7. SITE 395: 23°N, MID-ATLANTIC RIDGE

Shipboard Scientific Party[1]

SITE DATA, HOLE 395

Date Occupied: 6 December 1975 (0000)

Date Departed: 9 December 1975 (0600)

Time on Hole: 3 days, 6 hours

Position: 22°45.35′ N; 46°04.90′W

Water Depth (sea level): 4484 corrected meters, echo sounding

Water Depth (rig floor): 4494 corrected meters, echo sounding

Bottom Felt (rig floor): 4528 meters, drill pipe

Penetration: 184.65 meters

Number of Holes: 1

Number of Cores: 20

Total Length of Cored Section: 184.65 meters

Total Core Recovered: 88.36 meters

Percentage Core Recovery: 47.9 per cent

Oldest Sediment Cored:
Depth sub-bottom: 93.0 meters
Nature: Calcareous brown clays
Chronostratigraphic unit: Upper Miocene
Measured velocity: 1.6 km/sec

Basement:
Depth sub-bottom: 91.65 meters sub-basement
Nature: Basalt, serpentinized peridotite, and gabbro
Velocity range: 4.30 km/sec for serpentinized peridotites to 5.30 to 6.10 km/sec for basalts and one gabbro

Principal Results: Hole 395 was drilled at 22°N45.35′N, 46°05.90′W in 4484 meters of water on the eastern edge of Pond A, survey area AT-5, within normal-polarity magnetic anomaly 4. The target was carefully chosen to avoid fracture zones. Pond A is bounded by north- to northeast-trending ridges. The drill penetrated 89 meters of Neogene foraminifer-nannofossil ooze and 4 meters of calcareous brown clays bearing manganese micronodules. The basalt/sediment contact was not recovered in undisturbed form. The lowest sediments are assigned to the *Discoaster quinqueramus* Zone (upper Miocene), in close agreement with the age of anomaly 4. Basalt and serpentinite sand and cobbles occur frequently in the sediments. A serpentinite-gabbro rubble zone apparently lies immediately over basement; it may be talus. Recovery in the sediments was 73 per cent.

We drilled 95 meters into basement; 22 per cent was recovered including drill cuttings, 10.8 per cent without cuttings. The drill penetrated 57 meters of aphyric basalt pillow lavas before encountering a gabbro-serpentinized peridotite complex. The contact with the overlying pillow lavas was not recovered. A small piece of gabbro separates basalt from peridotites. The gabbro/peridotite contact was not recovered. The peridotite is 20 to 40 per cent serpentinized and preserves many primary minerals, including olivine, but contains no plagioclase. It is among the freshest so far obtained from the Atlantic Ocean floor. It includes a 1.4-meter section of continuously recovered tectonized harzburgite with large elongate enstatite augen inclined 40° to the vertical. Tectonic foliation predates serpentinization. The harzburgite is separated from a 1-meter section of continuously recovered non-foliated serpentinized lherzolite by a carbonate-cemented serpentinite breccia zone containing what is probably a basalt dike in the middle. Traces of microfossils are preserved in the carbonate breccia matrix.

The basalt is plagioclase-olivine-clinopyroxene phyric. The lower lherzolite is separated from massive plagioclase-olivine phyric basalt by another carbonate-cemented breccia zone. There is no evidence for pillow lava features in this basalt, where the hole terminated.

Basalts analyzed are fresh to moderately altered mid-ocean ridge basalts with 0.09 to 0.30 per cent K_2O and 1.0 to 1.7 per cent TiO_2. Four distinct types were analyzed, but are not readily relatable by shallow crystal fractionation or accumulation: (1) high-Ca-Al aphyric basalt: (2) low-Ca-Al aphyric basalt; (3) plagioclase-olivine-clinopyroxene phyric basalt; (4) plagioclase-olivine phyric basalt. Types 3 and 4 are found exclusively in the gabbro-ultramafic complex, and are quite different from Types 1 and 2.

The uppermost aphyric basalt is normally polarized, with a mean inclination of 24°; inclination decreases slightly with depth. The average intensity of basalt magnetization is 0.003 emu/cm^3. Peridotites show no stable remanence, because of magnetization induced by the magnetic steel collar used during drilling.

We infer that the gabbro-ultramafic complex was emplaced away from fracture zones, and may be an important component of Layer 2 in this structurally complex region, which could be typical of much of the Central Atlantic.

SITE DATA, HOLE 395A

Date Occupied: 9 December 1975 (0930)

Date Departed: 10 January 1976 (0930)

Time on Hole: 32 days, 0 hours

---

[1]William G. Melson, Smithsonian Institution, Washington, D.C. (Co-Chief Scientist); Philip D. Rabinowitz, Lamont-Doherty Geological Observatory, Palisades, New York (Co-Chief Scientist); Henri Bougault, Centre Oceanologique de Bretagne, Brest, France; Toshitsugu Fujii, University of Tokyo, Tokyo, Japan; Andrew L. Graham, British Museum of Natural History, London, England; H. Paul Johnson, University of Washington, Seattle, Washington; James Lawrence, Lamont-Doherty Geological Observatory, Palisades, New York; James H. Natland, Scripps Institution of Oceanography, La Jolla, California; Egfrid C. Prosser, Institute for Applied Geophysics of the Technical University, Munich, Federal Republic of Germany; J. Michael Rhodes, Lockheed Electronics Company, Houston, Texas (now at University of Massachusetts, Amherst, Massachusetts); and Boris P. Zolotarev, Geological Institute of the USSR, Moscow, USSR.

Position: 22°45.35'N; 46°04.90'W

Water Depth (sea level): 4484 corrected meters, echo sounding

Water Depth (rig floor): 4494 corrected meters, echo sounding

Bottom Felt (rig floor): 4485 meters, drill pipe

Penetration: 664.09 meters

Number of Holes: 1

Number of Cores: 68[2]

Total Length of Cored Section: 587.94 meters

Total Core Recovered: 105.97 meters

Percentage Core Recovery: 18 per cent

Oldest Sediment Cored:
Depth sub-bottom: See Hole 395
Nature: See Hole 395
Chronostratigraphic unit: See Hole 395
Measured velocity: See Hole 395

Basement:
Depth sub-bottom: 576.49 meters sub-basement
Nature: Predominantly aphyric and phyric basalt units
Velocity range: 5.1 to 6.0 km/sec

Principal Results: We drilled 571 meters of igneous basement at Hole 395A (22°45'N, 46°04'W), on magnetic anomaly 4 (upper Miocene) on the western flank of the Mid-Atlantic Ridge. Basement begins at about 93 meters sub-bottom. The sequence cored includes three massive, chemically uniform aphyric basalt units with many glassy zones (111 to 172 m, 361 to 565 m, and 565 to 665 m sub-bottom). The upper two aphyric units are separated by at least two cycles of porphyritic basalts (plagioclase phenocrysts 15 to 30%; olivine phenocrysts 2 to 10%; clinopyroxene phenocrysts 0 to 5%) which proceed upward from most fractionated to least fractionated (174 to 261 m sub-bottom). The upper aphyric basalt and the topmost phyric basalts correspond stratigraphically and chemically to basalts cored in Hole 395. All basalts are somewhat fractionated, but high-MgO picritic basalts and low-Mg-O, high-Fe-Ti basalts are absent. A porphyritic basalt intrusion occurs within the third massive aphyric basalt 608 to 630 m sub-bottom); it is chemically similar to one of the phyric basalt types higher in the section. Alteration and fracturing increase generally but erratically downward. Between 344 and 354 meters sub-bottom, a breccia with clay-carbonate matrix occurs that has been reheated sufficiently by hydrothermal fluids to change the magnetic polarity of the breccia clasts. Hyaloclastites and other breccias occur elsewhere. The topmost basement unit is an aphyric basalt which overlies a sediment breccia zone containing clasts of gabbro, serpentinized peridotite, and basalt. These cobbles and pebbles are cemented by calcareous sediments, and probably represent talus from surrounding exposures. Basalt extrusion and formation of these sedimentary breccias seems to have occurred in an axial rift setting.

Basalts in the top 150 meters sub-basement (upper aphyric and some phyric) have a positive magnetic inclination of +40°. The first magnetic reversal (average inclination of −40°) occurs at 243 meters sub-bottom, in phyric basalts; no major lithologic change is associated with this reversal. This magnetically reversed section persists for 330 meters, and includes several different lithologic units. Below this magnetic unit, beginning at 573 meters sub-bottom, lies a 40-meter section of normally magnetized (inclination +55°) aphyric pillow basalt. Underlying this, beginning at 520 meters sub-basement, are two (10 m each) reversely magnetized (inclination −38°) dolerite intrusions. And below these, the basalts appear to have been remagnetized to various degrees by the intrusions. Average intensity of magnetization for the total drilled column of igneous crust is 0.005 emu/cm^3. The intensity of magnetization is very uniform within the various lithologic units, and no systematic variation in intensity with depth is evident. This is consistent with the occurrence of several field reversals within the time span of magnetic anomaly 4. The inclinations oscillate only slightly around the 40° inclinations theoretically predicted for this latitude.

The basalts comprise seven distinct chemical types, three aphyric, the rest plagioclase, olivine, and clinopyroxene phyric. Each basalt type is compositionally homogeneous consisting of thin flows, pillow sequences, and perhaps intrusives, ranging in thickness from 30 to 250 meters. Each has the chemical characteristics of mid-ocean ridge tholeiites. All types have low Mg/(Mg + Fe) values (0.51 to 0.66), low abundances of Ni (85 to 180 ppm) and Cr (200 to 370 ppm), and relatively high concentrations of TiO_2 (1.0-1.7%), Zr (67 to 130 ppm), and Sr (117 to 164 ppm). These values, together with the presence of pyroxene phenocrysts in the least fractionated phyric units, indicate the evolved nature of these basalts. It is unlikely that they represent unfractionated, primary, mantle-derived melts. The seven basalt types belong to at least three unrelated near-surface fractionation series. The compositional characteristics of each of these three series appear to have been controlled by varying degrees of partial melting of a common mantle source, and subsequent extensive crystal fractionation.

OPERATIONS

The results of the excellent survey of survey area AT-5 (Hussong et al., this volume) enabled us to locate the optimum drilling location with minimum operational time aboard *Glomar Challenger.* Pond A[3] was selected for drilling (see Chapter 1, this volume, for regional geophysical results and reasons for selecting Pond A). Detailed topography and the sediment isopach for Pond A are given in Figure 1; superimposed is the track defined by *Glomar Challenger* in approaching the site, dropping the beacon, and coming onto site.

Since the primary purpose at this site was to study the ocean crust beneath the sediments, we attempted to select the site in a region of minimum sediment thickness. It was an operational necessity, however, to have about 100 meters of sediment for the drill assembly to spud into. A second aim was to drill as near as possible to the center of a magnetic polarity interval. Magnetic inversions of the site survey data show that this aim was most closely accommodated, for the normal-polarity magnetic anomaly 4, by drilling as close as possible to the eastern edge of North Pond. Seismic reflection profiles (Figure 2) show 0.3 sec two-way reflection time near the center of North Pond. We chose the eastern

[2]Core 68 contained cuttings obtained while we were attempting to clean the hole. The amount recovered was not included in total recovery.

[3]Originally called "North Pond" (Hussong et al., this volume), but changed to Target Pond A by Site Survey Management.

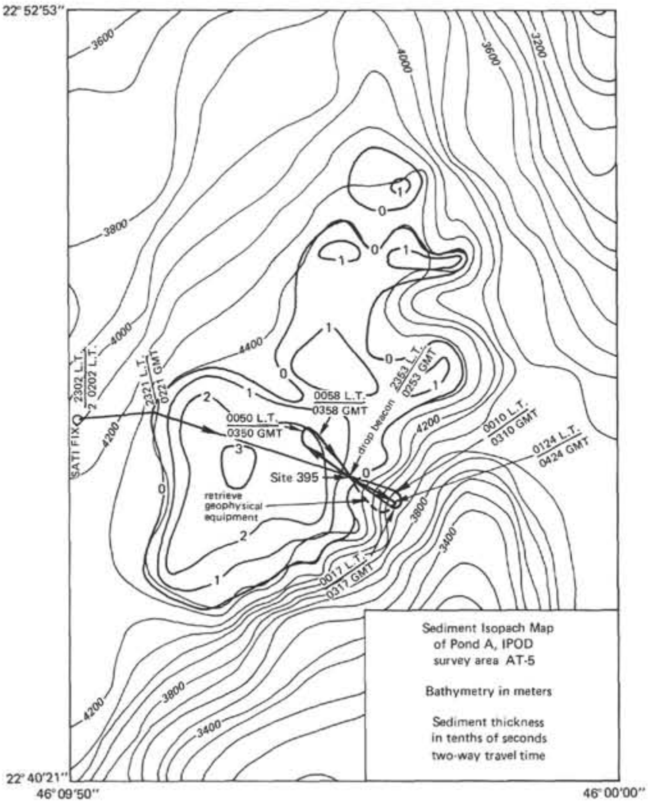


Figure 1. *Sediment isopach map of Pond A, IPOD survey area AT-5, showing* Challenger *approach track and location of Site 395.*

edge of North Pond to minimize sediment overburden and to be near the center of the magnetic block. We dropped the beacon on the east flank of North Pond (sediment thickness corresponding to 0.11 sec two-way travel time—99 m if we assume $\overline{v}$ = 180 km/sec in the sediments). We then passed over the beacon twice, first when it was falling to the sea floor, and again when it was positioned on the sea floor. We did so in order to confirm sediment thickness (see Figures 1 and 2).

Hole 395

We encountered no major operational difficulties. We cored continuously until the core bit became completely worn; this occurred at 185[4] meters beneath the sea floor. Basement was encountered at 93 meters beneath the sea floor, in close accord with our estimate from profile data. We cored 92 meters of basement and recovered 20 meters (22%). This figure is misleading, since about half our recovery was in the form of drill chips (actual recovery of rock was 10.8%).

The drilling rates, total time for drilling and coring, and amounts recovered are given in Figures 3 and 4 and in Table 1.

Hole 395A

After Hole 395 was drilled successfully, we decided to attempt a very deep hole at this site. The plan was to set a re-entry cone on the sea floor and drill and case to basement. The re-entry cone was set to the sea floor, together with five joints of 16-inch casing. The length of this upper casing was 62 meters (sea floor at 4485 m, bottom of 16-inch casing at 4547 m, and top of cone at 4480 m). After continued drilling through basement, an inner 11¾-inch casing (109.4 m long) was dropped through the cone and latched into it (bottom of casing at 4597 m, 19 m into basement). Then the casing was cemented with 200 sacks of cement. This was the first time that the operation of setting a re-entry cone and casing to basement was ever attempted on the deep-sea floor. Figure 5 shows a schematic of the re-entry cone and casing.

The total time between recovering the final core of Hole 395 and obtaining the first basement core after setting the casing at Hole 395A was 11 days. Three re-entries were made during this process. We encountered numerous problems during this time, and they resulted in substantial loss of time. These included the following:

1) Drill pipe became stuck in the hole after we placed the 16-inch casing. The torquing was extremely serious, and we were fortunate to have freed the pipe. This incident resulted in additional time lost in cleaning the hole so as to continue casing (an additional re-entry was required).

2) Four re-entry failures. As a result of the deep water (~4500 m), together with adverse weather conditions, the re-entry stabs required a good bit of experience before techniques could be mastered. During one of the re-entry failures, the bottom hole assembly was lost, perhaps as a result of smashing against the rim of the cone. Again, we were very fortunate that the lost bottom hole assembly did not fall into the cone.

3) We lost about an additional day because large swells prevented safe operations.

Although no further operational problems occurred, we were still plagued by minor difficulties between the time casing was set and the hole abandoned. The primary problems were with Edo tool failures in re-entry. Coring difficulties (torquing) occurred on many occasions, probably because of the large units of highly fractured rocks we were drilling. The hole was terminated as a result of excessive torquing and difficulties in re-establishing circulation, after an attempt to cement a troublesome zone deep in the hole.

The zone that caused problems lay immediately below a dolerite unit deep in the hole. Pieces of the dolerite were recovered at the top of each core taken below it, indicating that dolerite fragments were caving

[4]A discrepancy of 34 meters exists between drill-string length to sea floor and PDR. Two different explanations can be given to resolve this discrepancy: (a) Error in measuring pipe lengths. Should this be the problem, then 34 meters should be subtracted from all readings in the column marked "Depths from Sea Surface" (Table 1). (b) We may have been 34 meters into the mud when we thought we were at sea floor. If so, then 34 meters should be added to all readings in the column marked "Depth Below Sea Floor" (Table 1). A pinger was used at the bottom of the drill string to locate sea floor. The pinger results strongly indicate that the second explanation cannot be correct. The uppermost sediments cored in Hole 395, however, are Pliocene. Hole 395A, drilled very close to Hole 395 (within about 100 feet), yielded Quaternary sediments at the surface. This suggests that the Quaternary is present in Hole 395, and we did not sample it. The 34 meters can thus be explained by the missing Quaternary. At present, we cannot resolve this discrepancy.

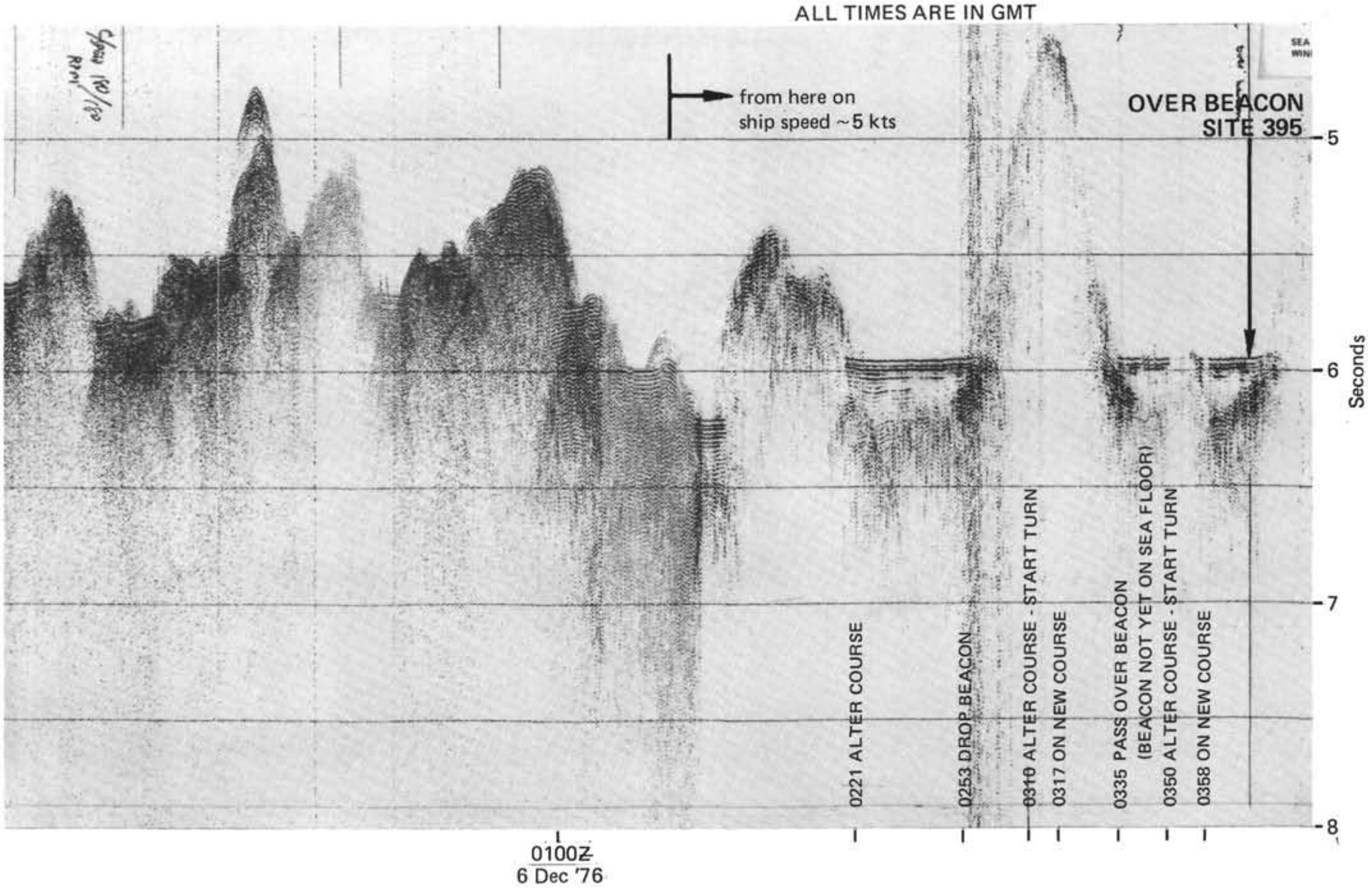


Figure 2. Challenger *approach profile to Site 395.*

into the hole. The rock material below the dolerite was highly fractured, but even with this and continued high torquing, recovery remained high. At this point, we speculate that the cause of torquing was dislodged dolerite fragments binding the bit.

After cement was pumped into the hole, the drill string was pulled to replace the bit. After our ninth and final re-entry, torquing at the bottom of the hole was extreme. The final core contained no cement but a large amount of cuttings. This suggested that the zone of caving below the dolerite had seriously enlarged the hole diameter, forming a trap for cuttings, which could not be lifted, owing to lowered annular fluid velocities. We decided at this point to abandon the hole, after performing a downhole seismic experiment. We obtained no results from this experiment. With the airgun as a sound source, the signal-to-noise ratio was too low. One final frustration: the hydrophone jammed at the core bit, upon coming up, and was snapped off in the hole. The hole was packed with mud, in anticipation of logging on Leg 46. Unfortunately, because of structural damage to the derrick, the hole was not logged on Leg 46. The hole is still open, however, and may yet be logged.

As in many operational summaries of this type, the events emphasized tend to be malfunctions or problems. For the most part, the skill and expertise of the excellent drilling team and supporting staff we had aboard overcame these difficulties—together with some luck. We wish to emphasize these positive aspects of the drilling at Site 395. The principal technological accomplishments at Site 395 are as follows: (a) a re-entry cone was placed in very deep water on the sea floor; (b) about 120 meters of casing were cemented through sediments to basement via this cone; and (c) nine re-entries were made on a single hole (seven recovering igneous rock). All of this was achieved during generally adverse sea conditions and in deep water (~4500 m).

In Table 1 the coring intervals are tabulated. A running plot of total recovery in basement, versus core number (or depth), is given in Figure 6 for Hole 395A. In Figure 7, the per cent recovery and the drilling and recovery rates are plotted; these numbers are tabulated in Table 2. The heave compensator was successfully employed at the first use of Bit 5. Soon afterward, but not coincident with the first use of the heave compensator, the percentage of core recovery increased. In summary, 597.85 meters were cored in Hole 395A, and 105.98 meters recovered (18%). This includes 571.5 meters of hard rock and 16.3 meters of sediment.

SEDIMENTS

Lithologic Description

Sediments were continuously cored from 4517.7 meters below sea level to 4610.9 meters in Hole 395;

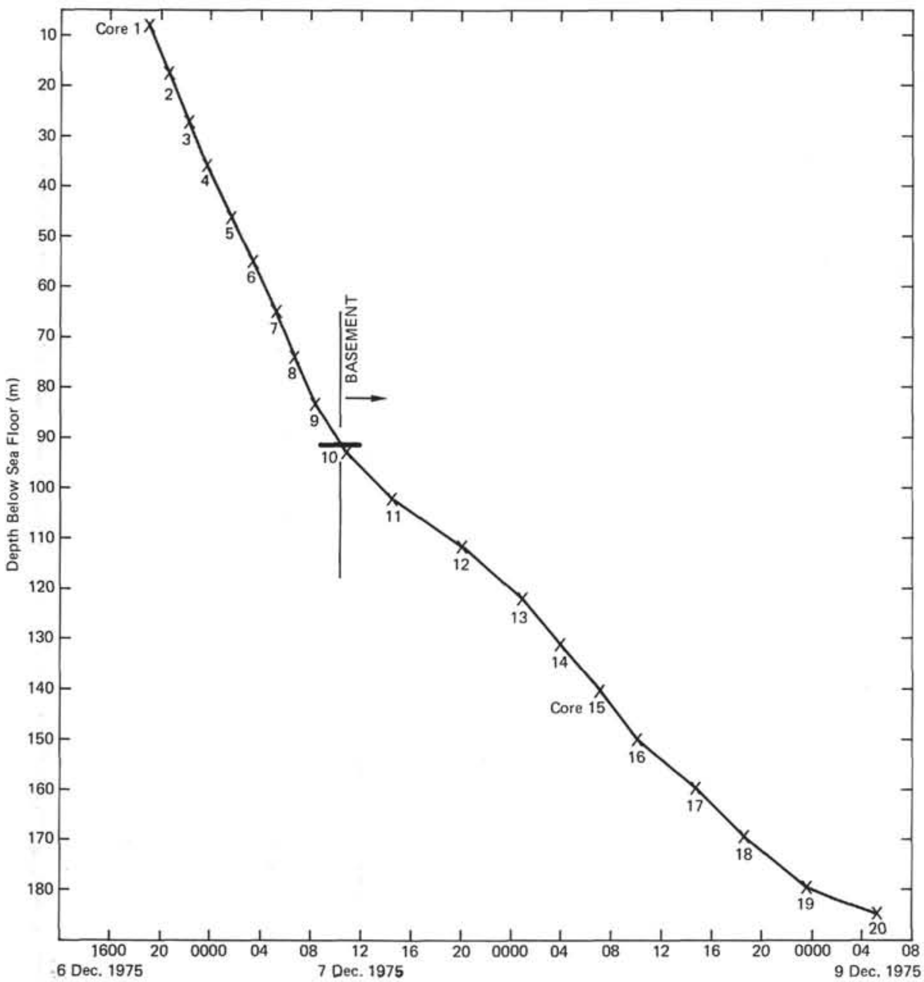


Figure 3. *Depth below sea floor versus time, Hole 395.*

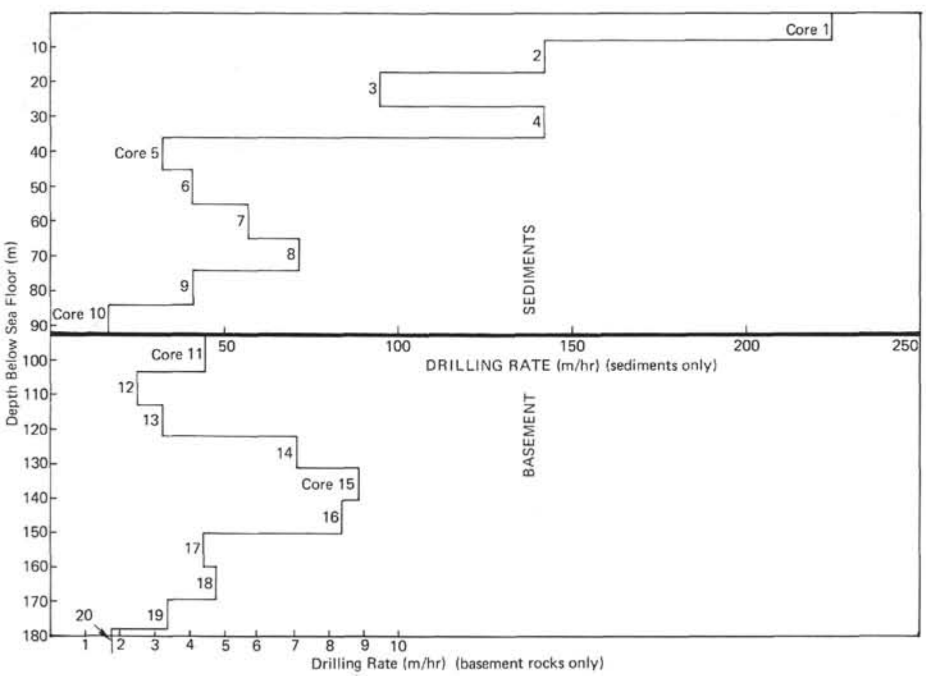


Figure 4. *Drilling rates (m/hr) for sediments and basement, Hole 395.*

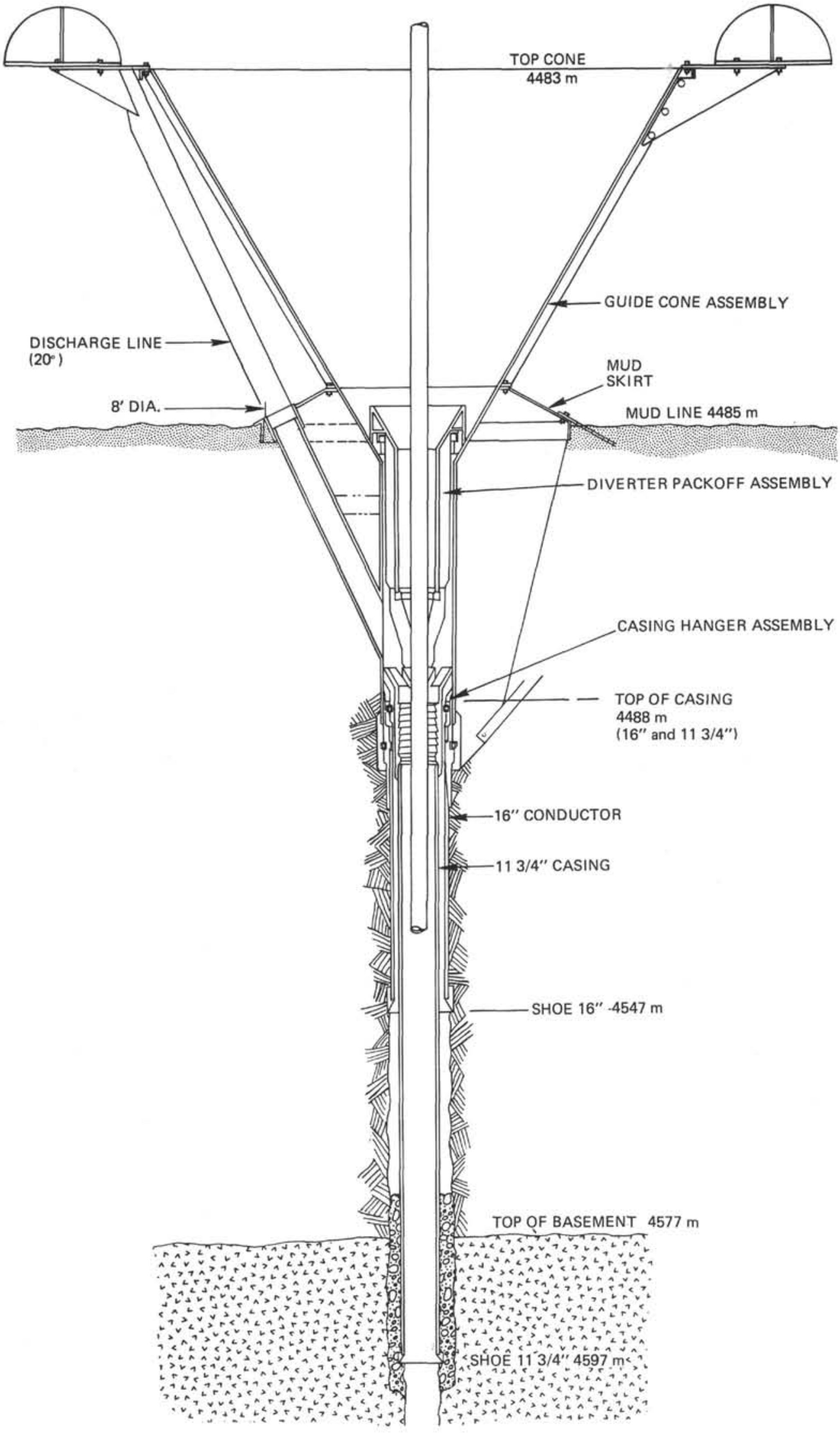


Figure 5. *Schematic of re-entry cone and casing at mud-line Hole 395A.*

TABLE 1
Coring Summary, Site 395

Core	Date	Time	Depth From Sea Surface[a] (m)	Depth Below Sea Floor[a] (m)	Length Cored (m)	Length Recovered (m)	Recovery (m)
Hole 395							
	December 1975						
1	6	1907	4517.7-4525.2	0.00-7.50	7.50	7.50	100
2	6	2035	4525.2-4534.7	7.50-17.03	9.53	8.55	90
3	6	2215	4534.7-4544.3	17.03-26.57	9.54	9.40	99
4	6	2338	4544.3-4553.8	26.57-36.10	9.53	6.97	73
5	7	0135	4553.8-4563.3	36.10-45.63	9.53	9.30	98
6	7	0321	4563.3-4572.8	45.63-55.15	9.52	4.09	43
7	7	0510	4572.8-4582.3	55.15-64.65	9.50	5.02	53
8	7	0645	4582.3-4591.9	64.65-74.19	9.54	6.40	67
9	7	0832	4591.9-4601.4	74.19-83.70	9.51	9.10	96
10	7	1043	4601.4-4610.9	83.70-93.23	9.53	1.90	20
11	7	1430	4610.9-4620.4	93.23-102.75	9.52	2.10	22
12	7	2015	4620.4-4629.9	102.75-112.25	9.50	1.92	20
13	8	0055	4629.9-4639.5	112.25-121.76	9.51	6.20	65
14	8	0400	4639.5-4649.0	121.76-131.27	9.51	0.62	7
15	8	0710	4649.0-4658.3	131.27-140.57	9.30	2.35	25
16	8	1010	4658.3-4667.8	140.57-150.08	9.51	2.25	24
17	8	1440	4667.8-4677.3	150.08-159.62	9.54	0.55	6
18	8	1828	4677.3-4686.8	159.62-169.15	9.53	2.57	27
19	8	2330	4686.8-4696.3	169.15-178.65	9.50	1.27	13
20	9	0510	4696.3-4702.3	178.65-184.65	6.00	0.30	5
Total					184.65	88.36	48
Hole 395A							
1	10	2030	4487.67-4497.20	2.67-12.20	9.53	2.35	25
2	10	2200	4485.75-4487.67	0.75-2.62	1.92	1.92	100
3	11	0700	4572.60-4581.84	87.60-96.84	9.24	0.62	7
4	11	0915	4581.84-4591.16	96.84-106.16	9.32	2.24	24
5	11	1550	4591.16-4600.42	106.16-115.42	9.26	1.50	16
5a[b]	12	0850	Cleaning Hole			Chips	–
Bit changed							
6	20	0400	4600.42-4601.00	115.42-116.00	0.58	0.12	21
7	20	0600	4601.00-4610.09	116.00-125.09	9.09	0.45	5
8	20	0810	4610.09-4619.62	125.09-134.62	9.53	0.98	10
9	20	1035	4619.62-4629.02	134.62-144.02	9.40	1.50	16
10	20	1415	4629.02-4638.53	144.02-153.53	9.51	0.27	3
11	20	1713	4638.53-4648.06	153.53-163.06	9.53	0.65	7
12	20	1945	4648.06-4657.44	163.06-172.44	9.38	0.04	0
13	20	2202	4657.44-4666.98	172.44-181.98	9.54	0.65	7
14	21	0129	4666.98-4676.49	181.98-191.49	9.51	3.65	38
15	21	0521	4676.49-4685.99	191.49-200.99	9.50	6.00	63
16	21	0800	4685.99-4695.52	200.99-210.52	9.53	0.70	7
17	21	1000	4695.52-4704.79	210.52-219.79	9.27	1.34	14
18	21	1249	4704.79-4914.34	219.79-229.34	9.55	0.82	9
Bit changed							
19	25	0920	4714.34-4716.90	229.30-231.90	2.56	0.15	6
20	25	1200	4716.90-4726.44	231.90-241.44	9.54	0.66	7
21	25	1530	4726.44-4735.97	241.44-250.97	9.53	0.35	4
22	25	1940	4735.97-4745.37	250.97-260.37	9.40	2.33	25
23	25	2215	4745.37-4754.88	260.37-269.88	9.51	0.76	8
24	26	0032	4754.88-4764.61	269.88-279.41	9.53	1.40	15
25	26	0247	4764.61-4773.79	279.41-288.79	9.38	1.25	13
26	26	0640	4773.79-4783.33	288.79-298.33	9.54	2.30	24
27	26	1100	4783.33-4792.84	298.33-307.84	9.51	1.40	15
28	26	1350	4792.84-4802.34	307.84-317.34	9.50	0.71	7
29	26	1630	4802.34-4811.87	317.34-326.87	9.53	0.30	3
30	26	1950	4811.87-4821.06	326.87-336.06	9.19	1.00	11
Bit changed (No. 4)							
31	28	0337	4821.06-4829.46	336.06-344.46	8.40	0.75	9
32	28	0650	4829.46-4839.00	344.46-354.00	9.54	2.30	24
33	28	0905	4839.00-4848.53	354.00-363.53	9.53	2.15	23
34	28	1152	4848.53-4857.93	363.53-372.93	9.40	0.35	4
35	28	1430	4857.93-4867.44	372.93-382.44	9.51	0.92	10
36	28	1810	4867.44-4876.97	382.44-391.97	9.53	1.00	10
37	28	2130	4876.97-4886.35	391.97-401.35	9.38	0.84	9
38	29	0050	4886.35-4895.89	401.35-410.89	9.54	0.50	5
39	29	0435	4895.89-4905.40	410.89-420.40	9.51	0.44	5
Bit changed (No. 5)							
40	30	1450	4905.40-4913.05	420.40-428.05	7.65	0.07	1
41	30	1946	4913.05-4922.56	428.05-437.56	9.51	0.48	5
42	30	2300	4922.56-4932.09	437.56-447.09	9.53	0.52	5
43	31	0215	4932.09-4941.62	447.09-456.62	9.53	0.20	2
44	31	0505	4941.62-4951.01	456.62-466.01	9.39	0.00	0
45	31	0740	4951.01-4960.53	466.01-475.53	9.52	0.22	2
46	31	0950	4960.53-4970.07	475.53-485.07	9.54	0.70	7
47	31	1245	4970.07-4979.44	485.07-494.44	9.37	1.98	21
48	31	1610	4979.44-4988.96	494.44-503.96	9.52	1.08	11
49	31	2050	4988.96-4998.47	503.96-513.47	9.51	2.07	22
	January 1976						
50	1	0020	4998.47-5007.97	513.47-522.97	9.50	1.70	18
51	1	0349	5007.97-5017.24	522.97-532.24	9.27	2.30	25
52	1	0630	5017.24-5026.51	532.24-541.51	9.27	1.60	17
53	1	1930	5026.51-5029.51	541.51-544.51	3.00	1.60	53
Bit changed (No. 6)							
54	3	1201	5029.51-5036.02	544.21-551.02	6.51	2.09	32
55	3	1640	5036.02-5045.55	551.02-560.55	9.53	1.86	20
56	3	2325	5045.55-5055.08	560.55-570.08	9.53	4.18	44
57	4	0305	5055.08-5064.47	570.08-579.47	9.39	1.50	16
58	4	0607	5064.47-5073.99	579.47-588.99	9.52	2.30	24
59	4	0910	5073.99-5083.53	588.99-598.53	9.54	2.45	26
60	4	1310	5083.53-5092.90	598.53-607.90	9.37	3.40	36
61	4	1708	5092.90-5102.42	607.90-617.42	9.52	3.82	40
62	5	0450	5102.42-5103.63	617.42-618.63	1.21	1.21	100

TABLE 1 – *Continued*

Core	Date	Time	Depth From Sea Surface[a] (m)	Depth Below Sea Floor[a] (m)	Length Cored (m)	Length Recovered (m)	Recovery (%)
Hole 395A – *Continued*							
	January 1976						
Bit changed (No. 7)							
63	6	0900	5103.63-5111.13	618.63-626.13	7.50	6.05	81
64	6	1615	5111.13-5120.64	626.13-635.64	9.51	5.85	62
65	6	2208	5120.64-5130.17	635.64-645.17	9.53	2.55	27
66	7	0225	5130.17-5139.70	645.17-654.70	9.53	3.93	41
67	7	0845	5139.70-5149.09	654.70-664.09	9.39	2.60	28
Bit changed (No. 8)							
68[c]	9	1000	5088.0-5134.0	603.0-649.0	–	5.0[d]	–
Total					587.94	105.97	18

[a]Using pipe lengths supplied by driller. See operations text for possible explanations of discrepancy between PDR and drill-string measurements to sea floor.

[b]After drilling Core 5, the drill became stuck, and the core barrel became full of cuttings. These have been retained and labeled 5a, and the total material is 6 meters of mafic and ultramafic plutonic rocks and basalt, including basaltic glass.

[c]Cuttings obtained when cleaning hole.

[d]Not counted in Hole 395A total recovery.

recovery was 68 meters (73%), in 10 cores. The sediments range from upper Pliocene to upper Miocene. Mudline spotting at the outset of Hole 395A resulted in recovery of Pleistocene to uppermost Pliocene sediments from 4475.8 meters to 4487.2 meters, leaving a gap of 30.5 meters uncored between the two holes. The depth to sediments, estimated by using the Precision Depth Recorder, was 4486 meters, different by six meters from that estimated using drill-string length. Sub-bottom depth to basement at Hole 395 was 93 meters, and at Hole 395A it was 97 meters. Basement is therefore 39 meters deeper at Hole 395 than at Hole 395A. Basement relief is evident on the seismic profiler records obtained during the initial approach to the site. (See footnote 3 for an alternative explanation of why the drill-string estimate to the sea floor differed from the PDR estimate).

Holes 395 and 395A are on the eastern edge of a small northeast-trending sediment pond about 6 × 12 km in areal extent. Sediments are about 300 meters thick in the deepest part of the pond (Figure 1). The pond is bounded by ridges to the east and west, and is the deepest part of a longer, more northerly trending trough

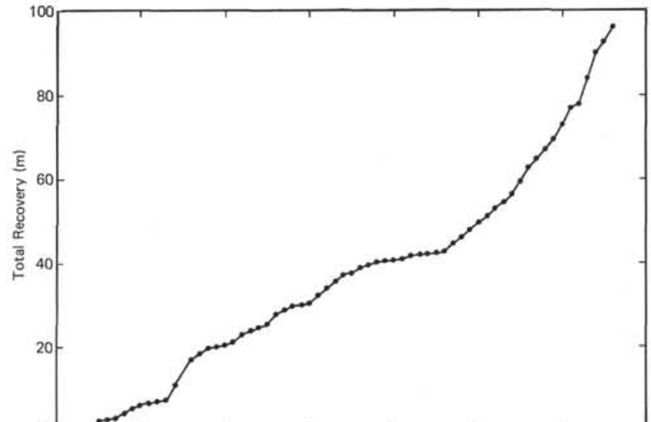


Figure 6. *Cumulative recovery curve, basement, Hole 395A.*

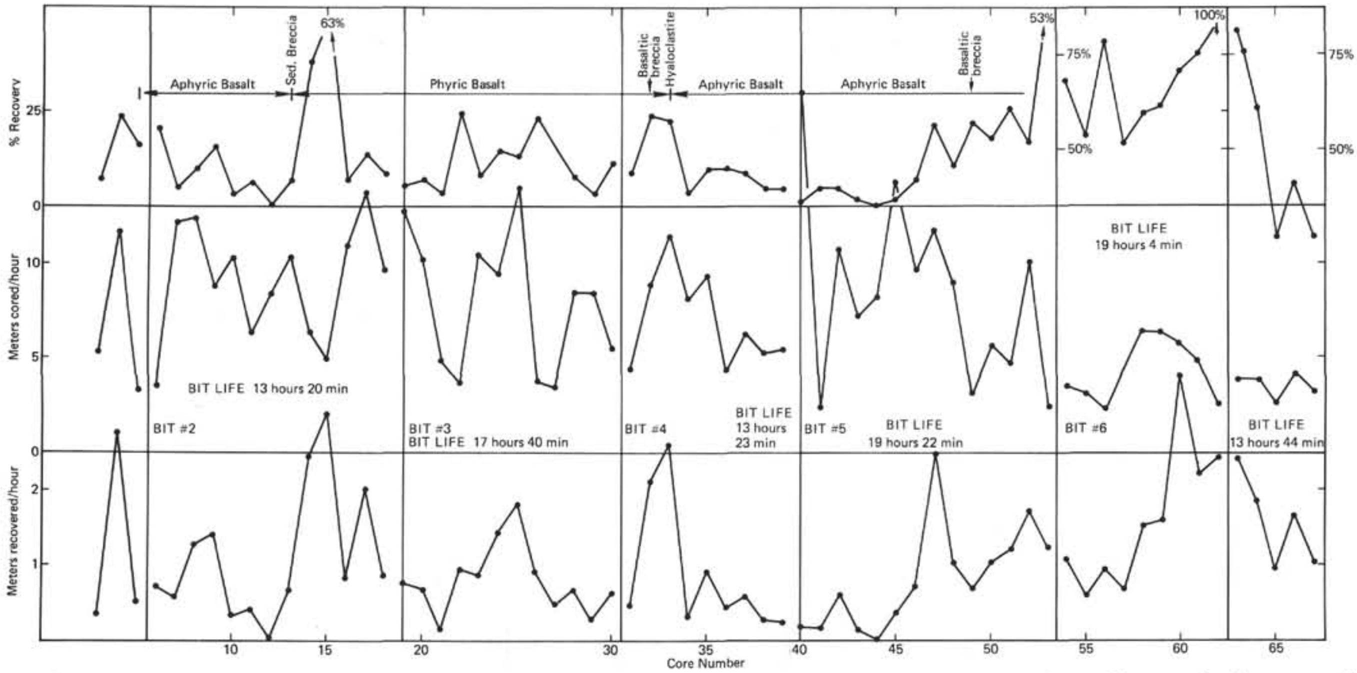


Figure 7. *Percentage recovery per core, Hole 395A. Total rotation hours for each bit are indicated. Note scale change on % recovery for bits 6 and 7.*

which contains much thinner sediments to the north. The eastern corner of the pond laps onto a topographic sill or depression in the eastern-bounding ridge. Immediately adjacent to Holes 395 and 395A, this ridge has a mean slope of 17° (measured between the 3400-m and 4400-m contours), and rises to less than 3000 meters. Profiler records indicate that the ridges surrounding the pond have no sediment cover, but nine dredge hauls, taken in the vicinity of the pond during the R/V *Kana Keoki* site survey, were unsuccessful, suggesting that a regional thin sediment cover may exist that prevented the dredge from hooking onto basement outcrops. Sediments have clearly slumped, and perhaps have been transported by bottom currents into the pond from these surrounding ridges, keeping the ridges relatively free of sediments. Profiler records reveal that the ponded sediments have well-defined acoustic reflectors. One major reflector at about 0.2 sec was not cored at either Hole 395 or Hole 395A.

The cored sediments can be divided into two units, as follows:

Unit I (Hole 395A, Cores 1 and 2, 0 to 11.5 m subbottom; Hole 395, Core 1 through Core 9, Section 4, 110 cm, 4517.7 to 4598.0 m) is foraminifer-nannofossil ooze interbedded with foraminifer sands. Colors range from pale brown to pale yellow-brown, and are slightly darker in Cores 1 and 2 than in Cores 3 to 8. The chief characteristic of this unit is that it consists of well-defined layers of subtly differing colors, undistorted by bioturbation. The brownish tints result from staining of coccoliths by clays or amorphous iron oxides. The layers in turn differ in color because of varying ratios of stained nannofossils to foraminifers; the lightest layers are the foraminifer sands, which are typically 20 to 40 cm thick. Both foraminifers and nannofossils are abundant and well preserved. Benthic and planktonic foraminifers occur. Traces of volcanic glass, sponge spicules, and basalt sand grains can be seen in some smear slides. Cores 2 and 3 of Hole 395 contain foraminifer sands with abundant basalt sand grains. The top of Core 3 has coarse basaltic sand fragments and a basalt cobble 4 cm in diameter. Pebbles of serpentinite occur in moderately deformed sediments in Core 4, and so were probably cored *in situ*. Below Core 4, serpentinite cobbles up to 5 cm in diameter frequently occur, but only in intensely deformed soupy sediments at the tops of cores, not in relatively undeformed sediments. Soupy sediments in the upper portions of cores in soft sediments normally are those, mixed with sea water during drilling, that settle to the bottom of the hole when the core barrel is pulled up. They are the first sediments cored when drilling resumes, and do not represent *in-situ* material. The mafic and ultramafic pebbles in the soupy sediments appear, then, to have come from one or more horizons in the sediments, probably those in Cores 2 and 3, and perhaps others, and to have fallen some distance down the hole as each subsequent core barrel was retrieved.

The size sorting represented by the varicolored layers in Unit I suggests either that the sediments were deposited primarily as turbidites, or that bottom currents winnowed and sorted the sediments—or both (see Timoveev et al., this volume). The foraminifer sands containing basalt sand grains provide the most positive evidence for turbidity currents. For the most part, however, drilling deformation is too intense for finer structures—such as cross bedding and graded bedding—to be preserved. Some of the foraminifer sand layers have very uniform textures, suggesting the action of bottom currents in producing the size sorting.

TABLE 2
Recovery Data, Hole 395A

Core	Drilling Time (min)	Cored Length (m)	Length Recovered (m)	Coring Rate (m/hr)	Recovery Rate (m/hr)	Recovery (%)	Comments	
Bit 1								
1		9.53	2.35	Sediments		25		
2		1.92	1.92	Sediments		100	Total cored	39.27
3	110	9.24	0.62	5.2	0.34	7	Total reocvered	8.63
4	48	9.32	2.24	11.9	2.80	24	Per cent recovery	21.97%
5	180	9.26	1.50	3.1	0.50	16		
Bit 2								
6	10	0.58	0.12	3.5	0.72	21	Total drilling time	13 hr, 20 min
7	45	9.09	0.45	12.1	0.60	5		
8	46	9.53	0.98	12.4	1.28	10	Total cored	113.92 meters
9	65	9.40	1.50	8.7	1.38	16		
10	55	9.51	0.27	10.4	0.29	3	Total recovered	17.7 meters
11	94	9.53	0.65	6.1	0.41	7		
12	68	9.38	0.04	8.3	0.04	0	Per cent recovery	15.1%
13	55	9.54	0.65	10.4	0.71	7		
14	90	9.51	3.65	6.3	2.43	38	Average coring rate	8.55 m/hr
15	120	9.50	6.00	4.8	3.00	63		
16	52	9.53	0.70	11.0	0.81	7	Average recovery rate	1.29 m/hr
17	40	9.27	1.34	13.9	2.01	14		
18	60	9.55	0.82	9.55	0.82	9		
Bit 3								
19	12	2.56	0.15	12.8	0.75	6	Total drilling time	17 hr, 40 min
20	56	9.54	0.66	0.22	0.71	7		
21	120	9.53	0.35	4.77	0.18	4	Total cored	106.72 meters
22	155	9.40	2.33	3.64	0.90	25		
23	55	9.51	0.76	10.37	0.83	8	Total recovered	12.62 meters
24	60	9.53	1.40	9.53	1.40	15		
25	40	9.38	1.25	14.07	1.88	13	Per cent recovery	11.8%
26	150	9.54	2.30	3.82	0.92	24		
27	176	9.51	1.40	3.24	0.48	15	Average coring rate	6.04 m/hr
28	68	9.50	0.72	8.38	0.64	7		
29	68	9.53	0.30	8.41	0.26	3	Average recovery rate	0.71 m/hr
30	100	9.19	100	5.51	0.60	11		
Bit 4								
31	115	8.40	0.75	4.38	0.39	9	Total drilling time	13 hr, 23 min
32	65	9.54	2.30	8.81	2.12	24		
33	50	9.53	2.15	11.44	2.58	23	Total cored	84.34
34	70	9.40	0.35	8.06	0.30	4		
35	62	9.51	0.92	9.20	0.89	10	Total recovered	9.25
36	136	9.53	1.00	4.20	0.44	10		
37	90	9.38	0.84	6.25	0.56	9	Per cent recovery	10.96
38	110	9.54	0.50	5.20	0.27	5		
39	105	9.51	0.44	5.43	0.25	5	Average coring rate	6.30 m/hr
							Average recovery rate	0.69 m/hr
Bit 5								
40	24	7.65	0.07	19.1	0.175	1	Total drilling time	19 hr, 22 min
41	180	9.51	0.48	3.17	0.160	5		
42	53	9.53	0.52	10.8	0.59	5	Total cored	124.02
43	80	9.53	0.20	7.1	0.15	2		
44	70	9.39	0.00	8.05	0.0	0	Total recovered	14.52
45	40	9.52	0.22	14.3	0.33	2		
46	60	9.45	0.70	9.45	0.70	7	Per cent recovery	11.70
47	48	9.37	1.98	11.7	2.48	21		
48	64	9.52	1.08	8.9	1.01	11	Average coring rate	6.40 m/hr
49	190	9.51	2.07	3.00	0.65	22		
50	100	9.50	1.70	5.7	1.02	18	Average recovery rate	0.75 m/hr
51	120	9.27	2.30	4.64	1.15	25		
52	55	9.27	1.60	10.1	1.74	17		
53	78	3.0	1.60	2.31	1.23	53		

TABLE 2 – *Continued*

Core	Drilling Time (min)	Cored Length (m)	Length Recovered (m)	Coring Rate (m/hr)	Recovery Rate (m/hr)	Recovery (%)	Comments	
Bit 6								
54	120	6.51	2.09	3.26	1.04	32.1	Total drilling time	19 hr, 04 min
55	190	9.53	1.86	3.01	0.59	19.5		
56	270	9.53	1.18	2.11	0.93	43.9	Total cored	74.12
57	130	9.39	1.50	4.33	0.69	16.0		
58	90	9.52	2.30	6.35	1.53	24.2	Total recovered	22.81
59	92	9.54	2.45	6.22	1.60	25.7		
60	98	9.37	3.40	5.74	3.51	36.3	Per cent recovered	30.77
61	124	9.52	3.82	4.61	2.23	40.1		
62	30	1.21	1.21	2.42	2.42	100	Average coring rate	3.89 m/hr
							Average recovery rate	1.20 m/hr
Bit 7								
63	152	7.50	6.05	2.96	2.39	81	Total drilling time	13 hr, 44 min
64	192	9.51	5.85	2.97	1.83	62		
65	160	9.53	2.55	3.57	0.96	27	Total cored	45.46 meters
66	140	9.53	3.93	4.08	1.68	41		
67	180	9.39	2.60	3.13	1.04	28	Total recovered	20.98 meters
							Per cent recovered	46.15
							Average coring rate	3.31 m/hr
							Average recovery rate	1.53 m/hr

Note: Bits 1 through 7 (including 16.3 m of sediment drilling). Total cored: 587.85. Total recovered: 105.98. Per cent recovery: 18.03.

Unit II (Hole 395, Sample 9-4, 110 cm to Sample 9-6, 150 cm; 4598.0 to 4601.4 m) is dark yellowish brown to dark brown calcareous basal clay, segregated into layers containing nannofossils and clay in varying proportions. Foraminifers are scarce to absent in the more clay-rich layers. Staining of coccoliths by amorphous iron oxides and/or clays is more intense than in Unit I. Traces of manganese oxide micronodules are present. The micronodules can be seen with a hand lens in the darker clay-rich layers as fine, black, silt-sized particles set in a uniform darker brown clay matrix. Unfortunately, none of this material was recovered in Core 10, which contains intensely disturbed foraminifer-nannofossil ooze with several large basalt cobbles embedded at various places within it. The core catcher of Core 10 contained several large serpentinite and gabbro cobbles, and numerous smaller serpentinite and gabbro chips. Nannofossils in the sediments of Core 10 reveal them to be younger than the brownish basal clays in Core 9. Apparently, the foraminifer-nannofossil oozes in Core 10 were shaken down the side of the hole upon contact of the bit with basement (noted by the onset of strong vibrations on board ship, the so-called "basement bounce"). The plutonic cobbles in the Core 10 core catcher probably represent a basal rubble or talus zone, also cored at Hole 395A. The basalt cobbles in Core 10 are fresh, and similar to basalts in Cores 11 through 17. They may have been part of the rubble zone, or may have broken from basement and mixed with rubble during drilling. Why they entered the core barrel before the plutonic rocks is a mystery.

Biostratigraphy (by Ansis Kaneps, DSDP)

The lithostratigraphic and biostratigraphic sequence at Site 395 is probably typical of small sediment ponds near the crest of the Mid-Atlantic Ridge. The sediments are compositionally typical, brownish, foraminifer-nannofossil oozes, but biostratigraphy indicates pervasive slumping or current reworking that accounts for most of the depositional sequence present. Drilling disturbance and carbonate dissolution further hamper biostratigraphic interpretation of the section.

At Site 395, the oldest sediments cored are upper Miocene. Nannofossils provide a more exact date than the foraminifers, allowing the sediments of Core 10 to be assigned to the *Amaurolithus primus* Subzone of the *Discoaster quinqueramus* Zone. These sediments thus have an age of about 6.1 (+1.6/−1.2) m.y., in general accordance with the presumed age of crust in this area (magnetic 4, ~7 m.y.). The foraminifer assemblage from Core 10 is a solution-impoverished, generalized fauna which in overall aspect is in agreement with an upper Miocene assignment.

The remainder of the section at Site 395 is roughly divisible into three biostratigraphic/chronologic units: lower Pliocene (Core 9), upper Pliocene (Cores 2 through 8), and Pleistocene (Core 1 and Section 1 of Core 2), but mixing here is so pervasive as to preclude all but tentative zonal assignment.

Sediment Magnetics

None of the sediment samples from Hole 395 analyzed for magnetic properties had stable remanence, apparently because of extensive deformation of the sediments during drilling.

Sediment Physical Properties and $CaCO_3$ Content

On Figure 8, density and porosity (determined by both the GRAPE and cube methods), water content, seismic velocity, and per cent $CaCO_3$ (as determined

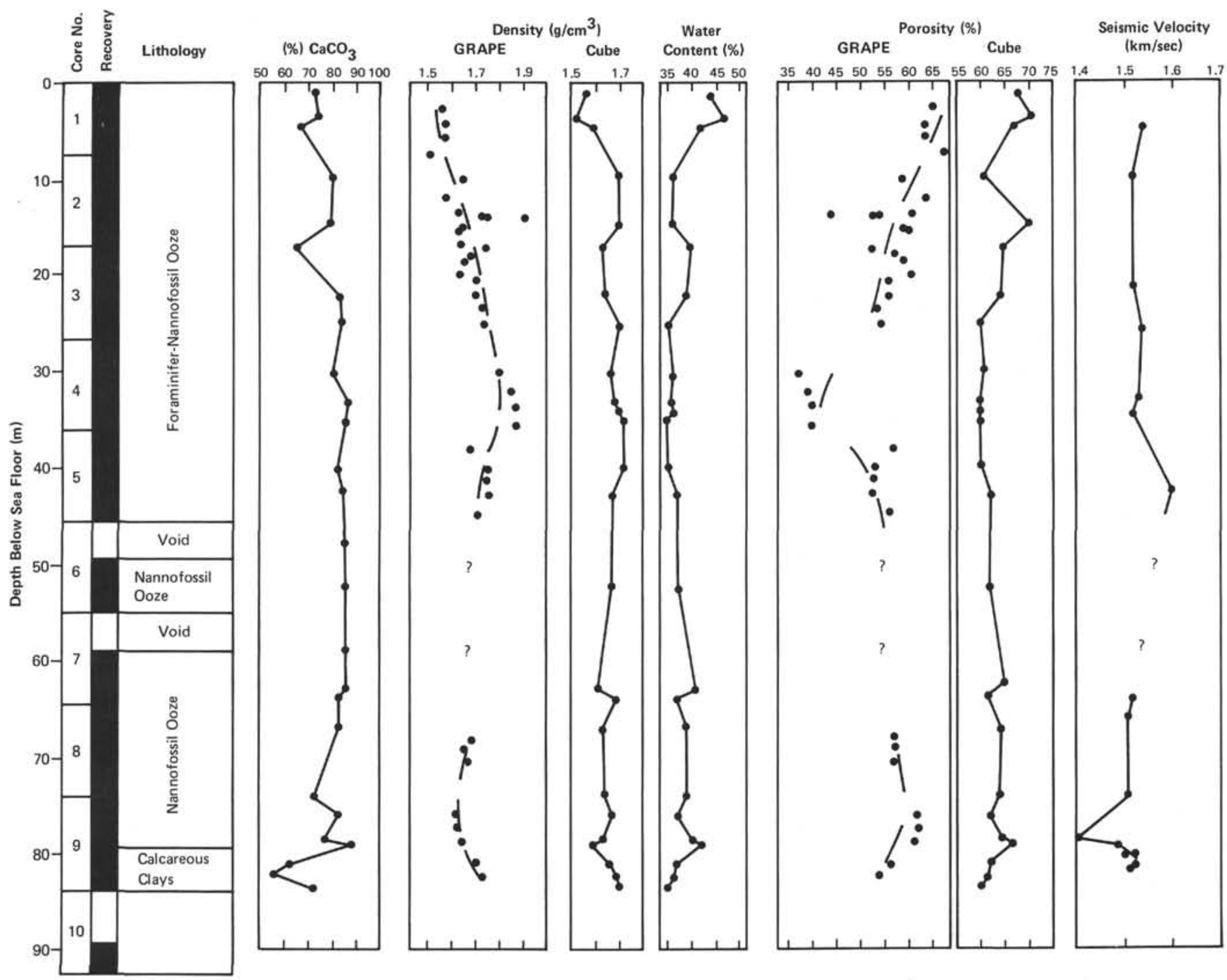


Figure 8. *Sediment recovery, lithology, $CaCO_3$ content (carbonate bomb data), and physical properties, plotted against depths, Hole 395. GRAPE density and porosity are based on 2-minute counts of individual samples.*

using the carbonate bomb) are plotted against depth (Table 3). The GRAPE and cube methods give considerably different results for both density and porosity. Apart from an initial increase in density and a decrease in porosity in Cores 1 and 2 of Hole 395, no further systematic changes occur in either through the rest of the sediments. Nor does sonic velocity change significantly with depth. The relationship of water content to cube density is entirely reciprocal, since one is derived from the other. Water content drops in Cores 1 and 2 to an erratic but consistent low of 35 to 40 per cent, indicating slight compaction of the deeper sediments.

The percentage of calcium carbonate is somewhat low in Cores 1 and 2, but increases to a high of around 85 per cent from Cores 3 to 8. The lower part of Core 9, which coincides with Unit II, has sediments in which $CaCO_3$ content is as low as 56 per cent. The low $CaCO_3$ content in Core 9 is attributable to addition of a component of basal Fe-Mn-rich clays to the normal carbonate sedimentation. The low $CaCO_3$ content in Cores 1 and 2 may be attributed to a decline in the rate of carbonate sedimentation, resulting from subsidence of the sea floor closer to the lysocline. There is, therefore, a larger component of pelagic clays in Cores 1 and 2, explaining their slightly darker color than in Cores 3 through 8. Pore-water salinity and alkalinity were those of sea water throughout Cores 1 through 9, and are not plotted on Figure 8.

The erratic nature of some of the data plotted on Figure 8 results from sediment heterogeneities (variations in the ratios of foraminifers to nannofossils) and, undoubtedly, from sediment disturbance during drilling. No part of any sediment core from Hole 395 is entirely free of such disturbance.

IGNEOUS AND METAMORPHIC ROCKS

Lithologic Summary

This summary is divided into (1) nature of the sediment/"basement" contact, (2) stratigraphic relationships between basalts and mafic or ultramafic plutonic rocks, (3) description of plutonic rocks, (4) de-

TABLE 3
Physical Properties of Sediments, Hole 395

Sample (Interval in cm)	Water Content (%) (E/A)	Porosity (%) (E/D)	Wet Bulk Density g/cm^3 (A/D)
CC	0.411	0.651	1.58
1-1, 45.5-47.5	0.439	0.683	1.56
1-3, 54.0-46.0	0.466	0.707	1.52
1-5, 89.0-91.0	0.419	0.667	1.59
2-2, 77.0-79.0	0.359	0.607	1.69
2-5, 107.0-109.0	0.355	0.604	1.70
2-6, 138.0-140.0	0.396	0.647	1.63
3-1, 107.0-109.0	0.390	0.639	1.64
3-4, 32.0-34.0	0.354	0.601	1.70
3-6, 64.0-66.0	0.360	0.605	1.68
4-3, 68.0-70.0	0.356	0.601	1.69
4-5, 49.0-51.0	0.355	0.603	1.70
4-6, 32.0-34.0	0.350	0.597	1.71
5-3, 105.0-107.0	0.351	0.598	1.71
6-2, 76.0-78.0	0.368	0.615	1.67
7-3, 62.0-64.0	0.408	0.654	1.61
7-4, 69.0-71.0	0.367	0.615	1.68
8-2, 88.0-90.0	0.390	0.636	1.63
8-6, 117.0-119.0	0.389	0.636	1.64
9-2, 16.0-18.0	0.369	0.616	1.67
9-3, 134.0-136.0	0.396	0.645	1.63
9-4, 45.0-47.0	0.416	0.663	1.59
9-5, 66.0-68.0	0.375	0.621	1.66
9-6, 26.0-28.0	0.365	0.613	1.68
9-6, 133.0-135.0	0.353	0.602	1.70

scription of basaltic rocks, and (5) alteration effects. The rocks types are not necessarily treated in the sequence in which they were drilled. Unlike sedimentary sequences, igneous sequences are not *a priori* age sequences, because of the possibility of intrusive bodies and of faulting, which would be difficult to recognize in cored samples where recoverv was low.

The cored igneous rocks of the two holes can be divided into seven major groups, according to the depths at which they were drilled: (1) sand-to-cobble-sized fragments in a foraminifer-nannofossil ooze matrix, in various zones of the approximately 93 meters of sediments overlying the first massive basement basalt; (2) a sequence of fine-grained aphyric basalt, present in both holes, about 60 meters thick, slightly shallower in Hole 395A than in Hole 395; (3) a sequence of mafic to ultramafic plutonic rocks with some zones of basalt, represented by Cores 18 and 19 of Hole 395, and by Core 13 of Hole 395A; (4) a sequence of phyric to strongly phyric glassy to medium-grained basalts, about 190 meters thick (only the top of this sequence was cored in Cores 19 and 20 of Hole 395; the entire sequence was cored between Cores 13 and 33 of Hole 395A); (5) a massive sequence of glassy to fine-grained aphyric basalts and breccias, from Cores 33 to 60 of Hole 395A; (6) two massive dolerite intrusions, both strongly phyric with fine-grained to glassy selvages in Cores 61 through 64 of Hole 395A; and (7) a sequence of hydrothermally altered aphyric basalt, from Cores 64 to 67 of Hole 395A. These sequences are shown on Figure 9. In the figure, core numbers and recovery are given to the right of each column. Lithologic units (1 through 4 in Hole 395 and 1 through 23 in Hole 395A) and chemical types ($A_2 - A_4$ and $P_1 - P_5$) are indicated to

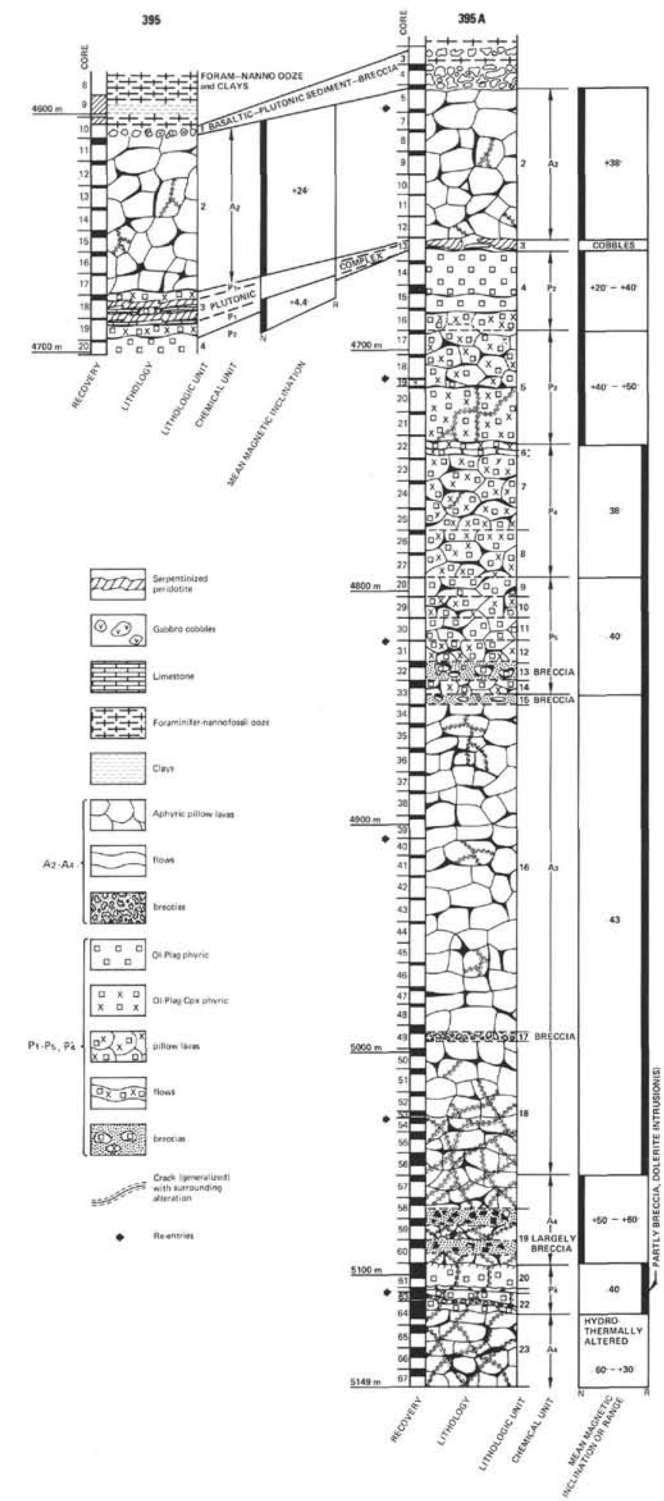


Figure 9. *Basement stratigraphy, Holes 395 and 395A. Recovery is shown at left of columns as area blackened for interval of each core. Lithologic units are as defined in Table 6. Chemical types (A_2-A_4; P_1-P_5) are as defined in the text. Magnetics column gives mean magnetic inclinations or ranges for each chemical unit. If left side of magnetics column is a heavy line, the polarity of the interval is positive; if the right side is a heavy line, it is reversed. Arrows indicate re-entries.*

the left of each column, and will be defined later in this chapter. Mean magnetic inclinations and polarities are to the right of the columns identifying chemical units.

Sediment/Basement Contact

The presence of fragments of basalt, gabbro, and serpentinized peridotite above the first continuous basalt sequence suggests a contact of sediments, talus, slumped igneous rocks, or igneous "rubble" on basalt. In Hole 395, the plutonic fragments at the contact are small enough that they may have dropped down the hole from a cobble zone in the sediments. But in Hole 395A, several pieces were distinctly "cored" (were greater in length than the diameter of the core liner), and so could not have fallen down the hole. The uppermost basalt unit (A_2 on Figure 9) probably consists of a pillow sequence; recovered fragments range in texture from nearly glossy to fine grained. Large black variolitic patches characterize the finest grained portions of these rocks, indicating that dozens of cooling units were cored. We therefore infer that these basalts are extrusive and are overlain by talus, apparently derived from the steep ridge (average slope 17°) just east of Site 395.

Relationship Between Basalts and Ultramafic Rocks

In Cores 17 through 19 of Hole 395, and in Core 13 of Hole 395A, we recovered a variety of mafic and ultramafic plutonic rocks. Two large ultramafic rocks were cored continuously, with essentially 100 per cent recovery, in Core 18 of Hole 395. The stratigraphic sequence through this "plutonic complex" of Hole 395 is shown in Figure 10(A); a detailed blow-up of the transition between the two large ultramafic blocks is presented in Figure 10(B). The upper ultramafic block in Core 18 is a serpentinized harzburgite with enstatite augen, showing a primary foliation. The lower block is serpentinized lherzolite with no foliation. The bottom of the harzburgite and the top of the lherzolite are intensely altered to a brick-red color, and are heavily veined with carbonate. Between the two occurs a carbonate-cemented ultramafic to basaltic breccia zone. The carbonate appears to be recrystallized foraminifer-nannofossil ooze, on the basis of foraminifer "ghosts" visible in thin sections. In the middle of this breccia zone are several pieces of fine-grained phyric basalt, two with glassy edges. The symmetry of the entire sequence, starting from the brick-red serpentinites, suggests that the basalt may be a dike that intruded and baked the previously soft sedimentary breccia. Some of the basalt pieces are of small diameter, and may have been turned or jumbled out of sequence during coring, so that the pieces with glass are not necessarily the topmost and bottommost pieces.

We recovered one gabbro cobble immediately above this zone. It, in turn, is overlain by the upper aphyric basalt (Unit A_2, Figure 9).

The serpentinite recovered in Core 13 of Hole 395A were too few and too altered to add to this stratigraphic picture, except to verify that the zone is distinctly between the upper aphyric and the phyric basalt units.

We infer that this deeper "plutonic complex" is not a fault zone, but rather a zone of cobbles or talus, according to the following lines of evidence:

1) The plutonic zone has a similar stratigraphic level between two distinctly different basalt types in both Holes 395 and 395A.

2) Magnetic inclinations are consistent in the basalts above and below the plutonic zone (so there probably was no fault-block rotation along a fault through the plutonic zone).

3) The metamorphic fabric in the large ultramafic blocks is primary (pre-serpentinization), and differs in the two large blocks. There is no evidence that they have experienced shear in this fault zone.

4) The possible basalt "dike" is similar to phyric basalts below the plutonic zone, and is very fine grained to glassy. It thus cooled rapidly. These features, and its "symmetrical" stratigraphic position with respect to the two ultramafic blocks, suggest that it represents a late varient of the phyric basalt sequence that in other places may have partly buried an ultramafic boulder-cobble sequence, and here squirted between the blocks in the soft sediments surrounding them. This would explain both the glass and the stratigraphic sequence of Figure 10(B).

5) There is another ultramafic-gabbroic cobble sequence above the upper aphyric basalt, and there are still other plutonic rocks in the sediment column. We have no reason to ascribe one such sequence to a fault zone and not the others; we feel that all are talus.

If indeed the plutonic rocks represent boulders strewn from a steep scarp on the adjacent steep ridge (less than 300 m away), then the age of basement (> 6 m.y.) inferred from biostratigraphy requires that this scarp must have been exposed in an axial-rift setting on the Mid-Atlantic Ridge, and that lavas erupting in the median rift buried talus from the exposures.

Description of the Plutonic Rocks

These range from completely serpentinized to about 40 per cent serpentinized. The two major continuously cored units occur in Core 18, Sections 1 and 2, and are separated by basalt and sedimentary breccia. The upper of these units, a partly serpentinized harzburgite, is a tectonite containing augen of orthopyroxene, probably enstatite, typically around 0.8 cm in longest direction, in a largely serpentinized olivine matrix. The lower unit is (1) more thoroughly serpentinized, (2) contains large enstatite grains, but with more distinctive green clinopyroxene grains, (3) is more properly termed a lherzolite, and (4) is not a tectonite (i.e., it has no pronounced fabric). The higher content of clinopyroxene (probably diopside or endiopside) in the lower ultramafic section, compared with the upper, is reflected in the higher content of lime (2.09 to 0.89%; see Bougault et al., this volume). The higher content of Al_2O_3 (1.37 versus 0.91%), lower MgO (44.35 versus 42.02%), lower iron (as Fe_2O_3) (10.25 versus 9.36%), and higher SiO_2 (43.15 to 43.36%) reflect a higher ratio of cpx + opx to olivine. Chromian spinel is an accessory phase in both varieties. Exsolution textures are well developed in the pyroxenes in both varieties.

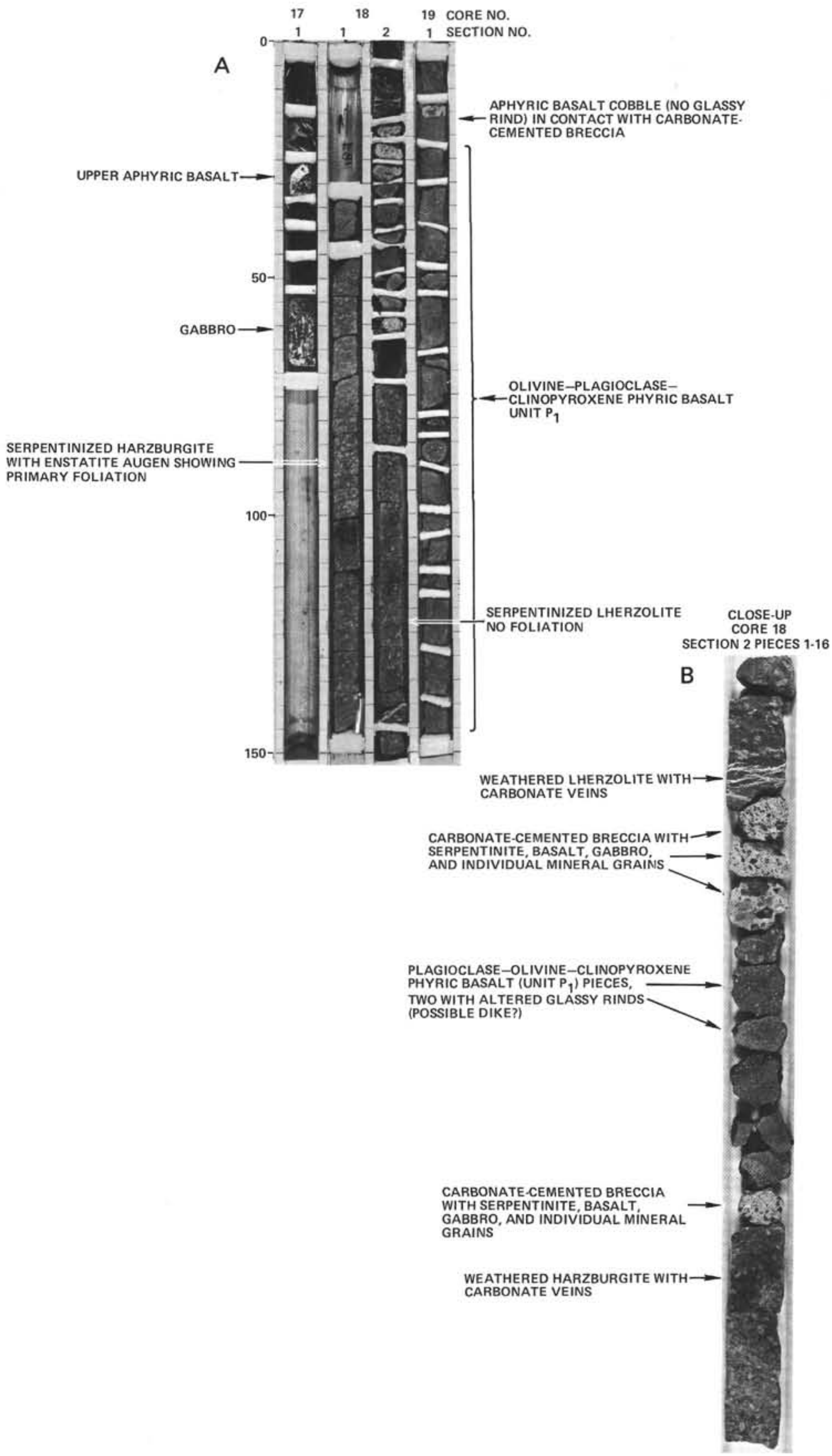


Figure 10. *Gabbroic and ultramafic sequence of Hole 395, Cores 17 and 18 (lithologic Unit 3).*

Gabbro was the first rock type cored (Core 17, Section 1) in the "mafic-ultramafic-volcanic complex" of Hole 395. This rock, a very coarse grained, largely recrystallized variety, contains considerable secondary amphibole, including colorless, light green, and brown varieties marginal to and in places completely replacing clinopyroxene.

Three mafic and ultramafic rock fragments were selected for chemical analysis from the core catcher of Core 10 (see Bougault et al., this volume, for data). These include (1) serpentinite (Sample 395-10, CC Piece #1), (2) partially serpentinized plagioclase peridotite (Sample 395-10, CC Piece #3), and (3) altered gabbro (Sample 395-10, CC Piece #2). These were selected to characterize some of the basement rocks derived from nearby slopes, probably transported to the drill site by turbidites or slumps. The ultramafic rocks are almost completely serpentinized. The gabbro is largely plagioclase ("gabbroic anorthosite") in which the mafic minerals are entirely altered to colorless amphibole and serpentine. The altered mafic areas are mostly interstitial to much larger areas of fresh single plagioclase crystals. The original mafic minerals thus may well have been intercumulus precipitates in a plagioclase cumulate, although this is far from proven. The plagioclase crystals do not show a clear-cut preferred orientation. The serpentinites contain relict, in some cases "bent," augen of euhedral crystals or orthopyroxene, with exsolution lamellae and blebs of clinopyroxene. Because of the extensive hydration, the chemical composition of serpentinite cannot be taken to record faithfully primary compositions. The K_2O contents, particularly, probably reflect a post-serpentinization weathering effect, indicated in the serpentinite (Sample 10, CC Piece #1) by small pools of brownish orange alteration products within the serpentine sagenitic webs.

Conventions For Description of Basaltic Rocks

Basement recovery was about 19 per cent at Holes 395 and 395A. This is similar to the average low recovery at Hole 332B (19%, Leg 37), drilled to similar sub-basement depth in young crust (less than 10 million years old) on the Mid-Atlantic Ridge. Such low recovery makes it impossible to locate lithologic contacts precisely in the hole. For this reason, certain conventions have been developed as follows:

1) DSDP policy places contacts where they actually occur in the recovered rocks, relative to the base of the cored interval. This has the advantage of relating the contact location directly to the cores, but can be off by up to almost 9.5 meters from where an actual contact is in the hole.

2) A second convention assumes that contacts are "evenly" located in the hole. That is, if there is a single contact in a core with low recovery, it is assumed to be in the middle of the cored interval. If there are two contacts, they are placed at one-third and two-thirds of the distance cored; and so on.

3) Finally, the inferred contact locations can be placed according to the proportion of the lithologies actually cored. If the upper 20 per cent of the core is Unit A, and the lower 80 per cent is Unit B, then the contact between A and B is placed at 20 per cent of the total cored interval below the top of the cored interval.

Of these three conventions, (2) and (3) probably give intervals that are more realistic than those according to (1). And (3)—placing contacts proportional to where they occurred in the cores—is deemed most realistic, and is used in Table 4. Since there is still a small possibility that Hole 395A will be logged, we feel this is the most appropriate way to attempt to locate unit contacts. It assumes, however, that all lithologies core equally well—an assumption that cannot be tested and is most likely wrong.

Location of Acoustic Basement

Acoustic basement occurs somewhere in the interval between 87.60 and 96.84 meters sub-bottom in Hole 395A. We have assumed an approximate depth of 93 meters, but it is difficult to locate precisely, and may be as shallow as 88 meters. The difficulty is that the uppermost basement unit (Unit 1, Table 4) appears to be talus in a sedimentary matrix (foraminifer-nannofossil ooze), and no clear contact between this unit and talus-free ooze was cored; there may not be a clear contact. The first continuously cored basement unit with consistent chemistry, paleomagnetic inclinations, and lithology starts in Core 5 of Hole 395A, at an inferred sub-bottom depth of 111 meters (Unit 2, Table 4).

Characterization of Lithologic Units

The lithologies of Hole 395 can be divided into four units, and in Hole 395A they can be divided into 23 units (Table 4, Figure 11). The top four units are the same in both holes. These units are based on any hand-specimen feature or features which can be used to distinguish one group of cored lithology from another. They include absence, presence, and relative abundance of phenocrysts in the basalt, extent of brecciation and fracturing, and abundance of secondary minerals. Even where a given lithology recurs, it is given a new unit number. For simplicity, units were not broken down into sub-units. In general, there is close correspondence among lithologic, chemical, and paleomagnetic units.

Main Lithologic Types of Hole 395A

The cored rocks of Hole 395A can be divided into the lithologies listed below. Also given are the sums of the intervals over which they occur and the percentage of the total basement cored (571 meters, placing the basement contact at the top of Unit 1).

Lithology	Sum of Cored Interval (m)	Percentage of Total Cored Interval
Aphyric basalt	332	58
Phyric basalt	177	31
Breccias (mainly basaltic)	40	7
Intrusive dolerite	22	4
	571	

TABLE 4
Lithologic Summary, Hole 395A

Unit	Short Name	Cores	Inferred Sub-Bottom Interval (m) and Thickness (in paren.)	Distinguishing Characteristics
1	Sedimentary breccia	3-5	87.60-110.79 (23.19)	Sub-rounded to angular fragments of aphyric basalt, and ultramafic to mafic plutonic rocks in foraminifer-nannofossil ooze
2	Aphyric basalt	5-13	110.79-172.44 (61.65)	Aphyric basalt
3	Sedimentary breccia	13	172.44-174.31 (1.87)	Two sub-angular fragments of serpentinite, 1 pc aphyric basalt
4	Phyric basalt	13-16	174.31-210.52 (36.11)	Plagioclase-olivine phyric fine-grained basalt
5	Phyric basalt	17-22	210.52-257.00 (46.48)	Plagioclase-olivine-clinopyroxene phyric
6	Phyric basalt	22	257.00-260.37 (3.37)	Plagioclase-olivine-clinopyroxene, phyric with fewer plagioclase phenocrysts than Unit 5
7	Phyric basalt	23-25	260.37-288.79 (28.42)	Plagioclase-olivine phyric with rare large clinopyroxene phenocrysts
8	Phyric basalt	26-27	288.79-307.84 (19.05)	Plagioclase-olivine clinopyroxene phyric
9	Phyric basalt	28	307.84-317.34 (9.50)	Plagioclase-olivine phyric
10	Phyric basalt	29	317.34-326.87 (9.53)	Plagioclase-olivine-clinopyroxene phyric pieces and plagioclase-olivine phyric pieces
11	Phyric basalt	30	326.87-336.06 (9.19)	Olivine-plagioclase phyric
12	Phyric basalt	31	336.06-344.46 (8.40)	Mixed pieces plagioclase-olivine-clinopyroxene phyric and plagioclase-olivine phyric
13	Basaltic breccia	32	344.46-354.00 (9.54)	Angular clasts of fine- to medium-grained plagioclase-olivine phyric basalt in carbonate clay-rich matrix; clasts include coarsest grained basalt found; evidence of hydrothermal alteration
14	Phyric basalt	33	354.00-360.87 (6.87)	Mixed pieces plagioclase-olivine-clinopyroxene and plagioclase-olivine phyric basalt
15	Hyaloclastite	33	360.87-362.24 (1.37)	Fine-grained basalt and basaltic glass in recrystallized carbonate ooze
16	Aphyric basalt	33-49	362.24-504.77 (142.53)	Aphyric basalt with very rare rounded plagioclase "xenocrysts"
17	Basaltic breccia	49	504.77-508.74 (3.97)	Angular, brecciated fine- to medium-grained basalt clasts, including variolitic rinds and altered glass clasts in clay-rich matrix
18	Aphyric basalt	49-58	508.74-585.00 (76.26)	Aphyric basalt with rare olivine and plagioclase "xenocrysts," highly fractured, abundant veins filled with secondary minerals
19	Glass-rich basaltic breccia and aphyric basalt	58-61	585.00-608.10 (23.10)	Breccias with abundant basaltic glass marginally altered to numerous secondary minerals in a matrix of alteration products; some zones of aphyric basalt with some glassy rinds with variolitic zones
20	Dolerite	61	608.10-617.49 (9.39)	Plagioclase-olivine-clinopyroxene basalt, medium grained
21	Aphyric basalt	62	617.49-617.96 (0.47)	Thin zone of aphyric basalt with glassy and variolitic rind; surfaces sheared and coated with clay and other secondary minerals
22	Dolerite	62-64	617.96-630.15 (12.19)	Plagioclase-olivine-clinopyroxene basalt, medium grained; quenched contact at base
23	Aphyric basalt with some glassy breccia zones	64-67+	630.15-664.09+ (+33.94)	Aphyric basalt, glassy basaltic breccias, numerous glassy-variolitic rinds, abundant soft light-colored clay in fractures; highly fractured

The cored interval is thus about 96 per cent basaltic rocks; 89 per cent are either extrusive or intrusive, and the remaining 7 per cent are basaltic breccias. The 4 per cent of the section which is not basalt is composed of breccia Units 1 and 2, which, in addition to fragments of basalt, include fragments of mafic to ultramafic rocks.

Sequence of Rock Types Recovered Down Hole 395A

The dominant lithology encountered in Hole 395A is basaltic, principally aphyric but with significant phyric units. After drilling about 88 meters of foraminifer-nannofossil ooze, we recovered cores containing rounded rock pebbles in the ooze. These pebbles were of highly serpentinized peridotite, aphyric basalt, and gabbro (in order of abundance). The recovery of *in-situ* basement began at about 111 meters with aphyric basalt which extends down for about 62 meters to Core 13. This unit is commonly variolitic and very fine grained, with glassy rinds on some pieces. We interpret it as a pillow lava sequence. Below this, at the top of Core 13, two rounded fragments of very altered peridotite were recovered; they may represent a sedimentary breccia zone between the aphyric basalts above and the phyric basalts below. No contact is preserved. These correlate stratigraphically with ultramafic rocks in Cores 17 through 19 of Hole 395 (Figure 9).

A series of phyric basaltic units begins in Core 13 and continues into Core 33. It has been subdivided, in terms of its phenocryst phases and chemistry, into four differing units. The first, extending from Core 13 to Core 16, about 36 meters, is plagioclase-olivine phyric. In the lower part of Core 16, clinopyroxene occurs as a phenocryst phase, and this change is also reflected in the chemistry of these basalts. This unit continues for about 46 meters to Core 23, where the olivine and clinopyroxene phenocrysts become larger and the modal proportion of plagioclase phenocrysts becomes slightly lower than in the preceding cores. For the next 100 meters, from Core 23 to Core 33, clinopyroxene comes and goes as a phenocryst phase in the phyric units in an apparently irregular manner. At the base of these phyric basalts there are two breccia zones. One occupies the whole of the recovered part of Core 32, and is composed of clasts of overlying phyric basalt set in a matrix of carbonate. Separating this breccia from the next is a thin layer (about 7 m), again of phyric basalt, the same as

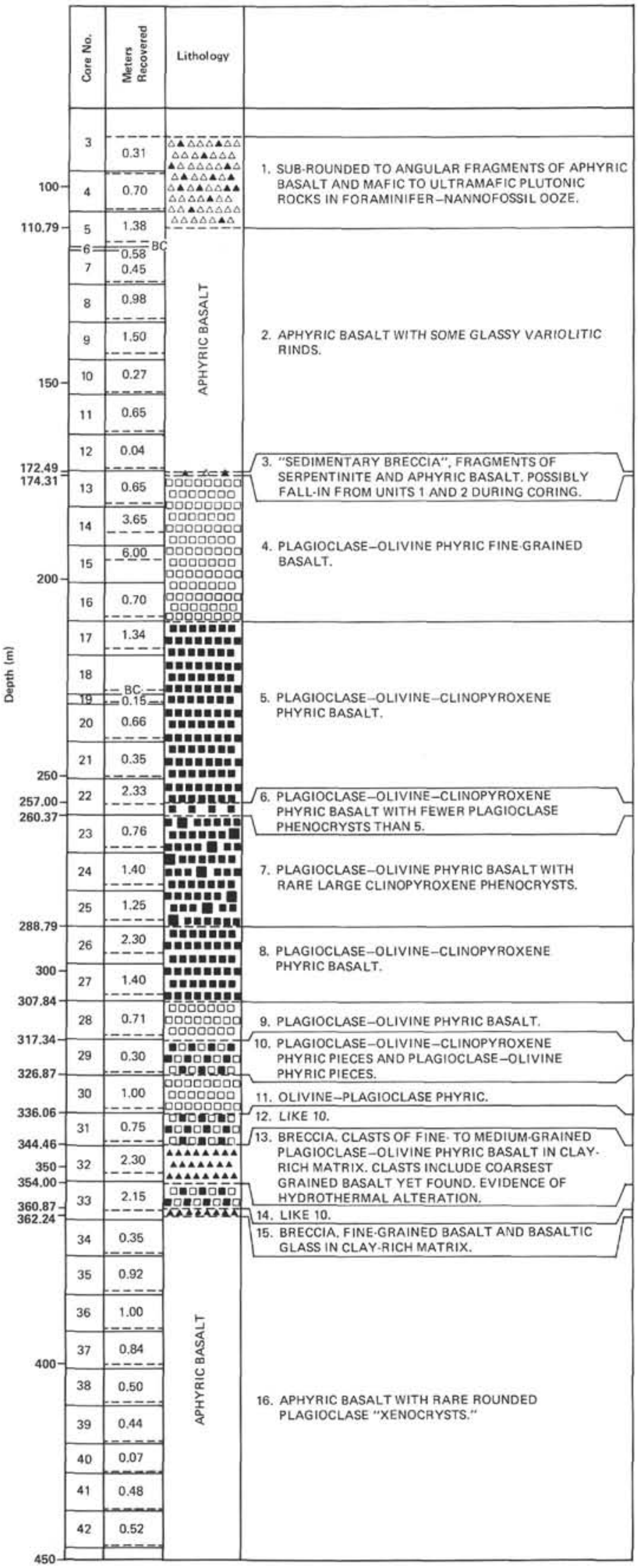


Figure 11. *Lithologic column for basement rocks, Hole 395A.*

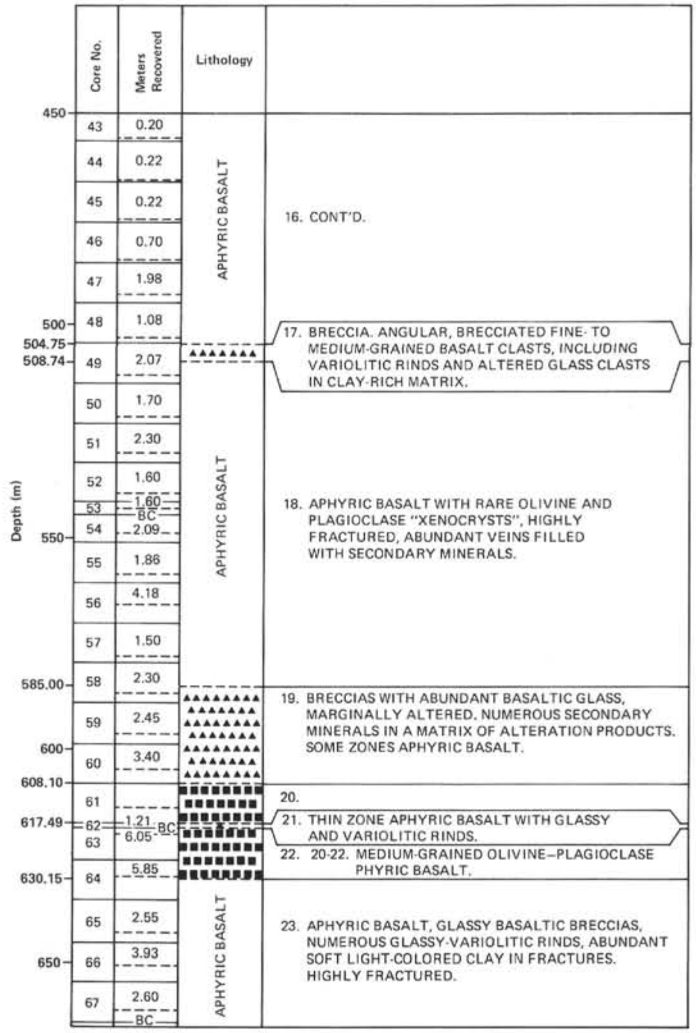


Figure 11. *(Continued).*

that over and within the breccia in Core 32. Below these phyric basalts in Core 33 is a second breccia zone, this time of aphyric and glassy clasts set in a cement of altered glass and carbonate, which forms the upper surface of the thickest basalt unit recovered from Hole 395A. This thick aphyric series extends downward for 247 meters, to Core 61, as a single lithologic unit. Toward its lower end (Unit 18, Cores 49 through 58), the glassy zones become more frequent, and fracturing of the specimens into small fragments causes difficulty in handling them. A change of chemistry, though not of petrography, occurs below a thin breccia zone in Core 56.

The major aphyric basalt series is intruded by a plagioclase-olivine phyric dolerite about 22 meters thick (Cores 61 through 64, Units 20 and 22). The aphyric basalt about this intrusion includes several breccia zones; for example, in Core 58, 25 per cent of the recovered material is glassy breccia. These glassy zones are less frequent below the intrusion, but throughout this aphyric unit glassy rinds are abundant, suggesting that it is a pillow lava sequence.

Two plagioclase-olivine phyric dolerite intrusions were cored in long coherent lengths terminated by high-angle shear surfaces covered by green slickensided material, probably chlorite. Within their 22 meters they contain thin autobrecciation zones in which the euhedral phenocrysts and ophitic groundmass texture have been destroyed and replaced by a disoriented aggregate of angular fragments in a slightly darker, fine-grained fragmental matrix. The base of the lower intrusion shows a chilled glassy contact with the underlying aphyric basalt. Between the dolerite intrusions is a small section of aphyric basalt (lithologic Unit 21), chemically and petrologically identical to the aphyric basalt hose of the dolerite.

At the bottom of Hole 395A, in Core 67, is an aphyric basalt chemically similar to the massive unit seen in Cores 34 to 56. Here, however, it is brecciated in places, with angular fragments, of differing size, of basalt and glass cemented together by—in part—a darker matrix of altered glass and clay minerals. Translucent opal occurs in veins and in the matrix of the breccias (Lawrence et al., this volume).

Correlation Between Lithology and Recovery Rate

There is a definite correlation between lithology and recovery (Figure 12). This is particularly clear down to Core 49. For example, the plagioclase-olivine massive basalt (Unit 3, Cores 13 to 16), possibly an intrusive, shows strikingly high recovery rate compared with the aphyric basalts, pillow lava sequences (?), on top of it. The entire sequence of phyric basalts, Cores 13 through 33, shows a recovery rate almost twice as high (13% versus 8.1 and 6.8%) as the aphyric sequences above and below it. What is controlling this relationship? One interpretation is that the amount of solid, unfractured, or fractured but "healed" (fractures cemented with secondary minerals) rock determines the recovery rate. At about Core 46 (about 382 m sub-basement), the recovery rate is high regardless of lithology, but is still higher in the massive doleritic intrusives (Unit 22, Cores 62 through 64), giving the maximum recovery rate, 39 per cent, of any lithologic type. The increase below 382 meters sub-basement correlates with an increase in the abundance of rocks containing fractures filled ("healed") by secondary minerals, including clays, zeolites, and opal.

Effect of Decompression(?) on Rock Fracturing

Lithologic units below about 382 meters sub-basement (starting at Core 46) commonly were cored in massive, sometimes long continuous pieces, which appeared quite "hard" when brought on board. When dried and then sawed for sampling, these commonly shattered along numerous fractures, creating problems in labeling, additional sampling, and preservation of contact relationships. This shipboard fracturing phenomenon was particularly striking for the lower aphyric basalts (Units 18, 21, and 23). We are not sure what caused the fracturing, but (1) drying and shrinkage of clays, or (2) expansion of trapped gases and/or sea water within fractures are possible explanations.

Mineralogy and Petrology of Basaltic Rocks

This section summarizes the petrography of Site 395 basalts. A more detailed exposition of basalt crystal morphologies is given in Natland (Chapter 18, this volume). The petrography of ultramafic rocks is treated by Sinton (this volume), Arai and Fujii (this volume), and Boudier (this volume).

In both Holes 395 and 395A, basaltic Unit A_2 is an aphyric pillow basalt sequence containing numerous glassy and variolitic zones. The dominant lithology is that of a fine-grained variolitic groundmass with sheaf-like radiating plagioclase crystals about 0.3 mm long. In this mat-like groundmass are dispersed small euhedral olivines about 0.02 mm across and acicular quench olivines, up to 0.7 mm long, with swallow-tail terminations. The texture is one of quench crystals radiating from nucleii. These nucleii are sometimes euhedral olivines or feldspars about 0.02 mm across, but more often no nucleation stimulant is visible. Skeletal euhedral olivines ranging in length up to 1 mm also occur, but they are rare.

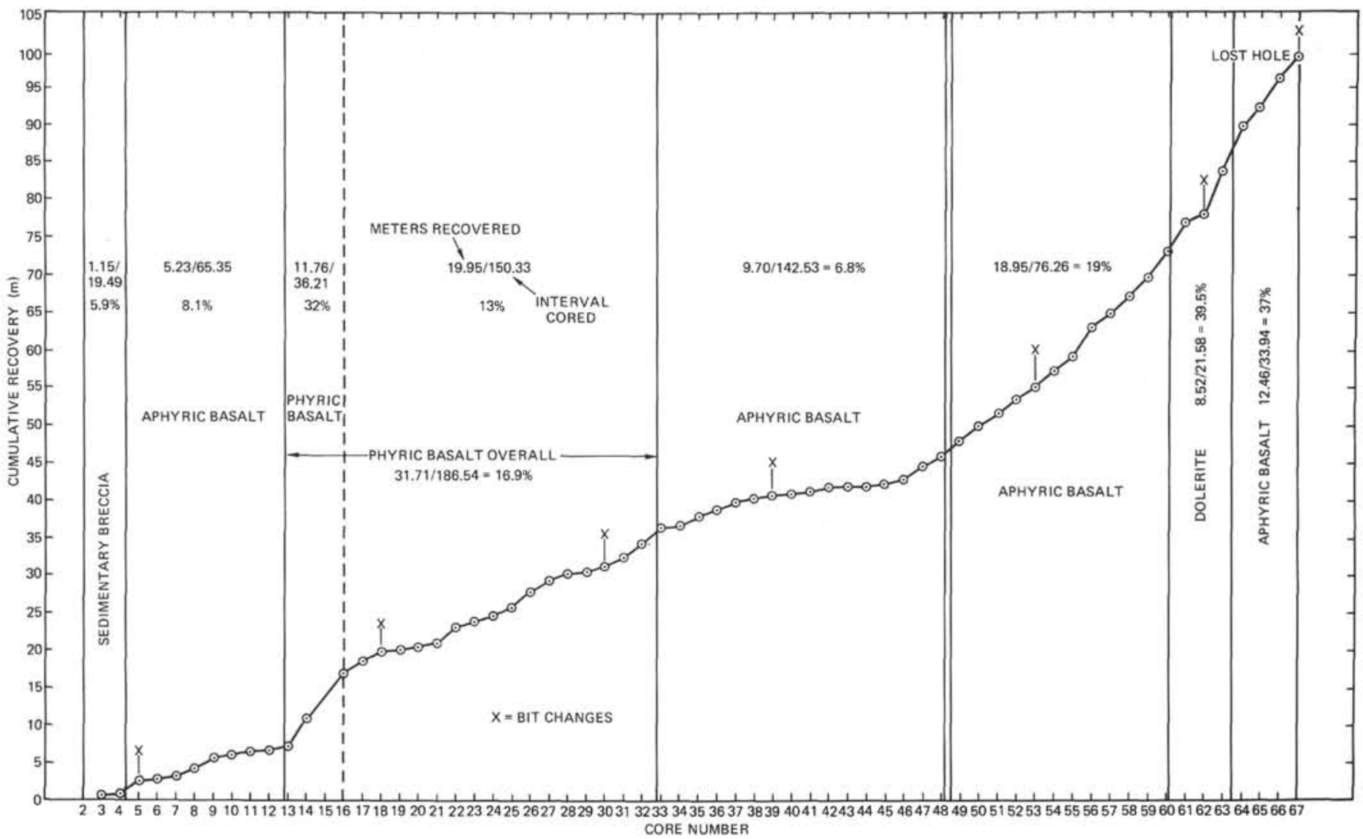


Figure 12. *Correlation between recovery rate and lithology, Hole 395A.*

Below Unit A_2 in Hole 395 is the plutonic complex already described; below it in Hole 395A are two rounded pebbles of highly serpentinized peridotite and one of aphyric basalt. These pebbles are believed to be part of a sedimentary breccia zone, or perhaps fell in from overlying units.

Below Unit A_2 in Hole 395 is phyric basalt type P_1, with abundant plagioclase, clinopyroxene, and olivine phenocrysts. Below Unit A_2 in Hole 395A lies a sequence of phyric basalts (Units P_2 through P_5) whose total thickness is 187 meters. These basalts are initially plagioclase-olivine phyric (Unit P_2), but after about 34 meters (in Core 16), clinopyroxene becomes a phenocryst phase joining the plagioclase and olivine (P_3 and P_4). Farther down, in Core 28 (P_5), clinopyroxene phenocrysts are absent, but they reappear in Core 29, then disappear in Core 30 only to reappear for a second time in Cores 31 and 33. In general, these phyric units are characterized by an abundance of euhedral plagioclase phenocrysts, up to 25 per cent in parts (visual estimate), with about 7 per cent olivine and minor clinopyroxene. A number of thin sections, made from hand specimens in which pale emerald green clinopyroxenes were seen, either with the unaided eye or using a binocular microscope (×6), have no clinopyroxene phenocrysts when examined microscopically, because the distribution of clinopyroxene as a phenocryst phase is patchy. In Cores 13 through 15, none was visible either in hand specimen or in thin section. These fine-grained phyric basalts contain as phenocrysts about 20 per cent plagioclase, An_{75} (0.3 to 0.5 cm across), and 7 per cent olivine (~Fo_{85} 2V~90°) 0.3 cm across, set in a holocrystalline groundmass of clinopyroxene (2V~60°), olivine, lath plagioclase, and titanomagnetite. The feldspar phenocrysts show both normal and oscillatory zoning, and often contain inclusions of brown glass as blebs in their cores. In Cores 16 through 22, clinopyroxene is present as a phenocryst phase, and rare, rounded, dark brown spinel occurs. The clinopyroxene phenocrysts are in a microcrystalline, often variolitic, groundmass. In Core 23, olivine becomes more abundant than in the preceding cores, and at Section 23-1, glomerocrysts of clinopyroxene and plagioclase are more common than elsewhere in this unit. The proportion of clinopyroxene as a phenocryst phase varies markedly from thin section to thin section in this region of the core. In a section at 23-1, 99-101 cm #9, the proportion of clinopyroxene phenocrysts is only slightly less than that of the olivines, whereas a section from the preceding piece in the core (#8) showed no clinopyroxene phenocrysts. Even on the patchy information available it appears, however, that in Section 23-1 the modal abundance of phenocryst clinopyroxene reaches its maximum; below that section it is less significant, particularly below Core 27. Spinel is a rare phenocryst phase occurring in sections from Cores 22 to 33. The groundmass of the phyric basalts in Cores 23 through 27 varies between very fine grained to variolitic and microcrystalline. Even in these phyric units, quenched groundmass textures are common, and it seems that the lavas forming them were extruded under conditions that produced in many cases only slightly less rapid cooling than in the aphyric units. This plagioclase-olivine ± clinopyroxene phyric unit continues into Core 33, where many of the basalt fragments have glassy rinds, but in Core 32 there is a breccia zone (lithologic Unit 13) consisting of phyric basalt fragments set in a clay and carbonate cement.

Below this phyric unit is aphyric basalt whose upper surface is marked by another breccia zone (Core 33, lithologic Unit 15), this time of aphyric basalt clasts set in a cement of basalt-fragment debris and minor calcite. The feldspar fragments in this breccia could not have been derived from the aphyric unit, so the plagioclase phyric basalt has contributed to this breccia. The aphyric basalt, generally variolitic, with rare rounded phenocrysts of plagioclase and olivine up to 2 mm in diameter, continues down to the bottom of Core 60, that is, for about 246 meters. Aphyric Unit A_3 continues to the base of Core 56. Below this lies Unit A_4, petrographically similar to A_3, but distinct chemically and magnetically (Figure 9). In this long section the degree of crystallinity of the groundmass varies from hyalo-variolitic to sub-variolitic and up to holocrystalline, medium-grained basalts with plagioclase laths 1 mm long. Fine-grained variolitic zones dominate the sequence, however, and glassy rinds are common. In thin section, the variolitic groundmass of radiating, sheaf-like aggregates of thin feldspar laths contains quench olivine, usually about 0.1 mm long, with swallow-tail terminations. In several sections there are rounded microphenocrysts of olivine up to 0.1 mm in diameter, though more commonly they are about 0.05 mm across. Within this aphyric basalt sequence, several breccia zones occur. The first is in Core 49 (lithologic Unit 17) and consists of angular to sub-rounded aphyric basalt fragments which vary in size from about 1 mm to about 1 centimeter across. The matrix of this breccia is ochre brown to dark brown, and consists of altered volcanic glass and basalt debris.

Frequent breccia zones occur at the bottom of the aphyric sequence, in Cores 56, 58, 59, and 60 (lithologic Unit 19, upper basalt type A_4). That in Core 56 is represented by two 5-mm fragments consisting of angular clasts of aphyric basalt set in a cement of calcite and altered volcanic glass. A very attractive breccia is represented by a 70-cm section in Core 58. It is composed of angular fragments of volcanic glass set in a pale green-yellow groundmass of altered glass. The glass fragments range from 1 mm to about a centimeter in diameter, and their border with the matrix is distinct. Breccia fragments similar to this occur in Cores 59 and 60. In Core 60, the breccia zones are less marked, and occur as borders to the predominant aphyric basalt host.

These breccia zones herald a change in lithology at Core 61, where a plagioclase-olivine-clinopyroxene phyric doleritic basalt unit begins and continues down to Core 64, except for a short return to aphyric basalt in Core 63. This unit is cored in long sections cut by fractures whose surfaces are coated by a slickensided chloritic material. In hand specimen, variation in grain size is obvious, but the overall texture is doleritic. In thin section, this variation is shown by the groundmass only—the phenocrysts in this unit remain much the same size; that is, plagioclases vary from 2 to 4 mm across, rarely up to 1 cm. Accompanying these are olivine phenocrysts about 2 mm across, usually partly altered to a brown iddingsitic material. Clinopyroxene phenocrysts are also present, though they are less common than the olivine. Most of the clinopyroxene in this unit occurs in the groundmass as crystals 0.2 to 0.4 mm across, with plagioclase laths 0.5 to 1 mm long; olivine is comparatively rare as a groundmass mineral. At the top of this dolerite (Core 61) there is a zone enriched in large plagioclase crystals about 6 mm long, possibly resulting from flotation in the cooling intrusion. Within this unit lie zones of brecciation in which the feldspar and clinopyroxene of the host have been broken into angular and sub-rounded fragments. The ophitic texture has been destroyed and the clinopyroxenes have been rounded. The fragments are set in a fine-grained plagioclase-rich matrix. The base of this unit occurs in Section 64-2, as a glassy contact zone between the phyric unit above and the aphyric unit below. Just above the contact, the groundmass of the phyric unit is much finer grained than in the overlying phyric basalts. Plagioclase phenocrysts still range up to 4 mm across, but the frequency distribution of their sizes is distinctly different: a broad peak occurs at about 0.8 mm and another at 0.06 mm. This is the finest grained groundmass seen in this unit.

At the base of Section 64-2, the lower portion of aphyric basalt type A_4 occurs, and continues to the bottom of the hole at Core 67. This unit is a fine-grained variolitic basalt containing rare euhedral olivine microphenocrysts about 0.5 mm in diameter and, more commonly, rounded olivines about 0.05 mm across. Quench olivine laths about 0.3 mm long are common, but in some cases have been partly altered or resorbed and now occur as brown streaks in the thin section. The development of the variolitic texture is variable. In some sections variolite plagioclase laths up to 1 mm long occur; in others the feldspar is so poorly developed as to be scarcely distinguishable from the pale brown microcrystalline groundmass. Within this aphyric unit, breccia zones of volcanic glass occur wherein angular glassy fragments are cemented together with pale green to whitish material, possibly a mixture of clays and zeolites.

The number of veins—mainly of clays, carbonate, zeolites, and possibly chlorite—increases markedly from below Core 49, in the aphyric basalt pillow lava sequences, to the bottom of the hole. In Core 67, breccia zones dominate the recovered material: Sections 67-1 and 67-2 are composed almost wholly of angular to sub-rounded aphyric basaltic clasts set in a darker gray matrix, but occasionally contain a large proportion of the white translucent vein material mentioned above.

Alteration of Basalts, Gabbros, and Serpentinites in Hole 395

Almost all the igneous rocks of the basement of Hole 395 have undergone slight to intense alteration, whether it be low-temperature hydration and formation of clays, higher temperature hydrothermal recrystallization, or both. The principal igneous rock types include basalts, gabbro, and peridotites. Lower temperature changes include oxidation and formation of palagonite, clay minerals, and carbonates. Higher temperature changes include serpentinization, recrystallization of plagioclase to albite and fine-grained micas, deformation and recrystallization of pyroxene, and replacement of mafic minerals by amphiboles.

The basalts and associated glass are affected only by low-temperature alteration. Dark glass associated with the basalts, almost certainly from pillows, is altered along conchoidal fractures to palagonite and clay minerals. Alteration rinds of clay minerals surrounding basalt cobbles further suggest low-temperature alteration of pillow lavas. The basalt section as a whole ranges from very altered to apparently very fresh. The more altered end members are brownish, and contain vugs and veins filled with clay minerals and carbonates; in type A_2 basalts, they contain variolites or blotches of fresher rock set in altered brown matrix. The actual degree of alteration can be measured semiquantitatively by decreases in wet saturated bulk density and sonic velocity (see Physical Properties section, this volume) and by an increase in K_2O (see Geochemistry section, this volume). For example, a brown-stained vesicular basalt had a ϱ = 2.61 g/cm³ and V_P = 4.4 km/sec, compared with a nearby homogeneous dark gray basalt with a ϱ = 2.96 g/cm³ and V_P = 6.0 km/sec.

The ultramafic rocks are partially to completely serpentinized. As is usual, the olivine is more extensively replaced by serpentine than is pyroxene. Chromian spinel is in places rimmed by secondary magnetite. The serpentinites contain "sagenitic webs," the distinctive arrangement of "chains" of small magnetite crystals in serpentine, derived by oxidation of primary olivine during serpentinization. The extent of serpentinization is greater in the lower of the two major continuously cored ultramafic intervals in Core 18. This is obvious in hand specimens and is manifested by a decrease in density from 2.88 to 2.74 g/cm³ (see Physical Properties section, this chapter). Stable natural remanent magnetization was not detected for these two major ultramafic intervals, because it was obscured by drilling remanence.

Deformation and hydrothermal alteration features are well developed in a gabbro recovered from Core 17, Section 1. The clinopyroxene shows deformed cleavage planes and extensive marginal recrystallization and alteration to amphibole. Plagioclase has been completely altered to albite, zeolites, and clay minerals. Large clinopyroxene grains in places contain pools of brown hornblende, believed to be a primary (magmatic) crystallization product.

Carbonate veining is associated with the puzzling sequence of rock types in Core 18, consisting of basalt, with some glassy rinds symmetrically bounded by sedimentary carbonate-cemented breccias, and, below that, ultramafic rocks. The ultramafic rocks show highly altered carbonate-veined zones where in contact with the sedimentary breccia. These are the most abundant, strikingly developed carbonate veins in the ultramafic rocks. This sequence may be interpreted as a basaltic intrusive (dike?) which followed a zone of weakness—the weathered ultramafic and carbonate breccia—during intrusion.

Alteration of Basalts in Hole 395A

In the cores from Hole 395A, a diverse suite of alteration products are present, ranging from low-temperature alteration products to (probable) hydrothermal alteration products. The occurrences of different constituents are presented in Table 5, where eight major categories of alteration products are given, with subdivisions in a few instances. The categories include:

1) Carbonate veins

2) Non-carbonate veins, fracture fillings, or matrix of brecciated zones

a) Granular (powdery and flaky)

b) "Micaceous" (shiny, platy with a soapy feel)

3) "Bleb-form" veins or fracture fillings composed of clear, usually colorless crystals, radiating from the center to the edges of approximately spherical intergrown "blebs." They usually have an index of refraction of less than 1.55, low to moderate relief, and low birefringence. These are multiply layered fairly frequently with (1), or occasionally with (2), above.

4) Black blotches commonly occurring with categories (3) or (2)

5) Basaltic glass altered to palagonite or associated with category (2)

6) Alteration products associated with variolites in aphyric basalts

7) Alteration products in vesicles

a) Pale to dark green fillings

b) White to gray fillings

c) Brown fillings

d) Empty, no fillings

8) Altered olivine.

Abundances of the constituents in Table 5 are indicated by A (abundant), C (common), and R (rare). An asterisk (*) indicates occurrence associated with another constituent.

A surface rubble or talus zone was partially recovered in Cores 3 and 4. Most of the clasts consist of basalt with palagonite veins, clay rinds, and vesicles. Serpentinite with talc veins and sausseritized gabbro also are present.

The aphyric basalts of Cores 5 to 12 exhibit principally low-temperature alteration products. Alteration surrounding variolites is common. Vesicles contain both carbonate and non-carbonate alteration.

A serpentinized peridotite with a brown altered surface occurs at the top of Core 13.

The phyric basalt of Cores 13 to 31 is massive in Cores 14 and 15, but has fairly numerous glassy boundaries below that level. The olivine phenocrysts are always altered to some extent. Vesicles and carbonate veins are the most common alteration products. The green vesicles in Cores 14 and 15 have been identified as chlorite (Lawrence et al., this volume).

Two volcanic breccias, perhaps hydrothermally altered, occur in Cores 32 and 33. In the upper breccia (Core 32) the clasts are composed of phyric basalt in a clay-carbonate matrix; the carbonate content decreases down the section. In the lower breccia (Core 33) the clasts are composed of aphyric basalt set in a clay and palagonite matrix.

In the aphyric basalts of Cores 33 through 49, the most common alteration occurs as "bleb-form" veins or fracture fillings commonly associated with black blotches or carbonate veins. These "bleb-form" veins consist of 0.1- to 1-mm intergrown spherical forms. In Cores 41, 42, and 47, a dull yellow thin coating, sometimes with black blotches, is overlain by a "bleb-form" layer. Black blotches are also intergrown with "bleb-form" fracture surfaces. In Cores 47 to 49, veins are composed of a mixture of carbonate and non-carbonate, frequently radiating around feldspar crystals.

A volcanic breccia composed of aphyric basalt clasts in a matrix of altered glass, with white-gray non-carbonate alteration, sometimes vein-like, occurs in Core 49. The basalt clasts become more altered toward the bottom of the breccia.

The aphyric basalt of Cores 50 through 60 contains two zones where a particular alteration suite predominates. The upper zone (Cores 50 through 55) have "bleb-form" fracture fillings commonly associated with a carbonate layer with the "bleb form" layer adjacent to the basalt. The lower cores (56 through 61) have fractures filled with alteration or clasts of glass or aphyric basalt set in an altered matrix. Two non-carbonate alteration products occur, one granular and usually pale green, the other darker green and "micaceous." Alteration in the lower cores is quantitatively more significant than in the upper cores. Lawrence et al. (this volume) have identified most of this material as saponite.

The doleritic basalts of Cores 61 through 64 exhibit alteration principally on fracture surfaces. By far the major constituent is a dark, brownish green alteration product which commonly has a "slickenside" appearance. This alteration product is multimineralic. It has constituents with refraction indexes both greater than and less than 1.55 and a range both in relief and in birefringence from low to high. A white, sometimes yellowish, granular powdery alteration product is also common. Carbonate veins occur in most cores. Core 63 contains a few large blotches, 0.5 to 3 mm, of a colorless clear mineral with pseudorhombohedral or rhombohedral cleavage. The index of refraction, n, is less than 1.55, and birefringence is low. This mineral is gypsum (Lawrence et al., this volume).

A large abundance of pale green to white granular powdery or flaky saponite (Lawrence et al., this volume) occurs in Cores 64 through 67. Fractures of aphyric basalt are filled with it, and some matrices of breccias with glass or basalt clasts are dominated by it. A "micaceous" pale yellow-green alteration product is also common. Some fracture surfaces have a red "slick-

TABLE 5
Summary of Alteration Types in Basement, Hole 395A

Core	Carbonate Veins	Non-Carbonate Veins: Granular	Non-Carbonate Veins: Micaceous	"Bleb-form" Veins	Black Blotches	Altered Glass	Variolites With Associated Alteration	Vesicles: Green	Vesicles: Gray-White	Vesicles: Brown	Vesicles: Empty	Altered Olivine
3						R	C	C	C		C	
4		R				C		C	C		C	
5	R							A		R		
6							R	C				
7					C	C	C	C		R		
8	C				C	C	C	C				R
9	R					R	A	C		R		C
10								C				R
11						C	C	C	C	C		
12					C		C	R				C
13								C		C		C
14	C							A		C		C
15	C	R						A				C
16	C					C						C
17						C						C
18	C*				C*	C					R	C
19						C						C
20	C*				C*					C		C
21						R						C
22	C				C							C
23						C					C	A
24					C	C					C	C
25	R					C				C		C
26		C				C					C	C
27	C	C				C		C	C			C
28					C	C		C		C		C
29					C						C	C
30	C	R				C			C			C
31	C											C
32	C					A						
33	C				R	A			R			C
34	C											
35	C					C		C	C			
36	C			C*	C*		R	C				
37	C				R	C		C		C	C	
38						C	R		C			R
39				C		C	R		C			R
40	C			C	C		R					
41		C*		C*	C*	C	R	C				
42	C*	C*		C*	C*	C			C		C	
43				C	C						C	
44												
45		C*		C*	C	C			C		C	
46	C	R		R	R	C			C			
47	A*	C*		C*			R	C	C			
48	C*	C*			C	R		R	C			R
49	C*	C*				C			R			
50	C*			C*		R	R	R	C			R
51	C*	C*		C*	C*	C	C	C	C	C		
52	C			C*	C*	C	C		C	C		R
53	C*			C*		C	R	C	C			R
54	C*	C		C*		C		C	C			R
55	C*			C*		C	C	C	C			R
56	C	C*		C		C		R		C		
57		C*		C		C*	C					
58	C*	C*		C*		C*	C					
59		C*	C*			C*	C		C			
60		C*	C*			C*	C	C				
61	C*	C	C	C*			C	R	R	C		C
62	C*	C*	C									C
63	C	C*	C*					R				C
64	C*	C*	C*	R	C*	C*	C					C
65		A*		R		C*	C	C	C			
66		A*	C*			C*	C	C	C	C		
67	C	A*	C*			C*	C	C				
68						C						

Note: Abundances: A = abundant, C = common, R = rare. * = occurrence associated with another constituent.

enside"-appearing alteration. In a breccia containing basalt clasts (Core 64), a soft, dark red alteration vein is present.

Chemistry of Basaltic and Plutonic Rocks Hole 395

Chemical data for basalts and ultramafic and mafic plutonic rocks from Site 395 are given in Appendix I, this volume. This discussion is based on shipboard XRF analyses (Bougault et al., this volume).

Basalt Chemistry

Basalts were recovered from below the sediment/basement interface to a depth of 67 meters; below this, basalt occurs with gabbro, serpentinized peridotite, and sedimentary breccia in the lower 28 meters of the hole. The hole ended in a good section (Cores 19 and 20) of plagioclase phyric basalt. On the basis of chemical data, it is possible to recognize three compositionally distinct basalt types, A_2*, P_1*, and P_2*. A means aphyric, P means phyric; the * refers especially to Hole 395 (Table 6). Each type appears, on present evidence, to be unrelated to the other types by processes of near-surface crystal fractionation; this implies that several magma types, with compositions controlled by mantle compositions and/or processes, have been sampled. All have the chemical characteristics of low-K mid-ocean ridge tholeiites, with uniform SiO_2 concentrations of about 49 per cent, Al_2O_3 content from 14.7 to 18.8 per cent, and MgO concentrations between 6.1 and 8.9 per cent. TiO_2 and K_2O contents vary between 1.0 to 1.7 per cent and 0.07 to 0.33 per cent, respectively. All have low Mg/(Mg + Fe) values (0.51 to 0.66), and it is unlikely that they represent primary, unfractionated, mantle-derived melts. Most of the basalts analyzed are fairly fresh. Loss on ignition is lower than 1.5 weight per cent in all samples. Some glassy samples are very fresh, and have very low volatile content; these actually gain weight resulting from oxidation of ferrous iron.

Type A_2*: Basalts of this type were sampled over an interval of 67 meters in the upper portions of Holes 395 and 395A. All are fine grained and aphyric, and are remarkably uniform in composition throughout this entire interval, which includes many distinct cooling units (see Visual Core Descriptions for details). A single analyzed sample (16-2, 104-105 cm) is glassy, indicating that the composition of this particular basalt closely reflects a liquid composition. Small differences in MgO concentrations (8.3 to 8.9%) among the other samples may reflect varying abundance of olivine microphenocrysts on alteration. At the same time, variation in K_2O (0.09 to 0.13%), which is greater than analytical precision, probably reflects sea-water alternation.

All the aphyric basalts of this upper unit are referenced as A_2* in Hole 395; A_2* defines a homogeneous unit from Cores 11 to 16. Some aphyric samples also referenced as A_2* (such as Samples 11-1, 105-107 cm and 19-1, 18-20 cm) are nevertheless significantly different in composition (Bougault et al., this volume). Sample 11-1, 105-107 cm, occurring in the upper 1 to 2 meters of basement, is aphyric but somewhat aluminous (Al_2O_3 = 15.9%) despite the absence of plagioclase phenocrysts. Compared with the other basalt types, this sample has higher iron and titanium concentrations, and has the lowest Mg/(Mg + Fe) value (0.51). It is clearly an evolved basalt, but does not appear to be related by crystal fractionation to the other basalt types sampled in this hole. This overall chemistry, though, resembles the A_2* basalts, so it is included with them. We had originally called this basalt type A_1*, but now have no basalt with this designation.

Type P_1*: These basalts are plagioclase-olivine-pyroxene phyric basalts that are interlayered with serpentinized peridotites at a depth of about 168 meters in Hole 395, as described earlier. They have high Al_2O_3 concentrations (17.3 to 18.2%), consistent with the presence of abundant plagioclase phenocrysts. Small differences in composition are readily attributable to minor (about 5%) variations in plagioclase phenocryst content. Relative to the other basalts, this type has comparable MgO values (7.9 to 8.5%) but markedly lower TiO_2 (about 1.0%) and Fe_2O_3 concentrations (8.4 to 8.6%). Type P_1* basalts are the most "primitive" of the basalts sampled in Hole 395, with relatively high Mg/(Mg + Fe) values (0.66).

Type P_2: Basalts of this type were sampled in the bottom 10 meters of Hole 395, beneath the mafic and ultramafic plutonic units. Most of this interval is occupied by plagioclase-phyric basalt (e.g., Sample 20-1, 32-36 cm). The highly aluminous nature of this sample, coupled with low Fe_2O_3, MgO, and TiO_2 concentrations, is undoubtedly attributable to abundant plagioclase phenocrysts. A single aphyric sample, occurring as a large clast in a sedimentary breccia immediately above the plagioclase-phyric basalt sequence (Sample 19-1, 18-20 cm), may reflect the parental magma composition for these rocks, since the two compositions can be closely related simply by the addition of about 25 per cent of plagioclase (An_{75}) to the aphyric basalt composition and removal of minor olivine. This aphyric composition compares closely with the composition of basaltic glasses dredged from the nearby median valley of the Mid-Atlantic Ridge at 22°N (Bryan and Sargent, this volume).

Ultramafic and Mafic Plutonic Rocks

Coarse-grained gabbro and serpentinized peridotite were sampled between 159 and 169 meters in Hole 395. The upper peridotite sample (18-1, 61-70 cm) is less serpentinized than the lower one (18-2, 85-95 cm). This is reflected in different values of loss on ignition (7.6 versus 9.1%). Both have Mg/(Mg + Fe) values typical of peridotites (e.g., about 0.90%). They are perhaps some of the freshest peridotite samples from the Atlantic Ocean that have been analyzed. The lower peridotite sample has higher Al_2O_3 and CaO concentrations and a higher Ca/Al ratio, reflecting a higher clinopyroxene content before serpentinization. The lower sample was probably originally a lherzolite, whereas the upper one may have been a harzburgite.

TABLE 6
Stratigraphic Summary of Chemical and Lithologic Units, Holes 395 and 395A

Unit	Core-Section-Piece No.	Approx. Sub-Bottom Interval (m)	Inferred (I) or Recovered (R) Thickness (m)	Lithology	Criteria for Unit Transition or Break
Hole 395					
[a] A_2*	Top 11-1 No. 2 Bottom 17-1 No. 6	93-~159	66 (I)	Aphyric basalt	Distinct lithologic break
G	17-1 No. 7	Intervals are small and uncertain, tops of cores are at following intervals Core 17 150.1 m Core 18 159.6 m Core 19 169.2 m Core 20 178.7 m	< 0.2 (R)	Gabbro (one piece)	As above
P_1*	18-1 No. 1		< 0.2 (R)	Plagioclase-olivine-clinopyroxene phyric basalt (one piece)	As above
Peridotite 1	Top 18-1 No. 2 Bottom 18-2 No. 2		~ 1.5 m (R)	Harzburgite	As above
P_1*	Top 18-2 No. 3 Bottom 18-2 No. 14		~ 0.5 m (R)	Plagioclase-olivine-clinopyroxene phyric basalt and interbedded limestone breccia	As above
Peridotite 2	Top 18-2 No. 15 Bottom 19-1 No. 1		~ 1 m (R)	Lherzolite	As above
A_2*	19-1 No. 2		< 0.5 m (R)	Aphyric basalt (one piece)	As above
P_2*	Top 19-1 No. 3 Bottom 20-1 No. 5	~175-185	~ 10 m (I)	Plagioclase-olivine phyric basalt	
Hole 395A					
[b] A_2	Top 5-1 Bottom 13-1 No. 3	111-173	62	Aphyric basalt	Lithology and chemistry
[c] P_2	Top 13-1 No. 4 Bottom 16-1 No. 2	181-120	29	Plagioclase-olivine phyric basalt	Chemical, principally TiO_2 content
P_3	Top 16-1 No. 3 Bottom 22-2 No. 9B	210-260	50	Plagioclase-olivine-clinopyroxene phyric basalt	Magnetic. Chemically indistinguishable; no oriented pieces to close gap 22-2 No. 9B to 23-1 No. 5
P_4	Top 23-1 No. 5 Bottom 27-2 No. 11	260-308	48	Plagioclase-olivine-clinopyroxene phyric basalt	Chemical, principally Sr
P_5	Top 28-1 No. 2 Bottom 33-1 No. 8	308-362	54	Plagioclase-olivine (± clinopyroxene) phyric basalt	Lithology and chemistry
A_3	Top 33-2 No. 9 Bottom 56-3 (137-141 cm)	362-570	207	Aphyric basalt	Magnetic and trace elements
A_4	Top 57-1 No. 7 Bottom 61-1 No. 1	570-616	46	Aphyric basalt, veined, fractured and altered	Lithology and chemistry
P_4	Top 61-1 No. 2 Bottom 62-1 No. 2	616- ~625	9	Plagioclase-olivine-clinopyroxene phyric dolerite	Lithology, chemistry, and chilled margin of P_4
A_4	Top 62-1 No. 3 Bottom 62-1 No. 6	~625	< 1	Aphyric basalt	Lithology and chemistry
P_4'	Top 62-1 No. 7 Bottom 64-2 (132 cm)	~625-633	8	Plagioclase-olivine-clinopyroxene phyric dolerite	Lithology, chemistry, and chilled margin of P_4
A_4	Top 64-2 (132 cm) Bottom 67, CC	633-671	38	Aphyric basalt, veined, fractured and altered	

[a]Gabbro, serpentinized peridotite, and basalt cobbles (probably talus) were recovered in Core 10 and piece No. 1 of Core 11.

[b]About 19 meters of serpentinized peridotite and gabbro cobbles (probably talus) were recovered in Cores 3 and 4.

[c]Two pieces of serpentinized peridotite, recovered at the top of Core 13, may have been *in situ*, or may have fallen down the hole.

The single coarse-grained gabbro sample (17-1, 56-69 cm) is compositionally distinct from any of the basalts sampled, and cannot be considered a slowly cooled variant of the basalts. The low TiO_2 content (0.4%), coupled with high Al_2O_3 (17.7%) and MgO (12.2%) concentrations indicates that it is probably a feldspathic-pyroxene cumulate. Mg/(Mg + Fe) is low, however, implying derivation from an evolved basaltic magma. This evolved composition would probably be manifested by the presence of small amounts of brown hornblende included in clinopyroxene crystals; none of the basalts sampled are sufficiently fractionated to satisfy this condition.

Three pebbles were recovered (Sample 10, CC) immediately above the sediment/basement interface: two serpentinized peridotites and an altered feldspathic gabbro (anorthositic gabbro). High loss on ignition (11.6 to 13.8%) indicates that the peridotites are almost entirely serpentinized, as does the almost complete absence of CaO in one of the samples (10, CC #1). The other peridotite is somewhat less altered and is higher in both Al_2O_3 and CaO, implying that it was a feldspathic peridotite before serpentinization. The gabbro sample (10, CC #2) is high in Al_2O_3 (24%) and MgO (13.9%), low in Fe_2O_3 (3.8%). It is not a coarsely crystallized variant of any of the basalts sampled, but a cumulate rock with troctolitic affinities, probably derived from basalt more mafic than those sampled in this hole.

Chemistry: Hole 395A

Basalts were recovered in Hole 395A from below the basement/sediment interface to a total sub-sediment depth of about 571 meters. Except for the two dolerite intrusions between 519 and 536 meters, the basalts are mostly extrusive, and consist of thin flow and pillow units. All have the chemistry typical of low-K mid-ocean ridge tholeiites, and are assumed to have been extruded along the axial zone of the nearby Mid-Atlantic Ridge. For example, SiO_2 concentrations are uniform at about 49 per cent; the Al_2O_3 content varies between 14.9 and 18.3 per cent, Fe_2O_3 between 8.5 and 12.3 per cent, and MgO between 6.1 and 8.6 per cent. All have low atomic Mg/(Mg + Fe) values (0.51 to 0.66), within the range prevalent for most mid-ocean tholeiites, but too low for these rocks to represent primary, mantle-derived melts. They have all undergone a substantial fractionation history, as is also evident from the presence in some basalts of multiple phenocryst phases, including clinopyroxene in some units.

In general, loss on ignition is low (mostly between 1.2 and 2.0%) compared with other drilled submarine basalts. Alteration (as indicated by loss on ignition) tends, however, to increase with increasing depth; the highest values were found in Cores 57 through 67. Potassium concentrations, although varying erratically with depth, and from unit to unit, also tend to be highest in these particular cores. Basaltic-breccia matrix and clasts sampled in Cores 54 and 56 have both high loss on ignition and high calcium concentrations, indicating the presence of secondary carbonate. Even with such extensive brecciation and alteration, the chemistry compares closely with associated fresher material, except for substantial MgO loss (7.2 to 5.5%) and K_2O gain (0.16 to 0.36%) in the altered samples.

In broad petrographic terms, two basalt types exist in Hole 395A: aphyric and phyric. The aphyric basalts make up about 59 per cent of the cored intervals, the phyric basalts about 31 per cent. These two types are also compositionally as well as texturally distinct. The phyric basalts contain substantially higher concentrations of Al_2O_3, CaO, and TiO_2 than the aphyric basalts, and correspondingly lower concentrations of Fe_2O_3. Mg/(Mg + Fe) for the phyric basalts is high (0.59 to 0.66) and more variable than the relatively constant but lower values (0.57 to 0.59) in the aphyric basalts.

Using the chemical data, eight compositional units can be recognized in Hole 395A: five phyric and three aphyric units. Average compositions and standard deviations are taken (Table 7) from shipboard data. A stratigraphic summary is given in Table 6.

Several of the units were also sampled in Hole 395. These data are also summarized in Table 7. In general, all data were used in making this chemical classification, but certain parameters, such as Ti, Zr, Sr, Ni, and Mg/(Mg + Fe), proved more useful than others (see Bougault et al., this volume).

Aphyric Basalts

Unit A_2: Basalts of this type were sampled in the upper 62 meters of Hole 395A. All are fine grained and aphyric and very uniform in composition throughout the entire interval, even though many cooling units have been sampled. This unit is the least fractionated of the aphyric basalts; it has the highest Mg/(Mg + Fe) values and Ni and Cr concentrations, and the lowest abundances of lithophile elements. Basalts essentially isochemical with these in Hole 395A were sampled in the upper 67 meters of Hole 395. They undoubtedly belong to the same thick magmatic unit. An average composition for the two holes is given in Table 7.

Unit A_3: Basalts in this unit are again remarkably uniform in composition, throughout a total thickness of 207 meters, including many thin flow and pillow units, from Core 33 to Core 56. This is by far the thickest single magmatic unit identified to date for oceanic basalts. It is more fractionated than type A_2 basalts, with lower Mg/(Mg + Fe), lower Ni and Cr concentrations, and higher abundances of lithophile elements (Ti, Zr). Type A_3 basalts were not recovered from Hole 395, although it is possible that a small aphanitic clast found in a breccia (Section 19-1) may be a slightly less evolved variant of this rock type. Although the available data are consistent with a model in which Type A_2 and Type A_3 basalts may be derived from partial melting of a common source, it is not evident that they are necessarily comagmatic (Bougault et al., this volume; Rhodes et al., this volume). In view of the contrast in magnetic properties, it seems nost unlikely that they could be comagmatic.

Unit A_4: This basalt occurs in two sub-units in Cores 57 through 66, separated by a massive doleritic unit (P_4') in Cores 62 through 64. Except for more extensive alteration in the lower sub-unit, these basalts are isochemical, and undoubtedly belong to a single chemically homogeneous, magmatic unit, containing many flow and pillow sections, and separated by a younger massive doleritic intrusion. A single aphyric specimen collected between the dolerite units (Core 62) also has the same composition. The total thickness of these two sub-units is about 66 meters. Unit A_4, although evolved, is among the least fractionated of the aphyric basalts, and except for its slightly lower iron abundances, is compositionally indistinguishable from Unit A_2 (Table 7).

A single sample altered basalt taken from Core 67 at the bottom of the hole (and analyzed on board) differs from Unit A_4. It is clearly distinguishable, on the basis of higher Ti concentrations and lower Fe content, from the overlying A_4; Zr, Cr, and Ni are in accord with this distinction. It is a fractionated basalt and, apart from a slightly lower Fe_2O_3 concentration, is compositionally indistinguishable from the thick aphyric Unit A_2, over 480 meters higher in the section. It may have fallen down the hole.

Phyric Basalts

Five phyric units have been recognized, four of which occur in a thick successive sequence (Cores 13 through

TABLE 7
Average Chemical Analyses and Standard Deviations of Basalts, Holes 395 and 395A

Unit	A2**	A2*	A2	A3	A4	A4	A4	P1*	P2*	P2	P3	P4	P4	P5
Hole	395 11-1, 105-107 cm	395	395A	395A	395A upper Core 61	395A lower Core 61	395A 67-2, 54-59 cm	395	395	395A	395A	395A	395A	395A
No. of Samples	1	6	6	16	4	4	1	2	1	8	6	6	4	6
SiO_2	48.9	49.37	49.45	49.73	49.37	48.90	49.90	49.40	49.60	49.71	49.47	49.82	49.47	49.54
		0.32	0.23	0.14	0.77	0.29				0.46	0.37	0.26	0.13	0.35
Al_2O_3	15.93	14.93	15.01	15.14	15.00	15.17	15.10	17.77	18.77	18.04	17.69	17.15	16.90	18.29
		0.12	0.14	0.22	0.36	0.10		0.63		0.32	0.19	0.61	0.47	0.39
Fe_2O_3 (t)	12.83	12.06	12.31	11.20	11.17	11.46	10.56	8.49	9.52	9.33	8.77	8.82	8.87	8.73
		0.15	0.23	0.19	0.23	0.23		0.18		0.49	0.26	0.30	0.20	0.13
MnO	0.20	0.18	0.18	0.18	0.18	0.20	0.17	0.14	0.13	0.14	0.14	0.14	0.14	0.14
		0.01	0.01	0.01	0.01	0.01		0.01		0.01	0.01	0.01	0.01	0.01
MgO	6.8	8.58	8.53	7.61	8.20	8.40	7.30	8.20	6.10	6.84	7.63	7.78	8.35	7.24
		0.20	0.15	0.25	0.14	0.18		0.42		0.41	0.35	0.83	0.19	0.66
CaO	11.01	10.53	10.60	11.29	10.97	11.09	11.40	12.71	12.05	12.13	12.75	12.25	12.03	12.26
		0.03	0.09	0.11	0.32	0.16		0.19		0.21	0.13	0.19	0.10	0.22
Na_2O	2.68	2.66	2.64	2.46	2.40	2.5	2.5	2.15	2.59	2.59	2.16	2.29	2.22	2.48
		0.02	0.04	0.06	0.04					0.08	0.05	0.09	0.01	0.06
K_2O	0.22	0.11	0.14	0.21	0.20	0.23	0.29	0.10	0.30	0.13	0.12	0.14	0.09	0.16
		0.02	0.03	0.05	0.08	0.02		0.04		0.04	0.02	0.05	0.03	0.04
TiO_2	1.70	1.62	1.64	1.72	1.59	1.62	1.69	1.01	1.28	1.37	1.05	1.12	1.13	1.18
		0.01	0.01	0.02	0.01	0.02		0.01		0.03	0.02	0.01	0.04	0.05
P_2O_5	0.18	0.15	0.17	0.17	0.14	0.15	0.15	0.11	0.13	0.14	0.11	0.11	0.10	0.11
		0.01	0.01	0.01	0.01	0.01				0.01	0.01	0.01	0.01	0.02
Total	100.45	100.01	100.67	99.71	99.22	99.72	99.06	100.08	100.47	100.42	99.89	99.62	99.30	100.13
LoI		−0.93	−0.98	−1.34	−1.9	−2.87	−2.60	−1.0	−1.5	−1.84	−1.2	−1.3	−1.85	−1.88

Note: ** originally A1*.

33) between aphyric Units A_2 and A_3. A fifth unit (P_4') intrudes aphyric basalts of Unit A_4, and was sampled in Cores 61 through 64. All are broadly comparable in chemistry, texture, and mineralogy, and contain plagioclase, olivine, and clinopyroxene phenocrysts. Looking at all the data, boundaries between the phyric units (P_2 to P_5) have been situated as follows (Table 6). P_2/P_3 16-1 #2/16-1 #3; P_3/P_4: 22-2 #9B/23-1 #5; P_4/P_5: 27-2 #11/28-1 #2. The distinction between Unit P_2 and Units P_3, P_4, and P_5 is real, but these units appear to vary more, overlapping each other chemically.

Unit P_2: This is the uppermost of the phyric units (Cores 13 through 16), and consists of about 29 meters of plagioclase-olivine phyric basalt in fairly massive cooling units. Compositionally, it is the most fractionated of the phyric basalts; it has the lowest Mg, Ni, Cr, and Mg/(Mg + Fe) values and the highest, Fe, Ti, and Zr concentrations. Similar basalt was cored at the bottom of Hole 395. The evolved characteristics of this rock type, coupled with an absence of clinopyroxene phenocrysts, contrasts with the presence of clinopyroxene-phenocrysts, in the other, compositionally more primitive, phyric basalts. This may indicate that the Type P_2 basalts are not cogenetic with other phyric basalts.

Units P_3, P_4, and P_5: These three units (and sub-unit P_4') are closely comparable in composition and mineralogy, but differ from one another in detail. All have high Mg/Mg + Fe), relative to other basalt types (0.62 to 0.65), but differ from each other largely in their lithophile-element concentrations (Ti, Zr, Sr). Concentrations of these elements are lowest in Unit P_3, and increase through Unit P_4 to P_5. There are also small differences in major-element chemistry, particularly in abundances of Al_2O_3 and CaO (Table 7). Unit P_3 is about 50 meters thick and overlies Unit P_4 (48 m thick), which in turn overlies Unit P_5 (54 m thick). Basalt compositionally similar to P_3 was sampled in Core 18, Hole 395. Sub-unit P_4' (Cores 61 through 64) is an intrusive sub-unit of P_4, with which it is essentially isochemical. In view of the similar chemistry (Table 7), comparable magnetic properties, and its situation within a compositionally uniform aphyric unit (A_4), it appears certain that sub-unit P_4' is an intrusive equivalent of the extrusive P_4 unit.

The chemical relationships of these three units are complicated by the abundance of plagioclase phenocrysts (10 to 25%, visual estimation). And they are further complicated because we do not know whether the bulk chemistry reflects magmatic compositions or magma compositions plus widely varying amounts of accumulated plagioclase phenocrysts—in which case it would be surprising that results of plagioclase control are not more readily discernible from the data. Trends within the three types are not clear, with the possible exception of minor variation in MgO and Ni, in reflecting some olivine control. Chemical trends among the three units (P_3, P_4, P_5), and by extension to the more evolved Unit P_2, are characterized by progressive increase in Ti, Zr, and Sr from P_3 through P_4 and P_5 to

P_2, together with corresponding decrease in Ni and Cr. Such tendencies suggest a fractionation trend from a common parental magma. There are, however, serious objections to such an interpretation. Briefly, the increase in lithophile elements (Ti, Zr) is compatible with fractionation involving any or all of the phases olivine, clinopyroxene, and plagioclase, but a comparable increase in Sr would suggest fractionation involving predominantly olivine or clinopyroxene. Plagioclase cannot be an important constituent, otherwise strontium would not increase rapidly, but would either remain roughly constant or decline. Conversely, the fall in Ni and Cr values from P_3 to P_2 is insufficient if olivine or pyroxene are the important crystallizing phases, and a substantial amount of plagioclase is required to compensate for the effect of the ferromagnesian minerals. So unless the strontium abundances are independent of fractionation (e.g., were affected by alteration or contamination), it appears unlikely that these phyric units belong to a single comagmatic fractionation sequence. Some more complicated relationship is required. This is also evident from the magnetic data, since Units P_2 and P_3 have positive inclinations, whereas those of P_4, P_4', and P_5 are negative.

Trace-Element Behavior Within Chemical Units

As crystallization proceeds in a given magma, we suppose that the Rayleigh law is valid. In this way, the relation existing between two elements as crystallization occurs is

$$\log CL_2 = \frac{P_2-1}{P_1-1}\log CL_1 + \frac{(P_1-1)\log CLO_2-(P_2-1)\log CLO_1}{P_1-1} \quad (1)$$

where
- CL_2 = concentration in the liquid of element 2
- CL_1 = concentration in the liquid of element 1
- P_2 = bulk partition coefficient of element 2
- P_1 = bulk partition coefficient of element 1
- CLO_2 = concentration of element 2 in the initial liquid
- CLO_1 = concentration of element 1 in the initial liquid.

Examples of relationships between any two elements are as follows:

(A) If two elements have very low partition coefficients or low partition coefficients of same order of magnitude, this relation can be approximated as

$$\log CL_2 = \log CL_1 + \frac{(P_1-1)\log CLO_2-(P_2-1)\log CLO_1}{P_1-1}$$

or, if A is the second term of the second member,

$$CL_2 = A\,CL_1 \quad (2)$$

It has been shown that in tholeiites TiO_2 behaves like a low-partition-coefficient element (Bougault, 1977). Zr is also a low-partition-coefficient element. It can be seen (Figure 13) that all analyzed basalts from Site 395 (Holes 395 and 395A) plot close to a straight line passing through the origin; in agreement with Equation 2, this confirms that Ti has a low partition coefficient. Two gabbros, believed to be of cumulate origin, do not plot on the same straight line passing through the origin; this could result from the difference between partition coefficients of Ti and Zr, because for crystallized products,

$$\alpha \times \frac{(P_1-1)\log P_2 - (P_2-1)\log P_1}{P_1-1}$$

should be added to Equation 1, modifying the A value of Equation 2, α being the proportion of cumulate phases in the rock. Alternatively, these rocks may not be genetically related to the sampled basalts: "A" depends on CLO_2 and CLO_1, which themselves depend on partial melting as

$$\frac{CLO}{CSO} = \frac{1}{D_O + F(1-D)} \quad (3)$$

where
- CLO = concentration of the element in the molten phase, which is the initial concentration for the crystallization process
- CSO = initial concentration in the solid
- D_O = initial bulk partition coefficient for partial melting process
- D = bulk partition coefficient, taking into account melting phase.

If we consider two elements with similar low D and D_O (low partition coefficient), then

$$\frac{CLO_1}{CLO_2} \cong \frac{CSO_1}{CSO_2}$$

Thus, constant A (all samples plotting close to a straight line passing through the origin) means that all such samples are derived from a mantle material having the same ratio $\frac{CSO_{Zr}}{CSO_{Ti}}$.

Samples from Site 332 of Leg 37 also plot on the same line (Figure 13), indicating the same Zr:Ti ratio in the mantle source (Bougault et al., this volume).

(B) Considering 2 as a high-partition-coefficient element and 1 as a low-partition-coefficient element, Equation 1 can be approximated as

$$\log CL_2 = (P_2 - 1)\log CL_1 + \log CLO_2 + (P_2 - 1)\log CLO_1$$

When partial melting occurs, CLO_2 is roughly constant (mainly for Ni), and CLO_1 varies.

For a given degree of partial melting, $\log CL_2 = f(\log CL_1)$ should be a straight line as crystallization occurs.

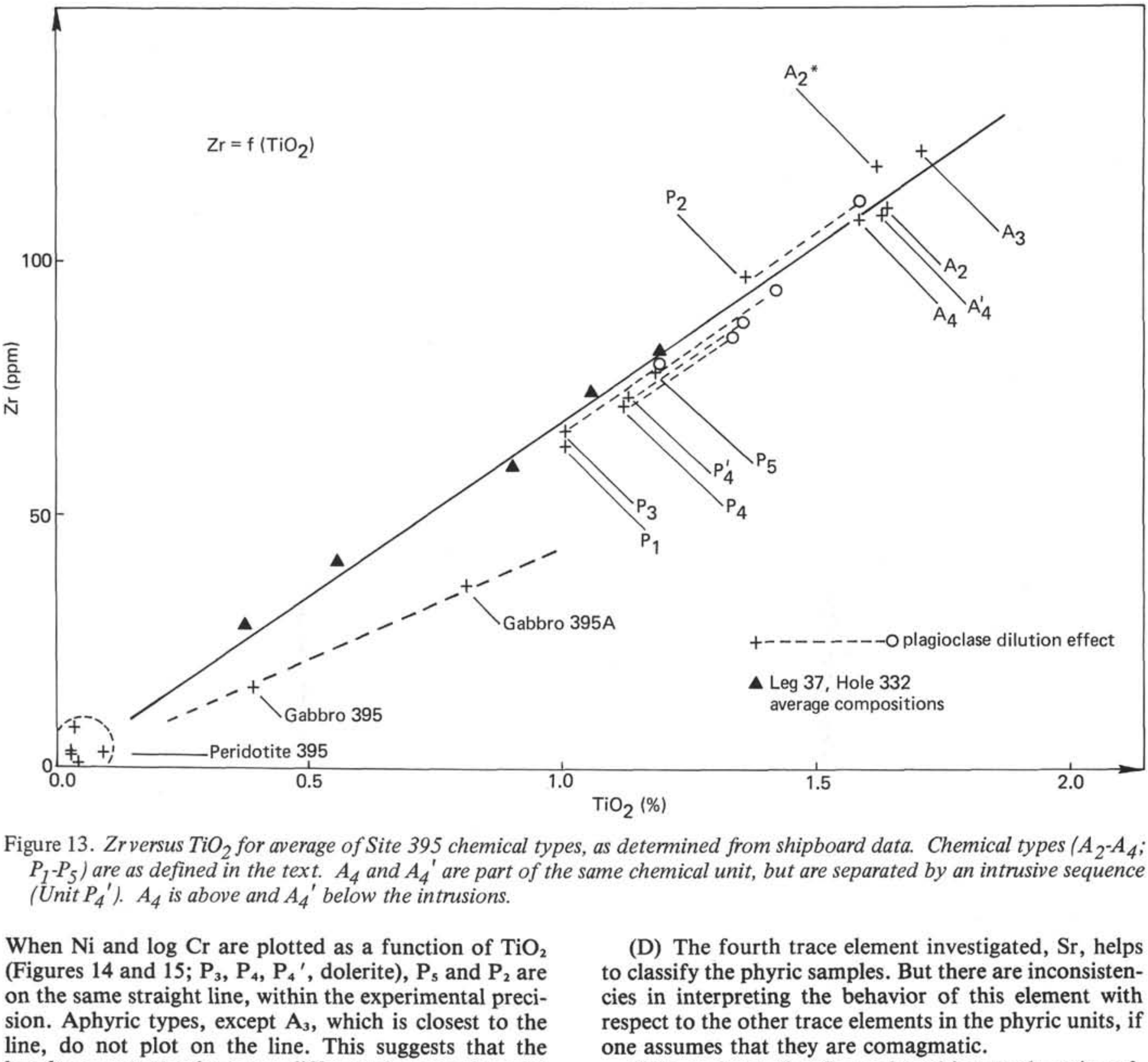


Figure 13. *Zr versus TiO_2 for average of Site 395 chemical types, as determined from shipboard data. Chemical types (A_2-A_4; P_1-P_5) are as defined in the text. A_4 and A_4' are part of the same chemical unit, but are separated by an intrusive sequence (Unit P_4'). A_4 is above and A_4' below the intrusions.*

When Ni and log Cr are plotted as a function of TiO_2 (Figures 14 and 15; P_3, P_4, P_4', dolerite), P_5 and P_2 are on the same straight line, within the experimental precision. Aphyric types, except A_3, which is closest to the line, do not plot on the line. This suggests that the basalts represent at least two different degrees of partial melting—phyric basalts on one hand and aphyric on the other—to explain the data. If the phyric basalts are comagmatic, then in the order of increasing crystallization, the samples are classified as follows:

$$P_1 \cong P_3(P_4, P_4'), P_5, P_2.$$

This order corresponds to the order observed for Zr-TiO_2 (Figure 13). Aphyric samples cannot be sequenced in such an order, except perhaps that A_3 is more fractionated than A_2.

(C) If 2 and 1 are high-partition-coefficient elements (e.g., Ni, Cr), then as CLO_2 and CLO_1 vary little with partial melting, log CL_2 = f(log CL_1) mainly reflects crystallization processes. Figure 16 clearly indicates the same sequence previously deduced for P_1, P_3, P_4, P_4' (dolerite), P_5, P_2, and the impossibility of ordering aphyric samples.

(D) The fourth trace element investigated, Sr, helps to classify the phyric samples. But there are inconsistencies in interpreting the behavior of this element with respect to the other trace elements in the phyric units, if one assumes that they are comagmatic.

First, we know that Sr can be subject to alteration effects; ion microprobe studies have shown that Sr-bearing calcic minerals can occur along cracks and mineral boundaries. Except for Unit P_5, where Sr is slightly scattered and where breccias occur, Units P_3, P_4, and P_2 are homogeneous with respect to Sr: this suggests that there may be no alteration effect relative to Sr within these units.

Second, known partition coefficients of Sr are low for olivine and clinopyroxene, but are between 1.5 and 2.0 for plagioclase (Philpotts and Schnetzler, 1970; Hart and Brooks, 1974; Arth, 1976). Taking into account these data, even if we assume a large variation of plagioclase content in the crystallization phases, the bulk partition coefficient should be around 1, except when the plagioclase content is nil or very small, which is not in agreement with petrographic observation. From this consideration, variation in Sr within these phyric series should vary only with the proportion of

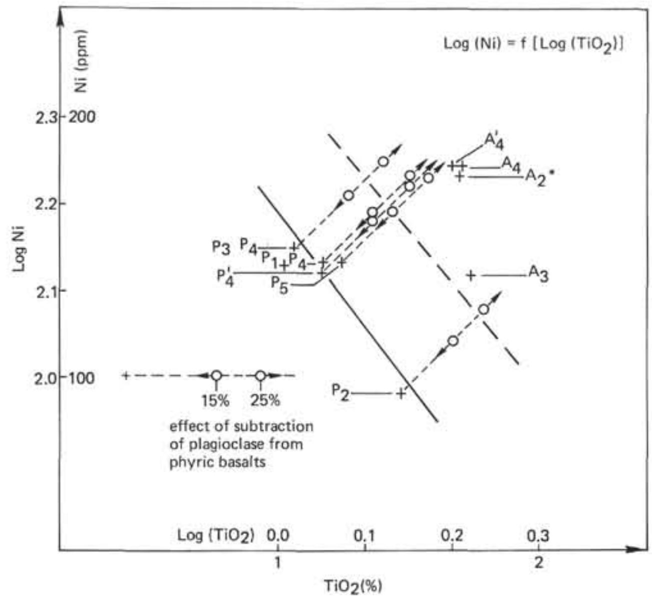


Figure 14. *Log Ni versus Log* TiO_2 *for Site 395 basalts. Chemical types as in Figure 13.*

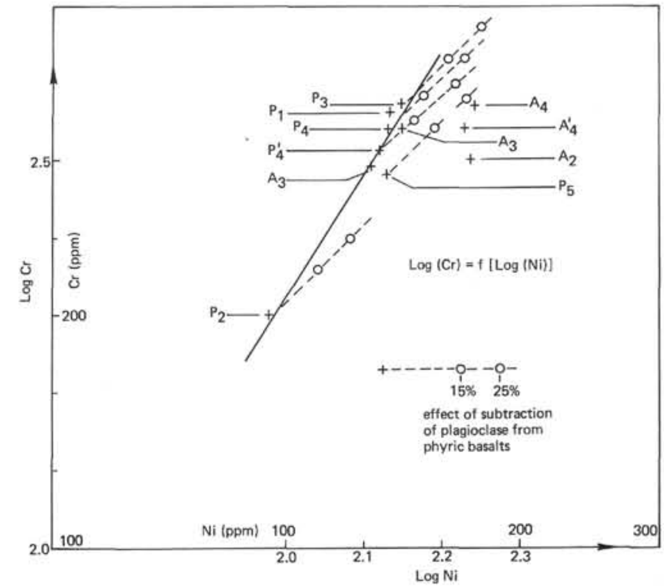


Figure 16. *Log Cr versus Log Ni for Site 395 basalts. Chemical types as in Figure 13.*

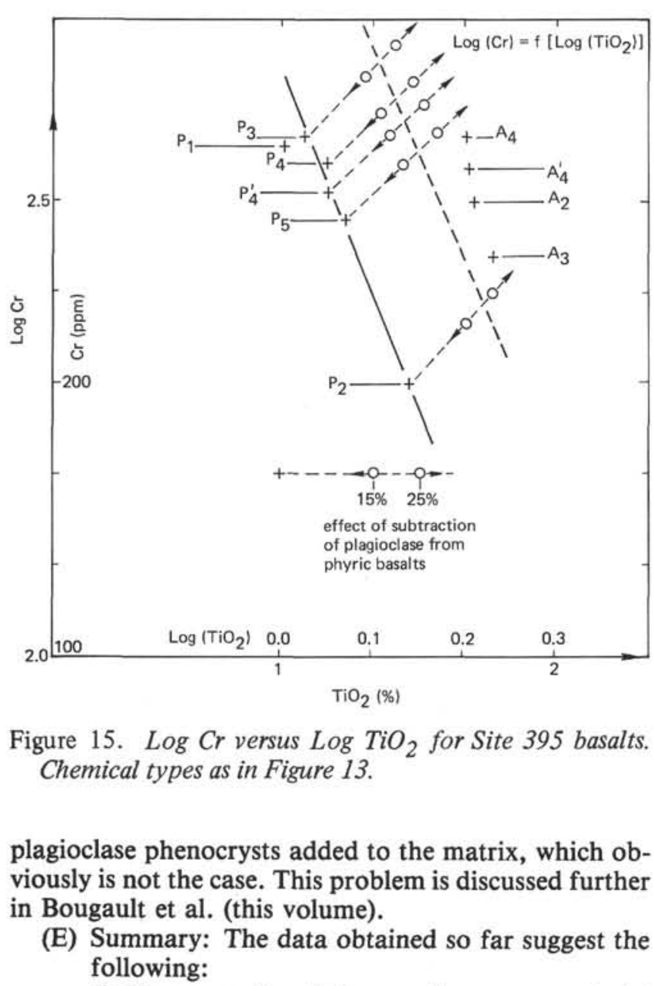


Figure 15. *Log Cr versus Log* TiO_2 *for Site 395 basalts. Chemical types as in Figure 13.*

plagioclase phenocrysts added to the matrix, which obviously is not the case. This problem is discussed further in Bougault et al. (this volume).

(E) Summary: The data obtained so far suggest the following:

1) Homogeneity of the mantle source material of all basalts with respect to Zr-Ti.

2) At least two different extents of partial melting are required to explain Ni-Ti and Cr-Ti values; the lower extent produced the aphyric basalts, the greater extent the phyric basalts.

3) Within the phyric basalts, Ti, Zr, Ni, and Cr data show that the extent of fractionation increases in the order P_1, P_3, (P_4, P_4'), P_5, P_2.

4) Sr data are inconsistent with this interpretation, reflecting either addition of accumulative plagioclase crystals, alteration, or other processes.

Conclusions

1. Eight magmatic units in Holes 395 and 395A have been recognized on the basis of chemical parameters, two of which are sub-units (A_4' and P_4') comagmatic with Units A_4 and P_4, respectively.

2. If the hole reflects a true stratigraphic sequence, not repeated by reverse faulting, then it appears that ocean ridge magmatic processes can repeatedly produce magmas of remarkably similar chemistry over a substantial time interval. This is all the more surprising when one considers that one of these magmas is a primary mantle melt, but each has undergone a substantial history of fractionation.

3. It is reasonably certain that the aphyric and phyric basalts are unrelated by fractionation processes, and are derived from different partial melts. Within the aphyric basalts, the data do not allow assessment of fractionation processes. On the basis of Ti, Zr, Ni, and Cr data, the phyric units may belong to a single comagmatic trend. Strontium data are inconsistent with this hypothesis, and more complex relationships are required.

Paleomagnetism in Igneous Rocks of Hole 395

All paleomagnetic samples were taken as 1-inch (2.5 cm) diameter "minicores" from the working half of the split core. Samples varied in length from 1.6 cm to 2.4 cm. Vertical orientation of the samples was obtained from the shape of the drilled rock section and from the orientation arrows drawn on the rock pieces during the initial core handling. We obtained significantly better orientation results when we decided to place orientation arrows on both working and archive core halves before the initial core splitting. Accuracy of determination of paleomagnetic directions is of the order of 2°, but measurements made on two minicores taken from pieces that could be fitted together as a single rock indicated that, in some cases, the combined measurement and orientation errors can be as high as 10°.

The igneous samples can be divided into three broad categories, according to their grain size and magnetic properties: fine-grained pillow basalts, coarse-grained massive flow or pillow interiors, and plutonic intrusive rocks (gabbro, serpentinized peridotite). A vertical component of magnetization, observed in all three types of samples during partial demagnetization, probably resulted from use of the standard (magnetic) steel drilling assembly in this hole. This component of "remanence" (probably a VRM acquired during the several hours required to drill 9.5 m of igneous rock) could be removed from the fine- and coarse-grained basalt samples by partial AF demagnetization to 100 Oe. The peridotite samples were apparently so magnetically unstable that the vertical drilling remanence completely dominated any initial remanence and made it impossible to identify the intensity and direction of the *in-situ* magnetization for these samples. The single gabbro sample measured (17-1, 66-68 cm) was sufficiently stable (MDF = 500 Oe) to be relatively unaffected by the drilling remanence. For the basalt samples, the normal-polarity vertical component of drilling remanence provided a useful check on possible misorientation of the rock cores during subsequent handling on shipboard.

The values of stable inclination after partial AF demagnetization are given in Johnson, this volume (Chapter 15). The criterion used to identify a stable direction is that the direction remain unchanged for several subsequent demagnetization steps. The interval of this "plateau" was generally several hundred oersteds wide. The top Cores of Hole 395 (Sections 11-1 to 17-1) basalt are all of normal polarity (in agreement with the normal polarity of the overlying magnetic anomaly 4), and range from +35° to +15°. Inclination shallows gradually with depth over this interval. All values of inclination shown are shallower than the axial centered dipole value of 40° for the latitude of the site. The single oriented gabbro sample (17-1, 66-68 cm), which is tectonically misoriented, showed a steeper value of inclination, +45°. The single piece of basalt (Sample 18-1, 33-35 cm) lying below the gabbro and above the serpentinized peridotite had a reversed inclination of −45°. No convincing stable directions were obtained from the peridotite samples. The four oriented basalt samples lying below the peridotite sections showed shallow inclinations ranging from -6° to +11.5°.

The average intensity of magnetization for the samples from Hole 395 is 3.0×10^{-3} emu/cm^3; this is consistent with previous work at other sites of roughly the same age. Intensity shows no convincing trend with depth. Although there is a correlation of high intensity with low median demagnetizing field, this correlation results from the association of high intensity and low MDF with relatively unoxidized coarse-grained massive flows and low intensity and high MDF with oxidized fine-grained pillow basalts. All of these results are somewhat biased, since recovery in the massive flow units was better than in the pillow basalts, and these flow units are more likely to be recovered as orientable cores.

Conclusions for Hole 395

1. The polarity of oriented samples agrees with the sign of the overlying magnetic anomaly.
2. The intensity of magnetization is close to that expected for oceanic crust of approximately the same age.
3. Inclinations are shallower than the expected value of 40° for a centered axial dipole value at the latitude of the site.
4. Inclinations seem to trend toward shallower angles with depth in the core.
5. For the top (Section 11-1 to Section 17-1) sections of basalt, the relatively small range of inclinations that differ significantly from the centered axial dipole value indicates that these basalts were erupted over a time interval that was short (10^2 years) with respect to the period of secular variation (10^3 years).
6. Drilling remanence, caused by a magnetic drilling assembly, obscures any measurement of *in-situ* direction and intensity in the coarse-grained serpentinized peridotite.

Paleomagnetism: Hole 395A

Measurement and Demagnetization Techniques

From the data obtained on the samples from Hole 395, the standard technique of single-axis demagnetization was found to be insufficient to demagnetize some of the coarse-grained unstable samples recovered. The demagnetization technique was then modified, and subsequent identification of stable magnetic directions in samples from Hole 395A was much improved. Standard non-tumbling single-axis demagnetization consists of exposing the three orthogonal axes of the sample to the alternating field sequentially. The technique was modified by demagnetizing the sample twice at every step of peak AF field intensity, with each axis of the sample inverted from the previous demagnetization interval. For example, the first demagnetization would be +x, +y, +z, and this would be followed by measurement, then second demagnetization, with −x, −y, −z, and then the second measurement. The two measurements are then averaged to give the correct value of direction and of intensity. In addition to this "double demagnetization," the sample was manually tumbled around the axis of the field while the alternating field was decaying. Although time-consuming, this demagnetization process allowed identification of the stable directions of magnetization even from coarse-grained samples. Demagnetization intervals were standardized at 50, 100, 200, 300, 400, 500, 600, 800, and 1000 Oe. As at Hole 395, the stable inclination was identified by the presence of a "plateau" of no directional change during several demagnetization steps.

In almost every sample (very fine grained oxidized pillow basalts being the only exceptions), there was present a vertical component of drilling remanence that was parallel to the axis of the drill core and directed downward. This drilling remanence, similar to that found on Leg 34, is probably a VRM component acquired during the several hours required to drill 9.5 meters of basement, and served as a useful orientation check during subsequent handling of the cores. Demagnetization to at least 100 Oe was necessary to remove this drilling remanence.

Paleomagnetic Stratigraphy

Table 8 shows stable inclination, intensity of magnetization, and median demagnetizing field, averaged over each rock type. Averaging was performed only where the samples had similar directions and polarities, and were of similar lithology. The standard deviations were calculated for intensity and inclination, but because of the small number of values in each group, it has little significance. The centered axial dipole inclination for the latitude of the site is ±40.0°. Cores 5 through 12, composed of fine-grained, oxidized, aphyric pillow basalts, have inclinations uniformly close to this theoretical value. This lack of scatter in the stable inclination values indicates that the entire 60-meter section was erupted in less than 10^2 years, and perhaps simultaneously. The plagioclase-olivine phyric units in Cores 13 through 22 (phyric units P_2 and P_3) show a much larger scatter in positive inclination values. This unit also trends toward steeper inclination values with increasing depth, and this is matched with a corresponding increase with depth in magnetic intensity. Shore-based studies of the opaque minerals will be necessary to determine whether this trend is recording a tectonic event or is a consequence of progressive low-temperature oxidation (top of the section more altered than the bottom).

TABLE 8
Integration for Magnetization of Entire Igneous Column, Hole 395A

Unit	Approximate Thickness (m)	Cores	Average Intensity[a] (× 10^{-3} emu/cm^3)	Standard Deviation
Aphyric 1	65	5-13	2.90	±1.46
Phyric 1	76	13-22	6.36	±0.68
Phyric 2	65	23-27	4.01	±0.36
Phyric 3	51	28-33	2.37	±0.42
Breccia 1	9.5	32	2.56	±0.33
Aphyric 2	211	33-57	3.99	±0.33
Breccia 2	4	49	1.62	±0.34
Aphyric 3	38	57-61	1.68	±0.20
Dolerite	26	61-64	4.25	±0.47
Aphyric 4	6.5	64	3.95	±1.28
Aphyric 4′ Hydrothermally altered	19.5	65-67	1.69	±0.54

[a]Integrated average intensity 3.78 ±0.65 × 10^{-3} emu/cm^3

The first magnetic reversal occurs between Cores 22 and 23; no samples with transitional directions were recovered. The last oriented piece in Section 22-2 is normal, and the first oriented piece in Section 23-1 is reversed. The cores from Section 23-1 seem to be more altered than those of Section 22-2, and it would seem logical to attribute this to a time break between the two sections longer at least than that of a magnetic transition (~2000 years). The negative inclinations continue, with very little scatter, through several different lithologic units, from Core 22 to Core 57, a total thickness of almost 280 meters of basement rock. The single exception to this is the breccia zone in Core 32, which will be discussed later. The small amount of scatter in inclination values indicates that no transitional values are represented in this column of basement crust.

The second reversal occurs between Cores 56 and 57, again with no transitional values obtained. The positive inclinations for the normally magnetized Cores 57 through 61 have values close to +60°; they probably deviate from the dipole value of +40° owing to secular variation of the magnetic field. The polarity of the two dolerite intrusions below Unit A_4 is again reversed, with inclinations very uniformly close to −40°. Core 61, Section 1 contained two rock samples, the upper one representing Unit A_4 and the lower one the uppermost dolerite sample. The aphyric rock was sampled to see if its direction had been affected by the dolerite intrusion, but it would appear that the contact between the two rock units was not recovered. The contact between the lower dolerite and aphyric Unit A_4 was recovered, but the directions of both units are identical. Between the two ~10-meter-thick dolerite units there is a thin (0.5 m) aphyric unit that was remagnetized by the dolerite, so that its direction is identical to that of the dolerite. Below the lower dolerite unit is a short 34-meter section of aphyric basalt the top 10 meters of which have a reversed polarity (related to the dolerite intrusion) and the bottom 20 meters of which have been extensively altered. The effects of hydrothermal alteration on pillow basalt seem to be to (a) lower the intensity of magnetization (with the possible exceptions of the lowest two samples) and (b) scatter the direction of magnetization.

Integrated over the entire drilled column of basement igneous rocks, approximately 1/3 of the column is normally magnetized and 2/3 of the column is reversed. Although Site 395 is situated within a broad positive magnetic anomaly, this result is consistent with several reversal events being represented within an anomaly of one polarity. The small scatter in inclinations around the dipole value, and the presence of several polarity units within the column, indicate that the upper 600 meters of oceanic igneous crust formation was episodic, with periods of rapid extrusion (10^2 years or less) followed by periods of quiescence (10^3 to 10^4 years). Also, the dipolar nature of the inclinations indicates that, unlike Site 332B (DSDP Leg 37), we recovered no crust at Site 395 that was formed during a magnetic transition.

Intensity of Magnetization

There is little systematic variation in the intensity of magnetization, except that the coarser grained samples (in Unit P_2 and the presumed intrusive dolerite) have the highest values. The integrated average intensity for the entire 571 meters of igneous basement drilled is 3.78 $\pm 0.65 \times 10^{-3}$ emu/cm^3. This is consistent with previous results obtained from FAMOUS data from the Mid-Atlantic Ridge at 36°N. The fine-grained pillow basalts seem to be somewhat lower in intensity, presumably because of a greater degree of low-temperature oxidation.

Breccia Zones

The presence of two zones of breccia (carbonate matrix in Core 32 and altered glass matrix in Core 49) within the igneous basement column, and recovery of oriented pieces of these sections, allowed us to perform a magnetic test to determine if the breccia was emplaced hot or cold. Cold emplacement would result in completely scattered magnetic directions within the breccia zone; hot emplacement, above the Curie temperature of the magnetic mineral, would yield coherent magnetic direcitons. The directions in each of the breccia zones are roughly coherent (+31° to +63° in Core 32, and −32° to −47° in Core 49). This could result if the breccias were emplaced hot or later reheated at intermediate temperatures somewhat below the Curie temperature (say, 100° to 200°C). This would impose a rough coherence on the initially random magnetization directions of the breccia clasts. The magnetization intensities of the breccia samples, both clasts and cement, are roughly the same, and this strengthens the case for a reheated zone. One can speculate that these breccia zones might have been conduits for hydrothermal circulation.

Physical Properties of Basement Rocks

The physical properties measured were sonic velocity, wet bulk density, porosity, and water content (Tables 9 and 10). The samples (or minicores) are cylindrical, with diameters of 2.50 cm and lengths of about 2.0 cm. Sonic velocities were measured with water-saturated samples at one atm. pressure, using the Hamilton Frame velocimeter. The instrument and techniques in measurement have been described by Boyce (Instructions for Hamilton Frame Velocimeter, 1975). These measurements were made both parallel (horizontal) and perpendicular (vertical) to sea level. Wet bulk densities were measured by the "weight in water-weight in air" technique, using a balance with minimum subdivisions of 0.01 g. The porosity and water content were measured by reweighing the samples after drying in an oven

TABLE 9
Physical Properties of Basalts, Hole 395

Sample (Interval in cm)	V_p (‖)	No. Measurements Averaged	V_p (⊥)	No. Measurements Averaged	ρ Wet Bulk Density (g/cm^3)	Porosity (%)	Rock Type
11-2, 122	6.06	2	6.11	2	2.94	0.025	Basalt
12-2, 109	–	–	–	–	2.91	0.033	Basalt
12-2, 123	–	–	–	–	2.87	0.052	Basalt
12-2, 145	–	–	–	–	2.87	0.053	Basalt
13, CC	5.81	3	5.61	3	2.90	0.047	Basalt
14-1, 095	–	–	–	–	2.94	0.028	Basalt
14-1, 112-114	4.37	4	4.46	4	2.61	0.172	Basalt (very oxidized and vesicular)
14-1, 130	6.03	1	5.94	1	2.93	0.030	Basalt
15-1, 71-73	4.50	2	4.62	3	2.67	0.141	Basalt (altered)
15-1, 93-95	5.68	3	5.74	3	2.94	0.028	Basalt
15-1, 112-114	5.46	3	5.42	3	2.92	0.029	Basalt
15-1, 147-149	5.51	2	5.55	2	2.92	0.039	Basalt
15-2, 3-5	5.34	2	5.48	2	2.92	0.039	Basalt
15-2, 43-45	–	–	–	–	2.92	0.035	Basalt
15-2, 130-133	6.02	2	5.99	2	2.96	0.015	Basalt
16-2, 15-17	5.73	2	5.94	2	2.94	0.025	Basalt
16-2, 55-57	NG	3	5.44	2	2.85	0.062	Basalt
16-2, 131-133	5.61	3	5.66	3	2.91	0.030	Basalt
16-3, 19-21	5.49	3	5.58	3	2.86	0.050	Basalt
17-1, 8-10	5.55	3	5.51	3	2.90	0.044	Basalt
17-1, 66-68	5.62	2	6.00	2	2.69	0.022	Gabbro
18-1, 33-35	5.57	2	5.60	2	2.88	0.036	Basalt
18-1, 78-80	4.39	3	4.35	3	2.88	0.054	Serpentinized peridotite
18-1, 123-125	4.40	2	4.31	2	2.80	0.050	Serpentinized peridotite
18-2, 90-92	4.89	3	4.73	3	2.74	0.054	Serpentinized peridotite
19-1, 36-38	5.51	3	NG	3	2.81	0.059	Basalt
19-1, 77-79	–	–	–	–	2.86	0.037	Basalt
19-1, 144	–	–	–	–	2.88	0.037	Basalt
20-1, 28	5.39	2	5.61	2	2.82	0.045	Basalt

TABLE 10
Physical Properties of Basalts, Hole 395A

Sample (Interval in cm)	Rock No.	V_p (∥)	V_p (⊥)	ρ Wet Bulk Density (g/cm^3)	Porosity (%)	Rock Type – Remarks
3-1, 89-91	2	3.80	4.14	2.48	8.8	Serpentinite with veinlets of talc and asbestos, gabbro
4-1, 99-100	8	–	–	2.87	–	
4-2, 56-58	3	3.61	3.83	2.47	12.1	Serpentinized peridotite, large talc grains (alteration product from Opx augen) are in matrix composed of serpentine and talc including many veinlets
5-1, 56-58	12	4.78	4.95	2.74	10.8	Fine-grained basalt, aphyric, vesicular (~10%)
5-1, 89-91	16B	5.89	5.89	2.93	2.6	Medium-grained basalt; radial aggregates of plagioclase quench crystals
5-1, 138-140	19B	5.59	5.70	2.93	3.1	Medium-grained basalt; radial aggregates of plagioclase quench crystals
5-2, 6-8	1	5.63	5.49	2.92	3.5	Fine-grained plagioclase phyric basalt (plagioclase phenocrysts > 5%); vesicles (~2%) filled with dark green material; partly fresh
7-1, 94-96	5	5.48	5.61	2.87	6.0	Fine-grained aphyric basalt containing olivine microphenocrysts (~15%), slightly variolitic vesicles (< 1%) filled with brownish gray clay minerals
7-1, 113-116	8	4.79	5.25	2.83	6.9	Same as 7-1, 94-96 cm, No. 5; weak signal on V∥
8-1, 20-22	4A	5.50	NG	2.89	5.4	Fine-grained aphyric basalt; microphenocrysts of olivine (< 5%)
8-1, 114-116	20	5.45	5.36	2.89	5.1	Fine-grained aphyric basalt; rare microphenocrysts are mainly olivine; not vesicular; contains thin veinlets of calcite
8-1, 124-126	21	5.45	5.39	2.85	6.2	Same as Sample 8-1, 114-116 cm
9-1, 70-72	1	5.69	5.78	2.92	3.2	Fine-grained aphyric basalt; microphenocrysts and quench needles of plagioclase, microlites and microphenocrysts of olivine; vesicles < 1%; slight alteration along cracks
9-2, 18-20	3	5.49	5.87	2.94	2.4	Signals both (∥) and (⊥) weak; aphyric fine-grained fresh basalt with vesicles filled with dark gray material
10-1, 132-134	2	5.65	5.43	2.89	6.0	Very fine grained aphyric, moderately altered basalt, a few vesicles, green mineral in vesicles (celadonite?)
11-1, 129-131	8	5.62	5.86	2.93	2.7	Fine-grained aphyric basalt; fresh; contains microphenocrysts of plagioclase and olivine
13-1, 97-99	6	5.54	5.46	2.86	5.0	Plagioclase-olivine phyric basalt; slightly vesicular; vesicles filled with brownish material
13-1, 140-142	11	5.26	5.58	2.86	3.6	Plagioclase-olivine phyric basalt; vesicles (~1%) filled with pale green material; partly very fresh
14-1, 139-144	17B	5.55	5.57	2.87	3.6	Plagioclase-olivine phyric basalt; plagioclase phenocrysts ~20%, grain size up to 1 cm, moderately altered
14-2, 116-118	8D	5.65	5.37	2.85	4.3	Plagioclase-olivine phyric basalt; plagioclase phenocrysts ~15%, olivine < 1%; slightly vesicular (filled with green and brown material)
14-3, 138-140	6I	5.52	5.61	2.91	2.4	Same as Sample 14-2, 116-118 cm
15-1, 142-144	1V	5.72	5.60	2.86	4.0	Plagioclase-olivine basalt, fairly fresh, with moderate alteration in places; abundant plagioclase phenocrysts (~25%) and glomerocrysts up to 8 mm long
15-2, 39-41	1G	5.53	5.51	2.85	4.1	Plagioclase-olivine phyric basalt (~15% plagioclase phenocrysts; ~2% olivine)
15-2, 55-57	1H	5.49	5.61	2.85	4.8	Plagioclase-olivine phyric basalt; similar to Sample 15-2, 39-41 cm
15-2, 76-78	1K	5.45	5.31	2.84	4.7	Plagioclase-olivine phyric basalt (~15% plagioclase phenocrysts; ~2% olivine)
15-2, 128-130	1R	5.72	5.55	2.85	4.2	Plagioclase-olivine phyric basalt (15% plagioclase; ~2% olivine)
15-3, 83-85	1I	5.60	5.51	2.87	3.7	Massive gray plagioclase phyric basalt; mostly fresh; plagioclase phenocrysts (~10-20%), up to 10 mm long
15-4, 113-115	1M	5.61	5.59	2.87	3.4	Plagioclase-olivine phyric basalt ~20% plagioclase, up to 1 cm long; ~5% olivine
15-5, 24-26	1A	5.78	5.76	2.87	2.9	Massive gray plagioclase-olivine phyric basalt containing ~10-15% plagioclase phenocrysts up to 10 mm long
16-1, 63-65	1F	5.69	5.68	2.86	3.5	Plagioclase-olivine phyric basalt; olivine mainly altered to brown material
16-1, 89-91	4	5.53	5.51	2.88	–	Similar to Sample 16-1, 63-65 cm, with glassy rind 1 cm thick; much altered to pale brown (palagonite?) material
17-1, 98-100	13	4.37	4.41	2.74	9.9	Plagioclase-olivine-clinopyroxene phyric basalt; plagioclase phenocrysts ~20%, olivine ~5%, clinopyroxene < 0.5%; highly altered
17-1, 114-116	15C	5.25	5.29	2.87	4.0	Plagioclase-olivine-clinopyroxene phyric basalt; plagioclase phenocrysts ~20%, olivine ~5%, clinopyroxene <0.5%
18-1, 142-144	16	5.64	5.55	2.90	3.2	Plagioclase-olivine-clinopyroxene phyric basalt; plagioclase phenocrysts are max. 5 mm long, 7-10%; olivine completely altered to brown clay mineral (~1%); clinopyroxene observed in trace amounts
20-1, 125-127	9	5.56	5.68	2.84	6.4	Plagioclase-olivine-clinopyroxene phyric basalt with plagioclase 15%, olivine < 5%, and clinopyroxene < 1%; carbonate coating and manganese spots
21-1, 125-127	6	5.66	5.80	2.90	2.8	Medium-grained plagioclase-olivine-clinopyroxene phyric basalt; slight alteration on surface; cut by cracks filled with dark brown material; (plagioclase ~15%, olivine ~5%, clinopyroxene 7%)
22-1, 100-102	13C	5.89	5.87	2.88	3.6	Plagioclase-olivine-clinopyroxene phyric basalt; plagioclase phenocrysts ~20%, up to 10 mm long (most commonly 1 mm); olivine 5-7%, up to 3 mm long, most are altered; clinopyroxene < 1%

TABLE 10 – *Continued*

Sample (Interval in cm)	Rock No.	V_p (‖)	V_p (⊥)	ρ Wet Bulk Density (g/cm^3)	Porosity (%)	Rock Type – Remarks
22-2, 34-36	1D	5.96	5.80	2.92	2.5	Plagioclase-olivine-clinopyroxene phyric basalt; plagioclase ~15%, olivine 7%, clinopyroxene 1%; along carbonate veinlets, alteration is intense
22-2, 106-108	8	–	–	2.90	3.1	Plagioclase-olivine-clinopyroxene phyric basalt; plagioclase ~15% (max. 4 mm), olivine ~5% (max. 2 mm), clinopyroxene ~1% (max. 3 mm)
22-2, 132-134	9C	5.97	5.91	2.90	–	Plagioclase-olivine-clinopyroxene phyric basalt; groundmass fine grained; plagioclase ~15%, olivine ~5%, clinopyroxene ~1%, vesicles ~3%
23-1, 72-74	5	5.16	5.06	2.74	–	Similar to Sample 22-2, 132-134 cm
23-1, 99-101	9	5.37	5.42	2.79	–	Similar to Sample 22-2, 132-134 cm
23-1, 120-122	12	–	–	2.87	–	Similar to Sample 22-2, 132-134 cm
23-1, 145-147	16	5.49	5.60	2.87	–	Plagioclase-olivine-clinopyroxene phyric basalt, vesicular (~3%); ~15% plagioclase phenocrysts; ~5-7% olivine
24-1, 143-145	5	5.15	5.11	2.84	–	Plagioclase-olivine-clinopyroxene phyric basalt; has glassy rind in part; many olivines altered to brown material
24-2, 5-7	1	5.24	5.22	2.84	6.7	Plagioclase-olivine-clinopyroxene phyric basalt; plagioclase phenocrysts ~20%, olivine phenocrysts ~5-7%, clinopyroxene phenocrysts < 1%
24-2, 69-71	9	5.29	5.25	2.84	–	Plagioclase-olivine-clinopyroxene phyric basalt; 20% plagioclase, up to 4 mm long; 5-7% olivine phenocrysts 2-3 mm across; < 1% clinopyroxene; ~2% vesicular
25-1, 85-87	10B	5.96	5.79	2.90	3.4	Plagioclase-olivine-clinopyroxene phyric basalt; plagioclase 15%, olivine 7%, clinopyroxene < 1%
26-1, 52-54	7	5.88	5.75	2.89	–	Plagioclase-olivine-clinopyroxene phyric basalt; ~15% plagioclase phenocrysts, 5% olivine phenocrysts, ~1% clinopyroxene phenocrysts
27-1, 121-123	2A	5.67	5.73	2.89	–	Plagioclase-olivine-clinopyroxene phyric basalt; plagioclase phenocrysts ~10%, olivine phenocrysts ~5%, clinopyroxene phenocrysts < 1%
27-2, 23-25	1C	5.73	5.66	2.89	–	Plagioclase-olivine-clinopyroxene phyric basalt; plagioclase phenocrysts ~20%, olivine phenocrysts ~5%, clinopyroxene phenocrysts ~1%
27-2, 145-147	11	5.46	5.66	2.87	–	Plagioclase-olivine-clinopyroxene phyric basalt; ~1% vesicular; plagioclase ~20%, olivine ~5%, clinopyroxene ~1%
28-1, 58-60	3	4.85	4.91	2.78	7.2	Plagioclase-olivine phyric basalt; plagioclase ~20%, olivine ~5%; material altered; phenocrysts set in aphanitic groundmass; vesicles are about 1% and partially filled with green materials
28-1, 117-119	9C	5.66	5.57	2.84	–	Plagioclase-olivine phyric basalt; plagioclase ~15%; olivine ~5%; set in aphanitic groundmass
29-1, 110-112	1	5.35	–	2.84	–	Plagioclase-olivine phyric basalt; plagioclase ~15%, olivine 3-5%; slightly vesicular (< 1%)
30-1, 82-84	9A	5.81	5.60 (?)	2.88	–	Plagioclase-olivine phyric basalt; plagioclase ~15%, olivine 5%; groundmass is fine- to medium-grained; partly altered
30-1, 144-146	15	5.80	5.69	2.83	3.9	Plagioclase-olivine phyric basalt; plagioclase ~15%, olivine ~5%
31-1, 90-92	7	5.90	5.91	2.86	4.4	Plagioclase-olivine phyric basalt; phenocrysts 0.1 to 0.3 cm long; plagioclase:olivine ratio uniform (~10:1)
32-1, 32-34	1	–	–	–	9.5	
32-1, 54-56	3A	4.51	4.68	2.68	–	Volcanic breccia (coarse-grained olivine-plagioclase basalt in carbonate-cemented matrix)
32-2, 56-58	7A	5.91	5.82	2.86	–	Volcanic breccia (fine-grained clasts of olivine-plagioclase phyric basalt)
32-2, 133-135	9B	5.73	5.59	2.85	–	Similar to Sample 32-2, 56-58 cm
33-1, 34-36	5A	5.19	5.37	2.80	–	Plagioclase-olivine phyric basalt; plagioclase ~20%, olivine ~5%; glass rinds present, partly altered to palagonite
33-2, 8-10	1A	5.87	5.80	2.87	4.0	Plagioclase-olivine phyric basalt; 20% plagioclase and 3-5% olivine phenocryst matrix, fine-grained
33-2, 130-132	15B	5.79	5.86	2.87	–	Aphyric basalt; vesicles ~2%
35-1, 27-29	3A	5.63	NG	2.86	3.3	Fine-grained aphyric basalt (a few plagioclase phenocrysts present – < 1%), vesicles ~1%
35-1, 85-87	10	5.57	5.63	2.87	–	Similar to Sample 35-1, 27-29 cm, but with glass exterior
36-1, 82-84	9	5.40	5.27	2.84	–	Fine-grained aphyric basalt (less than 1% plagioclase phenocrysts); ~1% vesicles; palagonite present
37-1, 37-39	2	5.65	5.64	2.87	–	Fine-grained aphyric basalt, ~1% vesicular; vesicles filled with dark brown material
37-1, 109-111	10B	5.79	5.88	2.90	–	Very fine grained aphyric basalt
38-1, 116-118	8	5.53	5.47	2.84	7.6	Fine-grained basalt; olivine phenocrysts present (~1%), and moderately fresh; slightly vesicular
40-1, 143-145	1	5.78	–	2.84	–	Aphyric basalt with rare plagioclase phenocrysts
41-1, 142-144	10	5.65	5.81	2.90	–	Fine-grained aphyric basalt with rare plagioclase phenocrysts; vesicles less than 1%; zeolite coating with black spots occurs on the weathered surface
46-1, 41-43	1	5.46	5.64	2.82	–	Fine-grained aphyric basalt with rare plagioclase phenocrysts or xenocrysts (< 1%); vesicular (3%) zeolites present on weathered surface and along cracks
47-1, 124-126	15	4.50	4.57	2.67	13.4	Aphyric basalt with rare plagioclase phenocryst vesicles ~1%, filled with dark gray clay minerals; badly altered
47-2, 118-120	12A	5.15	–	2.77	9.9	Aphyric basalt with zeolite-incrusted vesicles ~2%; badly altered

TABLE 10 – *Continued*

Sample (Interval in cm)	Rock No.	V_p (‖)	V_p (⊥)	ρ Wet Bulk Density (g/cm³)	Porosity (%)	Rock Type – Remarks
48-1, 55-57	7B	5.59	–	2.87	–	Fine-grained aphyric basalt vesicular. Microphenocrysts of olivine; rare plagioclase phenocrysts
49-1, 119-121	9A	–	–	2.65	–	Volcanic breccia: angular fragments of aphyric basalt cemented together by an aggregate of small fragments of plagioclase and volcanic glass
49-1, 122-124	9A	–	–	2.69	–	Same as Sample 49-1, 119-121 cm
49-1, 145-147	9D	–	–	2.65	–	Same as Sample 49-1, 119-121 cm
49-2, 101-103	13A	5.54	5.60	2.85	–	Fine-grained basalt; vesicles small and ~1%
50-1, 140-142	9	5.30	5.46	2.84	–	Fine-grained basalt with rare phenocrysts of plagioclase
50-2, 92-94	10	5.40	5.52	2.81	7.9	Aphyric basalt with rare phenocrysts of plagioclase vesicles < 1%
51-1, 113-115	3	5.32	5.23	2.86	–	Aphyric basalt with rare plagioclase phenocrysts
51-2, 77-79	11	–	–	2.87	–	Same as Sample 51-1, 113-115 cm
51-3, 39-41	5	–	–	2.84	–	Same as Sample 51-1, 113-115 cm
52-1, 103-105	(?)	4.87	4.84	2.78	–	Fine-grained basalt with many cracks, most filled with calcite; badly altered
52-2, 51-53	7	4.58	4.55	2.71	–	Fine-grained aphyric basalt with many cracks partly filled with calcite; rare phenocrysts of plagioclase and altered olivine are present; badly altered
53-1, 99-101	10	5.52	5.50	2.84	–	Very fine grained aphyric basalt; rare phenocrysts of plagioclase present; many cracks; badly altered
53-2, 62-64	7	–	–	2.89	3.4	Aphyric fine-grained basalt with rare phenocrysts of plagioclase
54-1, 74-76	10A	5.81	5.77	2.89	–	Fine-grained aphyric basalt similar to Sample 53-1, 99-101 cm
54-2, 116-118	14	5.16	5.21	2.83	8.0	Very fine grained aphyric basalt; badly altered
55-1, 75-77	4B	–	–	2.85	–	Aphyric basalt; vesicles < 1%, moderately altered
55-2, 78-80	3D	5.30	5.30	2.85	–	Fine-grained aphyric basalt with rare plagioclase phenocrysts; slightly vesicular
56-2, 79-81	4F	5.65	5.71	2.91	–	Fine-grained aphyric basalt with rare olivine and plagioclase phenocrysts; reasonably fresh
56-3, 117-119	X	5.44	5.45	2.85	5.6	Fine-grained aphyric basalt with rare plagioclase phenocrysts; moderately altered
57-1, 110-112	16A	4.67	4.76	2.74	–	Fine-grained aphyric basalt; cracks filled with white non-carbonate material (zeolites?)
57-1, 127-129	16B	5.63	5.70	2.89	–	Fine-grained aphyric basalt; reasonably fresh
58-1, 56-58	1B	5.13	5.24	2.81	8.4	Similar to Sample 57-1, 110-112 cm
58-2, 115-117	6I	4.57	–	2.50	–	Hyaloclastite, basaltic glass fragments in matrix of altered glass fragments
59-1, 26-28	3	5.74	5.82	2.91	2.7	Very fine grained aphyric basalt with variolitic texture
59-2, 37-39	5	5.20	5.16	2.84	–	Very fine grained aphyric basalt; alteration intense along cracks
60-1, 30-32	2	5.50	5.47	2.89	–	Fine-grained aphyric vesicular basalt; vesicles (~1%) filled with dark green material; one plagioclase phenocryst observed
60-2, 60-62	7	4.71	4.91	2.72	10.7	Aphyric vesicular basalt vesicles (< 1%) filled with pale green and dark green material; badly altered
60-3, 34-36	2	5.37	5.44	2.83	–	Aphyric basalt with rare plagioclase phenocrysts; vesicles (~1%) filled with dark green and greenish white minerals
60-3, 110-112	8	–	–	2.80	9.5	Very fine grained aphyric basalt
60-3, 137-139	10	5.58	5.46	2.87	–	Aphyric basalt with variolitic texture. Moderately altered
61-1, 117-119	1	5.42	–	2.79	–	Aphyric, variolitic, vesicular basalt
61-2, 74-76	5	5.69	5.61	2.90	–	Plagioclase (15-20%)-olivine (5-6%)-clinopyroxene (< 1%) phyric dolerite basalt
61-3, 75-77	6	5.82	5.89	2.90	2.2	Plagioclase (20%)-olivine (10%)-clinopyroxene (1%) phyric doleritic basalt
61, CC, 13-15	2	5.59	5.78	2.88	–	Plagioclase (15-20%)-olivine (5-7%)-clinopyroxene (< 1%) phyric doleritic basalt
61, CC, 53-55	5	5.43	5.68	2.88	–	Same as Sample 61, CC, 13-15 cm
62-1, 40-42	5	–	–	2.90	–	Fine-grained aphyric basalt
62-1, 84-86	7B	5.55	5.74	2.91	–	Medium-grained plagioclase-olivine-rare clinopyroxene phyric basalt
63-1, 38-40	3C	5.95	6.04	2.90	–	Plagioclase-olivine-clinopyroxene phyric doleritic basalt; (~5-10% plagioclase and olivine; clinopyroxene < 1%)
63-2, 2-4	1A	5.68	–	2.88	2.5	Plagioclase-olivine-clinopyroxene phyric doleritic basalt; plagioclase ~15-20%, olivine ~5-7%, clinopyroxene ~1%
63-3, 50-52	1D	5.69	5.78	2.88	–	Similar to Sample 63-2, 2-4 cm
63-4, 32-34	1C	5.72	5.67	2.87	–	Similar to Sample 63-2, 2-4 cm
64-1, 106-108	1H	6.07	6.05	2.90	–	Similar to Sample 63-2, 2-4 cm
64-2, 56-58		5.82	5.87	2.90	–	Similar to Sample 63-2, 2-4 cm
64-2, 135-137		–	–	2.77	–	Plagioclase-olivine-clinopyroxene phyric basalt
64-3, 8-10		5.39	5.56	2.85	–	Aphyric basalt
64-3, 42-44		–	–	2.82	–	Aphyric basalt
64-4, 67-69		–	–	2.79	–	Aphyric basalt; alteration vein in sample
64-4, 123-125		–	–	2.86	–	Aphyric basalt
65-1, 148-150		5.34	–	2.87	5.8	Very fine grained vesicular aphyric basalt; badly altered
65-2, 13-15		5.01	–	2.70	–	Fine-grained aphyric basalt; badly altered; alteration veins in sample

TABLE 10 – *Continued*

Sample (Interval in cm)	Rock No.	V_p (∥)	V_p (⊥)	ρ Wet Bulk Density (g/cm^3)	Porosity (%)	Rock Type – Remarks
65-2, 31-33		–	–	2.90	–	Same as Sample 65-2, 13-15 cm
66-1, 83-85		–	–	2.88	4.6	Very fine grained aphyric basalt
66-2, 21-23		5.26	–	2.88	–	Same as Sample 65-2, 13-15 cm
66-2, 85-87		5.14	–	2.74	–	Same as Sample 65-2, 13-15 cm
66-3, 110-112	11	5.22	5.23	2.82	7.7	Same as Sample 65-2, 13-15 cm
67-1, 83-85		5.45	5.54	2.84	–	Brecciated fine-grained aphyric basalt containing glass in part; badly altered
67-1, 113-115		–	–	2.62	–	Same as Sample 67-1, 83-85 cm; alteration veins in sample
67-2, 88-90		4.89	–	2.80	8.5	Same as Sample 67-1, 83-85 cm

at 110°C for about 12 hours and drying subsequently at 50°C *in vacuo* for about 24 hours. If water remains in closed pores, the porosity and water values are minimum values.

Hole 395

Velocity measurements were made on 21 samples (17 basalts, 3 serpentinized peridotites, and 1 gabbro). Bulk density, porosity, and water content measurements were made on 29 samples (25 basalts, 3 serpentinized peridotites, 1 gabbro). These measurements are listed in Table 9. The principal results are as follows:

1) Anisotropy: for 15 of the basalt samples, V⊥ > V∥ mean difference of 0.10 km/sec); in the remaining four basalt samples, V∥ > V⊥ (mean difference of 0.08 km/sec). The gabbro sample was highly anisotropic (V∥ = 5.62 km/sec; V⊥ = 6.00 km/sec). All three serpentinized peridotites yielded V∥ > V⊥ (mean difference of 0.10 km/sec).

2) From the spread on the histogram (Figure 17), we observe that the velocities measured fall into two groups (4.30 to 4.90 km/sec; 5.30 to 6.10 km/sec). Two of the basalt specimens were highly weathered and vesicular, and yielded velocities in the lower range. The velocities of the 15 remaining basalt samples and the one gabbro sample were in the higher range. All the serpentinized peridotites have velocities in the lower range.

3) The velocity-density relationship for the basalt samples is nearly linear (Figure 18). Two of the serpentinized peridotites and the gabbro sample vary considerably from this linear relationship.

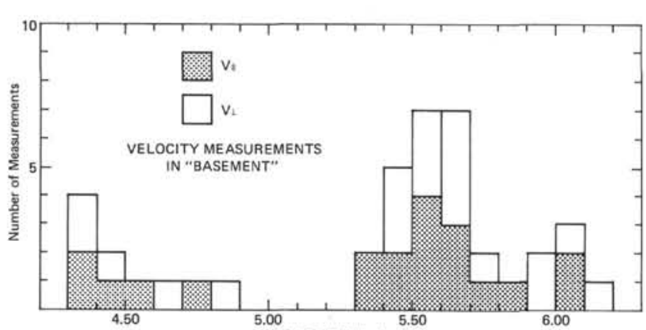


Figure 17. *Histogram of velocity measurements in "Basement" rocks, Hole 395.*

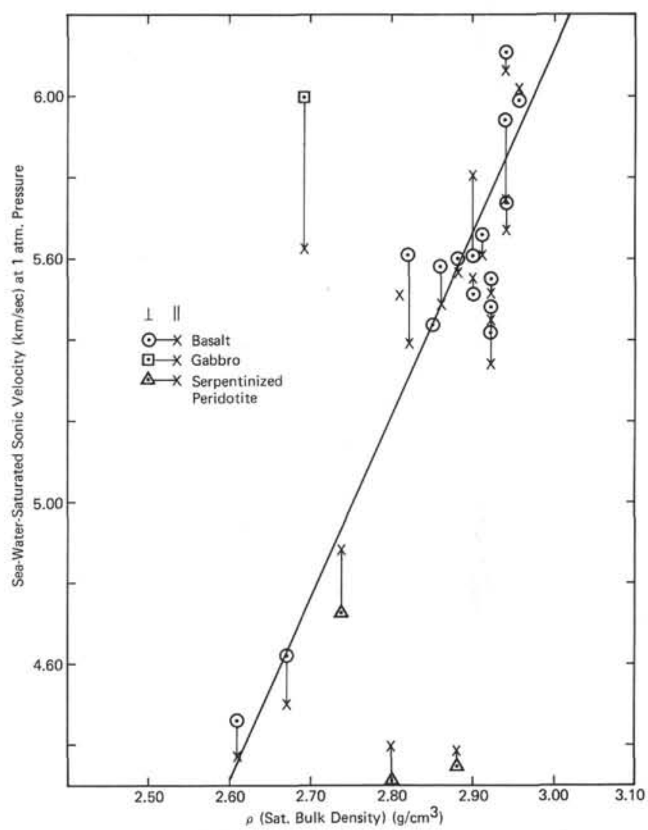


Figure 18. *Water-saturated sonic velocity versus saturated bulk density for Hole 395 basalts, gabbro, and serpentinized peridotite.*

4) The velocity-porosity relationship (Figure 19) is similarly linear for all basalt samples and the gabbro sample. The three serpentinized peridotite samples measured do not fit this relationship. For an equivalent porosity with the basalt, they have a lower measured velocity (and vice versa).

5) In Figure 20, porosity is plotted as a function of density. For the basalts a linear relationship exists, indicating that change in pore space is the major cause of density changes. The porphyritic basalts from Cores 18, 19, and 20 (see encircled values on Figure 20) exhibit slightly lower ϱ values for the same porosity range as the other basalts. A possible explanation is that the por-

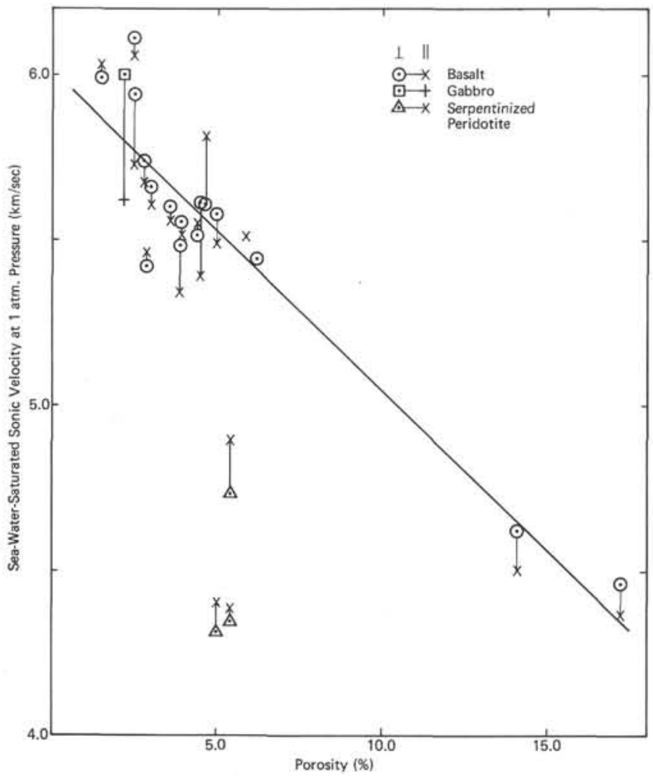


Figure 19. *Water-saturated sonic velocity versus porosity for Hole 395 basalts, gabbro, and serpentinized peridotite.*

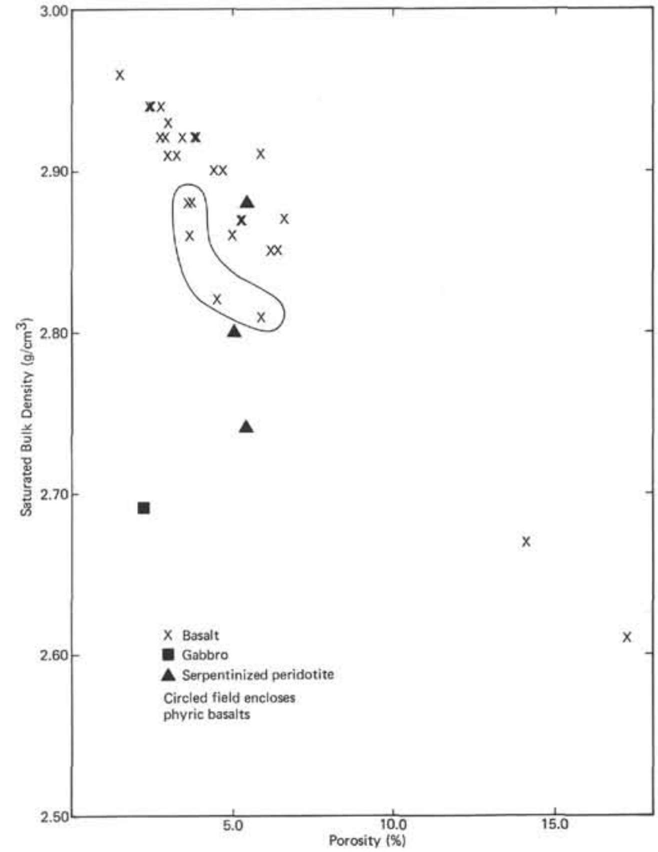


Figure 20. *Water-saturated bulk density versus porosity for Hole 395 basalts, gabbro, and serpentinized peridotite.*

phyritic basalts have more abundant plagioclase phenocrysts than the other basalts. Plagioclase is less dense than Fe-bearing minerals. The serpentinized peridotites show essentially no correlation with porosity, indicating that the principal effect on the density of these samples is the degree of serpentinization.

Hole 395A

Velocity measurements were made on 115 samples; bulk density measurements were made on 138 samples; porosity and water content measurements were made on 63 samples. These measurements are listed in Table 10. The velocity measurements were obtained by averaging five independent readings for each sample. The principal results are as follows:

1) There appears to be no systematic change in velocities with lithologic units (Figure 21). In general, wide ranges of velocities are observed within the same broad lithologic units. This may be an artifact of the sampling process (i.e., the velocities are dependent on degree of alteration; no attempt was made to segregate unaltered rocks from rocks with different degrees of alteration). Furthermore, many of the samples, especially within the aphyric units, were highly fractured. The velocities measured depend on how fractured these rocks are. The exceptions are the plagioclase-olivine phyric basalts in Cores 13 to 16, where the sonic velocities were reasonably constant (5.60 km/sec), and the serpentinites in Cores 3 and 4, where the velocities were low (3.60 to 4.20 km/sec).

2) From the spread on the histogram (Figure 22), we observe that most of the measured velocities fall in the range 5.1 to 6.0 km/sec, with peaks in the range 5.5 to 5.7 km/sec. The rocks with velocities lower than 5.1 km/sec are either the serpentinites or are in general highly altered.

3) Even though a wide scatter is observed with measured velocities, the velocity-density curve is reasonably linear (Figure 23).

4) The principal cause of density changes in the basalts of Site 395A is a change in the porosity. This can be seen in Figure 24, where density and porosity correlate in linear fashion. Note that the drying procedures were changed midway in the sequence of measurements. No large change in the linear relation is observable. The exact point of the change in procedure can be seen in Table 10, from Section 23-1 downward.

REFERENCES

Arth, J.G., 1976. Behavior of trace elements during magmatic processes—a summary of theoretical models and their applications, *J. Research, U.S. Geological Survey,* v. 4, p. 41-47.

Bougault, H., 1977. First transition series elements: fractional crystallization and partial melting, *In* Aumento, F., Melson, W.G., et al., *Initial Reports of the Deep Sea Drilling Project,* v. 37: Washington (U.S. Government Printing Office), p. 539-546

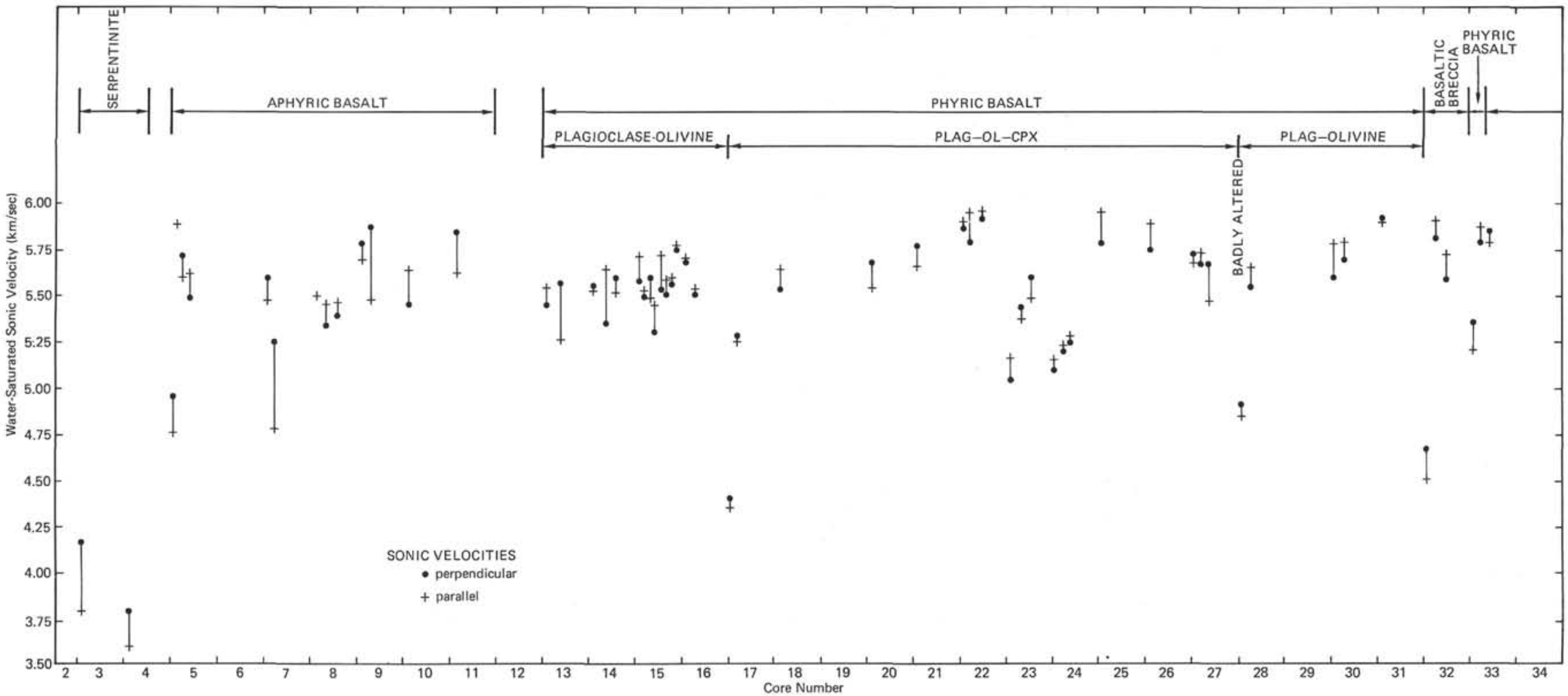


Figure 21. *Water-saturated sonic velocity plotted as a function of core number, Hole 395A.*

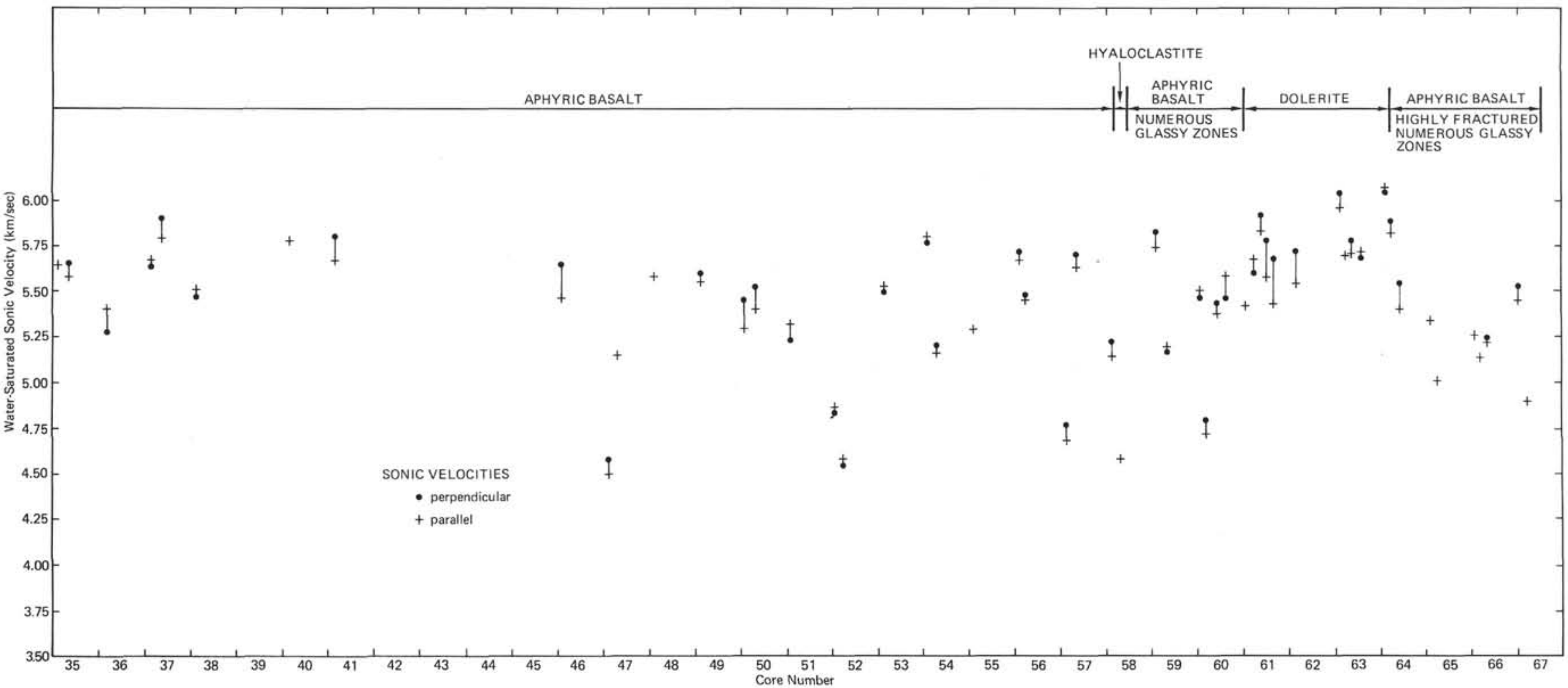


Figure 21. *(Continued).*

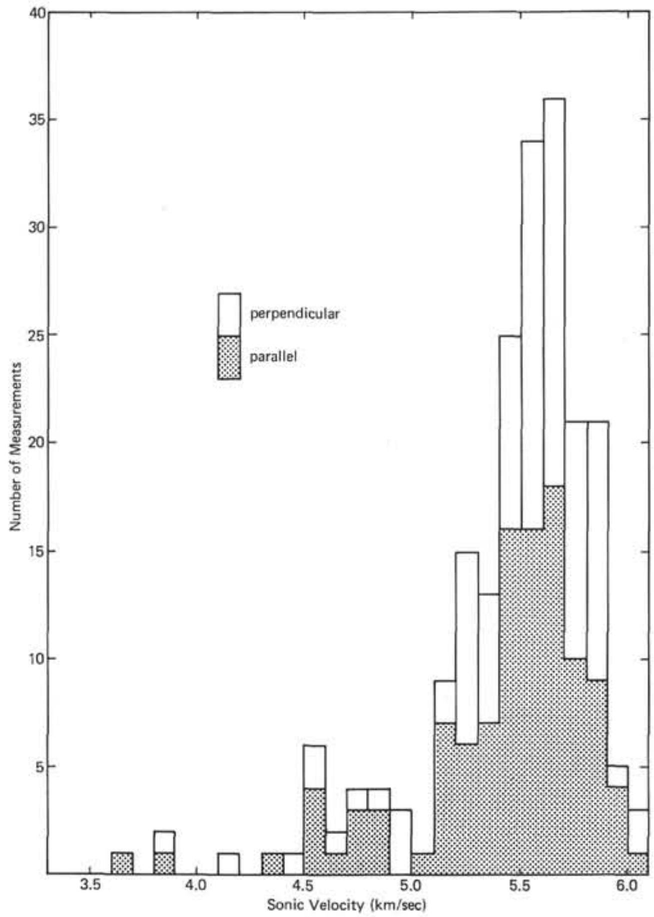


Figure 22. *Histogram of sonic velocity measurement in basement rocks, Hole 395A.*

Hart, S. and Brooks, C., 1974. Clinopyroxene-matrix partitioning of K, Rb, Cs, Sr, and Ba, *Geochim. Cosmochim. Acta,* v. 38, p. 1799-1806.

Philpotts, J.A. and Schnetzler, C.C., 1970. Phenocryst-matrix partition coefficients for K, Rb, Sr, and Ba with applications to anorthosite and basalt genesis, *Geochim. Cosmochim. Acta,* v. 34, p. 307-332.

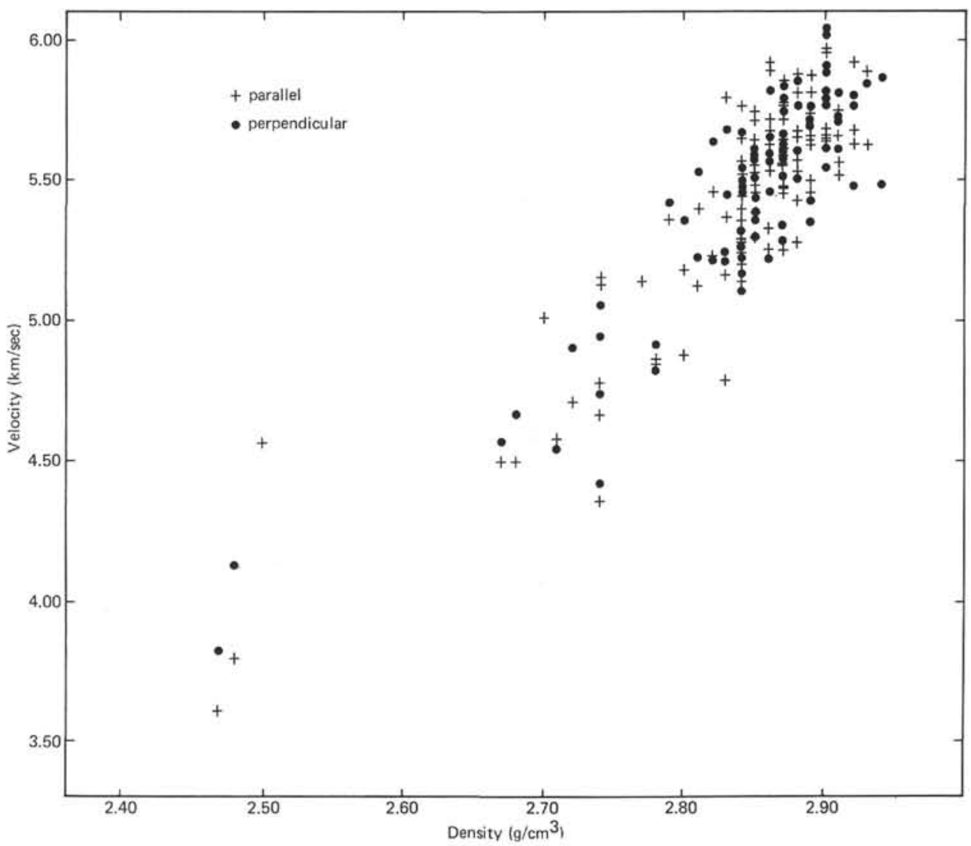


Figure 23. *Water-saturated sonic velocity versus saturated bulk density for Hole 395A basalts and serpentinized peridotites.*

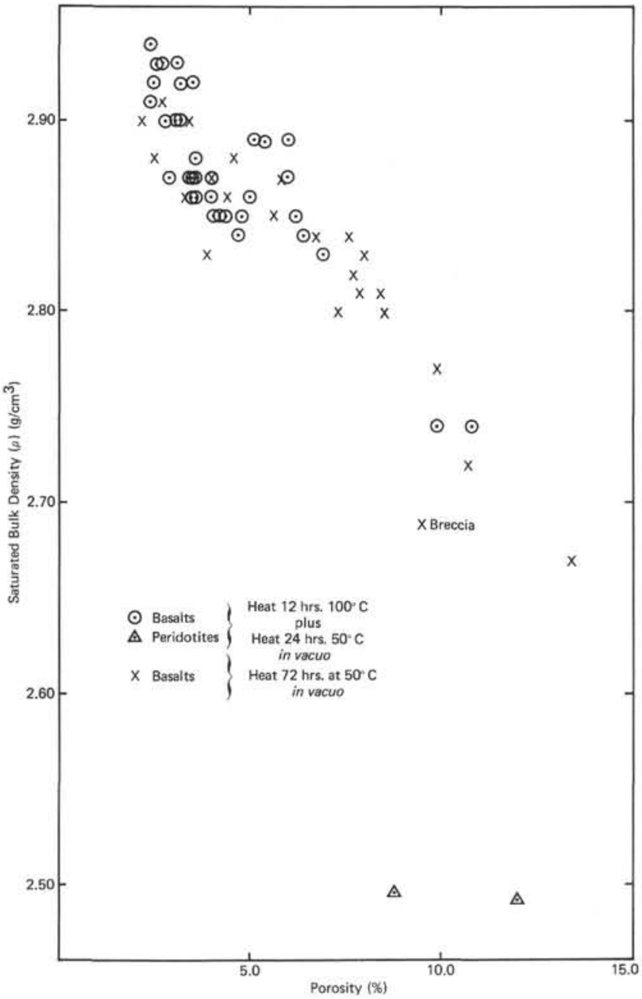
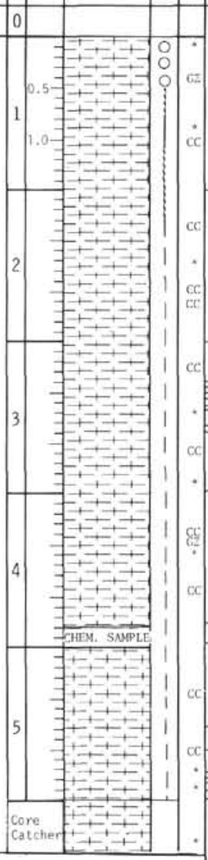


Figure 24. *Water-saturated bulk density versus porosity for Hole 395A basalts and serpentinized peridotites.*

Site 395 Hole Core 1 Cored Interval: 4517.7-4525.2 m (0.00-7.50 subbottom)

AGE	ZONE	FOSSIL CHARACTER: FORAMS	FOSSIL CHARACTER: NANNOS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
PLEISTOCENE	Mixed G. oceanica-E. huxleyi; Globigerina calida calida	AG	AG	0, 1, 2, 3, 4, 5, Core Catcher	0.5, 1.0	CHEM. SAMPLE			



FORAMINIFER-NANNOFOSSIL OOZE

10YR 7/4
10YR 7/4
10YR 6/3
10YR 6/4
10YR 5/4
10YR 6/3
10YR 6/4
10YR 6/4
7.5YR 6/6
10YR 7/6
7.5YR 6/6

Very pale brown, light yellow brown, and pale brown foraminifer-nannofossil ooze. Extreme drilling deformation in upper sections, but somewhat coherent in sections 3-5. There, bedding in the form of faint color changes can be seen. The texture is gritty owing to abundant foraminifera which appear to vary in proportion from place to place. No bioturbation is evident. In some smear slides, coccoliths appear iron stained. Traces of glass can also be seen in smear slides. Fossil preservation is good.

ss 1-2,1-90,2-70, 3-67,3-140,5-140

Forams	0-20%
Nannos	80-100%
Fe-oxides	Tr
Sponge Spicules	Tr
Fish Debris	Tr
Glass	Tr

ss 4-60, 5-120

Forams	20-50%
Nannos	50-80%
Fe-oxides	Tr
Sponge spicules	Tr
Fish Debris	Tr

Note: forams under-represented in smear slides; discoasters abundant.

Texture: Sand 0, Silt 5-20%, Clay 80-95%

Carbonate Bomb (% $CaCO_3$)

1-45-47	73%
3-54-56	75%
5-89-91	67%

Carbon Carbonate

1-88	9.6	0.1	79
2-40	9.4	0.1	77
2-100	8.4	0.1	69
2-119	9.2	0.1	76
3-14	9.3	0.1	77
3-103	9.2	0.1	76
4-36	9.4	0.1	78
4-91	8.7	0.1	71
5-43	9.4	0.1	77
5-102	9.6	0.5	76

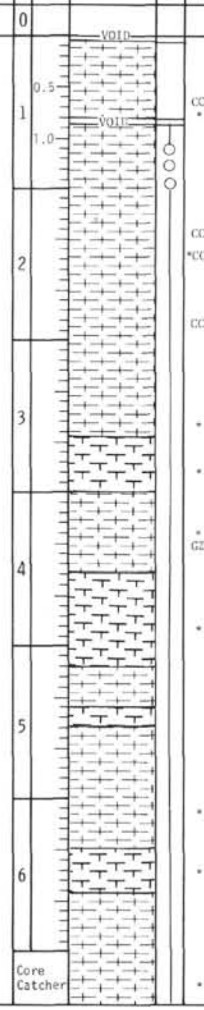
Grain Size

1-46	86.9	4.0	9.0
4-50	15.8	20.7	63.5

Explanatory notes in Chapter 1

Site 395 Hole Core 2 Cored Interval: 4525.2-4534.7 m (7.50-17.03 subbottom)

AGE	ZONE	FOSSIL CHARACTER: FORAMS	FOSSIL CHARACTER: NANNOS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
PLEISTOCENE; PLIOCENE	Mixed G. caribbeanica; G. crassaformis hessi; G. crassaformis viola; C. macintyrei; G. crassaformis; G. tosaensis	AG	AG	0, 1, 2, 3, 4, 5, 6, Core Catcher	0.5, 1.0	VOID			



FORAMINIFER-NANNOFOSSIL OOZE INTERBEDDED WITH FORAMINIFER OOZE

10YR 7/2
10YR 5/8
10YR 7/2
10YR 7/6
10YR 7/6
10YR 8/4
10YR 7/6
2.5Y 7/4
10YR 7/4
10YR 7/4
10YR 8/3
10YR 6/6
10YR 7/4
10YR 6/6
10YR 7/4
10YR 6/6
10YR 8/4
10YR 6/6
10YR 8/4
10YR 7/6
10YR 7/4

Yellow, very pale brown, pale yellow brown, and brownish yellow foraminifer-nannofossil ooze, interbedded with very pale brown sandy foraminifer ooze in sections 3-6. Tiny grains of basaltic sand are present in foram sands of sections 5 and 6. Core is a series of parallel beds of different color and proportion of nannos to forams. No bioturbation is evident. Size sorting and basalt sand grains suggest that these are calcareous turbidites. Deformation is moderate to intense.

Foram-nanno ooze

ss 1-70, 2-57, 3-80, 3-130, 4-40, 6-15, CC

Forams	5-10%
Nannos	90-95%
Fe-oxides	Tr
Sponge spicules	Tr
Fish Debris	Tr
Glass	Tr
Heavies	Tr

Foram sand

ss 4-120, 5-110

Forams	23-60%
Nannos	40-75%
Heavies	0- 2%
Fe-oxides	Tr
Sponge spicules	Tr
Fish Debris	Tr
Glass	Tr

Texture	Sand%	Silt%	Clay%
F-N ooze	0	5-10	90-95
F- sand	0	20-50	50-80

Note: forams under-represented in smear slides; discoasters abundant.

Carbonate Bomb (% $CaCO_3$)

2-77-79	81%
5-107-109	79%
6-138-140	65%

Carbon Carbonate

1-57	10.1	0.0	84
2-39	10.1	0.0	84
2-74	10.0	0.0	83
2-127	10.0	0.7	78

Grain Size

4-50	6.8	39.3	53.9

Site 395 Hole Core 3 Cored Interval: 4534.7-4544.3 m (17.03-26.57 m subbottom)

AGE	ZONE	FOSSIL CHARACTER: FORAMS	FOSSIL CHARACTER: NANNOS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
PLIOCENE	Mixed D. brouweri-R. pseudoumbilica / Globorotalia tosaensis	AG	AG	0, 1, 2, 3, 4, 5, 6, Core Catcher	0.5, 1.0	VOID; HEM. SAMPLE; VOID		•, CC •, •, GZ •, CC •, CC •, CC	see below

10YR 7/4

10YR 6/6

10YR 7/4

10YR 7/4

FORAMINIFER-NANNOFOSSIL OOZE

Very pale brown and light yellowish brown foraminifer-nannofossil ooze. Interbedded very subtle darker and lighter layers, distorted or obliterated by drilling deformation. The zero section has a basalt cobble, small basalt pebbles, and basaltic sand in intensely disturbed ooze. Foraminifera are quite abundant in the upper sections of the core.

ss 1-100, 2-100, 3-100

Forams	20-60%
Nannos	30-80%
Carb Unspec.	0-10%
Heavy Mins.	Tr
Glass	Tr
Fe-oxides	Tr

ss 4-100, 5-80, 6-80, cc

Forams	5-10%
Nannos	90-95%
Heavy Mins.	Tr
Glass	Tr
Fe-oxides	Tr

Texture: Sand 0, Silt 5-30%, Clay 70-95%

Carbonate Bomb (% $CaCO_3$)

1-107-109	79%
4-32-34	83%
6-64-66	84%

Carbon Carbonate

2-100	10.8	0.0	89
5-21	10.3	0.0	85
6-21	10.3	0.0	85
6-136	10.3	0.1	85

Grain Size

4-50	0.0	14.1	85.9

Explanatory notes in Chapter 1

Site 395 Hole Core 4 Cored Interval: 4544.3-4553.8 m (26.57-36.10 m subbottom)

AGE	ZONE	FOSSIL CHARACTER: FORAMS	FOSSIL CHARACTER: NANNOS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
PLIOCENE	Mixed D. brouweri-R. pseudoumbilica / Globorotalia tosaensis; Globorotalia miocenica	AG	AG	0, 1, 2, 3, 4, 5, 6, Core Catcher	0.5, 1.0	VOID; VOID; VOID; VOID	V	•, •, GZ • CC, CC •, •, •	see below

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

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

10YR 8/4

10YR 6/4

10YR 7/4

10YR 7/4

FORAMINIFER-NANNOFOSSIL OOZE

Very pale brown, light yellowish brown, and white foraminifer-nannofossil ooze. Moderately to intensely deformed, but more coherent in lower sections. Bedding, in the form of subtle color changes is evident. Texture is somewhat gritty because of abundant foraminifera. No bioturbation noted. In some smear slides, coccoliths appear iron stained. Traces of glass can also be seen in smear slides. Fossil preservation is good. Scattered 1-3 cm serpentinite cobbles are found in sections 1 and 3.

ss 1-70, 3-70, 4-70, 5-70, 6-50, and cc.

Foraminifera	2-10%
Nannofossils	90-98%
Sponge spicules	Tr
Fe-oxides	Tr
Glass	Tr

Texture (range from ss.)
Sand 0, Silt 1-30%, Clay 70-99%

Note: Discoasters abundant

Carbonate Bomb (% $CaCO_3$)

3-68-70	81%
5-49-51	87%
6-32-34	86%

Carbon Carbonate

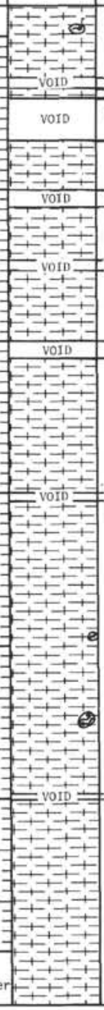
4-68	10.4	0.0	87
5-60	10.5	0.1	87

Grain Size

4-50	0.1	16.3	83.6

Site 395 Hole Core 5 Cored Interval: 4553.8-4563.3 m (36.10-45.64 m subbottom)

AGE	ZONE	FOSSIL CHARACTER: FORAMS	FOSSIL CHARACTER: NANNOS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
PLIOCENE	Mixed D. brouweri-R. pseudoumbilica; Globorotalia miocenica			0, 1, 2, 3, 4, 5, 6, Core Catcher	0.5, 1.0	VOID intervals	V	CC, GZ	



10YR 6/6 — 10YR 7/4 — 10YR 7/4 — 10YR 7/4 — 10YR 8/4 — 10YR 7/4-10YR 5/4 — 10YR 7/4-10YR 8/4 — 10YR 7/4-10YR 8/4 — 10YR 7/4-10YR 8/4 — 10YR 7/4

FORAMINIFER-NANNOFOSSIL OOZE

Very pale brown foraminifer-nannofossil ooze intensely to extravagantly deformed. Subtle color changes partly due to deformation (amount of water in sediments), partly due to primary bedding. Texture is somewhat gritty because of abundant foraminifera. Minor mottling may result from bioturbation. Coccoliths appear iron stained in smear slides. Fossil preservation is good. Scattered pebbles of serpentinite are present in Sections 0,4, and 5.

ss 0-143, 1-140, 2-60, 3-70, 4-90, 5-90, 6-90, cc

Foraminifera	0-30%
Nannofossils	70-99%
Sponge spicules	Tr
Fe-oxides	Tr
Glass	Tr

Texture: range from ss

Sand 0, Silt 5-10%, Clay 90-95%

Notes: Discoasters abundant. Many broken foraminifera fragments in 2-60, 5-90, and 6-90.

Carbonate Bomb (% $CaCO_3$)

3-105-107	82%
5-53-55	85%

Carbon Carbonate

2-100	10.4	0.0	87

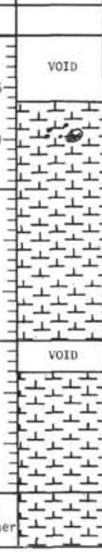
Grain Size

4-50	0.1	16.3	83.6

Explanatory notes in Chapter 1

Site 395 Hole Core 6 Cored Interval: 4563.3-4572.8 m (45.63-55.15 m subbottom)

AGE	ZONE	FOSSIL CHARACTER: FORAMS	FOSSIL CHARACTER: NANNOS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
PLIOCENE	Mixed D. brouweri-R. pseudoumbilica; G. margaritae evoluta	RG	AG	0, 1, 2, 3, Core Catcher	0.5, 1.0	VOID intervals	V	GZ, CC	



10YR 7/4 — 10YR 7/4 — 10YR 8/4 mottle

NANNOFOSSIL OOZE

Very pale brown, intensely disturbed, nannofossil ooze with local angular bits and chips of serpentinite, probably not cored in situ. Forams present, but lower than in previous cores. Still under-represented in smear slides. Rare mottles are present. Coccoliths appear iron stained in smear slides. Fossil preservation is good

ss 1-110, 2-90, 3-80, cc

Foraminifera	0-Tr
Nannofossils	99-100%
Fe-oxides	Tr

Texture (ss 1-110, 2-90, 3-80)

Sand 0, Silt 0-Tr, Clay 99-100%

ss cc

Sand 0, Silt 50%, Clay 50% (?)

Carbonate Bomb (% $CaCO_3$)

2-76-78	86%

Carbon Carbonate

3-82	10.5	0.7	82

Grain Size

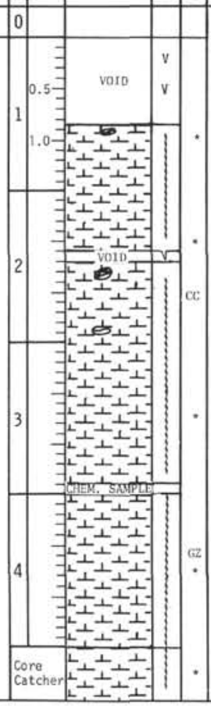
2-65	0.3	18.6	81.1

Site 395 Hole Core 7 Cored Interval: 4572.8-4582.3 m (55.15-64.65 m subbottom)

AGE: PLIOCENE

ZONE: Mixed D. brouweri-R. pseudoumbilica / G. margaritae evoluta

FOSSIL CHARACTER: FORAMS RG; NANNOS AG



LITHOLOGIC DESCRIPTION

10YR 7/4
10YR 4/4
5GY 4/1
10YR 7/4

NANNOFOSSIL OOZE

Very pale brown, intensely disturbed nannofossil ooze, with local pebbles and angular chips of serpentinite, variously altered. Forams are present, but are under-represented in smear slides. Coccoliths appear iron stained in smear slides. Fossil preservation is good.

ss 1-30, 3-70, 4-70, cc

Foraminifera	Tr-5%
Nannofossils	95-99%
Sponge spicules	Tr
Fe-oxides	Tr
Volc. glass	Tr

Texture: ss 4-70

Sand 0, Silt 10 %, Clay 90%

Carbonate Bomb (% $CaCO_3$)

3-62-64	85%
4-69-71	83%

Carbon Carbonate

2-100	10.0	0.1	82

Grain Size

4-50	0.3	17.3	82.5

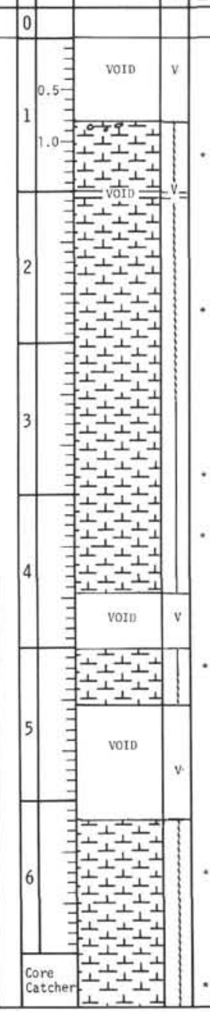
Explanatory notes in Chapter 1

Site 395 Hole Core 8 Cored Interval: 4582.3-4591.9 m (64.65-74.19 m subbottom)

AGE: PLIOCENE

ZONE: Discoaster tamalis / Globorotalia margaritae evoluta; C. rugosus / ?G. margaritae margaritae

FOSSIL CHARACTER: FORAMS RG; NANNOS AG



LITHOLOGIC DESCRIPTION

Serpentinite chips
10YR 6/6
10YR 6/6
10YR 6/6
10YR 7/6
10YR 6/6
10YR 6/6
10YR 5/8

NANNOFOSSIL OOZE

Brownish yellow and yellowish brown intensely disturbed nannofossil ooze. Slightly less disturbance in lower sections where some bedding (subtle color changes) is evident. Chips of serpentinite are present in the upper part of Section 1. Forams are present, but are under-represented in smear slides. Colors are darker than in previous cores. Coccoliths appear iron stained in smear slides. Fossil preservation is good.

ss 1-120, 2-120, 3-120, 4-40,5-20, 6-70, cc

Foraminifera	Tr-5%
Nannofossils	95-99%
Fe-oxides	Tr
Clay	Tr
Volc. glass	Tr
Heavy Minerals	Tr
Opaques (Mn oxides?)	Tr

Texture (range of ss)

Sand 0, Silt 0-50%, Clay 0-50%

Note: Discoasters abundant (silt sized)

Carbonate Bomb (% $CaCO_3$)

2-88-90	83%
6-117-119	73%

Carbon Carbonate

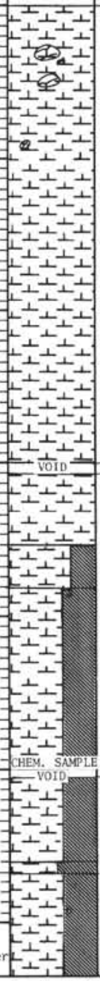
2-100	10.3	0.0	85
6-110	8.6	0.0	71
6-126	8.9	0.0	74

Grain Size

4-50	0.9	16.2	82.9

Site 395 Hole Core 9 Cored Interval: 4591.9-4601.4 m (74.19-83.70 m subbottom)

AGE	ZONE	FOSSIL CHARACTER: FORAMS	FOSSIL CHARACTER: NANNOS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
PLIOCENE	C. rugosus; ?Globorotalia margaritae margaritae	RG	AG	0, 1, 2, 3, 4, 5, 6, Core Catcher	0.5, 1.0	VOID; CHEM. SAMPLE; VOID		*, * CC, *, GZ, CC, *, CC, CC, *



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE GRADING DOWNWARD TO MORE-OR-LESS CALCAREOUS BASAL YELLOW-BROWN CLAYS

N1 pebble
N1 pebble
10YR 6/6

Sections 1,2,3, and 4 (up to 110 cm) are brownish yellow, intensely deformed nannofossil ooze with pebbles, chips and cobbles of serpentinite (green and black, or black) in Section 1. Color is slightly darker in these oozes compared with previous cores because of a greater component of brownish clays. Coccoliths appear iron stained in smear slides, but fragments of Fe-oxides are present as well. Fossil preservation is good.

ss 1-90, 2-90, 3-90

10YR 6/6

Foraminifera	Tr
Nannofossils	99-100% Discoasters abundant
Clays	Tr
Fe-oxides	Tr
Palagonite	Tr

Texture (range of ss)

Sand 0, Silt Tr, Clay 99-100%

10YR 6/6

Sections 4-110-150 cm, 5, and 6 are moderately t~ intensely deformed dark yellowish brown and dark brown calcareous clays, The smear slides typically show manganese oxide micronodules, which are also apparent in the clays with a hand lens. Because of the proximity to basement, and the presence of hydrous iron and manganese oxides, these sediments are classified as calcareous metalliferous clays. The clay-rich layers are firmer and less deformed than the nannofossil oozes immediately above them.

10YR 6/6

ss 4-90, 5-90, 6-90, CC

10YR 5/4
10YR 4/4

Foraminifera	Tr
Nannofossils	98-100%
Clays	Tr
Carb. Unspec.	Tr Discoasters abundant
Mn Micronodules	Tr
Fe-oxides	Tr
Volc. glass	Tr

Texture (range of ss)

10YR 4/4

Sand 0, Silt Tr, Clay 99-100%

Note: clays have nearly the same refractive index as Caedex, the smear slide mounting medium. They are therefore grossly underestimated in smear slides.

Carbonate Bomb (% $CaCO_3$)

10YR 4/4

2-16-18	83%	5-66-68	63%
3-134-136	78%	6-26-28	56%
4-45-47	88%	6-133-135	73%

Carbon Carbonate

7.5YR 4/4

2-100	9.0	0.0	75	5-133	5.8	0.1	48
5-40	7.4	0.0	61	6-44	6.8	0.1	56

Grain Size

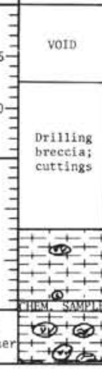
7.5YR 5/4

4-50 0.3 18.1 81.6

Explanatory notes in Chapter 1

Site 395 Hole Core 10 Cored Interval: 4601.4-4610.9 m (83.70-93.23 m subbottom)

AGE	ZONE	FOSSIL CHARACTER: FORAMS	FOSSIL CHARACTER: NANNOS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
UPPER MIOCENE	Mixed Amaurolithus primus			0, 1, 2, Core Catcher	0.5, 1.0	VOID; Drilling breccia; cuttings; CHEM. SAMPLE	V, V, V, DB, C, DB, C, DB, C, DB	*, *



LITHOLOGIC DESCRIPTION

NANNOFOSSIL OOZE WITH EMBEDDED BASALT COBBLES, PROBABLY FROM BASEMENT, PLUS SERPENTINITE AND GABBRO COBBLES IN THE CORE CATCHER

Brownish yellow, intensely deformed nannofossil ooze, younger than sediments in Core 9 (see biostratigraphy portion of sediment section in text). The cuttings above these sediments are primarily serpentinite chips and sand-sized grains, but with lesser basalt, basalt glass, and foraminifera. Basalt cobbles, probably from basement, are embedded in the ooze. Two were found in the chemist's sample (2-140-150 cm). The basalts have been placed in a special section (see description of Section 10-3).

N1

2.5YR 4/4

N1 ss 1-150 (mud surrounding cuttings)

Nannofossils	90%	Sand	0%
Carb. Unspec.	5%	Silt	10%
Palagonite	2%	Clay	90%
Feldspar	2%		
Heavy Minerals	1%		

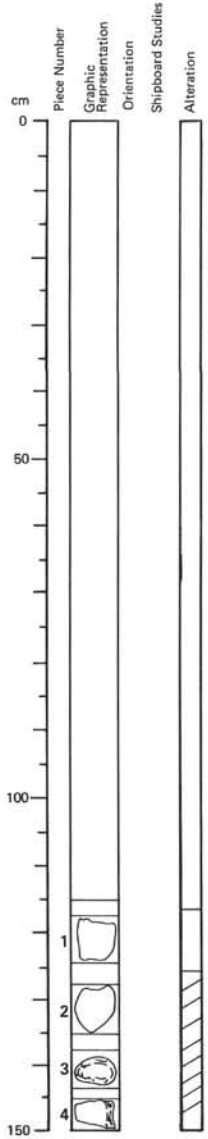
ss 2-100

Nannofossils	80%	Sand	0%
Carb. Unspec.	10%	Silt	20%
Palagonite	5%	Clay	80%
Feldspar	5%		

Ooze, basalt cobbles, and plutonic rocks are inferred to have been chaotically mixed during drilling with the first contact with basement.

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395		10	3



This is a special section for basalts recovered in Section 2. The last 10 cm of Section 2 (140-150 cm) were removed by the Chemist. Two basalt cobbles were found within those sediments (#'s 3 and 4 here). Two other basalt cobbles (#'s 1 and 2) were in highly deformed foraminifer-nannofossil ooze. These four pieces of basalt represent initial contact with basaltic basement at Site 395. In order to store them with the rest of the igneous rocks of Site 395, all four pieces have been placed in this special section. Serpentinite cobbles were recovered in the core-catcher of this core, below the basalt cobbles. Either there is a serpentinite rubble zone (talus?) above basalt, or the serpentinite cobbles fell down the hole from above (note presence of serpentinite cobbles in previous cores). In either case, neither stratigraphy nor orientation has been preserved. The basalt-sediment contact was not recovered. Red clays in Core 9 were not in Core 10.

Macroscopic Description

Fine-grained, aphyric, homogeneous basalt. Vesicles are less than 1%. Alteration is moderate in pieces 2-4. Brownish alteration rinds are present on those pieces. Vesicles and cracks are usually filled with green or very dark green clays, possibly celadonite.

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395		10	CC

The core-catcher of Core 10 contained several mafix and ultramafic cobbles for which thin sections and analyses were obtained. They were not photographed, however, and are stored in a freezer box.

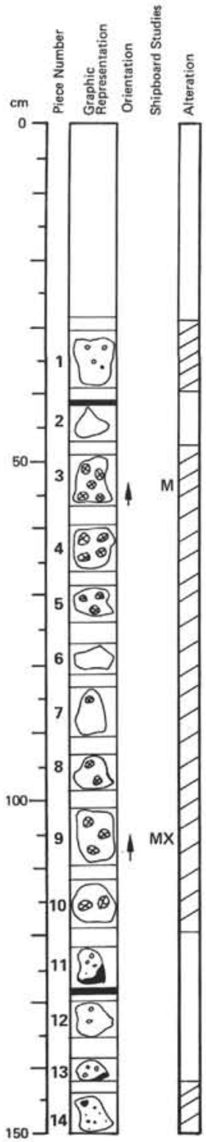
#1 Serpentinize peridotite, 80% serpentinized, with about 20% relict orthopyroxene. Serpentinite includes about 10% magnetite, in "veins", and traces of chlorite.

#2 Feldspathic gabbro with cumulus texture. Rounded aggregates of plag. showing cumulus texture. Interstitial and also rounded areas of alteration products including principally chlorite and serpentine. Pyroxene is partially serpentinized. Plagioclase is about 80% of the rock (An_{80} and 1-2 mm diam.).

#3 Serpentinized peridotite, not as serpentinized as #1 with some clinopyroxene in addition to orthopyroxene in addition to orthopyroxene (has higher CaO and Al_2O_3 than #1, see analyses below.

#4 Serpentinized peridotite, estimated original composition 55% opx., 40% ol., and 5% cpx. Ol. is completely serpentinized, opx. partially serpentinized. Magnetite is abundant (breakdown product of olivine, 5%). There are traces of sericite(?), chlorite, and chrome spinel.

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
#1	43.56	1.26	9.95	43.73	0.03	0.02	0.03	13.79	0.90	2104	2158	6	3
#2:	45.67	24.24	3.81	13.87	12.61	0.08	0.04	4.21	0.88	318	554	99	8
#3:	44.77	6.27	10.66	35.31	1.85	0.02	0.09	11.56	0.87	962	1128	4	4



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395		11	1

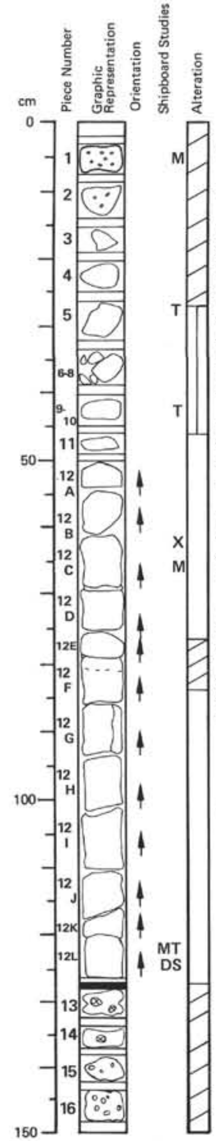
MAJOR ROCK TYPE – BASALT

Macroscopic Description

Generally fine-grained aphyric basalt, dark gray in color, variously moderately altered to gray brown. Alteration is most prominent in vesicular zones (pieces 1 and 14) and in spectacular variolite zones (especially pieces 3, 9 and 11), where the variolites appear as dark gray circular patches set in a browner altered matrix. Vesicles in 1 and 14 are sparse, and less than 1 mm in diameter. Vesicles are not present in the variolitic pieces. Throughout the section, plagioclase microphenocrysts are rare, and olivine very rare. Platy quench crystals of plagioclase are present in 2 and in the brownish matrix of the variolitic pieces. Piece 11 contains the freshest, and most clearly glassy zone of the section. A bit of glass is on one edge of 13. Cooling unit boundaries occur between 1 and 2, 11 and 12, and possibly 12 and 13.

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
105-107 cm:	48.9	15.93	12.83	6.79	11.01	0.22	1.70	.95	0.51	352	161	127	121

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
49-51 cm:	+35°	.304	350	—	—	—	—
105-107 cm:	+32°	.476	550	—	—	—	—



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395		11	2

MAJOR ROCK TYPE – BASALT

Macroscopic Description

Fine-grained, generally aphyric, dark gray in color, locally altered to gray brown. Alteration is most prominent in vesicular pieces (1, 2, 15, and 16) and in variolitic pieces (13 and 14). Vesicles in 1, 15 and 16 are less than 1 mm in diameter, and about 1% of 1 and 5% of 15 and 16. Variolites in 13 and 14 are less well developed than those in Section 1, but exhibit the typical relationship to vesicular basalts found in pillow lavas (variolites near quench glassy margins, vesicles further into the pillow). For this reason, a cooling unit boundary is shown above 13. Alteration in 6 and 7 highlights olivine microphenocrysts and intersertal glass by giving them a brown or reddish brown cast. Pieces 12A-12L are almost certainly part of a single flow as they all appear uniformly moderately crystallized and fit together precisely. Platy quench crystals of plagioclase are prominent in 5. Plagioclase and olivine microphenocrysts occur in 6 and 7 (olivine highlighted by alteration). Thin plagioclase laths can be seen throughout 12.

Thin Section Description

27-32 cm (Piece 5): Basalt, coarse-grained with well developed quench sheaths of plagioclase (An_{75-80}) enclosing augite or glass, up to 3 mm. Plag. = 60%; cpx. = 15%; ol. = 20%; glass = 15%, now almost all as orange-yellow smectites.

40-43 cm (Piece 9): Basalt, fine-grained, aphyric, sub-variolitic, with well developed, but small plagioclase quench crystals, very long and slender, sometimes with splayed ends. Abundant plagioclase microlites in glass, partly altered to clays, locally yellow in color. Plag. = 50% (An_{70-75}); cpx. = 10%; ol. (microphenocrysts) = TR; glass = 30%; opaques = 10%.

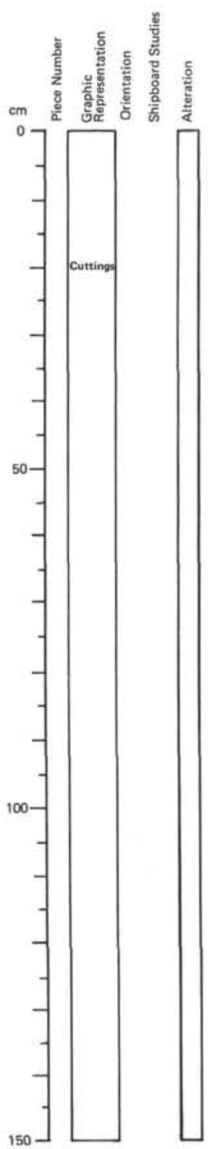
120-126 cm (Piece 12L): Fairly well crystallized basalt with subhedral to anhedral plagioclase (60%), clinopyroxene (40%) and olivine (TR) with lesser magnetite (0.5%) and intersertal glass (TR) altered to brown clays. Rare vesicles filled with clays. Plag. is An_{70-75}.

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
62-64 cm:	49.3	14.88	11.95	8.47	10.49	0.09	1.61	1.08	0.58	315	173	120	112

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
3-5 cm:	+30°	.455	350	—	—	—	—
62-64 cm:	+29°	3.94	75	—	—	—	—
120-122 cm:	+29°	3.37	<50	6.06	6.11	2.94	.025

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

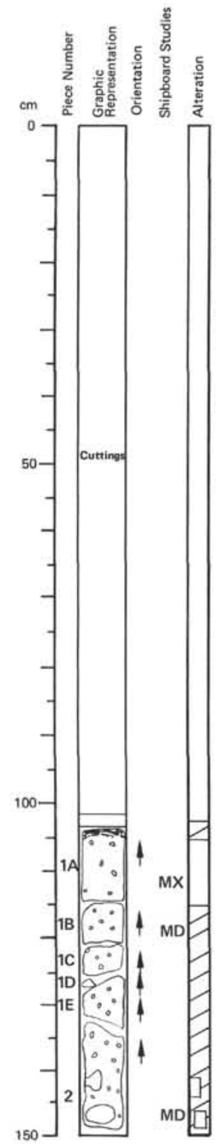
LEG	SITE	HOLE	CORE	SECT.
45	395		12	1



This section is entirely cuttings consisting of chips of basalt glass, lithic basalt, serpentinite, and foraminifera. Basalt glass and lithic basalt are 95% of the cuttings. Glass is so abundant that it is probable that cuttings represent thin, glassy flows too brittle to be cored.

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395		12	2



MAJOR ROCK TYPE – BASALT

Macroscopic Description

Slightly vesicular uniform aphyric fine-grained gray basalt variously altered to brownish-gray colors. Vesicles are .5-1 mm in diameter, and highlighted by alteration fillings of celadonite and calcite. Some vesicles in weathered parts of 2 have brown rims and white-gray cores. Felty plagioclase laths are evident throughout, but no plagioclase microphenocrysts are present.

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
109-111 cm:	49.8	15.11	11.90	8.88	10.50	0.09	1.61	1.25	0.59	314	172	120	119

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
109-111 cm:	+23°	2.79	75	—	—	–	–
123-125 cm:	+28°	.948	200	—	—	2.87	.052
145-147 cm:	+22°	2.83	50	—	—	2.87	.053

Note: Cuttings from 0-104 cm are similar to those in Core 12, Section 1.

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395		13	1

cm | Piece Number | Graphic Representation | Orientation | Shipboard Studies | Alteration

0, 50, 100, 150

Cuttings

Cuttings: more than 95% basalt glass and lithic basalt chips; the rest serpentinite-gabbro grains and a small fraction of foraminifera.

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395		13	2

cm | Piece Number | Graphic Representation | Orientation | Shipboard Studies | Alteration | Special Storage

0, 50, 100, 150

Cuttings

Cuttings: more than 95% basalt glass and lithic basalt chips; the rest serpentinite-gabbro grains and a small fraction of foraminifera.

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395		13	3

cm | Piece Number | Graphic Representation | Orientation | Shipboard Studies | Alteration

0

Cuttings

50

100

150

Cuttings: more than 95% basalt glass and lithic basalt chips; the rest serpentinite-gabbro grains and a small fraction of foraminifera.

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395		13	4

cm | Piece Number | Graphic Representation | Orientation | Shipboard Studies | Alteration

0

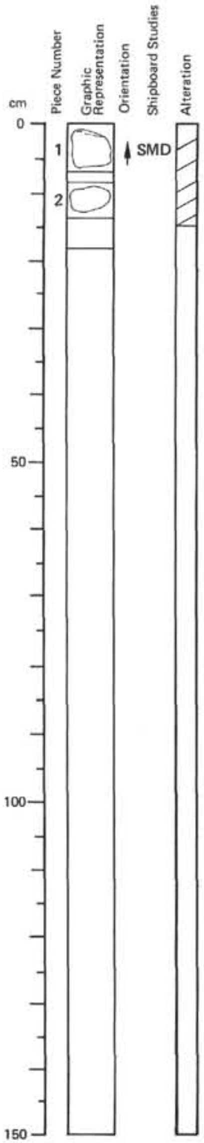
Cuttings

50

100

150

Cuttings: more than 95% basalt glass and lithic basalt chips; the rest serpentinite-gabbro grains and a small fraction of foraminifera.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395		13	CC

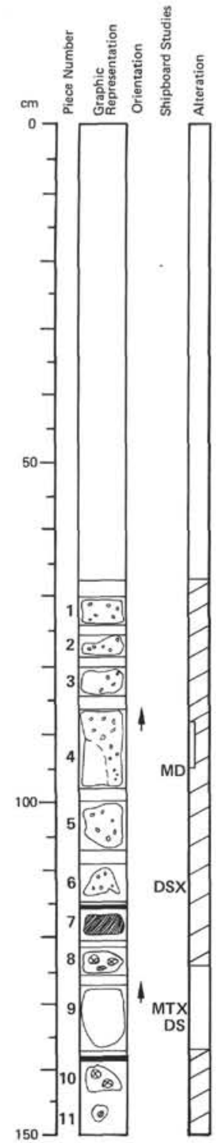
MAJOR ROCK TYPE – BASALT

Macroscopic Description

1) Basalt - aphyric, moderately altered with tiny plagioclase laths visible using a hand lens, fairly uniformly distributed. The plagioclase is most apparent on the round side, where it appears as criss-crossed needles and laths. Groundmass intersertal glass is stained dull orange by weathering. Manganese oxide(?) dendrites occur on the flat lower end. The oblique upper end is a crack surface with a thin layer of ferruginous clays produced by weathering.

2) Basalt - aphyric, slightly finer-grained and more altered than 1; otherwise similar.

	Inc.	NRM	MDF	V_p (∥)	V_p (⊥)	D	P
3-5 cm:	+32°	2.50	75	5.81	5.61	2.09	.047



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395		14	1

MAJOR ROCK TYPE – BASALT

Macroscopic Description

At least three cooling units are represented by this core, with boundaries placed above 7 (fresh glass) and 10 (variolitic basalt). Rocks above 7 are moderately altered for the most part, with small vesicles a millimeter or less in diameter made more prominent by alteration fillings of calcite, ferruginous clays, and dark green clays (saponite?). Vesicles are less noticeable in the fresh portion of piece 4. Tiny needles and laths of plagioclase form radiating and criss-crossed patterns especially visible on the rounded surfaces of pieces 1-4. Piece 7 is nearly glassy, and very fresh except for minor palagonite lining tiny fractures parallel to the exterior (upper?) surface. Variolites occur in pieces 10 and 11, set in an oxidized brownish matrix. Piece 9 is very fresh and coarser-grained than either 8 or 10.

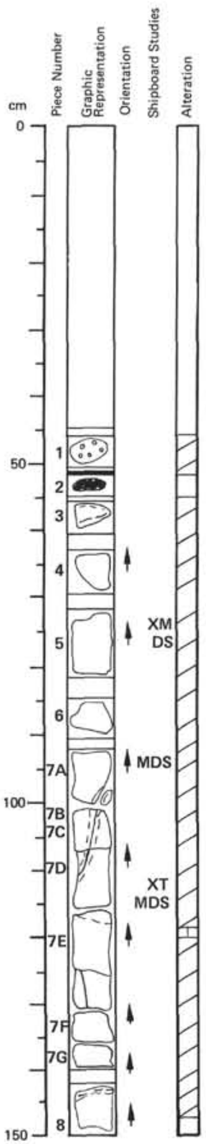
Thin Section Description

131-132 cm (Piece 9): Variolitic basalt, characterized by acicular quench crystals of olivine, with abundant double "swallow-tail" terminations, and tiny needles of plagioclase arrayed in typical variolitic sworls. There are 1-2% olivine microphenocrysts that crystallized before quenching. Quench crystals up to 0.5 mm.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
131-132 cm:												
49.7	14.94	11.97	8.31	10.56	0.13	1.63	1.20	0.58	331	177	120	114
112-114 cm (altered basalt):												
47.01	16.79	13.76	6.64	10.93	0.28	1.83	2.07	0.49	–	–	–	–

	Inc.	NRM	MDF	V_p (∥)	V_p (⊥)	D	P
95-97 cm:	+23°	.853	200	—	—	2.94	.028
130-132 cm:	+23°	.877	350	6.03	5.94	2.93	.030
112-114 cm:	—	—	—	4.37	4.46	2.61	.172

Note: Piece 11 in plastic bag in this liner.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395		15	1

MAJOR ROCK TYPE – BASALT

Macroscopic Description

This entire section may represent a single cooling unit. Piece 2 is volcanic glass with spherulitic fracture and palagonite lining cracks in the glass. Piece 1 is vesicular and closely resembles 3 and 4. It may be out of sequence in the core because both it and 1 are very small and could have been interchanged during drilling. The top of the cooling unit, though, is placed between 1 and 2 because of this ambiguity. The proportion of vesicles decreases from 5% to less than 1% downward from 4 to 7. 7A-7G are a single piece fractured into several fragments. A prominent crack has fairly intensely altered basalt adjacent to it on either side for about 2 cm through several of these fragments. Alteration is primarily oxidation to brownish gray colors. The crack is filled with calcite. The vesicles in 1, 3, 4, and 5 are usually filled with ferruginous clays and/or calcite, although some are empty.

The basalt itself is predominantly aphyric. An olivine phenocryst was found in 7E. Plagioclase needles and laths form radiating and criss-crossed patterns in 7, visible on the rounded side of the pieces with a hand lens.

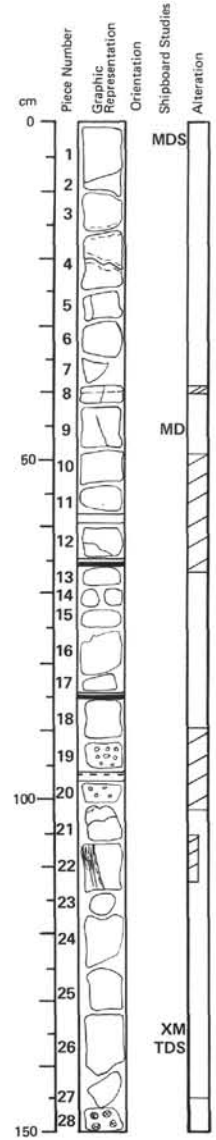
Magnetic inclinations on 7A and 7E are about 10° apart, the largest difference between adjacent samples anywhere in Cores 11-15. But since they are from the same rock, the difference cannot constitute a magnetic break. Rather, it reflects the accuracy of the magnetic data.

Thin Section Description

112-115 cm (Piece 7D): Olivine basalt, with radial aggregates of plagioclase and clinopyroxene. Larger quench crystals of plagioclase are present (An_{75}), and less than 5% olivine microphenocrysts. Acicular opaques are found in the mesostasis. Clay minerals replace rare glass. Plag. = 60%; cpx. = 30%; ol. = 5%; opaques = 5%; glass = TR.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
71-73 cm (altered basalt):												
49.8	15.11	11.76	7.47	10.92	0.25	1.61	4.22	0.56	–	–	–	–
112-115 cm:												
49.1	15.01	12.05	8.57	10.53	0.10	1.62	1.50	0.59	–	167	124	115

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
71-73 cm:	+30°	1.79	75	4.50	4.62	2.67	.141
93-95 cm:	+27°	4.01	60	5.68	5.74	2.94	.028
112-114 cm:	+17°	3.82	<50	5.46	5.42	2.92	.029
147-149 cm:	+16°	5.11	<50	5.51	5.55	2.92	.039



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395		15	2

MAJOR ROCK TYPE – BASALT

Macroscopic Description

Homogeneous fine-grained basalt, fresh to moderately altered. Small plagioclase laths evident on exterior surfaces of many pieces. Cooling unit boundaries are inferred between pieces 17 and 18 (18 is much finer-grained) and between pieces 19 and 20 (18 and 21 are coarser-grained than either). Piece 28 is variolitic and thus may be the bottom of one flow unit or the top of another. The variolites are dark gray circular patches set in a brownish oxidized matrix. Elsewhere in the section, cracks and vesicles are locally filled with clays, calcite, and iron hydroxides, especially the vesicles in 19 and 20. Weathering is prominent adjacent to cracks.

Thin Section Description

130-133 cm (Piece 26): Subophitic basalt with olivine microphenocrysts and well developed radiating quench crystals of plagioclase with intergrowths of clinopyroxene and glass (plagioclase sheaths), 0.2 x 1-3 mm. Plag. is An_{70-75}. Abundant rather large opaques (5%). Minor vesicles (less than 1%). Plag. = 40%; cpx. = 40%; ol. = 5%; opaques = 5%; glass = 10%, altered to brownish clays. Vesicles filled with similar clays.

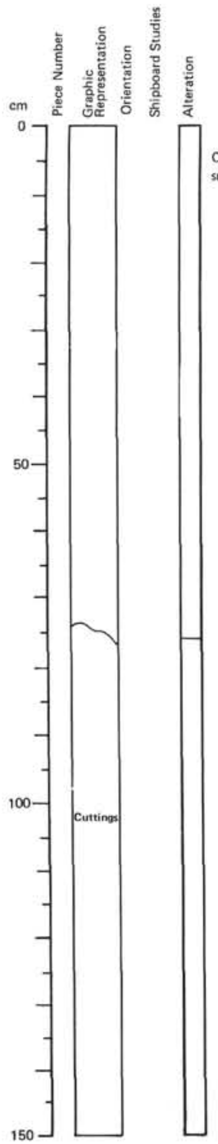
SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
130-133 cm:												
49.0	14.75	12.22	8.46	10.54	0.13	1.62	.82	0.58	323	182	118	116

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
3-5 cm:	+16°	5.56	50	5.34	5.48	2.92	.039
43-45 cm:	+14° *	5.60	75	—	—	2.92	.035
130-132 cm:	+19°	5.43	50	6.02	5.99	2.96	.015

*possible 10° orientation error.

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

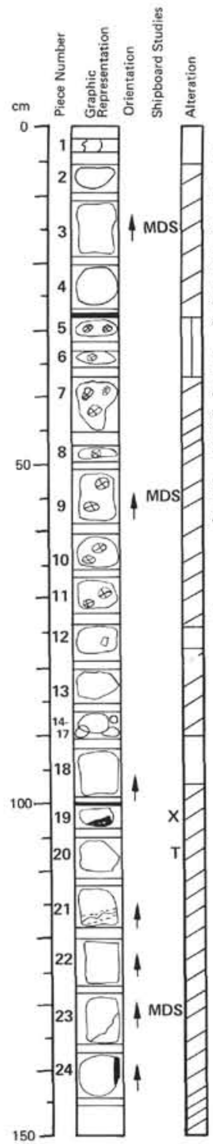
LEG	SITE	HOLE	CORE	SECT.
45	395		16	1



Cuttings: more than 95% basalt glass and lithic basalt chips; the rest – serpentinite-gabbro grains and a small fraction of foraminifers.

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395		16	2



MAJOR ROCK TYPE – BASALT

Macroscopic Description

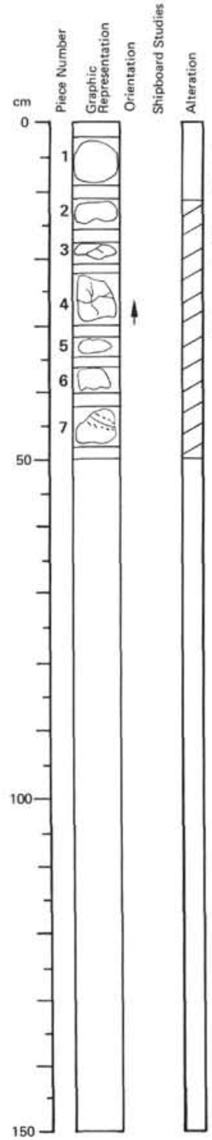
Very fine-grained, aphyric basalt, locally fresh, but generally moderately altered. Small needles and laths of plagioclase form criss-crossed and radiating patterns visible on exterior surfaces of especially pieces 20-24. An 8 mm diameter rounded plagioclase phenocrysts (xenocryst?) occurs in 12. Pieces 5-11 have circular gray variolites set in an oxidized brownish matrix. Cooling unit boundaries are placed between 4, an aphyric basalt, and 5, a variolitic basalt, and above 19, which has a glassy surface. Several cooling units may be represented by 5-11. There is a clay-filled crack with thin zones of altered basalt adjacent to it in 21. Pieces 3, 9, and 23 have similar magnetic inclinations.

Thin Section Description

109-111 cm (Piece 20): Olivine basalt, moderately fine-grained, showing parallel growth of acicular plagioclase and clinopyroxene and scattered radial aggregates of plagioclase sheathing clinopyroxene. The mesostasis is magnetite and clay minerals (devitrified glass?). Vesicles (0.2-1 mm less than 1%) are filled with clay minerals. Plag. = 60%, cpx. = 30%; ol. phenocrysts = 2-3%; opaques = 5%; glass and alteration products = 2-3%. Plag. up to 0.5 mm.

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
104-105 cm:	49.3	14.91	12.26	8.75	10.56	0.12	1.62	+.33	0.59	334	176	118	120

	Inc.	NRM	MDF	Vρ (‖)	Vρ (⊥)	D	P
15-17 cm:	+21°	.970	350	5.73	5.94	2.94	.025
55-57 cm:	+27°	.579	500	—	5.44	2.85	.062
131-133 cm:	+21°	5.48	50	5.61	5.66	2.91	.030



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

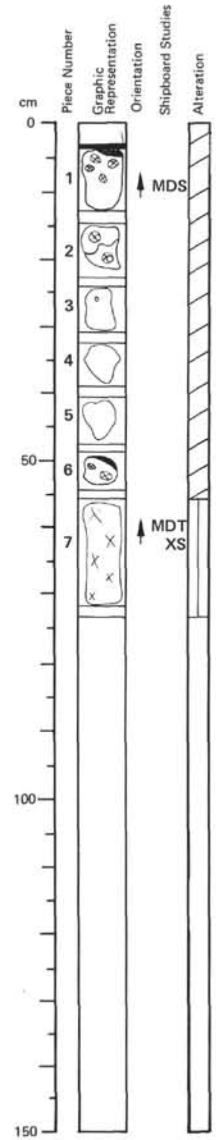
LEG		SITE			HOLE	CORE		SECT.	
4	5	3	9	5			1	6	3

MAJOR ROCK TYPE – BASALT

Macroscepic Description

Very fine-grained, aphyric basalt. Piece 1 is fresh; all others are moderately altered. May represent a single cooling unit beginning with Core 16, Section 2, piece 19. Tiny plagioclase needles are apparent on exterior surfaces. Dark clays fill veinlet-like cracks in piece 4. An alteration zone is adjacent to a crack in piece 7.

Note: This section was not actually recovered, but exists because spacers were added to Sections 1 and 2, requiring shifting of several pieces of basalt into this section.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE	CORE		SECT.	
4	5	3	9	5			1	7	1

MAJOR ROCK TYPES – 0.55 cm BASALT; 55-70 cm GABBRO

Macroscopic Description

Basalt – fine-grained, aphyric, moderately altered. Pieces 1, 2 and 6 are variolitic, with 1 and 6 having glassy rinds. Vesicles form 2-3% of 1; most are filled with clay minerals. Piece 2 contains vugs with drusy linings of secondary minerals, including calcite. Pieces 3-5 have poorly developed variolites. All are interpreted as probably fragments of pillow lavas.

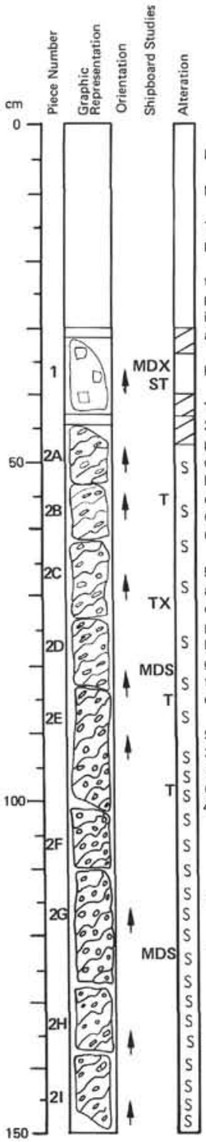
Gabbro – this is the first of the mafic-ultramafic rocks encountered at Site 395. The contact with basalt was not recovered. The gabbro is feldspathic and fairly intensively altered, perhaps hydrothermally. Secondary minerals are abundant, including a vein with a pink mineral. Mafic minerals have been altered to chloritic or clay minerals, and perhaps include secondary amphibole. Grain size is about 0.5-1.5 cm. Shears are common. The gabbro has a much higher magnetic inclination than the basalt.

Thin Section Description

66-68 cm (Piece 7): Altered (recrystallized gabbro), showing granular texture with some relict clinopyroxene augen. Relict clinopyroxene has exsolution lamellae and is bent. Grain size 0.5-2 cm. Hornblende replaces cpx. patchily. Recrystallized clinopyroxene is almost completely altered to sericite, chlorite, and other clay minerals, although twinning is preserved. Many veinlets of clay minerals cut clinopyroxene and altered plagioclase. The original rock is estimated to be recrystallized granular gabbro. Plag. = 40%; cpx. (relict) = 50%; cpx. (recrystallized) = 10%.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
56-69 cm (gabbro):												
50.2	17.71	6.52	12.22	9.32	0.20	0.39	4.9	0.79	207	155	324	16

	Inc.	NRM	MDF	Vp (∥)	Vp (⊥)	D	P
8-10 cm:	+21°	.675	500	5.55	5.51	2.90	.044
66-68 cm:	+47°	.018	500	5.62	6.00	2.69	.022



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395		18	1

MAJOR ROCK TYPES – 33-42 cm BASALT; 42-150 cm SERPENTINIZED PERIDOTITE

Macroscopic Description

Basalt – medium-grained, plagioclase-olivine phyric, moderately altered near upper and lower edges. There are about 15% plagioclase phenocrysts, and about 2% each of phenocrysts of olivine and clinopyroxene. Pyroxene and olivine phenocrysts are about 1 mm; plagioclase up to 0.5 cm.

Serpentinized peridotite – moderately fresh (15-30% serpentinized) peridotite, with large augen up to 10 mm long of enstatite defining a fabric inclined about 45° from the horizontal. The least serpentinized pieces are uppermost (2A-D). Small (1-3 mm) green clinopyroxene grains and chromite are present. Enstatite is much more abundant than clinopyroxene. The matrix is predominantly serpentinized olivine. Plagioclase is absent. The top-most piece of peridotite has about a 1 cm thick organish (7.5YR 6/6) weathered zone.

The basalt is the only rock from Site 395 for which a reversed polarity was determined. The peridotite has no stable remanence.

Thin Section Description

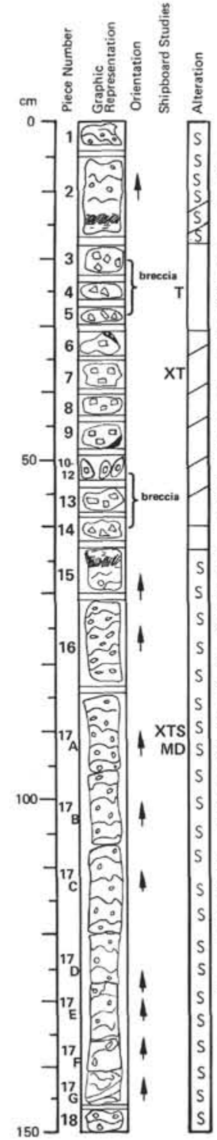
37-39 cm (Piece 1): Plagioclase-olivine phyric basalt. The basalt has sub-ophitic texture with 35% plag. phenocrysts (.3-1.5 mm, An_{80} core, An_{70} rim), showing both normal and rare reverse zoning. Plag. forms clumps up to 10 mm. Large plag. phenocrysts often have partially resorbed (fretted) interior zones with blebs of brown glass or a fine-grained, low birefringent mineral, possibly clay, after glass. Olivine phenocrysts are usually less than 1 mm and are about 5% of the rock. Smaller olivine granules (0.2 mm) are present. Olivine cracks and margins are replaced by olive-green clays (about 10% of the olivine is altered in this way). Clinopyroxene (2V+ = 55-60°) forms 30% of the rock, all in the groundmass.

54-56 cm (Piece 2B), 56-58 cm (Piece 2B), 68-70 cm (Piece 2C), 68-70 cm (Piece 2C), 83-85 cm (Piece 2E), and 98-100 cm (Piece 2E): Serpentinized harzburgite. Six thin sections cut in orientations parallel and perpendicular to foliation on various pieces. Thin sections show 30-50% enstatite augen (2V near 90°), and rare clinopyroxene (pale green, less than 2%) set in a variously serpentinized (15-30%) olivine matrix. Minor (1%) red-brown chrome spinel forms patches at the edges of olivine grains. Olivine is present as large crystals with granular smaller (1 mm) recrystallized olivine at the margins of the larger crystals, or forming bead-like strings through the larger crystals. Rock foliation is pre-serpentinization. Opx. shows Schiller texture and some cpx. exsolution. It is locally bent. Plagioclase is absent. Serpentinite forms sagenitic webs in olivine.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
37-41 cm (basalt):												
49.4	17.32	8.62	8.46	12.58	0.07	1.01	1.4	0.66	381	139	112	67
61-70 cm (serp. harzburgite):												
43.2	0.91	10.25	44.35	0.89	0.00	0.03	7.59	0.89	2228	2370	6	4

	Inc.	NRM	MDF	Vp (∥)	Vp (⊥)	D	P
33-35 cm:	-45°	8.23	100	5.57	5.60	2.88	.036
78-80 cm*:	–	–	–	4.39	4.35	2.88	.054
123-125 cm*:	–	–	–	4.40	4.31	2.80	.050

*No stable remanence. Drilling remanence only.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395		18	2

MAJOR ROCK TYPES – SERPENTINIZED PERIDOTITE, PLAGIOCLASE-PHYRIC BASALT, AND CARBONATE-CEMENTED BRECCIA

Macroscopic Description

The serpentinized peridotite of Core 18, Section 1 continues into this section to about 17 cm (piece 2). It is separated from serpentinite of the lower part of this section (63-150 cm) by a breccia zone the dominant feature of which is basalt, now broken into several pieces (6-13), but originally probably a single rock. Two of the basalt pieces have altered glassy margins, suggesting that the basalt may have been a dike which intruded along the weak breccia zone. Alternatively, the basalt is a boulder within the breccia. The breccia was cored both above and below basalt and itself is about 60-70% plutonic clasts (serpentinite, gabbro), a few basalt clasts, and large plagioclase grains, often quite well rounded. The matrix is recrystallized nannofossil limestone. Only very tiny coccoliths can be seen in smear slides of the matrix, and they are very scarce.

The basalt resembles Core 18, Section 1,piece 1 in being plagioclase-olivine-clinopyroxene (rare) phyric. Phenocrysts comprise up to 30% of the rocks and are up to 0.8 mm in size.

The serpentinite bordering each end of the breccia-basalt zone is intensely altered to a rusty orange color. The altered zones merge with dark serpentinite (nearly black), thence with green serpentinite both above and below. The symmetric alteration zones may have something to do with the possible dike in the breccia zone.

The serpentinitized peridotite below the breccia zone is more serpentinized than that of Core 18, Section 1, but a planar fabric is not apparent in the distribution of augen. The augen are primarily enstatite, but emerald green clinopyroxene up to 5 mm is present as large grains as well. The matrix appears sheared, and is composed of olivine and serpentinite. A calcite vein occurs in 17G.

Thin Section Description

25-28 cm (Piece 4): Breccia, carbonate cemented, containing angular to rounded fragments of serpentinite, plagioclase, and pyroxene crystals. Matrix is recrystallized calcite with faint traces of foram texts and tiny nannofossils (present in smear slides only). Calcite = 70%; serp. = 20%; plag. = 5%; clinopyroxene = 5%. opaques = TR; chromite = TR.

37-38 cm (Piece 7): Plagioclase-clinopyroxene-olivine phyric basalt. Phenocrysts set in sub-variolitic quench sheaf groundmass of feathery plag-cpx-opaques intergrowths. Phenocryst proportions are plag. = 30%, cpx. = 1-2%, ol. = 15%. Olivine-plag. clumps are up to 0.5 cm. Vesicles are less than 1% and filled with clay minerals. Otherwise, the rock is quite fresh. Plag. shows oscillitory, normal, and reverse zoning.

90-92 cm (Piece 17A): Serpentinized peridotite (lherzolite). Augen of orthopyroxene ($2V^+$=80°) up to 1 cm long, are about 60% of the thin section, but only 25% of the rock. Clinopyroxene is 5-10% and serpentinized olivine 60% of the rock. Olivine is generally recrystallized. Both cpx. and opx. contain exsolution lamellae or blebs and show wavy extinction probably due to shearing. Chrome spinel is also present (1%). Over half the olivine is altered to serpentinite.

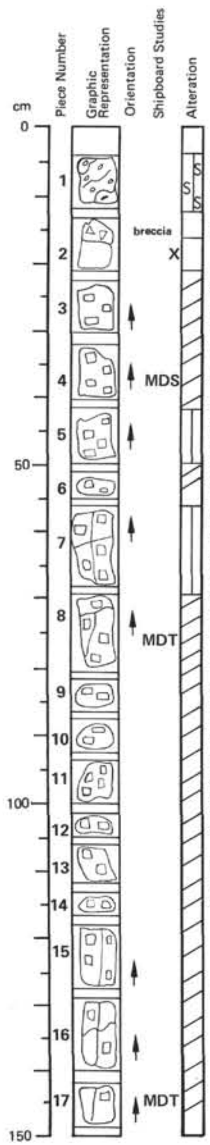
SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
33-38 cm (basalt):												
49.4	18.21	8.37	7.89	12.85	0.13	1.02	.59	0.65	345	130	114	67
85-95 cm (serpentinite):												
43.4	1.37	9.36	42.02	2.09	–	0.04	9.11	0.90	4174	2114	10	1

	Inc.	NRM	MDF	Vp (∥)	Vp (⊥)	D	P
90-92 cm*:	–	–	–	4.89	NG	2.74	.054

*No stable remanence; drilling remanence only.

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395		19	1



MAJOR ROCK TYPE – BASALT (ONE PIECE OF SERPENTINITE)

Macroscopic Description

1) Serpentinite - strongly weathered, with enstatite augen (up to 6 mm) and chromite(?). Abundant calcite veinlets. Orange brown in color.

2) Breccia – calcite-cemented, similar to those of Core 18, Section 2. Has serpentinized peridotite, gabbro, and aphyric basalt fragments up to 3 cm in diameter. The lower portion is a piece of fresh, aphyric, slightly vesicular basalt. The contact with the breccia is sharp, with a thin weathered edge to the basalt colored a pale brown. There are no variolites. The basalt is clearly a clast in the breccia, not a dike, and is not a fine-grained contact to the basalts below.

3-17) Plagioclase-olivine phyric basalt, generally moderately weathered, but locally intensely weathered (5 and 7). Phenocrysts range from 15-30%, and plagioclase predominates. Pieces 7-10 have larger and more abundant plagioclase phenocrysts than those below. Olivine phenocrysts are smaller (about 1 mm) and rarer (less than 1%). There are no clear variations in groundmass texture. All are fairly fine-grained and homogeneous. Thus, there are no obvious cooling unit boundaries in the core. It is not possible to say whether the basalts represent one or more dikes, or extrusive pillow basalts. Unlike the plagioclase-phyric basalts at the top of Core 18, Section 1, these basalts are normally polarized, but with small inclinations. These basalts compare with those of Core 18 by having no clinopyroxene phenocrysts, and by having a somewhat greater percentage of plagioclase phenocrysts.

Thin Section Description

74-77 cm (Piece 9): Porphyritic basalt with abundant plagioclase phenocrysts (30%), and clinopyroxene and olivine microphenocrysts (both about 5%), set in a quench-sheaf matrix of intergrown crystallites of plagioclase and clinopyroxene, plus tiny opaques. Plag. phenocrysts are up to 5 mm, show normal, reverse, and oscillatory zoning, and many are clumped in synneusis twins. Interior zones are sometimes partially resorbed, and filled with dark brown glass. Olivine phenocrysts are locally skeletal, others euhedral. Vesicles (1 mm, 2%) are filled with brownish light green clays.

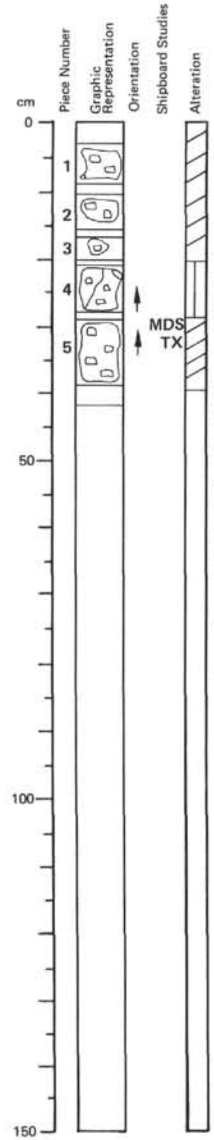
144-146 cm (Piece 17): Porphyritic basalt with abundant plagioclase phenocrysts (20%), olivine phenocrysts and microphenocrysts (5%) and clinopyroxene microphenocrysts (3%), set in a medium-grained basaltic groundmass in which clinopyroxene predominates over plagioclase 3:2. Opaques are about 5% of the groundmass. Plagioclase shows similar range of zoning as piece 9 and has similar resorbtion blebs. One large megacryst has resorbtion cavities filled with fine-grained quench basalt, of an earlier generation than the groundmass surrounding the crystal. Synneusis clumps are moderately abundant, but there are one or two clumps of smaller plagioclase and olivine in about equal proportions. Olivine is now completely altered in these clumps, and is about 50% altered in the rest of the rock, to clays and Fe-hydroxides. Vesicles (0.5-1.5 mm, 1-2%) are mostly filled with brownish clay minerals, locally lined with fine-grained glassy basalt with crystallites of cpx., plag., and magnetite.

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
18-20 cm:	49.8	15.08	11.05	8.53	11.25	0.31	1.65	0.93	0.61	346	141	130	127

	Inc.	NRM	MDF	Vp (∥)	Vp (⊥)	D	P
36-38 cm:	- 6°	1.32	350	5.51	NG	2.81	0.59
77-79 cm:	+11.5°	1.03	600	—	—	2.86	.037
144-146 cm:	+ 3.5°	4.39	75	—	—	2.88	.037

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395		20	1



MAJOR ROCK TYPE – BASALT

Macroscopic Description

Plagioclase-olivine-phyric basalt, fairly fresh, but one piece (4) moderately altered. Plagioclase phenocrysts are large (up to 0.5 cm in glomeroporphyritic clumps), constituting as much as 15% of any piece. Vesicles are less than 1%, and tiny, less than 1 mm. They are often filled with a white interior lining. Vesicles in piece 4 are more noticeable because it is somewhat more altered than the other pieces. Olivine phenocrysts are fairly small (0.2-0.3 cm) and rare (less than 2%). Piece 5 has a small positive magnetic inclination. These basalts resemble those of Core 19, and differ from those of Core 18 by lacking clinopyroxene phenocrysts.

Thin Section Description

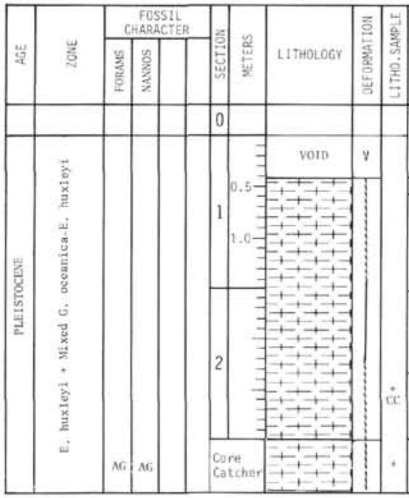
32-38 cm (Piece 5): Porphyritic basalt with phenocrysts of plagioclase (20%), phenocrysts and microphenocrysts of olivine (10%) and microphenocrysts of clinopyroxene (2%) set in a medium-grained basaltic groundmass which has plagioclase to cpx. of 2:1. Plag. phenocrysts are up to 2.5 mm separately, and rarely 1 cm in clumps or synneusis twins. Groundmass plag. is acicular, cpx. is anhedral. Opaques are abundant (8%). Olivine is largely altered to brownish clays in some places, to iddingsite in others. Large olivines sometimes are replaced by carbonate as well as clays and Fe-hydroxides. In one instance, the carbonate is aragonite ($2V^{-}=15°$). Plag. phenocrysts are typically rounded, zoned, corroded, or partially resorbed in interior zones.

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
32-36 cm*:	49.64	18.77	9.52	6.13	12.05	0.30	1.28	1.51	0.56	225	86	162	94

	Inc.	NRM	MDF	Vp (∥)	Vp (⊥)	D	P
28-30 cm:	+8.6°	1.72	450	5.39	5.61	2.82	.045

*Note: K_2O probably reflects alteration.

Site 395 Hole A Core 1 Cored Interval: 4477.67-4487.20 m (2.67-12.20 m subbottom)



LITHOLOGIC DESCRIPTION

FORAMINIFER-NANNOFOSSIL OOZE

10YR 8/3
10YR 5/6

Uniform, highly disturbed foraminifer-nannofossil ooze, brownish yellow to very pale brown in color. This was a punch core attempting to define the mudline. Discoasters are sparse, but present in this core, indicating that it was taken at some depth below the mudline. However, the fossil assemblage indicates that the interval cored is above the topmost core of Hole 395 stratigraphically.

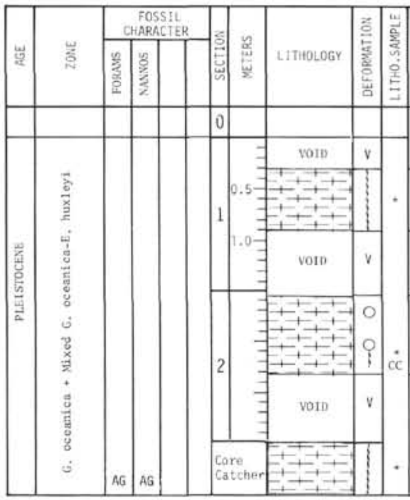
10YR 6/6

Carbon Carbonate

2-100 6.9 0.1 57

10YR 5/6

Site 395 Hole A Core 2 Cored Interval: 44.75-4477.67 m (0.75-2.62 m subbottom)



LITHOLOGIC DESCRIPTION

FORAMINIFER-NANNOFOSSIL OOZE

10YR 5/6

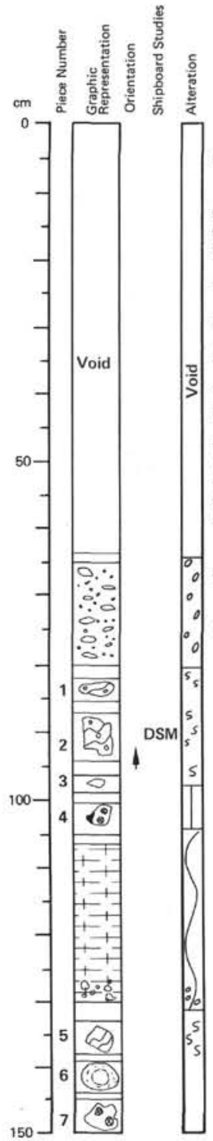
Yellowish brown and brownish yellow intensely deformed foraminifer-nannofossil ooze. This core was taken at a shallower depth than 395A-1 because of indications from the fossil assemblage of 395-1 that the mudline was shallower. Discoasters are not present in this core, indicating that Quaternary sediments were recovered. The mudline was therefore considered to be just above the interval recovered in this core.

10YR 6/6

Carbon Carbonate

2-74 9.0 0.1 74

Explanatory notes in Chapter 1



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	3	1

MAJOR ROCK TYPES – SERPENTINIZED PERIDOTITE AND FINE-GRAINED APHYRIC BASALT

Rounded cobbles and short cored (cylindrical) pieces of serpentinized peridotite and fine-grained, aphyric, generally variolitic basalt embedded in the upper part of the section in drilling cuttings composed of fine-grained aphyric basalt, serpentinized peridotite, and minor foraminifera. Embedded in the lower part in cuttings mixed with pale yellowish brown foraminifera-nannofossil ooze.

Pieces 1, 2, 3, and 5 are variously serpentinized peridotite with orthopyroxene augen up to 1 cm and talcose veinlets.

Pieces 4, 6 and 7 are portions of pillow lavas with large variolites (up to 1 cm) on 4 and 7, and altered margins on 4 and 6. Vesicles are rare and less than 1 mm in the variolitic pieces.

The pieces were removed from their matrix of cuttings and foram-nanno ooze for ease of description and handling.

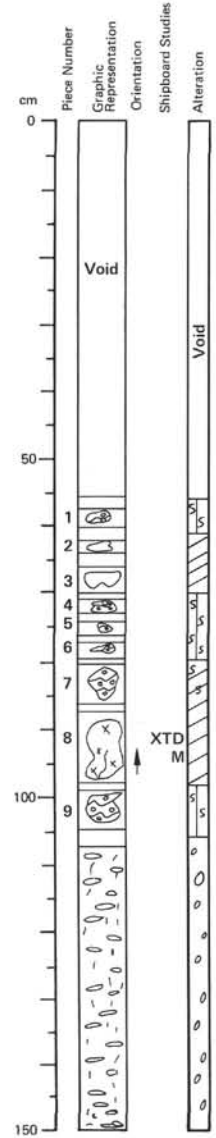
The variolitic basalts are similar to those of the aphyric basalt of Hole 395 and are inferred to represent first contact with basement in Hole 395A. The serpentinized peridotite may represent a talus or gravel layer above basalt, especially since piece 2 appears to have been cored.

Thin Section Description

146-150 cm: Near glassy variolitic basalt. Mats of plagioclase microlites and dust-like titanomagnetite with needles of quench olivine, now altered to iddingsite-like material. Non-variolitic portions of section are brown colored (oxidized) and have finer-grained plag., no opaques. Minor vesicles either unfilled or partially filled with reddish Fe-stained alteration minerals.

	Inc.	NRM	MDF	V_p (∥)	V_p (⊥)	D	P
89-91 cm (Piece 2):	+12.2	1.02	125	3.80	4.14	2.48	8.8

Note: Sequence of pieces in this core has no stratigraphic significance that we can infer.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	4	1

MAJOR ROCK TYPES – SERPENTINIZED PERIDOTITE, FINE-GRAINED APHYRIC BASALT, AND GABBRO

Macroscopic Description

Major rock types were embedded in drilling cuttings. The cuttings were removed from around the rocks for ease of description and handling.

The basalts (pieces 2 and 3) are fine-grained, aphyric and moderately altered, similar to those of Core 3.

The peridotites (pieces 1, 4-7 and 9) are moderately to intensely serpentinized and, beyond that, altered by contact with sea water to some degree. Some enstatite augen are present. Piece 9, the most altered, has relic cataclastic texture cut by numerous magnetite, Fe-oxide and talc-bearing veinlets.

The gabbro (piece 8) has 60-70% fresh to altered feldspar, with the remainder clinopyroxene and other mafics.

The cuttings are primarily aphyric basalt sand and chips with some volcanic glass, serpentinite, and individual mineral grains broken from ultramafic rocks–orthopyroxene and talc, with minor foraminifera.

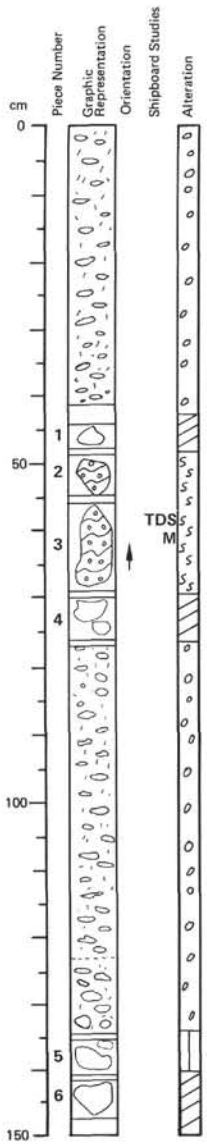
Thin Section Description

95-98 cm (Piece 8): Recrystallized gabbro, granular texture, with some relict clinopyroxenes and feldspar. Plag. (= 60%) is An_{55} and largely mosaic grains about 0.1 mm. Cpx. has 2V+ = 55-60°, about 10% relict and 20% mosaic. Mosaic cpx. interlocked with 2-3% brown or green hornblende and magnetite. Relict cpx. has abundant exsolution blebs and, with mosaic cpx., is arrayed in bands (foliation?). One or two crystals of altered olivine were found. One segment of plag. is altered to a clear, high 2V⁻ radiating mineral with low birefringence (a zeolite?).

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
91-103 cm (gabbro):												
51.6	18.86	7.11	5.5	12.42	0.10	0.81	-1.1	0.60	234	124	36	178

	Inc.	NRM	MDF	V_p (∥)	V_p (⊥)	D	P
99-100 cm (Piece 8):	-10.0	2.47	800	—	—	2.87	–

Note: Sequence of pieces in this section has no stratigraphic significance that we can infer.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

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

MAJOR ROCK TYPES – FINE-GRAINED APHYRIC BASALT, SERPENTINIZED PERIDOTITE AND GABBRO

Macroscopic Description

Major rock types were embedded in drilling cuttings. The cuttings were removed from around the rocks for ease of description and handling. Cuttings mostly basalt, some serp. and forams.

The basalts (pieces 1, 5 and 6) are fine-grained, aphyric, and moderately to intensely altered. No glass rinds or variolite zones are present. Piece 6 has a carbonate vein.

The serpentinized peridotites have large talc grains (after opx. augen) set in a matrix composed of serpentine and talc. Many talcose veinlets are present.

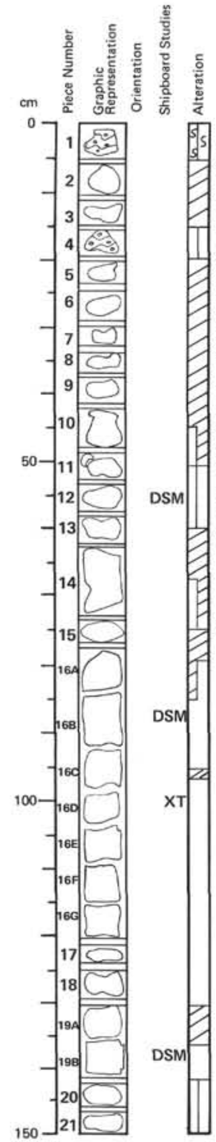
The gabbro (piece 5) is primarily felsic but intensely altered (sausseritized?).

Thin Section Description

58-61 cm: Serpentinized peridotite, with mesh texture of totally serpentinized olivine with enstatic augen. Enstatite shows exsolution lamellae, and is about 40% of the rock. Chrome spinel and chlorite are present in trace amounts.

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
56-58 cm (Piece 3):	–4.0	2.42	75	3.61	3.83	2.47	12.1

Note: Drilling breccia has small pebbles between 125-130 cm. Sequence of pieces in this section has no stratigraphic significance that we can infer.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

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

MAJOR ROCK TYPES – FINE-GRAINED APHYRIC BASALT WITH ONE PIECE OF SERPENTINIZED PERIDOTITE

Macroscopic Description

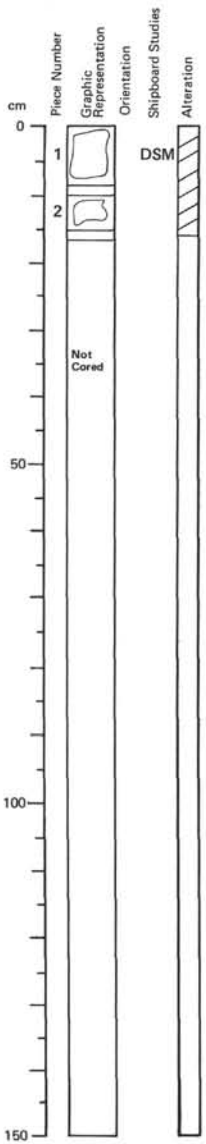
Serpentinized peridotite (pieces 1 and 4) – similar to those of Cores 3 and 4; have enstatite augen. Lithologic Unit 1 ends at base of piece 4. Enstatites in 4 are altered to talc. Fine-grained aphyric basalt (pieces 2, 3 and 5-21) – moderately to intensely altered for the most part, but fresh especially in pieces 16-18. Basalt is generally fine-grained, but no glassy zones or variolitic zones are present. Piece 16 has long quench crystals of plagioclase in sub-radiating sheafs, and small crystals of olivine. It is unusually coarse-grained for this type of basalt. Vesicles are small (less than 1 mm) and minor (less than 1%) and are more evident in altered pieces where they are filled with greenish clays (pieces 2 and 10-15). A carbonate vein occurs in piece 16D. Vesicles in piece 20 are filled with yellow brown to pale yellow brown materials, mostly clays.

Thin Section Description

100-103 cm: Aphyric olivine basalt. Plag. in radiating or sub-radiating arrays, sheathing cpx. Plag. = 55%, cpx. = 30%, ol. = 20%, tithanomagnetite = 5%, glass = TR (visual estimates). Ol. microphenocrysts = 10%. Plag. 0.8-2 mm long. Texture is intersertal. Interstitial glass is altered to brown clay minerals. Trace vesicles are filled with clay minerals.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
100-103 cm (aphyric basalt):												
49.4	14.87	12.20	8.8	10.53	0.10	1.62	–0.9	0.59	298	173	121	113

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
56-58 cm (Piece 12):	–	.161	–	4.78	4.95	2.74	10.8
89-91 cm (Piece 16B):	+38.8	3.52	60	5.89	5.89	2.93	2.6
138-140 cm (Piece 19B):	+27.3	2.42	80	5.59	5.70	2.93	3.1



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

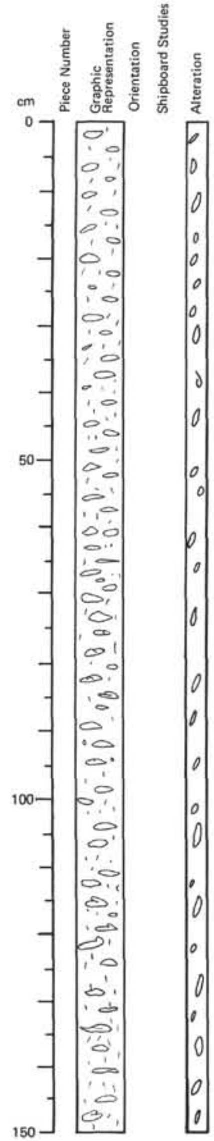
LEG	SITE	HOLE	CORE	SECT.
45	395	A	5	2

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Similar to those of Section 1. Moderately altered. Vesicles (about 2%) filled with dark green clays(?).

	Inc.	NRM	MDF	Vp (∥)	Vp (⊥)	D	P
6-8 cm (Piece 1):	+41.3	2.52	60	5.63	5.49	2.92	3.5

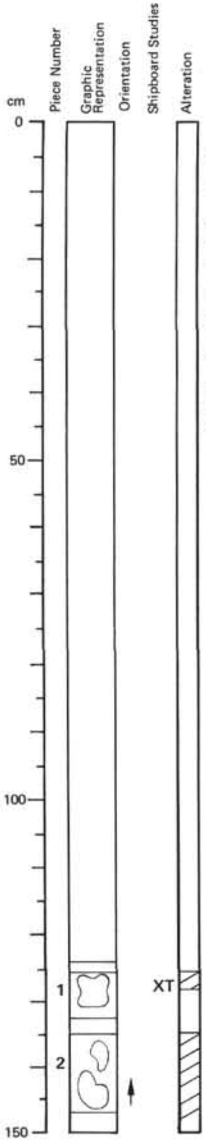
Note: This section exists because spacers were placed in Section 1, forcing these two pieces into a separate liner. No core exists below 15 cm.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	5A	1-4

Sections 1-4 are drill cuttings obtained when bit and core barrel both became stuck in the hole with the 14" diameter core bit prior to setting casing. They came from the same interval as Core 5, hence are called Core 5A. Cuttings consist mainly of angular grains and fragments of basalt, basalt glass, and minor foraminifera.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	6	1

MAJOR ROCK TYPE – BASALT

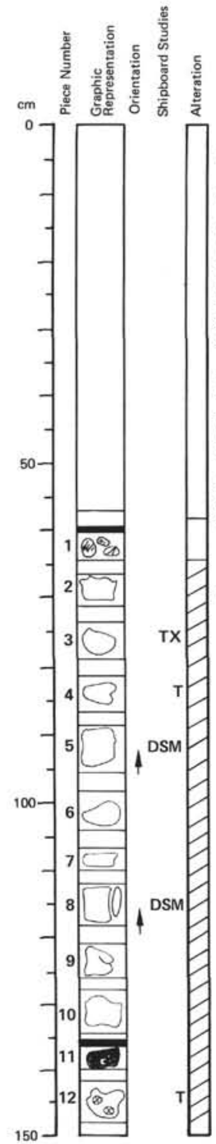
Macroscopic Description

Medium-grained aphyric basalt with elongate plagioclase laths interlocked with clinopyroxene (1-2 mm) and rare olivine microphenocrysts. Sub-variolitic texture. Piece 2 is coarser-grained than 1. The upper half of 1 and all of 2 are moderately altered. Vesicles (rare, less than 1 mm) are filled with greenish gray clay minerals. Olivine microphenocrysts are altered to reddish-brown minerals.

Thin Section Description

130-134 cm: Aphyric olivine basalt, intersertal, partly subvariolitic texture. Plag. = 60%, cpx. = 30%, ol. = 12%, some as microphenocrysts. Plag. is acicular, very slender and elongate, locally with splayed ends. Some glass present in trace amounts altered to orange clays similar to palagonite.

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
130-134 cm (aphyric basalt):	49.6	15.19	12.03	8.5	10.60	0.16	1.64	-1.9	0.58	315	177	122	107



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	7	1

MAJOR ROCK TYPE – APHYRIC FINE-GRAINED BASALT

Macroscopic Description

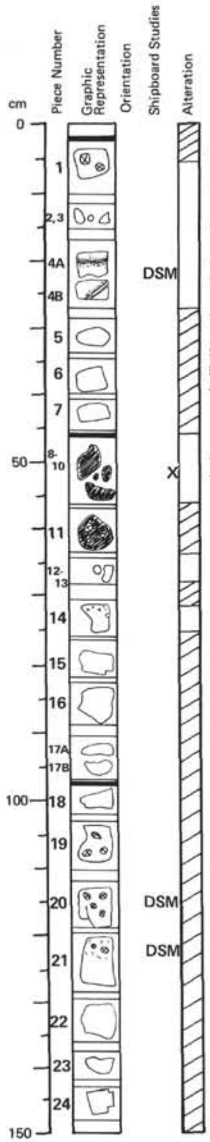
Fine-grained aphyric basalt containing small olivine microphenocrysts on coarser-grained pieces. Elongate olivine crystallites visible in pieces 1 and 4. Piece 12 is variolitic. Vesicles are small (less than 1 mm) and between 1 and 5%. They are filled with clay and/or carbonate in 2, 3, 5, 6, 7, 8, 9, and 10. Piece 11 is glassy, and has minor palagonite. Pieces 1-10 appear to be a single cooling unit, finer-grained toward the top and bottom. An important textural feature is that elongate quench olivine crystallites are visible in the finer-grained (glassy to near glassy) pieces, but plagioclase is more prominent in the coarser-grained pieces. It is acicular and sub-radiating, and associated with euhedral olivines without skeletal extensions.

Thin Section Description

76-80 cm (Piece 3): Quench olivine with c-axis elongate skeletal extensions up to 0.4 mm. Plag. present as much smaller acicular needles in sub-parallel sheafs or mats, with tiny titanomagnetite "dust". Vesicles (0-0.5 mm) are filled with pale green clay minerals. Groundmass form subvariolitic.
82-86 cm (Piece 4): Virtually identical to previous thin section.

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
76-82 cm (aphyric basalt):	49.4	14.92	12.27	8.4	10.61	0.17	1.63	-1.0	0.57	332	186	122	111

	Inc.	NRM	MDF	$V\rho$ (∥)	$V\rho$ (⊥)	D	P
94-96 cm (Piece 5):	–	–	–	5.48	5.25	2.83	6.9
113-116 cm (Piece 8):	–	–	–	4.79	5.61	2.87	6.0



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	8	1

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

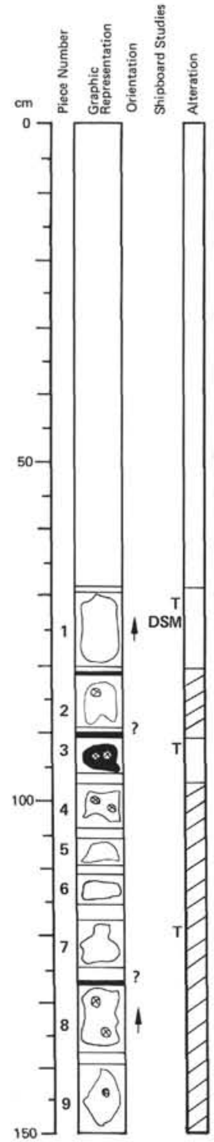
Macroscopic Description

Fine-grained aphyric basalt, ranging from glassy to subvariolitic in texture, moderately altered except for the glassy pieces and small portions of the more massive pieces. Weathered edges next to cracks in 4, 14 and 21. Vesicles are small (less than 1 mm) and minor (about 2% or less), usually filled with clays. Quench olivine is the most prominent mineral in the glassy and variolitic pieces. Variolites are large (up to 1 cm) and set in an oxidized brownish matrix.

Cooling unit boundaries are placed above 1, 8 and 18 so there are a minimum of three cooling units represented by this core.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
50-52 cm (aphyric basalt):												
49.1	14.89	12.49	8.4	10.49	0.13	1.64	-0.1	0.57	331	178	117	111

	Inc.	NRM	MDF	Vp (∥)	Vp (⊥)	D	P
20-22 cm (Piece 4A):	–	–	–	5.50	NG	2.89	5.4
114-116 cm (Piece 20):	–	–	–	5.45	5.36	2.89	5.1
124-126 cm (Piece 21):	–	–	–	5.45	5.39	2.85	6.2



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	9	1

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description (for 9-1 and 9-2)

Fine-grained aphyric basalt, ranging from glassy to subvariolitic in texture, moderately altered except for the glassy pieces and small portions of the more massive pieces. Vesicles are small (less than 1 mm) and minor (2% or less), usually filled with clays. Quench olivine is apparent in the glassy and variolitic pieces. Variolitic pieces are unusually abundant in both sections, suggesting that a large number of thin flows were drilled and only partially cored. Assignment ofcooling unit boundaries is difficult because of this, but are tentatively placed above pieces 2, 3 and 8 of Section 1 and pieces 4 and 8 of Section 2. These represent the minimum number of cooling units.

Thin Section Description

68-70 cm (Piece 1): Subvariolitic aphyric olivine basalt. Plag. quench crystals up to 2.5 mm long sheathing cpx. in radiating clusters nucleating around olivine microphenocrysts in places. Ol. locally altered to iddingsite, intersertal glass to orange-colored clays.

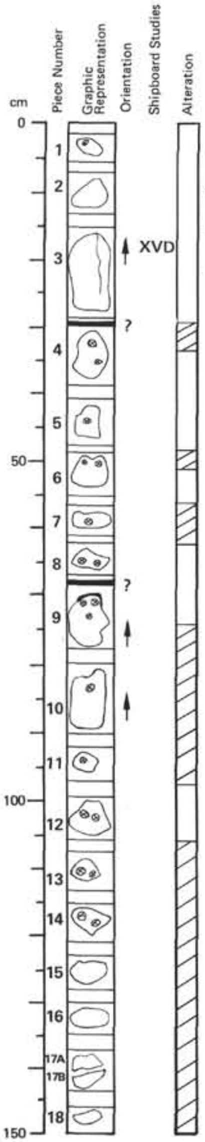
81-83 cm (Piece 3): Much finer-grained than above thin section with radiating bundles of extremely acicular plagioclase, and olivine quench crystals with very long c-axis skeletal extensions (up to 0.5 mm). Has abundant dustlike titanomagnetite.

119-123 cm (Piece 7): Subvariolitic fine-grained basalt, similar to section of piece 3. Olivine has similar skeletal extensions.

	Inc.	NRM	MDF	Vp (∥)	Vp (⊥)	D	P
70-72 cm (Piece 1):	–	–	–	5.69	5.78	2.92	3.2

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	9	2



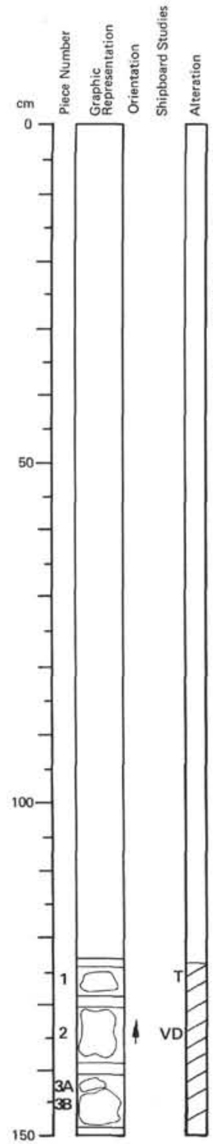
Described under 395A-9-1.

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
18-21 cm (aphyric basalt):	49.4	15.14	12.20	8.5	10.65	0.11	1.64	-0.7	0.58	328	193	120	112

	Inc.	NRM	MDF	V_p (∥)	V_p (⊥)	D	P
18-20 cm (Piece 3):	–	–	–	5.49	5.87	2.94	2.4

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	10	1



MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

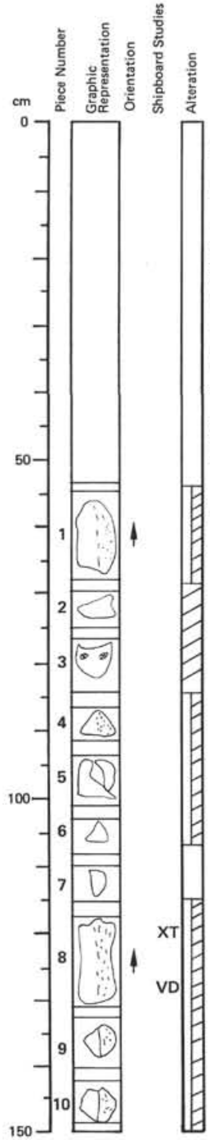
Macroscopic Description

Very fine-grained moderately weathered basalt with a few small vesicles. Elongate quench olivines visible on weathered edge of 1, not as prominent in other pieces. Vesicles have linings of green clays.

Thin Section Description

120-128 cm (Piece 1): Subvariolitic texture; mats of fine acicular plagioclase and dustlike titanomagnetite. Plag. often sheaths cpx. Quench olivines with skeletal extensions are abundant. Plag. = 45%; cpx = 40%; ol. = 10%; titanomagnetite = 2% (visual estimates).

	Inc.	NRM	MDF	V_p (∥)	V_p (⊥)	D	P
132-134 cm (Piece 2):	–	–	–	5.65	5.43	2.89	6.0



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	11	1

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

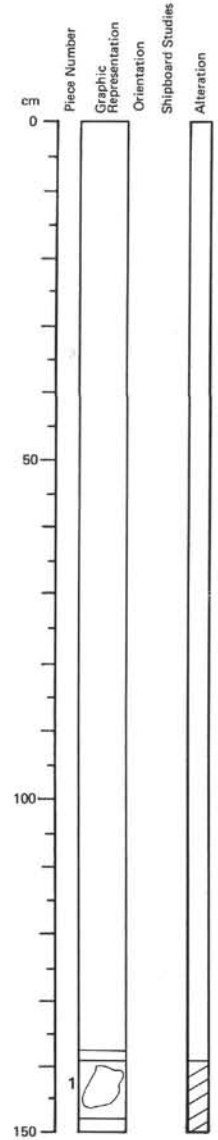
Fine-grained, aphyric, moderately altered basalt of fairly uniform texture, somewhat coarser-grained than subvariolitic except for 3, which has small variolites (at least for this type of basalt). Piece 3 contains quench needles of olivine. All others have somewhat felty-textured fine acicular plagioclase (visible using a hand lens or binocular microscope). Vesicles are small (less than 1 mm) and minor (less than 1%) and are usually lined with yellow-brown or green clays. Most intense weathering follows cracks or edges of pieces.

Thin Section Description

117-128 cm (Piece 8): Subvariolitic basalt with skeletal olivine microphenocrysts set in an acicular plagioclase-cpx.-"dustlike" titanomagnetite groundmass. Plag. sheaths cpx. and is arrayed in sub-parallel swaths or radial clusters. Clays present after glass between groundmass crystals.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
117-129 cm (aphyric basalt):												
49.8	15.06	12.65	8.6	10.74	0.16	1.65	-1.3	0.57	307	176	124	108

	Inc.	NRM	MDF	$V\rho$ (∥)	$V\rho$ (⊥)	D	P
129-131 cm (Piece 8):	–	–	–	5.62	5.86	2.93	2.7



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

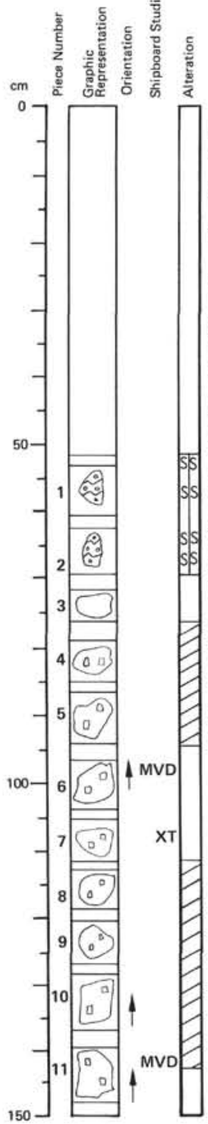
LEG	SITE	HOLE	CORE	SECT.
45	395	A	12	1

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Fine-grained, aphyric, moderately altered basalt. Olivine alteration visible – brown specks. Mn-oxide specks visible on one surface. Angular piece. Subvariolitic in part.

Note: Lithologic Unit 2 ends at the bottom of this core.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	13	1

MAJOR ROCK TYPES – SERPENTINIZED PERIDOTITE, FINE-GRAINED APHYRIC BASALT, AND PLAGIOCLASE-OLIVINE PHYRIC BASALT

Macroscopic Description

Serpentinized peridotite (pieces 1 and 2) – 1 is green, about 80% serpentinized and has partially altered enstatite augen. Piece 2 is similar texturally to 1 but has been intensely oxidized and/or weathered to a yellow brown color (due to goethite after magnetite?).

Fine-grained aphyric basalt (piece 3) – very dark gray, fresh basalt with no visible crystals. Small angular piece.

Note: This sequence is identical to the lowest part of the carbonate-cemented serpentinite breccia of Hole 395, except the carbonate breccia matrix is absent. This may be due to low recovery in this core. In both Holes 395 and 395A there is a serpentinite breccia or gravel zone between the upper aphyric basalts (Lith. Unit 2) and the plagioclase-olivine phyric basalts of Unit 4. The breccia is given a separate designation - Unit 3.

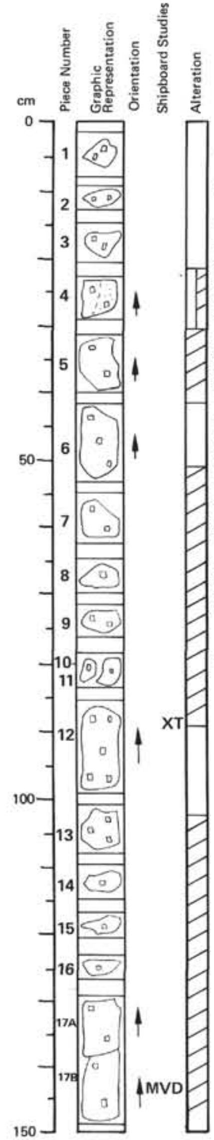
Plagioclase-olivine phyric basalt (pieces 4-11) – has 15-30% phenocrysts of plagioclase up to 1 cm in size (mostly aggregates when that large) and 1-2% olivine phenocrysts up to 0.3 cm, set in a fine-grained basaltic groundmass. Rocks are fresh to moderately altered. Vesicles are less than 1% and rarely more than 1 mm in diameter, usually filled with pale green clays.

Thin Section Description

100-110 (piece 7): Pl.-ol. phyric basalt, intersertal to subophitic groundmass. Abundant plag. phenocrysts with skeletal interiors, normal, reverse, and oscillatory zones. Skeletal interiors have finer-grained (nearly subvariolitic) blebs. Plag. phenocrysts = 10%, groundmass = 35%; cpx., groundmass only = 40%; ol. phenocrysts = TR, groundmass = 2%. "Mesostasis" consists of feathery cpx.,plag., and opaques. Vesicles are filled with carbonate or clay minerals, and are sometimes lined with "glassy" zones with cpx., plag., and opaques. May be good orientation indicators.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
106-110 cm (plagioclase-olivine phyric basalt):												
49.9	18.64	8.37	6.5	12.62	0.15	1.39	-2.1	0.61	198	134	166	98

	Inc.	NRM	MDF	Vρ (‖)	Vρ (⊥)	D	P
97-99 cm (Piece 6):	+26.7	.855	500	5.54	5.46	2.86	5.0
140-142 cm (Piece 11):	+22.6	2.54	275	5.26	5.58	2.86	3.6



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	14	1

MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE PHYRIC BASALT

General Macroscopic Description of Cores 14 and 15

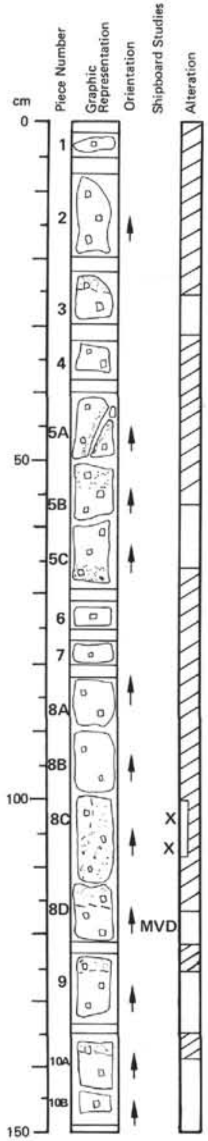
Beginning with Core 13, Section 1, 80 cm (piece 4) is a single, massive, fairly homogeneous cooling unit that encompasses all of Core 14 and most of Core 15. The basalt is gray, plagioclase and olivine phyric. It is fairly fresh, but with moderate alteration in patches, especially adjacent to cracks which often are the upper, lower, or side edges of pieces. There are up to 25% plagioclase phenocrysts and glomerocrysts up to 1.5 cm. Phenocryst abundance varies, not progressively, but in irregular zones or patches. In addition to large plagioclase phenocrysts are finer acicular plagioclase crystals in the groundmass. Olivine is not as abundant (2-3%) but fresh crystals are evident, some in clusters up to 3 mm diameter. Small vesicles 1-2 mm in diameter are filled with pale green or orange colored clays and are scattered throughout. There are a few carbonate veinlets in pieces 6B and 6I of Core 14, Section 3 but these are the only ones noted in Cores 14 and 15. Olivine is generally altered to red-stained clays in the more altered portions of the rocks, especially next to cracks.

Thin Section Description

90-100 cm (Piece 12) – Intersertal/subophitic porphyritic basalt. Plag. phenocrysts 15%, groundmass 55%; clinopyroxene phenocrysts = none, groundmass = 40%; olivine phenocrysts = TR, groundmass 3%; titanomagnetite = 3%; "mesostasis" (consists of feathery cpx., acicular opaques and plagioclase laths) = 5%. Plagioclase megacrysts include some with skeletal interior zones (fine-grained, nearly glassy included blebs), or have multiple zones. All usually have an outer zone. Crystallization sequence for this rock is plag. + ol. first, then cpx. and plag. in the groundmass, and finally titanomagnetite (which is quite skeletal).

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
92-99 cm (plag.-olivine phyric basalt):												
49.2	17.81	9.43	7.1	11.97	0.11	1.36	-1.6	0.60	198	88	160	97

	Inc.	NRM	MDF	Vρ (‖)	Vρ (⊥)	D	P
139-144 cm (Piece 17B):	+19.8	4.42	150	5.55	5.57	2.87	3.6



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	14	2

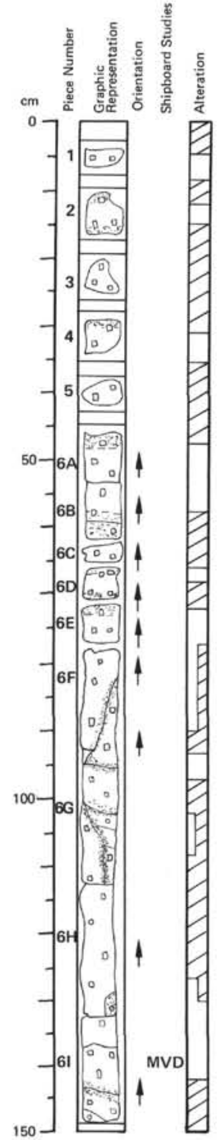
MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE PHYRIC BASALT

Macroscopic Description

Given in Core 14, Section 1.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
98-112 cm (plag.-olivine phyric basalt):												
49.5	18.28	8.94	6.9	12.10	0.08	1.33	-1.8	0.60	191	89	162	95
98-112 (altered – plag.-olivine phyric basalt):												
49.0	17.93	9.24	6.1	12.11	0.20	1.36	-2.0	0.57	203	110	171	99

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
116-118 cm (Piece 8D):	+17.7	1.87	110	5.65	5.37	2.85	4.3



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

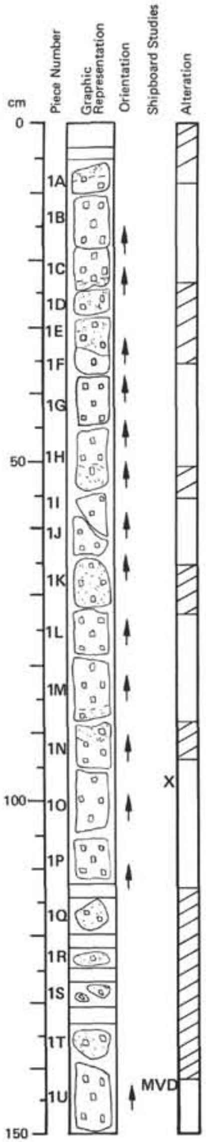
LEG	SITE	HOLE	CORE	SECT.
45	395	A	14	3

MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE PHYRIC BASALT

Macroscopic Description

Given in Core 14, Section 1. Carbonate veinlets in 6B and 6I.

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
138-140 cm (Piece 6I):	+21.8	4.59	90	5.52	5.61	2.91	2.4



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	15	1

MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE PHYRIC BASALT

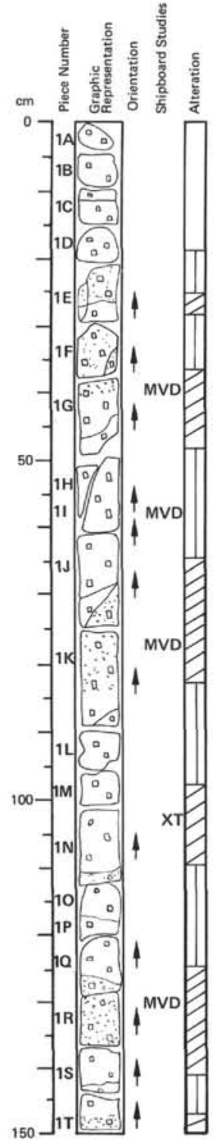
General Macroscopic Description

Given in Core 14, Section 1. A single olivine phenocrysts 6 mm in length is present in piece 1O.

93-102 cm (plag.-olivine phyric basalt):

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
49.7	18.25	9.40	7.3	12.10	0.09	1.34	–1.9	0.61	203	98	160	100

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
142-144 cm (Piece 1U)	+19.2	3.96	150	5.72	5.60	2.86	4.0



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	15	2

MAJOR ROCK TYPE – PLAGIOCLASE OLIVINE PHYRIC BASALT

Macroscopic Description

Given in Core 14, Section 1. Cracks in 1E, 1F, 1G, 1J, and 1K filled with brown alteration products, others with carbonate(?). Vugs as well as vesicles in 1Q-T.

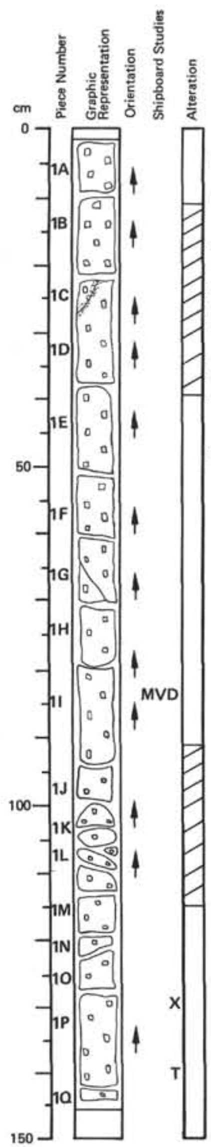
Thin Section Description

102-104 (Piece 1N): Fine-grained plagioclase-olivine phyric basalt, porphyritic texture with intersertal groundmass, plag. (1-5 mm) phenocrysts = 15%, groundmass = 40%. Olivine phenocrysts (0.5 mm) = about 1%, groundmass 10%. Cpx. groundmass = 35%, titanomagnetite 1-3% (visual estimates). Vesicles present up to 1.5-2 mm filled either with devitrified glass or dark brown alteration products. Devitrified glass present as blebs in large skeletal plagioclase phenocrysts.

102-108 cm (plag.-olivine phyric basalt):

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
50.2	17.97	9.73	6.8	12.01	0.10	1.39	–2.1	0.58	197	93	155	97

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
39-41 cm (Piece 1G):	+26.5	4.30	150	5.53	5.51	2.85	4.1
55-57 cm (Piece 1H):	+31.6	4.81	75	5.49	5.31	2.84	4.7
76-78 cm (Piece 1K):	+28.5	6.27	50	5.45	5.31	2.84	4.7
128-130 cm (Piece 1R):	+33.3	6.42	<50	5.72	5.55	2.85	4.2



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	15	3

MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE PHYRIC BASALT

Macroscopic Description

Given in Core 14, Section 1.

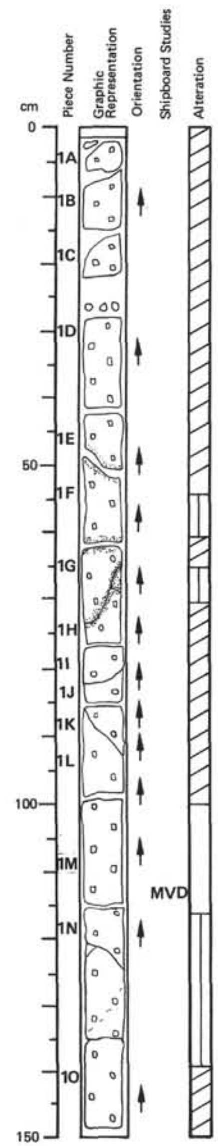
Thin Section Description

146-150 cm (Piece 1P): porphyritic intersertal fine-grained plagioclase-phyric basalt. Plag. phenocrysts = 25%, olivine phenocrysts = less than 1%. Groundmass plag. = 40%, cpx. = 30%, titanomagnetite = 5% (visual estimates), plag. = An_{60-70}. Vesicles form up to 2% of the rock. Some are partly filled with devitrified glass. Others are filled with yellow-gray clay minerals.

128-142 cm (plag.-olivine phyric basalt):

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
49.9	17.72	9.91	7.3	12.15	0.11	1.37	-1.2	0.59	195	91	160	97

	Inc.	NRM	MDF	Vρ (‖)	Vρ (⊥)	D	P
83-85 cm (Piece 1I):	+39.0	6.48	<50	5.60	5.51	2.87	3.7



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

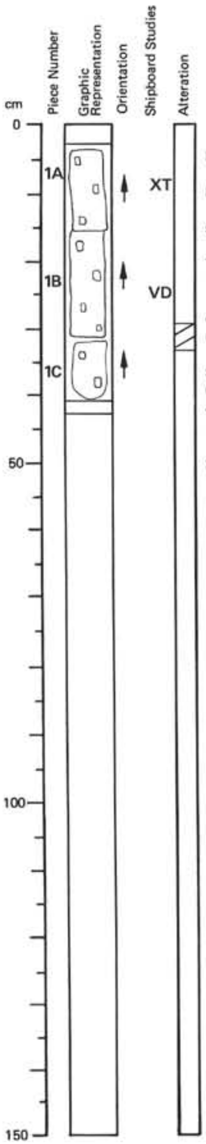
LEG	SITE	HOLE	CORE	SECT.
45	395	A	15	4

MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE PHYRIC BASALT

Macroscopic Description

Given in Core 14, Section 1.

	Inc.	NRM	MDF	Vρ (‖)	Vρ (⊥)	D	P
113-115 cm (Piece 1M):	+35.8	8.18	<50	5.61	5.59	2.87	3.4



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	15	5

MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE PHYRIC BASALT

Macroscopic Description

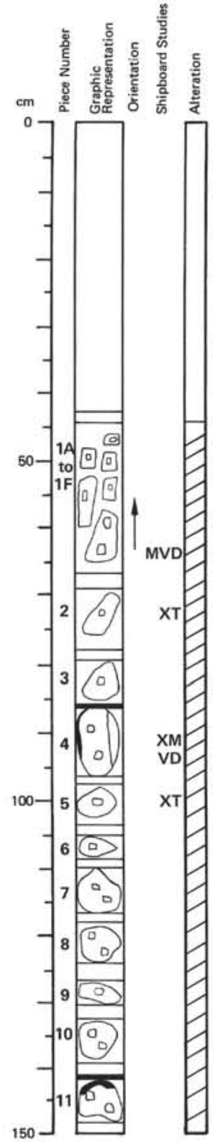
Given in Core 14, Section 1. Plag. and olivine present oftimes as clumps. Olivine associated with minor spinel(?). The pieces in this section are located here because of addition of spacers to Sections 3 and 4.

Thin Section Description

15-19 cm (Piece 1A): Plagioclase-olivine phyric basalt with intersertal groundmass texture. Plag. phenocrysts 15%, olivine phenocrysts about 1%. Plag. groundmass 45%, cpx. 25%, ol. 10%, titanomagnetite 1-2% (visual estimates). Plag. phenocrysts up to 3 mm in size, ol. up to 1 mm. Vesicles up to 0.5 mm filled with clay minerals.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
0-11 cm (plag.-olivine phyric basalt):												
49.1	19.17	8.49	7.0	12.16	0.07	1.16	-1.4	0.62	182	95	158	84

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
24-26 cm (Piece 1B):	–	–	–	5.78	5.76	2.87	2.9



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	16	1

MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE PHYRIC BASALT

Macroscopic Description

Plagioclase olivine phyric basalt, 10-25% plagioclase phenocrysts up to 5 mm and even larger plagioclase clumps. Olivine up to 3 mm but much more rare (1-2%). Olivine usually altered to brown materials but fresh in 4, 5, and 6. Pieces 4 and 11 have glassy portions. Pieces 4 through 11 may thus be a single cooling unit, although 7 and 9 have slightly vitric portions. Calcite veins separate the portions of 1 and are present as well in 2.

Thin Section Description

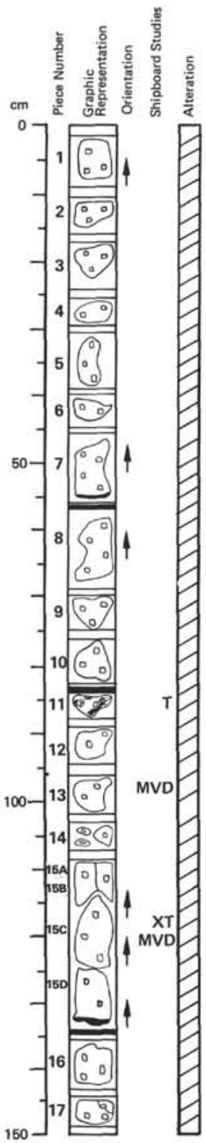
69-74 cm (Piece 2): Fine-grained plagioclase-olivine phyric basalt porphyritic with intersertal groundmass. Plag. phenocrysts 15%, groundmass 40%; olivine phenocrysts less than 1%, groundmass 10%; cpx. groundmass 30%, titanomagnetite 3% (visual estimates). Plag. phenocrysts 2-5 mm, ol. phenocrysts 1-1.5 mm. Extent of alteration not noted.

100-104 cm (Piece 5): Plagioclase-olivine-clinopyroxene phyric basalt, with porphyritic texture and glassy groundmass containing quench plagioclase and cpx. Plag. phenocrysts + 25%, groundmass 15%; olivine phenocrysts 10%, groundmass 5%; cpx. phenocrysts trace, groundmass 5%; titanomagnetite 1%; glass 40% (visual estimates). Groundmass glass somewhat oxidized; rare vesicles present.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
69-74 cm:												
50.3	17.74	9.61	6.7	12.01	0.18	1.40	-2.0	0.58	203	104	202	93
90-98 cm:												
48.8	17.84	8.94	7.5	12.67	0.12	1.05	-0.7	0.62	391	134	115	66
100-104 cm:												
49.5	17.36	8.67	7.8	12.57	0.12	1.07	-0.5	0.64	389	144	115	66

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
63-65 cm (Piece 1F):	+39.0	4.52	75	5.69	5.68	2.86	3.5
89-91 cm (Piece 4):	unoriented	3.75	600	5.53	5.51	2.88	–

Note: Although cpx. phenocrysts were not noted in the hand specimens, it is possible that the boundary between plagioclase-olivine phyric basalts (Lithologic Unit 4, Chemical Unit P_3), and plagioclase-olivine-clinopyroxene phyric basalts (Lithologic Unit 5, Chemical Unit P_4) is between pieces 3 and 4, since piece 5 has a small proportion of cpx. phenocrysts in thin section.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	17	1

MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE-CLINOPYROXENE PHYRIC BASALT

Macroscopic Description

Plagioclase phenocrysts up to 5 mm, 15-25%; olivine varies from 3-5 up to 10% (3 mm), cpx. TR-0.5% up to 5 mm. Olivine mainly altered to brown materials, but fairly fresh in 2, 3, 4, 5, and 6. Glass zones present at bottom of 7 and 15D, and 11. In 11, the glassy rim shown brown alteration. Piece 17 has a white-yellow incrustation (clays?) at the surface. The entire core is minimally moderately altered. Note at least 3 cooling unit boundaries in this core.

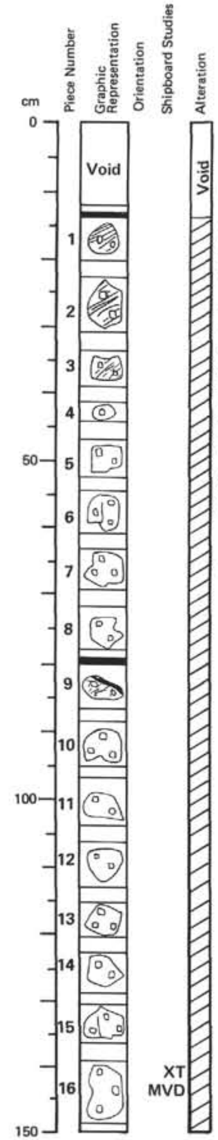
Thin Section Description

85-87 cm (Piece 11): Plag.-olivine-cpx. phyric basalt, vitrophyric groundmass. Plag. phenocrysts 25%, groundmass 2%; cpx. phenocrysts 2%; ol. phenocrysts 5%; glass 65%. Plag. 0.5-3 mm; cpx. 0.2-0.5 mm; ol. 0.2-1 mm. Glass is fresh, very pale brown, partly palagonitized, grading to dark brown spherulitic texture. Large plag. phenocryst is present with brown glass inclusions. Most plag. phenocrysts are at least partly skeletal, and many have an outer "quench" zone.

115-124 cm (Piece 15C): Plag.-olivine-cpx. phyric basalt with a spherulitic groundmass. Plag. phenocrysts 10%, microhpenocrysts 7%, groundmass 5%; cpx. microphenocrysts 3%, groundmass 20%, ol. phenocrysts 3%, microphenocrysts 3%, groundmass TR (visual estimates). Ol. difficult to estimate because some large phenocrysts are apparently plucked. Some plag. phenocrysts have included blebs of glass (skeletal texture). The mesostasis (50%) has feathery cpx., plag., and titanomagnetite; devitrified glass). Plag. up to 3 mm, ol. up to 3 mm, cpx. up to 0.5 mm in size.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
115-124 cm (plag.-olivine [pyroxene] phyric basalt):												
49.9	17.84	8.49	7.2	12.82	0.12	1.04	–2.0	0.63	357	144	122	67

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
98-100 cm (Piece 13):	unoriented	4.01	700	4.37	4.41	2.74	9.9
114-116 cm (Piece 15C):	+36.2	6.21	300	5.25	5.29	2.87	4.0



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	18	1

MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE-CLINOPYROXENE PHYRIC BASALT

Macroscopic Description

Plagioclase (7-10%, 1-5 mm) olivine (1%, 1-2 mm), cpx. (TR, 1 mm max.) phyric basalt, generally moderately altered. Cpx. not observed in Pieces 4-7 and 12-16. Most pieces very fine-grained probably sub-variolitic groundmass. Pieces 1 and 9 are notably glassy, 8 and 12 are coarsest grained. Olivine noted because of alteration to brownish minerals. Piece 9 has a thin coat of palagonite and calcite with small dendritic Mn encrustations.

Thin Section Description

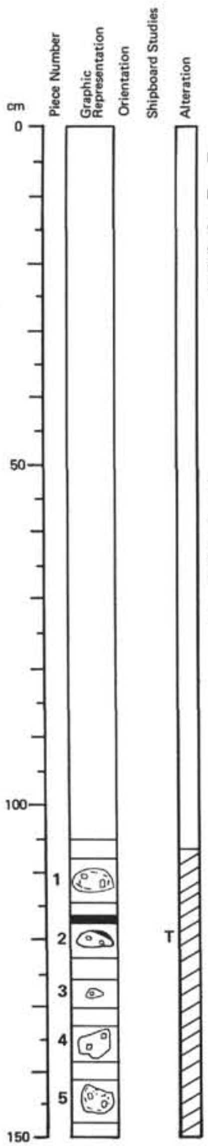
140-146 cm (Piece 16): Porphyritic pl.-cpx.-ol. phyric basalt. Phenocrysts invidivual and as glomerocrysts with a fine-grained to cryptocrystalline mesostasis of devitrified glass. Plag. phenocrysts 25% (0.2-4 mm), groundmass 10%; cpx. phenocrysts 2% (0.1-0.8 mm), groundmass 2%; ol. phenocrysts 1-2% (0.1-0.3 mm), groundmass 5%; titanomagnetite 5%; glass (subvariolitic) 45%. Some ol. phenocrysts are completely altered to pale green or orangish clay minerals; some plag. shows sausseritization. Perhaps different plag. generations present in this and Core 17, Section 1, Piece 15C. Groundmass plag. is skeletal and miarolitic. One cpx. shows plag. inclusion.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
140-146 cm (Plag.-olivine-pyroxene phyric basalt):												
49.4	17.57	8.58	7.3	12.68	0.11	1.05	–1.7	0.63	374	136	118	64

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
142-144 cm (Piece 16):	unoriented	8.34	350	5.64	5.55	2.90	3.2

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	19	1



MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE-CLINOPYROXENE PHYRIC BASALT

Macroscopic Description

Pl.-ol.-cpx. phyric basalt, moderately altered. Olivine is generally altered to brownish alteration minerals. Plag. and ol. phenocrysts from 1-5 mm. Plag.: ol. about 3:1 to 1:1 with cpx. not as abundant in hand specimen. Piece 4 is not so porphyritic and somewhat coarser grained than 1-3 and 5. Important: weathered rinds on 1 and 3 indicate primary shapes. Imply rubble. Weathered surfaces darkened with Mn-oxides. Piece 2 has glassy edge. No orientation preserved.

	Plag.*	Ol.*	Cpx.*	Sum.*	
1.	9%	9%	2%	20%	
2. glass	21%	7%	2%	30%	inhomogeneous
2. other	7%	7%	1%	15%	distribution
3.	Too small to judge				
4.	7%	2%	1%	10%	
5.	7%	7%	1%	15%	

*Visual estimates

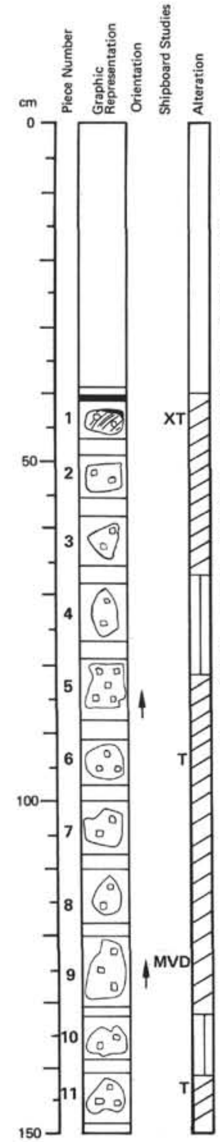
Thin Section Description

119-122 cm (Piece 2): Plag. phenocrysts + microphenocrysts 35%, groundmass 10%; ol. phenocrysts 2% (some plucked) groundmass TR; cpx. phenocrysts 1%, groundmass 5%; titanomagnetite 2%; glass 45% (visual estimates). Plag. 0.3-5 mm; ol. 0.2-0.8 mm; cpx. 0.1-0.7 mm). Some olivine altered to pale green to orange clays. Glassy groundmass is subvariolitic, and contains a vein partly filled with opaques and clays.

Note circumferential weathered zones on 1 and 5. Back of 1 has possible glassy zone.

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	20	1



MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE-CLINOPYROXENE PHYRIC BASALT

Macroscopic Description

Pl.-ol.-cpx. phyric basalt, moderately to intensely altered. Olivine is generally altered to brownish alteration products. Plag. 15-25%, Ol. 1-5%, cpx. about 1% from piece to piece. Plag. 1-5 mm typically, but there is a 1 cm plag. phenocrysts in 1. Plag. is most abundant in 2 and 8. Vesicles are up to 4% in 10, but from 1-2% elsewhere, rarely more than 1 mm diameter. Vesicles typically have brown encrustation. Piece 1 is somewhat glassy. Others are very fine-grained (subvariolitic). Most vesicular pieces (4 and 10) are most altered. Surface of 4 is partly covered with carbonate, and in some places, carbonate cover contains Mn spots. Piece 9 is similar.

Thin Section Description

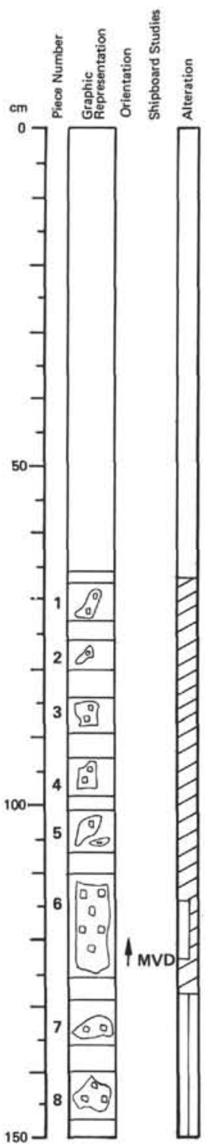
43-44 cm (Piece 1): Porphyritic plag.-ol.-cpx. basalt, with glassy to subvariolitic groundmass. Plag. phenocrysts 25% (2-4 mm), groundmass 20%; cpx. phenocyrsts less than 1% (0.1-0.3 mm), olivine phenocrysts 2-3% (0.1-0.2 mm), groundmass TR; titanomagnetite 5%, glass 40% (visual estimates). Glass is pale brown to dark brown, partly altered to palagonite and clay minerals. In some crystals of plagioclase there are relict blebs of devitrified glass. Groundmass is spherulitic in texture (sheaf spherules), except where glassy.

92-95 cm (Piece 6): Porphyritic plag.-ol.-cpx. basalt, intersertal groundmass. Plag. phenocrysts 30% (0.2-8 mm), groundmass 20%; cpx. phenocrysts less than 1% (0.1-0.4 mm); groundmass 35%; ol. phenocrysts 3-5% (0.1-0.5 mm), groundmass 5%; titanomagnetite 5% (visual estimates). Glass blebs in some larger plag. phenocrysts.

142-144 cm (Piece 11): Porphyritic plag.-ol.-cpx. basalt with intersertal groundmass. Plag. phenocrysts 30% (0.2-6.0 mm), groundmass 25%; cpx. phenocrysts 1% (0.1-1.2 mm), groundmass 35%; ol. phenocrysts 2-5% (0.1-1.0 mm), groundmass TR; titanomagnetite 5%; picotite TR.

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
43-45 cm:	49.6	17.71	9.20	8.0	12.85	0.16	1.07	–0.4	0.63	384	141	117	69

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
125-127 cm (Piece 9):	+56.4	7.73	275	5.56	5.68	2.84	6.4



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

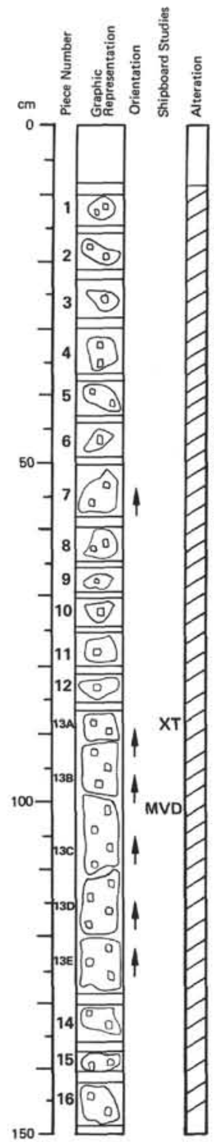
LEG	SITE	HOLE	CORE	SECT.
45	395	A	21	1

MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE-CLINOPYROXENE PHYRIC BASALT

Macroscopic Description

Plagioclase-olivine-clinopyroxene basalt (Pieces 2-5, 7, and 8). Plagioclase-olivine-clinopyroxene(?) basalt (Pieces 1 and 6). Plag. 15-20%; ol. 5%; cpx. 0-1%, phenocrysts up to 5 mm. All pieces moderately to intensely altered. Pieces 1, 2, 7, and 8 very fine, almost, but not quite glassy. Pieces 1 and 2 have crusts 1-2 mm thick of carbonates and orange clays. Piece 6 has cracks filled with brownish clays. Piece 8 has brown patches and alteration products especially of olivine.

	Inc.	NRM	MDF	$V\rho$ (∥)	$V\rho$ (⊥)	D	P
125-127 cm (Piece 6):	+41.1	8.69	250	5.66	5.80	2.90	2.8



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	22	1

MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE-CLINOPYROXENE PHYRIC BASALT

Macroscopic Description

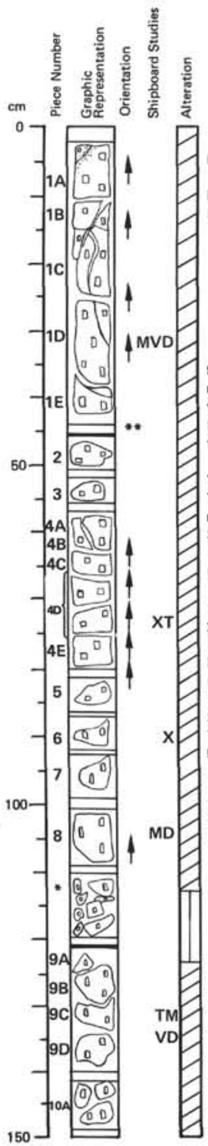
Plag. phenocrysts 15-20% - up to 10 mm long but most commonly about 1 mm, no apparent preferred orientation. Olivine phenocrysts 5-7%, mostly altered to brownish materials; up to 3 mm in diameter. Clinopyroxene less than 1% (few visible), pale emerald green in color, not present in all pieces. Moderately to intensely altered, except for a few small (1x2 cm at surface) less altered portions in 13D. Calcite veins in 13C, D, E, 15, 16, and 7. Groundmass fairly uniformly fine-grained, with no glassy contacts.

Thin Section Description

87-92 cm (Piece 13A): Plagioclase-olivine-clinopyroxene phyric basalt with intersertal groundmass. Plag. phenocrysts 25% (0.2-6.0 mm), groundmass 25%; cpx. phenocrysts less than 1% (0.1-0.6 mm), groundmass 35%; ol. phenocrysts 7% (0.1-1.0 mm), groundmass 5%. Some ol. partly altered to clays. Some large plag. phenocrysts have skeletal glass inclusions. Titanomagnetite 2% (visual estimates).

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
87-92 cm (plag.-olivine-pyroxene phyric basalt):												
49.6	17.80	8.73	8.0	12.91	0.10	1.02	–1.9	0.65	347	152	115	70

	Inc.	NRM	MDF	$V\rho$ (∥)	$V\rho$ (⊥)	D	P
100-102 cm (Piece 13C):	+40.6	9.62	175	5.89	5.87	2.88	3.6



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

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

MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE-CLINOPYROXENE PHYRIC BASALT

Macroscopic Description

Phenocryst Abundances / Sizes (mm)

	Plag.	Ol.	Cpx.	Plag. (mm)	Ol. (mm)	Cpx. (mm)
1A-C	15-20%	7%	1%	2-6	1-2	1
2-3	10-15%	5%	1%	2-3	1-3	1
4A-E	10%	5-7%	1%	1.5-3	1-3	1
5-7	25%	5%	1%	2-4	1-2	1-3
8	20%	5%	1%	2-4	1-2	1
9A-D, 10	15%	5%	1%	1-3	1-2	1

9C contains large plag. glomerocryst (10 mm diam.). Pieces moderately to intensely altered, olivine to reddish brown clays. Carbonate veins and veinlets in 1A-E, along which alteration is intense. 1A has a fairly fresh part. Along the crack between 4A and 4B are iron-hydroxides(?) with Mn-oxide spots. Similar Mn spots are found on the weathered surface of 9C. 9A-D are very fine-grained, almost glassy. 1A-E are fairly coarse-grained. The base of 1E is the probable chemical boundary between chemical types C-1 and C-2.

Thin Section Description

72-76 cm (Piece 4D): Plag. phenocrysts 20% (0.3-4.0 mm), groundmass 30%; ol. phenocrysts 5% (0.2-3.0 mm), groundmass not noted; cpx. phenocrysts less than 1% (0.2-0.6 mm), groundmass 40%; titanomagnetite 3-5%. Ol. somewhat altered to clays. Plag. present as phenocrysts, microphenocrysts, and groundmass laths. Large plag. phenocrysts are somewhat skeletal, a few with included glass blebs. Plag. glomerocrysts present. Groundmass texture intersertal.

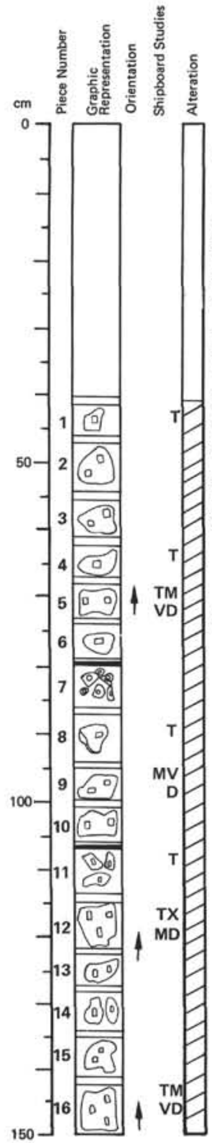
132-134 cm (Piece 9C): Plag. phenocrysts 25% (0.2-8.0 mm), groundmass 30%; ol. phenocrysts 3% (0.1-2.5 mm), groundmass not noted; cpx. phenocrysts less than 1% (0.2-0.6 mm); titanomagnetite 7%. Vesicles 1-2% filled with clay minerals. Intersertal glass and ol. altered partly to clays. Some large plag. phenocrysts have skeletal interiors with glassy inclusions. Glomerocrysts are present. Chemical analysis for Piece 4D under Core 22, Section 1.

72-76 cm (plag.-olivine-pyroxene phyric basalt):

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
50.1	16.25	9.32	8.4	12.39	0.08	1.13	–1.6	0.64	383	137	136	71

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
34-36 cm (Piece 1D):	+44.6	4.52	150	5.96	5.80	2.92	2.5
106-108 cm (Piece 8):	+47.8	7.02	300	—	—	2.90	3.1
132-134 cm (Piece 9C):	+51.2	6.87	300	5.97	5.91	2.90	–

* Tiny fragments
** Boundary between chemical Units P_3 and P_4



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

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

MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE-CLINOPYROXENE PHYRIC BASALT

Macroscopic Description

Plagioclase 15-20%, olivine 5-7%, clinopyroxene TR-1%, not apparent in all pieces. Olivine is partly fresh, but usually somewhat altered to rust-colored alteration minerals. Plag. is from 1-10 mm, ol. up to 3 mm. Piece 7 has large cpx. (4 mm) as does 8 (3 mm). Vesicles are present in all pieces (about 3%). 11 is finer-grained and has more olivine than other pieces. It is possibly glassy in parts. Pieces 2, 3, 8, 9, 10 and 12 contain "veins" - irregular meandering "zones" about 1-3 mm wide which are less weathered than the rest of the pieces. Part of 7 is glassy.

Thin Section Description

45-46 cm (Piece 1), 65-68 cm (Piece 4), 72-74 cm (Piece 5), 91-93 cm (Piece 8), 109-115 cm (Piece 11), 117-122 cm (Piece 12), 120-122 cm (Piece 12): Phenocrysts: plagioclase 20-35% (includes microphenocrysts); olivine 3-10%, cpx. 0-3%. Glassy (Piece 11) through sub-variolitic textures. Groundmass: plagioclase 10-30%; cpx. 10-40%; olivine 0-3%. TR chromite (picotite?) seen in all but Pieces 1 and 4. Much evidence for crystal growth in undercooled conditions - skeletal phenocryst interiors and rims. Alteration generally in devitrified glass - to clays. Olivine locally altered to "iddingsite."

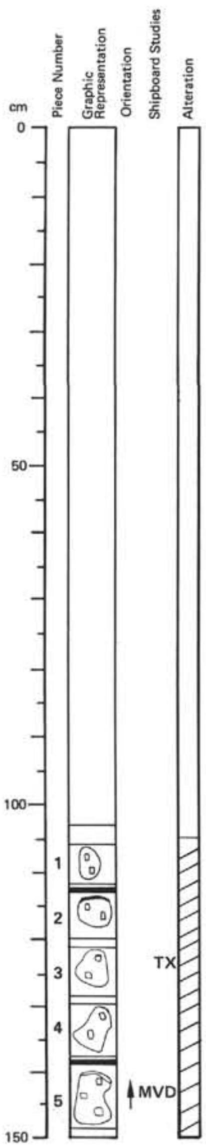
117-122 cm (plag.-olivine-pyroxene phyric basalt):

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
50.1	17.65	8.51	8.4	12.39	0.16	1.11	–0.7	0.66	380	147	138	75

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
72-74 cm (Piece 5):	–41.2	6.48	800	5.16	5.06	2.74	–
99-101 cm (Piece 9):	–30.0	3.38	500	5.37	5.42	2.79	–
120-122 cm (Piece 12):	–34.0	3.91	700	—	—	2.87	–
145-147 cm (Piece 16):	–31.0	4.70	600	5.49	5.60	2.87	–

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	24	1



CORE 24 SECTIONS 1 AND 2: MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE-CLINOPYROXENE PHYRIC BASALT

Macroscopic Description

Plagioclase 15-20% (1-10 mm, some larger glomerocrysts), olivine 5-7% up to 3 mm, cpx. TR-1%, rarely seen as large crystals 3-5 mm. Glass in Section 1, Piece 2 (partly palagonitized) and Piece 5; Section 2, Pieces 2, 14 [partly palagonitized] and 15). Vesicles generally 2-3%, 1-2 mm. Olivine is partially altered to brownish secondary minerals. Some calcite and zeolite(?) crack fillings. Some pieces are broken along cracks with a brownish (Mn?) coating. Section 1, Piece 5 has a black "specular" mineral on its upper edge (probable crack filling).

Thin Section Description

125-129 cm (Piece 3): Phenocrysts: plagioclase 20%; olivine 5%; cpx. 1%. Groundmass: plagioclase 15%; olivine nil; cpx. 15%; glass 40%; titanomagnetite 5%. Plag. phenos. contain glass blebs. Olivine locally altered to clays. Glass partially "devitrified."

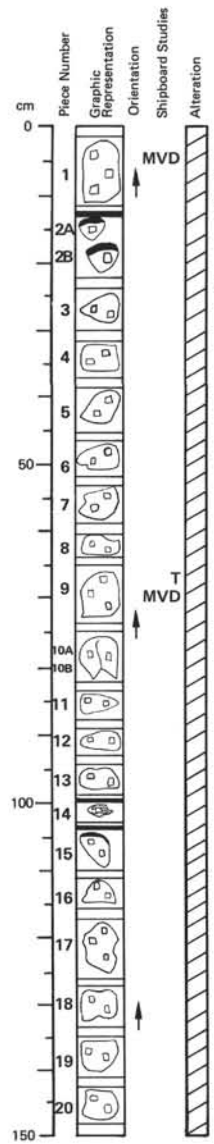
125-129 cm (plag.-olivine-pyroxene phyric basalt):

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
49.7	17.76	8.69	7.8	12.50	0.10	1.12	–0.9	0.64	349	136	135	72

	Inc.	NRM	MDF	V_p (∥)	V_p (⊥)	D	P
143-145 cm (Piece 5):	–39.1	2.92	500	5.15	5.11	2.84	–

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

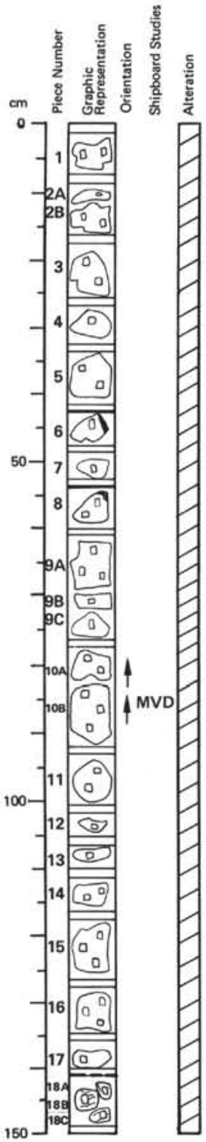
LEG	SITE	HOLE	CORE	SECT.
45	395	A	24	2



Thin Section Description

60-65 cm (Piece 8): Phenocrysts: plagioclase 20%; cpx. less than 1%; olivine not observed. Groundmass: plagioclase 30%; cpx. 10% titanomagnetite 10%. Groundmass subvariolitic. Plag. phenos. show reverse zoning and contain glass blebs in some cases. Olivine phenos. rounded. Plag. composition An_{70}.

	Inc.	NRM	MDF	V_p (∥)	V_p (⊥)	D	P
5-7 cm (Piece 1):	–23.8	4.13	600	5.24	5.22	2.84	6.7
69-71 cm (Piece 9):	–33.0	2.33	400	5.29	5.25	2.84	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

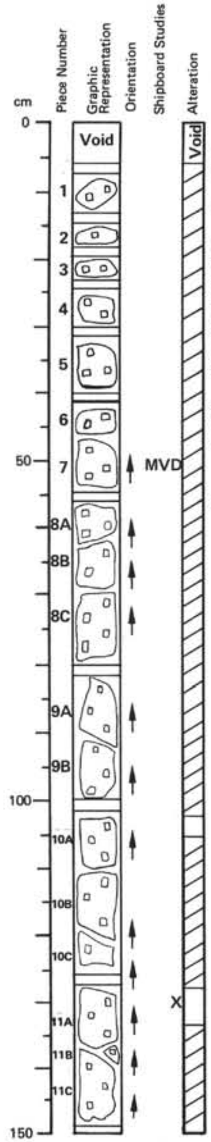
LEG	SITE	HOLE	CORE	SECT.
45	395	A	25	1

MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE-CLINOPYROXENE PHYRIC BASALT

Macroscopic Description

Plagioclase 15% (1-10 mm, some larger glomercrysts), olivine 5-7% (1-3 mm), clinopyroxene TR-1% (1-2 mm, rarely up to 4 mm). Pieces 6 and 8 have glassy portions. Most pieces fairly fine-grained. Olivines partially altered to reddish brown secondary minerals. Fine carbonate-filled veins occur in 5 and 10A and B. Piece 18 is very fine-grained, nearly glassy. Cooling unit boundaries are placed above 6 and 8; a probable boundary is placed above 18.

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
85-87 cm (Piece 10B):	–37.0	3.15	450	5.96	5.79	2.90	3.4



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	26	1

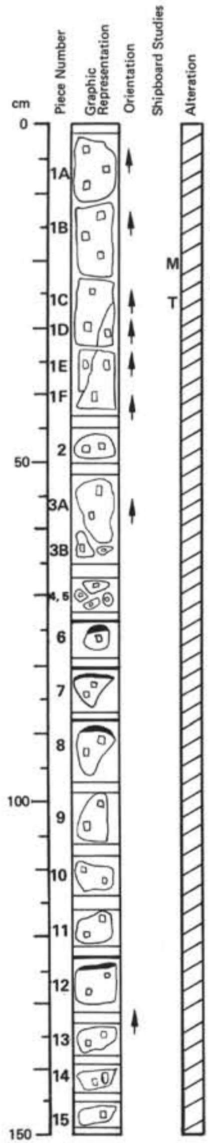
CORE 26, SECTIONS 1 AND 2: MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE-CLINOPYROXENE PHYRIC BASALT

Macroscopic Description

Plagioclase 15-20% (1-10 mm, some larger glomerocrysts), olivine 5-7% (1-3 mm), clinopyroxene TR-1% (1-2 mm rarely up to 4 mm). Section 1 has no glassy pieces, but piece 5 is very fine-grained. Below 5, a probable single cooling unit extends into Section 2, piece 6. In Section 2, pieces 6-8, and 12 have glassy edges. Apart from the tops of 10A and 11A, which are fresh, and the glassy pieces in Section 2, the entire core is moderately altered, with olivine replaced partially by brownish or reddish secondary minerals. Alteration is centered on veins or filled cracks in Section 1, pieces 5, 8C, 9A,B, 10A,B,C, 11A,C, and Section 2, piece 1B. Several pieces in Section 2 have faces coated with yellow brown or greenish yellow material (1C,E,F, 3A,B). Piece 1A has a "vug" partially filled with botryoidal material (carbonate?). Section 2, piece 6 has altered glass.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
129-133 cm (plag.-olivine-pyroxene phyric basalt):												
49.6	17.20	8.76	7.9	12.21	0.06	1.13	–1.7	0.64	311	127	134	70

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
52-54 cm (Piece 7):	–32.7	3.36	290	5.88	5.75	2.89	–



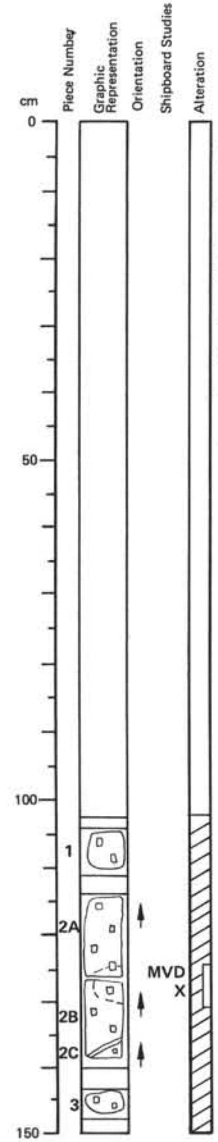
VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	26	2

Thin Section Description

25-33 cm (Piece 1C): Phenocrysts: plagioclase 35%; olivine 10%; cpx. TR. Groundmass: plagioclase 20%; cpx. 20%; olivine 5%; titanomagnetite 10%. Plag. An_{75}; ol. approx. Fo_{85}. Trace of picotite present. Plag. phenos. 2-4 mm. Cpx. 2 mm. Ol. 3 mm. Ol. phenos. rounded. Groundmass texture subophitic. No alteration information given.

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
21-23 cm	-31.4	6.01	400	—	—	–	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	27	1

CORE 27, SECTIONS 1 AND 2: MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE-CLINOPYROXENE PHYRIC BASALT

Macroscopic Description

Plagioclase 10-20%, more typically 15-20% (1-10 mm, except for glomerocrysts, up to 2 cm), olivine 5-7% (1-3 mm), clinopyroxene TR-1% (1-3 mm). Vesicles up to 3% (1-2 mm), locally filled with bluish-gray or yellowish material. Glass in Section 2, Piece 4. Tiny, carbonate-filled veinlets in Section 1, Pieces 2A-C, Section 2, Pieces 2A,B. Section 2, Piece 4 has plag. megacrysts (up to 2 cm) with glassy inclusions. Largest clinopyroxene (8 mm) occurs in 2-4; cpx. up to 3 mm is in 2-7. Entire core is generally moderately altered. Plag. is least (around 10%) in Section 1, Piece 1.

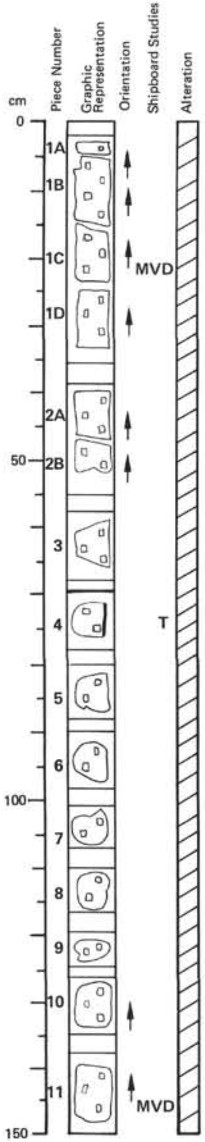
127-131 cm (plag.-olivine-pyroxene phyric basalt):

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
49.6	16.90	8.84	8.3	12.11	0.06	1.13	-1.6	0.65	303	129	133	64

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
121-123 cm (Piece 2A):	-30.2	3.78	200	5.67	5.73	2.89	–

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	27	2

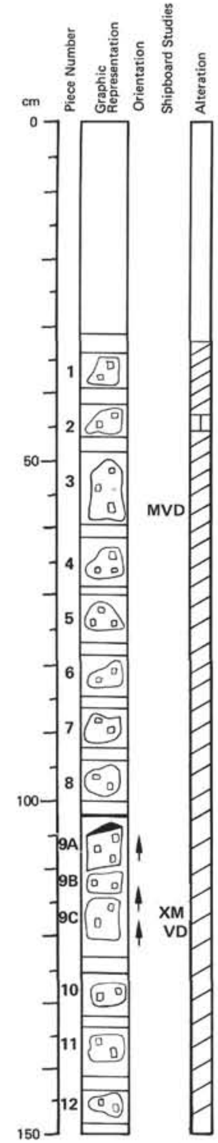


	Inc.	NRM	MDF	Vp (∥)	Vp (⊥)	D	P
23-25 cm (Piece 1C):	−33.7	6.47	180	5.73	5.66	2.89	–
145-147 cm (Piece 11):	−31.4	3.16	550	5.46	5.66	2.87	–

Description under 395A-27-1

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	28	1



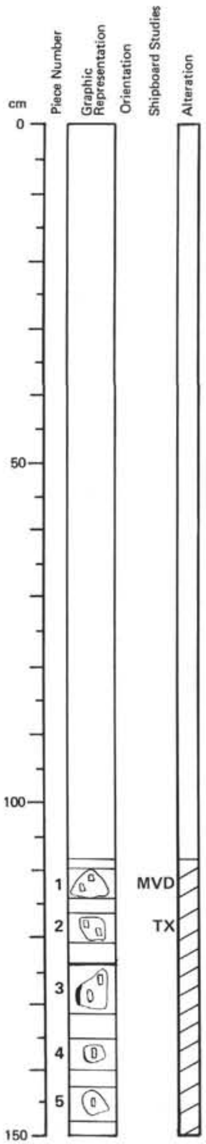
MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE PHYRIC BASALT

Macroscopic Description

Beginning of Lithologic Unit 9 Chemical Unit P_5. Plagioclase 10-20%, olivine 3-5%. Clinopyroxene not noticed in any hand specimens. Olivine is generally partially altered to reddish-brown secondary minerals. Pieces are generally moderately altered, but 2 has some intensely altered portions. Vesicles are 1-3%, about 1 mm, oftimes filled with secondary minerals, gray or dark green in color. Piece 1 has tiny black spots (Mn-oxides?) on a weathered surface. Glass is present at the top of 9A. 9B and C have slightly coarser groundmass than 9A.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
116-122 cm (plag.-olivine phyric basalt):												
49.6	18.61	8.56	6.6	12.27	0.15	1.19	−1.4	0.60	269	148	168	81

	Inc.	NRM	MDF	Vp (∥)	Vp (⊥)	D	P
58-60 cm (Piece 3):	+29.6	1.65	450	4.85	4.91	2.78	7.2
117-119 cm (Piece 9C):	−43.3	2.07	500	5.66	5.57	2.84	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	29	1

MAJOR ROCK TYPE – OLIVINE-PLAGIOCLASE PHYRIC BASALT

Macroscopic Description

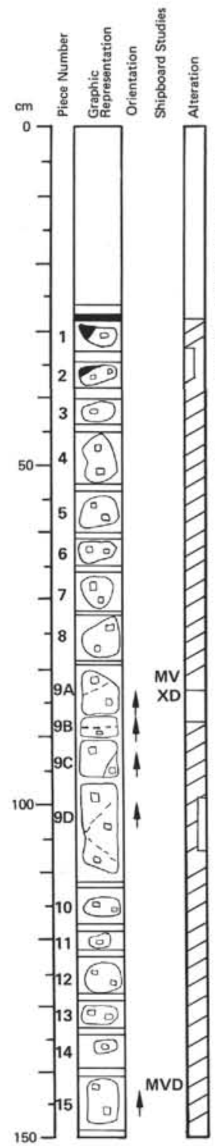
Plagioclase 10-15% (1-10 mm), olivine 3-5% (1-3 mm). Vesicles 1% (about 1 mm). Glass on edge of 3. Piece 2 has minor cpx. (about 2 mm). Piece 3 has a weathered surface coated with tiny black dots (Mn-oxides?).

Thin Section Description

119-122 cm (Piece 2): Phenocrysts: plagioclase 20% (1-3 mm); olivine 3% (to 0.5 mm) cpx. TR (about 0.4 mm). Groundmass: plagioclase 20%; cpx. 20%; olivine 3%; picotite TR; microcrystalline glass 30%; titanomagnetite 6%. Plag. phenos. An_{75}. Olivine Fo_{85}. Groundmass subvariolitic. Evidence for skeletal growth during undercooling. Zoned plag. Glass blebs and skeletal edges to plag. phenocrysts. Section quite fresh.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
119-122 cm (plag.-olivine-pyroxene phyric basalt):												
49.1	18.13	8.71	7.2	12.26	0.21	1.25	−1.2	0.62	296	127	158	80

	Inc.	NRM	MDF	V_p (∥)	V_p (⊥)	D	P
110-112 cm (Piece 1):	unoriented	3.59	550	5.35	—	2.84	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	30	1

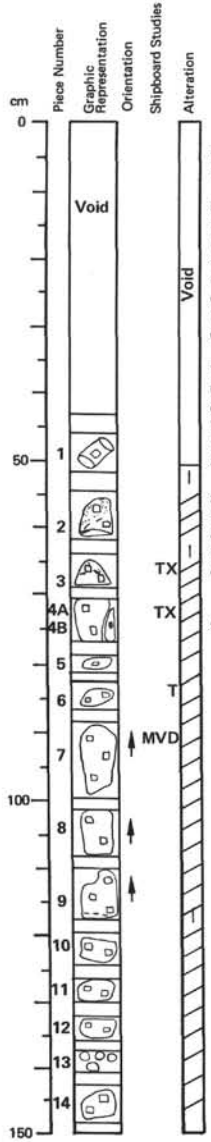
MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE PHYRIC BASALT

Macroscopic Description

Plagioclase 10-15% (1-10 mm with some larger glomerocrysts), olivine 3-5% (1-3 mm). Glass in Pieces 1 and 2. Vesicles 1% less than 1 mm, locally filled with pale greenish gray clays(?) or carbonate. Carbonate veinlets in 9A-D; carbonate surface coatings on parts of Pieces 1 and 2. The core is generally moderately altered, but Piece 2 is intensely altered. Portions of 9 are quite fresh, but olivine even in those portions is slightly altered to reddish-brown secondary minerals. Pieces 3-15 have a quite uniform texture, suggesting a single cooling unit.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
82-87 cm (plag.-olivine phyric basalt):												
49.3	17.69	8.80	8.3	11.92	0.09	1.15	−1.7	0.65	2.98	142	158	76

	Inc.	NRM	MDF	V_p (∥)	V_p (⊥)	D	P
82-84 cm (Piece 9A):	−30.2	1.76	300	5.81	5.60?	2.88	–
144-146 cm (Piece 15):	−45.8	1.72	550	5.80	5.69	2.83	3.9



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	31	1

MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE PHYRIC BASALT AND PLAGIOCLASE-OLIVINE-CLINOPYROXENE PHYRIC BASALT

Macroscopic Description

Piece 1: Cuttings in 3 cc bottle.

Pieces 2, 4-11, 13, and 14: Plagioclase 25-30% (1-10 mm, with some large glomerocrysts), olivine 3-5%. Vesicles 1% (less than 1 mm). Olivine partly altered to reddish brown secondary minerals, especially near cracks. No variation in groundmass texture or grain size. No glassy zones. Faint 0.5-1 cm weathered zones on Pieces 2, 3, and 9. Piece 13 is 6 small pieces of basalt in a plastic bag.

Pieces 3 and 12: Plagioclase 20-25% (1-10 mm), olivine 3-5% (1-3 mm), clinopyroxene Tr (1-2 crystals per rock). In Piece 12, cpx. appears intergrown with plagioclase.

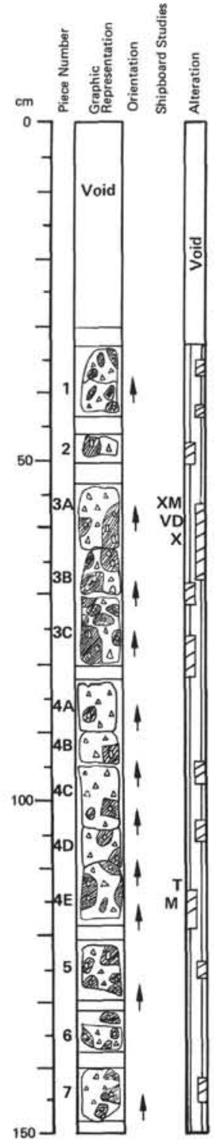
Thin Section Description

63-67 cm (Piece 3) and 70-76 cm (Piece 4): Both very similar. Phenocrysts: plagioclase 20% (2-6 mm); olivine 5% (.1-2 mm); cpx. nil. Groundmass: plag. 25-30%; ol. 10%; cpx. 20% (Piece 4), nil (Piece 3). Piece 3 has more groundmass glass than Piece 4 (40% versus 10%). Glass microcrystalline - subvariolitic in Piece 3. Trace of picotite present in both. Plag. is An_{75}. Olivine altering to clays.

83-87 cm (Piece 6): Is very similar to Piece 4.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
63-67 cm (plag.-olivine-pyroxene phyric basalt):												
49.7	18.59	8.67	6.8	12.33	0.17	1.17	–2.5	0.61	287	134	165	82
70-76 cm (plag.-olivine-phyric basalt):												
49.1	18.42	8.69	7.	12.31	.17	1.14	–2.4	—	3.27	131	172	81

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
90-92 cm (Piece 7):	–37.2	1.67	550	5.90	5.91	2.86	4.4



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	32	1

MAJOR ROCK TYPE – VOLCANIC BRECCIA WITH SUBDIABASIC OLIVINE-PLAGIOCLASE PHYRIC BASALT FRAGMENTS IN CLAY AND/OR CARBONATE-CEMENTED MATRIX.

Macroscopic Description Sections 1 and 2

The breccia contains basalt clasts 0.5-20 cm long, angular to rounded. The matrix contains sand-sized basalt and mineral grains (mostly plagioclase) and is yellowish to orange in color probably from clays and ferruginous secondary minerals after glass and olivine. There are tiny carbonate veins in the matrix and some of the clasts, as well as around some of the clasts.

Basalt clasts have about 15% plagioclase phenocrysts, 5% olivine phenocrysts. Plag. ranges from 0.1 to 4 cm. Olivine typically 1-3 mm.

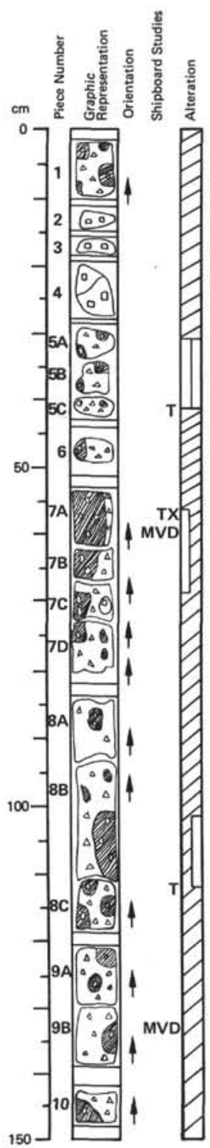
Pieces 4E and 5 of Section 1 may have shear-oriented breccia matrix next to large clasts. The matrix of Section 2, Pieces 7B,C, and 8B, C is partly hyaloclastite. Pieces 2, 3, and 4 of Section 2 are isolated plagioclase-olivine phyric basalt, but probably were large cobbles in the breccia. The breccia in Section 2 Pieces 5A-C appears to have two types of clasts – medium-grained pl.-ol. phyric basalt, and fine-grained (probably vitric) pl.-ol. phyric basalt.

Thin Section Description

115-118 cm (Piece 4E): Clasts of basalt, medium-grained, with plag. phenos in a breccia of broken plag. fragments. Olivine completely altered to clays. Cemented with about 10% calcite.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
54-62 cm (breccia matrix):												
49.0	18.25	8.09	5.9	15.64	0.36	1.09	–7.7	0.59	238	165	172	70
54-62 cm [approx. depth (m) 352 breccia clast]:												
49.6	18.79	8.73	5.5	13.90	0.15	1.19	–3.1	0.55	287	111	177	80

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
54-56 cm (Piece 3A):	+31.4	1.82	75	4.51	4.68	2.68	–
117-119 cm:	+55.0	2.75	75 unstable	—	—	–	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	32	2

Thin Section Description

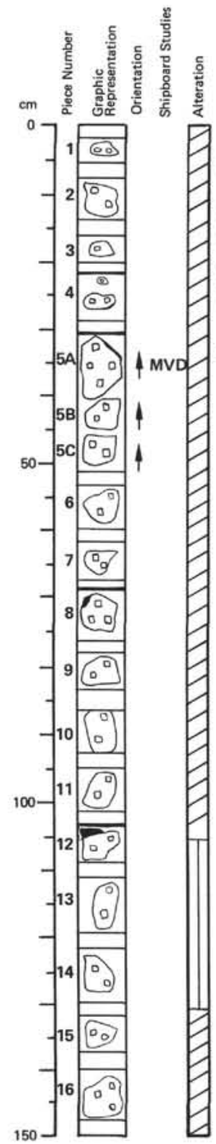
40-43 cm (Piece 5C): Carbonate-cemented breccia; clastic texture. Clasts: plag.-ol. phyric basalts with glassy groundmass (25%). Single plagioclase grains (25%). Olivine (about 1%) now clays and 80% carbonate. Matrix (45%) about 20% clays.

56-58 cm (Piece 7A): Basalt clast in breccia. Phenocrysts: plagioclase 25% (1-2.5 mm); olivine 5% (.5-1.5 mm); cpx. nil. Groundmass plagioclase 30%; cpx. 30%; olivine 3%; titanomagnetite 3%. Olivine is partly replaced by carbonate and iddingsite. Plag. phenos contain glass blebs (skeletal interiors). Plag. is An_{75}.

110-113 (Piece 8C): Carbonate-cemented breccia: texture clastic-autoclastic. Clasts 40% (.5-3 cm). Matrix: carbonate 25%; clays 35%. Clasts are basaltic 80% (of clasts); vitreous 15%; crystals of plag. 5%. Vitreous fragments and portions of matrix altered to palagonite. Plag. in clasts partially replaced by carbonate.

IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
56-63 cm (breccia clast):					
-1.9	—	304	121	180	76

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
56-58 cm (Piece 7A):	+45.0	3.36	225	5.91	5.82	2.86	–
133-135 cm (Piece 9B):	+62.7	2.31	225	5.73	5.59	2.85	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

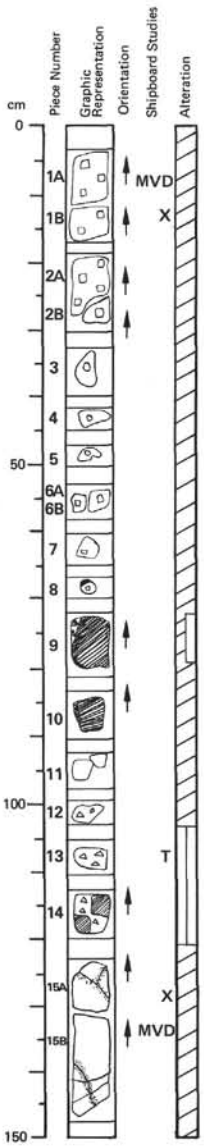
LEG	SITE	HOLE	CORE	SECT.
45	395	A	33	1

MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE PHYRIC BASALT, LESSER PLAGIOCLASE-OLIVINE-CLINOPYROXENE PHYRIC BASALT

Macroscopic Description

Plagioclase 15-20% (1-10 mm), olivine 3-5% (1-3 mm) in all but 2, which has less than 1% clinopyroxene in addition to plag. and olivine. The entire section is moderately to intensely altered. Pieces 4, 5A, 8 and 12 contain glass rinds which are partly altered to palagonite. These probably indicate the margins of pillow lavas. Pieces 5B, 8, 10, 11 and 14 have carbonate-coated surfaces. Large plagioclase megacrysts (1-2 cm) occur in 1, 4, 8, 9, 10, and 15.

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
34-36 cm (Piece 5A):	–40.1	1.34	950	5.19	5.37	2.80	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	33	2

MAJOR ROCK TYPES – PIECES 1-8 PLAGIOCLASE-OLIVINE PHYRIC BASALT; PIECES 9-15 FINE-GRAINED APHYRIC BASALT AND APHYRIC BASALT BRECCIA

Macroscopic Description

The upper part of the section (Pieces 1-8) are a continuation of the lithologic unit described in Section 1, except there are no plagioclase-olivine-clinopyroxene phyric basalts, only plagioclase-olivine phyric basalts. Phenocryst abundances and sizes are similar. Olivine is partly altered to reddish brown secondary minerals. Piece 1A contains carbonate veinlets associated with black spots (Mn?). Piece 3 contains a cavity (1 cm diameter) filled with carbonate. Piece 8, which is in a small plastic bottle, has a glassy rind (and thus could be the base of a flow). It is the deepest extrusive phyric basalt recovered in 395A.

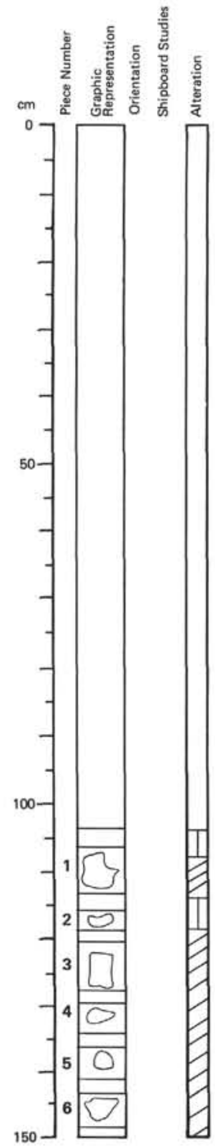
Pieces 9-15 include large angular cobbles (3-20 cm long) of fine-grained aphyric basalt set in a carbonate cemented matrix with fragments of basalt and basaltic glass, mostly altered to a yellowish brown. The larger clasts are very fine-grained, nearly glassy. The proportion of vesicles varies (Piece 9, 2% (1/4 mm); 10, 5% (1/2-1 mm); 11, 1% (1/4 mm); 14, 3% (1/4 mm). Piece 9 also has one or two plagioclase phenocrysts. Pieces 15A and B have no coating of matrix material, but may be a large clast in the matrix.

Thin Section Description

107-109 cm (Piece 13): Autoclastic breccia. Aphyric basalt: dark brown to black, locally red (oxidized and palagonitized). No carbonate cement. Much is very fine-grained to glassy. Matrix is mostly clays. Rest is subvariolitic with elongate radiating plagioclase bundles.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
9-13 cm (plag.-olivine phyric basalt):												
50.0	18.44	8.89	7.3	12.53	0.17	1.13	−2.1	0.62	326	135	162	69
127-129 cm (aphyric basalt):												
49.7	15.29	11.07	7.7	11.33	0.25	1.70	−1.7	0.58	315	114	132	118

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
8-10 cm (Piece 1A):	−36.1	1.84	550	5.87	5.80	2.87	4.0
130-132 cm (Piece 15B):	−47.8	6.43	650	5.79	5.86	2.87	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	34	1

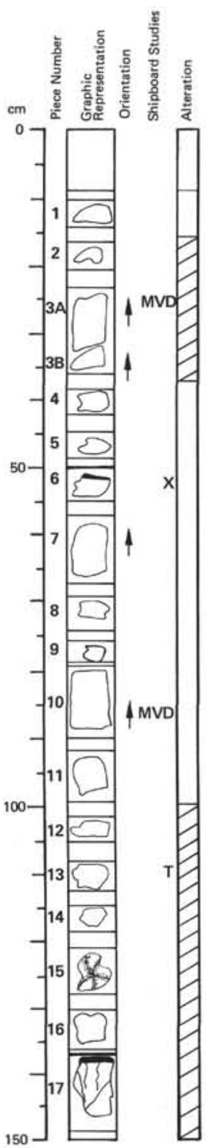
MAJOR ROCK TYPE – APHYRIC BASALT

Macroscopic Description

Fine-grained aphyric basalt, with no more than 1 plagioclase phenocryst in Pieces 3-6, and none in Pieces 1 and 2. Pieces 1-3 have pale brownish gray altered rinds and thin carbonate encrustations. The rinds may indicate the original surface of the pieces. All pieces are moderately to intensely altered.

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	35	1



MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Similar to basalts in Core 33 Section 2 and Core 34. Pieces 3A, 7, 10, 11, and 15 contain very sparse large plagioclase phenocrysts. Pieces 6 and 17 have glassy rims. Carbonate veins or surface encrustations are observed on all pieces. Vesicles are less than 1%, typically 1 mm diameter, filled with light gray, bluish gray, and dark green secondary minerals.

Thin Section Description

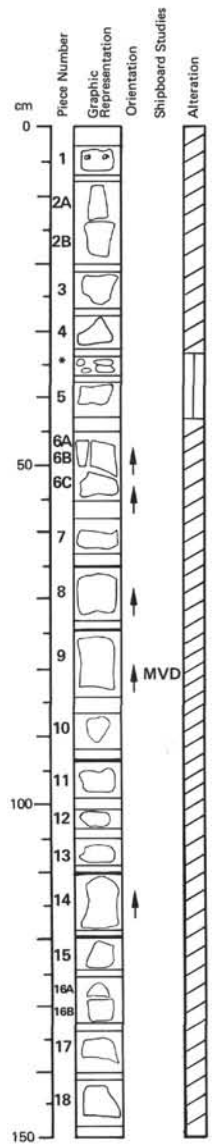
109-113 cm (Piece 13): Aphyric subvariolitic basalt. Plag. bundles 40%; cpx. 5-7%; titanomagnetite 5%; microcrystalline 50%; clays – trace. All crystals very skeletal.

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
53-54 cm (aphyric basalt):	49.8	15.14	11.13	7.7	11.29	0.18	1.71	-1.1	0.58	314	113	129	127

	Inc.	NRM	MDF	V_p (‖)	V_p (⊥)	D	P
27-29 cm (Piece 3A):	-42.2	3.25	700	5.63	NG	2.86	3.3
85-87 cm (Piece 10):	-45.3	4.32	650	5.57	5.63	2.87	–

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	36	1



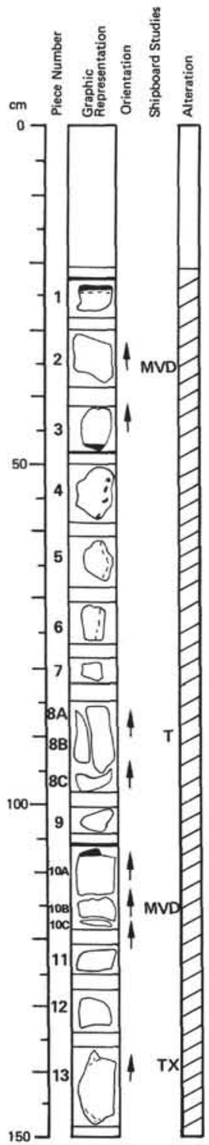
MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Occasional plagioclase phenocrysts (noted in Pieces 1-6 especially), 1-2% vesicles locally containing dark green secondary minerals (celadonite?). Piece 1 is slightly variolitic, Piece 7 is very fine-grained, and Pieces 8, 9, 11, 14, 15, and 18 have palagonite and zeolite(?) encrustations with black spots (Mn?). The sequence suggests thin glassy flows or pillows.

	Inc.	NRM	MDF	V_p (‖)	V_p (⊥)	D	P
82-84 cm (Piece 9):	-45.0	3.64	350	5.40	5.27	2.84	–

*small chips



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	37	1

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Fine-grained, very fine-grained, and glassy aphyric basalt with very rare plagioclase phenocrysts (Pieces 1 and 13, for example). Glass on Pieces 1, 3, and 10A. Moderately altered throughout. Thin oxidized borders on Pieces 1, 5, and 6, sometimes with coatings of a pale greenish-white secondary mineral and tiny Mn spots. There are 1-2% vesicles, sometimes filled with secondary minerals. Vesicles are less than 1 mm diameter.

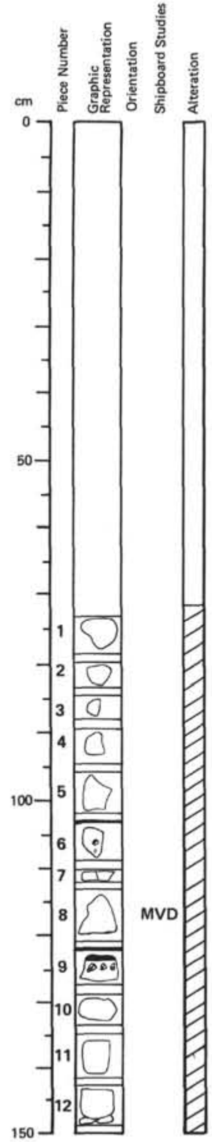
Thin Section Description

88-90 cm (Piece 8B): No phenocrysts. Texture variolitic. Skeletal plagioclase 40%; ol. 7%; titanomagnetite 3-5%; microcrystalline 50%. Trace of clays and zeolites(?). Olivine altered to clays, especially along "spike-like" projections.

136-141 cm (Piece 13): Very similar to Piece 8B. Skeletal plagioclase encloses fine-grained cpx., opaques, and dusty glass.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
136-141 cm (aphyric basalt):												
49.9	15.06	10.90	7.5	11.24	0.29	1.70	−1.9	0.58	301	121	135	117

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
37-39 cm (Piece 2):	−42.2	3.36	450	5.65	5.64	2.87	–
109-111 cm (Piece 10B):	−39.6	3.00	650	5.79	5.88	2.90	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

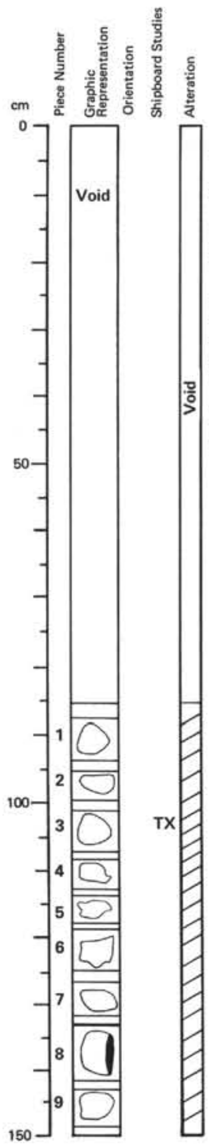
LEG	SITE	HOLE	CORE	SECT.
45	395	A	38	1

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Fine-grained, very fine-grained, and glassy basalt with rare phenocrysts of olivine and plagioclase (not in all pieces). Where present, olivine is altered partly to reddish brown secondary minerals. Piece 6 contains small patches of altered interstitial glass and Piece 9 has a glassy edge and is partly variolitic. Piece 1 has a weathered rim, and the entire core is at least moderately altered. Vesicles are small (less than 1 mm) and rare (less than 1%) to absent, and typically partly filled with secondary gray or gray-green minerals. Note that Piece 12 is not oriented. It was rotated in the core-catcher into a perpendicular position relative to the surface.

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
116-118 cm (Piece 8):	unoriented	5.45	300	5.53	5.47	2.84	7.6



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	39	1

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

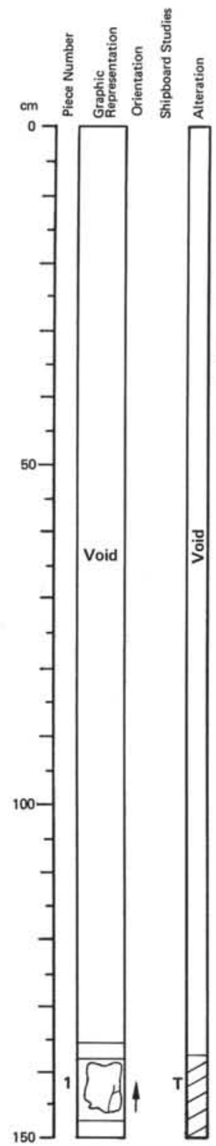
Macroscopic Description

Fine-grained, very fine-grained, and glassy aphyric basalt. Rare plagioclase phenocrysts in isolated pieces, and typical small vesicles less than 1 mm diameter and 1% in abundance filled with whitish or greenish secondary minerals. Piece 8 is partly glassy and variolitic. Where plagioclase is seen (Pieces 2 and 8 for example) it can be fairly large, up to 5 mm. The entire core is moderately altered.

Thin Section Description

102-107 cm (Piece 3): Aphyric variolitic olivine basalt: 40% skeletal plagioclase needles 0.01 x 0.6 mm enclosing cpx., opaques, and dusty glass. Matrix is 50% of rock, composed of feathery cpx., anhedral plag., and rare opaques and clay minerals. Olivine about 5%, skeletal microphenocrysts 0.04 x 0.2 mm.

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
102-107 cm (aphyric basalt):	49.9	15.33	10.98	7.6	11.39	0.28	1.72	-1.9	0.58	306	128	129	122



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	40	1

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

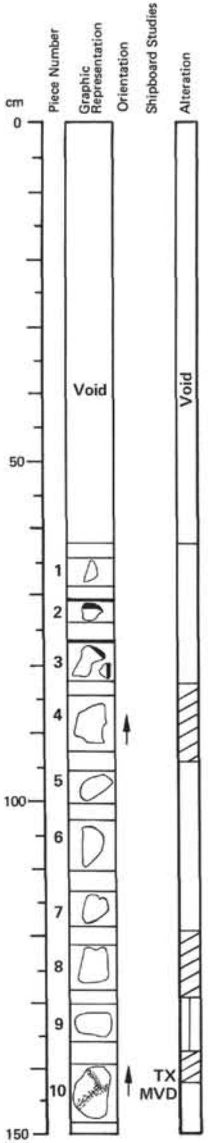
Macroscopic Description

A single piece of fine-grained aphyric basalt, moderately altered, with very rare plagioclase phenocrysts. On the surface, subvariolitic textures formed by quench plagioclase laths can be seen. The piece is cut by carbonate veinlets. A weathered surface on the piece is coated by zeolite(?) with black spots (Mn?).

Thin Section Description

143-148 cm (Piece 1): Olivine basalt with intersertal texture (locally looking nearly variolitic). Plag. crystals 40% (.03 x .2 mm); olivine 5% (.04 mm anhedral, granular mostly, but locally skeletal). Opaques 5%. Microcrystalline matrix 50% composed of feathery cpx., plag., opaque and clay mineral intergrowths.

	Inc.	NRM	MDF	$V\rho$ (∥)	$V\rho$ (⊥)	D	P
143-145 cm (Piece 1):	-46.2	5.03	500	5.78	—	2.84	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	41	1

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Fine-grained, very fine-grained, and glassy aphyric basalt. One or two plagioclase phenocrysts in Pieces 4 and 10. Vesicles from 1-2%, about 1 mm or less diameter, locally filled with gray or greenish secondary minerals. Pieces 2 and 3 have glassy edges. Piece 4 has an oxidized coat with black spots (Mn?) and is variolitic. Pieces 8 and 10 have a "zeolite" coating associated with black spots. Alteration is more intense along the cracks in Piece 10.

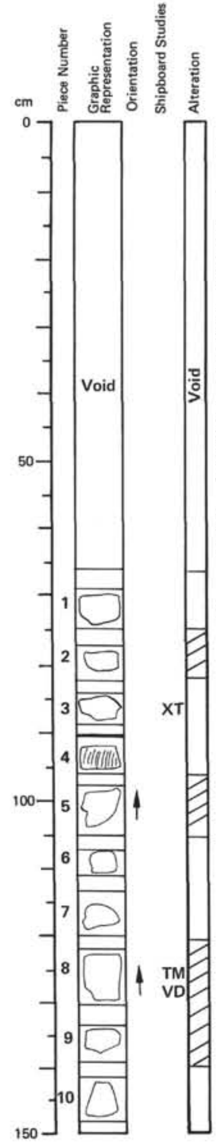
Thin Section Description

142-144 cm (Piece 10): Variolitic olivine basalt. Plagioclase 30% (.005 x .1 mm); olivine 5% (.02 x .2 mm), both skeletal. Microcrystalline matrix composed of feathery intergrowths of plag., cpx., opaques, and clays. Vesicles 3% filled with light brown clay minerals.

142-144 cm (aphyric basalt):

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2		Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
49.7	15.07	11.17	7.5	11.25	0.27	1.74	–1.3	0.57	291	121	130	128

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
142-144 cm (Piece 10):	–41.9	4.89	550	5.65	5.81	2.90	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	42	1

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Fine-grained and very fine-grained aphyric basalt. Coarser grained rocks have visible needle-like plagioclase sworls (subvariolitic), and tiny crystals of olivine partially altered to reddish secondary minerals. Vesicles range from 1-5%, but are more typically 3%. They are often filled with whitish or greenish secondary minerals. Piece 4 is nearly glassy. Piece 7 is especially vesicular (5%). A carbonate-filled vein occurs in Piece 8, along which the basalt is more altered.

Thin Section Description

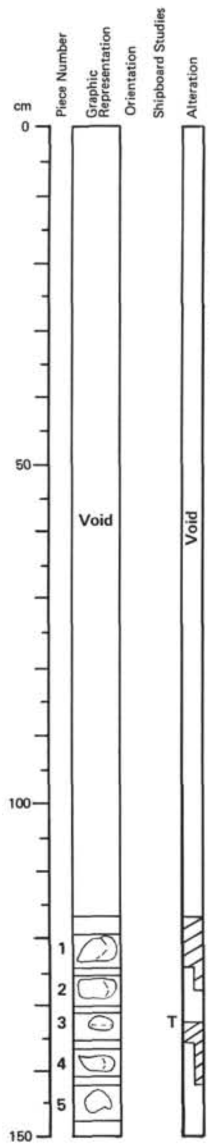
86-89 cm (Piece 3): Variolitic olivine basalt. Plagioclase 25% (.005 x .2 mm) highly skeletal; olivine 5% (.02 x .4 mm) skeletal. Variolites probably acicular growths of cpx., opaques, and plag. around various nuclei. Glass abundant.

126-128 cm (Piece 8): Aphyric intersertal, partly subvariolitic basalt. Plagioclase and olivine microphenocrysts less than 1%. Groundmass plagioclase 40% (.05 x .6 mm) skeletal; olivine 7% (.1 mm, fairly equant) skeletal. Mesostasis is titanomagnetite, acicular brown cpx., small plag. laths, and brown clays (altered glass) totalling about 40%. Vesicles 3% partly filled with yellowish brown and/or clear clay minerals. Possibly some olivine totally altered to clays.

86-89 cm (aphyric basalt):

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
49.7	15.19	11.42	7.4	11.23	0.16	1.75	–0.8	0.56	296	115	132	131

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
126-128 cm:	–43.6	4.08	500	—	—	–	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	43	1

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

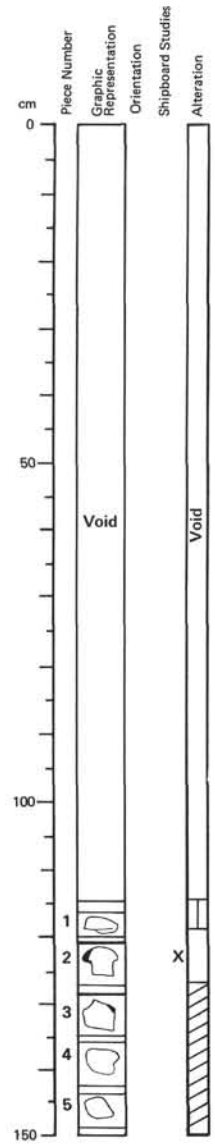
Mascroscopic Description

Fine-grained vesicular (1-3%, 1 mm diam.) aphyric basalt. Piece 5 is the most vesicular and the freshest. Pale brown alteration rims occur on Pieces 1-4.

Thin Section Description

132-134 cm (Piece 3): Subvariolitic olivine basalt. Plagioclase 40% (.01-.5 mm) skeletal; cpx. 30% (.005 mm long) skeletal; olivine 5% (.02 × .2 mm) skeletal. Titanomagnetite 5% (.003 mm equant or as chains) skeletal. Interstitial material 20% microcrystalline cpx., opaque, plag. with glass altered to brownish clays.

No recovery Core 44 Section 1



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

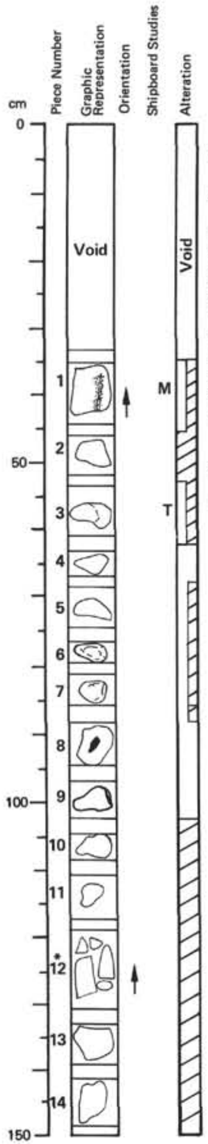
LEG	SITE	HOLE	CORE	SECT.
45	395	A	45	1

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Fine-grained, very fine-grained, and glassy aphyric basalt. There are 1-3% vesicles (3% on 1, 2% on 2). Pieces 2 and 3 have glassy rims. Piece 1 is intensely altered. On its surface is a rust-colored coating with zeolites(?). A zeolite(?) encrustation is also found on Piece 3.

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
124-127 cm (aphyric basalt):	49.8	15.09	11.45	7.3	11.27	0.18	1.76	−1.1	0.56	286	111	131	131



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	46	1

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

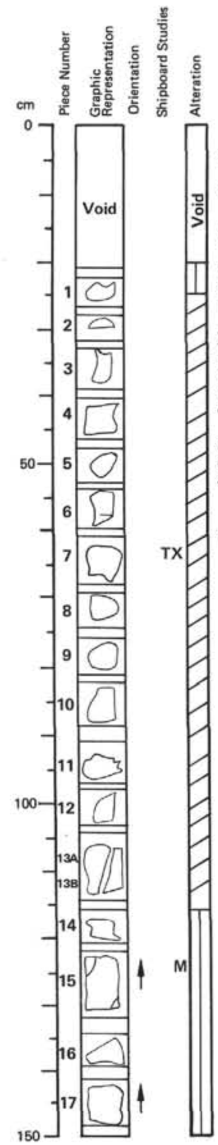
Fine-grained, very fine-grained, and glassy aphyric basalt, fresh to moderately altered, with rare plagioclase phenocrysts in some pieces. Vesicles are 1-3% of the rocks, some filled with whitish or greenish secondary minerals. Pieces 8 and 9 have some glass. Piece 13 has more abundant plagioclase phenocrysts than usual. It also has carbonate-filled druses. Piece 1 has a crack along which alteration is most intense. It appears to be filled with zeolites(?). There is a carbonate encrustation on Piece 14. Partial weathered rinds occur on Pieces 3, 6 and 7.

Thin Section Description

54-60 cm (Piece 3): "Aphyric" intersertal olivine basalt. Plagioclase 40% (.04 x .4 mm) skeletal; olivine 7% (.05 mm equant) skeletal; titanomagnetite 5% (.005 mm) skeletal. Rest is brown mesostasis composed of acicular cpx., opaques, and glass. Vesicles are filled partly with Fe-hydroxide, and very pale brown clay minerals.

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
41-43 cm:	-51.5	8.00	450	—	—	–	–

*fragments



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	47	1

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

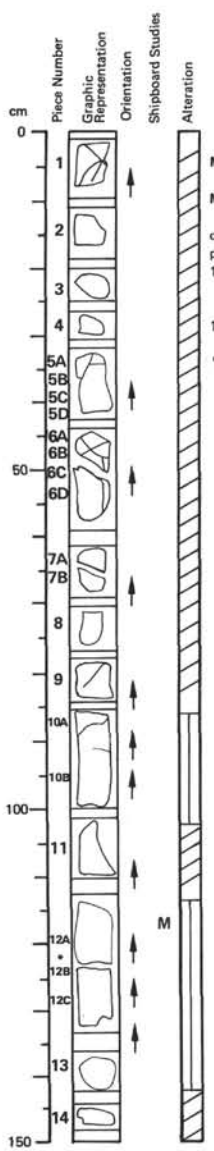
Fine-grained, and very fine-grained aphyric basalt with rare "rounded" plagioclase phenocrysts (1-3 mm diam.). Vesicles are about 1% and filled with dark gray clay minerals. Variolitic texture is observed in some pieces. Pieces 1, 4, 14, 15, 16, and 17 contain carbonate veinlets, and Piece 17 contains the most abundant carbonate veinlets among them. Some specimens have zeolite(?) coatings on weathered surfaces (Pieces 1, 6, 7, 8, 9, 10, 11, 15, and 16). The entire core is moderately to intensely altered.

Thin Section Description

63-67 cm (Piece 7): Variolitic olivine basalt, no phenocrysts. Plagioclase 30% (.005 x .2 mm) with rare larger (.02 x .3 mm); olivine 3-5% (.01 x .1 mm) skeletal; cpx. rare up to .005 mm. Titanomagnetite .005 mm skeletal 5%. Matrix is microcrystalline plag., cpx., opaques, and brownish yellow clay minerals after glass. Plag. is main mineral in variolites.

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
63-67 cm (aphyric basalt):	49.8	15.81	11.05	7.2	11.52	0.21	1.67	-1.2	0.56	305	119	134	118

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
124-126 cm:	-48.7	0.88	350	—	—	–	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	47	2

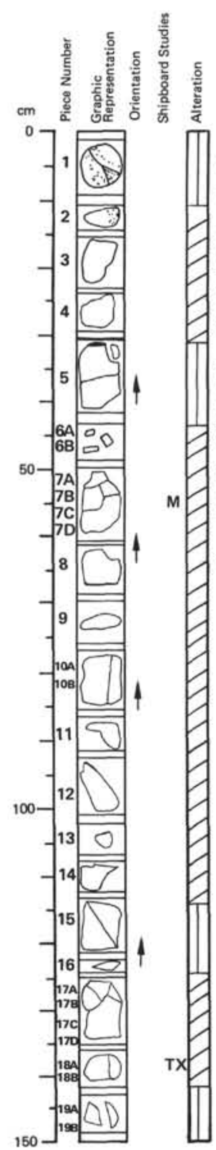
MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Fine-grained and very fine-grained aphyric basalt with some rare plagioclase and olivine phenocrysts in Pieces 8, 10, 12, and 14. Moderately to intensely altered, with 1-2% vesicles (1 mm diam.) partially or completely filled with whitish or greenish secondary minerals. Pieces 6, 7, 10, 12, and 13 have carbonate veins.

	Inc.	NRM	MDF	Vp (∥)	Vp (⊥)	D	P
118-120 cm:	-47.2	2.17	900	—	—	–	–

*Piece not on surface, but beneath 12A and 12C



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	48	1

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

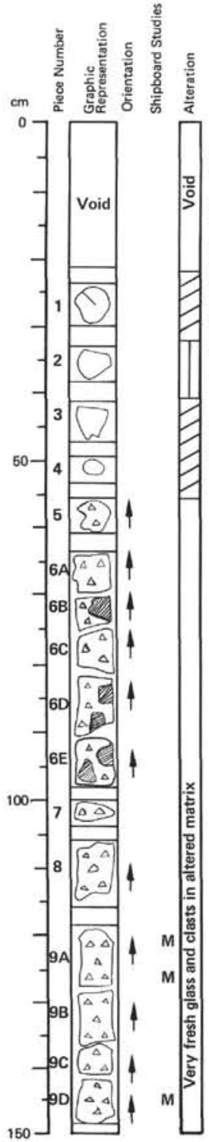
Fine-grained and very fine-grained aphyric basalt with isolated plagioclase phenocrysts and tiny olivine crystals in Pieces 7A-C, 10, 14, and 15. The core is moderately to intensely altered. Olivine is more readily seen in those pieces where it has partially or totally altered to reddish alteration minerals. Cracks lined with carbonate and possibly zeolite occur in many pieces which have a tendency to break along them. Weathered crack surfaces with reddish alteration minerals are common. Vesicles are small (less than 1 mm) and rare (1-2%) and quite often filled with white or pale green alteration products. A thin glassy zone occurs on the top edge of Piece 5.

Thin Section Description

135-140 cm (Piece 18A): Variolitic olivine basalt, no phenocrysts. Plagioclase 1% (.1 x .6 mm) tabular, and 30% (.01 x .4 mm) skeletal; olivine 5% (.05 x .4 mm) skeletal; cpx. .01 mm max. anhedral and skeletal. Mesostasis composed of fine-grained cpx., plag. and opaques (in variolites only). Vesicles are filled with a very pale brown clay mineral.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
135-140 cm (aphyric basalt):												
49.4	15.09	11.16	7.9	11.23	0.25	1.71	-1.5	0.58	291	120	131	124

	Inc.	NRM	MDF	Vp (∥)	Vp (⊥)	D	P
55-57 cm:	-43.5	3.64	450	—	—	–	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	49	1

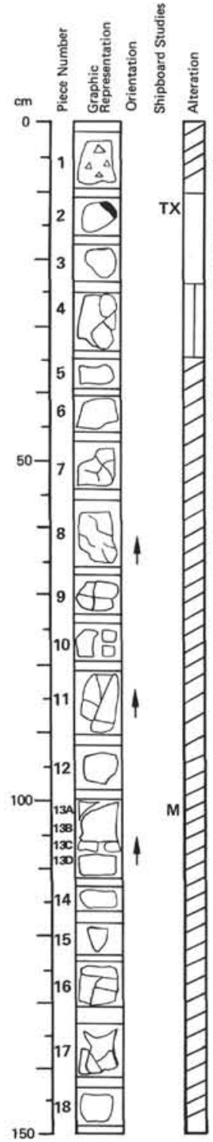
MAJOR ROCK TYPE – PIECES 1-4: FINE-GRAINED APHYRIC BASALT; PIECES 5-9: GLASSY VOLCANIC BRECCIA

Macroscopic Description

Pieces 1-4: Fine-grained aphyric basalt, with rare plagioclase phenocrysts and veins filled with whitish secondary minerals. Piece 2 is pale brown due to alteration.

Pieces 5-9D: Volcanic breccia. Angular fragments of aphyric basalt cemented together by an aggregate of small fragments of plagioclase and volcanic glass. There are thin veins of whitish material and patches in Pieces 6C, 8, 9A, 9B (zeolites?). In Piece 5, one basalt fragment contains olivine phenocrysts. The breccia shows no fragment sorting or orientation. Alteration of basalt fragments in the breccia increases down-core. The matrix is ochre brown in Piece 5, as are parts of the matrix of Pieces 6A-E. In Piece 6, a darker brown matrix is also present. A dark brown matrix is the only matrix to Pieces 9A-D. Pieces 9A and 9B are more lithified than Pieces 6-8.

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
119-121 cm:	-35.7	1.06	650	–	–	–	–
122-124 cm:	-47.0	2.22	600	–	–	–	–
145-147 cm:	-32.7	1.57	600	–	–	–	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	49	2

MAJOR ROCK TYPE – PIECE 1: VOLCANIC BRECCIA; PIECES 2-18: FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Piece 1: Volcanic breccia, with generally altered angular fine-grained basalt fragments. Largest fragment seen on cut surface has a few olivine and plagioclase phenocrysts. The matrix is dark brown, the same as that in the bottom of Section 1. One fragment has a glassy interior, but is altered to yellowish clays(?) along its edges.

Pieces 2-18: Fine-grained, very fine-grained, and glassy aphyric basalt. Very sparse phenocrysts of plagioclase and olivine are present in some pieces. Piece 2 has a glassy edge. Pieces 4-12 are cut by veins of carbonate about 0.05 mm across. Alteration of the basalt is concentrated next to these veins where the basalt is pale brown. Some relatively fresh areas of basalt remain but they are small. There are about 1% empty vesicles. Pieces 13-18 are fresher than Pieces 4-12, but their 1% of vesicles are filled with whitish secondary minerals. Veins of carbonate are also present.

Thin Section Description

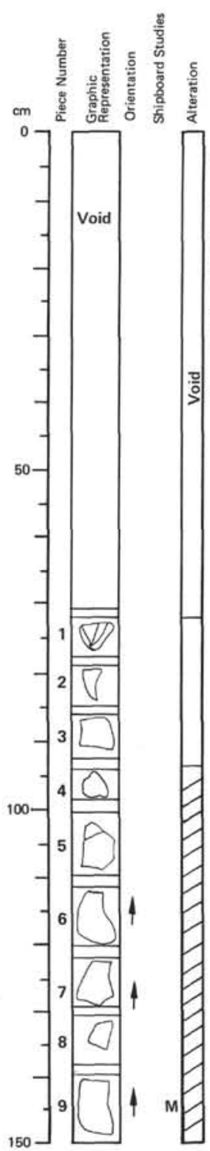
13-17 cm (Piece 2): Variolitic olivine basalt no phenocrysts. Plagioclase 35% (.01 x .2 mm), 1% (.1 x 1.5 mm). Olivine 5% (.2 mm) skeletal. Matrix is now pale brown feathery crystal aggregate (cpx., plag., opaques). No alteration information given.

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
13-17 cm (aphyric basalt):	49.6	15.08	11.14	8.1	11.32	0.17	1.72	-1.2	0.59	300	118	128	128

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
101-103 cm:	-43.5	4.14	500	—	—	–	–

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	50	1



MAJOR ROCK TYPE (50-1, 2) – FINE-GRAINED APHYRIC BASALT

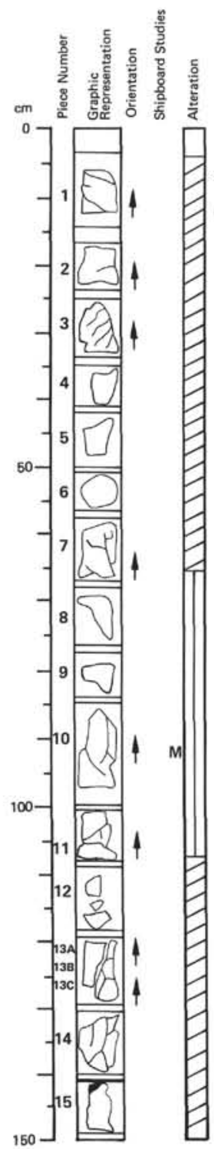
Macroscopic Description

Fine-grained and very fine-grained aphyric basalt, generally moderately to intensely altered. Sparse plagioclase and olivine quench crystals observed in Section 1, Pieces 1, 4, and 7-9. Section 2, Pieces 1 and 2. In other pieces, crystals are too small to identify. Vesicles are 1-2%, less than 1 mm diameter, locally empty or filled with whitish or greenish alteration minerals. Olivine is partially altered to secondary reddish minerals. Many pieces have cracks less than 0.5 mm thick lined with carbonate or other whitish secondary minerals. Some fracture surfaces have an oxidized coating, possibly with Mn spots. Several pieces have partial alteration "rinds". Section 2, Piece 15 has a glassy edge. The sequence represents low recovery in thin flows or pillow lavas.

	Inc.	NRM	MDF	Vp (∥)	Vp (⊥)	D	P
140-142 cm:	-45.8	3.41	500	—	—	–	–

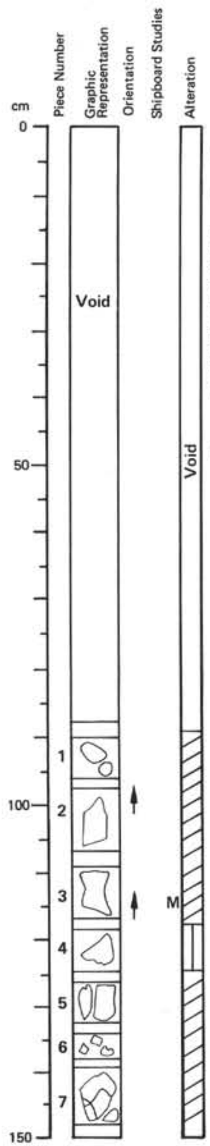
VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	50	2



	Inc.	NRM	MDF	Vp (∥)	Vp (⊥)	D	P
92-94 cm	-46.3	4.29	550	—	—	–	–

Descriptions under 395A-50-1



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

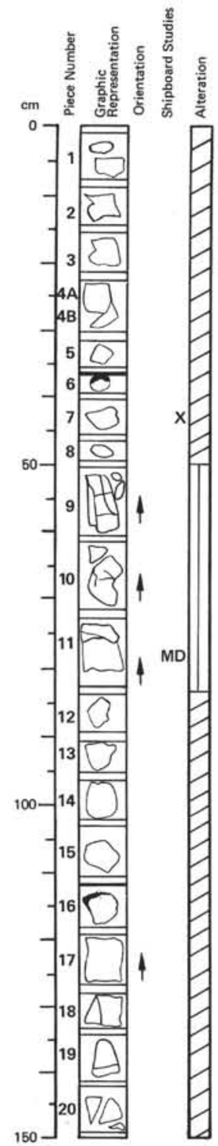
LEG	SITE	HOLE	CORE	SECT.
45	395	A	51	1

MAJOR ROCK TYPE (51-1, 2, & 3) – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Fine-grained and very fine-grained aphyric basalt with very sparse plagioclase phenocrysts in isolated pieces, moderately to intensely altered. Many pieces have subvariolitic texture, with quench plagioclase sworls evident. Vesicles are 1-2% and less than 1 mm. Locally empty or filled with whitish or greenish secondary minerals. Carbonate fillings occur in narrow cracks (less than 0.5 mm thick) and on fracture surfaces on many pieces. Glass is present on the edges of Section 2, Pieces 6 and 16. Piece 2 in Section 1 has a three layer coating in places. The three layer coating consists of two layers of reddish oxidized material separated by a thin layer of carbonate. This was undoubtedly a crack filling which did not separate cleanly along a single layer. Glass is partially palagonitized in Section 2, Pieces 6 and 16. Section 3 is much like Sections 2 and 1. Carbonate encrustations are common especially on Section 3, Pieces 1 through 5, and 9. Very sparse "rounded" plagioclase phenocrysts are present in Section 3, Pieces 7, 8, 19 and 21.

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
113-115 cm:	-41.8	4.87	550	—	—	–	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	51	2

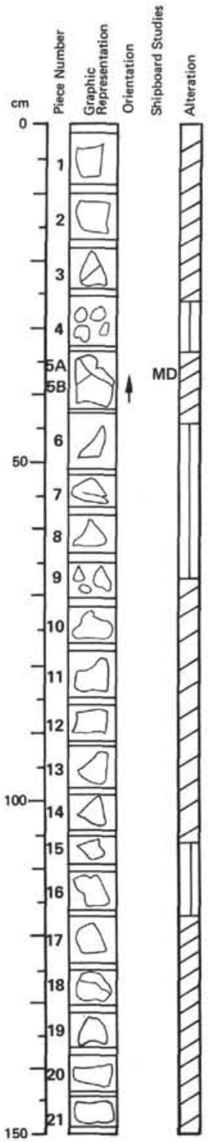
	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
41-44 cm (aphyric basalt):	49.8	15.08	11.34	7.5	11.33	0.23	1.72	−1.3	0.57	291	119	130	128

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
77-79 cm (Piece 11):	-46.1	3.42	525	—	—	2.87	–

Description under 395A-51-1

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	51	3

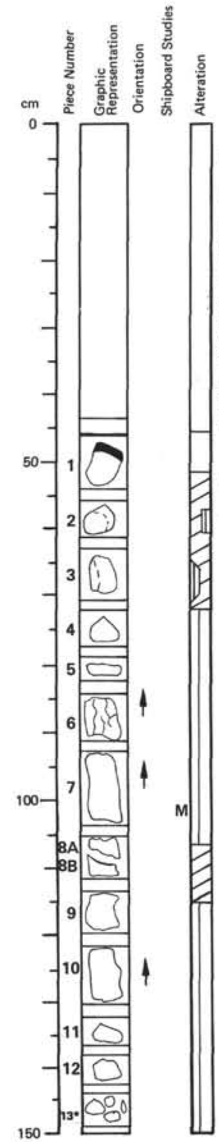


	Inc.	NRM	MDF	V_p (∥)	V_p (⊥)	D	P
39-41 cm (Piece 5):	−46.4	3.79	550	—	—	2.84	—

Description under 395A-51-1

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	52	1



MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

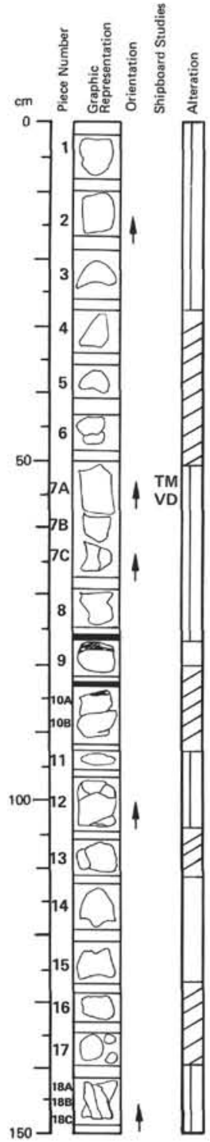
Macroscopic Description (52-1 AND 52-2)

Fine-grained, very fine-grained, and glassy aphyric basalt, variously fresh, moderately altered, and intensely altered. Local "rounded" very rare plagioclase phenocrysts. Usually quench plagioclase needles can be seen in the coarser-grained pieces. Glass present on Section 1, Piece 1 and Section 2, Pieces 9 and 10A. Alteration "rinds" present on Section 2, Pieces 2 and 3. Tiny olivine crystals, which are present in the coarser-grained pieces, are partially altered to reddish secondary minerals. Carbonates line cracks and coat fracture surfaces. Alteration is somewhat more intense next to such cracks and surfaces. Often, the carbonate crusts a thin layer of reddish iron oxidation alteration products. Botryoidal crystals of zeolite(?) occur on one surface of Section-1, Piece 3. Vesicles are tiny (less than 1 mm) and rare (less than 1%) but are locally filled with whitish or greenish alteration minerals, probably clays.

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
48-53 cm (aphyric basalt):	49.8	15.03	11.61	7.3	11.47	0.18	1.74	−1.0	0.55	303	118	134	123

	Inc.	NRM	MDF	V_p (∥)	V_p (⊥)	D	P
103-105 cm (Piece 7):	−41.3	3.82	450	4.87	4.84	2.78	—

*Fragments



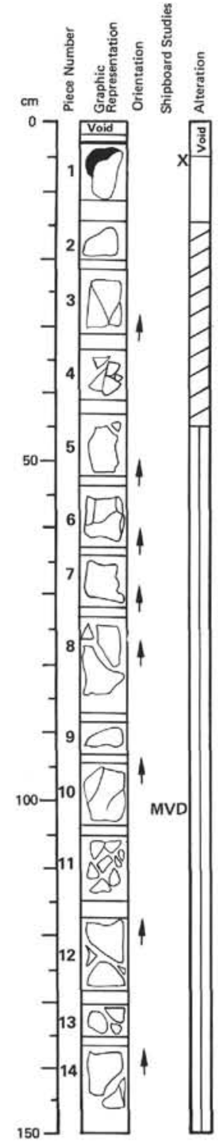
VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

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

Thin Section Description

58-60 cm (Piece 7A): Variolitic olivine basalt, no phenocrysts. Plagioclase 40% (.01 x .4 mm) acicular and skeletal. Olivine 15% (up to .2 mm) skeletal; titanomagnetite 5% skeletal. Microcrystalline glass 35%; vesicles 5%.

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
51-53 cm (Piece 7A):	−51.1	1.70	550	4.58	4.55	2.71	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

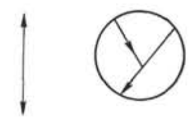
LEG		SITE			HOLE	CORE		SECT.	
4	5	3	9	5	A	5	3		1

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description (53-1 AND 53-2)

Fine-grained, very fine-grained, and glassy aphyric basalt, moderately to intensely altered except locally fresh. Very rare "rounded" plagioclase phenocrysts up to 5 mm in diameter and even more rare microphenocrysts of olivine. Vesicles are less than 1% and 1 mm in diameter. In Section 1, Pieces 11-14 are somewhat more vesicular than Piece 10. Vesicles filled with whitish or greenish alteration minerals (clays, most likely) in many pieces. Cracks are common, and often lined with pale yellow to orange or whitish alteration minerals. The cracks may be conjugate fractures, as below. In Section 2, Pieces 1-4 are more vesicular than those below, and are a continuation of the vesicular zone at the base of Section 1.

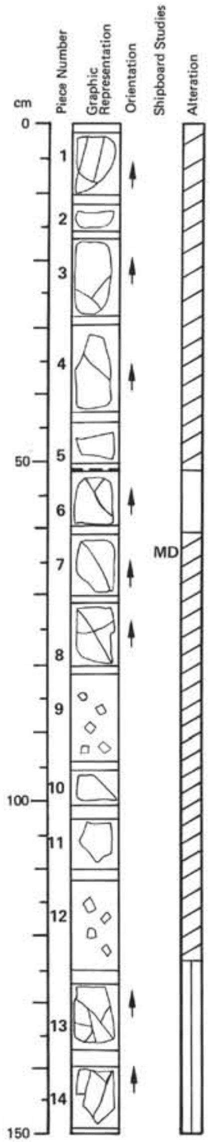
Note: Fractured pieces were pieced together, wrapped in tape, and then split. They are still partially held together by tape and thus have no A,B,C type labels.



Axis of stress (or ⊥ to this).

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
7-11 cm (aphyric basalt):												
49.6	15.11	11.28	7.9	11.22	0.18	1.72	−1.3	0.58	298	119	131	128

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
99-101 cm (Piece 10):	−41.5	2.23	900	5.52	5.50	2.84	–

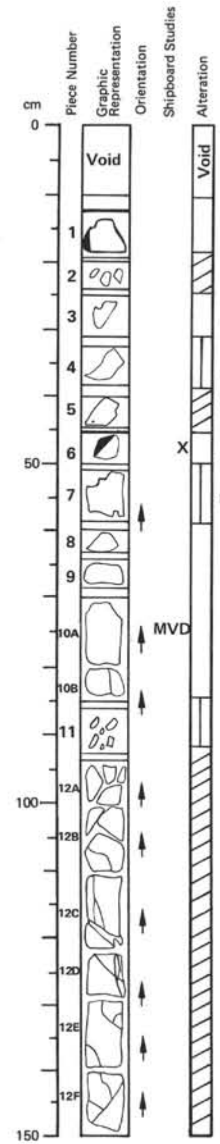


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	53	2

	Inc.	NRM	MDF	V_p (∥)	V_p (⊥)	D	P
62-64 cm (Piece 7):	-43.2	2.15	650	—	—	2.89	3.4

Description under 395A-53-1



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	54	1

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

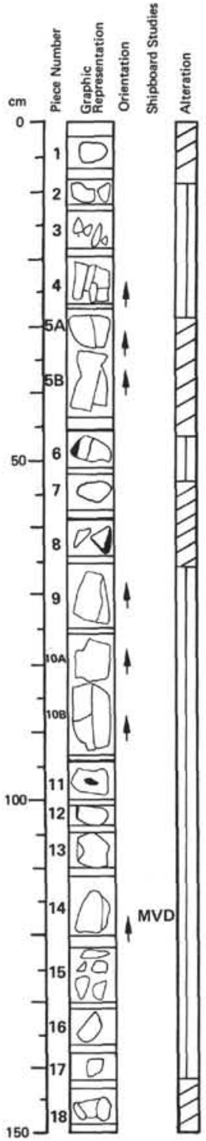
Macroscopic Description (Sections 54-1 AND 54-2)

Fine-grained, very fine-grained, and glassy aphyric basalt ranging from fresh to intensely altered, locally highly fractured and containing very sparse plagioclase and/or olivine phenocrysts in some pieces. Alteration is primarily oxidation to various shades of pale brown. Olivine is partially altered to reddish secondary minerals. Many cracks are lined with thin veins of carbonate. Vesicles vary from 1-2% and are very tiny (less than 1 mm), locally filled with whitish, greenish, or orange secondary minerals. Glass rinds occur on Section 1, Piece 1, Section 2, Pieces 6A, 8B, and 11. Fracture surfaces are along former cracks, and are coated with "chloritic" or carbonate minerals, and sometimes reddish alteration minerals. Note that fractured pieces have been taped and split as in Core 53, Section 1.

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
48-51 cm (aphyric basalt):	49.6	14.90	11.11	7.7	11.11	0.14	1.72	-0.7	0.58	296	111	124	132

	Inc.	NRM	MDF	V_p (∥)	V_p (⊥)	D	P
74-76 cm (Piece 10A):	-43.9	4.67	900	5.81	5.77	2.89	–

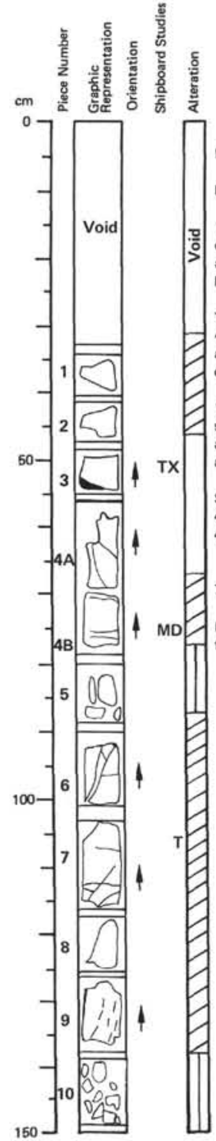
Description under 395A-54-1



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	54	2

	Inc.	NRM	MDF	$V\rho$ (‖)	$V\rho$ (⊥)	D	P
116-118 cm (Piece 14):	-43.8	3.00	550	5.16	5.21	2.83	8.0



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	55	1

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description (Sections 55-1 AND 55-2)

The general features of this core are virtually identical to Core 54, described under Core 54, Section 1. In Core 55, glass is found on Section 1, Piece 3 only. In the lower part of Section 1, Piece 8, large druses are developed, partially filled with white fine-grained, white spherical, light greenish white spherical, and light brown and gray spherical secondary minerals. The former two are carbonate. In Section 2, Piece 8 may have glass, but it is highly altered.

Thin Section Description

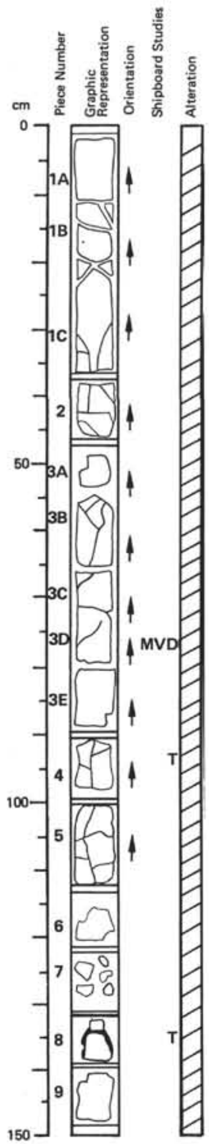
49-54 cm (Piece 3): Subvariolitic olivine basalt, no phenocrysts. Plagioclase 10% (.05 x .1 mm) skeletal, acicular; olivine 5% (.02 x .2 mm) skeletal - acicular to anhedral, occasionally up to .5 mm. Microcrystalline groundmass 85%. No alteration information given.

104-107 cm (Piece 7): Subvariolitic olivine basalt, no phenocrysts. Plagioclase 40% (.05 x .8 mm) acicular, skeletal laths. Olivine 15% (.1 mm) rounded; cpx. 20% (about .3 mm) crystallized after plagioclase, and grew around it. Microcrystalline groundmass 20%, vesicles 5%, filled with olivine green clays. Olivines also slightly altered to clays.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
49-54 cm (aphyric basalt):												
49.3	14.88	11.13	8.0	11.18	0.17	1.73	−1.6	0.59	303	116	131	126

	Inc.	NRM	MDF	$V\rho$ (‖)	$V\rho$ (⊥)	D	P
75-77 cm (Piece 4B):	−32.2	3.14	450	—	—	2.85	–

Note: Highly fractured pieces are taped together as in Core 53, Section 1. Some pieces are too highly fractured to piece together and are clumped together as in Section 1, Pieces 5 and 10.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

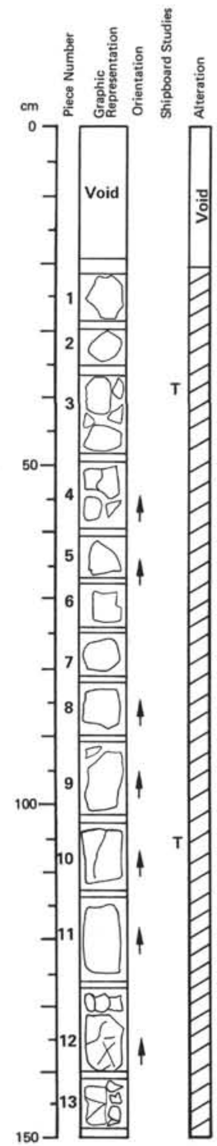
LEG	SITE	HOLE	CORE	SECT.
45	395	A	55	2

Thin Section Description

91-98 cm (Piece 4): Subophitic to subvariolitic olivine basalt, no phenocrysts. Plagioclase 45% sub-anhedral; cpx. 35% sub- to anhedral; olivine 5% subhedral; titanomagnetite 5%; vesicles 5% filled with pale green clay minerals and reddish brown Fe-hyrdroxides; interstitial clay 3%.

137-138 cm (Piece 8): Vitrophyric to variolitic. Plag. and olivine both rare (1-2%). Dark glass ("devitrified") 80%, of which 15% is palagonite. Vesicles 1% filled with clay minerals and chlorite(?). Sheaf-like spherulites present.

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
78-80 cm (Piece 3D):	−38.0	5.71	350	5.30	5.30	2.85	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	56	1

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

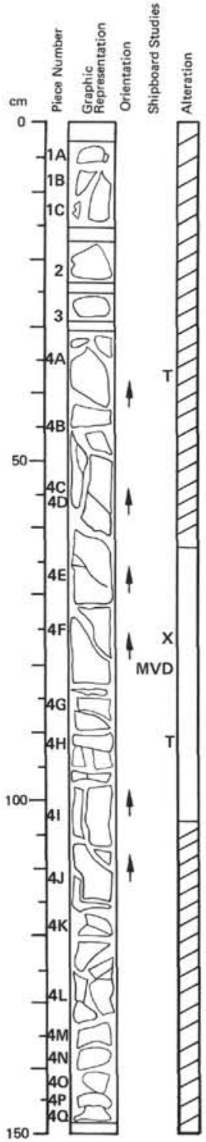
Macroscopic Description (56-1, 56-2, 56-3, AND 56, CC)

In general, this core is identical in lithology to that described in Core 54, Section 1. However, fracturing is much more intense than in previous cores, so much so that the placing of spacers between distinct pieces was abandoned because any handling of the basalt would have disrupted order and sequence more than it would have helped. The fracturing is similar to that of the immediately previous cores in that conjugate cracks are well developed, possibly evidence for compressional failure of these deeply buried rocks. Alteration is commensurately more intense. Clays, chlorite, hydrous iron-oxides, carbonates and possibly zeolites are prominent secondary minerals. Fracture surfaces are almost invariably coated with soft clay minerals. Glass was noted on several pieces in Sections 3 and CC, and is fairly fresh. The basalt immediately adjacent to glass, however, is more altered than typically more massive and coarse-grained basalt, possibly reflecting differences in porosity to altering fluids.

Thin Section Description

35-37 cm (Piece 3): Variolitic olivine basalt. Plagioclase 35% (.01-.1 mm) acicular and skeletal; olivine 5% (.01-.2 mm) skeletal. Matrix is microcrystalline plagioclase, cpx., opaque dust, and clays (60%).

105-106 cm (Piece 10): Intersertal basalt, no phenocrysts. Plagioclase 45% (.1-.3 mm) subhedral laths, 1% up to 2 mm. Olivine 2% subhedral; cpx. 40% (.05-.2 mm) anhedral to subhedral, skeletal; titanomagnetite 3%; matrix 10% (fine-grained intergrowth of plag., cpx., opaques, and clay minerals. Vesicles (1-2%) are filledby yellow-brown and dark brown clay minerals.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	56	2

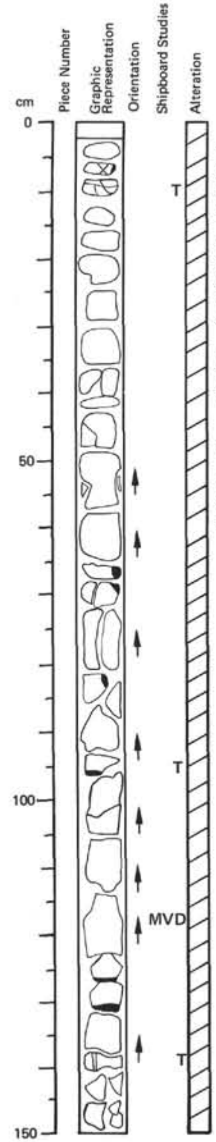
Thin Section Description

34-36 cm (Piece 4A): Subophitic-subvariolitic olivine basalt, no phenocrysts. Plagioclase 30% subhedral (An_{70}); cpx. 15% subhedral; olivine 5% subhedral, all .01-.5 mm. Plagioclase acicular, olivine more equant. Mesostasis 50% has 70% cpx., 20% plag., 10% titanomagnetite. Vesicles are present and filled by red-brown and yellow-brown clays.

89-91 cm (Piece 4H): Intersertal olivine basalt. Plagioclase 45% (.1-.3 mm), TR up to 2.5 mm (An_{65}); cpx. 45% (.1-.3 mm) anhedral; olivine 5% (.08-.2 mm) subhedral; titanomagnetite 2-3%, skeletal; vesicles 2-3% filled with greenish gray and yellowish brown clays (or chlorite?).

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
75-81 cm (aphyric basalt):	49.9	14.88	11.13	7.8	11.18	0.17	1.74	–1.9	0.58	260	102	131	129

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
79-81 cm (Piece 4F):	–45.2	3.52	175	5.65	5.71	2.91	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	56	3

Thin Section Description

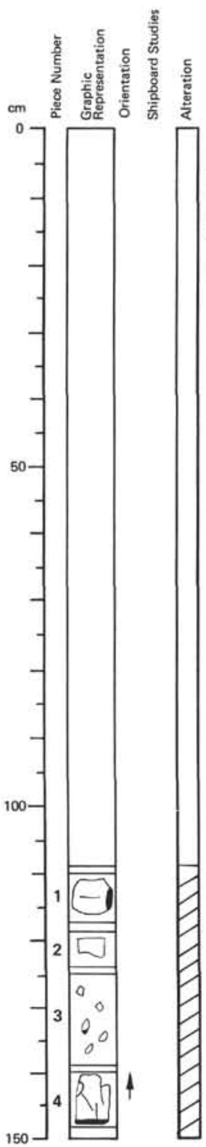
8-10 cm (Piece 1C): Hyaloclastite. Yellow and black volcanic glass fragments with trace of skeletal olivine crystals. Pieces .1-1 cm. Most fragments rimmed with palagonite. Cement is clays and zeolites(?). Glass = 90%. Cement = 10%.

94-96 cm: Basalt glass, with about 1% each of skeletal, tiny plagioclase (.2-.4 mm) and ol. (.05 mm) crystals. Glass is brown to opaque. Glass grades from clear (quench) to dark colors by agglomeration of tiny variolites of dark incipient crystalline material (indeterminant mineralogy) which has either olivine crystallite or plagioclase crystallite cores. This represents a transition between truly quenched and highly undercooled but unquenched glassy material.

137-141 cm: Hyalophitic olivine basalt: Plagioclase 45% subhedral laths; cpx. 15% anhedral; olivine 5% subhedral; titanomagnetite dust; vesicles 5% filled with greenish gray to brownish gray clays and perhaps chlorite. Microcrystalline mesostasis contains interbrown plag., cpx., opaque dust, and clays.

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
117-119 cm:	–42.9	3.14	550	5.44	5.45	2.85	5.6

Note: Spacers were not placed between pieces in this section. Pieces are designated by interval only. Small drilling breaks probably occur between many pieces in this section. At least 5 and probably 6 cooling unit boundaries were recovered in this section, at 7, 65, 82, 95, 125, and 130 cm.

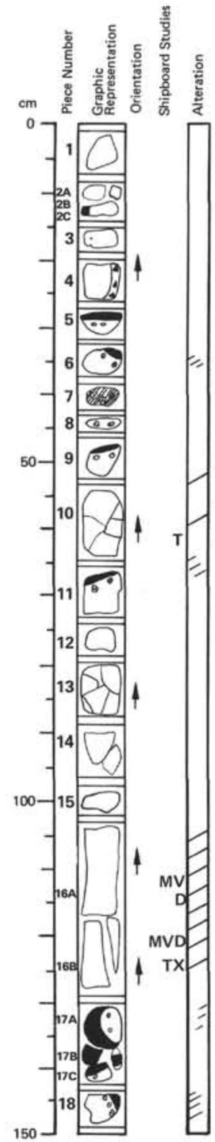


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	56	CC

Pieces recovered in the core-catcher of Core 56 were placed in this section. However, they should have been placed at the top of the section as there is no major drilling break (unrecovered interval) between the base of Section 3 and the top of core-catcher. As the pieces were photographed in this position, however, this description is presented consistent with the photographs (a minor lapse in quality control).

At least two cooling unit boundaries were recovered in this section.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	57	1

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Fine-grained, very fine-grained, and glassy aphyric basalt. Many glassy rinds and zones as shown. Glass spectacular on 17A-C which is nearly all glass, set in a clay matrix. 17A-C are breccias (see similar glass breccias in Core 58, Section 2).

Piece 4 shows vertical junction between basalt and basaltic glass breccia, a choice specimen. Piece 7 is the freshest in the core, and variolitic and glassy. Piece 8 is also variolitic. Cracks cross many pieces, particularly 10, 11, 13, 15, and 16A. They are usually with a white, non-carbonate material (zeolite?).

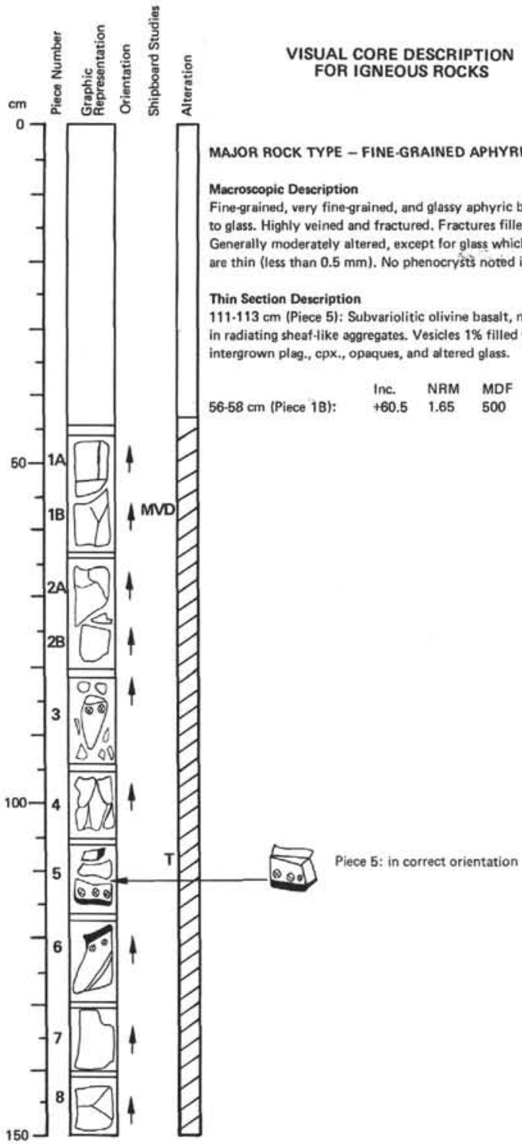
60-62 cm (Piece 10): Subvariolitic olivine basalt, no phenocrysts; plagioclase 15% as sheafs; olivine 5% highly skeletal. Vesicles 2% filled with clay minerals. Mesostasis 78% very fine-grained microcrystalline, dark brown sheaf-like in places, indeterminant mineralogy.

125-131 cm (Piece 16B): Subvariolitic olivine basalt, no phenocrysts. Similar to Piece 10, only slightly more crystalline (35% plag.). Vesicles 1-2% filled with clay minerals, zeolites(?), and possibly green celadonite.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
125-131 cm (aphyric basalt):												
49.2	15.14	11.20	8.1	11.09	0.22	1.59	–2.3	0.59	363	163	134	105

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
110-112 cm (Piece 16A):	+57.4	1.60	450	4.67	4.76	2.74	–
127-129 cm (Piece 16B):	unstable	1.12	700	5.63	5.70	2.89	–

Cooling unit boundaries at 27, 48, 58, and 130 cm.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	58	1

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

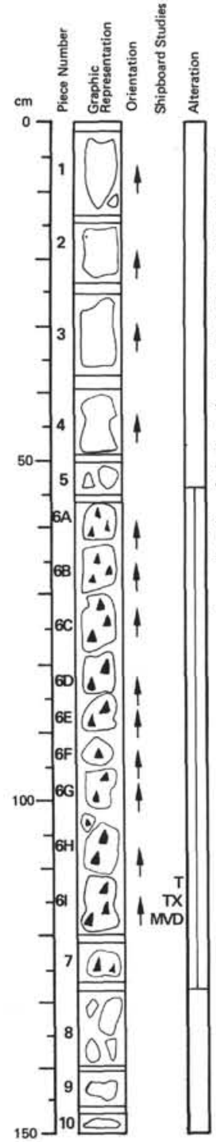
Macroscopic Description

Fine-grained, very fine-grained, and glassy aphyric basalt, glass as marked. Variolites present adjacent to glass. Highly veined and fractured. Fractures filled with whitish secondary mineral (zeolites?). Generally moderately altered, except for glass which is fresh apart from minor palagonite. All veins are thin (less than 0.5 mm). No phenocrysts noted in any pieces. Cooling unit boundary at 115 cm.

Thin Section Description

111-113 cm (Piece 5): Subvariolitic olivine basalt, no phenocrysts: Plagioclase 40%, olivine 15%. Plag. in radiating sheaf-like aggregates. Vesicles 1% filled with clay minerals. Mesostasis microcrystalline 45%, intergrown plag., cpx., opaques, and altered glass.

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
56-58 cm (Piece 1B):	+60.5	1.65	500	5.13	5.24	2.81	8.4



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	58	2

MAJOR ROCK TYPES – FINE-GRAINED APHYRIC BASALT AND FRESH HYALOCLASTITE BRECCIA

Macroscopic Description

Pieces 1-5: Very fine-grained aphyric basalt with very rare phenocrysts of plagioclase. Piece 4 has vugs partially filled with pale yellow and pale white secondary minerals. Cracks cross 3 and 4.

Pieces 6A-7: Hyaloclastite. Basaltic glass fragments in matrix of altered glass fragments. Some glass fragments 4 cm across and rounded. A mixture of angular and rounded pieces. Piece 7 is partly very fine-grained basalt "grading into" hyaloclastite breccia. Glass in breccia is fresh. Matrix 20-50% of pieces.

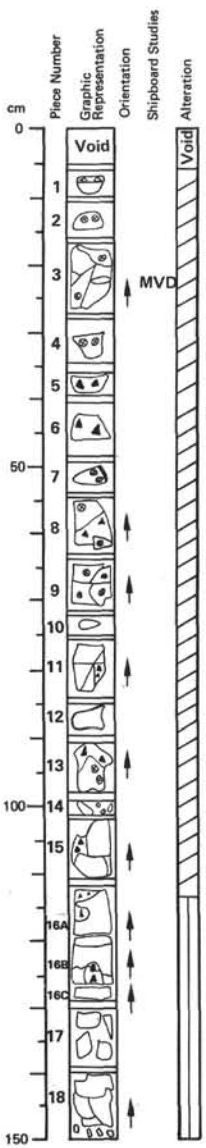
Pieces 8-10 are similar to Pieces 1-5.

Thin Section Description

112-115 cm (Piece 6I) and 115-117 cm (Piece 6I): Hyaloclastite. Glass 90%+. Trace of ornate skeletal tiny olivine crystals and chromite. Glass is partly "devitrified" and partly altered to pale green or brown clay minerals. Matrix around fragments is composed of pale green or brown clay minerals, and clear clay minerals.

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
115-122 cm (glass):	50.5	14.47	10.86	8.2	10.50	0.10	1.58	-0.5	0.60	381	169	119	110

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
115-117 cm (Piece 6I):	+42.0	9.62+ 10^{-7}	450	4.57	—	2.50	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	59	1

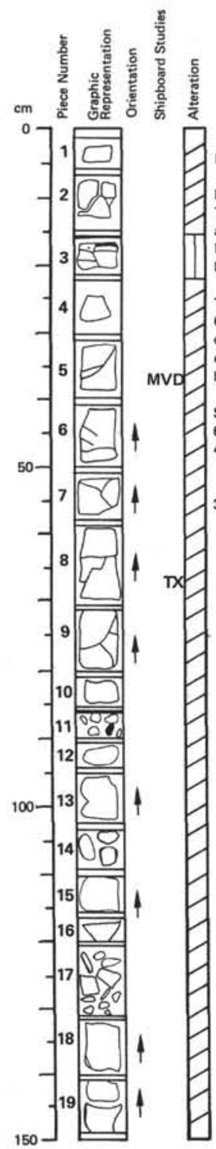
MAJOR ROCK TYPES – FINE-GRAINED APHYRIC BASALT AND BASALT GLASS (HYALOCLASTITE) BRECCIA

Macroscopic Description

Fine-grained, very fine-grained, and glassy aphyric basalt. Glass as marked. Variolites present adjacent to glass. Moderately to intensely altered. Abundantly cracked with secondary clays(?), carbonates, and/or zeolites lining cracks and forming on fracture surfaces. Plagioclase phenocrysts very rare. Variolites no more than 1-2 mm diameter. Olivine phenocrysts (rounded) are found in Piece 7.

The breccia, present in Pieces 5, 6, 11, 12, 15, and 16, is composed of 0.2-1.0 cm glass fragments (fresh, angular) in a matrix with abundant greenish clays after glass and rare carbonate secondary minerals. The breccia is stuck to larger clasts of basalt which were obviously co-extrusive.

	Inc.	NRM	MDF	V_p (‖)	V_p (⊥)	D	P
26-28 cm (Piece 3):	+64.6	0.543	>1000	5.74	5.82	2.91	2.7



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	59	2

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

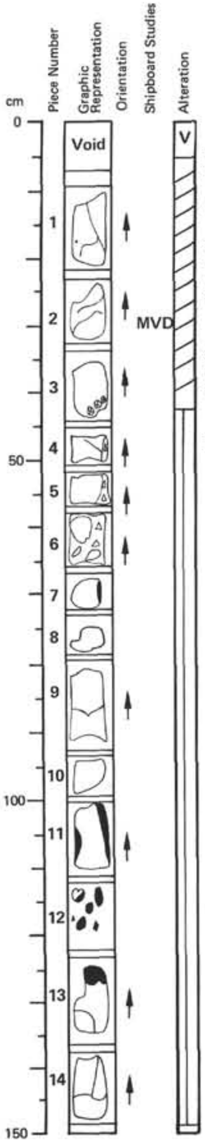
The description of fine-grained basalt in Core 59, Section 1 applies here. Glass is noted in Piece 3 and among the Pieces in 8. Vesicles filled with secondary minerals are especially noticeable in Pieces 6-10. In Pieces 18 and 19, a crack plane is coated with a chloritic secondary mineral and a brownish yellow mineral. Plagioclase phenocrysts are noted in Piece 12.

Thin Section Description

65-69 cm (Piece 8): Subvariolitic olivine basalt, no phenocrysts. Plagioclase 30% (.03-.3 mm) skeletal; cpx. trace (.03 x .3) acicular, intergrown with plagioclase; olivine 5% (.04 mm) skeletal but not elongate, Fo_{80-85}. Greenish yellow clays 5% filling vesicles. Mesostasis 60% composed of fine needle-like cpx., magnetite, plag., clays. Highly supercooled type of crystal growth.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
65-69 cm (aphyric basalt):												
49.0	15.24	11.25	8.1	11.18	0.30	1.59	–2.9	0.59	358	177	127	111

	Inc.	NRM	MDF	V_p (‖)	V_p (⊥)	D	P
37-39 cm (Piece 5):	+56.3	2.34	450	5.20	5.16	2.84	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	60	1

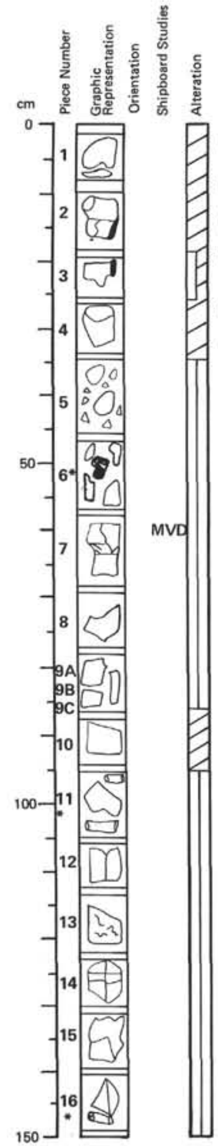
MAJOR ROCK TYPES – FINE-GRAINED APHYRIC BASALT AND LESSER BASALT GLASS BRECCIA

Macroscopic Description

Fine-grained, very fine-grained, and glassy aphyric basalt. Glass as marked. Variolites present adjacent to glass and in some pieces without glass, no more than 1-2 mm in diameter. Moderately to intensely altered. Abundantly cracked with secondary clays(?), carbonates, and or zeolites(?) lining cracks and forming on fracture surfaces. Plagioclase phenocrysts noted in Pieces 2, 9, and 10. Glass altered to palagonite in some pieces.

The breccia is again a basalt glass (hyaloclastite) breccia similar to that of Core 58, Section 2 and Core 59 Section 1. It occurs in Pieces 4, 5, and 6, and consists of angular glass fragments in a matrix of crushed and altered glass (mostly to clays and partly cemented by carbonates). It is not extensively palagonitized. Palagonite was noted in Pieces 6 and 12, however.

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
30-32 cm (Piece 2):	+64.0	1.78	450	5.50	5.47	2.89	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	60	2

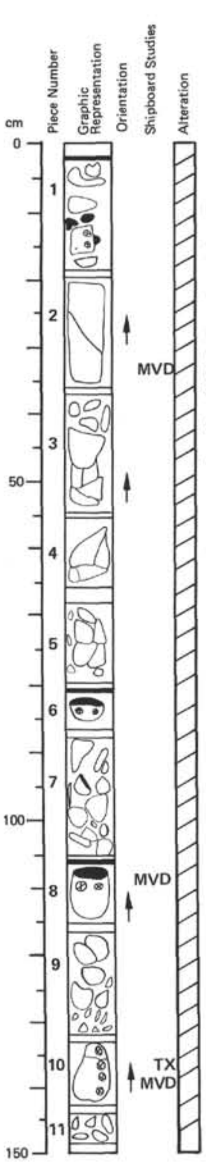
MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

As given in Section 1. Glass in Pieces 2 and 3, partially altered to palagonite. Glass and variolites in Piece 14. An increase in grain size is noted from Pieces 6 to 12, and a decrease from Pieces 12 to 15. The soft pale green (clay) minerals of crack fillings from Pieces 6, 11, and 16 are kept in glass bottles. They expanded noticeably after the section was split.

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
60-62 cm (Piece 7):	+64.2	1.47	650	4.71	4.91	2.72	10.7

*clays in bottles



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	60	3

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

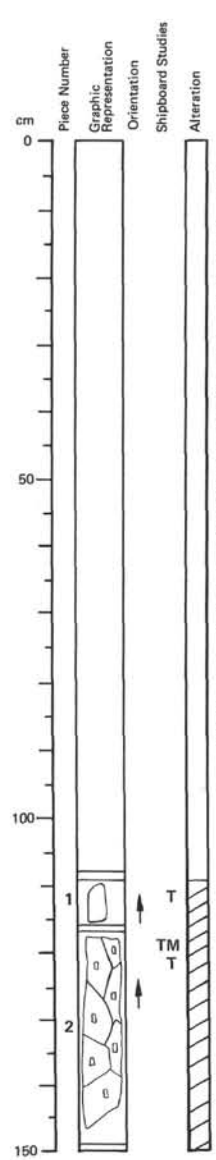
As in Section 1, pretty much. Glass in Pieces 1, 6, 7, 8, 9, and 10. Palagonite in Pieces 1, 6, and 9. Plag. phenocrysts in Pieces 1, 2, and 8. Clays filling cracks especially in Pieces 1, 2, 6, 9, and 10. Variolites adjacent to glass in most pieces having glass.

Thin Section Description

137-143 cm (Piece 10): Variolitic to vitrophyric basalt. Plagioclase 20%, .005-.2 mm skeletal crystals in variolites with sheaf-like projections in some places. Larger plag. forms cores to such sheaves. Olivine 5% (.01-.2 mm) skeletal and elongate, 3% (.04-.4 mm) skeletal but not elongate; trace of chromite; mesostasis 60% composed of glass (altered to clays) and intergrown microcrystalline sheaves of indeterminate mineralogy, brown in color.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
137-143 cm (aphyric basalt):												
48.8	15.15	11.39	8.4	11.12	0.17	1.59	–1.9	0.59	375	174	130	119

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
34-36 cm (Piece 2):	+71.7	1.33	600	5.37	5.44	2.83	–
110-112 cm (Piece 8):	+60.9	2.29	550	—	—	2.80	9.5
137-139 cm (Piece 10):	+43.6	0.693	700	5.58	5.46	2.87	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	61	1

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT AND PLAGIOCLASE-OLIVINE-CLINOPYROXENE DOLERITIC BASALT

Macroscopic Description Sections 1 through CC

Piece 1 in this section is aphyric, fine-grained, variolitic slightly vesicular basalt. The vesicles are filled with pale green and dark green secondary minerals. Cracks and fracture surfaces are covered with zeolites(?) and clay(?) minerals. This piece may have been cored at the bottom of Core 60, but not trapped in the core-catcher when that core was pulled.

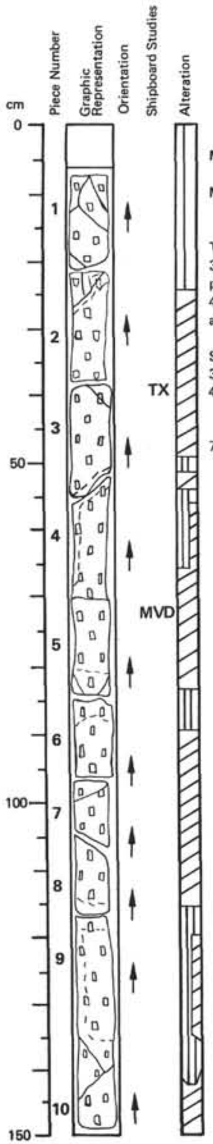
Piece 2 in this section and the entire rest of the core is massive, moderately altered plagioclase-olivine-clinopyroxene doleritic basalt. Plagioclase is typically 15-20% (up to 1.5 cm), olivine 5-6% (partly highly altered to clays and/or a yellow brown secondary mineral. The texture is medium-grained to ophitic, with clinopyroxene becoming readily resolvable with a hand lens in the coarser-grained pieces. The texture is fairly uniform through most of this core and into the next. Alteration is most prominent next to cracks which are lined with clays, chlorite, and/or carbonates. Zeolites may also be present. Rock surfaces have a greenish tinge due to these secondary minerals. Fractures are common, and tend to make an angle of 30° to the vertical. Sections 3 and CC have more abundant cracks than Pieces 1 or 2. The most distinctive feature of the doleritic basalt, apart from the cracks and alteration, is the large plagioclase megacrysts and glomerocrysts, similar to those of phyric basalts higher in the hole. Olivine is also clearly a phenocryst, but whether clinopyroxene was a phenocrysts as well is not so certain because of the large size of groundmass crystals.

Thin Section Description

110-115 cm (Piece 1): Variolitic olivine basalt. Plagioclase 40% (.02-.1 mm) in cores of variolites; olivine 10% (.02-.2 mm) skeletal; cpx. 20% (.01 mm) skeletal. Matrix 30% skeletal feathery acicular cpx., mt., and pl. No alteration information given.

120-122 cm (Piece 2) and 122-124 cm (Piece 2): Intersertal holocrystalline plag.-ol.-cpx. basalt. Phenocrysts: plagioclase 15-20% (1-10 mm); olivine 5% (.3-2 mm); cpx. 5-7% (.3-1 mm). Groundmass: Plagioclase 35-40% (.1 mm); cpx. 30-35% (.05 mm); olivine - trace; titanomagnetite 1-2%. Plag. An_{70}? has wavy extinction and phenocrysts are zoned. Some have skeletal interiors. Olivine altered to clay minerals. Some plag.-olivine glomerocrysts present.

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
117-119 cm:	+53.0	2.55	700	—	—	–	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE			HOLE	CORE	SECT.
45	3	9	5	A	61	2

MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE-CLINOPYROXENE DOLERITIC BASALT

Macroscopic Description

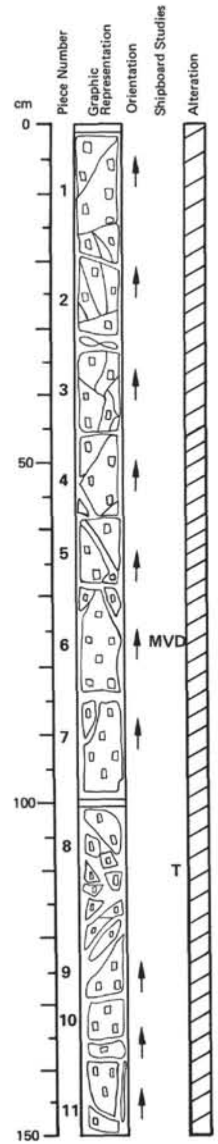
Given in Section 1. Note: spacers have not been placed between pieces .

Thin Section Description

39-42 cm (Piece 3): Porphyritic plag.-ol.-cpx. basalt with intersertal groundmass. Phenocrysts: plagioclase 10% (.8-3 mm); cpx. 7% (.6-1.5 mm); olivine 5% (1.5 mm). Groundmass: plagioclase 40%; cpx. 30% (.02-.5 mm); olivine 2% (.2 mm) Fo_{85}; titanomagnetite 3%; clays 3% filling vesicles and after rare groundmass glass. Olivine partly altered to clays.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
37-45 cm (plag.-olivine-pyroxene dolerite):												
49.5	16.96	8.97	8.3	11.93	0.07	1.14	−1.8	0.65	315	133	129	86

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
74-76 cm (Piece 5):	−39.5	5.18	375	5.69	5.61	2.90	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE			HOLE	CORE	SECT.
45	3	9	5	A	61	3

MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE-CLINOPYROXENE DOLERITIC BASALT

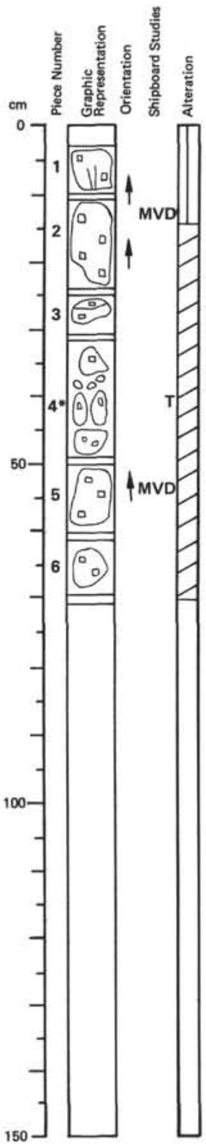
Macroscopic Description

Given in Section 1. Note: spacers have not been placed between all pieces.

Thin Section Description

110-112 cm (Piece 8): Porphyritic plag.-cpx.-ol. basalt, subophitic texture. Phenocrysts: plagioclase 20% (to 4 mm); olivine 5%; cpx. 1%. Groundmass: plagioclase 40%; cpx. 30%; ol. tr; titanomagnetite 1%; secondary calcite 4%. Carbonate forms in vesicles and veinlets. Pale green and green clays also fill vesicles. Olivine highly altered to red-brown clays and Fe-hydroxides(?).

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
75-77 cm (Piece 6):	−38.0	3.14	475	5.82	5.89	2.90	2.2



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	61	CC

MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE-CLINOPYROXENE DOLERITIC BASALT

Macroscopic Description

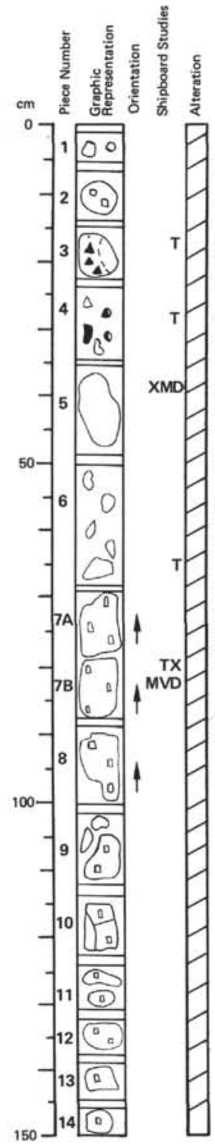
Given in Section 1.

Thin Section Description

Core-catcher, 40-41 cm (Piece 4): Plagioclase-cpx.-ol. phyric dolerite. Phenocrysts: plagioclase 30% (.2-10 mm); olivine 5%; cpx. 10% (2 mm). Groundmass: plagioclase 20% (1 mm); cpx. 25% (.2 mm); olivine-trace; titanomagnetite 5%; spinel-trace; chlorite(?) 5%. Plag. is An_{70}, some zoned. Olivine very altered to brownish clays and light chlorite(?). Some carbonate in veins and vesicles.

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
13-15 cm (Piece 2):	–39.5	4.94	75	5.59	5.78	2.88	–
53-55 cm (Piece 5):	–39.0	3.87	375	5.43	5.68	2.88	–

*broken fragments



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	62	1

MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE-CLINOPYROXENE DOLERITIC BASALT AND FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Pieces 1, 2, and 7A through 14 are plagioclase-olivine-clinopyroxene doleritic basalt, essentially identical to that described in Core 61 Section 1. Pieces 7A, 7B, and 8 are medium-grained basalts; Pieces 9-14 are coarser-grained, closer to true dolerite. This suggests that the dolerite recovered in Core 61 is a separate cooling unit than pieces in this core.

Pieces 4-6 are fine-grained aphyric basalts of the type recovered above the dolerite. Piece 3 has a large clast of fine-grained aphyric basalt attached to a basalt glass breccia similar to those described in Core 49 Section 1 and Core 58 Section 2. Fragments in Piece 4 include glass.

Thin Section Description

17-22 cm (Piece 3), 25-36 cm (Piece 4), and 60-67 cm (Piece 6): Variolitic olivine basalts, no phenocrysts. Pieces 3 and 6 have 50-60% plagioclase up to .5 mm skeletal. Piece 4 has only 10% and a greater proportion of mesostasis. Mesostasis contains titanomagnetite dust, cpx., plag., and altered glass (to clays). Vesicles 2-3% filled with clays.

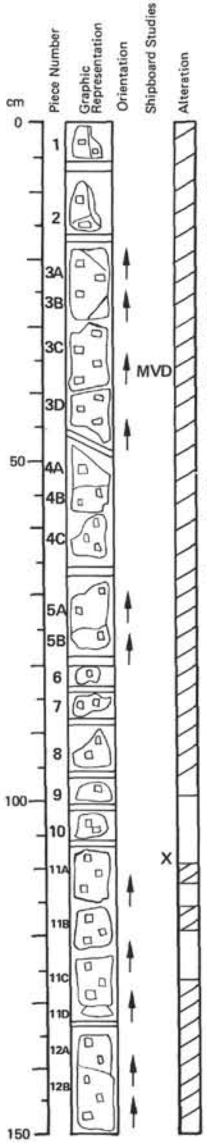
80-87 cm (Piece 7B): porphyritic basalt. Phenocrysts: plagioclase 20% (up to 2 mm); cpx. 3% (.3-.5 mm) olivine 5% (.4 mm); Groundmass: plagioclase 30% (.05 mm laths); cpx. 25% (.05 mm) olivine - trace; titanomagnetite, 7%; chlorite(?) after olivine and in interstitial spaces. Plag. is An_{75}, is locally zoned, and contains glass blebs in larger phenocrysts. Olivine is Fo_{85}.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
40-42 cm (aphyric basalt):												
48.6	15.06	11.15	8.5	11.09	0.22	1.59	–1.9	0.60	377	179	128	117
80-87 cm (plag.-olivine-clinopyroxene dolerite):												
49.6	16.30	9.05	8.1	11.98	0.12	1.18	–1.8	0.64	304	116	129	74

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
40-42 cm (Piece 5):	–39.0	6.27	700	—	—	2.90	–
84-86 cm (Piece 7B):	–35.3	3.94	275	5.55	5.74	2.91	–

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	63	1



MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE-CLINOPYROXENE DOLERITIC BASALT

Macroscopic Description

This core and the upper sections of Core 64 contain several meters of largely continuously recovered doleritic basalt, virtually identical in all particulars to that recovered in Cores 61 and 62. The dolerite in Cores 63 and 64 is the major part of the second dolerite which begins in Core 62. In this second dolerite, plagioclase is again prominent as megacrysts and glomerocrysts, and alteration is most extensive along cracks lined with clays, carbonates, and possibly zeolites. As in the previous dolerite, cracks appear to be conjugate, and close to 30° from the vertical. In Section 1, grain size increases from Pieces 4 to 11B, accompanied by an increase in the proportion of plagioclase and a decrease in the proportion of olivine.

Pieces	4	5, 6, 7, 8, 9	10, 11A, 11B	11C, 11D, 12A, 12B
% Pl.	15	15-20	~20	15-20
% Ol.	>5	~5	<5	5

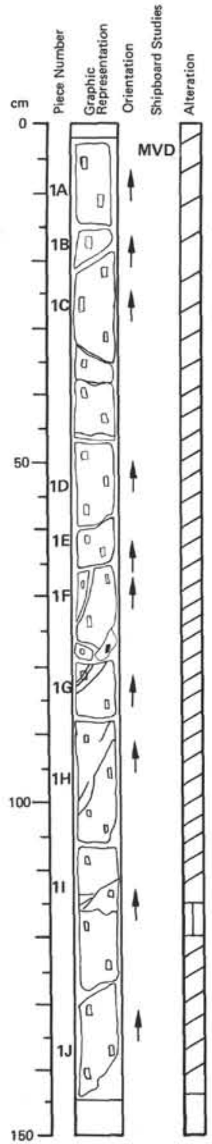
These features may be considered as large-scale rock inhomogeneities.

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
108-116 cm (plag.-olivine-clinopyroxene dolerite):	49.5	17.44	8.59	8.5	12.16	0.07	1.08	−1.8	0.66	348	129	132	68

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
38-40 cm (Piece 3C):	−39.1	2.24	400	5.95	6.04	2.90	–

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	63	2



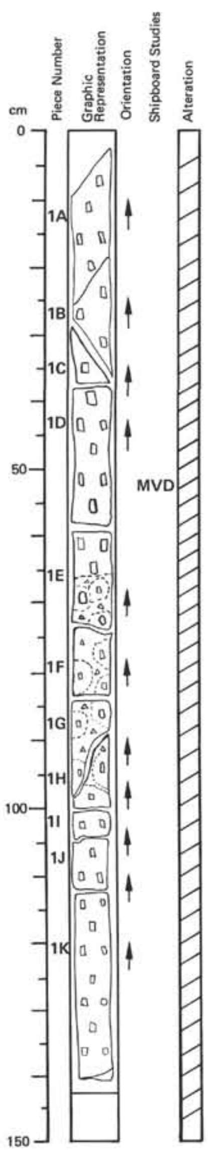
MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE-CLINOPYROXENE DOLERITIC BASALT

Macroscopic Description

A continuation of the dolerite described in Core 62 Section 2 and Core 63 Section 1. No systematic change in grain size nor modal composition was detected. Plagioclase is 15-20% (up to 1.5 cm), olivine 5-7%, and clinopyroxene about 1% as visible phenocrysts. Groundmass is subophitic. Alteration moderate except right next to cracks where secondary minerals abound. Piece 1I is badly altered.

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
2-4 cm (Piece 1A):	-36.4	3.20	350	5.68	—	2.88	2.5

Note: spacers have not been placed in this section because it appears to have been continuously recovered.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	63	3

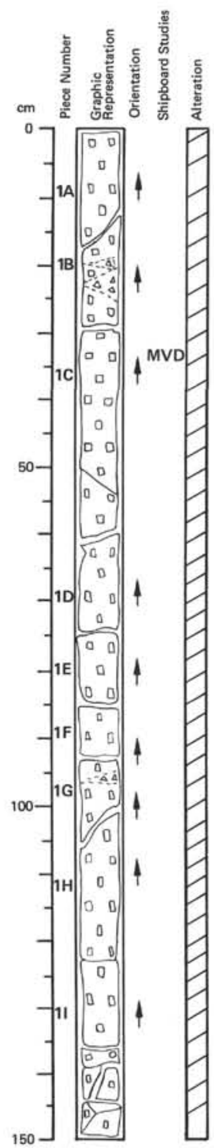
MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE-CLINOPYROXENE DOLERITIC BASALT

Macroscopic Description

A continuation of the doleritic basalt described in Core 62 Section 2 and Core 63 Section 1, apparently continuously recovered at least from the top of Piece 12A in Core 63 Section 1 probably to the end of the core. Grain size in this section is fairly coarse, subophitic, with about 20% plagioclase phenocrysts, 5% olivine phenocrysts, and less than 1%. Alteration and fracture inclinations as in the previous sections. Texture is uniform.

In this section, pieces 1E-1H have an auto- or proto-clastic texture. In this breccia zone, rock fracturing has apparently proceeded to such an extent that pieces of rock have been crushed against each other. The result is "clasts" in a breccia "matrix" of crushed dolerite. Alteration is fairly extensive in the breccia matrix, with clays and possibly chlorite abundant. Shear planes in the section inclined at about 30° to the vertical cross-cut the breccia, hence are younger. Some shear planes in Core 63 are coated with secondary minerals which are slickensided.

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
50-52 cm (Piece 1D):	-39.4	2.72	100	5.69	5.78	2.88	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

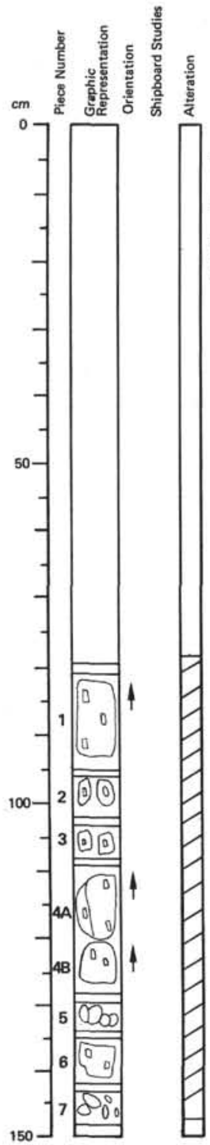
LEG	SITE	HOLE	CORE	SECT.
45	395	A	63	4

MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE-CLINOPYROXENE DOLERITIC BASALT

Macroscopic Description

A continuation of the doleritic basalt described in Core 62 Section 2 and Core 63 Section 1, with similar alteration and conjugate fracture patterns. Plagioclase phenocrysts are a bit less abundant (15%) and olivine a bit more abundant (7%) than in Sections 1 and 2. Some cracks are coated with chlorite and a greenish-white clay mineral. Others are coated with a "spherical" carbonate partly covered with fine gray minerals (esp. 1E). In such instances, a clear hard mineral is also observed. Cracks are so abundant in 1B and 1G that the pieces are nearly breccias such as those described in Core 63 Section 3.

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
32-34 cm (Piece 1C):	-39.7	3.60	325	5.72	5.67	2.87	–



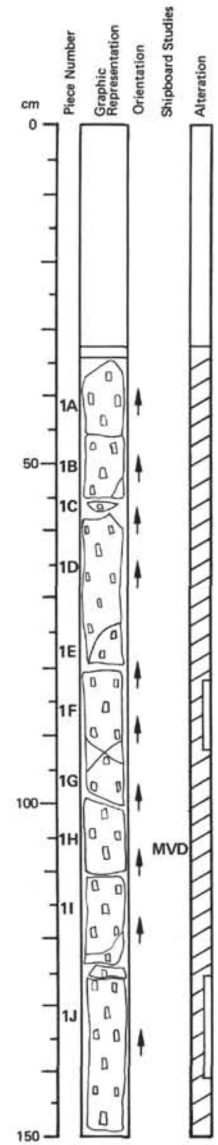
VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	63	CC

MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE-CLINOPYROXENE DOLERITIC BASALT

Macroscopic Description

A continuation of the doleritic basalt described in Core 62 Section 2 and Core 63 Section 1. No noticeable decrease or increase in grain size or phenocrysts proportions in this section. Pieces should have been placed at the top of the section, as they were cored continuously from the base of Core 63 Section 4.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

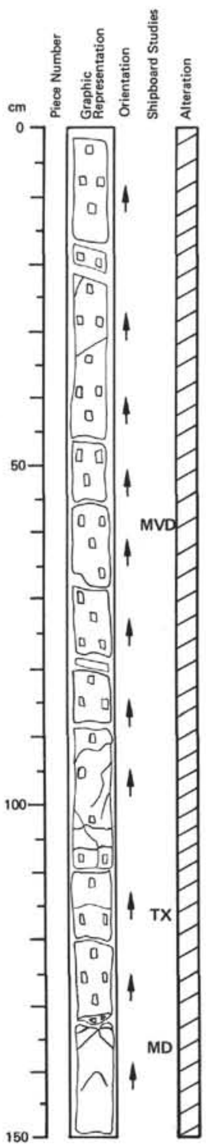
LEG	SITE	HOLE	CORE	SECT.
45	395	A	64	1

MAJOR ROCK TYPE – PLAGIOCLASE-OLIVINE-CLINOPYROXENE DOLERITIC BASALT

Macroscopic Description

A continuation of the doleritic basalt described in Core 62 Section 2 and Core 63 Section 1. Plag. phenocrysts 2-10 mm are 15-20%; ol. phenocrysts 2-6 mm are 5-7%. Cpx. phenocrysts up to 5 mm are rare. No systematic macroscopic variation in phenocryst and groundmass grain size and in modal composition of phenocrysts is detected. Alteration along cracks similar to that in dolerite of Cores 62 and 63. Olivine here is sometimes altered to brownish secondary minerals, but is generally fresh. This section was continuously recovered.

	Inc.	NRM	MDF	V_p (∥)	V_p (⊥)	D	P
106-108 cm (Piece 1H):	-40.3	3.55	25	6.07	6.05	2.90	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE		CORE		SECT.	
4	5	3	9	5	A		6	4		2

MAJOR ROCK TYPES – PLAGIOCLASE-OLIVINE-CLINOPYROXENE DOLERITIC BASALT AND FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Dolerite from 0-133 cm. Note: no numbers on pieces. Intervals are marked on the pieces. The dolerite is a continuation of that described in Core 62 Section 2 and Core 63 Section 1. A chill zone is located at the base of the dolerite (129-133 cm). Fracturing and alteration of the dolerite are as described in previous sections.

The aphyric basalt below 133 cm has one large (2 cm) plagioclase phenocryst about 1 cm from the base of the section. The aphyric basalt is partially altered to reddish secondary minerals.

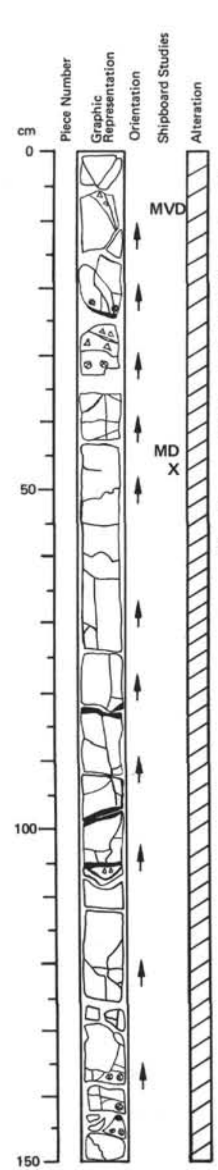
Basaltic glass fragments occur at 133 cm but it is not clear whether they are from the chill zone at the base of the dolerite or from the top of the aphyric basalt. The glass fragments are rather badly altered.

Thin Section Description

116-122 cm: Plagioclase-clinopyroxene-olivine phyric doleritic basalt. Phenocrysts: plagioclase 25% (.6-4 mm); clinopyroxene 3% (2 mm); olivine 10% (.2-2 mm). Groundmass: plagioclase 20% (.1 mm); clinopyroxene 30% (.04 mm); olivine - trace; titanomagnetite 10%. Olivine is Fo_{85}. Plag. is An_{75}; phenocrysts are zoned, and contain blebs of glass. Some glomerocrysts of plagioclase and olivine occur. No information on alteration given.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
116-122 cm (plag.-olivine-clinopyroxene dolerite):												
49.3	16.91	8.85	8.5	12.06	0.11	1.10	–2.0	0.65	330	144	139	66

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
56-58 cm:	–39.7	4.67	150	5.82	5.87	2.90	–
135-137 cm:	–39.0	8.76	250	—	—	2.77	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG		SITE			HOLE		CORE		SECT.	
4	5	3	9	5	A		6	4		3

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

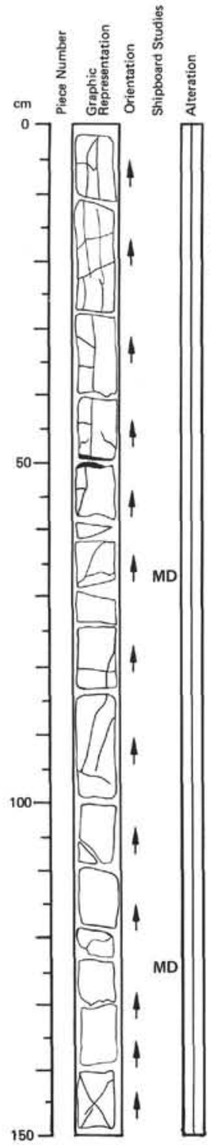
Macroscopic Description

Fine-grained, very fine-grained, and glassy aphyric basalt, with isolated rare phenocrysts of plagioclase up to 7 mm across. Section too fractured to remove from liner for numbering. Intervals indicated directly on cut surfaces of pieces. Glass present at 24 cm, variolites just above, brecciated nearly glassy aphyric basalt below (cemented with greenish white clay minerals and very rare carbonate, and "intruded" by a reddish-brown vein. Basalt glass is partly palagonitized). Glass also present at 82 cm and at 99 cm. Partially brecciated and glassy at 107-108 cm. Glass present at 142 cm with variolitic fragmented basalt above and below. Section is moderately altered throughout. Sequence appears to be pillow lavas fairly highly fractured probably by overburden weight.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
48-53 cm (aphyric basalt):												
49.2	15.27	11.60	8.6	10.87	0.25	1.63	–4.9	0.59	338	180	126	108

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
8-10 cm:	–43.6	4.09	600	5.39	5.56	2.85	–
42-44 cm:	–37.0	3.44	800	—	—	2.82	–

Cooling unit boundaries at 24, 83, 100, and 105 cm.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	64	4

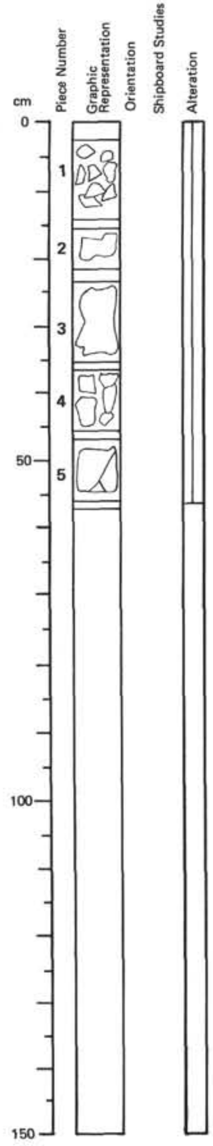
MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

A continuation of the pillow sequence of fine-grained, very fine-grained and glassy basalts described in Section 3. Glass present at 50 cm. Secondary clays, chlorite, hydrous iron oxide minerals, and possibly zeolites are abundant in the numerous cracks. Interiors of some of the larger basalt fragments are fresher than the edges, but cracks are so abundant that overall the section is intensely altered.

	Inc.	NRM	MDF	V_p (∥)	V_p (⊥)	D	P
67-69 cm:	-38.7	1.17	600	—	—	2.79	–
123-125 cm:	-41.2	2.39	700	—	—	2.86	–

Note: Surface of samples marked with intervals.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	64	CC

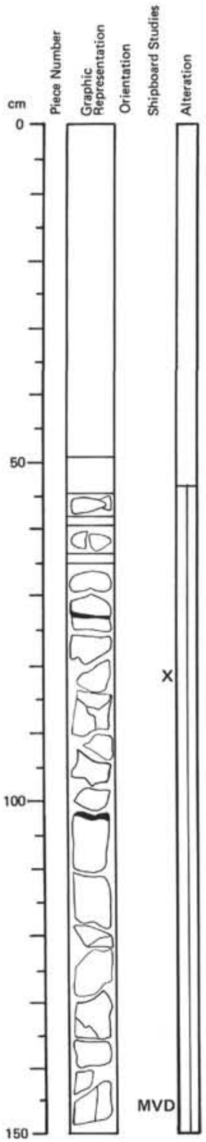
MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Given in Sections 3 and 4. Crack planes covered with dark green chloritic mineral. Zeolites may be present.

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	65	1



MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Fine-grained, very fine-grained, and glassy aphyric basalt, with rare isolated plagioclase phenocrysts up to 7 mm across, generally intensely altered, with secondary clays, chlorite, and possibly zeolites abundant in numerous cracks and fractures. Cracks and fractures are so abundant that pieces could not be removed from liners without disruption. Intervals are marked on sawed surface of pieces. The topmost piece in the section is a piece of plagioclase-olivine-clinopyroxene doleritic basalt, which apparently fell down the hole from the interval drilled at Core 61 Section 1 to Core 64 Section 2.

Glass is present at 70-72 cm and at 101-105 cm, with adjacent variolites. The glass at 70-72 verges on hyaloclastite and is cemented by palagonite, clays and other secondary minerals. The entire section is overall intensely altered, with secondary minerals concentrated in the numerous cracks and in the rare tiny vesicles.

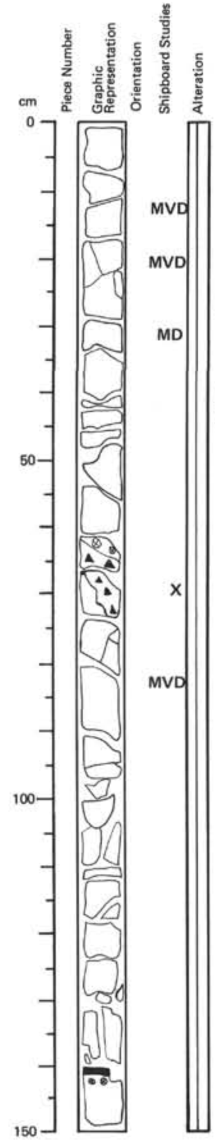
	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
81-86 cm (aphyric basalt):	48.7	15.12	11.45	8.2	11.23	0.23	1.63	-2.1	0.59	365	170	130	114

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
148-150 cm:	-23.3	0.868	700	5.34	—	2.87	5.8

Cooling unit boundaries at 72 and 102 cm.

VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	65	2



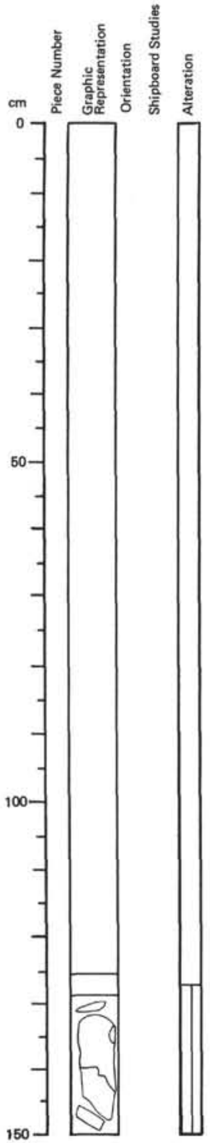
MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

A continuation of the aphyric pillow basalt sequence described in Core 64 Section 3 through CC and in Core 65 Section 1. Glass present from 61-64 cm and 139-140 cm, with adjacent variolites. State and type of alteration is similar to that described in Core 65 Section 1.

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
66-71 cm (aphyric basalt):	49.1	15.24	11.65	8.3	11.17	0.20	1.64	-2.6	0.59	340	158	131	106

	Inc.	NRM	MDF	Vρ (∥)	Vρ (⊥)	D	P
13-15 cm:	+45.4	0.909	350	6.01	—	2.70	–
21-23 cm:	unstable ~-20	0.508	450	5.26	—	2.88	–
31-33 cm:	-20.0	1.17	550	—	—	2.90	–
85-87 cm:	unstable -20 to -30	0.516	700	5.14	—	2.74	–



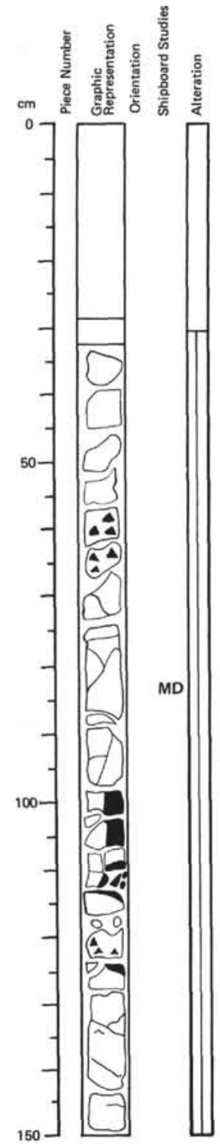
VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	65	CC

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

A continuation of the fine-grained, aphyric basalt pillow sequence described in Core 65 Section 1, essential in all particulars. No glass or variolites present. Alteration intense. The piece should have been placed at the top of the section because it was adjacent to the lowest piece in Core 65 Section 2 prior to dividing the core into sections.



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

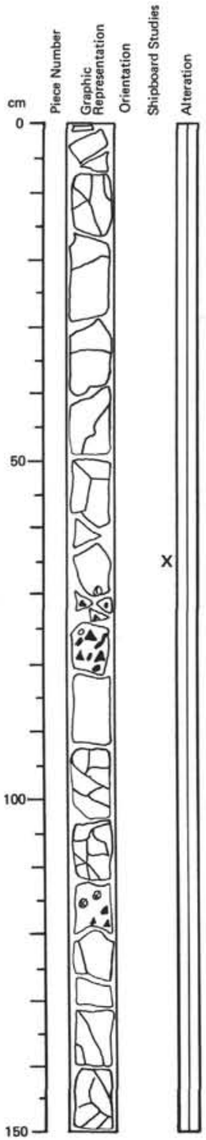
LEG	SITE	HOLE	CORE	SECT.
45	395	A	66	1

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Fine-grained, very fine-grained, and glassy aphyric basalt, with rare isolated plagioclase phenocrysts, generally intensely altered, with secondary clays, chlorite, and possibly zeolites abundant in numerous cracks and fractures. Cracks and fractures are so abundant that the pieces could not be removed from the liner without disruption. Intervals are thus marked on sawed surfaces of pieces. Glass is present from 56-62 cm, 63-67 cm, 98-112 cm and 122-126 cm. Variolites are present near the glass. Vesicles are rare and tiny, locally filled with secondary minerals. Glass from 123-126 cm is partly palagonitized.

	Inc.	NRM	MDF	V_p (‖)	V_p (⊥)	D	P
83-85 cm:	unstable ~-26	0.591	>1000	—	—	2.88	4.6



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

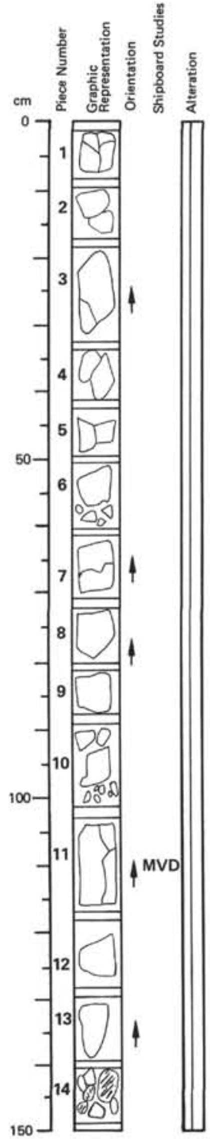
LEG	SITE	HOLE	CORE	SECT.
45	395	A	66	2

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

A continuation of the fine-grained pillow sequence recovered in Section 1, essentially identical in most particulars. Glassy breccia is present from 70-80 cm and from 112-120 cm, associated with fine-grained variolitic basalt. Alteration is intense throughout, especially along cracks where clays, chlorite, and possibly zeolites are well developed. Some pieces have up to 5% vesicles filled with yellow-green, green, and white clays. The glass-breccia zones are partly palagonitized. Druses partially filled with clays are present from 35-38 cm.

	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
66-71 cm (aphyric basalt):	49.1	15.24	11.65	8.3	11.17	0.20	1.64	−2.6	0.59	340	158	131	106



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

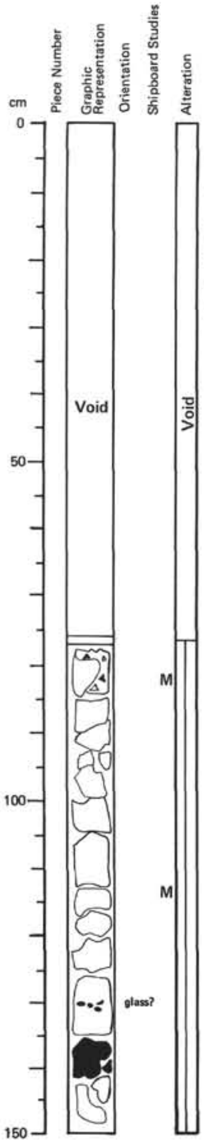
LEG	SITE	HOLE	CORE	SECT.
45	395	A	66	3

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Fine-grained, very fine-grained, and glassy basalt with glass present in Piece 14 only, with 3-5% vesicles (0.5-1 mm) filled with secondary yellow-green and dark-brown minerals. Alteration is intense throughout, as described in previous sections of this core.

	Inc.	NRM	MDF	V_p (∥)	V_p (⊥)	D	P
110-112 cm (Piece 11):	−44.7	1.11	450	5.22	5.23	2.82	7.7



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

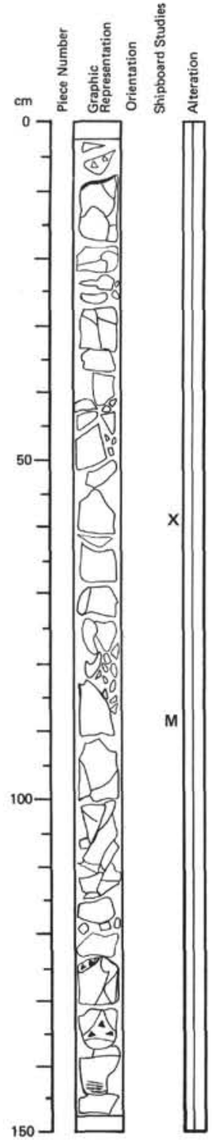
LEG	SITE	HOLE	CORE	SECT.
45	395	A	67	1

MAJOR ROCK TYPE – FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Highly fractured fine-grained aphyric basalt with bits of glass in some places. The basalt is microcrystalline to glassy, with some pieces showing variolitic texture. In the fractures are greenish white to white and clear secondary minerals (chlorite plus zeolites?). Glass is present from 137-142 cm and may be present from 132-133 cm because secondary alteration products there resemble palagonite. The basalt is so highly fractured (perhaps by compression from the overburden weight that it is effectively a breccia. Alteration is intense throughout, especially on fracture surfaces, but even the largest basalt pieces are pretty rotten.

	Inc.	NRM	MDF	Vρ (‖)	Vρ (⊥)	D	P
83-85 cm:	-75.0	5.56	800	—	—	–	–
113-115 cm:	-66.0	4.03	500	—	—	–	–



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	67	2

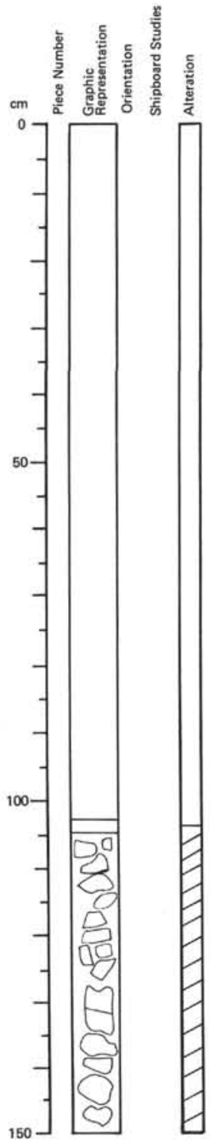
MAJOR ROCK TYPE – HIGHLY FRACTURED FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Highly fractured, aphyric, partly glassy to microcrystalline basalt, intensely altered, with secondary clays, chlorite and zeolites(?) abundant on fracture surfaces and in cracks. Glass is present from 7-9 cm, 123-124 cm, 132-136 cm and from 142-145 cm. From 18-25 cm, crack planes are coated with reddish brown secondary minerals, and partly with a dark green chloritic mineral. In most cracks and on fracture surfaces from 2-121 cm, secondary chlorites(?) and brownish green minerals have a shiny luster. A large plagioclase phenocryst occurs at 110 cm (7 mm across).

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	TiO_2	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
54-59 cm (aphyric basalt):												
49.9	15.10	10.56	7.3	11.40	0.29	1.69	-2.6	0.58	306	139	132	124

	Inc.	NRM	MDF	Vρ (‖)	Vρ (⊥)	D	P
88-90 cm:	-54.0	1.67	350	—	—	–	–



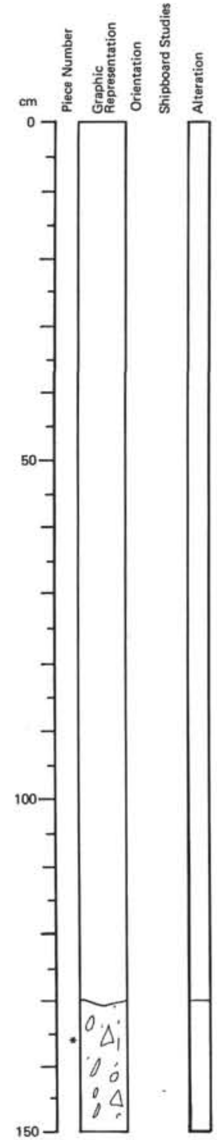
VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	67	CC

MAJOR ROCK TYPE – HIGHLY FRACTURED FINE-GRAINED APHYRIC BASALT

Macroscopic Description

General description given in Sections 1 and 2. The interval from 130-139 cm is coarser grained than that above or below. Alteration pervasive. Cracks lined with greenish-white clays. Pieces should have been put at the top of the section, as they were contiguous with those in Section 2.

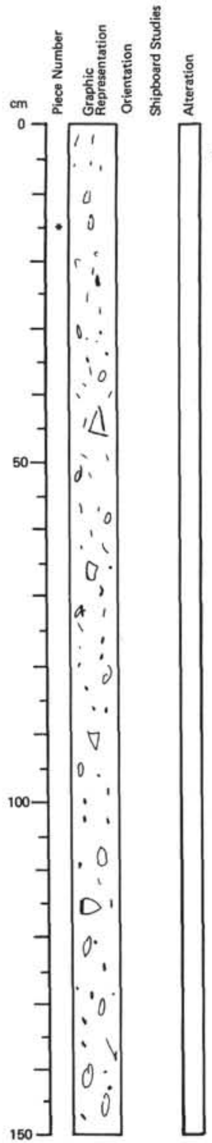


VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	68	1

Drilling breccia, containing fragments of plagioclase, olivine, clinopyroxene, volcanic glass, foraminifera and basalt chips. This core was recovered following cementing of the lower part of the hole and re-entry. No cement was recovered. The cuttings in Section 1 are finer-grained than in Sections 2-4 and CC.

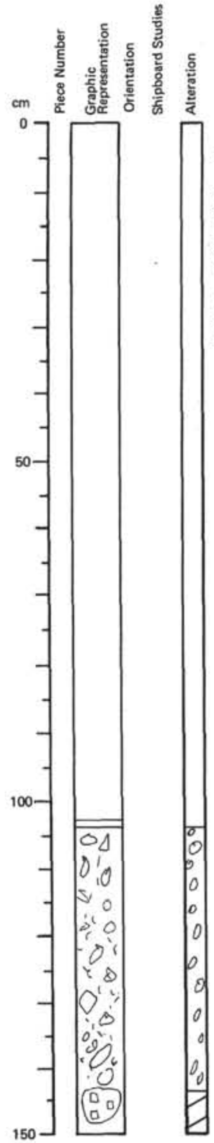
*cuttings



VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.
45	395	A	68	2-4

Drilling cuttings.



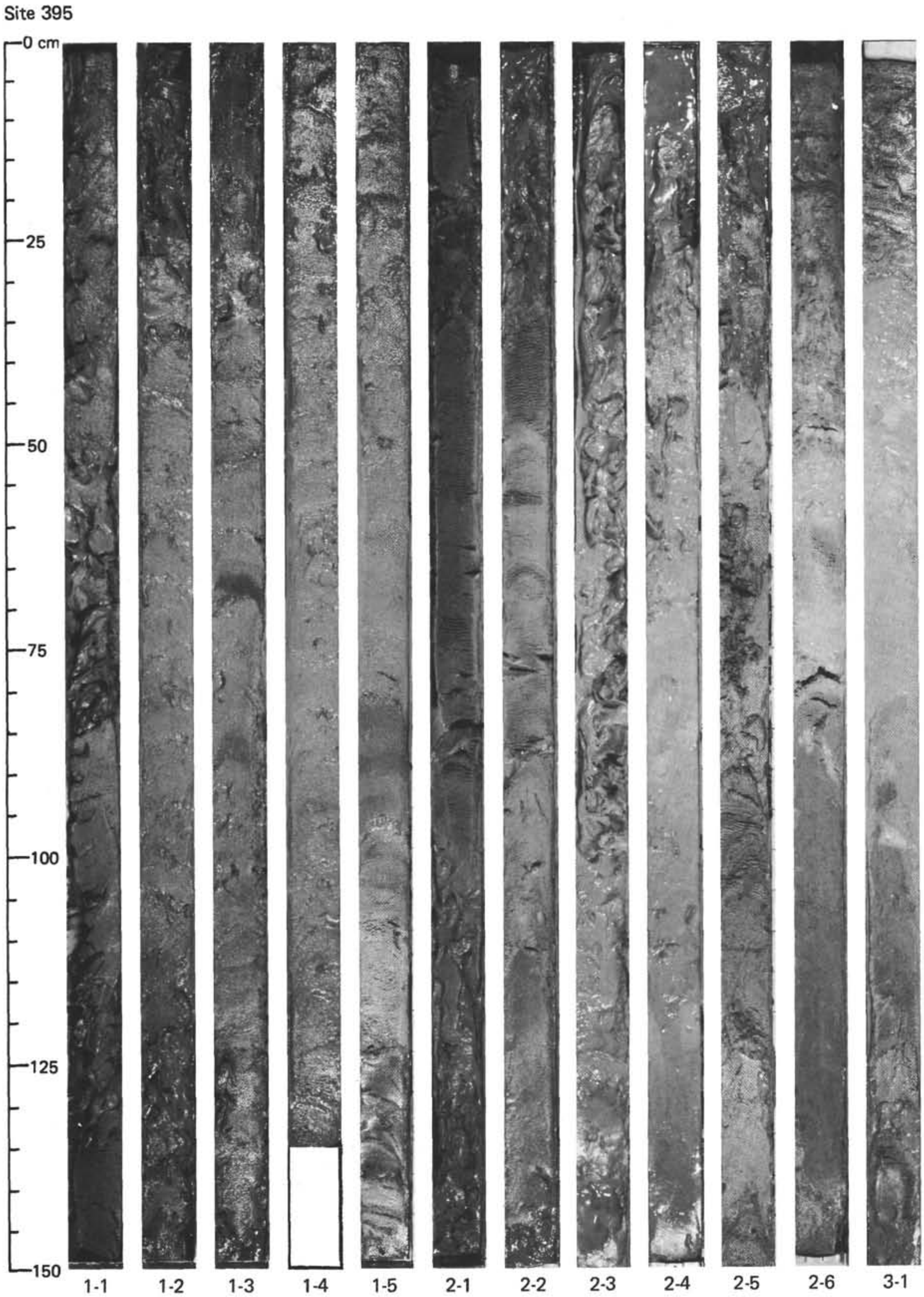
VISUAL CORE DESCRIPTION FOR IGNEOUS ROCKS

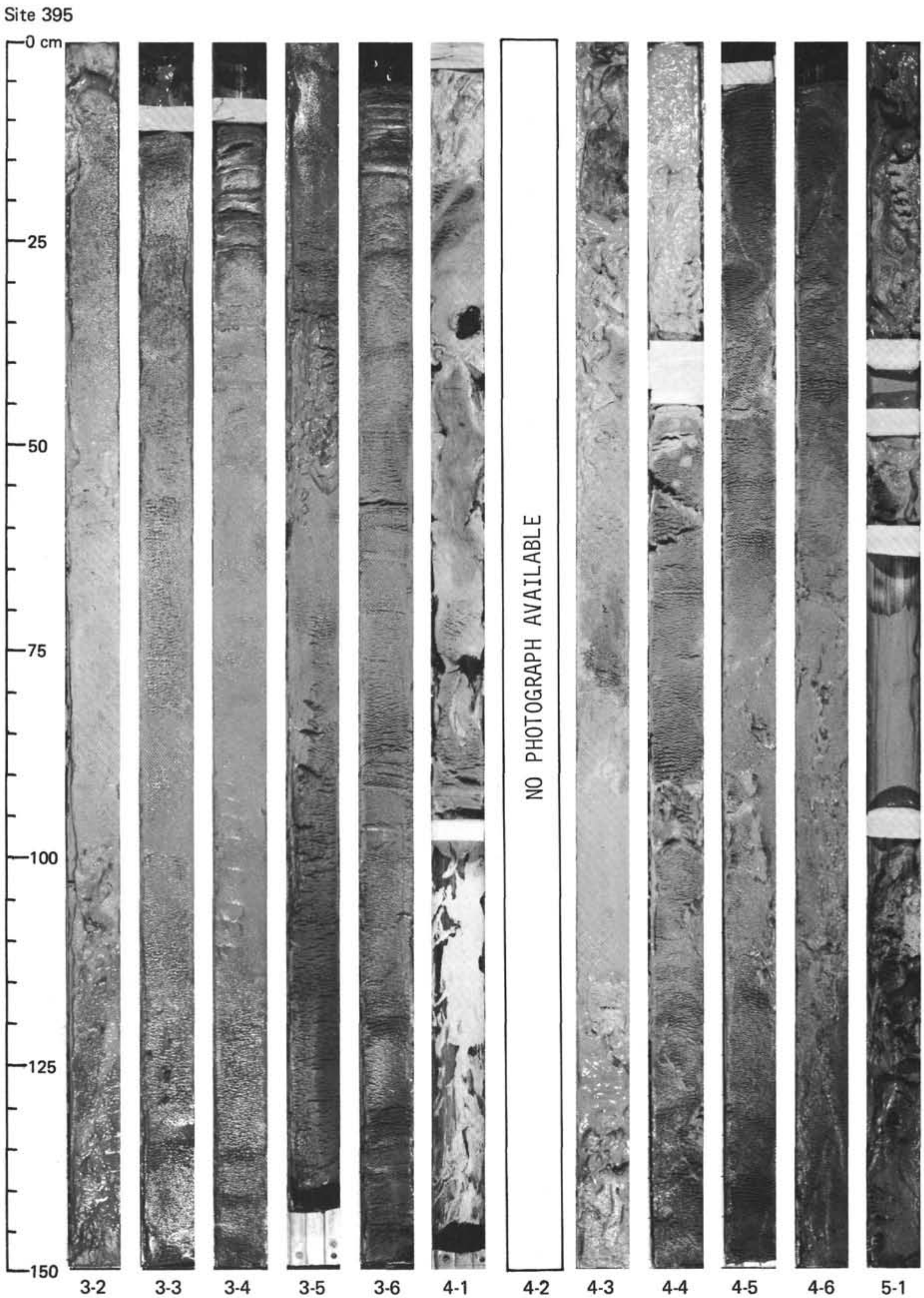
LEG	SITE	HOLE	CORE	SECT.
45	395	A	68	CC

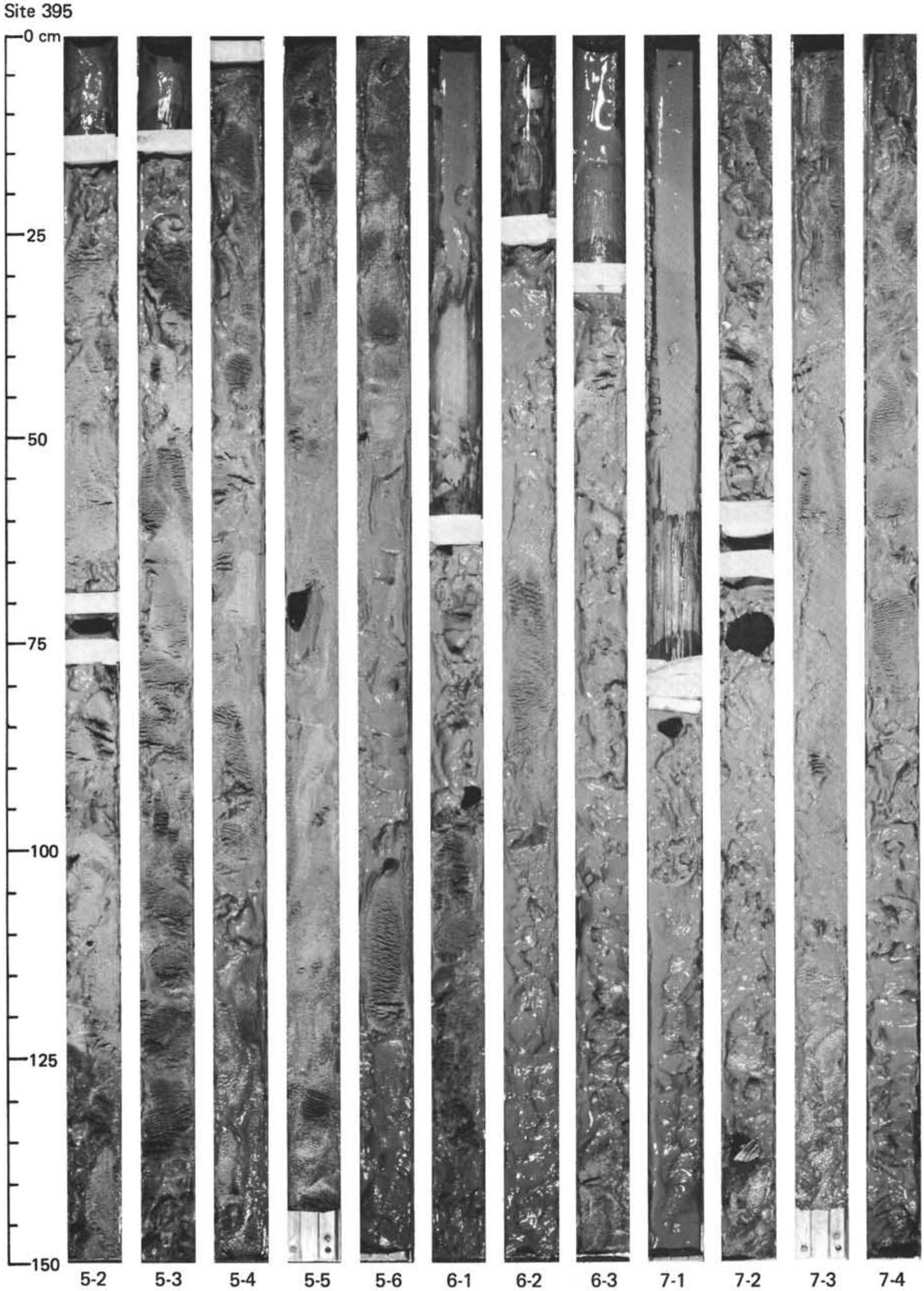
Drilling cuttings.

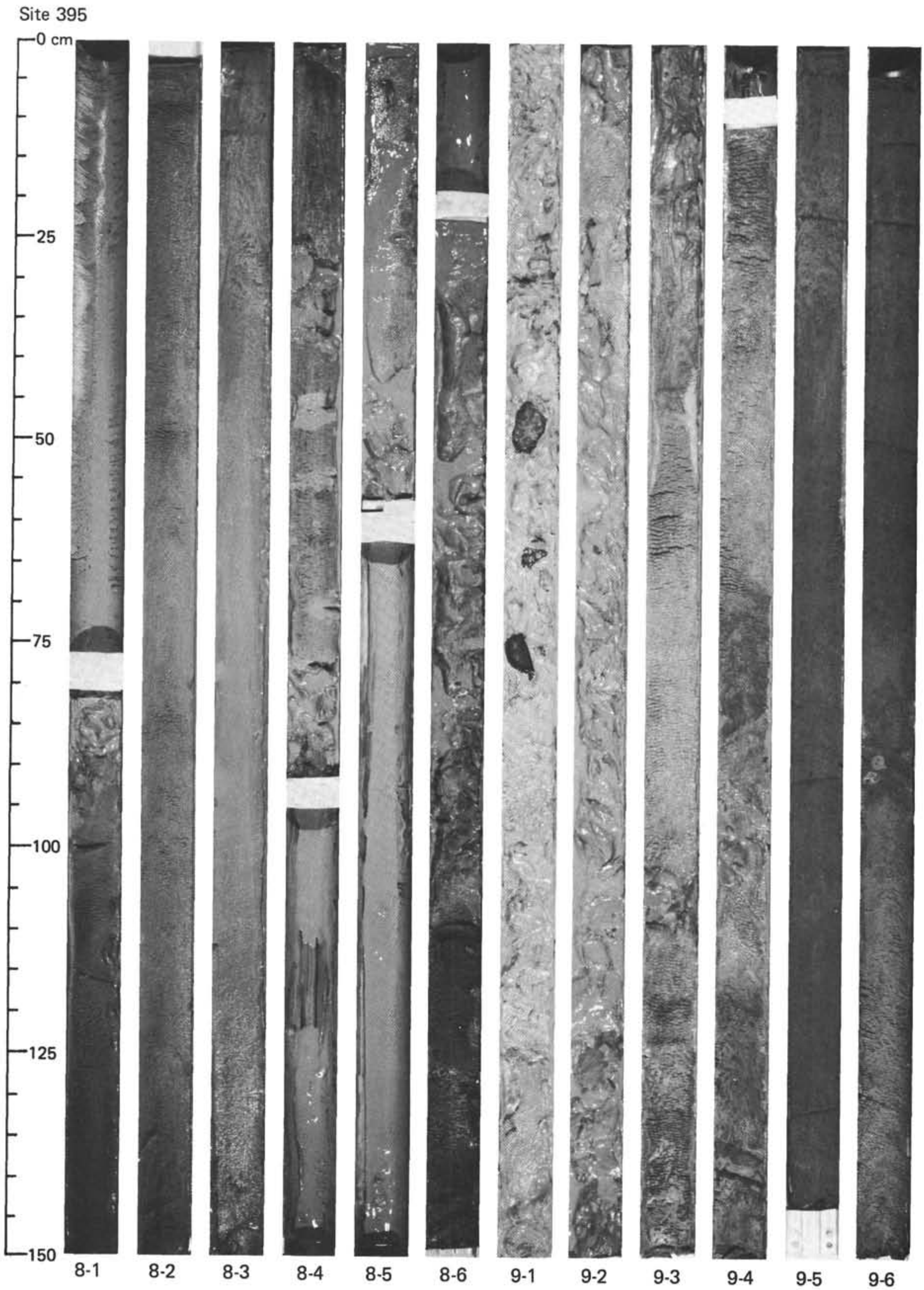
Fragments of fine-grained phyric basalt in fairly coarse cuttings. Phenocrysts of plagioclase, olivine, and rare clinopyroxene in phyric basalts. Phyric dolerite also present. From 143-148 cm is a large fragment of dolerite (5x4 cm). Plagioclase phenocrysts 15% (up to 4 mm); olivine phenocrysts about 5% (up to 2 mm); clinopyroxene less than 1% (up to 1 mm). Vesicles are less than 1% (0.5-1.0 mm) and filled by white and greenish white secondary minerals.

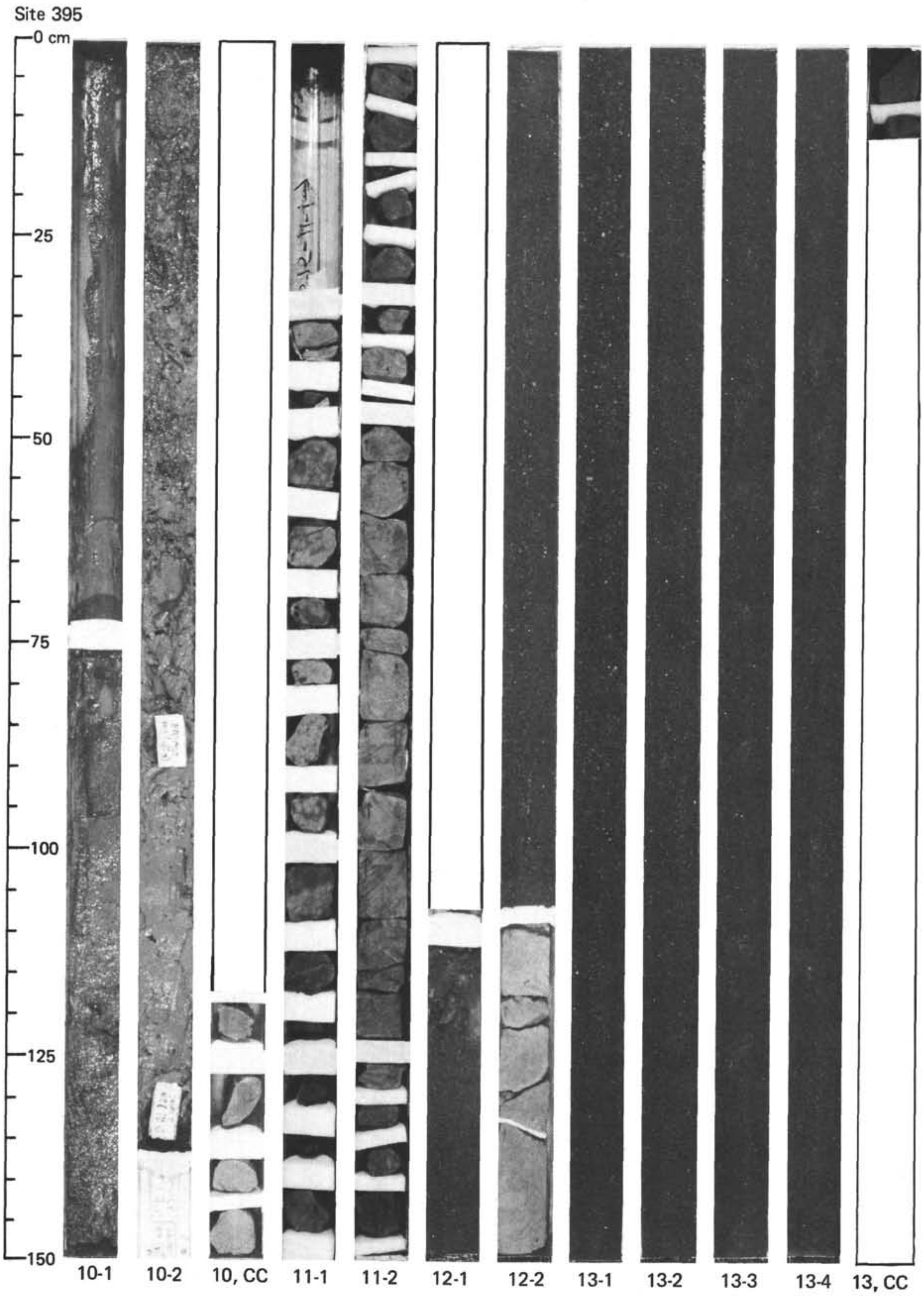
Note: Cuttings were removed from the core-catcher and placed in the liner in their approximate original position in the core-catcher. They should have been placed at the top of the liner since they were recovered contiguous to those in Section 4.

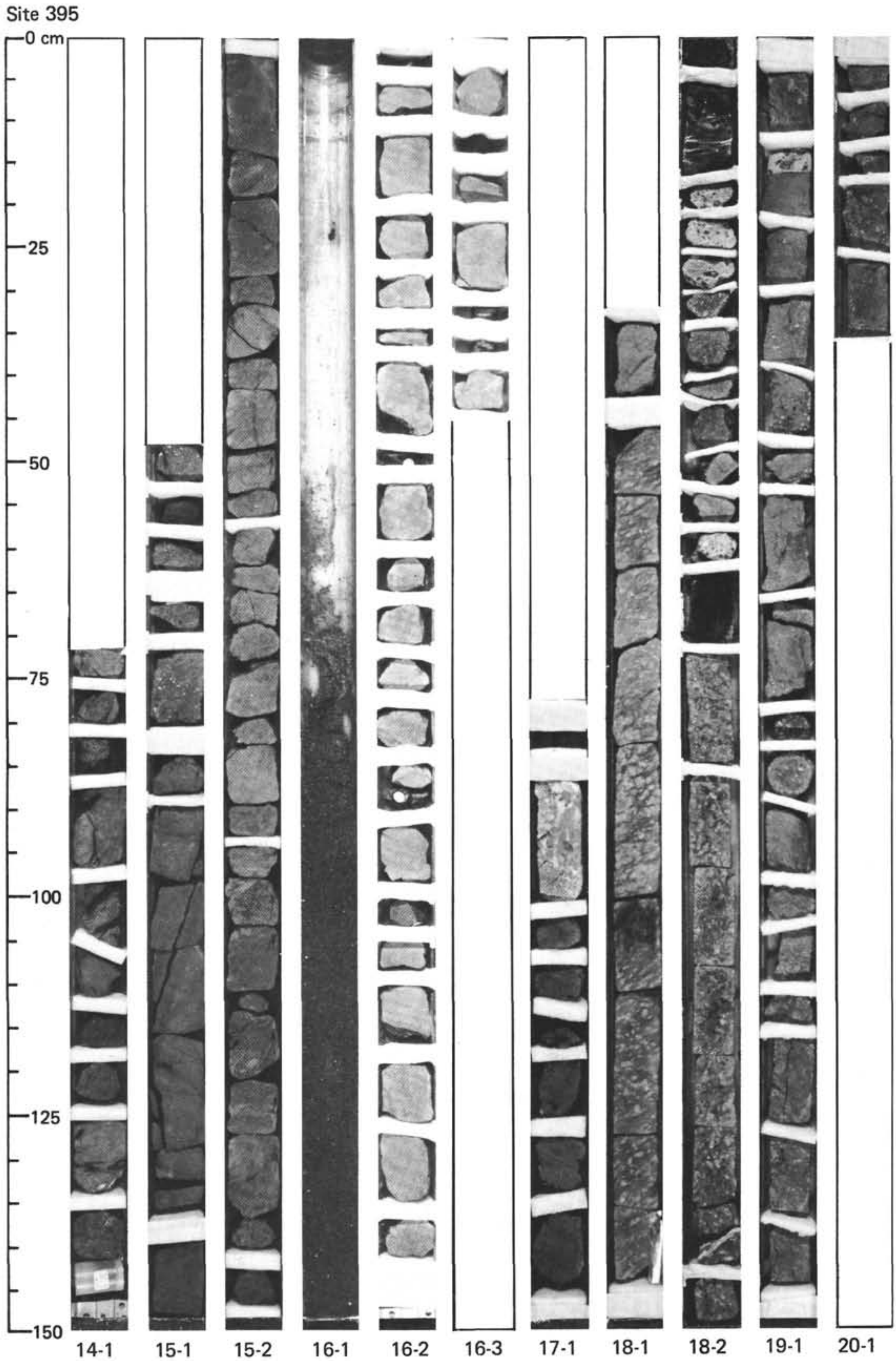

Site 395
0 cm
25
50
75
100
125
150
1-1
1-2
1-3
1-4
1-5
2-1
2-2
2-3
2-4
2-5
2-6
3-1

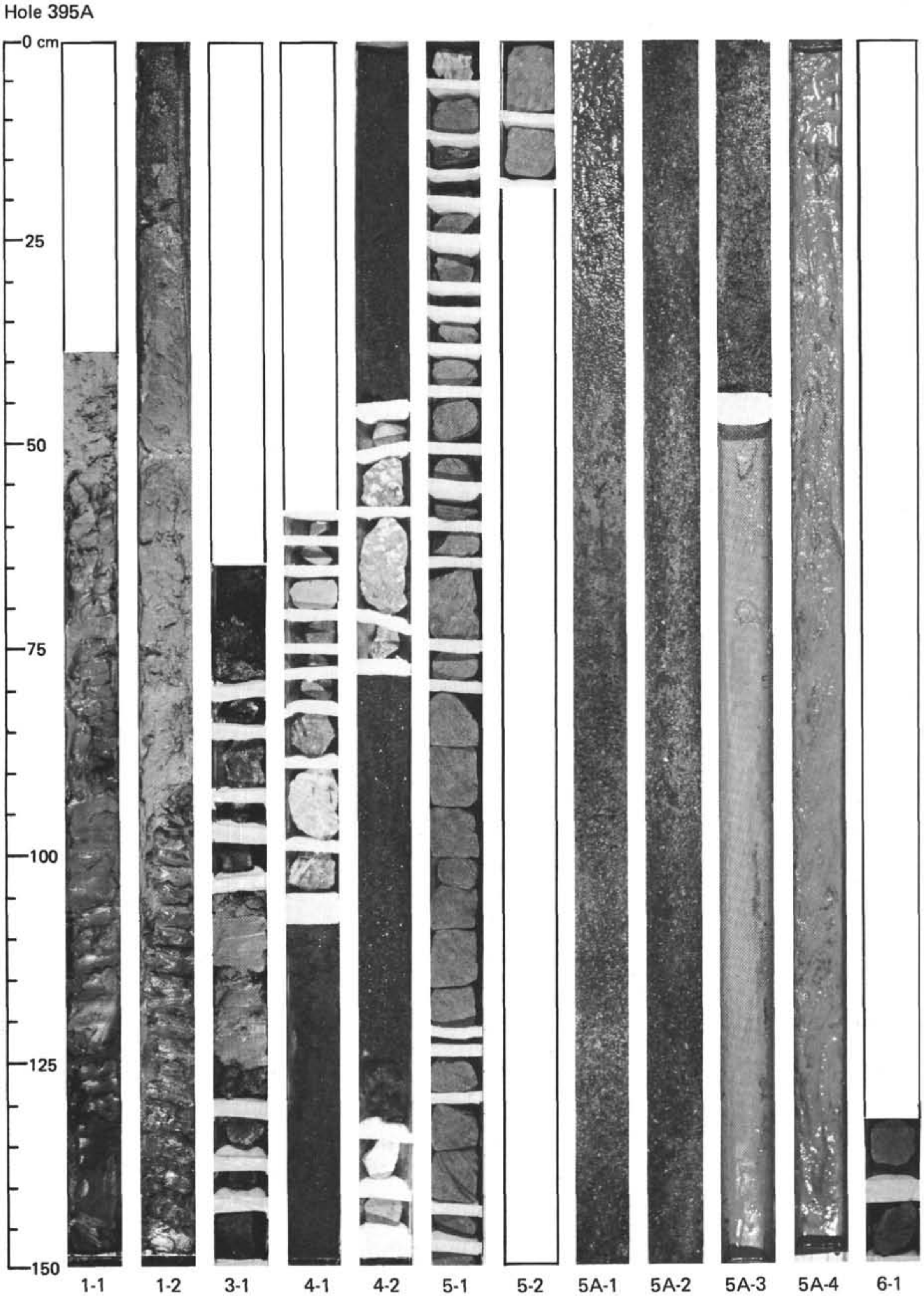

Site 395
0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
3-2
3-3
3-4
3-5
3-6
4-1
4-2
4-3
4-4
4-5
4-6
5-1

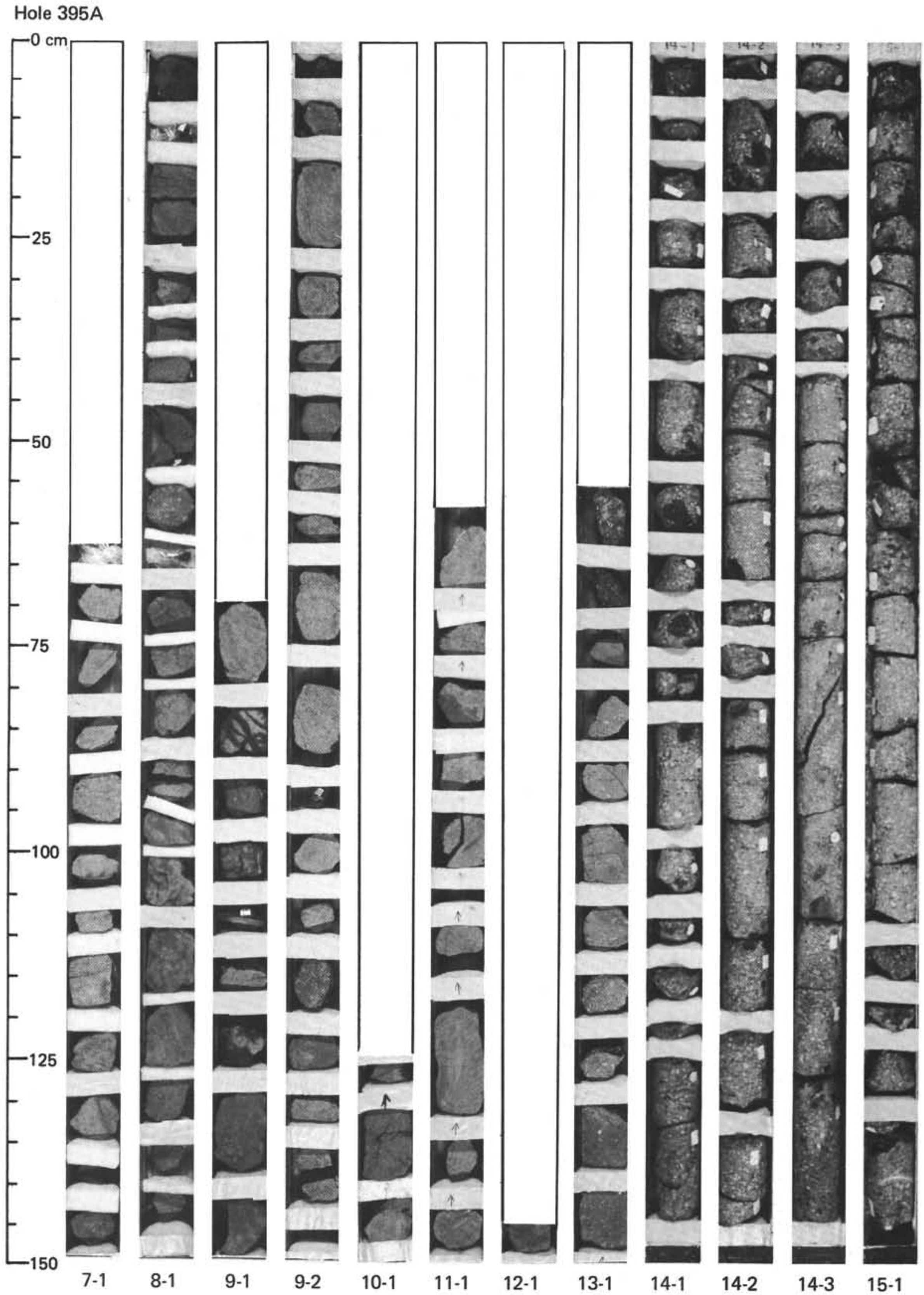

Site 395
0 cm
25
50
75
100
125
150
5-2
5-3
5-4
5-5
5-6
6-1
6-2
6-3
7-1
7-2
7-3
7-4

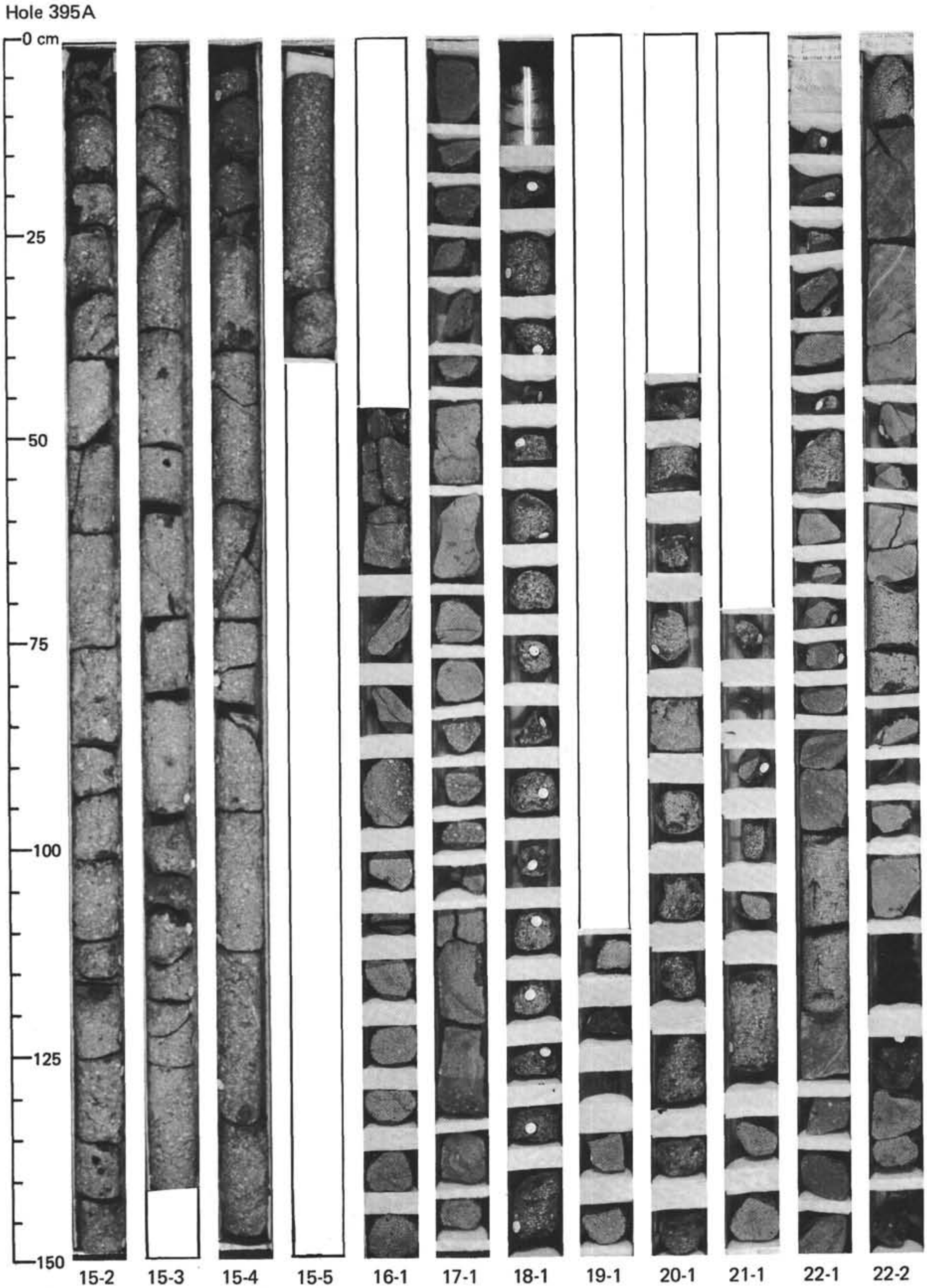

Site 395
0 cm
25
50
75
100
125
150
8-1
8-2
8-3
8-4
8-5
8-6
9-1
9-2
9-3
9-4
9-5
9-6


Site 395
0 cm
25
50
75
100
125
150
10-1
10-2
10, CC
11-1
11-2
12-1
12-2
13-1
13-2
13-3
13-4
13, CC

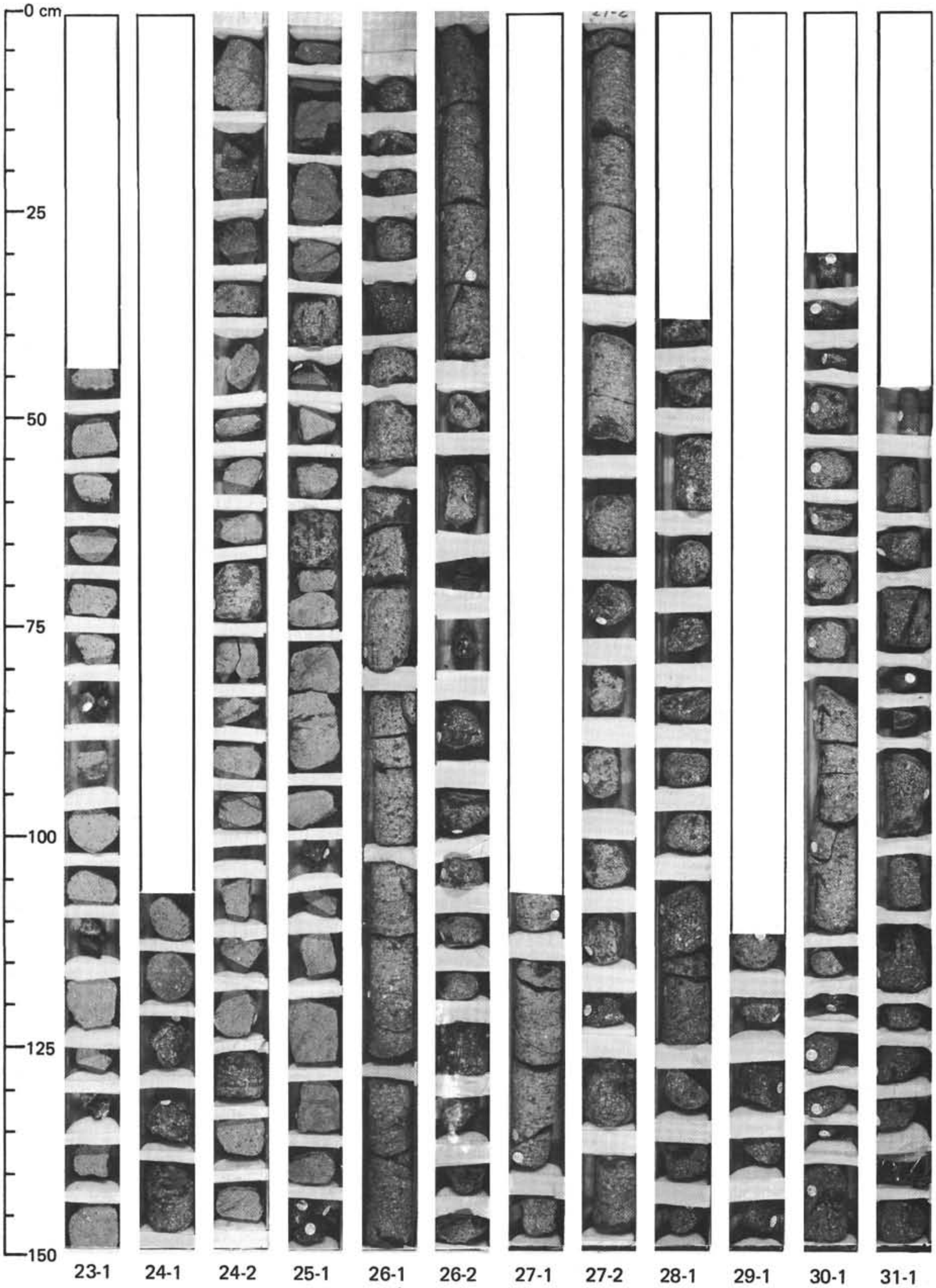

Site 395
0 cm
25
50
75
100
125
150
14-1
15-1
15-2
16-1
16-2
16-3
17-1
18-1
18-2
19-1
20-1


Hole 395A
0 cm
25
50
75
100
125
150
1-1
1-2
3-1
4-1
4-2
5-1
5-2
5A-1
5A-2
5A-3
5A-4
6-1

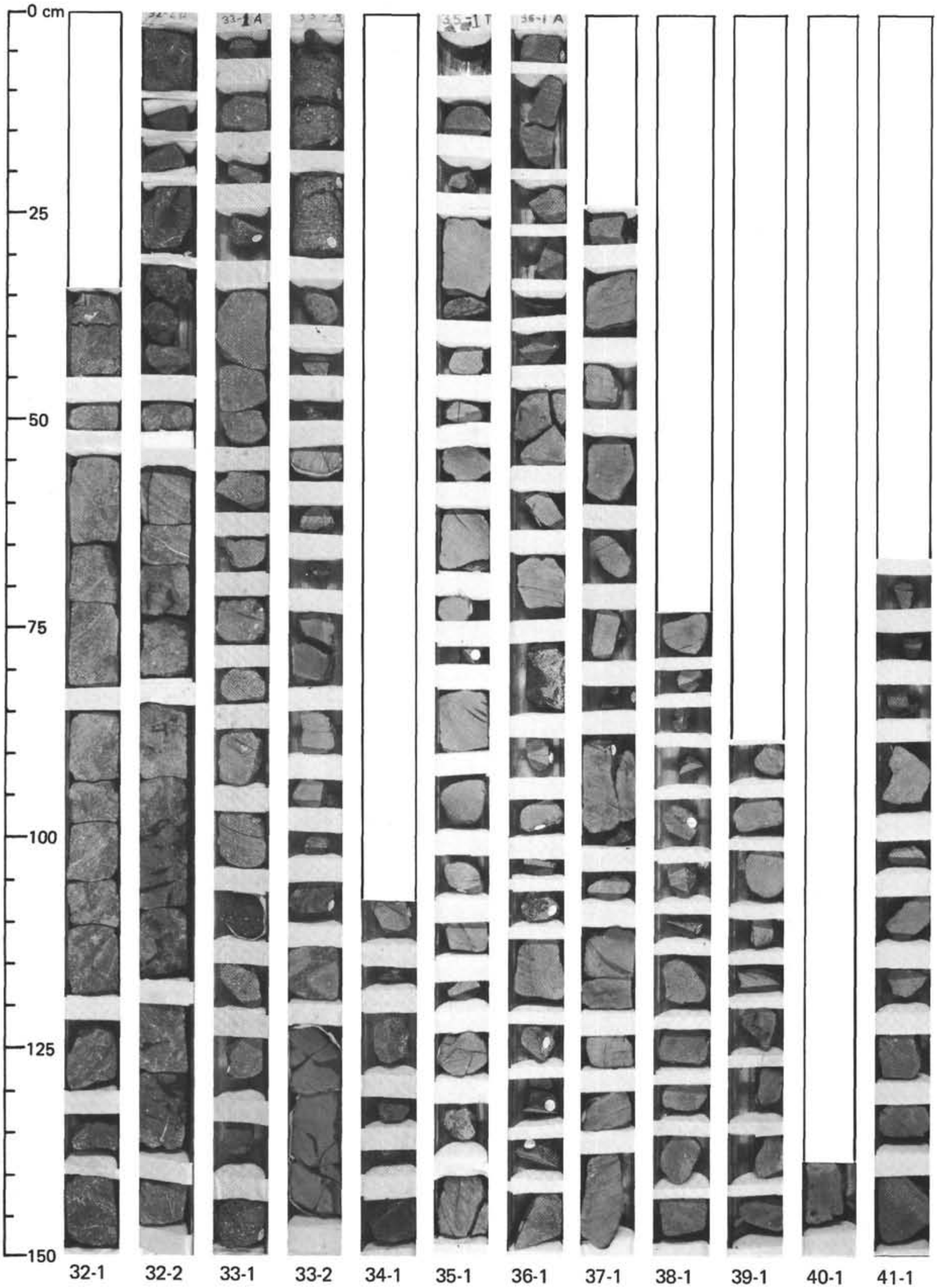

Hole 395A
0 cm
25
50
75
100
125
150
7-1
8-1
9-1
9-2
10-1
11-1
12-1
13-1
14-1
14-2
14-3
15-1


Hole 395A
0 cm
25
50
75
100
125
150
15-2
15-3
15-4
15-5
16-1
17-1
18-1
19-1
20-1
21-1
22-1
22-2

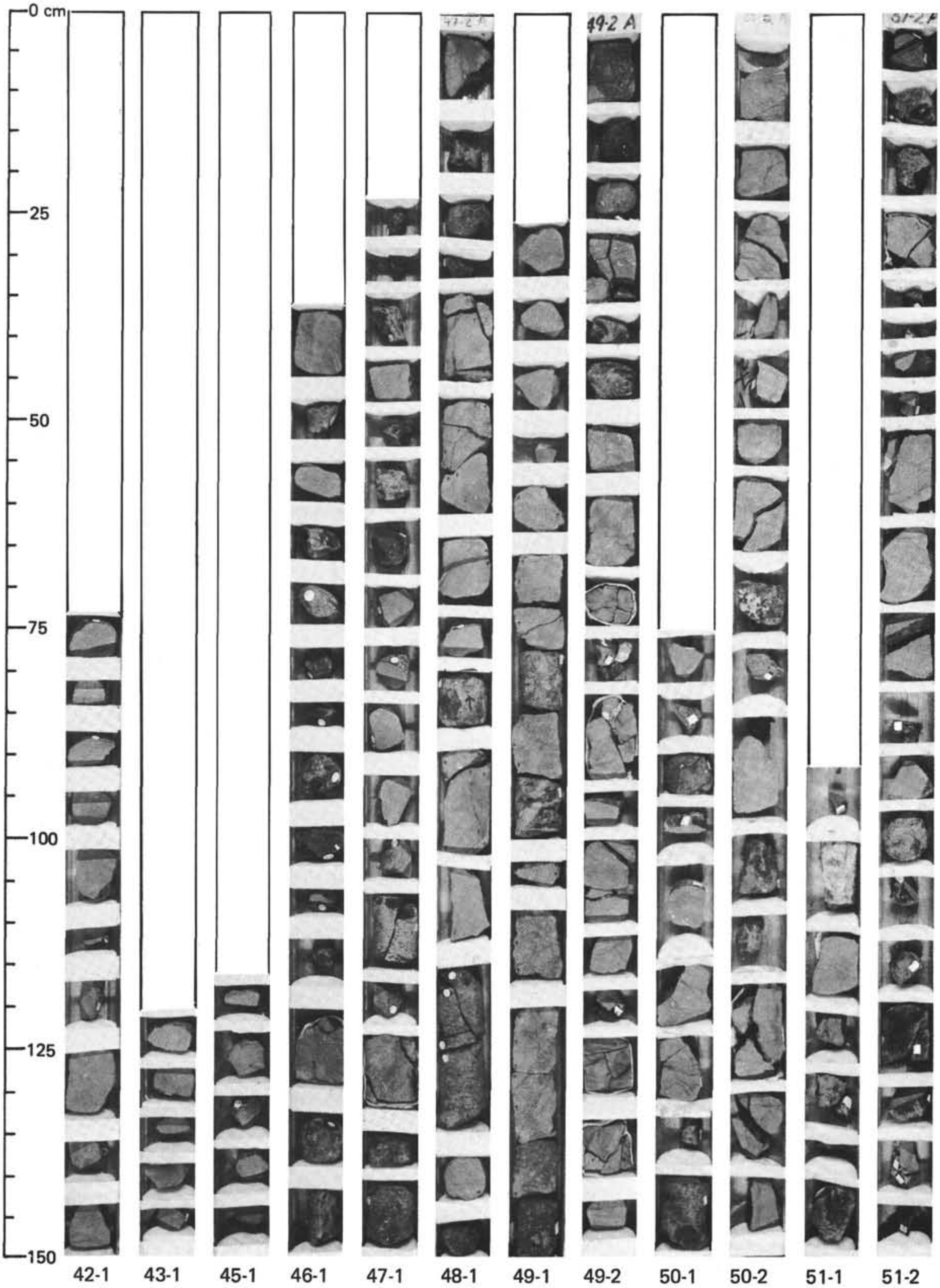
Hole 395A

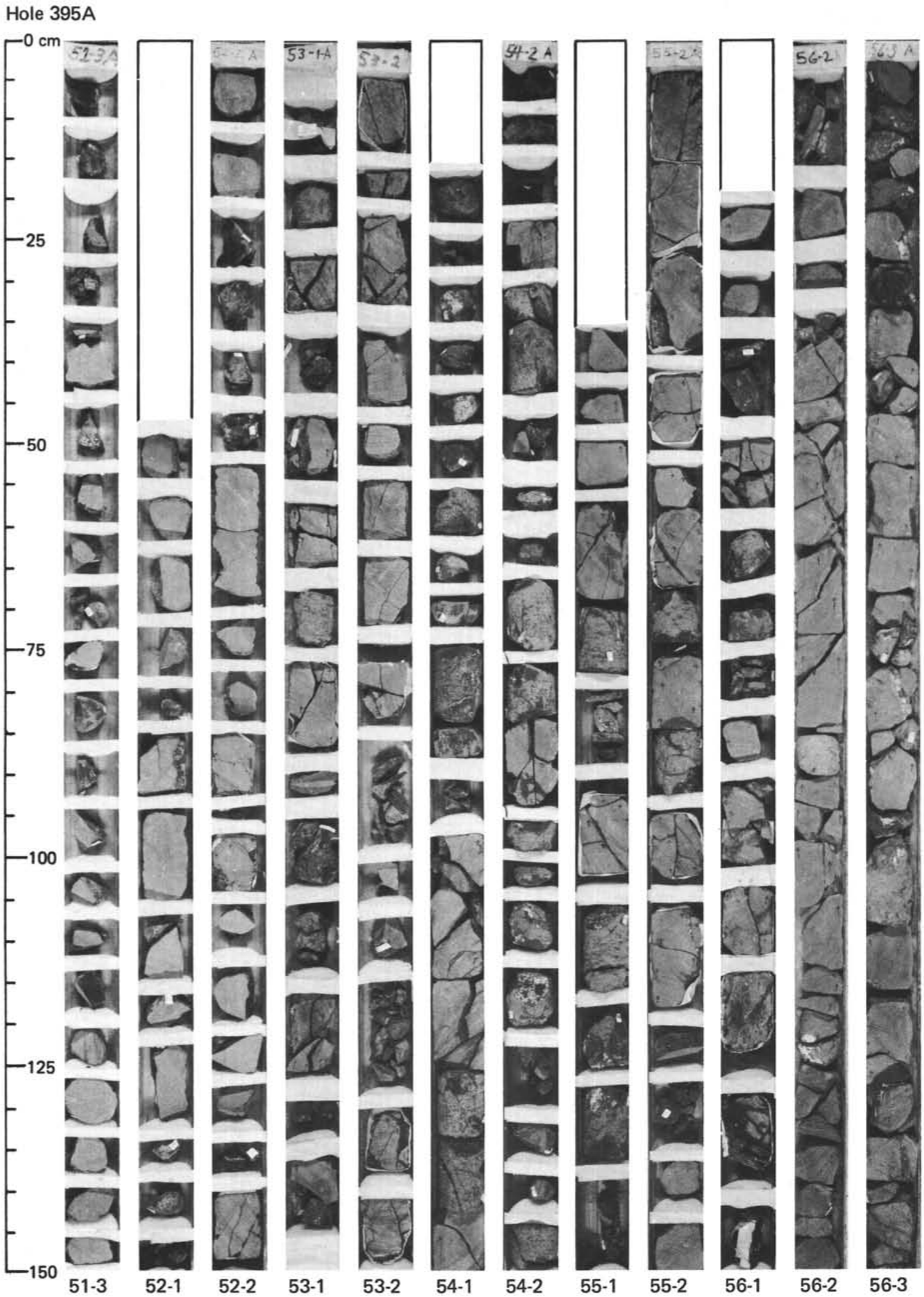

0 cm
25
50
75
100
125
150
23-1
24-1
24-2
25-1
26-1
26-2
27-1
27-2
28-1
29-1
30-1
31-1

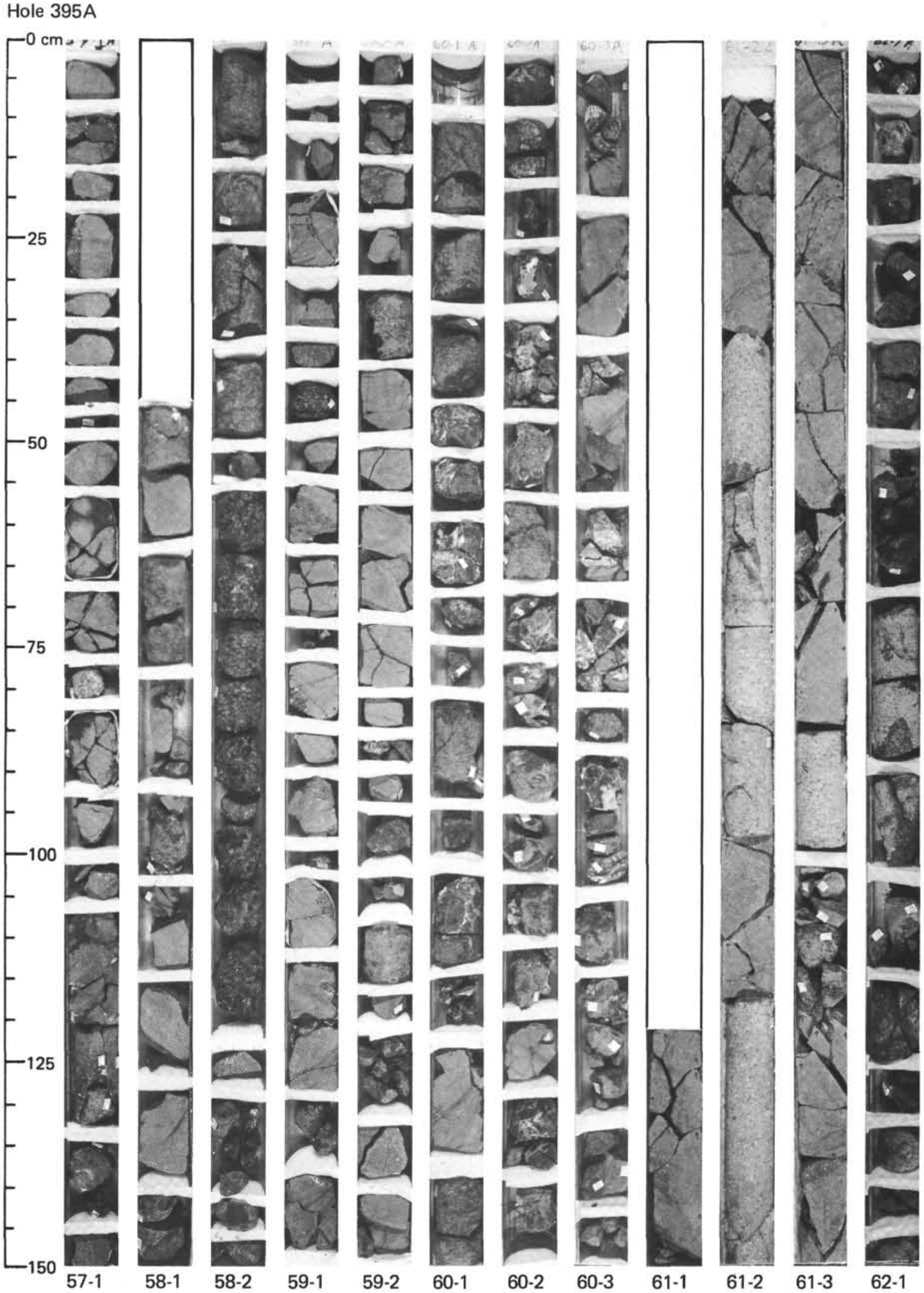
Hole 395A


0 cm
25
50
75
100
125
150
32-1
32-2
33-1
33-2
34-1
35-1
36-1
37-1
38-1
39-1
40-1
41-1

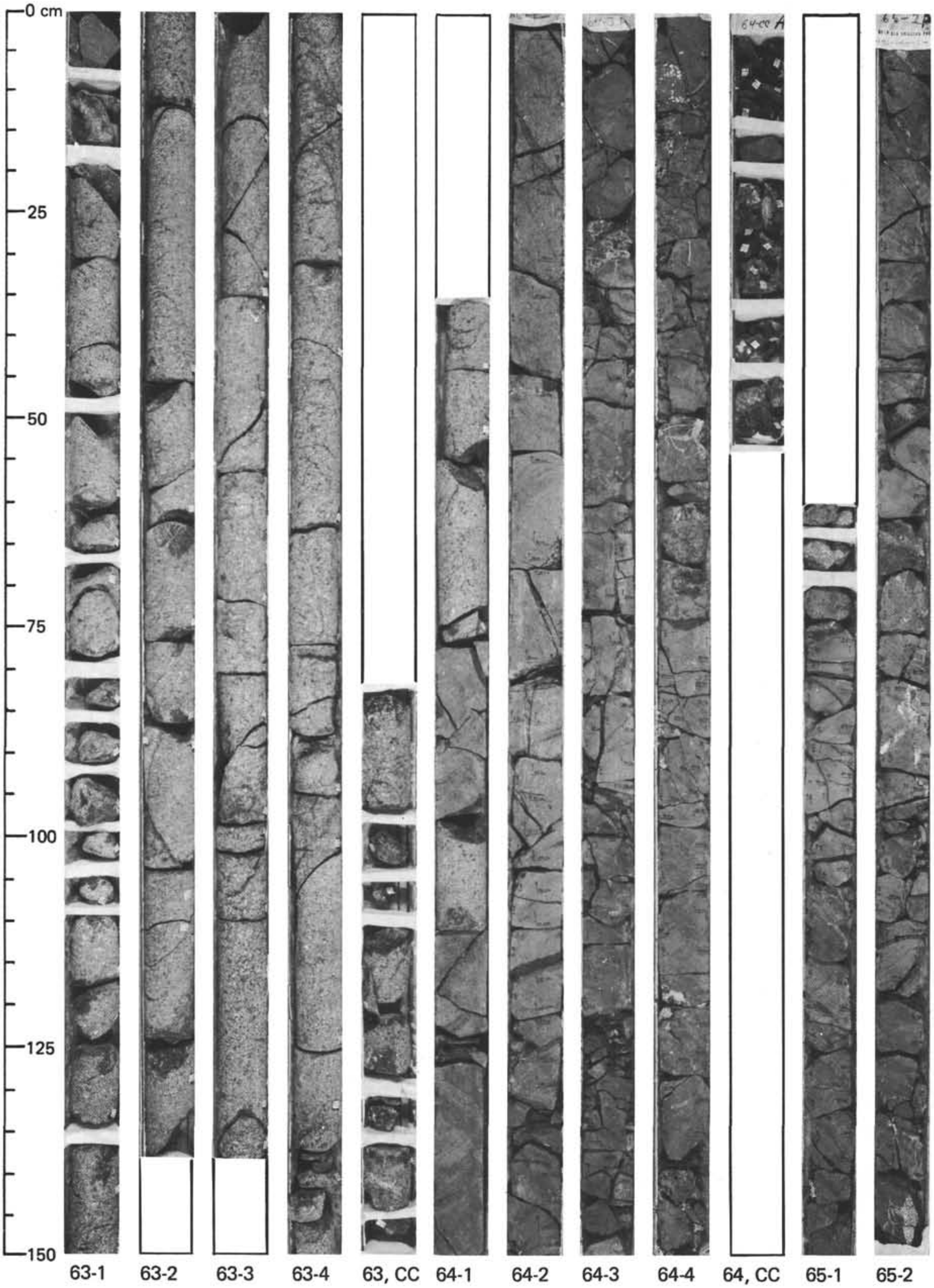
Hole 395A


0 cm
25
50
75
100
125
150
42-1
43-1
45-1
46-1
47-1
48-1
49-1
49-2
50-1
50-2
51-1
51-2

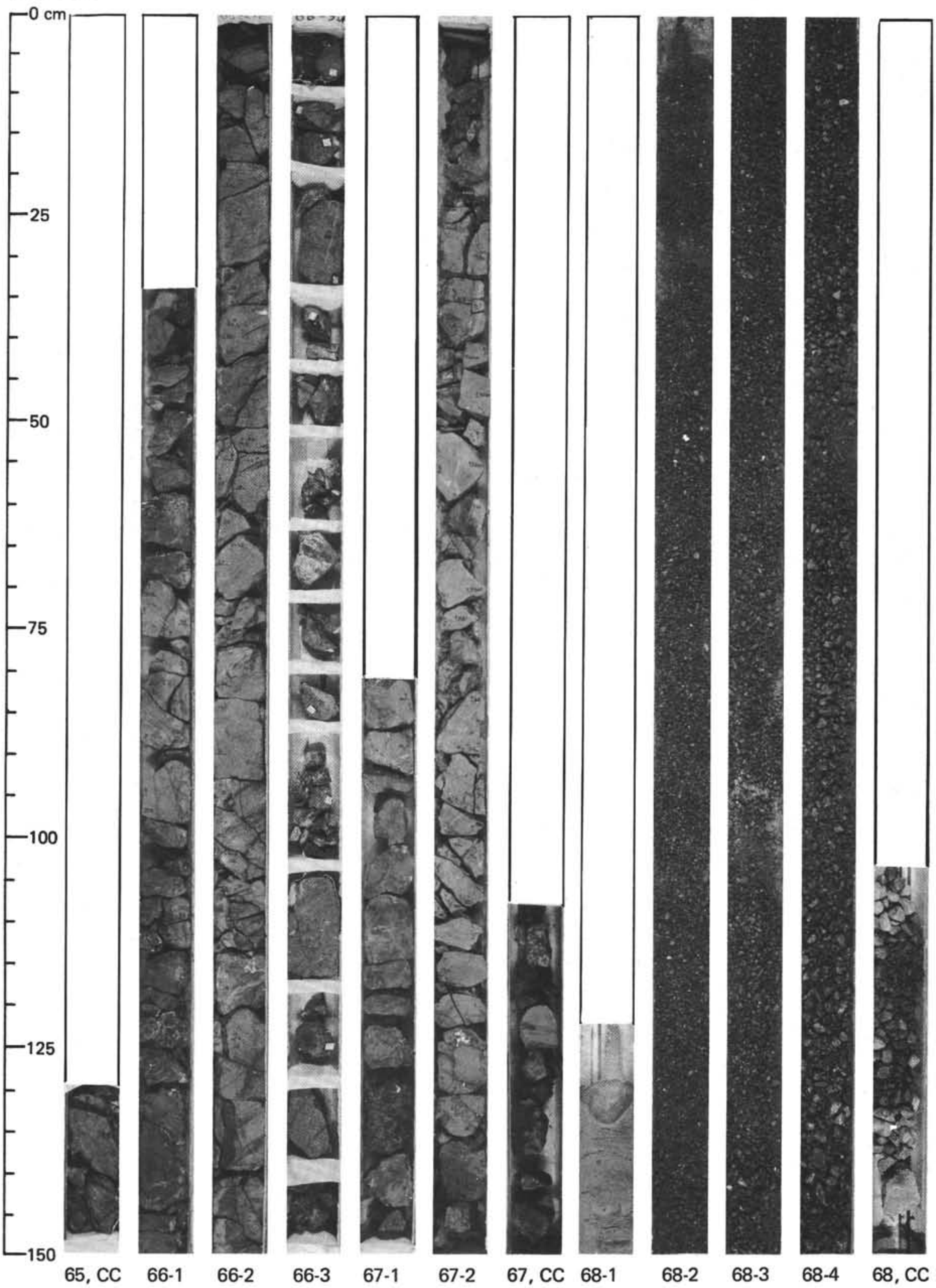

Hole 395A
0 cm
25
50
75
100
125
150
51-3
52-1
52-2
53-1
53-2
54-1
54-2
55-1
55-2
56-1
56-2
56-3


Hole 395A
0 cm
25
50
75
100
125
150
57-1
58-1
58-2
59-1
59-2
60-1
60-2
60-3
61-1
61-2
61-3
62-1

Hole 395A


0 cm
25
50
75
100
125
150
63-1
63-2
63-3
63-4
63, CC
64-1
64-2
64-3
64-4
64, CC
65-1
65-2

Hole 395A


0 cm
25
50
75
100
125
150
65, CC
66-1
66-2
66-3
67-1
67-2
67, CC
68-1
68-2
68-3
68-4
68, CC