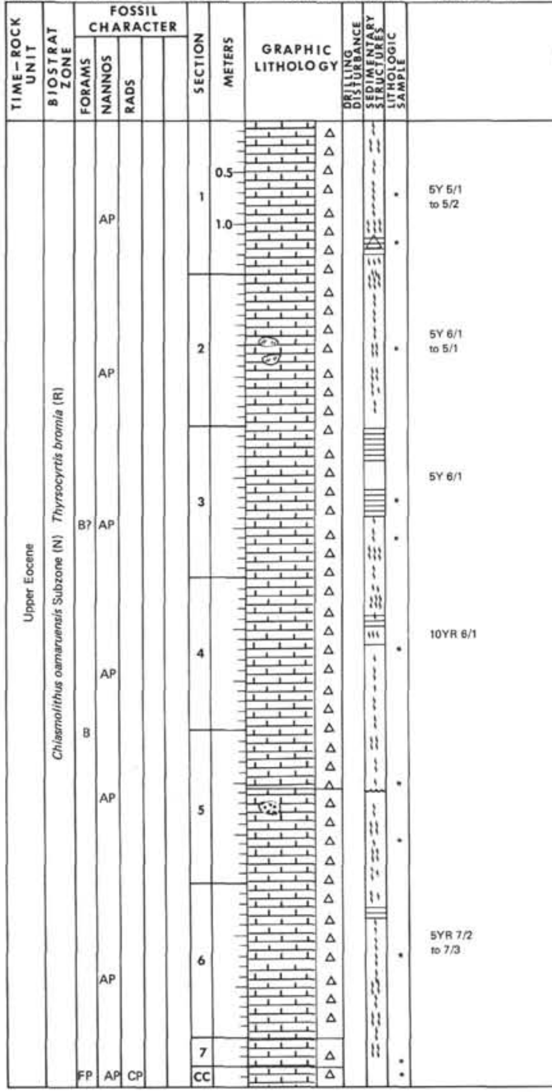
4-5 (Radiolarians Nannofossil Mudstone)

Sand	5%	Quartz, Feldspar	5%
Silt	10%	Clay minerals	15%
Clay	85%	Opaque minerals	15%
		Volcanic glass	5%
		Nannofossils	30%
		Radiolarians	15%
		Sponge spicules	5%

CARBON-CARBONATE:

2-67 (7.5, 0.0, 62)

SITE 445 HOLE CORE 61 CORED INTERVAL: 569.0-578.5 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: gray (5Y 5/1, 5Y 6/1), olive gray (5Y 5/2), light gray (5Y 7/1, rY 7/2) mottled hard **Siliceous Nannofossil Chalk**, with numerous dark siliceous streaks throughout. Local pumice pebbles. Siliceous remains (radiolarians, sponge spicules) up to 30%.

Sediment structures: extensive bioturbation, sometimes cutting the parallel bedding (laminae) off, sometimes being parallel with bedding.

SMEARS:

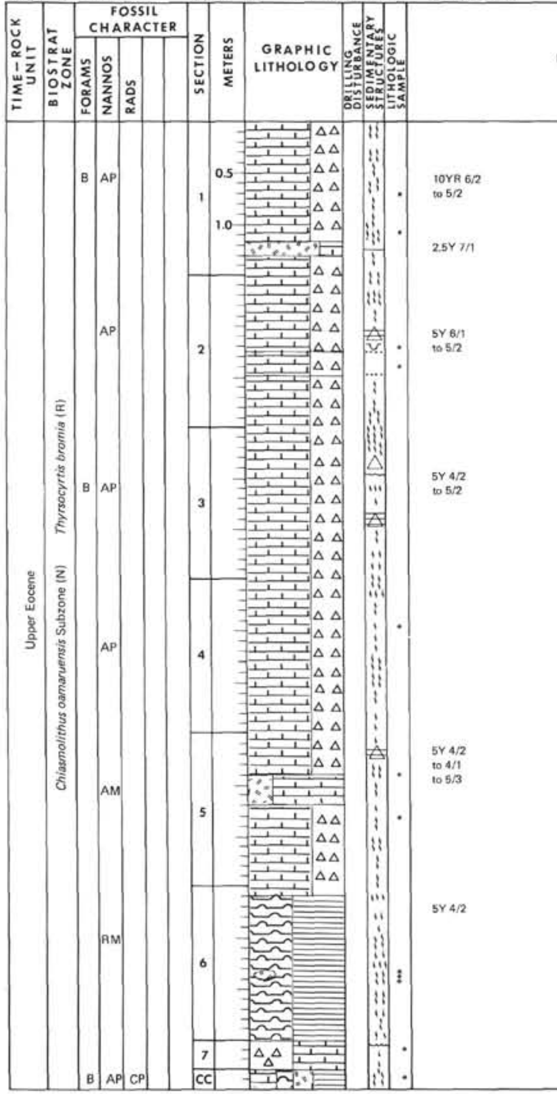
1-75, 1-120, 2-75, 3-75, 3-115, 4-75, 5-55, 5-105, 6-75, 7-35, CC (Siliceous Nannofossil Chalk)

Clay minerals	5-10%	Sponge spicules	3-15%
Volcanic glass	1- 5%	Carbonate unspecified	3-10%
Nannofossils	50-63%		
Radiolarians	7-20%		

CARBON-CARBONATE:

2-99 (5.8, 0.0, 48)

SITE 445 HOLE CORE 62 CORED INTERVAL: 578.5-588.0 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: Olive gray (5Y 4/2, 5Y 5/2) to gray (5Y 6/1) **Siliceous Nannofossil Marly Chalk and Siliceous Nannofossil Chalk** (Sections 1 to 5), olive gray (5Y 4/2) to dark olive gray (5Y 3/2) **Radiolarian Mudstone** (Section 6).

Minor Lithologies: light gray **Nannofossil Tuff** (hard volcanic ash) to **Nannofossil Tuff and Clayey Nannofossil Tuff,** in Section 1, 107-117 cm, Section 2, 80-98 cm, and Section 5, 35-65 cm. These beds are generally graded-bedded, and show a sharp contact at the bottom, a gradational contact at the top.

Sedimentary structures: extensive bioturbation throughout, generally moderate to intense, often parallel with bedding. Internal deformation (Section 5, 75 cm), siliceous streaks (Section 7, 5-20 cm). Some graded beds.

SMEARS:

1-75 (Siliceous Nannofossil Marly Chalk)

Sand	30%	Clay minerals	<10%
Silt	20%	Volcanic glass	2%
Clay	50%	Nannofossils	49%
		Radiolarians	20%
		Sponge spicules	7%

2-75, 2-90, 4-50, 5-85, 7-25 (Siliceous Nannofossil Chalk)

Clay minerals	< 5%	Radiolarians	10-25%
Volcanic glass	2- 5%	Sponge spicules	2- 5%
Nannofossils	50-73%		

1-110 (Nannofossil Tuff)

Sand	70%	Clay minerals	5%
Silt	10%	Volcanic glass	73%
Clay	20%	Nannofossils	20%
		Sponge spicules	TR

5-40 (Vitric Nannofossil Marly Chalk)

Sand	40%	Clay minerals	< 10%
Silt	20%	Opaque minerals	15%
Clay	40%	Volcanic glass	30%
		Nannofossils	49%
		Sponge spicules	1%

6-85, 6-90, 6-95 (Radiolarian Mudstone)

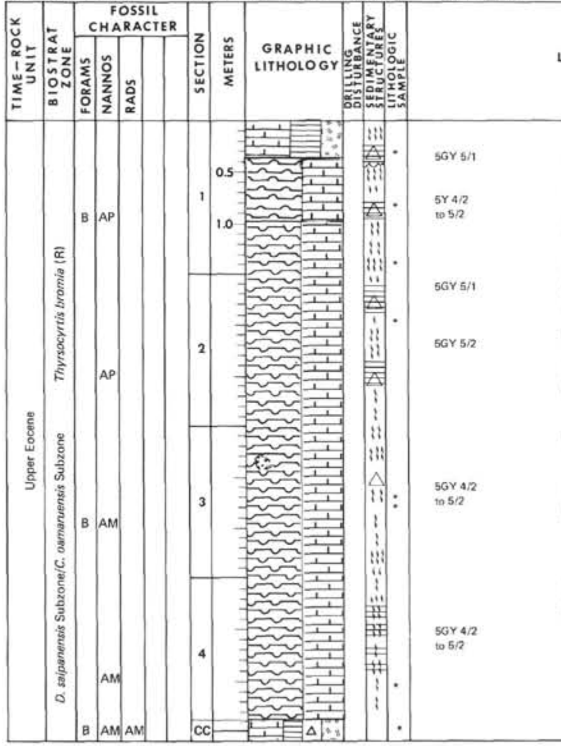
Sand	20%	Quartz, Feldspar	15-20%
Silt	10-20%	Clay minrals	20-45%
Clay	60-70%	Opaque minerals	15-20%
		Volcanic glass	3- 5%
		Nannofossils	1- 2%
		Radiolarians	10-40%
		Sponge spicules	5%

CC (Clayey Vitric Siliceous Nannofossil Marly Chalk)

Sand	25%	Clay minrals	15%
Silt	5%	Volcanic glass	20%
Clay	70%	Nannofossils	32%
		Radiolarians	10%
		Sponge spicules	10%

CARBON-CARBONATE:
2-61 (3.0, 0.0, 25)

SITE 445 HOLE CORE 63 CORED INTERVAL: 588.0-597.5 m



LITHOLOGIC DESCRIPTION

Lithology: Section 1, 0-90 cm: olive gray (5Y 4/2 to 5Y 5/2) hard **Clayey Vitric Nannofossil Marly Chalk and Radiolarians Nannofossil Chalk.**
Section 1, 90 cm – Section 4, 63 cm and CC: olive gray (5Y 4/2 to 5Y 5/2) hard **Nannofossil Radiolarite,** with **Clayey Vitric Siliceous Nannofossil Marly Chalk** in Core-Catcher.

Sedimentary structures: frequent parallel laminae, especially where graded-bed occurs. Graded-beds show normal grain size decrease upwards, sharp contact at bottom, gradational contact at top.

SMEARS:

1-135, 2-50, 3-75, 3-85, 4-105 (Nannofossil Radiolarite)

Clay minerals	0- 5%	Radiolarians	40-50%
Volcanic glass	1- 5%	Sponge spicules	5-15%
Nannofossils	18-29%		

1-87 (Radiolarian Nannofossil Chalk)

Clay minerals	5%	Radiolarians	20%
Nannofossils	58%	Sponge spicules	5%

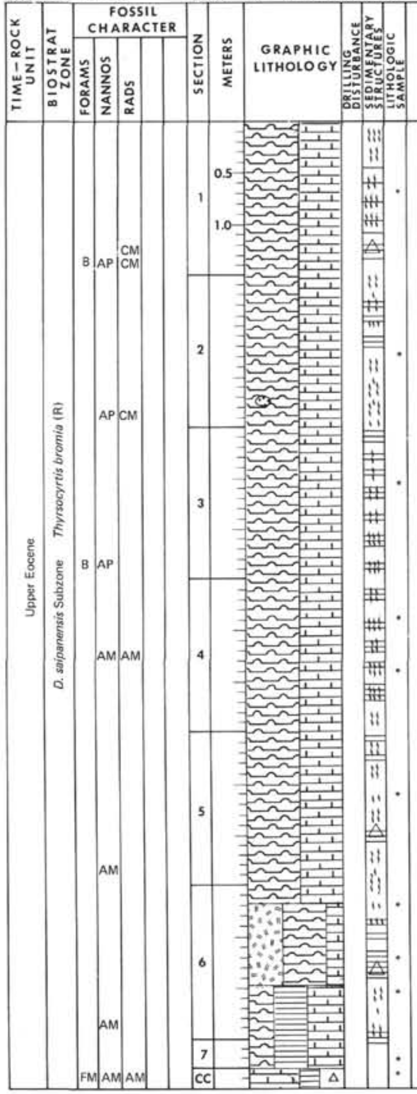
1-30 (Clayey Vitric Nannofossil Marly Chalk)

Sand	25%	Clay minerals	20%
Silt	25%	Voclanic glass	30%
Clay	50%	Nannofossils	39%
		Radiolarians	3%
		Sponge spicules	3%

CC (Clayey Vitric Siliceous Nannofossil Marly Chalk)

Sand	6%	Clay minerals	15%
Silt	40%	Volcanic glass	15%
Clay	90%	Nannofossils	26%
		Foraminifers	5%
		Radiolarians	15%
		Sponge spicules	15%

SITE 445 HOLE CORE 64 CORED INTERVAL: 597.5-607.0 m



LITHOLOGIC DESCRIPTION

5Y 4/2
to 5/2

5Y 10/2
to 5/2

5Y 5/2
5Y 6/3

10YR 8/3

10YR 8/3

10YR 6/4

Dominant Lithology: mottled olive gray (5Y 4/2, 5Y 5/2) to light yellowish brown (10YR 6/4) and yellowish brown (10YR 5/4), very hard no deformed **Nannofossil Radiolarite,** locally **Vitric** (Section 6). Numerous minor color changes throughout, related to silt layers and bioturbation.

Minor Lithology: Radiolarian Nannofossil Chalk at Core-Catcher.

Sedimentary structures: parallel horizontal laminae and moderate to intense bioturbation throughout. Silt/ash layers show normal graded beds. Note one mud-crack in Section 4, 122-126 cm.

SMEARS:
1-70, 2-80, 3-60, 4-40, 4-90, 5-65, 6-105, 7-35 (Nannofossil Radiolarite)

Clay minerals	<5-10%	Diatoms	0- 5%
Volcanic glass	1-10%	Radiolarians	35-60%
Nannofossils	11-28%	Sponge spicules	10-15%

6-20, 6-75 (Vitric Nannofossil Radiolarite)

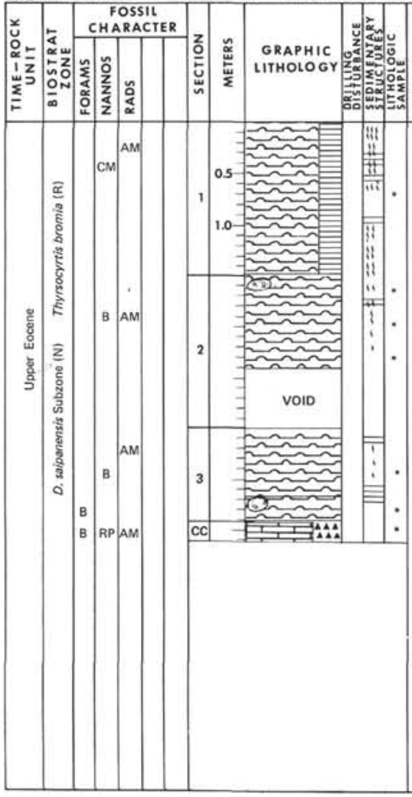
Sand	4-25%	Clay minerals	0- 5%
Silt	65-76%	Volcanic glass	37-40%
Clay	10-20%	Nannofossils	10-11%
		Diatoms	2- 5%
		Radiolarians	40%
		Sponge spicules	3- 5%

CC (Radiolarian Nannofossil Chalk)

Clay minerals	<5%	Nannofossils	65%
Volcanic glass	3%	Radiolarians	15%

CARBON-CARBONATE:
2-137 (2.6, 0.0, 22)

SITE 445 HOLE CORE 65 CORED INTERVAL: 607.0-616.5 m



LITHOLOGIC DESCRIPTION

2.5Y 6/4

5YR 4/4
to 7.5YR 3/2

10YR 5/4-6
7.5YR 4/4

Dominant Lithology: light yellowish brown (2.5Y 6/4) very fine, locally laminated hard sediment, with minor to intense bioturbation – **Radiolarite** (with clay or ash). The color progressively changes downwards as follows:
Section 1 = light yellowish brown (2.5Y 6/4), with lightening in homogeneous areas: light gray (2.5Y 7/2) darkening in bioturbated areas: grayish brown (2.5Y 5/2).
Section 2 = 0.20 cm light brownish gray (2.5Y 6/2) , 20-45 cm pale brown (10YR 6/3), 45-70 cm light yellowish brown (10YR 6/4), 70-90 cm brown (7.5Y 5/4).
Section 3 = 5-17 cm brown (7.5Y 5/4) and 11-56 cm reddish yellow (5YR 7/6).
Section 3, 56-67 cm shows alternating reddish brown (5YR 5/3) and very dark gray (5YR 3/1) laminations of radiolarite.

Minor Lithologies: Section 3, 67-90 cm as well as part of Core-Catcher, contain reddish brown (5YR 4/4) to dark brown (7.5YR 3/2) massive and very hard homogeneous **Chert and Siliceous Nannofossil Limestone.**

SMEARS:
2-50, 2-80, 3-50 (Radiolarite)

Clay minerals	< 5%	Radiolarians	69-71%
Volcanic glass	3- 5%	Sponge spicules	10-15%

1-85 (Clayey Radiolarite)

Sand	30%	Clay minerals	10%
Silt	50%	Volcanic glass	9%
Clay	20%	Radiolarians	60%
		Sponge spicules	15%

2-15, 3-83 (Vitric Radiolarite)

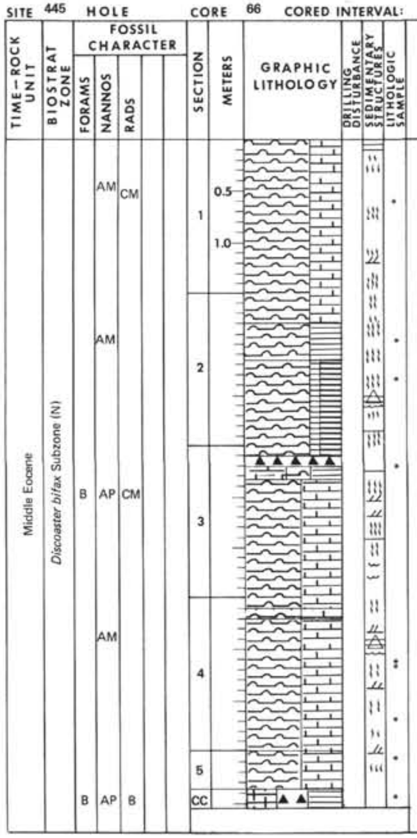
Sand	50%	Clay minerals	<5- 7%
Silt	40%	Volcanic glass	10-12%
Clay	10%	Radiolarians	60-64%
		Sponge spicules	15-20%

CC (Siliceous Nannofossil Limestone)

Sand	15%	Clay minerals	5%
Silt	25%	Volcanic glass	3%
Clay	60%	Nannofossils	60%
		Radiolarians	10%
		Sponge spicules	15%

CARBON-CARBONATE:
1-50 (2.7, 0.1, 22)

SITE 445 HOLE CORE 66 CORED INTERVAL: 616.5-626.0 m



LITHOLOGIC DESCRIPTION

7.5YR 5/4,
7.5YR 6/4,
7.5YR 7/2

7.5YR 5/4,
6/4, 7/2

10YR 5/3-4

7.5YR 5/4,
6/4, 7/2

7.5YR 5/4,
6/4, 7/2

Brown (7.5YR 5/4), light brown (7.5YR 6/4), pinkish gray (7.5YR 7/2) **Nannofossil Radiolarite,** associated with **Clayey Radiolarite** (Section 2), **Calcareous Radiolarite** (Section 3), **Clayey Calcareous Radiolarite** (Section 4), and **Siliceous Nannofossil Marly Limestone** (CC). Slight to intense bioturbation evidence, occasional normal graded beds (Section 2, 112 cm and Section 3, 58 cm) and micro-faulting (Section 1, 124 cm). Color changes are very frequent and rapid.
Chert in Section 3, 14-19 cm: weak red (10R 5/3-4), very hard and massive, finely laminated rock!

SMEARS:

1-60, 4-62, 4-66, 5-10 (Nannofossil Radiolarite)

Clay minerals	< 5%	Nannofossils	15-32%
Volcanic glass	1- 4%	Radiolarians	40-60%
Foraminifers	0- 4%	Sponge spicules	5-12%

2-50, 2-85 (Clayey Radiolarite)

Sand	20-35%	Clay minerals	15-16%
Silt	40-55%	Volcanic glass	1- 2%
Clay	10-40%	Nannofossils	1-10%
		Radiolarians	55%
		Sponge spicules	10%

3-26 (Calcareous Radiolarite)

Volcanic glass	3%	Nannofossils	10%
Carbonate unspecified	22%	Radiolarians	40%
Foraminifers	10%	Sponge spicules	5%

4-120 (Clayey Calcareous Radiolarite)

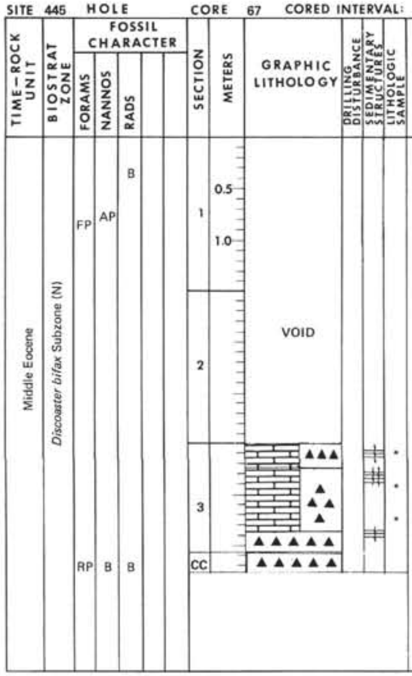
Sand	25%	Clay minerals	20%
Silt	55%	Carbonate unspecified	8%
Clay	20%	Nannofossils	5%
		Radiolarians	44%
		Sponge spicules	20%

CC (Siliceous Nannofossil Marly Limestone)

Sand	15%	Clay minerals	21%
Silt	25%	Volcanic glass	2%
Clay	50%	Nannofossils	35%
		Radiolarians	15%
		Sponge spciules	15%

CARBON-CARBONATE:
1-60 (5.0, 0.1, 41)

SITE 445 HOLE CORE 67 CORED INTERVAL: 626.0-635.5 m



LITHOLOGIC DESCRIPTION

5YR 6/3

5YR 6/3
to 5Y 5/2
2.5Y 6/2
5Y 4/2

Dominant Lithology: Section 1, 0-84 cm light reddish brown (5YR 6/3) to locally lighter or darker, well-lithified to very hard **Foraminifera-Nannofossil Chert, Radiolarian Foraminifera Limestone and Radiolarian Nannofossil Limestone.** Generally laminated; slight and local bioturbation.
Section 1, 84-104 cm light reddish brown (5YR 6/3), very dark grayish brown (10YR 3/2), olive gray (5Y 5/2), to dark olive gray (5Y 5/3), massive, very hard and homogeneous **Chert.**
Core-Catcher: light brownish gray (2.5Y 6/2) to olive gray (5Y 4/2) **Chert.**

SMEARS:

1-13 (Foraminifera-Nannofossil Chert)

Clay minerals	<5%	Radiolarians	36%
Foraminifers	15%	Sponge spicules	20%
Nannofossils	17%		

1-45 (Radiolarian Foraminifera Limestone

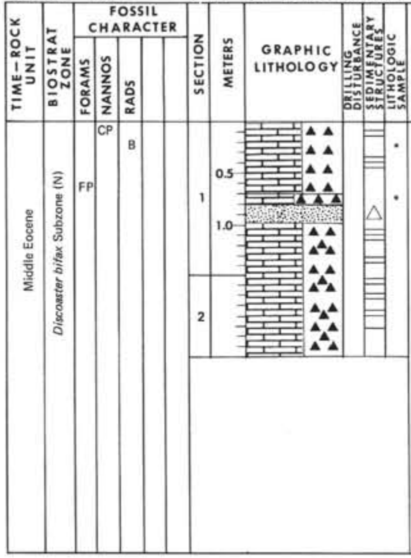
Sand	0%	Clay minerals	< 10%
Silt	5%	Foraminifers	51%
Clay	95%	Carbonate unspecified	20%
		Radiolarains	15%
		Sponge spicules	1%

1-75 (Radiolarian Nannofossil Limestone)

Sand	10%	Clay minerals	<10%
Silt	25%	Volcanic glass	2%
Clay	65%	Carbonate unspecified	20%
		Nannofossils	40%
		Radiolarians	20%
		Sponge spicules	3%

CARBON-CARBONATE:
1-70 (8.0, 0.1, 66)

SITE 445 HOLE CORE 68 CORED INTERVAL: 635.5-645.0 m



LITHOLOGIC DESCRIPTION

10YR 5/1

5Y 4/3

5GY 5/1

5GY 5/1

Highly colored, massive well-lithified, very hard, finely laminated chert-like rocks probably represented by **Nannofossil Limestone** (Section 1, 25 and 27 cm) and **Radiolarian Nannofossil Marly Limestone** (Section 1, 75 cm).
Main colors of limestone sequence are as follows: Section 1, 0-20 cm yellowish brown (10YR 5/4), 20-25 cm pale red (2.5Y 6/2), 29-45 cm grayish brown (2.5Y 5/2), 45-62 cm olive (5Y 4/3), 95-150 cm chiefly greenish gray (5GY 5/1).
Section 2: same variations, added with dark greenish gray (5GY 4/1).

SMEARS:

1-25, 1-27 (Nannofossil Limestone)

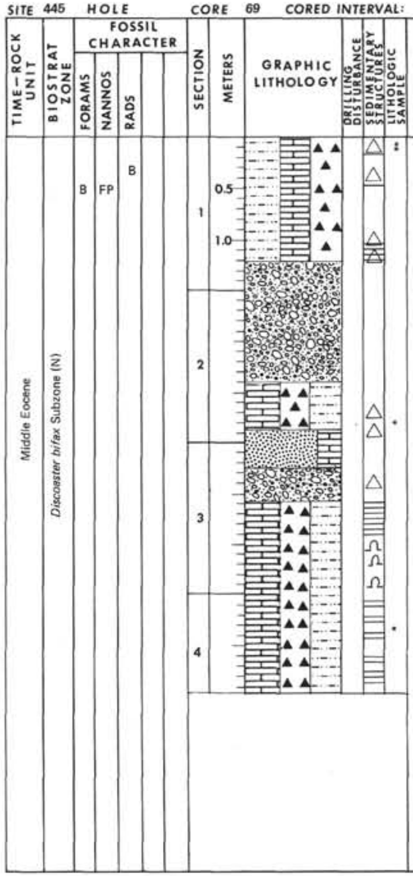
Quartz, Feldspar	4-10%	Nannofossils	41-72%
Clay minerals	< 10%	Radiolarians	0- 6%
Carbonate unspecified	5-25%		

1-75 (Radiolarian Nannofossil Marly Limestone)

Sand	30%	Quartz, Feldspar	<10%
Silt	50%	Clay minerals	<10%
Clay	20%	Carbonate unspecified	20%
		Foraminifers	5%
		Nannofossils	17%
		Radiolarians	25%

CARBON-CARBONATE:
1-17 (5.6, 0.0, 46)

SITE 445 HOLE CORE 69 CORED INTERVAL: 645.0-654.0 m



LITHOLOGIC DESCRIPTION

5GY 5/1

5GY 4/1

5GY 4/1

5GY 4/1

Varying Lithology:
Radiolarian Calcareous Mudstone and Chert (Section 1, 0-106 cm) greenish gray (5GY 5/1) to grayish green (5G 5/2) and dark greenish gray (5GY 4/1) alternating massive hard laminated chert and normal-graded **Silty Mudstone**. Mudstone is laminated and presents local micro-fault(12).
Lithic Conglomerate (Section 1, 106-150 cm, and Section 2, 0-92 cm) breccias subangular mixture of large **nummulites** (to 3 cm) and greenish, brownish, reddish and blackish rock fragments. White to dark greenish gray (5GY 4/1), changing.
Thin section: foraminifers, basalt, quartz, mica, mudstone, sandstone – matrix of nannofossils, foraminifers, clay, glauconite extensive, small cherty areas. Also in Section 3, 0-5 cm.
Radiolarian Nannofossil Marly Limestone to Calcareous Sandy Mudstone to Sandstone (Section 2, 92 cm to Section 3, 56 cm), dark greenish gray (5GY 4/1) fine to coarse, graded-bedded, irregularly laminated and interbedded sediment. Mudstone clasts and grain size increase toward bottom.
Radiolarian Nannofossil-Marly Limestone (Section 3, 56 cm to Section 4, 92 cm), greenish gray mudstone with laminae, conglomerate subangular pebbles, hard mudstone.

SMEARS:

1-11 (Radiolarian Calcareous Mudstone)

Sand	10%	Clay minerals	30%
Silt	20%	Volcanic glass	2%
Clay	70%	Carbonate	
		unspecified	15%
		Foraminifers	2%
		Nannofossils	10%
		Radiolarians	25%
		Sponge spicules	2%

1-12 (Radiolarian Mudstone)

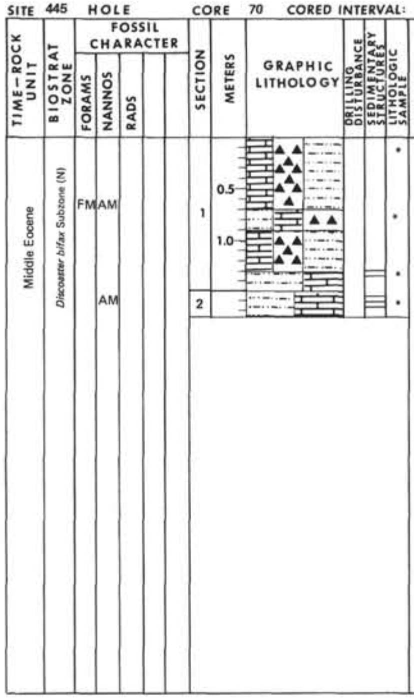
Sand	7%	Clay minerals	65%
Silt	15%	Volcanic glass	1%
Clay	78%	Radiolarians	25%

2-136, 4-35 (Radiolarian Nannofossil Marly Limestone)

Sand	5- 8%	Clay minerals	15-16%
Silt	15-28%	Carbonate	
Clay	70-80%	unspecified	20-28%
		Foraminfiers	3%
		Nannofossils	10-20%
		Radiolarians	30%

CARBON-CARBONATE:
1-77 (2.2, 0.0, 18)

SITE 445 HOLE CORE 70 CORED INTERVAL: 654.5-664.0 m



LITHOLOGIC DESCRIPTION

5GY 4/1

Dominant Lithology: Muddy Chert (Dominant) to Cherty Mudstone alternating with a **Calcareous Mudstone to Radiolarian Mudstone and Vitric Nannofossil Clayey Radiolarite.** Dominant color is dark greenish gray (5GY 4/1) for both chert and mudstone, but chert often shows color changes: dark reddish brown (5YR 3/2) in Section 1, 66-71 cm and 120-125 cm, dark gray (10YR 4/1) in Section 1, 125-144 cm, greenish gray (5GY 6/1) in Section 1, 144-150 cm. Lamination throughout, more abundant in mudstone.

SMEARS:

1-137, 2-10 (Calcareous Mudstone)

Sand	2-15%	Quartz, Feldspar	5-10%
Silt	9-25%	Clay minerals	31-52%
Clay	62-89%	Volcanic glass	5-10%
		Carbonate	
		unspecified	0-12%
		Nannofossils	5-40%
		Radiolarians	3%

1-137 = sandy mudstone

1-15 (Radiolarian Calcareous Mudstone)

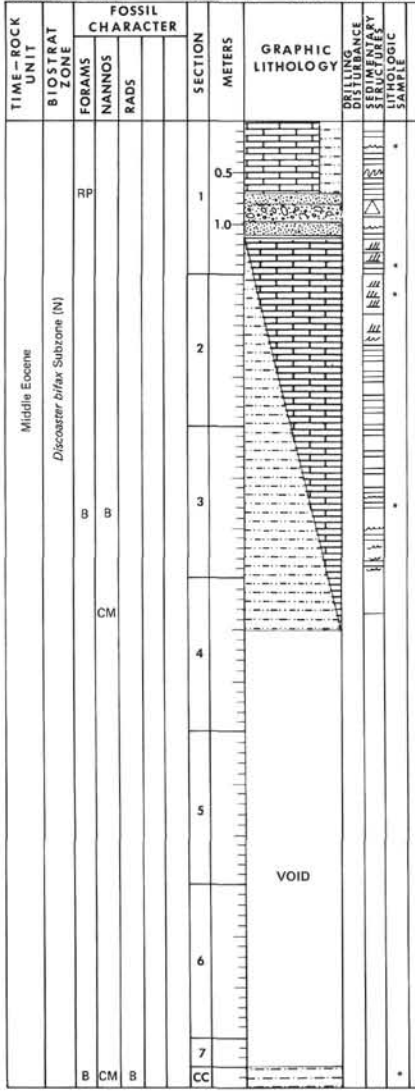
Sand	2%	Clay minerals	36%
Silt	13%	Carbonate	
Clay	85%	unspecified	20%
		Nannofossils	15%
		Diatoms	3%
		Radiolarians	20%
		Sponge spicules	1%

1-77 (Vitric Nannofossil Clayey Radiolarite)

Sand	8%	Clay minerals	16%
Silt	22%	Volcanic glass	13%
Clay	70%	Nannofossils	15%
		Radiolarians	40%

CARBON-CARBONATE:
1-62 (2.8, 0.1, 23)

SITE 445 HOLE CORE 71 CORED INTERVAL: 664.0-673.5 m



5G 5/1

5G 5/1

10R 3/1

5G 5/1

10R 3/1

LITHOLOGIC DESCRIPTION

Dominant Lithology: greenish gray (5G 5/1) often laminated **Muddy Nannofossil Limestone, Nannofossil Limestone, Mudstone, and Nannofossil Mudstone.** Distinction of lithologies difficult by visual observation.

Minor Lithologies: Section 1, 35-90 cm = **Mudstone** passing downward to a **Sandstone** and then a **conglomerate** with numerous nummulites tests (mostly broken) and blackish, greenish, dark gray mixed rock fragments (granules or small pebbles, subangular). 90-95 cm: very coarse **Sandstone.**
Section 2, 10-40 cm: dark reddish gray (10R 3/1) cherty mudstone. Also in Section 4, 0-35 cm.

Sedimentary structures: numerous parallel laminae throughout, with silty very faint layers. Graded bed in Section 1, 35-90 cm.

SMEARS:

3-80 (Nannofossil Mudstone)

Sand	1%	Quartz, Feldspar	5%
Silt	19%	Clay minerals	40%
Clay	80%	Nannofossils	24%
		Radiolarians	< 10%
		Heavy minerals, mica	4%

1-25 (Muddy Nannofossil Limestone)

Sand	5%	Clay minerals	15%
Silt	15%	Quartz, Feldspar	2%
Clay	80%	Volcanic glass	4%
		Foraminifers	2%
		Nannofossils	62%
		Diatoms	4%
		Heavy minerals, mica	17%

1-145 (Nannofossil Limestone)

Sand	4%	Clay minerals	<10%
Silt	15%	Nannofossils	73%
Clay	81%	Diatoms	2%
		Quartz, Feldspar	3%

2-20 (Mudstone)

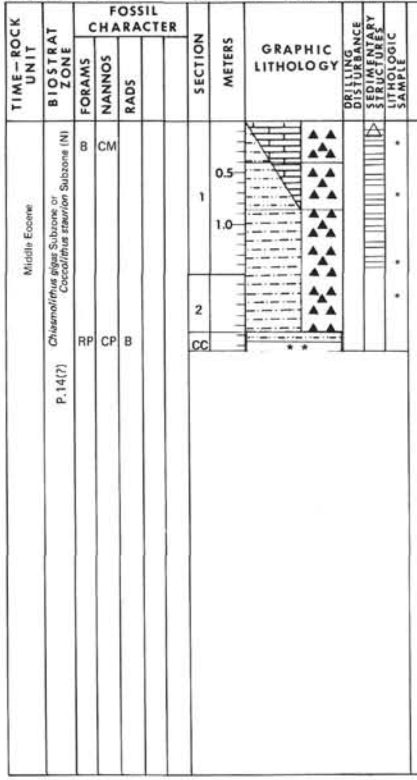
Sand	1%	Clay minerals	69%
Silt	15%	Nannofossils	<10%
Clay	84%	Radiolarians	<10%
		Heavy minerals, mica	3%
		Quartz, Feldspar	3%

CC (Silty Sandstone)

Sand	60%	Quartz, Feldspar	30%
Silt	30%	Clay minerals	28%
Clay	10%	Opaque minerals	10%
		Heavy minerals, mica	15%
		Carbonate unspecified	10%
		Foraminifers	2%
		Nannofossils	3%
		Radiolarians	2%

CARBON-CARBONATE:
1-124 (3.5, 0.1, 28)

SITE 445 HOLE CORE 72 CORED INTERVAL: 673.5-683.0 m



5G 5/1

10R 3/1

5G 5/1

5G 5/1

Undetermined hard rock pieces.

LITHOLOGIC DESCRIPTION

Dominant Lithology: greenish gray (5G 5/1) well laminated, well lithified **Radiolarian Nannofossil Marly Limestone, Nannofossil Radiolarian Mudstone, and Radiolarian Sandy Mudstone.**

Sedimentary structures: parallel laminae throughout, Section 1.

SMEARS:

1-25 (Radiolarian Nannofossil Marly Limestone)

Sand	1%	Quartz, Feldspar	7%
Silt	24%	Clay minerals	10%
Clay	75%	Heavy minerals, mica	6%
		Opaque minerals	5%
		Volcanic glass	6%
		Foraminifers	2%
		Nannofossils	34%
		Diatoms	4%
		Radiolarians	15%

1-75 (Nannofossil Radiolarian Mudstone)

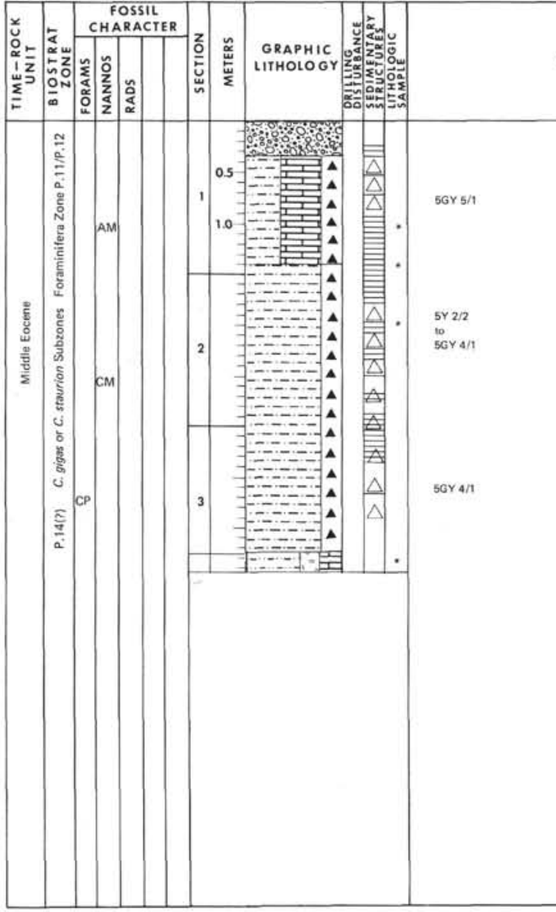
Sand	3%	Quartz, Feldspar	6%
Silt	46%	Clay minerals	15%
Clay	51%	Heavy minerals, mica	3%
		Opaque minerals	15%
		Volcanic glass	2%
		Nannofossils	15%
		Diatoms	2%
		Radiolarians	40%

1-142, 2-25 (Radiolarian Sandy Mudstone)

Sand	10%	Quartz, Feldspar	15-25%
Silt	40%	Clay minerals	20%
Clay	50%	Heavy minerals, mica	5%
		Opaque minerals	10%
		Nannofossils	4%
		Radiolarians	30-40%

CARBON-CARBONATE:
1-21 (3.9, 0.1, 32)

SITE 445 HOLE CORE 73 CORED INTERVAL: 683.0-692.5 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: greenish gray (5GY 4/1) irregularly alternating **Sandy Mud and Sandy Siltstone**, with numerous minor color changes into black (5Y 2/2).

Minor Lithologies: Section 1, 0-37 cm, mainly dark greenish gray (5G 4/1) **Congomerate** with whitish more or less broken nummulites, and a mixture of greenish gray, greenish, blackish brownish rock fragments.
Section 1, 37-150 cm: **Mudstone to Calcareous Mudstone** (5GY 5/1 changing to 2.5YR 2/2 at 141-150 cm.

Sedimentary structures: parallel laminae throughout, except in the very coarse layers.
Normal graded beds throughout.
Lenticular bedding in Section 2, 80-90 cm.
Silt dike in Section 2, 56-60 cm.

SMEARS:
1-145, 2-55 (Radiolarian Sandy Mudstone)

Sand	10-20%	Quartz, Feldspar	18-25%
Silt	40-55%	Clay minerals	17-33%
Clay	25-50%	Heavy minerals, mica	11-15%
		Opaque minerals	20-25%
		Nannofossils	3- 4%
		Radiolarians	10-15%

1-103 (Radiolarian Nannofossil Sandy Mudstone)

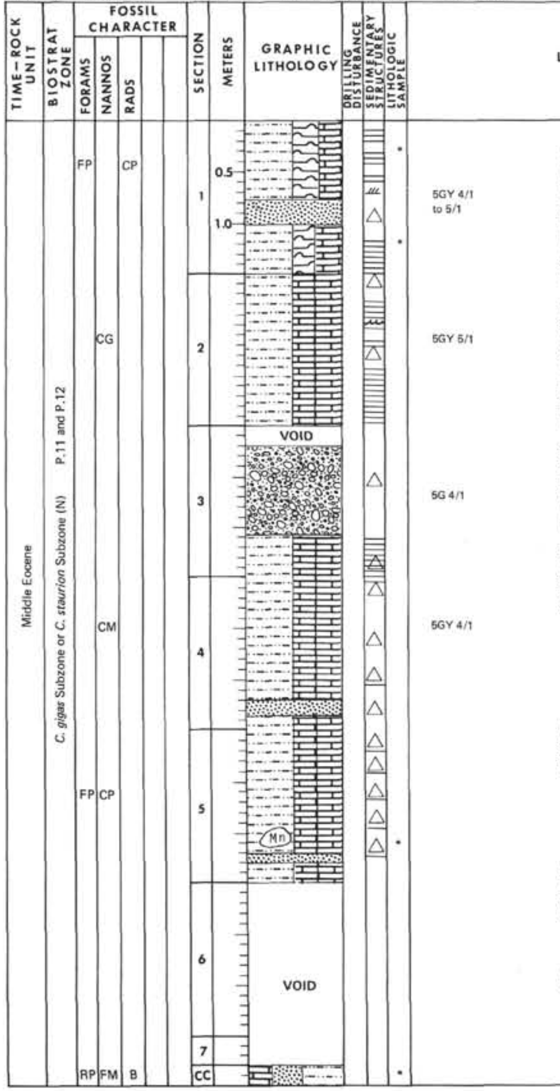
Sand	15%	Quartz, Feldspar	20%
Silt	25%	Clay minerals	10%
Clay	60%	Heavy minerals, mica	10%
		Opaque minerals	5%
		Foraminifers	3%
		Nannofossils	40%
		Radiolarians	10%
		Glauconite	TR

CC (Vitric Calcareous Sandy Mudstone)

Sand	20%	Quartz, Feldspar	8%
Silt	30%	Clay minerals	45%
Clay	50%	Heavy minerals, mica	8%
		Opaque minerals	3%
		Volcanic glass	15%
		Foraminifers	3%
		Nannofossils	5%
		Radiolarians	5%

CARBON-CARBONATE:
2-94 (1.8, 0.1, 14)

SITE 445 HOLE CORE 74 CORED INTERVAL: 692.5-702.0 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: dark greenish gray (5GY 5/1) finely alteranting **Nannofossil Marly Limestone and Nannofossil Mudstone** associated with **Nannofossil Radiolarian Sandy Mudstone** in Section 1, with local dark reddish brown (5YR 2/2) interbeds (Section 1, 143-150 cm). Frequent silty thin layers, with color lightening (5GY 6/1) or darkening (5GY 4/1). Where lightening, aspect of salt and pepper **Siltstone to Sandstone. Nannofossil Marly Limestone** (CC) with 1% glauconite.

Minor Lithology:
Section 1, 90-100 cm: **Coarse Sandstone** with large nummulites and various rock fragments.
Section 3, 19-107 cm: graded-bedded **Conglomerate** with large broken nummulites and various blackish, dark greenish, brownish, dark reddish , rock fragments.
Section 4, 125-138 cm and Section 5, 120-126 cm, and upper half of CC thin layers of coarse sandstone with various rock fragments.

Sedimentary structures: frequent bioturbation in Section 4, 85 cm. Numerous parallel laminae in Sections 1 and 2. Microfault in Section 1 at 28 and 35 cm. Graded beds throughout, increasing in Sections 4 and 5. Lenticular bedding in Section 2, 47-50 cm. Cross-bedding in Section 1, 55 cm and Section 3, 135 cm.

SMEARS:
1-120, CC (Nannofossil Marly Limestone)

Sand	5-12%	Quartz, Feldspar	3- 6%
Silt	20-50%	Clay minerals	12-18%
Clay	17-68%	Heavy minerals, mica	5-12%
		Opaque minerals	2- 3%
		Nannofossils	40-44%
		Radiolarians	7-10%
		Glauconite (CC)	1%

1-30 (Nannofossil Radiolarian Sandy Mudstone)

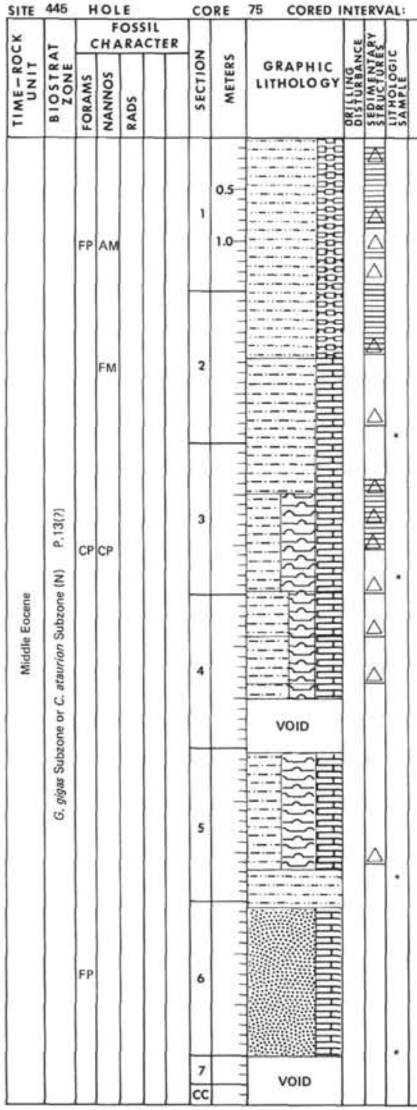
Sand	30%	Quartz, Feldspar	10%
Silt	40%	Clay minerals	30%
Clay	40%	Heavy minerals, mica	15%
		Opaque minerals	5%
		Nannofossils	15%
		Radiolarians	20%

5-110 (Nannofossil Mudstone)

Sand	7%	Quartz, Feldspar	3%
Silt	30%	Clay minerals	40%
Clay	63%	Heavy minerals, mica	3%
		Nannofossils	28%
		Radiolarians	5%

CARBON-CARBONATE:
2-89 (4.3, 0.1, 35)

SITE 445 HOLE CORE 75 CORED INTERVAL: 702.0-711.5 m



5GY 6/1

5GY 4/1

N4

N4

LITHOLOGIC DESCRIPTION

Dominant Lithology: dark greenish gray (5GY 4/1) to gray (N5) **Calcareous Sandy Mudstone, Radiolarian Nannofossil Marly Limestone, and Radiolarian Nannofossil Mudstone** in Sections 1 to 5; **Calcareous Sandstone** in Section 6. Generally color darkening in silty layers and lightening (salt and pepper) in sandy layers (carbonates). Continuous alternating sequence, locally passing to a **Calcareous Mudstone** with silty layers (Section 1, Section 2 top, Section 3, base). **Calcareous Sandy Mudstone** (Section 2, 145 cm) with TR% glauconite.

Sedimentary structures:
Graded beds throughout Sections 1 to 4 with many minor graded sequences within layer sequences 5-10 cm thick, in the calcareous mudstone. Laminations throughout Sections 1 to 4 (silty layers, clay layers). Microfaults, scour features in Section 2 and 3. Minor bioturbation in Sections 1 and 3. Rounded clay clasts, dark greenish gray, in Sections 5 and 6.

SMEARS:

2-145 (Calcareous Sandy Mudstone)

Sand	15%	Quartz, Feldspar	10%
Silt	40%	Clay minerals	36%
Clay	25%	Heavy minerals, mica	9%
		Opaque minerals	10%
		Foraminifers	5%
		Nannofossils	10%
		Radiolarians	5%
		Glauconite	TR

3-133 (Radiolarian Nannofossil Marly Limestone)

Sand	5%	Quartz, Feldspar	5%
Silt	20%	Clay minerals	10%
Clay	75%	Heavy minerals, mica	2%
		Opaque minerals	5%
		Carbonate unspecified	10%
		Nannofossils	44%
		Radiolarians	20%

5-125 (Radiolarian Nannofossil Mudstone)

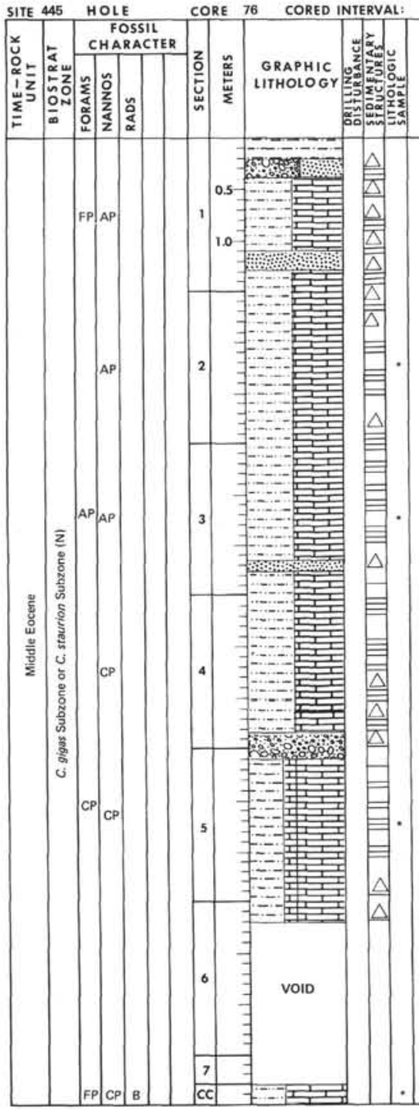
Sand	5%	Quartz, Feldspar	3%
Silt	15%	Clay minerals	33%
Clay	80%	Heavy minerals, mica	5%
		Opaque minerals	5%
		Volcanic glass	7%
		Nannofossils	20%
		Radiolarians	10%
		Sponge spicules	5%

6-150 (Calcareous Sandstone)

Sand	70%	Quartz, Feldspar	20%	Carbonate unspecified	7%
Silt	20%	Clay minerals	2%	Foraminifers	9%
Clay	10%	Heavy minerals, mica	10%		
		Opaque minerals and lithic fragments	50%		

CARBON-CARBONATE:
2-90 (2.4, 0.1, 19)

SITE 445 HOLE CORE 76 CORED INTERVAL: 711.5-721.0 m



5GY 4/1

5G 4/1

5GY 4/1

5GY 4/1

LITHOLOGIC DESCRIPTION

Dominant Lithology: finely alternating **Nannofossil Mudstone–Nannofossil Sandy Mudstone and Nannofossil Limestone–Nannofossil Marly Limestone;** dominantly dark greenish gray (5GY 4/1), forming fine color band alternation of darker and lighter throughout; large grading upward sequences enclosing smaller sequences. Some **Sand** layers with color lightening (carbonates) = light gray. Nannofossil limestone and nannofossil sandy mudstone with TR-1% glauconite (3-75, 5-75).
Minor Lithologies: Section 1, 0-36 cm and 110-130 cm, coarse gravelly **Sandstone** grading upward into fine **Sandstone/Siltstone,** with foraminifers and grayish green clay clasts. Color dark (N5) salt and pepper.
Section 5, 0-5 cm, **Foraminiferal Lithic Conglomerate,** with both round and angular clasts (nummulites, limestone, sandstone, mudstone, basalt(?), quartz, glauconite).

Sedimentary structure: parallel laminae throughout. Graded beds mainly in Sections 1, 2, 4, and 5 base. Minor bioturbation in Sections 1, 2, 4 and 5. Clay clasts in Section 1, 110-130 cm. Changes in deformation direction in Section 1 ↖ 10° to 5° ↗, Section 2 10° ↗. Section 3 5° ↗ to ↖ 5°, Section 5 ↖ 5° to 5° ↗.

SMEARS:

2-75 (Nannofossil Mudstone)

Sand	5%	Quartz, Feldspar	13%	Volcanic glass	2%
Silt	10%	Clay minerals	45%	Carbonate unspecified	10%
Clay	85%	Opaque minerals	5%	Nannofossils	31%
		Heavy minerals, mica	3%		

5-75 (Nannofossil Sandy Mudstone)

Sand	15%	Quartz, Feldspar	7%	Foraminifers	5%
Silt	15%	Clay minerals	25%	Nannofossils	30%
Clay	70%	Opaque minerals	3%	Radiolarians	10%
		Heavy minerals, mica	13%	Glauconite	1%
		Carbonate unspecified	16%		

3-75 (Nannofossil Limestone)

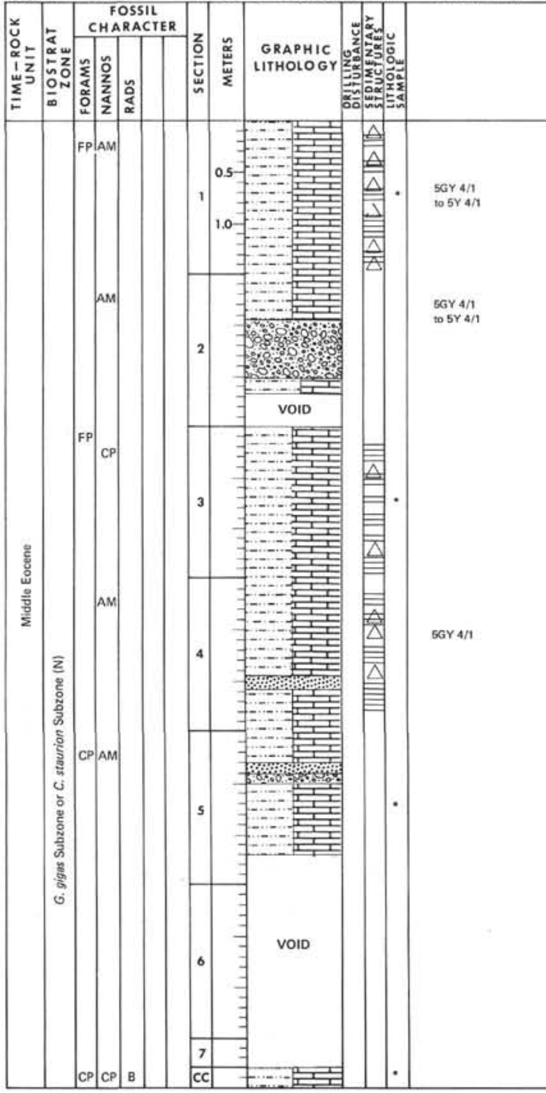
Sand	5%	Clay minerals	<10%	Foraminifers	<5%
Silt	15%	Quartz, Feldspar	5%	Nannofossils	61%
Clay	80%	Opaque minerals	5%	Radiolarians	<10%
		Heavy minerals, mica	4%	Glauconite	TR

CC (Nannofossil Marly Limestone)

Sand	10%	Quartz, Feldspar	5%
Silt	30%	Clay minerals	<10%
Clay	60%	Opaque minerals	1%
		Heavy minerals, mica	10%
		Nannofossils	43%
		Radiolarians	7%

CARBON-CARBONATE:
2-74 (2.8, 0.1, 23)

SITE 445 HOLE CORE 77 CORED INTERVAL: 721.0-730.5 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: dominantly greenish gray (5GY 4/1), hard, laminated; finely alternating **Radiolarian Nannofossil Marly Limestone–Nannofossil Limestone** (lighter colored) and **Nannofossil Mudstone** (darker colored); glauconite 1%.

Minor Lithologies: Section 2, 43-98 cm (also Section 4, 100-105 cm, Section 5, 40-88 cm) **Lithic Conglomerate,** grading upward into sand with mudstone laminations. Presence of numerous white Nummulites, clay, chert, rock clasts, round to angular pumice fragments, basalt. Foraminifera fragments sometimes unfilled with glauconite. **Thin Sandstone** layers (Sections 4 and 5).

Sedimentary structures: laminae throughout Sections 1, 2 (top), 3 and 4, together with graded beds. Changes in deformation direction in Section 1, 0-90 cm ↙ 5°, Section 1, 90 to 150 cm 5° ↗, Section 4, 100 cm ↙ 5°, Section 5, 30 cm — 5° ↙. Evidence of irregular laminations, lenses, stringers, clasts, rip-up and other current figures. Minor and local bioturbation.

SMEARS:

1-75, 3-75 (Radiolarian Nannofossil Marly Limestone)

Sand	5%	Quartz, Feldspar	3- 5%
Silt	15%	Clay minerals	<10%
Clay	80%	Opaque minerals	5%
		Heavy minerals, mica	3%
		Nannofossils	46-51%
		Radiolarians	20%
		Glauconite	1%

5-75 (Nannofossil Limestone)

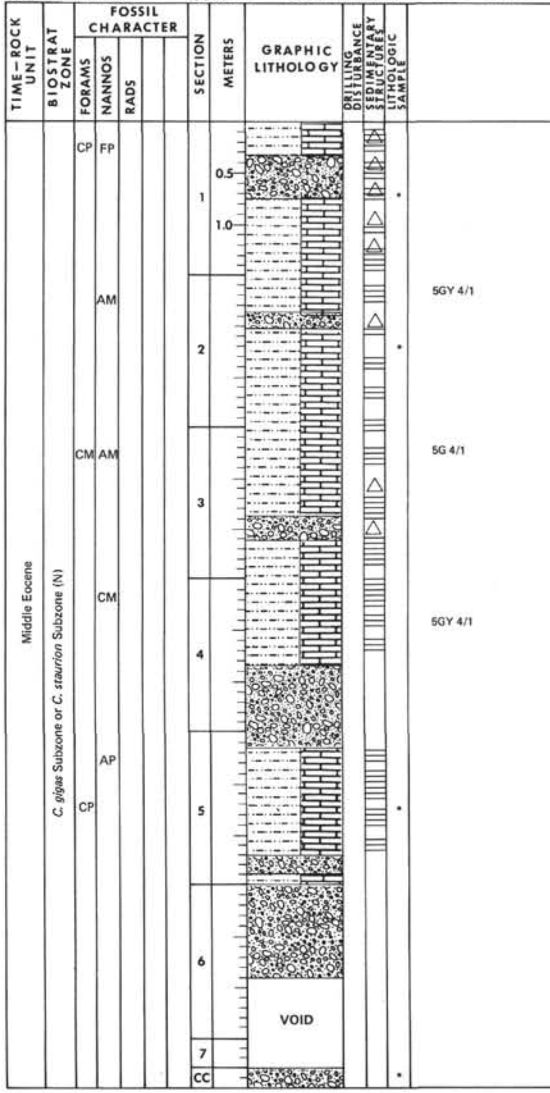
Sand	5%	Quartz, Feldspar	3%
Silt	10%	Clay minerals	<10%
Clay	85%	Opaque minerals	3%
		Heavy minerals, mica	8%
		Nannofossils	66%
		Foraminifers	5%
		Glauconite	1%

CC (Nannofossil Mudstone)

Sand	5%	Quartz, Feldspar	3%
Silt	15%	Clay minerals	40%
Clay	80%	Opaque minerals	2%
		Heavy minerals, mica	1%
		Nannofossils	37%
		Foraminifers	5%
		Glauconite	1%

CARBON-CARBONATE:
2-23 (3.7, 0.1, 30)

SITE 445 HOLE CORE 78 CORED INTERVAL: 730.5-740.0 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: massive, hard, laminated, dark greenish gray (5GY 4/1 to 5G 4/1) silty **Nannofossil Mudstone.** Carbonates are chiefly nannofossils tests, local lightening, darkening; dark bluish gray (5B 4/1) at Section 1, 65-73 cm, with glauconite (up to 1%). Numerous laminations, whitish coarser sandy stringers, lenses, slight to no biotrubations. Some graded beds, current ripples, clasts. Chiefly horizontal laminae.

Minor Lithology: In Sections 1, 2, 3, 4, 5, and 6, presence of **Conglomerate** layers, sometimes graded with numerous white nummulites, claystone clasts, more or less abundant glauconite and various rock fragments (chert, sandstone, mudstone, igneous rocks, etc.).

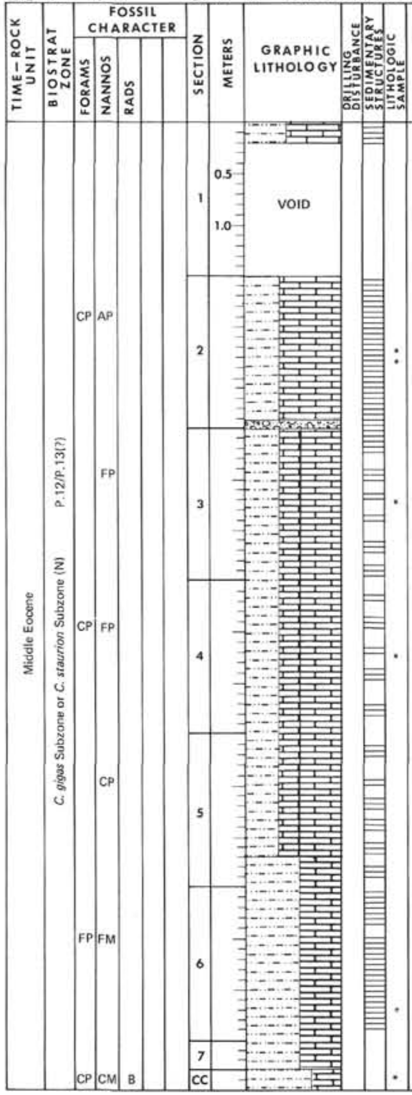
SMEARS:

1-75, 2-75, 5-75 (Nannofossil Mudstone)

Sand	5%	Quartz, Feldspar	2- 5%
Silt	10-15%	Clay minerals	20-65%
Clay	75-85%	Opaque minerals	0- 5%
		Heavy minerals, mica	2- 6%
		Nannofossils	20-50%
		Foraminifers	TR- 5%
		Glauconite (5-75)	1%

CARBON-CARBONATE:
2-18 (3.9, 0.1, 32)

SITE 445 HOLE CORE 79 CORED INTERVAL: 740.0-749.5 m



LITHOLOGIC DESCRIPTION

5GY 4/1

5G 4/1

5GY 4/1

5G 4/4

7.5YR N/3

Dominant Lithology: dominantly dark greenish gray (5GY 4/1); finely alternating, laminated **Nannofossil Limestone** (lighter) and **Nannofossil Mudstone** (darker), with coarser grained white **Limestone** (foraminifera-rich) (Sections 1 to 5); rather massive darker colored **Nannofossil Mudstone** (Sections 6 and 7, CC); all the sediments with 1% glauconite, sharp lower boundaries often gradational upwards. Evidence of soft sediment deformation and moderate/minor bioturbation. Current scours at base of coarse units, sometimes rip-up clasts, clay clasts, laminations throughout.

Minor Lithology: Section 2, 145-150 cm = **Conglomerate** grading upward to sand. Red and black mudstone chunks and several other kinds of lithic fragments.

SMEARS:

2-75, 3-75 (Nannofossil Limestone)

Quartz, Feldspar	2- 3%	Nannofossils	60-70%
Clay minerals	10-17%	Glauconite	1%
Opaque minerals	2- 5%		
Heavy minerals, mica	5%		

2-95 (Limestone)

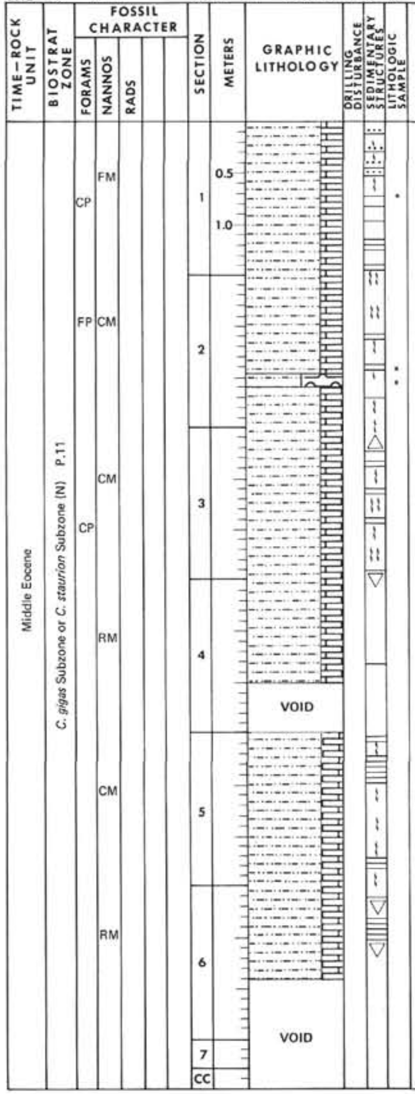
Quartz, Feldspar	1%	Carbonate unspecified	67%
Clay minerals	10%	Foraminifers	20%
Opaque minerals	1%	Glauconite	1%
Heavy minerals, mica	TR		

4-75, 6-120, CC (Nannofossil Mudstone)

Sand	3-10%	Quartz, Feldspar	2-15%
Silt	7-15%	Clay minerals	10-40%
Clay	75-90%	Opaque minerals	5-10%
		Heavy minerals, mica	1- 5%
		Foraminifers	3- 5%
		Nannofossils	25-40%
		Glauconite (6-120, CC)	1%

CARBON-CARBONATE:
3-46 (1.7, 0.1, 13)

SITE 445 HOLE CORE 80 CORED INTERVAL: 749.0-749.5 m



LITHOLOGIC DESCRIPTION

5GY 5/1

10R 2/2

5GY 4/1,
5G 4/1,
5B 4/1

Dominant Lithology: dark greenish gray (5G 4/1 to 5G 4/1) nannofossils rich **Mudstone, Sandy Mudstone** with numerous silt layers and laminations throughout , glauconite streaks.

Silt layers generally show a sharp contact at base, and a gradational one upwards. Sequence and structure identical to Core 79. Some lenses, clay streaks, carbonate-rich sediment streaks; generally normal graded beds, but sometimes intense (Section 3, 145 cm, Section 6, 25 and 53 cm). Bioturbation minor to moderate.

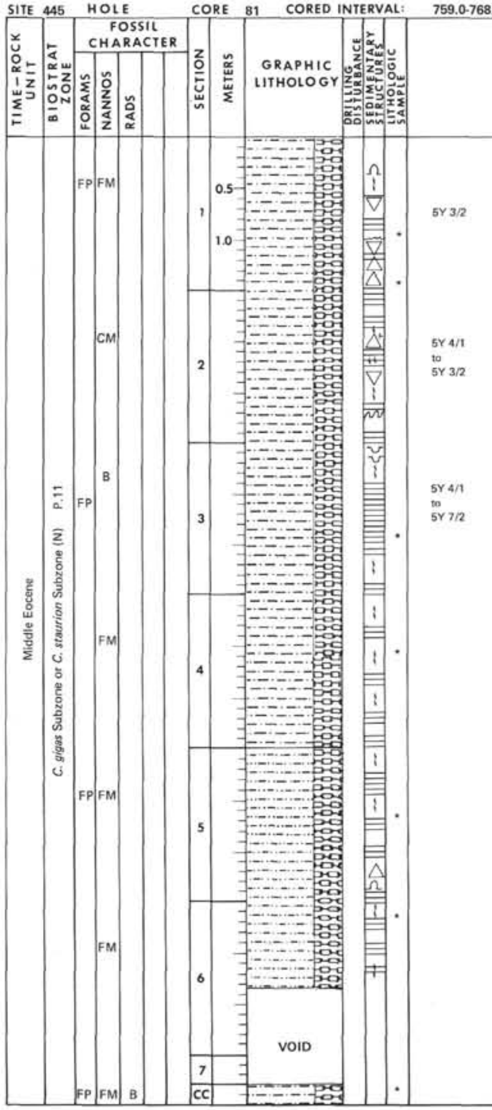
SMEARS:

1-75, 2-95, 2-105 (Nannofossil Mudstone)

Sand	7-20%	Quartz, Feldspar	3- 7%
Silt	13-20%	Clay minrals	30-48%
Clay	20-60%	Opaque minerals	0-20%
		Heavy minerals, mica	2-10%
		Foraminifers	3- 5%
		Nannofossils	10-40%
		Glauconite	1- 2%

CARBON-CARBONATE
2-59 (2.5, 0.1, 20)

SITE 445 HOLE CORE 81 CORED INTERVAL: 759.0-768.5 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: dark olive gray (5Y 3/2) to dark greenish gray (5GY 4/1) **Calcareous Sandy Mudstone** with silt and sand interbeds, and 1% glauconite. Laminations throughout, frequent graded bedding, often intense in Section 1. Occurrence of irregular laminae, lenses, contorted beds, slump structures (Section 4, 50-60 cm), clayey or sandy streaks, microfaults. Bioturbation absent or minor.

SMEARS:
5-65, 6-20 (Calcareous Mudstone)

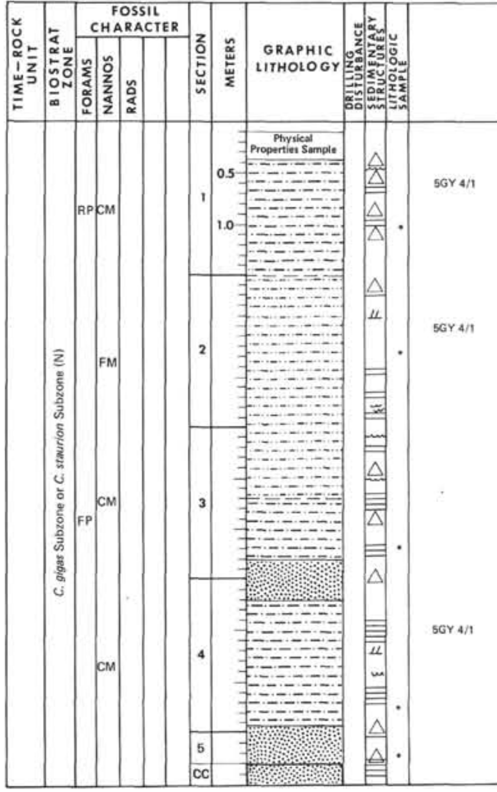
Sand	TR- 5%	Quartz, Feldspar	10-25%
Silt	40-55%	Clay minerals	37-55%
Clay	40-60%	Opaque minerals	5%
		Heavy minerals, mica	7-15%
		Carbonate unspecified	10-15%
		Nannofossils	3- 5%
		Glauconite (6-20)	1%

1-96, 1-140, 3-93 (Calcareous Sandy Mudstone)

Sand	10-30%	Quartz, Feldspar	10-20%
Silt	10-60%	Clay minerals	0-52%
Clay	25-40%	Opaque minerals	3-10%
		Heavy minerals, mica	10-20%
		Carbonate unspecified	5-50%
		Nannofossils	3-15%
		Glauconite (CC)	1%

CARBON-CARBONATE
2-41 (1.7, 0.1, 13)

SITE 445 HOLE CORE 82 CORED INTERVAL: 768.5-778.0 m



LITHOLOGIC DESCRIPTION

Dominant Lithology:
Dark greenish gray (5GY 4/1) hard **Mudstone and Sandy Mudstone,** frequently interbedded with very thin layers or laminae of **Siltstone,** fine and coarse **Sandstone,** in an irregular alteration. Silt and sand layers, often normally graded bedded, increase downwards, together with an increase in $CaCO_3$ content (Section 5, 32 cm).

Sedimentary structures: graded beds mainly in sediments in Section 1, 50, 63, 94, and 122 cm, and Sections 3 and 4 (one bed from Section 3, 110 cm to Section 4, 13 cm) and Section 5 (coarse sandstone: calcareous shells and subangular rock pebbles). Laminae frequent in Sections 1, 2, 3, 4, and 5. Flaser and contorted beddings in Sections 3 and 5 especially. Frequent lenses.

SMEARS:
2-80, 4-123 (Mudstone)

Sand	TR- 8%	Quartz, Feldspar	15%
Silt	35-42%	Clay minerals	45-55%
Clay	60-65%	Opaque minerals	5-10%
		Heavy minerals, mica	7-20%
		Nannofossils	2%

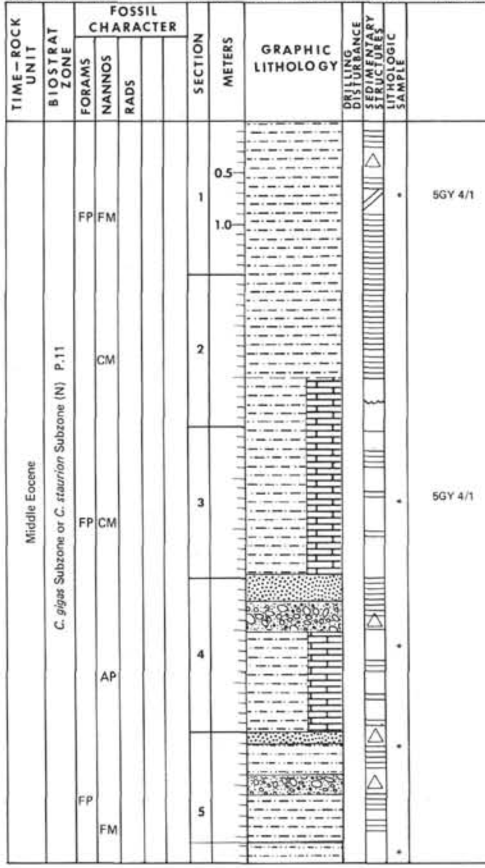
1-100, 3-125 (Sandy Mudstone)

Sand	20-25%	Quartz, Feldspar	30-40%
Silt	65%	Clay minerals	5-18%
Clay	10-15%	Opaque minerals	13-14%
		Heavy minerals mica	30%
		Nannofossils	2- 3%

5-32 (Limestone)

Sand	15%	Quartz, Feldspar	10%
Silt	75%	Clay minerals	<5%
Clay	10%	Opaque minerals	3%
		Heavy minerals, mica	10%
CARBON-CARBONATE		Carbonate unspecified	70%
1-20 (1.1, 0.1, 8)		Nannofossils	2%

SITE 445 HOLE CORE 83 CORED INTERVAL: 778.0-787.5 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: mainly dark greenish gray (5GY 4/1), hard **Sandy Mudstone, Mudstone, and Calcareous Sandy Mudstone,** interbedded with many sandy thin layers and laminations. Graded beds occur at some intervals, and micro-convolutions and microfaults frequently occur throughout laminated mudstone. Graded conglomerate and coarse sandstone interbeds: at Section 3, 140 cm to Section4, 52 cm, Section 5 0-12 cm, and Section 5, 38-57 cm, with numerous small fragments of calcareous fossil shells and subangular to subrounded pebbles.

SMEARS:

3-75, 4-63 (Calcareous Sandy Mudstone)

Sand 15-25%	Quartz, Feldspar 17-20%
Silt 45-50%	Clay minerals 29-36%
Clay 25-40%	Opaques minerals 25%
	Heavy minerals, mica 16-17%
	Carbonate unspecified 15-33%
	Nannofossils 3- 5%

1-75 (Sandy Mudstone)

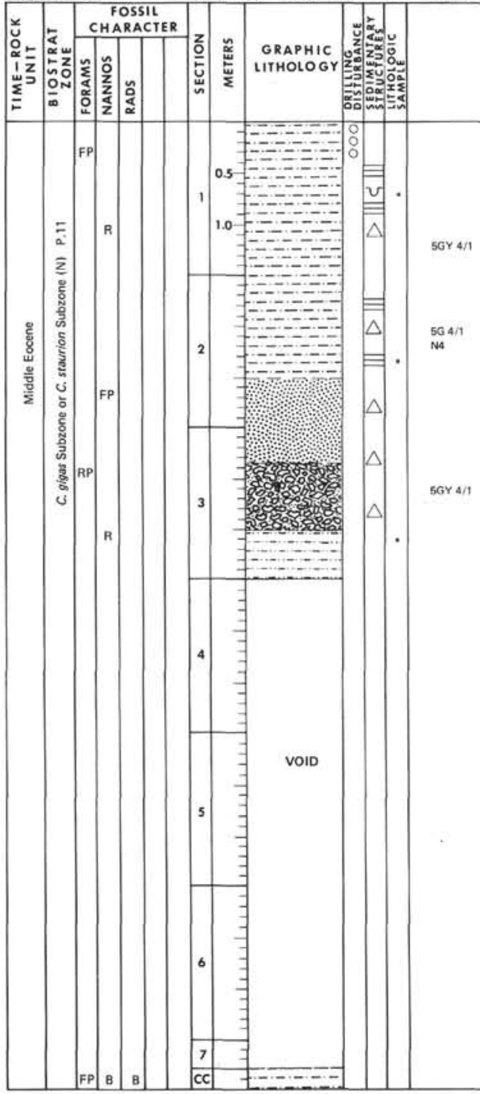
Sand 25%	Quartz, Feldspar 20%
Silt 40%	Clay minerals 44%
Clay 35%	Opaque minerals 10%
	Heavy minerals, mica 18%
	Carbonate unspecified 5%
	Nannofossils 3%

5-17, CC (Mudstone)

Sand 7-10%	Quartz, Feldspar 10-12%
Silt 25-30%	Clay minerals 38-62%
Clay 60-68%	Opaque minerals 6-10%
	Heavy minerals, mica 14%
	Nannofossils TR- 5%

CARBON-CARBONATE:
1-104 (1.1, 0,2, 8)

SITE 445 HOLE CORE 84 CORED INTERVAL: 787.5-797.0 m



LITHOLOGIC DESCRIPTION

Dominant Lithologies:
Section 1 – **Sandy Mudstone,** with fine laminations, lenses, patches, CO_3 streaks.

Section 2 – **Silty Mudstones, Siltstones, Sandstone, Mudstones;** white calcareous streaks; coarse beds without laminations.

Section 3 – graded **Sandstones Breccias** to 98 cm; **Mudstones, Silty Mudstones** at 98-150 cm; fragments = lithics up to 5 cm, including igneous, large foraminifers. Below 98 cm = alteration of fine **Mudstone/Silty Mudstone** without laminations.

SMEARS:

1-71 (Sandy Mudstone)

Sand 20%	Quartz, Feldspar 10%
Silt 40%	Mica 18%
Clay 40%	Heavy minerals 4%
	Clay minerals 43%
	Volcanic glass 8%
	Opaque minerals 10%
	Carbonate unspecified 5%
	Nannofossils 2%

2-85 (Mudstone)

Sand 5%	Quartz, Feldspar 15%
Silt 25%	Mica 8%
Clay 70%	Heavy minerals 2%
	Clay minerals 50%
	Opaque minerals 10%
	Volcanic glass 8%
	Carbonate unspecified 4%
	Nannofossils 3%

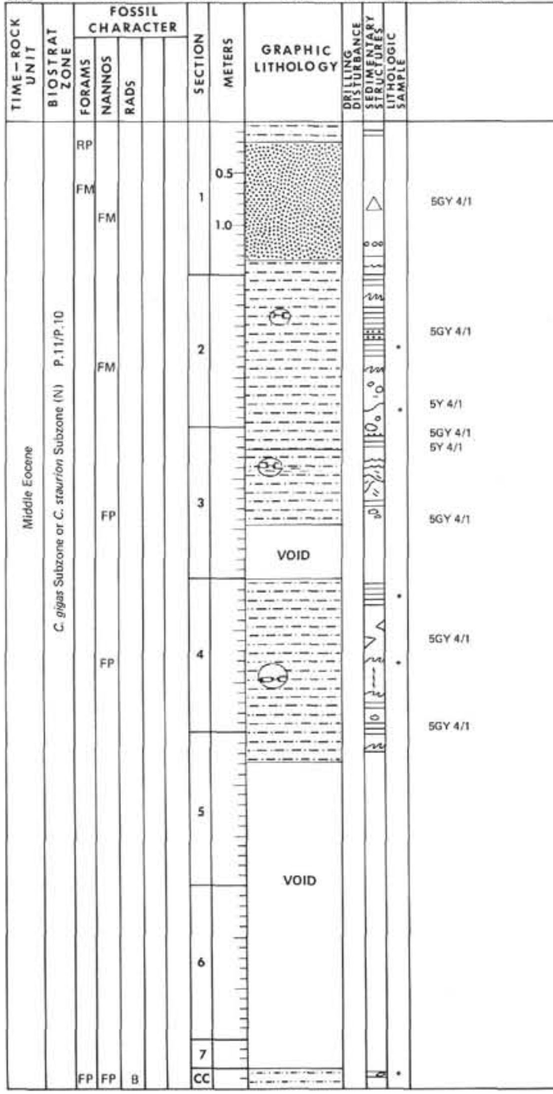
3-119 (Silty Mud)
Quartz, Feldspar 19%
Clay minrals 45%

CC (Silty Sandstone)

Sand 75%	Lithics,Opaques 70%

CARBON-CARBONATE:
1-120 (0.8, 0.1, 6)

SITE 445 HOLE CORE 85 CORED INTERVAL: 797.0-806.5 m



LITHOLOGIC DESCRIPTION

Dominant Lithologies:
Mudstone and Sandy Mudstone.
Section 1 = fine, alternating **Sandstone and Siltstone.**

Section 2 = irregular alternations of **Mudstone, Siltstone.** Clay patches in silty mdudy matrix 100-115 cm, 130-150 cm.

Section 3 = alternation of **Silty Mudstone** and soft fine **Claystone,** with laminations irregular at 0-22 cm, 22-98 cm: alternating **Mudstone and Siltstone** without laminations. Lenticular soft-sediment deformation.

Minor Lithologies:
Sandstone
Section 1, 14-135 cm = irregular graded bed; very coarse sandstone to sandstone, composed of rock fragments – igneous and sedimentary – and pelecypod fragments.

SMEARS:
2-75 (Calcareous Sandy Mudstone)

Sand	20%	Quartz, Feldspar	10%
Silt	40%	Heavy minerals	3%
Clay	40%	Clay minerals	38%
		Rock fragments	25%
		Carbonate unspecified	18%
		Sponge spicules	1%

2-138 (Mudstone)

Sand	8%	Quartz, Feldspar	26%
Silt	35%	Heavy minerals	5%
Clay	63%	Clay minerals	42%
		Rock fragments	8%
		Volcanic glass	8%
		Carbonate unspecified	4%
		Zeolites	3%

4-20 (Mudstone)

Sand	5%	Quartz, Feldspar	15%
Silt	20%	Heavy minerals	11%
Clay	75%	Clay minerals	62%
		Rock fragments	8%
		Volcanic glass	2%
		Carbonate unspecified	2%

4-89 (Calcareous Sandy Mudstone)

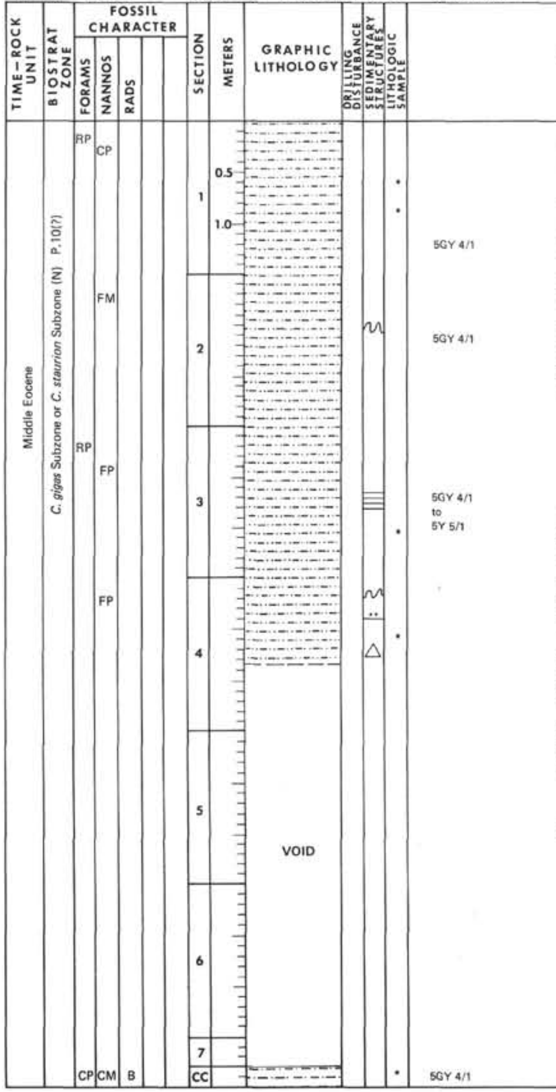
Sand	40%	Quartz, Feldspar	15%
Silt	40%	Heavy minerals	12%
Clay	20%	Clay minerals	15%
		Rock fragments	29%
		Volcanic glass	TR
		Carbonate unspecified	29%

CC (Silty Mudstone)

Sand	15%	Quartz, Feldspar	15%
Silt	40%	Heavy minerals	10%
Clay	45%	Clay minerals	48%
		Rock fragments	20%
		Volcanic glass	1%
		Carbonate unspecified	6%

CARBON-CARBONATE:
2-64 (0.2, 0.0, 1)

SITE 445 HOLE CORE 86 CORED INTERVAL: 806.5-816.0 m



LITHOLOGIC DESCRIPTION

Dominant Lithologies:
Section 1 = alternating **Mudstone and Muddy Siltstone;** lighter carbonate streaks.

Section 2 = **Silty Mudstone,** with few silt layers.

Section 3 = as per Section 2, some laminations; **Mudstone** with nannofossils.

Section 4 = **Muddy Siltstone, Silty Mudstone, Sandy Mudstone,** graded beds, convolute beds, laminae lenses.

SMEARS:
1-90 (Mudstone with Carbonate)

Sand	8%	Quartz, Feldspar	7%
Silt	25%	Mica	5%
Clay	67%	Heavy minerals	2%
		Clay minerals	67%
		Opaque minerals	6%
		Volcanic glass	1%
		Carbonate unspecified	5%
		Foraminifers	TR
		Nannofossils	7%

1-60 (Sandy Clayey Mudstone)

Sand	20%	Quartz, Feldspar	15%
Silt	55%	Opaques, Lithics	28%
Clay	25%		

3-109 (Mudstone with Nannofossils)

Sand	3%	Quartz, Feldspar	25%
Silt	27%	Clay minerals	57%
Clay	70%	Nannofossils	7%

4-60 (Sandy Mudstone)

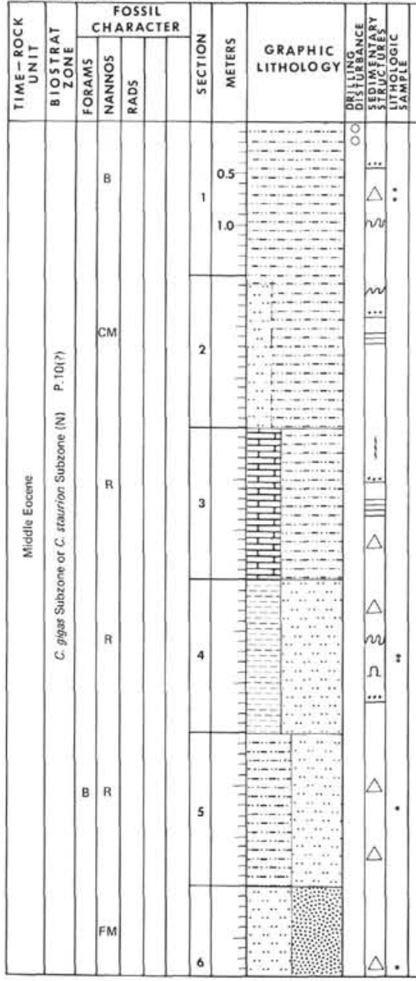
Sand	20%	Quartz, Feldspar	15%
Silt	30%	Clay minerals	57%
Clay	50%	Heavy minerals	10%

CC (Silty Sandstone)

Sand	70%	Quartz, Feldspar	13%
Silt	20%	Opaques, Lithics	65%
Clay	10%	Clay minerals	5%
		Carbonate unspecified	5%

CARBON-CARBONATE:
1-66 (1.4, 0.2, 10)

SITE 445 HOLE CORE 87 CORED INTERVAL: 816.0-825.5 m



5GY 4/1

5GY 4/1

5GY 4/1

5GY 4/1

5GY 4/1

5GY 4/1

LITHOLOGIC DESCRIPTION

Dominant Lithologies:
Section 1 = alternating **Silty Mudstone and Muddy Siltstone**, grading.

Section 2 = alternating **Silty Mudstone, Muddy Siltstone, Sandstone.** Numerous sediment structures.

Section 3 = **Calcareous Mudstone** with sediment structures.

Section 4 = **Clayey Siltstone**, with grading, slump structures.

Section 5 = **Silty Mudstone,** white CO_3 laminations, local color darkening; microfaults.

Section 6 = **Silty Sandstone**

SMEARS:

1-64 (Mudstone)

Sand	2%	Quartz, Feldspar	15%
Silt	20%	Clay minerals	76%
Clay	78%		

1-75 (Mudstone)

Sand	25%	Quartz, Feldspar	15%
Silt	40%	Heavy minerals	5%
Clay	35%	Opaques, Lithics	15%
		Carbonate unspecified	10%

3-79 (Calcareous Mudstone)

Sand	5%	Quartz, Feldspar	12%
Silt	30%	Clay minerals	53%
Clay	65%	Carbonate unspecified	20%

4-75 (Clayey Siltstone)

Sand	4%	Quartz, Feldspar	50%
Silt	60%	Clay minerals	38%
Clay	36%	Volcanic glass	5%

5-75 (Silty Mudstone)

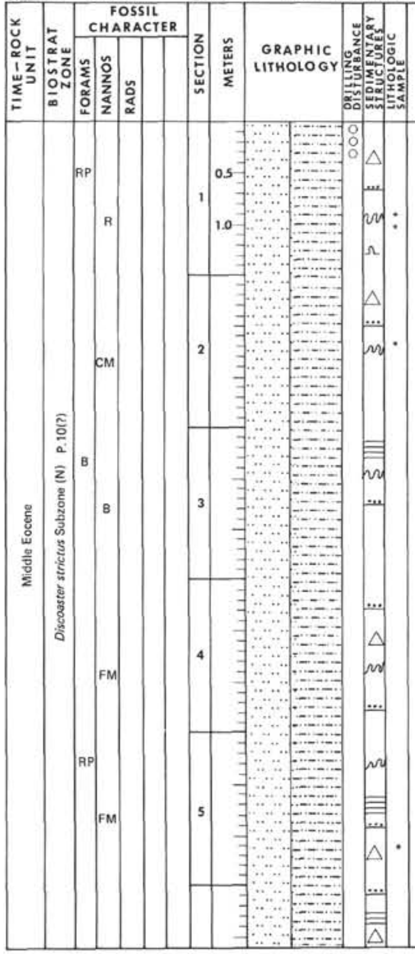
Sand	5%	Quartz, Feldspar	18%
Silt	45%	Clay minerals	52%
Clay	50%	Carbonate unspecified	5%
		Foraminifers	2%
		Nannofossils	3%

6-80 (Silty Sandstone)

Sand	55%	Quartz, Feldspar	15%
Silt	30%	Lithics	60%
Clay	15%	Carbonate unspecified	5%

CARBON-CARBONATE:
1-70 (1.3, 0.1, 10)

SITE 445 HOLE CORE 88 CORED INTERVAL: 825.5-835.0 m



5GY 4/1
with 5Y 2/1,
2.5YR 2/2

5GY 4/1

5GY 4/1

5GY 4/1,
N4

5GY 4/1,
N4

5GY 4/1,
N4

LITHOLOGIC DESCRIPTION

Dominant Lithologies:
Section 1 = alternating **Silty Mudstone/Muddy Siltstones**. Convolute beds, graded, slump structures.

Section 2 = alternation of **Silty Mudstone, Muddy Siltstones** with convolute microfaults, Nummulities fragments.

Section 3 = **Silty Mudstones/Muddy Siltstones;** with laminae. Convolutes, graded beds, microfaults – local darkening.

Section 4 = **Muddy Siltstone, Silty Mudstone;** coarser lenses, stringers, laminations, microfaults rip-up clasts.

Sections 5 and 6 = ⇀ dips. **Mudstone** with coarser laminations, stringers, lenses. White CO_3 laminations = calcarenites; microfaults, current scour.

SMEARS:

1-100 (Sandy Silty Mudstone)

Sand	30%	Quartz, Feldspar	20%
Silt	40%	Clay minerals	53%
Clay	30%	Nannofossils	7%

1-90 (Silty Mudstone)

Sand	20%	Quartz, Feldspar	25%
Silt	40%	Clay minerals	42%
Clay	40%	Lithics	5%
		Nannofossils	10%
		Carbonate unspecified	7%

2-70 (Silty Mudstone)

Sand	15%	Quartz, Feldspar	15%
Silt	45%	Clay minerals	54%
Clay	40%		

5-115 (Silty Sandy Mudstone)

Sand	50%	Quartz, Feldspar	40%
Silt	30%	Clay minerals	51%
Clay	20%		

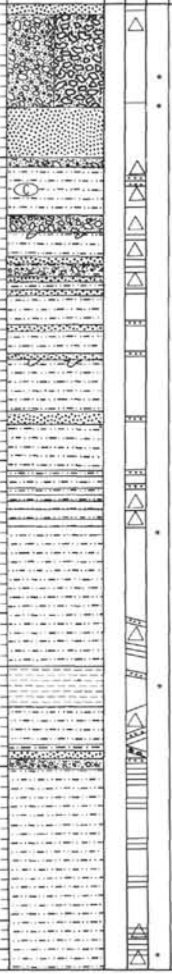
CARBON-CARBONATE:
1-94 (0.4, 0.1, 3)

SITE 445 HOLE CORE 89 CORED INTERVAL: 835.0-844.5 m

TIME-ROCK UNIT: Middle Eocene

BIOSTRAT ZONE: *Discoaster strictus* Subzone (N)

SECTION	FOSSIL CHARACTER (FORAMS / NANNOS)	COLOR
1		5GY 4/1
2	RP FM	5GY 4/1 with N4 2.5YR 3/2 5GY 4/1
3	CM	5GY 4/1 with N4
4	RM	5GY 4/1 with N4
5	RM	5GY 4/1 with N4 N5
6	FM	5GY 4/1 N4
7		5GY 4/1
CC		5GY 4/1



LITHOLOGIC DESCRIPTION

Dominant Lithology: Mudstone, dark greenish gray with dark gray **Mudstone.** Sandy zones scattered throughout are graded, fining upward sequences in irregular lenses. Also clayey lenses. Units irregular – 2 mm to 2 cm. Thicker sandy units show load casts. Rip-up clasts of claystone. Extensive microfaults. High $CaCO_3$ content. Sandy-silty stringers throughout. Soft sediment deformation.

Minor Lithologies:
(1) Conglomerate, dusky red – **Sandy Conglomerate** with reddish black and green clasts.

(2) Sandstone – rounded and angular fragments of chert, mudstone, limestone, 0.5 to 3 cm. Fining upward.

SMEARS:

1-75 (Siliceous Calcareous Lithic Sandstone)

Sand 15%		Quartz, Feldspar	20%
Silt 30%		Clay minerals	54%
Clay 55%		Heavy/Opaque min.	7%
		Volcanic glass	2%
		Carbonate unspecified	14%
		Glauconite	1%
		Zeolites	1%

1-101 (Lithic Sandstone)

Sand 65%		Quartz, Feldspar	15%
Silt 20%		Clay minerals	11%
Clay 15%		Heavy/Opaque min.	21%
		Lithics	50%
		Carbonate unspecified	12%
		Glauconite	1%
		Zeolites	1%

4-75 (Silty Mudstone)

Sand 20%		Quartz, Feldspar	25%
Silt 50%		Clay minerals	42%
Clay 30%		Heavy/Opaque min.	17%
		Lithics	5%
		Carbonate unspecified	9%
		Glauconite	1%
		Zeolites	1%

5-75 (Silty Mudstone)

Sand 10%		Quartz, Feldspar	20%
Silt 30%		Clay minerals	59%
Clay 70%		Heavy/Opaque min.	9%
		Carbonate unspecified	8%
		Manganese	2%

CC (Mudstone)

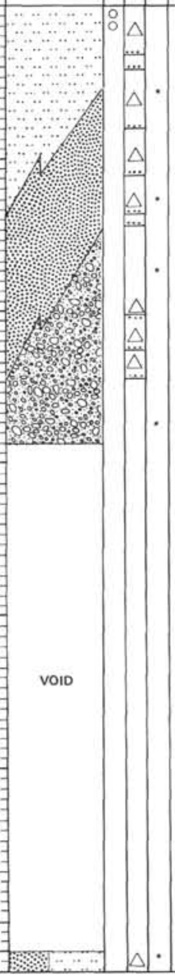
Sand 4%		Quartz, Feldspar	25%
Silt 36%		Clay minerals	57%
Clay 60%		Heavy/Opaque min.	10%
		Volcanic glass	TR
		Carbonate unspecified	3%

CARBON-CARBONATE:
3-57 (1.2, 0.1, 9)

SITE 445 HOLE CORE 90 CORED INTERVAL: 844.5-854.0 m

TIME-ROCK UNIT: Middle Eocene

SECTION	FOSSIL CHARACTER (FORAMS / NANNOS)	COLOR
1	B RP	5G 4/1
2		
3	RM	
4		
5		
6		
7		
CC	B B	N4



LITHOLOGIC DESCRIPTION

Dominant Lithologies: Conglomerate – Mudstones. Generally dark greenish gray (5G 4/1) with reddish, blue,green,black,brown colors for clasts.

Section 1, 12-21 cm = conglomerate grading upward to **Sandstone/Siltstones;** 21-50 cm – repetitive. Series of **Conglomerate-Silt-Mud with Mudstone** as 1-2 mm laminations; 50-75 cm – **Basal Conglomerate-Mudstone** with interbedded **Silt/Sandstone/Mudstone** from 50-60 cm; 75-85 cm – interbeds lenses of **Sandstone/Siltstone;** 85-120 cm – **Conglomerate-breccia,** rounded fragments up to 2 cm; 120-150 cm – basal **Conglomerate** upwards to siltstone with interbeds of **Sand-Silt.** Fragments = chert, mudstone.

Section 2, 0-22 cm – upward fining. **Conglomerate Sandstone** with sharp contact to **Siltstone** at 22 cm; 22-65 cm – basal **Conglomerate** followed by interbeds of **Sand-Silt-Mud.** Conglomerate again at 30-40 cm, 45-49 cm, 65-150 cm - basal conglomerate with interbedded series of **Sand-Silts, Mudstone.** Soft sediment deformation features; grading poor, rounded fragments.

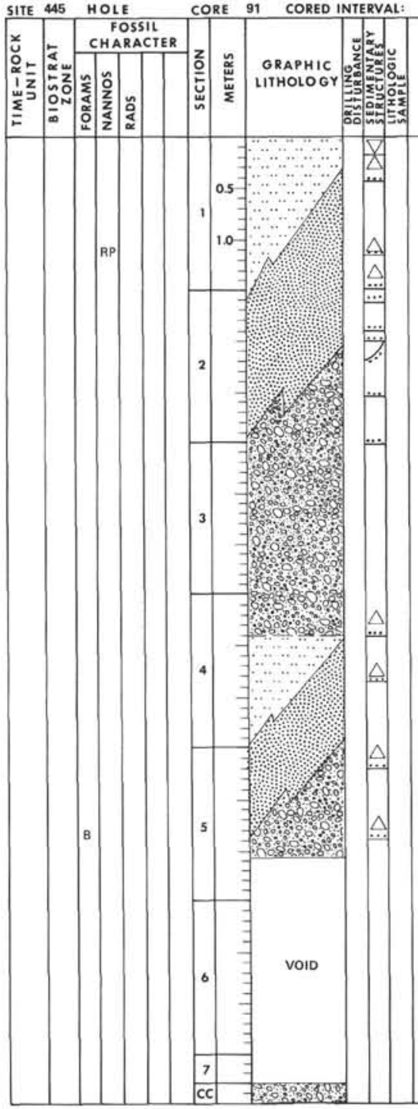
Section 3, 0-35 cm – conglomerate continues from Section 2; 35-65 cm basal conglomerate fining upward to sandstone-siltstone with soft sediment deformation; large fragments settle in silt; 65-150 cm – series of interbedded **Silty Mudstones** with sand-silt lenses. Carbonate present.

Core-Catcher – **Clayey Sandy Siltstone,** upward fining, laminated.

SMEARS:
1-83 (Calcareous Silty Mudstone)
2-41 (Sandy Lithic Siltstone)
2-112 (Calcareous Silty Mudstone)
3-112 (Mudstone)
CC (Clayey Sandy Siltstone)

CARBON-CARBONATE:
2-108 (1.0, 0.1, 8)

SITE 445 HOLE CORE 91 CORED INTERVAL: 854.0-863.5 m



LITHOLOGIC DESCRIPTION

Dominant Lithology: Conglomerate
Dark greenish gray (5GY 4/1) with reds, greens fragments; calcite reaction in cement; round fragments.

Section 1, 0-30 cm – **Conglomerate** which fins downward; 30-40 cm – **Conglomerate** at 30 cm load casts into **Silty Sandy Mudstone to Conglomerate** at 40 cm; soft sediment deformation; 45-150 cm – cyclic series of **Conglomerates, Sandstones;** vague size grading upward; soft sediment disturbance.

Section 2 – series of interbedded **Sandstone Conglomerate** with red, green clasts, only one sharp boundary at 60 cm with **Sandstone** above **Conglomerate;** deformation, load casts; generally fines upward. 0-38 cm – **Conglomerate** from Section 2 38-48 cm – basal **Conglomerate** interbedded with **Sandstone** fining up; 48-70 cm – massive **Sandstone,** no grading; 70-80 cm – intermixed **Conglomerate-Sandstone,** poor grading; 80-150 cm – basal conglomerate fining upward to **Sandstone or Conglomerate Sandstone to Limestone** clasts at base.

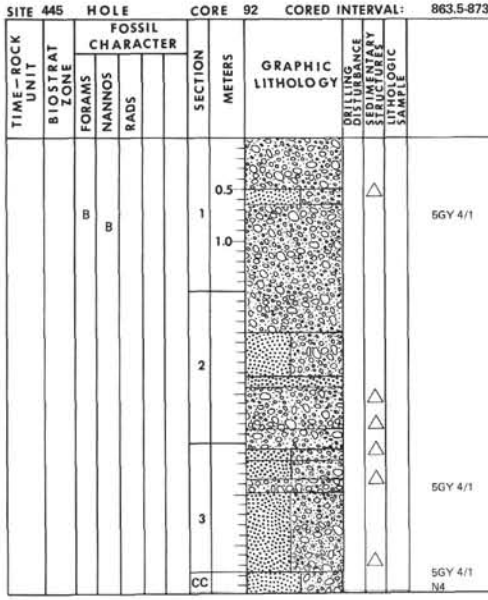
Section 3 – variegated **Lithic Conglomerate** round fragments 1 mm to 2 cm. Vague size decrease up section into Section 4.

Section 4 – variegated **Lithic Conglomerate** 1 mm to 3 cm clasts and as matrix; CO_3 in matrix. Continues to Section 5 at 30 cm.

Section 5 – 0-33 cm – variegated **Lithic Conglomerate;** 33-80 cm basal **Conglomerate** with vague contact to underlying **Sandstone** – fines upward to sandstone; 80-105 cm – basal **Conglomerate** with interbedded **Sandstone.** Large (3 cm) limestone clasts.

CARBON-CARBONATE:
2-56 (1.9, 0.1, 15)

SITE 445 HOLE CORE 92 CORED INTERVAL: 863.5-873.0 m



LITHOLOGIC DESCRIPTION

Dominant Lithology:
Section 1 – variegated **Lithic Conglomerate,** clast size 1 mm to 6 cm. Clasts in limestone, andesite, basalt, mudstone, etc. and also form matrix with minor CO_3 and clay; rounded much more than angular. No orientation, no grading, to Section 2, 38 cm. Decrease in size toward base.

Section 2 – interbedded mixture of variegated **Conglomerate and Sandstone.** Size increase downward (graded).

Section 3 – mixture of **Lithic Conglomerate and Sandstone;** possibly graded.

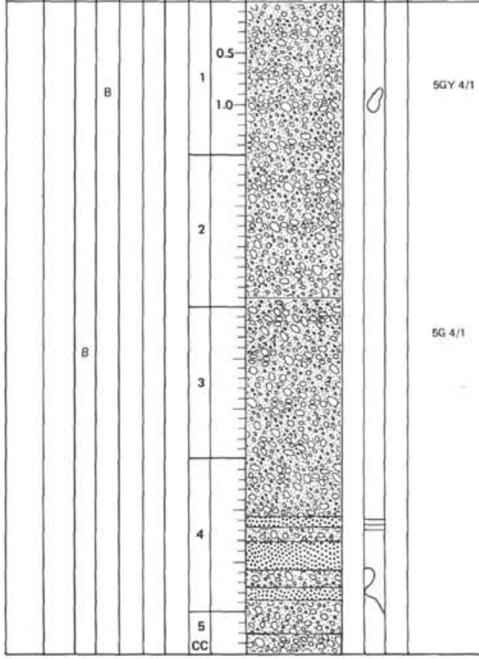
Note: Graded sandstone recovered in Section 1 has red and green lithic fragments; graded.

CARBON-CARBONATE:
2-45 (0.3, 0.0, 3)

SITE 445 HOLE CORE 93 CORED INTERVAL: 873.0-882.5 m

TIME-ROCK UNIT | BIOSTRAT ZONE | FOSSIL CHARACTER: FORAMS, NANNOS, RADS | SECTION | METERS | GRAPHIC LITHOLOGY | DRILLING DISTURBANCE | SEDIMENTARY STRUCTURES | LITHOLOGIC SAMPLE

LITHOLOGIC DESCRIPTION



Dominant Lithology:
Sections 1 and 2 – variegated **Lithic Conglomerate.** Dark greenish gray with reds, greens, dark greens, browns. Fragment size up to 15 cm, 1 mm minimum. Sizes bimodal = >3-4 cm = clast, <1-4 mm = matrix. Matrix high in $CaCO_3$. Large size clastics increase downward at expense of matrix (grading?). Clasts = basalt, limestone, andesite, red ang green mudstones, chert, and metamorphics(?), serpentine? (igneous downward). Basalt clast at 90-105 cm in Section 1 is subrounded.

Section 3 – beginning at 140 cm in Section 2, **Conglomerate** becomes unimodal (no large clasts) (matrix only). Dark greenish gray with red, green and white clasts. CO_3 cement approximately 1-2 mm. No grading. Size increase in Section 4.

Section 4 – **Bimodal Conglomerate** up to 35-55 mm clasts to approximately 3 cm. Angular fragments increase grading-fining up from base (coarse clasts at base).

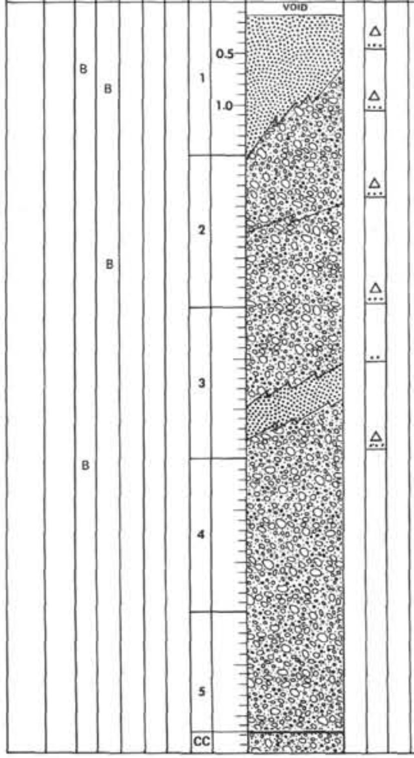
Core-Catcher – variegated pebble cycles.

CARBON-CARBONATE:
2-140 (0.4, 0.0, 3)

SITE 445 HOLE CORE 94 CORED INTERVAL: 882.5-892.0 m

TIME-ROCK UNIT | BIOSTRAT ZONE | FOSSIL CHARACTER: FORAMS, NANNOS, RADS | SECTION | METERS | GRAPHIC LITHOLOGY | DRILLING DISTURBANCE | SEDIMENTARY STRUCTURES | LITHOLOGIC SAMPLE

LITHOLOGIC DESCRIPTION



Dominant Lithology: Conglomerate.
Basic dark greenish gray (5G 4/1) with red and green clasts.

Section 1, 0-55 cm – basal **Conglomerate** with load cast boundary to **Sandstone** at 55 cm. Decrease size upward to **Sandstone** at 30 cm followed by intermixed zone to 10 cm, high and bedding dip ⟍ ; 55-150 cm – basal medium bimodal **Conglomerate,** fining upward into **Conglomerate Sandstone** at 110 cm (55 to 100) with intermixing of **Conglomerate Sandstone** to 55 cm and appearance of grading with intermixing rounded fragments. Dip below 70 cm is ⟋ with soft sediment microfaults.

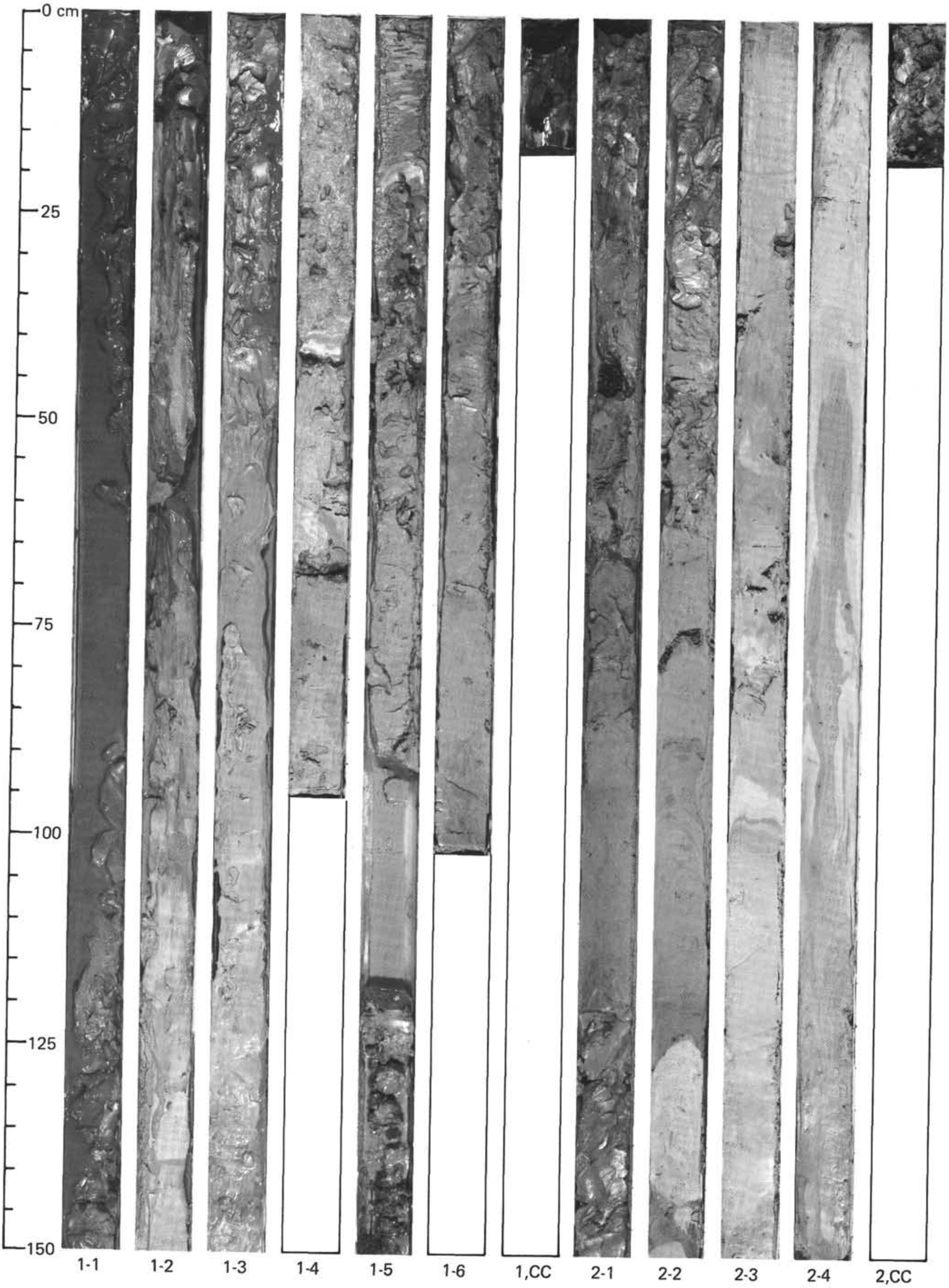
Section 2, 0-15 cm – *continuation of* **Conglomerate** at Section 1. Clast size up to 0.5 mm. ⟋ : 15 to 70 or 80 = intermixed series of **Sandstone/Conglomerate Sandstone** merging into **Conglomerate** at 57 cm; bimodal. Conglomerate clast size to 2 cm, soft sediment load casts. 60-70 cm = bimodal **Conglomerate.** 70, 80 to 150 cm = basal bimodal **Conglomerate** fins upward to **Conglomerate** at 123 cm with horizontal bedding and to 70 or 80 cm. **Basal Conglomerate** to 35 cm of Section 3.

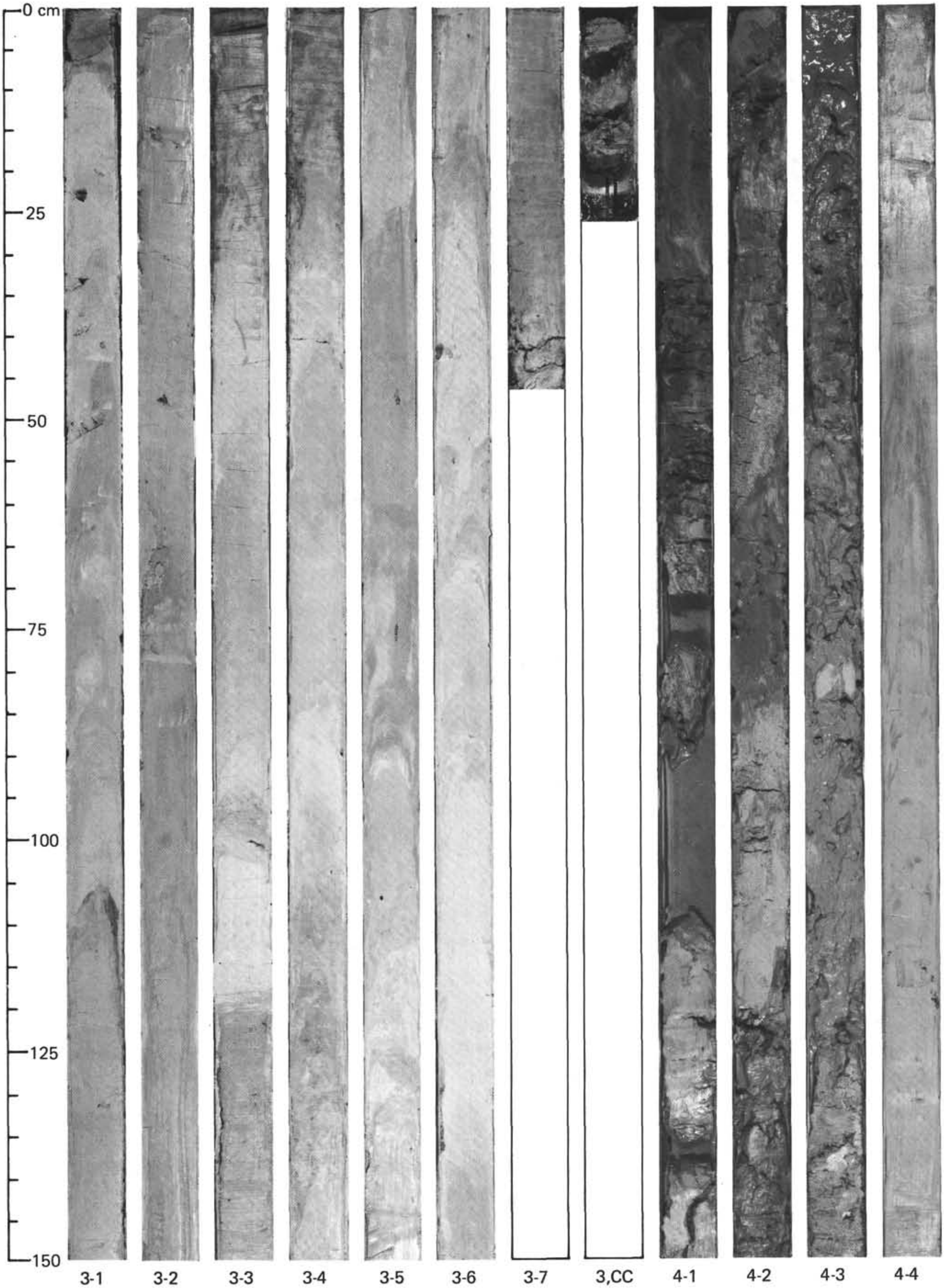
Section 3, 0-40 cm – bimodal variegated **Conglomerate** fins down; vague boundary at 40 cm. 40-67 cm – dominant **Sandstone** down boundary gradational to conglomerate. 67-140 cm – bimodal **Conglomerate** (3 cm clasts) fins down and upward. 140-150 cm – **Sandstone–Conglomerate.**

Section 4, 0-30, 40 cm – intermixed; 30, 40-75 cm = intermixed to **Conglomerate** at 75 cm; pebble conglomerate starts at 150 cm into Section 5.

CARBON-CARBONATE:
2-102 (0.4, 0.0, 3)

Site 445

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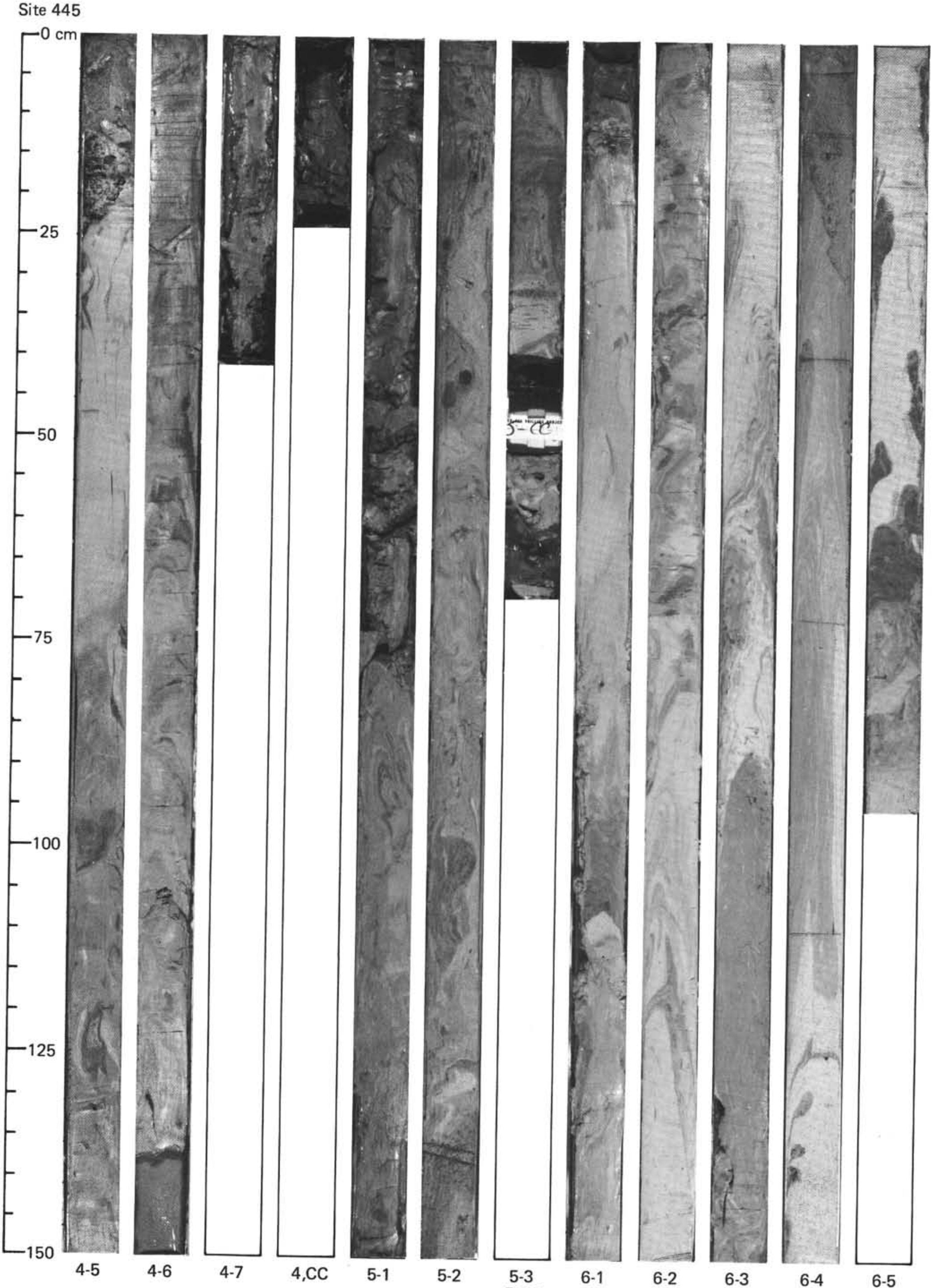
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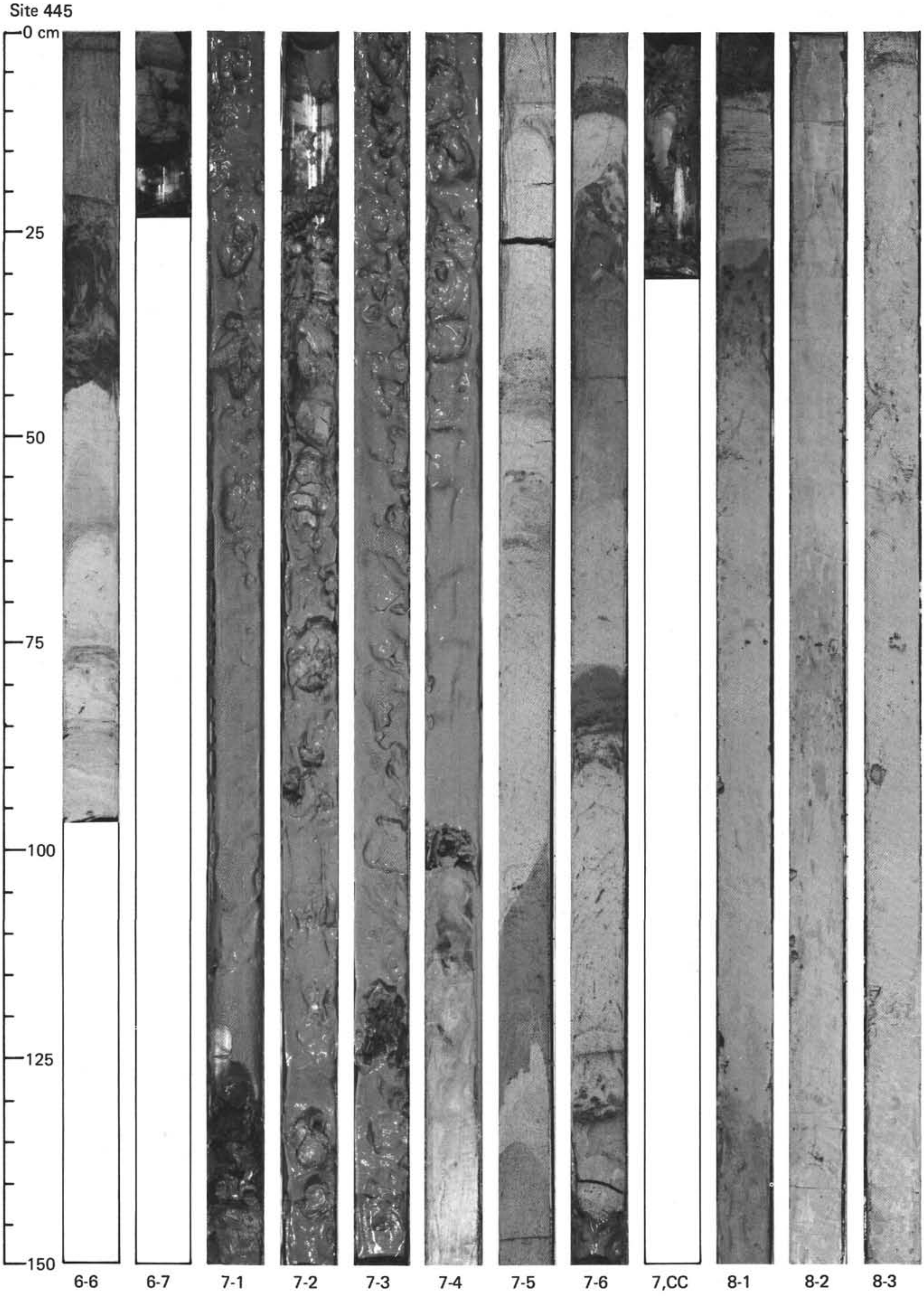
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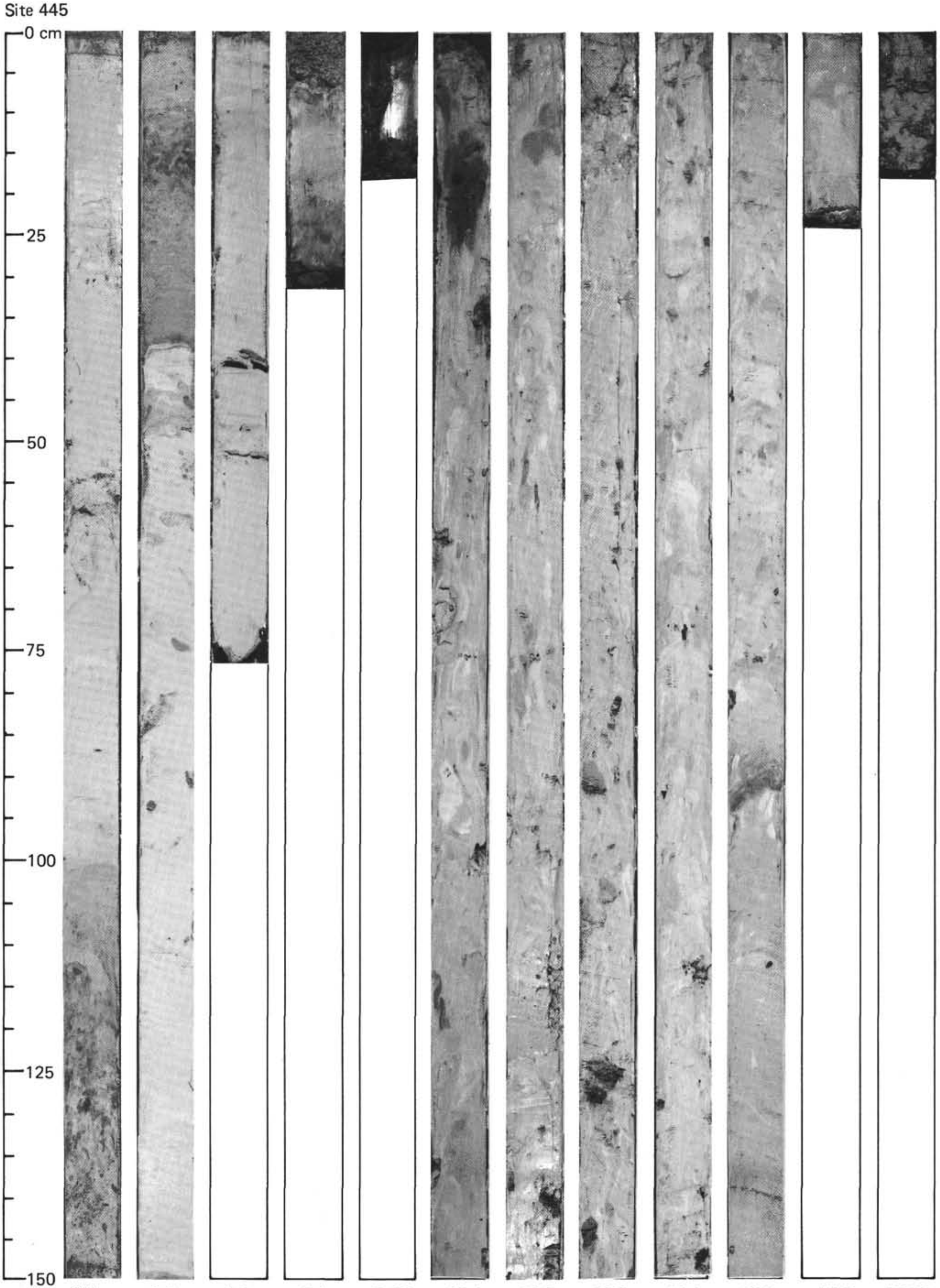
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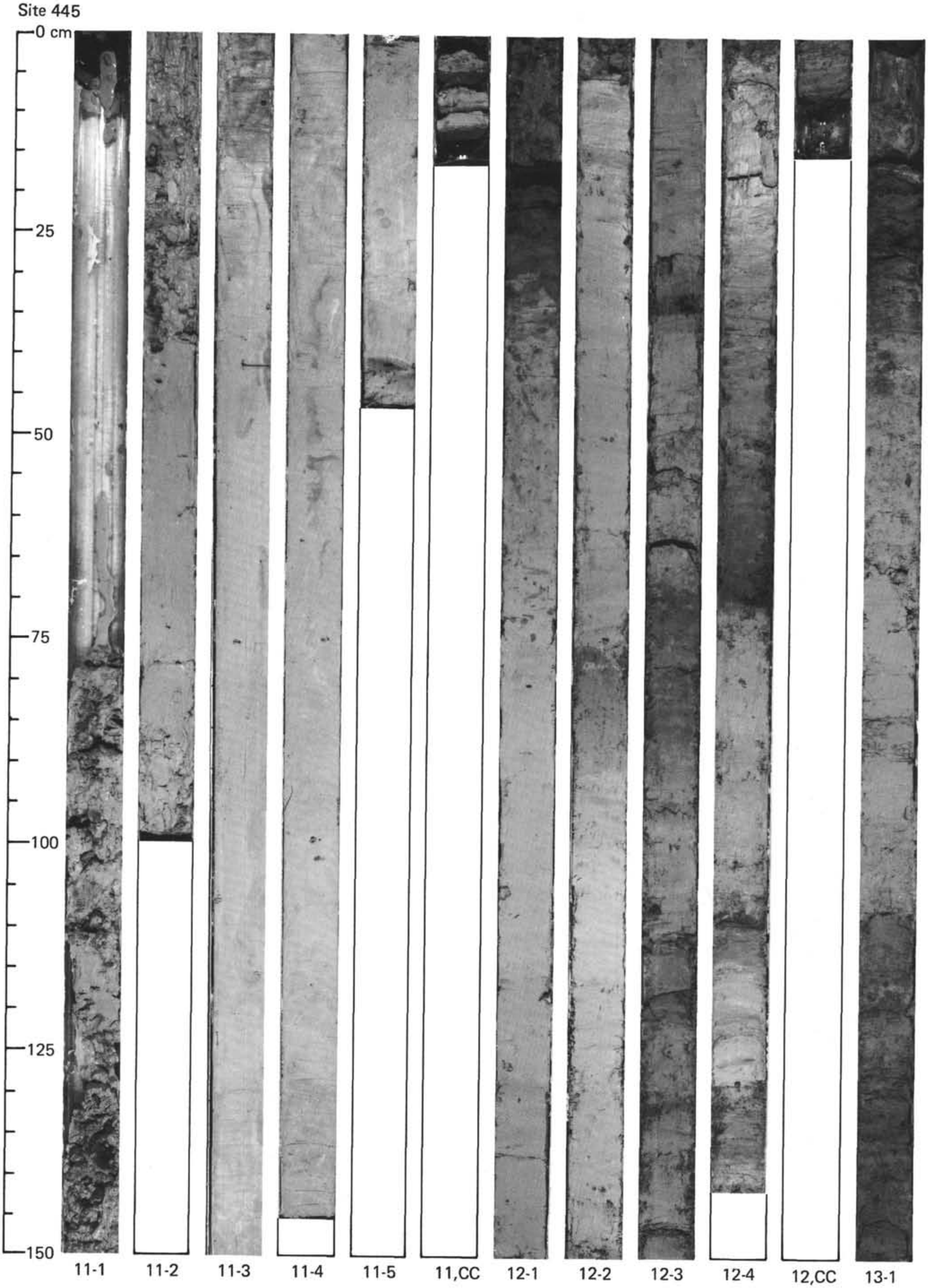
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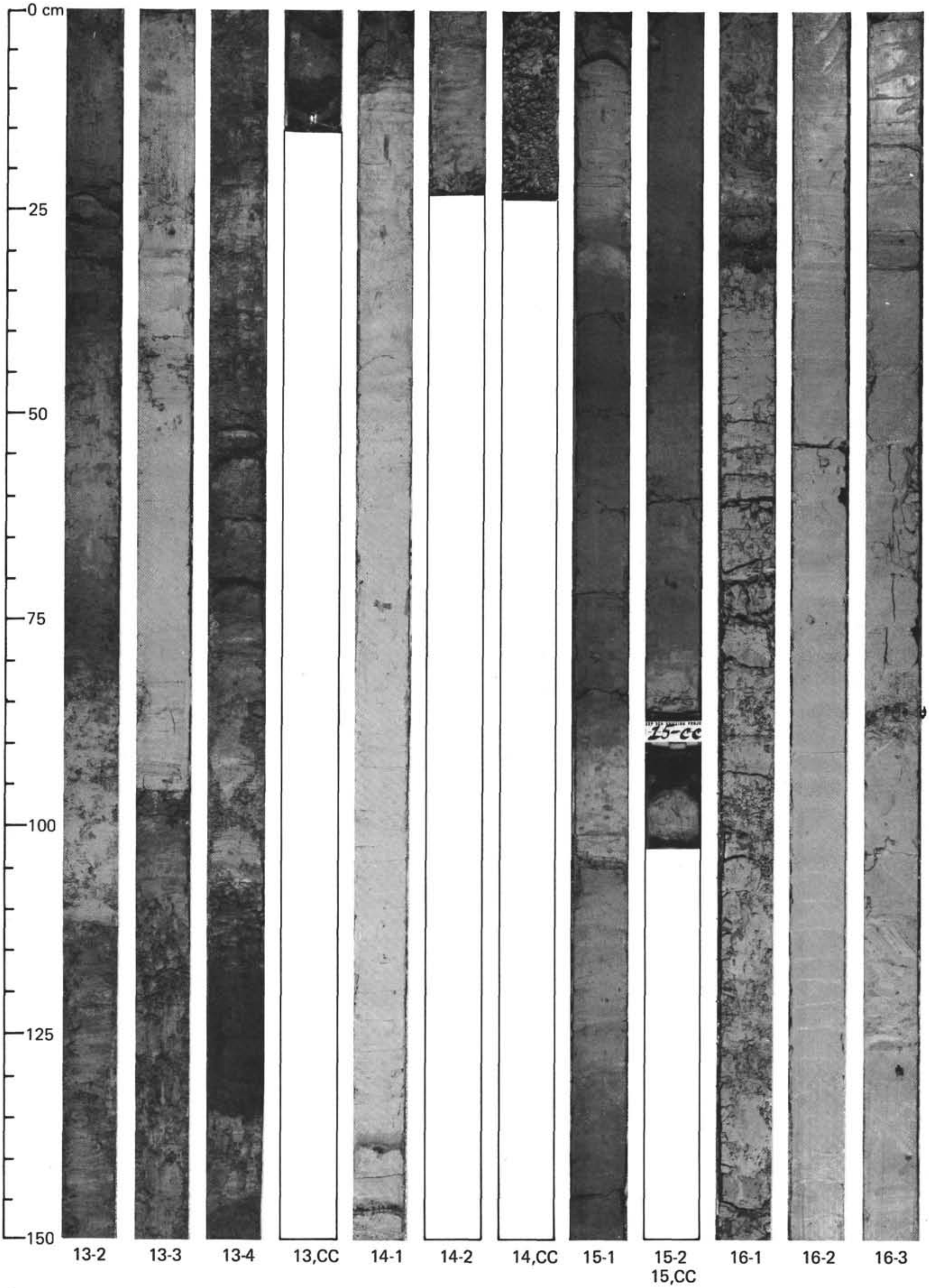
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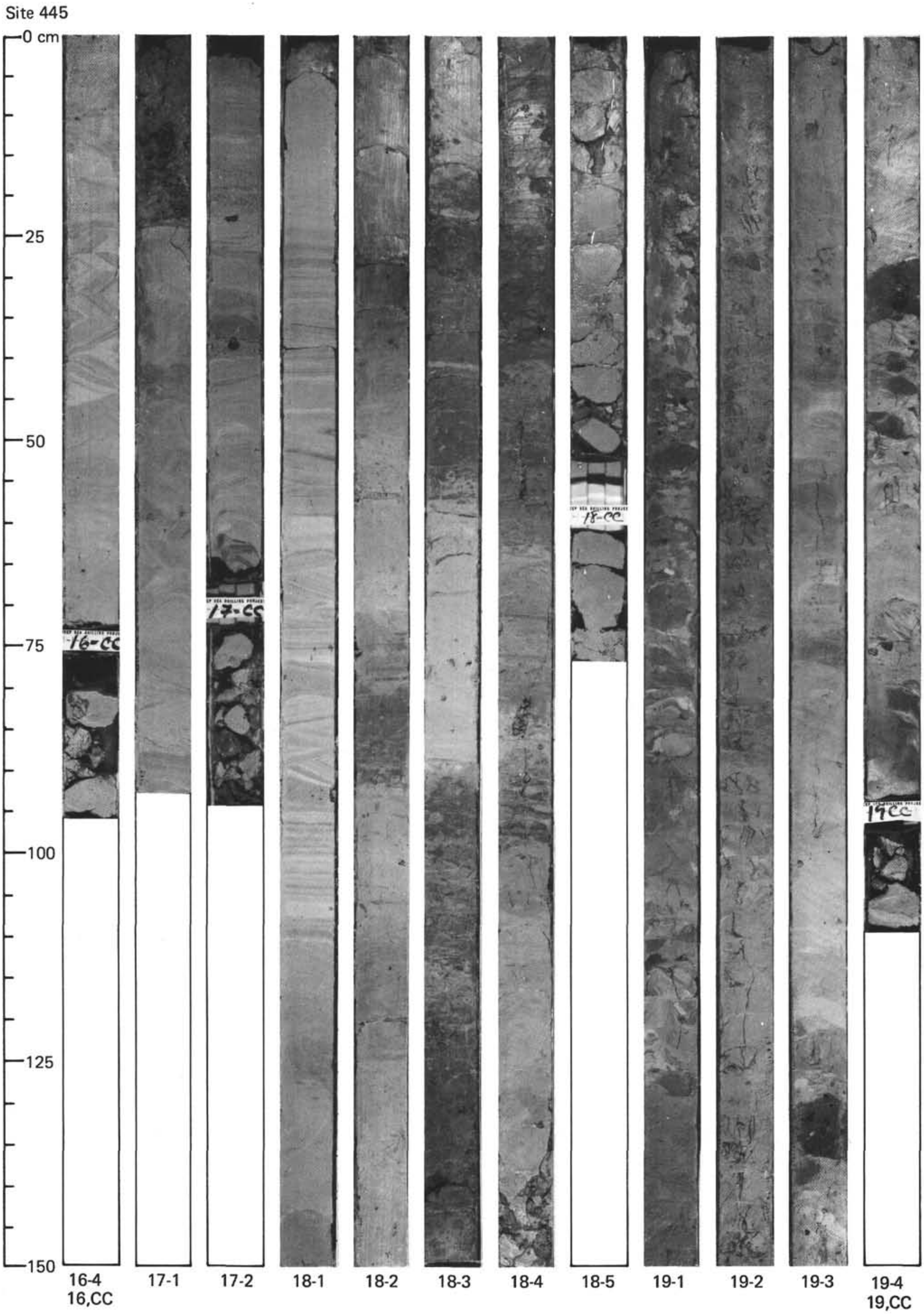
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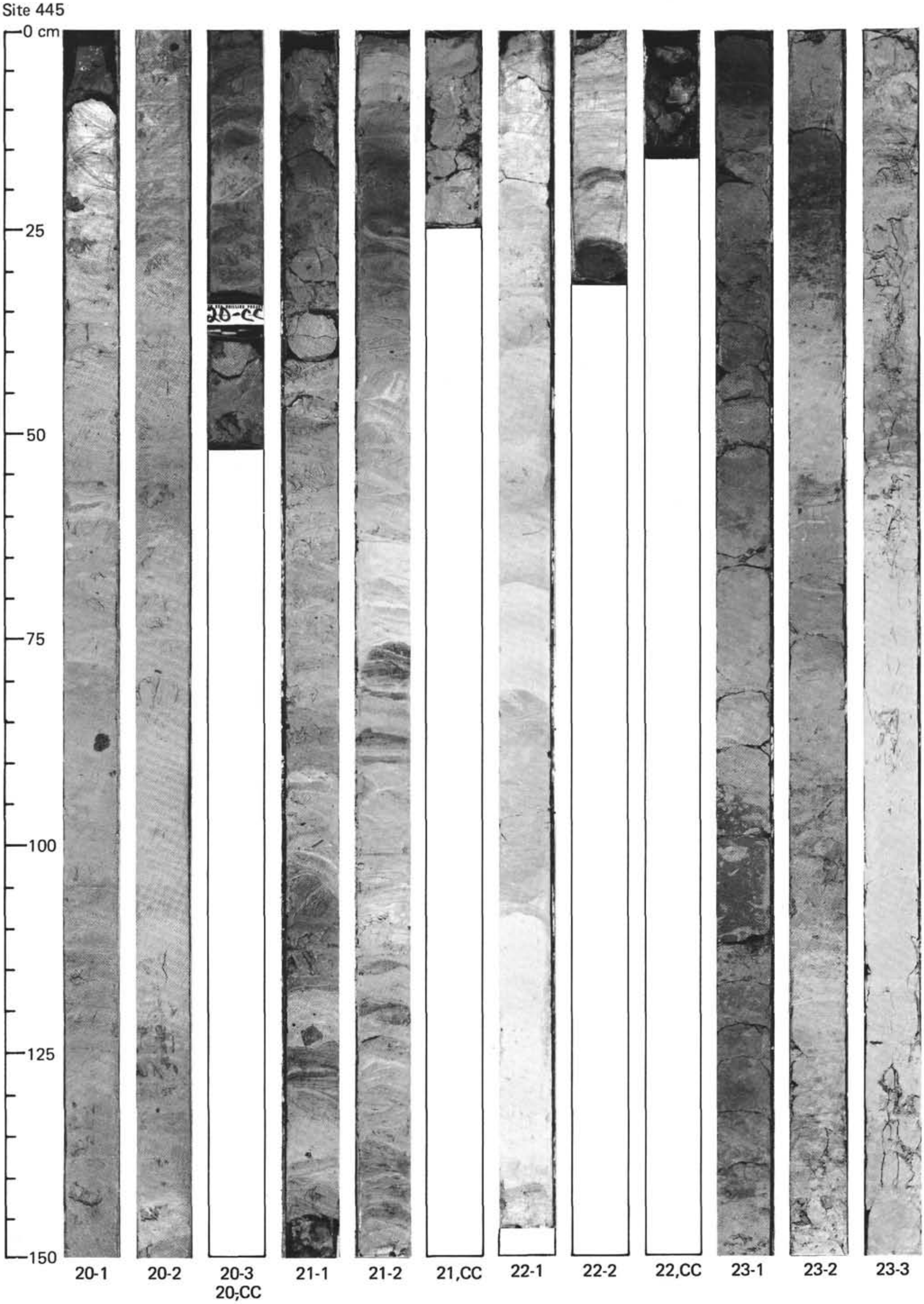
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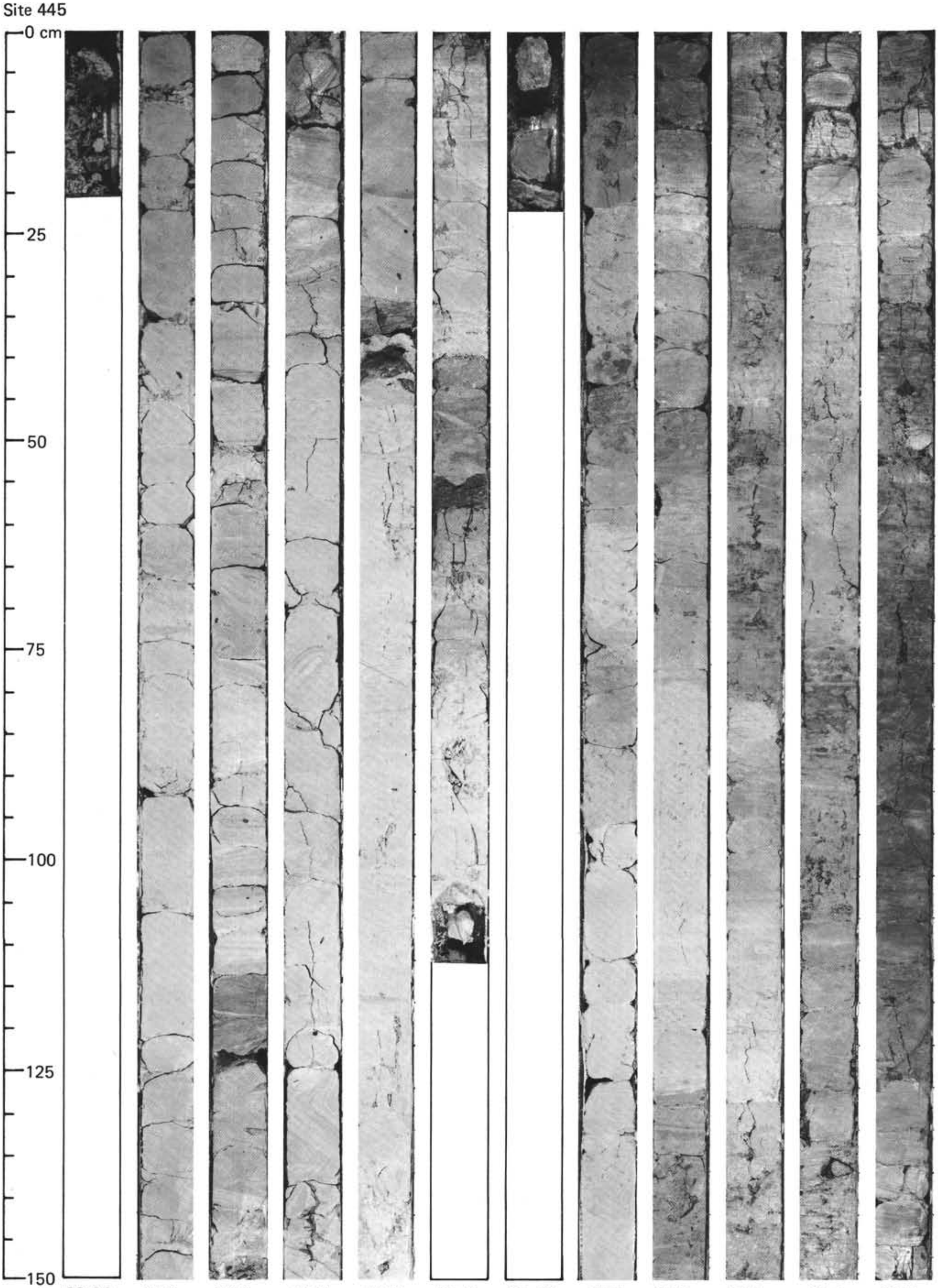
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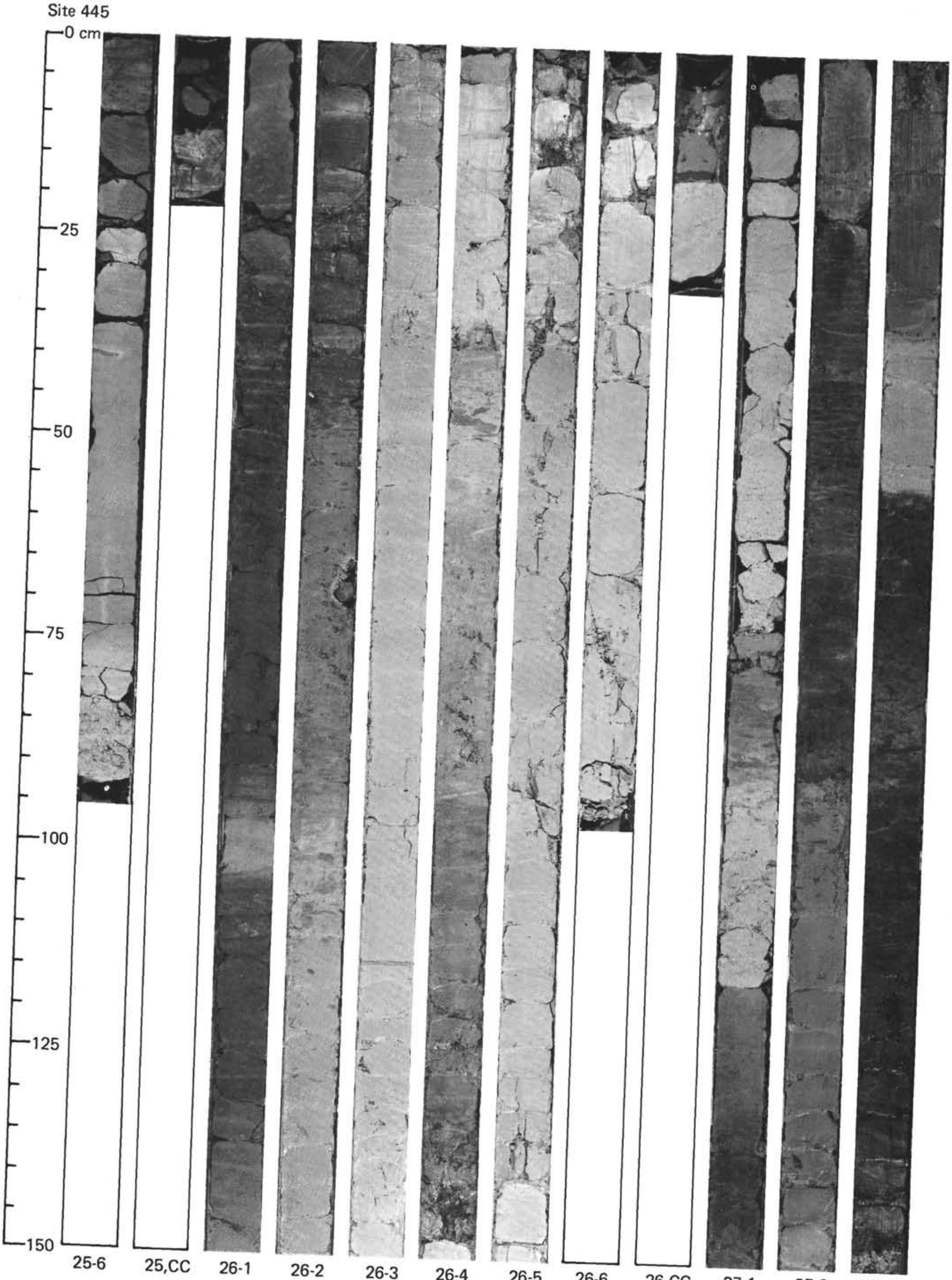
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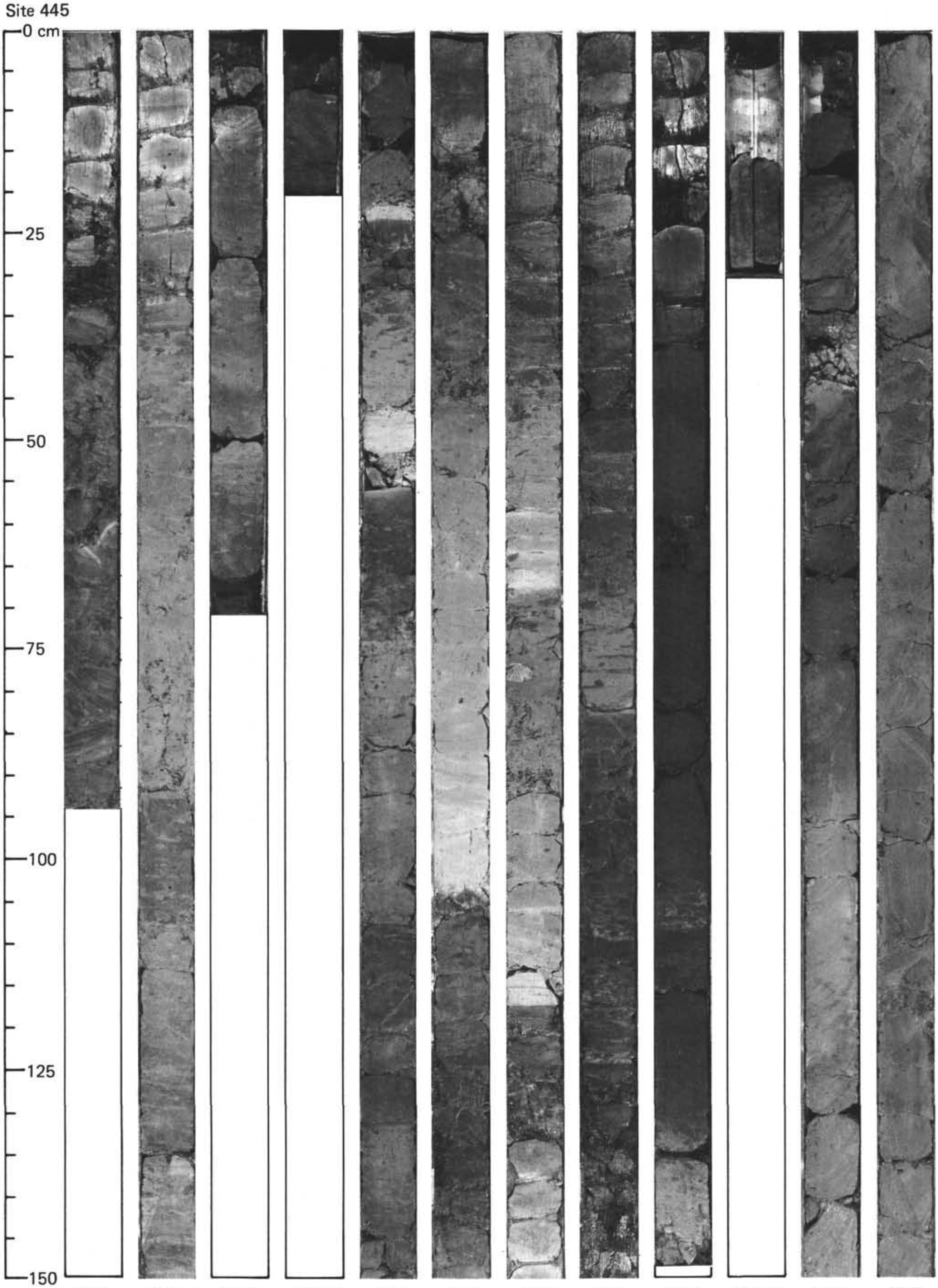
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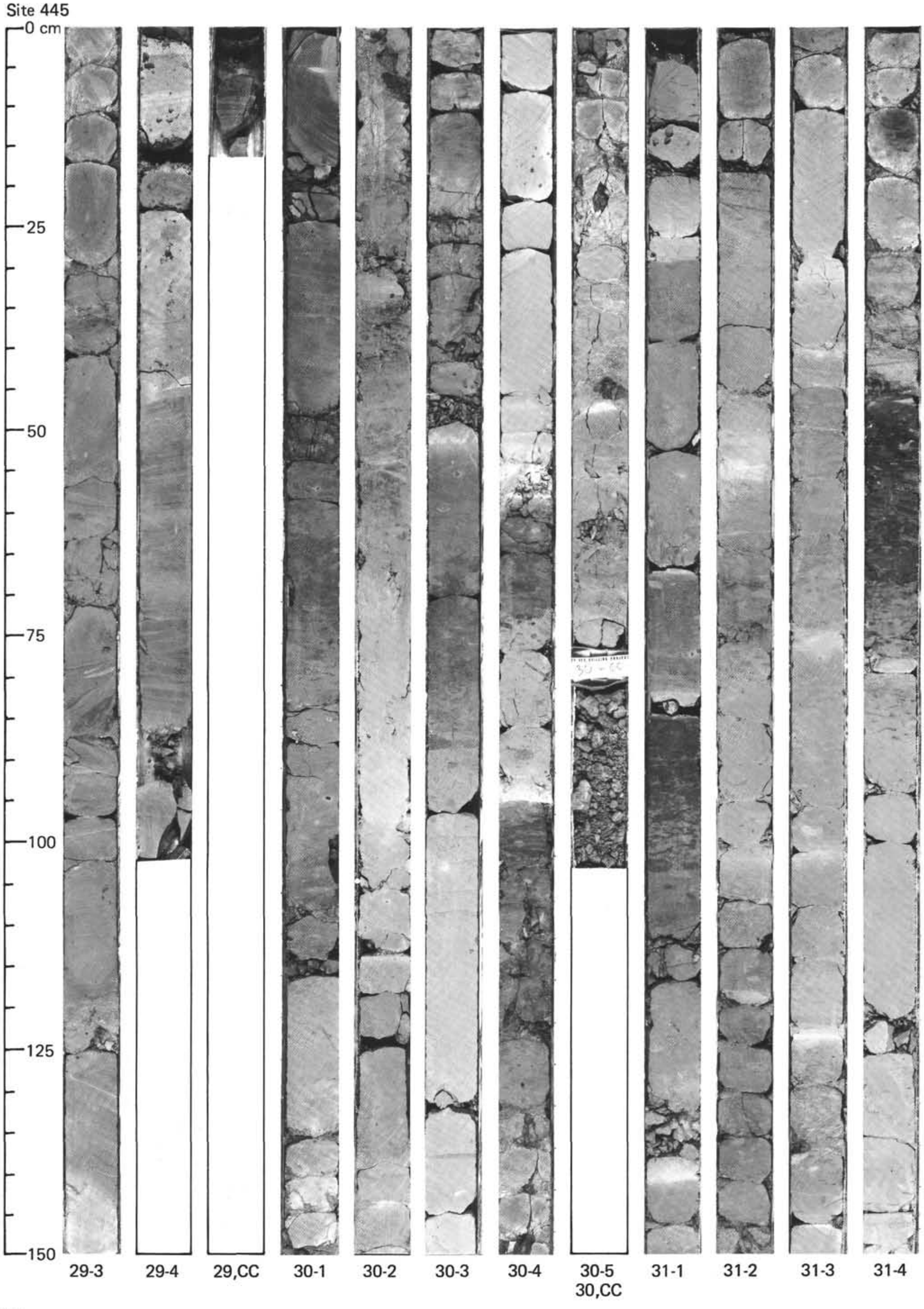
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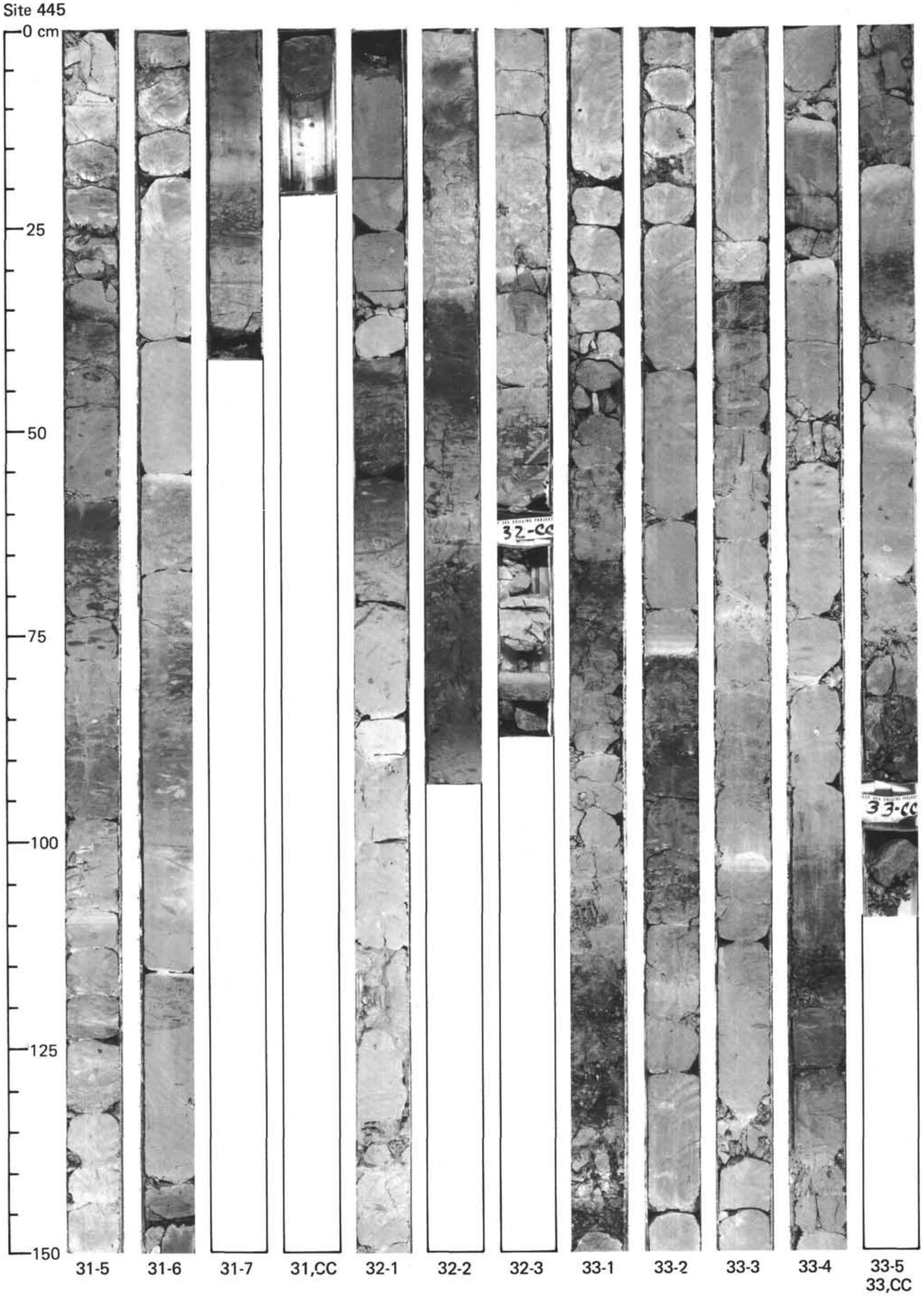
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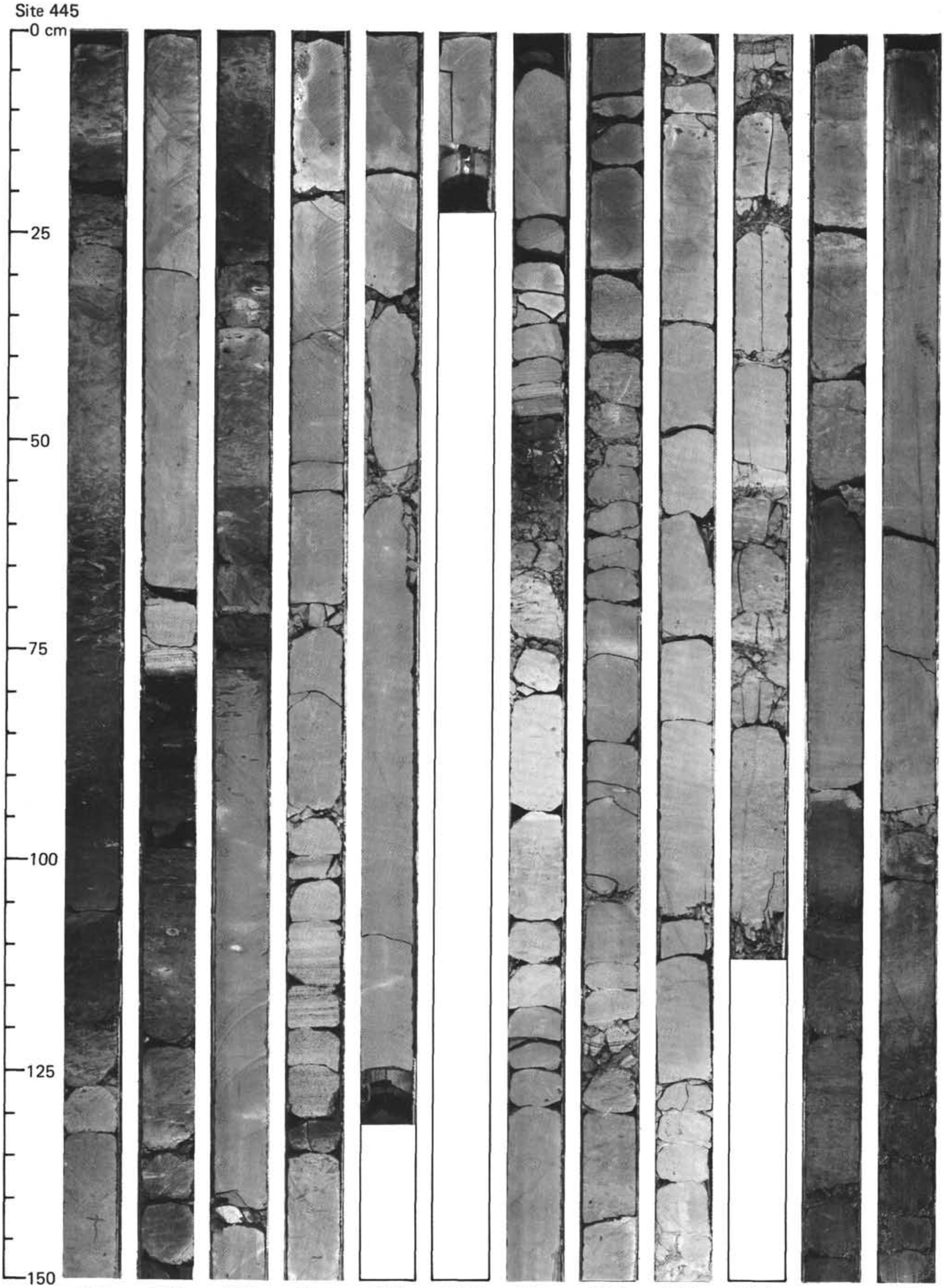
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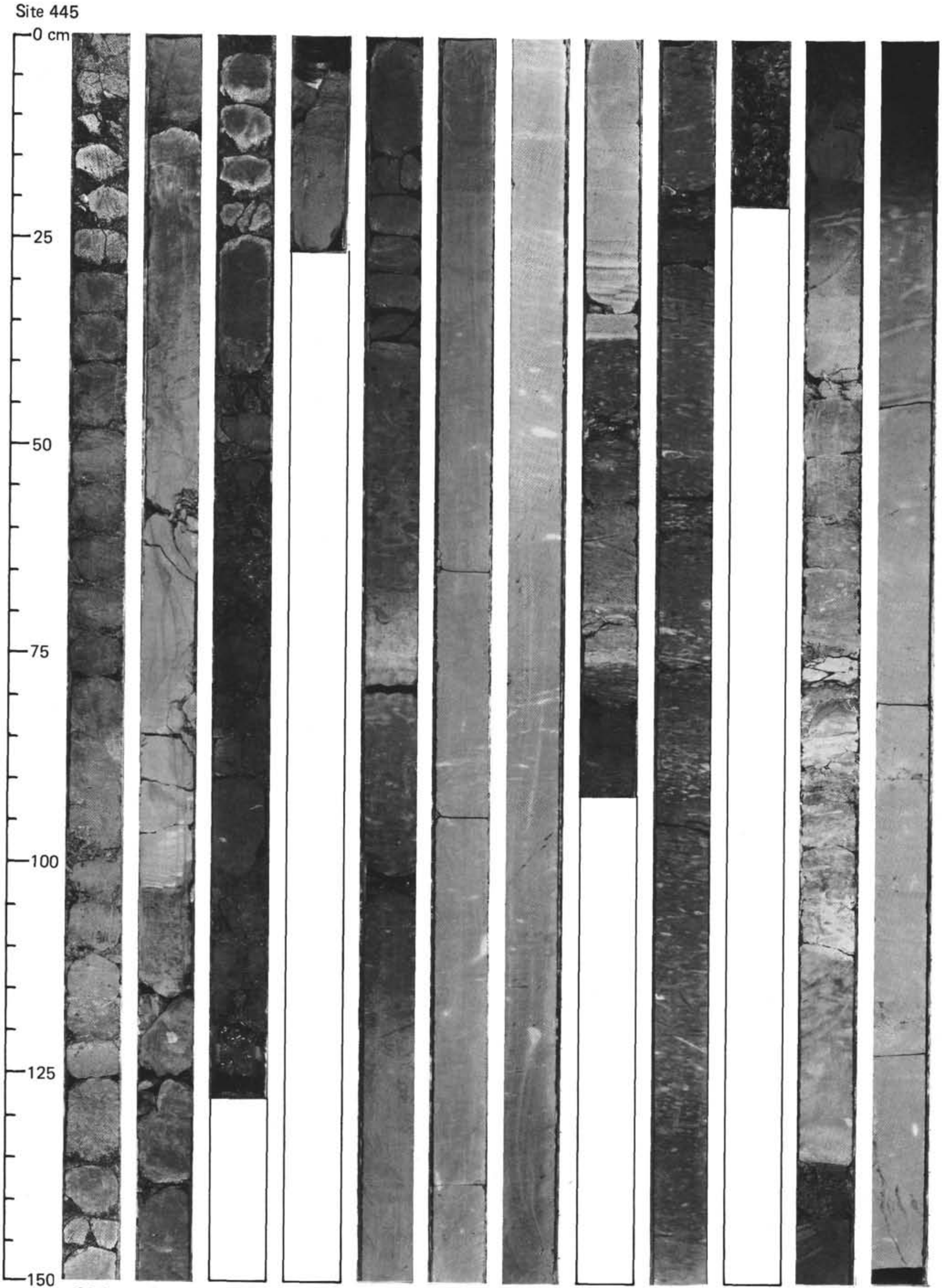
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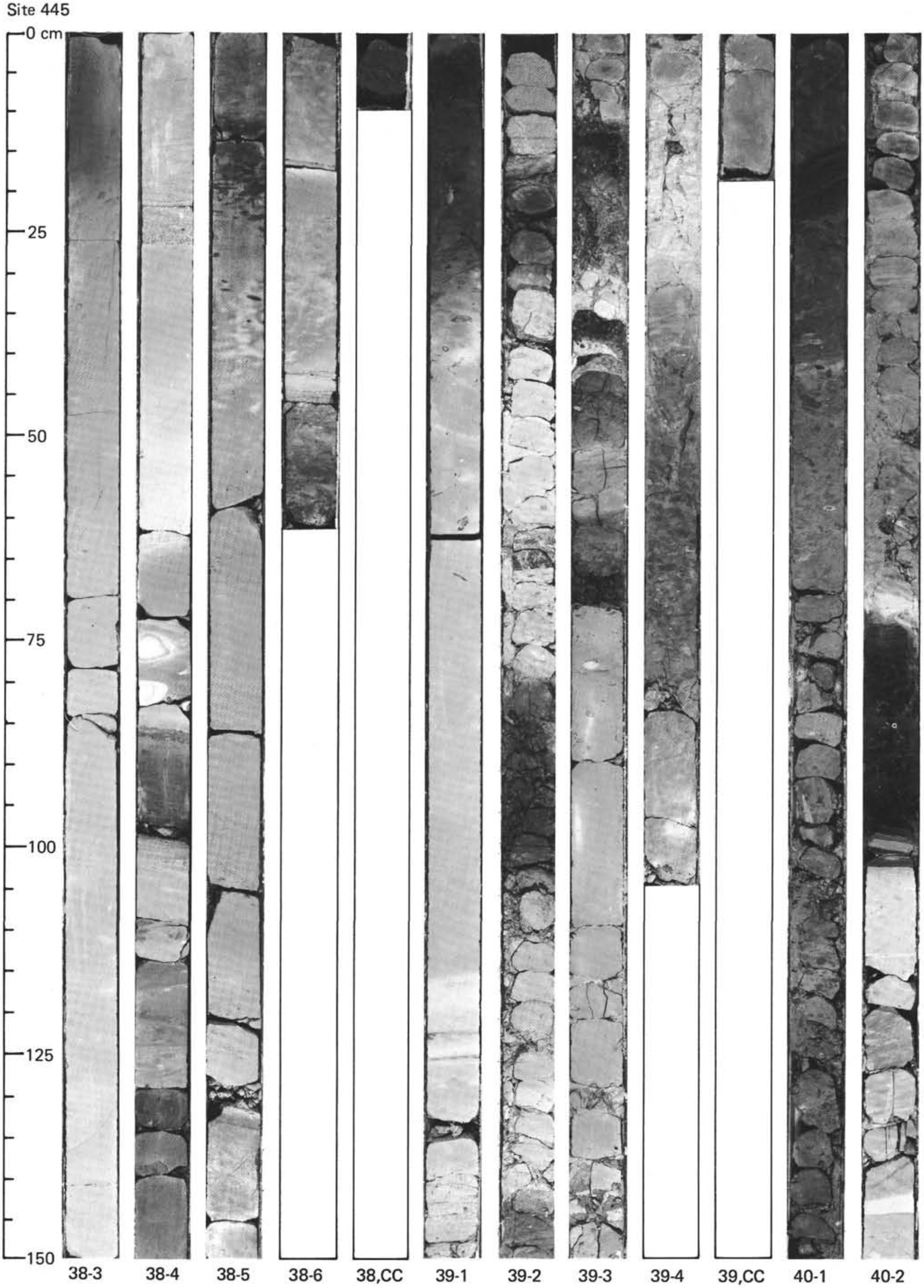
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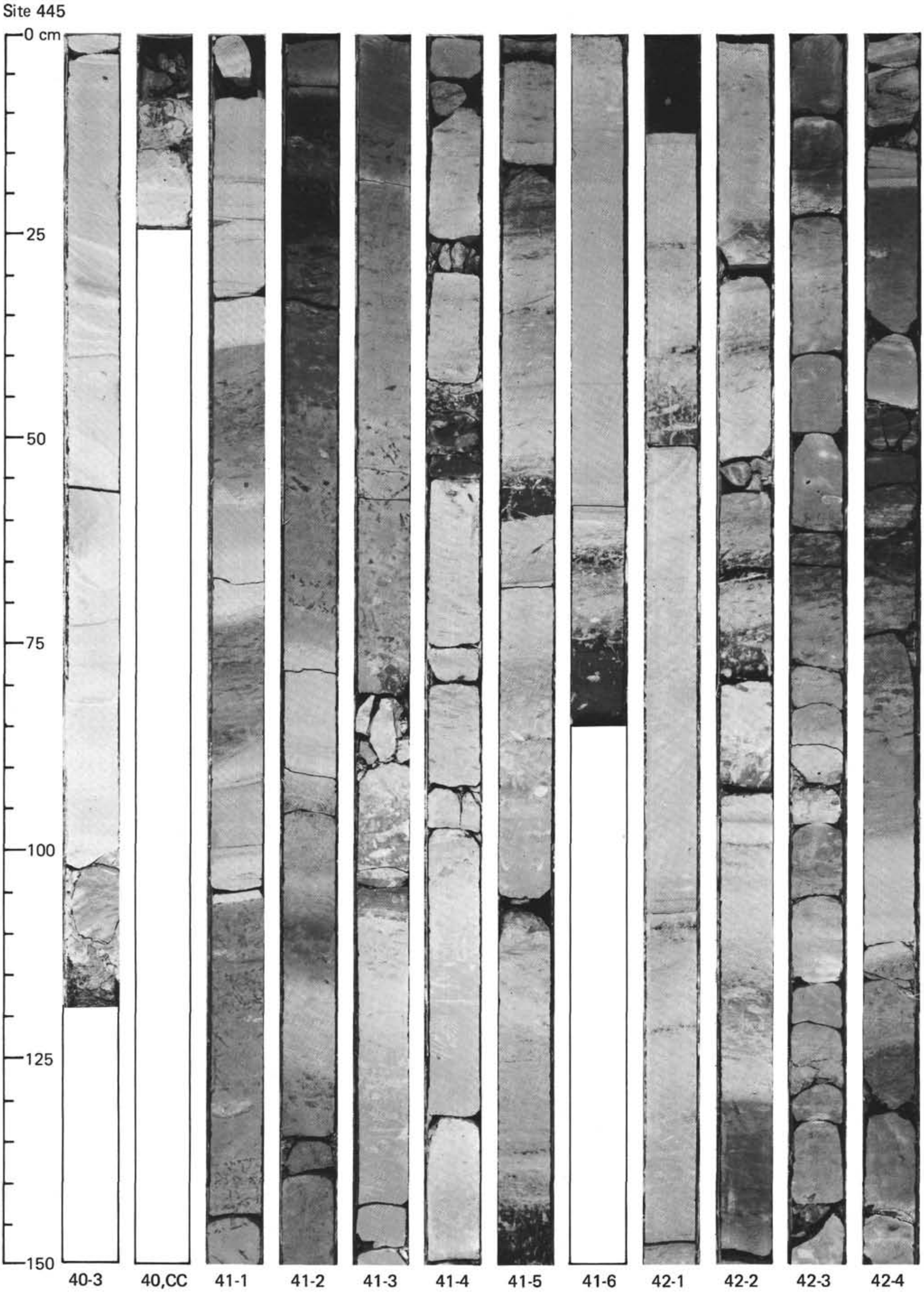
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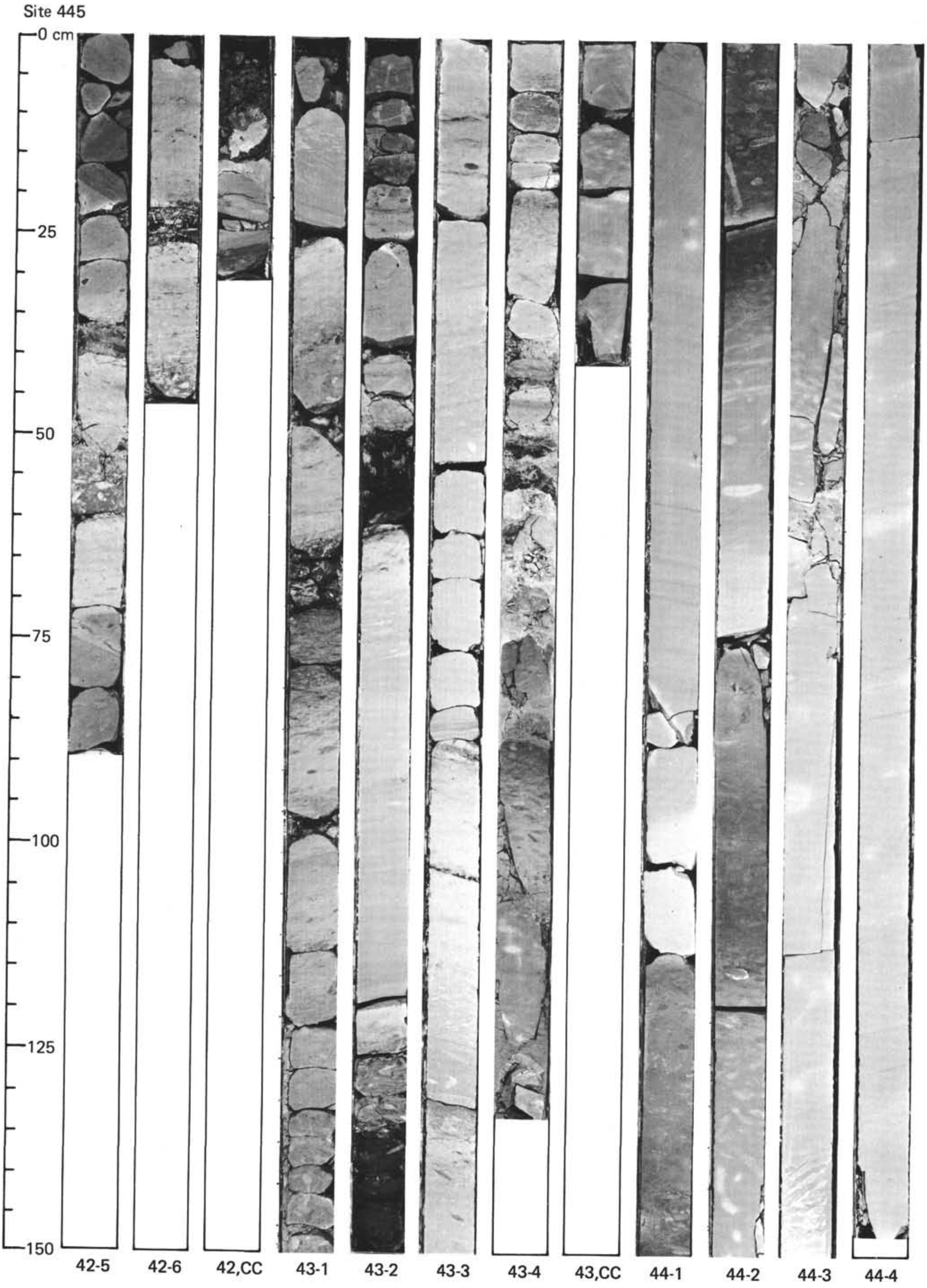
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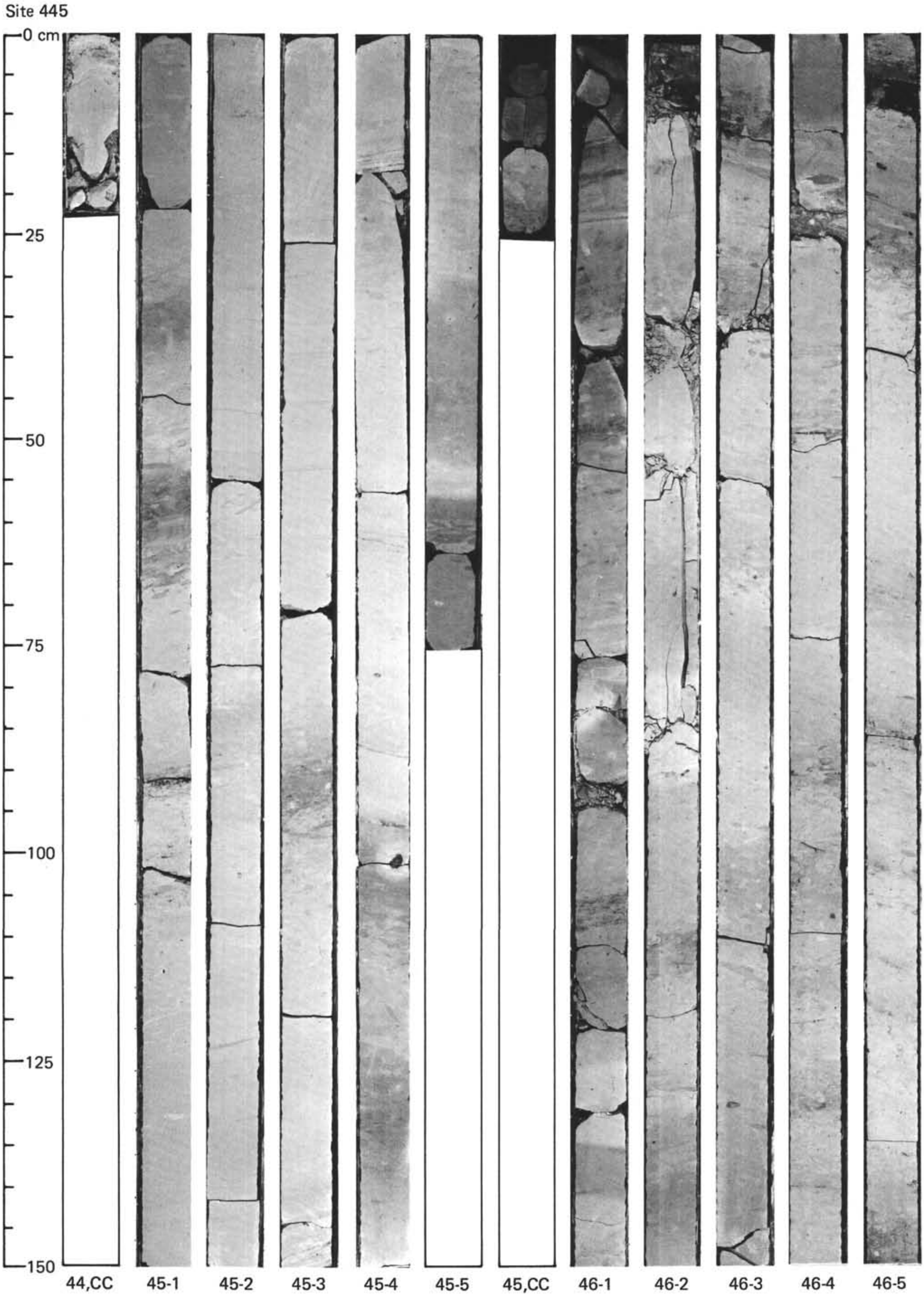
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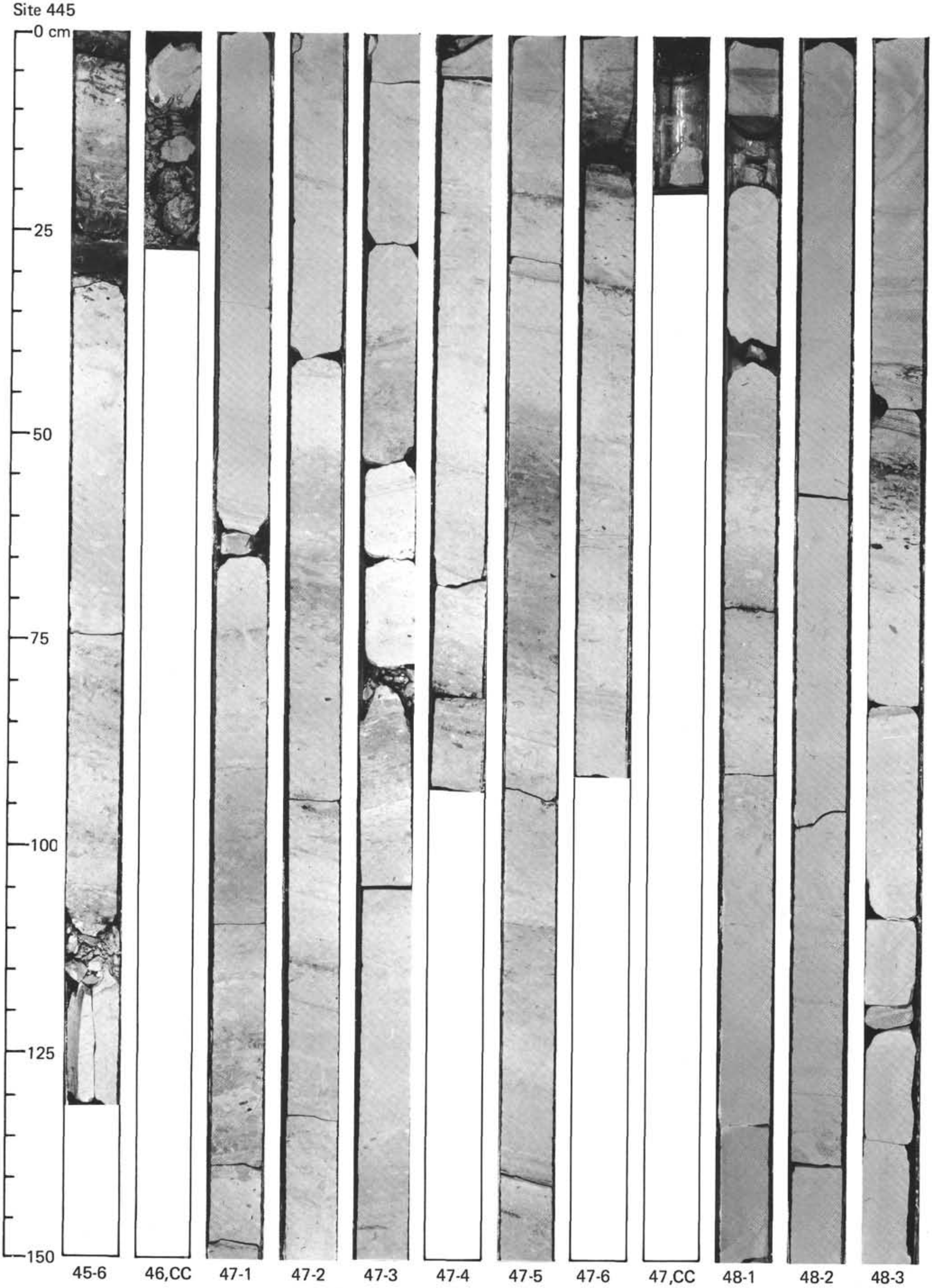
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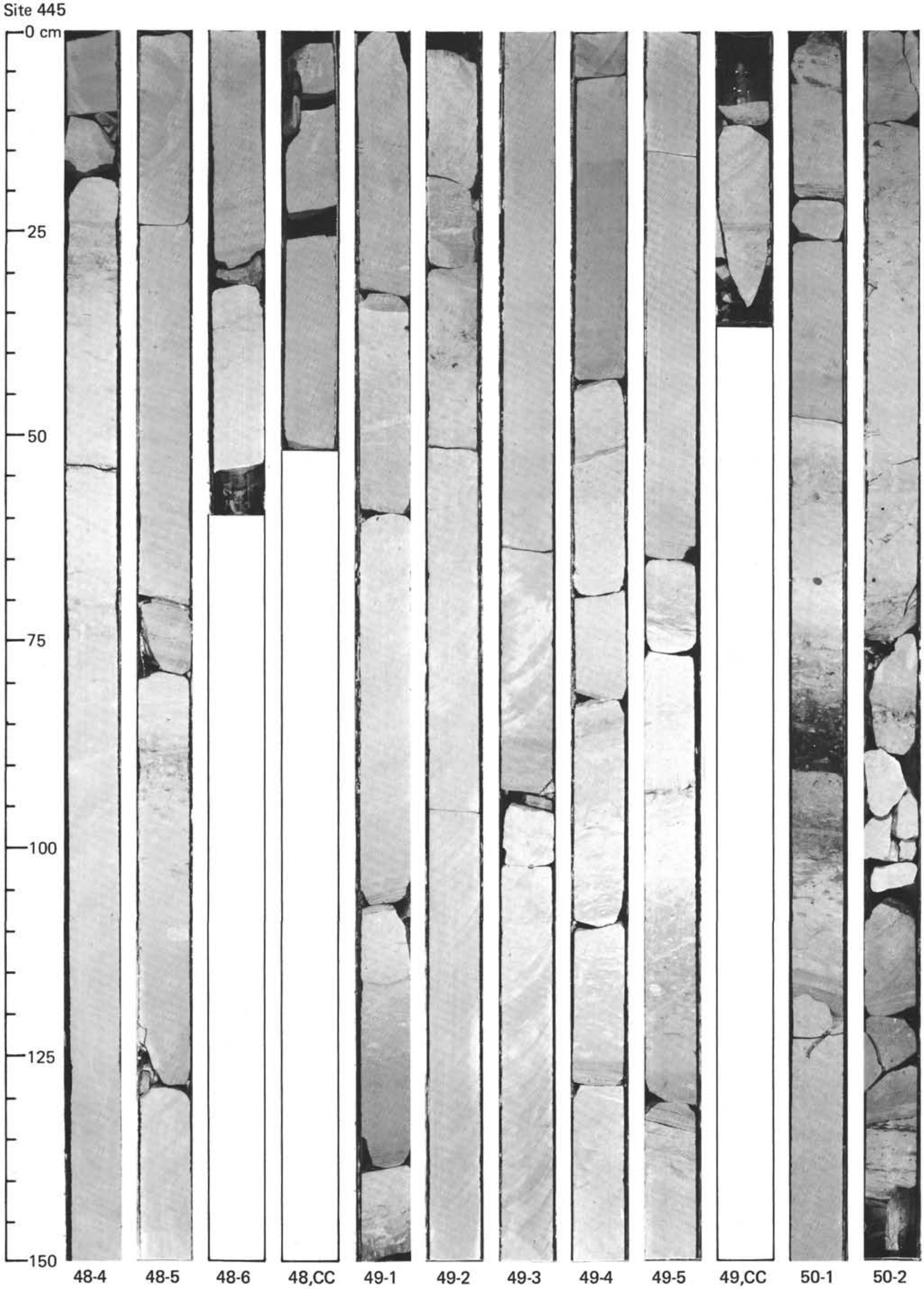
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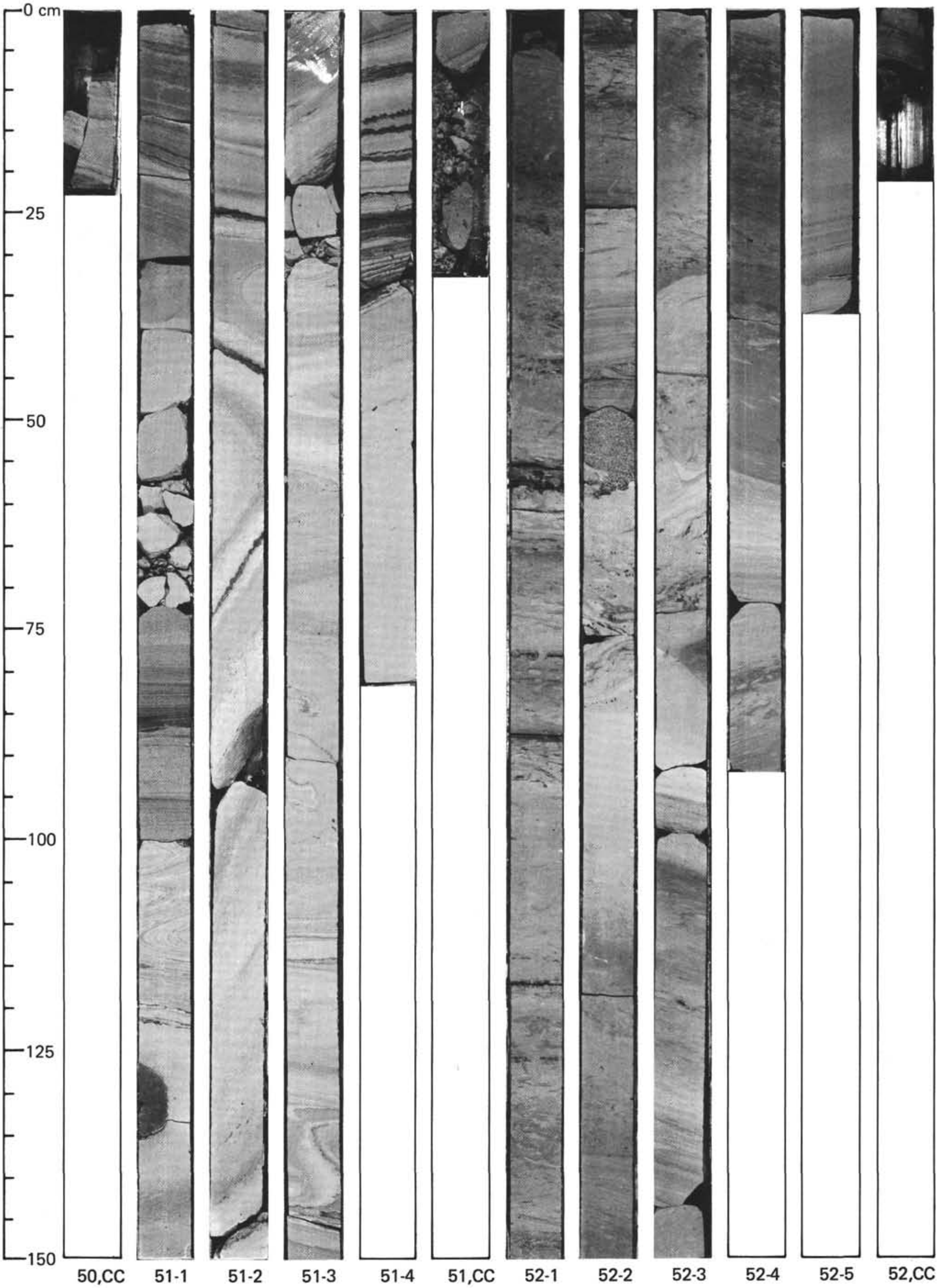
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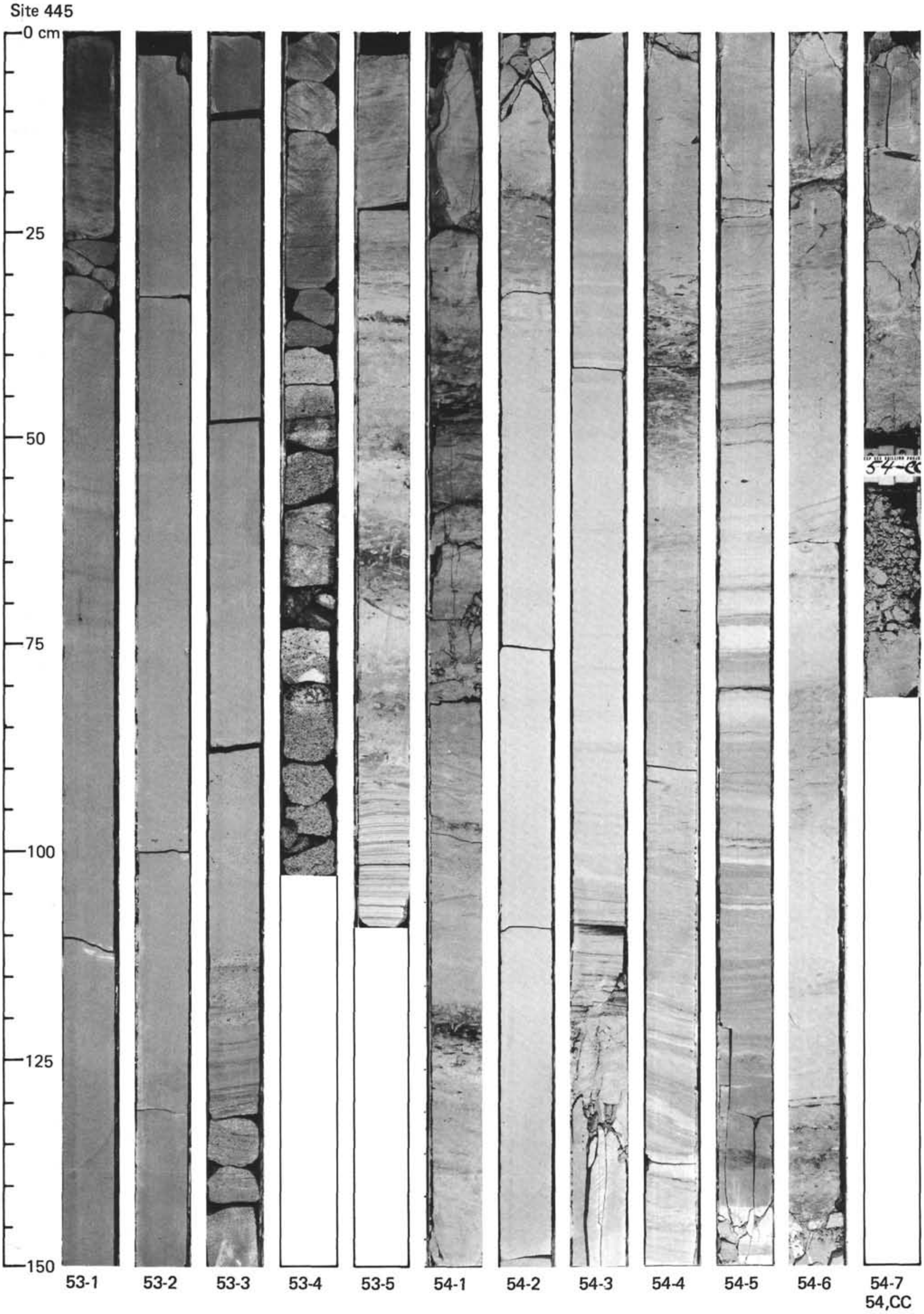
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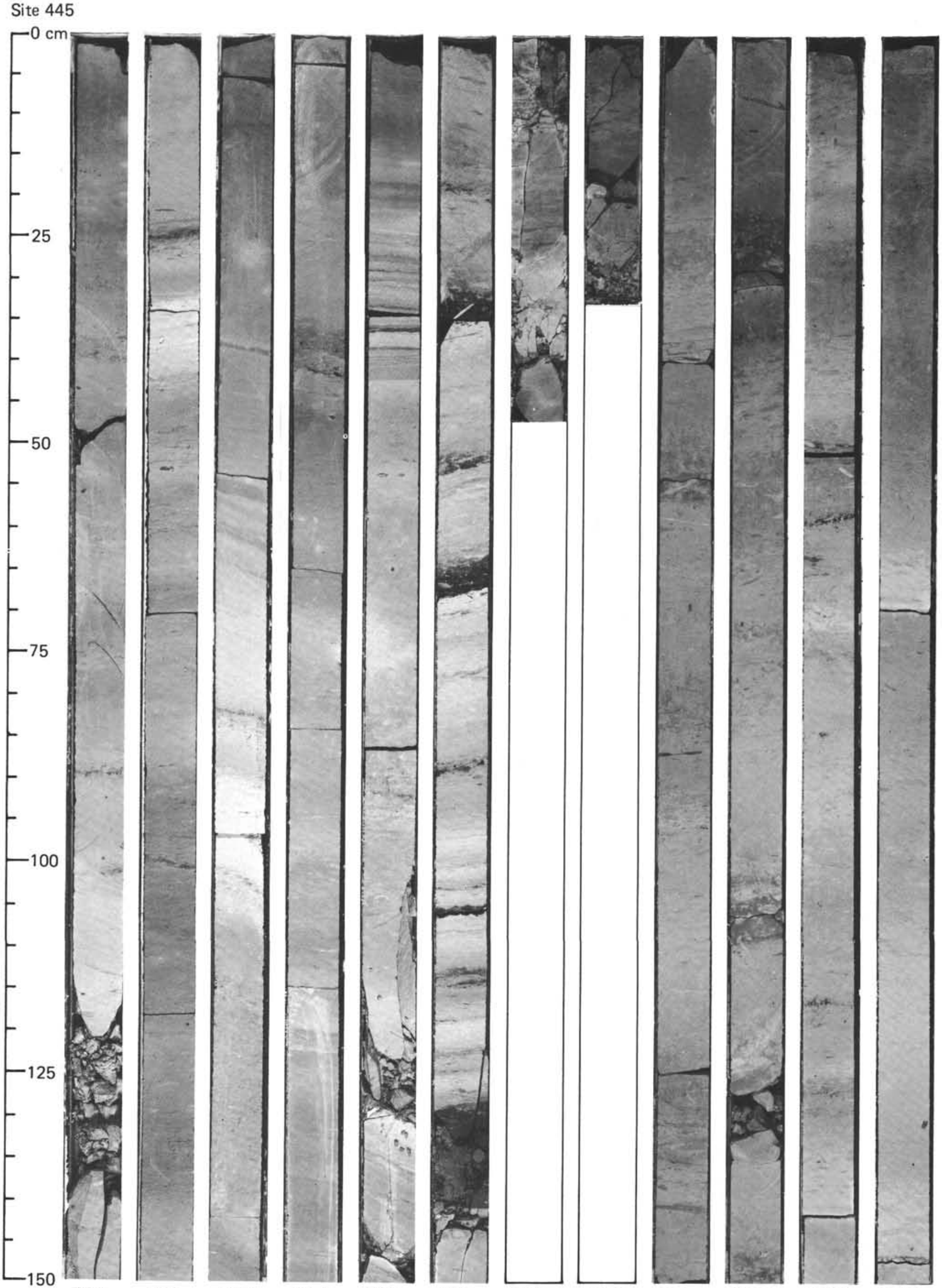
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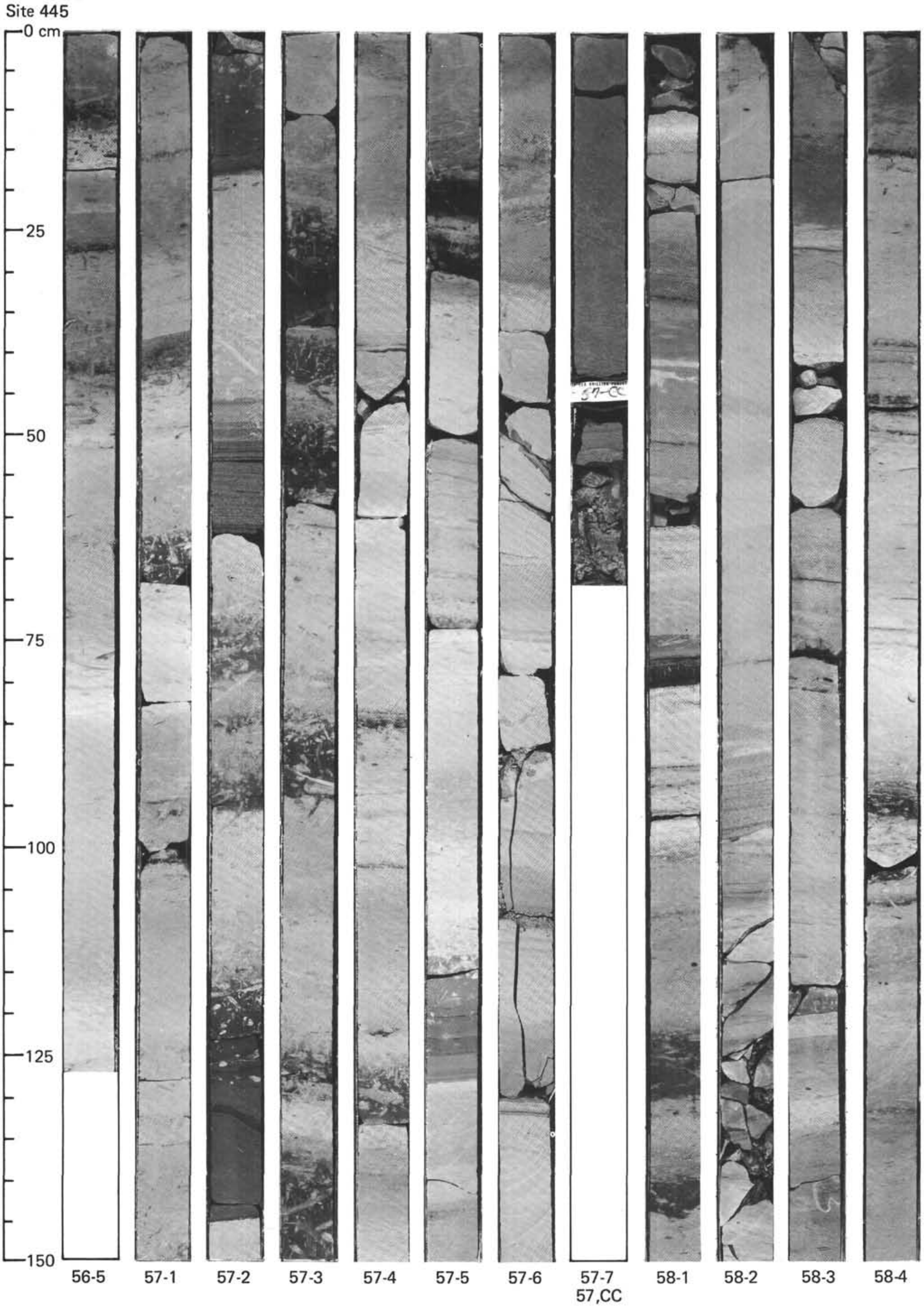
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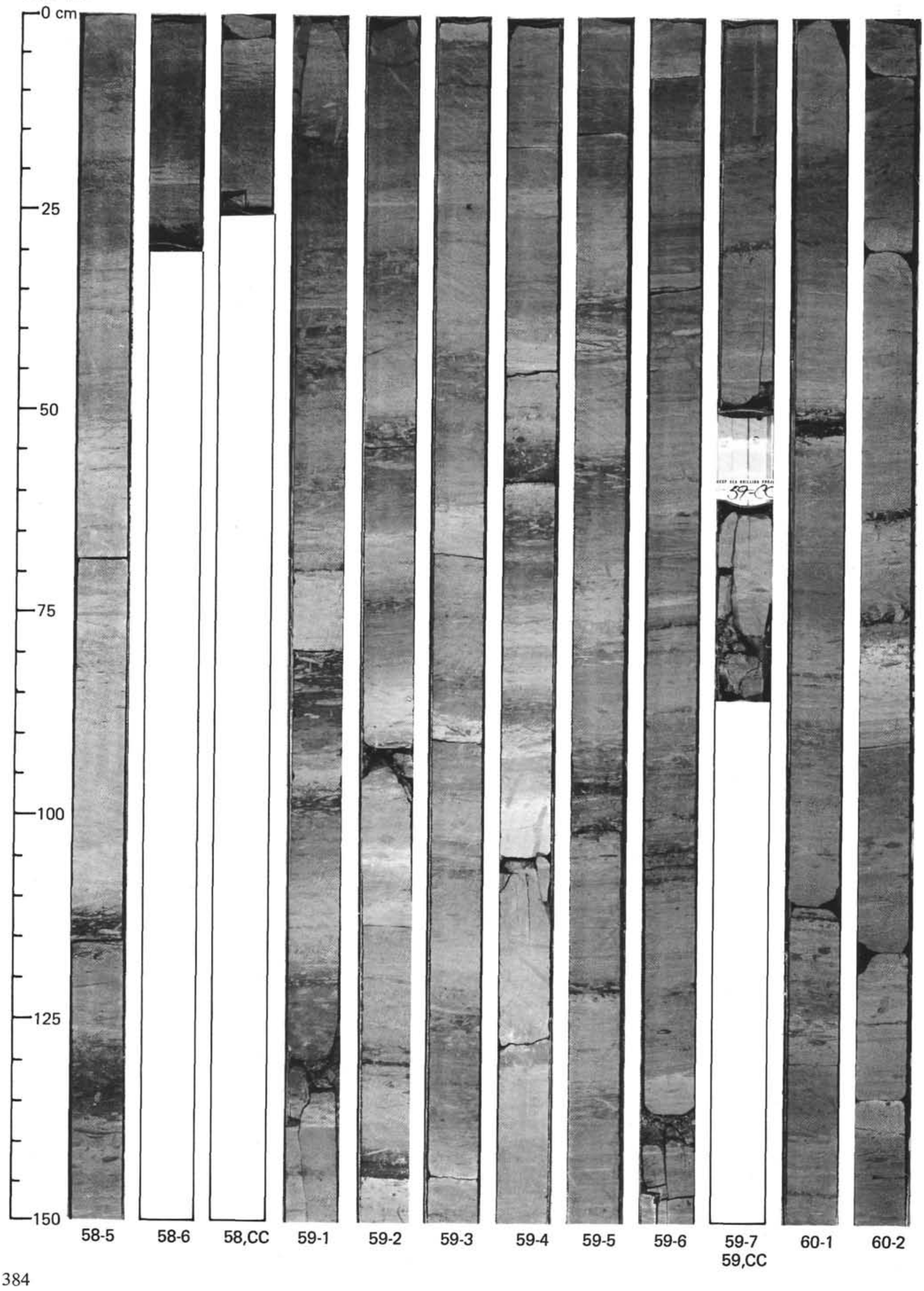
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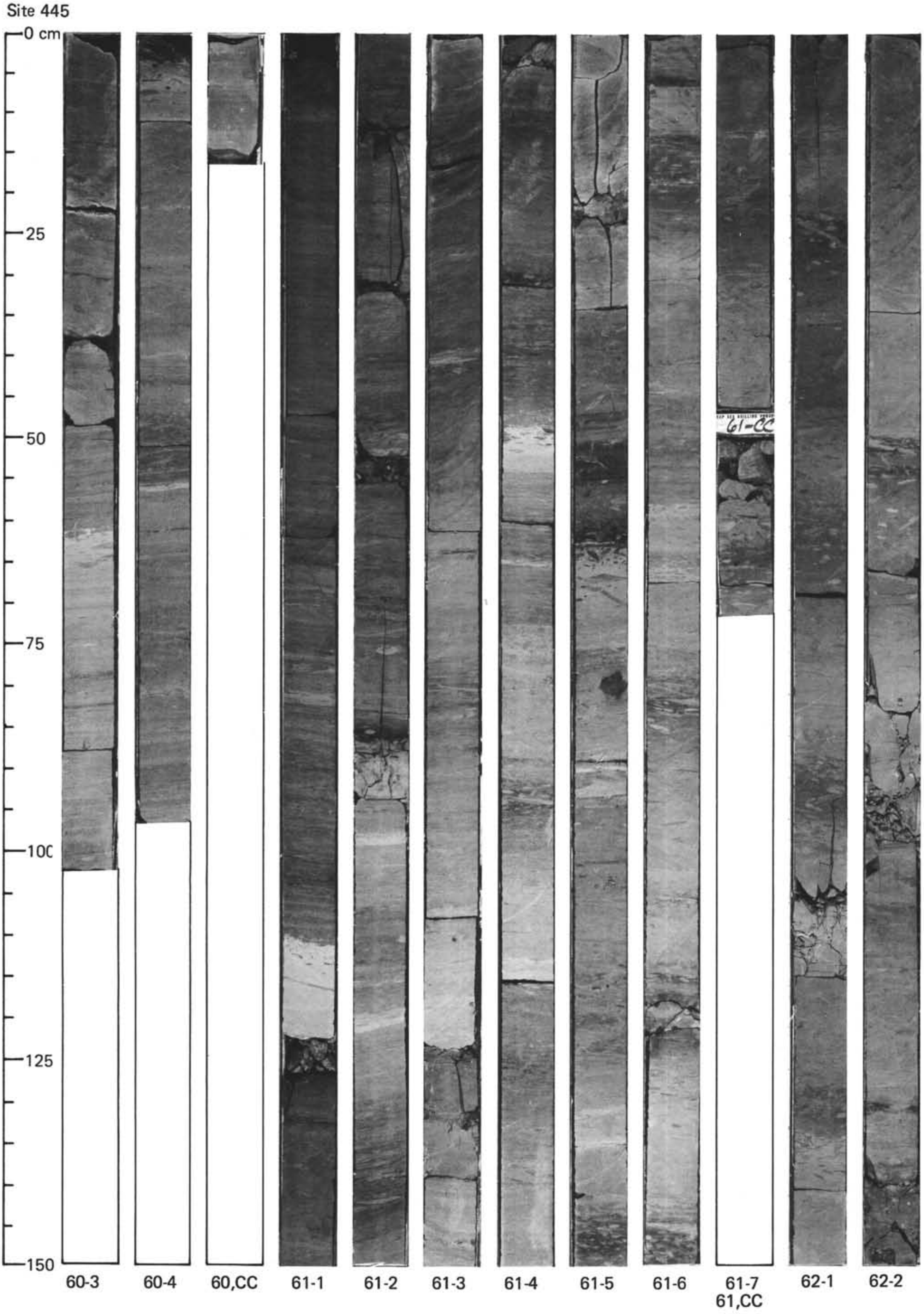
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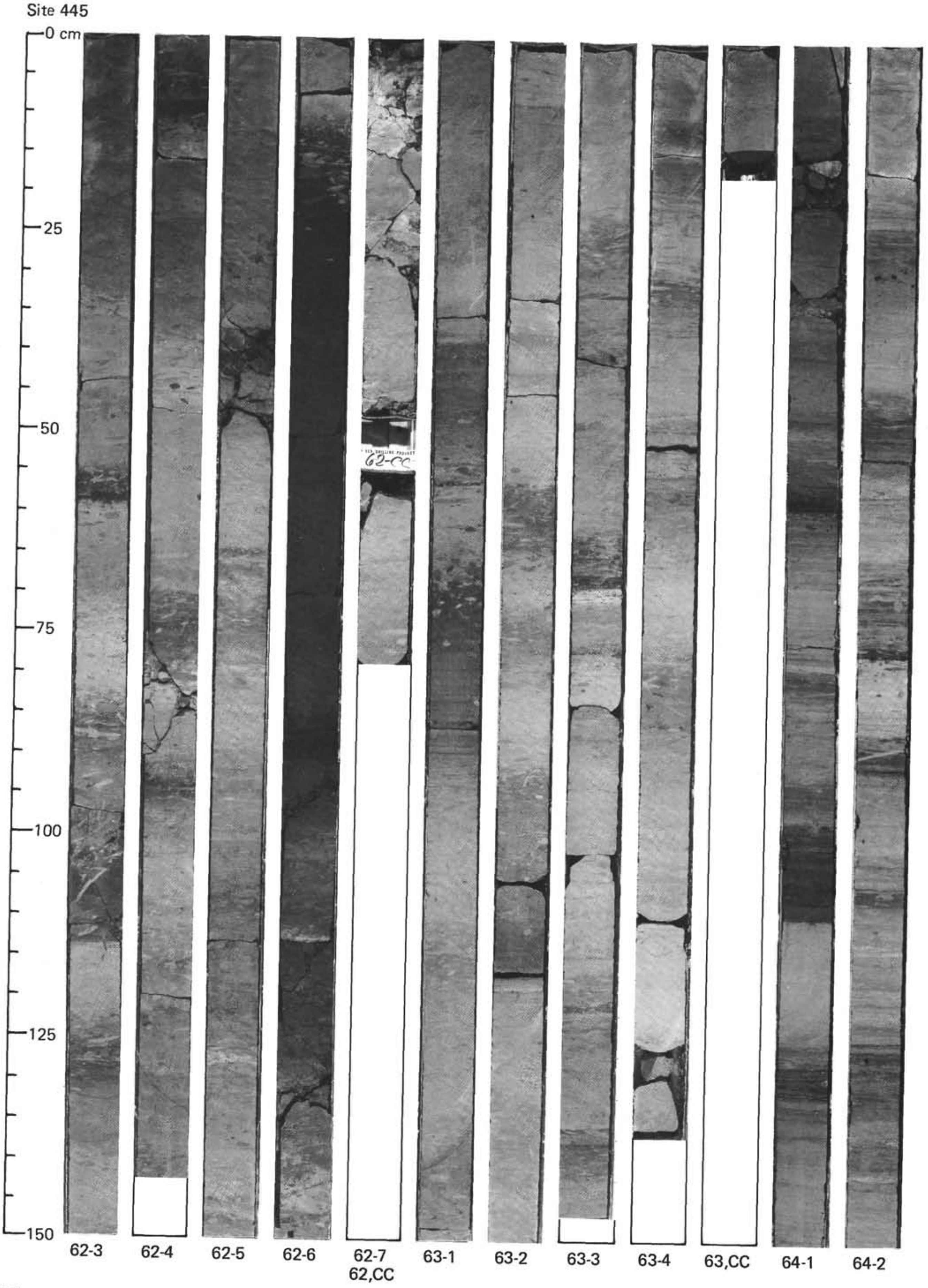
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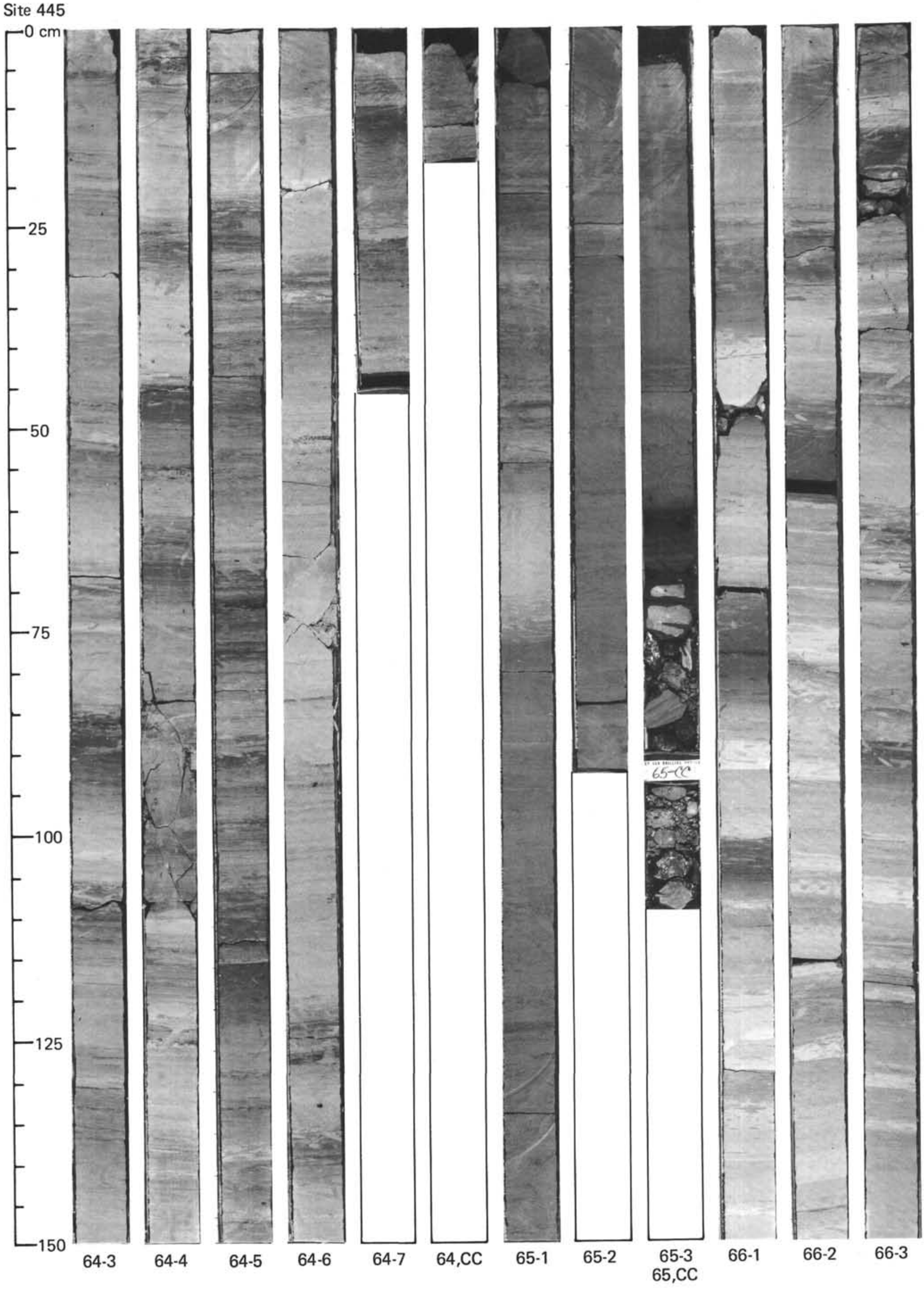
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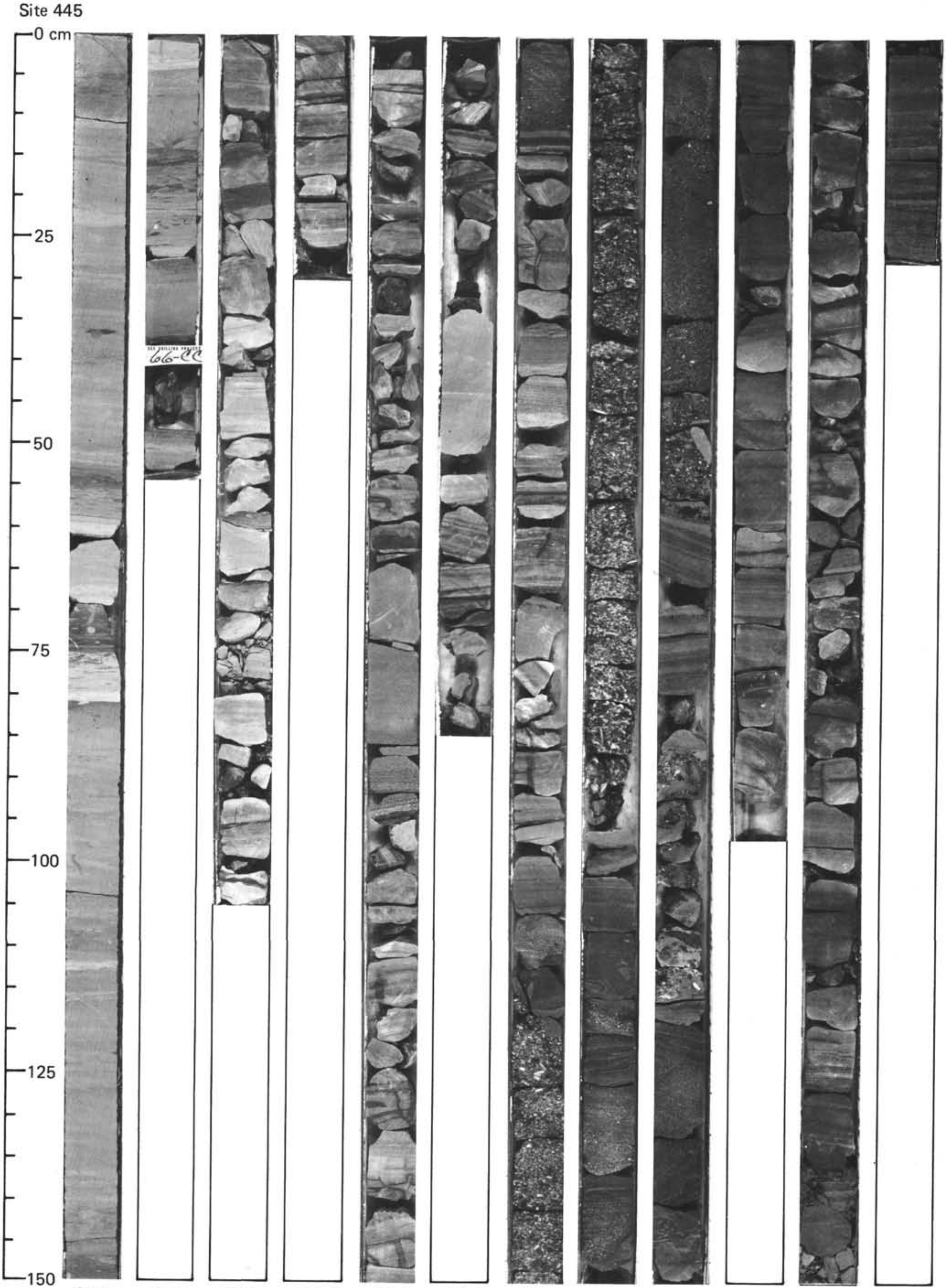
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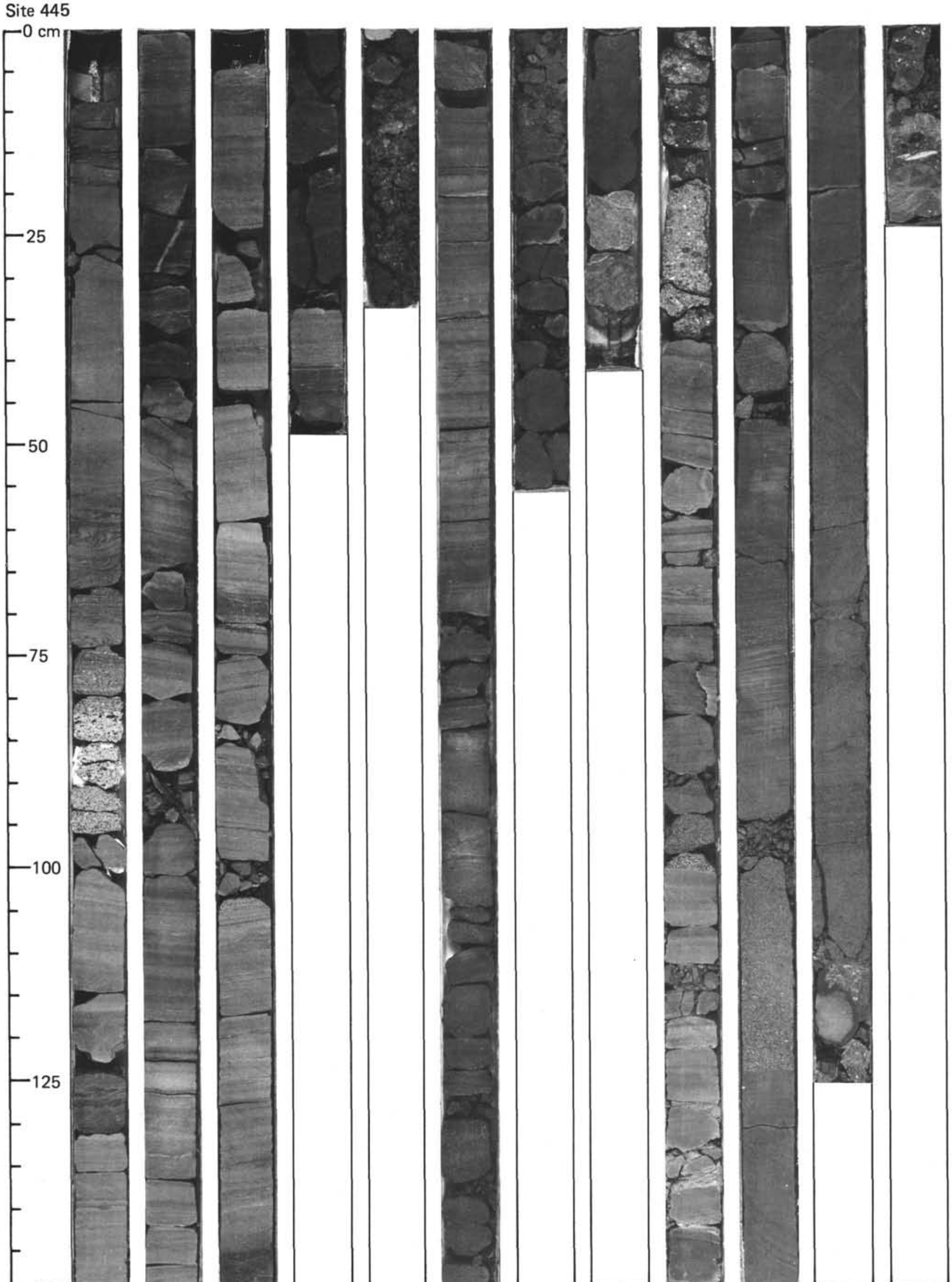
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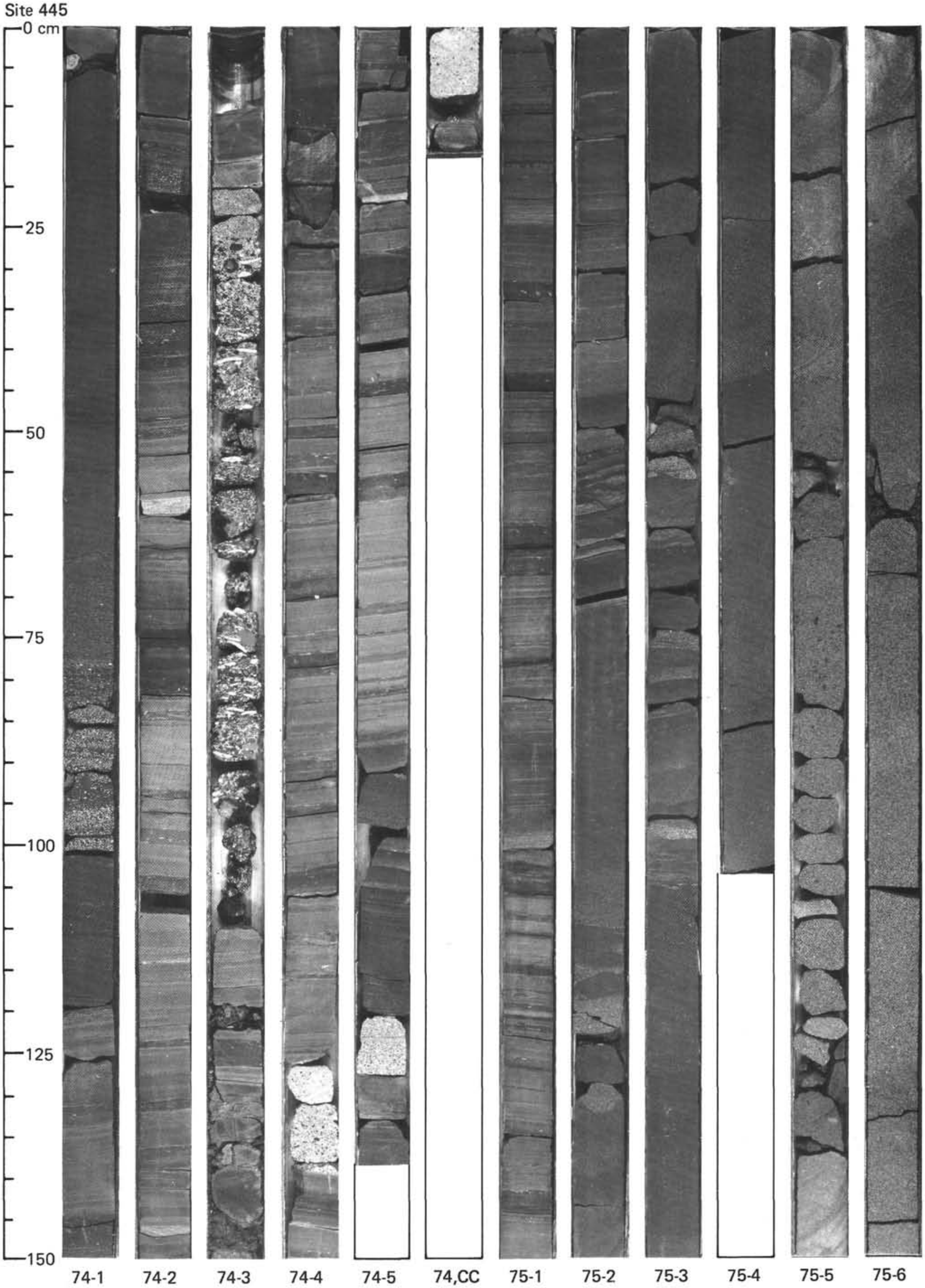
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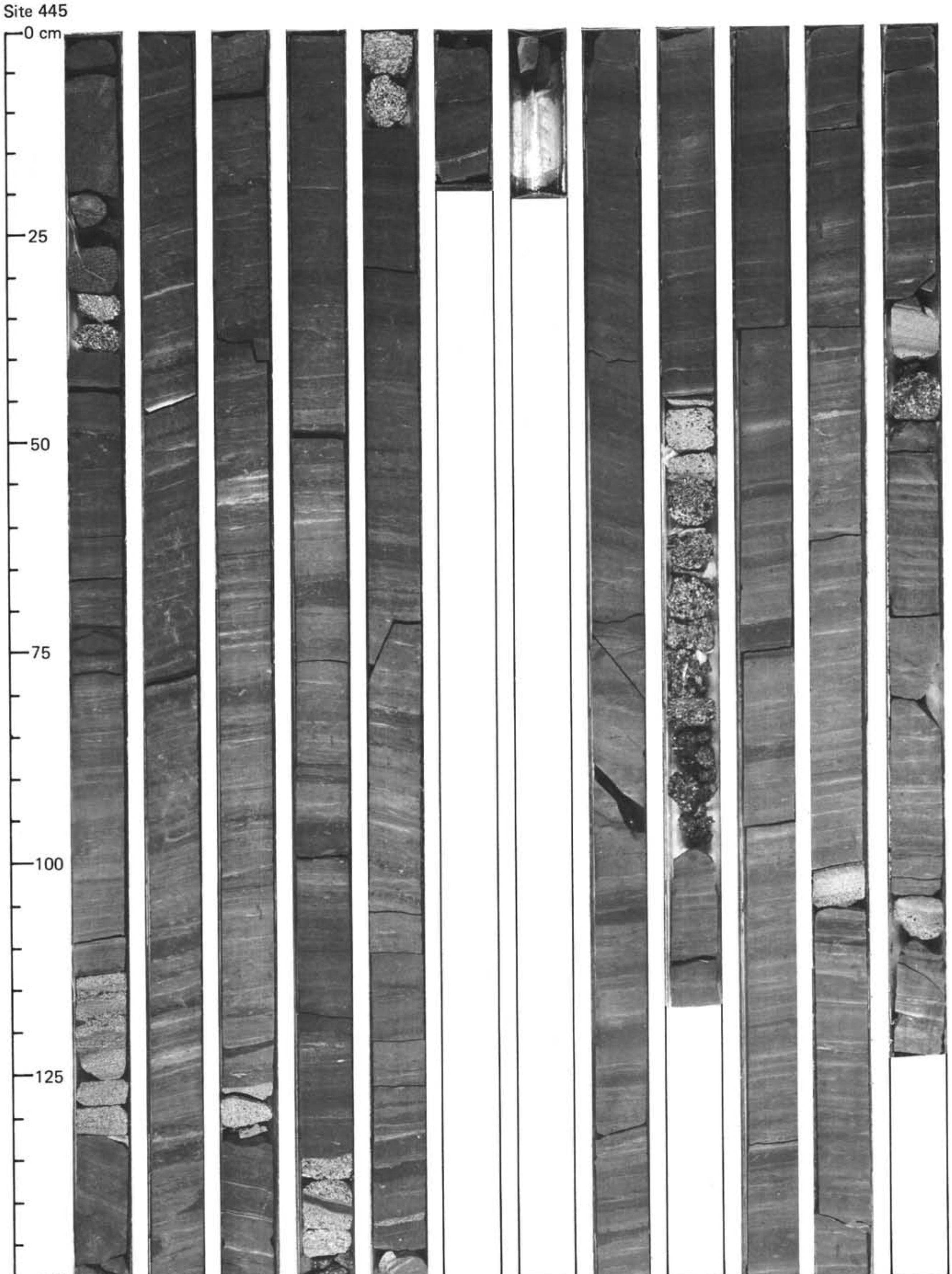
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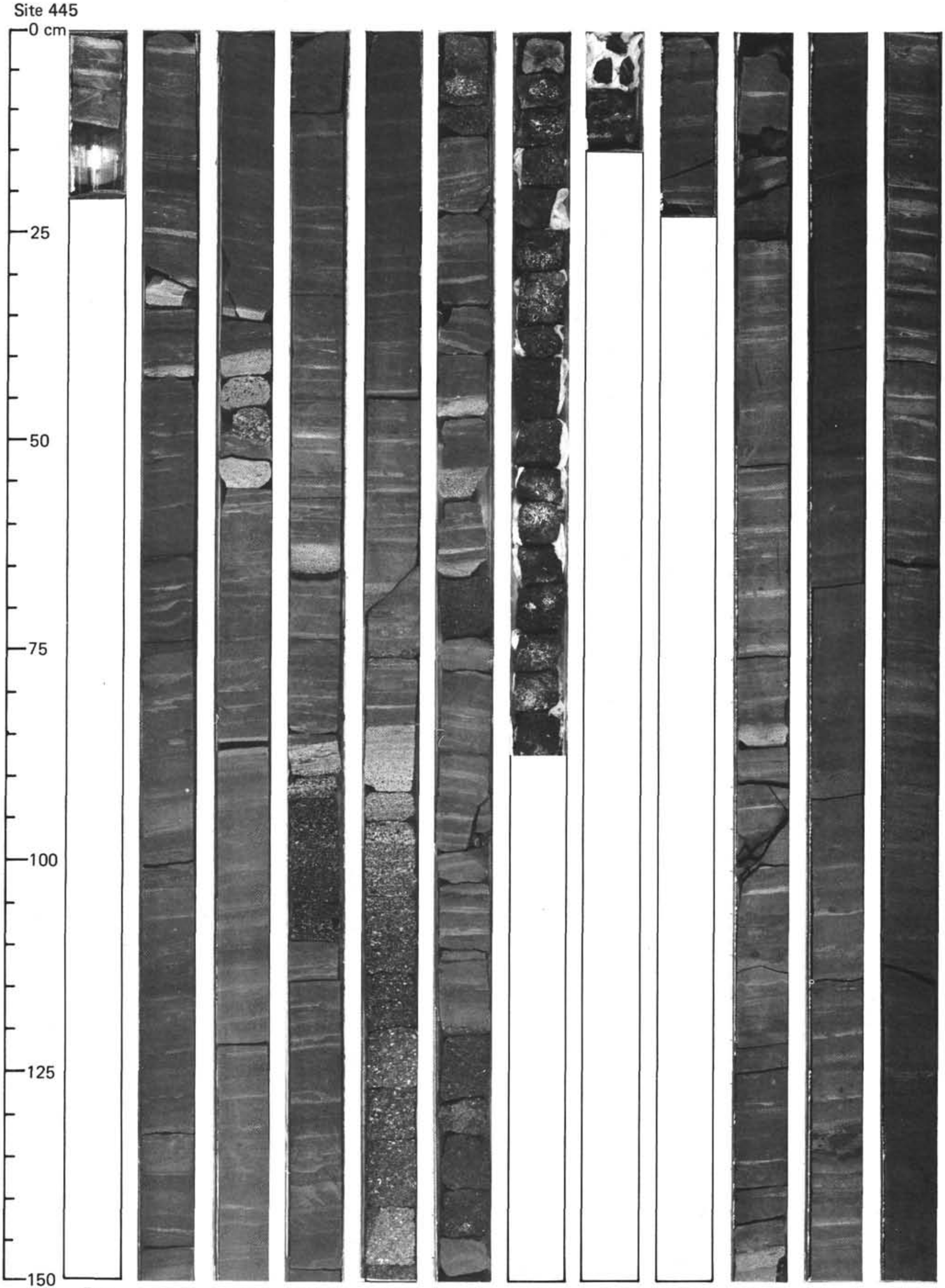
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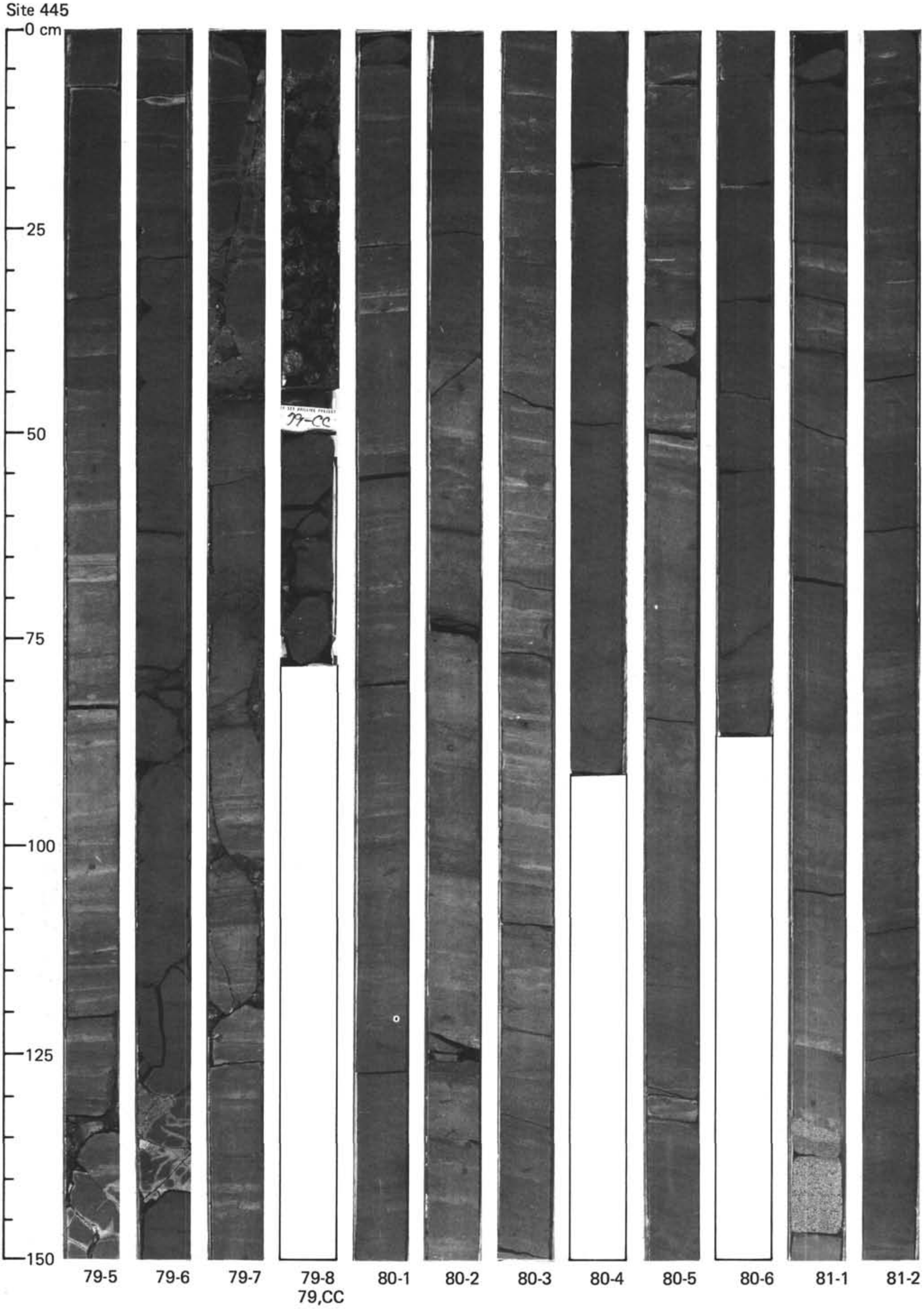
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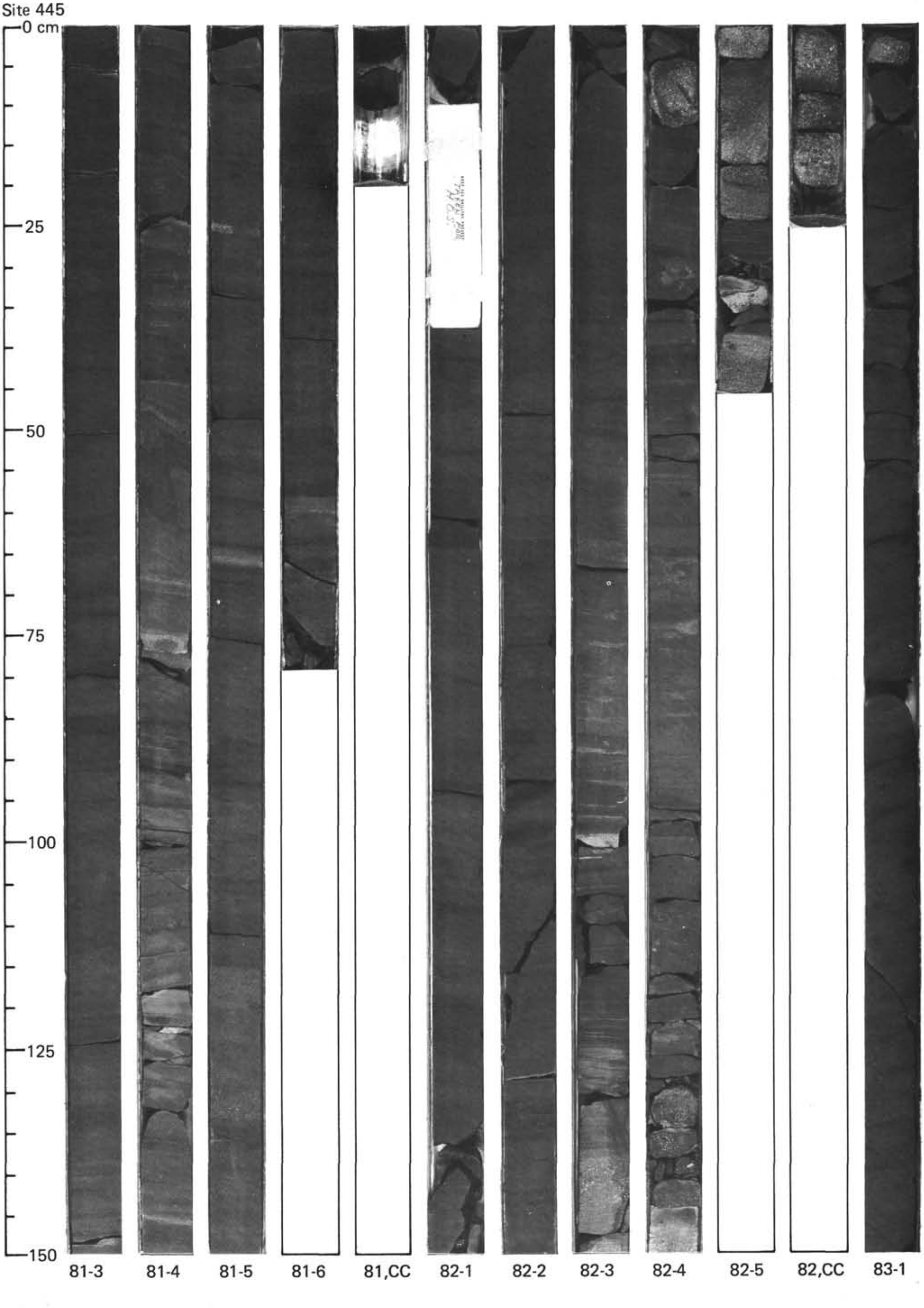
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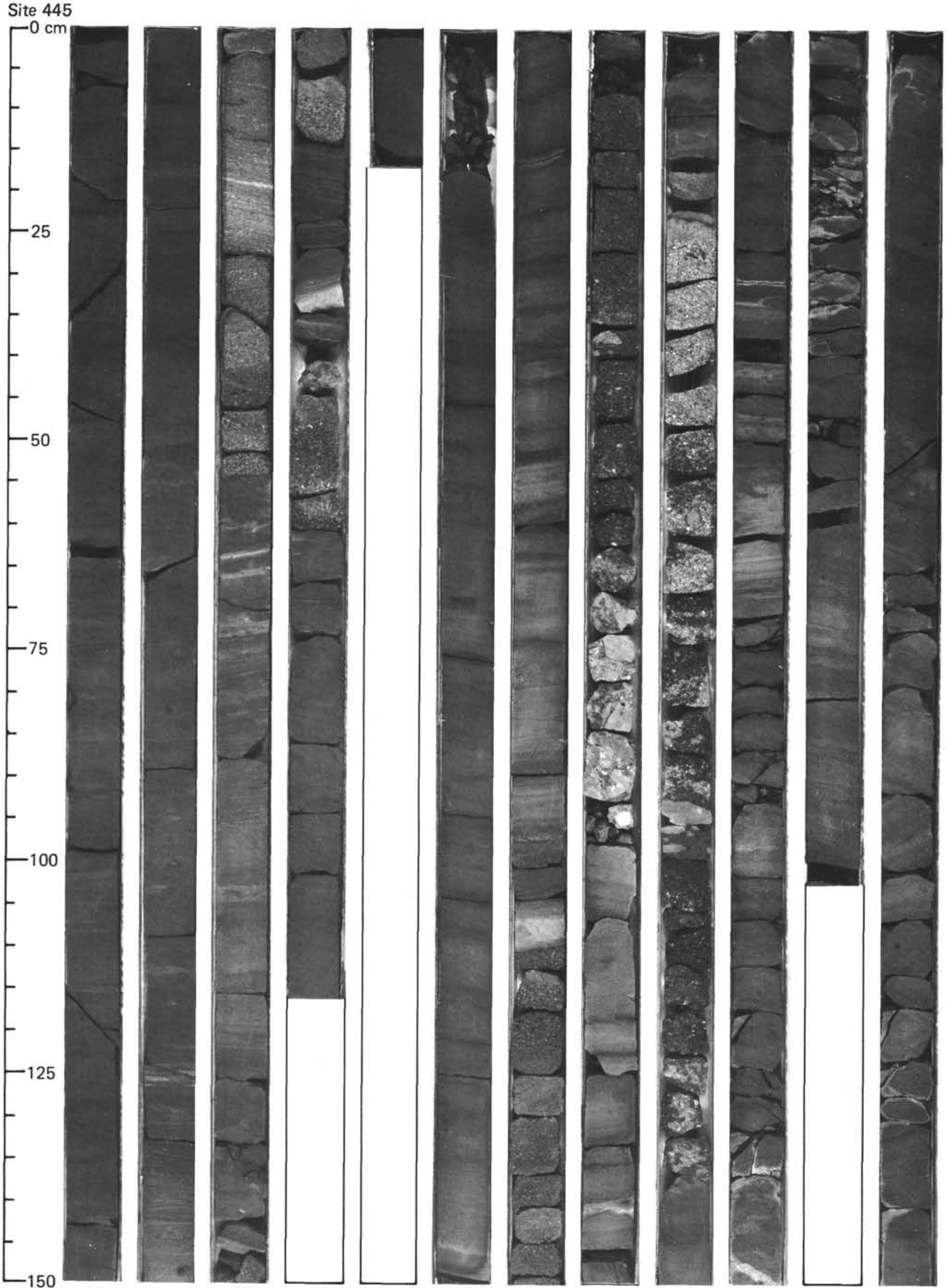
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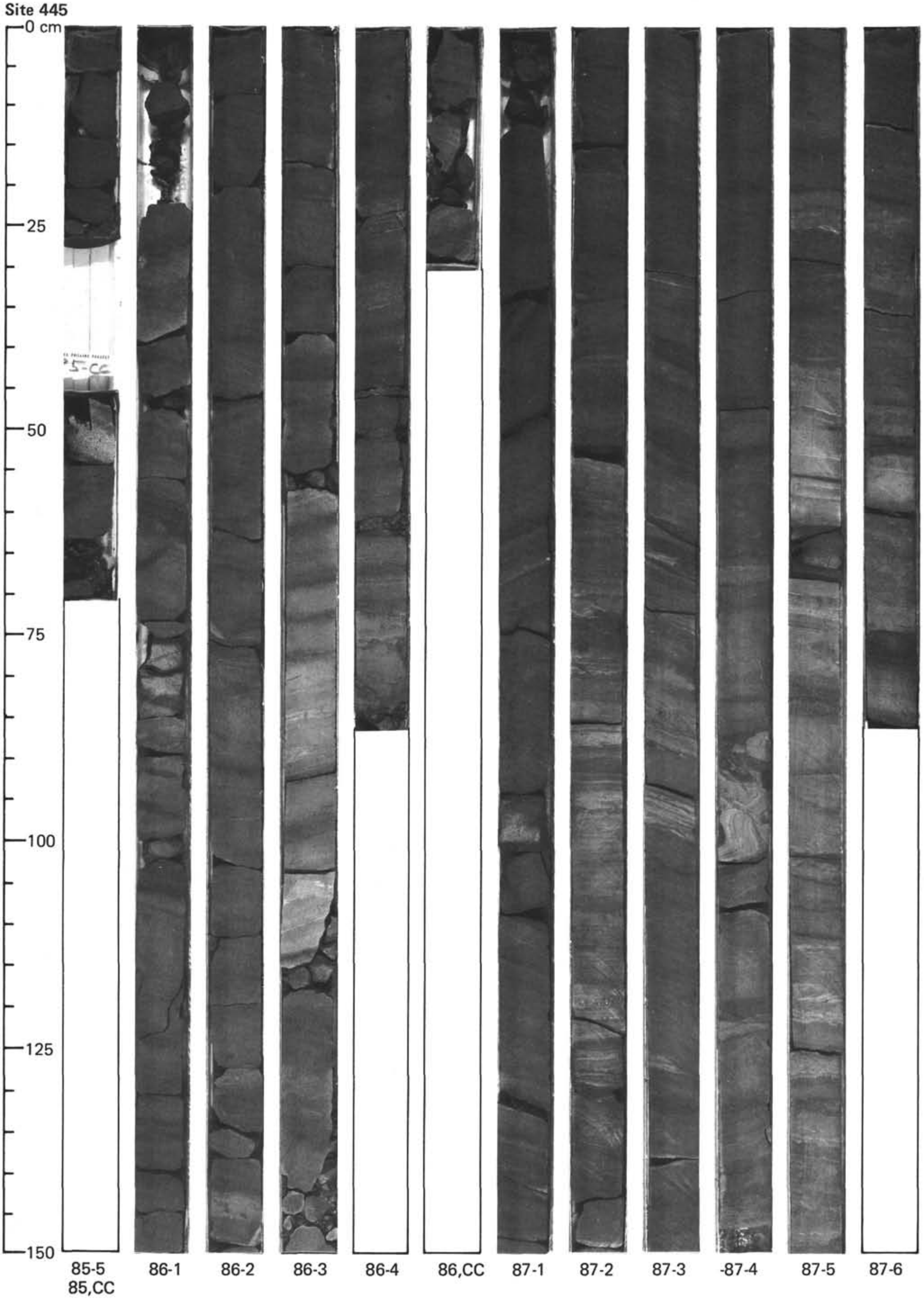
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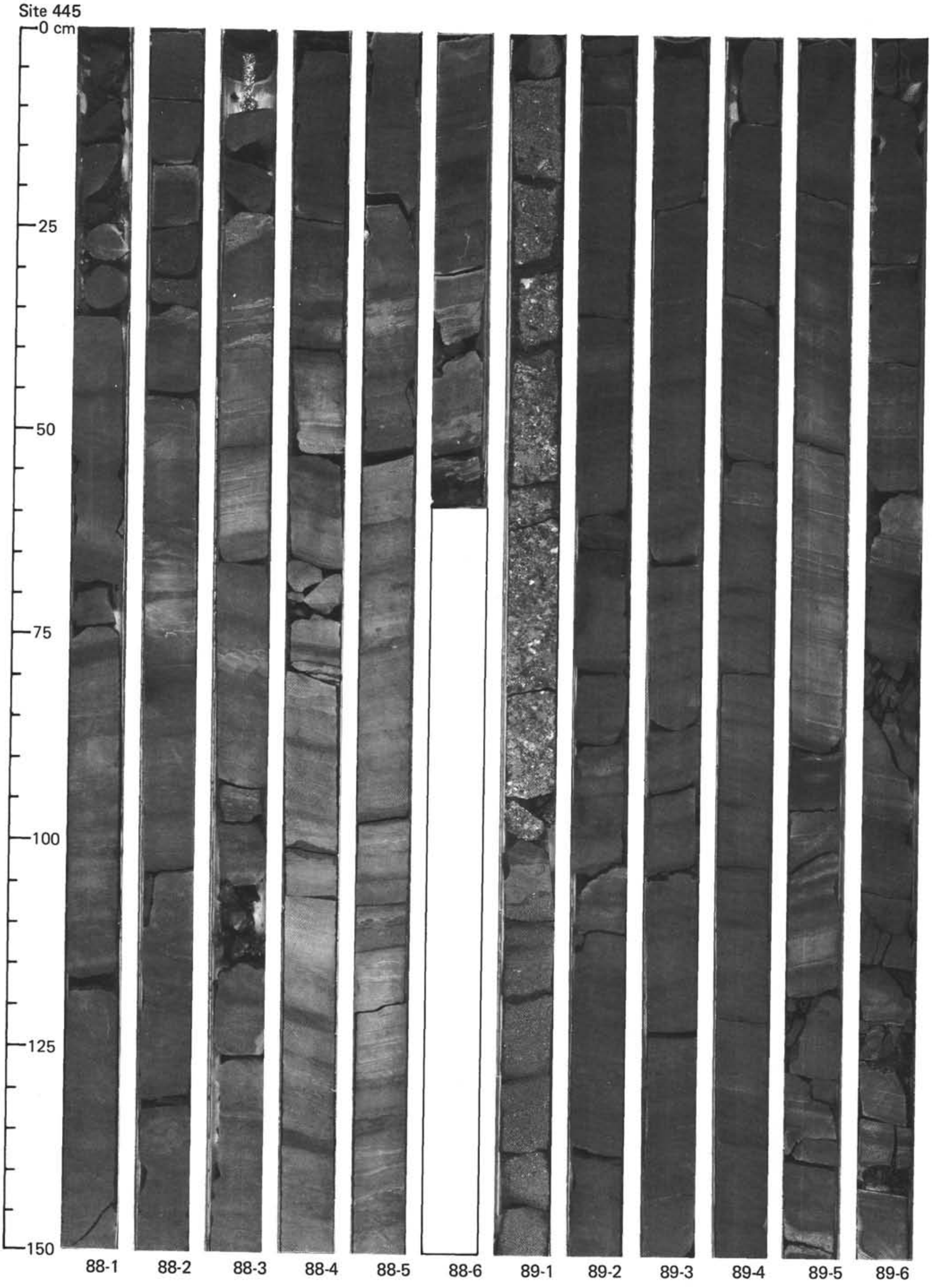
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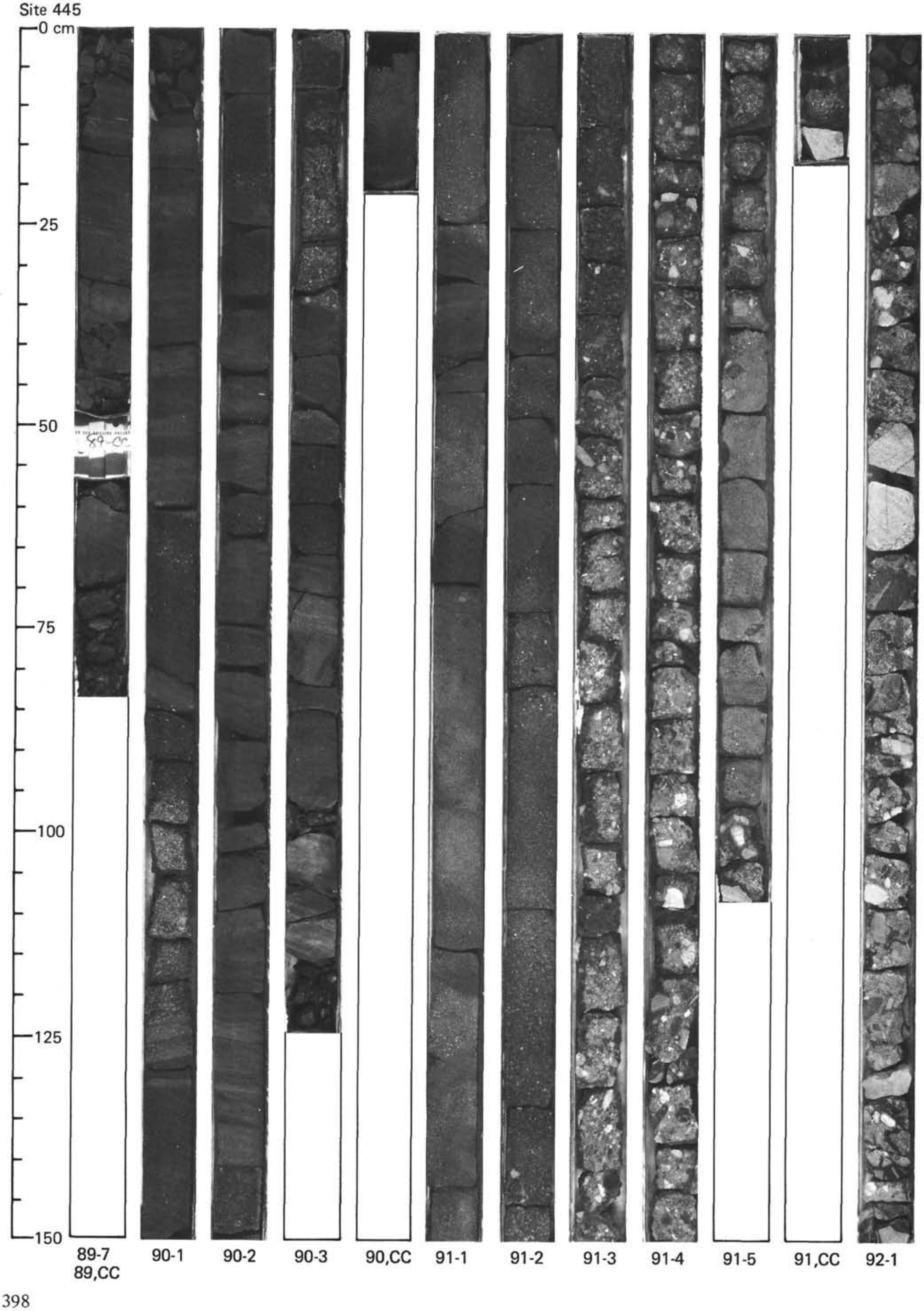
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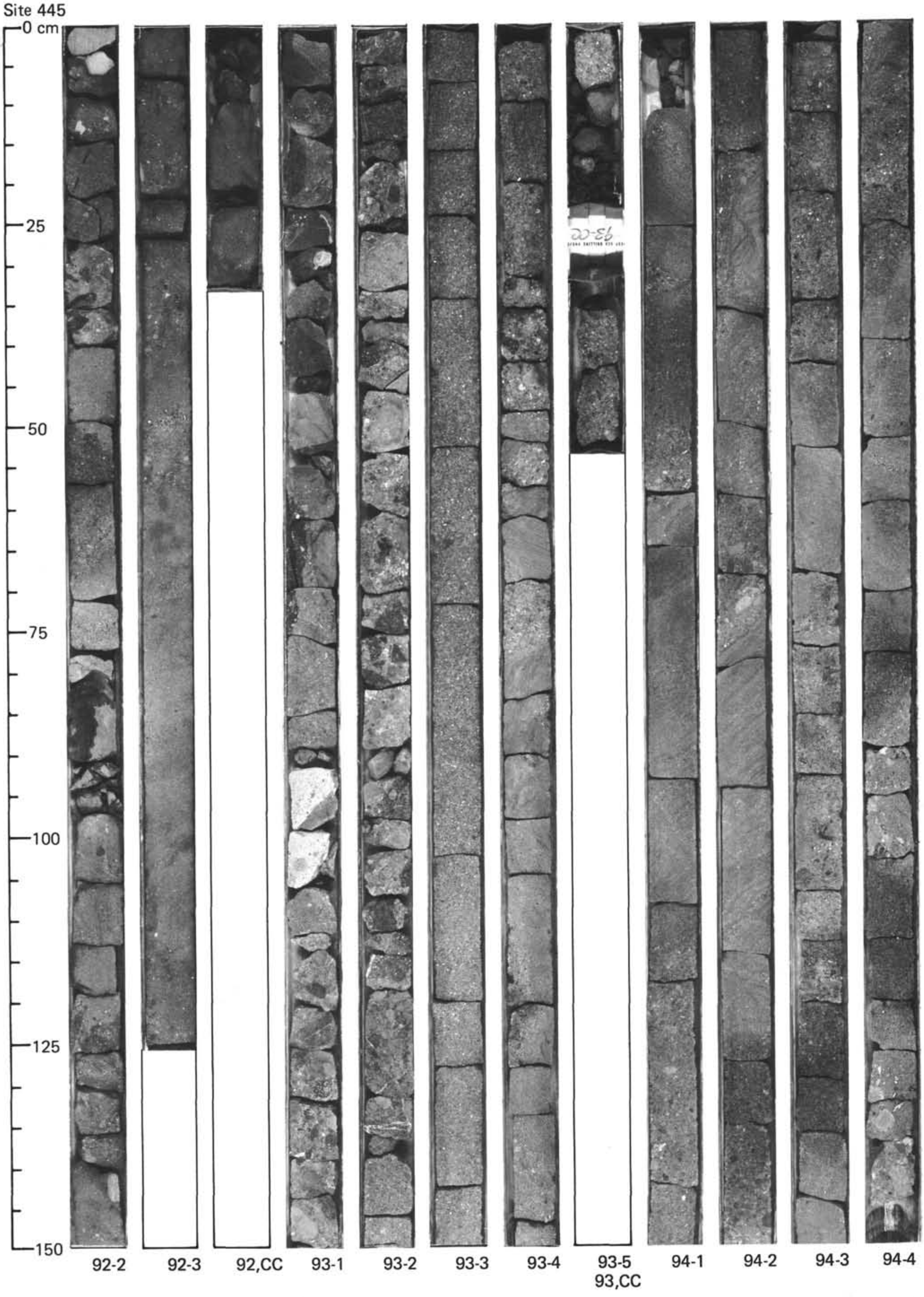
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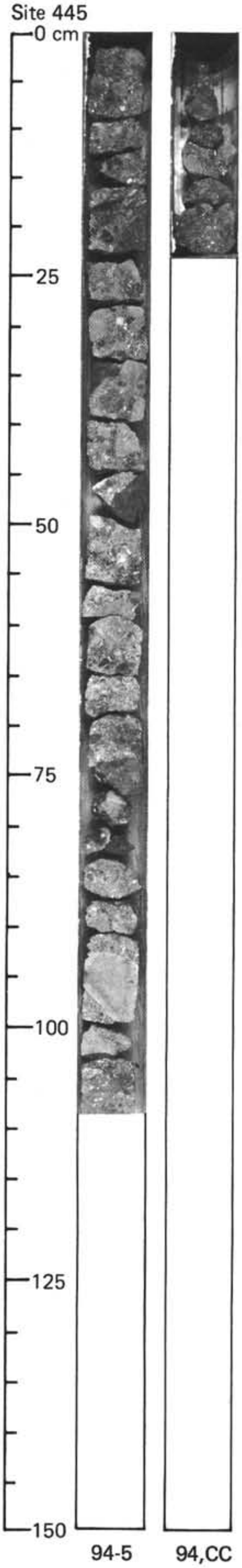
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