3. SITE 418

Shipboard Scientific Parties[1]

SITE DATA — HOLE 418

Date Occupied: 10 February 1977

Date Departed: 12 February 1977

Time on Hole: 1 day, 20 hours 15 minutes

Position: 25°02.10'N; 68°03.44'W

Water Depth (sea level): 5511 corrected meters, echo sounding

Water depth (rig floor): 5521 corrected meters, echo sounding

Bottom Felt at: 5519 meters, drill pipe

Penetration (m): 109

Number of Cores: 1

Total Length of Cored Section (m): 6

Total Core Recovered (m): 6

Percentage Core Recovery: 100

Oldest Sediment Cored:
Depth sub-bottom (m): 6
Nature: Brown pelagic clay
Chronostratigraphic unit: Quaternary

Principal Results: Hole 418 was drilled as a pilot hole for Hole 418A. After a single core was taken to determine the mudline, the hole was washed to a depth of 101 meters to establish the casing depth.

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Leg 52: Wilfred B. Bryan (Co-Chief Scientist), Woods Hole Oceanographic Institution, Woods Hole, Massachusetts; Paul T. Robinson (Co-Chief Scientist), Department of Earth Sciences, University of California, Riverside, California; Claire Bollinger, Centre Océanologique de Bretagne, Brest, France; Gary Byerly, National Museum of Natural History, Smithsonian Institution, Department of Mineral Sciences, Washington, D.C. (now at: Louisiana State University, Department of Geology, Baton Rouge, Louisiana); Rolf Emmermann, Institut für Petrographie und Geochemie der Universität-Karlsruhe, Karlsruhe, Federal Republic of Germany; Yozo Hamano, Geophysical Institute, University of Tokyo, Tokyo, Japan; Shaul Levi, Department of Geology and Geophysics, University of Minnesota, Minneapolis, Minnesota (now at: Oregon State University, School of Oceanography, Corvallis, Oregon); Gregory A. Miles, Department of Geology, University of Oregon, Eugene, Oregon (now at: Exxon Corporation, Exploration Department, Houston, Texas); Nikolai Pertsev, Institute of Ore Deposits and Geology, Moscow, USSR; Luc-Emmanuel Ricou, Laboratoire de Géologie Historique, Orsay, France; William G. Siesser, University of Cape Town, Rondebosch, South Africa; Ralph A. Stephen, University of Cambridge, Department of Geodesy and Geophysics, Cambridge, England (now at: Woods Hole Oceanographic Institution, Woods Hole, Massachusetts); Donald A. Swanson, U.S. Geological Survey, Menlo Park, California; and Stan White, Deep Sea Drilling Project, Scripps Institution of Oceanography, La Jolla, California.

Leg 53: Martin F. J. Flower (Co-Chief Scientist), Department of Geology, Imperial College, London, England (now at: Smithsonian Institution, National Museum of Natural History, Washington, D.C.); Matthew Salisbury (Co-Chief Scientist), Deep Sea Drilling Project, Scripps Institution of Oceanography, La Jolla, California; Dennis Bohrer, Deep Sea Drilling Project, Scripps Institution of Oceanography, La Jolla, California; Michael Hobart, Lamont-Doherty Geological Observatory, Palisades, New York; Douglas Johnson, Department of Geosciences, University of Texas at Dallas, Richardson, Texas (now at: University of Washington, Department of Geophysics, Seattle, Washington); Edmond Mathez, Department of Geological Sciences, University of Washington, Seattle, Washington; Catherine Mevel, Laboratoire de Pétrographie, Université Paris IV, Paris, France; Nikolai Pertsev, Institute of Ore Deposits and Geology, Moscow, USSR; R. G. Pritchard, School of Environmental Sciences, University of East Anglia, Norwich, England (now at: Department of Geology, University of Newcastle, Tyne and Wear, England); Harald Puchelt, Institut für Petrographie und Geochemie der Universität-Karlsruhe, Karlsruhe, Federal Republic of Germany; Peter A. Rigotti, Department of Geology, University of Pittsburgh, Pittsburgh, Pennsylvania (now at: Department of Geology and Geography, City University of New York, Hunter College, New York, New York); and Hubert Staudigel, Department of Earth and Planetary Sciences, Massachusetts Institute of Technology, Cambridge, Massachusetts (now at: Ruhr-Universität Bochum, Institut für Mineralogie, Bochum Federal Republic of Germany).

SITE DATA — HOLE 418A

Date Occupied:
Leg 52: 12 February 1977
Leg 53: 15 March 1977

Date Departed:
Leg 52: 2 March, 1977
Leg 53: 14 April, 1977

Time on Hole:
Leg 52: 17 days, 22 hours, 45 minutes
Leg 53: 30 days, 9 hours, 30 minutes
Final: 48 days, 8 hours, 15 minutes

Position:
Latitude: 25°02.10′N
Longitude: 68°03.44′W

Water Depth (sea level): 5511 corrected meters, echo sounding

Water Depth (rig floor): 5521 corrected meters, echo sounding

Bottom Felt at: 5519 meters, drill pipe

Penetration (m):
Leg 52: 570.5
Leg 53: +297.5
Final: 868

Number of Cores:
Leg 52: 48
Leg 53: 38
Final: 86

Sediment Cored (m):
Leg 52: 137.5
Leg 53: 0
Final: 137.5

Sediment Recovered (m):
Leg 52: 58.15
Leg 53: 0
Final: 58.15

Percentage Sediment Recovery:
Leg 52: 42
Leg 53: —
Final: 42

Basalt Cored (m):
Leg 52: 246.5
Leg 53: 297.5
Final: 544.0

Basalt Recovered (m):
Leg 52: 158.4
Leg 53: 231.3
Final: 389.7

Percentage Basalt Recovery:
Leg 52: 64
Leg 53: 78
Final: 72

Total Length of Cored Section (m):
Leg 52: 384.0
Leg 53: 297.5
Final: 681.5

Total Core Recovered (m):
Leg 52: 211.8
Leg 53: 231.3
Final: 443.1

Percentage Core Recovery:
Leg 52: 55.2
Leg 53: 78
Final: 65.0

Oldest Sediment Cored:
Depth sub-bottom (m): 324
Nature: Nannofossil clay/ooze
Chronostratigraphic unit: Lower aptian
Measured velocity (km/s): 1.6

Basement:
Depth sub-bottom (m): 324
Nature: Basalt
Velocity range (km/s): 2.8–6.3

Principal Results: Hole 418A, located in 5511 meters of water at the southern end of the Bermuda Rise near the eastern boundary of the *M0* anomaly, was occupied and drilled as the second of two multiple-leg, multiple-re-entry, deep-basement penetration attempts in old Atlantic crust. During this attempt (Legs 52 and 53), 324 meters of sediment and 544 meters of basement were cored. As in Holes 417A and 417D, much higher recovery was obtained in the basement (72%) than in the sediments (42%).

The sediment section drilled during Leg 52 consists of 324 meters of Cretaceous to Holocene sediments similar to those recovered at Site 417 during Leg 51. The lower 118 meters consists largely of interbedded multicolored clay, nannofossil chalk, and radiolarian sand of Aptian to early Cenomanian age. These are overlain by 206 meters of uniform brown to gray pelagic clay with an interval of middle Eocene radiolarian clay between 159 and 178 meters and an interval of nannofossil clay at the top. The section suggests pelagic sedimentation below the calcium carbonate compensation depth (CCD) during most of the Cenozoic and deposition (again pelagic) under alternating oxidizing and euxinic conditions in restricted basement depressions during the Cretaceous.

Sixteen major lithologic units — distinguished on the basis of eruptive character (massive versus pillow basalt), phenocryst assemblages, brecciation, and alteration — have been recognized in the basalts recovered. Approximately 75 per cent of the recovered material is composed of pillow basalt and pillow breccia, while the remaining 25 per cent is composed of massive basalt — the latter cut by dikes at deep levels in the hole. The basalts are almost exclusively plagioclase-phyric with subordinate and variable amounts of clinopyroxene and olivine, and rare inclusions of microphenocrysts of spinel. Although the basalts are relatively uniform in composition (most may be characterized by high CaO and Al_2O_3 and very low K_2O content), three, and possibly more, magma types can be distinguished on the basis of composition, especially TiO_2 content. Some lithologic units are composed of a single type, while others show interlayering of types.

Most of the basalts are fresh, but incipient alteration to smectite is pervasive and locally intense at glassy cooling unit margins, suggesting low-temperature interaction with sea water. Secondary carbonate is common in veins and vesicles, and as a replacement mineral in the groundmass. A steady decrease in porosity and an increase in the wet-bulk density and compressional wave velocity of the basalts with depth suggest that alteration decreases with depth, becoming insignificant below 750 meters sub-basement.

Paleomagnetic inclinations average +23° in the upper 1751 meters of basement but are reversed throughout the deeper levels of the hole, with the exception of two positive high-inclination excursions at 325 and 525 meters sub-basement, the deeper of which is associated with dikes. Steep negative inclinations (−70°) of basalt near the bottom of the hole suggest complex tectonic rotation at the time of crustal formation.

SITE DATA — HOLE 418B

Date Occupied: 14 April, 1977

Date Departed: 18 April, 1977

Time on Hole: 3 days, 17 hours

Position:
Latitude 25°02.08'N; Longitude 68°03.45'W

Water Depth (sea level): 5514 corrected meters, echo sounding

Water Depth (rig floor): 5524 corrected meters, echo sounding

Bottom felt at: 5523 meters, drill pipe

Penetration (m): 329.6

Number of Cores: 35

Total Length of Cored Section (m): 329.6

Total Core Recovered (m): 172.7

Percentage Core Recovery: 52.4

Oldest Sediment Cored:
Depth sub-bottom (m): 319.5
Nature: Nannofossil clay/ooze
Chronostratigraphic unit: Upper Aptian
Measured velocity (km/s): 1.62

Basement:
Depth sub-bottom (m): 319.5
Nature: Basalt
Velocity range (km/s): 4.1-5.8

Principal Results: Hole 418B was drilled at the end of Leg 53 at a site 400 feet to the north of Hole 418A in an attempt to obtain a complete sediment record in the immediate vicinity of the deep penetratin site drilled on Legs 52 and 53. The hole was drilled to a depth of 329.6 meters of which 10 meters was in basalt. Althouth the hole was continuously cored, the objective was not completely fulfilled because of low recovery (52.4%).

The material recovered from Hole 418B is virtually indistinguishable from that in Hole 418A. The basalts cored consist of fresh, fine-grained, plagioclase-phyric pillows having a stable natural remanent magnetization (NRM) inclination of approximately +35°. These, in turn, are overlain by pyrite-bearing multicolored clay with interlayered chert and chalk, a thick unit of brown to gray pelagic clay, and a thin cap of nannofossil ooze.

BACKGROUND AND OBJECTIVES

After the deep-penetration attempt at Hole 417D had failed because of loss of the bottom hole assembly, two options were open — to drill single-bit holes at several sites on the Atlantic transect or to begin another deep-penetration attempt in the same general location as Site 417. After consultation with the Project Director, approval was given by the JOIDES Planning Committee to extend Leg 52 for one week and to continue the deep-penetration attempt on Leg 53. Accordingly, Site 418 was selected (Figure 1) mindful of the following requirements: (1) the site must be in the vicinity of Site 417 to ensure that basement has the same drilling characteristics as those at Site 417; (2) the site must be located clearly within magnetic anomaly *M0*, as was Site 417; and (3) the site must be far enough from Site 417 to eliminate any possible confusion in identification of beacons or cones on the sea floor.

A close scrutiny of the survey data suggested a suitable site could be found about 3.5 nautical miles south-southwest of Site 417. The sonic profiles suggested a sediment thickness of about 350 meters, similar to that at Site 417, and a relatively flat basement surface without any prominent hills. The projected site was clearly in anomaly *M0* along strike of the anomaly from Site 417.

Upon leaving Site 417, the ship steamed north-northeast for 1 mile while the sonic gear was streamed, subsequently turned south-southeast to pass over the beacon at Site 417, and finally steamed on a course of approximately 190° which was judged to make sufficient allowance for set due to wind and current. However, comparison of the developing bathymetric and reflection profiles to the *Lynch* profile F showed that the ship was being set more to the east than had been anticipated. A course correction was made to compensate for this, and the beacon was dropped at 25°02.8'N, 68°03.45'W (Figure 2) after steaming for about 3.5 nautical miles. Subsequent surveys have confirmed that this site is about 1 nautical mile east of the location originally intended and close to the eastern boundary of the *M0* anomaly, as projected to the sea floor (Figure 3).

The principal objective for Site 418 was the same as that for Site 417; that is, to achieve at least 1000 meters of penetration into basement in order to investigate the petrology and structure of crustal Layer 2. A secondary objective was to investigate in more detail the Cretaceous sediments drilled in Hole 417D, which were presumably deposited during an early stage of the opening of the Atlantic Ocean. In moving downslope from Hole 417D, we hoped to penetrate a relatively greater thickness of the euxinic sedimentary section. The site was selected above a strong basement reflector which minimized uncertainty about basement depth.

OPERATIONS

Underway Operations to Site 418

Upon termination of drilling in Hole 417D, the *Challenger* left Hole 417D at 0800, 10 February 1977, following a course of 190° at a speed of six knots. Only one 80-in.^{3} airgun was towed. Although a sonobuoy was dropped when leaving the site, the results were unsatisfactory because of equipment malfunctions.

Operations at Holes 418 and 418A

At 0943, 10 February, a 16-kHz beacon was dropped at Site 418 (Figure 2) in 5511 meters of water. From 0945 to 1930, most of the shipboard operations were directed to rigging a new bottom-hole assembly and various components of the re-entry cone. At 1930, the pipe was lowered for drilling and at 0655, 11 February, a mudline core was taken to establish a depth of 5519 meters (Table 1). Subsequently, Hole 418 was washed to

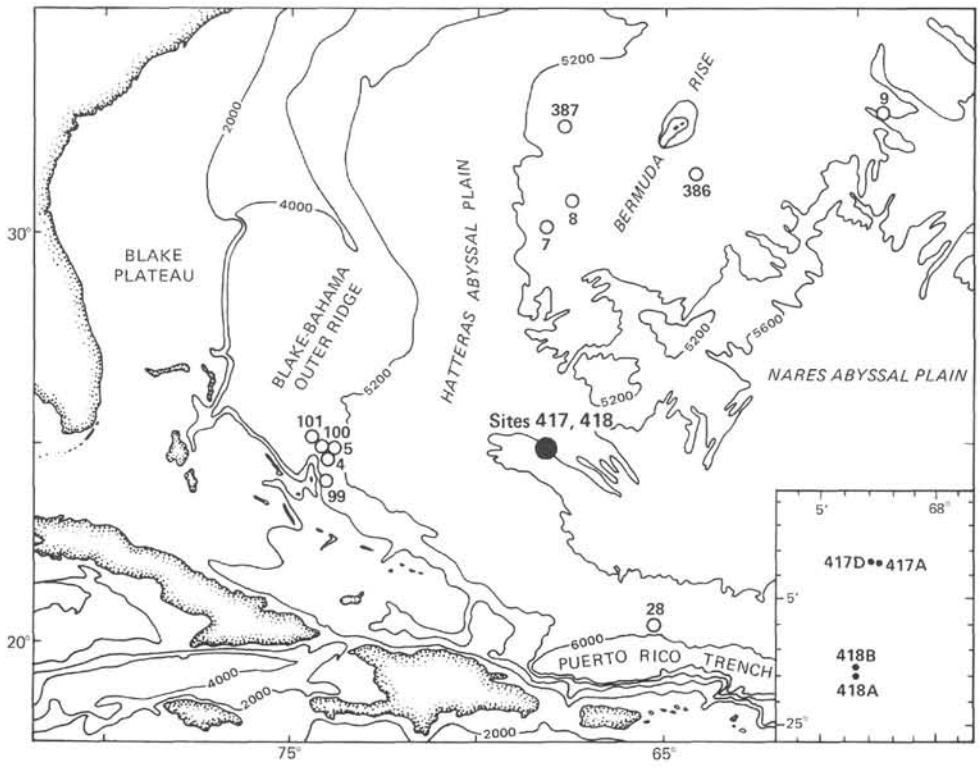


Figure 1. *Location of Site 418.*

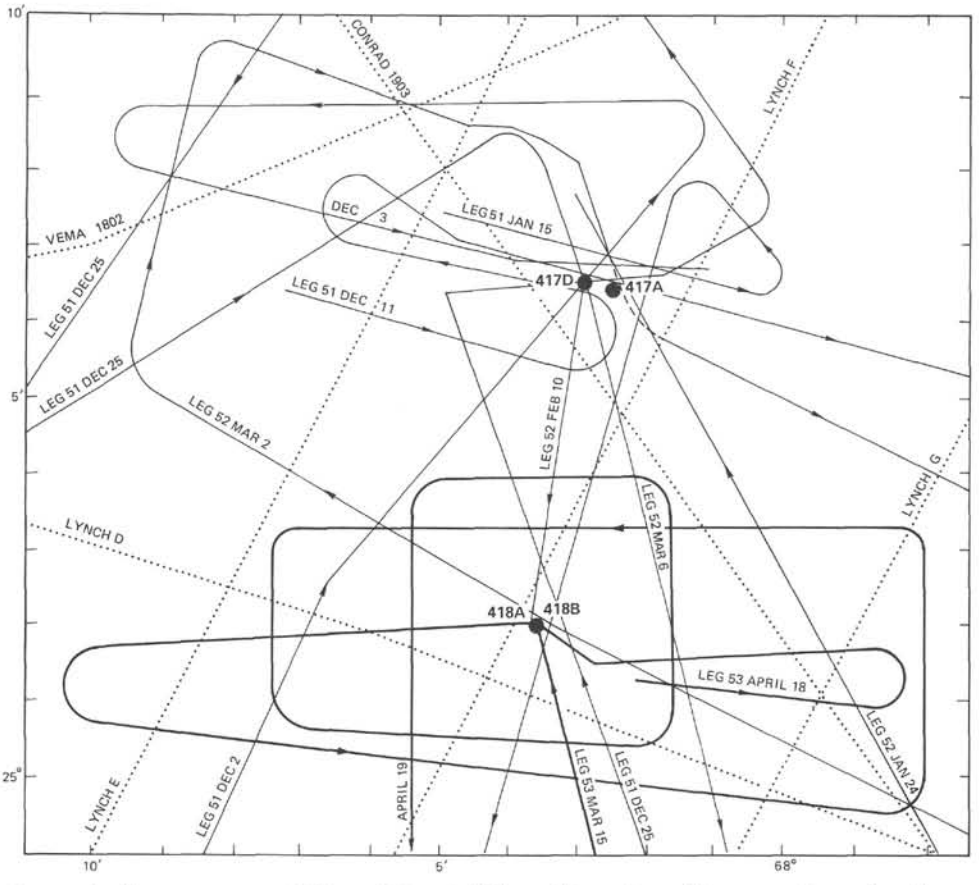


Figure 2. *Surveys around Sites 417 and 418, and location of beacon drops for these sites.*

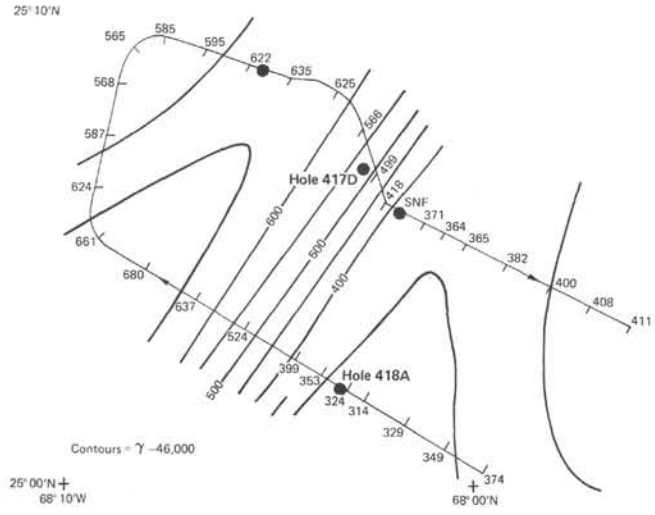


Figure 3. *Magnetic survey of 2 March, 1977, establishing the location of Holes 418A and 417D within the magnetic anomaly pattern. A constant field value of 46,000 gammas has been subtracted from the total field intensity values recorded during the survey. The magnetic anomalies have been contoured at 50-gamma intervals. Hole 417D is on the steep slope of the magnetic anomaly and thus near the center of the* M0 *source block. Hole 418A is close to the axis of the magnetic anomaly low and thus near the eastern boundary of the* M0 *source block (see figure in section under the heading "Background and Objectives" Site 417).*

a depth of 5620 meters to establish a casing depth of 71.06 meters. At 1045, the pipe was pulled from the hole in order to hang 16-in. casing for another wash-in determination. At 0600, 12 February, the pipe with 16-in. casing attached was run in and washed down to about 71 meters; it was then pulled again to prepare for the setting of the cone. On 13 February, the cone was keelhauled; and the cone, pipe, and casing were lowered to the sea floor.

At 0345, 14 February, the rotary shifting tool was lowered to allow the drill string to separate from the cone. At 0600, the tool was shifted, and the hole was subsequently washed to 5630 meters, or 111 meters sub-bottom, where Core 1 was taken to a depth of 120.5 meters (Table 1). Continuous cores were then taken through Core 7 to 177.5 meters, after which the hole was alternately washed and cored prior to taking Core 10. Continuous cores were then taken until the basement was reached in Core 15 at 324 meters sub-bottom. A total of 137.5 meters of sediment (15 cores) was cored in Holes 418 and 418A, and 58.15 meters (42%) was recovered.

A program of continuous coring was followed in the basement. Basalts were recovered in Section 418A-15-1 through Core 418A-20 until a decrease in the core diameter, heavy torque, and a very slow drilling rate prompted a decision to change the bit. Accordingly, the pipe was pulled at 2230 on 16 February, with the bit reaching the deck at 0900, 17 February. At this time, the core barrel was retrieved with 0.85 meters of basalt from 1 meter of coring (Core 21). The bit was then changed, the pup joint magnafluxed, and the pipe lowered into the hole beginning at 1345, 17 February. At 2347, the EDO tool was lowered down the pipe to scan for the cone (re-entry number 1). The cone was stabbed after a 3-hour search, but re-entry was not verified.

Lowering of the EDO tool for another re-entry scan began at 0704. The actual scan began at 0955, and after 2 hours and 11 minutes the cone was stabbed. Re-entry was verified and the remaining drill string, Bowen sub, and heave compensator were made up for continued drilling.

Core 22 was cut but the loss of the core catcher dogs apparently allowed an undetermined amount of core to fall back down the pipe. These fragments lodged in the pipe causing the core barrel to become wedged at about 7000 feet. After an unsucessful attempt to dislodge the obstruction using a center bit, the pipe was pulled beginning at 0200, 19 February. After removal of 85 stands, the center bit and the obstructing basalt were located. However, another drop of the center bit showed that it would not seat at the bottom of the pipe. The remainder of the pipe was pulled, and about 10 pieces of basalt were found wedged in the bit. Also, the bit showed damage to one of its cones, possibly due to hitting the cone on re-entry. A new bit-and-pipe assembly was made up and at 1515, 19 February, the pipe was lowered for re-entry.

Re-entry attempt number 3 began at 0506, 20 February. After a 3-hour, 7-minute scan, the cone was stabbed, but re-entry could not be verified. The next re-entry attempt (number 4) was successful after a 2-hour, 2-minute scan. However, when the EDO tool was pulled, the rope socket to the Schlumberger cable snapped and the tool fell back in the pipe. Although the tool was retrieved, we found the transducer and stainless steel motor shaft missing. After conditioning the hole with a chisel center bit, we drilled without further incidents and a 0.24-meter core devoid of metal cutting (Core 23) was recovered at 2053, 20 February. Apparently, the steel shaft had been pushed into the side of the hole in a soft sediment section, allowing us to resume normal coring operations.

Cores 24 through 29 were recovered routinely, but heavy torque and extremely slow cutting necessitated pulling out of the hole to examine the bit and establish the cause of slow drilling. Pulling was accordingly commenced at 0715, 22 February, but was stopped at 3447.5 meters to lower the oblique seismic geophone for testing. Testing continued from 1430 to 1715, after which the remaining pipe was pulled and the bit changed. At 2330, the pipe was run back in the hole, reaching a depth of 5502 meters at 0915 on 23 February. Re-entry attempt number 5 began at 1249, and the cone was stabbed after a 2-hour, 5-minute scan. After verifying the re-entry, we lowered the remaining pipe and resumed coring with the cutting of Core 30. A minor problem occurred when only the latch-and-swivel

TABLE 1
Coring Summary, Site 418

Core	Date (1977)	Time	Depth From Drill Floor (m)	Depth Below Sea Floor (m)	Length Cored (m)	Length Recovered (m)	Recovery (%)
Hole 418							
1	2/11	0800	5519.0–5525.0	0.0–6.0	6.0	6.0	100
Hole 418A							
1	2/14	0938	5630.0–5639.5	111.0–120.5	9.5	4.56	48.0
2	2/14	1115	5639.5–5649.0	120.5–130.0	9.5	2.13	22.4
3	2/14	1250	5649.0–5658.5	130.0–139.5	9.5	9.5	100
4	2/14	1431	5658.5–5668.0	139.5–149.0	9.5	6.73	70.8
5	2/14	1615	5668.0–5677.5	149.0–158.5	9.5	7.85	82.6
6	2/14	1750	5677.5–5687.0	158.5–168.0	9.5	6.66	70.1
7	2/14	2000	5687.0–5695.5	168.0–177.5	9.5	8.00	84.2
	2/14	2100	5695.5–5715.5	177.5–196.5	Wash	(0.00)	–
8	2/14	2214	5715.5–5725.0	196.5–206.0	9.5	0.75	7.9
	2/14	2300	5725.0–5753.5	206.0–234.5	Wash	(0.00)	–
9	2/15	0132	5753.5–5763.0	234.5–244.0	9.5	0.18	1.8
10	2/15	0503	5791.5–5801.0	272.5–282.0	9.5	1.83	19.3
11	2/15	0715	5801.0–5810.5	282.0–291.5	9.5	0.23	2.4
12	2/15	0855	5810.5–5820.0	291.5–301.0	9.5	1.95	20.5
13	2/15	1045	5820.0–5829.5	301.0–310.5	9.5	2.58	27.2
14	2/15	1240	5829.5–5839.0	310.5–320.0	9.5	0.2	2.1
15	2/15	1607	5839.0–5848.5	320.0–329.5	9.5	4.8	50.5
16	2/15	2014	5848.5–5851.0	329.5–332.5	3.0	3.55	118.3
17	2/16	0058	5851.0–5858.0	332.5–339.0	6.5	5.63	86.6
18	2/16	0725	5858.0–5867.0	339.0–348.0	9.0	7.7	85.6
19	2/16	1515	5867.0–5876.0	348.0–357.0	9.0	9.7	108.0
20	2/16	2010	5876.0–5885.0	357.0–366.0	9.0	8.8	98.0
21	2/17	0910	5885.0–5886.0	366.0–367.0	1.0	0.85	85.0
22	2/18	2037	5886.0–5894.5	367.0–375.5	8.5	1.91	22.5
23	2/20	2058	5894.5–5895.0	375.5–376.0	0.5	0.24	48.0
24	2/21	0220	5895.0–5900.5	376.0–381.5	5.5	1.95	35.5
25	2/21	0630	5900.5–5903.5	381.5–384.5	3.0	3.5	117.0
26	2/21	1255	5903.5–5912.5	384.5–393.5	9.0	5.18	57.6
27	2/21	1857	5912.5–5921.5	393.5–402.5	9.0	3.05	33.9
28	2/22	0056	5921.5–5930.5	402.5–411.5	9.0	5.22	61.7
29	2/22	0658	5930.5–5933.5	411.5–414.5	3.0	1.95	65.0
30	2/23	2355	5933.5–5941.0	414.5–422.0	7.5	4.80	68.6
31	2/24	0527	5941.0–5950.0	422.0–431.0	9.0	3.32	36.8
32	2/24	1555	5950.0–5959.0	431.0–440.0	9.0	0.1	1.1
33	2/24	2122	5959.0–5968.0	440.0–449.0	9.0	7.86	87.3
34	2/25	0208	5968.0–5977.0	449.0–458.0	9.0	7.15	79.4
35	2/25	0650	5977.0–5986.0	458.0–467.0	9.0	5.67	63.0
36	2/25	1120	5986.0–5995.0	467.0–476.0	9.0	6.36	70.6
37	2/25	1511	5995.0–5998.5	476.0–479.5	3.5	1.94	55.4
38	2/25	2037	5998.5–6007.5	479.5–488.5	9.0	7.10	78.8
39	2/26	0100	6007.5–6016.5	488.5–497.5	9.0	1.60	17.8
40	2/27	1228	6016.5–6017.5	497.5–498.5	1.0	3.24	32.4
41	2/27	1637	6017.5–6026.5	498.5–507.5	9.0	5.80	64.4
42	2/27	2118	6026.5–6035.5	507.5–516.5	9.0	5.62	62.4
43	2/28	0203	6035.5–6044.5	516.5–525.5	9.0	4.06	45.1
44	2/28	0715	6044.5–6053.5	525.5–534.5	9.0	6.13	68.1
45	2/28	1813	6053.5–6062.5	534.5–543.5	9.0	5.91	65.7
46	3/1	0042	6062.5–6071.5	543.5–552.5	9.0	5.84	64.9
47	3/1	0630	6071.5–6080.5	552.5–561.5	9.0	6.23	69.2
48	3/1	1310	6080.5–6089.5	561.5–570.5	9.0	5.64	62.7
49	3/17	1040	6089.5–6092.5	570.5–573.5	3.00	2.82	94.0
50	3/17	1552	6092.5–6101.9	573.5–582.9	9.40	6.01	62.6
51	3/17	2238	6101.9–6111.2	582.9–592.2	9.30	5.62	60.4
52	3/19	2114	6111.2–6120.6	592.2–601.6	9.40	7.86	83.6
53	3/20	0150	6120.6–6130.0	601.6–611.0	9.40	3.45	36.7
54	3/20	0910	6130.0–6139.4	611.0–620.4	9.38	1.62	17.2
55	3/20	1420	6139.4–6148.8	620.4–629.8	9.40	7.24	77.0
56	3/20	1935	6148.8–6158.0	629.8–639.0	9.20	7.60	82.6
57	3/21	0028	6158.0–6167.2	639.0–648.2	9.20	6.94	75.2
58	3/21	0540	6167.2–6176.4	648.2–657.4	9.20	4.85	52.6

TABLE 1 – *Continued*

Core	Date (1977)	Time	Depth From Drill Floor (m)	Depth Below Sea Floor (m)	Length Cored (m)	Length Recovered (m)	Recovery (%)
Hole 418A							
59	3/21	1030	6176.4–6186.0	657.4–667.0	9.60	8.21	85.5
60	3/22	0245	6186.0–6195.5	667.0–676.5	9.50	7.50	79.0
61	3/23	1454	6195.5–6205.0	676.5–686.0	9.50	1.81	19.1
62	3/25	1355	6205.0–6209.0	686.0–690.0	4.00	5.40	135.0
63	3/25	1905	6209.0–6214.5	690.0–695.5	5.50	5.86	106.5
64	3/26	0147	6214.5–6224.1	695.5–705.1	9.60	8.28	86.3
65	3/26	0900	6224.1–6233.5	705.1–714.6	9.50	7.10	74.7
66	3/26	1442	6233.5–6243.1	714.6–724.1	9.50	7.54	78.5
67	3/26	1947	6243.1–6248.1	724.1–729.1	5.00	4.30	86.0
68	3/26	0059	6248.1–6252.6	729.1–733.6	4.50	3.31	73.6
69	3/27	0759	6252.6–6262.1	733.6–743.1	9.50	8.03	84.4
70	3/28	0050	6262.1–6271.7	743.1–752.7	9.60	7.48	77.9
71	3/29	1615	6271.7–6277.8	752.7–758.8	6.10	4.75	77.9
72	3/29	2048	6277.8–6283.8	758.8–764.8	6.00	5.07	84.5
73	3/30	0436	6283.8–6293.3	764.8–774.3	9.50	8.44	88.8
74	3/31	2055	6293.3–6300.7	774.3–781.7	7.40	7.90	106.8
75	4/1	0218	6300.7–6306.1	781.7–787.1	5.40	5.44	100.7
76	4/1	0615	6306.1–6312.1	787.1–793.1	6.00	4.05	67.5
77	4/1	1238	6312.1–6321.4	793.1–802.4	9.30	7.38	79.4
78	4/1	1840	6321.4–6331.0	802.4–812.0	9.60	8.50	88.5
79	4/2	0200	6331.0–6340.5	812.0–821.5	9.50	9.26	97.5
80	4/2	0935	6340.5–6350.0	821.5–831.0	9.50	8.50	89.5
81	4/2	1750	6350.0–6356.5	831.0–837.5	6.50	6.87	105.7
82	4/3	0805	6356.5–6359.5	837.5–840.5	3.00	2.99	100.0
83	4/5	0845	6359.5–6364.5	840.5–845.5	5.00	5.43	108.6
84	4/5	1240	6364.5–6369.0	845.5–850.0	4.50	4.95	108.8
85	4/5	2045	6369.0–6378.5	850.0–859.5	9.50	8.38	88.2
86	4/8	0332	6378.5–6387.0	859.5–868.0	8.50	6.39	75.2
Hole 418B							
1	4/15	1445	5523.0–5529.8	0.0–6.8	6.8	0.5	7.3
2	4/15	1620	5529.8–5539.3	6.8–16.3	9.5	3.9	41.1
3	4/15	1800	5539.3–5548.9	16.3–25.9	9.6	9.15	95.3
4	4/15	1922	5548.9–5558.4	25.9–35.4	9.5	9.15	96.3
5	4/15	2100	5558.4–5567.9	35.4–44.9	9.5	9.25	97.4
6	4/15	2225	5567.9–5577.4	44.9–54.4	9.5	8.25	86.8
7	4/15	2359	5577.4–5586.9	54.4–63.9	9.5	9.00	94.7
8	4/16	0140	5586.9–5596.3	63.9–73.3	9.4	9.62	102.3
9	4/16	0325	5596.3–5605.7	73.3–82.7	9.4	9.15	97.3
10	4/16	0500	5605.7–5615.1	82.7–92.1	9.4	9.08	96.6
11	4/16	0640	5615.1–5624.5	92.1–101.5	9.4	9.57	101.8
12	4/16	0810	5624.5–5633.9	101.5–110.9	9.4	5.7	60.6
13	4/16	0950	5633.9–5643.3	110.9–120.3	9.4	6.3	67.0
14	4/16	1120	5643.3–5652.6	120.3–129.6	9.3	0.0	0.0
15	4/16	1305	5652.6–5662.1	129.6–139.1	9.5	5.17	54.4
16	4/16	1435	5662.1–5671.6	139.1–148.6	9.5	1.32	13.9
17	4/16	1630	5671.6–5681.2	148.6–158.2	9.6	4.23	49.3
18	4/16	1755	5681.2–5690.7	158.2–167.7	9.5	1.5	15.8
19	4/16	1935	5690.7–5700.2	167.7–177.2	9.5	2.01	21.2
20	4/16	2120	5700.2–5709.7	177.2–186.7	9.5	7.24	76.2
21	4/16	2310	5709.7–5719.3	186.7–196.3	9.6	9.66	100.6
22	4/17	0105	5719.3–5728.8	196.3–205.8	9.5	5.63	59.3
23	4/17	0307	5728.8–5738.3	205.8–215.3	9.5	8.06	84.8
24	4/17	0450	5738.3–5747.9	215.3–224.9	9.6	1.91	19.9
25	4/17	0650	5747.9–5757.4	224.9–234.4	9.5	2.43	25.6
26	4/17	0845	5757.4–5767.0	234.4–244.0	9.6	1.07	11.1
27	4/17	1025	5767.0–5776.4	244.0–253.4	9.4	1.38	14.7
28	4/17	1200	5776.4–5785.9	253.4–262.9	9.5	3.77	39.7
29	4/17	1417	5785.9–5795.4	262.9–272.4	9.5	2.17	22.8
30	4/17	1550	5795.4–5804.9	272.4–281.9	9.5	3.80	40.0
31	4/17	1730	5804.9–5814.4	281.9–291.4	9.5	3.08	32.4
32	4/17	1910	5814.4–5824.0	291.4–301.0	9.6	1.30	13.5
33	4/17	2054	5824.0–5833.5	301.0–310.5	9.5	1.50	15.8
34	4/17	2247	5833.5–5843.0	310.5–320.0	9.5	0.60	6.3
35	4/18	0445	5843.0–5852.6	320.0–329.6	9.6	5.71	59.5

assemblies were recovered upon retrieving Core 32. A short latch pin had caused the swivel assembly to unscrew from the remaining inner barrel. The latter was recovered after two "fishing" attempts and normal drilling resumed after replacement of the core barrel.

After analyzing the time remaining before it would be necessary to leave the site in order to return to Hole 417D for the oblique seismic experiment, we decided to change the bit after Core 39. Accordingly, at 0115, 26 February, the pipe was pulled and at 1220, the bit was on the drill floor. At 1330, the pipe was again run in the hole. Scanning for the cone began at 0302, 27 February, when the EDO tool reached the bottom of the pipe at a depth of 5495 meters. After a one-hour, 21-minute scan, the cone was stabbed at 0423. After verifying re-entry at 0538, the remaining pipe was lowered to 6016.5 meters (497.5 m sub-bottom) and we resumed coring.

Drilling operations at Hole 418A were stopped on 1 March after pulling Core 48 in order to prepare for departure to Hole 417D to conduct the oblique seismic experiment.

After the pipe had been pulled, the *Challenger* left Site 418 at 0445 on 2 March for a magnetic and seismic survey of the Site 417 and 418 areas. While en route to Hole 417D the survey was completed at 1005; at 1115, 2 March, the ship reoccupied a position at the Hole 417D beacon. After successful completion of the oblique seismic experiment (Stephen et al., this volume), we left Site 417 on 6 March and returned to San Juan at the end of Leg 52.

On 13 March, upon leaving San Juan, we tried out the thrusters off the entrance to the harbor. After the magnetometer was successfully tested and the 20- and 80-in.^{3} airguns were streamed, the ship was set on a direct course for Hole 418A at 1530.

Since the site had been well surveyed during Legs 51 and 52 and no further survey work was deemed necessary, we stowed the underway geophysical gear at 1145 on 15 March, or about 2 hours before the estimated time of arrival, in order to increase the ship's maneuverability while positioning over the beacons left by Leg 52. The 16-kHz beacon was acquired without difficulty at 1320 and the ship was stabilized over the site by 1415 (Figure 2). The 13.5-kHz beacon used at the site during Leg 52 was detectable but weak.

Beginning at 1415, 15 March, a bottom-hole assembly including three bumper subs and an F94CK bit was lowered to the sea floor. After the bit reached the floor at 0045 on 16 March, we lowered the EDO and began to search for the cone at 0423. At 1935 we found the cone and stabbed 2160 feet north-northeast of its predicted position based on Leg 52 computer offsets from the beacon. (This error, it was subsequently discovered, was introduced by one of the hydrophones having slipped downward 5 feet in its housing, causing a 6° tilt in the ship's horizontal reference plane.) Curiously, the cone was found by ignoring the offsets and returning to the cone's satellite navigation position. Thus, any cone whose position is know from satellite navigation can be relocated at any time by returning to this position, dropping a new beacon, and surveying with the new beacon as a reference.

After the hole was cleaned, Leg 53 coring operations were begun in Hole 418A at 0700, 17 March. After cutting the first three cores (Cores 49 through 51), the core barrel failed to seat and finally stuck, necessitating a pipe trip to the surface. When the bottom-hole assembly was brought on deck, we found that the wash pipe in the lowest bumper sub had unscrewed, blocking the passage of the core barrel down the pipe. The bumper sub was replaced and the drill string lowered with a new F94CK bit between 1800, 18 March, and 0600, 19 March. After the cone was located and stabbed, we resumed routing coring at 1700 until 1500, 21 March, at which time the pipe was tripped to the surface for a bit change. The bit was recovered worn but intact, at 0300, 22 March. Nine cores (Cores 52 through 60) had been cut in 27 rotating hours on the bit for a penetration of 84.3 meters and an average recovery of 66 per cent (Table 1). An Eastman survey at the top of Core 52 indicated a hole deviation from the vertical of 2.1°.

Between 1230 and 2045, the pipe was again lowered to the sea floor. The cone was found and stabbed at 0048 on 23 March and coring operations were begun with a F99CK buton bit at 0715. The first core (Core 61) drilled very slowly and had very low basalt recovery because of a plugged core catcher. In addition, the presence of chert and marlstone fragments and unconsolidated sediments in the core barrel suggested that caving had occurred during or prior to re-entry. When the next core barrel became stuck, breaking both circulation and the sandline sent to retrieve it, the pipe was again brought to the surface and the bit arrived on deck at 0815, 24 March. The jets had filled with clay, breaking circulation, while the core barrel had jammed in fragments of basalt filling the bit and lower core-barrel assembly.

Between 0815 and 1838, the bottom-hole assembly (with the bit unchanged) and drill string were again lowered to the sea floor. The cone was stabbd at 2155 and coring operations were resumed at 0830, 25 March, after the heave compensator had been put on line and the hole cleaned with a center bit. The cutting of Cores 62 through 70 proceeded slowly, but without incident through 1315, 27 March, at which time the pipe was tripped to the surface for a bit change during an hiatus in drilling caused by heavy swells. 76.2 meters of basalt had been cut on the bit during 41 hours of rotation for a recovery of 78 per cent (Table 1). An Eastman survey at the top of Core 63 indicated a hole deviation from the vertical of 2.8°.

Starting at 1215 on 28 March, the drill string, fitted with an F94CK bit and 60 joints of new pipe, was lowered to the sea floor. Coring was resumed at 1200 on 29 March after a difficult re-entry (aggravated by moderate swells) in which the bit bounced off the lip of the cone into the hole. Cores 71 and 72 were cut without incident, but the pipe became stuck midway through the cutting of Core 73. Although the pipe was freed within an hour and cutting resumed, when the core was receiv-

ed on deck the core diameter was found to have abruptly decreased from 6.0 to 5.0 cm, suggesting damage to the bit. Beginning at 0500 on 30 March, the pipe was accordingly tripped back to the surface. During 9 hours and 45 minutes of rotation, the bit had cut 21.6 meters of basalt with a recovery of 84.7 per cent. Somewhat surprisingly the bit was received on deck worn but with cones and bearing otherwise in quite good condition.

Between 1630 on 30 March and 0411, 31 March, the drill string was lowered to the sea floor with an F99CK bit. After a brief search, the cone was found and stabbed at 0423.Coring was begun at 1315 after the hole was cleaned with a center bit and 20 barrels of guar gum. Nine cores (Cores 74 through 82) were cut with the heave compensator on line before it became necessary at 2115 on 2 April to pull for a bit change. During 41 hours of rotation, the bit had cut 66.2 meters of basalt for a recovery of 92 per cent (Table 1). An Eastman survey at the top of Core 75 indicated a deviation of the hole from the vertical of 2.8°.

At 0815, 3 April, a new 13.5-kHz beacon was dropped and the pipe and bottom-hole assembly with an F99CK bit were started toward the sea floor. During re-entry operations early the next morning, the Schlumberger cable began to unravel when the tool had been lowered to within 200 feet of the sea floor. The tool was raised (gingerly) to the surface, the cable replaced and re-entry operations were resumed. The cone was stabbed at 1823 and coring operations were resumed at 0315 on 5 April. Midway through cutting Core 86, the penetration rate increased, suggesting that the drill had entered a new formation. This was followed at 0230 by a decrease in pump pressure and shortly afterward, at 0240, by an abrupt loss of 60,000 pounds on the drill string weight gauge indicating twist-off of the bottom-hole assembly. Operations were begun immediately to return the pipe to the surface in order to assess the damage and rig for fishing. When the entire remaining string was received on deck, we determined that 379 meters of pipe (the bottom-hole assembly and 14 stands of pipe) had been left in the hole. Since the break was clear and well above the next joint, the decision was made to attempt to fish for the pipe.

Between 2030, 6 April, and 0900, 7 April, the drill string, equipped with a bottom-hole assembly and Bowen fishing tool, was tripped to the sea floor and the re-entry tool lowered for scanning. Re-entry was accomplished in 8 minutes, after which the fishing tool was lowered onto the twisted-off section of pipe and latched at 1245. The entire pipe was then raised to the surface, the bit and Core 86 reaching the deck at 0350 on 8 April. Since no major change in lithology or metamorphic grade was observed in Core 86 but the recovered material suggested a marked increase in brecciation which lead to hole instability, we decided to log immediately while the hole was both deep and stable. The bit recovered had cut 27.5 meters in 17 hours of rotation for a recovery of 91.5 per cent (Table 1).

Between 0930 and 2219, 8 April, the drill string, bottom-hole assembly, and logging sub were lowered to the seafloor, and the EDO re-entry tool was rigged and lowered for scanning. The cone was stabbed at 0045 on 9 April and the hole cleaned with mud and MTGEL after the pipe had been run the rest of the way to the bottom. The bottom of the pipe was then raised to just below the deepest sediment bridge detected during re-entry and an attempt made between 1030 and 2115 to run the sonic velocity tool to bottom. The tool caught on a sediment bridge, and 300 meters of cable was paid out on top of the tool before the problem was detected. When an attempt was made to raise the tool, the cable knotted and the tool became stuck. The Schlumberger cable was finally clamped and cut at 2115 and the drill string tripped to the surface, leaving the sonic tool and about 300 meters of knotted cable behind. After the bottom-hole assembly and bit sub had been received on deck at 1545 on 10 April, the remaining 4000 feet of cable on the Schlumberger winch was removed and the spliced cable strengthened and reinstalled for re-entry.

Between 1530 and 2315 on 13 April (after considerable delay due to bad weather), a bottom-hole assembly with a short bit sub was tripped to the seafloor as the first stage in an attempt to find and fish the logging tool. The attempt was discontinued, however, when the EDO re-entry tool became stuck and the Schlumberger cable severed above the splice in trying to pull the tool free. Since the remaining cable was too short (by 60 m) for re-entry, the pipe was pulled. Operations at Hole 418A were terminated when the bit sub arrived on deck at 2330 on 14 April. It should be noted for the record that if the logging tool remains in the hole (which is uncertain, since it may have been cut off by chafing during the pipe trip to the surface), there is an even chance that it could be fished. Below this possible obstruction, the hole remains in good condition.

Operations at Hole 418B

After termination of operations at Hole 418A and the hole was abandoned, the decision was made to drill a single-bit hole in the immediate vicinity of Hole 418A in order to core the sediments continuously. (The sediments at Hole 418A had been sampled during Leg 52, but for the most part only by spot cores of low recovery.) Between 2330, 14 April, and 1315, 15 April, a bottom-hole assembly with an F93C bit was made up and tripped to the sea floor and the ship moved 130 meters north to Hole 418B. Coring operations were begun at 1315 and continued without interruption until 0600 on 18 April, at which time drilling was terminated since the objectives for the hole had been met. In 9 hours and 46 minutes of coring, the bit had penetrated 329.6 meters below the mudline (of which approximately 10 meters was in basalt) for a total recovery of 52.4 per cent.

After the bit was received on deck at 1600, the gear was streamed and an airgun/magnetometer survey con-

ducted on a grid over the site until 0330, 19 April, at which time a direct course was set for San Juan.

SEDIMENT LITHOSTRATIGRAPHY

Introduction

Site 418 is just to the north of Vema Gap, the abyssal passage connecting the Hatteras and Nares abyssal plains. The site also lies near the southern extremity of the Bermuda Rise, over the *M0* magnetic anomaly; therefore, the basement age prediction is 108 to 109 m.y. Drilling at Hole 417D, about eight miles to the north, penetrated approximately 340 meters of sediment before encountering basaltic basement. A mudline core only was taken at Hole 418 and the sediments were washed to 111 meters after setting a cone and casing. Subsequently, 209 meters of sediment was drilled of which 133 meters was cored with 39 per cent recovery before reaching basaltic basement at 324 meters. The sediments were cored from 111 to 177.5 meters and from 272.5 meters to basement. The entire 319.5-meter sediment section was continuously cored with 54 per cent recovery at Hole 418B, only 40 meters to the north.

Sediments from Hole 418A were described on board Leg 52, while the cut sections from Hole 418B were shipped from Leg 53 and described at Scripps' DSDP laboratories during a shore-based study. This section attempts to treat these two holes, only 40 meters apart, as equivalent lithologies in spite of differences in initial terminologies used. The lithology is given in Table 2, and the correlation is given in Figure 4. The sediment sections have been divided into eight lithological units, which, although artificial, were selected to closely match units from Site 417. Units I through IV are Cenozoic pelagic muds, whereas Units V through VIII are Late to Middle Cretaceous. The water depth of Hole 418B (5514) is only 3 meters more than that of Hole 418A (5511), but both holes have the same depth to the sediment basalt contact (5834). The basalt floor appears uniform, and major color boundaries below 172 meters match exactly.

Description of Lithologic Units

Unit I — Brown Pelagic Clay and Nannofossil Clay; Quaternary

The mudline Core 418-1 and Cores 418B-1 and 2 contain sediments comprising dominantly very fine grained, homogeneous, non-calcareous, soft pelagic clay with little structure. Colors are dark yellow brown (10YR 4/2). Clay minerals form 60 to 85 per cent of the mineral components, with minor amounts of quartz, feldspar, ferruginous and/or Fe/Mn specks. Silt comprises up to 10 or 15 percent, clay 85 to 90 per cent.

Drilling disturbances have homogenized most of this unit, but in Section 4 and Sample 418-1, CC more or less distinct but disturbed bands and streaks of light yellowish brown (10YR 6/4), clayey nannofossil ooze persist. The latter also contains foraminifers. The sediment of Unit I is a widespread Pleistocene lithologic type in the western North Atlantic and was deposited near or below the CCD. The boundary is placed at the bottom of Core 418B-2 (16 m), although Core 418A-2 was not taken until 111 meters sub-bottom. This unit is considered to be the equivalent of Unit I at Site 417.

Unit II — Brown, Gray Orange and Light Olive-Brown, Pelagic Clay

This unit is about 140 meters thick and begins with a gray-brown, pelagic clay in transitional contact with Unit I. Because of a rather sharp color change in Core 418B-8, the unit is subdivided into two parts.

Sub-Unit IIa

Sub-unit IIa is uniform dark to moderate yellow brown (10YR 5/2-4/2), hemipelagic mud with a few streaks and mottles of Fe/Mn specks. Sedimentary structures have been obliterated by drill disturbances, but pale wisps may indicate interbeds. Downward, the composition is uniform, including mostly terrigenous clays (80 to 90%), illite, chlorite, kaolinite, some quartz, and feldspar. A suite of diverse 2- to 10-micron-size, terrestrial heavy minerals (e.g., rutile, hornblende needles), fish debris, opaques, Fe/Mn specks, and ferruginous blebs determines color intensity.

Sub-Unit IIb

This sub-unit begins in Hole 418B, Core 8 with a pale orange clay and extends through Core 15. In Hole 418A it extends from Core 1 through Core 5, Section 2. The sediments are firm, gray-orange (10YR 7/4) and light olive-brown or gray (5Y 7/2 to 2.3YR 5/4), fine-grained, homogenous, pelagic clay. Disturbance is moderate to intense, but bedding is indicated by numerous blue to pale blue-green (5BG 7/2) streaks and bands. Some of these are zeolite-rich, others monomineralic pale clay. A few well-preserved, bluish beds are clearly graded, devitrified ash (e.g., Core 418-1, and Intervals 418B-11-2, 80 to 113 cm, 418B-12-3, 32 to 52 cm). Smear slides of the dominant pale orange lithology consist mainly of clays (69 to 89%), quartz (10 to 15%), opaques (2 to 5%), and traces of fish debris. Various tiny heavy minerals, along with rutile and possibly sphalerite, indicate terrigenous input. A unique feature if Unit II in Hole 418B is the occurrence of cigar-shaped, dolomite-rhodochrosite lozenges in coarse fractions from 90 to 139 meters sub-bottom (Cores 8 through 15, Hole B and Cores 1 through 5, Hole A). The same minerals were found at Site 417. Scarce, poorly preserved siliceous fossil fragments were observed in Core 418B-10.

Unit II is considered the equivalent of Unite II in Hole 417A (Table 2). In Hole 417A the unit is 97.2 meters thick, having its base at 105.7 meters sub-bottom. In Hole 418A, the thickness could be as much as 145.2 meters with its base at 151.2 meters. Although nannoplankton were found, they are sporadic and generally consist of poorly preserved specimens of *Coccolithus pelagicus*. The age is considered Miocene/Oligocene.

TABLE 2
Sedimentary Lithologic Units – Site 418

Unit/ Sub-Unit	Lithology	Chronostratigraphy	Holes 418 and 418A			Hole 418B		
			Depth (m)	Thickness (m)	Core-Section, Interval	Depth (m)	Thickness (m)	Core-Section, Interval
I	Brown pelagic clay with nannofossil horizons (10YR 4/2)	Quaternary	0.0–6.0[a]	6.0	418-1	0–16.3	~16.3	418B-1 418B-2
II	Pelagic clay Yellow brown to pale yellow gray, grayish orange (10YR 7/4) to light olive brown (2.5Y 5/4)	Miocene/Oligocene (?)	111.0–151.2[b] or 6.0–151.2	40.2(?) or 145.2 to base of Core 1	418A-1 to 418A-2	16.3–139.1	122.8	418B-3-1 to 418B-15, CC
IIa	Yellow brown					16.3–73.3	57	418B-3-1 to 418B-8, CC
IIb	Pale orange					73.3–139.1	65.8	418B-9-1 to 418B-15, CC
III	Dark gray brown pelagic clay Some pale zeolitic interbeds	?	151.2–159.3	~8.1	418A-5-2 to 418A-6-1	139.1–158	18.9	418B-16-1 to 418B-17, CC
IV	Dark gray brown to red brown pelagic clay with radiolarians (2.4Y 4/2)	Middle Eocene	159.3–177.5	~18.2	418A-6-1 to 418A-7, CC	158.0–177.2	19.2	418B-18-1 to 418B-19, CC
Va	Dark gray brown to red brown pelagic clay (5YR 2 5/2)	?	177.5–206[c]	~29.0	418A-7, CC to 418A-8, CC	177.2–196.3	19.1	418B-19, CC to 418B-21, CC
Vb	Multicolored zeolite clay Pale orange, brown to pale green	Upper Cretaceous	–[c]			196.3–236	39.7	418B-22-1 to 418B-26-1, 90 cm
VI	Green, black, light to olive gray, blue green claystones, marls, nannofossil chalks and radiolarian sands including pyrite, chert and organics (black-clay facies)	Albian to Cenomanian	234.5–291.0[d]	~56.4	418A-9 to 418A-11, CC	236–291.6	55.6	418B-26, CC to 418B-32-1, 20 cm
VII	Pale to dark red brown, pink and pale green Radiolarian claystones, clays, marls and nannofossil chalks and black to green clay including chert	Upper Aptian to Albian	291.5–324.0[e]	~32.5	418A-12-1 to 418A-15-1	291.6–319.5[e]	28.1	418B-32-1, 30 cm to 418B-34-1, 60 cm
VIIa	Pale to dark red brown nannofossil chalks to radiolarian marls	Upper Aptian to lower Albian	291.5–303.3	11.8	418A-12-1 to 418A-13-2, 80 cm	291.6–301.6	10	418B-32-1, 30 cm to 418B-33-1, 60 cm
VIIb	Black and green claystones, marls and chert		303.3–320.0	16.7	418A-13-2, 80 cm to 418A-14, CC	301.6–319.5[e] (311.1)	18.1 (9.5)	418B-33-1, 60 cm to 418B-34-1, 60 cm
VIII	Gray nannofossil chalk	Lower Aptian	323.8–324.0[e] or (320.0–320.2)	20 cm recovered above basalt	418A-15-1, 0-20 cm		Not recovered	
IX	Basalt with interpillow limestone							

[a] Core 1 at Hole 418; no coring until 111 meters at Hole 418A.
[b] No coring prior to 111 meters.
[c] Washed intervals = 177.5–196.5 = 19 meters; 206–234.5 = 28.5 meters.
[d] Washed after 244.0 to 272.5 = 28.5 meters.
[e] Based on driller's depth to basalt.

Unit III

In Sections 418A-5-2 and 418B-16-1, dark gray brown (2.5Y 3/2), pelagic clay suddenly becomes the dominant lithology, although pale orange clay interbeds and mottles continue. Sediments are highly deformed to brecciated. Unit III is approximately 19 meters thick between Section 16-1 and Sample 17, CC in Hole 418B, and only 8.5 meters thick in Hole 418A (Section 5-2 to Section 6-1). The contact between pale and dark clay bands or mottles is sharp. Near the base of the unit, pale mottles diminish. Another distinguishing feature is the occurrrence of significant zeolites, particularly in pale beds in Cores 418B-17 and 418A-6. Sediments consist of 90 to 95 per cent clay minerals, 1 to 5 per cent opaques, and traces of quartz, feldspar, and fish debris. Unit III is considered equivalent to Unit III of Hole 417A, although it contains fewer zeolites.

Unit IV — Dark Red Brown Pelagic Clay With Radiolarians; Middle Eocene

The dark gray brown Unit IV spans Section 418A-6-1 to Sample 418A-7, CC and Core 418B-18 to Sample 418B-19, CC, and is about 18 meters thick. Sediments are similar to Unit III, except that pale orange mottles almost disappear and are replaced (Core 418B-19) by reddish-brown (5YR 5/4-7/2) clay interbeds. Zeolites are common to abundant (Core 418B-18) and contain more than 10 per cent radiolarian debris. In addition to abundant zeolites (10 to 30%: clinoptilolite) and clay minerals (30 to 60%: illite and palygorskite), trace amounts of sponge spicules, silicoflagellates, feldspar, quartz, heavy minerals and cristobalite are present. Chert or silicified claystone were not recovered.

This unit is probably equivalent to Unit IV of Site 417 but is 20 meters thinner and contains fewer radiolarians. Drilling disturbances are intense except in firm, reddish brown clay bands.

Unit V — Multicolor Brown Pelagic Clay

Pelagic clays of indeterminate age with cm to decimeter interlayered beds of dark gray brown to light yellow brown color occur from 177 to 236 meters in Hole 418B. In Hole 418A they were only recovered in Core 8. Two sub-units are distinguished.

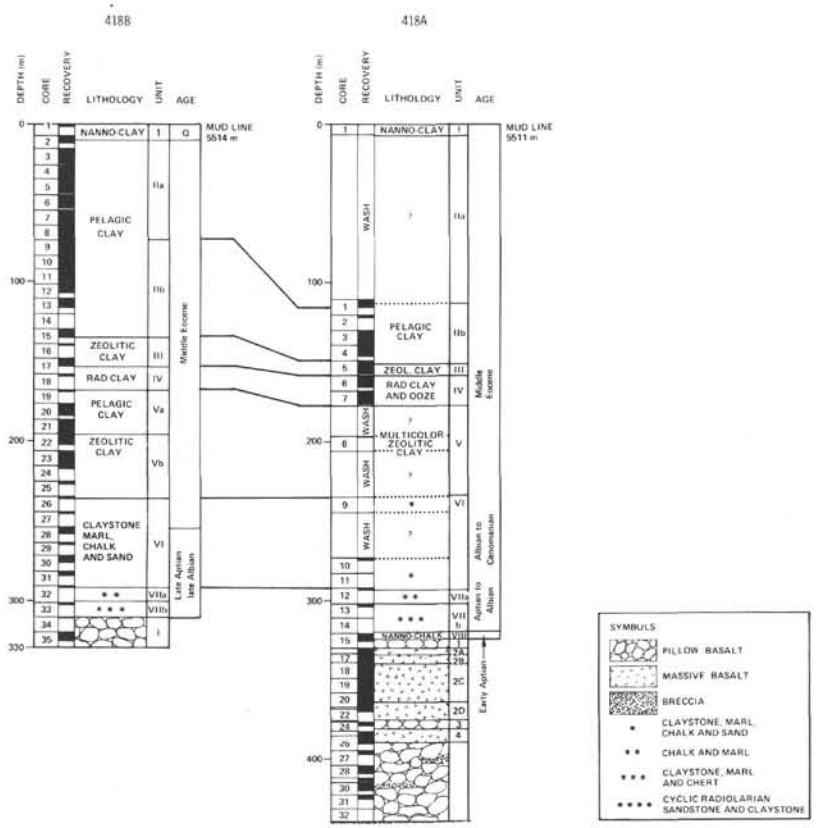


Figure 4. *Sediment unit correlation between Holes 418A and 418B.*

Sub-Unit Va — Dark Gray Brown Pelagic Clay

This sub-unit is poorly recovered in Hole 418A and defined by Cores 418B-20 and 21. Sediments are intensely disturbed to soupy, showing only traces of former pale interbeds. These non-calcareous clays are distinguished by a lack of radiolarians and only traces of zeolites and unspecified carbonate. Constituents are mainly clay (80 to 90%), opaques (5%), fish debris (2 to 5%), and Fe/Mn micronodules. These two cores are considered equivalent to Cores 418A-8 and 417A-19.

Sub-Unit Vb — Multicolored Zeolite Clay; Late Cretaceous(?)

This sub-unit is distinguished mainly by the high zeolite content (10 to 50%) in centimeter to decimeter interbeds of dark brown, yellow-brown to pale orange and pale green pelagic clay. In Hole 418A, only a few cm of this sub-unit were recovered in Core 8, most of the section having been washed. The sub-unit was continuously cored for 40 meters in Hole 418B (Sections 22-1 to 26-1, 90 cm). Drilling disturbance ranges from intense to slight, depending on firmness of the clays. Some banding reflects concentrations of Fe/Mn micronodules. The later also form millimeter laminations, particularly in Intervals 418B-22-1, 0-40 cm, 418B-22-2, 40-90 cm, and 418B-23-1, 0-45 cm. Contacts are sharp or burrowed to wispy, and some sediments show current winnowing.

Zeolites are consistently enriched in all beds but slightly more abundant in pale beds and may form thin laminae in pale blue green clays as in Site 417. Scatterd thin light gray smectite layers (e.g., Hole 418B, 25-1, 18 cm) may be former ash layers. There is a dearth of carbonates, but other constituents include clay (40 to 60%), opaques (1 to 10%), and some rare fish debris. In contrast to the overlying pelagic clays, mixed heavy minerals are rare, which may be evidence of less terrigenous input. Coarse fractions commonly contain zeolite molds of former radiolarians.

In general, this sub-unit is considered equivalent to sub-unit Vb of Site 417, but two main differences are apparent. At Hole 418B the section is 25 meters thinner and contains far fewer of the characteristic green bands in the lower part. The base is marked by a chert bed in Sample 418B-26, CC. Perhaps the lower contact represents a significant hiatus, and the lowest 25 meters has been eroded.

Unit VI — Green and Black Organic Claystone to Chalk; Albian/Cenomanian

This unit is 55.6 meters thick and was cored from Core 418A-9 through Sample 418A-11, CC and continuously from Sample 418B-26-1, CC through Sample 418B-31, CC. Sediments from Hole 418A are intensely disturbed to brecciated but much less so in Hole 418B. The upper contact is sharply defined by a vitreous brown chert and the bottom by the appearance of red-brown, oxidized marls and clays. A prominent feature is the presence of interbeds — in some cases cyclic — all showing reducing conditions. Laminated black clays are interbedded with burrowed green clays. The transition

between these is marked by black burrow fills. Light gray (N-6) and drab olive-gray (5Y 4/1), laminated chalks, and white to pale green nannofossil burrowed chalks to marls occur in the upper levels (Cores 418B-27 and 28). Calcareous components other than rare siderite strings and scattered dolomite rhombs disappear below Section 418B 29-1,70 cm. Chert and siliceous claystones occur throughout. Radiolarians are chalcedony molds commonly concentrated as radiolarian sands. Pyrite nodules up to 6 cm (e.g., 418A-9, CC and 418A-30-1, 145 to 150 cm) and disseminated pyrite crystals were found in green and black clays. Clusters of barite crystals over 2 millimeters long occur in some green clays. Clearly repetitive cycles are rare, but a typically observed pattern is the transtition upward from a thinly laminated, olive chalk to black, commonly laminated clay, followed by burrowed blue-green clay. This sequence may include light gray-green, burrowed nannofossil chalks. In other sections there is a cm-scale oscillation of black clays, many radiolarian-rich, with bioturbated green clay. Contacts are either sharp or gradational. All burrows observed are black-fill-in-light types.

If we assume some differences in recovery, this unit closely corresponds to Unit VI in Site 417. Several black to green clay and nannofossil cycles appear to have a direct counterpart. In other DSDP Atlantic legs similarly intercalated sediments are grouped together as the "black clay facies."

Unit VII — Red Brown and Green Clays to Marls; Late Aptian to Early Albian

Sub-Unit VIIa

This unit, 10 to 20 meters thick, was designated in order to underline an oxidized sequence within the black clay facies. It begins in Section 418-12-1. Nannofossils reappear along with a few decimeter-scale brown marl layers interspersed in light green to white cyclic nannofossil chalk beds. In Core 418B-32, colors alternate from light red-brown to tan, and sediments from nannofossil marls to clays with radiolarians. Downward, sediments pass into dark reddish brown mudstones. Various cherts and silicified mudstones occur. Pale green bands are radiolarian-rich. The cyclic appearance of 5 to 10-cm interbeds is related to varying radiolarian-rich, nannofossil-rich, and clay-rich layers. Bioturbation and dark burrows are ubiquitous, although thin laminations punctuate some horizons. Bedding is diffuse, and most contacts are transitional.

Sub-Unit VIIb

Sediments similar to Unit VI reappear below the level with brown beds. Interbeds include white to green nannofossil chalks, green clays, black radiolarian mudstones, and black clays. Several hard black, grainy layers are radiolarian sands. In Hole 418B, coarse-grained, dark blue cherts similar to those in Section 417D-21-3, with volcanogenic debris, were recovered above basalts.

Unit VIII — Gray Nannofossil Chalk to Claystone; Early Aptian

Only 20 cm of this unit was recovered in Core 418A, 15, directly overlying basalt. Bedding dips about 5°. Drilling records indicate basalt at 324 meters subbottom beginning in Section 418A-15-1. The lithology and lower Aptian date confirm the syncrronous nature of the *M*0 age crust and the equivalency of Site 418 and Site 417 units. These gray to olive-gray chalks to marls to clays are finely laminated with white specks and contain fine-grained pyrite. One-mm sulfide streaks are noted lower in the section, at the base of which pyrite crystals are found within the sediment as well as in a calcite vein. The sediments also contain some ash, zeolite, and possibly glauconite. It is not known whether the sediments directly overlie the basalt or whether part of the sequence is missing.

Basalt/Sediment Contacts and Interpillow Limestone

Sediment interbeds were encountered at the following intervals:

418A-15-2 (12-17 cm) and (95-98 cm): Gray green (5G 5/2 and dark yellow brown (10YR 4/2) zones of clayey nannofossil chalk, about 5 cm thick are extensively recrystallized. Sufficient unaltered nannofossils remain to indicate the sedimentary origin of the chalk.

418A-15-3 (90-95 cm): This interpillow sequence consists of a brown (5YR 3/4), clayey nannofossil chalk fragment. At the contact with the basalt, the brown colors appear to grade to green gray (5G 6/1). The chalk contains up to 35 per cent glass fragments, much of which is altered.

418-15-4 (38-43 cm and 47-54 cm): Both intervals are characterized by moderate olive-brown (5Y 4/4) and gray-green (5G 5/2) fragments in a white calcite matrix, in contact with basalt. Lithologies include a very clayey siltstone containing a great deal of altered ash, clayey limestone, and green chalk.

418A-16-1 to 16-3: Olive-brown (5Y 4/4) and grayish green (5G 5/2) fragments occur as interpillow breccia in a calcite matrix. Fragments average 2 to 3 mm, although sizes up to 1 to 2 cm are present. The occurrence of this breccia is also noted in Samples 418A-16-2, 110-114 cm and 418A-16-3, 53-58 cm. Calcite interveining is common, and most green fragments show a brown alteration rim. The breccia fragments consist of clay minerals and altered ash (50 to 75%), chalk (5 to 15%), opaques (5 to 10%). plus feldspar, zeolites, and nannofossils.

BIOSTRATIGRAPHY

Holes 418 and 418A

Planktonic Foraminifers

Planktonic foraminifers are sparse in most of Core 418-l, but Section 418-1-4 contains a large, diverse assemblage consisting of the following species: *Candeina nitida, Globierinella aequilateralis, Globigerina bulloides, G. calida, G. digitata, G. falconensis, G. pachyderma, G. quinqueloba, Globigerinita glutinataq,*

Globgerinoides conglobatus, G. ruber, G. sacculifer, Globorotalia cultrata, G. inflata, G. Scitula, G. truncatulinoides, G. tumida, Hastigerina pelagica, Neogloboquadrina dutertrei, Neogloboquadrina rubescens, Orbulina universa, Pulleniatina obliquiloculata, Sphaeroidinella dehiscens, and Turborotalita humilis. The presence of *Globorotalia truncatulinoides* indicates a Quaternary age for this assemblage.

Planktonic foraminifer occur only in Cores 10, 12, 13, and 15 of Hole 418A. Species diversity and numerical abundance of these microfossils are low. A sample from Section 418A-10-1 yielded the following species: *Hedbergella delrioensis, H. planispira, H. yezoana, and Ticinella praeticinesis.* This assemblage is assigned to the upper Albian. Sediments from Section 418A-15-1 yielded an assemblage essentially identical to the one immediately above the acoustic basement in Hole 417D. The fauna consists of extremely small globigerinaceans, including *Hedbergella H. sigali* and *H. similis*, which are found only in Lower Cretaceous rocks.

Radiolarians

Radiolarians are present only in Cores 6, 7, 12, 13, and 15 of Hole 418A. Core 6 contains abundant and well-preserved specimens from the middle Eocene *Podocyrtis chalara* Zone. Species present in this core include: *Cycladophora hispida, Eusyringium fistuligerum, Lithochytris vespertilio, Lithocyclia ocellus* gp., *Podocyrtis chalara, P. mitra, P. sinuous, Sethochytris triconiscus, Theocampe mongolfieri, Thyrsocyrtis rhizodon,* and *T. triacantha.* This fauna is identical to that of Core 14 at Site 417A. The upper four and one-half sections of Core 7 contain unidentifiable radiolarians replaced by zeolite. The lower part of Core 7 contains a well-preserved faunas similar to that of Core 6 but lacking in *Podocyrtis chalara.* Core 7 is here assigned to the middle Eocene *Podocyrtis mitra* Zone.

Cores 12, 13, and 15 contain poorly preserved Cretaceous faunas identical to those found in Hole 417D in the interval from Core 7 through Core 21. Species present include: *Acaeniotyle umbilicata, Amphibrachium* (?) sp., *D.* (?) *lacrimula, D. torquata, Gongylothirax verbeeki, Rhopalodictyum* sp., *Spongosaturnalis* cf. *S. lateralis, S.* cf. *S. polymorphus, Staurosphaera* cf. *S. amplissima,* and *Theocampe* sp.

Calcareous Nannofossils

Samples from each section of each core were examined for calcareous nannofossils. Only Core 1 at Hole 418 and Cores 10, 11, 12, 13, 14, and 15 at Hole 418 contained nannofossils in sufficient numbers to justify study.

Hole 418

Core 1: Early Pleistocene

Core 1 contains nannofossils in Sections 3, 4, and the core catcher sample. Fossils are poorly to moderately preserved and are abundant only in Section 4. Species present are: *Braarudosphaera bigelowi, Ceratolithus cristatus, C. telesmus, Cyclococcolithus leptopora, C. macintyrei, Gephyrocapsa oceanica, Gephyrocapsa spp., Helicosphaera carteri, H. sellii, Pseudoemiliania lacunosa, Scyphosphaera pulcherrima, Syracosphaera* sp., and *Thoracosphaera* spp. Several reworked Neogene discoasters are present but scarce.

Hole 418A

Cores 1 through 9: Age Indeterminate

These cores are barren of calcareous nannofossils with the exception of several poorly preserved specimens of *Coccolithus pelagicus* in Section 3-1 and *Cyclicargolithus floridanus* in Section 6-2. *C. floridanus* has an age range of middle Eocene to middle Miocene.

Cores 10-14: Aptian

Cores 10 and 11 contain scarce to common, mostly poorly preserved calcareous nannofossils. Core 12, 13, and 14 contain an abundant, mostly moderately preserved assemblage. Species in these cores include: *Assipetra infracretacea, Braarudosphaera bigelowi, Chiastozygus litterarius, Cretarhabdus conicus, C. crenulatus, Cylindralithus* aff. *C. serratus, Lithastrinus floralis, Lithraphidites carniolensis, Manivitella pemmatoidea, Markalius circumradiatus, Parhabdolithus* cf. *P. angustus, P. asper, P. embergeri, P. splendens, Rucinolithus* cf. *R. irregularis, Stephanolithion laffittei, Vagalapilla elliptica, V. imbricata, Watznaueria barnesae, Zygodiscus diplogrammus,* and *Z. elegans.*

Core 15: Early Aptian

Core 15 contains two lithologically different types of sediment — about 5 cm of highly disturbed nannofossil clay at the top and 15 cm of well-bedded nannofossil chalk just below the clay, overlying basalt. Both contain abundant, moderate to well preserved nannofossils. The species present in the chalk, which contains the more diverse and slightly better preserved assemblage, include: *Assipetra infracretacea, Bidescus rotatorius, Chiastozygus litterarius, Cretarhabdus conicus, C. crenulatus, Hayesites radiatus, Lithraphidites carniolensis, Manivitella pemmatoidea, Markalius circumradiatus, Micrantholithus obtusus, Parhabdolithus asper, P. decorus, P. embergeri, P. splendens, Podorhabdus decorus, Reinhardites fenestratus, Rhabdolithus* cf. *R. Rectus, Rucinolithus irregularis, Tetralithus* sp. *Vagalapilla elliptica, V. imbricata, Watznaueria barnesae,* and *W. communis.*

This is almost exactly the assemblage present in Core 21 (early Aptian) which overlies basalt at Hole 417D (except for the notable lack of nannoconids at Hole 418A). This distinctive assemblage is not found in any of the cores above 21 at Hole 417D, nor is it found above Core 15 at Hole 418A. Core 15 is thus tentatively dated as early Aptian on the basis of the close similarity to the early Aptian assemblage at Hole 417D.

Ichthyoliths

In Core 1 of Hole 418 ichthyoliths are well-preserved but scarce. Regardless of this, the subtypes that are present are reliable Neogene guide fossils. Section

418-1-1, is marked by the presence of *Three tall peaks* indicating either a late Pliocene or Quaternary age. Sections 418-1-2 and 6 bear *Long triangle stepped margin*, suggesting an age no older than late Miocene. The occurrence of *Three equal peaks flared base* in the core catcher indicates an age no younger that late Miocene.

In Hole 418A, well-preserved ichthyoliths in moderate quantities are present in Cores 1 through 7 and Core 12.

Core 418A-1 and Section 418A-2-2, and 418A-2, CC contain no diagnostic *in situ* ichthyoliths. *Triangle short wing* is represented by a single specimen in Sections 418A-1-3 and 418A-2-2, but this may be because of reworking.

Section 418A-3-1 bears *Short triangle stepped margin* as well as abundant specimens of *Triangle short wing* and is assigned to the late Oligocene to mid-Miocene interval.

The presence of *Polygonal cavity* (undescribed form) in Section 418A-3-3 indicates an age no younger than middle Miocene.

Section 418A-3-7 through Section 418A-4-1 is assigned to the early Oligocene by the occurrence together of *Triangle concave base* and *Polygonal cavity long rays* and *Rhombus undulating margin*.

Section 418A-4-4 to Core 418A-5 are assigned to the late Eocene by the occurrence in this interval of *Skewed four or five peaks*.

Section 418A-5-3 to Section 418-5-5, is assigned to the middle Eocene by the occurrence together of *Polygonal cavity, Three similar peaks, Rounded apex triangle, Polygonal cavity long rays, Flexed triangle 102-112,* and *Plain lanceolate*.

The occurrence of *Triangle pointed margin ends* in Section 418A-7-2 indicates an early Eocene age for the interval.

Hole 418B

Foraminifers

Foraminifers were recovered at this hole from Cores 1, 2, 27, 28, 32, and 33. Core 1 bears a fauna which shows considerable evidence of solution. Species present include: *Sphaeroidinella dehiscens, Globigerinoides sacculifer, Globorotalia truncatulinoides, Orbulina universa, Globigerinoides conglobatus, Pulleniatina obliquiloculata,* and *Globorotalia tumida*. The presence of *G. truncatulinoides* implies a Quaternary age. Coiling ratios of other species suggest that the top of the Quaternary is missing, and the core interval is probably below the Brunhes event.

Core 2 faunas exhibit much more solution than those of Core 1, but the age is still clearly early Quaternary.

Core 27 contains a rich assemblage of Early Cretaceous foraminifers. In addition to the Cretaceous planktonic foraminifers, several species of calcareous and arenaceous benthic foraminifers are evident. Planktonic foraminifers present include: *Rotalipora appenninica, Rotalipora evoluta, Rotalipora ticinensis, Hedbergella delrioensis, Praeglobotruncana delrioensis, Schackoina cenomana, Hedbergella libyce, Hedbergella planispira, Hedbergella amabilis, Hedbergella yezoana, Globigerinelloides bentonensis, Clavihedbergella moremani,* and *Clavihedbergella simplex*. The age of this assemblage is regarded as early Cenomanian. Section 28-1 contains well-preserved uppermost Albian to lower Cenomanian faunas of planktonic foraminifers including: *Rotalipora ticinensis, Hedbergella delrioensis, Hedbergella planispira, Hedbergella yezoana, Clavihedbergella moremani, Clavihedbergella simplex,* and *Globigerinelloides bentonensis*. Section 28-2 contains an upper Albian assemblage which includes *Ticinella praeticiniensis* and *T. primula*. Core 32 bears well-preserved Lower Cretaceous planktonic foraminifers in addition to several species of benthic foraminifers. The stratigraphic position of this core is lower to middle Albian.

Radiolarians

Radiolarians were recovered at Hole 418B from Cores 9, 10, 19, 30, 32, and 33. Core 9 samples are rich in siliceous debris that apparently consists of badly dissolved radiolarian remains. A single radiolarian specimen from this core is tentatively identified as *Podocrytis papalis,* an Eocene form that ranges as high as the *Thyrsocyrtis bromia* Zone in the upper Eocene. This form is particularly long-ranging and ubiquitous in the Eogene. Its presence here may be contamination and should be regarded with caution.

Core 10 contained much of the same type of siliceous debris evident in Core 9; however, a few radiolarian (orosphaerid) fragments are present as well as fish debris (teeth, spines, scales, bones, etc.). These remains may indicate an age no older than late Eocene and no younger than Oligocene.

Core 19 contained zeolite clay bearing several broken fragments of radiolarians. Species present include: *Podocyrtis mitra, Podocyrtis papalis, Lithochytris vespertilio, Theocampe mongolfieri,* and *Thyrsocyrtis rhizodon*. Mutually overlapping ranges of species place this assemblage in the upper middle Eocene *Podocyrtis mitra* or *Podocyrtis chalara* zones.

Cores 30, 32, and 33 each contain a few marginally preserved Cretaceous radiolarians. Although the assemblages are dominated by *Dictyomitra* spp., species of *Acaeniotyle, Spongosaturnalis, Staurosphaera,* and *Theocampe* are also present in this interval.

Calcareous Nannofossils

At Hole 418B calcareous nannofossils were recovered in Cores 1 and 2 near the surface of the ocean floor, and in Cores 26 through 34, the interval immediately above basaltic basement. The nannofossil assemblage in Cores 1 and 2 consist principally of Pleistocene to late Pliocene species, including *Ceratolithus cristatus, Pseudoemiliania lacunasa, Cyclococcolithus leptoporus, Cyclococcolithus macintyrei, Syracosphaera* sp., *Coccolithus pelagicus, Helicosphaera carteri, Gephyrocapsa* sp., *Thoracosphaera heimi, Thoracosphaera saxea,* and *Discolithina anisotrema*. The last three species suggest a hemipelagic origin for this calcareous sediment. Very

probably the material has been redeposited at its present site by a process other than normal pelagic sedimentation.

The nannofossils in Cores 26 through 34 are associated with dark carbonaceous marls, claystones, and chalks which may make up an appreciable proportion of the Early and "mid" Cretaceous carbonaceous sediment. The age of this interval extends from Cenomanian at the top to late Albian (possibly early Albian) near the base of the sediment section. A Cenomanian age is indicated from Core 26 to Core 28, Section 1, 22 cm by the presence of *Lithraphidites alatus*. From Core 28, Section 1, 92 cm to Core 28, Section 3, a late Albian age is indicated by the presence of *Prediscosphaera cretacea* and *Eiffellithus turriseiffeli*. Core 29 yielded only sparse fossils from Section 1, and these consist primarily of the most solution-resistant species. Core 30 yielded no nannofossils, and Core 31 yielded only a few, solution-resistant species. Present throughout the interval from Core 29 through Core 33 is *Lithastrinus floralis*, which indicates an age no older than late Aptian for this interval, although it may be as young as early Albian. Core 34 did not yield any specimens of *Lithastrinus floralis* and may thus be assigned an early Aptian age. It should be pointed out that the assemblage from Section 34-1, 3-4 cm is dominated by the most solution-resistant forms and all specimens are severely corroded. Nevertheless, the above age assignment is probably correct because *Lithastrinus floralis* is generally well-represented in residual assemblages.

Ichthyoliths

Ichthyoliths were recovered at Hole 418B from Cores 2 through 8, 12, 16, 17, 18, 20 and 21. Their preservation was good and frequency ranged from sparse to moderate.

Cores 2 and 3 appear to be no younger than middle Miocene because of the presence of *Narrow triangle cross-hachured*.

Cores 4 through 8 are assigned to the interval from late Oligocene to early Miocene because of the occurence of an undescribed form of a2/b2/c7. Section 5-2 is assigned to the early Miocene by the occurrence of *Skewed four or five peaks*. Section 8-2 is marked by the initial appearance of *Short triangle stepped margin* which would suggest a late Oligocene age.

The lack of diagnostic subtypes in Cores 12 through 18 prevents the assignment of a date any more exact than late Eocene to Oligocene.

The initial appearance of *Polygonal cavity long rays* in Section 20-4 would indicate a late Eocene age for this horizon.

Core 21 did not yield any diagnostic subtypes, and Cores 22, 24, and 26 were barren of ichthyoliths.

PHYSICAL PROPERTIES OF SEDIMENTS

As at Site 417, measurements of wet-bulk density, compressional wave velocity (V_p), shear strength, water content, porosity, and thermal conductivity were made on the sediments recovered at Site 418 in order to study changes in physical properties with depth and for comparison with the seismic-reflection record at the site. These data, along with computed values of grain density and acoustic impedance, are presented in Table 3 for Holes 418A and 418B. Since these holes were drilled only 130 meters apart and virtually identical sections were recovered from them, the data have been treated as if derived from a single hole; they are presented in composite form in Figure 5.

Wet-Bulk Density and Grain Density

The wet-bulk density and grain density values shown in Figure 5 were obtained by the syringe technique and from X-ray diffraction analysis, respectively. Also shown for comparison are semi-continuous estimates of wet-bulk density obtained by the continuous GRAPE technique. As discussed previously, the syringe data are determined at room temperature and pressure; they are considered no more accurate than to ± 5 per cent owing to distortion during sampling. The syringe values of wet-bulk density tend to increase with depth from approximately 1.50 to 1.60 g/cm^3 near the top of the section to values exceeding 1.80 g/cm^3 in the lower part of the hole. The only distinct features within this trend are a possible step increase in density to values of 1.60 to 1.70 g/cm^3 at approximately 110 meters, a small step increase below 190 meters to about 1.8 g/cm^3, and a marked increase in density at the clay/claystone transition at 235 meters. Below 235 meters values as high as 2.6 g/cm^3 are encountered owing to the presence of claystone, chalk, and stringers of black chert.

The wide range in wet-bulk density observed in the column is not reflected in the grain densities. The latter range narrowly from appproximately 2.70 g/cm^3 near the top of the section to a minimum of about 2.60 g/cm^3 at intermediate levels, and then increase again to about 2.70 g/cm^3 near the base. As at Site 417, the increase in grain density at the base of the sediments is due to the appearance of mixed-layer clays.

Compressional Wave Velocity

The compressional wave velocity values shown in Figure 5 were measured perpendicular to the core axis at zero pore and confining pressure and room temperature using the Hamilton Frame Velocimeter. With the exception of two relatively high velocity samples at the top of the section, the velocities of the unconsolidated sediments recovered from the upper levels of the sediment column at Site 418 increase slowly with depth from approximately 1.45 km/s near mudline to about 1.60 km/s at a depth of 190 meters. Within the more consolidated sediments below 190 meters, the velocities increase sharply to 1.70 km/s and locally reach values as high as 5.0 km/s in chert stringers near the clay/claystone transition at 235 meters before decreasing again to about 1.60 km/s near the sediment/basement contact.

Acoustic Impedance

As at Site 417, the values of acoustic impedance computed from laboratory measurements of density and compressional wave velocity increase irregularly with depth to the base of the sediment column. The only

TABLE 3
Physical Properties of Sediments

Sample (Interval in cm)	Density Wet-Bulk (g/cm^3)	Density Grain[a] (g/cm^3)	*P*-Wave Velocity (km/s)	Acoustic Impedance ($\times 10^5$ g/cm^2-s)	Shear Strength ($tans/ft^2$)	Water Content (% wet weight)	Porosity (vol. %)	Mean Thermal Conductivity (10^{-3} cal/cm-s-C°)
Hole 418A								
2-1, 14-16	–	2.62	–	–	–	–	–	–
2-1, 100-103	–	–	1.54	2.53	–	–	–	–
2-1, 111-116	1.64	–	–	–	–	38.2	62.8	–
3-2, 35-36	–	2.62	–	–	–	–	–	–
3-2, 99-102	–	–	1.51	2.31	–	–	–	–
3-2, 111-113	1.53	–	–	–	–	44.9	68.6	–
3-6, 44-46	–	2.64	–	–	–	–	–	–
3-6, 95-98	–	–	1.57	2.65	–	–	–	–
3-6, 106-109	1.69	–	–	–	–	35.8	60.3	–
4-5, 47-49	–	2.62	–	–	–	–	–	–
4-5, 51-54	–	–	1.58	2.70	–	–	–	–
4-5, 55-57	1.71	–	–	–	–	35.1	60.0	–
5-4, 102-104	1.67	–	–	–	–	37.9	63.1	–
5-4, 105-108	–	–	1.58	2.64	–	–	–	–
5-4, 109-111	–	2.60	–	–	–	–	–	–
6-1, 67-70	–	2.60	–	–	–	–	–	–
6-1, 70-73	1.65	–	–	–	–	37.4	62.5	–
6-1, 81-84	–	–	1.61	2.66	–	–	–	–
7-4, 20-22	1.59	–	–	–	–	40.0	63.7	–
7-4, 28-32	–	2.54	1.61	2.56	–	–	–	–
7-5, 96-99	1.61	–	1.61	2.59	–	39.3	63.4	–
8-1, 144-146	–	2.59	–	–	–	–	–	–
13-2, 15-18	–	2.72	–	–	–	–	–	–
13-2, 23-26	–	–	1.64	–	–	31.9	–	–
13-2, 110-114	1.82	–	1.62	2.95	–	29.0	52.8	–
Hole 418B								
1-1, 141-143	–	2.69	–	–	–	–	–	–
2-1, 47-52	1.24	2.66	1.65	2.05	–	69.1	85.7	–
2-1, 102-105	–	–	1.69	–	–	–	–	–
3-1, 67-69	–	2.66	–	–	–	–	–	–
3-2, 30	1.55	–	–	–	–	46.7	72.4	–
3-2, 45-48	–	–	1.48	2.28	–	–	–	–
3-2, 97-100	–	–	1.44	–	–	–	–	–
3-3, 25-125	–	–	–	–	–	–	–	2.16 ± 0.15
4-2, 20	1.54	–	–	–	–	44.9	69.2	–
4-3, 16-19	–	–	1.49	–	–	–	–	–
4-3, 104-107	–	–	1.47	2.34	–	–	–	–
4-3, 138	1.59	–	–	–	–	–	–	–
4-4, 86-89	–	–	1.52	–	–	–	–	–
4-4, 120-123	–	–	1.49	–	–	–	–	–
5-1, 74-76	–	2.64	–	–	–	–	–	–
5-2, 20	1.59	–	–	–	–	43.0	68.4	–
5-2, 23-26	–	–	1.55	2.46	0.18	–	–	–
5-2, 94-97	–	–	1.48	–	0.15	–	–	–
5-2, 145	–	–	–	–	0.45	–	–	–
6-2, 20	1.41	–	–	–	–	51.9	73.2	–
6-2, 30	–	–	–	–	0.12	–	–	–
6-2, 33-36	–	–	1.61	2.27	–	–	–	–
6-2, 96	–	–	–	–	0.07	–	–	–
6-2, 100-103	–	–	1.59	–	–	–	–	–
6-4, 20	1.57	–	–	–	–	41.8	65.6	–
6-6, 36-38	–	2.68	–	–	–	–	–	–
7-5, 20	1.58	–	–	–	–	45.3	71.5	–
7-5, 23-26	–	–	1.46	2.31	–	–	–	–
7-5, 28	–	–	–	–	0.19	–	–	–
7-5, 64-67	–	–	1.50	–	0.28	–	–	–
7-5, 109-112	–	–	1.49	–	0.32	–	–	–
7-6, 56-58	–	2.62	–	–	–	–	–	–
8-1, 76-79	–	2.62	–	–	–	–	–	–
8-4, 20	1.60	–	–	–	–	43.7	69.9	–
8-4, 22-25	–	–	1.47	2.35	0.48	–	–	–
8-4, 35-38	–	–	1.51	–	0.55	–	–	–
8-4, 117-120	–	–	1.49	–	0.60	–	–	–
9-1, 72-74	–	2.63	–	–	–	–	–	–
9-2, 20	1.88	–	–	–	–	33.2	62.5	–
9-2, 75-78	–	–	1.57	2.95	0.20	–	–	–
9-5, 20	1.54	–	–	–	–	50.8	78.3	–
9-5, 23-26	–	–	1.53	2.39	0.15	–	–	–
9-5, 45-48	–	–	1.54	–	–	–	–	–
9-5, 96-99	–	–	1.52	–	0.31	–	–	–
9-7, 15	1.40	–	–	–	–	–	–	–
10-1, 71-73	–	2.57	–	–	–	–	–	–
10-2, 20	1.46	–	–	–	–	51.0	74.5	–
10-2, 23-26	–	–	1.47	2.12	0.13	–	–	–

TABLE 3 – *Continued*

Sample (Interval in cm)	Density Wet-Bulk (g/cm^3)	Density Grain[a] (g/cm^3)	*P*-Wave Velocity (km/s)	Acoustic Impedance ($\times 10^5$ g/cm^2-s)	Shear Strength ($tans/ft^2$)	Water Content (% wet weight)	Porosity (vol. %)	Mean Thermal Conductivity (10^{-3} cal/cm-s-C°)
Hole 418B								
10-2, 109-112	–	–	1.50	–	0.44	–	–	–
11-2, 20	1.57	–	–	–	–	45.3	71.1	–
11-2, 22-25	–	–	1.47	2.31	0.47	–	–	–
11-2, 52-55	–	–	1.51	–	–	–	–	–
11-2, 85-87	–	2.59	–	–	–	–	–	–
11-2, 91-94	–	–	1.50	–	–	–	–	–
11-2, 109-112	–	–	1.54	–	–	–	–	–
11-2, 132-135	–	–	1.52	–	0.60	–	–	–
11-4, 10-13	–	–	1.50	2.18	0.28	–	–	–
11-4, 60	1.45	–	–	–	–	45.9	66.6	–
11-5, 20-120	–	–	–	–	–	–	–	2.20 ± 0.01
12-2, 31-34	–	–	1.58	–	0.60	–	–	–
12-2, 95-98	–	–	1.56	2.20	0.58	–	–	–
12-4, 80	1.41	–	–	–	–	43.9	61.9	–
13-1, 27-30	1.63	–	1.62	2.64	0.57	42.1	68.7	–
13-1, 65-67	–	2.56	–	–	–	–	–	–
13-1, 76-79	–	–	1.54	–	0.78	–	–	–
13-3, 144	1.51	–	–	–	–	–	–	–
15-2, 20	1.77	–	–	–	–	48.2	85.4	–
15-2, 24-27	–	–	1.44	2.55	–	–	–	–
15-2, 78-80	–	2.62	–	–	–	–	–	–
15-2, 124-127	–	–	1.55	–	–	–	–	–
16-1, 20-22	1.66	2.59	–	–	–	37.8	62.8	–
16-2, 21-24	–	–	1.47	2.44	0.09	–	–	–
16-2, 94-97	–	–	1.45	–	0.12	–	–	–
17-1, 92-94	–	2.60	–	–	–	–	–	–
17-2, 50	1.64	–	–	–	–	46.2	75.8	–
18-1, 65-68	–	–	1.56	–	–	–	–	–
18-1, 109-111	–	2.57	–	–	–	–	–	–
19-1, 35-38	–	–	1.41	2.14	0.22	–	–	–
19-1, 50	1.52	–	–	–	–	–	–	–
19-1, 113-116	–	–	1.52	–	–	–	–	–
19-2, 23-25	–	2.66	–	–	–	–	–	–
20-2, 50	1.67	–	–	–	–	–	–	–
20-2, 77-79	–	2.64	–	–	–	–	–	–
21-1, 50	1.61	–	–	–	–	–	–	–
21-1, 56-59	–	–	1.52	2.45	0.18	–	–	–
21-1, 111-114	–	–	1.45	–	0.25	–	–	–
21-6, 49-50	–	2.59	–	–	–	–	–	–
22-1, 22-24	–	2.62	–	–	–	–	–	–
22-1, 28-31	–	–	1.66	–	0.94	–	–	–
22-1, 116-119	–	–	1.67	–	0.63	–	–	–
22-2, 14-17	–	–	1.70	–	0.82	–	–	–
22-2, 81-84	–	–	1.70	2.77	0.66	–	–	–
22-2, 100	1.63	–	–	–	–	–	–	–
22-4, 30-80	–	–	–	–	–	–	–	2.27 ± 0.07
23-1, 12-16	–	2.58	1.78	–	1.19	–	–	–
23-1, 29-32	–	–	1.74	2.23	0.85	–	–	–
23-1, 100	1.28	–	–	–	–	–	–	–
24-1, 3-6	–	–	1.70	–	1.02	–	–	–
24-1, 50	1.63	–	–	–	–	–	–	–
24-1, 62-65	–	–	1.67	2.72	0.19	–	–	–
25-1, 12-15	–	–	1.69	–	0.94	–	–	–
25-1, 80-83	–	–	1.71	2.91	1.12	–	–	–
25-2, 78-80	1.70	2.61	–	–	–	–	–	–
26-1, 61-64	–	–	1.71	–	1.10	–	–	–
26-1, 80-82	–	2.60	–	–	–	–	–	–
26-1, 111-114	–	–	1.66	–	1.42	–	–	–
26-1, 140-143	–	–	4.75	–	–	–	–	–
27-1, 3-7	–	2.59	1.72	–	1.65	–	–	–
27-1, 45	1.87	–	–	–	–	–	–	–
27-1, 51-54	–	–	1.68	3.14	1.15	–	–	–
27-1, 92-95	–	–	1.65	–	1.25	–	–	–
27-1, 97	–	–	–	–	0.25	–	–	–
27-CC, 5	2.55	–	5.19	13.23	–	–	–	–
28-1, 19-22	–	–	1.52	–	0.75	–	–	–
28-1, 81-84	–	–	1.63	–	1.60	–	–	–
28-2, 69	1.68	–	–	–	–	–	–	–
28-3, 35-38	–	–	1.62	2.72	1.15	–	–	–
29-1, 55-57	–	2.65	–	–	–	–	–	–
30-2, 84-85	–	2.67	–	–	–	–	–	–
31-2, 16-19	–	–	1.56	–	0.92	–	–	–
32-1, 119-121	–	2.67	–	–	–	–	–	–
33-1, 74-77	–	–	1.62	–	1.00	–	–	–

[a]From XRD.

sharp impedance contrast in the entire section occurs at the clay/claystone transition, suggesting that a pronounced reflector is present at Site 418 at a depth of 235 meters. An additional reflector will of course be present at the sediment/basalt transition at a depth of about 320 meters.

Shear Strength

The shear strength values of sediments in Table 3 and Figure 5 were measured at room temperature and zero pore and confining pressure, using a Soiltest Torvane shear-strength meter with its axis of rotation aligned parallel to bedding. The values obtained by this means for the unconsolidated sediments found to a depth of 190 meters range commonly between 0.1 and 0.6 tons/square foot (t/ft^2). Within the more consolidated sediments below 190 meters, the shear strength increases to 1.0 to 1.25 t/ft^2 and occasionally reaches values as high as 1.6 t/ft^2 below the clay/claystone transition. Because the shear strength of sediments is lowered by drilling disturbance, only the highest values obtained for any given interval are likely to be representative. With this reservation in mind, the only major discontinuity in sediment shear strength occurs at the unconsolidated/firm clay transition at approximately 190 meters sub-bottom.

Water Content and Porosity

The water content and porosity values in Table 3 were obtained by the syringe technique supplemented by continuous GRAPE determinations of porosity. As can be seen in Figure 5, the porosity of sediments as determined by the syringe technique decreases from 70 per cent near the mudline to about 55 per cent near the sediment/basement contact, while the water content decreases from about 45 to 30 per cent over the same interval. Although the porosity and water content of the sediments from the lower levels of Hole 418B could not be determined on shipboard by the syringe technique because of equipment failure, it is clear from the available data that the trends of these parameters with depth at Site 418 are broadly similar to those at Site 417.

Thermal Conductivity

This property was measured in the sediments recovered in Hole 418B to ± 4 per cent by means of the heated needle-probe described by von Herzen and Maxwell (1959). Between three and five measurements 20 to 30 cm apart were made in one section per core in three cores for a total of 11 measurements. All sections were first left to equilibrate to room temperature for six to eight hours, before being tested. The values were corrected to *in situ* conditions according to Ratcliffe (1960), using a -1 per cent/4°K temperature correction and a $+1$ per cent/1829 meters (1000 fathoms) pressure correction. The harmonic mean of the thermal conductivity for each core shown in Figure 5 ranges narrowly between 2.16 and 2.27 $\times 10^{-3}$ cal/cm-s-°C. These values are similar to those observed at Site 417 but higher than those reported for this region of the Atlantic by Langseth and von Herzen (1970).

Conclusions

Since the physical properties of unconsolidated to semiconsolidated sediments are strongly affected by drilling disturbance, the data in Table 3 and Figure 5 are qualitative only, with the possible exception of the grain density values presented for the entire hole and the density and porosity data shown for the chert stringers below 235 meters. Although there are several acoustic reflectors above the basement in the seismic-reflection record at Site 418 (see section on Correlation, this chapter), only two physical-property discontinuities have survived the drilling process: (1) an increase in compressional wave velocity and shear strength at approximately 190 meters; and (2) a sharp impedance contrast associated with chert stringers at the clay/claystone transition at about 235 meters. Because of the impedance contrast between the cherts and the overlying sediments is large, the clay/claystone transition should be marked by a prominent reflector at about 0.1 s above the basement reflector.

GEOCHEMISTRY

Chemistry of Interstitial Solutions

Hole 418A

Only two interstitial water samples were taken during coring of the sediment section of Hole 418A. These data are presented in Table 4. The number of samples does not warrant further interpretation.

Hole 418B

Interstitial water data for Hole 418B are presented in Table 4 and Figure 6.

*p*H values show a slight decrease from 32 to 130 meters (7.187 to 6.88); they generally increase thereafter to 309 meters where a pH of 8.45 is noted. This corresponds to a drop in alkalinity as recorded in this section of silicified chalks and claystones with chert.

Ca^{+2} increases regularly with depth (with an exception at 250 to 294 meters), whereas Mg^{+2} decreases, again with an exception at 250 to 294 meters. This interval consists dominantly of nannofossil chalks and marls, with some organic, phosphatic zones.

Salinity shows little variation through the cored depth, whereas alkalinity decreases to 130 meters, increases thereafter to 250 meters and decreases again to terminal depth.

In summary, the main features at this site are the gradual increases in dissolved calcium and decreases in dissolved magnesium. The concentration changes in these constituents are linearly correlated with $\Delta Ca/\Delta Mg = -1.24$ ($r^2 = 0.996$). As in Site 417, the data are interpreted in terms of basalt alteration and diffusional communication with the overlying ocean.

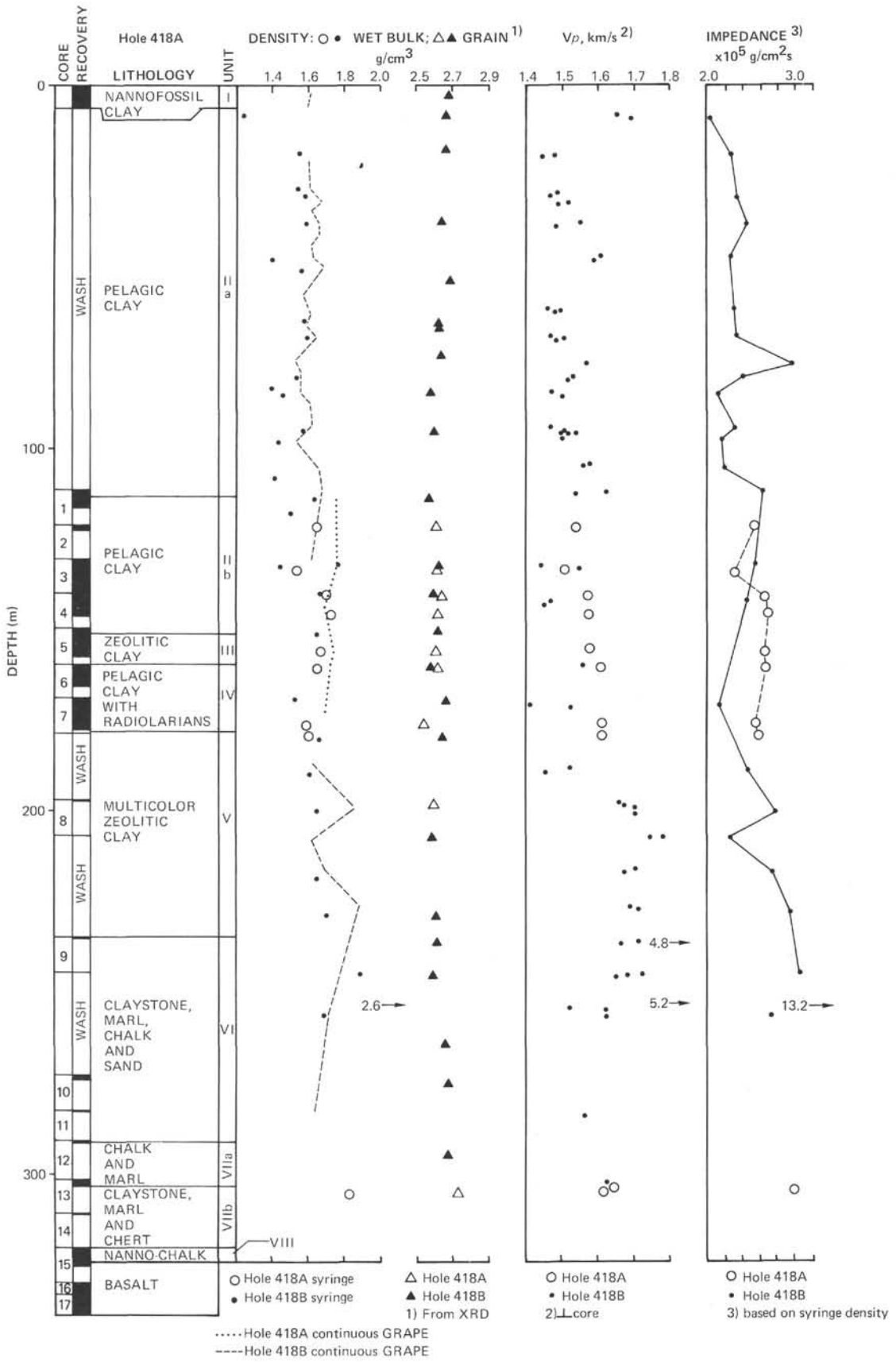


Figure 5. *Holes 418A and 418B: Physical properties of sediment.*

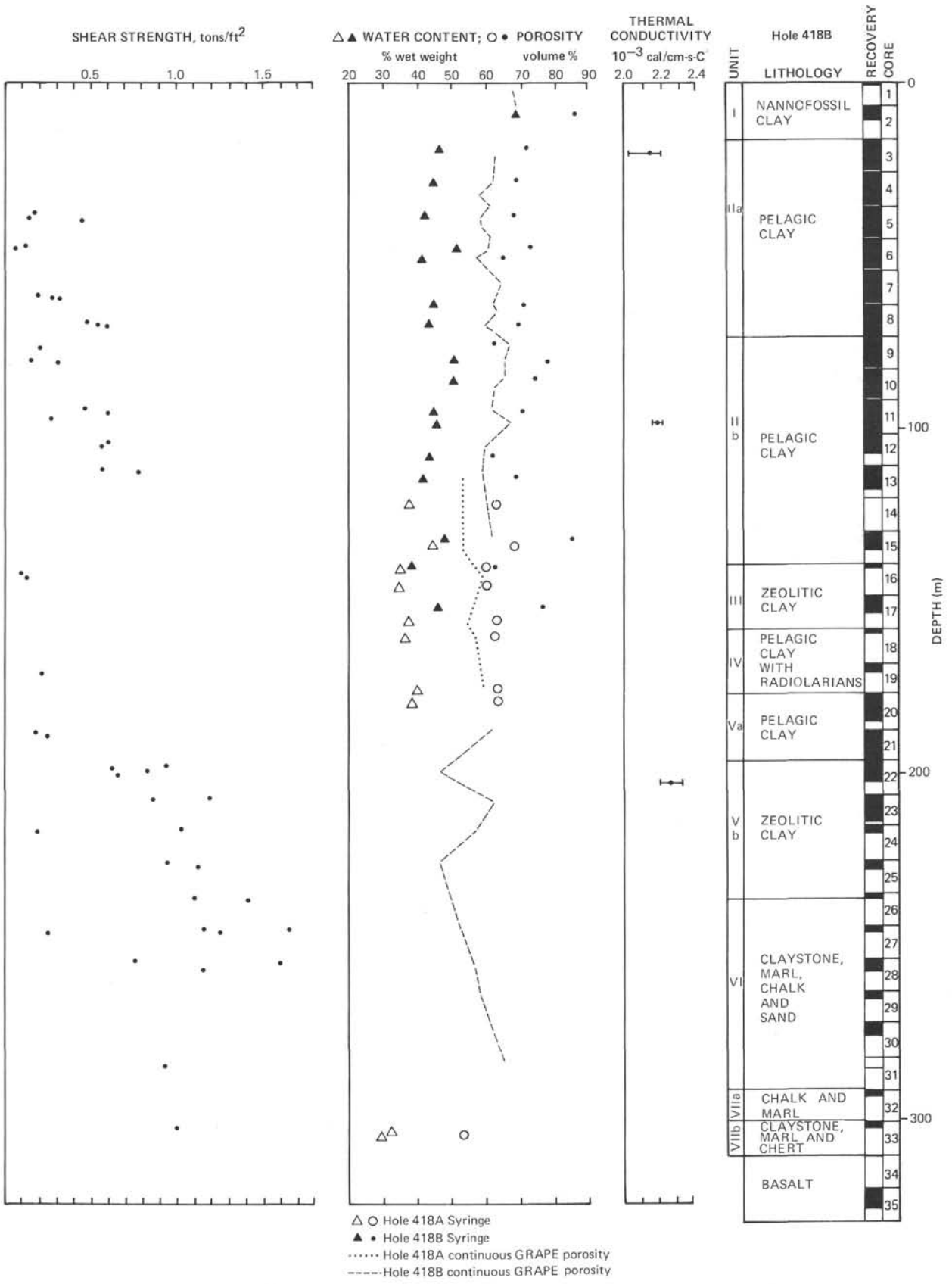


Figure 5. *(Continued).*

TABLE 4
Interstitial Water Geochemistry

Sample (Interval in cm)	Sub-Bottom Depth (m)	pH	Alkalinity (meg/ℓ)	Salinity (‰)	Chlorinity (‰)	Ca^{+2} (m moles/ℓ)	Mg^{2+} (m moles/ℓ)
418A-1-2, 140-150	120.5	6.9	1.30	36.3	19.6	14.0	50.3
6-2, 144-150	168	7.0	1.26	35.8	19.7	16.0	50.4
418B-4-3, 138-150	32	7.2	2.68	35.5	19.6	11.3	50.2
9-7, 0-15	75	7.1	1.64	36.3	20.1	12.8	51.4
15-3, 144-146	130	6.9	1.36	36.3	20.0	14.1	50.7
27-1, 144-146	250	7.8	2.97	36.3	20.1	20.8	45.6
31-2, 0-10	294	7.5	2.55	36.3	20.0	21.2	45.1
33-1, 144-146	309	8.4	1.06	36.3	20.3	23.5	42.8
34-1, 34-35	319	7.4	2.15	36.3	20.0	25.5	41.3

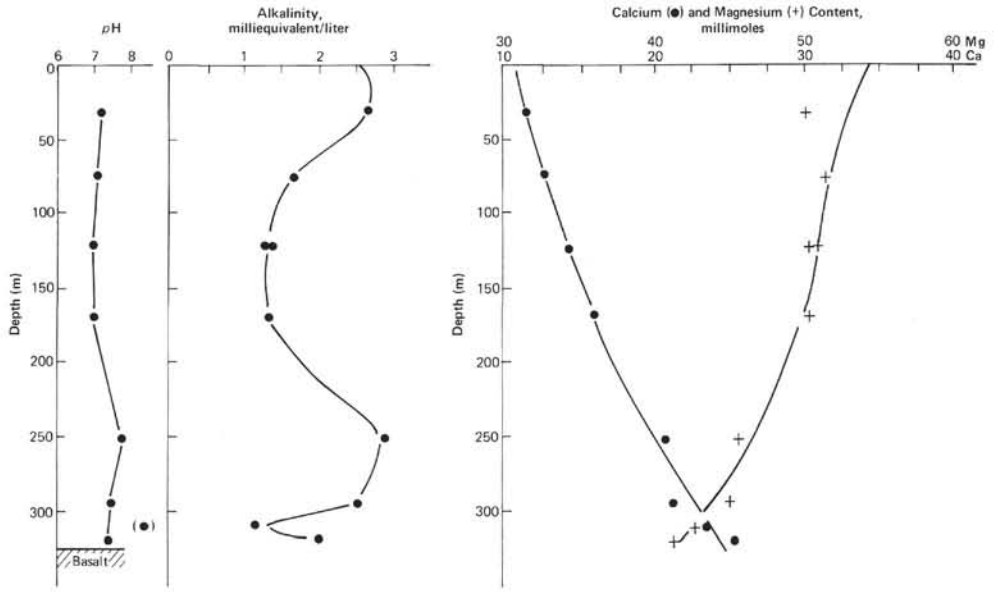


Figure 6. *Interstitial water geochemistry of Holes 418A and 418B.*

BASEMENT LITHOSTRATIGRAPHY

Hole 418A

Acoustic basement was encountered at 324.0 meters sub-bottom and drilled to a depth of 868.0 meters. A total of 391.3 meters of basalt was recovered from the drilled interval for an average recovery of 72 per cent. The recovered sequence was divided into 16 major lithologic units based on cooling characteristics and phenocryst content (Table 5 and Figure 7). Interpretation of cooling units was the single most useful basis for defining the stratigraphy. Cooling breaks were recognized using glassy selvages or abrupt changes in grain size across unrecovered intervals. Cooling units less than 1 meter thick were inferred to represent single pillows; a non-pillowed origin was inferred for cooling units more than 3 meters thick. Most thick cooling units also have a coarser grain size and a more nearly holocrystalline groundmass than individual pillows. These criteria were used to define two basic types of stratigraphic unit in the hole: pillow basalt and massive basalt. The stratigraphic units were numbered sequentially from the top down and several of them were subdivided according to textural or petrographic criteria. For example, Units 2 and 14 were subdivided on the basis of observed or inferred cooling breaks, and Unit 6 was subdivided into pillowed and brecciated units. Unit 8 was divided into three sub-units on the presence of a thin massive cooling unit in Core 56. Because this massive unit is thin and since it has the same phenocryst mineralogy as the enclosing pillow basalts, it was not given a separate number designation.

Except for Unit 15, comprising the basalt dikes in the lower part of the hole, all contacts are interpreted as being depositional. However, the breccia in the upper 10 cm of Unit 5 may have been slightly sheared.

The entire section consists of sparsely to moderately phyric basalt. Plagioclase phenocrysts make up 5 to 10 per cent and olivine phenocrysts 1 to 3 per cent of most specimens. Clinopyroxene occurs as very rare phenocrysts or xenocrysts in most units, and traces of spinel are locally present. Alteration of the basalts is extensive but weak. Fresh glass persists throughout the drilled sequence, and fresh olivine is locally present. Smectite, carbonate, and quartz are the most common secondary minerals, typically filling veins and vesicles or replacing

TABLE 5
Basement Lithologic Units, Hole 418A, from Results of Legs 52 and 53

Unit	Top[a] (m)	Base[a] (m)	Thickness (m)	Type Cooling Unit	Phenocryst Assemblage	Intervals (Core-Section, cm)
1	324.0	329.6	5.6	Pillow basalt	Plag-(Oliv)	15-1, 20 to 16-1, 10
2A	329.6	331.7	2.1	Massive basalt	Plag-(Oliv)	16-1, 10 to 16-2, 105
2B	331.7	339.0	7.3	Massive basalt	Plag-(Oliv)	16-2, 105 to 17-4, 150
2C	339.0	363.1	24.1	Massive basalt	Plag-(Oliv)	18-1, 0 to 20-5, 81
2D	363.1	376.6	13.5	Massive basalt	Plag-(Oliv)-[Cpx]	20-5, 81 to 24-1, 57
3	376.6	383.3	6.7	Pillow basalt	Plag-(Oliv)-[Cpx]	24-1, 57 to 25-2, 60
4	383.3	387.1	3.8	Massive basalt	Plag-(Oliv)-[Cpx]	25-2, 60 to 26-2, 110
5	387.1	498.5	111.4	Pillow basalt and breccia	Plag-(Oliv)-[Cpx]	26-2, 110 to 40-3, 47
6A	498.5	510.5	12.0	Breccia	Plag-Oliv-(Sp)-[Cpx]	41-1, 0 to 42-2, 150
6B	510.5	611.0	100.5	Pillow basalt	Plag-Oliv-(Sp)-[Cpx]	42-3, 0 to 53-3, 150
7	611.0	629.2	18.2	Pillow basalt	Plag-Oliv-Cpx	54-1, 0 to 55-7, 70
8A	629.2	632.9	3.7	Pillow basalt	Plag-Oliv-Cpx	55-7, 70 to 56-3, 45
8B	632.9	636.3	3.4	Massive(?) basalt	Plag-Oliv-Cpx	56-3, 45 to 56-5, 125
8C	636.3	671.8	35.5	Pillow basalt	Plag-Oliv-Cpx	56-5, 125 to 60-4, 33
9	671.8	676.5	4.7	Massive, vesicular basalt	Plag	60-4, 33 to 60-6, 66
10	676.5	686.0	9.5	Massive basalt	Plag	61-1, 0 to 61 bit, 95
11	686.0	695.5	9.5	Pillow basalt	Plag-Cpx-Oliv	62-1, 0 to 63-5, 119
12	695.5	698.2	2.7	Massive(?) basalt	Plag-Cpx-Oliv	64-1, 0 to 64-2, 122
13	698.2	786.5	88.3	Pillow basalt and breccia	Plag-Cpx-Oliv	64-2, 122 to 75-4, 150
14A	786.5	793.6	7.1	Massive basalt	Plag-Cpx-Oliv	75-5, 0 to 77-1, 50
14B	793.6	821.5	27.9	Massive basalt	Plag-Cpx-Oliv	77-1, 50 to 79.7, 124
14C	821.5	859.8	38.3	Massive basalt	Plag-Cpx-Oliv	80-1, 0 to 86-1, 25
15A	—[b]	—	—	Basalt dikes	Plag-Oliv-Cpx	79-1, 75 to 79-1, 110 79-2, 78 to 79-2, 105 79-3, 105 to 79-4, 95
15B	—	—	—	Basalt dikes	Plag-Oliv	80-2, 117 to 80-3, 127 80-4, 2 to 80-4, 42 80-4, 107 to 80-5, 110
16	859.8	868.0	8.2	Pillow basalt and breccia	Plag-Oliv-Cpx-Sp	86-1, 25 to 86-6, 55

[a] Depths corrected for spacers.
[b] Undetermined.

glass. Alteration intensity does not vary significantly with depth, and all of the alteration is low temperature in character.

Unit 1

This unit consists of 5.5 meters of pillow basalt in Core 15, and 10 cm of pillow breccia in the uppermost part of Core 16. The top of the unit occurs at 324 meters sub-bottom, where it underlies sedimentary rock dated as early Aptian on the evidence of its nannofossil assemblage. Unfortunately, the basalt sediment contact was not recovered. The base of the unit is taken at Section 16-1, 10 cm, at the top of the underlying massive unit. A thin limestone occurs between pillows in Section 15-2, 15 cm.

The basalts of Unit 1 are sparsely to moderately phyric with about 5 per cent plagioclase phenocrysts ranging in size to 2 mm. Plagioclase phenocrysts are moderately zoned with calcic cores and distinctly more sodic rims; many also contain altered glass inclusions. Olivine microphenocrysts are present in all specimens but rarely exceed 1 per cent of the rock; they occur as discrete grains up to 1 mm in diameter and in glomerophyric clusters with plagioclase. Both plagioclase and olivine phenocrysts are seriate in size with groundmass microlites.

Groundmass textures range from glassy to fine-grained quench with acicular microlites of plagioclase surrounded by radiating sheaves of poorly crystallized clinopyroxene. Euhedral crystals of magnetite, up to 0.02 mm in size, form about 5 per cent of the groundmass. Many thick, fresh glass selvages occur within the unit.

Vesicles make up 1 to 2 per cent of the rock and range in diameter to 1 mm. They are commonly filled with carbonate, with or without smectite. Plagioclase phenocrysts are sometimes altered to a green smectite causing many of the large plagioclase aggregates to look in hand specimen like intergrowths of plagioclase and a ferromagnesian mineral. Olivine phenocrysts and microlites are completely replaced by smectite. Breccias with a calcite and smectite matrix occur in Section 15-2, 140 to 150 cm, as well as in Section 15-4, 45 to 50 cm, and in Section 16-1, 2 to 10 cm; these probably represent highly altered pillow breccias with a once-glassy matrix.

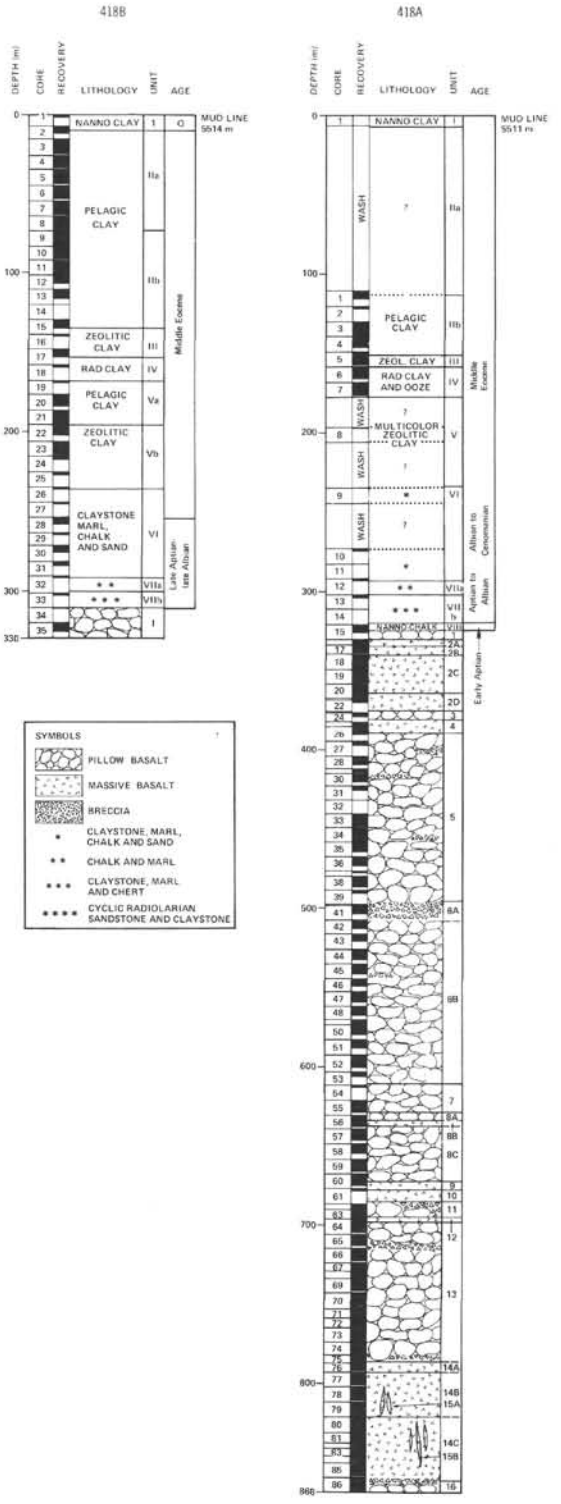


Figure 7. *Stratigraphy of sediment with basement sections, Holes 418A and 418B.*

Unit 2

This unit consists of 47 meters of sparsely to moderately phyric massive basalt. The upper contact at Core 16, Section 1, 10 cm, was not recovered but the grain size of the basalt becomes smaller upward, and presumably a glassy margin existed a few centimeters higher. The base of the unit is at Section 24-1, 57 cm, at the top of the underlying pillow sequence. All of the massive basalts in this sequence have been interpreted as flows on the basis of criteria outlined in the Site 417 Report discriminating flows from sills. Four sub-units have been recognized within Unit 2 based on internal cooling breaks.

All of the basalts of Unit 2 are sparsely to moderately phyric with plagioclase phenocrysts comprising between 4 and 10 per cent and olivine microphenocrysts less than 1 per cent of the rock. Phenocrysts are typically smaller in glassy flow margins than in the coarser-grained interiors where plagioclase is up to 5 mm and olivine up to 2 mm in size. Plagioclase phenocrysts are typically zoned (normal, oscillatory, or sector) and often contain devitrified glass inclusions. Olivine microphenocrysts occur either as single crystals or in glomerophyric clusters with plagioclase.

The groundmass of most flows in Unit 2 has a fine-grained quench texture, except in the interiors of the thickest cooling units where a medium to coarse-grained subophitic texture occurs. In fine-grained portions of the unit, slender needles of plagioclase up to 1 mm long are irregularly distributed producing a mottled appearance to the rock. Olivine commonly forms 1 to 4 per cent of the groundmass, occurring in small euhedral crystals seriate in size with the microphenocrysts. Clinopyroxene varies from radiating sheaves in the quench specimens to subophitic intergrowths with plagioclase in the coarse-grained rocks.

Vesicles are present throughout the unit, forming up to 2 per cent of the rock. Some are open, others filled with smectite and minor calcite. Olivine is completely altered to smectite, and plagioclase often exhibits incipient alteration along cleavage planes.

Unit 2 is divided into four sub-units on the basis of observed or reasonably inferred cooling breaks. Other cooling breaks may have gone undetected, although generally the grain size changes systematically from the margins of a sub-unit toward the center, consistent with the presence of only one cooling unit.

The uppermost cooling unit (Sub-unit 2A) is 2.2 meters thick and extends from the top of Unit 2 down to Section 16.2, 105 cm. A poorly recovered, altered volcaniclastic breccia containing many once-glassy clasts of basalt underlies Sub-unit 2A at the bottom of Section 16-2. Carbonate veins and oxidation are very common in this sub-unit.

Sub-unit 2B, 7.2 meters thick, continues down to the bottom of Core 17. Glassy margins were not recovered and separation of Sub-unit 2B from Unit 2C is largely on the basis of variations in grain size, the rock coarsening upward in Section 17-4, and downward in Section 18-1. A 518-gram pyrite nodule occurs between the two sub-units. It may be *in situ* or it may have fallen into the hole when the bit was raised into the sedimentary section between Cores 17 and 18. Several wide veins of carbonate and quartz occur in the unit, which is much less oxidized than Sub-unit 2A.

Sub-unit 2C is about 24.2 meters thick, extending from the top of Core 18 down to Section 20-5, 81 cm.

Recovery was very good in this unit, and no definite internal cooling break was found. Internal grain-size variations are present but, with one exception, these are gradual. The exception is at Section 18-5, 95 to 100 cm, where a thin zone of aphyric basalt is sharply bounded above and below by coarser-grained, phyric basalt. The aphyric zone is tentatively considered a textural variant of a thicker flow, such as a "segregation vein," rather than an important cooling break. The lower part of the sub-unit is marked by a downward decrease in grain size in Section 20-5, culminating in a glass rind in Piece 3. This glassy zone is taken as the base of the sub-unit. The coarsest-grained specimens from the center of this rather thick cooling unit have well-developed subophitic textures, yet they retain over 10 per cent interstitial glass. Zones of intense vuggy alteration occur in Sections 19-4 and 5, and in Section 19-7.

The top of Sub-unit 2D is defined as Piece 4 of Section 20-5, which has an altered glassy upper margin. The sub-unit is about 13.4 meters thick, with its base assumed to be at the bottom of Piece 1 in Section 24-1. No glass was found at the base of the Sub-unit, but it may be present in the unrecovered interval above the glassy top of Unit 3. Recovery was unsatisfactory in the lower 7.5 meters of Sub-unit 2D and cooling breaks could easily have been missed. The sub-unit is petrographically similar to those higher in the hole, except for the presence of rare, rounded clinopyroxene phenocrysts or xenocrysts in the interval from Section 20-6 to the base of the sub-unit. A narrow glassy zone at Section 23-1, 13 to 18 cm, does not extend across the core; it is interpreted as an internal cooling break, perhaps related to an incipiently pillowed or cracked base of the sub-unit.

Unit 3

This unit consists of about 6.9 meters of moderately phyric pillow basalt and minor broken-pillow breccia. The top of the unit is marked by a glassy margin on Piece 2, Section 24-1, 56 cm. A glass selvage also occurs at the base of the unit in Piece 2, Section 25-2, 60 cm.

Plagioclase phenocrysts comprise about 10 per cent of the basalt, and range up to 4 mm in size. Olivine microphenocrysts form less than 1 per cent of the basalt and are less than 1 mm long. Rare, rounded phenocrysts or xenocrysts of clinopyroxene are also present. The groundmass has a well-developed quench texture and consists of olivine and plagioclase microlites, sheaf-like aggregates of clinopyroxene, and interstitial glass.

Vesicles are less than 1 per cent of the rock and are mostly filled with calcite. All of the olivine is replaced by smectite, and plagioclase is incipiently altered to smectite along cleavage traces. Most glass selvages are altered to smectite.

Aphyric basalts occur at two intervals in this unit — Section 25-1, 9 to 12 cm and 55 to 75 cm. In both cases the transition from aphyric to phyric basalt occurs within a single pillow, suggesting that the aphyric intervals result from flow segregation. This segregation may have taken place in feeder dikes or small lava tubes which, in turn, formed the pillowed flows. Gravitational segregation, at least *in situ,* is not likely because both tops and bottoms of the pillows containing these aphyric intervals are phyric.

Unit 4

This unit is a single 3.5-meter-thick cooling unit of moderately phyric basalt considered to be a single massive flow. Its top, Piece 2 in Section 25-2, is glassy and dips 20 to 25 degrees. The basalt becomes coarser-grained downward and is medium-grained from about 1.5 meters below the top of the unit to about 30 cm above the base. Grain size decreases abruptly in the lower 30 cm, and the bottom of Piece 2f, Section 26-2, 100 cm, is very fine grained. The underlying piece is a breccia defined as the top of Unit 5.

Plagioclase phenocrysts make up between 5 and 6 per cent of the flow, and are up to 4 mm in size. Olivine microphenocrysts are less than 1 per cent and up to 1 mm in size. Clinopyroxene phenocrysts or xenocrysts are rare. The groundmass is a fine- to medium-grained, intergranular mixture consisting largely of plagioclase and clinopyroxene. Olivine is unevenly distributed in the groundmass, ranging up to 5 per cent, and magnetite averages about 2 per cent. Small amounts of interstitial glass are usually present, particularly in the finer-grained portions. Aphyric basalt gradational to phyric basalt occurs within the flow at Section 25-2, 86 to 101 cm, and Section 25-3, 2 to 5 cm.

Small vesicles are sparsely distributed in this unit and are normally filled with calcite. Olivine and glass are usually completely altered to smectite, and plagioclase exhibits incipient alteration along many cleavage traces.

Unit 5

This unit contains about 111.5 meters of pillow basalt and lesser broken-pillow breccia and hyaloclastite. The top of the unit is a breccia in Piece 2g, Section 26-2, 114 cm, and the base is arbitrarily placed at the top of Core 41. Recovery was moderately good, and there is little likelihood that any major cooling units were missed in the sequence. The unit consists dominantly of pillows of moderately phyric basalt, with many once-glassy selvages preserved. Broken-pillow breccia occurs in small amounts throughout the unit and is particularly common in Cores 28, 31, and 34. Hyaloclastite breccias are present in Cores 27 and 28.

Small fragments of sedimentary rock occur at two levels. Rounded fragments of analcime-cemented volcaniclastic sandstone were recovered at the top of Core 28 below an intensely oxidized sequence of basalt in the lower part of Core 27; a small piece of chert was recovered at the top of Core 40. Basalts above and below these intervals are petrographically similar, and the sedimentary fragments may represent sedimentary interbeds of fragments that fell into the hole from higher levels.

Plagioclase phenocrysts make up from 5 to 15 per cent and average about 8 per cent of the basalt in Unit 5. They typically occur as weakly zoned, subhedral crystals averaging 1 to 3 mm in size. One phenocryst in Sample 27-1, 118-120 cm, has a small spinel inclusion. Olivine phenocrysts make up 1 per cent of the rock, and range

up to 3 mm in size, significantly larger than in Units 1 through 4. Rare clinopyroxene occurs as rounded crystals up to 2 mm in size. Plagioclase-olivine glomerocrysts are common, most often with olivine attached to the outside of larger plagioclase phenocrysts.

Groundmass textures are distinctly coarser-grained than those of flows and pillows in Units 1 through 4. Quench textures are present near the pillow rims, but medium-grained intersertal to intergranular textures are characteristic of pillow centers. Subophitic clots of plagioclase and clinopyroxene occur in some of the coarser-grained specimens. Groundmass microlites are commonly flow-aligned in eddies around phenocrysts and glomerophyric clots. One pillow at Section 27-2, 125 to 145 cm, has an aphyric core with phyric margins, probably formed by flow segregation.

Broken pillow breccias consist largely of pillow fragments — many with glassy rinds — in a finer-grained matrix of small grains and altered glassy material. The hyaloclastite breccias also contain glassy and cryptocrystalline basalt clasts in a smectite matrix, probably formed by alteration of glassy detritus. A number of the breccias contain small, pillow-like bodies, 5 to 10 cm across, with glassy margins. Some of these bodies contain small inclusions of the breccia (Figure 8). These relationships suggest that the breccia may have formed at a flow front, with lava being injected into the accumulating detritus.

Unit 6

This unit consists of 112.5 meters of moderately phyric pillow basalt and broken-pillow breccia. It is distinguished from Unit 5 by the presence of slightly more olivine and trace amounts of spinel. The top of the unit is arbitrarily defined as the top of Core 41, but it could be placed anywhere in a 1.5-meter-thick interval between Section 40-2, 95 cm, and Section 41-1, 40 cm, the locations of thin sections containing no spinel and spinel, respectively. The unit extends to the base of Core 53 (611.0 m sub-bottom).

Unit 6 is divided into two sub-units: Sub-unit 6A, composed chiefly of broken-pillow breccia and Sub-unit 6B, composed chiefly of pillow basalt. Sub-unit 6A is about 12 meters thick, extending to the bottom of Section 42-2. The lower 50 cm of the sub-unit grades down into the unbroken pillows of Sub-unit 6B. Many sharply angular clasts of basalt 1 to 5 cm across with glassy or variolitic rinds occur within the breccia. The matrix is now mostly smectite, presumably formed by alteration of glassy detritus. Where the matrix is dominantly calcite (e.g., at the top of Section 42-1), small angular fragments of altered glass, less than 0.5 mm across, can be recognized. The two thin sections available of clasts within the breccia are spinel-bearing; on this basis, the breccia is included in Unit 6.

Sub-unit 6B consists mainly of pillow basalts with minor amounts of calcareous sediment, volcaniclastic detritus, and broken-pillow breccia between some of the pillows. The top of the sub-unit at Section 42-3 is gradational into Sub-unit 6A; the base at the bottom of Core 53 is sharp.

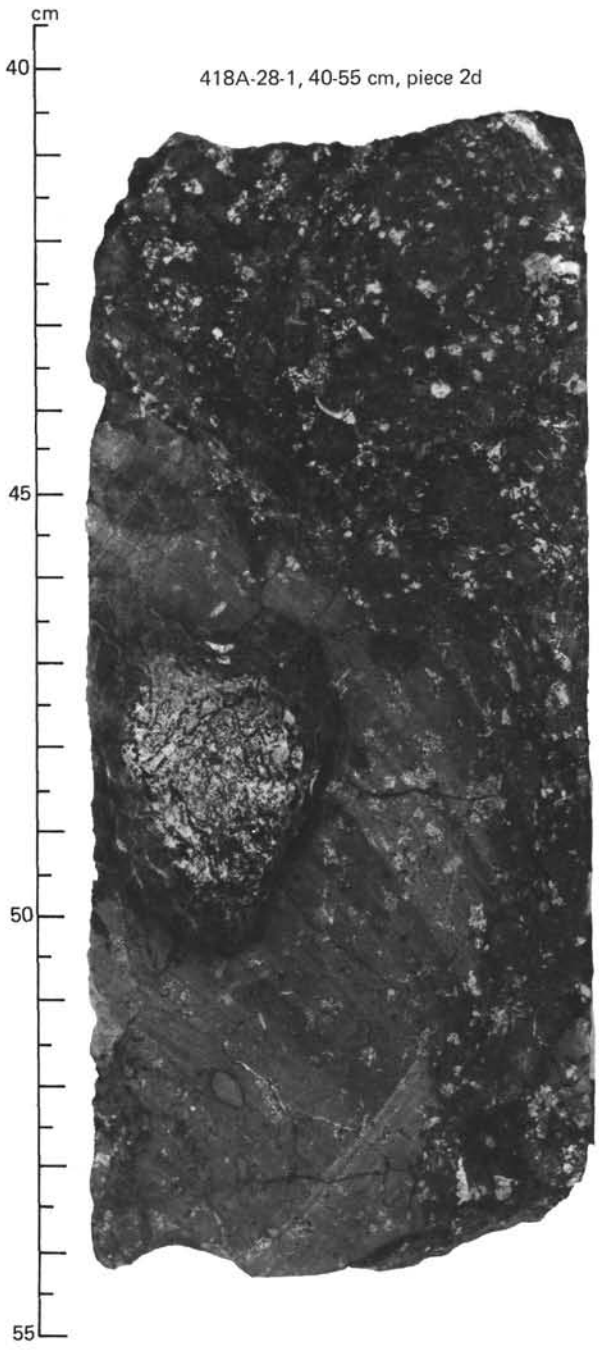


Figure 8. *Unit 5, Hole 418A, Section 28-1, 40–50 cm. A small pillow-like feature, about 10 cm in diameter is intruded into hyaloclastite breccia (and consumes) a small, 3-cm fragment of the breccia. Hyaloclastite and pillows are considered part of a single eruptive event.*

Plagioclase phenocrysts are generally 10 per cent and occasionally as much as 15 per cent of the unit. They range in length up to 15 mm, but most are between 2 and 4 mm. Most are euhedral and fresh, and many are prominently zoned with oscillatory zoning the most common. Glass inclusions are often present in certain zones within the phenocrysts. Olivine phenocrysts make

up 2 to 3 per cent of the basalt and generally are less than 2 mm in size, rarely up to 4 mm. They occur as single crystals or in glomerophyric clots with plagioclase. Many of the olivine crystals are fresh, particularly those occurring in fresh glass selvages. Rounded clinopyroxene crystals, up to 4 mm in length, are recognizable in hand samples but form much less than 1 per cent of the rock. Such crystals often have small plagioclase crystal inclusions. Spinel octahedra are widespread, though they never exceed one per cent of the rock. Occurring as individual grains in the groundmass and as inclusions in plagioclase and olivine phenocrysts, the crystals are reddish to greenish brown, and range up to 0.2 mm in size. Some have dark rims and vermicular intergrowths, indicating that they may have been reacting with the liquid.

Groundmass textures vary from glassy to microcrystalline, with a nearly cryptocrystalline mixture of clinopyroxene, opaque minerals, and devitrified or altered glass filling interstices between plagioclase needles and olivine crystals. The olivine typically forms small, barbed and hollow, skeletal crystals up to 0.2 mm in size. The plagioclase microlites often exhibit weak flow alignment around phenocrysts.

The entire unit is relatively fresh and moderately veined. Vesicles are much less than 1 per cent and are filled with calcite, smectite, or both. Traces of secondary pyrite are present in some veins and in the groundmass. Breccias are occasionally present at glassy margins and consist of altered basalt fragments cemented with calcite and smectite. A red-stained zeolite, phillipsite, is also present in the groundmass of some breccias.

Unit 7

This unit comprises an 18.4-meter-thick sequence of moderately phyric pillow basalt. Its upper contact is at the top of Core 54 and its base at Section 55-7, 70 cm. The basalts of Unit 7 are distinguished from those of Unit 6 by their generally smaller phenocryst sizes and absence of spinel. They differ from the underlying basalts of Unit 8 in their greater abundance of plagioclase phenocrysts and generally coarse-grained groundmass textures.

Fresh, euhedral-to-subhedral plagioclase phenocrysts generally make up 5 to 15 per cent of the rock, except in a few nearly aphyric zones. The plagioclase crystals are seriate with the groundmass laths and range up to 3 mm in length. The largest crystals are complexly zoned and often contain numerous glassy inclusions. Euhedral olivine phenocrysts and microphenocrysts make up 1 to 5 per cent of the rock and average about 2 per cent. Most of the olivine crystals are euhedral to subhedral, and range from 0.5 to 2 mm in diameter. They are generally altered except in fresh glass rinds. Clinopyroxene forms subophitic crystals, up to 3 mm across, enclosing small plagioclase laths. The clinopyroxene is always fresh and, though subhedral, does not have the rounded forms typical of clinopyroxene in Unit 6.

Groundmass textures are typically intersertal with plagioclase needles in a micro- to crypto-crystalline matrix of clinopyroxene, devitrified glass, and opaque minerals. Some interstitial material is present even in the coarsest-grained specimens, which are characterized by numerous subophitic clots of plagioclase and clinopyroxene. The plagioclase : clinopyroxene ratio in the groundmass is about 1:2, notably lower than in the basalts of Unit 6. Disseminated sulfides are locally abundant in the groundmass (e.g., Section 55-3) and may include pyrrhotite and chalcopyrite as well as pyrite.

The basalts of Unit 7 are relatively fresh, being only moderately veined. Fresh glass and olivine are present in many pillow rinds; elsewhere, olivine is typically altered to smectite. Sparse vesicles ($<1\%$) are filled with smectite and calcite, as are the veins. Locally, secondary pyrite is abundant.

Unit 8

This unit consists of 44.1 meters of moderately plagioclase-olivine-clinopyroxene phyric basalt. The top of the unit corresponds to the top of Core 56, and the base is at Section 60-4 (35 cm). Glassy margins were not recovered at either contact. These basalts, although chiefly pillowed, can be distinguished from those of Unit 7 by their greater abundance of plagioclase phenocrysts and generally coarser-grained groundmass.

The sequence is divided into three sub-units on the basis of a massive cooling unit between two pillowed units. Sub-unit 8A, the upper pillowed sequence, extends from the top of the unit to Section 56-3, 45 cm; Sub-unit 8B, the massive unit, extends from the base of Sub-unit 8A to Section 56-5, 125 cm; and Sub-unit 8C extends from the base of Sub-unit 8B to Section 60-4, 33 cm. The pillowed sequences in Sub-units 8A and 8C are texturally and mineralogically similar, except that the lower part of Sub-unit 8C is moderately brecciated. Plagioclase phenocrysts make up 8 to 12 per cent of the rock, olivine phenocrysts about 2 to 5 per cent, and clinopyroxene phenocrysts about 1 per cent. The plagioclase is euhedral to subhedral, occurring either in individual crystals or in glomerophyric clusters with clinopyroxene. The largest plagioclase crystals are often zoned, typically with oscillatory zoning in the center of crystals and normal zoning on the rims. Glassy inclusions are also common in the larger crystals, and spinel inclusions were observed in one crystal in Section 56-1. Olivine generally forms individual euhedral crystals up to 3 mm in size. These are typically altered except in fresh glassy pillow rinds. Clinopyroxene phenocrysts occur as subophitic plates, from 0.3 to 1 mm across, partly surrounding plagioclase. Many of the clinopyroxene crystals are optically zoned.

Groundmass textures vary from quench to intersertal, being somewhat better crystallized and coarser grained in pillow interiors. Groundmass plagioclase and clinopyroxene are present in approximately equal proportions. Plagioclase occurs in fresh needles or skeletal crystals up to 1 mm long. Clinopyroxene is granular or acicular and is always fresh. Groundmass olivine is rare; if formerly present, it has been mostly altered to smectite, except in Section 56-1, where fresh olivine is still

present. Magnetite is abundant in most specimens, occurring in small elongate crystals. Sulfide minerals are sparsely disseminated in the groundmass.

The breccias in the lower part of Sub-unit 8C consist of angular basalt clasts, 0.1 to 4 cm across, in a matrix of altered glass debris. Most of the breccia is associated with glassy pillow rinds, but some appears to be within pillow interiors.

The massive basalt of Sub-unit 8B is mineralogically similar to the pillow basalts above and below. Plagioclase is the most abundant phenocryst, followed by olivine. Clinopyroxene phenocrysts count for about 1 per cent of the rock, being somewhat coarser-grained than in the pillow basalts. Groundmass textures in the massive unit are typically intersertal, with some interstitial glass present throughout. Glass selvages are present only at the top and bottom of the unit.

Alteration is comparatively weak in Unit 8, being most intense toward the base of the unit where breccias are most common. Sparse vesicles are filled with calcite and smectite, as are veins. Smectite also occurs as pseudomorphs after olivine and replaces glass. Pink phillipsite and carbonate are present in altered glassy margins and breccias.

Unit 9

This unit is a single massive cooling unit, 3.2 meters thick, composed of vesicular, sparsely to moderately phyric basalt. The upper contact at Section 60-4, 33 cm, is marked by a highly vesicular zone with up to 10 per cent vesicles. The vesicle content decreases somewhat downward to about 5 per cent at the lower contact, which is drawn at the base of Core 60. The underlying massive basalts of Unit 10 are non-vesicular. No glass selvages were found at either contact.

The basalt of Unit 9 has 5 to 10 per cent of plagioclase phenocrysts, but unlike the overlying pillow basalts, phenocrysts of olivine and pyroxene are absent. The plagioclase phenocrysts are euhedral to subhedral, and generally range from 2 to 4 mm across, although a few are up to 7 mm. Many of the larger crystals are normally zoned and some contain glassy inclusions.

The groundmass is composed of plagioclase, clinopyroxene, opaque minerals, and minor interstitial glass, altered to smectite. The plagioclase : clinopyroxene ratio is about 1:1 and the content of opaque minerals varies from 5 to 10 per cent. The texture and grain size of the groundmass vary within the unit. The uppermost rocks have a fine-grained quench texture with acicular plagioclase and acicular to granular pyroxene. Toward the base of the unit, the basalt becomes coarser grained and contains subophitic clots of plagioclase and clinopyroxene.

High vesicularity is the main megascopic feature of this unit. The vesicles are round and vary from 1 to 3 mm in diameter. They are always filled with secondary minerals: smectite, calcite, quartz, iron oxides, and, less commonly, pyrite. Rare, thick veins of calcite, smectite, and minor quartz occur in the top of the unit, whereas the bottom is relatively unfractured.

Unit 10

This unit is restricted to Core 61, having a thickness of 9.5 meters. Distinctive characteristics are its massiveness, lack of veins or fractures, relatively coarse-grained groundmass, and fresh appearance in hand specimen. Glass selvages were not found at either the top or bottom contact, nor within the unit itself. However, only 1.8 meters of basalt was recovered from this interval, and it is possible that some glassy selvages were missed. On the other hand, the relatively coarse grained nature of the rock and the uniformity of the groundmass texture argue for a single cooling unit.

The basalt is moderately phyric with about 10 per cent plagioclase phenocrysts and 2 per cent olivine microphenocrysts. The plagioclase crystals are generally 2 to 4 mm across, euhedral, and relatively free of inclusions. All of the crystals have strong normal zoning with narrow, distinct rims of more sodic composition. The olivine phenocrysts are less than 1 mm in diameter, euhedral to subhedral, and completely replaced by smectite.

The groundmass is relatively coarse grained, with plagioclase and clinopyroxene between 0.1 and 0.5 mm and granular opaque minerals about 0.1 mm in diameter. The plagioclase : clinopyroxene ratio is about 5 : 4, and both minerals are often intergrown in subophitic clots surrounded by interstitial glass. Opaque minerals make up from 5 to 10 per cent.

Rare vesicles, up to 1 mm in diameter, and veinlets are filled with smectite or calcite. Interstitial glass and olivine crystals are altered to smectite. Secondary sulfides were not observed.

Unit 11

This unit is a 9.5-meter-thick sequence of pillow basalt, comprising the whole of Cores 62 and 63. It is bounded above and below by massive basalts of Units 10 and 12. Partly brecciated, glassy margins are abundant within the unit, but glass selvages were not recovered at either contact.

These basalts are sparsely to moderately phyric, containing about 3 to 5 per cent plagioclase phenocrysts and 1 per cent olivine phenocrysts. The plagioclase forms euhedral-to-subhedral crystals, 1 to 2 mm long, occurring either singly or in glomerophyric clots up to 3 mm across. Some plagioclase crystals are strongly corroded, particularly in the cores. These crystals are also strongly zoned. Olivine forms subhedral crystals, 0.5 to 1 mm long, which are completely replaced by calcite and smectite.

Groundmass textures range from quench to intersertal. Most intersertal specimens have well-developed, granular clinopyroxene in the groundmass and, in the coarser-grained specimens, small amounts of clinopyroxene are intergrown with plagioclase in the glomerophyric clots.

The basalts of Unit 11 range from nearly fresh to moderately altered. Vesicles make up about 1 per cent of most specimens and these are typically filled with calcite. Veins and fractures are rare; where present, they

are also filled with calcite and smectitie. Olivine is completely altered throughout the unit, but plagioclase is normally fresh. Brecciated glassy rinds are partly replaced by smectite and pink phillipsite(?) but most still contain some glass. Interstitial glass in the groundmass is partly replaced by calcite and smectite.

Unit 12

This unit comprises a massive basalt sequence in Core 64. It extends from the top of Core 64 to Section 64-2, 122 cm, for a total thickness of 2.7 meters. Recovery within this interval was 100 per cent, eliminating the possibility of internal cooling breaks and providing a complete cross section of a single massive unit. The lower contact is marked by a glassy selvage, the upper contact is not.

The basalt is moderately phyric with 10 to 12 per cent plagioclase phenocrysts and 1 to 2 per cent olivine phenocrysts. Plagioclase crystals average 1 to 2 mm in length but range up to 5 mm. They occur singly or often in glomerophyric clots up to 8 mm across. The individual crystals form subhedral prisms, often strongly zoned and partly corroded in the core. Olivine phenocrysts are euhedral to subhedral, have a maximum length of 1 mm and are seriate with groundmass crystals. All of the olivine is altered to smectite, except in the lower glassy selvage.

The groundmass varies from subophitic to intersertal. Typically, small clusters of intergrown plagioclase and clinopyroxene are surrounded by interstitial glass, producing an "ophimottled" texture. The plagioclase : clinopyroxene ratio is about 1:1 in the groundmass. In addition to these minerals, the groundmass contains about 10 per cent granular magnetite and 15 to 20 per cent interstitial glass. The grain size of the groundmass decreases and the glass content increases gradually toward the basalt glassy selvage in Section 64-2.

The rock is rather fresh in hand specimen but contains fairly abundant smectite after olivine and interstitial glass. Vesicles average about 1 per cent and are filled with smectite and calcite. Veins are present only in the lower 50 cm of the unit, where they are filled with smectite, calcite, silica, and minor pyrite.

Unit 13

This unit is an 88.4-meter-thick sequence of mainly pillow basalt with minor pillow breccia and extends from Section 64-2, 122 cm, to the base of Section 75-4. It is bounded above and below by massive basalts of Units 11 and 13, respectively. The upper contact is marked by a glass selvage,, the lower contact by a minor breccia zone.

In addition to pillow basalts, Unit 13 contains broken pillow breccias, several sedimentary fragments, and a feature interpreted as a possible lava tube. The breccias are best developed in Sections 65-4 and 66-5 and consist of angular fragments of crystalline basalt. The latter range from 1 mm to 10 cm across in a matrix of smectite, presumably formed by the alteration of glassy detritus. A few broken-pillow breccias are also present and consist of large basalt clasts, often with glassy rinds in a matrix of massive smectite and minor carbonate. Sedimentary inclusions occur in Section 69-1 and 4; 71-1, 3, and 4; 71-1, 2, and 3; and 73-2 and 6. These sedimentary fragments are typically pale reddish brown, very hard and very fine grained. Petrographically, they appear to be silicified limestones, consisting of nearly equal amounts of silica and carbonate. Most of the fragments lie between glassy pillow rinds and represent either sedimentary interbeds or small masses of sedimentary material caught up in the flow. In Core 71, the fragments are enclosed in crystalline basalt and probably represent material incorporated into the flow during eruption.

In Sections 70-4 and 5, there is a 2.4-meter-thick sequence lacking glassy selvages. However, this sequence is cut by a 60-cm-thick, fine-grained zone near its center. The contact between the fine-grained and coarse-grained zones is sharp and slightly inclined to the core axis. In thin section, the fine-grained material shows subparallel orientation of plagioclase needles interpreted as a flow lineation. The coarser-grained material is clearly cut by the fine-grained basalt as shown by the fact that crystals in the host material are fractured against the contact. The fine-grained zone is not chilled against the coarse-grained material, and there is no evidence of recrystallization or alteration along the contact. The fine- and coarse-grained basalts are mineralogically similar, differing only in grain size. This entire sequence is tentatively interpreted as a section through a lava "tube" or conduit through which lava was continuously fed to the flow front. The coarse-grained outer material presumably formed a carapace protecting the inner zone. Later solidification of lava in the inner zone is believed to have formed the fine-grained material in sharp contact with the outer zone.

Mineralogically, Unit 13 is relatively uniform consisting of moderately to highly phyric basalt with a characteristic plagioclase–clinopyroxene–olivine phenocryst assemblage. Euhedral plagioclase is always the dominant phenocryst phase, but its abundance varies from 2 to 20 per cent. The phenocrysts generally range from 0.5 to 5 mm across; megacrysts up to 8 mm are sometimes present. Typically, the feldspars are fresh; however, some crystals in Core 64 and 65 are partly altered to smectite. Most plagioclase phenocrysts are relatively free of glassy inclusions or inclusions of primary crystalline phases. The only spinel inclusions in the entire unit are found in plagioclase phenocrysts in Core 63.

Clinopyroxene phenocrysts generally exceed olivine phenocrysts but they vary from 1 to 5 per cent. Overall clinopyroxene is more abundant in basalts below Section 65-3 than in the upper part of the unit. The clinopyroxene forms euhedral-to-subhedral, slightly rounded crystals and irregular subophitic intergrowths with plagioclase. The clinopyroxene phenocrysts usually measure from 0.5 to 4 mm across but a few crystals range up to 8 mm. Completely altered olivine phenocrysts rarely exceed 10 per cent of the rock.

Veinlets and small vesicles are common throughout the unit and are usually filled with calcite, smectite, and minor phyrite; some veins also contain silica and iron

oxides. Pink phillipsite(?) is associated with smectite in some breccias. Olivine is altered to smectite and carbonate, except in glassy selvages; plagioclase is incipiently altered to smectite in Cores 64 and 65.

Unit 14

This unit consists of three massive basalt cooling units separated by breccia zones or chilled margins. The sequence is cut by several dikes which are given a separate unit designation; we will describe them under the heading "Unit 15."

The top of Unit 14 at Section 75-5, 0 cm, is marked by an 80-cm-thick zone of brecciated glass, believed to be the top of a flow sequence. A glass selvage marks the base of the unit at Section 86-1, 25 cm. Sub-unit 14A is 7 meters thick, extending from the top of the sequence to Section 77-1, 50 cm. Here a small glass selvage is in contact with the underlying breccia, which is thought to be the top of Sub-unit 14B. The latter continues downward to Section 79-7, 124 cm, and is 27.9 meters thick. The top of Sub-unit 14C at Section 80-1, 0 cm, is marked by a glass selvage as is the base. This sub-unit is 38.3 meters thick.

All three sub-units have similar mineralogies and textures, except that Sub-units 14B and 14C have a somewhat higher phenocryst content than Sub-unit 14A. Plagioclase phenocrysts are always the most abundant, ranging up to 5 per cent in Sub-unit 14A and about 10 per cent in the other two sub-units. The crystals are always euhedral to subhedral and are fresh. Clinopyroxene phenocrysts average about 4 per cent in all sub-units and occur as individual rounded crystals, from 1 to 2 mm across, or as subophitic intergrowths with plagioclase. Olivine varies from 1 to 3 per cent and typically occurs as euhedral-to-subhedral crystals, seriate with the groundmass. The maximum size of olivine phenocrysts is about 1 mm.

Groundmass textures range from fine-grained intersertal and quench near the cooling-unit margins to medium grained, subophitic within the units. Near the center of the thickest sub-unit (14C), the grain size is so large that distinguishing between phenocryst and groundmass phases is not always possible. In Sections 81-3 and 82-2 the basalt has an irregular, patchy appearance resulting from the presence of fine-grained spots, up to 1 cm across, enclosed in normal, coarser-grained basalt.

The groundmass consists chiefly of plagioclase and clinopyroxene in an approximate 1:1 ratio. Granular iron oxides average about 5 per cent, and trace amounts of disseminated sulfides are usually present. The amount of interstitial glass varies with location in the cooling unit, but some glass is present in all specimens.

Most of the basalts are only sparsely vesicular and are relatively fresh. Sub-unit 2b has about 5 per cent vesicles near the upper margin, but these decrease rapidly downward to about 1 per cent. The vesicles and veinlets are filled with smectite, calcite, and minor pyrite. Olivine is altered to smectite and minor calcite, except in Cores 85 and 86 and in fresh glass selvages elsewhere in the unit. Both plagioclase and clinopyroxene are normally fresh. Irregular patches of smectite are present in the groundmass of some basalts in the interval between Sections 83-4 and 84-2.

Unit 15

This unit comprises two discordant bodies within Unit 14 considered to be basalt dikes. The uppermost dike (Sub-unit 15A) occurs in Sections 79-1 through 4, and the lower one (Sub-unit 15B) in Sections 80-2, 3, and 4. The dikes are clearly defined by their chilled, glassy margins and steep discordant contacts. Available information suggests that both units are about 30 cm thick.

Sub-unit 15A is a moderately phyric basalt with about 5 per cent plagioclase, 3 per cent olivine, and 2 per cent clinopyroxene phenocrysts. The phenocrysts are relatively small, ranging from about 0.5 to 2 mm across, and are set in a relatively fresh cryptocrystalline matrix. Moderately plagioclase–olivine phyric basalt makes up Sub-unit 15B; the phenocrysts in this sub-unit are both larger and more abundant than in Sub-unit 15A. Subhedral plagioclase crystals range up to 6 mm across and euhedral olivine crystals to about 2 mm. The groundmass consists of plagioclase and clinopyroxene in a ratio of about 1:1, as well as minor olivine, iron oxides, and some interstitial glass. Sub-unit 15A is relatively fresh, but both olivine crystals and glass are altered to smectite in Sub-unit 15B.

Unit 16

The lowest unit in Hole 418A, Unit 16, is a sequence of moderately phyric pillow basalts. The top of the unit at Section 86-1, 28 cm, is marked by a 100-cm-thick breccia zone below the chilled base of the overlying massive basalt. The unit is at least 8.2 meters thick, extending to the base of the hole at Section 86-6, 55 cm.

Phenocrysts of plagioclase, olivine, and clinopyroxene normally make up about 7 to 12 per cent, but one cooling unit in Section 86-5 is sparsely phyric. Plagioclase is the dominant phenocryst and forms euhedral-to-subhedral crystals up to 6 mm across. Olivine makes up about 1 per cent and occurs in euhedral crystals up to 1 mm across, which are altered to smectite. Clinopyroxene phenocrysts also make up about 1 per cent and occur as single, slightly rounded, often zoned crystals up to 3 mm across, or as subophitic intergrowths with plagioclase.

The groundmass is very fine grained to glassy, typically with quench textures. Acicular plagioclase crystals and granular iron oxides are surrounded by sheaf-like masses of poorly crystallized clinopyroxene.

Vesicles and veins are rare in Unit 16, and alteration is restricted to the breccia zone and glassy selvages. The glass is partly altered to smectite and calcite, and olivine is always replaced by smectite.

The sparsely phyric zone in Section 86-5, is about 50 cm thick, having a sharp horizontal upper glassy margin at 25 cm and a lower contact at 80 cm. This rock has about 2 to 5 per cent plagioclase, 1 per cent olivine, and very rare clinopyroxene phenocrysts; it also contains minor quantities of brown spinel in small corroded crystals. The mineralogy of this interval suggests that it is

not a part of the normal pillow sequence but is perhaps an intrusive body. However, there are no significant chemical differences between this interval and the rest of Unit 16, and the origin of this feature is unknown.

BASEMENT PALEOMAGNETICS

Paleomagnetic measurements were made on board *Glomar Challenger* on 62 samples from Hole 418A during Leg 52 and on 156 samples from the hole during Leg 53. Results are given in Appendix II and the data are summarized in Table 6.

Paleomagnetic Results

An interesting pattern of magnetic stratigraphy down Hole 418A becomes evident from the shipboard measurements. The top 190 meters of the basaltic section is normally magnetized, with positive inclinations averaging $23.9 \pm 5.4°$ results having been averaged over 10-meter intervals). Below 190 meters sub-basement, the section is generally reversely magnetized (with negative inclinations), except for a 1.5-meter-thick zone at 300 meters sub-basement (Core 55) and a zone with dikes at about 490 to 505 meters sub-basement, which are both normally magnetized. It is clear that the upper 190 meters of basalt must have been emplaced after magnetic anomaly *M*0 time, when the field was normal according to the geomagnetic time scale. The lower boundary of the normally magnetized crust is marked by a basaltic breccia. This is consistent with a time gap between the emplacement of reversed and normal crust. The boundary at 190 meters below basement is probably part of an interface sloping down to the east toward the former accreting plate boundary. An east–west line of holes would be required to test this assumption, but the inferred proximity of Hole 418A to the eastern edge of *M*0 is entirely compatible with this hypothesis.

The inclination data for Hole 418A are in agreement with the expected paleo-inclination at this Cretaceous site, except for a bottom 150-meter-thick section which has inclinations steeper by about 30° (mean of -60.2 and -54.3 ± 18.7; Table 6). A strong argument can be made for tilting of this anomalous section on the basis of paleomagnetic data alone, because the section includes dikes that are normally magnetized with the same anomalous inclinations ($53.2 \pm 3.7°$; Table 6). This is completely unambiguous and the possibility that the axial nature of the polarity change would take place during a field excursion is highly unlikely. The paleomagnetic data at this site show that large-scale tilting on gravity faults is possible in a mid-ocean ridge setting soon after emplacement of the crust. Compressive brittle deformation has been found in the lower 340 meters of this hole (Choukroune, this volume). The time sequence is as follows: (1) emplacement of 150 meters of reversely magnetized flows during *M*0 times; (2) intrusion of this flow sequence by a normally magnetized series of dikes after *M*0 time; (3) rotation on a listric fault or series of faults of these flows and dikes by at least 30° about an axis roughly perpendicular to the ridge crest, thus making it possible that the faulting is due partly to the proximity of the transform fault lying to the north; (4) emplacement of nearly 85 meters of reversely magnetized flows on top of the rotated block; (5) emplacement of a thin (1.5-m) flow with normal polarity covered by 110 meters of reversed flows, the latter marking the end of *M*0 time; and finally, (6) overlapping by a 190-meter-thick section of normal flows of the 354-meter-thick sequence of flows emplaced towards the end of *M*0 time.

The lack of natural remanent magnetization (NRM) intensity drop on either side of the polarity changes strongly suggests that each reversal corresponds to a significant time gap. The occurrence in Hole 418A of five polarity reversals implies that the basaltic sequence was emplaced over a time scale of 50,000 to 100,000 years. This duration is incompatible with emplacement within the inner floor of the inferred Cretaceous rift valley at the site.

TABLE 6
Summary of Magnetic Results, Hole 418A, Legs 52 and 53

Lithologic Unit	Mean Intensity ($\times 10^{-3}$ emu/cm^3)		Mean Stable Inclination (°)		MDF (Oe)	
1–6	16.4	*N*=41	23.2	*N*=41	121	*N*=41
6B	20.5 ±5.7	*N*=23	−22.6 ±4.0	*N*=10	242 ±106	*N*=9
7	17.3 ±7.5	*N*=11	−34.5 ±6.7	*N*=4	99 ±9	*N*=5
8	14.2 ±7.5	*N*=20	−31.5 ±12.1	*N*=10	98 ±32	*N*=9
11–13	9.5 ±4.9	*N*=56	−28.9 ±10.2	*N*=8	101 ±25	*N*=31
			−60.2 ±8.7	*N*=24		
14	4.8 ±4.0	*N*=32	−54.3 ±8.7	*N*=18	90 ±46	*N*=21
Dikes	27.0 ±6.1	*N*=5	53.2 ±3.7	*N*=5		
16	13.5 ±8.0	*N*=3	32.8 ±6.7	*N*=3		
Total	12.0 ±8.1	*N*=155			122 ±65	*N*=79

Note: The breccia samples have been excluded. Unit weight is given to the samples of Tables 12 and 13.

Magnetic Properties

The basalts of Hole 418A are the most intensely magnetized DSDP basalts recovered to date. On the basis of 155 samples from Leg 53, the average NRM intensity is $12.0 \pm 8.1 \times 10^{-3}$ emu/cm^3 (Table 6). Resulting from shipboard studies, the intensity of magnetization in the different rock types is as follows:

Rock Type	J_{NRM} ($\times 10^{-3}$ emu/cm^3)	Number of Samples	Leg
Pillows	17.5 ± 8.1	43	52
Massive flows	18.2 ± 14.1	14	52
Breccia	3.8 ± 3.3	5	52
Dikes	26.9 ± 6.1	5	53

Massive flows and pillowed flows are both fine grained at Hole 418A, in contrast with Holes 417D and 417A. Thus, these rock types display no significant difference in their magnetic properties; those of the breccias are consistent with their formation at a temperature below the blocking temperature of the basalt fragments.

There is a general decrease in intensity of magnetization with depth from about 17×10^{-3} emu/cm^3 on top to about 10×10^{-3} emu/cm^3 between 360 and 460

meters below the basement/sediment interface and to about 5×10^{-3} emu/cm^3 in the lower part of the basaltic section. A notable exception is the presence of the strongly magnetized dikes in the bottom part of the section and the pillow lavas in the lowest 8 meters of the section (Unit 16; see Table 6). Another departure from the simple trend occurs for lithologic Sub-unit 6B, which is characterized by a lower TiO_2 content and a higher NRM intensity (Table 6). Note that this unit straddles the major polarity change at 190 meters below basement.

The high mean NRM intensities for this hole are attributed to a higher cooling rate of the section in comparison with that of previous DSDP holes (Hamano, Nishitani, and Kono, this volume).

A second point of interest in the magnetic properties for Hole 418A concerns magnetic stability. The Hole 418A samples, especially pillow samples, have exceptional directional stability. They are distinctly more stable than Hole 417D samples. Note that Sub-unit 6B discussed above also have a very high mean demagnetizing field (MDF) value. Some of the massive flows near the dikes have been remagnetized and have the same normal polarity.

Finally, we should note that induced magnetization in these rocks will not contribute significantly to the magnetic anomalies. The generally reversed rock sequence which is known through an interval of 354 meters and is characterized by a steep magnetization vector in a 150-meter-thick block near the base of the hole will generate a significant portion of the *M0* anomaly, even with the overlying 190-meter-thick normally magnetized cap. Quantitative simulation is needed to proceed further.

PHYSICAL PROPERTIES OF BASEMENT ROCKS

Measurements of wet-bulk density, compressional wave velocity, and porosity were made, as at Site 417, throughout the basement section recovered from Holes 418A and 418B for comparison with shipboard measurements of the petrology, geochemistry, and rock magnetism of the section and with geophysical studies in the vicinity of the site. The data, together with core recovery statistics, section-by-section estimates of the relative abundance of interstitial clay and limestone, and computed values of grain density and acoustic impedance, are tabulated in Table 7 and plotted as a function of sub-bottom depth in Figure 9. In addition, the results of a small number of permeability measurements in basalts from Hole 418A are presented in Table 8.

Since velocity, density, and porosity measurements are sensitive to water saturation, samples were selected for physical property studies and stored in sea water as soon as possible after receiving the cores on board. Each sample was cut to a right cylinder one inch in diameter and approximately one inch long with polished ends and an orientation mark indicating vertical direction. A complete set of measurements was then made on each sample to enable us to correlate physical properties and to compute grain density and acoustic impedance.

Wet-Bulk Density

Values for this parameter are presented in Table 7 and were obtained on samples from all levels of Holes 418A and 418B by the immersion technique to an accuracy of ±1 per cent. Additional values were obtained using the 2-minute GRAPE counting procedure outlined by Boyce (1973). Since this technique is less accurate (±2%) and prone to systematic error, only the gravimetric results have been plotted in Figure 9 or are considered in the following discussion.

The wet-bulk densities of the samples studied from Hole 418A range between 2.3 and 3.0 g/cm^3 about a mean of 2.8 ± 0.1 g/cm^3. As in Hole 417D, the massive basalts display the highest densities (2.8 through 3.0 g/cm^3) and the interstitial fillings, the lowest (2.3 through 2.5 g/cm^3). As can be seen in Figure 9, however, the density varies with depth in Hole 418A in a manner entirely different from that in either hole at Site 417. Whereas the densities increase rapidly with depth in Hole 417A — showing irregular variations but no pronounced trend with depth in Hole 417D — in Hole 418A they increase first irregularly and then steadily with depth from 2.7 to nearly 3.0 g/cm^3 beneath a massive, high-density (2.9 g/cm^3) basalt sequence (Units 2 and 4) near the top of the section. Not unexpectedly, the basalts drilled in Hole 418B, approximately 100 meters to the north, increase rapidly in density from 2.6 g/cm^3 at the basalt/sediment contact to values similar to those in the massive basalts at the top of Hole 418A.

Sonic Velocity

The values of compressional wave velocity shown in Figure 9 for Cores 15 through 48 in Hole 418A were measured on water-saturated samples at room temperature and pressure, using the Hamilton Frame Velocimeter (Boyce, 1973). For the remaining samples from Hole 418A and all of the samples from Hole 418B, the values were obtained after modifying the equipment to improve the signal-to-noise ratio. This was done by removing the transducers from the Hamilton Frame (in which acoustic coupling is poor unless the sample ends are perfectly parallel) and attaching them to steel plates which were then applied directly to the ends of the samples. In this configuration, the velocity was computed from the length of the sample as measured by calipers and the delay time read from the oscilloscope corrected for the travel time through the plates. The velocity measurements were made for propagation directions perpendicular to the core axis throughout both holes. In addition, measurements were made parallel to the core in the upper levels of Hole 418A (Cores 15 through 48) to check for seismic anisotropy. Despite a system drift of ±3 per cent, the measurements were made to an estimated accuracy of ±1 per cent by repeated calibration checks against standards of known velocity and thickness.

As at Site 417, the samples studied at each level were selected to be representative of the core and section from which they were taken. Although most of the samples were thus fresh basalts from pillow and flow in-

TABLE 7
Physical Properties of Basement Rock

Sample (Interval in cm)	Density: Wet-Bulk[a] (g/cm^3)	Density: Grain[b] (g/cm^3)	*P*-Wave Velocity (km/s): ∥	⊥	⊥	Mean	Acoustic Impedance[c] ($\times 10^5$ g/cm^2-s)	Porosity[b] (vol. %)
Hole 418A								
15-2, 33-36	2.65(2.64)	2.87	5.03	4.99	4.98	5.00	13.3	12.0
15-3, 36-38	2.84(2.82)	2.94	5.70	5.76	5.68	5.71	16.2	5.3
16-1, 54-57[d]	2.70(2.72)	2.88	5.01	4.87	5.02	4.97	13.4	9.5
16-3, 44-47[d]	2.62(2.63)	2.83	4.79	4.94	4.86	4.86	12.7	11.7
17-1, 49-51[d]	2.69(2.73)	2.88	5.24	5.15	5.23	5.21	14.0	10.3
17-2, 128-130[d]	2.65(2.68)	2.86	4.93	4.91	4.94	4.93	13.1	11.3
17-4, 9-11[d]	2.70(2.75)	2.88	5.09	5.15	5.02	5.09	13.7	9.4
18-1, 47-50[d]	2.86(2.87)	2.94	5.90	5.89	5.87	5.89	16.9	3.7
18-3, 44-46[d]	2.86(2.91)	2.99	5.88	6.04	5.86	5.93	17.0	6.7
18-5, 64-67[d]	2.44(2.37)	2.88	4.07	3.87	4.01	3.98	9.7	23.5
19-1, 102-105[d]	2.85 –	2.95	5.69	5.66	5.75	5.70	16.3	4.9
19-3, 83-86[d]	2.89 –	2.95	6.22	6.08	6.20	6.17	17.8	2.8
19-5, 30-33[d]	2.93 –	2.97	6.21	6.29	6.29	6.26	18.3	2.0
20-1, 59-61[d]	2.91(2.90)	2.96	6.12	6.13	6.09	6.11	17.8	2.5
20-3, 19-21[d]	2.91(2.94)	2.96	5.96	5.94	5.96	5.95	17.3	2.3
22-1, 35-38[d]	2.79(2.79)	2.93	5.59	5.53	5.65	5.59	15.6	6.8
24-1, 45-47	2.86(2.91)	2.96	5.92	6.02	5.90	5.95	17.0	4.8
25-1, 145-147	2.80(2.84)	2.91	5.62	5.64	5.63	5.63	15.8	5.8
26-1, 60-62[d]	2.87(2.90)	2.95	5.78	5.97	5.88	5.88	16.9	4.3
26-3, 21-24	2.71(2.73)	2.86	5.20	5.24	5.21	5.22	14.2	8.0
27-1, 21-24	2.73(2.75)	2.90	5.28	5.34	5.27	5.30	14.5	8.8
27-2, 88-90	2.71(2.75)	2.86	5.36	5.25	5.31	5.31	14.4	8.1
28-1, 65-67[e]	2.29(2.27)	2.84	3.47	3.50	3.44	3.47	8.0	30.1
28-3, 27-29	2.66(2.68)	2.82	5.13	5.12	5.15	5.13	13.7	8.6
30-2, 46-49	2.83(2.84)	2.92	5.70	5.74	5.73	5.72	16.2	4.5
30-4, 24-27	2.72(2.68)	2.83	5.33	5.46	5.36	5.38	14.6	6.2
31-1, 119-121	2.75(2.77)	2.88	5.52	5.43	5.51	5.49	15.1	6.9
31-3, 6-8[e]	2.30(2.34)	2.86	3.46	3.49	3.37	3.44	7.9	30.2
33-1, 142-145[e]	2.50(2.51)	2.87	4.51	4.54	4.56	4.54	11.4	16.9
33-3, 60-63	2.74(2.74)	2.85	5.42	5.32	5.39	5.38	14.7	6.0
33-5, 145-148	2.82(2.83)	2.93	5.61	5.71	5.66	5.66	16.0	5.7
34-1, 33-35	2.82(2.83)	2.92	5.73	5.57	5.63	5.64	15.9	5.1
34-3, 13-16[e]	2.39(2.43)	2.80	4.05	4.19	4.19	4.14	9.9	22.9
35-1, 30-32	2.67(2.69)	2.85	5.08	5.10	5.11	5.10	13.6	9.7
35-3, 29-31	2.72(2.72)	2.85	5.19	5.25	5.18	5.21	14.2	7.2
35-5, 21-23[e]	2.54(2.53)	2.79	4.53	4.59	4.50	4.54	11.5	13.8
36-1, 81-83	2.73(2.75)	2.87	5.21	5.34	5.32	5.29	14.4	7.3
36-3, 71-74	2.82(2.81)	2.91	5.67	5.71	5.61	5.66	16.0	4.8
37-1, 77-80	2.56(2.53)	2.76	4.61	4.53	4.58	4.57	11.7	11.6
38-1, 39-41	2.65(2.61)	2.81	4.93	4.93	4.98	4.95	13.1	8.7
38-3, 35-37	2.77(2.75)	2.90	5.47	5.33	5.45	5.42	15.0	6.7
38-5, 49-51	2.70(2.71)	2.83	5.27	5.23	5.23	5.24	14.2	7.3
39-1, 135-137	2.82(2.85)	2.92	5.72	–	5.62	5.67	16.0	5.2
40-1, 34-37	2.74(2.76)	2.89	5.17	5.17	5.32	5.13	5.21	14.3
41-1, 98-100	2.77 –	2.88	5.54	5.65	5.51	5.57	15.4	5.9
41-3, 62-65[e]	2.36 –	2.75	4.12	4.32	3.98	4.14	9.8	22.4
42-1, 88-90[e]	2.48(2.49)	–	4.83	4.81	4.61	4.75	11.8	–
42-3, 59-61	2.77(2.78)	2.89	5.48	5.52	5.56	5.52	15.3	6.7
43-1, 11-13	2.81(2.85)	–	5.72	5.81	5.77	5.77	16.2	–
44-1, 43-45	2.80(2.83)	2.89	5.72	5.67	5.69	5.69	15.9	4.7
44-4, 4-6	2.77(2.74)	2.89	5.59	5.87	5.46	5.64	15.6	6.2
45-1, 86-89	2.80(2.77)	–	5.80	5.72	5.67	5.73	16.0	–
45-3, 7-9	2.79(2.79)	2.89	5.63	5.71	5.56	5.63	15.7	5.0
46-1, 11-13	2.79(2.80)	2.88	5.69	5.72	5.69	5.70	15.9	4.6
46-3, 8-10	2.85(2.88)	–	5.95	6.26	6.06	6.09	17.4	–
47-1, 7-10	2.78(2.80)	2.90	5.58	5.52	5.51	5.54	15.4	6.3
47-4, 115-118	2.83(2.83)	2.90	5.84	5.86	5.88	5.86	16.6	3.6
48-1, 26-29	2.80(2.81)	–	5.68	5.76	5.70	5.71	16.0	–
48-3, 106-109	2.83(2.87)	–	5.99	5.86	5.91	5.92	16.8	–
49-1, 57-59	2.86(2.82)	2.93	–	6.04	–	–	17.3	3.4

TABLE 7 – *Continued*

Sample (Interval in cm)	Density Wet-Bulk[a] (g/cm^3)	Density Grain[b] (g/cm^3)	*P*-Wave Velocity (km/s) ∥	*P*-Wave Velocity (km/s) ⊥	*P*-Wave Velocity (km/s) ⊥	*P*-Wave Velocity (km/s) Mean	Acoustic Impedance[c] (×10^5 g/cm^2-s)	Porosity[b] (vol. %)
Hole 418A								
50-1, 57-59	2.79(2.77)	2.91	–	5.55	–	–	15.5	6.7
50-3, 136-138	2.87(2.89)	2.93	–	5.97	–	–	17.1	3.6
50-3, 139-141	– (2.80)	–	–	–	–	–	–	–
51-1, 49-51	2.78(2.76)	2.94	–	5.07	–	–	14.4	8.0
51-4, 109-111	2.79(2.80)	2.92	–	5.45	–	–	15.2	6.8
52-3, 129-131	– –	–	–	5.61	–	–	–	–
52-7, 10-12	2.86(2.86)	2.97	–	5.60	–	–	16.0	5.7
53-2, 6-8	– (2.76)	–	–	–	–	–	–	–
53-2, 9-11	– (2.76)	–	–	–	–	–	–	–
53-2, 13-15	2.82(2.82)	2.94	–	5.40	–	–	15.2	6.4
53-3, 23-25	2.87(2.85)	2.97	–	5.72	–	–	16.4	4.9
54-1, 51-53	– (2.57)	–	–	–	–	–	–	–
54-2, 7-9	– (2.95)	–	–	5.96	–	–	–	–
54-2, 25-27	2.94(2.93)	3.00	–	5.92	–	–	17.4	2.8
55-2, 4-6	2.93 –	3.02	–	5.56	–	–	16.3	4.3
55-5, 28-30	2.90 –	3.00	–	5.48	–	–	15.9	5.1
56-1, 104-106	2.90(2.90)	2.97	–	6.07	–	–	17.6	3.8
56-6, 129-131	2.89(2.87)	2.97	–	5.75	–	–	16.6	4.3
57-2, 119-121	2.85(2.86)	2.92	–	5.69	–	–	16.2	3.7
57-2, 122-124	– (2.85)	–	–	5.77	–	–	–	–
57-5, 141-143	2.86(2.85)	2.95	–	5.66	–	–	16.2	4.4
57-6, 4-6	– (2.91)	–	–	5.50	–	–	–	–
58-1, 10-12	2.90(2.91)	2.98	–	5.60	–	–	16.2	3.8
59-2, 7-9	2.81(2.81)	2.93	–	5.70	–	–	16.0	6.4
59-6, 59-61	2.83(2.82)	2.95	–	5.45	–	–	15.4	6.2
60-2, 60-62	2.85(2.81)	2.95	–	5.69	–	–	16.2	5.1
60-4, 47-49[d]	2.76(2.77)	2.87	–	5.17	–	–	14.3	5.8
60-6, 21-23[d]	– (2.86)	–	–	5.87	–	–	–	–
60-6, 24-26[d]	2.91(2.88)	2.96	–	5.74	–	–	16.7	2.9
61-1, 7-9[d]	– –	–	–	5.69	–	–	–	–
61-CC, 2-4	2.92(2.91)	2.97	–	5.69	–	–	16.6	2.8
62-1, 82-84	2.89(2.89)	2.98	–	5.45	–	–	15.8	4.6
62-4, 21-23	2.84(2.83)	2.97	–	5.71	–	–	16.2	6.7
63-2, 8-10	2.79(2.79)	2.94	–	5.28	–	–	14.7	8.2
63-5, 46-48[d]	2.84(2.84)	2.95	–	5.31	–	–	15.1	6.1
64-1, 86-88[d]	2.82(2.83)	2.93	–	5.37	–	–	15.7	5.9
64-1, 89-91	– (2.82)	–	–	5.53	–	–	–	–
64-4, 129-131	2.76(2.76)	2.91	–	5.19	–	–	14.3	8.1
64-4, 131-133	– (2.82)	–	–	5.14	–	–	–	–
65-1, 63-65	– (2.82)	–	–	5.55	–	–	–	–
65-1, 66-68	2.82(2.85)	2.93	–	5.47	–	–	15.4	5.3
65-3, 128-130[e]	– –	–	–	2.81	–	–	–	–
65-4, 105-107[e]	2.68(2.68)	2.91	–	4.50	–	–	12.1	12.3
65-6, 24-26	2.91(2.94)	2.96	–	5.71	–	–	16.6	3.0
66-3, 129-131	2.80(2.76)	2.92	–	5.28	–	–	14.8	6.4
66-6, 132-134	– –	–	–	5.58	–	–	–	–
67-1, 38-40	– (2.93)	–	–	6.10	–	–	–	–
68-2, 98-100	– (2.95)	–	–	6.11	–	–	–	–
68-2, 101-103	2.93(2.92)	2.97	–	6.13	–	–	18.0	2.3
69-1, 92-94	2.93(2.92)	2.98	–	5.85	–	–	17.1	2.5
69-1, 95-97	– (2.90)	–	–	6.03	–	–	–	–
69-4, 67-69	2.88(2.84)	2.96	–	5.85	–	–	16.8	4.4
70-2, 63-65	2.92(2.89)	2.98	–	5.96	–	–	17.4	2.8
70-4, 67-69	– (2.92)	–	–	–	–	–	–	–
70-4, 134-136	2.90 –	2.97	–	5.72	–	–	16.6	3.6
70-5, 18-20	2.93(2.93)	2.98	–	5.89	–	–	17.3	2.6
71-1, 16-18	2.94(2.94)	2.99	–	–	–	–	–	2.8
71-4,	– (2.93)	–	–	–	–	–	–	–
72-1, 103-105	2.88(2.87)	2.97	–	5.64	–	–	16.2	4.6
72-2, 5-7	– –	–	–	4.94	–	–	–	–

TABLE 7 – *Continued*

Sample (Interval in cm)	Density Wet-Bulk[a] (g/cm^3)	Density Grain[b] (g/cm^3)	*P*-Wave Velocity (km/s) ∥	⊥	⊥	Mean	Acoustic Impedance[c] ($\times 10^5$ g/cm^2-s)	Porosity[b] (vol. %)
Hole 418A								
72-4, 117-119	2.93(2.91)	2.97	–	5.98	–	–	17.5	2.4
73-1, 106-108	– (2.94)	–	–	6.03	–	–	–	–
73-1, 109-111	2.94(2.96)	2.99	–	6.06	–	–	17.8	2.2
73-2, 5-7[e]	2.30 –	–	–	3.13	–	–	7.2	–
73-6, 33-35	– (2.89)	–	–	5.59	–	–	–	–
73-6, 35-37	2.88(2.88)	2.97	–	5.64	–	–	16.2	4.3
74-1, 100-102	2.94(2.86)	2.98	–	5.98	–	–	17.6	1.9
74-4, 134-136	– (2.94)	–	–	6.06	–	–	–	–
74-4, 136-138	2.95(2.96)	2.99	–	6.18	–	–	18.2	2.0
75-2, 19-21	– (2.94)	–	–	6.09	–	–	–	–
75-2, 21-23	2.92(2.92)	2.97	–	6.00	–	–	17.5	2.4
75-5, 46-48[e]	2.52(2.48)	2.78	–	4.00	–	–	10.1	14.6
76-1, 117-119[d]	2.89(2.90)	2.97	–	5.72	–	–	16.5	4.0
76-1, 119-121[d]	– (2.90)	–	–	5.61	–	–	–	–
76-3, 92-94[d]	2.91(2.92)	2.98	–	5.57	–	–	16.2	3.6
76-3, 94-96[d]	– (2.90)	–	–	5.51	–	–	–	–
77-2, 20-22[d]	2.93(2.94)	2.98	–	5.71	–	–	16.7	2.6
77-3, 75-77[d]	2.93(2.91)	2.95	–	5.93	–	–	17.4	1.4
77-5, 28-30[d]	2.92(2.90)	2.96	–	5.98	–	–	17.5	2.0
78-6, 63-65[d]	2.92(2.88)	2.96	–	5.85	–	–	17.1	2.0
79-3, 65-67[d]	2.94(2.96)	2.98	–	6.08	–	–	17.9	1.7
79-3, 67-69[d]	– (2.93)	–	–	6.04	–	–	–	–
79-4, 2-4[d]	2.95(2.96)	2.99	–	6.01	–	–	17.7	2.0
79-7, 43-45[d]	2.90(2.89)	2.94	–	6.10	–	–	17.7	1.7
79-7, 46-48[d]	– (2.92)	–	–	6.15	–	–	–	–
80-2, 65-67[d]	2.93(2.94)	2.96	–	6.04	–	–	17.7	1.5
80-2, 68-70[d]	– (2.94)	–	–	5.98	–	–	–	–
80-3, 69-71[d]	2.94(2.92)	2.97	–	5.85	–	–	17.2	1.5
80-5, 52-54[d]	– –	–	–	5.78	–	–	–	–
80-6, 91-93[d]	– –	–	–	6.01	–	–	–	–
81-2, 92-94[d]	2.97(2.97)	3.00	–	5.78	–	–	17.2	1.5
81-5, 108-110[d]	2.93(2.95)	2.99	–	6.04	–	–	17.7	2.8
82-1, 122-124[d]	2.96(2.95)	2.99	–	5.78	–	–	17.1	1.7
82-1, 125-127[d]	– (2.96)	–	–	5.89	–	–	–	–
83-2, 53-55[d]	2.94(2.95)	2.96	–	5.89	–	–	17.3	1.3
83-2, 56-58[d]	– (2.94)	–	–	5.76	–	–	–	–
83-4, 79-81[d]	2.79(2.82)	2.92	–	5.08	–	–	14.2	6.7
83-4, 82-84[d]	– (2.92)	–	–	5.35	–	–	–	–
84-2, 24-26[d]	2.94(2.93)	3.00	–	5.62	–	–	16.5	3.2
84-3, 135-137[d]	2.97(2.98)	3.01	–	5.47	–	–	16.2	1.6
85-2, 9-11[d]	2.98(2.99)	3.00	–	6.13	–	–	18.3	1.0
85-5, 21-23[d]	2.95(2.97)	2.99	–	6.13	–	–	18.1	1.9
85-7, 86-88[d]	2.95(2.93)	2.99	–	5.96	–	–	17.6	2.2
86-1, 46-48[e]	2.63(2.67)	2.91	–	4.86	–	–	12.8	14.3
86-2, 71-73	– (2.86)	–	–	5.87	–	–	–	–
86-4, 105-107	2.89(2.90)	–	–	6.14	–	–	17.7	3.6
86-4, 108-110	– (2.81)	–	–	5.68	–	–	–	–
86-6, 34-36	2.89(2.88)	2.98	–	5.62	–	–	16.2	4.8
Hole 418B								
34-1, 72-74	2.61 –	–	–	4.13	–	–	10.8	–
35-1, 72-74	2.84 –	–	–	5.32	–	–	15.1	–
35-2, 144-146	2.90 –	–	–	5.64	–	–	16.4	–
35-3, 118-120	2.88 –	–	–	5.82	–	–	16.8	–

[a] GRAPE values in parentheses.
[b] Cores 15 through 48 heated for 24 hours at 110°C in a vacuum. Cores 49 through 55 heated for 144 hours at 80°C in a vacuum. Cores 56 through 86 heated 70 hours at 80°C in a vacuum.
[c] Based on gravimetric density and *Vp* or mean.
[d] Massive basalt.
[e] Smectite filling.

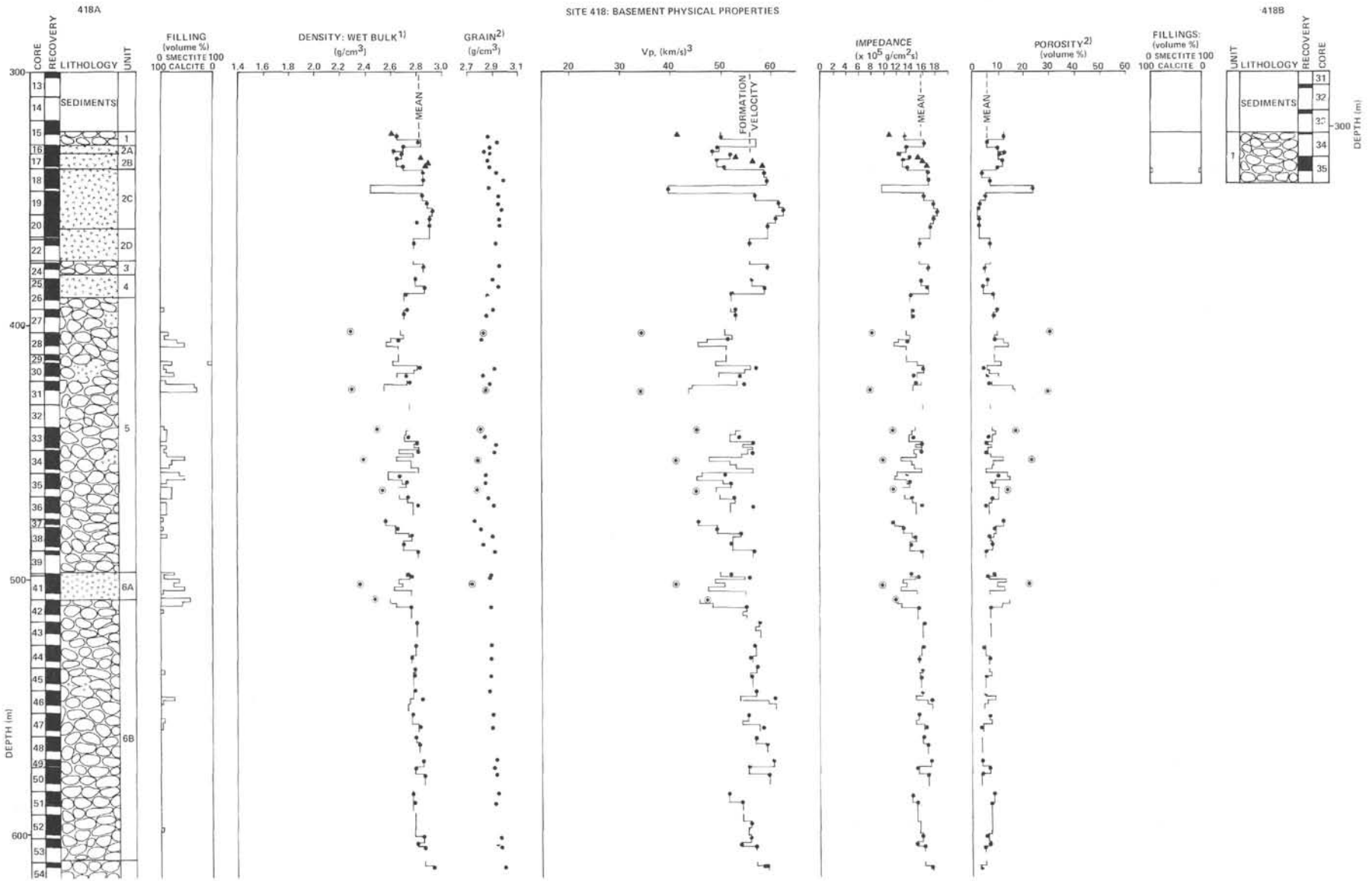


Figure 9. *Physical properties of Site 418 basement.*

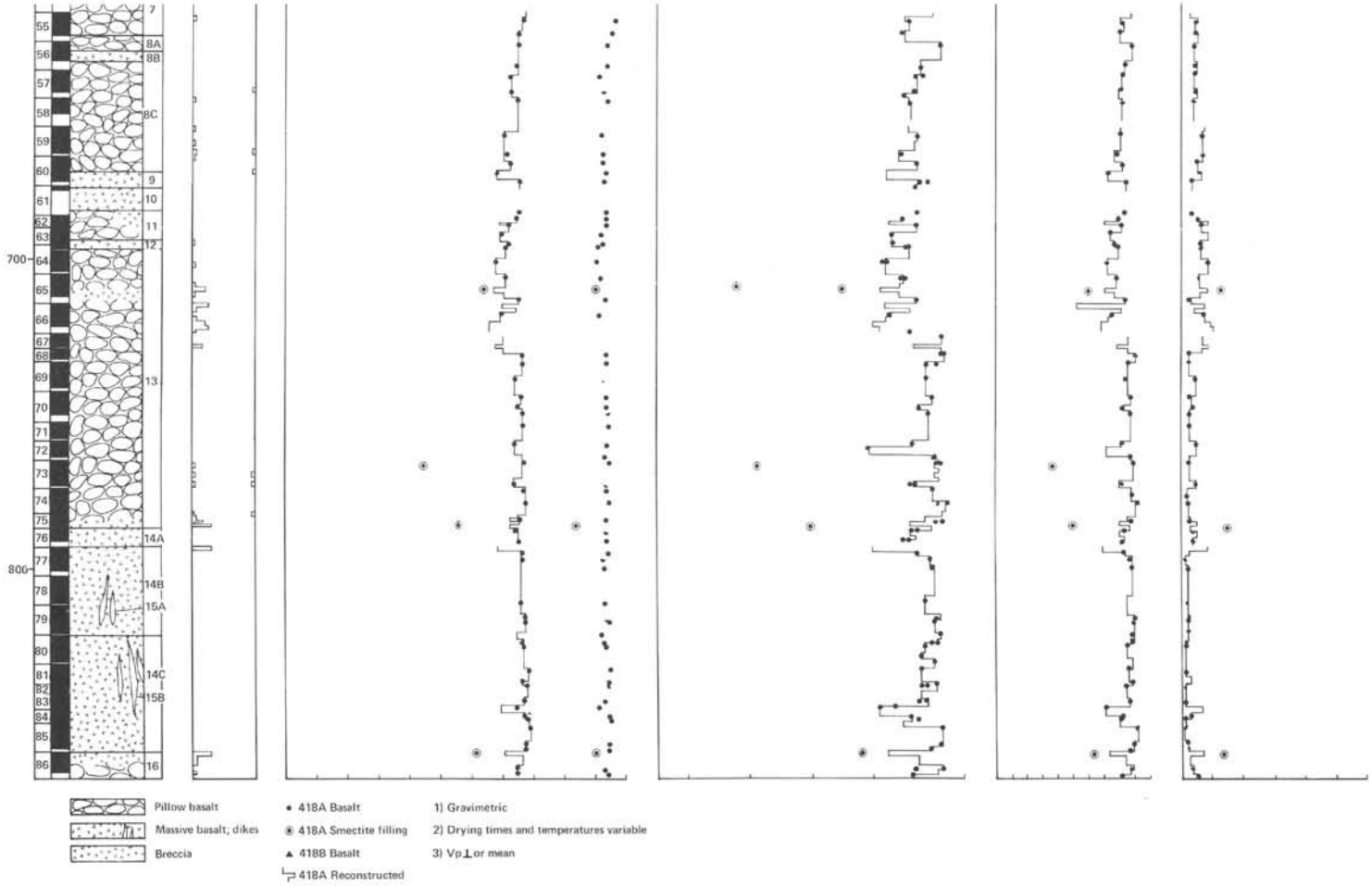


Figure 9. *(Continued).*

TABLE 8
Basalt Permeability in Hole 418A

Sample (Interval in cm)	Description	Permeability (cm^2)
57-5, 141-143	Fresh, fine-grained basalt; no cracks	3.1×10^{-16}
66-3, 129-131	Fine-grained basalt cut by veins of smectite	1.0×10^{-15}
75-5, 46-48	Basalt breccia with open cracks	1.4×10^{-13}
77-5, 28-30	Coarse-grained basalt; no cracks	2.0×10^{-16}
82-1, 123-125	Fine-grained basalt with large vertical vein filled by calcite	7.7×10^{-14}

teriors, specimens of breccia, basaltic glass, interstitial fillings, and altered basalts from pillow and flow margins were also measured.

As can be seen in Figure 9, the basalts in Holes 418A range in velocity between 3.98 and 6.26 km/s, with the majority between 5.0 and 6.2 km/s and an average of approximately 5.6 km/s. Unlike Hole 417D, in which there is only a slight trend of increasing velocity with depth, the velocities in Hole 418A increase regularly with depth below a massive, high-velocity cap from approximately 5.25 km/s at 400 meters sub-bottom to over 6.0 km/s near the base of the hole. As in Hole 417D, the massive basalts commonly display the highest velocities (5.75 through 6.24 km/s), while the breccias and interstitial fillings display the lowest (2.80 through 4.85 km/s). The velocities in the uppermost 20 meters of Hole 418A and in the 20-meter section of basement drilled in Hole 418B increase sharply with depth in response to decreasing alteration.

Porosity

The porosities reported in Table 7 for Cores 15 through 48 in Hole 418A were determined from the difference between the initial wet-bulk density and the dry-bulk density of each sample after heating in air to 110°C for periods ranging from one to four days. The values reported for Cores 49 through 86 were obtained after heating in a vacuum desiccator at 80°C for periods of three to twelve days. The data have not been corrected for heating to $t = \infty$; therefore the true porosities may be low by as much as 10 per cent of the reported values.

The basalts in Hole 418A range in porosity between 1 and 23 per cent, with most values falling between 1 and 10 per cent and a mean of 5.4 per cent. As can be seen in Figure 9, the porosities decrease steadily with depth from values of 5 to 10 per cent immediately below the massive, low-porosity basalts near the top of the section to values of 1 to 2 per cent near the bottom of the hole. The only marked exceptions to this pattern are in the breccias and the interstitial fillings of Unit 5, Sub-unit 6A, and Units 13 and 16, in which the porosities range from 14 to 30 per cent.

Grain Density

The grain density data presented in Table 7 and Figure 9 were derived from the porosity and wet-bulk density data discussed previously. The values in Hole 418A average 2.93 ±0.05 g/cm^3 and range between 2.78 and 3.02 g/cm^3, with the massive basalts displaying the highest values (2.9 through 3.0 g/cm^3) and the interstitial fillings the lowest (2.8 through 2.9 g/cm^3). Unlike Hole 417D, in which the grain densities show little variation with depth, the grain densities in Hole 418A increase steadily from values of about 2.85 g/cm^3 immediately below the massive basalts at the top of the column to approximately 3.00 g/cm^3 near the base. As might be expected, the mean grain density is about equal to the maximum wet-bulk density.

Acoustic Impedence

The acoustic impedance data in Table 7 were determined from the velocity and wet-bulk density data discussed previously for comparison with seismic reflection studies conducted over the site. As can be seen in Figure 9, the values range between 7.2 and 18.3×10^5 g/cm^2-s with most values between 14 and 18×10^5 g/cm^2-s. As in Hole 417D, the highest values of acoustic impedance are associated with massive basalts (16 to 18×10^5 g/cm^2-s), while the lowest are associated with interstitial fillings and breccia (7 to 13×10^5 g/cm^2-s). As expected, the acoustic impedance increases with depth in response to increasing velocity and wet-bulk density, both within the upper 20 meters of basement drilled in Holes 418A and 418B and within the thick basalt sequence in Hole 418A underlying the massive basalts at the top of the section.

Permeability

The fluid permeability of a small number of samples from Hole 418A was determined by cutting each specimen to a right cylinder, exposing one end to filtered sea water at a given pressure, and measuring the volume of fluid passing through the cylinder as a function of time. The permeability values shown in Table 8 were then calculated from the relation:

$$K = \frac{qud}{tpA} \quad (1)$$

where K is the fluid permeability of the sample in cm^2, q is the volume flux, u is the dynamic viscosity of the fluid, d is the sample length, t is the duration of the experiment, p is the pressure of the fluid, and A is the area of the sample in cross section.

The measured values listed in Table 8 range from 2.0×10^{-16} cm^2 for a fresh, coarse-grained basalt to 1.4×10^{-13} cm^2 for a basalt breccia. Although these values are very low, they are sufficiently high to ensure complete saturation of pillow basalts within a few hours of extrusion onto the sea floor at water pressures appropriate to the ridge crest (~0.25 kbar). The values are also high enough to ensure saturation of intrusives at subbasement depths of 0.5 km within 500,000 years if the overlying basement is devoid of fractures, and in considerably less time if the crust is fractured. Since only 1.5 meters of sediment will have accumulated in 500,000 years at a sedimentation rate of 3.0 meters/m.y., the

sediments will not be a significant factor in changing either the pressure or the net permeability of the formation. Since the crust at Site 418 is about 110 m.y. old, it is clear that the basalts in Hole 418A are saturated at depth, and that saturation occurred quickly relative to the age of the rock.

Formation Properties

One of the most important results of the drilling conducted at Site 418 was the high recovery, not only of massive flow basalts, but also of complete pillows in a matrix of interstitial limestone and altered glass. If it is assumed that the interstitial material and the basalts are present *in situ* in the same proportion as that observed in the recovered material, it is possible, from a knowledge of their relative abundance and density as a function of depth, to reconstruct a synthetic density versus depth profile for each hole from the relation:

$$\rho_s = x_b\rho_b + x_{sm}\rho_{sm} + x_{ls}\rho_{ls} \; . \qquad (2)$$

Here, ρ_s is the mean density of the depth interval under construction, x_b, x_{sm}, and x_{ls} are the respective volumetric fractions of basalt, interstitial clay (smectite), and limestone in the interval, ρ_b is the nearest measured density in basalt, ρ_{sm} is the mean density of smectite in the hole (2.45 g/cm^3 in both Holes 418A and 418B), and ρ_{ls} is the density of limestone (2.7 g/cm^3).

By analogy, velocity, impedance, and porosity profiles may be determined as a function of depth from the relations:

$$V_{p_b} = \left(\frac{x_b}{V_{p_b}} + \frac{x_{sm}}{V_{p_{sm}}} + \frac{x_{ls}}{V_{p_{ls}}}\right)^{-1} \qquad (3)$$

$$Z_s = \left(V_{p_s}\right)\left(p_s\right) \qquad (4)$$

and

$$\phi_s = x_b\phi_b + s_{sm}\phi_{sm} + s_{ls}\phi_{ls} \qquad (5)$$

where V_{p_s}, V_{p_b}, $V_{p_{sm}}$, and $V_{p_{ls}}$ are, respectively, the compressional wave velocity of the interval in question, the nearest measured velocity in basalt, the mean smectite velocity in the hole (4.0 km/s in both Holes 418A and 418B), and the velocity of limestone (5.9 km/s); Z_s is the acoustic impedance of the interval; and ϕ_s, ϕ_b, ϕ_{sm}, and ϕ_{ls} are, respectively, the porosity of the interval, the nearest measured porosity value in basalt, the mean porosity of smectite (20%), and the porosity of limestone (equated to that of the nearest basalt). The profiles shown in Figure 9 were calculated on a section-by-section basis; that is, in 1.5-m-long increments approximately equivalent to the sensor spacing in downhole logging tools. Since for the purposes of calculation, the formation was considered to be crack-free, the velocities, densities, and impedance shown will be maximum values and the porosities minimum values.

A comparison between these profiles and the underlying laboratory measurements indicates that the density and velocity measurements do not represent formation properties but rather maximum density and porosity envelopes for each hole, while the porosity values represent minimum envelopes. The discrepancy between laboratory values and formation properties can be substantial, particularly in zones of strong alteration. For example, the formation velocities of Unit 5 and Sub-unit 6a in Hole 418A are considerably lower than the laboratory velocities of samples which bracket this interval above and below.

It is apparent in Figure 9 that a number of the units distinguished in Hole 418A on petrologic grounds can also be delineated on the basis of physical properties. For example, Units 1 through 4 can be clearly distinguished from Units 5 through 6a and 6b through 16. As at Site 417, the breccia zones are notable for their high smectite content (locally 30% by volume) and consequent high porosity, low density, and low velocity, while the massive basalts display low porosities, high densities, and high velocities. Not unexpectedly, the physical properties of the pillow basalts tend to range between these two extremes. Although the foremen-tioned units can be distinguished in terms of physical properties, it is unlikely that many can be detected geophysically. The only likely exceptions are the breccias which may be detectable as sub-basement reflectors because of their low acoustic impedances.

Conclusions

It is clear from Table 9 that the basement section drilled in Hole 418A, despite its age, is relatively fresh. As in Hole 417D, approximately 7.5 km to the north, the formation velocities and densities at Site 418 are high while the porosity of the section is very low. Since Holes 418A and 418B were drilled in a topographic depression similar to that at Hole 417D, we have concluded that the lack of alteration is due to burial of the site under sediments soon after formation.

Perhaps the most striking feature of the crustal section at Site 418, however, is the steady increase in density and compressional wave velocity and decrease in porosity with depth. Since these changes appear to be independent of lithology, we deduce they are due to decreasing alteration with depth. This implies that compressional wave velocity gradients observed in the top of

TABLE 9
Site 418 Formation Properties[a]

Hole	Interstitial Fillings (vol. %)	Wet-Bulk Density (g/cm^3)	Formation Velocity (km/s)	Acoustic Impedance ($\times 10^5$ g/cm^2-s)	Porosity (vol. %)
418A	3.6[b]	2.83	5.58	15.8	5.4
418B	1.5[c]	2.83	5.31	15.0	–

[a] Assuming no cracks.
[b] 3.5% smectite, 0.1% limestone.
[c] 0.8% smectite, 0.7% limestone.

Layer 2 (e.g., Whitmarsh, 1978) may be caused in part by a linear decrease in alteration with depth in the crust.

BASALT CHEMISTRY AND MAGMATIC VARIATION

Introduction

During Legs 52 and 53, shipboard X-ray fluorescence (XRF) analyses were completed on Hole 418A samples taken down to the maximum penetration depth of 868 meters. No shipboard XRF analyses were completed for MnO, Na_2O, and trace elements. The samples analyzed included fresh and altered basalts and provide an indication both of magma types and the chemical effects of secondary alteration on the basalts. In this section, we are concerned with chemical variation in the fresh basalt as an indicator of the chemistry of basalt magmas represented at this site.

The routine analyses produced data for SiO_2, Al_2O_3, total Fe as FeO*, MgO, CaO, K_2O, and TiO_2. Leg 53 analyses included P_2O_5, and all P_2O_5 values included in chemical averages are based on those data. Standards and methods employed are the same as those used during Legs 51 and 52 at Site 417. No estimate of Na_2O or MnO was possible by the methods used on shipboard; the amounts reported for both oxides, when enclosed in brackets, are estimates based on values observed in glass or whole-rock data of otherwise similar composition. These estimates are included to permit calculation of normative mineral assemblages. Shore-based analytical results should be consulted for more complete whole-rock data. The volatile components CO_2 and H_2O were determined on shipboard using an instrumental CHN analyzer. These components, along with K_2O and the loss on ignition determined during preparation of the XRF sample disks, provide an estimate of the degree of alteration of the samples, as will be discussed later.

The XRF data were recalculated to a dry-weight basis of 97.0 weight per cent to allow for the omission of Na_2O, MnO, and, in the case of Leg 52 data, P_2O_5. All data were corrected for excess CaO in carbonate by subtracting the amount of CaO required to combine with Co_2 as $CaCO_3$. Many of these "carbonate-corrected" analyses still showed obvious effects of alteration, as indicated by excessive loss on ignition, high water and K_2O contents and CaO and MgO depletion. Analyses considered "fresh" for purposed of this discussion were selected by the same criteria as used at Site 417. Only the carbonate-corrected fresh analyses (Table 10) are used in the averages and discussions which follow.

Definition of Chemical Batches

To simplify discussion and facilitate comprehension of the major chemical features of the basalts at Site 418 and their stratigraphic relations, it is useful to define chemical types, or "batches," which are recognized by their distinctive compositions and their stratigraphic coherence. A chemical "batch," as the term implies, is suspected to represent a single magma extruded over a relatively short time interval. During periods of volcanic quiescence, significant changes in the magma composition may result from crystal fractionation in the underlying storage reservoirs, influx of new magma representing different degrees of mantle melting, or derivation from different depths in the mantle. Thus, the next eruptive episode may produce a compositionally distinct unit overlying the first. In those cases where no compositional changes are produced between eruptions, a chemical batch may embrace several lithologic units, which are distinguished mainly on textural or structural criteria such as grain size, occurrence as pillowed or massive flows, and size and abundance of phenocrysts.

Since the shipboard XRF analyses are bulk-rock analyses, they include both the crystalline (phenocryst) and liquid (groundmass) components of the magma in various proportions. Random variations in the relative proportions of phenocrysts and of liquid relative to total phenocrysts can easily be produced in any given sample, owing to settling or floating of crystals under the influence of gravity, or as a result of sorting produced by flowage. These random variations in phenocryst proportions produce a certain amount of variation in the bulk-rock composition and may mask subtle variations in composition of the liquid component. Thus, the composition of basalt glasses, which exclude the contribution of phenocrysts, provide a more precise, and more subtle, indication of liquid composition. These liquid compositions may also be subdivided into stratigraphic units having compositional coherence (Byerly and Sinton, this volume), and several of these are likely to be included within a chemical batch defined on bulk-rock data.

The shipboard analyses can be grouped into seven chemical batches, on the basis of combination of stratigraphic separation and composition. In terms of composition alone, only three major types appear to be present; they are clearly distinguished by distinct differences in TiO_2 and FeO*, as shown in Table 11. The stratigraphic sequence of these batches is indicated in alphabetic order, from the top down. Batch D does not form a distinct unit, being interbedded in part with batch C above, and batch E below. Batch E may be subdivided into two additional sub-units (Ea and Eb), based on rather subtle differences in MgO, with batch Eb representing the lowest interval in Hole 418A. As indicated by the arrangement of the table, batch A is characterized by relatively low TiO_2 and FeO*; batches B, E, Ea, and Eb are intermediate in $TiO_2$and FeO*. Batches C and D are relatively high in TiO_2 and FeO*. The distinctions have been considerably refined in several of the shore-based contributions to this volume.

The stratigraphic relations of the chemical batches are summarized in Table 12. This shows the correspondence between chemical batches, lithologic units, glass units defined by microprobe analysis (Byerly and Sinton, this volume), and the approximate depth intervals represented. Chemical batch A included six lithologic units and five chemical glass units, while chemical batch C included four lithologic units but conforms closely to glass unit H. Batch D has the least stratigraphic coherence, being most characteristic of the top of Unit 11, but appears also within Units 10 and 13, and is close-

TABLE 10
Shipboard X-Ray Fluorescence Analyses for Hole 418A[a]

Sample (Interval in cm)	SiO_2	TiO_2	Al_2O_3	FeO*	MgO	CaO	K_2O	P_2O_5	Lithologic Unit	Chemical Unit
15-3, 36-38	50.2	1.12	16.6	8.53	7.48	13.1	0.04	–	1	A
17-2, 72-75	50.7	1.28	18.2	7.84	7.17	11.8	0.10	–	2B	A
17-4, 139-141	50.9	1.16	16.7	8.45	6.93	12.8	0.05	–	2B	A
18-4, 48-50	50.2	1.10	16.1	9.41	7.22	12.9	0.03	–	2C	A
19-4, 101-105	50.7	1.11	15.7	9.24	7.47	12.8	0.03	–	2C	A
20-7, 62-64	50.4	1.13	16.0	9.32	7.50	12.7	0.03	–	2D	A
22-2, 33-35	50.5	1.14	16.1	9.80	6.23	13.2	0.05	–	2D	A
24-1, 50-52	50.4	1.13	16.0	9.01	7.30	13.1	0.03	–	3	A
24-1, 76-79	51.2	1.20	17.3	8.75	6.18	12.3	0.08	–	3	A
25-1, 66-68	50.9	1.31	15.3	9.33	7.43	12.7	0.04	–	3B	B
25-2, 87-89	49.9	1.39	15.7	10.0	7.81	12.2	0.04	–	4B	B
34-7, 76-78	50.1	1.18	18.0	8.10	6.46	13.2	0.02	–	5	A
36-4, 18-21	49.9	1.18	17.4	8.37	6.46	13.6	0.01	–	5	A
38-4, 34-36	50.0	1.24	17.4	8.30	7.47	12.5	0.04	–	5	A
42-4, 89-91	49.9	1.00	18.5	9.04	5.42	14.1	0.02	–	6B	A
44-2, 34-36	49.5	1.06	16.0	9.44	7.78	13.0	0.03	–	6B	A
47-1, 27-30	49.4	1.04	16.6	9.17	8.15	12.8	0.03	–	6B	A
48-5, 84-84	50.1	1.05	16.6	8.89	7.52	12.8	0.01	–	6B	A
52-5, 127-129	50.9	1.10	17.0	9.05	6.28	12.6	0.10	0.14	6B	A
52-6, 37-39	50.9	1.10	17.0	9.45	5.66	13.0	0.03	0.13	6B	A
53-3, 28-30	49.0	1.12	17.3	9.55	6.84	13.1	<0.03	0.12	6B	A
54-1, 68-70	49.1	1.31	15.8	10.2	7.87	12.7	0.03	0.12	7	B
54-1, 121-123	49.7	1.35	15.8	10.4	6.74	12.9	<0.03	0.11	7	B
56-7, 20-22	50.3	1.39	17.1	10.2	6.15	11.7	0.03	0.15	8C	B
57-1, 67-68	49.7	1.43	16.2	10.4	5.99	13.2	0.04	0.17	8C	C
57-1, 90-92	50.1	1.52	15.8	10.6	5.95	12.6	0.09	0.29	8C	C
57-4, 66-67	49.5	1.52	16.5	10.6	6.10	12.6	0.08	0.16	8C	C
60-2, 123-126	49.1	1.59	16.7	11.4	6.56	12.6	<0.03	0.16	8C	C
62-1, 113-115	50.6	1.57	16.1	10.2	7.69	11.9	0.09	0.15	11	D
63-3, 85-87	49.0	1.64	15.6	11.2	6.91	12.5	<0.03	0.14	11	D
67-1, 86-88	52.1	1.21	17.4	9.70	5.89	10.6	<0.03	0.12	13	E
67-3, 46-48	51.4	1.28	15.8	9.95	6.97	11.5	0.04	0.10	13	E
69-2, 117-119	49.5	1.50	15.9	10.1	7.21	12.6	0.05	0.12	13	D
74-2, 115-117	50.2	1.26	16.7	9.68	6.25	12.7	<0.03	0.13	13	E
75-4, 24-25	49.3	1.35	16.0	9.75	7.89	12.5	0.09	0.12	13	E
80-2, 49-51	50.0	1.33	16.3	9.92	6.71	12.6	<0.03	0.16	14C	Ea
80-3, 73-75	49.5	1.19	16.6	9.16	7.57	12.9	<0.03	0.09	14C	A
80-5, 69-71	49.4	1.19	17.5	8.94	6.76	12.9	0.04	0.10	Dike (15B)	A
87-5, 133-135	50.2	1.41	15.1	10.4	7.45	12.3	<0.03	0.13	14C	Ea
82-1, 133-137	50.7	1.59	13.6	11.3	7.80	11.8	<0.03	0.13	14C	D
82-2, 130-133	50.0	1.29	15.9	9.91	7.34	12.5	<0.03	0.10	14C	Ea
83-1, 71-75	50.0	1.21	16.4	9.16	7.12	12.9	<0.03	0.12	14C	Ea
84-4, 48-51	48.6	1.25	16.0	9.89	8.91	12.3	<0.03	0.09	14C	Eb
85-2, 42-44	49.9	1.21	15.5	9.87	8.03	12.4	<0.03	0.12	14C	Eb
86-4, 62-65	48.8	1.27	15.7	10.0	8.47	12.6	0.06	0.11	16	Eb

[a]Data are carbonate-corrected and screened to exclude altered samples (see text). P_2O_5 values were determined only during Leg 53.

ly associated with glasses H, J, and K. Chemical batch Eb overlaps the lower part of Unit 14 and includes Unit 16. Batch B conforms rather well to Unit 7, and Ea conforms to Unit 14; each batch can be equated with several distinct glass units.

Chemical Variation

Consideration of chemical variation logically falls into two categories; intra-group variation, and the overall inter-group variation and including the whole data set. The success with which the batches may be distinguished on the basis of TiO_2, FeO*, and Al_2O_3 suggests that graphical plots utilizing these variables might be useful to show overall variation trends. A plot of FeO* versus TiO_2 (Figure 10) does indeed show the chemical coherence of each compositional group. Intra-group correlation shows no definable pattern. The data set as a whole shows a distinct positive correlation between FeO* and TiO_2. A plot of Al_2O_3 versus TiO_2 (Figure 11) reveals a similar relation, with distinct

TABLE 11
Average Compositions of Defined Magma Batches, Hole 418A, Based on Shipboard X-ray Fluorescence Analyses from Legs 52 and 53[a]

Chemical Unit	Low TiO_2	Moderate TiO_2				High TiO_2	
	A	B	E	Ea	Eb	C	D
SiO_2	50.1	50.0	50.8	50.1	49.1	49.6	50.0
TiO_2	1.14	1.35	1.28	1.31	1.24	1.52	1.58
Al_2O_3	16.9	15.9	16.5	15.9	15.7	16.3	15.3
FeO*	9.38	10.0	9.77	9.84	9.92	10.8	10.7
(MnO)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)
MgO	6.95	7.19	6.75	7.16	8.47	6.15	7.40
CaO	12.4	12.4	11.8	12.6	12.4	12.8	12.2
(Na_2O)	(2.20)	(2.35)	(2.30)	(2.45)	(2.40)	(2.00)	(2.00)
K_2O	0.04	0.03	0.05	0.03	0.04	0.03	0.05
P_2O_5	0.12	0.13	0.12	0.13	0.11	0.20	0.14
N	21	5	4	4	3	4	4
Or	0.24	0.18	0.30	0.18	0.24	0.18	0.30
Ab	18.6	19.89	19.5	20.7	20.3	16.9	16.9
An	36.1	32.8	34.6	32.3	32.0	35.4	32.6
Di	20.4	23.1	19.2	24.3	23.7	22.4	22.4
Hy	18.1	14.7	23.0	12.2	6.57	20.1	22.1
Ol	3.49	6.01	0.33	7.26	14.2	1.25	1.89
Il	2.17	2.56	2.43	2.49	2.36	2.89	3.00
Ap	0.28	0.31	0.28	0.31	0.26	0.47	0.33

[a]All data are carbonate-corrected and screened for altered samples (see text). Na_2O and MnO are estimated based on shore-based analyses of similar material.

TABLE 12
Chemical Batches, Equivalent Glass and Lithologic Units, and Stratigraphic Intervals for Hole 418A[a]

Chemical Batch	Equivalent Glass Unit	Lithologic Unit	Depth Interval
A	A–E	1–6	324–611
B	F, G, H	7	611–629
C	H	8, 9, 10	629–686
D	H, J, K	10, 11, 13	Interbedded
E	I, J	11, 12, 13	686–786
Ea	K, L, M	14	786–860
Eb	N	14–16	860–868
Dikes	–	15	Interbedded

[a]Depths are in meters below sea floor. Glass units from Byerly and Sinton (this volume).

definition of groups, but no significant correlation within them; overall, there is a negative association between Al_2O_3 and TiO_2.

"Dilution" of TiO_2 might be expected from simple accumulation of phenocrysts low in TiO_2, such as plagioclase or olivine. The relative abundance of plagioclase suggests that it may be responsible for the negative correlation between Al_2O_3 and TiO_2; if so, Al_2O_3 should show a strong positive correlation with CaO, as both components are concentrated in plagioclase. However, correlation between these oxides is only 0.204; apparently another Ca-rich phase, such as clinopyroxene, is involved. As at Site 417, there is a strong negative correlation (−0.79) between Al_2O_3 and (FeO* + MgO); this at least suggests selective accumulation of an alumina-rich mineral assemblage (Figure 12). The relative roles of crystal accumulation

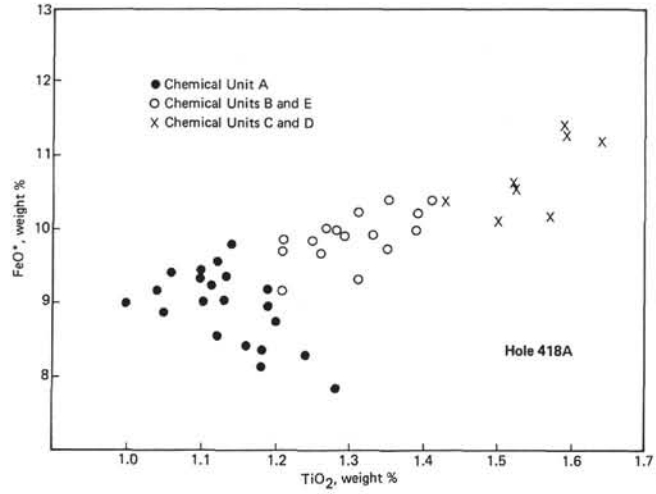


Figure 10. *FeO* as a function of TiO_2.*

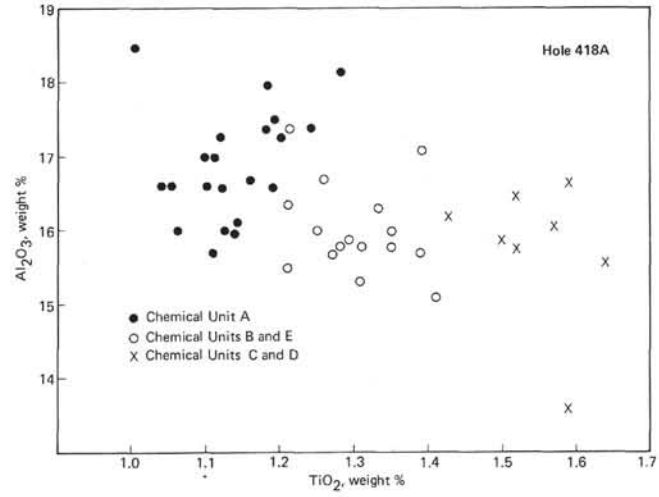


Figure 11. *Al_2O_3 as a function of TiO_2.*

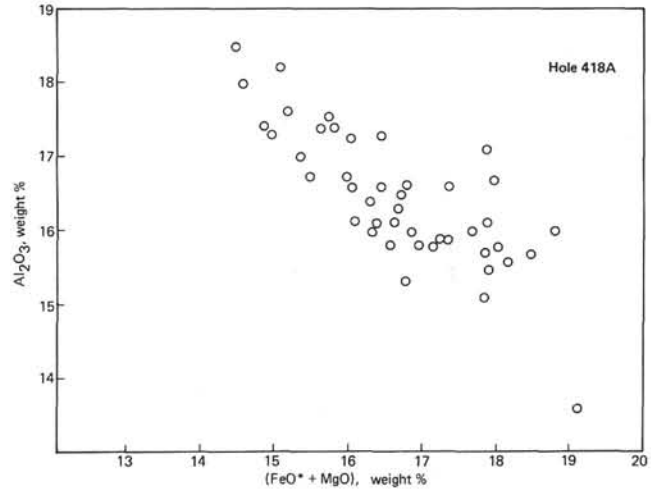


Figure 12. *Al_2O_3 as a function of (FeO* + MgO).*

and crystal-liquid fractionation indicated by these relations are considered in more detail in several of the shore-based studies.

CORRELATION OF SEISMIC PROFILES WITH DRILLING RESULTS

Upon leaving Site 417, the *Glomar Challenger* steamed on a course of approximately 190° for about 3.5 miles. The position of Hole 418A can reasonably be assumed to be at the beacon position and thus directly on the 10 February profile (Figure 13). Upon leaving Hole 418A to return to Hole 417D on 2 March, a profile was made on a heading of 297° from a point about 4 miles east-southeast of Hole 418A to a point about 8 miles west-northwest. The profile was run directly over the Hole 418A beacon (see Figure 2 for location). The two seismic profiles provide the basis for correlation of acoustic horizons to the drilled lithology.

On 10 February, the beacon was dropped above a prominent basement reflector judged to lie at about 0.4 s depth, at the boundary between definable layering and diffuse reverberation. This acoustic horizon is not very distinct. Erratic penetration rates in the last 50 meters above the basalt and the recovery of chert fragments in this interval suggest that the basalt/sediment interface is partly masked by reflections from overlying chert horizons. The average velocity of the 324-meter-thick sediment column at Hole 418A corresponds to 1.62 km/s, in close agreement with the mean sediment velocity at Hole 417D. The principal reflector within the sedimentary cover is at 0.20 s. It is best defined in the north-south profile of 10 February (Figure 13). The depth of this reflector, traced east and west on the 2 March profile (Figure 13), varies slightly being as little as 0.15 s at some points. West of Hole 418A an offset in the 0.20-s reflector overlies an abrupt, upward projection of the

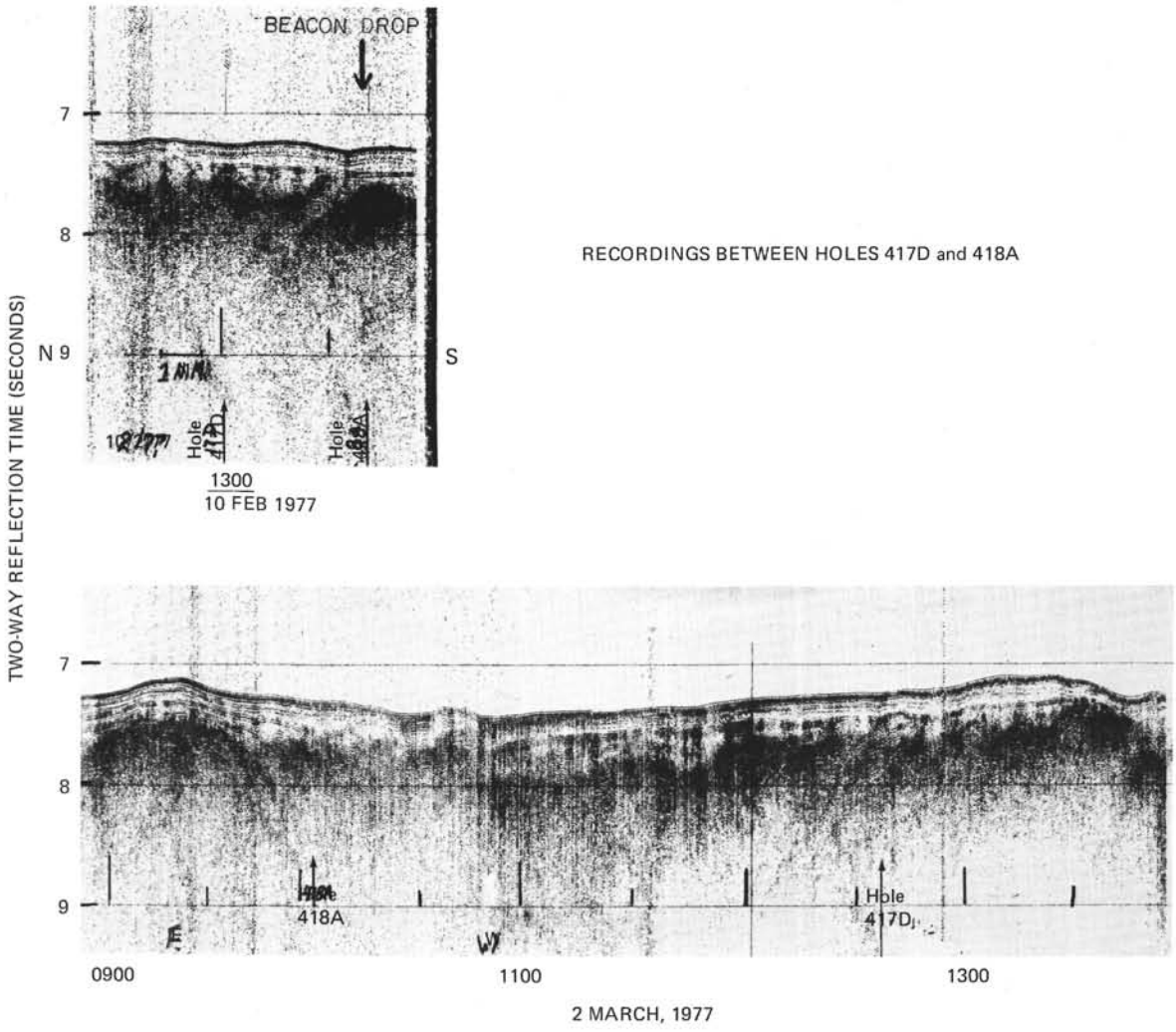


Figure 13. *Single-channel seismic reflection profiles made from* Glomar Challenger *over Hole 418A. The top profile was made on a course of 190° on 10 February, 1977 and passed directly over Hole 418A (indicated by the beacon drop). The bottom profile includes, in the left-hand portion, an approximately east-west section over Hole 418A.*

basement reflector which rises here to within about 0.2 s from the surface. The north-south profile of 10 February shows that the 0.20-s reflector in Hole 418A can be traced directly through the area of Hole 417D, where it appears at about 0.18 to 0.20 s (Figure 13). It is tempting to correlate the reflector at 0.20 s, as in Hole 417D, with the top of the multicolored clay (Unit V). In Hole 418B, 130 meters to the north of Hole 418A, the top of Unit V lies at about 177 meters sub-bottom. This results in an interval velocity of 1.77 km/s for the upper transparent layer and of 1.47 km/s for the lowest sediments.

Alternatively, the 0.20-s reflector may correspond to the boundary between Units II and III at a depth of about 150 meters in the sediment column. This marks the top of the middle Eocene and the appearance of zeolites in the pelagic clay of Unit III. The interval velocity with this correlation is 1.50 km/s for the upper transparent layer and 1.74 km/s for the lower sediments. The velocities appear to be in closer agreement with the laboratory values with this correlation.

Depths of reflectors and interval velocities are as follows:

Reflector	Two-Way Time (s)	Depth Below Sea Floor (m)	Interval Velocity (km/s)	
Sea floor	0.0	0	1.5	1.6
	0.2	150	1.7	
Basement	0.4	324		

SUMMARY AND CONCLUSIONS

Although the original objective of deep penetration (1000 m or more into basement) at Site 418 was not achieved, the study of this site remains nevertheless one of the more significant accomplishments of the DSDP/IPOD program. Sediment recovered at Holes 418A and 418B, along with that recovered at Hole 417D, has provided important additional data on the Upper Cretaceous paleoenvironment in this part of the Atlantic. The 554 meters of basalt penetration, with an overall average recovery of 72 per cent, represents one of the largest basement-sample recoveries yet achieved. The nearly continuous core recovery over some intervals makes this material exceptionally suitable for studies of stratigraphic variations in basalt chemistry and petrography and for detailed study of subtle variations in texture and composition within discrete cooling units. Tectonic inferences, determination of physical properties of basement, and detailed study of rock alteration are also especially appropriate in these cores. Results of initial investigations on shipboard, along with those of preliminary shore-based studies, suggest many exciting lines of inquiry that will justify further carefully formulated and detailed laboratory research for years to come.

Sedimentary sections at the two holes are almost identical in thickness (324m at Hole 418A; 320m at Hole 418B). Core recovery in sediment was 42 per cent at Hole 418A and 52 per cent at Hole 418B. Unfortunately, the recovery was not significantly better at Hole 418B than at Hole 418A; in both holes it was especially poor in the Aptian, Albian, and Cenomanian intervals, which were of particular interest in these old sites. In most respects, the two sedimentary sections are very similar. Eight lithologic units were recognized, of which Units I through IV are Cenozoic pelagic muds, and Units V through VIII are Late to Middle Cretaceous, brown to black pelagic clays, claystones, and chert beds. Sediment interbeds or pockets were also recognized within the uppermost part of the basalt sequence at four locations in Cores 418A-15 and 418A-16. Poor core recovery precludes a detailed description of the Cretaceous lithologies; possibly only the more indurated material was recovered and this may not be typical. Units VIII and VII contain interbedded cherts and brown, green and black marls and clays, some of which contain disseminated pyrite. Evidence of predominantly euxinic conditions continues up through Units VII and VI. Unit VI contains disseminated pyrite and barite crystals and some large pyrite nodules. Unit V is characterized by zeolitic clays; somewhat similar lithologies are represented in Units IV and III. Evidence of terrigenous clastic material, including quartz and feldspar, persists in the pelagic clays of Units II and I. Sediment ages based on planktonic foraminifers, nannofossils, and radiolarians are consistent with the basement age indicated by the *M*0 magnetic anomaly. Sediment immediately above the basalt Sections 418A-15 and 418B-33 is considered to be of early Aptian age.

The physical properties of sediment also appear virtually identical in the two holes. Compressional wave velocities increase from about 1.45 km/s near the mudline to as much as 1.70 km/s below 190 meters; in cherts, velocities may be as high as 5 km/s. There appears to be only one important impedance contrast within the sedimentary section, at 235 meters sub-bottom. This is near the observed lithologic change from overlying unconsolidated pelagic clay to more indurated clays and claystones. Shear strength shows the sharpest increase at 190 meters sub-bottom — the point at which compressional wave velocity also begins to increase significantly.

Downhole magnetic polarities are evidently consistent with the position of Hole 418a near the eastern boundary of the *M*0 anomaly. Positive inclinations in the first 186 meters of basement drilled are replaced by predominantly negative inclinations in the rest of the hole, with the exception of dikes and tectonically disturbed basalt. This is consistent with at least one model of the magnetized crustal blocks, in which the boundaries dip fairly steeply to the east. Thus, a hole drilled near this boundary should penetrate younger basalt with the normal inclination expected in the next younger block to the east, while deeper and older basalt should exhibit the negative polarity of the *M*0 anomaly.

The basalt section can be subdivided into 16 lithologic units with both stratigraphic and chemical coherence; units at the tope of Hiles 418A and 418B appear identical. Boundaries between other major units in Hole 418A can generally be equated with obvious lithologic changes in the core, such as a change from massive to pillowed basalt, a prominent breccia horizon, or a change in phenocryst assemblages. Plagioclase phenocrysts are present in almost all samples recovered; in most samples they are accompanied by a very small amount of olivine, largely altered. Clinopyroxene is rarely present — sometimes as large, rounded unzoned crystals, apparently xenocrystal. Other pyroxene occurs as rounded phenocrysts, usually intergrown with plagioclase. These rounded forms which may show patchy optical zoning or sector zoning suggesting relatively rapid growth in cooling basalt, are probably true phenocrysts. In the larger individual cooling units for which there is nearly continuous core recovery, there are measureable variations in phenocryst abundance indicating differential sorting of crystals and liquid by gravity or as a result of flowage.

The chemical variation of the extrusive basalts covers a slightly greater range than that observed at Site 417. One of the critical components, TiO_2, ranges from 1.00 to 1.65 weight per cent, compared with a range of 1.14 to 1.66 at Hole 417D. At Site 418, however, there is also a significantly greater abundance of basalts near the low TiO_2 end of the data distribution. The basalts tend to fall into three major compositional groups characterized by low, intermediate, and high TiO_2 values. The low TiO_2 group appears in Cores 15 through 53 in the upper part of the hole, and the intermediate and high TiO_2 groups are interstratified in the lower part of the hole. Preliminary consideration of inter-element correlations suggests that selective accumulation of both plagioclase and pyroxene may contribute to chemical variation in the basalts. Since pyroxene does not appear to be a major phenocryst phase, and both plagioclase and pyroxene may show complex zoning and evidence of reaction with the magma, a polybaric fractionation history is implied in which a mineral assemblage crystallized at high pressure is sorted and partly re-equilibrated during ascent of the magma to the surface.

As at Site 417, we recognized a number of thick, massive cooling units in Hole 418A. These are considered to be flows rather than later intrusive units on account of their texture and because they show consistency in chemistry and magnetic polarity with adjacent pillowed flows. The thickest single cooling unit includes over 24 meters in Cores 18 through 20. Even the coarsest samples from the center of this unit include about 10 per cent interstitial glass. Few dikes were clearly definable in the drill core. Two distinct dikes were identified in Cores 79 and 80 near the base of Hole 418A. They have steeply dipping glassy margins, discordant against adjacent pillow lavas. Composition of the glassy margin and positive magnetic polarity indicate a relation between these dikes and flows in the upper part of the hole.

REFERENCES

Boyce, R. E., 1973, Appendix I: Physical Property Methods. *In* Edgar, N. T., Saunders, J. B. et al., *Init. Repts. DSDP,* v. 15: Washington (U.S. Govt. Printing Office), p. 1115–1128.

Langseth, M. G., Jr and von Herzen, R. I., 1970. Heat flow through the floor of the world oceans. In *The Sea,* A. E. Maxwell (Ed.), v. 4, Part I, p. 299–352.

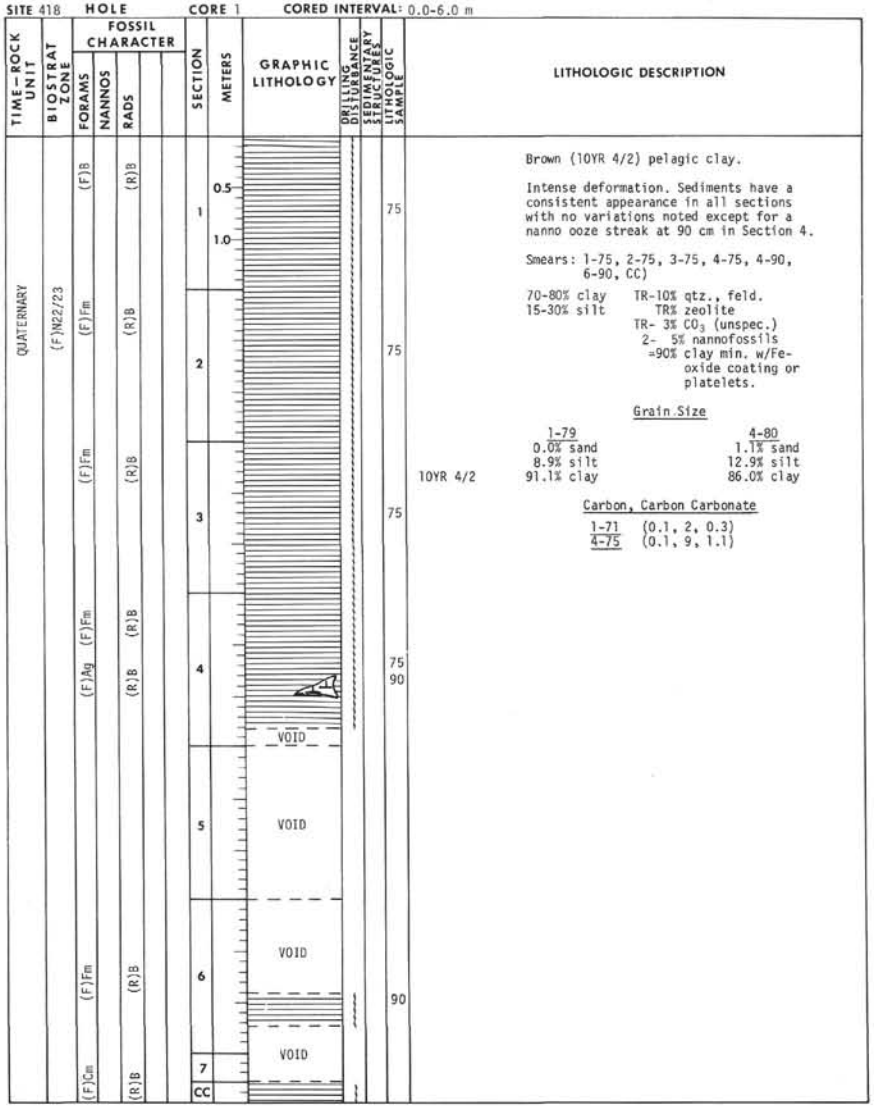
Ratcliffe, E. H. 1960. The thermal conductivities of ocean sediments, *J. Geohpys. Res.,* 65, p. 1535–1541.

von Herzen, R. I. and Maxwell, A. E., 1959. The measurement of thermal conductivity of deep-sea sediments by a needle-probe method, *J. Geophys. Res.,* v. 64, p. 1557–1563.

Whitmarsh, R. B., 1978, Seismic refraction studies of the upper igneous crust in the North Atlantic and porosity estimates for Layer 2. *Earth Planet. Sci. Lett.,* v. 37, p. 451,64.

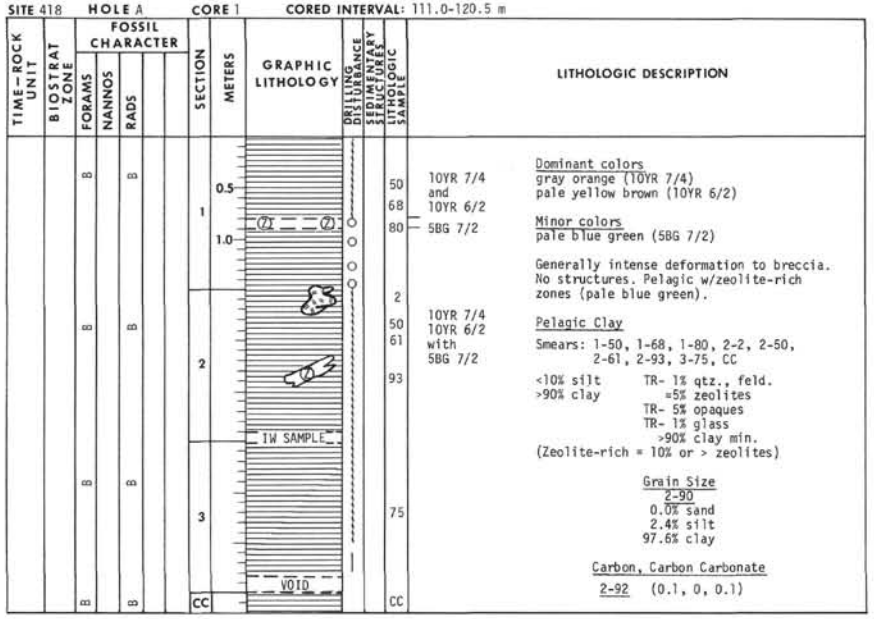
CORE DESCRIPTIONS, SITE 418[1]

SITE 418 HOLE CORE 1 CORED INTERVAL: 0.0-6.0 m

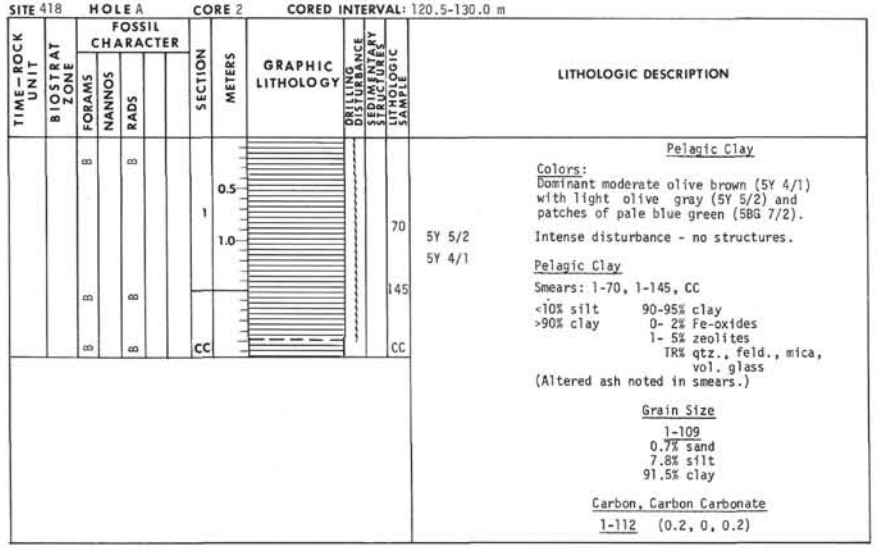


[1] Information on core description sheets represents field notes taken aboard ship under time pressure. Some of this information has been refined in accord with postcruise findings, but production schedules prohibit definitive correlation of these sheets with subsequent findings. Thus the reader should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

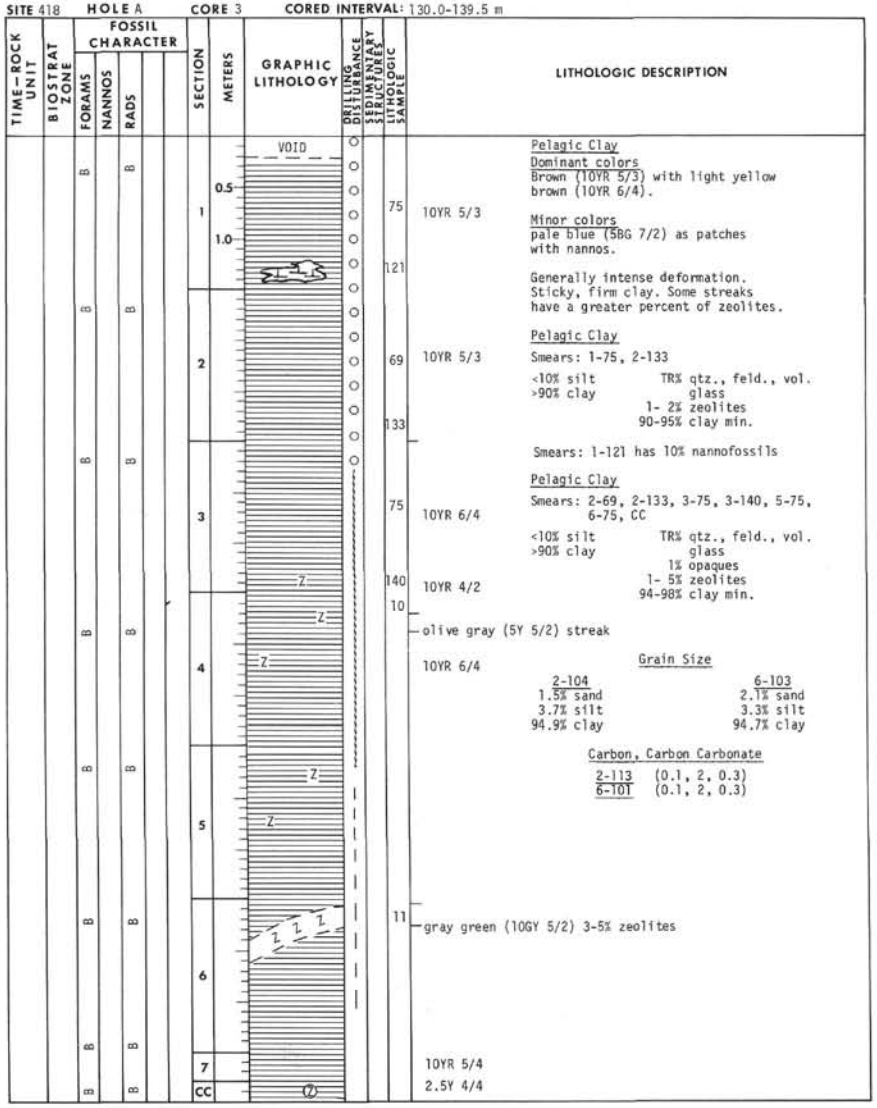
SITE 418 HOLE A CORE 1 CORED INTERVAL: 111.0-120.5 m



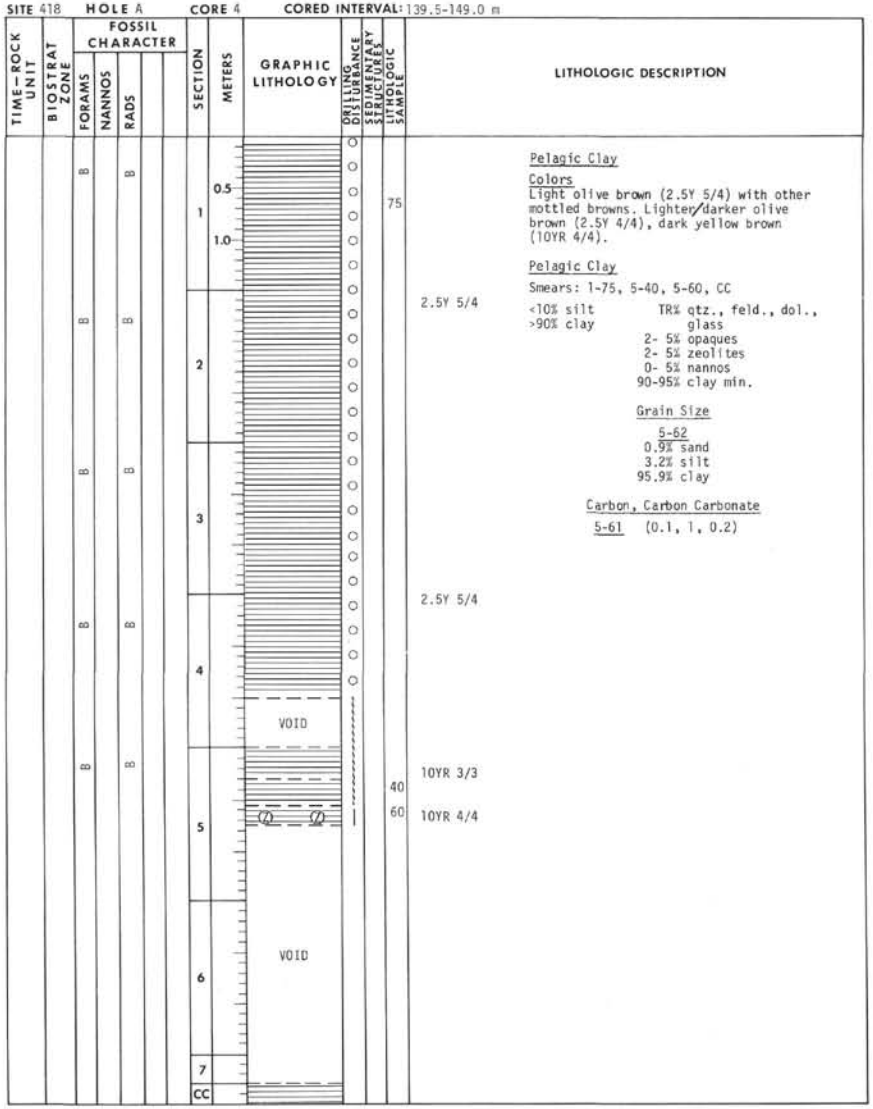
SITE 418 HOLE A CORE 2 CORED INTERVAL: 120.5-130.0 m



SITE 418 HOLE A CORE 3 CORED INTERVAL: 130.0-139.5 m



SITE 418 HOLE A CORE 4 CORED INTERVAL: 139.5-149.0 m



Pelagic Clay

Colors

Light olive brown (2.5Y 5/4) with other mottled browns. Lighter/darker olive brown (2.5Y 4/4), dark yellow brown (10YR 4/4).

Pelagic Clay

Smears: 1-75, 5-40, 5-60, CC

<10% silt
>90% clay

TR% qtz., feld., dol., glass
2- 5% opaques
2- 5% zeolites
0- 5% nannos
90-95% clay min.

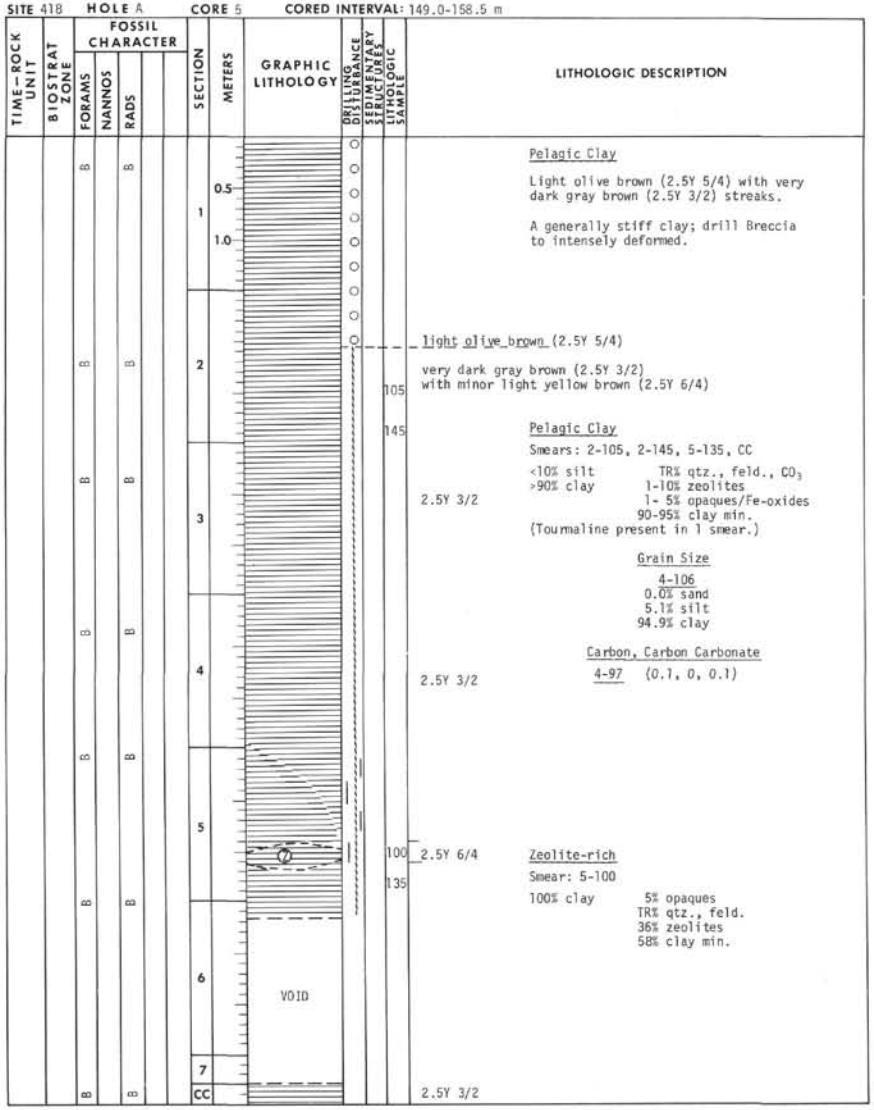
Grain Size

5-62
0.9% sand
3.2% silt
95.9% clay

Carbon, Carbon Carbonate

5-61 (0.1, 1, 0.2)

SITE 418 HOLE A CORE 5 CORED INTERVAL: 149.0-158.5 m



Pelagic Clay

Light olive brown (2.5Y 5/4) with very dark gray brown (2.5Y 3/2) streaks.

A generally stiff clay; drill Breccia to intensely deformed.

light olive brown (2.5Y 5/4)

very dark gray brown (2.5Y 3/2) with minor light yellow brown (2.5Y 6/4)

Pelagic Clay

Smears: 2-105, 2-145, 5-135, CC

<10% silt
>90% clay

TR% qtz., feld., CO_3
1-10% zeolites
1- 5% opaques/Fe-oxides
90-95% clay min.
(Tourmaline present in 1 smear.)

Grain Size

4-106
0.0% sand
5.1% silt
94.9% clay

Carbon, Carbon Carbonate

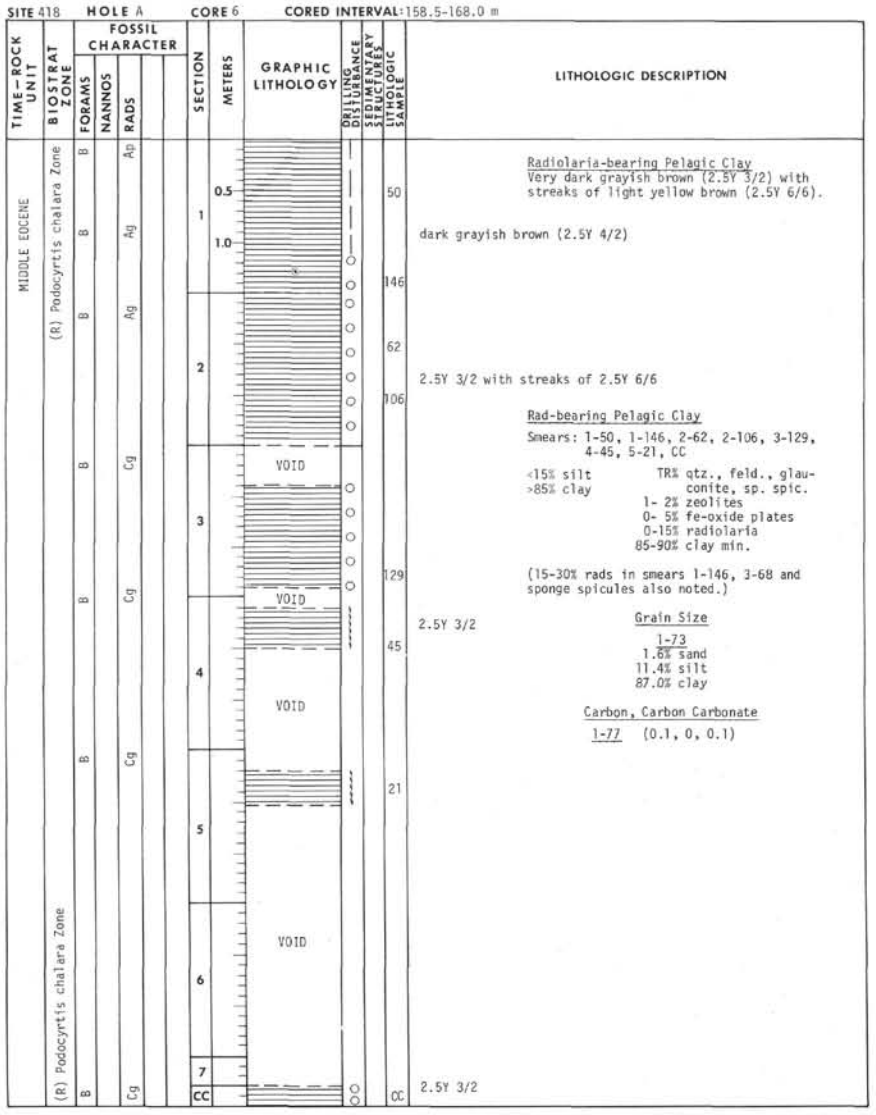
4-97 (0.1, 0, 0.1)

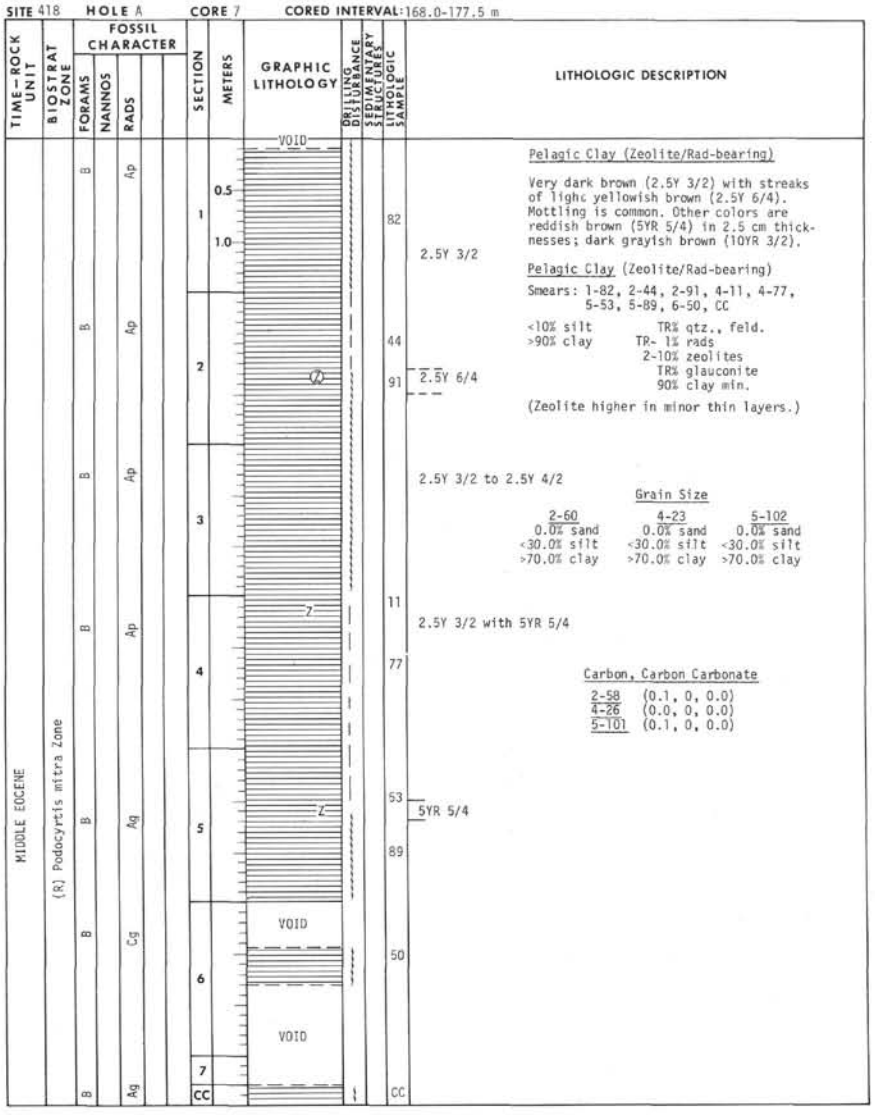
Zeolite-rich

Smear: 5-100

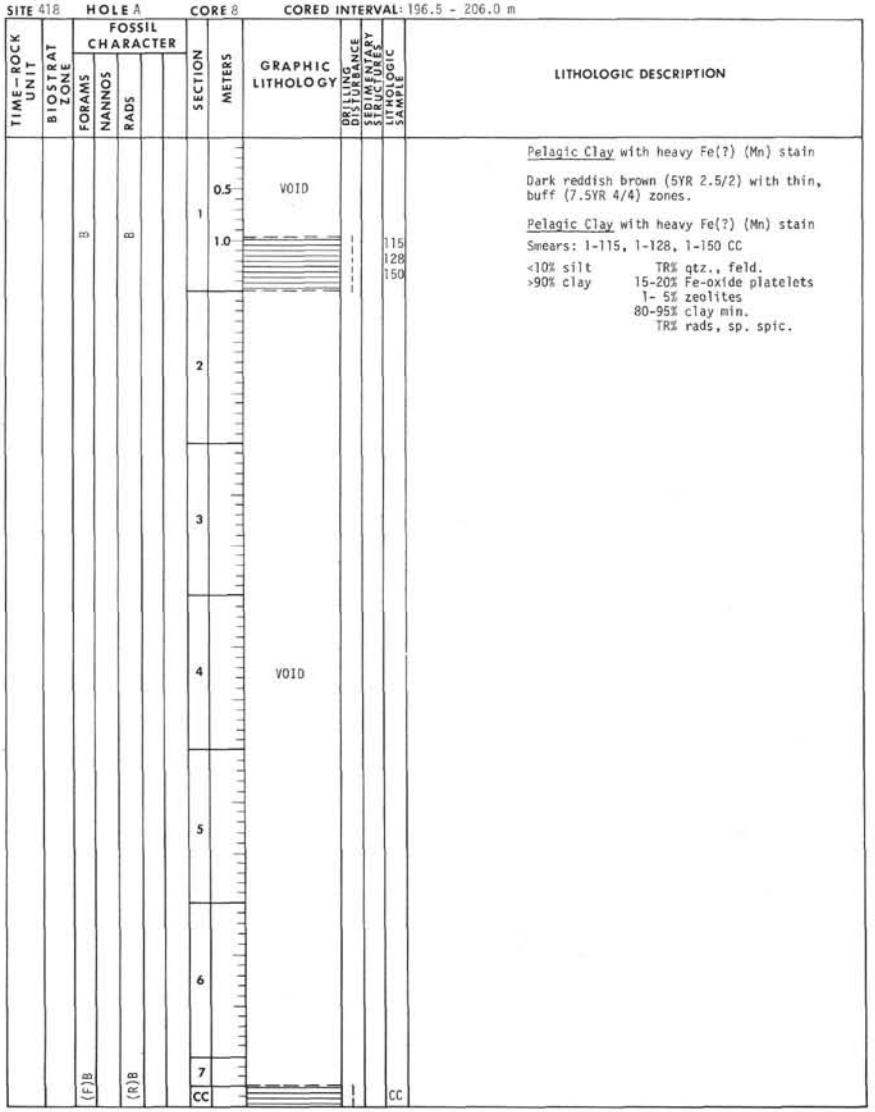
100% clay

5% opaques
TR% qtz., feld.
36% zeolites
58% clay min.

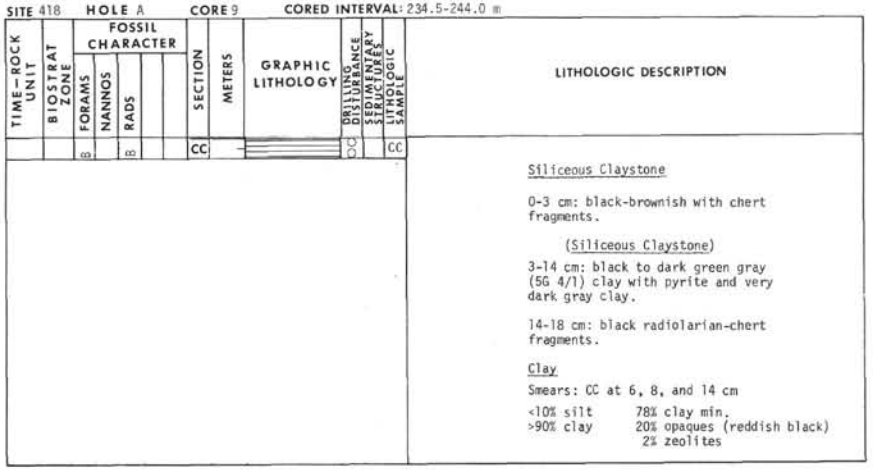

SITE 418 HOLE A CORE 6 CORED INTERVAL: 158.5-168.0 m
TIME-ROCK UNIT
BIOSTRAT ZONE
FOSSIL CHARACTER
FORAMS
NANNOS
RADS
SECTION
METERS
GRAPHIC LITHOLOGY
DRILLING DISTURBANCE
SEDIMENTARY STRUCTURES
LITHOLOGIC SAMPLE
LITHOLOGIC DESCRIPTION
MIDDLE EOCENE
(R) Podocyrtis chalara Zone
VOID
Radiolaria-bearing Pelagic Clay
Very dark grayish brown (2.5Y 3/2) with streaks of light yellow brown (2.5Y 6/6).
dark grayish brown (2.5Y 4/2)
2.5Y 3/2 with streaks of 2.5Y 6/6
Rad-bearing Pelagic Clay
Smears: 1-50, 1-146, 2-62, 2-106, 3-129, 4-45, 5-21, CC
<15% silt
>85% clay
TR% qtz., feld., glauconite, sp. spic.
1- 2% zeolites
0- 5% fe-oxide plates
0-15% radiolaria
85-90% clay min.
(15-30% rads in smears 1-146, 3-68 and sponge spicules also noted.)
2.5Y 3/2
Grain Size
1-73
1.6% sand
11.4% silt
87.0% clay
Carbon, Carbon Carbonate
1-77 (0.1, 0, 0.1)
2.5Y 3/2


SITE 418 HOLE A CORE 7 CORED INTERVAL: 168.0-177.5 m
TIME-ROCK UNIT
BIOSTRAT ZONE
FOSSIL CHARACTER
FORAMS
NANNOS
RADS
SECTION
METERS
GRAPHIC LITHOLOGY
DRILLING DISTURBANCE
SEDIMENTARY STRUCTURES
LITHOLOGIC SAMPLE
LITHOLOGIC DESCRIPTION
MIDDLE EOCENE
(R) Podocyrtis mitra Zone
VOID
Pelagic Clay (Zeolite/Rad-bearing)
Very dark brown (2.5Y 3/2) with streaks of light yellowish brown (2.5Y 6/4). Mottling is common. Other colors are reddish brown (5YR 5/4) in 2.5 cm thicknesses; dark grayish brown (10YR 3/2).
2.5Y 3/2
Pelagic Clay (Zeolite/Rad-bearing)
Smears: 1-82, 2-44, 2-91, 4-11, 4-77, 5-53, 5-89, 6-50, CC
<10% silt
>90% clay
TR% qtz., feld.
TR- 1% rads
2-10% zeolites
TR% glauconite
90% clay min.
(Zeolite higher in minor thin layers.)
2.5Y 6/4
2.5Y 3/2 to 2.5Y 4/2
Grain Size
2-60 0.0% sand <30.0% silt >70.0% clay
4-23 0.0% sand <30.0% silt >70.0% clay
5-102 0.0% sand <30.0% silt >70.0% clay
2.5Y 3/2 with 5YR 5/4
Carbon, Carbon Carbonate
2-58 (0.1, 0, 0.0)
4-26 (0.0, 0, 0.0)
5-101 (0.1, 0, 0.0)
5YR 5/4

SITE 418 HOLE A CORE 8 CORED INTERVAL: 196.5 - 206.0 m



SITE 418 HOLE A CORE 9 CORED INTERVAL: 234.5-244.0 m



SITE 418 HOLE A CORE 10 CORED INTERVAL: 272.5-282.0 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FOSSIL CHARACTER: FORAMS	FOSSIL CHARACTER: NANNOS	FOSSIL CHARACTER: RADS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	LITHOLOGIC SAMPLE
ALBIAN-CENOMANIAN		B Rm	Rm	B Fp	1	0.5				8
						1.0				34
										53
										87
										90
							VOID			98
				B Fp	2					12
										27
					3					
					4		VOID			
					5					
					6					
					7					
					CC					CC

LITHOLOGIC DESCRIPTION

Pelagic Clay

Multicolored drilling breccia in Section 1 composed of:

- (A) grayish blue green (5BG 5/2) to green clay
- (B) dark gray (N3) clay with nannos
- (C) olive gray (5Y 4/1) nanno clay

} 5 mm micro-laminae

Tubular pyrite (2 cm) noted at 75-80 cm; burrows common; barite noted.

Below the pyrite zones is a black brown clay (Smears 1-87 and 1-90). Barite noted in rosettes(?) (Smear 1-98).

Dep. cycle appears to be: B, C, A ↑ inc. reducing conditions

Green Clay

Smears: 1-8, 2-12, 2-27, CC

5% silt	95% clay min.
95% clay	5% opaques
	TR% nannos, rads
	0- 5% zeolites

Brown to Dark Gray Clay

Smears: 1-34, 1-87, 1-90

30% silt	85% clay min.
70% clay	6% Fe-oxides
	TR% zeolites, rads
	5% nannos

(Pyroxenes, phosphate?)

Olive Gray Clay

Smear: 1-53

5% silt	35% nannofossils
95% clay	5% forams
	10% opaques
	50% clay min.

Grain Size

1-97
2.0% sand
33.4% silt
64.6% clay

Carbon, Carbon Carbonate

1-118	(3.0, 10, 4.1)
2-12	(0.1, 0, 0.1)

Rad Chert fragments in Core Catcher.

SITE 418 HOLE A CORE 11 CORED INTERVAL: 282.0-291.5 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FOSSIL CHARACTER: FORAMS	FOSSIL CHARACTER: NANNOS	FOSSIL CHARACTER: RADS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	LITHOLOGIC SAMPLE
		B		B	CC					CC

LITHOLOGIC DESCRIPTION

Nannofossil Clay
Burrowed, dark gray - laminated with opaques and green clay (gray green [5G 5/2] to blue green [5BG 5/2])

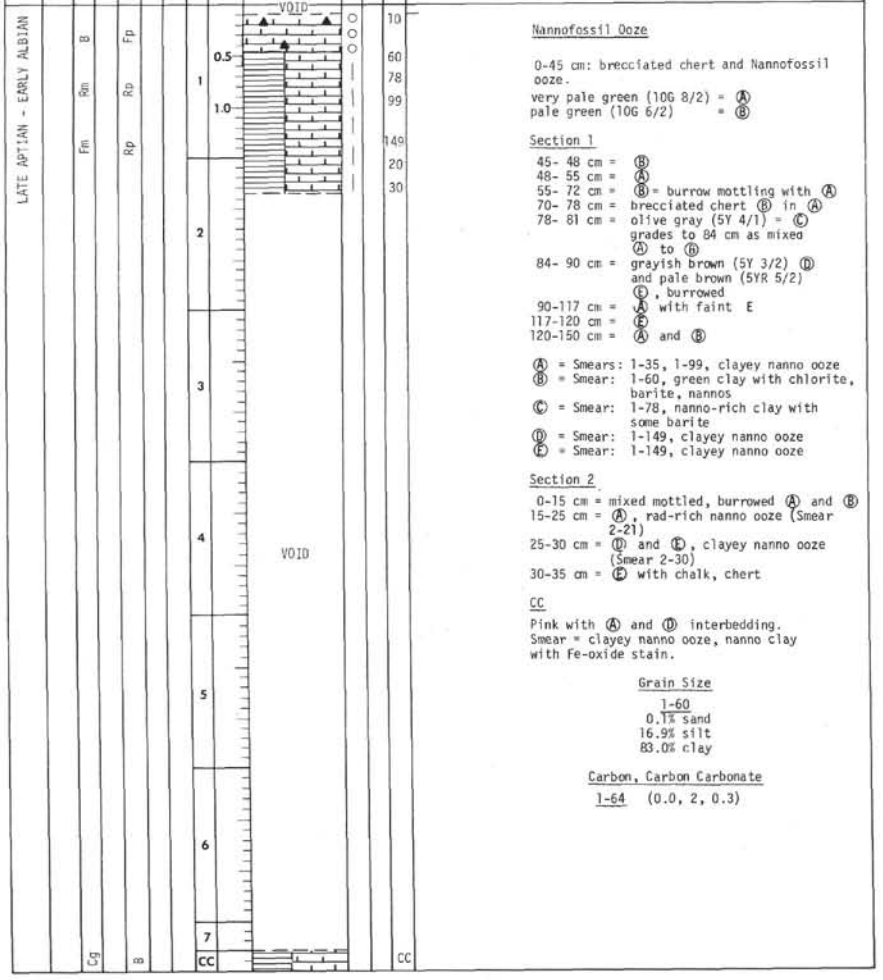
Pale green (10G 6/2)

Nanno Clay

Smear: CC

50% silt	45% clay min.
50% clay	50% nannofossils
	5% rads

SITE 418 HOLE A CORE 12 CORED INTERVAL: 291.5-301.0 m



LITHOLOGIC DESCRIPTION

Nannofossil Ooze

0-45 cm: brecciated chert and Nannofossil ooze.
very pale green (10G 8/2) = Ⓐ
pale green (10G 6/2) = Ⓑ

Section 1

45- 48 cm = Ⓑ
48- 55 cm = Ⓐ
55- 72 cm = Ⓑ = burrow mottling with Ⓐ
70- 78 cm = brecciated chert Ⓑ in Ⓐ
78- 81 cm = olive gray (5Y 4/1) = Ⓒ grades to 84 cm as mixed Ⓐ to Ⓗ
84- 90 cm = grayish brown (5Y 3/2) Ⓓ and pale brown (5YR 5/2) Ⓔ, burrowed
90-117 cm = Ⓐ with faint E
117-120 cm = Ⓔ
120-150 cm = Ⓐ and Ⓑ

Ⓐ = Smears: 1-35, 1-99, clayey nanno ooze
Ⓑ = Smear: 1-60, green clay with chlorite, barite, nannos
Ⓒ = Smear: 1-78, nanno-rich clay with some barite
Ⓓ = Smear: 1-149, clayey nanno ooze
Ⓔ = Smear: 1-149, clayey nanno ooze

Section 2

0-15 cm = mixed mottled, burrowed Ⓐ and Ⓑ
15-25 cm = Ⓐ, rad-rich nanno ooze (Smear 2-21)
25-30 cm = Ⓓ and Ⓔ, clayey nanno ooze (Smear 2-30)
30-35 cm = Ⓔ with chalk, chert

CC

Pink with Ⓐ and Ⓓ interbedding.
Smear = clayey nanno ooze, nanno clay with Fe-oxide stain.

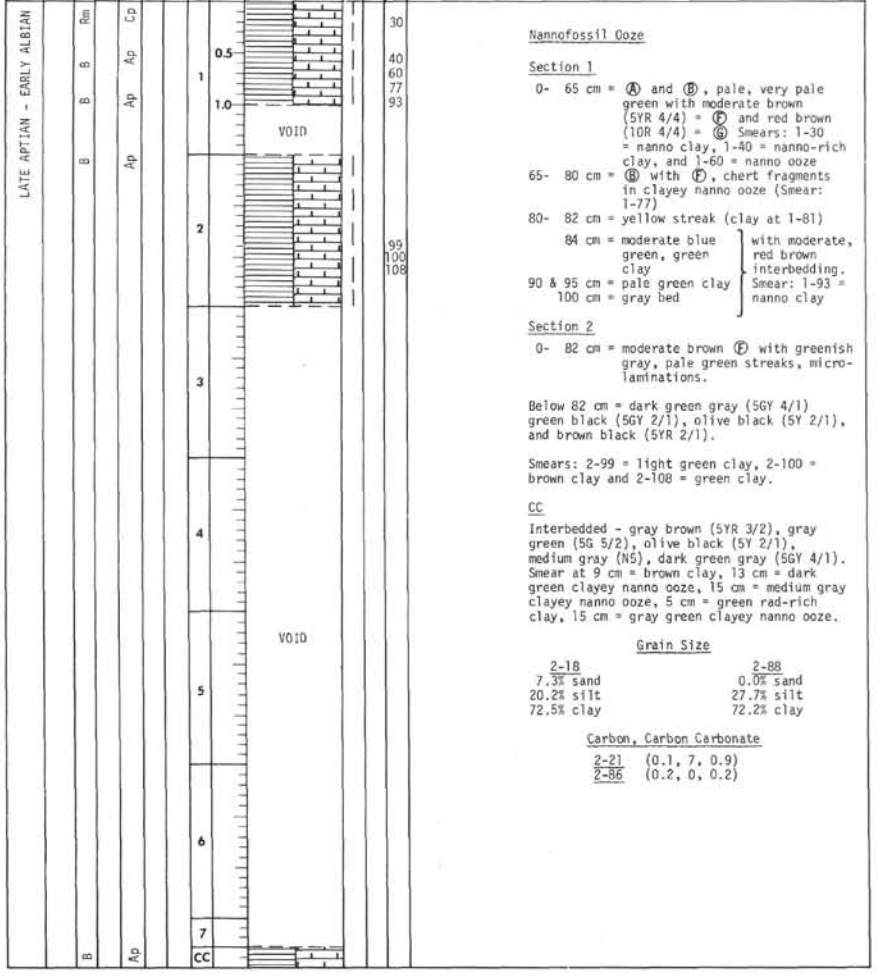
Grain Size

1-60
0.1% sand
16.9% silt
83.0% clay

Carbon, Carbon Carbonate

1-64	(0.0, 2, 0.3)

SITE 418 HOLE A CORE 13 CORED INTERVAL: 301.0-310.5 m



LITHOLOGIC DESCRIPTION

Nannofossil Ooze

Section 1

0- 65 cm = Ⓐ and Ⓑ, pale, very pale green with moderate brown (5YR 4/4) = Ⓕ and red brown (10R 4/4) = Ⓖ Smears: 1-30 = nanno clay, 1-40 = nanno-rich clay, and 1-60 = nanno ooze
65- 80 cm = Ⓑ with Ⓕ, chert fragments in clayey nanno ooze (Smear: 1-77)
80- 82 cm = yellow streak (clay at 1-81)
84 cm = moderate blue green, green clay
90 & 95 cm = pale green clay
100 cm = gray bed
} with moderate, red brown interbedding. Smear: 1-93 = nanno clay

Section 2

0- 82 cm = moderate brown Ⓕ with greenish gray, pale green streaks, micro-laminations.

Below 82 cm = dark green gray (5GY 4/1) green black (5GY 2/1), olive black (5Y 2/1), and brown black (5YR 2/1).

Smears: 2-99 = light green clay, 2-100 = brown clay and 2-108 = green clay.

CC

Interbedded - gray brown (5YR 3/2), gray green (5G 5/2), olive black (5Y 2/1), medium gray (N5), dark green gray (5GY 4/1). Smear at 9 cm = brown clay, 13 cm = dark green clayey nanno ooze, 15 cm = medium gray clayey nanno ooze, 5 cm = green rad-rich clay, 15 cm = gray green clayey nanno ooze.

Grain Size

2-18	2-88
7.3% sand	0.0% sand
20.2% silt	27.7% silt
72.5% clay	72.2% clay

Carbon, Carbon Carbonate

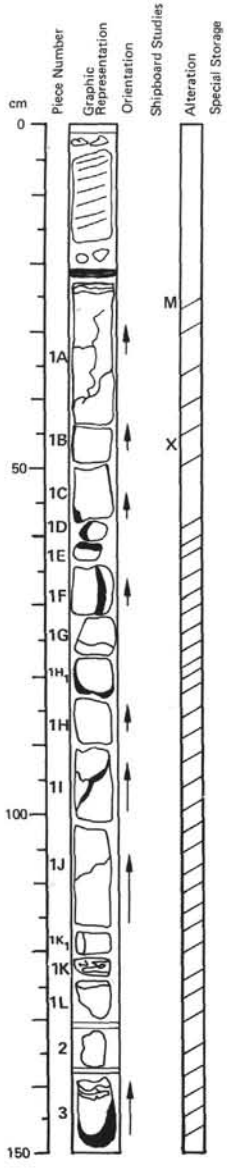
2-21	(0.1, 7, 0.9)
2-86	(0.2, 0, 0.2)

SITE 418 HOLE A CORE 14 CORED INTERVAL: 310.5-320.0 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FOSSIL CHARACTER: FORAMS	FOSSIL CHARACTER: NANNOS	FOSSIL CHARACTER: RADS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	LITHOLOGIC SAMPLE	LITHOLOGIC DESCRIPTION
LATE APTIAN - EARLY ALBIAN					CC					CC	Nanno Clay and Clay-rich Nanno Ooze Core Catcher only. 20-60% clay min. 40-80% nannos TR% opaques, zeolites Nanno ooze = pale green (10G 6/2) Nanno with clay = gray black (N2)

SITE 418 HOLE A CORE 15 CORED INTERVAL: 320.0-329.5 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FOSSIL CHARACTER: FORAMS	FOSSIL CHARACTER: NANNOS	FOSSIL CHARACTER: RADS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	LITHOLOGIC SAMPLE	LITHOLOGIC DESCRIPTION
EARLY APTIAN		Fm		B	1	0.5	Basalt				Clayey Nannofossil Ooze Brown to olive gray clay, laminated = 1 mm with black layers/ pyrite at base near basalt contact. Smears: 1-5 = Nanno Clay; 1-15 = Clayey Nanno Ooze with some ash, zeolite, glauconite(?); 1-19 = very dark Nanno Clay. Basalt first cored at 324.0 m.
					1	1.0					
					2		Basalt				
					3		Basalt				
					4		Basalt				
					5		VOID				
					6						
					7						
					CC		Basalt				



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		1	5	1

Visual Description

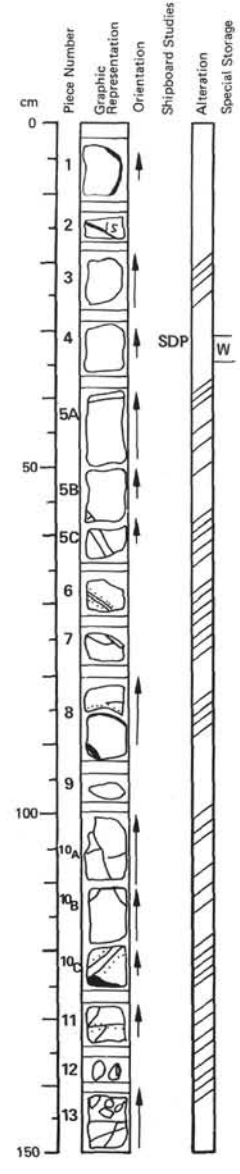
Sparsely phyric pillow basalt. Basalt-sediment contact is at 20 cm. Basalt is gray to greenish-gray; moderately altered. Plagioclase phenocrysts 3-5%, <8 mm, fresh, sometimes in glomerophyric clusters; olivine phenocrysts 1-2%, <1 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles 1%, filled with carbonate and smectite. Scattered veins are filled with carbonate, smectite and minor pyrite.

Shipboard Data

Bulk Analysis: 46-48 cm

SiO_2	49.10
Al_2O_3	16.50
Fe_2O_3	9.92
MgO	6.88
CaO	13.20
Na_2O	2.08
K_2O	0.04
TiO_2	1.12
P_2O_5	0.11
MnO	0.15
LOI	1.7
H_2O^+	0.79
H_2O^-	N.D.
CO_2	0.41

Magnetic Data:	26-28 cm
NRM Intensity (emu/cc)	35.28×10^{-3}
Stable Inclination	+23.5°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		1	5	2

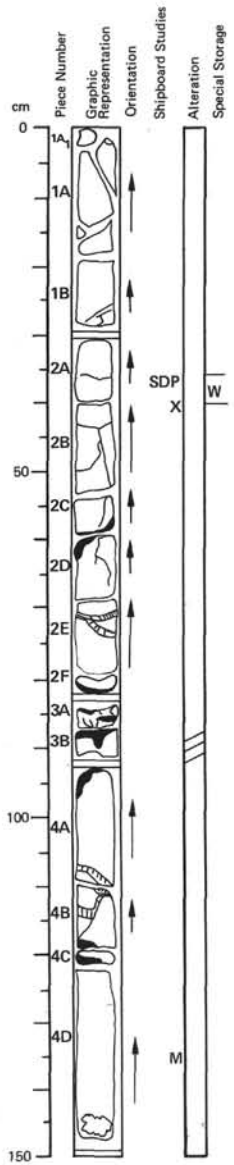
Visual Description

Sparsely phyric pillow basalt. Basalt is gray to greenish-gray; moderately altered. Plagioclase phenocrysts 4-5%, <6 mm, fresh, occur as single crystals and as glomerocrysts; olivine phenocrysts <1%, <1 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Many veins and veinlets are filled with smectite, carbonate and minor pyrite.

Piece 2 is a limestone fragment in contact with glass selvedge. Piece 13 contains minor breccia composed of angular basalt clasts in a matrix of carbonate, smectite, pyrite, iron oxide and zeolite(?).

Shipboard Data

Physical Property Data:	33-35 cm
$\overline{V}p$ (km/sec)	5.00
Porosity (%)	12.0
Wet Bulk Density (g/cc)	2.645
Grain Density (g/cc)	2.87



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

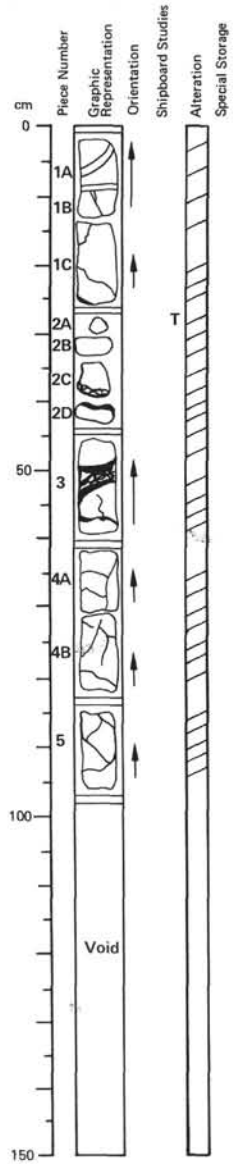
LEG		SITE		HOLE	CORE		SECT.	
5	2	4	1	8	A	1	5	3

Visual Description

Sparsely phyric pillow basalt. Basalt is medium to dark gray; slightly altered. Phenocryst content is variable, both within and between pillows; plagioclase phenocrysts 3-7%, <6 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 2-7%, <6 mm, fresh either as single crystals or as glomerocrysts with plagioclase. Groundmass is fine-grained to glassy; glass selvedges are altered to smectite. Vesicles 2-3%, filled with smectite, carbonate and quartz. Large quartz-filled vug occurs in piece 4D. Scattered veinlets also filled with smectite and carbonate. Some pyrite is desseminated in the groundmass. Interpillow areas have minor glass breccia or altered sediment.

Shipboard Data

Bulk Analysis: 36-38 cm		Magnetic Data:	133-135 cm
SiO_2	49.96	NRM Intensity	16.48×10^{-3}
Al_2O_3	16.50	Stable Inclination	+24.4°
Fe_2O_3	9.44		
MgO	7.44	Physical Property Data:	36-38 cm
CaO	13.10	$\overline{V}p$ (km/sec)	5.71
Na_2O	2.06	Porosity (%)	5.3
K_2O	0.04	Wet Bulk Density (g/cc)	2.83
TiO_2	1.11	Grain Density (g/cc)	2.94
P_2O_5	0.11		
MnO	0.16		
LOI	1.6		
H_2O^+	0.82		
H_2O^-	N.D.		
CO_2	0.07		



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE		HOLE	CORE		SECT.	
5	2	4	1	8	A	1	5	4

Visual Description

Sparsely phyric pillow basalt. Basalt is gray to greenish-gray; moderately altered. Plagioclase phenocrysts 3%, <7 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are altered to smectite. Vesicles 1%, filled with carbonate and smectite. Veins and veinlets are filled with carbonate, smectite, and pyrite. Minor breccia occurs between glass selvedges in piece 2C.

Thin Section Description

Location: 32 cm

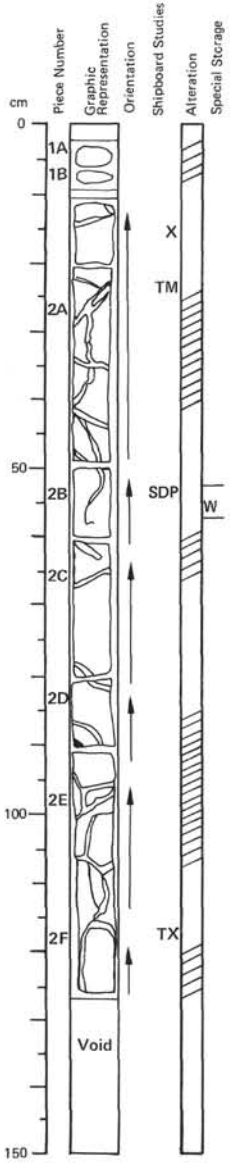
Texture: porphyritic - quench

Phenocrysts: plagioclase, 5%, <4 mm; olivine, <1%, <1 mm

Groundmass: olivine <1%, 0.2 mm, euhedral; plagioclase, 35%, seriate <0.5 mm, skeletal; clinopyroxene, 60%, <0.5 mm, radiating sheaves; opaque, 5%, <0.02 mm, euhedral

Vesicles: 1%, <0.25 mm, round

Alteration: olivine to carbonate and smectite; plagioclase partly to zeolite(?); carbonate and smectite fill vesicles and veins; minor sulfide in veins



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 2	4 1 8	A	1 6	1

Visual Description

Pillow basalt breccia and sparsely phyric massive basalt. Piece 1 consists of pillow breccia; the remainder of the section is a single cooling unit of massive basalt. Breccia is reddish-brown; highly altered. Basalt clasts with quench textures occur in a matrix of carbonate, smectite and iron oxide. Massive basalt is gray to greenish-gray, reddish-brown where oxidized along veins in pieces 2C to 2F. Plagioclase phenocrysts 5%, ≤2 mm, fresh; olivine phenocrysts 1%, ≤3 mm, altered to smectite. Groundmass is holocrystalline, fine-grained at the top but gradually increasing in grain size to medium-grained at 20 cm. Vesicles 1-4%, most in pieces 2A and 2B, filled with carbonate and smectite. Veins occur throughout the section, filled with carbonate, smectite and minor pyrite. Pyrite is also disseminated in the groundmass.

Thin Section Description

Location: 22 cm

Texture: porphyritic - quench

Phenocrysts: olivine, 1%, ≤2 mm, euhedral; plagioclase, 8%, ≤4 mm, euhedral

Groundmass: plagioclase, 12%, 0.5 mm, acicular; clinopyroxene, 72%, radiating sleaves; opaque, 5%, 0.02 mm, euhedral

Vesicles: 2%, ≤0.5 mm, round

Alteration: olivine to smectite; smectite and carbonate fill vesicles

Thin Section Description

Location: 119 cm

Texture: porphyritic - quench

Phenocrysts: olivine, 1%, ≤3 mm, euhedral; plagioclase, 7%, ≤3 mm, euhedral

Groundmass: olivine, 1%, 0.3 mm, subhedral; plagioclase, 20%, 0.7 mm, laths; clinopyroxene, 67%, radiating sleaves; opaque, 3%, 0.05 mm, euhedral

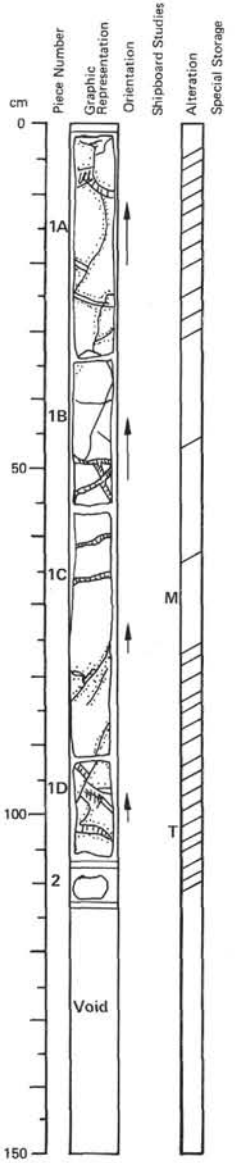
Vesicles: 1%, 0.2 mm, round

Alteration: olivine to smectite and carbonate; plagioclase partly to zeolite(?); smectite fills vesicles

Shipboard Data

Bulk Analysis:	13-15 cm	118-120 cm
SiO_2	50.50	50.00
Al_2O_3	17.80	18.40
Fe_2O_3	8.26	8.21
MgO	7.28	7.67
CaO	11.80	11.00
Na_2O	2.50	2.54
K_2O	0.09	0.06
TiO_2	1.28	1.31
P_2O_5	0.13	0.10
MnO	0.16	0.13
LOI	2.7	3.5
H_2O^+	1.50	1.65
H_2O^-	N.D.	N.D.
CO_2	0.54	0.64

Magnetic Data:	21-23 cm
NRM Intensity (emu/cc)	6.66×10^{-3}
Stable Inclination	+16.8°
Physical Property Data:	54-56 cm
$\overline{V}p$ (km/sec)	4.97
Porosity (%)	9.5
Wet Bulk Density (g/cc)	2.71
Grain Density (g/cc)	2.88



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 2	4 1 8	A	1 6	2

Visual Description

Moderately phyric massive basalt. Basalt is gray, reddish-brown where stained along veins; moderately altered. Plagioclase phenocrysts 12-15%, ≤8 mm, often partly altered to smectite. Olivine phenocrysts <1%, ≤1 mm, altered to smectitie. Groundmass is holocrystalline, fine-grained; distinct mottling occurs between 40 and 80 cm. Vesicles 5-10%, ≤1 mm, filled with smectite, carbonate and pyrite; many veins are partly oxidized. Piece 2 is an altered glass breccia with a carbonate matrix.

Thin Section Description

Location: 100 cm

Texture: porphyritic - quench

Phenocrysts: plagioclase, 15%, ≤3 mm, subhedral

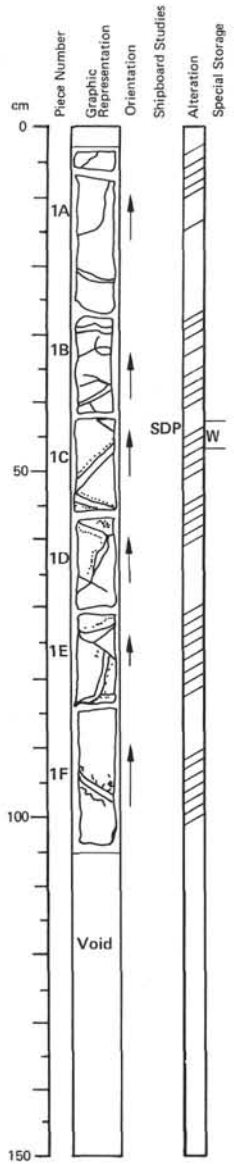
Groundmass: olivine, 2%, 0.3 mm, subhedral; plagioclase, 25% ≤0.8 mm, laths; clinopyroxene, 68%, poorly crystallized sleaves; opaque 5%, 0.01 mm granular

Vesicles: 3%, <0.7 mm round

Alteration: olivine to smectite and carbonate; smectite, carbonate and zeolite fill vesicles and veins

Shipboard Data

Magnetic Data:	69-71 cm
NRM Intensity (emu/cc)	4.70×10^{-3}
Stable Inclination	+14.7°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

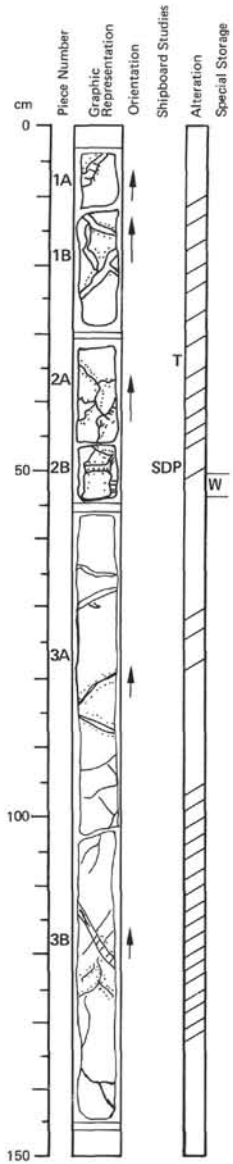
LEG	SITE	HOLE	CORE	SECT.
52	418	A	16	3

Visual Description

Sparsely phyric massive basalt. Basalt is gray to greenish-gray, reddish-brown along oxidized veins; moderately altered. Plagioclase phenocrysts 5%, <5 mm, fresh, often in glomerophyric clusters; olivine phenocrysts <1%, <1 mm, altered to smectite; clinopyroxene phenocrysts <1%, <1 mm, fresh. Groundmass is holocrystalline, fine- to medium-grained. Vesicles 0-20%, unevenly distributed in clusters, <1 mm, filled with smectite and carbonate. Veins are filled with calcite, smectite and minor pyrite. Many veins below 45 cm have oxidized haloes.

Shipboard Data

Physical Property Data:	44-46 cm
$\overline{V}p$ (km/sec)	4.86
Porosity (%)	11.7
Wet Bulk Density (g/cc)	2.625
Grain Density (g/cc)	2.83



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	17	1

Visual Description

Sparsely phyric massive basalt. A cooling break occurs at 55 cm but the rocks above and below the break are similar. Basalt is gray to greenish-gray, reddish-brown along oxidized veins; moderately altered. Plagioclase phenocrysts 5%, <3 mm, fresh, often in glomerophyric clusters to 8 mm; olivine phenocrysts <1%, <1 mm, altered to smectite; clinopyroxene phenocrysts <1%, intergrown with plagioclase in glomerophyric clusters. Groundmass is fine- to very fine-grained. Vesicles 1-5%, most abundant in upper 55 cm, <1.5 mm, filled with carbonate and smectite. Veins also filled with carbonate and smectite, many oxidized. Lower 95 cm have minor pyrite in groundmass.

Thin Section Description

Location: 34 cm

Texture: porphyritic - quench

Phenocrysts: plagioclase, 5%, <2.5 mm, euhedral

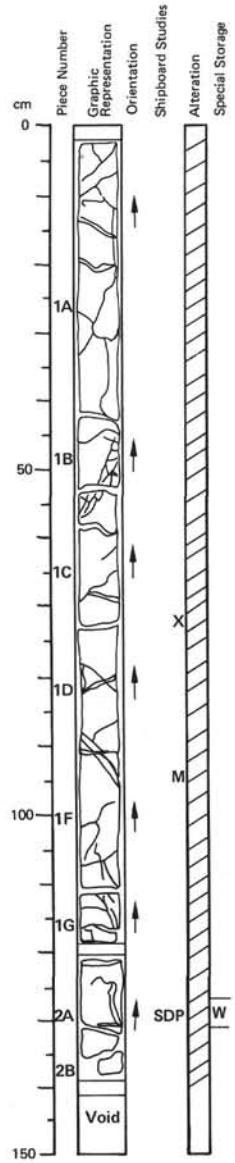
Groundmass: olivine, 1%, 0.3 mm, subhedral; plagioclase, 25%, <0.7 mm, skeletal; clinopyroxene, 64%, poorly crystallized sheaves; opaque, 2%, 0.01 mm, euhedral

Vesicles: 3%, 0.7 mm, round

Alteration: olivine to smectite; carbonate fills vesicles

Shipboard Data

Physical Property Data:	49-51 cm
$\overline{V}p$ (km/sec)	5.21
Porosity (%)	10.3
Wet Bulk Density (g/cc)	2.71
Grain Density (g/cc)	2.88



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A	1	7		2

Visual Description

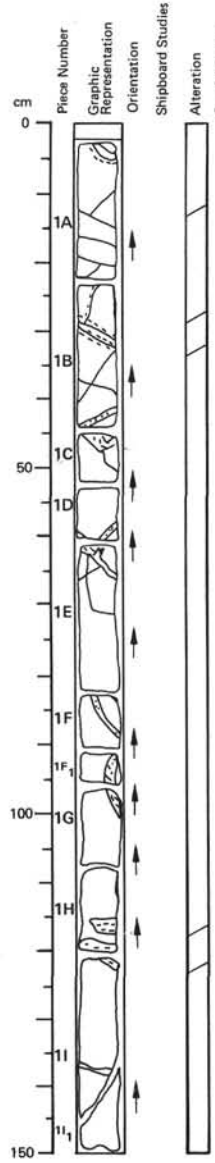
Sparsely phyric massive basalt. Basalt is gray to greenish-gray; moderately altered. Plagioclase phenocrysts 5%, ≤ 4 mm, fresh or partly altered to smectite; clinopyroxene phenocrysts < 1%, ≤ 1 mm, fresh. Groundmass is fine-grained. Vesicles 2-3%, filled with carbonate and smectite. Veins are common throughout, filled with smectite and carbonate.

Shipboard Data

Bulk Analysis: 72-75 cm

SiO_2	50.80
Al_2O_3	18.20
Fe_2O_3	8.73
MgO	7.19
CaO	12.00
Na_2O	2.40
K_2O	0.10
TiO_2	1.28
P_2O_5	0.12
MnO	0.13
LOI	2.3
H_2O^+	1.18
H_2O^-	N.D.
CO_2	0.12

Magnetic Data:	93-95 cm
NRM Intensity (emu/cc)	10.14×10^{-3}
Stable Inclination	+22.0°
Physical Property Data:	128-130 cm
$\bar{V}p$ (km/sec)	4.93
Porosity (%)	11.3
Wet Bulk Density (g/cc)	2.66
Grain Density (g/cc)	2.86

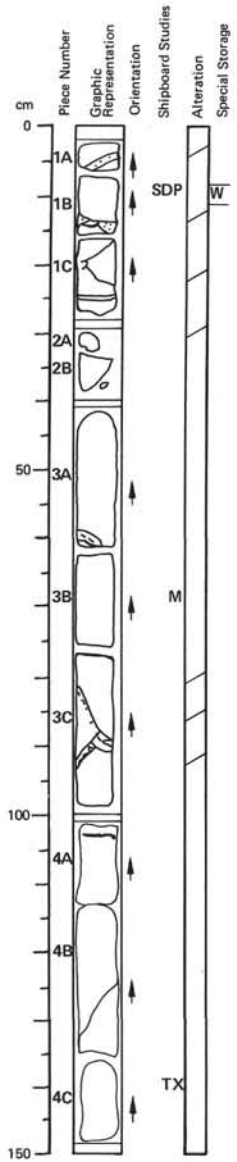


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A	1	7		3

Visual Description

Sparsely phyric massive basalt. Basalt is gray to greenish-gray; moderately altered. Plagioclase phenocrysts 5-7%, < 3 mm, fresh or partly altered to smectite; olivine microphenocrysts < 1%, ≤ 1 mm, altered to smectite. Groundmass is fine-grained, coarsening somewhat towards bottom of the section. Vesicles 2%, ≤ 1 mm, filled with smectite and carbonate. Veins common throughout, filled with carbonate, smectite and minor pyrite.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	17	4

Visual Description

Sparsely to moderately phyric massive basalt. Basalt is gray to greenish-gray, reddish-brown along oxidized veins; moderately altered. Plagioclase phenocrysts 5-10%, <3 mm, fresh or partly altered to smectite, often in glomerophyric clusters; olivine microphenocrysts 1%, <1 mm, altered to smectite. Groundmass is fine-grained, often mottled. Vesicles 2%, <1 mm, filled with carbonate and some smectite. Veins are common throughout, filled with carbonate, smectite and minor quartz and pyrite. Some veins are oxidized.

Thin Section Description

Location: 140 cm

Texture: porphyritic - quench

Phenocrysts: olivine, <1%, 0.6 mm, euhedral; plagioclase, 12%, <3 mm, euhedral

Groundmass: olivine, 2%, 0.3 mm, subhedral; plagioclase, 30%, 0.5 mm, laths; clinopyroxene, 45%, radiating sheaves;opaque, 3%, 0.01, euhedral; glass, 6%, interstitial, altered

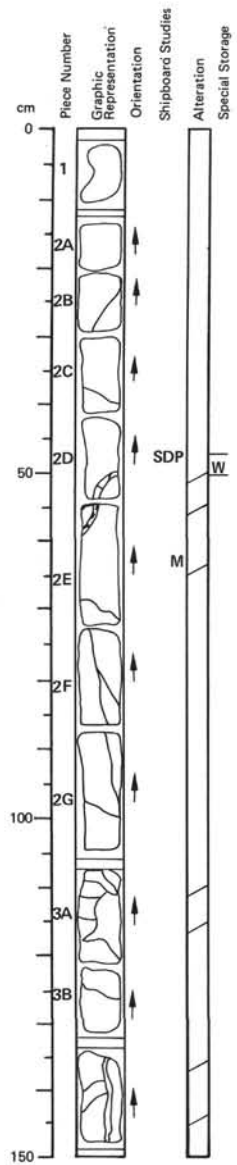
Vesicles: 2%, <0.7 mm, round

Alteration: olivine and glass to smectite; smectite and carbonate fill vesicles

Shipboard Data

Bulk Analysis: 139-141 cm	
SiO_2	50.8
Al_2O_3	16.7
Fe_2O_3	8.42
MgO	6.91
CaO	12.9
Na_2O	N.D.
K_2O	0.05
TiO_2	1.16
P_2O_5	N.D.
MnO	N.D.
LOI	1.9
H_2O^+	0.75
H_2O^-	N.D.
CO_2	0.11

Magnetic Data:	67-69 cm
NRM Intensity (emu/cc)	15.73×10^{-3}
Stable Inclination	16.5°
Physical Property Data:	9-11 cm
$\overline{V}p$ (km/sec)	5.09
Porosity (%)	9.4
Wet Bulk Density (g/cc)	2.725
Grain Density (g/cc)	2.88



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

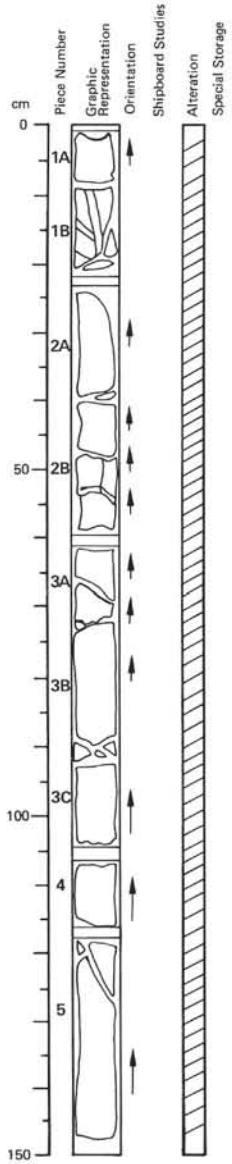
LEG	SITE	HOLE	CORE	SECT.
52	418	A	18	1

Visual Description

Moderately phyric massive basalt. Basalt is medium to dark gray; moderately altered. Plagioclase phenocrysts 10-15%, <3 mm, incipiently altered to smectite; olivine phenocrysts <1%, <1 mm, altered to smectite. Groundmass is fine-grained, often mottled due to distribution of plagioclase needles and dark groundmass minerals. Vesicles 2-3%, filled with smectite and carbonate. Piece 1 is a pyrite nodule (518 g) with minor smectite on the surface. Veins and veinlets are filled with smectite and carbonate.

Shipboard Data

Magnetic Data:	61-63 cm
NRM Intensity (emu/cc)	38.68×10^{-3}
Stable Inclination	+23.9°
Physical Property Data:	47-49 cm
$\overline{V}p$ (km/sec)	5.89
Porosity (%)	3.7
Wet Bulk Density (g/cc)	2.865
Grain Density (g/cc)	2.94

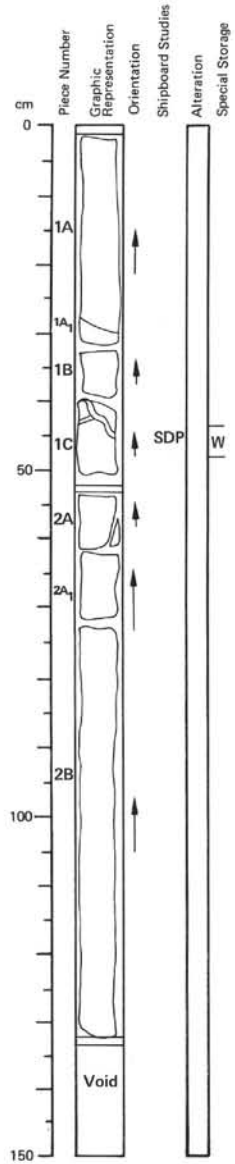


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		1	8	2

Visual Description

Sparsely phyric massive basalt. Basalt is gray to greenish-gray; moderately altered. Plagioclase phenocrysts 5%, <4 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite. Groundmass is fine-grained. Vesicles 4%, <2 mm, filled with smectite and some carbonate. Veins are filled with smectite and carbonate.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

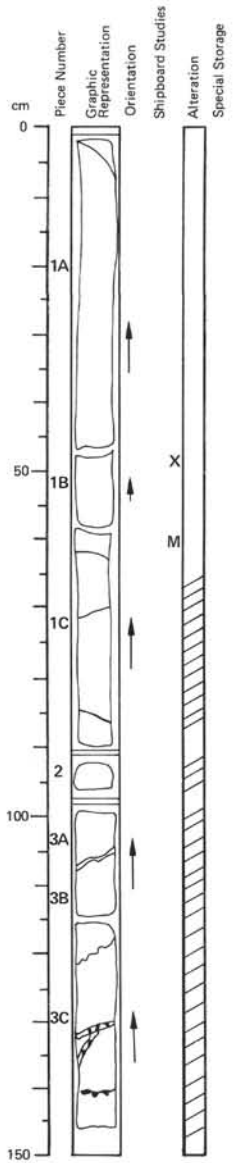
LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		1	8	3

Visual Description

Sparsely phyric massive basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 5-7%, <6 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite. Groundmass is fine-grained, uniform. Vesicles 2-4%, filled with smectite and carbonate. Scattered veins and veinlets are filled with carbonate, smectite and minor pyrite.

Shipboard Data

Physical Property Data:	44-46 cm
$\bar{V}p$ (km/sec)	5.93
Porosity (%)	6.7
Wet Bulk Density (g/cc)	2.885
Grain Density (g/cc)	2.99



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	18	4

Visual Description

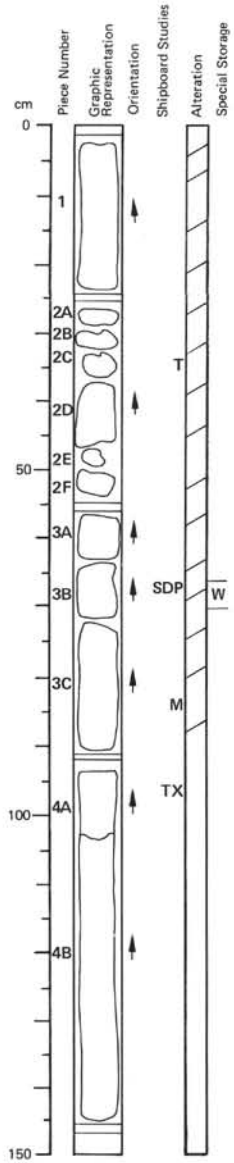
Sparsely phyric massive basalt. Basalt is gray to greenish-gray; relatively fresh to 60 cm, moderately to highly altered in lower part of section. Plagioclase phenocrysts 5-7%, ≤ 7 mm, mostly fresh. Groundmass is fine-grained uniform. Vesicles 2-3%, < 1 mm, filled with smectite and carbonate. Veins most common in lower part of section, filled with smectite, carbonate and minor pyrite.

Shipboard Data

Bulk Analysis: 48-50 cm

SiO_2	49.50
Al_2O_3	15.90
Fe_2O_3	10.30
MgO	7.11
CaO	12.80
Na_2O	1.99
K_2O	0.03
TiO_2	1.08
P_2O_5	0.12
MnO	0.16
LOI	1.7
H_2O^+	0.83
H_2O^-	N.D.
CO_2	0.10

Magnetic Data:	60-62 cm
NRM Intensity (emu/cc)	16.78×10^{-3}
Stable Inclination	+24.2°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	18	5

Visual Description

Sparsely phyric massive basalt. Basalt is gray to light gray, greenish-gray or reddish-brown where altered; highly altered in upper 95 cm, moderately altered in lower part of section. Plagioclase phenocrysts 7%, ≤3 mm, most fresh; olivine phenocrysts <1%, ≤ 1 mm, altered to smectite. Groundmass is fine-grained, uniform, highly altered from 0 to 95 cm; alteration has formed vuggy areas with vugs up to 10 mm, either open or partly filled with smectite, carbonate, silica, pyrite and zeolite(?); locally oxidized. Vesicles in piece 4 are about 1%, filled with smectite and carbonate. Pieces 3 and 4 may fit together but the relationship is not clear.

Thin Section Description

Location: 34 cm

Texture: porphyritic - quench

Phenocrysts: plagioclase, 15%, ≤3 mm, euhedral

Groundmass: olivine, 3%, 0.3 mm, subhedral; plagioclase, 25%, ≤0.5 mm, acicular; clinopyroxene, 50%, poorly crystallized radiating sheaves; opaque, 6%, 0.02 mm, euhedral

Vesicles: 1%, ≤0.8 mm, round; several large vugs to 2 cm

Alteration: plagioclase partly to zeolite(?); olivine to smectite; smectite, carbonate and zeolite(?) fill vesicles and vugs

Thin Section Description

Location: 95 cm

Texture: quench

Phenocrysts: plagioclase, <1%, 0.3 mm, subhedral

Groundmass: olivine, <1%, 0.3 mm, subhedral; plagioclase, 12%, ≤0.5 mm, acicular; clinopyroxene, 85%, radiating sheaves; opaque, 2% 0.01 mm, granular

Vesicles: <1%, 0.5 mm, round

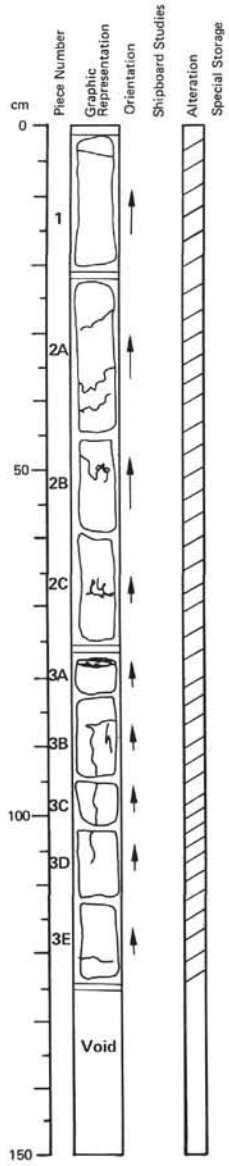
Alteration: olivine to carbonate; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 94-96 cm

SiO_2	50.50
Al_2O_3	15.90
Fe_2O_3	11.44
MgO	7.81
CaO	10.30
Na_2O	2.71
K_2O	0.10
TiO_2	1.55
P_2O_5	0.13
MnO	0.18
LOI	2.0
H_2O^+	1.29
H_2O^-	N.D.
CO_2	0.09

Magnetic Data:	82-86 cm
NRM Intensity (emu/cc)	16.82×10^{-3}
Stable Inclination	+22.7°
Physical Property Data:	64-66 cm
$\overline{V}p$ (km/sec)	3.98
Porosity (%)	23.5
Wet Bulk Density (g/cc)	2.405
Grain Density (g/cc)	2.88

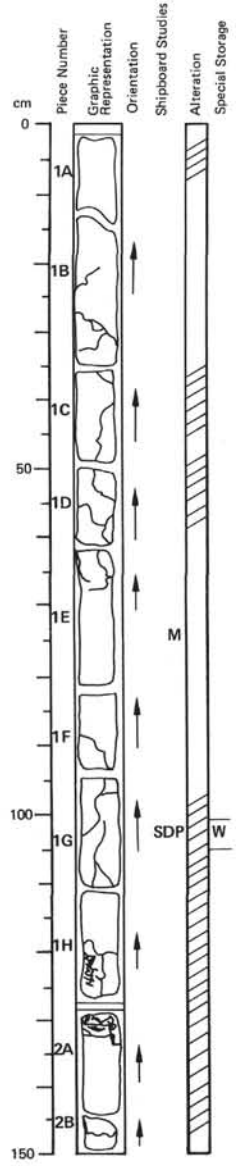


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		1	8	6

Visual Description

Sparsely phyric massive basalt. Basalt is gray to greenish-gray with brown staining along veins, particularly in piece 3A. Plagioclase phenocrysts unevenly distributed ranging from 4-7%, <5 mm, fresh. Groundmass is very fine-grained, uniform. Vesicles <1%, filled with smectite, carbonate and minor pyrite. Veins and veinlets present throughout, filled with carbonate, smectite and pyrite.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

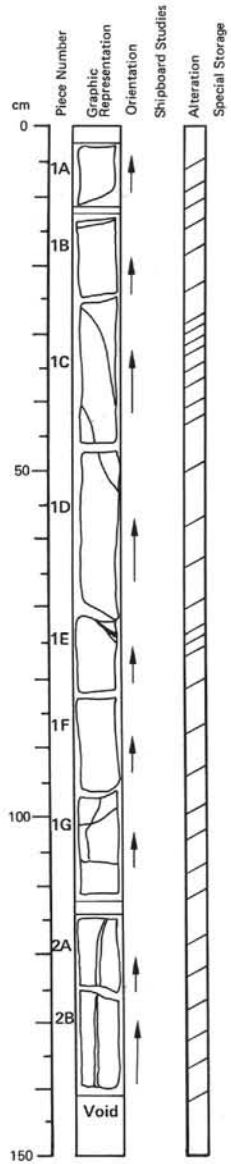
LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		1	9	1

Visual Description

Sparsely phyric massive basalt. Basalt is gray to greenish-gray; moderately to weakly altered. Plagioclase phenocrysts 5-8%, <3 mm, fresh. Groundmass is fine-grained with irregular patchy appearance. Vesicles <1%, filled with carbonate and smectite. Veins are filled with carbonate, smectite, zeolite(?) and minor silica(?).

Shipboard Data

Magnetic Data:	73-75 cm
NRM Intensity (emu/cc)	13.12×10^{-3}
Stable Inclination	+27.3°
Physical Property Data:	102-104 cm
$\overline{V}p$ (km/sec)	5.70
Porosity (%)	4.9
Wet Bulk Density (g/cc)	2.85
Grain Density (g/cc)	2.95

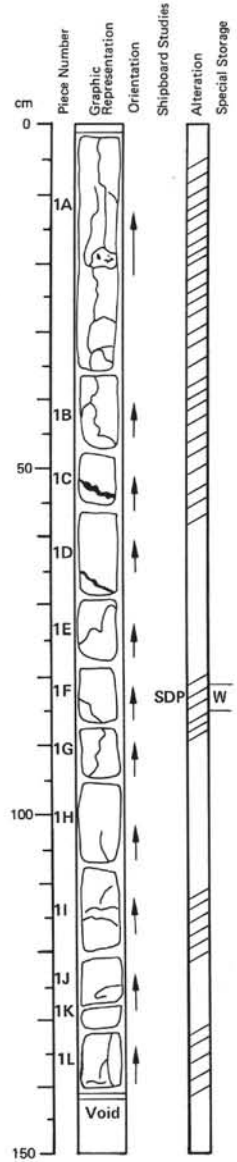


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	19	2

Visual Description

Sparsely to moderately phyric massive basalt. Basalt is gray to greenish-gray; moderately altered. Plagioclase phenocrysts 5-10%, <3 mm, fresh, occur either as single crystals or as glomerocrysts; olivine phenocrysts <1%, <1 mm, altered to smectite. Groundmass is fine- to medium-grained, uniform. Narrow veinlets cut entire section, filled with carbonate and smectite. Minor pyrite is disseminated in groundmass.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

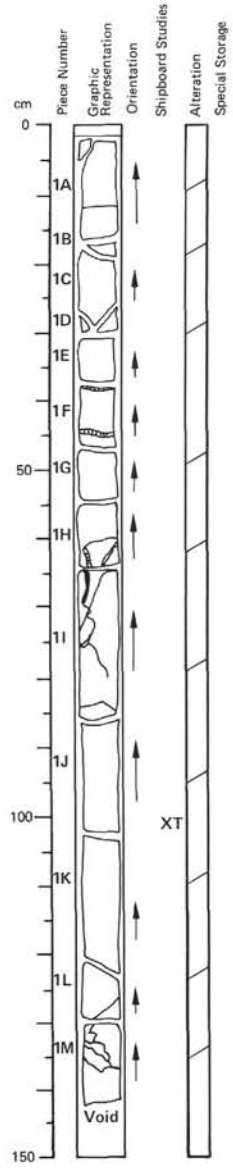
LEG	SITE	HOLE	CORE	SECT.
52	418	A	19	3

Visual Description

Sparsely phyric massive basalt. Basalt is gray to greenish-gray; moderately altered. Plagioclase phenocrysts 5-8%, <8 mm, fresh; olivine phenocrysts <1%, filled with smectite and carbonate. Veins cut entire section, filled with smectite, carbonate and minor pyrite. Some pyrite is also disseminated in groundmass.

Shipboard Data

Physical Property Data:	83-85 cm
$\bar{V}p$ (km/sec)	6.17
Porosity (%)	2.8
Wet Bulk Density (g/cc)	2.89
Grain Density (g/cc)	2.95



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
51	418	A	19	4

Visual Description

Sparsely to moderately phyric massive basalt. Basalt is medium to dark gray; relatively fresh. Plagioclase phenocrysts 7-10%, <5 mm, fresh; olivine phenocrysts <1%, <2 mm, altered to smectite. Groundmass is fine- to medium-grained, uniform, mottled. Vesicles <1%, filled with carbonate. Sparse veins filled with smectite and carbonate.

Thin Section Description

Location: 104 cm

Texture: porphyritic - quench

Phenocrysts: plagioclase, 10%, <3 mm, euhedral

Groundmass: olivine, 3%, 0.3 mm, euhedral; plagioclase, 10%, <0.5 mm, skeletal laths; clinopyroxene, 72%, radiating sheaves; opaque, 5%, 0.01 mm, granular

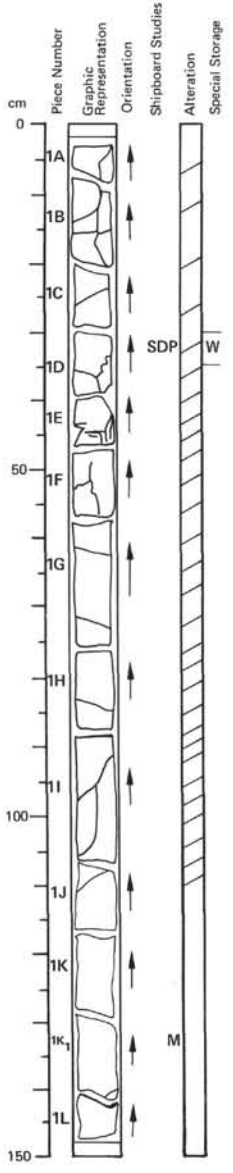
Vesicles: <1%, 0.2 mm, round

Alteration: olivine to smectite; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 102-105 cm

SiO_2	50.50
Al_2O_3	15.60
Fe_2O_3	10.22
MgO	7.44
CaO	12.80
Na_2O	2.03
K_2O	0.03
TiO_2	1.11
P_2O_5	0.11
MnO	0.16
LOI	1.2
H_2O^+	0.83
H_2O^-	N.D.
CO_2	0.07



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

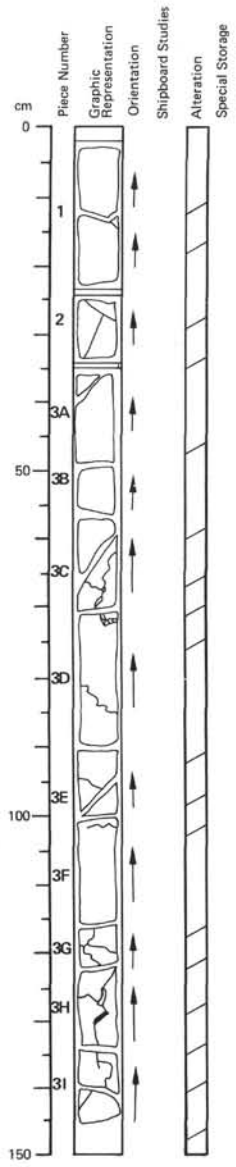
LEG	SITE	HOLE	CORE	SECT.
52	418	A	19	5

Visual Description

Sparsely to moderately phyric massive basalt. Basalt is gray to greenish-gray; moderately altered. Plagioclase phenocrysts 7-10%, <3 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite. Groundmass is fine- to medium-grained, uniform. Scattered veins are filled with carbonate and smectite.

Shipboard Data

Magnetic Data:	131-133 cm
NRM Intensity (emu/cc)	16.23×10^{-3}
Stable Inclination	+27.4°
Physical Property Data:	30-32 cm
$\bar{V}p$ (km/sec)	6.26
Porosity (%)	2.0
Wet Bulk Density (g/cc)	2.93
Grain Density (g/cc)	2.97

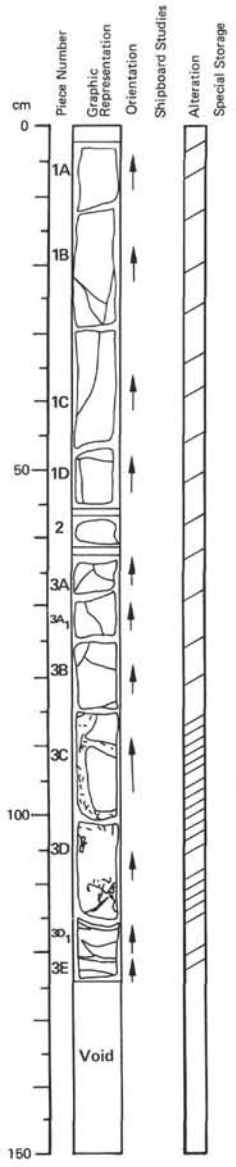


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		1	9	6

Visual Description

Sparsely to moderately phyric massive basalt. Basalt is gray to greenish-gray; relatively fresh. Plagioclase phenocrysts 7-10%, <3 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite. Groundmass is fine- to medium-grained, uniform, somewhat mottled due to variations in phenocrysts content. Vesicles 1%, filled with smectite. Scattered veinlets are filled with smectite, carbonate and minor pyrite.

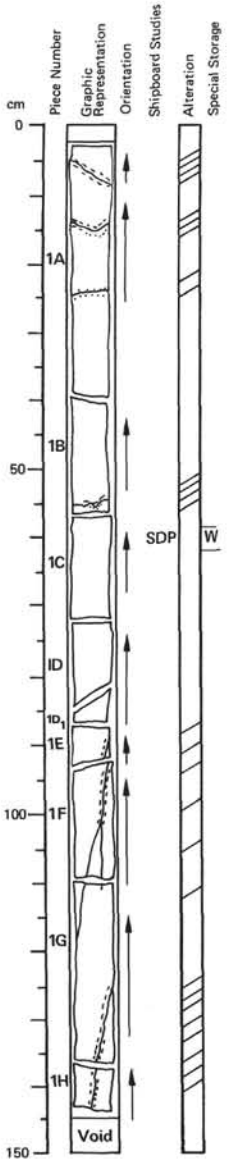


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		1	9	7

Visual Description

Sparsely phyric massive basalt. Basalt is medium gray to greenish-gray; moderately to highly altered. Plagioclase phenocrysts 5-8%, <3 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite. Groundmass is fine- to coarse-grained, with grain size increasing gradually downward. Scattered veinlets filled with smectite, carbonate and minor pyrite. Pyrite is also disseminated in groundmass. Two highly altered zones occur in pieces 3C and 3D.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

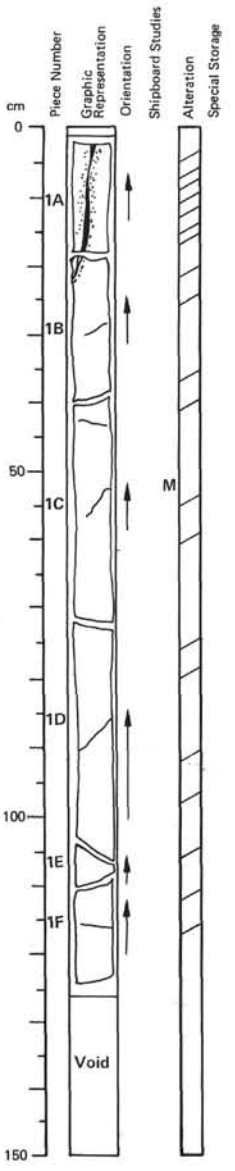
LEG	SITE	HOLE	CORE	SECT.
52	418	A	20	1

Visual Description

Sparsely to moderately phyric massive basalt. Basalt is gray to greenish-gray; weakly to moderately altered. Plagioclase phenocrysts 5-10%, ≤ 3 mm, fresh; olivine phenocrysts < 1%, ≤ 1 mm, altered to smectite. Groundmass is holocrystalline, medium- to coarse-grained, uniform. Scattered veins are filled with smectite and carbonate.

Shipboard Data

Physical Property Data:	59-61 cm
$\overline{V}p$ (km/sec)	6.11
Porosity (%)	2.5
Wet Bulk Density (g/cc)	2.905
Grain Density (g/cc)	2.96



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

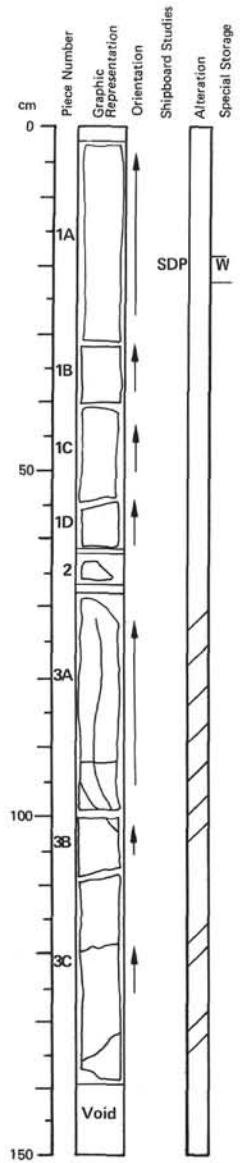
LEG	SITE	HOLE	CORE	SECT.
52	418	A	20	2

Visual Description

Sparsely to moderately phyric massive basalt. Basalt is gray to greenish-gray; weakly to moderately altered. Plagioclase phenocrysts 7-10%, ≤ 10 mm, fresh; olivine phenocrysts < 1%, ≤ 1 mm, altered to smectite. Groundmass is fine- to medium-grained, uniform. Vesicles < 1%, filled with carbonate. Scattered veins are also filled with carbonate. Minor smectite occurs in groundmass.

Shipboard Data

Magnetic Data:	57-59 cm
NRM Intensity (emu/cc)	4.82×10^{-3}
Stable Inclination	+30.9°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

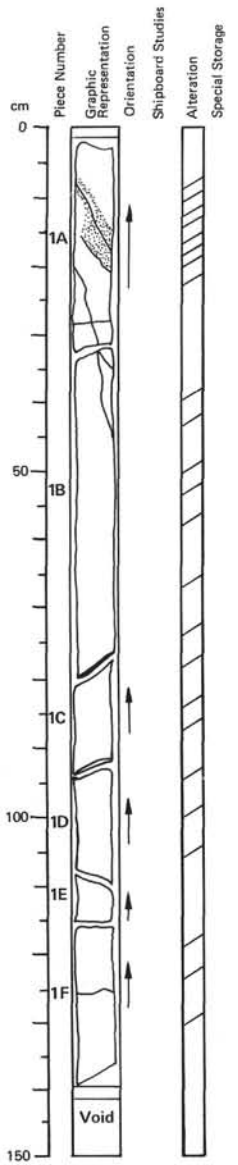
LEG	SITE	HOLE	CORE	SECT.
52	418	A	20	3

Visual Description

Sparsely to moderately phyric massive basalt. Basalt is gray to greenish-gray; weakly altered. Plagioclase phenocrysts 5-10%, <4 mm, fresh; olivine phenocrysts <1%, <1.5 mm, altered to smectite, somewhat irregular in distribution. Groundmass is holocrystalline, medium- to coarse-grained, uniform. Sparse veins are filled with carbonate and smectite. Minor smectite and pyrite occur in groundmass.

Shipboard Data

Physical Property Data:	19-21 cm
$\overline{V}p$ (km/sec)	5.95
Porosity (%)	2.3
Wet Bulk Density (g/cc)	2.925
Grain Density (g/cc)	2.96

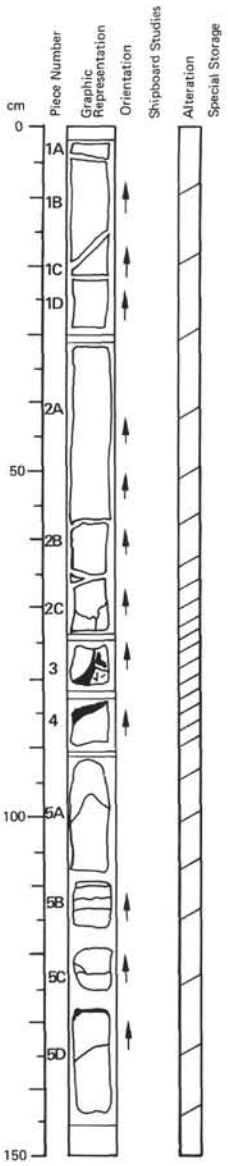


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	20	4

Visual Description

Sparsely to moderately phyric massive basalt. Basalt is gray to greenish-gray; weakly to moderately altered. Plagioclase phenocrysts 7-10%, <8 mm, fresh; olivine phenocrysts 1%, <5 mm, altered to smectite and carbonate. Groundmass is holocrystalline, medium-grained, uniform. Vesicles <1%, filled with smectite. Sparse veinlets also filled with smectite; prominent veins in piece 1 filled with smectite and pyrite. Minor smectite also occurs in groundmass.

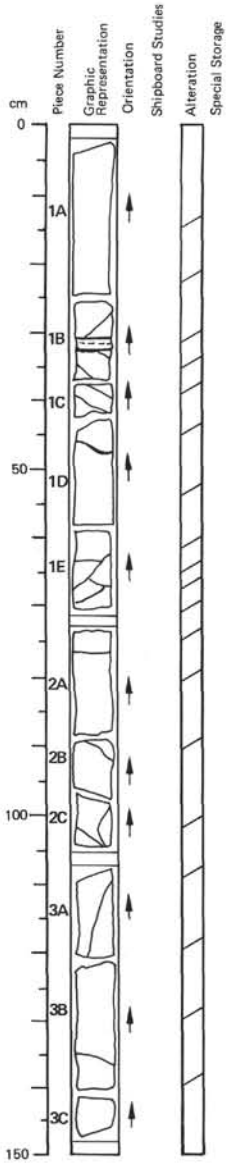


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	20	5

Visual Description

Sparsely phyric massive basalt. A cooling break occurs between pieces 3 and 4 but the basalt above and below is mineralogically similar. Basalt is medium to dark gray; relatively fresh. Plagioclase phenocrysts 5-7%, <4 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite. Groundmass is fine- to medium-grained, decreasing in grain size toward the glass selvedges on pieces 3 and 4; glass selvedges are completely altered to smectite. Vesicles 1-2%, filled with smectite, carbonate and minor pyrite. Sparse veins also are filled with smectite and carbonate.

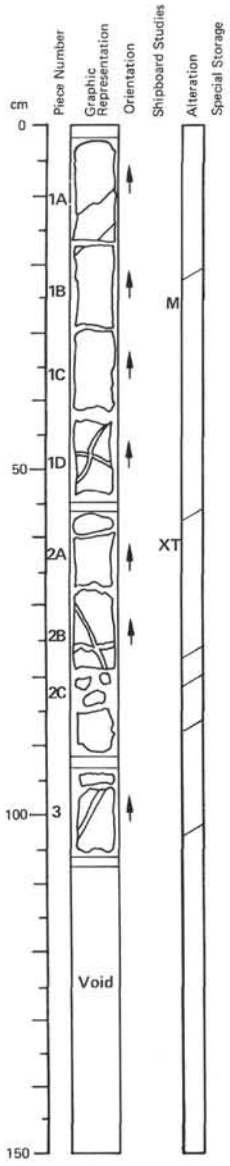


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	20	6

Visual Description

Sparsely phyric massive basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 5-7%, <3 mm, fresh; olivine phenocrysts <1%, <2 mm, altered to smectite. Groundmass is holocrystalline, fine- to medium-grained, somewhat mottled. Vesicles 1%, filled with smectite and minor carbonate. Veins are common, filled mostly with smectite and minor carbonate and pyrite; prominent vein in piece 1B also has silica. Pyrite is also disseminated in groundmass.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	20	7

Visual Description

Sparsely phyric massive basalt. Basalt is gray to greenish-gray; weakly altered. Plagioclase phenocrysts 7%, ≤5 mm, fresh; olivine phenocrysts 1%, ≤3 mm, altered to smectite. Groundmass is holocrystalline, fine- to medium-grained, uniform. Vesicles 2%, ≤2 mm, filled with smectite and carbonate. Veinlets are common, filled with smectite and carbonate.

Thin Section Description

Location: 63 cm

Texture: porphyritic - quench

Phenocrysts: plagioclase, 7%, ≤3 mm, euhedral

Groundmass: olivine, 4%, ≤0.5 mm, euhedral; plagioclase, 40%, ≤0.5 mm, acicular; clinopyroxene, 42%, 0.1 mm, granular to radiating sheaves; opaque, 2%, 0.02 mm, granular; glass, 3%, devitrified

Vesicles: 2%, ≤0.8 mm, round

Alteration: olivine to smectite; smectite and carbonate fill vesicles

Shipboard Data

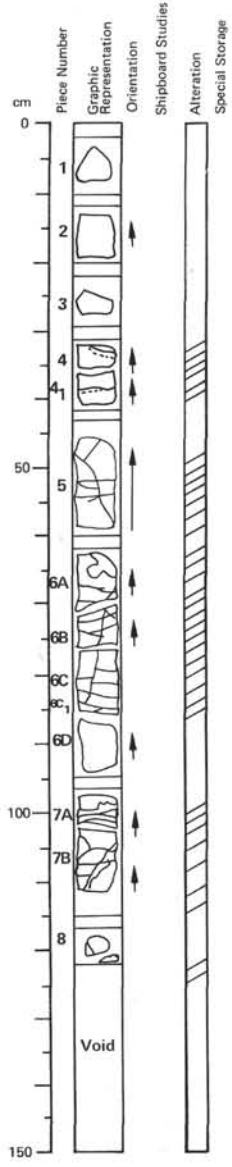
Bulk Analysis: 62-64 cm

SiO_2	50.60
Al_2O_3	16.00
Fe_2O_3	10.39
MgO	7.53
CaO	12.80
Na_2O	2.10
K_2O	0.03
TiO_2	1.13
P_2O_5	0.11
MnO	0.16
LOI	1.16
H_2O^+	0.79
H_2O^-	N.D.
CO_2	0.06

Magnetic Data: 24-26 cm

NRM Intensity (emu/cc): 41.67×10^{-3}

Stable Inclination: +22.5°

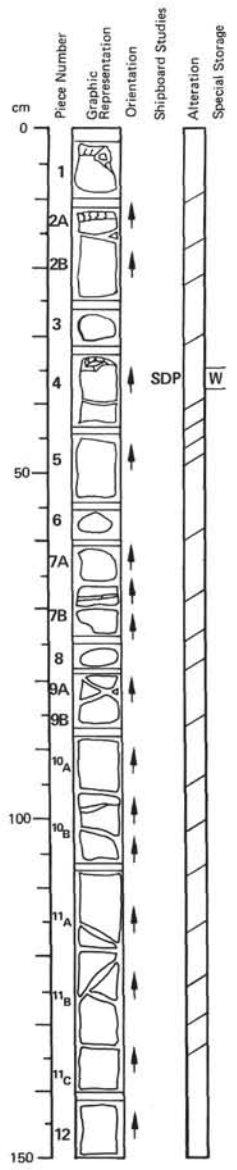


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	21	1

Visual Description

Sparsely phyric massive basalt. Basalt is gray to greenish-gray; weakly to moderately altered. Plagioclase phenocrysts 5-8%, ≤3 mm, fresh; olivine phenocrysts <1%, ≤1 mm, altered to smectite. Groundmass is holocrystalline, fine- to medium-grained; piece 6D is somewhat coarser grained than the rest of the section but grades into the finer-grained portions. Vesicles 1-2%, ≤1 mm, filled with carbonate and smectite. Basalt is heavily veined, especially in pieces 5 through 8; veins are filled with carbonate, smectite, silica(?) and zeolite(?).



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

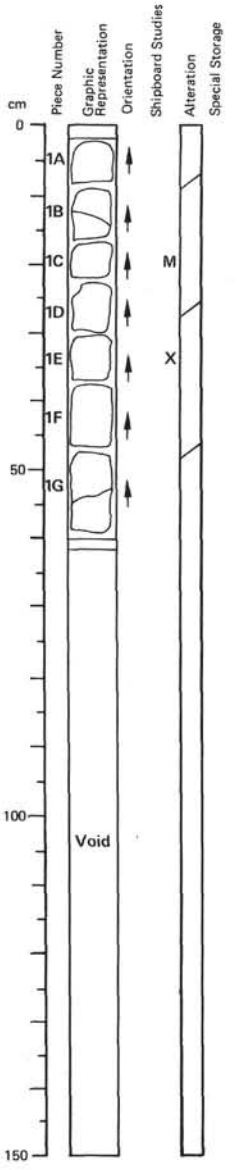
LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A	2	2		1

Visual Description

Sparsely phyric massive basalt. Basalt is gray to greenish-gray; moderately altered. Plagioclase phenocrysts 5%, <5 mm, fresh, though often stained green; olivine phenocrysts <1%, <1 mm, altered to smectite. Groundmass is holocrystalline, fine-grained, often mottled. Vesicles <1%, <1 mm, filled with carbonate and smectite. Veins are common, filled with carbonate, smectite and pyrite. Pyrite is also disseminated in groundmass.

Shipboard Data

Physical Property Data:	35-37 cm
$\overline{V}p$ (km/sec)	5.59
Porosity (%)	6.8
Wet Bulk Density (g/cc)	2.79
Grain Density (g/cc)	2.93



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A	2	2		2

Visual Description

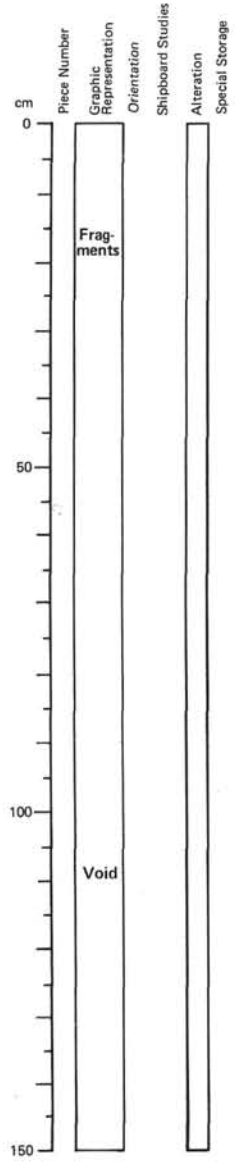
Sparsely phyric massive basalt. Basalt is medium gray; weakly altered. Plagioclase phenocrysts 7%, <4 mm, fresh or stained along cleavages, often in glomerocrysts; olivine phenocrysts 1%, <1 mm, altered to smectite. Groundmass is holocrystalline, fine-grained, often mottled due to uneven distribution of plagioclase needles. Vesicles 1%, <1 mm, filled with smectite and carbonate. Sparse veins are filled with smectite, carbonate and minor pyrite.

Shipboard Data

Bulk Analysis: 33-35 cm

SiO_2	50.90
Al_2O_3	16.20
Fe_2O_3	10.98
MgO	6.28
CaO	13.40
Na_2O	2.09
K_2O	0.05
TiO_2	1.15
P_2O_5	0.12
MnO	0.17
LOI	1.3
H_2O^+	0.82
H_2O^-	N.D.
CO_2	0.08

Magnetic Data:	19-21 cm
NRM Intensity (emu/cc)	48.25×10^{-3}
Stable Inclination	+26.0°

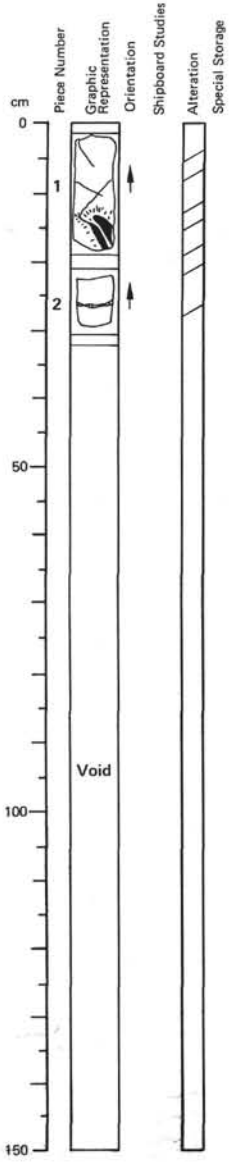


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		2	2	3

Visual Description

Sparsely phyric massive basalt. Section consists of 9 basalt fragments that stuck in the pipe after pulling Core 22. Two fragments fit together. The fragments are lithologically similar to the remainder of Core 22 and are probably derived from the interval below Core 22, Section 2, 60 cm and above the bit.

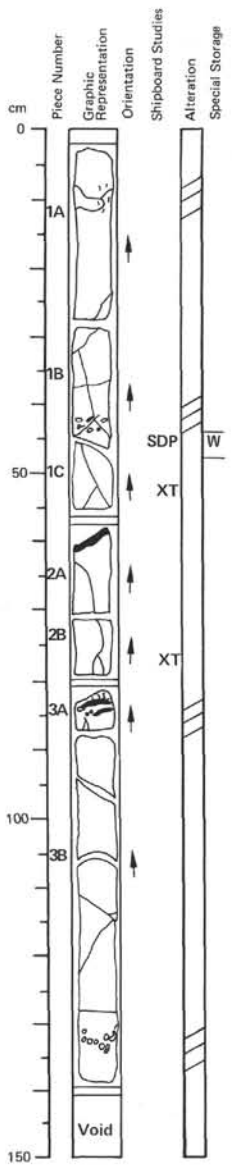


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		2	3	1

Visual Description

Sparsely phyric basalt. Basalt is gray to greenish-gray; slightly altered. Plagioclase phenocrysts 7%, ≤5 mm, partly altered and stained green; olivine phenocrysts 1%, ≤3 mm, altered to smectite. Groundmass is fine-grained to glassy; glass zone in piece 1 is surrounded by a fine-grained zone; glass is fresh. Veins filled with carbonate and smectite.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	24	1

Visual Description

Sparsely phyric pillow basalt. Basalt is medium to dark gray; relatively fresh. Plagioclase phenocrysts 5%, <3 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite; clinopyroxene phenocrysts <1%, <2 mm, rounded, fresh. Groundmass is fine-grained to glassy; glass selvedges are mostly altered to smectite but fresh glass is present in piece 3A. Vesicles <1%, <0.5 mm, filled with smectite and carbonate. Veins are filled with smectite, carbonate and minor pyrite. Vuggy patches of carbonate occur in pieces 1B and 3B.

Thin Section Description

Location: 54 cm

Texture: porphyritic - quench

Phenocrysts: plagioclase, 8%, <3.5 mm, euhedral

Groundmass: olivine, 3%, 0.2 mm, subhedral; plagioclase, 45%, <0.5 mm, laths; clinopyroxene, 34%, <0.1 mm, granular to radiating sheaves; opaque, 3%, 0.02 mm, granular; glass, 5%, altered

Vesicles: 2%, 0.5 mm, round

Alteration: olivine and glass to smectite; smectite and carbonate fill vesicles

Thin Section Description

Location: 78 cm

Texture: porphyritic - quench

Phenocrysts: plagioclase, 10%, <8 mm, euhedral

Groundmass: olivine, 4%, 0.5 mm, euhedral; plagioclase, 15%, <0.5 mm, acicular; clinopyroxene, 69%, poorly cyrstallized, radiating sheaves; opaque, 1%, 0.01 mm, granular

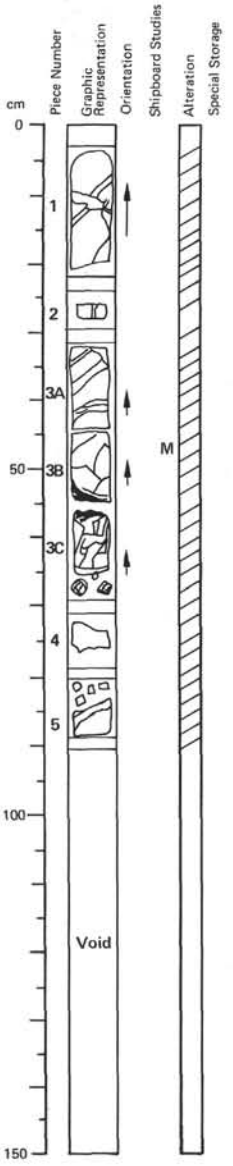
Vesicles: 1%, 0.2 mm, round

Alteration: plagioclase partly to smectite; olivine to smectite; smectite and carbonate fill vesicles.

Shipboard Data

Bulk Analysis:	50-52 cm	79 cm
SiO_2	50.30	50.40
Al_2O_3	16.00	17.00
Fe_2O_3	10.01	9.57
MgO	7.30	6.11
CaO	13.20	12.20
Na_2O	2.02	2.34
K_2O	0.03	0.08
TiO_2	1.13	1.18
P_2O_5	0.11	0.12
MnO	0.16	0.12
LOI	1.8	2.0
H_2O^+	0.82	1.13
H_2O^-	N.D.	N.D.
CO_2	0.07	0.06

Physical Property Data:	45-47 cm
$\overline{V}p$ (km/sec)	5.95
Porosity (%)	4.8
Wet Bulk Density (g/cc)	2.885
Grain Density (g/cc)	2.96



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

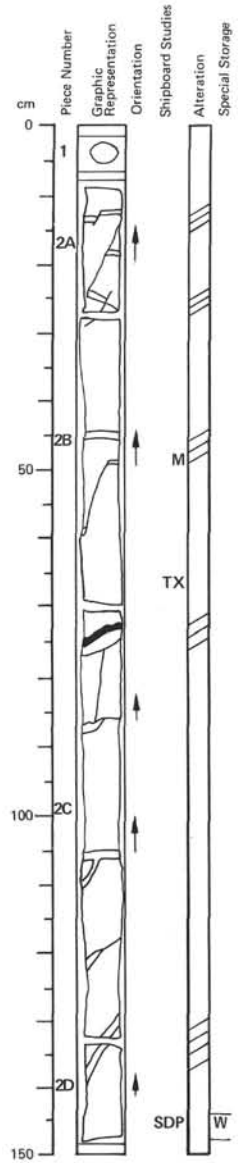
LEG	SITE	HOLE	CORE	SECT.
52	418	A	24	2

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray; moderately altered. Plagioclase phenocrysts 10%, <4 mm, fresh; olivine phenocrysts 1%, <2 mm, altered to carbonate and smectite; clinopyroxene phenocrysts <1%, <2 mm, fresh, in glomerocrysts with plagioclase. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles 1%, <2 mm, filled with carbonate and smectite. Veins are present throughout, some 1 cm wide, filled with smectite, carbonate, silica and minor pyrite. Groundmass is partly replaced by smectite in pieces 1 and 2A. Piece 3C is somewhat brecciated.

Shipboard Data

Magnetic Data:	45-47 cm
NRM Intensity (emu/cc)	14.59×10^{-3}
Stable Inclination	+31.8°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		2	5	1

Visual Description

Moderately phyric to aphyric pillow basalt. Phenocrysts distribution is uneven, mostly moderately phyric but with aphyric zones from 8 to 22 cm and 48 to 72 cm. Basalt is medium to dark gray; slightly altered. Plagioclase phenocrysts 0-10%, <3 mm, fresh; olivine phenocrysts 0-1%, <3 mm, fresh; olivine phenocrysts 0-1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 0-1%, <2 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite; fresh glass occurs at 75 cm; in aphyric zones groundmass is somewhat granular. Vesicles 0-2%, unevenly distributed, <1 mm, filled with smectite and carbonate. Veins are common, some up to 1 cm wide, filled with smectite and carbonate; some show slight oxidation.

Thin Section Description

Location: 67 cm

Texture: aphyric - quench

Phenocrysts: none

Groundmass: olivine, <1%, ≤0.2 mm, euhedral; plagioclase, 50%, 0.2 mm, skeletal; clinopyroxene, 45%, radiating sheaves; opaque, 4%, 0.02 mm, granular

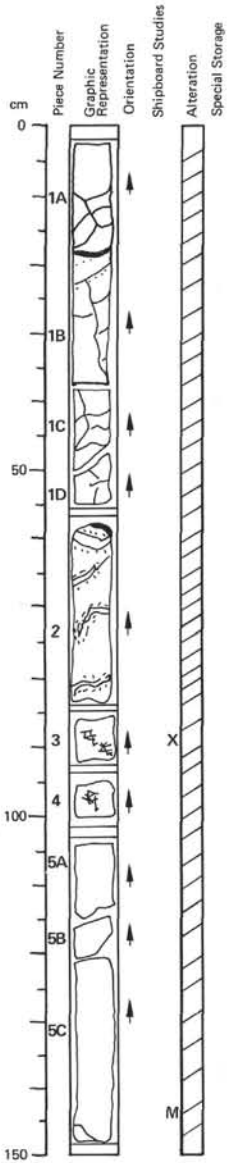
Vesicles: 1%, <0.2 mm, ground

Alteration: olivine and minor interstitial material to smectite; smectite and carbonate fill vesicles

Shipboard Data

Bulk Analysis: 66-67 cm	
SiO_2	50.80
Al_2O_3	15.30
Fe_2O_3	10.32
MgO	7.40
CaO	12.90
Na_2O	2.30
K_2O	0.04
TiO_2	1.31
P_2O_5	0.13
MnO	0.16
LOI	1.7
H_2O^+	0.65
H_2O^-	N.D.
CO_2	0.15

Magnetic Data:	47-49 cm
NRM Intensity (emu/cc)	13.66×10^{-3}
Stable Inclination	+35.0°
Physical Property Data:	145-147 cm
$\bar{V}p$ (km/sec)	5.63
Porosity (%)	5.8
Wet Bulk Density (g/cc)	2.82
Grain Density (g/cc)	2.91



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		2	5	2

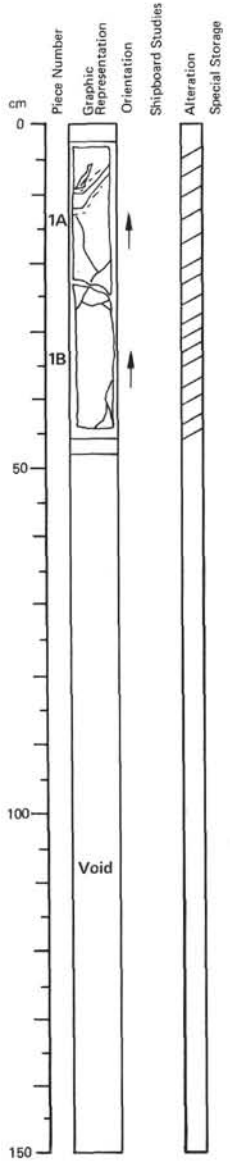
Visual Description

Moderately phyric to aphyric pillow basalt. Most of section is moderately phyric; pieces 3 and 4 are aphyric. Basalt is gray to greenish-gray; moderately altered. Plagioclase phenocrysts 0-10%, ≤3 mm, fresh; olivine phenocrysts 0-1%, <2 mm, altered to smectite; clinopyroxene phenocrysts <1%, <2 mm, anhedral, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles 1-2%, <1 mm, filled with carbonate and smectite. Veins are common, some to 1 cm wide, filled with carbonate and smectite.

Shipboard Data

Bulk Analysis: 87-89 cm	
SiO_2	50.00
Al_2O_3	15.70
Fe_2O_3	11.11
MgO	7.81
CaO	12.40
Na_2O	2.23
K_2O	0.04
TiO_2	1.39
P_2O_5	0.11
MnO	0.16
LOI	1.9
H_2O^+	0.85
H_2O^-	N.D.
CO_2	0.09

Magnetic Data:	142-144 cm
NRM Intensity (emu/cc)	9.49×10^{-3}
Stable Inclination	+33.6°

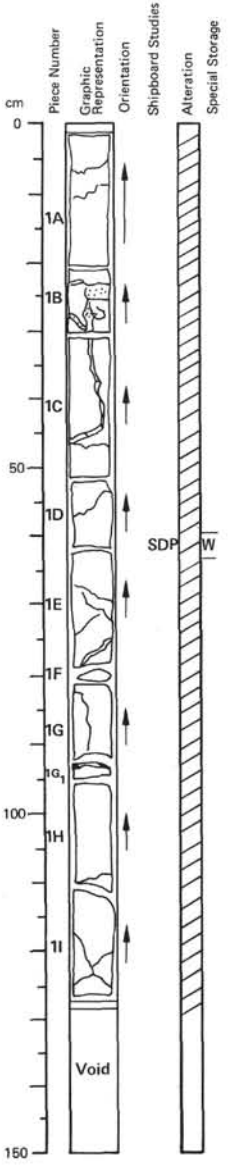


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	25	3

Visual Description

Sparsely phyric to aphyric basalt. Basalt is aphyric at top of section, gradually becoming sparsely phyric in piece 1B. Basalt is gray to greenish-gray; moderately altered. Plagioclase phenocryst 0-6%, <4 mm, fresh. Groundmass is fine-grained but no glass selvedges are present. Vesicles 1-2%, filled with smectite and carbonate. Veins are filled with carbonate and smectite. Minor pyrite occurs in groundmass.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

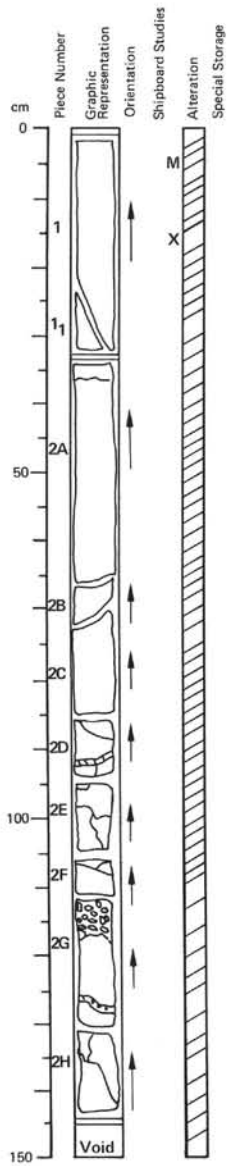
LEG	SITE	HOLE	CORE	SECT.
52	418	A	26	1

Visual Description

Sparsely phyric massive basalt. Basalt is gray to greenish-gray, reddish-brown along oxidized veins; moderately altered. Plagioclase phenocrysts 5%, <5 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 1%, <2 mm, fresh. Groundmass is fine-grained, often mottled due to slight variations in grain size. Vesicles <1%, filled with smectite and carbonate. Veins and veinlets are present throughout section, filled with smectite, carbonate and minor silica. Some veins are slightly oxidized.

Shipboard Data

Physical Property Data:	60-62 cm
$\overline{V}p$ (km/sec)	5.88
Porosity (%)	4.3
Wet Bulk Density (g/cc)	2.885
Grain Density (g/cc)	2.95



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	2	4	1	8	A	2	6	2

Visual Description

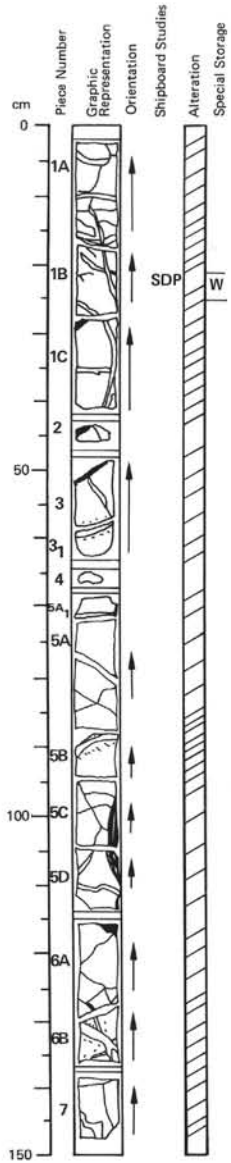
Sparsely phyric massive basalt and pillow basalt. Massive basalt occurs from top of section to base of piece 2F at 110 cm; pillow basalt extends from 110 cm to base of section. Massive basalt is gray to greenish-gray; moderately altered. Plagioclase phenocrysts 7%, <5 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite; clinopyroxene phenocrysts <1%, <2 mm, fresh. Groundmass is medium-grained to very fine-grained, generally decreasing in grain size downward. Vesicles <1%, filled with carbonate and smectite. Veins are common between 85 and 110 cm, filled with carbonate and smectite. Pillow basalt is gray to greenish-gray, reddish-brown where stained along oxidized veins; highly altered. Plagioclase phenocrysts 5%, <4 mm, fresh; olivine 1%, <1 mm, altered to smectite; clinopyroxene phenocrysts <1%, <2 mm, fresh. Groundmass is very fine-grained. Many veins and veinlets are present, filled with smectite and carbonate. Minor breccia occurs at top of pillow sequence in piece 2G.

Shipboard Data

Bulk Analysis: 14-17 cm

SiO_2	50.90
Al_2O_3	16.00
Fe_2O_3	10.94
MgO	6.82
CaO	13.70
Na_2O	1.96
K_2O	0.03
TiO_2	1.13
P_2O_5	0.11
MnO	0.17
LOI	1.7
H_2O^+	0.84
H_2O^-	N.D.
CO_2	0.41

Magnetic Data:	3-5 cm
NRM Intensity (emu/cc)	12.01×10^{-3}
Stable Inclination	+23.0°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

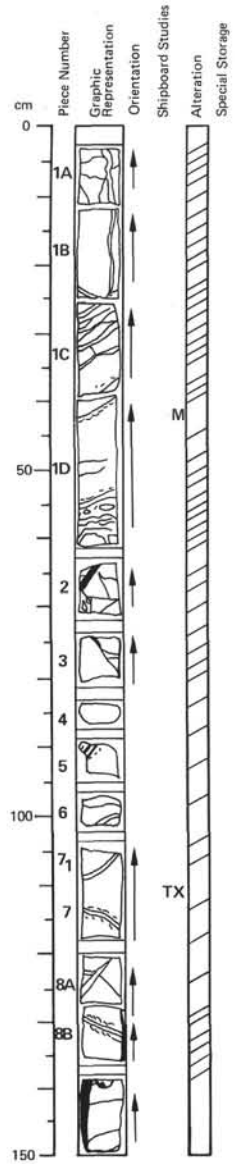
LEG		SITE			HOLE	CORE		SECT.
5	2	4	1	8	A	2	6	3

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray, reddish-brown in some oxidized zones; moderately altered. Plagioclase phenocrysts 8-10%, <4 mm, fresh, occur as single crystals or in glomerocrysts; olivine phenocrysts 1%, <1 mm, altered to smectite, irregularly distributed; clinopyroxene phenocrysts <1%, <2 mm, fresh, rounded. Groundmass is fine-grained to glassy; glass selvedges are mostly altered to smectite but some fresh glass is present in pieces 5C and 5D. Veins are common throughout, filled with smectite and carbonate. Minor pyrite is disseminated in groundmass.

Shipboard Data

Physical Property Data:	21-23 cm
$\overline{V}p$ (km/sec)	5.22
Porosity (%)	8.0
Wet Bulk Density (g/cc)	2.72
Grain Density (g/cc)	2.86



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 2	4 1 8	A	2 6	4

Visual Description

Moderately phyric pillow basalt. Basalt is greenish-gray; moderately to highly altered. Plagioclase phenocrysts 8-10%, <5 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are mostly altered to smectite but some fresh glass is present in the core catcher sample. Mostly non-vesicular, but rare vesicles occur in breccia of piece 2; vesicles <1 mm, filled with carbonate. Scattered veins are filled with carbonate, smectite and minor pyrite. Some pyrite is also disseminated in groundmass.

Thin Section Description

Location: 112 cm

Texture: porphyritic - quench

Phenocrysts: olivine, 1%, <1 mm, euhedral; plagioclase, 10%, <2 mm, euhedral

Groundmass: olivine, 2%, <0.2 mm, subhedral, plagioclase, 12%, <0.3 mm, skeletal; clinopyroxene, 69%, very poorly crystallized; opaque, 4%, 0.02 mm, granular

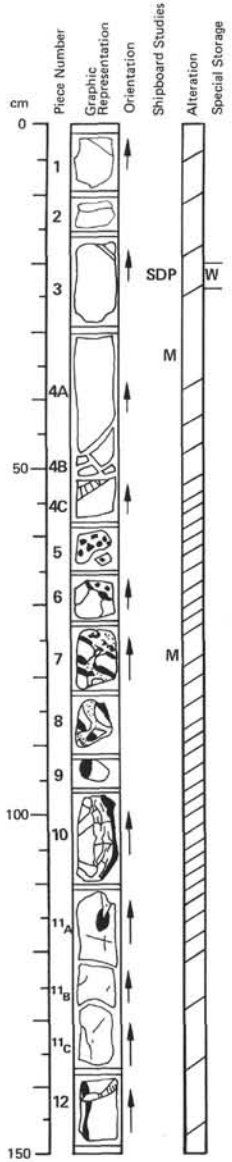
Vesicles: 2%, <0.4 mm, round

Alteration: olivine to smectite and carbonate; smectite and carbonate fill vesicles

Shipboard Data

Bulk Analysis: 111-114 cm	
SiO_2	49.70
Al_2O_3	18.30
Fe_2O_3	9.14
MgO	7.03
CaO	12.60
Na_2O	2.25
K_2O	0.07
TiO_2	1.28
P_2O_5	0.12
MnO	0.21
LOI	2.5
H_2O^+	1.23
H_2O^-	N.D.
CO_2	0.50

Magnetic Data:	41-43 cm
NRM Intensity (emu/cc)	17.56×10^{-3}
Stable Inclination	+26.5°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 2	4 1 8	A	2 7	1

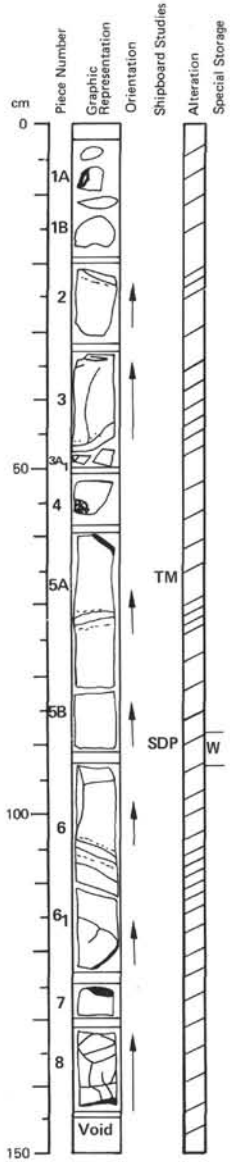
Visual Description

Sparsely to moderately phyric pillow basalt and broken pillow breccia. Pillow basalt occurs in the upper and lower parts of the section and is separated by breccia in the interval between 60 and 95 cm. Pillow basalt is medium to dark gray; relatively fresh. Phenocryst distribution is non-uniform, ranging from 2-5% in the upper part of the section to 15-20% in the lower part. Plagioclase phenocrysts 2-18%, <9 mm, fresh; olivine phenocrysts 0-3%, <4 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Fractures are filled with smectite and carbonate. Piece 11A has glass zone at end of fracture suggesting fracturing during quenching. Breccia is dark greenish-gray; moderately altered. Angular fragments of crystalline basalt and glass are in a matrix of dark green smectite.

Shipboard Data

	31-33 cm	78-80 cm
Magnetic Data:		
NRM Intensity (emu/cc)	12.48×10^{-3}	5.96×10^{-3}
Stable Inclination	+22.8°	+54.8°

Physical Property Data:	21-23 cm
$\bar{V}p$ (km/sec)	5.30
Porosity (%)	8.8
Wet Bulk Density (g/cc)	2.74
Grain Density (g/cc)	2.90



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A	2	7		2

Visual Description

Sparsely to moderately phyric pillow basalt. Basalt is gray to greenish-gray; moderately altered. Phenocrysts distribution is variable ranging from 1-2% in pieces 7 and 8 to 15% in pieces 5 and 6. Plagioclase phenocrysts 2-14%, <2 mm, fresh; olivine phenocrysts 0-1%, <1 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges partly altered to smectite. Vesicles <1%, <1 mm, filled with carbonate. Veins and veinlets are filled with smectite, carbonate and minor pyrite.

Thin Section Description

Location: 69 cm

Texture: porphyritic - quench

Phenocrysts: olivine, 2%, <0.8 mm, euhedral; plagioclase, 8%, <2.5 mm, euhedral

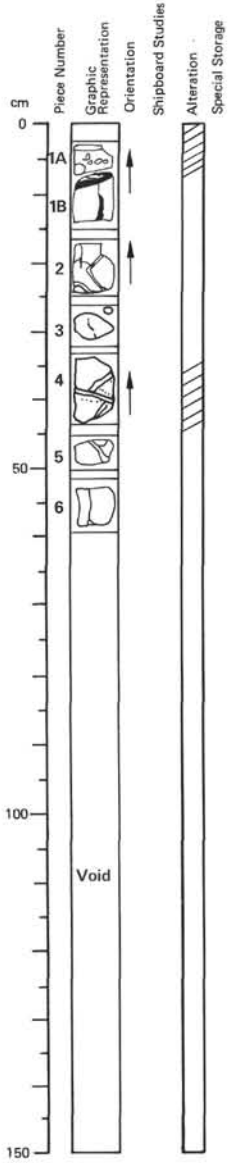
Groundmass: plagioclase, 10%, <0.2 mm, acicular; clinopyroxene, 75%, radiating sheaves; opaque, 4% 0.01 mm, granular

Vesicles: 1%, 0.2 mm, round to ovoid

Alteration: olivine and minor plagioclase to smectite; smectite fills vesicles

Shipboard Data

Magnetic Data:	67-69 cm
NRM Intensity (emu/cc)	20.19×10^{-3}
Stable Inclination	+36.6°
Physical Property Data:	*88-90 cm*
$\overline{Vp}$ (km/sec)	5.31
Porosity (%)	8.1
Wet Bulk Density (g/cc)	2.73
Grain Density (g/cc)	2.86

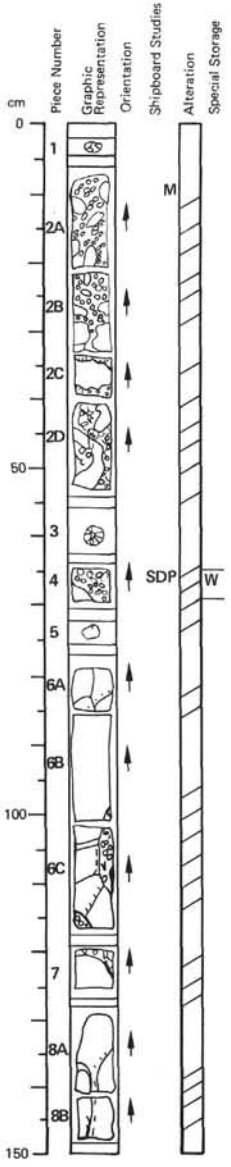


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A	2	7		3

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray; weakly to moderately altered. Plagioclase phenocrysts 10%, <4 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles <1%, <1 mm, filled with carbonate and smectite. Veins are also filled with smectite and carbonate. Piece 1A is sideromelane breccia derived from pillow rinds; partly altered glass fragments are in a green smectite matrix.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

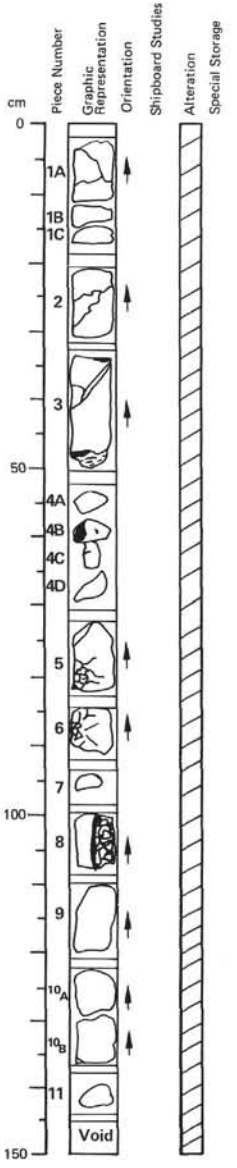
LEG		SITE			HOLE	CORE		SECT.
5	2	4	1	8	A	2	8	1

Visual Description

Moderately phyric pillow basalt and pillow breccia. Breccia and pillow basalt are intermixed; breccia occurs at and between glassy pillow margins. Basalt is gray to greenish-gray; moderately altered. Plagioclase phenocrysts 5-10%, <6 mm, normally fresh but stained green or yellow near altered breccia zones; olivine phenocrysts 1%, <1 mm, altered to smectite. Groundmass is very fine-grained to glassy; glass selvedges are completely altered to smectite. Vesicles <1%, <0.5 mm, filled with smectite and carbonate. Scattered veins are filled with smectite and carbonate. Breccia is dark green to greenish-gray; intensely altered. Breccia consists of angular fragments of crystalline basalt and glass mineralogically similar to the pillow basalts, with a matrix of dark green smectite. All glass fragments are altered to smectite and most smectite in the matrix probably formed by alteration of glass. Carbonate and pink zeolite(?) replace some matrix material.

Shipboard Data

Magnetic Data:	11-13 cm
NRM Intensity (emu/cc)	0.035×10^{-3}
Stable Inclination	-35.5°
Physical Property Data:	65-67 cm
$\overline{V}p$ (km/sec)	3.47
Porosity (%)	30.1
Wet Bulk Density (g/cc)	2.28
Grain Density (g/cc)	2.84

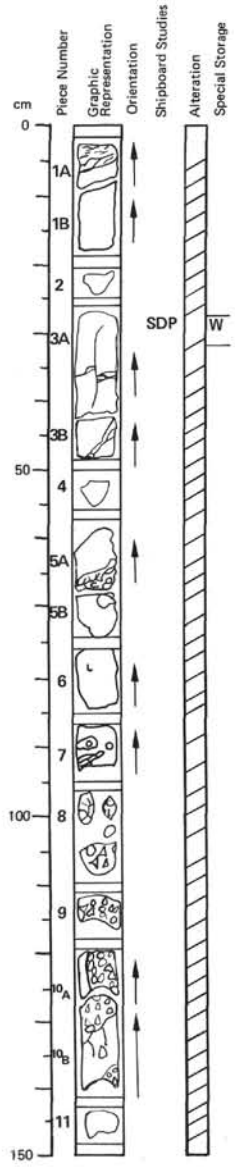


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	2	4	1	8	A	2	8	2

Visual Description

Moderately to highly phyric pillow basalt. Basalt is gray to greenish-gray; moderately altered. Phenocryst content is variable ranging from 10-15% in pieces 1 to 8 to about 25% in pieces 9 to 11. Plagioclase phenocrysts 10-20%, <7 mm, fresh; olivine phenocrysts 1-2%, <2 mm, altered to smectite; clinopyroxene phenocrysts 1-3%, <3 mm, fresh, mostly in glomerocrysts with plagioclase. Groundmass is fine-grained to glassy; minor breccia zones are associated with glass selvedges; glass selvedges are completely altered to smectite. Vesicles 1%, <2 mm, filled with smectite and carbonate. Minor pink zeolite(?) occurs in breccia matrix. Piece 4D contains a fragment of altered sediment.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

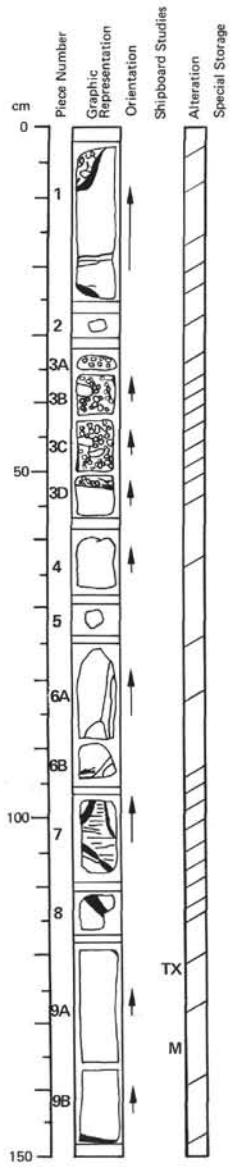
LEG	SITE	HOLE	CORE	SECT.
52	418	A	28	3

Visual Description

Moderately to highly phyric pillow basalt and breccia. Breccia is abundant only between 85 and 130 cm where it occurs between pillows and consists mostly of broken glass selvedges. Pillow basalt is gray to greenish-gray; moderately altered. Phenocryst content varies from about 10% near chilled pillow margins to about 20% in pillow interiors. Plagioclase phenocrysts 8-16%, <6 mm, *fresh; olivine phenocrysts* 1-2%, <2 mm, *altered to smectite; clinopyroxene phenocrysts* 1-2%, <2 mm, fresh. Groundmass is fine-grained to glassy, slightly coarser-grained in pillow interiors; glass selvedges are completely altered to smectite. Vesicles 1-2%, <1 mm, filled with smectite and carbonate. One large vesicle (1 cm diameter) occurs in piece 10B. Veins are also filled with smectite and carbonate. Interpillow breccia is composed chiefly of altered glass fragments in a matrix of dark green smectite containing minor carbonate and pink zeolite(?). Pieces 1A and 5B have small inclusion of altered sediment.

Shipboard Data

Physical Property Data:	27-29 cm
$\bar{V}p$ (km/sec)	5.13
Porosity (%)	8.6
Wet Bulk Density (g/cc)	2.67
Grain Density (g/cc)	2.82



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	28	4

Visual Description

Moderately phyric pillow basalt and pillow breccia. Basalt is medium to dark gray; weakly altered. Breccia is dark green; highly altered. Plagioclase phenocrysts 10-15%, <8 mm, fresh to very slightly altered; olivine phenocrysts 1%, <2 mm, altered to smectite; clinopyroxene phenocrysts <1%, <1 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are completely altered to *smectite. Vesicles 1%, filled with smectite and carbonate. Sparse veins are also filled with smectite* and carbonate. Breccia is mostly in piece 3; composed of angular glass and basalt fragments in a matrix of dark green smectite. Minor carbonate, pyrite and pink zeolite(?) are also present in the matrix.

Thin Section Description

Location: 120 cm

Texture: porphyritic - quench

Phenocrysts: olivine, 1%, <1 mm, euhedral; plagioclase, 8%, <3 mm, subhedral

Groundmass: olivine, 2%, 0.3 mm, euhedral; plagioclase, 45%, 0.2 mm, skeletal; clinopyroxene, radiating sheaves; opaque, 3%, 0.01 mm, granular

Vesicles: 1%, <0.4 mm, round

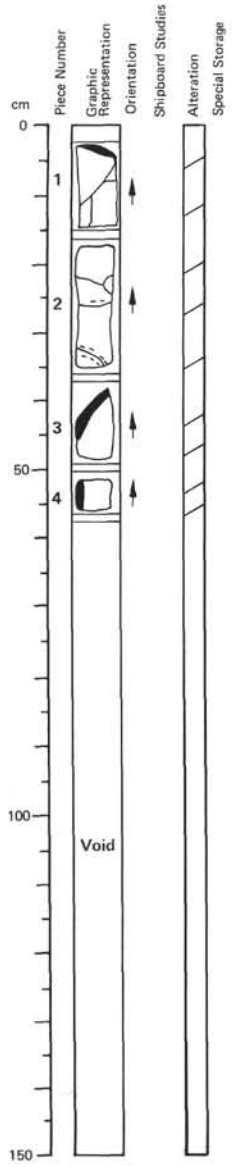
Alteration: olivine to smectite and carbonate; smectite and carbonate fill vesicles

Shipboard Data

Bulk Analysis: 120-122 cm

SiO_2	50.50
Al_2O_3	18.30
Fe_2O_3	8.81
MgO	6.60
CaO	12.10
Na_2O	2.60
K_2O	0.12
TiO_2	1.27
P_2O_5	0.12
MnO	0.17
LOI	2.2
H_2O^+	1.25
H_2O^-	N.D.
CO_2	0.07

Magnetic Data:	130-132 cm
NRM Intensity (emu/cc)	20.79×10^{-3}
Stable Inclination	+21.6°

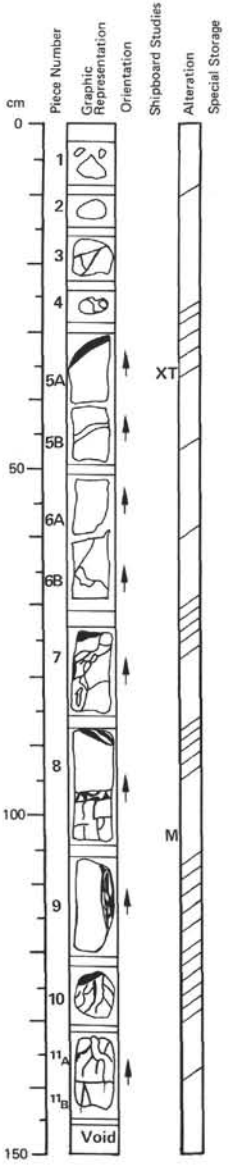


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	28	5

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; relatively fresh. Plagioclase phenocrysts 10%, <8 mm, fresh; olivine phenocrysts 2%, <2 mm, altered to smectite. Groundmass is fine-grained to glassy; most glass selvedges are altered to smectite but some fresh glass is present in piece 1. Vesicles 1%, <0.5 mm, filled with carbonate. Scattered veinlets are filled with smectite, carbonate and minor pyrite.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	29	1

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; relatively fresh except for glass selvedges. Plagioclase phenocrysts 8%, <8 mm, fresh; olivine phenocrysts 1-2%, <1 mm, altered to smectite. Groundmass is very fine-grained to glassy; glass selvedges are completely altered to smectite. Vesicles <1%, <0.5 mm, filled with carbonate. Veins are common in incipiently brecciated zones, filled with smectite, carbonate and minor pink zeolite(?).

Thin Section Description

Location: 36 cm

Texture: porphyritic - quench

Phenocrysts: olivine 1%, <0.5 mm, euhedral; plagioclase 8%, <3 mm, euhedral

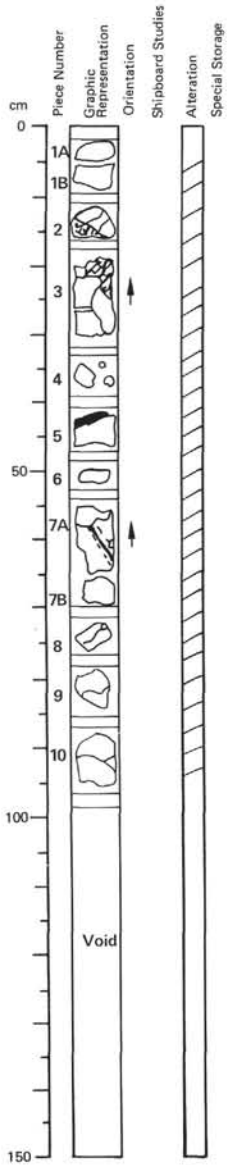
Groundmass: olivine 1%, 0.1 mm, euhedral; plagioclase 10%, <0.4 mm, acicular; clinopyroxene 75%, poorly crystallized, radiating sheaves; opaques 5%, 0.01 mm; granular

Vesicles: <1%, <0.7 mm, round

Alteration: olivine to carbonate; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 35-37 cm		Magnetic Data:	106-108 cm
SiO_2	49.80	NRM Intensity (emu/cc)	19.25×10^{-3}
Al_2O_3	18.20	Stable Inclination	+12.5°
Fe_2O_3	8.20		
MgO	6.78		
CaO	13.20		
Na_2O	2.56		
K_2O	0.36		
TiO_2	1.27		
P_2O_5	0.12		
MnO	0.23		
LOI	2.6		
H_2O^+	0.82		
H_2O^-	N.D.		
CO_2	1.13		

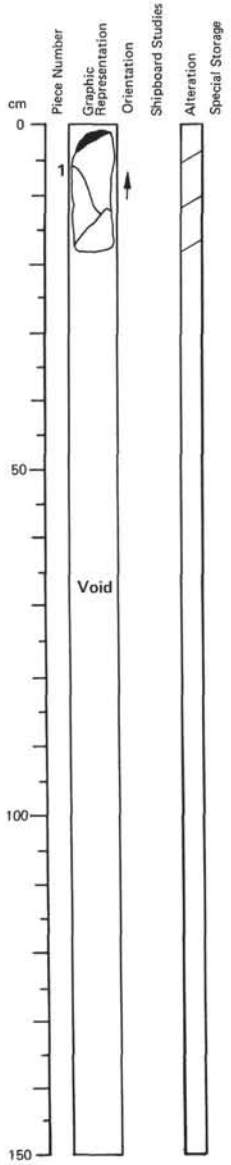


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	2	4	1	8	A	2	9	2

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray; moderately altered. Plagioclase phenocrysts 15%, <7 mm, fresh; olivine phenocrysts 1-2%, <2 mm, altered to smectite. Groundmass is fine-grained to glassy; some glass selvedges are brecciated and all are altered to smectite, carbonate and minor silica. Vesicles 1%, filled with smectite and carbonate. Veins are also filled with smectite and carbonate. Groundmass is locally altered to smectite.

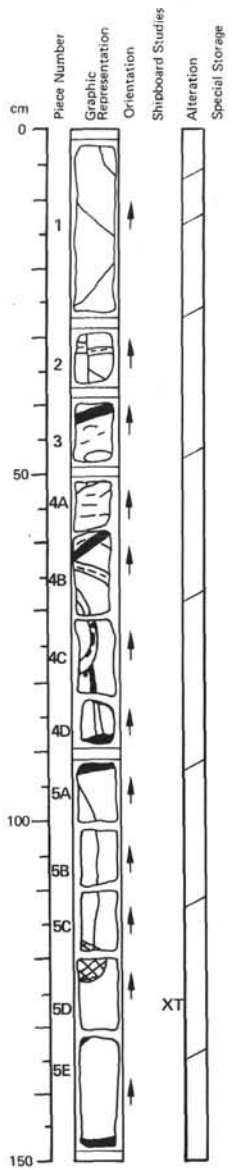


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	2	4	1	8	A	2	9	3

Visual Description

Sparsely phyric pillow basalt. This fragment was found in the bit during the bit change after Core 29. Basalt is gray to greenish-gray; slightly altered. Plagioclase phenocrysts 8%, <5 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are completely altered to smectite. Vesicles 1%, <0.5 mm, filled with carbonate. Several veins are present, filled with smectite and carbonate.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	30	1

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 10-15%, ≤8 mm, fresh or somewhat stained near fractures; olivine phenocrysts 1%, ≤2 mm, altered to smectite; clinopyroxene phenocrysts <1%, ≤0.5 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are mostly altered to smectite but fresh glass occurs in piece 4D. Vesicles <1%, filled with smectite. Numerous veins are present, filled with smectite and carbonate; some veins are oxidized.

Thin Section Description

Location: 128 cm

Texture: porphyritic - quench

Phenocrysts: olivine 1%, <2 mm, euhedral; plagioclase 15%, <4 mm, euhedral

Groundmass: olivine 4%, ≤0.4 mm, euhedral; plagioclase 30%, ≤0.5 mm, laths; clinopyroxene 44%, granular to radiating sheaves; opaques 5%, 0.01 mm, euhedral

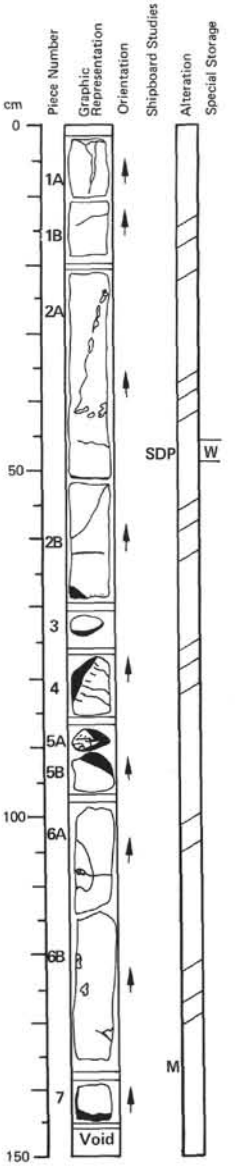
Vesicles: 1%, <0.5 mm, round

Alteration: olivine to smectite and carbonate; smectite and carbonate fill vesicles

Shipboard Data

Bulk Analysis: 50-52 cm

SiO_2	49.70
Al_2O_3	19.50
Fe_2O_3	7.93
MgO	6.51
CaO	13.40
Na_2O	2.36
K_2O	0.06
TiO_2	1.06
P_2O_5	0.10
MnO	0.14
LOI	2.5
H_2O^+	0.88
H_2O^-	N.D.
CO_2	0.66



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

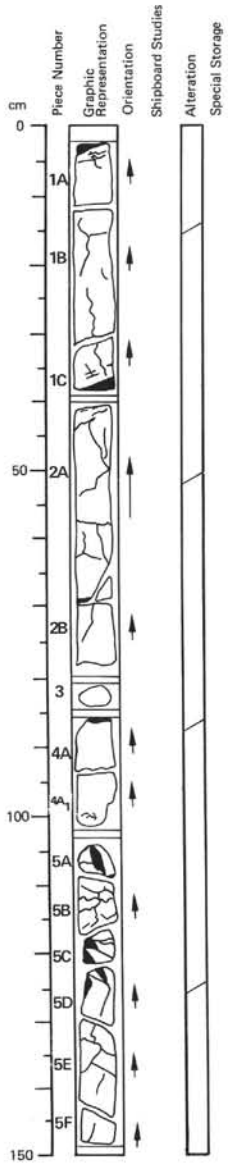
LEG	SITE	HOLE	CORE	SECT.
52	418	A	30	2

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray; weakly altered. Plagioclase phenocrysts 10%, ≤5 mm, fresh; olivine phenocrysts 1%, ≤2 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are mostly altered to smectite. Vesicles <1%, ≤0.5 mm, round and irregular in shape, filled with smectite, carbonate and minor pyrite.

Shipboard Data

Magnetic Data:	137-139 cm
NRM Intensity (emu/cc)	29.17×10^{-3}
Stable Inclination	+17.3°
Physical Property Data:	46-48 cm
$\overline{V}p$ (km/sec)	5.72
Porosity (%)	4.5
Wet Bulk Density (g/cc)	2.835
Grain Density (g/cc)	2.92

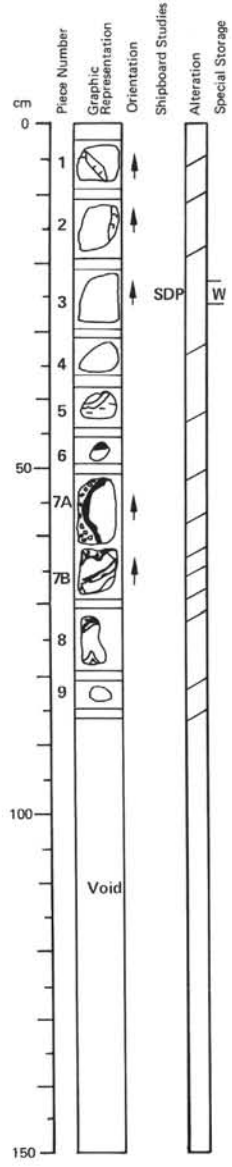


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	30	3

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; relatively fresh. Phenocryst distribution is uneven, more abundant in pillow centers and less abundant in quenched rims. Plagioclase phenocrysts 6-12%, <5 mm, fresh; olivine phenocrysts 1%, <2 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

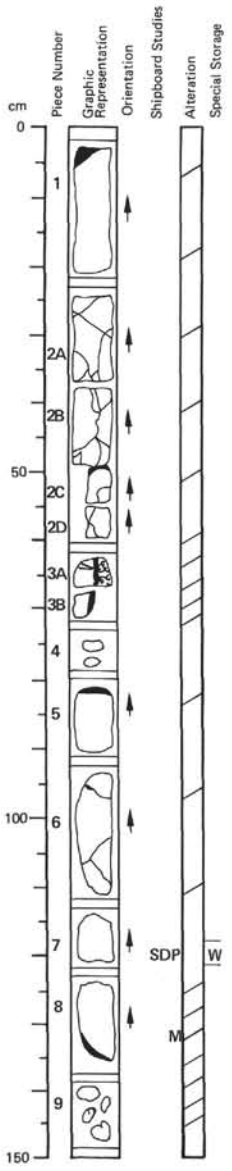
LEG	SITE	HOLE	CORE	SECT.
52	418	A	30	4

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray, reddish-brown or yellow where oxidized; moderately to weakly altered. Plagioclase phenocrysts 10%, <4 mm, fresh or stained green or yellow near veins; olivine phenocrysts 1%, <1 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are completely altered to smectite. Veins to 1 cm wide are filled with smectite and carbonate. Minor hyaloclastic breccia occurs in piece 7A.

Shipboard Data

Physical Property Data:	24-26 cm
$\overline{V}p$ (km/sec)	5.38
Porosity (%)	6.2
Wet Bulk Density (g/cc)	2.70
Grain Density (g/cc)	2.83



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

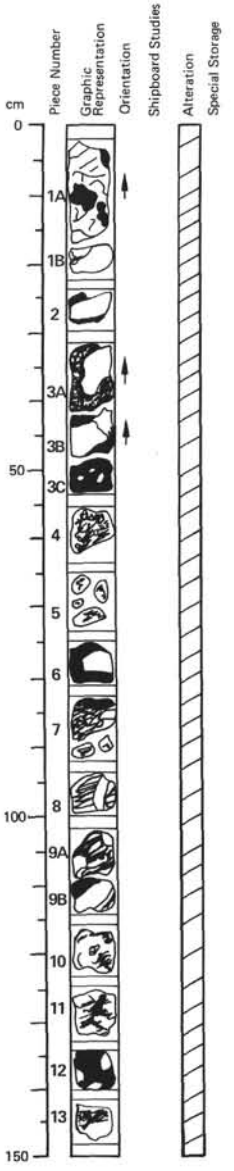
LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		3	1	1

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray, reddish-brown or yellow where oxidized; moderately altered. Plagioclase phenocrysts 10-15%, ≤6 mm, fresh or stained green or yellow near veins; olivine phenocrysts 1%, ≤2 mm, altered to smectite; clinopyroxene phenocrysts <1%, ≤4 mm, subrounded, fresh. Groundmass is fine-grained to glassy; glass selvedges are completely altered to smectite. Vesicles 1%, filled with smectite and carbonate. Rock is heavily veined and fractured, particularly in piece 2; veins are filled with smectite, carbonate and minor pyrite.

Shipboard Data

Magnetic Data:	129-131 cm
NRM Intensity (emu/cc)	20.56×10^{-3}
Stable Inclination	+34.3°
Physical Property Data:	119-121 cm:
$\bar{V}p$ (km/sec)	5.49
Porosity (%)	6.9
Wet Bulk Density (g/cc)	2.76
Grain Density (g/cc)	2.88

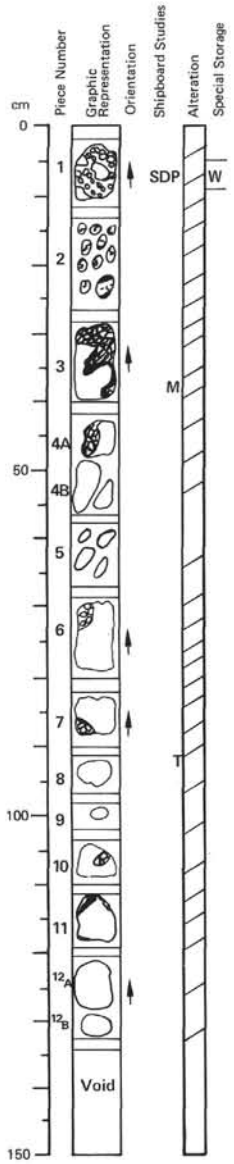


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		3	1	2

Visual Description

Moderately phyric pillow basalt breccia. Breccia is dark greenish-gray; highly altered. Angular fragments of crystalline basalt and glass are in a matrix of dark green smectite, carbonate and minor pink zeolite(?). Crystalline fragments have 10-15% phenocrysts. Plagioclase phenocrysts 12-14%, ≤7 mm, partly altered to smectite; olivine phenocrysts 1-2%, ≤2 mm, altered to smectite. Glass selvedges and glass fragments are completely altered to smectite.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A	3	1		3

Visual Description

Moderately phyric pillow basalt and breccia. Basalt is gray to greenish-gray; moderately altered. Breccia is dark greenish-gray; highly altered. Plagioclase phenocrysts in basalt are 5-15%, <5 mm, partly altered along cracks and stained green or yellow; olivine phenocrysts 1-2%, < 1 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are completely altered to smectite. Vesicles 1-3%, <0.5 mm, filled with carbonate. Breccia is hyaloclastite composed of crystalline and glassy fragments in a matrix of green smectite, carbonate, silica and pink zeolite(?).

Thin Section Description

Location: 95 cm

Texture: porphyritic - quench

Phenocrysts: olivine 2%, <0.6 mm, euhedral; plagioclase 16%, <3 mm, euhedral

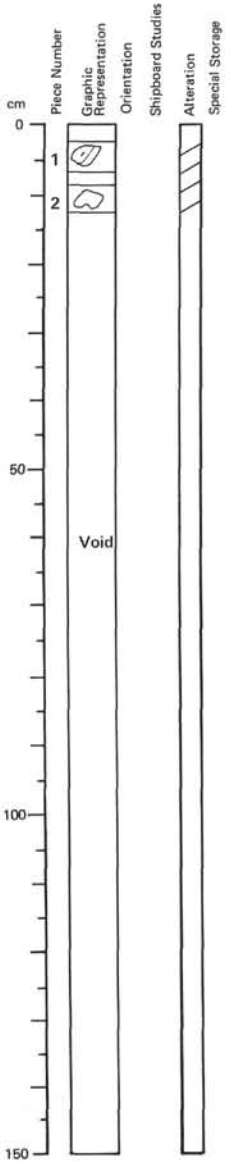
Groundmass: glass 79%, slightly devitrified

Vesicles: 3%, < 1 mm, ovoid to irregular

Alteration: olivine and some plagioclase to smectite

Shipboard Data

Magnetic Data:	35-37 cm
NRM Intensity (emu/cc)	7.86×10^{-3}
Stable Inclination	+27.8°
Physical Property Data:	6-8 cm
$\bar{V}p$ (km/sec)	3.44
Porosity (%)	30.2
Wet Bulk Density (g/cc)	2.32
Grain Density (g/cc)	2.86

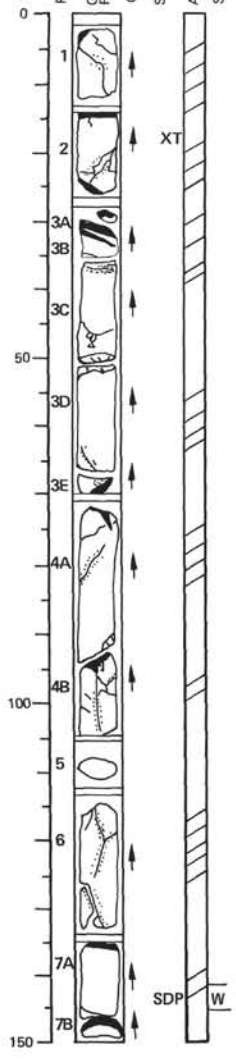


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A	3	2	C	C

Visual Description

Moderately phyric basalt. Basalt is greenish-gray to reddish- or yellowish-brown where oxidized; moderately altered. Plagioclase phenocrysts 10%, <5 mm, fresh; olivine phenocrysts 1%, < 1 mm, altered to smectite. Groundmass is fine-grained. Vesicles 1%, filled with smectite. Minor veins are filled with smectite and are usually oxidized.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	33	1

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray, reddish- to yellowish-brown where oxidized; moderately altered. Plagioclase phenocrysts 10%, <10 mm, partly altered to smectite and stained green or blue-green; olivine phenocrysts 1%, <3 mm, altered to smectite. Groundmass is very fine-grained to glassy; glass selvedges are altered to smectite. Vesicles 1%, filled with carbonate and smectite; vug at 50 cm is filled with smectite, carbonate, zeolite(?) and minor pyrite. Scattered veins are filled with smectite, carbonate and minor pyrite.

Thin Section Description

Location: 19 cm

Texture: porphyritic - quench

Phenocrysts: olivine 2%, <1.5 mm, euhedral; plagioclase 13%, <3 mm, euhedral

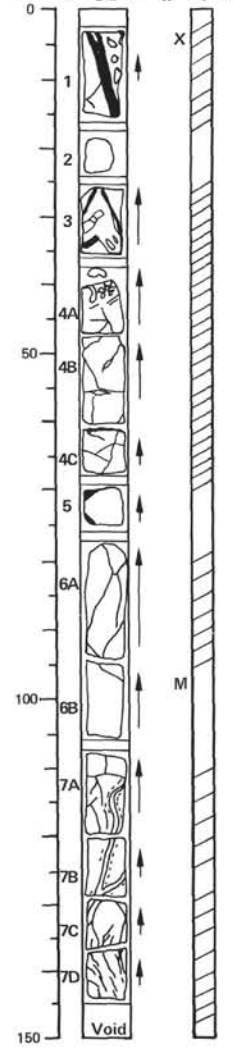
Groundmass: olivine 1%, 0.1 mm, euhedral; plagioclase 15%, <0.3 mm, acicular; clinopyroxene 62%, poorly crystallized, radiating sheaves; opaque, 5%, 0.01 mm, granular

Vesicles: 2%, <0.3 mm, round

Alteration: olivine to carbonate; plagioclase partly to smectite; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 18-20 cm		Physical Property Data:	142-144 cm
SiO_2	49.50	$\overline{V}p$ (km/sec)	4.54
Al_2O_3	18.90	Porosity (%)	16.9
Fe_2O_3	8.28	Wet Bulk Density (g/cc)	2.505
MgO	6.81	Grain Density (g/cc)	2.81
CaO	12.30		
Na_2O	2.59		
K_2O	0.60		
TiO_2	1.25		
P_2O_5	0.14		
MnO	0.18		
LOI	3.5		
H_2O^+	1.39		
H_2O^-	N.D.		
CO_2	0.91		



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

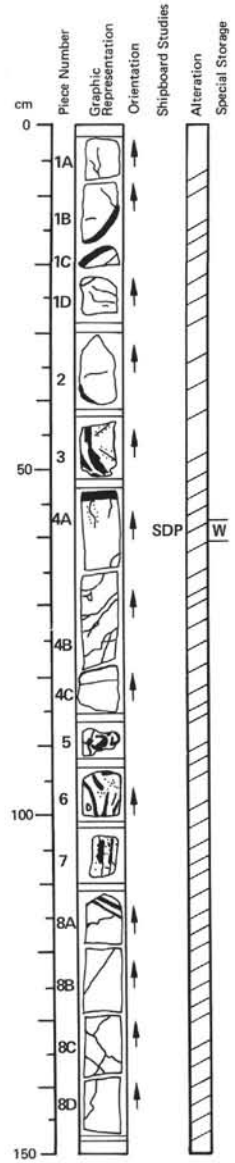
LEG	SITE	HOLE	CORE	SECT.
52	418	A	33	2

Visual Description

Moderately phyric pillow basalt. Basalt is greenish-gray, reddish- to yellowish-brown where oxidized; moderately to highly altered. Plagioclase phenocrysts 7-10%, <5 mm, partly altered to smectite and carbonate; olivine phenocrysts 1-3%, <1.5 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are completely altered to smectite. Rock is highly fractured and minor breccia occurs in pieces 1 and 4A. Breccia consists of crystalline basalt fragments and altered glass chips in a matrix of green smectite, carbonate and zeolite(?).

Shipboard Data

Bulk Analysis:	2-5 cm fresh	2-5 cm oxidized	2-5 cm smectite	Magnetic Data:	97-99 cm
SiO_2	50.11	51.80	54.90	NRM Intensity (emu/cc)	9.84×10^{-3}
Al_2O_3	18.19	18.22	20.55	Stable Inclination	+27.9°
Fe_2O_3	9.10	10.01	7.79		
MgO	6.69	7.93	7.38		
CaO	10.9	6.07	2.01		
Na_2O	9.64	2.60	1.22		
K_2O	0.91	2.55	5.01		
TiO_2	1.29	1.59	1.69		
P_2O_5	0.11	0.11	0.04		
MnO	.13	.07	.03		
LOI	2.99	4.96	8.83		
H_2O^+	3.00	4.30	8.31		
H_2O^-	N.D.	N.D.	N.D.		
CO_2	0.82	0.41	1.2		



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

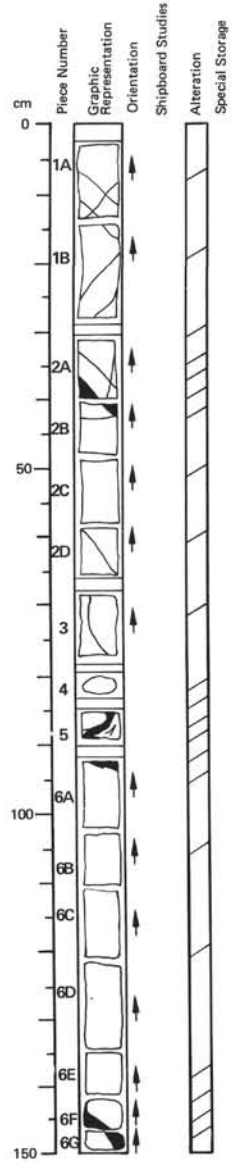
LEG		SITE			HOLE	CORE		SECT.
5	2	4	1	8	A	3	3	3

Visual Description

Moderately phyric pillow basalt. Basalt is grayish-green, yellowish-brown where oxidized; moderately to highly altered. Plagioclase phenocrysts 10%, <8 mm, partly altered to smectite; olivine phenocrysts 1%, <6 mm, altered to smectite. Groundmass is very fine-grained to glassy; glass selvedges are altered to smectite. Vesicles <1%, <1 mm, filled with carbonate. Veins are filled with smectite, carbonate and minor pyrite. Minor hyaloclastic breccia consists of altered glass fragments in a matrix of greenish-brown smectite and carbonate.

Shipboard Data

Physical Property Data:	60-62 cm
$\bar{V}p$ (km/sec)	5.38
Porosity (%)	6.0
Wet Bulk Density (g/cc)	2.74
Grain Density (g/cc)	2.85

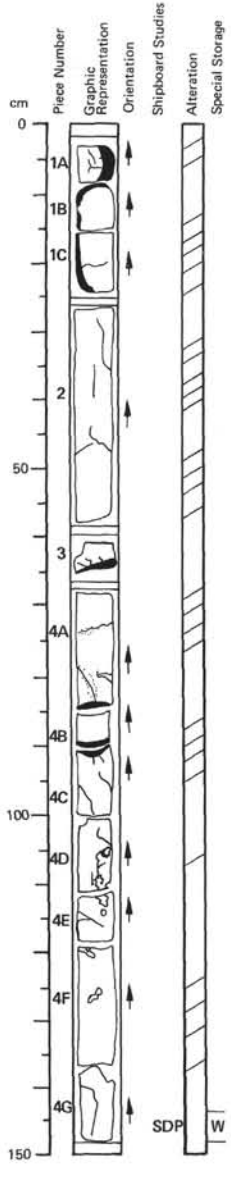


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	2	4	1	8	A	3	3	4

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray; moderately altered. Plagioclase phenocrysts 10-15%, <8 mm, fresh or stained green or yellow; olivine phenocrysts 1%, <1 mm, altered to smectite and carbonate. Groundmass is fine-grained to glassy; glass selvedges are completely altered to smectite and carbonate. Vesicles 1%, <0.5 mm, filled with carbonate and smectite. Veins are filled with smectite, carbonate and minor pyrite; some veins are oxidized.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

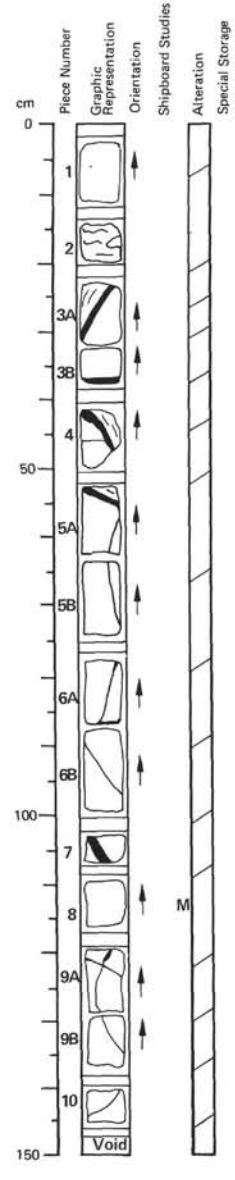
LEG		SITE			HOLE		CORE		SECT.	
5	2	4	1	8	A		3	3		5

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray; moderately altered. Plagioclase phenocrysts 10%, <5 mm, fresh or stained green or yellow; olivine phenocrysts 1-2%, <2 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are completely altered to smectite. Vesicles <1%, <0.2 mm, filled with smectite, carbonate and minor pyrite. Veins are filled with smectite, and carbonate; some veins are slightly oxidized.

Shipboard Data

Physical Property Data:	145-147 cm
$\bar{V}p$ (km/sec)	5.66
Porosity (%)	5.7
Wet Bulk Density (g/cc)	2.825
Grain Density (g/cc)	2.93



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

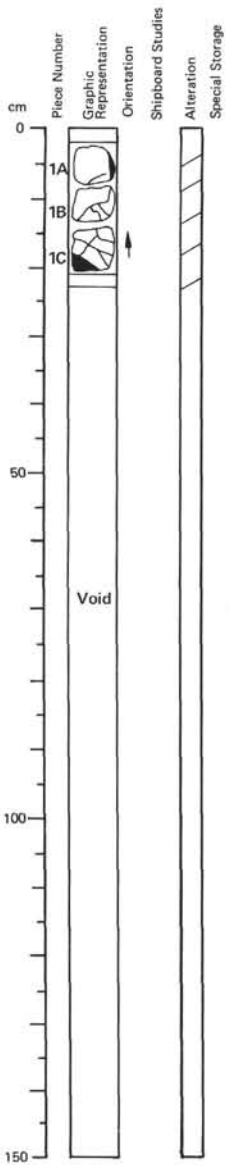
LEG		SITE			HOLE		CORE		SECT.	
5	2	4	1	8	A		3	3		6

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray, yellowish-brown where oxidized; moderately to weakly altered. Plagioclase phenocrysts 10%, <4 mm, usually fresh, some are stained green or yellow; olivine phenocrysts 1%, <2 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are completely altered to smectite with minor carbonate, silica and zeolite(?). Vesicles 1%, <0.5 mm, filled with carbonate and smectite. Veins are filled with smectite and carbonate and often oxidized.

Shipboard Data

Magnetic Data:	110-112 cm
NRM Intensity (emu/cc)	10.71×10^{-3}
Stable Inclination	+13.0°

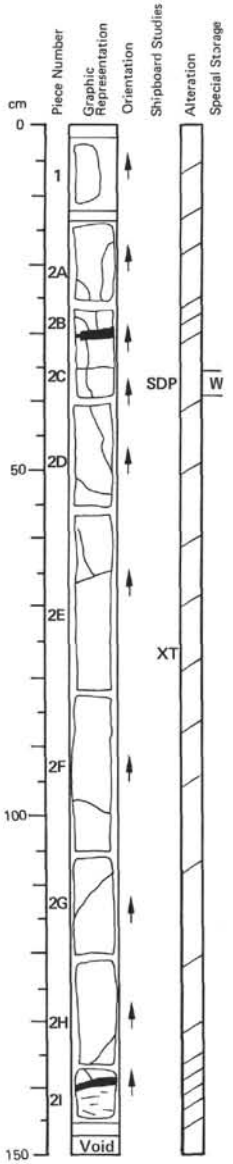


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 2	4 1 8	A	3 3	7

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray, yellowish-brown where oxidized; moderately altered. Plagioclase phenocrysts 10%, <6 mm, fresh or stained green, yellow or black; olivine phenocrysts 1%, <2 mm, completely altered to smectite. Groundmass is fine-grained to glassy; glass selvedges altered to smectite. Vesicles 1%, <0.5 mm, filled with smectite and carbonate.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 2	4 1 8	A	3 4	1

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray, reddish- to yellowish-brown where oxidized; moderately altered. Plagioclase phenocrysts 8-10%, <6 mm, fresh or stained green, yellow or black; olivine phenocrysts 2%, <2 mm, completely altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are completely altered to smectite and minor zeolite(?). Vesicles 1%, <0.5 mm, filled with smectite and carbonate. Veins are filled with smectite and minor pyrite; some are oxidized.

Thin Section Description

Location: 77 cm

Texture: porphyritic - intergranular

Phenocrysts: olivine <1%, <0.8 mm, euhedral; plagioclase 8%, <3.5 mm, subhedral

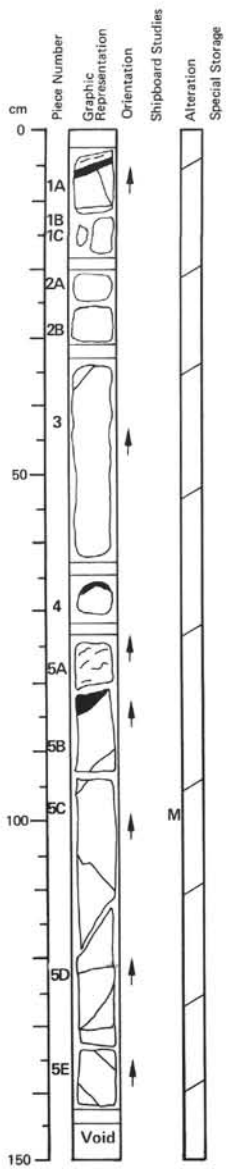
Groundmass: olivine 2%, <0.2 mm, euhedral; plagioclase 40%, <0.2 mm, subhedral; clinopyroxene 40%, <0.2 mm, anhedral; opaque 2%, 0.03 mm, granular; glass 8%, interstitial

Vesicles: <1%, <0.2 mm, round

Alteration: olivine to smectite and carbonate; smectite fills vesicles

Shipboard Data

Bulk Analysis: 76-78 cm		Physical Property Data:	33-35 cm
SiO_2	50.20	$\bar{V}p$ (km/sec)	5.64
Al_2O_3	18.00	Porosity (%)	5.1
Fe_2O_3	9.03	Wet Bulk Density (g/cc)	2.825
MgO	6.48	Grain Density (g/cc)	2.92
CaO	13.30		
Na_2O	2.30		
K_2O	0.02		
TiO_2	1.18		
P_2O_5	0.11		
MnO	0.16		
LOI	2.0		
H_2O^+	0.88		
H_2O^-	N.D.		
CO_2	0.10		



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

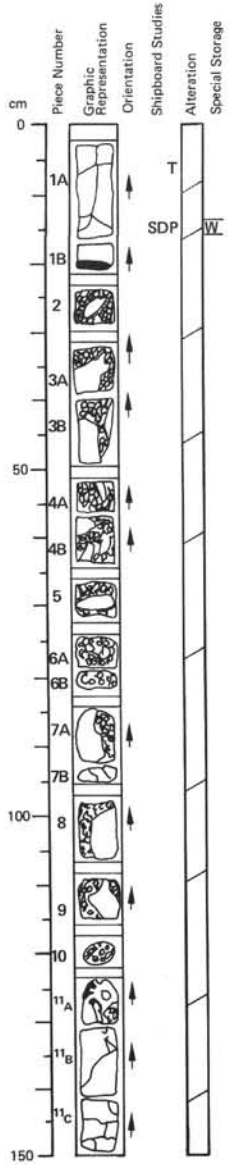
LEG	SITE	HOLE	CORE	SECT.
52	418	A	34	2

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray, weakly altered. Plagioclase phenocrysts 8-10%, < 6 mm, fresh, often stained yellow, green or black; olivine phenocrysts 1%, < 1.5 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are completely altered to smectite. Vesicles 1%, <0.5 mm, filled with carbonate and smectite. Veins are filled with smectite, carbonate and minor pyrite.

Shipboard Data

Magnetic Data:	100-102 cm
NRM Intensity (emu/cc)	15.77×10^{-3}
Stable Inclination	+19.6°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	34	3

Visual Description

Moderately phyric pillow basalt and pillow breccia. Basalt is gray; weakly altered. Breccia is dark greenish-gray; highly altered. Basalt contains 10-12% of phenocrysts. Plagioclase phenocrysts 10%, < 6 mm, fresh, often stained yellow, green or black; olivine phenocrysts 1%, < 4 mm, altered to smectite, clinopyroxene phenocrysts < 1%, < 2 mm, subhedral, fresh. Groundmass is fine-grained to glassy; most glass selvedges are altered to smectite but fresh glass is present at 20 cm. Breccia consists of crystalline basalt and altered sideromelane fragments in a matrix of dark green smectite, carbonate and minor zeolite(?).

Thin Section Description

Location: 5 cm

Texture: porphyritic - intersertal

Phenocrysts: olivine 1%, < 3.5 mm, euhedral; plagioclase 10%, < 7 mm, euhedral; clinopyroxene < 1%, < 1.5 mm, rounded

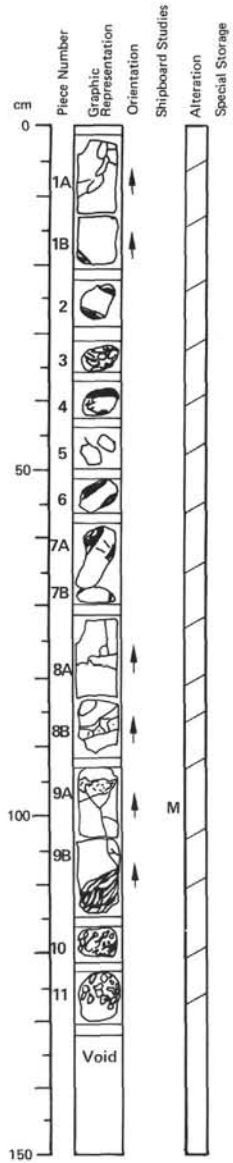
Groundmass: olivine 5%, <0.5 mm, euhedral; plagioclase 40%, <0.6 mm, laths; clinopyroxene 30%; <0.25 mm, subhedral; opaques 5%, 0.01 mm, euhedral; glass 8%

Vesicles: 1%, <0.4 mm, round

Alteration: olivine to smectite; smectite fills vesicles

Shipboard Data

Physical Property Data:	13-15 cm
$\overline{V}p$ (km/sec)	4.14
Porosity (%)	22.9
Wet Bulk Density (g/cc)	2.41
Grain Density (g/cc)	2.80



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

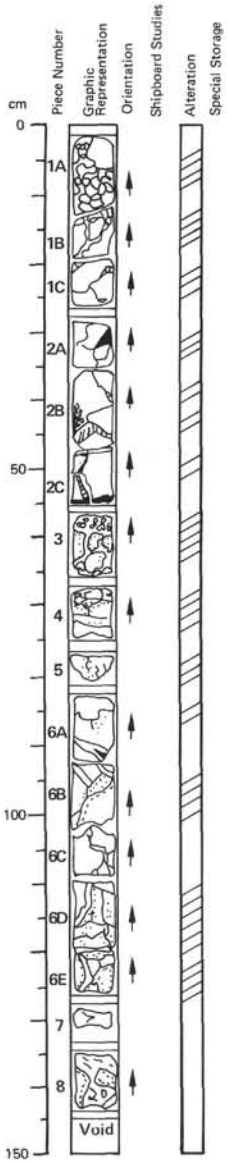
LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		3	4	4

Visual Description

Moderately phyric pillow basalt and pillow breccia. Basalt is green to grayish-green; moderately altered. Breccia is dark greenish-gray; highly altered. Plagioclase phenocrysts 10%, <5 mm, fresh; olivine phenocrysts 3-4%, <1 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are altered to smectite. Vesicles 2-3%, <5 mm, filled with carbonate and smectite. Veins are also filled with carbonate and smectite. Breccia consists mostly of altered glass fragments in a matrix of dark green smectite, carbonate and minor zeolite(?).

Shipboard Data

Magnetic Data:	99-101 cm
NRM Intensity (emu/cc)	8.79×10^{-3}
Stable Inclination	+14.7°

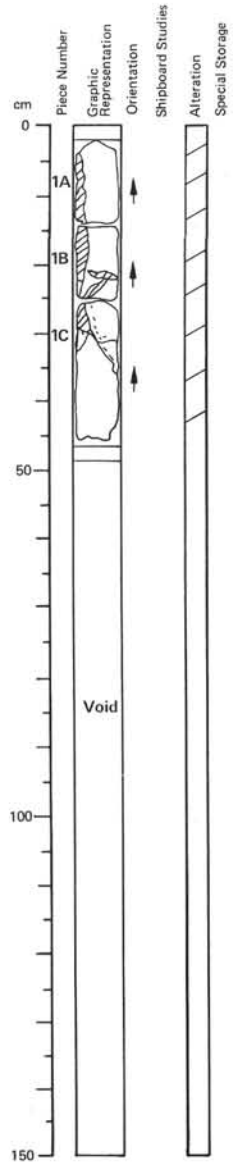


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		3	4	5

Visual Description

Sparsely phyric pillow basalt and pillow breccia. Basalt is gray to greenish-gray; moderately altered. Breccia is dark greenish- to brownish-gray; highly altered. Plagioclase phenocrysts 5%, <2 mm, stained and partly altered to smectite; olivine phenocrysts 1%, <2 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are altered to smectite. Breccia consists of crystalline basalt and altered sideromelane fragments in a matrix of dark green smectite and carbonate. Veins are also filled with smectite and carbonate.

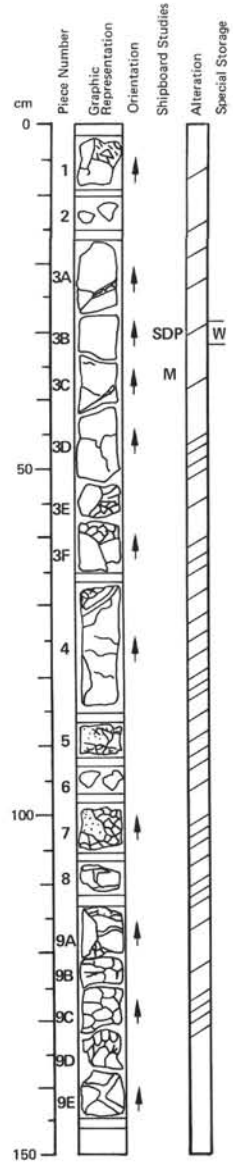


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		3	4	6

Visual Description

Sparsely phyric pillow basalt. Basalt is gray to greenish-gray; moderately altered. Plagioclase phenocrysts 5-7%, < 7 mm, fresh; olivine phenocrysts 1%, < 1 mm, altered to smectite. Groundmass is fine-grained. A large vein along the side of the core is filled with smectite and carbonate.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

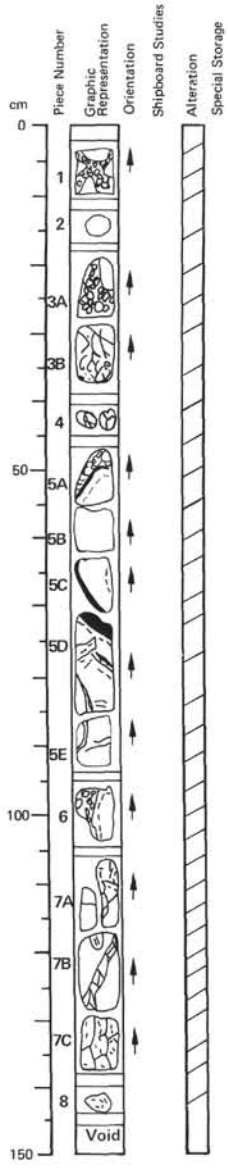
LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		3	5	1

Visual Description

Sparsely phyric basalt and minor breccia. Basalt is dark gray, yellowish-brown where oxidized along fractures and in breccia; moderately altered. Plagioclase phenocrysts 5%, < 3 mm, partly altered to smectite; olivine phenocrysts 1%, < 3 mm, altered to smectite. Groundmass is finely crystalline in the upper part to aphanitic in the lower. Breccia consists of aphanitic basalt fragments in a matrix of smectite and carbonate. Sparse veinlets are filled with carbonate and smectite.

Shipboard Data

Magnetic Data:	34-36 cm
NRM Intensity (emu/cc)	6.25×10^{-3}
Stable Inclination	+21.1°
Physical Property Data:	30-32 cm
$\overline{V}p$ (km/sec)	5.10
Porosity (%)	9.7
Wet Bulk Density (g/cc)	2.68
Grain Density (g/cc)	2.85

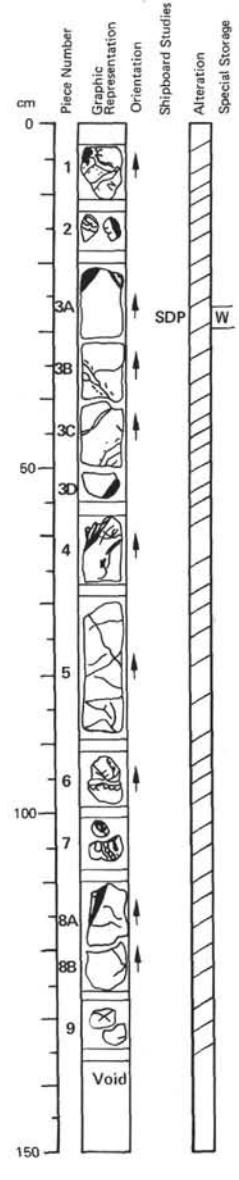


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	3 5	2

Visual Description

Sparsely phyric pillow basalt and minor breccia. Basalt is dark gray, brown or yellow where oxidized along veins and in breccias; moderately to highly altered. Plagioclase phenocrysts 8%, ≤6 mm, partly altered to smectite; olivine phenocrysts 1%, ≤2 mm, completely altered to smectite. Groundmass is very fine-grained to glassy; glass selvedges are completely altered to smectite. Veins are common throughout, filled with smectite and carbonate. Breccias are broken pillow fragments or hyaloclastites in which the glass has been altered to smectite.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

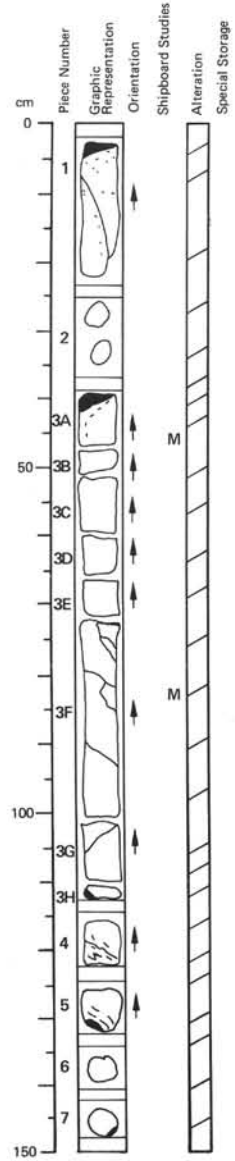
LEG	SITE	HOLE	CORE	SECT.
52	418	A	3 5	3

Visual Description

Moderately phyric pillow basalt with minor breccia. Basalt is dark gray, brown to yellowish-brown where oxidized along fractures; highly oxidized and altered. Plagioclase phenocrysts 7%, ≤6 mm, partly altered to smectite; olivine phenocrysts 1%, ≤2 mm, completely altered to smectite. Groundmass is aphanitic to glassy; glass selvedges are completely altered to smectite, carbonate, silica and zeolite(?). Vesicles 1%, ≤1 mm, filled with smectite and carbonate. Veins are locally present, filled with smectite. Breccia consists of broken pillow fragments in which the glass has been completely altered to smectite.

Shipboard Data

Physical Property Data:	29-31 cm
$\overline{Vp}$ (km/sec)	5.21
Porosity (%)	7.2
Wet Bulk Density (g/cc)	2.72
Grain Density (g/cc)	2.85



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

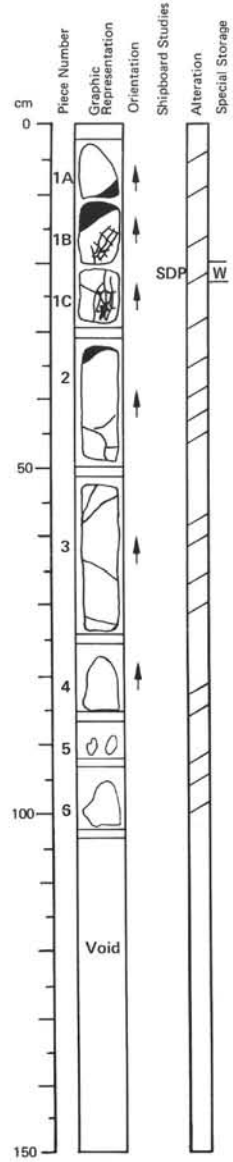
LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		3	5	4

Visual Description

Moderately phyric pillow basalt. Basalt is dark gray, locally yellowish-brown where oxidized along fractures; moderately altered. Plagioclase phenocrysts 10-15%, <8 mm, locally discolored to blue-green, yellow or brown; olivine phenocrysts 1%, <2 mm, completely altered to smectite. Groundmass is very fine-grained to glassy; glass selvedges are completely replaced by smectite, silica and zeolite(?). Vesicles 1%, <0.5 mm, partly filled with smectite and carbonate.

Shipboard Data

Magnetic Data:	43-45 cm	81-83 cm
NRM Intensity (emu/cc)	8.76×10^{-3}	13.45×10^{-3}
Stable Inclination	+24.9°	+18.6°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

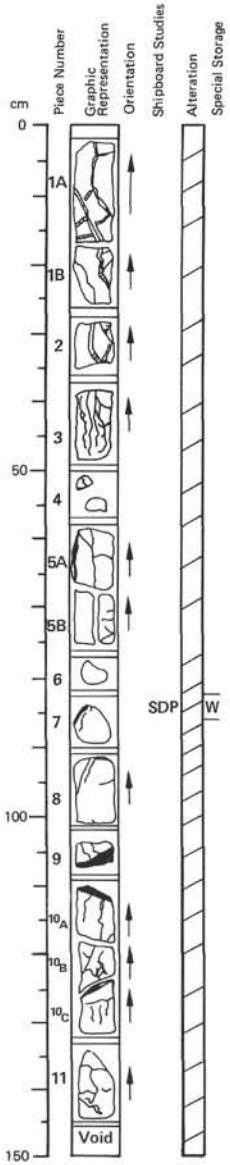
LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		3	5	5

Visual Description

Moderately phyric pillow basalt. Basalt is dark gray to greenish-gray; moderately altered. Plagioclase phenocrysts 10%, <8 mm, sometimes stained green, yellow or brown; olivine phenocrysts 1%, ≤3 mm, completely altered to smectite; clinopyroxene phenocrysts <1%, <1 mm, subhedral, fresh. Groundmass is fine-grained to glassy; glass selvedges are completely altered to smectite, silica and zeolite(?). Vesicles 1%, filled with smectite and carbonate.

Shipboard Data

Physical Property Data:	21-23 cm
$\overline{V}p$ (km/sec)	4.54
Porosity (%)	13.8
Wet Bulk Density (g/cc)	2.535
Grain Density (g/cc)	2.79



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

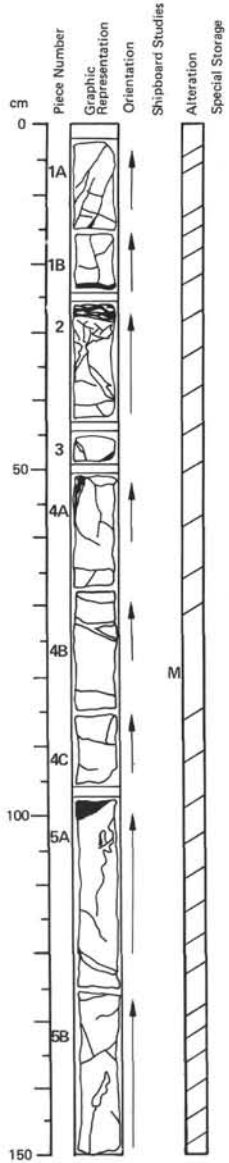
LEG	SITE	HOLE	CORE	SECT.
5 2	4 1 8	A	3 6	1

Visual Description

Moderately phyric pillow basalt. Basalt is dark gray except for brown staining along fractures and veinlets; moderately altered. Plagioclase phenocrysts 5%, < 10 mm, fresh; olivine phenocrysts 1%, < 1 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are altered to smectite. Vesicles 1% in piece 1, rare elsewhere, filled with smectite and carbonate. Veinlets are scattered throughout, filled with smectite and carbonate; many partly oxidized.

Shipboard Data

Physical Property Data:	81-83 cm
$\overline{V}p$ (km/sec)	5.29
Porosity (%)	7.3
Wet Bulk Density (g/cc)	2.74
Grain Density (g/cc)	2.87



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

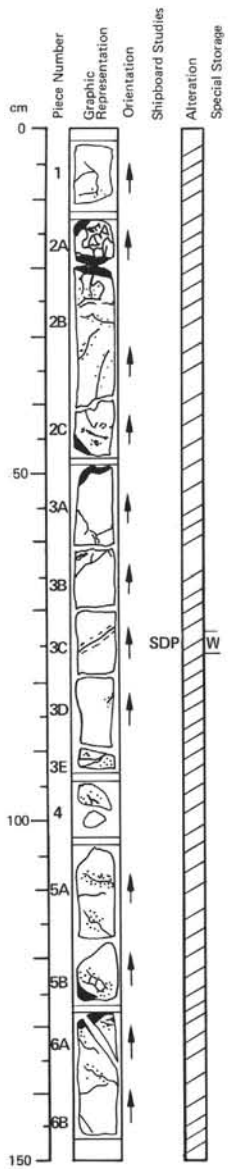
LEG	SITE	HOLE	CORE	SECT.
5 2	4 1 8	A	3 6	2

Visual Description

Moderately phyric pillow basalt. Basalt is dark gray except for brown staining in piece 5A; moderately altered. Plagioclase phenocrysts 5-8%, < 4 mm, fresh; olivine phenocrysts 1%, < 1 mm, altered to smectite. Groundmass is fine-grained to glassy with "blotchy" texture in piece 4; glass selvedges are altered to smectite. Vesicles 1%, < 1 mm, filled with carbonate and zeolite(?); carbonate filled vug occurs in piece 5B.

Shipboard Data

Magnetic Data:	75-77 cm
NRM Intensity (emu/cc)	6.03×10^{-3}
Stable Inclination	+19.2°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

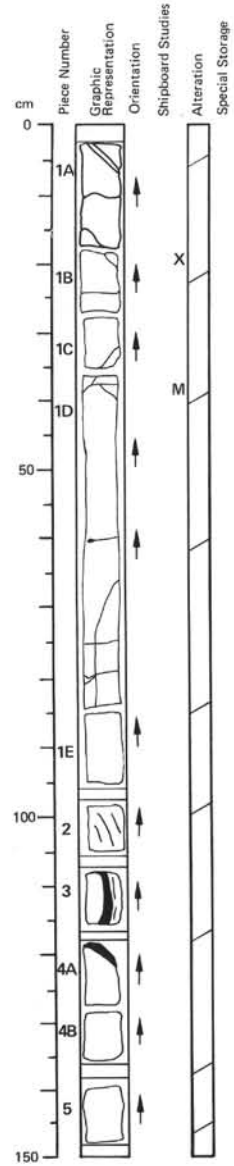
LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		3	6		3

Visual Description

Sparsely phyric pillow basalt and minor breccia. Basalt is dark gray except for brown staining along veins; moderately altered. Plagioclase phenocrysts 6%, <6 mm, fresh; olivine phenocrysts 1-2%, <5 mm, altered to smectite. Groundmass is fine-grained to glassy, mottled in piece 6; glass selvedges are altered to smectite. Vesicles <1%, <1 mm, filled with carbonate. Numerous veins are filled with brown and green smectite and carbonate; many somewhat oxidized. Pyrite is present in piece 6. Breccia in piece 2 was formed by close fracturing of the basalt without rotation of the fragments.

Shipboard Data

Physical Property Data:	71-73 cm
$\overline{V}p$ (km/sec)	5.66
Porosity (%)	4.8
Wet Bulk Density (g/cc)	2.815
Grain Density (g/cc)	2.91



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

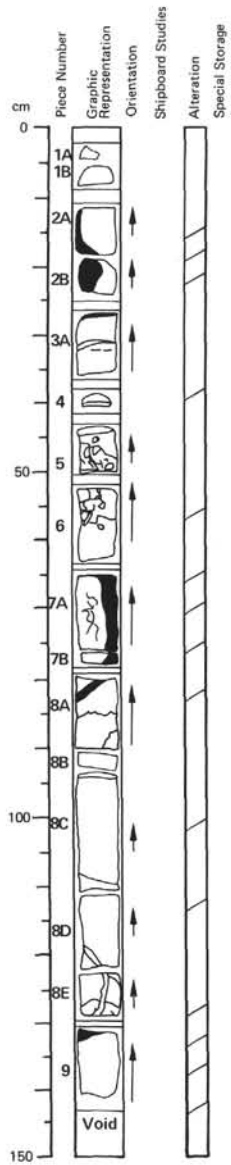
LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		3	6		4

Visual Description

Moderately phyric pillow basalt. Basalt is dark gray except for brown staining in pieces 3 and 4; weakly altered. Plagioclase phenocrysts 10%, <6 mm, slightly discolored, otherwise fresh; olivine phenocrysts 1%, <2 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are altered to smectite, carbonate and zeolite(?). Vesicles 1%, filled with smectite and carbonate.

Shipboard Data

Bulk Analysis: 18-20 cm		Magnetic Data:	37-39 cm
SiO_2	49.50	NRM Intensity (emu/cc)	25.45×10^{-3}
Al_2O_3	17.30	Stable Inclination	+21.9°
Fe_2O_3	9.24		
MgO	6.41		
CaO	13.60		
Na_2O	2.39		
K_2O	0.01		
TiO_2	1.17		
P_2O_5	0.11		
MnO	0.20		
LOI	2.0		
H_2O^+	0.98		
H_2O^-	N.D.		
CO_2	0.07		

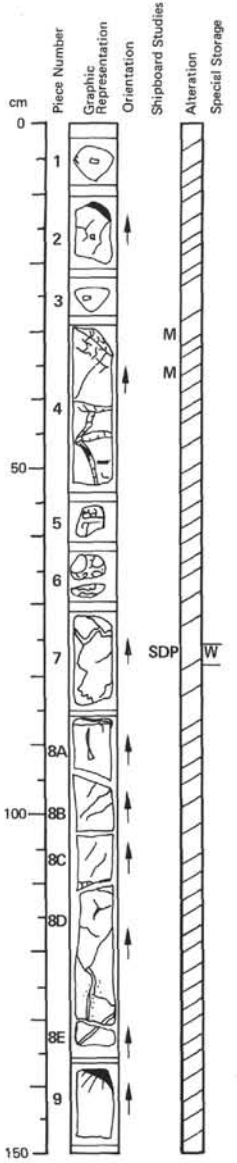


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 2	4 1 8	A	3 6	5

Visual Description

Moderately phyric pillow basalt and minor breccia. Basalt is dark gray except for brown staining along fractures, particularly in pieces 1-3; weakly to moderately altered. Plagioclase phenocrysts 5-8%, <4 mm, fresh; olivine phenocrysts 1%, ≤1 mm, altered to smectite. Vesicles <1%, ≤1 mm, filled with smectite. Basalt is highly fractured; veins filled with smectite, carbonate and zeolite(?) are common. Minor interpillow breccia occurs on top of piece 8.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 2	4 1 8	A	3 7	1

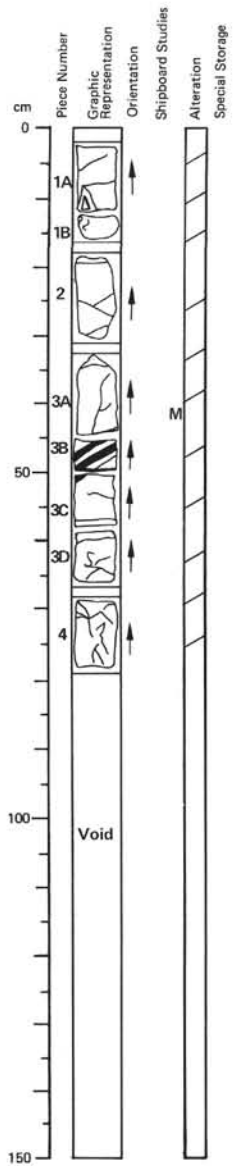
Visual Description

Sparsely to moderately phyric pillow basalt. Basalt is mostly brown and red, locally medium to dark gray; highly altered. Plagioclase phenocrysts 5%, ≤8 mm, often chalky; olivine phenocrysts 1%, ≤1 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are altered to smectite and carbonate. Numerous veinlets are present, filled with smectite and carbonate; often oxidized.

Shipboard Data

Magnetic Data:	31-33 cm	35-37 cm
NRM Intensity (emu/cc)	3.37×10^{-3}	3.66×10^{-3}
Stable Inclination	+16.1°	+20.1°

Physical Property Data:	77-79 cm
$\bar{V}p$ (km/sec)	4.57
Porosity (%)	11.6
Wet Bulk Density (g/cc)	2.545
Grain Density (g/cc)	2.76



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

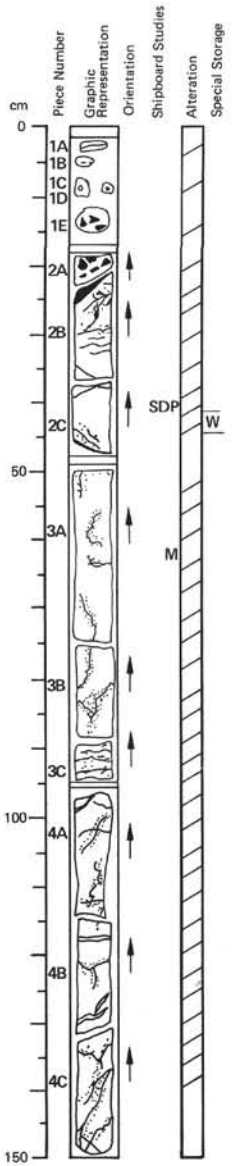
LEG	SITE	HOLE	CORE	SECT.
5 2	4 1 8	A	3 7	2

Visual Description

Moderately phyric pillow basalt. Basalt is dark gray to reddish-brown in oxidized areas; moderately altered. Plagioclase phenocrysts 5-8%, <5 mm, often milky and soft; olivine phenocrysts 1%, <1.5 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are altered to smectite and carbonate. Numerous veinlets are present, filled with carbonate, iron oxides, smectite and quartz; many are oxidized.

Shipboard Data

Magnetic Data:	40-42 cm
NRM Intensity (emu/cc)	10.82×10^{-3}
Stable Inclination	+23.3°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

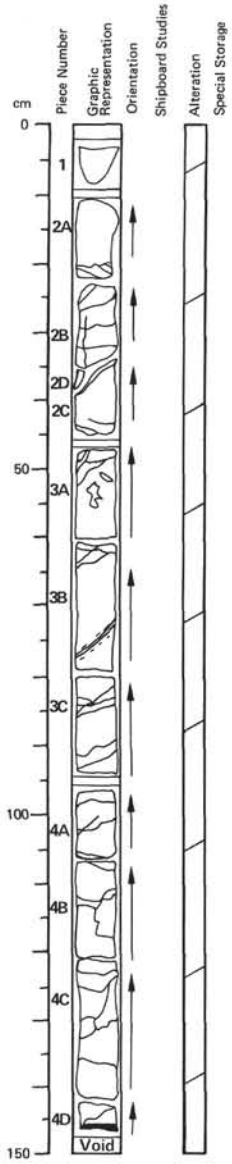
LEG	SITE	HOLE	CORE	SECT.
5 2	4 1 8	A	3 8	1

Visual Description

Sparsely phyric pillow basalt and minor hyaloclastic breccia. Basalt is dark gray except for brown staining along some fractures; moderately altered. Plagioclase phenocrysts 5%, <8 mm, somewhat chalky; olivine phenocrysts 1%, <2 mm, altered to smectite and iron oxides. Groundmass is fine-grained to glassy; glass selvedges are altered to smectite. Vesicles are present in pieces 4A and 4B, <1%, round to irregular, filled with smectite, iron oxides and minor carbonate. Hyaloclastic breccia and some altered sediment occur in piece 1. Glass fragments in the breccia are altered to smectite, carbonate, silica and zeolite(?).

Shipboard Data

Magnetic Data:	63-65 cm
NRM Intensity (emu/cc)	12.26×10^{-3}
Stable Inclination	+24.6°
Physical Property Data:	39-41 cm
$\bar{V}p$ (km/sec)	4.95
Porosity (%)	8.7
Wet Bulk Density (g/cc)	2.63
Grain Density (g/cc)	2.81

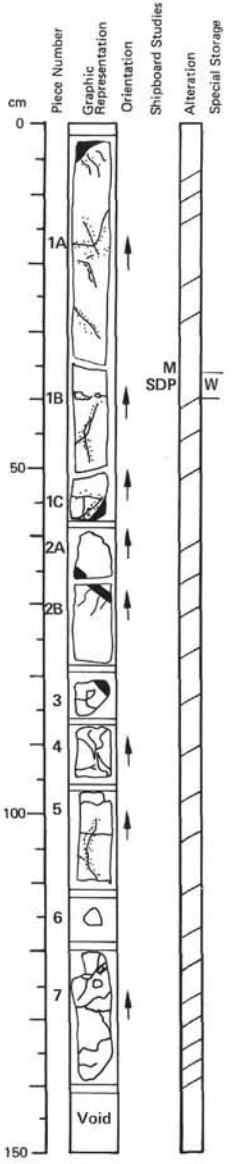


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	38	2

Visual Description

Sparsely to moderately phyric pillow basalt. Basalt is dark gray except for minor staining along fractures; weakly altered. Plagioclase phenocrysts 4-8%, <4 mm, partly altered to green smectite; olivine phenocrysts 1%, <1.5 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges mostly altered to smectite but fresh glass occurs in piece 4D. Vesicles 1%, <1 mm, filled with smectite and carbonate. Veinlets are filled with carbonate, smectite and quartz(?). Quartz filled vug occurs in pieces 2A and 2B.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

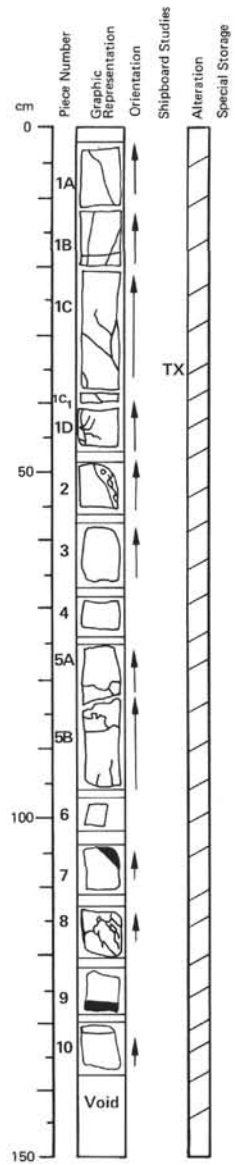
LEG	SITE	HOLE	CORE	SECT.
52	418	A	38	3

Visual Description

Sparsely phyric pillow basalt and minor hyaloclastic breccia. Basalt is dark gray with local mottling; weakly altered. Plagioclase phenocrysts 5%, <5 mm, often stained green; olivine phenocrysts 1%, <1 mm, altered to smectite and iron oxides. Groundmass is fine-grained to glassy; glass mostly altered to smectite but fresh glass locally preserved. Vesicles 1%, <0.5 mm, filled with carbonate. Veins are filled with smectite, carbonate and minor iron oxides. Glass breccia in piece 2A has matrix of smectite and zeolite(?).

Shipboard Data

Magnetic Data:	34-36 cm
NRM Intensity (emu/cc)	16.96×10^{-3}
Stable Inclination	+22.6°
Physical Property Data:	35-37 cm
$\bar{V}p$ (km/sec)	5.42
Porosity (%)	6.7
Wet Bulk Density (g/cc)	2.76
Grain Density (g/cc)	2.90



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 2	4 1 8	A	3 8	4

Visual Description

Moderately phyric pillow basalt. Basalt is dark gray except for minor oxidation along veins; weakly altered. Plagioclase phenocrysts 3-8%, < 6 mm, some partly altered to smectite; olivine phenocrysts 1%, < 1.5 mm, altered to smectite. Groundmass is medium-grained to glassy, piece 1 shows downward decrease in grain size from medium grained at 28 cm to very fine-grained at 45 cm; glass selvedges altered to smectite. Vesicles 1%, filled with smectite and carbonate. Veinlets are filled with smectite and minor quartz. Minor carbonate occurs in piece 8. Minor altered hyaloclastic breccia occurs in piece 2.

Thin Section Description

Location: 35 cm

Texture: porphyritic - quench

Phenocrysts: olivine 1%, <0.7 mm, euhedral; plagioclase 7%, <2.5 mm, euhedral

Groundmass: olivine 1%, 0.2 mm, subhedral; plagioclase 20%, <0.3 mm, acicular; clinopyroxene 66%, radiating sheaves; opaques 5%, 0.01 mm, granular

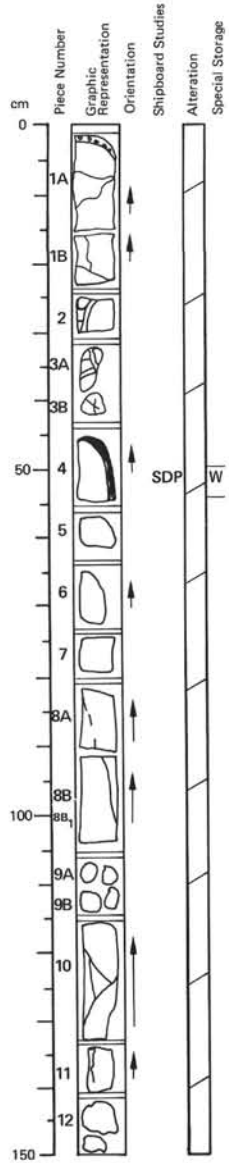
Vesicles: <1%, <0.5 mm, round

Alteration: olivine to smectite and carbonate; smectite and carbonate fill vesicles

Shipboard Data

Bulk Analysis: 34-36 cm

SiO_2	50.20
Al_2O_3	17.50
Fe_2O_3	9.89
MgO	6.98
CaO	12.70
Na_2O	2.22
K_2O	0.04
TiO_2	1.24
P_2O_5	0.13
MnO	0.24
LOI	1.6
H_2O^+	0.88
H_2O^-	N.D.
CO_2	0.06



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

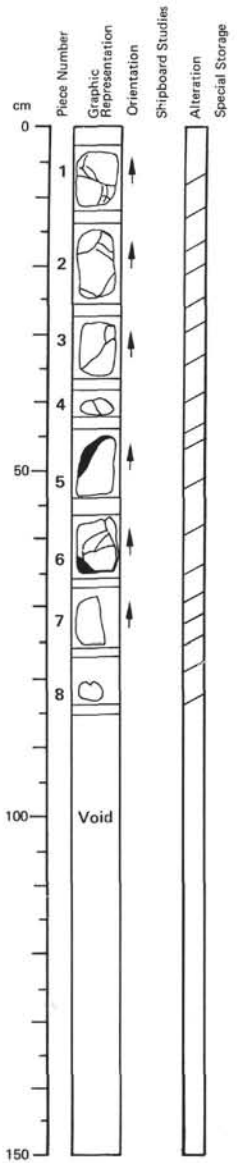
LEG	SITE	HOLE	CORE	SECT.
5 2	4 1 8	A	3 8	5

Visual Description

Sparsely to moderately phyric pillow basalt. Basalt is dark gray except for brown staining along some fractures and veinlets; weakly altered. Plagioclase phenocrysts 5-7%, < 6 mm, fresh; olivine phenocrysts 1%, < 1 mm, completely altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are mostly fresh. Vesicles 1%, < 0.5 mm, filled with smectite and carbonate. Veinlets are filled with carbonate and minor smectite.

Shipboard Data

Physical Property Data:	49-51 cm
$\bar{V}p$ (km/sec)	5.24
Porosity (%)	7.3
Wet Bulk Density (g/cc)	2.705
Grain Density (g/cc)	2.83

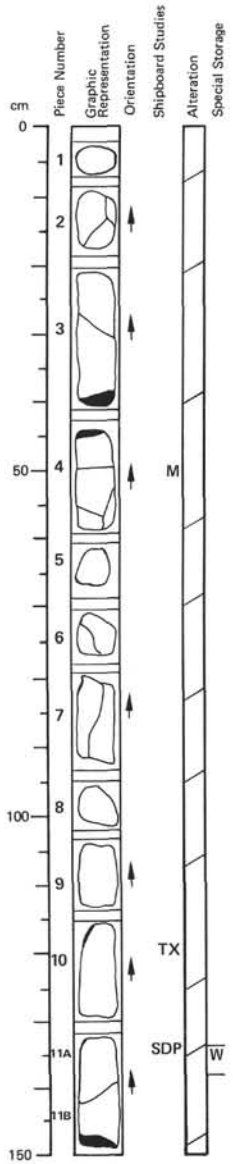


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	38	6

Visual Description

Moderately phyric pillow basalt. Basalt is dark gray except for brown staining along fractures; moderately altered. Plagioclase phenocrysts 7%, <6 mm, commonly stained yellow, black or blue-green; olivine phenocrysts 1%, <3 mm, completely altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are altered to smectite. Vesicles 1%, <0.5 mm, filled with smectite and carbonate. Veinlets are filled with smectite and carbonate.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	39	1

Visual Description

Moderately phyric pillow basalt. Basalt is dark gray except where oxidized along veins; weakly altered. Plagioclase phenocrysts 10%, <4 mm, often stained black, green or yellow; olivine phenocrysts 1%, <1.5 mm, completely altered to smectite. Groundmass is very fine-grained to glassy; glass selvedges are completely altered to smectite, carbonate, zeolite(?) and silica. Some pyrite occurs in pieces 9 and 10.

Thin Section Description

Location: 120 cm

Texture: porphyritic - quench

Phenocrysts: olivine <1%, <0.8 mm, euhedral; plagioclase 7%, <3 mm, subhedral

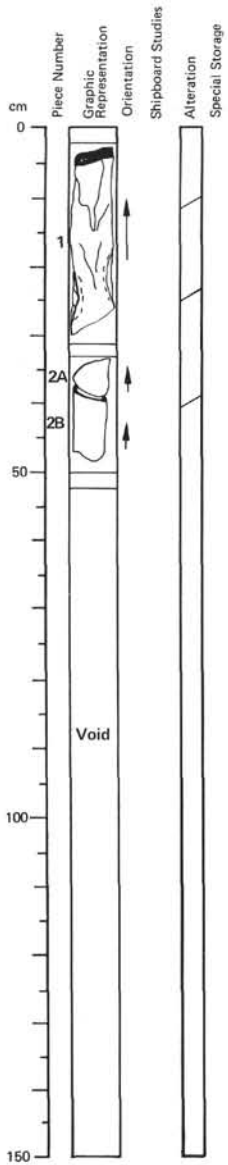
Groundmass: plagioclase 15%, <0.4 mm, acicular; clinopyroxene 72%, radiating aggregates; opaques 5%, 0.01 mm, granular

Vesicles: 1%, <0.5 mm, round

Alteration: olivine to carbonate; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 119-121 cm		Magnetic Data:	49-51 cm
SiO_2	50.00	NRM Intensity (emu/cc)	11.10×10^{-3}
Al_2O_3	17.60	Stable Inclination	+28.2°
Fe_2O_3	9.82		
MgO	6.99	Physical Property Data:	135-137 cm
CaO	13.70	$\bar{V}p$ (km/sec)	5.67
Na_2O	2.26	Porosity (%)	5.2
K_2O	0.08	Wet Bulk Density (g/cc)	2.835
TiO_2	1.24	Grain Density (g/cc)	2.92
P_2O_5	0.11		
MnO	0.20		
LOI	1.7		
H_2O^+	0.81		
H_2O^-	N.D.		
CO_2	0.70		

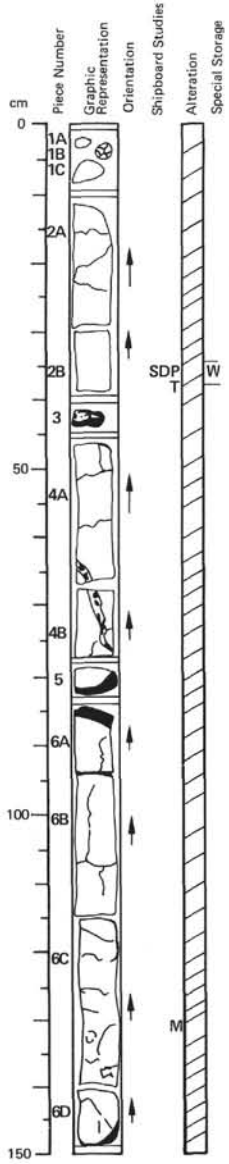


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	39	2

Visual Description

Moderately phyric pillow basalt. Basalt is dark gray except for minor brown staining along oxidized veins; weakly altered. Plagioclase phenocrysts 10-12%, <5 mm, fresh; olivine phenocrysts 3%, <2 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are mostly altered to smectite, carbonate and zeolite(?). Vesicles 1-2%, <1 mm, filled with smectite and carbonate.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	40	1

Visual Description

Moderately phyric pillow basalt. Basalt is dark gray except for brown staining along fractures, particularly in piece 6; weakly to moderately altered. Plagioclase phenocrysts 7%, <4 mm, sometimes stained blue or green; olivine phenocrysts 1%, <2 mm, completely altered to smectite. Groundmass is very fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles are chiefly in piece 4, 2%, filled with smectite and carbonate. Veinlets are also filled with smectite and carbonate; one large vein is present in piece 4. A fragment of dark gray, bedded hyaloclastite occurs in piece 1.

Thin Section Description

Location: 35 cm

Texture: porphyritic - quench

Phenocrysts: olivine 1%, <2 mm, euhedral; plagioclase 12%, <2.5 mm, euhedral

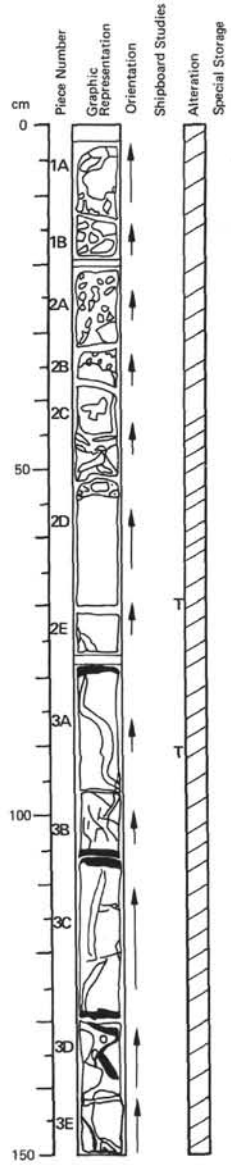
Groundmass: olivine 2%, 0.2 mm, subhedral; plagioclase 25%, 0.6 mm, acicular; clinopyroxene 52%, poorly crystallized, radiating sheaves; opaques 7%, 0.01 mm, granular

Vesicles: 1%, 0.5 mm, round

Alteration: plagioclase partly to smectite and carbonate; olivine to smectite; carbonate fills vesicles

Shipboard Data

Magnetic Data:	128-130 cm
NRM Intensity (emu/cc)	35.64×10^{-3}
Stable Inclination	+19.6°
Physical Property Data:	34 cm
$\overline{V}p$ (km/sec)	5.21
Porosity (%)	8.0
Wet Bulk Density (g/cc)	2.75
Grain Density (g/cc)	2.89



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	40	2

Visual Description

Moderately phyric pillow basalt and pillow breccia. Basalt is dark gray except for brown oxidized clasts in the breccia and brown staining along fractures; weakly to moderately altered. Plagioclase phenocrysts 10%, ≤4 mm, partly altered to chalky white clay; olivine phenocrysts 1%, ≤1 mm, completely altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are altered to smectite. Vesicles <1%, ≤1 mm, filled with carbonate. Veins are filled with carbonate and white zeolite(?). A carbonate filled vug occurs in piece 3A. Pillow breccia consists of glassy and oxidized lithic basalt fragments in a dark green matrix of glass altered to smectite.

Thin Section Description

Location: 70 cm

Texture: porphyritic - quench

Phenocrysts: olivine 1%, <0.6 mm, euhedral; plagioclase 15%, ≤3 mm, euhedral

Groundmass: olivine 2%, <0.3 mm, subhedral; plagioclase 23%, <0.5 mm, acicular; clinopyroxene 52%, poorly crystallized, radiating sheaves; opaques 6%, ≤0.05 mm, granular

Vesicles: 1%, ≤0.5 mm, round

Alteration: olivine to smectite; plagioclase partly to smectite and carbonate; smectite and carbonate fill vesicles

Location: 90 cm

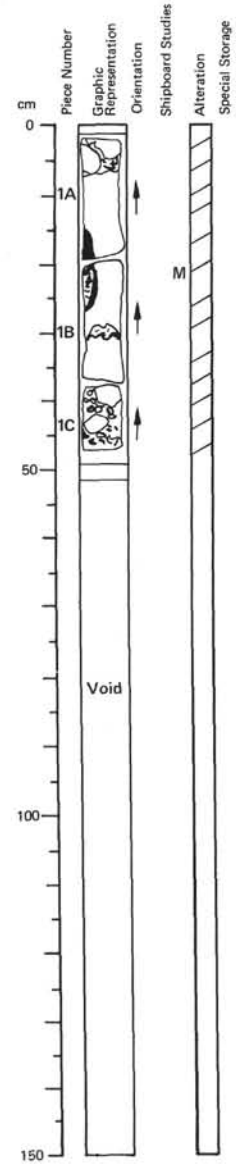
Texture: porphyritic - quench

Phenocrysts: olivine 1%, ≤2 mm, euhedral; plagioclase 15%, ≤4 mm, euhedral

Groundmass: olivine 3%, <0.4 mm, subhedral; plagioclase 18%, <0.4 mm, acicular; clinopyroxene 61%, radiating sheaves, poorly crystallized

Vesicles: 2%, 0.3 mm, round

Alteration: plagioclase partly to zeolite(?) and carbonate; olivine and some matrix to carbonate and smectite; carbonate fills vesicles



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

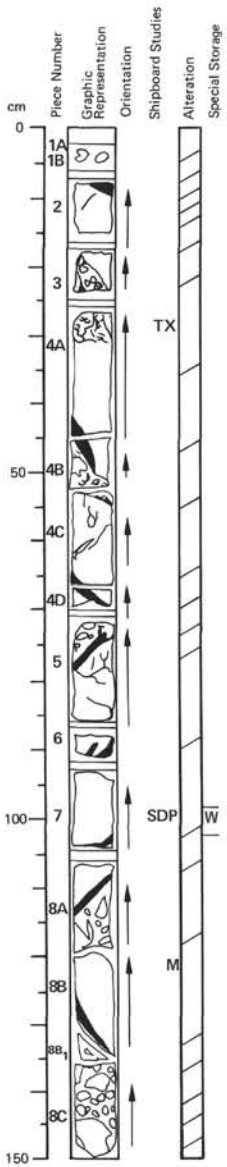
LEG	SITE	HOLE	CORE	SECT.
52	418	A	40	3

Visual Description

Sparsely phyric pillow basalt and minor breccia. Basalt is dark gray; weakly altered. Plagioclase phenocrysts 5%, ≤5 mm, fresh; olivine phenocrysts 1%, ≤1 mm, altered to smectite. Groundmass is very fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles <1%, filled with smectite and carbonate. Minor sulfide occurs in piece 1B. Veins and veinlets are also filled with smectite and carbonate. Breccia in piece 1C consists of lithic basalt fragments in a matrix of altered glass.

Shipboard Data

Magnetic Data:	21-23 cm
NRM Intensity (emu/cc)	19.16×10^{-3}
Stable Inclination	-74.0°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	4	1

Visual Description

Moderately phyric pillow basalt breccia. Breccia clasts are dark gray, matrix is dark green; rock is weakly to moderately altered. Plagioclase phenocrysts 12-15%, <6 mm, fresh; olivine phenocrysts 1%, ≤1.5 mm, altered to smectite. Groundmass of clasts is fine-grained to glassy; glass is partly altered to smectite. Vesicles <1%, filled with carbonate. Breccia matrix consists of dark green smectite presumably formed by alteration of glass.

Thin Section Description

Location: 40 cm

Texture: porphyritic - quench

Phenocrysts: olivine <1%, ≤0.6 mm, euhedral; plagioclase 8%, ≤8 mm, euhedral

Groundmass: olivine 3%, ≤0.3 mm, subhedral; plagioclase 40%, ≤0.5 mm, acicular; clinopyroxene 43%, radiating sheaves; opaques 2%, 0.01, granular

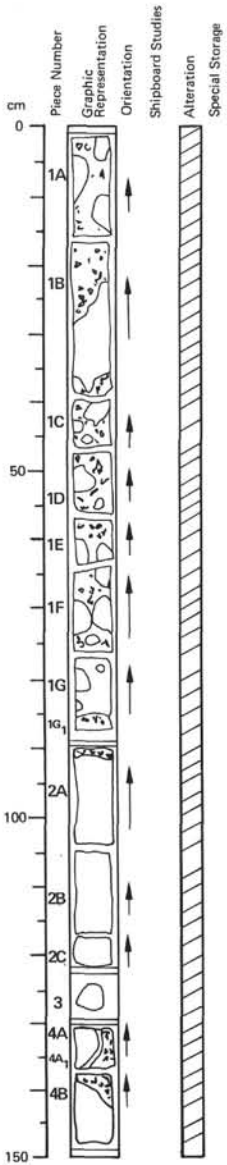
Vesicles: 4%, ≤0.4 mm, round

Alteration: olivine to smectite and carbonate; smectite and carbonate fill vesicles

Shipboard Data

Bulk Analysis: 40-42 cm	
SiO_2	49.70
Al_2O_3	18.50
Fe_2O_3	9.80
MgO	5.50
CaO	14.50
Na_2O	2.25
K_2O	0.16
TiO_2	1.09
P_2O_5	0.11
MnO	0.14
LOI	2.3
H_2O^+	1.14
H_2O^-	N.D.
CO_2	0.69

Magnetic Data:	122-124 cm
NRM Intensity (emu/cc)	11.14×10^{-3}
Stable Inclination	-81.3°
Physical Property Data:	98 cm
$\bar{V}p$ (km/sec)	5.57
Porosity (%)	5.9
Wet Bulk Density (g/cc)	2.77
Grain Density (g/cc)	2.88

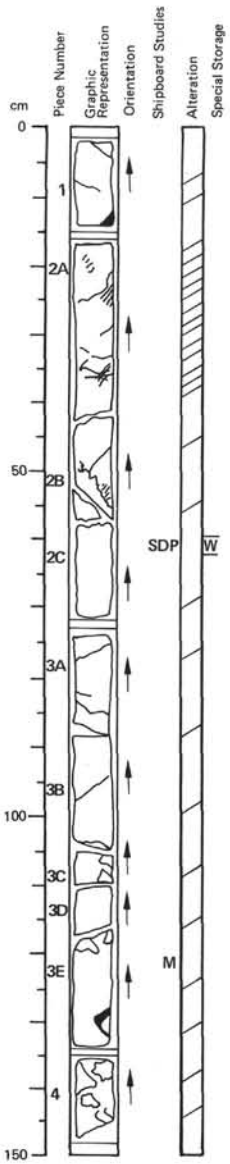


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	4	2

Visual Description

Broken pillow basalt breccia. Breccia clasts are dark gray; weakly altered. Breccia matrix is dark green; highly altered. Clasts are angular and range from a few millimeters to 30 cm across. Clasts consist of moderately phyric basalt with 10% plagioclase phenocrysts, ≤5 mm, and 1-2% of olivine phenocrysts, ≤1 mm, altered to smectite. Groundmass of the clasts is very fine-grained. Breccia matrix is dark green smectite presumably formed by alteration of glass.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

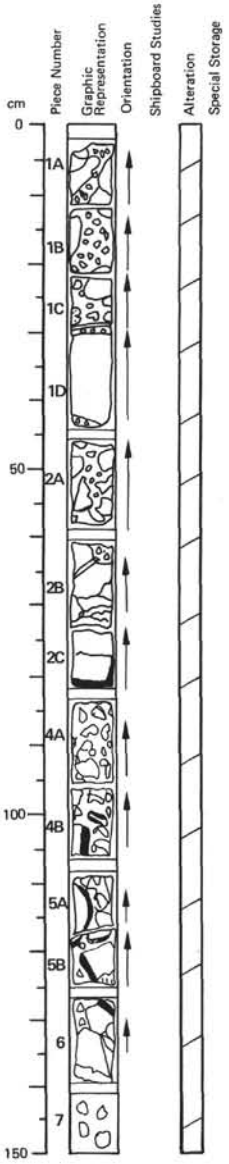
LEG	SITE	HOLE	CORE	SECT.
52	418	A	4 1	3

Visual Description

Broken pillow basalt breccia. Breccia clasts are dark gray to brown; weakly altered. Breccia matrix is dark green; highly altered. Clasts are angular, ranging from a few millimeters to 40 cm in diameter. Clasts are predominately sparsely phyric lithic basalt and some glass. Clasts have 5% plagioclase phenocrysts, ≤ 6 mm, fresh and 1% olivine phenocrysts, ≤ 1 mm, altered to smectite. Groundmass of the clasts is variable, ranging from fine-grained to very fine-grained. Sparse vesicles are filled with carbonate, smectite and quartz. Veins and veinlets are filled with carbonate and smectite; pyrite occurs in piece 3B. Carbonate filled vugs are present in piece 2A. Breccia matrix is dark green smectite presumably formed by alteration of glass.

Shipboard Data

Magnetic Data:	121-123 cm
NRM Intensity (emu/cc)	4.09×10^{-3}
Stable Inclination	+39.7°
Physical Property Data:	62-64 cm
$\bar{V}p$ (km/sec)	4.14
Porosity (%)	2.24
Wet Bulk Density (g/cc)	2.36
Grain Density (g/cc)	2.75

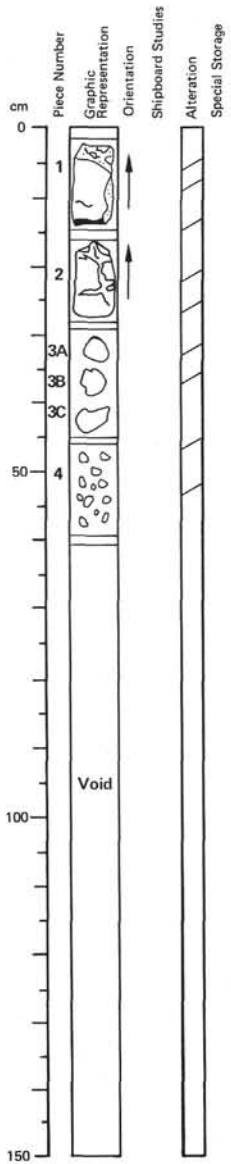


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	4 1	4

Visual Description

Broken pillow basalt breccia. Breccia fragments are various parts of pillows, some with glass rinds. Fragments are dark gray, weakly altered, angular and unsorted, ranging from a few millimeters to 15 cm across. Clasts are composed of moderately phyric basalt with 10-12% plagioclase phenocrysts, ≤ 4 mm, fresh and 1% olivine phenocrysts, ≤ 1 mm, altered to smectite. The groundmass of the clasts is very fine-grained to glassy; glass selvedges are partly altered to smectite. Breccia matrix consists of dark green smectite presumably formed by alteration of glass. Matrix contains abundant pyrite.

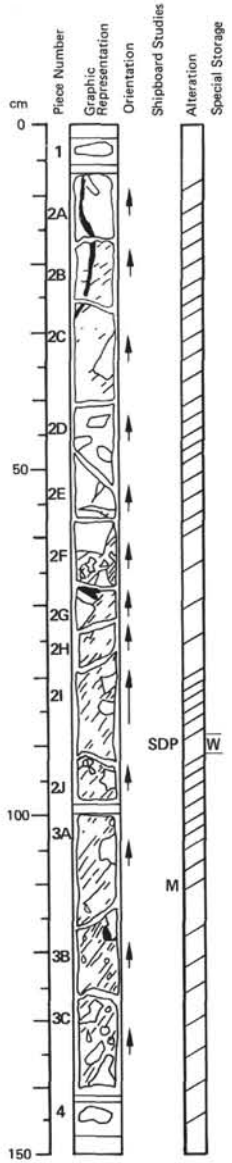


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		4	1	5

Visual Description

Broken pillow basalt breccia. Breccia fragments are various parts of pillows, some with glass rinds. Fragments are dark gray, weakly altered, angular pieces of lithic basalt with 5-8% plagioclase phenocrysts and 1% olivine phenocrysts. Piece 1 is aphyric lithic basalt with a glass rind. Breccia matrix consists of dark green smectite, presumably formed from altered glass. Sparse vesicles in fragments are filled with carbonate and quartz. Small veinlets are filled with smectite and minor pyrite.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

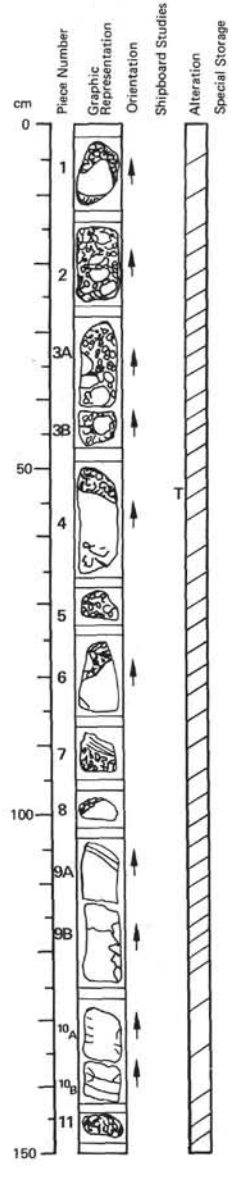
LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		4	2	1

Visual Description

Broken pillow basalt breccia. Breccia fragments are various parts of pillows, some with glass rinds. Fragments are dark gray, weakly altered, angular, and range from a few millimeters to 10 cm across. Most fragments are composed of lithoidal basalt with 5% plagioclase phenocrysts and 1% olivine phenocrysts, now altered to smectite. Groundmass of the fragments is fine- to very fine-grained with some glass. Breccia matrix is dark green smectite, presumably formed by alteration of glass, with minor pyrite and carbonate. Veins are filled with smectite, carbonate and pyrite.

Shipboard Data

Magnetic Data:	110-112 cm
NRM Intensity (emu/cc)	0.867×10^{-3}
Stable Inclination	+29.3°
Physical Property Data:	88-90 cm
$\overline{V}p$ (km/sec)	4.75
Wet Bulk Density (g/cc)	2.485



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	2	4	1	8	A	4	2	2

Visual Description

Broken pillow basalt breccia. Breccia fragments consist of various parts of pillows, some with glass rinds. Fragments are angular, ranging from a few millimeters to 20 cm across. Most fragments are sparsely phyric lithic basalt with 8% plagioclase phenocrysts, <6 mm, and 1% olivine phenocrysts, <2 mm, altered to smectite. Groundmass of the clasts is very fine-grained to glassy; all glass is altered to smectite. Breccia matrix consists of dark green smectite with minor carbonate. Thick veins of quartz and carbonate occur in pieces 7 and 9A. Piece 4 is probably a hyaloclastite fragment.

Thin Section Description

Location: 52 cm

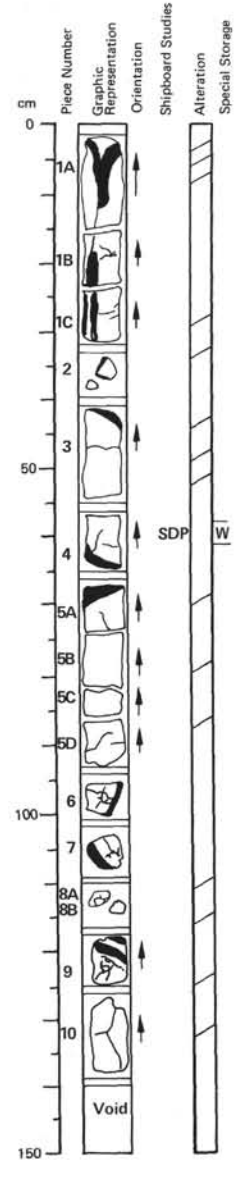
Texture: porphyritic - intergranular to intersertal

Phenocrysts: plagioclase 20%, <4 mm, euhedral

Groundmass: olivine 6%, <0.4 mm, subhedral; plagioclase 18%, <0.9 mm, subhedral; clinopyroxene 25%, <0.9 mm, granular; opaques 6%, 0.05 mm, granular; spinel <1%, <0.3 mm euhedral; glass 15%, altered

Vesicles: 10%, <3 mm, round to irregular

Alteration: olivine and some matrix to smectite and carbonate; smectite and carbonate fill vesicles



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

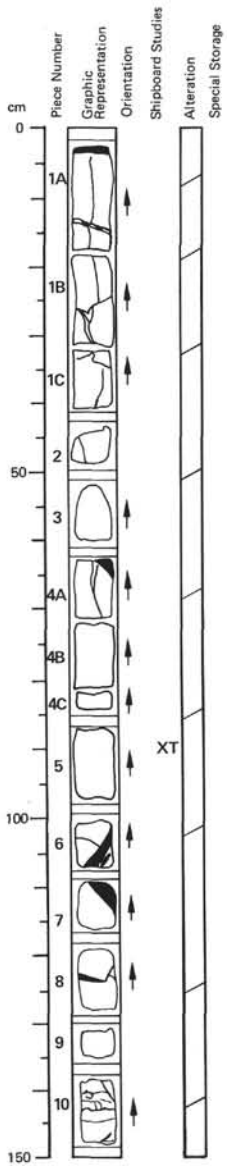
LEG		SITE			HOLE	CORE		SECT.
5	2	4	1	8	A	4	2	3

Visual Description

Sparsely to moderately phyric pillow basalt. Basalt is gray to greenish-gray; weakly altered. Plagioclase phenocrysts 7%, <8 mm, slightly altered to smectite; olivine phenocrysts 1%, <2 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Occasional veins are filled with carbonate, smectite and minor pyrite. Piece 1 has an internal glassy margin, presumably formed by water entering a fissure in hot rock. Piece 8A is a poorly sorted lithic sandstone with carbonate cement.

Shipboard Data

Physical Property Data:	59-61 cm
$\bar{V}p$ (km/sec)	5.52
Porosity (%)	6.7
Wet Bulk Density (g/cc)	2.775
Grain Density (g/cc)	2.89



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	42	4

Visual Description

Moderately phyric pillow basalt. Basalt is dark gray with little or no staining; weakly altered. Plagioclase phenocrysts 10%, <8 mm, often discolored to blue-green or yellow; olivine phenocrysts 2%, <2 mm, altered to smectite and carbonate. Groundmass is very fine-grained to glassy; fresh glass is present in many selvedges. Vesicles 1%, <1 mm, filled with smectite and carbonate. A 3 cm-thick vein of carbonate, smectite and zeolite(?) occurs in piece 10.

Thin Section Description

Location: 90 cm

Texture: porphyritic - quench

Phenocrysts: olivine 3%, <3 mm, euhedral; plagioclase 15%, <5 mm, euhedral

Groundmass: plagioclase 30%, <0.5 mm, acicular; clinopyroxene 44%, radiating sheaves; opaques 5%, 0.02 mm, granular; spinel <1%, 0.2 mm, euhedral

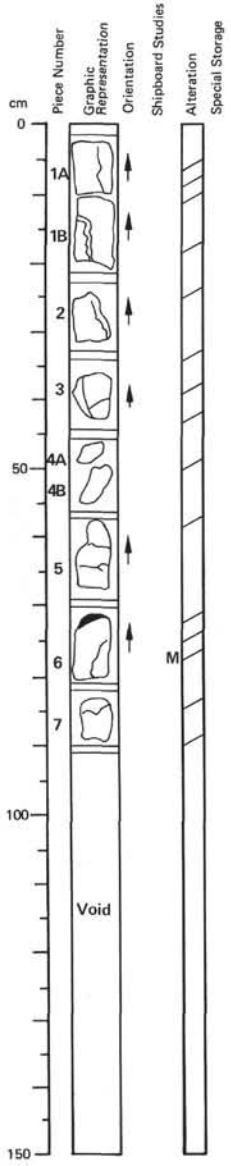
Vesicles: 3%, <0.4 mm, round

Alteration: olivine and groundmass to smectite and carbonate; smectite and carbonate fill vesicles

Shipboard Data

Bulk Analysis: 89-91 cm

SiO_2	49.80
Al_2O_3	18.40
Fe_2O_3	10.00
MgO	5.40
CaO	14.30
Na_2O	2.00
K_2O	0.02
TiO_2	0.99
P_2O_5	0.09
MnO	0.15
LOI	2.0
H_2O^+	0.95
H_2O^-	N.D.
CO_2	0.13



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

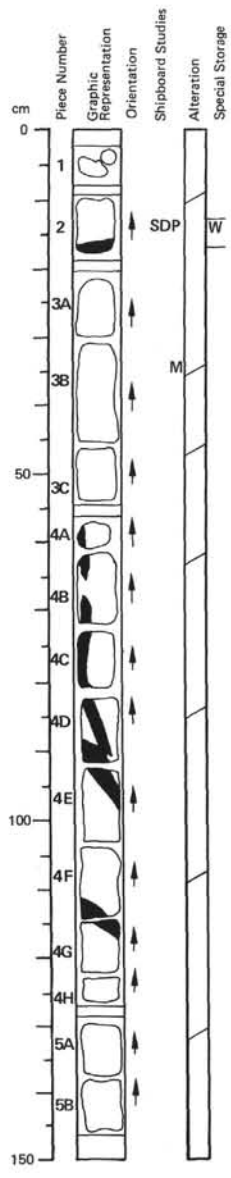
LEG	SITE	HOLE	CORE	SECT.
52	418	A	42	5

Visual Description

Sparsely to moderately phyric pillow basalt. Plagioclase phenocrysts 5-7%, <10 mm, partly altered to green smectite; olivine phenocrysts 1%, <2 mm, altered to smectite and carbonate. Groundmass is fine-grained to glassy; glass selvedges are altered to green smectite. Scattered veinlets are filled with smectite, carbonate, and in piece 6, pyrite.

Shipboard Data

Magnetic Data:	76-78 cm
NRM Intensity (emu/cc)	17.18×10^{-3}
Stable Inclination	-31.0°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

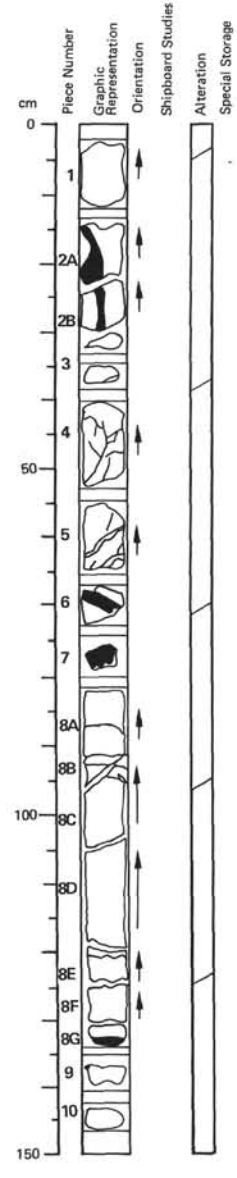
LEG	SITE	HOLE	CORE	SECT.
52	418	A	43	1

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray with minor brown staining along veins; weakly altered. Plagioclase phenocrysts 12%, <8 mm, stained green near veins; olivine phenocrysts 2%, <2 mm, altered to smectite and carbonate; clinopyroxene phenocrysts <1%, <2 mm, rounded, fresh. Groundmass is fine-grained to glassy; glass selvedges are fresh. Vesicles <1%, <1 mm, filled with carbonate. Scattered veinlets are filled with smectite, carbonate and minor pyrite. A smectite-carbonate vein or fragment of sediment is adjacent to the glass selvedge in piece 4D.

Shipboard Data

Magnetic Data:	30-32 cm
NRM Intensity (emu/cc)	14.43×10^{-3}
Stable Inclination	-34.7°
Physical Property Data:	11-13 cm
$\bar{V}p$ (km/sec)	5.77
Wet Bulk Density (g/cc)	2.83

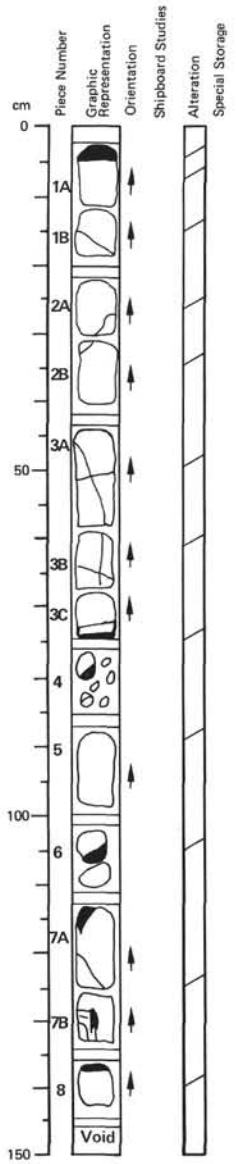


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	43	2

Visual Description

Moderately to highly phyric pillow basalt. Basalt is medium to dark gray with little or no staining along fractures; relatively fresh. Plagioclase phenocrysts 15-18%, <7 mm, fresh; olivine phenocrysts 2%, <2 mm, altered to smectite. Groundmass is fine-grained to glassy; most glass selvedges are altered to smectite but fresh glass is present in pieces 8G and 9. Vesicles <1%, filled with smectite. Scattered veins are filled with carbonate and quartz. Minor amounts of altered sediment occur next to glass selvedges.

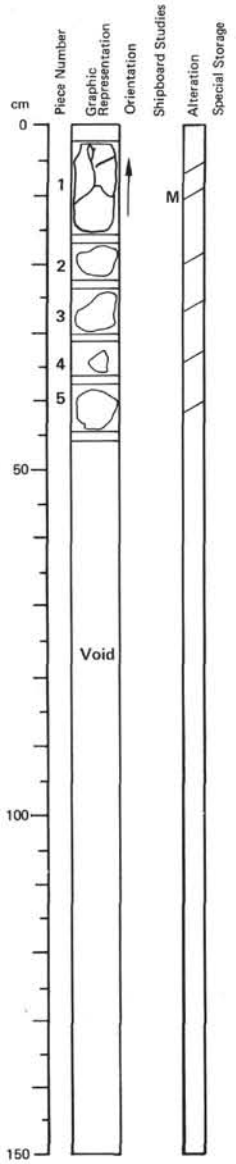


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 2	4 1 8	A	4 3	3

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray with minor brown staining along veins; weakly altered. Plagioclase phenocrysts 12%, <8 mm, occasionally stained bluish-green; olivine phenocrysts 2%, <2 mm, altered to smectite; clinopyroxene phenocrysts <1%, <2 mm, rounded, fresh. Groundmass is fine-grained to glassy; glass selvedges are mostly fresh. Vesicles <1%, <1 mm, filled with carbonate. Veinlets are filled with smectite and carbonate.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

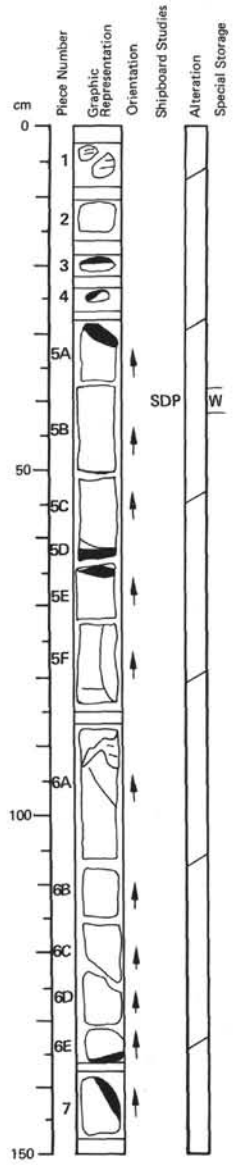
LEG	SITE	HOLE	CORE	SECT.
5 2	4 1 8	A	4 3	4 CC

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray with minor staining along fractures; weakly altered. Plagioclase phenocrysts 12-15%, <7 mm; olivine phenocrysts 3%, <2 mm, altered to smectite. Groundmass is fine-grained. Occasional veins are filled with carbonate and smectite.

Shipboard Data

Magnetic Data:	10-12 cm
NRM Intensity (emu/cc)	23.26×10^{-3}
Stable Inclination	-31.2°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

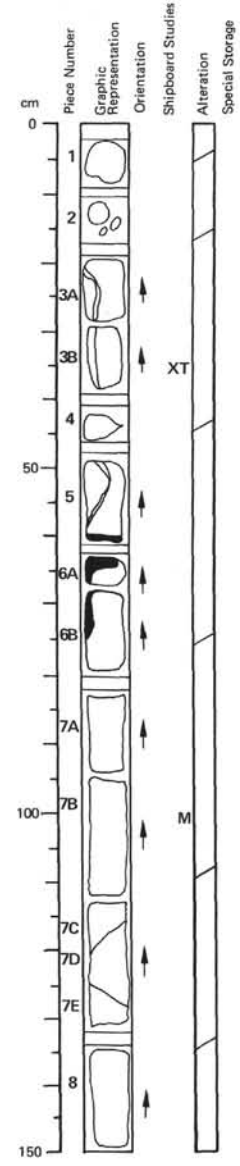
LEG		SITE			HOLE	CORE		SECT.
5	2	4	1	8	A	4	4	1

Visual Description

Basalt is medium to dark gray with little or no staining along fractures; relatively fresh. Plagioclase phenocrysts 15%, <8 mm, fresh, sometimes in glomerophyric clots with clinopyroxene; olivine phenocrysts 1-2%, <2 mm, altered to smectite; clinopyroxene phenocrysts <1%, <2 mm, rounded, sometimes in clots with plagioclase, fresh. Groundmass is fine-grained to glassy; glass selvedges are mostly fresh. Occasional veins are filled with smectite and carbonate.

Shipboard Data

Physical Property Data:	43-45 cm
$\bar{V}p$ (km/sec)	5.69
Porosity (%)	4.7
Wet Bulk Density (g/cc)	2.825
Grain Density (g/cc)	2.89



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	2	4	1	8	A	4	4	2

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray with very minor staining; relatively fresh. Plagioclase phenocrysts 8-10%, <8 mm, fresh; olivine phenocrysts 1-2%, <2 mm, mostly fresh with minor alteration to smectite; clinopyroxene phenocrysts <1%, <2 mm, rounded, fresh. Groundmass is fine-grained to glassy; glass selvedges are mostly fresh. Vesicles <1%, partly filled with carbonate and smectite. Occasional veins are also filled with carbonate and smectite.

Thin Section Description

Location: 35 cm

Texture: porphyritic - quench

Phenocrysts: olivine 3%, <1 mm, euhedral; plagioclase 10%, <2 mm, euhedral

Groundmass: olivine 5%, 0.2 mm, anhedral; plagioclase 40%, 0.5 mm, acicular; clinopyroxene 37%, <0.3 mm, anhedral to radiating sheaves; opaques 5%, 0.01 mm, granular; spinel <1%, 0.2 mm, euhedral

Vesicles: <1%, <0.2 mm, round

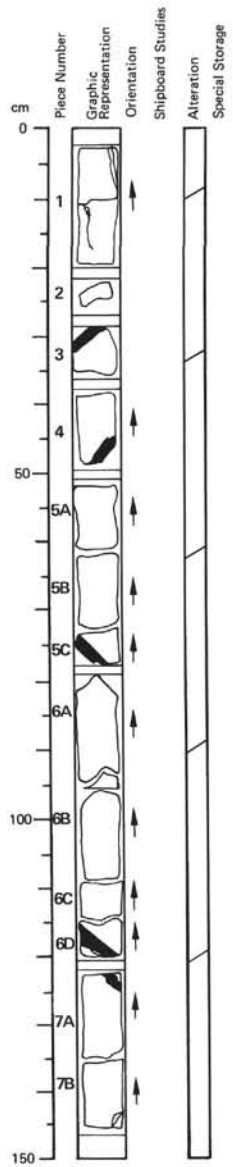
Alteration: olivine and minor groundmass to smectite; smectite and carbonate fill vesicles

Shipboard Data

Bulk Analysis: 34-36 cm

SiO_2	50.10
Al_2O_3	16.20
Fe_2O_3	10.60
MgO	7.87
CaO	13.20
Na_2O	1.86
K_2O	0.03
TiO_2	1.07
P_2O_5	0.11
MnO	0.17
LOI	1.5
H_2O^+	0.77
H_2O^-	N.D.
CO_2	0.05

Magnetic Data:	99-101 cm
NRM Intensity (emu/cc)	17.15×10^{-3}
Stable Inclination	+27.4°

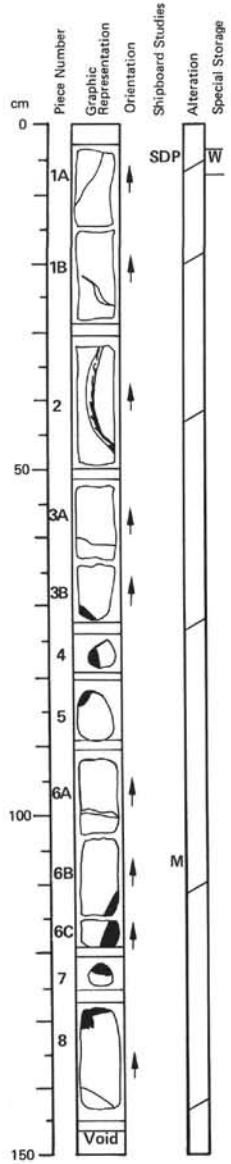


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE		CORE		SECT.	
5	2	4	1	8	A		4	4		3

Visual Description

Highly phyric pillow basalt. Basalt is medium to dark gray with little or no staining along fractures; relatively fresh. Plagioclase phenocrysts 20%, < 10 mm, fresh; olivine phenocrysts 1%, < 2 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are mostly fresh with only minor alteration to smectite. Occasional veins are filled with smectite and carbonate. Piece 2 is probably altered sediment composed of smectite, carbonate and quartz.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

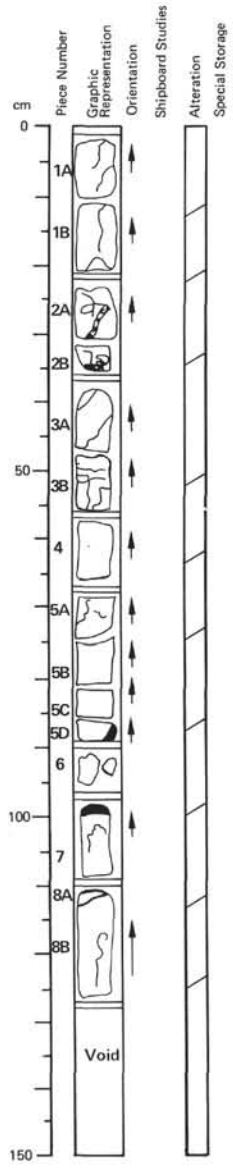
LEG		SITE			HOLE		CORE		SECT.	
5	2	4	1	8	A		4	4		4

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; relatively fresh. Plagioclase phenocrysts 10-12%, <8 mm, fresh, sometimes intergrown with olivine; olivine phenocrysts 2-3%, <2 mm, partly altered to smectite; clinopyroxene phenocrysts <1%, < 1 mm, rounded, fresh. Groundmass is fine-grained to glassy; glass selvedges are very fresh. Rare vesicles are filled with smectite.

Shipboard Data

Magnetic Data:	105-107 cm
NRM Intensity (emu/cc)	26.28×10^{-3}
Stable Inclination	-29.4°
Physical Property Data:	4-6 cm
$\overline{V}p$ (km/sec)	5.64
Porosity (%)	6.2
Wet Bulk Density (g/cc)	2.765
Grain Density (g/cc)	2.89

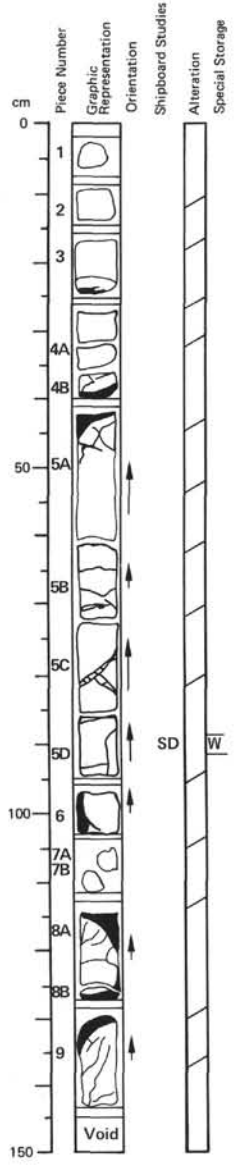


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	44	5

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; moderately altered. Plagioclase phenocrysts 9%, unevenly distributed, <10 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite and carbonate; clinopyroxene phenocrysts <1%, <5 mm, rounded, fresh. Groundmass is fine-grained to glassy; glass selvedges are altered to smectite. Vesicles <1%, filled with carbonate and smectite. Veins and veinlets are common, filled with smectite and carbonate.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

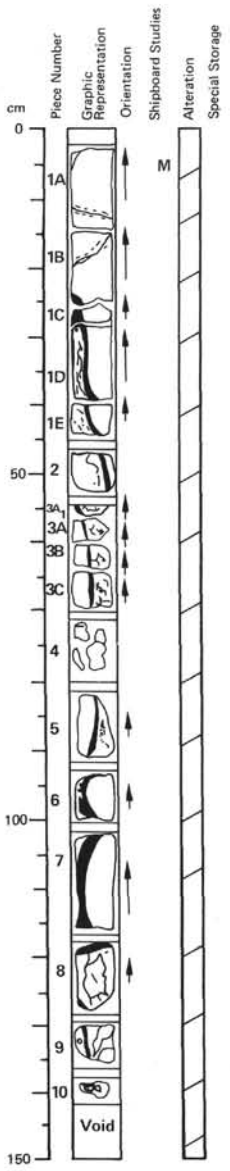
LEG	SITE	HOLE	CORE	SECT.
52	418	A	45	1

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; relatively fresh. Plagioclase phenocrysts 7%, <6 mm, fresh; olivine phenocrysts 1-2%, <4 mm, partly altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are mostly fresh. Veins are filled with carbonate and smectite; minor pyrite in pieces 5 and 9.

Shipboard Data

Physical Property Data:	86-88 cm
$\bar{V}p$ (km/sec)	5.73
Wet Bulk Density (g/cc)	2.785



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

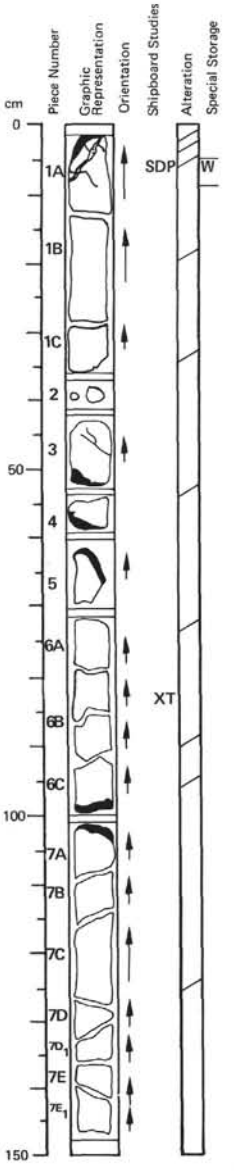
LEG		SITE			HOLE	CORE		SECT.
5	2	4	1	8	A	4	5	2

Visual Description

Moderately phyric pillow basalt and minor hyaloclastic breccia. Basalt is mostly medium to dark gray, dark green where glass is altered; moderately altered. Plagioclase phenocrysts 10-13%, <7 mm, fresh; olivine phenocrysts 2-3%, <2 mm, mostly altered to smectite but some still fresh; clinopyroxene phenocrysts <1%, <1.5 mm, rounded, fresh. Groundmass is fine-grained to glassy; glass selvedges are mostly replaced by smectite but some fresh glass is present. Vesicles <1%, <0.05 mm, filled with smectite. Narrow veinlets are filled with smectite, carbonate and pyrite. Breccia is composed of glass slivers in a dark green smectite matrix.

Shipboard Data

Magnetic Data:	4-6 cm
NRM Intensity (emu/cc)	22.42×10^{-2}
Stable Inclination	-35.0°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	2	4	1	8	A	4	5	3

Visual Description

Aphyric to moderately phyric pillow basalt. Basalt is mostly medium to dark gray; relatively fresh. Plagioclase phenocrysts 0-10%, <13 mm, usually fresh but with minor green staining; olivine phenocrysts 1%, <2 mm, partly altered to smectite. Aphyric zones are cores of pillows. Groundmass is fine-grained to glassy; glass selvedges are mostly fresh with only minor alteration to smectite. Occasional veinlets are filled with smectite, carbonate and minor pyrite.

Thin Section Description

Location: 84 cm

Texture: porphyritic - quench

Phenocrysts: olivine 2%, 0.6 mm, euhedral; plagioclase 5%, <2 mm, euhedral

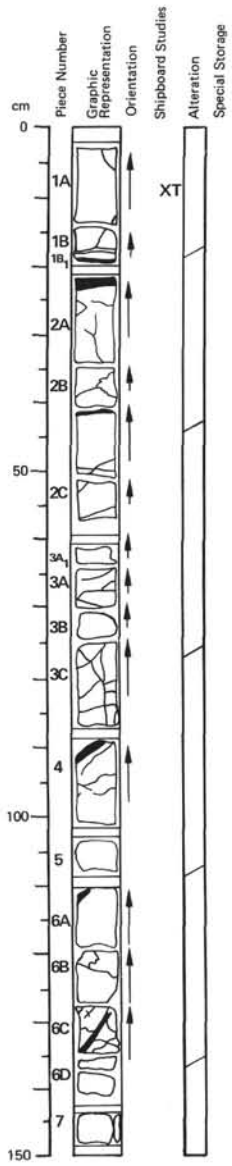
Groundmass: olivine 2%, <0.2 mm, subhedral; plagioclase 20%, 0.2 mm, acicular; clinopyroxene 65%; poorly crystallized, radiating sheaves; opaques 5%, 0.01 mm, granular

Vesicles: 1%, <0.2 mm, round

Alteration: olivine and groundmass to smectite and carbonate; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 82-84 cm		Physical Property Data:	7-9 cm
SiO_2	49.00	$\overline{V}p$ (km/sec)	5.63
Al_2O_3	15.20	Porosity (%)	5.0
Fe_2O_3	10.83	Wet Bulk Density (g/cc)	2.79
MgO	6.94	Grain Density (g/cc)	2.89
CaO	15.50		
Na_2O	1.99		
K_2O	0.17		
TiO_2	1.17		
P_2O_5	0.10		
MnO	0.20		
LOI	3.4		
H_2O^+	1.0		
H_2O^-	N.D.		
CO_2	2.43		



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	45	4

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; relatively fresh. Plagioclase phenocrysts 8-14%, ≤6 mm, some partly altered to smectite; olivine phenocrysts 2%, ≤3 mm, mostly altered to smectite; clinopyroxene phenocrysts <1%, ≤2 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges partly altered to smectite and fresh glass is present in most pieces. Vesicles <1%, ≤1 mm, filled with carbonate and smectite. Numerous veinlets are filled with smectite, carbonate and minor pyrite.

Thin Section Description

Location: 10 cm

Texture: porphyritic - quench

Phenocrysts: olivine 5%, ≤1 mm, euhedral; plagioclase 16%, ≤4 mm, euhedral; spinel <1%, 0.7 mm subhedral

Groundmass: olivine 3%, 0.2 mm, subhedral; plagioclase 25%, 0.4 mm, acicular; clinopyroxene 32%, poorly crystallized sheaves; opaques 3%, 0.02 mm, granular; glass 15%, devitrified

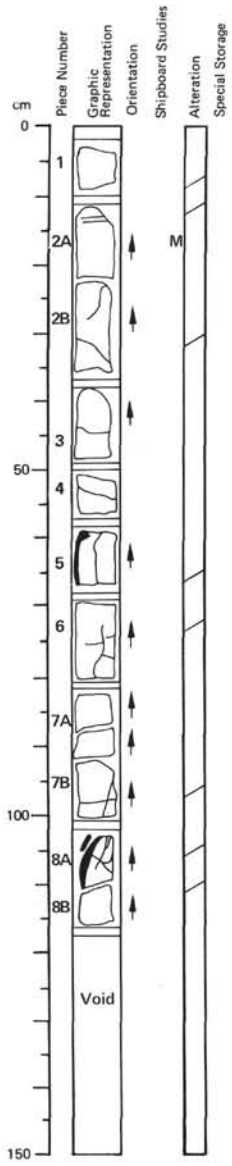
Vesicles: 1%, 0.2 mm, irregular to round

Alteration: olivine partly to smectite and carbonate; groundmass to carbonate; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 9-12 cm

SiO_2	49.20
Al_2O_3	17.10
Fe_2O_3	10.31
MgO	6.65
CaO	14.20
Na_2O	1.88
K_2O	0.03
TiO_2	1.04
P_2O_5	0.11
MnO	0.16
LOI	2.4
H_2O^+	0.82
H_2O^-	N.D.
CO_2	0.72



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

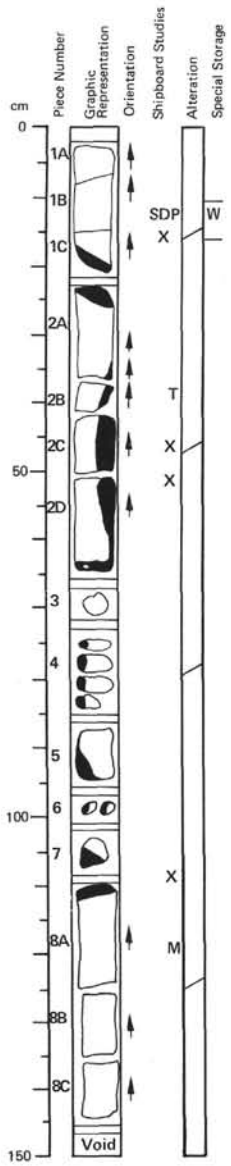
LEG	SITE	HOLE	CORE	SECT.
52	418	A	45	5

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray with minor green staining; weakly altered. Plagioclase phenocrysts 7%, ≤12 mm, mostly fresh, some stained green; olivine phenocrysts 1%, ≤2 mm, mostly altered to smectite, relatively fresh in piece 3. Groundmass is fine-grained to glassy; glass selvedges mostly fresh with minor alteration to smectite. Vesicles <1%, chiefly in piece 2, irregularly distributed, filled with smectite and carbonate. Occasional veinlets are filled with smectite and rare pyrite.

Shipboard Data

Magnetic Data:	15-17 cm
NRM Intensity (emu/cc)	21.97×10^{-3}
Stable Inclination	-33.8°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	2	4	1	8	A	4	6	1

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; relatively fresh. Plagioclase phenocrysts 10-12%, ≤8 mm, fresh; olivine phenocrysts 2%, mostly ≤2 mm, but one grain to 8 mm, partly altered to smectite but up to 50% is fresh; clinopyroxene phenocrysts ≤1%, ≤2 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are very fresh. Small veinlets are common, filled with carbonate, smectite and pyrite.

Thin Section Description

Location: 40 cm

Texture: porphyritic - glassy

Phenocrysts: olivine 2%, ≤1 mm, euhedral; plagioclase 10%, ≤4 mm, euhedral

Groundmass: glass 88%, poorly devitrified

Vesicles: <1%, ≤0.2 mm, round

Alteration: some olivine to smectite

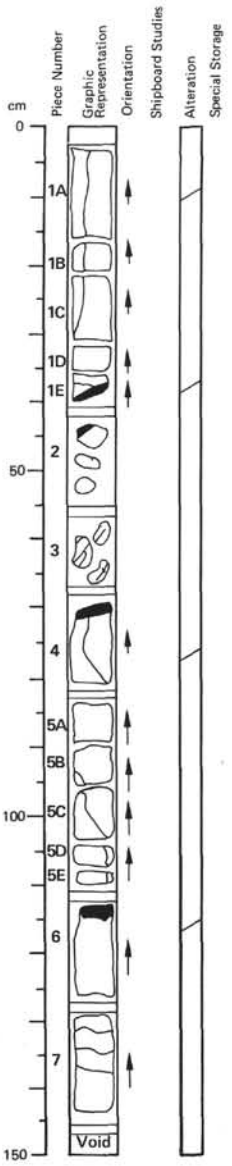
Shipboard Data

Bulk Analysis:

	12-19 cm	44-46 cm fresh glass	44-46 cm altered glass	51-54 cm	108-110 cm fresh rock	108-110 cm fresh glass	108-110 cm altered rock
SiO_2	49.1	49.08	49.93	46.3	49.18	48.78	48.79
Al_2O_3	17.3	16.31	17.40	16.4	17.57	17.36	16.96
Fe_2O_3	9.46	10.37	9.58	10.79	9.88	9.37	10.1
MgO	6.76	8.17	6.87	8.37	5.38	7.70	5.97
CaO	13.09	12.29	13.20	12.36	14.2	12.75	13.3
Na_2O	N.D.	2.19	2.28	N.D.	2.24	2.20	2.34
K_2O	0.15	0.12	0.15	0.20	0.09	0.09	0.07
TiO_2	1.09	1.09	1.08	1.08	1.08	1.16	1.10
P_2O_5	N.D.	0.08	0.02	N.D.	0.10	0.09	0.09
MnO	N.D.	.16	.14	N.D.	.14	.15	.14
LOI	N.D.	0.49	1.09	N.D.	1.82	0.33	2.10
H_2O^+	0.91	0.44	0.52	0.77	1.58	0.50	0.57
H_2O^-	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
CO_2	1.01	0.83	0.90	0.32	0.70	0.18	0.22

Magnetic Data:	117-119 cm
NRM Intensity (emu/cc)	31.83×10^{-3}
Stable Inclination	-32.6°

Physical Property Data:	11-13 cm
$\overline{V}p$ (km/sec)	5.70
Porosity (%)	4.6
Wet Bulk Density (g/cc)	2.795
Grain Density (g/cc)	2.88

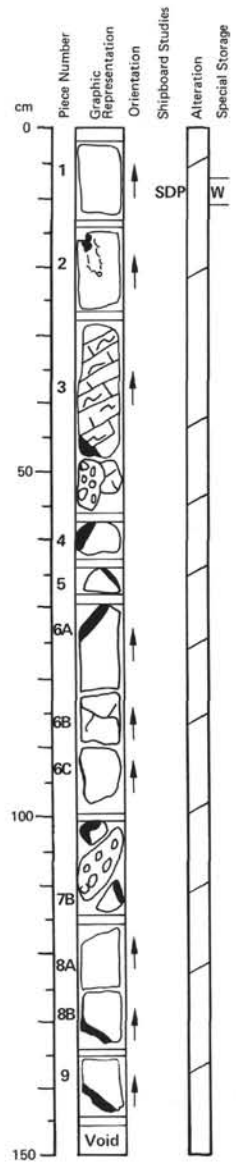


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	2	4	1	8	A	4	6	2

Viusal Description

Moderately phyric pillow basalt. Basalt is mostly medium to dark gray; relatively fresh. Plagioclase phenocrysts 10-12%, ≤8 mm, fresh; olivine phenocrysts 2%, ≤3 mm, partly altered to smectite but at least 50% are fresh; clinopyroxene phenocrysts ≤1%, ≤2 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are very fresh. Scattered veinlets are filled with smectite, carbonate and minor pyrite.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

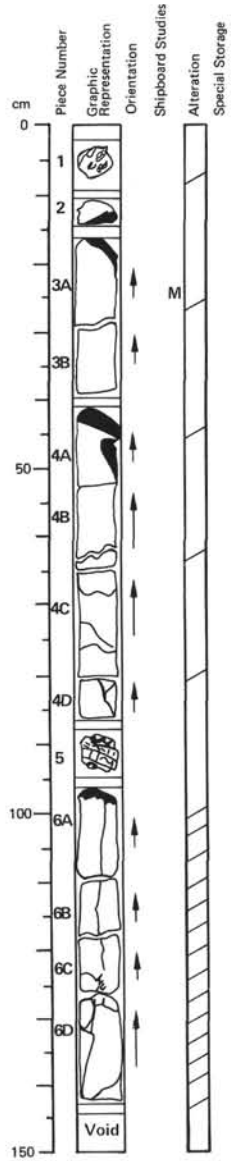
LEG	SITE	HOLE	CORE	SECT.
5 2	4 1 8	A	4 6	3

Visual Description

Highly phyric pillow basalt and minor interlayered sediment. Basalt is mostly medium to dark gray with minor green staining along veins; weakly altered. Plagioclase phenocrysts 20-25%, < 10 mm, fresh; olivine phenocrysts 3-4%, < 2 mm, mostly altered to smectite but with fresh olivine in pieces 1 and 2. Groundmass is fine-grained to glassy; glass selvedges are partly altered to green smectite. Scattered veinlets are filled with smectite, carbonate and pyrite. Piece 3 is altered sediment inclusion composed chiefly of carbonate and smectite.

Shipboard Data

Physical Property Data:	8-10 cm
$\bar{V}p$ (km/sec)	6.09
Wet Bulk Density (g/cc)	2.865



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

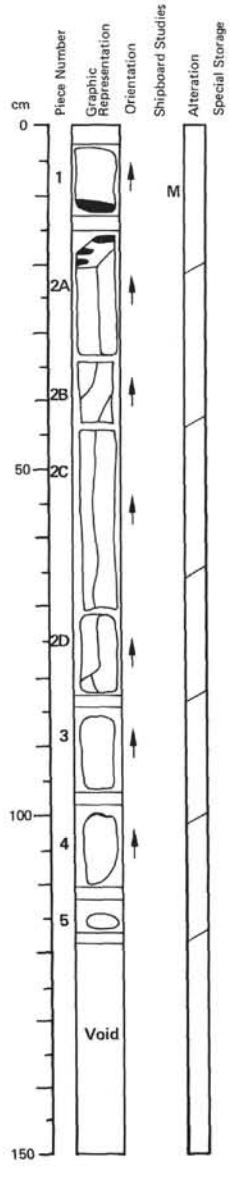
LEG	SITE	HOLE	CORE	SECT.
5 2	4 1 8	A	4 6	4

Visual Description

Highly phyric pillow basalt. Basalt is medium to dark gray with minor staining along fractures; weakly altered. Plagioclase phenocrysts 20-25%, < 10 mm, fresh; olivine phenocrysts 3%, < 3 mm, partly altered to smectite, fresh olivine is present in piece 3; clinopyroxene phenocrysts < 1%, < 3 mm, anhedral, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite with some fresh glass present throughout. Veins and veinlets are filled with smectite and carbonate. Piece 5 consists of altered sediment composed of carbonate and smectite.

Shipboard Data

Magnetic Data:	23-25 cm
NRM Intensity (emu/cc)	14.85×10^{-3}
Stable Inclination	-33.8°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

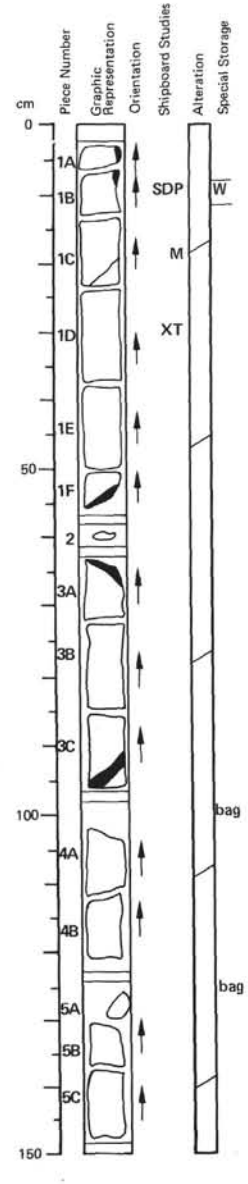
LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		4	6	5

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; relatively fresh. Plagioclase phenocrysts 10-12%, <8 mm, fresh; olivine phenocrysts 2%, <4 mm, partly altered to smectite but about 50% is fresh. Groundmass is fine-grained to glassy; glass selvedges are fresh. Veinlets are common, filled with carbonate, smectite and pyrite.

Shipboard Data

Magnetic Data:	7-9 cm
NRM Intensity (emu/cc)	30.22×10^{-3}
Stable Inclination	-29.1°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		4	7	1

Visual Description

Moderately phyric pillow basalt. Basalt is mostly medium to dark gray; relatively fresh. Plagioclase phenocrysts 10-12%, <8 mm, fresh; olivine phenocrysts 2%, <3 mm, partly altered to smectite with some fresh olivine present throughout the section; clinopyroxene phenocrysts <1%, <3 mm, anhedral, fresh. Groundmass is fine-grained to glassy; glass selvedges are fresh. Small veinlets are common, filled with smectite, carbonate and pyrite.

Thin Section Description

Location: 30 cm

Texture: porphyritic - quench

Phenocrysts: olivine 3%, <1 mm, euhedral; plagioclase 10%, <3 mm, subhedral; spinel <1%, 0.2 mm, euhedral

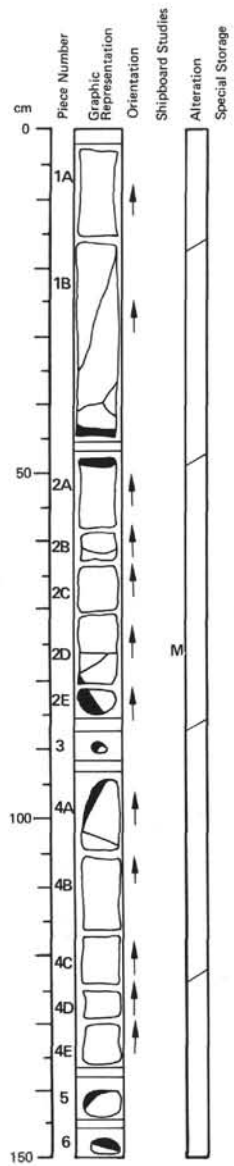
Groundmass: olivine 3%, <0.25 mm, euhedral; plagioclase 25%, <0.5 mm, acicular; clinopyroxene 53%; radiating sheaves; opaques 6%, 0.01 mm, granular to lath - shaped

Vesicles: <1%, <0.5 mm, round

Alteration: olivine and groundmass partly to smectite and carbonate; smectite and carbonate fill vesicles

Shipboard Data

Bulk Analysis: 27-29 cm		Magnetic Data:	18-20 cm
SiO_2	49.50	NRM Intensity (emu/cc)	22.85×10^{-3}
Al_2O_3	16.60	Stable Inclination	-29.0°
Fe_2O_3	10.22		
MgO	8.17	Physical Property Data:	7-9 cm
CaO	12.90	$\overline{Vp}$ (km/sec)	5.54
Na_2O	1.92	Porosity (%)	6.3
K_2O	0.03	Wet Bulk Density (g/cc)	2.79
TiO_2	1.04	Grain Density (g/cc)	2.90
P_2O_5	0.10		
MnO	0.16		
LOI	1.4		
H_2O^+	1.05		
H_2O^-	N.D.		
CO_2	0.05		



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

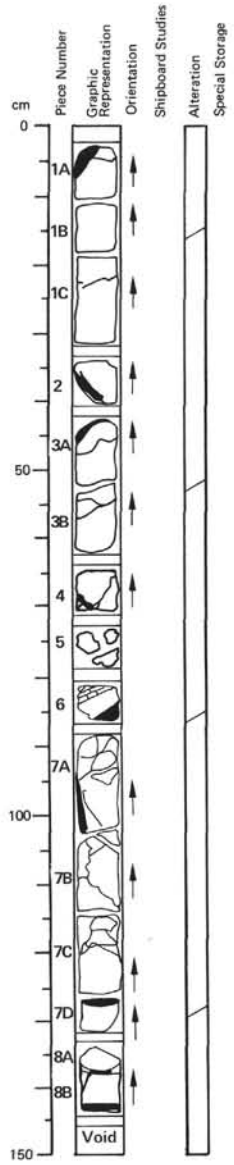
LEG	SITE	HOLE	CORE	SECT.
52	418	A	47	2

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; relatively fresh. Plagioclase *phenocrysts 10-12%, <8 mm, fresh; olivine phenocrysts 3%, <2 mm, mostly altered to smectite* but some fresh olivine occurs throughout the section; clinopyroxene phenocrysts <1%, <3 mm, rounded, fresh. Groundmass is fine-grained to glassy; glass selvedges are very fresh. Minor veinlets are filled with smectite, carbonate and pyrite.

Shipboard Data

Magnetic Data:	77-79 cm
NRM Intensity (emu/cc)	14.36×10^{-3}
Stable Inclination	-30.0°

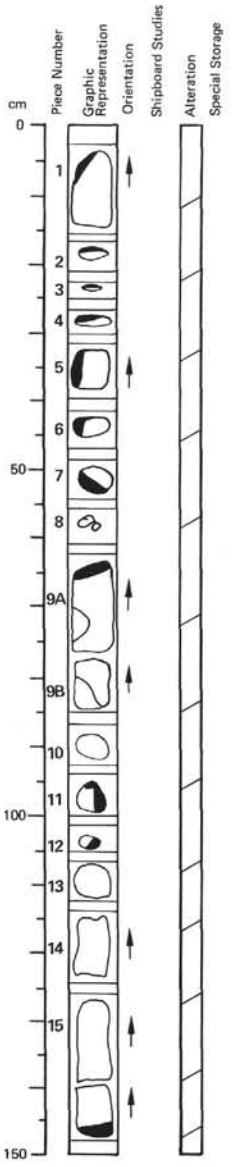


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	47	3

Visual Description

Moderately phyric pillow basalt. Basalt is mostly medium to dark gray; relatively fresh. Plagioclase phenocrysts 12%, <8 mm, fresh; olivine phenocrysts 3%, <5 mm, mostly altered to smectite but with fresh olivine locally present; clinopyroxene phenocrysts <1%, subophitic intergrowths with plagioclase, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite, but fresh glass is present throughout the section. Veinlets are common, filled with smectite and carbonate. In pieces 5 and 6 there are fragments of altered sediment composed of carbonate and smectite.

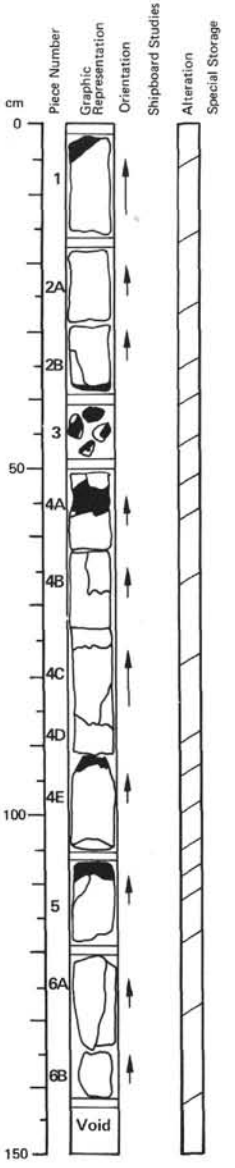


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A	4	7		4

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 12%, <8 mm, fresh; olivine phenocrysts 3%, <2 mm, completely altered to smectite; clinopyroxene phenocrysts <1%, fresh. Groundmass is fine-grained to glassy; glass selvedges are generally fresh with minor alteration to smectite. Scattered veinlets are filled with carbonate and smectite.

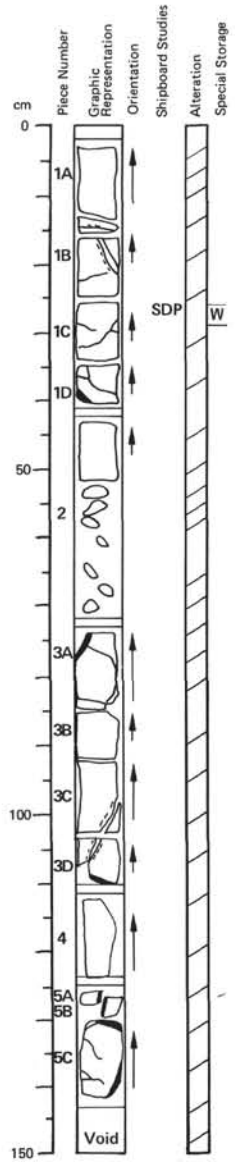


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A	4	7		5

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly to moderately altered. Plagioclase phenocrysts 15%, <8 mm, fresh; olivine phenocrysts 4%, <4 mm, mostly altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite but some fresh glass persists throughout the section. Veinlets are scattered, filled with smectite and carbonate.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

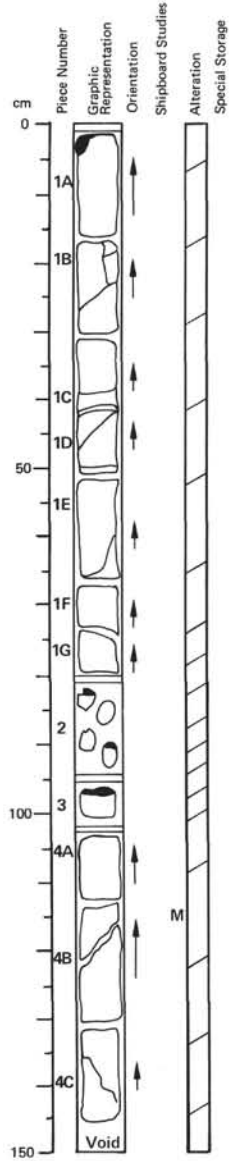
LEG	SITE	HOLE	CORE	SECT.
52	418	A	48	1

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray with some alteration to green smectite in pieces 2C through 2G; weakly to moderately altered. Plagioclase phenocrysts 10-12%, <7 mm, fresh; olivine phenocrysts 1-2%, <2 mm, partly altered to smectite; clinopyroxene phenocrysts <1%, <1 mm, anhedral, fresh. Groundmass is fine-grained to glassy; glass selvedges all contain fresh glass. Vesicles <1%, <0.5 mm, filled with smectite and carbonate. Veinlets are scattered throughout, filled with smectite, carbonate and pyrite. Zeolite(?) fills a vug in pieces 3A and 3B.

Shipboard Data

Physical Property Data:	26-28 cm
$\overline{Vp}$ (km/sec)	5.71
Wet Bulk Density (g/cc)	2.805



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

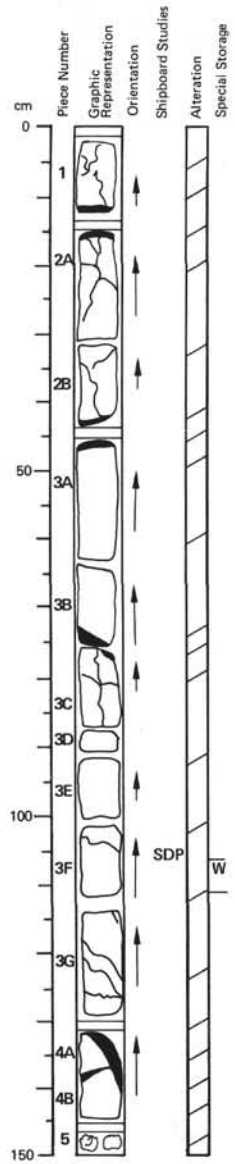
LEG	SITE	HOLE	CORE	SECT.
52	418	A	48	2

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly to moderately altered. Plagioclase phenocrysts 9%, <7 mm, fresh; olivine phenocrysts 1%, <2 mm, replaced by smectite and carbonate; clinopyroxene phenocrysts <1%, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite but fresh glass persists throughout. Vesicles are rare. Veinlets are scattered throughout, filled with smectite, carbonate and minor pyrite. Some pyrite is also disseminated in the groundmass.

Shipboard Data

Magnetic Data:	114-116 cm
NRM Intensity (emu/cc)	18.37×10^{-3}
Stable Inclination	-26.7°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

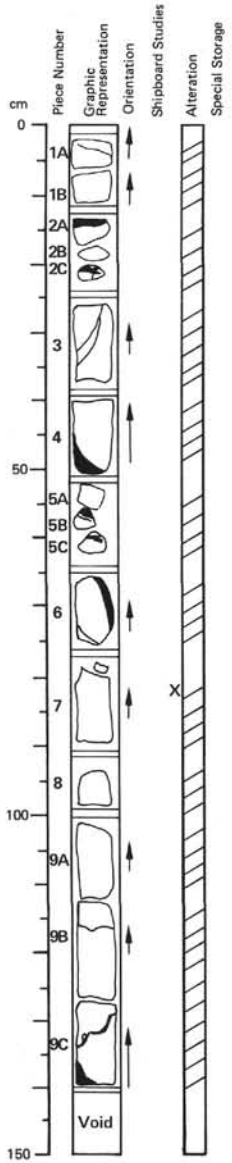
LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		4	8	3

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly to moderately altered. Plagioclase phenocrysts 10%, ≤8 mm, some glomerocrysts up to 15 mm, fresh; olivine phenocrysts 1%, ≤2 mm, altered to smectite and carbonate; clinopyroxene phenocrysts ≤1%, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite but fresh glass occurs throughout the section. Vesicles are rare. Veinlets are scattered throughout, filled with smectite, carbonate and minor pyrite.

Shipboard Data

Physical Property Data:	106-108 cm
$\bar{V}p$ (km/sec)	5.92
Wet Bulk Density (g/cc)	2.85



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	2	4	1	8	A		4	8	4

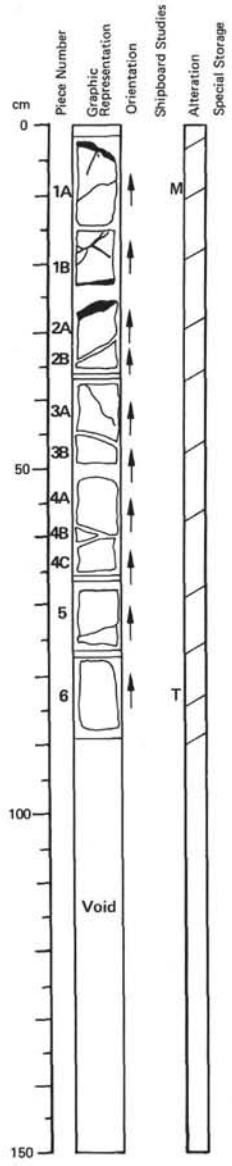
Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly to moderately altered. Plagioclase phenocrysts 3-12%, ≤7 mm, fresh; olivine phenocrysts 1%, ≤2 mm, altered to smectite and carbonate; clinopyroxene phenocrysts ≤1%, present only in the lower 50 cm of the section. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles are rare. Veinlets are scattered throughout, filled with smectite and carbonate. Pyrite is locally present.

Shipboard Data

Bulk Analysis: 82-84 cm

SiO_2	49.6
Al_2O_3	16.4
Fe_2O_3	8.80
MgO	7.45
CaO	12.7
Na_2O	N.D.
K_2O	0.01
TiO_2	1.04
P_2O_5	N.D.
MnO	N.D.
LOI	1.6
H_2O^+	0.67
H_2O^-	N.D.
CO_2	0.05



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
52	418	A	48	5

Visual Description

Moderately phyric pillow basalt. Basalt is dark gray to medium gray; weakly altered. Plagioclase phenocrysts 10-12%, <8 mm, often in glomerocrysts with olivine, fresh; olivine phenocrysts 1-2%, <1 mm, mostly altered to smectite; clinopyroxene phenocrysts <1 mm, mostly altered to smectite; clinopyroxene phenocrysts <1%, <1.5 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are fresh. Vesicles <1%, ≤0.5 mm, filled with smectite and carbonate. Narrow veinlets are filled with smectite and carbonate. Minor pyrite is present in the groundmass.

Thin Section Description

Location: 83 cm

Texture: porphyritic - quench

Phenocrysts: olivine 3%, <2 mm, euhedral; plagioclase 18%, <4 mm, euhedral

Groundmass: olivine 3%, <0.2 mm, subhedral; plagioclase 25%, 0.6 mm, acicular; clinopyroxene 45%, radiating sheaves; opaques 5%, 0.01 mm, granular; spinel <1%, 0.15 mm, euhedral

Vesicles: 1%, <0.4 mm, round

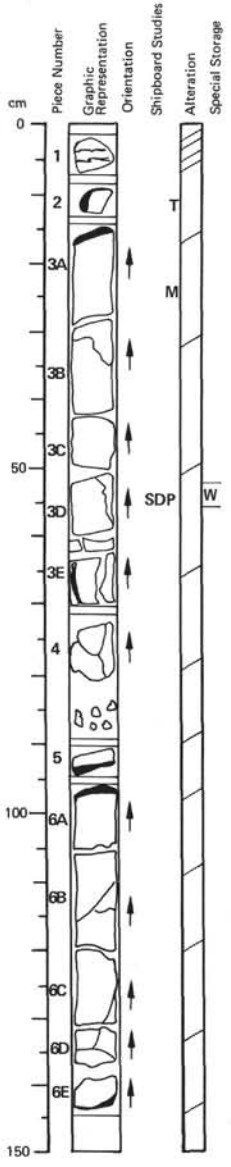
Alteration: olivine partly to smectite and carbonate; smectite and carbonate fill vesicles

Shipboard Data

Magnetic Data:	8-10 cm
NRM Intensity (emu/cc)	30.13×10^{-3}
Stable Inclination	-25.1°

Bulk Analysis: 32-34 cm

SiO_2	49.60
Al_2O_3	16.40
Fe_2O_3	9.78
MgO	7.45
CaO	12.70
Na_2O	1.82
K_2O	0.01
TiO_2	1.04
P_2O_5	0.10
MnO	0.16



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	49	1

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 10%, <10 mm, fresh; olivine phenocrysts 2-3%, <1 mm, mostly altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are relatively fresh with only minor alteration to smectite. Occasional veinlets are filled with carbonate and smectite with minor silica(?) and pyrite.

Thin Section Description

Location: 10 cm

Texture: porphyritic - quench

Phenocrysts: olivine 1%, <1.5 mm, euhedral; plagioclase 15%, <3.5 mm, euhedral

Groundmass: olivine 2%, <0.3 mm, subhedral; plagioclase 35%, <0.3 mm, acicular; glass 46%, some poorly crystallized; opaques 2%, 0.01 mm, granular; spinel tr, 0.05 mm, euhedral

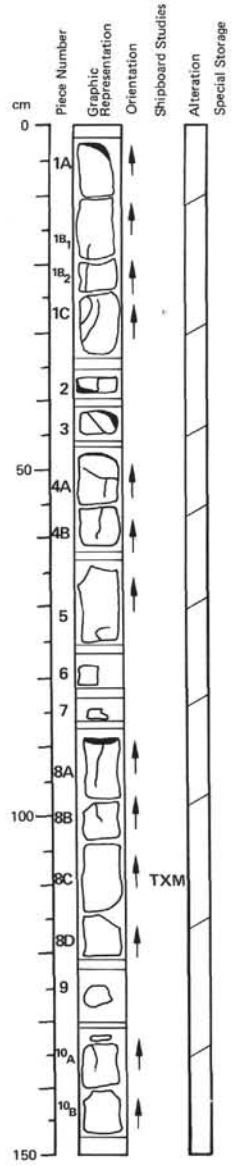
Vesicles: 1%, 0.2 mm, round

Alteration: olivine and glass, partly to smectite and minor carbonate; smectite and carbonate fill vesicles

Shipboard Data

Magnetic Data:	20-22 cm
NRM Intensity (emu/cc)	17.38×10^{-3}
NRM Inclination	-28.7°

Physical Property Data:	57-59 cm
$\overline{V}p$ (km/sec)	6.04
Porosity (%)	3.41
Wet Bulk Density (g/cc)	2.86
Grain Density (g/cc)	2.93



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	49	2

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 10%, < 10 mm, fresh; olivine phenocrysts 2%, < 2 mm, mostly altered to smectite but with some fresh olivine preserved. Groundmass is fine-grained to glassy; glass selvedges are fresh. Scattered veinlets are filled with smectite, carbonate and minor pyrite.

Thin Section Description

Location: 110 cm

Texture: porphyritic - quench

Phenocrysts: olivine 3%, <2.5 mm, euhedral; plagioclase 15%, <7 mm, euhedral

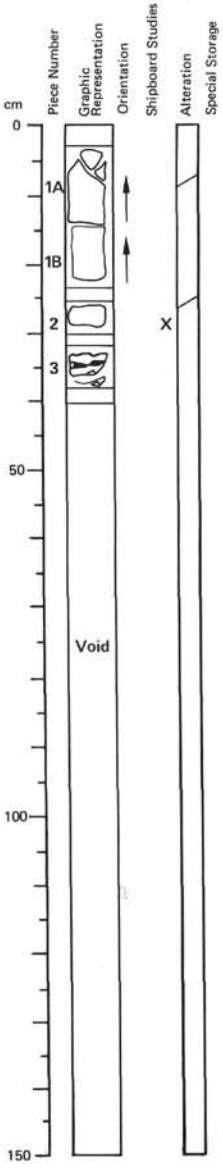
Groundmass: olivine 2%, <0.2 mm, subhedral; plagioclase 3%, <0.7 mm, acicular; clinopyroxene 44%, poorly crystallized, radiating sheaves; opaques 6%, 0.02 mm, granular; spinels tr, <0.15 mm, euhedral

Vesicles: <1%, 0.15 mm, round

Alteration: olivine and some groundmass to smectite and carbonate; smectite and carbonate fill vesicles

Shipboard Data

Bulk Analysis: 108-110 cm		Magnetic Data:	108-110 cm
SiO_2	50.51	NRM Intensity (emu/cc)	22.51×10^{-3}
Al_2O_3	18.04	NRM Inclination	-25.9°
Fe_2O_3	10.66	Stable Inclination	-27.2°
MgO	5.32		
CaO	14.03		
Na_2O	N.D.		
K_2O	< 0.03		
TiO_2	1.10		
P_2O_5	N.D.		
MnO	N.D.		
LOI	2.94		
H_2O^+	1.18		
H_2O^-	N.D.		
CO_2	0.45		



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	49	3

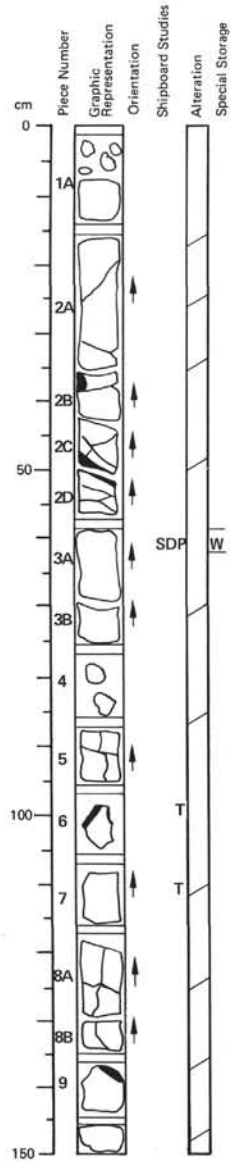
Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 10%, <8 mm, fresh; olivine phenocrysts 2%, <1 mm, completely altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are altered to smectite. Veinlets are common, filled with smectite and carbonate. Pyrite occurs locally in the groundmass.

Shipboard Data

Bulk Analysis: 32-35 cm

SiO_2	50.59
Al_2O_3	10.48
Fe_2O_3	13.68
MgO	16.34
CaO	3.98
Na_2O	1.63
K_2O	0.88
TiO_2	1.03
P_2O_5	0.04
MnO	.05
LOI	10.20
H_2O^+	8.47
H_2O^-	N.D.
CO_2	0.74



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	50	1

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 12%, <6 mm, fresh; olivine phenocrysts 4%, <2 mm, partly altered to smectite. Groundmass is mostly fine-grained to glassy, some zones are medium grained and subophitic; glass selvedges are fresh. Veinlets are scattered throughout, filled with smectite, carbonate and pyrite. Pyrite is also disseminated in the groundmass.

Thin Section Description

Location: 100 cm

Texture: porphyritic - quench

Phenocrysts: olivine 2%, <1 mm, subhedral; plagioclase 18%, <3.5 mm, euhedral

Groundmass: olivine 2%, <0.3 mm, subhedral; plagioclase 35%, <0.4 mm, acicular; opaques 5%, 0.02 mm, granular; spinels tr, 0.04 mm, euhedral; glass 38%, some poorly devitrified

Vesicles: <1%, <0.2 mm, round

Alteration: olivine partly to smectite and carbonate; smectite and carbonate fill vesicles

Thin Section Description

Location: 110 cm

Texture: porphyritic - quench

Phenocrysts: olivine 2%, <0.3 mm, subhedral; plagioclase 12%, <4 mm, euhedral

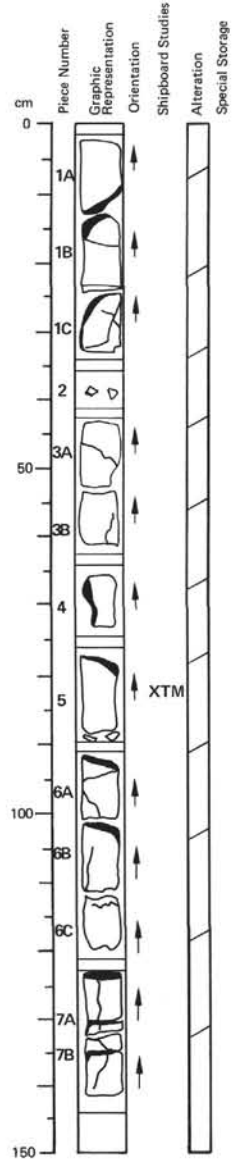
Groundmass: olivine 2%, <0.3 mm, subhedral; plagioclase 25%, <0.5 mm, acicular; clinopyroxene 53%, radiating sheaves; opaques 5%, 0.01 mm, granular, spinel tr, 0.5 mm

Vesicles: 1%, <0.2 mm, round

Alteration: olivine and some groundmass to smectite; smectite and minor carbonate fill vesicles

Shipboard Data

Physical Property Data:	57-59 cm
$\bar{V}p$ (km/sec)	5.55
Porosity (%)	6.67
Wet Bulk Density (g/cc)	2.79
Grain Density (g/cc)	2.91



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	50	2

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 7-12%, <6 mm, fresh; olivine phenocrysts 1-2%, <2 mm, partly altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are fresh. Veinlets are common, filled with smectite and carbonate.

Thin Section Description

Location: 83 cm

Texture: porphyritic - quench

Phenocrysts: olivine 3%, <2 mm, euhedral; plagioclase 12%, <2.5 mm, euhedral; clinopyroxene <1%, <2 mm, rounded

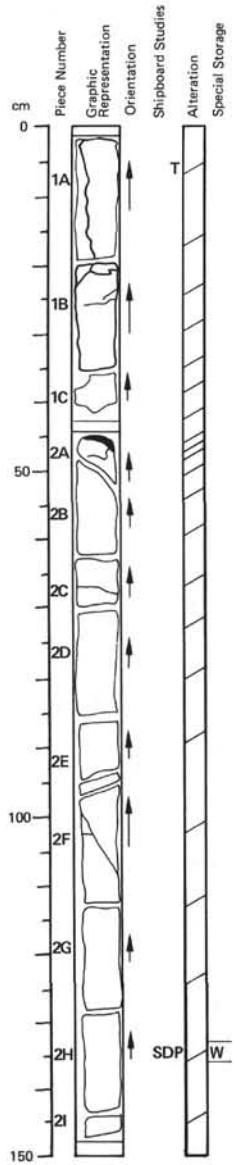
Groundmass: olivine 3%, 0.2 mm, subhedral; plagioclase 30%, 0.3 mm, acicular; clinopyroxene 47%, poorly crystallized, radiating sheaves; opaques 5%, 0.01 mm, granular

Vesicles: <1%, 0.2 mm, round

Alteration: olivine and minor groundmass to smectite; smectite and carbonate fill vesicles

Shipboard Data

Bulk Analysis: 82-84 cm		Magnetic Data:	82-84 cm
SiO_2	48.67	NRM Intensity (emu/cc)	28.36×10^{-3}
Al_2O_3	16.88	NRM Inclination	-22.4°
Fe_2O_3	11.18	Stable Inclination	-23.0°
MgO	5.28		
CaO	14.25		
Na_2O	2.13		
K_2O	< 0.03		
TiO_2	1.10		
P_2O_5	0.11		
MnO	.15		
LOI	1.75		
H_2O^+	1.40		
H_2O^-	N.D.		
CO_2	0.70		



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	5 0	3

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly to moderately altered. Plagioclase phenocrysts 15%, < 10 mm, fresh; olivine phenocryts 1-5%, < 1 mm, most abundant in piece 1, partly altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are altered to smectite, carbonate and rare pyrite. Pyrite is also disseminated in the groundmass.

Thin Section Description

Location: 5 cm

Texture: porphyritic - quench

Phenocrysts: olivine 3%, < 1 mm, euhedral; plagioclase 20%, < 2.5 mm euhedral; clinopyroxene < 1%, < 0.6 mm, rounded

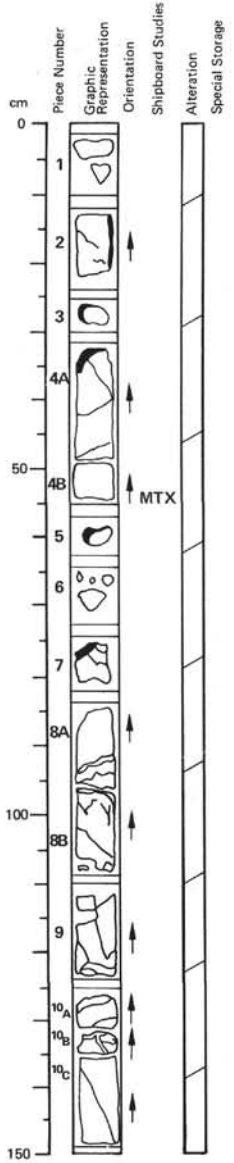
Groundmass: olivine 2%, < 0.2 mm, subhedral; plagioclase 30%, < 0.5 mm, acicular; clinopyroxene 39%, radiating sheaves; opaques 6%, 0.02 mm, granular; spinel tr, 0.08 mm, euhedral

Vesicles: < 1%, < 0.2 mm, round

Alteration: olivine and some groundmass to smectite; smectite and carbonate fill vesicles and veinlets

Shipboard Data

Physical Property Data:	136-138 cm
$\bar{V}p$ (km/sec)	5.97
Porosity (%)	3.60
Wet Bulk Density (g/cc)	2.87
Grain Density (g/cc)	2.93



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	5 0	4

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray, weakly altered. Plagioclase phenocrysts 10-15%, < 6 mm, fresh; olivine phenocrysts 2-3%, < 3 mm, some fresh but most altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are mostly fresh, some partly altered to smectite and carbonate. Veins are filled with carbonate and smectite. Pyrite nodule 8 mm across occurs in piece 10A.

Thin Section Description

Location: 52 cm

Texture: porphyritic - quench

Phenocrysts: olivine 3%, < 1 mm, euhedral; plagioclase 15%, < 3-5 mm, euhedral; spinel tr, < 0.6 mm, euhedral

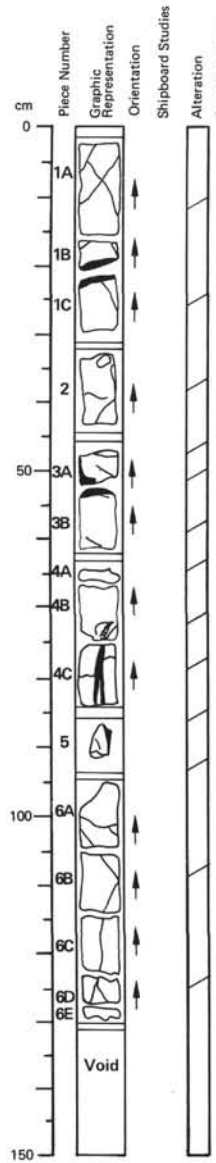
Groundmass: olivine 2%, < 0.1 mm, subhedral; plagioclase 25%, < 0.3 mm, acicular; clinopyroxene 50%, radiating sheaves, poorly crystallized; opaque 5%, 0.01 mm, granular

Vesicles: < 1%, < 0.2 mm, round

Alteration: olivine and minor groundmass to smectite; smectite and carbonate fill vesicles

Shipboard Data

Bulk Analysis: 51-53 cm		Magnetic Data:	51-53 cm
SiO_2	47.83	NRM Intensity (emu/cc)	15.43×10^{-3}
Al_2O_3	18.08	NRM Inclination	-25.2°
Fe_2O_3	10.88	Stable Inclination	-25.4°
MgO	5.67		
CaO	14.34		
Na_2O	2.14		
K_2O	0.06		
TiO_2	1.13		
P_2O_5	0.12		
MnO	.16		
LOI	2.45		
H_2O^+	1.04		
H_2O^-	N.D.		
CO_2	0.69		

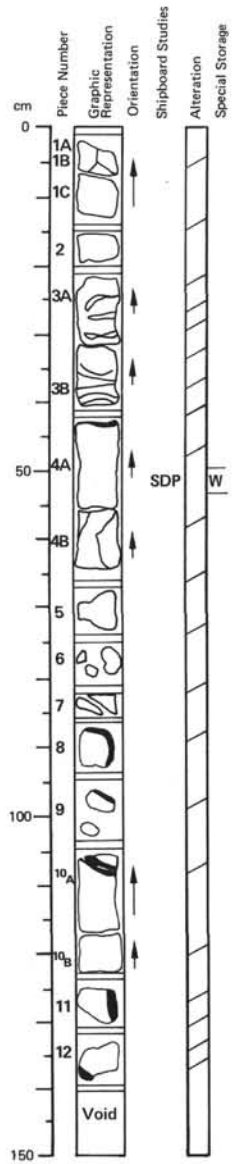


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	3	4	1	8	A	5	0	5

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray, weakly altered. Plagioclase phenocrysts 10-12%, ≤10 mm, mostly 4-5 mm long, fresh; olivine phenocrysts 2%, ≤2 mm, partly altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are mostly fresh. Vesicles 1%, filled with carbonate. Veins are filled with smectite, carbonate and minor pyrite.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

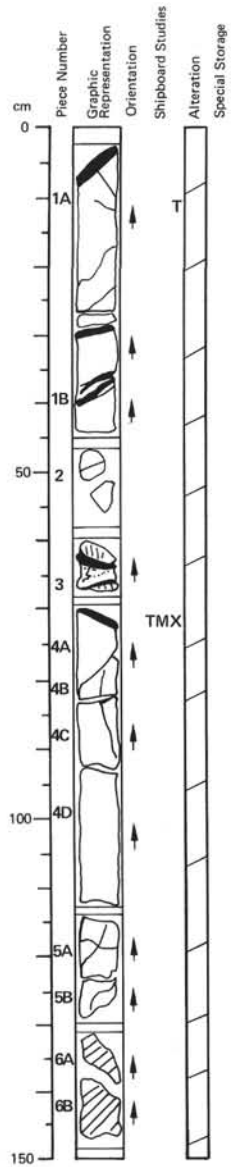
LEG		SITE			HOLE	CORE		SECT.
5	3	4	1	8	A	5	1	1

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray; weakly to moderately altered. Plagioclase phenocrysts 10-15%, <4 mm, fresh; olivine phenocrysts 2-5%, ≤2 mm, slightly altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are fresh except in pieces 3A, 3B and 12, where they are altered to smectite, palagonite and minor carbonate. Veins are filled with smectite.

Shipboard Data

Physical Property Data:	49-51 cm
$\bar{V}p$ (km/sec)	5.17
Porosity (%)	7.96
Wet Bulk Density (g/cc)	2.78
Grain Density (g/cc)	2.94



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	5 1	2

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray; weakly to moderately altered. Plagioclase phenocrysts 15%, ≤8 mm, fresh; olivine phenocrysts 3%, ≤1 mm, partly altered to smectite; clinopyroxene phenocrysts <1%, ≤1 mm, rounded, fresh. Groundmass is fine-grained to glassy; glass selvedges are usually fresh, but are altered to smectite and minor carbonate in pieces 3, 6A and 6B. Veinlets are common throughout, filled with carbonate, smectite and minor pyrite. Minor pyrite also is disseminated in the groundmass.

Thin Section Description

Location: 11 cm

Texture: porphyritic - quench

Phenocrysts: olivine 3%, ≤2 mm, euhedral; plagioclase 15%, ≤3 mm, euhedral; clinopyroxene 3%, ≤3 mm, rounded

Groundmass: olivine 2%, ≤0.2 mm, subhedral; plagioclase 15%, ≤0.3 mm, acicular; clinopyroxene 57%, radiating sheaves; opaques 5%, 0.01 mm, granular

Vesicles: <1%, ≤0.5 mm, round

Alteration: olivine and some groundmass to smectite

Thin Section Description

Location: 74 cm

Texture: porphyritic - quench

Phenocrysts: olivine 3%, ≤0.9 mm, euhedral; plagioclase 15%, ≤3.5 mm, euhedral; clinopyroxene tr, 1 mm, rounded

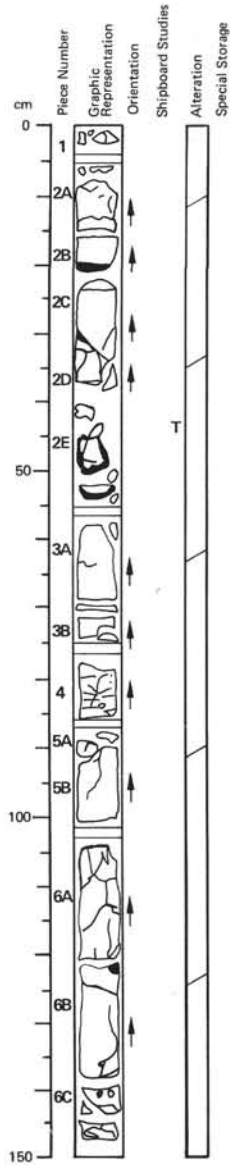
Groundmass: olivine 1%, ≤0.2 mm, subhedral; plagioclase 12%, ≤0.3 mm, acicular; clinopyroxene 68% poorly crystallized, radiating sheaves; opaques 1%, 0.01 mm, euhedral

Vesicles: <1%, 0.2 mm, round

Alteration: olivine to smectite; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 73-75 cm		Magnetic Data:	73-75 cm
SiO_2	49.07	NRM Intensity (emu/cc)	13.68×10^{-3}
Al_2O_3	17.47	NRM Inclination	-23.8°
Fe_2O_3	9.88	Stable Inclination	-24.2°
MgO	6.77		
CaO	13.76		
Na_2O	2.26		
K_2O	< 0.03		
TiO_2	1.16		
P_2O_5	0.11		
MnO	0.15		
LOI	1.47		
H_2O^+	1.13		
H_2O^-	N.D.		
CO_2	0.39		



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	5 1	3

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray, relatively fresh. Plagioclase phenocrysts 15%, ≤8 mm, fresh; olivine phenocrysts 2%, ≤1.5 mm, altered to smectite; clinopyroxene phenocrysts <1%, <1.5 mm, rounded, fresh. Groundmass is fine-grained to glassy; glass selvedges are generally fresh with minor alteration to smectite in piece 2A. Veinlets are filled with carbonate and smectite.

Thin Section Description

Location: 44 cm

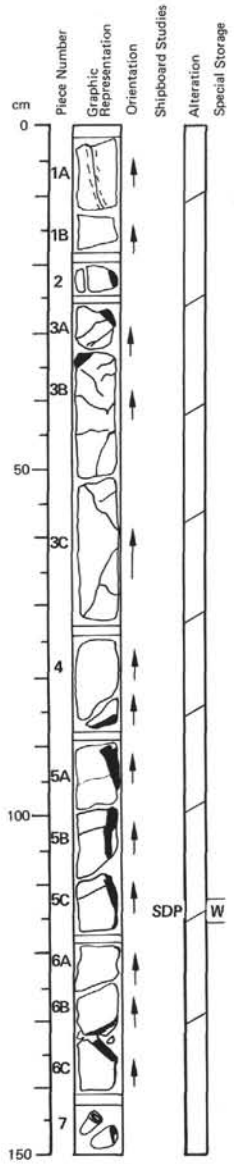
Texture: porphyritic - glassy

Phenocrysts: olivine 2%, ≤1.5 mm, euhedral; plagioclase 15%, ≤2 mm, euhedral; clinopyroxene tr, 1.5 mm, rounded

Groundmass: olivine 1%, ≤0.1 mm, subhedral; plagioclase 12%, 0.3 mm, acicular; opaques <1%, 0.01 mm, granular; spinel tr, 0.05 mm, euhedral; glass 70%, devitrified

Vesicles: none

Alteration: olivine and minor glass to smectite



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

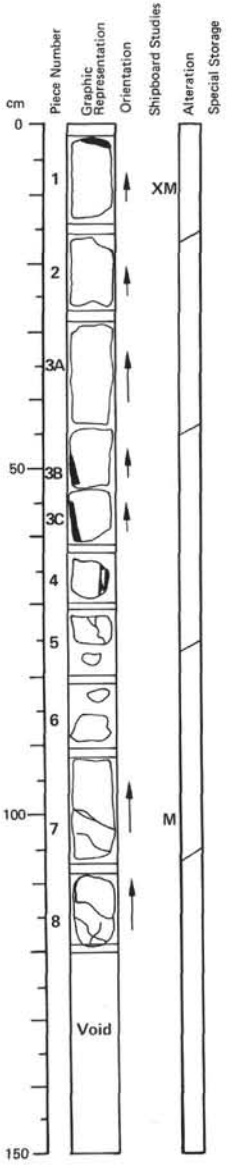
LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	5 1	4

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray, weakly altered. Plagioclase phenocrysts 15%, <8 mm, fresh; olivine phenocrysts 3-4%, <3 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are altered to smectite except in piece 5 which has fresh glass. Veins are filled with smectite, carbonate and minor pyrite. Minor pyrite is also disseminated in the groundmass.

Shipboard Data

Physical Property Data:	109-111 cm
$\overline{V}p$ (km/sec)	5.45
Porosity (%)	6.77
Wet Bulk Density (g/cc)	2.79
Grain Density (g/cc)	2.92



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

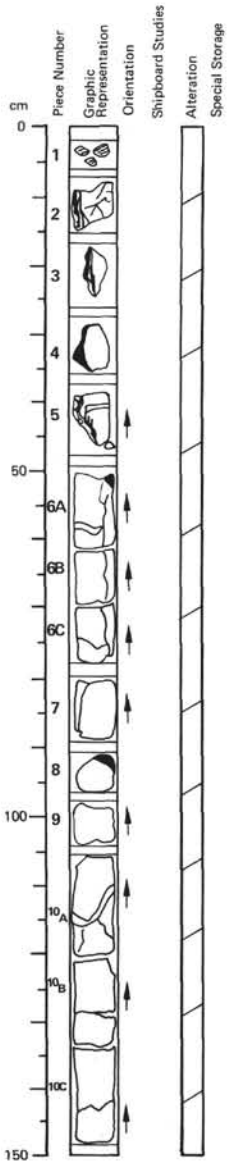
LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	5 1	5

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; relatively fresh. Plagioclase phenocrysts 15%, <7 mm, fresh; olivine phenocrysts 3-4%, <3 mm partly altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are altered to smectite and minor carbonate. Veins are filled with smectite and carbonate; one vein in piece 4 is filled with dolomite(?) and magnesite(?).

Shipboard Data

Bulk Analysis: 8-10 cm		Magnetic Data:	8-10 cm	101-103 cm
SiO_2	48.86	NRM Intensity (emu/cc)	13.42×10^{-3}	25.58×10^{-3}
Al_2O_3	18.29	NRM Inclination	-14.3°	-19.8°
Fe_2O_3	10.57	Stable Inclination	-14.2°	-19.8°
MgO	5.37			
CaO	13.87			
Na_2O	2.12			
K_2O	0.11			
TiO_2	1.14			
P_2O_5	0.11			
MnO	.14			
LOI	1.38			
H_2O^+	1.07			
H_2O^-	N.D.			
CO_2	0.36			

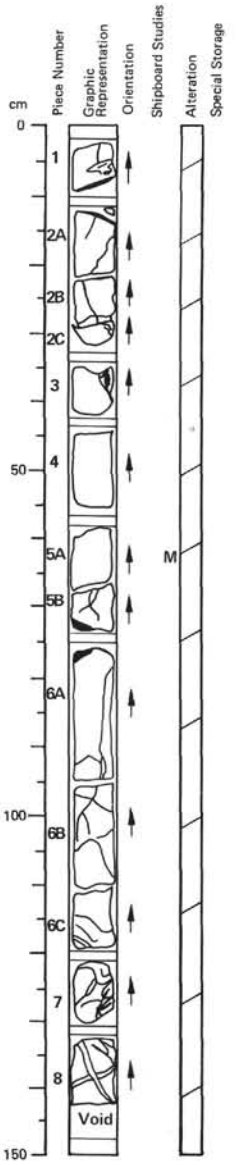


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A	5	2		1

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray; moderately altered. Plagioclase phenocrysts 10-15%, < 10 mm, fresh; olivine phenocrysts 5%, <4 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are altered to smectite, carbonate and minor zeolite(?); fresh glass is present in piece 8. Vesicles 1%, filled with smectite and carbonate . Veins are filled with smectite, carbonate and minor pyrite. Piece 1 consists of chert fragments, probably slumped into the hole during bit change.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

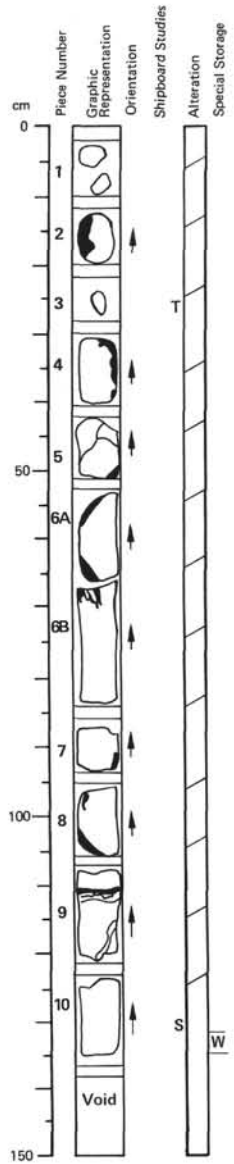
LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A	5	2		2

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray; moderately altered. Plagioclase phenocrysts 10%, 7 mm, fresh; olivine phenocrysts 4%, 4 mm, completely altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Veins are filled with smectite and carbonate. Minor pyrite occurs locally.

Shipboard Data

Magnetic Data:	62-64 cm
NRM Intensity (emu/cc)	26.66×10^{-3}
NRM Inclination	-17.3°
Stable Inclination	-19.2°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	3	4	1	8	A	5	2	3

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray; moderately altered. Plagioclase phenocrysts 10-12%, <8 mm, fresh; olivine phenocrysts 4%, <3 mm, completely altered to smectite; clinopyroxene phenocrysts 1%, <1 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are mostly altered to smectite and minor zeolite(?). Vesicles 1%, filled with smectite and carbonate. Sparse veins are filled with smectite, carbonate and minor pyrite. Some smectite and pyrite are disseminated in the groundmass.

Thin Section Description

Location: 24 cm

Texture: porphyritic - quench

Phenocrysts: olivine 4%, <1.5 mm, euhedral; plagioclase 12%, <2 mm, euhedral; clinopyroxene 1%, <1 mm, anhedral

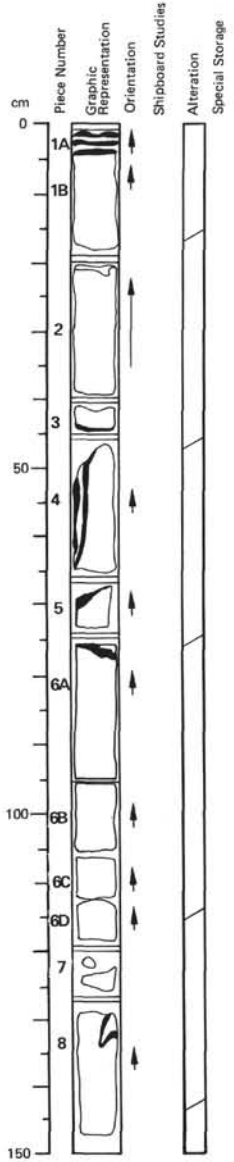
Groundmass: olivine 1%, <0.2 mm, subhedral; plagioclase 25%, <0.5 mm, acicular; clinopyroxene 54%, radiating sheaves, poorly crystallized; opaques 3%, 0.01 mm, granular

Vesicles: <1%, <0.5 mm, round

Alteration: olivine and minor groundmass to smectite and carbonate; smectite fills vesicles

Shipboard Data

Physical Property Data:	129-131 cm
$\bar{V}p$ (km/sec)	5.61

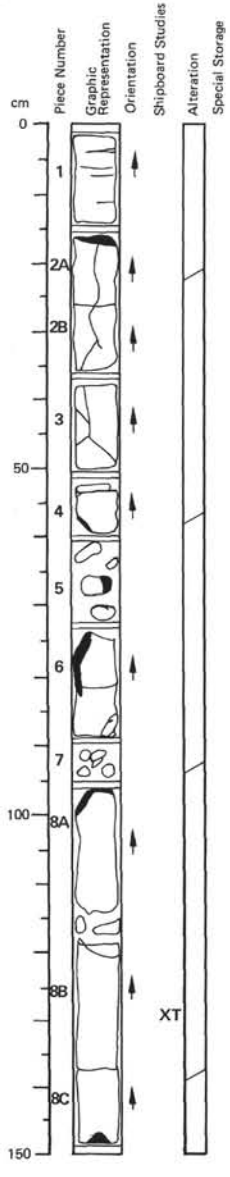


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	3	4	1	8	A	5	2	4

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; relatively fresh. Plagioclase phenocrysts 8-15%, <4 mm, fresh; olivine phenocrysts 4%, <4 mm, partly altered to smectite; clinopyroxene phenocrysts 1%, <1 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Veins are common throughout, filled with smectite, carbonate and minor pyrite.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	5 2	5

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; relatively fresh. Plagioclase phenocrysts 10-15%, <4 mm, fresh; olivine phenocrysts 2%, <2 mm, partly altered to smectite; clinopyroxene phenocrysts 1%, <1 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are mostly fresh, some are partly altered to smectite. Veins are filled with smectite, carbonate, zeolite(?) and minor pyrite.

Thin Section Description

Location: 128 cm

Texture: porphyritic - quench

Phenocrysts: olivine 4%, <2 mm, euhedral; plagioclase 12%, <2.5 mm, euhedral; clinopyroxene 1%, anhedral

Groundmass: olivine 1%, 0.2 mm, subhedral; plagioclase 25%, <0.4 mm, acicular; clinopyroxene 54%, poorly crystallized, radiating sheaves; opaques 3%, 0.01 mm, granular; spinel tr, 0.3 mm euhedral

Vesicles: <1%, 0.6 mm, irregular

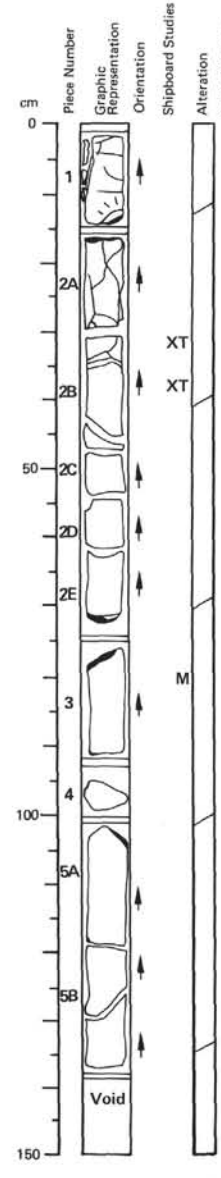
Alteration: olivine and some groundmass to smectite and carbonate; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 127-129 cm

SiO_2	50.89
Al_2O_3	17.04
Fe_2O_3	10.10
MgO	6.28
CaO	12.72
Na_2O	2.19
K_2O	0.10
TiO_2	1.10
P_2O_5	0.14
MnO	.16
LOI	1.15
H_2O^+	0.74
H_2O^-	N.D.
CO_2	0.27

Sr	99 p.p.m.
Zr	59
Y	21
Nb	2.4



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	5 2	6

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 8-15%, <6 mm, fresh; olivine phenocrysts 1-3%, <1 mm, partly altered to smectite; clinopyroxene phenocrysts 1%, <1.5 mm, rounded, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite, fresh glass occurs in pieces 2A, 2E, and 3. Veins are filled with carbonate, smectite, zeolite(?) and minor pyrite.

Thin Section Description

Location: 30 cm

Texture: porphyritic - quench

Phenocrysts: olivine 3%, <1.5 mm, euhedral; plagioclase 15%, <3.5 mm, euhedral; clinopyroxene 1%, <1.5 mm, rounded

Groundmass: olivine 1%, 0.2 mm, subhedral; plagioclase 35%, 0.3 mm, acicular; clinopyroxene 38% radiating sheaves; opaques 6%, 0.03 mm, euhedral to granular

Vesicles: 1%, <0.2 mm, round

Alteration: olivine and minor groundmass to smectite; smectite and carbonate fill vesicles

Thin Section Description

Location: 39 cm

Texture: porphyritic - quench

Phenocrysts: olivine 4%, <2 mm, euhedral; plagioclase 12%, <3 mm, euhedral; clinopyroxene 1%, <1 mm, rounded

Groundmass: olivine 2%, 0.2 mm, subhedral; plagioclase 35%, 0.4 mm, acicular; clinopyroxene 37%, radiating sheaves; opaques 8%, 0.05 mm, granular to lath-shaped

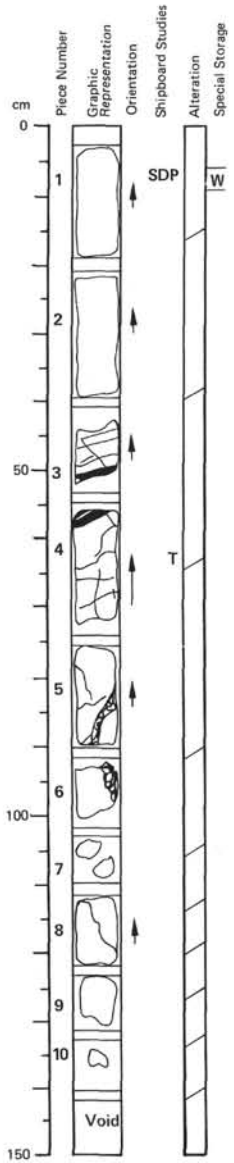
Vesicles: 1%, 0.5 mm, round

Alteration: olivine and minor groundmass to smectite and carbonate; carbonate and smectite fill vesicles

Shipboard Data

Bulk Analysis:	30-32 cm	37-39 cm
SiO_2	49.72	49.73
Al_2O_3	16.37	17.52
Fe_2O_3	10.30	10.47
MgO	8.18	5.64
CaO	12.05	13.35
Na_2O	2.25	2.32
K_2O	0.05	< 0.03
TiO_2	1.15	1.15
P_2O_5	0.12	0.13
MnO	.19	.17
LOI	1.28	1.43
H_2O^+	0.66	0.79
H_2O^-	N.D.	N.D.
CO_2	0.77	0.28

Magnetic Data:	80-82 cm
NRM Intensity (emu/cc)	18.23×10^{-3}
NRM Inclination	-21.9°
Stable Inclination	-21.8°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A	5	2		7

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray; weakly to moderately altered. *Plagioclase phenocrysts 10%, <8 mm, fresh; olivine phenocrysts 4%, <3 mm, mostly altered* to smectite; clinopyroxene phenocrysts 1-2%, <1 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are mostly altered to smectite. Veins are filled with carbonate, smectite and minor pyrite. Groundmass is partly altered to smectite, particularly in pieces 7 through 10.

Thin Section Description

Location: 64 cm

Texture: porphyritic - quench

Phenocrysts: olivine 4%, <1 mm, euhedral; plagioclase 15%, <2 mm, subhedral to rounded; clinopyroxene 2%, <1 mm, subhedral

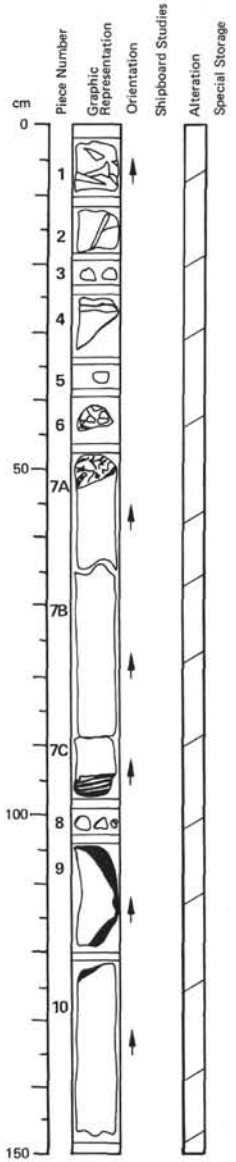
Groundmass: olivine 2%, 0.2 mm, subhedral; plagioclase 30%, 0.4 mm, acicular; clinopyroxene 42%, radiating sheaves; opaques 5%, 0.02 mm, granular

Vesicles: <1%, 0.4 mm, round to irregular

Alteration: olivine and minor groundmass to smectite and carbonate; carbonate fills vesicles

Shipboard Data

Physical Property Data:	10-12 cm
$\bar{V}p$ (km/sec)	5.60
Porosity (%)	5.69
Wet Bulk Density (g/cc)	2.86
Grain Density (g/cc)	2.97

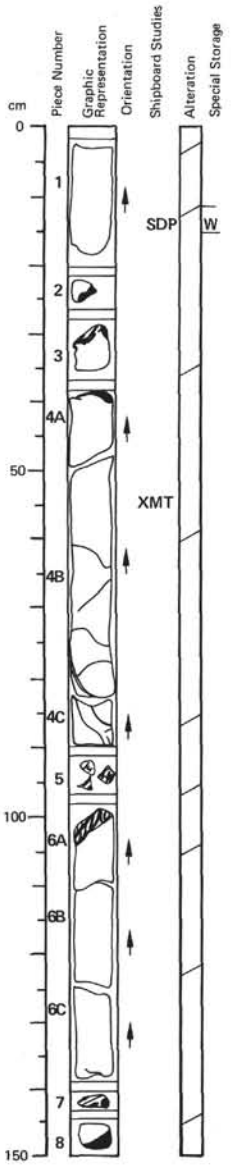


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A	5	3		1

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray; moderately altered. Plagioclase *phenocrysts 8-10%, <8 mm, fresh; olivine phenocrysts 3%, <5 mm, altered to smectite, except* in some glassy margins; clinopyroxene phenocrysts 1%, <1 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges in pieces 6 and 7A are altered to smectite, those elsewhere are fresh. Veins are filled with smectite, carbonate and minor pyrite. Smectite and pyrite are also locally present in the groundmass. Pieces 1 through 4 are partly brecciated.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	53	2

Visual Description

Moderately to highly phyric pillow basalt. Basalt is medium gray to greenish-gray; weakly to moderately altered. Plagioclase phenocrysts 10-15%, < 10 mm, fresh; olivine phenocrysts 3-5%, <3 mm, partly altered to smectite; clinopyroxene phenocrysts 1-2%, <2.5 mm, subophitic to rounded, fresh. Groundmass is fine-grained to glassy; glass selvedges are slightly altered to smectite, selvedges in pieces 5 and 6 are highly altered. Veins are filled with carbonate, smectite and minor pyrite. Some smectite and pyrite also occur in the groundmass.

Thin Section Description

Location: 52 cm

Texture: 1%, 0.5 mm, round

Phenocrysts: olivine 5%, <1.5 mm, euhedral; plagioclase 15%, <3 mm, euhedral; clinopyroxene 2%, <2.5 mm, subophitic to rounded; spinel tr, 0.3 mm, euhedral

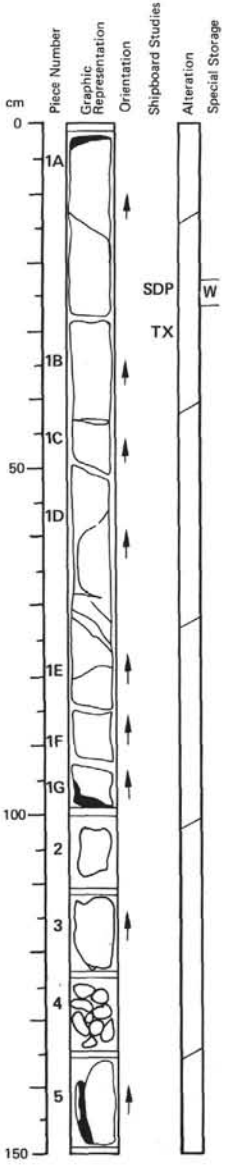
Groundmass: olivine 1%, 0.2 mm, subhedral; plagioclase 10%, 0.3 mm, acicular; clinopyroxene 60% radiating sheaves; opaques 6%, 0.01 mm, granular

Vesicles: 1%, 0.5 mm, round

Alteration: olivine and minor groundmass to smectite; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 51-53 cm		Magnetic Data:	51-53 cm
SiO_2	49.39	NRM Intensity (emu/cc)	17.30×10^{-3}
Al_2O_3	17.43	NRM Inclination	-23.9°
Fe_2O_3	8.81	Stable Inclination	-26.3°
MgO	6.50		
CaO	15.15	Physical Property Data:	13-15 cm
Na_2O	2.23	$\bar{V}p$ (km/sec)	5.40
K_2O	0.11	Porosity (%)	6.41
TiO_2	0.98	Wet Bulk Density (g/cc)	2.82
P_2O_5	0.22	Grain Density (g/cc)	2.94
MnO	.18		
LOI	3.19		
H_2O^+	0.55		
H_2O^-	N.D.		
CO_2	2.03		
Sr	112.9		
Zr	53.0		
Y	20.3		
Nb	1.9		



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	53	3

Visual Description

Moderately phyric pillow basalt. Basalt is medium gray; weakly altered. Plagioclase phenocrysts 12-15%, <6 mm, fresh; olivine phenocrysts 3-5%, <2 mm, partly replaced by smectite and carbonate; clinopyroxene phenocrysts, 1-2%, <1 mm, subophitic, fresh. Groundmass is very fine-grained to glassy; glass selvedges are mostly altered to smectite. Veins are filled with smectite, carbonate, zeolite(?) and minor pyrite.

Thin Section Description

Location: 29 cm

Texture: porphyritic - quench

Phenocrysts: 5%, <1.5 mm, euhedral; plagioclase 15%, <2 mm, euhedral; clinopyroxene 2%, <0.5 mm subhedral

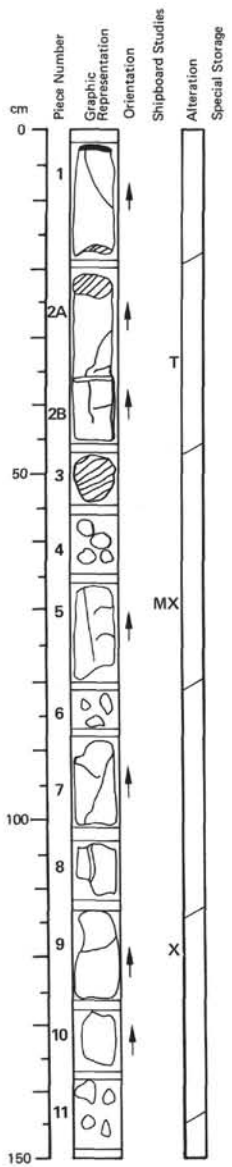
Groundmass: olivine 2%, 0.2 mm subhedral; plagioclase 30%, 0.4 mm, acicular; clinopyroxene 41%, radiating sheaves; opaques 5%, 0.01 mm, granular; spinel tr, 0.2 mm, euhedral

Vesicles: <1%, 0.2 mm, round

Alteration: olivine and minor groundmass to smectite and carbonate

Shipboard Data

Bulk Analysis: 28-30 cm		Physical Property Data:	23-25 cm
SiO_2	49.02	$\bar{V}p$ (km/sec)	5.72
Al_2O_3	17.33	Porosity (%)	4.86
Fe_2O_3	10.65	Wet Bulk Density (g/cc)	2.87
MgO	6.85	Grain Density (g/cc)	2.97
CaO	13.26		
Na_2O	2.28		
K_2O	< 0.03		
TiO_2	1.12		
P_2O_5	0.12		
MnO	.19		
LOI	1.06		
H_2O^+	0.65		
H_2O^-	N.D.		
CO_2	0.16		
Sr	96.3		
Zr	63.5		
Y	21.9		
Nb	0.6		



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	5 4	1

Visual Description

Moderately phyric basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 10-15%, <5 mm, fresh; olivine phenocrysts 3%, <1 mm, partly altered to smectite; clinopyroxene phenocrysts 5%, <1.5 mm, subophitic fresh. Groundmass is fine-grained to glassy; glass selvedges partly altered to smectite. Vesicles 1%, filled with carbonate and smectite. Veins are filled with smectite, carbonate and pyrite. Piece 3 consists of smectite and silica and may be altered sediment.

Thin Section Description

Location: 34 cm

Texture: glomeroporphyritic - quench

Phenocrysts: plagioclase 15%, <4 mm, glomerophyric clusters; clinopyroxene 10%, <1.5 mm, subophitic clusters

Groundmass: olivine 5%, <0.4 mm, euhedral; plagioclase 15%, <0.3 mm, acicular; clinopyroxene 49%, radiating sheaves; opaques 5%, 0.03 mm, euhedral to granular

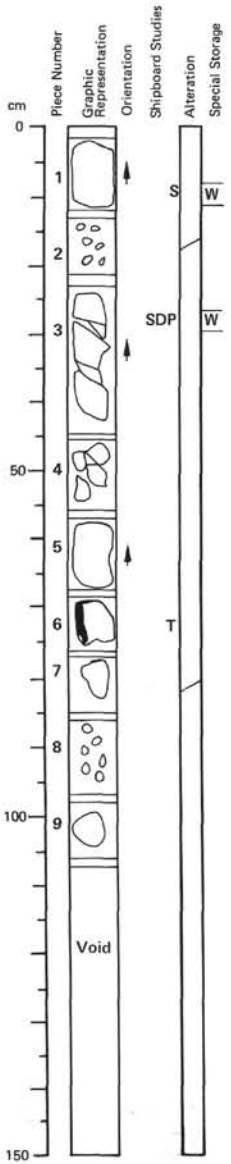
Vesicles: 1%, <0.5 mm, round

Alteration: olivine and minor groundmass to smectite; carbonate fills vesicles

Shipboard Data

Bulk Analysis:	68-70 cm	121-123 cm
SiO_2	48.96	48.46
Al_2O_3	15.71	15.36
Fe_2O_3	11.29	11.31
MgO	7.79	6.58
CaO	13.02	13.10
Na_2O	2.22	2.07
K_2O	< 0.03	< 0.03
TiO_2	1.31	1.32
P_2O_5	0.12	0.11
MnO	.19	.19
LOI	0.99	0.72
H_2O^+	0.57	0.55
H_2O^-	N.D.	N.D.
CO_2	0.33	0.39
Sr	N.D.	95.9
Zr	N.D.	76.0
Y	N.D.	25.9
Nb	N.D.	2.0

Magnetic Data:	68-70 cm
NRM Intensity (emu/cc)	23.97×10^{-3}
NRM Inclination	-32.7°
Stable Inclination	-33.0°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	5 4	2

Visual Description

Moderately phyric basalt. Basalt is medium to dark gray; relatively fresh. Plagioclase phenocrysts 10%, <3 mm, fresh; olivine phenocrysts 5%, <1 mm, partly altered to smectite; clinopyroxene phenocrysts 5%, <0.5 mm, in subophitic clots with plagioclase, fresh. Groundmass is fine-grained to glassy; glass selvedge in piece 6 is fresh. Vesicles 1-2%, <1.5 mm, filled with carbonate and smectite. Veinlets are filled with smectite and pyrite.

Thin Section Description

Location: 73 cm

Texture: glomeroporphyritic - quench

Phenocrysts: olivine 5%, <1 mm, euhedral; plagioclase 10%, <2 mm, in clusters or individual crystals; clinopyroxene 7%, <1 mm, subophitic intergrowths; opaques <1%, 0.4 mm, skeletal

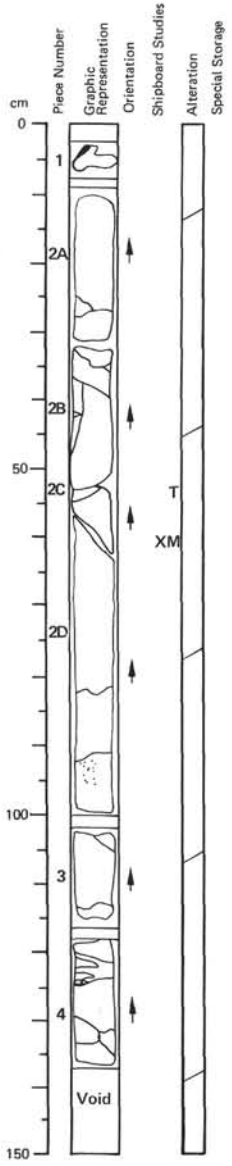
Groundmass: olivine 1%, 0.15 mm, euhedral; plagioclase 8%, 0.4 mm, acicular; opaques 5%, 0.01 mm, granular; glass 62%, devitrified

Vesicles: 2%, <0.4 mm, round

Alteration: olivine and minor groundmass to smectite; carbonate fills vesicles

Shipboard Data

Physical Property Data:	1-9 cm	26-27 cm
$\overline{V}p$ (km/sec)	5.96	5.92
Porosity (%)		2.84
Wet Bulk Density (g/cc)		2.94
Grain Density (g/cc)		3.00



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	3	4	1	8	A	5	5	1

Visual Description

Sparsely to moderately phyric basalt. Basalt is medium gray; weakly altered. Plagioclase phenocrysts 5-10%, <3 mm, fresh; olivine phenocrysts 2-4%, <1 mm, altered to smectite; clinopyroxene phenocrytsts 1%, <1 mm, fresh. Groundmass is fine-grained; one glass selvedge is present on piece 1; glass is fresh. Vesicles <1%, filled with smectite and carbonate. Veinlets are filled with smectite, carbonate and pyrite.

Thin Section Description

Location: 51 cm

Texture: porphyritic - quench

Phenocrysts: olivine 4%, <1 mm, euhedral; plagioclase 12%, <2.5 mm, euhedral; clinopyroxene 1%, < 0.4 mm, subophitic

Groundmass: olivine 2%, 0.2 mm, subhedral; plagioclase 10%, <0.3 mm, acicular; opaques 7%, 0.02 mm, granular; glass 63%, devitrified

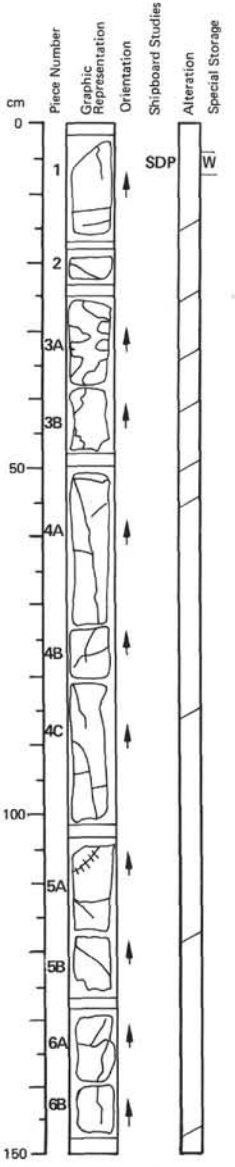
Vesicles: 1%, <0.5 mm, round

Alteration: olivine and minor groundmass to smectite; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 62-64 cm	
SiO_2	49.66
Al_2O_3	15.41
Fe_2O_3	11.24
MgO	6.85
CaO	12.81
Na_2O	2.27
K_2O	0.05
TiO_2	1.35
P_2O_5	0.13
MnO	.17
LOI	1.46
H_2O^+	0.75
H_2O^-	N.D.
CO_2	0.70

Magnetic Data:	62-64 cm
NRM Intensity (emu/cc)	6.62×10^{-3}
NRM Inclination	8.5°
Stable Inclination	-31.0°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

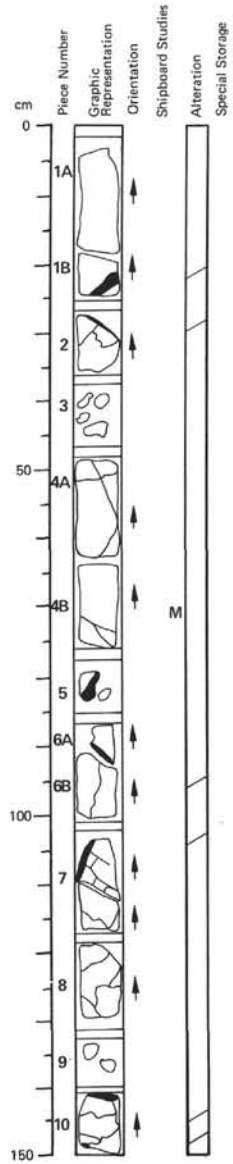
LEG		SITE			HOLE	CORE		SECT.
5	3	4	1	8	A	5	5	2

Visual Description

Sparsely phyric basalt. Basalt is gray to greenish-gray; weakly altered. Plagioclase phenocrysts 2-5%, <3 mm, fresh; olivine phenocrysts 3%, <2 mm, mostly altered to smectite. Groundmass is fine-grained with one glass selvedge on piece 4A; glass is altered to smectite. Vesicles <1%, filled with carbonate. Veins are filled with carbonate, smectite and minor pyrite. Pieces 2 and 3 are breccia composed of basalt fragments in a smectite matrix.

Shipboard Data

Physical Property Data:	4-6 cm
$\overline{V}p$ (km/sec)	5.56
Porosity (%)	4.29
Wet Bulk Density (g/cc)	2.93
Grain Density (g/cc)	3.02



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

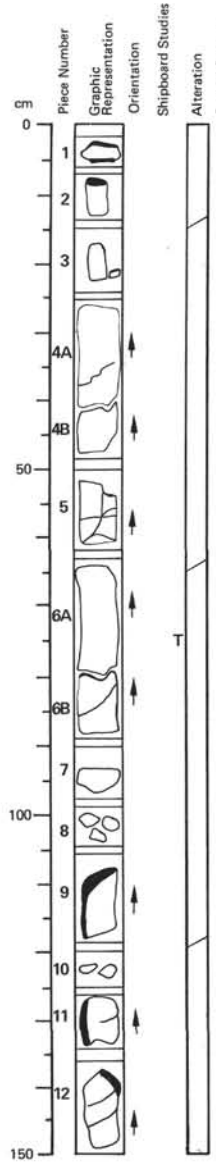
LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	5 5	3

Visual Description

Sparsely phyric pillow basalt. Basalt is medium to dark gray; relatively fresh. Plagioclase phenocrysts 1%, <2 mm, fresh; olivine phenocrysts 1%, <2 mm, mostly altered to smectite; clinopyroxene phenocrysts <1%, <2 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are almost completely altered to smectite. Vesicles <1%, filled with carbonate. Veins are filled with smectite, carbonate and minor pyrite. Some pyrite is also disseminated in groundmass. Slickensides are present on pieces 2, 4A, and 4B.

Shipboard Data

Magnetic Data:	69-71 cm
NRM Intensity (emu/cc)	14.42×10^{-3}
NRM Inclination	-26.6°
Stable Inclination	-29.6°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	5 5	4

Visual Description

Sparsely phyric pillow basalt. Basalt is medium to dark gray; relatively fresh. Plagioclase phenocrysts 1%, <6 mm, fresh; olivine phenocrysts 2%, <2 mm, generally altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite and zeolite(?). Vesicles 1%, filled with carbonate and smectite. Veins are filled with carbonate, smectite and minor pyrite. Piece 1 is altered sediment between two glass selvedges; sediment is altered, now composed of silica and zeolite(?).

Thin Section Description

Location: 72 cm

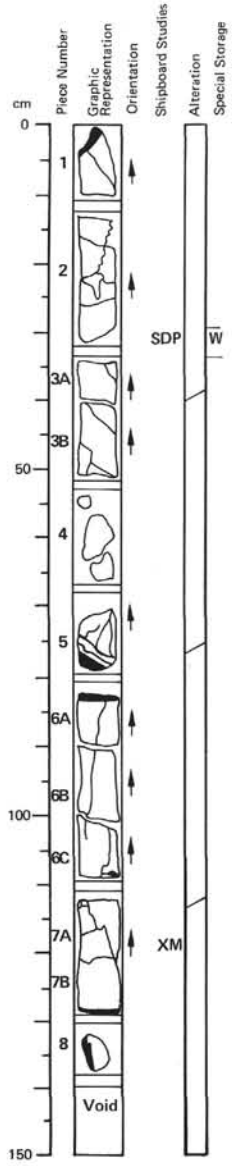
Texture: porphyritic - quench

Phenocrysts: plagioclase 10%, <2 mm; olivine 3%, <0.5 mm

Groundmass: plagioclase 10%, 0.3 mm, skeletal; opaques 10%, 0.01 mm; clinopyroxene 65%, radiating sheaves

Vesicles: 2%, <0.3 mm round

Alteration: olivine to smectite and carbonate; carbonate fills vesicles



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	55	5

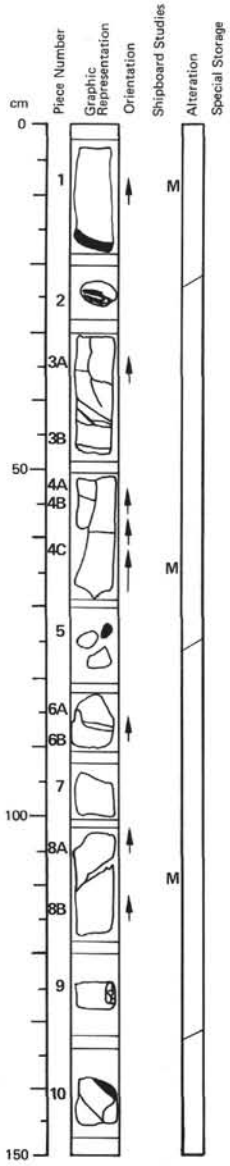
Visual Description

Sparsely phyric pillow basalt. Basalt is medium to dark gray; relatively fresh. Plagioclase phenocrysts 1%, ≤8 mm, fresh; olivine phenocrysts 2%, ≤ 1 mm, partly altered to smectite; clinopyroxene phenocrysts < 1%, ≤ 1 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite and zeolite(?). Vesicles < 1%, filled with carbonate. Veins are filled with smectite, carbonate, zeolite(?) and minor pyrite. Minor pyrite is also disseminated in the groundmass.

Shipboard Data

Bulk Analysis: 118-120 cm	
SiO_2	49.83
Al_2O_3	15.72
Fe_2O_3	10.63
MgO	7.07
CaO	13.84
Na_2O	2.34
K_2O	0.04
TiO_2	1.32
P_2O_5	0.13
MnO	.19
LOI	1.44
H_2O^+	0.80
H_2O^-	N.D.
CO_2	0.55
Sr	106.9
Zr	71.5
Y	24.5
Nb	2.1

Magnetic Data:	118-120 cm
NRM Intensity (emu/cc)	011.64×10^{-3}
NRM Inclination	+43.2°
Stable Inclination	+45.1°
Physical Property Data:	28-30 cm
$\overline{V}p$ (km/sec)	5.48
Porosity (%)	5.09
Wet Bulk Density (g/cc)	2.90
Grain Density (g/cc)	3.00



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

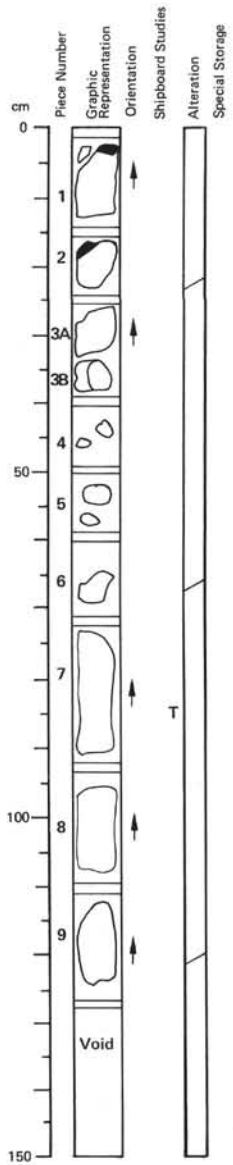
LEG	SITE	HOLE	CORE	SECT.
55	418	A	55	6

Visual Description

Sparsely phyric pillow basalt. Basalt is medium to dark gray, relatively fresh. Plagioclase phenocrysts 1%, ≤ 3 mm, fresh; olivine phenocrysts 2%, <2 mm, generally altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Veins are filled with smectite and carbonate.

Shipboard Data

Magnetic Data:	6-8 cm	65-67 cm	110-112 cm
NRM Intensity (emu/cc)	21.68×10^{-3}	9.50×10^{-3}	10.49×10^{-3}
NRM Inclination	+43.1°	+37.9°	-42.6°
Stable Inclination	+45.1°		-44.4°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	5 5	7

Visual Description

Sparsely phyric pillow basalt and highly phyric basalt. Sparsely phyric basalt comprises the upper half of the section to 72 cm; the highly phyric basalt comprises the lower part of the section. The sparsely phyric basalt is medium to dark gray; relatively fresh. Plagioclase phenocrysts 1%, <4 mm, fresh; olivine phenocrysts 2%, <2 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Veins are filled with smectite and carbonate. Piece 5 is rich in smectite and may be altered glass. The highly phyric basalt is medium to dark gray; relatively fresh. Plagioclase phenocrysts 12%, <3 mm, fresh; olivine phenocrysts 8%, <2 mm, altered to smectite; clinopyroxene phenocrysts 3%, <1 mm, fresh. Groundmass is holocrystalline, fine-grained.

Thin Section Description

Location: 85 cm

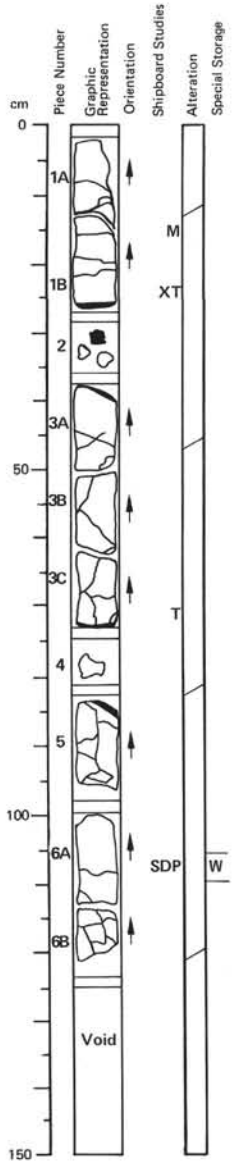
Texture: porphyritic, intersertal to intergranular

Phenocrysts: olivine 8%, <0.5 mm, subhedral; plagioclase 12%, <3 mm; clinopyroxene 3%, <0.5 mm, anhedral

Groundmass: olivine 5%, 0.05, anhedral; plagioclase 30%, 0.3 mm; clinopyroxene 35%, 0.15 mm, granular; opaques 5%, 0.01 mm, subhedral

Vesicles: 2%, <0.6 mm, filled with carbonate, round

Alteration: olivine to smectite, carbonate fills vesicles



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	5 6	1

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 10-12%, <6 mm, sometimes with inclusions of spinel, fresh; olivine phenocrysts 2%, <2 mm, partly altered to smectite; clinopyroxene phenocrysts 3%, <1 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are altered to smectite. Vesicles 1-2%, <0.5 mm, filled with carbonate. Veins are filled with smectite and carbonate.

Thin Section Description

Location: 24 cm

Texture: porphyritic - quench

Phenocrysts: olivine 3%, <0.5 mm, subhedral; plagioclase 25%, <4 mm; clinopyroxene 3%, <0.5 mm, subhedral; spinel tr, 0.15 mm, anhedral

Groundmass: plagioclase 5%, 0.2 mm, skeletal; opaques 1%, 0.01 mm, anhedral; clinopyroxene 60%, radiating sheaves

Vesicles: 2%, 0.5 mm, round

Alteration: olivine to carbonate and smectite; carbonate and manganese(?) fill vesicles

Thin Section Description

Location: 70 cm

Texture: porphyritic

Phenocrysts: olivine 5%, <3 mm, subhedral; plagioclase 20%, <5 mm, subhedral, seriate; clinopyroxene 2%, <0.5 mm, anhedral

Groundmass: olivine 4%, 0.05 mm; plagioclase 30%, 0.3 mm, skeletal; clinopyroxene 30%, 0.1 mm, granular to sheaf-like; opaques 7%, 0.01 mm.

Vesicles: 2%, <0.3 mm, round

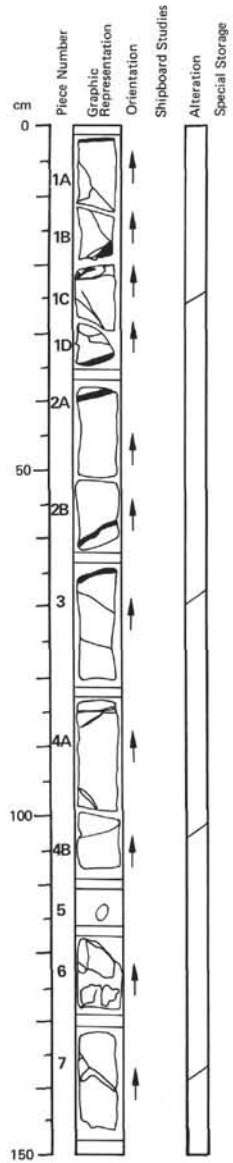
Alteration: olivine to smectite and minor carbonate; carbonate and manganese fill vesicles

Shipboard Data

Bulk Analysis: 22-24 cm

SiO_2	47.96
Al_2O_3	16.50
Fe_2O_3	9.95
MgO	7.25
CaO	13.47
Na_2O	2.26
K_2O	< 0.03
TiO_2	1.24
P_2O_5	0.11
MnO	.19
LOI	0.67
H_2O^+	0.58
H_2O^-	N.D.
CO_2	0.81

Magnetic Data:	16-18 cm
NRM Intensity (emu/cc)	8.03×10^{-3}
NRM Inclination	-49.0°
Stable Inclination	-49.4°
Physical Property Data:	104-106 cm
$\overline{V}p$ (km/sec)	6.07
Porosity (%)	3.78
Wet Bulk Density (g/cc)	2.90
Grain Density (g/cc)	2.97

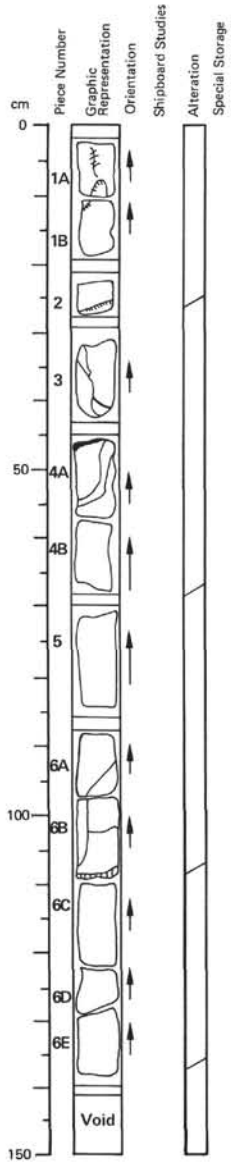


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	3	4	1	8	A	5	6	2

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray, weakly altered. Plagioclase phenocrysts 12%, <5 mm, fresh; olivine phenocrysts 2%, <2 mm, partly altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are altered to smectite. Veins are filled with carbonate and smectite. Carbonate vug occurs in piece 7. Slickensides are present on pieces 2B and 4B. Pieces 4B, 5 and 6 are slightly brecciated.

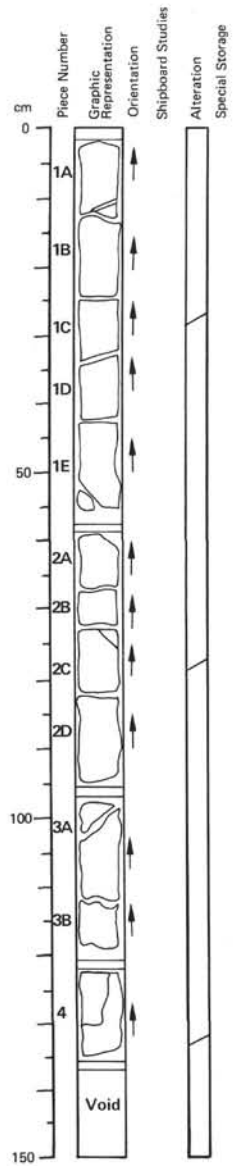


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	3	4	1	8	A	5	6	3

Visual Description

Moderately phyric basalt. Pieces 1 through 3 are a continuation of the pillow sequence of Section 2; piece 4A is the top of a massive cooling unit extending to Section 5. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 8%, <6 mm, fresh; olivine phenocrysts 4-6%, <5 mm, mostly altered to smectite. Groundmass is fine-grained to glassy; glass selvedge in piece 4A is altered to smectite.Vesicles < 1%, filled with smectite and carbonate. Veins are filled with smectite, carbonate and minor pyrite.

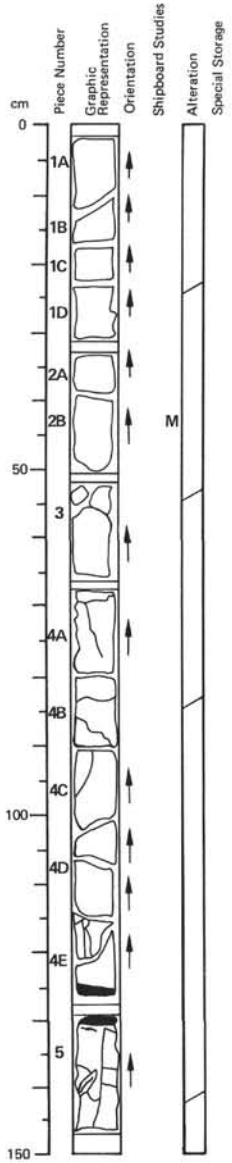


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	5 6	4

Visual Description

Moderately phyric massive basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 8-10%, <4 mm, fresh; olivine phenocrysts 3%, <2 mm, mostly fresh with only minor alteration to smectite. Groundmass is fine-grained, holocrystalline. Sparse vesicles are filled with carbonate and smectite. Minor pyrite is disseminated in the groundmass.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

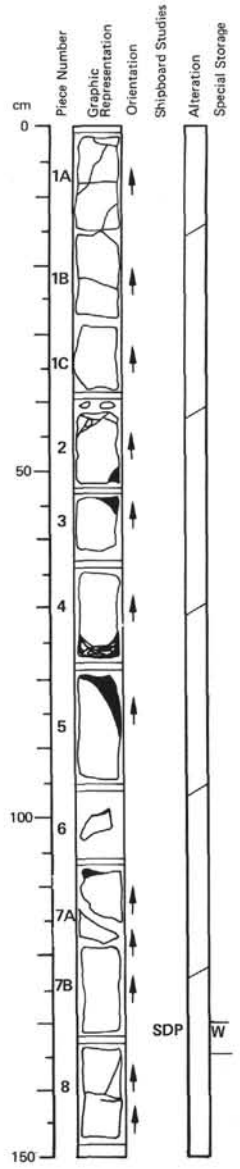
LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	5 6	5

Visual Description

Moderately phyric basalt. Pieces 1 through 4C are a continuation of the massive cooling unit in Section 4; piece 5 is the top of a pillow basalt sequence. Basalt is medium gray; weakly altered. Plagioclase phenocrysts 10%, <5 mm, fresh; olivine phenocrysts 5%, <3 mm, altered to smectite. Groundmass is fine-grained to glassy with glass selvedges only on pieces 4A and 5; glass selvedges are slightly altered to smectite. Veins are filled with smectite, carbonate and minor pyrite. Minor pyrite is also disseminated in the groundmass.

Shipboard Data

Magnetic Data:	42-44 cm
NRM Intensity (emu/cc)	6.07×10^{-3}
NRM Inclination	-59.9°
Stable Inclination	-50.0°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

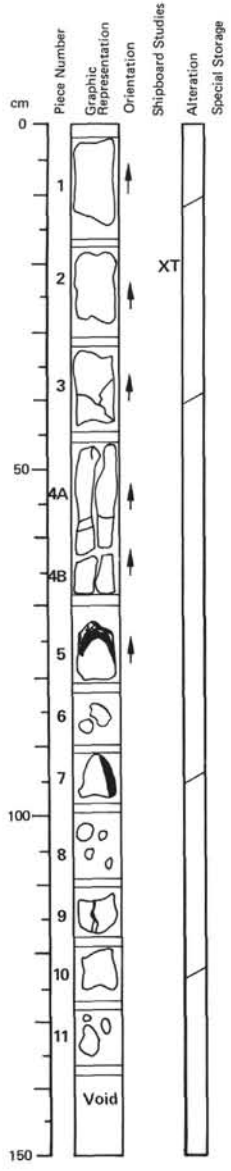
LEG		SITE			HOLE	CORE		SECT.
5	3	4	1	8	A	5	6	6

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray; weakly altered. Plagioclase phenocrysts 8-12%, <6 mm, fresh; olivine phenocrysts 2%, <1 mm, partly altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are partly altered to palagonite and smectite. Vesicles 1%, filled with smectite, carbonate, zeolite and minor pyrite.

Shipboard Data

Physical Property Data:	129-131 cm
$\overline{V}p$ (km/sec)	5.75
Porosity (%)	4.25
Wet Bulk Density (g/cc)	2.89
Grain Density (g/cc)	2.97



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	3	4	1	8	A	5	6	7

Visual Description

Moderately phyric pillow basalt. Basalt is medium gray to greenish-gray; weakly altered. Plagioclase phenocrysts 10%, <5 mm, fresh; olivine phenocrysts 5%, <3 mm, altered to smectite; clinopyroxene phenocrysts 2%, <1 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite and palagonite. Vesicles 1%, <1 mm, filled with smectite and carbonate. Veins are filled with smectite and minor pyrite. Some pyrite is also disseminated in groundmass.

Thin Section Description

Location: 21 cm

Texture: porphyritic - quench

Phenocrysts: olivine 3%, <0.8 mm, euhedral; plagioclase 15%, <3 mm, subhedral; clinopyroxene 2%, <0.8 mm, subhedral

Groundmass: olivine 4%, <0.3 mm, subhedral; plagioclase 25%, <0.5 mm, acicular; clinopyroxene 39%, radiating sheaves; opaques 6%, 0.01, granular; glass 5%

Vesicles: 1%, 0.5 mm, round

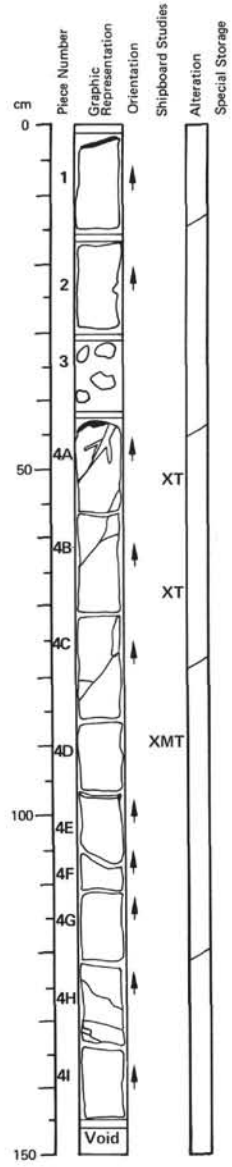
Alteration: olivine to smectite and carbonate; smectite and carbonate fill vesicles

Shipboard Data

Bulk Analysis: 20-22 cm

SiO_2	49.86
Al_2O_3	16.89
Fe_2O_3	11.22
MgO	6.09
CaO	11.91
Na_2O	2.28
K_2O	< 0.03
TiO_2	1.38
P_2O_5	0.15
MnO	.17
LOI	0.83
H_2O^+	0.71
H_2O^-	N.D.
CO_2	0.25

Sr	103.0
Zr	79.7
Y	28.7
Nb	1.8



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	5 7	1

Visual Description
Moderately phyric pillow basalt. Basalt is medium gray to greenish gray; weakly altered. Plagioclase phenocrysts 8-12%, <4 mm, fresh; olivine phenocrysts 2-4%, <1 mm, partly altered to smectite; clinopyroxene phenocrysts 3-5%, <1 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are mostly altered to smectite. Vesicles 1%, filled with smectite and carbonate. Veins are filled with smectite, carbonate and minor pyrite. Piece 3 consists of silicified sediment.

Thin Section Descriptions
Location: 55 cm
Texture: porphyritic - quench
Phenocrysts: olivine 4%, <1 mm, euhedral; plagioclase 15%, <1.5 mm, subhedral; clinopyroxene 5%, subophitic
Groundmass: olivine 1%, <0.3 mm, subhedral; plagioclase 20%, <0.5 mm, acicular; clinopyroxene 52%, radiating sheaves; opaques 2%, 0.01, granular
Vesicles: 1%, <2 mm, round
Alteration: olivine and minor groundmass to smectite and carbonate; carbonate fills vesicles

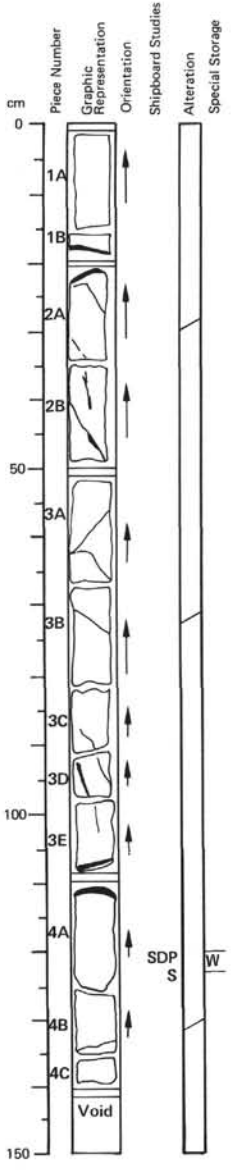
Location: 68 cm
Texture: porphyritic - quench
Phenocrysts: olivine 5%, <0.8 mm, euhedral; plagioclase 12%, <3 mm, euhedral; clinopyroxene 5%, <1 mm, subophitic
Groundmass: plagioclase 30%, <0.5 mm, acicular; clinopyroxene 30%, radiating sheaves; opaques 8%, 0.01 mm, granular; glass 5%
Vesicles: 5%, <2 mm, round
Alteration: olivine and some groundmass to smectite; carbonate and smectite fill vesicles

Location: 90 cm
Texture: porphyritic - quench
Phenocrysts: olivine 2%, 0.4 mm, euhedral; plagioclase 12%, <3.5 mm, euhedral glomerocrysts; clinopyroxene 1%, 0.3 mm, subophitic
Groundmass: plagioclase 35%, 0.7 mm, acicular; clinopyroxene 35%, radiating sheaves; opaques 8%, 0.05 mm, granular to lath-shaped; glass 5%, altered
Vesicles: 2%, <0.8 mm, round
Alteration: olivine and glass to smectite and carbonate; smectite and carbonate fill vesicles

Shipboard Data

Bulk Analysis:	50-54 cm	67-68 cm	90-92 cm
SiO_2	49.88	48.85	48.69
Al_2O_3	16.42	15.93	15.37
Fe_2O_3	10.90	11.34	11.45
MgO	5.48	5.89	5.78
CaO	12.48	13.16	12.75
Na_2O	2.38	2.26	2.26
K_2O	0.15	0.04	0.09
TiO_2	1.49	1.41	1.48
P_2O_5	0.22	0.17	0.28
MnO	.15	.17	.17
LOI	1.44	0.77	1.16
H_2O^+	0.88	0.79	0.85
H_2O^-	N.D.	N.D.	N.D.
CO_2	0.60	0.15	0.36
Sr	106.3	97.0	98.7
Zr	71.3	77.6	76.5
Y	29.0	25.1	25.5
Nb	2.8	2.4	2.1

Magnetic Data:	90-92 cm
NRM Intensity (emu/cc)	11.32×10^{-3}
NRM Inclination	-17.8°
Stable Inclination	-29.5°



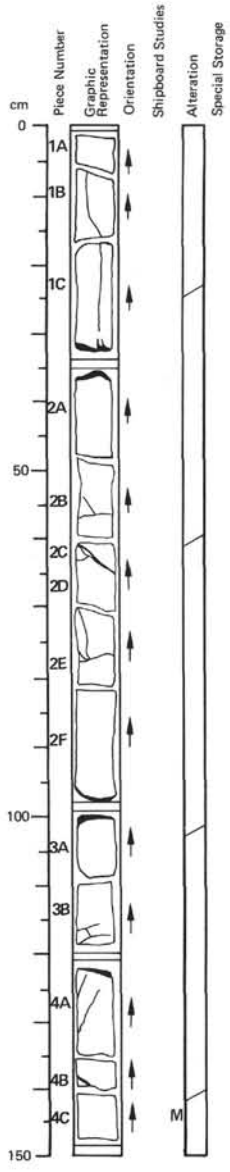
VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	5 7	2

Visual Description
Moderately phyric pillow basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 8-12%, <6 mm, fresh; olivine phenocrysts 1-2%, <1 mm, mostly altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are mostly fresh with only minor alteration to palagonite. Vesicles 0-5%, filled with smectite and carbonate. Veins are filled with smectite, carbonate, zeolite(?) and minor pyrite.

Shipboard Data

Physical Property Data:	119-121 cm	122-124 cm
$\overline{V}p$ (km/sec)	5.69	5.77
Porosity (%)	3.69	
Wet Bulk Density (g/cc)	2.85	
Grain Density (g/cc)	2.92	



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

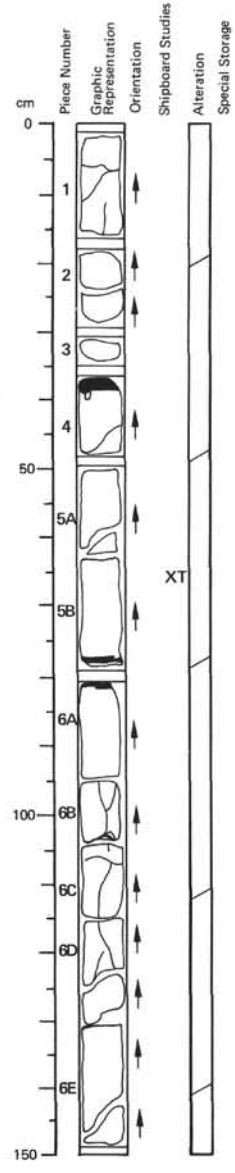
LEG	SITE	HOLE	CORE	SECT.
53	418	A	57	3

Visual Description

Moderately phyric pillow basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 8-15%, <6 mm, fresh; olivine phenocrysts 2%, <1 mm, most altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are mostly fresh with minor palagonite alteration. Vesicles 0-5%, filled with smectite. Veins are filled with carbonate, smectite, zeolite(?) and minor pyrite.

Shipboard Data

Magnetic Data:	143-145 cm
NRM Intensity (emu/cc)	25.45×10^{-3}
NRM Inclination	-39.3°
Stable Inclination	-39.5°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	57	4

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray; weakly altered. Plagioclase phenocrysts 10-15%, <7 mm, fresh; olivine phenocrysts 2%, <1.5 mm, altered to smectite; clinopyroxene phenocrysts 2%, <1 mm, in subophitic clots with plagioclase, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to palagonite and smectite. Vesicles 1%, <2 mm, filled with smectite and carbonate. Veins are filled with smectite, carbonate, zeolite(?) and pyrite.

Thin Section Description

Location: 65 cm

Texture: porphyritic - quench

Phenocrysts: olivine 3%, <1 mm, euhedral; plagioclase 15%, <3 mm, subhedral; clinopyroxene 2%, <1 mm, subophitic

Groundmass: olivine 2%, <0.4 mm, euhedral; plagioclase 25%, <0.5 mm, acicular; clinopyroxene 41%, radiating sheaves; opaques 6%, 0.02 mm, granular; glass 5%

Vesicles: 1%, <2 mm, round

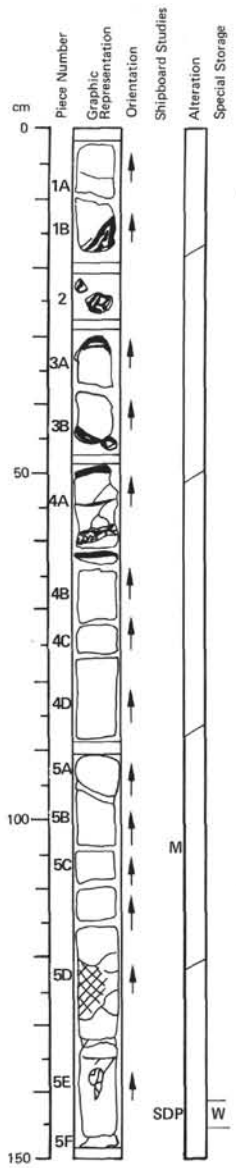
Alteration: olivine and minor groundmass to smectite and carbonate; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 66-68 cm

SiO_2	47.85
Al_2O_3	15.99
Fe_2O_3	11.35
MgO	5.90
CaO	12.70
Na_2O	2.23
K_2O	0.08
TiO_2	1.47
P_2O_5	0.15
MnO	.20
LOI	1.06
H_2O^+	0.68
H_2O^-	N.D.
CO_2	0.40

Sr	104.0
Zr	77.7
Y	26.1
Nb	2.5



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

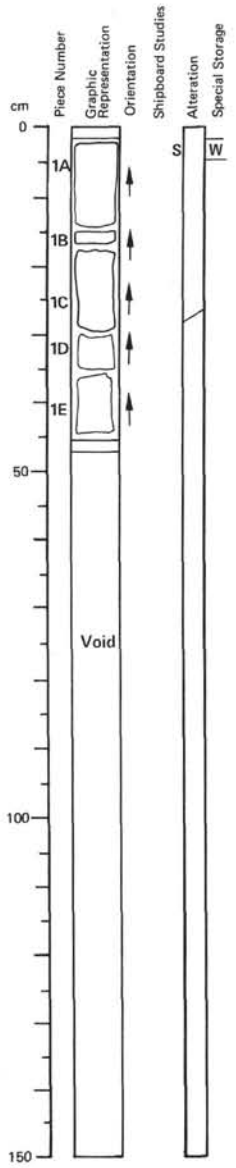
LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	5 7	5

Visual Description

Moderately phyric pillow basalt. Upper part of section to 62 cm is pillowed; lower part is massive cooling unit which continues into Section 6. Basalt is medium gray to greenish-gray; weakly altered. Plagioclase phenocrysts 12-15%, <5 mm, fresh; olivine phenocrysts 3%, <2 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite, carbonate and pink zeolite(?). Vesicles 1-2%, filled with smectite, carbonate and pyrite. Piece 5D contains an inclusion composed of quartz, carbonate and smectite.

Shipboard Data

Magnetic Data:	105-107 cm
NRM Intensity (emu/cc)	6.22×10^{-3}
NRM Inclination	-25.6°
Stable Inclination	-32.2°
Physical Property Data:	141-143 cm
$\bar{V}p$ (km/sec)	5.66
Porosity (%)	4.40
Wet Bulk Density (g/cc)	2.86
Grain Density (g/cc)	2.95



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

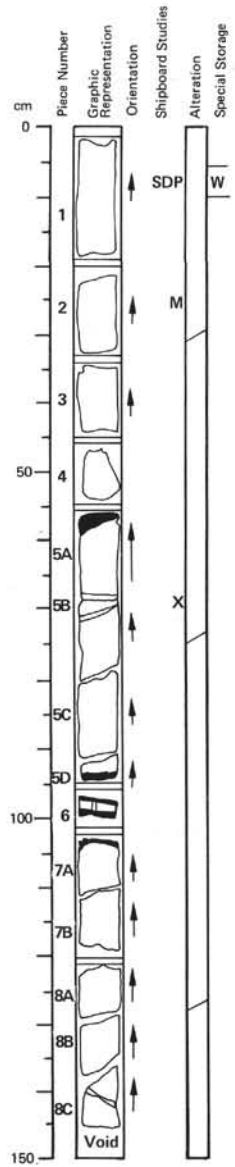
LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	5 7	6

Visual Description

Moderately phyric massive basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 12-15%, <5 mm, fresh; olivine phenocrysts 2%, <3 mm, altered to smectite. Groundmass is holocrystalline, fine-grained.

Shipboard Data

Physical Property Data:	4-6 cm
$\bar{V}p$ (km/sec)	5.50



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

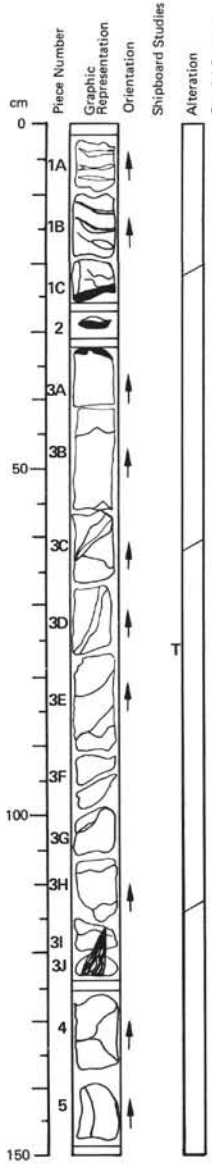
LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A	5	8		1

Visual Description

Moderately phyric pillow basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 8-12%, <5 mm, fresh; olivine phenocrysts 3%, <1 mm, partly replaced by smectite. Groundmass is fine-grained to glassy; glass selvedges are mostly fresh with minor development of palagonite. Vesicles 0.5%, filled with carbonate and zeolite(?). Veins are filled with carbonate, smectite and pyrite.

Shipboard Data

Bulk Analysis: 68-70 cm		Magnetic Data:	25-27 cm
SiO_2	45.23	NRM Intensity (emu/cc)	15.47×10^{-3}
Al_2O_3	15.27	NRM Inclination	-22.2°
Fe_2O_3	13.26	Stable Inclination	-23.0°
MgO	5.86		
CaO	13.80	Physical Property Data:	10-12 cm
Na_2O	2.34	$\bar{V}p$ (km/sec)	5.60
K_2O	0.24	Porosity (%)	3.80
TiO_2	1.56	Wet Bulk Density (g/cc)	2.90
P_2O_5	0.16	Grain Density (g/cc)	2.98
MnO	.17		
LOI	1.84		
H_2O^+	1.16		
H_2O^-	N.D.		
CO_2	1.09		



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A	5	8		2

Visual Description

Moderately to highly phyric pillow basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 15-20%, <7 mm, fresh; olivine phenocrysts 2%, <2 mm, altered to smectite; clinopyroxene phenocrysts 1-2%, <3 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite and zeolite(?). Vesicles 1-2%, smectite and silica. Veins are filled with smectite, carbonate and pyrite. Slickensides are present on many fractures.

Thin Section Description

Location: 75 cm

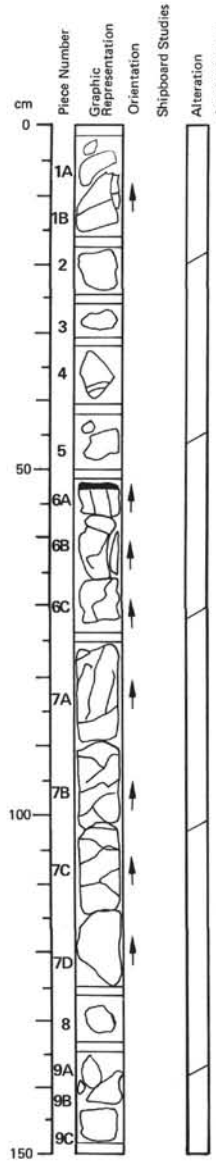
Texture: porphyritic - quench

Phenocrysts: olivine 2%, <1 mm, subhedral; plagioclase 20%, <3 mm, subhedral; clinopyroxene 2%, <0.3 mm, anhedral

Groundmass: olivine 1%, 0.25 mm; plagioclase 15%, <0.5 mm; clinopyroxene 50%, radiating sheaves; opaques 8%, 0.01 mm, euhedral

Vesicles: 2%, <0.5 mm, round

Alteration: olivine to smectite; smectite fills vesicles

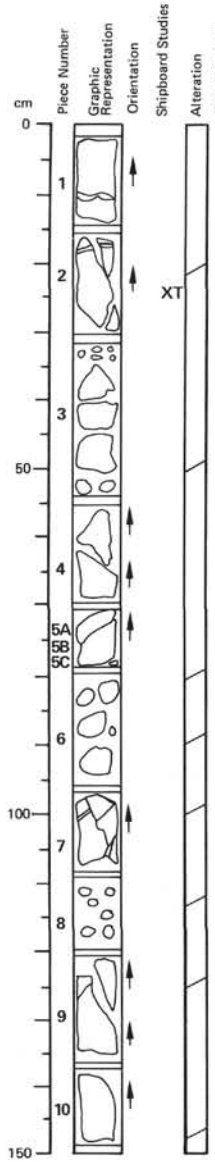


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	3	4	1	8	A	5	8	3

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray; weakly altered. Plagioclase phenocrysts 10-15%, <7 mm, fresh, some with inclusions of spinel; olivine phenocrysts 2%, <3 mm, altered to smectite; clinopyroxene phenocrysts 1%, <1 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles 1-2%, <2 mm, filled with carbonate and smectite. Veins are filled with smectite, carbonate and minor pyrite. Groundmass is slightly altered to smectite. Slickensides occur on many fractures.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	3	4	1	8	A	5	8	4

Visual Description

Moderately phyric basalt. Basalt is gray to greenish-gray; weakly to moderately altered. Plagioclase phenocrysts 10%, <5 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 1%, <1 mm, fresh. Groundmass is fine-grained to glassy; no glass selvedges were recovered but groundmass has glassy intersertal texture. Vesicles 1-2%, filled with smectite, zeolite(?) and pyrite. Veins are filled with smectite, carbonate, zeolite(?) and minor pyrite.

Thin Section Description

Location: 25 cm

Texture: porphyritic - quench

Phenocrysts: olivine <1%, 0.3 mm, euhedral; plagioclase 10%, <2 mm; clinopyroxene 1%, 0.3 mm, anhedral

Groundmass: plagioclase 25%, <0.6 mm, skeletal, seriate; clinopyroxene 55%, radiating sheaves; opaques 8%, 0.01 mm, euhedral, some laths <0.3 mm

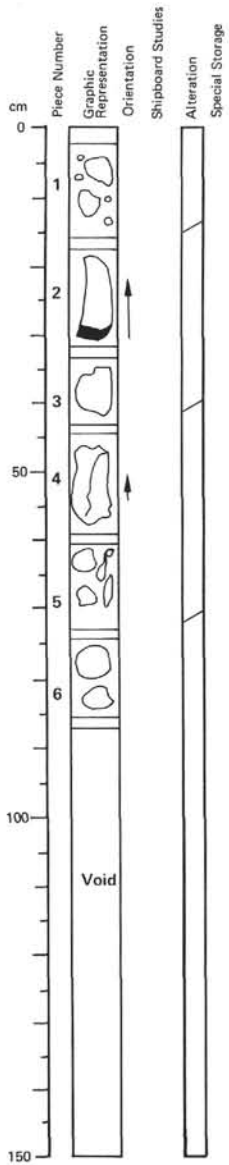
Vesicles: 1%, 0.2 mm, round

Alteration: olivine to smectite; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 25-27 cm

SiO_2	49.14
Al_2O_3	15.62
Fe_2O_3	13.31
MgO	6.79
CaO	12.73
Na_2O	2.33
K_2O	0.14
TiO_2	1.57
P_2O_5	0.18
MnO	.21
LOI	1.34
H_2O^+	0.98
H_2O^-	N.D.
CO_2	0.35
Cr	N.D.
Ni	N.D.
Sr	107.9
Zr	87.7
Y	30.5
Nb	3.5

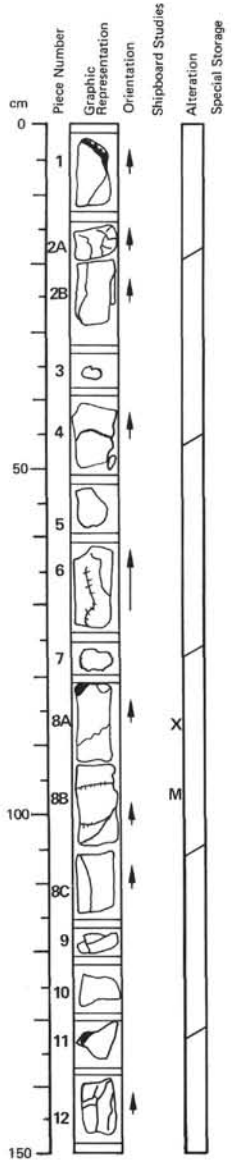


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A	5	8		5

Visual Description

Moderately phyric pillow basalt. Basalt is gray to greenish-gray; weakly altered. Plagioclase phenocrysts 10%, <5 mm, fresh; olivine phenocrysts 1%, <2 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedge in piece 2 is partly altered to smectite. Veins are common, filled with smectite and often slickensided.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A	5	9		1

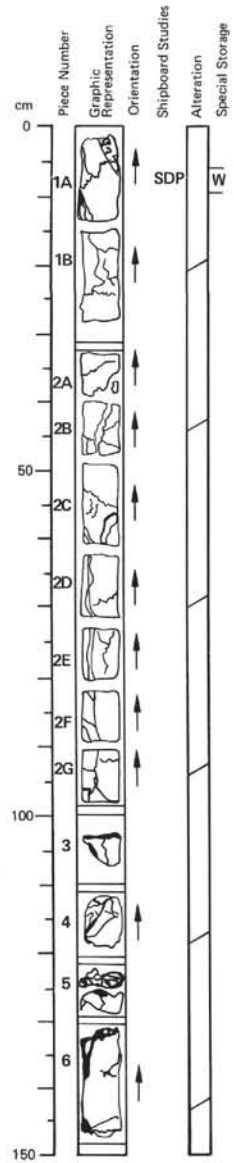
Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 10%, <5 mm, fresh; olivine phenocrysts 1%, <2 mm, partly altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are mostly altered to smectite. Vesicles 1%, filled with carbonate and smectite. Scattered veins are also filled with carbonate and smectite. Piece 2A is brecciated with a matrix of carbonate and smectite. Zeolite(?) occurs in piece 1.

Shipboard Data

Bulk Analysis: 84-86 cm	
SiO_2	48.67
Al_2O_3	15.88
Fe_2O_3	11.60
MgO	6.12
CaO	13.36
Na_2O	2.47
K_2O	0.09
TiO_2	1.62
P_2O_5	0.14
MnO	.18
LOI	1.63
H_2O^+	1.15
H_2O^-	N.D.
CO_2	0.77

Magnetic Data:	97-99 cm
NRM Intensity (emu/cc)	34.93×10^{-3}
NRM Inclination	-27.2°
Stable Inclination	-27.9°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

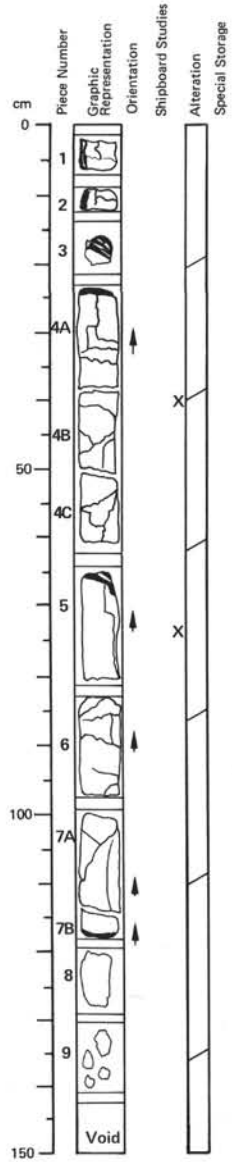
LEG	SITE	HOLE	CORE	SECT.
53	418	A	59	2

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 8-12%, <2 mm, fresh; olivine phenocrysts 3%, ≤ 1 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are partly altered to dark green smectite. Veins are scattered throughout, filled with coarsely crystalline carbonate and smectite. Pyrite is present in piece 2D. Minor breccia occurs in piece 4.

Shipboard Data

Physical Property Data:	7-9 cm
$\overline{V}p$ (km/sec)	5.70
Porosity (%)	6.43
Wet Bulk Denstiy (g/cc)	2.81
Grain Density (g/cc)	2.93



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

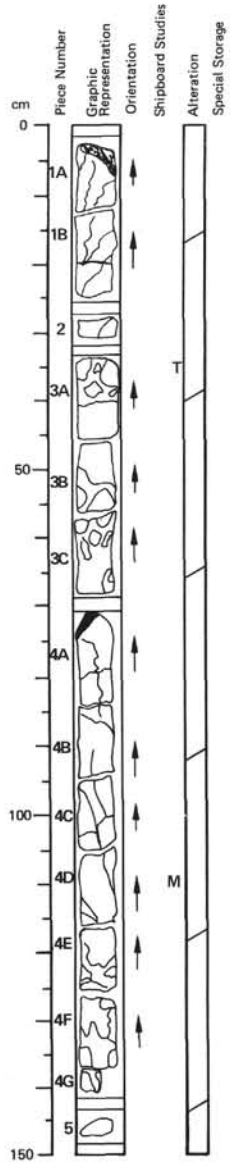
LEG	SITE	HOLE	CORE	SECT.
53	418	A	59	3

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 7-10%, <5 mm, fresh; olivine phenocrysts 1-2%, generally altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are mostly fresh, some are partly altered to dark green smectite. Vesicles 1%, filled with smectite and carbonate. Veins are scattered throughout, filled with smectite and carbonate. Minor disseminated pyrite is present in the groundmass.

Shipboard Data

Bulk Analysis:	40-42 cm	74-76 cm
SiO_2	48.36	50.12
Al_2O_3	15.09	15.02
Fe_2O_3	12.23	12.83
MgO	6.79	7.21
60	12.55	10.74
Na_2O	2.43	2.30
K_2O	0.11	0.50
TiO_2	1.57	1.50
P_2O_5	0.17	0.11
MnO	.20	.13
LOI	1.48	2.34
H_2O^+	1.22	1.96
H_2O^-	N.D.	N.D.
CO_2	0.47	0.42



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A	5	9		4

Visual Description

Moderately phyric pillow basalt and minor basalt breccia. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 1-2%, <2 mm, generally altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Minor breccia occurs in pieces 2, 3 and 4; breccia consists of angular fragments of crystalline basalt in a matrix of dark green smectite, carbonate and zeolite(?).

Thin Section Description

Location: 35 cm

Texture: porphyritic - glassy

Phenocrysts: olivine 3%, ≤2.5 mm, euhedral; plagioclase 5%, <3 mm, euhedral

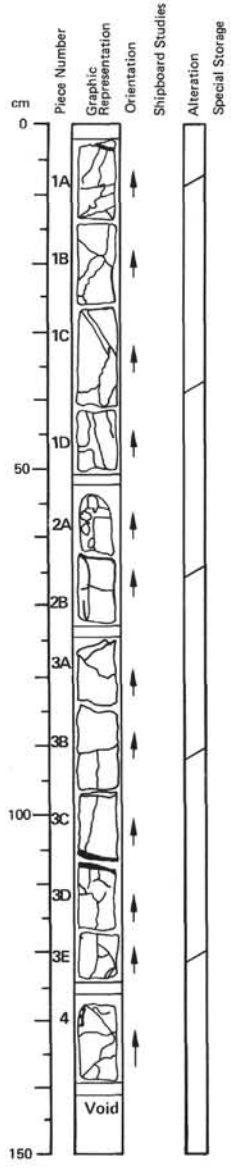
Groundmass: plagioclase 2%, <0.3 mm, skeletal; glass 88%, partly devitrified

Vesicles: <1%, 0.1 mm, round, in glass

Alteration: olivine to carbonate and smectite, smectite fills vesicles; glass to carbonate and silica

Shipboard Data

Magnetic Data:	110-112 cm
NRM Intensity (emu/cc)	15.06×10^{-3}
NRM Inclination	-15.1°
Stable Inclination	-17.7°

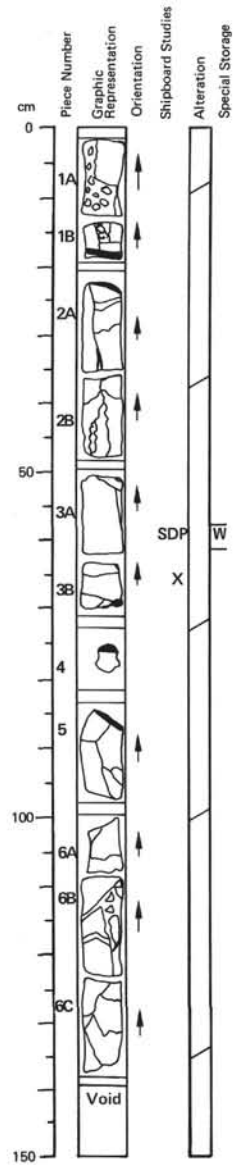


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A	5	9		5

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 6%, ≤4 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 1%, <5 mm, fresh, euhedral, occur only below 107 cm. Groundmass is fine-grained to glassy; glass selvedges are mostly fresh with only minor alteration to smectite. Vesicles 1%, filled with carbonate. Veins are scattered throughout, filled with carbonate and smectite.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	5 9	6

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 7%, <6 mm, fresh; olivine phenocrysts 1-2%, <1 mm, partly altered to smectite; clinopyroxene phenocrysts <1%, <2 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite but fresh glass is present throughout. Vesicles <1%, filled with carbonate. Veins are present throughout, filled with smectite, carbonate, minor pyrite and minor zeolite(?).

Shipboard Data

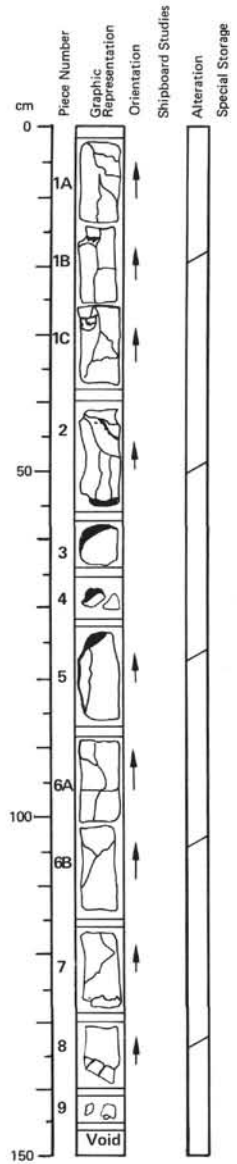
Bulk Analysis: 65-67 cm

SiO_2	48.91
Al_2O_3	15.64
Fe_2O_3	11.80
MgO	5.95
CaO	12.63
Na_2O	2.45
K_2O	0.12
TiO_2	1.60
P_2O_5	0.17
MnO	.18
LOI	1.09
H_2O^+	0.90
H_2O^-	N.D.
CO_2	0.31

Sr	114.2
Zr	94.4
Y	32.7
Nb	3.8

Physical Property Data: 59-61 cm

$\bar{V}p$ (km/sec)	5.45
Porosity (%)	6.20
Wet Bulk Density (g/cc)	2.83
Grain Density (g/cc)	2.95

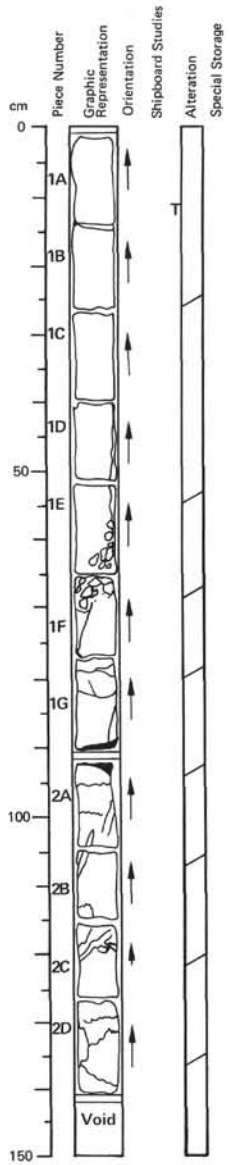


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	5 9	7

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 8-10%, <5 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite; clinopyroxene phenocrysts, 1 grain, 4 mm, in piece 3. Groundmass is fine-grained to glassy; glass selvedges are partly altered to dark green smectite. Vesicles <1%, filled with carbonate. Scattered veins are filled with carbonate and smectite. Zeolite occurs in altered selvedge in piece 3.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	60	1

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray, some brown staining in lower part of section; weakly to moderately altered. Plagioclase phenocrysts 5-10%, ≤5 mm, fresh, most abundant in upper half of section; olivine phenocrysts 2%, ≤1 mm, mostly altered to smectite; clinopyroxene phenocrysts 1%, ≤1 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are mostly fresh with minor alteration to smectite. Vesicles 1-2%, filled with smectite, carbonate and zeolite(?). Scattered veins are filled with smectite, carbonate, iron oxides and minor pyrite. The basalt is incipiently brecciated below 60 cm.

Thin Section Description

Location: 12 cm

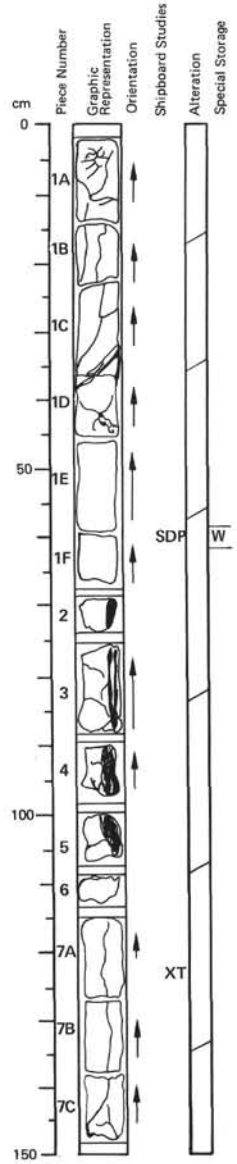
Texture: porphyritic - quench

Phenocrysts: olivine 1%, <1.3 mm, euhedral; plagioclase 10%, ≤3.5 mm, euhedral; clinopyroxene <1%, ≤0.8 mm, subophitic

Groundmass: plagioclase 35%, ≤0.5 mm, acicular; clinopyroxene 45%, 0.15 mm, granular; opaques 7%, 0.01 mm, granular

Vesicles: 2%, 0.8 mm, round

Alteration: olivine to smectite; smectite and carbonate fill vesicles



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	60	2

Visual Description

Sparsely to moderately phyric pillow basalt. Basalt is mostly medium to dark gray, stained brown in upper part; weakly altered. Plagioclase phenocrysts 4-12%, ≤7 mm, fresh, most abundant in the lower part of section; olivine phenocrysts 2%, ≤1 mm, altered to smectite; clinopyroxene phenocrysts <1%, ≤3 mm, subhedral often intergrown with plagioclase, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles 2%, ≤3 mm, filled with smectite and carbonate. Scattered veins are filled with smectite and carbonate.

Thin Section Description

Location: 124 cm

Texture: porphyritic - quench

Phenocrysts: olivine 2%, <1.5 mm, euhedral; plagioclase 10%, ≤2.5 mm, subhedral

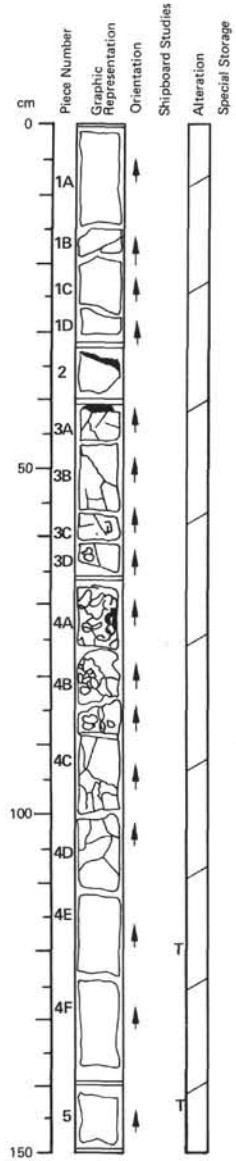
Groundmass: plagioclase 5%, <0.3 mm, skeletal; clinopyroxene 72%, radiating sheaves; opaques <1%, .03 mm; pyrite(?).

Vesicles: 1%, 0.7 mm, round

Alteration: olivine to carbonate and smectite. Smectite and carbonate fill vesicles and replace groundmass

Shipboard Data

Bulk Analysis: 123-126 cm		Physical Property Data:	60-62 cm
SiO_2	48.07	$\bar{V}p$ (km/sec)	5.69
Al_2O_3	16.67	Porosity (%)	5.14
Fe_2O_3	12.69	Wet Bulk Density (g/cc)	2.85
MgO	6.56	Grain Density (g/cc)	2.95
CaO	12.82		
Na_2O	2.32		
K_2O	< 0.03		
TiO_2	1.59		
P_2O_5	0.13		
MnO	.21		
LOI	0.85		
H_2O^+	0.82		
H_2O^-	N.D.		
CO_2	0.19		
Sr	109.9		
Zr	91.4		
Y	30.6		
Nb	4.0		



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	6 0	3

Visual Description

Sparsely to moderately phyric pillow basalt. Basalt is medium to dark gray, moderately altered. Plagioclase phenocrysts 2-6%, ≤8 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 2%, <2 mm, often intergrown with plagioclase, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite; fresh glass occurs in piece 2. Vesicles 1%, filled with smectite, carbonate and zeolite(?). Scattered veins are filled with carbonate, smectite, silica and minor zeolite(?). In pieces 2, 4D and 5 the basalt is incipiently brecciated.

Thin Section Description

Location: 122 cm

Texture: porphyritic - quench

Phenocrysts: olivine 2%, <2 mm, euhedral; plagioclase 20%, ≤4 mm, subhedral

Groundmass: plagioclase 20%, ≤0.4 mm, skeletal; clinopyroxene 48%, radiating sheaves; opaques 8%, 0.05 mm, laths

Vesicles: 2%, 0.3 mm, round

Alteration: olivine to carbonate and smectite. Smectite, carbonate and silica(?) fill veinlets and vesicles

Thin Section Description

Location: 142 cm

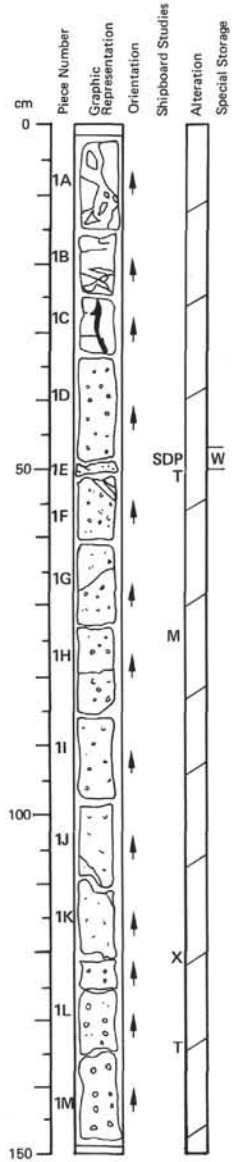
Texture: porphyritic - quench

Phenocrysts: olivine 4%, 0.6 mm, euhedral; plagioclase 12%, ≤4 mm, euhedral; clinopyroxene <1%, 0.2 mm, rounded

Groundmass: plagioclase 30%, <0.5 mm, acicular; clinopyroxene 46%, radiating sheaves; opaques 8%, 0.01 mm, granular

Vesicles: <1%, ≤0.5 mm round

Alteration: olivine to smectite; smectite and carbonate fill vesicles



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	6 0	4

Visual Description

Sparsely phyric pillow basalt 0 to 25 cm, sparsely phyric massive basalt 25 to 150 cm. Pillow basalt is medium to dark gray; moderately altered. Plagioclase phenocrysts 2%, ≤4 mm, fresh; olivine phenocrysts <1%, ≤1 mm, altered to smectite; clinopyroxene phenocrysts ≤1%, ≤1 mm, intergrown with plagioclase, fresh. Groundmass is fine-grained. Vesicles 1-2%, ≤2 mm, filled with smectite and carbonate. Numerous veinlets are filled with carbonate, smectite and silica. Massive basalt is medium to dark gray with brownish discoloration along fractures and veins; moderately altered. Plagioclase phenocrysts 4-5%, ≤7 mm, fresh. Groundmass is fine- to medium-grained with grain size increasing downward. Vesicles 7-10%, <2 mm, filled with carbonate and smectite. Veins are sparse, filled with smectite, carbonate and minor pyrite.

Thin Section Description

Location: 50 cm

Texture: porphyritic - quench

Phenocrysts: plagioclase 8%, ≤1.5 mm, subhedral

Groundmass: plagioclase 25%, 0.5 mm, skeletal; clinopyroxene 30%, radiating sheaves; opaques 8%, 0.03 mm glass 14%

Vesicles: 15%, 1 mm, round

Alteration: smectite and carbonate fill vesicles and veins; some glass to smectite

Thin Section Description

Location: 132 cm

Texture: porphyritic - subophitic

Phenocrysts: plagioclase 5%, ≤4 mm, subhedral

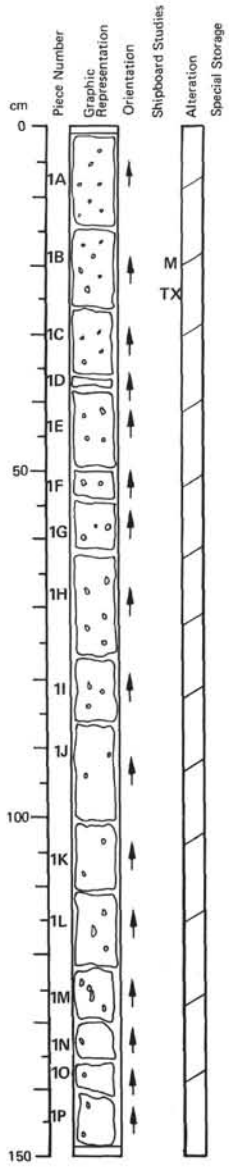
Groundmass: olivine 5%, 0.4 mm, euhedral; plagiocase 30%, 0.5 mm; clinopyroxene 15%, anhedral; opaques 5%, 0.1 mm, subhedral; smectite 20%

Vesicles: 20%, 1 mm, round

Alteration: olivine to smectite; abundant interstitial smectite

Shipboard Data

Bulk Analysis: 121-124 cm		Magnetic Data:	74-76 cm
SiO_2	47.43	NRM Intensity (emu/cc)	8.17×10^{-3}
Al_2O_3	15.28	NRM Inclination	6.8
Fe_2O_3	12.76	Stable Inclination	15.1
MgO	5.76		
CaO	12.89	Physical Property Data:	47-49 cm
Na_2O	2.30	$\bar{V}p$ (km/sec)	5.17
K_2O	0.24	Porosity (%)	5.82
TiO_2	1.56	Wet Bulk Density (g/cc)	2.76
P_2O_5	0.15	Grain Density (g/cc)	2.87
MnO	.20		
LOI	1.90		
H_2O^+	1.18		
H_2O^-	N.D.		
CO_2	0.83		



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	3	4	1	8	A	6	0	5

Visual Description

Sparsely phyric massive basalt. Basalt is medium to dark gray; moderately altered. Plagioclase phenocrysts 0-4%, ≤5 mm, fresh, most abundant in lower part of section. Groundmass is fine-grained to glassy but with no glassy selvedges. Vesicles 5%, filled with smectite, carbonate and minor pyrite. Veins are scattered throughout, filled with carbonate, smectite, zeolite(?) and minor pyrite.

Thin Section Description

Location: 25 cm

Texture: porphyritic - intersertal

Phenocrysts: plagioclase 4%, ≤4 mm, euhedral

Groundmass: plagioclase 30%, ≤1 mm, euhedral; clinopyroxene 30%, ≤0.8 mm, subophitic; opaques 8%, 0.1 mm, granular to lath-shaped; glass 18%

Vesicles: 10%, ≤7 mm, round

Alteration: glass to smectite; smectite and carbonate fill vesicles

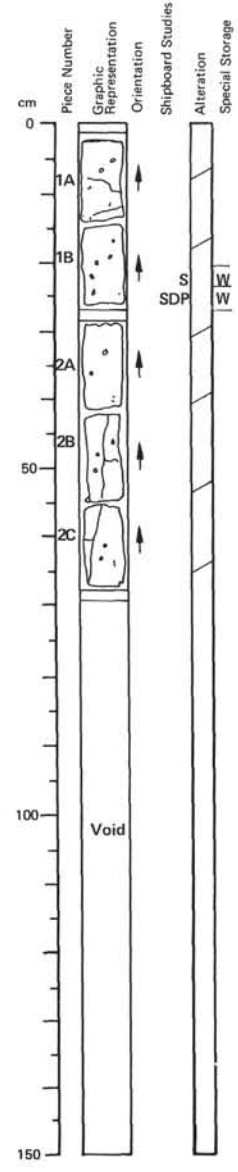
Shipboard Data

Bulk Analysis: 25-27 cm

SiO_2	49.79
Al_2O_3	15.46
Fe_2O_3	13.65
MgO	6.91
CaO	11.73
Na_2O	2.42
K_2O	0.08
TiO_2	1.50
P_2O_5	0.28
MnO	.19
LOI	2.06
H_2O^+	1.39
H_2O^-	N.D.
CO_2	0.86

Magnetic Data: 18-20 cm

NRM Intensity (emu/cc)	3.02×10^{-3}
NRM Inclination	1.5°
Stable Inclination	-19.5°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

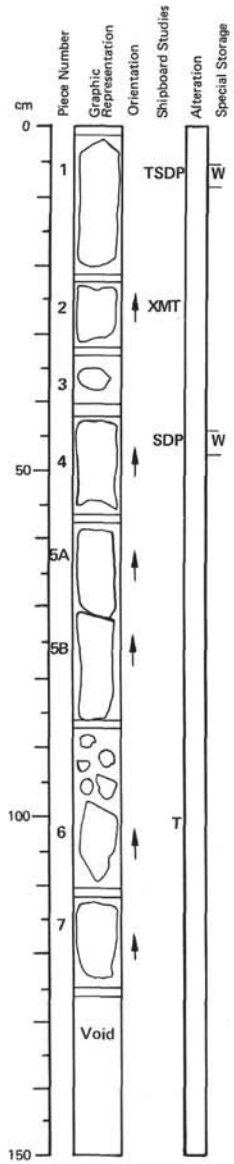
LEG		SITE			HOLE	CORE		SECT.
5	3	4	1	8	A	6	0	6

Visual Description

Moderately phyric massive basalt. Basalt is medium to dark gray; moderately altered. Plagioclase phenocrysts 7-9%, ≤4 mm, fresh. Groundmass is fine-grained with no glass selvedges. Vesicles 2%, ≤1 mm, filled mostly with smectite. Minor veins are filled with smectite.

Shipboard Data

Physical Property Data:	21-23 cm	24-26 cm
$\overline{V}p$ (km/sec)	5.87	5.74
Porosity (%)		2.89
Wet Bulk Density (g/cc)		2.91
Grain Density (g/cc)		2.96



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	6 1	1

Visual Description

Moderately phyric massive basalt. Basalt is medium gray; fresh. Plagioclase phenocrysts 8-10%, ≤4 mm, fresh; olivine phenocrysts <1%, ≤1 mm, altered to smectite. Groundmass consists of subophitic clots in glassy matrix - 'ophimottled' texture. Vesicles <1%, <1 mm, filled with smectite. Veins are rare, filled with carbonate and smectite.

Thin Section Description

Location: 5 cm
Texture: porphyritic - intersertal
Phenocrysts: plagioclase 15%, ≤4 mm, subhedral
Groundmass: olivine 5%, 0.5 mm, euhedral; plagioclase 35%, 0.5 mm; clinopyroxene 30%, <0.5 mm, granular; opaques 5%, ≤0.2 mm, laths and octahedra; glass 9%, interstitial, devitrified
Vesicles: 1%, 0.6 mm, round
Alteration: olivine to smectite; vesicles filled with smectite and carbonate

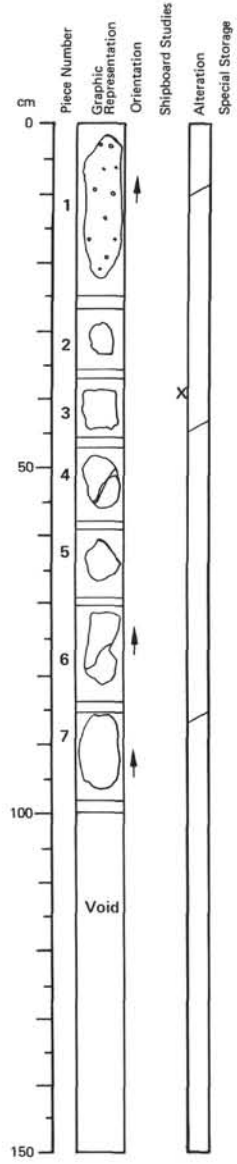
Location: 30 cm
Texture: porphyritic - intersertal
Phenocrysts: plagioclase 15%, ≤2 mm, subhedral
Groundmass: olivine 10%, 0.5 mm, subhedral; plagioclase 25%, 0.3 mm; clinopyroxene 35%, ≤0.2 mm, subhedral; glass 10%, interstitial
Vesicles: <1%, 0.6 mm, round
Alteration: olivine to smectite; smectite after glass; carbonate fills vesicles

Location: 105 cm
Texture: porphyritic - intersertal
Phenocrysts: plagioclase 5%, <3 mm, euhedral
Groundmass: olivine 3%, 0.4 mm, euhedral; plagioclase 30%, 0.5 mm; clinopyroxene 40%, 0.2 mm, granular; opaques 5%, 0.1 mm, granular to lath-shaped; glass 17%, interstitial
Vesicles: <1%, 0.3 mm, round
Alteration: olivine and some glass to smectite; smectite fills vesicles

Shipboard Data

Bulk Analysis: 28-30 cm	
SiO_2	49.81
Al_2O_3	14.93
Fe_2O_3	13.69
MgO	5.85
CaO	10.80
Na_2O	2.47
K_2O	0.11
TiO_2	1.52
P_2O_5	0.27
MnO	.19
LOI	0.86
H_2O^+	0.82
H_2O^-	N.D.
CO_2	0.39
Cr	125.1
Ni	87.9
Y	29.2
Nb	3.5

Magnetic Data:	28-30 cm	
NRM Intensity (emu/cc)	010.07×10^{-3}	
NRM Inclination	-15.4°	
Stable Inclination	-18.5°	
Physical Property Data:	7-9 cm	45-47 cm
$\bar{V}p$ (km/sec)	5.69	5.69
Porosity (%)		2.84
Wet Bulk Density (g/cc)		2.94
Grain Density (g/cc)		2.97



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

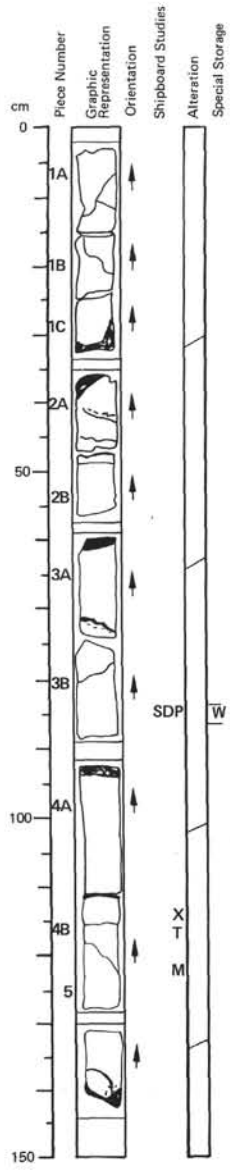
LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	6 1	Bit

Visual Description

Moderately phyric massive basalt. Basalt is medium gray; weakly altered. Plagioclase phenocrysts 8-10%, ≤4 mm, fresh. Groundmass consists of subophitic clots in glassy matrix - 'ophimottled' texture. Vesicles are common in piece 1, filled with green smectite. Veins are rare, filled with smectite and carbonate.

Shipboard Data

Bulk Analysis: 40-42 cm	
SiO_2	49.48
Al_2O_3	14.86
Fe_2O_3	11.86
MgO	6.99
CaO	12.30
Na_2O	2.43
K_2O	0.11
TiO_2	1.52
P_2O_5	0.13
MnO	.19
LOI	1.19
H_2O^+	0.68
H_2O^-	N.D.
CO_2	0.51
Sr	119.6
Zr	88.3
Y	29.6
Nb	2.4



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	6 2	1

Visual Description

Sparsely to moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 3-8%, <3 mm, fresh, locally concentrated; olivine phenocrysts <1%, <1 mm, partly altered to smectite; clinopyroxene phenocrysts 1%, fresh. Groundmass is fine-grained to glassy; glass selvedges are somewhat brecciated and partly altered to smectite and zeolite(?). Vesicles 1%, increasing in abundance toward bottom of section, filled with smectite and carbonate. Scattered veins are filled with smectite and carbonate. Small pyrite vug occurs in piece 4A.

Thin Section Description

Location: 115 cm

Texture: porphyritic - quench

Phenocrysts: olivine 3%, <0.7 mm, subhedral; plagioclase 5%, <3 mm, subhedral

Groundmass: olivine 3%, 0.2 mm, subhedral; plagioclase 30%, 0.3 mm; clinopyroxene 35%, 0.1 mm, granular or in sheaves; opaques 5%, 0.05 mm, laths; glass 18%, interstitial

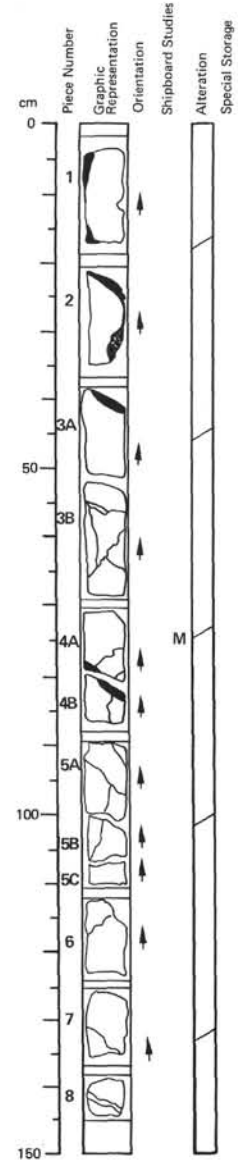
Vesicles: <1%, 0.5 mm, round

Alteration: olivine to smectite and carbonate

Shipboard Data

Bulk Analysis: 113-115 cm	
SiO_2	49.31
Al_2O_3	16.12
Fe_2O_3	11.36
MgO	7.70
CaO	12.36
Na_2O	2.52
K_2O	0.09
TiO_2	1.57
P_2O_5	0.17
MnO	.20
LOI	1.58
H_2O^+	1.25
H_2O^-	N.D.
CO_2	0.32

Magnetic Data:	122-124 cm
NRM Intensity (emu/cc)	6.73×10^{-3}
NRM Inclination	-11.9°
Stable Inclination	-14.4°
Physical Property Data:	82-84 cm
$\bar{V}p$ (km/sec)	5.45
Porosity (%)	4.57
Wet Bulk Density (g/cc)	2.89
Grain Density (g/cc)	2.98



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

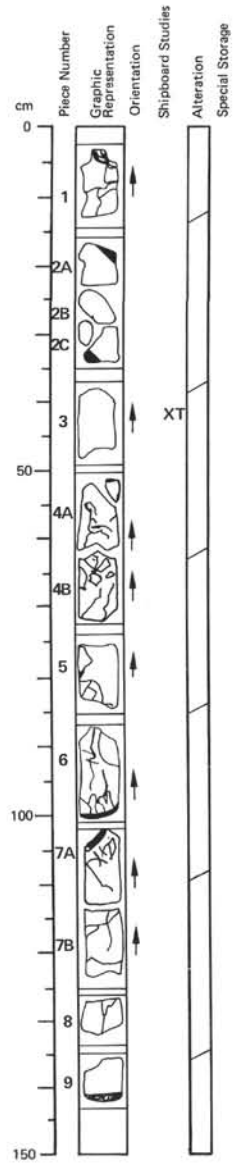
LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	6 2	2

Visual Description

Sparsely to moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 5%, <3 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 2-3%, <3 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to green smectite. Vesicles 1%, filled with carbonate. Scattered veins are filled with smectite, carbonate and zeolite(?).

Shipboard Data

Magnetic Data:	73-75 cm
NRM Intensity (emu/cc)	16.08×10^{-3}
NRM Inclination	-23.0°
Stable Inclination	-24.0°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	3	4	1	8	A	6	2	3

Visual Description

Sparsely to moderately phyric pillow basalt. Basalt is medium to dark gray, weakly altered. Plagioclase phenocrysts 5%, ≤5 mm, fresh; olivine phenocrysts 1%, ≤1 mm, altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are partly replaced by smectite and zeolite(?). Vesicles 3%, filled with carbonate and smectite. Scattered veins are filled with smectite and carbonate. Brecciation is common with fragments of crystalline basalt in a smectite matrix.

Thin Section Description

Location: 40 cm

Texture: porphyritic - quench

Phenocrysts: olivine(?) <1%, 0.5 mm, subhedral; plagioclase 5%, ≤1 mm, euhedral

Groundmass: plagioclase 15%, <0.5 mm, acicular; clinopyroxene 70%, poorly crystallized sheaves; opaques 8%, 0.01 mm, granular

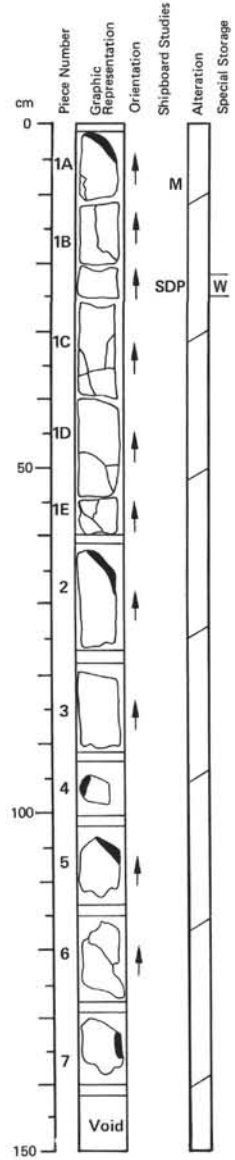
Vesicles: 2%, ≤1 mm, round

Alteration: olivine and interstitial material to carbonate; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 40-42 cm

SiO_2	49.70
Al_2O_3	16.06
Fe_2O_3	10.56
MgO	7.08
CaO	12.22
Na_2O	2.60
K_2O	0.13
TiO_2	1.61
P_2O_5	0.15
MnO	.20
LOI	1.64
H_2O^+	1.40
H_2O^-	N.D.
CO_2	0.89



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

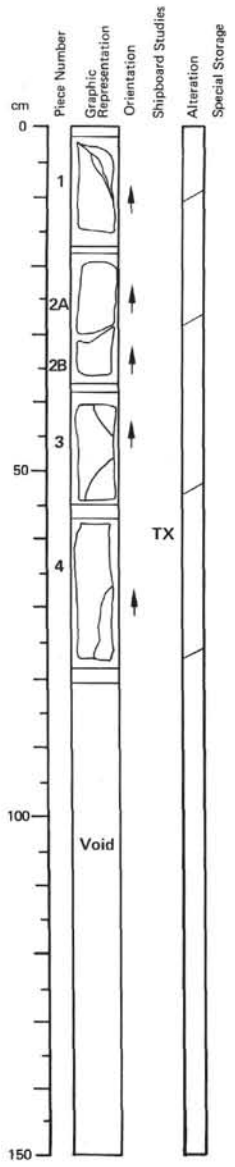
LEG		SITE			HOLE	CORE		SECT.
5	3	4	1	8	A	6	2	4

Visual Description

Sparsely to moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 3-5%, ≤5 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 1-2%, <3 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles 1%, filled with carbonate and smectite. Scattered veins are filled with smectite, carbonate, and zeolite(?).

Shipboard Data

Magnetic Data:	9-11 cm
NRM Intensity (emu/cc)	17.35×10^{-3}
NRM Inclination	-19.6°
Stable Inclination	-19.0°
Physical Property Data:	21-23 cm
$\bar{V}p$ (km/sec)	5.71
Porosity (%)	6.73
Wet Bulk Density (g/cc)	2.84
Grain Density (g/cc)	2.97



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	62	5

Visual Description

Sparsely to moderately phyric basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 2-5%, decreasing in abundance downward, <3 mm, fresh; olivine phenocrysts 1%, ≤1 mm, altered to smectite; clinopyroxene phenocrysts 1%, ≤2 mm, fresh. Groundmass is fine-grained. Scattered veins are filled with carbonate and smectite. Irregular patch of carbonate occurs in piece 3.

Thin Section Description

Location: 60 cm

Texture: porphyritic - quench

Phenocrysts: olivine 5%, 0.6 mm, euhedral; plagioclase 5%, <2 mm, subhedral

Groundmass: plagioclase 35%, 0.5 mm, acicular; clinopyroxene 50%, <0.1 mm, radiating sheaves; opaques 5%, 0.02 mm granular

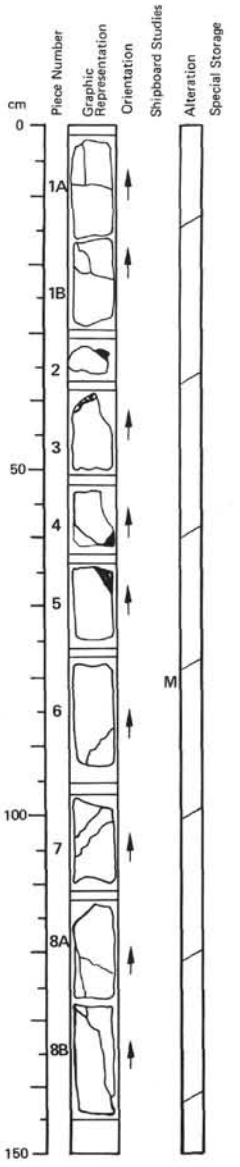
Vesicles: <1%, 0.5 mm, round

Alteration: olivine and groundmass to carbonate; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 59-63 cm

SiO_2	48.19
Al_2O_3	16.52
Fe_2O_3	11.99
MgO	5.79
CaO	14.29
Na_2O	2.39
K_2O	0.04
TiO_2	1.56
P_2O_5	0.15
MnO	.20
LOI	1.54
H_2O^+	0.80
H_2O^-	N.D.
CO_2	1.47
Cr	N.D.
Ni	N.D.
Sr	112.8
Zr	85.6
Y	28.8
Nb	1.7



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

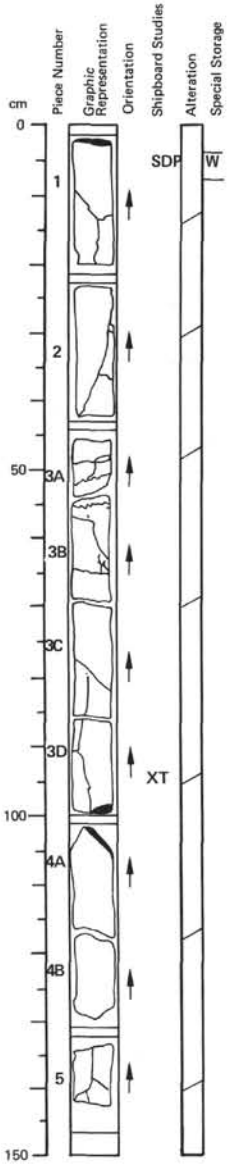
LEG	SITE	HOLE	CORE	SECT.
53	418	A	63	1

Visual Description

Sparsely phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 3%, ≤5 mm, fresh; olivine phenocrysts 1%, ≤1 mm, altered to smectite; clinopyroxene phenocrysts <1%, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite, carbonate and zeolite(?). Vesicles 5%, ≤1 mm, filled with carbonate and smectite. Scattered veins are filled with smectite, carbonate and zeolite(?).

Shipboard Data

Magnetic Data:	82-84 cm
NRM Intensity (emu/cc)	18.33×10^{-3}
NRM Inclination	-23.9°
Stable Inclination	-24.0°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	3	4	2	8	A	6	3		2

Visual Description

Sparsely to coarsely phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Phenocrysts are unevenly distributed, sparsely phyric in pieces 1 to 3 and highly phyric in pieces 4 and 5. Plagioclase phenocrysts 3-20%, <5 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 1%, <1 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are altered to smectite and zeolite(?). Veins are scattered throughout, filled with smectite and carbonate. A vug in pieces 3A and 3B is filled with quartz, smectite and dolomite(?).

Thin Section Description

Location: 90 cm

Texture: porphyritic - quench

Phenocrysts: olivine 2%, 0.5 mm, euhedral; plagioclase 10%, <4 mm, euhedral; clinopyroxene 1%, <0.5 mm anhedral

Groundmass: plagioclase 35%, <0.5 mm; clinopyroxene 40%, radiating sheaves; opaques 11%, 0.05 mm, granular

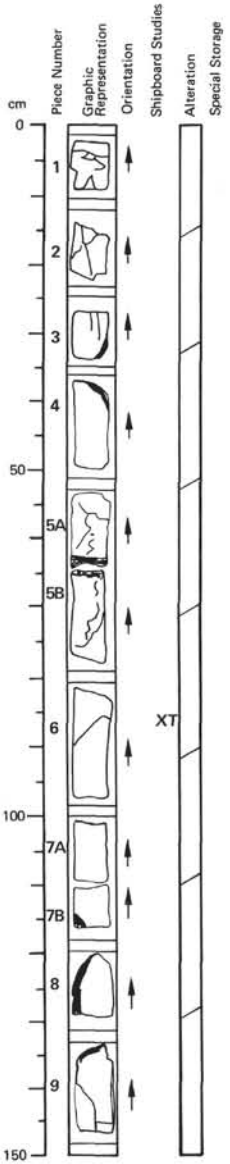
Vesicles: 1%, <0.3 mm, round

Alteration: olivine to smectite

Shipboard Data

Bulk Analysis: 90-92 cm	
SiO_2	47.12
Al_2O_3	16.67
Fe_2O_3	10.97
MgO	6.81
CaO	14.47
Na_2O	2.33
K_2O	< 0.03
TiO_2	1.28
P_2O_5	0.13
MnO	.19
LOI	1.36
H_2O^+	0.87
H_2O^-	N.D.
CO_2	0.57
Sr	108.4
Zr	77.4
Y	26.9
Nb	3.4

Physical Property Data:	8-10 cm
$\overline{V}p$ (km/sec)	5.28
Porosity (%)	8.22
Wet Bulk Density (g/cc)	2.79
Grain Density (g/cc)	2.94



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A	6	3		3

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 8-10%, <3 mm, fresh; olivine phenocrysts <1%, <1 mm, partly altered to smectite; clinopyroxene phenocrysts 1%, <2 mm, fresh; clinopyroxene megacryst occurs in piece 6. Groundmass is fine-grained to glassy; glass selvedges are mostly altered to smectite and zeolite(?). Vesicles <1%, filled with carbonate and smectite. Scattered veins are also filled with carbonate and smectite.

Thin Section Description

Location: 85 cm

Texture: porphyritic - quench

Phenocrysts: olivine 2%, <1 mm, subhedral; plagioclase 5%, <2 mm, subhedral

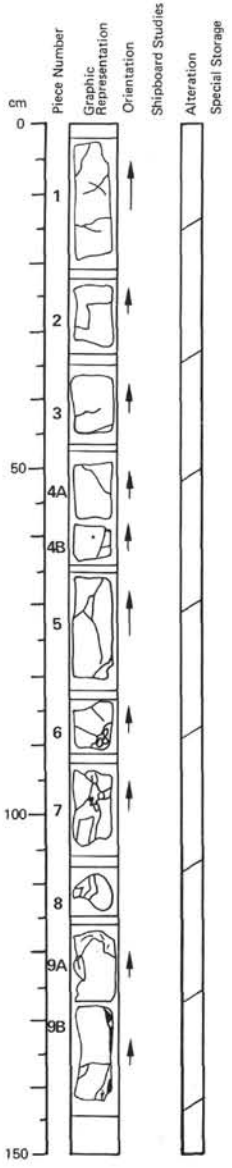
Groundmass: plagioclase 30%, 0.3 mm, subhedral; clinopyroxene 35%, radiating sheaves; opaques 10%, 0.1 mm, laths; glass 17%, interstitial

Vesicles: 1%, 0.5 mm, round

Alteration: olivine to smectite

Shipboard Data

Bulk Analysis: 85-87 cm	
SiO_2	47.98
Al_2O_3	15.24
Fe_2O_3	12.21
MgO	6.76
CaO	12.38
Na_2O	2.32
K_2O	< 0.03
TiO_2	1.60
P_2O_5	0.14
MnO	.19
LOI	0.68
H_2O^+	0.73
H_2O^-	N.D.
CO_2	0.15
Sr	106.5
Zr	88.5
Y	30.4
Nb	3.1

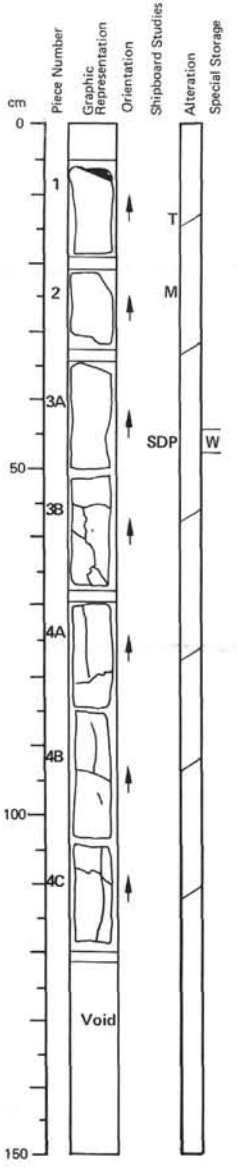


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	63	4

Visual Description

Sparsely to moderately phyric basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 5-10%, increasing downward, <3 mm, fresh; olivine phenocrysts <1%, <3 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 1%, fresh. Groundmass is fine-grained; possible glassy margin occurs in piece 9B, now altered to smectite. Vesicles 1%, filled with smectite and carbonate. Scattered veins are filled with smectite and carbonate. Basalt in lower part of the section is brecciated with fragments of crystalline basalt in a matrix of smectite and minor zeolite(?).



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	63	5

Visual Description

Moderately phyric basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 10%, <5 mm, fresh, one with spinel inclusion; olivine phenocrysts <1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 3%, <2 mm, fresh. Groundmass is fine-grained to glassy; one glass selvedge in piece 1 is completely altered to smectite. Scattered veinlets are filled with smectite and carbonate with minor zeolite(?) and pyrite.

Thin Section Description

Location: 14 cm

Texture: porphyritic - quench

Phenocrysts: olivine 1%, <0.8 mm, euhedral; plagioclase 10%, <2.5 mm, euhedral; clinopyroxene <1%, <0.5 mm, subophitic

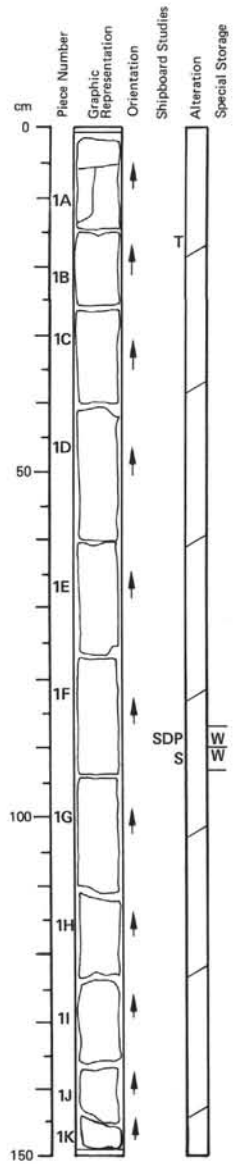
Groundmass: plagioclase 30%, 0.3 mm, acicular; clinopyroxene 45%, radiating sheaves; opaques 8%, 0.01 mm, granular; glass 4%

Vesicles: 2%, 0.25 mm, round

Alteration: olivine and minor glass to smectite; carbonate fills vesicles

Shipboard Data

Magnetic Data:	24-26 cm
NRM Intensity (emu/cc)	11.94×10^{-3}
NRM Inclination	-33.2°
Stable Inclination	-33.1°
Physical Property Data:	46-48 cm
$\overline{V}p$ (km/sec)	5.31
Porosity (%)	6.06
Wet Bulk Density (g/cc)	2.84
Grain Density (g/cc)	2.95



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	6 4	1

Visual Description

Moderately phyric basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 8-10%, <6 mm, fresh; olivine phenocrysts 1%, <2 mm, fresh. Groundmass is fine-grained to sub-ophitic, holocrystalline. Vesicles <1%, filled with carbonate. Scattered veins are filled with smectite, carbonate and minor pyrite.

Thin Section Description

Location: 14 cm

Texture: porphyritic - intersertal

Phenocrysts: olivine 3%, <1 mm, euhedral; plagioclase 15%, <4 mm, euhedral

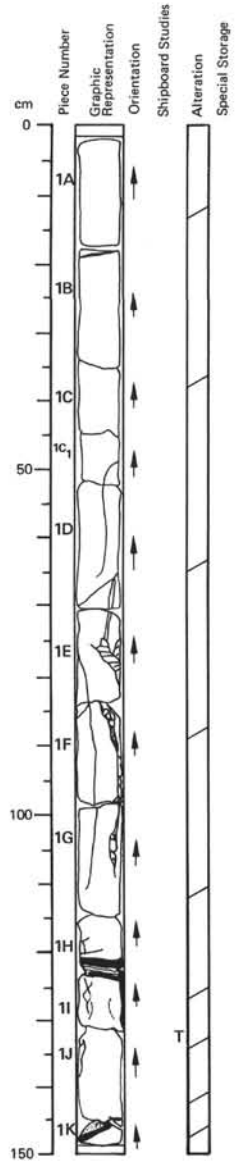
Groundmass: plagioclase 30%, 0.5 mm, subhedral; clinopyroxene 30%, 0.2 mm, subophitic; opaques 6%, 0.05 mm, euhedral; glass 14%, interstitial

Vesicles: 2%, 0.4 mm, round

Alteration: olivine to smectite; smectite and carbonate fill vesicles

Shipboard Data

Physical Property Data:	86-88 cm	89-91 cm
$\bar{V}p$ (km/sec)	5.57	5.53
Porosity (%)	5.94	
Wet Bulk Density (g/cc)	2.82	
Grain Density (g/cc)	2.93	



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	6 4	2

Visual Description

Moderately phyric basalt. Basalt is medium to dark gray; weakly altered; moderately altered in lower 25 cm. Plagioclase phenocrysts 8-10%, <6 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite except in glass selvedges. Groundmass is fine-grained to glassy; glass selvedges occur in lower 30 cm of the section and are mostly fresh. Vesicles 1%, <1 mm, filled with smectite and carbonate. Relatively thick veins occur in pieces 1E, 1F and 1G; these are filled with smectite, carbonate, silica and minor pyrite.

Thin Section Description

Location: 130 cm

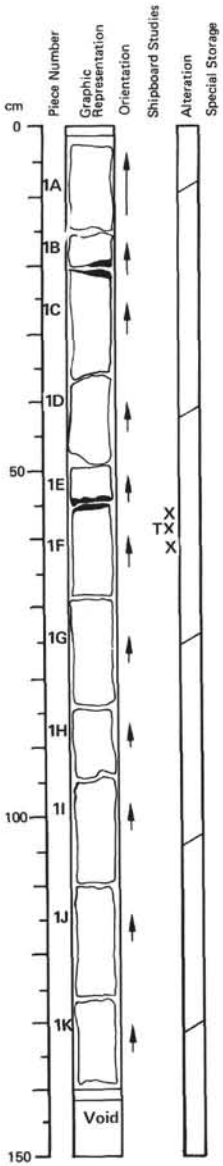
Texture: porphyritic - quench

Phenocrysts: olivine <1%, 0.6 mm, euhedral; plagioclase 10%, <1.5 mm, euhedral; clinopyroxene <1%, <1 mm, subophitic

Groundmass: plagioclase 20%, <0.5 mm, acicular; clinopyroxene 65%, radiating sheaves; opaques 5%, 0.01 mm, granular

Vesicles: none

Alteration: minor groundmass to smectite



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A		6	4	3

Visual Description

Moderately phyric basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 8%, <3 mm, fresh, sometimes in glomerophyric clusters; olivine phenocrysts 1%, up to 3% in pieces 1F through 1K, <2 mm, partly altered to smectite; clinopyroxene phenocrysts <1%, fresh. Groundmass is fine-grained to glassy; glass selvedges are fresh. Vesicles 2%, filled with smectite, carbonate and minor pyrite. Scattered veinlets are filled with smectite, carbonate and pyrite. A vug in piece 1J is filled with smectite, carbonate, quartz and opal(?) from rim to center. Minor brecciation occurs in piece 1K; basalt fragments are in a smectite-carbonate matrix.

Thin Section Description

Location: 57 cm

Texture: porphyritic - glassy

Phenocrysts: olivine 1%, ≤1 mm, euhedral; plagioclase 15%, <2 mm, euhedral; clinopyroxene <1%, 0.5 mm, rounded

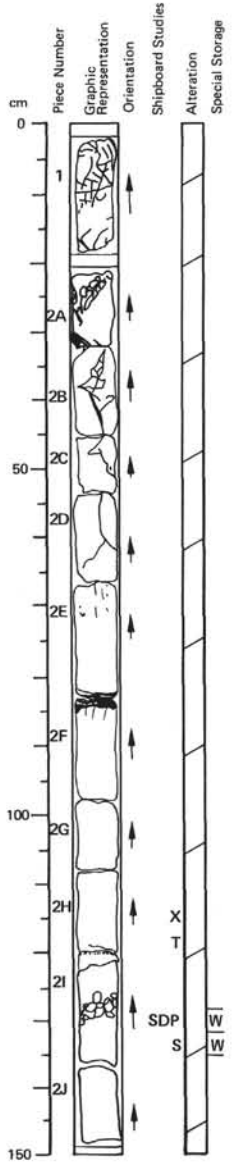
Groundmass: glass 84%, partly devitrified

Vesicles: none

Alteration: olivine to smectite and carbonate

Shipboard Data

Bulk Analysis:	55-56 cm	56-58 cm	58-62 cm
SiO_2	47.92	48.02	48.25
Al_2O_3	16.11	14.79	15.73
Fe_2O_3	10.78	12.68	10.59
MgO	6.27	8.85	6.57
CaO	13.48	12.29	13.72
Na_2O	1.95	2.43	2.31
K_2O	0.30	0.27	0.07
TiO_2	1.29	1.24	1.26
P_2O_5	0.11	0.09	0.15
MnO	.16	.15	.20
LOI	1.52	1.46	1.28
H_2O^+	2.21	1.20	0.66
H_2O^-	N.D.	N.D.	N.D.
CO_2	0.14	0.45	0.82
Sr	95.2	106.6	103.2
Zr	65.6	68.6	69.4
Y	24.1	25.5	25.0
Nb	2.7	1.6	1.9



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A		6	4	4

Visual Description

Moderately phyric basalt. Basalt is medium to dark gray; moderately altered. Plagioclase phenocrysts 8%, ≤6 mm, fresh; olivine phenocrysts <1%, ≤1 mm, altered to smectite; clinopyroxene phenocrysts ≤1%, fresh. Groundmass is very fine-grained to glassy, slightly coarser-grained in lower part of the section; glass selvedges are partly altered to smectite, carbonate and zeolite(?). Minor breccia occurs in pieces 1, 2A, 2B, and 2I.

Thin Section Description

Location: 118 cm

Texture: porphyritic - quench

Phenocrysts: olivine 1%, ≤1 mm, euhedral; plagioclase 15%, ≤3 mm, euhedral; clinopyroxene <1%, 0.5 mm, anhedral

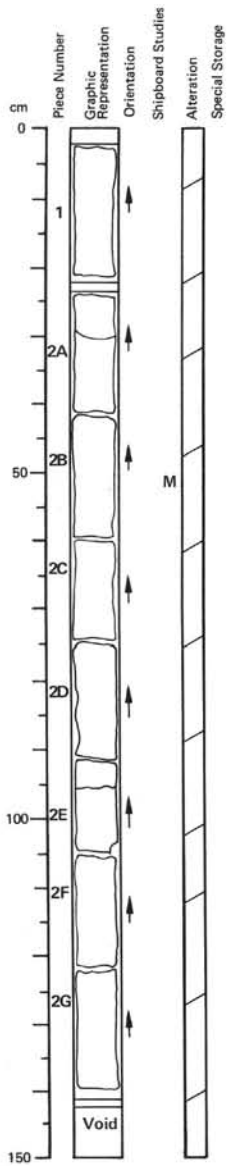
Groundmass: plagioclase 20%, <0.7 mm, acicular; clinopyroxene 60%, radiating sheaves; opaques 4%, 0.01 mm, granular

Vesicles: 1%, 0.5 mm, round

Alteration: olivine to carbonate; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 117-119 cm		Physical Property Data:	129-131 cm	131-133 cm
SiO_2	47.98	$\overline{V}p$ (km/sec)	5.19	5.14
Al_2O_3	16.26	Porosity (%)	8.05	
Fe_2O_3	9.89	Wet Bulk Density (g/cc)	2.76	
MgO	6.28	Grain Density (g/cc)	2.91	
CaO	14.03			
Na_2O	2.50			
K_2O	0.11			
TiO_2	1.30			
P_2O_5	0.14			
MnO	.15			
LOI	2.90			
H_2O^+	1.19			
H_2O^-	N.D.			
CO_2	1.29			



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

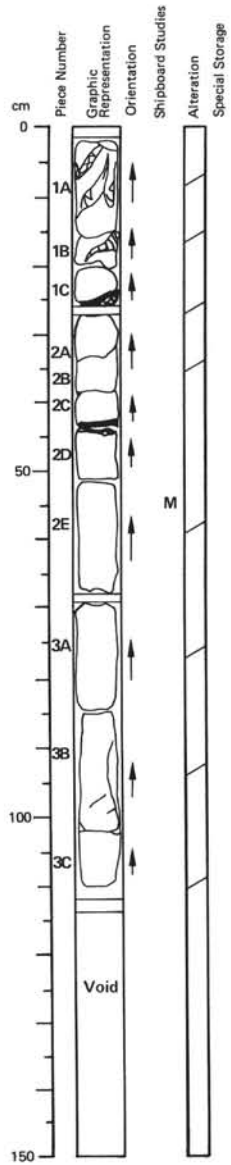
LEG		SITE			HOLE	CORE		SECT.
5	3	4	1	8	A	6	4	5

Visual Description

Sparsely to moderately phyric basalt. Basalt is medium to dark gray except for minor brown staining along oxidized veins; moderately altered. Plagioclase phenocrysts 4-8%, <4 mm, fresh; clinopyroxene phenocrysts <1%, <1 mm, fresh. Groundmass is medium-grained, subophitic, holocrystalline. Vesicles 1%, filled with smectite and carbonate. Lower half of section exhibits minor brecciation.

Shipboard Data

Magnetic Data:	53-55 cm
NRM Intensity (emu/cc)	5.81×10^{-3}
NRM Inclination	-29.4°
Stable Inclination	-33.5°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

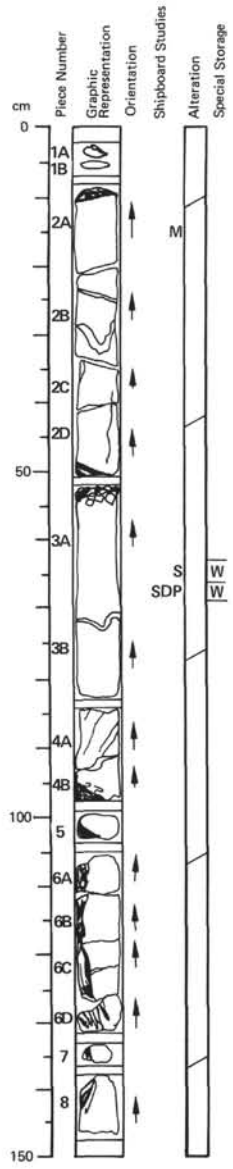
LEG		SITE			HOLE	CORE		SECT.
5	3	4	1	8	A	6	4	6

Visual Description

Moderately phyric basalt. Basalt is medium to dark gray; weakly to moderately altered. Plagioclase phenocrysts 7-10%, <5 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles <1%, <1 mm, filled with smectite. Minor breccia occurs in pieces 1A and 1B; basalt fragments are set in a matrix of smectite and carbonate.

Shipboard Data

Magnetic Data:	54-56 cm
NRM Intensity (emu/cc)	9.63×10^{-3}
NRM Inclination	-38.7°
Stable Inclination	-39.9°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

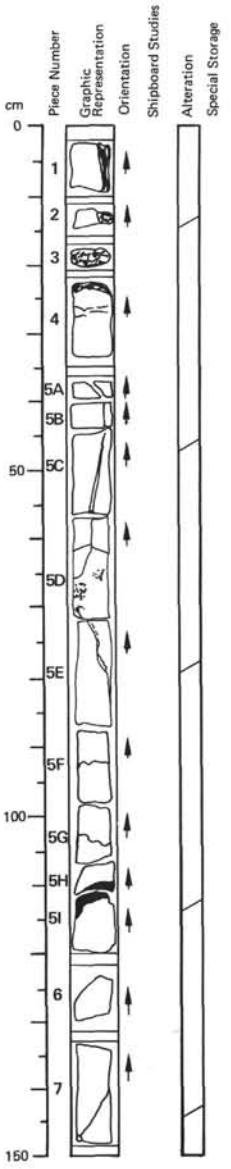
LEG		SITE			HOLE	CORE		SECT.
5	3	4	1	8	A	6	5	1

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 4-8%, <4 mm, fresh, crystals are most abundant near the rims of pillows; olivine phenocrysts 1%, < 1 mm, partly altered to smectite, fresh in glass selvedges; clinopyroxene phenocrysts < 1%, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite and zeolite(?). Vesicles < 1%, filled with carbonate and smectite. Large veins are filled with carbonate and smectite in pieces 1B, 4A and 4B.

Shipboard Data

Magnetic Data:	13-15 cm	
NRM Intensity (emu/cc)	14.70×10^{-3}	
NRM Inclination	-43.8°	
Stable Inclination	-43.4°	
Physical Property Data:	63-65 cm	66-68 cm
$\overline{V}p$ (km/sec)	5.55	5.47
Porosity (%)		5.30
Wet Bulk Density (g/cc)		2.82
Grain Density (g/cc)		2.93

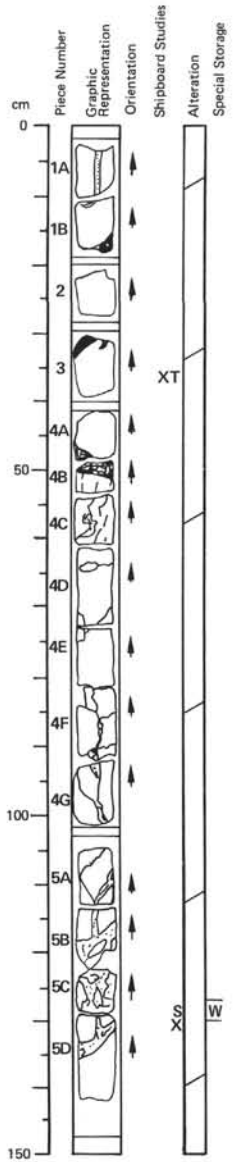


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	3	4	1	8	A	6	5	2

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 5-8%, <4 mm, fresh, most abundant in pillow rims; olivine phenocrysts < 1%, altered to smectite except in glassy selvedges; clinopyroxene phenocrysts 1%, <2 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly brecciated and partly altered to smectite and zeolite(?). Vesicles < 1%, filled with carbonate. Large veins occur in pieces 5E, 5I and 7, filled with carbonate and smectite. Irregular patches of smectite and carbonate occur in piece 5D.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A	6	5		3

Visual Description

Moderately to sparsely phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 3-7%, <3 mm, fresh, plagioclase abundance decreases from piece 3 to piece 4G; olivine phenocrysts 1%, <1 mm, partly altered to smectite and minor zeolite(?). Thick veins occur in pieces 1A, 4C, 4D, 4F and 4G, filled with smectite and carbonate. Lower 50 cm of section is brecciated with basalt clasts in a matrix of smectite and minor zeolite(?).

Thin Section Description

Location: 35 cm

Texture: porphyritic - quench

Phenocrysts: olivine 2%, <1 mm, euhedral; plagioclase 12%, <1.5 mm, euhedral; clinopyroxene <1%, <0.4 mm, anhedral

Groundmass: plagioclase 15%, <0.5 mm, skeletal; clinopyroxene 70%, radiating sheaves; opaques 3%, 0.01 mm, granular

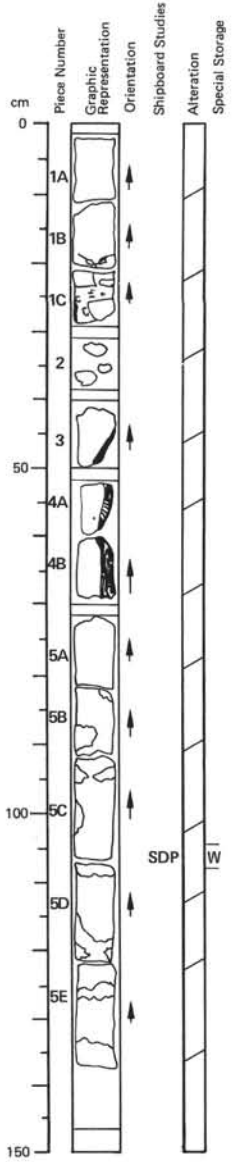
Vesicles: 1%, 0.2 mm, irregular

Alteration: olivine and interstitial material to carbonate and minor smectite

Shipboard Data

Bulk Analysis:	35-37 cm	128-130 cm
SiO_2	49.05	52.44
Al_2O_3	16.21	13.84
Fe_2O_3	10.19	13.44
MgO	5.77	10.66
CaO	14.35	5.23
Na_2O	2.36	1.39
K_2O	0.20	1.34
TiO_2	1.28	1.21
P_2O_5	0.21	0.02
MnO	.15	.02
LOI	1.63	7.80
H_2O^+	0.98	3.86
H_2O^-	N.D.	N.D.
CO_2	0.75	0.73

Physical Property Data:	128-130 cm
$\bar{V}p$ (km/sec)	2.81



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

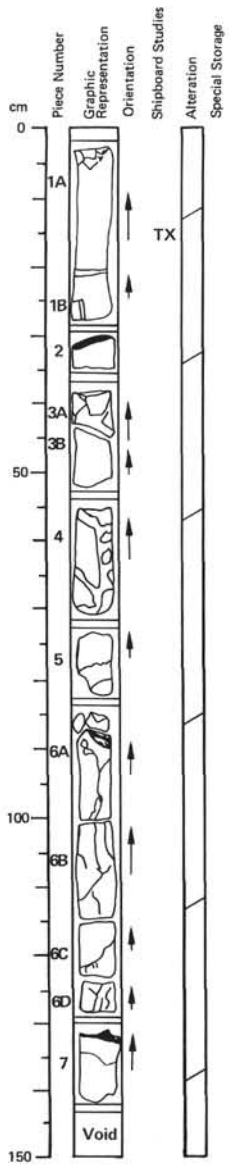
LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A	6	5		4

Visual Description

Sparsely to moderately phyric basalt and basalt breccia. Basalt is gray to greenish-gray; moderately altered. Upper half of section is fine-grained, sparsely to moderately phyric basalt. Plagioclase phenocrysts 3-8%, <5 mm, partly altered to smectite; olivine phenocrysts <1%, <1 mm, altered to smectite; clinopyroxene phenocrysts <1%, <3 mm, fresh. Groundmass is aphanitic to glassy; glass selvedges in pieces 3 and 4 are completely altered to smectite. Lower half of section is breccia composed of crystalline basalt fragments in a matrix of smectite, carbonate and minor zeolite(?).

Shipboard Data

Physical Property Data:	105-107 cm
$\bar{V}p$ (km/sec)	4.50
Porosity (%)	12.29
Wet Bulk Density (g/cc)	2.68
Grain Density (g/cc)	2.91



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	6 5	5

Visual Description

Sparsely to moderately phyric basalt and basalt breccia. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts range from 2% at the top of the section to 7% near the base. They are <3 mm, fresh. Olivine phenocrysts <1%, <1 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are mostly altered to smectite and minor zeolite(?). Vesicles 1%, filled with smectite. Veinlets are common, particularly in piece 6D, filled with smectite. One large vein in piece 6A is filled with smectite and carbonate. Minor breccia occurs in pieces 1A, 4, 5 and 6; breccia consists of angular fragments of crystalline basalt, 1 mm to 10 mm, in a matrix of smectite and carbonate. Small angular fragments of smectite in the breccia are probably altered glass.

Thin Section Description

Location: 15 cm

Texture: porphyritic - quench

Phenocrysts: plagioclase 7%, <2.5 mm, subhedral; clinopyroxene <1%, 0.5 mm

Groundmass: olivine(?) 1%, 0.2 mm; plagioclase 20%, <0.5 mm, opaques 6%, 0.02 mm, granular

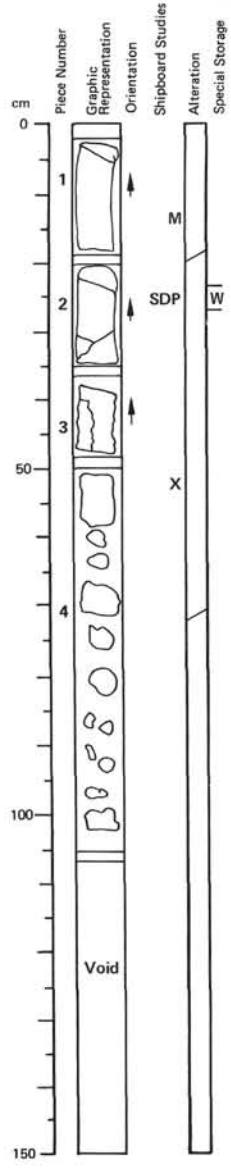
Vesicles: <1%, 0.2 mm, round

Alteration: olivine(?) to smectite

Shipboard Data

Bulk Analysis: 15-17 cm

SiO_2	49.40
Al_2O_3	16.43
Fe_2O_3	9.74
MgO	6.99
CaO	13.42
Na_2O	2.33
K_2O	0.05
TiO_2	1.31
P_2O_5	0.22
MnO	.18
LOI	1.71
H_2O^+	1.32
H_2O^-	N.D.
CO_2	0.65



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	6 5	6

Visual Description

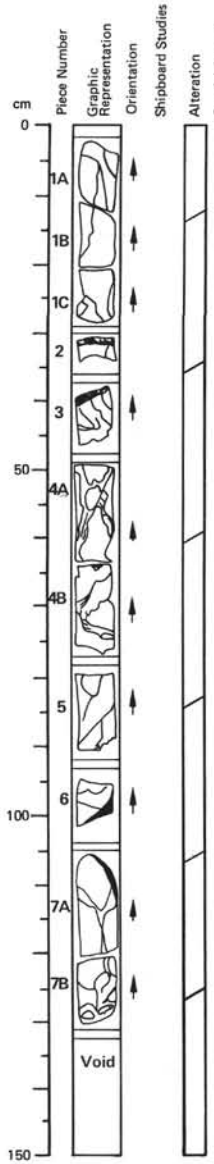
Sparsely phyric basalt. Basalt is medium to dark gray; relatively fresh. Plagioclase phenocrysts 3%, <4 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 1%, <4 mm, fresh. Groundmass is aphanitic. Scattered veins are filled with smectite and carbonate.

Shipboard Data

Bulk Analysis: 52-54 cm

SiO_2	49.10
Al_2O_3	15.26
Fe_2O_3	11.31
MgO	7.33
CaO	12.85
Na_2O	2.26
K_2O	0.08
TiO_2	1.50
P_2O_5	0.23
MnO	.21
LOI	1.80
H_2O^+	1.20
H_2O^-	N.D.
CO_2	0.63

Magnetic Data:	13-15 cm
NRM Intensity (emu/cc)	7.60×10^{-3}
NRM Inclination	-64.5°
Stable Inclination	-63.2°
Physical Property Data:	24-26 cm
$\bar{V}p$ (km/sec)	5.71
Porosity (%)	3.02
Wet Bulk Density (g/cc)	2.91
Grain Density (g/cc)	2.96

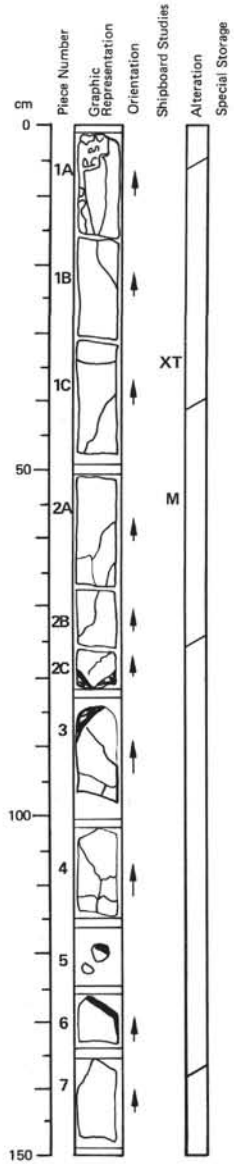


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	6 6	1

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 6-8%, <3 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 1%, <1 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite and minor zeolite(?). Veinlets are scattered throughout the section, filled with smectite and carbonate. An irregular patch of carbonate occurs in piece 4A. Minor breccia occurs in piece 7.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	6 6	2

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Phenocryst content is variable from about 5 to 20%, generally being most abundant in pillow rims. Plagioclase phenocrysts 5-15%, <5 mm, fresh; olivine phenocrysts 1%, <2 mm, altered to smectite; clinopyroxene phenocrysts 1%, <4 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are completely altered to smectite except in pieces 5 and 6. Vesicles 1%, <1 mm, filled with carbonate and minor pyrite. Scattered veins are filled with smectite, carbonate and zeolite(?).

Thin Section Description

Location: 35 cm

Texture: porphyritic - quench

Phenocrysts: olivine 2%, <0.7 mm, euhedral; plagioclase 10%, <2.5 mm, euhedral; clinopyroxene 4%, <2 mm, subophitic clots

Groundmass: plagioclase 20%, <0.2 mm, acicular; clinopyroxene 55%, <0.2 mm, radiating sheaves; opaques 8%, 0.05 mm, granular

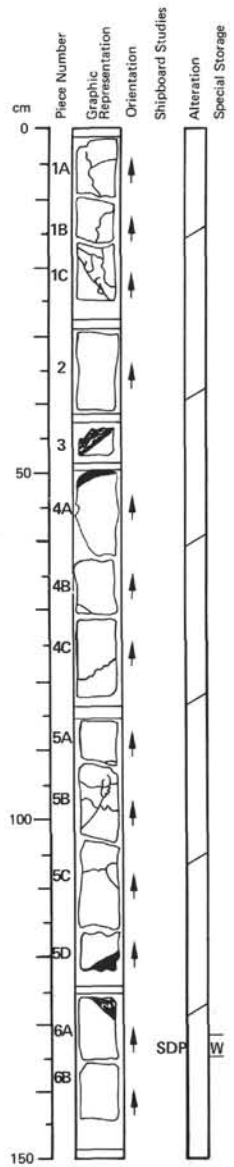
Vesicles: 1%, 0.5 mm, round

Alteration: olivine to smectite; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 34-36 cm	
SiO_2	47.84
Al_2O_3	14.90
Fe_2O_3	10.89
MgO	7.16
CaO	13.34
Na_2O	2.22
K_2O	0.17
TiO_2	1.30
P_2O_5	0.11
MnO	.19
LOI	0.87
H_2O^+	0.73
H_2O^-	N.D.
CO_2	0.30
Sr	104.9
Zr	75.5
Y	25.3
Nb	2.6

Magnetic Data:	54-56 cm
NRM Intensity (emu/cc)	11.14×10^{-3}
NRM Inclination	-74.5°
Stable Inclination	-74.6°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

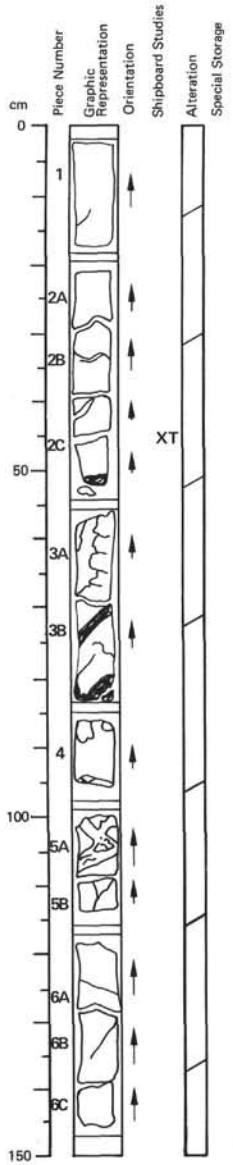
LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	6 6	3

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Phenocryst content varies from about 5 to 15%, generally being most abundant in pillow rims. Plagioclase phenocrysts 5-10%, <5 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 1-2%, <5 mm, rare megacrysts to 10 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are altered to smectite except in pieces 5D and 6A. Vesicles are rare. Scattered veins and veinlets are filled with smectite and carbonate. Minor disseminated pyrite occurs in the groundmass.

Shipboard Data

Physical Property Data:	129-131 cm
$\bar{V}p$ (km/sec)	5.28
Porosity (%)	6.36
Wet Bulk Density (g/cc)	2.80
Grain Density (g/cc)	2.92



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	6 6	4

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 7-10%, <1 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 2%, <2 mm, fresh, often in subophitic clots with plagioclase. Groundmass is fine-grained to glassy; glass selvedges are altered to smectite and minor zeolite(?). Vesicles <1%, filled with carbonate. Rare veins are filled with carbonate and smectite. Minor pyrite is disseminated in the groundmass. Minor breccia occurs in pieces 3, 4, 5A and 6C; breccia consists of basalt fragments in a matrix of smectite.

Thin Section Description

Location: 47 cm

Texture: porphyritic - quench

Phenocrysts: olivine 3%, <1.5 mm, euhedral; plagioclase 20%, <4 mm, euhedral; clinopyroxene 4%, <1.5 mm, rounded

Groundmass: plagioclase 20%, 0.3 mm, acicular; clinopyroxene 56%, radiating sheaves; opaques 6%, 0.02 mm, granular

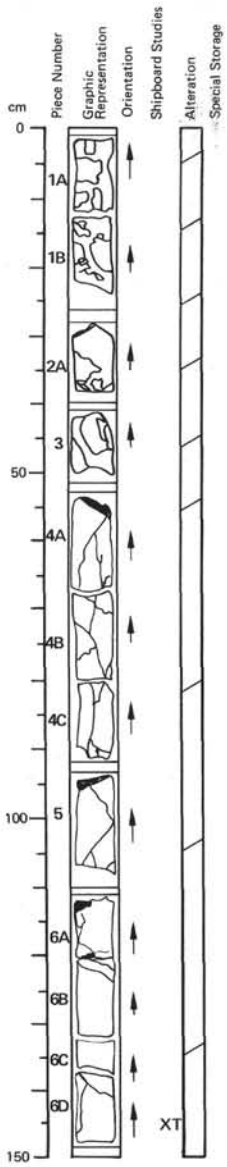
Vesicles: 1%, 0.3 mm, round

Alteration: olivine and minor interstitial material to smectite

Shipboard Data

Bulk Analysis: 46-48 cm

SiO_2	48.33
Al_2O_3	16.20
Fe_2O_3	11.58
MgO	6.18
CaO	13.22
Na_2O	2.18
K_2O	< 0.03
TiO_2	1.33
P_2O_5	0.13
MnO	.21
LOI	0.95
H_2O^+	0.60
H_2O^-	N.D.
CO_2	0.51
Cr	N.D.
Ni	N.D.
Sr	100.4
Zr	74.1
Y	24.1
Nb	4.0



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	66	5

Visual Description

Moderately phyric pillow basalt and minor basalt breccia. Basalt is mostly medium to dark gray, greenish-gray in breccia zones; weakly to moderately altered. Plagioclase phenocrysts 10-15%, <5 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite; clinopyroxene phenocrysts <1%, <3 mm, fresh. Groundmass is very fine-grained to glassy; glass selvedges are altered to smectite. Vesicles <1%, filled with carbonate. Scattered veins are filled with smectite and carbonate. Upper 50 cm of section are becciated; breccia consists of basalt fragments in a smectite matrix. Minor pyrite is disseminated in breccia matrix.

Thin Section Description

Location: 144 cm

Texture: porphyritic - quench

Phenocrysts: olivine 3%, <0.8 mm, euhedral; plagioclase 10%, <3.5 mm, euhedral

Groundmass: plagioclase 30%, 0.2 mm, acicular; clinopyroxene 46%, radiating sheaves; opaques 10%, 0.03 mm, granular

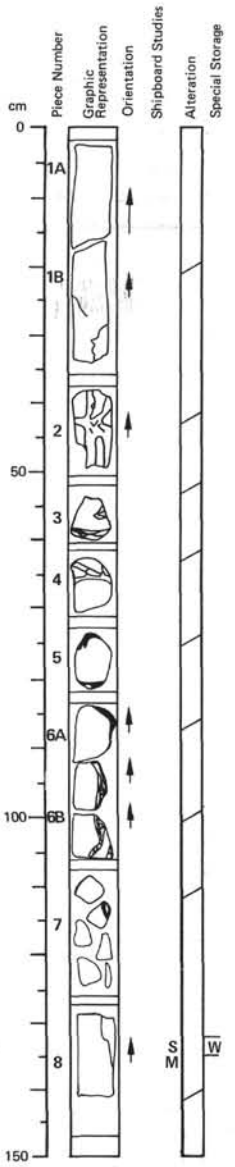
Vesicles: 1%, 0.8 mm, round

Alteration: olivine and minor groundmass to smectite; carbonate and smectite fill vesicles

Shipboard Data

Bulk Analysis: 143-145 cm

SiO_2	47.93
Al_2O_3	17.43
Fe_2O_3	10.70
MgO	6.12
CaO	13.38
Na_2O	2.22
K_2O	< 0.03
TiO_2	1.40
P_2O_5	0.13
MnO	.21
LOI	1.07
H_2O^+	0.68
H_2O^-	N.D.
CO_2	0.76
Sr	104.1
Zr	70.8
Y	23.7
Nb	2.6



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

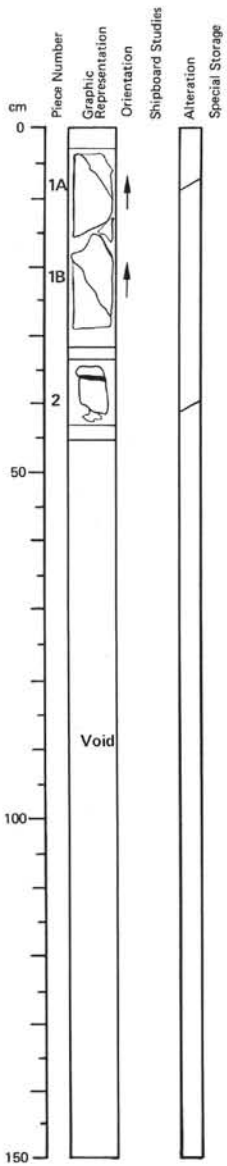
LEG	SITE	HOLE	CORE	SECT.
53	418	A	66	6

Visual Description

Moderately phyric pillow basalt and minor basalt breccia. Basalt is medium to dark gray, greenish-gray in breccia zones; weakly to moderately altered. Plagioclase phenocrysts 10%, <5 mm, fresh; clinopyroxene phenocrysts 2%, <2 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Scattered veins are filled with carbonate and smectite. Minor pyrite is disseminated in groundmass. Breccia occurs in pieces 2, 4 and 6B; breccia consists of rounded fragments of crystalline basalt in a matrix of smectite, carbonate and minor pyrite.

Shipboard Data

Magnetic Data:	135-137 cm
NRM Intensity (emu/cc)	9.76×10^{-3}
NRM Inclination	-37.2°
Stable Inclination	-50.5°
Physical Property Data:	132-134 cm
$\bar{V}p$ (km/sec)	5.58

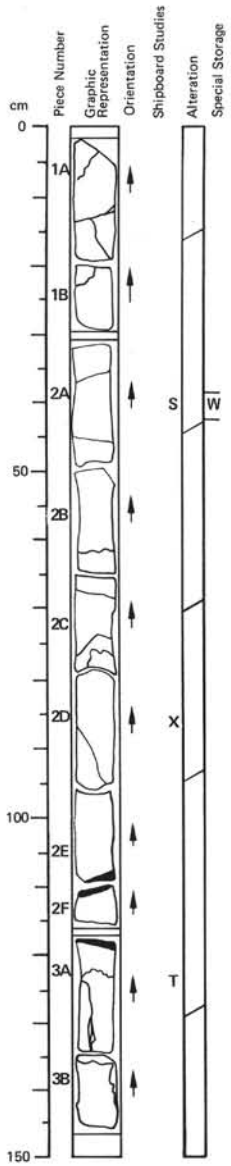


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	6 6	7

Visual Description

Moderately phyric basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 15%, <5 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite; clinopyroxene phenocrysts <1%, <3 mm, fresh. Groundmass is fine-grained without glass selvedges. Prominent veins in pieces 1 and 2 are filled with smectite and carbonate.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	6 7	1

Visual Description

Moderately phyric basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 15%, <8 mm, fresh, some have spinel inclusions; olivine phenocrysts 1%, <2 mm, altered to smectite; clinopyroxene phenocrysts 1%, <2 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are fresh. Scattered veins are filled with smectite, carbonate and minor pyrite. Minor pyrite is also disseminated in the groundmass.

Thin Section Description

Location: 123 cm

Texture: porphyritic - quench

Phenocrysts: olivine 1%, ≤0.5 mm, euhedral; plagioclase 15%, ≤2.5 mm, euhedral; clinopyroxene 3%, ≤2 mm, subhedral crystals or subophitic clots

Groundmass: olivine 3%, 0.2 mm, subhedral; plagioclase 20%, <0.5 mm, acicular; clinopyroxene 47%, radiating sheaves; opaques 10%, <0.05 mm, granular

Vesicles: 1%, 0.2 mm, round

Alteration: olivine and minor groundmass to smectite; carbonate and smectite fill vesicles

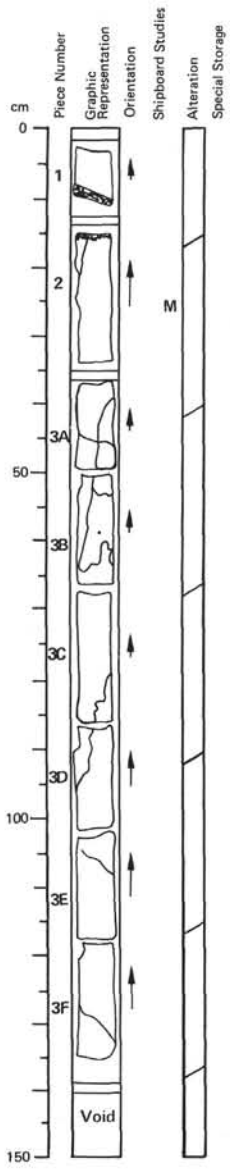
Shipboard Data

Bulk Analysis: 86-88 cm

SiO_2	51.58
Al_2O_3	17.23
Fe_2O_3	10.70
MgO	5.84
CaO	10.89
Na_2O	2.22
K_2O	< 0.03
TiO_2	1.20
P_2O_5	0.12
MnO	.18
LOI	0.85
H_2O^+	0.70
H_2O^-	N.D.
CO_2	0.30

Physical Property Data: 38-40 cm

$\bar{V}p$ (km/sec)	6.10



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

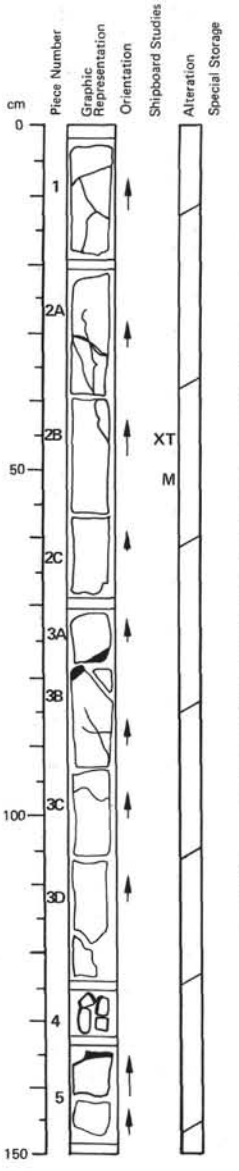
LEG	SITE	HOLE	CORE	SECT.
53	418	A	67	2

Visual Description

Moderately phyric basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 10%, ≤5 mm, fresh; olivine phenocrysts 1%, ≤1 mm, altered to smectite; clinopyroxene phenocrysts 2%, <2 mm, fresh, often in subophitic clots with plagioclase. Groundmass is fine-grained to glassy; glass selvedges on pieces 1 and 2 are partly altered to smectite. Section below 15 cm is probably a massive flow. Vesicles <1%, filled with smectite and carbonate. Scattered veins are also filled with smectite and carbonate. Minor pyrite is disseminated in the groundmass. Irregular patches of smectite and carbonate occur in pieces 3E and 3F.

Shipboard Data

Magnetic Data:	28-30 cm
NRM Intensity (emu/cc)	12.64×10^{-3}
NRM Inclination	-45.1°
Stable Inclination	-44.8°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	67	3

Visual Description

Moderately phyric basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 12%, ≤5 mm, fresh; olivine phenocrysts 1%, <2 mm, altered to smectite; clinopyroxene phenocrysts 2%, <3 mm, fresh, often in subophitic clots with plagioclase. Groundmass is fine-grained to glassy; glass selvedges at 80 and 135 cm is probably continuation of flow in Section 2; the lower part of the section is pillow basalt. Rare veins are filled with smectite and carbonate. Minor pyrite is disseminated in groundmass.

Thin Section Description

Location: 47 cm

Texture: porphyritic - intersertal

Phenocrysts: olivine 5%, <1 mm, euhedral; plagioclase 12%, <4 mm, euhedral; clinopyroxene 5%, <2 mm, subhedral to rounded

Groundmass: olivine 5%, 0.15 mm, euhedral; plagioclase 30%, 0.5 mm, subhedral; clinopyroxene 35%, 0.5 mm, granular; opaques 4%, 0.05 mm, euhedral; glass 5%, devitrified

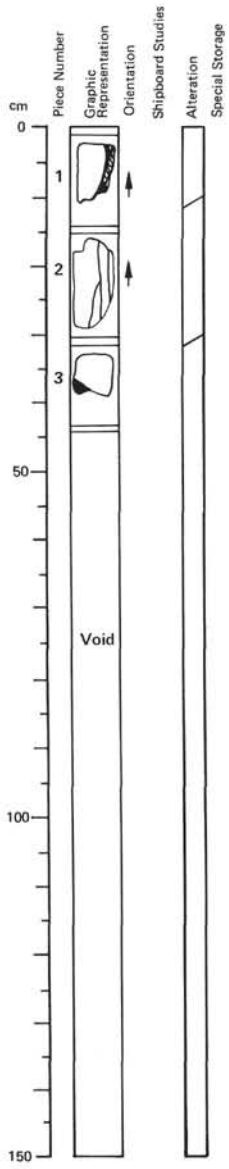
Vesicles: <1%, 0.5 mm, round

Alteration: olivine and interstitial material to smectite; smectite and carbonate in vesicles

Shipboard Data

Bulk Analysis: 46-48 cm	
SiO_2	50.95
Al_2O_3	15.72
Fe_2O_3	10.97
MgO	6.92
CaO	11.63
Na_2O	2.22
K_2O	0.04
TiO_2	1.27
P_2O_5	0.10
MnO	.18
LOI	0.68
H_2O^+	0.65
H_2O^-	N.D.
CO_2	0.20
Sr	105.8
Zr	70.6
Y	23.9
Nb	2.5

Magnetic Data:	53-55 cm
NRM Intensity (emu/cc)	6.19×10^{-3}
NRM Inclination	-73.3°
Stable Inclination	-52.4°

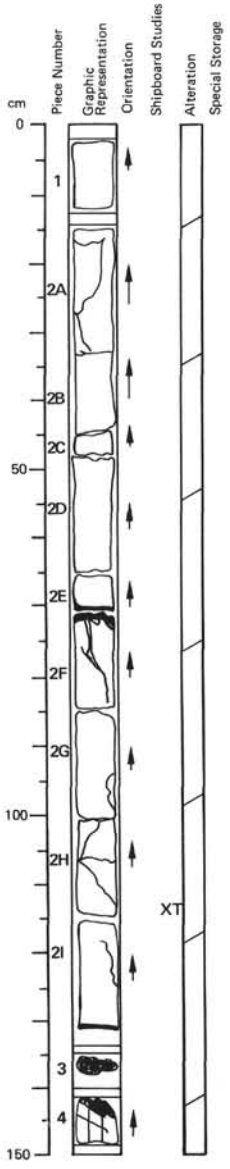


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	67	4

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 15%, <5 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 1%, <2 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite, zeolite(?) and minor pyrite and silica. Veins in piece 2 are filled with smectite and minor pyrite. Minor pyrite is also disseminated in the groundmass.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	68	1

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 8%, <5 mm, fresh; olivine phenocrysts 2%, <3 mm, altered to smectite; clinopyroxene phenocrysts 3%, <2 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are mostly fresh with minor alteration to smectite. Vesicles <1%, <1 mm, filled with smectite, zeolite(?) and carbonate. Scattered veins are filled with carbonate, smectite and minor pyrite. A pyrite-filled vein occurs in glass selvedge in piece 2F.

Thin Section Description

Location: 115 cm

Texture: porphyritic - quench

Phenocrysts: olivine 5%, <1.5 mm, euhedral; plagioclase 15%, <3 mm, euhedral; clinopyroxene 5%, <1.5 mm, anhedral to rounded

Groundmass: plagioclase 10%, <0.6 mm, acicular; clinopyroxene 57%, radiating sheaves; opaques 7%, 0.05 mm, granular to euhedral

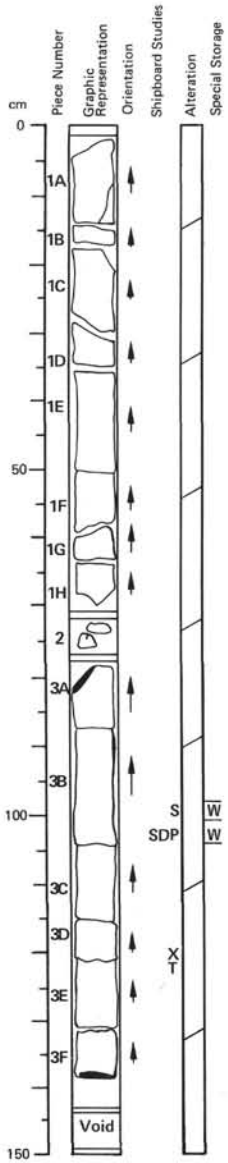
Vesicles: 1%, <0.4 mm, round

Alteration: olivine and minor interstitial material to smectite; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 113-116 cm

SiO_2	47.91
Al_2O_3	14.85
Fe_2O_3	11.01
MgO	8.19
CaO	13.92
Na_2O	2.23
K_2O	0.06
TiO_2	1.25
P_2O_5	0.14
MnO	.22
LOI	1.27
H_2O^+	0.41
H_2O^-	N.D.
CO_2	1.14



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	6 8	2

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Upper half of Section is more phyric and has less clinopyroxene phenocrysts than lower half. Plagioclase phenocrysts 12-15%, <4 mm, fresh; olivine phenocrysts 4%, <1 mm, completely altered to smectite; clinopyroxene phenocrysts 3%, <2 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are fresh. Vesicles <1%, <1 mm, filled with smectite, carbonate and minor pyrite. Scattered veins are also filled with smectite, carbonate and pyrite. Minor carbonate and pyrite also occurs in the groundmass.

Thin Section Description

Location: 125 cm

Texture: porphyritic - quench

Phenocrysts: olivine 5%, <1.5 mm, euhedral; plagioclase 15%, <5 mm, euhedral; clinopyroxene 5%, <2.5 mm, rounded

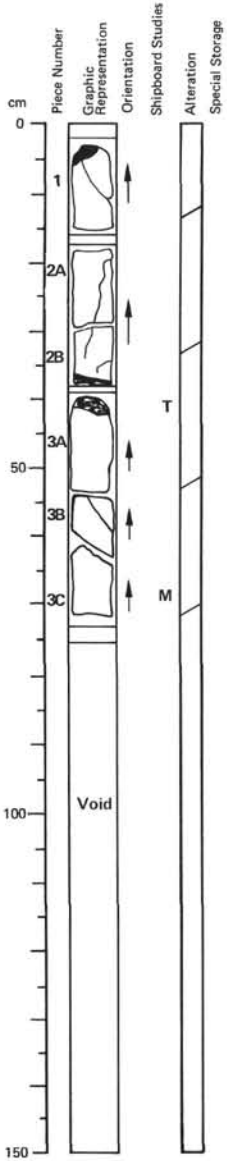
Groundmass: plagioclase 10%, 0.3 mm, skeletal; clinopyroxene 57%, radiating sheaves; opaques 6%, 0.05 mm, granular

Vesicles: 2%, 0.5 mm, round

Alteration: olivine to smectite and carbonate; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 121-123 cm		Physical Property Data:	98-100 cm	101-103 cm
SiO_2	48.08	$\bar{V}p$ (km/sec)	6.11	6.13
Al_2O_3	14.84	Porosity (%)		2.27
Fe_2O_3	10.74	Wet Bulk Density (g/cc)		2.93
MgO	6.53	Grain Density (g/cc)		2.97
CaO	14.20			
Na_2O	2.29			
K_2O	< 0.03			
TiO_2	1.26			
P_2O_5	0.13			
MnO	.21			
LOI	1.44			
H_2O^+	0.41			
H_2O^-	N.D.			
CO_2	1.18			
Sr	109.1			
Zr	71.3			
Y	23.5			
Nb	1.7			



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	6 8	3

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 10%, <6 mm, fresh; olivine phenocrysts 2%, <3 mm, altered to smectite; clinopyroxene phenocrysts 2%, <5 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly brecciated and altered to smectite, carbonate and minor zeolite(?). Vesicles 1%, <1 mm, filled with smectite, carbonate and minor pyrite.

Thin Section Description

Location: 41 cm

Texture: porphyritic - glassy

Phenocrysts: olivine 1%, <1 mm, euhedral; plagioclase 10%, <5 mm, euhedral; clinopyroxene 2%, <1.5 mm, rounded

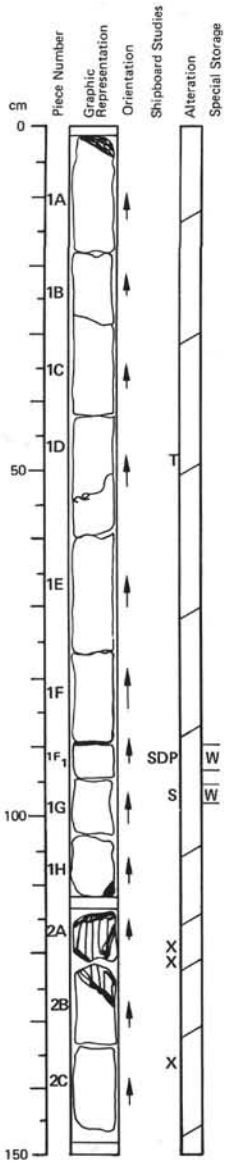
Groundmass: glass 87%, mostly fresh

Vesicles: none

Alteration: olivine to smectite

Shipboard Data

Magnetic Data:	68-70 cm
NRM Intensity (emu/cc)	14.60×10^{-3}
NRM Inclination	-67.5°
Stable Inclination	-66.9°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	6 9	1

Visual Description

Moderately to highly phyric basalt. Basalt is medium to dark gray; weakly altered. Phenocrysts abundance is variable being greatest near glassy margins. Plagioclase phenocrysts 10-15%, 7 mm, fresh; olivine phenocrysts 1%, ≤1 mm, altered to smectite; clinopyroxene phenocrysts 5%, ≤4 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are somewhat brecciated and partly altered to smectite, carbonate and zeolite(?). Vesicles 1%, filled with carbonate, smectite and minor pyrite. Scattered veinlets are filled with carbonate, smectite and pyrite. Pyrite also occurs as small clusters in the groundmass. Inclusions of altered sediment occur along some glass selvedges.

Thin Section Description

Location: 48 cm

Texture: porphyritic - quench

Phenocrysts: olivine 2%, ≤1 mm, euhedral; plagioclase 15%, ≤4 mm, euhedral; clinopyroxene 4%, ≤5 mm, subophitic clots

Groundmass: olivine 1%, 0.2 mm, subhedral; plagioclase 25%, ≤0.4 mm, acicular; opaques 8%, 0.03 mm, granular; clinopyroxene 44%, radiating sheaves

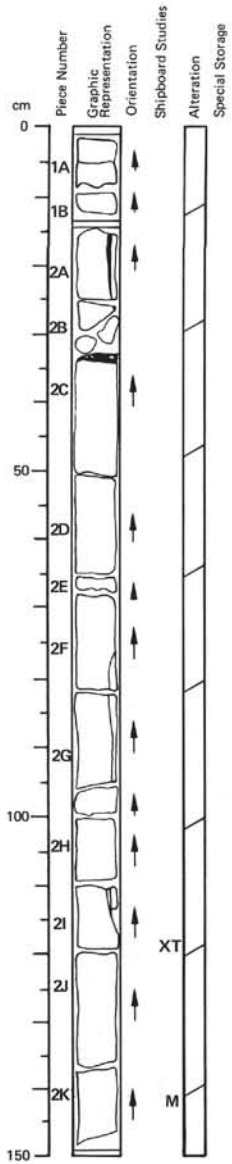
Vesicles: 1%, ≤0.5 mm, round

Alteration: olivine to smectite; carbonate and smectite fill vesicles

Shipboard Data

Bulk Analysis:	118-122 cm smectite	118-122 cm vein	133-139 cm
SiO_2	50.13	49.92	47.05
Al_2O_3	14.94	14.32	15.59
Fe_2O_3	11.95	11.85	10.31
MgO	11.09	12.09	7.72
CaO	6.80	5.93	14.28
Na_2O	1.55	.96	2.22
K_2O	0.13	0.16	0.07
TiO_2	1.67	1.64	1.21
P_2O_5	0.04	0.47	0.14
MnO	.02	.02	.20
LOI	9.18	5.00	1.39
H_2O^+	4.78	5.33	0.37
H_2O^-	N.D.	N.D.	N.D.
CO_2	4.38	1.72	1.33
Sr	85.3	N.D.	N.D.
Zr	72.2	N.D.	N.D.
Y	5.4		
Nb	0.6		

Physical Property Data:	92-94 cm	95-97 cm
$\overline{V}p$ (km/sec)	5.85	6.03
Porosity (%)	2.54	
Wet Bulk Density (g/cc)	2.93	
Grain Density (g/cc)	2.98	



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	6 9	2

Visual Description

Moderately phyric basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 8-10%, ≤3 mm, fresh; olivine phneocrysts 3%, ≤2 mm, altered to smectite and carbonate; clinopyroxene phenocrysts 2%, ≤3 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are only slightly altered to smectite. Vesicles <1%, ≤1 mm, filled with carbonate.

Thin Section Description

Location: 118 cm

Texture: porphyritic - quench

Phenocrysts: olivine 4%, ≤1.5 mm, euhedral; plagioclase 10%, ≤3 mm, euhedral; clinopyroxene 3%, ≤2.5 mm, rounded

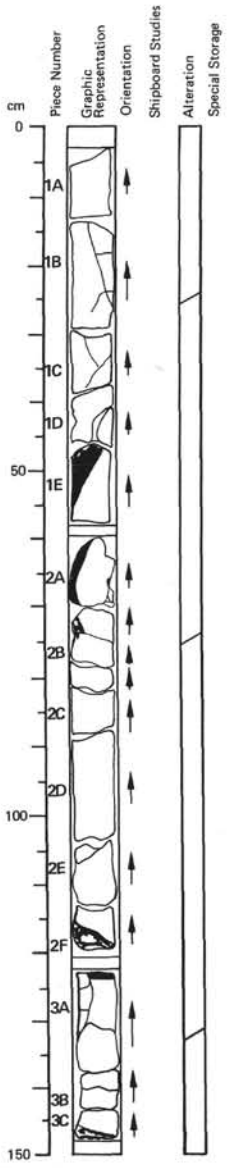
Groundmass: plagioclase 10%, 0.5 mm, acicular; clinopyroxene 67%, radiating sheaves; opaques 6%, 0.05 mm, granular

Vesicles: <1%, 0.3 mm, round

Alteration: olivine and minor interstitial material to smectite; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 117-119 cm		Magnetic Data:	142-144 cm
SiO_2	48.78	NRM Intensity (emu/cc)	6.23×10^{-3}
Al_2O_3	15.68	NRM Inclination	-65.5°
Fe_2O_3	11.02	Stable Inclination	-62.9°
MgO	7.10		
CaO	12.84		
Na_2O	2.15		
K_2O	0.05		
TiO_2	1.48		
P_2O_5	0.12		
MnO	.18		
LOI	1.16		
H_2O^+	0.69		
H_2O^-	N.D.		
CO_2	0.36		

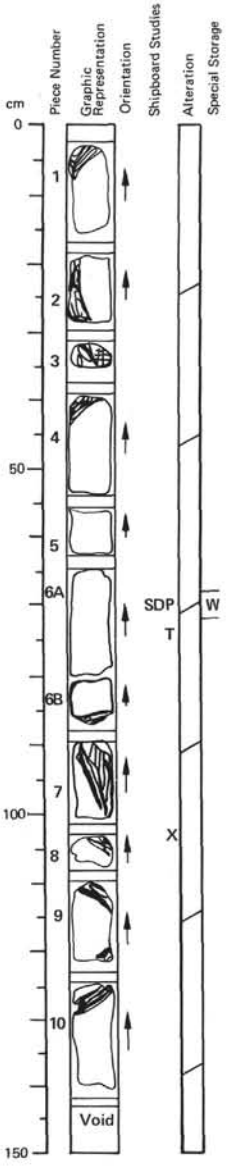


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	6 9	3

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; relatively fresh. Plagioclase phenocrysts 10%, ≤6 mm, fresh; olivine phenocrysts 2%, <3 mm, completely altered to smectite and carbonate; clinopyroxene phenocrysts 2%, ≤4 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles <1%, <1 mm, filled with carbonate, smectite and pyrite. Veinlets are present throughout, filled with smectite, carbonate and pyrite.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	6 9	4

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 10%, <5 mm, fresh; olivine phenocrysts 2%, ≤3 mm, altered to smectite; clinopyroxene phenocrysts 1-2%, ≤4 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite, carbonate and zeolite(?). Vesicles 1%, ≤1 mm, filled with smectite and carbonate. Scattered veins are filled with smectite, carbonate and minor zeolite(?). Minor glass breccia occurs between selvedges; glass fragments are altered to smectite.

Thin Section Description

Location: 70 cm

Texture: porphyritic - quench

Phenocrysts: olivine 1%, ≤1 mm, euhedral; plagioclase 10%, ≤4 mm, euhedral; clinopyroxene 4%, <0.7 mm; anhedral

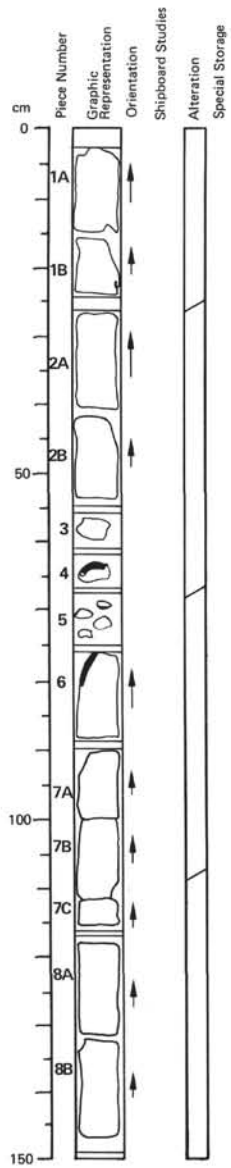
Groundmass: plagioclase 20%, 0.5 mm, acicular; clinopyroxene 56%, radiating sheaves; opaques 8%, 0.02 mm, granular and lath-shaped

Vesicles: 1%, 0.2 mm, round

Alteration: olivine and interstitial glass to smectite; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 100-105 cm		Physical Property Data:	67-69 cm
SiO_2	55.13	$\overline{V}p$ (km/sec)	5.85
Al_2O_3	2.45	Porosity (%)	4.35
Fe_2O_3	1.77	Wet Bulk Density (g/cc)	2.88
MgO	1.88	Grain Density (g/cc)	2.96
CaO	38.46		
Na_2O	.11		
K_2O	0.30		
TiO_2	0.02		
P_2O_5	0.13		
MnO	.42		
LOI	24.33		
H_2O^+	0.60		
H_2O^-	N.D.		
CO_2	23.5		
Sr	61.7		
Zr	2.8		
Y	18.7		
Nb	1.8		

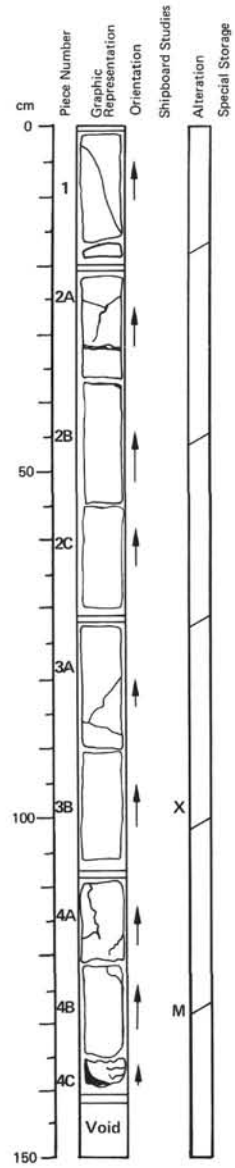


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	6 9	5

Visual Description

Moderately phyric basalt. Basalt is medium to dark gray, very weakly altered. Plagioclase phenocrysts 5-7%, <4 mm, fresh; olivine phenocrysts 1-2%, <1 mm, altered to smectite, carbonate and minor pyrite; clinopyroxene phenocrysts 3%, <2 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles 1%, <0.5 mm, filled with carbonate. Scattered veinlets are filled with smectite, carbonate and minor pyrite.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	6 9	6

Visual Description

Moderately phyric basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 12%, <5 mm, fresh; olivine phenocrysts 2%, <2 mm, altered to smectite; clinopyroxene phenocrysts 1%, <3 mm, fresh. Groundmass is very fine-grained to glassy; glass selvedges are completely altered to smectite. Vesicles are rare. Veins are filled with smectite, carbonate and pyrite.

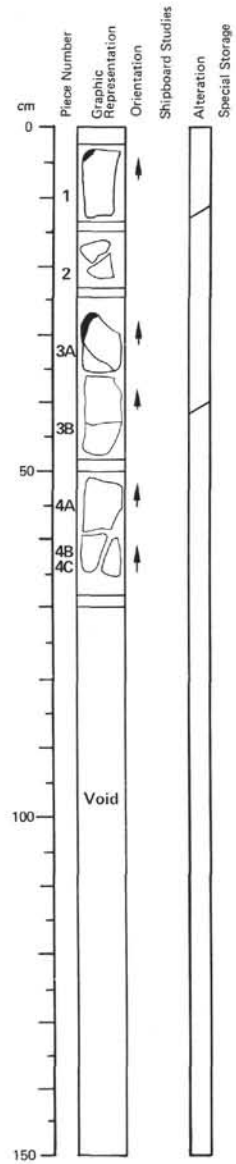
Shipboard Data

Bulk Analysis: 97-99 cm

SiO_2	48.43
Al_2O_3	15.20
Fe_2O_3	11.09
MgO	7.72
CaO	13.75
Na_2O	2.09
K_2O	0.06
TiO_2	1.27
P_2O_5	0.13
MnO	.19
LOI	1.28
H_2O^+	0.52
H_2O^-	N.D.
CO_2	0.88

Magnetic Data: 128-130 cm

NRM Intensity (emu/cc)	9.28×10^{-3}
NRM Inclination	-50.8°
Stable Inclination	-51.3°

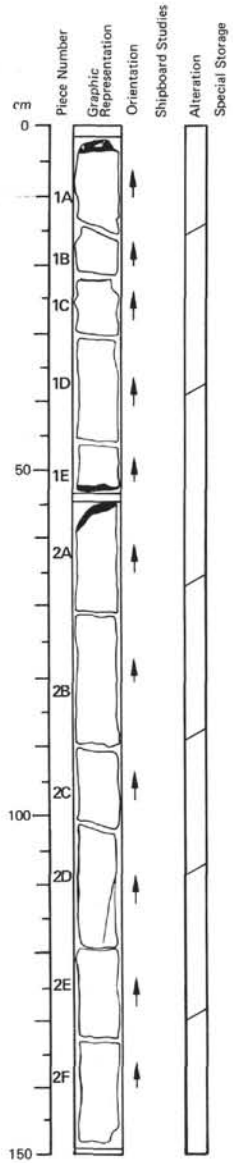


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	69	7

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 10%, <3 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 1%, <2 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Sparse veins are filled with smectite.

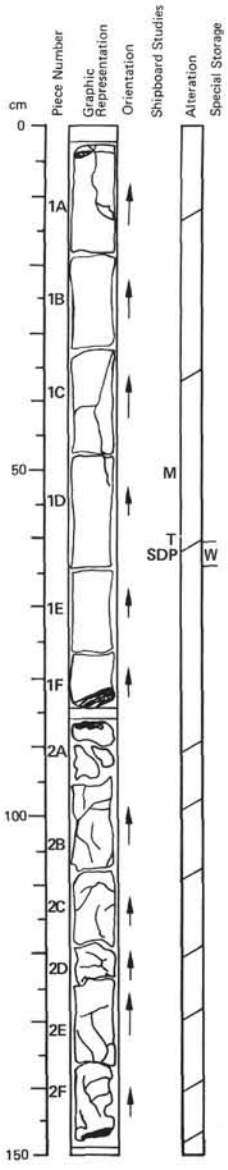


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	70	1

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 8-10%, <2 mm, fresh; olivine phenocrysts 2-4%, <1 mm, altered to smectite, carbonate and minor pyrite; clinopyroxene phencorysts 2-4%, <2 mm, fresh. Groundmass is very fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles 1%, <0.1 mm, filled with carbonate. Scattered veinlets are filled with smectite, carbonate, pyrite and zeolite(?).



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 0	2

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; upper 8 cm weakly altered, lower 65 cm moderately altered. Plagioclase phenocrysts 7%, < 7 mm, fresh; olivine phenocrysts 3-4%, < 3 mm, altered to smectite; clinopyroxene phenocrysts 2%, < 4 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles < 1%, < 1 mm, filled with carbonate and smectite. Veinlets are common in lower 65 cm, sparse in upper part of section, filled wtih smectite, carbonate and pyrite. Pyrite is also disseminated in the groundmass.

Thin Section Description

Location: 60 cm

Texture: porphyritic - quench

Phenocrysts: olivine 3%, < 1 mm, euhedral; plagioclase 15%, < 4 mm, euhedral; clinopyroxene 4%, < 2.5 mm, subophitic clots

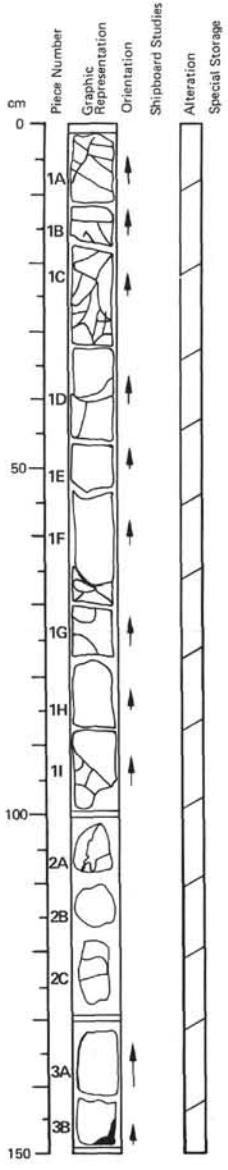
Groundmass: olivine 2%, 0.2 mm, subhedral; plagioclase 25%, 0.4 mm, acicular; clinopyroxene 43%, radiating sheaves; opaques 8%, 0.02 mm, granular

Vesicles: none

Alteration: olivine to smectite

Shipboard Data

Magnetic Data:	52-54 cm
NRM Intensity (emu/cc)	4.57×10^{-3}
NRM Inclination	-62.3°
Stable Inclination	-61.4°
Physical Property Data:	63-65 cm
$\bar{V}p$ (km/sec)	5.96
Porosity (%)	2.78
Wet Bulk Density (g/cc)	2.92
Grain Density (g/cc)	2.98

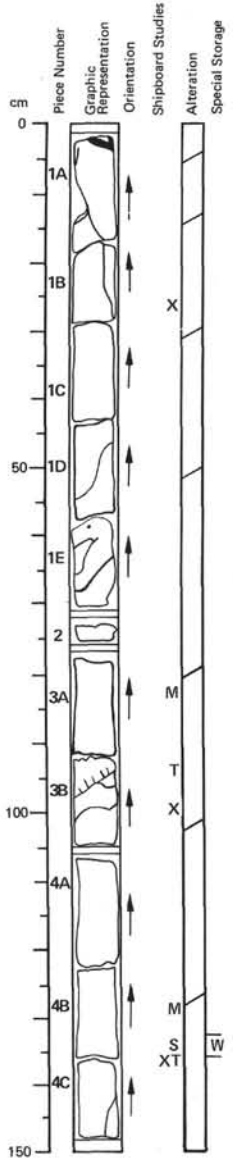


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 0	3

Visual Description

Moderately phyric basalt. Basalt is medium to dark gray, locally greenish-gray; moderately altered. Plagioclase phenocrysts 8-12%, < 4 mm, fresh; olivine phenocrysts < 1%, < 1 mm, altered to smectite; clinopyroxene phenocrysts 2%, < 4 mm, fresh or slightly altered to smectite. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles < 1%, filled with smectite. Veins and fractures are common in upper 30 cm, less common in lower part of section; veins are filled with smectite, carbonate and zeolite(?) with minor iron hydroxides locally present.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	70	4

Visual Description

Sparsely phyric basalt and aphyric basalt dike. Sparsely phyric basalt extends from top of section to 94 cm. Basalt is medium to dark gray; weakly altered. Phenocryst content varies from 15% near upper glassy selvedge at top of section to 2% in pieces 2 and 3A. Plagioclase phenocrysts 1-12%, ≤5 mm, fresh; olivine phenocrysts 1%, ≤1 mm, altered to smectite; clinopyroxene phenocrysts 2%, ≤2 mm, fresh. Groundmass is medium-grained to glassy with grain size increasing downward from glass selvedge at top of section; glass selvedge partly altered to smectite. Vesicles vary from 1 to 7%, increasing downward to contact with dike at 94 cm, filled with carbonate, smectite, silica and minor pyrite. Scattered veinlets are filled with smectite and pyrite. Basalt dike extends from 94 cm to base of section. Dike is medium to dark gray, weakly altered, nearly aphyric basalt. Piece 4B is sparsely phyric with plagioclase phenocrysts 2-3%, olivine phenocrysts (altered to smectite) 1%, and clinopyroxene phenocrysts 1%. Groundmass increases in grain size from aphanitic at the upper contact to medium-grained in piece 4B, then decreases to bottom of section. Vesicles 3-5%, filled with carbonate, smectite, silica and pyrite. Thin veinlets are filled with smectite and pyrite.

Thin Section Descripton

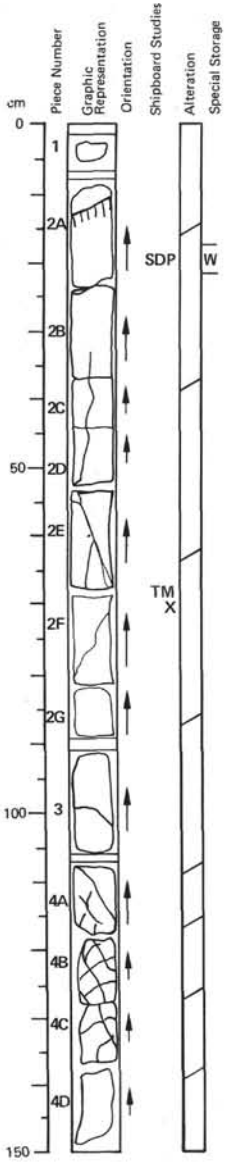
Location: 93 cm
Texture: porphyritic - intersertal
Phenocrysts: olivine(?) 2%, 0.5 mm, subhedral; plagioclase 10%, ≤4 mm, euhedral; clinopyroxene 2%, ≤1 mm, subophitic
Groundmass: plagioclase 40%, 0.7 mm, subhedral; clinopyroxene 17%, 0.4 mm, subophitic; opaques 4%, 0.03 mm, euhedral; glass 15%
Vesicles: 10%, ≤1.5 mm, round
Alteration: olivine(?) to carbonate and smectite; carobnate fills vesicles

Location: 135 cm
Texture: porphyritic - intersertal
Phenocrysts: olivine 1%, 0.7 mm, subhedral; plagioclase 6%, ≤2.5 mm, euhedral; clinopyroxene 1%, 0.4 mm, anhedral
Groundmass: plagioclase 30%, 0.25 mm, subhedral; clinopyroxene 40%, 0.1 mm, granular; opaques 8%, 0.05 mm, euhedral; glass 11%
Vesicles: 3%, ≤3 mm, round
Alteration: olivine to smectite and carbonate; carbonate fills vesicles; minor smectite after glass

Shipboard Data

Bulk Analysis:	26-29 cm	96-99 cm	134-138 cm
SiO_2	48.84	50.51	47.35
Al_2O_3	14.78	15.21	14.87
Fe_2O_3	10.39	11.81	10.94
MgO	7.51	7.26	7.60
CaO	14.13	11.27	13.66
Na_2O	2.27	2.26	2.16
K_2O	0.11	0.09	0.06
TiO_2	1.42	1.23	1.30
P_2O_5	0.14	0.12	0.12
MnO	.19	.16	.18
LOI	1.88	1.72	1.53
H_2O^+	0.45	1.32	0.59
H_2O^-	N.D.	N.D.	N.D.
CO_2	1.73	0.48	1.93
Sr	N.D.	100.3	102.8
Zr	N.D.	82.6	78.6
Y		27.3	27.0
Nb		4.2	6.0

Magnetic Data:	85-87 cm
NRM Intensity (emu/cc)	3.5×10^{-3}
NRM Inclination	-71.7°
Stable Inclination	-70.4°
Physical Property Data:	134-136 cm
$\bar{V}p$ (km/sec)	5.72



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	70	5

Visual Description

Aphyric basalt dike and sparsely phyric basalt. Dike is a continuation of dike in lower part of Section 4 and it extends from the top of the section to 14 cm. It consists of medium gray, relatively fresh, aphyric basalt. Groundmass is fine-grained, generally decreasing in grain-size toward the contact. Vesicles 2-3%, filled with smectite, carbonate, silica and minor pyrite. Sparse veinlets are filled with smectite and pyrite. Sparsely phyric basalt extends from 14 cm to base of the section. It is medium to dark gray; weakly altered, except in interval from 107 to 135 cm where it is moderately altered. Phenocryst content decreases downward from about 10% at contact with dike to 0% at base of the section. Plagioclase phenocrysts 0-8%, ≤4 mm, fresh; olivine phenocrysts 0-2%, ≤1 mm, altered to smectite; clinopyroxene phenocrysts 0-3%, ≤3 mm, fresh. Groundmass is fine-grained to glassy; glass selvedge in piece 4A is partly altered to smectite. Vesicles 1-4%, decreasing in abundance downward, filled with smectite and carbonate. Veins are most common in the lower 45 cm of the section, filled with smectite and carbonate.

Thin Section Description

Location: 68 cm

Texture: porphyritic - intersertal

Phenocrysts: olivine 3%, ≤1 mm, euhedral; plagioclase 8%, ≤4 mm, euhedral; clinopyroxene 3%, ≤0.8 mm, anhedral to rounded

Groundmass: plagioclase 40%, ≤0.3 mm, acicular; clinopyroxene 33%, 0.05 mm, granular; opaques 7%, 0.03 mm, euhedral; glass 5%

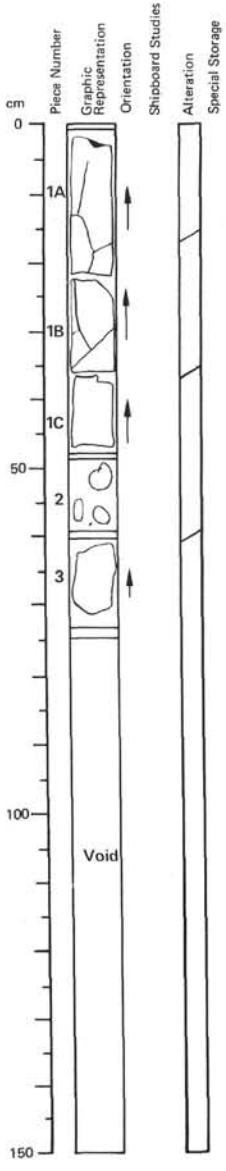
Vesicles: 1%, 0.1 mm, round

Alteration: olivine and glass to smectite; carbonate fills vesicles

Shipboard Data

Bulk Analysis:	68-71 cm
SiO_2	47.57
Al_2O_3	15.07
Fe_2O_3	10.50
MgO	6.69
CaO	15.06
Na_2O	2.25
K_2O	0.08
TiO_2	1.24
P_2O_5	0.13
MnO	.20
LOI	2.81
H_2O^+	0.35
H_2O^-	N.D.
CO_2	2.14
Sr	117.7
Zr	75.3
Y	26.3
Nb	3.7

Magnetic Data:	69-71 cm
NRM Intensity (emu/cc)	1.68×10^{-3}
NRM Inclination	-83.6°
Stable Inclination	-73.0°
Physical Property Data:	18-20 cm
$\bar{V}p$ (km/sec)	5.89
Porosity (%)	2.64
Wet Bulk Density (g/cc)	2.93
Grain Density (g/cc)	2.64

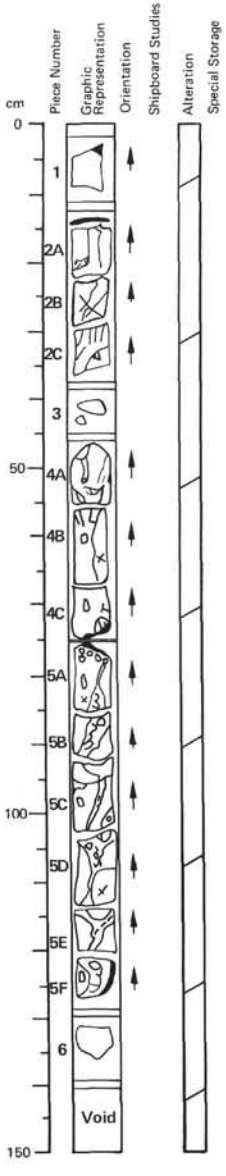


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	70	6

Visual Description

Moderately phyric basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 15%, ≤ 4 mm, mostly fresh with minor alteration to smectite; olivine phenocrysts 1%, ≤ 1 mm, altered to smectite; clinopyroxene phenocrysts 3-5%, ≤ 3 mm, fresh. Groundmass is fine-grained. Vesicles 1%, filled with carbonate and smectite. Scattered veins are filled with carbonate, smectite, zeolite(?) and minor iron hydroxides.

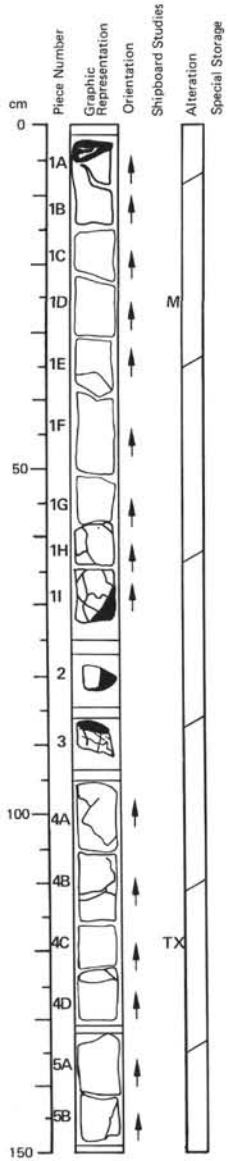


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	71	1

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 10%, ≤ 3 mm, fresh; olivine phenocrysts 2%, ≤ 1 mm, usually altered to smectite but some are fresh; clinopyroxene phenocrysts 2%, ≤ 2 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles < 1%, ≤ 1 mm filled with carbonate and smectite. Basalt is moderately brecciated throughout; fractures and veins are filled with carbonate and smectite. Pyrite is disseminated in the groundmass. A small piece of altered sediment is present in piece 1.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 1	2

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 10-15%, mostly ≤4 mm but with a few megacrysts to 8 mm, fresh; olivine phenocrysts 1%, ≤2 mm, altered to smectite; clinopyroxene phenocrysts 1-2%, ≤2 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are fresh or partly altered to smectite. Vesicles 1%, ≤0.5 mm, filled with carbonate and smectite. Rare veinlets are filled with smectite, carbonate and minor pyrite.

Thin Section Description

Location: 117 *cm*

Texture: porphyritic - quench

Phenocrysts: olivine 3%, ≤1.5 mm, euhedral; plagioclase 10%, ≤3 mm, euhedral; clinopyroxene 3%, ≤1.5 mm, subhedral

Groundmass: olivine 2%, 0.2 mm, subhedral; plagioclase 30%, ≤0.5 mm, acicular; clinopyroxene 46%, radiating sheaves; opaques 5%, 0.01 mm, granular

Vesicles: 1%, ≤0.2 mm, round

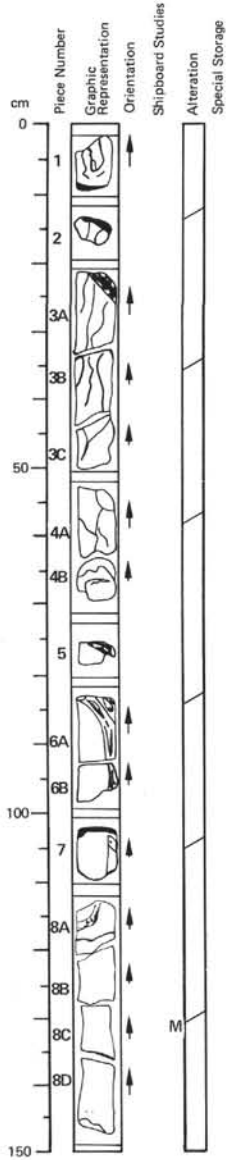
Alteration: olivine to smectite and carbonate; smectite and carbonate fill vesicles

Shipboard Data

Bulk Analysis: 116-118 cm

SiO_2	47.83
Al_2O_3	15.46
Fe_2O_3	10.60
MgO	7.08
CaO	13.70
Na_2O	2.22
K_2O	0.06
TiO_2	1.17
P_2O_5	0.11
MnO	.22
LOI	1.45
H_2O^+	0.51
H_2O^-	0.94
CO_2	N.D.
Sr	108.8
Zr	72.9
Y	26.9
Nb	3.9

Magnetic Data:	26-28 cm
NRM Intensity (emu/cc)	8.36×10^{-3}
NRM Inclination	-58.7°
Stable Inclination	-60.4°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

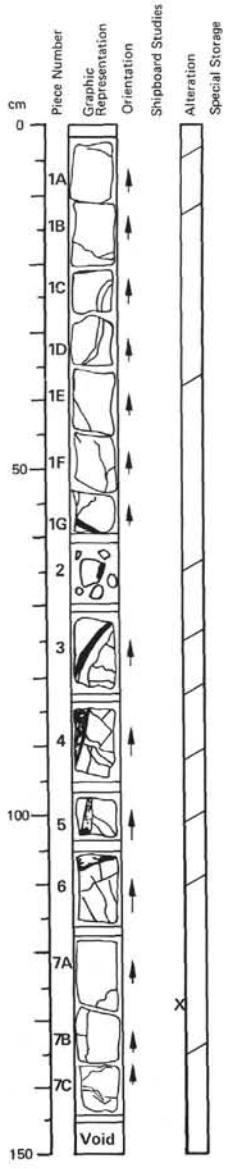
LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 1	3

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 10%, <4 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 2%, ≤2 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Many scattered veinlets are filled with smectite, carbonate and minor pyrite. A small piece of chert is attached to the base of piece 8D.

Shipboard Data

Magnetic Data:	132-134 cm
NRM Intensity (emu/cc)	4.88×10^{-3}
NRM Inclination	-80.5°
Stable Inclination	-69.7°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 1	4

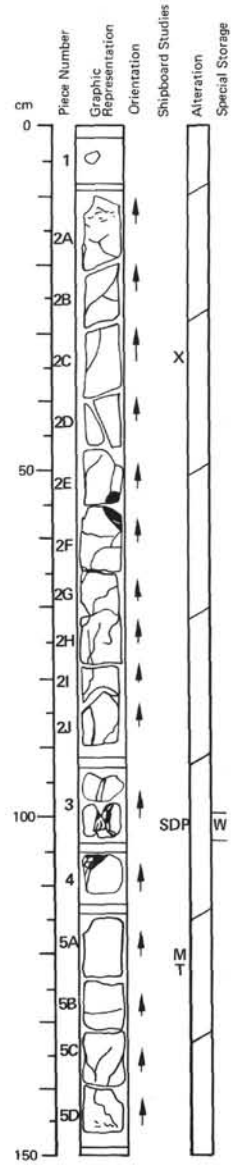
Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly to moderately altered. Plagioclase phenocrysts 8-12%, <5 mm, fresh; olivine phenocrysts <1%, <2 mm, altered to smectite; clinopyroxene phenocrysts 2-3%, <3 mm fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles 1%, filled with carbonate and smectite. Veinlets are scattered throughout, filled with carbonate, smectite and zeolite(?). Disseminated pyrite occurs in the groundmass. Small pieces of altered sediment occur in pieces 1A and 2.

Shipboard Data

Bulk Analysis: 126-129 cm

SiO_2	48.93
Al_2O_3	15.01
Fe_2O_3	11.02
MgO	8.24
CaO	13.97
Na_2O	2.12
K_2O	0.06
TiO_2	1.29
P_2O_5	0.12
MnO	.20
LOI	1.10
H_2O^+	0.47
H_2O^-	N.D.
CO_2	1.62



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 2	1

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 12-15%, <5 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 3%, <3 mm, fresh, sometimes occur in subophitic clots with plagioclase. Groundmass is fine-grained to glassy; glass selvedges are altered to smectite. Veinlets are common in piece 2, filled with smectite. Minor pyrite is disseminated in the groundmass. Irregular patches of smectite and carbonate occur in piece 2A. Piece 3 contains a fragment of altered sediment.

Thin Section Description

Location: 121 cm

Texture: porphyritic - quench

Phenocrysts: olivine 4%, <2 mm, euhedral; plagioclase 8%, <2.5 mm, euhedral; clinopyroxene 3%, <1.5 mm, anhedral

Groundmass: olivine 3%, 0.07 mm, anhedral; plagioclase 25%, <0.5 mm, acicular; clinopyroxene 43%, radiating sheaves; opaques 5%, 0.01 mm, granular; glass 8%

Vesicles: 1%, 0.25 mm, round

Alteration: olivine to smectite, carbonate and silica; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 31-34 cm

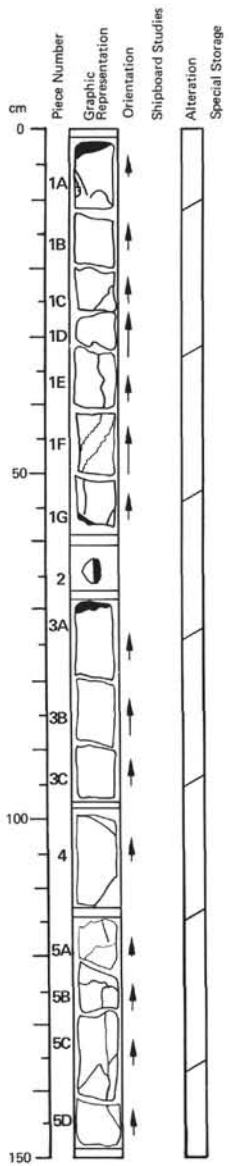
SiO_2	48.23
Al_2O_3	14.87
Fe_2O_3	10.84
MgO	7.78
CaO	14.67
Na_2O	2.19
K_2O	0.07
TiO_2	1.30
P_2O_5	0.12
MnO	.21
LOI	1.75
H_2O^+	0.42
H_2O^-	N.D.
CO_2	1.49
Sr	108.3
Zr	74.1
Y	24.7
Nb	5.8

Magnetic Data: 120-122 cm

NRM Intensity (emu/cc)	20.55×10^{-3}
NRM Inclination	-63.7°
Stable Inclination	-63.8°

Physical Property Data: 103-105 cm

$\overline{V}p$ (km/sec)	5.64
Porosity (%)	4.45
Wet Bulk Density (g/cc)	2.88
Grain Density (g/cc)	2.97

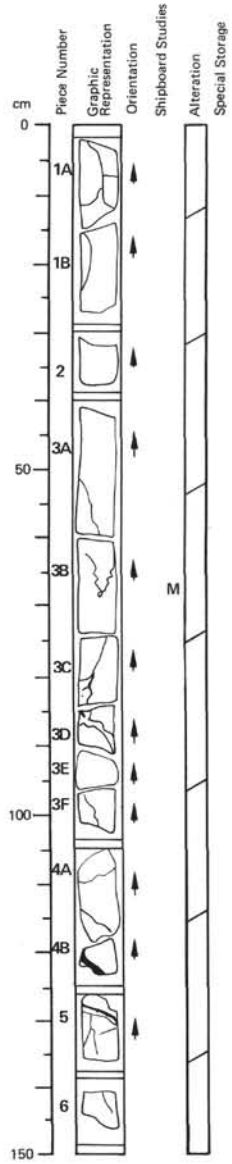


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 2	2

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 5-7%, <4 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 1-2%, <4 mm, fresh. Groundmass is fine-grained to glassy; some glass selvedges are fresh, some partly altered to smectite. Vesicles 1%, filled with carbonate and smectite. Numerous veins are present particularly in pieces 1 and 5, filled wtih smectite, carbonate and minor pyrite. Some pyrite is disseminated in the groundmass. A chert fragment occurs in piece 1D.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

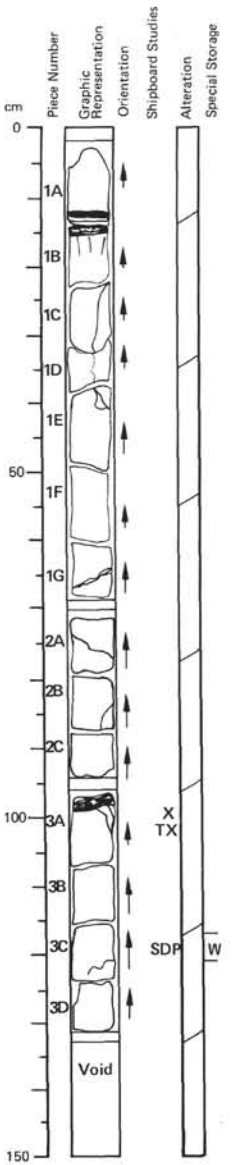
LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 2	3

Visual Description

Moderately phyric basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 5-7%, <10 mm, fresh; olivine phenocrysts 1-2%, <3 mm, altered to smectite; clinopyroxene phenocrysts 2-3%, <4 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite and zeolite(?). Vesicles 1-2%, <2 mm, filled with carbonate and smectite. Scattered veins are filled with carbonate and smectite. Minor pyrite is disseminated in the groundmass. A small fragment of altered sediment occurs in piece 5.

Shipboard Data

Magnetic Data:	68-70 cm
NRM Intensity (emu/cc)	6.20×10^{-3}
NRM Inclination	-58.5°
Stable Inclination	-57.1°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 2	4

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 10%, ≤8 mm, fresh; olivine phenocrysts 1-2%, ≤3 mm, altered to smectite and carbonate; clinopyroxene phenocrysts 1%, ≤4 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are generally fresh with only minor alteration to smectite. Vesicles 1%, ≤2 mm, filled with carbonate and smectite. Scattered veins are filled with quartz, carbonate, smectite and minor pyrite. Pyrite is also disseminated in the groundmass.

Thin Section Description

Location: 100 cm

Texture: porphyritic - glassy

Phenocrysts: olivine 1%, ≤1.5 mm, euhedral; plagioclase 10%, ≤4 mm, euhedral; clinopyroxene 4%, ≤2 mm, subhedral

Groundmass: glass 83%, partly devitrified

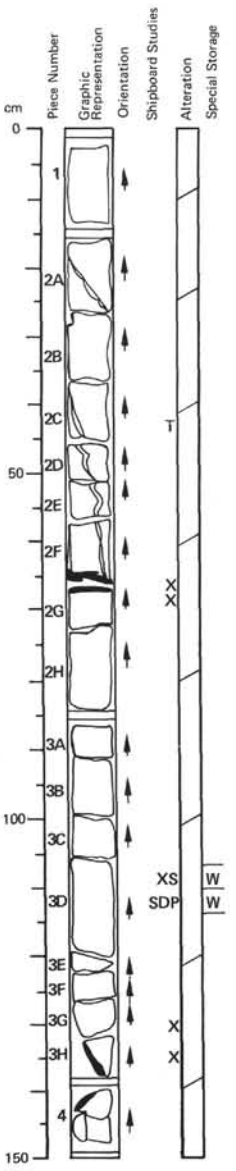
Vesicles: 2%, 0.2 mm, round

Alteration: olivine to smectite and carbonate; smectite and carbonate fill vesicles

Shipboard Data

Bulk Analysis:	98-99 cm	99-102 cm
SiO_2	49.41	48.92
Al_2O_3	15.49	15.17
Fe_2O_3	9.85	10.90
MgO	7.20	7.93
CaO	13.22	13.63
Na_2O	2.28	2.14
K_2O	0.35	0.08
TiO_2	1.21	1.26
P_2O_5	0.13	0.12
MnO	.15	.17
LOI	2.35	0.89
H_2O^+	0.80	0.43
H_2O^-	N.D.	N.D.
CO_2	1.09	0.94
Sr	141.4	109.0
Zr	73.2	76.7
Y	23.3	24.9
Nb	0.0	5.6

Physical Property Data:	117-119 cm
$\bar{V}p$ (km/sec)	5.98
Porosity (%)	2.36
Wet Bulk Density (g/cc)	2.93
Grain Density (g/cc)	2.97



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 3	1

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 8-12% (5-8% in piece 1), ≤7 mm, slightly altered to smectite, often in glomerocrysts; olivine phenocrysts 1%, ≤1 mm, mostly altered to smectite, carbonate and zeolite(?); clinopyroxene phenocrysts 3%, ≤6 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles <1%, ≤1 mm, filled with carbonate. Scattered veins are filled with smectite, carbonate and pyrite.

Thin Section Description

Location: 43 cm

Texture: porphyritic - intersertal

Phenocrysts: olivine 4%, ≤3.5 mm, euhedral; plagioclase 10%, ≤4 mm, euhedral; clinopyroxene 3%, ≤1.5 mm, subhedral

Groundmass: olivine 3%, 0.2 mm, subhedral; plagioclase 30%, ≤0.3 mm, acicular; clinopyroxene 44%, ≤0.2 mm, anhedral; opaques 5%, 0.005 mm, granular

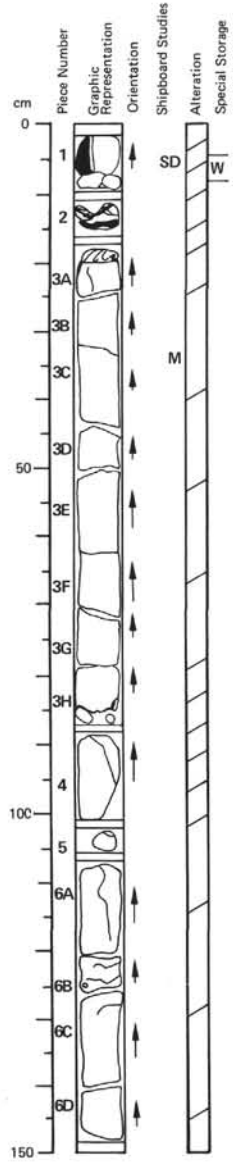
Vesicles: 1%, ≤0.3 mm, round

Alteration: olivine to smectite and carbonate; smectite and carbonate fill vesicles

Shipboard Data

Bulk Analysis:	65-66 cm	66-68 cm	105-107 cm	130-137 cm margin	130-137 cm inner margin
SiO_2	52.13	48.21	48.69	50.1	48.1
Al_2O_3	15.85	15.28	15.42	15.1	14.7
Fe_2O_3	11.19	10.66	10.74	11.6	10.8
MgO	6.65	7.88	7.05	6.94	7.16
CaO	9.88	11.59	12.60	9.73	14.3
Na_2O	1.97	2.07	2.23	2.51	2.22
K_2O	1.27	0.15	0.11	0.89	0.12
TiO_2	1.25	1.26	1.28	1.28	1.27
P_2O_5	0.10	0.12	0.10	0.08	0.15
MnO	.11	.15	.17	.14	.21
LOI	1.99	0.52	0.92	2.57	1.41
H_2O^+	1.90	0.69	0.60	0.50	2.40
H_2O^-	N.D.	N.D.	N.D.	N.D.	N.D.
CO_2	0.25	0.39	0.35	1.33	0.29
Sr	126.6	106.0	103.0	110.5	132.4
Zr	70.5	69.3	71.8	71.4	71.5
Y	22.7	23.7	25.4	22.8	21.7
Nb	2.6	3.8	1.2	1.7	8.1

Physical Property Data:	106-108 cm	109-111 cm
$\bar{V}p$ (km/sec)	6.03	6.06
Porosity (%)		2.24
Wet Bulk Density (g/cc)		2.94
Grain Density (g/cc)		2.99



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

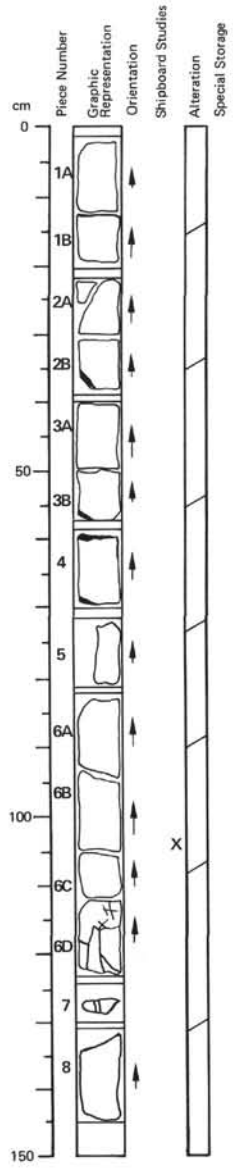
LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 3	2

Visual Description

Moderately phyric pillow basalt. Basalt is medium gray to greenish gray; moderately to highly altered. Plagioclase phenocrysts 10-15%, <9 mm, fresh; olivine phenocrysts 1-2%, <3 mm, altered to carbonate and smectite; clinopyroxene phenocrysts 2%, <4 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Scattered veins are filled with smectite, carbonate and pyrite. Minor altered sediment is associated with glass selvedges.

Shipboard Data

Magnetic Data:	35-37 cm
NRM Intensity (emu/cc)	9.01×10^{-3}
NRM Inclination	-74.5°
Stable Inclination	-73.1°
Physical Property Data:	5-7 cm
$\bar{V}p$ (km/sec)	3.13
Wet Bulk Density (g/cc)	2.30



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 3	3

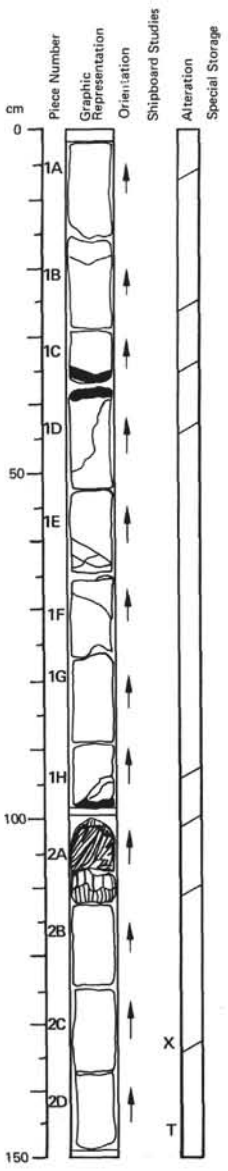
Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 12-14%, <8 mm, fresh, commonly in glomerocrysts to 20 mm; olivine phenocrysts 1%, <1 mm, mostly altered to smectite and carbonate; clinopyroxene phenocrysts 2-3%, <2 mm, fresh. Groundmass is fine-grained toglassy; glass selvedges are partly altered to smectite. Vesicles <1%, <0.2 mm, some empty, some filled with carbonate, smectite and pyrite. Some pyrite is also disseminated in the groundmass.

Shipboard Data

Bulk Analysis: 105-108 cm

SiO_2	47.81
Al_2O_3	16.00
Fe_2O_3	11.46
MgO	6.38
CaO	14.37
Na_2O	2.18
K_2O	< 0.03
TiO_2	1.25
P_2O_5	0.14
MnO	.20
LOI	1.17
H_2O^+	0.38
H_2O^-	N.D.
CO_2	1.21



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	73	4

Visual Description

Moderately phyric pillow basalt. Basalt is medium gray; moderately to weakly altered. Plagioclase phenocrysts 10-15%, < 10 mm, fresh; olivine phenocrysts 1-2%, < 3 mm, altered to smectite; clinopyroxene phenocrysts 2-3%, < 2 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Scattered veins are filled with carbonate, smectite, silica and pyrite. Pyrite is also disseminated in the groundmass. A vein in piece 1H contains pink zeolite(?).

Thin Section Description

Location: 147 cm

Texture: porphyritic - quench

Phenocrysts: olivine 5%, < 1.5 mm, euhedral; plagioclase 10%, < 3 mm, euhedral; clinopyroxene 4%, < 2 mm, anhedral

Groundmass: olivine 3%, 0.2 mm, subhedral; plagioclase 35%, 0.3 mm, acicular; clinopyroxene 35%, 0.2 mm, radiating sheaves; opaques 2%, 0.01, euhedral; glass 5%

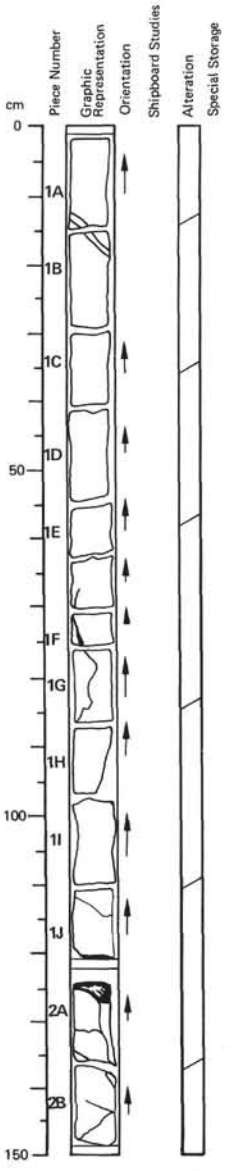
Vesicles: 1%, 0.5 mm, round

Alteration: olivine and minor glass to smectite; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 132-134 cm

SiO_2	48.11
Al_2O_3	14.94
Fe_2O_3	10.70
MgO	7.30
CaO	12.96
Na_2O	2.19
K_2O	0.13
TiO_2	1.23
P_2O_5	0.15
MnO	.18
LOI	1.08
H_2O^+	0.62
H_2O^-	N.D.
CO_2	0.43
Sr	106.3
Zr	71.1
Y	25.6
Nb	2.7

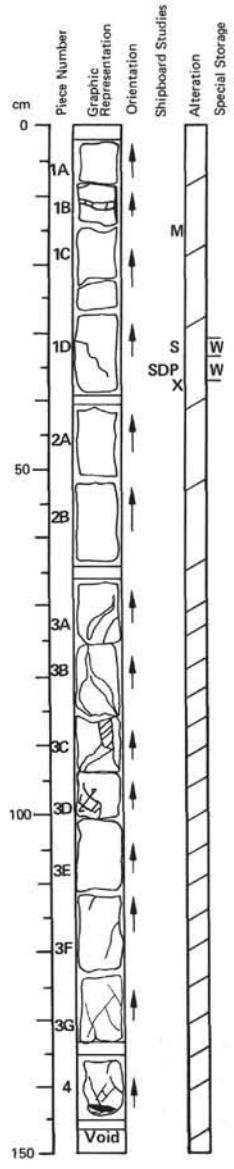


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	73	5

Visual Description

Moderately phyric basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 10-15%, < 10 mm, fresh; olivine phenocrysts 1%, < 1 mm, altered to smectite and carbonate; clinopyroxene phenocrysts 2%, < 2 mm, fresh, usually in subophitic clusters with plagioclase. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles 1%, < 1 mm, filled with smectite and carbonate. Scattered veins are filled with carbonate, smectite and pyrite.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 3	6

Visual Description

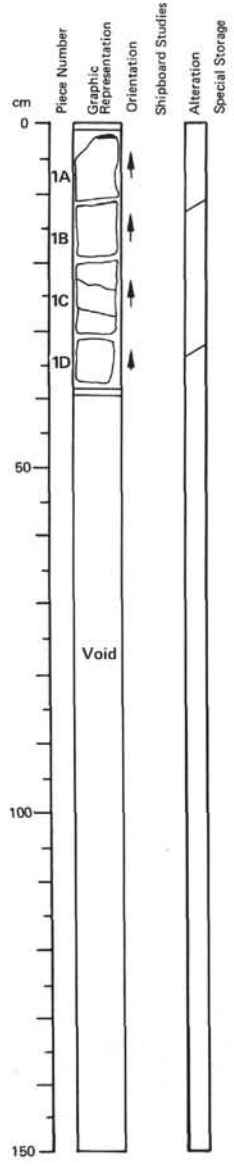
Moderately phyric pillow basalt. Basalt is medium gray; weakly to moderately altered in upper 65 cm, highly altered in the lower 85 cm. Plagioclase phenocrysts 10-15%, <8 mm, fresh; olivine phenocrysts 2%, <3 mm, altered to smectite; clinopyroxene phenocrysts 3%, <5 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles 1%, <2 mm, filled with smectite. Piece 3 is partly brecciated; fractures and veins are filled with silica, carbonate, smectite and minor pyrite.

Shipboard Data

Bulk Analysis: 33-36 cm	
SiO_2	48.81
Al_2O_3	14.87
Fe_2O_3	10.66
MgO	7.55
CaO	13.03
Na_2O	2.19
K_2O	0.13
TiO_2	1.22
P_2O_5	0.14
MnO	.19
LOI	0.98
H_2O^+	0.68
H_2O^-	N.D.
CO_2	0.44
Sr	110.8
Zr	78.8
Y	23.4
Nb	3.1

Magnetic Data:	16-18 cm
NRM Intensity (emu/cc)	5.69×10^{-3}
NRM Inclination	-51.2°
Stable Inclination	-49.4°

Physical Property Data:	33-35 cm	35-37 cm
$\overline{V}p$ (km/sec)	5.59	5.64
Porosity (%)		4.30
Wet Bulk Density (g/cc)		2.88
Grain Density (g/cc)		2.97

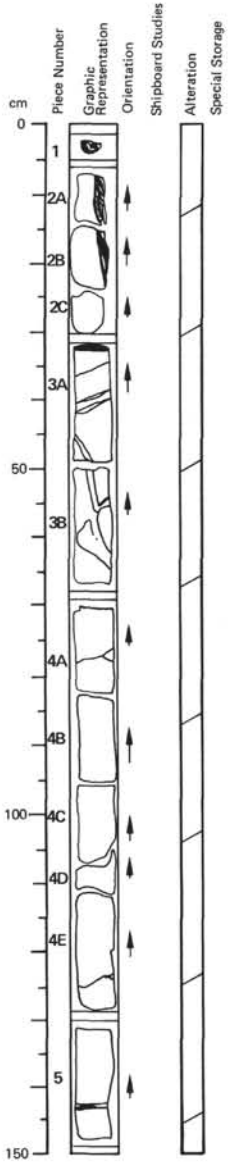


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 3	7

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 10-15%, <9 mm, fresh; olivine phenocrysts 1%, <0.5 mm, altered to smectite; clinopyroxene phenocrysts 2%, <1 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Vesciles <1%, <0.5 mm, filled with smectite and carbonate. Scattered veins are filled with carbonate and smectite.

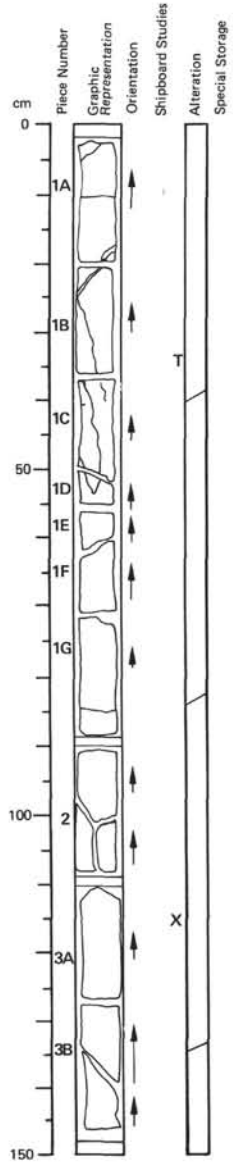


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 4	1

Visual Description

Moderately phyric basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 12%, ≤5 mm, some megacrysts to 10 mm, partly altered to smectite; olivine phenocrysts 0-1%, ≤1 mm, altered to smectite; clinopyroxene phenocrysts 1-2%, ≤2 mm, fresh, often occur in glomerocrysts with plagioclase. Groundmass varies from fine-grained or glassy in the upper 30 cm to medium-grained in the lower 120 cm. No glass selvedges occur below 30 cm and the grain size increases gradually from this point to the base of the section; glass selvedges are relatively fresh with only minor alteration to smectite. Vesicles 1%, ≤1.5 mm, filled with carbonate. Veins and veinlets are filled with carbonate, smectite and minor pyrite. Pyrite is also disseminated in the groundmass.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 4	2

Visual Description

Moderately phyric massive basalt. Basalt is medium to dark gray; relatively fresh. Plagioclase phenocrysts 8-10%, ≤7 mm, fresh; olivine phenocrysts 1%, ≤1 mm, altered to smectite; clinopyroxene phenocrysts 3%, ≤2 mm, fresh, often in glomerophyric clusters with plagioclase. Groundmass is medium-grained, subophitic, with grain size increasing gradually with depth. Vesicles 1%, ≤0.5 mm, filled with carbonate and minor smectite.

Thin Section Description

Location: 36 cm

Texture: porphyritic - subophitic

Phenocrysts: plagioclase 10%, ≤4 mm, euhedral

Groundmass: olivine 5%, ≤0.3 mm, euhedral; plagioclase 40%, ≤0.5 mm, euhedral; clinopyroxene 37%, ≤0.3 mm, subophitic; opaques 5%, 0.1 mm, subhedral

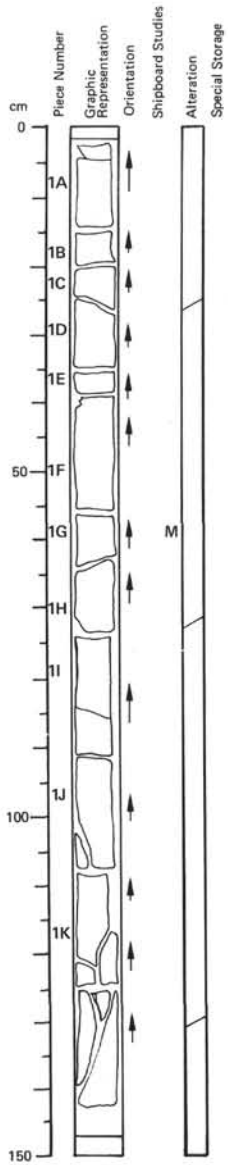
Vesicles: 3%, ≤2 mm, round

Alteration: olivine to smectite; smectite and carbonate fill vesicles

Shipboard Data

Bulk Analysis: 115-117 cm

SiO_2	49.39
Al_2O_3	16.47
Fe_2O_3	10.59
MgO	6.15
CaO	13.03
Na_2O	2.15
K_2O	< 0.03
TiO_2	1.24
P_2O_5	0.13
MnO	.17
LOI	1.06
H_2O^+	0.59
H_2O^-	N.D.
CO_2	0.41



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

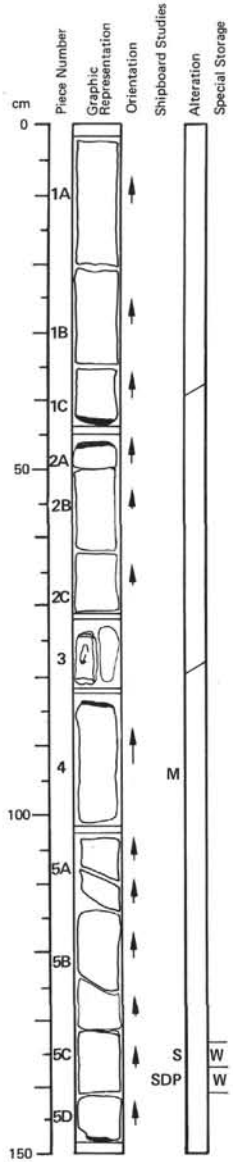
LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A		7	4	3

Visual Description

Moderately phyric massive basalt. Basalt is medium to dark gray; relatively fresh. Plagioclase phenocrysts 10%, <5 mm, one megacryst in piece 1C is 25 mm across, fresh; olivine phenocrysts <1%, <1mm, altered to smectite; clinopyroxene phenocrysts 3%, <3 mm, fresh. Groundmass is massive, medium-grained, subophitic. Vesicles 1%, <0.2 mm, filled with carbonate. Sparse veins are filled with smectite and carbonate. Slickensides are present on pieces 1C and 1D.

Shipboard Data

Magnetic Data:	59-61 cm
NRM Intensity (emu/cc)	2.19×10^{-3}
NRM Inclination	-20.6°
Stable Inclination	-53.9°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

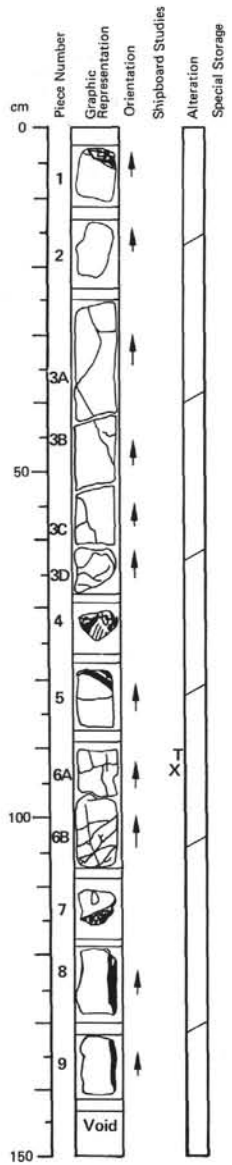
LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A		7	4	4

Visual Description

Moderately phyric massive basalt and pillow basalt. Basalt is medium to dark gray; very slightly altered. Piece 1 is a continuation of the massive unit in sections 2 and 3; remainder of the section consists of pillow basalt. Plagioclase phenocrysts 10%, 6 mm, fresh; olivine phenocrysts 1%, 2 mm, altered to smectite and carbonate; clinopyroxene phenocrysts 2-4%, 6 mm, fresh, often forms glomerocrysts with plagioclase. Groundmass is fine-grained to glassy; grain size in piece 1 decreases downward to glassy margin in piece 1C; glass selvedges are fresh. Scattered veinlets are filled with smectite and carbonate.

Shipboard Data

Magnetic Data:	93-95 cm	
NRM Intensity (emu/cc)	8.19×10^{-3}	
NRM Inclination	-67.5°	
Stable Inclination	-65.6°	
Physical Property Data:	134-136 cm	136-138 cm
$\overline{V}p$ (km/sec)	6.06	6.18
Porosity (%)		1.95
Wet Bulk Density (g/cc)		2.95
Grain Density (g/cc)		2.99



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 4	5

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 10%, <8 mm, fresh; olivine phenorysts 1%, <2 mm, altered to smectite; clinopyroxene phenocrysts 2-3%, <4 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles 1%, <2 mm, filled with carbonate and smectite. Veinlets are present throughout, filled with smectite and minor pyrite. Pyrite is also disseminated in the groundmass. A piece of altered sediment occurs between glass selvedges in piece 4.

Thin Section Description

Location: 91 cm

Texture: porphyritic - quench

Phenocrysts: olivine 3%, <0.7 mm, euhedral; plagioclase 12%, <5 mm, euhedral; clinopyroxene 2%, <3 mm, euhedral

Groundmass: plagioclase 4%, <0.5 mm, laths; clinopyroxene 73%, poorly crystallized radiating sheaves; opaques 2%, 0.005, granular

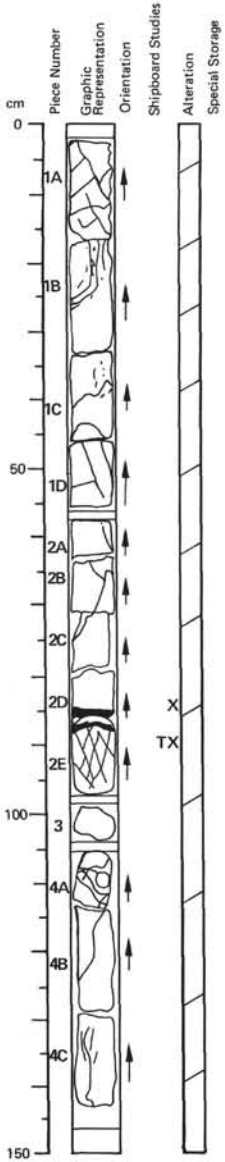
Vesicles: 2%, <0.6 mm, round to irregular

Alteration: olivine to smectite, carbonate, and quartz(?); carbonate fills vesicles

Shipboard Data

Bulk Analysis: 90-94 cm

SiO_2	48.25
Al_2O_3	16.87
Fe_2O_3	10.54
MgO	7.11
CaO	13.80
Na_2O	2.10
K_2O	0.04
TiO_2	1.25
P_2O_5	0.11
MnO	.20
LOI	N.D.
H_2O^+	0.34
H_2O^-	N.D.
CO_2	0.79



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 4	6

Visual Description

Moderately phyric pillow basalt. Basalt is medium gray to greenish-gray; moderately altered. Plagioclase phenocrysts 10%, <8 mm, fresh; olivine phenocrysts 1%, <3 mm, altered to smectite; clinopyroxene phenocrysts 2%, <3 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles 1-2%, <2 mm, filled with carbonate and smectite. Fractures are present throughout the section, filled with smectite, carbonate and pyrite.

Thin Section Description

Location: 87 cm

Texture: porphyritic - glassy

Phenocrysts: olivine 3%, <0.8 mm, euhedral; plagioclase 15%, <3.5 mm, euhedral; clinopyroxene 5%, <3.5 mm, euhedral

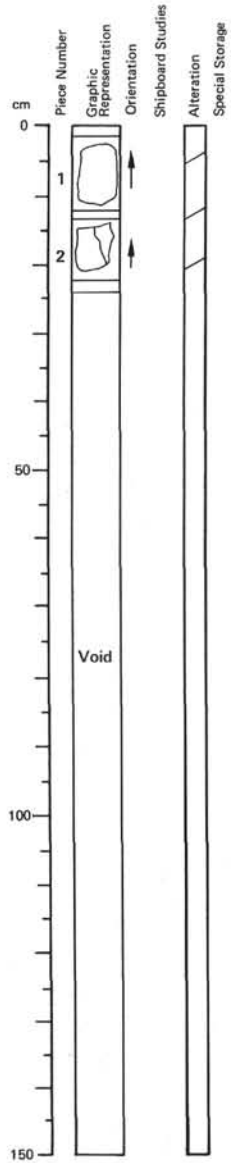
Groundmass: glass 75%, partly devitrified

Vesicles: 2%, 0.2 mm, round

Alteration: smectite after some olivine

Shipboard Data

Bulk Analysis:	85-86 cm	86-88 cm
SiO_2	50.0	48.9
Al_2O_3	16.8	16.9
Fe_2O_3	13.1	12.7
MgO	6.62	7.57
CaO	8.73	11.6
Na_2O	1.92	2.04
K_2O	1.17	0.42
TiO_2	1.33	1.33
P_2O_5	0.12	0.11
MnO	.13	.08
LOI	1.94	3.95
H_2O^+	1.69	5.72
H_2O^-	N.D.	N.D.
CO_2	0.18	0.21
Sr	123.6	N.D.
Zr	72.1	N.D.
Y	24.0	
Nb	2.3	

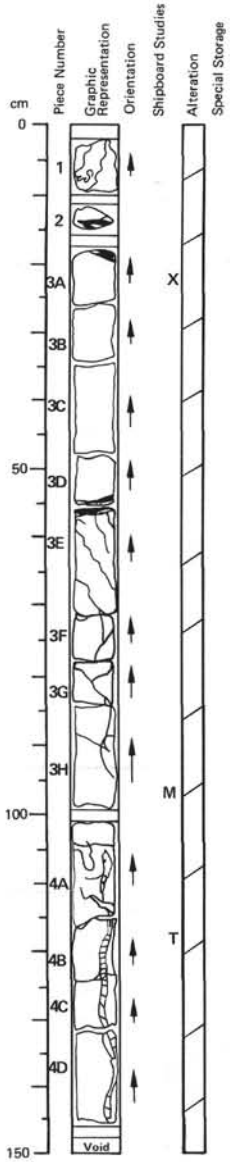


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A	7	4		7

Visual Description

Moderately phyric pillow basalt. Basalt is medium gray to greenish-gray; moderately altered. Plagioclase phenocrysts 7-8%, <6 mm, fresh; olivine phenocrysts 1%, <2 mm, altered to smectite; clinopyroxene phenocrysts 2%, <3 mm, fresh. Groundmass is fine-grained. Vesicles <0.5%, <1 mm, filled with carbonate. Carbonate also fills scattered veins.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A	7	5		1

Visual Description

Moderately phyric pillow basalt. Basalt is medium gray to greenish-gray; moderately altered. Plagioclase phenocrysts 7-8%, <6 mm, fresh; olivine phenocrysts 1%, <2 mm, altered to smectite; clinopyroxene phenocrysts 1%, <3 mm, fresh, mostly in glomerocrysts with plagioclase. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Veins are scattered throughout, filled with smectite; one large vein in piece 4 is filled with carbonate, smectite, silica and pyrite. Pyrite is also disseminated in the groundmass. Piece 1 is brecciated with basalt fragments in a smectite matrix.

Thin Section Description

Location: 120 cm

Texture: porphyritic - quench

Phenocrysts: olivine 3%, <1 mm, euhedral; plagioclase 12%, <3 mm, euhedral; clinopyroxene 6%, <4 mm, subhedral

Groundmass: plagioclase 15%, <0.5 mm, acicular; clinopyroxene 58%, radiating sheaves; opaques 5%, 0.01 mm, granular

Vesicles: 1%, 0.7 mm, round

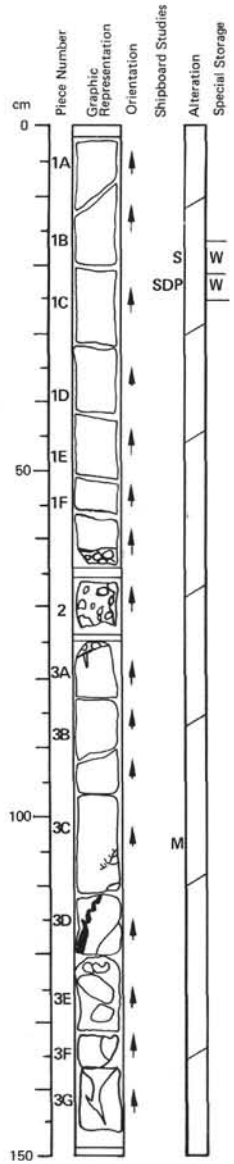
Alteration: olivine to carbonate and smectite; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 22-24 cm	
SiO_2	48.61
Al_2O_3	16.72
Fe_2O_3	10.60
MgO	6.87
CaO	13.71
Na_2O	2.31
K_2O	0.04
TiO_2	1.31
P_2O_5	0.16
MnO	.19
LOI	1.58
H_2O^+	0.86
H_2O^-	N.D.
CO_2	1.04

Sr	113.4
Zr	74.5
Y	25.0
Nb	3.7

Magnetic Data:	93-95 cm
NRM Intensity (emu/cc)	8.43×10^{-3}
NRM Inclination	-47.6°
Stable Inclination	-46.9°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	7	2

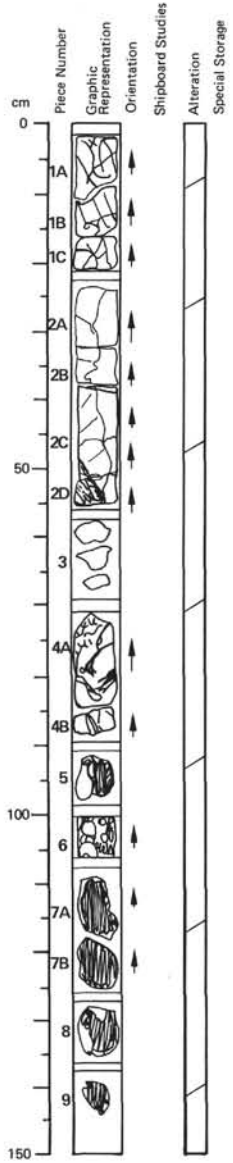
Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 8-10%, <8 mm, fresh; olivine phenocrysts <1%, <0.5 mm, mostly altered to smectite and carbonate; clinopyroxene phenocrysts 4%, <6 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles <0.5%, <0.5 mm, filled with smectite and carbonate. Veins are present throughout, filled with smectite and carbonate. Minor brecciation is present particularly in pieces 1F, 2 and 3A; breccia consists of angular basalt fragments in a smectite matrix.

Shipboard Data

Magnetic Data:	104-106 cm
NRM Intensity (emu/cc)	8.72×10^{-3}
NRM Inclination	-55.2°
Stable Inclination	-56.9°

Physical Property Data:	19-21 cm	21-23 cm
$\overline{V}p$ (km/sec)	6.09	6.00
Porosity (%)		2.42
Wet Bulk Density (g/cc)		2.92
Grain Density (g/cc)		2.97

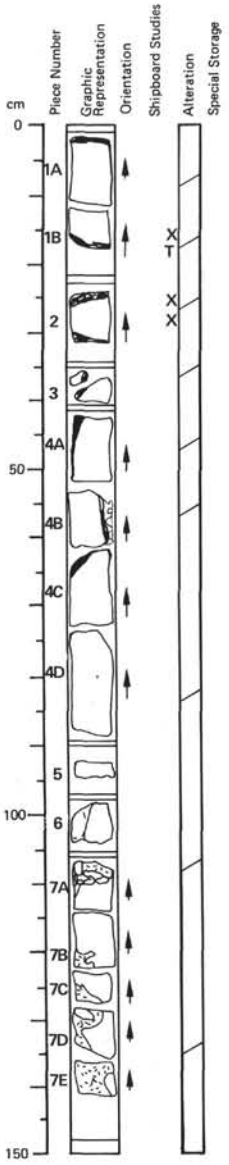


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	7	3

Visual Description

Moderately phyric pillow basalt and sparsely phyric basalt glass. Pieces 1 through 4 (0-90 cm) consist of mostly crystalline basalt; pieces 5-9 (90-150 cm) consist of basalt glass. Lithic basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 10%, <5 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 1%, <3 mm, fresh. Lithic basalt is partly brecciated with angular fragments in smectite matrix. Basalt glass has 1-2% phenocrysts; plagioclase 1-2%, <5 mm, fresh; olivine <1%, <1 mm, altered to smectite. Glass in piece 6 is brecciated. Fragments of altered sediment occur in piece 8.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	7	4

Visual Description

Moderately phyric pillow basalt breccia. Breccia consists of crystalline basalt fragments with many glass selvedges. Breccia is gray to greenish-gray; weakly to moderately altered. Plagioclase phenocrysts 8-10%, ≤ 6 mm, fresh; olivine phenocrysts 1%, ≤ 1 mm, altered to smectite and carbonate; clinopyroxene phenocrysts 2%, ≤ 2 mm, fresh. Groundmass of breccia fragments is fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles 1-3%, ≤ 2 mm, filled with smectite and carbonate. Breccia matrix is green smectite.

Thin Section Description

Location: 18 cm

Texture: porphyritic - quench

Phenocrysts: olivine 2%, ≤ 1 mm, euhedral; plagioclase 10%, ≤ 5 mm, euhedral; clinopyroxene 4%, ≤ 1.5 mm, anhedral to rounded

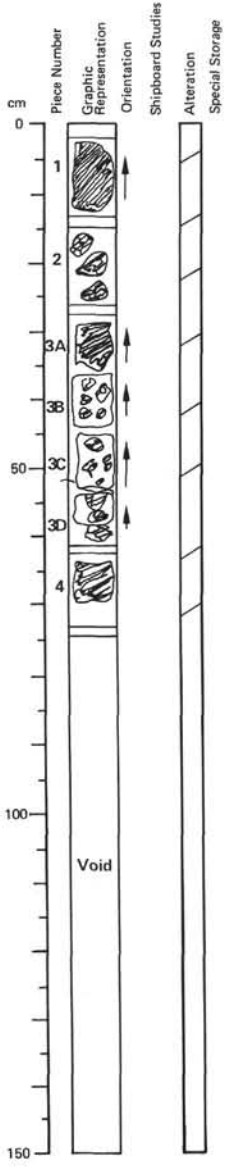
Groundmass: olivine 2%, 0.15 mm, subhedral; plagioclase 25%, 0.3 mm, acicular; clinopyroxene 54%, radiating sheaves; opaques 2%, 0.005 mm, granular

Vesicles: 1%, 0.5 mm, round

Alteration: olivine to carbonate and smectite; carbonate fills vesicles

Shipboard Data

Bulk Analysis:	14-15 cm	24-25 cm	23-24 cm
SiO_2	48.61	48.46	49.42
Al_2O_3	16.14	15.78	15.29
Fe_2O_3	10.43	10.66	12.67
MgO	7.31	7.76	8.29
CaO	13.22	12.51	9.43
Na_2O	2.29	2.34	2.17
K_2O	< 0.03	0.09	0.85
TiO_2	1.32	1.33	1.32
P_2O_5	0.13	0.12	0.14
MnO	.26	.21	.13
LOI	1.30	1.46	7.74
H_2O^+	0.85	0.92	3.45
H_2O^-	N.D.	N.D.	N.D.
CO_2	0.66	0.22	0.27
Sr	N.D.	110.5	151.1
Zr	N.D.	75.2	71.6
Y		26.6	23.5
Nb		3.6	2.6

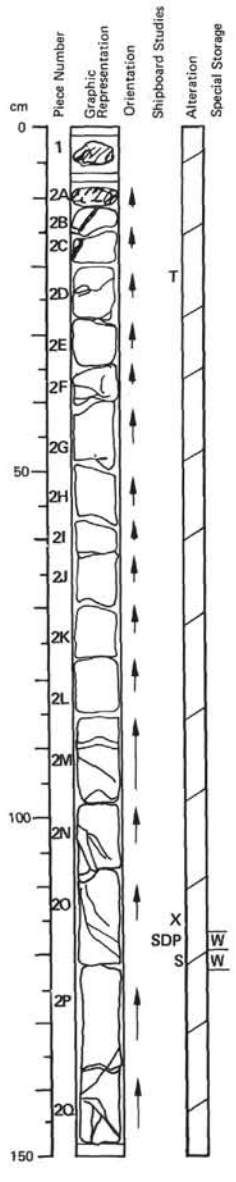


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	7	5

Visual Description

Moderately phyric basalt glass. Glass is partly massive, partly brecciated. Plagioclase phenocrysts 5-7%, fresh; olivine phenocrysts 1%, altered to smectite; plagioclase microlites 3%, fresh. Breccia matrix consists of smectite, carbonate and zeolite(?).



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	75	1

Visual Description

Sparsely phyric basalt and basalt glass. Pieces 1 through 2C are basalt glass, a continuation of the material in Core 75; pieces 2D through 2Q are crystalline basalt. Crystalline basalt is gray to greenish-gray; moderately altered. Plagioclase phenocrysts 2-5%, <4 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 1%, <2 mm, fresh. Groundmass of crystalline basalt is medium- to fine-grained, often mottled. Vesicles 1-2%, usually <2 mm, a few up to 5 mm, filled with carbonate and smectite. Veins are filled with carbonate, smectite, silica and pyrite. Pyrite is also disseminated in the groundmass. Basalt glass has same phenocrysts content as crystalline basalt; glass is partly altered to smectite.

Thin Section Description

Location: 21 cm

Texture: porphyritic - quench

Phenocrysts: olivine 2%, <1 mm, euhedral; plagioclase 8%, <3 mm, euhedral; clinopyroxene 5%, <3 mm, anhedral to rounded

Groundmass: olivine(?) 2%, 0.05 mm, subhedral; plagioclase 15%, 0.3 mm, subhedral; clinopyroxene 35%, radiating sheaves; opaques 6%, 0.005, granular; glass 26%

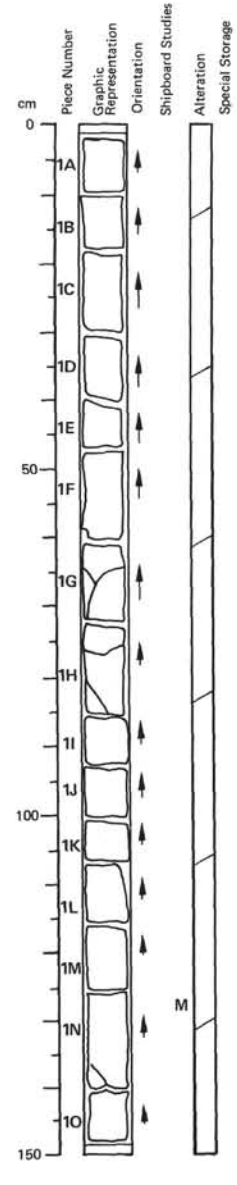
Vesicles: 1%, 0.2 mm, round

Alteration: olivine to smectite and carbonate; smectite fills vesicles

Shipboard Data

Bulk Analysis: 115-118 cm	
SiO_2	49.54
Al_2O_3	16.41
Fe_2O_3	10.82
MgO	7.03
CaO	13.13
Na_2O	2.39
K_2O	0.05
TiO_2	1.36
P_2O_5	0.10
MnO	.17
LOI	2.09
H_2O^+	0.92
H_2O^-	N.D.
CO_2	0.84
Sr	114.1
Zr	75.3
Y	25.4
Nb	3.2

Physical Property Data:	117-119 cm	119-121 cm
$\overline{V}p$ (km/sec)	5.72	5.61
Porosity (%)	3.92	
Wet Bulk Density (g/cc)	2.89	
Grain Density (g/cc)	2.97	



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

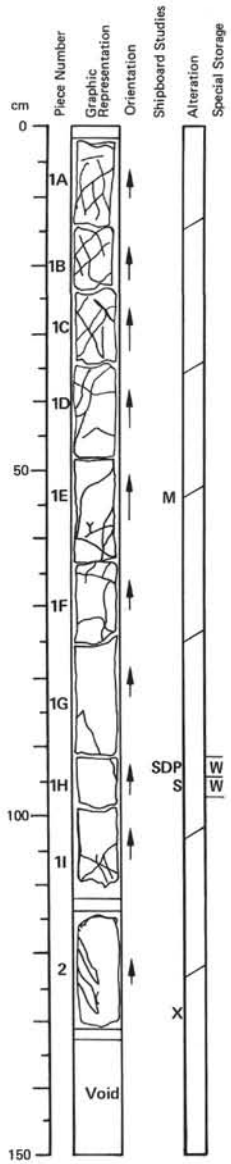
LEG	SITE	HOLE	CORE	SECT.
53	418	A	76	2

Visual Description

Sparsely phyric massive basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 2-3%, <3 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 1-2%, <4 mm, fresh. Groundmass is fine-grained to medium-grained, subophitic. Vesicles 0.5%, <0.5 mm, filled with carbonate, smectite and pyrite. Veins are also filled with smectite, carbonate and pyrite.

Shipboard Data

Magnetic Data:	129-131 cm
NRM Intensity (emu/cc)	2.82×10^{-3}
NRM Inclination	-25.0°
Stable Inclination	-33.8°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	76	3

Visual Description

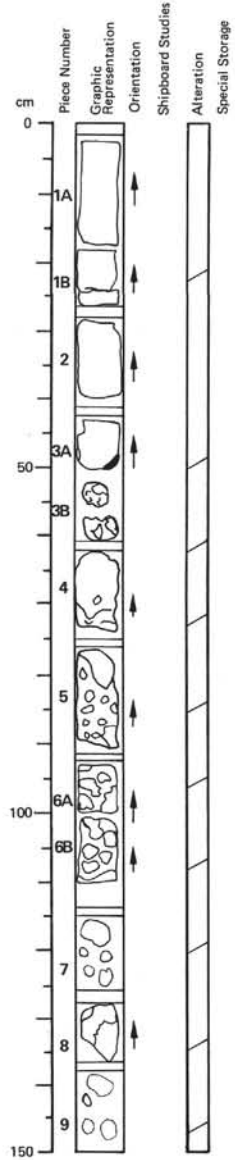
Sparsely phyric massive basalt. Basalt is medium to dark gray, weakly altered. Plagioclase phenocrysts 3-4%, <3 mm, fresh; olivine phenocrysts 1-2%, <1 mm, altered to smectite; clinopyroxene phenocrysts 1%, <2 mm, fresh. Groundmass is fine-grained, holocrystalline. Basalt is highly fractured, filled with carbonate and smectite.

Shipboard Data

Bulk Analysis: 125-130 cm

SiO_2	47.87
Al_2O_3	16.02
Fe_2O_3	10.47
MgO	6.70
CaO	13.25
Na_2O	2.65
K_2O	0.08
TiC_2	1.46
P_2O_5	0.14
MnO	.18
LOI	2.92
H_2O^+	1.16
H_2O^-	N.D.
CO_2	1.69

Magnetic Data:	54-56 cm	
NRM Intensity (emu/cc)	1.41×10^{-3}	
NRM Inclination	47.7°	
Physical Property Data:	92-94 cm	94-96 cm
$\bar{V}p$ (km/sec)	5.57	5.51
Porosity (%)	3.62	
Wet Bulk Density (g/cc)	2.91	
Grain Density (g/cc)	2.98	

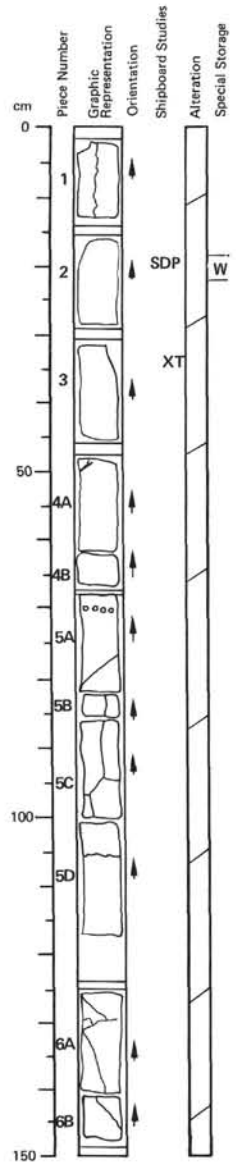


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	77	1

Visual Description

Aphyric to sparsely phyric basalt and basalt breccia. The upper 50 cm of the section consists of aphyric to sparsely phyric basalt. Basalt is medium gray; weakly altered. Plagioclase phenocrysts 1-2%, <2 mm, fresh; clinopyroxene phenocrysts 1%, <2 mm, fresh, often intergrown with plagioclase in subophitic clots. Groundmass is fine-grained with only one glass selvedge at the base of piece 3A; glass selvedge is altered to smectite. The lower 100 cm consist of moderately altered basalt breccia. Angular fragments, 1 mm to 10 cm, consist chiefly of crystalline basalt, many with glass rinds; many small fragments are completely glass. Breccia matrix is green smectite.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 7	2

Visual Description

Aphyric to sparsely phyric massive basalt. Basalt is medium to dark gray, weakly altered. Plagioclase phenocrysts 2-4%, ≤4 mm, fresh; olivine phenocrysts <1%, ≤1 mm, altered to smectite; clinopyroxene phenocrysts <1%, ≤2 mm, fresh, often in subophitic clots with plagioclase. Groundmass is holocrystalline, aphanitic in piece 1, fine-grained in pieces 2 and 3, and medium-grained, subophitic in lower 100 cm of the section. Vesicles are abundant only in pieces 4A through 5B where they are 5%, <2 mm, filled with carbonate and smectite. Scattered veinlets are filled with carbonate, smectite, and pyrite. Pyrite is also disseminated in the groundmass.

Thin Section Description

Location: 35 cm

Texture: porphyritic - quench

Phenocrysts: olivine 3%, 0.5 mm, euhedral; plagioclase 10%, <1 mm, euhedral; clinopyroxene 7%, 0.5 mm, subhedral

Groundmass: olivine 10%, 0.1 mm, subhedral; plagioclase 25%, 0.4 mm, acicular; clinopyroxene 36%, radiating sheaves; opaques 8%, 0.05 mm, granular

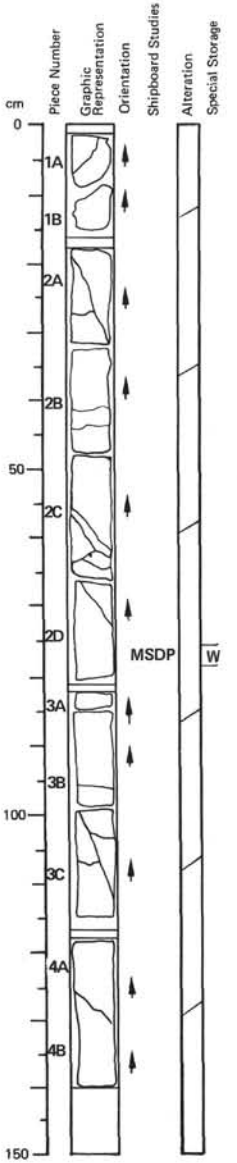
Vesicles: 1%, 0.5, round

Alteration: olivine to smectite and carbonate; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 34-36 cm	
SiO_2	48.10
Al_2O_3	14.97
Fe_2O_3	10.06
MgO	6.96
CaO	14.75
Na_2O	2.39
K_2O	< 0.03
TiO_2	1.21
P_2O_5	0.13
MnO	.17
LOI	3.31
H_2O^+	0.80
H_2O^-	N.D.
CO_2	2.26

Physical Property Data:	20-22 cm
$\overline{V}p$ (km/sec)	5.71
Porosity (%)	2.57
Wet Bulk Density (g/cc)	2.93
Grain Density (g/cc)	2.98



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 7	3

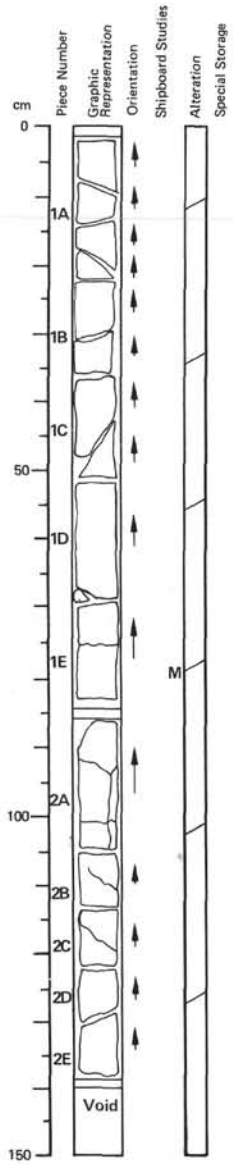
Visual Description

Sparsely phyric massive basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 3-5%, ≤6 mm, fresh; olivine phenocrysts <1%, ≤1 mm, altered to smectite; clinopyroxene phenocrysts <1%, ≤1 mm, fresh, often in subophitic clots with plagioclase. Groundmass is holocrystalline, medium-grained, subophitic; piece 1 is slightly finer-grained than the rest of the section. Vesicles 2% in pieces 1, 2A, 3A, and 3B, elsewhere <1%, filled with smectite and carbonate. Sparse veinlets are filled with carbonate and smectite; prominent vein in piece 2A is filled with carbonate.

Shipboard Data

Magnetic Data:	75-77 cm
NRM Intensity (emu/cc)	2.08×10^{-3}
NRM Inclination	-51.4°
Stable Inclination	-52.2°

Physical Property Data:	75-77 cm
$\overline{V}p$ (km/sec)	5.93
Porosity (%)	1.36
Wet Bulk Density (g/cc)	2.93
Grain Density (g/cc)	2.95



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

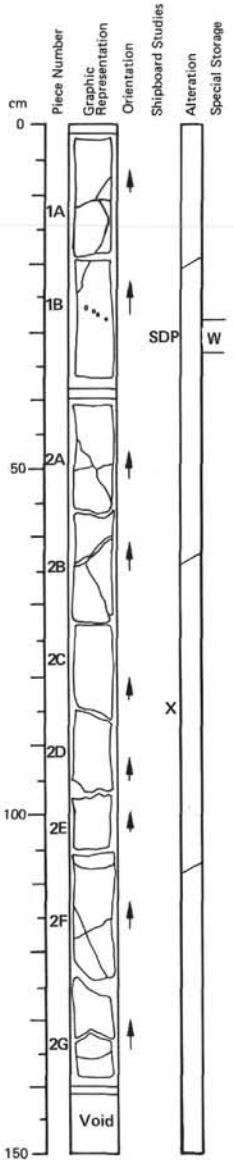
LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 7	4

Visual Description

Sparsely phyric massive basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 3-5%, ≤8 mm, fresh; olivine phenocrysts 1%, < 1 mm, altered to smectite; clinopyroxene phenocrysts < 1%, ≤ 1 mm, fresh. Groundmass is holocrystalline, medium-grained, subophitic. Vesicles 1-3%, increasing in abundance toward base of section, ≤3 mm, filled with smectite and carbonate. Sparse veinlets are filled with smectite and minor pyrite.

Shipboard Data

Magnetic Data:	77-79 *cm*
NRM Intensity (emu/cc)	1.81×10^{-3}
NRM Inclination	−72.3°
Stable Inclination	−53.3°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 7	5

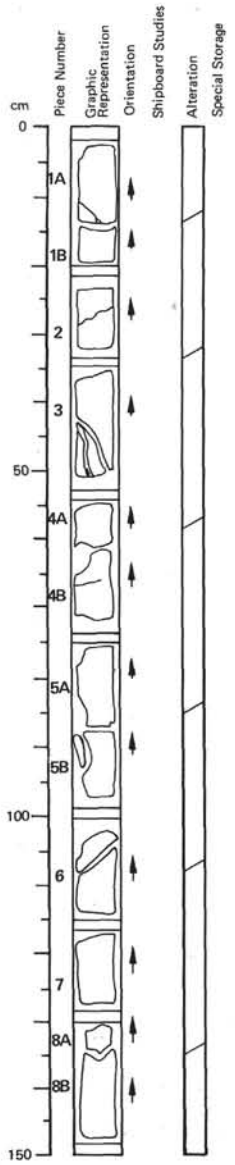
Visual Description

Sparsely phyric massive basalt. Basalt is medium to dark gray, very weakly altered. Plagioclase phenocrysts 3-5%, ≤7 mm, fresh; olivine phenocrysts 1%, ≤1 mm, altered to smectite; clinopyroxene phenocrysts 2%, ≤2 mm, fresh. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Vesicles 1-2%, ≤3 mm, filled with smectite and carbonate. Prominent veins in pieces 2B and 2C are filled with smectite, carbonate and pyrite.

Shipboard Data

Bulk Analysis: 84-86 *cm*		Physical Property Data:	28-30 *cm*
SiO_2	48.73	$\bar{V}p$ (km/sec)	5.98
Al_2O_3	16.23	Porosity (%)	2.01
Fe_2O_3	10.58	Wet Bulk Density (g/cc)	2.92
MgO	5.99	Grain Density (g/cc)	2.96
CaO	13.59		
Na_2O	2.20		
K_2O	< 0.03		
TiO_2	1.21		
P_2O_5	0.13		
MnO	.18		
LOI	1.15		
H_2O^+	0.50		
H_2O^-	N.D.		
CO_2	0.78		

Sr	112.4
Zr	68.3
Y	23.0
Nb	2.3

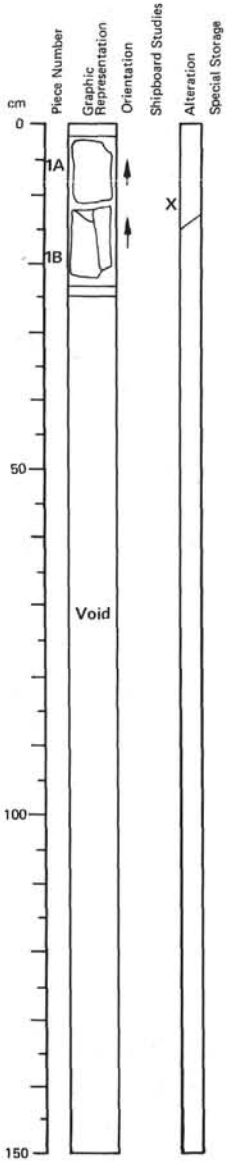


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 7	6

Visual Description

Sparsely phyric massive basalt. Basalt is medium to dark gray, weakly altered. Plagioclase phenocrysts 3-5%, <6 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 3%, <2 mm, fresh, often in glomerophyric clots with plagioclase. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Vesicles 1%, filled with carbonate and smectite. Prominent vein in piece 3 is filled with smectite; vein in piece 8B is filled with carbonate. Slickensides are present on pieces 4B and 6.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 7	7

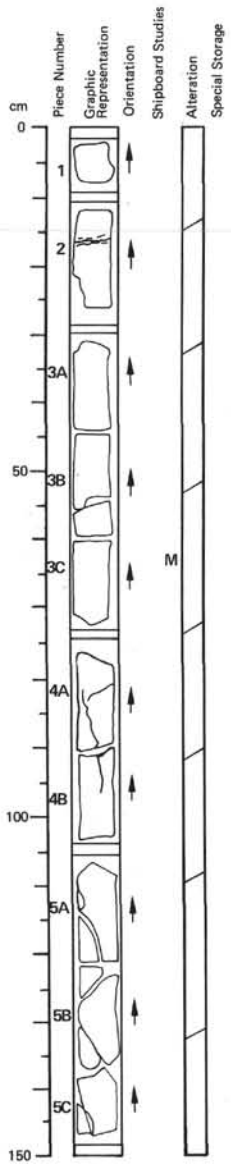
Visual Description

Sparsely phyric massive basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 3-5%, <5 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 1%, <3 mm, fresh. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Vesicles <1%, <1 mm, filled with smectite and carbonate.

Shipboard Data

Bulk Analysis: 11-13 cm

SiO_2	49.26
Al_2O_3	15.55
Fe_2O_3	10.11
MgO	6.53
CaO	14.56
Na_2O	2.26
K_2O	0.06
TiO_2	1.30
P_2O_5	0.14
MnO	.15
LOI	1.86
H_2O^+	0.73
H_2O^-	N.D.
CO_2	1.24



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

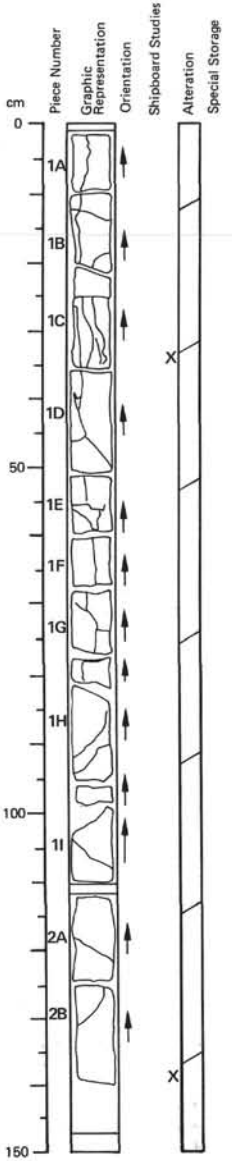
LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 8	1

Visual Description

Sparsely phyric massive basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 3-5%, <6 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 2%, <2 mm, fresh, often in subophitic clots with plagioclase. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Notable veins in pieces 2, 3B, and 4B are filled with carbonate, smectite and minor pyrite.

Shipboard Data

Magnetic Data:	64-66 cm
NRM Intensity (emu/cc)	2.35×10^{-3}
NRM Inclination	-22.5°
Stable Inclination	-53.4°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

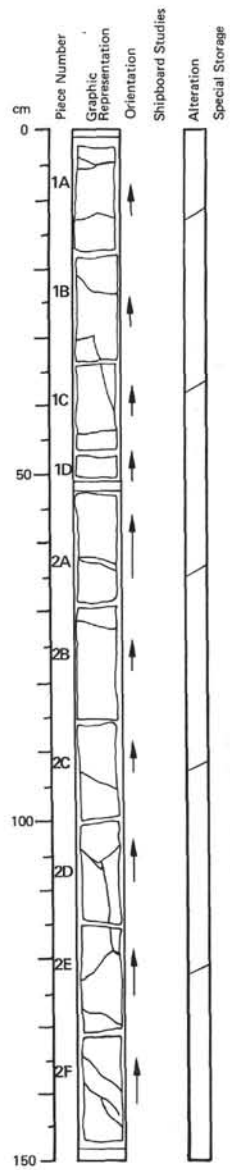
LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 8	2

Visual Description

Moderately phyric massive basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 3-5%, <8 mm, fresh; olivine phenocryst 1%, <1 mm, altered to smectite; clinopyroxene phenocrysts <1%, <2 mm, fresh, often in subophitic clots with plagioclase. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Vesicles <1%, <2 mm, filled with carbonate and smectite with minor pyrite. Scattered veinlets are filled with carbonate and smectite.

Shipboard Data

Bulk Analysis:	35-37 cm	140-142 cm
SiO_2	48.94	49.10
Al_2O_3	15.00	14.76
Fe_2O_3	10.37	10.60
MgO	6.48	6.30
CaO	13.92	13.92
Na_2O	2.17	2.18
K_2O	0.06	0.06
TiO_2	1.25	1.29
P_2O_5	0.14	0.15
MnO	.16	.18
LOI	1.35	1.12
H_2O^+	0.49	0.48
H_2O^-	N.D.	N.D.
CO_2	1.00	0.92
Sr	124.0	N.D.
Zr	70.2	N.D.
Y	25.6	
Nb	1.9	

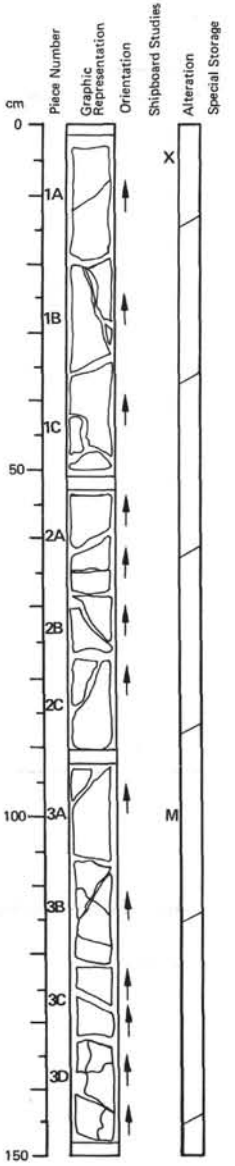


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	78	3

Visual Description

Sparsely phyric massive basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 5%, <7 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite; clinopyroxene phenocrysts <1%, <2 mm, fresh, often in subophitic clots with plagioclase. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Vesicles <1%, <1 mm, filled with carbonate. Prominent veins in pieces 1 and 2 are filled with smectite, carbonate and minor pyrite.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	78	4

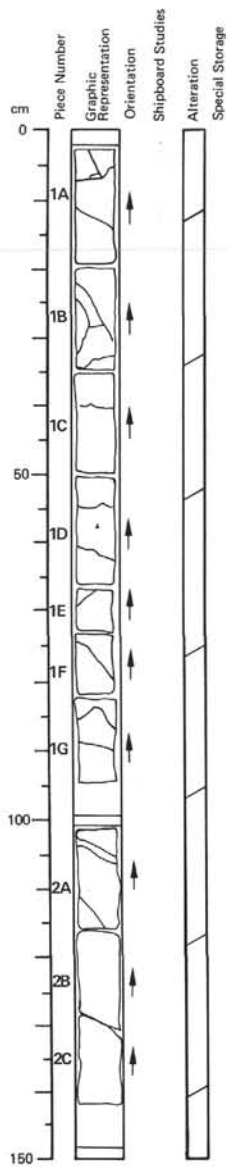
Visual Description

Sparsely phyric massive basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 3-5%, <6 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 2%, <2 mm, fresh. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Vesicles 1%, <0.2 mm, filled with carbonate. Notable veins in pieces 1B, 2B, and 3D are filled with smectite and minor pyrite. Slickensides are present on pieces 3A and 3D.

Shipboard Data

Bulk Analysis: 0-3 cm	
SiO_2	49.64
Al_2O_3	15.22
Fe_2O_3	10.75
MgO	6.44
CaO	13.34
Na_2O	2.23
K_2O	< 0.03
TiO_2	1.28
P_2O_5	0.15
MnO	.17
LOI	1.23
H_2O^+	0.52
H_2O^-	N.D.
CO_2	0.68

Magnetic Data:	101-103 cm
NRM Intensity (emu/cc)	6.28×10^{-3}
NRM Inclination	-57.9°
Stable Inclination	-58.9°

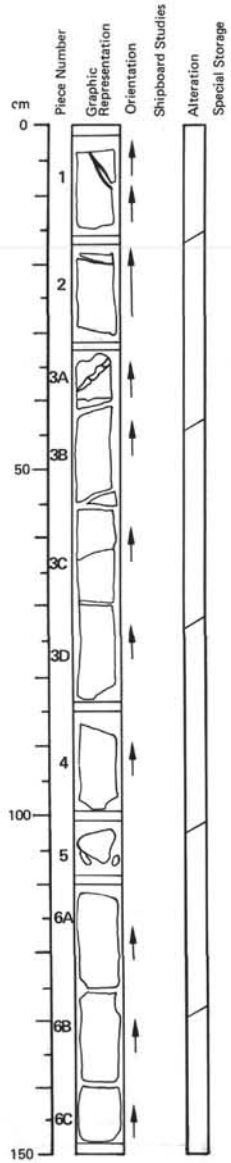


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 8	5

Visual Description

Sparsely phyric massive basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 3%, <6 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite; clinopyroxene phenocrysts <1%, <2 mm, fresh, often in subophitic clots with plagioclase. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Vesicles <1%, filled with carbonate. Prominent veins in pieces 1G and 2A are filled with smectite and carbonate.

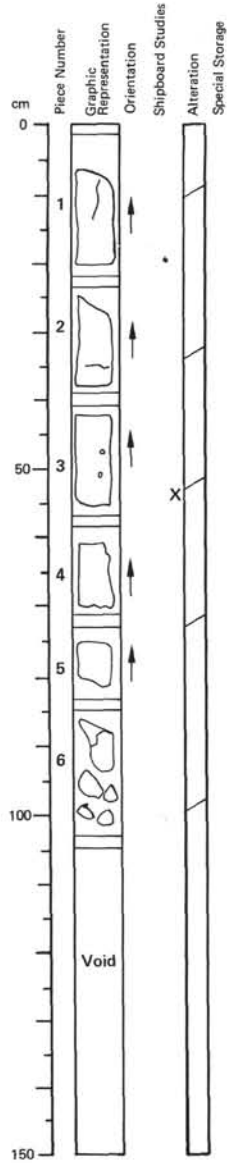


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 8	6

Visual Description

Sparsely phyric massive basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 1-2%, <4 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 2%, <1 mm, fresh. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Prominent veins in pieces 2, 3A, and 3C are filled with carbonate and smectite. Slickensides are present on piece 1.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	7 8	7

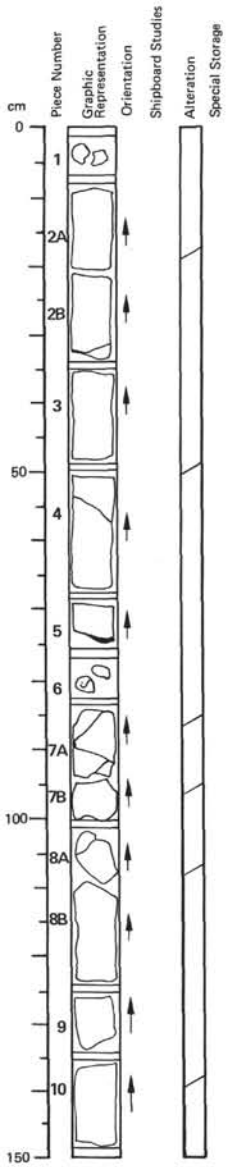
Visual Description

Very sparsely phyric massive basalt. Basalt is medium to dark gray; weakly altered. Plagioclase phenocrysts 1%, < 2 mm, fresh; olivine phenocrysts < 1%, < 1 mm, altered to smectite. Groundmass is holocrystalline, coarse-grained and subophitic. Vesicles are present in piece 1, 3 and 6, filled with carbonate, smectite and minor pyrite.

Shipboard Data

Bulk Analysis: 57-59 cm

SiO_2	50.25
Al_2O_3	15.15
Fe_2O_3	10.64
MgO	6.74
CaO	13.29
Na_2O	2.23
K_2O	< 0.03
TiO_2	1.32
P_2O_5	0.12
MnO	.19
LOI	1.24
H_2O^+	0.56
H_2O^-	N.D.
CO_2	0.78

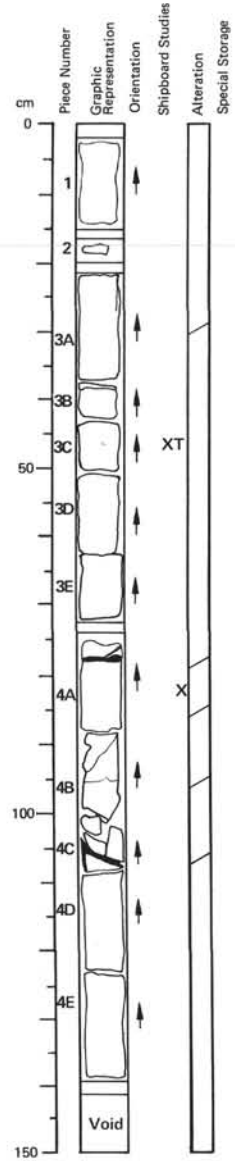


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	7 9	1

Visual Description

Aphyric basalt flow and sparsely phyric basalt dike. Section consists chiefly of aphyric basalt flow cut by a dike between 75 and 110 cm. Basalt flow is medium to dark gray; weakly altered. Plagioclase phenocrysts < 1%, <3 mm; clinopyroxene phenocrysts < 1%, fresh. Groundmass is holocrystalline, medium-grained, subophitic. Large vesicle in piece 10 is filled with carbonate and smectite. Piece 1 consists of small fragment of altered sediment, probably slumped into the hole. Dike consists of greenish-gray, moderately altered basalt. Plagioclase phenocrysts < 1%, <1 mm, fresh; olivine phenocrysts 2%, <1 mm. Groundmass is fine-grained to glassy; chilled margins are present on both upper and lower contacts; glass is altered to smectite.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 9	2

Visual Description

Aphyric basalt flow and sparsely phyric basalt dike. Section consists chiefly of aphyric basalt cut by a dike between 88 and 107 cm. Basalt flow is medium gray; relatively fresh. Basalt is aphyric, holocrystalline, medium- to coarse-grained, subophitic. Vesicles <1%, filled with carbonate and smectite, not uniformly distributed. Minor carbonate and pyrite are disseminated in the groundmass. Dike consists of greenish-gray, moderately altered, sparsely phyric basalt. Plagioclase phenocrysts 5%, <2 mm, fresh; olivine phenocrysts 3%, <0.5 mm, altered to smectite; clinopyroxene phenocrysts 1%, <1 mm, fresh. Groundmass is fine-grained to glassy; glassy margins are present on top and bottom of the dike; glass is mostly altered to smectite. Scattered veinlets are filled with smectite and pyrite.

Thin Section Description

Location: 48 cm

Texture: coarse-grained, subophitic

Phenocrysts: none

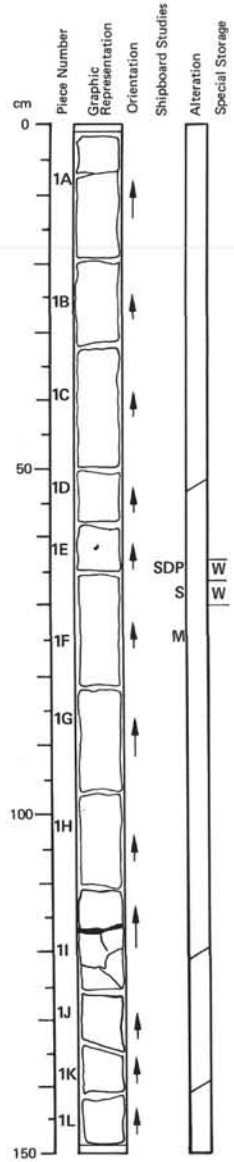
Groundmass: plagioclase 50%, <5 mm; euhedral; clinopyroxene 35%; opaques 5%, <0.5 mm, subhedral; interstitial material 10%, altered to smectite

Vesicles: <1%, 1 mm, round

Alteration: interstitial material to smectite; carbonate fills vesicles

Shipboard Data

Bulk Analysis:	46-48 cm	81-83 cm
SiO_2	49.33	47.74
Al_2O_3	15.38	13.90
Fe_2O_3	10.41	11.72
MgO	6.36	7.66
CaO	13.80	13.37
Na_2O	2.24	2.17
K_2O	0.03	< 0.03
TiO_2	1.28	1.39
P_2O_5	0.14	0.12
MnO	.20	.18
LOI	1.42	1.44
H_2O^+	0.37	1.37
H_2O^-	N.D.	N.D.
CO_2	1.06	1.83
Sr	104.5	99.6
Zr	73.0	76.4
Y	25.3	25.9
Nb	3.6	1.9



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 9	3

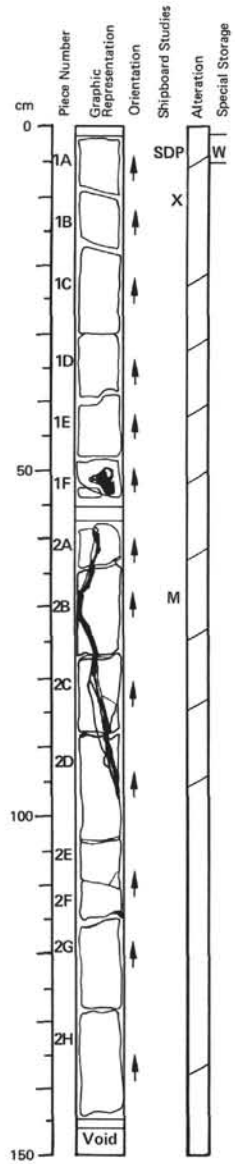
Visual Description

Aphyric basalt flow and sparsely phyric basalt dike. Upper 115 cm of the section consist of aphyric basalt flow and lower 35 cm of basalt dike. Flow consists of medium gray, relatively fresh, aphyric basalt. Rock is holocrystalline, medium- to coarse-grained, subophitic. Vesicles 1%, filled with carbonate and smectite. Dike consists of medium gray, slightly altered, sparsely phyric basalt. Plagioclase phenocrysts 1-2%, <1 mm, fresh; olivine phenocrysts 2-3%, <1 mm, altered to smectite. Groundmass is fine-grained to glassy; glass margin occurs at 115 cm.

Shipboard Data

Magnetic Data:	74-76 cm
NRM Intensity (emu/cc)	1.36×10^{-3}
NRM Inclination	13.1°
Stable Inclination	-44.0°

Physical Property Data:	65-67 cm	67-69 cm
$\bar{V}p$ (km/sec)	6.08	6.04
Porosity (%)	1.74	
Wet Bulk Density (g/cc)	2.94	
Grain Density (g/cc)	2.98	



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	79	4

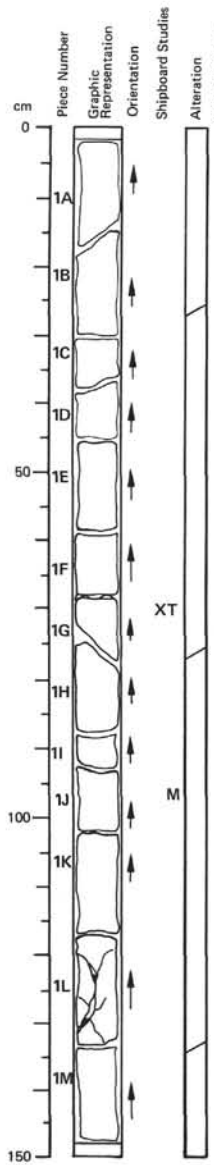
Visual Description

Moderately phyric basalt dike and sparsely phyric basalt flow. Dike continues from Section 3 and extends from top of Section 4 to 95 cm. The lower part of the section is a massive basalt flow. The contact between the flow and dike is very steep, extending from 58 to 96 cm. Dike consists of gray to greenish-gray, moderately altered, sparsely phyric basalt. Plagioclase phenocrysts 10-15%, ≤5 mm, fresh; olivine phenocrysts 4%, <2 mm, altered to smectite; clinopyroxene phenocrysts 1%, ≤3 mm, fresh. Groundmass is fine-grained to glassy; glassy zone marks contact of dike and flow; glass is altered to smectite and minor pyrite. Sparse veins are filled with smectite and pyrite. Flow consists of gray, relatively fresh, sparsely phyric basalt. Plagioclase phenocrysts 3%, ≤8 mm, fresh. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Vesicles <1%, ≤3 mm, filled with carbonate. Sparse veins are filled with smectite and pyrite.

Shipboard Data

Bulk Analysis: 9-12 cm	
SiO_2	48.94
Al_2O_3	14.99
Fe_2O_3	11.26
MgO	7.69
CaO	13.51
Na_2O	2.22
K_2O	< 0.03
TiO_2	1.35
P_2O_5	0.12
MnO	.19
LOI	1.32
H_2O^+	0.65
H_2O^-	N.D.
CO_2	0.77
Sr	97.8
Zr	73.9
Y	26.5
Nb	2.7

Magnetic Data:	69-71 cm
NRM Intensity (emu/cc)	17.70×10^{-3}
NRM Inclination	+57.5°
Stable Inclination	+58.5°
Physical Property Data:	2-4 cm
$\bar{V}p$ (km/sec)	6.01
Porosity (%)	1.98
Wet Bulk Density (g/cc)	2.95
Grain Density (g/cc)	2.99



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	79	5

Visual Description

Sparsely phyric massive basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 5-8%, ≤5 mm, fresh; olivine phenocrysts 3%, <1 mm, altered to smectite; clinopyroxene phenocrysts 4%, <2 mm, fresh. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Prominent vein in piece 1E is filled with smectite and carbonate

Thin Section Description

Location: 68 cm

Texture: porphyritic - subophitic to intersertal

Phenocrysts: olivine 3%, <1 mm, euhedral; plagioclase 8%, ≤3 mm, subhedral; clinopyroxene 1%, ≤1.5 mm, rounded

Groundmass: olivine 8%, 0.2 mm, subhedral; plagioclase 50%, <1 mm, subhedral; clinopyroxene 24%, ≤0.5 mm, subophitic; glass 5%, interstitial

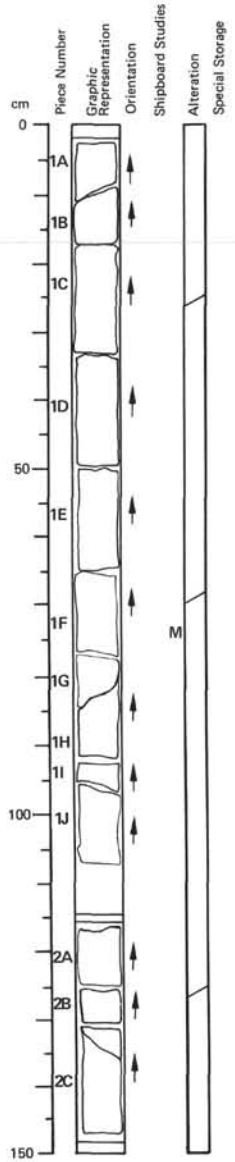
Vesicles: 1%, 1 mm, round to irregular

Alteration: olivine to smectite; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 67-69 cm	
SiO_2	50.25
Al_2O_3	16.36
Fe_2O_3	10.84
MgO	5.86
CaO	13.36
Na_2O	2.24
K_2O	< 0.03
TiO_2	1.31
P_2O_5	0.15
MnO	.17
LOI	0.84
H_2O^+	0.46
H_2O^-	N.D.
CO_2	0.55
Sr	103.8
Zr	71.8
Y	26.6
Nb	2.0

Magnetic Data:	96-98 cm
NRM Intensity (emu/cc)	11.11×10^{-3}
NRM Inclination	+50.2°
Stable Inclination	+49.7°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

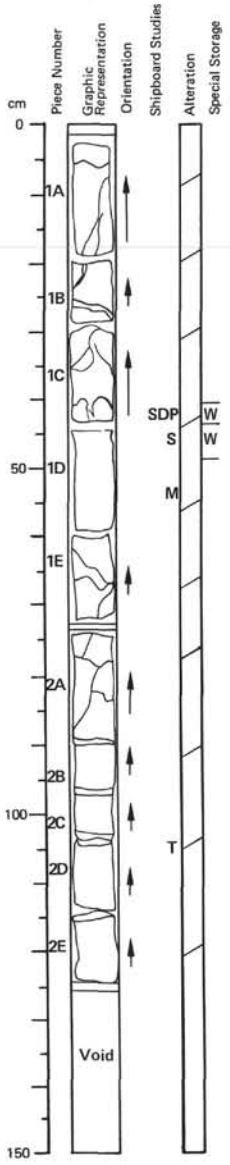
LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 9	6

Visual Description

Sparsely phyric massive basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 2-8%, <8 mm, fresh, increasing in abundance downward; olivine phenocrysts 1%, <1 mm, partly replaced by smectite. Groundmass is fine- to medium-grained with some interstitial glass altered to smectite. Vesicles 1%, filled with smectite and carbonate. Scattered veins are also filled with smectite and carbonate.

Shipboard Data

Magnetic Data:	75-77 cm
NRM Intensity (emu/cc)	9.45×10^{-3}
NRM Inclination	-56.9°
Stable Inclination	-55.3°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	7 9	7

Visual Description

Moderately phyric massive basalt. Basalt is gray to greenish-gray; weakly to moderately altered. Plagioclase phenocrysts 10%, <5 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 1%, <2 mm, fresh. Groundmass is fine-grained; grain size decreases gradually with depth. Numerous fractures and veinlets are filled with smectite.

Thin Section Description

Location: 102 cm

Texture: porphyritic - quench

Phenocrysts: olivine 1%, 0.6 mm, euhedral; plagioclase 12%, <3.5 mm, euhedral; clinopyroxene 1%, 1 mm, anhedral

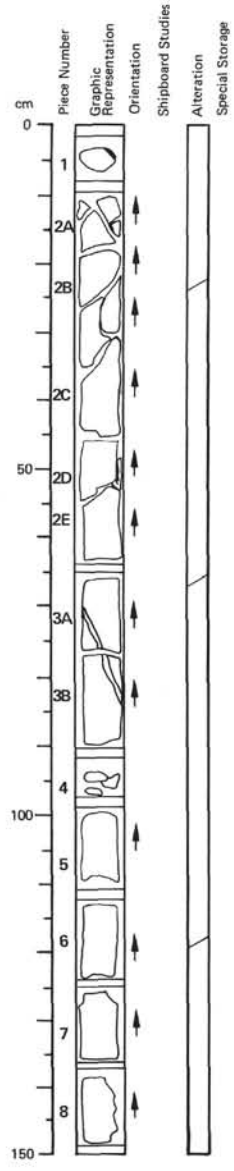
Groundmass: plagioclase 10%, <1 mm, acicular; clinopyroxene 70%, radiating sheaves; opaques 6%, 0.02 mm, euhedral

Vesicles: none

Alteration: olivine to carbonate and smectite

Shipboard Data

Magnetic Data:	52-54 cm	
NRM Intensity (emu/cc)	6.13×10^{-3}	
NRM Inclination	-60.6°	
Stable Inclination	-56.1°	
Physical Property Data:	43-45 cm	46-48 cm
$\overline{V}p$ (km/sec)	6.10	6.15
Porosity (%)	1.68	
Wet Bulk Density (g/cc)	2.90	
Grain Density (g/cc)	2.94	

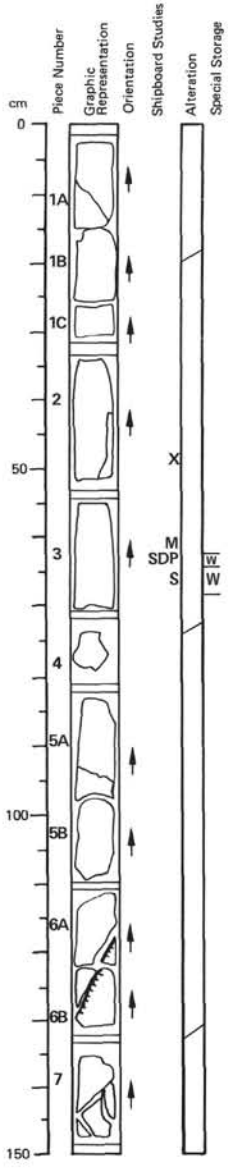


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A	8	0		1

Visual Description

Moderately to sparsely phyric massive basalt. Basalt is medium to dark gray; relatively fresh. Plagioclase phenocrysts 5-8%, ≤5 mm, fresh, phenocrysts abundance decreases slightly with depth; olivine phenocrysts <1%, ≤1 mm, altered to smectite; clinopyroxene phenocrysts <1%, ≤1 mm, fresh. Groundmass is fine- to very fine-grained with grain size increasing downward. Scattered veins are filled with smectite, carbonate and pyrite.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A	8	0		2

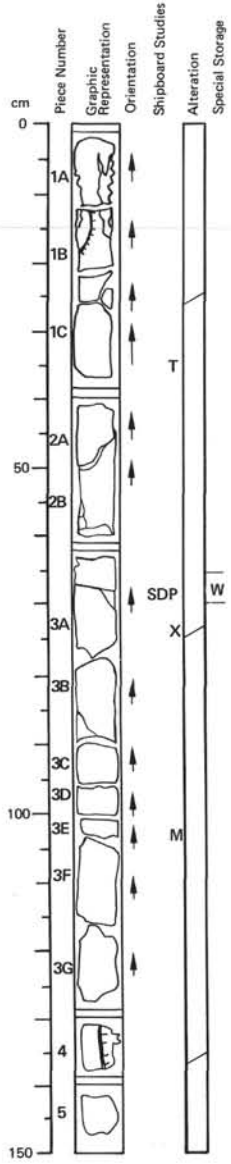
Visual Description

Sparsely phyric massive basalt and moderately phyric basalt dike. Upper 117 cm of the section consist of massive basalt flow and lower 33 cm are composed of a moderately phyric basalt dike. Contact between the two is steep, extending from 117 to 129 cm. The basalt flow is medium gray; relatively fresh. Plagioclase phenocrysts 3-5%, ≤4 mm, fresh; olivine phenocrysts <1%, ≤1 mm, altered to smectite; clinopyroxene phenocrysts <1%, ≤1 mm fresh. Groundmass is medium- to coarse-grained, subophitic. Dike consists of medium gray, relatively fresh basalt. Plagioclase phenocrysts 10-12%, ≤7 mm, fresh; olivine phenocrysts 2%, ≤1 mm, altered to smectite. Groundmass is fine-grained to glassy; glassy chilled zone marks upper contact of dike. Scattered veins are filled with smectite and minor pyrite.

Shipboard Data

Bulk Analysis: 49-51 cm	
SiO_2	49.86
Al_2O_3	16.27
Fe_2O_3	11.02
MgO	6.70
CaO	13.03
Na_2O	2.25
K_2O	< 0.03
TiO_2	1.33
P_2O_5	0.16
MnO	.17
LOI	0.58
H_2O^+	0.48
H_2O^-	N.D.
CO_2	0.36
Sr	102.4
Zr	73.7
Y	26.0
Nb	2.1

Magnetic Data:	60-62 cm	
NRM Intensity (emu/cc)	11.34×10^{-3}	
NRM Inclination	+58.6°	
Stable Inclination	+47.2°	
Physical Property Data:	65-67 cm	68-70 cm
$\overline{V}p$ (km/sec)	6.04	5.98
Porosity (%)	1.52	
Wet Bulk Density (g/cc)	2.93	
Grain Density (g/cc)	2.96	



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	8 0	3

Visual Description

Moderately phyric basalt dike and sparsely phyric massive basalt. Basalt dike is a continuation of the dike in Section 2, extending from the top of the section to 140 cm. The host rock, a massive flow, is present only in pieces 1B, 4 and 5. The boundary between the dike and flow, preserved in pieces 1B and 4, is apparently very steep. Dike is medium gray, moderately phyric, relatively fresh basalt. Plagioclase phenocrysts 8-10%, <6 mm, fresh; olivine phenocrysts 1-2%, <1 mm, altered to smectite. Groundmass is fine-grained to glassy; grain size increases slightly from margin to center of dike; glass selvedges are preserved in chill zones in pieces 1B and 4. Minor pyrite is disseminated in groundmass of dike. Minor breccia occurs in pieces 1A and 1B, composed of angular basalt fragments in a matrix of smectite, carbonate, pyrite and quartz(?). Flow consists of medium gray, sparsely phyric, relatively fresh basalt. Plagioclase phenocrysts 3-5%, <4 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite; clinopyroxene phenocrysts <1%, <1 mm, fresh. Groundmass is holocrystalline, medium- to coarse-grained, subophitic.

Thin Section Description

Location: 36 cm

Texture: porphyritic - intergranular to intersertal

Phenocrysts: olivine 2%, <1.5 mm, euhedral; plagioclase 8%, <2 mm, euhedral

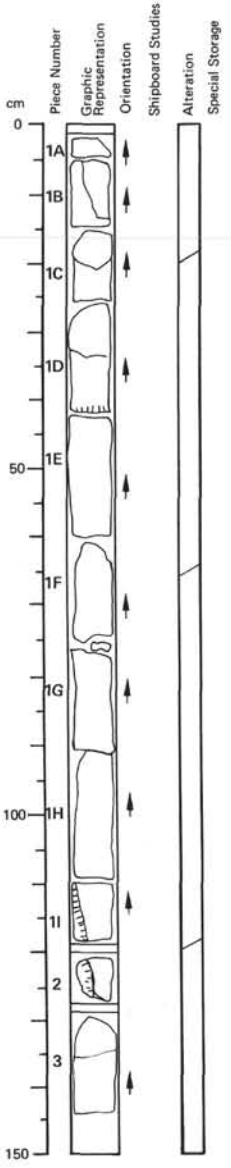
Groundmass: olivine 3%, 0.05 mm, subhedral; plagioclase 42%, 0.25 mm, laths; clinopyroxene 40%, 0.1 mm, granular to acicular; opaques 5%, <0.1 mm, laths and granules

Vesicles: <1%, 0.2 mm, irregular

Alteration: olivine to smectite and carbonate

Shipboard Data

Bulk Analysis: 73-75 cm		Magnetic Data:	104-106 cm
SiO_2	49.31	NRM Intensity (emu/cc)	33.45×10^{-3}
Al_2O_3	16.49	NRM Inclination	+50.1°
Fe_2O_3	10.16	Stable Inclination	+49.4°
MgO	7.54		
CaO	12.97	Physical Property Data:	69-71 cm
Na_2O	2.10	$\overline{V}p$ (km/sec)	5.85
K_2O	< 0.03	Porosity (%)	1.51
TiO_2	1.18	Wet Bulk Density (g/cc)	2.94
P_2O_5	0.09	Grain Density (g/cc)	2.97
MnO	.16		
LOI	0.58		
H_2O^+	0.51		
H_2O^-	N.D.		
CO_2	0.13		
Sr	100.6		
Zr	60.7		
Y	23.1		
Nb	0.6		

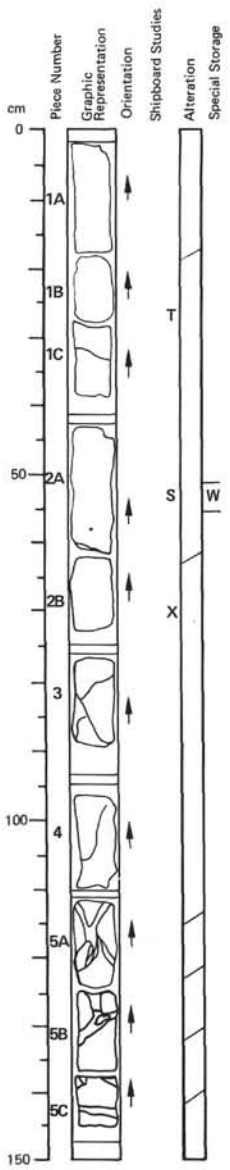


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	8 0	4

Visual Description

Sparsely phyric massive basalt and moderately phyric basalt dikes. Central part of section from 42 to 127 cm is a massive flow. The upper and lower parts consist of dikes intruding the flow. The contact between the dike and flow is steep as seen in piece 1H, 1I, and 2, or flat as in piece 1D. The upper contact of the dike at the top of the section is preserved on back of piece 1A. The massive basalt is medium gray, relatively fresh. Plagioclase phenocrysts 8%, <4 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite; clinopyroxene phenocrysts <1%, <2 mm, fresh, often intergrown with plagioclase in subophitic clots. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Dikes are medium to dark gray, fine-grained, relatively fresh. Plagioclase phenocrysts 10%, <5 mm, fresh; olivine phenocrysts <1%, <2 mm, altered to smectite; clinopyroxene phenocrysts <1%, not definitely identified. Groundmass is very fine-grained to glassy. Glass chill zone is preserved along contacts.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	80	5

Visual Description

Moderately phyric basalt dike and sparsely phyric massive basalt. Dike extends from the top of the section to 110 cm. Flow extends from 110 cm to base of section. The contact between dike and flow is preserved on back of piece 5A. Dike is medium gray; relatively fresh. Phenocryst content varies from 10-20%; plagioclase phenocrysts 10-18%, <5 mm, fresh; olivine phenocrysts 1%, <2 mm, altered to smectite. Groundmass is very fine-grained to glassy; glass chilled zone occurs at contact in piece 5A. A xenolith of the host rock is enclosed in the dike in pieces 2B and 3. The massive flow is gray to greenish-gray, locally red-brown; moderately altered. Plagioclase phenocrysts 5-7%, <5 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite; clinopyroxene phenocrysts <1%, <2 mm, fresh. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Prominent veins are filled with smectite, carbonate, minor pyrite and iron hydroxide.

Thin Section Description

Location: 27 cm

Texture: porphyritic - intergranular

Phenocrysts: olivine 1%, 0.7 mm, euhedral; plagioclase 12%, <3 mm, euhedral

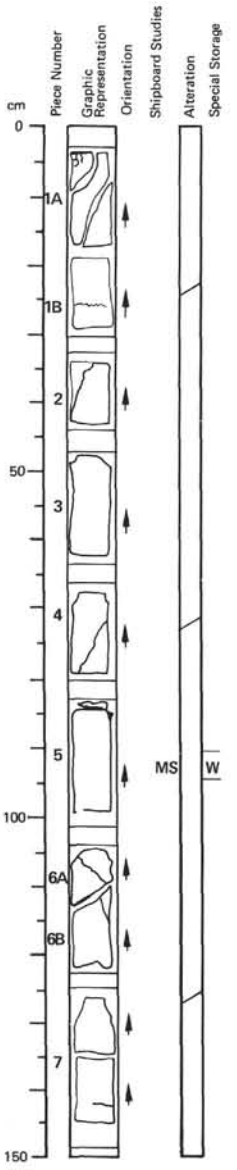
Groundmass: olivine 3%, 0.05 mm, subhedral; plagioclase 40%, 0.3 mm, laths; clinopyroxene 38%, 0.1 mm, granular; opaques 4%, 0.01 mm, granular; glass 2%

Vesicles: <1%, 0.2 mm, round

Alteration: olivine to smectite; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 69-71 cm		Physical Property Data:	52-54 cm
SiO_2	48.93	$\bar{V}p$ (km/sec)	5.78
Al_2O_3	17.41		
Fe_2O_3	9.86		
MgO	6.69		
CaO	13.11		
Na_2O	2.22		
K_2O	0.04		
TiO_2	1.18		
P_2O_5	0.10		
MnO	.14		
LOI	0.66		
H_2O^+	0.66		
H_2O^-	N.D.		
CO_2	0.25		
Sr	106.4		
Zr	66.0		
Y	22.6		
Nb	0.0		



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

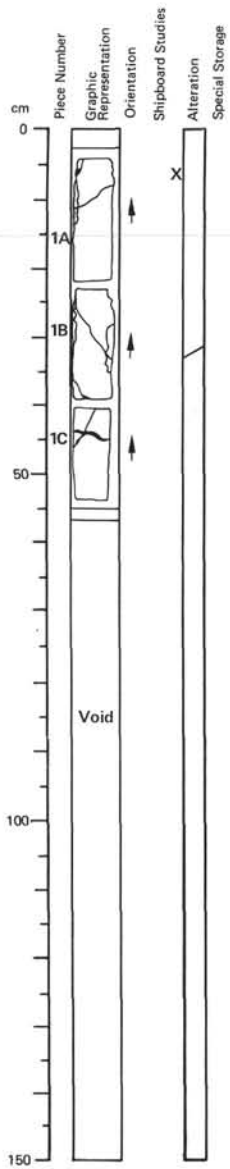
LEG	SITE	HOLE	CORE	SECT.
53	418	A	80	6

Visual Description

Sparsely phyric massive basalt. Basalt is massive, medium-gray; relatively fresh. Plagioclase phenocrysts 5-7%, <8 mm, fresh; olivine phenocrysts <1%, <1mm, altered to smectite; clinopyroxene phenocrysts <1%, <1 mm, fresh, intergrown with plagioclase. Groundmass is medium- to coarse-grained, subophitic. Sparse veinlets are filled with smectite and carbonate. Minor smectite alteration occurs in piece 1A.

Shipboard Data

Magnetic Data:	91-93 cm
NRM Intensity (emu/cc)	5.94×10^{-3}
NRM Inclination	+48.5°
Stable Inclination	+18.4°
Physical Property Data:	91-93 cm
$\bar{V}p$ (km/sec)	6.01



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	8 0	7

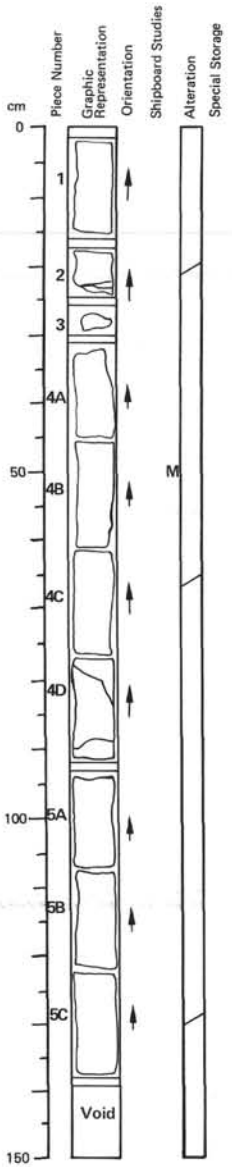
Visual Description

Sparsely phyric massive basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 4-7%, ≤6 mm, fresh; clinopyroxene phenocrysts <1%, ≤1 mm, fresh, intergrown with plagioclase. Groundmass is holocrystalline, medium- to coarse-grained, subophitic.

Shipboard Data

Bulk Analysis: 0-2 cm

SiO_2	48.77
Al_2O_3	16.09
Fe_2O_3	10.95
MgO	6.01
CaO	13.13
Na_2O	2.20
K_2O	< 0.03
TiO_2	1.33
P_2O_5	0.14
MnO	.17
LOI	0.84
H_2O^+	0.39
H_2O^-	N.D.
CO_2	0.49
Sr	107.3
Zr	76.0
Y	26.3
Nb	2.2



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

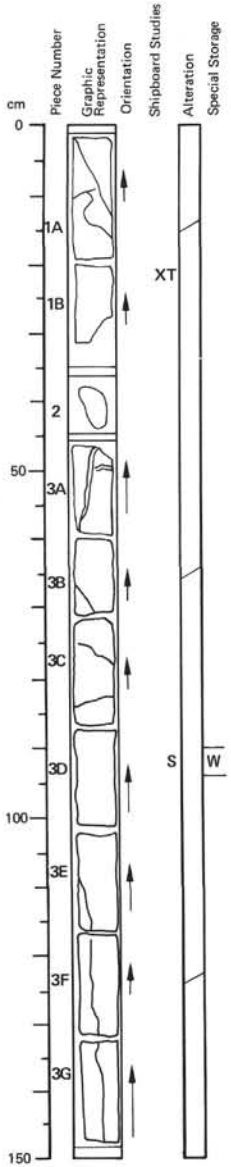
LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	8 1	1

Visual Description

Sparsely phyric massive basalt. Basalt is medium-gray; relatively fresh. Plagioclase phenocrysts 4-7%, ≤6 mm, fresh; olivine phenocrysts <1%, ≤1 mm, altered to smectite; clinopyroxene <1%, ≤2 mm, fresh, intergrown with plagioclase. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Prominent vein in piece 2 is filled with carbonate, smectite and zeolite(?).

Shipboard Data

Magnetic Data:	49-51 cm
NRM Intensity (emu/cc)	14.08×10^{-3}
NRM Inclination	-68.4°
Stable Inclination	-64.6°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	8	1 2

Visual Description

Sparsely phyric massive basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 4-7%, ≤6 mm, fresh; olivine phenocrysts <1%, ≤1 mm, altered to smectite; clinopyroxene phenocrysts <1%, ≤1 mm, fresh, intergrown with plagioclase. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Prominent veins in pieces 3A and 3B is filled with carbonate and smectite.

Thin Section Description

Location: 20 cm

Texture: porphyritic - subophitic to intersertal

Phenocrysts: olivine 2%, ≤1 mm, euhedral; plagioclase 10%, ≤4 mm, euhedral; clinopyroxene 5%, ≤1.5 mm, subophitic

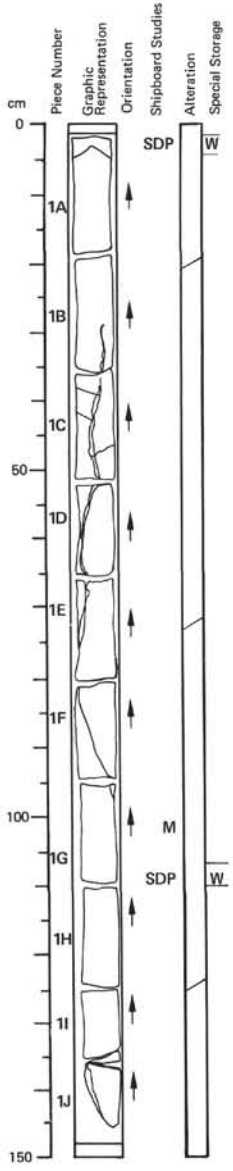
Groundmass: olivine 3%, 0.3 mm, subhedral; plagioclase 40%, ≤0.6 mm, laths; clinopyroxene 30%, 0.2 mm, granular to subophitic; opaques 5%, 0.05 mm, euhedral; glass 5%, interstitial, devitrified

Vesicles: none

Alteration: olivine to smectite

Shipboard Data

Bulk Analysis: 19-21 cm		Physical Property Data:	92-94 cm
SiO_2	49.52	$\overline{V}p$ (km/sec)	5.78
Al_2O_3	15.54		
Fe_2O_3	10.86		
MgO	6.58		
CaO	13.15		
Na_2O	2.35		
K_2O	< 0.03		
TiO_2	1.33		
P_2O_5	0.13		
MnO	.17		
LOI	0.73		
H_2O^+	0.43		
H_2O^-	N.D.		
CO_2	0.54		



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

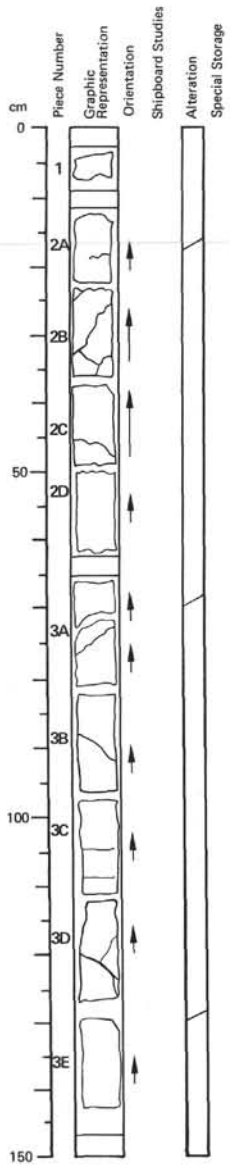
LEG	SITE	HOLE	CORE	SECT.
53	418	A	8	1 3

Visual Description

Sparsely phyric massive basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 3-5%, ≤5 mm, fresh; olivine phenocrysts 1%, ≤1 mm, altered to smectite; clinopyroxene phenocrysts <1%, ≤2 mm, fresh. Groundmass is holocrystalline, medium- to coarse-grained, subophitic; pieces 1A, 1D, 1H and 1I have irregular patches of finer-grained material. Scattered veins are filled with smectite and carbonate; a thick carbonate vein occurs in piece 1J. Minor pyrite is disseminated in the groundmass.

Shipboard Data

Magnetic Data:	103-105 cm	
NRM Intensity (emu/cc)	5.08×10^{-3}	
NRM Inclination	-83.2°	
Stable Inclination	-66.1°	
Physical Property Data:	2-4 cm	108-110 cm
$\overline{V}p$ (km/sec)	5.78	6.04
Porosity (%)	1.51	2.78
Wet Bulk Density (g/cc)	2.93	2.93
Grain Density (g/cc)	2.99	2.99

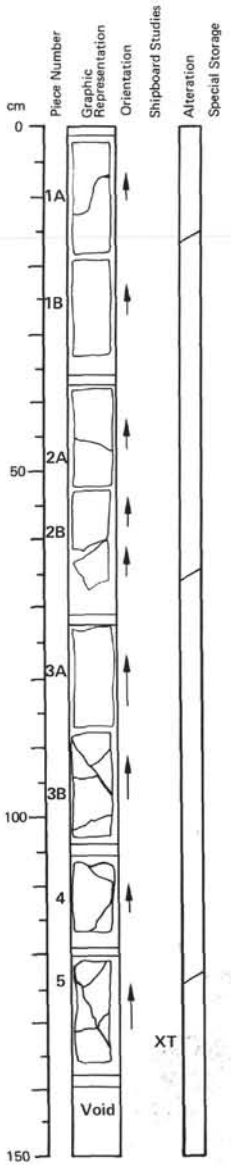


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A	8	1	4	

Visual Description

Sparsely phyric massive basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 3-6%, <6 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite; clinopyroxene phenocrysts <1%, <2 mm, fresh. Groundmass is holocrystalline, medium- to coarse-grained, subophitic; scattered finer-grained patches are locally present. Sparse fractures are filled with smectite, carbonate and zeolite(?).



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A	8	1	5	

Visual Description

Sparsely to moderately phyric massive basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 5-10%, <3 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 1%, <2 mm, fresh, in subophitic clots with plagioclase. Groundmass is holocrystalline, fine- to coarse-grained, subophitic; in pieces 2B and 5 texture is mottled with fine-grained and coarse-grained patches. Sparse veins are filled with carbonate, smectite and pyrite. Minor pyrite is also disseminated in the groundmass.

Thin Section Description

Location: 134 cm

Texture: porphyritic - quench

Phenocrysts: olivine 1%, <1 mm, euhedral; plagioclase 12%, <4 mm, euhedral; clinopyroxene 2%, <0.5 mm, anhedral

Groundmass: olivine 2%, 0.3 mm, euhedral; plagioclase 10%, <0.6 mm, skeletal; clinopyroxene 68%, radiating sheaves; opaques 5%, 0.02 mm, granular

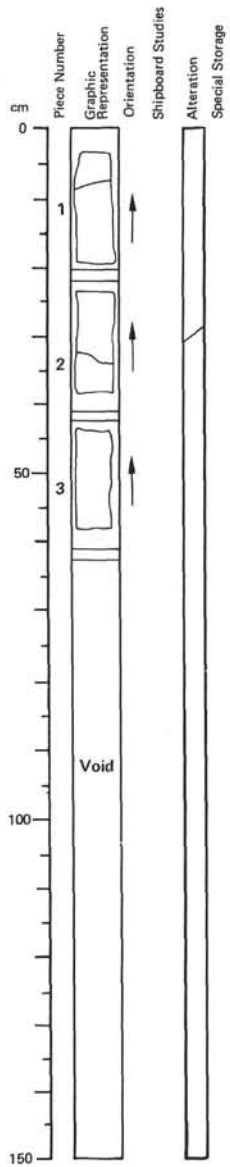
Vesicles: none

Alteration: olivine to smectite and carbonate

Shipboard Data

Bulk Analysis: 133-135 cm

SiO_2	49.51
Al_2O_3	14.87
Fe_2O_3	11.43
MgO	7.35
CaO	12.50
Na_2O	2.35
K_2O	< 0.03
TiO_2	1.39
P_2O_5	0.13
MnO	.19
LOI	0.83
H_2O^+	0.44
H_2O^-	N.D.
CO_2	0.29
Sr	99.8
Zr	78.9
Y	29.1
Nb	3.0

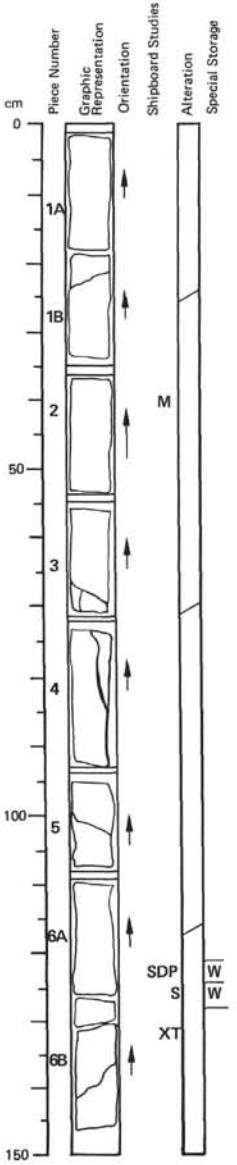


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A		8	1	6

Visual Description

Sparsely phyric massive basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 3-5%, <7 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite; clinopyroxene phenocrysts <1%, <2 mm, fresh, intergrown with plagioclase. Groundmass is holocrystalline with irregular patches of fine-grained and coarse-grained basalt giving a mottled texture.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A		8	2	1

Visual Description

Sparsely to moderately phyric massive basalt. Basalt is medium gray; relatively fresh. Phenocryst content increases gradually with depth. Plagioclase phenocrysts 3-8%, <8 mm, fresh; olivine phenocrysts 3%, <1 mm, altered to smectite; clinopyroxene phenocrysts 3%, <2 mm, fresh. Groundmass is holocrystalline, medium- to fine-grained, subophitic; grain size decreases gradually with depth. Fine-grained patches and schlieren occur throughout the section and are prominent in piece 6B.

Thin Section Description

Location: 135 cm

Texture: ophimottled to intersertal

Phenocrysts: plagioclase 1%, <2.5 mm, subhedral

Groundmass: olivine 3%, <0.5 mm, euhedral; plagioclase 50%, 1 mm, subhedral; clinopyroxene 31%, 0.2 mm, granular to subophitic; opaques 5%, 0.05 mm, euhedral; glass 10%, interstitial patches, devitrified

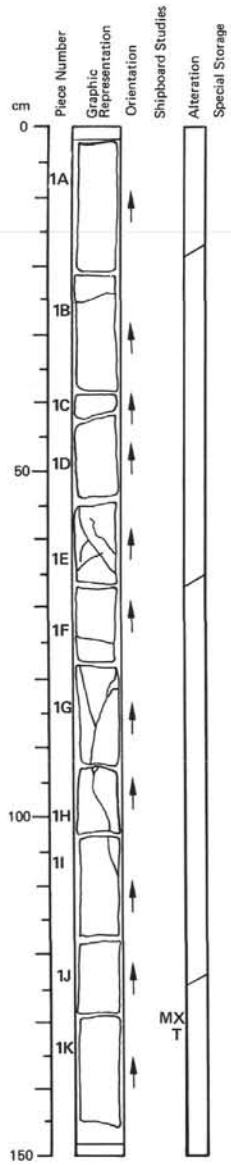
Vesicles: none

Alteration: olivine to smectite

Shipboard Data

Bulk Analysis: 133-137 cm	
SiO_2	50.05
Al_2O_3	13.41
Fe_2O_3	12.42
MgO	7.70
CaO	11.95
Na_2O	2.35
K_2O	< 0.03
TiO_2	1.57
P_2O_5	0.13
MnO	.19
LOI	0.34
H_2O^+	0.49
H_2O^-	N.D.
CO_2	0.23
Sr	91.9
Zr	89.4
Y	32.0
Nb	3.6

Magnetic Data:	41-43 cm	
NRM Intensity (emu/cc)	1.91×10^{-3}	
NRM Inclination	66.9°	
Stable Inclination	-57.0°	
Physical Property Data:	122-124 cm	125-127 cm
$\overline{V}p$ (km/sec)	5.78	5.89
Porosity (%)	1.68	
Wet Bulk Density (g/cc)	2.96	
Grain Density (g/cc)	2.99	



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	8 2	2

Visual Description

Sparsely to moderately phyric massive basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 5%, ≤ 10 mm, fresh; olivine phenocrysts 1-2%, ≤ 1 mm, altered to smectite; clinopyroxene phenocrysts 2%, ≤ 1 mm, fresh. Groundmass is holocrystalline, medium-grained, subophitic. Fine-grained schlieren occur in piece 1D. Veins are common, filled with smectite, carbonate and silica. Minor pyrite is disseminated in the groundmass.

Thin Section Description

Location: 131 cm

Texture: porphyritic - quench

Phenocrysts: olivine 3%, ≤ 1 mm, euhedral; plagioclase 8%, ≤ 1.5 mm, euhedral; clinopyroxene 4%, subophitic clots

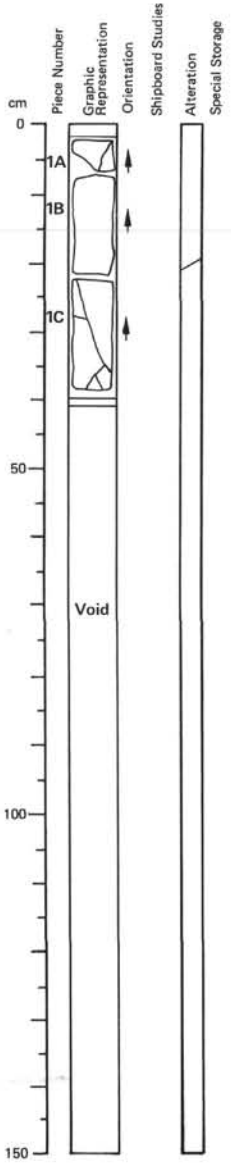
Groundmass: olivine 2%, <0.2 mm, subhedral; plagioclase 30%, 0.3 mm, acicular; clinopyroxene 48%, radiating sheaves; opaques 5%, 0.05 mm, granular

Vesicles: <1%, 0.2 mm, round

Alteration: olivine to smectite; smectite fills vesicles

Shipboard Data

Bulk Analysis: 130-133 cm		Magnetic Data:	129-131 cm
SiO_2	49.05	NRM Intensity (emu/cc)	11.74×10^{-3}
Al_2O_3	15.60	NRM Inclination	-53.2°
Fe_2O_3	10.85	Stable Inclination	-57.5°
MgO	7.21		
CaO	12.58		
Na_2O	2.20		
K_2O	< 0.03		
TiO_2	1.27		
P_2O_5	0.10		
MnO	.17		
LOI	0.68		
H_2O^+	0.49		
H_2O^-	N.D.		
CO_2	0.23		
Sr	98.2		
Zr	72.9		
Y	26.1		
Nb	1.4		

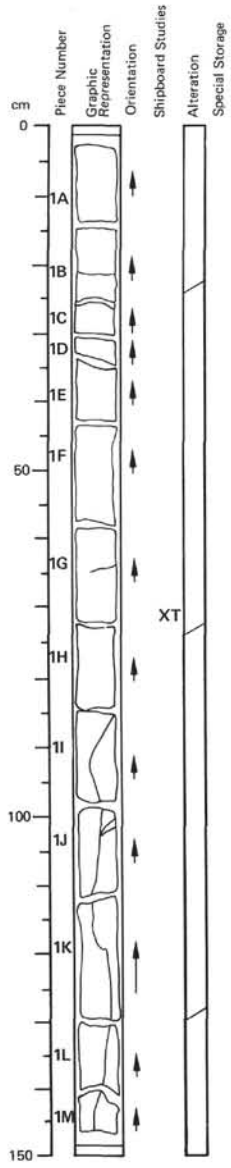


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	8 2	C C

Visual Description

Moderately phyric massive basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 8%, ≤ 10 mm, fresh; olivine phenocrysts 2%, ≤ 1 mm, altered to smectite; clinopyroxene phenocrysts 1%, ≤ 2 mm, fresh. Groundmass is holocrystalline, very fine-grained. Vesicles <1%, filled with carbonate. Sparse veins are also filled with carbonate.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	8 3	1

Visual Description

Sparsely to moderately phyric massive basalt. Basalt is medium-gray; relatively fresh. Plagioclase phenocrysts 8%, <8 mm, fresh; olivine phenocrysts 3%, <1 mm, altered to smectite; clinopyroxene phenocrysts 2%, <2 mm, fresh, often in subophitic clots with plagioclase. Groundmass is holocrystalline, fine-grained; aphyric zones in pieces 1B and 1D probably don't represent cooling breaks. Vesicles 1%, <1 mm, filled with smectite. Scattered veinlets are filled with smectite and minor carbonate. Groundmass is locally altered to smectite, carbonate and minor pyrite.

Thin Section Description

Location: 70 cm

Texture: porphyritic - intersertal to intergranular

Phenocrysts: olivine 2%, <1 mm, euhedral; plagioclase 8%, <3 mm, euhedral; clinopyroxene 3%, <1.5 mm, subophitic

Groundmass: olivine 3%, 0.3 mm, subhedral; plagioclase 40%, 0.6 mm, subhedral; clinopyroxene 34%, 0.25 mm, granular; opaques 5%, 0.1 mm, euhedral; glass 5%, interstitial, devitrified

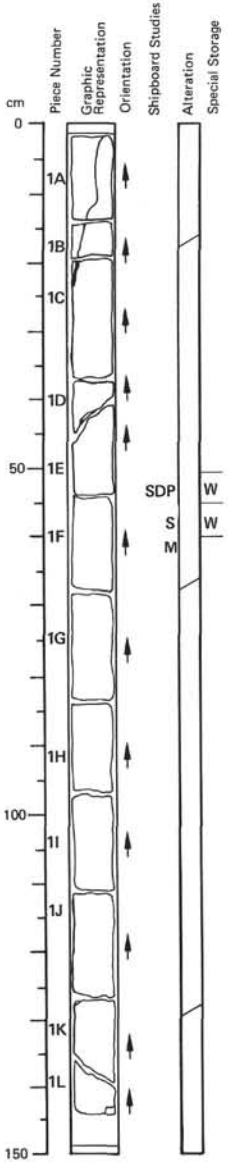
Vesicles: None

Alteration: olivine to smectite and carbonate

Shipboard Data

Bulk Analysis: 71-75 cm

SiO_2	48.65
Al_2O_3	15.92
Fe_2O_3	9.92
MgO	6.92
CaO	13.22
Na_2O	2.26
K_2O	< 0.03
TiO_2	1.18
P_2O_5	0.12
MnO	.15
LOI	0.97
H_2O^+	0.66
H_2O^-	N.D.
CO_2	0.50



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

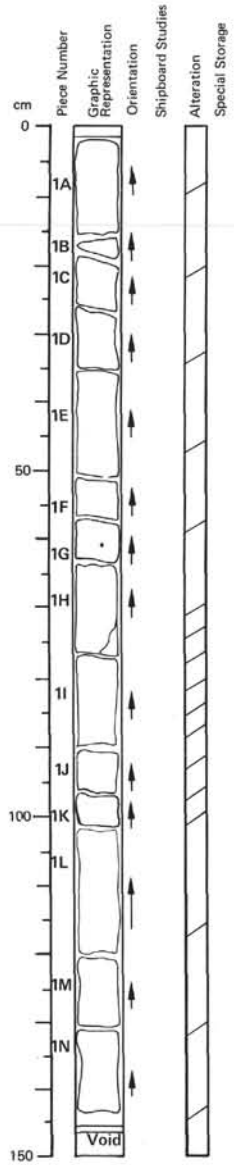
LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	8 3	2

Visual Description

Sparsely to moderately phyric massive basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 3-7%, <8 mm, fresh; olivine phenocrysts 2%, <2 mm, fresh, often in subophitic clots with plagioclase. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Veins are filled with carbonate and green smectite. Slickensides are present on fracture separating pieces 1D and 1E.

Shipboard Data

Magnetic Data:	64-66 cm	
NRM Intensity (emu/cc)	4.74×10^{-3}	
NRM Inclination	-52.2°	
Stable Inclination	-57.3°	
Physical Property Data:	53-55 cm	56-58 cm
$\bar{V}p$ (km/sec)	5.89	5.76
Porosity (%)	1.25	
Wet Bulk Density (g/cc)	2.94	
Grain Density (g/cc)	2.96	

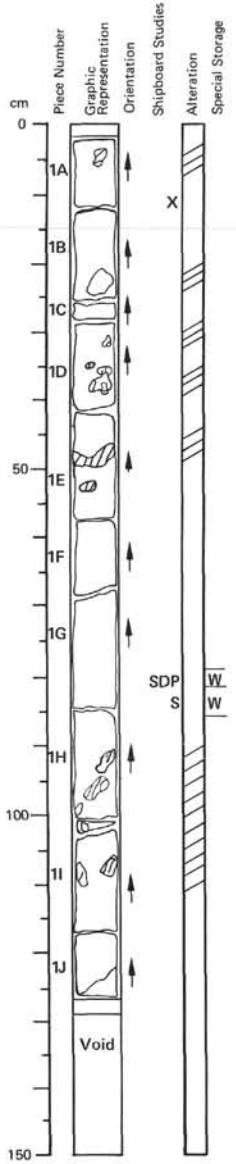


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	8 3	3

Visual Description

Aphyric to sparsely phyric massive basalt. Basalt is medium gray to greenish-gray; moderately altered, except for interval from 70 to 100 cm which is highly altered. Plagioclase phenocrysts 1%, <6 mm, fresh. Groundmass is holocrystalline, fine-grained. Vesicles 0.5%, <1 mm, filled with smectite and carbonate. Groundmass is altered to smectite, zeolite(?) and minor carbonate between 70 and 100 cm. Piece 1E has slickensided surfaces.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	8 3	4

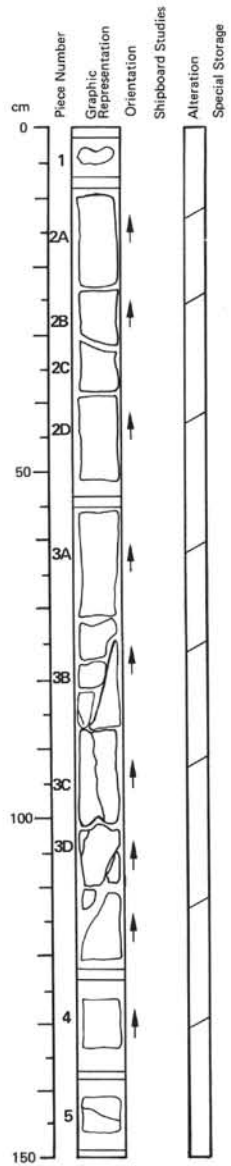
Visual Description

Sparsely phyric massive basalt. Basalt is gray to greenish-gray; relatively fresh except for irregular patches of intense alteration. Plagioclase phenocrysts 5%, <8 mm, fresh or partly altered to smectite. Groundmass is holocrystalline, medium-grained; in altered zones groundmass is replaced by smectite, carbonate and minor pyrite.

Shipboard Data

Bulk Analysis: 8-12 cm	
SiO_2	49.42
Al_2O_3	15.44
Fe_2O_3	9.11
MgO	9.30
CaO	8.34
Na_2O	4.24
K_2O	1.41
TiO_2	0.99
P_2O_5	0.12
MnO	.08
LOI	5.67
H_2O^+	4.56
H_2O^-	N.D.
CO_2	0.92
Sr	174.0
Zr	51.5
Y	17.0
Nb	0.1

Physical Property Data:	79-81 cm	82-84 cm
$\overline{V}p$ (km/sec)	5.08	5.35
Porosity (%)	6.74	
Wet Bulk Density (g/cc)	2.79	
Grain Density (g/cc)	2.92	

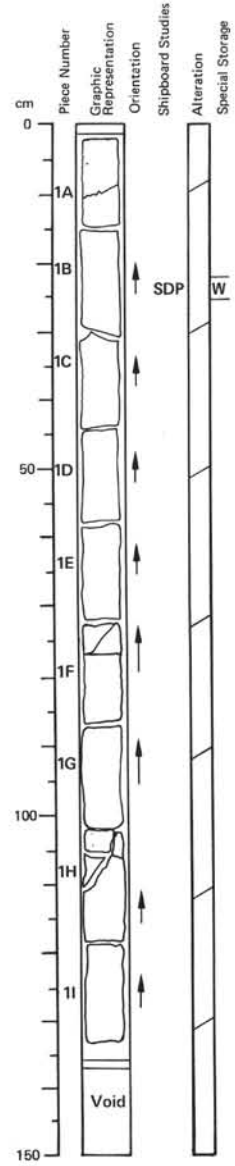


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	8 4	1

Visual Description

Sparsely phyric massive basalt. Basalt is medium gray to greenish-gray; slightly to moderately altered. Plagioclase phenocrysts 2-3%, <5 mm, fresh; olivine phenocrysts 1-2%, <1 mm, fresh; clinopyroxene phenocrysts 1%, <1 mm, fresh, often in subophitic clots with plagioclase. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Veins are filled with smectite and carbonate with minor pyrite. Irregular patches of smectite occur in groundmass. Piece 3B is slickensided. Piece 1 is moderately phyric basalt with very fine-grained groundmass. It probably slumped from higher in the hole.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

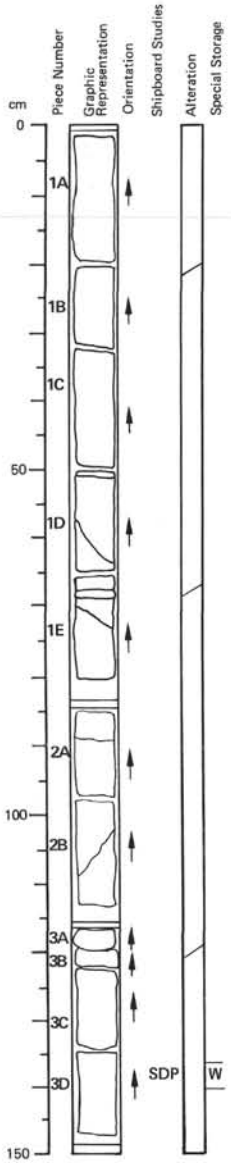
LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	8 4	2

Visual Description

Sparsely to moderately phyric massive basalt. Basalt is medium-gray; slightly altered. Phenocryst content increases slightly with depth. Plagioclase phenocrysts 3-8%, <6 mm, fresh; olivine phenocrysts 2-3%, <1 mm, altered to smectite; clinopyroxene phenocrysts 2%, <2 mm, in subophitic clots with plagioclase. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Groundmass has small patches of smectite and minor pyrite.

Shipboard Data

Physical Property Data:	24-26 cm
$\bar{V}p$ (km/sec)	5.62
Porosity (%)	3.23
Wet Bulk Density (g/cc)	2.94
Grain Density (g/cc)	3.00



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

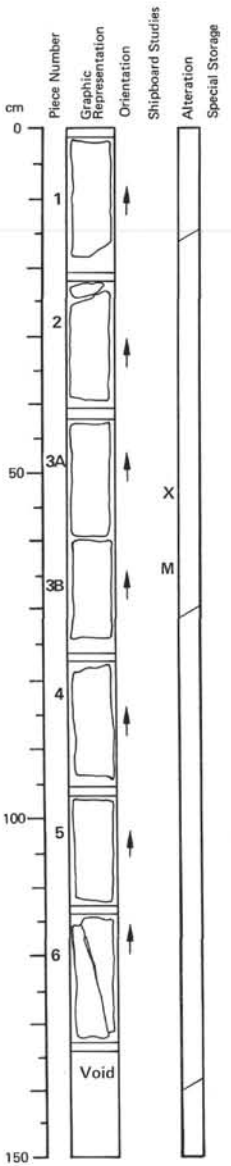
LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	8 4	3

Visual Description

Moderately phyric massive basalt. Basalt is medium-gray; relatively fresh. Plagioclase phenocrysts 5-8%, <8 mm, fresh; olivine phenocrysts <1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 1-3%, <2 mm, often in subophitic clots with plagioclase. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Occasional veinlet is filled with carbonate, smectite and minor pyrite.

Shipboard Data

Physical Property Data:	135-137 cm
$\overline{Vp}$ (km/sec)	5.47
Porosity (%)	1.56
Wet Bulk Density (g/cc)	2.97
Grain Density (g/cc)	3.01



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	8 4	4

Visual Description

Moderately phyric massive basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 5-8%, <2 mm, fresh; olivine phenocrysts 1%, <2 mm, altered to smectite; clinopyroxene phenocrysts 1-3%, <2 mm, usually in subophitic clots with plagioclase. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Prominent veins in pieces 2 and 6 are filled with smectite, minor carbonate and minor pyrite.

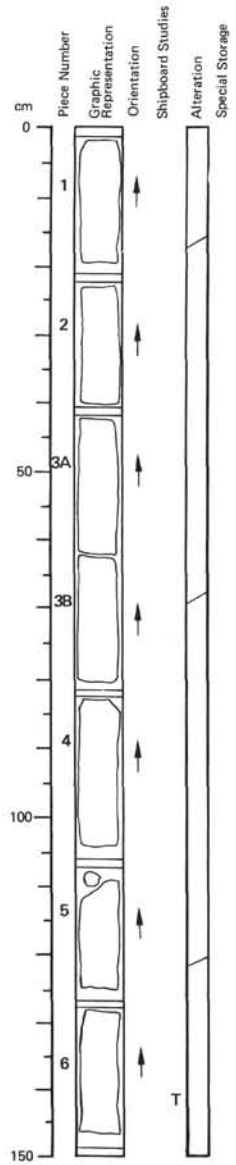
Shipboard Data

Bulk Analysis: 48-57 cm

SiO_2	48.89
Al_2O_3	16.06
Fe_2O_3	11.06
MgO	8.95
CaO	12.69
Na_2O	2.00
K_2O	< 0.03
TiO_2	1.16
P_2O_5	0.09
MnO	.16
LOI	1.15
H_2O^+	0.64
H_2O^-	N.D.
CO_2	0.28
Sr	99.3
Zr	65.7
Y	23.3
Nb	1.5

Magnetic Data: 62-64 cm

NRM Intensity (emu/cc)	4.05×10^{-3}
NRM Inclination	-64.1°
Stable Inclination	-59.7°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	8	1

Visual Description

Moderately phyric massive basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 6-9%, <8 mm, fresh; olivine phenocrysts 5%, <3 mm, mostly fresh, some altered to smectite and carbonate; clinopyroxene phenocrysts 4-8%, <3 mm, fresh, often in subophitic clots with plagioclase. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Rare veinlets are filled with smectite.

Thin Section Description

Location: 143 cm

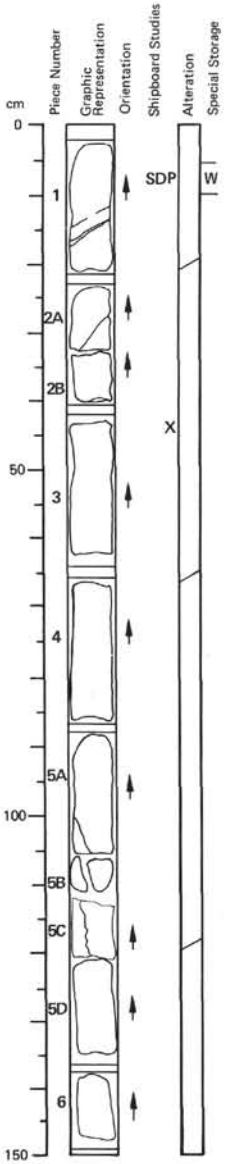
Texture: porphyritic - subophitic

Phenocrysts: olivine 4%, <2.5 mm, subhedral; plagioclase 2.5%, <4 mm, subhedral; clinopyroxene 20%, <4 mm, anhedral to subophitic

Groundmass: olivine 2%, <0.4 mm, subhedral; plagioclase 20%, <0.7 mm, subhedral; clinopyroxene 22%, 0.2 mm, granular; opaques 7%, <0.25 mm, subhedral

Vesicles: none

Alteration: olivine partially altered to smectite



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

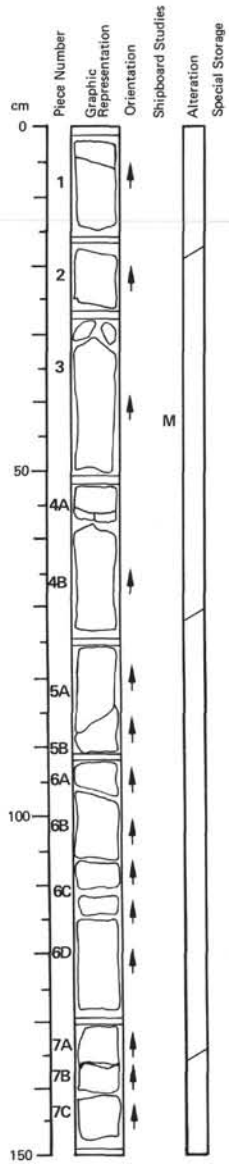
LEG	SITE	HOLE	CORE	SECT.
53	418	A	8	2

Visual Description

Moderately phyric massive basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 4-5%, <5 mm, fresh; olivine phenocrysts 4-5%, <4 mm, partly altered to smectite; clinopyroxene phenocrysts 2%, <2 mm, often in subophitic clots with plagioclase. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Pieces 2A, 5A, 5B, and 5C are slickensided.

Shipboard Data

Bulk Analysis: 42-44 cm		Physical Property Data:	9-11 cm
SiO_2	49.67	$\overline{V}p$ (km/sec)	6.13
Al_2O_3	15.39	Porosity (%)	0.95
Fe_2O_3	10.95	Wet Bulk Density (g/cc)	2.98
MgO	8.00	Grain Density (g/cc)	3.00
CaO	12.90		
Na_2O	2.16		
K_2O	< 0.03		
TiO_2	1.21		
P_2O_5	0.12		
MnO	.17		
LOI	1.54		
H_2O^+	0.96		
H_2O^-	N.D.		
CO_2	0.39		



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

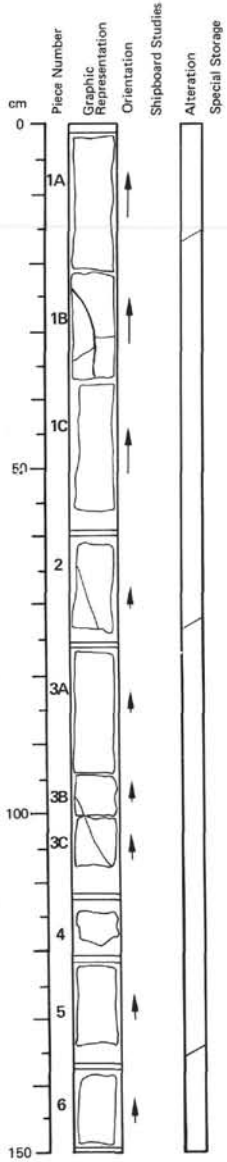
LEG	SITE	HOLE	CORE	SECT.
53	418	A	85	3

Visual Description

Sparsely phyric massive basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 2%, <3 mm, fresh. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Sparse veins are filled with smectite and carbonate.

Shipboard Data

Magnetic Data:	44-46 cm
NRM Intensity (emu/cc)	4.49×10^{-3}
NRM Inclination	-61.2°
Stable Inclination	-59.9°

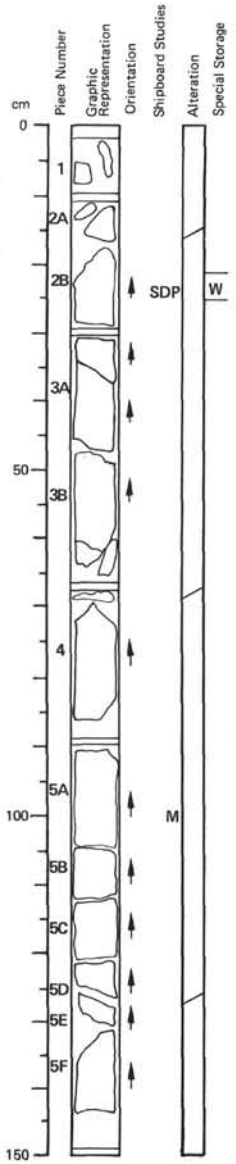


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
53	418	A	85	4

Visual Description

Sparsely phyric massive basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 2-3%, <4 mm, fresh. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Sparse veins are filled with smectite.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	8 5	5

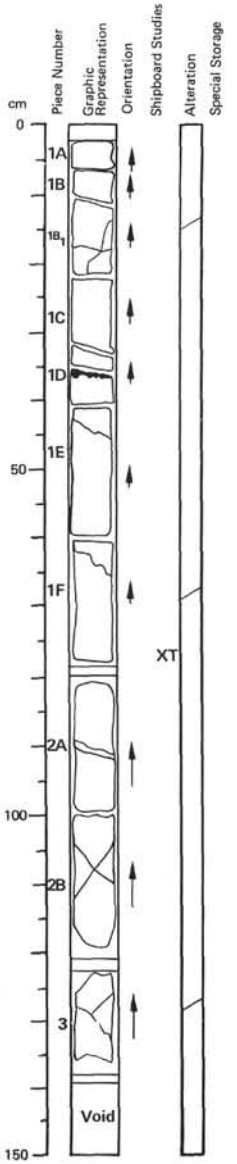
Visual Description

Sparsely phyric massive basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 4%, <3 mm, fresh. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Scattered veins are filled with smectite. Piece 5E is slickensided.

Shipboard Data

Bulk Analysis: 122-124 cm

Magnetic Data:	99-101 cm
NRM Intensity (emu/cc)	7.33×10^{-3}
NRM Inclination	-56.1°
Stable Inclination	-61.5°
Physical Property Data:	21-23 cm
$\overline{V}p$ (km/sec)	6.13
Porosity (%)	1.90
Wet Bulk Density (g/cc)	2.95
Grain Density (g/cc)	2.99



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	8 5	6

Visual Description

Sparsely to moderately phyric massive basalt. Basalt is medium-gray; relatively fresh. Plagioclase phenocrysts 5%, <8 mm, fresh; olivine phenocrysts 3-5%, <3 mm, partly altered to smectite. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Scattered veins are filled with smectite and carbonate. Fractures are often slickensided.

Thin Section Description

Location: 78 cm

Texture: ophitic

Phenocrysts: plagioclase 5%, <8 mm; olivine 3-5%, <3 mm

Groundmass: olivine 5%, <1.5 mm, euhedral; plagioclase 40%, <2 mm, euhedral; clinopyroxene 40%, <2 mm, ophitic; opaques 5%, 0.15 mm, euhedral; interstitial material 10%, altered to smectite

Vesicles: none

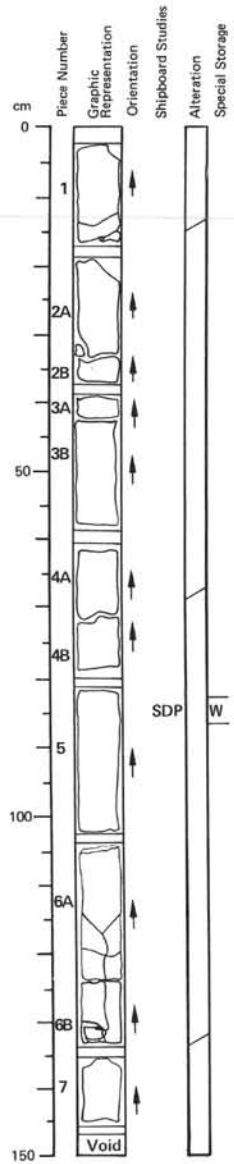
Alteration: olivine to smectite, smectite fills vesicles and interstitial areas.

Shipboard Data

Bulk Analysis: 77-79 cm

SiO_2	49.14
Al_2O_3	15.61
Fe_2O_3	10.54
MgO	8.08
CaO	12.94
Na_2O	2.17
K_2O	< 0.03
TiO_2	1.25
P_2O_5	0.14
MnO	.16
LOI	1.74
H_2O^+	0.54
H_2O^-	N.D.
CO_2	0.98

Sr	129.3
Zr	64.9
Y	21.9
Nb	2.6



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

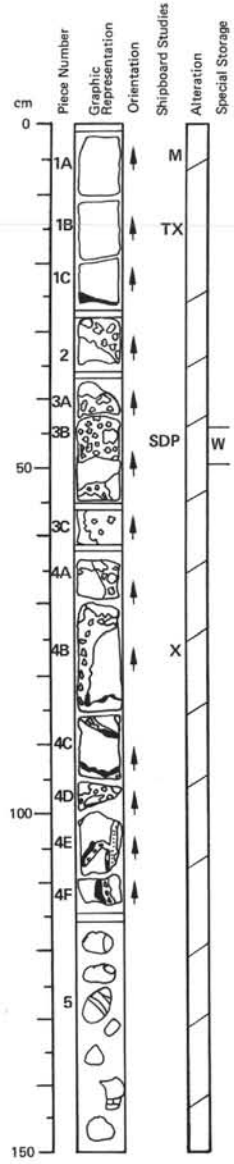
LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	8 5	7

Visual Description

Sparsely to moderately phyric massive basalt. Basalt is medium gray; relatively fresh. Plagioclase phenocrysts 5%, <8 mm, fresh; olivine phenocrysts 5%, <4 mm, partly altered to smectite. Groundmass is holocrystalline, medium- to coarse-grained, subophitic. Scattered veins are filled with smectite. Some fractures are slickensided.

Shipboard Data

Physical Property Data:	86-88 cm
$\overline{V}p$ (km/sec)	5.96
Porosity (%)	2.24
Wet Bulk Density (g/cc)	2.95
Grain Density (g/cc)	2.99



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
5 3	4 1 8	A	8 6	1

Visual Description

Moderately phyric massive basalt and basalt breccia. Massive basalt extends from top of section to 25 cm; breccia from 25 cm to base of section. Massive basalt is medium gray; relatively fresh. Plagioclase phenocrysts 10%, <4 mm, fresh; olivine phenocrysts 3%, <1 mm, partly altered to smectite; clinopyroxene phenocrysts 5%, <2 mm, fresh. Groundmass is holocrystalline, medium-grained to fine-grained, subophitic; grain size decreases gradually toward base of unit at 25 cm. Breccia is greenish-gray; moderately altered. Poorly sorted angular clasts up to 20 cm across are in a matrix of greenish to bluish smectite. Clasts are moderately phyric basalt with glass rinds. Plagioclase phenocrysts 10%, <4 mm, fresh; olivine phenocrysts 1%, <1 mm, altered to smectite; clinopyroxene phenocrysts 3%, <3 mm, fresh. Groundmass is fine-grained to glassy; glassy rinds are altered to palagonite and smectite.

Thin Section Description

Location: 15 cm

Texture: porphyritic - intersertal

Phenocrysts: olivine 3%, <0.8 mm, euhedral; plagioclase 10%, <3.5 mm, euhedral; clinopyroxene 5%, <1.5 mm, subophitic

Groundmass: olivine 2%, 0.2 mm, subhedral; plagioclase 35%, 0.3 mm, subhedral; clinopyroxene 34%, 0.1 mm, granular; opaque 3%, 0.1 mm, euhedral; glass 8% interstitial; devitrified

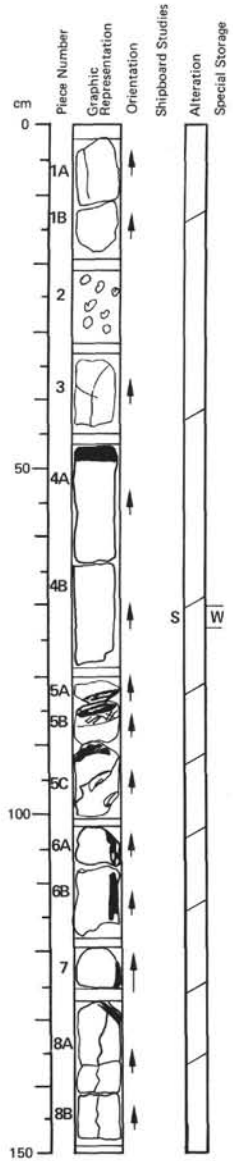
Vesicles: none

Alteration: olivine to smectite

Shipboard Data

Bulk Analysis:	14-19 cm	74-78 cm
SiO_2	48.66	48.82
Al_2O_3	15.27	15.68
Fe_2O_3	10.70	9.93
MgO	8.81	8.32
CaO	12.71	12.67
Na_2O	2.30	2.72
K_2O	0.11	0.18
TiO_2	1.28	1.30
P_2O_5	0.11	0.12
MnO	.22	.17
LOI	1.08	1.31
H_2O^+	0.57	0.82
H_2O^-	N.D.	N.D.
CO_2	0.44	0.74
Sr	N.D.	115.1
Zr	N.D.	73.9
Y	N.D.	24.1
Nb	N.D.	3.6

Magnetic Data:	4-6 cm
NRM Intensity (emu/cc)	1.21×10^{-3}
NRM Inclination	-73.3°
Stable Inclination	-67.5°
Physical Property Data:	46-48 cm
$\overline{V}p$ (km/sec)	4.86
Porosity (%)	14.30
Wet Bulk Density (g/cc)	2.63
Grain Density (g/cc)	2.91



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

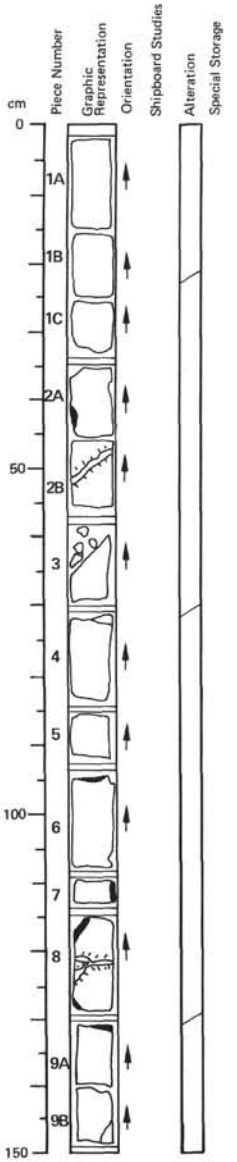
LEG		SITE			HOLE	CORE		SECT.
5	3	4	1	8	A	8	6	2

Visual Description

Moderately phyric pillow basalt. Basalt is dark gray to greenish-gray; weakly to moderately altered. Plagioclase phenocrysts 12-14%, ≤6 mm, fresh; olivine phenocrysts 3%, ≤4 mm, altered to smectite; clinopyroxene phenocrysts <1%, ≤5 mm, fresh, rimmed with plagioclase, probably xenocrystic. Groundmass is fine-grained to glassy; glass selvedges are partly palagonitized and partly altered to smectite. Minor breccia occurs at pillow margins. Veins and cracks are filled with smectite and minor pyrite.

Shipboard Data

Physical Property Data:	71-73 cm
$\overline{V}p$ (km/sec)	5.87

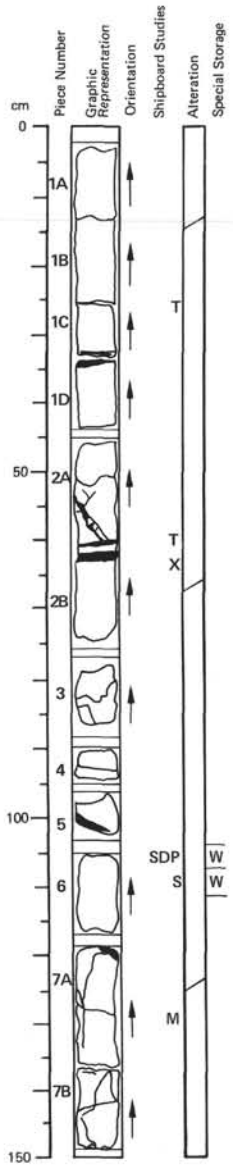


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	3	4	1	8	A	8	6	3

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; relatively fresh. Plagioclase phenocrysts 10%, ≤4 mm, fresh; olivine phenocrysts 4%, ≤3 mm, altered to smectite and carbonate; clinopyroxene phenocrysts 4%, ≤6 mm, fresh, often in subophitic clots with plagioclase. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Vesicles <1%, filled with smectite and carbonate. Prominent veins in pieces 2B, 8 and 9B are filled with smectite and carbonate.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A	8	6		4

Visual Description

Moderately phyric pillow basalt. Basalt is medium to dark gray; relatively fresh. Plagioclase phenocrysts 12-15%, <8 mm, fresh; olivine phenocrysts 3-4%, <3 mm, altered to smectite; clinopyroxene phenocrysts 1-2%, <3 mm, fresh, often in subophitic clots with plagioclase. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite, carbonate and zeolite(?). Some glassy selvedges are partly brecciated. Scattered veins are filled with smectite and carbonate; veins in piece 2A is slickensided. One pillow (piece 2B through 5) has smaller phenocrysts and finer-grained groundmass than the remainder of the section.

Thin Section Description

Location: 25 cm

Texture: porphyritic - quench

Phenocrysts: olivine 3%, <1.5 mm, euhedral; plagioclase 12%, <4 mm, euhedral; clinopyroxene 1%, <3 mm, rounded

Groundmass: plagioclase 15%, 0.3 mm, skeletal; clinopyroxene 65%, radiating sheaves; opaques 2%; 0.005, granular

Vesicles: 2%, 0.2 mm, round

Alteration: olivine to smectite; carbonate fills vesicles

Thin Section Description

Location: 61 cm

Texture: porphyritic - quench

Phenocrysts: olivine 1%, <2 mm, euhedral; plagioclase 10%, <3 mm, euhedral; clinopyroxene 2%, <2 mm, rounded

Groundmass: olivine 1%, 0.2 mm, subhedral; plagioclase 15%, 0.3 mm, acicular; clinopyroxene 56%, radiating sheaves; opaques 5%, 0.01 mm, granular

Vesicles: <1%, 0.1 mm, round

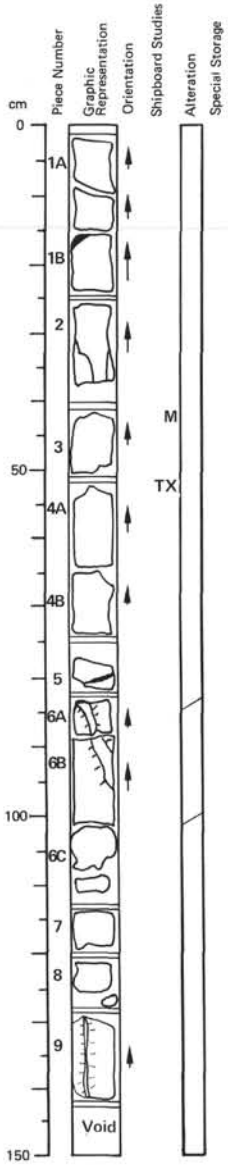
Alteration: olivine to smectite and carbonate; carbonate fills vesicles

Shipboard Data

Bulk Analysis: 62-65 cm	
SiO_2	48.75
Al_2O_3	15.67
Fe_2O_3	10.89
MgO	8.46
CaO	12.95
Na_2O	2.14
K_2O	0.06
TiO_2	1.27
P_2O_5	0.11
MnO	.22
LOI	0.81
H_2O^+	0.56
H_2O^-	N.D.
CO_2	0.34

Magnetic Data:	129-131 cm
NRM Intensity (emu/cc)	13.31×10^{-3}
NRM Inclination	-32.8°
Stable Inclination	-33.3°

Physical Property Data:	105-107 cm	108-110 cm
$\bar{V}p$ (km/sec)	6.14	5.68
Porosity (%)	3.56	
Wet Bulk Density (g/cc)	2.89	
Grain Density (g/cc)	2.96	



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	3	4	1	8	A	8	6		5

Visual Description

Moderately phyric pillow basalt and aphyric basalt. Moderately phyric basalt is present in the upper and lower parts of the section; aphyric basalt is between 25 and 80 cm (pieces 2 through 5) and is either a pillow or a small intrusion. The moderately phyric basalt is medium to dark gray; slightly altered in pieces 6A and 6B. Plagioclase phenocrysts 8%, <4 mm, fresh; olivine phenocrysts 1%, <1.5 mm, altered to smectite; clinopyroxene phenocrysts 1-2%, <1 mm, fresh usually in subophitic clots with plagioclase. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Prominent veins in pieces 6A, 6B and 9 are filled with smectite, carbonate and minor pyrite. Aphyric basalt is medium gray; relatively fresh. Plagioclase phenocrysts <1%, <1 mm, fresh. Groundmass is very fine-grained to glassy; glass selvedges are present at the top and bottom; glass is mostly fresh.

Thin Section Description

Location: 55 cm

Texture: porphyritic - quench

Phenocrysts: olivine 1%, <0.8 mm, euhedral; plagioclase 5%, <1.5 mm, euhedral; clinopyroxene <1%, <0.8 mm, rounded

Groundmass: plagioclase 40%, 0.2 mm, acicular; clinopyroxene 46%, radiating sheaves; opaques 8%, 0.01 mm, granular; spinel tr, 0.25 mm, euhedral

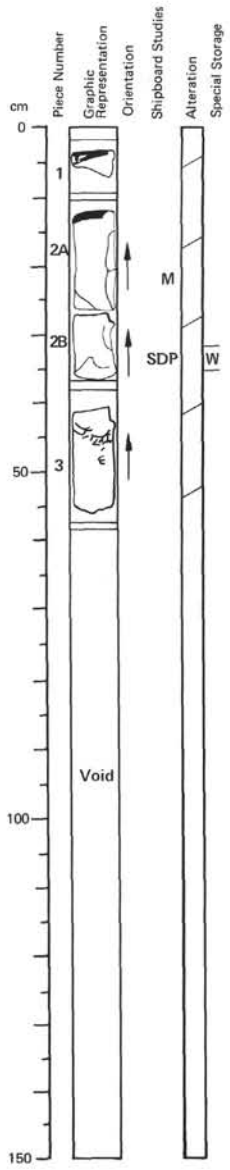
Vesicles: <1%, 0.1 mm, round

Alteration: olivine to smectite; smectite and carbonate fill vesicles

Shipboard Data

Bulk Analysis: 54-57 cm	
SiO_2	47.29
Al_2O_3	15.68
Fe_2O_3	10.02
MgO	8.47
CaO	12.61
Na_2O	2.32
K_2O	0.13
TiO_2	1.31
P_2O_5	0.14
MnO	.17
LOI	1.67
H_2O^+	1.12
H_2O^-	N.D.
CO_2	0.60

Magnetic Data:	45-47 cm
NRM Intensity (emu/cc)	21.53×10^{-3}
NRM Inclination	-42.1°
Stable Inclination	-39.2°



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	3	4	1	8	A	8	6	6

Visual Description

Moderately phyric pillow basalt. Basalt is greenish-gray; moderately altered. Plagioclase phenocrysts 7%, <3 mm, fresh; olivine 1%, <3 mm, altered to smectite and carbonate; clinopyroxene phenocrysts <1%, <1 mm, fresh. Groundmass is fine-grained to glassy; glass selvedges are partly altered to smectite. Veins are filled with smectite and minor pyrite. Piece 3 has minor breccia.

Shipboard Data

Magnetic Data:	25-27 cm
NRM Intensity (emu/cc)	5.55×10^{-3}
NRM Inclination	-25.0°
Stable Inclination	-25.8°
Physical Property Data:	34-36 cm
$\overline{V}p$ (km/sec)	5.62
Porosity (%)	4.72
Wet Bulk Density (g/cc)	2.89
Grain Density (g/cc)	2.98

SITE 418 HOLE B CORE 1 CORED INTERVAL: 0.0-6.8 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	LITHOLOGIC SAMPLE	LITHOLOGIC DESCRIPTION
EARLY QUATERNARY		Ag		B	1	0.5 1.0				133 140	10YR 5/2

Nannofossil Ooze and Nannofossil-rich clay: yellow brown, contains foraminifera. Highly disturbed, homogenized.

Smear: 1-133

5% quartz
50% clay
10% opaques
5-10% foraminifera
20% nannofossils
TR% silicoflag.
1- 2% fish debris

Smear: 1-140

5% quartz
40% clay
5% opaques
TR% rutile
40% nannofossils
8% silic. debris

SITE 418 HOLE B CORE 2 CORED INTERVAL: 6.8-16.3 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	LITHOLOGIC SAMPLE	LITHOLOGIC DESCRIPTION
EARLY QUATERNARY		Rp		B	1	0.5 1.0				42 71	10YR 5/3
		Rp		B	2					90	
					CC					CC	

Foraminifera-Rich, Nannofossil Ooze and Pelagic Clay. Interbeds of yellow-orange (10YR 7/2) foram-rich nannofossil ooze and yellowish brown (10YR 5/3) pelagic clay. In some parts patches specked with Fe-Mn micronodules. Highly disturbed by drilling.

Major lithology (yellowish brown)

Smear: 1-71

5% quartz
85% clay
10% opaques
TR% manganite(?)
TR% fish debris

Minor lithology (yellow orange)

Smear: 1-42

20% clay
5% opaques
TR% rutile
15% forams
60% nannofossils
TR% fish debris

Minor lithology (dusky yellow brown)

Smear: 2-90

5% quartz
30% nannofossils
62% clay
3% rutile
TR% fish debris

Grain Size

1-40
0.0% sand
6.8% silt
93.2% clay

Carbon, Carbon-Carbonate

1-60 (0.2, 0.1, 0)

SITE 418 HOLE B CORE 3 CORED INTERVAL: 16.3-25.9 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	LITHOLOGIC SAMPLE	LITHOLOGIC DESCRIPTION
					1	0.5 1.0			X	74	10YR 4/2 10YR 5/2
					2					99	
					3					73	
					4						
					5		VOID				
					6						
					CC					CC	

Pelagic Clay

Extremely disturbed by drilling, almost homogenized. Dominant lithology is a dark yellow brown (10YR 4/2) pelagic clay containing abundant micronodules and fine-grained residual heavy minerals. Rare mottles of yellow brown occur at the top. Downward a yellow brown color (10YR 5/2) is dominant. Scattered patches of Fe-Mn micronodules. Zones of coarser material occur.

Smear: 1-99 (dark yellowish-brown)

5% quartz
80% clay
10% micronodules
3% rutile
2% fish remains
TR% pollen

Smear: 1-74 (dark yellowish brown)

5% quartz
73% clay
TR% hornblende
20% micronodules
2% rutile
TR% fish remains

Smear: 3-73 (yellowish brown)

5% quartz
87% clay
5% opaques
3% rutile
TR% fish remains

Grain Size

2-40	4-40
0.0% sand	0.2% sand
4.9% silt	6.2% silt
95.1% clay	93.6% clay

Carbon, Carbon-Carbonate

2-60 (0.1, 0.1, 0)

SITE 418 HOLE B CORE 4 CORED INTERVAL: 25.9-35.4 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS			SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	LITHOLOGIC SAMPLE	LITHOLOGIC DESCRIPTION
							1	0.5				88	10YR 5/2-4/2
								1.0				106	10YR 5/4 (mottles)
							2						
							3		VOID				10YR 4/2 (10YR 5/4)
							4					76	10YR 5/2 (10YR 5/4 mottle)
							5						10YR 5/2-5/4
							6						10YR 5/2
							CC					CC	

Pelagic Clay

Highly disturbed, pelagic clay; 90% is a dark yellowish brown (10YR 5/2-4/2) with rare diffuse "mottles" of lighter moderate yellowish brown (10YR 5/4). There is an overall trend to slightly lighter hues downward as a result of fewer scattered micronodules. Micronodule streaks most common in the upper two sections.

Smear: 1-88 (yellowish brown)

5% quartz
88% clay
5% opaques
2% rutile
TR% sponge spicules

Smear: 1-106 (yellow brown)

15% quartz
78% clay
5% opaques
2% rutile

Smear: 4-76 (dusky yellow)

5% quartz
86% clay
5% opaques
2% rutile
TR% zeolites
2% fish remains

Grain Size

	2-40	4-40
	0.0% sand	0.0% sand
	8.2% silt	6.8% silt
	91.8% clay	93.2% clay

Carbon, Carbon-Carbonate

4-60 (0.1, 0.1, 0)

SITE 418 HOLE B CORE 5 CORED INTERVAL: 35.4-44.9 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS			SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	LITHOLOGIC SAMPLE	LITHOLOGIC DESCRIPTION
							1	0.5				60	10YR 5/4 to 5Y 7/4
								1.0					
							2					89	
							3						
							4					71	
							5		VOID				5Y 7/4
							6						
							7						
							CC					CC	

Pelagic Clay

Highly disturbed pelagic clay; homogenized by drilling so that 95% is dusky yellow (5Y 7/4) and some light yellow gray (5Y 7/2). There is a brownish cast transitional to Core 4. Some streaky patches of Fe-Mn micronodules occur, especially at 4-100 to 150.

Smear: 1-60 (dark dusky brown)

5% quartz
87% clay
TR% hornblende
5% opaques
2% rutile
1% fish remains

Smear: 2-89 (dusky yellow)

10% quartz
82% clay
5% opaques
1% rutile
2% fish remains

Smear: 4-71 (dark dusky yellow)

2% quartz
85% clay
5% opaques
3% rutile
5% fish remains

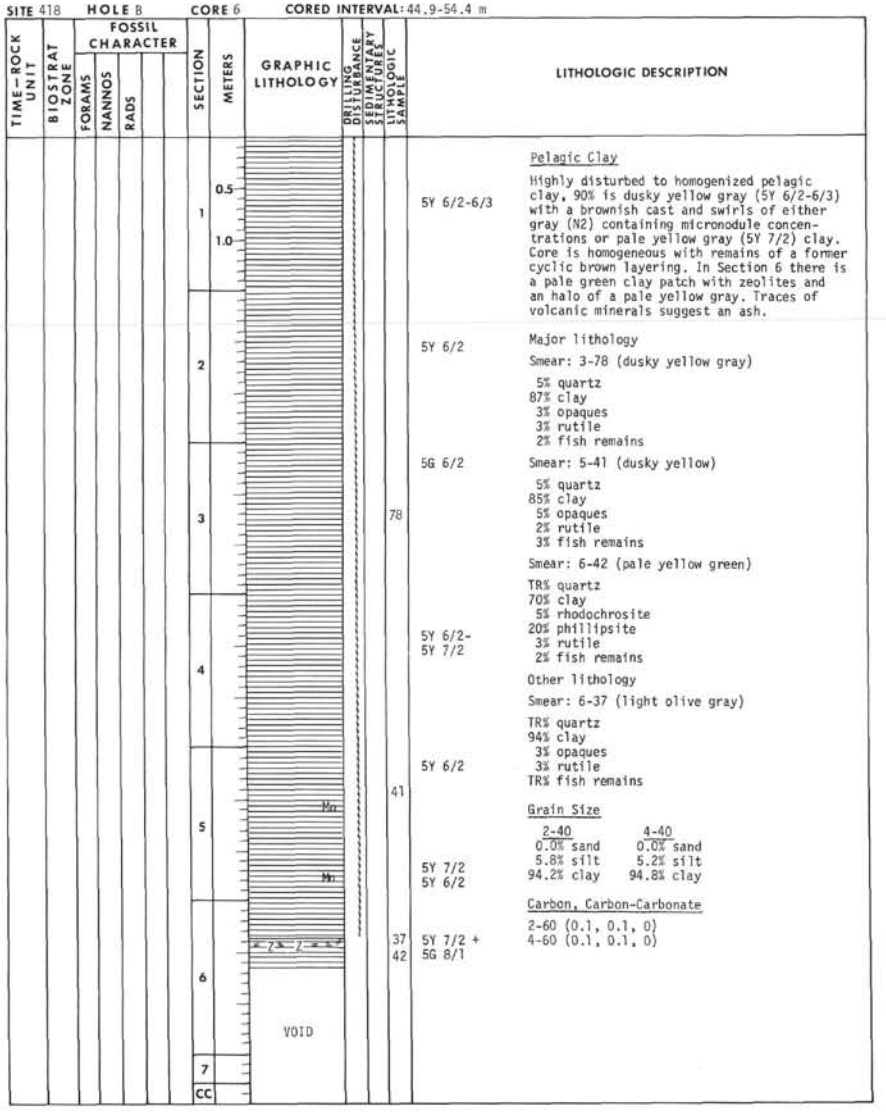
Grain Size

	2-40	4-40
	0.0% sand	0.0% sand
	4.9% silt	5.9% silt
	95.1% clay	94.1% clay

Carbon, Carbon-Carbonate

2-60 (0.2, 0.1, 0)
4-60 (0.1, 0.2, 0)

SITE 418 HOLE B CORE 6 CORED INTERVAL: 44.9-54.4 m



Pelagic Clay

Highly disturbed to homogenized pelagic clay, 90% is dusky yellow gray (5Y 6/2-6/3) with a brownish cast and swirls of either gray (N2) containing micronodule concentrations or pale yellow gray (5Y 7/2) clay. Core is homogeneous with remains of a former cyclic brown layering. In Section 6 there is a pale green clay patch with zeolites and an halo of a pale yellow gray. Traces of volcanic minerals suggest an ash.

5Y 6/2-6/3

Major lithology

5Y 6/2

Smear: 3-78 (dusky yellow gray)

5% quartz
87% clay
3% opaques
3% rutile
2% fish remains

5G 6/2

Smear: 5-41 (dusky yellow)

5% quartz
85% clay
5% opaques
2% rutile
3% fish remains

78

Smear: 6-42 (pale yellow green)

TR% quartz
70% clay
5% rhodochrosite
20% phillipsite
3% rutile
2% fish remains

5Y 6/2-
5Y 7/2

Other lithology

Smear: 6-37 (light olive gray)

TR% quartz
94% clay
3% opaques
3% rutile
TR% fish remains

5Y 6/2

41

Grain Size

2-40	4-40
0.0% sand	0.0% sand
5.8% silt	5.2% silt
94.2% clay	94.8% clay

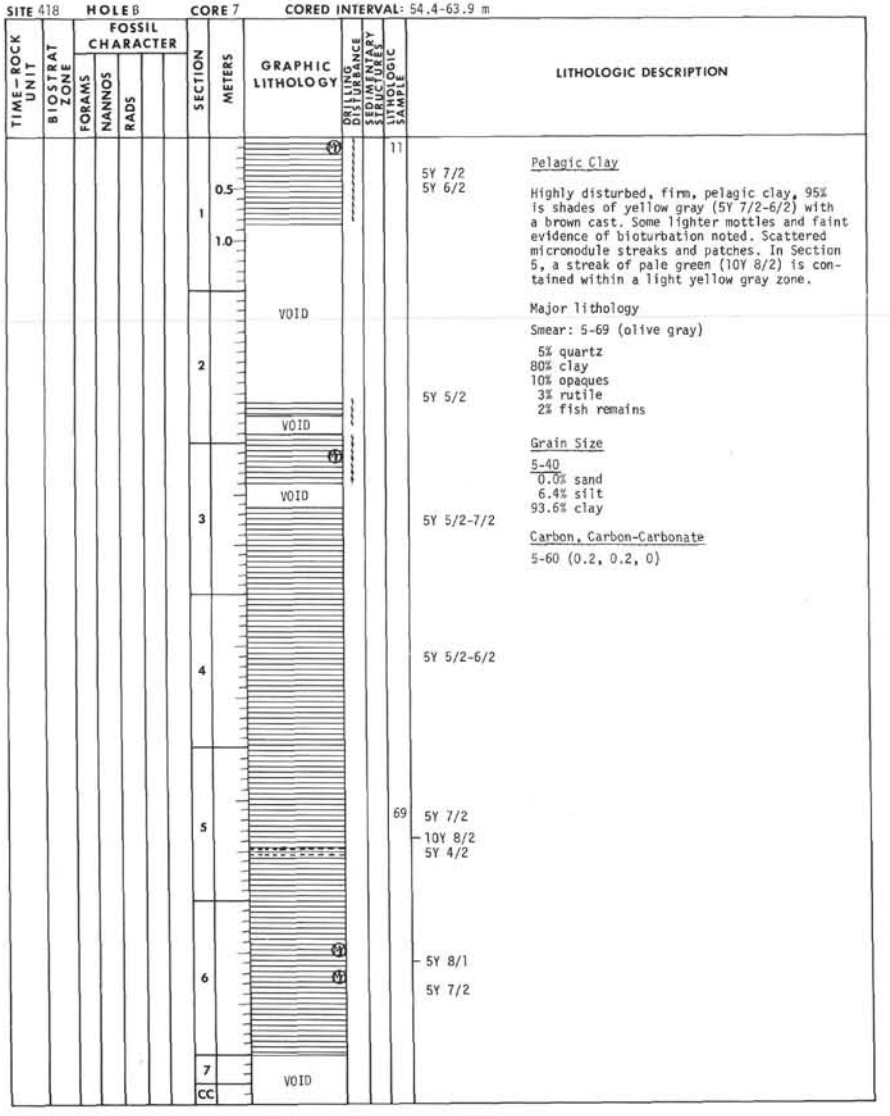
5Y 7/2
5Y 6/2

Carbon, Carbon-Carbonate

2-60 (0.1, 0.1, 0)
4-60 (0.1, 0.1, 0)

37 5Y 7/2 +
42 5G 8/1

SITE 418 HOLE B CORE 7 CORED INTERVAL: 54.4-63.9 m



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Pelagic Clay

5Y 7/2
5Y 6/2

Highly disturbed, firm, pelagic clay, 95% is shades of yellow gray (5Y 7/2-6/2) with a brown cast. Some lighter mottles and faint evidence of bioturbation noted. Scattered micronodule streaks and patches. In Section 5, a streak of pale green (10Y 8/2) is contained within a light yellow gray zone.

Major lithology

Smear: 5-69 (olive gray)

5% quartz
80% clay
10% opaques
3% rutile
2% fish remains

5Y 5/2

Grain Size

5-40

0.0% sand
6.4% silt
93.6% clay

5Y 5/2-7/2

Carbon, Carbon-Carbonate

5-60 (0.2, 0.2, 0)

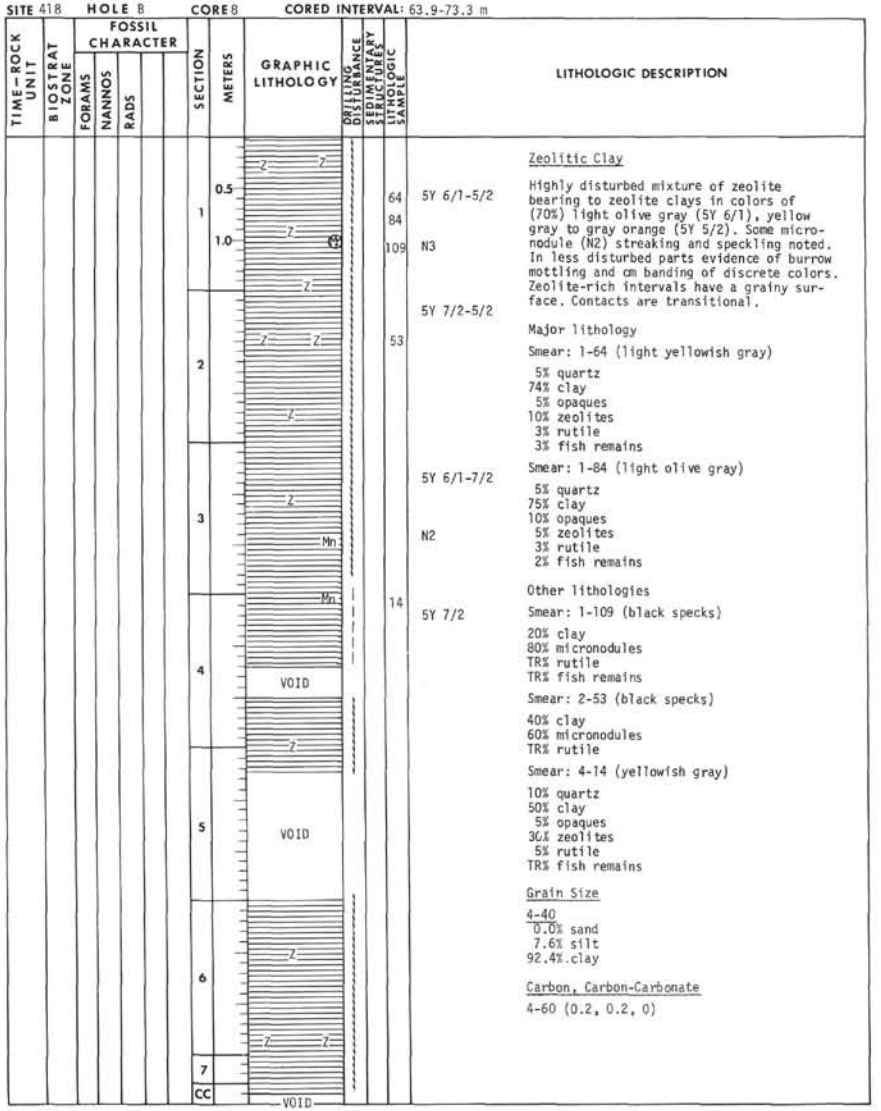
5Y 5/2-6/2

69

5Y 7/2
10Y 8/2
5Y 4/2

5Y 8/1
5Y 7/2

SITE 418 HOLE B CORE 8 CORED INTERVAL: 63.9-73.3 m



Zeolitic Clay

Highly disturbed mixture of zeolite bearing to zeolite clays in colors of (70%) light olive gray (5Y 6/1), yellow gray to gray orange (5Y 5/2). Some micronodule (N2) streaking and speckling noted. In less disturbed parts evidence of burrow mottling and cm banding of discrete colors. Zeolite-rich intervals have a grainy surface. Contacts are transitional.

Major lithology

Smear: 1-64 (light yellowish gray)

5% quartz
74% clay
5% opaques
10% zeolites
3% rutile
3% fish remains

Smear: 1-84 (light olive gray)

5% quartz
75% clay
10% opaques
5% zeolites
3% rutile
2% fish remains

Other lithologies

Smear: 1-109 (black specks)

20% clay
80% micronodules
TR% rutile
TR% fish remains

Smear: 2-53 (black specks)

40% clay
60% micronodules
TR% rutile

Smear: 4-14 (yellowish gray)

10% quartz
50% clay
5% opaques
30% zeolites
5% rutile
TR% fish remains

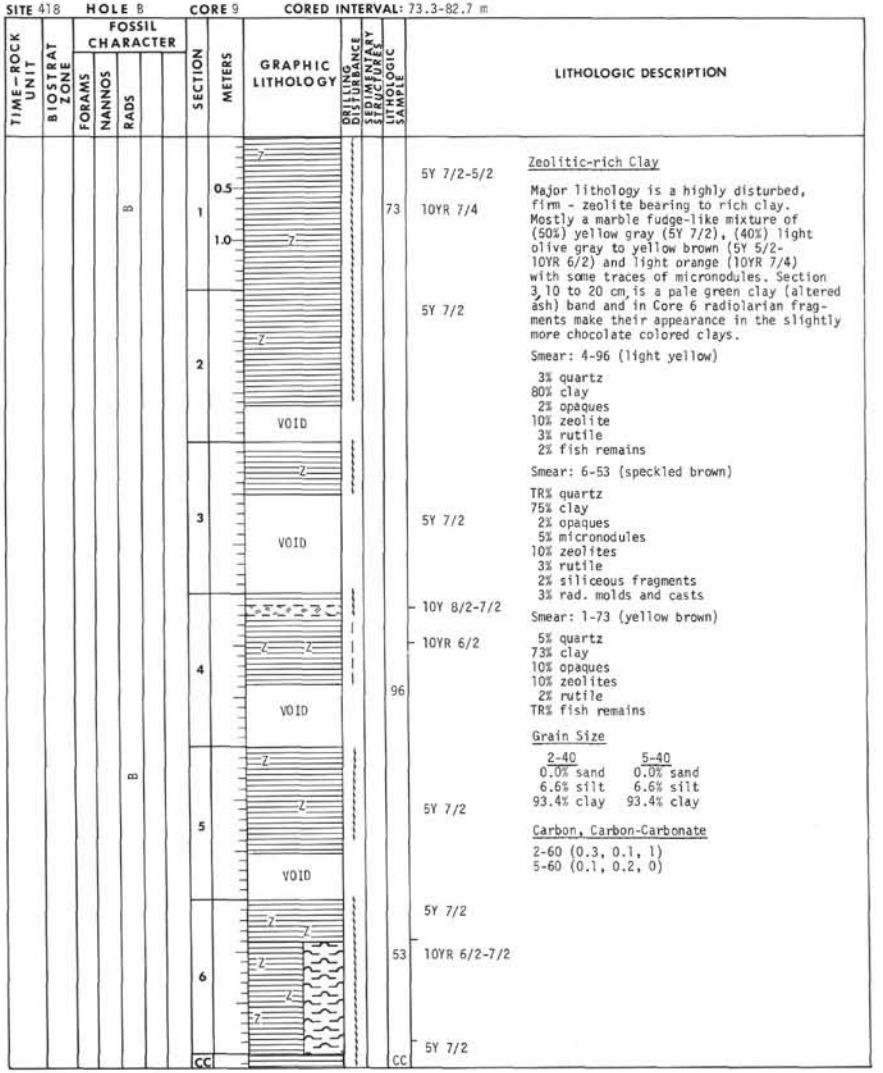
Grain Size

4-40
0.0% sand
7.6% silt
92.4% clay

Carbon, Carbon-Carbonate

4-60 (0.2, 0.2, 0)

SITE 418 HOLE B CORE 9 CORED INTERVAL: 73.3-82.7 m



Zeolitic-rich Clay

Major lithology is a highly disturbed, firm - zeolite bearing to rich clay. Mostly a marble fudge-like mixture of (50%) yellow gray (5Y 7/2), (40%) light olive gray to yellow brown (5Y 5/2-10YR 6/2) and light orange (10YR 7/4) with some traces of micronodules. Section 3, 10 to 20 cm, is a pale green clay (altered ash) band and in Core 6 radiolarian fragments make their appearance in the slightly more chocolate colored clays.

Smear: 4-96 (light yellow)

3% quartz
80% clay
2% opaques
10% zeolite
3% rutile
2% fish remains

Smear: 6-53 (speckled brown)

TR% quartz
75% clay
2% opaques
5% micronodules
10% zeolites
3% rutile
2% siliceous fragments
3% rad. molds and casts

Smear: 1-73 (yellow brown)

5% quartz
73% clay
10% opaques
10% zeolites
2% rutile
TR% fish remains

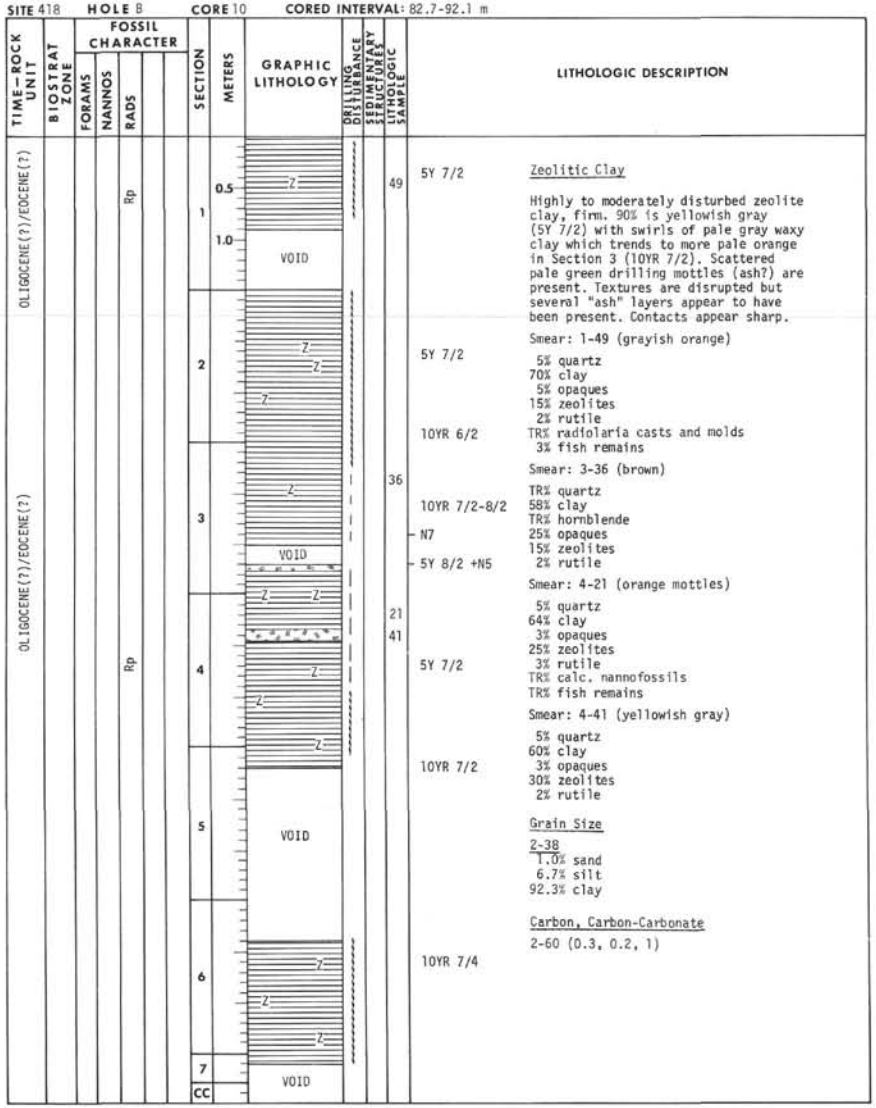
Grain Size

2-40	5-40
0.0% sand	0.0% sand
6.6% silt	6.6% silt
93.4% clay	93.4% clay

Carbon, Carbon-Carbonate

2-60 (0.3, 0.1, 1)
5-60 (0.1, 0.2, 0)

SITE 418 HOLE B CORE 10 CORED INTERVAL: 82.7-92.1 m



LITHOLOGIC DESCRIPTION

5Y 7/2

Zeolitic Clay

Highly to moderately disturbed zeolite clay, firm. 90% is yellowish gray (5Y 7/2) with swirls of pale gray waxy clay which trends to more pale orange in Section 3 (10YR 7/2). Scattered pale green drilling mottles (ash?) are present. Textures are disrupted but several "ash" layers appear to have been present. Contacts appear sharp.

Smear: 1-49 (grayish orange)

5Y 7/2
5% quartz
70% clay
5% opaques
15% zeolites
2% rutile

10YR 6/2
TR% radiolaria casts and molds
3% fish remains

Smear: 3-36 (brown)

TR% quartz
10YR 7/2-8/2 58% clay
TR% hornblende
N7 25% opaques
15% zeolites
5Y 8/2 +N5 2% rutile

Smear: 4-21 (orange mottles)

5% quartz
64% clay
3% opaques
25% zeolites
5Y 7/2 3% rutile
TR% calc. nannofossils
TR% fish remains

Smear: 4-41 (yellowish gray)

5% quartz
60% clay
10YR 7/2 3% opaques
30% zeolites
2% rutile

Grain Size

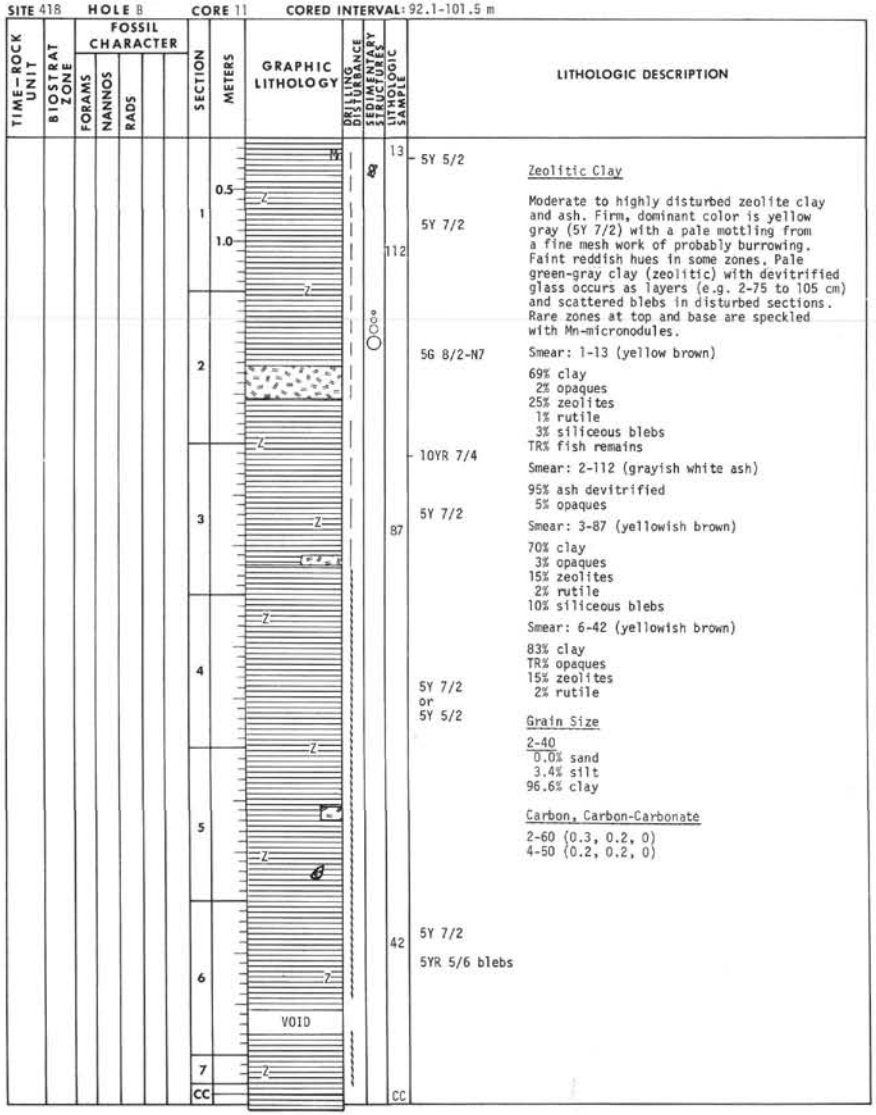
2-38
1.0% sand
6.7% silt
92.3% clay

Carbon, Carbon-Carbonate

2-60 (0.3, 0.2, 1)

10YR 7/4

SITE 418 HOLE B CORE 11 CORED INTERVAL: 92.1-101.5 m



LITHOLOGIC DESCRIPTION

5Y 5/2

Zeolitic Clay

Moderate to highly disturbed zeolite clay and ash. Firm, dominant color is yellow gray (5Y 7/2) with a pale mottling from a fine mesh work of probably burrowing. Faint reddish hues in some zones. Pale green-gray clay (zeolitic) with devitrified glass occurs as layers (e.g. 2-75 to 105 cm) and scattered blebs in disturbed sections. Rare zones at top and base are speckled with Mn-micronodules.

5Y 7/2

5G 8/2-N7 Smear: 1-13 (yellow brown)

69% clay
2% opaques
25% zeolites
1% rutile
3% siliceous blebs
TR% fish remains

10YR 7/4 Smear: 2-112 (grayish white ash)

95% ash devitrified
5% opaques

5Y 7/2 Smear: 3-87 (yellowish brown)

70% clay
3% opaques
15% zeolites
2% rutile
10% siliceous blebs

Smear: 6-42 (yellowish brown)

83% clay
TR% opaques
15% zeolites
5Y 7/2 2% rutile
or
5Y 5/2

Grain Size

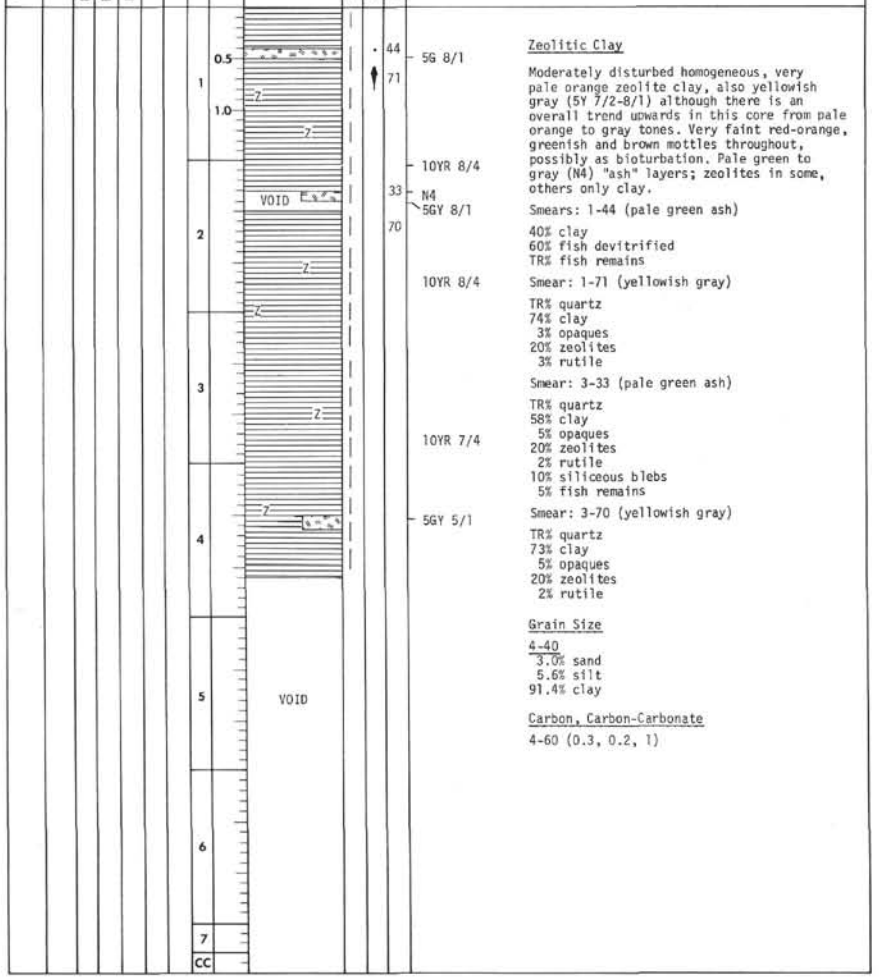
2-40
0.0% sand
3.4% silt
96.6% clay

Carbon, Carbon-Carbonate

2-60 (0.3, 0.2, 0)
4-50 (0.2, 0.2, 0)

5Y 7/2
5YR 5/6 blebs

SITE 418 HOLE B CORE 12 CORED INTERVAL: 101.5-110.9 m



Zeolitic Clay

Moderately disturbed homogeneous, very pale orange zeolite clay, also yellowish gray (5Y 7/2-8/1) although there is an overall trend upwards in this core from pale orange to gray tones. Very faint red-orange, greenish and brown mottles throughout, possibly as bioturbation. Pale green to gray (N4) "ash" layers; zeolites in some, others only clay.

Smears: 1-44 (pale green ash)

40% clay
60% fish devitrified
TR% fish remains

Smear: 1-71 (yellowish gray)

TR% quartz
74% clay
3% opaques
20% zeolites
3% rutile

Smear: 3-33 (pale green ash)

TR% quartz
58% clay
5% opaques
20% zeolites
2% rutile
10% siliceous blebs
5% fish remains

Smear: 3-70 (yellowish gray)

TR% quartz
73% clay
5% opaques
20% zeolites
2% rutile

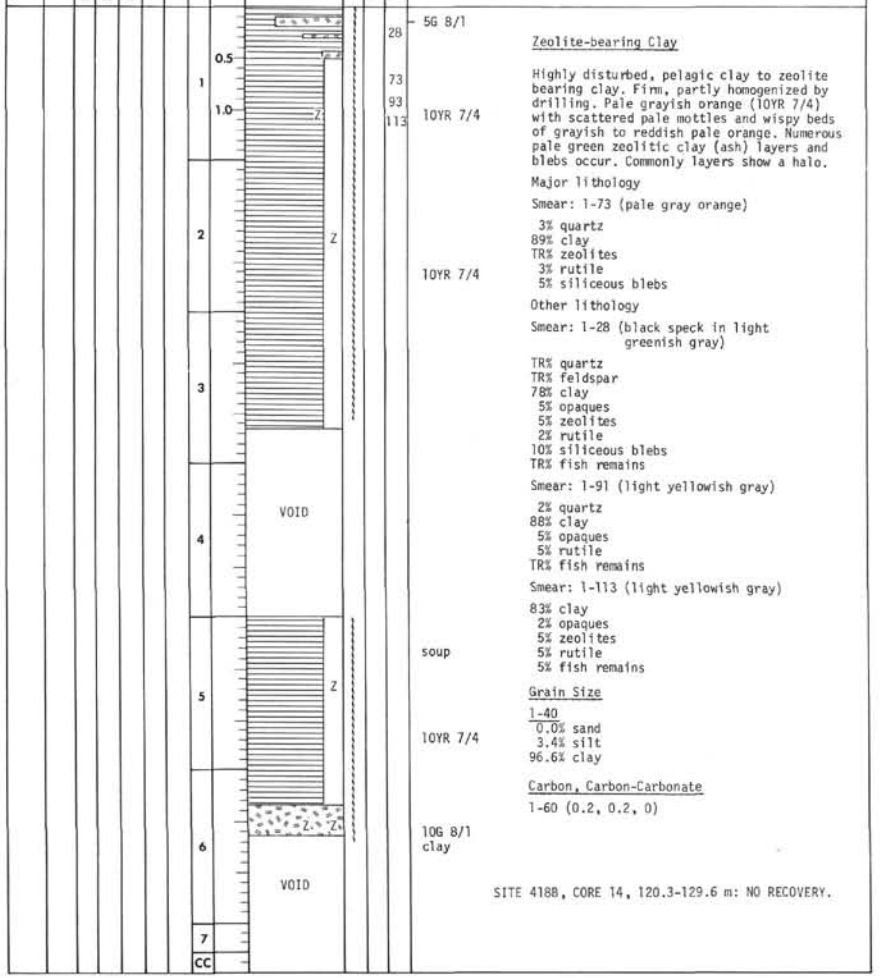
Grain Size

4-40
3.0% sand
5.6% silt
91.4% clay

Carbon, Carbon-Carbonate

4-60 (0.3, 0.2, 1)

SITE 418 HOLE B CORE 13 CORED INTERVAL: 110.9-120.3 m



Zeolite-bearing Clay

Highly disturbed, pelagic clay to zeolite bearing clay. Firm, partly homogenized by drilling. Pale grayish orange (10YR 7/4) with scattered pale mottles and wispy beds of grayish to reddish pale orange. Numerous pale green zeolitic clay (ash) layers and blebs occur. Commonly layers show a halo.

Major lithology

Smear: 1-73 (pale gray orange)

3% quartz
89% clay
TR% zeolites
3% rutile
5% siliceous blebs

Other lithology

Smear: 1-28 (black speck in light greenish gray)

TR% quartz
TR% feldspar
78% clay
5% opaques
5% zeolites
2% rutile
10% siliceous blebs
TR% fish remains

Smear: 1-91 (light yellowish gray)

2% quartz
88% clay
5% opaques
5% rutile
TR% fish remains

Smear: 1-113 (light yellowish gray)

83% clay
2% opaques
5% zeolites
5% rutile
5% fish remains

Grain Size

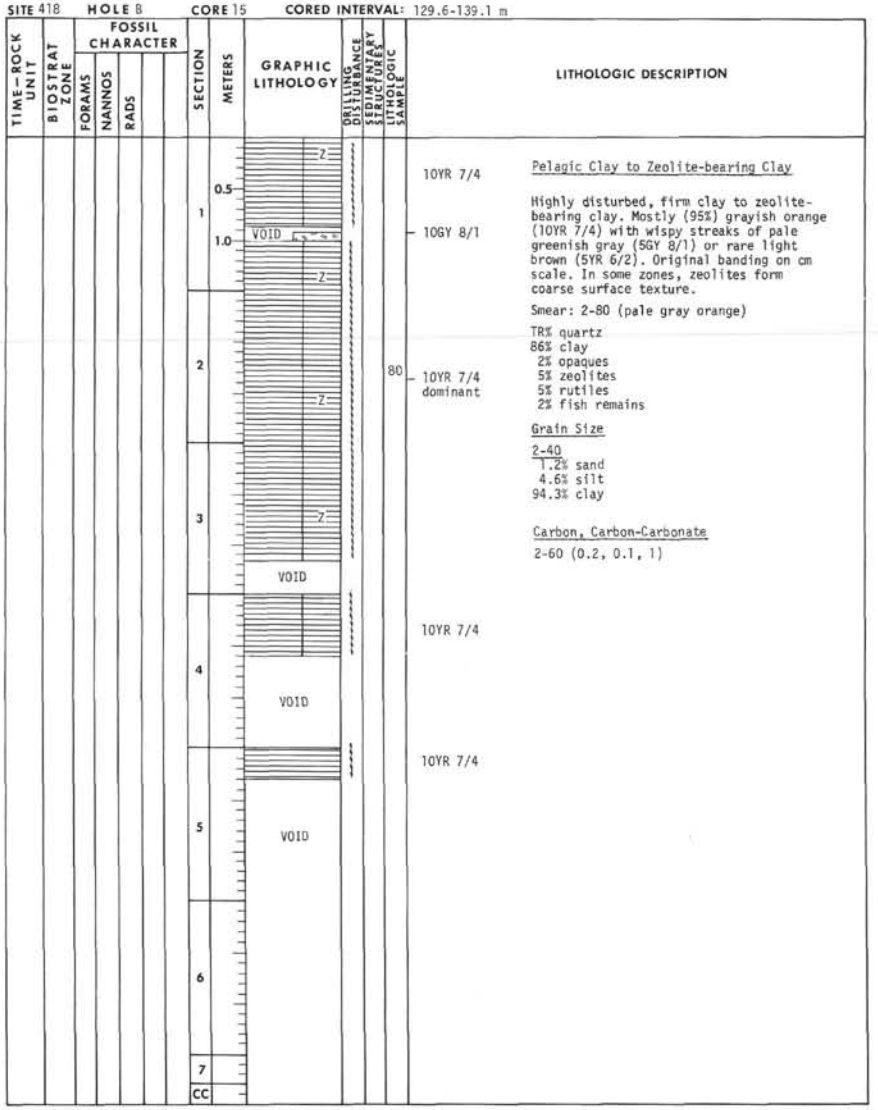
1-40
0.0% sand
3.4% silt
96.6% clay

Carbon, Carbon-Carbonate

1-60 (0.2, 0.2, 0)

SITE 418B, CORE 14, 120.3-129.6 m: NO RECOVERY.

SITE 418 HOLE B CORE 15 CORED INTERVAL: 129.6-139.1 m



Pelagic Clay to Zeolite-bearing Clay

Highly disturbed, firm clay to zeolite-bearing clay. Mostly (95%) grayish orange (10YR 7/4) with wispy streaks of pale greenish gray (5GY 8/1) or rare light brown (5YR 6/2). Original banding on cm scale. In some zones, zeolites form coarse surface texture.

Smear: 2-80 (pale gray orange)

TR% quartz
86% clay
2% opaques
5% zeolites
5% rutiles
2% fish remains

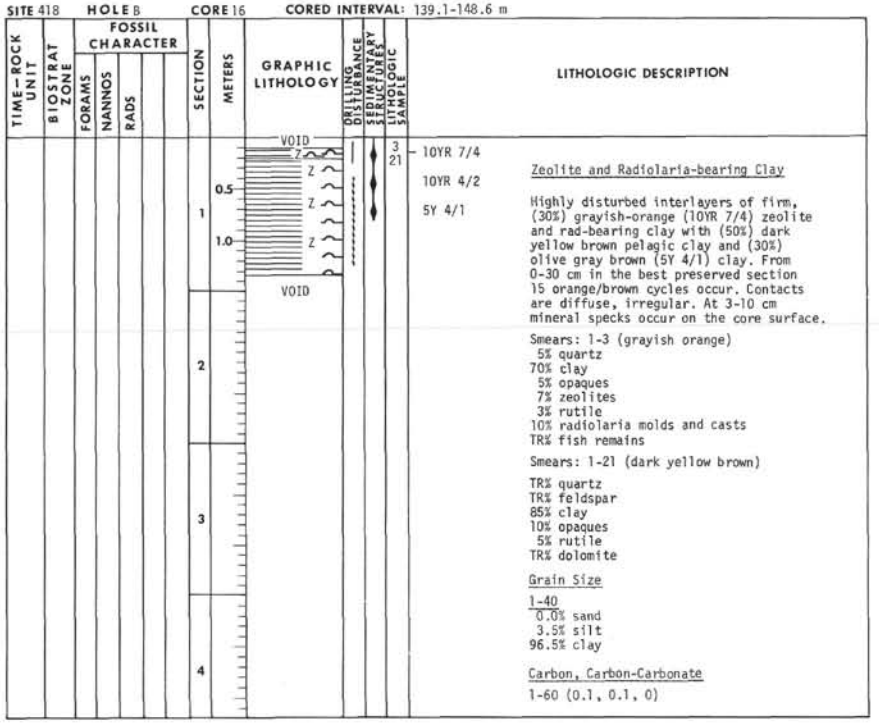
Grain Size

2-40
1.2% sand
4.6% silt
94.3% clay

Carbon, Carbon-Carbonate

2-60 (0.2, 0.1, 1)

SITE 418 HOLE B CORE 16 CORED INTERVAL: 139.1-148.6 m



Zeolite and Radiolaria-bearing Clay

Highly disturbed interlayers of firm, (30%) grayish-orange (10YR 7/4) zeolite and rad-bearing clay with (50%) dark yellow brown pelagic clay and (30%) olive gray brown (5Y 4/1) clay. From 0-30 cm in the best preserved section 15 orange/brown cycles occur. Contacts are diffuse, irregular. At 3-10 cm mineral specks occur on the core surface.

Smears: 1-3 (grayish orange)
5% quartz
70% clay
5% opaques
7% zeolites
3% rutile
10% radiolaria molds and casts
TR% fish remains

Smears: 1-21 (dark yellow brown)

TR% quartz
TR% feldspar
85% clay
10% opaques
5% rutile
TR% dolomite

Grain Size

1-40
0.0% sand
3.5% silt
96.5% clay

Carbon, Carbon-Carbonate

1-60 (0.1, 0.1, 0)

SITE 418 HOLE B CORE 17 CORED INTERVAL: 148.6-158.2 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FOSSIL CHARACTER: FORAMS	FOSSIL CHARACTER: NANNOS	FOSSIL CHARACTER: RADS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	LITHOLOGIC SAMPLE	LITHOLOGIC DESCRIPTION
					1	0.5	VOID			60	10YR 4/2
						1.0					Highly disturbed mixture of firm, (60%) dark yellow brown (10YR 4/2) and grayish-orange (10YR 7/2, 40%) zeolitic clay. Small amounts of light brown (5YR 5/6) clay blebs occur which are remnants of former cm-banding.
											10YR 7/4
										10	10YR 7/4
					2						Smear: 1-60 (dark yellowish brown)
											TR% quartz 70% clay 15% opaques 12% zeolites 3% rutile TR% fish remains
											10YR 4/2
											Smear: 2-10 (grayish orange)
					3						TR% quartz 85% clay 12% zeolites 3% rutile TR% fish remains
											10YR 4/2 minor 10YR 7/4
											Grain Size 2-40 0.0% sand 4.7% silt 95.3% clay
					4		VOID				10YR 5/4
											Carbon, Carbon-Carbonate 2-60 (0.1, 0.1, 0)

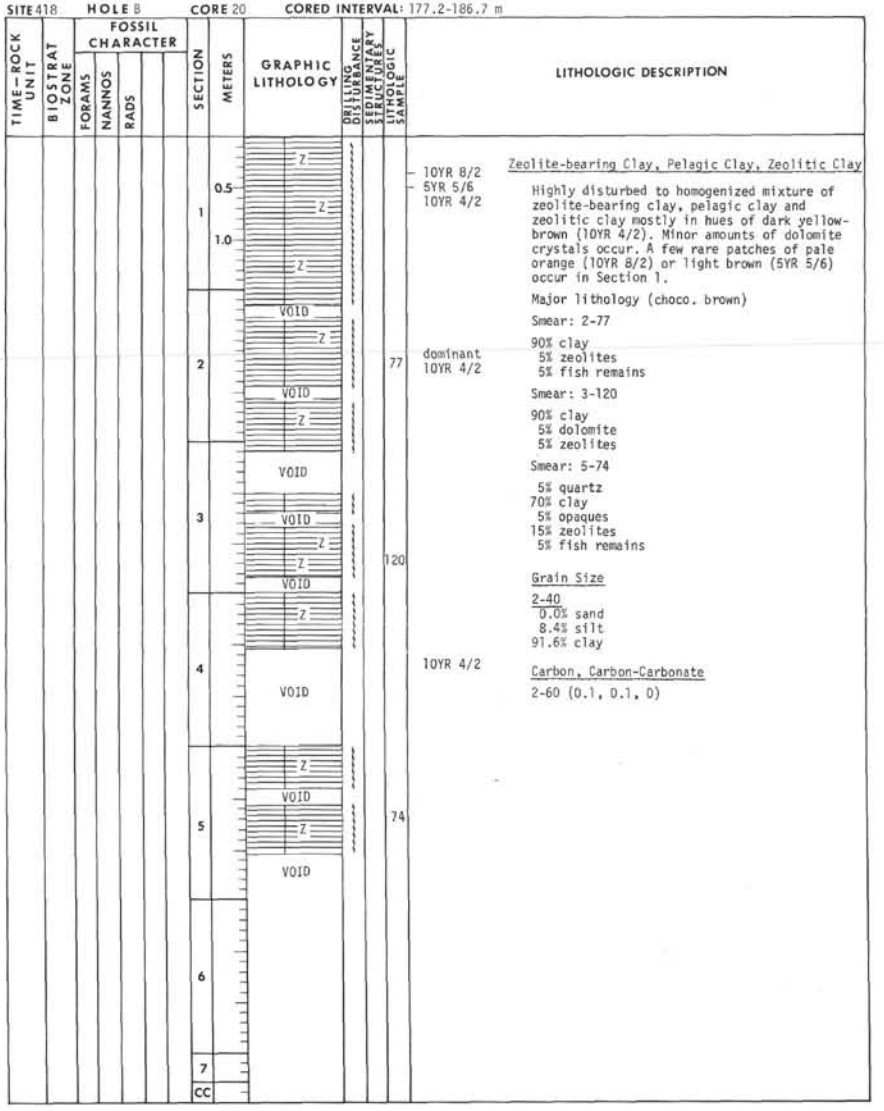
SITE 418 HOLE B CORE 18 CORED INTERVAL: 158.2-167.7 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FOSSIL CHARACTER: FORAMS	FOSSIL CHARACTER: NANNOS	FOSSIL CHARACTER: RADS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	LITHOLOGIC SAMPLE	LITHOLOGIC DESCRIPTION
					1	0.5	VOID			76	Zeolite Clay: drill mixture of firm, mostly (75-80%) dark yellow brown (10YR 4/2) to olive brown (5Y 4/1) and pale yellow orange (10YR 8/6) chunks of highly zeolitic clay. Within both color bands thin laminae of almost pure zeolite occur. Contacts were probably sharp.
						1.0				88	10YR 4/2
											10YR 8/6
					2		VOID				Smear: 1-76 (olive brown)
											TR% quartz 55% clay 5% opaques 40% zeolites TR% fish remains
											Smear: 1-88 (pale orange)
											TR% quartz 45% clay 5% opaques 50% zeolite TR% fish remains

SITE 418 HOLE B CORE 19 CORED INTERVAL: 167.7-177.2 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FOSSIL CHARACTER: FORAMS	FOSSIL CHARACTER: NANNOS	FOSSIL CHARACTER: RADS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	LITHOLOGIC SAMPLE	LITHOLOGIC DESCRIPTION
LATE MIDDLE EOCENE	Podocyrtis mitra(?) -P. chalara(?)			Rp	1	0.5				19	10YR 8/2
						1.0					Zeolite Clay, Nannofossil Chalk, Radiolarian-bearing Zeolite Clay
											10YR 4/2
											Highly zeolitic clay and nanno chalk with rad bearing zeolite clay. Moderately to highly disturbed banded highly zeolitic clay in dominantly dark yellow brown (10YR 4/2) tones. Near the base of Section 1 and in Section 2, a nannofossil chalk occurs as a moderate reddish-orange (10R 6/), with cm-scale diffuse banding. No laminations or burrowing evident. Radiolarian molds are scattered throughout with a pale orange (10YR 8/2) color.
										114	10YR 4/2 10YR 7/2 5YR 4/4
											10R 6/6
							VOID			6	10R 6/6
										10	5YR 5/2
					CC					CC	10R 6/6
											Smear: 1-19 (brown)
											40% zeolites 45% clay 5% opaques 10% radiolaria casts and molds
											Smear: 1-114 (dusky yellow brown)
											45% zeolites TR% quartz 45% clay 5% rad casts and molds 5% sponge spicules TR% silicoflag. TR% fish remains
											Smear: 2-6 (orange brown)
											30% zeolites 15% clay 5% foraminifera 40% calc. nannofossils 10% rad casts and molds
											Smear: 2-10 (reddish dark brown)
											40% zeolites 50% clay 10% opaques TR% fish remains
											Grain Size 1-40 2.5% sand 32.6% silt 64.9% clay
											Carbon, Carbon-Carbonate 1-60 (0.1, 0.1, 0)

SITE 418 HOLE B CORE 20 CORED INTERVAL: 177.2-186.7 m



Zeolite-bearing Clay, Pelagic Clay, Zeolitic Clay

Highly disturbed to homogenized mixture of zeolite-bearing clay, pelagic clay and zeolitic clay mostly in hues of dark yellowish brown (10YR 4/2). Minor amounts of dolomite crystals occur. A few rare patches of pale orange (10YR 8/2) or light brown (5YR 5/6) occur in Section 1.

Major lithology (choco. brown)

Smear: 2-77

90% clay
5% zeolites
5% fish remains

Smear: 3-120

90% clay
5% dolomite
5% zeolites

Smear: 5-74

5% quartz
70% clay
5% opaques
15% zeolites
5% fish remains

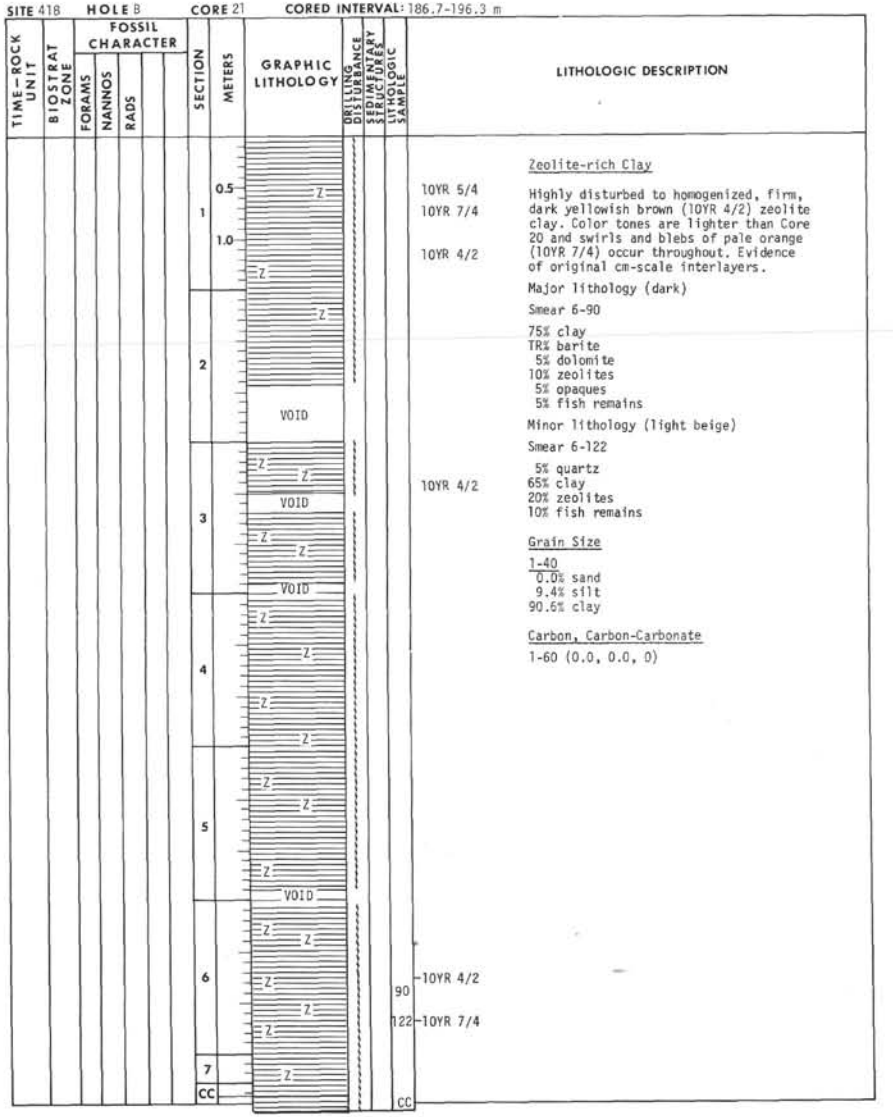
Grain Size

2-40
0.0% sand
8.4% silt
91.6% clay

Carbon, Carbon-Carbonate

2-60 (0.1, 0.1, 0)

SITE 418 HOLE B CORE 21 CORED INTERVAL: 186.7-196.3 m



Zeolite-rich Clay

Highly disturbed to homogenized, firm, dark yellowish brown (10YR 4/2) zeolite clay. Color tones are lighter than Core 20 and swirls and blebs of pale orange (10YR 7/4) occur throughout. Evidence of original cm-scale interlayers.

Major lithology (dark)

Smear 6-90

75% clay
TR% barite
5% dolomite
10% zeolites
5% opaques
5% fish remains

Minor lithology (light beige)

Smear 6-122

5% quartz
65% clay
20% zeolites
10% fish remains

Grain Size

1-40
0.0% sand
9.4% silt
90.6% clay

Carbon, Carbon-Carbonate

1-60 (0.0, 0.0, 0)

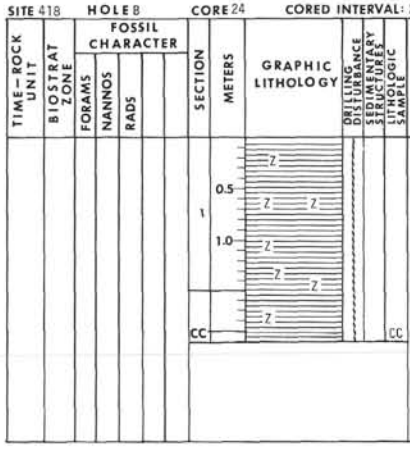
SITE 418 HOLE B CORE 22 CORED INTERVAL: 196.3-205.8 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FOSSIL CHARACTER: FORAMS	FOSSIL CHARACTER: NANNOS	FOSSIL CHARACTER: RADS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	LITHOLOGIC SAMPLE	LITHOLOGIC DESCRIPTION
					1	0.5	Z				10YR 3/2 Zeolite Clay Firm zeolitic clay, moderate to highly disturbed with alternating bands of grayish orange with coarse thin laminae of zeolite forming light pale orange (10YR 8/6) streaks. Also, there is a dusky to pale yellow brown (10YR 2/2-6/2-3/2) zeolitic clay with some micronodule patches and streaks, especially in lower sections. In Section 1 - 41 to 150 cm and Section 2-0 to 40 cm, 79 cycles of light-dark colors are present, with cm bands and moderately sharp to wavy contacts. No evidence of grading or turbidite. 5YR 5/6 10YR 7/4 + 10YR 4/2 10YR 7/2 + 5YR 2/2 Major lithology Smear: 1-90 (yellow brown) 20% clay 80% zeolites Smear 1-138 (dark) 10YR 7/4 + 10YR 6/2 50% clay 30% zeolites 20% opaques Other lithologies Smear: 1-106 (coarse, light beige) 20% clay 80% zeolites Grain Size 2-110 0.4% sand 30.4% silt 69.2% clay 10YR 4/2
						1.0	Z			90 106 138	
					2		Z				
					3		Z				
					4						
					CC					CC	

SITE 418 HOLE B CORE 23 CORED INTERVAL: 205.8-215.3 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FOSSIL CHARACTER: FORAMS	FOSSIL CHARACTER: NANNOS	FOSSIL CHARACTER: RADS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	LITHOLOGIC SAMPLE	LITHOLOGIC DESCRIPTION
					1	0.5	Z			16 34	10YR 5/2 Zeolitic Clay Highly disturbed, partly drilling breccia, of firm, zeolitic clay with alternating color bands to swirls of dominantly pale grayish orange (10YR 7/4) and pale yellow brown (10YR 6/2) with streaks and blebs of light brown (5YR 6/4) or dusky yellow brown (4/2). Contacts appear sharp to transitional. Overall light colors dominant except from 1 - 0 to 40 where more than 40 clay bands occur. 10YR 7/4 dom. + 10Y 6/2 5YR 6/4 rare Smear: 1-16 (coarse dark) 50% clay 10% opaques 30% zeolites Smear: 1-34 (dark bleb) 55% clay 15% opaques 25% zeolites 5% quartz Grain Size 1-60 0.2% sand 8.5% silt 91.3% clay Carbon, Carbon-Carbonate 1-80 (0.1, 0.1, 0) 10YR 6/2-4/2 10YR 2/2 rare 10YR 6/2 and 10YR 7/4 10YR 2/2 minor 10YR 6/2 10YR 7/4 trace 10YR 4/2
					2		Z				
					3		VOID				
					4		Z				
					5		VOID				
					6		Z Z				
					7						
					CC						

SITE 418 HOLE B CORE 24 CORED INTERVAL: 215.3-224.9 m



10YR 2/2

10YR 6/2
+
5YR 5/6

Zeolitic Clay

Extremely disturbed, light brown, hard zeolitic clay in several hues of brown: dominantly pale yellow brown (10YR 6/2) to light brown (5YR 5/6) and some patches of moderate dusky yellow brown (10YR 2/2)

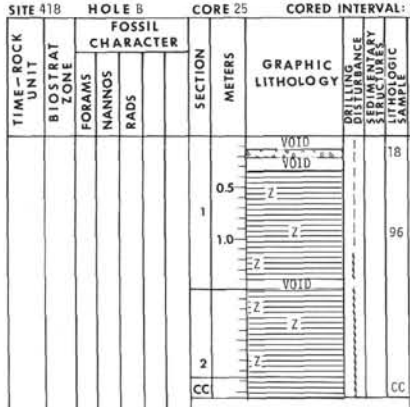
Grain Size

1-40
1.1% sand
16.9% silt
82.0% clay

Carbon, Carbon-Carbonate

1-60 (0.0, 0.1, 0)

SITE 418 HOLE B CORE 25 CORED INTERVAL: 224.9-234.4 m



10G 8/2

5YR 6/4-5/4

10YR 2/2
+
5YR 5/6

Zeolitic Clay

Moderate to highly deformed, hard to firm zeolitic clay occurring as banded color cycles with diffuse to discrete layering on a cm scale. Dominant colors are light brown (5YR 6/4-5/4) with lesser amounts of dusky yellow brown (10YR 2/2) (20%) cm bands. Scattered blebs of pale green clay, possibly ash, and one ash bed (1-18 to 20) also occur.

Major lithology (dusky yellowish brown)

Smear: 1-96

50% clay
20% opaques
30% zeolites

Minor lithology (pale green)

Smear: 1-18

90% clay
5% opaques
5% quartz

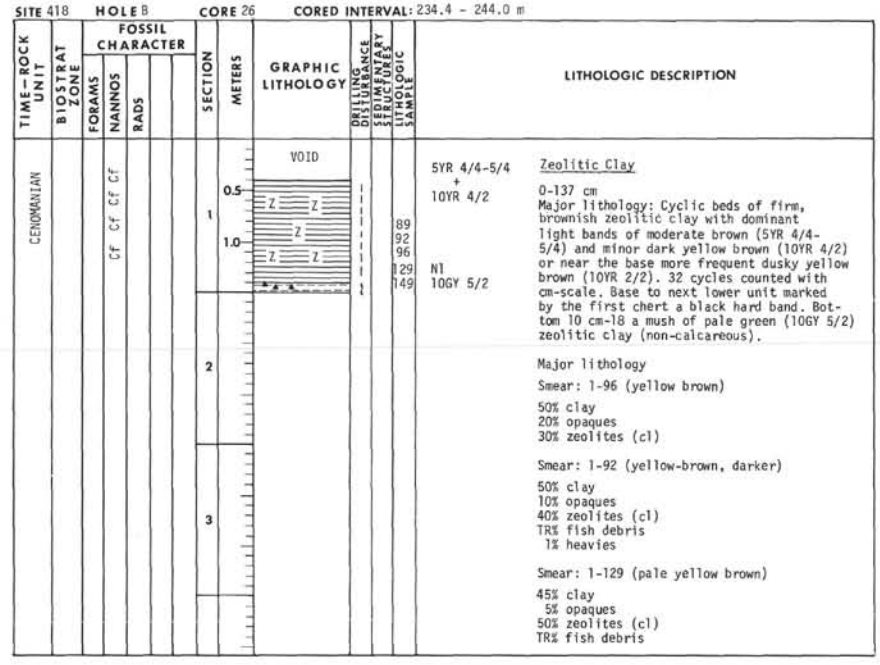
Grain Size

2-40
0.0% sand
9.2% silt
90.8% clay

Carbon, Carbon-Carbonate

2-60 (0.1, 0.1, 0)

SITE 418 HOLE B CORE 26 CORED INTERVAL: 234.4 - 244.0 m



5YR 4/4-5/4
+
10YR 4/2

N1
10GY 5/2

Zeolitic Clay

0-137 cm
Major lithology: Cyclic beds of firm, brownish zeolitic clay with dominant light bands of moderate brown (5YR 4/4-5/4) and minor dark yellow brown (10YR 4/2) or near the base more frequent dusky yellow brown (10YR 2/2). 32 cycles counted with cm-scale. Base to next lower unit marked by the first chert a black hard band. Bottom 10 cm-18 a mush of pale green (10GY 5/2) zeolitic clay (non-calcareous).

Major lithology

Smear: 1-96 (yellow brown)

50% clay
20% opaques
30% zeolites (cl)

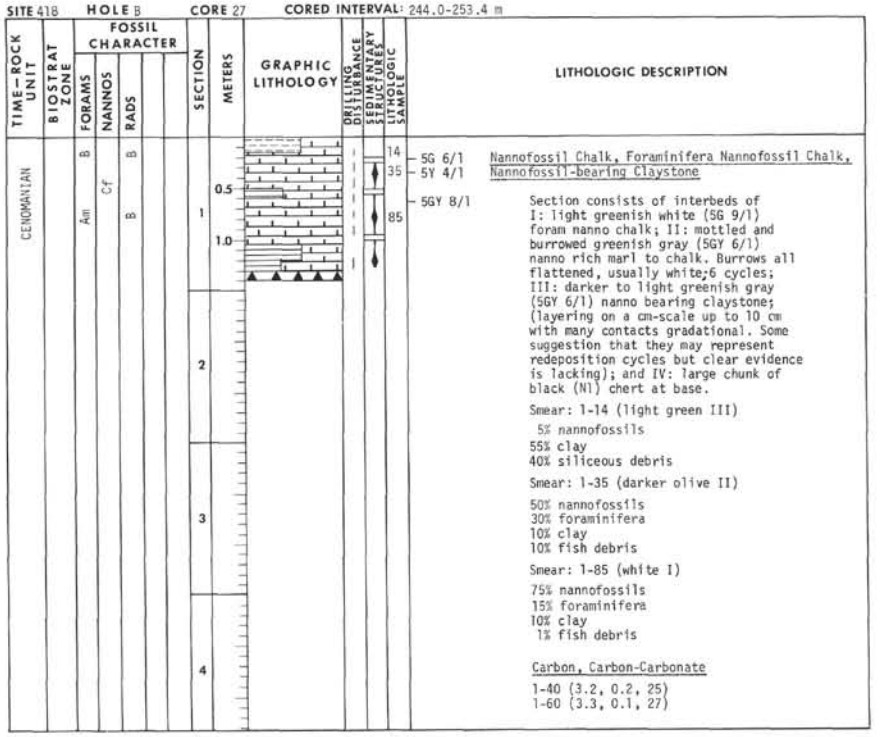
Smear: 1-92 (yellow-brown, darker)

50% clay
10% opaques
40% zeolites (cl)
TR% fish debris
1% heavies

Smear: 1-129 (pale yellow brown)

45% clay
5% opaques
50% zeolites (cl)
TR% fish debris

SITE 418 HOLE B CORE 27 CORED INTERVAL: 244.0-253.4 m



Nannofossil Chalk, Foraminifera Nannofossil Chalk, Nannofossil-bearing Claystone

Section consists of interbeds of I: light greenish white (5G 9/1) foram nanno chalk; II: mottled and burrowed greenish gray (5GY 6/1) nanno rich marl to chalk. Burrows all flattened, usually white;6 cycles; III: darker to light greenish gray (5GY 6/1) nanno bearing claystone; (layering on a cm-scale up to 10 cm with many contacts gradational. Some suggestion that they may represent redeposition cycles but clear evidence is lacking); and IV: large chunk of black (N1) chert at base.

Smear: 1-14 (light green III)

5% nannofossils
55% clay
40% siliceous debris

Smear: 1-35 (darker olive II)

50% nannofossils
30% foraminifera
10% clay
10% fish debris

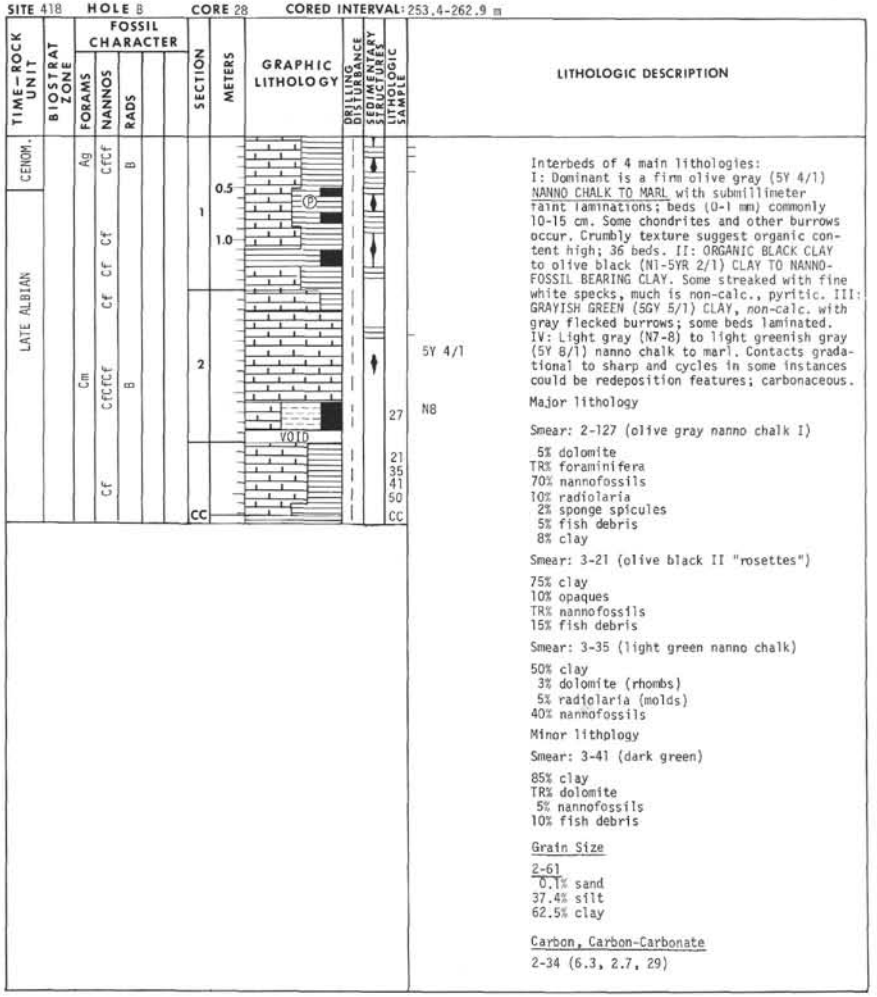
Smear: 1-85 (white I)

75% nannofossils
15% foraminifera
10% clay
1% fish debris

Carbon, Carbon-Carbonate

1-40 (3.2, 0.2, 25)
1-60 (3.3, 0.1, 27)

SITE 418 HOLE B CORE 28 CORED INTERVAL: 253.4-262.9 m



Interbeds of 4 main lithologies: I: Dominant is a firm olive gray (5Y 4/1) NANNO CHALK TO MARL with submillimeter faint laminations; beds (0-1 mm) commonly 10-15 cm. Some chondrites and other burrows occur. Crumbly texture suggest organic content high; 36 beds. II: ORGANIC BLACK CLAY to olive black (N1-5YR 2/1) CLAY TO NANNOFOSSIL BEARING CLAY. Some streaked with fine white specks, much is non-calc., pyritic. III: GRAYISH GREEN (5GY 5/1) CLAY, non-calc. with gray flecked burrows; some beds laminated. IV: Light gray (N7-8) to light greenish gray (5Y 8/1) nanno chalk to marl. Contacts gradational to sharp and cycles in some instances could be redeposition features; carbonaceous.

Major lithology

Smear: 2-127 (olive gray nanno chalk I)

5% dolomite
TR% foraminifera
70% nannofossils
10% radiolaria
2% sponge spicules
5% fish debris
8% clay

Smear: 3-21 (olive black II "rosettes")

75% clay
10% opaques
TR% nannofossils
15% fish debris

Smear: 3-35 (light green nanno chalk)

50% clay
3% dolomite (rhombs)
5% radiolaria (molds)
40% nannofossils

Minor lithology

Smear: 3-41 (dark green)

85% clay
TR% dolomite
5% nannofossils
10% fish debris

Grain Size

2-61
0.1% sand
37.4% silt
62.5% clay

Carbon, Carbon-Carbonate

2-34 (6.3, 2.7, 29)

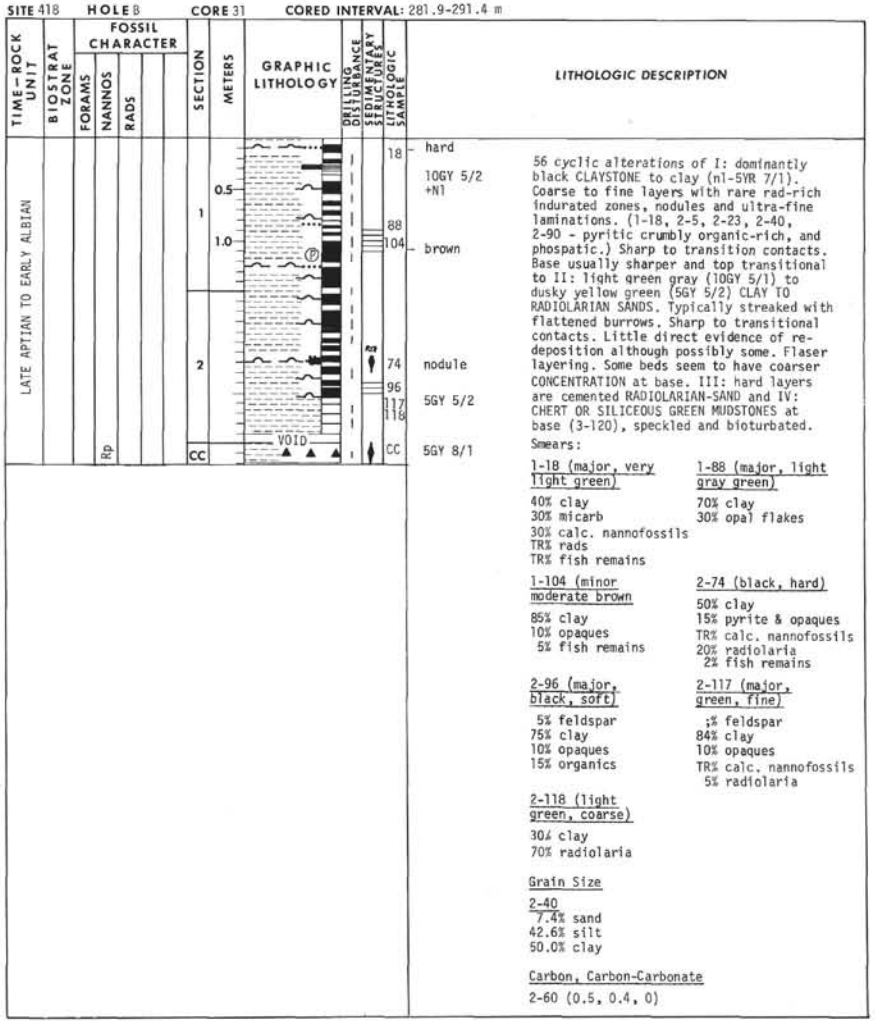
SITE 418 HOLE B CORE 29 CORED INTERVAL: 262.9-272.4 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FOSSIL CHARACTER: FORAMS	FOSSIL CHARACTER: NANNOS	FOSSIL CHARACTER: RADS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	LITHOLOGIC SAMPLE	LITHOLOGIC DESCRIPTION
LATE APTIAN TO EARLY ALBIAN			ff		1	0.5, 1.0				33, 122, 130	5Y 2/1 N1 10G 6/2-5/2 5B 5/1 N1 Interbeds of I: olive black (5Y 2/1) to black (N1) NANNO CHALK with some traces of fine laminations; II: BLACK CLAY to sandy clay pyritic + organic-rich in some levels, coarse sandy parts in both green and black zones are rad-rich almost as rad sands; possible re-deposit; III: PALE TO GRAYISH-GREEN (10G 6/2-5/2) CLAYSTONE alternating with black bands, some levels are rad-rich; and IV: at 2-1-0 to 10 there is a medium bluish gray, homogeneous CHERT bed. Core is interlayered on a decimeter scale with some mm-laminations in darker layers. Black clay is lustrious to crumbly, and contacts with green clays are both sharp and transitional over a few mm. Burrowing is faint in green clays. Hard cemented layers occur at 1-50: a laminated crumbly black bed at 1-130 has radiolaria laminae. Smear: 1-33 (olive black I) 23% clay 15% opaques 1% dolomite rhombs 50% nannofossils 10% radiolaria molds 2% fish debris Smear: 1-122 (medium green major III) 80% clay 5% opaques 10% radiolaria molds 5% fish debris Smear: 1-130 (black laminae minor II) 50% clay 15% opaques 30% radiolaria molds 5% fish debris Grain Size 1-114 0.0% sand 25.0% silt 75.0% clay Carbon, Carbon-Carbonate 1-34 (6.3, 2.7, 29)
					2						
					3						
					4						
					5						

SITE 418 HOLE B CORE 30 CORED INTERVAL: 272.4-281.9 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FOSSIL CHARACTER: FORAMS	FOSSIL CHARACTER: NANNOS	FOSSIL CHARACTER: RADS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	LITHOLOGIC SAMPLE	LITHOLOGIC DESCRIPTION
		B	B	Rm	1	0.5, 1.0				50, 125, 129	N1 + 5GY 2/1 N1 5GY 6/1 crumbly N1 nodule 10GY 5/2 +N1-N2 hard 10GY 5/2+N1 Complex mixture of cycles of (60%) I: hard light green (5GY 6/1) CLAYSTONE with flattened burrows and some rad-rich zones and II: BLACK, ORGANIC-PHSP. PYRITIC CLAYS (N1-N2). Some zones finely laminated (<mm) and indurated (Section 2) and III: COARSE RADIOLARIAN SANDS which occur interspersed in both BLACK AND GREEN. One hard rad-nodule 1-145. One cycle 1-117 to 129 appears redeposited, with a black crumbly, org. coarse base grading up to smooth lustrous black clay and a transition to burrowed green clay. Authigenic crystal growth noted in green clay at 2-133. Overall lighter green dominant. Smears: 1-51 (minor brown coarse) 60% clay 10% opaques 30% rad molds & casts TR% fish remains 1-116 (major green) 75% clay 5% opaques 10% opal 10% fish remains 1-119 (major black laminae) 78% clay 20% pyrite & opaques 2% fish remains 1-125 (black) 60% clay 40% pyrite & opaques 1-129 (minor brown coarse) 75% clay 10% opaques 10% rad casts & molds 5% fish remains 1-142 (minor gray-green, hard) 30% clay 65% radiolaria casts & molds 5% fish remains 2-6 (green) 83% clay 2% micarb TR% calc. nannofossils 15% rad casts & molds TR% fish remains 2-29 (green coarse, hard) 40% clay 60% radiolaria casts & molds 2-134 (light green crystals) 60% clay 40% unknown minerals Grain Size 2-40 0.1% sand 25.3% silt 74.6% clay Carbon, Carbon-Carbonate 2-74 (0.1, 0.1, 0)
					2						
					3						
					4						
					5						
					6						
					7						
					CC						

SITE 418 HOLE B CORE 31 CORED INTERVAL: 281.9-291.4 m



LITHOLOGIC DESCRIPTION

56 cyclic alterations of I: dominantly black CLAYSTONE to clay (n1-5YR 7/1). Coarse to fine layers with rare rad-rich indurated zones, nodules and ultra-fine laminations. (1-18, 2-5, 2-23, 2-40, 2-90 - pyritic crumbly organic-rich, and phospatic.) Sharp to transition contacts. Base usually sharper and top transitional to II: light green gray (10GY 5/1) to dusky yellow green (5GY 5/2) CLAY TO RADIOLARIAN SANDS. Typically streaked with flattened burrows. Sharp to transitional contacts. Little direct evidence of re-deposition although possibly some. Flaser layering. Some beds seem to have coarser CONCENTRATION at base. III: hard layers are cemented RADIOLARIAN-SAND and IV: CHERT OR SILICEOUS GREEN MUDSTONES at base (3-120), speckled and bioturbated.

Smears:

1-18 (major, very light green)
40% clay
30% micarb
30% calc. nannofossils
TR% rads
TR% fish remains

1-88 (major, light gray green)
70% clay
30% opal flakes

1-104 (minor moderate brown
85% clay
10% opaques
5% fish remains

2-74 (black, hard)
50% clay
15% pyrite & opaques
TR% calc. nannofossils
20% radiolaria
2% fish remains

2-96 (major, black, soft)
5% feldspar
75% clay
10% opaques
15% organics

2-117 (major, green, fine)
;% feldspar
84% clay
10% opaques
TR% calc. nannofossils
5% radiolaria

2-118 (light green, coarse)
30% clay
70% radiolaria

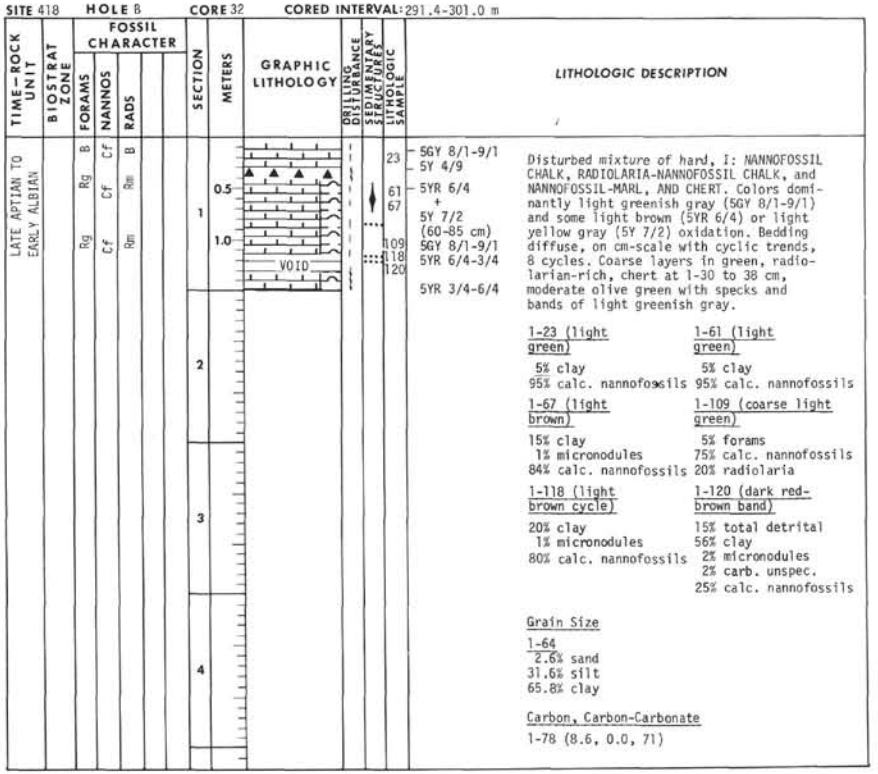
Grain Size

2-40
7.4% sand
42.6% silt
50.0% clay

Carbon, Carbon-Carbonate

2-60 (0.5, 0.4, 0)

SITE 418 HOLE B CORE 32 CORED INTERVAL: 291.4-301.0 m



LITHOLOGIC DESCRIPTION

Disturbed mixture of hard, I: NANNOFOSSIL CHALK, RADIOLARIA-NANNOFOSSIL CHALK, and NANNOFOSSIL-MARL, AND CHERT. Colors dominantly light greenish gray (5GY 8/1-9/1) and some light brown (5YR 6/4) or light yellow gray (5Y 7/2) oxidation. Bedding diffuse, on cm-scale with cyclic trends, 8 cycles. Coarse layers in green, radiolarian-rich, chert at 1-30 to 38 cm, moderate olive green with specks and bands of light greenish gray.

1-23 (light green)
5% clay
95% calc. nannofossils

1-61 (light green)
5% clay
95% calc. nannofossils

1-67 (light brown)
15% clay
1% micronodules
84% calc. nannofossils

1-109 (coarse light green)
5% forams
75% calc. nannofossils
20% radiolaria

1-118 (light brown cycle)
20% clay
1% micronodules
80% calc. nannofossils

1-120 (dark red-brown band)
15% total detrital
56% clay
2% micronodules
2% carb. unspec.
25% calc. nannofossils

Grain Size

1-64
2.6% sand
31.6% silt
65.8% clay

Carbon, Carbon-Carbonate

1-78 (8.6, 0.0, 71)

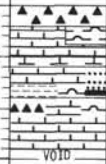
SITE 418 HOLE B CORE 33 CORED INTERVAL: 301.0-310.5 m

TIME-ROCK UNIT: LATE APTIAN TO EARLY ALBIAN

FOSSIL CHARACTER: FORAMS B, B, Rg, B; NANNOS Cf, Af, Cf; RADS B, Rm, Rm, B

SECTION: 1, 2, 3, 4, 5, 6, 7, CC — METERS: 0.5, 1.0

GRAPHIC LITHOLOGY:



LITHOLOGIC SAMPLE: 28, 29, 30, 32, 51.5, 57, 60, 72, 96, 118

LITHOLOGIC DESCRIPTION

10YR 4/2, 5Y 5/6, 5B 5/7

5YR 3/4
5G 8/1
5Y 4/1

4 cycles
5GY 8/1-6/1

Interlayered lithologies of I: (0-25, 100-102 cm), multi-colored CHERTS OR SILICIFIED CHALKS AND CLAYSTONES. Dark yellow-brown, olive brown, medium bluish and gray green hard mudstones; II: (25-32 cm), one cycle of a redeposited RADIOLARIAN SAND TO NANNOFOSSIL CLAY with coarse base and moderate reddish brown (5YR 3/4) clay plus light green mottles. Nannofossil-rich in mid-zone. Other coarse laminae in core are also radiolarian-rich; III: (50-62 cm), olive green gray (5Y 4/1) NANNO CHALK with microlaminations; IV: (62-90 cm), 4 cycles burrowed NANNO MARL, each cycle has a thin basal coarse radiolaria laminae; and V: (90-135 cm), light greenish gray (5G 8/1) clayey nannofossil chalk, hard, some streaks and burrows.

Smears:

1-28 (red-brown clay)
80% clay
8% micronodules
10% calc. nannofossils
2% fish remains

1-29 (dark brown, bottom turbidite?)
55% clay
5% pyrite opaques
30% calc. nannofossils
10% rads

1-30 (dark brown-black)
1% heavy mins.
32% clay
15% pyrite opaques
2% carb. unspec.
40% radiolaria
5% plant debris
5% fish remains

1-32 (brown)
54% clay
1% calc. nannos
25% siliceous debris
10% radiolaria
5% fish remains

1-51.5 (gray, top turb?)
25% quartz
TR% heavy mins.
65% clay
5% calc. nannofossils
5% fish remains

1-57 (gray brown, mid-cycle)
15% clay
85% calc. nannofossils

1-60 (dark brown, bottom of cycle)
20% opaques
80% calc. nannofossils

1-72 (light green gray)
10% clay
90% calc. nannofossils

1-96 (green gray, coarse)
60% calc. nannofossils
40% rads

1-118 (light greenish gray)
20% clay
TR% opaques
80% calc. nannofossils

Grain Size

1-70
4.3% sand
19.8% silt
75.9% clay

Carbon, Carbon-Carbonate

1-80 (1.0, 0.1, 8)

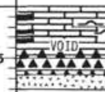
SITE 418 HOLE B CORE 34 CORED INTERVAL: 310.5-320.0 m

TIME-ROCK UNIT: LATE APTIAN TO EARLY ALBIAN

FOSSIL CHARACTER: FORAMS B; NANNOS Cp; RADS Rm

SECTION: 1, 2, 3, 4, 5, 6, 7, CC — METERS: 0.5, 1.0

GRAPHIC LITHOLOGY:



LITHOLOGIC SAMPLE: 2, 11, 13, 16, 21, 26, 44

LITHOLOGIC DESCRIPTION

5GY 8/1
5Y 4/1
N1

Moderately disturbed mixtures of: I: soft, light greenish gray (5GY 8/1) NANNOFOSSIL OOZE (0-2 cm); II: dominantly black to olive BLACK FRIABLE CLAY with organic matter (N1-5GY 2/2). Some have sub-mm thin nanno-rich laminae and rads; discontinuous. Four beds present; III: dark green gray streaked CLAY with some coarse (radiolaria) laminae; IV: one nodule (15-17 cm) of hard cemented RADIOLARIA-SAND; V: bright grayish blue green 95BG 6/6) NANNOFOSSIL CLAY; VI: three pieces of CHERT from the base olive green to green, replacement grain with relict structure, burrows, etc; one sprinkled with pyrite.

Contacts are mostly sharp especially the base of black layers. No clear cyclicity except transtion black to green.

Major lithology

Smear: 1-2 (light green)

15% silic. micronodules
60% calc. nannofossils
2% detrital
23% clay

Smear: 1-11 (black clay)

1% calc. nannofossils
30% detrital
30% clay
TR% dolomite
10% fish remains
29% plant debris

Other lithologies

Smears:

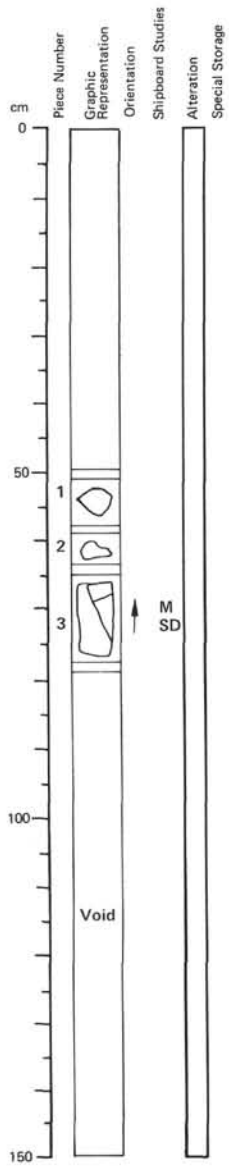
1-13 (gray brown nodule)
10% other
15% opaques
13% clay
TR% carb. unspec.
2% calc. nannofossils
60% rads

1-16 (black laminated)
5% other
25% clay
60% calc. nannofossils
5% rads

1-21 (organic clay)
10% other
65% clay
5% zeolite?
20% plant debris

1-26 (light green)
10% opaques
5% heavy mins.
45% clay
30% calc. nannofossils
10% fish remains

1-44
13% other
5% opaques
40% clay
30% chert
2% calc. nannofossils
10% rads



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

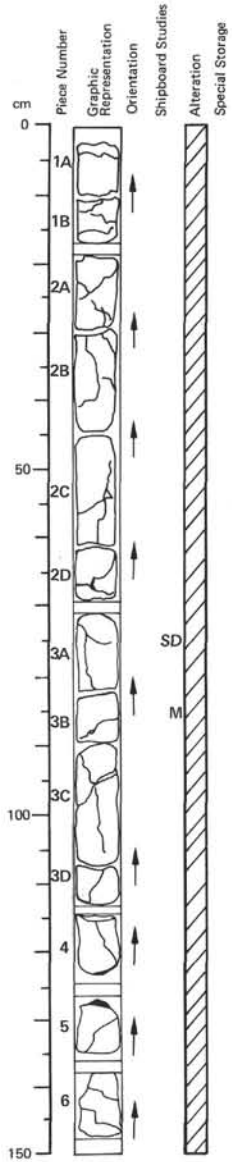
LEG		SITE			HOLE	CORE		SECT.	
5	1	4	1	8	B		3	4	1

Visual Description

0-64 cm: clay, nanno-chalk, sand and chert (described in sediment section). Piece 3: altered plagioclase-phyric basalt with chilled margin. Groundmass fine-grained, microlitic, locally altered to smectite. Altered plagioclase phenocrysts 5%, < 3 mm. Calcite-filled vesicles < 1%, 1 mm. Veins filled by calcite and smectite.

Shipboard Data

Magnetic Data:	70-71 cm
NRM Intensity (emu/cc)	22.22×10^{-3}
NRM Inclination	+41.6°
Stable Inclination	+41.9°
Physical Property Data:	72-74 cm
$\overline{V}p$ (km/sec)	4.13
Wet Bulk Density (g/cc)	2.61



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

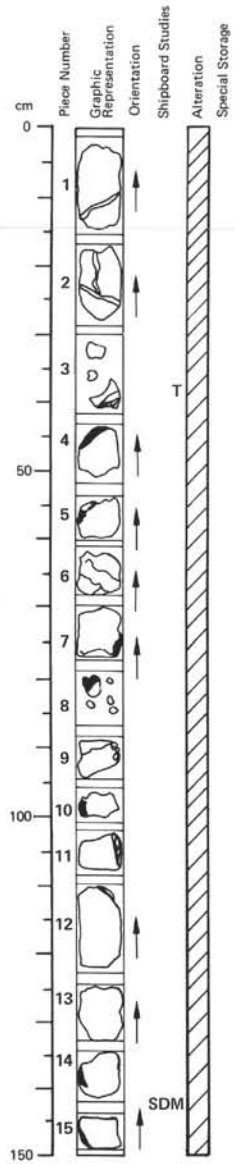
LEG		SITE			HOLE	CORE		SECT.	
5	1	4	1	8	B		3	5	1

Visual Description

Moderately to strongly altered plagioclase-phyric basalt with glassy chilled margins in pieces 4 and 5. Groundmass fine grained, microlitic. Plagioclase phenocrysts 7%, < 5 mm; plagioclase microlites 10%. Calcite-filled vesicles 1%, < 1 mm. Veins common, filled by calcite, pyrite and dark green, yellow or brown smectite.

Shipboard Data

Magnetic Data:	85-86 cm
NRM Intensity (emu/cc)	14.63×10^{-3}
NRM Inclination	+29.3°
Stable Inclination	+29.8°
Physical Property Data:	72-74 cm
$\overline{V}p$ (km/sec)	5.32
Wet Bulk Density (g/cc)	2.84



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	1	4	1	8	B		3	5	2

Visual Description

Slightly to moderately altered phyric pillow basalt with numerous glassy margins. Groundmass aphanitic to fine-grained. Plagioclase phenocrysts 8%, <6 mm; olivine phenocrysts <1%, <2 mm, replaced by calcite, smectite. Vesicles <1%, <1 mm. Veins filled by smectite and calcite.

Thin Section Description

Location: glassy margin, 38 cm

Texture: porphyritic, glassy to variolitic

Phenocrysts: fresh to partially altered olivine <1%, 0.1-0.7 mm, euhedral; plagioclase 7%, 0.3-2.2 mm, occasionally with glass inclusions.

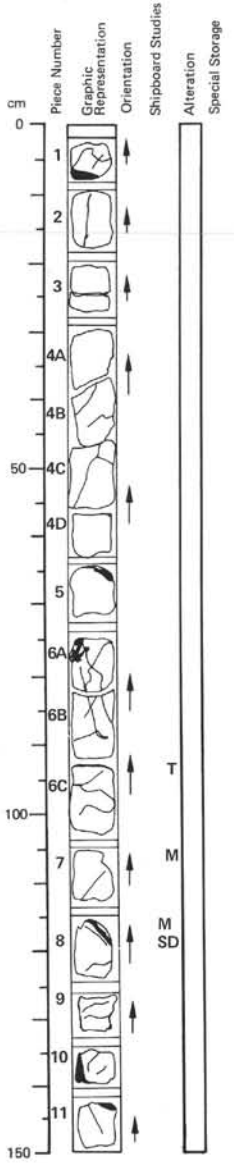
Groundmass: glass 92%

Vesicles: 1%, filled by green smectite.

Alteration: calcite in veins and with smectite after olivine.

Shipboard Data

Magnetic Data:	143-144 cm
NRM Intensity (emu/cc)	19.70×10^{-3}
NRM Inclination	+34.2°
Stable Inclination	+34.4°
Physical Property Data:	144-146 cm
$\bar{V}p$ (km/sec)	5.64
Wet Bulk Density (g/cc)	2.90



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
5	1	4	1	8	B		3	5	3

Visual Description

Moderately altered plagioclase-phyric basalt with glassy chilled margins in pieces 1, 5, 6A, 8, 10 and 11. Basalt dark gray, altered to brown along veins and cracks. Groundmass aphanitic to fine-grained with fresh plagioclase microlites. Glass relatively fresh except along cracks. Plagioclase phenocrysts 8%, <5 mm. Vesicles <1%, <1 mm, filled by calcite and smectite. Veins common, filled by calcite, dark smectite and minor pyrite. Piece 4A contains irregular leached cavities filled by calcite.

Thin Section Description

Location: near chilled margin, 103 cm

Texture: cryptocrystalline, variolitic

Phenocrysts: altered olivine <1%; plagioclase 10%, 0.3-3 mm, euhedral with devitrified glass inclusions; spinel rare, found as inclusions in plagioclase.

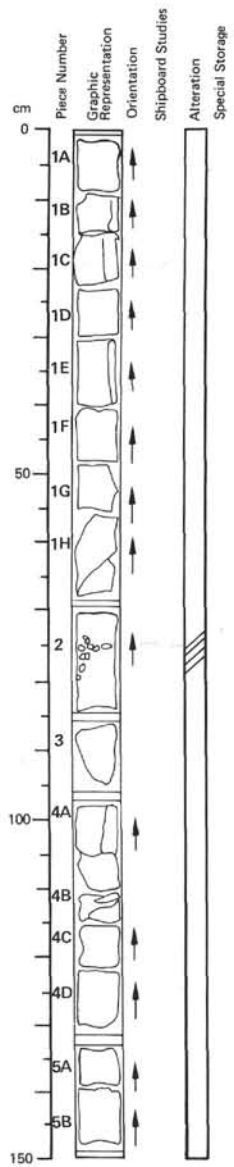
Groundmass: plagioclase laths and dendritic clinopyroxene 90%; minor granular opaques.

Vesicles: <1%, filled by smectite, minor calcite.

Alteration: olivine replaced by calcite and smectite; veins filled by calcite and smectite.

Shipboard Data

Magnetic Data:	117-118 cm
NRM Intensity (emu/cc)	23.86×10^{-3}
NRM Inclination	+34.9°
Stable Inclination	+35.1°
Physical Property Data:	118-120 cm
$\bar{V}p$ (km/sec)	5.82
Wet Bulk Density (g/cc)	2.88

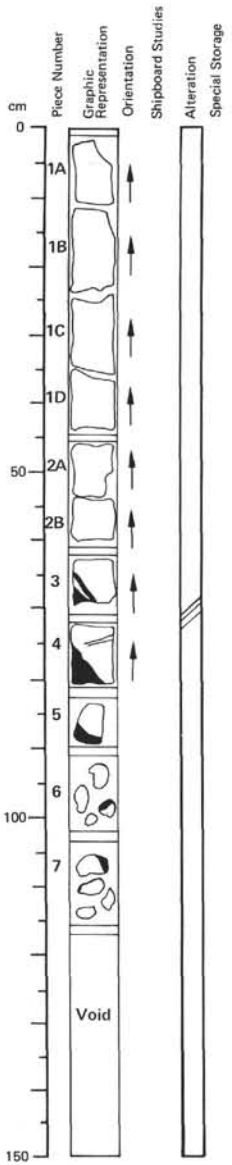


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	1	4	1	8	B	3	5	4

Visual Description

Slightly altered, sparsely to moderately phyric basalt. Groundmass intersertal. Plagioclase phenocrysts ≤5%, <4 mm; olivine phenocrysts < 1%, < 1 mm, completely altered to smectite. Vesicles <1%, 0.5 mm, filled by smectite ± cores of calcite and minor pyrite. Veins filled by smectite, calcite and pyrite. Piece 2 locally strongly altered, contains white and green montmorillonite, calcite, minor pyrite and chalcedony(?). Piece 3 is composed entirely of large calcite crystals in a secondary (sedimentary?) matrix of smectite and chalcedony.

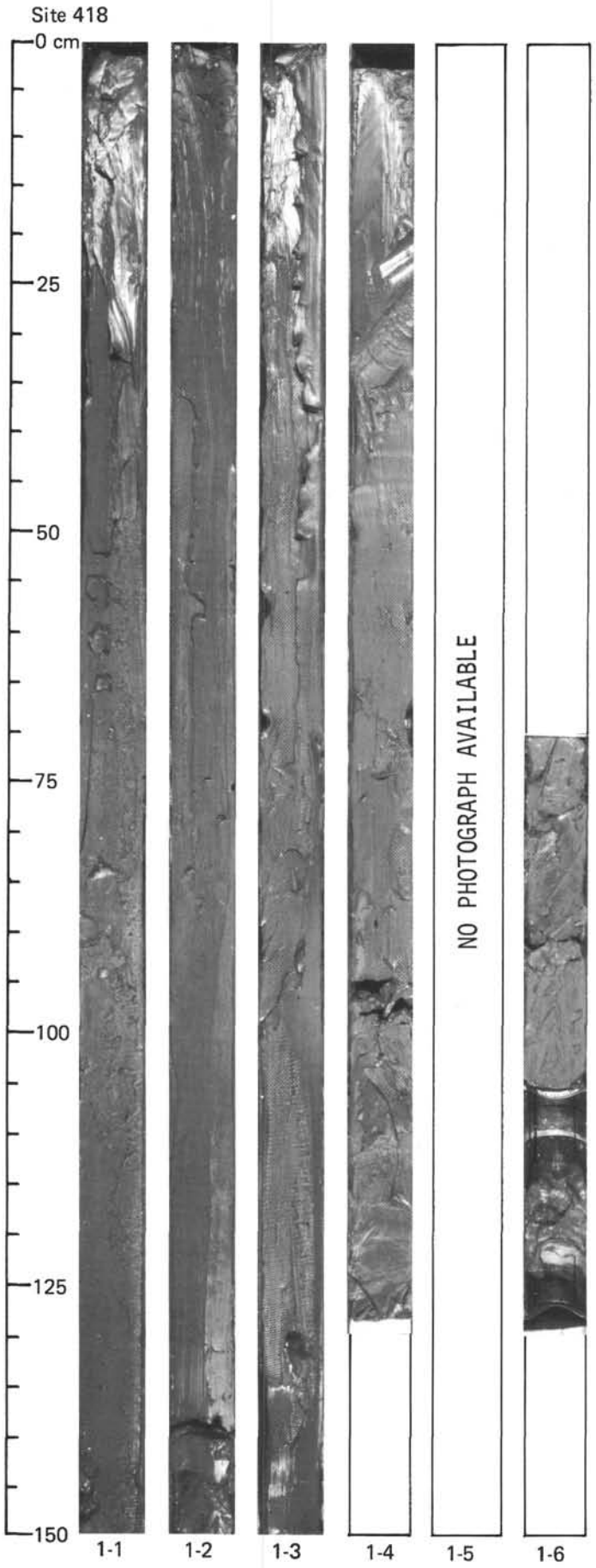


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.
5	1	4	1	8	B	3	5	5

Visual Description

Sparsely to moderately plagioclase phyric basalt with glassy chilled margins in pieces 3-5. Groundmass glassy to intersertal. Plagioclase phenocrysts ≤5%, <4 mm. Smectite-filled vesicles <1%, <0.1 mm. Veins filled by calcite and smectite.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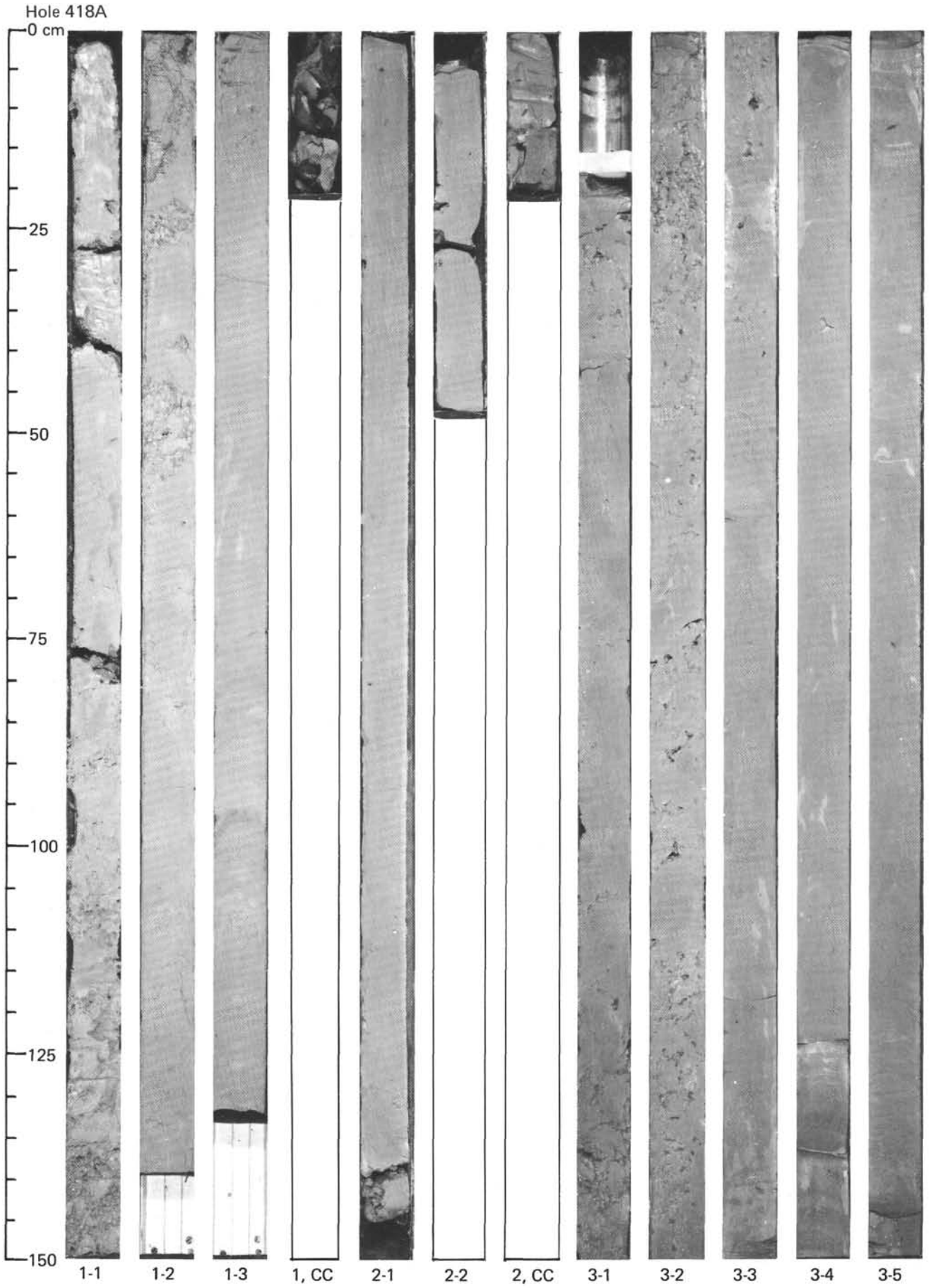
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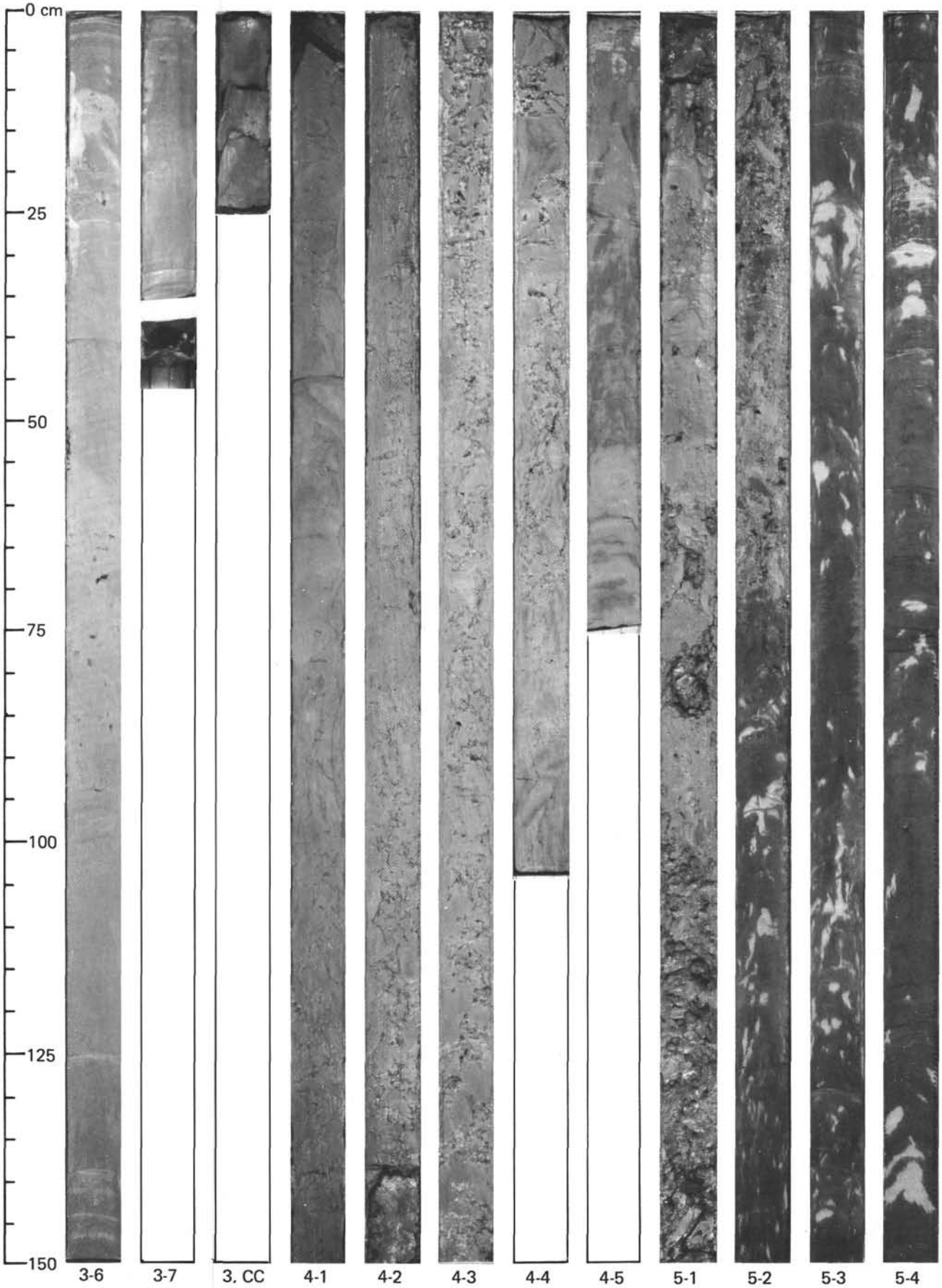
3-5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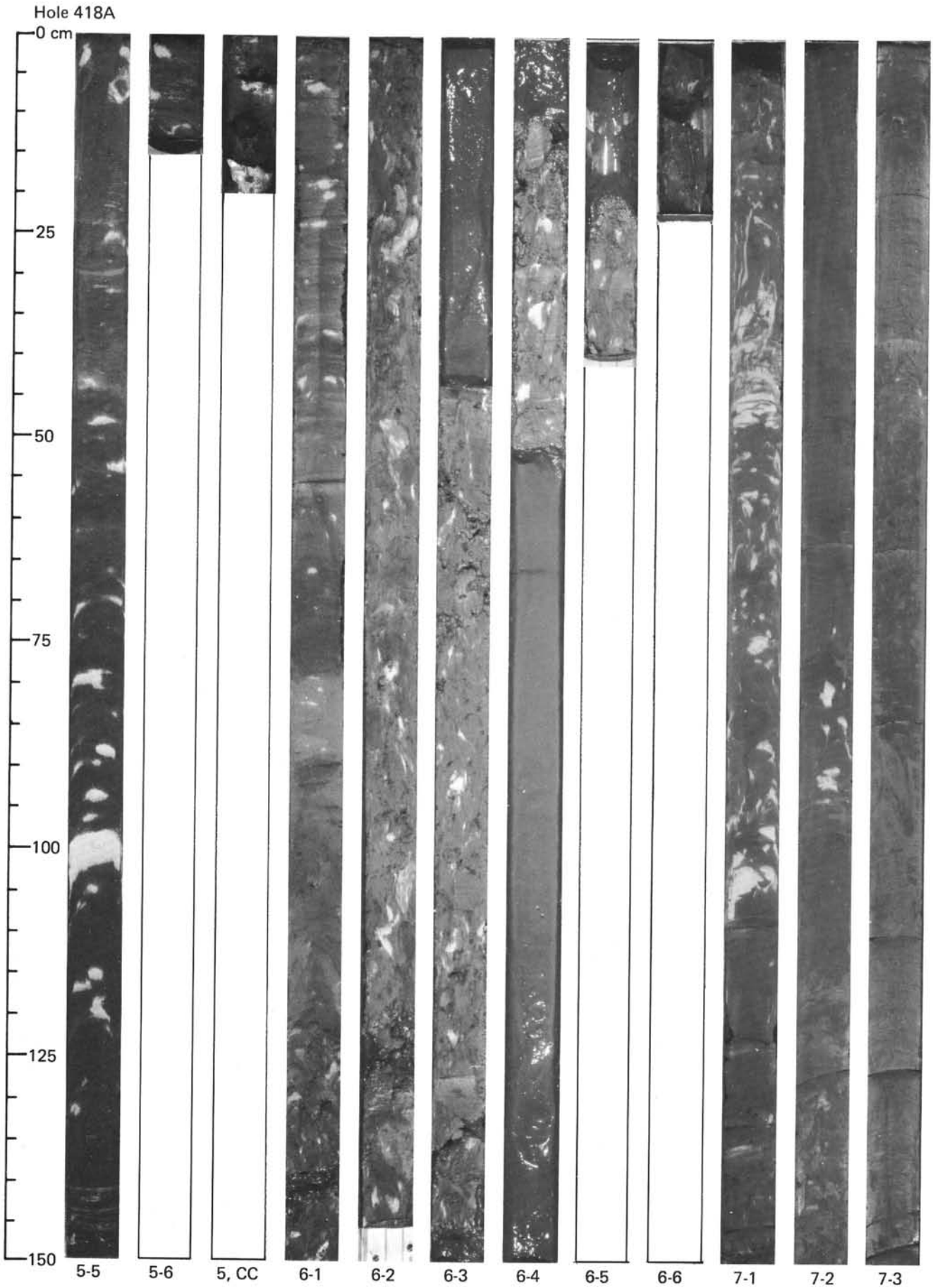
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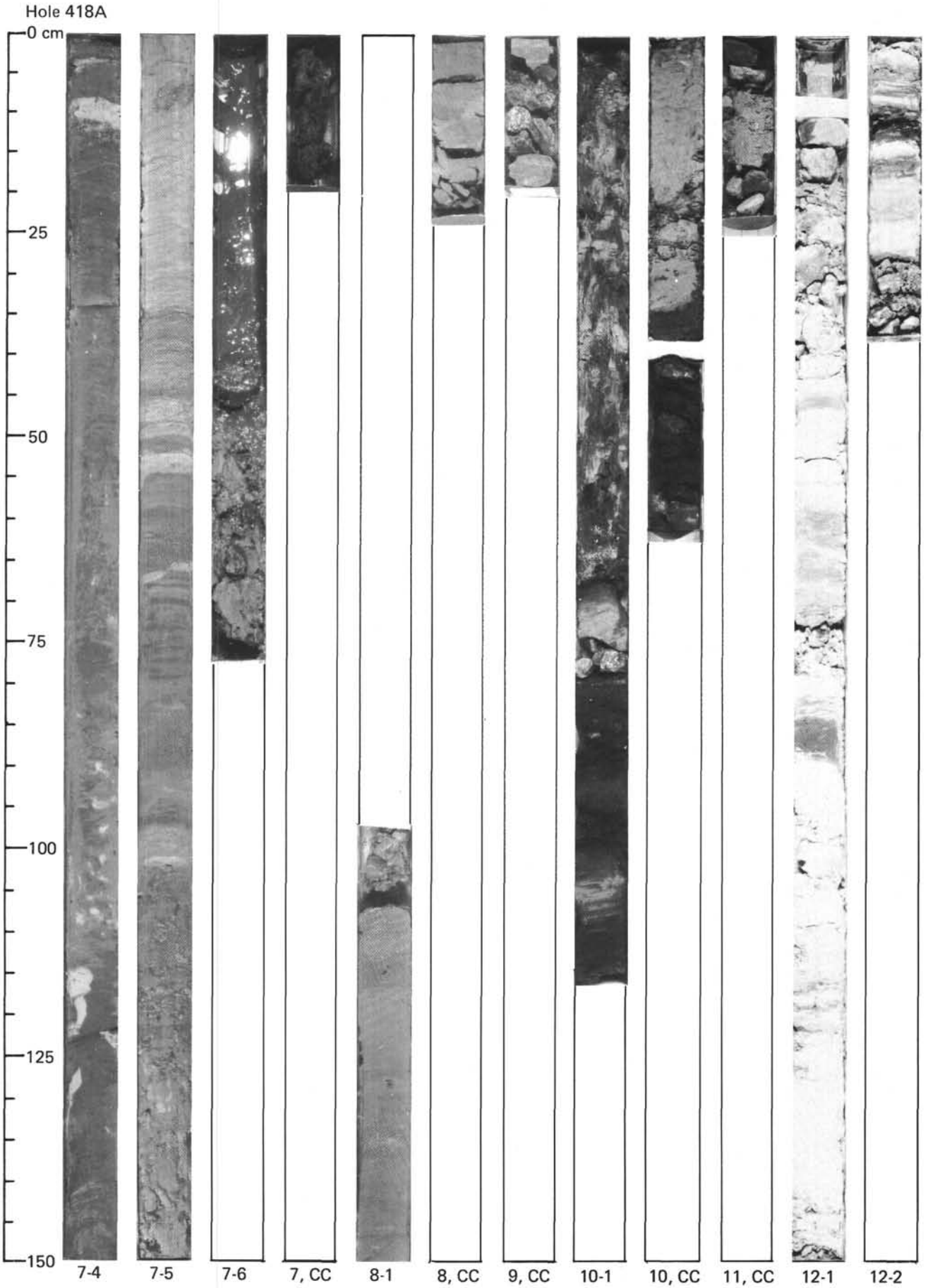
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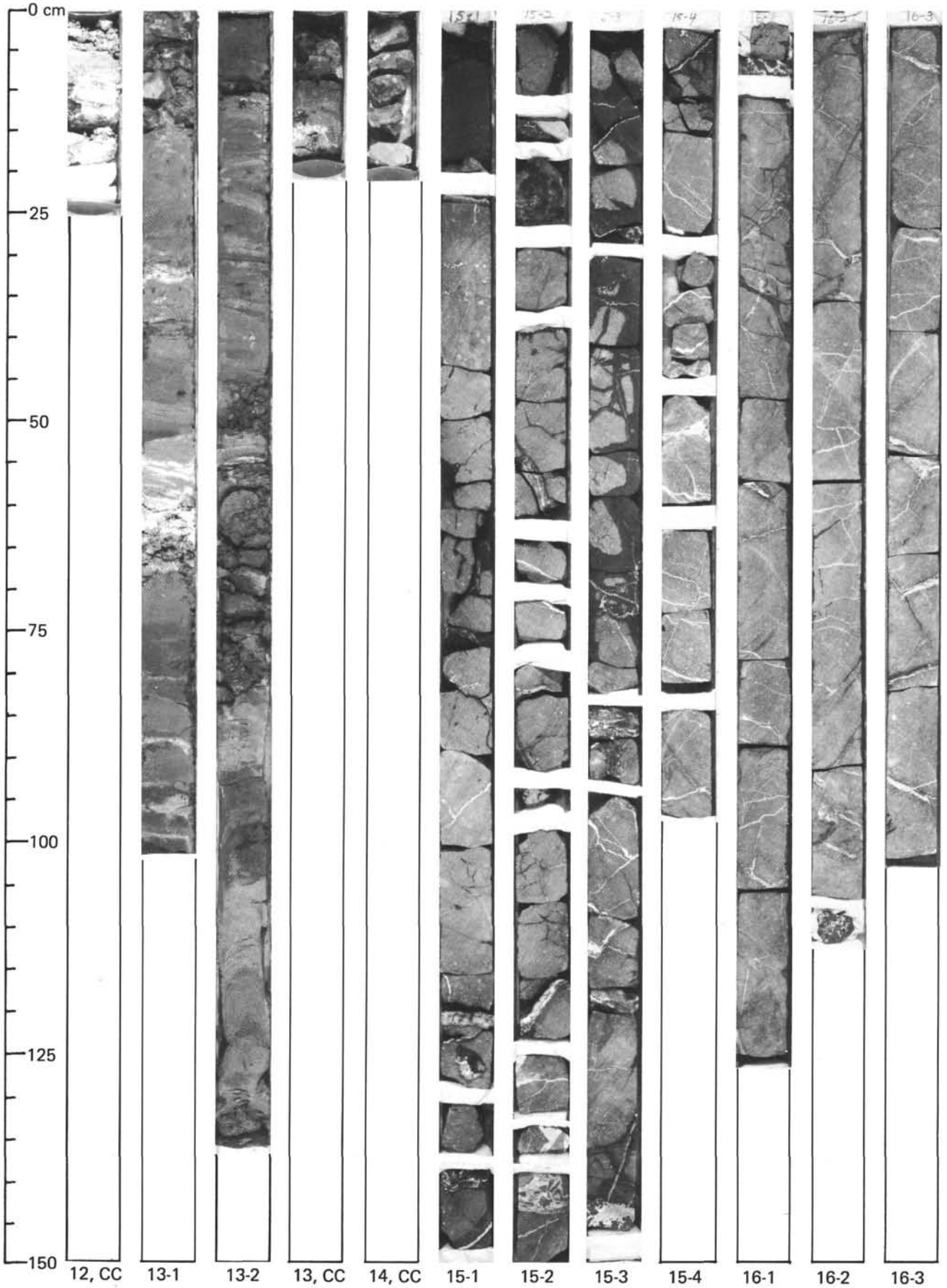
Hole 418A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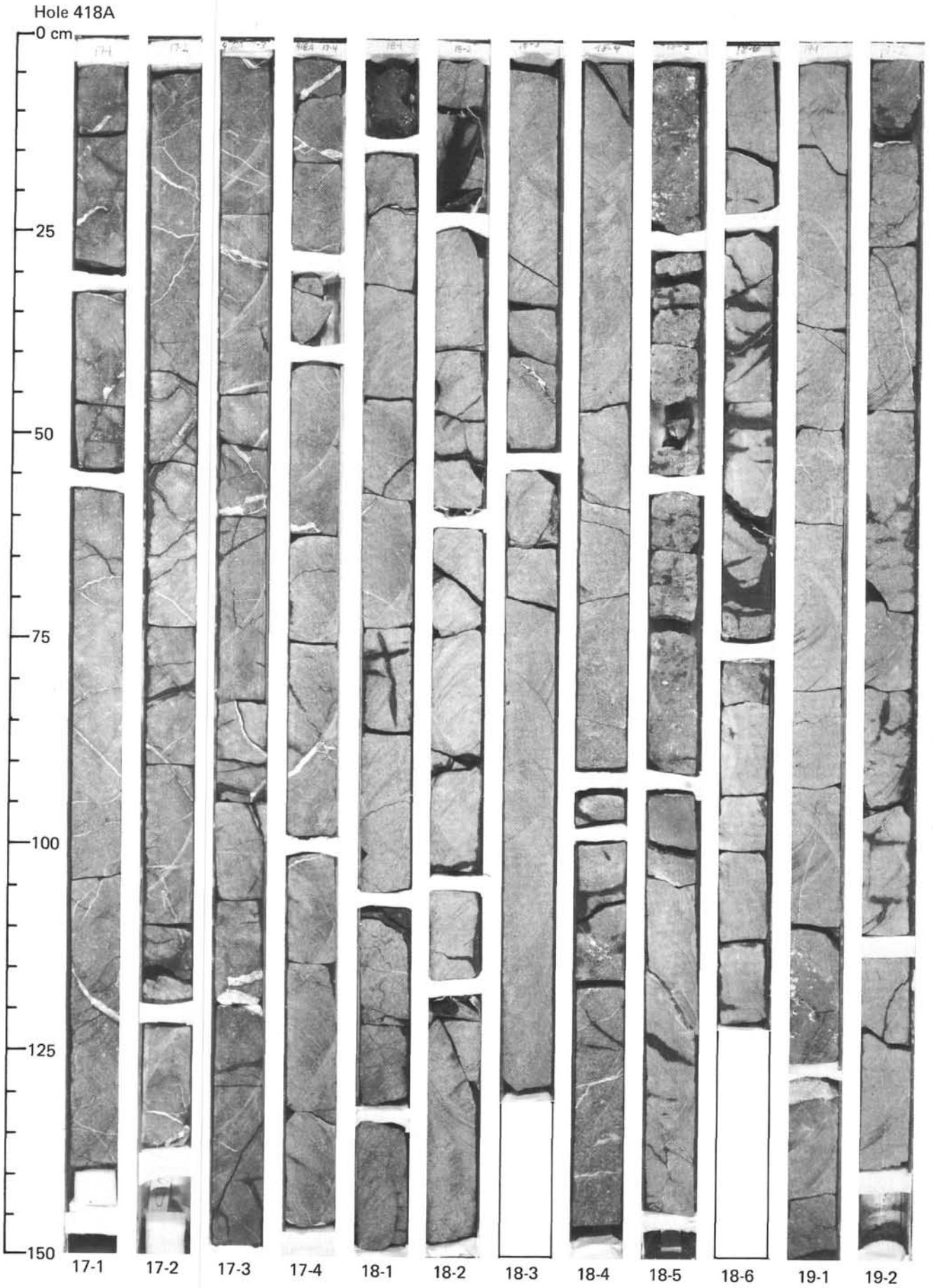
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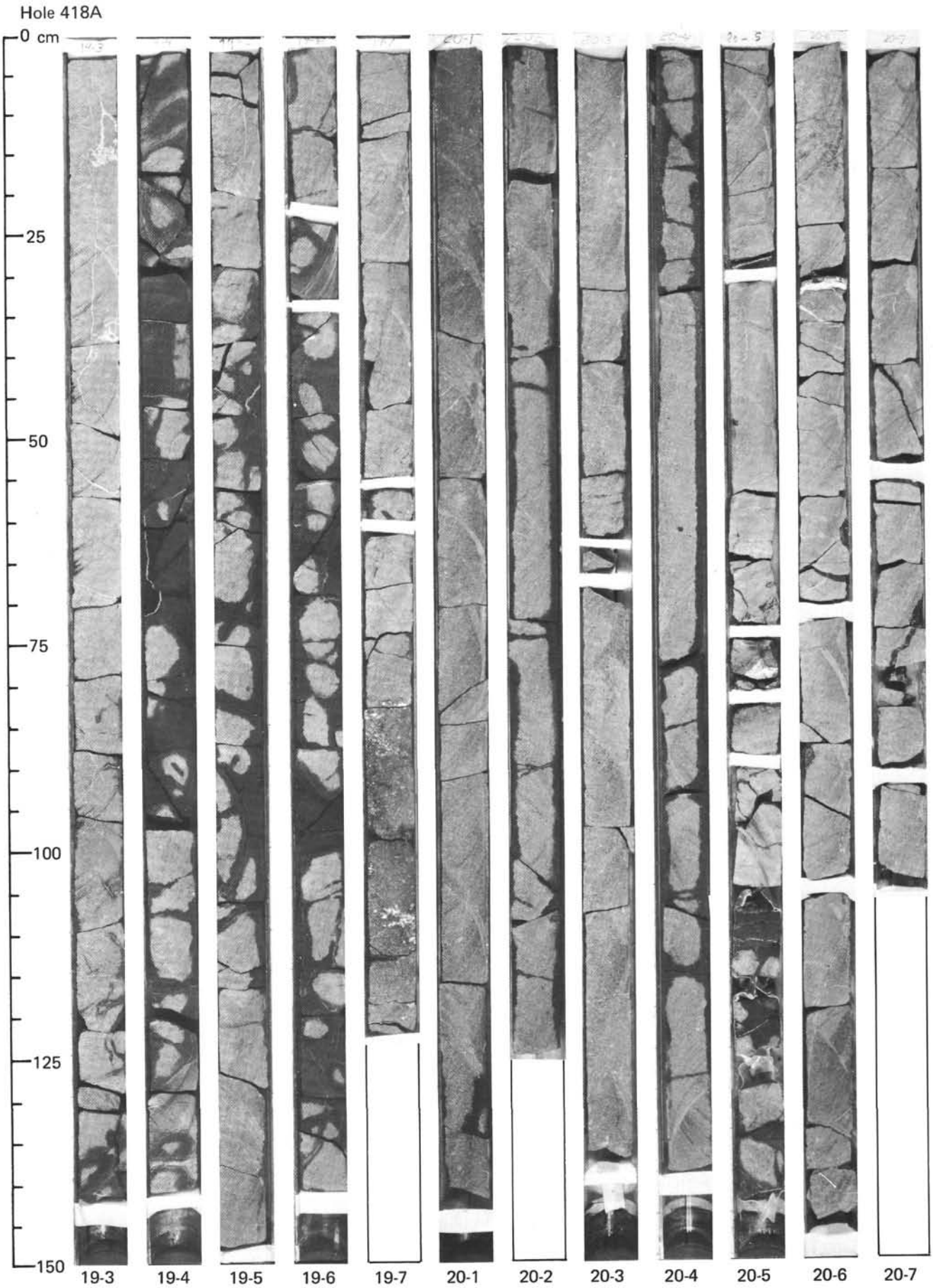
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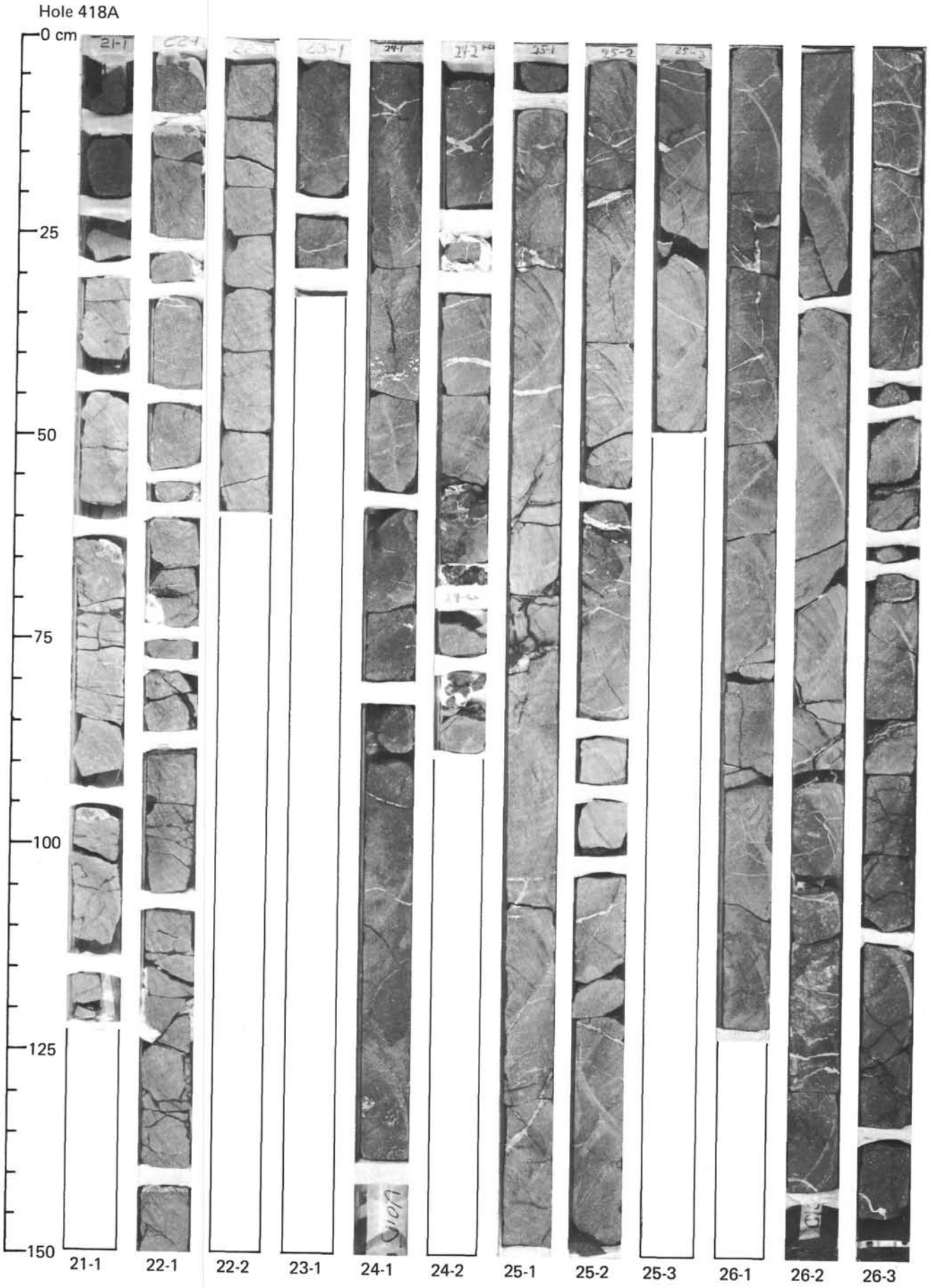
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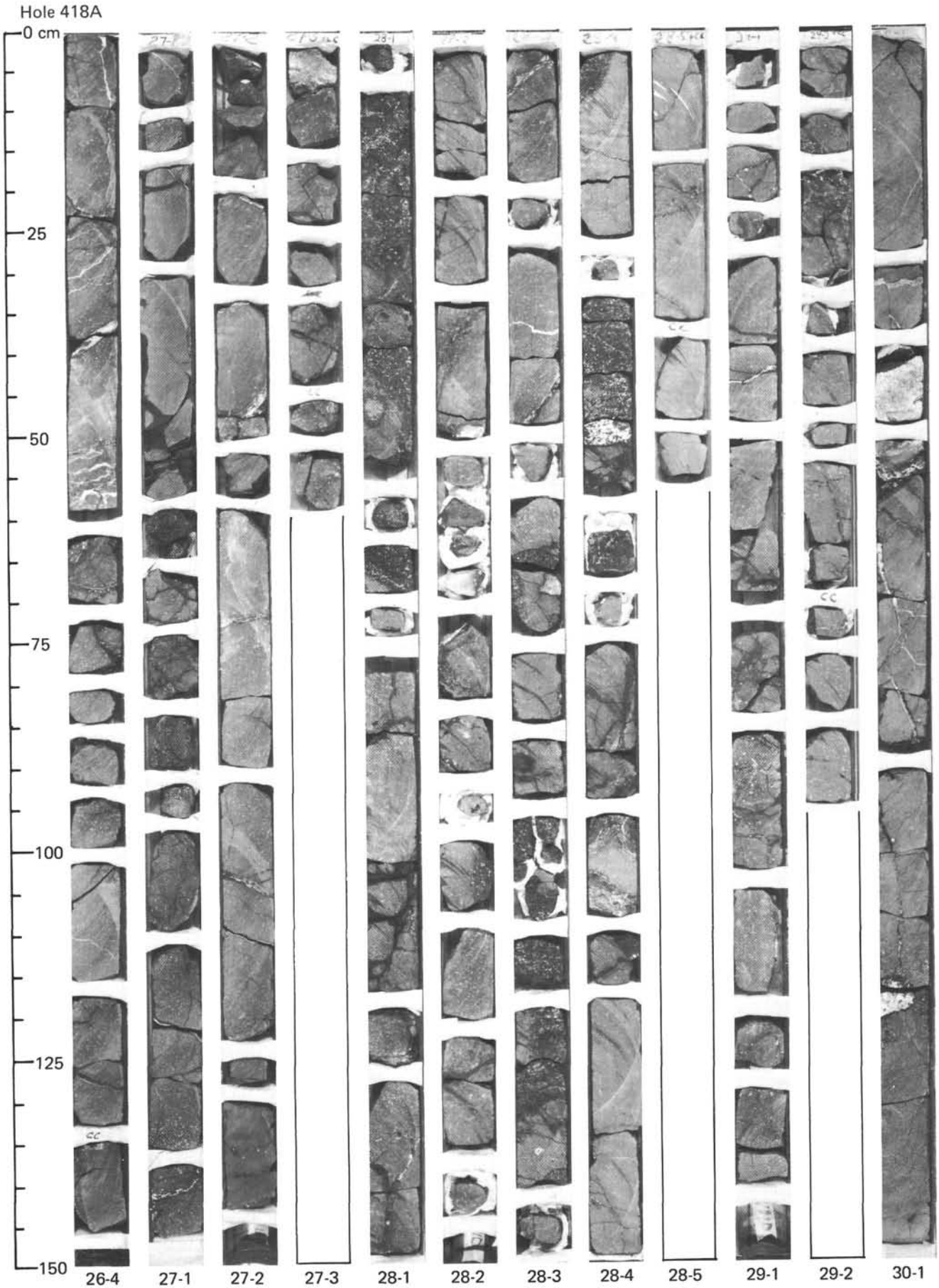
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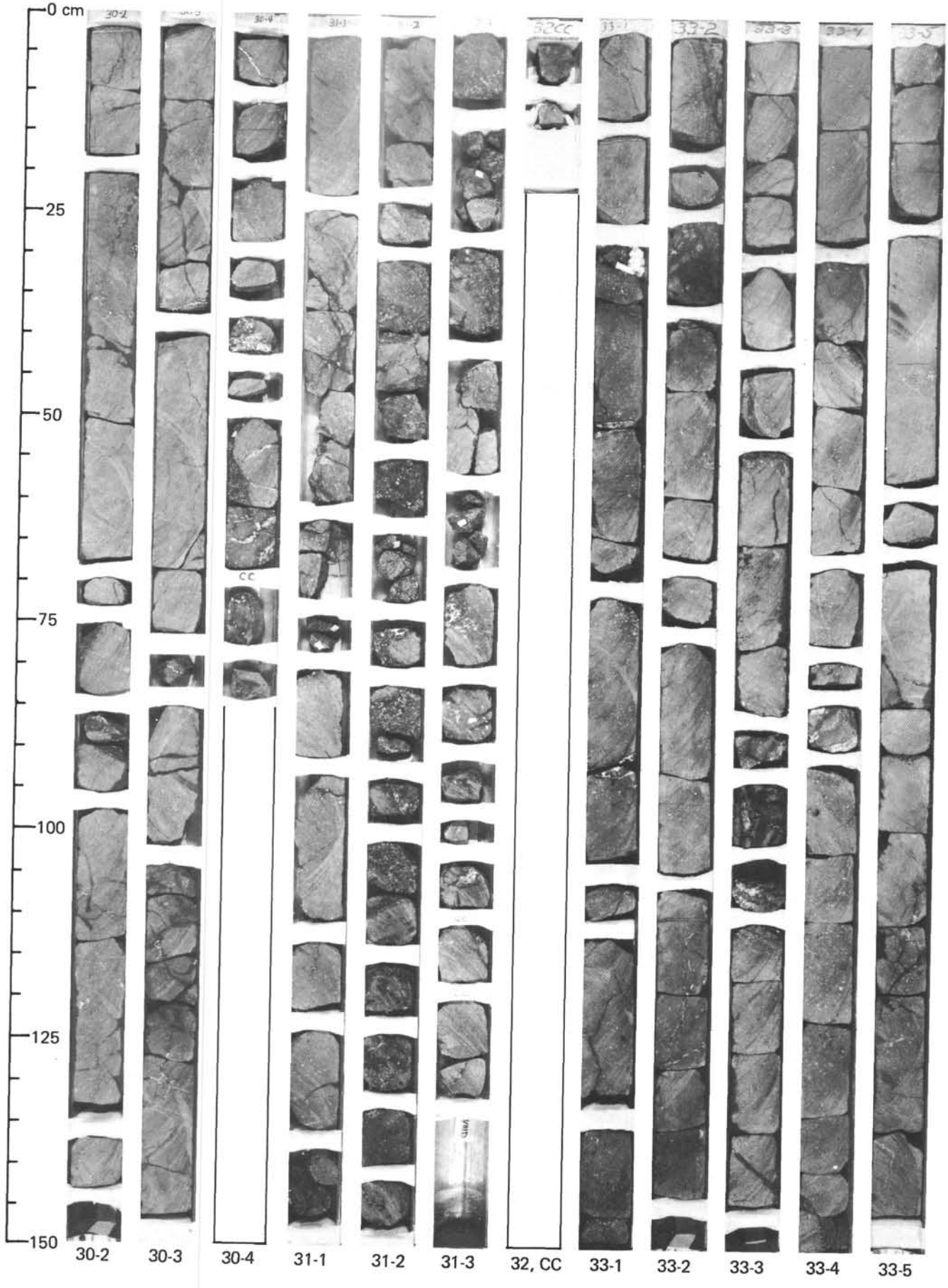
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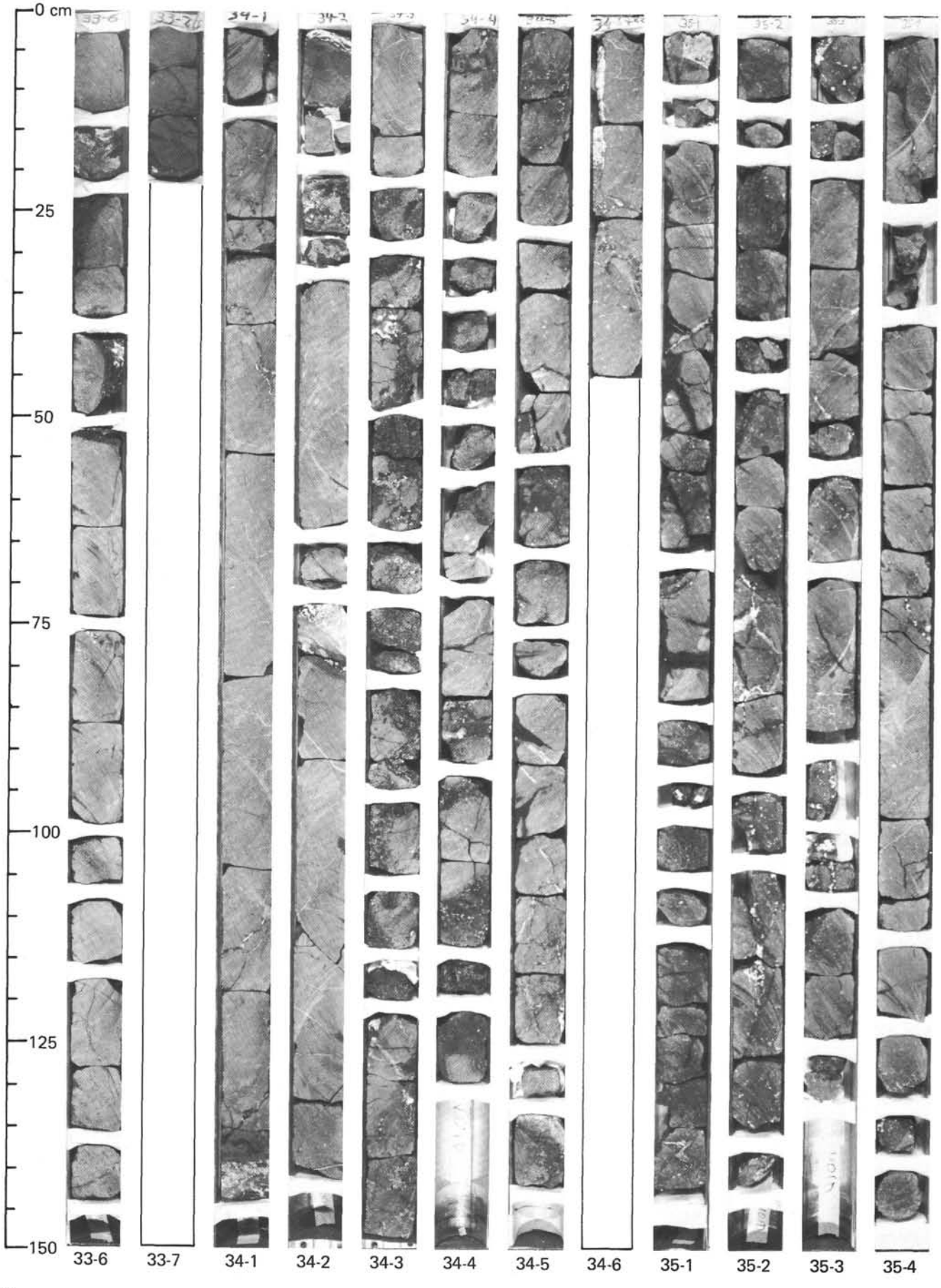
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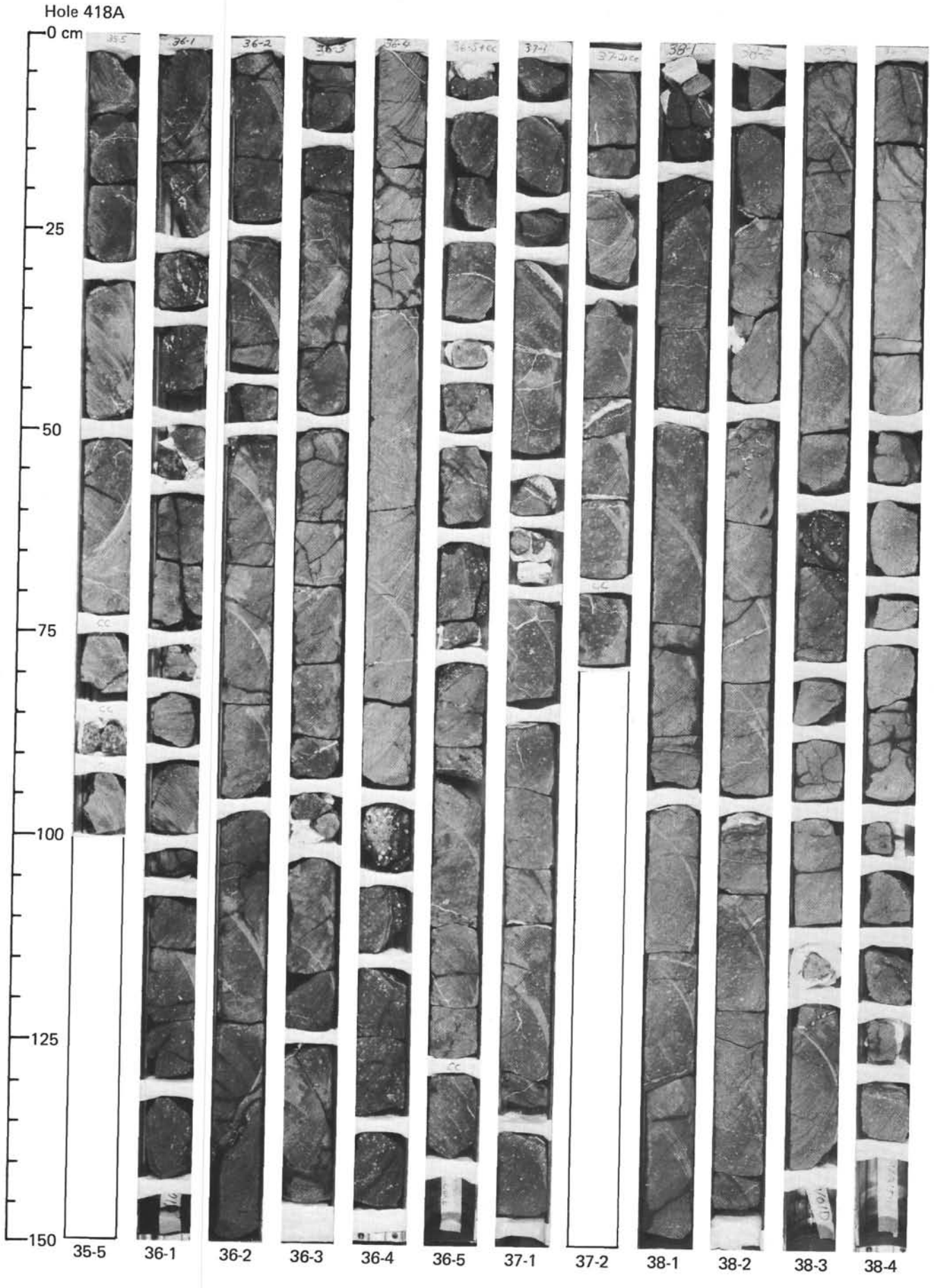
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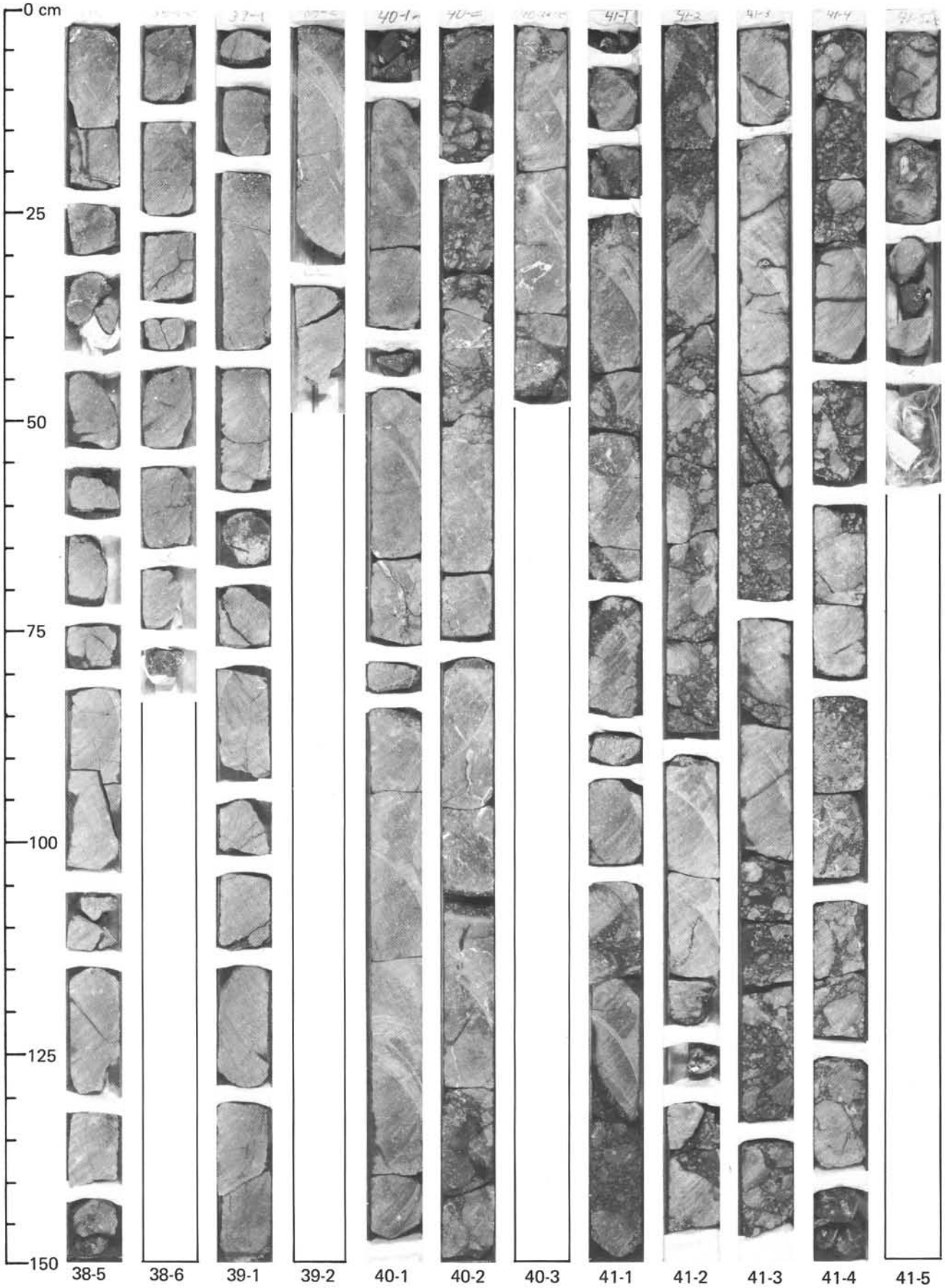
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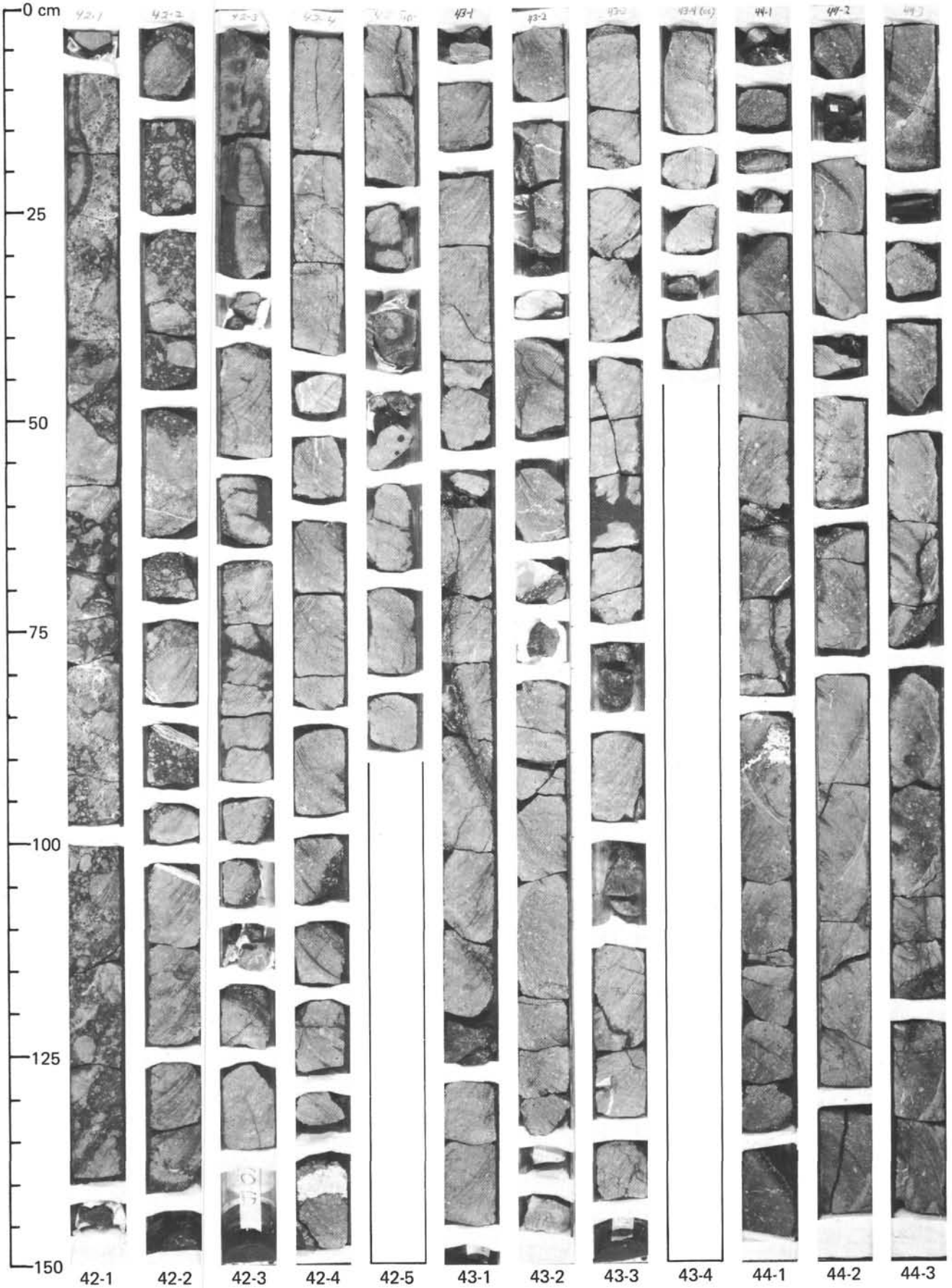
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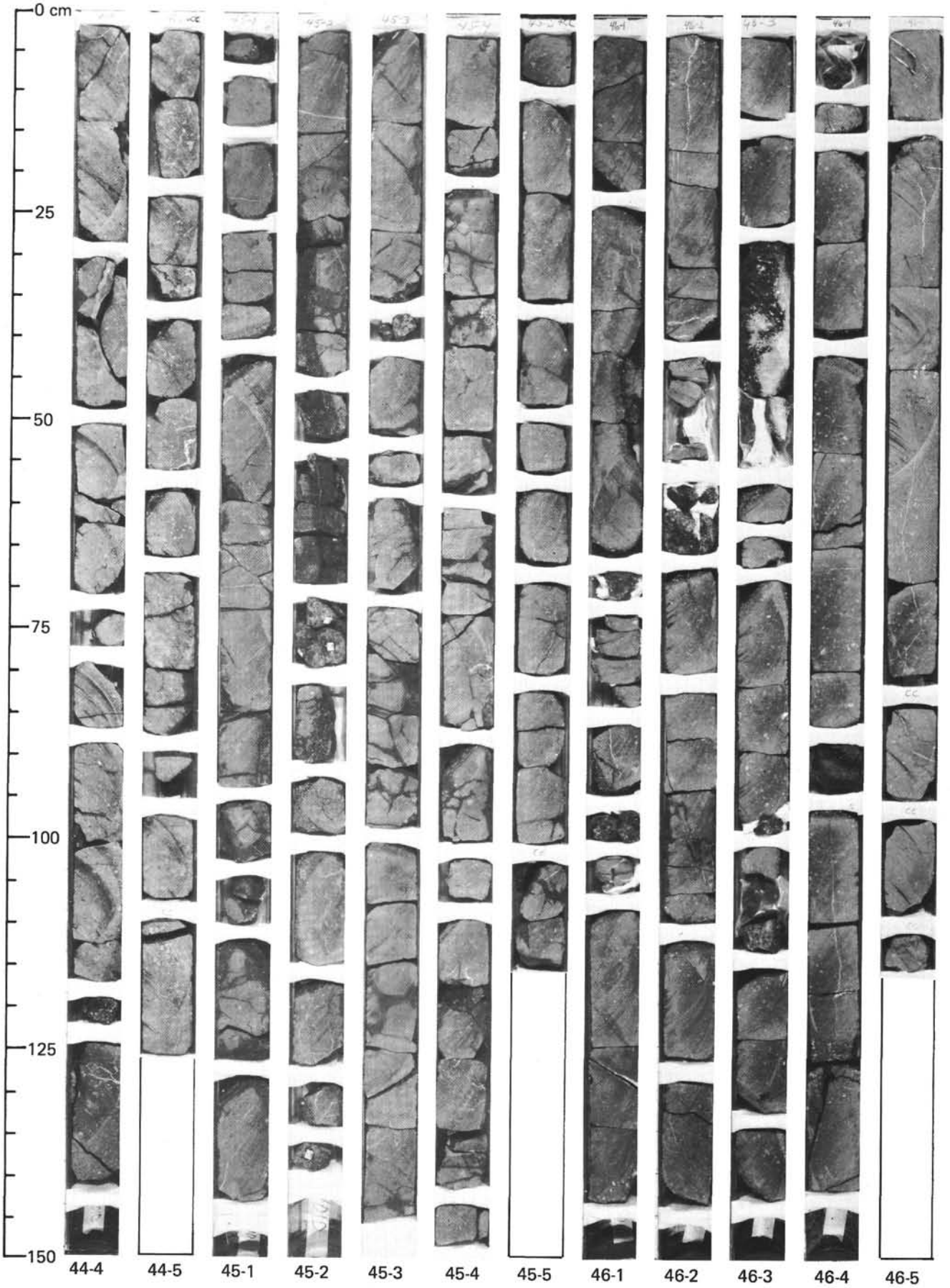
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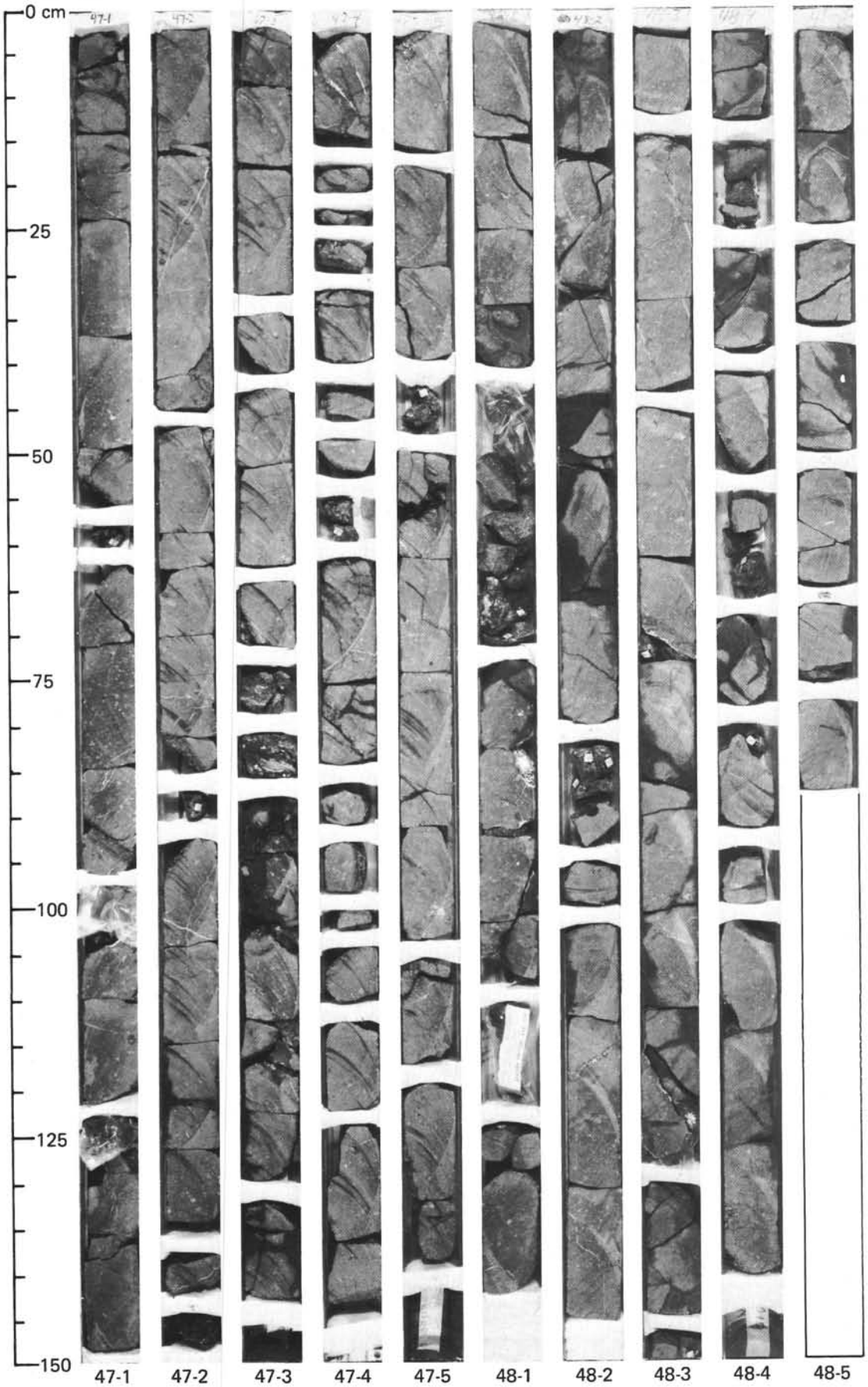
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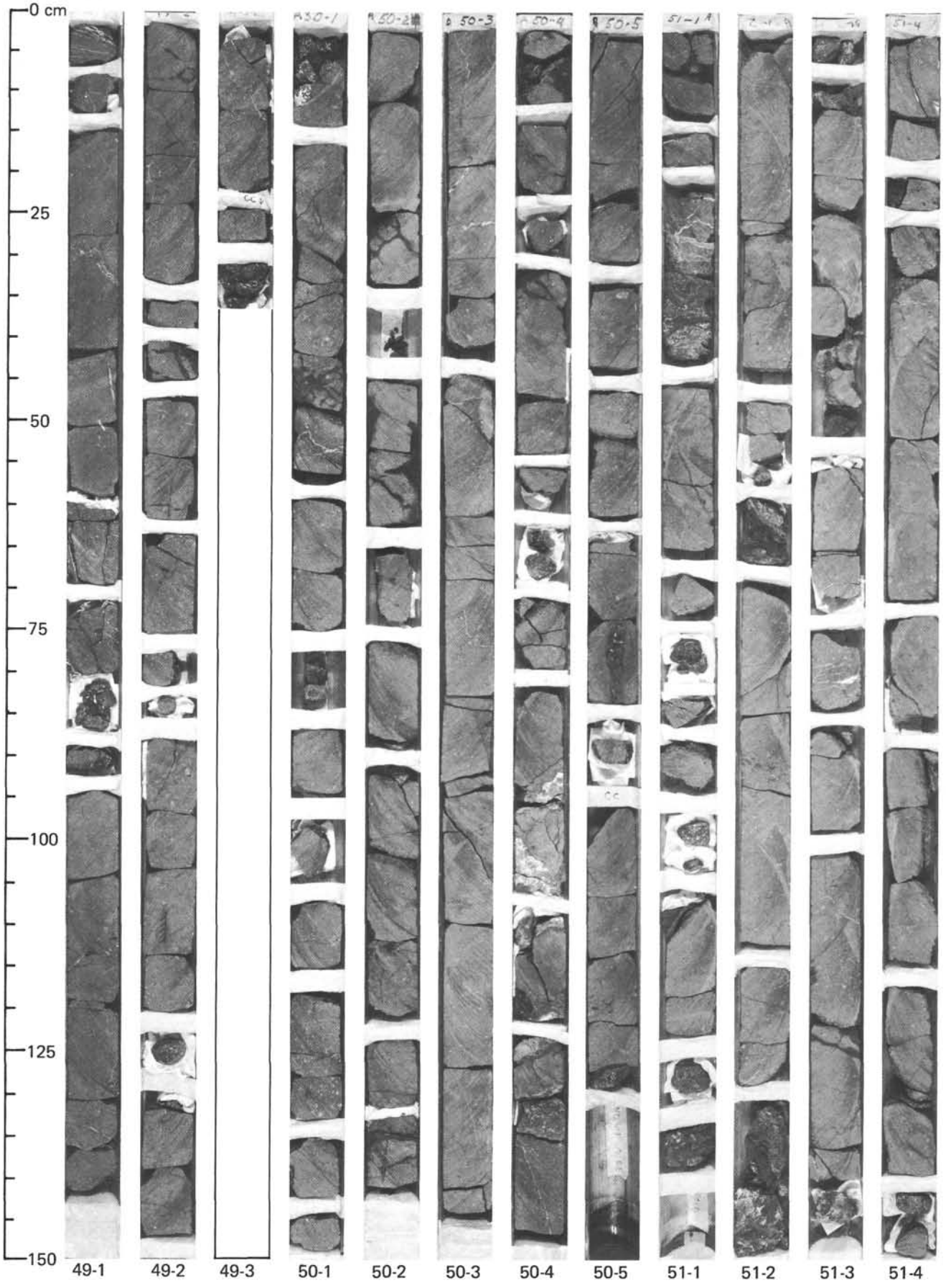
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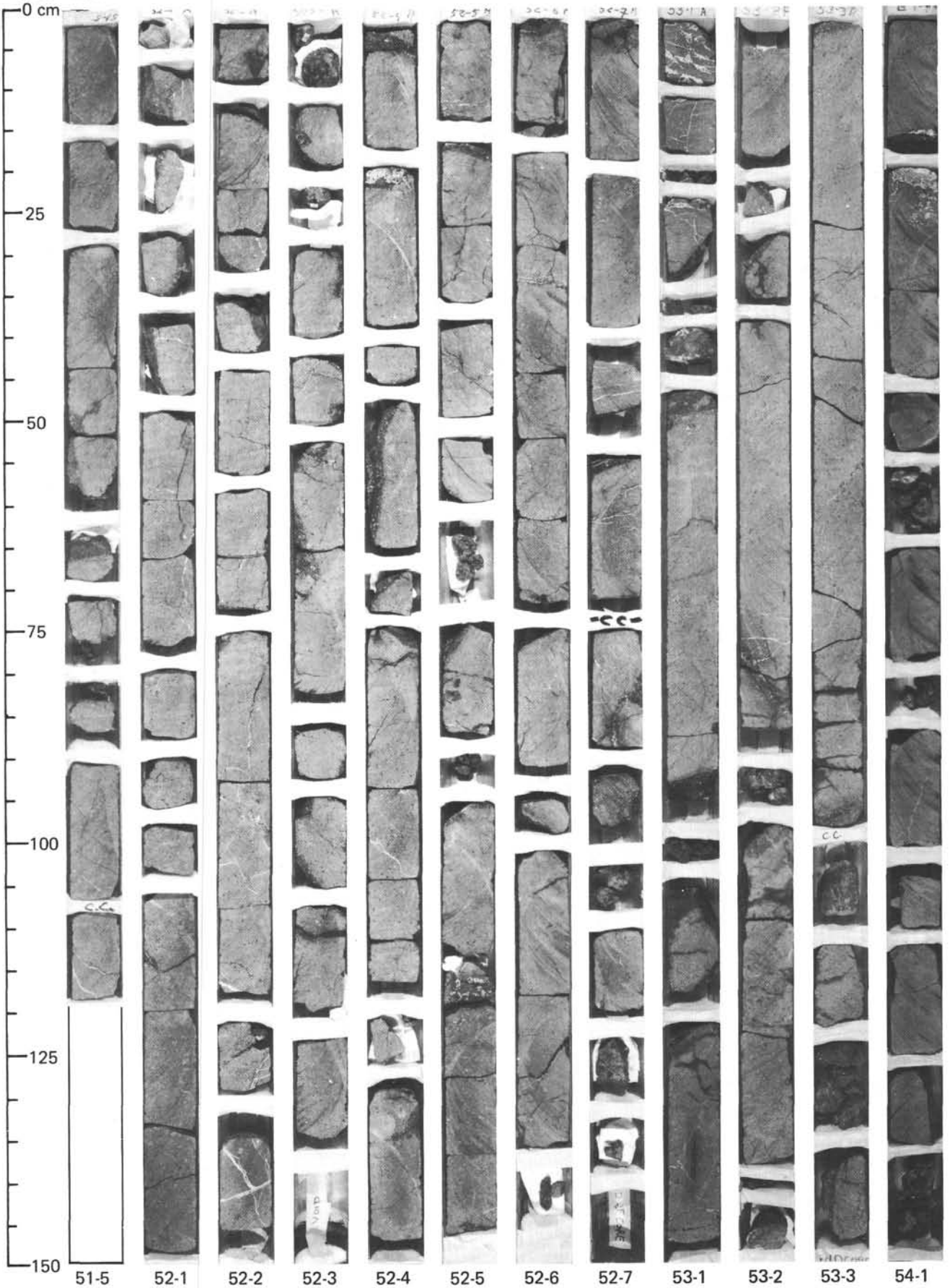
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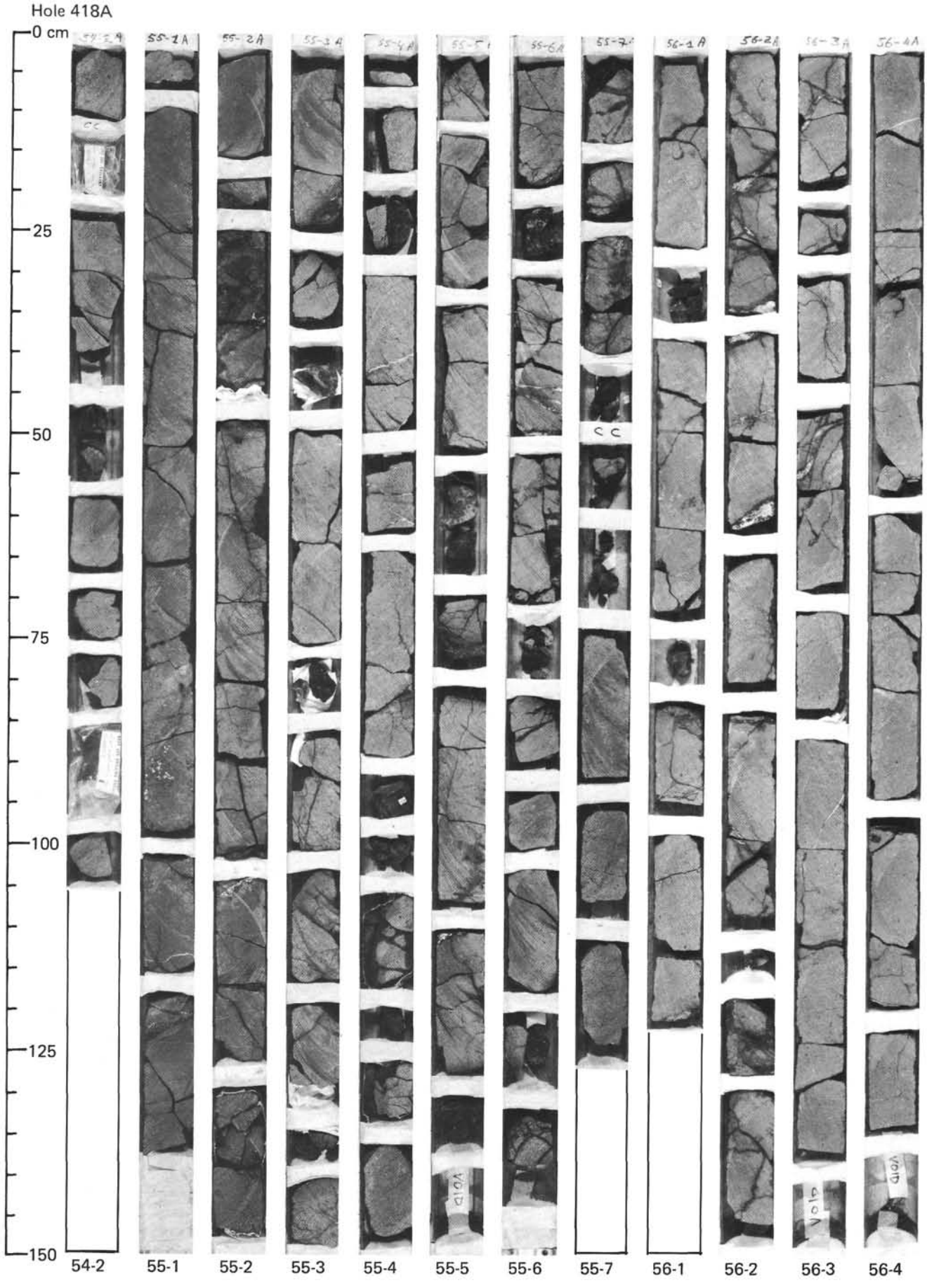
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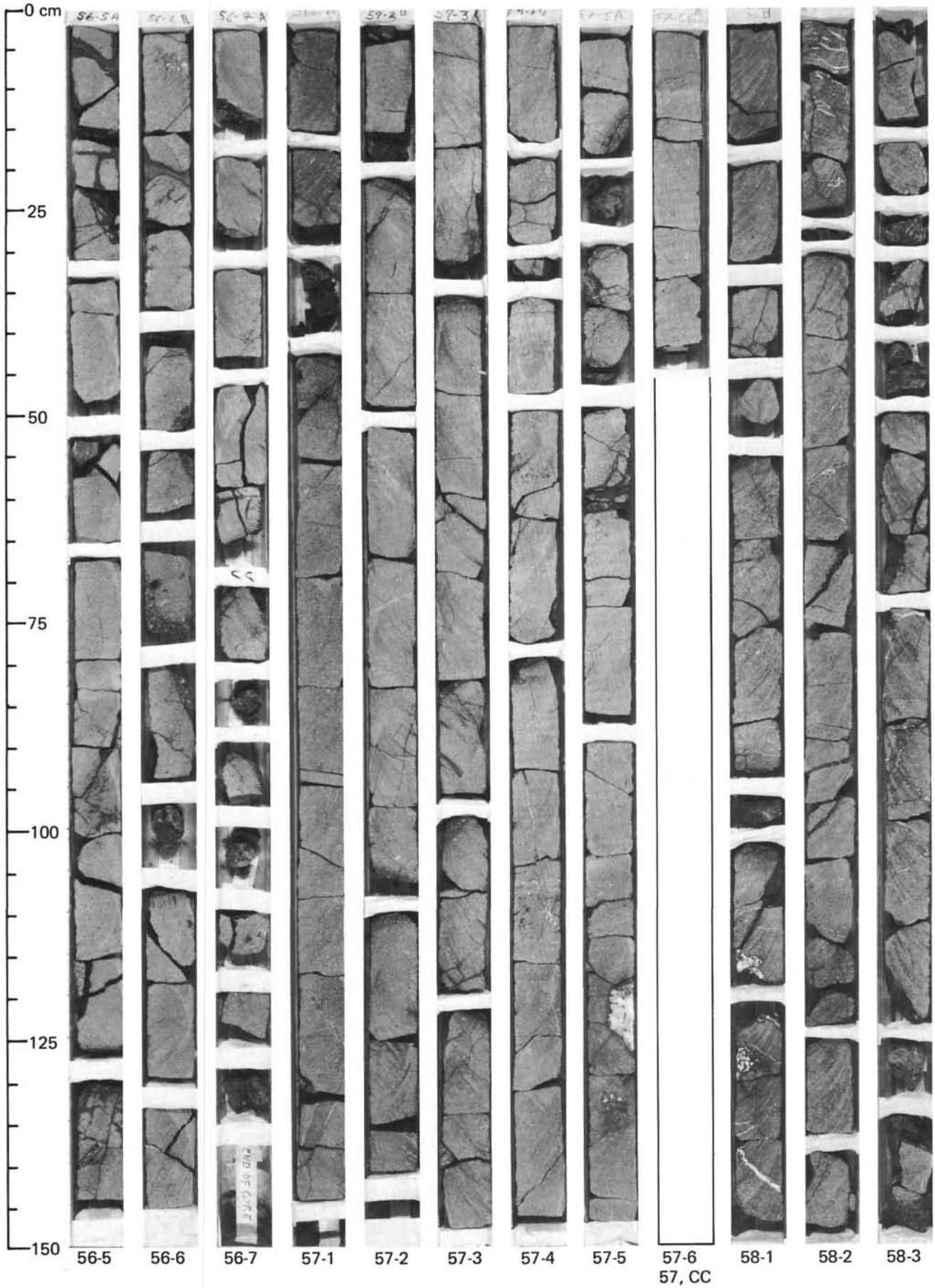
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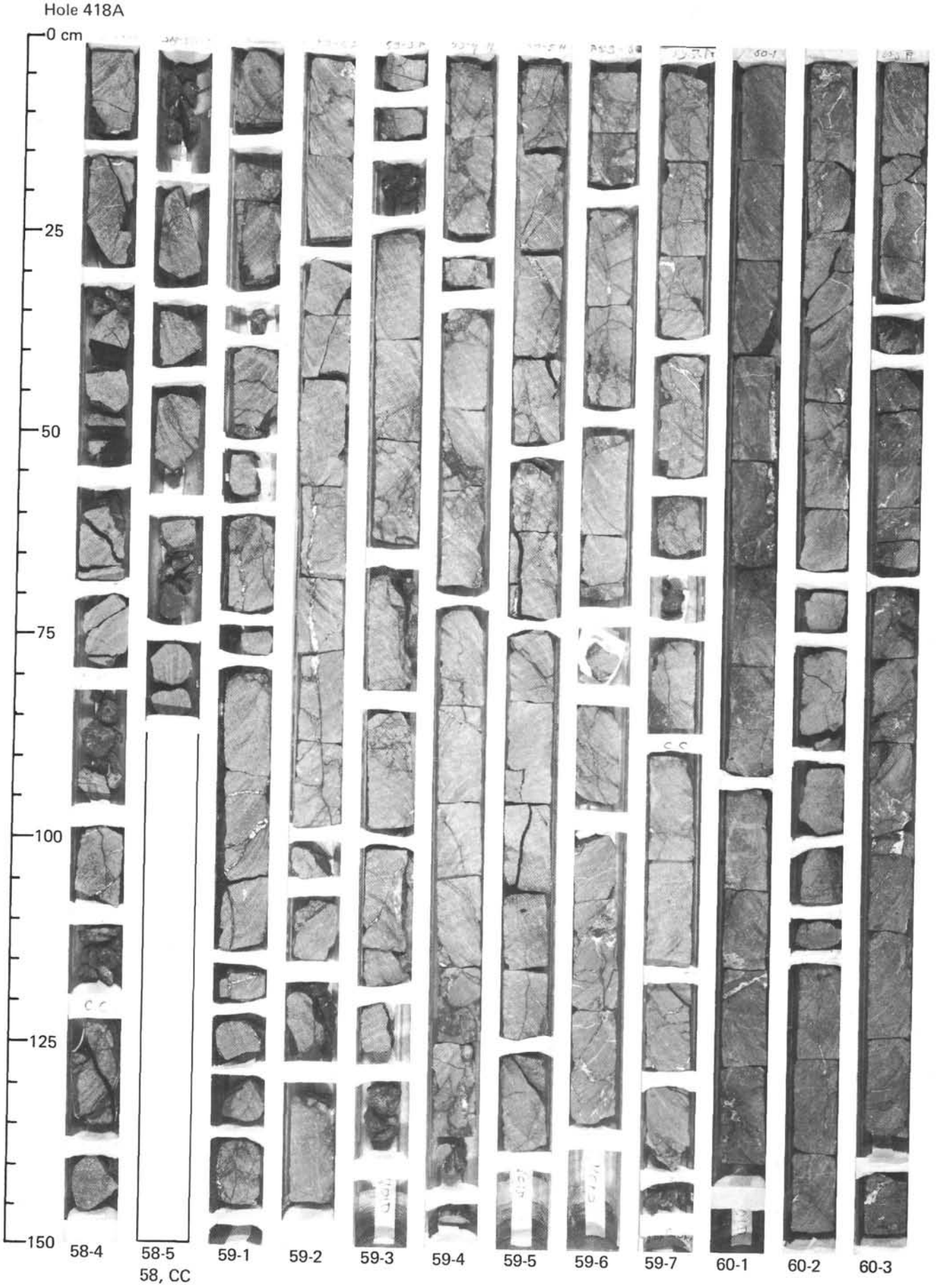
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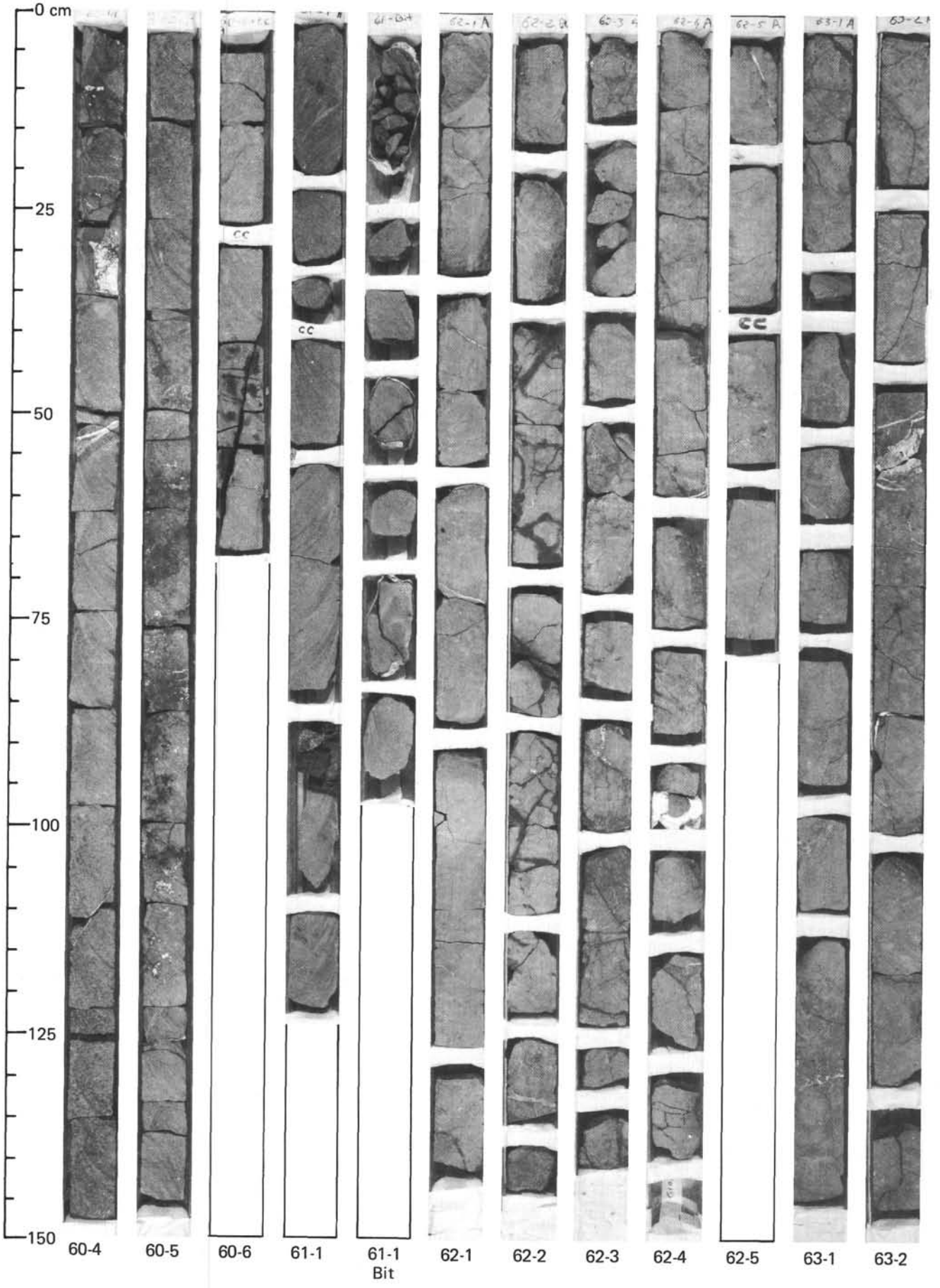
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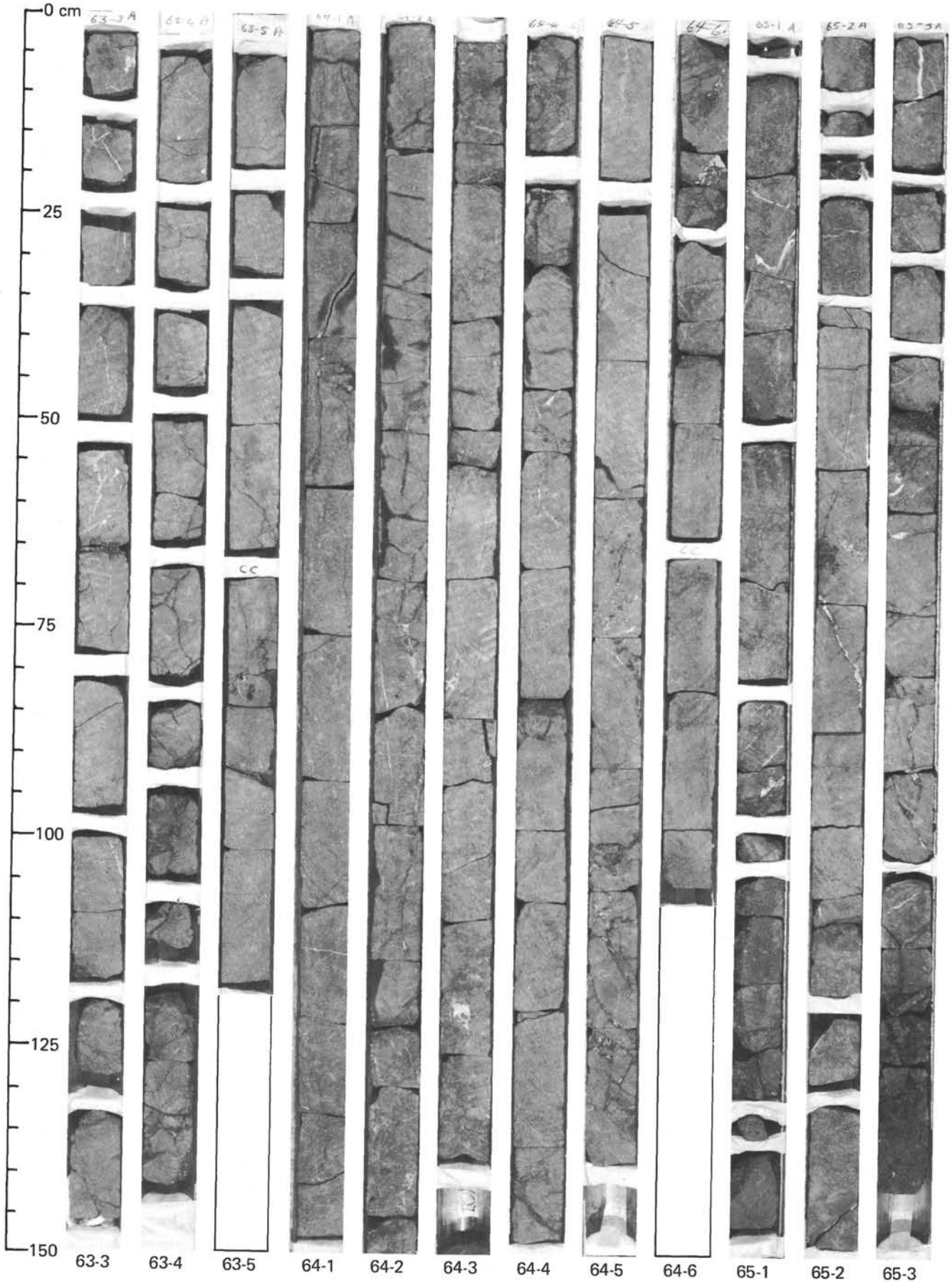
Hole 418A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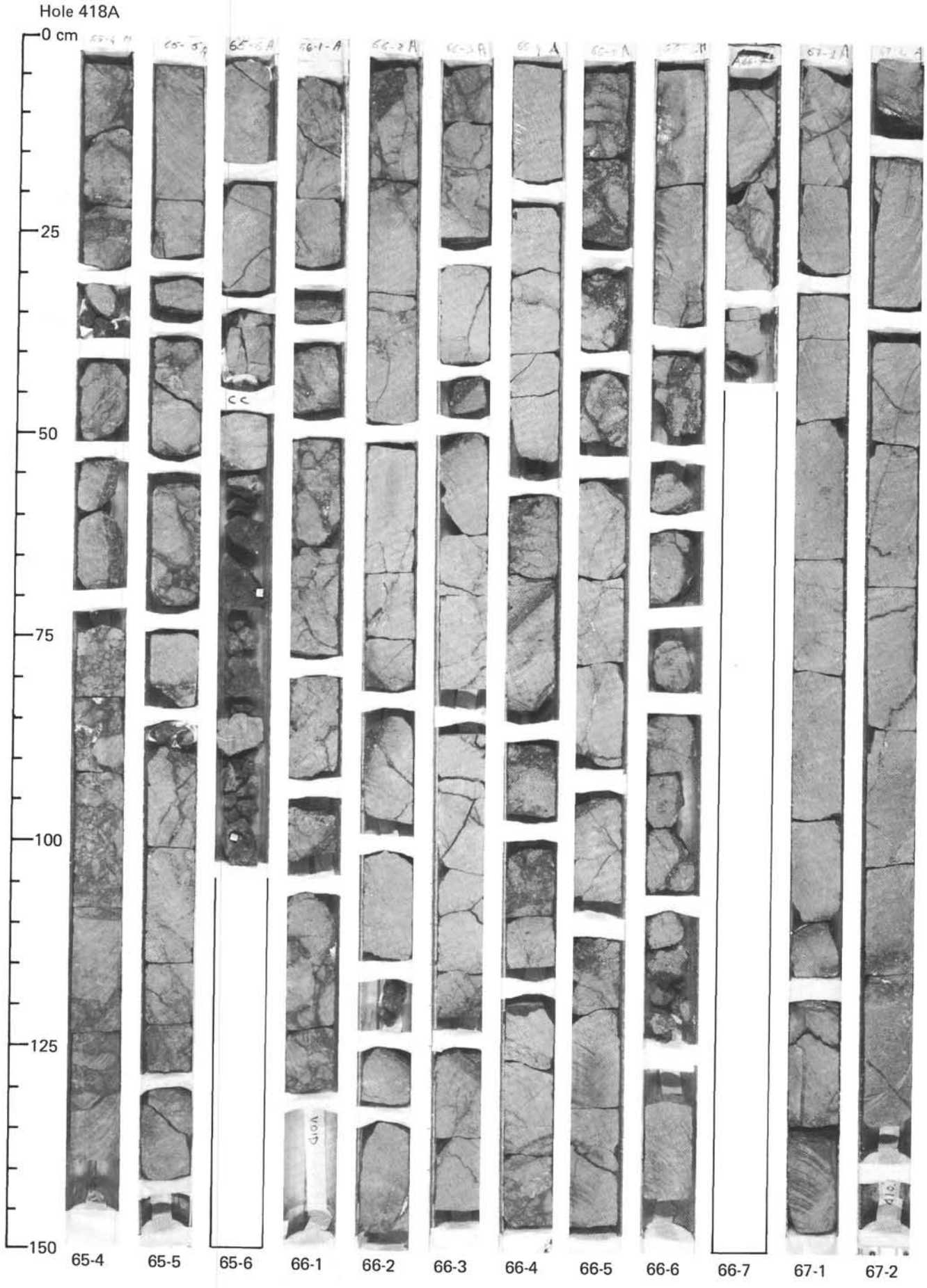
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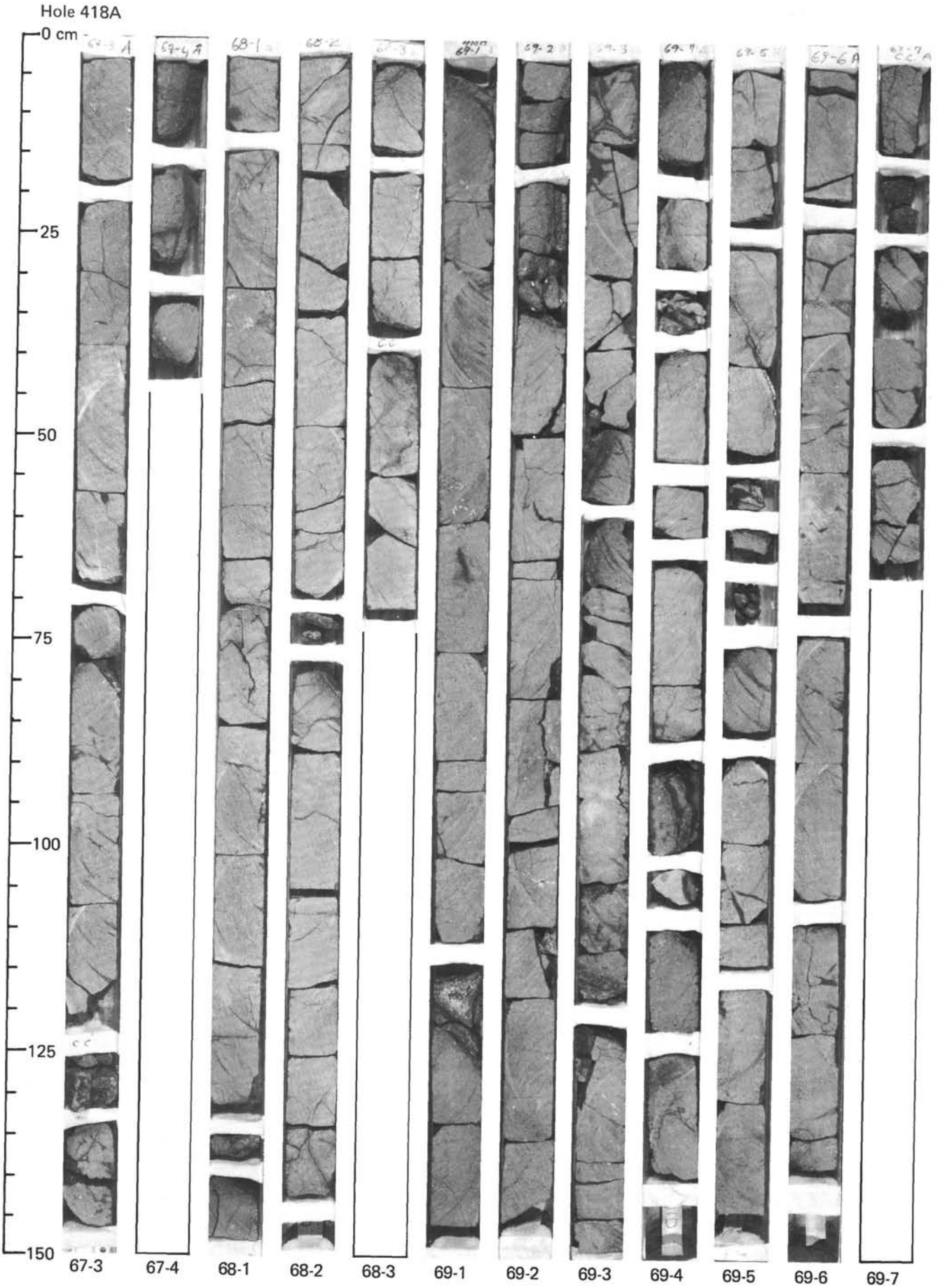
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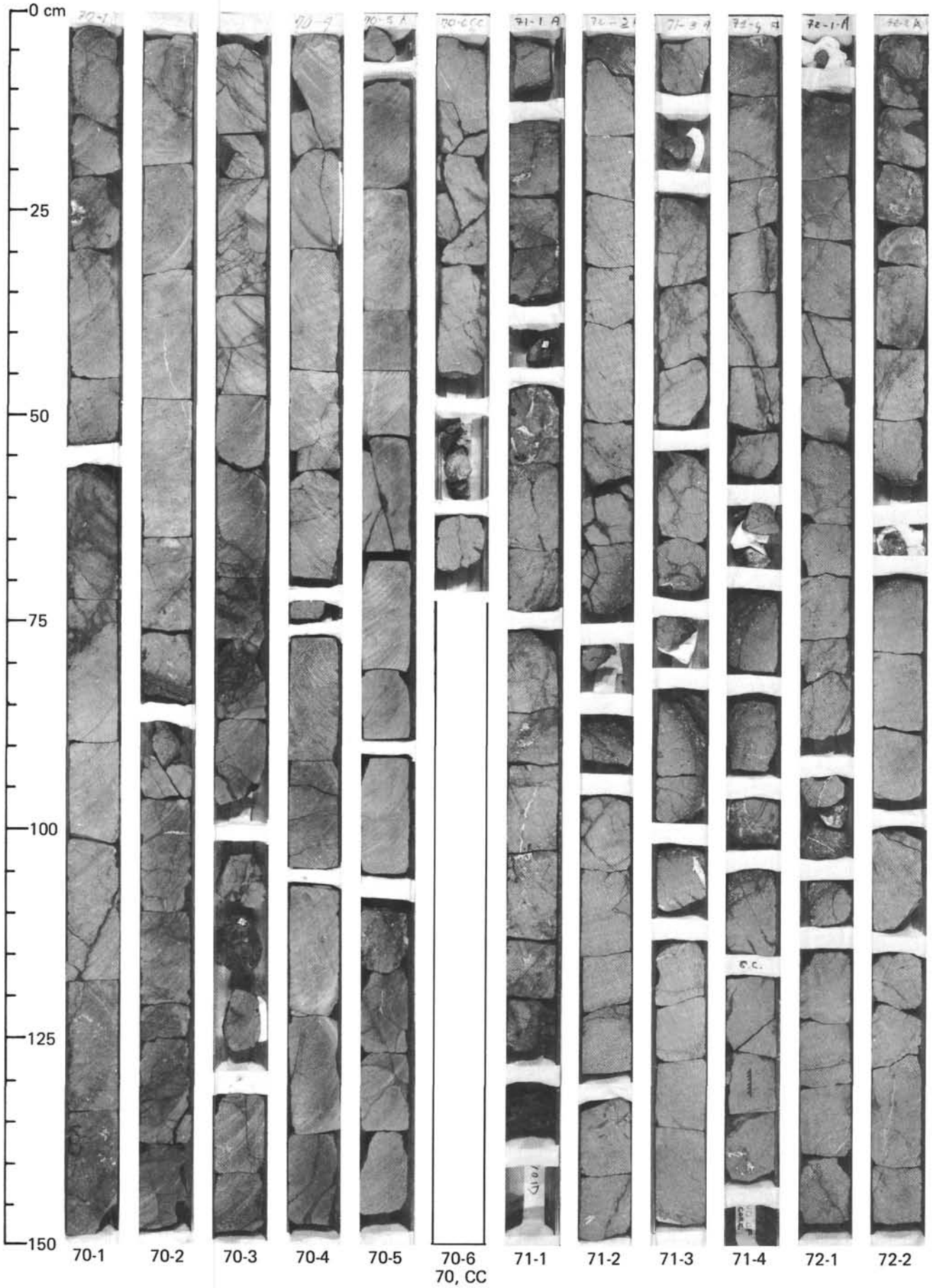
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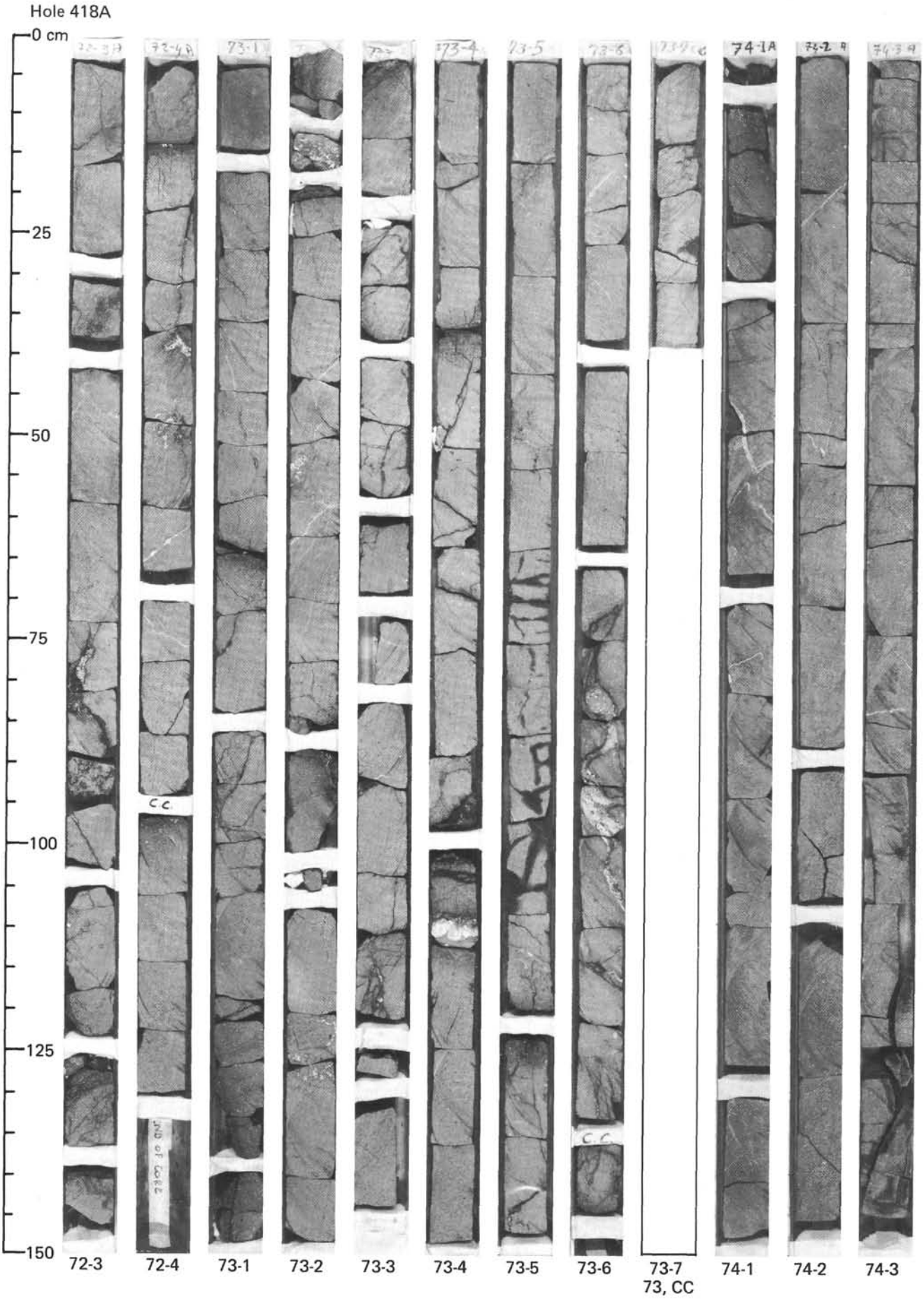
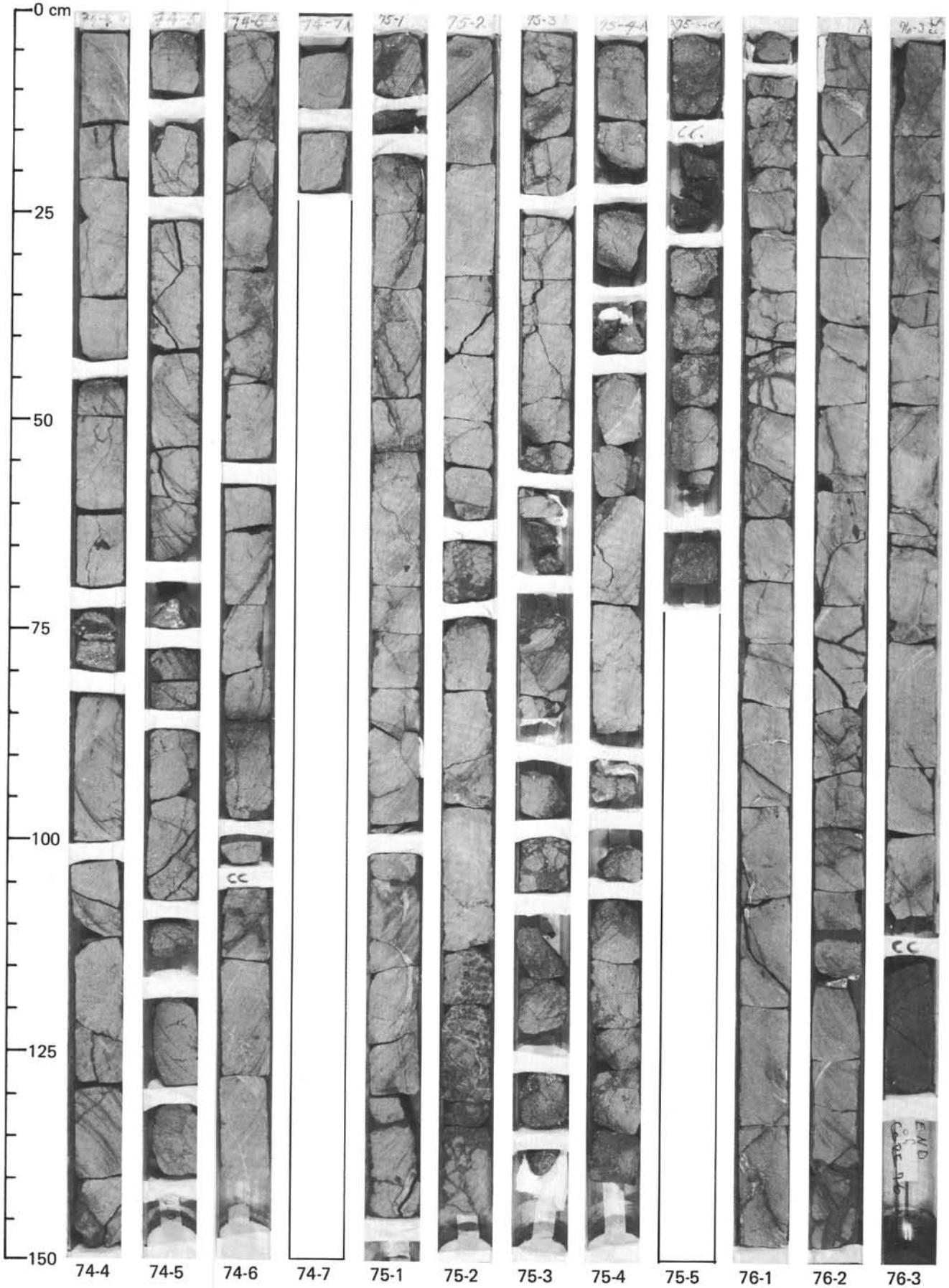
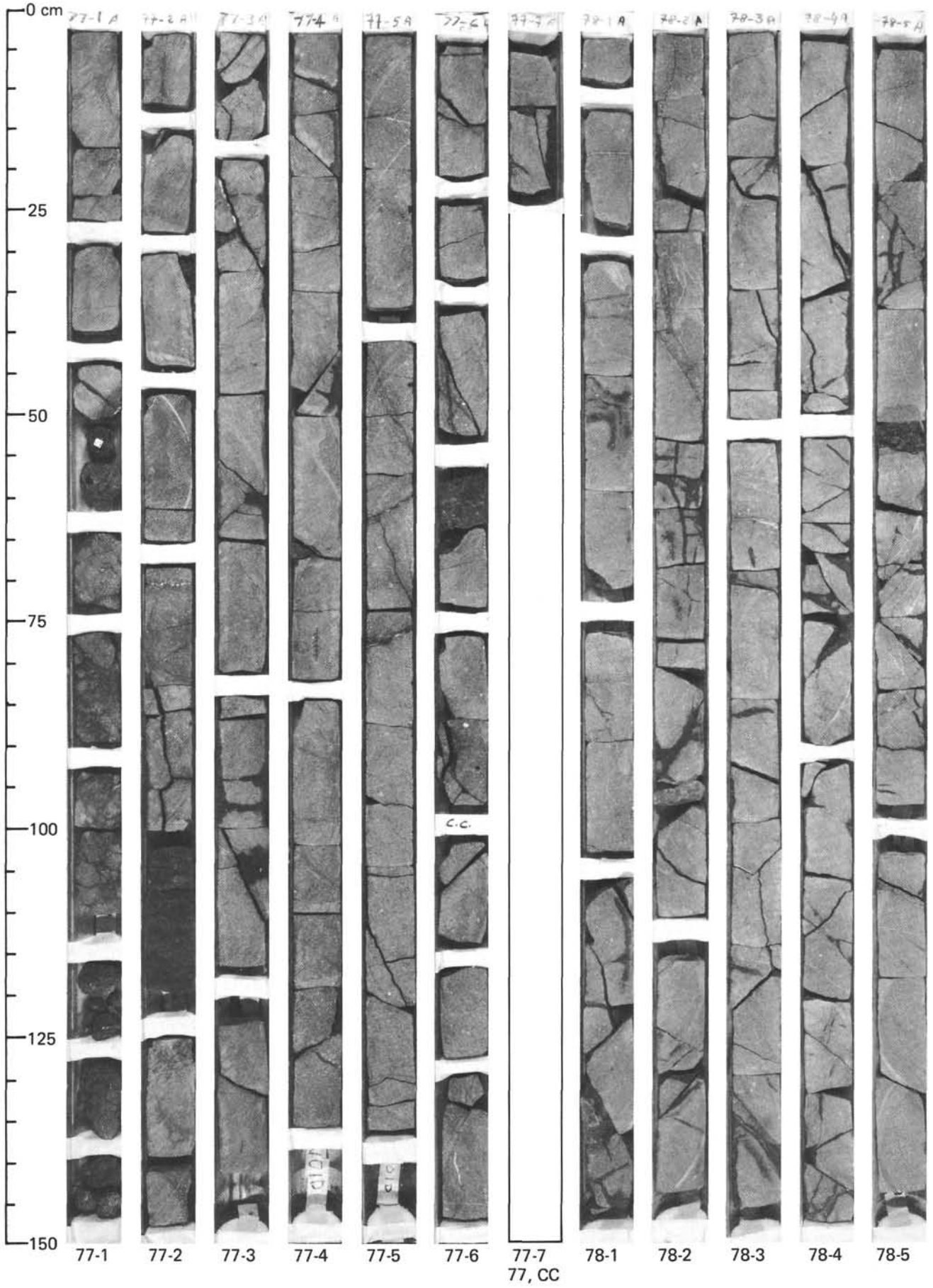
100
125
150
70-1
70-2
70-3
70-4
70-5
70-6
70, CC
71-1
71-2
71-3
71-4
72-1
72-2

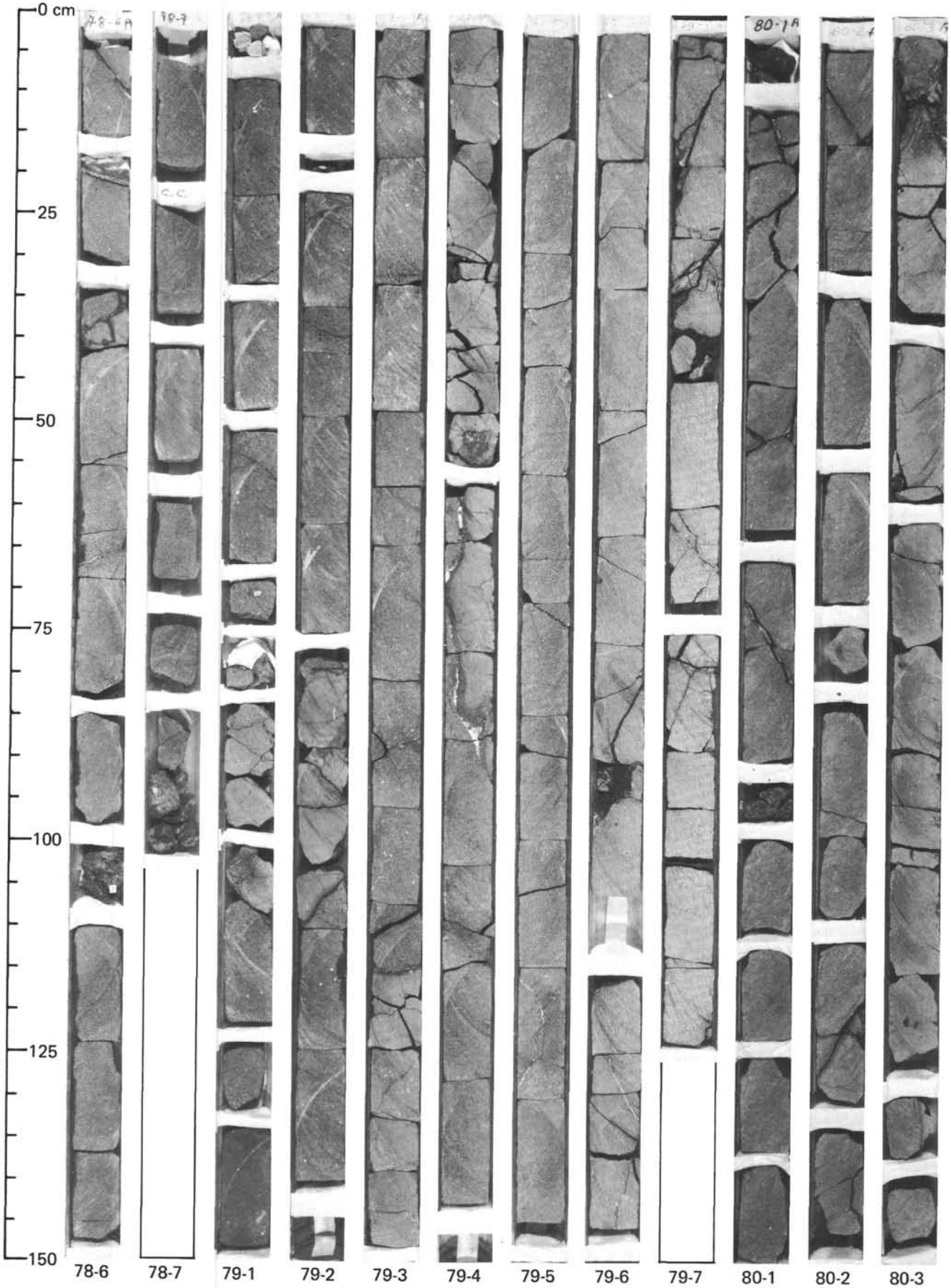

Hole 418A
0 cm
25
50
75
100
125
150
72-3
72-4
73-1
73-2
73-3
73-4
73-5
73-6
73-7
73, CC
74-1
74-2
74-3

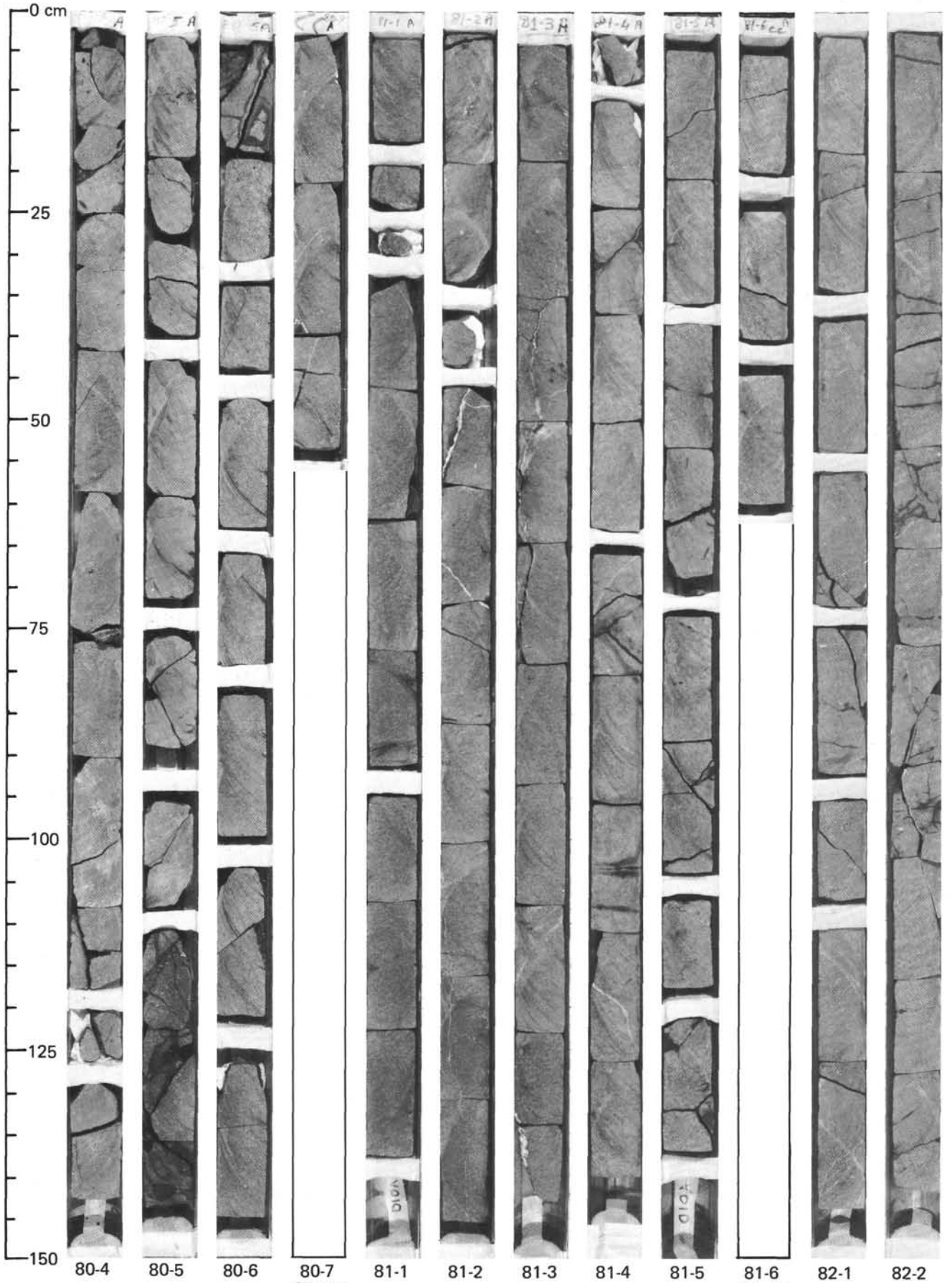
Hole 418A


0 cm
25
50
75
100
125
150
74-4
74-5
74-6
74-7
75-1
75-2
75-3
75-4
75-5
76-1
76-2
76-3
CC
CC
CC
A
END
CORE

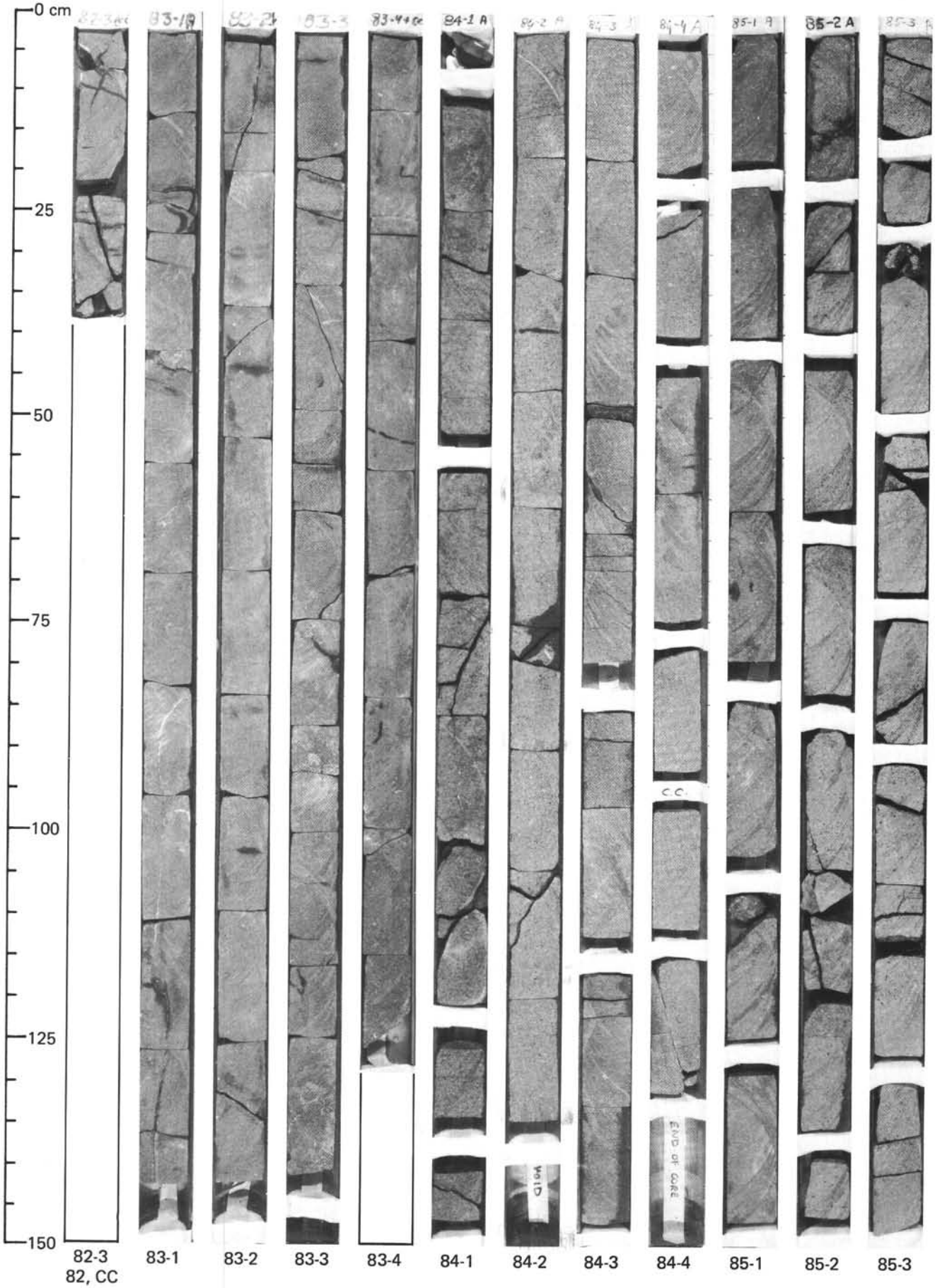
Hole 418A


0 cm
25
50
75
100
125
150
77-1
77-2
77-3
77-4
77-5
77-6
77-7
77, CC
78-1
78-2
78-3
78-4
78-5
C.C.

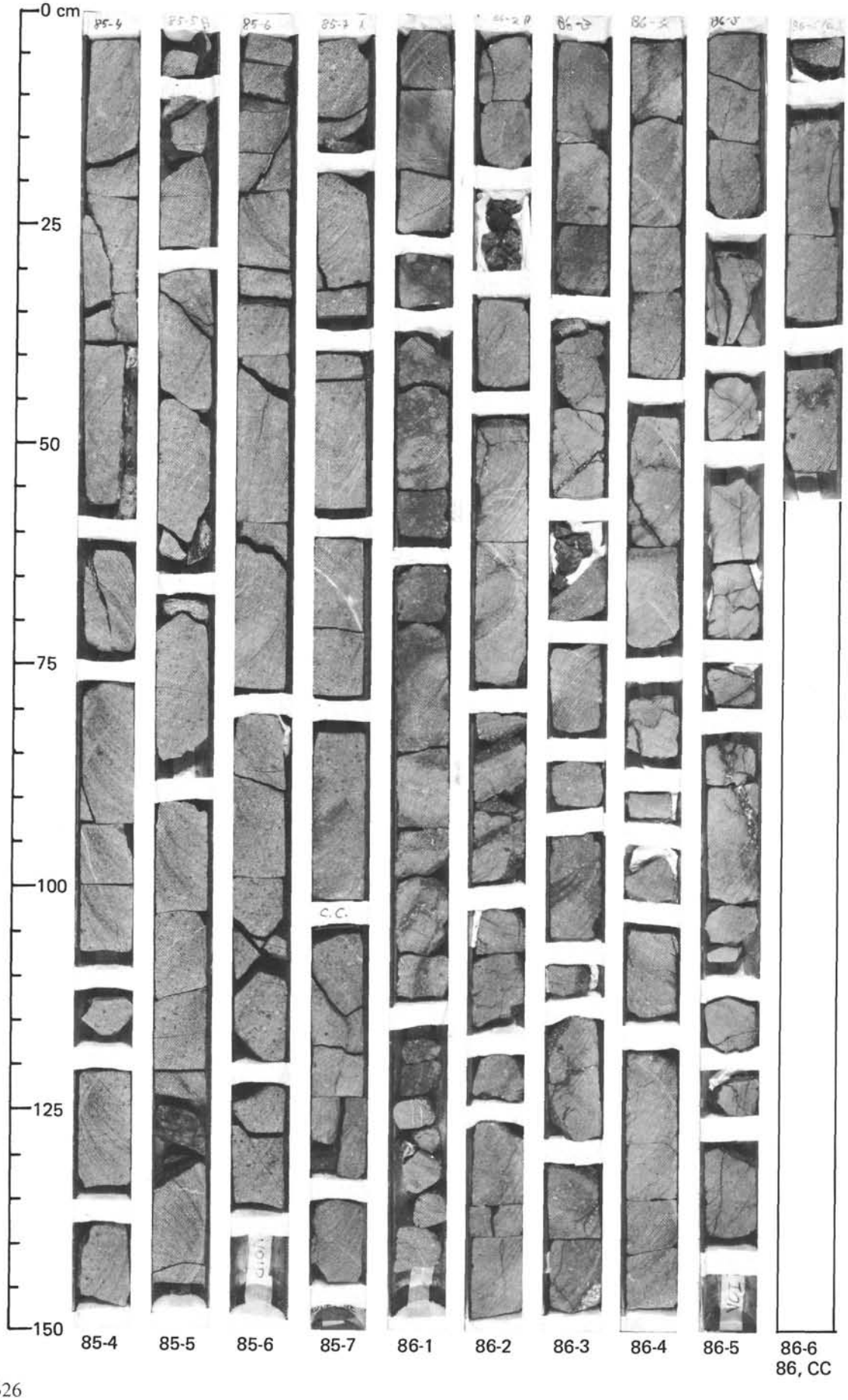

Hole 418A
0 cm
25
50
75
100
125
150
78-6
78-7
79-1
79-2
79-3
79-4
79-5
79-6
79-7
80-1
80-2
80-3


Hole 418A
0 cm
25
50
75
100
125
150
80-4
80-5
80-6
80-7
80, CC
81-1
81-2
81-3
81-4
81-5
81-6
81, CC
82-1
82-2

Hole 418A


0 cm
25
50
75
100
125
150
82-3
82, CC
83-1
83-2
83-3
83-4
84-1
84-2
84-3
84-4
85-1
85-2
85-3
VOID
END OF CORE

Hole 418A


0 cm
25
50
75
100
125
150
C.C.
85-4
85-5
85-6
85-7
86-1
86-2
86-3
86-4
86-5
86-6
86, CC