3. SITE 483[1]

Shipboard Scientific Party[2]

HOLE 483

Date occupied: February 12, 1979

Date departed: February 17, 1979

Time on hole: 4 days, 20 hours

Position: 22°53.00′N, 108°44.90′W

Water depth (sea level; corrected m, echo-sounding): 3070

Water depth (rig floor; corrected m, echo-sounding): 3080

Bottom felt (m, drill pipe): 3084

Penetration (m): 204.5

Number of cores: 26

Total length of cored section (m): 204.5

Total core recovered (m): 110.92

Core recovery (%): 54

Oldest sediment cored above basement:
Depth sub-bottom (m): 107
Nature: clay
Age: About 2 m.y.
Measured velocity (km/s): 1.5

Basement:
Depth sub-bottom (m): 110
Nature: basalt
Velocity range (km/s): 5.5–5.9

Principal results: The sediments above basement consist principally of hemipelagic clays with an ash horizon at about 40 meters sub-bottom. The upper basalts are mostly massive units, ranging in thickness from 3 to 10 meters with interlayered sediments up to 9 meters thick. The lower basalts contain pillows between 163 and 190.5 meters but become more massive toward the base of the hole.

HOLE 483A

Date occupied: February 17, 1979

Date departed: February 17, 1979

Time on hole: 1 day

Position: 22°52.99′N, 108°44.84′W

Water depth (sea level; corrected m, echo-sounding): 3070

Water depth (rig floor; corrected m, echo-sounding): 3080

Bottom felt (m, drill pipe): 3084

Penetration (m): 60

Number of cores: 0

Principal results: Hole 483A, located 100 meters east of Hole 483, was a wash-in test with the 14⅞-in. bit to determine how much casing to use for setting the re-entry cone on the next hole.

HOLE 483B

Date occupied: February 18, 1979

Date departed: March 3, 1979

Time on hole: 13 days, 8 hours

Position: 22°52.99′N, 108°44.84′W

Water depth (sea level; corrected m, echo-sounding): 3070

Water depth (rig floor; corrected m, echo-sounding): 3080

Bottom felt (m, drill pipe): 3084

Penetration (m): 267.0

Number of cores: 32

Total length of cored section (m): 175.5

Total core recovered (m): 91.59

Core recovery (%): 52

Oldest sediment cored above basement:
Depth sub-bottom (m): 110
Nature: clay
Age: About 2 m.y.

Basement:
Depth sub-bottom (m): 110
Nature: basalt
Velocity range (km/s): 5.8–6.1

Principal results: Hole 483B was intended to be a deep re-entry hole with casing to basement so that geophysical experiments could be conducted in the hole after drilling was completed. Drilling conditions were very good until the hole had to be prematurely terminated because the ship lost position, which caused the bit and bit sub to break off and jam near the top of the casing. The topmost section of basement in this hole consists of massive basalt units with interlayered sediments. Below 160.5 meters sub-bottom, the section consists of interlayered pillow basalts, massive basalts, and sediments. The hole was lost before logging or temperature measurements could be made.

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[1] Lewis, B. T. R., Robinson, P., et al., *Init. Repts. DSDP*, 65: Washington (U.S. Govt. Printing Office).

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HOLE 483C

Date occupied: February 21, 1979

Date departed: February 22, 1979

Time on hole: 23 hours

Position: 22°52.98′N, 108°44.58′W

Water depth (sea level; corrected m, echo-sounding): 3070

Water depth (rig floor; corrected m, echo-sounding): 3080

Bottom felt (m, drill pipe): 3084

Penetration (m): 114

Number of cores: 4

Total length of cored section (m): 37.5

Total core recovered (m): 26.24

Core recovery (%): 70

Oldest sediment cored:
Depth sub-bottom (m): 107
Nature: clay
Age: About 2 m.y.
Measured velocity (km/s): 1.5

Basement:
Depth sub-bottom (m): 109.5
Nature: basalt
Velocity range (km/s): 5.8

Principal results: The object of Hole 483C was to measure temperatures down the hole and to sample a volcanic ash layer at 40 meters sub-bottom, the sediment/basalt contact, and the uppermost basalts. This was done while the cement around the casing in Hole 483B was drying. All of the objectives of the hole were achieved. The temperature at the base of the sediments was determined to be 30°±5°C.

BACKGROUND AND OBJECTIVES

After failing to drill a deep hole at Site 482, we decided to drill a series of single-bit holes along a transect across the mouth of the Gulf of California from the crest of the East Pacific Rise to the continental margin off the east coast of Baja California. By this means we hoped to sample basalts of different ages extruded along a single spreading flow line and to test drilling conditions at other localities prior to making another re-entry attempt. Thus, even if deep basement penetration did not prove feasible, we would accomplish one of the major objectives of the leg.

Since we had already drilled a site near the ridge crest (Site 482) and since a site had been drilled off Baja California on Leg 64 (Site 474), we decided to drill Site 483 in intermediate-age crust about 52 km west of the East Pacific Rise crest and 25 km east of the base of the continental slope off Baja California. The site lies in a NE-trending sediment pond about 8 km wide underlain by a very flat, regular basement reflector. The sediment thickness and water depth were estimated to be about 105 meters and 3088 meters, respectively.

The primary scientific goal at the site was to sample the basement for lithologic, magnetic, and geochemical comparison with rocks drilled at Sites 482 and 474 in order to characterize young crust formed at a fast-spreading ridge in an area of relatively high sedimentation.

OPERATIONS

The *Glomar Challenger* left Site 482 at about noon on February 12 and reached Site 483 at 1820 on the same day after profiling between the two sites. Although the beacon was dropped about 1.5 miles south of the intended location (Fig. 1), as a result of poor satellite fixes, the reflection profile through the site (Fig. 2) indicates that the basement is so flat that the site actually drilled is geologically equivalent to that intended. The water depth was estimated to be about 3090 meters and the sediment thickness to be about 108 meters, assuming a *P*-wave velocity of 1.5 km/s.

The first hole drilled at Site 483 was a single-bit hole in which coring was begun at 0100 on February 13. After an unsuccessful attempt to measure the temperature at 86 meters sub-bottom, the basement was reached at a depth of 110 meters sub-bottom at 1700. Coring of the basalts and interlayered sediments continued to 1400 on February 16, at which time the bit was released after 196 meters of penetration and preparations were made to log. Several successful logging runs were made before the pipe was pulled at about 0800 on February 17.

Although it had been our intention to drill two more single-bit holes at other sites before trying a re-entry hole again, we decided to set a re-entry cone and case to basement at Site 483 because of the demonstrated ease of drilling. A wash test (Hole 483A) was thus begun with a 14⅞-in. bit on February 17 about 100 meters east of Hole 483. Since the washing went easily to 60 meters, we spent the next day building the cone and a 16-in. casing string. After washing in and releasing the string from the casing, we drilled the 14⅞-in. bit into the basement to create a hole for the 11-in. casing. After a brief problem with a broken hydraulic line to the Bowen power sub, the last basalt core was pulled from Hole 483B at 1800 February 19. The hole was then washed and filled with mud prior to pulling the string. On February 20, the 11-in. casing was assembled and lowered, and the hole was re-entered at about 2350 after one malfunction of the re-entry tool.

At 0400 on February 21, the 11-in. casing was set into the basement and cemented. After pulling the string, we decided to drill another hole 500 meters to the east of Hole 483B, while the cement was drying, in order to obtain temperature measurements in the sediments and to obtain selected sediment cores and a core at the sediment/basement contact. The bit used in this hole would then be used to re-enter 483B, saving a round trip with the pipe.

After starting to lower the pipe at about 1200 on February 21, we obtained several cores and two successful temperature measurements in Hole 483C before the basement was reached at 110 meters at 0430 on February 22. At 0800, the basalt core was pulled, the hole was abandoned, and we started offsetting with the string down to re-enter Hole 483B.

After we had re-entered Hole 483B on February 22, we drilled out the cement plug at about 1800. At 2300, it was determined from the lack of core recovery that the

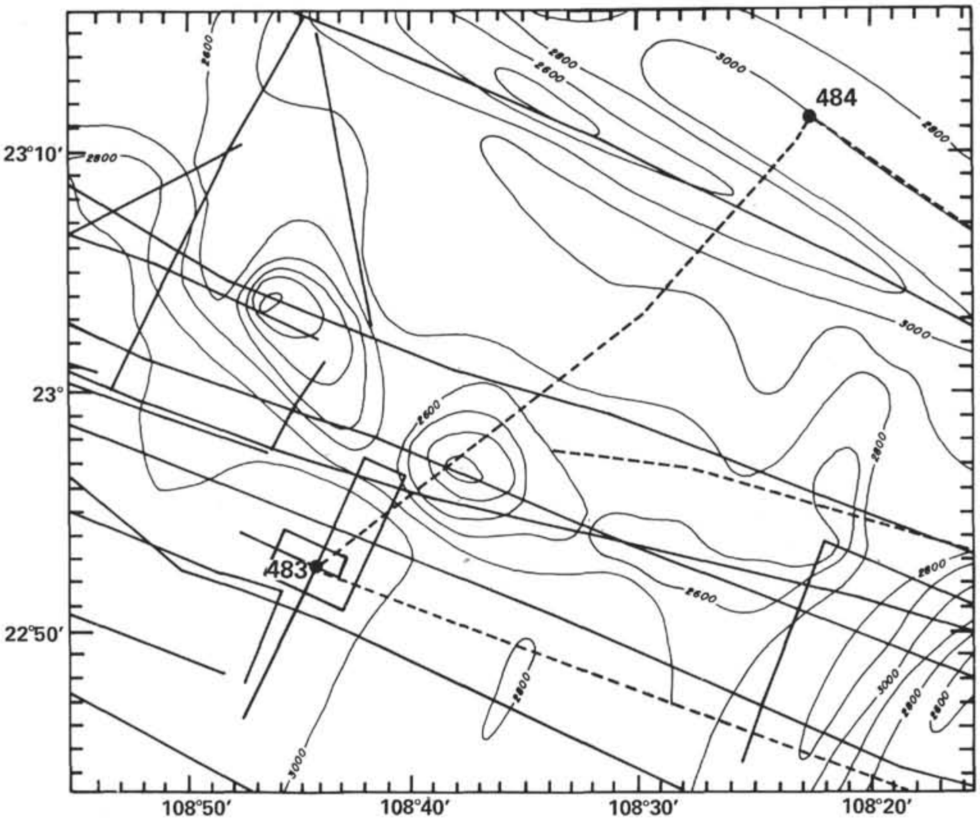


Figure 1. Bathymetry map showing location of Site 483. (Dashed lines show track of *Glomar Challenger*. Solid lines show locations of profiles obtained during site surveys. The profile through Site 483 was obtained by the R/V *T. G. Thompson* while the site was being drilled. Depths in meters.)

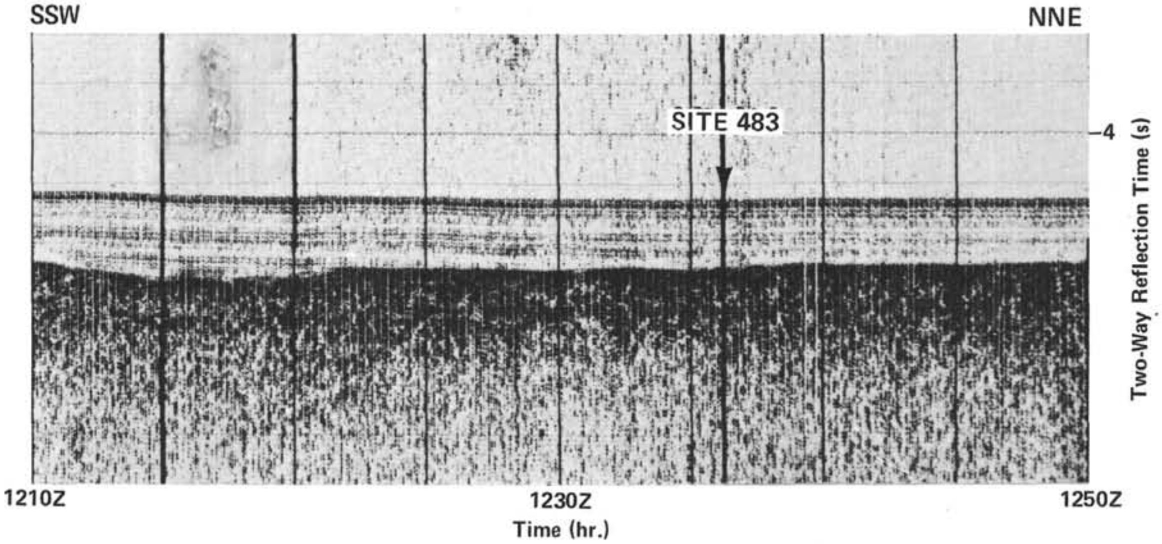


Figure 2. Seismic reflection profile recorded aboard R/V *T. G. Thompson* through Site 483. (Vertical scale in seconds of two-way reflection time. Horizontal scale is given in time along ship's track. One hour represents about 10 km.)

bit was plugged. The center bit was dropped to try unplugging the bit, but since subsequent cores were almost empty, it was decided to trip the pipe and change bits. When the bit was finally inspected at 0200 on February 24, basalt cobbles were found stuck in the bit throat. After changing the bit, re-entering the hole, and resuming coring, the recovery of more empty cores on February 25 made us suspect that the bit had become plugged again. We thus re-tripped the pipe but found nothing unusual when the bit was inspected on February 26. After lowering the pipe with a new bit and re-entering the hole at 1500, we continued drilling until we reached a sub-bottom depth of 269 meters, at which point we tripped the pipe for another bit change. On March 1 at

1000, the next re-entry was begun, but a malfunctioning tool caused the re-entry to be delayed until 1600.

At 1810, while the re-entry tool was being retrieved, the ship lost position and started to drag the string out of the hole. We pulled the string the rest of the way out and attempted another re-entry at 2200. After lowering two stands of pipe, however, we found that the string could not be rotated. We pulled the string for inspection and found that the bottom-hole assembly was covered with mud, that the lowermost bumper sub was bent, and that the bit and bit sub were missing. This suggested that the bit had broken off in the casing when the ship lost position and the subsequent re-entry had missed the cone. We decided to re-enter the hole to see if the casing was indeed blocked, verifying at 2200 that the hole was blocked about 11 meters below the cone. After deciding, with great disappointment, to abandon the hole, we retrieved the pipe at 0400 on March 3 and set sail for Site 484 in the Tamayo Fracture Zone.

A listing of cores taken at Site 483 is given in Table 1.

SEDIMENT LITHOLOGY

Hole 483

Hole 483 was cored continuously from the mud line to a total depth of 204.5 meters. One hundred ten meters of sediments were drilled above the uppermost basaltic unit, and several sediment interlayers were partially recovered within the igneous pile (Table 2, Fig. 3).

Sediments Overlying Basement

Three depositional units were defined in the sediment section overlying basement on the basis of composition:

Unit I is distinguished by its relatively high content of siliceous fossils and low content of detrital silt.

Unit II is composed of sedimentary layers similar to those of Unit I, alternating with more hemipelagic material. This unit could be considered transitional between Units I and III.

Unit III is composed mainly of fine-grained clastic material and only minor siliceous biogenic material.

Unit I (0–36.5 m)

The top of Unit I consists of clayey nannofossil ooze and olive gray silty clay from the mud line to a sub-bottom depth of 1.5 meters. The $CaCO_3$ content in the nannofossil ooze is 8.5%. The clayey silts are composed of approximately 60% silt and 40% clay.

The middle part of Unit I (1.5–23 m) is composed of diatomaceous mud and ooze with 50 to 55% siliceous fossils and 3 to 25% calcareous nannofossils. Numerous burrows filled with olive gray clayey silt are present between 4.0 and 5.5 meters sub-bottom but become scarce between 13.5 and 15 meters.

A small homogeneous turbidite composed of silty sand (50% sand, 25% silt) was found between 14.8 and 16 meters sub-bottom. This deposit has a gradational contact with the overlying mud and a sharp contact with diatomaceous mud at the base. These features may indicate fast redeposition of a coarser-grained turbidite or mud flow.

Table 1. Coring summary, Site 483.

Core	Date	Time	Depth from Drill Floor (m)	Depth below Seafloor (m)	Length Cored (m)	Length Recovered (m)	Recovery (%)
Hole 483							
1	2/13/79	0042	3084.0–3085.0	0.0–1.0	1.0	0.50	50
2	2/13/79	0146	3085.0–3094.5	1.0–10.5	9.5	4.60	48
3	2/13/79	0245	3094.5–3104.0	10.5–20.0	9.5	6.00	63
4	2/13/79	0345	3104.0–3113.5	20.0–29.5	9.5	4.40	46
5	2/13/79	0445	3113.5–3123.0	29.5–39.0	9.5	7.61	80
6	2/13/79	0555	3123.0–3132.5	39.0–48.5	9.5	4.55	48
7	2/13/79	0650	3132.5–3142.0	48.5–58.0	9.5	6.96	73
8	2/13/79	0755	3142.0–3151.5	58.0–67.5	9.5	5.74	60
9	2/13/79	0902	3151.5–3161.0	67.5–77.0	9.5	9.64	101
10	2/13/79	1011	3161.0–3170.5	77.0–86.5	9.5	2.75	29
11	2/13/79	1250	3170.5–3180.0	86.5–96.0	9.5	7.31	77
12	2/13/79	1350	3180.0–3189.5	96.0–105.5	9.5	9.81	103
13	2/13/79	1653	3189.5–3199.0	105.5–115.0	9.5	4.67	49
14	2/13/79	2327	3199.0–3208.0	115.0–124.0	9.0	2.28	25
15	2/14/79	0105	3208.0–3217.0	124.0–133.0	9.0	3.32	37
16	2/14/79	1111	3217.0–3226.0	133.0–142.0	9.0	2.76	31
17	2/14/79	1520	3226.0–3235.0	142.0–151.0	9.0	3.00	33
18	2/14/79	1951	3235.0–3244.0	151.0–160.0	9.0	4.95	55
19	2/15/79	0112	3244.0–3253.0	160.0–169.0	9.0	0.07	1
20	2/15/79	0745	3253.0–3262.0	169.0–178.0	9.0	1.79	20
21	2/15/79	1157	3262.0–3266.5	178.0–182.5	4.5	3.00	67
22	2/15/79	1706	3266.5–3271.0	182.5–187.0	4.5	4.86	108
23	2/15/79	2232	3271.0–3275.5	187.0–191.5	4.5	2.50	56
24	2/16/79	0240	3275.5–3280.0	191.5–196.0	4.5	2.15	48
25	2/16/79	1052	3280.0–3284.0	196.0–200.0	4.0	1.90	48
26	2/16/79	1511	3284.0–3288.5	200.0–204.5	4.5	3.80	84
Hole 483B							
1	2/19/79	0210	3175.5–3185.0	91.5–101.0	9.5	7.51	79
2	2/19/79	0550	3185.0–3194.5	101.0–110.5	9.5	9.78	103
3	2/19/79	1200	3194.5–3203.5	110.5–119.5	9.0	1.23	14
4	2/19/79	1809	3203.5–3211.0	119.5–127.0	7.5	8.07	108
5	2/22/79	2137	3211.0–3214.0	127.0–130.0	3.0	0.00	0
6	2/23/79	0227	3214.0–3217.0	130.0–133.0	3.0	0.00	0
7	2/23/79	0749	3217.0–3221.5	133.0–137.5	4.5	3.24	72
8	2/23/79	1148	3221.5–3230.5	137.5–146.5	9.0	3.17	35
9	2/23/79	1347	3230.5–3235.0	146.5–151.0	4.5	0.30	7
10	2/23/79	1645	3235.0–3244.0	151.0–160.0	9.0	0.00	0
11	2/23/79	2343	3244.0–3253.0	160.0–169.0	9.0	0.00	0
B-1	2/24/79	0715	—	—	—	0.33	—
12	2/24/79	2333	3253.0–3258.5	169.0–174.5	5.5	2.87	52
13	2/25/79	0446	3258.5–3264.0	174.5–180.0	5.5	4.09	74
14	2/25/79	0821	3264.0–3268.5	180.0–184.5	4.5	2.13	47
15	2/25/79	1345	3268.5–3273.5	184.5–189.5	5.0	0.07	1
16	2/25/79	1800	3273.5–3278.0	189.5–194.0	4.5	0.00	0
17	2/26/79	1844	3278.0–3283.0	194.0–199.0	5.0	3.00	60
18	2/26/79	2148	3283.0–3288.0	199.0–204.0	5.0	3.00	60
19	2/27/79	0210	3288.0–3292.5	204.0–208.5	4.5	3.60	80
20	2/27/79	0522	3292.5–3297.0	208.5–213.0	4.5	3.17	70
21	2/27/79	0811	3297.0–3301.5	213.0–217.5	4.5	2.62	58
22	2/27/79	1159	3301.5–3306.0	217.5–222.0	4.5	2.83	63
23	2/27/79	1555	3306.0–3310.5	222.0–226.5	4.5	4.45	99
24	2/27/79	1803	3310.5–3315.0	226.5–231.0	4.5	1.80	40
25	2/27/79	2044	3315.0–3319.5	231.0–235.5	4.5	2.72	60
26	2/27/79	2258	3319.5–3324.0	235.5–240.0	4.5	2.44	54
27	2/28/79	0328	3324.0–3328.5	240.0–244.5	4.5	5.06	112
28	2/28/79	0730	3328.5–3333.0	244.5–249.0	4.5	3.31	74
29	2/28/79	1125	3333.0–3337.5	249.0–253.5	4.5	1.14	25
30	2/28/79	1537	3337.5–3342.0	253.5–258.0	4.5	3.00	67
31	2/28/79	1830	3342.0–3346.5	258.0–262.5	4.5	3.45	77
32	2/28/79	2304	3346.5–3351.0	262.5–267.0	4.5	3.40	76
Hole 483C							
1	2/21/79	2209	3122.5–3132.0	38.5–48.0	9.5	7.47	79
2	2/22/79	0315	3170.0–3179.5	86.0–95.5	9.5	9.40	99
3	2/22/79	0420	3179.5–3189.0	95.5–105.0	9.5	3.05	32
4	2/22/79	0958	3189.0–3198.0	105.0–114.0	9.0	6.32	70

The lower part of Unit I (23–36.5 m) is composed predominantly of muddy diatomaceous ooze and muddy nannofossil ooze. The detrital mineral content is low (less than 15%).

Unit II (36.5–52.2 m)

The upper part of Unit II (36.5–43.0 m) is composed of siliceous silty clay grading downward to muddy siliceous nannofossil ooze and muddy siliceous ooze. Between 40.5 meters and 43 meters, these sediments contain soft white patches of tuffaceous clay up to a few centimeters across, containing 86% glass shards. Indurated fragments, up to 10 cm long, of black claystone

Table 2. Sedimentary lithologic units, Site 483.

Unit	Lithology	Age	Depth (m)	Thickness (m)	Core-Section (level in cm)
Hole 483					
Sediments overlying basement					
I	Diatomaceous mud, muddy diatomaceous ooze, and muddy nannofossil ooze	Upper Quaternary	0.0–36.5	36.5	1-1, 0 to 5-5, 80
II	Muddy siliceous nannofossil ooze, muddy siliceous ooze, clay, and clayey siliceous ooze	Upper Quaternary	36.5–52.2	15.7	5-5, 80 to 7-3, 70
III	Clay and silty clay	Lower Quaternary	52.5–110.1	57.6	7-3, 70 to 13-4, 5
Sediments interlayered in basement					
	Not sampled	—	114.0–117.0	3.0	13-4, 95 to 14-1, 5
	Not sampled	—	129.0–132.0	3.0	15-2, 128 to 15-2, 128
	Siltstone	Upper Pliocene	137.0–145.5	8.5	16-3, 12 to 17-1, 18
	Silty clay and sandy silt	Upper Pliocene	149.0–158.0	9.0	17-3, 24 to 18-4, 130
	Not sampled	—	161.0–163.0	2.0	19-1, 10 to ?
	Not sampled	—	171.0–174.0	3.0	? to 20-1, 5
	Not sampled	—	190.5–191.5	1.0	23-2, 150 to 24-1, 5
	Silty claystone	Upper Pliocene	200.2–201.0	0.8	26-1, 40 to 26-1, 50
Hole 483B					
Sediments overlying basement					
I	Silty clay	Lower Quaternary	91.5–110.0	18.5	1-1, 0 to 2-6, 130
Sediments interlayered in basement					
	Not sampled	—	112.0–116.0	4.0	3-1, 75 to 3-1, 75
	Silty clay	—	130.0–132.0	2.0	? to 7-1, 7
	Claystone and sandstone	—	137.5–142.5	5.0	7-3, 75 to 8-1, 10
	Claystone	—	148.0–155.5	7.5	9-1, 0 to 9-1, 5
	Not sampled	—	159.7–160.5	0.8	? to ?
	Not sampled	—	189.0–191.0	3.0	15-1, 6 to 17-1, 0
	Not sampled	—	199.0–200.0	1.0	17-3, 45 to 18-1, 0
	Clay	—	210.5–211.1	0.6	20-2, 65 to 20-2, 130
	Not sampled	—	227.7–228.8	1.1	24-1, 145 to 24-1, 145
	Claystone	—	232.4–233.8	1.4	25-2, 5 to 25-2, 20
	Claystone	—	238.5–238.7	0.2	26-1, 150 to 26-2, 5
	Not sampled	—	249.5–251.6	2.1	29-1, 65 to 29-1, 65
Hole 483C					
Sediments overlying basement					
I	Radiolarian and diatomaceous mud and nannofossil marl	—	38.5–48.0	9.5	1-1, 0 to 1,CC
II	Silty clay and clayey silt	—	86.0–107.0	21.0	2-1, 0 to 4-1, 46

with molds of sideromelane shards filled with pelletoidal green clay are also present. The ashy clay patches could represent ash fall remnants, but the hard black claystones are probably associated with a nearby eruption. The muddy siliceous ooze noted above contains 30% volcanic glass and grades downward to vitric silty sand with 25% glass shards.

From 43 meters to 52.2 meters sub-bottom, the sediments grade downward to a thin (60 cm) fine-grained, glass-poor turbidite in sharp contact along its base with a fine-grained, dark greenish gray clay. The nature of the contact and the relatively fine grain size of the material are suggestive of distal turbidites. The soft clay underlying the turbidites has less than 5% volcanic glass and only sparse pieces of vitric claystone. The clay grades downward to a 1.5-meter section of clayey siliceous ooze.

Unit III (52.2–110.1 m)

Unit III is composed predominantly of hemipelagic sediments with minor thin turbidite layers and relatively few siliceous fossils. The hemipelagic sediments are represented by silty clay and clayey silt with an average content of 50% silt and 50% clay and show no major change throughout the unit. The turbidites, which are found occasionally throughout the unit, are very thin (10–30 cm) and tend to be fine-grained. An 8-cm-thick layer of black claystone, similar to the pieces described in Unit II, is present at the top of Core 8 at a sub-bottom depth of 58.5 meters.

The $CaCO_3$ content in the unit is low (0–2%), and the siliceous fossil content gradually decreases from 15% at the top of the unit to 1% in the lower 23 meters. Calcareous nannofossils are locally preserved in this interval, but no evidence of diagenesis was observed, despite the fact that the hemipelagic sediments become noticeably firmer within 10 meters of the basement.

Sediments Interlayered in Basement

As can be seen in Table 2 and Figure 3, eight sediment layers were drilled in the basement in Hole 483. The geophysical logs run in the hole indicate that only 11% of the interlayered sediments was recovered, and that the layers tend to decrease in thickness with depth in the basement. Only the three layers actually sampled will be described.

137.0–145.5 m: The sediments recovered from the uppermost interval sampled consist of 20 cm of firm, olive black siltstone, containing small zeolite crystals suggestive of incipient diagenesis. Although the contact with the underlying basalt was not recovered, the underlying basalt appears to be from the top of a cooling unit since it is aphyric, fine grained, and increases in grain size with depth.

149.0–158.0 m: Nearly 4.5 meters of sediment were recovered from this interval. The upper meter consists

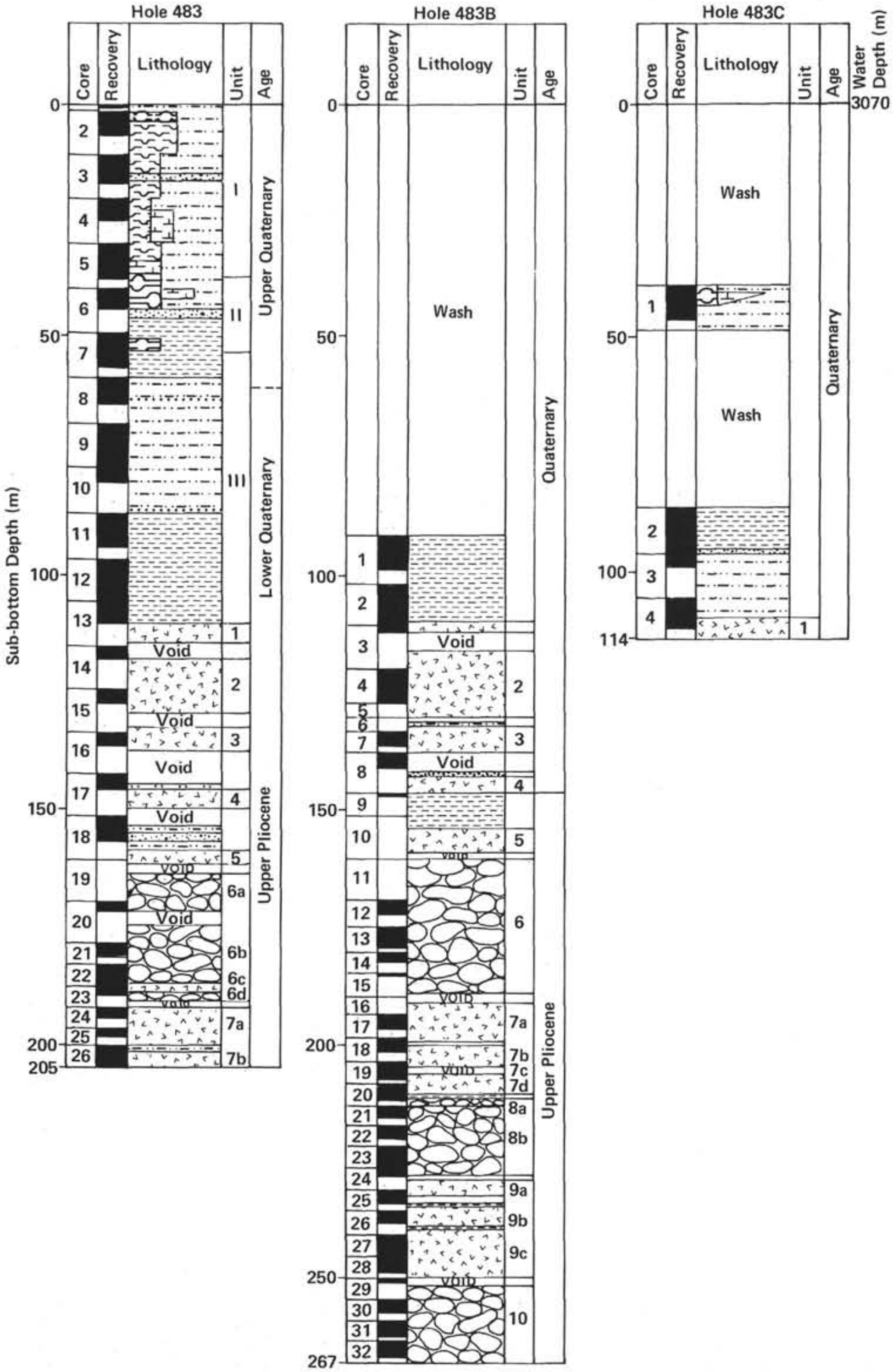


Figure 3. Sediment and basement lithology at Site 483. (For explanation of symbols, see Explanatory Notes, this volume. Thickness of sediment layers in basement in Holes 483 and 483B determined from geophysical logs and drilling rate logs, respectively.)

of highly deformed, silty clay containing several small pieces of basalt. With depth the clay becomes stiffer and less deformed and grades into a 1.7-meter-thick layer of clayey to sandy silt. This in turn grades downward into silty clay whose grain size decreases downward toward the base of the interval. A 10-cm-thick piece of basalt is intercalated with the sediments about 25 cm above the base of the sedimentary interval.

The silty clay contains up to 15% volcanic glass fragments and 5 to 10% each of zeolites and pyrite, both of which are most abundant near the basalt contact. Rare nannofossils, diatoms, and silicoflagellates are preserved in the clays.

200.2-201.0 m: Several pieces of firm, black, sandy to silty claystone were recovered from this interval. These sediments contain about 10% volcanic glass fragments and abundant small dolomite crystals.

Hole 483B

Hole 483B, located about 100 meters east of Hole 483, was continuously cored between 91.5 and 267.0 meters sub-bottom. Acoustic basement, encountered at 110 meters sub-bottom, consists largely of massive basalt with minor interlayered sediment.

Sediments Overlying Basement

The sediments recovered above basement are homogeneous, olive gray to olive black, silty clay containing rare diatoms, radiolarians, and calcareous nannofossils. Secondary calcite and dolomite occur in small patches and lenses throughout the sediment but are particularly abundant in a 50-cm-thick interval directly above the basement contact.

Sediments Interlayered in Basement

The drilling record suggests 12 sedimentary interbeds in the 157 meters of basement cored in Hole 483B (Table 2; Fig. 3). In general, the sedimentary layers are distributed rather uniformly through the sampled section but are thickest in the upper parts. Only those layers from which material was recovered will be described.

130.0-132.0 m: Several small pieces of firm olive black silty clay were recovered from this interval. A single piece of glassy aphyric basalt is incorporated in the sediment.

137.5-142.5 m: The sediments recovered from this interval are composed of fragments of firm, brownish black, silty clay and indurated hyaloclastite. The hyaloclastite consists of sand-size, angular, glassy fragments replaced by dark green to greenish black smectite (Fig. 4). White zeolites form radial clusters between the shards. Most of the hyaloclastite fragments are thinly laminated and a few exhibit distinct cross-bedding.

148.0-155.5 m: A single 5-cm-thick piece of firm, olive black, silty claystone was recovered from this interval.

210.5-211.1 m: Approximately 65 cm of partially disrupted sediment was recovered from this interval. At the top there is about 4 mm of greenish gray hyaloclastite which overlies 30 cm of firm black clay. The lower part of the section consists of firm, black, silty clay with a 2-cm-thick layer of sandy silt. This layer contains small quantities of calcareous nannofossils and some fragments of volcanic glass.

232.4-233.8 m: The recovered material from this layer consists of black indurated silty claystone cut by narrow oxidized pyrite veins. Thin laminations are inclined about 25 degrees from the horizontal and small flame structures are visible on the cut core surface.

238.5-238.7 m: A single piece of black indurated silty claystone was recovered from this interval.

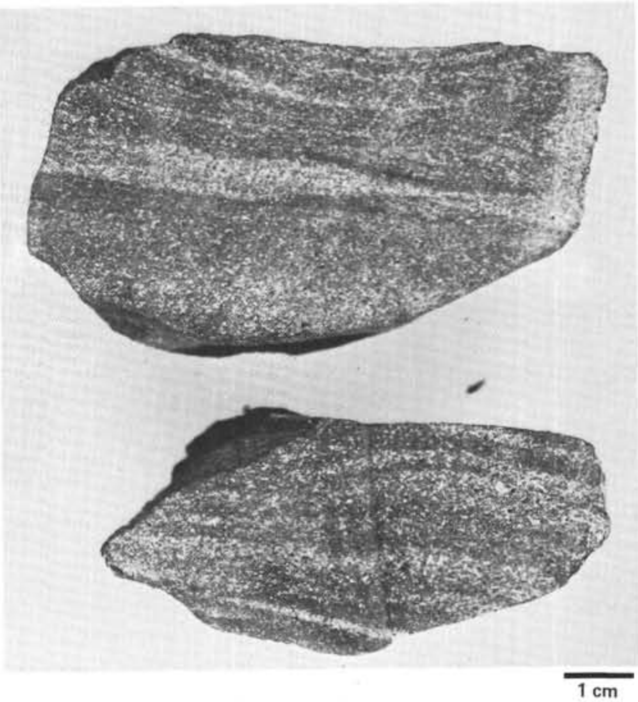


Figure 4. Well-bedded, indurated hyaloclastite interbedded with basalt in basement (Sample 483B-8-1, 0-40 cm).

Hole 483C

Hole 483C is located about 500 meters east of Hole 483B and about 600 meters east of Hole 483. It was washed to 38.5 meters sub-bottom, at which level a single 9-meter core was taken. The hole was again washed from 48.0 to 86.0 meters sub-bottom and then continuously cored to a total depth of 114 meters. The top of acoustic basement was encountered at a depth of 107 meters sub-bottom. No sediments were recovered from the 7 meters of cored basement.

Sediments Overlying Basement

Three lithologic units were defined in the sediments overlying basement (Table 2):

Unit I consists chiefly of soft, gray, siliceous silty clay; small light-colored inclusions of ash, up to about 1 cm across, are scattered through the clay (Fig. 5). These consist of small, light-colored shards of volcanic glass with traces of feldspar. Only 1.5 meters of this unit were recovered between 38.5 and 40.0 meters sub-bottom.

Unit II consists of about 2.0 meters of siliceous nannofossil marl and nannofossil-bearing siliceous silty clay between 40.0 and 42.0 meters sub-bottom. These soft, relatively light-colored sediments are highly disturbed by drilling.

Unit III consists chiefly of dark gray, firm, silty clay with minor clayey silt. It presumably extends from 112 to 107 meters sub-bottom, but much of this interval was not cored. A few patches of ash similar to those in Unit I are present in the upper meter of Unit III, and rare pieces of limestone and dolostone occur between 93 and 95 meters sub-bottom (Fig. 6). These latter pieces prob-

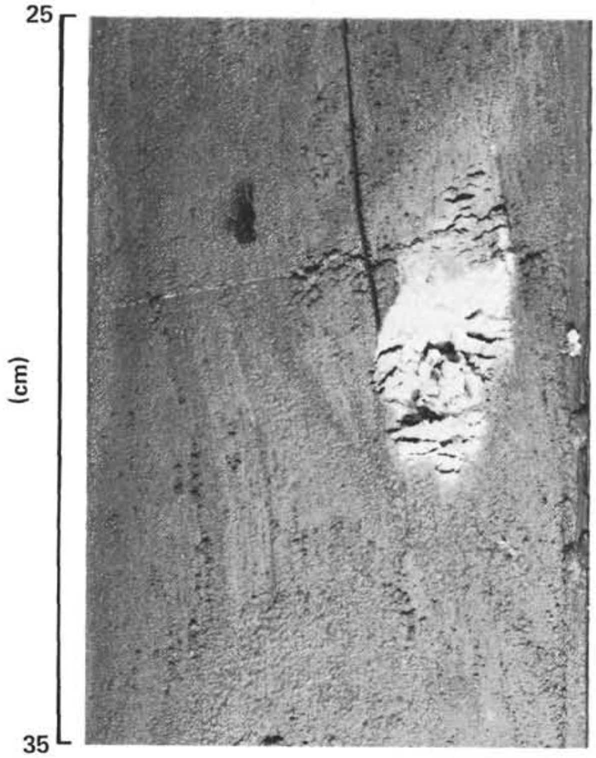


Figure 5. Small patch of white ash in matrix of muddy siliceous nannofossil ooze (Sample 483-6-2, 25–35 cm).

ably represent thin authigenic carbonate lenses or layers broken by drilling. Highly deformed pyrite-rich streaks are locally abundant, and small burrows filled with sandy silt are present in Core 3. Several thin layers of sandy silt are interbedded with the clay at the bottom of Core 2. In the lowest 17 meters, the sediments become much stiffer and authigenic zeolites are common. No baking was observed immediately above the basement contact.

In summary, the sediments at this site are predominantly clays and silty clays with minor silty sands, sandy silts, and calcareous or siliceous oozes.

Site 483 is separated from the tip of Baja California by a positive area and a basin and was presumably isolated from the continental border landmass, which produced the great quantities of terrigenous material drilled at Site 474. Most of the fine-grained sediments at Site 483 are believed to be hemipelagic in origin, although the silts and sands may have been deposited by turbidity currents. The sediment/basement contact is not marked by obvious baking, but the sediments above basement often have authigenic zeolites and carbonates. The sediments interlayered with basalts are similar to those overlying basement except that they are somewhat more indurated.

BIOSTRATIGRAPHY

Most of the sediments recovered above basement at Site 483 contain moderately preserved calcareous nannofossils and well-preserved radiolarians and foraminifers (Fig. 7). Diatoms and silicoflagellates are common and moderately preserved in Cores 483-1 to 4, with both

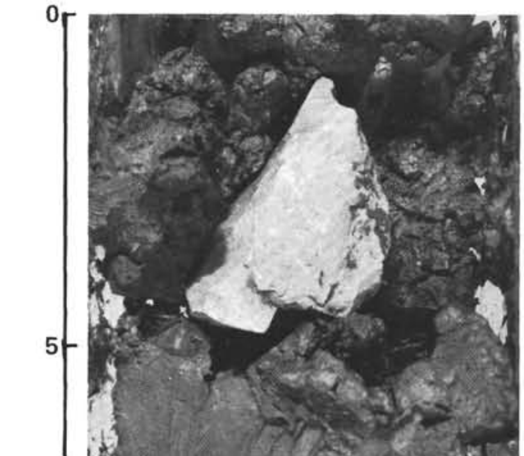


Figure 6. Small pieces of partially dolomitized limestone in a silty clay matrix. Pieces may represent fragments of a thin layer broken by drilling (Sample 483C-3-1, 0–18 cm).

abundance and preservation decreasing downhole. Fossils are sparse in the sediments interlayered in basement, consisting chiefly of poorly preserved calcareous nannofossils.

The sediments between 0 and 33 meters are assigned to Zones NN20/21 (undifferentiated) and are thus less than 0.41 m.y. old. Older nannofossils in the uppermost 20 meters are believed to be reworked. Between 33 and 110 meters sub-bottom the sediments are assigned to Zone NN19, indicating an age of between 0.44 and 1.65 m.y. The first occurrence of *Helicopontosphaera sellii*, which defines the boundary of Gartner's (1977) *Helicopontosphaera sellii* Zone, is in Sample 483-10-1, 50–52 cm, indicating an age of 1.22 m.y. Calcareous nannofossils from sediments just above basement (Cores 483-12 and 13; 483B-1 and 2; 483C-2) define the *Cyclococcolithina macintyrei* Zone of Gartner (1977), which spans the interval between 1.51 and 1.65 m.y. ago. The highest

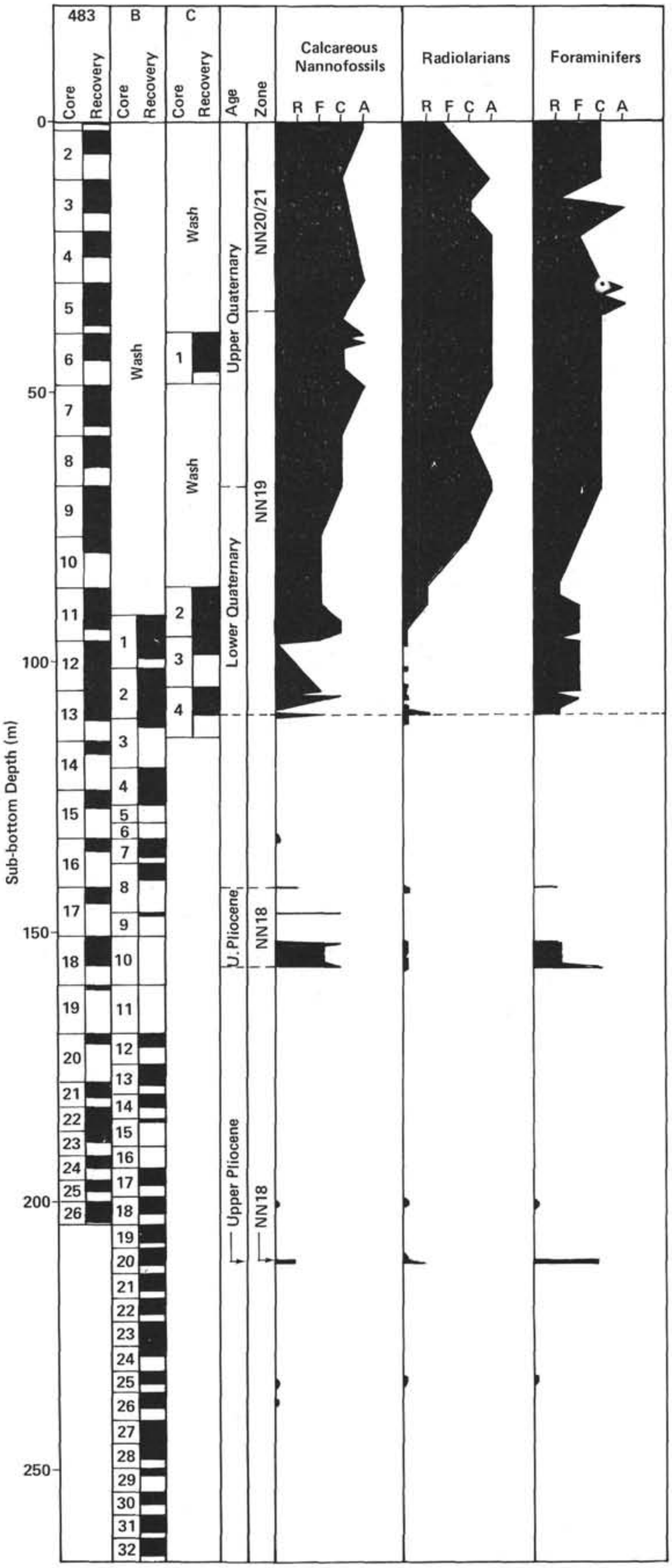


Figure 7. Biostratigraphic summary for sediments at Site 483. (R = rare, F = few, C = common, and A = abundant. Dotted line at 110 m sub-bottom shows position of uppermost basalt.)

occurrence of the radiolarian *Axoprunum angelinum* (= *Stylatractus universus*) (0.41 m.y. ago) is in Sample 483-5-3, 110–102 cm (33.5 m subsea). The highest occurrences of *Lamprocyrtis neoheteroporos* (extinction 1.03 m.y. ago at equatorial latitudes, 0.54 at higher latitudes) and *Theocorythium vetulum* (extinction 0.94 m.y. ago) are in Sample 483-8,CC (11–13 cm) (63.65 m subsea), but the latter is only a single occurrence in all of Site 483. A single specimen of *Anthocyrtidium angulare* (extinction at 0.94 m.y. ago) occurs in Sample 483-9-1, 74–76 cm (68.25 m subsea).

The uppermost nannofossil-bearing sediments recovered from within the basement (Cores 483-17 and 18; 483B-19) are assigned to Zone NN18 of late Pliocene age. They are further restricted to being no older than 2.0 m.y. Because these sediments occur below a basalt sequence showing normal magnetic polarity above (Olduvai) and reversed below (Matuyama), they must be older than 1.8 m.y., the beginning of the Olduvai event. Sediments recovered from Core 483B-20 are of the same age.

Calcareous Nannofossils

The small size, moderate to poor preservation, and extensive reworking of the nannofossils complicate the dating of the sediments at Site 483. Cores 483-1 to 13, 483B-1 to 2, and 483C-1 to 2 are Pleistocene in age. Reworked specimens of *Cyclococcolithina macintyrei, Discoaster asymmetricus*, and *Pseudoemiliania lacunosa* are present in Cores 483-1 to 3 and are believed to be of Zones NN20/21

The remaining sedimentary sections above basement, Cores 483-5 to 13, are assigned to Zone NN19. The *Helicopontosphaera sellii* subzone (Gartner, 1977) is located between 483-9,CC and 483-10-1, and the *C. macintyrei* subzone (Gartner, 1977) is recognized in Cores 483-12 and 13 and 483B-1 and 2.

The boundary between Zones NN20/21 and NN19 is not well defined, because specimens of *P. lacunosa* are sparse and poorly preserved in Cores 483-4 to 5.

The first Pliocene calcareous nannofossils occur within the basement section in Cores 483-17 and 18 and Core 483B-9. Pliocene nannofossils were also observed in Core 483B-20. These fossils all appear to be representative of the late Pliocene Zone NN18, *D. brouweri*, but they are poorly preserved and may be slightly older.

The Pliocene/Pleistocene boundary occurs in Hole 483 between Cores 13 and 17. The upper limit is fixed by the *C. macintyrei* subzone 1.65 to 1.51 m.y. and the Olduvai magnetic event, which occurred from 1.6 to 1.8 m.y. ago and was found in basalt recovered from Core 483-13. The presence in Core 483-17 of *D. brouweri*, which became extinct at the end of the Pliocene, marks the lower limit of this boundary. Because no sediments were recovered from the intervening Cores 483-14 and 15, the boundary cannot be located more precisely.

Foraminifers

Foraminifers are common in the upper 70 meters of the sedimentary section at this site but are sparse in the lower 40 meters (Fig. 7). They are rare in the sediments within the basement section. Planktonic foraminifers comprise 80 to 95% of the assemblages from the sediments above basement, whereas benthic species are most common in the basement section.

All of the recovered foraminifers appear to be indigenous to Site 483. Common to abundant occurrences are not associated exclusively with sandy intervals of presumed turbidite origin, as was the case at Site 482. The species composition is relatively uniform throughout the sedimentary section. The benthic populations show little variation and are characterized by lower bathyal to abyssal species, consistent with the water depth at the site of over 3000 meters.

Most of the foraminifers in the sediments above basement are well preserved. Preservation is poor to moderate in sediments intercalated with the basalts and in the lower 5 meters of sediment above basement. In Section 483-20-2 most of the foraminiferal tests are flattened and partly-to-completely recrystallized. This may have resulted from extrusion of basalt over the soft, watery sediment.

Planktonic Foraminifers

Globorotalia truncatulinoides, the planktonic foraminiferal species used to define sediments of Quaternary age, was not found at Site 483. Pliocene marker species likewise are absent.

There do not appear to be any statistically valid subdivisions of the planktonic foraminifers into tropical, subtropical, or transition zone assemblages as defined by Bé (1977). The dominant species in nearly every sample represents a mixture of these three assemblages, probably reflecting convergence of the faunal provinces near the mouth of the Gulf of California (Bé, 1977, Fig. 7). This convergence results from the transport of the higher-latitude transition-zone fauna southward along the California and Baja California coasts.

The dominant species in most samples are representative of the subtropical assemblage, namely, *Globoquadrina dutertrei* (the dominant species in nearly every sample), *Globigerinoides ruber*, and *Globigerina bulloides*, all of which are generally common to abundant. *Orbulina universa* is also consistently present but ranges from rare to common. Occurring with these species are the tropical species *Globorotalia menardii* s.l., *Pulleniatina obliquiloculata*, and *Globigerinoides sacculifer*, and the transition zone species *Globoquadrina pachyderma* (right coiling). Associated with the above but occurring rarely and sporadically are the subtropical species *Globorotalia scitula, G. tumida, Globigerina falconensis*(?), *G. calida, Globigerinita glutinata, Globigerinella aequilateralis, Globigerinoides conglobatus, Hastigerina pelagica*, the tropical species *Globoquadrina hexagona, Candeina nitida, Sphaeroidinella dehiscens, Globorotalia theyeri, Globigerina digitata*, and the transition zone species *Globorotalia inflata*.

Benthic Foraminifers

Despite their generally low abundance (5–15% of the assemblage in any sample), a few species of benthic foraminifers are consistently present throughout the cored sedimentary section at Site 483. *Uvigerina senticosa* occurs commonly and generally is the dominant species. Others which are generally present but rare to few include *Melonis pompilioides, M. barleeanus, Hoeglundina elegans, Pyrgo depressa, Gyroidina soldani, Oridorsalis tener* (or *O. umbonatus*?), and *Pullenia bulloides*. Associated with these, but rarely and more sporadically, are *Anomalinoides globulosus, Bulimina mexicana, Eggerella bradyi, Globobulimina pacifica, G. pupoides, Martinottiella nodulosa, Sphaeroidina bulloides*, and *Uvigerina auberiana*. According to Ingle (1973), most of the above species are found living at depths between 2500 and 3500 meters in the eastern North Pacific. These depths are consistent with the water depth of over 3000 meters at Site 483.

The sandy sediments of Cores 483-3 and 483-18 suggest deposition by turbidity currents. Benthic foraminifers in samples from these intervals represent shallower water depths than those of the species listed above; therefore, they probably were displaced basinward from where they lived on the shelf or upper continental slope. They occur together with the deep-living species and include *U. hollicki, U. peregrina, Bolivina* spp., *Brizalina* spp., *Buliminella elegantissima, Cassidulinoides* sp., *Cibicides lobatus, Hanzawaia* sp., *Epistominella* sp., *Nonionella* sp., and others.

Radiolarians

Radiolarians are generally common to abundant and are well preserved in the upper 77 meters of Quaternary sediments at Site 483. Assemblages are diverse—each sample consisting of well over 100 species, nearly all of which are present in Holocene sediments throughout the Gulf of California (Benson, 1966). In Core 483-1 preservation of the few radiolarians is moderate to good. Many of the specimens are thin-walled, which may be the result of partial dissolution. The possibility of their having been reworked from deposits elsewhere cannot be ruled out.

Below 77 meters, radiolarians are still well preserved but are rare to about 90 meters (Sections 483-9,CC through 10,CC; 483C-2, Sections 1–3). Samples are barren between 90 meters and the basement at about 110 meters. Radiolarians from Section 483-9,CC (77 m) are dominated by thick-walled actinommids, including abundant *Axoprunum angelinum, Actinomma* spp., *Xiphatractus* spp., *Druppatractus* spp., and a few robust nasselline species such as *Theocalyptra davisiana davisiana, Botryostrobus aquilonaris, Carpocanarium papillosum, Plectopyramis dodecoma*, and *Cornutella profunda*. Although they show little indication of chemical attack, this concentration of robust and presumably more solution-resistant skeletons may be the result of dissolution of the less resistant skeletons comprising an originally more diverse assemblage typical of the samples from above.

Samples from 94 to 110 meters are generally barren (483-11,CC; 483-12,CC; 483B-2; 483C-2, Section 6; and 483C-3), but the sample from sediments immediately overlying the basement at 109.4 meters (Sample 483-13-3, 85–87 cm) contains rare, well-preserved radiolarians. With one exception, all samples from sediments within the basalt-sediment sequence below 110 meters are barren. The exception is Sample 483B-20-2, 120–130 cm (211.2 m), where rare, well-preserved radiolarians are present, although biostratigraphic marker species were not observed. The very diverse Quaternary radiolarian assemblages at Site 483 are similar to those of Site 482. As at the latter site, the species composition is primarily tropical, with the addition of some higher latitude species which appear to have been transported southward to the Gulf by the California Current system.

The highest occurrence of *Axoprunum angelinum* (= *Stylatractus universus*) is in Sample 483-5-3, 100–102 cm. Below this level the species is consistently present, ranging from rare to abundant. Although no radiolarian zonal designations were made for Leg 65 sites, the sedimentary section above the highest occurrence of this species corresponds to Kling's (1973) *Artostrobium miralestense* Zone. The section below 33.5 meters, which includes *Axoprunum angelinum* corresponds to the *A. angelinum* Zone of Kling (1973). He defined the base of this zone at the highest occurrence of *Eucyrtidium matuyamai*, but this species was not found at any Leg 65 site and for this reason his zonal scheme was not utilized.

The top of the *Anthocyrtidium angulare* Zone of Nigrini (1971), which may be the approximate time equivalent of the *E. matuyamai* Zone of Kling (1973), is defined by the latest appearance of *A. angulare;* associated with this species is *Theocorythium vetulum*, which is confined to the zone. Because only one individual each of these species was found at Site 483 (*A. angulare* in Sample 483-9-1, 74–76 cm; *T. vetulum* in Sample 483-8,CC (11–13 cm), Nigrini's zone is not recognized.

Hays and Shackleton (1976) claim that there was a globally synchronous extinction of *Axoprunum angelinum* (= *Stylatractus universus*) at 410,000 ± 5000 years ago. Johnson and Knoll (1975), however, claim that its last appearance in the equatorial Pacific may be significantly younger than this, perhaps 320,000 years. The last occurrence of this species at Site 483 is within the same core (Core 483-5) in which the boundary between Zones NN20/21 and NN19 is placed. Because the top of NN19 is dated at about 0.44 m.y., there is considerable support for adherence to the 0.41 m.y. extinction datum of *A. angelinum* for Site 483.

A date of 0.94 m.y. ago for the last occurrence of *Anthocyrtidium angulare* in the equatorial Pacific was determined by Johnson and Knoll (1975). The extinction of *Eucyrtidium matuyamai* also occurs at about 0.9 m.y. ago (Hays, 1970); therefore, the *A. angulare* Zone may be the approximate time equivalent of the *E. matuyamai* Zone of Kling (1973). Because only a single specimen of *A. angulare* was found at Site 483, at a sub-bottom depth of 68.25 meters, the date of 0.94 m.y. ago for this level should be used with caution.

Collosphaera tuberosa and *Lamprocyrtis neoheteroporos* are two other radiolarian species for which datum levels have been determined. Single specimens of *C. tuberosa* were found in two samples—Samples 483-5,CC (5–7 cm) and 483-6-2 (28–31 cm). The species is present in the latter sample in association with a rhyolitic(?) ash.

Johnson and Knoll (1975) dated the first appearance of *C. tuberosa* in the equatorial Pacific at approximately 0.37 ± 0.1 m.y. ago. If the extinction level of *A. angelinum* is at 0.41 m.y. ago, then *C. tuberosa* first appears at Site 483 before this time, because it appears below the last occurrence of *A. angelinum*.

The highest occurrence of *Lamprocyrtis neoheteroporos* is in Sample 483-8,CC (11–13 cm) (63.65 m subsea). Johnson and Knoll (1975) calculated a date of 1.03 m.y. ago for the extinction of this species in their equatorial Pacific cores. They also calculated the age of the morphotypic upper limit of this species as 0.45 m.y. at DSDP Site 175 and 0.76 m.y. at Site 173 in the North Pacific. The date of its highest occurrence in the Gulf of California must be between the extremes of the above estimates. Because its highest occurrence is just above the occurrence of *Anthocyrtidium angulare* at Site 483, its local "extinction" level may be about 0.9 m.y. ago.

SEDIMENT ACCUMULATION RATE

The datum points used to construct the diagram illustrating the sediment-accumulation rate (Fig. 8) are as follows:

A. The highest occurrence of the radiolarian *Axoprunum angelinum* at 33.5 meters sub-bottom (0.41 ± 0.05 m.y.);

B. A single occurrence of the radiolarian *Anthocyrtidium angulare* at 63.25 meters sub-bottom (0.94 m.y. represents the highest occurrence of this species);

C. The highest occurrence of *Helicopontosphaera sellii* at 78 meters sub-bottom (1.22 m.y.);

D. The highest occurrence of the coccolith *Cyclococcolithina macintyrei* at 93.2 meters sub-bottom (1.51 m.y.).

Also included were recognition of the Olduvai interval of normal polarity in the first downhole basalt (Core 483-13), the reversed polarity of basalt beneath it, and, in turn, the presence of *Discoaster brouweri* in the first downhole basement sediments (Core 483-17) below this.

On this basis, the sediment can be no younger than 1.8 m.y., the beginning of the Olduvai interval. Other fossils present here and in Cores 483-18 and 483B-9 and 20 suggest that the sediments encountered to a hole depth of 211 meters are no older than 2.0 m.y. No hiatuses were observed in the sediments at Site 483. Assuming continuous sedimentation, the following are minimum rates of sediment accumulation:

	Hole Depth Interval (m)	Sediment Accumulation Rate (m/m.y.)
	0.0–33	80
	33.5–68.25	68
	68.25–93.2	43
	93.2–111(+?)	57
Av.:	0–111	62

SEDIMENT GEOCHEMISTRY

Calcium carbonate and reduced (organic) carbon were determined for Site 483 sediments using the shipboard bomb (Müller and Gastner, 1971) and the CHN analyzer (Table 3). These measurements were supplemented by shorebased determinations of total carbon, organic carbon, and $CaCO_3$ (Table 4) made with LECO WR-12 analyzer, using the technique described by Bader, Gerard, et al. (1970) and Boyce and Bode (1972).

Calcium carbonate ranges from a maximum of 16.5% in muddy nannofossil ooze to zero in some of the

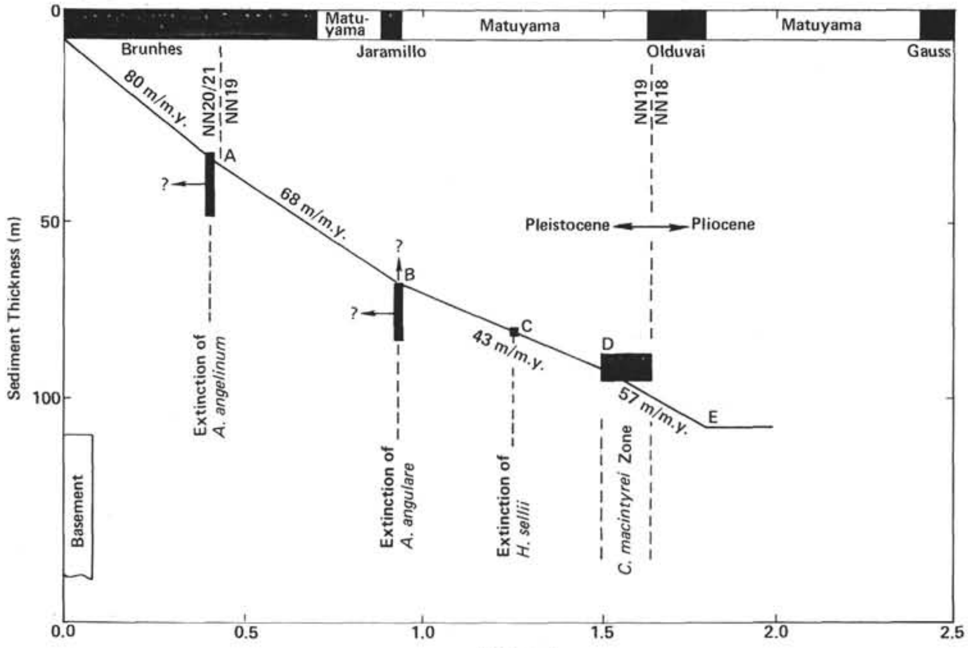


Figure 8. Sediment thickness plotted against age at Site 483. (Key biostratigraphic markers are designated A, B, C, and D; appearance of Olduvai normal polarity interval designated by E. Calculated sediment-accumulation rates are shown for intervals between the markers.)

Table 3. $CaCO_3$ (bomb) and reduced carbon determinations, Site 483.

Sample (interval in cm)	$CaCO_3$ (%)	Reduced Carbon (%)	Lithology
Hole 483			
1-1, 23–25	2.5	—	Silty clay
1-1, 25–27	8.5	2.53	Clayey nannofossil ooze
2-3, 103–105	4.5	1.96	Diatomaceous mud
2-3, 111–113	1.0	—	Diatomaceous mud
3-2, 51–53	3.3	—	Diatomaceous mud
3-2, 58–60	3.3	2.04	Diatomaceous mud
4-2, 82–85	1.5	—	Diatomaceous mud
4-2, 89–91	2.0	2.24	Diatomaceous mud
5-3, 69–71	14.0	—	Muddy nannofossil ooze
5-3, 77–79	16.5	1.80	Muddy nannofossil ooze
6-2, 69–71	1.0	—	Muddy siliceous ooze
6-2, 77–79	1.5	1.26	Muddy siliceous ooze
7-2, 77–79	2.5	1.43	Clayey siliceous ooze
7-2, 84–86	3.3	—	Clayey siliceous ooze
8-2, 61–63	2.5	—	Silty clay
8-2, 68–70	3.0	1.26	Silty clay
9-2, 70–72	1.5	—	Silty clay
9-2, 78–80	1.5	1.35	Silty clay
10-2, 86–88	2.0	—	Silty clay
10-2, 94–96	2.8	0.70	Silty clay
11-2, 20–22	0.0	—	Clay
11-2, 27–29	0.0	2.46	Clay
12-3, 80–82	0.5	—	Clay
12-3, 88–90	1.0	3.96	Clay
13-2, 80–82	0.0	—	Clay
13-2, 86–88	0.0	1.60	Clay
18-2, 74–76	2.0	—	Sandy silt
18-2, 77–79	1.5	1.68	Sandy silt
18-3, 72–74	1.5	—	Sandy silt
18-3, 75–77	1.5	0.66	Sandy silt
18-4, 73–75	1.0	—	Silty clay
18-4, 74–76	1.5	3.14	Silty clay
Hole 483B			
1-4, 101–103	1.0	—	Clay
1-4, 109–111	1.5	2.23	Clay
2-5, 106–108	2.0	—	Clay
2-5, 113–115	2.5	1.74	Clay
20-2, 74–76	2.5	2.56	Clay
Hole 483C			
1-3, 106–108	3.0	0.81	Silty clay
1-3, 134–136	3.5	—	Silty clay
2-4, 103–105	1.5	—	Silty clay
2-4, 109–111	0.5	1.07	Silty clay
3-2, 30–32	1.0	—	Silty clay
3-2, 38–40	1.0	1.04	Silty clay
4-1, 13–15	1.0	1.26	Silty clay
4-1, 15–17	1.5	—	Silty clay

Note: — = not determined.

clays. Most samples contain less than 5%. The organic carbon content is also relatively low, averaging about 2%, although one specimen has nearly 4% reduced carbon (Table 3).

SEDIMENT PHYSICAL PROPERTIES

Measurements of wet-bulk density, compressional-wave velocity (V_p), shear strength, and porosity were carried out on a number of sediments recovered at Site 483. The data were obtained using the techniques described for Site 482 and are listed together with computed values of acoustic impedance in Table 5 and shown as a function of depth in Figure 9.

Table 4. Carbon and carbonate analyses, Site 483.

Sample (level in cm)	Depth (m)	Total Carbon (%)	Organic Carbon (%)	$CaCO_3$ (%)	Lithology
Hole 483					
2-3, 113	5.13	2.4	1.8	5	Diatomaceous mud
3-1, 50	11.00	2.2	1.5	6	Diatomaceous mud
4-2, 81	22.31	1.9	1.6	3	Diatomaceous mud
5-3, 67	33.17	2.9	1.3	14	Muddy nannofossil ooze
6-2, 67	41.17	1.3	1.0	3	Muddy siliceous ooze
7-2, 86	50.86	1.4	0.9	4	Clayey siliceous ooze
8-2, 60	60.10	1.6	1.1	5	Silty clay
10-2, 85	79.35	0.6	0.2	3	Sandy silt
18-4, 83	156.33	2.6	2.0	5	Silty clay

With the exception of shear strength, which increases from 0.04 ton/ft.^{2} to about 0.1 ton/ft.^{2} in the upper 70 meters of the sediment column, the physical properties of the upper sediments show remarkably little variation with depth: the wet-bulk density ranges narrowly between 1.40 to 1.44 g/cm^3, the compressional-wave velocity ranges from 1.47 to 1.49 km/s, and the porosity ranges between 73% and 76%. Between 70 meters and the base of the sediments at about 109 meters, however, the physical properties of the sediments change markedly with depth in response to increasing compaction: wet-bulk densities increase to about 1.7 g/cm^3, compressional-wave velocity increases to values as high as 1.67 km/s, shear strength rises to 0.7 tons/ft.^{2}, and porosity decreases to about 55%. The physical properties of the sediments interlayered in basalt change with depth from values similar to those of the sediments just above the sediment/basalt contact to values of wet-bulk density, velocity, and porosity (2.19 g/cm^3, 2.22 km/s, and 29% in Core 25), reflecting increased compaction and possibly diagenesis.

IGNEOUS PETROGRAPHY

Hole 483

Hole 483 reached acoustic basement at 110 meters sub-bottom and terminated at 204.5 meters sub-bottom. Of the 94.5 meters drilled in basement, 37.4 meters, or 39.6%, were recovered. However, as will be discussed, logging data and drilling rates suggest that only 63 meters, or 67%, of the basement is composed of basalt, of which more than 50% was recovered.

The upper 53 meters of basement consist of five, mostly aphyric, massive basaltic cooling units, each separated by several meters of sediment. Sedimentary interbeds decrease in abundance below 53 meters sub-basement, and the lower part of the hole consists largely of interlayered massive and pillow basalts. Most of the upper sequence is aphyric whereas the lower cooling units are sparsely phyric. Plagioclase is the most common phenocryst, followed by olivine and clinopyroxene.

Table 5. Sediment physical properties, Site 483.

Sample (interval in cm)	Wet-Bulk Density (g/cm^3)	*P*-Wave Velocity[a] (km/s)	Acoustic Impedance ($\times 10^5 g/cm^2 \cdot s$)	Shear Strength[b] ($tons/ft.^2$)	Porosity[c] (vol.%)	Remarks
Hole 483						
2-3, 54–77	1.39	1.47	2.04	0.04	76	Disturbed
3-2, 65–88	1.44	1.48	2.13	0.05	73	Disturbed
4-2, 43–78	1.41	1.49	2.10	0.11	74	Stiff
6-2, 75–97	1.42	1.49	2.12	0.13	74	Stiff
7-4, 88–103	1.41	1.49	2.10	0.04	74	Disturbed
8-4, 44–67	1.42	1.49	2.12	0.11	74	Stiff
9-4, 70–89	1.43	1.49	2.13	0.25	73	Firm
10-2, 41–56	1.54	1.49	2.29	0.18	66	Firm
11-4, 52–67	1.57	1.51	2.37	0.20	64	Firm
12-4, 53–80	1.70	1.51	2.57	0.48	56	Firm
13-2, 39–72	1.64	1.50	2.46	0.69	60	Firm
18-4, 24–57	1.76	1.58	2.78	0.68	53	Interlayered in basalt
Hole 483B						
1-3, 102–111	1.58	1.52	2.40	—	64	Firm
1-3, 141–143	—	—	—	0.37	—	Firm
1-5, 80–82	1.54	1.52	2.34	—	66	Firm
2-3, 98–124	1.65	1.57	2.59	0.46	59	Firm
2-6, 95–112	1.67	1.53	2.56	—	58	Very firm
20-2, 120–129	1.93	1.93	3.72	—	45	Very firm
25-2, 5–24	2.19	2.22	4.86	—	29	Indurated
Hole 483C						
2-5, 90–107	1.52	1.48	2.25	—	60	Firm
2-7, 15–17	—	1.55	—	—	—	Firm
3-2, 105–107	—	1.55	—	—	—	Firm
4-1, 34–36	—	1.67	—	—	—	Firm
4-2, 16–32	1.47	1.62	2.38	—	71	Firm

Note: — = not determined.
[a] Measured at atmospheric pressure, ⊥ core.
[b] Torvane measurement.
[c] Assuming a grain density of 2.60 g/cm^3.

Seven major lithologic units are recognized in the cored basement section, and two of these (6 and 7) are further subdivided (Table 6, Fig. 3). The lithologic units may consist of one or more cooling units depending on the nature of the basalt. All of the major units are separated by thin sedimentary interbeds recognized from recovered material or inferred from the drilling rate and downhole logs.

Unit 1

Unit 1 (Section 13-4, 5 cm to Section 13-4, 95 cm) consists of two thin massive cooling units of basalt distinguished on the basis of phenocryst content. A combined thickness of about 4 meters is indicated by the downhole log. No glassy margin is preserved at the contact with the overlying sediments (Fig. 10), but the grain size increases away from the boundary. Sparse vesicles and veinlets filled with smectite, zeolite, and carbonate occur in the upper 30 cm.

Plagioclase and olivine phenocrysts comprise 5%–8% and are subhedral to euhedral. The groundmass is fine to medium grained with an intergranular texture.

Unit 2

Unit 2 (Section 14-1, 5 cm to Section 15-2, 128 cm) comprises about 12 meters of aphyric massive basalt of which about 5.5 meters were recovered. Based on the downhole logs a sedimentary interbed separates Units 1 and 2, but none of this material was recovered. A glassy margin occurs at the top of the unit, but no other cooling breaks were observed in the sequence. Except near the upper margin, the rock is coarse grained with an intersertal to subophitic texture. Vesicles comprise 5 to 10 vol.%, and they are partly filled with smectite and carbonate.

Unit 3

Unit 3 (Section 15-2, 128 cm to Section 16-3, 12 cm) is a single cooling unit of massive basalt about 5 meters thick. It is separated from Units 2 and 4 by sedimentary interbeds composed of clayey siltstone or silty clay. The basalt is aphyric, fine to coarse grained, and relatively fresh. Several thin dikelets cut this unit (Fig. 11). Sparse vesicles and veinlets are lined or filled with smectite and carbonate.

Unit 4

Unit 4 (Section 17-1, 18 cm to Section 17-3, 24 cm) consists of about 3.5 meters of massive, aphyric basalt comprising a single cooling unit. It is bounded above and below by sedimentary interbeds up to 9 meters thick. No glassy margins are preserved, but the grain size increases from the margins toward the center of the unit. The basalt is dark gray, medium grained, and relatively fresh. Sparse vesicles and veinlets occur locally, and these are partly filled with smectite and carbonate.

Unit 5

Unit 5 (Section 18-4, 130 cm to Section 19-1, 10 cm) is a 3.0-meter-thick cooling unit of massive basalt separated from Units 4 and 6 by sedimentary interbeds. Only about 45 cm of basalt were recovered from this unit, and no chilled margins are preserved. The basalt is fine to medium grained, aphyric and relatively fresh. Vesicles make up about 1% and are filled with smectite. A few small veinlets filled with zeolite and carbonate have narrow alteration halos.

Unit 6

Unit 6 (Section 19-1, 10 cm to Section 23-2, 150 cm) is about 27.5 meters thick and consists predominantly of fine-grained, sparsely phyric, pillow basalt. It is divided into four subunits based on the presence of sedimentary interbeds or interlayered massive basalt. No core was recovered for Unit 6a, and its presence is inferred from the downhole log. Based on the log, a 3-meter-thick sedimentary interbed separates this unit from the underlying unit, 6b. Unit 6b is about 12.5 meters thick and is characterized by numerous curved glassy margins, interpreted as pillow rinds. Unit 6c is interpreted as a massive cooling unit because no glassy rinds were recovered in this interval and the basalt is somewhat coarser grained than that in surrounding units. A 2-meter-thick sequence of pillow basalt comprises Unit 6d, which is separated from the underlying unit by a sedimentary interbed.

All of the recovered basalt is sparsely to moderately phyric with about 5 to 15% phenocrysts. Plagioclase is always the most abundant phenocryst, followed by olivine and clinopyroxene. Groundmass textures range from quench to fine-grained intergranular in the pillow basalts. Vesicles are small and sparse and filled with smectite and carbonate. The basalts are generally fresh except for minor alteration halos along narrow veins.

Unit 7

Unit 7 (Section 24-1, 5 cm to Section 26-3, 150 cm) comprises two cooling units of massive basalt separated by a thin layer of sediment. Unit 7a is about 8.7 meters thick and consists of sparsely plagioclase-olivine phyric basalt with a medium- to coarse-grained groundmass. Unit 7b, also composed of sparsely phyric basalt, has a minimum thickness of 3.5 meters. Vesicles comprise 1 to 2% of both units, and hairline fractures are common. The vesicles and veinlets are lined or filled with smectite and carbonate.

Hole 483B

At Hole 483B we encountered acoustic basement at 110 meters sub-bottom and penetrated 157 meters of interlayered basalt and sediment. As in Hole 483, the upper 50 to 60 meters of basement consists of massive basalts with fairly thick sequences of interlayered sediment. Below about 60 meters sub-basement, sediments decrease significantly, and the basement consists of interlayered massive and pillow basalt. Ten major lithologic units are recognized on the basis of cooling unit type, presence of sediment interlayers, and phenocryst content (Table 6, Fig. 3). Three of these (7, 8, and 9) are further subdivided on the basis of chemical or mineralogical composition. Most of the upper basalt units are aphyric, whereas the lower units are sparsely to moderately phyric.

Unit 1

Unit 1 (Section 2-7, 0 cm to Section 3-1, 75 cm) is a 2-meter-thick cooling unit of massive basalt. Only a single piece of sparsely phyric basalt, 15 cm long, was recovered from this interval, and the contact with the overlying sediment is not preserved. The basalt has 3 to 5% of plagioclase phenocrysts set in a medium-grained, fresh groundmass.

Unit 2

Unit 2 (Section 3-1, 75 cm to Section 4-7, 20 cm) consists of about 14 meters of aphyric massive basalt without any glassy margins. It is separated from the overlying and underlying units by sedimentary layers. The basalt is medium to coarse grained with an intergranular to intersertal texture. Vesicles are common in the center of the unit, ranging up to 7% by volume and up to 2 mm across. These are partly to completely filled with smectite and carbonate, as are sparse veinlets.

Unit 3

Unit 3 (Section 7-1, 7 cm to Section 7-3, 75 cm) is a single cooling unit of massive aphyric basalt. It is about 5.5 meters thick and is bounded above and below by interlayered sediments. Although no glassy margins were recovered, the grain size increases fairly systematically from the margins to the center of the unit. In the central parts the basalt is coarse grained with a well-developed subophitic texture. Vesicles and veins are sparse and the rock is quite fresh.

Unit 4

Unit 4 (Section 8-1, 10 cm to Section 8-3, 63 cm) is another single cooling unit of massive basalt about 5.5 meters thick. A glassy rim is preserved on one of the basalt fragments enclosed in the sedimentary interbed. The grain size increases downward from the glassy margin, and the unit is medium to coarse grained in the central parts. Several relatively large veins filled with smectite, carbonate, and zeolite occur in the upper 2 meters of the unit.

Unit 5

Unit 5 (Section 9-1, 5 cm to Bit 1, 36 cm) is a massive cooling unit of aphyric basalt at least 4.2 meters thick. However, recovery was nil in Cores 10 and 11 so the base of the unit is unknown. Most of the basalt is medium grained, but a quenched, nonglassy zone occurs at the top, beneath several centimeters of sediment. Sparse vesicles and veinlets are filled with smectite and carbonate, and some veinlets have narrow alteration halos.

Unit 6

Unit 6 (Section 12-1, 0 cm to Section 51-1, 6 cm) comprises a 28.5-meter-thick sequence of pillow basalt bounded above and below by sedimentary layers. Numerous carved glassy margins are present and other cooling breaks are suggested by rapid changes in grain size. These basalts are moderately phyric with 5 to 10% phenocrysts, chiefly plagioclase. Olivine phenocrysts make up 1 to 3 modal percent and clinopyroxene phenocrysts less than 1%. The groundmass textures range from quench to fine-grained intersertal. Vesicles are small and sparse, except in the upper parts of some pillows. Relatively large veins filled with smectite and car-

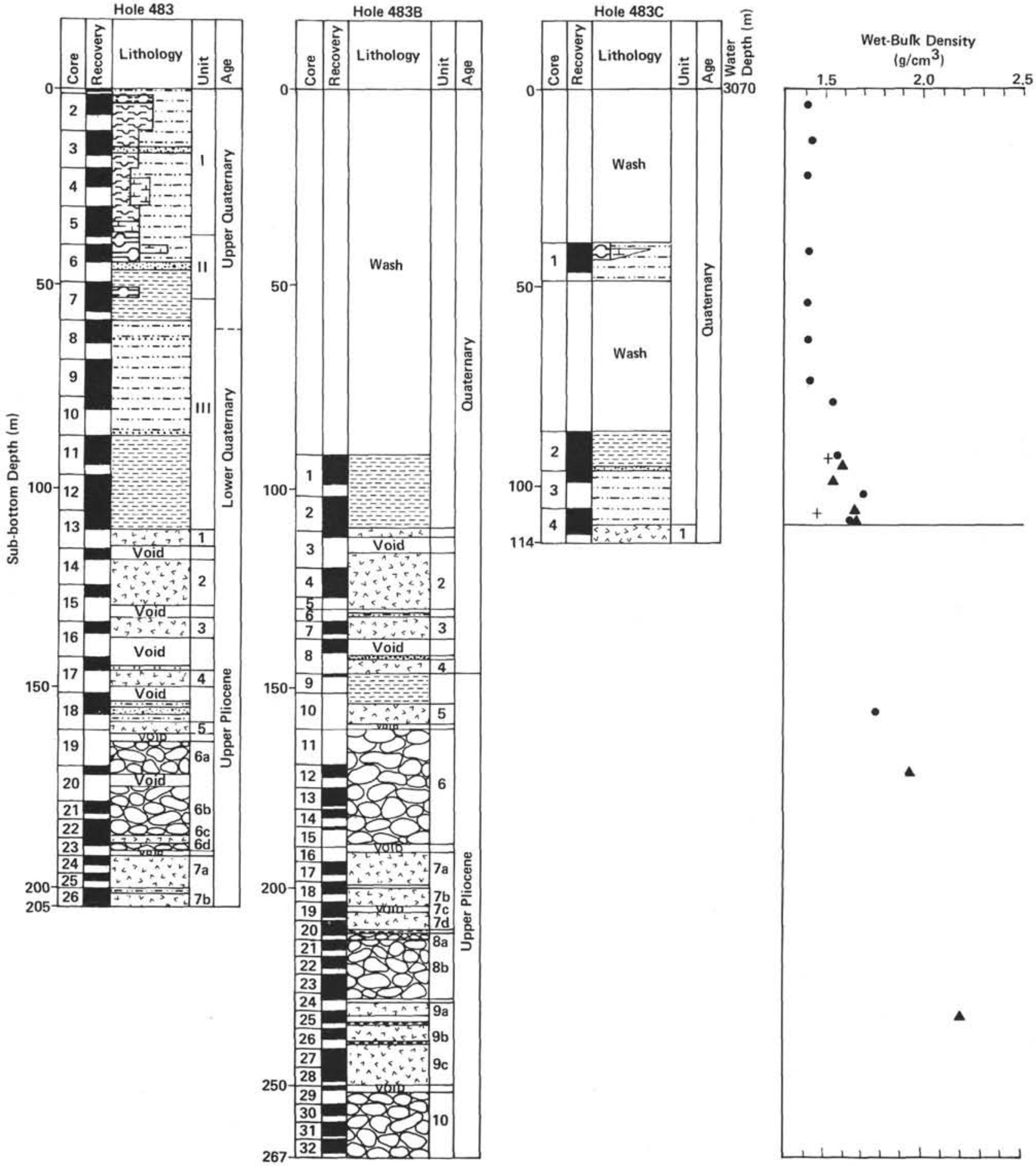


Figure 9. Sedimentary physical properties plotted versus depth at Site 483. (For explanation of lithologic symbols, see Explanatory Notes, this volume. Hole 483, filled circle; Hole 483B, triangle; Hole 483C, plus sign).

bonate are present in Section 483B-13-1; elsewhere veins are small and widely scattered.

Unit 7

Unit 7 (Section 17-1, 0 cm to Section 20-2, 65 cm) consists of four distinct cooling units of massive basalt. The drilling rate log suggests a sedimentary layer between Subunits 7a and 7b, but the only glassy margin recovered is at the top of the unit. The other cooling-unit breaks are recognized by rapid changes in grain size and phenocryst content. The upper three cooling units are aphyric whereas Unit 7d is aphyric to moderately plagioclase-olivine phyric. Groundmass textures are medium- to coarse-grained, subophitic to "ophimottled." Vesicles and veins are sparse and small, except near the middle of Unit 7b (Fig. 12). The basalt is generally fresh.

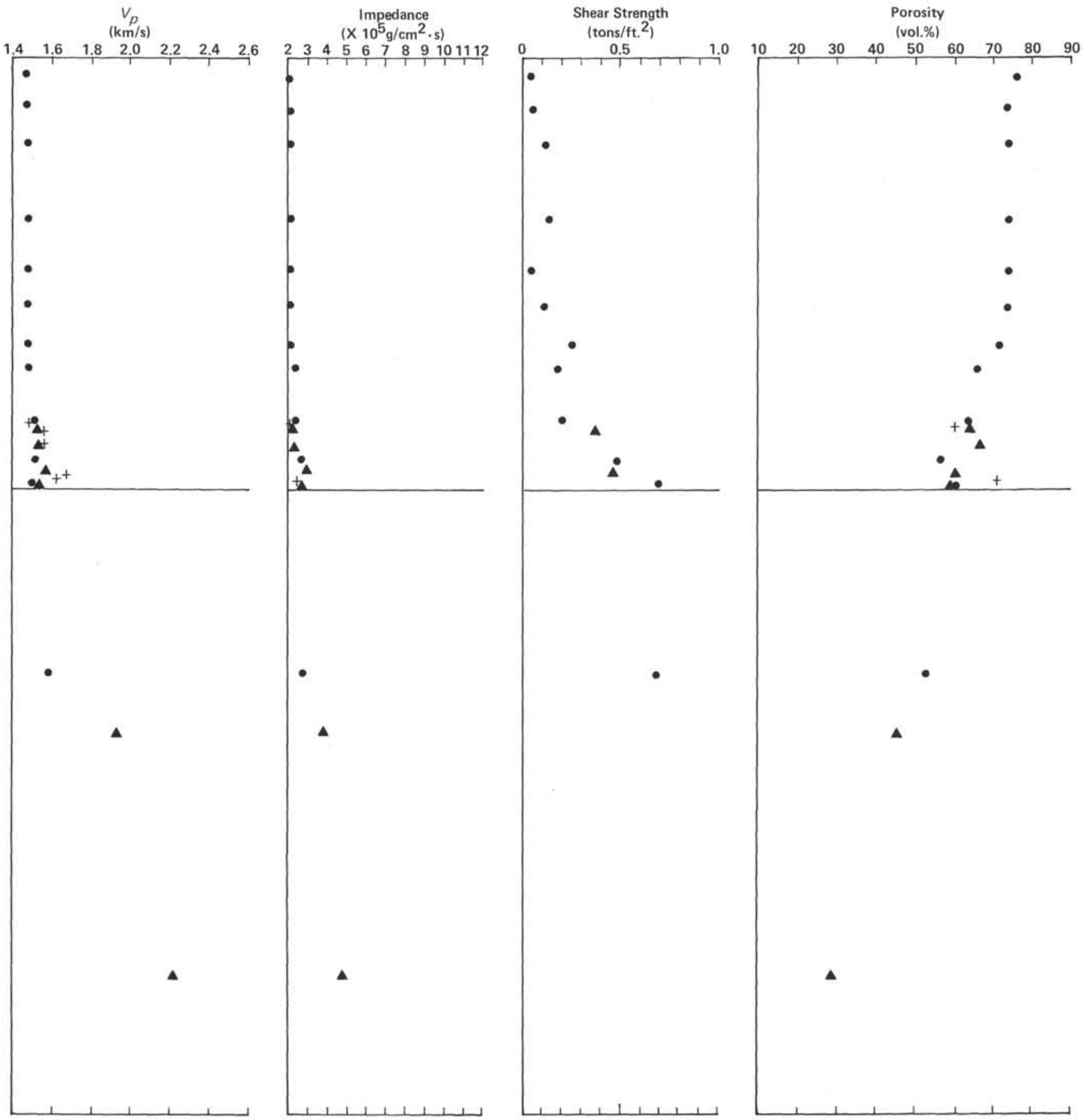


Figure 9. (Continued).

Unit 8

Unit 8 (Section 20-2, 130 cm to Section 24-1, 145 cm) is a 16.6-meter-thick sequence of pillow basalt, divided into two subunits on the basis of small differences in phenocryst content. A glassy selvedge marks the top of the unit beneath a prominent sedimentary layer, and a similar selvedge occurs at the base. The many curved glassy selvedges within the unit are interpreted as pillow rinds. A sedimentary layer is inferred between Units 8 and 9 from the drilling rate log.

Unit 8a is very sparsely plagioclase-olivine phyric with about 5% phenocrysts. Unit 8b is moderately phyric with about 10% plagioclase phenocrysts and 2 to 3% each of clinopyroxene and olivine phenocrysts. The groundmass is similar in both subunits, being quench to very fine grained. Vesicles and veinlets are rare, and the rocks are relatively fresh.

Table 6. Basement lithologic units, Site 483.

Unit	Top (m) a	Top (m) b	Base (m) a	Base (m) b	Thickness (m) a	Thickness (m) b	Type of Cooling Unit	Phenocryst Assemblage	Core-Section (level in cm)
Hole 483									
1	110.0	110.0	111.0	114.0	1.0	4.0	Massive basalt	Plagioclase-Olivine	13-4, 5 to 13-4, 95
	Interlayered Sediment?								
2	115.0	117.0	127.0	129.0	12.0	12.0	Massive basalt	Aphyric	14-1, 5 to 15-2, 128
	Interlayered sediment?								
3	127.0	132.0	135.8	137.0	8.8	5.0	Massive basalt	Aphyric	15-2, 128 to 16-3, 12
	Interlayered sediment								
4	142.2	145.5	145.0	149.0	2.8	3.5	Massive basalt	Aphyric	17-1, 18 to 17-3, 24
	Interlayered sediment								
5	156.5	158.0	160.1	161.0	3.6	3.0	Massive basalt	Aphyric	18-4, 130 to 19-1, 10
	Interlayered sediment								
6a	ND	163.0	ND	171.0	ND	8.0	Pillowed basalt?	Not recovered	
	Interlayered sediment?								
6b	169.0	174.0	186.5	186.5	17.5	12.5	Pillowed basalt	Plagioclase-Olivine-Clinopyroxene	20-1, ? to 22-4, 60
6c	186.5	186.5	188.5	188.5	2.0	2.0	Massive? basalt	Plagioclase-Olivine	22-4, 60 to 23-2, 20
6d	188.5	188.5	190.0	190.5	1.5	2.0	Pillowed basalt	Plagioclase-Olivine-Clinopyroxene	23-2, 20 to 23-2, 150
	Interlayered sediment?								
7a	191.5	191.5	200.3	200.2	8.8	8.7	Massive basalt	Plagioclase-Olivine	24-1, 5 to 26-1, 40
	Interlayered sediment								
7b	200.4	201.0	204.5	204.5	4.1	3.5	Massive basalt	Plagioclase	26-1, 50 to 26-3, 150
Hole 483B									
1	110.0	110.0	111.3	112.0	1.3	2.0	Massive basalt	Plagioclase-Olivine	2-7, 0 to 3-1, 75
	Interlayered sediment?								
2	111.3	116.0	127.0	130.0	15.7	14.0	Massive basalt	Aphyric	3-1, 75 to 4-7, 20
	Interlayered sediment								
3	133.0	132.0	136.4	137.5	3.4	5.5	Massive basalt	Aphyric	7-1, 7 to 7-3, 75
	Interlayered sediment								
4	137.6	142.5	141.0	148.0	3.4	5.5	Massive basalt	Aphyric	8-1, 10 to 8-3, 63
	Interlayered sediment								
5	146.6	155.5	?	159.7	?	4.2	Massive basalt	Aphyric	9-1, 5 to Bit 1, 36
	Interlayered sediment?								
6	169.0	160.5	184.6	189.0	15.6	28.5	Pillowed basalt	Plagioclase-Olivine-Clinopyroxene	12-1, 0 to 15-1, 6
	Interlayered sediment?								
7a	194.0	191.0	197.3	199.0	3.3	8.0	Massive basalt	Aphyric	17-1, 0 to 17-3, 45
	Interlayered sediment?								
7b	199.0	200.0	204.6	204.6	5.6	4.6	Massive basalt	Aphyric	18-1, 0 to 19-1, 65
7c	204.6	204.6	206.2	206.2	1.6	1.6	Massive basalt	Aphyric	19-1, 65 to 19-2, 85
7d	206.2	206.5	210.5	210.5	4.3	4.0	Massive basalt	Plagioclase-Olivine-Clinopyroxene	19-2, 85 to 20-2, 65
	Interlayered sediments								
8a	211.1	211.1	213.0	213.0	1.9	1.9	Pillowed basalt	Plagioclase-Olivine	20-2, 130 to 20-3, 30
8b	213.0	213.0	227.7	227.7	14.7	14.7	Pillowed basalt	Plagioclase-Clinopyroxene-Olivine	21-1, 0 to 24-1, 145
	Interlayered sediment?								
9a	227.7	228.8	232.4	232.4	4.7	3.6	Massive basalt	Plagioclase-Clinopyroxene-Olivine	24-1, 145 to 25-2, 5
	Interlayered sediment								
9b	232.6	233.8	236.9	238.5	4.3	4.7	Massive basalt	Plagioclase-Olivine	25-2, 20 to 26-1, 150
	Interlayered sediment								
9c	237.0	238.7	249.5	249.5	12.5	10.8	Massive basalt	Plagioclase-Olivine	26-2, 5 to 29-1, 65
	Interlayered sediment								
10	249.5	251.6	267.0	267.0	17.5	15.4	Pillow basalt	Plagioclase-Olivine-Clinopyroxene	29-1, 65 to 32-3, 82
Hole 483C									
1	109.5	ND	114.0	ND	4.0	ND	Massive basalt	Aphyric	4-2, 47 to 4-5, 120

Note: ND = not determined.
[a] Calculated from core, corrected for spacers.
[b] Calculated from drilling rate and downhole logs.

Unit 9

Unit 9 (Section 24-1, 145 cm to Section 25-2, 5 cm) comprises three massive cooling units of basalt, each separated by a sedimentary layer. The upper and middle units are 3.6 meters and 4.7 meters thick, respectively, whereas the lowest unit is nearly 11 meters thick. Glassy selvedges are preserved at several of the subunit contacts with interlayered sediment, and a glassy rind was recovered on a single piece of basalt in Section 26-2. Other cooling breaks are marked by rapid changes in grain size. Some brecciation occurs in the upper part of the unit (Fig. 13). All of the basalts in this unit are moderately phyric with about 15% phenocrysts. Unit 9a has about 10% plagioclase phenocrysts and 2 to 3% each of olivine and clinopyroxene phenocrysts. In Units 9b and 9c only plagioclase and olivine occur as phenocrysts. The groundmass ranges from quench in the glassy selvedges to coarse-grained subophitic in the center of Unit 9c. The basalts are all relatively fresh, with sparse vesicles and veinlets either lined or filled with smectite and carbonate.

Unit 10

Unit 10 (Section 29-1, 65 cm to Section 32-3, 82 cm) is interpreted as another sequence of pillow basalts, based on the presence of numerous curved glassy selvedges.

Hole 483C

Hole 483C penetrated basement at 109.5 meters sub-bottom and terminated at 114.0 meters sub-bottom. Of the 4.5 meters drilled, about 4.0 meters were recovered. Only one lithologic unit was recognized, consisting of massive, aphyric basalt (Table 6). No glassy margins are preserved, and no obvious cooling breaks occur in the sequence. The basalt is fine to medium grained, relatively fresh, and uniform in texture; sparse vesicles and veinlets are filled with smectite and carbonate.

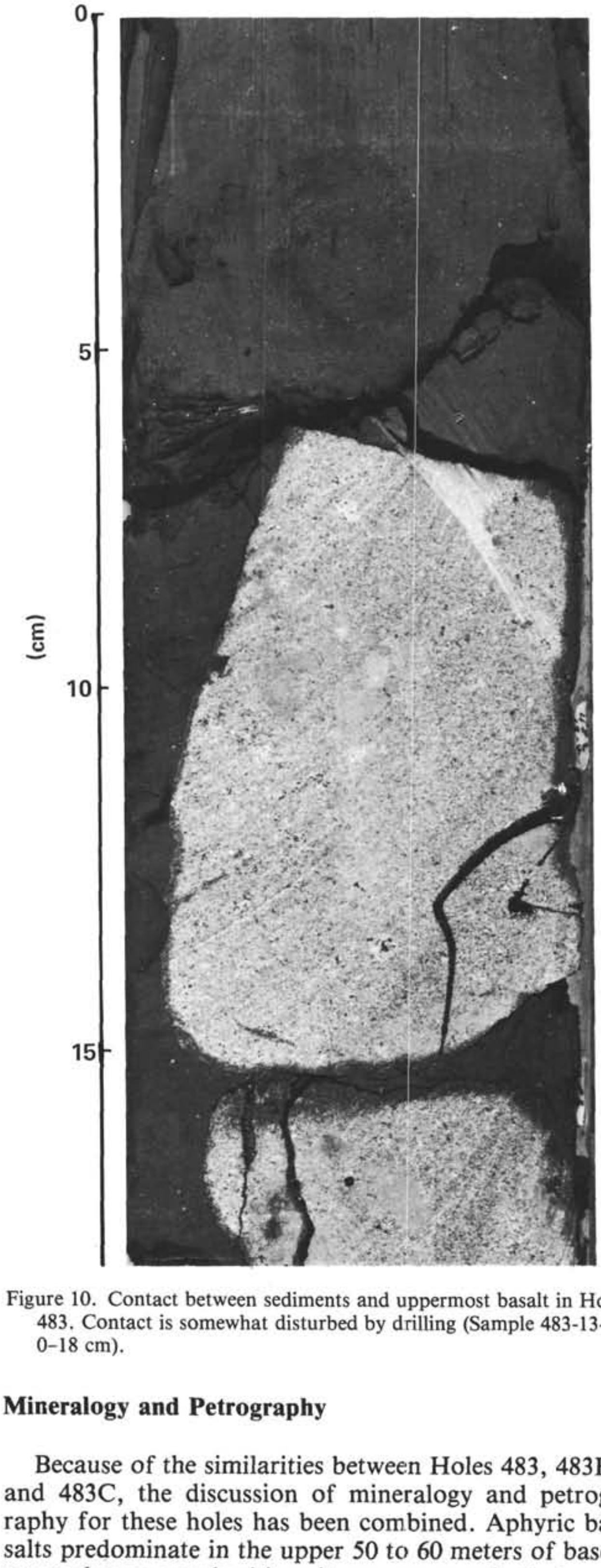


Figure 10. Contact between sediments and uppermost basalt in Hole 483. Contact is somewhat disturbed by drilling (Sample 483-13-4, 0–18 cm).

Mineralogy and Petrography

Because of the similarities between Holes 483, 483B, and 483C, the discussion of mineralogy and petrography for these holes has been combined. Aphyric basalts predominate in the upper 50 to 60 meters of basement whereas porphyritic units are common in the lower units. The aphyric basalts are usually fine to medium grained with textures ranging from subophitic, intergranular, and intersertal to variolitic. Plagioclase, olivine, clinopyroxene, and opaques are common groundmass phases, but rare quartz and apatite occur in late-stage interstitial patches. In most basalts, the groundmass olivine has been pervasively altered to clay, but fresh grains are locally present. Interstitial glass is often partly replaced by smectite and rarely by chlorite and/or amphibole.

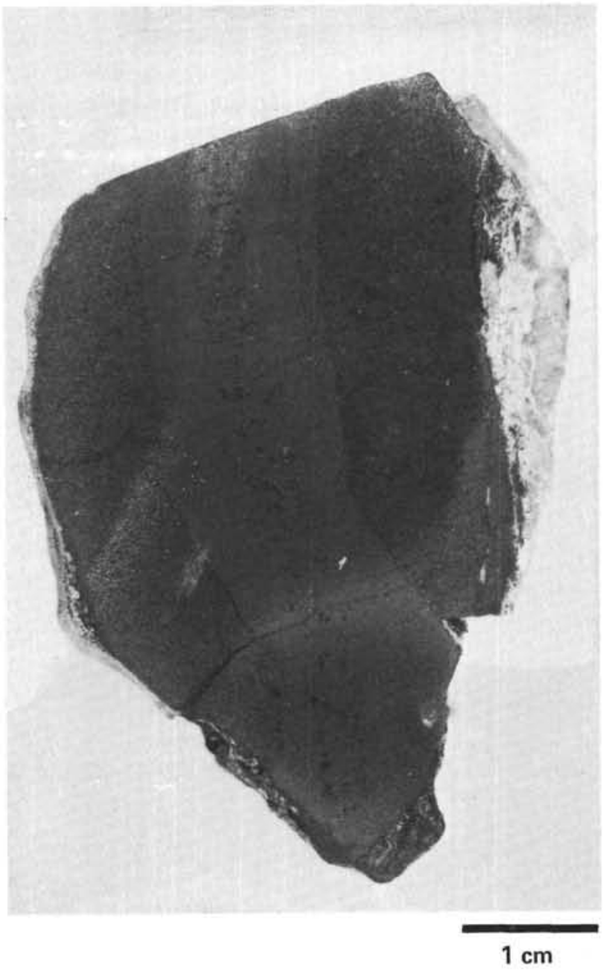
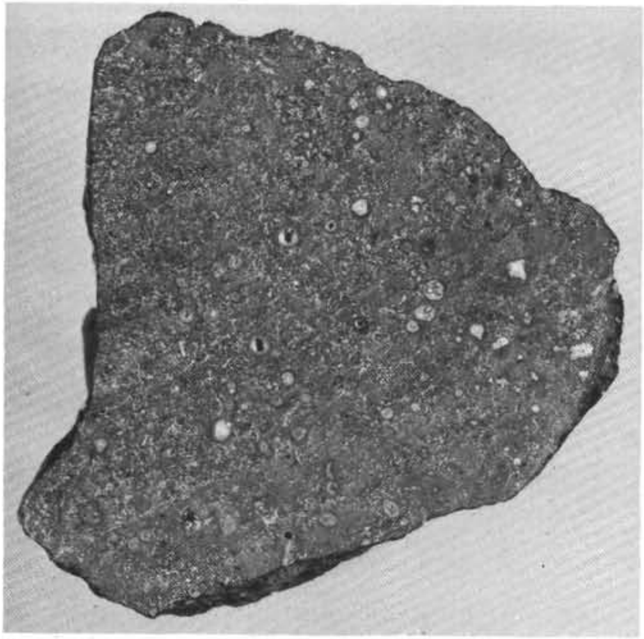


Figure 11. An auto-intrusive(?) dikelet cutting the massive basalt of Lithologic Unit 3 in Hole 483 (Sample 483-16-2, 100 cm).

Three phenocryst assemblages occur in the phyric basalts: plagioclase (with minor olivine), plagioclase + olivine, and plagioclase + olivine + clinopyroxene. The two most abundant phenocrysts are plagioclase and olivine, and less abundant clinopyroxene often occurs in glomerocrystic aggregates with plagioclase. Plagioclase phenocrysts are seriate, ranging in size up to 4 mm and down into microphenocrysts and groundmass plagioclase. They are generally lath shaped, often with dovetail forms, but subrounded and corroded crystals are also present. Olivine phenocrysts are commonly euhedral, ranging from 0.5 to 2 mm across. A few large (up to 12 mm) fresh olivine grains with possible red spinel are present in Sections 483-20-1 and 483-23-1. The clinopyroxenes are anhedral and generally small (< 1 mm), but several large (1.5–2 mm), rounded, single clinopyroxene crystals occur. A few crystals display sector zoning. The 2V's of the clinopyroxene appear to be moderately low (ca. 35°–40°), suggestive of a low-Ca augite.



1 cm

Figure 12. Moderately vesicular basalt from massive basalt of Lithologic Unit 7b in Hole 483B. Vesicles partly filled with smectite, carbonate, and sulfides. (Sample 483B-18-2, 30–35 cm).

1 cm

Figure 13. Brecciated basalt from the upper part of Lithologic Unit 9c in Hole 483B (Sample 483B-26-2, 50–56 cm).

The textural relationships suggest the following paragenesis: plagioclase → olivine → clinopyroxene → opaques; or olivine → plagioclase → clinopyroxene → opaques. The relative position of plagioclase and olivine is difficult to determine. In some basalts, the olivine is euhedral and is poikilitically enclosed in plagioclase; in others, both plagioclase and olivine occur in glomerophyric aggregates. The large olivines, corroded plagioclases, and rounded and corroded clinopyroxenes have been excluded from the paragenesis given above.

In the light of experimental studies, the petrography of the phyric basalts suggests two stages of crystallization of the basaltic magma: An early one at pressures above 5 kb, and a later stage at lower pressures. The large unaltered olivine, red chromian(?) spinel, and the rounded clinopyroxene phenocrysts are indicative of the higher pressure stage of crystallization. The presence of large, rounded, clinopyroxene phenocrysts suggests disequilibrium, the clinopyroxene being resorbed by the magma during its rise to the seafloor; however, it must have been a near-liquidus phase at pressures above about 5 kb. The red spinel is also indicative of high pressures, and its inclusion in the "megacrystic" fresh olivine in Section 23-1 indicates high-pressure crystallization of both the red spinel and the olivine. Some of the larger oscillatory and normally zoned and corroded plagioclase phenocrysts, a few in glomerocrystic contacts with fresh olivine, may have crystallized at depth also. Seafloor or shallow crystallization of the phyric basalts resulted in a normal near-cotectic crystallization of plagioclase, olivine, clinopyroxene, and opaques in the groundmass. Near-cotectic crystallization of the same minerals took place for the aphyric basalts as well.

Variolitic textures are most common in thin flows, pillow basalts, and chilled margins. The variolites, composed of submicroscopic aggregates of plagioclase, clinopyroxene, and opaques, are probably indicative of quick cooling and devitrification of the glass.

Alteration

Most of the secondary minerals recognized in the basalts at Site 483 are characteristic of low-temperature interaction between basalt and seawater—e.g., smectites, carbonates, sulfides, and zeolites (probably phillipsite), occurring in veins and vesicles. Olivine and interstitial glass are generally replaced by smectites, serpentine(?), and occasionally calcite. Sulfides are present throughout most of the section cored—probably related to the frequent sediment interbeds detected by the drilling records and logging.

Variations in the relative abundances of the various secondary minerals can be related to cooling unit thickness. The massive basalts are generally fresh and vesicles are sparse, although one massive basalt in Core 483B-18 contains up to 20 vol.% of vesicles. Typically, these massive units are cut by sparse but continuous veins, 1 to 2 mm wide, lined by smectite, calcite, and, more rarely, zeolites. With the exception of Core 483B-18, alteration haloes around the veins are uncommon.

In contrast, the pillow lavas and thin cooling units contain 1 to 2 vol.% vesicles and numerous discontinuous fractures. In these units calcite is subordinate to smectite, occurring as a thin film on fracture surfaces or replacing olivine in some rocks. Many of the thin fractures and veins are curved, and they are often subparallel to the glassy margins of the cooling units.

No change in the secondary mineral assemblages with depth was observed at Site 483, but there is a downward increase in the extent of basalt alteration. Fresh olivine is present in several units in the top part of each hole, whereas all the olivine is altered in the lower parts of Holes 483 and 483B. Many of the glassy rinds in the lower part of Hole 483B are palagonitized or replaced by calcite, smectite, and zeolite. Frequently, the margins are cracked and veined and have a tendency to spall off. In the upper part of Hole 483B, the veins in the thin basalt units are hairlike, whereas in the lower half of the hole they are 2 to 3 mm wide and are frequently surrounded by diffuse alteration haloes. This change corresponds with a decrease in density and an increase in the porosity of the basalts toward the bottom of the hole.

Evidence for high-temperature greenschist-facies alteration was observed in Section 483B-8-2 and Hole 482C. Here pyroxene, plagioclase, and titanomagnetite are partly replaced by chlorite, amphibole, and carbonate.

Mode of Emplacement

Thin cooling units, less than one meter thick, with curved glassy selvedges are interpreted as pillow lavas emplaced on the seafloor. They are characterized by irregular, sometimes radial fractures, generally fine-grain size, and variolitic or other quench textures.

The vertical thickness of these pillows averages about 0.45 meters, although some loss of basalt during drilling is likely. For example, basal glass margins are less commonly recovered than upper glass rinds, and thin pillows are more commonly complete than thick pillows.

Most of the basalts drilled at Site 483 are massive and generally greater than 1-meter thick where recovery is good. Grain size ranges from fine near the margins to medium and coarse in the centers of the units, with grain size generally increasing with thickness of cooling unit. Grain size increases away from the margins over distances of several decimeters. Glassy margins are rarely preserved, and contacts are usually disturbed by drilling.

Vesicles, typically less than 1 mm across, occur in most cooling units, especially the thinner ones, but are generally less than 1% by volume. They are more common in the upper few decimeters of a unit and are absent in the central and lower parts of many. Intersertal or subophitic textures are dominant over most of a cooling unit (with the mesostasis largely represented by clay), but some are nearly holocrystalline in the center with groundmass apatite and quartz.

A few dikelets occur in Sections 483-16-2 and 3. One dikelet is about 20 cm thick and has subhorizontal fine-grained margins. Two 1- to 2-cm-thick dikelets with a central vesicle train occur 30 and 80 cm below the thicker dike.

We interpret most or all of the massive cooling units at Site 483 as flows. The most convincing evidence is the well-preserved contact of sediment in Section 483-26-1, where the indurated basal sediment shows clear imprints of the vesicular texture of the underlying basalt. This could only form by deposition of the sediment onto the basalt surface. We interpret the absence of a glassy or very fine-grained rind on top of the basalt as resulting from erosion prior to deposition of the sediments. The contact of the basalt overlying the sediment is also well preserved, the basalt showing an even base with a thin (0.5 cm) basal zone of wrinkled devitrified glass. Other massive cooling units are similar in grain size, vesicularity, and fracture pattern, supporting their interpretation as flows.

However, some massive cooling units cannot be interpreted definitely as either flows or sills. These are coarse-grained, well-crystallized basalts with relatively few vesicles and regular fracture patterns. They are thicker than some of the definite flows, but are still comparatively thin (<5 m). Groundmass plagioclase and clinopyroxene are less than 1 mm in diameter, compared with the coarse ophitic textures of sills known from land, Leg 41 (*Initial Reports*, Leg 41), and from the massive unit drilled at Site 478 (Guaymas Basin). Thin dikelets were found in some of these units. On the basis of petrographic, chemical, and magnetic evidence these dikelets are interpreted as auto-intrusions. These features thus most likely represent differential movement within a partly crystallized mush at different stages of cooling. While this might be expected to occur more commonly in intrusions because of their slower cooling rate, it could also occur in a flow.

IGNEOUS GEOCHEMISTRY

Chemical analyses were made of 30 basalt samples from Hole 483; 33 from Hole 483B; and 2 from Hole 483C (Table 7). All analyses were corrected for carbonate contamination and normalized to dry weight before the oxides were plotted on variation diagrams.

Hole 483

Basalts analyzed from Hole 483 have an MgO range of 9.7 to 6.4% (Fig. 14). Eight chemical types (A–H) are identified, which mostly consist of stratigraphically contiguous cooling units. The chemical types are notated alphabetically downhole and average compositions are given in Table 8. Chemical Type A coincides with Lithologic Unit 1, which forms the uppermost, sparsely-phyric, basalt unit. This unit has 7.0 to 7.2% MgO, low contents of TiO_2, P_2O_5, FeO*, and Zr, and high Al_2O_3, compared to most subjacent units. Chemical Types B and C comprise aphyric Lithologic Units 2 and 3, respectively, which are separated by sediment layers. Type B is distinguished from Type A by its higher MgO content and lower Ti/Zr ratio, and from Type C, which has lower MgO, Al_2O_3, and higher FeO*. Chemical Type D comprises aphyric Lithologic Unit 4 and is characterized by unusually high MgO contents (9.3–9.6%) and Mg/(Mg + Fe^{2+}) ratios (0.66–0.69). Chemical Type E (Lithologic Unit 5) is considerably more evolved and appears to be a basaltic unit largely unrecovered by drilling, but indicated by logging. Like Type A, Type E differs from Types B and D in its lower MgO content and in its higher P_2O_5, TiO_2, FeO*, Zr, and Sr contents for equivalent MgO. Type F is exclusive to the pillowed sequence (Lith-

Table 7. Shipboard X-ray fluorescence analyses of basalts, Site 483.

Sample	Major Elements (wt.%)											Volatiles (wt.%)			Trace Elements (ppm)		
(interval in cm)	SiO_2	TiO_2	Al_2O_3	Fe_2O_3*	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Total	LOI[a]	H_2O^{+}[b]	CO_2[b]	Ni	Sr	Zr
Hole 483																	
13-4, 17–19	49.89	1.28	16.00	10.96	0.16	7.26	12.39	2.22	0.05	0.11	100.32	1.04	0.49	0.15	70	93	74
14-1, 35–37	49.28	1.20	14.79	10.76	0.23	8.40	12.49	2.38	0.07	0.11	99.71	2.08	0.73	0.58	69	110	78
14-2, 12–14	49.82	1.22	14.86	10.58	0.16	8.00	12.44	2.55	0.06	0.11	99.80	1.53	0.73	0.20	73	114	75
15-1, 21–24	49.53	1.20	14.74	10.60	0.17	8.52	12.57	2.44	0.05	0.11	99.93	1.04	0.48	0.09	71	113	77
15-2, 96–98	49.20	1.20	14.75	10.41	0.16	8.83	12.65	2.48	0.05	0.11	99.84	1.18	0.53	0.16	68	114	78
15-3, 7–9	50.34	1.39	14.55	11.00	0.17	7.68	12.23	2.47	0.04	0.10	99.97	1.18	0.64	0.17	57	97	79
16-1, 114–115	50.05	1.32	14.47	10.98	0.18	7.76	12.35	2.66	0.05	0.11	99.93	1.11	0.68	0.34	58	94	75
16-1, 133–134	49.82	1.36	14.46	11.29	0.18	7.73	12.16	2.47	0.05	0.11	99.63	1.18	0.83	0.18	57	94	75
16-2, 58–60	50.11	1.38	14.47	11.30	0.18	7.83	12.15	2.36	0.05	0.11	99.94	0.97	0.63	0.14	57	94	80
16-3, 10–12	50.27	1.27	14.66	10.76	0.16	8.40	11.83	2.57	0.05	0.11	100.08	1.46	1.03	0.21	61	103	72
17-1, 64–66	48.94	0.98	16.35	9.66	0.17	9.61	12.46	2.08	0.02	0.09	100.36	1.39	0.93	0.15	107	97	57
17-3, 16–18	48.86	0.96	16.54	9.60	0.16	9.44	12.81	1.98	0.02	0.08	100.45	1.39	0.78	0.31	106	134	61
18-4, 103–105	49.08	0.97	16.38	9.63	0.16	9.29	12.76	1.98	0.02	0.09	100.36	1.73	1.05	0.34	112	101	60
18-4, 140–142	49.60	1.74	15.06	10.39	0.15	7.05	12.00	2.70	0.13	0.19	99.01	1.11	0.66	0.05	89	166	124
19-1, 6–8	49.57	1.73	15.46	10.55	0.16	7.20	12.36	2.75	0.06	0.17	100.01	1.94	1.15	0.48	88	166	128
20-1, 39–40	49.37	1.90	14.38	12.41	0.20	7.10	11.66	2.53	0.11	0.18	99.84	0.83	0.68	0.17	68	101	132
20-1, 144–146	49.50	1.93	14.98	11.81	0.20	7.13	11.70	2.51	0.06	0.19	100.01	1.25	0.63	0.26	66	106	138
21-1, 86–88	49.38	1.87	14.80	12.23	0.22	7.00	11.72	2.41	0.08	0.17	99.88	0.69	0.49	0.09	67	101	131
21-2, 78–80	49.45	1.88	14.80	12.30	0.20	7.01	11.74	2.47	0.08	0.18	100.11	0.69	0.50	0.10	67	101	134
21-3, 53–55	49.16	1.80	14.76	12.15	0.22	7.32	11.95	2.38	0.06	0.18	99.98	1.18	0.59	0.16	68	100	124
22-1, 40–42	49.15	1.73	14.47	11.85	0.20	7.30	12.00	2.33	0.10	0.16	99.29	0.76	0.58	0.09	78	98	123
22-2, 84–87	49.59	1.67	14.94	11.52	0.19	7.05	12.10	2.38	0.11	0.15	99.70	1.18	0.80	0.16	82	96	116
22-3, 38–40	49.42	1.73	15.47	10.86	0.17	6.78	12.27	2.53	0.05	0.16	99.40	2.22	0.93	0.21	89	102	126
22-4, 30–32	49.26	1.62	14.92	11.48	0.18	7.24	12.05	2.39	0.11	0.16	99.41	1.11	0.69	0.09	91	99	115
23-1, 12–14	49.17	1.73	15.25	11.67	0.19	6.80	12.39	2.29	0.07	0.17	99.73	1.67	0.76	0.19	77	103	120
23-1, 108–110	49.43	1.61	14.78	11.53	0.19	7.70	12.04	2.45	0.04	0.14	99.41	1.18	0.70	0.16	98	99	113
23-2, 32–35	49.36	1.66	15.00	11.64	0.19	7.18	12.02	2.38	0.07	0.17	99.67	1.32	0.72	0.21	77	101	118
24-2, 58–60	48.97	2.19	13.62	13.16	0.19	6.48	11.04	2.55	0.11	0.21	98.52	0.83	0.62	0.15	70	105	185
25-1, 3–5	49.44	1.28	15.85	10.88	0.19	6.94	12.63	2.34	0.06	0.12	99.73	0.97	0.48	0.28	64	89	71
25-1, 67–69	49.40	2.21	14.86	12.04	0.18	7.20	11.22	2.58	0.07	0.22	99.98	1.87	0.97	0.31	77	114	156
26-1, 20–22	49.65	2.16	13.87	12.98	0.18	6.94	10.97	2.50	0.09	0.21	99.59	0.97	0.63	0.13	68	104	158
26-1, 128–130	49.19	2.23	14.67	12.24	0.19	7.15	10.96	2.66	0.11	0.21	99.61	1.88	0.90	0.36	67	109	156
26-3, 3–5	49.55	2.15	14.01	13.13	0.20	6.88	11.19	2.53	0.09	0.22	99.95	1.18	0.79	0.11	63	104	150
Hole 483B																	
3-1, 49–50	49.50	1.25	15.66	11.05	0.17	7.28	12.43	2.35	0.05	0.10	99.84	0.69	0.55	0.19	65	88	67
3-1, 124–126	49.98	1.25	14.94	10.40	0.14	7.95	12.31	2.60	0.05	0.11	99.73	1.66	1.27	0.12	71	116	75
4-4, 50–53	49.90	1.23	15.05	10.08	0.17	7.80	12.87	2.64	0.06	0.12	99.92	1.32	0.69	0.23	72	114	75
7-2, 48–50	49.82	1.36	14.19	11.63	0.19	8.03	12.00	2.44	0.04	0.11	99.81	1.67	1.06	0.22	60	105	78
8-1, 46–48	49.00	0.97	16.30	9.65	0.16	9.55	12.38	2.24	0.03	0.08	100.36	1.88	—	—	115	93	62
9-1, 40–42	48.00	0.98	16.17	9.59	0.15	9.55	12.53	2.12	0.03	0.08	99.80	1.25	0.87	0.15	107	98	58
B-1, 1–3	49.25	1.58	15.18	11.50	0.19	7.34	12.18	2.44	0.08	0.15	99.89	1.53	0.79	0.15	74	116	104
12-1, 15–17	49.62	1.57	15.37	11.34	0.19	7.14	12.28	2.41	0.07	0.14	100.13	1.53	0.75	0.19	75	117	106
12-2, 94–96	48.82	1.75	14.41	11.89	0.21	7.50	12.16	2.52	0.04	0.14	99.44	1.66	0.75	0.26	66	115	113
13-1, 3–5	49.35	1.93	14.89	11.88	0.19	7.13	11.84	2.58	0.07	0.19	100.05	1.32	0.73	0.24	71	106	135
13-1, 145–147	48.98	1.85	14.48	12.23	0.19	6.99	11.69	2.38	0.14	0.18	99.11	1.18	0.80	0.15	75	102	135
13-2, 146–148	49.29	1.86	14.63	12.22	0.19	7.11	11.74	2.45	0.10	0.18	99.77	1.04	0.61	0.10	67	102	140
13-3, 135–137	49.56	1.85	14.66	12.32	0.19	7.07	11.78	2.50	0.13	0.17	100.23	1.25	0.87	0.11	69	105	136
14-2, 44–46	49.25	1.98	14.06	12.58	0.20	7.33	11.33	2.65	0.06	0.19	99.63	0.83	0.54	0.16	66	102	140
17-1, 85–87	49.25	2.19	13.77	13.09	0.20	6.60	11.37	2.59	0.05	0.20	99.31	1.53	0.76	0.16	64	107	156
17-3, 7–9	49.53	2.11	13.81	13.07	0.21	7.17	11.38	2.63	0.05	0.20	100.16	1.18	0.57	0.12	65	105	153
18-1, 30–32	49.21	2.17	13.63	12.62	0.22	7.01	11.37	2.67	0.08	0.21	99.19	1.81	0.76	0.63	62	107	157
18-3, 45–48	48.52	2.18	14.38	12.83	0.22	6.92	11.78	2.54	0.05	0.21	99.63	2.36	1.18	0.29	65	108	156
19-1, 123–125	49.66	2.22	13.97	12.55	0.19	6.93	11.24	2.68	0.10	0.21	99.75	1.32	0.58	0.22	59	109	161
19-2, 122–124	49.15	2.16	13.90	13.09	0.19	6.88	11.12	2.67	0.08	0.21	99.45	1.22	0.76	0.18	65	105	155
20-2, 137–139	48.91	2.07	14.18	12.57	0.20	7.33	11.75	2.48	0.07	0.20	99.75	1.73	0.70	0.21	69	100	147
21-2, 100–102	49.68	1.67	14.44	11.85	0.20	7.56	12.12	2.29	0.07	0.16	100.04	0.69	0.46	0.08	63	108	108
22-1, 115–117	48.88	1.69	14.06	11.77	0.19	6.94	12.10	2.43	0.06	0.15	98.27	1.11	0.04	0.17	59	107	107
23-1, 95–97	49.26	1.66	14.91	11.57	0.18	7.30	12.20	2.42	0.05	0.14	99.69	2.08	0.71	0.08	54	108	106
23-2, 29–31	49.36	1.65	14.73	11.67	0.19	7.50	12.14	2.37	0.06	0.14	99.81	1.11	0.75	0.13	69	109	106
23-4, 69–71	49.27	1.80	14.04	12.22	0.20	7.38	11.80	2.56	0.09	0.16	99.52	0.90	0.74	0.14	67	109	118
24-2, 11–14	49.56	1.95	15.12	11.03	0.21	7.16	12.08	2.66	0.10	0.19	100.06	3.34	0.90	0.98	68	119	121
25-3, 10–12	49.33	1.94	14.35	12.48	0.18	6.59	11.78	2.88	0.08	0.17	99.78	1.39	0.67	0.15	54	114	130
26-2, 96–100	49.22	1.93	15.17	11.54	0.18	7.00	11.42	2.88	0.12	0.17	99.63	3.06	1.26	0.39	66	119	121
26-2, 145–147	49.51	1.87	15.16	11.50	0.17	7.58	10.37	2.81	0.11	0.16	99.24	2.84	1.52	0.27	68	115	117
27-3, 85–87	49.85	1.87	14.10	12.56	0.18	7.14	11.60	2.48	0.08	0.16	100.02	1.11	0.76	0.12	61	112	126
28-1, 66–68	49.76	1.73	14.29	11.93	0.18	7.64	11.85	2.43	0.08	0.15	100.04	1.25	0.65	0.16	80	109	117
30-1, 31–34	49.56	1.77	14.62	11.50	0.21	7.53	11.85	2.56	0.07	0.16	99.83	1.10	0.65	0.19	109	112	118
31-2, 86–89	49.03	1.60	14.57	11.66	0.22	7.45	11.99	2.33	0.18	0.15	99.18	1.25	0.74	0.40	128	110	99
32-1, 135–137	49.40	1.62	15.53	10.18	0.17	8.00	12.29	2.30	0.04	0.14	99.67	1.80	0.93	0.46	123	121	110
32-3, 62–64	49.33	1.83	14.15	12.23	0.22	7.12	11.77	2.38	0.17	0.16	99.36	0.76	0.63	0.23	68	106	122
Hole 483C																	
4-2, 110	50.22	1.33	14.52	11.32	0.17	7.64	12.37	2.53	0.04	0.11	100.25	0.90	0.58	0.09	67	109	89
4-5, 103–105	50.20	1.33	14.44	11.36	0.17	7.45	12.25	2.64	0.05	0.11	100.00	1.04	0.57	0.19	70	108	84

[a] Loss on ignition.
[b] Percent composition after baking off H_2O^{-}

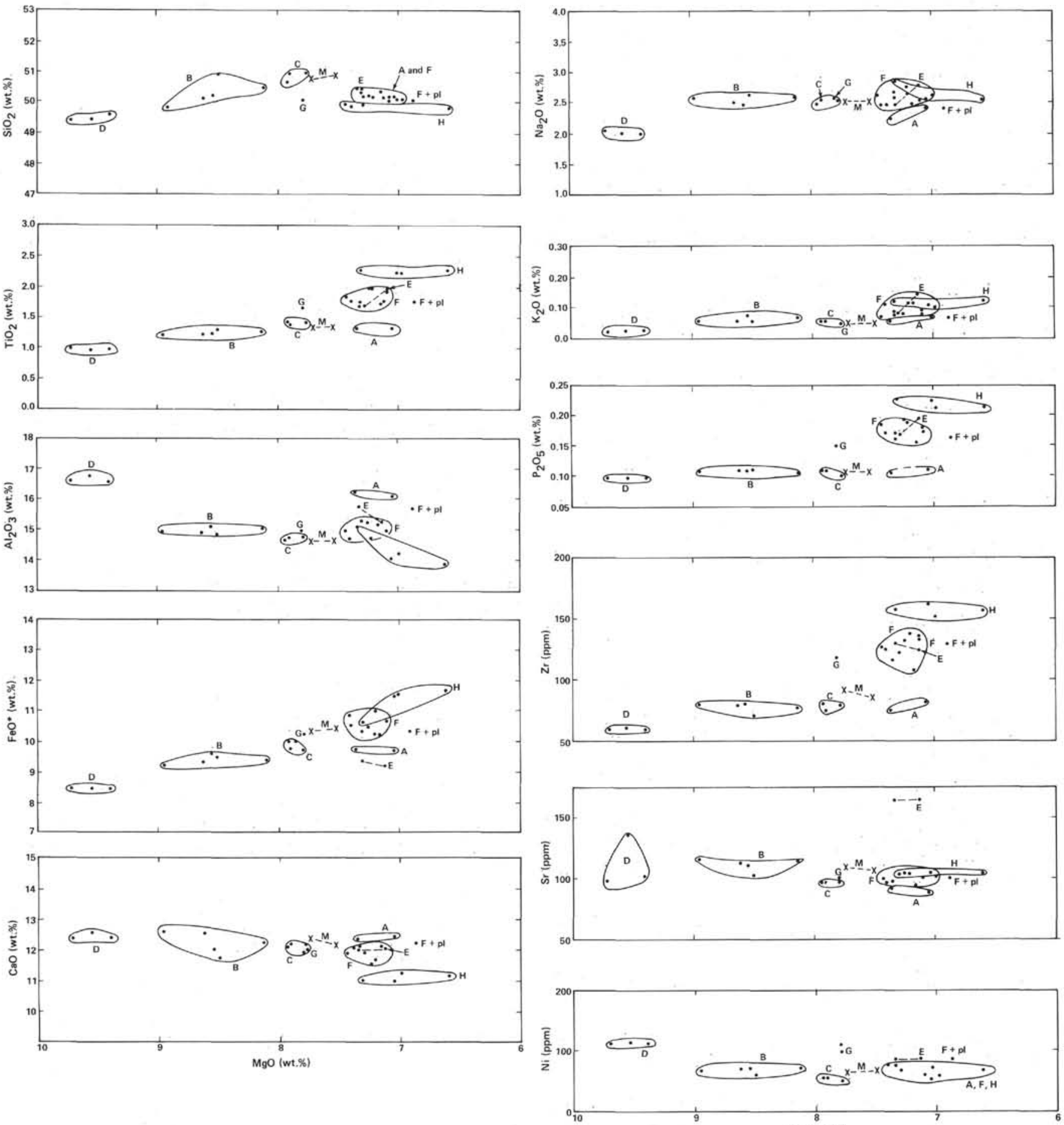


Figure 14. Oxide and element variation diagrams for Holes 483 and 483C. (Oxide data are corrected for $CaCO_3$ contamination and normalized to H_2O^+-free basis. Basalt chemical types are indicated by letters; filled circle = Hole 483; x = Hole 483C.)

Table 8. Average chemical compositions of basalt chemical types at Site 483.[a]

Chemical Type	Major Elements (wt.%)									Trace Elements (ppm)			Ratios					No. of Analyses
	SiO_2	Al_2O_3	FeO*[b]	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	Ni	Sr	Zr	$\frac{TiO_2}{Al_2O_3}$	$\frac{Mg}{Mg + Fe^{2+}}$	$\frac{Ti}{Zr}$	$\frac{Zr}{Ni}$	$\frac{P}{Zr}$	
Hole 483																		
A	50.40	16.17	9.98	7.21	12.43	2.32	0.06	1.31	0.12	67	91	73	0.081	0.57	107.52	1.09	7.23	2
B	50.34	15.05	9.70	8.59	12.42	2.50	0.06	1.23	0.11	68	111	76	0.083	0.64	96.97	1.18	6.36	4
C	50.95	14.76	10.12	8.01	12.08	2.55	0.05	1.37	0.11	57	95	77	0.094	0.60	106.61	1.35	6.28	5
D	49.49	16.60	8.76	9.55	12.47	2.03	0.02	0.98	0.10	108	111	59	0.059	0.68	99.53	0.55	7.45	3
E	50.61	15.58	9.62	7.27	12.09	2.78	0.10	1.77	0.18	89	166	126	0.120	0.62	84.17	1.42	6.28	2
F	50.29	15.13	10.84	7.24	11.95	2.48	0.08	1.81	0.17	76	101	122	0.122	0.57	88.89	1.61	6.13	10
G	50.19	15.29	10.62	7.38	12.21	2.41	0.05	1.70	0.15	88	101	117	0.111	0.58	87.06	1.33	5.64	2
H	50.47	14.53	11.69	7.09	11.05	2.62	0.09	2.24	0.22	69	107	155	0.154	0.55	86.59	2.25	6.24	5
Hole 483B																		
A	50.35	13.93	10.11	7.41	12.40	2.39	0.05	1.27	0.10	65	88	67	0.080	0.59	113.58	1.03	6.56	1
B	50.74	15.24	9.36	8.00	12.57	2.66	0.05	1.26	0.12	72	115	75	0.083	0.63	100.67	1.04	7.03	2
C	50.75	14.46	10.65	8.18	11.93	2.49	0.04	1.39	0.11	60	105	78	0.096	0.60	106.78	1.30	6.20	1
D	49.35	16.42	8.75	9.66	12.51	2.21	0.03	0.99	0.08	111	96	60	0.060	0.69	98.97	0.54	5.86	2
F	50.22	14.82	11.23	7.26	11.70	2.56	0.10	1.93	0.18	70	103	137	0.130	0.56	84.41	1.96	5.78	5
H	50.29	14.27	11.80	7.14	11.34	2.67	0.07	2.21	0.21	64	106	155	0.155	0.54	85.43	2.42	5.96	7
I	50.13	15.26	10.61	7.46	12.17	2.51	0.06	1.66	0.14	72	116	108	0.109	0.58	92.10	1.50	5.70	3
J	50.33	14.74	10.86	7.49	12.17	2.46	0.07	1.73	0.15	62	108	109	0.117	0.58	95.10	1.76	6.05	5
K	50.56	15.00	10.87	7.33	11.30	2.75	0.10	1.92	0.17	63	116	123	0.129	0.57	93.53	1.95	6.08	6
L	50.46	14.99	10.51	7.69	11.83	2.51	0.10	1.77	0.16	105	112	114	0.118	0.59	93.03	1.09	6.28	4
Hole 483C																		
M	50.96	14.77	10.46	7.67	12.19	2.44	0.05	1.35	0.11	69	109	87	0.092	0.59	92.98	1.26	5.55	2

[a] All analyses are carbonate corrected and normalized on an anhydrous basis.
[b] Total iron as FeO.

ologic Unit 6), characterized by sparsely to moderately phyric basalt. The F-type compositions are relatively evolved, with MgO in the range 7.0 to 7.75%; and (although phenocryst abundances may exceed 5%) appear to lie on a "liquid"-type noncumulate fractionation trend. For equivalent MgO content, Type F compositions are slightly richer in P_2O_5, TiO_2, FeO*, and Zr than Type C compositions. A single analysis, from Lithologic Unit 6, indicates the existence of a magnesian variant of F-type chemistry, which we term Type G. In contrast, a thin flow near the base of Lithologic Unit 6 consists of a plagioclase-rich variant of Type F, denoted as "F-pl." Chemical Type H is sharply distinguished from F by its higher P_2O_5, TiO_2, FeO*, and Zr contents, higher TiO_2/Al_2O_3 ratio, and lower contents of Al_2O_3 and CaO, although petrographically it is similar.

A single piece from the top of Core 21 appears to have Type A chemistry. We suspect that this piece fell from the top of basement during retraction of the bit and re-entry of basement.

Hole 483B

Hole 483B is located about 100 meters from Hole 483 and most 483 chemical types are also found in 483B (Fig. 15). Specifically, Chemical Types A (Lithologic Unit 1), B (Lithologic Unit 2), C (Lithologic Unit 3), and D (Lithologic Unit 4) are recognized in both holes. Types E and G are not represented in Hole 483B, but these may be represented in two poorly or nonrecovered intervals (Cores 11 and 15–16, respectively). Chemical Type I, forming the upper part of Lithologic Unit 5 is distinct from the subjacent F-type and is not represented in Hole 483. Type I is chemically less evolved than the subjacent Types F, G, and H (Fig. 15).

Other chemical types encountered in Hole 483B are from greater depths than those reached by Hole 483. Type J comprises a phyric pillowed sequence (Lithologic Unit 8) and has similar contents of P_2O_5, TiO_2, FeO*, CaO, and Zr, but significantly lower Sr and Al_2O_3 than does Type I for equivalent MgO (Fig. 16). The differences in average composition (Table 8) appear to reflect slightly different compositional trends with decreasing MgO—that of Type I indicating greater accumulation of plagioclase than Type J, while J has proportionally more phenocrystic clinopyroxene. Type K, consisting of three massive flows, follows a more characteristically "liquid"-type trend, i.e., increasing P_2O_5, TiO_2, FeO*, and Zr and decreasing CaO and Al_2O_3 with decreasing MgO (Fig. 15). It is possible that the divergent J and K trends relate to a common parent liquid, with J forming a cumulate trend from the most magnesian K-type compositions (Fig. 15). Type L is the lowermost encountered in Hole 483B (Lithologic Unit 10) and appears to form a liquid-type trend unique to the Site 483 basalts.

Hole 483C

The two analyses from Hole 483C basalts are close in composition, though not identical, to Chemical Type C in Hole 483 (Table 7). If the sampled lithologic unit was continuous from Hole 483, small degrees of fractionation could explain the differences. This appears unlikely, however, as a significant difference exists in the Ti/Zr ratio between the two, suggesting that the Hole

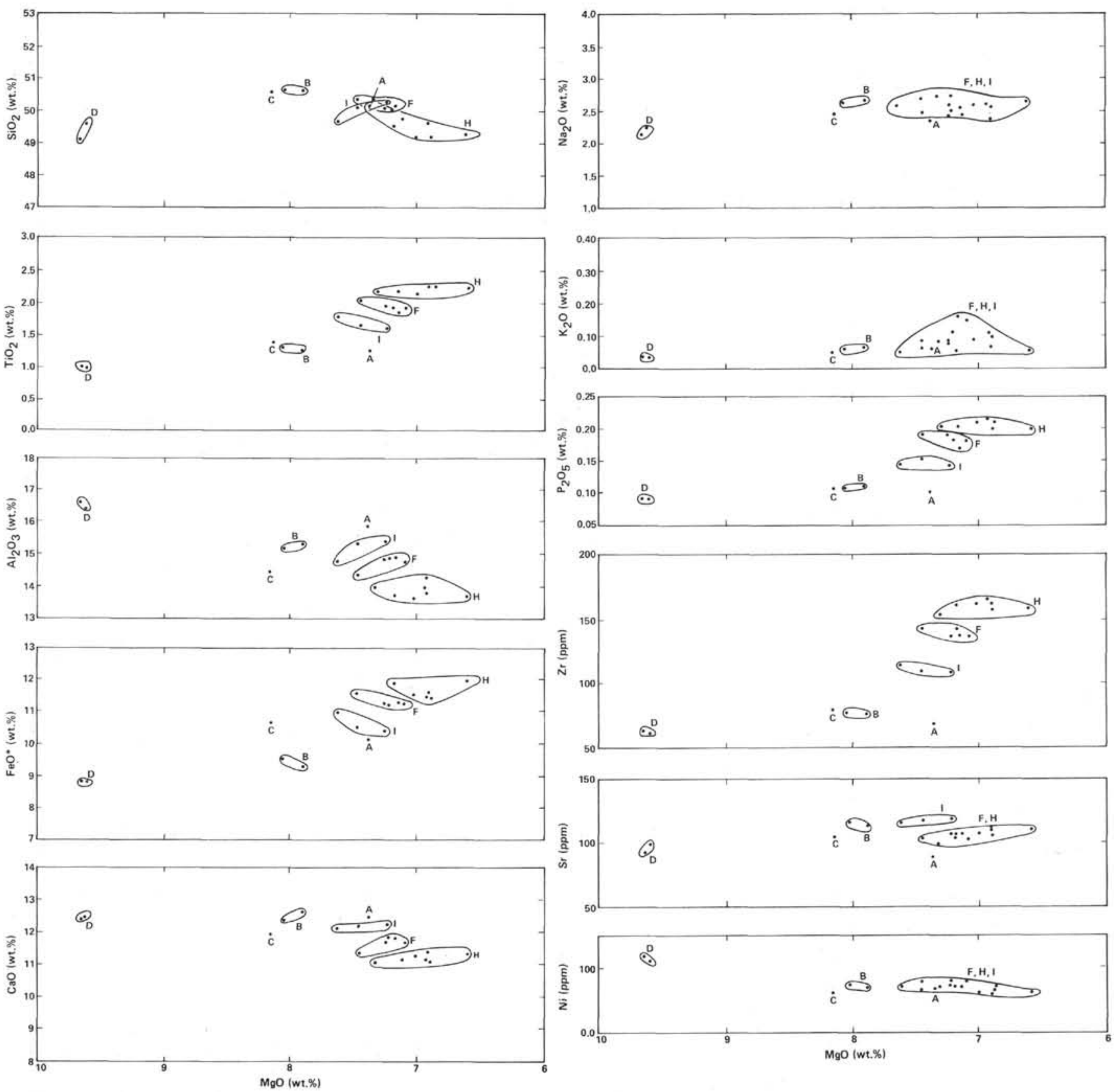


Figure 15. Oxide and element variation diagrams for basement Lithologic Units 1 through 7 in Hole 483B. (Oxide data are corrected for $CaCO_3$ contamination and normalized to H_2O^+-free basis. Basalt chemical types are indicated by letters.)

483C unit, identified as Chemical Type M, is probably of independent origin (Fig. 14).

In summary, basalt chemical types identified from Holes 483, 483B, and 483C fall into two broad types:

1) Aphyric Types B, C, and D, and sparsely phyric Type A, characterized by wide range of MgO content (7.0–9.8%), high CaO (12–13%), and low contents of TiO_2 (1.0–1.5%), P_2O_5 (0.9–0.12%), and Zr (60–90 ppm), and high values of Ti/Zr (99–109) as compared to:

2) Sparsely phyric Types E, G, and H and more phyric Types F, I, J, K, and L, characterized by a narrow range of MgO content (7.7–6.5%), lower CaO (11–12.2%), higher (and more variable) contents of TiO_2 (1.5–2.5%), P_2O_5 (0.14–0.23%), and Zr (110–170 ppm), and lower values of Ti/Zr (84–95).

The first group forms an upper stratigraphic sequence, whose constituent types are difficult to relate by low-pressure fractionation hypotheses and appear to have been emplaced at comparatively infrequent intervals. The second group has more abundant and diverse phenocrysts, more textural evidence of crystal-liquid reaction, and more protracted evolution by fractional crystallization than the first group.

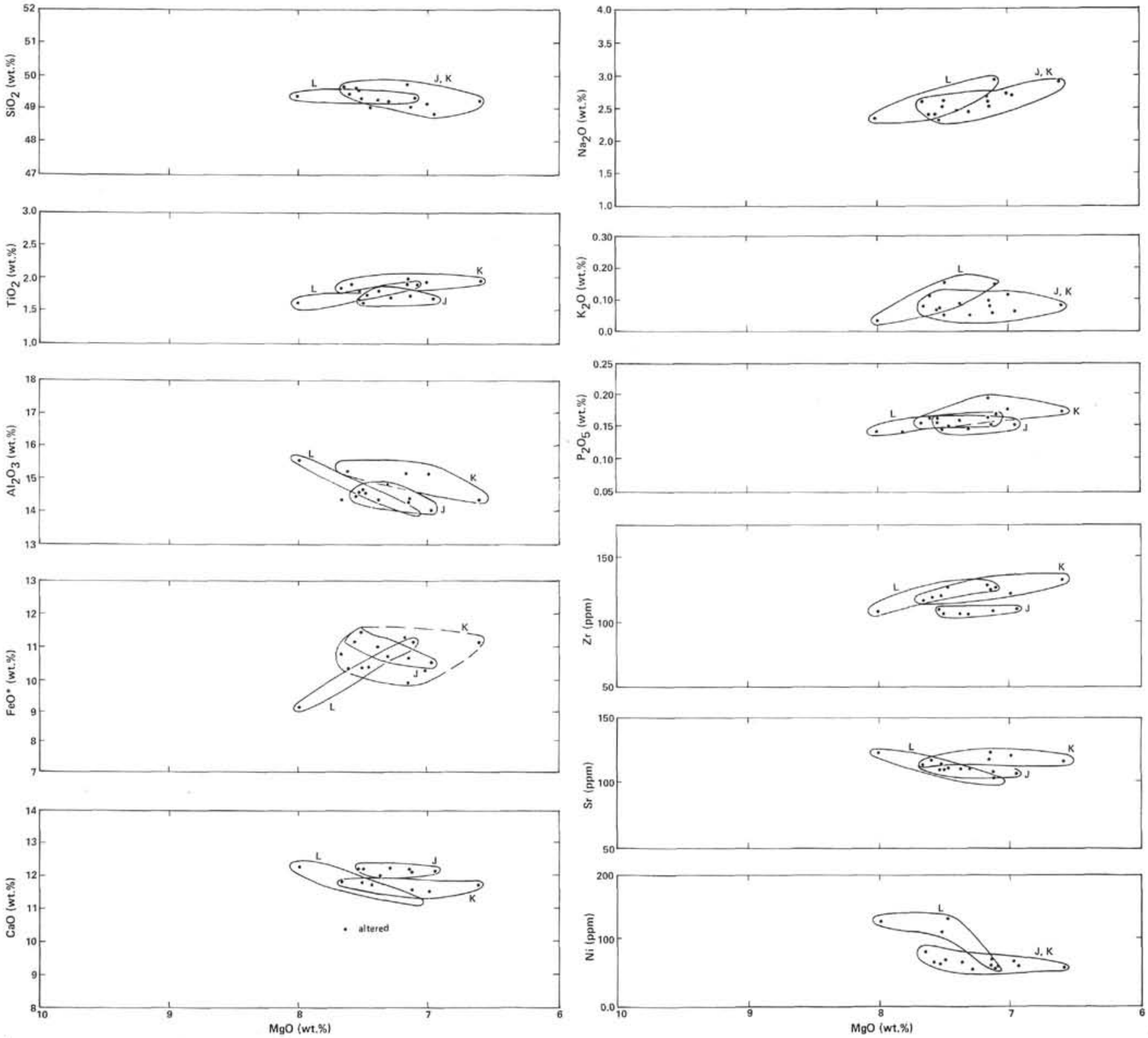


Figure 16. Oxide and element variation diagrams for basement Lithologic Units 8 through 10 in Hole 483B. (Oxide data are corrected for $CaCO_3$ contamination and normalized to H_2O^+-free basis. Basalt chemical types are indicated by letters.)

There appear to be three main influences on the observed chemical variation, each superimposed on the other, sometimes with opposing effect:

1) "Internal" phenocryst accumulation, reflected by variation trends, often unique to a given chemical type, and consistent with observed phenocryst parageneses.

2) Liquid fractionation, indicated by an overall trend or family of trends, between aphyric chemical types and magnesian members of phyric types. Declining Al_2O_3, CaO, and Sr, and increasing TiO_2, P_2O_5, FeO*, and Zr with decreasing MgO suggest fractionation by phenocryst removal (plagioclase, clinopyroxene, and olivine) from a parental liquid or series of liquid batches.

3) Differentiation in the source region, resulting from variable degrees of partial melting or from compositional heterogeneity, reflected by differences in the Ti/Zr ratio between separate groupings of basalt chemical types.

BASALT PHYSICAL PROPERTIES

Measurements of wet-bulk density, compressional-wave velocity (V_p), and porosity were conducted on the basalts recovered in Holes 483 and 483B for comparison with the geophysical data in the vicinity of the site. The results of these measurements, together with calculated values of grain density and acoustic impedance, are presented in Table 9 and Figures 17 and 18. As at Site 482, the basalts studied were placed in seawater shortly after arrival on shipboard to prevent desiccation.

The densities of the basalts recovered from Holes 483 and 483B range from 2.83 to 2.99 g/cm^3 and average approximately 2.92 g/cm^3. Although no particular

Table 9. Basalt physical properties, Holes 483, 483B.

Sample (interval in cm)	Density Wet-Bulk (g/cm^3)	Density Grain[a] (g/cm^3)	P-Wave Velocity[b] (km/s)	Acoustic Impedance[c] ($\times 10^5$ $g/cm^2 \cdot s$)	Porosity[a] (vol.%)	Remarks
Hole 483						
14-1, 105-107	2.858	2.99	5.41	15.5	6.6	Basalt
15-2, 104-106	2.892	2.99	5.84	16.9	4.9	Basalt
16-2, 33-35	2.940	3.00	6.01	17.7	3.0	Basalt
17-2, 112-114	2.920	2.97	6.17	18.0	2.5	Basalt
20-1, 55-57	2.962	3.01	5.95	17.6	2.3	Basalt
21-2, 112-114	2.958	3.01	6.12	18.1	2.7	Basalt
22-3, 72-74	2.881	2.96	6.09	17.5	4.1	Basalt
23-1, 30-32	2.861	2.97	5.94	17.0	5.6	Basalt
24-1, 134-136	2.857	3.00	5.29	15.1	7.1	Basalt
25-1, 40-42	2.950	3.03	5.78	17.1	4.0	Basalt
26-2, 118-120	2.905	2.99	5.81	16.9	4.5	Basalt
Hole 483B						
2-7, 39-42	2.946	3.00	5.93	17.5	2.7	Basalt
3-1, 66-68	2.950	3.02	5.76	17.0	3.4	Cracked sample
4-2, 105-107	2.945	3.01	5.92	17.4	3.1	Basalt
4-5, 114-116	2.989	3.01	6.18	18.5	1.1	Basalt
7-2, 36-38	2.959	3.01	6.13	18.1	2.6	Basalt
8-2, 64-66	2.926	2.96	6.18	18.1	1.9	Basalt
9-1, 18-20	2.921	2.96	6.09	17.8	2.2	Basalt
12-1, 53-55	2.924	3.00	—	—	3.8	Basalt
13-3, 59-61	2.908	3.00	5.82	16.9	4.4	Basalt
14-2, 4-6	2.929	3.00	6.17	18.1	3.4	Basalt
17-2, 121-123	2.932	3.01	5.97	17.5	3.7	Basalt
18-2, 112-114	2.847	3.03	5.42	15.4	9.0	Basalt
19-1, 115-117	2.922	3.02	5.65	16.5	5.0	Basalt
20-1, 132-134	2.934	3.03	5.83	17.1	4.8	Basalt
21-1, 121-123	2.867	2.99	—	—	6.3	Basalt
22-1, 120-122	2.935	3.02	6.16	18.1	4.1	Basalt
23-2, 33-35	2.924	2.99	5.99	17.5	3.4	Basalt
24-1, 25-27	2.939	3.05	6.13	18.0	5.3	Basalt
25-2, 49-51	2.838	3.00	5.40	15.3	8.1	Basalt
26-2, 17-19	2.826	3.01	5.39	15.2	9.3	Basalt
27-2, 124-126	2.950	3.03	6.03	17.8	4.0	Basalt
28-2, 86-88	2.929	3.02	6.18	18.1	4.7	Basalt
29-1, 6-8	2.924	3.00	5.91	17.3	3.9	Basalt
30-2, 81-83	2.968	3.03	—	—	3.2	Basalt
31-2, 46-48	2.899	3.01	5.94	17.2	5.4	Basalt
32-3, 5-7	2.909	3.01	5.80	16.9	5.2	Basalt

[a] Determined by heating for 24 hours in air at 110°C.
[b] Measured at atmospheric pressure.
[c] From wet-bulk density and P-wave velocity.

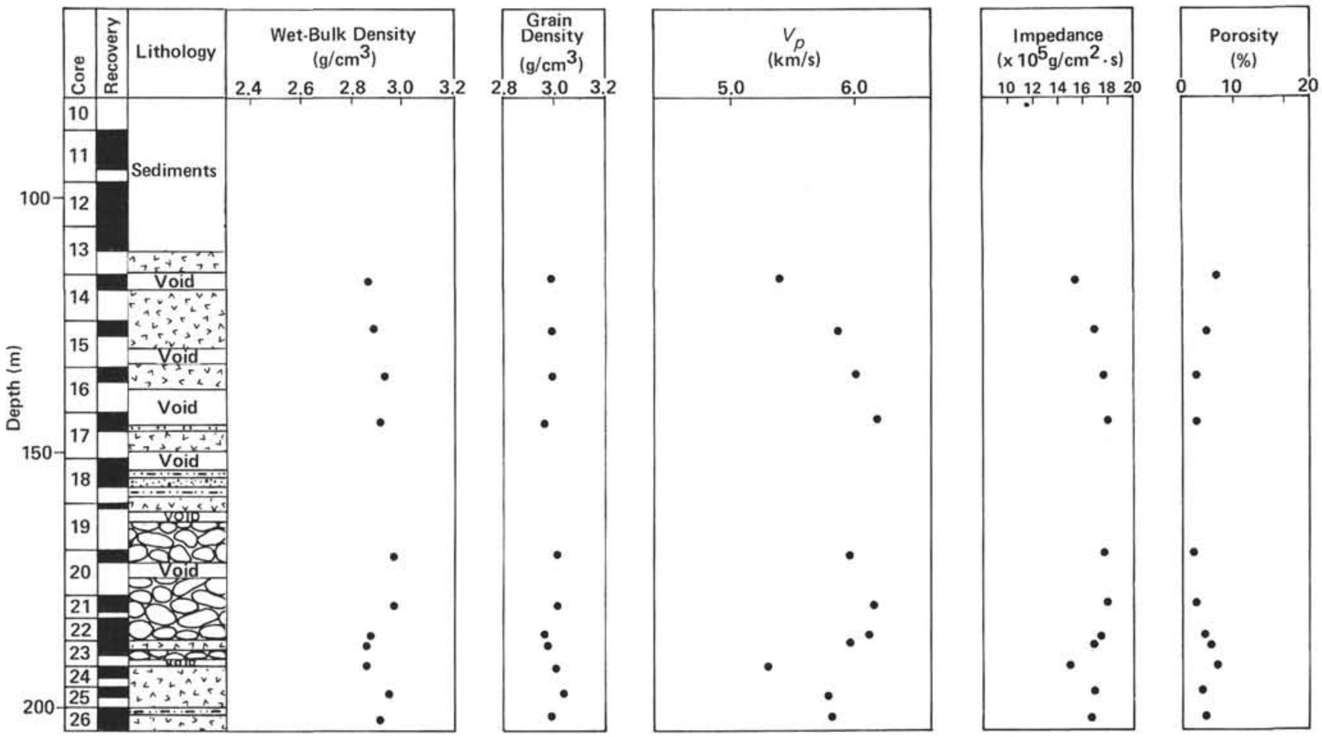


Figure 17. Basement physical properties plotted against sub-bottom depth for Hole 483. (For explanation of symbols, see Explanatory Notes, this volume.)

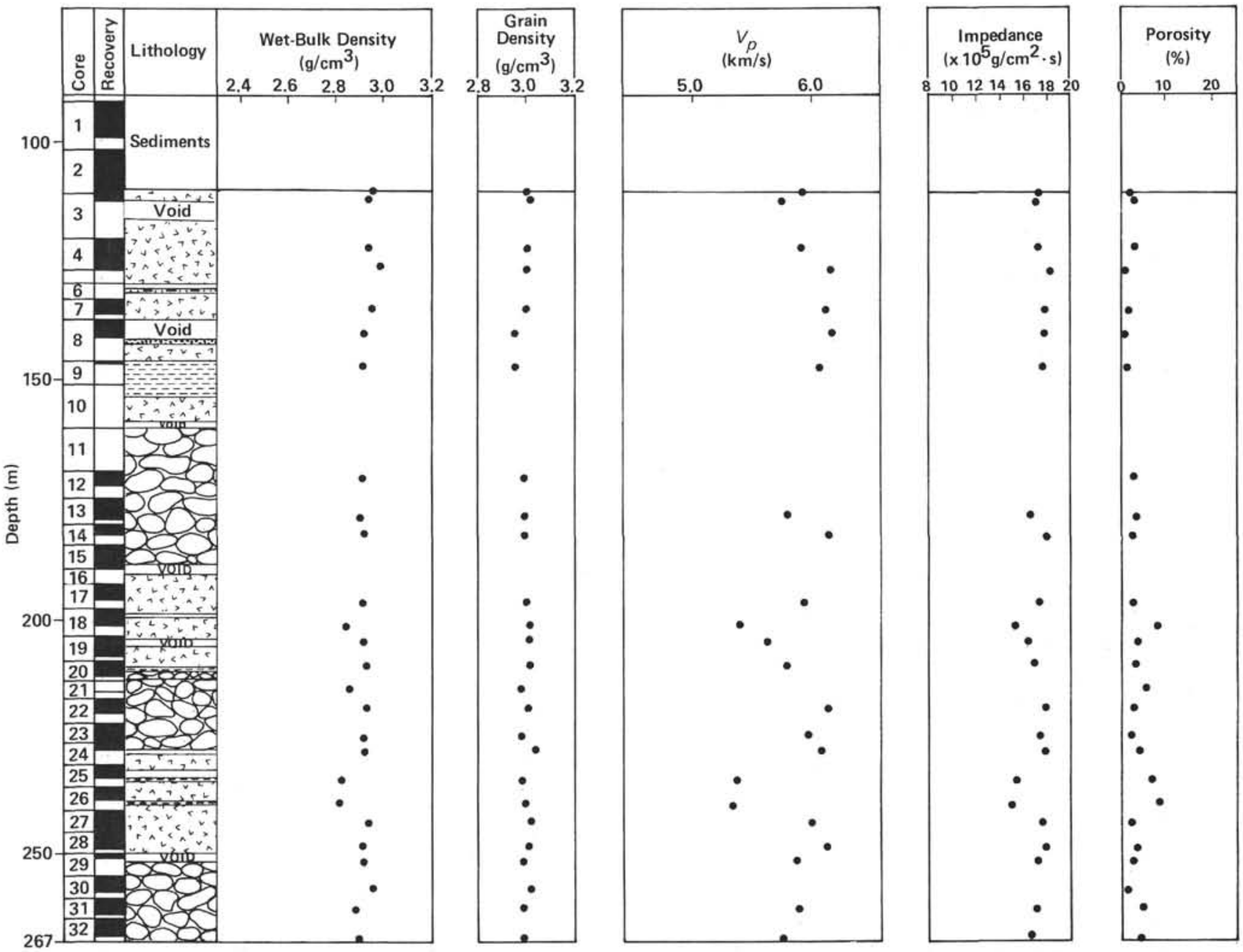


Figure 18. Basement physical properties plotted against sub-bottom depth for Hole 483B. (For explanation of symbols, see Explanatory Notes, this volume.)

trend is observed with depth in either hole, the scatter of the wet-bulk density values tends to increase with depth in Hole 483B, apparently in response to variable alteration near interlayered sediments. This pattern is confirmed by the porosity values in Hole 483B, which range from 1.1 to 9.3%, with the highest values observed in the thin massive units recovered in Cores 18, 25, and 26, near confirmed or inferred sediment interlayers.

The values of compressional-wave velocity shown in Figures 17 and 18 range from 5.29 to 6.18 km/s and average about 5.9 km/s. As in Hole 482B, the velocities in Hole 483B decrease irregularly with depth in response to increasing alteration and increase with increasing density.

The measured wet-bulk densities, compressional-wave velocities, and porosities at Site 483 are typical of relatively young, fresh basalt. Since the basalts have relatively high velocities and are commonly massive, the formation velocities are likely to be quite high. However, because the velocity tool failed in Hole 483, and no refraction data are available for the site, this cannot be confirmed at present.

BASALT PALEOMAGNETISM

Basalts were sampled from Holes 483 and 483B for paleomagnetic studies. The age of basement at Site 483 is 1.5 to 2.0 m.y. Fossil data for the sediments directly above basement indicate an age of 1.51 to 1.65 m.y., whereas an age of 1.9 m.y. is estimated from the spreading rate. The period from 1.5 to 2.0 m.y. ago is well within the Matuyama Reversed Epoch although the Olduvai Normal Event occurs between 1.71 and 1.86 m.y.

Hole 483

Hole 483 reached basement at 110 meters sub-bottom and terminated at 204 meters sub-bottom. Of the 94 meters drilled, 37.4 meters (39.6%) were recovered. However, logging data and drilling-rate data suggest that only 63 meters (67%) of the basement is composed of basalt, therefore the basement recovery percentage is close to 59%. The cored basement section can be divided into two parts. The upper 53 meters (Cores 13–19) are made up of about five massive basaltic cooling units separated from each other by several meters of sediment. The lower section (Cores 20-26) consists largely of basalt, most of which was recovered. Cores 20 to 22 and part of Core 23 consist of phyric pillow basalts overlying massive sparsely phyric basalts (Cores 23-26). These massive basalts are each less than 3 meters thick.

Sixty-one oriented samples were taken for shipboard measurements and 53 of these were stepwise demagnetized (Table 10). The magnetic polarity of the basement rocks is consistent with the surface magnetic anomaly (Matuyama Reversed Epoch). The two uppermost samples in this hole are positively magnetized; it is believed that this represents normally magnetized crust, as the uppermost section of Hole 483B is also normally magnetized. This could be the Olduvai Normal Event. The mean stable inclination of Hole 483 is $-36°$, again close to the axial dipole value ($-39°$) (Table 11). However, the mean inclination for the massive basalts (both upper and lower) is $-31°$ whereas the mean for the pillows is $-43°$. Although these values are well within the inclination range that can be explained by secular variation, it is surprising that the two means spread about the overall mean. It is also puzzling that the mean inclination of the lower massive section (31.70°) is the same as that of the upper massive basalts (31.1°) (Table 11).

The mean intensity of NRM is 1.24×10^{-2} gauss (G), but this value is meaningless because it is biased by the relative proportions of pillow basalts and massive basalts. The mean NRM's of the upper massive basalts, lower massive basalts, and pillow basalts are 3.12×10^{-3}, 1.22×10^{-2}, and 2.05×10^{-2} G, respectively. The higher value for the pillow basalt reflects the finer-grain size of the titanomagnetite grains in these samples. This is substantiated by the high values observed in the pillow lavas (49 for pillow basalts, 11.6 for the lower massive basalts, and 3.4 for the upper massive basalts) and the higher median destructive fields (139 Oe for pillow basalts, 90 Oe for the lower massive basalts, and 78 Oe for the upper massive basalts). These data also suggest that the upper massive basalts are coarser grained than are the lower units. Inclination changes correspond closely with lithological and chemical boundaries.

Hole 483B

Only nine samples of basalt from Hole 483B have been measured (Table 10). The nine samples were collected from the interval between 110 and 128 meters sub-bottom. As is the case in Hole 483, the uppermost part of the section (again the top two samples) is positively magnetized, whereas the remainder of the samples are reversely magnetized. A very preliminary correlation between Holes 483 and 483B shows that the upper part of the section in each hole is magnetically the same.

SUMMARY AND CONCLUSIONS

Site 483, which lies between Site 482 and 474, was drilled to complete a transect at the mouth of the Gulf of California from the crest of the East Pacific Rise to the edge of the continental slope off Baja California. The site is located about 52 km from the rise crest and about 25 km from the base of the continental slope. The site is underlain by a flat, regular basement reflector overlain by about 110 meters of sediment.

Four holes were drilled at this site, including a multiple re-entry hole. Hole 483 was continuously cored to a sub-bottom depth of 204.5 meters, of which 94.5 meters was in basement. Holes 483A and B were drilled 100 meters east of Hole 483: Hole 483A was a wash test in the sediments during which no cores were recovered; Hole 483B was the re-entry hole. Hole 483B was cored continuously from 91.5 to 267.0 meters sub-bottom, with 157 meters of basement penetration. Four cores were taken in Hole 483C, drilled 500 meters east of Hole 483B. Three of these cores were in sediment and one in basement. The holes were located so as to provide maximum information on lateral continuity of the uppermost basement unit along an east-west line.

Basement recovery averaged 40% in Hole 483, 48% in Hole 483B, and 100% in Hole 483C. Sediment recovery, mostly in Hole 483, averaged about 67%.

Sediment Lithology

Three units were recognized in the 110 meters of sediment above basement. Unit I consists of 36.5 meters of nannofossil marl and radiolarian-bearing mud with minor silty sand. Unit II extends from 36.5 to 52 meters sub-bottom and consists of clayey silt grading downward into nannofossil marl and radiolarian-diatom mud. The lower 9 meters of this unit consists of fine-grained silty sand, interpreted as a turbidite, which passes downward into silty clay and radiolarian-diatom mud. Except for the silty sand, the sediments of Unit II contain abundant glass shards scattered through the core and concentrated in small patches of tuffaceous clay. Several fragments of indurated claystone contain abundant fresh and altered sideromelane shards, probably representing a hyaloclastite deposit. Unit III is a 58-meter-thick interval of hemipelagic silty clay and clayey silt with a few siliceous fossils.

The sediments above basement are all believed to be Quaternary in age on the basis of nannofossils, radiolarians, and foraminifers. Cores 483-1 to the upper part of Core 5 (0-33 m sub-bottom) are assigned to Zones NN20/21. The highest occurrence of the radiolarian *Axoprunum angelinum* (0.41 m.y. ago) is at 33.5 meters subsea. The highest occurrence of *Helicopontosphaera sellii* is in Sample 483-10-1, 50-52 cm and is assigned an age of 1.22 m.y. The lowermost sediments above basement are estimated to be between 1.51 and 1.65 m.y. old based on the nannofossil zone *Cyclococcolithina macintyrei* of Gartner (1977).

Basement Lithology

As at Site 482, the upper part of basement consists of interlayered massive basalts and sediments. Below about 50 meters subbasement the percent of sediment decreases markedly, and basement consists largely of interlayered pillowed and massive basalts. We recognize seven major lithologic units in the basalts of Hole 483 and ten in Hole 483B.

The massive cooling units in the lower part of the basement section, all greater than one meter in thick-

Table 10. Paleomagnetic properties of basalts from Holes 483, 483B.

Sample (level in cm)	Depth (m)	Declination (°)	Inclination (°)	NRM Intensity ($\times 10^{-3}$ G)	Stable Inclination (°)	Susceptibility ($\times 10^{-3}$ G/Oe)	Median Destructive Field (Oe)	Koenigsberger Ratio (ϕ)
Hole 483								
13-4, 13	110.13	225	35	6.63	+32	2.40	68	6.1
13-4, 89	110.89	70	43	5.91	+36	2.76	65	4.8
14-1, 31	115.31	174	4	5.33	−23	2.31	55	5.1
14-1, 83	115.83	276	14	4.28	+29	2.12	94	4.5
14-2, 10	116.60	232	−14	5.25	−26	1.91	75	6.1
14-2, 53	117.03	87	23	2.47	−18	2.13	75	2.6
14-2, 106	117.56	261	0	3.92	+21?	2.43	110	3.6
15-1, 20	124.20	111	78	3.03	?	2.46	18	2.7
15-1, 102	125.02	43	38	2.23	−16	2.03	57	2.4
15-2, 99	126.49	221	25	3.01	−11	2.36	45	2.8
15-3, 4	127.04	54	−25	3.42	−36	2.51	80	3.0
16-1, 54	133.54	249	−11	3.62	−38	2.42	67	3.3
16-1, 112	134.12	344	31	1.21	−34	2.36	107	0.9
16-1, 138	134.38	265	7	2.38	−34	2.37	70	2.2
16-2, 14	134.64	123	14	2.53	−26	2.62	59	2.1
16-2, 62	135.12	157	−11	3.98	−34	2.35	81	3.8
16-2, 140	135.90	313	6	1.85	−36	2.34	100	1.8
17-1, 60	142.60	205	−13	1.59	−40	1.24	91	2.8
17-1, 101	143.01	210	−27	1.65	ND	1.17	ND	3.1
17-2, 30	143.80	197	−19	1.46	−40	1.29	90	2.5
17-2, 96	144.46	82	−29	2.71	−40	1.18	96	5.1
17-3, 20	145.20	215	−30	1.85	−44	1.14	130	3.6
18-4, 110	156.60	329	52	2.03	+49?	1.23	75	3.7
18-4, 148	157.08	48	6	2.72	−22	2.21	85	2.7
20-1, 14	169.14	203	−31	18.9	−48	2.30	102	18.3
20-1, 92	169.92	278	−31	14.1	ND	1.56	ND	20.1
20-1, 110	170.10	280	−30	19.4	−42	1.22	138	35.4
20-1, 142	170.42	24	−30	18.8	−44	1.73	100	24.0
20-2, 22	170.72	53	−22	12.4	−48	2.12	122	13.0
21-1, 29	178.29	238	−26	21.1	−43	1.61	82	29.1
21-1, 106	179.06	297	20	7.3	−47	2.31	138	7.0
21-2, 4	179.54	148	−23	17.3	−50	1.99	80	19.3
21-2, 36	179.86	81	−42	32.9		0.73		100.3
21-2, 39	179.89	89	−35	18.7	−47	1.24	130	33.6
21-2, 124	180.84	117	−8	12.3	−50	1.89	90	14.5
21-3, 56	181.56	145	−2	14.7		2.06		15.8
22-1, 34	182.84	197	−34	22.8		1.38		36.8
22-1, 84	183.34	347	−31	24.4	−39	0.92	155	59.2
22-1, 135	183.85	131	−46	28.5	−50	0.65	185	97.8
22-2, 8	184.08	302	−37	35.2		0.88		88.9
22-2, 77	184.77	156	−47	25.8	−49	0.35	339	163.0
22-3, 34	185.84	307	−41	24.1		1.03		51.9
22-3, 52	186.02	35	−41	15.3		0.76		44.7
22-3, 103	186.53	99	−46	22.5	−49	0.43	265	117.0
22-3, 115	186.65	324	−42	26.8		0.38		155.8
22-4, 35	187.35	354	−26	24.5	−34	1.02	122	53.2
22-4, 79	187.79	346	−31	47.6		1.46		72.2
22-4, 102	188.02	173	−7	8.43	−35	2.13	93	8.8
23-1, 64	187.64	111	−26	25.5	−36	1.50	78	37.9
23-1, 113	188.13	162	−15	14.1	−42	2.02	90	15.5
23-2, 37	188.87	59	−18	10.3	−43	1.82	110	12.5
23-2, 64	189.14	117	−24	11.5		1.76		14.6
23-2, 120	189.70	119	−21	19.9	−29	0.70	230	63.5
24-1, 48	191.98	281	35	7.5	−31	2.28	76	7.3
24-2, 4	193.04	163	−9	13.9	−32	2.87	85	10.7
24-2, 61	193.61	301	19	7.0	−28	3.52	80	4.4
25-1, 24	195.24	147	−19	31.2	−28	1.97	92	35.3
25-1, 84	196.84	218	1	14.9	−33	3.09	83	10.7
25-2, 4	197.54	78	−14	6.8		3.07		4.9
25-2, 74	198.24	170	18	5.9	−31	3.15	67	4.1
26-1, 11	200.11	288	45	7.9	−32	2.99	74	5.9
26-1, 82	200.82	151	0	12.9		1.98		14.4
26-1, 138	201.38	94	12	5.2	−30	2.37	81	4.9
26-2, 13	201.63	2	−9	6.6	−34	2.55	122	5.7
26-2, 60	202.10	219	−22	28.5	−35	1.75	82	36.1
26-3, 8	203.80	281	−19	16.2	−33	2.63	128	13.8
26-3, 118	204.18	15	0	6.3	−34	3.30	106	4.3
Hole 483B								
2-7, 91	110.91	161	40	8.14	27	2.76	75	6.5
3-1, 46	110.96	125	49	7.28	29	2.82	77	5.7
3-1, 121	111.71	330	−11	6.05	−22	2.23	115	6.0
4-1, 64	120.14	4	0	2.27	−16	2.31	82	2.2
4-2, 83	121.83	3	43	2.13	−12	2.40	54	2.0
4-3, 127	123.77	237	30	2.38	−16	2.20	64	2.4
4-4, 111	125.11	69	32	1.31	−12	2.22	115?	1.1
4-5, 94	126.44	131	−1	2.03	−19	2.14	100	2.1
4-7, 4	128.54	232	43	2.64	−18	2.30	71	2.5

Note: ND = not determined.

Table 11. Mean values of paleomagnetic measurements, Site 483.

	Upper Massive Basalts	Pillow Basalts	Lower Massive Basalts	All Samples
Stable inclination (°)	31 (22)[a]	43 (19)	32 (12)	36 (53)
Intensity of NRM ($\times 10^{-3}$ G)	3.12 (24)	20.5 (28)	12.2 (14)	12.4 (66)
Mean destructive field (Oe)	78 (23)	139 (19)	90 (12)	102 (54)
Susceptibility ($\times 10^{-3}$ G/Oe)	2.06 (24)	1.38 (29)	2.68 (14)	1.89 (67)
Koenigsberger ratio (ϕ)	3.4 (24)	49 (29)	11.6 (14)	25 (67)

[a] Number in parentheses = number of samples used to calculate mean.

ness, are interpreted as submarine lava flows on the basis of their textures and contact relationships. Grain size increases from fine near the margins to medium or coarse in the central parts of the massive units. A few have glassy chilled zones at one or both contacts. Intersertal textures are common even in the coarser-grained portions and holocrystalline groundmass textures with interstitial quartz and apatite are restricted to the thickest units. Basalt/sediment contacts are rarely preserved. At one well-preserved contact in Section 483-26-1 the overlying sediment shows clear imprints of the vesicular texture of the underlying basalt. This could only form by deposition of the sediment onto the basalt.

Dikelets were found in Cores 483-15 and 16. These range in width from 1-2 cm to about 20 cm and are usually subhorizontal. Some have sharp, chilled margins, others have diffuse margins grading into the host rock. The dikelets have magnetic inclinations and chemical compositions identical to those of the host rock and are interpreted as late-stage segregation veins or "autointrusions."

Thin cooling units (up to 1 m thick) with curved glassy rinds and quench textures are interpreted as basalt pillows. These first appear at a sub-bottom depth of about 178 meters and are interbedded with massive flows in the lower part.

Both phyric and aphyric basalts occur at this site. The most common phenocryst assemblages in the phyric varieties are plagioclase (with minor olivine), plagioclase + olivine, and plagioclase + olivine + clinopyroxene. Plagioclase and olivine are the most common phases, usually occurring as euhedral to subhedral crystals. Clinopyroxene occurs as anhedral intergrowths with plagioclase or as single, rounded crystals, some of which have well-developed sector zoning. The partly resorbed nature of some of the phenocrysts and the presence of small spinel inclusions in some olivine phenocrysts suggest two stages of crystallization; one at pressures above about 5 kilobars and a later one at shallower levels.

Alteration of the basalts is similar to that occurring at Site 482. An early pervasive alteration results in replacement of olivine and interstitial glass by smectite and minor carbonate. Veins are filled with smectite, carbonate, and zeolite, and glass selvages are partly altered to the same minerals. One patch of higher grade alteration in Section 483B-8-2 is indicated by the presence of chlorite and actinolite(?) replacing clinopyroxene. The amount of alteration increases slightly downhole, but no systematic change was noted in alteration grade.

Basalt Chemistry

From oxide/element variation of the basalts, 13 tholeiitic chemical types were identified for Holes 483, 483B (A–L inclusive), and 483C (M). The upper four massive units in Holes 483 and 483B are chemically distinct from those below, being higher in MgO, lower in TiO_2, P_2O_5, and Zr, and having higher Ti/Zr ratios (99–109) than lower igneous units. Type D, lowermost in the upper sequences, is a primitive composition, with $Mg/(Mg + Fe^{2+})$ ratios up to 0.69; it could be an unfractionated mantle-derived melt. This type appears to succeed the main break in chemical stratigraphy (represented by thick sediment) in Holes 483 and 483B.

Below this horizon, Chemical Types E–L (inclusive) comprise mostly phyric units, which are considerably more fractionated and have higher contents of TiO_2, P_2O_5, and Zr, and lower ratios of Ti/Zr (80–89). These basalts occur as alternating series of pillows and massive lavas, the latter interlayered with minor sediment. Stratigraphic relations of the chemical types suggest that this sequence may show a cyclic pattern, with a series of massive lavas (and sediments) succeeded by cogenetic pillow lavas (e.g., chemical types K–J; H–F–G). Most of the basalt variation within these series can probably be explained in terms of shallow-level fractionation processes. However, Ti/Zr changes may indicate slight changes in the parent magma compositions for successively erupted magma batches.

In general, the basaltic variation follows "liquid"-type fractionation trends typical for the East Pacific Rise (and other fast-spreading axes), showing strong enrichment in FeO*, TiO_2, P_2O_5, and Zr, and declining Al_2O_3 and CaO as MgO decreases. Individual (phyric) basalt units show slight phenocryst accumulation trends superimposed on the liquid variation.

In contrast to predictions for fast-spreading axes, diverse liquid lines are evident in the evolution of basaltic magma.

Sediments within Basement

Sediment layers up to 9 meters thick are interbedded with basalts in the upper part of basement. These comprise nearly 50% of the upper 50 meters, but only about 5% of the section below this level. These are chiefly hemipelagic, slightly to moderately fossiliferous clays and silty clays similar to the sediments above basement. A thin altered hyaloclastite layer occurs directly above basalt in Section 483B-8-1. This consists of angular glass shards replaced by smectite and zeolite in a matrix of radiating fibrous zeolite, probably phillipsite. A 20-cm-thick layer of hard, black, well-bedded silty claystone occurs in Section 483B-25-2. The bedding in this piece seems to be inclined about 25° from the horizontal. There is no clear evidence of baking or extensive diagenesis in most interlayered sediments, but many are well indurated and black and most contain no fossils.

A few of the interlayered sediments contain moderately to poorly preserved nannofossils, radiolarians, and foraminifers. However, some of the sediments are probably turbidites, and many of the fossils may be reworked. Based on calcareous nannofossils, the Pliocene/Pleistocene boundary is placed between Cores 13 and 17 in Hole 483 and between Cores 8 and 9 in Hole 483B.

Paleomagnetism

Paleomagnetic measurements were completed for Holes 483 and 483B. The uppermost basalt layer has a positive inclination averaging about 34°. Below this level measured polarities are mostly negative, with inclinations ranging from 11° to 50°. Magnetic intensities range from 1.21 to 47.6×10^{-3} G, the low values being from massive units and the high values from pillow basalts. The median destructive field ranges from 18 to 339 Oe—again, with the low values from massive units and the high values from pillows.

Physical Properties

Physical properties in the upper 70 meters of sediment are very uniform, with wet-bulk density between 1.40 and 1.44 g/cm^3, compressional-wave velocity of 1.47 to 1.49 km/s, and porosity of 73 to 76%. From 70 meters to the top of the basement at 110 meters, the properties change markedly in response to increasing compaction. Wet-bulk densities increase to about 1.7 g/cm^3, compressional-wave velocities to about 1.67 km/s, and porosities to about 55%. Sediments within the basement have even higher densities and velocities and lower porosities in response to increased compaction and possibly diagenesis.

Basalt densities range from 2.83 to 2.99 g/cm^3, in reasonable agreement with the formation densities obtained by logging (Salisbury, this volume), and vary inversely with porosity, which ranges from 1.1 to 9.3%. Compressional-wave velocities average 5.9 km/s and range from 5.29 to 6.18 km/s, decreasing irregularly with depth, perhaps as a result of increased alteration. The physical properties measured at this site are typical of fresh, relatively young basalt and, except for velocities, show no clear downhole trends.

Conclusions

The sediments at Site 483 are similar to those at Site 482, being mostly hemipelagic clays and silty clays with a few interbedded sandy layers of possible turbidite origin. Generally, fossils are somewhat more abundant and better preserved at Site 483 than at 482. Abundant glass shards and tubular pumice in some layers indicate fairly active silicic volcanism on adjacent landmasses during part of the sedimentation history. The fragments of hyaloclastite with sideromelane shards in a clay matrix are tentatively interpreted as representing erosion and reworking of basalt glass from older basalt lavas exposed on the seafloor or perhaps from a later eruption of basalt.

The lithology, chemistry, and physical properties of the basalts at Site 483 are also similar to those at Site 482. At both sites the uppermost basement consists of interlayered massive basalts and sediments; at Site 483 pillow basalts were encountered below this sequence at a depth of 66 meters sub-basement. A similar pillow sequence underlies interlayered massive basalts and sediments at Site 474 about 20 km to the west.

Comparisons of the basement sections at Sites 482, 483, and 474 suggest a mode of eruption and emplacement of basalt along this part of the East Pacific Rise for the last 3 m.y., characterized by continued, intermittent eruption for at least 700,000 years (based on sediment accumulation rates) after the bulk of the crust had been formed. Preliminary studies suggest no major secular changes in lithology, chemistry, or degree of alteration between the basalts at these sites. Drilling at Site 483 did not resolve the origin of the massive basalts in the upper part of basement, but it did provide clear evidence that at least one sediment/basalt contact was depositional.

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SITE 483 HOLE CORE 1 CORED INTERVAL 0.0–1.0 m

TIME-ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	METERS
UPPER QUATERNARY	NN20–21 (N)	CG	AM	FM		1, CC	

GRAPHIC LITHOLOGY; DRILLING DISTURBANCE; SEDIMENTARY STRUCTURES; SAMPLES

LITHOLOGIC DESCRIPTION

5GY 3/2
5Y 3/2
5GY 3/2

Soft, olive gray and grayish olive CLAYEY NANNOFOSSIL OOZE and SILTY CLAY.

SMEAR SLIDE SUMMARY

	1-2	1-28
TEXTURE:		
Sand	–	3
Silt	37	57
Clay	63	40
COMPOSITION:		
Quartz	5	10
Mica	–	2
Heavy minerals	TR	TR
Clay	63	50
Pyrite	TR	TR
Carbonate unspec.	TR	5
Foraminifers	TR	–
Calc. nannofossils	35	35
Diatoms	–	3
Radiolarians	TR	2
Sponge spicules	1	3
Silicoflagellates	TR	–

SITE 483 HOLE CORE 2 CORED INTERVAL 1.0–10.5 m

TIME-ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	METERS
UPPER QUATERNARY	NN20–21 (N)	CG	CM	AG		1, 2, 3, CC	0.5, 1.0

GRAPHIC LITHOLOGY (VOID); DRILLING DISTURBANCE; SEDIMENTARY STRUCTURES; SAMPLES

LITHOLOGIC DESCRIPTION

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

Section 1, 0–130 cm: Soft, olive gray SILTY CLAY.
Section 1, 130 cm–Section 2, 110 cm: Soft, olive gray MUDDY RADIOLARIAN-bearing DIATOMACEOS OOZE.
Section 3, 0 cm–Core-Catcher: Relatively firm, olive gray to grayish olive DIATOMACEOUS MUD and MUDDY OOZE.

SMEAR SLIDE SUMMARY

	1-7	1-140	2-50	3-12	3-53	3-62
TEXTURE:						
Sand	5	–	–	–	3	–
Silt	40	60	63	70	70	40
Clay	55	40	37	30	27	60
COMPOSITION:						
Quartz	10	1	5	8	3	3
Feldspar	2	–	–	1	TR	TR
Mica	–	–	TR	–	TR	–
Heavy minerals	–	–	–	TR	–	–
Clay	55	40	37	30	27	60
Pyrite	TR	TR	1	1	TR	2
Carbonate unspec.	1	–	–	TR	TR	–
Foraminifers	TR	–	–	–	–	–
Calc. nannofossils	25	2	1	4	3	25
Diatoms	5	40	30	35	50	5
Radiolarians	2	15	20	15	10	10
Sponge spicules	–	1	5	5	2	–
Silicoflagellates	–	1	1	–	5	–

SITE 483 HOLE CORE 3 CORED INTERVAL 10.5–20.0 m

TIME-ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	METERS
UPPER QUATERNARY	NN20–21 (N)	RG		CG		3	
		FG		CG			
		AG		CG		4	

Sections 1, 2, 3, 4; METERS 0.5, 1.0

GRAPHIC LITHOLOGY; DRILLING DISTURBANCE; SEDIMENTARY STRUCTURES; SAMPLES

LITHOLOGIC DESCRIPTION

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

Section 1, 0 cm–Section 3, 130 cm: Very soft, grayish olive DIATOMACEOUS MUD and MUDDY OOZE with burrows in Section 3.
Section 3, 130 cm–Section 4, 100 cm: Olive gray SANDY SILT, grading to grayish olive with depth.
Section 4, 100–150 cm: Soft grayish olive DIATOMACEOUS MUD.

SMEAR SLIDE SUMMARY

	1-140	2-5	2-99	2-113	2-130	3-32	4-6	4-73	4-140
TEXTURE:									
Sand	–	–	–	–	–	–	50	50	–
Silt	58	53	58	50	51	59	26	25	45
Clay	42	47	42	50	49	41	24	25	55
COMPOSITION:									
Quartz	<1	10	12	10	1	5	70	70	3
Feldspar	–	5	8	5	<1	1	<1	3	–
Mica	–	1	2	–	–	1	4	–	–
Heavy minerals	–	5	4	–	–	–	–	–	–
Clay	42	47	42	50	49	41	24	25	55
Volcanic glass	–	–	2	–	–	–	–	–	–
Pyrite	3	–	–	–	–	<1	<1	<1	1
Carbonate unspec.	–	–	–	–	–	1	–	–	1
Foraminifers	–	1	–	2	–	–	1	–	–
Calc. nannofossils	15	–	2	2	8	6	1	2	7
Diatoms	25	10	15	15	30	35	<1	–	25
Radiolarians	15	5	6	3	10	10	–	–	10
Sponge spicules	–	7	5	7	–	–	–	–	3
Silicoflagellates	–	2	2	2	2	–	–	–	–
Plant Debris	–	1	–	4	–	–	–	–	–

SITE 483 HOLE CORE 4 CORED INTERVAL 20.0–29.5 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FOSSIL CHARACTER: FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	METERS
UPPER QUATERNARY	NN20–21 (N)	FG		AG		1	0.5, 1.0
						2	
						3	
		CG	AM	AG		CC	

GRAPHIC LITHOLOGY

DRILLING DISTURBANCE / SEDIMENTARY STRUCTURES / SAMPLES

LITHOLOGIC DESCRIPTION

10Y 4/2

5Y 3/2

10Y 4/1

5Y 3/2

Soft olive gray to grayish olive DIATOMACEOUS MUD grading with depth in Section 3 to a MUDDY DIATOMACEOUS NANNOFOSSIL OOZE of the same color.

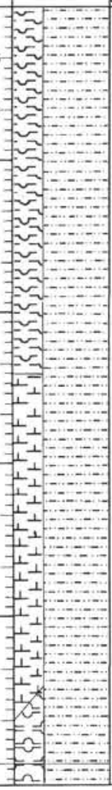
SMEAR SLIDE SUMMARY

	3-13	3-29	3-122 (M)
TEXTURE:			
Sand	–	2	10
Silt	74	74	74
Clay	26	26	16
COMPOSITION:			
Quartz	TR	2	7
Feldspar	–	–	TR
Mica	–	–	TR
Clay	26	26	16
Pyrite	1	1	–
Carbonate unspec.	1	1	5
Foraminifers	TR	TR	2
Calc. nannofossils	50	50	30
Diatoms	15	15	30
Radiolarians	5	5	10
Sponge spicules	2	1	TR
Silicoflagellates	–	1	–

SITE 483 HOLE CORE 5 CORED INTERVAL 29.5–39.0 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FOSSIL CHARACTER: FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	METERS
UPPER QUATERNARY	Above extinction of *Axoprunum angelinum* NN20–21 (N)	AG		AG		1	0.5, 1.0
		CG		AG		2	
		AG		AG		3	
	NN19 (N)	CG		AG		4	
			CM			5	
		CG	AM	AG		CC	

GRAPHIC LITHOLOGY



DRILLING DISTURBANCE / SEDIMENTARY STRUCTURES / SAMPLES

LITHOLOGIC DESCRIPTION

10Y 4/2

5Y 3/2

10Y 4/2

5Y 3/2

10Y 4/2

5Y 3/2

10Y 4/2

5Y 3/2

Section 1, 0 cm–Section 3, 60 cm: Alternating layers of soft grayish olive and olive gray MUDDY DIATOMACEOUS OOZE containing abundant radiolarians and calcareous nannofossils.

Section 3, 60 cm–Core-Catcher: MUDDY NANNOFOSSIL OOZE grading with depth to SILICEOUS SILTY CLAY near the base of Section 5.

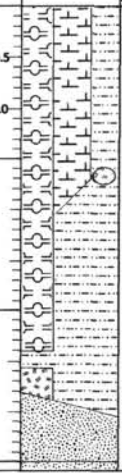
SMEAR SLIDE SUMMARY

	1-90	3-77	3-87 (M)	5-111
TEXTURE:				
Sand	–	–	–	–
Silt	72	68	44	54
Clay	28	32	56	46
COMPOSITION:				
Quartz	5	5	1	15
Feldspar	TR	TR	TR	2
Mica	TR	TR	–	TR
Heavy minerals	–	–	TR	–
Clay	28	32	56	46
Volcanic glass	–	–	–	TR
Pyrite	<1	5	4	4
Carbonate unspec.	2	3	4	TR
Foraminifers	–	TR	TR	TR
Calc. nannofossils	15	30	30	3
Diatoms	30	20	–	10
Radiolarians	15	5	–	15
Sponge spicules	5	–	5	5
Silicoflagellates	–	–	–	TR

SITE 483 HOLE CORE 6 CORED INTERVAL 39.0–48.5 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	METERS
UPPER QUATERNARY	NN19 (N)	CG		AG		1, 2, 3, CC	0.5, 1.0
		CG	AM	AG			

GRAPHIC LITHOLOGY



DRILLING DISTURBANCE · SEDIMENTARY STRUCTURES · SAMPLES

LITHOLOGIC DESCRIPTION

5Y 3/2

10Y 4/2

5Y 3/2

10Y 3/2

Section 1, 0 cm–Section 3, 40 cm: Very soft, olive gray to grayish olive (10Y 4/2) MUDDY SILICEOUS NANNOFOSSIL *OOZE* grading with depth in Section 2 to *MUDDY SILICEOUS OOZE* containing pieces of VOLCANIC ASH near the top of the section.
Section 3, 40 cm–Core-Catcher: SILTY CLAY containing up to 25% VOLCANIC GLASS grading with depth to SILTY *SAND.*

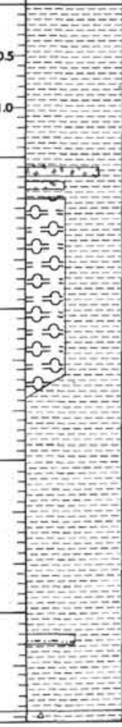
SMEAR SLIDE SUMMARY

	1-75	2-28	2-30 (M)	2-37 (M)	2-75	3-42	3-76	3-86
TEXTURE:								
Sand	–	5	70	20	–	20	–	40
Silt	75	67	20	60	42	55	38	20
Clay	25	28	10	20	58	25	62	40
COMPOSITION:								
Quartz	5	TR	3	1	1	5	10	50
Feldspar	TR	TR	TR	TR	TR	TR	3	5
Mica	TR	TR	–	–	TR	–	–	–
Clay	25	28	10	20	58	25	62	40
Volcanic glass	–	–	86	30	TR	25	–	–
Pyrite	2	–	–	1	TR	–	25	3
Carbonate unspec.	3	1	–	1	–	5	–	TR
Foraminifers	TR	–	–	TR	–	–	–	1
Calc. nannofossils	35	1	1	15	1	5	TR	1
Diatoms	20	20	–	15	20	15	–	–
Radiolarians	10	20	–	15	15	10	TR	–
Sponge spicules	–	30	–	2	5	10	–	–

SITE 483 HOLE CORE 7 CORED INTERVAL 48.5–58.0 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	METERS
UPPER QUATERNARY	NN19 (N)					1, 2, 3, 4, 5, CC	0.5, 1.0
		CG	CM	CG			

GRAPHIC LITHOLOGY



DRILLING DISTURBANCE · SEDIMENTARY STRUCTURES · SAMPLES

LITHOLOGIC DESCRIPTION

5GY 4/1

5Y 3/2

5GY 4/1

5Y 3/2

5GY 3/2

Section 1, 0 cm–Section 2, 40 cm: Very soft, dark greenish gray CLAY and SILTY CLAY with minor amounts (5%) of volcanic glass in Section 1 and pieces composed of sideromelane shards in a matrix of pelletized green clay near the top of Section 2.
Section 2, 40 cm–Core-Catcher: Dark greenish gray CLAYEY SILICEOUS OOZE grading with depth in Section 3 to olive gray and grayish olive CLAY. The clay in the Core-Catcher contains fragments of porcellanite(?).

SMEAR SLIDE SUMMARY

	1-74	1-120	2-15	2-16 (M)	2-22	3-75	4-75	5-25 (M)
TEXTURE:								
Sand	5	–	–	–	–	–	–	–
Silt	40	4	50	1	17	18	15	50
Clay	55	96	50	99	83	82	85	50
COMPOSITION:								
Quartz	5	3	20	–	–	2	2	15
Feldspar	–	–	15	–	–	–	–	6
Mica	–	–	5	–	–	–	–	5
Heavy minerals	–	–	5	–	–	–	–	10
Clay	55	96	50	99	83	82	85	50
Volcanic glass	5	1	5	2	–	1	1	–
Pyrite	–	–	–	–	–	2	TR	–
Zeolite	–	?	–	–	–	–	–	–
Carbonate unspec.	–	–	–	–	–	–	–	3
Foraminifers	–	–	–	–	–	–	–	3
Calc. nannofossils	–	–	–	–	5	2	5	3
Diatoms	15	–	–	–	5	5	5	5
Radiolarians	10	–	–	–	5	1	2	–
Sponge spicules	10	–	–	–	2	5	–	–

SITE 483 HOLE CORE 8 CORED INTERVAL 58.0–67.5 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FOSSIL CHARACTER: FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	METERS
QUATERNARY	NN19 (N)	CG	CM	AG		1, 2, 3, 4, CC	0.5, 1.0

GRAPHIC LITHOLOGY

DRILLING DISTURBANCE / SEDIMENTARY STRUCTURES / SAMPLES

LITHOLOGIC DESCRIPTION

10GY 3/2

5Y 3/2

10GY 3/2

Dusky yellow green SILTY CLAY containing a thin layer of sideromelane shards (≤ 10%) in a matrix of pelletized green clay near the top of the core (Section 1, 55–68 cm), a thicker layer of SILTY SAND near the middle (Section 3, 80–100 cm) and streaks of slightly coarser olive gray SILTY CLAY throughout. The sediments are soft to a depth of 60 cm in Section 3 and firm below.

SMEAR SLIDE SUMMARY

	1-69	1-112	2-14 (M)	3-61	3-92
TEXTURE:					
Sand	–	–	–	–	50
Silt	58	65	50	50	20
Clay	42	35	50	50	30
COMPOSITION:					
Quartz	20	20	25	20	30
Feldspar	15	10	14	10	20
Mica	3	5	4	15	5
Heavy minerals	5	5	–	1	5
Clay	42	35	50	50	30
Volcanic glass	1	–	–	1	–
Pyrite	–	–	–	–	1
Carbonate unspec.	3	5	–	–	4
Foraminifers	3	3	–	TR	1
Calc. nannofossils	5	15	1	–	–
Diatoms	3	2	1	3	3
Radiolarians	–	–	1	TR	1
Sponge spicules	–	–	4	TR	–
Silicoflagellates	–	–	–	–	TR
Plant debris	–	–	1	–	–

SITE 483 HOLE CORE 9 CORED INTERVAL 67.5–77.0 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FOSSIL CHARACTER: FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	METERS
LOWER QUATERNARY	NN19 (N)	CG; FG	FM	AG; CG		1, 2, 3, 4, 5, 6, 7, CC	0.5, 1.0

GRAPHIC LITHOLOGY

DRILLING DISTURBANCE / SEDIMENTARY STRUCTURES / SAMPLES

LITHOLOGIC DESCRIPTION

5GY 3/2

Soft, homogeneous, grayish olive green SILTY CLAY with small concretions of pyrite or chalcopyrite in Section 1 and diatoms (8–10%) disseminated throughout the core.

SMEAR SLIDE SUMMARY

	1-75	3-75
TEXTURE:		
Sand	5	–
Silt	55	50
Clay	40	50
COMPOSITION:		
Quartz	12	15
Feldspar	10	8
Mica	10	15
Heavy minerals	3	–
Clay	40	50
Pyrite	3	–
Foraminifers	1	1
Calc. nannofossils	4	2
Diatoms	10	8
Radiolarians	6	–
Sponge spicules	1	–

SITE 483 HOLE CORE 10 CORED INTERVAL 77.0–86.5 m

TIME – ROCK UNIT | BIOSTRATIGRAPHIC ZONE | FOSSIL CHARACTER: FORAMINIFERS, NANNOFOSSILS, RADIOLARIANS, DIATOMS | SECTION | METERS | GRAPHIC LITHOLOGY | DRILLING DISTURBANCE | SEDIMENTARY STRUCTURES | SAMPLES | LITHOLOGIC DESCRIPTION

LOWER QUATERNARY

NN19 (N)

RG FM RG

Sections: 1, 2; Meters: 0.5, 1.0

VOID
5GY 3/2

Relatively firm, homogeneous, grayish olive green SILTY CLAY grading with depth in Section 2 to SANDY SILT.

SITE 483 HOLE CORE 11 CORED INTERVAL 86.5–96.0 m

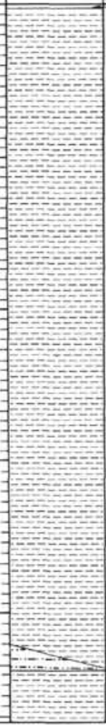
TIME – ROCK UNIT | BIOSTRATIGRAPHIC ZONE | FOSSIL CHARACTER: FORAMINIFERS, NANNOFOSSILS, RADIOLARIANS, DIATOMS | SECTION | METERS | GRAPHIC LITHOLOGY | DRILLING DISTURBANCE | SEDIMENTARY STRUCTURES | SAMPLES | LITHOLOGIC DESCRIPTION

LOWER QUATERNARY

NN19 (N)

RG FM B

Sections: 1, 2, 3, 4, 5; Meters: 0.5, 1.0



VOID
5Y 3/2
5GY 3/2
5Y 3/2
5GY 3/2
5Y 3/2
5GY 3/2
5Y 3/2

Olive gray CLAY and SILTY CLAY with occasional burrows near the top of Section 1 and a small turbidite layer near the base of the core (Section 5, 30–55 cm). The sediments are soft to a depth of 90 cm in Section 2, then firm to the base of Section 3, then soft again to the base of the core.

SMEAR SLIDE SUMMARY

	1-27 (M)	1-75	5-54
TEXTURE:			
Sand	–	1	–
Silt	43	10	30
Clay	57	89	70
COMPOSITION:			
Quartz	20	5	20
Feldspar	10	2	7
Mica	2	–	–
Heavy minerals	3	2	3
Clay	57	89	70
Volcanic glass	5	2	–
Pyrite	2	–	TR
Diatoms	–	TR	–
Radiolarians	1	–	–

SITE 483 HOLE CORE 12 CORED INTERVAL 96.0–105.5 m

TIME – ROCK UNIT | BIOSTRATIGRAPHIC ZONE | FOSSIL CHARACTER: FORAMINIFERS, NANNOFOSSILS, RADIOLARIANS, DIATOMS | SECTION | METERS | GRAPHIC LITHOLOGY | DRILLING DISTURBANCE | SEDIMENTARY STRUCTURES | SAMPLES | LITHOLOGIC DESCRIPTION

LOWER QUATERNARY

NN19 (N)

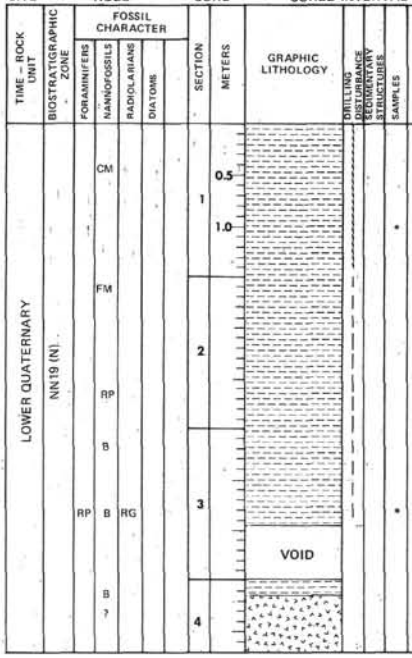
FM FM B

Sections: 1, 2, 3, 4; Meters: 0.5, 1.0

5GY 3/2
VOID

Slightly mottled grayish olive green CLAY with a small clam at a depth of 15 cm in Section 4. The 30 cm of Section 1, then firm to the base of Section 2 and very firm in Sections 3 and 4.

SITE 483 HOLE CORE 13 CORED INTERVAL 105.5–115.0 m



LITHOLOGIC DESCRIPTION

5GY 3/2

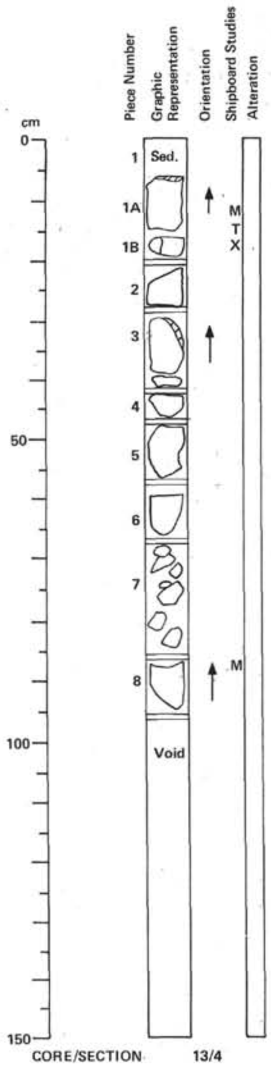
5Y 2/1

5YR 2/1

Firm, mottled grayish olive green CLAY and SILTY CLAY grading to olive black near the base of Section 1 and to brownish black from the top of Section 2 to the base of the sediments at a depth of 7 cm in Section 4. The remainder of the core consists of BASALT.

SMEAR SLIDE SUMMARY

	1-100	3-80
TEXTURE:		
Sand	–	2
Silt	30	14
Clay	70	84
COMPOSITION:		
Quartz	7	5
Feldspar	2	2
Mica	2	3
Heavy minerals	5	6
Clay	70	84
Calc. nannofossils	10	–
Radiolarians	1	–
Plant debris	3	–



HOLE 483, CORE 13

Visual Description

Gray, phyric massive basalt. Plagioclase phenocrysts 5%, locally intergrown with altered olivine. Rock is medium-grained, increases in grain size with depth and is generally fresh. Vesicles $\ll 1\%$, $\ll 1$ mm, filled with blue-green smectite. Pieces 1A and 3 contain veins filled respectively with phillipsite(?) and calcite.

Thin Section Description

Location: Section 4, 15–16 cm

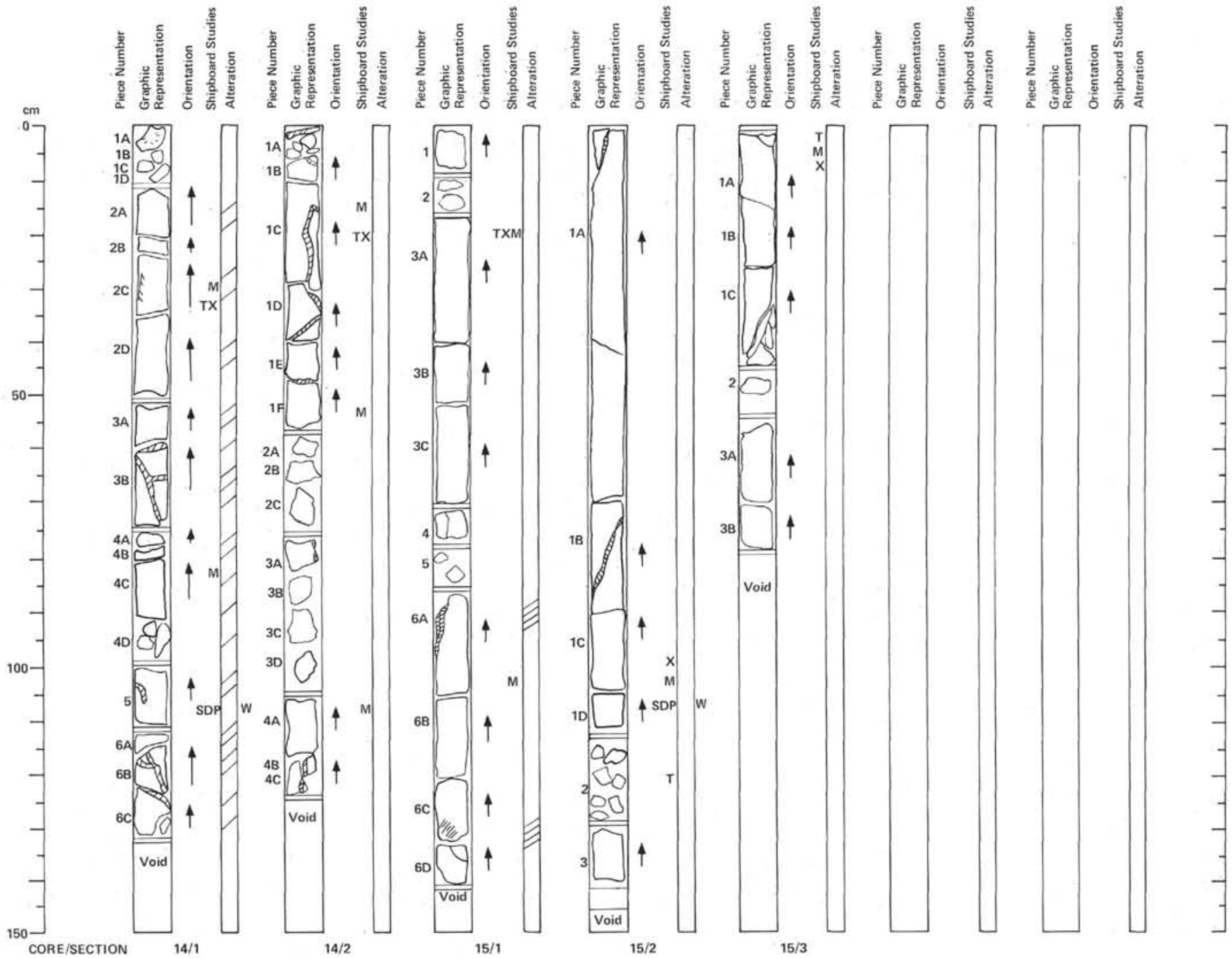
Texture: Sparsely phyric; medium-grained, intergranular

Phenocrysts: Olivine $< 1\%$, 1–2 mm, subhedral, altered to smectite, usually in glomerophyric clots with plagioclase; plagioclase 5–7%, 1–4 mm, subhedral prisms, fresh, usually in glomerophyric clots.

Groundmass: Olivine 2–3%, 0.3–0.5 mm, subhedral, altered to smectite; plagioclase 55%, 0.1–0.6 mm, subhedral laths, fresh; clinopyroxene 30%, 0.2–0.6 mm, anhedral, fresh, $2V_z \sim 35°$; opaques 3%, 0.1–0.3 mm, subhedral, probably magnetite; interstitial material 5–10%, replaced by green smectite.

Vesicles: 1%, 0.2–0.5 mm, round, filled with green smectite and minor carbonate.

Alteration: Olivine and interstitial material replaced by green smectite.



HOLE 483, CORE 14

Visual Description

Medium gray, aphyric, massive basalt. Rock is medium-grained, with grain size increasing somewhat downward from glass selvedge at top of Section 1. Vesicles 5–10%, most abundant in middle part of core, 1–2 mm, round, filled with smectite and carbonate. Veins and fractures abundant, particularly in upper meter of core, 1–5 mm wide, filled with carbonate, smectite, pyrite aod zeolite(?).

Thin Section Description

Location: Section 1, 33–35 cm

Texture: Aphyric, coarse-grained, subophitic to intersertal

Groundmass: Olivine 3–5%, 0.2–0.5 mm, subhedral, partly replaced by smectite and carbonate, some fresh, $2V_z \sim 88°$; plagioclase 55–60%, 0.2–1.2 mm, subhedral laths, fresh; clinopyroxene 30–35%, 0.2–0.7 mm, anhedral, tabular crystals, fresh, $2V_z \sim 35–40°$; opaques 2–3%, 0.03–0.15 mm, subhedral, probably magnetite; interstitial material 5%, replaced by smectite.

Vesicles: 3–5%, 0.5–1 mm, round, filled with smectite and carbonate, many with glassy segregations.

Alteration: Interstitial material and some olivine replaced by smectite and carbonate.

Location: Section 2, 9–100 cm

Texture: Aphyric, coarse-grained, subophitic to intersertal

Groundmass: Olivine 3–5%, 0.2–0.5 mm, subhedral, completely replaced by smectite; plagioclase 55–60%, 0.2–1.2 mm, subhedral laths, fresh; clinopyroxene 30–35%, 0.2–0.7 mm, mostly fresh, some rimmed with smectite or amphibole(?), $2V_z \sim 35–40°$; opaques 2–3%, 0.03–0.15 mm, subhedral, probably magnetite; interstitial material 5–10%, altered to smectite and minor carbonate.

Vesicles: 2–3%, 0.5–1 mm, round, rimmed with prismatic crystals and filled with smectite; some with glassy segregations.

Alteration: Olivine and interstitial material replaced by smectite and minor carbonate. Some green prismatic crystals (amphibole?) rim some pyroxene grains.

HOLE 483, CORE 15

Visual Description

Medium gray, sparsely phyric, massive basalt. Plagioclase phenocrysts 1–3%, <2 mm, sometimes in clots up to 7 mm across with minor clinopyroxene, fresh. Groundmess fine- to medium-grained, uniform, generally fresh. Vesicles <1%, mostly in Section 1, 0.1–0.2 mm, round, filled with smectite and minor carbonate. Veins fairly common, most 2–3 mm wide but some up to 30 mm across, filled with carbonate, smectite, pyrite and minor zeolite(?); some surrounded by alteration halos. Some small vugs are associated with the veins.

Thin Section Description

Location: Section 1, 17–21 cm

Texture: Very sparsely phyric, coarse-grained, subophitic to intersertal

Phenocrysts: Plagioclase <1%, 1–3 mm, subhedral, fresh.

Groundmass: Olivine 3–5%, 0.2–0.5 mm, subhedral, partly replaced smectite, much fresh olivine remains, $2V_z \sim 90°$; plagioclase 50–55%, 0.5–1.2 mm, subhedral laths, fresh; clinopyroxene 35–40%, 0.2–0.6 mm, anhedral to tabular, fresh, $2V_z \sim 35–40°$; opaques 2–3%, 0.05–0.15 mm, subhedral, probably magnetite; interstitial material 5–10%, microcrystalline material mostly replaced with smectite, some quartz and apatite.

Vesicles: < 1%, 0.1–0.2 mm, round, filled with brown smectite and traces of carbonate.

Alteration: Some olivine and interstitial material replaced by smectite.

Location: Section 2, 120–121 cm

Texture: Aphyric, medium-grained, intergranular to intersertal

Groundmass: Olivine 3–5%, 0.3–0.5 mm, subhedral, replaced by smectite and minor carbonate; plagioclase 50%, 0.5–1 mm, subhedral laths, fresh; clinopyroxene 35%, 0.2–0.6 mm, anhedral, fresh, $2V_z \sim 40°$; opaques 3%, 0.06–0.1 mm, often skeletal, probably magnetite; interstitial material 5–10%, replaced by smectite.

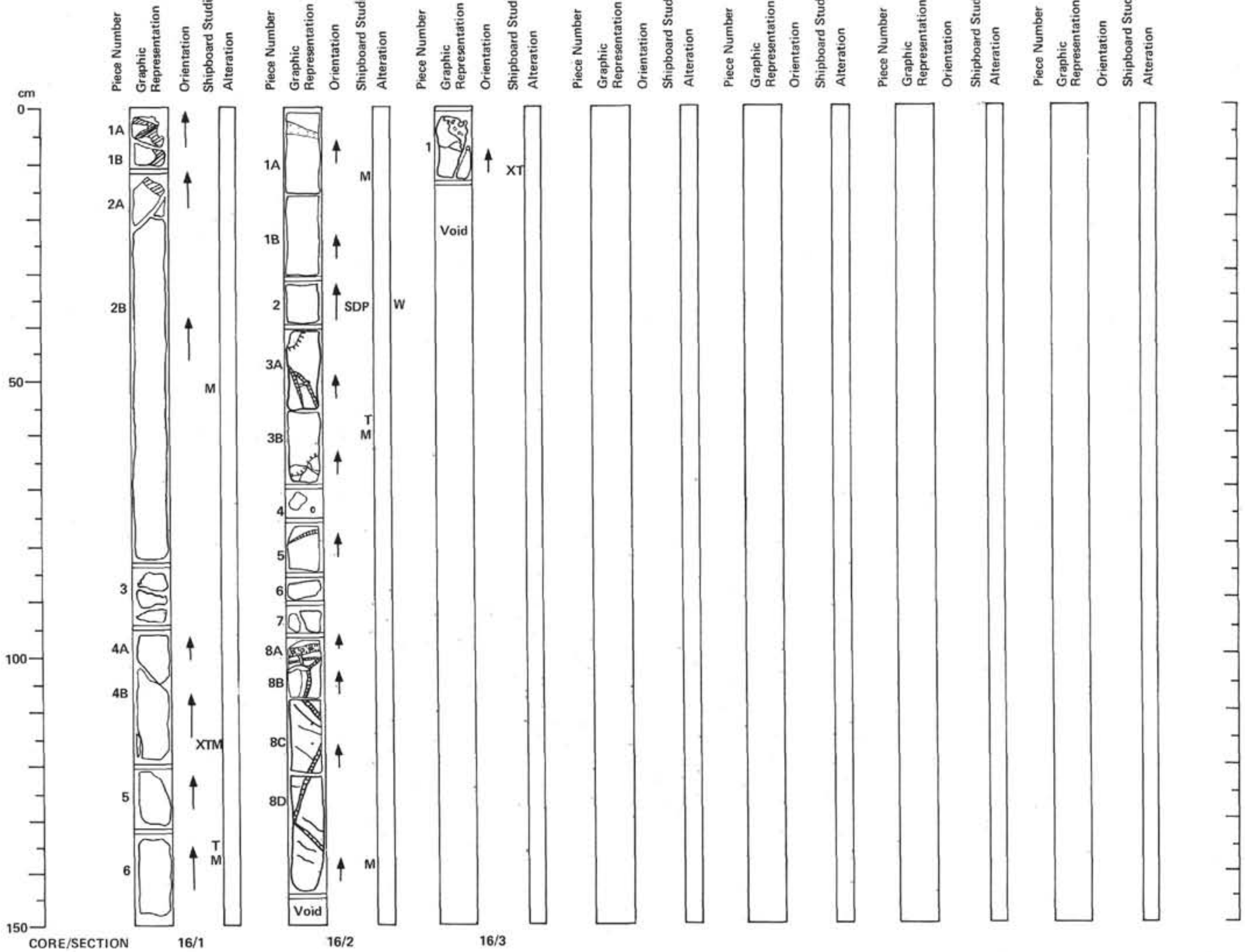
Alteration: Olivine and interstitial material replaced by smectite and minor carbonate.

Location: Section 3, 1–2 cm

Texture: Aphyric, fine- to medium-grained, intergranular to intersertal or slightly subophitic.

Groundmass: Olivine 5–8%, 0.2–0.3 mm, subhedral, replaced by smectite; plagioclase 50%, 0.3–0.5 mm, subhedral laths, fresh; clinopyroxene 35%, 0.1–0.3 mm, anhedral, fresh, $2V_z \sim 40°$; opaques 2–3%, 0.1–0.3 mm, skeletal, probably magnetite; interstitial material 5%, replaced by smectite.

Alteration: Olivine and interstitial material replaced by smectite.



HOLE 483, CORE 16

Visual Description

Medium gray, very sparsely phyric, massive basalt. Plagioclase phenocrysts ≤1%, 1–5 mm, sometimes in glomerophyric clusters with minor clinopyroxene. Groundmass medium-grained, uniform, relatively fresh; some small 'dikelets' in Section 2. Vesicles <1%, <1 mm, round, filled with smectite. Veinlets and fractures sparse, 1–3 mm wide, filled or lined with smectite, carbonate, pyrite, and minor zeolite(?).

Thin Section Descripton

Location: Section 1, 114–115 cm

Texture: Aphyric, fine- to medium-grained, intergranular to intersertal.

Groundmass: Olivine 2–3%, 0.1–0.5 mm, subhedral, replaced by smectite and traces of carbonate; plagioclase 55%, 0.2–0.6 mm, subhedral laths, fresh; clinopyroxene 35–40%, 0.1–0.2 mm, anhedral, fresh, $2V_z \sim 40°$; opaques 2–3%, 0.05–0.2 mm, subhedral, often skeletal, probably magnetite; interstitial material 5%, replaced by smectite.

Vesicles: <1%, 0.2 mm, round, filled with smectite.

Alteration: Olivine and interstitial material replaced by smectite.

Location: Section 1, 133–134 cm

Texture: Very sparsely phyric, medium-grained, intersertal to intergranular

Phenocrysts: Olivine <1%, 1–3 mm, subhedral, partly replaced by smectite; plagioclase <1%, 1–4 mm, subhedral prisms, fresh.

Groundmass: Olivine 5%, 0.5–1 mm, subhedral, mostly replaced by smectite; plagioclase 55–60%, 0.2–1 mm, subhedral laths, fresh, somewhat zoned; clinopyroxene 30–35%, 0.1–0.4 mm, anhedral, fresh, $2V_z \sim 35°$; opaques 1–2%, 0.02–0.2 mm, microcrystalline, largely replaced by smectite, some quartz and apatite.

Alteration: Olivine and interstitial material mostly replaced by smectite.

Location: Section 2, 58–60 cm

Texture: Aphyric, medium-grained, intergranular to intersertal.

Phenocrysts: Plagioclase <1%, subhedral, fresh.

Groundmass: Olivine 2–3%, 0.1–0.3 mm, subhedral, replaced by smectite; plagioclase 55%, 0.1–0.5 mm, subhedral laths, fresh; clinopyroxene 0.1–0.3 mm, anhedral, fresh, $2V_z \sim 40°$; opaques 2–3%, 0.02–0.2 mm, subhedral, probably magnetite; interstitial material 5%, replaced by smectite.

Alteration: Olivine and interstitial material replaced by smectite.

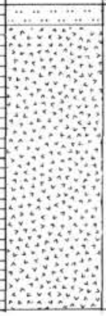
Location: Section 3, 9–10 cm

Texture: Aphyric, fine-grained, intergranular to intersertal.

Groundmass: Olivine 1–2%, 0.05–0.15 mm, subhedral, replaced by smectite; plagioclase 45–50%, 0.1–0.3 mm, subhedral laths, fresh; clinopyroene 35–45%, 0.05–0.15 mm, anhedral, fresh, some poorly crystallized patches, $2V_z \sim 40°$; opaques 2%, 0.01–0.05 mm, subhedral, probably magnetite; interstitial material 5–15%, glassy or poorly crystallized material in irregular patches, mostly fresh, some replacement by smectite.

Alteration: Olivine and some interstitial material replaced by smectite.

SITE 483 HOLE CORE 17 CORED INTERVAL 142.0–151.0 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FOSSIL CHARACTER: FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	SAMPLES
UPPER PLIOCENE	NN18 (N)	RM	RP	B		1	0.5 1.0				*
						2					

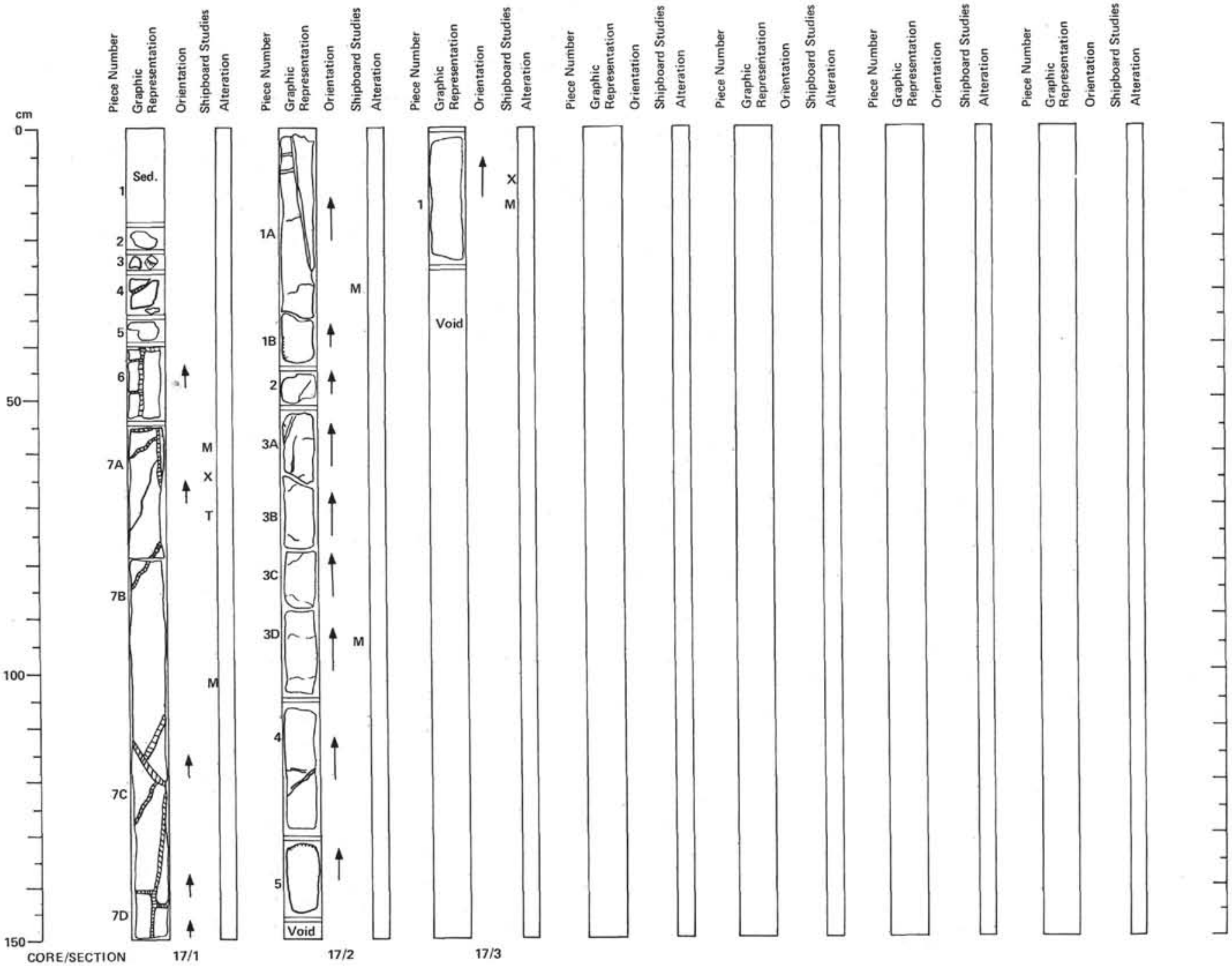
LITHOLOGIC DESCRIPTION

5Y 2/1

Section 1, 0–20 cm: Firm, partially indurated olive black SILTSTONE underlain by coarse-grained BASALT displaying a fine-grained, aphyric contact against the sediments.

SMEAR SLIDE SUMMARY

	1-5
TEXTURE:	
Sand	3
Silt	60
Clay	37
COMPOSITION:	
Quartz	15
Feldspar	10
Mica	5
Heavy minerals	2
Clay	37
Volcanic glass	15
Pyrite	5
Zeolite	10
Carbonate unspec.	1



HOLE 483, CORE 17

Visual Description

Section 1, 0–20 cm: Olive black, firm siltstone.

Section 1, 20 cm–base of core: Medium gray, phyric, massive basalt. Rock is fine- to medium-grained, increasing in grain size downward, generally fresh. Vesicles <1%, ≤0.5 mm, round, filled with smectite. Small 'dikelet' in Section 1, 25 cm. Veinlets and fractures sparse, hairline to 4 mm, filled with smectite and minor carbonate and zeolite(?).

Thin Section Description

Location: Section 1, 64–66 cm

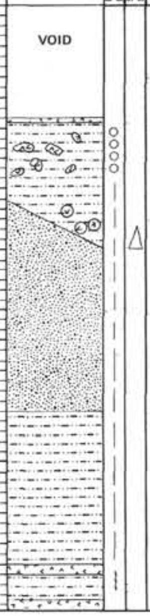
Texture: Aphyric, medium- to coarse-grained, subophitic.

Groundmass: Olivine 5–7%, 0.05–0.2 mm, partly altered to smectitle, $2V_z$ ~90°; plagioclase 45%, 0.2–1.1 mm, subhedral laths, fresh; clinopyroxene 45%, 0.2–1.5 mm, anhedral, ophitic crystals, fresh, $2V_z$ ~40°; opaques 2–3%, 0.02–0.1 mm, subhedral, probably magnetite; interstitial material 1–2%, replaced by smectite and minor carbonate.

Alteration: Olivine rimmed by smectite; minor smectite and carbonate replacing interstitial material.

SITE 483 HOLE CORE 18 CORED INTERVAL 151.0–160.0 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	SAMPLES	LITHOLOGIC DESCRIPTION
UPPER PLIOCENE	NN18 (N)					1	0.5 1.0	VOID				
		RM	CM	B							•	10YR 2/2
		RM	FM	B		2					•	
		RP		B							•	
		RM		B		3					•	5Y 2/1
		RG	FP	B							•	
		CM	CM	B		4					• •	



Section 1, 110–115 cm: Small piece of altered BASALT.

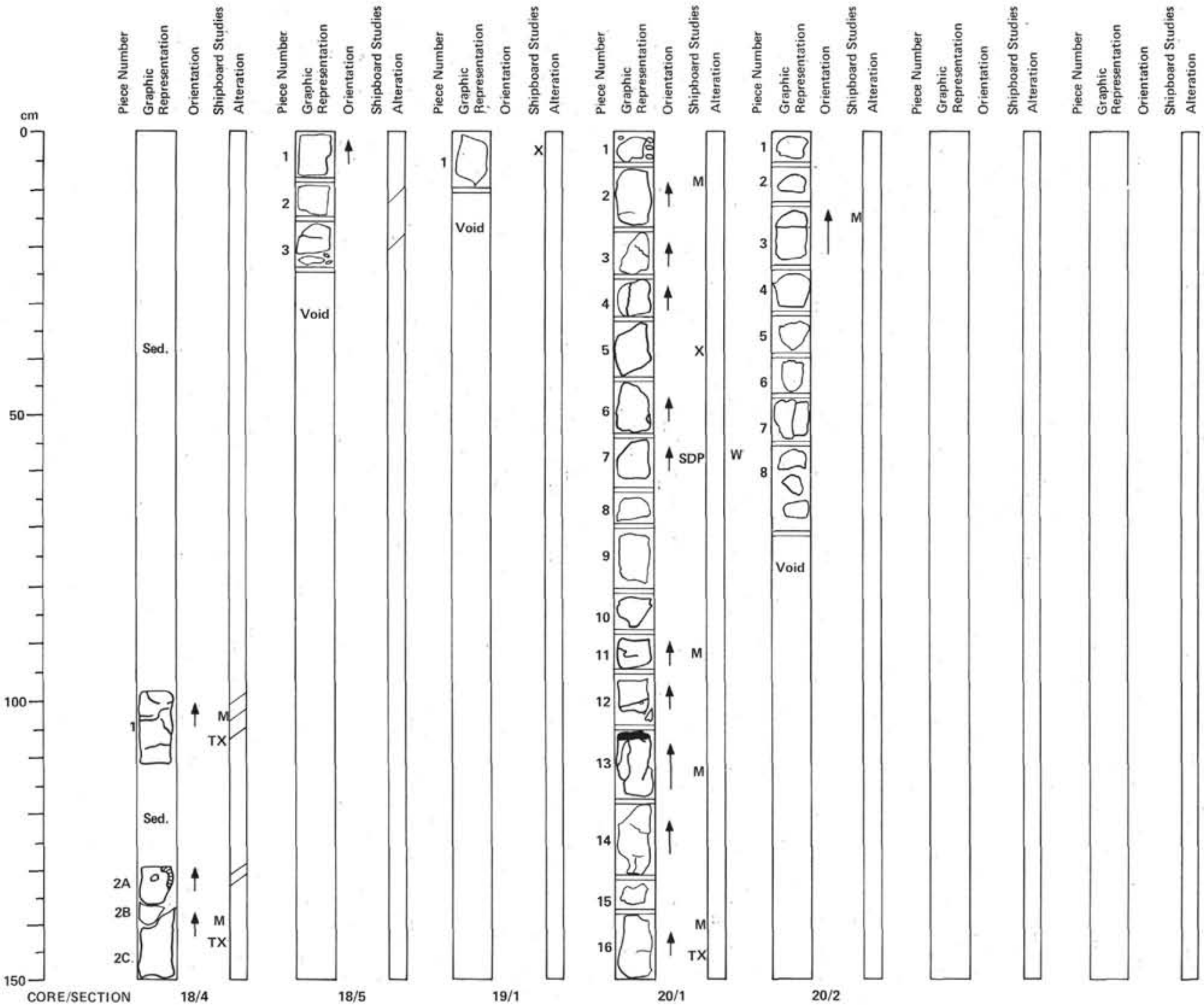
Section 1, 115–Section 3, 100 cm: SILTY CLAY containing numerous pieces of BASALT and shards of glass, grading with depth in Section 2 to homogeneous SANDY SILT.

Section 3, 100 cm–Section 4, 135 cm: Firm SILTY CLAY with a thin layer or cobble of BASALT at a depth of 100–110 cm in Section 4.

Section 4, 135–150 cm: BASALT.

SMEAR SLIDE SUMMARY

	1-123	2-36	2-126	3-100	3-127	4-95	4-125
TEXTURE:							
Sand	2	5	30	30	25	3	5
Silt	46	40	46	32	30	36	45
Clay	52	55	24	38	45	61	50
COMPOSITION:							
Quartz	25	1	30	35	20	15	20
Feldspar	10	15	15	12	10	5	10
Mica	2	1	3	TR	5	TR	1
Heavy minerals	TR	TR	TR	TR	4	2	3
Clay	52	55	24	38	45	61	50
Volcanic glass	1	15	10	TR	1	5	1
Clinopyroxenes	–	–	10	5	–	–	–
Pyrite	3	5	5	10	8	1	10
Zeolite	10	5	3	TR	–	10	5
Carbonate unspec.	–	–	TR	–	–	–	–
Foraminifers	–	TR	TR	–	–	TR	TR
Calc. nannofossils	–	3	TR	TR	3	1	TR
Diatoms	–	TR	–	–	–	–	TR
Silicoflagellates	–	–	TR	–	–	–	–



HOLE 483, CORE 18

Visual Description

Section 1, 0–109 cm: Void.

Section 1, 109 cm–Section 4, 135 cm: Firm, silty clay with numerous pieces of basalt in Section 1.

Section 4, 135 cm–base of core: Medium gray, aphyric, massive basalt. Rock is fine- to medium-grained with grain size increasing slightly downward; generally fresh. Vesicles 1%, < 1 mm, round, filled with smectite; small vug in Section 4, 131 cm is 5 mm across, filled with carbonate, smectite, and minor zeolite(?); some veins have narrow alteration halos.

Thin Section Description

Location: Section 4, 103–105 cm.

Texture: Aphyric, medium- to coarse-grained, mostly subophitic

Groundmass: Olivine 5%, 0.1–0.2 mm, subhedral, partly replaced by smectite, $2V_z \sim 90°$; plagioclase 40–45%, 0.2–1 mm, subhedral, fresh; clinopyroxene 40%, 0.1–1.2 mm, anhedral, subophitic, fresh, $2V_z \sim 40°$; opaques 2–3%, 0.05–0.15 mm, subhedral, probably magnetite; interstitial material 2%, replaced by smectite and minor carbonate.

Veins and Fractures: Rare, hairline, filled with smectite.

Alteration: Olivine and interstitial material replaced by smectite and minor carbonate.

Location: Section 4, 140–142 cm

Texture: Very sparsely phyric, medium-grained, intersertal to intergranular

Phenocrysts: Olivine <1%, 0.5 mm, subhedral, altered to smectite; plagioclase <1%, 2–3 mm, subhedral glomerocrysts, fresh

Groundmass: Olivine 5–7%, 0.1–0.5 mm, subhedral, replaced by brown smectite; plagioclase 50%, 0.2–1 mm, subhedral laths, fresh; clinopyroxene 35%, 0.1–0.3 mm, anhedral, fresh, $2V_z \sim 40°$; opaques 2–3%, 0.05–0.2 mm, subhedral, probably magnetite; interstitial material 5%, mostly replaced by smectite.

Vesicles: <1%, 0.5 mm, round, filled with brown smectite.

Alteration: Olivine and interstitial material replaced by smectite.

HOLE 483, CORE 19

Visual Description

Gray, medium-grained, aphyric, massive(?) basalt. Vesicles 3–5%, < 1 mm, spherical, filled with smectite.

HOLE 483, CORE 20

Visual Description

Section 1, 0–6 cm: Medium gray, fine-grained, aphyric, massive(?) basalt. Vesicles 2–3%, < 1 mm, spherical, filled with smectite.

Section 1, 6 cm–base of core: Medium gray, moderately phyric, pillowed(?) basalt. Plagioclase phenocrysts 5–7%, 2–6 mm, euhedral to subhedral, fresh; olivine phenocrysts 3%, 2–4 mm, euhedral, partly replaced by smectite; clinopyroxene phenocrysts < 1%, 1–2 mm, anhedral, fresh, sometimes in clots with plagioclase; phenocryst size and abundance decreases toward base of core in Section 2. Groundmass is fine-grained to glassy; glass selvedge occurs in Section 1, 105 cm; groundmass fresh to weakly altered. Vesicles 1–2%, most abundant near base of core, < 1 mm, spherical, filled with smectite and carbonate. Fractures and veinlets sparse, hairline to 2 mm, lined or filled with smectite, carbonate and rare pyrite.

Thin Section Description

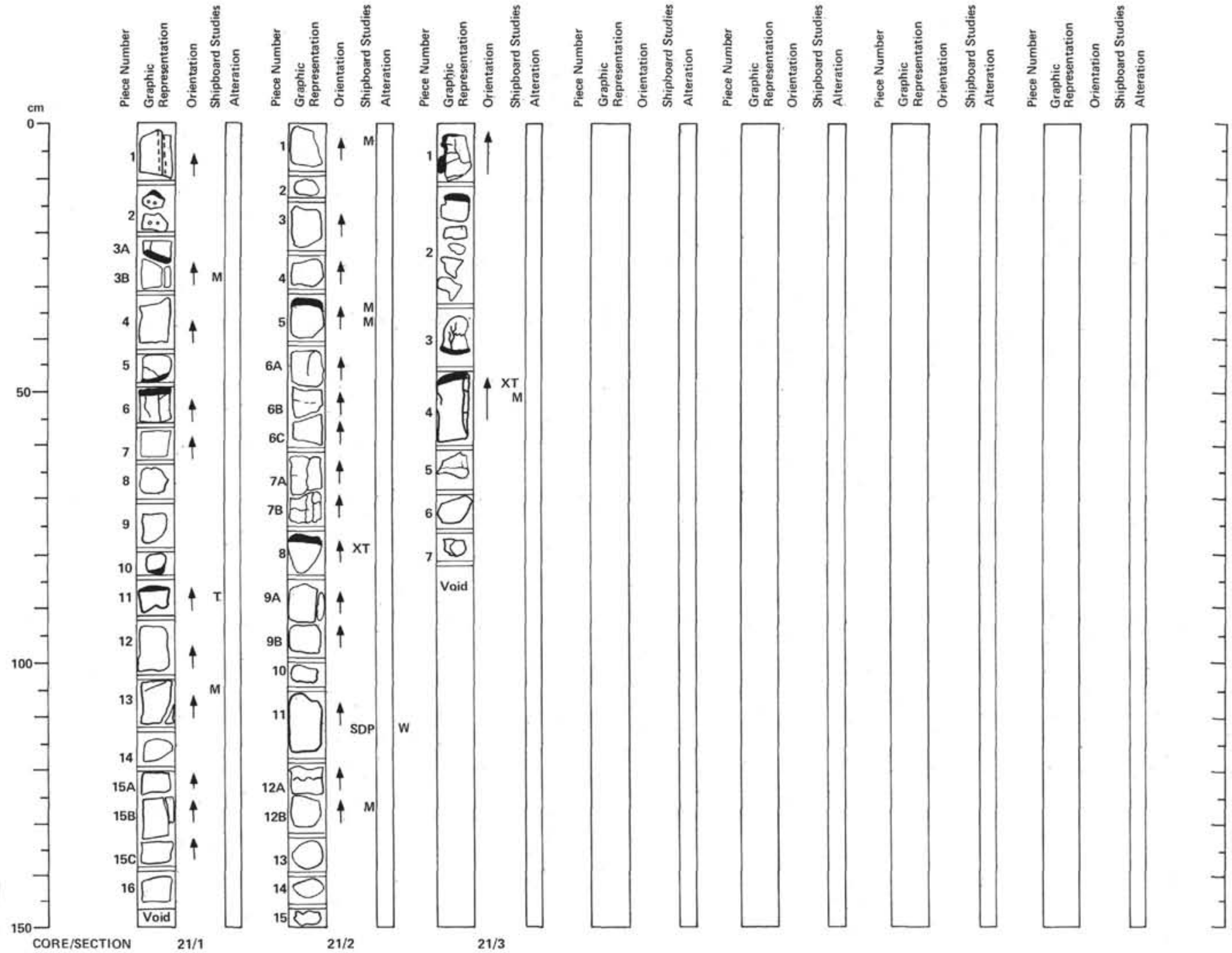
Location: Section 1, 144–146 cm

Texture: Moderately phyric, intergranular, variolitic

Phenocrysts: Olivine 3–4%, 1–2 mm, subhedral, replaced by smectite; plagioclase 55%, 0.3–0.8 mm, subhedral, often skeletal, fresh; clinopyroxene 30%, 0.05–0.2 mm, granular, often poorly crystallized, fresh, $2V_z \sim 40°$; opaques 3–4%, minute grains and laths, probably magnetite.

Vesicles: < 1%, < 0.8 mm, round, filled with brown smectite, some with segregation patches.

Alteration: Olivine altered to smectite and minor carbonate.



HOLE 483, CORE 21

Visual Description

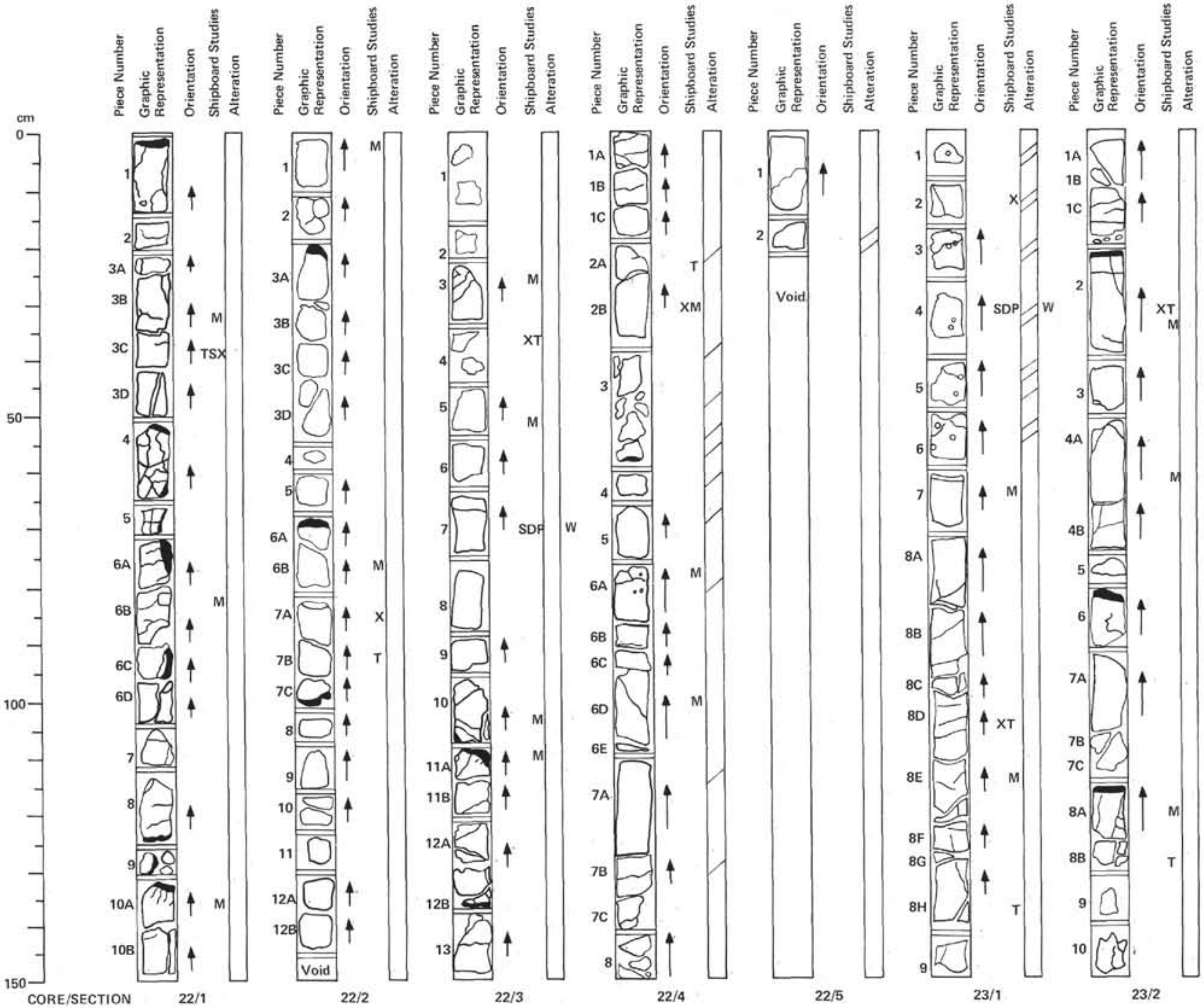
Dark gray, moderately phyric, pillowed basalt. Plagioclase phenocrysts 5%, generally 2–4 mm, euhedral to subhedral, fresh, a few rounded crystals to 7 mm across and a few glomerocrysts with olivine and clinopyroxene; olivine phenocrysts 1–2%, 1–3 mm, euhedral to subhedral, mostly altered to green smectite and carbonate, some partly fresh; clinopyroxene phenocrysts <1%, 1–2 mm, anhedral, both in glomerophyric clots with plagioclase and as rounded single crystals, fresh. Groundmass is fine-grained to glassy; glass selvedges occur in Section 1 at 12, 25, 48, 50, 83, and 85 cm, in Section 2 at 33 and 77 cm and in Section 3 at 2, 13, 42, and 46 cm. Vesicles <1%, mostly in variolitic zones next to glassy selvedges, spherical, <1 mm, partly filled with smectite. Fractures and veinlets fairly common, hairline to 1 mm, filled with smectite and locally pyrite. Rock generally fresh; glassy selvedges partly altered to smectite and groundmass weakly altered in narrow halos along fractures.

Thin Section Description

Location: Section 1, 86–88 cm
Texture: Sparsely phyric, quench
Phenocrysts: Olivine 1%, 0.2–0.5 mm, subhedral, replaced by smectite and carbonate; plagioclase 3–5%, 0.2–1.5 mm, subhedral laths, fresh, often zoned; clinopyroxene <1%, 0.5–1 mm, round, usually *intergrown with plagioclase*, fresh, $2V_z \sim 40°$.
Groundmass: Olivine 1–2%, 0.05–0.1 mm, euhedral, replaced by smectite; plagioclase 15%, 0.05–0.3 mm, acicular, fresh; clinopyroxene, 3%, 0.03–0.05 mm, granular, fresh; opaques 5%, 0.005-0.01 mm, octahedra and granules, probably magnetite; matrix 70–75%, quench mixture with poorly developed sheaf-like patterns.
Vesicles: <1%, 0.5–1 mm, round, lined with smectite
Alteration: Olivine altered to smectite and minor carbonate

Location: Section 2, 79–81 cm
Texture: Sparsely phyric, quench
Phenocrysts: Olivine <1%, 0.2–2.5 mm, euhedral, replaced by smectite and carbonate; plagioclase 5%, 0.5–2 mm, subhedral, fresh, often in clusters; clinopyroxene <1%, 0.05 mm, rounded grains and some microphenocrysts intergrown with plagioclase; spinel < 1%, slightly rounded, fresh
Groundmass: Glassy material, incipiently crystallized 93–95%, slightly variolitic.
Vesicles: <1%, 0.2–1 mm, round, filled with smectite or open
Alteration: Olivine replaced by smectite and minor carbonate

Location: Section 3, 52–54 cm
Texture: Sparsely phyric, quench
Phenocrysts: Olivine 1%, 0.5–1 mm, subhedral, replaced by smectite and carbonate; plagioclase 5%, 1–3 mm, subhedral, fresh, often strongly zoned; clinopyroxene 1%, 0.1–0.5 mm, anhedral, intergrown with plagioclase, fresh, $2V_z \sim 40°$; some crystals have good sector zoning.
Groundmass: Plagioclase 5%, 0.1–0.2 mm, acicular crystals, fresh; clinopyroxene <1%, 0.05–0.1 mm, granular, fresh; opaques 1–2%, minute granules of magnetite; microcrystalline mesostasis 85–90%, fresh
Vesicles: < 1%, <0.5 mm, irregular, filled with smectite
Alteration: Olivine replaced by smectite and carbonate



HOLE 483, CORE 22

Visual Description

Section 1, 0 cm–Section 4, 60 cm: Dark gray, moderately phyric, pillowed basalt. Plagioclase phenocrysts 5%, 2–3 mm, euehdral to subhedral, often in glomerophyric clots with olivine and clinopyroxene; olivine 1%, generally 1–3 mm, rare crystals to 8 mm, euhedral to subhedral, partly altered to smectite and carbonate; clinopyroxene phenocrysts < 1%, 1–3 mm, anhedral, intergrown with plagioclase, fresh. Groundmass fine-grained to glassy, often mottled, generally fresh. Glass selvedges at 1, 52, 63–78, 91–95, 124, and 132 cm in Section 1, at 21, 68, and 100 cm in Section 2, at 108 and 136 cm in Section 3 and 58 cm in Section 4; selvedges are 1–2 cm thick, flat or curved, partly altered to smectite and pyrite along curved, subhorizontal fractures. Vesicles 1%, most common in zones 5–10 cm from glassy selvedges, < 1 mm, spherical, filled with blue-green smectite and rare zeolite(?). Fractures and veinlets common, hairline to 2 mm wide, filled with blue-green smectite, carbonate and minor pyrite; larger vein 5 mm–1 cm wide occurs in Section 4, 45–55 cm, filled with smectite. Rock generally slightly altered in narrow halos adjacent to fractures.

Section 4, 60 cm–base of core: Dark gray, moderately phyric, massive basalt. Plagioclase phenocrysts 5–8%, 2–3 mm, euhedral to subhedral, fresh, sometimes in glomerophyric clots with olivine and clinopyroxene; olivine phenocrysts, 2–3%, 2–3 mm, euhedral to subhedral, altered to smectite and minor carbonate; clinopyroxene phenocrysts < 1%, 1–2 mm, usually intergrown with plagioclase, fresh. Groundmass is fine- to medium-grained, generally fresh except near veins. Vesicles 0.5–2%, mostly in Section 4, 75–130 cm, 1–2 mm, spherical, filled with smectite and minor carbonate. Veins and fractures fairly common, hairline to 2 mm, filled with smectite, carbonate and minor pyrite. Groundmass altered to smectite and pyrite in narrow halos around some veins.

Thin Section Description

Location: Section 1, 40–42 cm

Texture: Sparsely phyric, quench

Phenocrysts: 2–3%, 0.5–2 mm, euhedral to subhedral, replaced by smectite and minor carbonate; plagioclase 6–7%, 0.5–2.5 mm, subhedral, fresh, strongly zoned; clinopyroxene < 1%, 0.5–1 mm, rounded, slightly zoned

Groundmass: Olivine 1%, 0.05–0.1 mm, anhedral, replaced by smectite; plagioclase 15–20%, 0.1–0.5 mm, acicular, fresh; clinopyroxene 60–65%, poorly crystallized, radiating sheaves, fresh; opaques 3–4%, 0.005–0.01 mm, granular

Alteration: Olivine altered to smectite and minor carbonate

Location: Section 2, 93–95 cm

Texture: Sparsely phyric, quench

Phenocrysts: Olivine 1%, 0.5 mm, subhedral to euhedral, altered to smectite and minor carbonate; plagioclase 2%, 0.5–1.5 mm, subhedral, fresh; clinopyroxene <1%, 1 mm, rounded, fresh

Groundmass: Olivine 1%, 0.05–0.1 mm, subhedral, altered to smectite; plagioclase 5%, 0.1–1 mm, acicular, seriate in size, fresh; microcrystalline mesostasis, 90%, poorly crystallized mixture of clinopyroxene and plagioclase, fresh

Vesicles: < 1%, 0.2–0.5 mm, round, filled with smectite, some with segregation rims.

Alteration: Olivine replaced by smectite and minor carbonate

Location: Section 3, 38–40 cm
Texture: Sparsely phyric, quench
Phenocrysts: Olivine 2–3%, 0.5–2 mm, subhedral to euhedral, replaced by smectite; plagioclase 5%, 1–2 mm, subhedral laths, fresh, often zoned; clinopyroxene <1%, 0.2–0.4 mm, anhedral, intergrown with plagioclase, fresh, $2V_z \sim 40°$.
Groundmass: Olivine 1%, 0.05–0.1 mm, subhedral, replaced by smectite; plagioclase 20%, 0.2–0.5 mm, acicular, fresh; clinopyroxene 40%, poorly crystallized sheaves, fresh; opaques 2–3%, minute granules, probably magnetite; microcrystalline mesostasis 30%, fresh
Vesicles: < 1%, 0.5 mm, round, segregation type
Alteration: Olivine replaced by smectite

Location: Section 4, 35–38 cm
Texture: Moderately phyric, quench
Phenocrysts: Olivine 2–3%, 0.3–3 mm, subhedral to euhedral, replaced by smectite, minor carbonate and some pyrite(?); plagioclase 8–10%, 0.5–2.5 mm, subhedral, strongly zoned, fresh; clinopyroxene <1%, 1–1.5 mm, rounded, fresh
Groundmass: Olivine 1–2%, 0.05–0.1 mm, subhedral, replaced by smectite; plagioclase 20–25%, 0.1–0.5 mm, seriate, often acicular, some in variolitic clusters, fresh; clinopyroxene 60%, poorly crystallized, radiating sheaves, fresh; opaques 2–4%, minute grains, some laths to 0.1 mm.
Vesicles: <1%, 0.5 mm, round, filled with smectite
Alteration: Olivine replaced by smectite and minor carbonate

HOLE 483, CORE 23

Visual Description

Section 1, 0 cm–Section 2, 20 cm: Dark gray, moderately phyric, massive basalt. Plagioclase phenocrysts 5–10%, increasing in abundance downward, 1–5 mm, euhedral to subhedral, fresh; olivine phenocrysts 2–3%, mostly 2–5 mm with some up to 10 cm, euhedral to subhedral, partly altered to smectite but often fresh; clinopyroxene 1%, 1–2 mm, rounded, fresh. Groundmass is medium-grained, uniform, generally fresh. Vesicles 1–2%, chiefly in upper 50 cm of Section 1, <1 mm, spherical, filled with smectite and carbonate. Fractures and veinlets common, hairline to 1 mm, lined or filled with smectite, carbonate and pyrite.

Section 2, 20 cm–base of core: Dark gray, moderately phyric pillowed(?) basalt. Plagioclase phenocrysts 5–10%, abundance decreases somehwat with depth, 2–5 mm, possibly 2 generations, one euhedral, the other anhedral, fresh; olivine phenocrysts 1–3%, 1 mm, euhedral to subhedral, altered to smectite; clinopyroxene phenocrysts < 1%, 1–1.5 mm, anhedral, usually intergrown with plagioclase, fresh. Groundmass fine-grained to glassy; glass selvedges at 21, 81, and 115 cm in Section 2, partly altered to smectite. Vesicles 0.5–2%, < 1 mm, spherical, filled with smectite and minor carbonate; and pyrite.

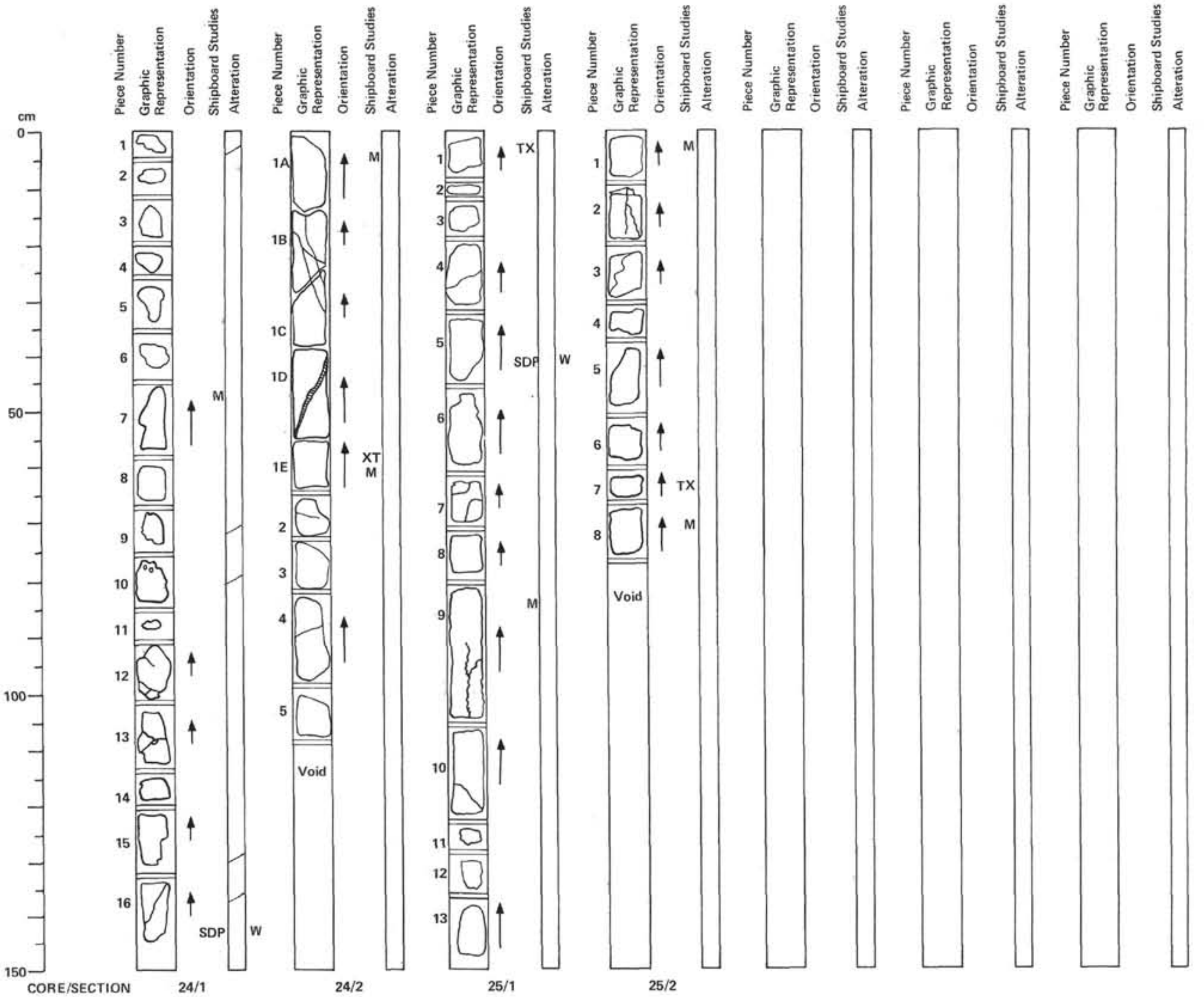
Thin Section Description

Location: Section 1, 108–110 cm
Texture: Sparsely to moderately phyric, intergranular to intersertal
Phenocrysts: Olivine 3%, 1.0–1.6 mm, subhedral, partly replaced by smectite; plagioclase 5%, 0.5–3 mm, subhedral, fresh, strongly zoned; clinopyroxene 1%, 0.5–1.5 mm, round, fresh, zoned, $2V_z \sim 45°$.
Groundmass: Olivine 2–3%; 0.05–0.15 mm, subhedral, mostly replaced by smectite; plagioclase 45%, 0.1–0.5 mm, subhedral, fresh; clinopyroxene 35%, 0.1–0.3 mm, anhedral, fresh, $2V_z \sim 40°$; opauqes 2–3%, 0.01–0.05 mm, anhedral, probably magnetite; interstitial material 5–7%, mostly glassy, slightly replaced by smectite.
Vesicles: < 1%, 0.5 mm, round, filled with smectite and carbonate
Alteration: Olivine and minor interstitial material partly replaced by smectite.

Location: Section 1, 136–138 cm
Texture: Sparsely phyric, medium-grained, intergranular to intersertal
Phenocrysts: Olivine 2%, 2–6 mm, subhedral, partly replaced by smectite, mostly fresh, $2V_z \sim 88°$; plagioclase 5–7%, 1–2 mm, subhedral, fresh, often in clusters with olivine
Groundmass: Olivine 3%, 0.1–0.3 mm, subhedral, mostly replaced by smectite; plagioclase 45%, 0.2–0.5 mm, subhedral, fresh; clinopyroxene 35%, 0.1–0.4 mm, anhedral, fresh, $2V_z \sim 45°$; opaques 1–2%, minute granules in interstitial patches; interstitial material 5–10%, mostly glassy, fresh
Vesicles: < 1%, 0.5 mm, round to irregular, filled with smectite and carbonate
Alteration: Olivine partly replaced by smectite.

Location: Section 2, 36–39 cm
Texture: Sparsely to moderately phyric, intersertal
Phenocrysts: Olivine 1–2%, 0.2–0.5 mm, subhedral, resorbed, replaced by smectite; plagioclase 5–7%, 1–2 mm, subhedral, fresh, strongly zoned, usually in glomerocrysts; clinopyroxene < 1%, 1–1.5 mm, subhedral, fresh, in clusters with plagioclase, $2V_z \sim 45°$.
Groundmass: Olivine 1–2%, 0.1–0.2 mm, subhedral, replaced by smectite; plagioclase 40%, 0.2–0.5 mm, subhedral, fresh; clinopyroxene 40%, 0.05–0.2 mm, subhedral to anhedral, fresh, $2V_z \sim 40°$; opaques 2–3%, minute granules in interstitial patches; interstitial material 10%, mostly glassy, fresh
Vesicles: 1–2%, 0.3–1 mm, round to irregular, filled with smectite, some with segregation patches
Alteration: Olivine altered to smectite

Location: Section 2, 126–128 cm
Texture: Sparsely phyric, quench
Phenocrysts: Olivine 1–2%, 0.5–1 mm, subhedral, altered to smectite; plagioclase 5%, 0.5–1.5 mm, subhedral, fresh
Groundmass: Poorly crystallized quench mixture with some sheaf-like structure 90–95%
Vesicles: < 1%, 0.5–1 mm, round, open or filled with smectite, some with segregation patches
Alteration: Olivine altered to smectite



HOLE 483, CORE 24

Visual Description

Section 1, 0–5 cm: Gray, medium-grained, sparsely phyric basalt. Probably ap iece from lithologic Unit 1 that has fallen into the hole.

Section 1, 5 cm–base of core: Medium to dark gray, sparsely phyric, massive basalt. Plagioclase phenocrysts 1–3%, 1–2 mm, subhedral to euhedral, fresh; sometimes in glomerophyric clots with olivine; olivine phenocrysts < 1%, 1 mm, euhedral to subhedral, completely rpelaced by green smectite. Groundmass fine-grained to medium-grained, grain size decreases rapidly in lower 30 cm of core, generally fresh. Vesicles < 1%, ≤ 1 mm, spherical, irregularly distributed, filled with green smectite; two small vugs 3–7 mm across occur in Section 1, 77 cm, irregular, partly filled with green and brown smectite. Fractures and veinlets sparse, generally hairline to 1 mm, one vein in Section 2 between 40 and 55 cm is 5 mm wide; veins filled with smectite, carbonate and pyrite; carbonate occurs mostly at vein intersections.

Thin Section Description

Location: Section 2, 58–60 cm

Texture: Very sparsely phyric, medium-grained, intergranular to intersertal

Phenocrysts: Plagioclase 1–2%, 1–2 mm, subhedral, fresh, somewhat zoned

Groundmass: Olivine 3–5%, 0.2–0.5 mm, subhedral, replaced by smectite; plagioclase 45–50%, 0.2–0.7 mm, subhedral, fresh; clinopyroxene 25–30%, 0.05–0.15 mm, anhedral, fresh, $2V_z$ ~40°; opaques 5%, 0.005–0.1 mm, granular, probably magnetite; interstitial material 7–8%, poorly crystallized material, partly replaced by smectite

Alteration: Olivine and some interstitial material replaced by smectite and traces of carbonate

HOLE 483, CORE 25

Visual Description

Section 1, 0–8 cm: Light gray, medium-grained, moderately phyric basalt. Probably a piece of Unit 1 that has fallen into the hole.

Section 1, 8 cm–base of core: Medium to dark gray, sparsely phyric, massive basalt. Plagioclase phenocrysts 1–3%, 1–3 mm, euhedral to subhedral, fresh, sometimes in glomerophyric clusters; olivine phenocrysts <1%, 1–1.5 mm, euhedral to subhedral, replaced by smectite. Groundmass is very fine-grained to medium-grained, grain size increases with depth, fresh to weakly altered. Vesicles 1–3%, most abundant in Section 1, 10–20 cm, ≤ 1 mm, spherical, filled with smectite. Fractures and veinlets sparse, hairline to 1 mm wide, lined or filled with smectite, carbonate and rare pyrite.

Thin Section Description

Location: Section 1, 3–5 cm

Texture: Sparsely phyric, fine-grained, intergranular to intersertal

Phenocrysts: Olivine 1%, 0.5–1 mm, subhedral, partly replaced by smectite, some fresh, $2V_z$ ~ 85°; plagioclase 5–7%, 0.5–3 mm, subhedral, strongly zoned, often in glomerocrysts

Groundmass: Olivine 2–3%, 0.05–0.2 mm, subhedral, altered to smectite; plagioclase 45%, 0.1–0.4 mm, subhedral laths, fresh; clinopyroxene 35–40%, 0.1–0.3 mm, anhedral, fresh, $2V_z$ ~40°; opaques 3–4%, 0.05–0.2 mm, subhedral, probably magnetite; interstitial material 5–6%, glassy to microcrystalline patches, mostly altered to smectite

Vesicles: 1–2%, 0.2–0.5 mm, round, filled with smectite and minor carbonate

Alteration: Olivine and interstitial material partly altered to smectite

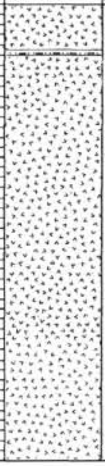
Location: Section 1, 67–69 cm

Texture: Aphyric, coarse-grained, ophimottled

Groundmass: Olivine 5–8%, 0.1–0.5 mm, subhedral, replaced by smectite and minor carbonate; plagioclase 30%, 0.5–2.5 mm, subhedral laths, fresh; clinopyroxene 25%, 0.5–1 mm, anhedral, in ophitic clots with plagioclase, $2V_z$ ~ 35°, fresh; opaques 2–3%, 0.05–0.1 mm, subhedral, probably magnetite; interstitial material 30–35%, microcrystalline mixture of opaques, pyroxene, and apatite, partly replaced by smectite

Alteration: Olivine and interstitial material replaced by smectite and minor carbonate

SITE 483 HOLE CORE 26 CORED INTERVAL 200.0–204.5 m

TIME-ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	SAMPLES	LITHOLOGIC DESCRIPTION
		B	B	B		1	0.5 1.0				•	
						2						
						3						

FOSSIL CHARACTER: FORAMINIFERS, NANNOFOSSILS, RADIOLARIANS, DIATOMS

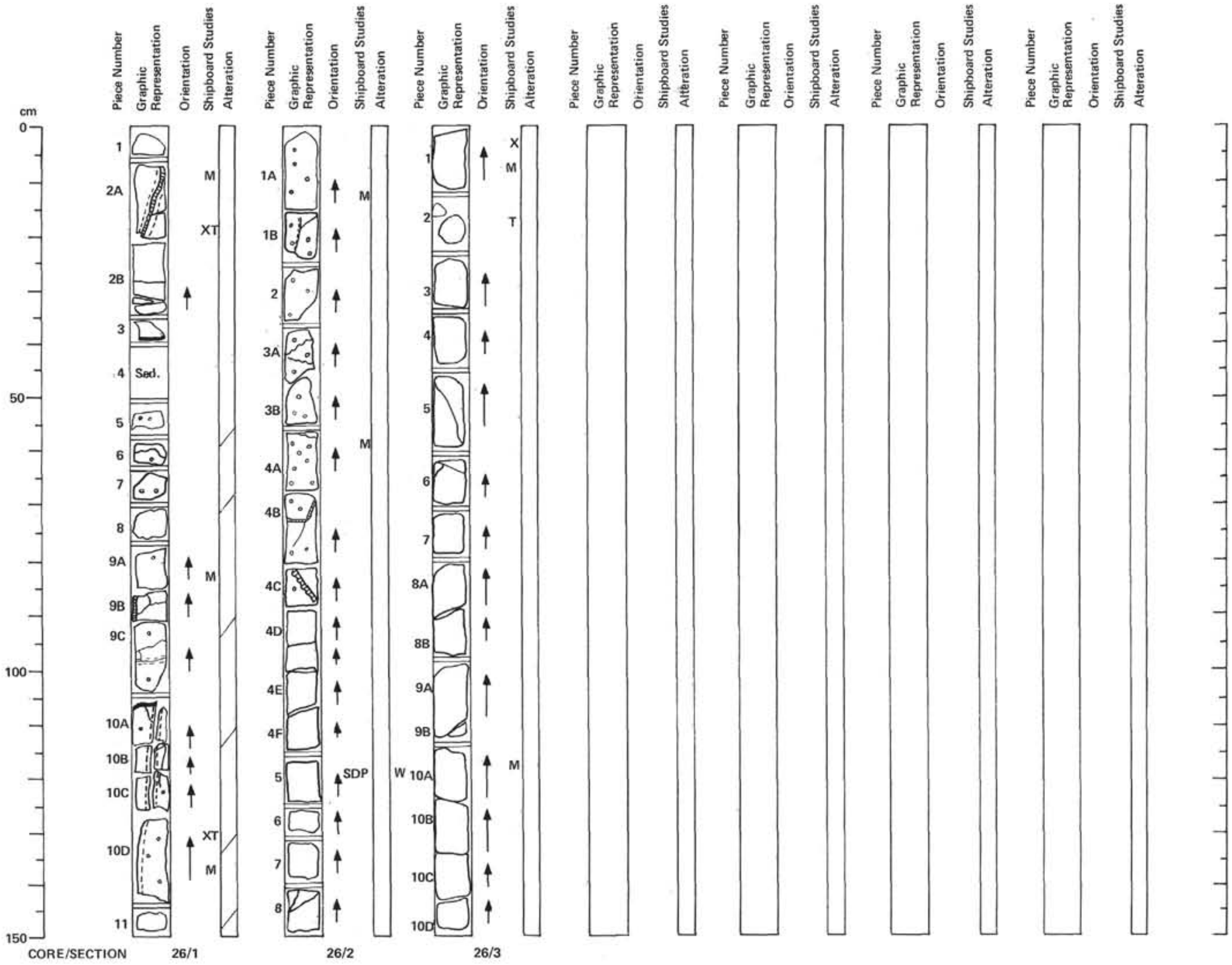
Section 1, 0–40 cm: Massive BASALT with a devitrified glassy margin against the underlying sediments. The basal surface of this contact is coated with patchy sulfides.

Section 1, 40–50 cm: Thin layer of black, indurated SILTY CLAYSTONE.

Section 1, 50 cm–Section 3, 150 cm: Massive BASALT.

SMEAR SLIDE SUMMARY

	1-45
TEXTURE:	
Sand	15
Silt	30
Clay	55
COMPOSITION:	
Quartz	10
Feldspar	15
Mica	2
Heavy minerals	5
Clay	55
Volcanic glass	10
Pyrite	1
Zeolite	1?
Carbonate unspec.	TR



HOLE 483, CORE 26

Visual Description

Section 1, 0–40 cm: Medium to dark gray, sparsely phyric, massive basalt. Plagioclase phenocrysts 1–2%, 1–2 mm, euhedral to subhedral, fresh; olivine phenocrysts 1%, <2 mm, subhedral, often resorbed, altered to smectite, with minor carbonate and pyrite. Groundmass is fine- to medium-grained, grain size decreases toward glassy margin at 40 cm; glass devitrified and partly coated with pyrite. Vein extends from 7 to 21 cm, 5–8 mm wide, filled with smectite, carbonate and minor pyrite.

Section 1, 40–50 cm: Black, highly indurated, silty claystone.

Section 1, 50 cm–base of core: Medium gray, very sparsely phyric, massive basalt. Plagioclase phenocrysts 1%, mostly <2 mm, some crystals and glomerophyric clusters are up to 6 mm, euhedral to subhedral, fresh; olivine <1%, <1 mm, euhedral to subhedral, sometimes resorbed, altered to smectite. Groundmass fine- to medium-grained with several cooling breaks, sometimes mottled, fresh to moderately altered in halos along veins. Vesicles 1–5%, abundance decreases in lower 70 cm of core, 1–3 mm, spherical, partly filled with smectite, minor carbonate and zeolite(?). Fractues and veinlets moderately common, hairline to 3 mm, filled with smectite, carbonate and minor pyrite, some slickensided; some fractures appear bleached and some have dark halos 2–3 mm wide containing pyrite.

Thin Section Description

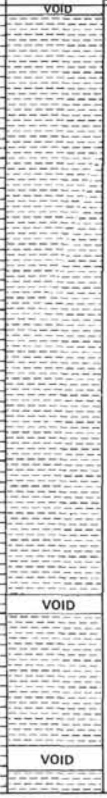
Location: Section 1, 20–21 cm
Texture: Sparsely phyric, fine- to medium-grained, intergranular
Phenocrysts: Olivine 1%, 0.4–0.7 mm, subhedral, replaced by smectite; plagioclase 3–4%, 0.7–1.5 mm, subhedral, fresh
Groundmass: Olivine 1–2%, 0.05–0.2 mm, subhedral, replaced by smectite; plagioclase 45–50%, 0.1–0.6 mm, subhedral, fresh; clinopyroxene 40–45%, 0.05–0.2 mm, granular, fresh, $2V_z \sim 40°$; opaques 3%, 0.05–0.1 mm, subhedral, probably magnetite; interstitial material 5%, microcrystalline, partly replaced by smectite
Veins and Fractures: A few hairline cracks filled with smectite
Alteration: Olivine and some interstitial material replaced by smectite.

Location: Section 1, 100–101 cm
Texture: Very sparsely phyric, fine-grained, intergranular to intersertal
Phenocrysts: Plagioclase 1–2%, 1–3 mm, subhedral, some corroded, fresh
Groundmass: Olivine 2–3%, 0.2–0.5 mm, subhedral, replaced by smectite and minor carbonate; plagioclase 55–60%, 0.1–1.5 mm, seriate, acicular, some variolitic clusters; clinopyroxene 25%, 0.005–0.2 mm, granular to prismatic, fresh; $2V_z \sim 45°$; opaques 3–5%, minute crystals, probably magnetite; interstitial material 7–8%, microcrystalline, mostly replaced by smectite
Vesicles: 1–2%, 0.3–0.5 mm, round, filled with smectite, carbonate and minor pyrite
Alteration: Olivine and interstitial material replaced by smectite and carbonate

Location: Section 1, 17–19 cm
Texture: Sparsely phyric, fine- to medium-grained, intergranular to intersertal
Phenocrysts: Plagioclase 1%, 1–1.2 mm, subhedral, fresh, often zoned.
Groundmass: Olivine 2–3%, 0.1–0.3 mm, subhedral, replaced by smectite; plagioclase 45%, 0.2–1 mm, subhedral, fresh, somewhat zoned; clinopyroxene 40%, 0.05–0.3 mm, anhedral, fresh, $2V_z \sim 40°$; opaques 3–4%, 0.05–0.1 mm, subhedral, probably magnetite; intersertal material 10–15%, microcrystalline, partly replaced by smectite.
Vesicles: <1%, <1 mm, round, filled with smectite
Alteration: Olivine and most interstitial material replaced by smectite

SITE 483 HOLE B CORE 1 CORED INTERVAL 91.5–101.0 m

TIME-ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	SAMPLES
QUATERNARY	NN19 (N)	CM				1, 2, 3, 4, 5, 6	0.5, 1.0	VOID; VOID; VOID			



LITHOLOGIC DESCRIPTION

5Y 3/2

5GY 3/2

5G 2/1

Sections 1–3: Soft olive gray CLAY containing a small, rounded fragment of limestone in Section 3.

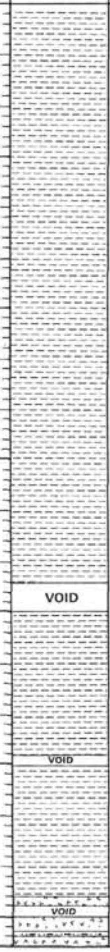
Sections 4–6: Firm greenish black CLAY containing small amounts of volcanic glass.

SMEAR SLIDE SUMMARY

	1-41	1-84 (M)	1-111	2-64	2-147	3-65	4-65	5-48	5-64
TEXTURE:									
Sand	3	–	2	–	–	–	–	–	10
Silt	11	10	10	15	10	14	12	12	6
Clay	86	90	88	85	90	86	88	88	84
COMPOSITION:									
Quartz	7	4	6	7	5	5	5	6	8
Feldspar	3	2	3	3	1	3	2	3	2
Mica	2	–	1	1	1	1	1	–	–
Heavy minerals	1	1	1	1	2	–	1	2	3
Clay	86	90	88	85	90	86	88	88	84
Volcanic glass	–	–	–	–	–	3	3	1	2
Pyrite	1	–	1	1	1	–	–	–	1
Calc. nannofossils	–	3	–	–	–	2	–	–	–
Radiolarians	–	–	–	2	–	–	–	–	–

SITE 483 HOLE B CORE 2 CORED INTERVAL 101.0–110.5 m

TIME-ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	SAMPLES
QUATERNARY	NN19 (N)	FG, FM, RM	FP	B, B, B		1, 2, 3, 4, 5, 6, 7	0.5, 1.0	VOID; VOID; VOID			



LITHOLOGIC DESCRIPTION

5Y 3/2

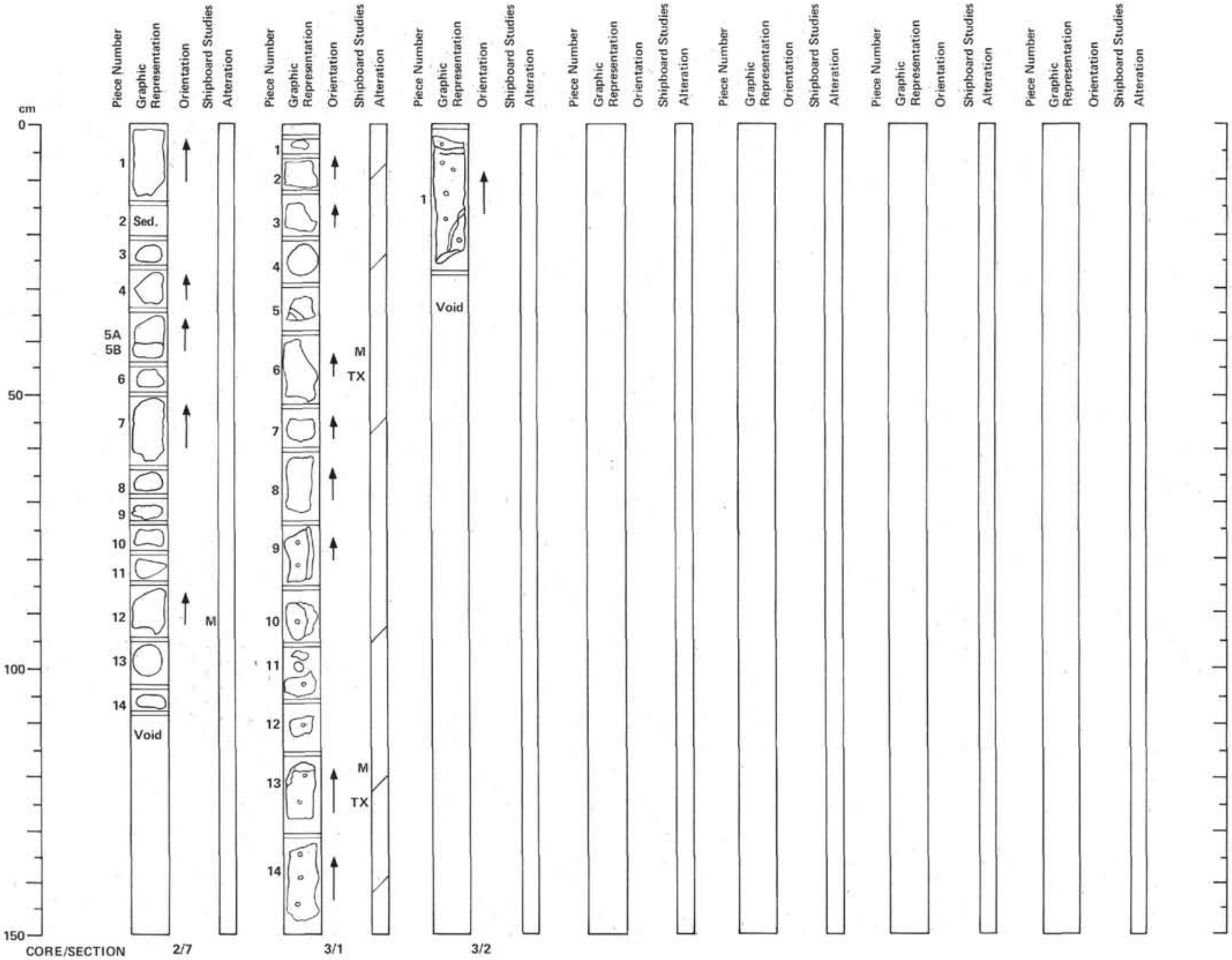
5Y 2/1

Section 1, 0 cm–Section 6, 130 cm: Olive gray to olive black CLAY with minor amounts of SAND at the base of Section 3 and the top of Section 4. Rare patches of silt-sized carbonate (dolomite?) grains are found in the middle of Section 6. The sediments are firm in Section 1 but firm throughout the rest of the core.

Section 6, 130 cm–Section 7, 30 cm: BASALT with a thin layer of SILTY CLAY at a depth of 15–20 cm in Section 7. Sediment contact with basalt at 130 cm in Section 6 distributed by drilling.

SMEAR SLIDE SUMMARY

	1-75	2-75	3-75	4-3	4-75	5-75	6-73
TEXTURE:							
Sand	–	–	–	3	–	–	1
Silt	15	12	8	5	14	10	90
Clay	85	88	92	92	86	90	9
COMPOSITION:							
Quartz	6	5	3	5	7	4	15
Feldspar	3	2	–	1	3	1	1
Mica	1	–	–	–	–	–	–
Heavy minerals	5	3	4	2	4	3	1
Clay	85	88	92	92	86	90	9
Volcanic glass	–	1	–	–	–	1	–
Pyrite	–	–	–	–	–	1	–
Carbonate unspec.	–	–	–	–	–	TR	74



HOLE 483B, CORE 2

Visual Description

Section 7, 0–15 cm: Gray, sparsely phyric, massive(?) basalt. Plagioclase phenocrysts 2–3%, 2–4 mm, euhedral, fresh. Groundmass medium-grained, fresh.

Section 7, 15–22 cm: Olive-black, silty claystone.

Section 7, 22 cm–base of core: Light gray, sparsely- to moderately-phyric, massive basalt. Plagioclase phenocrysts 8–10%, 2–6 mm, euhedral, fresh; olivine phenocrysts 1–2%, 1–2 mm, replaced by smectite. Groundmass medium-grained, uniform, fresh. Vesicles 1%, irregularly distributed, 1–1.5 mm, spherical, filled with smectite.

HOLE 483B, CORE 3

Visual Description

Section 1, 0–74 cm: Gray, moderately phyric, massive basalt. Plagioclase phenocrysts 10%, 1–4 mm, euhedral, fresh; olivine phenocrysts 1–2%, < 1 mm, euhedral, partly replaced by smectite. Groundmass medium-grained, uniform, relatively fresh. Vesicles < 1%, < 0.5 mm, spherical, filled with smectite. Fractures and veinlets sparse, one vein at 35 cm is 3 mm wide, most < 1 mm, filled with smectite and carbonate.

Section 1, 74 cm–base of core: Medium gray, aphyric, massive basalt. Groundmass is medium- to coarse-grained, generally weakly to moderately altered. Vesicles 1–7%, 0.5–1.5 mm, spherical, filled with smectite, carbonate and zeolite(?). Fractures and veins sparse, 1–3 mm wide, filled with smectite, carbonate and rare pyrite.

Thin Section Description

Location: Section 1, 49–50 cm

Texture: Moderately phyric, medium-grained, intergranular to intersertal

Phenocrysts: Olivine 2%, 0.3–0.8 mm, euhedral, partly altered to smectite; plagioclase 10%, 0.2–2.5 mm, subhedral, fresh, mostly in glomerophyric clots.

Groundmass: Olivine 1–2%, 0.05–0.2 mm, subhedral, partly altered to smectite, $2V_z \sim 90°$; plagioclase 45%, 0.1–0.5 mm, subhedral, fresh; clinopyroxene 35%, 0.1–0.2 mm granular, fresh, $2V_z \sim 40°$; opaques 3%, 0.05–0.1 mm, subhedral, probably magnetite; interstitial material 10%, glassy, mostly altered to smectite.

Vesicles: <1%, 0.3 mm, round, filled with smectite.

Alteration: Olivine and interstitial material partly replaced by smectite and traces of carbonate.

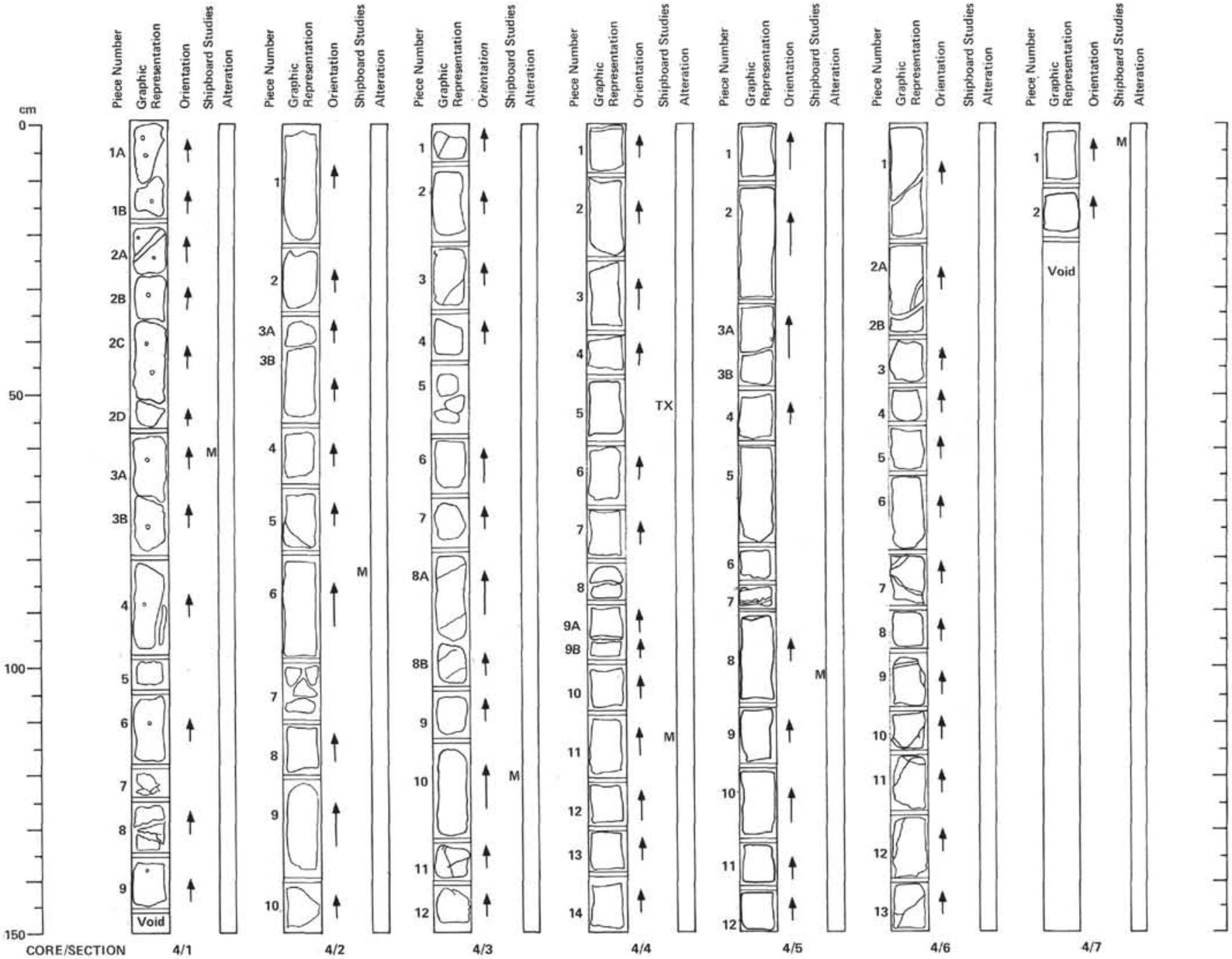
Location: Section 1, 125–126 cm

Texture: Aphyric, medium- to coarse-grained, subophitic

Groundmass: Olivine 2%, 0.1–0.3 mm, subhedral, replaced by smectite; plagioclase 45%, 0.1–1 mm, subhedral, fresh; clinopyroxene 45%, 0.1–0.5 mm, anhedral, fresh, $2V_z \sim 40°$; opaques 2%, 0.05–0.2 mm, probably magnetite; interstitial material 7%, glassy, altered to smectite.

Vesicles: 1–2%, 0.5–0.8 mm, round, filled with smectite and carbonate.

Alteration: Olivine and interstitial material replaced by smectite and minor carbonate.



HOLE 483B, CORE 4

Visual Description

Medium to light gray, aphyric, massive basalt. Traces of plagioclase microphenocrysts, < 1 mm, fresh. Groundmass medium- to coarse-grained, generally fresh, some alteration along veins. Vesicles 0–5%, most abundant in upper meter of core, 0.5–1.5 mm, spherical, filled with smectite and carbonate. Veinlets and fractures fairly common, 1–3 mm wide, lined and filled with smectite, carbonate and rare pyrite.

Thin Section Description

Location: Section 4, 50–53 cm

Texture: Aphyric, coarse-grained, subophitic to intersertal

Groundmass: Olivine 2–3%, 0.2–0.5 mm, subhedral, replaced by smectite; plagioclase 45%, 0.3–1.3 mm, subhedral, fresh; clinopyroxene 45%, 0.3–0.7 mm, subhedral to anhedral, fresh, usually *in subophitic plates, often zoned,* $2V_z \sim 40°$; *opaques* 3%, 0.05–0.1 mm, subhedral, probably magnetite; interstitial material 2–3%, glassy, replaced by smectite.

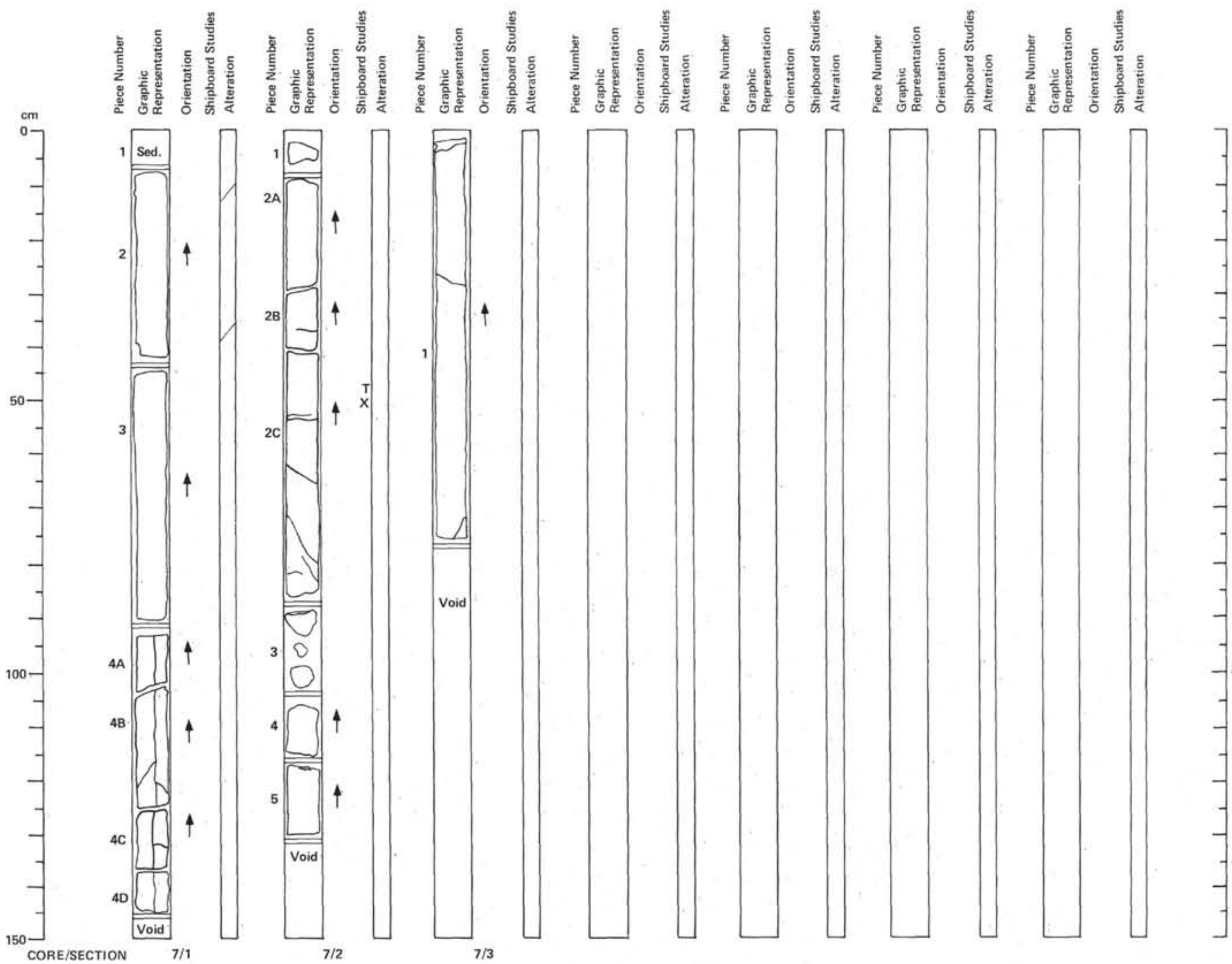
Alteration: Olivine and interstitial material replaced by smectite.

SITE 483B, CORE 5, 127.0–130.0 m: NO RECOVERY

SITE 483B, CORE 6, 130.0–133.0 m: NO RECOVERY

SITE 483 HOLE B CORE 7 CORED INTERVAL 133.0–137.5 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FOSSIL CHARACTER: FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	SAMPLES	LITHOLOGIC DESCRIPTION
			B			1	0.5 1.0	VOID				5Y 2/1 Section 1, 0–7 cm: Firm olive black SILTY CLAY overlying BASALT.
						2						
						3						



HOLE 483B, CORE 7

Visual Description

Section 1, 0–12 cm: Olive black, silty clay with a few pieces of basal.

Section 1, 1 cm–base of core: Light to medium gray, very sparsely phyric, massive basalt. Plagioclase phenocrysts $<1\%$, 3–5 mm, scattered, fresh, rarely in clusters; olivine phenocrysts, $<1\%$, 1–2 mm, altered to smectite. Groundmass medium- to coarse-grained, uniform, generally fresh, except for narrow halos along fractures. Fractures and veins fairly common, $\leq$ 1 mm, filled with smectite, carbonate and minor pyrite.

Thin Section Description

Location: Section 2, 48–50 cm

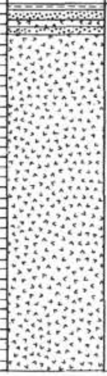
Texture: Aphyric, coarse-grained, intergranular to subophitic

Groundmass: Olivine 3–5%, 0.1–0.3 mm, subhedral, replaced by smectite; plagioclase 45–50%, 0.1–0.6 mm, subhedral, fresh; clinopyroxene 40–45%, 0.02–0.04 mm, anhedral, fresh, $2V_z \sim 40°$; opaques 5%, 0.05–0.15 mm, subhedral, skeletal, probably magnetite; interstitial material 2–3%, replaced by smectite.

Veins and Fractures: 1 veinlet, 0.3 mm wide, lined with brown smectite and filled with carbonate.

Alteration: Olivine and minor interstitial material replaced by greenish-brown smectite.

SITE 483 HOLE B CORE 8 CORED INTERVAL 137.5–146.5 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FOSSIL CHARACTER: FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	SAMPLES	LITHOLOGIC DESCRIPTION
						1	0.5 1.0				*	5YR 2/1
						2						
						3						

Section 1, 0–5 cm: Firm brownish black CLAYSTONE.

Section 1, 5–10 cm: Hard, finely laminated SANDSTONE composed in part of hyaloclastite. Glass partially replaced by dark green to greenish black smectite.

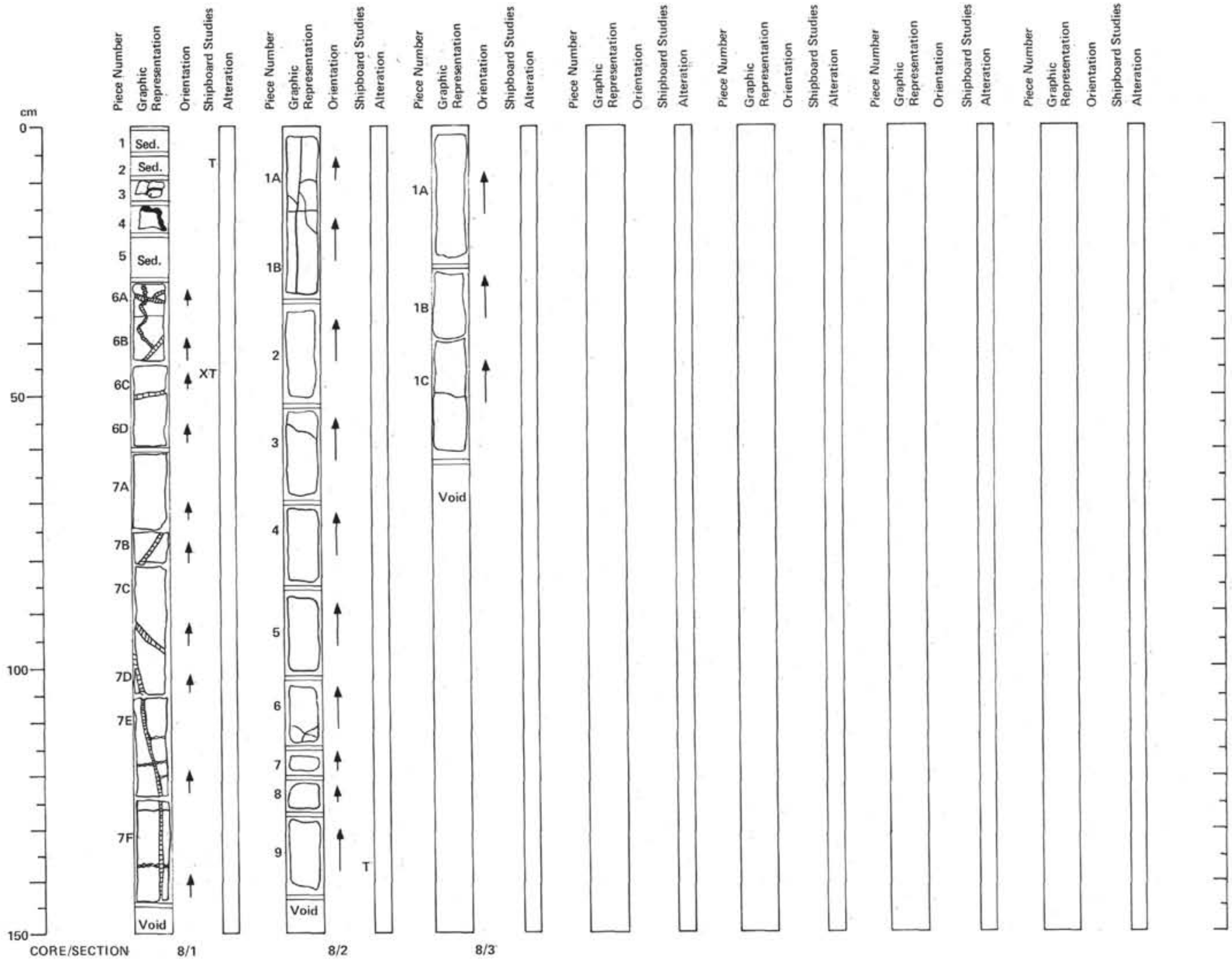
Section 1, 10–20 cm: Fine-grained basalt with glassy chilled margins.

Section 1, 20–30 cm: Dark green TUFFACEOUS SANDSTONE containing numerous shards of basaltic glass altered to green smectite(?), abundant zeolites and small amounts of biogenic debris and non-volcanic detritus. The sandstone is finely laminated with well-developed cut and fill structures and displays numerous small open cavities.

Section 1, 30 cm–Section 3, 60 cm: Massive BASALT.

SMEAR SLIDE SUMMARY

	1-4
TEXTURE:	
Sand	–
Silt	16
Clay	84
COMPOSITION:	
Quartz	7
Feldspar	3
Heavy minerals	2
Clay	84
Pyrite	3
Diatoms	1



HOLE 483B, CORE 8

Visual Description

Section 1, 0–10 cm: Light brown, fine- to medium-grained, slightly bedded hyaloclastite.

Section 1, 10–15 cm: Dark gray, aphyric basalt. Veinlets common, filled with carbonate.

Section 1, 15–20 cm: Gray, sparsely phyric basalt with glassy crust. Plagioclase phenocrysts 5–7%, 1–2 mm, often in glomerocrysts to 4 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite. This piece probably fell into hole from above.

Section 1, 20–28 cm: Dark greenish-gray, hyaloclastite with small cross-laminations; chiefly basaltic glass shards, altered to smectite and zeolite(?).

Section 1, 28 cm–base of core: Medium gray, aphyric, massive basalt. Rock grades downward from fine-grained to medium-grained; rock relatively fresh. Veins and fractures common, mostly steep, <1 cm wide, filled with smectite, carbonate and minor zeolite(?).

Thin Section Description

Location: Section 1, 8–9 cm

Texture: Vitroclastic, fine- to medium-grained

Phenocrysts: Plagioclase 2–3%, 0.3–0.8 mm, subhedral to anhedral, some crystal slivers, fresh; clinopyroxene(?) < 1%, granules; quartz and heavy mineral grains 1–2%, sand-size, angular; foraminifers and sponge spicules 1–2%; lithic fragments 1%, mostly microcrystalline basalt.

Groundmass: Glass shards 50–75%, 0.2–0.6 mm, angular, mostly replaced by brown and green smectite or zeolite; cement 45%, brown fibrous zeolite (phillipsite?) with minor calcite.

Alteration: Glass to smectite and zeolite.

Location: Section 1, 45–46 cm

Texture: Aphyric, fine- to medium-grained, subophitic to intersertal

Groundmass: Olivine 5–8%, 0.1–0.3 mm, subhedral, partly replaced by smectite; plagioclase 45–50%, 0.2–0.8 mm, subhedral, fresh; clinopyroxene 40–45%, 0.3–0.5 mm, anhedral, fresh, $2V_z \sim 40°$; opaques 3%, 0.05–0.1 mm, subhedral, probably magnetite; interstitial material 2–3%, replaced by smectite.

Vesicles: < 1%, 0.5 mm, round, filled with smectite and carbonate

Veins and Fractures: 1 veinlet, hairline, filled with brownish-green smectite

Alteration: Interstitial material and some olivine replaced by smectite.

Location: Section 2, 133–137 cm

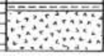
Texture: Aphyric, fine- to coarse-grained, ophimottled to intersertal

Groundmass: Olivine 10–12%, 0.1–0.8 mm, subhedral, replaced by smectite; plagioclase 40–45%, 0.3–1 mm, subhedral, fresh; clinopyroxene 30–45%, 0.2–3 mm, granular to large, irregular ophitic plates, fresh, $2V_z \sim 45°$; opaques 2%, 0.05–0.1 mm, subhedral, probably magnetite

Vesicles: < 1%, 0.5 mm, round, filled with smectite

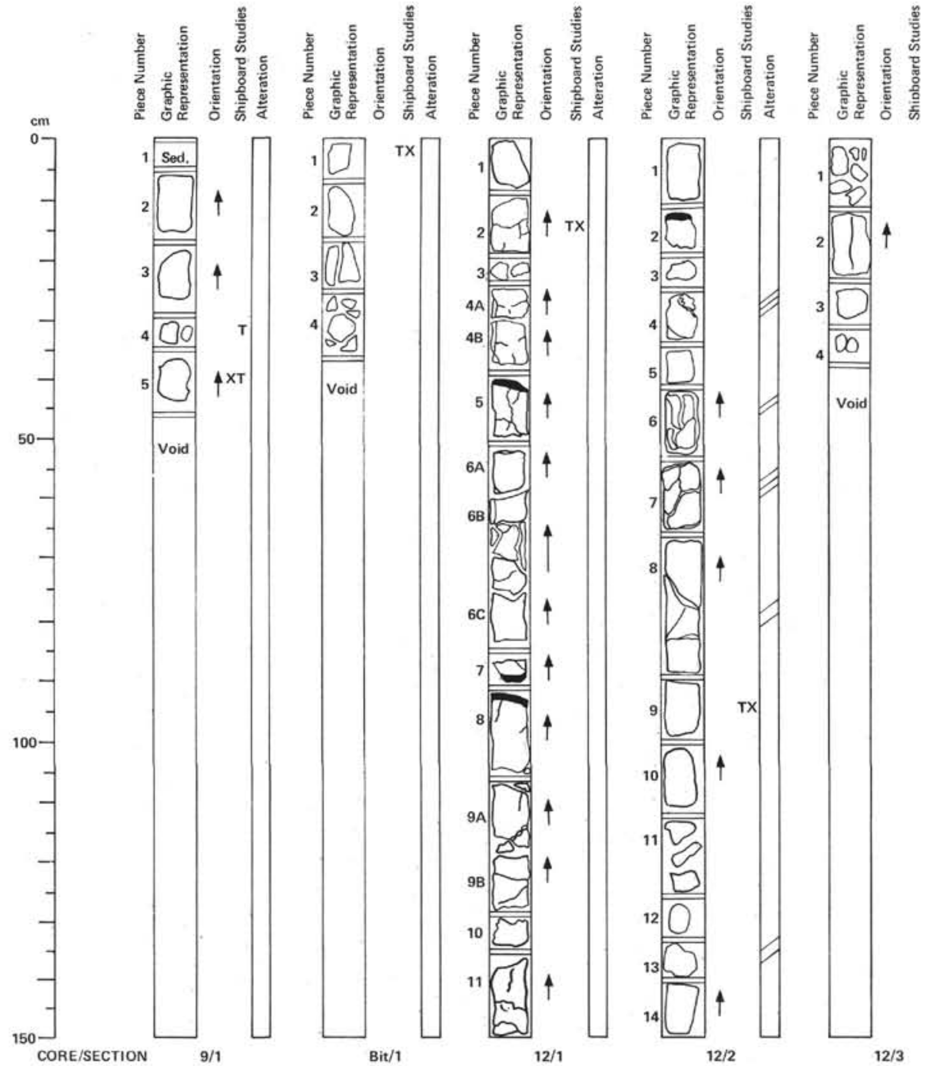
Alteration: Olivine altered to smectite; some patches show replacement of plagioclase and pyroxene by smectite, chlorite and carbonate.

SITE 483 HOLE B CORE 9 CORED INTERVAL 146.5–151.0 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	SAMPLES	LITHOLOGIC DESCRIPTION
UPPER PLIOCENE	NN18 (N)		CM			1					*	Section 1, 0–5 cm: Firm olive black CLAYSTONE overlying massive BASALT.

SMEAR SLIDE SUMMARY

	1-3
TEXTURE:	
Sand	–
Silt	23
Clay	77
COMPOSITION:	
Quartz	7
Feldspar	2
Clay	77
Pyrite	6
Calc. nannofossils	8
Diatoms	TR



HOLE 483B, CORE 9

Visual Description

Section 1, 0–5 cm: Brownish-black, fine-grained, sandy claystone.

Section 1, 5–30 cm: Medium gray, aphyric, medium-grained, massive basalt. Fractures sparse, <1 mm, filled with carbonate, and smectite; some alteration of rock adjacent to veins.

Section 1, 30 cm–base of core: Dark gray, aphyric to sparsely phyric basalt. Piece 4 is sparsely phyric, Piece 5 is aphyric. Plagioclase microphenocrysts 3–5%, < 0.5 mm, subhedral, fresh; olivine microphenocrysts 2–3%, < 0.4 mm, subhedral, altered to smectite; clinopyroxene microphenocrysts < 1%, < 0.4 mm, intergrown with plagioclase in small clots. Groundmass quenched but no glassy rinds present; slightly altered. Fractures and veinlets sparse, < 1 mm, filled with smectite and carbonate.

Thin Section Description

Location: Section 1, 33–35 cm

Texture: Sparsely phyric, quench

Phenocrysts: Olivine 2–3%, 0.2–0.4 mm, subhedral, replaced by smectite; plagioclase 3–5%, 0.5 mm, subhedral laths, fresh; clinopyroxene 1%, 0.2–0.4 mm, anhedral, often in small clots with plagioclase, fresh, $2V_z$ ~45°.

Groundmass: 90%, quench mixture of plagioclase needless, poorly crystallized clinopyroxene with sheaf-like texture, and granular opaques.

Alteration: Olivine replaced by smectite and some carbonate.

Location: Section 1, 40–42 cm

Texture: Aphyric, medium-grained, subophitic to intergranular

Groundmass: Olivine 5%, 0.1–0.3 mm, subhedral to anhedral, mostly fresh, some grains rimmed with smectite, $2V_z$ ~90°; plagioclase 40–45%, 0.1–1 mm, subhedral, fresh; clinopyroxene 45%, 0.1–1 mm, anhedral, usually subophitic, fresh, $2V_z$ ~45°; opaques 2–3%, minute grains, probably magnetite; interstitial material 2–3%, glassy, partly replaced by smectite.

Alteration: Some olivine and interstitial material altered to smectite.

HOLE 483B, CORE Bit 1

Visual Description

Medium gray, aphyric to sparsely phyric, massive basalt. Pieces 1, 2, and 4 are phyric with plagioclase phenocrysts 5%, 1–10 mm, subhedral, fresh; olivine phenocrysts 2%, 0.5–1 mm, subhedral, partly replaced by smectite; clinopyroxene phenocrysts <1%, <0.5 mm, fresh; Piece 3 is aphyric. Groundmass fine- to medium-grained, generally fresh. Vesicles <1%, <0.5 mm, spherical, filled with smectite and carbonate.

Thin Section Description

Location: Section 1, 1–3 cm

Texture: Sparsely phyric, medium-grained, intersertal to subophitic.

Phenocrysts: Olivine 2%, 0.5–1 mm, subhedral, partly replaced by smectite; plagioclase 5%, 1–10 mm, subhedral, often corroded, strongly zoned, fresh; clinopyroxene <1%, 0.2–0.5 mm, fresh.

Groundmass: Olivine 3%, 0.1–0.5 mm, subhedral, mostly replaced by smectite; plagioclase 35–40%, 0.3–1 mm, subhedral, fresh; clinopyroxene 30–35%, 0.2–0.5 mm, anhedral, often subophitic, fresh, $2V_z$ ~45°; opaques 3%, minute subhedral grains in interstitial patches; interstitial material 15–20%, mostly glassy, partly replaced by smectite.

Vesicles: 1%, 0.2–0.4 mm, round, filled with smectite and carbonate

Alteration: Some olivine and interstitial material replaced by smectite.

HOLE 483B, CORE 12

Visual Description

Medium gray, moderately phyric, pillow basalt. Phenocryst content decreases somewhat with depth; plagioclase phenocrysts 5–10%, 1–3 mm, euhedral, fresh; olivine phenocrysts 3–5%, ≤ 2 mm, subhedral, replaced by smectite; clinopyroxene phenocrysts 3%, ≤ 0.6 mm, anhedral, often in clots with plagioclase. Groundmass fine-grained to glassy, coarsest in centers of pillows; glass selvedges at 41 cm, 89 cm, and 91 cm in Section 1 and at 12 cm in Section 2; generally fresh. Vesicles 1–2%, < 1 mm, spherical, filled with smectite and carbonate. Veins and fractures common, ≤ 2 mm wide, filled with smectite and minor carbonate.

Thin Section Description

Location: Section 1, 15–17 cm

Texture: Moderately phyric, quench

Phenocrysts: Olivine 2–5%, 1–2 mm, subhedral, replaced by smectite; plagioclase 10–12%, 1–3 mm, subhedral laths, often in clusters with clinopyroxene, fresh; clinopyroxene 3%, 0.2–0.6 mm, anhedral, in subophitic clots with plagioclase, fresh, $2V_z$ ~40°.

Groundmass: 80–85%, quench mixture of small plagioclase laths, poorly crystallized clinopyroxene and granular magnetite, mostly fresh.

Vesicles: 1–2%, 0.5–1 mm, round, some with segregation patches, mostly filled with smectite and carbonate.

Alteration: Olivine and some groundmass material replaced by smectite.

Location: Section 2, 94–96 cm

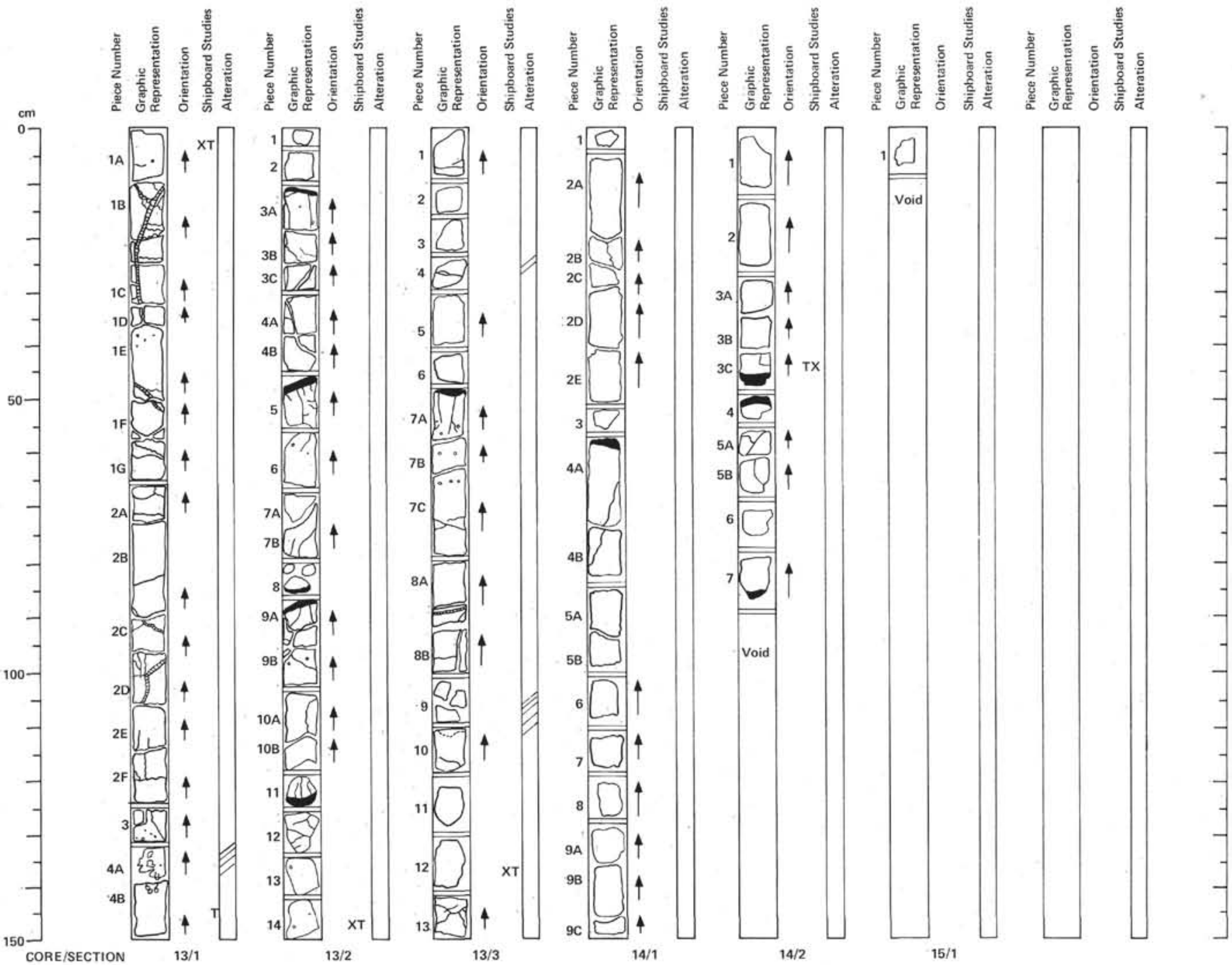
Texture: Very sparsely phyric, fine-grained, intergranular to intersertal

Phenocrysts: Olivine 1%, 0.6 mm, subhedral, replaced by smectite; plagioclase 2%, 0.5–1 mm, subhedral, fresh.

Groundmass: Olivine 1–2%, 0.1–0.2 mm, subhedral, replaced by smectite; plagioclase 50%, 0.2–0.5 mm, subhedral laths, fresh; clinopyroxene 40%, 0.05–0.3 mm, usually granular, fresh, $2V_z$ ~40°; opaques 1–2%, minute crystals of magnetite; interstitial material 2–3%, replaced by smectite.

Vesicles: 2–3%, 1–2 mm, round to irregular, filled with smectite and carbonate.

Alteration: Olivine and interstitial material replaced by smectite.



HOLE 483B, CORE 13

Visual Description

Dark gray, moderately to sparsely phyric, pillow basalt. Plagioclase phenocrysts 5–7%, ≤4 mm, euhedral, fresh; olivine phenocrysts 1–2%, <1 mm, subhedral, replaced by smectite; clinopyroxene phenocrysts 1%, ≤0.5 mm, anhedral, intergrown with plagioclase in small clots. Groundmass fine-grained to glssy, coarsest near pillow centers; glass selvedges at 12 cm, 46–49 cm, 84 cm, 86–88 cm, and 124 cm in Section 2 and at 48 cm in Section 3; non-glassy cooling unit boundaries at 65 and 125 cm in Section 1. Groundmass generally fresh, some glass altered to smectite. Vesicles <1%, most abundant at tops of cooling units, <1 mm, spherical, filled with smectite and carbonate. Fractures and veinlets common, ≤2 mm, wide, mostly steep, filled with smectite, carbonate and minor pyrite.

Thin Section Description

Location: Section 1, 3–5 cm

Texture: Moderately phyric, quench

Phenocrysts: Olivine 1–2%, 0.5–1 mm, subhedral, replaced by smectite and minor carbonate; plagioclase 5–7%, 1–4 mm, subhedral, fresh, zoned, some in glomerophyric clusters; clinopyroxene <1%, 0.2–0.4 mm, anhedral, in glomerophyric clusters with plagioclase, fresh, $2V_z$ ~40°.

Groundmass: 90%, quench mixture of small crystals of olivine, plagioclase and magnetite in a matrix of poorly crystallized clinopyroxene with radiating sheaves; minor glass also present; fresh.

Vesicles: 1%, 0.2–0.6 mm, round, filled with smectite; some with segregation

Alteration: Olivine replaced by smectite and minor carbonate

Location: Section 1, 145–147 cm

Texture: Sparsely phyric, quench

Phenocrysts: Olivine 1–2%, 1–4 mm, subhedral, partly replaced by smectite, some fresh; plagioclase 3–5%, 1–3 mm, subhedral, fresh, mostly in glomerophyric clusters; clinopyroxene <1%, 1–4 mm, anhedral, intergrown with plagioclase and olivine, fresh.

Groundmass: Olivine 2%, 0.1–0.4 mm, subhedral, mostly replaced by smectite; plagioclase 15–20%, 0.3–1 mm, skeletal, fresh; clinopyroxene 20–25%, granular to radiating sheaves; opaques 2–3%, minute granules, probably magnetite; interstitial glass 30–50%, fresh.

Vesicles: <1%, 0.05–0.3 mm, round to irregular, filled with smectite.

Alteration: Olivine replaced by smectite

Location: Section 2, 146–148 cm

Texture: Sparsely to moderately phyric, quench.

Phenocrysts: Olivine 1%, 0.2–0.5 mm, subhedral, replaced by smectite; plagioclase 8–10%, 0.5–3 mm, subhedral laths, fresh, strongly zoned; clinopyroxene <1%, 0.3 mm anhedral, intergrown with plagioclase in glomerophyric clots, fresh, $2V_z$ ~45°.

Groundmass: 90%, quench mixture composed mostly of poorly crystallized clinopyroxene with acicular plagioclase needles, small olivine crystals, replaced by smectite, and minute opaque granules.

Vesicles: 1%, 1–2 mm, round, filled with brown smectite

Alteration: Olivine replaced by smectite

Location: Section 3, 135–137 cm

Texture: Sparsely phyric, medium-grained, intergranular to intersertal

Phenocrysts: Olivine 1%, 0.5 mm, seriate to groundmass grains, subhedral, mostly replaced by smectite, some fresh; plagioclase 5%, 1–2 mm, subhedral, fresh, zoned; clinopyroxene 1%, 0.5 mm, seriate to groundmass grains, anhedral, intergrown with plagioclase, fresh, $2V_z \sim 45°$.

Groundmass: Olivine 3–4%, 0.2–0.5 mm, subhedral, mostly replaced by smectite; plagioclase 40–45%, 0.2–0.8 mm, subhedral, fresh; clinopyroxene 35%, 0.1–0.3 mm, anhedral, fresh, $2V_z \sim 45°$; opaques 2–3%, minute granules and laths, in interstitial areas; interstitial material 10%, mostly glassy, fresh.

Veins and Fractures: One hairline veinlet filled with carbonate

Alteration: Olivine partly replaced by smectite.

HOLE 483B, CORE 14

Visual Description

Dark gray, sparsely phyric, pillow basalt. Plagioclase phenocrysts 3–5%, <4 mm, euhedral, fresh; olivine phenocrysts <1%, <3 mm, subhedral, replaced by smectite. Groundmass fine-grained to glassy, coarsest in pillow centers, generally fresh; glass selvedges at 59 cm, in Section 1 and at 46 cm, 51 cm, and 86 cm in Section 2; glass fractured and partly altered to smectite, carbonate and zeolite(?). Vesicles <1%, irregularly distributed, < 0.5 mm, spherical, filled with smectite and carbonate. Fractures and veinlets sparse, filled with smectite, carbonate and minor pyrite.

Thin Section Description

Location: Section 2, 46–48 cm

Texture: Sparsely phyric, quench

Phenocrysts: Olivine < 1%, 0.2–0.3 mm, subhedral, replaced by smectite and minor carbonate; plagioclase 3%, 0.2–3 mm, subhedral laths, largest grains corroded, fresh.

Groundmass: Quench mixture with 10%, acicular plagioclase laths, 1–2%, granular opaques and 85%, very poorly crystallized matrix with sheaf-like texture.

Vesicles: 1%, 0.2–0.3 mm, round, filled with smectite and carbonate.

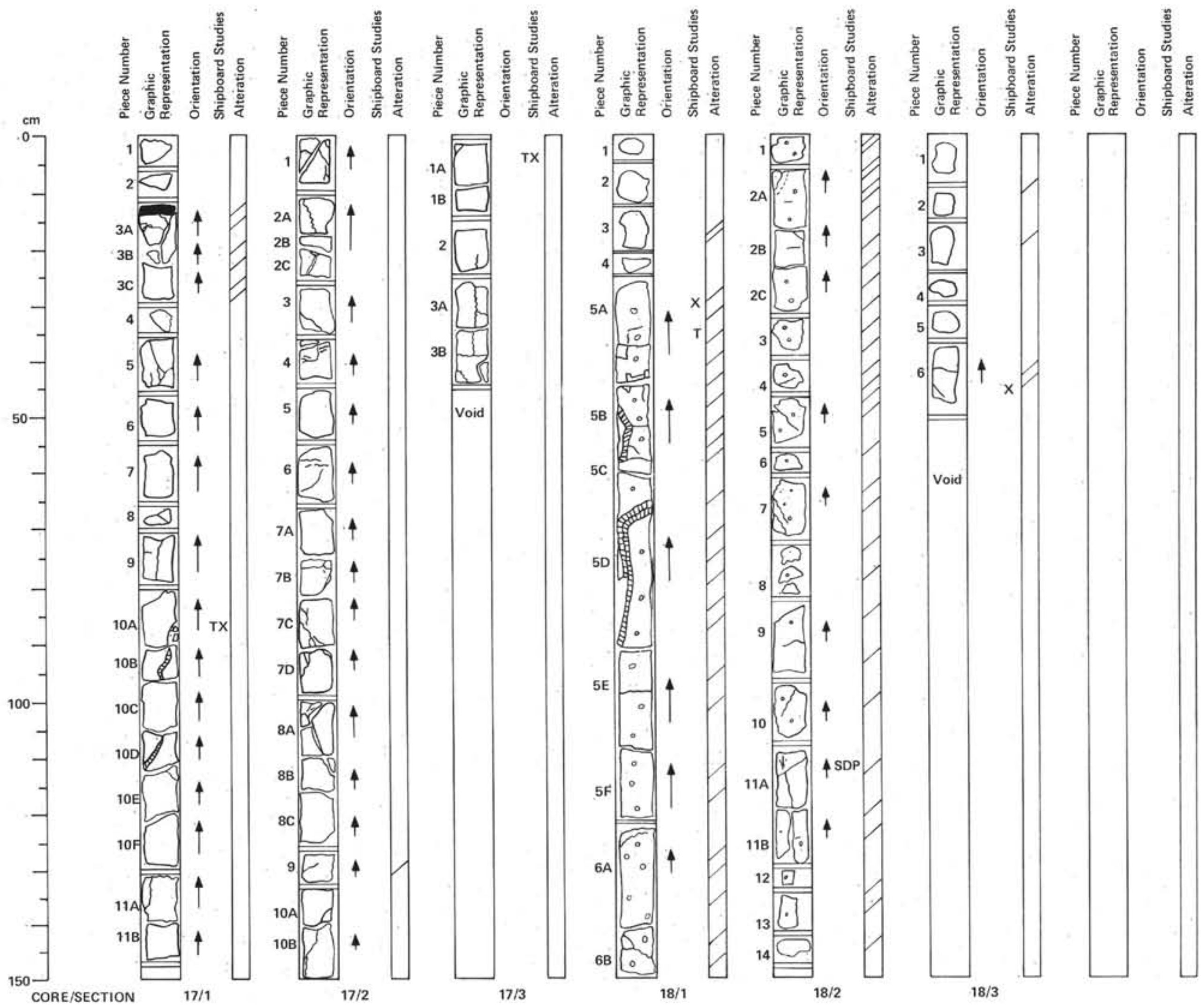
Alteration: Olivine replaced by smectite.

HOLE 483B, CORE 15

Visual Description

Dark gray, sparsely phyric basalt. Plagioclase phenocrysts 5–7%, < 3 mm, euhedral, fresh; sometimes in glomerophyric clots; olivine phenocrysts < 1%, 1–2 mm, subhedral, altered to smectite. Groundmass fine-grained, relatively fresh. Vesicles < 1%, < 1 mm, spherical, filled with smectite and minor pyrite.

HOLE 483B, CORE 16, 189.5–194.0 m: NO RECOVERY.



HOLE 483B, CORE 17

Visual Description

Gray, sparsely to very sparsely phyric, massive(?) basalt. Phenocrysts decrease in abundance downward; plagioclase phenocrysts 2–5%, ≤ 2 mm, euhedral, fresh; olivine phenocrysts 1–2%, ≤ 1 mm, subhedral, partly replaced by smectite. Groundmass fine- to very fine-grained, grain size increases slightly downward from chilled margin at 13 cm, Section 1; generally fresh. Vesicles < 1%, < 0.5 mm, spherical, filled with smectite and carbonate. Fractures and veinlets sparse, < 1 mm, mostly steep, filled with smectite, carbonate, and minor pyrite.

Thin Section Description

Location: Section 1, 85–87 cm

Texture: Sparsely phyric, quench

Phenocrysts: Olivine 2%, 0.2–1 mm, subhedral, mostly replaced by smectite; plagioclase 4–5%, 0.5–1.5 mm, skeletal laths, strongly zoned, fresh

Groundmass: Plagioclase 35–40%, 0.05–0.5 mm, acicular, often skeletal, some slight replacement by smectite; clinopyroxene 45–50%, 0.05–0.2 mm, poorly crystallized, granular to sheaf-like, fresh; opaques 5%, 0.005–0.05 mm, square to irregular granules, probably magnetite

Vesicles: < 1%, 0.5 mm, round, filled with smectite and carbonate

Alteration: Olivine and groundmass material partly replaced by smectite

Location: Section 3, 7–9 cm

Texture: Very sparsely phyric, medium-grained, intersertal

Phenocrysts: Olivine < 1%, 0.5–1.5 mm, subhedral, replaced by smectite; plagioclase 2%, 1–2 mm, subhedral, often corroded, fresh

Groundmass: Olivine 4%, 0.2–0.5 mm, subhedral, replaced by smectite; plagioclase 45–50%, 0.5–1 mm, subhedral, fresh; clinopyroxene 30%, 0.2–0.6 mm, anhedral, fresh, $2V_z \sim 40°$; opaques 5%, 0.05–1 mm, square to lath-shaped crystals, magnetite-ilmenite; interstitial material 10–12%, mostly glassy to microcrystalline material, partly replaced by smectite

Vesicles: < 1%, 0.5–1 mm, subround to irregular, filled with smectite

Alteration: Olivine and some interstitial material replaced by smectite.

HOLE 483B, CORE 18

Visual Description

Medium gray, very sparsely to sparsely phyric, massive basalt. Plagioclase phenocrysts 1–3%, < 2 mm, euhedral, fresh; olivine phenocrysts 1–2%, <1 mm, a few to 10 mm, subhedral, replaced by smectite. Groundmass fine-grained, generally uniform, weakly to strongly altered, most alteration along veins. Vesicles < 5%, increasing downward in Section 1 and decreasing downward in Sections 2 and 3, < 3 mm, spherical, to irregular, filled with smectite, carbonate and pyrite. Fractures and veins common, particularly in Section 1, hairline to 3 mm wide, mostly steep, filled with smectite, carbonate and pyrite; many with alteration halos up to 15 mm wide. Groundmass alteration pervasive in highly fractured areas, most intense in upper meter of Section 2.

Thin Section Description

Location: Section 1, 35–37 cm

Texture: Very sparsely phyric, fine-grained, intergranular to intersertal

Phenocrysts: Olivine < 1%, 0.5–1 mm subhedral, replaced by smectite; plagioclase 2%, 1–2 mm, subhedral laths, fresh

Groundmass: Olivine 1–2%, 0.2–0.3 mm, subhedral, replaced by smectite; plagioclase 45–50%, 0.2–0.4 mm, acicular, fresh; clinopyroxene 40–45%, 0.1–0.3 mm, granular, fresh, often poorly crystallized; opaques 5%, 0.005–0.1 mm, square to lath-like crystals, magnetite-ilmenite

Vesicles: 3–5%, 1–2 mm, subround, filled with smectite and carbonate

Alteration: Olivine replaced by smectite

Location: Section 3, 45–48 cm

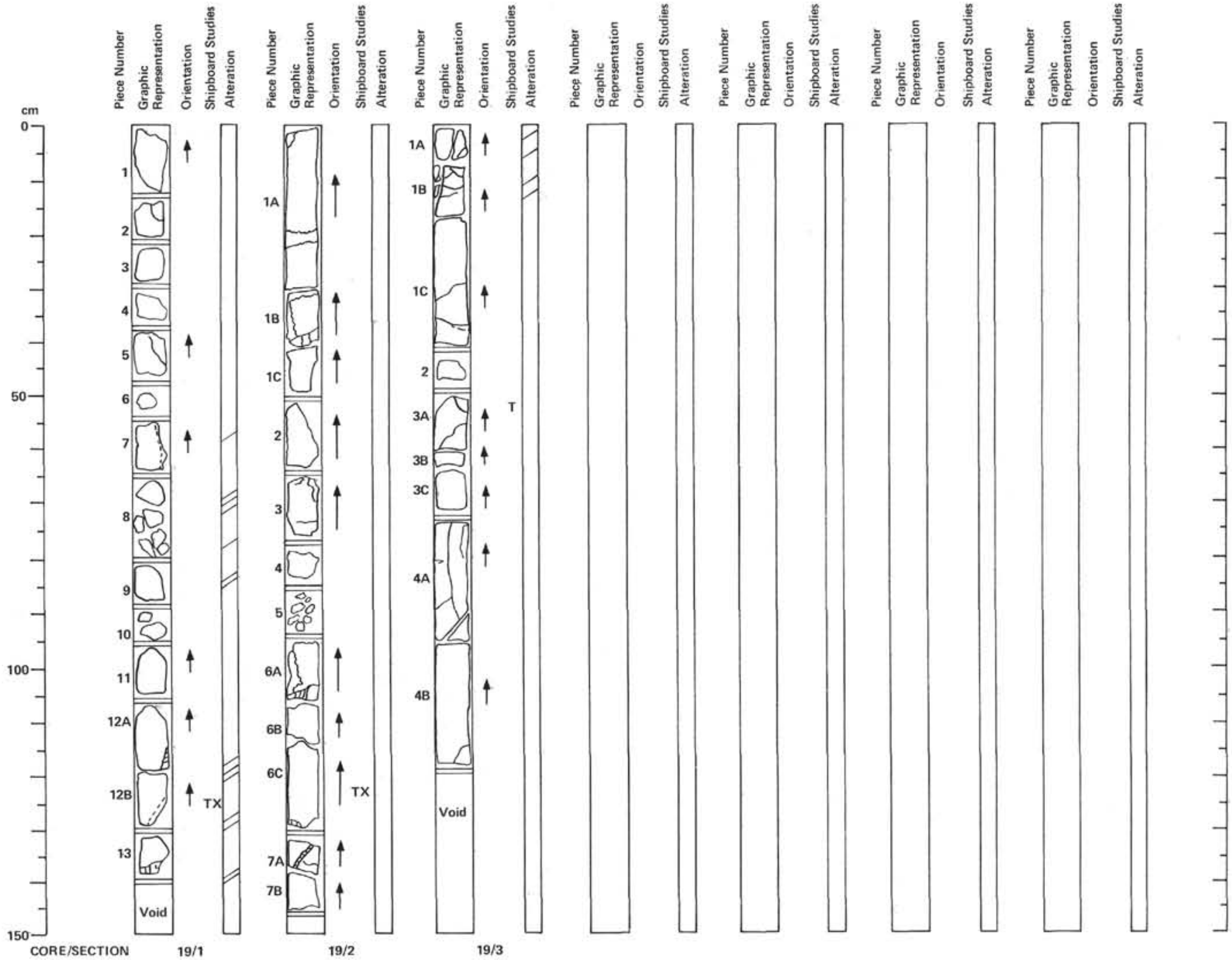
Texture: Sparsely phyric, fine-grained, intersertal to intergranular, somewhat variolitic

Phenocrysts: Olivine 1–2%, 0.5–1 mm, subhedral, replaced by smectite; plagioclase 2–3%, 1–2 mm, prisms and laths, seriate with groundmass, some crystals corroded and most zoned, fresh.

Groundmass: Olivine 1–2%, 0.3–0.5 mm, subhedral, often skeletal, replaced by smectite and minor carbonate; plagioclase 45%, 0.05–0.5 mm, subhedral laths, often in clots intergrown with olivine and clinopyroxene; clinopyroxene 30%, 0.05–0.5 mm, granular to acicular, fresh, $2V_z \sim 45°$; opaques 3–4%, 0.005–0.2 mm, granular, probably magnetite; interstitial material 10%, glassy to microcrystalline, partly replaced by smectite

Vesicles: 2–3%, 1 mm, round, filled with smectite, some segregation vesicles

Alteration: Olivine and some interstitial material replaced by smectite



HOLE 483B, CORE 19

Visual Description

Medium to dark gray, aphyric to moderately phyric, massive basalt. Section 1 and upper 85 cm of Section 2 are very sparsely phyric; lower part of Section 2 moderately phyric; Section 3 sparsely phyric to aphyric. Plagioclase phenocrysts 2–12%, < 4 mm, euhedral, fresh; olivine phenocrysts 2–3%, < 1 mm, subhedral, replaced by smectite; clinopyroxene phenocrysts < 1%, < 1 mm, intergrown with plagioclase, fresh. Groundmass very fine- to coarse-grained; cooling breaks at 65 cm in Section 1 and at 75 cm in Section 2; groundmass relatively fresh, some pervasive alteration in Piece 1, Section 3. Vesicles < 1%, < 2 mm, spherical, filled with smectite. Veins and fractures common, mostly steep, hairline to 2 mm, filled with smectite, calcite and minor pyrite.

Thin Section Description

Location: Section 1, 123–125 cm

Texture: Very sparsely phyric, medium-grained, intergranular to intersertal

Phenocrysts: Plagioclase 2–3%, 1–2 mm, subhedral, often zoned, fresh

Groundmass: Olivine 2–3%, 0.1–0.3 mm, subhedral, replaced by smectite and carbonate; plagioclase 45–50%, 0.2–1 mm, subhedral, fresh; clinopyroxene 40–45%, 0.1–0.5 mm, anhedral, fresh, $2V_z \sim 45°$; opaques 3–5%, 0.005–0.1 mm, square crystals, magnetite; interstitial material 5–7%, mostly microcrystalline material, partly replaced by smectite

Vesicles: 1%, 1–2 mm, round to irregular, filled with smectite

Alteration: Olivine and some interstitial material replaced by smectite and minor carbonate

Location: Section 2, 122–124 cm

Texture: Moderately phyric, quench

Phenocrysts: Olivine 2–3%, 0.3–0.6 mm, subhedral, replaced by smectite, often in glomerophyric clusters with plagioclase; plagioclase 10–12%, 0.3–3.5 mm, euhedral to subhedral, fresh; clinopyroxene < 1%, 0.4–0.8 mm, anhedral, intergrown with plagioclase, fresh

Groundmass: 85%, quench mixture of acicular plagioclase, granular magnetite and poorly crystallized clinopyroxene, fresh

Vesicles: < 1%, 1 mm, round, filled with smectite

Alteration: Olivine replaced by smectite

Location: Section 3, 51–53 cm

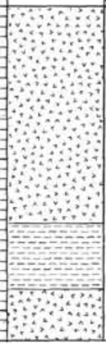
Texture: Aphyric to medium- to coarse-grained, ophimottled

Groundmass: Olivine 3%, 0.5–1.5 mm, subhedral, replaced by smectite and carbonate; plagioclase 35–40%, 0.5–2 mm, subhedral laths, in glomerophyric clots with clinopyroxene, fresh, often zoned; clinopyroxene 20–25%, 0.2–1 mm, subhedral to anhedral, in subophitic clots with plagioclase, fresh, $2V_z \sim 45°$; opaques 5%, 0.05–0.3 mm, mostly laths, probably ilmenite-magnetite, all in interstitial areas; interstitial material 25–30%, microcrystalline material surrounding clots of plagioclase and clinopyroxene, partly replaced by smectite

Veins and Fractures: 1 veinlet, 1 mm wide, filled with greenish-brown smectite

Alteration: Olivine and some interstitial material replaced by smectite and carbonate

SITE 483 HOLE B CORE 20 CORED INTERVAL 208.5–213.0 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FOSSIL CHARACTER: FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	SAMPLES		LITHOLOGIC DESCRIPTION
UPPER PLIOCENE	NN18 (N)	CP RP	RM RP	B RG		1 2 3	0.5 1.0			△		N1 N2 N1	

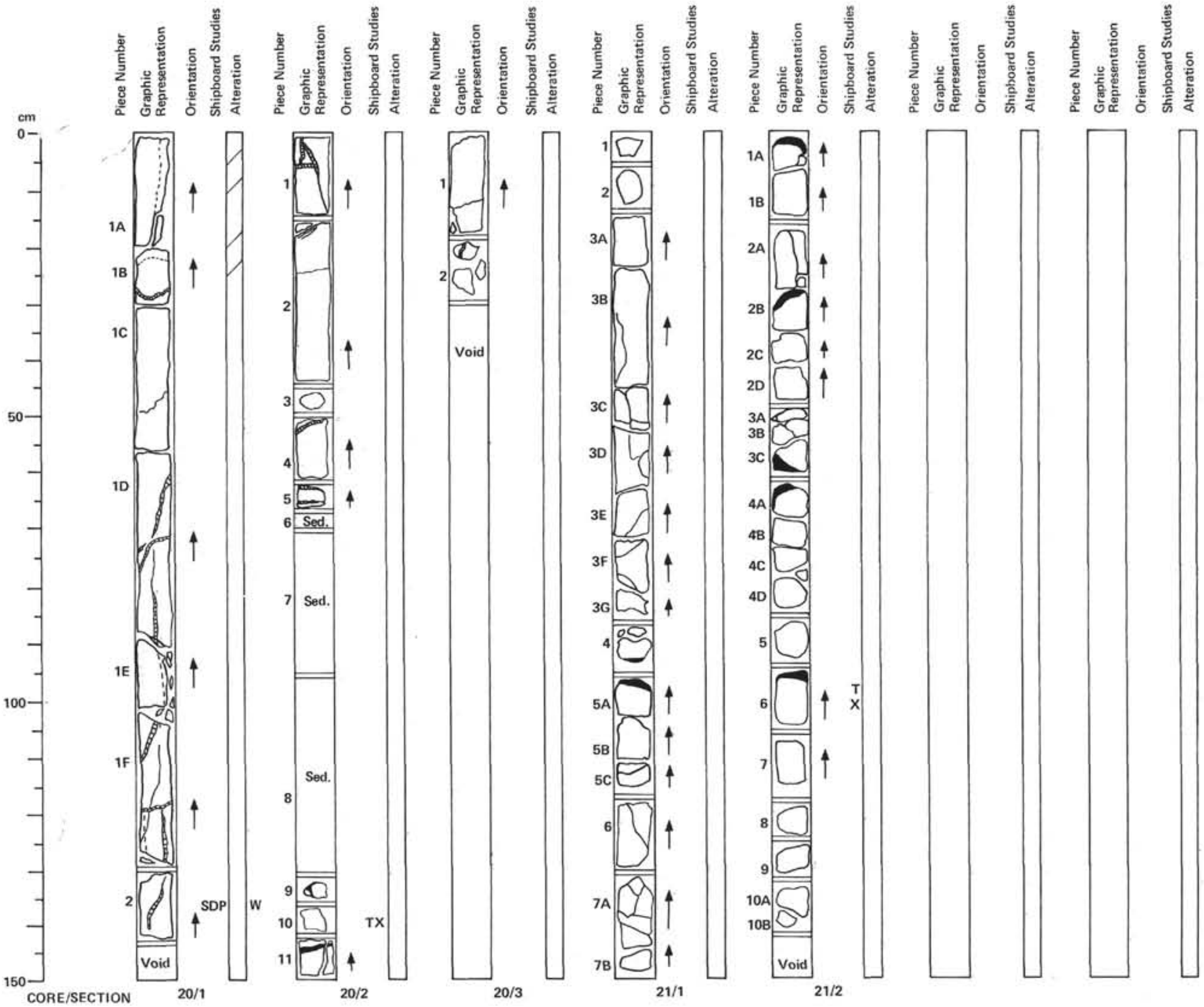
Section 1, 0 cm–Section 2, 65 cm: Massive BASALT with a glassy chilled margin coated with palagonite tuff along the contact with the underlying sediments.

Section 2, 65–130 cm: Black to grayish black CLAY with a thin, relativey coarse-grained laminated turbidite at a depth of 95–97 cm in Section 2. The sediments are indurated near the overlying and underlying basalts and firm throughout the remainder of the section.

Section 2, 130 cm–Section 3, 30 cm: BASALT with a devitrified glassy chilled margin against the overlying sediments.

SMEAR SLIDE SUMMARY

	2-65 (M)	2-67	2-98	2-102	2-112	2-128
TEXTURE:						
Sand	–	–	3	–	–	1
Silt	5	6	10	16	13	12
Clay	95	94	87	84	87	87
COMPOSITION:						
Quartz	5	4	3	3	4	3
Feldspar	–	–	1	1	1	1
Heavy minerals	–	–	3	4	5	5
Clay	95	94	87	84	87	87
Volcanic glass	–	–	5	2	–	–
Pyrite	–	–	1	2	–	1
Zeolite	?	?	?	?	?	?
Calc. nannofossils	–	2	7	4	3	3



HOLE 483B, CORE 20

Visual Description

Section 1, 0 cm–Section 2, 65 cm: Medium to dark gray, sparsely phyric, massive basalt. Plagioclase phenocrysts 1–5%, <0.6 mm, euhedral, fresh; olivine phenocrysts 1%, < 0.5 mm, subhedral, mostly altered to smectite; clinopyroxene < 1%, < 0.3 mm, anhedral, intergrown with plagioclase. Groundmass fine- to medium-grained, grain size decreases rapidly downward in Section 2 to glass selvedge at 72 cm; groundmass relatively fresh. Vesicles < 1%, <1 mm, spherical, filled with green smectite. Veins and fractures moderately abundant, mostly subhorizontal, hairline to 2 mm, many filled with carbonate and smectite, some with slickensides, many with narrow alteration halos.

Section 2, 75–130 cm: Brown, moderately bedded, strongly indurated, mudstone and silty mudstone.

Section 2, 130 cm–base of core: Dark gray, very sparsely phyric basalt. Plagioclase phenocrysts 2–3%, < 3 mm, euhedral, fresh; olivine phenocrysts 1–2%, < 1 mm, subhedral, replaced by smectite. Groundmass fine-grained to glassy; glass selvedges at 132 and 143 cm in Section 2; groundmass slightly altered in Section 3. Vesicles < 1%, <1 mm, spherical, filled with smectite. Veinlets sparse, < 1 mm, filled with smectite and carbonate.

Thin Section Description

Location: Section 2, 137–139 cm

Texture: Very sparsely phyric, fine-grained, intersertal to intergranular

Phenocrysts: Olivine 1–2%, 0.5–1 mm, euhedral to subhedral, replaced by smectite; plagioclase 2–3%, 1–1.5 mm, subhedral, strongly zoned, fresh

Groundmass: Olivine 1–2%, 0.1–0.3 mm, subhedral, replaced by smectite; plagioclase 45–50%, 0.2–1 mm, subhedral laths, fresh; clinopyroxene 30–35%, 0.1–0.4 mm, granular, fresh, $2V_z \sim 45°$; opaques 3–4%, 0.005–0.1 mm, granular to lath-shaped, magnetite-ilmenite; interstitial material 10–12%, dark brown glassy to microcrystalline material, minor replacement by smectite

Vesicles: < 1%, 0.5 mm, round, filled with smectite, some with segregation patches

Alteration: Olivine and minor interstitial material, replaced by smectite

HOLE 483B, CORE 21

Visual Description

Section 1, 0–94 cm: Gray, very sparsely phyric, massive(?) basalt. Plagioclase phenocrysts 1%, < 2 mm, euhedral, fresh; olivine phenocrysts <1%, <1 mm, subhedral, replaced by smectite. Groundmass very fine- to fine-grained, grain size decreases toward glassy selvedge at 94 cm; groundmass moderately altered. Vesicles 1–2%, decreasing in abundance downward, < 1 mm, spherical, filled with smectite, sometimes with a dark rim. Fractures fairly common, mostly steep, < 1 mm wide, filled with smectite, carbonate and minor pyrite.

Section 1, 94 cm–base of core: Dark gray, moderately phyric, pillow basalt. Plagioclase phenocrysts 10%, < 5 mm, euhedral, fresh; olivine phenocrysts 2%, <1 mm, euhedral, replaced by smectite and carbonate; clinopyroxene phenocrysts 2–3%, < 1 mm, anhedral, often intergrown with plagioclase, fresh. Groundmass fine-grained to glassy; glass selvedges at 95 cm in Section 1 and at 0 cm, 29–32 cm, 59 cm, 62 cm, and 95 cm, in Section 2; glass partly altered to palagonite and replaced by smectite and carbonate. Vesicles <1%, irregularly distributed, < 0.5 mm, spherical, open or filled with smectite. Fractures fairly common, < 2 mm, filled with smectite, carbonate and minor pyrite.

Thin Section Description

Location: Section 2, 100–102 cm

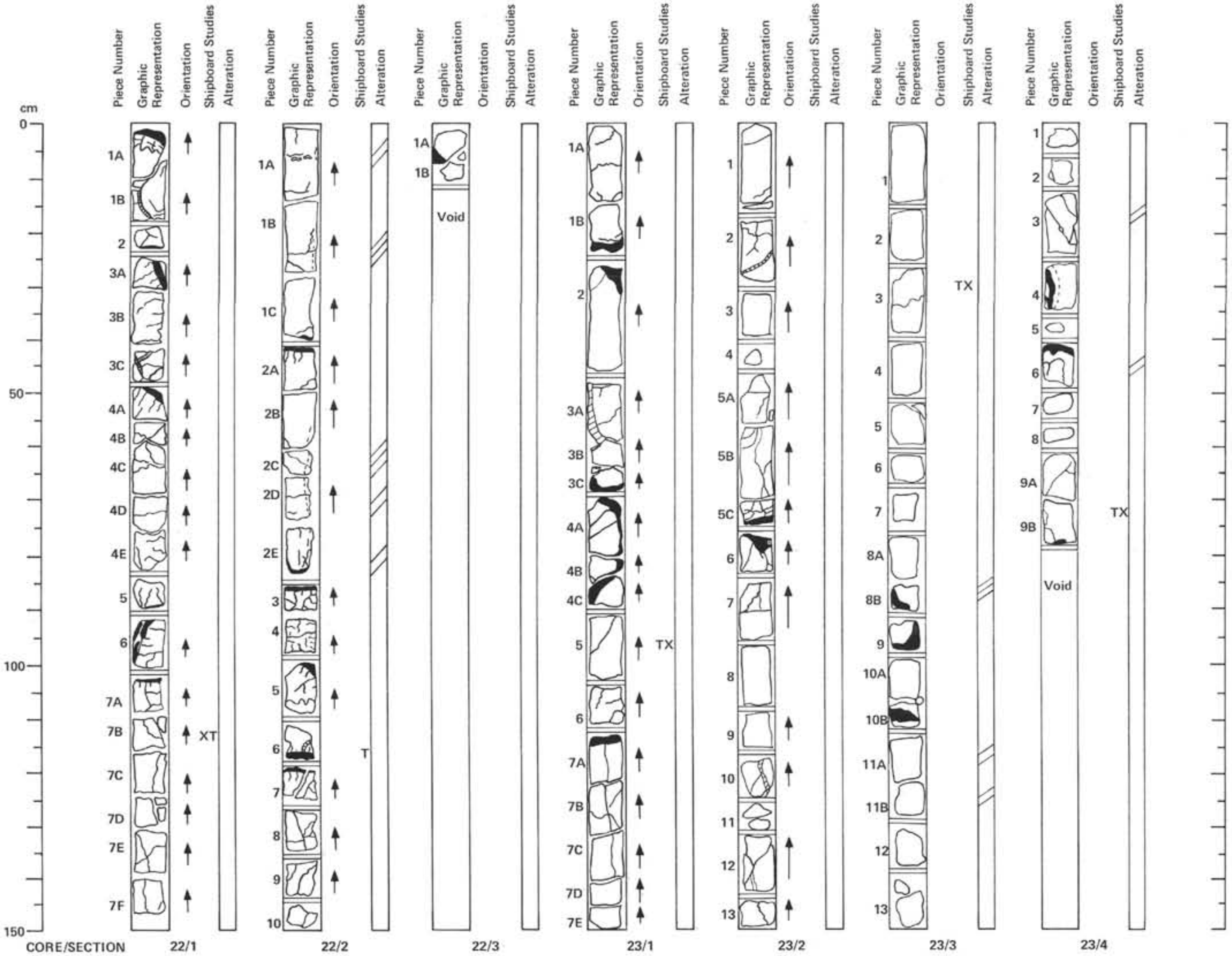
Texture: Moderately phyric, quench

Phenocrysts: Olivine 2%, 0.5–1 mm, euhedral, replaced by smectite and carbonate; plagioclase 10%, 1–5 mm, subhedral prisms, fresh, often in clots with clinopyroxene; clinopyroxene 2–3%, 02–1 mm, anhedral to rounded, fresh, $2V_z \sim 45°$, sometimes zoned

Groundmass: 85%, quench mixture of poorly crystallized plagioclase, radiating sheaves of clinopyroxene, minute granules of opaques and glassy interstitial material, fresh

Vesicles: < 1%, 0.2-0.5 mm, round, filled with smectite; some segregation vesicles

Alteration: Olivine replaced by smectite



HOLE 483B, CORE 22

Visual Description

Dark gray, moderately phyric, pillow basalt. Phenocryst content varies from 8–15%, generally decreasing with depth in core; plagioclase phenocrysts 5–10%, <2.5 mm, euhedral, fresh; olivine phenocrysts 1–4%, <2 mm, euhedral, altered to smectite; clinopyroxene phenocrysts 1–4%, < 3 mm, anhedral, fresh, often intergrown with plagioclase. Groundmass fine-grained to glassy; glass selvedges at 3 cm, 34 cm, 51 cm, 90 cm, 92–100 cm and 103 cm in Section 1, at 39 cm, 42 cm, 83 cm, 86 cm, 101 cm, 118 cm and 120 cm in Section 2 and at 5–7 cm in Section 3; glass usually fractured and partly altered to smectite and zeolite(?), remainder of groundmass relatively fresh. Vesicles 1–2%, <1 mm, spherical to irregular, filled with smectite and carbonate. Veins and fractures common, hairline to 3 mm, filled or lined with smectite, carbonate and minor pyrite.

Thin Section Description

Location: Section 2, 117–119 cm

Texture: Moderately phyric, very fine-grained, intergranular to intersertal

Phenocrysts: Olivine 4%, 0.3–1.5 mm, euhedral to subhedral, replaced in glomerocrysts; clinopyroxene 3–4%, 0.4–2.6 mm, anhedral to rounded, occurs as individual, rounded crystals and in glomerocrysts with plagioclase, fresh, $2V_z \sim 45°$, often sector zoned

Groundmass: Olivine 2–3%, 0.1–0.2 mm, subhedral, replaced by smectite; plagioclase 35–40%, 0.1–0.4 mm, subhedral laths, fresh; clinopyroxene 30–35%, 0.1–0.3 mm, granular, fresh; opaques 3%, 0.005–0.05 mm, granules probably magnetite; interstitial material 5%, glassy, partly replaced by smectite

Vesicles: < 1%, 0.5 mm, round, segregation vesicles

Alteration: Olivine and some interstitial mateiral replaced by smectite

HOLE 493B, CORE 23

Visual Description

Dark gray, moderately phyric, pillow basalt. Phenocrysts vary somewhat in size and abundance; plagioclase phenocrysts 8–12%, 2–10 mm, euhedral, fresh, sometimes in glomerophyric clots; olivine phenocrysts 2–4%, < 1 mm, euhedral, replaced by smectite; clinopyroxene phenocrysts 3–5%, < 1 mm, anhedral, fresh, usually in clots with plagioclase. Groundmass fine-grained to glassy; glass selvedges at 23 cm, 27–30 cm, 67 cm, 70–89 cm and 113 cm in Section 1, at 74 cm and 76–77 cm in Section 2, at 86–89 cm, 91–96 cm and 110 cm in Section 3 and at 42 cm and 77 cm in Section 4; glass often fractured and partly replaced by smectite carbonate and zeolite(?), otherwise groundmass relatively fresh. Vesicles 1–2%, 1 mm, spherical, filled with smectite. Fractures and veinlets common, hairline to 2 mm, filled or lined with carbonate and smectite.

Thin Section Description

Location: Section 1, 95–97 cm

Texture: Moderately phyric, quench

Phenocrysts: Olivine 2–3%, 0.3–0.8 mm, euhedral to subhedral, altered to smectite; plagioclase 10%, 0.5–2 mm, subhedral laths, fresh; clinopyroxene 4%, 0.5–1 mm, anhedral, mostly intergrown with plagioclase in glomerophyric clots, fresh, $2V_z \sim 45°$, often sector zoned

Groundmass: 80–85%, quench mixture of plagioclase microlites, radiating sheaves of clinopyroxene and granular opaques. A few grains of fresh olivine

Vesicles: 1–2%, 0.3–0.5 mm, round, filled with smectite, some segregation vesicles

Alteration: Olivine partly replaced by smectite

Location: Section 3, 29–31 cm

Texture: Moderately phyric, quench

Phenocrysts: Olivine 2%, 0.2–0.4 mm, subhedral, replaced by smectite; plagioclase 5%, 0.3–3 mm, subhedral, fresh, usually zoned; clinopyroxene 3%, 0.3–0.8 mm, subhedral, often in glomerophyric clots with plagioclase, fresh, $2V_z \sim 45°$, often zoned, some crystals corroded

Groundmass: 90%, quench mixture of plagioclase microlites, small olivine crystals, radiating sheaves of clinopyroxene and granular opaques

Vesicles: 1%, 0.05–0.5 mm, round, filled with smectite

Alteration: Olivine replaced by smectite

Location: Section 4, 69–71 cm

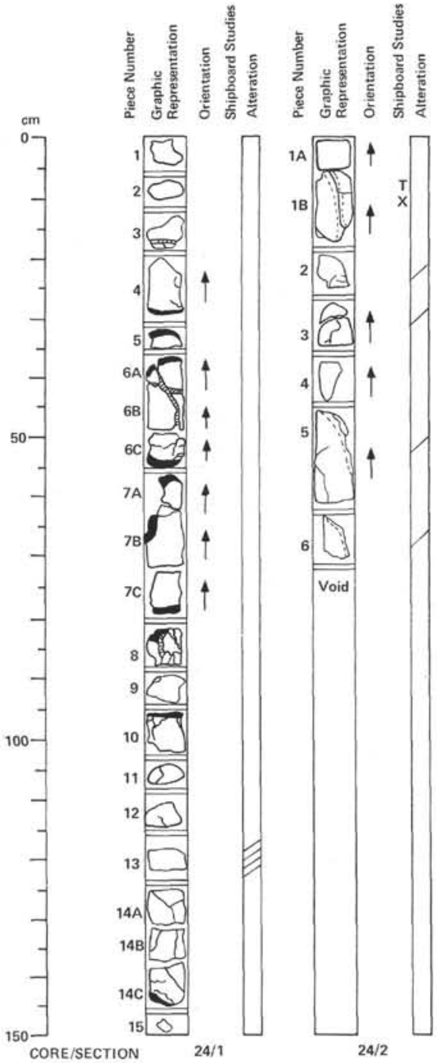
Texture: Moderately phyric, quench

Phenocrysts: Olivine 2%, 0.2–0.4 mm, euhedral; replaced by smectite and carbonate; plagioclase 7–8%, 0.5–2 mm, subhedral prisms, highly zoned, fresh; clinopyroxene 3–4%, 0.5–1 mm, anhedral, usually intergrown with plagioclase in glomerophyric clots, fresh, $2V_z \sim 45°$, usually zoned

Groundmass: 85%, poorly crystallized mixture of plagioclase microlites, radiating sheaves of clinopyroxene, minute granules of opaques, and some interstitial glass; fresh

Vesicles: <1%, 0.5–0.8 mm, round, filled with smectite

Alteration: Olivine altered to smectite



HOLE 483B, CORE 24

Visual Description

Dark gray, moderately phyric, pillow basalt and massive(?) basalt. Pillow basalt extends to base of Section 1; Section 2 lacks cooling breaks. Plagioclase phenocrysts 6–8%, <3 mm, euhedral, fresh, often in glomerophyric clots; olivine phenocrysts 2–3%, <1 mm, euhedral partly to completely replaced by smectite; clinopyroxene phenocrysts 3–4%, <1 mm, anhedral, usually intergrown with plagioclase. Groundmass fine-grained to glassy; glass selvedges at 79 cm, 32 cm, 37–40 cm, 54 cm, 57–67 cm, 78 cm, 82 cm, 96 cm and 144 cm in Section 1; glass somewhat altered to smectite, otherwise groundmass quite fresh. Vesicles 1–2%, <1 mm, spherical, filled with smectite and carbonate. Veins and fractures common, hairline to 2 mm, lined or filled with smectite, carbonate and pyrite; some veins have narrow alteration halos.

Thin Section Description

Location: Section 2, 11–14 cm

Texture: Moderately phyric, quench

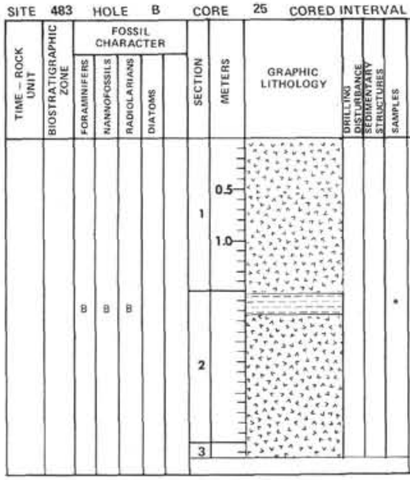
Phenocrysts: Olivine 2–3%, 0.4–1 mm, subhedral, replaced by smectite and carbonate; plagioclase 7%, 0.3–2.5 mm, subhedral, often in clusters, fresh, strongly zoned; clinopyroxene 3–4%, 0.4–0.6 mm, anhedral to rounded, usually in glomerophyric clots with plagioclase, fresh, $2V_z = 45°$.

Groundmass: 85%, quench mixture of skeletal plagioclase microlites, radiating sheaves of clinopyroxene, granular opaques and minor glass; fresh

Vesicles: 1–2%, 0.5–1 mm, round, filled with smectite and carbonate; some with segregation patches

Alteration: Olivine replaced by smectite and carbonate

SITE 483 HOLE B CORE 25 CORED INTERVAL 231.0–235.5 m



N1

LITHOLOGIC DESCRIPTION

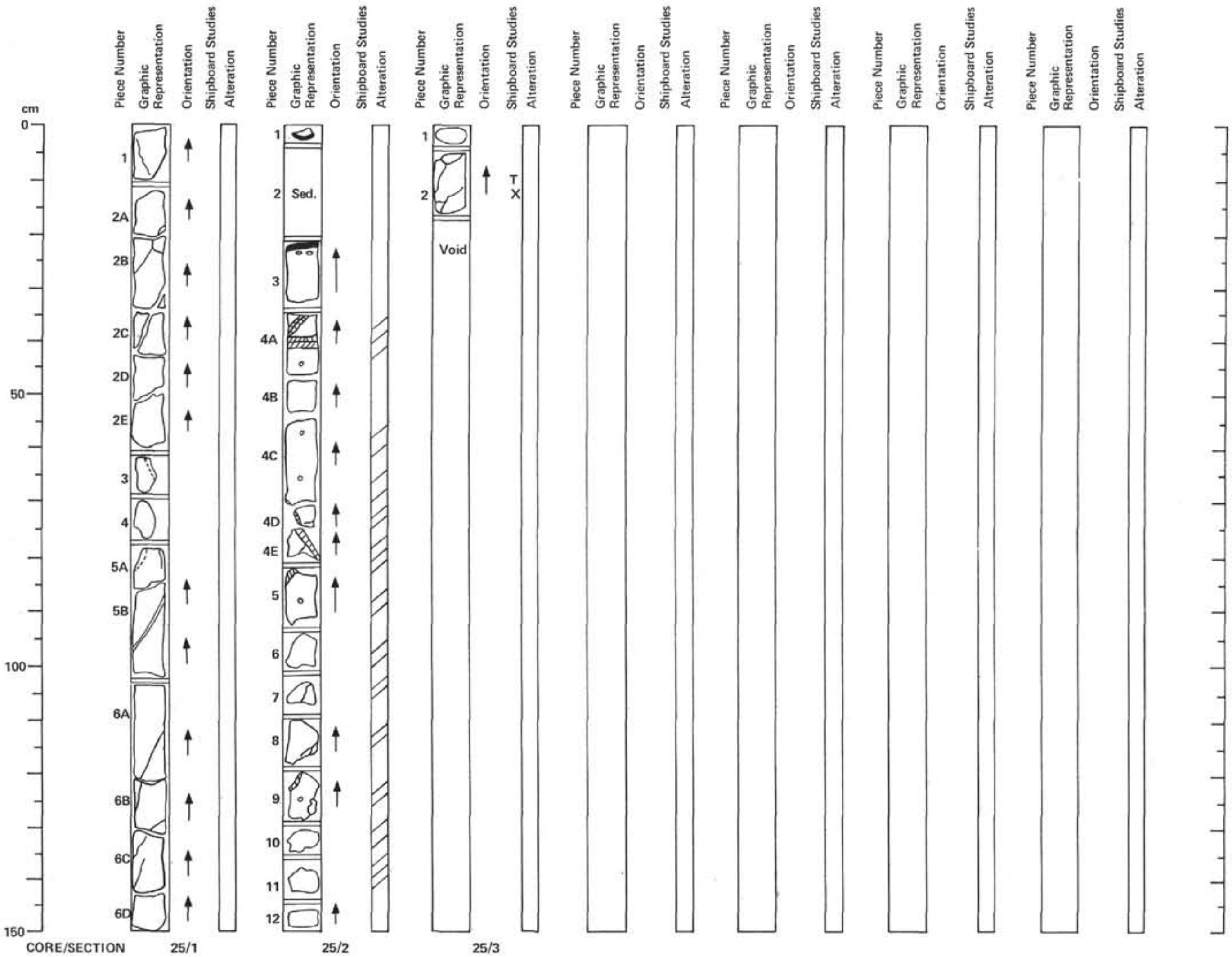
Section 1, 0 cm–Section 2, 5 cm: Massive BASALT with a chilled margin against the underlying sediments.

Section 2, 5–25 cm: Hard black CLAYSTONE with veins of dusky yellow oxidized pyrite. The sediments display flame structures and bedding displaying a 20–30° dip.

Section 2, 25 cm–Section 4, 16 cm: BASALT with a chilled margin against the overlying sediments.

SMEAR SLIDE SUMMARY

	2-14
TEXTURE:	
Sand	–
Silt	23
Clay	77
COMPOSITION:	
Quartz	10
Feldspar	3
Heavy minerals	10
Clay	77
Volcanic glass	TR
Zeolite	?



HOLE 483B, CORE 25

Visual Description

Section 1, 0 cm–Section 2, 4 cm: Medium to dark gray, moderately phyric, massive basalt. Plagioclase phenocrysts 8–10%, <1 mm, euhedral fresh; olivine phenocrysts 2%, <1 mm, euhedral, replaced by smectite; clinopyroxene phenocrysts 3%, <1 mm, anhedral, fresh, often in glomerophyric clots with plagioclase. Groundmass fine- to medium-grained; glass selvedge at 3 cm, Section 2; groundmass relatively fresh. Vesicles < 1%, < 0.5 mm, spherical, filled with smectite. Veins and fractures fairly common, mostly steep, filled or lined with smectite, carbonate and minor pyrite; some have alteration halos 3–4 mm wide.

Section 2, 4–22 cm: Black, well indurated, silty claystone.

Section 2, 22 cm–base of core: Medium gray, moderately phyric, massive basalt. Plagioclase phenocrysts 8–10%, <1 mm, euhedral, fresh; olivine phenocrysts 2%, <1 mm, euhedral, altered to smectite; clinopyroxene phenocrysts 3%, <1 mm, anhedral, fresh, often in clots with plagioclase. Groundmass fine- to medium-grained; glass selvedge at 22 cm, Section 2, grain size increases downward from selvedge; groundmass generally fresh. Vesicles 1–3%, largest and most abundant in upper half of Section 2, 0.5–3 mm, spherical, filled with smectite and minor pyrite. Veins and fractures sparse, one large vein between 70 and 80 cm, Section 1; veins hairline to 5 mm, filled with smectite, carbonate and minor pyrite; some veins have narrow alteration halos; some are slickensided.

Thin Section Description

Location: Section 3, 8–10 cm

Texture: Moderately phyric, fine-grained, intergranular to intersertal

Phenocrysts: Olivine 2%, 0.4–0.8 mm, subhedral, replaced by smectite; plagioclase 8–10%, 0.4–1 mm, seriate with groundmass, fresh, some clots with clinopyroxene; clinopyroxene 3%, 0.4–1 mm, anhedral, fresh, often in clots with plagioclase, $2V_z \sim 45°$.

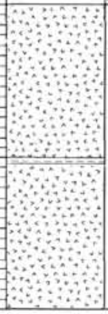
Groundmass: Olivine 1–2%, 0.1–0.3 mm, subhedral, replaced by smectite; plagioclase 40%, 0.2–0.4 mm, subhedral laths, fresh; clinopyroxene 30%, 0.05–0.3 mm, granular to radiating sheaves, fresh, $2V_z \sim 45°$; opaques 2–3%, 0.005–0.1 mm, granular to lath-shaped, magnetite-ilmenite; interstitial material 10%, microcrystalline, partly replaced by smectite

Vesicles: <1%, 0.5 mm, round, filled with brown smectite

Alteration: Olivine replaced by smectite

SITE 483 HOLE B CORE 26 CORED INTERVAL 235.5–240.0 m

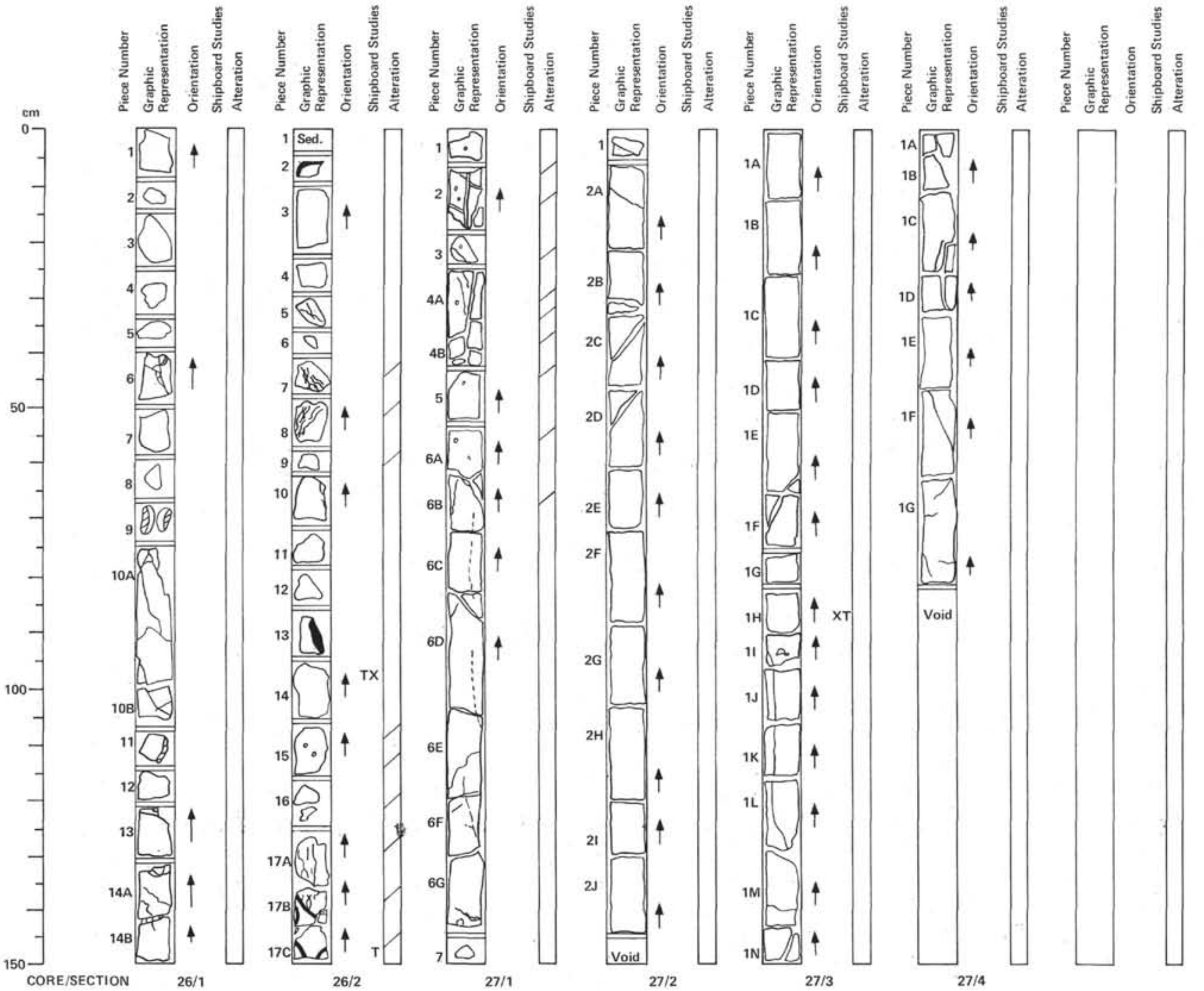
TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FOSSIL CHARACTER: FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	SAMPLES		LITHOLOGIC DESCRIPTION
						1	0.5, 1.0						
			B			2			i	*		N1	



Section 1: BASALT.
Section 2, 0–5 cm: Firm, black CLAYSTONE.
Section 2, 5–150 cm: BASALT with a chilled margin against the overlying sediments.

SMEAR SLIDE SUMMARY

	2-2
TEXTURE:	
Sand	–
Silt	12
Clay	88
COMPOSITION:	
Quartz	6
Feldspar	1
Clay	88
Volcanic glass	TR
Calc. nannofossils	5



HOLE 483B, CORE 26

Visual Description

Section 1, 0–150 cm: Medium gray, moderately phyric, massive basalt. Plagioclase phenocrysts 6–8%, < 2 mm, euhedral, fresh; olivine phenocrysts 1–2%, <1 mm, euhedral, altered to smectite; clinopyroxene phenocrysts 3–5%, 1 mm, anhedral, fresh, often intergrown with plagioclase in glomerophyric clots. Groundmass fine-grained, uniform, relatively fresh. Vesicles 1%, < 1 mm, spherical, filled wih smectite. Veins and fractures sparse, hairline to 3 mm, filled with smectite and carbonate.

Section 2, 0–5 cm: Black, well indurated, silty claystone.

Section 2, 5 cm–base of core: Medium gray, moderately phyric massive basalt. Plagioclase phenocrysts 8–10%, <2 mm, euhedral, fresh; olivine phenocrysts 2%, <1 mm, euhedral, replaced by smectite; clinopyroxene phenocrysts 3–4%, < 1 mm, anhedral, often in glomerophyric clots with plagioclase. Groundmass fine-grained to glassy; glass selvedges at 5 cm and possibly at 89–94 cm, Section 2; grain size increases slightly away from selvedges; groundmass relatively fresh but some patches of pervasive alteration occur. Vesicles 1–2%, <1 mm, spherical, filled with smectite. Fractures and veinlets common, hairline to 2 mm, filled with smectite.

Thin Section Description

Location: Section 2, 86–100 cm

Texture: Moderately phyric, fine-grained, intersertal

Phenocrysts: Olivine 2%, 0.4–0.6 mm, subhedral, replaced by smectite; plagioclase 8–10%, 0.5–2 mm, seriate with groundmass, often in glomerophyric clots with clinopyroxene, strongly zoned, fresh; clinopyroxene 3–4%, 0.3–0.8 mm, subhedral, occurs mostly in glomerophyric clots with plagioclase but there are some individual, corroded crystals, fresh, $2V_z \sim 45°$.

Groundmass: Olivine 2%, 0.1–0.2 mm, subhedral, replaced by smectite; plagioclase 40%, 0.1–0.5 mm, subhedral laths, fresh; clinopyroxene 20%, 0.1–0.3 mm, granular to radiating sheaves, fresh, $2V_z \sim 45°$; opaques 2–3%, 0.005–0.1 mm, granular to lath-shaped, magnetite-ilmenite; interstitial material 20%, microcrystalline, partly replaced by smectite

Vesicles: 1–2%, 0.3–0.5 mm, round, filled with brown smectite; a few segregation vesicles

Alteration: Olivine and some interstitial material replaced by smectite

Location: Section 2, 145–147 cm

Texture: Moderately phyric, quench

Phenocrysts: Olivine 1–2%, 0.3–0.8 mm, subhedral, replaced by smectite; plagioclase 8–10%, 0.3–1.5 mm, subhedral laths, often intergrown with clinopyroxene, fresh; clinopyroxene 2%, 0.2–0.8 mm, subhedral, intergrown with plagioclase, fresh, $2V_z \sim 45°$.

Groundmass: 85–90%, quench mixture of plagioclase microlites, sheaves of clinopyroxene, granular opaques, and abundant dark brown glass; fresh

Vesicles: < 1%, 0.4 mm, round, filled with smectite

Alteration: Olivine replaced by smectite

HOLE 483B, CORE 27

Visual Description

Medium gray to light gray, aphyric to very sparsely phyric, massive basalt. Plagioclase phenocrysts < 2%, 2–6 mm, euhedral, fresh; olivine phenocrysts < 1%, <2 mm, euhedral, replaced by carbonate and smectite. Groundmass holocrystalline, medium- to coarse-grained, generally uniform, slightly altered. Vesicles < 2%, most abundant at top of core, <1.5 mm, spherical, filled with smectite. Fractures and veins sparse to common, mostly steep, hairline to *3 mm wide, filled with smectite, carbonate and zeolite(?).*

Thin Section Description

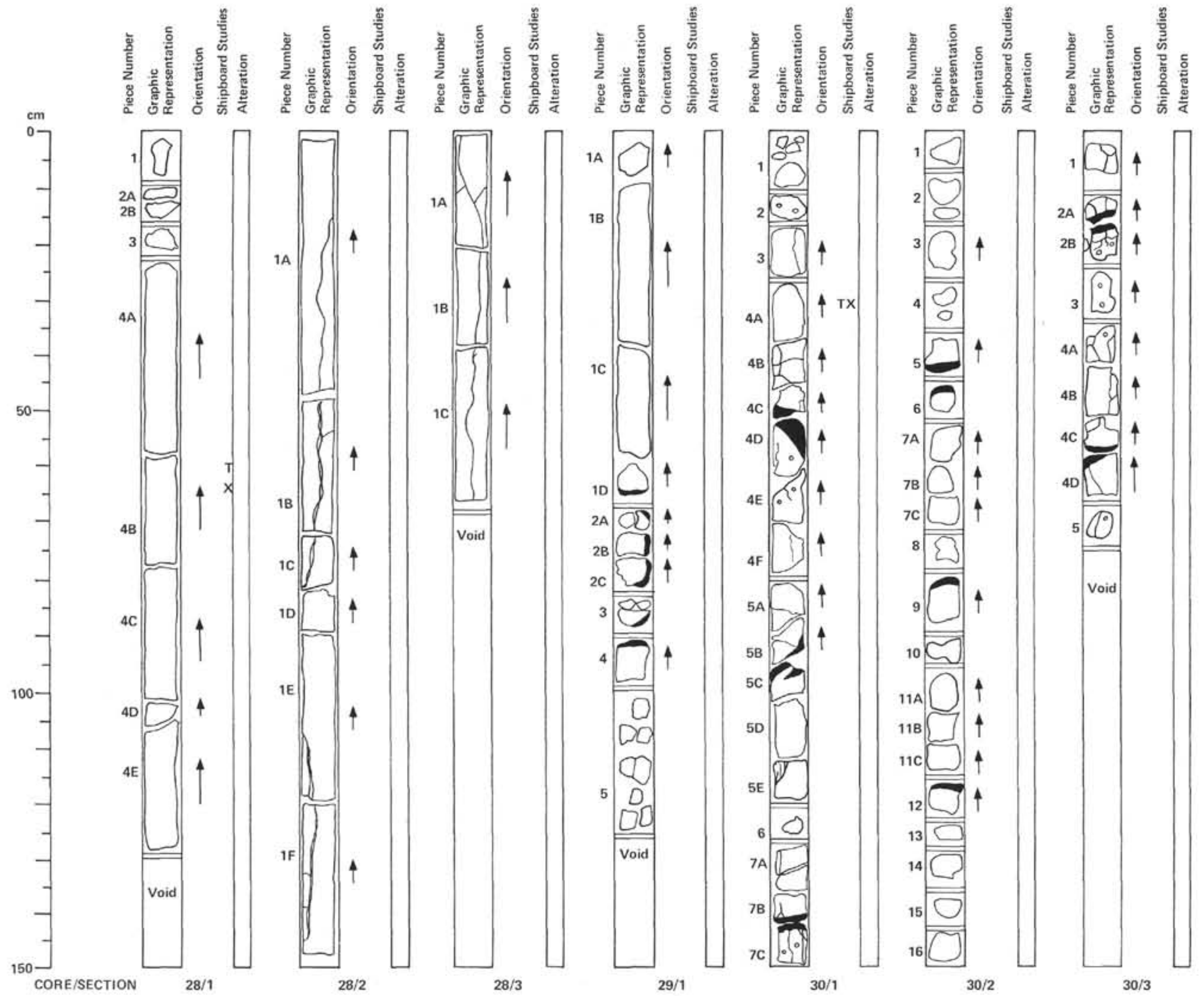
Location: Section 3, 85–87 cm

Texture: Aphyric, medium- to coarse-grained, intergranular to intersertal

Groundmass: Olivine 2–3%, 0.2–0.6 mm, subhedral, replaced by smectite; plagioclase 40–45%, 0.2–1.5 mm, subhedral laths, fresh; clinopyroxene 35–40%, 0.2–2 mm, often in subophitic plates, fresh, $2V_z \sim 45°$; opaques 3–4%, 0.05–0.7 mm, square crystals to laths, magnetite-ilmenite; interstitial material 15%, glassy to devitrified, partly replaced by smectite

Vesicles: < 1%, < 0.5 mm, round, filled with brown smectite

Alteration: Olivine and some interstitial material replaced by smectite



HOLE 483B, CORE 28

Visual Description

Medium to light gray, aphyric to very sparsely phyric, massive basalt. Platioclase phenocrysts <2%, <2 mm, euhedral, fresh; olivine phenocrysts < 1%, <2 mm, euhedral, replaced by smectite. Groundmass holocrystalline, medium-grained, slightly altered. Vesicles < 1%, < 0.5 mm, spherical, filled with smectite. Veins and fractures sparse to common, mostly steep, hairline to 3 mm wide, filled or lined with smectite, carbonate and zeolite(?).

Thin Section Description

Location: Section 1, 66–68 cm

Texture: Aphyric, medium-grained, intersertal

Groundmass: Olivine 2–3%, 0.5–1 mm, subhedral, partly replaced by smectite, some fresh remnants; plagioclase 35–40%, 0.2–1.5 mm, subhedral laths, fresh; clinopyroxene 30–35%, 0.2–0.8 mm, anhedral intergrown with plagioclase, fresh, $2V_z \sim 45°$; opaques 3–4%, 0.05–0.5 mm, square crystals to laths, magnetite-ilmenite, occurs in interstitial patches; interstitial material 20%, glassy to microcrystalline, in large irregular patches, partly replaced by smectite, mostly fresh

Vesicles: < 1%, < 0.5 mm, round to irregular, filled with brown smectite

Alteration: Olivine and interstitial material partly replaced by smectite

HOLE 483B, CORE 29

Visual Description

Section 1, 0–65 cm: Medium to light gray, aphyric to very sparsely phyric, massive basalt. Plagioclase phenocrysts < 2%, < 2 mm euhedral, fresh; olivine phenocrysts < 1%, < 2 mm, euhedral, replaced by smectite. Groundmass medium-grained to glassy; glass selvedge at 65 cm; groundmass slightly altered. Vesicles < 1%, 0.5 mm, spherical, filled with smectite. Veins and fractures sparse, mostly steep, hairline to 3 mm wide, filled with smectite, carbonate and zeolite(?).

Section 1, 65 cm–base of core: Dark gray, sparsely to moderately phyric, pillow basalt. Plagioclase phenocrysts 5–8%, < 2 mm, euhedral, fresh; olivine phenocrysts 1–3%, < 4 mm, euhedral, altered to smectite; clinopyroxene phenocrysts 1–2%, < 0.5 mm, fresh, sometimes intergrown with plagioclase. Groundmass fine-grained to glassy; glass selvedges at 66–81 cm, 85–87 cm, and 91 cm, Section 1; glass partly altered to smectite and carbonate, otherwise groundmass is relatively fresh. Vesicles 1–5%, most abundant in lower 25 cm of core, < 1 mm, spherical, filled with smectite. Veins and fractures sparse, filled with smectite.

HOLE 483B, CORE 30

Visual Description

Dark gray, moderately phyric, pillow basalt. Plagioclase phenocrysts 8%, most ≤2 mm, some to 10 mm, euhedral, fresh; olivine phenocrysts 2–3%, <4 mm, euhedral, replaced by smectite and carbonate; clinopyroxene phenocrysts 1–2%, ≤1 mm, intergrown with plagioclase, fresh. Groundmass fine-grained to glassy; glass selvedges at 50–59 cm, 90–98 cm, and 140–142 cm in Section 1, at 43 cm, 47 cm, 80 cm, and 116 cm in Section 2 and at 15–17 cm and 56–60 cm in Section 3; groundmass slightly altered, glassy selvedges partly replaced by smectite. Vesicles 1–5%, most abundant in upper parts of pillows, < 0.5 mm, spherical, most filled with smectite, carbonate and pyrite, some open. Fractures and veinlets sparse, hairline to 2 mm, mostly steep, filled with smectite and carbonate.

Thin Section Description

Location: Section 1, 31–34 cm

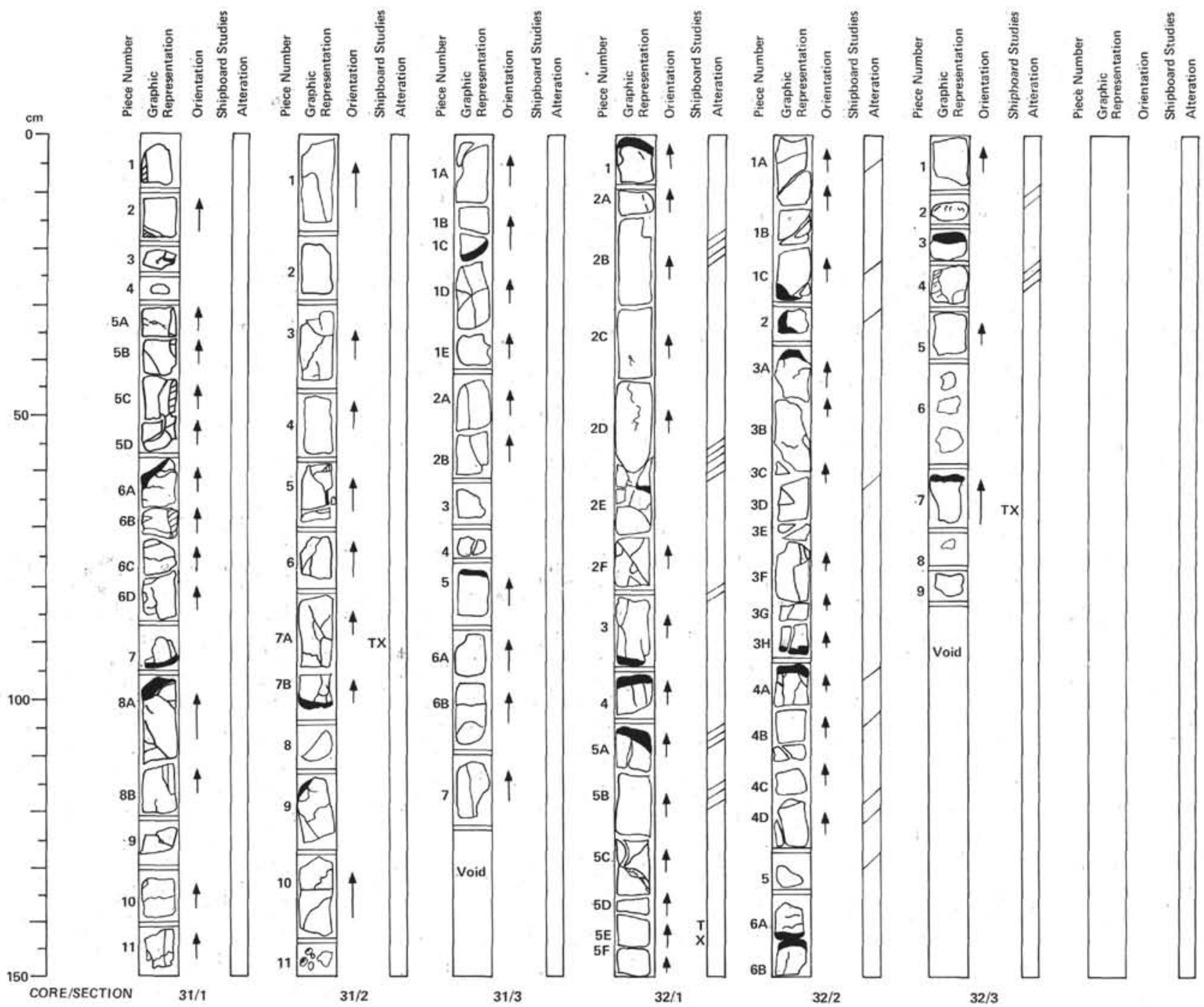
Texture: Moderately phyric, quench

Phenocrysts: Olivine 3%, 0.5–4 mm, subhedral, often corroded, replaced by smectite and minor carbonate; plagioclase 8%, 0.3–2 mm, euhedral to subhedral, fresh, sometimes in glomerophyric clusters; clinopyroxene 1–2%, 0.1–0.5 mm, intergrown with plagioclase, fresh, $2V_z \sim 45°$

Groundmass: 85–90%, quench mixture of plagioclase microlites, sheaves of clinopyroxene, granular opaques and interstitial glass

Vesicles: 1%, <0.4 mm, round, filled with brown smectite

Alteration: Olivine altered to smectite and minor carbonate



HOLE 483B, CORE 31

Visual Description

Dark gray, moderately phyric, pillow basalt. Plagioclase phenocrysts 5–7%, < 8 mm, euhedral, fresh; olivine phenocrysts 3–5%, < 2 mm, euhedral, altered to smectite. Groundmass fine-grained to glassy; glass selvedges t 57–62 cm, 93 cm, and 96–100 cm in Section 1, at 101 cm and 114–116 cm in Section 2 and at 18–22 cm and 77 cm in Section 3. Groundmass moderately altered, particularly near fractures; glass selvedges partly replaced by smectite. Vesicles 1–3%, < 1 mm, spherical, filled with smectite and minor pyrite. Fractures and veinlets common, hairline to 2 mm, mostly steep, filled with smectite, carbonate and minor pyrite.

Thin Section Description

Location Section 2, 86–89 cm

Texture: Moderately phyric, quench

Phenocrysts: Olivine 3–5%, 0.3–2 mm, euhedral to subhedral, altered to smectite and carbonate; plagioclase 5–7%, 0.3–3 mm, subhedral, fresh

Groundmass: 90%, quench groundmass, mostly brown glass with minor plagioclase microlites, granular opaques, and poorly crystallized clinopyroxene, fresh

Vesicles: < 1%, < 0.6 mm, round, filled with brown smectite

Alteration: Olivine replaced by smectite and carbonate

HOLE 483B, CORE 32

Visual Description

Dark gray, moderately phyric, pillow basalt. Plagioclase phenocrysts 5–8%, < 2 mm, euhedral, fresh; olivine phenocrysts 1–2%, < 1 mm, subhedral, altered to smectite and carbonate; clinopyroxene phenocrysts < 3%, < 0.5 mm, intergrown with plagioclase, fresh. Groundmass fine-grained to glassy; glass selvedges at 0 cm, 93 cm, 96 cm and 94 cm and possibly 143 cm in Section 2 and 61 cm, Section 3, by smectite. Vesicles < 2%, < 1 mm, spherical, filled with smectite. Fractures and veinlets common, hairline to 3 mm wide, filled with smectite, carbonate and minor pyrite; smectite masses at 17 cm and 23–30 cm in Section 3 may be altered glass.

Thin Section Description

Location: Section 1, 135–137 cm

Texture: Moderately phyric, fine-grained, intersertal

Phenocrysts: Olivine 2–3%, 0.3–1.1 mm, subhedral, replaced by smectite and carbonate; plagioclase 7–8%, 0.5–2 mm, seriate with groundmass, fresh, skeletal

Groundmass: Olivine 1–2%, 0.05–0.2 mm, subhedral, replaced by smectite; plagioclase 30–35%, 0.1–0.5 mm, subhedral, fresh; clinopyroxene 30–35%, 0.05–0.4 mm, anhedral, fresh, $2V_z \sim 45°$; opaques 3–4%; 0.05–0.3 mm, square crystals to laths, magnetite-ilmenite; interstitial material 15–20%, devitrified glass, mostly fresh

Vesicles: < 1%, < 1 mm, round, filled with smectite

Alteration: Olivine replaced by smectite and carbonate

Location: Section 3, 63–65 cm

Texture: Moderately phyric, quench

Phenocrysts: Olivine 2%, 0.2–1 mm, subhedral, replaced by smectite; plagioclase 5–7%, 0.3–1.5 mm, subhedral laths, fresh; clinopyroxene 3%, 0.2–0.4 mm, anhedral, intergrown in clots with plagioclase, fresh, $2V_z \sim 45°$.

Groundmass: 85–90%, mostly devitrified glass with minor plagioclase microlites and granular opaques

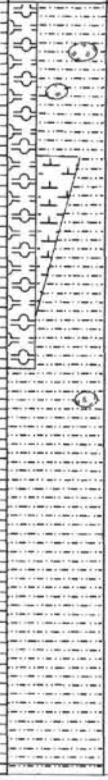
Vesicles: 2%, 0.4–0.8 mm, round, filled with smectite

Alteration: Olivine altered to smectite

SITE 483 HOLE C CORE 1 CORED INTERVAL 38.5–48.0 m

TIME-ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	METERS
QUATERNARY	NN19 (N)		CM			1	0.5, 1.0
			AG			2	
			CM			2	
						3	
						4	
			CM			5	
						CC	

GRAPHIC LITHOLOGY



DRILLING DISTURBANCE / SEDIMENTARY STRUCTURES / SAMPLES

LITHOLOGIC DESCRIPTION

10Y 4/2

5GY 3/2

5P 2/2

5GY 3/2

10Y 4/2

5GY 3/2

10Y 4/2

5GY 3/2 and 10Y 4/2

Section 1: Soft, vitric SILICEOUS SILTY CLAY with small (< 1 cm) inclusions of ASH.

Section 2, 0 cm–Section 3, 60 cm: Soft, SILICEOUS NANNOFOSSIL MARL grading with depth in Section 2 to a NANOFOSSIL-bearing SILICEOUS SILTY CLAY underlain by SILICEOUS SILTY CLAY.

Section 3, 60–150 cm: Soft, vitric SILTY CLAY with rare inclusions of ASH and numerous streaks of pyrite.

Section 4–Core-Catcher: Firm SILTY CLAY containing small amounts of volcanic glass.

SMEAR SLIDE SUMMARY

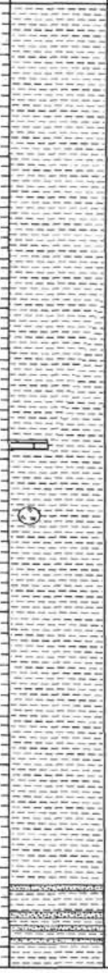
	1-45 (M)	1-75	1-127 (M)	2-14	2-75	2-148
TEXTURE:						
Sand	60	TR	TR	TR	TR	TR
Silt	30	63	38	71	52	52
Clay	10	37	62	29	48	48
COMPOSITION:						
Quartz	–	15	4	TR	TR	10
Feldspar	TR	TR	TR	–	TR	2
Mica	–	TR	–	–	–	TR
Heavy minerals	–	TR	TR	–	TR	TR
Clay	10	37	62	29	48	48
Volcanic glass	80	TR	5	–	TR	TR
Pyrite	TR	2	TR	TR	TR	TR
Carbonate unspec.	–	1	–	1	–	TR
Calc. nannofossils	10	5	2	40	20	TR
Diatoms	TR	20	15	15	15	20
Radiolarians	TR	15	10	10	10	10
Sponge spicules	TR	5	2	5	7	10
Silicoflagellates	TR	–	TR	TR	TR	TR

	3-75	3-85 (M)	3-94 (M)	3-138	4-75	5-75
TEXTURE:						
Sand	–	–	40	2	–	–
Silt	25	68	53	20	55	31
Clay	75	32	7	78	45	69
COMPOSITION:						
Quartz	10	5	–	3	10	10
Feldspar	TR	TR	–	TR	TR	1
Mica	1	–	–	TR	–	–
Heavy minerals	–	TR	TR	TR	TR	TR
Clay	75	32	7	78	45	69
Volcanic glass	10	TR	93	10	5	2
Pyrite	TR	60	–	1	2	1
Foraminifers	–	–	TR	–	–	–
Calc. nannofossils	–	–	1	7	8	–
Diatoms	2	1	TR	TR	15	2
Radiolarians	2	1	1	1	10	10
Sponge spicules	TR	1	–	TR	5	5
Silicoflagellates	–	TR	–	–	TR	–

SITE 483 HOLE C CORE 2 CORED INTERVAL 86.0–95.5 m

TIME-ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	METERS
QUATERNARY	NN19 (N)	RM		RG		1	0.5, 1.0
			FM			2	
		FG		RG		3	
						4	
						5	
			CM			6	
						7	
						CC	

GRAPHIC LITHOLOGY



DRILLING DISTURBANCE / SEDIMENTARY STRUCTURES / SAMPLES

LITHOLOGIC DESCRIPTION

10Y 4/2

10Y 4/2 and 5Y 3/2

5Y 3/2

5Y 3/2 and 10Y 4/2

5Y 3/2

CLAY and SILTY CLAY containing pieces of LIMESTONE in Section 3, a small patch of vitric SILTY CLAY (ash?) at a depth of 46 cm in Section 4 and thin layers of SANDY SILT near the base of the core. The sediments are soft to the base of Section 4, then firm throughout the remainder of the core.

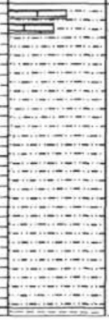
SMEAR SLIDE SUMMARY

	2-130	3-104	3-138 (M)	4-17	4-56 (M)	6-75	6-148 (M)
TEXTURE:							
Sand	–	TR	–	–	TR	–	10
Silt	11	30	100	6	37	45	60
Clay	89	70	–	94	63	55	30
COMPOSITION:							
Quartz	1	15	–	4	10	20	30
Feldspar	TR	5	–	TR	2	5	15
Mica	–	TR	–	–	–	TR	1
Heavy minerals	2	TR	–	TR	1	TR	1
Clay	89	70	–	94	63	55	30
Volcanic glass	3	TR	–	1	14	2	TR
Pyrite	5	10	–	–	5	–	10
Zeolite	–	–	–	–	5	15	10
Carbonate unspec.	TR	TR	100	–	–	TR	–
Calc. nannofossils	TR	TR	–	TR	TR	3	3
Diatoms	TR	–	–	TR	–	TR	–
Radiolarians	TR	–	–	TR	–	–	–
Sponge spicules	TR	–	–	1	–	–	–

SITE 483 HOLE C CORE 3 CORED INTERVAL 95.5–105.0 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	METERS
		FM	B	B		1	0.5, 1.0
						2	
		B		B		CC	

GRAPHIC LITHOLOGY



LITHOLOGIC DESCRIPTION

5Y 3/2

Firm, olive gray SILTY CLAY containing small pieces of partially dolomitized LIMESTONE near the top of Section 1, dusky purple streaks of pyrite in the middle of Section 1 and burrows filled with SANDY SILT in the lower half of Section 1.

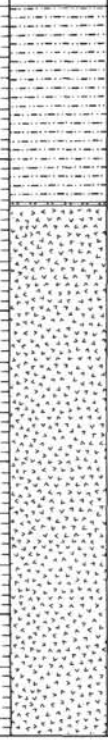
SMEAR SLIDE SUMMARY

	2-75	2-110 (M)
TEXTURE:		
Sand	1	–
Silt	40	20
Clay	59	80
COMPOSITION:		
Quartz	15	10
Feldspar	10	2
Mica	TR	TR
Heavy minerals	TR	TR
Clay	59	80
Volcanic glass	5	3
Pyrite	1	–
Zeolite	10	5

SITE 483 HOLE C CORE 4 CORED INTERVAL 105.0–114.0 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	METERS
			B			1	0.5, 1.0
						2	
						3	
						4	
						5	

GRAPHIC LITHOLOGY



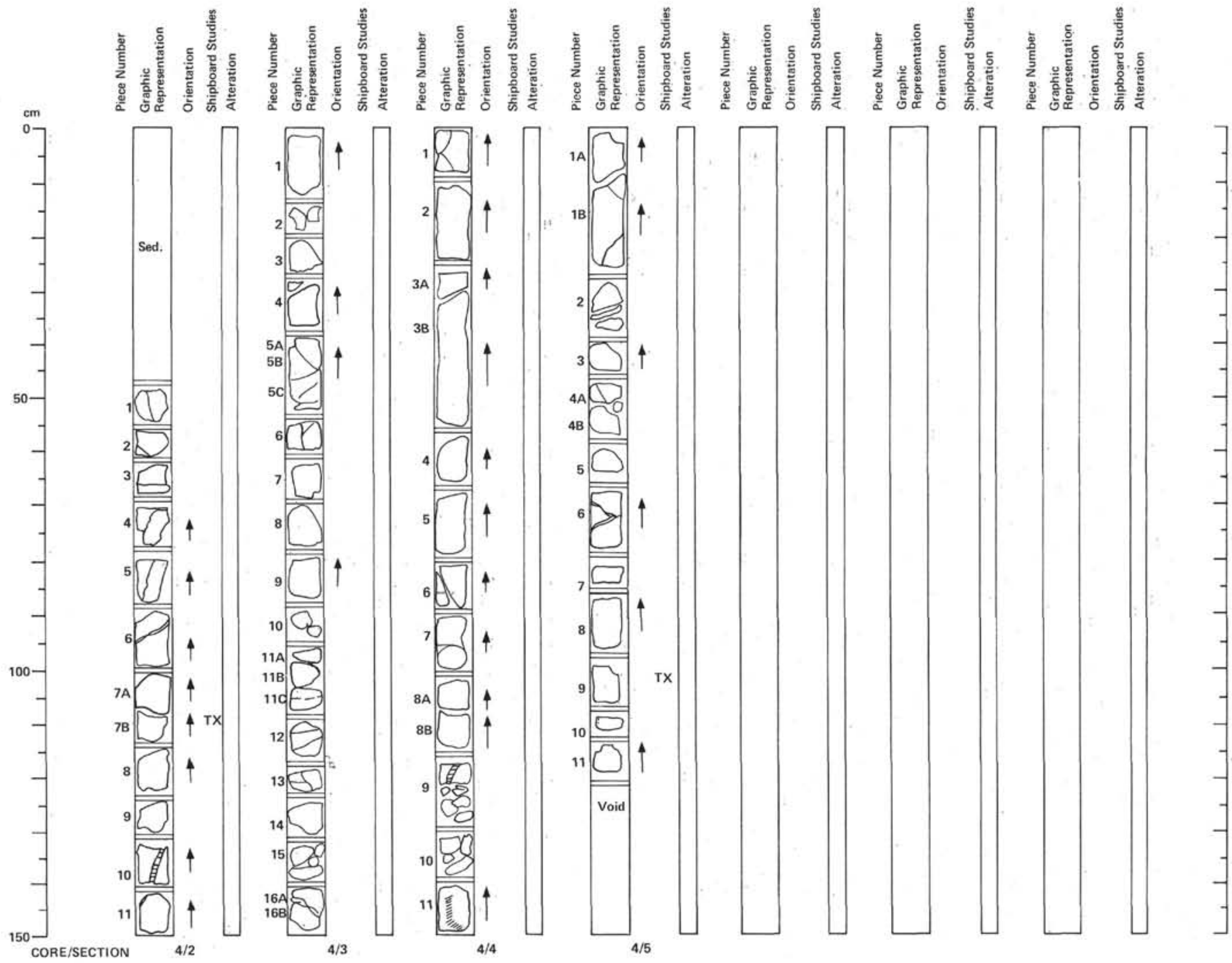
LITHOLOGIC DESCRIPTION

5Y 3/2

Section 1, 0 cm–Section 2, 47 cm: Firm olive gray SILTY CLAY underlain by a thin (3 cm) indurated layer of gray SILTY CLAYSTONE and light gray SILTSTONE overlying massive BASALT.

SMEAR SLIDE SUMMARY

	1-107	2-15	2-42
TEXTURE:			
Sand	2	–	1
Silt	38	33	39
Clay	60	67	60
COMPOSITION:			
Quartz	30	15	20
Feldspar	2	2	10
Mica	TR	TR	TR
Heavy minerals	TR	TR	–
Clay	60	67	60
Volcanic glass	–	–	?
Pyrite	1	TR	< 1
Zeolite	7	10	10



HOLE 483C; CORE 4

Visual Description

Section 1, 0–46 cm: Brown siltstone

Section 1, 46 cm–base of core: Gray, aphyric, massive basalt. Rock fine- to medium-grained, uniform, relatively fresh. Vesicles rare, a few at top of core, <1 mm, spherical, filled with carbonate. Veins sparse, ≤2 mm, filled with carbonate.

Thin Section Description

Location: Section 2, 110–112 cm

Texture: Aphyric, medium-grained, intergranular

Groundmass: Olivine 5%, 0.15–0.3 mm, subhedral, altered to smectite, a few grains with fresh remnants; plagioclase 50–55%, 0.2–1 mm, subhedral lahts, fresh; clinopyroxene 35–40%, 0.05–0.25 mm, granular, mostly fresh, minor alteration to chlorite(?), $2V_z$ ~40°; opaques 3–4%, 0.05–0.15 mm, subhedral, skeletal crystals, magnetite-ilmenite, interstitial material 1–2%, glassy to microcrystalline patches altered to smectite with minor apatite and chlorite(?).

Vesicles: <1%, 0.2–0.4 mm, spherical, filled with smectite

Alteration: Some olivine and interstitial material replaced by smectite

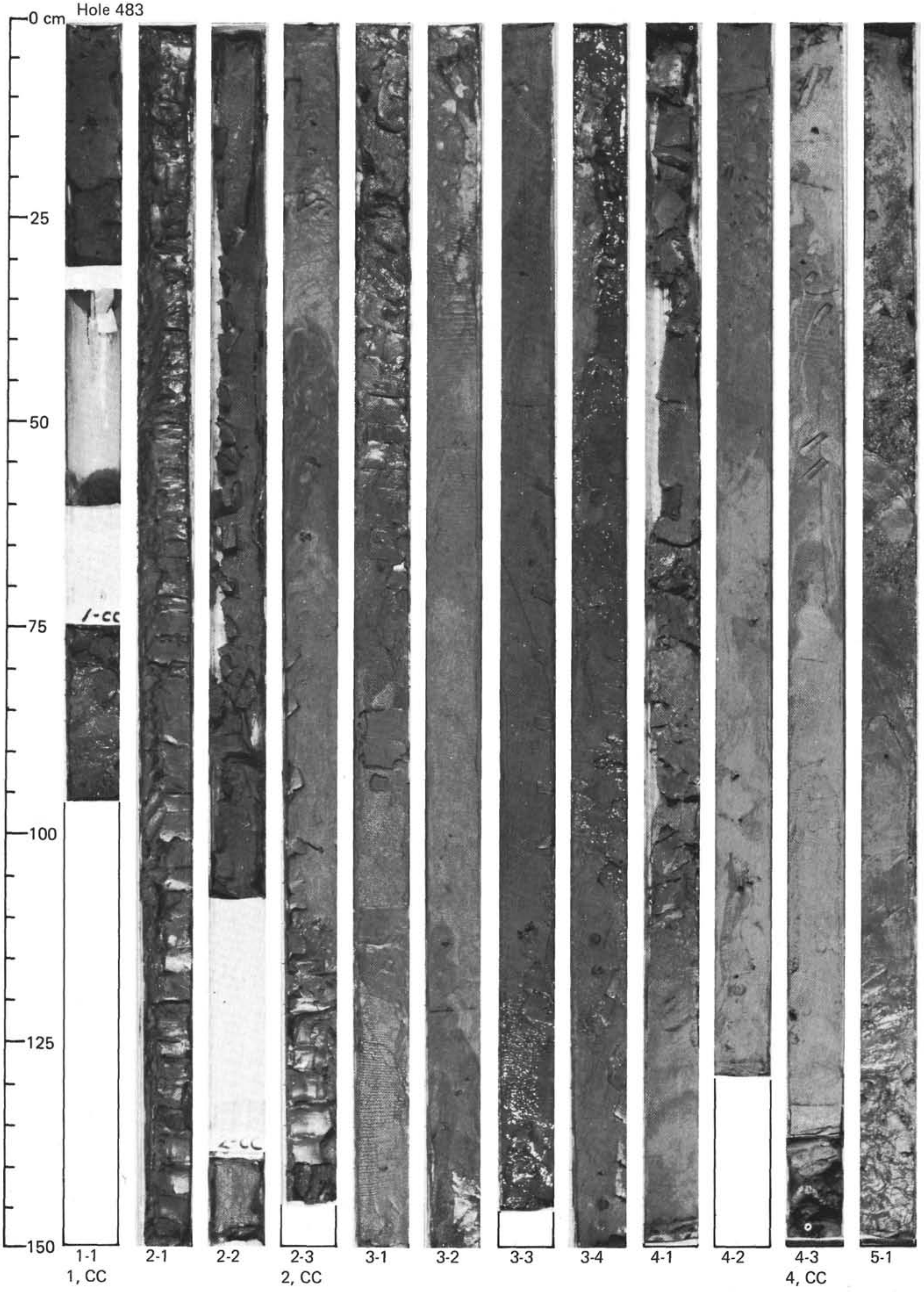
Location: Section 5, 98–101 cm

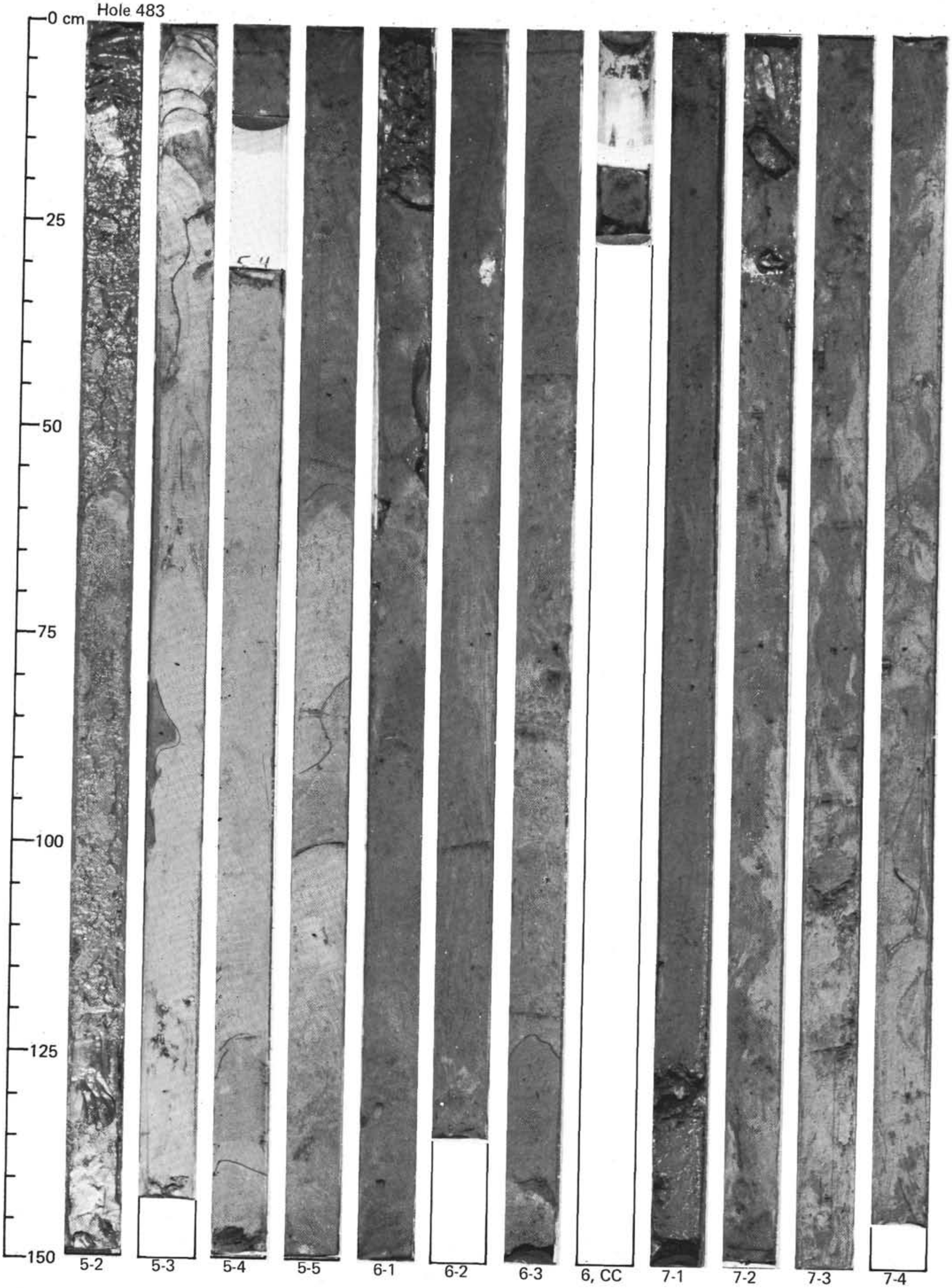
Texture: Aphyric, medium-grained, intergranular

Groundmass: Olivine 5%, 0.2–0.5 mm, subhedral, partly altered to smectite; plagioclase 55%, 0.4–1.5 mm, subhedral laths, fresh; clinopyroxene 35%, 0.1–0.3 mm, granular, mostly fresh, some marginally altered to chlorite(?); opaques 2–3%, 0.1–0.3 mm, anhedral, often skeletal, probably magnetite; interstitial material 1%, mostly quartz with minor apatite.

Vesicles: <1%, 0.3–0.5 mm, spherical, filled with smectite

Alteration: Some olivine altered to smectite


0 cm
25
50
75
100
125
150
Hole 483
1-cc
2-cc
1-1
1, CC
2-1
2-2
2-3
2, CC
3-1
3-2
3-3
3-4
4-1
4-2
4-3
4, CC
5-1


Hole 483
0 cm
25
50
75
100
125
150
5-2
5-3
5-4
5-5
6-1
6-2
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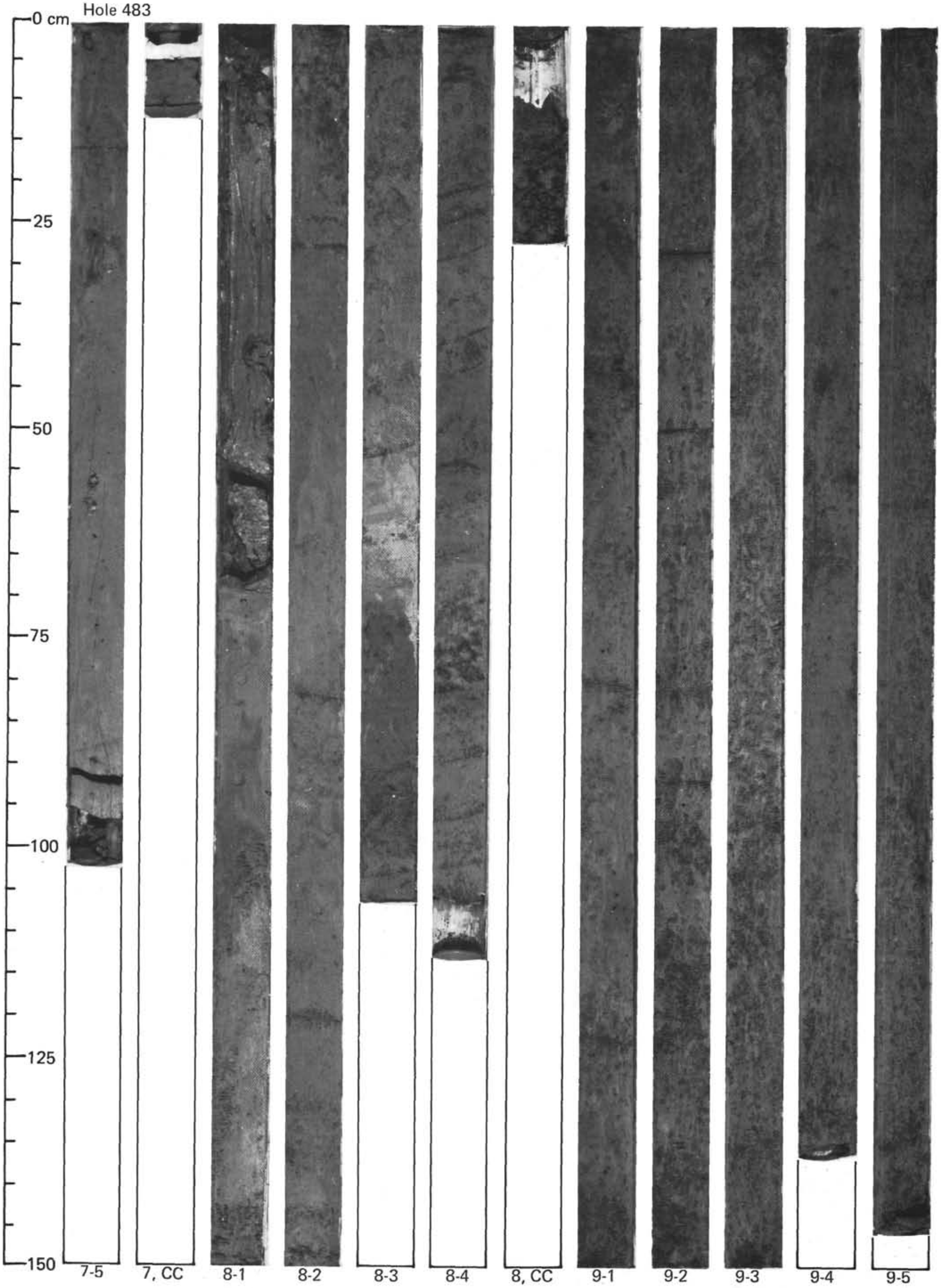
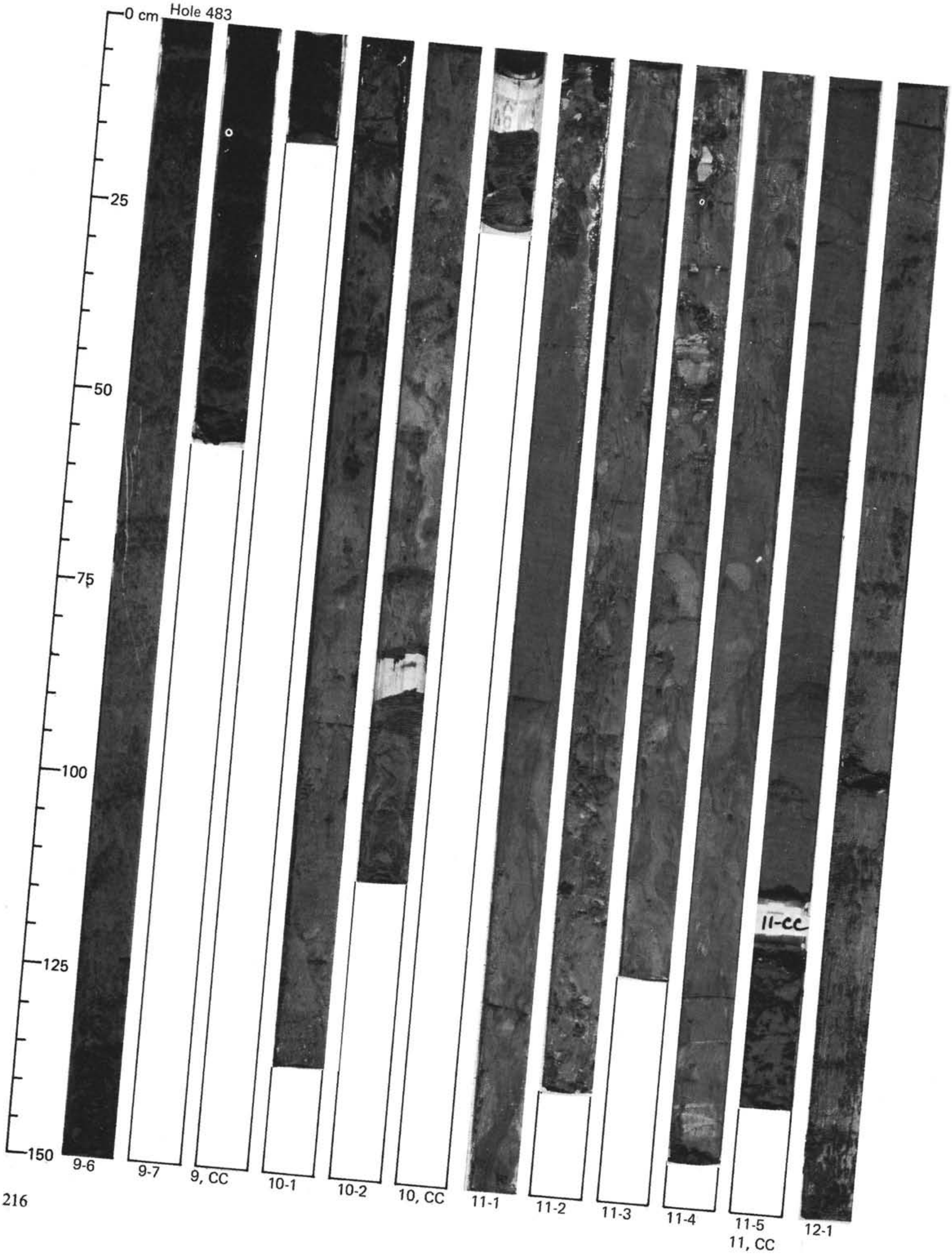
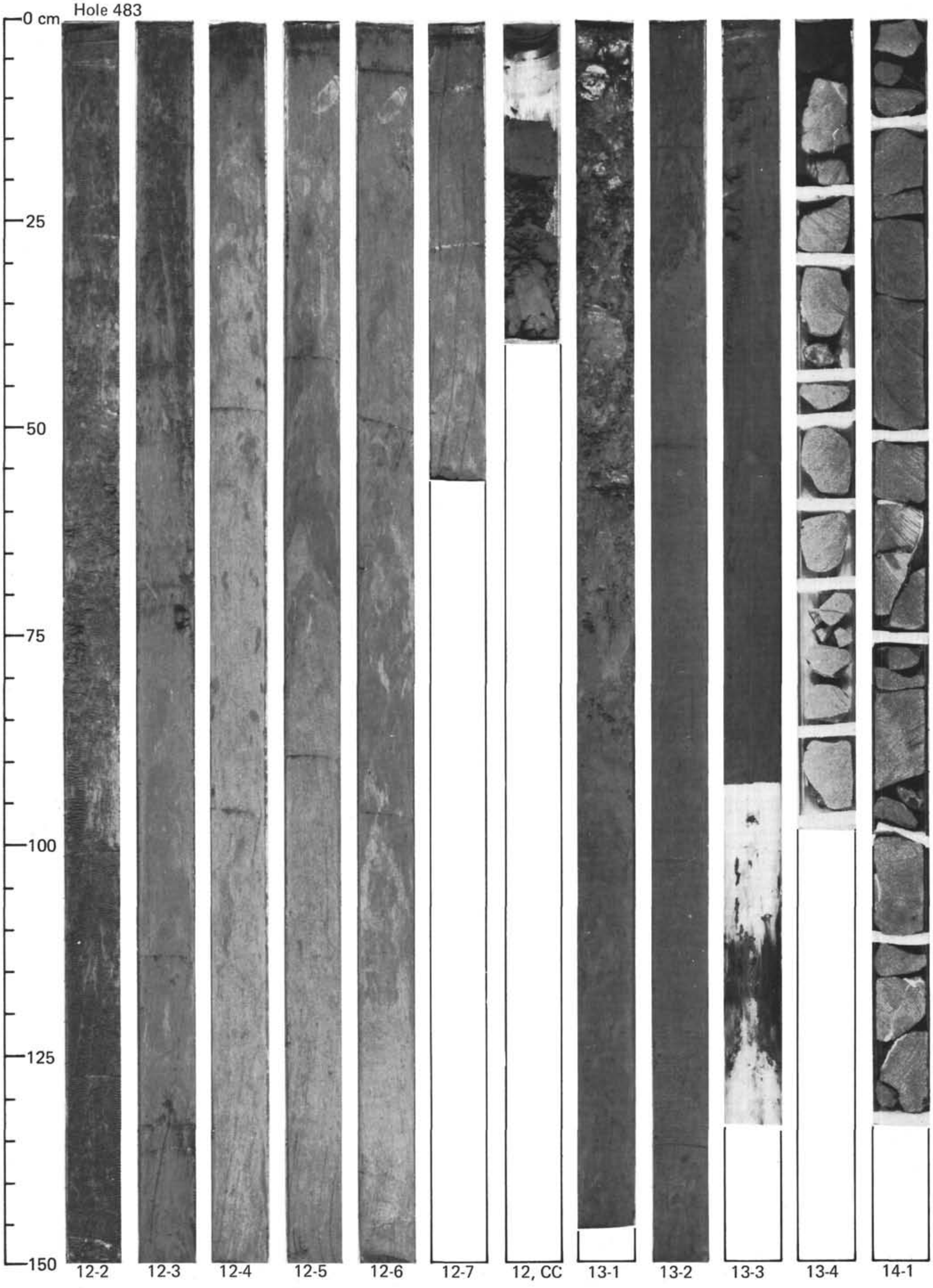
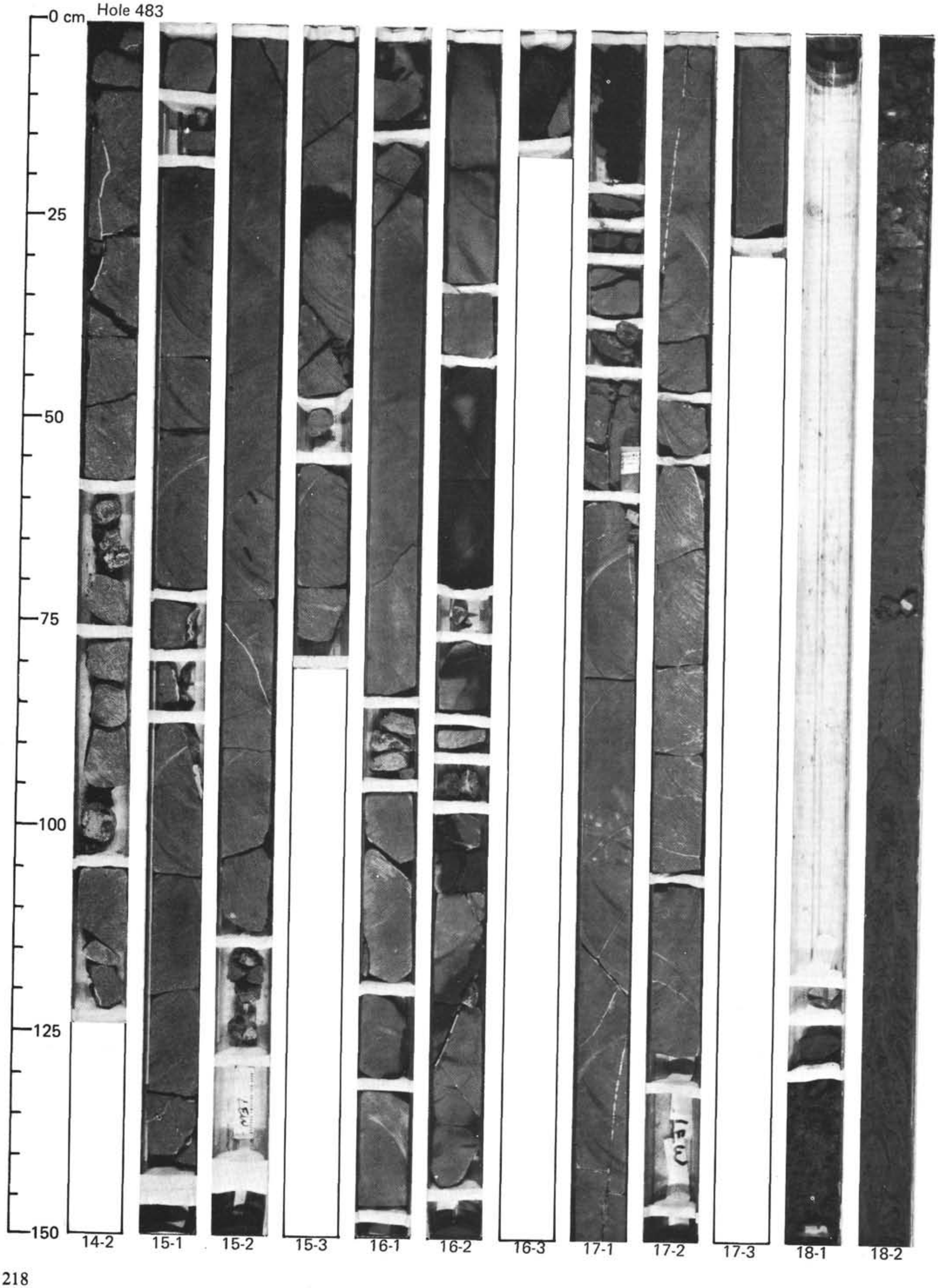
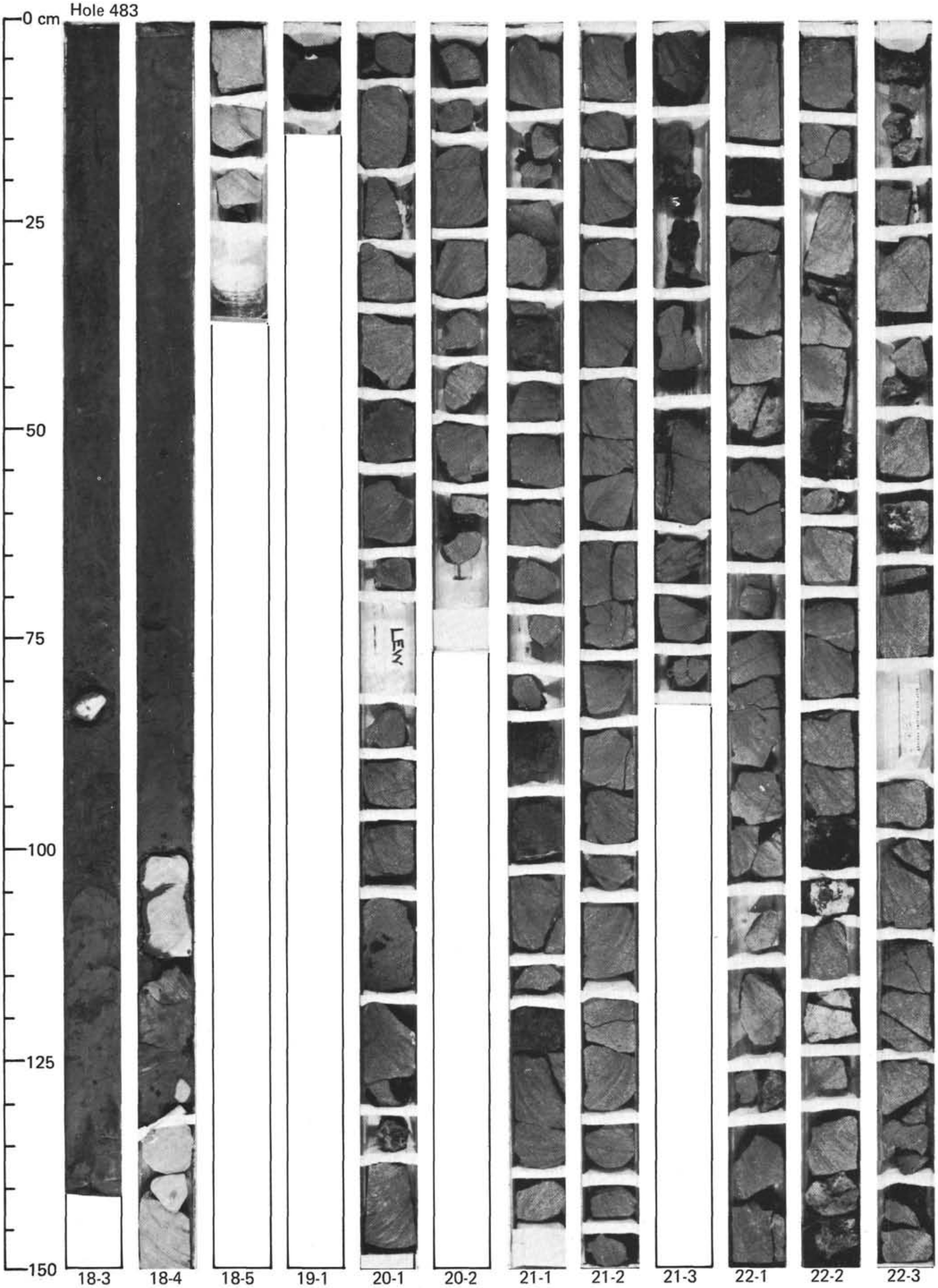
6, CC
7-1
7-2
7-3
7-4

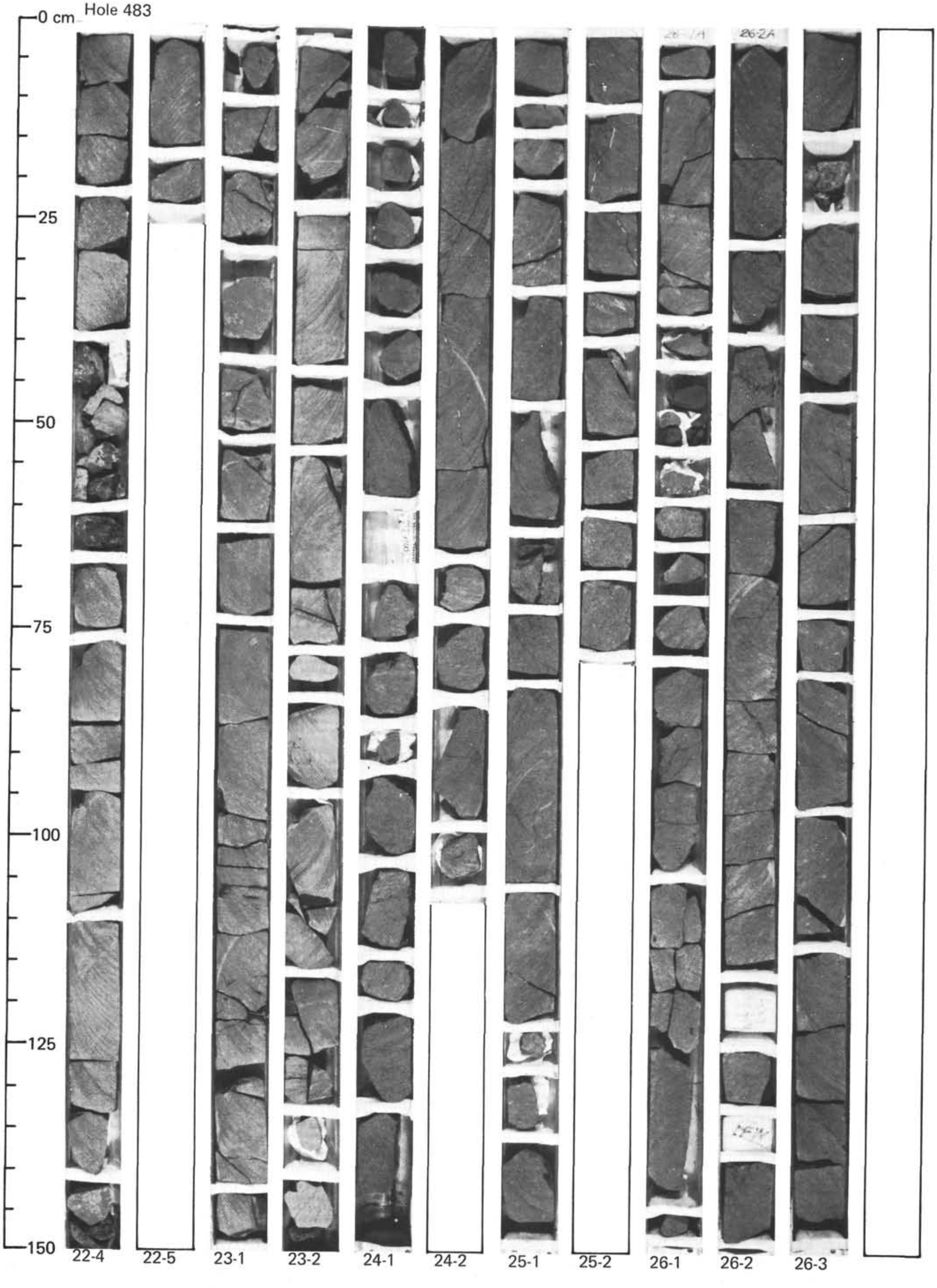

0 cm
Hole 483
25
50
75
100
125
150
7-5
7, CC
8-1
8-2
8-3
8-4
8, CC
9-1
9-2
9-3
9-4
9-5


0 cm
Hole 483
25
50
75
100
125
150
9-6
9-7
9, CC
10-1
10-2
10, CC
11-1
11-2
11-3
11-4
11-5
11, CC
12-1
11-CC

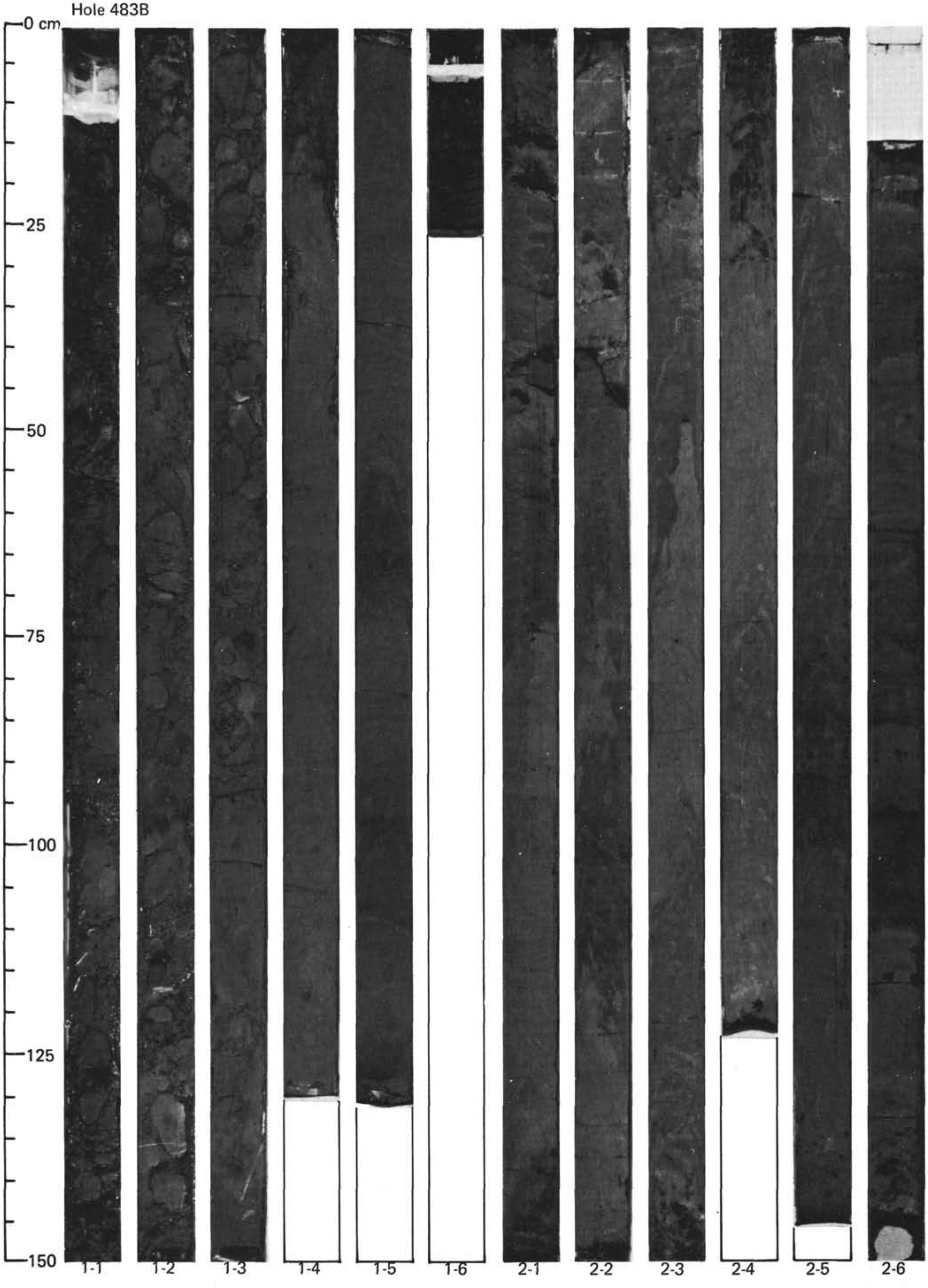

Hole 483
0 cm
25
50
75
100
125
150
12-2
12-3
12-4
12-5
12-6
12-7
12, CC
13-1
13-2
13-3
13-4
14-1

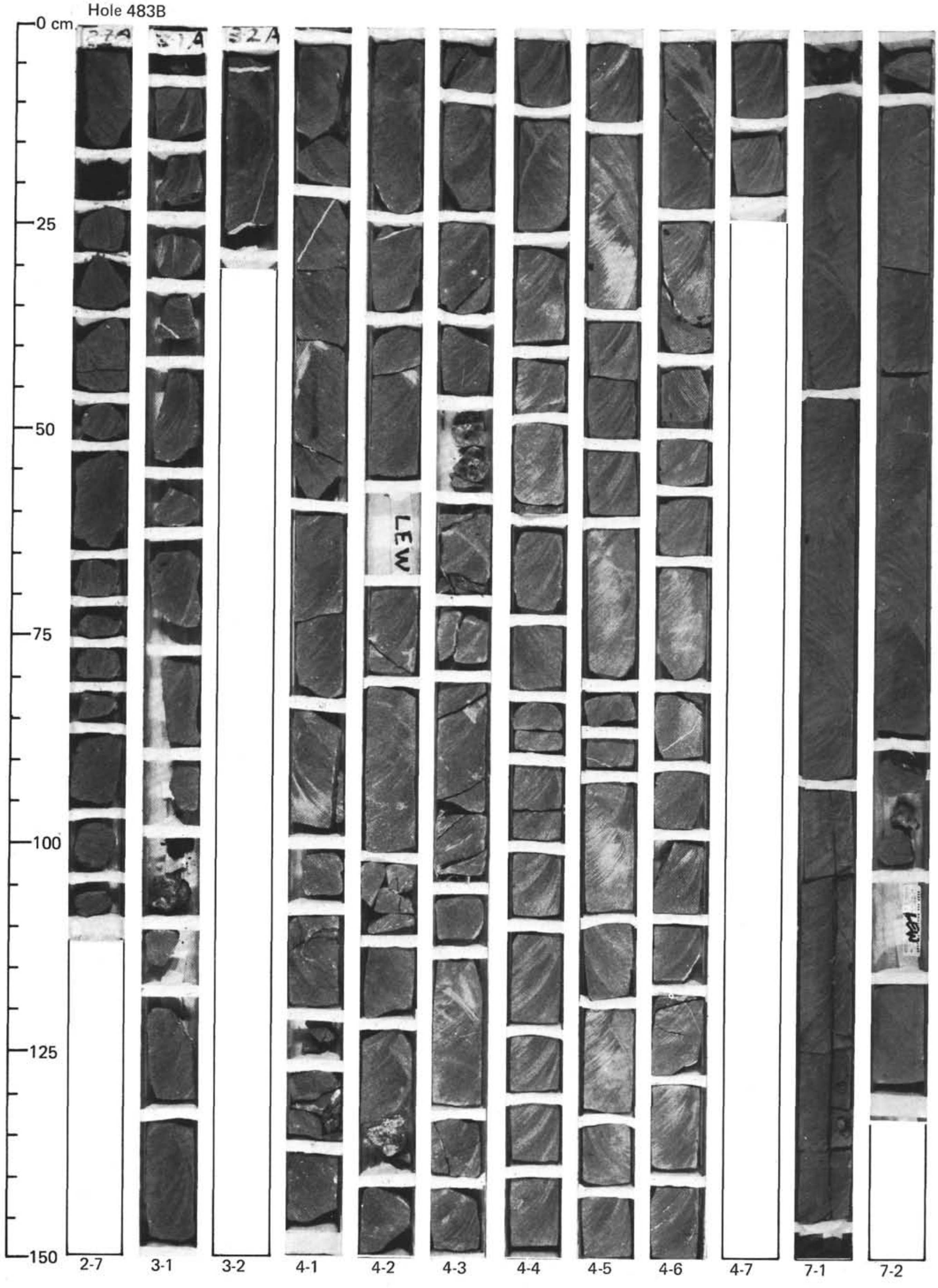

0 cm
Hole 483
25
50
75
100
125
150
14-2
15-1
15-2
15-3
16-1
16-2
16-3
17-1
17-2
17-3
18-1
18-2

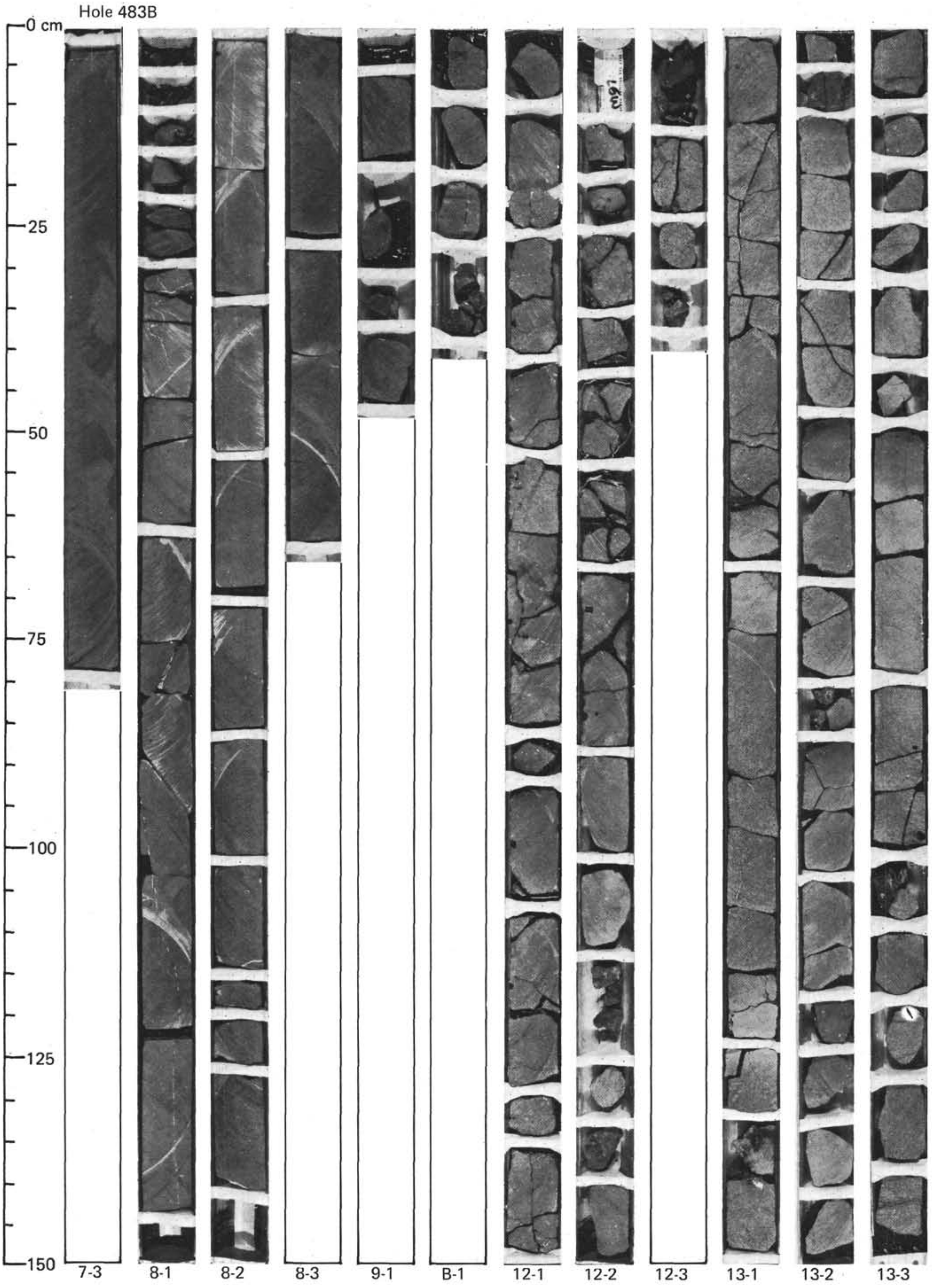

Hole 483
0 cm
25
50
75
100
125
150
18-3
18-4
18-5
19-1
20-1
20-2
21-1
21-2
21-3
22-1
22-2
22-3

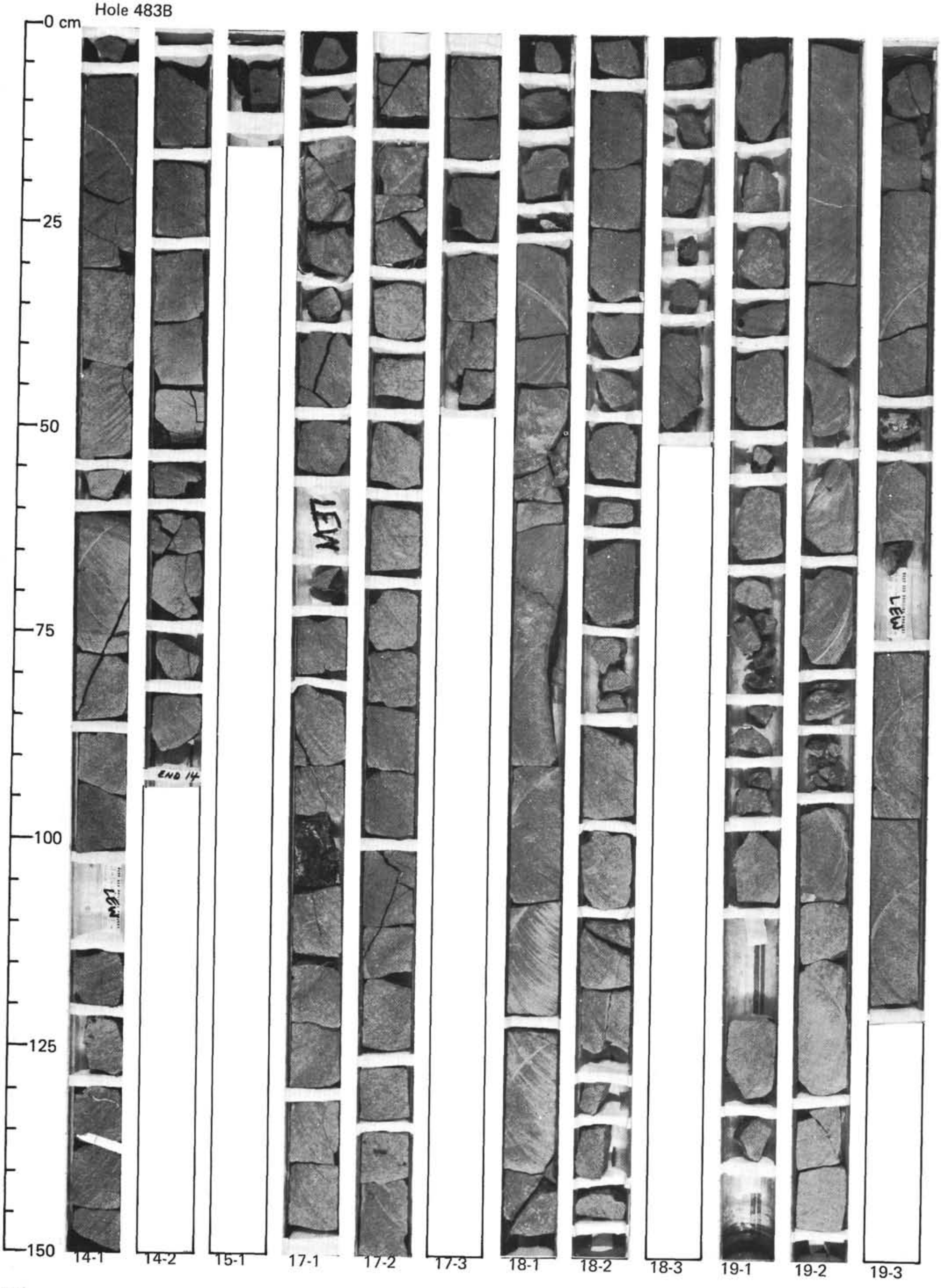


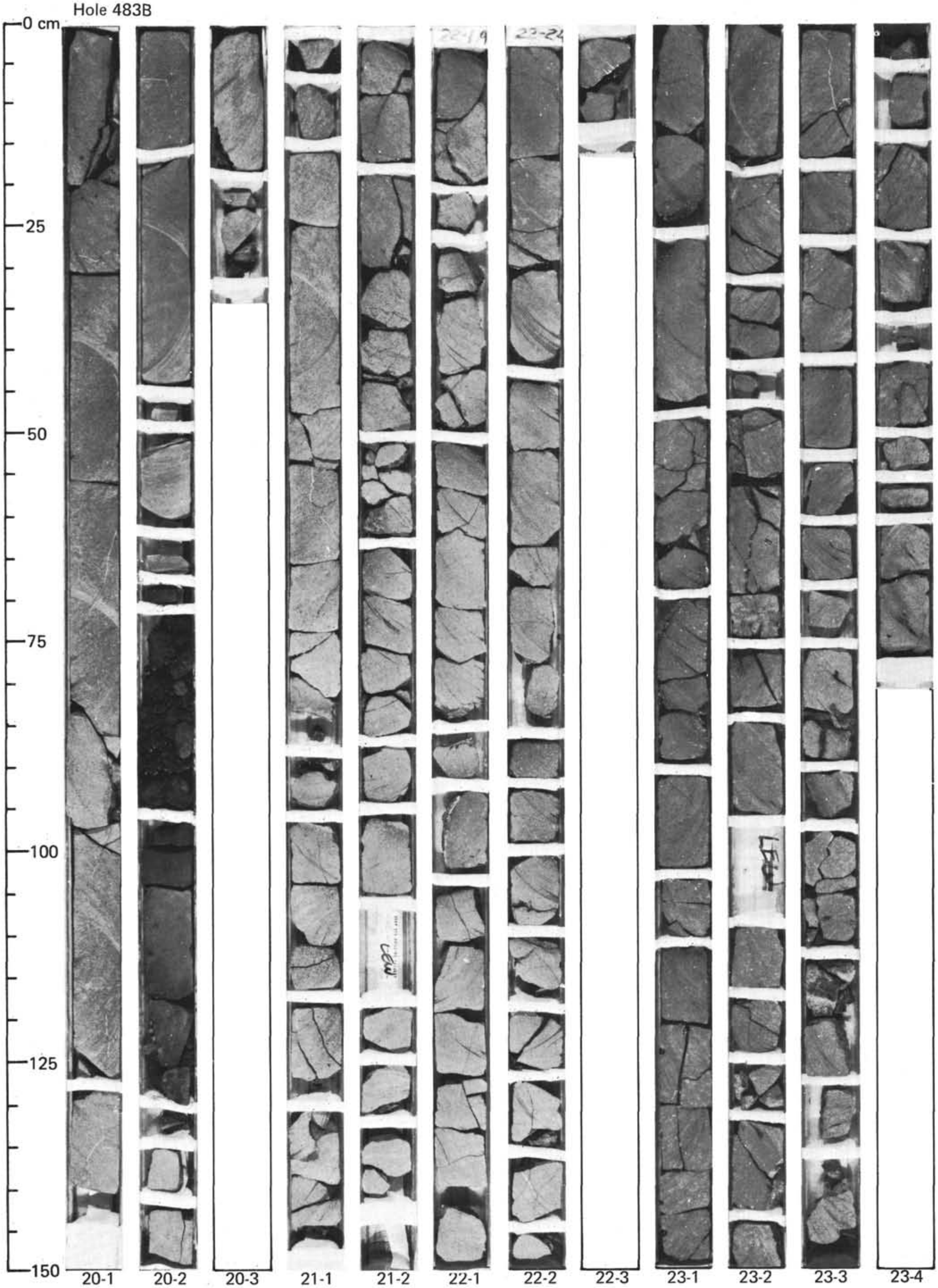
Hole 483
0 cm
25
50
75
100
125
150
22-4
22-5
23-1
23-2
24-1
24-2
25-1
25-2
26-1
26-2
26-3
26-2A

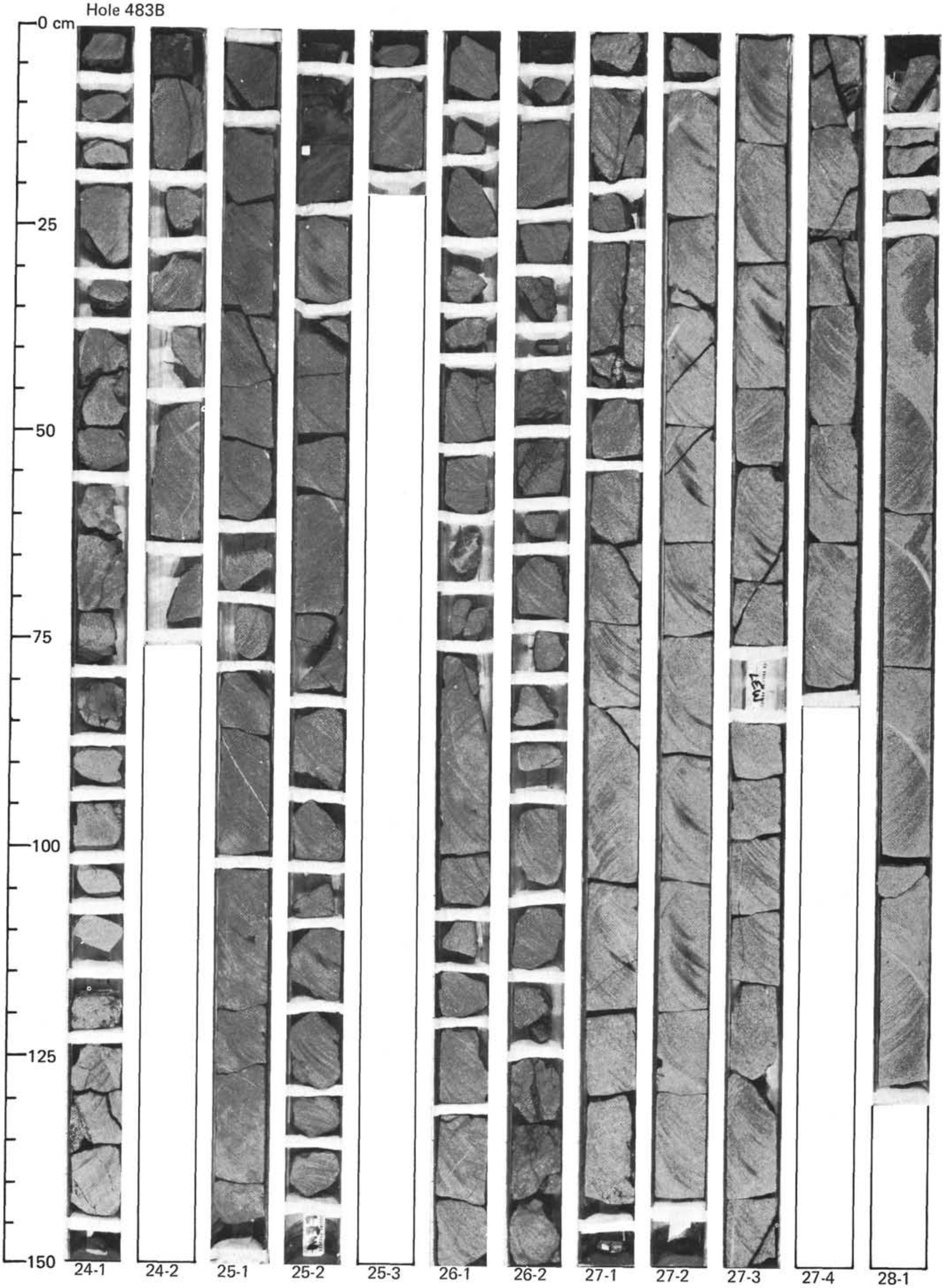

Hole 483B
0 cm
25
50
75
100
125
150
1-1
1-2
1-3
1-4
1-5
1-6
2-1
2-2
2-3
2-4
2-5
2-6

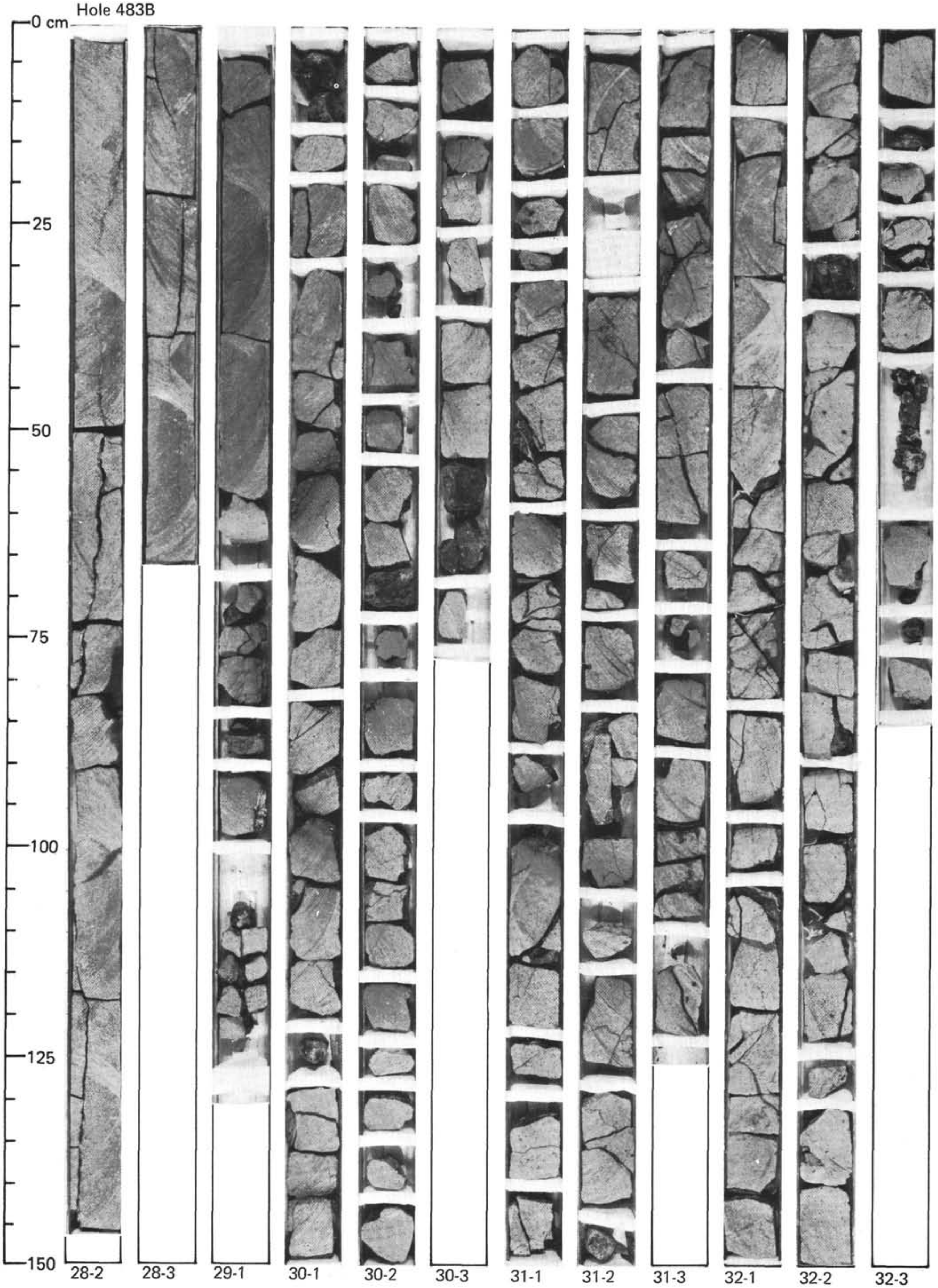

Hole 483B
0 cm
25
50
75
100
125
150
2-7
3-1
3-2
4-1
4-2
4-3
4-4
4-5
4-6
4-7
7-1
7-2
LEW

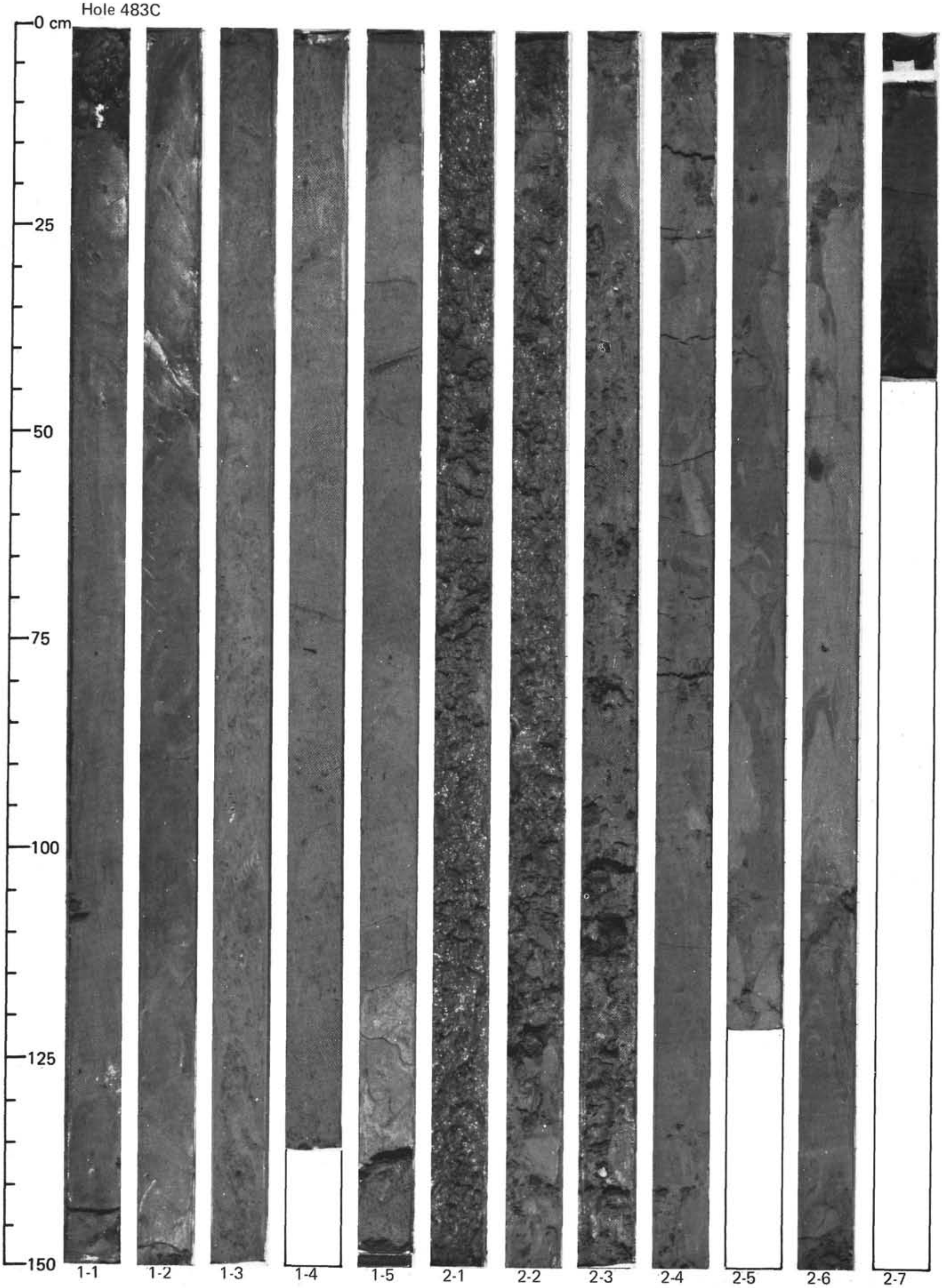

Hole 483B
0 cm
25
50
75
100
125
150
7-3
8-1
8-2
8-3
9-1
B-1
12-1
12-2
12-3
13-1
13-2
13-3


Hole 483B
0 cm
25
50
75
100
125
150
14-1
14-2
15-1
17-1
17-2
17-3
18-1
18-2
18-3
19-1
19-2
19-3


Hole 483B
0 cm
25
50
75
100
125
150
20-1
20-2
20-3
21-1
21-2
22-1
22-2
22-3
23-1
23-2
23-3
23-4


Hole 483B
0 cm
25
50
75
100
125
150
24-1
24-2
25-1
25-2
25-3
26-1
26-2
27-1
27-2
27-3
27-4
28-1


Hole 483B
0 cm
25
50
75
100
125
150
28-2
28-3
29-1
30-1
30-2
30-3
31-1
31-2
31-3
32-1
32-2
32-3


Hole 483C
0 cm
25
50
75
100
125
150
1-1
1-2
1-3
1-4
1-5
2-1
2-2
2-3
2-4
2-5
2-6
2-7

Hole 483C