6. SITE 446, DAITO BASIN, DEEP SEA DRILLING PROJECT LEG 58

The Shipboard Scientific Party[1]

HOLE 446

Date occupied: 18 January 1978

Date departed: 21 January 1978

Time on hole: 3½ days

Position (latitude; longitude): 24°42.04'N; 132°46.49'E

Water depth (sea level; corrected m, echo sounding): 4952.0

Water depth (rig floor; corrected m, echo sounding): 4962.5

Bottom felt (m, drill pipe): 4980.0

Penetration (m): 420.5

Number of cores: 46

Total length of cored section (m): 420.5

Total core recovered (m): 197.10

Core recovery (%): 47

Oldest sediment cored:
- **Depth sub-bottom (m):** 395.7
- **Nature:** claystone
- **Age:** early Eocene
- **Measured velocity (km/s):** 1.85

Basement:
- **Depth sub-bottom (m):** 420.5
- **Nature:** basalt
- **Velocity range (km/s):** 4.22–5.38

Principal Results: Site 446 is in the Daito Basin, south of the Daito Ridge, northwest Philippine Sea. The sedimentary section consists of 14.2 meters of Pliocene terrigenous mud and clay which overlies 158.3 meters of Pliocene, Miocene, Oligocene, and Eocene pelagic clay. Next below is 190.0 meters of Eocene mudstone, claystone, siltstone, and turbidite sandstone. Underlying those rocks is a 266.0-meter succession of interlayered calcareous mudstone, siltstone, sandstone, conglomerate, and ash, intruded by 23 post-early Eocene basalt sills.

Shipboard analysis of paleomagnetism shows that Site 446 has migrated from an equatorial latitude over the past 52 m.y. The age of the basement of the northwest Philippine Sea is possibly as young as early Eocene.

HOLE 446A

Date occupied: 22 January 1978

Date departed: 26 January 1978

Time on hole: 4 days

Position (latitude; longitude): 24°42.04'N; 132°46.49'E

Water depth (sea level; corrected m, echo sounding): 4952.0

Water depth (rig floor; corrected m, echo sounding): 4962.5

Bottom felt (m, drill pipe): 4980.0

Penetration (m): 628.5

Number of cores: 28

Total length of cored section (m): 256.5

Total core recovered (m): 117.09

Core recovery (%): 46

Oldest sediment cored:
- **Depth sub-bottom (m):** 619.0
- **Nature:** claystone
- **Age:** late early Eocene
- **Measured velocity (km/s):** 2.53

Basement:
- **Depth sub-bottom (m):** 621.0
- **Nature:** basalt sills
- **Velocity range (km/s):** 3.74–5.84

Principal Results: See Hole 446.

BACKGROUND AND OBJECTIVES

Background

The objectives at Site 446 were identical to those at Site 445. Site 446 is in the triangular part of the northwest Philippine Sea, in an intermediate-sized basin immediately south of the Daito Ridge and north of the Oki–Daito Ridge. The Daito Ridge and Basin province is part of a remnant-arc. This area has been of considerable interest to several workers, and prior study included deep drilling at Site 445 and in the adjoining Kyushu–Palau Ridge at Site 296 (Karig, Ingle, et al., 1975), structural and regional tectonic analysis (Karig, 1975; Hilde et al., 1977; Watts et al., 1977; Mizuno et al., 1975, in press), and dredging of bottom samples (Mizuno et al., 1975, in press; Shiki et al., 1976). Magnetic lineations were identified south of the Daito

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Ridge and Basin province by Louden (1976) and Watts et al. (1977), but none have been identified in the province itself. All available data prior to drilling of Site 445 suggested that the Daito Ridge and Basin is very old, and that in fact this part of the northwest Philippine Sea is underlain by older crust trapped behind the remnant arc of the Daito Ridge and the Oki-Daito Ridge (Karig, 1975; Hilde et al., 1977; Watts et al., 1977; Mizuno et al., 1975, in press). The trapping mechanism should show similarities with the hypothetical origin of the Bering Sea (Cooper et al., 1976).

Drilling at Site 445 did not provide any new insights into these tectonic relations: the site was abandoned because of bad weather. However, shipboard analysis of paleomagnetism indicated that Site 445 migrated from an equatorial latitude to its present position over a period of 48 m.y.

Dredge hauls from the Daito Ridge and Basin, the Oki-Daito Ridge, and the Amami Plateau 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, Drilling at Site 445 confirmed this variability: middle-Eocene debris-flow conglomerates contain the same variety of pebble clasts as the dredge hauls.

One of the more interesting discoveries prior to Leg 58 was the dredge recovery of limestone specimens containing *Nummulites boninensis*, an Eocene larger foraminifer of shallow-water origin (Konda et al., 1977). These samples were recovered from the Daito and Oki-Daito Ridges and the Amami Plateau from present water depths of 1160 to 2340 meters. *Nummulites boninensis* was recovered in several conglomerates of debris-flow origin at Site 445, clearly indicating resedimentation from shallow water. This casts some doubt on prior suggestions of large-scale regional subsidence in the region of Daito Ridge and Oki-Daito Ridge (Mizuno et al., 1975, in press), although some subsidence may have occurred. We expected to clarify this problem of regional subsidence from drilling results at Site 446.

Site 446 was located in an intermediate-sized basin between the Daito Ridge and Oki-Daito Ridge, along a seismic profile surveyed by the R/V *Kaiyo-Maru* (IPOD-Japan, 1977) (Figure 1). The seismic-reflection profile obtained by the D/V *Glomar Challenger* is shown in Figure 2.

Objectives

The primary objectives at Site 446 were fourfold. Of prime importance was to determine the age of the oldest sediment and of the basement, to determine whether this portion of the north Philippine Sea is underlain by 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 was to determine the subsidence history of the northwest Philippine Sea from sedimentological and paleontological study. Fourth, climatic changes at the site, due to its northward drift over the past 47 m.y., were to be determined from paleontology and paleomagnetism.

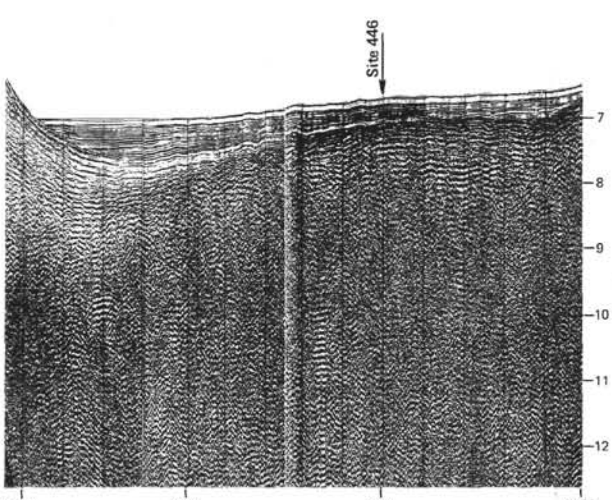


Figure 1. *Seismic-reflection profile through Daito Ridge and south of Daito Ridge by R/V* Kaiyo-Maru.

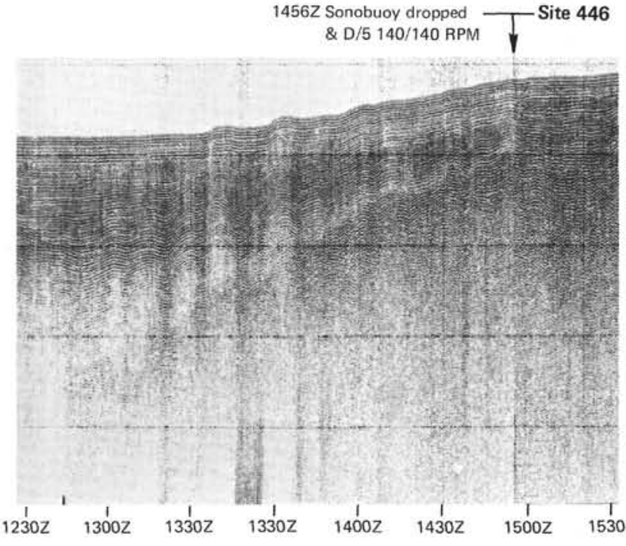


Figure 2. Glomar Challenger *seismic-reflection profile approaching Site 446. See Figure 3 for location.*

OPERATIONS

The *Challenger* left Site 445 at 1530 hours on 17 January. Gear was streamed, and at 1612 hours the *Challenger* passed over the Site 445 beacon and headed for Site 446 on a course of 206° (Figure 3).

At 2354 hours, 17 January, after steaming approximately 57 nautical miles, the Site 446 location was reached, and a 16-kHz beacon was dropped. At 0244 hours, 18 January, after a sonobuoy run over the site, gear was pulled in, and at 0336 hours ship's positioning was in the auto mode. RIH for Hole 446 began.

At 1251 hours, 18 January, Hole 446 was spudded in at a water depth of 4980 meters (drill pipe). A program of continuous coring was maintained, and basalt was

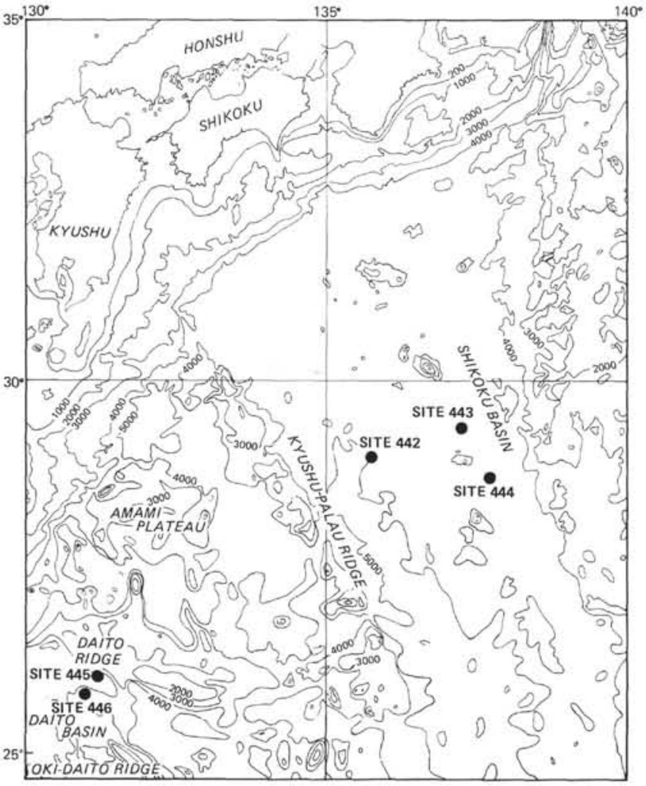


Figure 3. *Site location map.*

first recovered in Core 41 at a sub-bottom depth of 381 meters (Table 1). Another 0.5 meters of basalt was recovered in the core catcher of Core 42, an interbed of sediment and basalt being recovered in Core 43. Cores 44 through 46 were recovered before deteriorating weather conditions on the evening of 21 January forced a decision to pull pipe above the mudline to wait on weather. Total recovery in 46 cores was 197.1 meters of 420.5 meters cored, or 47 per cent. Suspension of operations continued through the morning of 22 January. At 0930 hours, 22 January, weather conditions had moderated and allowed automatic positioning; it was decided to begin lowering pipe to spud Hole 446A. The operational plan for this hole was to drill through the sediment section to just above the first sediment/basalt contact at 372.0 meters, and then to core continuously until destruction of the bit.

At 1130 hours, Hole 446A was spudded; it was drilled to 5352.0 meters. The center bit was retrieved, and coring operations resumed, Core 1 being retrieved at 2158 hours, 22 January (Table 1).

Coring continued until 2015 hours on 26 January, when the low recovery and very low core diameter indicated that the bit was exhausted. Bit life was 71.8 hours. In all at Hole 446A, 28 cores were recovered; recovery was 117 meters, or 46 per cent. At 1200 hours on 27 January, pulling of pipe from the hole was completed, including magnafluxing the bottom-hole assembly and Bowen sub.

At 1400 hours, 27 January, gear was streamed for the journey to Naha, Okinawa. After a Williamson turn to pass over the site, the *Challenger* headed east for a short

TABLE 1
Site 446 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 (%)
446-1	18	1352	4980.0–4981.5	0.0–1.5	1.5	1.00	67
2	18	1520	4981.5–4991.0	1.5–11.0	9.5	0.85	9
3	18	1636	4991.0–5000.5	11.0–20.5	9.5	8.56	90
4	18	1802	5000.5–5010.0	20.5–30.0	9.5	0.30	3
5	18	1931	5010.0–5019.5	30.0–39.5	9.5	8.72	92
6	18	2042	5019.5–5029.0	39.5–49.0	9.5	6.67	70
7	18	2200	5029.0–5038.5	49.0–58.5	9.5	9.60	101
8	18	2327	5038.5–5048.0	58.5–68.0	9.5	7.22	78
9	19	0044	5048.0–5057.5	68.0–77.5	9.5	7.17	75
10	19	0210	5057.5–5067.0	77.5–87.0	9.5	8.24	86
11	19	0326	5067.0–5076.5	87.0–96.5	9.5	5.36	56
12	19	0450	5076.5–5086.0	96.5–106.0	9.5	5.35	56
13	19	0608	5086.0–5095.5	106.0–115.5	9.5	6.47	68
14	19	0724	5095.5–5105.0	115.5–125.0	9.5	7.09	75
15	19	0846	5105.0–5114.5	125.0–134.5	9.5	4.65	49
16	19	1012	5114.5–5124.0	134.5–144.0	9.5	5.65	59
17	19	1148	5124.0–5133.5	144.0–153.5	9.5	0.72	8
18	19	1321	5133.5–5143.0	153.5–163.0	9.5	1.60	17
19	19	1448	5143.0–5152.5	163.0–172.5	9.5	0.55	6
20	19	1610	5152.5–5162.0	172.5–182.0	9.5	1.50	16
21	19	1730	5162.0–5171.5	182.0–191.5	9.5	3.14	33
22	19	1850	5171.5–5181.0	191.5–201.0	9.5	0.00	0
23	19	2025	5181.0–5190.5	201.0–210.5	9.5	3.30	35
24	19	2153	5190.5–5200.0	210.5–220.0	9.5	5.74	60
25	19	2332	5200.0–5209.5	220.0–229.5	9.5	4.83	51
26	20	0116	5209.5–5219.0	229.5–239.0	9.5	5.07	53
27	20	0239	5219.0–5228.5	239.0–248.5	9.5	3.78	40
28	20	0400	5228.5–5238.0	248.5–258.0	9.5	0.97	10
29	20	0525	5238.0–5247.5	258.0–267.5	9.5	2.98	31
30	20	0647	5247.5–5257.0	267.5–277.0	9.5	8.13	86
31	20	0815	5257.0–5266.5	277.0–286.5	9.5	4.57	48
32	20	0941	5266.5–5276.0	286.5–296.0	9.5	7.72	81
33	20	1112	5276.0–5285.5	296.0–305.5	9.5	2.93	31
34	20	1243	5285.5–5295.0	305.5–315.0	9.5	8.67	91
35	20	1423	5295.0–5304.5	315.0–324.5	9.5	0.20	2
36	20	1558	5304.5–5314.0	324.5–334.0	9.5	6.49	68
37	20	1746	5314.0–5323.5	334.0–343.5	9.5	0.90	9
38	20	1935	5323.5–5333.0	343.5–353.0	9.5	8.95	94
39	20	2118	5333.0–5342.5	353.0–362.5	9.5	3.90	41
40	20	2301	5342.5–5352.0	362.5–372.0	9.5	2.42	25
41	21	0053	5352.0–5361.5	372.0–381.5	9.5	4.51	47
42	21	0234	5361.5–5371.0	381.5–391.0	9.5	0.19	2
43	21	0448	5371.0–5380.5	391.0–400.5	9.5	5.21	55
44	21	1014	5380.5–5390.0	400.5–410.0	9.5	4.50	47
45	21	1528	5390.0–5399.5	410.0–419.5	9.5	0.05	1
46	21	2205	5399.5–5400.5	419.5–420.5	1.0	0.68	68
				Totals	420.5	197.10	47
446A-1	22	2158	5352.0–5361.5	372.0–381.5	9.5	3.73	39
2	22	2340	5361.5–5371.0	381.5–391.0	9.5	2.41	25
3	23	0221	5371.0–5380.5	391.0–400.5	9.5	3.57	38
4	23	0655	5380.5–5385.5	400.5–405.5	5.0	3.36	67
5	23	1046	5385.5–5390.0	405.5–410.0	4.5	2.90	64
6	23	1432	5390.0–5399.5	410.0–419.5	9.5	4.35	46
7	23	1844	5399.5–5409.0	419.5–429.0	9.5	5.66	60
8	23	2148	5409.0–5418.5	429.0–438.5	9.5	2.58	27
9	24	0133	5418.5–5428.0	438.5–448.0	9.5	3.51	37
10	24	0309	5428.0–5437.5	448.0–457.5	9.5	6.99	74
11	24	0519	5437.5–5447.0	457.5–467.0	9.5	2.56	27
12	24	0835	5447.0–5456.5	467.0–476.5	9.5	4.82	51
13	24	1121	5456.5–5466.0	476.5–486.0	9.5	3.18	33
14	24	1512	5466.0–5475.5	486.0–495.5	9.5	3.23	34
15	24	2009	5475.5–5485.0	495.5–505.0	9.5	4.72	50
16	24	2318	5485.0–5494.5	505.0–514.5	9.5	5.10	54
17	25	0114	5494.5–5504.0	514.5–524.0	9.5	3.99	42
18	25	0330	5504.0–5513.5	424.0–533.5	9.5	4.48	47
19	25	0620	5513.5–5523.0	533.5–543.0	9.5	3.77	40
20	25	1016	5523.0–5532.5	543.0–552.5	9.5	4.48	47
21	25	1507	5532.5–5542.0	552.5–562.0	9.5	7.44	78
22	25	1858	5542.0–5551.5	562.0–571.5	9.5	4.89	51
23	26	0103	5551.5–5561.0	571.5–581.0	9.5	7.73	81
24	26	0528	5561.0–5570.5	581.0–590.5	9.5	4.47	47
25	26	0853	5570.5–5580.0	590.5–600.0	9.5	5.04	53
26	26	1200	5580.0–5589.5	600.0–609.5	9.5	4.16	44
27	26	1538	5589.5–5599.0	609.5–619.0	9.5	2.21	23
28	26	1942	5599.0–5608.5	619.0–628.5	9.5	1.76	19
				Totals	256.5	117.09	46

seismic survey of the area before turning west for Okinawa. ETA for Okinawa was 0800 hours 30 January.

SEDIMENT LITHOLOGY

Hole 446

The stratigraphic sequence is presented in Table 2, Figure 4. The sediments ranged in age from late Pliocene to late early Eocene; no Quaternary sediments were recovered.

Unit I

Unit I consists of brown terrigenous (hemipelagic) intermixed mud and clay. It contains 10 to 20 per cent silt-sized particles and is composed of clay minerals (72-89%), quartz and feldspar (5-10%), mica (1-5%), heavy minerals (augite and hornblende; 1-2%), opaque minerals (1-3%), and a trace of volcanic glass. Pumice fragments and ashy zones are present. The unit is devoid of visible sedimentary structures.

Unit II

Unit II is distinguished by a change from terrigenous to pelagic sedimentation. It is a distinctive, dark-brown to very dark-grayish-brown pelagic clay and claystone with scattered zones and patches of yellowish-brown clay. The sediment generally has less than 5 per cent silt-sized particles, and 95 per cent or more clay-sized particles. Major mineralogic components include zeolites (commonly 1-5%, but as high as 35%), micronodules and opaque minerals (commonly 1-10%, but as high as 20%), and clay minerals (40-96%). Small amounts of quartz, feldspar, volcanic glass, and carbonate are present. The unit is devoid of visible sedimentary structures. Variations in the general lithology occur, but do not warrant subdivision of the unit. These variations include siliceous-fossil zones (radiolarians and sponge spicules) in Cores 9 and 17; nannofossil ooze in Core 14; a variable zeolite content in Cores 10, 11, and 12; chert in Cores 17 and 18; and a variable content of volcanic glass in the sediments.

Unit III

Unit III is marked by a change from dark browns to greenish grays, and from pelagic to turbiditic and hemipelagic sedimentation. We distinguished two sub-units: sub-unit IIIa, greenish-gray, silty to sandy mudstones and mudstones as turbidites; and subunit IIIb, brownish- to greenish-gray, calcareous mudstones and claystones.

Between unit II in Core 19-1 and unit III in Core 19,CC, the lithology changes from brown, zeolitic pelagic clay to greenish-gray terrigenous mudstone in turbidite sequences. Greenish-gray and dark-greenish-gray, glauconitic mudstone forms the major portion of the

TABLE 2
Stratigraphy of Site 446

Lithologic Unit	Sub-Bottom Depth (m)	Core	Thickness (m)	Characteristics	Age
I	0–14.2	446-1 to 446-3-3, 20 cm	14.2	Brown (10YR4/3), terrigenous mud, clay	Pliocene
II	14.2–172.5	446-3-3, 20 cm to 446-19,CC	158.3	Dark-brown (10YR3/3), very dark-grayish-brown (10YR3/2), pelagic clay with ash, siliceous fossils, variable zeolite content.	Miocene to middle Eocene
IIIa	172.5–324.5	446-19,CC through 446-35,CC	152.0	Dark-greenish-gray (56Y4/1), greenish-gray (5GY5/1) mudstones, claystones, siltstones, and sandstones, in turbidite sequences.	Middle Eocene
IIIb	324.5–362.5	446-36-1 to 446-39,CC	38.0	Brown (7.5YR5/4), dark-brown (7.5YR4/4), calcareous claystones and mudstones, interbedded with dark-greenish-gray (5GY4/1 and 5G4/1) to greenish-gray (5G5/1), calcareous claystones and mudstones, in turbidite sequences, plus pelagic biogenic components.	Middle Eocene
IV	Hole 446 362.5–395.7	446-40-1 to 446-43-3, 120 cm	Hole 446 17.9 (est.)	Hole 446 Dark-greenish-gray (5G4/1) to greenish-gray (5G5/1) and bluish-green (5B4/1), calcareous claystones, nannofossil claystones, glauconitic claystones, mudstones, ash.	Middle–early Eocene
	Hole 446A 372.0–628.0	446A-1-1 through 446A-28, CC	Hole 446A 60 (est.)	Hole 446A As above, with abundant ash through Core 17. Sediment occurs as interbeds between basalt sills.	

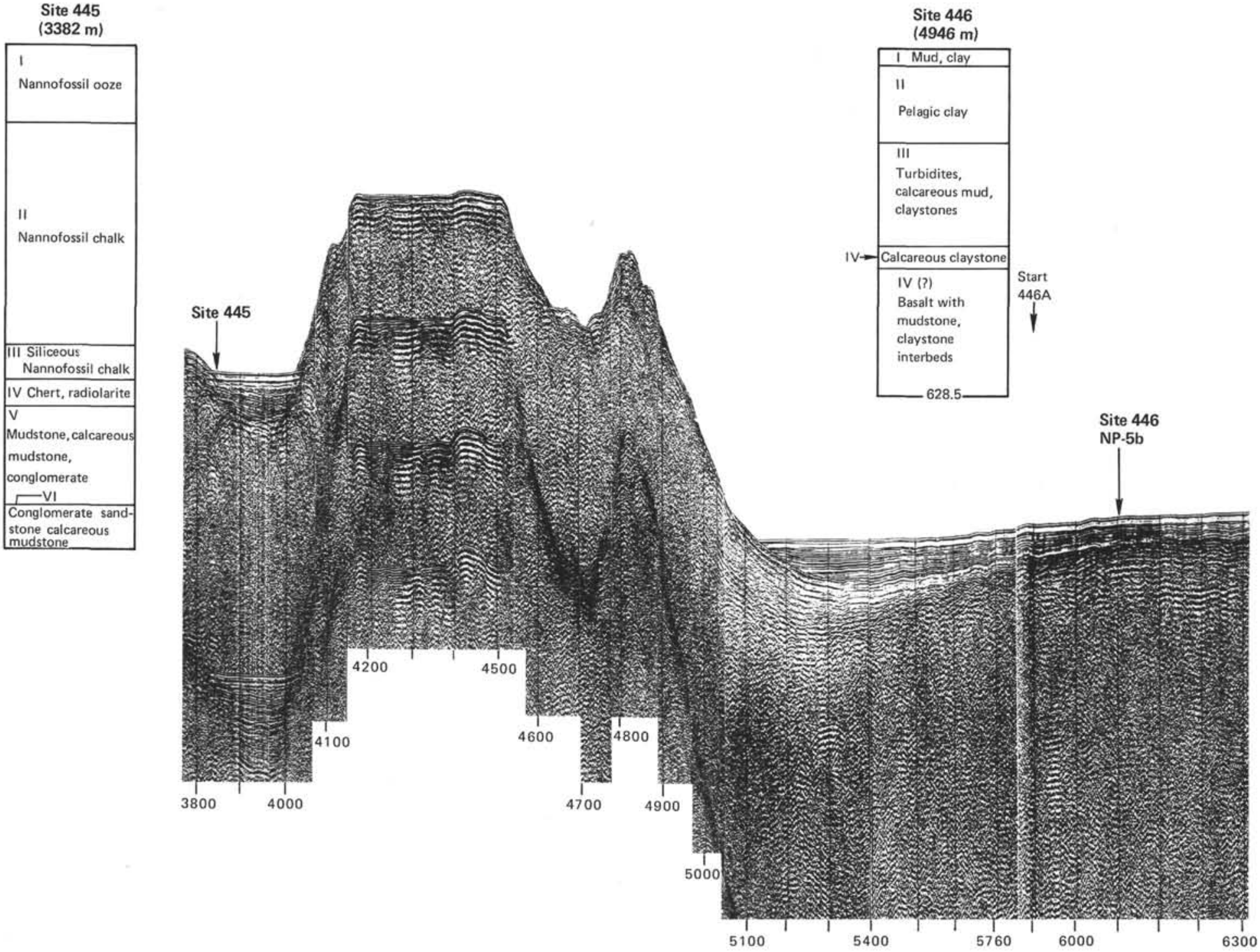


Figure 4. *Stratigraphic sections at Sites 445 and 446, with seismic profile.*

repetitive fining-upward turbidite sequences that make up this unit. Most of the fining-upward sequences begin with sandstone or sandy mudstone at the base, followed by mudstone with thin laminae of fine sand and silty sand, clayey mudstone, and (or) claystone. Rare interbeds of light-gray and greenish-gray, clayey chalk are present in the upper parts of the fine-grained turbidite sequences.

Most of the cycles are a half meter or less thick, and the fine mudstones or claystones at the tops of the cycles are the thickest part. Some of the thinner cycles, however, are actually subcycles in larger overall fining-upward, thickening-upward sequences. The coarse basal part of each cycle in many cases has a sharp or scoured contact with the fine upper end of a preceding cycle. Cross-lamination may be present in the lower parts of cycles, and is more common in the lower section of sub-unit IIIa. Parallel laminae are generally present, but become more abundant and more closely spaced upward in each cycle. Evidence for minor bioturbation is present, generally in the upper half of cycles, but is not common in this sub-unit. Some of the mudstones are massive, with little visible evidence of any sedimentary structures. Evidence of slumping is rare; some small-scale slump structures are present in the lower part of the sub-unit.

Most of the sediments in this sub-unit contain abundant terrigenous components: relatively high proportions of feldspar (up to 30%), heavy minerals (up to 25%), lithic fragments (up to 40%), and terrigenous clays (up to 90%). Glauconite is present throughout, in quantities ranging from 1 to about 35 per cent. Small percentages of mica are present in almost all samples. There are significant (up to 10%) quantities of opaque minerals (probably both terrigenous and authigenic) throughout the sub-unit, and minor percentages of zeolites. Calcareous biogenic components are minor constituents, except in interbeds of chalky clay in Cores 24, 25, 26, 27, 32, and 34. Siliceous biogenic components are generally absent.

We distinguish sub-unit IIIb from IIIa principally because of a change from dark-greenish-gray to brown and reddish-brown, and an increase in biogenic components. Sub-unit IIIb has thick sequences of brown, dark-brown, reddish-brown, and grayish-brown, generally calcareous mudstones and claystones, interbedded with dark-greenish-gray to greenish-gray, calcareous claystones and mudstones. The boundary between sub-unit IIIa and IIIb is not sharp; a gradual transition from sub-unit IIIa to sub-unit IIIb occurs in Core 36. The depositional sequences in sub-unit IIIb closely resemble those of IIIa; they are a series of fining-upward cycles. However, those in IIIb contain large proportions of both resedimented and pelagic biogenic components.

In the lower part of the sub-unit, we observed two complete turbidite cycles, each almost 1 meter thick, starting with coarse calcareous sandstone. The sandstones are cross-laminated as well as parallel laminated, and graded; they contain abundant foraminifers and nannofossils, along with terrigenous grains. They grade upward through calcareous mudstones and calcareous claystones which show parallel and(or) wavy laminations and bioturbation. Most of the sub-unit, however, consists of calcareous mudstone alternating with calcareous claystone in a series of fining-upward cycles with parallel laminations and slight to moderate bioturbation. Siliceous biogenic components form a significant part (10% or more) of the sediment in only two layers in Cores 37 and 38. Zeolites and micronodules are abundant in a mudstone that underlies a radiolarian-rich claystone in Core 37.

Unit IV

Unit IV consists of dark-greenish-gray to greenish-gray to dark-gray calcareous claystones, nannofossil claystones, glauconitic claystones, and altered ash beds. The claystones are finely laminated and moderately bioturbated; they contain silty (fining-upward) and calcareous laminae, and some evidence of soft-sediment deformation. In Core 43, the claystones are glauconitic and contain vertical veins of clay and calcite.

This unit is also characterized by thicker (1–5 cm) ash and altered ash beds, which tend to be dark gray and massive and fine upward into claystones. The lower boundaries are sharp and well defined. Other lithologies include lithic sandstones, nannofossil claystones, and glauconitic sandstones.

Sediments of the section just above the second basalt cored in Core 43 consist of breccia fragments of clayey limestone, a zeolitic clayey limestone, and a glauconitic claystone at the basalt contact.

Hole 446A

Hole 446A was washed to a depth of 372 meters, where continuous coring began in sediments representing unit IV of Hole 446. Twenty-eight cores recovered 117.09 meters of sediment and basalt. Except for the first 10.3 meters of sediment above the first basalt contact, all other recovered sediments represent interbeds between basalts.

The thickness of the interbeds ranges from about 1 cm (several representative cores) to about 6.8 meters in Core 10. Low recovery in some cores may have led to underestimation of thickness of some sediment interbeds.

We made no attempt to designate specific lithologic units.

Sediment Interbeds

Sediments occurring as interbeds include (in general order of abundance) mudstone and claystone; glauconitic sandy mudstone, mudstone and claystone; calcareous mudstone and claystone; and ashy mudstones and siltstones; as well as ash and altered ash beds or zones. Other sediments present in small amounts are zeolitic claystones, chalk or clayey chalk, lithic sandstones and siltstones, and chert.

Throughout the interbed section, sediment colors are dominantly dark-greenish gray, greenish gray, and grayish green, with variations into or tinges of dark gray, and bluish gray, and dusky red.

In some interbeds, overlying or underlying basalt, the sediments appear baked and assume dark-brown to black colors. This was particularly noticeable in Cores 12, 25, and 26, where very obvious basalt/sediment contacts were recovered. These sediments are well indurated and have feldspar content as high as 35 per cent, zeolites up to 40 per cent, micronodules, and abundant glauconite.

The recovered sediments for the most part (mudstones and claystones) have the following characteristics: laminated bedding (1 mm to 1–2 cm); silty laminations that fine upward into claystones; evidence of bioturbation; and soft-sediment deformation including microfaults, rip-up clasts, and clastic dikes. Other sedimentary structures include cross-beds, graded beds, and rippled or undulating bedding surfaces.

Ash zones occur throughout the cored interval, but we noticed a concentration of ash and altered ash higher in the cored section as compared to lower portions. The ash and altered-ash zones are present in Core 1 above the first basalt, and then in Cores 2, 3, 10 (up to 5 meters thick), 12, 13, 16, and 17. Below Core 17, we consider the occurrences minor.

ORGANIC GEOCHEMISTRY

Organic-carbon and nitrogen contents were measured in 59 samples. Results of the analyses are reported elsewhere (Waples and Sloan, this volume) and are plotted in Figure 5. In the section above the basalt sills, the maximum organic-carbon contents, about 0.1 per cent, occur in the youngest recovered sediments. The upper part of the carbon-depletion curve shows the same features as did curves for the other Leg 58 sites (Waples and Sloan, this volume). Because the youngest recovered sediments were Pliocene, however, much of the loss of organic carbon had already occurred; therefore the exponential decay observed in the uppermost part of the section at the other sites is barely visible. Organic-carbon values for the pelagic part of the section level out at a constant value (about 0.05%) which is very similar to that found for the pelagic sequence at Site 445.

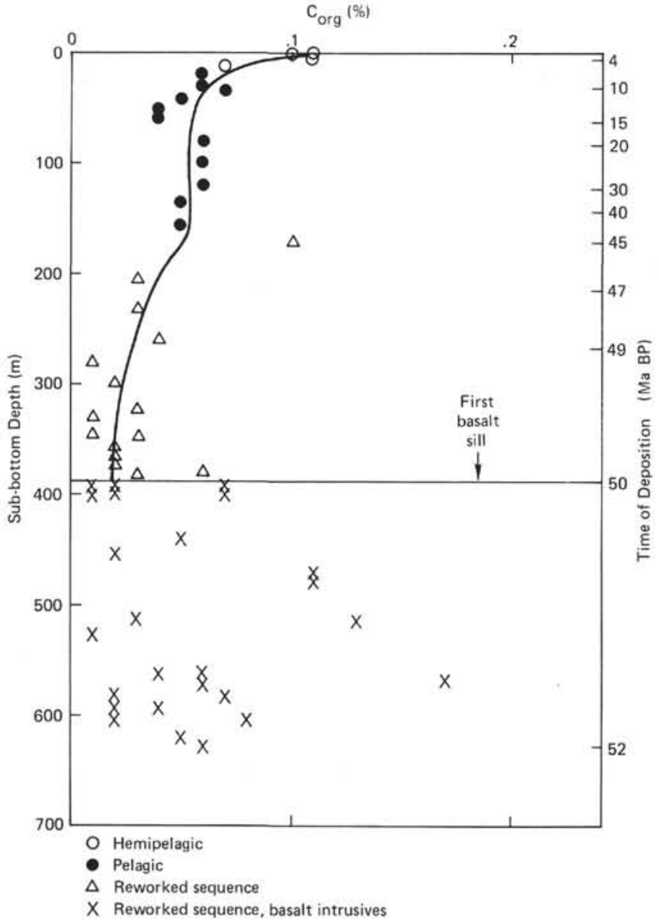


Figure 5. *Organic carbon versus depth, Hole 446A.*

TABLE 3
Nitrogen and Organic- and Inorganic-Carbon Content of Sediments, Site 446

Sample (interval in cm)	Litho-logic Unit	Sub-Bottom Depth (m)	$CaCO_3$* (%)	C_{org} (%)	N^b (%)	C/N** (atomic)
446-1-1, 18–19	I	0.2	–	.11	.039	3.3
1-1, 105–106	I	1.1	–	.10	.022	5.1
2-1, 44–45	I	1.9	–	.11	.032	4.0
3-2, 89–90	I	13.4	–	.07	.036	2.3
3-6, 89–90	II	19.4	–	.06	.029	2.2
4,CC	II	29.8	–	.06	.020	3.3
5-3, 76–77	II	33.8	–	.07	.028	2.8
6-2, 82–83	II	41.8	–	.05	.030	1.9
7-2, 88–89	II	51.4	–	.04	.020	2.6
8-2, 68–69	II	60.7	–	.04	.028	1.8
10-2, 144–145	II	80.4	–	.06	.022	3.3
12-2, 75–76	II	98.8	–	.06	.016	4.3
14-4, 40–41	II	120.4	–	.06	.017	4.0
16-2, 30–31	II	136.3	–	.05	.006	10.1
18-1, 137–138	II	154.9	–	.05	.009	7.3
20-1, 66–67	III	173.2	+	.10	.006	22.7
23-2, 77–78	III	203.3	–	.03	.003	10.7
26-4, 19–20	III	234.2	–	.03	.005	8.1
29-1, 34–35	III	258.3	–	.04	.006	8.5
31-2, 89–90	III	279.4	–	.01	.005	2.9
33-2, 51–52	III	298.0	–	.02	.005	5.5
36-1, 53–54	III	325.0	–	.03	.003	10.3
36-5, 0–1	III	330.5	–	.01	.006	2.7
38-1, 100–101	III	344.5	++	.01	.004	4.0
38-3, 100–101	III	347.5	–	.03	.004	7.9
39-1, 70–71	III	353.7	–	.02	.005	4.1
40-2, 5–6	IV	364.1	–	.02	.001	22.1
41-1, 125–126	IV	373.3	++	.02	.007	2.7
446A-1,CC	IV	381.3	++	.06	n.d.	n.d.
2-1, 50–52	IV	382.0	–	.06	n.d.	n.d.
2-1, 68–70	IV	382.2	+	.03	n.d.	n.d.
446-43-1, 49–50	IV	391.5	–	.02	.008	2.6
446A-3-1, 58–60	IV	391.6	–	.07	.002	37.6
3-2, 130–132	IV	393.8	+	.07	.009	9.7
446-43-2, 130–131	IV	393.8	–	.01	.002	6.7
43-3, 4–5	IV	394.0	++	.02	.005	6.1
43-3, 119–120	IV	395.2	–	.02	.005	5.9
43-4, 0–2	IV	395.5	++	.01	.001	2.9
43-4, 14–15	IV	395.6	–	.02	.004	5.9
446A-9-1, 16–17	IV	438.7	+	.05	n.d.	n.d.
10-5, 62–64	IV	454.6	+	.02	n.d.	n.d.
12-3, 105–106	IV	471.1	–	.11	n.d.	n.d.
13-3, 74–75	IV	480.2	+	.11	n.d.	n.d.
16,CC	IV	514.3	+	.03	.004	9.1
17-2, 57–59	IV	516.6	+	.13	.017	8.8
18-2, 50–52	IV	526.0	–	.01	.001	11.4
22-1, 65–66	IV	562.7	–	.06	.001	52.8
22-1, 109–110	IV	563.1	–	.04	.001	32.1
22-1, 122–123	IV	563.2	–	.17	.007	29.1
23-1, 60–62	IV	572.1	–	.06	.006	11.1
24-1, 109–110	IV	582.1	–	.02	.004	6.5
24-2, 70–71	IV	583.2	–	.07	.012	6.7
25-3, 71–72	IV	594.2	+	.04	.004	12.1
25-3, 93–94	IV	594.4	–	.02	.003	7.2
25-3, 99–100	IV	594.5	–	.02	.008	2.3
26-3, 70–71	IV	603.7	–	.06	.007	10.4
26-3, 104–105	IV	604.0	–	.02	.002	15.8
28-1, 23–24	IV	619.2	+	.05	.003	21.9
28,CC	IV	628.3	++	.06	.010	7.1

*– = no carbonate detected with conc. HCl; **n.d. = not determined.
+ = small amount of carbonate present; ++ = large amount of carbonate present.

There is another aspect of the organic-carbon–depth curve which differs from the results consistently obtained at the other sites. Although the organic-carbon values level off at about 0.05 per cent, they begin to decrease steadily again at a depth of about 160 to 200 meters, and reach values nearly at the lower limit of detection by our method (0.01%). The causes for this second decrease and for the exceedingly low organic-carbon values are not known, but may be related to the fact that these sediments are current deposits, rather than pelagic. This period (47–50 Ma) was characterized by high sedimentation rates, as seen from the time scale in Figure 5.

Many samples from the sediments intruded by basalts were also analyzed, and the analyses are included in Table 3. Several of these show relatively high organic-carbon contents (0.10–0.17%), although they have been severely baked by lava. The causes for these high values seem to be quite different from those in the thermally affected sediments in Hole 444A (Waples, this volume), where the depositional mode was uniformly hemipelagic, both in the intruded sediment and in the overlying section. Here deposition seems to have been by turbidites in many of the inter-basalt sediments. This regime apparently gave over in later times to current deposits, and finally to a pelagic environment. Because of the inconstancy of the depositional environment during this time interval, there is no way to correlate the quantities of residual organic carbon in the baked sediments with the carbon-depletion curve, and no dating of the sills (as for Site 444; Waples, this volume) can be attempted.

Both the highly variable organic-carbon values, which bear no apparent relation to distance from the basalt sills, and the low nitrogen contents of many of the interbasalt sediments support some sort of resedimentation mechanism which brought varying but small amounts of terrestrial organic material to this location.

INORGANIC GEOCHEMISTRY

Samples for interstitial-water studies were taken from the recovered sediments at Holes 446 and 446A. In total, 11 samples were taken, eight from Hole 446, and three from Hole 446A. The samples are representative of lithologic units II, IIIa, and IV. All data are found in Table 4 and Figure 6.

*p*H

*p*H averages 8.10, higher than the IAPSO standard and lower than the surface-sea-water standard. The general trend is an increase in *p*H with depth, to Cores 446-41 and Core 446A-3. *p*H below these cores decreases. Sediments below Core 446A-3 (unit IV) are interbedded with basalt intrusions, whereas all other sediments occurred above the basalt.

Alkalinity

Alkalinity averaged 1.02 meq/kg, below the value for the two standards. Alkalinity decreases relatively sharply with increasing depth to Core 446-21, being generally constant in lower cores. A slight increase in alkalinity is noted for Cores 446A-3 through 446A-25; these samples represent the interbedded (unit IV) sediments of Hole 446A.

Salinity and Chlorinity

Salinity averaged 36.6 per mill, and chlorinity 19.6 per mill, both higher than the two standards. Trends of the two parameters are closely matched, as expected, and values of both parameters increase with depth to Core 446-41. Salinity and chlorinity for cores from Hole 446A show considerable variability, decreasing from Core 446A-3 to Core 446A-10, then increasing again to Core 446A-25.

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

Ca^{++} averages 74.86 mmol/1, considerably higher than the standards, whereas Mg^{++} averages 17.62 mmol/1, lower than the standards.

Ca^{++} shows a definite trend to increase with depth, whereas Mg^{++} decreases with depth. A crossover of these two trends occurs in Core 446-14, which is the lowermost sample taken from unit II sediments. This crossover thus occurs at the interval where the sediments change from dominantly pelagic in unit II to hemipelagic in unit III.

BIOSTRATIGRAPHY

Site 446 is characterized by very low sedimentation rates in the upper part of the section and very high sedimentation rates in the lower part, by poor preservation of all microfossils, and by intrusion of sediments intruded by basalt sills at the bottom of Hole 446 and throughout Hole 446A.

The present water depth of Site 446 is 4952 meters, which is well below the CCD. Sedimentation at this site is believed to have been below the CCD; this and the low rates have resulted in poor preservation of calcareous fossils. Sporadic zones of good preservation are due to special conditions. The lower part of the sediments (Cores 20–43 in Hole 446; all of Hole 446A) shows occasional moderately well- to well-preserved calcareous microfossils. Since they often include shallow-water benthic foraminifers and occur with resedimented material, they either come down-slope with the shallower sediment and were originally deposited above the CCD, or were covered in place and protected from dissolution by the overlying sediments. Well-preserved radiolarians are seen in abundance only in two cores. Once (Core 9), they are associated with an ash layer, and in Core 17 with the uppermost chert. All three of these modes of preservation are often seen in deep-sea sediments.

Because of the sporadic occurrence of microfossils at Site 446, the biostratigraphy is fragmentary. Fortunate-

TABLE 4
Summary of Shipboard Geochemical Data for Holes 446 and 446A

Sample (interval in cm)	Sample Number	Sub-Bottom Depth (m)	*p*H	Alkalinity (meq/kg)	Salinity ($^{0}/_{00}$)	Ca^{++} (mmol/l)	Mg^{++} (mmol/l)	Cl^{-} ($^{0}/_{00}$)
–	IAPSO	–	7.96	2.50	35.2	10.55	53.99	19.375
–	SSW	–	8.31	2.40	35.2	10.80	52.60	19.208
446-3-5, 140–150	42	18.40–18.50	7.51	2.63	35.5	17.31	46.23	19.441
9-4, 90–100	43	73.40–73.50	7.19	2.11	35.8	28.59	41.53	19.408
14-4, 144–150	44	121.44–121.50	7.31	1.82	35.8	37.54	36.59	19.075
21-2, 144–150	45	184.94–185.00	8.13	0.53	36.3	54.75	21.10	19.541
26-2, 140–150	46	232.40–232.50	8.34	0.58	36.3	68.66	12.97	19.608
30-5, 140–150	47	274.90–275.00	7.87	0.60	36.3	79.84	12.89	19.808
34-5, 140–150	48	312.90–313.00	8.25	0.35	36.3	85.68	3.05	19.475
41-2, 140–150	49	374.90–375.00	8.71	0.42	36.6	98.81	–1.78	19.808
446A-3-3, 0–10	50	394.00–394.10	8.88	0.83	38.5	110.48	–4.87	20.041
10-2, 140–150	51	450.90–451.00	8.73	0.58	36.6	109.70	–6.38	19.508
25-3, 140–150	52	594.90–595.00	8.19	0.82	38.5	132.07	–6.42	19.907

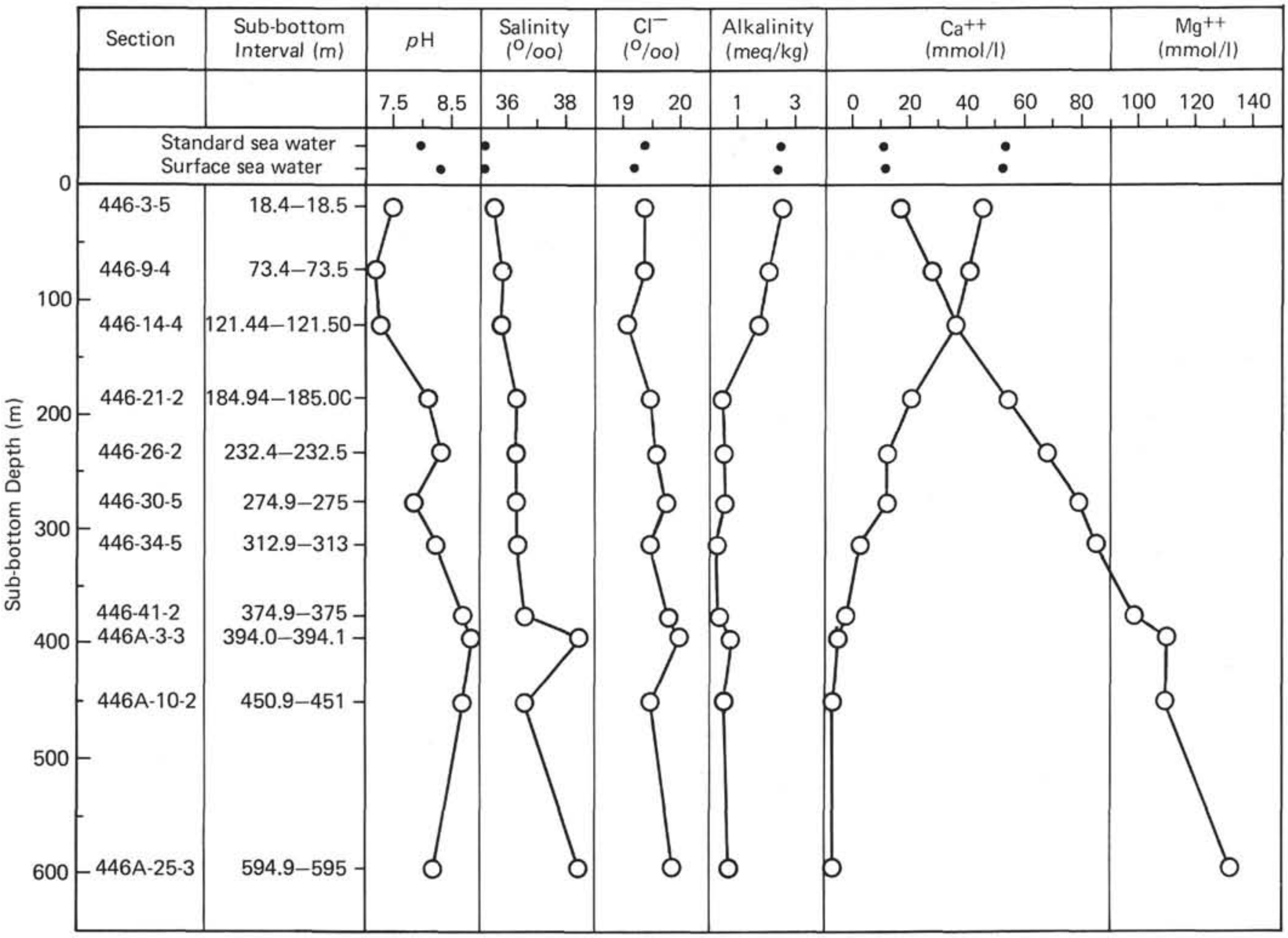


Figure 6. *Interstitial-water geochemistry, Holes 446 and 446A.*

ly, the areas of preservation good enough to give an age determination are spaced rather evenly throughout the hole (Table 5).

The oldest sediments found, excluding reworked Cretaceous material, are late early Eocene (50–52 m.y.) for Hole 446. Core 1 of Hole 446A corresponds to Core 41 of Hole 446. All sediments from 446A are of the same age (50–52 m.y.), and all dates for Hole 446A are from scattered foraminifer and nannofossil occurrences.

Throughout the section, reworking is evident. It increases down-hole, and is severe from Core 20 on. Displaced Eocene shallow-water benthic foraminifers are found throughout this part of the section.

Core 40 contains a small amount of reworked Upper Cretaceous sediment. It contains nannofossils and both planktonic and benthic foraminifers. We believe that this material represents at least two episodes of transportation and deposition.

Foraminifers

Foraminifers recovered from the two holes drilled at Site 446 spanned the early Eocene through the Pliocene. (A few macerated Cretaceous forms were found incorporated in one of the lower-Eocene turbidites.)

One core in Hole 446, at approximately 182 meters, contained a shallow-water benthic fauna of *Nummulites, Amphistegina,* and *Lenticulina*; the source of this material is not known. In Hole 446A, at approximately 480 meters, a diverse benthic fauna which contained the shallow- and warm-water genus *Asterocyclina* was recovered. The oldest reliable date for sediments drilled at this site is 51 to 52 m.y.

Hole 446

The first core recovered from Hole 446, at 1.5 meters below the sea floor, was Pliocene. *Globorotalia tosaensis, G. inflata, G. tumida,* and *Sphaeroidinella dehiscens* dominate the planktonic assemblage. The present depth of water at the site is 4952 meters, which is below the solution depth of calcium-carbonate foraminifers.

The Pliocene record in this hole is very short: Core 2,CC at 11 meters indicates very early Pliocene (N.19). The characteristic planktonic forms show effects of solution. The benthic forms are moderately well preserved and are represented by a diverse assemblage which indicates a deep-water marine environment (upper bathyal; ~500m). A middle-Miocene fauna was recovered from Core 3, Section 1. The foraminifers are

TABLE 5
Biostratigraphic Zones, Site 446

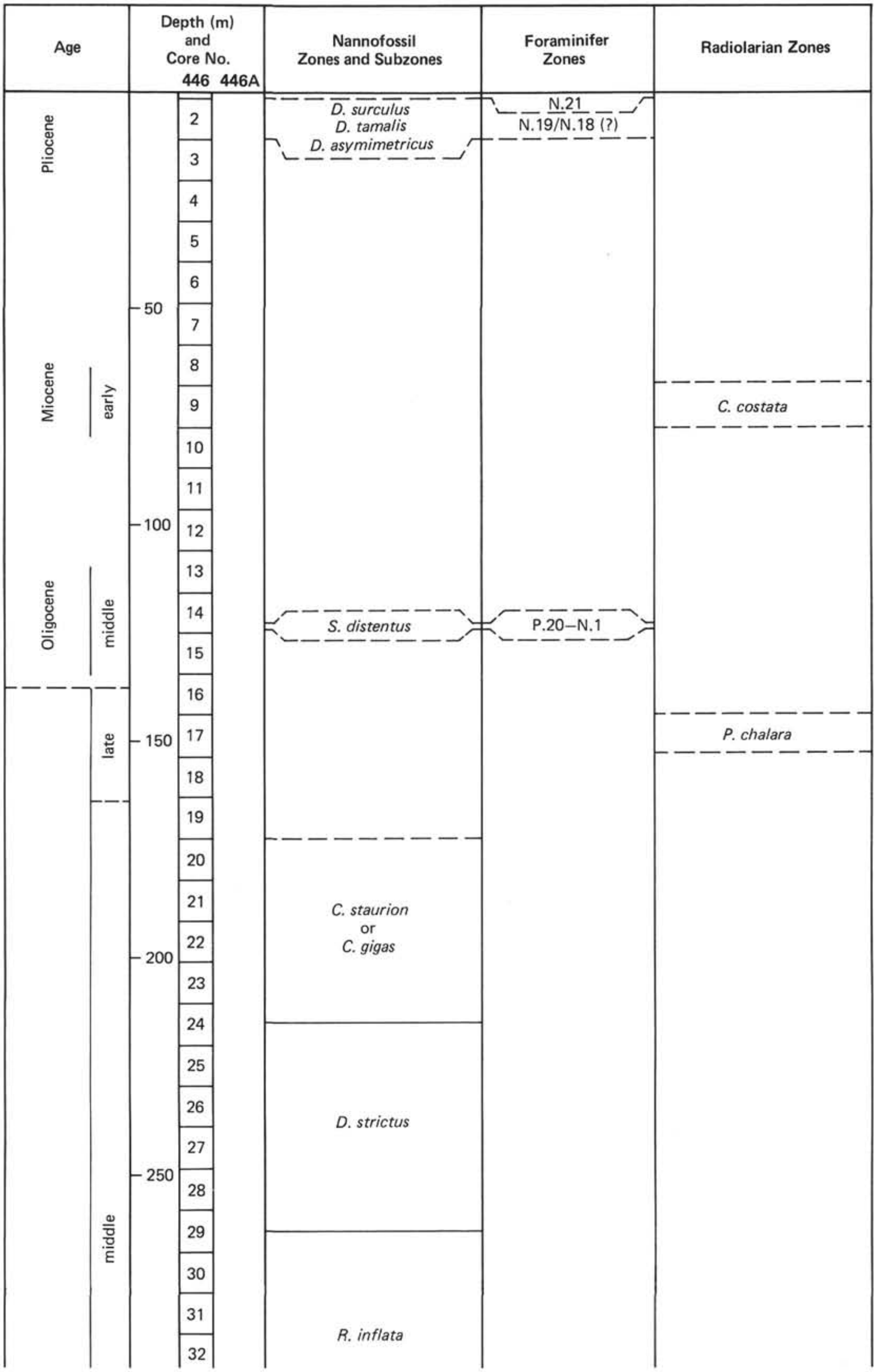


TABLE 5 – *Continued*

Age		Depth (m) and Core No.			Nannofossil Zones and Subzones	Foraminifer Zones	Radiolarian Zones
			446	446A			
Eocene		300	33				
			34				
			35				
			36				
			37				
		350	38				
			39		*D. kuepperi*		
			40				
			41	1	*D. lodoensis*	P.9/P.8	
			42	2			
		400	43	3			
			44	4			
			45	5			
				6			
				7			
				8			
		450		9			
				10			
				11			
				12			
				13			
	early	500		14			
				15			
				16			
				17	*T. orthostylus*		
				18			
		550		19			
				20			
				21			
				22			
				23			
				24			
		600		25			
				26			
				27			

not abundant, and preservation is poor. However, the fragmented index species do suggest a middle-Miocene age. This indicates that material representing the late-Miocene foraminifer zones was not recovered in this hole. Cores 5 to 13, to a depth of 115 meters, are barren of recognizable foraminifers. Interpretation of this section must await further study to determine whether microforaminifer-sized individuals are present.

In Core 14, at approximately 120 meters, a normal-sized, fairly diverse planktonic and benthic foraminifer fauna can be identified as Oligocene. The species are indicative of the *Globigerina ampliapertura* Zone (N.1/P.20; 30–32 m.y.). The benthic forms and ostracodes indicate an open-water marine environment. From this depth down to 180 meters, sediments contain only rare casts of foraminifers. In the core catcher of Core 20, in a redeposited rubble of green sandstone, common shallow-water Eocene benthic foraminifers belonging to Nummulitidae, Amphisteginidae, and Nodosaridae were recovered. In Core 23, at approximately 210 meters, middle-Eocene planktonic forms occur in turbidites with shallow-water benthic forms. This sample also contain benthic and planktonic microforaminifers; and as mentioned previously, the environmental significance of these tiny forms is not clear.

The next important foraminifer assemblage was found in Core 34, Section 4 in which planktonic species of the late early Eocene were found. Approximately 50 meters below this, material in Core 40 also suggests the late early Eocene, possibly P.9/P.8.

Another sample taken from this core catcher, within 10 cm of the Eocene material, contained silicified and distorted, reworked Cretaceous planktonic and benthic forms.

Basalt was encountered in the core catcher of Core 41, and interspersed sediments of Eocene age were recovered from Cores 42 and 43. The foraminifers in Core 43 are badly worn, reworked, shallow-water benthic forms.

Hole 446A

This hole was washed down to a depth of 372 meters. Core 1 contained a badly worn planktonic and benthic fauna of the late early Eocene. Core 2 recovered basalt; below, sediments interspersed between basalt sills were either barren or contained severely worn and crushed tests. Core 13 is of interest because if contains a transported warm- and shallow-water benthic fauna of *Asterocyclina, Amphistegina, Cibicides,* and *Planulina.* The accompanying planktonic forms are of the early Eocene (51–52 m.y.), and this represents the oldest sediment recovered from the hole.

Nannofossils

Because of the great water depth (well below the present CCD), the occurrence of nannofossils was minimal at this site. Sporadic nannofossils representing the middle Pliocene and middle Oligocene occur in two of 19 upper cores. Preservation of the Pliocene nannofossils is moderate, the fossils suffering some etching, whereas preservation is poor for the Oligocene fossils because of recrystallization. In the lower cores, where Eocene turbidites are encountered, nannofossils are preserved more frequently. Heavy reworking prevails in this sequence, and nannofossil preservation is generally moderately good to poor because of a combination of etching and recrystallization. Age identification is summarized in Table 5.

Pliocene

Sample 446-2-1, 53 cm contains common nannofossils. Although heavy reworking of early Miocene to early Pliocene forms hampers age identification, several Pliocene discoasters, together with *Pseudoemiliania* sp. aff. *P. lacunosa*, suggest a middle-Pliocene assemblage of the *Discoaster asymmetricus* Subzone or the lower part of the *Discoaster brouweri* Zone (*D. tamalis* or *D. surculus* Subzone). A similar assemblage without *P.* sp. aff. *P. lacunosa* identifies the *D. asymmetricus* Subzone for Section 2,CC.

Oligocene

Cores 446-3 through 446-14-3 are barren of nannofossils. Section 14-5 contains approximately 10 cm of calcareous ooze. No reworking has occurred in this ooze, and the assemblage indicates the *Sphenolithus distentus* Zone of the middle Oligocene. Sections 14,CC to 19,CC are barren of nannofossils.

Eocene

Rare specimens of *Chiasmolithus gigas* occur in restricted intervals of Sections 20-1 to 23,CC. Reworking is common in these cores, and the last occurrence of *C. gigas* is not clear. Therefore, the *C. gigas* and *Coccolithus staurion* Subzones are assigned to this sequence. Cores 25-1 to 29-1 represent the *Discoaster strictus* Subzone. Cores 29-2 to 37-1 are barren of nannofossils, except in two short intervals of Sections 30-1 and 34-4 which contain an assemblage of the *Rhabdosphaera inflata* Subzone. Cores 38-4 to 39,CC belong to the *Discoasteroides kuepperi* Subzone, and Cores 40-2 to 43-2 represent the *Discoaster lodoensis* Zone.

Approximately 10 cm of light-bluish-green sediment overlying 3 cm of dark-green sediment was recovered as one solid piece of rock in Section 40,CC. The boundary of these two sediments indicates turbidite deposition. The light-colored material contains abundant nannofossils whose assemblage is about 90 per cent Cretaceous nannofossils and about 10 per cent early-Eocene species. On the other hand, the dark-green sediment yields common nannofossils consisting almost equally of Cretaceous and early-Eocene fossils. The early-Eocene assemblage in both sediments clearly indicates the *D. lodoensis* Zone, whereas the Cretaceous flora indicates an age of Albian or Cenomanian. This suggests that Cretaceous chalk on the adjacent ridges was redeposited at this site by a turbidite flow during the late early Eocene.

Beneath the first basalt sill, approximately 5 meters of sediment was recovered in Core 43. The assemblage of nannofossils in this sediment is almost identical with that observed in Section 41-2, and the common occurrence of *Coccolithus crassus* confirms that this sediment represents the *D. lodoensis* Zone.

Cores 1 to 3 of Hole 446A were drilled to recover the same sediments as Cores 41 to 43 of Hole 446; naturally, the nannofossils are similar. Small pieces of light-bluish-green sediment which contain reworked Cretaceous nannofossils were recovered in Section 446A-1-1. Cores 446A-4 to 446A-8 are all basalt. Between Cores 446A-9 and 28, many alternative sequences of basalt and sedimentary rock were recovered. Nannofossils are sporadic in this sequence, and the assemblage indicates the *Tribrachiatus orthostylus* Zone of the late early Eocene. Therefore, the age of the oldest sediment recovered at this site is about 50 to 52 m.y. This sediment does not contain any reworked nannofossils.

Radiolarians

Well-preserved radiolarians at Site 446 are rare. Two cores (9 and 17) provided abundant radiolarians in a state of excellent preservation. Every other core is either barren of radiolarians (Cores 1-8 and 10-16) or the radiolarians are altered beyond specific recognition (Cores 18-43). Site 446, although it has a poor radiolarian biostratigraphic record, provides an excellent opportunity to observe the preservational and diagenetic history of the radiolarians.

The two biostratigraphic "windows" are late early Miocene in Core 9 and early late Eocene in Core 17. Core 9 contains *Stichocorys delmontensis, S. wolffii, Calocycletta costata,* and *Crytocapsella cornuta*, which indicates an age of 15 to 17 m.y., *Calocycletta costata* Zone. Core 17 is in the *Podocyrtis chalara* Zone (44-45 m.y.) and contains the Eocene species *Rhabdolithis pipa, Lithochytris vespertilio, Eusyringium fistuligerum, Thyrsocyrtis triacantha,* and *Calocyclas hispida*. Both cores contain many tropical species.

The radiolarians of Hole 446A are similar to those of the bottom of Hole 446. Evidence of recrystallization is evident in all the cores with sediments. No cores contain radiolarians preserved well enough for age determination.

SEDIMENTATION RATE

An age-depth plot is shown in Figure 7. The sediment ages 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 6 shows sediment accumulation rates calculated for each stratigraphic unit.

The sediment accumulation rates at Site 446 show a systematic change down-hole, similar to changes observed at Site 445, although the reasons for the change are different. Rates are very low for the last 44 m.y. of deposition (Pleistocene through very late middle Eocene), because the sedimentation pattern was dominantly pelagic with a terrigenous influx only during the Pliocene (unit I). Sedimentation rates show an increase to moderate values for the middle and early Eocene at Site 446. The sudden increase in sediment accumulation rate is attributed to the influx of sandy turbidites during the early and middle Eocene into the Daito Basin at Site 446.

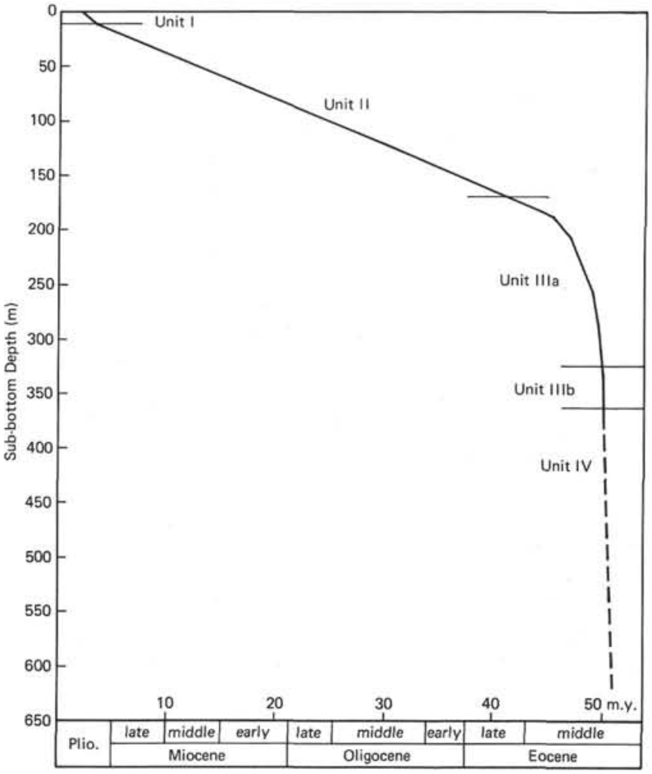


Figure 7. Sedimentation-rate curve for Site 446, based on biostratigraphic determinations. For unit IV, thickness of sediment is based on adding thicknesses of recovered sediment according to core-description sheets. Because of inaccuracies and poor recovery, the curve for unit IV is dashed.

TABLE 6
Sedimentation Rates, Site 446

Unit	Depth (m)	Interval Thickness (m)	Sedimentation Rate (m/m.y.)
I	0.0-14.2	14.2	2.5
II	14.2-172.5	158.3	4.0
IIIa	172.5-324.5	152.0	36.2
IIIb	324.5-362.5	38.0	63.3
IV	362.5-628.5	69.0[a]	31.4

[a] Sediment thickness based on total sediment recovered between basalt sills.

Although the pattern of sediment accumulation rates parallels that of Site 445, and also Sites 285 and 286 (Andrews, Packham et al., 1975; Klein, 1975) in the South Fiji and New Hebrides marginal basins, respectively, the overall rate is much lower at Site 446 in the Daito Basin, because pelagic clays are dominant (Site 446) and the sandy-turbidite units are thin compared to those at Sites 445, 285, and 286. Because deposition at Site 446 was at or near the CCD, Pleistocene or other changes in productivity do not appear to have influenced the sediment accumulation rate there.

IGNEOUS PETROLOGY

Introduction

In Hole 446A, basalt was first encountered at approximately 384 meters sub-bottom and was drilled to 628.5 meters sub-bottom. Basement consists of massive basalt sills with numerous interbeds of claystone, mudstone, and volcanic ash (Figures 8 and 9). In all, at least 23 sills and 16 sediment interbeds were drilled. Based on proportionate expansion of recovery to fill the entire drilled interval, the average sill thickness is approximately 7.8 meters (ranging from 22.0 to 0.3 meters), and the average sediment interbed is approximately 4.04 meters thick (ranging from 14.8 to 0.2 meters). Hole 446 was aborted because of weather after relatively short basement penetration, and because the basement stratigraphy is identical to that at Hole 446A, the two sites are discussed here together as Site 446, except where specified.

Numerous baked sediment contacts are present both below and above individual sills. In many cases the sediment still adheres to the igneous contact. The sediment typically is very hard at the contact, and chunks will readily scratch glass, whereas away from the contact the sediment can be scratched easily with a fingernail. The sediment is also generally discolored adjacent to igneous contacts, ranging from green to brown to gray-brown and gray-black at the contact; locally it may also appear brick red or bleached white. The effects of baking on the sediment appeared to vary considerably; there was a greater effect on overlying sediment than on underlying sediment. Because of poor recovery, it is difficult to give accurate estimates of the thickness of the baked zones, but in various cores it appears to range from centimeters to a meter.

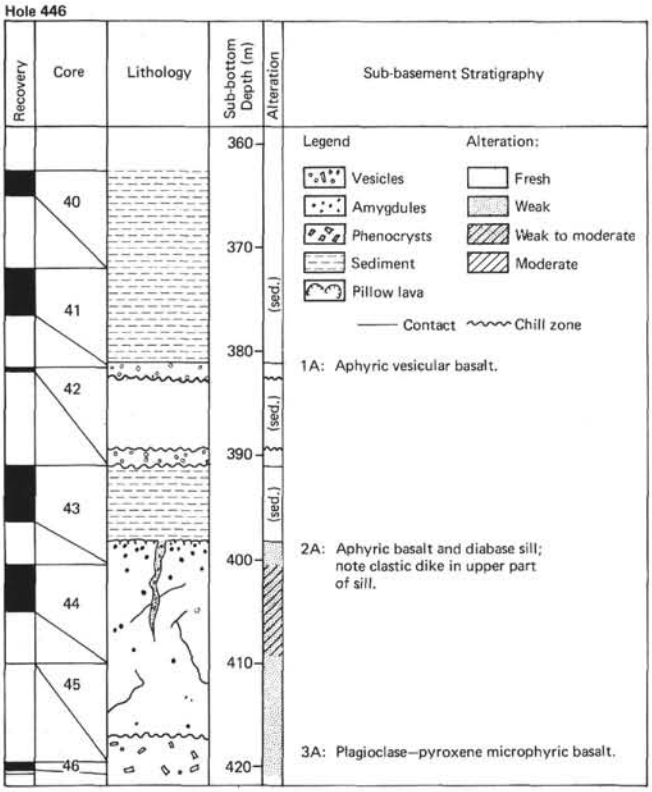


Figure 8. *Sub-basement stratigraphy, Hole 446.*

The chill zones found in the basalt at contacts also appear to be highly variable. In a few instances, glassy zones up to 2 cm were found, but in general, as in the Shikoku Basin, the sills tend to have fine-grained or aphanitic contacts, poor in glass.

Interestingly, the sills were generally finer grained than those drilled during Leg 58 in the Shikoku Basin. Only in a few cases was diabase actually recovered. Nonetheless, on the basis of the baked contacts, rarity of chill zones, lack of glass at the chilled margins, and massive nature of the basalt, it is clear that the Site 446 basalts are sills intruded into the sediment.

Fractures and Veins

Fracturing and the subsequent formation of veins is evident in nearly all the basalt cores. In many instances rocks are crisscrossed by several generations of veins formed along fracture surfaces. Vein fillings at Holes 446 and 446A differ substantially from those in the sills from the Shikoku Basin. Clay is the most common filling while carbonate, although very abundant, is less common. Pyrite and pyrrhotite are also exceptionally abundant as vein fillings at Site 446. Curiously, units 4B and 4C, unlike all the other sills, contain abundant thick carbonate veins, and in this respect are very similar to veins in the Shikoku Basin sills. Quartz was found along with clay in unit 2A of Hole 446A, and numerous clastic dikes were found in the same unit in Hole 446. The clastic dikes can be traced into zones of green, chloritic-appearing clay, recrystallized carbonate, and quartz. Zeolites also form vein fillings in some of the sills.

Petrography

The most common basalt is aphyric, with about 20 to 35 per cent plagioclase (An_{60} to An_{78}), 15 to 25 per cent clinopyroxene , and 7 to 20 per cent titanomagnetite, in a highly altered intersertal groundmass of clay, zeolites, and chlorite. Plagioclase and clinopyroxene phyric basalts are also common. In general, phenocrysts are small, averaging 1 mm in length and not exceeding 4 mm. Microphenocrysts from 0.5 to 1.0 mm are far more common than phenocrysts. In the thin sections examined, olivine is no longer present, because of alteration. Olivine pseudomorphs filled with clay, talc, iddingsite, calcite, and chlorite were identified in nine sills. Generally, it appears to have been a fairly common phenocryst and microphenocryst, amounting to as much as 4 or 5 per cent in some rocks. In one case, 30 to 40 per cent large olivine relics appear to be present. Because of intense alteration, identification of groundmass olivine is impossible. The vesicularity of these basalts is generally low, although locally there may be as much as 15 per cent vesicles.

Units 1, 4, and 5 are clearly unlike ocean-ridge basalts, containing 10 to 15 per cent basaltic hornblende and 20 to 40 per cent vesicles. In addition, the pyroxene is very pink, apparently reflecting a high titanium content, and titanomagnetite is exceptionally abundant (8–25%). These basalts have an intergranular texture, unlike all the rest of the Site 446 basalts, and in some cases are very coarse grained. Unit 4A, in fact, consists of coarse diabase with 30 to 40 per cent vesicles.

Unit 1

Unit 1 consists of aphyric, highly vesicular basalt. It contains from 10 to 15 per cent kaersutite, 20 to 30 per cent plagioclase ($\sim An_{70}$), 15 per cent clinopyroxene, and 15 to 25 per cent titanomagnetite. The rocks range from fine to medium grained and have an intergranular texture, with little evidence of alteration. The pyroxene is pink, suggesting high titanium contents. The hornblende is fresh and is clearly primary, although in places it also is either replacing clinopyroxene or forming an overgrowth on it.

There are two sills in unit 1, both of which are highly vesicular. Baked sediment was found above the contacts of both sills in either Hole 446 or 446A. The lower unit, however, apparently has a somewhat irregular contact, with intermixing of sediment and basalt. This might be due to intrusion into relatively unconsolidated sediment and formation of incipient pillow structures.

Unit 2

Unit 2 consists of a single thick aphyric basalt sill. No chilled contact was found. The sill is highly vesicular in its upper part, while vesicles are nearly absent in the lower half. The basalt is fine to medium grained, with an intersertal texture. It contains abundant plagioclase laths (An_{65}–An_{75}), granular clinopyroxene, and about 10 per cent titanomagnetite. Rare olivine pseudomorphs also appear to be present. Clay, quartz, and pyrite are common fracture fillings, and several excellent examples of clastic dikes are present. The sediment in the dikes consists of angular claystone fragments of various colors, in a fine-grained claystone matrix. Relatively unaltered sediment can be traced into highly altered zones of green chloritic clay, pyrite segregations, carbonate, and recrystallized quartz.

Unit 3

Unit 3 consists of three plagioclase and plagioclase–clinopyroxene phyric basalt sills, separated by two sediment interbeds. The upper unit consists of plagioclase (40%) and clinopyroxene ($\sim 1\%$) microphyric basalt, which has an intersertal texture and a felty groundmass of plagioclase laths, pyroxene, titanomagnetite granules, and alteration products. The middle sill (3B) consists of plagioclase (3–15%) and pyroxene (0–8%) phyric basalt, with a groundmass of plagioclase (An_{65}–An_{68}), clinopyroxene, and 10 to 15 per cent skeletal or granular titanomagnetite. A few relict olivine pseudomorphs are also present in some thin sections. The middle sill ranges from fine to medium grained and contains from 0 to 5 per cent vesicles. The lower sill (3C) consists of very sparsely phyric plagioclase and clinopyroxene basalt. Plagioclase phenocrysts exceed clinopyroxene although together they amount to only 1 to 4 per cent of the rock. The groundmass consists of plagioclase (An_{66-76}), clinopyroxene, up to 15 per cent titanomagnetite, and alteration products. The pyroxene has a slight brown tint. The sill is fine grained, with 0 to 10 per cent vesicles, and calcite- and clay-filled amygdules. The vesicles appear to be largely empty in the lower half of the sill. Chill zones were recovered only at the upper contacts of units 2A and 2C.

Unit 4

Unit 4 can be split into 3 sub-units.

Sub-unit 4A consists of a very vesicular (25–40%, 0.1–3.0 mm), aphyric, aphanitic to coarse grained, gray-black diabase. The vesicles often contain euhedral calcite rhombs and pyrite. The high vesicularity and coarse, elongate grains give the diabase a skeletal appearance.

Thin sections show an intergranular texture composed of 30 per cent plagioclase laths (0.05–6.0 mm; An_{67}), 10 per cent pinkish-brown pyroxene laths (0.2–4.0 mm), 15 per cent basaltic hornblende (0.1–2.0 mm), and 10 per cent titanomagnetite (0.02–0.4 mm granular crystals and 0.2–1.5 mm acicular crystals). Zeolites were observed in some vesicles. Both pyroxene and plagioclase are elongate and appear to be quench growths.

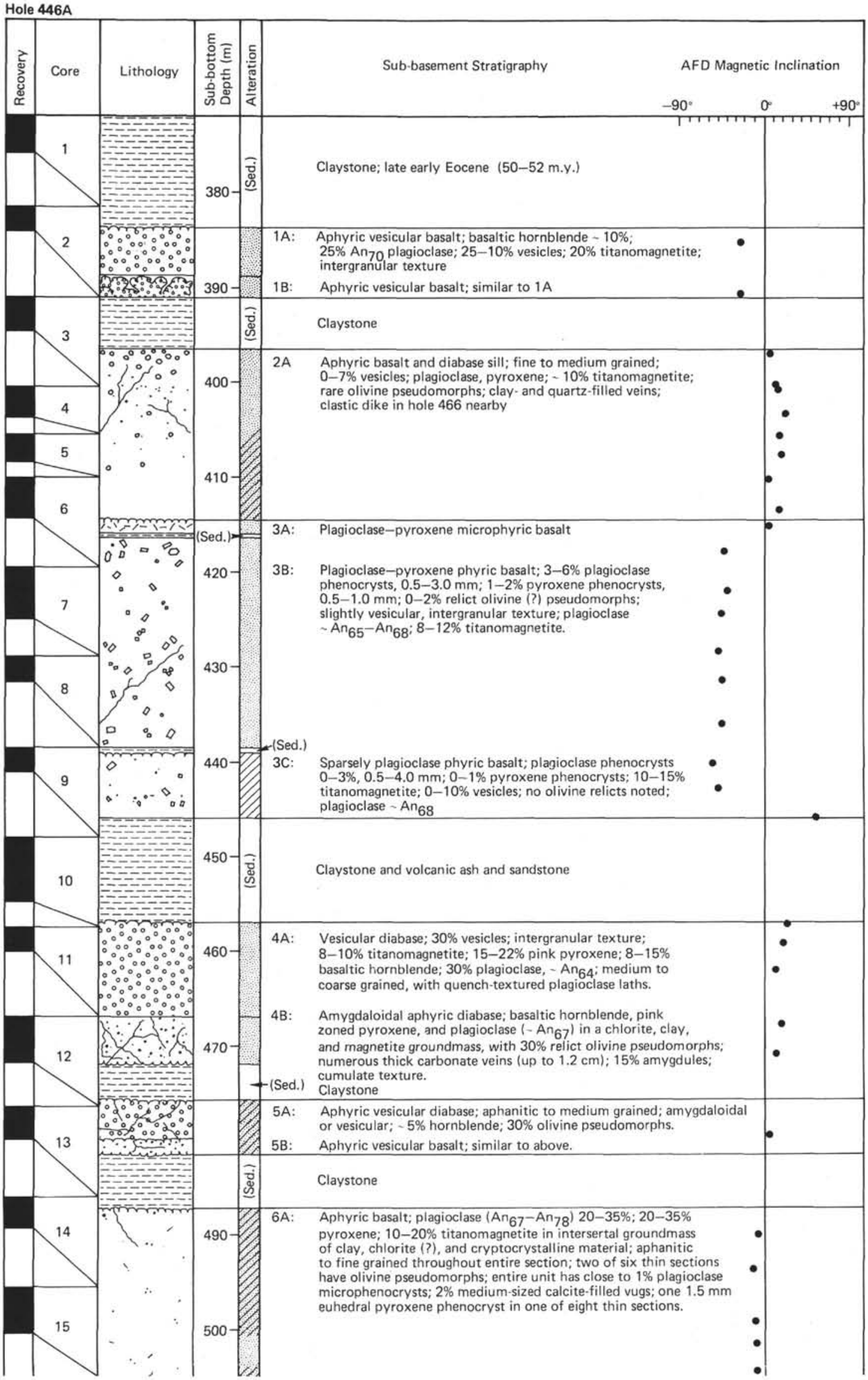
Sub-unit 4B consists of an aphyric, amygdaloidal, dark-gray basalt. The vesicles (0.2–1.5 mm) are filled by a light-olive-green clay and calcite. The sub-unit is cut by numerous calcite- and clay-lined veins, normally 1.0 to 2.0 mm wide, but reaching 2 cm. Lying on top of this unit in the recovery is a fragment of plagioclase phyric basalt; this probably was stoped from a higher unit, because no other material was recovered between sub-units 4A and 4B. Thin sections show an intersertal to intergranular texture comprising 10 to 15 per cent plagioclase ($\sim An_{67}$), 25 to 30 per cent pinkish clinopyroxene (frequently twinned and zoned), 7.5 per cent titanomagnetite, and 40 to 60 per cent groundmass, containing acicular and feathery microlites. Also observed was 2.5 to 5 per cent basaltic hornblende as anhedral laths or overgrowths on pyroxene. One pyroxene phenocryst was found (3.5 × 1.0 mm).

Sub-unit 4C is separated from sub-unit 4B by sediments. The upper part resembles sub-unit 4A and grades into material in the lower part resembling sub-unit 4C. This suggests that 4A and 4B may be parts of the same sill and that 4C is a smaller, but similar sill.

A K–Ar age determination by McKee and Klock (this volume) yielded a 48.2 ± 1.0 m.y. date for sample 446A-11-2, 28–31 cm from this unit.

Unit 5

The unit starts at the top of core 13, immediately below unit 4. The unit consists of an aphyric, amygdaloidal (5%, 0.25–2.0 mm), dark-gray basalt, which grades downwards from aphanitic to medium grained and back to fine grained. The vesicles are filled by smectite or calcite. The lower portion contains vesicular (5%, 0.25–2.0 mm) basalt which terminates with a chill zone. Probable pseudomorphs after olivine phenocrysts (~ 1 mm) were observed.



Claystone; late early Eocene (50–52 m.y.)

1A: Aphyric vesicular basalt; basaltic hornblende ~ 10%; 25% An$_{70}$ plagioclase; 25–10% vesicles; 20% titanomagnetite; intergranular texture

1B: Aphyric vesicular basalt; similar to 1A

Claystone

2A Aphyric basalt and diabase sill; fine to medium grained; 0–7% vesicles; plagioclase, pyroxene; ~ 10% titanomagnetite; rare olivine pseudomorphs; clay- and quartz-filled veins; clastic dike in hole 466 nearby

3A: Plagioclase–pyroxene microphyric basalt

3B: Plagioclase–pyroxene phyric basalt; 3–6% plagioclase phenocrysts, 0.5–3.0 mm; 1–2% pyroxene phenocrysts, 0.5–1.0 mm; 0–2% relict olivine (?) pseudomorphs; slightly vesicular, intergranular texture; plagioclase ~ An$_{65}$–An$_{68}$; 8–12% titanomagnetite.

3C: Sparsely plagioclase phyric basalt; plagioclase phenocrysts 0–3%, 0.5–4.0 mm; 0–1% pyroxene phenocrysts; 10–15% titanomagnetite; 0–10% vesicles; no olivine relicts noted; plagioclase ~ An$_{68}$

Claystone and volcanic ash and sandstone

4A: Vesicular diabase; 30% vesicles; intergranular texture; 8–10% titanomagnetite; 15–22% pink pyroxene; 8–15% basaltic hornblende; 30% plagioclase, ~ An$_{64}$; medium to coarse grained, with quench-textured plagioclase laths.

4B: Amygdaloidal aphyric diabase; basaltic hornblende, pink zoned pyroxene, and plagioclase (~ An$_{67}$) in a chlorite, clay, and magnetite groundmass, with 30% relict olivine pseudomorphs; numerous thick carbonate veins (up to 1.2 cm); 15% amygdules; cumulate texture.

Claystone

5A: Aphyric vesicular diabase; aphanitic to medium grained; amygdaloidal or vesicular; ~ 5% hornblende; 30% olivine pseudomorphs.

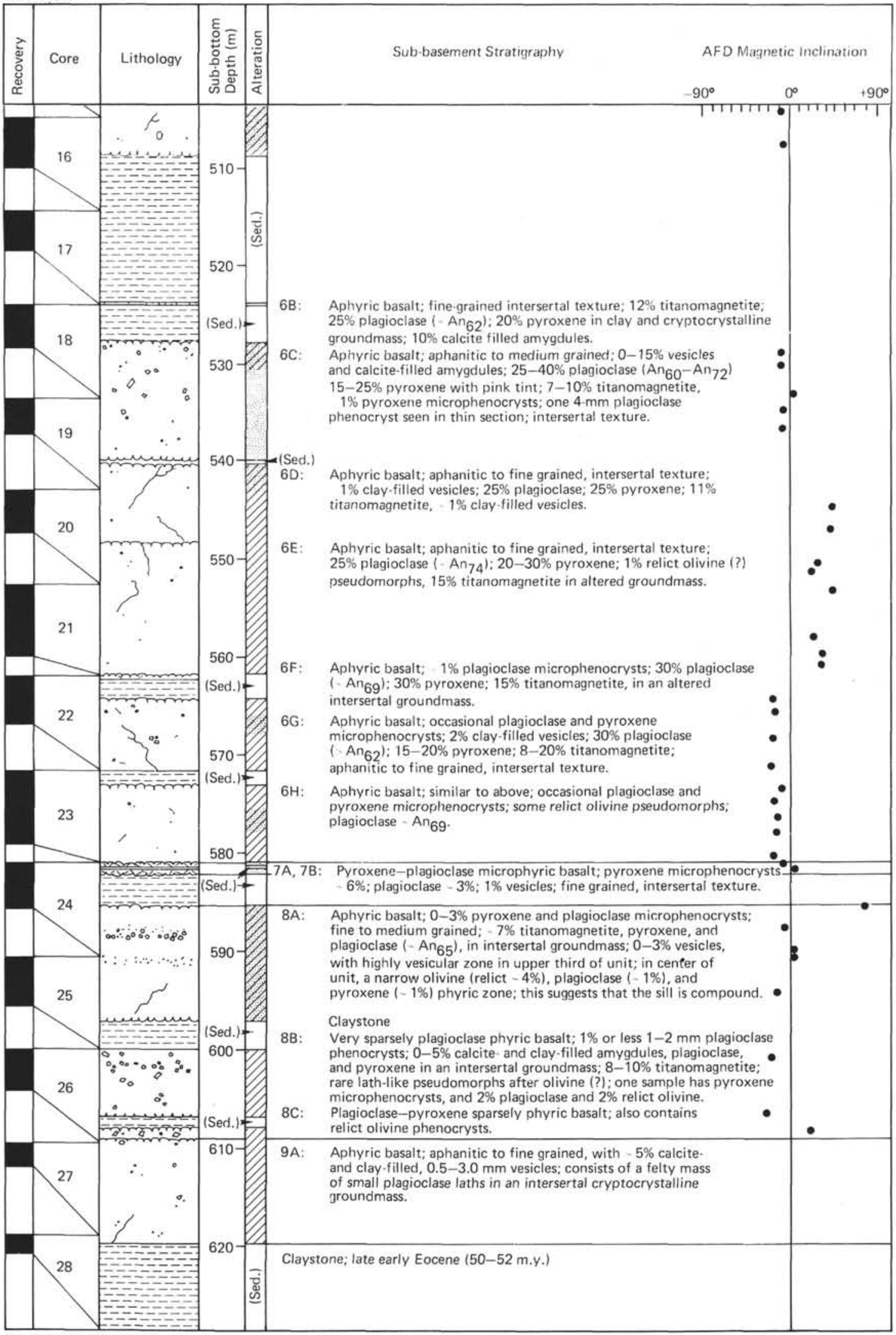
5B: Aphyric vesicular basalt; similar to above.

Claystone

6A: Aphyric basalt; plagioclase (An$_{67}$–An$_{78}$) 20–35%; 20–35% pyroxene; 10–20% titanomagnetite in intersertal groundmass of clay, chlorite (?), and cryptocrystalline material; aphanitic to fine grained throughout entire section; two of six thin sections have olivine pseudomorphs; entire unit has close to 1% plagioclase microphenocrysts; 2% medium-sized calcite-filled vugs; one 1.5 mm euhedral pyroxene phenocryst in one of eight thin sections.

Figure 9. *Sub-basement stratigraphy, Hole 446A.*

Hole 446A



6B: Aphyric basalt; fine-grained intersertal texture; 12% titanomagnetite; 25% plagioclase (~ An_{62}); 20% pyroxene in clay and cryptocrystalline groundmass; 10% calcite filled amygdules.

6C: Aphyric basalt; aphanitic to medium grained; 0–15% vesicles and calcite-filled amygdules; 25–40% plagioclase (An_{60}–An_{72}) 15–25% pyroxene with pink tint; 7–10% titanomagnetite, 1% pyroxene microphenocrysts; one 4-mm plagioclase phenocryst seen in thin section; intersertal texture.

6D: Aphyric basalt; aphanitic to fine grained, intersertal texture; 1% clay-filled vesicles; 25% plagioclase; 25% pyroxene; 11% titanomagnetite, ~ 1% clay-filled vesicles.

6E: Aphyric basalt; aphanitic to fine grained, intersertal texture; 25% plagioclase (~ An_{74}); 20–30% pyroxene; 1% relict olivine (?) pseudomorphs, 15% titanomagnetite in altered groundmass.

6F: Aphyric basalt; ~ 1% plagioclase microphenocrysts; 30% plagioclase (~ An_{69}); 30% pyroxene; 15% titanomagnetite, in an altered intersertal groundmass.

6G: Aphyric basalt; occasional plagioclase and pyroxene microphenocrysts; 2% clay-filled vesicles; 30% plagioclase (~ An_{62}); 15–20% pyroxene; 8–20% titanomagnetite; aphanitic to fine grained, intersertal texture.

6H: Aphyric basalt; similar to above; occasional plagioclase and pyroxene microphenocrysts; some relict olivine pseudomorphs; plagioclase ~ An_{69}.

7A, 7B: Pyroxene–plagioclase microphyric basalt; pyroxene microphenocrysts ~ 6%; plagioclase ~ 3%; 1% vesicles; fine grained, intersertal texture.

8A: Aphyric basalt; 0–3% pyroxene and plagioclase microphenocrysts; fine to medium grained; ~ 7% titanomagnetite, pyroxene, and plagioclase (~ An_{65}), in intersertal groundmass; 0–3% vesicles, with highly vesicular zone in upper third of unit; in center of unit, a narrow olivine (relict ~ 4%), plagioclase (~ 1%), and pyroxene (~ 1%) phyric zone; this suggests that the sill is compound.

Claystone

8B: Very sparsely plagioclase phyric basalt; 1% or less 1–2 mm plagioclase phenocrysts; 0–5% calcite- and clay-filled amygdules, plagioclase, and pyroxene in an intersertal groundmass; 8–10% titanomagnetite; rare lath-like pseudomorphs after olivine (?); one sample has pyroxene microphenocrysts, and 2% plagioclase and 2% relict olivine.

8C: Plagioclase–pyroxene sparsely phyric basalt; also contains relict olivine phenocrysts.

9A: Aphyric basalt; aphanitic to fine grained, with ~ 5% calcite- and clay-filled, 0.5–3.0 mm vesicles; consists of a felty mass of small plagioclase laths in an intersertal cryptocrystalline groundmass.

Claystone; late early Eocene (50–52 m.y.)

(see Figure 8 for legend)

Figure 9. *(Continued).*

The one available thin section indicates a composition of about 15 per cent plagioclase (at least An_{58}), 25 per cent pinkish-brown-tinged clinopyroxene, 5 per cent titanomagnetite, and 5 per cent basaltic hornblende (0.02–0.3 mm as grains, or up to 1 mm in fibrous forms). The remainder (~50%) consists of groundmass, one third of which is brownish, cryptocrystalline clay or talc, and the rest chlorite, usually in euhedral pseudomorphs after olivine (0.1–1.0 mm). Apatite is an accessory phase.

Unit 6

These basalts are represented by six sills, ranging in thickness from 7 to 22 meters (Figure 8).

The sills consist of very fine-grained (to aphanitic), aphyric basalts in the upper part of the unit (6A–6C) and of fine-grained basalts in the lower part (6D–6H). The vesicularity of the basalts ranges from 0 to 5 per cent (and in sill 6C up to 10 or 15%), with vesicle diameters up to 2 or 3 mm. The vesicles are filled completely with calcite and zeolites, or calcite and chlorite. The basalts are lightly to moderately altered.

Under the microscope, the basalts from all sills are characterized by similar textures and mineral composition. Sub-units 6A to 6C have a cryptocrystalline texture, which grades into intersertal in the basalt of sub-units 6D to 6H.

The basalts with cryptocrystalline texture contain less than 1 per cent euhedral plagioclase phenocrysts (An_{55-57}), 0.3 mm long. The groundmass is an aggregate of fine-grained plagioclase and pyroxene.

In a slide from Core 15, a single olivine crystal was observed which had a diameter of 4 mm. All the basalts have high contents of opaque minerals (up to 10–15%).

The basalts of intersertal texture have phenocrysts of plagioclase (An_{55-60}) up to 0.7 mm long; these make up 1 per cent of the rock. The groundmass comprises plagioclase (0.2–0.4 mm), pyroxene (0.04–0.1 mm), and interstitial glass (50%) which is almost completely palagonitized.

Like the basalts of sub-units 6A and 6B, the basalts of sub-units 6C, 6D, and 6E have high opaque-mineral contents (up to 10–15%). Many of the feldspar crystals are not twinned and show undulatory extinction.

Unit 7

The unit is split into two similar sub-units by a claystone interbed. Sub-unit 7A starts at the top of Core 24, Section 1 with a chill zone and glassy rind, and consists of plagioclase phyric basalt (3–4% plagioclase phenocrysts, 0.5–2 mm), possibly with odd relict olivine phenocrysts in the glassy margin (~1 mm) and rare clay-filled amygdules. Sub-unit 7B starts below the claystone with a chill zone and, apart from the lack of a glassy margin, appears identical to sub-unit 7A.

The only thin section available, from sub-unit 7a, contains approximately 5 per cent plagioclase phenocrysts (0.1–1 mm, at least An_{60}), 5 per cent pyroxene phenocrysts (0.1–0.6 mm), 2.5 per cent vesicles (0.05–0.4 mm, filled by a yellowish clay), 7.5 per cent disseminated magnetite, and 80 per cent groundmass showing chloritic alteration and containing microlites of plagioclase (>0.1 mm) and pyroxene micrograins (>0.05 mm).

Unit 8

Two sub-units were recognized, both carrying pseudomorphs after olivine. Sub-unit 8A starts with a chill zone underlying baked sediment; it consists of a fine-grained, massive, aphyric basalt with a vesicular zone (Core 24, Section 3, 0 cm through Core 24, Section 4, 1.5 cm) and a zone containing relict olivine (Core 25, Section 1, 0–50 cm). A discontinuity in the sub-unit occurs about a chlorite-lined fracture in Core 25, Section 2, 36 to 41 cm. Above the fracture, the basalt is a lighter gray. The basalt in the vicinity of the fracture appears finer grained. In thin section these basalts generally consist of 35 to 45 per cent plagioclase (at least An_{64}), 15 to 25 per cent pyroxene (augitic), and 10 to 20 per cent magnetite, with 20 to 40 per cent groundmass. Above the discontinuity, the groundmass shows light-brownish alteration and below dark-greenish alteration.

Sub-unit 8B consists of two sections. The upper section is composed of a very sparsely phyric plagioclase basalt with about 1 per cent vesicles (~ 1 mm) filled by calcite and clays with a more-vesicular zone (Core 26, Section 1, 60–100 cm) having 5 per cent vesicles up to 2 mm across.

Thin sections show a fine-grained, intersertal texture of about 30 per cent plagioclase microphenocrysts and microlites (at least An_{63}), 40 per cent pyroxene (augitic), 10 per cent magnetite, and 20 per cent brownish, altered, cryptocrystalline material. Occasional pyroxene and plagioclase phenocrysts were observed (up to 0.7 × 0.3 mm), as were lath-like pseudomorphs of brown chloritic material and calcite after olivine (3 × 0.5 mm in one case). The lower section (sub-unit 8C) is finer grained, but otherwise similar to the upper section.

All sub-units of unit 8 are cut by occasional fractures and veins lined by chloritic or clayey material.

Unit 9

Unit 9 starts with a glassy margin and chill zone adjacent to the base of sub-unit 8C. The unit consists of an aphanitic to very fine-grained, gray basalt with occasional amygdules reaching 10 per cent in the region of Core 27, Section 1, 0 to 110 cm. The amygdules near the top of the unit are filled by calcite and pyrite, lower by clay and pyrite. Odd large vugs, up to 30 by 10 mm were observed, lined by similar material. Occasional (<1%) plagioclase phenocrysts (0.5–1 mm) occur.

Thin sections show about 30 per cent plagioclase microlites (at least An_{60}) and 10 per cent magnetite in a cryptocrystalline groundmass, giving a felty texture.

The unit is cut by occasional calcite- or chlorite- and clay-lined veins, one of the latter being 10 mm wide.

Summary

The basalts drilled at Site 446 include rocks with both alkalic and tholeiitic element and petrographic affinities. As a suite, these rocks are very vesicular. Some are clearly unlike any MORB, particularly the hornblende-bearing varieties. All the basalts have incompatible-trace-element concentrations completely unlike MORB. These basalts show closest affinity to alkalic suites typical of ocean islands. High contents of volatiles, including H_2O, are indicated by both the high vesicularity of these basalts and the presence of kaersutite in a number of sills.

PALEOMAGNETISM

Site 446 is about 100 km south-southwest of Site 445 on the Daito Ridge. Paleomagnetism samples were taken both from sediments and basalts. NRM and AF-demagnetized NRM were measured in the same manner as described in the previous site reports. NRM stability was examined, as described for Site 445. Because Site 446 is close to Site 445, paleomagnetism data from both sites are supplementary and provide an opportunity for testing inter-site reliability. Sample positions in the cores, results of magnetic measurements, and AF demagnetization are listed in Tables 7 and 8 and are shown in Figure 10. In Hole 446A, many basalt sequences were recovered, and paleomagnetism was measured. Stable NRM of basalts is largely scattered, and the NRM inclinations of basalts and adjacent sedimentary interbeds do not show any positive correlation, as shown in Figure 11. It seems likely that almost all the basalt sequences were formed by intrusion after sediment deposition, and that they do not carry the NRM of surrounding sediment. Although the possibility of excursion-type deviation of the geomagnetic field from the geocentric dipole field cannot be ruled out, it is clear that basalt NRM data do not represent the mean geomagnetic field direction at the time of formation of surrounding sediment. Therefore, only sediment NRM data will be used hereafter for analyses. After careful examination, only 28 samples for Hole 446 and 12 for Hole 446A were found to be reliable. Most of the samples taken from unconsolidated sediments and coarse-grained mudstone layers were not stable; therefore, the stable NRM absolute inclination values are not homogeneously distributed with depth, but concentrated between 150 and 600 meters sub-bottom (Figure 12). According to shipboard paleontological study, this layer was formed during the Eocene. Using the method described for Site 445, an average value of absolute inclination is calculated for the Eocene, giving the following figures:

Hole	Number of Stable-NRM Measurements	Mean (degrees)	Standard Deviation (degrees)
446	28	12.3	9.0
446A	12	8.6	5.8

Therefore, the latitudes for Holes 446 and 446A during the Eocene are calculated as 6.2±4.5 (446) and 4.3±3.0 (446A) degrees north or south, respectively.

These values are plotted in addition to points for other sites in Figure 13. They reveal good agreement between paleomagnetism results for Site 445 and 446. Consistency of paleomagnetism data among various sites in the same lithospheric plate, with sediments of

TABLE 7
Paleomagnetism Measurements of Sedimentary Cores of Site 446[a]

Sample (interval in cm)	Sub-Bottom Depth (m)	J_{NRM} (10^{-5} gauss)	Susceptibility (10^{-5} gauss/oe)	Inclination		Polarity
				NRM	AFD	
446-2-1, 65–67	2.16	0.99	0.44	-27.9	-32.0	–
3-3, 120–122	15.21	0.33	0.60	30.9	17.5	+
3-4, 120–122	16.71	0.67	0.60	-37.5	-67.7	–
3-5, 3–5	17.04	0.56	0.56	29.6	27.6	+
5-4, 94–96	35.46	0.12	0.50	70.0	-27.5	+/–
5-5, 94–96	36.95	1.59	0.56	-38.1	-44.4	–
5-6, 94–96	38.45	0.26	0.41	-39.0	-50.0	–
6-5, 42–44	45.93	2.81	0.58	47.2	49.4	+
7-1, 91–93	49.92	9.81	0.59	-14.9	-15.8	–
7-2, 91–93	51.42	0.36	0.78	-16.5	-66.4	–
7-3, 91–93	52.92	1.20	0.67	14.3	-5.4	+/–
7-4, 91–93	54.42	2.10	0.47	-33.7	-37.4	–
7-5, 91–93	55.92	0.81	0.44	-26.8	2.4	–/+
8-1, 29–31	58.80	2.53	0.67	-32.2	-31.0	–
8-5, 51–53	65.02	1.76	0.66	-9.2	-0.7	–
8,CC, 10–12	67.61	0.70	0.52	-2.2	36.4	–/+
9-1, 74–76	68.75	0.043	–	-26.9	–	
9-2, 97–99	70.49	0.034	0.42	-55.3	-60.3	–
9-3, 21–23	71.22	0.56	0.41	-25.6	-85.6	–
9-4, 5–7	72.56	1.06	0.47	-53.6	-86.7	–
9-5, 57–59	74.59	2.32	0.52	3.1	-1.1	+/–
10-6, 106–108	86.07	1.96	0.50	-17.2	-22.7	–
10-7, 29–31	86.80	0.97	0.36	-55.7	-52.2	–
11-1, 25–27	87.26	0.77	0.44	-33.7	-67.8	–
11-2, 66–68	89.17	0.98	1.01	-56.4	-65.0	–
11-3, 25–27	90.26	0.89	0.44	-3.4	-63.5	–
11-4, 25–27	91.76	1.43	0.42	14.7	24.7	+
12-1, 130–132	97.81	1.15	0.46	-3.8	-56.8	–
12-2, 105–107	99.06	0.77	0.45	-10.5	-75.5	–
12-3, 105–107	100.56	0.70	0.44	-70.5	-58.3	–
12-4, 55–57	101.56	1.78	0.53	-1.0	6.6	–/+
13-1, 116–118	107.17	1.18	0.42	-52.4	-77.0	–
13-2, 32–34	108.83	1.44	0.66	0.8	-9.5	–/+
13-3, 115–117	110.16	4.17	1.31	0.2	-4.2	+/–
14-1, 140–142	116.91	0.33	0.54	81.1	43.6	–
14-2, 61–63	117.62	1.21	0.54	-43.5	-16.7	–
14-3, 61–63	119.12	0.02	0.61	-45.5	-35.0	–
14-4, 61–63	120.62	1.12	1.10	-4.7	-34.0	–
14-5, 61–63	122.12	5.49	1.15	22.7	27.0	+
15-2, 123–125	127.74	2.33	1.41	-34.6	-24.2	–
15-3, 123–125	129.24	4.83	1.30	-28.2	-19.0	–
16-2, 38–40	136.39	0.88	1.14	12.2	-31.9	+/–
16-3, 122–124	138.73	7.51	0.84	19.3	19.0	+
16-4, 38–40	139.39	4.51	1.04	-22.4	-27.1	–
21-1, 88–90	182.89	4.72	1.59	43.4	44.5	+
21-2, 88–90	184.39	2.57	3.15	-44.7	-53.2	–
23-1, 55–57	201.56	12.94	2.24	26.7	29.7	+
23-2, 55–57	203.06	9.25	1.42	31.6	31.2	
23-3, 8–10	204.09	3.48	2.60	-23.3	-21.9	–
24-1	210.50	2.40	2.63	-23.4	-0.3	–
24-3, 126–128	214.77	7.98	2.29	13.1	18.9	+
25-2, 87–89	222.38	22.50	3.13	15.5	15.5	+
25-3, 61–63	223.62	66.57	1.64	-5.3	-5.9	–
26-1, 43–45	229.94	13.74	1.24	-31.3	-31.9	–
26-2, 109–111	232.10	17.38	0.73	-20.3	-20.5	–
26-3, 129–131	253.80	36.10	1.81	55.4	56.9	+
27-1, 142–144	240.43	15.10	1.08	10.0	12.1	+
27-2, 115–117	241.66	13.35	0.95	45.6	46.8	+
28-1, 76–78	249.27	6.44	2.81	35.8	39.1	+
29-1, 28–30	258.29	34.35	2.07	10.5	9.5	+
30-1, 54–56	268.05	5.14	1.90	8.7	8.8	+
30-2, 126–128	270.27	6.87	2.20	11.7	8.7	+
30-3, 104–106	271.55	6.37	3.37	8.8	11.8	+
31-1, 7–9	277.08	12.88	2.42	-13.6	-12.8	–
31-3, 88–90	280.89	0.25	1.08	-2.6	-9.9	–
31,CC, 13–15	286.14	9.41	1.73	32.7	34.1	+
32-2, 98–100	288.99	33.07	2.78	14.7	14.6	+
32-3, 116–118	290.67	9.62	2.61	-5.3	-4.0	–
32-4, 49–51	291.50	16.73	1.37	6.2	5.9	+
32-5, 124–126	293.75	13.92	3.68	32.0	41.0	+
33-1, 126–128	297.27	34.98	1.73	-37.9	-38.7	–
34-1, 35–37	305.86	36.01	1.99	23.4	21.7	+
34-2, 123–125	308.24	19.76	2.73	0.1	2.4	+
34-3, 40–42	308.91	43.91	1.90	13.8	14.2	+
34-4, 11–13	310.12	56.55	1.34	8.7	8.7	+
34-6, 48–50	313.49	25.54	2.03	5.8	5.1	+
35,CC	324.00	23.72	3.00	4.5	5.9	+
36-1, 142–144	325.93	9.54	1.45	0.8	-0.4	+/–
36-2, 98–100	326.99	1.14	0.39	4.7	5.0	+

TABLE 7 – *Continued*

Sample (interval in cm)	Sub-Bottom Depth (m)	J_{NRM} (10^{-5} gauss)	Suscepti-bility (10^{-5} gauss/oe)	Inclination		Polar-ity
				NRM	AFD	
446-36-3, 107-109	328.58	10.31	1.88	-2.9	-3.3	
37-1, 125-127	335.26	4.17	2.53	4.6	6.5	+
38-1, 12-14	343.63	34.16	2.77	1.5	0.7	+
38-3, 132-134	347.83	30.97	3.11	18.2	18.8	+
38-4, 120-122	349.21	25.93	2.63	-4.4	-5.2	–
38-6, 62-64	351.63	78.6	2.13	-0.4	-1.0	–
39-1, 26-28	353.27	50.2	2.07	11.6	12.0	+
39-3, 7-9	356.08	2.66	1.17	-14.3	-12.0	–
40-1, 59-61	363.10	5.77	0.38	-14.0	-16.8	–
41-1, 122-124	373.22	3.14	0.64	27.0	17.3	
41-2, 17-19	373.68	8.88	0.43	36.8	34.7	+
41-3, 120-122	376.21	7.13	0.75	-9.7	-13.5	–
43-1, 127-129	392.29	4.02	0.39	20.1	19.9	+
43-2, 97-99	393.48	11.74	0.43	-1.0	-1.8	–
43-3, 118-120	395.19	17.23	0.78	23.3	22.7	+
446A-1-2, 7-9	373.56	3.15	0.52	19.0	14.6	+
1-3, 8-9	375.07	0.005	0.24	1.8	-1.7	+/–
3-1, 110-112	392.11	6.44	0.52	27.1	25.1	+
10-1, 42-44	448.43	6.57	0.57	8.3	6.5	+
10-3, 115-117	452.16	1.71	0.57	28.9	20.7	+
10-5, 50-52	454.51	3.56	0.56	32.5	27.2	+
12-3, 101-103	471.02	4.54	0.43	0.0	-2.9	–
13-3, 73-75	480.24	2.77	0.49	14.1	9.1	+
16-4, 128-130	510.79	1.03	0.40	9.8	15.5	+
17-1, 77-79	515.28	0.69	0.30	2.8	-1.7	+/–
17-3, 50-52	518.01	8.68	1.04	13.5	13.4	+
18-1, 107-109	525.06	11.10	0.87	-14.8	-19.4	–
18-2, 27-29	525.78	63.72	4.19	-10.6	-12.4	–
19-3, 22-24	536.73	37.43	2.64	-11.4	-11.6	–
22-1, 104-106	563.05	26.59	4.54	0.1	0.7	
23-1, 64-66	572.15	43.06	4.30	11.7	12.3	+
24-1, 117-119	582.16	200.39	7.04	6.8	7.2	+
24-2, 28-30	582.79	122.11	7.95	-0.1	1.1	–/+
25-3, 97-99	594.48	67.80	4.80	0.2	-0.3	
25-4, 62-64	595.63	66.77	3.65	-7.5	-8.7	–
26-3, 59-61	603.60	3.57	0.87	5.9	7.8	+

[a] 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 (–).

TABLE 8
Paleomagnetism of Basalts, Site 446[a]

Sample (interval in cm)	Sub-Bottom Depth (m)	J_{NRM} (10^{-5} gauss)	Inclination		MDF (oe)	X_{in} (10^{-5} gauss/oe	Q_n'	Remarks (oe)
			NRM	AFD				
446-4-1,CC, 19-21	381.2	85.66	-55.7	-17.1	150	11.60	17.6	200
44-1, 5-7	400.56	793.10	10.1	13.6	75	19.39	97.4	100
44-2, 49-51	402.50	2004.7	15.7	18.0	75	9.78	488.5	100
43-4, 21-23	395.70	1084.1	16.1	24.6	120	6.53	395.6	150
46-1, 47-49	419.90	1209.3	-49.1	-51.3	130	10.85	265.6	150
446A-2-1, 145-147	382.96	348.69	-35.6	-25.7	–	9.2	90.3	200
2-3, 41-43	384.92	5234.29	-24.1	-25.2	155	13.0	959.6	200
3-3, 50-52	394.51	744.88	-4.6	5.2	70	11.2	158.5	100
3-4, 34-36	395.83	81.56	2.3	13.5	80	13.4	14.5	100
4-1, 32-34	400.83	667.97	7.1	15.5	90	14.5	109.8	100
4-2, 44-46	401.95	399.24	5.4	23.1	120	11.7	81.3	150
4-3, 43-45	403.94	1156.96	14.2	17.6	90	13.0	212.1	100
5-1, 16-18	405.67	550.71	9.0	21.2	–	11.0	119.3	200
5-2, 24-26	407.23	590.12	-2.1	17.6	110	12.5	112.5	150
6-1, 10-12	410.11	474.41	-17.8	3.6	40	12.8	88.3	50
6-2, 38-40	411.89	970.36	10.6	16.0	120	13.6	170.1	150
6-2, 118-120	412.69	2917.34	-5.2	1.7	90	9.3	747.5.	100
6-3, 109-111	414.10	1547.11	-44.3	-43.1	110	11.6	317.9	150
7-2, 24-26	421.25	447.46	-43.7	-39.2	90	13.8	77.3	100
7-3, 38-40	422.89	672.58	-39.5	-45.3	95	10.9	147.1	100
7-4, 138-140	425.39	833.75	-48.8	-49.1	100	12.5	159.0	100
8-1, 75-77	429.76	820.48	-40.9	-44.5	115	11.1	176.2	150
8-2, 72-74	431.23	466.22	-48.8	-45.1	80	12.4	89.6	100
9-1, 82-84	439.33	619.99	-53.8	-53.2	80	14.4	102.6	100
9-2, 54-56	440.55	352.75	-60.9	-49.2	110	15.1	55.7	150
9-3, 51-53	442.02	446.08	56.7	53.6	85	13.5	78.8	100
10-5, 110-112	455.11	163.75	23.0	23.5	90	25.2	15.5	100
11-1, 69-71	458.20	354.85	16.2	20.7	75	23.5	36.0	100
11-2, 23-25	459.24	537.98	11.4	12.8	75	17.4	73.7	100
12-1, 53-55	467.54	59.80	-30.5	1.8	35	14.8	9.6	50
12-1, 53-55	–	–	–	19.8	–	–	–	150
12-2, 69-71	469.20	180.64	-8.1	11.5	60	18.4	23.4	100
12-2, 69-71	–	–	–	14.8	–	–	–	150
13-1, 107-109	477.56	228.08	-3.0	4.8	155	10.3	52.8	200
14-1, 102-104	487.03	41.41	-50.4	-38.7	45	19.3	5.1	50
14-1, 102-104	–	–	–	+19.0	–	–	–	150
14-2, 44-46	487.95	469.37	-9.8	-5.6	120	16.2	69.1	150
14-3, 66-68	489.67	361.06	-13.5	-10.5	90	16.1	53.4	100
15-2, 16-18	497.17	751.04	-10.1	-8.8	130	15.4	116.2	150
15-3, 58-60	499.09	290.51	-10.9	-5.5	110	14.4	48.1	150
15-4, 73-75	500.74	331.11	-7.6	-7.8	75	15.5	70.7	100
16-1, 53-55	505.54	260.78	-26.4	-8.8	60	15.8	39.3	100
16-2, 44-46	506.95	626.18	-4.4	-2.0	130	15.1	98.8	150
18-3, 83-85	527.84	381.21	-10.9	-7.5	55	15.8	57.5	100
18-4, 23-25	528.74	213.46	1.8	-7.3	80	13.5	37.7	100
18-5, 29-31	530.30	224.62	9.9	4.3	40	18.7	28.6	50
19-1, 69-71	534.20	413.37	-2.5	-3.0	105	20.0	49.3	150
19-2, 14-16	535.15	414.61	-5.9	-3.5	75	16.9	58.5	100
19-4, 122-124	539.23	834.03	21.2	29.8	125	14.9	77.4	150
19-5, 18-20	539.69	619.11	18.1	29.9	130	15.0	98.4	150
20-1, 105-107	544.06	499.42	30.7	44.2	120	17.9	66.5	150
20-2, 82-84	545.33	294.81	43.9	44.7	95	16.6	42.3	100
20-3, 140-142	547.41	438.05	34.5	32.0	140	15.3	68.2	150
23-3, 38-40	574.68	243.23	-18.3	-12.1	75	15.4		100
23-4, 44-46	575.51	165.35	-14.8	-10.1	65	14.7		100
23-5, 37-39	577.47	151.41	-18.0	-10.6	50	18.1		100
23-6, 101-103	579.51	99.63	-27.8	-15.5	120	16.6		150
24-1, 18-20	581.18	2467.72	-2.4	-4.3	85	12.9		100
24-1, 43-45	581.43	1719.88	1.7	5.8	155	12.1		200
24-2, 99-101	583.39	197.91	47.0	79.1	50	28.2		100
24-2, 99-101	583.39	–	–	50.4	–	–	–	150
24-3, 74-76	584.54	581.92	1.0	-1.5	90	27.2		100
24-4, 86-88	585.76	222.28	-8.2	2.5	105	24.7		150
25-1, 13-15	590.63	192.35	-9.6	2.4	85	22.0		100
25-2, 69-71	592.59	151.93	-23.3	-11.1	50	25.1		100
20-4, 35-37	547.86	38.05	37.6	25.6	130	17.2	5.3	150
21-1, 82-84	553.33	607.30	48.5	47.5	160	14.4	100.5	200
21-2, 128-130	555.29	109.90	-16.7	19.3	60	14.9	17.6	150
21-3	555.5	130.94	34.5	34.6	130	14.0	22.3	150
21-4, 61-63	557.62	162.67	15.7	26.9	80	15.0	25.8	100
21-5, 87-89	559.38	83.41	15.7	36.3	140	17.5	11.4	150
21-6, 16-18	560.17	185.44	-7.7	34.7	45	16.4	26.9	100
22-1, 145-147	563.46	365.97	-14.8	-13.2	130	20.8	41.9	150
22-2, 75-77	564.26	594.35	-16.2	-12.5	115	22.2	63.8	150
22-3, 80-82	565.81	732.47	-14.2	-16.5	95	20.2	86.4	100
22-4, 95-97	567.46	619.42	-20.2	-17.8	120	21.4	69.0	150
23-2, 43-45	573.44	275.42	-3.8	-4.8	80	14.6	45.0	100
25-3, 41-43	593.92	329.65	4.5	1.5	90	20.0	39.3	100
26-1, 47-49	600.48	198.05	-34.6	-16.6	110	15.1	31.3	150
26-3, 44-46	603.46	972.98	-22.3	-21.6	110	11.3	205.2	150
26-3, 140-142	604.41	198.20	25.6	22.2	90	13.5	35.0	100

[a] MDF is the median destructive field (of AF demagnetization) at which the remanent magnetism of a specimen decreases to 50% of its initial value; X_{in} is the initial susceptibility of a specimen; Q_n' is the Koenigsberger ratio of NRM; peak field strength listed in remarks column is that at which inclination of AFD remanent magnetization was taken; for other notations refer to Table 7.

different lithologies, indicates that these results are significant. The gradual changes in magnetic inclination with age are in good agreement with those obtained for DSDP samples from the west Philippine Basin (Site 292) by Louden (1977). This implies that the Daito Ridge and Basin province has been drifting northward at an almost constant rate (minimum 4 cm/yr) for the last 50 m.y., in conjunction with the west Philippine Basin.

PHYSICAL PROPERTIES

Physical-properties measurements for sediments recovered from Holes 446 and 446A included shear strength, sonic velocity, thermal conductivity, wet-bulk density, water content, and porosity (Table 9). Values for wet-bulk density, grain density, thermal conductivity, and sonic velocity for basalts are given in Table 10. Special 2-minute GRAPE counts for basalts are summarized in Table 11. A grain density of 3.034 g/cm³ was assumed for the 2-minute-GRAPE calculations.

The variation of sediment shear strength with depth is presented in Figure 14. Although there is considerable scatter in the data, there is a tendency for the average values of shear strength to increase with depth. A similar increase of shear strength with depth was observed for clays and muds of Sites 442, 443, and 444, but the increase at these sites began 80 meters below the sea floor. In contrast, shear-strength values for Hole 446 are relatively high within the upper 60 meters of the sediment column. The top 60 meters of sediment in Hole 446, therefore, behaves the same as the Shikoku Basin sediments between depths of 80 and 160 meters.

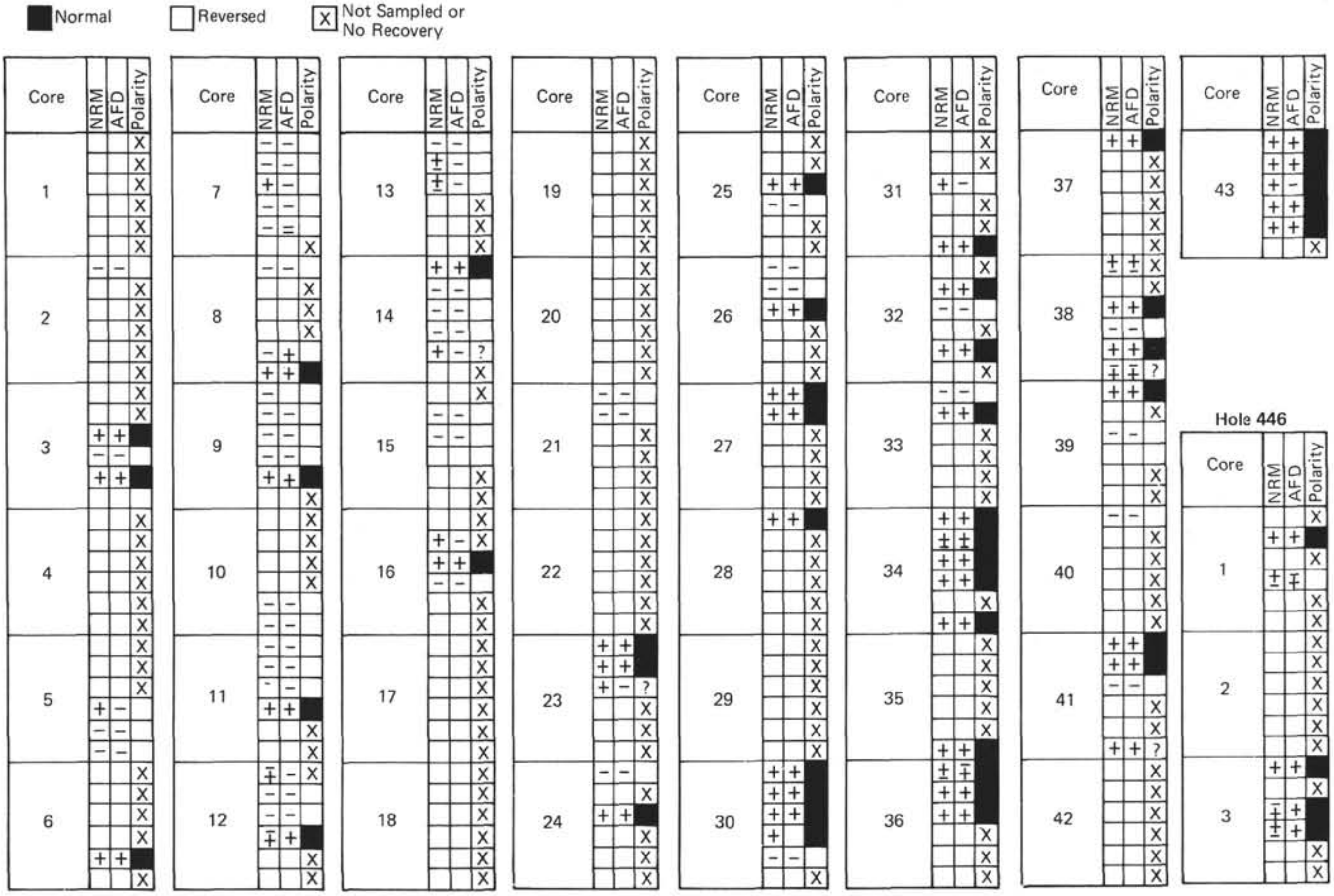


Figure 10. *Results listed in Table 7 illustrated in descending order. Also shown are diagrams for some basalt cores next to the bottom layer of sediments.*

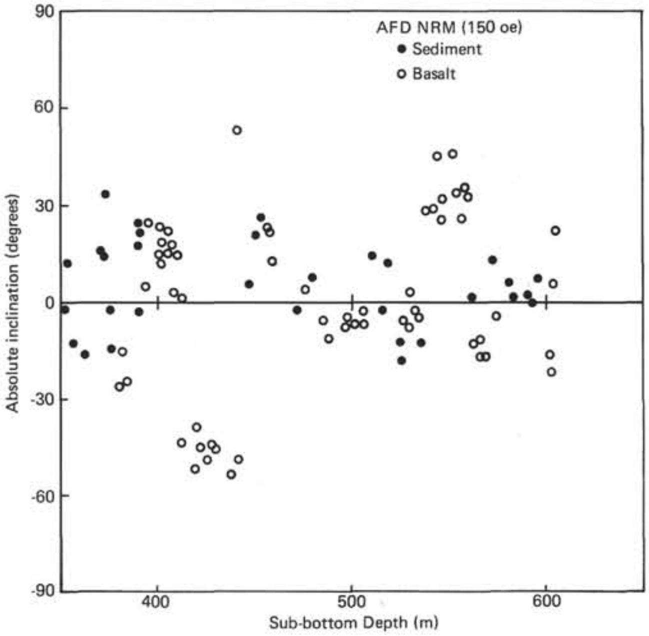


Figure 11. *Stable-NRM inclination values for all samples from Hole 446A plotted against sub-bottom depth. Data for Hole 446 are also plotted between 350 and 400 meters.*

Sonic velocities in Hole 446 sediments range from 1.55 to 1.60 km/s in the upper 140 meters of the hole (Figure 15). A thin layer of chert at about 140 meters (point A in Figure 15) causes velocities to increase to 2.85 km/s. This chert layer probably corresponds to the uppermost seismic reflector observed at the site. Velocities below this layer are lower, ranging from 1.5 to 1.6 km/s. Velocities increase again at 210 meters (point B in Figure 15). The scatter in sonic velocities below this depth is caused by the wide lithologic variability of the sediments. Point B is the logical choice for the position of the second seismic reflector at Site 446, but the calculated travel time from A to B is smaller than the travel time determined from the reflection profile. It is possible that any lithologic unit below B, particularly the sandstones, may correspond to the second seismic reflector. The velocity increase at C in Figure 15, for example, may be significant enough to produce an acoustic reflector.

The third seismic reflection at Site 446 corresponds to the uppermost basaltic sill in the sequence of sills penetrated in Hole 446A. The interlayering of sills and sediments produced an alternating sequence of high and low sonic velocities. Sonic velocities for the basalts are generally about 4.5 km/s. Velocities in unit 2A, however, exceed 5.0 km/s and reach a maximum of 5.9 km/s. Interesting variations of velocity can be observed

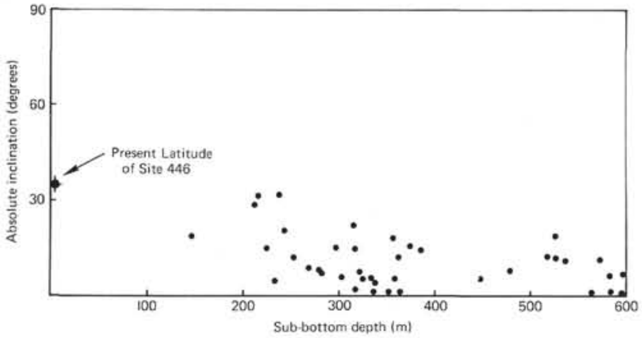


Figure 12. *Absolute values of stable NRM inclinations, bottom depth. Mixed data for Holes 446 and 446A.*

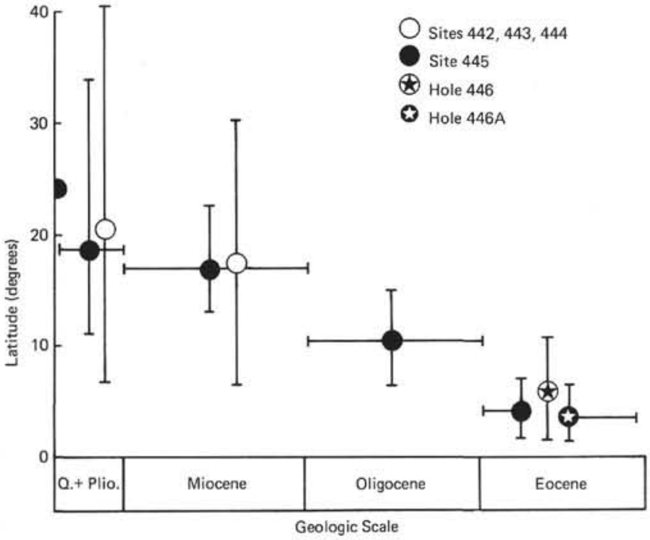


Figure 13. *Latitudes of Sites 442 through 446, plotted against ages determined from the shipboard paleontological studies. Vertical bars represent probable deviations calculated from the standard deviations of NRM inclination values; horizontal bars represent time spans for the data.*

within individual basalt layers. Velocities increase to a maximum within certain units, and then decrease toward the bottom of the layer (Figure 16). In sub-units 6D and 6E (Figure 16), however, velocities decrease with depth and then increase. This pattern may reflect the presence of two distinct units (see igneous petrology section). Sonic velocities for sediments between the basalt layers average about 2.0 km/s in the upper portion of the sequence, and tend to increase toward the bottom of the hole, perhaps reflecting a greater degree of thermal metamorphism or induration.

Approximately 75 per cent of the material recovered from Hole 446A is basalt, and the remainder is sediment. Assuming that these values reflect the true proportions of each rock type, and assuming average velocities of 4.5 and 2.0 km/s for basalt and sediment, respectively, the average bulk interval sonic velocity for the entire sill–sediment sequence is about 3.9 km/s. Although very low, this is a realistic value for the sonic velocity of layer 2A (e.g. Christensen and Salisbury, 1975). This value would be higher if the effect of overburden pressure were taken into consideration. The numerous cracks and veins observed in the basalts tend to lower the average velocity.

Sonic-velocity variations observed in Site 446 basalts are primarily related to variations in porosity and, therefore, vesicularity. The inverse relationship between sonic velocity and porosity is shown in Figure 17. The correlation coefficient is −0.83, and the least-squares parameters (slope −8.008, intercept 5.7125) are similar to those reported for Site 443 (see physical-properties section, Site 443 report). The high grain densities for Site 446 (Table 10) indicate that mineral alteration does not significantly influence sonic velocity. Most wet-bulk-density values plot along density–porosity theoretical curves for non-altered basalts (Figure 18). Wet-bulk-density variations, therefore, are also related to changes in porosity, suggesting that the empirical relationship between sonic velocity and wet-bulk density presented in Figure 19 is expected. The correlation coefficient for this relationship is 0.83. Thermal conductivity is also inversely related to porosity (Figure 20), although the correlation coefficient, 0.65, is low and the scatter is considerable. The linear fit, however, is very similar to that derived for Site 443 thermal conductivity data (see physical-properties section, Site 443 report).

CORRELATION OF GEOPHYSICAL DATA WITH DRILLING RESULTS

Seismic Profile and Lithology of Recovered Samples

Site 446 is located on a shot point 6000 of line 3-2 of the multichannel seismic profile of S/V *Kaiyo-Maru*. The upper layer, with two-way normal time of 0.4 seconds, is well stratified and horizontal. At least two reflectors are recognized. The underlying layer is semi-stratified, but the reflectors are very rugged, and even discontinuous; its bottom is unclear, although one indistinct reflector is scarecely recognizable at 0.73 seconds two-way normal time.

Lithology observed in the recovered cores can be correlated with these acoustic reflectors as follows (Figure 21):

1. The uppermost reflector, at 0.16 seconds, is the boundary between dark-brown pelagic clay and gray clay and mudstone with chert and ferromanganese nodules, recovered at a sub-bottom depth of about 145 meters.
2. The second reflector, at 0.30 seconds, appears to be in a mudstone-and-sandstone layer about 260 meters deep, at which sonic velocity and sedimentation rate sharply increase.
3. Roughness of the underlying reflector indicates that sills revealed at this site are not regionally uniform. Overall continuation of this reflector in the seismic profile shows that the upper surface of the sills becomes deeper as it approaches the Daito Ridge.

Magnetic Anomalies and Paleomagnetism Results

Measurement of paleomagnetism of sediments and basalts shows that the average inclination of natural

TABLE 9
Summary of Physical Properties of Sediments, Site 446

Sample (interval in cm)	Lithology	Sonic Velocity (km/s)	Thermal Conductivity (mcal/cm-s-°C)	Shear Strength (× 10^{-5} dynes/cm^2)	Wet-Bulk Density (g/cm^3)	Porosity (%)	Water Content (%)
446-3-5, 47–57	clay	1.508	2.486	1.34	1.42	76.54	55.29
3-5, 140–141	"	–	–	–	1.46	76.42	53.48
5-4, 114–124	"	1.564	2.300	2.30	1.37	75.02	56.21
6-3, 128–131	"	–	–	0.19	–	–	–
6-4, 128–141	"	1.504	2.336	3.06	1.40	78.17	57.15
7-1, 60–63	"	–	–	1.92	–	–	–
7-4, 60–72	"	1.506	2.289	2.30	–	–	–
7-6, 60–63	"	–	–	4.40	1.34	80.85	61.93
8-5, 38–48	"	1.523	2.253	2.49	1.39	80.78	59.38
9-3, 33–43	"	–	2.278	1.05	1.39	81.49	59.96
9-4, 33–36	"	–	–	3.64	–	–	–
9-4, 90–91	"	–	–	–	1.35	83.73	63.37
9-5, 33–36	"	1.519	–	–	–	–	–
10-5, 85–88	"	–	–	1.53	–	–	–
10-6, 50–60	"	1.511	2.197	2.68	1.35	83.73	63.37
10-7, 23–26	"	–	–	1.92	–	–	–
11-1, 70–73	"	–	–	0.67	–	–	–
11-2, 70–73	"	–	–	1.24	–	–	–
11-3, 70–80	"	1.507	2.267	1.34	1.42	80.23	57.85
11-4, 30–33	"	–	–	5.46	–	–	–
12-1, 45–48	"	–	–	1.34	–	–	–
12-2, 45–48	"	–	–	0.67	–	–	–
12-3, 45–48	"	–	–	9.58	–	–	–
12-4, 45–55	"	1.520	2.283	4.50	1.37	83.56	62.47
13-1, 108–111	"	–	–	1.24	–	–	–
13-2, 108–111	"	–	–	5.07	–	–	–
13-3, 111–121	"	1.518	2.275	6.70	1.39	79.92	58.96
13-4, 108–111	"	–	–	11.30	–	–	–
13-5, 24–27	"	–	–	6.22	–	–	–
14-2, 56–59	"	–	–	1.72	–	–	–
14-3, 56–59	"	–	–	3.06	–	–	–
14-4, 56–59	"	–	–	3.64	1.55	73.24	48.36
14-4, 144–145	"	–	–	–	1.47	75.12	52.44
14-5, 56–59	"	–	–	11.90	–	–	–
15-1, 133–136	"	–	–	3.06	–	–	–
15-2, 133–136	"	–	–	8.62	–	–	–
15-3, 133–143	"	1.536	2.336	3.45	1.47	73.80	51.57
16-4, 19–32	"	1.560	2.389	11.30	1.46	74.32	52.00
18-1, 10–13	"	1.734	–	–	1.53	72.20	48.37
18-1, 79–82	cherty clay	2.848	–	–	1.79	44.57	25.45
19-1, 127–137	clay	1.535	1.906	–	1.53	70.70	47.43
20-1, 65–75	mudstone	1.563	2.469	6.10	1.57	66.15	43.05
21-2, 74–84	clay	1.547	2.539	10.90	1.64	68.50	42.72
21-2, 144–145	mudstone	–	–	–	1.49	72.94	50.18
23-1, 80–90	clayey mudstone	1.581	2.736	–	1.58	72.43	47.08
24-1, 76–79	sandstone	1.903	–	–	1.74	61.94	36.55
24-2, 79–82	clay	1.773	–	–	–	–	–
25-2, 48–61	mudstone	2.188	2.408	–	1.74	58.85	34.64
26-1, 43–53	"	2.063	3.306	–	1.59	66.46	42.76
26-2, 140–150	"	–	–	–	1.64	63.79	39.76
27-1, 142–145	"	2.179	–	–	1.81	55.73	31.54
27-2, 44–54	"	–	2.811	–	–	–	–
28-1, 76–79	"	1.658	–	–	1.60	68.05	43.49
29-2, 47–50	"	2.734	–	–	2.06	37.93	18.89
30-4, 74–77	sandstone	2.129	–	–	1.79	53.39	30.50
30-5, 140–150	mudstone	–	–	–	1.65	62.89	39.09
31,CC, 13–16	"	1.893	–	–	1.72	58.86	34.97
32-2, 88–91	"	2.100	–	–	1.70	61.64	37.07
33-1, 52–62	claystone	–	2.447	–	–	–	–
33-2, 126–129	"	2.168	–	–	1.65	64.25	39.91
34-2, 123–126	mudstone	2.226	–	–	1.80	54.13	30.74
34-2, 134–137	sandstone	2.473*	–	–	1.97	44.99	23.42
34-5, 140–150	mudstone	–	–	–	1.64	66.47	41.42

TABLE 9 – *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 (%)
446-34-6, 48–51	siltstone	2.144	–	–	1.71	59.57	35.65
35,CC	mudstone	2.442	–	–	1.89	52.55	28.51
446-36-1, 142–145	"	1.949	–	–	1.80	56.94	32.41
36-2, 98–101	"	1.897	–	–	1.80	56.50	32.16
36-3, 107–109	"	1.935	–	–	1.83	63.41	35.47
37-1, 117–130	claystone	1.733	2.294	–	1.73	61.28	36.29
38-3, 132–142	mudstone	2.085	3.325	–	1.95	48.99	25.70
38-5, 103–113	calcareous mudstone	1.956	3.275	–	1.89	47.91	26.04
39-1, 26–36	"	2.236	3.181	–	2.02	41.42	21.06
39-3, 7–10	"	3.371	–	–	2.14	31.32	14.98
40-1, 59–62	mudstone	2.060	–	–	1.68	59.54	36.25
41-1, 120–130	calcareous claystone	2.090	3.042	–	1.91	47.94	25.71
41-2, 140–150	"	–	–	–	1.94	49.07	25.96
43-2, 97–100	claystone	1.845	–	–	–	–	–
446A-1-2, 7–10	mudstone	2.045	–	–	1.73	58.41	34.60
1-3, 8–18	siltstone	1.968	2.569	–	1.68	62.31	38.00
2-1, 46–49	ash	1.774*	–	–	–	–	–
10-1, 42–45	claystone	1.980	–	–	–	–	–
10-1, 77–80	ash	1.988*	–	–	–	–	–
10-2, 45–48	"	1.987*	–	–	–	–	–
10-2, 140–150	"	–	–	–	1.69	58.87	35.60
10-3, 20–23	"	1.859*	–	–	–	–	–
10-3, 115–118	"	2.062	–	–	–	–	–
10-5, 50–53	sandstone	2.199	–	–	–	–	–
12-3, 101–111	mudstone	1.901	2.469	–	1.62	66.50	42.12
13-3, 73–76	siltstone	2.210	–	–	1.90	52.30	28.24
13-3, 73–76	"	2.245	–	–	–	–	–
16-3, 120–130	volcanic ash	–	2.769	–	–	–	–
16-4, 102–105	mudstone	1.956*	–	–	1.74	60.27	35.49
16-4, 128–131	"	2.149	–	–	–	–	–
17-1, 77–80	"	2.101	–	–	1.74	58.86	34.74
17-3, 50–55	"	2.263	–	–	1.80	48.33	27.49
18-1, 107–110	"	1.757	–	–	1.73	60.43	35.71
18-2, 23–30	"	2.057	–	–	1.90	21.93	11.84
19-3, 22–25	"	2.537	–	–	–	–	–
22-1, 104–115	claystone	3.797	–	–	2.29	27.84	12.44
23-1, 64–67	mudstone	2.425	–	–	–	–	–
24-1, 117–120	"	2.304	–	–	–	–	–
24-2, 28–31	"	2.569	–	–	–	–	–
25-3, 97–100	mudstone (baked?)	3.190	3.525	–	–	–	–
25-3, 140–150	mudstone	–	–	–	2.09	41.67	20.40
25-4, 62–65	"	2.354	–	–	–	–	–
26-3, 59–62	"	2.472	–	–	1.99	44.48	22.92
28-1, 81–84	"	2.145	–	–	–	–	–
28-1, 100–103	"	3.486	–	–	2.55	25.29	10.15

[a] Propagation direction parallel to core axis

remanent magnetization is lower than 10 degrees. Magnetic anomalies on the crest of the Daito Ridge, measured during underway geophysical survey approaching this site, appears to show the same direction of bulk magnetization of the basement body constituting the Daito Ridge. Figure 22 shows the correlation of bottom topography and magnetic total force along the ship's track approaching Site 446. The correspondence of a magnetic trough with each topographic high is remarkable. Considering that the ship's course was roughly north–south, and that the ridge trends roughly east–west, this correlation indicates the nearly horizontal normal magnetization of the basement. More detailed calculation of magnetization will be done later, based upon anomaly distributions measured on the site-survey cruises. A rough estimate is that the Daito Ridge was magnetized at a position farther south, near the equator.

If this is valid for the whole igneous body of the ridge, we may be able to estimate the approximate shape of the igneous (or "magnetic") basement underlying the flat-topped crest of the main Daito Ridge, schematically shown in Figure 22. This basement seems to be overlain by weakly magnetized limestone, mudstone, or metamorphic rocks.

Another interesting finding is the smoothness of the magnetic anomaly in the basin south of the Daito Ridge, in contrast to an appreciable amplitude of anomalies

TABLE 10
Summary of Physical Properties of Igneous Rocks, Site 446

Sample (interval in cm)	Piece No.	Sonic Velocity (km/s)	Thermal Conductivity (mcal/ cm-s-°C)	Wet-Bulk Density (g/cm3)	Grain Density (%)	Porosity (%)
446-41,CC, 22–25	3	4.544	–	2.62	2.99	18.42
44-1, 6–8	1	–	–	2.84	3.05	10.57
44-2, 45–55	1d	5.251	4.469	2.90	2.99	4.66
44-4, 48–62	5	5.381	–	2.96	3.04	4.17
446A-2-1, 145–148	8	4.462	–	2.70	2.96	13.40
2-3, 41–44	5	4.444	–	2.70	3.01	15.76
3-3, 50–53	3a	4.836	–	2.82	3.10	13.56
3-4, 34–37	2	5.485	–	2.97	3.05	3.73
4-1, 32–42	1a	5.263	4.164	2.90	3.01	5.26
4-2, 44–47	4	5.894	–	2.92	2.98	2.76
4-3, 43–53	2c	5.550	4.206	3.01	3.05	2.36
5-1, 16–27	1a	5.739	4.231	2.99	3.05	2.73
5-2, 24–35	3a	5.593	4.244	3.03	3.10	3.34
6-1, 10–23	1a	5.844	4.225	3.00	3.09	4.38
6-2, 3–13	1a	–	4.464	–	–	–
6-2, 38–41	3a	5.576	–	3.02	3.08	3.36
6-2, 119–121	8a	–	–	2.87	3.15	13.23
6-3, 71–81	7e	–	3.225	–	–	–
6-3, 109–112	8f	4.880	–	2.64	2.97	16.96
6-3, 115–125	8f	–	3.697	–	–	–
7-2, 23–33	2a	4.627	4.128	2.74	3.02	13.92
7-3, 38–48	1c	4.718	3.808	2.80	3.13	15.49
7-4, 75–77	6a	–	–	2.83	3.01	8.77
7-4, 138–148	10	4.694	3.953	–	–	–
8-1, 74–77	9	4.419	–	2.74	3.00	13.02
8-2, 72–75	6	4.948	–	2.82	2.99	8.75
9-1, 82–85	4a	4.638	–	–	–	–
9-2, 54–57	3c	4.376	–	–	–	–
9-3, 51–54	3c	4.638	–	–	–	–
10-5, 110–113	4	4.518	–	2.64	3.09	21.76
11-1, 69–72	8b	4.562	–	–	–	–
11-2, 23–26	3	3.945*	–	–	–	–
11-2, 28–33	3	4.406	–	2.59	2.97	19.35
12-1, 50–60	3	4.476	4.381	2.79	3.09	14.27
12-1, 132–142	4b	–	3.961	–	–	–
12-2, 69–80	1c	5.250	4.506	2.73	3.10	17.61
13-1, 105–116	8b	4.262	3.775	–	–	–
14-1, 100–110	13d	4.056	3.689	2.71	3.05	16.86
14-2, 44–47	5	4.428	–	2.76	3.03	13.11
14-2, 53–63	6a	4.211	–	–	–	–
14-3, 66–69	6b	4.349	–	2.77	3.02	12.78
15-2, 16–26	1b	4.291	3.928	2.80	3.10	14.26
15-3, 58–71	6b	4.517	4.033	2.75	3.03	14.04
15-4, 73–84	4e	4.601	4.175	2.80	3.00	10.34
16-1, 53–56	5	4.763	–	2.78	2.99	10.64
16-2, 44–47	6a	4.247	–	2.74	3.04	14.80
17,CC, 26–29	1	3.838	–	–	–	–
18-3, 83–86	6b	4.041	–	2.61	2.98	19.80
18-4, 23–26	2	3.802	–	2.57	3.01	21.92
18-5, 29–32	3	3.744	–	2.57	2.97	20.53
19-1, 69–72	3a	3.965	–	2.66	3.02	17.78
19-5, 18–21		5.042	–	2.71	3.03	16.10
20-1, 96–98	9b	–	–	2.78	3.10	15.41
20-1, 105–115	9b	4.751	3.747	–	–	–
20-2, 82–85	9	4.319	–	–	–	–
20-3, 140–150	9	3.713	3.619	–	–	–
20-4, 34–44	3	4.619	3.033	2.66	3.09	20.89
21-1, 82–92	3c	4.132	3.508	2.71	3.06	17.38
21-2, 127–137	9b	3.860	3.733	–	–	–
21-3, 79–89	8b	4.052	3.992	2.63	2.87	13.00
21-4, 61–71	3a	4.173	3.850	–	–	–
21-5, 7–17	2a	–	4.122	–	–	–
21-5, 87–90	4c	4.445	–	2.72	3.04	15.87
21-6, 15–25	1b	4.413	4.131	–	–	–
22-1, 135–145	7	3.539	3.397	–	–	–
22-2, 73–83	7	3.817	3.589	2.68	3.05	18.29
22-3, 78–88	3	4.265	3.508	2.83	3.17	16.06
22-4, 95–105	1g	3.903	3.678	–	–	–
23-2, 43–53	1c	4.477	4.114	–	–	–
23-3, 38–48	1b	4.852	4.117	2.80	2.99	9.47
23-4, 44–54	2	4.915	4.125	–	–	–
23-5, 37–47	2a	4.643	3.900	2.89	3.07	9.20
23-6, 100–101	7c	4.388	3.683	–	–	–
24-1, 18–21	2b	4.466	–	2.79	3.13	16.18
24-1, 43–46	3	4.408	–	–	–	–
24-2, 78–88	1	–	4.353	–	–	–
24-2, 99–102	2	3.961	–	2.60	2.96	18.50
446A-24-3, 74–77	4b	4.551	–	2.75	3.03	13.73
24-4, 86–89	2a	4.986	–	2.89	3.02	6.16
25-1, 13–23	1a	5.189	4.278	2.83	3.02	9.70
25-2, 69–72	1c	4.745	–	–	–	–
25-3, 41–51	1b	4.391	4.111	–	–	–
26-1, 47–57	2	4.364	3.892	2.76	3.01	12.29
26-3, 44–47	4e	5.719	–	–	–	–
26-3, 140–143	7d	4.884	–	2.86	3.05	9.55
27-1, 77–80	9c	3.442	–	2.56	3.16	28.04

*Propagation direction perpendicular to core axis.

(approximately 100 gammas) in the basin north of the Daito Ridge. Whether this is due to the thick sequence intruded by sills at Site 446, or to other modes of crustal formation, is unknown.

SUMMARY AND CONCLUSIONS

Summary

The stratigraphic succession at Site 446 consists of four lithologic units, three of which are sedimentary, and one of which consists of interlayered sedimentary rocks and 16 basalt sills.

The total penetration at Site 446 was 628.5 meters, and both a sedimentary and an igneous succession were recovered. Although we did not reach acoustic basement, drilling terminated approximately 80 meters above it.

Sedimentary unit IV is the only one with significant amounts of ash. Ash is abundant in the sediment cores from Hole 446A, both as ash beds up to 1 meter thick and as a sediment component.

The relative depth of deposition of the sedimentary units at Site 446 is shown in Figure 23. The sediment suggests that during the depositional history at Site 446 the depositional surface was at or just below the CCD. Deposition was clearly below the CCD during deposition of unit I and unit II clays. Although calcareous foraminifers and nannofossils were recovered, they are poorly preserved and appear to have been reworked. In unit III, where turbidites are common, reworked nannofossils are common, suggesting that the depositional depth of this unit was also below the CCD. Most of unit IV also was deposited below the CCD.

Sedimentation at Site 446 involves two contrasting modes of deposition. During the earlier history of the basin (mostly Eocene), the dominant deposits were turbidites and hemipelagic deposits. However, most deposits are pelagic, and pelagic deposition occurred below the CCD from the latest Eocene to the present. The rates of sediment accumulation reflect these two contrasting styles; during the last 44 m.y., rates of sediment accumulation were very low because of the dominance of pelagic processes, whereas during the first 8 m.y. of depositional history the rates were moderate to high, because of sediment deposition by turbidity currents.

TABLE 11
Wet-Bulk Density and Porosity from 2-Minute GRAPE Counts, Igneous Rocks, Site 446

Sample (interval in cm)	Piece No.	Wet-Bulk Density (g/cm3)	Porosity (%)
446-41,CC	3	2.51	24.2
41,CC[a]	3	2.61	19.5
44-2, 30–31	1e	2.84	10.8
44-2, 49–51[a]	1d	2.92	6.7
44-2, 50–51	1d	2.81	12.34
44-2, 107–108	8	2.87	9.13
44-4, 12–13	1b	2.89	8.3
44-4, 38–39	3	2.85	10.2
44-4, 55–56	5	2.80	12.8
44-4, 62–63	5	2.93	6.7
446A-2-1, 106–107	4	2.38	30.7
2-1, 145–146	8	2.64	17.7
2-2, 55–56	8	2.66	16.5
2-2, 104–105	14	2.64	17.8
2-3, 18–19	3	2.54	22.7
2-3, 41–42[a]	5	2.68	15.5
3-3, 50–51[a]	3a	2.85	10.1
3-4, 34–35[a]	2	2.97	4.3
4-1, 10–11	1a	2.74	15.7
4-1, 32–33[a]	1a	2.90	7.6
4-1, 126–127	5	2.82	11.9
4-2, 30–31	3b	2.84	10.8
4-2, 44–45[a]	4	2.99	3.2
4-2, 125–126	13a	2.84	10.8
4-3, 40–41	2c	3.04	0.8
4-3, 43–44[a]	2c	2.96	4.75
5-1, 16–17[a]	1a	2.96	4.69
5-1, 17–18	1a	2.83	11.2
5-1, 103–104	5b	2.89	8.1
5-2, 24–25[a]	3a	2.96	5.0
5-2, 25–26	3a	2.93	6.5
5-2, 86–87	9a	2.93	6.1
6-1, 13–15	1a	2.90	7.8
6-1, 139–140	3b	2.86	9.9
6-3, 3–4	1a	2.86	9.9
6-2, 116–117	8a	2.76	14.5
6-3, 70–71	7e	2.54	23.9
6-3, 120–121	8f	2.58	22.1
7-2, 23–24	2a	2.61	20.4
7-2, 93–94	3c	2.70	16.0
7-3, 20–21	1b	2.73	14.7
7-3, 107–108	1h	2.75	13.6
7-4, 132–133	10	2.68	17.1
8-1, 74–75	9	2.64	19.0
8-2, 97–98	7b	2.81	10.8
9-1, 56–57	3b	2.70	15.0
9-2, 29–30	3a	2.72	14.3
9-2, 114–115	6	2.64	18.2
9-3, 20–21	3	2.74	13.2
9-3, 40–41	3c	2.69	15.8
11-1, 94–95	10b	2.60	22.6
11-2, 0–1	1a	2.58	23.9
11-2, 83–84	11	2.58	23.6
12-1, 40–41	3c	2.73	16.4
12-1, 132–133	4b	2.60	22.8
12-2, 72–73	1c	2.57	24.5
13-1, 51–52	6b	2.65	17.6
13-1, 105–106	8b	2.60	20.33
13-2, 22–23	2b	2.54	23.3
446A-14-1, 87–88	13b	2.61	21.5
14-2, 55–56	6a	2.71	16.6
14-3, 64–65	6b	2.73	15.5
15-2, 18–19	1b	2.70	17.0
15-3, 51–52	6a	2.66	19.1
15-3, 105–106	7c	2.71	16.5
15-4, 41–42	4a	2.77	13.8
15-4, 86–87	4f	2.72	16.3
16-1, 6–7	1a	2.71	16.3
16-1, 89–90	10	2.70	17.2
16-2, 55–56	6a	2.68	18.4
18-3, 91–92	6b	2.58	–
18-3, 116–117	6d	2.55	23.1
18-4, 21–22	2	2.56	22.1
18-4, 86–87	10	2.61	19.9
18-5, 33–34	3	2.55	22.9
19-1, 51–52	3a	2.44	28.6
19-2, 132–133	5a	2.57	22.0
19-3, 0–1	1	2.50	29.1
20-1, 9–10	2a	2.79	15.4
20-1, 107–108	9b	2.73	18.1
20-3, 4–5	1a	2.70	19.8
20-3, 139–140	9	2.61	24.1
20-4, 35–36	3	2.62	23.4
21-1, 17–18	1a	2.64	22.6
21-1, 108–109	4b	2.55	26.8
21-1, 108–109	4b	2.60	24.6
21-2, 94–95	8b	2.60	24.4
21-3, 75–76	5a	2.67	21.0
21-4, 10–11	1	2.66	21.4
21-4, 64–65	3a	2.63	23.2
21-5, 76–77	4c	2.67	21.3
21-6, 18–19	1b	2.72	18.5
22-2, 73–75	7	2.65	19.0
22-3, 40–41	2d	2.75	14.2
22-3, 78–79	3	2.73	15.1
22-4, 13–14	1a	2.72	15.7
23-2, 0–1	1a	2.59	21.8
23-3, 0–1	1a	2.53	24.9
23-3, 86–87	3a	2.66	18.3
23-4, 0–1	1	2.69	17.1
23-4, 120–121	5	2.52	25.4
23-5, 102–103	6	2.60	21.5
23-6, 76–77	7a	2.70	16.3
24-1, 26–26	2b	2.72	15.51
24-2, 89–90	2	2.51	25.7
24-3, 0–1	1a	2.47	28.2
24-4, 100–101	2c	2.63	19.9

[a] Counts through basalt minicores.

The igneous rocks at Site 446 consist of at least 23 basalt sills which intruded sedimentary rocks of the late early Eocene, mostly mudstone. The sills consist of aphyric basalt, phyric basalt, vesicular basalt, and fine-grained basalt. Chill zones were observed at both the base and the top of the sill units. The chill zones also contained isolated fragments of mudstone which were incorporated into the basalt during intrusion. Most of the interbedded sedimentary rocks showed baked contacts with the sills. These baked zones usually display a

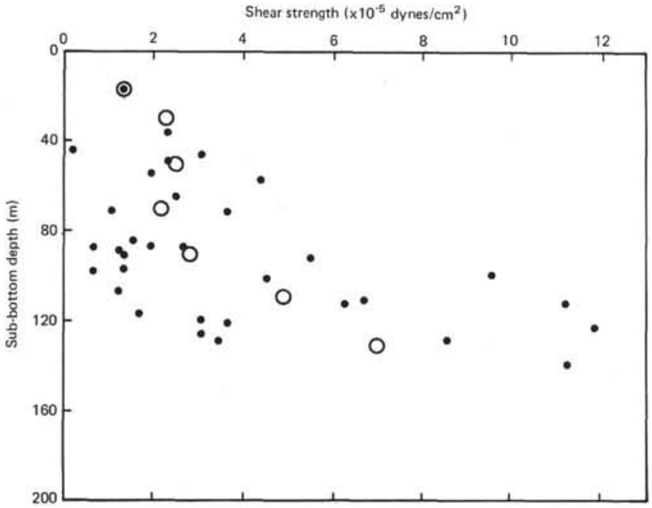


Figure 14. *Shear strength versus depth for Hole 446. Large open circles are average values for each 20-meter depth increment.*

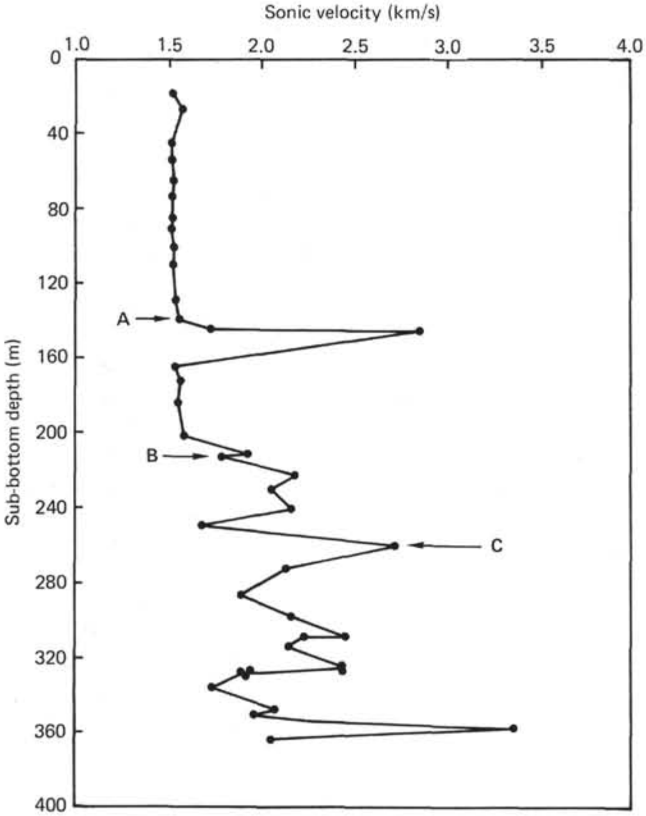


Figure 15. *Sonic velocity versus depth for Site 446 sediments.*

darker color. The mineralogy of the basalts is fairly complex: olivine replaced by chlorite and clay, hornblende in the upper sills, and oceanic-type plagioclase.

Paleomagnetic analysis of the sediments and sedimentary rocks indicates that Site 446 drifted in a net northerly direction over the past 52 m.y., and migrated nearly 2000 km to its present position. These data are in

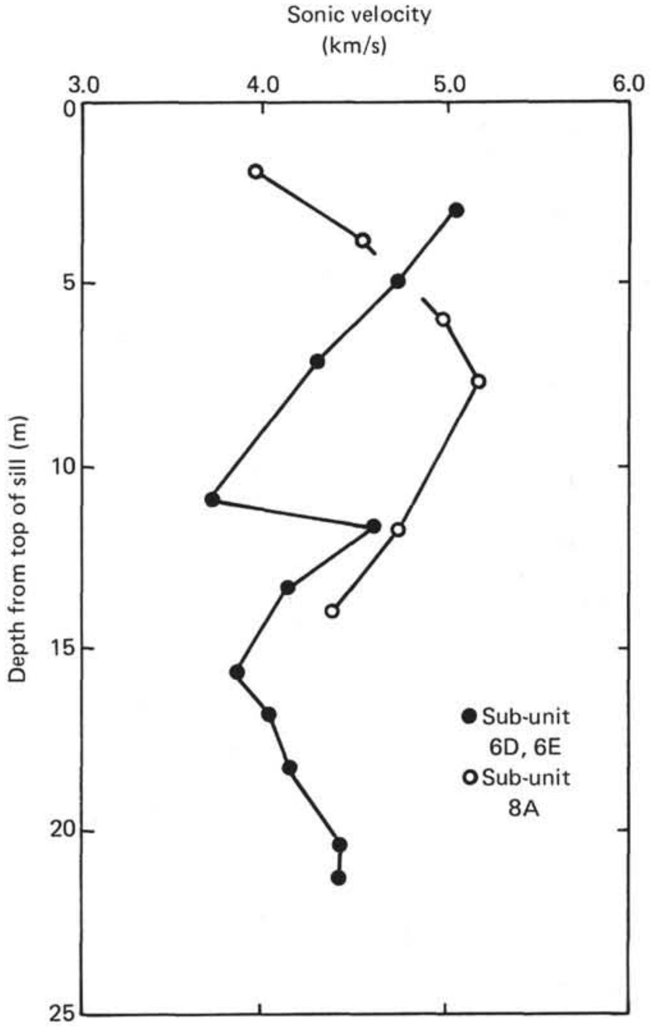


Figure 16. *Sonic velocity versus depth from top of sill for igneous sub-unit 8A (open circles) and sub-units 6D and 6E (closed circles).*

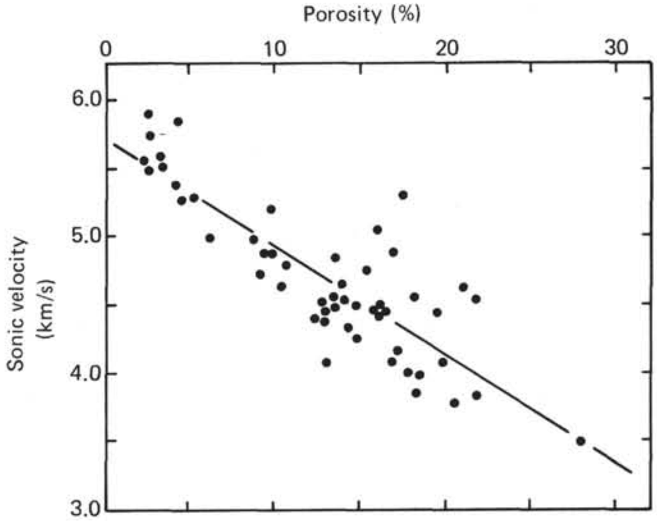


Figure 17. *Relationship between sonic velocity and porosity for Site 446 igneous rocks.*

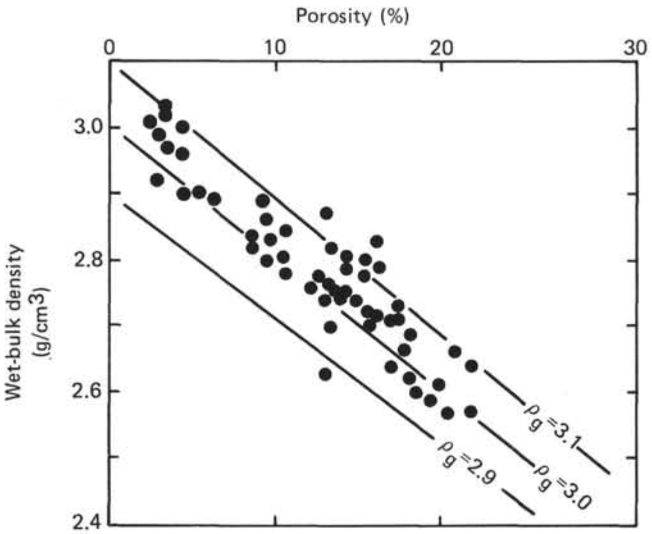


Figure 18. *Wet-bulk density versus porosity for Site 446 igneous rocks. The lines predict wet-bulk density from porosity for a rock of specified grain density.*

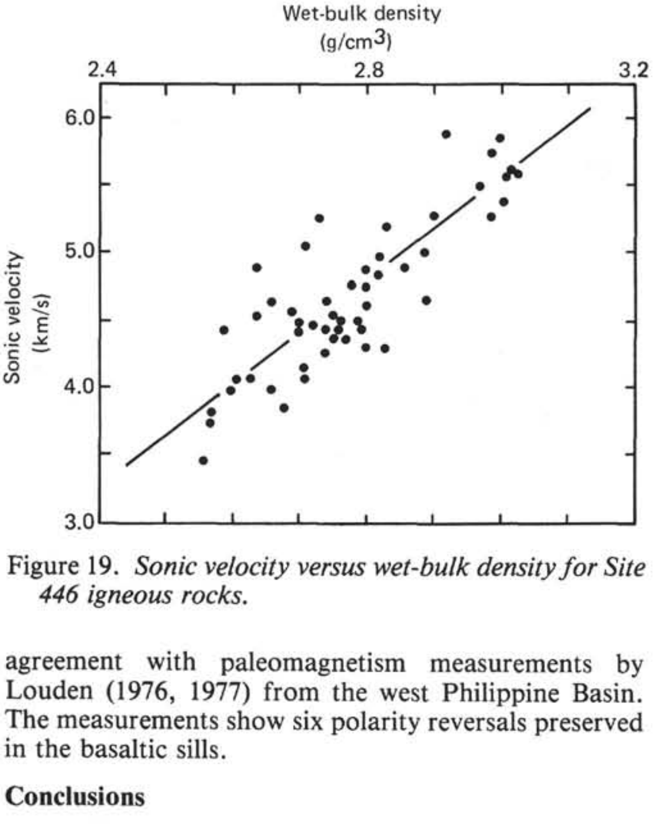


Figure 19. *Sonic velocity versus wet-bulk density for Site 446 igneous rocks.*

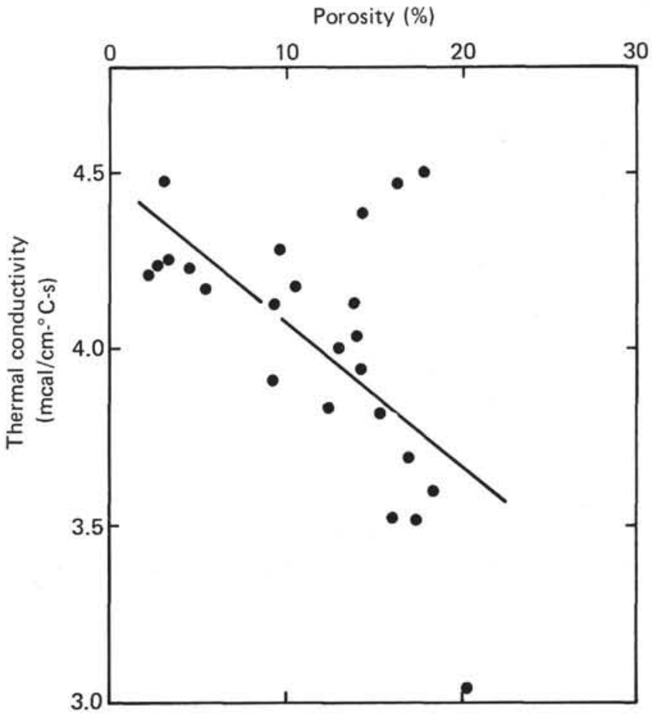


Figure 20. *Thermal conductivity versus porosity for Site 446 igneous rocks.*

agreement with paleomagnetism measurements by Louden (1976, 1977) from the west Philippine Basin. The measurements show six polarity reversals preserved in the basaltic sills.

Conclusions

Our findings permit us to draw the following conclusions about the geology at Site 446:

1. The age of the oldest sediment is late early Eocene (52 m.y.). Sediment of this age is intruded by basalt sills. We interpret this age to mean that acoustic basement could be no younger than late early Eocene and is perhaps not much older. This interpretation is in agreement with the suggested age for the Daito region by Karig (1975), Watts et al. (1977), and Louden (1976, 1977); it assumes both continuity of high rates of sedimentation by turbidity currents below our penetration depth, and an absence of hiatuses.

2. The depositional surface at Site 446 was at or below the CCD during its depositional history.

3. The dominant sediments at Site 446 are pelagic for the last 44 m.y. of deposition, and a combination of hemipelagic deposits and turbidites for the first 8 m.y. of deposition. The sediment accumulation rates reflect these modes of sedimentation, being low for the past 44 m.y., and moderate to high during the first 8 m.y. This parallels the changes in sedimentation rates at Site 445, Site 285 in the South Fiji Basin, and Site 286 in the New Hebrides Basin (Andrews, Packham, et al., 1975; Klein, 1975).

4. A total of 23 sills of phyric, aphyric, and fine-grained basalt intruded the sediments of the late early Eocene (K-Ar age 48.2 ± 1.0 m.y.). These basalts show evidence of replacement of olivine by chlorite and clay, and they contain hornblende in the upper part. The plagioclase is petrographically similar to that of oceanic basalts. Chill zones and baked sediment confirm the intrusive origin.

5. Paleomagnetic analysis has demonstrated that Site 446 drifted in a northerly direction from the equator at least 2000 km over the past 52 m.y. Six polarity reversals are recorded in the intrusive basalts.

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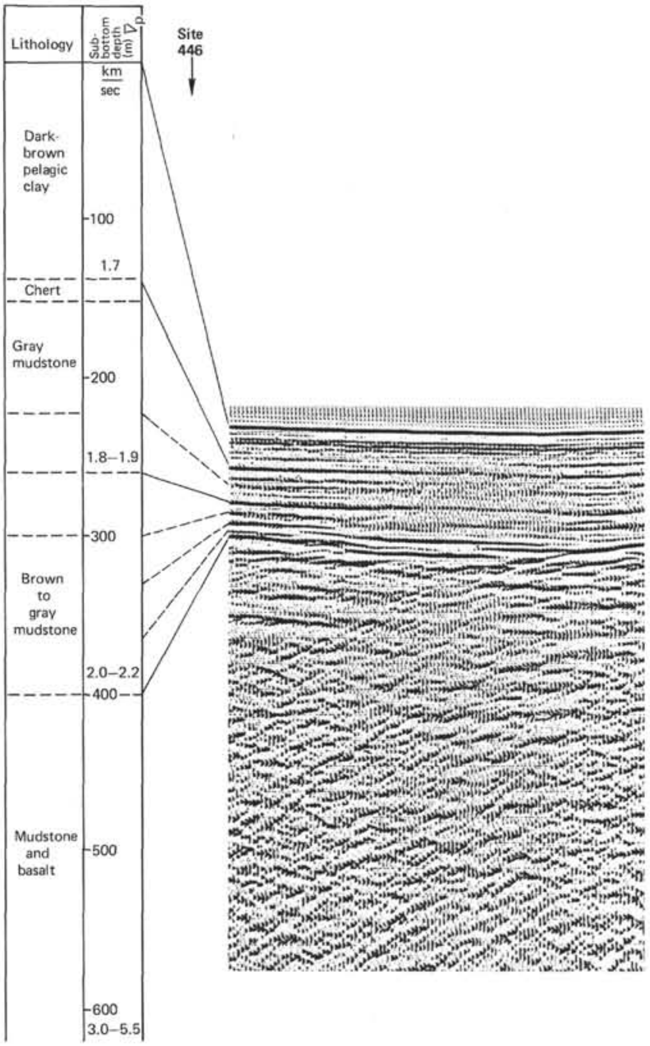

Figure 21. *Correlation of lithology of Holes 446 and 446A with seismic-reflection profile.*

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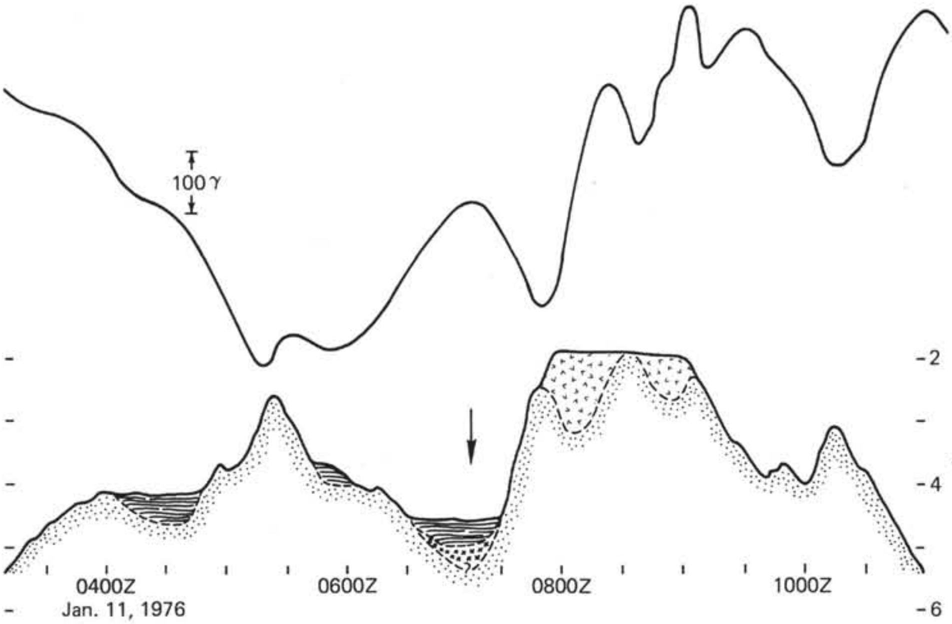


Figure 22A. *Correlation of magnetic total-force anomalies with bottom topography. Sub-bottom structure beneath the flat-topped crest of the Daito Ridge is assumed to fit the observed anomalies assuming horizontal magnetization with normal polarity.*

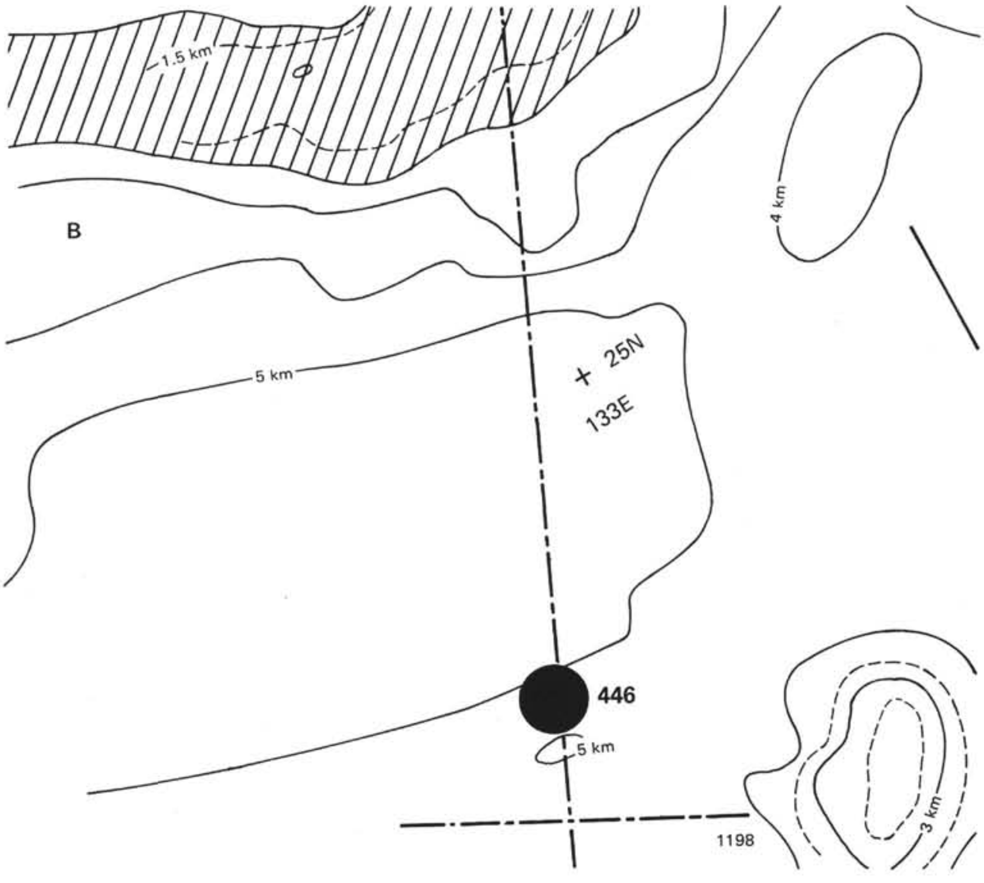


Figure 22B. *Topographic map compiled with site-survey data.*

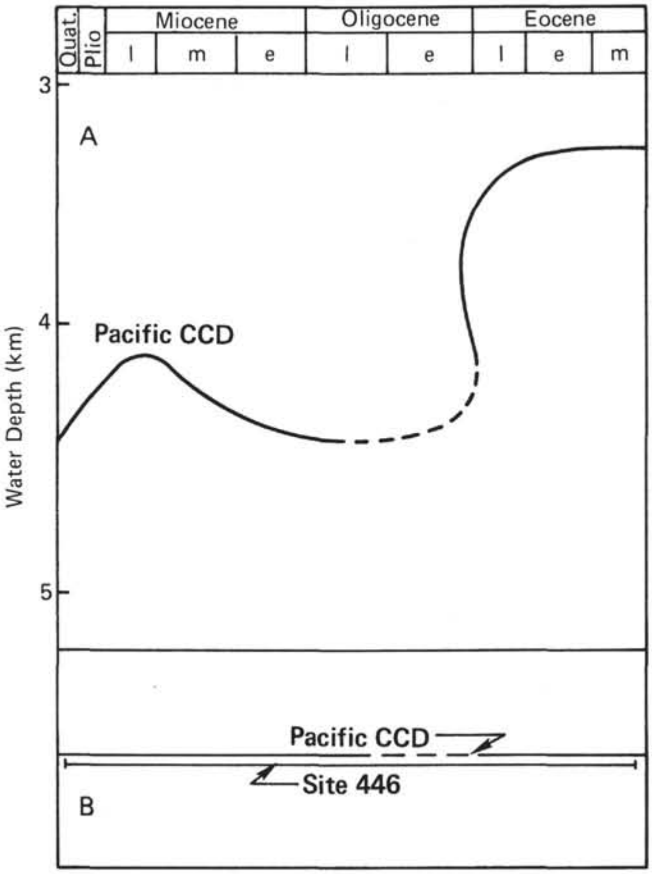
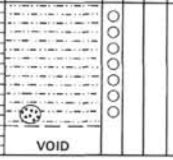


Figure 23. A. *General curve showing estimated water depth of CCD in Pacific Ocean (after van Andel et al., 1975, p. 47, fig. 29).* B. *Relative depth of deposition at Site 446 compared to CCD curve for Pacific Ocean.*

SITE 446 HOLE CORE 1 CORED INTERVAL: 0.0-1.5 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FOSSIL CHARACTER FORAMS	FOSSIL CHARACTER NANNOS	FOSSIL CHARACTER RADS	SECTION	METERS
Pliocene	N.21	B	B		1	0.5
		FM	B	B		1.0



10YR 4/3

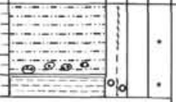
Dominant Lithology: Brown Mud (10YR 4/3), one pumice pebble at 105 cm (dark brown drilling breccia).

GRAIN SIZE:
1-91 (0.2, 30.9, 68.9)

CARBON-CARBONATE:
1-96 (0.2, 0.2, 0)

SITE 446 HOLE CORE 2 CORED INTERVAL: 1.5-11.0 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FOSSIL CHARACTER FORAMS	FOSSIL CHARACTER NANNOS	FOSSIL CHARACTER RADS	SECTION	METERS
Pliocene N18/N19	*Discoaster asymmetricus* or *Discoaster tamalis* Subzone (N) N.18	CP	FP		1	0.5
		CM	FP	B	CC	



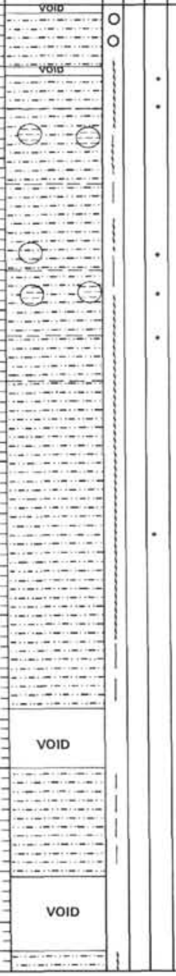
Dominant Lithology: Mud/Clay,
brown (10YR 5/3), homogeneous soupy to firm. Coarse sandy pumice patches at Section 1, 67-69 cm. No sedimentary structures.

SMEARS:
1-40, CC (Mud/Clay)

Sand	1- 2%	Quartz, Feldspar	5- 7%
Silt	9-16%	Clay minerals	80%
Clay	82-90%	Heavy minerals	1%
		Mica	3%
		Opaque minerals	1%
		Calcareous fossils	TR- 7%
		Zeolites	1- 2%

SITE 446 HOLE CORE 3 CORED INTERVAL: 11.0-20.5 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FOSSIL CHARACTER FORAMS	FOSSIL CHARACTER NANNOS	FOSSIL CHARACTER RADS	SECTION	METERS
Miocene	*Cert. formosa robusta*	FM	B		1	0.5 1.0
					2	
		B	B		3	
					4	
		B	B		5	
					6	
					7	
		B	B	B	CC	



10YR 5/3
10YR 4/3
10YR 5/3
10YR 4/3
10YR 5/3
10YR 4/3
10YR 4/3
10YR 5/3
10YR 5/3

Dominant Lithology: Mud,
brown, homogeneous, soft to semi-firm patches of more firm clay form granules and pebbles – hard and distinct – (mistaken for sandy or pumaceous on preliminary observation).

Minor Lithology present is a **Mud** (very clayey), brown, homogeneous. Slightly darker color results from slight increase in micronodules. Silt fraction very minor.

No sedimentary structures observed.

SMEARS:
1-75

Sand	0%	Quartz, Feldspar	7%
Silt	>20%	Clay minerals	89%
Clay	>70%	Heavy minerals	1%
		Manganese	3%
		Zeolites	TR
		Mica	1%

1-100

Quartz, Feldspar	5%	Manganese	2%
Clay minerals	79%	Zeolites	5%
Heavy minrals	2%	Mica	1%

2-99

Quartz, Feldspar	3%	Volcanic glass	1%
Clay minerals	89%	Manganese	2%
Heavy minerals	1%	Mica	2%
Zeolites	3%		

2-135

Quartz, Feldspar	2%	Manganese	5%
Clay minrals	85%	Zeolites	7%
Heavy minerals	1%	Mica	1%

3-30

Sand	< 1%	Quartz, Feldspar	2%
Silt	>25%	Clay minerals	92%
Clay	<75%	Heavy minerals	1%
		Manganese	2%
		Zeolites	2%
		Mica	2%

4-75

Quartz, Feldspar	3%	Manganese	3%
Clay minerals	91%	Zeolites	1%
Heavy minerals	1%	Mica	2%

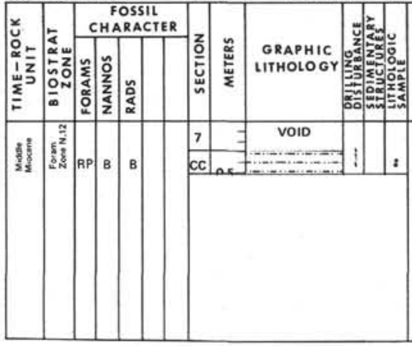
6-50

Quartz, Feldspar	2%	Manganese	2%
Clay minerals	92%	Zeolites	2%
Heavy minerals	1%	Mica	1%

GRAIN SIZE:
1-55 (0.1, 29.4, 70.4)
3-55 (0.1, 27.4, 72.5)

CARBON-CARBONATE:
1-59 (0.1, 0.1, 0)
3-59 (0,1, 0.1, 0)
5-59 (0.1, 0.1, 0)

SITE 446 HOLE CORE 4 CORED INTERVAL: 20.5-30.0 m



LITHOLOGIC DESCRIPTION

10YR 5/3,
10YR 3/3

Brown **Mud** with dark brown patch. Granular patch at 8-12 cm, dark patch at 20-30 cm.

SMEARS:

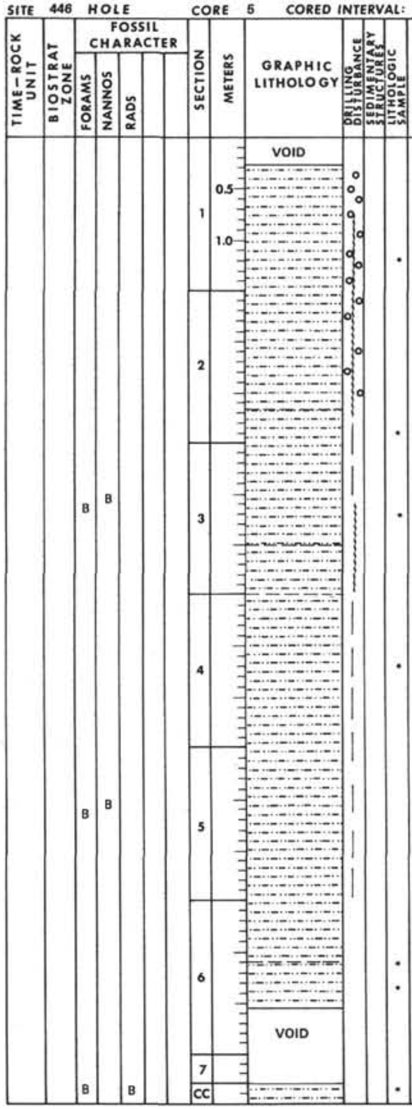
CC-6

Sand	0%	Quartz, Feldspar	5%	Opaque min.	1%
Silt	9%	Clay minerals	89%	Mica	3%
Clay	91%	Heavy minerals	1%	Zeolites	1%

CC-26

Sand	1%	Quartz, Feldspar	3%	Mica	1%
Silt	9%	Clay minerals	86%	Manganese	7%
Clay	90%	Heavy minerals	TR	Zeolites	3%
		Opaque minerals	TR		

SITE 446 HOLE CORE 5 CORED INTERVAL: 30.0-39.5 m



LITHOLOGIC DESCRIPTION

Mud, soupy to firm, brown to dark brown, with yellowish brown patches, massive, homogeneous. Composition includes micronodules, zeolites, mica, terrigenous components.

10YR 3/3

SMEARS:

1-120

Quartz, Feldspar	3%
Clay minerals	91%
Heavy minerals	1%
Mica	TR
Manganese	3%
Zeolites	2%

2-140

Quartz, Feldspar	2%
Clay minerals	92%
Heavy minerals	1%
Mica	2%
Manganese	1%
Zeolites	1%

3-75

Sand	< 1%	Quartz, Feldspar	1%
Silt	>20%	Clay minerals	92%
Clay	>75%	Heavy minerals	1%
		Opaque minerals	1%
		Mica	1%
		Manganese	3%
		Zeolites	1%

10YR 3/3
with
10YR 5/4

4-75

Quartz, Feldspar	3%
Clay minerals	94%
Heavy minerals	TR
Opaque minerals	1%
Mica	1%
Manganese	1%
Zeolites	1%

10YR 3/3

6-62

Quartz, Feldspar	3%	Mica	2%
Clay minerals	92%	Manganese	1%
Opaque minerals	TR	Zeolites	1%

10YR 3/3
with
10YR 5/4

6-90

Quartz, Feldspar	4%	Mica	5%
Clay minerals	89%	Manganese	TR
Heavy minerals	1%	Zeolites	1%
Opaque minerals	TR		

CC

Quartz, Feldspar	4%	Opaque minerals	1%
Clay minerals	88%	Mica	3%
Heavy minerals	1%	Manganese	1%
Volcanic glass	TR	Zeolites	1%

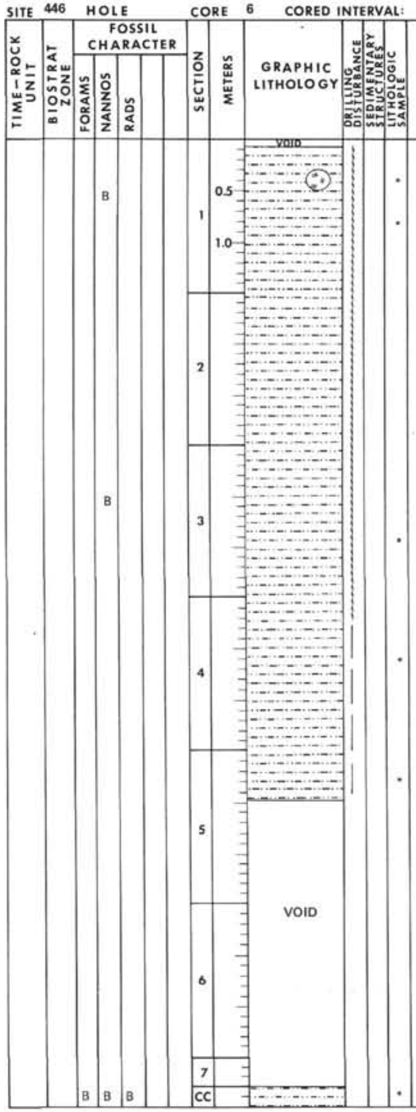
10YR 4/3

GRAIN SIZE:
3-82 (0.6, 23.4, 76.0)
5-82 (0.3, 22.0, 77.7)

CARBON-CARBONATE:
3-87 (0.1, 0.1, 0)
5-87 (0.1, 0.1, 0)

10YR 3/3

SITE 446 HOLE CORE 6 CORED INTERVAL: 39.5-49.0 m



LITHOLOGIC DESCRIPTION

10YR 5/3

10YR 3/3

10YR 3/3
with
10YR 3/2
10YR 3/2

10YR 3/3
with
10YR 3/2

10YR 3/3

10YR 5/3

Mud (close to clay) dark brown (10YR 3/3) with mottling of very dark grayish brown (10YR 3/2) especially in Sections 3, 4, and 5.

Minor patches of brown (10YR 5/3). This is volcanic glass in Section 1, but with same color of the clay in Section 5. Homogeneous; no bedding, soft to firm.

Minor Lithology includes: Volcanic glass (one smear at Section 1, 42 cm), brown (10YR 5/3); 89% altered volcanic glass.

SMEARS:

1-42

Quartz, Feldspar	5%	Manganese	4%
Clay minerals	89%	Zeolites	1%
Heavy minerals	1%		
Volcanic glass	89%*		

* = altered volcanic glass

1-82

Sand	< 1%	Quartz, Feldspar	3%
Silt	>10%	Clay minerals	93%
Clay	>85%	Carbonate unspecified	TR
		Manganese	3%
		Zeolites	1%

3-98

Sand	< 1%	Quartz, Feldspar	5%
Silt	>10%	Clay minerals	90%
Clay	>85%	Heavy minerals	1%
		Carbonate unspecified	TR
		Manganese	3%
		Zeolites	1%

4-60

Quartz, Feldspar	4%	Manganese	2%
Clay minerals	93%	Zeolites	1%
Carbonate unspecified	TR		

5-31

Quartz, Feldspar	4%	Manganese	1%
Clay minerals	92%	Zeolites	3%
Carbonate unspecified	TR		

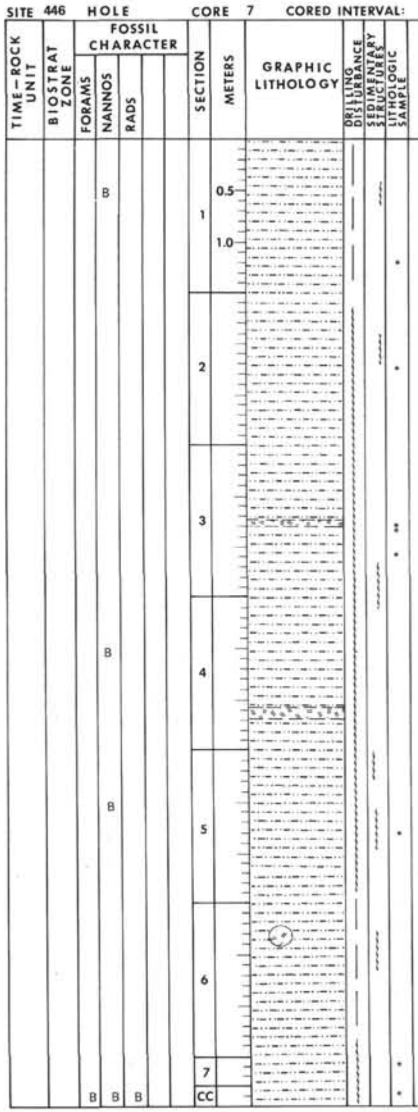
CC

Quartz, Feldspar	6%	Opaque minrals	1%
Clay minerals	87%	Mica	1%
Heavy minerals	1%	Manganese	2%
Volcanic glass	TR	Zeolites	2%

GRAIN SIZE:
1-90 (0.1, 12.7, 87.1)
3-90 (0.1, 13.5, 86.4)

CARBON-CARBONATE:
1-95 (0.1, 0.1, 0)

SITE 446 HOLE CORE 7 CORED INTERVAL: 49.0-58.5 m



LITHOLOGIC DESCRIPTION

(minor
10YR 5/4)
10YR 3/3
with
10YR 3/2

10YR 3/3
with
10YR 3/2
10YR 5/4

10YR 3/3

+10YR 3/2
+10YR 2/1
+10YR 5/4

10YR 3/3
with
10YR 3/2
+10YR 5/4

Mud/Clay, firm (but mottled streaks indicate moderate to intense drilling disturbance), dark brown, mottled with very dark brownish gray, with patches of yellowish brown, which are altered volcanic ash (Section 3, 80 cm) or clay. Components include: Quartz, Feldspar 1-3%, Volcanic ash 0-1%, Micronodules 1-10%, Zeolites 1-3%, and Carbonate unspecified 0-1%. Mottling is partly bioturbation.

Minor Lithology: Altered Volcanic Ash, yellowish brown to black.

SMEARS:

1-125

Sand	< 1%	Quartz, Feldspar	2%
Silt	>10%	Clay minerals	92%
Clay	<90%	Heavy minerals	TR
		Opaque minerals	+
		Volcanic glass	1%
		Manganese	3%
		Zeolites	2%
		Mica	+

2-75

Quartz, Feldspar	1%	Carbonate unspecified	TR
Clay minerals	86%	Manganese	7%
Heavy minerals	TR	Zeolites	5%
Opaque minerals	+	Mica	1%
Volcanic glass	TR		

3-80

Quartz, Feldspar	1%	Manganese	3%
Clay minerals	10%	Mica	1%
Volcanic glass	85%		

3-85

Quartz, Feldspar	5%	Manganese	10%
Clay minerals	81%	Mica	1%
Volcanic glass	3%		
Carbonate unspecified	TR		

3-110

Quartz, Feldspar	3%	Carbonate unspecified	TR
Clay minerals	86%	Manganese	7%
Heavy minerals	TR	Zeolites	3%
		Mica	1%

5-80

Quartz, Feldspar	1%	Carbonate unspecified	1%
Clay minerals	83%	Manganese	10%
Heavy minerals	+	Zeolites	3%
Opaque minerals	TR	Mica	2%
Volcanic glass	TR		

7-20

Quartz, Feldspar	1%	Carbonate unspecified	TR
Clay minerals	85%	Manganese	10%
Heavy minerals	+	Zeolites	2%
Opaque minerals	+	Mica	1%
Volcanic glass	1%		

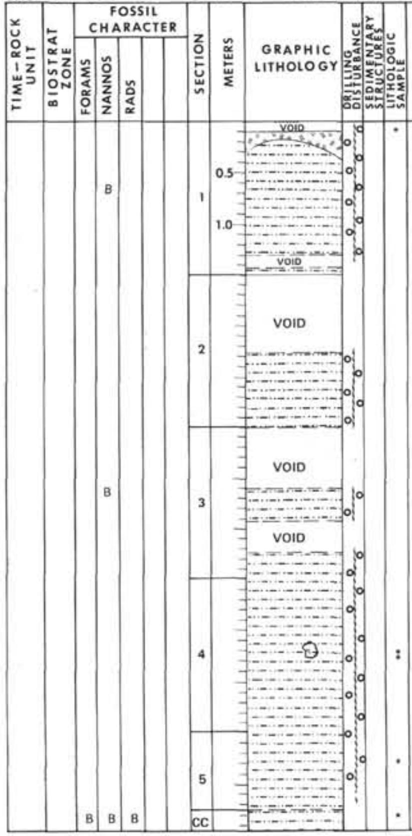
CC

Quartz, Feldspar	1%	Manganese	1- 2%
Clay minerals	96%	Zeolites	1%
Heavy minerals	TR	Mica	+
Opaque minerals	+		

GRAIN SIZE:
1-91 (0.0, 11.4, 88.6)
4-91 (0.1, 11.7, 88.2)

CARBON-CARBONATE:
1-88 (0.1, 0.1, 0)
5-88 (0.1, 0.1, 0)

SITE 446 HOLE CORE 8 CORED INTERVAL: 58.5-68.0 m



LITHOLOGIC DESCRIPTION

10YR 3/3

Mud/Clay

Intensely disturbed to drilling breccia. Firm **Mud/Clay**. Dominant color is dark brown (10YR 3/3) with scattered light yellowish brown (10YR 5/4) in ashy zones. Local mottling in black.

SMEARS:

1-10, 4-74, 4-80 5-30, CC (Mud/Clay)

Silt	<15%	Quartz, Feldspar	1- 3%
Clay	>85%	Mica	1%
		Heavy minerals	1%
		Opaque minerals	3-10%
		Zeolites	2- 3%
		Carbonate unspecified	TR
		Clay minerals	88-91%

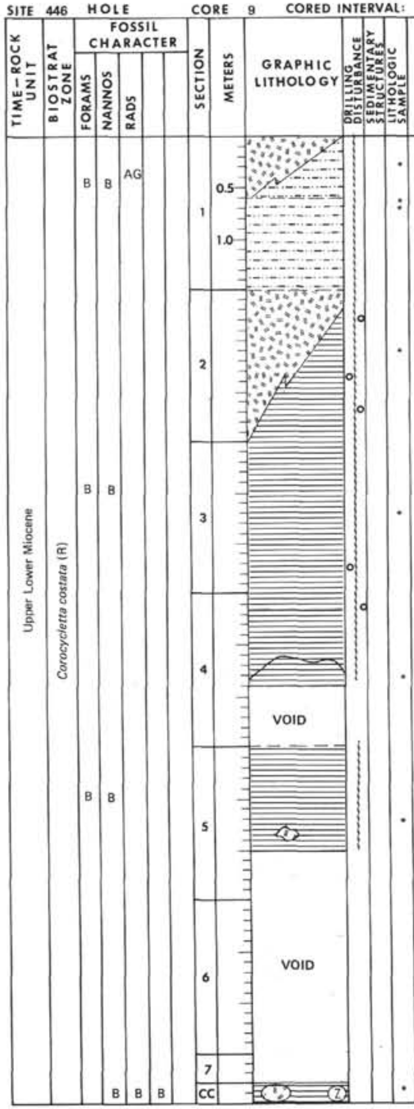
GRAIN SIZE:

1-29 (0.1, 11.0, 88.9)
4-124 (0.1, 10.9, 89.0)

CARBON-CARBONATE:

1-31 (0.1, 0.1, 0)
4-129 (0.1, 0.1, 0)

SITE 446 HOLE CORE 9 CORED INTERVAL: 68.0-77.5 m



LITHOLOGIC DESCRIPTION

10YR 3/2

10YR 3/2
with
7.5YR 7/6

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

10YR 5/4

10YR 3/2
10YR 5/4

10YR 3/3

Mud/Clay (with siliceous fossils)

Generally intense deformation throughout. Dominant color is very dark brown (10YR 3/2), with mottles of yellowish brown (10YR 5/4) and black (N2). Yellowish brown has less opaques, also very pale brown (10YR 8/3).

SMEARS:

1-30 (Clayey Ash – Minor)

Sand	40%	Quartz, Feldspar	3%
Silt	10%	Mica	1%
Clay	50%	Clay minerals	33%
		Opaque minerals	5%
		Volcanic glass	50%
		Carbonate unspecified	TR
		Radiolarians, Sponge spicules	3%

1-75, 1-68, 3-75, 5-75 (Mud/Clay)

Sand	< 1%	Quartz, Feldspar	1%
Silt	<10%	Mica	1- 2%
Clay	>90%	Opaque minerals (micronodules)	3-10%
		Zeolites	1- 2%
		Radiolarians, Sponge spicules	1- 2%
		Carbonate unspecified	TR
		Volcanic glass	TR
		Clay minerals	81-83%

2-60 (Ashy Siliceous Clay)

4-85 (Clay)

Silt	< 5%	Quartz, Feldspar	< 1%
Clay	>95%	Mica	2%
		Opaque minerals	3%
		Carbonate unspecified, Nannofossils	TR
		Radiolarians, Sponge spicules	1%
		Heavy minerals	TR
		Zeolites	3%
		Clay minerals	88%

CC (Zeolitic Clay)

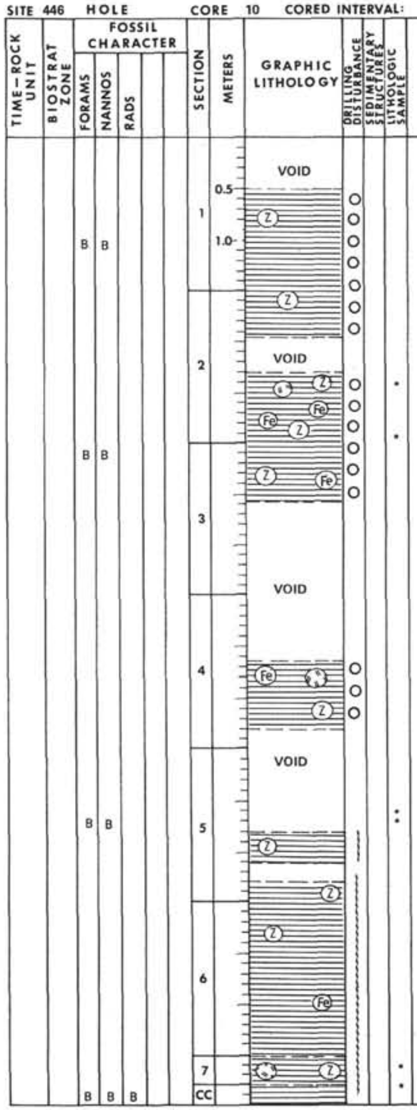
GRAIN SIZE:

1-74 (0.8, 11.5, 87.7)
3-21 (1.5, 9.9, 88.6)
5-57 (0.0, 6.4, 93.5)

CARBON-CARBONATE:

1-72 (0.1, 0.1, 0)
3-72 (0.1, 0.1, 0)
5-72 (0.1, 0.1, 0)

SITE 446 HOLE CORE 10 CORED INTERVAL: 77.5-87.0 m



10YR 3/2

10YR 3/2

LITHOLOGIC DESCRIPTION

Clay (Variable Zeolites)
Extensive intense deformation – drilling breccia. Color is very dark grayish brown (10YR 3/2) with local lighter-darker mottling. Scattered altered ash zones and zones of high Fe concentration.

SMEARS:
2-95, 7-15 (Fe-Clay – Minor)

Clay	100%	Quartz, Feldspar	< 1%
		Mica	1- 2%
		Clay minerals	94-97%
		Heavy Fe stain	>70%

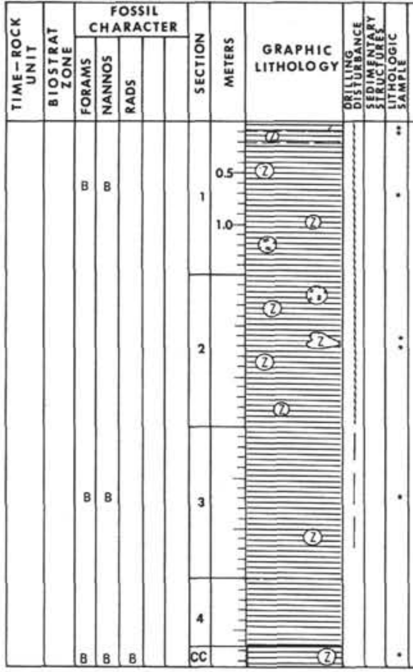
6-70, CC (Zeolitic Clay)

Silt	< 8%	Quartz, Feldspar	1- 2%
Clay	>90%	Mica	1- 2%
		Opaques, (Micronodules)	5-15%
		Zeolites	10-25%
		Carbonate unspecified, Nannofossils	TR
		Volcanic glass	2- 3%
		Clay minerals	56-80%

GRAIN SIZE:
1-138 (0.1, 8.7, 91.2)
3-48 (0.1, 8.9, 91.0)
5-94 (0.1, 8.9, 91.3)

CARBON-CARBONATE:
1-138 (0.1, 0.1, 0)
3-46 (0.0, 0.0, 0)
5-92 (0.1, 0.1, 0)

SITE 446 HOLE CORE 11 CORED INTERVAL: 87.0-96.5 m



10YR 3/2
10YR 3/3
↑ graded
10YR 3/2

10YR 3/3
with
7.5YR 6/4

10YR 3/2

10YR 3/2

LITHOLOGIC DESCRIPTION

Clay (Variable Zeolites)
Firm to stiff, moderate to intense deformation. Lighter clays in Sections 1 and 2 contain a higher zeolite percentage. Local darker-lighter mottling.

SMEARS:
1-5, 1-75, CC (Clay)

Silt	< 5%	Quartz, Feldspar	1%
Clay	>95%	Mica	2- 3%
		Opaque minerals	5-10%
		Zeolites	3- 5%
		Carbonate unspecified	TR
		Clay minerals	83-86%

1-10, 2-75 (Zeolite Clay)

Silt	< 5%	Quartz, Feldspar	1%
Clay	>95%	Mica	1- 2%
		Zeolites	15-20%
		Opaque minerals	3- 5%
		Volcanic glass	0- 5%
		Carbonate unspecified	TR
		Clay minerals	68-79%

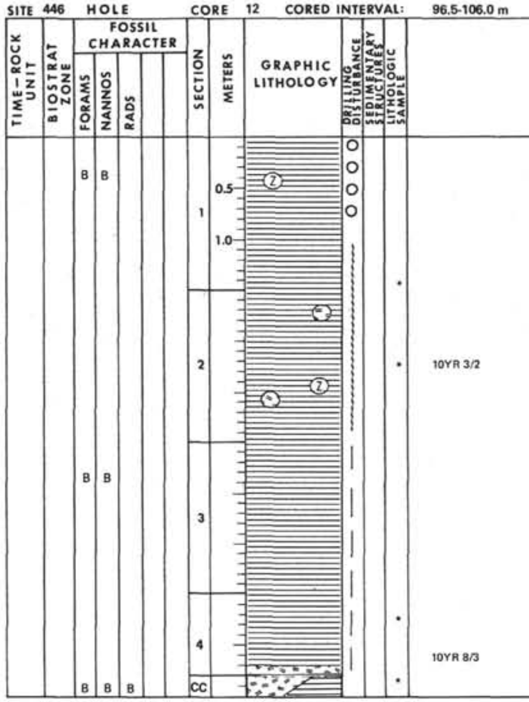
2-65 (Claye; Zeolite – Minor)

3-75 (Zeolitic-Rich Clay – Minor)

GRAIN SIZE:
1-25 (0.0, 4.4, 95.6)
3-25 (0.0, 3.4, 96.6)

CARBON-CARBONATE:
1-29 (0.1, 0.1, 0)
3-29 (0.1, 0.1, 0)

SITE 446 HOLE CORE 12 CORED INTERVAL: 96.5-106.0 m



LITHOLOGIC DESCRIPTION

Clay, very stiff, intense to moderate deformation. Color very dark grayish brown (10YR 3/2) with local very pale brown (10YR 8/3) ash in Section 4 and Core-Catcher. Local light-dark zones.

SMEARS:
1-145, 2-75, 4-25, CC (Clay)

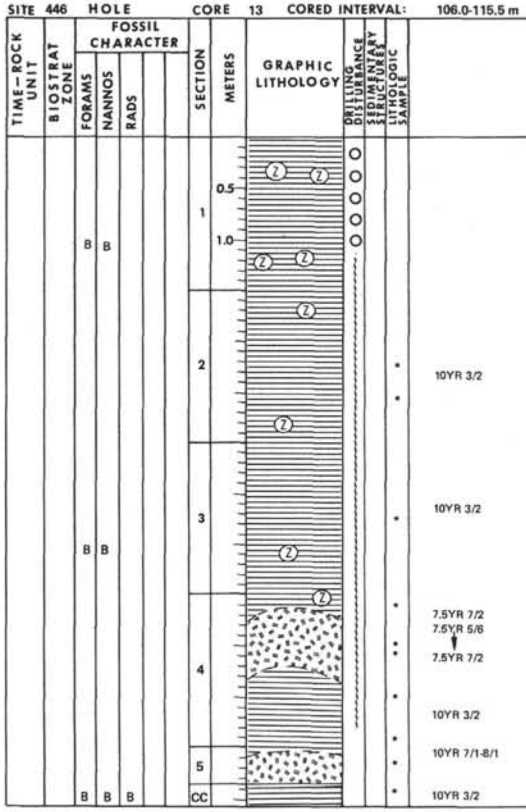
Silt	<10%	Quartz, Feldspar	1%
Clay	>90%	Opaque minerals	2- 3%
		Zeolites	1- 2%
		Clay minerals	93-96%

CC (Volcanic Ash – *Minor*)

GRAIN SIZE:
1-130 (0.1, 6.8, 93.2)
3-105 (0.1, 10.8, 89.1)

CARBON-CARBONATE:
1-132 (0.1, 0.1, 0)
3-32 (0.0, 0.1, 0)

SITE 446 HOLE CORE 13 CORED INTERVAL: 106.0-115.5 m



LITHOLOGIC DESCRIPTION

Zeolitic Clay
Generally intense to moderate deformation. Very dark grayish brown (10YR 3/2) with *lighter areas* of **Clay** = dark yellowish brown (10YR 4/4). Section 4, 0-23 cm – very dark gray brown **Clay** (zeolite); 23-25 cm – pinkish gray (7.5YR 7/2) **Altered Ash**; 55-70 cm – strong brown (7.5YR 5/6) **Clayey Ash**; 70-130 cm – very dark gray brown (10YR 3/2) **Zeolitic Clay**. Section 5 – light gray (10YR 7/1) **Altered Ash** including white-light gray.

SMEARS:
2-85, 3-64, 3-75, 4-10, 4-100, CC (*Zeolitic Pelagic Clay*)

Silt	<10%	Quartz, Feldspar	1%
Clay	>90%	Mica	1%
		Opaque minerals	3-20%
		Carbonate unspecified	TR- 1%
		Volcanic glass	TR- 1%
		Zeolites	20-40%
		Clay minerals	49-71%

2-105 (Clay – Minor)

4-50, 4-144 (Clay Altered Ash – Minor)

4-58 (Clayey Zeolitic Altered Ash – Minor)

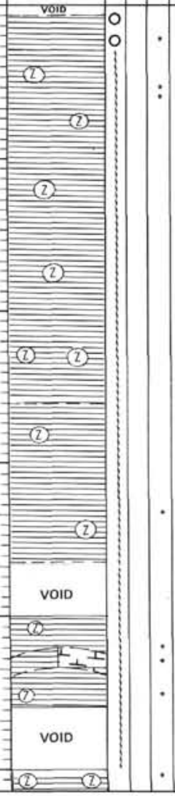
5-15 (Altered Ash – Minor)

GRAIN SIZE:
1-116 (0.0, 7.2, 92.7)
3-115 (0.0, 16.4, 83.5)

CARBON-CARBONATE:
1-98 (0.0, 0.0, 0)
3-99 (0.0, 0.0, 0)

SITE 446 **HOLE** **CORE** 14 **CORED INTERVAL:** 115.5-125.0 m

TIME–ROCK UNIT	BIOSTRAT ZONE	FOSSIL CHARACTER			SECTION	METERS	
		FORAMS	NANNOS	RADS			
Middle Oligocene	*Sphenolithus distentus* Zone (N) *G. ampliapertura* N.1 – P.20 Zone				1	0.5	10YR 3/2
		B	B			1.0	10YR 3/3
					2		10YR 3/3
					3		10YR 3/3
		B	B				10YR 3/2
					4		
		CM	AP	B	5		10YR 3/2
							10YR 3/2 with 10YR 5/4
		RP	B	B	CC		10Y 3/2



LITHOLOGIC DESCRIPTION

Zeolitic Clay
Firm to stiff with intense deformation. Colors dominantly very dark grayish brown (10YR 3/2), dark brown (10YR 3/3). Yellowish brown (10YR 6/4) streaks throughout. Local dark mottling.

SMEARS:
1-35, 1-88, 1-90, 4-50, 5-75, CC (Zeolitic Clay with variable Zeolites)

Silt	<10%	Quartz, Feldspar	TR- 1%
Clay	>90%	Mica	TR- 2%
		Volcanic glass	1%
		Opaque minerals	1-10%
		Zeolites	2-30%
		Carbonate unspecified	TR
		Clay minerals	55-97%

5-35, 5-45 (Clayey Nannofossil Ooze – Minor)

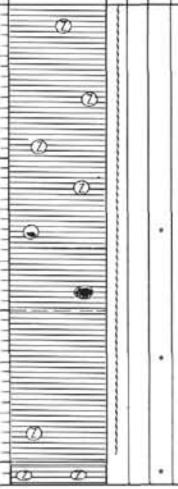
Sand	5%	Quartz, Feldspar	1- 2%
Silt	5%	Mica	1%
Clay	90%	Heavy minerals	TR
		Volcanic glass	1%
		Foraminifers	5-70%
		Zeolites	5-10%
		Opaque minerals	3- 5%
		Clay minerals	40%
		Nannofossils	38-47%

GRAIN SIZE:
1-140 (0.0, 9.5, 90.5)
3-61 (0.0, 8.4, 91.6)
5-61 (0.0, 18.1, 81.9)

CARBON-CARBONATE:
1-101 (0.0, 0.0, 0)
3-101 (0.1, 0.0, 0)

SITE 446 **HOLE** **CORE** 15 **CORED INTERVAL:** 125.0-134.5 m

TIME–ROCK UNIT	BIOSTRAT ZONE	FOSSIL CHARACTER			SECTION	METERS	
		FORAMS	NANNOS	RADS			
		B	B		1	0.5	
						1.0	
					2		10YR 3/2
							10YR 3/3
		B	B		3		
		B	B	B	CC		10YR 3/3



LITHOLOGIC DESCRIPTION

Zeolitic Clay and Clay
Firm, stiff, moderate to intense deformation; very dark grayish brown (10YR 3/2) with scattered lighter-darker zones.

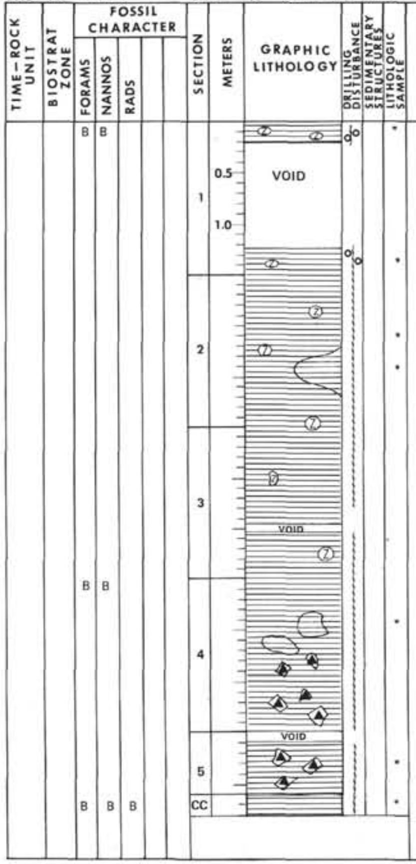
SMEARS:
2-75, 3-60, CC (Zeolitic Clay and Clay)

Silt	0- 5%	Quartz, Feldspar	TR- 2%
Clay	95-100%	Opaque minerals	7-12%
		Zeolites	5-25%
		Mica	1- 2%
		Volcanic glass	TR- 1%
		Clay minerals	60-86%

GRAIN SIZE:
1-123 (0.2, 13.9, 85.9)
3-123 (0.2, 27.0, 72.8)

CARBON-CARBONATE:
1-127 (0.1, 0.1, 0)
3-127 (0.0, 0.0, 0)

SITE 446 HOLE CORE 16 CORED INTERVAL: 134.5-144.0 m



LITHOLOGIC DESCRIPTION

10YR 3/3

Zeolitic Clay,
dark brown (10YR 3/3), firm, stiff, intensely deformed.

10YR 3/3

Note:
Scattered stains of yellowish brown (10YR 5/6) to brownish yellow (10YR 6/6) **Clay** (large stains in Section 2, 90 cm and Section 3, 40-50 cm).
Numerous pieces of 2 mm to 2 cm angular, very dark gray (10YR 3/1) **Chert**, in Section 4, 65-150 cm and Section 5.

SMEARS:
1-5 Opaques 10%, Zeolites 5%
1-140 Opaques 1%, Zeolites 25%

10YR 7/2

2-65 (Zeolitic Clay)

Silt	15%	Feldspar	2%
Clay	85%	Mica	3%
		Clay minrals	50%
		Volcanic glass	TR
		Opaques (micronodules)	10%
		Zeolites	35%
		Carbonate unspecified	TR

10YR 3/3

2-93 (Clay – Minor)

Quartz, Feldspar	15%
Mica	2%
Heavy minerals	1%
Opaque minerals	1%
Clay minerals	81%

4-45

Quartz, Feldspar	12%
Mica	2%
Clay minrals	85%
Opaque minerals	1%

5-30 Opaques 10%, Zeolites 25%
CC Opaques 1%, Zeolites 3%

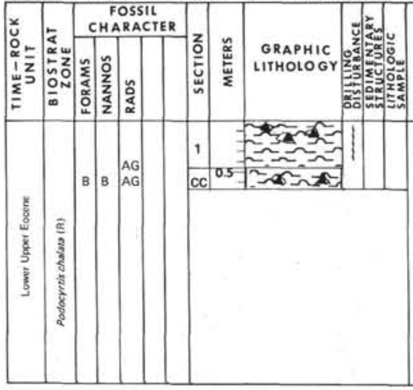
10YR 3/3
(10YR 3/1)

GRAIN SIZE:
1-135 (0.1, 16.3, 83.7)
3-135 (0.1, 21.1, 78.8)

10YR 3/3

CARBON-CARBONATE:
1-140 (0.1, 0.1, 0)
3-140 (0.0, 0.0, 0)

SITE 446 HOLE CORE 17 CORED INTERVAL: 144.0-153.5 m



LITHOLOGIC DESCRIPTION

10YR 3/3
10YR 5/6
2.5YR 2/2
10YR 3/3, 2.5YR 2/2

Clayey Radiolarian Ooze,
dark brown (10YR 3/3) to yellowish brown (10YR 5/6) firm to soft; many very dusky red (1.5YR 2/2) 2 mm to 6 cm **Chert** pieces.

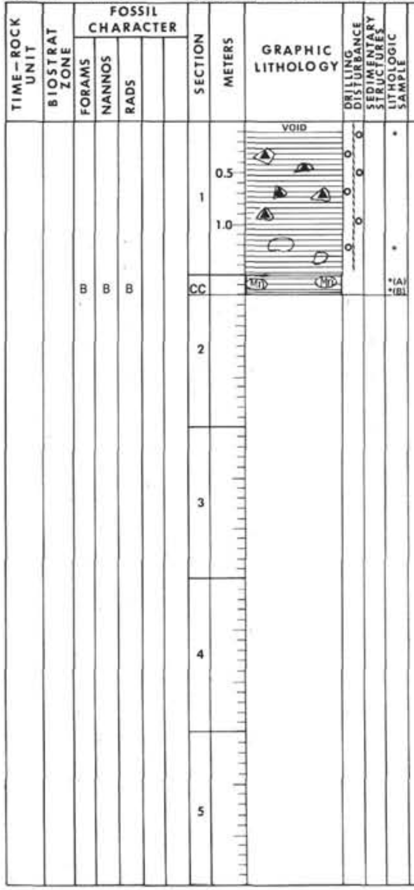
SMEARS:
1-30 Radiolarians 18%, Sponge spicules 7%

1-40 (Clayey Radiolarian Ooze)

Sand	20%	Feldspar	1%
Silt	35%	Clay minerals	45%
Clay	45%	Volcanic glass	2%
		Opaque minerals	2%
		Radiolarians	35%
		Sponge spicules	15%

CC Radiolarians 40%, Sponge spicules 10%, Volcanic glass 5%

SITE 446 HOLE CORE 18 CORED INTERVAL: 153.5-163.0 m



LITHOLOGIC DESCRIPTION

Clay
Drilling breccia of mixed, reworked and in situ sediment, mainly very dark grayish brown (10YR 3/2) **Clay with Zeolites and Micronodules.**

Minor Lithologies include:
Section 1, 10-99 cm – scattered pieces of black (10YR 2/1), very dark gray (10YR 3/1) to very dusky red (2.5YR 2/2) **Chert** (up to 6 cm diameter).

Section 1, 99-150 cm – scattered stains of yellowish brown (10YR 5/6-5/8) **Clay.**

Core-Catcher – **Fe-Mn Nodules,** diameter 0.1-1.0 cm, in black (10YR 2/1) stains.

SMEARS:
1-17

Quartz, Feldspar	2%
Clay minerals	85%
Micronodules	8%
Zeolites	5%

1-122

Sand	< 1%	Quartz, Feldspar	12%
Silt	33%	Mica	2%
Clay	67%	Heavy minerals	1%
		Clay minerals	82%
		Opaque minerals	2%
		Volcanic glass	1%

CC (A)

Quartz, Feldspar	1%
Mica	2%
Clay minerals	94%
Volcanic glass	2%
Opaque minerals	1%
Zeolites	TR

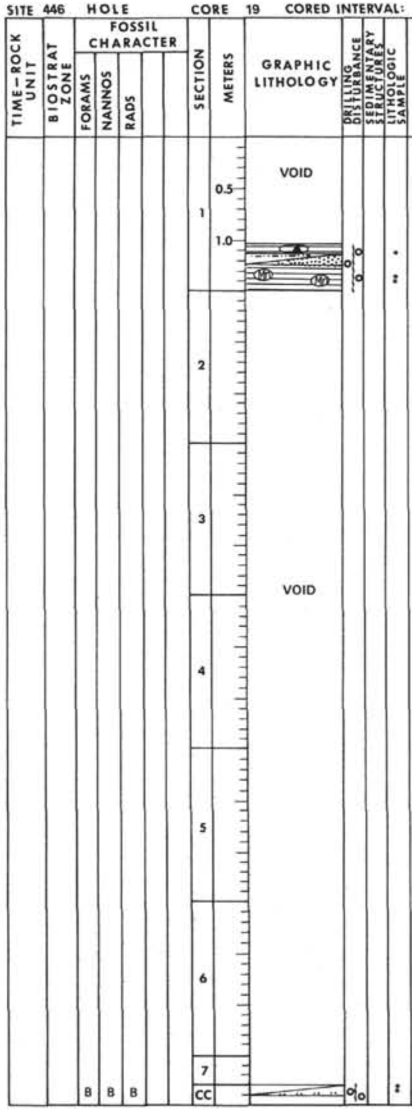
CC (B)

Quartz, Feldspar	2%
Mica	2%
Heavy minerals	1%
Clay minerals	89%
Opaque minerals	10%
Zeolites	1%

GRAIN SIZE:
1-122 (0.8, 32.5, 66.7)

CARBON-CARBONATE:
1-126 (0.0, 0.0, 0)

SITE 446 HOLE CORE 19 CORED INTERVAL: 163.0-172.5 m



LITHOLOGIC DESCRIPTION

Very Varying Lithology:
Section 1, 105-112 cm – brecciated pieces of black (10YR 2/1) and very dark grayish brown (10YR 3/2) **Chert and Pelagic Clay.**

Section 1, 112-122 cm – brecciated pieces of very dark grayish brown (2.5Y 3/2) and dark grayish brown (2.5Y 4/2) **Mud and Sand.**

Section 1, 122-150 cm – Very firm, moderately deformed brown (7.5YR 5/4) **Clay** with large impregnations of very dark gray (10YR 3/1) Mn-rich zones. Presence of Mn-Fe nodules (average size 1 mm).

Core-Catcher – brecciated pieces of brown (7.5YR 5/4) **Mudstone** and grayish brown (10YR 5/2) cross-bedded **Siltstone.**

SMEARS:

1-118 (Ashy Mineral Silty Sand – Minor)

Sand	50%	Quartz, Feldspar	42%
Silt	45%	Mica	5%
Clay	5%	Heavy minerals	20%
		Clay minerals	5%
		Opaque minerals	8%
		Volcanic glass	20%

1-139 (Clay)

Sand	2%	Quartz, Feldspar	3%
Silt	7%	Mica	TR
Clay	91%	Heavy minerals	TR
		Clay minerals	91%
		Volcanic glass	4%
		Micronodules	2%

1-143 (Zeolitic Clay with Micronodules – Minor)

Sand	+	Quartz, Feldspar	2%
Silt	21%	Mica	1%
Clay	79%	Heavy minerals	TR
		Clay minerals	69%
		Micronodules	8%
		Zeolites	20%

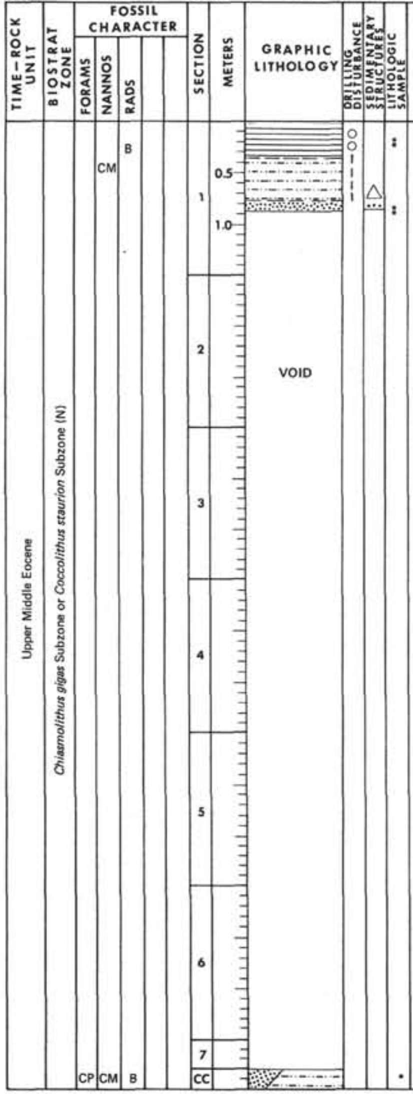
CC (Zeolitic Ashy Mudstone)

Sand	1%	Quartz, Feldspar	20%
Silt	51%	Heavy minerals	1%
Clay	42%	Clay minerals	42%
		Volcanic glass	25%
		Micronodules	1%
		Zeolites	10%
		Carbonate unspecified	TR
		Radiolarians	1%

CC (Mineral Clayey Mudstone)

Sand	5%	Quartz, Feldspar	20%
Silt	50%	Mica	5%
Clay	45%	Heavy minerals	5%
		Clay minerals	45%
		Opaque minerals	8%
		Volcanic glass	15%
		Zeolites	1%
		Radiolarians	1%

SITE 446 HOLE CORE 20 CORED INTERVAL: 172.5-182.0 m



LITHOLOGIC DESCRIPTION

10YR 4/2
7.5Y 5/4
10YR 3/2
5GY 5/1

Mudstones

Section 1, 0-19 cm – contamination.

Section 1, 19-33 cm – **Mudstones** with sharp contacts with colors dark grayish brown (10YR 4/2), brown (7.5Y 5/4) and very dark gray brown (10YR 3/2).

Section 1, 33-81 cm – greenish gray (5GY 5/1) **Mudstone** into salt and pepper **Sand,** graded.

Core-Catcher – dark greenish gray (5GY 4/1) sand, greenish gray (5GY 5/1) **Calcareous Mudstone.**

SMEARS:

1-23, 1-28, 1-32 (Clay)

Sand	1%	Quartz, Feldspar	2- 3%
Silt	6-15%	Mica	TR- 1%
Clay	84-93%	Heavy minerals	TR- 3%
		Volcanic glass	2%
		Opaque minerals	2-10%
		Zeolites	3- 5%
		Clay minerals	81-93%

1-90, CC (Mudstone)

Sand	< 1%	Quartz, Feldspar	9-12%
Silt	>65%	Mica	2- 3%
Clay	>30%	Heavy minerals	3- 4%
		Volcanic glass	3- 5%
		Opaque minerals	3%
		Carbonate unsepcified	1%
		Clay minerals	73-75%

CC (Sand – Minor)

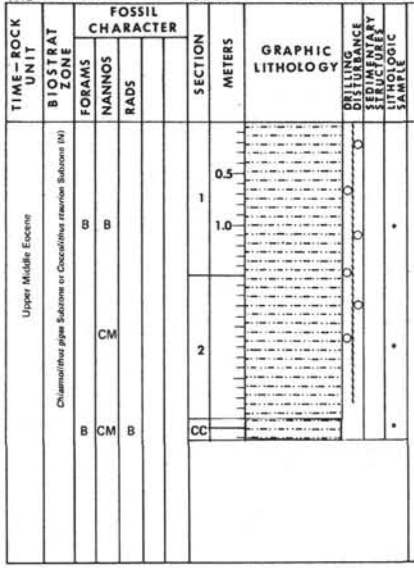
Sand	72%	Quartz, Feldspar	31%
Silt	20%	Mica	5%
Clay	8%	Heavy minerals	20%
		Opaques, Lithics	25%
		Volcanic glass	10%
		Clay minerals	3%

GRAIN SIZE:
CC-10 (71.9, 20.4, 7.8)
CC-34 (0.5, 65.7, 33.8)

CARBON-CARBONATE:
1-6 (4.1, 0.1, 34)

5GY 4/1-5/1

SITE 446 HOLE CORE 21 CORED INTERVAL: 182.0-191.5 m



LITHOLOGIC DESCRIPTION

5GY 6/1

5GY 6/1

Mudstone
Dominant color is dark greenish gray (5GY 6/1).

Section 1 – contamination, drilling breccia.

Section 2, 0-33 cm – drilling breccia.
Section 2, 35-140 cm – intense deformation, massive **Clay, Mud.**

SMEARS:
1-100, 2-75, CC (Claystone [Mudstone])

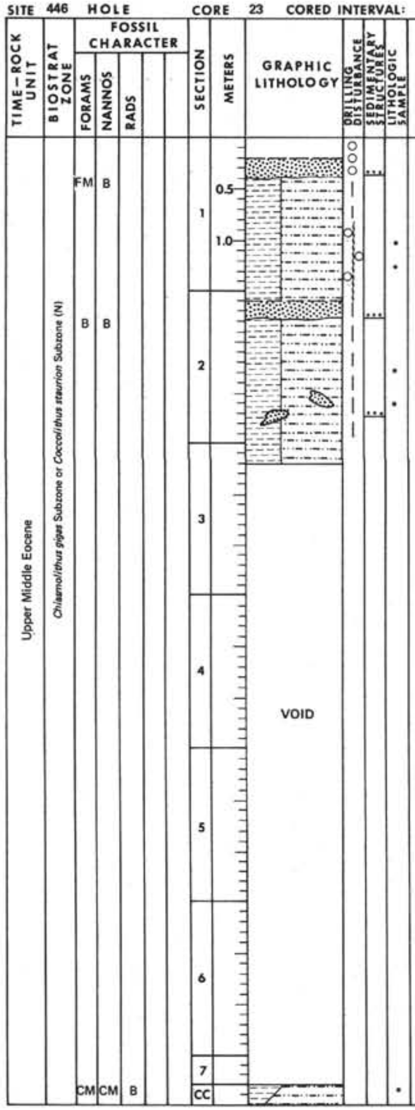
Sand	< 3%	Quartz, Feldspar	20-25%
Silt	>50%	Mica	1- 3%
Clay	>45%	Heavy minerals	3- 5%
		Opaque minerals	2- 5%
		Micronodules	3%
		Zeolites	2%
		Carbonate unspecified	TR- 1%
		Nannofossils	TR
		Clay minerals	60-65%

GRAIN SIZE:
1-132 (1.5, 51.6, 46.9)

CARBON-CARBONATE:
1-136 (0.5, 0.0, 4)

NOTE: Site 446, Core 22, 191.5-201.0 m: NO RECOVERY.

SITE 446 HOLE CORE 23 CORED INTERVAL: 201.0-210.5 m



LITHOLOGIC DESCRIPTION

5G 5/1
5BG 5/1

5GY 5/1

5GY 5/1

5BG 5/1

5BG 5/1

Mudstones

Section 1 – dark greenish gray (5BG 5/1) with sands at 21-41 cm, graded; interbedded **Muds - Sands** at 41-150 cm.

Section 2 – dark greenish gray (5BG 5/1) and greenish gray (5GY 5/1) sandy layers, graded, scoured within **Mudstones.**

SMEARS:
1-107, 1-124, 2-80, CC (Mudstone)

Sand	1%	Quartz, Feldspar	15-20%
Silt	60%	Mica	1- 2%
Clay	39%	Heavy minerals	2- 3%
		Opaque minerals	3- 5%
		Glauconite	3- 5%
		Micronodules	3-10%
		Zeolites	1- 5%
		Carbonate unspecified	TR
		Clay minerals	63-64%

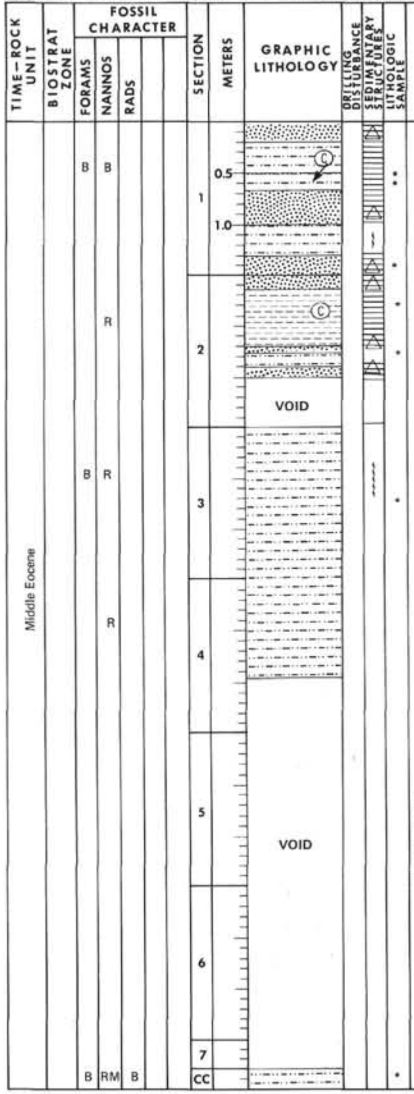
2-117 (Sandy Mud – Minor)

Sand	40%	Quartz, Feldspar	30%
Silt	30%	Mica	2%
Clay	30%	Heavy minerals	25%
		Clay minerals	29%
		Opaque minerals	5%
		Lithics	1%
		Glauconite	3%
		Micronodules	5%

GRAIN SIZE:
1-73 (1.1, 60.7, 38.2)

CARBON-CARBONATE:
1-77 (0.1, 0.0, 0)

SITE 446 HOLE CORE 24 CORED INTERVAL: 210.5-220.0 m



5B 4/1
5G 5/1
5BG 5/1
5B 4/1
5BG 5/1
5B 4/1
N4
5BG 4/1
to 5/1
N4
5BG 4/1
5B 4/1
5BG 4/1
5BG 4/1
to 5/1

GRAIN SIZE:
1-53 (0.9, 43.8, 55.3)
3-53 (0.4, 65.7, 33.8)

CARBON-CARBONATE:
1-52 (0.9, 0.0, 7)
3-52 (0.2, 0.1, 1)

LITHOLOGIC DESCRIPTION

Sandstone and Sand
Dark blue gray, **Clayey or Muddy Sand or Sandstone;** or dark gray (N4) **Muddy Sandstone.** Distinct units with sharp basal contacts, frequently with scour, grading upward into **Muddy Sands, Silty Mudstones, Clayey Mudstones, or Clay. Sands and Silts** are finely laminated. Color mottling = possible mild bioturbation. (Units present in Section 1, Section 2)

Mudstone
Dark greenish gray (5BG 5/1, 5BG 4/1) to greenish gray (5G 5/1) (where calcareous), grading upward from **Sand or Sand/Silt** at base of graded units in Sections 3 and 4. Massive,no evidence of grading or lamination. Faint evidence of mild bioturbation.

Claystone
Dark greenish gray (5BG 4/1) to greenish gray (5BG 5/1); finely laminated. May be calcareous.

SMEARS:

1-52

Sand	1%	Quartz, Feldspar	+	Manganese	+
Silt	44%	Heavy minerals	2%	Zeolites	3%
Clay	55%	Clay minerals	62%	Glauconite	1%
		Mica	2%	Carbonate	
		Opaque minerals	5%	unsepcified	25%

1-60

Quartz, Feldspar	3%	Opaque minerals	5%
Heavy minerals	2%	Zeolites	2%
Clay minerals	75%	Carbonate	
Mica	5%	unspecified	3%

1-140

Quartz, Feldspar	20%	Opaque minerals	5%
Heavy minerals	3%	Zeolites	1%
Clay minerals	54%	Glauconite	1%
Mica	3%	Carbonate	
		unspecified	3%

2-30

Quartz, Feldspar	2%	Zeolites	2%
Heavy minerals	1%	Glauconite	1%
Clay minerals	56%	Carbonate	
Opaque minerals	3%	unspecified	35%

2-73

Quartz, Feldspar	20%	Opaque minerals	7%
Heavy minerals	10%	Zeolites	1%
Clay minerals	54%	Glauconite	1%
Mica	7%	Carbonate unspecified	1%

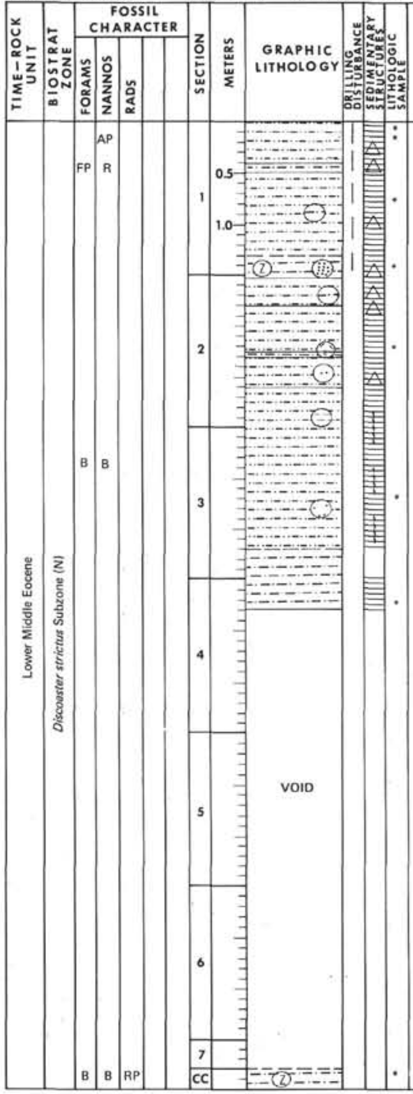
3-75

Sand	1%	Quartz, Feldspar	5%	Opaque min.	5%
Silt	65%	Heavy minerals	2%	Zeolites	3%
Clay	44%	Clay minerals	80%	Carb. unspec.	4%

CC

Quartz, Feldspar	20%	Manganese	1%
Heavy minerals	2%	Zeolites	2%
Clay minerals	70%	Glauconite	1%
Mica	3%	Carbonate	
Opaque minerals	1%	unspecified	1%

SITE 446 HOLE CORE 25 CORED INTERVAL: 220.0-229.5 m



CB=10YR 6/3
N4
N4
5B4/1
with
5BG 5/1
5B 4/1
with
5BG 4/1
and
5BG 5/1
5B 4/1
with 5BG 4/1
5B 4/1

LITHOLOGIC DESCRIPTION

Sandy to Silty Mudstone
Section 1 to 4 cm in top of Section 2 – dark gray (N4) **Sandy to Silty Mudstone** in approximately 9.5 meter-long fining-upward sequence, with numerous subcycles of alternating coarser to finer mudstone. Coarse graded portion is laminated (2-10 cm).

Section 2 to 110 cm – dark bluish gray to dark greenish gray **Mudstone** in alternating short fining-upward cycles. Finely laminated throughout. Fine lighter-colored (5BG 5/1) laminae may be thin (< 1 mm) ash beds, as at 75 cm.

Section 2, 110 cm to Section 4, 30 cm plus Core-Catcher – **Mudstone** with more silty to less silty variations; closely spaced fine laminations, 5BG 5/1. Mild bioturbation, rare. No graded bedding visible.

SMEARS:

1-10

Sand	5%	Quartz,Feldspar	15%	Volcanic glass	1%
Silt	25%	Clay minerals	63%	Carbonate unspec.	1%
Clay	70%	Heavy minerals	7%	Manganese	1%
		Mica	2%	Zeolites	2%
		Opaque minerals	7%	Glauconite	1%

1-16

Sand	0%	Quartz, Feldspar	1%	Volcanic glass	1%
Silt	5%	Clay minerals	40%	Carbonate unspec.	53%
Clay	95%	Heavy minerals	1%	Zeolites	3%
		Opaque minerals	1%		

1-75

Sand	25%	Quartz, Feldspar	20%	Volcanic glass	TR
Silt	40%	Clay minerals	52%	Carbonate unspec.	1%
Clay	35%	Heavy minerals	10%	Zeolites	3%
		Mica	3%	Glauconite	1%
		Opaque minerals	10%		

1-140

Sand	50%	Quartz, Feldspar	20%	Volcanic glass	TR
Silt	30%	Clay minerals	36%	Zeolites	12%
Clay	20%	Heavy minerals	25%	Glauconite	1%
		Opaque minerals	5%		

2-75

Sand	5%	Quartz, Feldspar	10%	Volcanic glass	10%
Silt	40%	Clay minerals	53%	Carbonate unspec.	15%
Clay	55%	Heavy minerals	7%	Manganese	2%
		Mica	3%	Zeolites	2%

3-75

Sand	5%	Quartz, Feldspar	3%	Carbonate unspec.	5%
Silt	55%	Clay minerals	68%	Manganese	2%
Clay	40%	Heavy minerals	5%	Zeolites	5%
		Mica	1%	Glauconite	1%
		Volcanic glass	10%		

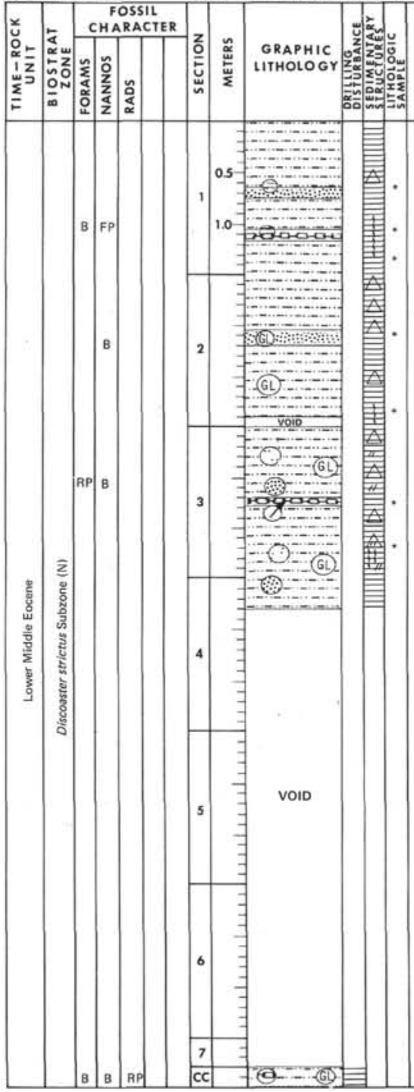
4-20

Sand	15%	Quartz, Feldspar	5%	Volcanic glass	10%
Silt	50%	Clay minerals	67%	Carbonate unspec.	2%
Clay	35%	Heavy minerals	7%	Manganese	1%
		Mica	2%	Zeolites	5%

CC

Sand	5%	Quartz, Feldspar	3%	Volcanic glass	5%
Silt	15%	Clay minerals	60%	Manganese	1%
Clay	85%	Heavy minerals	2%	Zeolites	25%
		Mica	1%	Glauconite	3%

SITE 446 HOLE CORE 26 CORED INTERVAL: 229.5-239.0 m



5BG 4/1
5BG 5/1
5B 4/1

5Y 7/1

5BG 4/1
with
5G 4/1

5B 4/1
with
5BG 4/1

with
5G 4/1

5B 4/1

LITHOLOGIC DESCRIPTION

Glauconitic Mudstone
Section 1 – dark greenish gray, greenish gray, dark blue-gray massive **Mudstones** with 1 mm to 1 cm laminations. Bioturbated sandy-silty interbeds (**Glauconitic Muddy Sandstones, Sandy Mudstones**) 0.5 mm to approximately 1 cm have sharp bases, graded fining upward.

Section 2 – **Mudstones** interbedded with fining upward sandy-silty (glauconitic) layers up to 3 cm. Bioturbation mild.

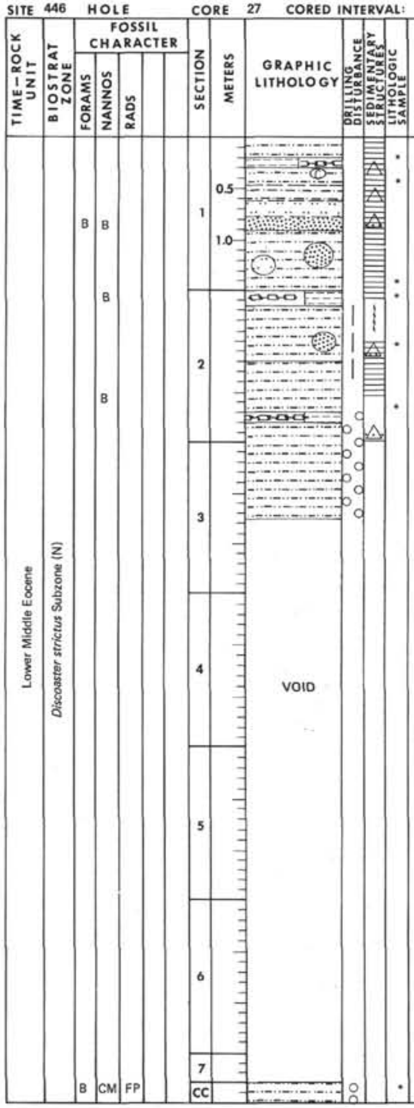
Section 3 – hard and soft (**Mudstone and Muddy Sandstone**) layers interbedded. Coarse layers graded(?). Coarse layers mushy and soft. Lamination-cross laminated.

Clayey Chalk
Section 1 – light gray (5Y 7/1) thin bed of chalk; also in base of Section 3, and in laminae in Core-Catcher.

SMEARS:

1-65					
Sand	40%	Quartz, Feldspar	15%	Volcanic glass	5%
Silt	20%	Clay minerals	51%	Carbonate unspec.	5%
Clay	40%	Heavy minerals	5%	Zeolites	10%
		Opaque minerals	7%	Glauconite	1%
		Mica	2%		
1-105					
Sand	0%	Quartz, Feldspar	1%	Volcanic glass	2%
Silt	15%	Clay minerals	38%	Carbonate unspec.	50%
Clay	85%	Heavy minerals	1%	Zeolites	3%
		Opaque minerals	3%	Glauconite	1%
		Mica	1%		
1-135					
Sand	5%	Quartz, Feldspar	3%	Volcanic glass	5%
Silt	15%	Clay minerals	67%	Carbonate unspec.	TR
Clay	80%	Heavy minerals	1%	Zeolites	3%
		Opaque minerals	5%	Glauconite	10%
		Mica	5%		
2-60					
Sand	60%	Quartz, Feldspar	2%	Carbonate unspec.	1%
Silt	20%	Clay minerals	30%	Manganese	1%
Clay	20%	Heavy minerals	10%	Zeolites	3%
		Opaque minerals	3%	Glauconite	36%
		Mica	3%		
		Volcanic glass	1%		
2-135					
Sand	0%	Quartz, Feldspar	3%	Volcanic glass	5%
Silt	15%	Clay minerals	72%	Carbonate unspec.	TR
Clay	85%	Heavy minerals	3%	Zeolites	5%
		Opaque minerals	10%	Glauconite	(cl)
		Mica	2%		
3-75					
Sand	0%	Quartz, Feldspar	1%	Volcanic glass	1%
Silt	5%	Clay minerals	20%	Carbonate unspec.	73%
Clay	95%	Heavy minerals	1%	Zeolites	2%
		Mica	1%	Glauconite	1%
3-120					
Sand	40%	Quartz, Feldspar	20%	Mica	3%
Silt	30%	Clay minerals	40%	Volcanic glass	3%
Clay	30%	Heavy minerals	2%	Zeolites	3%
		Opaque minerals	3%	Glauconite	26%
4-25					
Sand	40%	Quartz, Feldspar	15%	Volcanic glass	5%
Silt	30%	Clay minerals	24%	Carbonate unspec.	TR
Clay	30%	Heavy minerals	15%	Zeolites	3%
		Mica	3%	Glauconite	25%
		Opaque minerals	10%		
CC					
Sand	5%	Quartz, Feldspar	5%	Volcanic glass	15%
Silt	20%	Clay minerals	70%	Carbonate unspec.	1%
Clay	75%	Heavy minerals	2%	Zeolites	5%
		Opaque minerals	+	Glauconite	(cl)
		Mica	2%		

SITE 446 HOLE CORE 27 CORED INTERVAL: 239.0-248.5 m



5B 4/1
with
5BG 5/1
with black

5G 5/1

5B 4/1
with
5BG 5/1

5B 4/1
5G 5/1

N4

N4

N4

LITHOLOGIC DESCRIPTION

Mudstone (to Sandy Mudstone, Muddy Sand).
Dark bluish gray **Mudstone** with lighter-colored layers (5BG 5/1) and laminae, and black laminae. Laminae = 0.5 mm to 1 cm. **Mudstones** form part of long fining upward sequence with **Muddy** at base grading up into **Mudstone to Calcareous Mudstone to Clayey Chalk;** chalk overlain by very fine grained **Mudstone.** Laminae and prominent except in coarsest portion. Sandy portion **Glauconitic** as in Core 26; sharp basal contacts. Also **Clayey Chalk,** light gray (5G 5/1 to 5B 4/1) interbeds toward top of fining upward sequence.

SMEARS:

1-20					
Sand	5%	Quartz, Feldspar	3%	Opaque minerals	3%
Silt	20%	Volcanic glass	1%	Carbonate unspec.	35%
Clay	75%	Clay minerals	50%	Zeolites	1%
		Heavy minerals	5%	Glauconite	1%
		Mica	1%		
1-45					
Sand	60%	Quartz, Feldspar	10%	Mica	1%
Silt	20%	Lithic Fragments	7%	Opaque minerals	10%
Clay	20%	Volcanic glass	1%	Carbonate unspec.	21%
		Clay minerals	20%	Zeolites	3%
		Heavy minerals	26%	Glauconite	2%
1-145					
Sand	5%	Quartz, Feldspar	7!	Opaque minerals	10%
Silt	25%	Volcanic glass	1%	Carbonate unspec.	1%
Clay	70%	Clay minerals	70%	Zeolites	2%
		Heavy minerals	5%	Glauconite	2%
		Mica	2%		
2-5					
Sand	5%	Quartz, Feldspar	1%	Carbonate unspec.	67%
Silt	5%	Clay minerals	30%	Glauconite	1%
Clay	90%	Heavy minerals	1%		
2-55					
Sand	60%	Lithic Fragments	10%	Opaque minerals	7%
Silt	20%	Quartz, Feldspar	15%	Carbonate unspec.	8%
Clay	20%	Clay minerals	20%	Zeolites	1%
		Heavy minerals	25%	Glauconite	5%
		Mica	3%		
2-115					
Sand	5%	Quartz, Feldspar	3%	Opaque minerals	10%
Silt	25%	Volcanic glass	5%	Carbonate unspec.	8%
Clay	70%	Clay minerals	70%	Zeolites	2%
		Heavy minerals	2%	Glauconite	2%
		Mica	3%		
CC					
Sand	5%	Quartz, Feldspar	7%	Opaque minerals	15%
Silt	25%	Volcanic glass	1%	Carbonate unspec.	6%
Clay	70%	Clay minrals	68%	Zeolites	3%
		Heavy minerals	2%	Glauconite	5%
		Mica	2%		

SITE 446 HOLE CORE 28 CORED INTERVAL: 248.5-258.0 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	SECTION	METERS
Lower Middle Eocene	*Discoaster strictus* Subzone (N)	B	R		1	0.5
		B	R	B	CC	1.0

N4

LITHOLOGIC DESCRIPTION

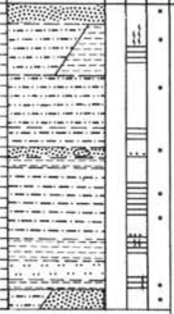
Mudstone
Firm, brecciated by drilling, dark gray (N4) massive, no structures; laminations.

SMEARS:
1-75, CC (Mudstone)

Sand	3- 5%	Quartz, Feldspar	3- 5%
Silt	25-27%	Mica	2%
Clay	70%	Heavy minerals	3- 4%
		Clay minerals	65-71%
		Opaque minerals	10%
		Volcanic glass	1-20%
		Lithics	5%
		Glauconite	1- 2%
		Zeolites	1%
		Carbonate unspecified	1- 5%
		Nannofossils	1-TR%

SITE 446 HOLE CORE 29 CORED INTERVAL: 258.0-267.5 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	SECTION	METERS
Lower Middle Eocene	*Discoaster strictus* Subzone (N)	B	CM		1	0.5 1.0
			B		2	
		B	B	RP	CC	



5G 4/1
N4
N4
5G 4/1
N4
5BG 4/1
N4

LITHOLOGIC DESCRIPTION

Mudstones, Claystones, Sandy Mudstones
Series of turbidite sequences of **Silty Sands, Mudstones, Claystones, Sandy Mudstones.**

Section 1 – **Silty Sand** – massive; **Mudstones** – bioturbated, laminated; **Mudstones** – massive, gray; **Sandy Mud** – coarse laminae; and **Clayey Sand** – glauconitic.

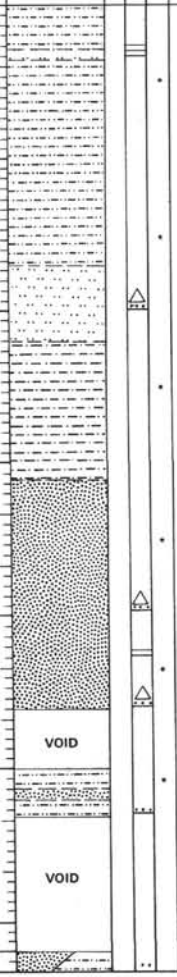
Section 2 – **Claystone** – laminated, bioturbated; **Sandy Mudstone** – laminated, cross-bedded; **Clay** – lamination, bioturbated; **Silt** – massive; **Clay Mudstone** – laminae.

Core-Catcher – Clayey Sand.

SMEARS:
1-10 (Silty Sand)
1-35 (Claystone)
1-85 (Mudstone)
1-145 (Glauconitic Silty Clayey Sand)
2-40 (Calcareous Sandy Mudstone)
2-60 (Clayey Sandy Mudstone)
2-125 (Mudstone)
CC (Clayey Sand)

SITE 446 HOLE CORE 30 CORED INTERVAL: 267.5-277.0 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	SECTION	METERS
Lower Middle Eocene	*Rhabdosphaera inflata* Subzone (N)	B	FP		1	0.5 1.0
			R		2	
		B	R		3	
			R		4	
		FP	R		5	
					6	
					7	
		B	B	CP	CC	



N4
5G 4/1
5Y 4/1
5GY 4/1
5GY 4/1
5GY 4/1
5G 4/1
5GY 4/1
5G 4/1
5GY 5/1
5GY 4/1

LITHOLOGIC DESCRIPTION

Mudstones, Sandy Mudstones and Sandstones
Probable turbidite sequence:
Section 1 – Massive, dark gray (N4) to dark greenish gray (5G 4/1 - 5GY 4/1) **Mudstone.**

Section 2 – Massive, homogeneous **Mudstone.**

Section 3 – Dark greenish gray (5GY 4/1) massive graded **Sandy Mudstone.**

Section 4 – **Clayey Sandstone** parallel laminae in upper, homogeneous.

Section 5 – Dark greenish gray, medium to coarse graded **Muddy Sandstone,** some parallel laminae. Graded section upwards Section 5 to Section 2.

Section 6 – **Mudstone to Sandstone and Clayey Sandstone.**

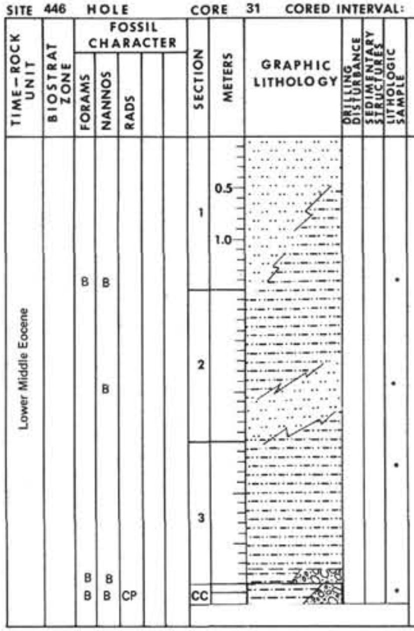
Core-Catcher – **Mudstone to Sandstone.**

SMEARS:
1-75, 2-75, 6-17, CC (Mudstone)

Sand	5%	Quartz, Feldspar	3- 5%
Silt	10-15%	Mica	1%
Clay	80-85%	Heavy minerals	1- 3%
		Clay minerals	76-88%
		Opaque minerals	7-10%
		Volcanic glass	1%
		Zeolites	1%
		Carbonate unspecified	1%

3-75 (Sandy Mudstone)
4-75 (Clayey Sand)
5-50 (Muddy Sand)

SITE 446 HOLE CORE 31 CORED INTERVAL: 277.0-286.5 m



LITHOLOGIC DESCRIPTION

Mudstones

5GY 4/1
with
variations

Section 1 – drilling breccia of **Mudstone, Silty Mudstone, Siltstone, Mudstone, Conglomerates, Mudstone.**

Section 2 – as per Section 1.

Section 3 – as per Section 1.

Sections consist of highly distrubed brecciated turbidite series.

5Y 4/1

SMEARS:

1-140, 2-90, CC (Silty Mudstones)

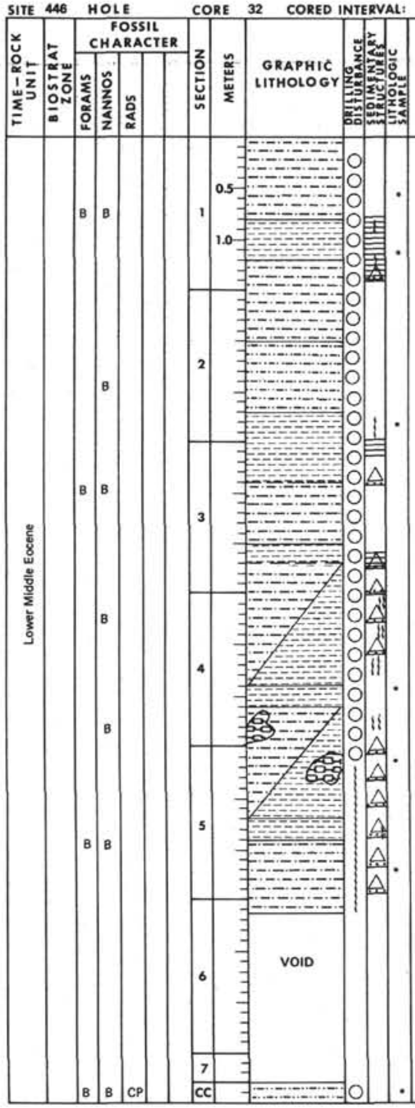
Sand	15%	Quartz, Feldspar	7-10%
Silt	25-30%	Mica	3- 5%
Clay	45-60%	Heavy minerals	3-15%
		Clay minerals	48%
		Opaque minerals	5-15%
		Lithics	15%
		Zeolites	2%
		Carbonate unspecified	2%

5GY 4/1
5GY 5/1

3-44 (Mudstone)

Sand	5%	Quartz, Feldspar	2%
Silt	25%	Mica	2%
Clay	70%	Heavy minerals	1%
		Clay minerals	85%
		Opaque minerals	5%
		Volcanic glass	1%
		Lithics	3%
		Zeolites	1%

SITE 446 HOLE CORE 32 CORED INTERVAL: 286.5-296.0 m



LITHOLOGIC DESCRIPTION

Claystone Mudstone, Silty Mudstone
Drilling blocks throughout.

Section 1, Section 2, 0-100 cm – dark greenish gray (5Y 4/1, 5GY 4/1) and greenish gray (5Y 5/1) firm to hard, sometimes laminated and bioturbated **Claystone to Mudstone.**

Section 2, 100 cm to bottom – dark greenish gray (5G 4/1) to greenish gray (5G 5/1) (equals greener) **Claystone and Mudstone,** with local patches of **Calcareous Ooze. Claystones** have laminae and moderate/minor bioturbation evidence and contain irregularly silty sandy stringers. Signs of soft sediment deformation.

SMEARS:

1-60 (Mudstone)

Sand	3%	Quartz, Feldspar	12%	Heavy minerals	6%
Silt	22%	Clay minerals	77%	Opaque minerals	2%
Clay	75%	Mica	1%	Volcanic glass	2%

1-115 (Claystone)

Sand	5%	Quartz, Feldspar	7%	Clay minerals	83%
Silt	9%	Mica, Chlorite	2%	Volcanic glass	TR
Clay	86%	Heavy minerals	5%	Glauconite	3%

2-130 (Claystone)

Sand	3%	Clay minerals	86%
Silt	9%	Quartz, Feldspar	7%
Clay	88%	Heavy minerals	3%

4-94 (Silty Mudstone)

Sand	12%	Quartz, Feldspar	20%	Volcanic glass	8%
Silt	48%	Clay minerals	48%	Mica	2%
Clay	40%	Heavy minerals	17%	Glauconite	1%
		Opaque minerals	4%		

5-19 (Calcareous Ooze – Minor)

Sand	1%	Quartz, Feldspar	2%	Carbonate unspecified	97%
Silt	30%	Heavy minerals	1%		
Clay	69%				

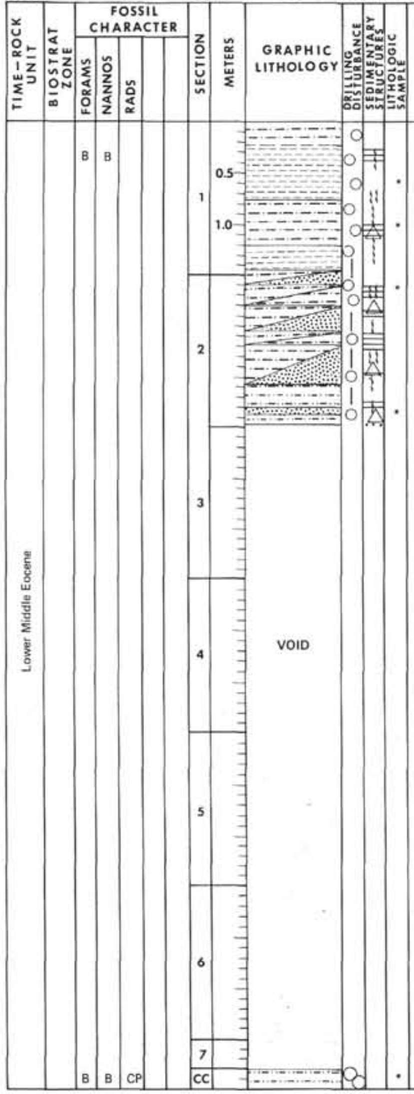
5-120 (Silty Mudstone)

Sand	13%	Quartz, Feldspar	12%
Silt	44%	Heavy minerals	18%
Clay	53%	Opaque minerals	5%

CC (Mudstone)

Sand	15%	Quartz, Feldspar	12%
Silt	17%	Heavy minerals	5%
Clay	78%	Clay minerals	78%

SITE 446 HOLE CORE 33 CORED INTERVAL: 296.0-305.5 m



LITHOLOGIC DESCRIPTION

Claystone, Mudstone, Silty Mudstone, Silty Sandstone
Alternation of drilling brecciated **Hard Claystone to Silty Sandstone. Claystone** shows slight to moderate bioturbation, sometimes irregular or parallel laminae. **Silt/Sandstone** are sometimes graded-bedded with sharp contact at base. Some "clay pebbles" in mudstone.
Main colors are as follows:
Section 1, 0-144 cm – dark greenish gray (5G 4/1) with dark greenish gray (5GY 4/1)/dark gray (N4) at 0-30 cm and 78-120 cm. At 1440-150 cm very dark grayish brown (2.5Y 3/2).
Section 2, 0-105 cm – very dark grayish brown (2.5Y 3/2) to dark grayish brown (2.5Y 4/2) and black (N2). At 105-145 cm – dark greenish gray (5BG 4/1) to greenish gray (5GY 5/1). Black (2.5Y 2/1) **Sandstone** at 130-136 cm.
Core-Catcher – dark greenish gray (5GY 4/1) to dark gray (N4).

SMEARS:

1-60 (Claystone)

Sand	2%	Quartz, Feldspar	4%	Heavy minerals	1%
Silt	9%	Opaque minerals	2%	Volcanic glass	4%
Clay	89%	Mica	TR	Clay minerals	89%

1-105 (Sandy Mudstone)

Sand	20%	Quartz, Feldspar	20%	VOlcanic glass	7%
Silt	32%	Opaque minerals	5%	Clay minerals	48%
Clay	48%	Heavy minerals	20%		

2-16 (Silty Mudstone)

Sand	15%	Quartz, Feldspar	12%	Heavy minerals	12%
Silt	35%	Clay minerals	50%	Opaque minerals	6%
Clay	50%	Mica	20%		

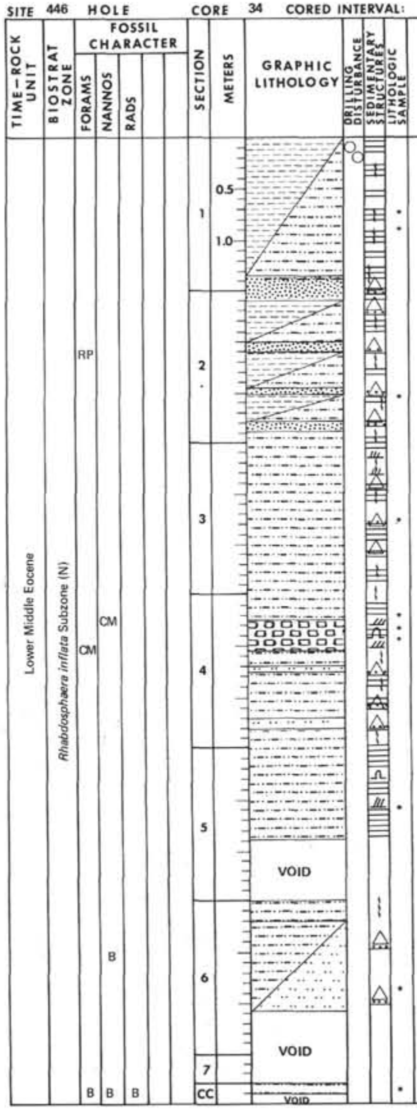
2-134 (Silty Sandstone)

Sand	70%	Quartz, Feldspar	20%	Volcanic glass	10%
Silt	25%	Lithics	40%	Clay minerals	5%
Clay	5%	Heavy minerals	25%		

CC (Mudstone)

Sand	6%	Quartz, Feldspar	12%	Heavy minerals	5%
Silt	19%	Opaque minerals	4%	Volcanic glass	1%
Clay	76%	Mica	3%	Clay minerals	75%

SITE 446 HOLE CORE 34 CORED INTERVAL: 305.5-315.0 m



LITHOLOGIC DESCRIPTION

Mudstone, with Claystone, Silty Mudstone, Silty Sandstone
Mottled, dark greenish gray (5GY 4/1 and 5G 4/1) with black (2.5Y 2/0), very hard, undeformed, broken **Mudstone,** with *numerous thin* **Silt** *layers, and local thicker interbeds of* **Claystone, Silty Mudstone and Sandstone.**

Sedimentary structures throughout, very various and variable: parallel laminae, waved laminae, graded-beds, cross-beds, lenses, micro-slumps. Bioturbation minor and local.

Minor Lithologies:
Section 4, 24-52 cm – **Silty/Sandy** light gray to greenish gray (5Y 7/1, 5GY 7/1, and 5GY 6/1) **Calcareous Ooze** with cross-beds.
Section 6, 28-107 cm – misted pale yellow (5Y 7/3) and dark green (5GY 4/1) **Sandy Siltstone.**

SMEARS:

1-73 (Claystone)

Sand	1%	Quartz, Feldspar	2%	Zeolites	1%
Silt	8%	Heavy minerals	1%	Carbonate unspecified	1%
Clay	91%	Clay minerals	89%	Nannofossils	1%

1-90 (Sandy Siltstone)

Sand	45%	Quartz, Feldspar	30%	Clay minerals	10%
Silt	50%	Heavy minerals	30%	Lithics	40%
Clay	10%				

3-75 (Mudstone)

Sand	5%	Feldspar	15%	Heavy minerals	5%
Silt	25%	Mica, Chlorite,		Clay minerals	71%
Clay	70%	Smectite?	5%	Opaque minerals	4%

4-26 (Calcareous – Minor)

Sand	2%	Feldspar	2%	Carbonate unspecified	88%
Silt	18%	Heavy minerals	2%	Foraminifers	5%
Clay	80%	Clay minerals	1%	Nannofossils	2%

4-32 (Calcareous Ooze – Minor)

Sand	40%	Carbonate unspecified	75%	Mica	6%
Silt	40%	Quartz	5%	Heavy minerals	5%
Clay	20%	Feldspar	5%	Foraminifers	2%

4-42 (Calcareous Ooze – Minor)

Sand	3%	Carbonate unspecified	84%
Silt	13%	Foraminifers	8%
Clay	84%	Nannofossils	2%

5-60 (Mudstone)

Sand	5%	Feldspar	10%
Silt	14%	Heavy minerals	5%
Clay	81%	Clay minerals	81%

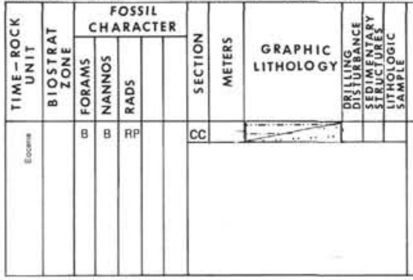
6-88 (Sandy Siltstone)

Sand	25%	Quartz, Feldspar	30%	Clay minerals	10%
Silt	65%	Heavy minerals	50%	Lithics	10%
Clay	10%				

CC (Mudstone)

Sand	10%	Feldspar	10%
Silt	12%	Heavy minerals	10%
Clay	78%	Clay minerals	78%

SITE 446 **HOLE** **CORE** 35 **CORED INTERVAL:** 315.0-324.5 m



LITHOLOGIC DESCRIPTION

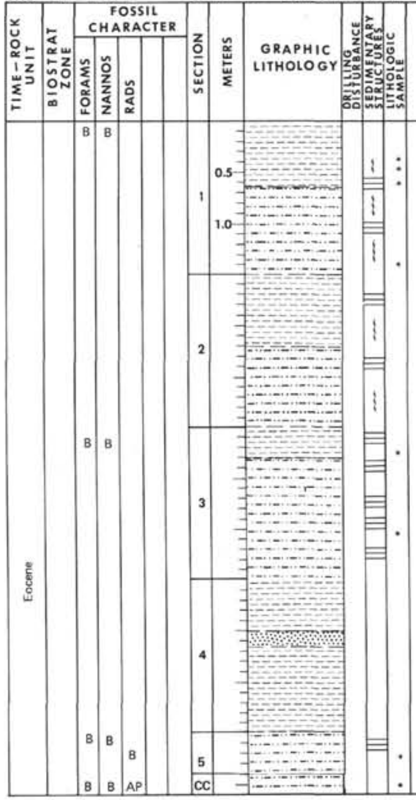
Among drilling contamination breccias, one piece of misted dark greenish gray (5BG 4/1) **Mudstone** and black (5Y 2/1) **Sandy Siltstone.**

SMEAR:

CC (Mudstone)

Sand	50%	Quartz, Feldspar	15%	Clay minerals	75%
Silt	20%	Mica	1%	Opaque minerals	3%
Clay	75%	Heavy minerals	5%		

SITE 446 **HOLE** **CORE** 36 **CORED INTERVAL:** 324.5-334.0 m



LITHOLOGIC DESCRIPTION

5Y 4/1
5GY 4/1

5Y 4/1
5GY 4/1

5Y 4/1
5GY 4/1
with
5Y 6/1
10R 4/2

5Y 4/1
5GY 5/1

5YR 5/3

5GY 5/1

Mudstone – Claystones

Sections 1 and 2 – Alternation of **Mudstones, Claystones** with variable laminae, minor bioturbation.
Section 3 – variable colored **Mudstones, Claystones, Siltstones.**
Section 4 – dark gray (5Y 4/1), greenish gray (5GY 5/1) with weak red (10R 4/2) cycles of interbedded **Claystones,** coarser units.
Section 5 – thin laminated, reddish brown (5YR 5/3) **Mudstone.**

SMEARS:

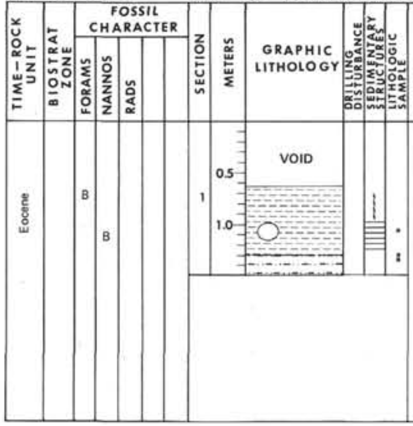
1-39, 1-49, 1-63, 3-30, 5-25 (Claystone)

Sand	0- 3%	Quartz, Feldspar	3- 5%
Silt	2- 8%	Mica	1- 3%
Clay	90-98%	Heavy minerals	0- 3%
		Clay minerals	90-98%
		Carbonate unspecified	0- 5%
		Zeolites	TR- 1%

1-144, 3-104, 5-25, CC (Mudstone)

Sand	5-10%	Quartz, Feldspar	10-15%
Silt	4-18%	Mica	0- 3%
Clay	79-86%	Heavy minerals	0- 8%
		Clay minerals	79-86%
		Opaque minerals	1- 6%
		Radiolarians	0-10%
		Volcanic glass	0- 1%

SITE 446 **HOLE** **CORE** 37 **CORED INTERVAL:** 334.0-343.5 m



LITHOLOGIC DESCRIPTION

7.5YR 5/4
7.5YR 4/4

Mudstones/Claystones

Brown (7.5YR 5/4) to dark brown (7.5YR 4/4), laminated, minor bioturbation.

SMEARS:

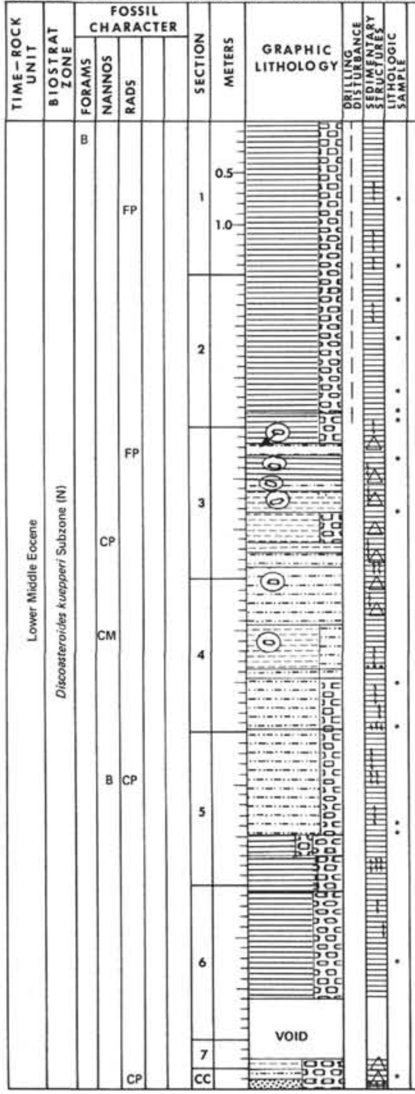
1-110, 1-132 (Claystones)

Sand	5-15%	Quartz, Feldspar	2- 3%
Silt	4-10%	Clay minerals	81-85%
Clay	81-85%	Micronodules	2%
		Zeolites	TR
		Radiolarians	10-15%
		Nannofossils	TR

1-135 (Mudstones)

Sand	15%	Quartz, Feldspar	5%
Silt	10%	Clay minerals	15%
Clay	75%	Opaque minerals	40%
		Micronodules	20%
		Zeolites	25%

SITE 446 **HOLE** **CORE** 38 **CORED INTERVAL:** 343.5-353.0 m



LITHOLOGIC DESCRIPTION

5YR 5/3
10YR 5/3
10YR 5/2
10YR 5/1
+ 10YR 6/3
10YR 5/2
10YR 5/1
5Y 4/2
5Y 5/1
5GY 5/1
5Y 5/1
N4
5G 4/1
N4
5GY 4/1
5G 4/1
5G 5/1
5GY 4/1
5GY 5/1
5Y 4/1
5GY 4/1
N4
5Y 4/1
N4
5Y 4/1
5BY 6/1
5Y 4/1
5GY 4/1
5GY 5/1
5Y 5/2
5Y 4/2
5Y 4/1
5Y 4/1
5G 4/1
5BG 4/1-4/2

Mudstone and Claystone plus **Calcareous (and Nannofossil) Mudstone and Claystone**

Section 1 – reddish brown to brown to grayish brown **Calcareous Claystone**. Faint laminations; slight bioturbation.

Section 2 – grayish brown to gray to olive gray **Calcareous or Nannofossil Claystone.** Bioturbation very rare. Transition to dark greenish gray calcareous **Claystone** in lower portion.

Section 3 – dark greenish gray to dark gray series of alternating coarser (silty or sandy) **Mudstone** and finer **Clay Mudstone or Calcareous Claystone in Fining Upward Sequences;** graded bed may be visible at base of sequence. Each sequence 20-30 cm long. Most are calcareous at least in part.

Section 4 – dark greenish gray to gray to dark gray section with **Fining Upward Series** continues from Section 3 to scoured contact at 36 cm. Then faintly laminated, mildly bioturbated **Calcareous Mudstone to Calcareous Claystone.**

Section 5 – Same as lower part of Section 4: **Calcareous Mudstone.** Thin (1-5 mm) with sandy texture greenish gray (5BG 6/1) **equals Radiolarian (dissolved) Ooze.**

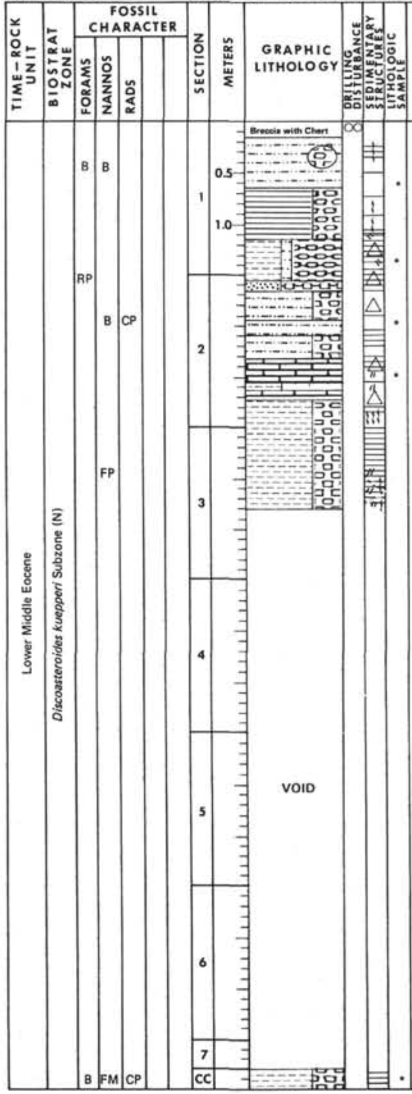
Section 6 – dark greenish gray to olive gray **Calcareous** (plus or minus **Nannofossils**) **Claystone.**

Core-Catcher – dark greenish gray, grayish green and light gray very coarse sand, grading up through calcareous **Siltstone, Mudstone, to Muddy Claystone; fining upward sequence.**

SMEARS (SUMMARY):

Sand	0- 5%	Quartz, Feldspar	1- 5%
Silt	5-10%	Clay minerals	50-75%
Clay	85-95%	Opaque minerals	5%
		Carbonate usnpecified	10-40%
		Zeolites	1- 5%
		Heavy minerals	1- 2%

SITE 446 **HOLE** **CORE** 39 **CORED INTERVAL:** 353.0-362.5 m



LITHOLOGIC DESCRIPTION

5YR 5/1
10YR 5/2
5G 4/2
with 5Y 7/1
10YR 6/2
10YR 5/3
10YR 7/2
5YR 4/4
+5YR 2/1
5Y 7/1
5Y 6/1
5YR 3/2
5Y 4/1
5Y 7/2 to
5Y 4/2
5Y 4/1
5Y 3/2
5Y 5/1
5G 4/1

Mudstone to Claystone plus or minus Calcareous

Section 1 – gray to grayish brown to dark grayish brown **Calcareous Claystone and Mudstone.** Faintly laminated and very mildy bioturbated.

122-150 cm – dark green and gray speckled **fining upward sequence with very coarse Sandstone** at base. **Calcareous,** cross-laminated; laminae equals concentration of dark minerals.

Section 2 – green and gray graded **Sandstone** continued from Section 1, then graded sequence of light gray (at base) to brown to light brownish gray to 38 cm.

38-80 cm – dark reddish brown mudstone.

80-135 cm – repeated **graded sequence,** parallel bedded and cross-bedded and gray, dark gray, to olive gray to light gray. Calcareous.

Section 3 – dark gray to olive gray **Calcareous Claystone.** Finely laminated, faintly bioturbated.

SMEARS:

1-65

Sand	5%	Quartz, Feldspar	2%	Opaque minerals	5%
Silt	5%	Clay minerals	64%	Carbonate unspec.	25%
Clay	90%	Heavy minerals	1%	Mica	1%
		Volcanic glass	1%	Zeolites	1%

1-133

Sand	0%	Quartz, Feldspar	1%	Opaque minerals	1%
Silt	10%	Clay minerals	31%	Carbonate unspec.	65%
Clay	90%	Heavy minerals	1%	Mica	1%

2-45

Sand	5%	Quartz, Feldspar	30%	Opaque minerals	5%
Silt	50%	Clay minerals	35%	Manganese	10%
Clay	45%	Heavy minerals	10%	Zeolites	10%

2-100

Sand	0%	Quartz, Feldspar	1%	Opaque minerals	3%
Silt	5%	Clay minerals	65%	Carbonate unspec.	35%
Clay	95%	Heavy minerals	?	Mica	2%
		Volcanic glass	1%		

3-12

Sand	0%	Quartz, Feldspar	1%	Carbonate unspec.	25%
Silt	5%	Clay minerals	68%	Zeolites	1%
Clay	95%	Opaque minerals	5%		

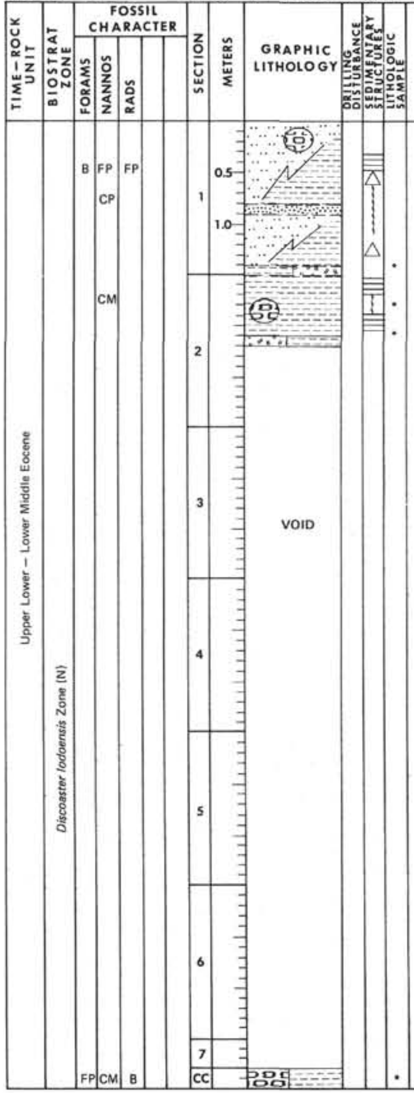
3-50

Sand	0%	Quartz, Feldspar	1%	Carbonate unspec.	20%
Silt	5%	Clay minerals	73%	Mica	1%
Clay	95%	Opaque minerals	5%		

CC

Quartz, Feldspar	1%	Opaque minerals	3%
Clay minerals	25%	Carbonate unspecified	40%
Heavy minerals	1%	Zeolites	1%
Volcanic glass	1%		

SITE 446 HOLE CORE 40 CORED INTERVAL: 362.5-372.0 m



LITHOLOGIC DESCRIPTION

5G 5/1
5GY 4/1
5GY 4/1

5B 4/1
5G 4/2

5G 5/2

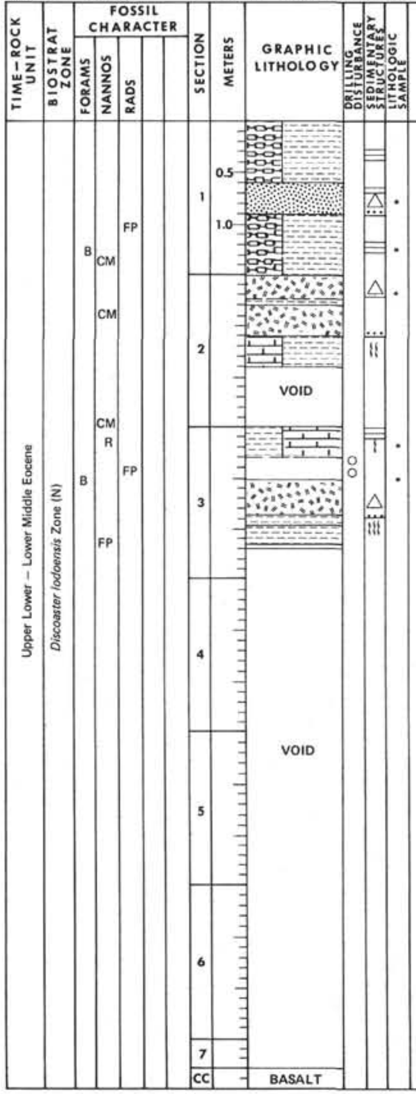
Dominant Lithology: Mudstone/Claystone, interbedded sequences of dark greenish gray (5G 5/1), greenish gray (5GY 5/1) **Calcareous Mudstones, Claystones,** with coarse **Silt/Sand** units; non-calcareous in lower parts of sequence. Laminated, mildly bioturbated. Basal coarser portions fining upward from **Sandy/Silty Mudstone to Claystone** with prominent biogenic (pelagic) component.

Minor Lithology: Volcanic Ash, bluish green (5B 4/1), generally at base of mudstone/claystone sequence.

Remarks: The top of this core is transitional between Unit IIIB above and UNIT IV.

SMEARS:	Calcareous Claystone	Clayey Ash
Quartz, Feldspar	1%	1%
Clay minerals	55-65%	46%
Volcanic glass	–	50%
Opaque minerals	1- 5%	–
Mica	0- 1%	1%
Carbonate unspecified	5-10%	+
Nannofossils	20-30%	
Siliceous fossils	+	
Glauconite	?	
Zeolites		1%

SITE 446 HOLE CORE 41 CORED INTERVAL: 372.0-381.5 m



LITHOLOGIC DESCRIPTION

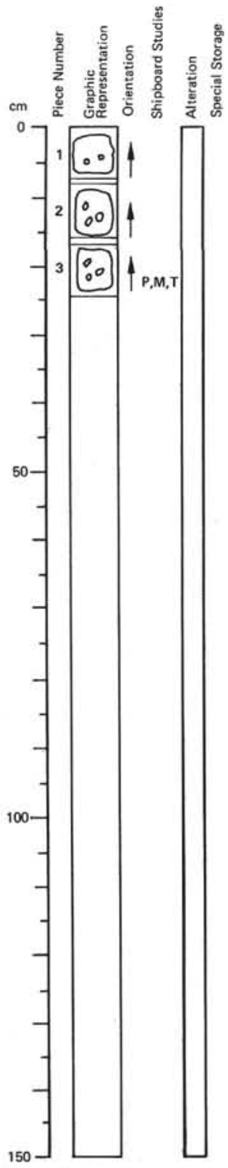
Dominant Lithology: (A) Calcareous Claystone/Nannofossil Claystone/Clayey Nannofossil Ooze; greenish gray (5G 5/1) to dark greenish gray (5G 4/1), with silt laminae; laminated, bioturbated; soft sediment deformation in upper part of core; lower boundaries of laminae sharp.

Minor Lithology: (B) gray (N6) to greenish gray (5G 5/1) **Altered Volcanic Ash, or Clayey Ash.**

Minor Lithology: (C) Lithic Sandstone; dark gray, calcareous, laminated.

Remarks: These three lithologies are parts of repeated fining-upward sequences, representing at least 6 cycles in the 4.2 meters recovered. The cycles have altered volcanic ash, or clayey ash at base, laminated, fining upward to calcareous claystone and more pelagic-dominated sediments; except in Section 1 where the cycle begins with coarse lithic sandstone. Laminae have sharp lower boundaries.

SMEARS:	A			B	C
Quartz, Feldspar	+	+	+	1- 2%	20%
Clay minerals	50-60%	40-50%	35%	1- 5%	25%
Volcanic glass	?	2- 3%	1%	90%	15%
Opaque minerals	2- 3%	1- 2%	1%	1- 2%	2%
Heavy minerals	+	+	+	1- 2%	15%
Carbonate unspec.	15-20%	15-20%	40%	–	+
Nannofossils	15-20%	15-25%	20%	–	forams.
Siliceous fossils	+	–	3%	–	5%
Mica	+	+	+	+	+
Zeolites	+	2%	+	?	5%
Glauconite	1- 2%	?	+	–	?
Lithic frags.				+	15%



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446		41	CC

Depth: 376.2 to 376.4 m

Visual Description

Light gray, vesicular, aphyric aphanitic basalt.

Vesicles lined by calcite, zeolites (tabular-heulandite? and acicular) and pyrite (possibly some pyrrohotite).

Piece 1: 5% vesicles (<1 mm), occasional vesicle (1-2 mm).

Pieces 2 and 3: 10% vesicles (<1 mm), 2% vesicles (1-10 mm), often pipe-like, perpendicular to hole orientation).

Thin Section Description – 19 cm

Phenocrysts: clinopyroxene <1%, 0.2 x 0.5 mm, rare microphenocryst, only 1 found.

Groundmass: plagioclase 25%, 0.1-0.75 mm, An_{70}, carlsbad-An content; clinopyroxene 25%, 0.02-0.1 mm, granules and hair-like, crystals in plagioclase; magnetite 20%, 0.02-0.1 mm; other basaltic hornblende 10%, 0.02-0.1 mm.

Vesicles: 20%, 0.1-1.0 mm, calcite (~6%), irregular.

Texture: intergranular.

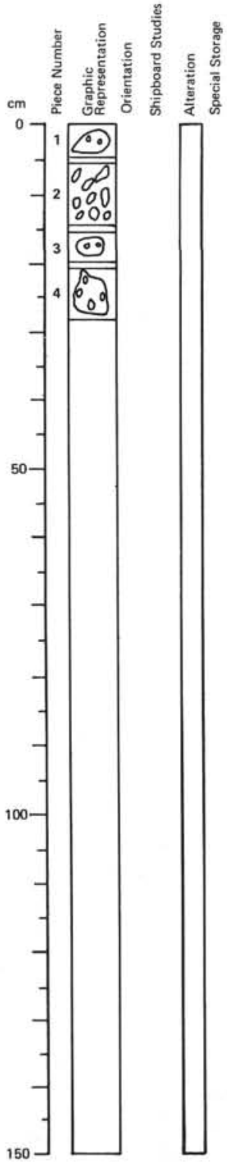
Alteration: 3% carbonate in vesicles, often euhedral.

Shipboard Data

Bulk Analysis:	**20 cm**
SiO_2	47.76
Al_2O_3	13.62
Fe_2O_3	1.21
FeO	7.99
MgO	4.64
CaO	11.46
Na_2O	3.23
K_2O	2.65
TiO_2	3.58
P_2O_5	0.36
MnO	0.32
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	39.00
Ni	28.00
Sr	693.00
Zr	210.00

Magnetic Data:	**19 cm**
Intensity (emu/cc)	86.6
Inclination before demag.	–55.7
Stable Inclination	–47.1

Physical Properties:	**22 cm**
$\overline{V}p$ (km/s)	4.54
Porosity (%)	18.42
Wet Bulk Density	2.62
Grain Density	2.99



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446		42	CC

Depth: 381.5 to 381.78 m

Visual Description

Light gray, vesicular, aphyric, aphanitic basalt.

Piece 1: 5-10% vesicles (<1 mm).

Piece 3: 8% vesicles (<1 mm), 2% vesicles (1-2 mm).

Piece 4: 7.5% vesicles (<1 mm), 7.5% vesicles (1-2 mm).

Vesicles lined by pyrite, calcite and zeolites.

Similar to previous section.

Thin Section Description – 17 cm

Groundmass: plagioclase 30%, average 0.5 mm, An_{70}, albite and carlsbad An determination; clinopyroxene 18%, 0.1-0.05 mm, quite pink, rare microphenocryst up to 0.75 mm; magnetite 15%, 0.01-0.15 mm; other basaltic hornblende 12%, 0.1-0.6 mm, primary-reaction-relation with pyroxene; other apatite <1%.

Vesicles: 25%

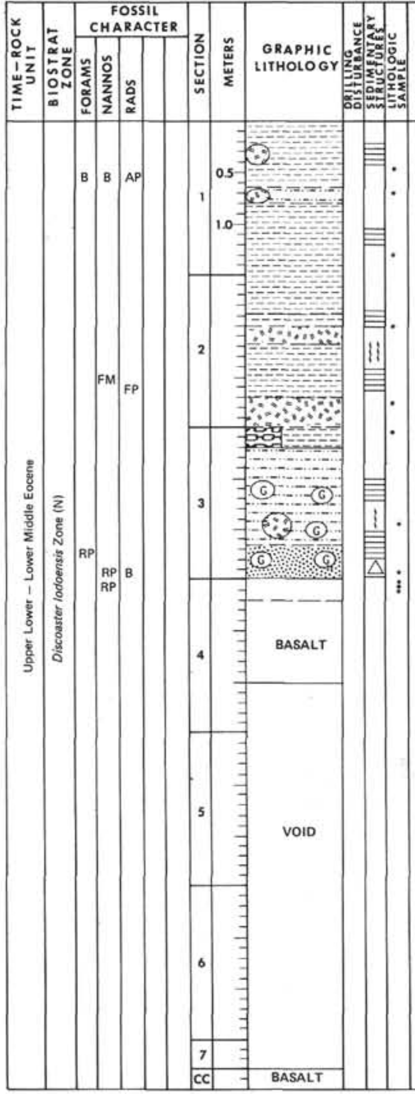
Texture: intergranular

Alteration: 1% carbonate in vesicles; other chlorite 2%, in groundmass.

Shipboard Data

Bulk Analysis:	**24 cm**
SiO_2	46.97
Al_2O_3	13.32
Fe_2O_3	1.30
FeO	8.59
MgO	4.85
CaO	11.21
Na_2O	3.69
K_2O	2.28
TiO_2	3.54
P_2O_5	0.35
MnO	0.34
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	18.00
Ni	29.00
Sr	689.00
Zr	206.00

SITE 446 HOLE CORE 43 CORED INTERVAL: 391.0-400.5 m



LITHOLOGIC DESCRIPTION

5G 4/1
5G 5/1

5Y 4/1

5G 5/1
5BG 5/1
5G 4/1
N4

5G 5/1
5BG 5/1
5G 4/1

Dominant Lithologies:

(A) Claystone: dark greenish gray (5G 4/1) and greenish gray (5G 5/1) **Claystones** with silt laminae; some massive; vertical fractures filled with clay, calcite.

(B) Glauconitic Mudstone and Sandstone: blue-green, finely laminated, (**Mudstone** with silt laminae), bioturbated; soft-sediment deformation; "solution veins" filled with clay, calcite, with

Minor Lithologies:

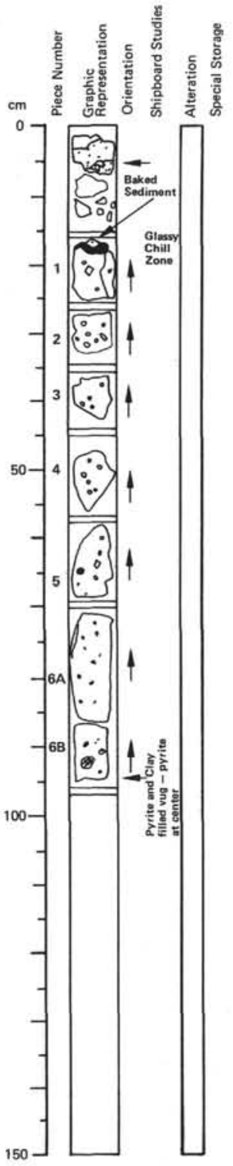
(C) Clayey Altered Ash or Ashy Mudstone: (occurs in Section 3 associated with the glauconitic mudstone or sandstone, and in Section 1, possibly in laminations).

(D) Clay Limestone or Calcareous Claystone.

Breccia fragments overlying basalts: 1 – clayey limestone; 2 – zeolitic clayey limestone; and 3 – glauconitic claystone.

SMEARS:

	A	B	C	D
Quartz, Feldspar	+	0- 5%	+	1%
Clay minerals	90-95%	25%	30-40%	40-50%
VOlcanic glass	+	50%	50-60%	
Opaque minrals	1%	1- 5%	1- 3%	1- 2%
Heavy minerals	1%	1- 5%	+	+
Carbonate unspec.	–	+	–	30-40%
Calcareous fossils	–	forams,	–	
Siliceous fossils	–	1- 2%	5-10%	+
Zeolites	0- 5%	?	?	–
Glauconite	0- 5%	10-15%	–	5%
Lithic fragments		+ - 5%	–	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446		43	4

Depth: 395.5 to 396.5 m

Visual Description

0-16 cm: baked green to brown clay and sandstone, hard and indurated compared to sediment higher in core.

17-97 cm: very sparsely plagioclase phyric vesicular basalt. Plagioclase phenocrysts $<1\%$, 1.0-3.0 mm long typically 0.75 x 2 mm. Aphanitic to very fine-grained groundmass with felty plagioclase laths 1.0 mm and less (acicular), randomly oriented as incipient groundmass crystallization. Alteration occurs largely in vesicles which are largely clay and pyrite filled amygdules. Amygdules 5-10%, 0.5 to 3.0 mm across. Clay minerals and pyrites often concentrically zoned in vesicles. Grain size progressively coarsens from glassy chill zone at top to fine-grained basalt at base of this section.

17-26 cm: glassy chill zone grading from baked clay microconglomerate to 1 cm of glass (partially devitrified) to aphanitic to fine-grained basalt. Glass is filled with 1 mm acicular plagioclase lathes.

Thin Section Description – 4-21 cm

Groundmass: plagioclase 35%, 0.5-2.0 mm, An_{65}, carlsbad twin; clinopyroxene 25%, 0.1-1.0 mm, clear, little color; magnetite 15%, 0.05-1.0 mm, granules and laths; other = grundage 25%, mixture of clay and cryptocrystalline material.

Alteration: clays in groundmass.

Thin Section Description – 4-81 cm

Phenocrysts: plagioclase 1%, 1-2.5 mm crystal.

Groundmass: plagioclase 30%, .05-1.0 mm, lathes; clinopyroxene 16%, .05-1.0 mm, granules and lathes; magnetite 20%, .05-1.0 mm, plates and skeletal crystals; other = grundage 33%, mixture of smectite, chlorite(?) and clay minerals and cryptocrystalline material.

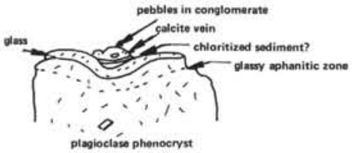
Vesicles: 7%, 0.5-4.0 mm, clay filling, round.

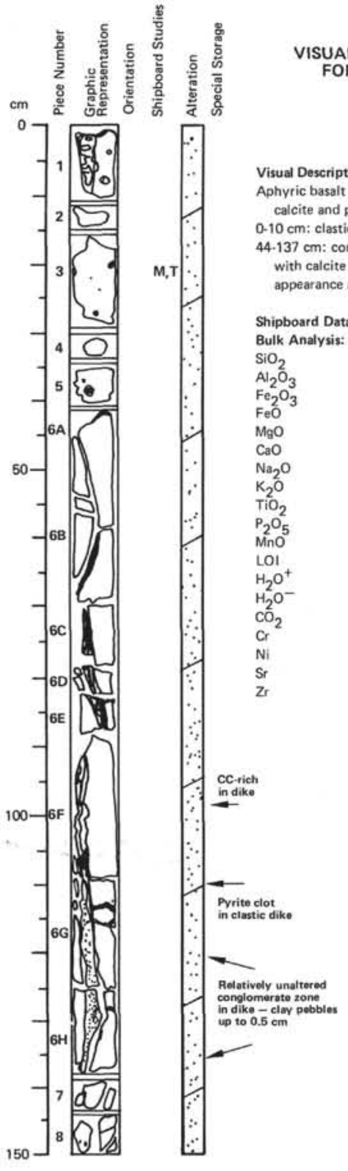
Texture: intersertal.

Alteration: clays in groundmass and vesicles.

Shipboard Data

Bulk Analysis:	**77 cm**
SiO_2	48.28
Al_2O_3	12.64
Fe_2O_3	1.62
FeO	10.72
MgO	5.95
CaO	9.81
Na_2O	2.92
K_2O	0.94
TiO_2	4.17
P_2O_5	0.52
MnO	0.24
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	124.00
Ni	77.00
Sr	396.00
Zr	296.00





VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446		44	1

Depth: 400.5 to 402.0 m

Visual Description

Aphyric basalt 0-150 cm: fine-grained, light to moderate alteration. Amygdaloidal with clay, calcite and pyrite fillings, 0 to 3% amygdules 0.5-5.0 mm.

0-10 cm: clastic dike – glauconitic clay matrix with clay fragments up to 1 cm across.

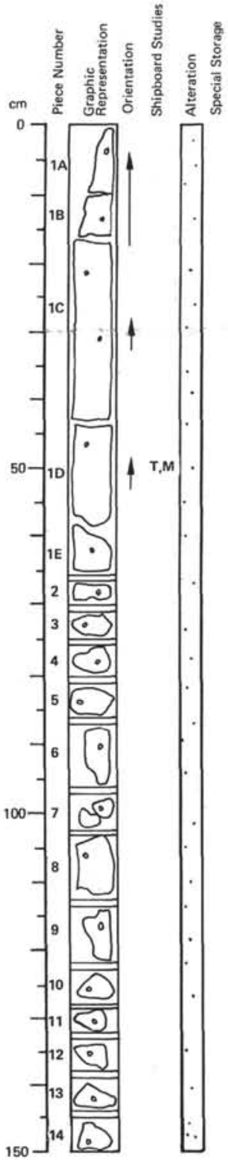
44-137 cm: continuous clastic dike. Upper portion of dike is chloritized and heavily altered with calcite replacing sediment. Lower portion has clastic breccia retaining its original appearance and texture with clay matrix.

Shipboard Data

Bulk Analysis:	**19 cm**
SiO_2	50.88
Al_2O_3	12.07
Fe_2O_3	1.57
FeO	10.37
MgO	6.12
CaO	9.40
Na_2O	3.16
K_2O	0.72
TiO_2	3.89
P_2O_5	0.43
MnO	0.21
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	122.00
Ni	73.00
Sr	359.00
Zr	275.00

Magnetic Data:	**5 cm**
Intensity (emu/cc)	793.1
Inclination before demag.	10.1
Stable Inclination	13.6

Physical Properties	**6 cm**
Porosity (%)	10.57
Wet Bulk Density	2.84
Grain Density	3.05



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446		44	2

Depth: 402.0 to 403.5 m

Visual Description

0-150 cm: basalt identical to that in Core 44, Section 1. Basalt aphyric, dark gray, fine-grained, fresh or lightly altered. About 0.5% dark spot (like crystals of pyroxene), often with pyrite, probably filled vesicles.

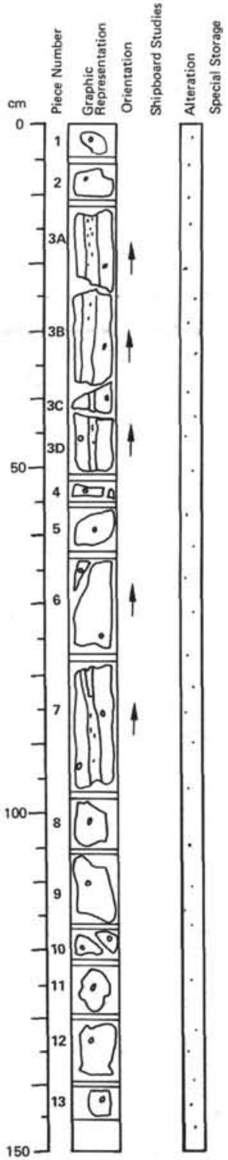
Shipboard Data

Bulk Analysis:	**53 cm**
SiO_2	52.04
Al_2O_3	12.77
Fe_2O_3	1.57
FeO	10.39
MgO	4.73
CaO	9.18
Na_2O	3.01
K_2O	0.95
TiO_2	3.86
P_2O_5	0.46
MnO	0.18
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	113.00
Ni	69.00
Sr	368.00
Zr	283.00

Magnetic Data:	**49 cm**
Intensity (emu/cc)	2004.7
Inclination before demag.	15.7
Stable Inclination	18.0

Physical Properties:	**45 cm**
$\overline{V}p$ (km/s)	5.25
Porosity (%)	4.66
Wet Bulk Density	2.90
Grain Density	2.99

Other Data:	**45 cm**
Therm. cond. (mcal/cm-s-°C)	4.47



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446		44	3

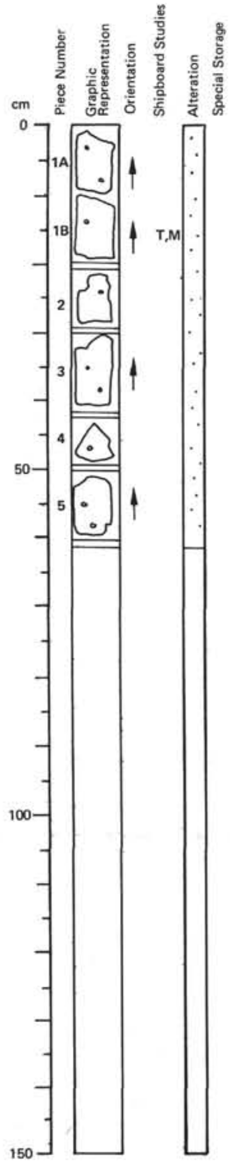
Depth: 403.5 to 405.0 m

Visual Description

0-145 cm: identical to basalt in Core 44, Section 1.

Basalt aphyric, fine-grained, dark gray, fresh or lightly altered. About 0.5% vesicles (1-2 mm up to 5 mm) with pyrite.

Pieces 3A, B, C, D, and 7: have a clastic dike-like that in Core 44, Section 1, but clastic breccia is fewer. In contact of dike is chlorite(?).



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446		44	4

Depth: 405.0 to 405.6 m

Visual Description

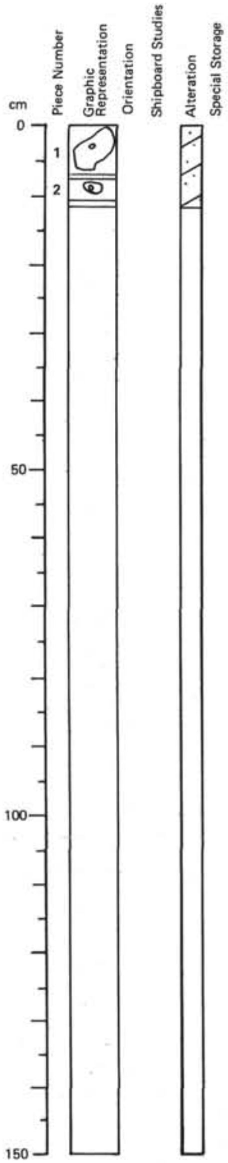
0-60 cm: identical to that (basalt) in Core 44, Section 2. Basalt aphyric, fine-grained, dark gray, fesh or lightly altered vesicles about 0.5%, filled with dark minerals and rare pyrite.

Shipboard Data

Bulk Analysis:	**56 cm**
SiO_2	50.13
Al_2O_3	12.84
Fe_2O_3	1.67
FeO	10.99
MgO	5.07
CaO	9.37
Na_2O	3.10
K_2O	0.60
TiO_2	3.95
P_2O_5	0.44
MnO	0.26
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	112.00
Ni	69.00
Sr	373.00
Zr	280.00

Magnetic Data:	**21 cm**
Intensity (emu/cc)	1084.1
Inclination before demag.	16.1
Stable Inclination	24.6

Physical Properties:	**48 cm**
$\overline{V}p$ (km/s)	5.38
Porosity (%)	4.17
Wet Bulk Density	2.96
Grain Density	3.04



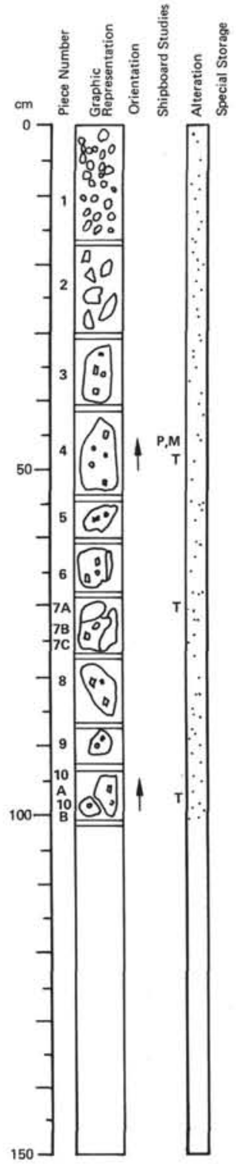
VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446		45	1

Depth: 410.0 to 410.1 m

Visual Description

0-11 cm: basalt aphyric, fine-grained, dark gray. Vesicles <0.5%, filled with calcite (size approximately 2 mm).



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446		46	1

Depth: 419.5 to 420.5 m

Visual Description

0-16 cm: drilling breccia includes sediment pebbles and small pieces of basalt (uphole contamination).

16-30 cm: drilling fragments includes fragments of basalt and mudstone (green with calcite veins similar to that in Core 43), uphole contamination.

30-100 cm: light gray, plagioclase phyric aphanitic basalt.

Plagioclase phenocrysts 10-15%, 1-3 mm (generally about 1 mm). Some phenocrysts of olivine(?) and pyroxene.

Approximately 1% vesicles lined by dark, clay minerals, carbonate, zeolite, and odd pyrite or chalcopyrite grains.

Veins and fractures in Pieces 6, 7 and 10 lined by greenish chloritic material and fine, disseminated pyrite or pyrrhotite.

Thin Section Description – 70 cm

Phenocrysts: plagioclase 0.5-2.0 mm, An_{65}; clinopyroxene 0.5-2.0 mm.

Groundmass: plagioclase 2.5 mm, acicular laths; clinopyroxene .02-.1 mm, granules; magnetite 10%, .01-.1 mm, granules and plates.

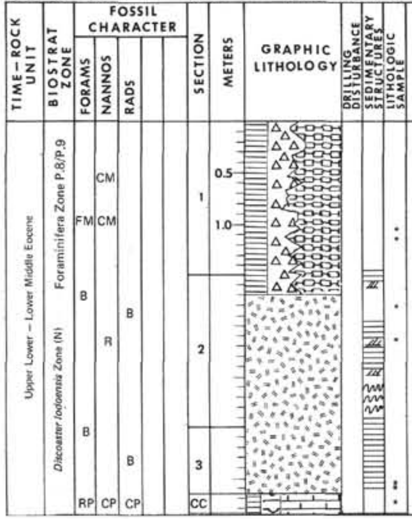
Texture: intersertal.

Shipboard Data

Bulk Analysis:	**49 cm**
SiO_2	48.61
Al_2O_3	13.04
Fe_2O_3	1.62
FeO	10.72
MgO	5.85
CaO	9.86
Na_2O	2.78
K_2O	0.58
TiO_2	4.01
P_2O_5	0.47
MnO	0.17
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	53.00
Ni	40.00
Sr	424.00
Zr	290.00

Magnetic Data:	**47 cm**
Intensity (emu/cc)	1209.3
Inclination before demag.	–49.1
Stable Inclination	–51.3

SITE 446 HOLE A CORE 1 CORED INTERVAL: 372.0-381.5 m



LITHOLOGIC DESCRIPTION

5BG 4/1

2.5Y N4

5G 5/2
2.5Y N4

2.5Y N5

5B 6/1

5G 5/1

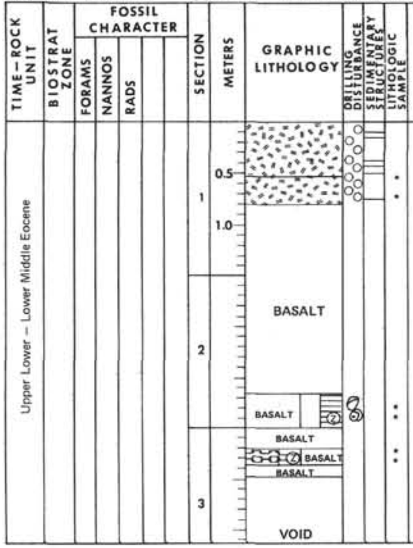
Dominant Lithologies:
(A) Clayey Chalk: interbedded dark greenish gray (5BG 4/1), grayish green (5G 5/2), and dark gray, with color bands 3-7 cm.

(B) Altered Volcanic Ash: dark gray (2.5YN 5/1) to bluish gray (5B 6/1) **Altered Volcanic Ash** in fining upward sequence.

SMEARS:

	A	B
Quartz, Feldspar	1- 3%	1- 2%
Clay minerals	20-25%	5-10%
Volcanic glass	0-+ %	75-88%
Opaque minerals	1- 2%	1- 2%
Carbonate unspecified	40-70%	–
Nannofossils	15-20%	–
Siliceous fossils	2-10%	1- 5%
Glauconite	1- 2%	1- 2%
Zeolite	1- 5%	0- 5%

SITE 446 HOLE A CORE 2 CORED INTERVAL: 381.5-391.0 m



LITHOLOGIC DESCRIPTION

5G 4/1

N4

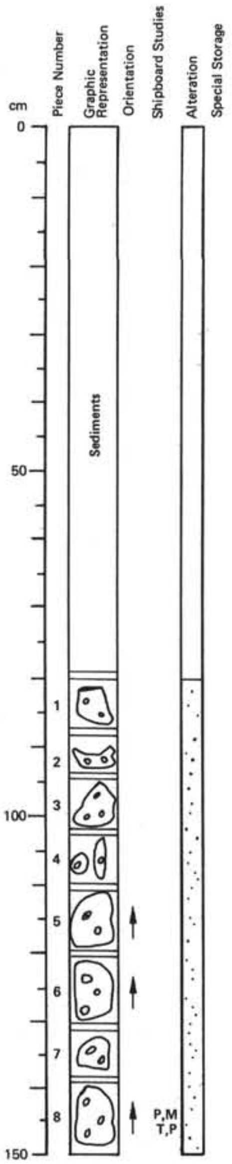
Dominant Lithology:
(A) Altered Volcanic Ash/Clayey Altered-Volcanic Ash: dark greenish gray (5G 4/1) faintly laminated, to dark gray (N4) massive; intensely fractured and brecciated by drilling.

Minor Lithologies:
(B) Zeolitic Clay: light green to light gray incrustations on basalt, or fillings in fractures in basalt.
(C) Clayey Limestone/Chalk: greenish gray or grayish green chunks, or incrustations on basalt.

Remarks: No evidence for baking in sediments overlying basalts.

SMEARS:

	A	B	C
Quartz, Feldspar	TR	3-10%	1%
Clay minerals	2-20%	40-50%	20-30%
Volcanic glass	67-97%		–
Heavy minerals	+ - 2%	1%	1- 2%
Opaque minerals	TR	3%	1- 3%
Glauconite	–	+	+ - 1%
Manganese		+ - 2%	0- 2%
Calcareous fossils }	–	Nannos +	+
Carbonate unspecified }			65-75%
Zeolites	–		+



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	2	1

Depth: 381.5 to 383.0 m

Visual Description

0-8 cm: altered ash (sediment).

80-150 cm: gray, aphyric, fine-grained vesicular basalt.

Vesicles: 5-10% <1 mm, 2-10% 1 mm-10 mm, lined by pyrite, calcite and zeolites. Some larger vesicles are pipe vesicles.

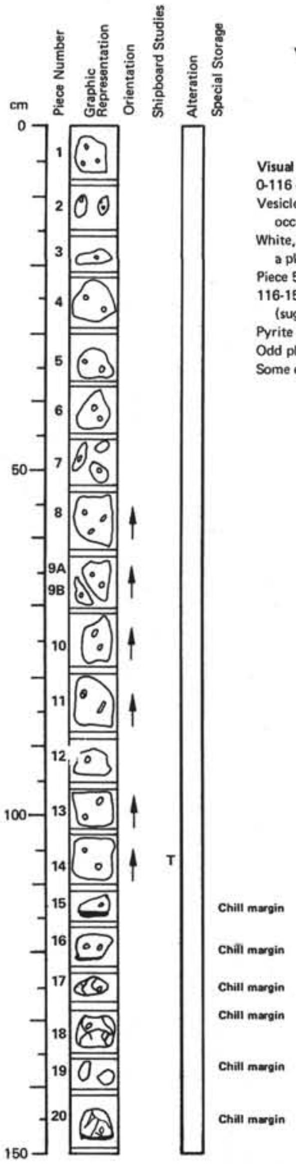
Piece 1, 80-87 cm: shows glassy margin and chill zone (about 1 cm thick).

Piece 5, 111-119 cm: partially covered by carbonate-clay vein material; also on one side of Piece 7 (122-127 cm). Vesicle-poor zone at top of piece. May be slightly finer grained.

Shipboard Data

Magnetic Data:	**145 cm**
Intensity (emu/cc)	348.7
Inclination before demag.	–35.6
Stable Inclination	–25.7

Physical Properties:	**145 cm**
$\overline{V}p$ (km/s)	4.46
Porosity (%)	13.40
Wet Bulk Density	2.70
Grain Density	2.96



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	2	2

Depth: 383.0 to 384.5 m

Visual Description

0-116 cm: gray, aphyric, fine-grained vesicular basalt, similar to last section.

Vesicles: 5-15% <1 mm, 2-15% 1 mm-5 mm, lined by carbonate, pyrite, zeolites, and occasionally a whitish green clay (smectite).

White, fine laths of plagioclase are visible in hand specimen and under binocular microscope a platy brown mineral.

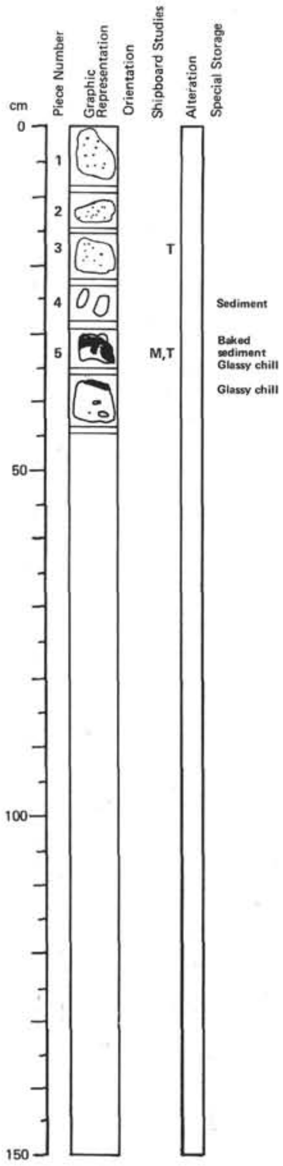
Piece 5, 111-116 cm: chill zone and glassy margin.

116-150 cm: aphanitic, gray, basalt. Many glassy zones and sediment infilled fractures (suggests sub-sediment pillows). Vesicles <1% <1 mm.

Pyrite and carbonate lining.

Odd plagioclase phenocryst.

Some carbonate veins.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	2	3

Depth: 384.5 to 384.95 m

Visual Description

0-21 cm: very fresh highly vesicular gray basalt, aphyric, approximately 25% vesicles. A little calcite in some vesicles.

23-78 cm: two lumps of hard indurated baked sediment. Green, glauconitic.

30-36 cm: glassy chill zone with baked ash on contact and filling veins , criss-crossing chill margin.

36-45 cm: aphyric vesicular basalt 10% fine approximately .1 to .5 mm vesicles in upper half, partially filled with calcite, 3-4 vugs up to 5 mm in lower half have calcite crystals in cavities.

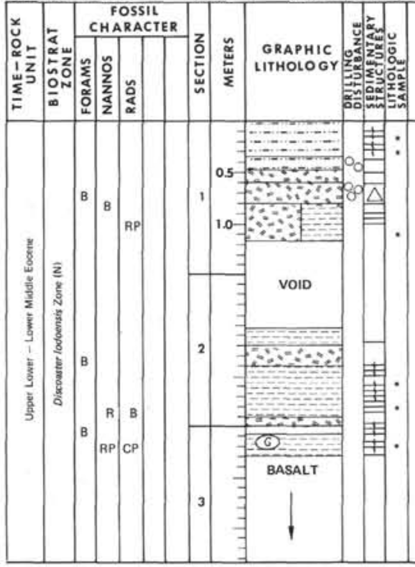
May be pillows but baked sediment suggests intrusion under sediment cover.

Shipboard Data

Magnetic Data:	**41 cm**
Intensity (emu/cc)	5234.3
Inclination before demag.	−24.1
Stable Inclination	−25.2

Physical Properties:	**41 cm**
$\bar{V}p$ (km/s)	4.44
Porosity (%)	15.76
Wet Bulk Density	2.70
Grain Density	3.01

SITE 446 HOLE A CORE 3 CORED INTERVAL: 391.0-400.5 m



LITHOLOGIC DESCRIPTION

N4, +5GY 4/1
and 5B 4/1
5BG 4/1
2.5Y N3
2.5Y N3
5B 4/1
5GY 4/1
N4

5GY 4/1 with
5GY 6/1 and 5B 4/1

N4 to 2.5Y N3

N4 to 5BG 4/1
and 5B 4/1

N4 to 2.5Y N3

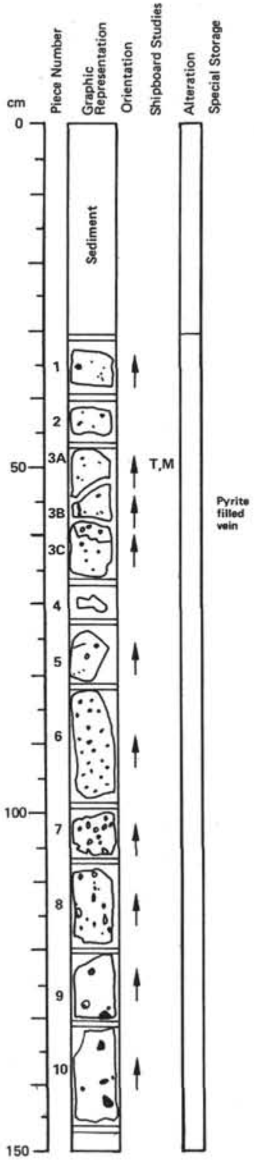
2.5Y N3 with
5B 4/1 +?

Dominant Lithologies:
(A) Mudstone and Claystone, dark greenish gray, dark gray, to dark bluish gray and greenish blue; mild bioturbation; faintly laminated with irregularly spaced 1 mm laminae in Sections 1 and 2. In Section 3 broader **(Calcareous Claystone)** color bands; higher **Calcareous** content; glauconitic. No evidence of baking above basalt.

(B) Volcanic Ash, dark gray to black, massive, no sedimentary structures.

SMEARS:

	A		B
Quartz, Feldspar	3- 5%	3%	5-10%
Clay minerals	73-86%	68%	7-30%
Volcanic glass	0- 1%	–	50-80%
Opaque minerals	2- 5%	5%	2- 5%
Heavy minerals	–	–	
Carbonate unspecified	2- 5%	20%	+ forams?
Siliceous fossils	1- 5%	–	0- 5%
Manganese	1- 2%	2%	1- 2%
Zeolites	1%	1%	+ - 1%
Glauconite	5-10%	5%	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	3	3

Depth: 392.6 to 394.0 m

Visual Description

Fine- to medium-grained aphyric basalt.

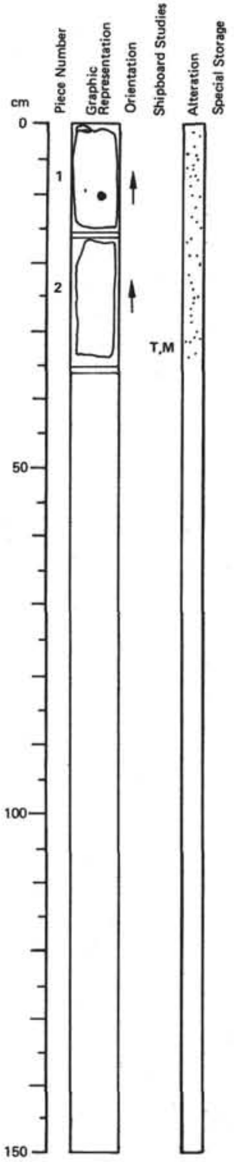
Vesicles 3-10%, from 0.5-7.0 mm approximately 50% of which are filled with clay, calcite, pyrrhotite.

No phenocrysts. A few veins filled with clay/chlorite and pyrrhotite or pyrite.

Shipboard Data

Magnetic Data:	**50 cm**
Intensity (emu/cc)	744.9
Inclination before demag.	−4.6
Stable Inclination	5.2

Physical Properties:	**50 cm**
$\overline{V}$p (km/s)	4.84
Porosity (%)	13.56
Wet Bulk Density	2.82
Grain Density	3.10



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	3	4

Depth: 394.0 to 394.4 m

Visual Description

Aphyric gray basalt.

Amygdules 1%, filled with calcite and clay.

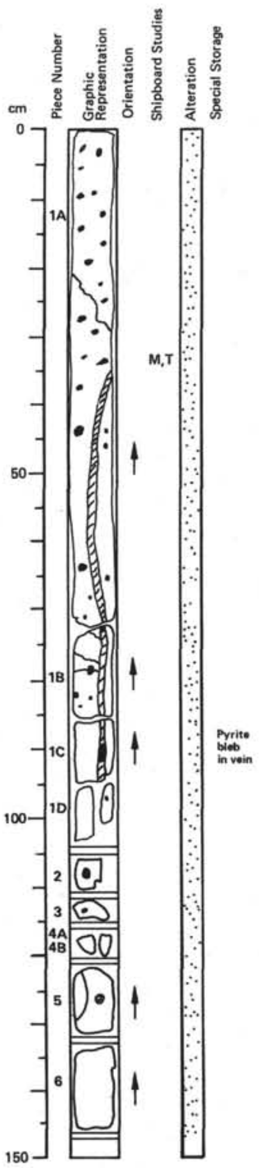
Massive, light alteration.

Shipboard Data

Bulk Analysis:	**33 cm**
SiO_2	51.91
Al_2O_3	12.64
Fe_2O_3	1.64
FeO	10.80
MgO	5.07
CaO	8.98
Na_2O	2.84
K_2O	0.93
TiO_2	3.74
P_2O_5	0.45
MnO	0.19
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	115.00
Ni	72.00
Sr	359.00
Zr	271.00

Magnetic Data:	**34 cm**
Intensity (emu/cc)	81.6
Inclination before demag.	2.3
Stable Inclination	13.5

Physical Properties:	**34 cm**
$\overline{V}$p (km/s)	5.49
Porosity (%)	3.73
Wet Bulk Density	2.97
Grain Density	3.05



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	4	1

Depth: 400.5 to 402.0 m

Visual Description

Aphyric gray amygdaloidal basalt, 0-12% amygdules with clay, calcite and pyrite fillings 0.5-8.0 mm across; 12% at top of section, none at bottom.

35-95 cm: 3-5 mm thick vein filled with clay, carbonate, pyrite, and quartz. Some zeolites may also be present.

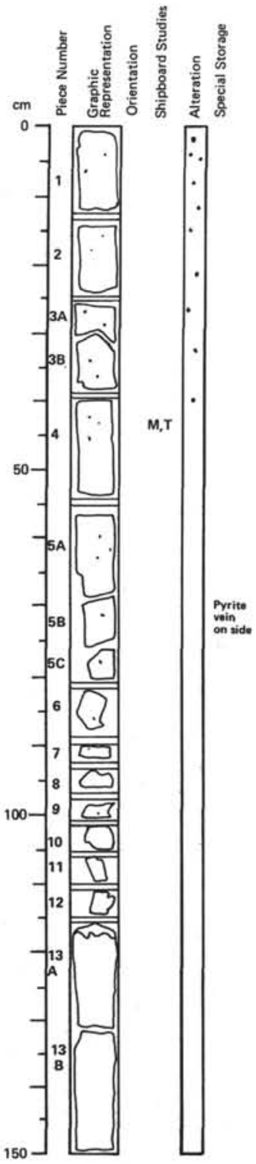
Shipboard Data

Bulk Analysis:	**39 cm**	**139 cm**
SiO_2	51.89	51.93
Al_2O_3	12.71	12.72
Fe_2O_3	1.64	1.62
FeO	10.81	10.70
MgO	4.96	5.10
CaO	9.09	9.18
Na_2O	2.90	2.95
K_2O	0.90	0.89
TiO_2	3.89	3.82
P_2O_5	0.44	0.48
MnO	0.17	0.21
LOI	—	—
H_2O^+	—	—
H_2O^-	—	—
CO_2	—	—
Cr	105.00	111.00
Ni	67.00	62.00
Sr	365.00	361.00
Zr	275.00	279.00

Magnetic Data:	**32 cm**
Intensity (emu/cc)	668.0
Inclination before demag.	7.1
Stable Inclination	15.5

Physical Properties:	**32 cm**
$\overline{V}p$ (km/s)	5.26
Porosity (%)	5.26
Wet Bulk Density	2.90
Grain Density	3.01

Other Data:	**32 cm**
Therm. cond. (mcal/cm-s-°C)	4.16



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	4	2

Depth: 402.0 to 403.4 m

Visual Description

Aphyric gray massive basalt.

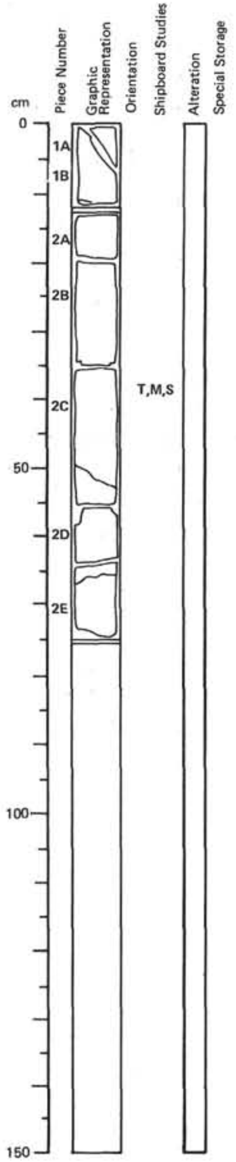
Clay filled amygdules 0-3%, fine-grained. Same as last section.

Pyrite vein fragment adhering to Piece 5B. Fresh.

Shipboard Data

Magnetic Data:	**44 cm**
Intensity (emu/cc)	399.2
Inclination before demag.	5.4
Stable Inclination	23.1

Physical Properties:	**44 cm**
$\overline{V}p$ (km/s)	5.89
Porosity (%)	2.76
Wet Bulk Density	2.92
Grain Density	2.98



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	4	3

Depth: 403.5 to 404.2 m

Visual Description

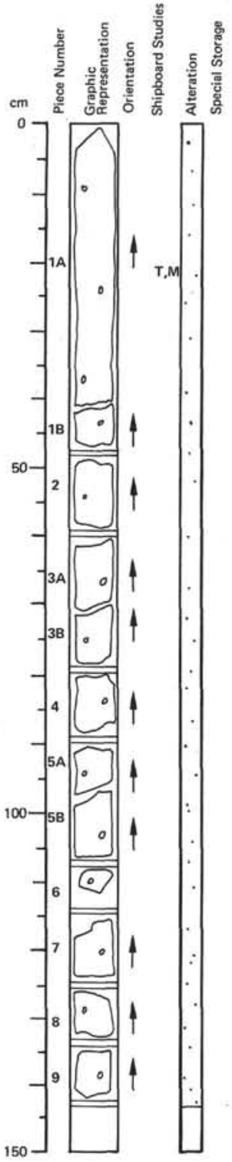
Aphyric gray basalt, 1-2% clay-filled vesicles, fresh, fine-grained, with a few clay and carbonate filled veins.

Shipboard Data

Magnetic Data:	**43 cm**
Intensity (emu/cc)	1157.0
Inclination before demag.	14.2
Stable Inclination	17.6

Physical Properties:	**43 cm**
$\bar{V}$p (km/s)	5.55
Porosity (%)	2.36
Wet Bulk Density	3.02
Grain Density	3.05

Other Data:	**43 cm**
Therm. cond. (mcal/cm-s-° C)	4.21



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	5	1

Depth: 405.5 to 407.0 m

Visual Description

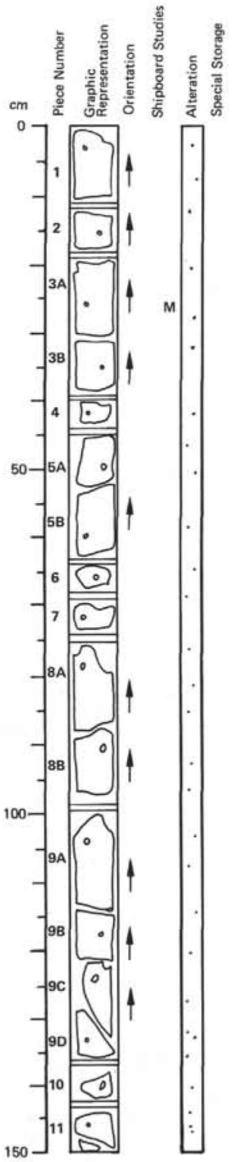
0-142 cm: basalt identical to that in Core 4, Section 3.
Basalt aphyric, fine-grained, dark gray, lightly vesicular.
Vesicles < 1%, filled with clay and aggregates of dark minerals.

Shipboard Data

Magnetic Data:	**16 cm**
Intensity (emu/cc)	550.7
Inclination before demag.	9.0
Stable Inclination	21.2

Physical Properties:	**16 cm**
$\bar{V}$p (km/s)	5.74
Porosity (%)	2.73
Wet Bulk Density	2.99
Grain Density	3.05

Other Data:	**16 cm**
Therm. cond. (mcal/cm-s-° C)	4.23



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 8	4 4 6	A	5	2

Depth: 407.0 to 408.4 m

Visual Description

0-150 cm: basalt identical to that in Core 5, Section 1, but coarser grained.
Aphyric, dark gray, vesicles, < 1%, filled with calcite and aggregate of dark minerals.
Between Pieces 9C and 9D a chlorite vein occurs with pyrite.

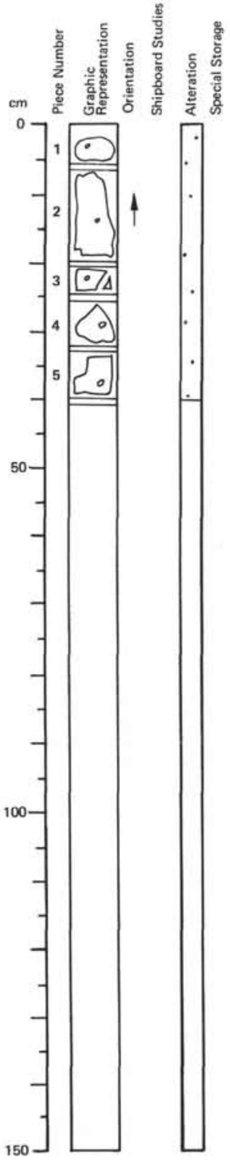
Shipboard Data

Bulk Analysis:	**26 cm**
SiO_2	50.74
Al_2O_3	13.00
Fe_2O_3	1.64
FeO	10.84
MgO	3.41
CaO	9.48
Na_2O	3.01
K_2O	0.63
TiO_2	3.78
P_2O_5	0.50
MnO	0.22
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	114.00
Ni	65.00
Sr	375.00
Zr	269.00

Magnetic Data:	**24 cm**
Intensity (emu/cc)	590.1
Inclination before demag.	−2.1
Stable Inclination	17.6

Physical Properties:	**24 cm**
$\overline{V}p$ (km/s)	5.59
Porosity (%)	3.34
Wet Bulk Density	3.03
Grain Density	3.10

Other Data:	**24 cm**
Therm. cond. (mcal/cm-s-°C)	4.24



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

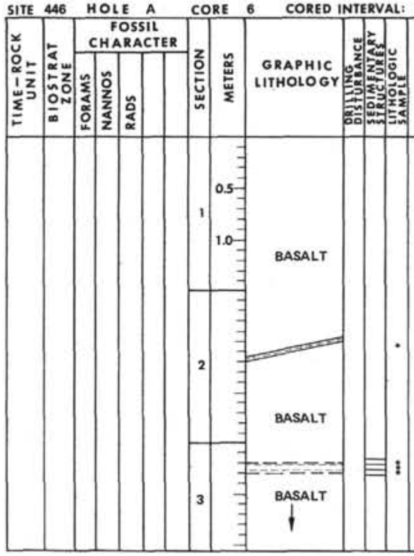
LEG	SITE	HOLE	CORE	SECT.
5 8	4 4 6	A	5	3

DEPTH: 408.4 to 409.0 m

Visual Description

0-40 cm: basalt identical to that in Core 5, Section 2 (coarser grained than in Core 5, Section 1).
Aphyric, dark gray, vesicles < 1% (1 mm and less), filled with calcite and dark minerals(?).

SITE 446 HOLE A CORE 6 CORED INTERVAL: 410.0-419.5 m



LITHOLOGIC DESCRIPTION

Basalt/Claystones

Section 2– greenish gray (5G 5/1), **Calcareous Claystone** on basalt.

Section 3 – laminated **Claystone**, dark greenish gray (5G 4/1), greenish gray (5G 6/1), and greenish gray (5G 5/1).

SMEARS:
2-70 (Calcareous Claystone)

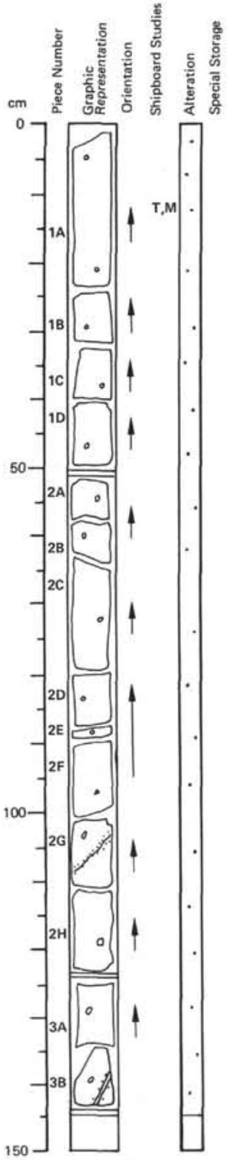
Sand	<1%	Feldspar	1%
Silt	< 1%	Heavy minerals	1%
Clay	98%	Clay minerals	93%
		Carbonate unspecified	5%

SMEARS:
3-25 (Claystones)
Feldspar 5%, Clay minerals 75%, Zeolites 20%

3-25 (Claystones)
Feldspar 15%, Clay minerals 75-80%, Zeolites 5-10%

3-25 (Claystones)
Feldspar 20%, Clay minerals 80%

(Note: all have rare heavy minerals).



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	6	1

Depth: 410.0 to 411.4 m

Visual Description

0-142 cm: basalt, aphyric fine-grained, dark gray. Vesicles < 1%, < 2 mm filled with calcite and chlorite(?).

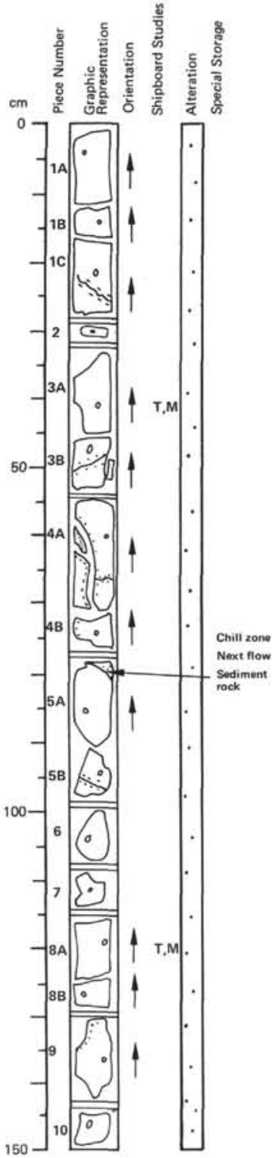
0-20 cm: basalt coarser grained,similar to Core 5, Section 3.

Shipboard Data

Magnetic Data:	**10 cm**
Intensity (emu/cc)	474.4
Inclination before demag.	−17.8
Stable Inclination	3.6

Physical Properties:	**10 cm**
$\overline{V}$p (km/s)	5.84
Porosity (%)	4.38
Wet Bulk Density	3.00
Grain Density	3.09

Other Data:	**10 cm**
Therm. cond. (mcal/cm-s-° C)	4.23



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	6	2

Depth: 411.4 to 413.0 m

Visual Description

0-78 cm: basalt identical to that described at the base of Core 6, Section 1. Basalt aphyric, fine-grained, dark gray, vesicular. Vesicles < 1%, < 2 mm, filled with calcite and chlorite.

78-150 cm: next lava flow.

78-90 cm: chill zone of basalt. Basalt close to aphanitic, dark gray, vesicular. Vesicles about 1%, < 2 mm, filled with calcite, chlorite and pyrite.

In Pieces 1C, 3B, 4A, 4B, 5B, 9 are veins with calcite, chlorite and pyrite.

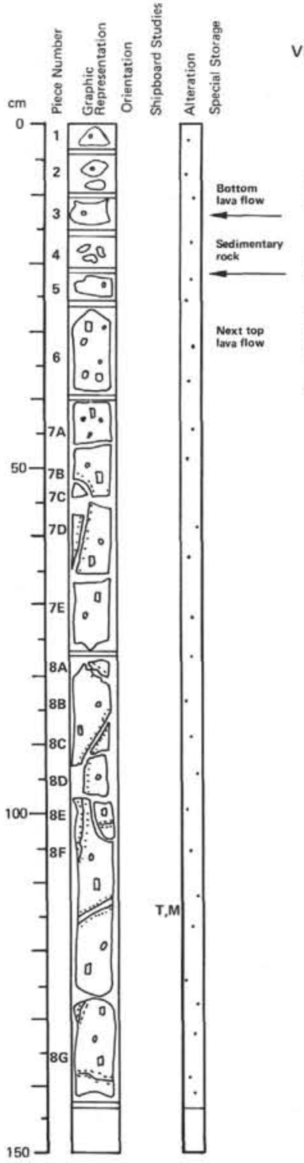
Shipboard Data

Bulk Analysis:	**34 cm**
SiO_2	52.55
Al_2O_3	12.98
Fe_2O_3	1.62
FeO	10.68
MgO	4.83
CaO	8.94
Na_2O	2.94
K_2O	1.03
TiO_2	3.77
P_2O_5	0.46
MnO	0.17
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	115.00
Ni	69.00
Sr	357.00
Zr	277.00

Magnetic Data:	**38 cm**	**118 cm**
Intensity (emu/cc)	970.4	2917.3
Inclination before demag.	10.6	−5.2
Stable Inclination	16.0	1.7

Physical Properties:	**119 cm**	**38 cm**
$\overline{V}$p (km/s)	—	5.58
Porosity (%)	13.23	3.36
Wet Bulk Density	2.87	3.02
Grain Density	3.15	3.08

Other Data:	**3 cm**
Therm. cond. (mcal/cm-s-° C)	4.46



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 8	4 4 6	A	6	3

Depth: 413.0 to 414.4 m

Visual Description

0-15 cm: basalt identical to that described at the base of Core 6, Section 2. Basalt aphyric, fine-grained, dark gray. Vesicles 1%, <2 mm, filled with calcite and chlorite.

15-25 cm: sedimentary rock.

27-142 cm: next lava flow. Basalt phyric, fine-grained, (27-40 cm to aphanitic), dark gray, vesicular. Phenocrysts of plagioclase 5%, 2-5 mm.

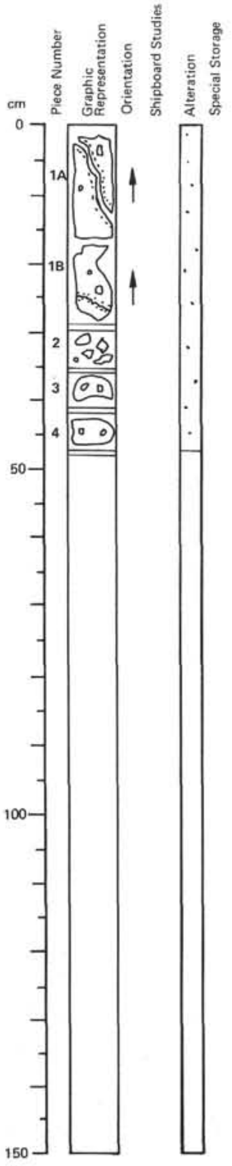
17-54 cm: vesicles 3-5%, <3 mm (one up to 5 mm).

54-142 cm: vesicles 1%, <2 mm. Vesicles filled with calcite and chlorite, and pyrite.

Calcite vein (Pieces 7B, 7D, 8A thru 8G) with chlorite and pyrite.

Shipboard Data

Magnetic Data:	**109 cm**	
Intensity (emu/cc)	154.7	
Inclination before demag.	–44.3	
Stable Inclination	–43.1	
Physical Properties	**109 cm**	
$\overline{V}p$ (km/s)	4.88	
Porosity (%)	16.96	
Wet Bulk Density	2.64	
Grain Density	2.97	
Other Data:	**71 cm**	**115 cm**
Therm. cond. (mcal/cm-s-°C)	3.23	3.70



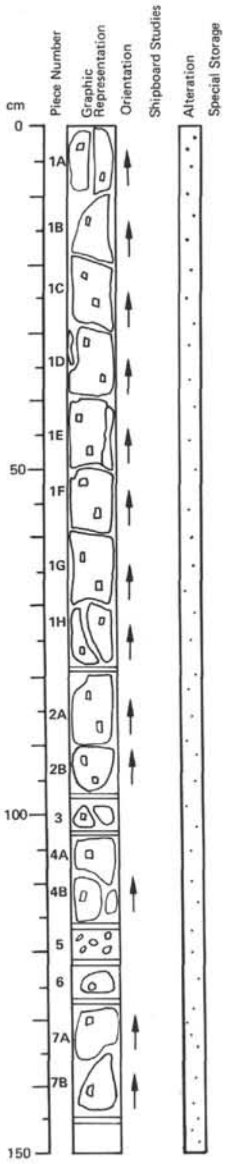
VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 8	4 4 6	A	6	4

Depth: 414.4 to 415.0 m

Visual Description

0-47 cm: basalt identical to that described for Core 6, Section 3. Basalt phyric, fine-grained, dark gray, vesicular. Plagioclase phenocrysts 5%, 2 mm. Vesicles <1%, filled with chlorite.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	7	1

Depth: 419.5 to 421.0 m

Visual Description

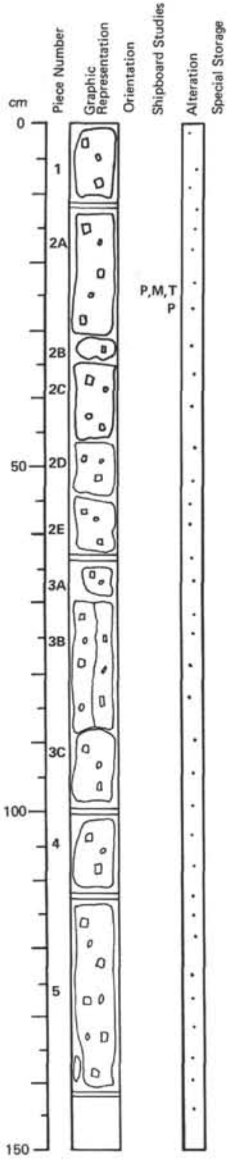
Gray, *fine-grained plagioclase, olivine(?), phyric massive basalt. Odd olivine(?), phenocryst* (approximately 1 mm), 3% plagioclase phenocrysts (2-4 mm). Odd pyroxene phenocryst (dark, acicular, 1-2 mm). Vesicles 3% (0.5-1 mm) lined or filled by dark clay material, carbonate and zeolites.

Piece 7A (128-136 cm): increase in number of vesicles to 5% (0.5-2 mm). Chloritic vein and fractures lined with pyrite throughout.

Piece 1 and Piece 3: similar to end of last core.

Shipboard Data

Bulk Analysis:	**48 cm**
SiO_2	52.18
Al_2O_3	12.16
Fe_2O_3	1.62
FeO	10.72
MgO	6.01
CaO	8.15
Na_2O	2.77
K_2O	0.96
TiO_2	3.65
P_2O_5	0.38
MnO	0.14
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	46.00
Ni	34.00
Sr	377.00
Zr	258.00



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	7	2

Depth: 421.0 to 422.4 m

Visual Description

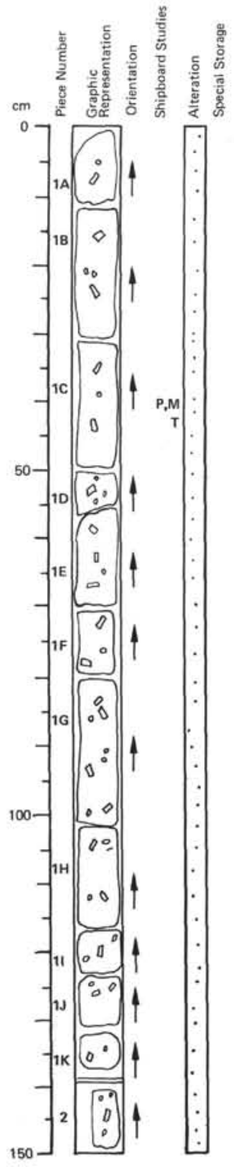
Gray, fine-grained, massive plagioclase phyric basalt. Plagioclase phenocrysts 5% (2-4 mm).
Vesicles 2-6% usually filled by dark clay, zeolites and carbonates (generally 0.5-2 mm).
Some clayey alteration zones around some larger vesicles.
Veins and fractures lined by clay/chloritic material and weathered pyrite or chalcopyrite(?).
55-75 cm: more large vesicles (6% up to 4 mm actoss).
Similar to previous section.

Shipboard Data

Magnetic Data:	**24 cm**
Intensity (emu/cc)	447.5
Inclination before demag.	–43.7
Stable Inclination	–39.2

Physical Properties:	**23 cm**
$\overline{V}p$ (km/s)	4.63
Porosity (%)	13.92
Wet Bulk Density	2.74
Grain Density	3.02

Other Data:	**23 cm**
Therm. cond. (mcal/cm-s-° C)	4.128



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	7	3

Depth: 422.4 to 423.9 m

Visual Description

Gray, fine-grained, massive, plagioclase phyric basalt. Plagioclase phenocrysts 5% (2-4 mm). Vesicles 2-6% (0.5-2 mm), lined by dark clay, carbonate and zeolites.

Chloritic/clayey lining to fracture surface on Piece 2 (140-150 cm).

Similar to previous section.

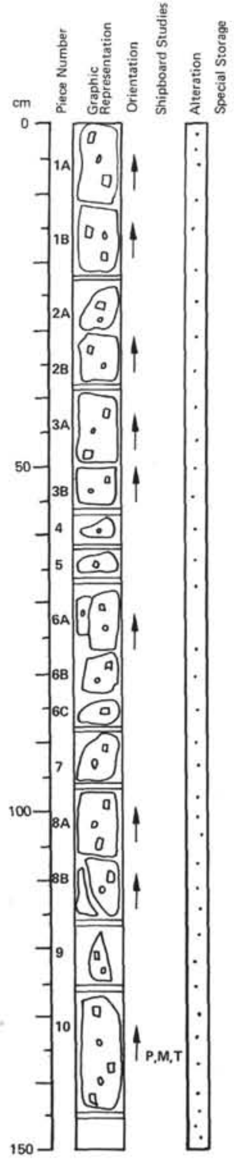
Shipboard Data

Bulk Analysis:	**97 cm**
SiO_2	52.08
Al_2O_3	12.58
Fe_2O_3	1.54
FeO	10.17
MgO	5.32
CaO	8.98
Na_2O	2.86
K_2O	0.90
TiO_2	3.80
P_2O_5	0.45
MnO	0.15
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	54.00
Ni	41.00
Sr	398.00
Zr	270.00

Magnetic Data:	**38 cm**
Intensity (emu/cc)	672.6
Inclination before demag.	–39.5
Stable Inclination	–45.3

Physical Properties:	**38 cm**
$\overline{V}p$ (km/s)	4.72
Porosity (%)	15.49
Wet Bulk Density	2.80
Grain Density	3.13

Other Data:	**38 cm**
Therm. cond. (mcal/cm-s-°C)	3.81



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	7	4

Depth: 423.9 to 425.3 m

Visual Description

Gray, fine-grained, massive, plagioclase phyric basalt. Plagioclase phenocrysts 5% (2-4 mm). Vesicles 2-6% (0.5-2 mm) lined by dark clay, carbonate and zeolites. Whitish green clay lining to fracture surfaces, some chalcopyrite.

66-80 cm: Pieces 6A and 6B thicker vein (3 mm across) filled by zeolite(?).

Large cluster of chalcopyrite on Piece 1A (5-6 cm).

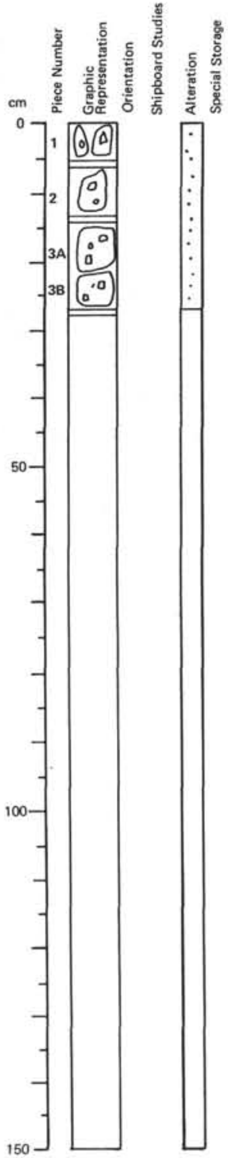
Similar to previous section.

Shipboard Data

Magnetic Data:	**138 cm**
Intensity (emu/cc)	833.8
Inclination before demag.	–48.8
Stable Inclination	–49.1

Physical Properties:	**75 cm**	**138 cm**
$\overline{V}p$ (km/s)	—	4.69
Porosity (%)	8.77	
Wet Bulk Density	2.83	—
Grain Density	3.01	—

Other Data	**138 cm**
Therm. conJ. (mcal/cm-s-°C)	3.95



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE			SECT.	
5	8	4	4	6	A			7		5

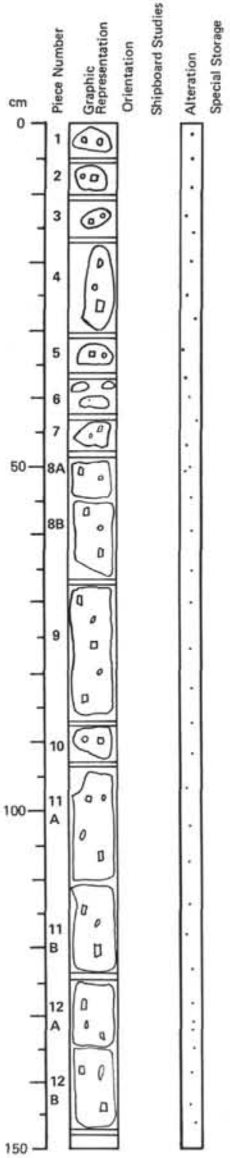
Depth: 425.3 to 425.6 m

Visual Description

Gray, fine-grained, massive, plagioclase phyric basalt. Plagioclase phenocrysts 5% (2-4 mm). Vesicles 2% (0.5-1 mm), lined by dark clay, carbonate.

Greenish chloritic lining to fracture in Piece 1. Olive greenish fracture lining with pyrite on Pieces 3A and 3B.

Simlar to previous section.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE			SECT.	
5	8	4	4	6	A			8		1

Depth: 429.0 to 430.5 m

Visual Description

Gray, massive, fine-grained, plagioclase phyric basalt. Plagioclase phenocrysts 5% (2-4 mm). Vesicles lined by dark brown clay and carbonate. Vesicles 1-5% (0.5-2 mm).

Fractures lined by whitish green clay.

Occasional larger pyroxene around plagioclase laths observed under binocular microscope.

Similar to previous core.

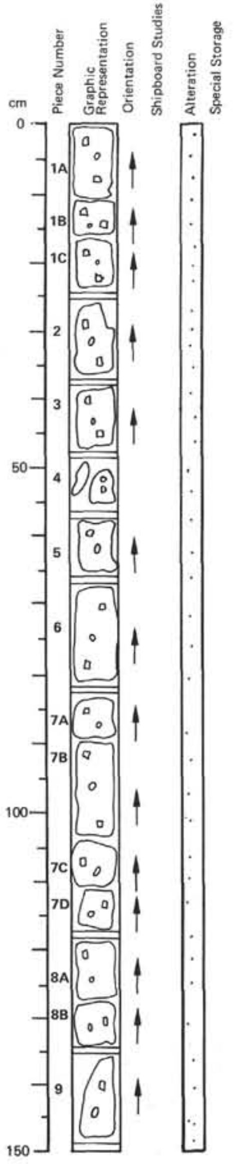
Pieces 1, 2, 3, and 5 are finer grained but may be due to uphole contamination (from top of unit).

Shipboard Data

Bulk Analysis:	**66 cm**
SiO_2	52.56
Al_2O_3	12.67
Fe_2O_3	1.53
FeO	10.07
MgO	5.38
CaO	8.74
Na_2O	3.21
K_2O	0.71
TiO_2	3,55
P_2O_5	0.44
MnO	0.15
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	81.00
Ni	46.00
Sr	388.00
Zr	258.00

Magnetic Data:	**75 cm**
Intensity (emu/cc)	820.5
Inclination before demag.	–40.9
Stable Inclination	–44.5

Physical Properties:	**74 cm**
$\bar{V}$p (km/s)	4.42
Porosity (%)	13.02
Wet Bulk Density	2.74
Grain Density	3.00



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE			CORE		SECT.
5	8	4	4	6	A			8		2

Depth: 430.5 to 432.0 m

Visual Description

Gray, massive, fine- to medium-grained plagioclase phyric basalt.

Vesicles lined by dark brown clay and carbonate (in upper part of section).

Vesicles 2-5% (0.5-3 mm). Plagioclase phenocrysts 5% (2-4 mm).

Olive greenish clay lining to fracture surfaces on Pieces 7D and 9.

In Pieces 7C and 8A square section of dark clay aggregates = replacement of early phenocryst(?) or plagioclase(?).

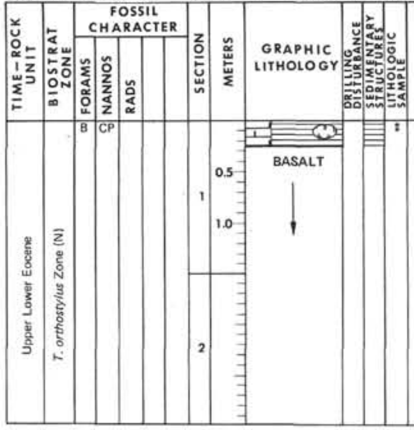
Odd grain of pyrite on some dark fracture surfaces (through section).

Shipboard Data

Magnetic Data:	**72 cm**
Intensity (emu/cc)	466.2
Inclination before demag.	–48.8
Stable Inclination	–45.1

Physical Properties:	**72 cm**
$\overline{V}$p (km/s)	4.95
Porosity (%)	8.75
Wet Bulk Density	2.82
Grain Density	2.99

SITE 446 HOLE A CORE 9 CORED INTERVAL: 438.5-448.0 m

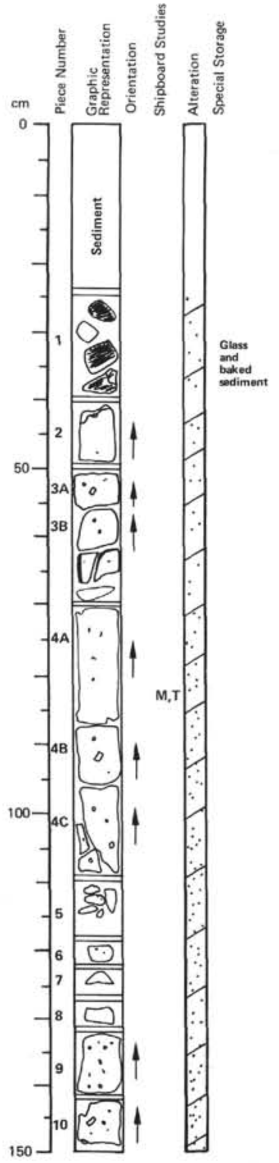


LITHOLOGIC DESCRIPTION

Calcareous Mudstone, greenish gray (5BG 5/1) calcareous mudstone with **Altered Volcanic Ash** (dark gray colored); laminated, with microfaults. 18-22 cm interval is the same **Calcareous Mudstone** baked by basalt intrusion.

SMEARS:

	1-10	1-17
Quartz, Feldspar	1- 3%	1%
Clay minerals	65-75%	60%
Volcanic glass	–	30%
Opaque minerals, Heavy minerals	+1%	1%
Micronodules	2- 3%	1%
Carbonate unspecified (including nannofossils)	20-25%	+ with forams.
Siliceous fossils	1%	–
Glauconite	2- 3%	3%



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	9	1

Depth: 438.5 to 440.0 m

Visual Description

0-24 cm: gray to green mudstones. Very indurated near basalt with color change to white and brick red in last 6-7 cm.

25-40 cm: assorted fragments of glassy aphanitic basalt and baked sediment. Sediment is white to green and is baked onto the glassy basalt.

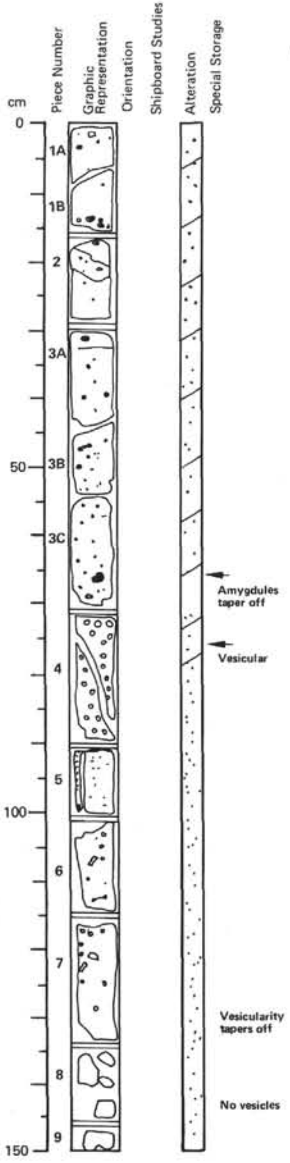
41-150 cm: very sparsely plagioclase phyric gray massive basalt. Grades down section from aphanitic to fine-grained basalt. About 3%, 0.5-3.0 mm calcite and clay filled amygdules. Plagioclase phenocrysts <1%, approximately 1 x 2 mm.

Shipboard Data

Bulk Analysis:	**79 cm**
SiO_2	51.93
Al_2O_3	11.78
Fe_2O_3	1.56
FeO	10.30
MgO	5.08
CaO	9.32
Na_2O	2.83
K_2O	1.01
TiO_2	3.60
P_2O_5	0.46
MnO	0.23
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	39.00
Ni	33.00
Sr	390.00
Zr	286.00

Magnetic Data:	**82 cm**
Intensity (emu/cc)	619.8
Inclination before demag.	−53.8
Stable Inclination	−53.2

Physical Properties:	**82 cm**
$\overline{V}p$ (km/s)	4.64



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	9	2

Depth: 440.0 to 441.5 m

Visual Description

0-150 cm: sparsely plagioclase phyric basalt, vesicles 1-10%.

0-70 cm: amygduloidal with calcite and clay fillings 0.5-<1 mm.

70-150 cm: vesicular 0.1-2.0 mm

Phenocrysts 3.0 x 2.0 mm to 1 x .5 mm, <1%, but slightly more abundant than in Section 1.

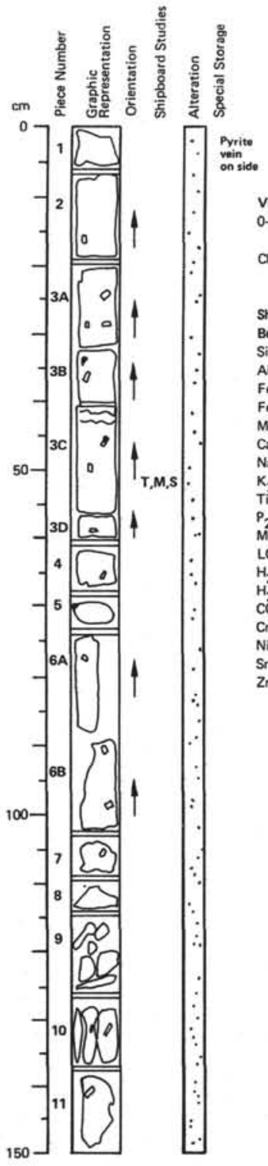
Ranges from fine-grained to fine to medium at end of section.

Shipboard Data

Bulk Analysis:	**120 cm**
SiO_2	52.23
Al_2O_3	12.47
Fe_2O_3	1.54
FeO	10.16
MgO	5.32
CaO	8.26
Na_2O	3.09
K_2O	1.04
TiO_2	4.03
P_2O_5	0.53
MnO	0.20
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	40.00
Ni	38.00
Sr	405.00
Zr	305.00

Magnetic Data:	**54 cm**
Intensity (emu/cc)	352.8
Inclination before demag.	−60.9
Stable Inclination	−49.2

Physical Properties:	**54 cm**
$\overline{V}p$ (km/s)	4.38



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	9	3

Depth: 441.5 to 443.0 m

Visual Description

0-150 cm: very sparsely plagioclase phyric basalt. Plagioclase 1.5 x .5 to approximately 2 x 3 mm < 1%, fine- to medium-grained.

Chloritic or clay alteration of groundmass visible. Few alterationveins present with dark green clay or chlorite filling.

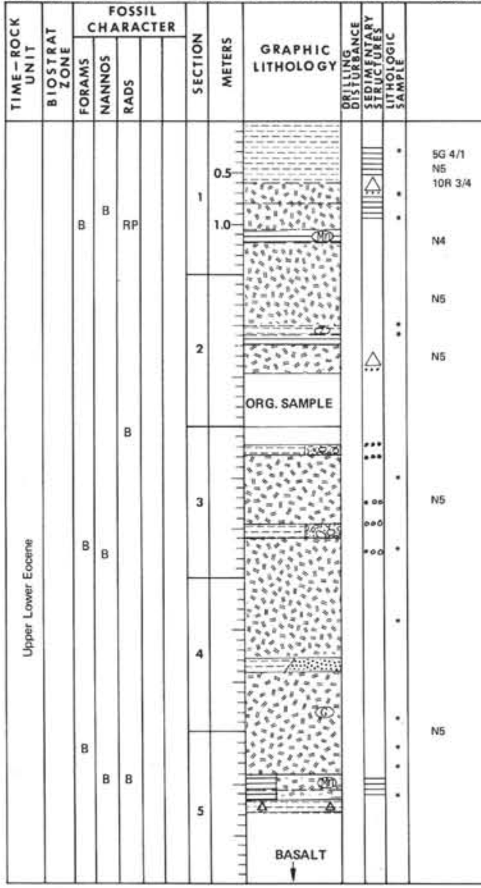
Shipboard Data

Bulk Analysis:	**97 cm**
SiO_2	49.02
Al_2O_3	12.24
Fe_2O_3	1.73
FeO	11.40
MgO	5.76
CaO	9.37
Na_2O	2.69
K_2O	0.63
TiO_2	4.04
P_2O_5	0.53
MnO	0.21
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	40.00
Ni	39.00
Sr	409.00
Zr	281.00

Magnetic Data:	**51 cm**
Intensity (emu/cc)	446.1
Inclination before demag.	56.7
Stable Inclination	53.6

Physical Properties:	**51 cm**
$\overline{V}p$ (km/s)	4.64

SITE 446 HOLE A CORE 10 CORED INTERVAL: 448.0-457.5 m



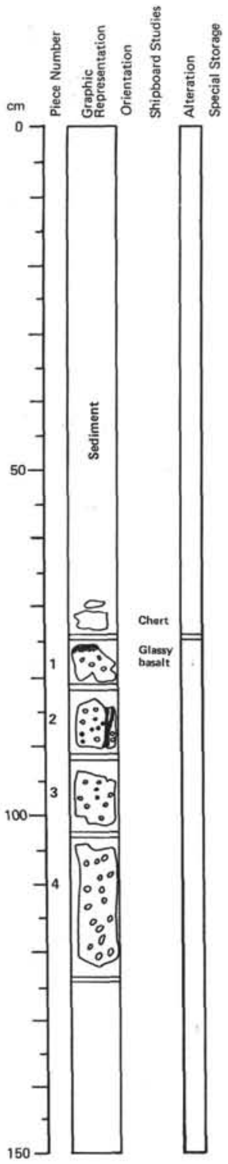
LITHOLOGIC DESCRIPTION

Dominant Lithology:
(A) Altered Ash: gray (N5) to dark gray (N4) with dusky red (10R 3/4) tinges; may be finely laminated, fining upward to massive; or massive with no lamination. In Section 5 black (5Y 2/1) massive.Isolated fining-upward silt laminae in Section 1, claystone laminae in Section 5; **Conglomeratic, Sandy or Silty Claystone** layers in Sections 3 and 4. Bioturbation rare.

Minor Lithologies:
(B) Clayey Zeolite (or Zeolitic Clay): gray (N5), occurs as drilling breccia fragments; in interbed between ash beds, as observed in Section 2. With decrease of zeolites, becomes **Claystone.**
(C) Pelagic Claystone: reddish black in bed of reddish black chert(?) overlying the basalt; or gray inter-laminae in volcanic ash.

SMEARS:

	A	B	C
Quartz, Feldspar	1- 5%	1%	+ - 5%
Clay minrals	10-30%	45%	85%
Volcanic glass	60-80%	–	–
Opaque minerals	1- 5%	1%	–
Micronodules	–	–	6-10%
Heavy minerals	+1%	1%	+ - 1%
Siliceous fossils	0- 2%	–	–
Glauconite	0- 5%	–	0- 1%
Lithic fragments	0-+ %	–	–
Zeolites	+1%	55%	+ - 2%



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	10	5

Depth: 454.0 to 455.2 m

Visual Description

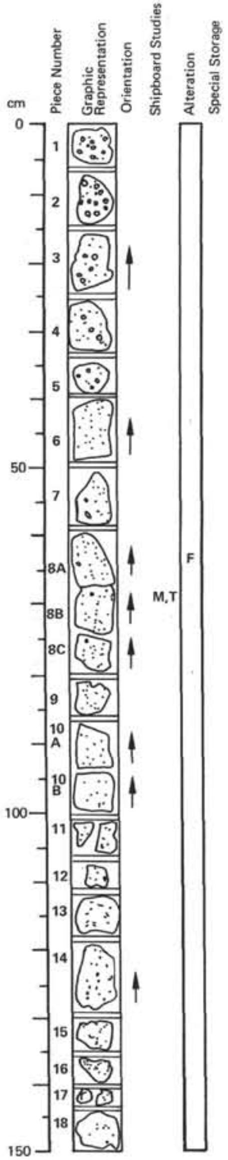
73-122 cm: fresh, highly vesicular aphyric basalt. Calcite crystals and pyrite octahedra common in vesicles. Vesicles 30-35%, 0.2-3.0 mm. Aphanitic to fine-grained. Glassy zone at top below sediment.

Shipboard Data

Bulk Analysis:	**107 cm**
SiO_2	46.94
Al_2O_3	12.51
Fe_2O_3	1.31
FeO	8.63
MgO	6.22
CaO	11.72
Na_2O	3.70
K_2O	1.74
TiO_2	4.27
P_2O_5	1.07
MnO	0.17
LOI	---
H_2O^+	---
H_2O^-	---
CO_2	---
Cr	69.00
Ni	45.00
Sr	1088.00
Zr	188.00

Magnetic Data:	**110 cm**
Intensity (emu/cc)	163.8
Inclination before demag.	23.0
Stable Inclination	23.5

Physical Properties:	**110 cm**
$\overline{V}p$ (km/s)	4.52
Porosity (%)	21.76
Wet Bulk Density	2.64
Grain Density	3.09



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	11	1

Depth: 457.5 to 459.0 m

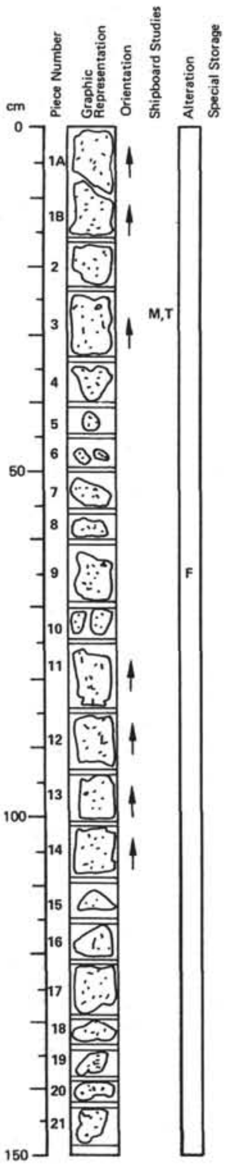
Visual Description

Aphyric highly vesicular basalt. Vesilces 30-40%, .1-1.5 mm, fine- to medium-grained, fresh.

Shipboard Data

Magnetic Data:	**69 cm**
Intensity (emu/cc)	354.9
Inclination before demag.	16.2
Stable Inclination	20.7

Physical Properties:	**69 cm**
$\overline{V}p$ (km/s)	4.56



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	11	2

Depth: 459.0 to 460.5 m

Visual Description

Aphyric, highly vesicular basalt, fine- to medium-grained, fresh. Pyrite and calcite visible in vesicles. Vesicles 25-40%, approximately 0.2-3.0 mm.

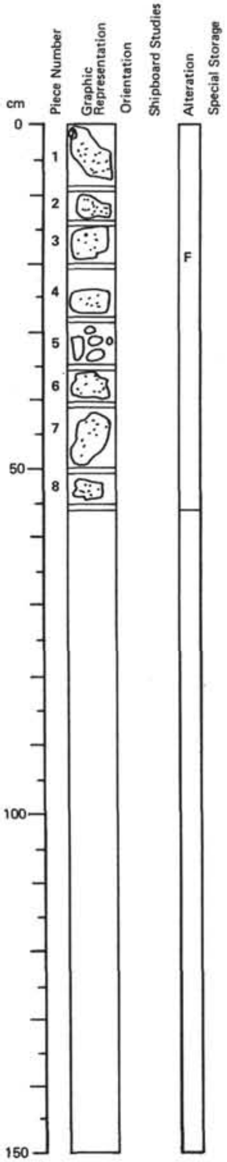
Shipboard Data

Bulk Analysis:	**27 cm**
SiO_2	48.68
Al_2O_3	14.24
Fe_2O_3	1.28
FeO	8.47
MgO	4.92
CaO	9.19
Na_2O	4.34
K_2O	2.20
TiO_2	2.84
P_2O_5	1.47
MnO	0.20
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	—
Ni	—
Sr	1553.00
Zr	229.00

Magnetic Data:	**23 cm**
Intensity (emu/cc)	538.0
Inclination before demag.	11.4
Stable Inclination	12.8

Physical Properties:	**23 cm**	**28 cm**
$\overline{V}p$ (km/s)	3.95*	4.41*
Porosity (%)	—	19.35
Wet Bulk Density	—	2.59
Grain Density	—	2.97

* Vertical direction



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

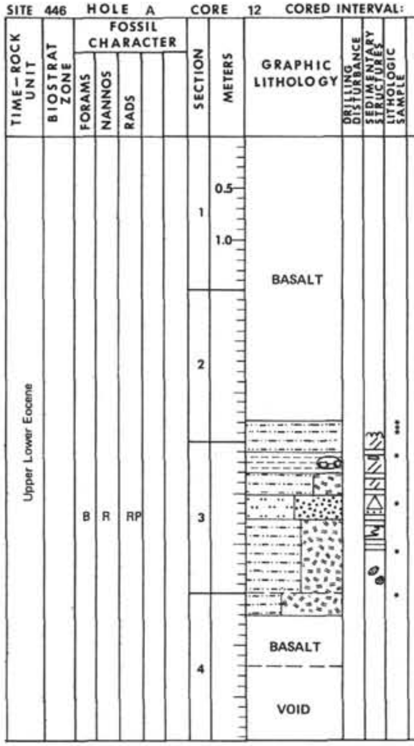
LEG	SITE	HOLE	CORE	SECT.
58	446	A	11	3

Depth: 460.5 to 461.0 m

Visual Description

Aphyric, highly vesicular, fresh basalt. Vesicles 30%, 0.2-3.0 mm. Vesicles often have euhedral calcite and pyrite growing in them.

SITE 446 HOLE A CORE 12 CORED INTERVAL: 467.0-476.5 m



LITHOLOGIC DESCRIPTION

7.5YR 4/2
10R 2/1
5BG 4/1
5BG 4/1

↓

N4/1

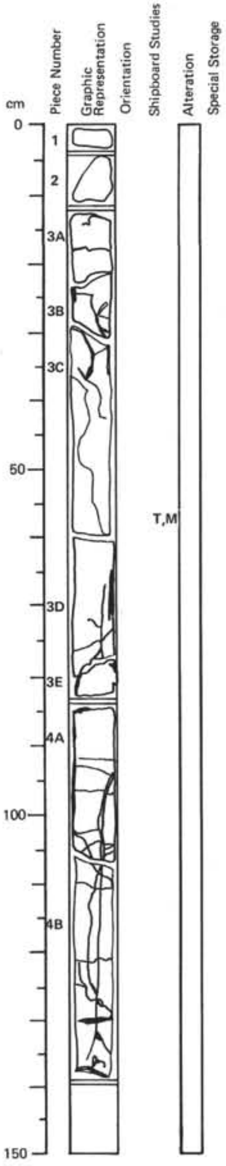
Dominant Lithology:
(A) **Claystone/Mudstone:** transition from overlying basalt to underlying normal sediment is baked, dark brown to black (7.5YR 4/2 to 10YR 2/1) feldspar-rich **Mudstone and Clayey Mudstone**, with laminae, current ripples, cross-beds.
The unbaked **Mudstone or Claystone** is mainly dark greenish gray (5BY 4/1) to dark gray (N4), with parallel laminae, cross-bedding, wavy bedding. Contacts sharp - especially at base of **graded** sequence of **Siltstone to Mudstone**, which is composed of mainly volcanic glass, altered ash, and clay.

Minor Lithology:
(B) **Ashy Mudstone or Siltstone to Muddy Ash:** dark gray (N4/1), composed of volcanic glass, altered ash, and clay in laminated, graded beds.

SMEARS:

	A	B
Quartz, Feldspar	2- 4%	2- 3%
Clay minerals	73-87%	20-75% (Altered ash?)
Volcanic glass	1- 2%	20-68% (part altered)
Opaque minerals	2- 3%	1%
Heavy minerals	1%	1- 2%
Carbonate unspecified (including nannofossils)	7-10%	+1%
Zeolites	0- 4%	0- 5%

CARBON-CARBONATE:
3-85 (0.1, 0.0, 1)



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	12	1

Depth: 467.0 to 468.4 m

Visual Description

Amygdaloidal aphyric basalt. Vesicles 15%, green clay and calcite filled (0.2-1.5 mm). Numerous criss-crossing calcite and clay filled veins.

Massive one chunk of fine-grained plagioclase microporphyritic basalt at top of section.

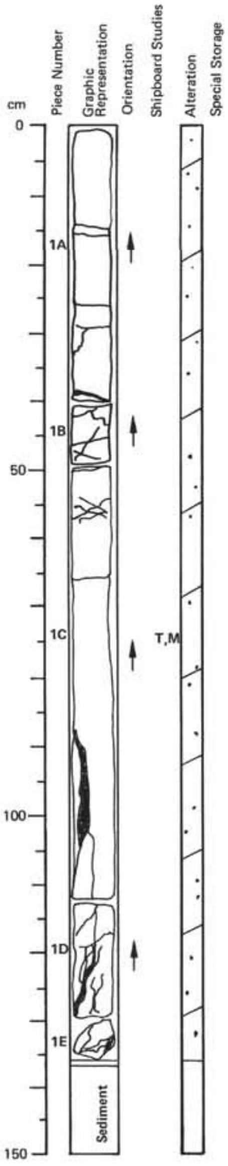
Shipboard Data

Bulk Analysis:	**59 cm**
SiO_2	45.43
Al_2O_3	9.05
Fe_2O_3	1.47
FeO	9.71
MgO	16.12
CaO	10.44
Na_2O	1.69
K_2O	0.91
TiO_2	3.59
P_2O_5	0.79
MnO	0.22
LOI	---
H_2O^+	---
H_2O^-	---
CO_2	---
Cr	1137.00
Ni	293.00
Sr	480.00
Zr	150.00

Magnetic Data:	**53 cm**	**53 cm**
Intensity (emu/cc)	59.8	---
Inclination before demag.	–30.5	---
Stable Inclination	19.8	1.8

Physical Properties:	**50 cm**
$\overline{V}p$ (km/s)	4.48
Porosity (%)	14.27
Wet Bulk Density	2.79
Grain Density	3.09

Other Data:	**50 cm**	**132 cm**
Therm. cond. (mcal/cm-s-°C)	4.38	3.96



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	12	2

Depth: 468.4 to 469.9 m

Visual Description

0-137 cm: basalt, aphyric, dark gray numerous calcite veins filled with chlorite. Thicknesses 1-2 mm (Piece 1C up to 20 mm).

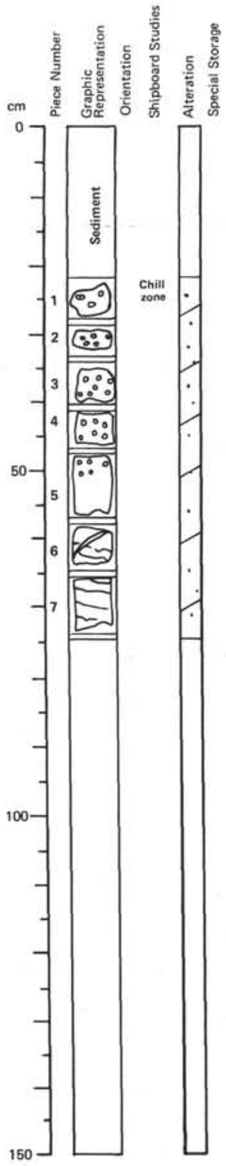
Shipboard Data

Bulk Analysis:	**72 cm**
SiO_2	45.08
Al_2O_3	7.63
Fe_2O_3	1.59
FeO	10.46
MgO	20.55
CaO	8.34
Na_2O	1.07
K_2O	0.77
TiO_2	3.20
P_2O_5	0.65
MnO	0.28
LOI	---
H_2O^+	---
H_2O^-	---
CO_2	---
Cr	1206.00
Ni	496.00
Sr	418.00
Zr	138.00

Magnetic Data:	**69 cm**	**69 cm**
Intensity (emu/cc)	180.64	---
Inclination before demag.	−8.1	---
Stable Inclination	11.5	14.8

Physical Properties:	**69 cm**
$\overline{V}p$ (km/s)	5.25
Porosity (%)	17.61
Wet Bulk Density	2.73
Grain Density	3.10

Other Data:	**69 cm**
Therm. cond. (mcal/cm-s-°C)	4.51



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	12	4

Depth: 471.4 to 472.1 m

Visual Description

0-21 cm: sedimentary rocks.

21-78 cm: basalt, aphyric gray to dark gray, vesicular.

21-27 cm: chill zone, basalt aphanitic.

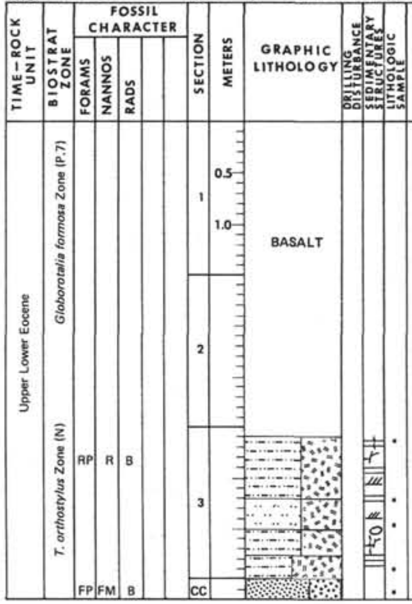
27-73 cm: basalt, fine-grained.

21-51 cm: basalt vesicular. Vesicles 15-20%, <2 mm.

Shipboard Data

Bulk Analysis:	36 cm	69 cm
SiO_2	46.76	45.30
Al_2O_3	11.24	7.83
Fe_2O_3	1.30	1.60
FeO	8.59	10.50
MgO	8.51	19.72
CaO	12.59	8.34
Na_2O	2.76	1.20
K_2O	1.34	0.67
TiO_2	3.58	2.80
P_2O_5	0.65	0.48
MnO	0.16	0.26
LOI	—	—
H_2O^+	—	—
H_2O^-	—	—
CO_2	—	—
Cr	305.00	1169.00
Ni	90.00	563.00
Sr	724.00	230.00
Zr	163.00	129.00

SITE 446 HOLE A CORE 13 CORED INTERVAL: 476.5-486.0 m



LITHOLOGIC DESCRIPTION

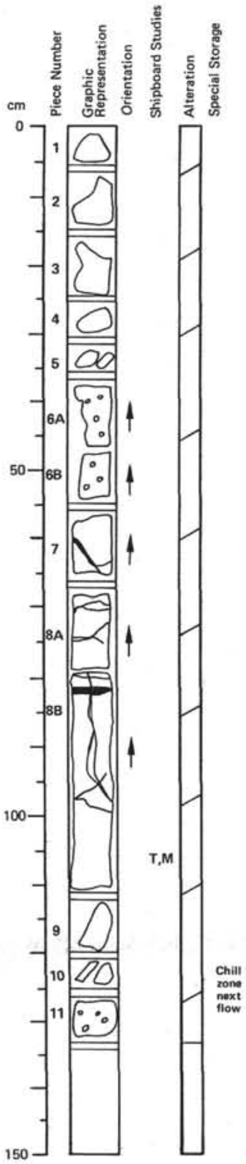
Ashy Mudstone, Siltstone, Sandstone to Altered Ash, dark greenish gray (5GY 4/1 and 5BG 4/1) to dark gray (N4) hard undeformed **Mudstone to Sandstone,** with a rather high content of volcanic particles (transparent uncolored glass, and mainly greenish shardy glass).

Sedimentary structures: no baked zone is noticeable in vicinity of overlying basalt intrusion, but some microfaults may be due to this intrusion.
Normal sedimentary structures appear:
parallel and irregular laminae, microfaults, cross-beds, silt patches, bioturbation slight at 15 and 110 cm.
Core-Catcher is composed mainly by laminated **Calcareous Siltstone and Altered Ash.**

SMEARS:

	Mudstone	**Ash**	**Calcareous Siltstone**
Feldspar	5- 6%	+	10%
Clay minerals	35-55%	17%	26%
Volcanic glass	30-53%	67%	25%
Opaque minerals	3- 4%	+	+
Heavy minerals	2- 4%	+	+
Carbonate unspec. (including nannofossils)	4- 5%	3%	25%

CARBON-CARBONATE:
3-64 (0.3, 0.1, 2)



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	13	1

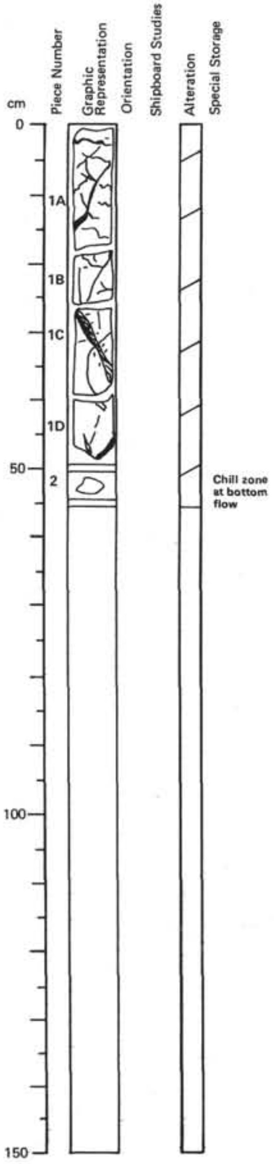
Depth: 476.5 to 477.8 m

Visual Description

0-120 cm: basalt aphyric, fine-grained (to aphanitic), vesicular (partly), dark. Vesicles 5%, <1 cm filled with calcite and smectite, partly unfilled.
120-133 cm: chill zone at top of next lava flow.
Basalt aphyric, fine-grained to aphanitic.
126-133 cm: vesicles 5%, unfilled.

Shipboard Data

Bulk Analysis:	**109 cm**	**Magnetic Data:**	**107 cm**
SiO_2	44.71	Intensity (emu/cc)	228.1
Al_2O_3	6.59	Inclination before	
Fe_2O_3	1.69	demag.	−3.0
FeO	11.14	Stable Inclination	4.8
MgO	22.71		
CaO	7.09	**Physical Properties:**	**105 cm**
Na_2O	0.94	$\overline{V}p$ (km/s)	4.26
K_2O	0.32		
TiO_2	2.00	**Other Data:**	**105 cm**
P_2O_5	0.33	Therm. cond.	
MnO	0.39	(mcal/cm-s-°C)	3.78
LOI	—		
H_2O^+	—		
H_2O^-	—		
CO_2	—		
Cr	1070.00		
Ni	627.00		
Sr	233.00		
Zr	134.00		



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	13	2

Depth: 477.8 to 478.4 m

Visual Description

0-54 cm: basalt aphyric, fine-grained, dark gray, vesicular. Vesicles 15-20%, <1-2 mm, filled with calcite and clay. Numerous calcite veins with thicknesses up to 15 mm.
45-54 cm: top of chill zone.

SITE 446 HOLE A CORE 14 CORED INTERVAL: 486.0-495.5 m

TIME–ROCK UNIT	BIOSTRAT ZONE	FOSSIL CHARACTER					SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	LITHOLOGIC SAMPLE	LITHOLOGIC DESCRIPTION
		FORAMS	NANNOS	RADS									
Upper Lower Eocene	*T. orthostylus* Zone (N)	B	FM	RP			1 2 3 4	0.5 1.0	BASALT BASALT				10-12 cm (1) 14-16 cm (2) (A) (2) (B)

Two very thin beds of sediment were recovered between basalt layers.

(1) Black Powdery Mudstone

(2) Greenish gray (5G 5/1, 5G 6/1) to bluish gray (5BG 5/1, 5B 5/1), very hard laminated **Mudstone** with pellet of coarser mudstone enclosed, both glauconitic.

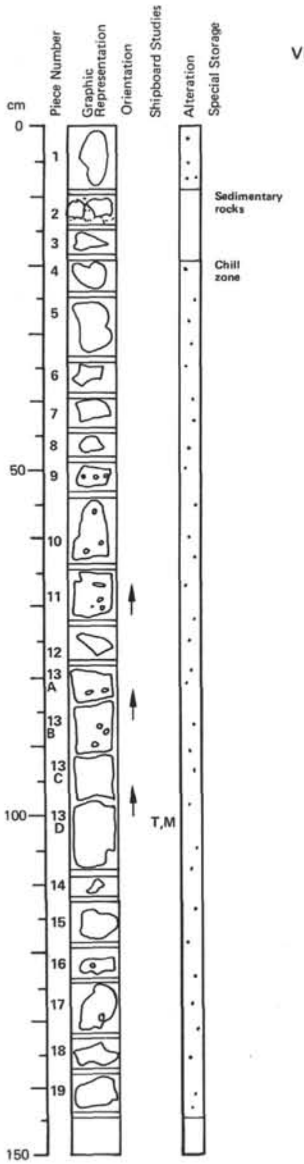
(A) Glauconitic Mudstone.

(B) Glauconitic Sandy Mudstone

SMEARS:

	1	2A	2B
Feldspar	5%	50%	35%
Clay minerals	65%	10%	18%
Volcanic glass	–	–	–
Opaques	5%	5%	5%
Pyrite	10%	–	–
Micronodules	5%	–	–
Heavy minerals	–	10%	5%
Carbonate unspec.	+	–	10% (forams?)*
Siliceous fossils	+	–	–
Glauconite	7%	15%	15%
Lithic fragments	–	10%	10%

*altered to or replaced by glauconite?



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	14	1

Depth: 486.0 to 487.4 m

Visual Description

0-9 cm: basalt, aphyric, fine-grained, dark gray.

9-18 cm: sedimentary rocks.

18-144 cm: basalt flow, very fine-grained (in distance 20-24 cm glass) gray, vesicles rare, but up to 7 mm, filled with calcite and zeolite. There are zones (2-10 mm) of vesicular basalt. Alteration is light.

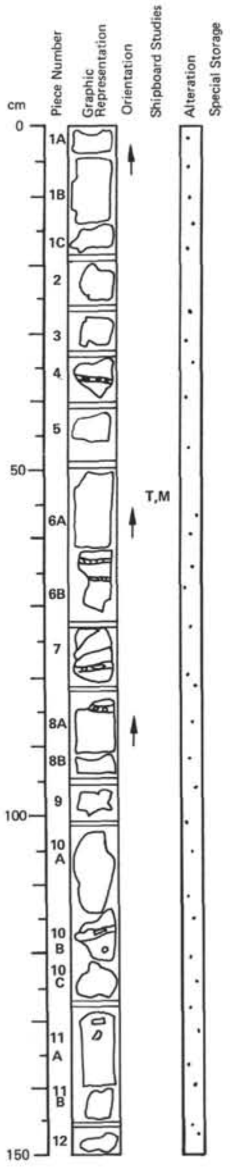
Shipboard Data

Bulk Analysis:	**92 cm**
SiO_2	48.83
Al_2O_3	13.40
Fe_2O_3	1.57
FeO	10.34
MgO	7.42
CaO	10.24
Na_2O	2.99
K_2O	0.62
TiO_2	3.48
P_2O_5	0.35
MnO	0.19
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	144.00
Ni	77.00
Sr	379.00
Zr	198.00

Magentic Data:	**102 cm**	**102 cm**
Intensity (emu/cc)	41.4	—
Inclination before demag.	50.4	—
Stable Inclination	–38.7	19.0

Physical Properties:	**100 cm**
$\overline{V}p$ (km/s)	4.06
Porosity (%)	16.86
Wet Bulk Density	2.71
Grain Density	3.05

Other Data:	**100 cm**
Therm. cond. (mcal/cm-s-°C)	3.69



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	14	2

Depth: 487.4 to 489.0 m

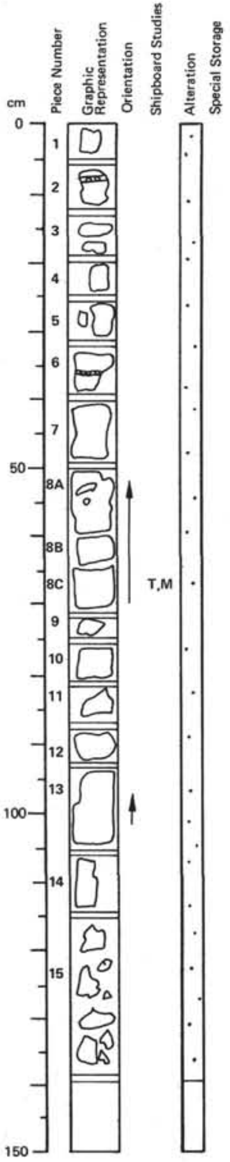
Visual Description

0-150 cm: basalt identical to that described for Core 14, Section 1. Aphyric, very fine-grained, gray, with rare, but big vesicles (up to 10 mm), filled with calcite, zeolite, and pyrite.

Shipboard Data

Magnetic Data:	**44 cm**
Intensity (emu/cc)	469.4
Inclination before demag.	–9.8
Stable Inclination	–5.6

Physical Properties:	**44 cm**	**53 cm**
$\overline{V}p$ (km/s)	4.43	4.21
Porosity (%)	13.11	—
Wet Bulk Density	2.76	—
Grain Density	3.03	—



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	14	3

Depth: 488.9 to 490.3 m

Visual Description

0-138 cm: basalt identical to that described for Core 14, Section 2. Aphyric, fine-grained, gray.

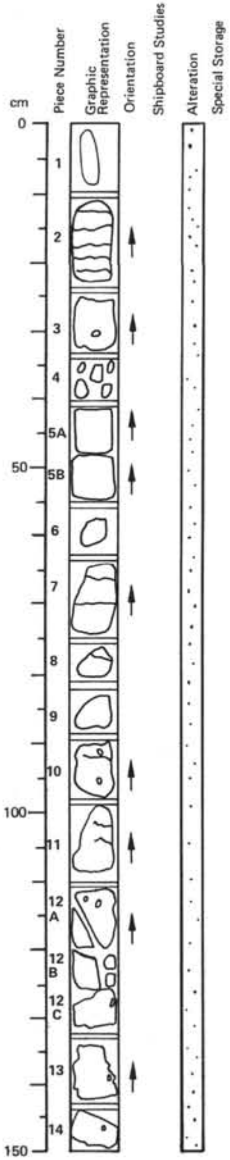
Piece 8A has two big vesicles (up to 25 x 8 mm), filled with calcite, zeolite and pyrite.

Shipboard Data

Bulk Analysis:	**64 cm**
SiO_2	51.54
Al_2O_3	12.89
Fe_2O_3	1.52
FeO	10.06
MgO	7.28
CaO	9.77
Na_2O	3.08
K_2O	0.29
TiO_2	3.29
P_2O_5	0.35
MnO	0.16
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	141.00
Ni	72.00
Sr	367.00
Zr	194.00

Magnetic Data:	**66 cm**
Intensity (emu/cc)	361.1
Inclination before demag.	–13.5
Stable Inclination	–10.5

Physical Properties:	**66 cm**
Vp (km/s)	4.35
Porosity (%)	12.78
Wet Bulk Density	2.77
Grain Density	3.02



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	15	1

Depth: 495.5 to 497.0 m

Visual Description

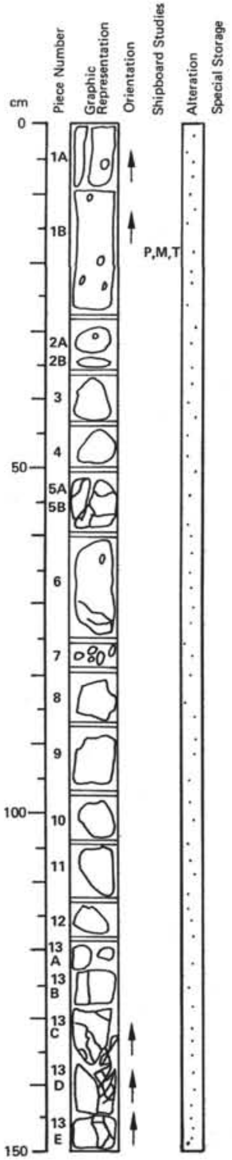
Dark gray, aphyric, very fine-grained basalt with occasional (<1%) large amygdules (1-5 mm) filled by carbonate (calcite). Carbonate, cross-cutting, and clay-lined veins are common.

Fracture surfaces on Pieces 5, 10, 11, 12 and 13 lined by chloritic/clay material, carbonate, and pyrite.

Piece 1, 0-10 cm: one large olivine phenocryst (outer surface 5 x 3 mm).

Shipboard Data

Bulk Analysis:	**70 cm**
SiO_2	50.98
Al_2O_3	12.71
Fe_2O_3	1.56
FeO	10.28
MgO	6.95
CaO	9.77
Na_2O	2.89
TiO_2	3.50
P_2O_5	0.32
MnO	0.17
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	139.00
Ni	72.00
Sr	368.00
Zr	194.00



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	15	2

Depth: 497.0 to 498.5 m

Visual Description

Dark gray, aphyric, very fine-grained basalt. Occasional large carbonate filled amygdules (<1%, 1-5 mm); also strings of vesicles and amygdules in Piece 6 (60-74 cm).

Cross-cutting clay and carbonate veins.

Fractures lined by greenish chloritic/clay material, carbonate and some pyrite.

In Pieces 10 (99-104 cm) and 13B (123-127 cm): large vesicles (8-15 mm across) occur, lined by whitish green clay and pyrite.

Vesicle in Piece 13B has a surrounding gray clayey alteration zone.

Pieces 5 and 13 heavily veined, Piece 13 very broken up along veins (fractures).

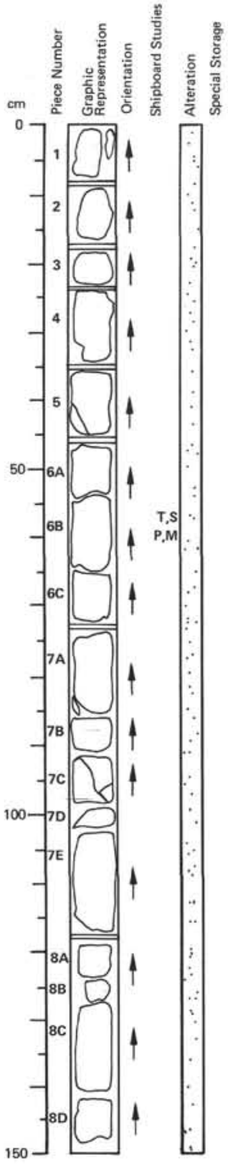
Similar to previous section.

Shipboard Data

Magnetic Data:	**16 cm**
Intensity (emu/cc)	751.04
Inclination before demag.	−10.1
Stable Inclination	−8.8

Physical Properties:	**16 cm**
$\bar{V}p$ (km/s)	4.29
Porosity (%)	14.26
Wet Bulk Density	2.80
Grain Density	3.10

Other Data:	**16 cm**
Therm. cond. (mcal/cm-s-° C)	3.93



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	15	3

Depth: 498.5 to 500.0 m

Visual Description

Dark gray, aphyric, very fine-grained basalt.

Cross-cutting carbonate filled veins.

Rows of fine vesicles in Pieces 5, 6B, 6C and 8. Some are carbonate filled, often with associated dark gray clayey alteration zone.

Fractures lined by dark green chloritic material and carbonate or light olive green clay and pyrite.

Occasional large vesicle (1-5 mm), thinly lined by grayish clay, carbonate and an odd one with pyrite.

Remnants of two large carbonate filled amygdules (at least 10-15 mm across) between Pieces 6A and 6B and 7C and 7D.

Similar to previous section.

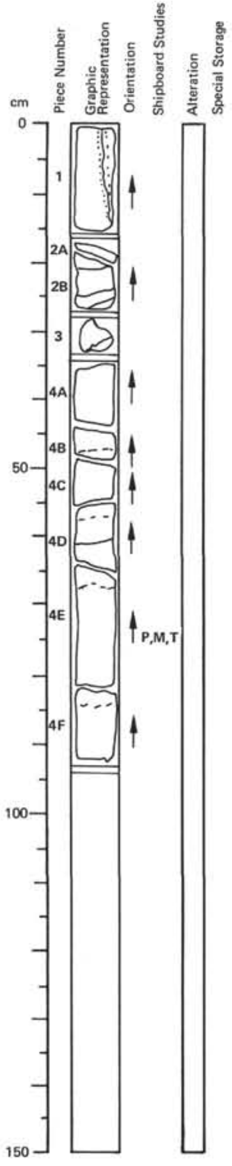
Shipboard Data

Bulk Analysis:	**75 cm**
SiO_2	50.87
Al_2O_3	13.30
Fe_2O_3	1.53
FeO	10.10
MgO	6.79
CaO	9.94
Na_2O	2.88
K_2O	0.46
TiO_2	3.32
P_2O_5	0.33
MnO	0.15
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	135.00
Ni	72.00
Sr	373.00
Zr	262.00

Magnetic Data:	**58 cm**
Intensity (emu/cc)	290.5
Inclination before demag.	−10.9
Stable Inclination	− 5.5

Physical Properties:	**58 cm**
$\overline{V}$p (km/s)	4.52
Porosity (%)	14.04
Wet Bulk Density	2.75
Grain Density	3.03

Other Data:	**58 cm**
Therm. cond. (mcal/cm-s-°C)	4.03



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	15	4

Depth: 500.0 to 500.9 m

Visual Description

Dark gray, aphyric, very fine-grained, basat.

Cross cutting calcite veins and rows of vesicles (often carbonate filled and with alteration zone).

Occasional large vesicles (10-20 mm) present, lined by olive green clay and pyrite.

Piece 3, 28-33 cm: dark fracture surface covered by fine-grained pyrite. Similar occurrence on lower surface of Piece 4B, 48 cm.

- - - - = rows of vesicles.

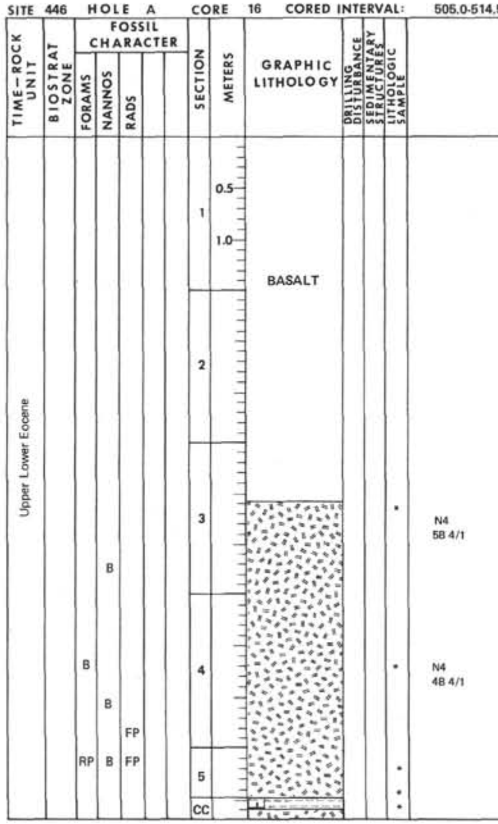
Shipboard Data

Magnetic Data:	**73 cm**
Intensity (emu/cc)	331.1
Inclination before demag.	−7.6
Stable Inclination	−7.8

Physical Properties:	**73 cm**
$\overline{V}$p (km/s)	4.60
Porosity (%)	10.34
Wet Bulk Density	2.80
Grain Density	3.00

Other Data:	**73 cm**
Therm. cond. (mcal/cm-s-°C)	4.18

SITE 446 HOLE A CORE 16 CORED INTERVAL: 505.0-514.5 m



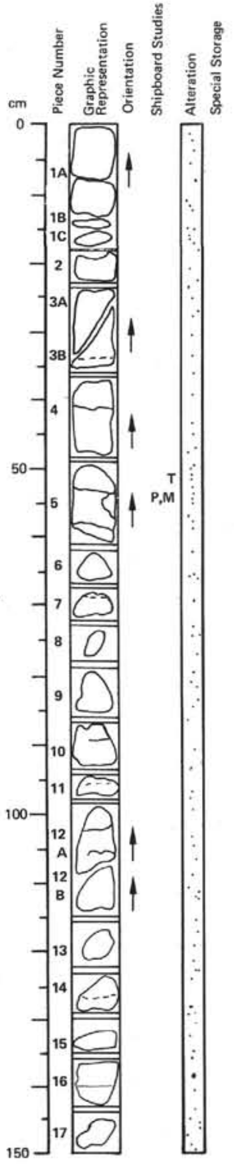
LITHOLOGIC DESCRIPTION

Dominant Lithology:
(A) **Altered Ash**, dark bluish gray (5B 4/1) to dark gray (N4) **Altered Hard Ash** with faint lamination, slightly coarser toward base of recovered section.

Minor Lithology:
(B) dark bluish gray (5B 4/1) to dark gray (N4) **Calcareous Mudstone and Altered Ash.**

SMEARS:

	A	B
Feldspar	25-35%	10%
Clay minerals	5-13%	50%
Volcanic glass	45-50%	+
Micronodules	0- 2%	2%
Heavy minerals	0- 5%	5%
Siliceous fossils (Radiolarians)	1- 5%	2%
Glauconite	–	1%
Zeolites	–	2%
Carbonate unspecified		20%



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 8	4 6 6	A	1 6	1

Depth: 505.0 to 506.5 m

Visual Description

Dark gray, aphyric, fine-grained basalt.

Cross-cutting veins and fractures lined by dark green or light olive green clays, pyrite and carbonate.

Occasional large vesicles lined by light gray clay or light olive green clay.

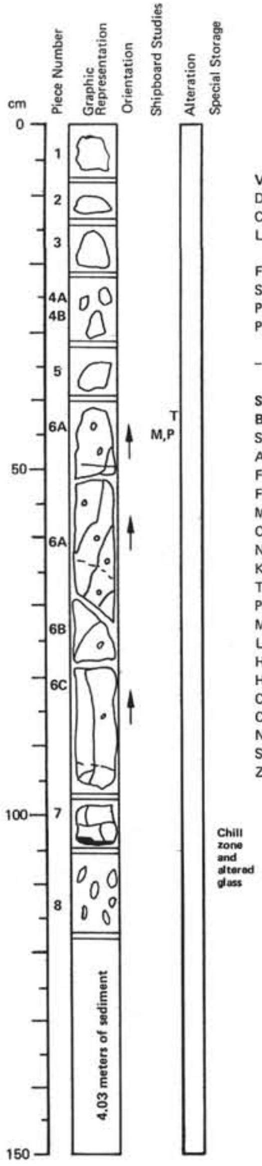
Odd fine-grained pyrite and carbonate.

Similar to previous core.

Shipboard Data

Magnetic Data:	**53 cm**
Intensity (emu/cc)	260.8
Inclination before demag.	–26.4
Stable Inclination	–8.8

Physical Properties:	**53 cm**
$\overline{V}$p (km/s)	4.76
Porosity (%)	10.64
Wet Bulk Density	2.78
Grain Density	2.99



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 8	4 4 6	A	1 6	2

Depth: 506.5 to 507.7 m

Visual Description

Dark gray, aphyric, fine-grained, basalt.

Cross-cutting calcite veins and dark clay filled veins (<0.5 mm wide).

Lines or zones of vesicles (<0.5 mm wide), cross-cut basalt, vesicles are carbonate filled. Alteration zone of gray clayey material in zone.

Fracture surfaces covered by greenish clay material and dark (black) material, rare pyrite.

Similar to previous section.

Piece 7, chill zone and glassy margin, glass (98-103 cm) altered to bluish gray material.

Piece 8, drilling rubble (105-117 cm).

– – – = line of vesicles and alteration.

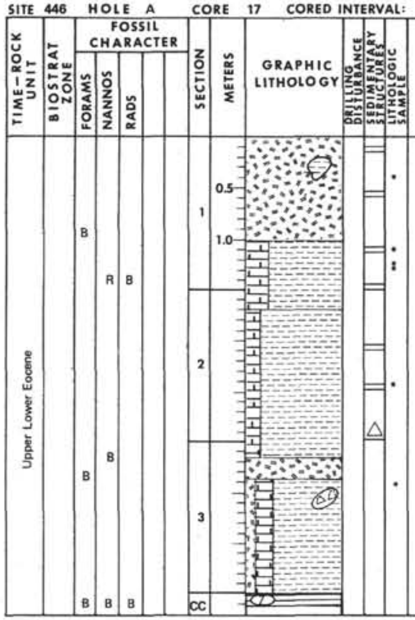
Shipboard Data

Bulk Analysis:	**72 cm**
SiO_2	51.72
Al_2O_3	13.02
Fe_2O_3	1.46
FeO	9.63
MgO	6.45
CaO	10.51
Na_2O	2.93
K_2O	0.45
TiO_2	3.40
P_2O_5	0.33
MnO	0.19
LOI	---
H_2O^+	---
H_2O^-	---
CO_2	---
Cr	131.00
Ni	74.00
Sr	374.00
Zr	198.00

Magnetic Data:	**44 cm**
Intensity (emu/cc)	626.2
Inclination before demag.	–4.4
Stable Inclination	–2.0

Physical Properties:	**44 cm**
$\overline{V}$p (km/s)	4.25
Porosity (%)	14.80
Wet Bulk Density	2.74
Grain Density	3.04

SITE 446 **HOLE** A **CORE** 17 **CORED INTERVAL:** 514.5-524.0 m



N4

5G 4/1,
5GY 4/1

N4

N4

N5

N5
Basalt chunk

LITHOLOGIC DESCRIPTION

Dominant Lithologies:

(A) Claystone-Mudstone/Calcareous and/or Siliceous Mudstone/Ashy Mudstone: dark gray (N4 to N5) finely laminated; variable siliceous and calcareous fossil content. The clay appears to be entirely volcanic ash alteration product. Fining upward sequence possible at base of Section 2.

(B) Altered Volcanic Ash: dark gray (N4) massive, with widely spaced fine laminae.

(C) Chalky Claystone: dark greenish gray (5G 4/1) with fine to 1 cm laminae.

(D) Zeolitic Claystone: dark gray (N5); identified only in Core-Catcher sample, associated with basalt. Clay may be altered volcanic or basaltic materials.

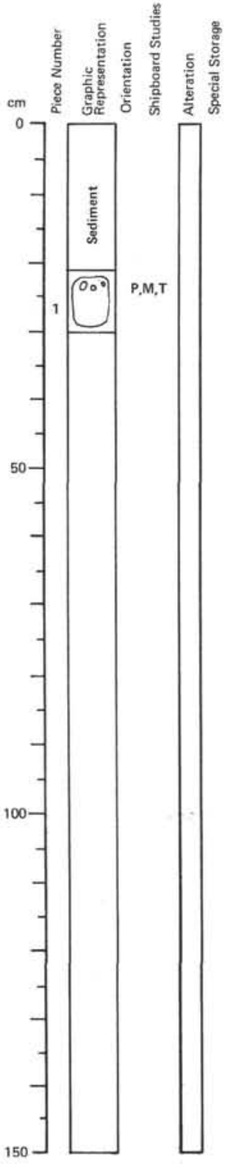
SMEARS:

	A	B	C	D
Feldspar	+ - 1%	5%	+	+
Clay minerals	65-80%	50%	60%	65%
Volcanic glass	2-10%	40%	–	–
Opaque minerals	3-10%	1%	+	1%
Heavy minerals	+ - 2%	1%	–	1%
Carbonate unspecified	0- 5%	–	35%	–
Calcareous fossils	forams at 1-30		nannos	–
Siliceous fossils	2-10%	2%	–	–
Zeolites	0- 2%	1%	–	30%
Glauconite	0- 1%	–	–	1%

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	17	CC

Depth: 523.5 to 523.9 m



Visual Description

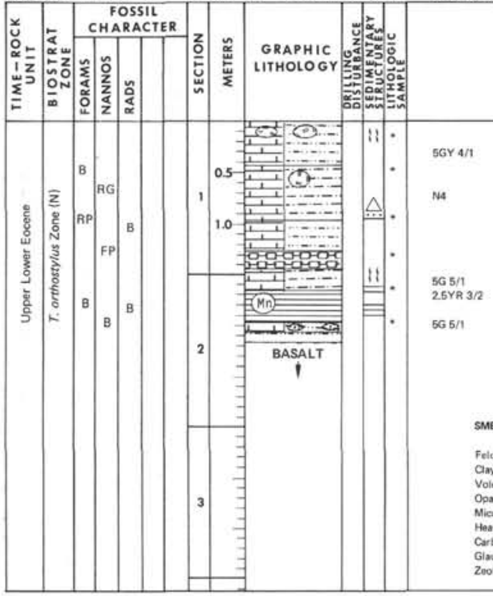
0-21 cm: sediment.

21-30 cm: dark gray, aphyric, fine-grained basalt. Several large vesicles at top of piece (often pipe-like). Rounded vesicles (10 mm across) and pipe vesicles (10-15 mm long, 2 mm across). Angular vesicles (triangular cross section) 10 x 8 mm. Vesicles often lined by gray clay material and carbonate. Light olive green clay on outer surface and some pyrite (also in some vesicles). Approximately 5% vesicles.

Shipboard Data

Physical Properties:	26 cm
$\overline{V}p$ (km/s)	3.84

SITE 446 HOLE A CORE 18 CORED INTERVAL: 524.0-533.5 m



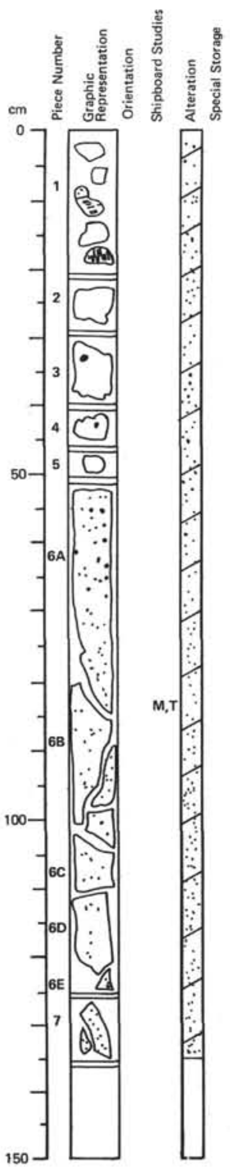
LITHOLOGIC DESCRIPTION

Dominant Lithology:
(A) Mudstone: dark greenish gray (5GY 4/1) to greenish gray (5G 5/1) to dark gray (N4) coarsely laminated **Vitric Calcareous Mudstone** fining upward, with current and soft-sediment deformation features; dark gray **Calcareous Sandy Mudstone**, coarse sand at base, fining upward; may be **Glauconitic.**

Minor Lithologies:
(B) Chalk: brownish, between greenish gray **Mudstone** layers.
(C) Claystone: dusky red (2.5YR 3/2), with soft sediment deformation features, clastic dike (pelagic clay with Mn micronodules).
(D) Baked Mudstone.

Note: Brecciated chunks of baked mudstone in 1 cm interval immediately overlying the basalt.

SMEARS:	A (Mudstone)			B	C
	Calc. Glauc.	Vitric	Vitric-Calc.		
Feldspar	1- 2%	1%	3%	+	3
Clay minrals	55-65%	75%	55%	30%	80%
Volcanic glass	–	20%	25%		–
Opaque minerals	2- 3%	3%	10%	1%	–
Micronodules	–	–	–	–	15%
Heavy minerals	1- 2%	1%	2%	1%	+
Carbonate unspec.	25-30%	–	5%	65%	–
Glauconite	5- 7%	–	–	–	–
Zeolites	–	+	+	–	+



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	18	3

Depth: 526.1 to 527.4 m

Visual Description

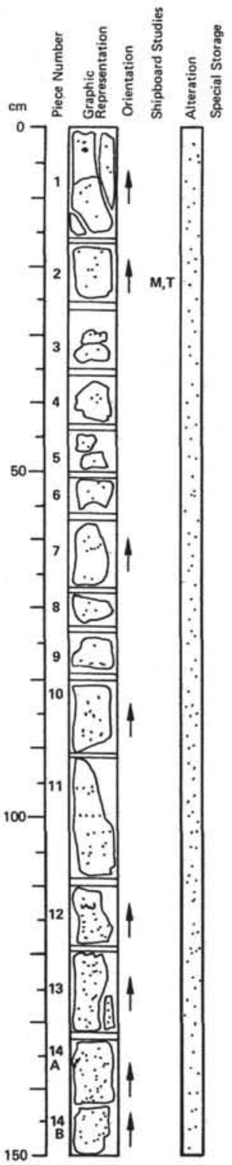
0-20 cm: bits of baked sediment and glassy basalt.

22-150 cm: aphyric vesicular massive basalt, 5-15% vesicles and amygdules (50-50), 0.2-3.0 mm. Calcite fillings, some aragonite needles visible in a few vugs.

Shipboard Data

Magnetic Data:	**83 cm**
Intensity (emu/cc)	381.21
Inclination before demag.	–10.9
Stable Inclination	–7.5

Physical Properties:	**83 cm**
$\overline{V}p$ (km/s)	4.04
Porosity (%)	19.80
Wet Bulk Density	2.61
Grain Density	2.98



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	18	4

Depth: 527.4 to 528.9 m

Visual Description

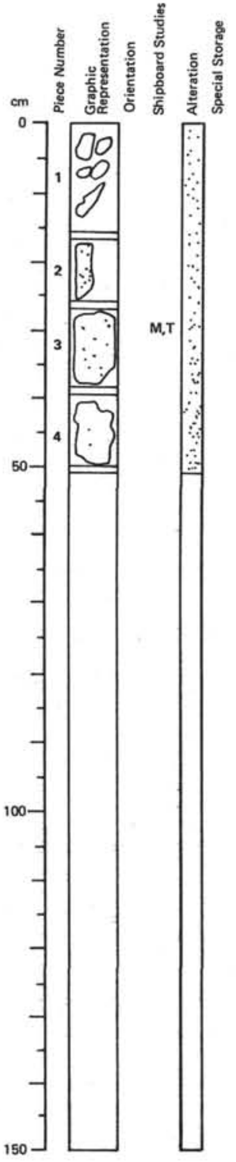
Aphyric massive basalt, similar to that in last section except for fewer vesicles (5-10%) and far less amygdules (calcite filled). Pyrites visible as free crystals in vesicles. Chains of vesicles oriented horizontally.

Shipboard Data

Bulk Analysis:	**85 cm**
SiO_2	48.93
Al_2O_3	12.95
Fe_2O_3	1.50
FeO	9.89
MgO	6.89
CaO	9.28
Na_2O	3.34
K_2O	1.42
TiO_2	3.74
P_2O_5	0.61
MnO	0.15
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	48.00
Ni	38.00
Sr	673.00
Zr	191.00

Magnetic Data:	**23 cm**
Intensity (emu/cc)	213.5
Inclination before demag.	1.8
Stable Inclination	–7.3

Physical Properties:	**23 cm**
$\overline{V}p$ (km/s)	3.80
Porosity (%)	21.92
Wet Bulk Density	2.57
Grain Density	3.01



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	18	5

Depth: 528.9 to 529.4 m

Visual Description

Aphyric massive basalt. Vesicles 0-7% approximately 0.2-1.0 mm, fine-grained. A little calcite, pyrite, and chlorite visible on vein surface.

Shipboard Data

Bulk Analysis:	**32 cm**
SiO_2	48.06
Al_2O_3	12.83
Fe_2O_3	1.50
FeO	9.92
MgO	6.94
CaO	9.99
Na_2O	3.25
K_2O	1.16
TiO_2	3.78
P_2O_5	0.68
MnO	0.18
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	52.00
Ni	49.00
Sr	720.00
Zr	200.00

Magnetic Data:	**29 cm**
Intensity (emu/cc)	224.6
Inclination before demag.	9.9
Stable Inclination	4.3

Physical Properties:	**29 cm**
$\overline{V}p$ (km/s)	3.74
Porosity (%)	20.53
Wet Bulk Density	2.57
Grain Density	2.97

SITE 446 HOLE A CORE 19 CORED INTERVAL: 533.5-543.0 m

TIME–ROCK UNIT	BIOSTRAT ZONE	FOSSIL CHARACTER					SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	LITHOLOGIC SAMPLE
		FORAMS	NANNOS	RADS								
Upper Lower Eocene							1	0.5 1.0	BASALT			
							2					
		B	B				3					• •

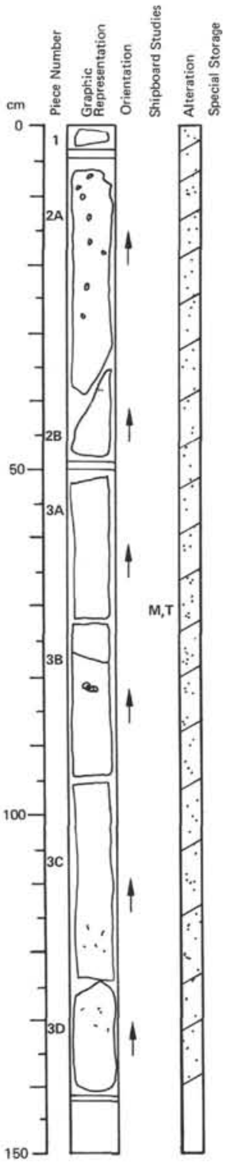
LITHOLOGIC DESCRIPTION

Mudstone

Dark greenish gray (5G 4/1) laminated mudstone, and reddish brown **Mudstone,** finely laminated. Greenish gray is glauconitic; reddish brown is not. Recovered 0.2 meters under basalt.

SMEARS:

Quartz, Feldspar	1- 3%
Clay minerals	70-75%
Volcanic glass	0-10%
Opaque minerals	5-10%
Carbonate unspecified	0- 2% (nannos)
Siliceous fossils	3% (sponge)
Glauconite	6- 7%
Zeolites	1%



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	19	1

Depth: 533.5 to 534.4 m

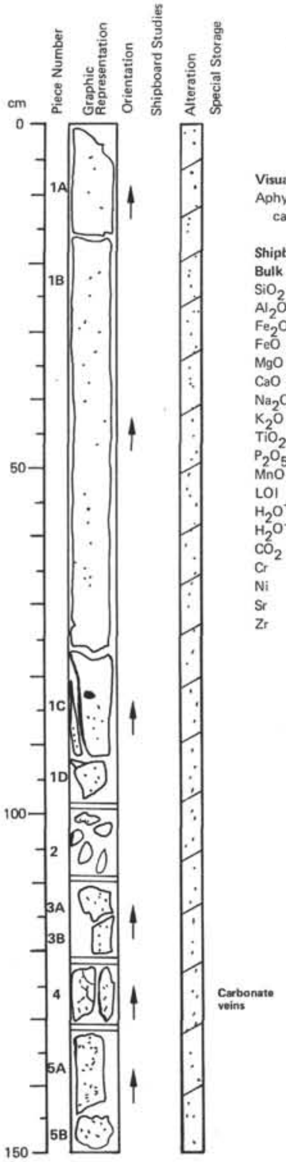
Visual Description

Aphyric massive basalt, fine-grained. Vesicles 0-3% – all calcite filled. A little green clay or chlorite on occasional fracture surfaces. No carbonate filled veins.

Shipboard Data

Magnetic Data:	**69 cm**
Intensity (emu/cc)	413.4
Inclination before demag.	−2.5
Stable Inclination	−3.0

Physical Properties:	**69 cm**
$\overline{V}$p (km/s)	3.97
Porosity (%)	17.78
Wet Bulk Density	2.66
Grain Density	3.02



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	19	2

Depth: 534.4 to 536.4 m

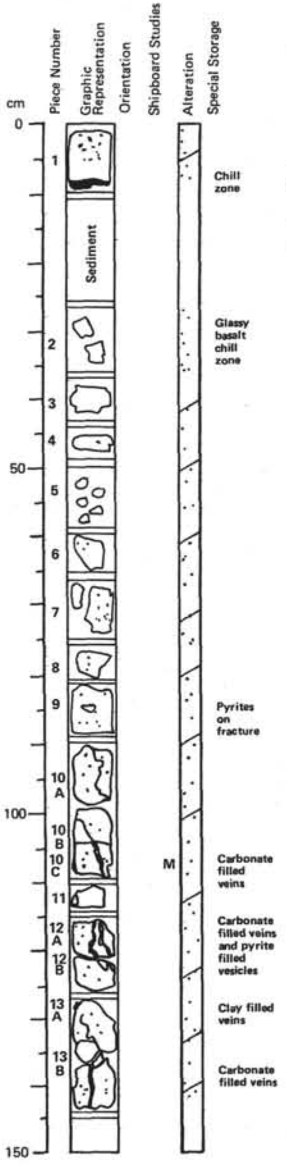
Visual Description

Aphyric gray massive basalt, 0-7%, 0.2-2.0 mm vesicles and calcite filled amygdules. A few carbonate filled veins, in Piece 4. Fine-grainedlight to moderate alteration.

Shipboard Data

Bulk Analysis:	**54 cm**
SiO_2	48.49
Al_2O_3	13.26
Fe_2O_3	1.52
FeO	10.00
MgO	6.78
CaO	9.73
Na_2O	3.29
K_2O	0.78
TiO_2	3.47
P_2O_5	0.43
MnO	0.19
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	147.00
Ni	76.00
Sr	385.00
Zr	243.00

Magnetic Data:	**14 cm**
Intensity (emu/cc)	414.6
Inclination before demag.	−5.9
Stable Inclination	−3.5



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	8	4	4	6	A		1	9		3

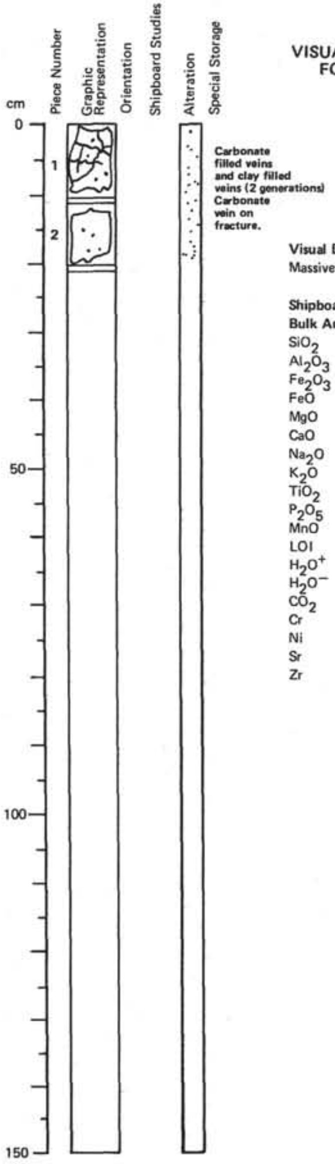
Depth: 536.4 to 537.8 m

Visual Description

0-10 cm: chill zone – vesicular aphyric basalt. Vesicles approximately 10%, 0.2-0.5 mm, absent from glassy zone.

10-25 cm: baked claystone.

27-143 cm: glassy to aphanitic and fine-grained massive basalt. Clay and sulphide filled vesicles (1-2%), approximately 0.5-1.0 mm. Carbonate filled veins common. Grain size increases downwards.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE			SECT.	
5	8	4	4	6	A		1	9		4

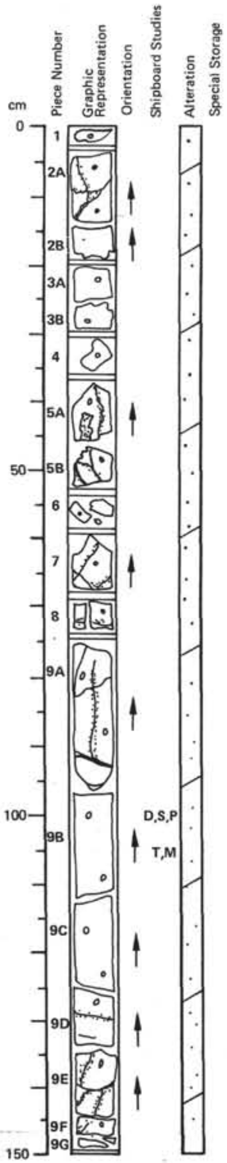
Depth: 537.8 to 538.0 m

Visual Description

Massive aphyric fine-grained basalt. Clay filled amygdules 1%, approximately 0.5-1.0 mm.

Shipboard Data

Bulk Analysis:	**7 cm**	**Magnetic Data:**	**122 cm**
SiO_2	51.84	Intensity (emu/cc)	834.0
Al_2O_3	13.08	Inclination before demag.	21.2
Fe_2O_3	1.58	Stable Inclination	29.8
FeO	10.44		
MgO	5.38		
CaO	9.16		
Na_2O	3.12		
K_2O	0.39		
TiO_2	3.87		
P_2O_5	0.43		
MnO	0.20		
LOI	---		
H_2O^+	---		
H_2O^-	---		
CO_2	---		
Cr	13.00		
Ni	31.00		
Sr	446.00		
Zr	302.00		



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	20	1

Depth: 543.0 to 544.5 m

Visual Description

0-150 cm: basalt aphyric, fine-grained,dark gray, vesicular. Vesicles 3-5%, <2 mm, filled with calcite, chlorite, and pyrite. Numerous calcite veins (1-2 mm) with chlorite and pyrite.

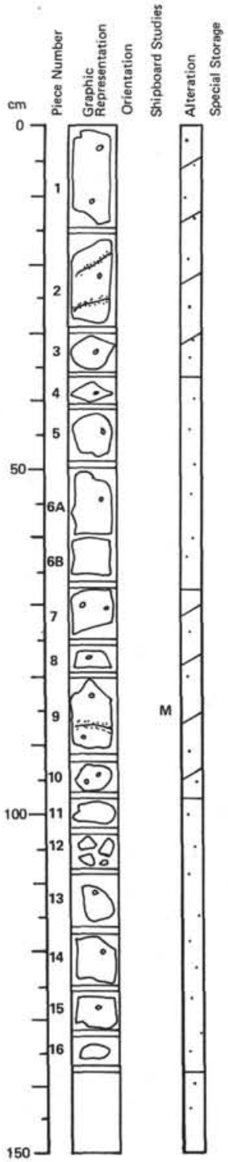
Shipboard Data

Bulk Analysis:	**97 cm**
SiO_2	49.73
Al_2O_3	13.01
Fe_2O_3	1.66
FeO	10.99
MgO	5.94
CaO	9.77
Na_2O	2.91
K_2O	0.22
TiO_2	4.04
P_2O_5	0.45
MnO	0.21
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	23.00
Ni	33.00
Sr	447.00
Zr	302.00

Magnetic Data:	**105 cm**
Intensity (emu/cc)	499.4
Inclination before demag.	30.7
Stable Inclination	44.2

Physical Properties:	**96 cm**	**105 cm**
$\overline{V}p$ (km/s)	—	4.75
Porosity (%)	15.41	
Wet Bulk Density	2.78	
Grain Density	3.10	

Other Data:	**105 cm**
Therm. cond. (mcal/cm-s-° C)	3.75



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	20	2

Depth: 544.5 to 545.9 m

Visual Description

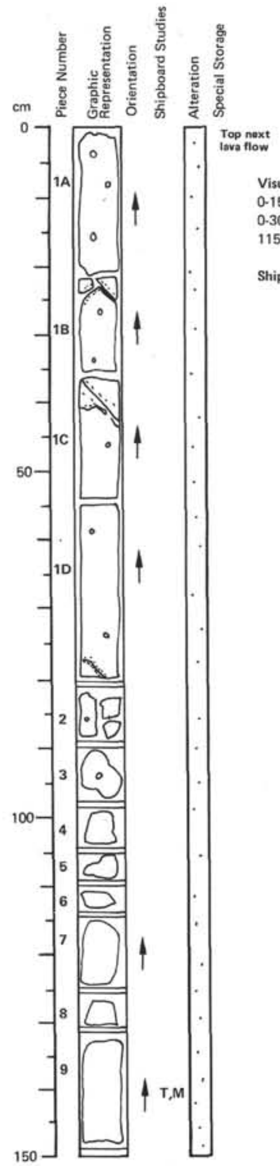
0-36 cm: basalt identical to that described at the base of Core 20, Section 1. Aphyric, fine-grained,dark gray. Vesicles approximately 3%, <1 mm, filled with chlorite, calcite, pyrite.

36-137 cm: fresh basalt, gray, fine-grained, vesicles less than 1%.

Shipboard Data

Magnetic Data:	**82 cm**
Intensity (emu/cc)	294.8
Inclination before demag.	43.9
Stable Inclination	44.7

Physical Properties:	**82 cm**
$\overline{V}p$ (km/s)	4.32



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	20	3

Depth: 545.9 to 547.4 m

Visual Description

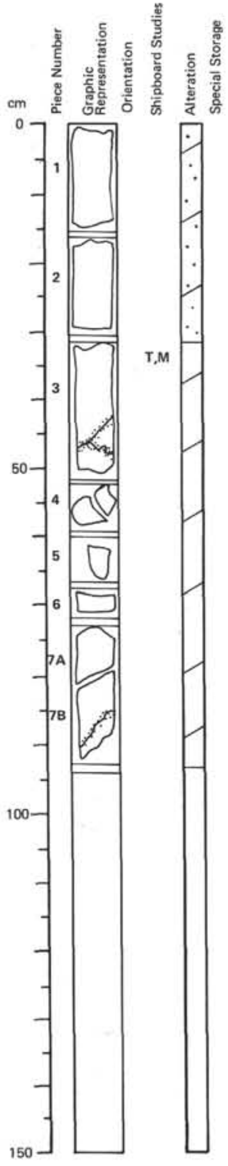
0-150 cm: basalt, aphyric, fine-grained, dark gray (up to 80 cm) and gray (80-150 cm).

0-30 cm: vesicular. Vesicles 1%, <2 mm, filled with calcite and zeolite(?).

115-150 cm: lightly altered (chloritization). Calcite vein with chlorite and pyrite.

Shipboard Data

Physical Properties:	**140 cm**
$\overline{V}$p (km/s)	3.71
Other Data:	**140 cm**
Therm. cond. (mcal/cm-s-°C)	3.62



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	20	4

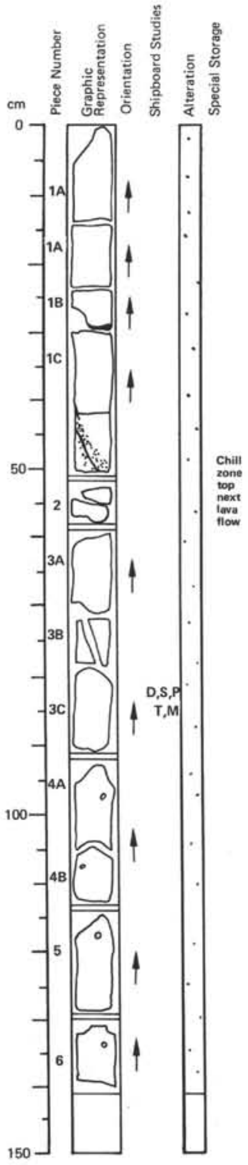
Depth: 547.4 to 548.3 m

Visual Description

0-93 cm: basalt identical to that described at the base of Core 20, Section 3, but more altered. Basalt aphyric, fine-grained, dark gray (greenish). Coarser-grained, then before. Alteration – chloritization.

Shipboard Data

Magnetic Data:	**35 cm**
Intensity (emu/cc)	58.1
Inclination before demag.	37.6
Stable Inclination	25.6
Physical Properties:	**34 cm**
$\overline{V}$p (km/s)	4.62
Porosity (%)	20.89
Wet Bulk Density	2.66
Grain Density	3.09
Other Data:	**34 cm**
Therm. cond. (mcal/cm-s-°C)	3.03



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 8	4 4 6	A	2 1	1

Depth: 552.5 to 553.9 m

Visual Description

0-50 cm: basalt aphyric, fine-grained, altered moderate (identical to that described for Core 20, Section 4).

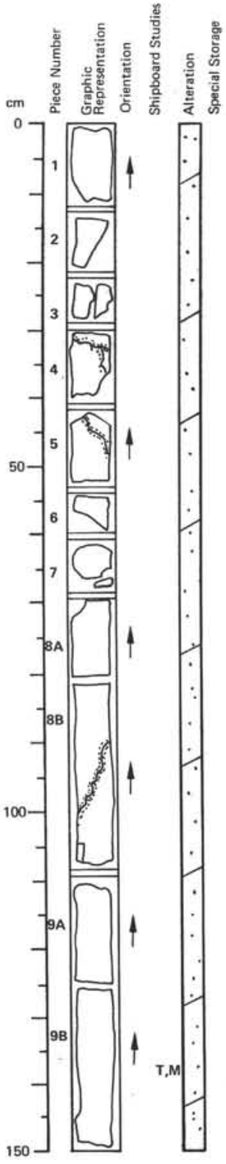
50-65 cm: chill zone (top of the next lava flow).

65-140 cm: basalt aphyric, fine-grained, altered. Vesicles < 1%, <0.5 mm, unfilled. Calcite vein with chlorite and pyrite.

Shipboard Data

Bulk Analysis:	**19 cm**
SiO_2	49.06
Al_2O_3	12.86
Fe_2O_3	1.65
FeO	10.92
MgO	6.76
CaO	9.96
Na_2O	2.72
K_2O	0.19
TiO_2	3.65
P_2O_5	0.42
MnO	0.18
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	28.00
Ni	36.00
Sr	439.00
Zr	274.00

Magnetic Data:	**82 cm**
Intensity (emu/cc)	607.3
Inclination before demag.	48.5
Stable Inclination	47.5
Physical Properties:	**82 cm**
$\overline{V}p$ (km/s)	4.13
Porosity (%)	17.38
Wet Bulk Density	2.71
Grain Density	3.06
Other Data:	**82 cm**
Therm. cond. (mcal/cm-s-°C)	3.51



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 8	4 4 6	A	2 1	2

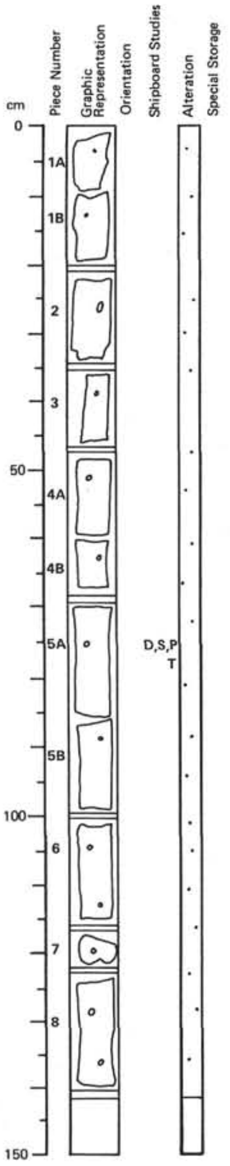
Depth: 553.9 to 555.4 m

Visual Description

0-150 cm: basalt identical to that described at the base of Core 21, Section 1.

Shipboard Data

Magnetic Data:	**128 cm**
Intensity (emu/cc)	109.9
Inclination before demag.	−16.7
Stable Inclination	19.3
Physical Properties:	**127 cm**
$\overline{V}p$ (km/s)	3.86
Other Data:	**127 cm**
Therm cond. (mcal/cm-s-°C)	3.73



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 8	4 4 6	A	2 1	3

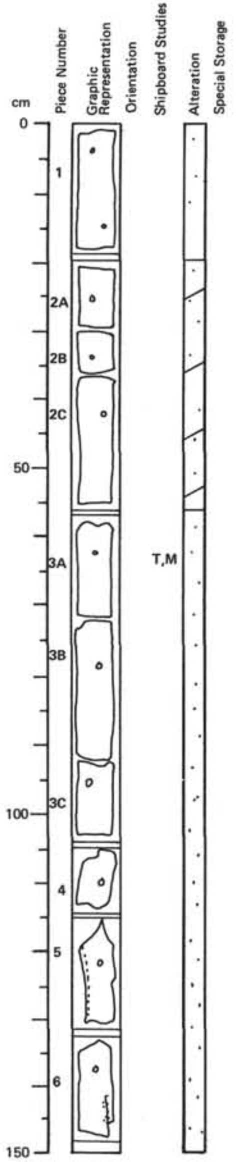
Depth: 555.4 to 556.8 m

Visual Description

0-140 cm: basalt, aphyric, fine-grained, very lightly altered (almost fresh). Vesicular, gray. Vesicles 10-15%, <1 mm, unfilled.

Shipboard Data

Magnetic Data:	**10 cm**
Intensity (emu/cc)	130.9
Inclination before demag.	34.5
Stable Inclination	34.6
Physical Properties:	**79 cm**
$\overline{V}$p (km/s)	4.05
Porosity (%)	13.00
Wet Bulk Density	2.63
Grain Density	2.87
Other Data:	**79 cm**
Therm. cond. (mcal/cm-s-°C)	3.99



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 8	4 4 6	A	2 1	4

Depth: 556.8 to 557.3 m

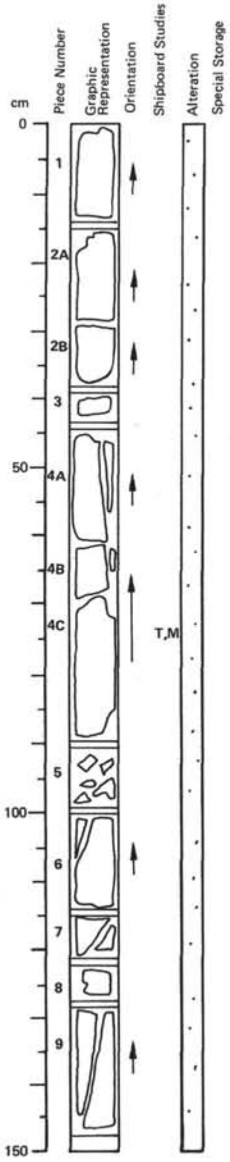
Visual Description

0-150 cm: basalt (fresh), aphyric, identical to that described for Core 21, Section 3. Typical gray color.

Shipboard Data

Bulk Analysis:	**79 cm**
SiO_2	52.48
Al_2O_3	12.44.
Fe_2O_3	1.52
FeO	10.00
MgO	6.59
CaO	8.71
Na_2O	3.02
K_2O	0.94
TiO_2	3.62
P_2O_5	0.41
MnO	0.15
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	27.00
Ni	35.00
Sr	430.00
Zr	290.00

Magnetic Data:	**61 cm**
Intensity (emu/cc)	162.7
Inclination before demag.	15.7
Stable Inclination	26.9
Physical Properties:	**61 cm**
$\overline{V}$p (km/s)	4.17
Other Data:	**61 cm**
Therm. cond. (mcal/cm-s-°C)	3.85



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	21	5

Depth: 557.3 to 558.8 m

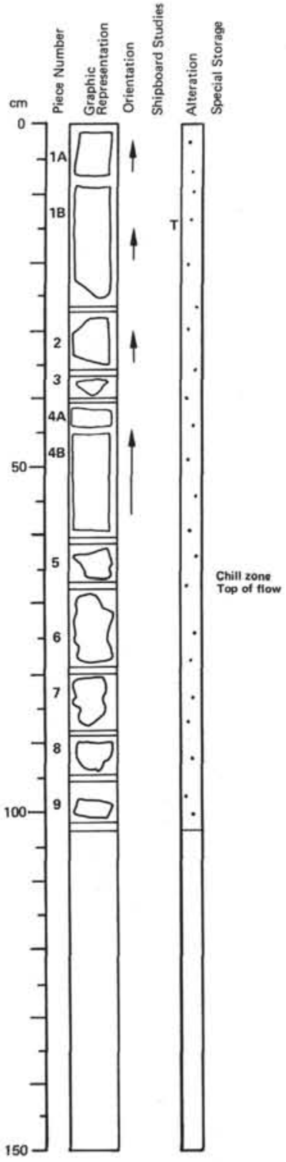
Visual Description

0-150 cm: similar basalt to that of Core 21, Section 4. Basalt aphyric, *fine-grained* (coarser then before – 50-110 cm), gray, vesicular. Vesicles 10%, <1 mm, filled with calcite, chlorite and pyrite.

110-150 cm: basalt, fine-grained.

Shipboard Data

Magnetic Data:	**87 cm**
Intensity (emu/cc)	83.4
Inclination before demag.	15.7
Stable Inclination	36.3
Physical Properties:	**87 cm**
$\overline{V}$p (km/s)	4.45
Porosity (%)	15.87
Wet Bulk Density	2.72
Grain Density	3.04
Other Data:	**7 cm**
Therm. cond. (mcal/cm-s-°C)	4.12



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	21	6

Depth: 558.8 to 559.8 m

Visual Description

0-67 cm: very fine-grained basalt. The same flow as described in Core 21, Section 5. It is the bottom of the lava flow. Basalt aphyric, gray, fresh.

67-78 cm: top of next lava flow. Chill zone (glass), dark.

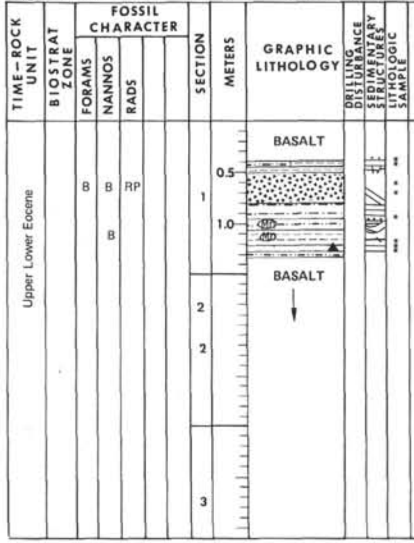
78-82 cm: very fine-grained (aphanitic) basalt, dark,dense.

88-101 cm: basalt fine-grained, dark gray, fresh.

Shipboard Data

Magnetic Data:	**16 cm**
Intensity (emu/cc)	185.4
Inclination before demag.	−7.7
Stable Inclination	34.7
Physical Properties:	**15 cm**
$\overline{V}$p (km/s)	4.41
Other Data:	**15 cm**
Therm. cond. (mcal/cm-s-°C)	4.13

SITE 446 **HOLE** A **CORE** 22 **CORED INTERVAL:** 562.0-571.5 m



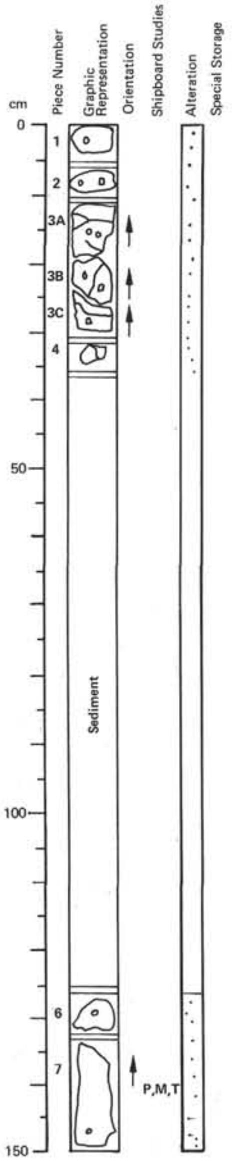
LITHOLOGIC DESCRIPTION

5Y 2/1, 5Y 3/1
N4
5B 4/1,
5Y 4/1
5BG 4/1

Mudstone, Claystone, Altered Ash and Chert
(Layer of sediment recovered between two basalts).
(1) Mudstone, Sandy Mudstone, very dark gray to black; light gray laminations; speckled black and white layers (5-10 mm), (possibly graded, with scour) within dark **Mudstone** beds inclined and parallel. Other dark blue green layers. Minor microfaulting. Composition dominantly feldspar, heavy minerals and clay.
(2) Claystone, very hard, dark gray to very dark bluish gray laminated, with widely spaced laminae – transitional to **Mudstone** where it overlies contact. May be glauconitic, zeolitic.
(3) Altered Ash, black to dark gray volcanic ash. Altered to clay-like material. Contains feldspars, heavy minerals, radiolarians and sponge spicules.
(4) Chert, 1 piece (2 cm) of very hard gray (10YR 5/1) chert may represent chert layer.

SMEARS:

Composition %	1			2		3
Quartz, Feldspar	5%	20%	50%	10-20%	10%	10%
Clay minerals	84%	44%	35%	55-85%	50%	22-45%
Volcanic glass	–	–	–	–		30-60%
Opaque minerals	7%	7%	7%	0- 5%	3%	0-+ %
Heavy minerals	1%	10%	10%	2- 5%	10%	2- 5%
Carbonate unspec.	+	–	–	0- 3%	–	0%
Siliceous fossils	1%	–	1%	0-+ %	–	2- 5%
Mica	–	1%	+	0- 2%	2%	0- 1%
Micronodules	+	10%	3%	0%	20%	0- 5%
Zeolites	1%	2%	2%	0- 1%	–	0- 2%
Glauconite	1%	3%	+	0-+ %	5%	1- 5%
Lithic fragments	+	+	+	–	+	0- 3%



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	22	1

Depth: 562.0 to 563.5 m

Visual Description

0-35 cm: very sparsely phyric, dark gray fine-grained basalt (<1% to 1% plagioclase phenocrysts 2-3 mm). Vesicles 1% infilled by dark clay, pyrite or zeolite (about 0.5 mm). Cross-cutting, chloritic and zeolite lined veins and fractures (dark clay). Similar to end of previous core.

35-126 cm: claystone, sandy mudstone and volcanic ash sediments. No immediately obvious signs of baking.

126-150 cm: light gray, fine-grained aphyric, sparsely vesicular basalt. Vesicles 1%, 0.5-2 mm, lined by green clay (overlying zeolites?). No evidence of chill margins above or below sediment.

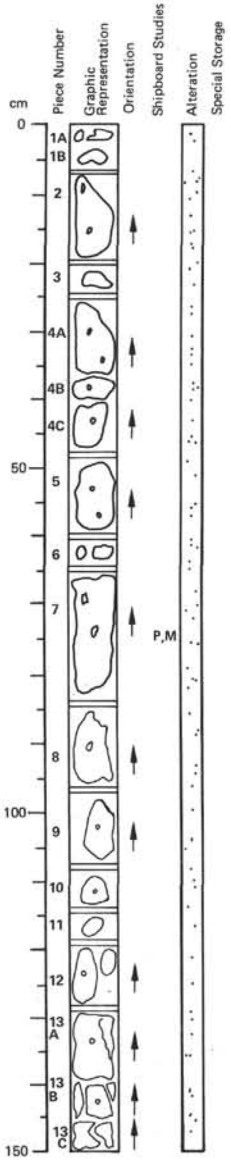
Shipboard Data

Bulk Analysis:	**29 cm**
SiO_2	48.06
Al_2O_3	12.23
Fe_2O_3	1.72
FeO	11.33
MgO	7.11
CaO	8.01
Na_2O	3.14
K_2O	1.08
TiO_2	4.65
P_2O_5	0.50
MnO	0.23
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	3.00
Ni	20.00
Sr	453.00
Zr	378.00

Magnetic Data:	**140 cm**
Intensity (emu/cc)	366.0
Inclination before demag.	−14.8
Stable Inclination	−13.2

Physical Properties:	**135 cm**
$\overline{V}p$ (km/s)	3.54

Other Data:	**135 cm**
Therm. cond. (mcal/cm-s-°C)	3.40



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	22	2

Depth: 563.5 to 565.0 m

Visual Description

Light gray, fine- to medium-grained aphyric, sparsely vesicular basalt. Similar to previous section (end of). Odd plagioclase phenocryst (1.5-2 mm). Vesicles 1-2%, in general 0.5-1 mm across. Occasionally 2 mm across. Occur mainly between 15-70 cm. Lined by green clay, occasional pyrite and zeolite. Chloritic lining to fracture surfaces with odd pyrite grain between Pieces 4A and 4B, 12, 13A,B,C and 2.

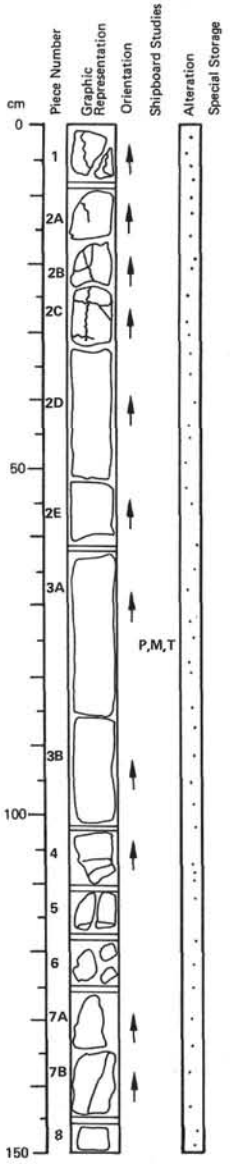
Shipboard Data

Bulk Analysis:	**82 cm**
SiO_2	47.50
Al_2O_3	13.65
Fe_2O_3	1.22
FeO	8.02
MgO	4.95
CaO	10.79
Na_2O	3.87
K_2O	2.17
TiO_2	3.76
P_2O_5	0.38
MnO	0.22
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	30.00
Ni	28.00
Sr	756.00
Zr	211.00

Magnetic Data:	**75 cm**
Intensity (emu/cc)	594.4
Inclination before demag.	−16.2
Stable Inclination	−12.5

Physical Properties:	**73 cm**
$\overline{V}p$ (km/s)	3.82
Porosity (%)	18.29
Wet Bulk Density	2.68
Grain Density	3.05

Other Data:	**73 cm**
Therm. cond. (mcal/cm-s-°C)	3.59



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	22	3

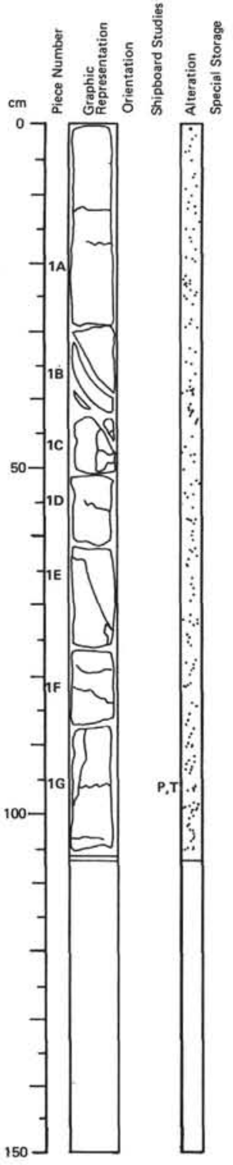
Depth: 565.0 to 566.5 m

Visual Description

Light gray, aphyric, medium-grained basalt. Similar to end of previous section. Plagioclase and pyroxene discernable under binocular microscope (<0.5-1 mm). Cross-cutting chloritic/clay (grayish and greenish). Lined veins from 0.5-2 mm wide also lines fractures. Pyrite visible on fracture surfaces.

Shipboard Data

Magnetic Data:	**75 cm**
Intensity (emu/cc)	732.5
Inclination before demag.	−14.2
Stable Inclination	−16.5
Physical Properties:	**78 cm**
$\overline{V}$p (km/s)	4.27
Porosity (%)	16.06
Wet Bulk Density	2.83
Grain Density	3.17
Other Data:	**78 cm**
Therm. cond. (mcal/cm-s-° C)	3.51



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	22	4

Depth: 566.5 to 567.6 m

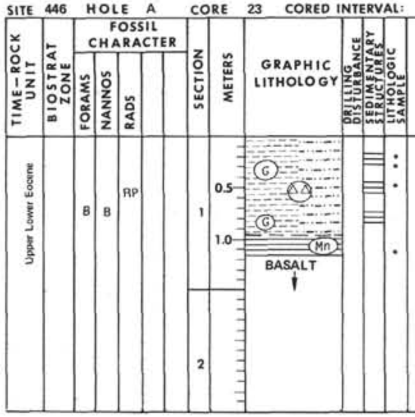
Visual Description

Light gray, medium- to fine-grained basalt, similar to previous section. Cross-cutting chloritic and pyrite lined fractures and veins.

Shipboard Data

Magnetic Data:	**95 cm**
Intensity (emu/cc)	619.4
Inclination before demag.	−20.2
Stable Inclination	−17.8
Physical Properties:	**95 cm**
$\overline{V}$p (km/s)	3.90
Other Data:	**95 cm**
Therm. cond. (mcal/cm-s-° C)	3.68

SITE 446 **HOLE** A **CORE** 23 **CORED INTERVAL:** 571.5-581.0 m



5G 4/1

5Y 4/1

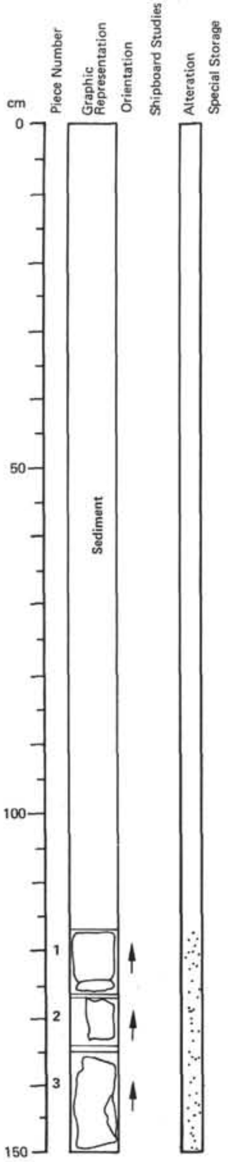
LITHOLOGIC DESCRIPTION

Section1, 0 to 113 cm

Claystone and Mudstone, dominantly dark greenish gray (5G 4/1) very hard **Mudstone to Claystone;** very faintly parallel laminated; partly glauconitic and radiolarian-rich, and locally with small patches of glauconite (concentrated at 32 cm and 80-81 cm, Dark gray (5Y 4/1) **Mudstone to Claystone,** partly radiolarian-rich in section overlying basalt; clay is pelagic with **10-15%** micronodules.

SMEARS:

Quartz, Feldspar	10%	2%	2%	2%
Clay minerals	71%	91%	85%	–
Micronodules	7%	3%	10-15%	5%
Radiolarians	8%	3%	7%	1%
Glauconite	2%	1%	–	92%



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	23	1

Depth: 571.5 to 573.0 m

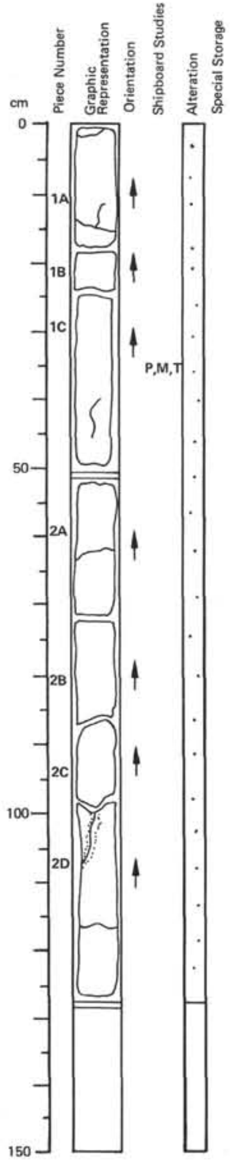
Visual Description

0-117 cm: sediment, mudstone and claystone.

117-150 cm: aphyric, gray, aphanitic to fine-grained basalt. Odd cross-cutting carbonate lined vein.

Pieces 2 and 3: 1% vesicles (carbonate filled amygdules or lined by light olive green clay [smectite?]).

Piece 3: two large (one – 20 mm x 5 mm, the other 8 mm x 3 mm) vugs infilled by carbonate.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	23	2

Depth: 573.0 to 574.3 m

Visual Description

Aphyric, gray, fine-grained basalt. Similar to previous section. Cross-cutting calcite or chloritic and pyrite line veins.

Occasional vesicles, 0.5-1 mm, usually filled by carbonate or lined by light olive green clay (smectite).

26 cm (between Pieces 1B and 1C): large vug at least 25 x 40 mm infilled by carbonate (continues through from outer surface to inner?).

84 cm (Piece 2B): large vug 17 x 10 mm filled by carbonate.

97-103 cm: chloritic vein with 2 mm wide alteration zone.

Some other large carbonate vugs (from 5 mm - 10 mm).

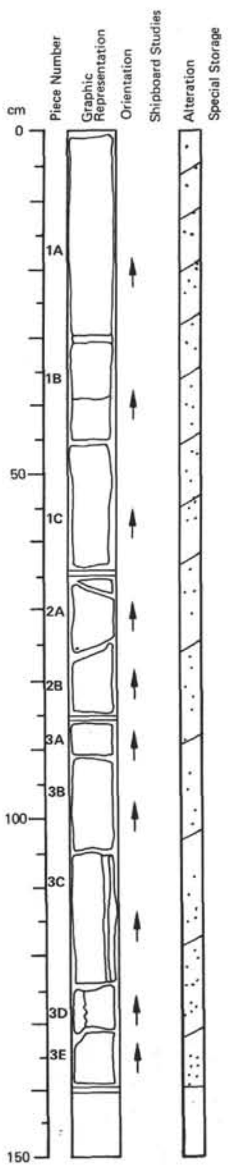
Shipboard Data

Bulk Analysis:	**52 cm**
SiO_2	52.17
Al_2O_3	12.02
Fe_2O_3	1.42
FeO	9.36
MgO	8.34
CaO	8.82
Na_2O	2.66
K_2O	0.83
TiO_2	3.31
P_2O_5	0.42
MnO	0.16
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	176.00
Ni	93.00
Sr	413.00
Zr	268.00

Magnetic Data:	**43 cm**
Intensity (emu/cc)	275.4
Inclination before demag.	−3.8
Stable Inclination	−4.8
Physical Properties:	**43 cm**
$\overline{V}p$ (km/s)	4.48
Other Data:	**43 cm**
Therm. cond. (mcal/cm-s-°C)	4.11

Alteration Symbols:

▯	= fresh
░	= weakly altered
▨	= moderately altered
▩	= extensively altered



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	23	3

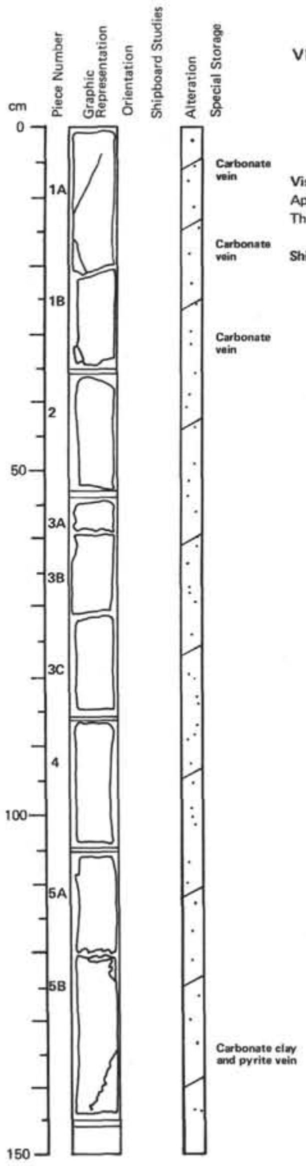
Depth: 574.3 to 575.7 m

Visual Description

Aphyric fine-grained basalt, <1% calcite filled amygdules. A few carbonate filled veins have caused the core to split lengthwise (Piece 3C).

Shipboard Data

Magnetic Data:	**38 cm**
Intensity (emu/cc)	243.2
Inclination before demag.	−18.3
Stable Inclination	−12.1
Physical Properties:	**38 cm**
$\overline{V}p$ (km/s)	4.85
Porosity (%)	9.47
Wet Bulk Density	2.80
Grain Density	2.99
Other Data:	**38 cm**
Therm. cond. (mcal/cm-s-°C)	4.12



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	23	4

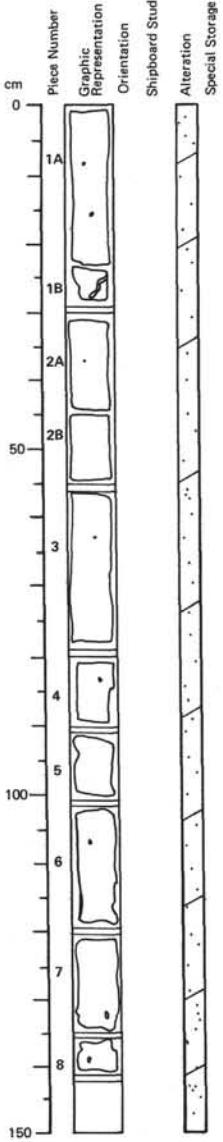
Depth: 575.7 to 577.1 m

Visual Description

Aphyric fine-grained basalt, <1% calcite filled vesicles.
Thick calcite, clay and pyrite filled veins (1 mm or less). Massive.

Shipboard Data

Magnetic Data:	**44 cm**
Intensity (emu/cc)	165.4
Inclination before demag.	−14.8
Stable Inclination	−10.1
Physical Properties:	**44 cm**
$\overline{V}p$ (km/s)	4.92
Other Data:	**44 cm**
Therm. cond. (mcal/cm-s-°C)	4.13



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	23	5

Depth: 577.1 to 578.5 m

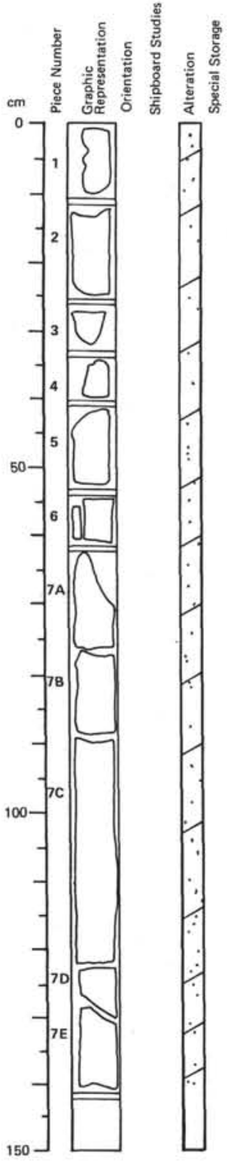
Visual Description

Aphyric massive basalt, appears to be moderately altered. Clay filled amygdules (< 1%). Fine-grained and massive. No chill zones.

Shipboard Data

Bulk Analysis:	**73 cm**
SiO_2	52.34
Al_2O_3	12.87
Fe_2O_3	1.39
FeO	9.20
MgO	7.22
CaO	9.18
Na_2O	2.95
K_2O	0.95
TiO_2	3.34
P_2O_5	0.42
MnO	0.14
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	174.00
Ni	93.00
Sr	409.00
Zr	273.00

Magnetic Data:	**37 cm**
Intensity (emu/cc)	151.4
Inclination before demag.	–18.0
Stable Inclination	–10.6
Physical Properties:	**37 cm**
$\overline{V}p$ (km/s)	4.64
Porosity (%)	9.20
Wet Bulk Density	2.89
Grain Density	3.07
Other Data:	**37 cm**
Therm. cond. (mcal/cm-s-°C)	3.90



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	23	6

Depth: 578.5 to 579.9 m

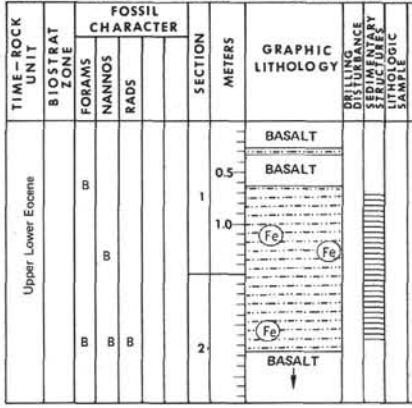
Visual Description

Basalt(?) massive, aphyric. Grain amount indicates that plagioclase is around An_{55}-An_{65}; however quartz is present. The rock appears to be quite leucocratic compared to most basalts, but there appears to be no break between it and the more basaltic appearing material above in Section 1 through 5. Mafics present in grain mount but lack cleavage and could be epidote, therefore this may be simply a highly altered basalt. Final determination awaits thin sections. Vesicles < 1%, virtually absent.

Shipboard Data

Magnetic Data:	**101 cm**
Intensity (emu/cc)	99.6
Inclination before demag.	–27.8
Stable Inclination	–15.5
Physical Properties:	**100 cm**
$\overline{V}p$ (km/s)	4.39
Other Data:	**100 cm**
Therm. cond. (mcal/cm-s-°C)	3.68

SITE 446 HOLE A CORE 24 CORED INTERVAL: 581.0-590.5 m



LITHOLOGIC DESCRIPTION

5B 4/1

10YR 4/1
5BG 7/1

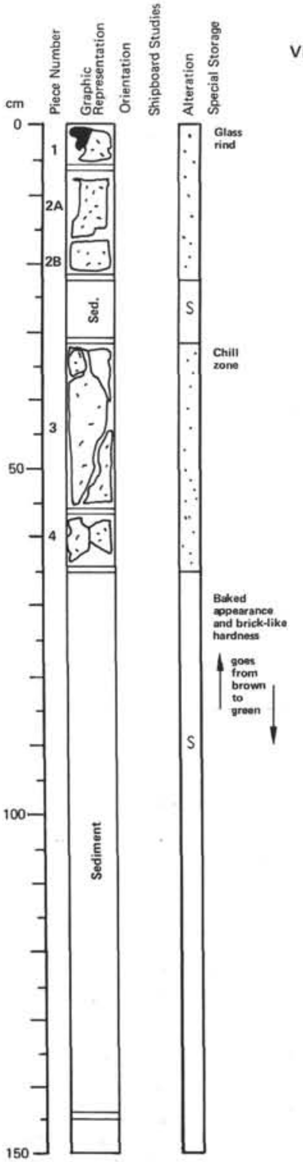
10YR 2/1

10YR 2/1

Dominant Lithology: Mudstone, occurs as thin interbed between two thin basalt layers, and a thicker bed overlying thick basalt flow. The mudstone includes **(1)** dark bluish gray (5B 4/1) to greenish gray (5BG 5/1), with faint parallel laminations; **(2)** dark gray (10YR 4/1) to black (10YR 2/1) **Ferruginous(?) Mudstone** with Fe(?) micronodules, faint parallel lamination, Possible **Chert** concretion?

SMEARS:

	(1)	(2)
Feldspar	2-10%	+ -10%
Clay minerals	77-78%	79-83%
Glauconite	10-20%	0- 2%
Micronodules	+ - 3%	10-15%



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	24	1

Depth: 581.0 to 582.4 m

Visual Description

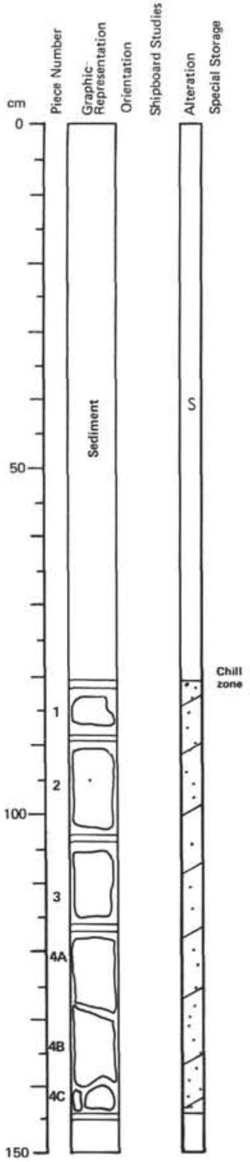
0-22 cm: plagioclase phyric basalt. Plagioclase laths 3-4%, 0.5-2.0 mm, in glassy zone. Possible relict olivine, rare clay-filled amygdules.
23-32 cm: claystone.
34-64 cm: plagioclase phyric basalt, similar to 0-22 cm.
65 cm: sediment.

Shipboard Data

Bulk Analysis:	**19 cm**
SiO_2	47.33
Al_2O_3	12.88
Fe_2O_3	1.63
FeO	10.75
MgO	5.19
CaO	11.08
Na_2O	2.71
K_2O	0.47
TiO_2	4.46
P_2O_5	0.52
MnO	0.44
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	64.00
Ni	50.00
Sr	452.00
Zr	341.00

Magnetic Data:	**18 cm**	**43 cm**
Intensity (emu/cc)	2467.7	1719.9
Inclination before demag.	– 2.4	1.7
Stable Inclination	– 4.3	5.8

Physical Properties:	**18 cm**	**43 cm**
$\overline{V}p$ (km/s)	4.47	4.41
Porosity (%)	16.18	
Wet Bulk Density	2.79	
Grain Density	3.13	



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	24	2

Depth: 582.4 to 583.8 m

Visual Description

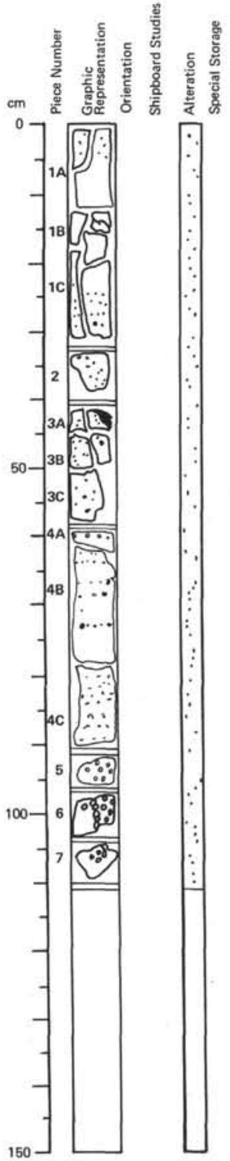
0-80 cm: sediment, noticeably harder near basalt.
80-150 cm: fine-grained massive aphyric basalt. Coarsens downwards.

Shipboard Data

Magnetic Data:	**99 cm**	**99 cm**
Intensity (emu/cc)	197.9	—
Inclination before demag.	47.0	—
Stable Inclination	79.0	50.4

Physical Properties:	**99 cm**
$\overline{V}p$ (km/s)	3.96
Porosity (%)	18.50
Wet Bulk Density	2.60
Grain Density	2.96

Other Data:	**78 cm**
Therm. cond. (mcal/cm-s-°C)	4.35



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 8	4 4 6	A	2 4	3

Depth: 583.8 to 584.9 m

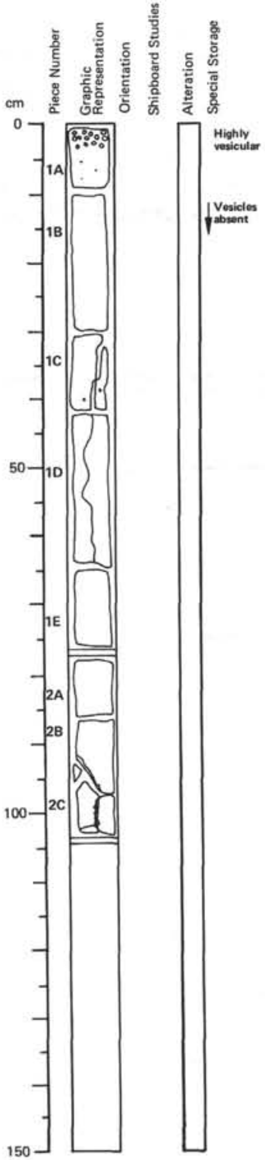
Visual Description

Amygdaloidal basalt. Aphyric, 0-30% vesicles, note horizontal orientation of some chains of vesicles, 0.2-4.0 mm calcite and clay infilling. Vesicles in Pieces 5, 6, and 7 empty. The basalt is fine-grained and lightly altered.

Shipboard Data

Magnetic Data:	**74 cm**
Intensity (emu/cc)	581.9
Inclination before demag.	1.0
Stable Inclination	−1.5

Physical Properties:	**74 cm**
$\bar{V}$p (km/s)	4.55
Porosity (%)	13.73
Wet Bulk Density	2.75
Grain Density	3.03



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 8	4 4 6	A	2 4	4

Depth: 584.9 to 586.0 m

Visual Description

Massive aphyric basalt. Vesicles 20% in top 1.5 cm, absent beneath. A few clay filled amygdules. Fine-grained up to Piece 2C which abruptly becomes medium-grained.

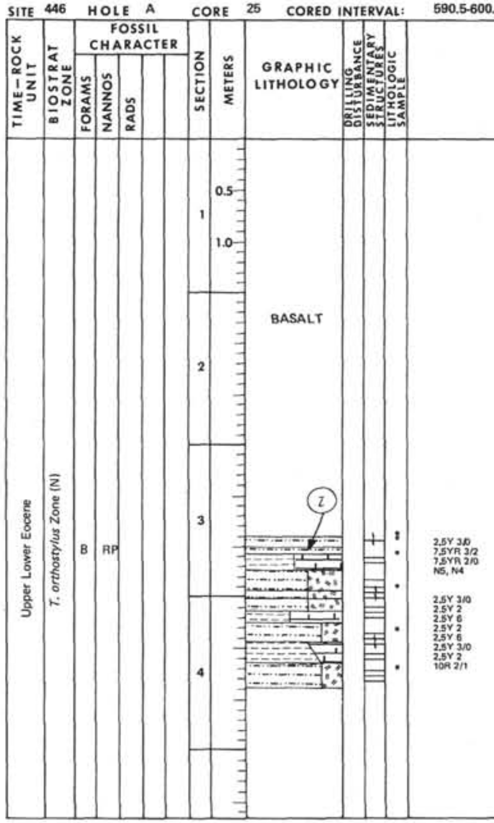
Shipboard Data

Bulk Analysis:	**73 cm**
SiO_2	49.51
Al_2O_3	13.43
Fe_2O_3	1.61
FeO	10.60
MgO	6.67
CaO	10.31
Na_2O	2.69
K_2O	0.37
TiO_2	3.11
P_2O_5	0.40
MnO	0.24
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	83.00
Ni	53.00
Sr	415.00
Zr	251.00

Magnetic Data:	**86 cm**
Intensity (emu/cc)	222.3
Inclination before demag.	−8.2
Stable Inclination	2.5

Physical Properties:	**86 cm**
$\bar{V}$p (km/s)	4.99
Porosity (%)	6.16
Wet Bulk Density	2.89
Grain Density	3.02

SITE 446 HOLE A CORE 25 CORED INTERVAL: 590.5-600.0 m



LITHOLOGIC DESCRIPTION

Mudstone, Clayey Nannofossil Chalk with Siliceous Fossils or Zeolites, or Feldspars, or Micronodules or/and Ash. Zeolitic and feldspar-rich mudstone underlies a basalt flow, with obvious contact zone. The contact zone shows new components (feldspars very close to basalt, zeolites at 5 cm) as well as remainders of previous structures = slight bioturbation, some laminae. Color very dark gray (2.5Y 3/0) to dark brown (7.5YR 3/2).

Below the contact zone, irregular alternating mudstone with ash and clayey nannofossil/calcareous ooze. Colors are chiefly gray (N5, 2.5Y 6) in the calcareous zone, chiefly very dark gray (2.5Y 3) to black (2.5Y 2) sometimes reddish black = micronodules (10R 2/1) in the muddy zone. Slight bioturbation is recognizable. Laminations appear throughout, but are more abundant in calcareous parts. Laminae are parallel or irregular. There are minor micro- cross-beds, lenses and other current structures.

Ash is common in mudstone, as well as siliceous fossils (mainly radiolarians), which are partly dissolved.

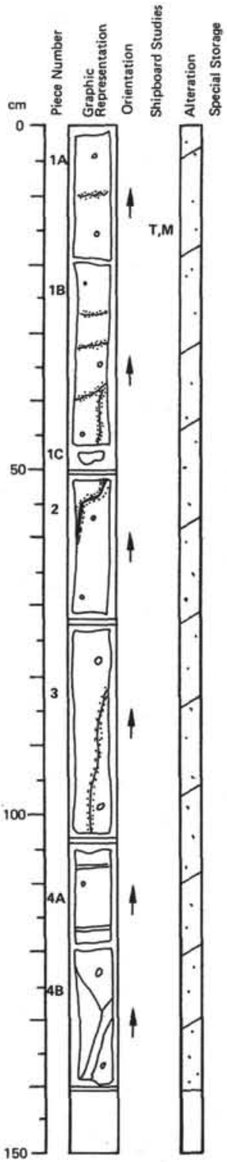
SMEARS:

	Mudstone			
	with Feldspars	with Ash	with Zeolites	with Ash and Micronodules
Feldspar	15%	6- 8%	5%	8%
Clay minerals	79%	44-48%	70%	44%
Volcanic glass	–	22-34%	–	21%
Opaque minerals	2%	5%	2%	+
Heavy minerals	1%	+ - 2%	1%	2%
Carbonate unspec.	3%	1- 5%	8%	5%
Siliceous fossils	–	10%	–	3%
Mica	–	1-5% (mica-chlorite)	–	5% (mica-chlorite)
Glauconite	–	+ - 3%	–	2%
Zeolites	–	–	15%	–

3-112 (Clayey Nannofossil Chalk)

Feldspar	1%
Clay minerals	48%
Mica	1%
Carbonate unspec.	15%
Nannofossils	35%

CARBON-CARBONATE:
4-14 (5.8, 2.9, 24)



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	25	1

Depth: 590.5 to 591.9 m

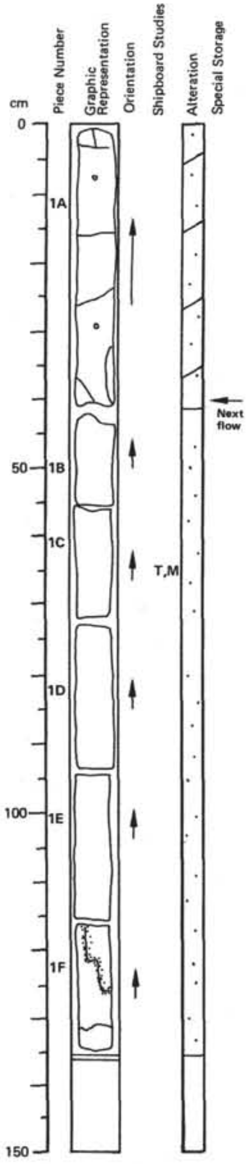
Visual Description

0-140 cm: basalt aphyric, fine-grained, dark gray. Vesicles 1-2%, 2-3 mm, filled with calcite (0-80 cm) and chlorite (80-140 cm).

Upper one-third appears to contain approximately 5% relict phenocrysts possibly after olivine as suggested by euhedral outlines with expansion cracks in alteration products.

Shipboard Data

Magnetic Data:	**13 cm**
Intensity (emu/cc)	192.3
Inclination before demag.	−9.6
Stable Inclination	2.4
Physical Properties:	**13 cm**
$\overline{V}p$ (km/s)	5.19
Porosity (%)	9.70
Wet Bulk Density	2.83
Grain Density	3.02
Other Data:	**13 cm**
Therm. cond. (mcal/cm-s-°C)	4.28



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	25	2

Depth: 591.9 to 593.3 m

Visual Description

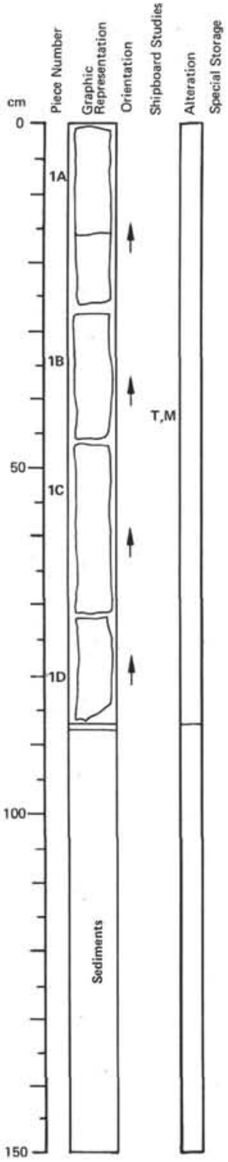
0-40 cm: basalt aphyric,fine-grained, gray. Vesicles <1%, <2 mm, filled with chlorite and calcite. Similar to Core 25, Section 1.

40-135 cm: basalt, aphyric fine-grained, dark,non-vesicular.

Shipboard Data

Bulk Analysis:	**51 cm**
SiO_2	52.60
Al_2O_3	12.78
Fe_2O_3	1.55
FeO	10.22
MgO	6.71
CaO	8.81
Na_2O	2.91
K_2O	0.84
TiO_2	3.28
P_2O_5	0.42
MnO	0.15
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	50.00
Ni	51.00
Sr	393.00
Zr	255.00

Magnetic Data:	**69 cm**
Intensity (emu/cc)	151.9
Inclination before demag.	−23.3
Stable Inclination	−11.1
Physical Properties:	**69 cm**
$\overline{V}p$ (km/s)	4.75



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	25	3

Depth: 593.3 to 594.1 m

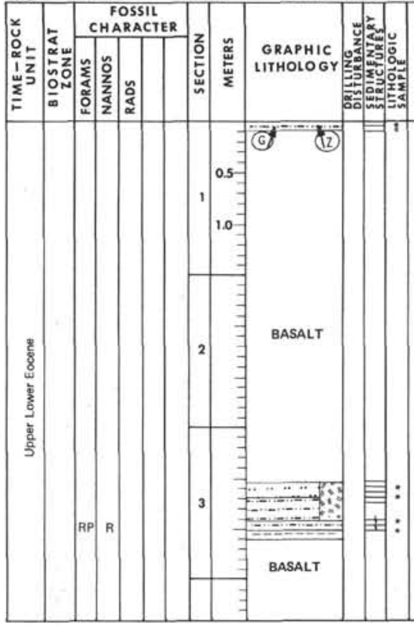
Visual Description

0-87 cm: basalt identical to that described at the base of Core 25, Section 2, but fresher, aphyric, fine-grained, dark.

Shipboard Data

Magnetic Data:	**41 cm**
Intensity (emu/cc)	329.6
Inclination before demag.	4.5
Stable Inclination	1.5
Physical Properties:	**41 cm**
$\overline{V}p$ (km/s)	4.39
Other Data:	**41 cm**
Therm. cond. (mcal/cm-s-°C)	4.11

SITE 446 HOLE A CORE 26 CORED INTERVAL: 600.0-609.5 m



LITHOLOGIC DESCRIPTION

5G 4/1
10R 2/1

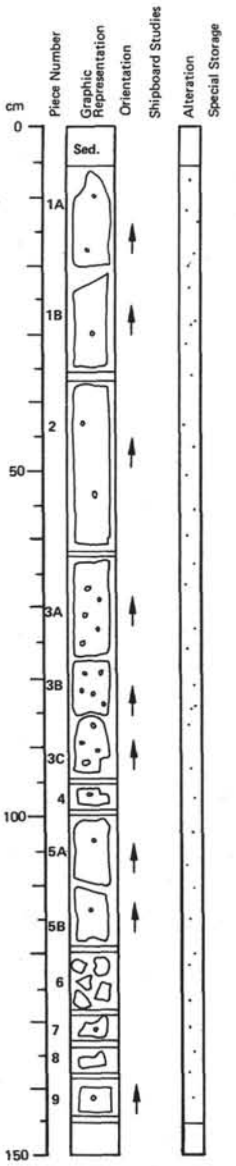
Dominant Lithology:
(A) Mudstone, dark greenish gray (5G 4/1) to reddish black (10R 2/1), very hard, glauconitic, to feldspar-rich, zeolitic laminated **Mudstone** overlies basalt section at top of Section 1. Dark greenish gray (5G 4/1) glauconite ashy, (may be sandy to silty) **Mudstone or Siltstone,** with frequent lamination. Slight bioturbation underlies the upper basalt in this core. May have calcareous or siliceous fossils.

Minor Lithology:
(B) Claystone, reddish black (10R 2/1) baked, very hard **Claystone** at contact with lower basalt. No sedimentary structures.

SMEARS:

		A		B
Feldspar	3%	3%	1%	3%
Clay minerals	17%	17%	56%	89%
Volcanic glass	20%	15%	5%	–
Opaque minerals	–	–	–	–
Heavy minerals	2%	1%	2%	2%
Carbonate unspecified	4%	10%	12%	2%
Nannofossils	1%		1%	
Radiolarians (altered)	3%	9%	+	–
Glauconite	50%	45%	20%	–
Mica	–	–	3%	–
Zeolites	–	–	–	4%

5G 4/1
10R 2/1



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	26	1

Depth: 600.0 to 601.5 m

Visual Description

5-145 cm: basalt aphyric, fine-grained, gray, vesicular. Vesicles 1%, <1 mm, filled with calcite and chlorite.

60-100 cm: vesicles 5-7%, <2 mm.

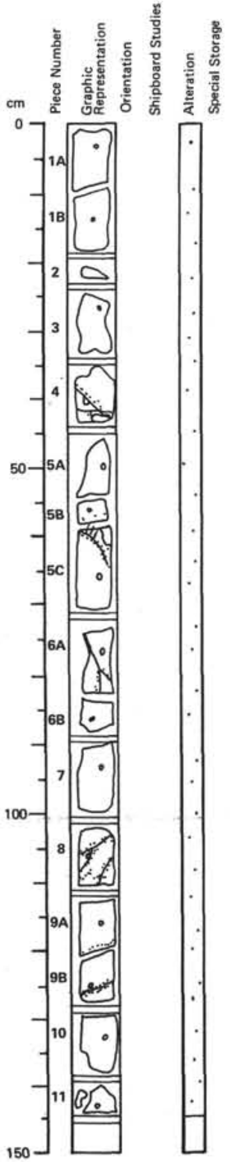
Shipboard Data

Bulk Analysis:	**33 cm**
SiO_2	48.69
Al_2O_3	13.05
Fe_2O_3	1.44
FeO	9.54
MgO	6.89
CaO	10.87
Na_2O	2.80
K_2O	0.83
TiO_2	3.41
P_2O_5	0.40
MnO	0.24
LOI	---
H_2O^+	---
H_2O^-	---
CO_2	---
Cr	169.00
Ni	88.00
Sr	423.00
Zr	243.00

Magnetic Data:	**47 cm**
Intensity (emu/cc)	198.1
Inclination before demag.	–34.6
Stable Inclination	–16.6

Physical Properties:	**47 cm**
$\overline{V}p$ (km/s)	4.36
Porosity (%)	12.29
Wet Bulk Density	2.76
Grain Density	3.01

Other Data:	**47 cm**
Therm. cond. (mcal/cm-s-°C)	3.89



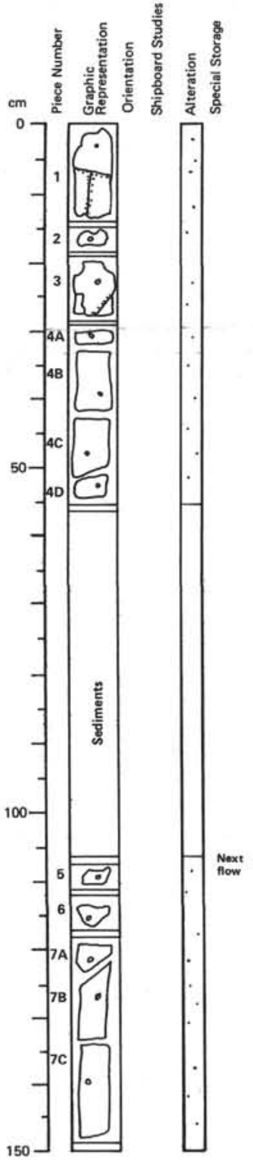
VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	26	2

Depth: 601.5 to 602.9 m

Visual Description

0-145 cm: basalt identical to that described for Core 26, Section 1, fresher. Vesicles <1%, <1 mm, filled with chlorite. Vein with calcite and chlorite.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE			SECT.	
5	8	4	4	6	A		2	6		3

Depth: 602.9 to 604.4 m

Visual Description

0-55 cm: basalt similar to Core 26, Section 2.

55-107 cm: sediments.

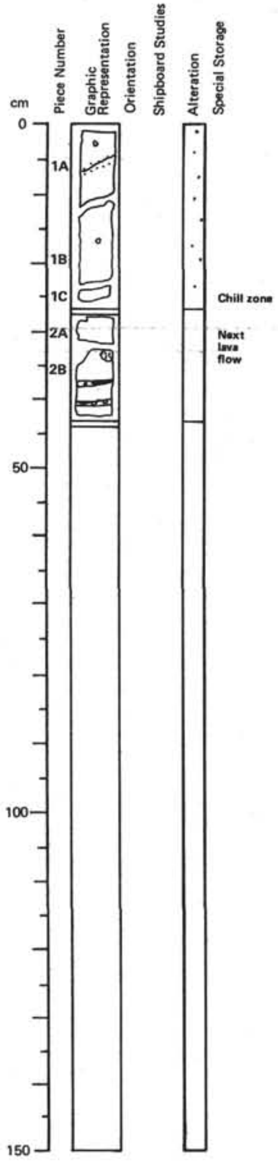
107-150 cm: next lava flow. Basalt aphyric, fine-grained, dark gray. Vesicles 1%, <2 mm filled with calcite and chlorite.

Shipboard Data

Bulk Analysis:	**46 cm**
SiO_2	51.05
Al_2O_3	13.64
Fe_2O_3	1.48
FeO	9.79
MgO	6.02
CaO	10.85
Na_2O	3.02
K_2O	0.31
TiO_2	3.12
P_2O_5	0.35
MnO	0.22
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	175.00
Ni	94.00
Sr	426.00
Zr	229.00

Magnetic Data:	**44 cm**	**140 cm**
Intensity (emu/cc)	973.0	198.2
Inclination before demag.	–22.3	25.6
Stable Inclination	–21.6	22.2

Physical Properties:	**44 cm**	**140 cm**
$\overline{V}p$ (km/s)	5.72	4.88
Porosity (%)	—	9.55
Wet Bulk Density	—	2.86
Grain Density	—	3.05



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE			SECT.	
5	8	4	4	6	A		2	6		4

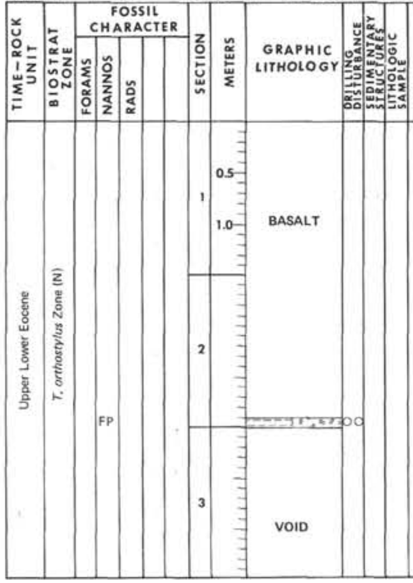
Depth: 604.4 to 604.8 m

Visual Description

0-27 cm: basalt identical to that described at the base of Core 26, Section 3.

27-43 cm: chill zone (27-31 cm glass), next lava flow. Basalt aphyric, fine-grained (to aphanitic), dark. Vein with calcite.

SITE 446 HOLE A CORE 27 CORED INTERVAL: 609.5-619.0 m



LITHOLOGIC DESCRIPTION

Drilling Breccia

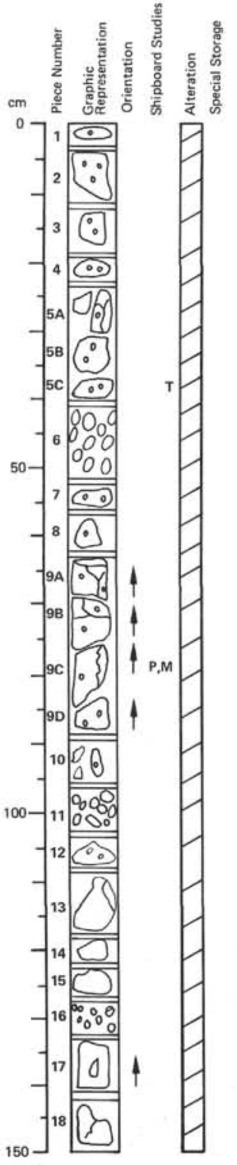
Three pieces plus small fragments
(1) Calcareous to Chalky Claystone
(2) Chalk
(3) Chalky Cleystone with Radiolarians

(1) Dark greenish gray to blue-green (5BG 4/1 to 5B 4/1) **Calcareous Claystone** faintly laminated, faintly bioturbated.
(2) Gray to light gray (5GY 6/1 to 5GY 7/1) **Chalk**, massive.
(3) Dark greenish gray (5BG 4/1) **Claystone** with calcareous laminae and thin (approximately 2 mm) very fine silty fining-upward layers with fairly well-developed load casts and sharp lower contacts.

146 cm
150 cm

SMEARS:

	(1)	(2)	(3)
Feldspar	+ - 1%	+	+
Clay minerals	55-65%	34%	55%
Volcanic glass	–	–	–
Opaque minerals	?	–	–
Heavy minerals	+	–	1%
Micronodules	10%	5%	5%
Carbonate unspec.	20-30% (with forams?)	60%	30%
Radiolarians	–	–	5%
Glauconite	+	+	2%
Zeolites	1%	–	1%



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	27	1

Depth: 609.5 m to 611.0 m

Visual Description

Gray, aphyric, amygdaloidal (initially) basalt.

5-40 cm: possibly altered microphenocrysts of olivine.

0-55 cm: amygdules filled by carbonate around 10%. Some pyrite and smectite (0.25-2 mm). Odd calcite vein.

55-110 cm: amygdules filled by greenish chloritic/clay material and fine-grained pyrite. Initially about 10% but fading out. Some chloritic/clay filled veins and lined fractures.

132-141 cm: Piece 17 has a large vug partially filled by dark clays and pyrite (30 x 10 mm).

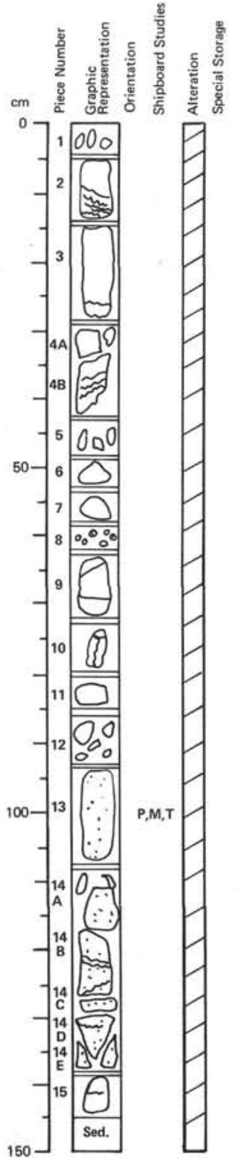
141-150 cm: pyrite lined vein.

Pieces 6, 11, and 16: drilling breccia.

Shipboard Data

Bulk Analysis:	**112 cm**
SiO_2	47.47
Al_2O_3	11.61
Fe_2O_3	1.75
FeO	11.55
MgO	7.10
CaO	9.47
Na_2O	2.40
K_2O	0.86
TiO_2	4.29
P_2O_5	0.45
MnO	0.23
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	32.00
Ni	35.00
Sr	431.00
Zr	312.00

Physical Properties:	**77 cm**
$\overline{V}p$ (km/s)	3.44
Porosity (%)	28.04
Wet Bulk Density	2.56
Grain Density	3.16



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
58	446	A	27	2

Depth: 611.0 to 612.5 m

Visual Description

Dark gray, aphyric basalt. Occasional plagioclase phenocrysts (0.5-1 mm) and altered olivine phenocrysts (0.5-1 mm). Some microphenocrysts of olivine(?) (altered). Occasional vesicles (0.25-10 mm) lined or filled by dark clay minrals. Cross-cutting clay and pyrite lined veins.

94-137 cm: 10% very fine vesicles (<0.25 mm) clay filled.

Piece 15, 137-145 cm: 3 mm wide vein with euhedral carbonate crystals.

Piece 4B, 41-42 cm: 1 cm thick clayey filled vein.

145-150 cm: sediment.

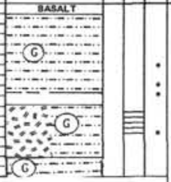
Shipboard Data

Bulk Analysis:	**94 cm**
SiO_2	47.29
Al_2O_3	12.11
Fe_2O_3	1.68
FeO	11.06
MgO	6.78
CaO	9.55
Na_2O	2.45
K_2O	0.89
TiO_2	4.36
P_2O_5	0.43
MnO	0.22
LOI	—
H_2O^+	—
H_2O^-	—
CO_2	—
Cr	36.00
Ni	42.00
Sr	442.00
Zr	307.00

SITE 446 **HOLE** A **CORE** 28 **CORED INTERVAL:** 619.0-628.5 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FOSSIL CHARACTER FORAMS	NANNOS	RADS			SECTION	METERS
Upper Lower Eocene	*T. orthostylus* Zone (N)	B	CM				1	0.5 1.0
		RP	FP				CC	

GRAPHIC LITHOLOGY / DRILLING DISTURBANCE / SEDIMENTARY STRUCTURES / LITHOLOGIC SAMPLE



LITHOLOGIC DESCRIPTION

N4

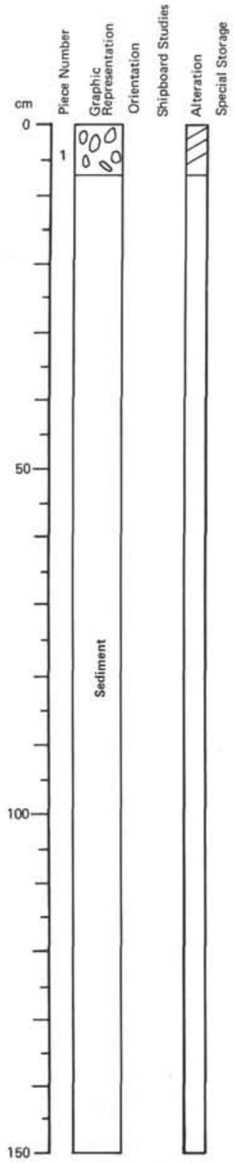
5G 4/1

N4

N4

Glauconitic Mudstone, dark gray (N4); locally laminated and with faint color band alternation with dark bluish gray (5B 4/1) to dark gray (N4); an interbed of dark greenish gray (5G 4/1) of **Glauconitic Altered Tuff (Ash)** at 80.5-82.0 cm (1.5 cm thick).

SMEARS:	Glauconitic Mudstone		Altered Ash
Feldspar	8%	1- 2%	15%
Clay minerals	68%	65-70%	–
Volcanic glass	–	–	75%
Micronodules	15%	5-15%	–
Radiolarians	4%	–	–
Glauconite	5%	10%	7%
Carbonate unspec. (Nannofossils)		4- 7%	
Biotite			3%



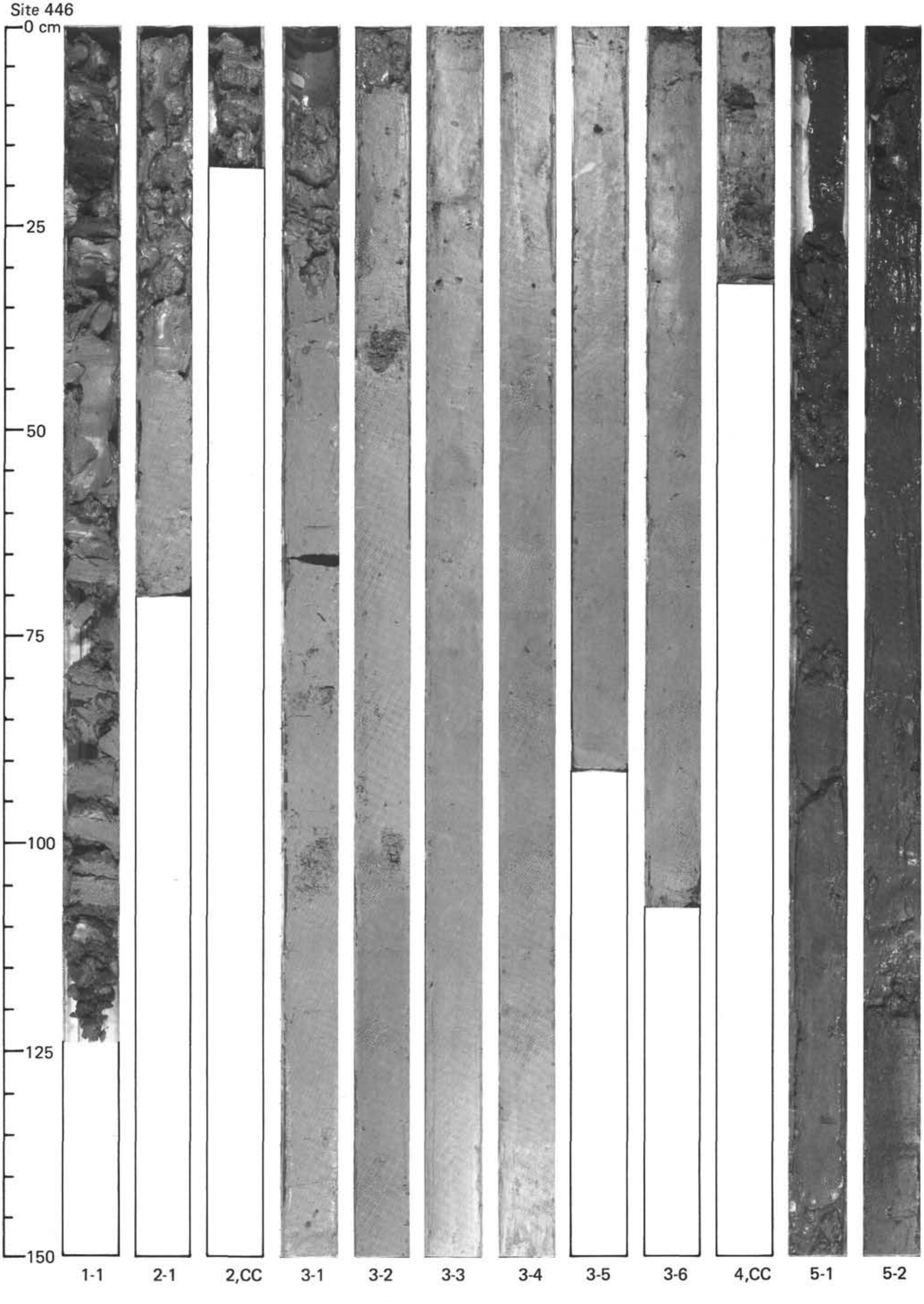
VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE			SECT.	
5	8	4	4	6	A		2	8		1

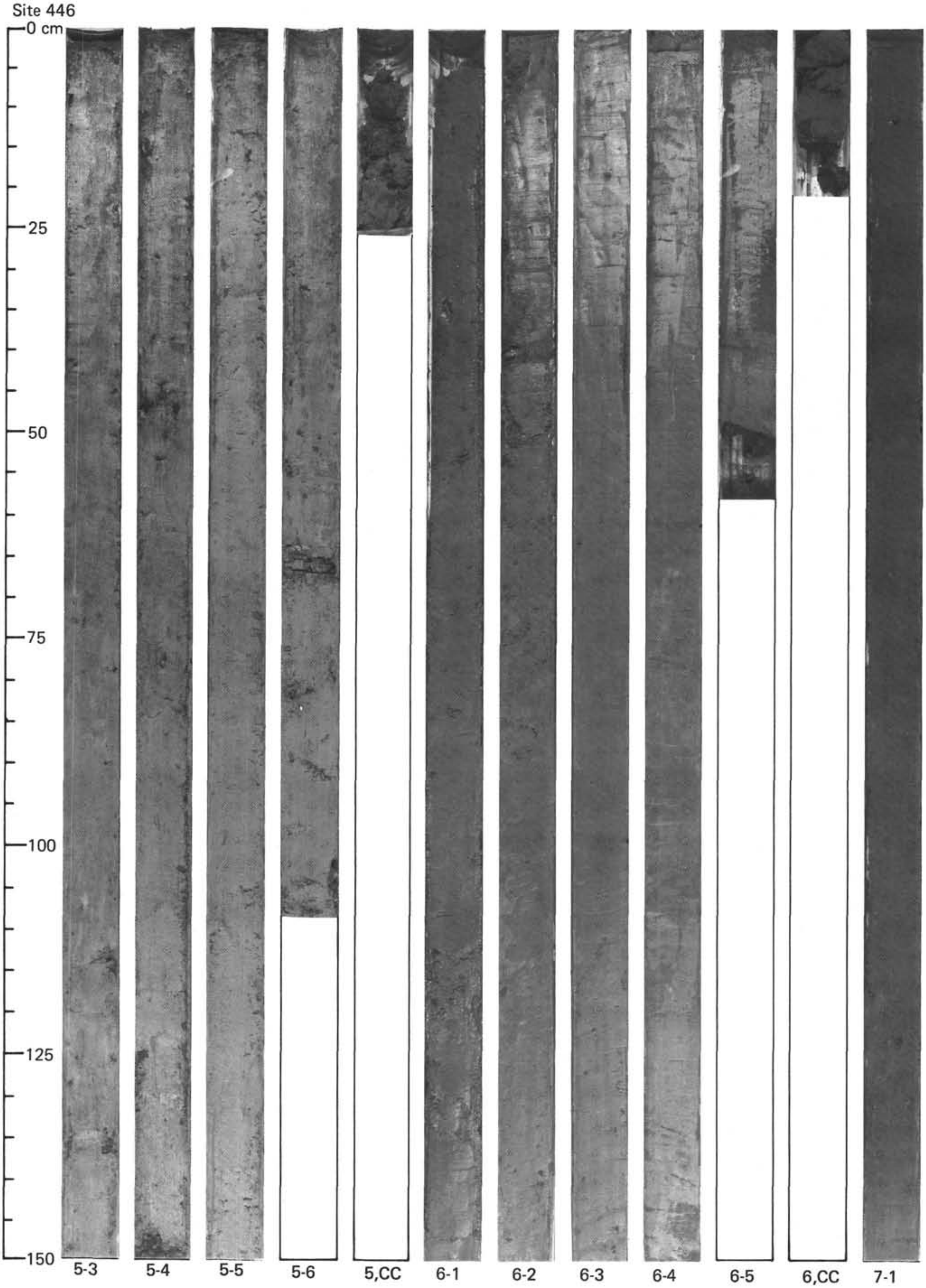
Depth: 619.0 to 620.5 m

Visual Description

0-7 cm: dark gray, aphyric, aphanitic basalt. Odd vesicle, 0.5-1 mm, lined by light olive green clay (smectite). Outer surfaces of pieces covered by dark green chloritic material with very fine pyrite or dark gray clayey material. Odd quartz or zeolite grain in vesicle on outer surface of one piece. Possible upholecontamination.



Site 446
0 cm
25
50
75
100
125
150
1-1
2-1
2,CC
3-1
3-2
3-3
3-4
3-5
3-6
4,CC
5-1
5-2


Site 446
0 cm
25
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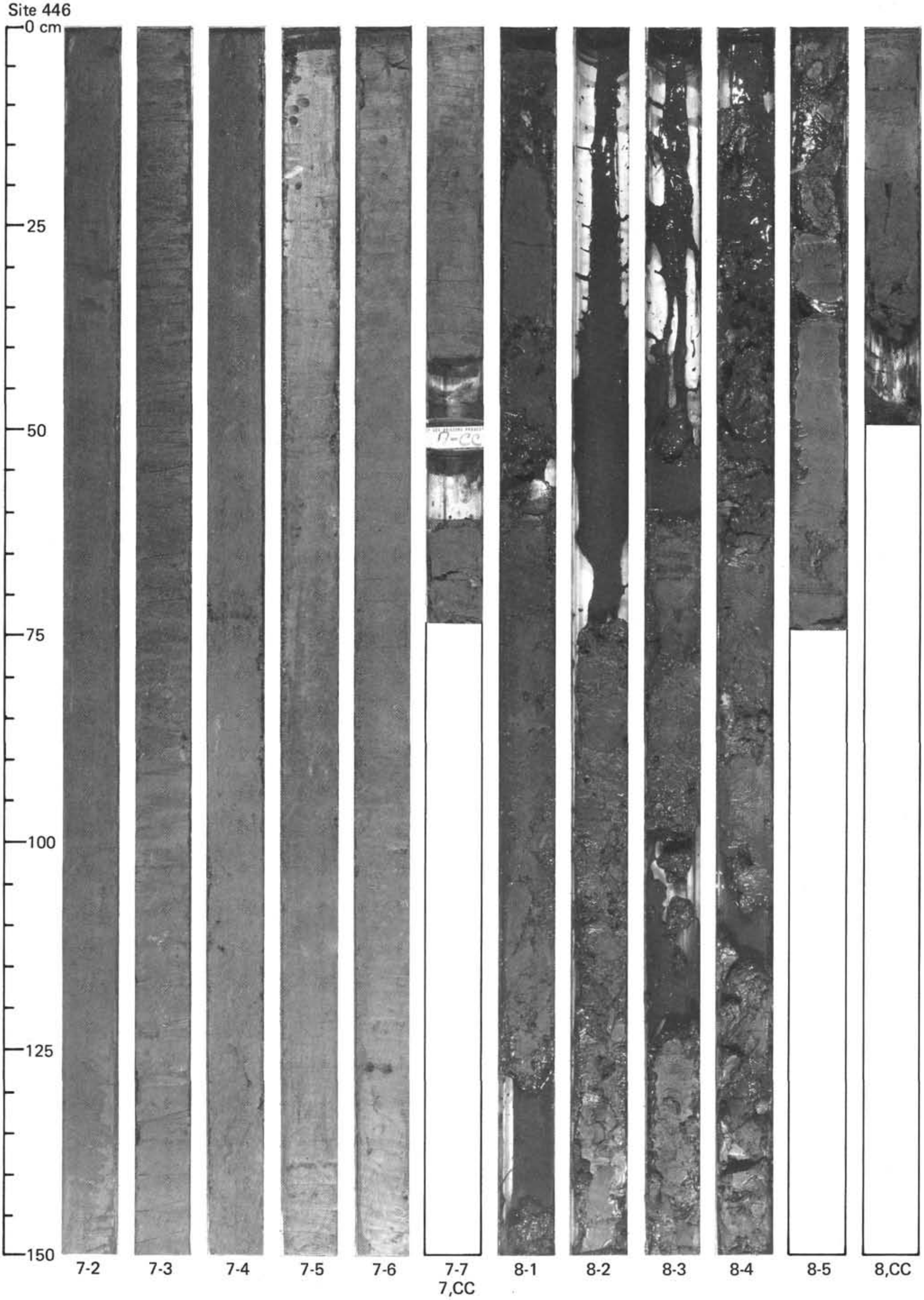
100
125
150
5-3
5-4
5-5
5-6
5,CC
6-1
6-2
6-3
6-4
6-5
6,CC
7-1


Site 446
0 cm
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75
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125
150
7-2
7-3
7-4
7-5
7-6
7-7
7,CC
8-1
8-2
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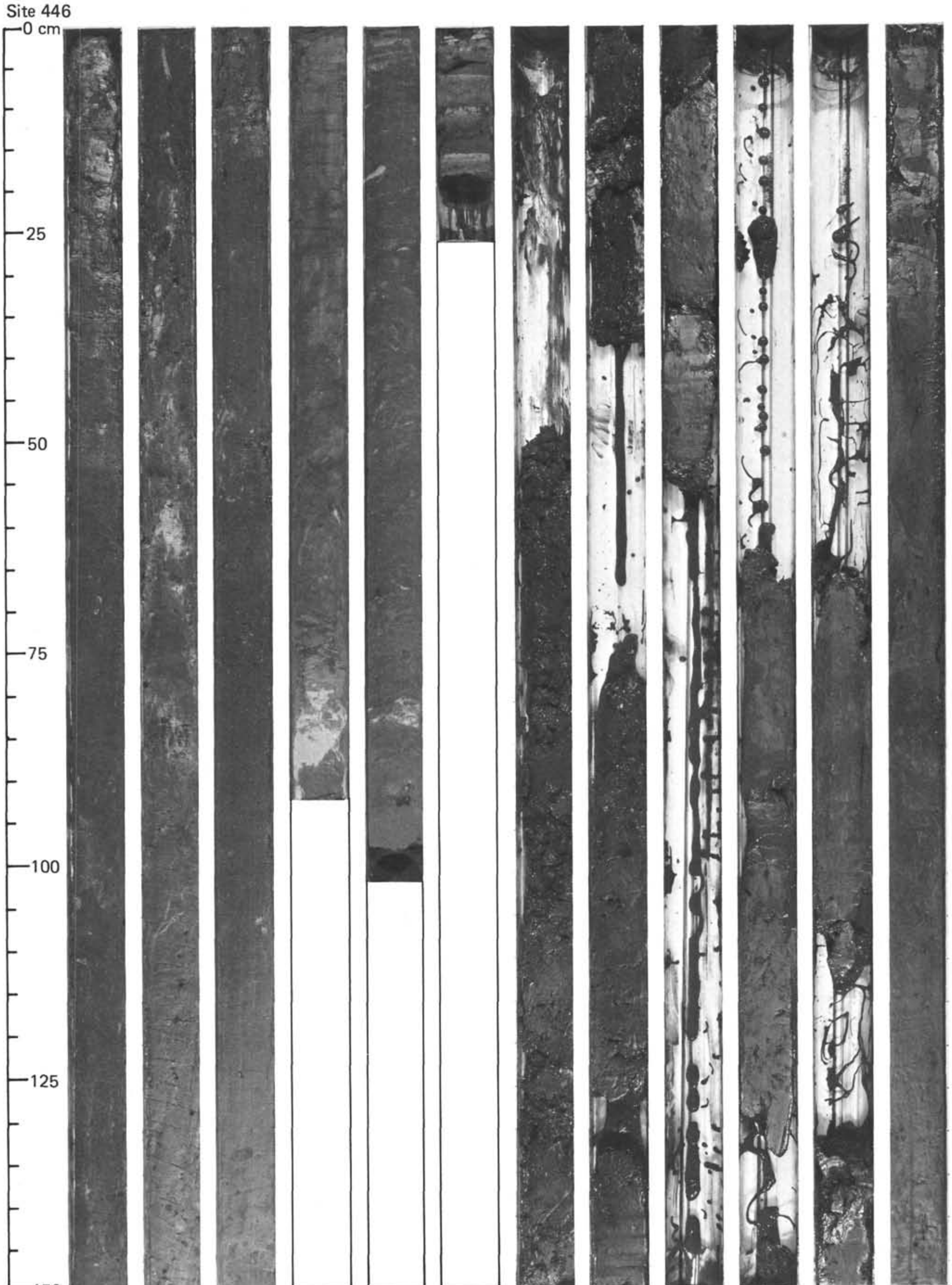
8-5
8,CC
7-CC


Site 446
0 cm
25
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75
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125
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9-1
9-2
9-3
9-4
9-5
9,CC
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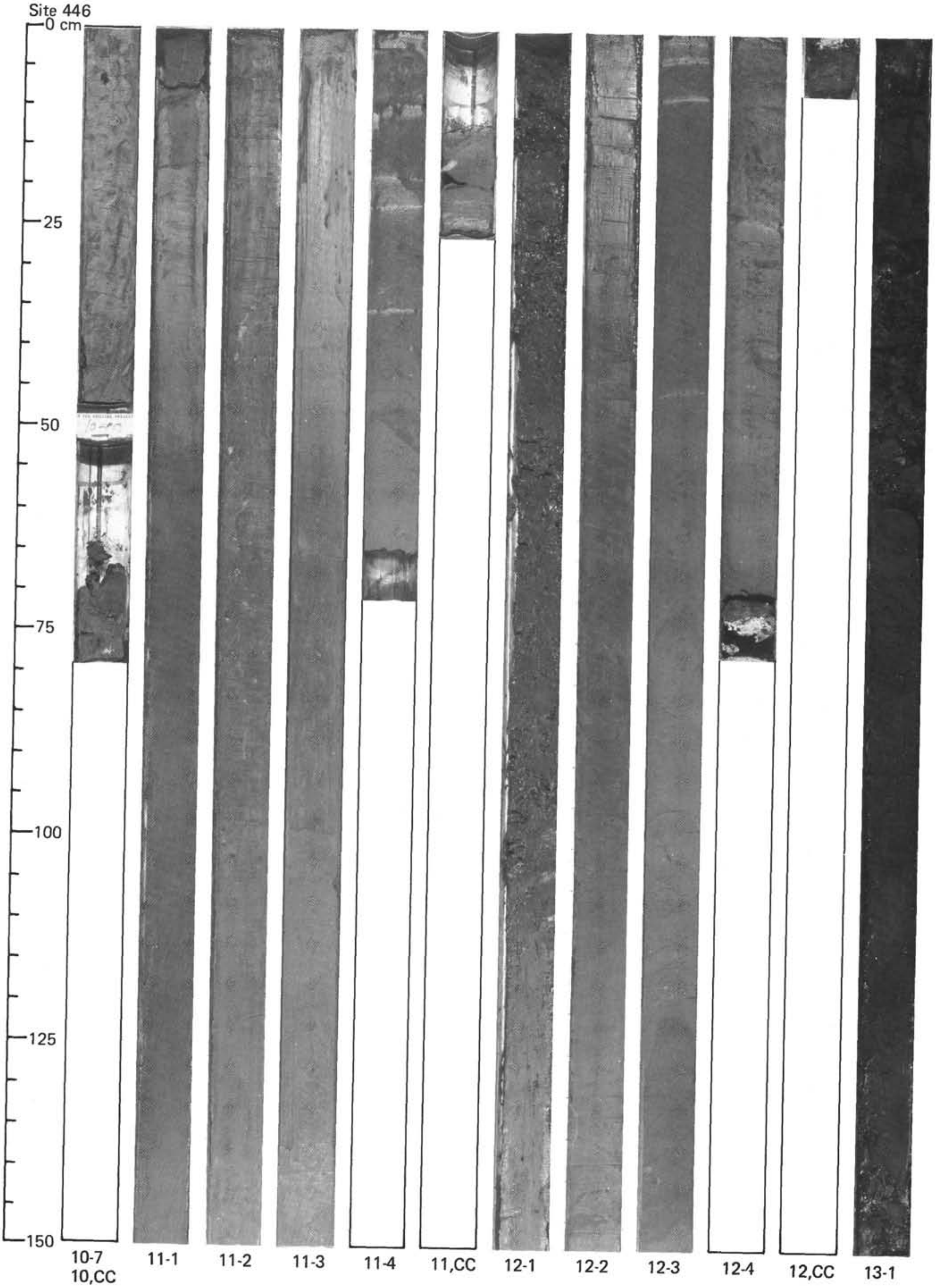
10-4
10-5
10,CC


Site 446
0 cm
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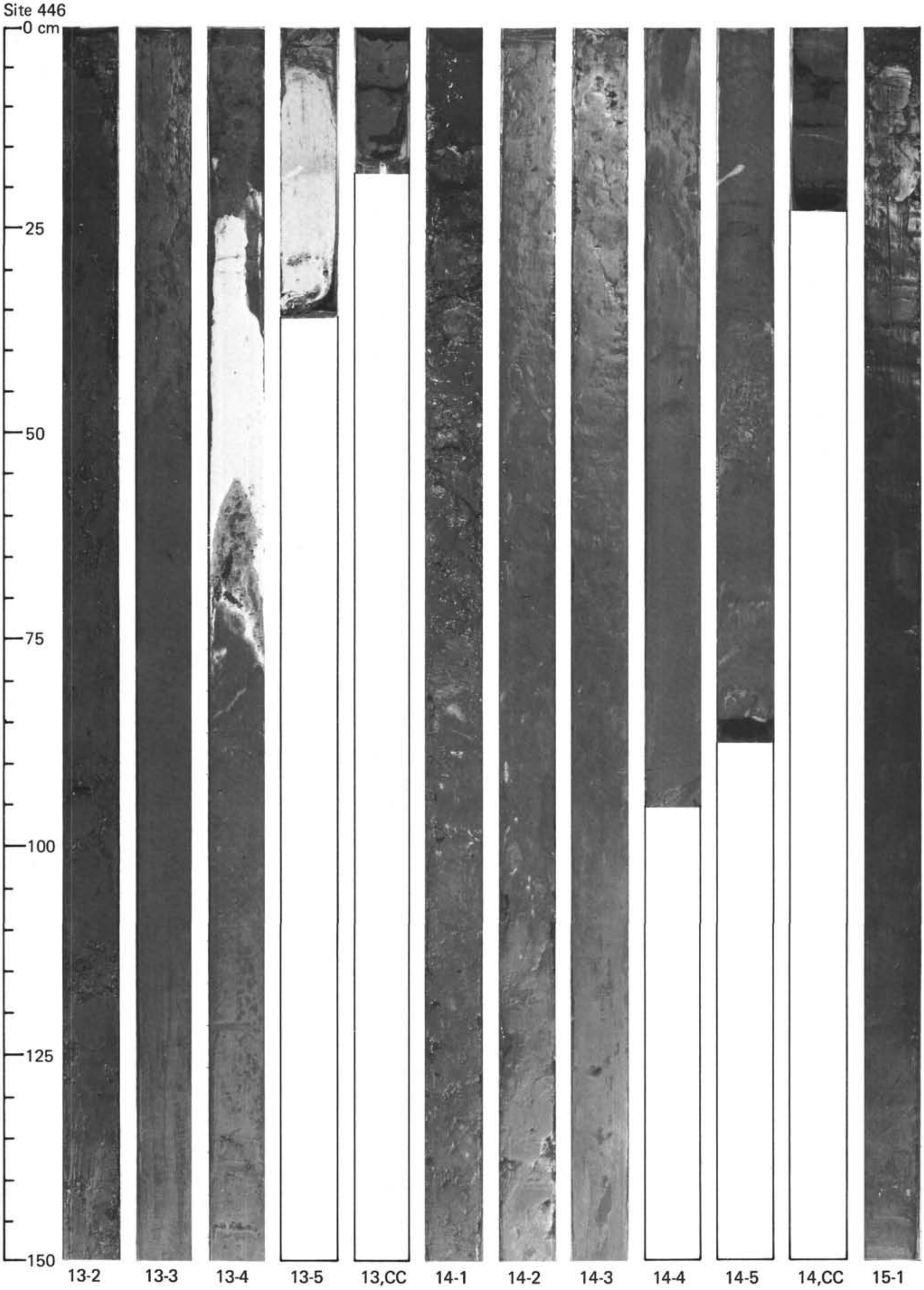
10-7
10,CC
11-1
11-2
11-3
11-4
11,CC
12-1
12-2
12-3
12-4
12,CC
13-1


Site 446
0 cm
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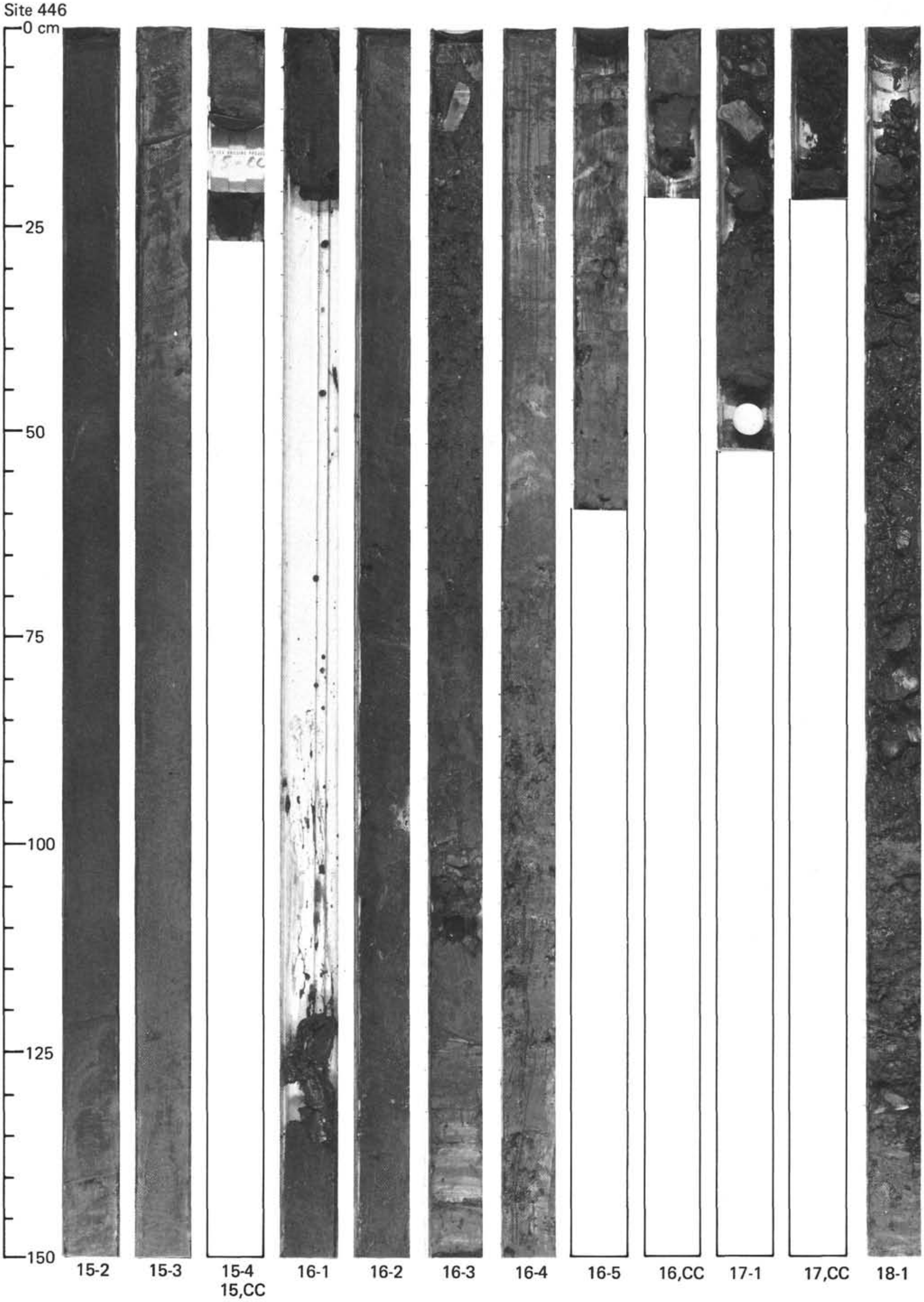
13-2
13-3
13-4
13-5
13,CC
14-1
14-2
14-3
14-4
14-5
14,CC
15-1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15-4
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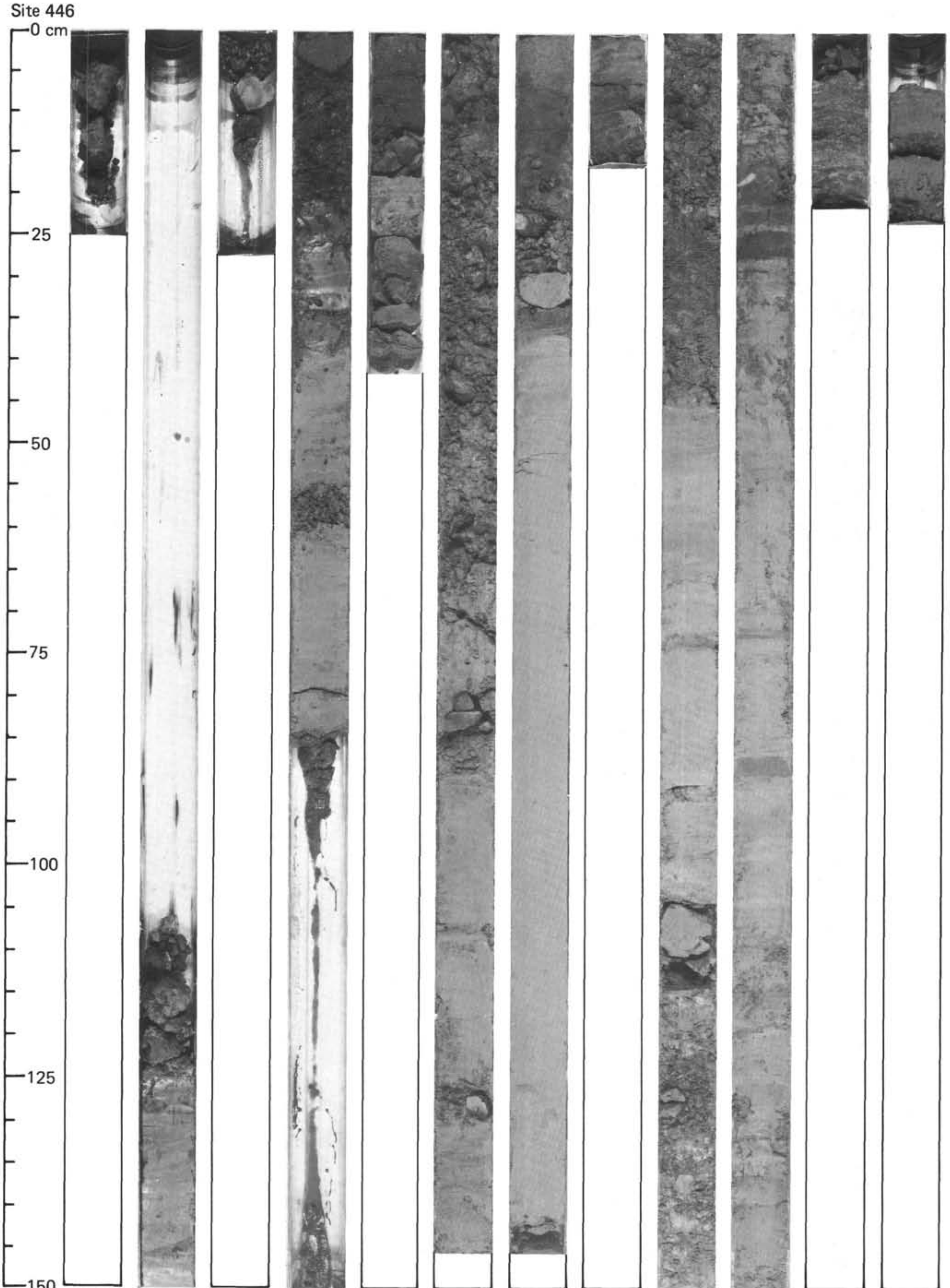
16-2
16-3
16-4
16-5
16,CC
17-1
17,CC
18-1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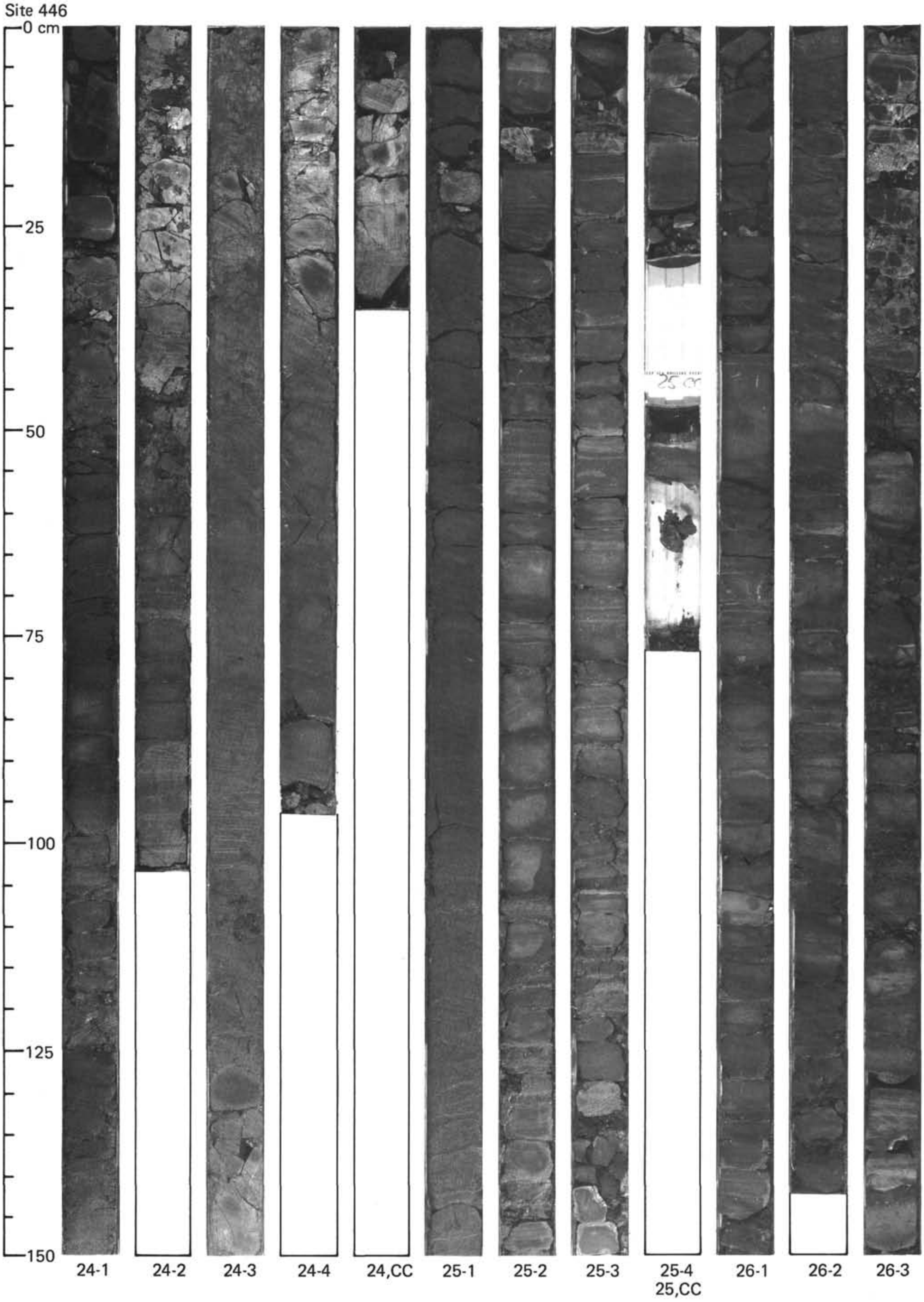
19,CC
20-1
20,CC
21-1
21-2
21,CC
23-1
23-2
23-3
23,CC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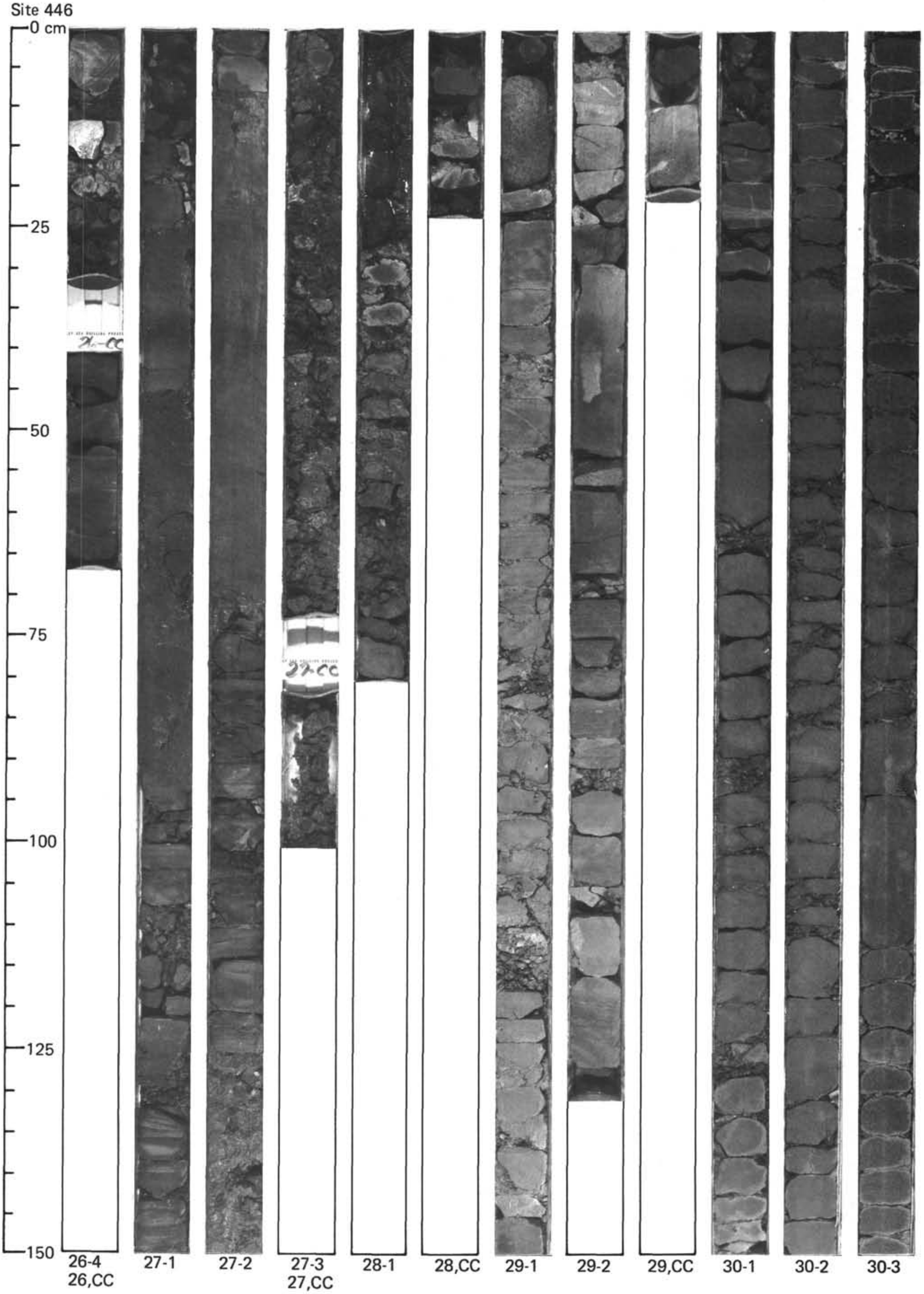
26-1
26-2
26-3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26-CC
27-CC
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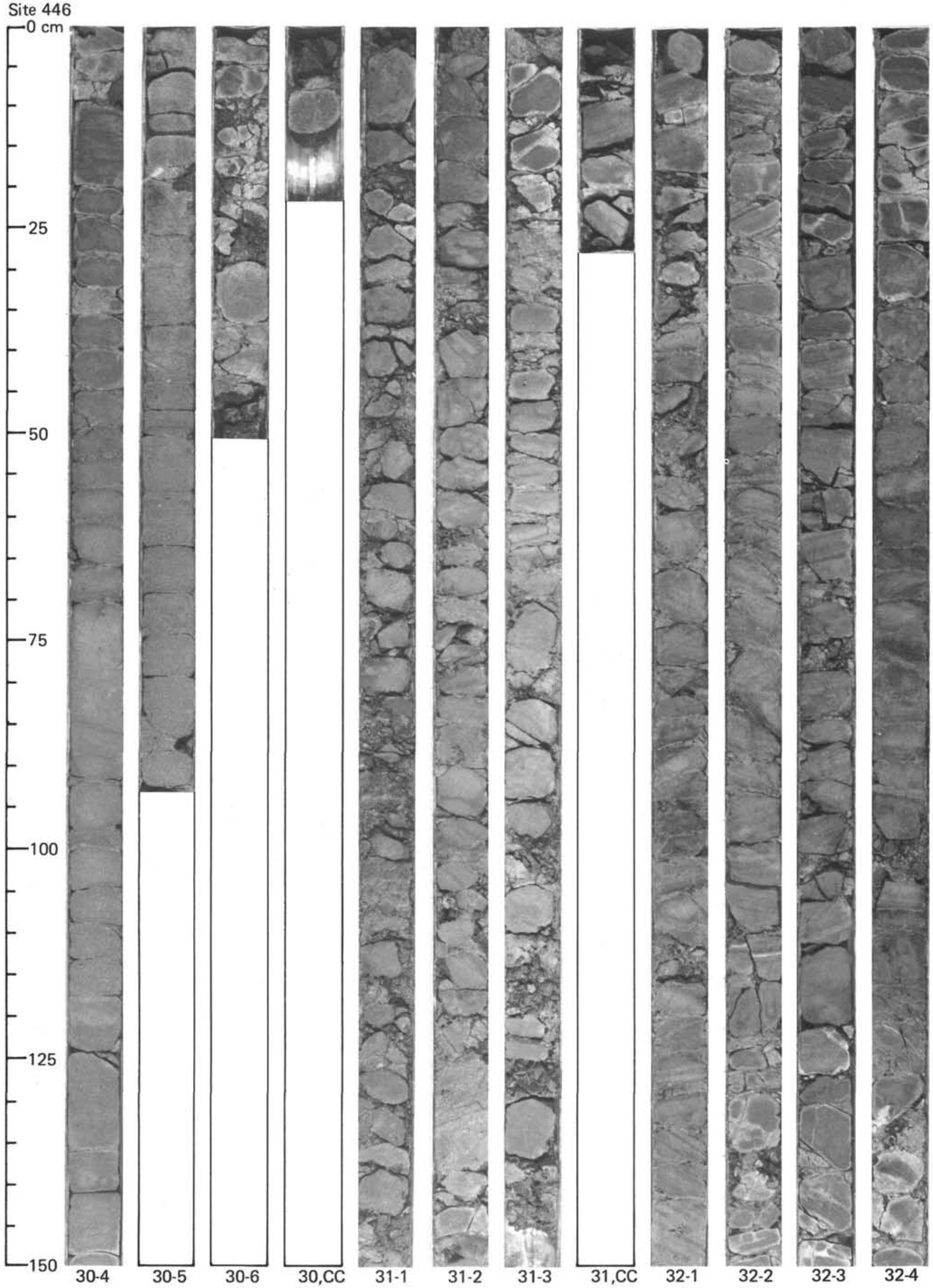
28-1
28,CC
29-1
29-2
29,CC
30-1
30-2
30-3


Site 446
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31,CC
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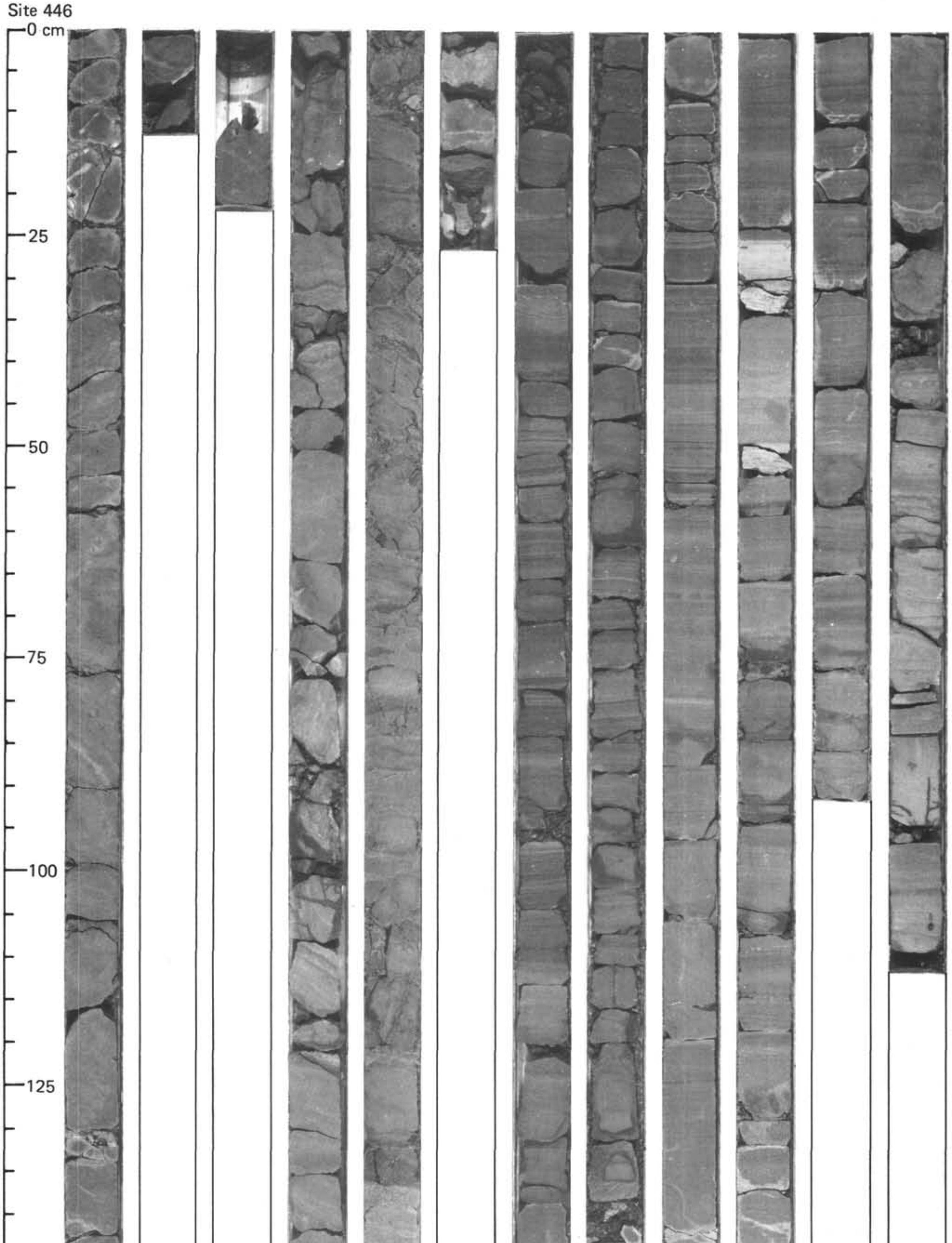
32-4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100
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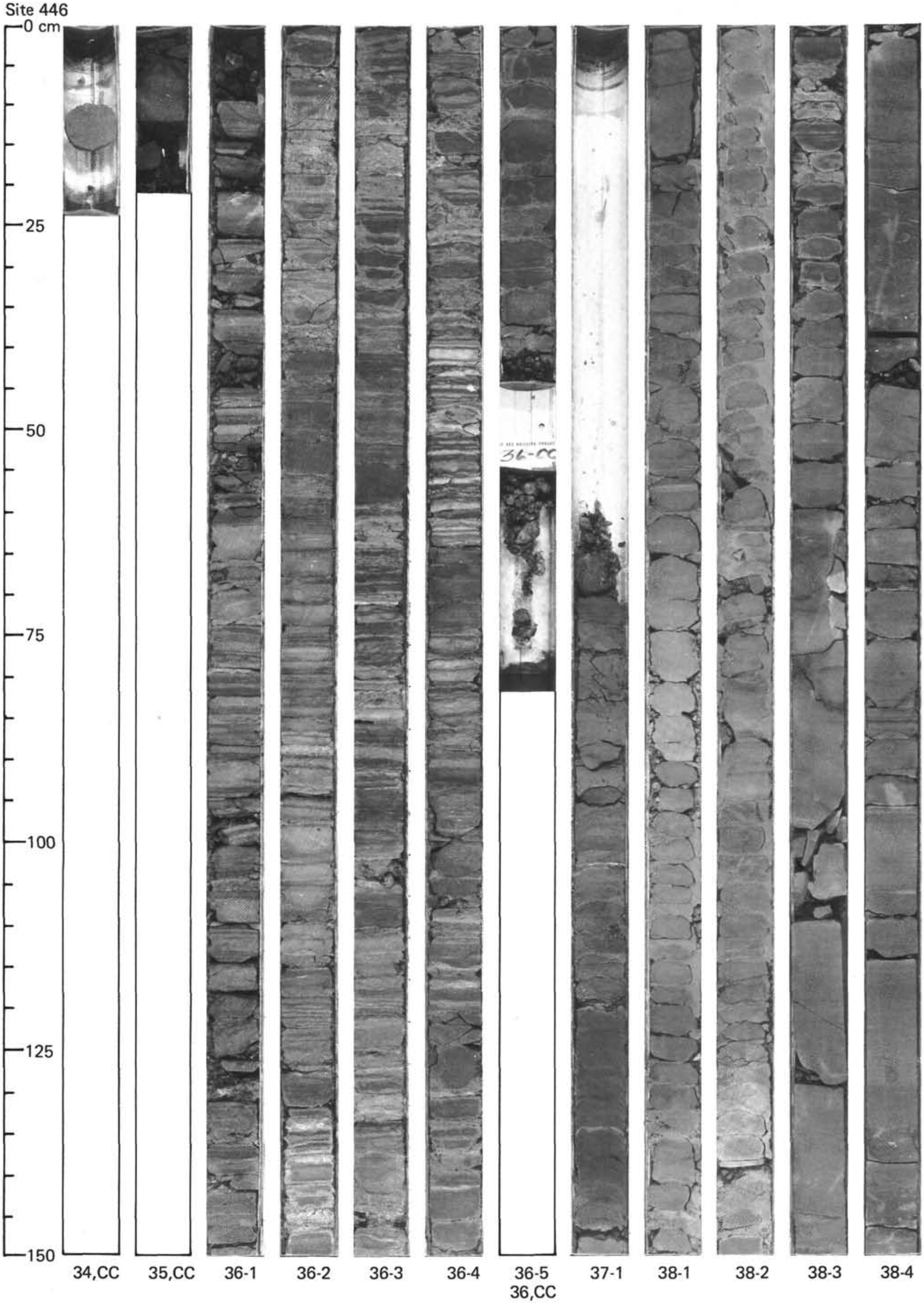
33-1
33-2
33,CC
34-1
34-2
34-3
34-4
34-5
34-6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75
100
125
150
34,CC
35,CC
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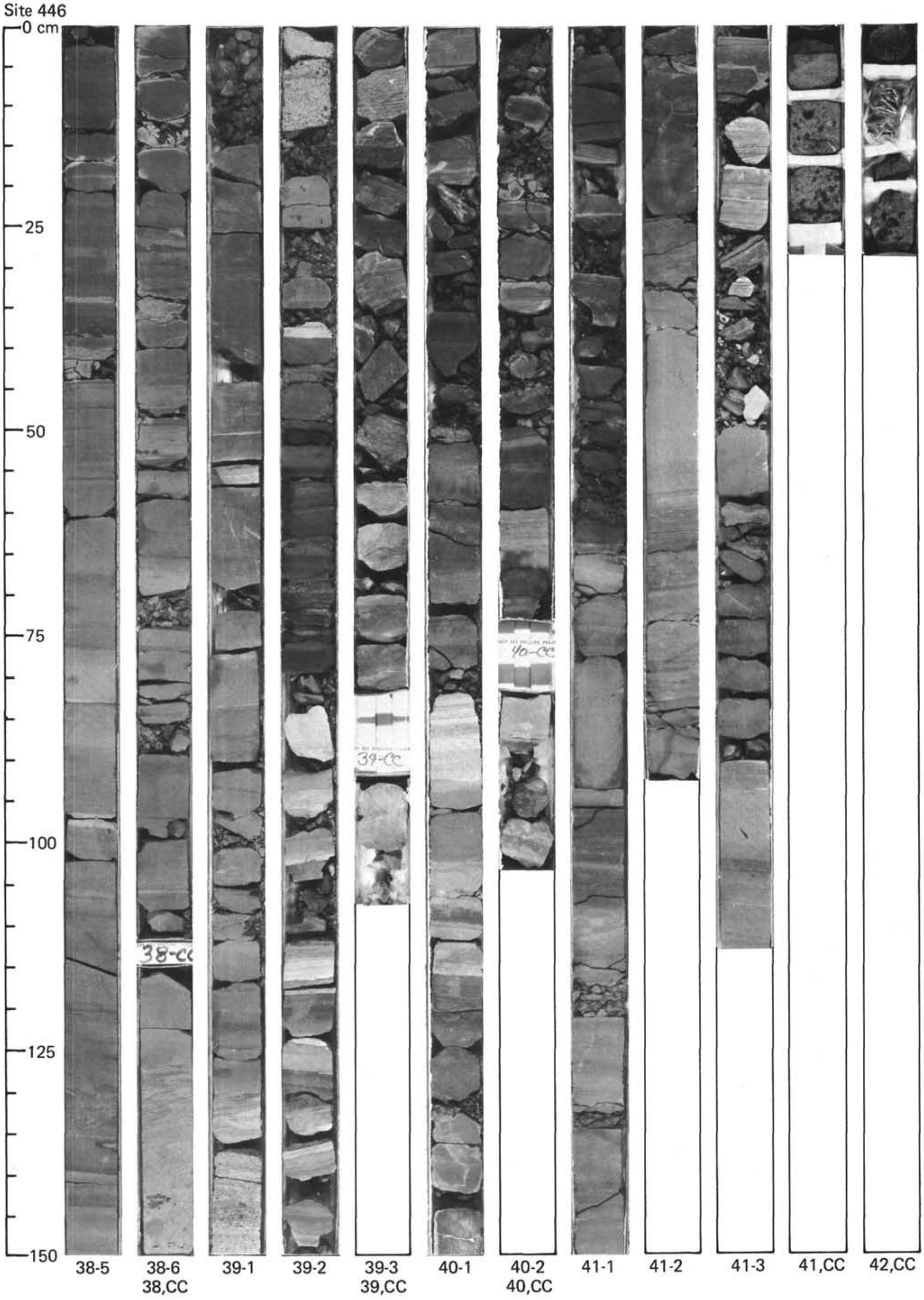
36-CC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39-CC
40-CC
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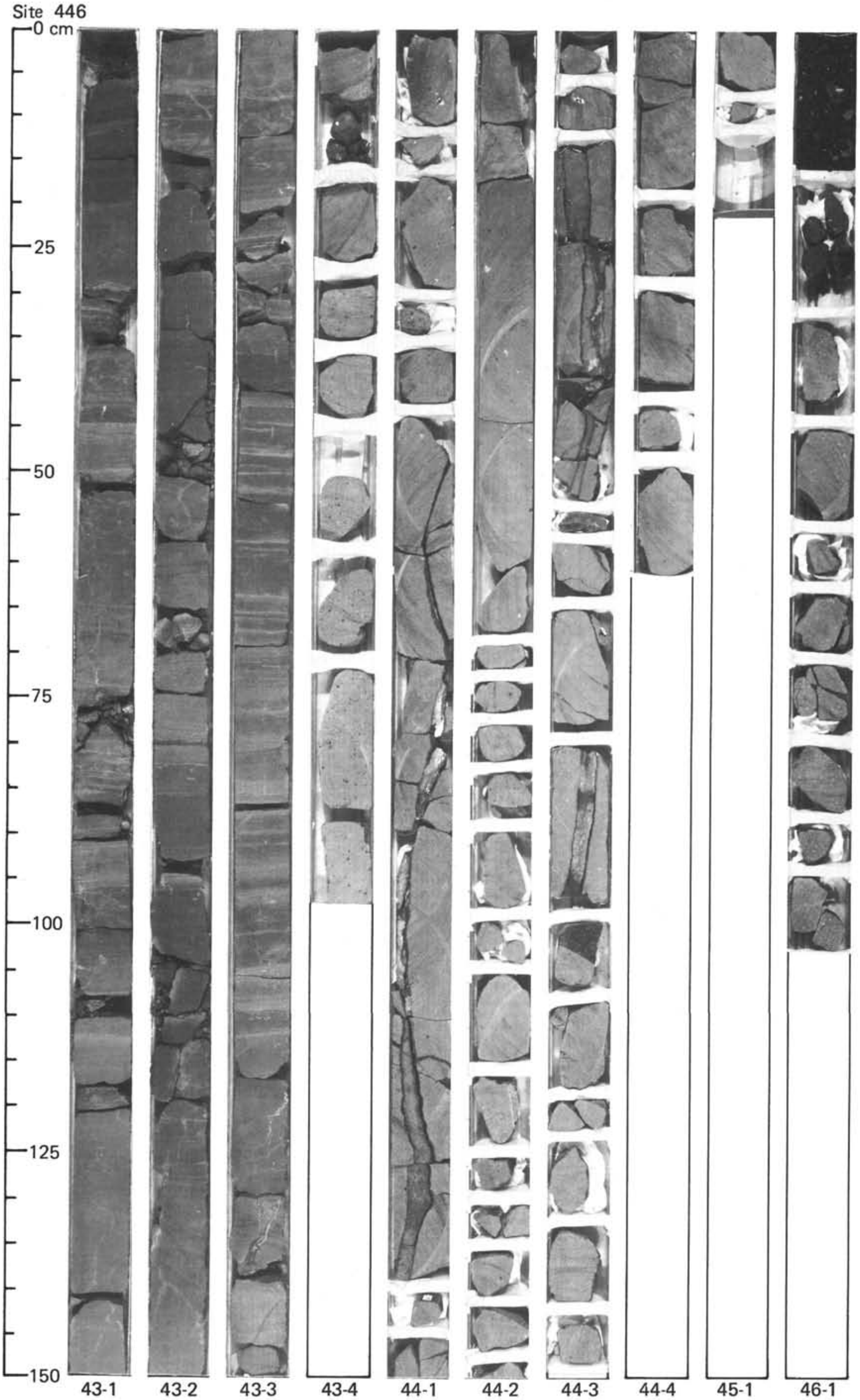
41-2
41-3
41,CC
42,CC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100
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44-1
44-2
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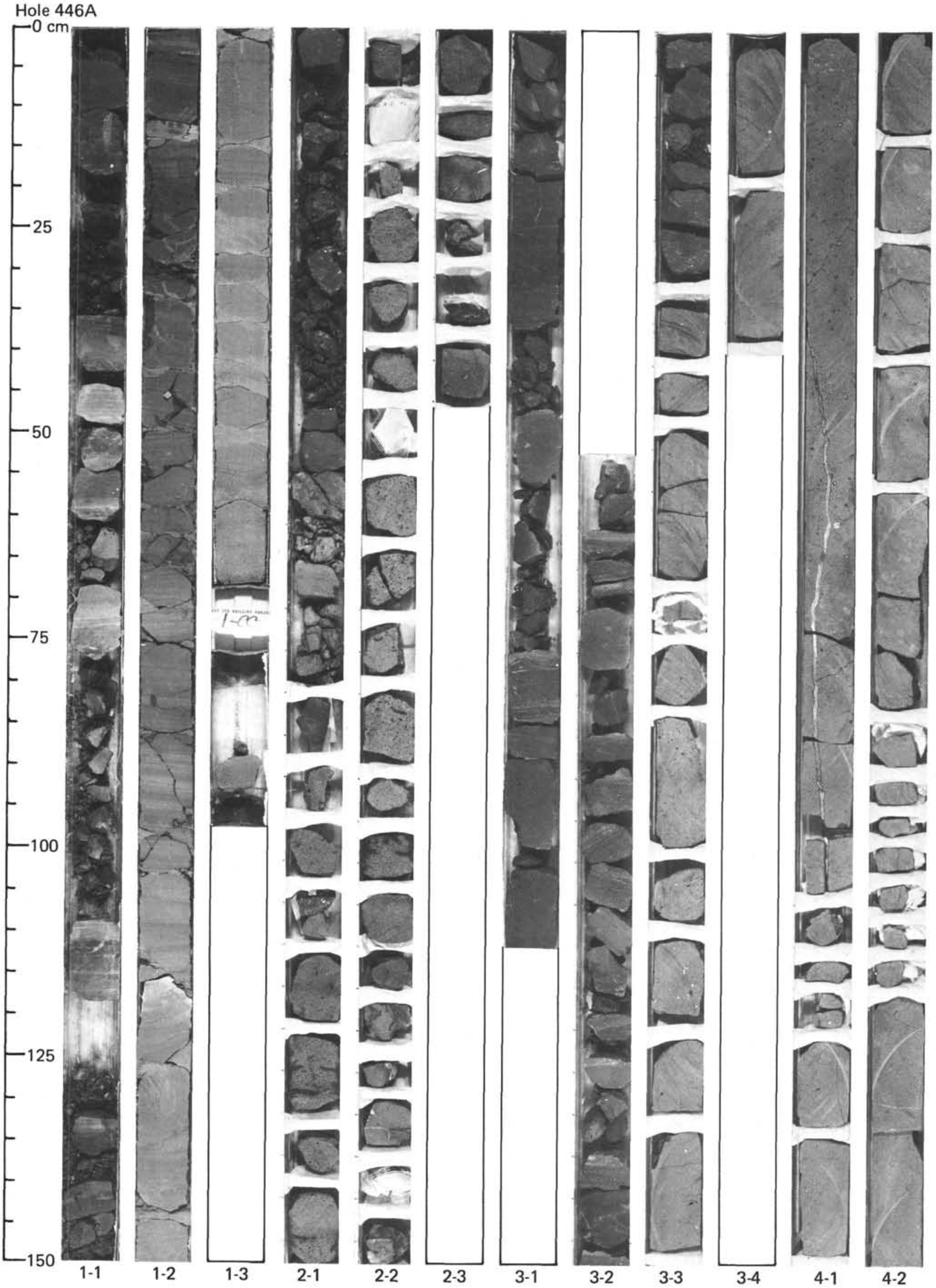
44-4
45-1
46-1


Hole 446A
0 cm
25
50
75
100
125
150
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1-2
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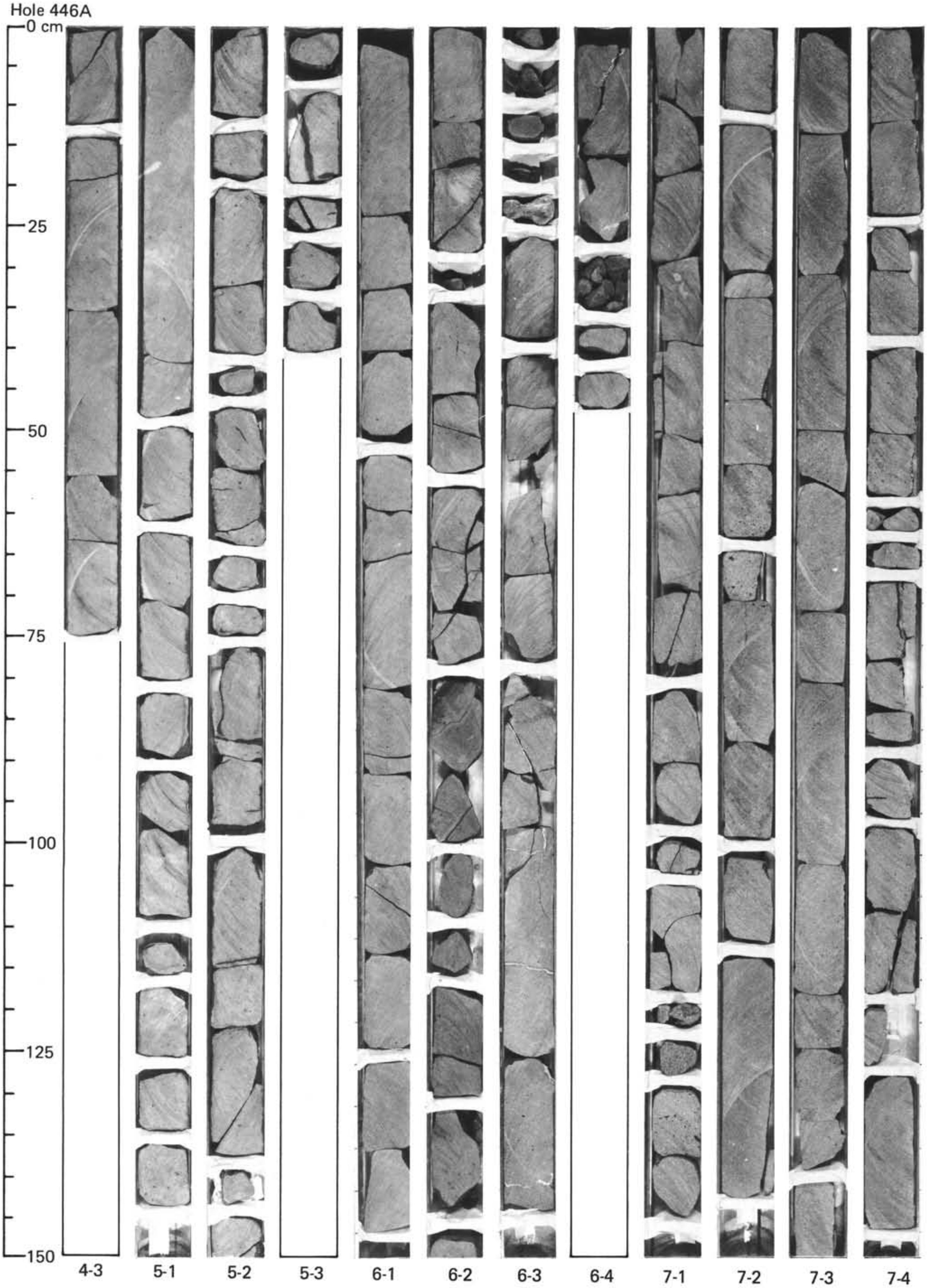
2-1
2-2
2-3
3-1
3-2
3-3
3-4
4-1
4-2


Hole 446A
0 cm
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125
150
4-3
5-1
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5-3
6-1
6-2
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6-4
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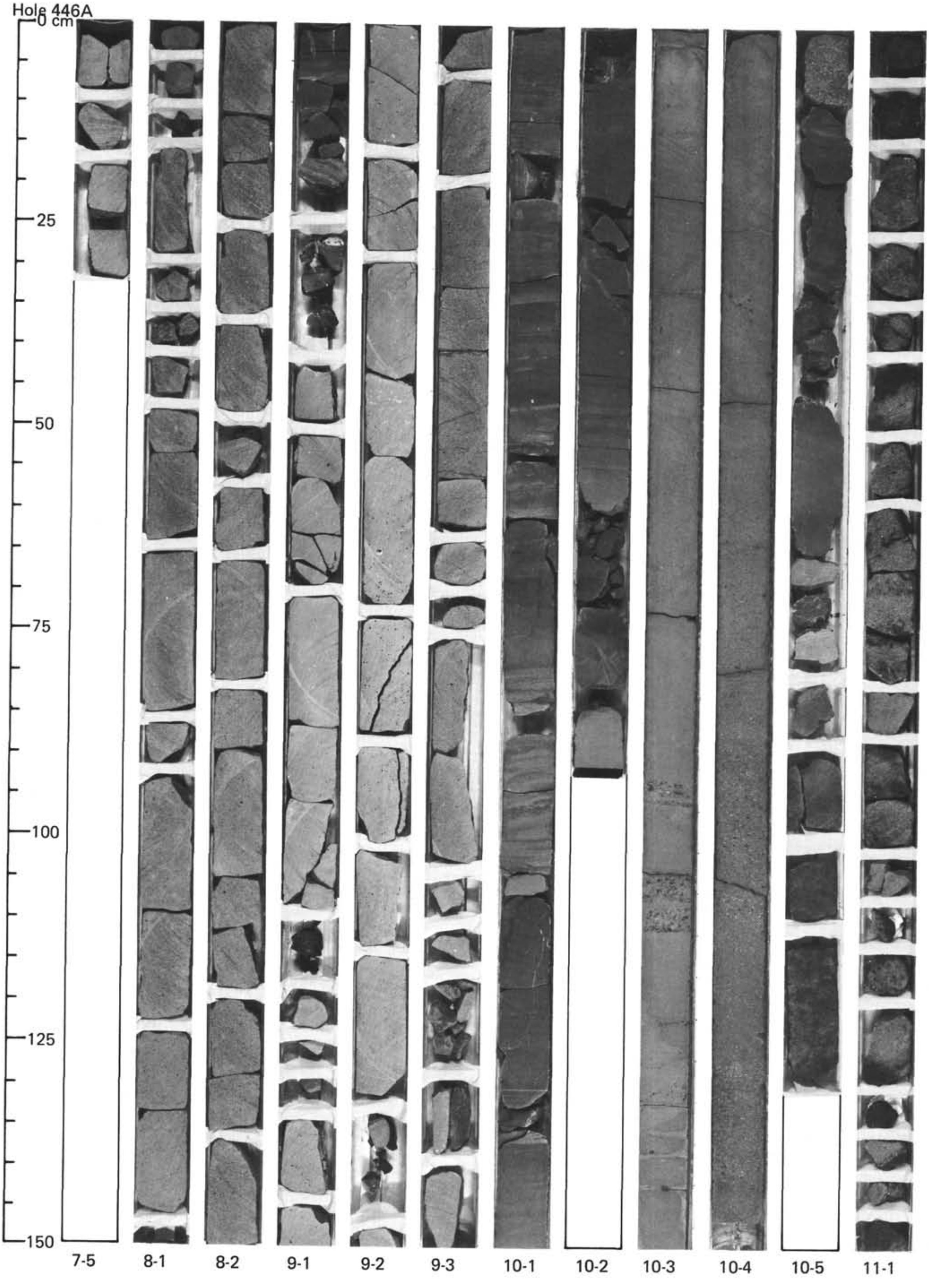
7-2
7-3
7-4


Hole 446A
0 cm
25
50
75
100
125
150
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8-1
8-2
9-1
9-2
9-3
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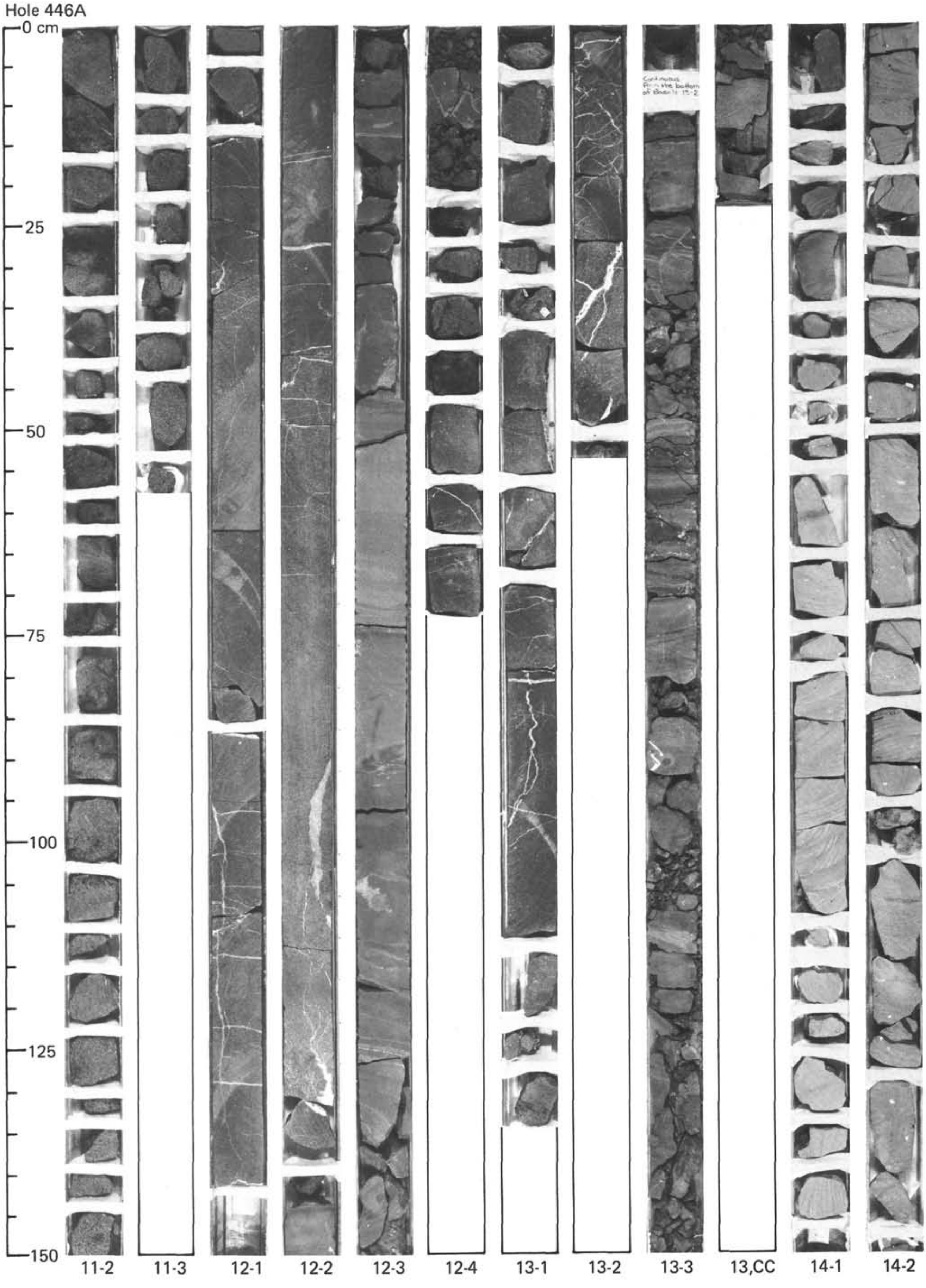
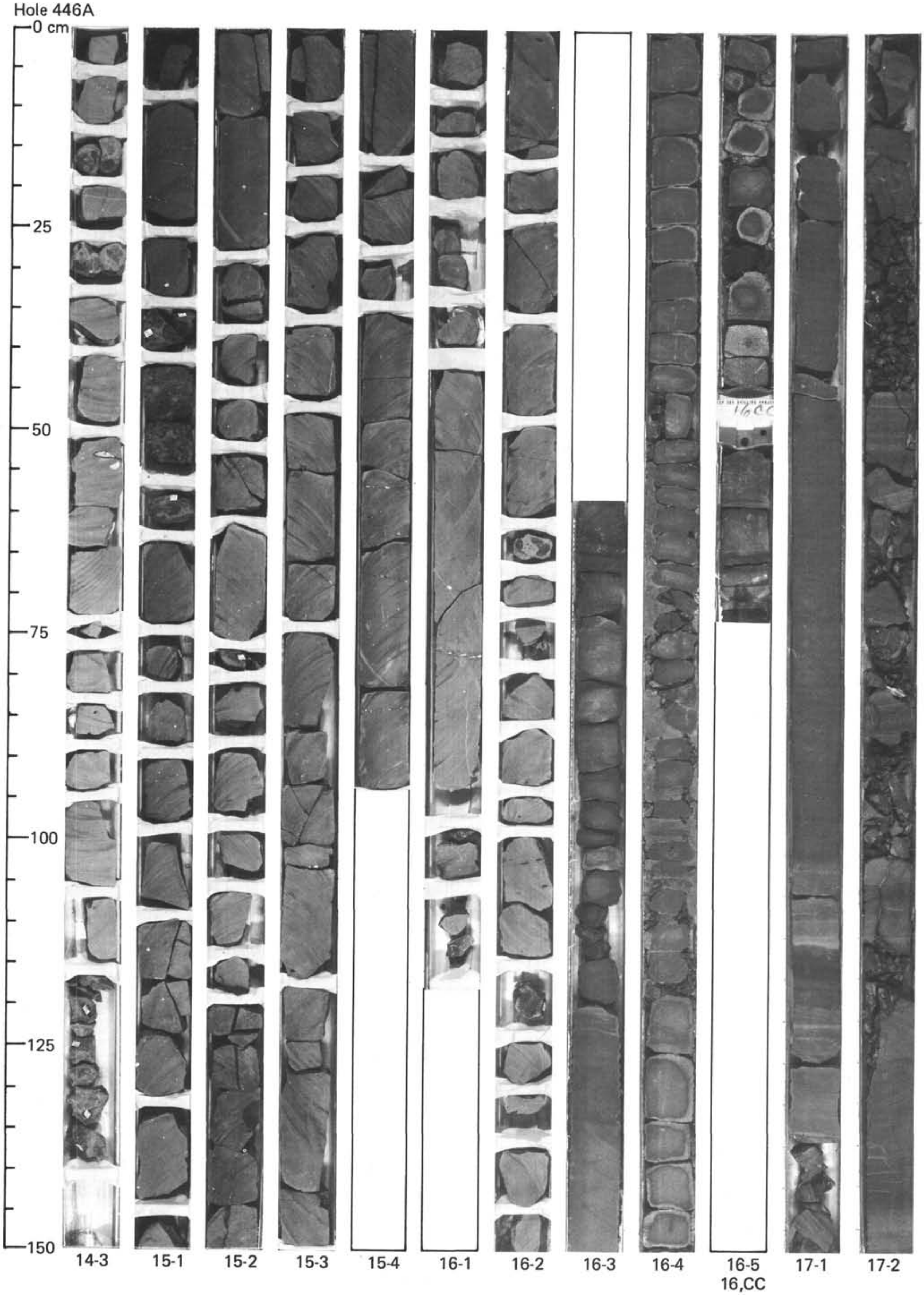
10-3
10-4
10-5
11-1


Hole 446A
0 cm
25
50
75
100
125
150
Continuous from the bottom of Basalt 13-2
11-2
11-3
12-1
12-2
12-3
12-4
13-1
13-2
13-3
13,CC
14-1
14-2


Hole 446A
0 cm
25
50
75
100
125
150
14-3
15-1
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16-1
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16-5
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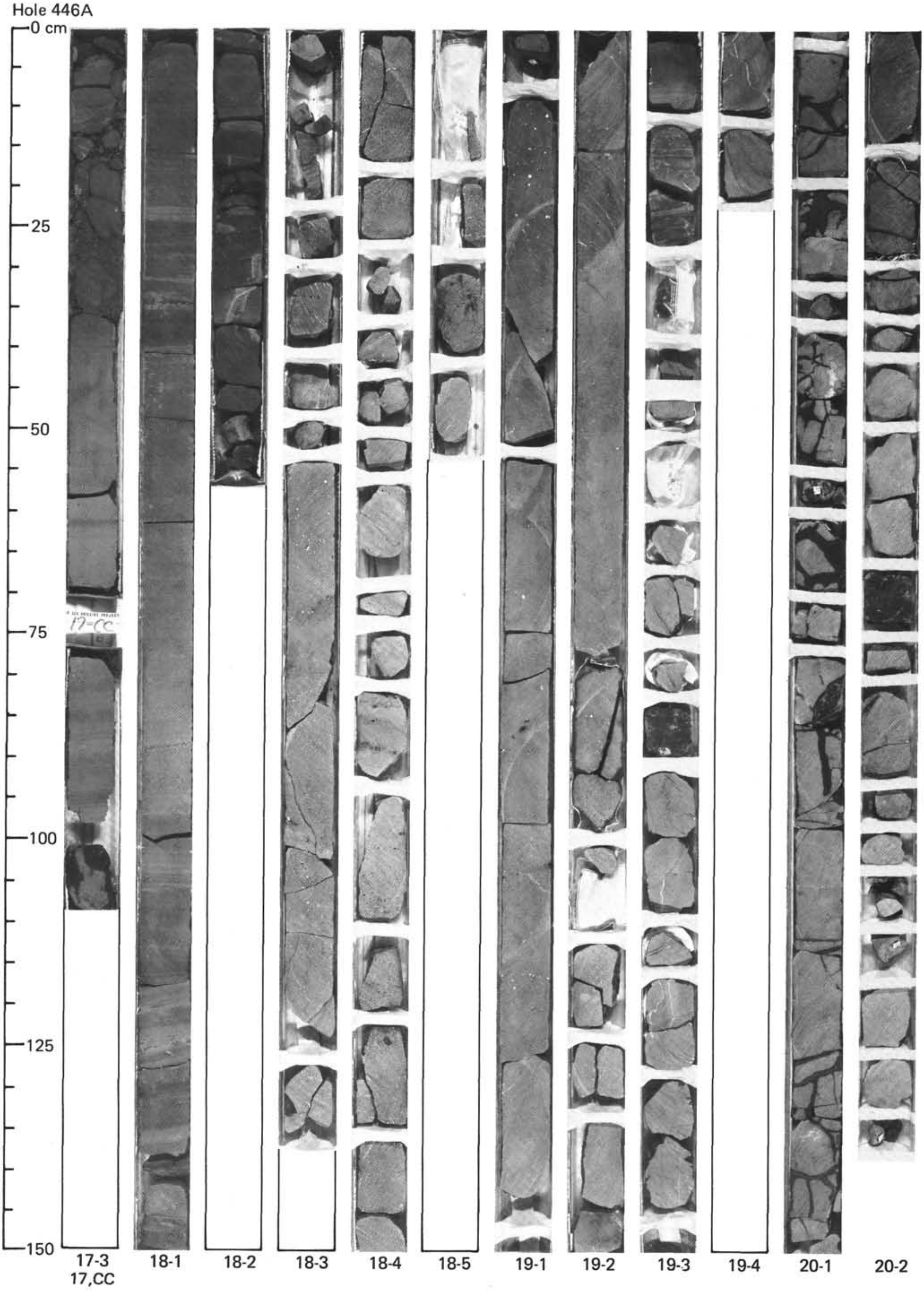
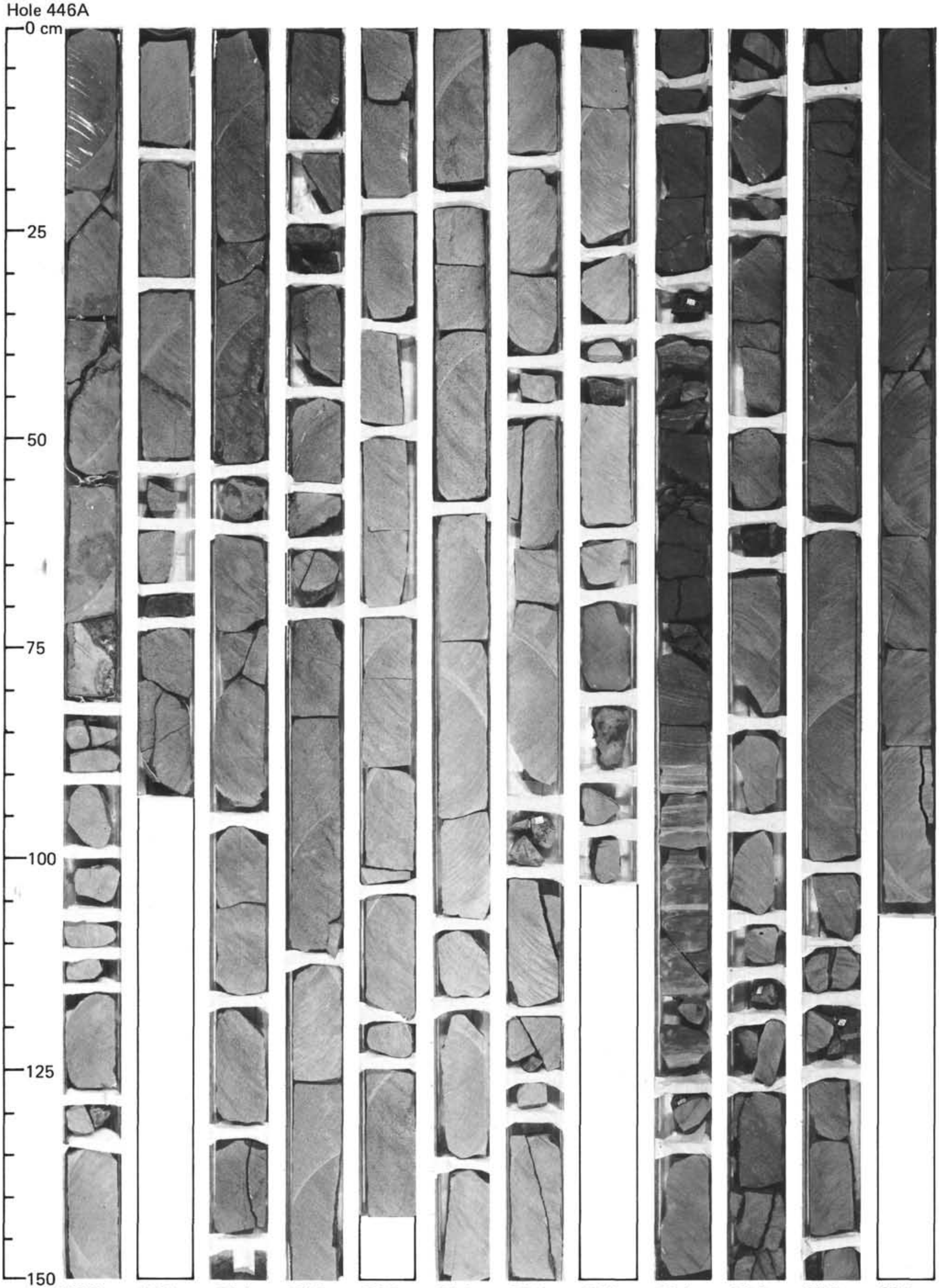
17-1
17-2
16CC


Hole 446A
0 cm
25
50
75
100
125
150
17-CC
17-3
17,CC
18-1
18-2
18-3
18-4
18-5
19-1
19-2
19-3
19-4
20-1
20-2


Hole 446A
0 cm
25
50
75
100
125
150
20-3
20-4
21-1
21-2
21-3
21-4
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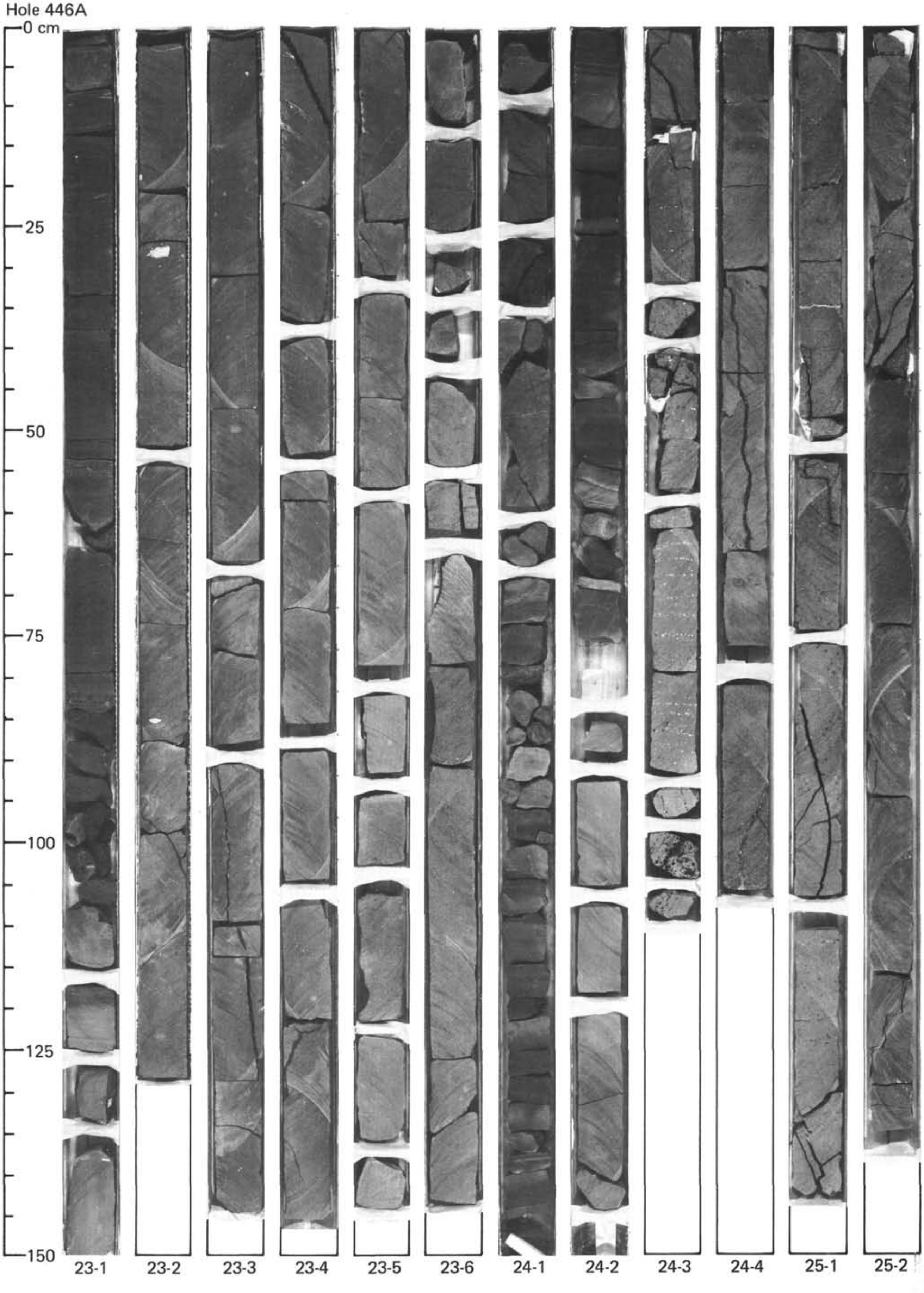
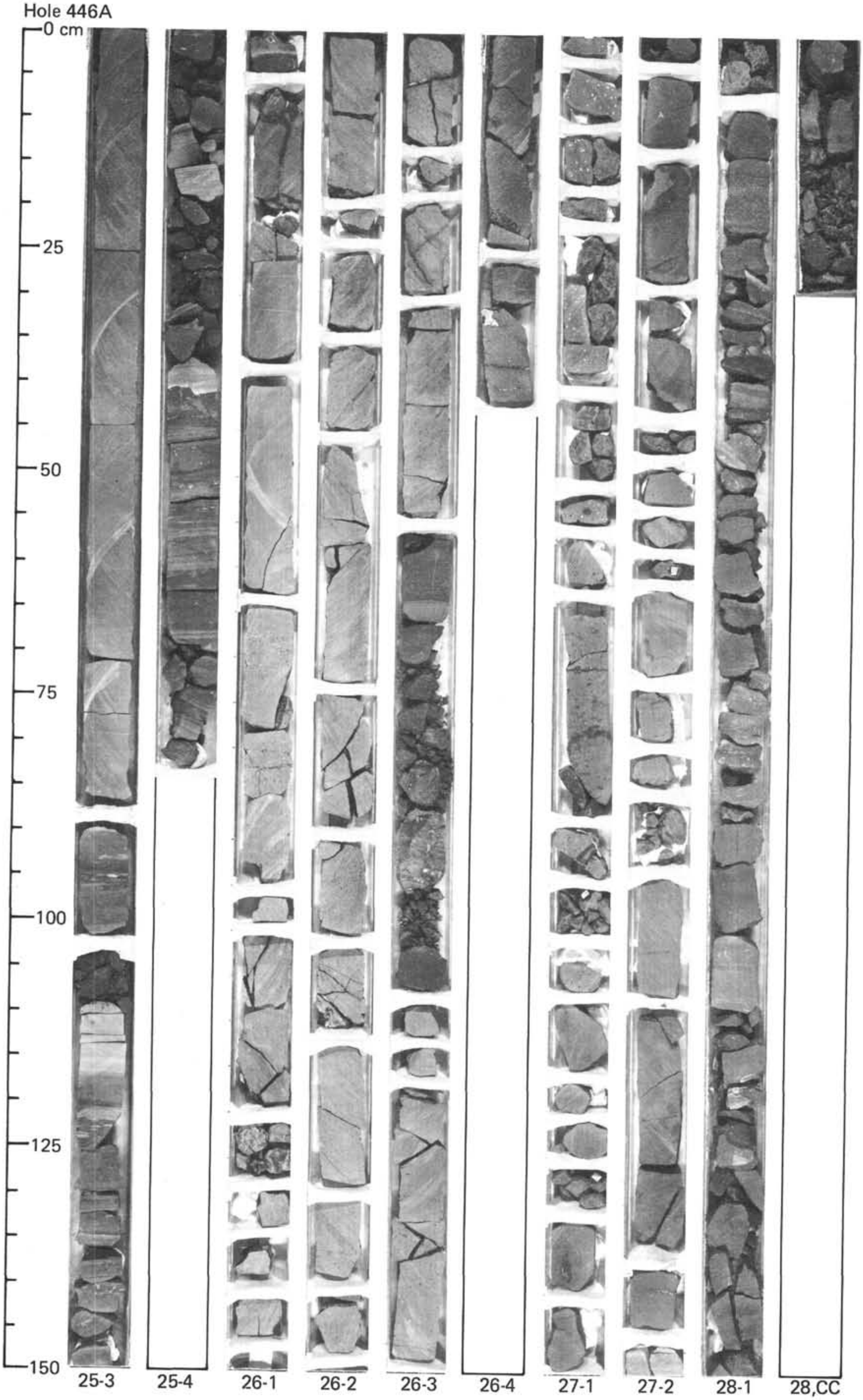
22-2
22-3
22-4


Hole 446A
0 cm
25
50
75
100
125
150
23-1
23-2
23-3
23-4
23-5
23-6
24-1
24-2
24-3
24-4
25-1
25-2


Hole 446A
0 cm
25
50
75
100
125
150
25-3
25-4
26-1
26-2
26-3
26-4
27-1
27-2
28-1
28,CC