

135-836A-1H
SMEAR SLIDE SUMMARY (%):

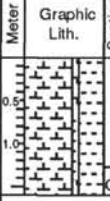
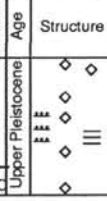
	1, 8 D	1, 85 D	1, 68 M	1, 85 M	1, 97 M	1, 112 D
TEXTURE:						
Sand	---	---	15	30	10	---
Silt	10	15	35	60	20	15
Clay	90	85	50	10	70	85

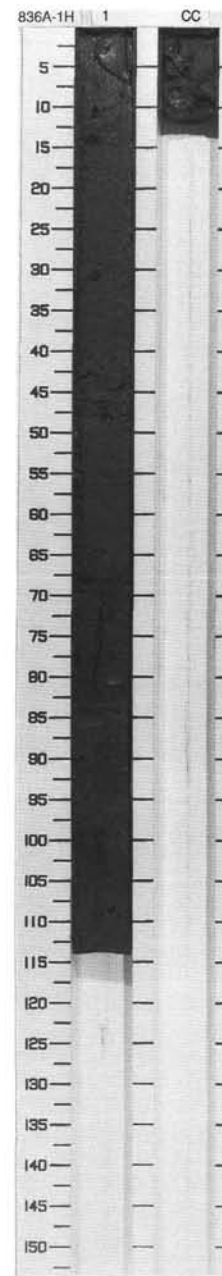
COMPOSITION:

Accessory minerals	Tr	Tr	2	5	2	Tr
Clay	30	30	24	5	28	30
Diatoms	2	2	Tr	---	5	1
Feldspar	Tr	Tr	1	3	1	Tr
Foraminifers	5	5	3	35	3	8
Glass	5	5	60	47	20	5
Nannofossils	57	57	10	5	40	55
Radiolarians	1	Tr	Tr	---	Tr	1
Silicoflagellates	Tr	---	---	---	---	---
Spicules	Tr	Tr	Tr	---	1	Tr

SITE 836 HOLE A CORE 1H

CORED 0.0 - 1.2 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	Description
0.5 1.0		1 Upper Pleistocene			---	5 10YR 4/3		CLAYEY NANNOFOSSIL OOZE Major lithology: CLAYEY NANNOFOSSIL OOZE, dark brown (10 YR 4/3). The sediment is homogenous, but contains clasts of pumice 1-2 cm in diameter. Minor lithologies: VOLCANIC SILT WITH CLAY AND NANNOFOSSILS occurs in Section 1, 68-69 cm. FORAM VOLCANIC SAND occurs in Section 1, 84-86 cm. CLAYEY NANNOFOSSIL MIXED SEDIMENT WITH GLASS occurs in Section 1, 96-100 cm. These three layers are all normally graded.



135-836A-2H
SMEAR SLIDE SUMMARY (%):

	1, 40	1, 77	1, 140	2, 40	2, 85	2, 139	3, 34
	D	M	D	D	M	M	D
TEXTURE:							
Sand	0	0	0	0	0	0	—
Silt	20	40	15	15	60	15	40
Clay	80	60	85	85	40	85	60

COMPOSITION:

Accessory minerals	Tr	Tr	Tr	Tr	Tr	—
Clay	30	10	30	30	30	35
Diatoms	Tr	Tr	Tr	Tr	—	Tr
Feldspar	—	Tr	Tr	Tr	Tr	—
Foraminifers	8	8	10	8	30	10
Glass	10	77	5	5	30	88
Nannofossils	50	5	55	56	10	25
Radiolarians	Tr	Tr	Tr	Tr	Tr	Tr
Spicules	2	Tr	Tr	Tr	—	Tr

SMEAR SLIDE SUMMARY (%):

	3, 119	4, 48	4, 92	5, 38	5, 39	5, 93	6, 32
	D	M	M	M	D	M	D
TEXTURE:							
Sand	---	---	50	---	---	---	---
Silt	15	65	40	53	8	40	---
Clay	85	15	10	47	92	60	---

COMPOSITION:

Accessory minerals	Tr	Tr	Tr	Tr	---	Tr	Tr
Clay	30	10	7	30	30	---	30
Diamonds	Tr	---	---	---	Tr	Tr	Tr
Feldspar	Tr	Tr	Tr	2	Tr	1	Tr
Foraminifers	8	Tr	20	1	3	4	3
Glass	10	85	70	50	4	40	5
Nannofossils	52	5	3	17	62	55	60
Radiolarians	Tr	---	---	---	---	---	Tr
Silicoflagellates	---	---	---	---	Tr	---	---
Spicules	Tr	---	---	---	Tr	---	2

SMEAR SLIDE SUMMARY (%):

	6,39	6,87	7,25
	M	D	D
TEXTURE:			
Sand	---	---	---
Silt	75	15	12
Clay	25	85	88

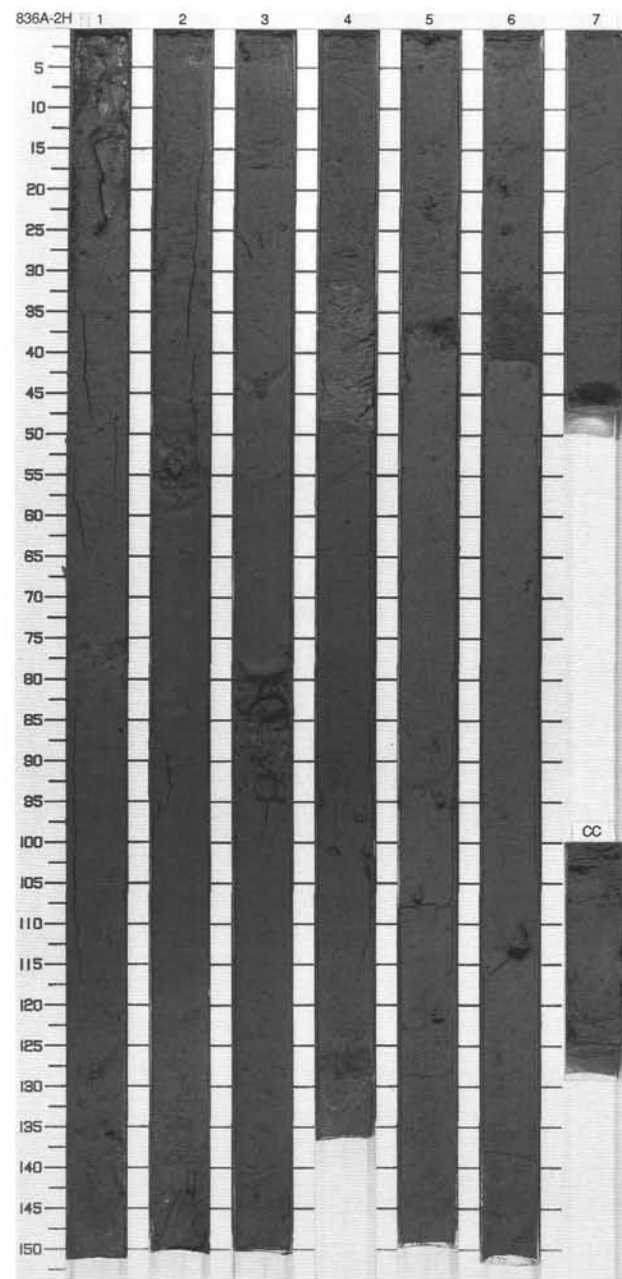
COMPOSITION:

Accessory minerals	Tr	Tr	Tr
Clay	20	30	30
Diatoms	---	Tr	Tr
Feldspar	2	Tr	—
Foraminifers	2	10	10
Glass	71	5	2
Nannofossils	5	53	58
Radiolarians	---	Tr	Tr
Spicules	---	2	Tr

SITE 836 HOLE A CORE 2H

CORED 1.2 - 10.7 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	Description
0 10								CLAYEY NANNOFOSSIL OOZE, AND CLAYEY NANNOFOSSIL OOZE WITH GLASS
		1		} ◇ aaa		S		Major lithologies: CLAYEY NANNO- FOSSIL OOZE and CLAYEY NANNO- FOSSIL OOZE WITH GLASS, brown to dark brown (10YR 4/3 to 10YR 5/3).
		2		} ◇ aaa		S		Minor lithologies: VITRIC CLAY WITH NANNOFOSSILS AND FORAMS, brown to dark brown (10YR 4/3), CLAYEY NANNOFOSSIL OOZE WITH FORAMS, grayish brown (10YR 5/2), VITRIC VOLCANIC SILT WITH CLAY, very pale brown (10YR 7/3) and CLAST-SUPPORTED PUMICE LAPILLI, brown to dark brown (10YR 4/3). VITRIC SILT WITH CLAY occurs in Section 1, 76-78 cm, Section 2, 137-139 cm, and Section 6, 35-40 cm.
		3		} ◇ aaa		S	10YR 4/3	FORAMINIFERAL VITRIC CLAYEY MIXED SEDIMENT WITH NANNO- FOSSILS occurs in Section 2, 83-84 cm, VITRIC SILT WITH FORAMS occurs in Section 4, 91-94 cm, CLAYEY VITRIC SILT occurs in Section 5, 35-39 cm, and VITRIC NANNOFOSSIL MIXED SEDIMENT occurs in Section 5, 92-95 cm.
		4	Middle Pleistocene	} ◇ aaa		S		
		5		} ◇ aaa		S		
		6		} ◇ aaa		S	10YR 5/3	
		7		} ◇ aaa		S		
		8		} ◇ aaa		S	10YR 5/2	
		9		} ◇ aaa		S	10YR 4/2	



135-836A-3H

SMEAR SLIDE SUMMARY (%):

	1, 69 D	2, 5 D	2, 26 M	2, 34 D	2, 96 D	2, 102 M	2, 106 D
TEXTURE:							
Sand	0	15	100	15	10	100	15
Silt	15	35	---	35	20	---	20
Clay	85	50	---	50	70	---	65

COMPOSITION:

Accessory minerals	Tr	Tr	---	Tr	Tr	---	Tr
Clay	30	20	Tr	20	30	Tr	25
Feldspar	Tr	---	---	---	Tr	---	---
Foraminifers	10	5	2	5	8	2	4
Glass	4	45	96	45	20	96	30
Nannofossils	56	30	Tr	30	42	Tr	41
Radiolarians	Tr	---	---	---	---	---	---
Spicules	Tr	---	---	---	---	---	---

SMEAR SLIDE SUMMARY (%):

	3, 6 D	3, 104 D	3, 122 D	3, 127 M	3, 130 D	4, 27 M	4, 127 M
TEXTURE:							
Sand	30	10	---	100	10	85	0
Silt	25	30	---	---	20	10	60
Clay	45	60	---	---	70	5	40

COMPOSITION:

Accessory minerals	Tr	Tr	---	Tr	Tr	2	Tr
Clay	5	25	20	Tr	30	2	25
Diatoms	---	---	---	---	---	---	Tr
Feldspar	---	Tr	---	---	---	1	1
Foraminifers	2	6	Tr	2	6	---	2
Glass	55	35	40	96	25	96	60
Nannofossils	38	34	40	Tr	39	---	10
Radiolarians	---	---	---	---	---	---	Tr

SMEAR SLIDE SUMMARY (%):

	5, 2 D	5, 14 D	5, 32 M	5, 50 D	5, 60 D	5, 127 M	6, 9 D
TEXTURE:							
Sand	5	10	100	80	---	40	20
Silt	5	10	---	20	5	10	60
Clay	90	80	---	---	95	50	20

COMPOSITION:

Accessory minerals	---	---	10	Tr	---	---	Tr
Clay	20	25	---	---	25	15	20
Feldspar	Tr	5	5	10	---	5	Tr
Foraminifers	10	10	---	10	Tr	15	25
Glass	Tr	5	85	80	5	30	20
Nannofossils	70	55	---	---	70	35	35

SMEAR SLIDE SUMMARY (%):

	6, 11 D	6, 13 D	6, 117 M	6, 124 M	6, 138 D	7, 25 D
TEXTURE:						
Sand	25	20	15	100	30	10
Silt	0	---	5	0	5	10
Clay	75	80	80	0	65	80

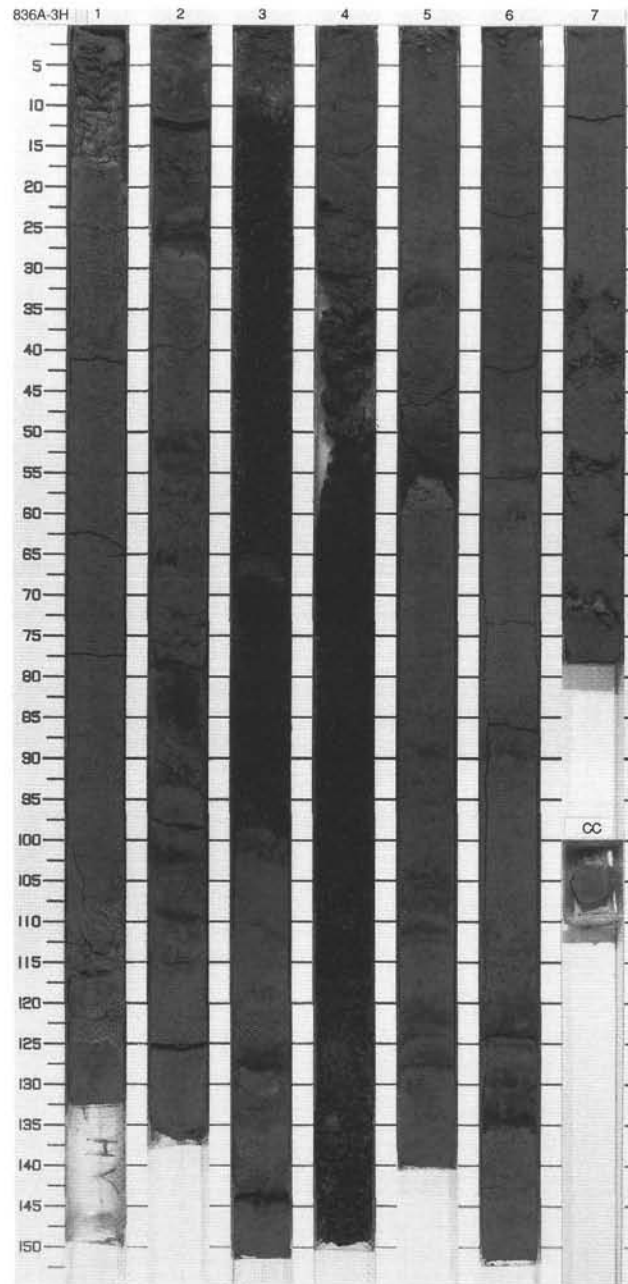
COMPOSITION:

Accessory minerals	Tr	Tr	---	---	---	---
Clay	20	25	20	---	20	20
Feldspar	Tr	Tr	Tr	Tr	Tr	---
Foraminifers	15	15	5	---	10	10
Glass	10	10	15	100	20	10
Nannofossils	55	50	60	---	50	60

SITE 836 HOLE A CORE 3H

CORED 10.7 - 20.2 mbsf

Meter	Graphic Lith.	Section Age	Structure	Disturb	Sample	Color	Description
0.5		1			S	10YR 3/3	CLAYEY NANNOFOSSIL OOZE WITH FORAMS, CLAYEY NANNOFOSSIL VITRIC MIXED SEDIMENT and HYALOCLASTITE
1.0		2			S	10YR 2/1 to 10YR 3/3	Major lithologies: CLAYEY NANNOFOSSIL OOZE, both with and without forams, dark brown (10YR 3/3). MIXED SEDIMENT with varying proportions of clay, glass, and nannofossils. CLAYEY NANNOFOSSIL VITRIC MIXED SEDIMENT, dark gray (10YR 4/1) to brown (10YR 4/3), and CLAYEY VITRIC NANNOFOSSIL MIXED SEDIMENT, dark brown (10YR 3/3) to black (10YR 2/1) are common. HYALOCLASTITE, black (5YR 2.5/1).
		3			S	10YR 2/1	
		4			S	10YR 4/3	Minor lithologies: Graded layers of VOLCANIC SAND and VOLCANIC SILT with varying percentages of glass, nannofossils, and clay occur within the mixed sediments. Their color varies from dark gray brown (2.5YR 4/2) to black (10YR 2/1).
		5			S	5YR 2.5/1	
		6			S	2.5Y 4/2	
		7			S	10YR 3/3	
					S	10YR 4/3	
					S	10YR 4/4	



SITE 836 HOLE A CORE 4H CORED 20.2 - 21.2 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	Description
20.2		CC						BASALTIC BRECCIA
								Major lithology: BASALTIC BRECCIA, black (10YR 2/1), unconsolidated, unsorted and structureless with clasts up to 23 mm in diameter.
								Minor lithology: None.

836A 5X HARD ROCK

SITE 836 HOLE A CORE 6X CORED 22.7 - 25.7 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	Description
22.7								NANNOFOSSIL CHALK WITH FORAMS AND CLAY
								Major lithology: NANNOFOSSIL CHALK WITH FORAMS AND CLAY, dark yellowish brown (10YR 4/4), structureless and indurated.
								Minor lithology: None.

836A 7X THROUGH 9X HARD ROCK

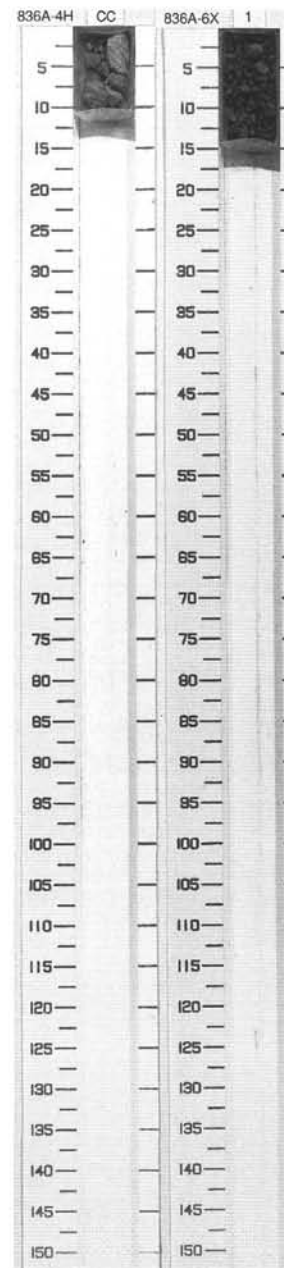
135 836A-6X
SMEAR SLIDE SUMMARY (%):

TEXTURE: 1, 1
M

Sand ---
Silt ---
Clay ---

COMPOSITION:

Foraminifers 5
Gothite 5
Nannofossils 83
Pore space 7



135-836B-1R
SMEAR SLIDE SUMMARY (%):

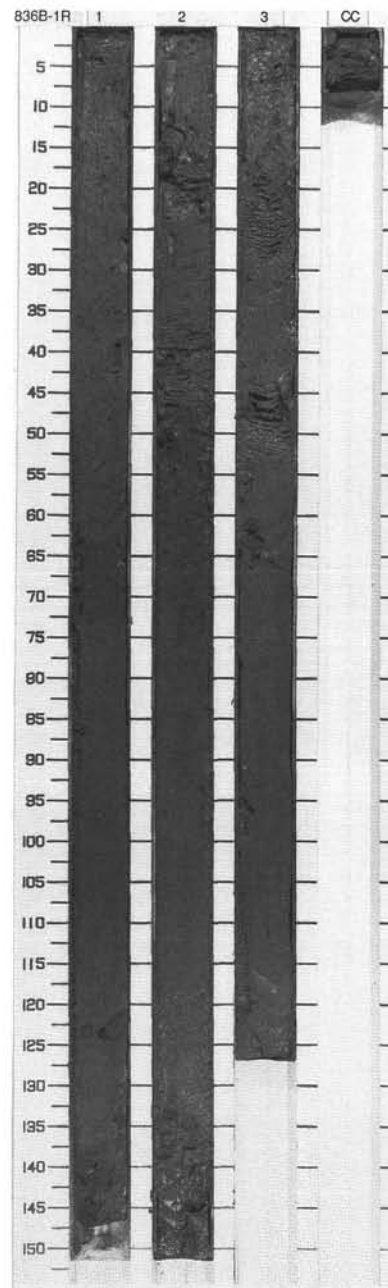
	1, 4 D	1, 14 D	2, 21 M	2, 28 D	3, 16 D	3, 24 M	3, 125 D
TEXTURE:							
Sand	---	---	10	---	---	40	---
Silt	20	10	35	40	40	55	15
Clay	80	90	55	60	60	5	85
COMPOSITION:							
Accessory minerals	Tr	Tr	Tr	Tr	Tr	Tr	Tr
Clay	30	35	20	25	25	3	30
Diatoms	---	Tr	---	---	---	---	---
Dolomite	---	---	---	---	---	---	Tr
Feldspar	2	---	Tr	Tr	Tr	Tr	---
Foraminifers	5	3	15	8	3	Tr	3
Glass	15	5	30	35	35	95	15
Nannofossils	48	57	35	32	37	2	52
Radiolarians	---	Tr	---	---	---	---	---
Spicules	---	Tr	---	---	---	---	---

SITE 836 HOLE B CORE 1R

CORED 0.0 - 4.5 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	Description
0.5		1		◇		S	10YR 3/3	CLAYEY NANNOFOSSIL MIXED SEDIMENT WITH GLASS, NANNOFOSSIL VITRIC MIXED SEDIMENT WITH CLAY and VITRIC NANNOFOSSIL MIXED SEDIMENT WITH CLAY
1.0		2	Middle Pleistocene	AAA ◇		S	10YR 6/2	Major lithologies: CLAYEY NANNOFOSSIL MIXED SEDIMENT WITH GLASS and NANNOFOSSIL VITRIC MIXED SEDIMENT WITH CLAY, dark brown (10YR 3/3) to brown (10YR 5/3), VITRIC NANNOFOSSIL MIXED SEDIMENT WITH CLAY, brown (10YR 5/3).
		3		AAA ◇		S	10YR 6/2	
				AAA ◇		S	10YR 5/3	Minor lithology: VITRIC VOLCANIC SILT, light brownish gray (10YR 6/2) occurs in Section 2, 40-47 cm, and in Section 3, 19-28 cm and 44-53 cm.

WASHED 4.5-18.0 mbsf



135-836B-2R
 SMEAR SLIDE SUMMARY (%):

 1, 5 1, 5
 D D

TEXTURE:

 Sand --- ---
 Silt 15 15
 Clay 85 85

COMPOSITION:

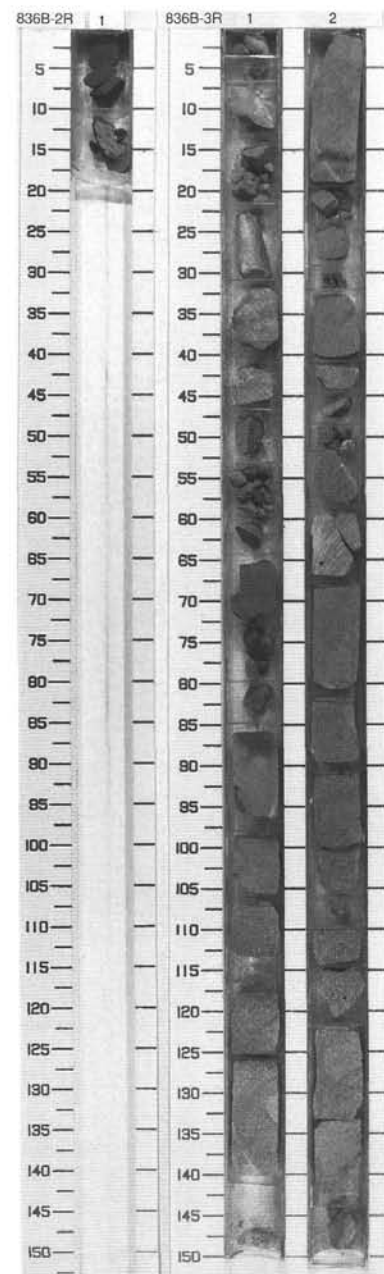
 Accessory minerals Tr Tr
 Clay 43 43
 Feldspar Tr Tr
 Foraminifers 4 4
 Glass 10 10
 Nannofossils 43 43

 SITE 836 HOLE B CORE 2R
 CORED 18.0 - 23.0 mbsf

Meter	Graphic Lith.	Section Age	Structure	Disturb	Sample	Color	Description
1		1			5		CLAYEY NANNOFOSSIL MIXED SEDIMENT WITH GLASS
							Major lithology: CLAYEY NANNOFOSSIL MIXED SEDIMENT WITH GLASS, dark brown (10YR 3/3), slightly indurated, mottled sediment with some mm-sized yellow intraclasts.
							Minor lithology: None.

 SITE 836 HOLE B CORE 3R
 CORED 23.0 - 28.5 mbsf

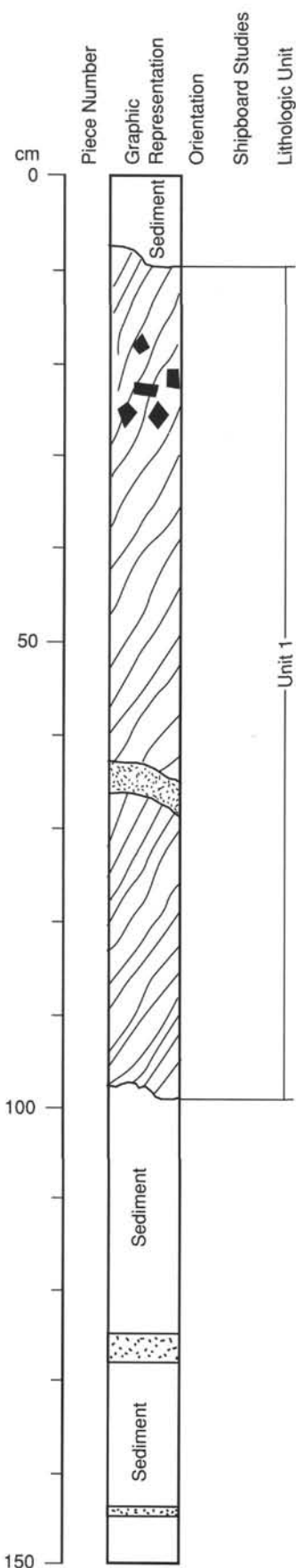
Meter	Graphic Lith.	Section Age	Structure	Disturb	Sample	Color	Description
0.5		1				2.5Y 6/4	VITRIC CLAYSTONE
1.0		2					Major lithology: VITRIC CLAYSTONE, light yellowish brown (2.5Y 6/4) to light greenish gray (10Y 5/2). The sediment is mottled due to bioturbation and shows cross-lamination and planar-lamination. Graded layers occur as well as pebbly intervals.
							Minor lithology: None.



135-836A-3H-3

UNIT 1: APHYRIC BASALTIC GLASS GRAVEL**Pieces 8–99 cm****CONTACTS:** None.**PHENOCRYSTS:**

Plagioclase: 1%–2%; <1 mm; euhedral.

GROUNDMASS: Glassy.**VESICLES:** Common, many fragment vesicular.**COLOR:** Black.**STRUCTURE:** N/A.**ALTERATION:** Fresh.**VEINS/FRACTURES:** None.**ADDITIONAL COMMENTS:** A deposit of fresh, angular glass fragments. Preservation of sharp edged conchoidal fractures indicates that this material has not been transported far (if at all) from its source. Fragments range in size from <1 mm to 2 cm in length.

Glassy basalt gravel

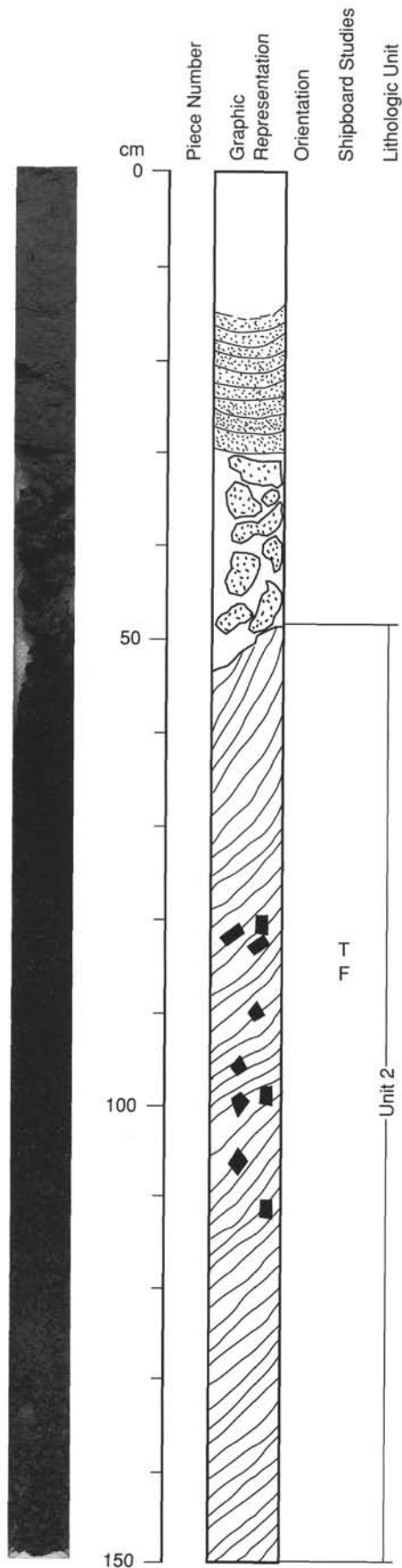
◆ (coarse fragments)

▨ = Graded layers of black volcanic sand

135-836A-3H-4

UNIT 2: APHYRIC BASALTIC GLASS GRAVEL**Pieces 50–150 cm****CONTACTS:** N/A.**PHENOCRYSTS:**

Plagioclase: 1%–2%; <1 mm; euhedral.

GROUNDMASS: Glassy.**VESICLES:** Common, many fragments vesicular.**COLOR:** Black.**STRUCTURE:** N/A.**ALTERATION:** Fresh.**VEINS/FRACTURES:** None.**ADDITIONAL COMMENTS:** A deposit of fresh, angular, basaltic glass. Excellent conchoidal fracturing is preserved, indicating that the fragments have been deposited very close to their origin. Fragments range from <1 mm up to 1.5 cm in length.

Bedded ash



Pebbles of indurated ash

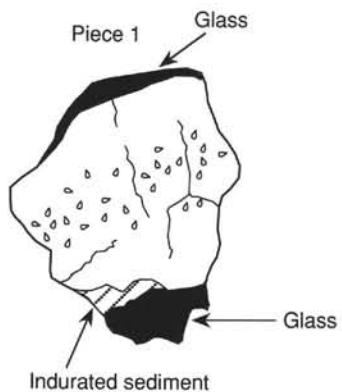
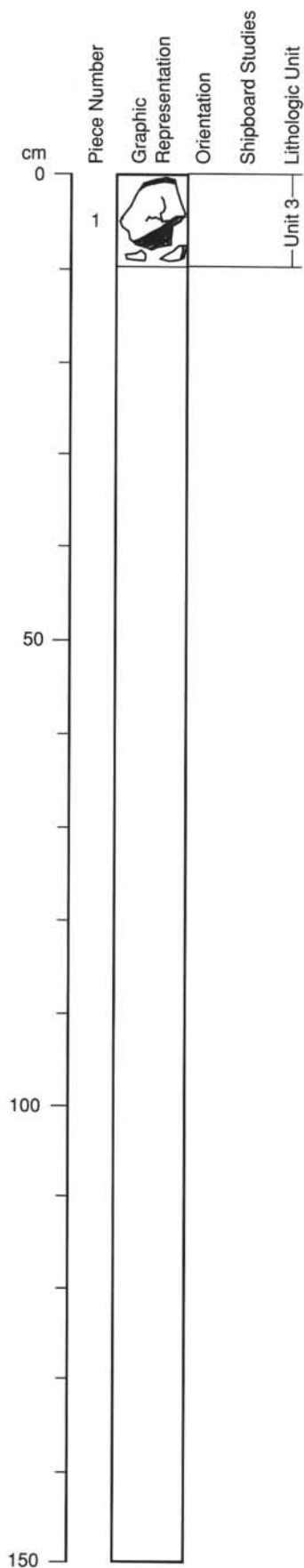


Glassy basalt gravel



Coarse glass fragments

135-836A-3H-CC

**UNIT 3: APHYRIC BASALT****Piece 1****CONTACTS:** None, but contains glass rinds on three sides.**PHENOCRYSTS:**

Plagioclase: Trace–1%; <1 mm; euhedral.

Olivine: Trace; <1 mm; subhedral.

GROUNDMASS: Fine-grained, microlitic to glassy.**VESICLES:** 0%–10%; <1 mm; round–irregular; variable distribution; sulfides (and their alteration products) occur in vesicles close to fractures. Vesicles absent in the glass but grade rapidly to about 10% in the interior.**COLOR:** Black, 2.5Y 2/0.**STRUCTURE:** Appears to represent part of a pillow.**ALTERATION:** None.**VEINS/FRACTURES:** 1%; small cracks; various orientations; sulfides occur as a fine dusting close to cracks; these are altered(?) to secondary blue-purple (azurite colored) material.

135-836A-4H-CC

UNIT 3: APHYRIC BASALT

Pieces 0–14 cm

CONTACTS: None.

PHENOCRYSTS: Plagioclase visible only in some fragments.

Plagioclase: <1%; up to 1.5 mm; glomeroporphyritic aggregates.

GROUNDMASS: Fine-grained to glassy.

VESICLES: 0%–10%; up to 2 mm; rounded; variable; some fragments vesicular.

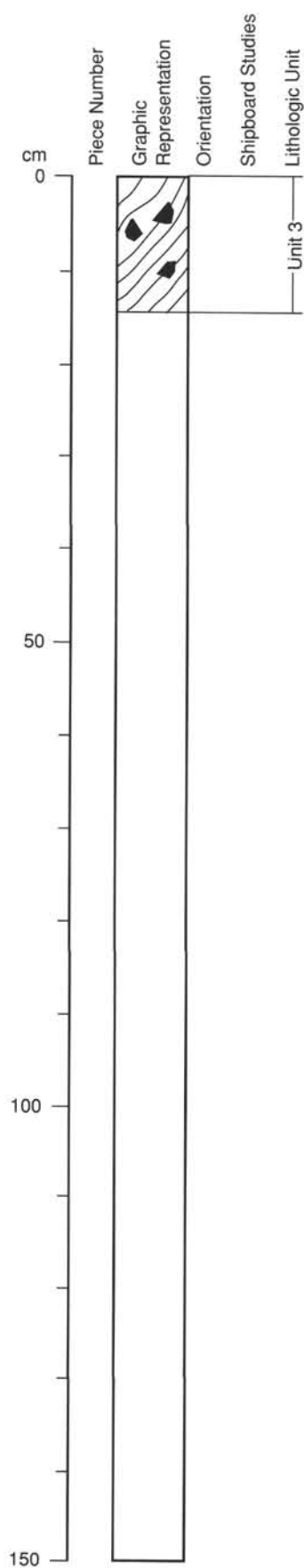
COLOR: Black.

STRUCTURE: N/A.

ALTERATION: Fresh to slightly altered.

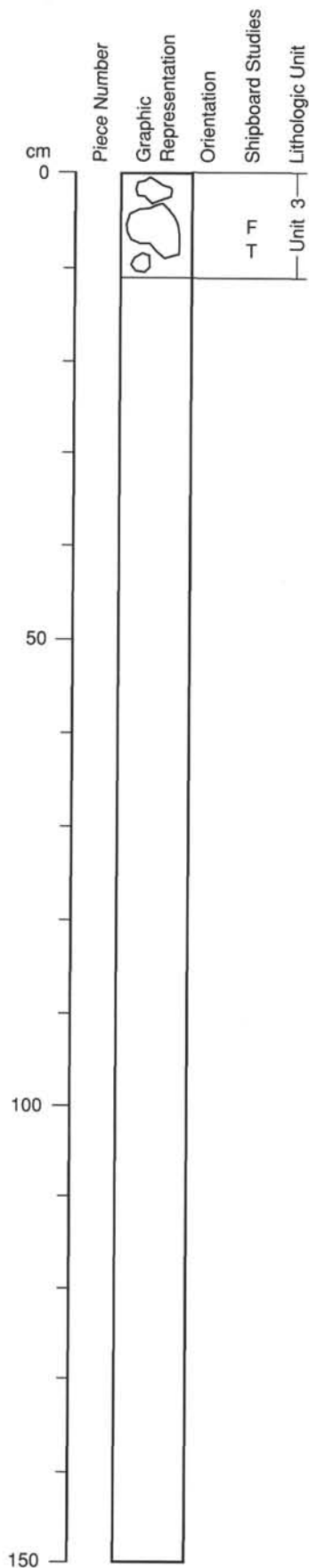
VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Some pieces (even chips only a few millimeters across) have well developed glassy rinds. Drilling rubble.



Basaltic glass and
rock fragments

135-836A-5X-1

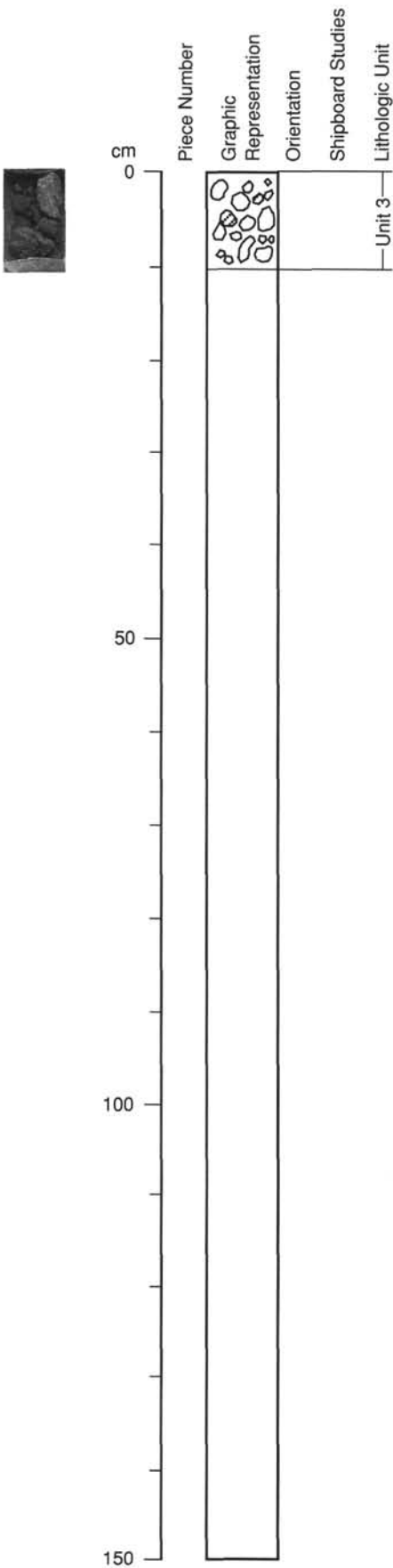
**UNIT 3: APHYRIC TO SPARSELY PHYRIC PLAGIOCLASE
BASALT****Pieces 1–11 cm****CONTACTS:** None.**PHENOCRYSTS:** Plagioclase; 1%; <1 mm; euhedral.**GROUNDMASS:** Fine-grained microcrystalline.**VESICLES:** 10%–20%; <0.5 mm and >1 mm; round to irregular; variable distribution; the very fine vesicles are distributed uniformly throughout, larger vesicles form pipes up to 4 cm in length.**COLOR:** 10YR 5/1 gray.**STRUCTURE:** Massive.**ALTERATION:** Fresh to slightly altered.**VEINS/FRACTURES:** None.

135-836A-6X-1

UNIT 3: APHYRIC BASALT

Pieces 0–10 cm

CONTACTS: Two igneous pebbles in drill rubble composed largely of sedimentary clasts
PHENOCRYSTS:
Plagioclase: Trace; 1 mm; euhedral.
GROUNDMASS: Microcrystalline.
VESICLES: 25%; < 0.5 mm; irregular; throughout.
COLOR: 7.5YR 5/0 gray.
STRUCTURE: Pebbles.
ALTERATION: Slight.
VEINS/FRACTURES: None.
ADDITIONAL COMMENTS: Drilling rubble.



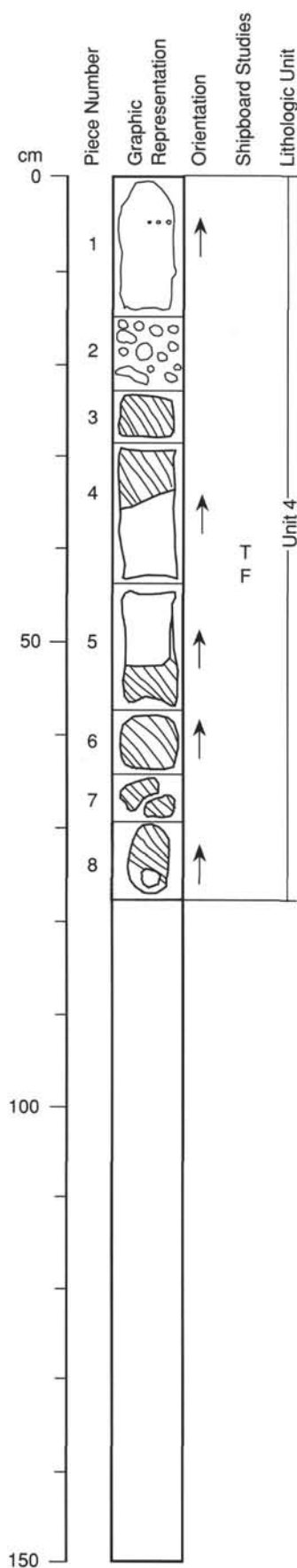
135-836A-7X-1

UNIT 4: APHYRIC BASALT

Pieces 1–8

CONTACTS: None.**PHENOCRYSTS:** None visible.**GROUNDMASS:** Fine- to medium-grained, 2 mm long ophitic clinopyroxene crystals intergrown with euhedral-anhedra plagioclases. Some olivine also noted.**VESICLES:** 0%–15%; <0.5 and >1 mm; round-irregular; variable; Colors vary from colorless, white, yellow, orange, brown. Fine vesicles uniformly distributed, larger ones are rare (eg. Pieces 1 and 8).**Miaroles:** Nearly all small vesicles are filled with spectacular zeolites including radiating acicular clusters, bladed and wormy-globular varieties.**COLOR:** 7.5YR gray (fresh) to 10YR 5/1, gray.**STRUCTURE:** Massive.**ALTERATION:** Slightly to highly (Piece 6) altered; very sharply defined alteration fronts.**VEINS/FRACTURES:** None.**ADDITIONAL COMMENTS:** Piece 2 contains glassy fragments indicating a flow boundary.

Yellow gray altered material



135-836A-9X-1

UNIT 4: APHYRIC BASALT

Pieces 1–9

CONTACTS: None.**PHENOCRYSTS:** Plagioclase phenocrysts not well-defined; grade into groundmass feldspar.

Plagioclase: <1%; 1–2 mm; euhedral.

GROUNDMASS: Fine- to medium-grained; holocrystalline. Plagioclase dominant, plus clinopyroxene; seriate texture.**VESICLES:** 15%–20%; 0.5–5 mm; rounded to coalescing; disseminated; higher concentrations of larger vesicles in Pieces 1 and 2.

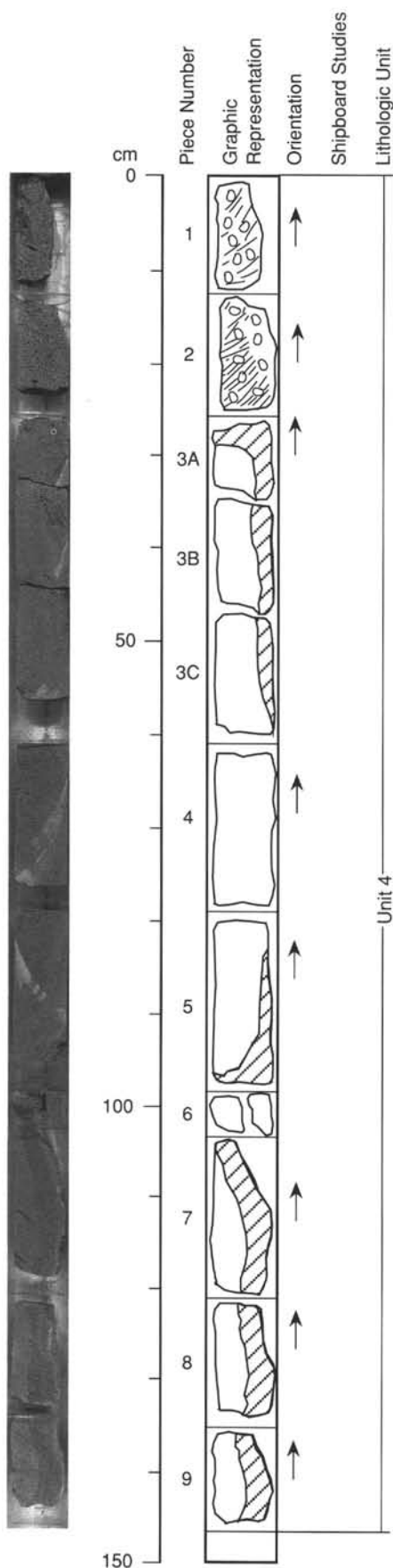
Miaroles: Linings of bluish-green encrusting zeolites; additional Fe-oxide in vesicles in weathered zone.

COLOR: 10YR 4/1, dark gray.**STRUCTURE:** Massive.**ALTERATION:** Zone of brown weathered and highly altered core runs nearly vertically down one edge of core length; otherwise moderately altered.**VEINS/FRACTURES:** Margin of Piece 1 is a fracture surface coated with yellow-brown clay(?) and Fe-oxide.**ADDITIONAL COMMENTS:** Diabasic appearance.

Altered brown basalt



Strongly vesiculated-coarser vesicles



135-836A-9X-2

UNIT 4: APHYRIC BASALT**Pieces 1-4****CONTACTS:** None.**PHENOCRYSTS:**

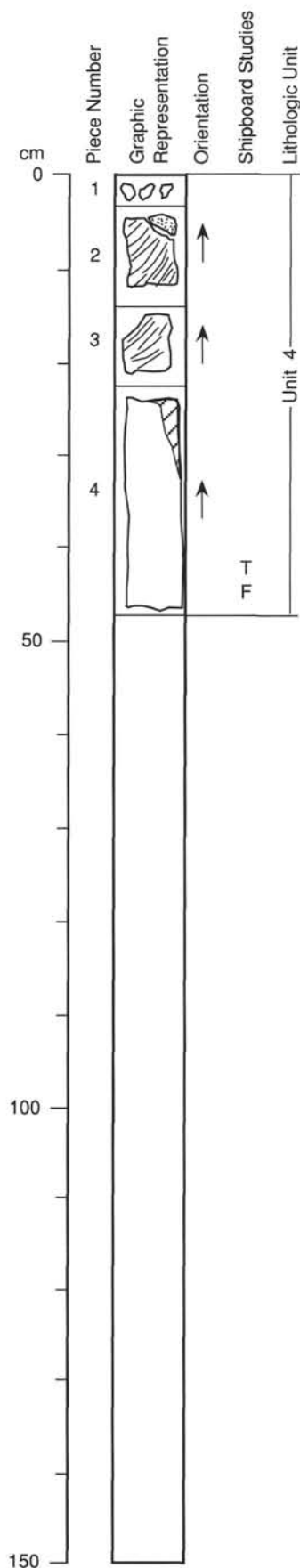
Plagioclase: Trace-1%; 0.9-1.5 mm; euhedral.

GROUNDMASS: Fine- to medium-grained; microcrystalline; plagioclase microlites (to 1.2 mm, average about 0.6 mm), intergranular to subophitic clinopyroxene, rare olivine(?).**VESICLES:** 8%-12%; 0.3-1.7 mm; rough, irregular; random distribution; large vesicles (around 1 mm) slightly more abundant in Piece 3.

Miaroles: Small zeolite linings common; altered zones in Pieces 1 to 4 have some orange to yellow-brown clayey linings of vesicles.

COLOR: 7.5YR 6/0 gray (fresh) to 2.5YR 6/0 and 10YR 6/0 grays (altered).**STRUCTURE:** Massive.**ALTERATION:** Zeolite vesicle linings in both fresh and altered varieties; Pieces 1 to 3 and the top corner of Piece 4 have the mesostasis altered to a clay giving the rock a greenish brown cast. Rock is moderately altered.**VEINS/FRACTURES:** Trace; < 1 mm; near vertical near vertical; one fracture break is Piece 2; its surface is coated with dark greenish brown zeolites and clays.**ADDITIONAL COMMENTS:** Surface coating in Piece 6 of white irregular layer of zeolite(?) next to basalt, then a patchy coating of yellow-orange clay(?) spotted with Mn-oxides.

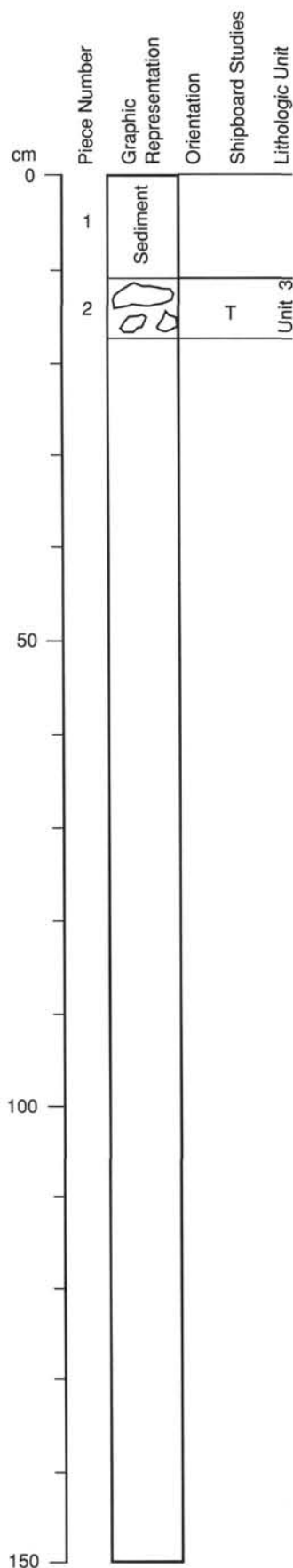
Weathered, brownish basalt



135-836B-2R-1

UNIT 3: SPARSELY PHYRIC PLAGIOCLASE BASALT**Piece 2****CONTACTS:** None, but one chip shows a textured surface consistent with a flow top.**PHENOCRYSTS:**

Plagioclase: 1%–2%; up to 2.5 mm; euhedral tabular crystals.

GROUNDMASS: Fine-grained.**VESICLES:** 5%–10%; <0.5 and >1.5; round to irregular; variable; some lined with dark gray material (Mn-oxide).**COLOR:** 2.5Y 5/0, gray.**STRUCTURE:** Massive.**ALTERATION:** Fresh to slightly altered.**VEINS/FRACTURES:** None.**ADDITIONAL COMMENTS:** Two small black fragments, and very fine-grained and vesicular, suggesting near flow top material. Drilling rubble.

135-836B-3R-1

UNIT 4A: APHYRIC BASALT

Pieces 8–17

CONTACTS: Piece 8 has a glassy rind and underlies the sediment interval, but no actual contacts are observed.

PHENOCRYSTS:

Plagioclase: Trace; <1 mm; as quenched laths in the glass and more rectangular euhedral crystals in the interior crystalline matrix.

GROUNDMASS: Fine-grained intergrowth of plagioclase laths and clinopyroxene (large oikocrysts?). Rare yellowish glassy grains may be olivine.

VESICLES: 5%–15%; <0.5 mm and >1; round to irregular; variable; estimates of vesicle content are almost meaningless owing to the high degree of zeolite infilling. Small vesicles appear to be uniformly distributed, while larger vesicles form pipes and randomly distributed clusters.

Miaroles: Zeolites fill most vesicles. Varieties include cream white hexagonal plates, radiating white acicular crystals and blue-white globules. White crystals appear Fe-stained in the more altered areas.

COLOR: 2.5Y 5/0, gray (fresh) to 10YR 6/1, gray (altered).

STRUCTURE: Massive.

ALTERATION: Slight to high. Alteration halos are sharply defined but are not related to obvious fracturing.

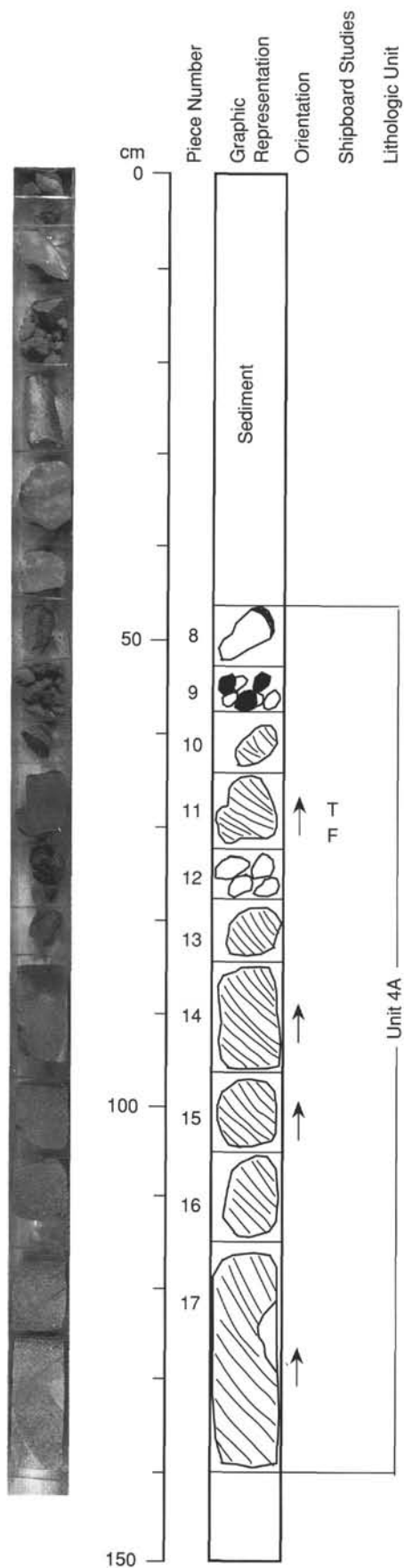
VEINS/FRACTURES: None.



Denotes glassy rim



Weathered to brownish color
(fresh where not hatchured)



135-836B-3R-2

UNIT 4A: APHYRIC BASALT


Pieces 1-18

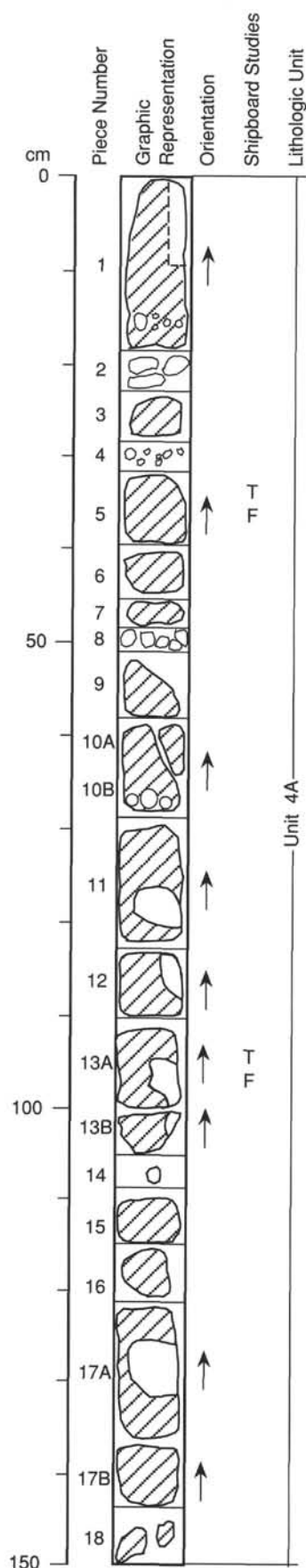
CONTACTS: None.**PHENOCRYSTS:**

Plagioclase: Trace; <1 mm; euhedral.

GROUNDMASS: Fine-grained intergrowth of plagioclase laths and clinopyroxene oikocrysts(?). Rare glassy olivines(?)**VESICLES:** 5%-15%; <0.5 and >1 mm; round to irregular; random distribution; estimates of vesicle percentages is largely meaningless owing to the high degree of zeolite infilling. Smaller vesicles appear to be uniformly distributed, while larger ones are rare and sometimes form pipes.

Miaroles: Larger cavities are filled with a variety of zeolites, including spectacular radiating acicular clusters. Most vesicles are lined with zeolites of some description (ie. blue-white, white, orange).

COLOR: 2.5Y 5/0, gray (fresh) to 10YR 6/1, gray (altered).**STRUCTURE:** Massive.**ALTERATION:** Slight to moderate.**VEINS/FRACTURES:** <1%; <1 mm wide; steeply dipping; irregular surfaces are coated with Fe-oxyhydroxides and Mn-oxide.
 Altered, brown basalt

 Highly vesicular zones (Pieces 1 and 10B)



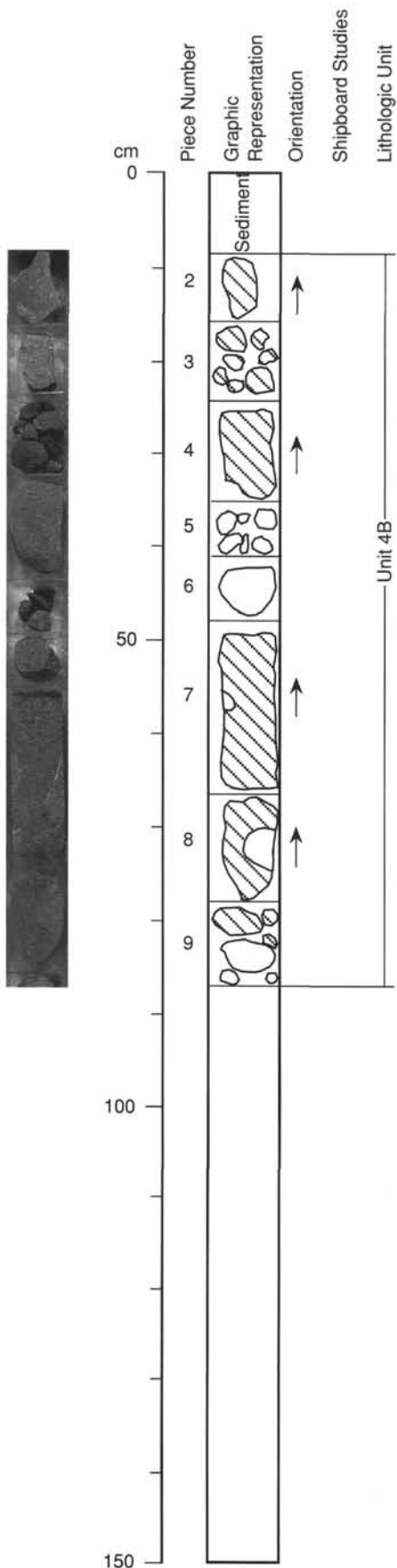
135-836B-4R-1

UNIT 4B: APHYRIC BASALT

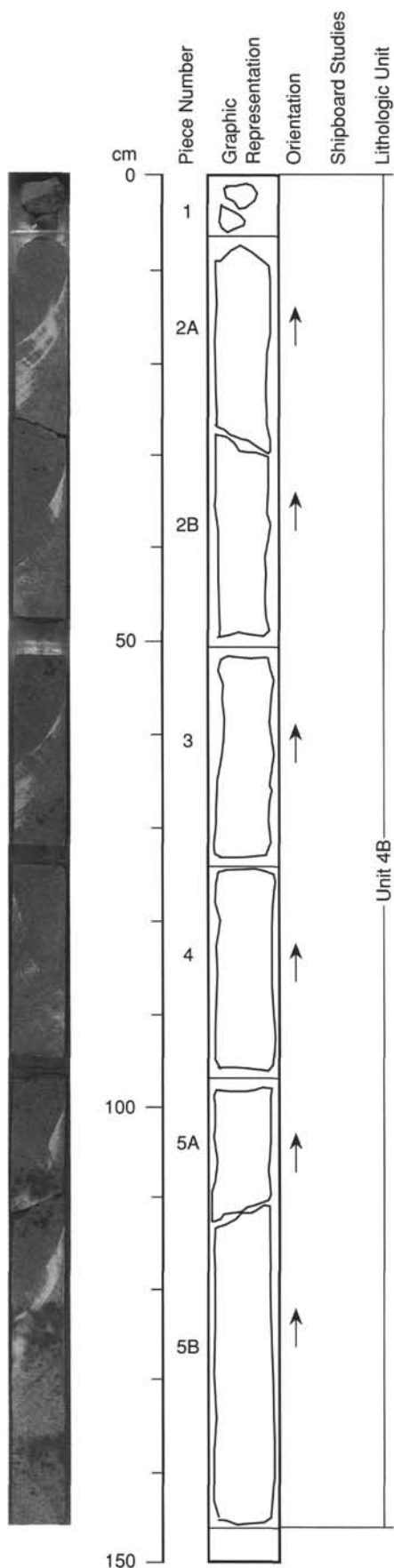
Pieces 2-9

CONTACTS: None.**PHENOCRYSTS:** None.**GROUNDMASS:** Fine-grained, euhedral plagioclase laths intergrown with large clinopyroxenes (oikocrysts?). Possible rare olivines (yellowish, glassy grains).**VESICLES:** 5%–15%; <0.5 and >1 mm; round to irregular; variable; the percentage of vesicles present is difficult to estimate owing to the large amount of zeolite infilling. Small vesicles are essentially uniformly distributed; however, the larger vesicles are more randomly scattered. Sometimes their distribution is higher in the more altered yellowish halos, which may indicate that material has been leached out.

Miaroles: Most vesicles are filled with white to orange zeolites.

COLOR: 2.5YR 5/0, gray (fresh), to 10YR 6/1, gray (altered).**STRUCTURE:** Massive.**ALTERATION:** Generally moderate, some patches are more bluish gray and look to be only slightly altered.**VEINS/FRACTURES:** None.**ADDITIONAL COMMENTS:** This basalt looks the same as that in Core 135-836B-3R. Therefore, despite the occurrence of a sediment clast at the top of this section, the unit has been called 4B rather than 5.
 Yellow gray alteration


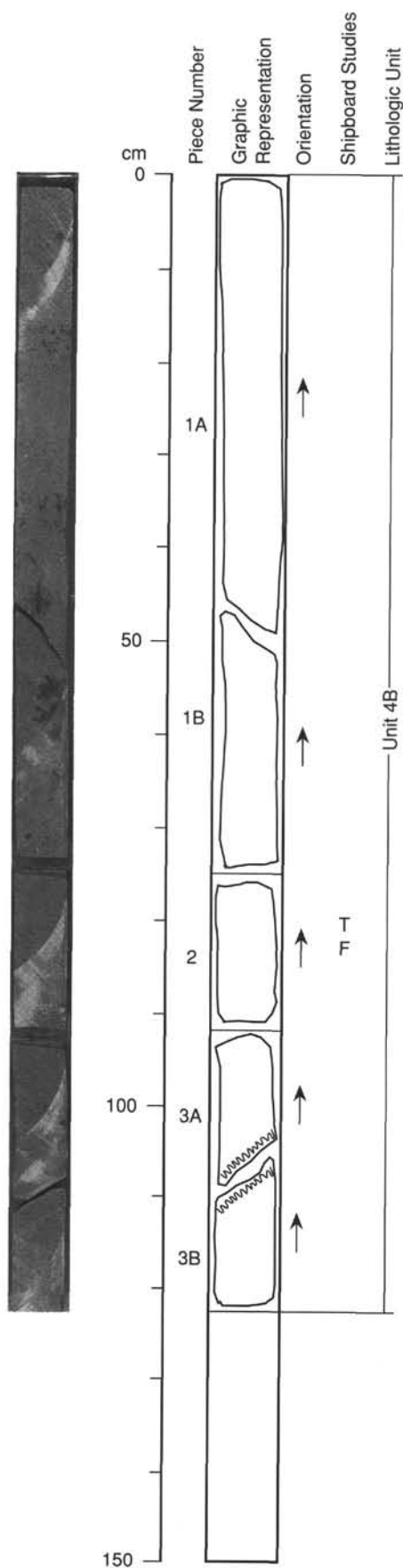
135-836B-5R-1

UNIT 4B: APHYRIC BASALT**Pieces 1–5B****CONTACTS:** None; one chip in Piece 1 shows a 2 mm thick glassy rim.**PHENOCRYSTS:** None visible.**GROUNDMASS:** Fine-grained plagioclase laths intergrown with clinopyroxene grains and rare olivine.**VESICLES:** 5%–15%; <0.5 and >1.0 mm; round to irregular; random distribution; fine vesicles are distributed uniformly throughout the rock. The larger vesicles tend to be distributed in patches.**Mirolles:** Most vesicles are devoid of infilling, however white hexagonal plates and long, acicular zeolites are commonly observed.**COLOR:** 2.5Y 4/0, gray.**STRUCTURE:** Massive.**ALTERATION:** Fresh to slightly altered (Piece 1 has alteration halos on two sides) up to moderately altered.**VEINS/FRACTURES:** <1%; <1 mm wide; subhorizontal; clear, irregular surfaces; possibly broken during drilling.**ADDITIONAL COMMENTS:** Possibly slightly coarser grained compared with samples from higher in the hole.

135-836B-5R-2

UNIT 4B: APHYRIC BASALT**Pieces 1A-3B****CONTACTS:** None visible.**PHENOCRYSTS:** None.**GROUNDMASS:** Fine-grained; euhedral plagioclase intergrown with clinopyroxene and rare olivine.**VESICLES:** 5%–15%; <0.5 and up to 4 mm; round to irregular; random distribution; small vesicles are uniformly distributed. Large cavities are more patchy in their distribution and may form long pipes (ie. over 10 cm long; see back of Piece 1B).

Miaroles: Relatively clear vesicles, occasionally spectacular radiating acicular zeolites, others include orange globular and white wormy zeolites.

COLOR: 2.5Y 4/0, gray.**STRUCTURE:** Massive.**ALTERATION:** Generally fresh to slightly altered; alteration halos on Pieces 3A and 3B tend to be moderately altered.**VEINS/FRACTURES:** <1%; <1 mm wide; steeply dipping; The fracture between Pieces 1A and 1B is irregular and clean. That dividing Pieces 3A and 3B is spotted with Fe-oxyhydroxides and an alteration halo extends for 1.5 to 2 cm on either side of the break.

135-836B-5R-3

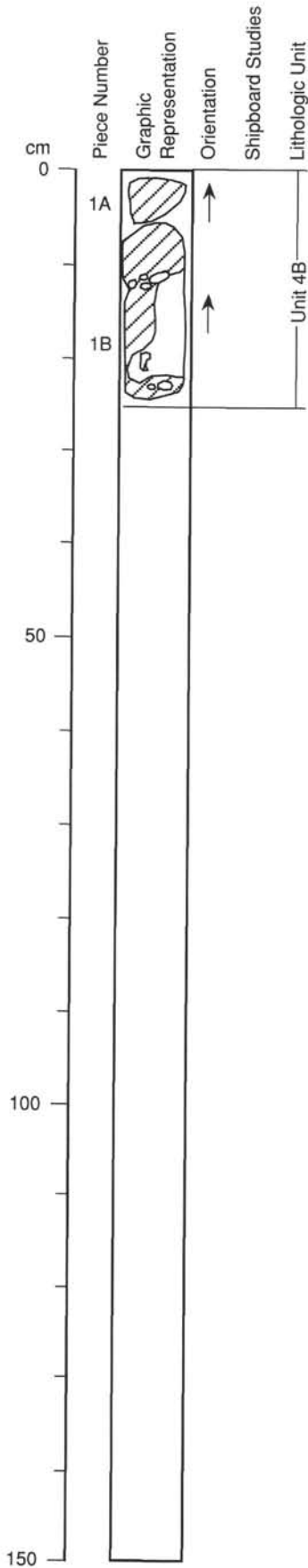
UNIT 4B: APHYRIC BASALT**Pieces 1B-8****CONTACTS:** None visible.**PHENOCRYSTS:** None visible.**GROUNDMASS:** Fine-grained interlocking lath shaped plagioclase and clinopyroxene with rare olivine.**VESICLES:** 5%–15%; <0.5 and >1 mm; round to irregular; random distribution; small vesicles are dominant and appear to be uniformly distributed. Larger vesicles are more dominant in the more altered areas.**Miaroles:** A large cavity in Piece 1A (8 mm diameter) is filled with a spectacular set of radiating colorless zeolites. Small orange, red, white zeolites also observed in smaller vesicles.**COLOR:** 2.5Y 4/0, gray to 10YR 6/1, gray (altered).**STRUCTURE:** Massive.**ALTERATION:** Fresh to moderately altered.**VEINS/FRACTURES:** <1%; <1 mm wide; random orientations; generally associated with wide (2–4 cm) wide alteration halos. Coated with orange-brown Fe-oxyhydroxides and acicular, colorless zeolites.

Yellowish brown alteration front

135-836B-5R-4

UNIT 4B: APHYRIC BASALT

Pieces 1A-1B



CONTACTS: None visible.
PHENOCRYSTS: None visible.
GROUNDMASS: Fine-grained, interlocking euhedral plagioclase with clinopyroxene and rare olivine.
VESICLES: 5%–15%; <0.5 and >1.0 mm; round to irregular; random distribution; small vesicles are uniformly distribute. Larger vesicles occur in patches (see above). Most have at least some zeolite infill.
Miaroles: Large coalesced vesicles form cavities up to 2 cm long which are parts of pipe features. These are filled with white radiating acicular zeolites as well as black globular and orange-brown zeolites.
COLOR: 2.5Y 4/0, gray (fresh) to 10YR 6/1, gray (altered).
STRUCTURE: Massive.
ALTERATION: Slightly to moderately altered
VEINS/FRACTURES: One edge of Piece 1A appears to be an old fracture. It contains Fe-oxyhydroxides on its surface.

- Yellowish brown altered basalt
- Highly vesicular zones of zeolites filling large vesicles

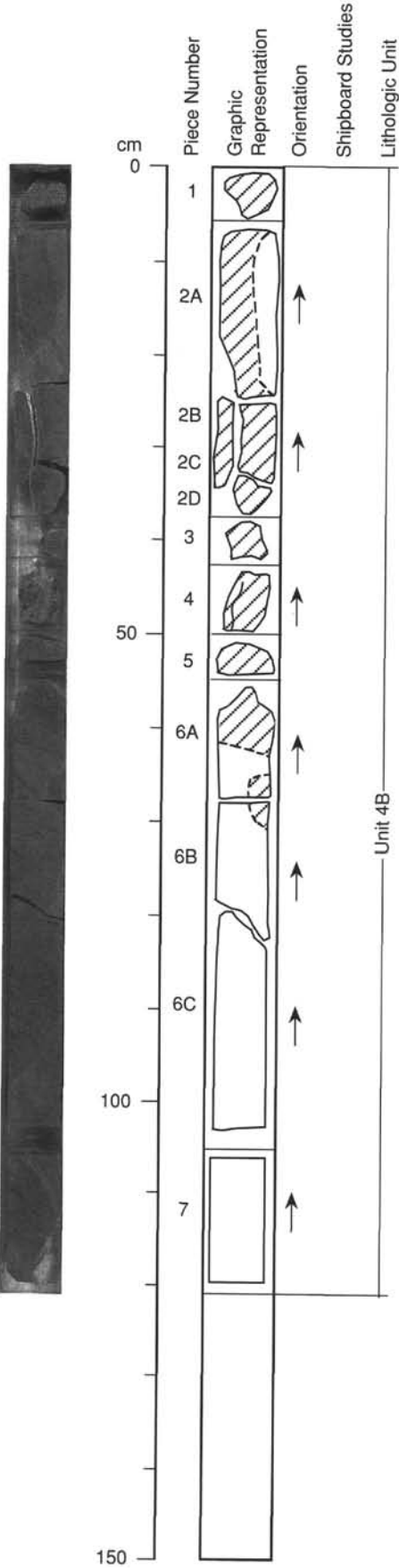
135-836B-6R-1

UNIT 4B: APHYRIC BASALT

Pieces 1-7

CONTACTS: None visible.
PHENOCRYSTS: None visible.
GROUNDMASS: Interlocking plagioclase and clinopyroxene with rare olivine (subophitic).
Plagioclase is tabular, subhedral; clinopyroxene is anhedral.
VESICLES: 5%-15%; 0.5-1 mm; subrounded; random distribution; tend to be aligned parallel to fracture in Pieces 2A to 2D.
Miaroles: Irregular cavities 0.02 to 0.05 mm diameter; tend to be partly or completely filled by zeolite.
COLOR: 2.5Y 4/0, gray (fresh) to 10YR 6/1, gray (altered).
STRUCTURE: Massive.
ALTERATION: Most intense in Piece 1; alteration boundary parallels fracture. Most of rock is slightly to moderately altered.
VEINS/FRACTURES: <1%; 20 cm; vertical; vein coated with zeolite; gray dense zone about 1-1.5 cm wide adjacent to fracture, possibly silicified.
ADDITIONAL COMMENTS: Alteration consists of oxidation and deposition of Fe-oxides in vesicles; plagioclase becomes chalky.

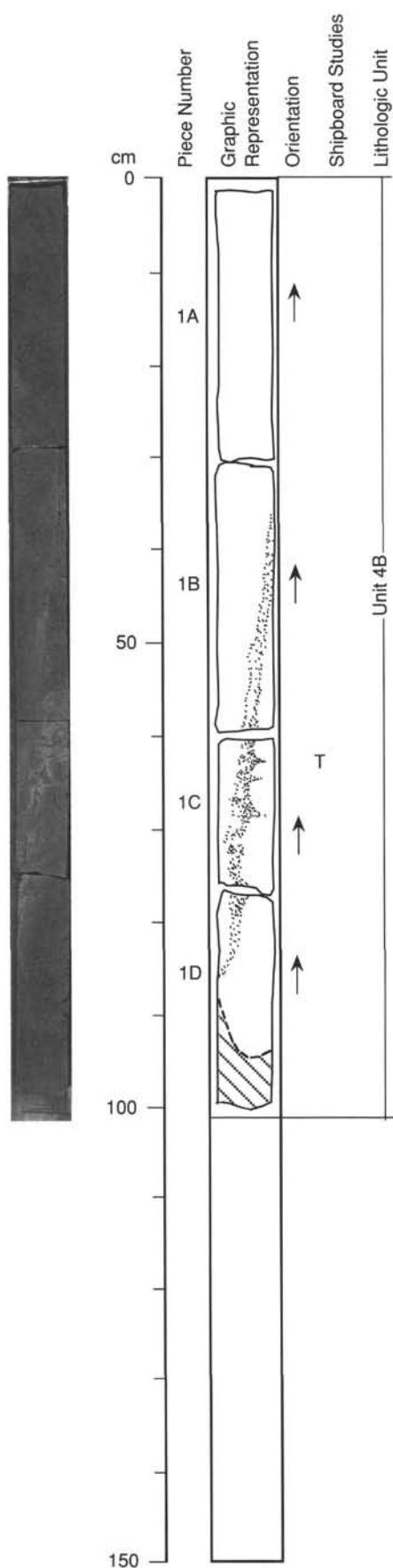
 Alteration/oxidation



135-836B-6R-2

UNIT 4B: APHYRIC BASALT**Pieces 1A-1D****CONTACTS:** See comments.**PHENOCRYSTS:** None visible.**GROUNDMASS:** Dominantly intergrown plagioclase and clinopyroxene with minor olivine.**VESICLES:** 1%–10%; 0.3–1 mm; subrounded; random distribution.

Mirolles: Irregular cavities 0.05–0.5 mm merge with vesicles.

COLOR: 2.5YR 5/2, yellow-gray when altered; dark blue-gray when fresh.**STRUCTURE:** Massive.**ALTERATION:** Slightly to moderately altered, most intense in 6 cm area at the bottom of Piece 1D.**VEINS/FRACTURES:** 2%; 55 mm wide; near vertical orientation; this is an internal flow contact, quenched on one side, and with deformed quenched boundaries on both sides of lower part of boundary zone.**ADDITIONAL COMMENTS:** Alteration at bottom of Piece 1D appears to be from low T oxidation, as at top of 135-836B-6R-1.

Piece 1C
(quenched Internal
flow boundary)

135-836B-7R-1

UNIT 4B: APHYRIC BASALT**Pieces 1-2****CONTACTS:** Bottom of Unit 4.**PHENOCRYSTS:** No clearly defined phenocrysts visible - note seriate texture with some crystals near phenocrystal size.**GROUNDMASS:** Fine-grained interlocking network of plagioclase and clinopyroxene; rare euhedral olivine; seriate, holocrystalline, subophitic.**VESICLES:** 10%-15%; 0.1-6.0 mm; rounded to coalescent; occur throughout; These two pieces of Unit 4 are at the base of Unit 4. They are significantly less vesicular than any of the overlying portions of Unit 4. Both vesicle size and vesicle distribution is less.

Largest vesicles are sporadically distributed and relatively scarce.

Microlites: Most are partially filled with acicular to globular zeolites of various colors; some Fe-oxide and Mn-oxide coatings.**COLOR:** 2.5Y 6/2 gray.**STRUCTURE:** Massive.**ALTERATION:** Moderate; slightly weathered (low-temperature alteration).**VEINS/FRACTURES:** None.**ADDITIONAL COMMENTS:** There is a prominent banding across Piece 1, but it is probably due to differential alteration.**UNIT 5: MODERATELY PHYRIC CLINOPYROXENE
PLAGIOCLASE BASALT****Pieces 3-20****CONTACTS:** Very fine to "glassy" botryoidal surface on Piece 9 has sediment embedded in cavities; relict (altered) glassy rim on Piece 4.**PHENOCRYSTS:**

Plagioclase: 1%-2%; <2.0 mm; fine laths.

Olivine: 1%-2%; <2.0 mm; subhedral to anhedral grains.

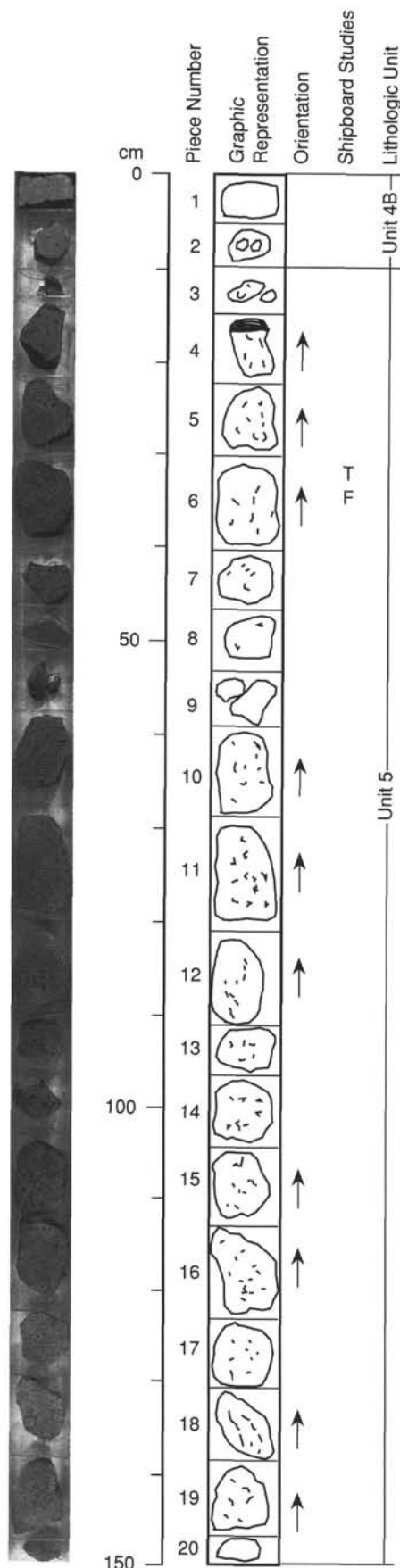
Clinopyroxene: 1%-2%; <2.0 mm; anhedral, isolated grains.

GROUNDMASS: Fine-grained.**VESICLES:** 25%-30%; <0.1 to 6 mm; round to irregular; uniform distribution; most vesicles are relatively clear of infilling. Piece 7 has a large void with yellow-green clays. Piece 5 also shows Fe-oxyhydroxide fillings.**COLOR:** 2.5Y 3/0, dark gray.**STRUCTURE:** Massive.**ALTERATION:** Fresh to slightly altered.**VEINS/FRACTURES:** None.

☉ Highly vesicular zone (local)

◻ Relict glassy margin (altered)

☼ Very vesicular samples (throughout)



135-836B-7R-2

**UNIT 5: SPARSELY TO MODERATELY PHYRIC
CLINOPYROXENE PLAGIOCLASE BASALT**
Pieces 1–9
CONTACTS: None visible.

PHENOCRYSTS:

Plagioclase: 1%–2%; <2.0 mm; elongate laths.

Olivine: Trace–1%; <1.5 mm; anhedral grains.

Clinopyroxene: 1%–2%; <2.0 mm; anhedral, isolated grains.

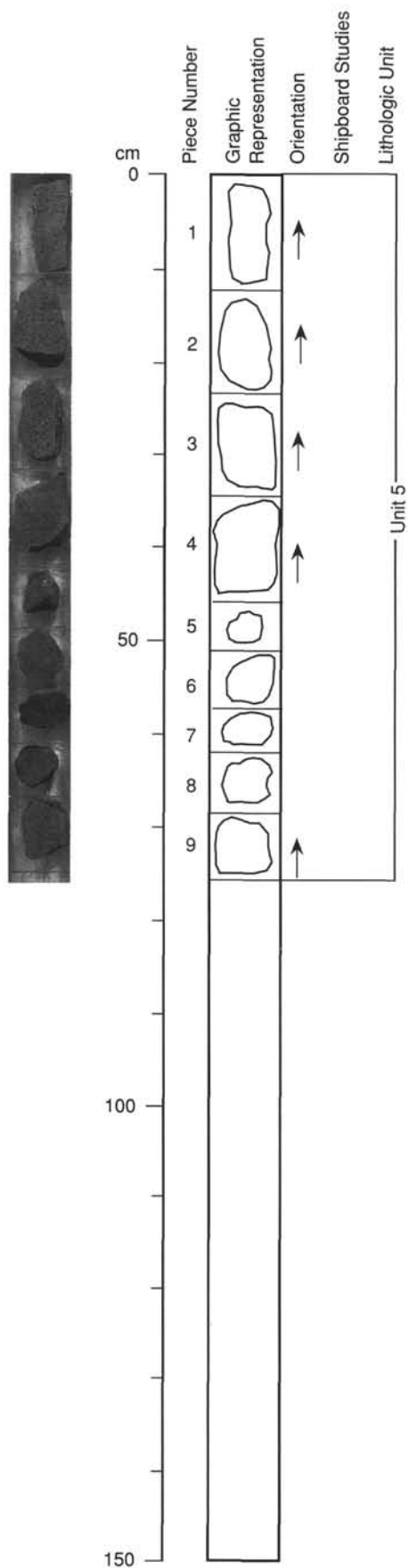
GROUNDMASS: Fine-grained.

VESICLES: 25%–30%; <0.1 to 4 mm; round to irregular; uniform distribution; larger vesicles (>2 mm) are rare but randomly distributed and empty.

COLOR: 2.5Y 3/0, dark gray.

STRUCTURE: Massive.

ALTERATION: Fresh to slightly altered.

VEINS/FRACTURES: Piece 1 has a very irregular side which may be a fracture surface. There are green and yellow-orange clays in the depressions along this side.


135-836B-8R-1

UNIT 5: SPARSELY TO MODERATELY PHYRIC CLINOPYROXENE PLAGIOCLASE BASALT

Pieces 1-12

CONTACTS: None.

PHENOCRYSTS:

Plagioclase: 1%–2%; up to 2.0 mm; euhedral tabular crystals.

Olivine: Trace–1%; up to 1.5 mm; euhedral to subhedral crystals.

Clinopyroxene: 1%–2%; up to 1.5 mm; anhedral, isolated grains.

GROUNDMASS: Seriate, holocrystalline, subophitic. Plagioclase and subordinate pyroxene visible.

VESICLES: 25%–30%; 0.1 to 7.0 mm; rounded to coalescing; disseminated; largest vesicles sporadically distributed and relatively scarce.

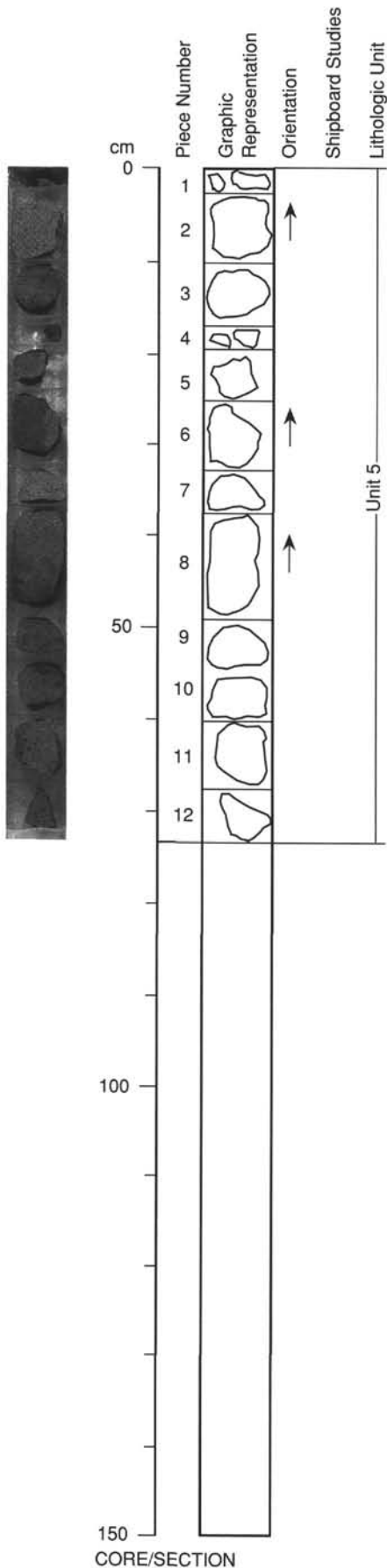
Miaroles: Very rare yellowish brown and brown clay and Fe-oxide linings.

COLOR: 2.5YR 4/0 dark gray.

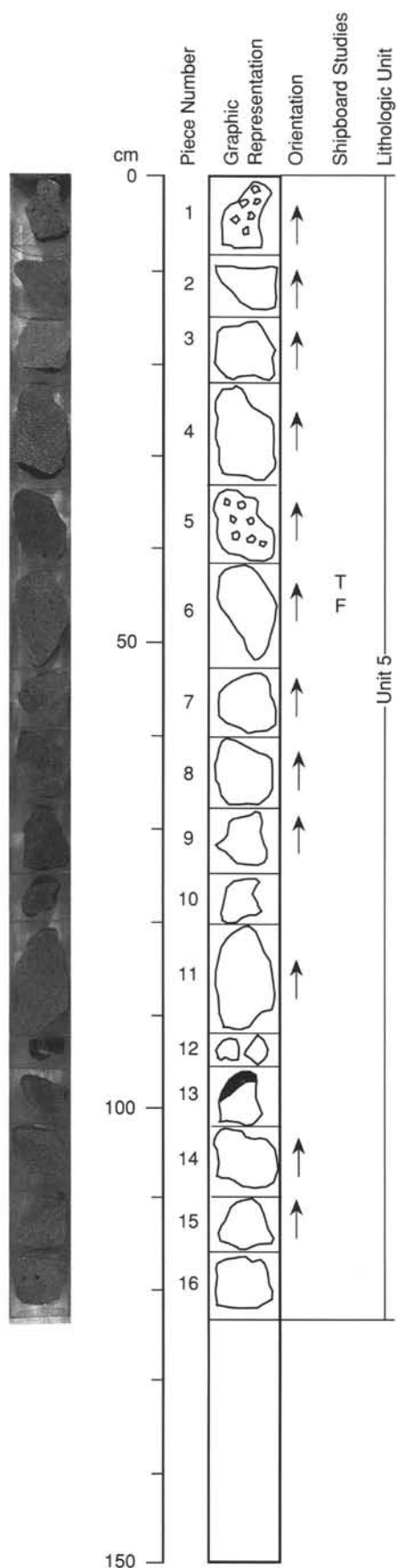
STRUCTURE: Massive.

ALTERATION: Fresh to slight.

VEINS/FRACTURES: No veins seen.



135-836B-9M-1

**UNIT 5: SPARSELY TO MODERATELY PHYRIC
CLINOPYROXENE PLAGIOCLASE BASALT**
Pieces 1–16

CONTACTS: Glassy rind on Piece 13.

PHENOCRYSTS: Olivine crystals tend to occur in localized groupings of phenocrysts (not as glomerocrysts).

Plagioclase: 1%–2%; up to 2 mm; euhedral tabular crystals.

Olivine: Trace–1%; up to 1.5 mm; euhedral to subhedral isolated crystals.

Clinopyroxene: 1%–2%; up to 1.5 mm; subhedral to anhedral.

GROUNDMASS: Very fine-grained.

VESICLES: 25%–40%; 0.1 to 7.0 mm; rounded to coalescive; disseminated; coarsest vesicles occur more commonly in Pieces 2 and 5.

Miaroles: Rare infillings and linings of yellow-brown and brown clays(?) and Fe-oxides.

COLOR: 2.5YR 5/0 gray.

STRUCTURE: Massive.

ALTERATION: None to slight.

VEINS/FRACTURES: None visible.

ADDITIONAL COMMENTS: Core has no stratigraphic significance as the drill bit did not advance.

135-836A-3H-04 (85 cm)

OBSERVER: KRI

WHERE SAMPLED: Unit 2

ROCK NAME: Aphyric basaltic glass

GRAIN SIZE: None

TEXTURE: Glassy, sparsely microphenocrystal

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	<1	<1	<1.0		euohedral	quench textures, sodic rims common
Clinopyroxene	<1	<1	<0.6		euohedral to subhedral	quench textures, some in small glomerocrystic clusters with plagioclase, many with growth imperfections
Orthopyroxene	<1	<1	<0.7		euohedral	lath shaped
GROUNDMASS						
Tan glass	60	60	n/a		n/a	extremely fresh to spherulitic
VESICLES/CAVITIES						
Vesicles	40	LOCATION occur throughout	SIZE (mm) <1.4 mm	FILLING rare opaque globular infillings	SHAPE rounded	COMMENTS the largest vesicles are clearly the result of several smaller ones coalescing; in some fragments vesicles are very elongate; the fillings could be Mn-oxides or goethite

COMMENTS: This section was made from pieces of a basaltic gravel layer. It includes six 1 cm fragments. The above description is an average over all of the pieces. Textures range from glassy to spherulitic. An 1121 point count gives: 57.9% glassy mesostasis, 41% vesicles, 0.5% plagioclase phenocrysts, 0.3% clinopyroxene and 0.3% orthopyroxene phenocrysts. Microphenocrysts (<0.1%) of magnetite are also present. The count was an average over all of the pieces. The pyroxene phenocrysts consist of both clinopyroxene and orthopyroxene (note green-brown pleochroism, straight extinction, and high 2V). Some crystals contain clinopyroxene-orthopyroxene intergrowths.

SITE 836

135-836A-5X-01 (Piece 1,0-11 cm)

OBSERVER: SHE

WHERE SAMPLED: Unit 3

ROCK NAME: Sparsely phyric olivine-plagioclase basalt

GRAIN SIZE: Fine grained to variolitic

TEXTURE: Vesicular, seriate porphyritic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	1-2	2-3	0.2-1	An68	euhedral to anhedral	blocky, tabular crystals; largest appear partly resorbed; at least some with more sodic rims
Olivine	tr-1	1-2	0.2-0.4		euhedral to skeletal	single crystals and intergrown with plagioclase
GROUNDMASS						
Plagioclase	20-25	20-25	<0.05-0.5	An65-68	euhedral to subhedral	long laths intergrown with olivine and in bundles with clinopyroxene; zoning common; serve as nucleation sites for quench clinopyroxenes
Clinopyroxene	15-20	15-20	<0.05-0.25		anhedral	intergrown with plagioclase, quench morphologies common; grades into quench crystallites included in mesostasis
Olivine	1-2	1-2	<0.05-0.3		euhedral to subhedral	intergrown with plagioclase and as single crystals
Opakes	2-4	2-4	<0.01		subhedral	disseminated in groundmass; all magnetite
Spinel	tr	tr	0.03-0.08		euhedral to subhedral	included in plagioclase
SECONDARY MINERALOGY						
Green clay	PERCENT 2	REPLACING/FILLING vesicle linings			COMMENTS	
red-brown hematite?	1	vesicle linings			linign vesicles along a distinct band or a hematite-stained clay?; occurs as a filling on top of the green clay	
VESICLES/CAVITIES						
Vesicles	PERCENT 15-20	LOCATION throughout	SIZE (mm) 0.07-1.2	FILLING partial linings in some		SHAPE ovoid (large) to irregular (small)
						COMMENTS largest (>0.4 mm) concentrated in areas with dark quench fill; largest also sometimes in elongate patches almost forming cavities; smaller ones sometimes coalesce to form larger ones

COMMENTS: Mesostasis is 30-35% and maybe 1-2% altered. The groundmass has a seriate texture of coalescing plagioclase bundles intergrown with clinopyroxene and olivine. Vesicular with a large amount of fresh groundmass formed by clinopyroxene-plagioclase-magnetite crystallites. There are discrete patches of darker quench material (aphyr, few microlites, coarsely vesicular) as patches (4-6 mm across), linings to vesicles, and as a band cutting across the sample. Clay linings in vesicles are concentrated along distinct lines, one of which is also a zone characterized by large vesicles. 1035 point count gives: Mesostasis (includes some cpx crystallites) 32.1%; Plagioclase groundmass 22.3%; Clinopyroxene groundmass 19.4%; Olivine groundmass 1.5%; Opakes 3.9%; Plagioclase phenocrysts 1.4%; Olivine phenocrysts 0.4%; Open vesicles 18.2%; Filled vesicles 0.8%; Total vesicles 19.0.

135-836A-7X-01 (Piece 4, 42-43 cm)

OBSERVER: EWE

WHERE SAMPLED: Unit 4

ROCK NAME: Aphyric basalt

GRAIN SIZE: Fine grained

TEXTURE: Vesicular, ophitic, diabasic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	30-35	30-35	0.1-1.6	An60-65	euhedral to subhedral	elongated laths, normally zoned; interlocking mosaic, intergrown with pyroxene and olivine
Clinopyroxene	20	20	0.1-2.5		subhedral to anhedral	ophitic to poikilitic; zoned
Olivine	2-3	2-3	up to 1		anhedral	interstitial with intergrown and included plagioclase
Magnetite	2-3	2-3	0.05-0.35		subhedral to anhedral	mostly interstitial; some skeletal
Mesostasis	0	15-20	n/a		interstitial	microcrystalline, intersertal, with fibrous growths and microspherulitic aggregates; largely altered possibly to (or with) fine fibrous actinolite

SECONDARY MINERALOGY	PERCENT	REPLACING/FILLING	COMMENTS
Aragonite	1-2	vesicle filling	erratically distributed
chlorite/actinolite	12-15	vesicle filling, mesostasis replacement	dominant alteration product
Fe-oxyhydroxide	tr	vesicle linings	

VESICLES/CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles	20-25	evenly distributed	up to 2	complete to partial	subrounded to interconnected	mostly filled by secondary minerals

COMMENTS: Traces of dark brown Cr-spinel occur included in plagioclase laths. Spinels are euhedral grains, about 0.03 mm in size. In spite of extensive vesicle infilling and alteration of mesostasis the primary mineral phases are very fresh. Continuous variations of grain size typify the texture, with no obvious phenocrystal grains. The mesostasis alteration product has been termed fine-grained clay aggregates by SHE in other slides from this unit. Rock is moderately altered.

SITE 836

135-836A-9X-02 (Piece 4,45-47 cm)

OBSERVER: JAN

WHERE SAMPLED: Unit 4

ROCK NAME: Aphyric basalt

GRAIN SIZE: Fine grained

TEXTURE: Vesicular, diabasic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPO- SITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	tr	tr	1.5		euhedral	large, blocky crystals rather than long laths; zoned
GROUNDMASS						
Plagioclase	25-30	30-40	0.2-1.5		subhedral	some as long as phenocrysts but narrow laths rather than euhedral phenocrysts
Clinopyroxene	20-30	20-30	0.1-0.9		subhedral to anhedral	undulose extinction common
Opaque	1	1	0.05-0.3		irregular	some rod-like crystals in the mesostasis, mainly irregular blobs
Olivine?	tr	tr	0.1 mm		anhedral	
Mesostasis	0-1	15	n/a		interstitial	cryptocrystalline; almost completely altered to clays

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Greenish-brown clays	15-20	replacing mesostasis and plagioclase	

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE
Vesicles	15-20	throughout	0.4-2.0	no fillings	irregularly shaped

COMMENTS: Appears to be some incipient breakdown of plagioclase; the rock is moderately altered. A 1057 point count gives 18.2% mesostasis, 35% groundmass plagioclase, 23.0% groundmass clinopyroxene, 2.2% groundmass olivine, 2.1% groundmass opaques, 16.3% open vesicles, 2.6% filled vesicles, 0.3% plagioclase phenocrysts, 0.3% clinopyroxene phenocrysts, 0.1% olivine phenocrysts. Phenocrysts were defined on the basis of shape and relative size.

135-836B-2R-01 (Piece 2,14-16 cm)

OBSERVER: EWE

WHERE SAMPLED: Unit 3

ROCK NAME: Moderately phyric olivine -plagioclase basalt

GRAIN SIZE: Fine grained

TEXTURE: Porphyritic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	3-5	3-5	0.1-0.4	An70-75	euhedral to subhedral	elongated laths, mostly in glomeroporphyritic aggregates; narrow more sodic rims; some of the larger angular grains may be xenocrysts
Olivine	2-3	2-3	0.1-0.9		euhedral to subhedral	isolated crystals, some skeletal
GROUNDMASS						
Plagioclase	10-15	10-15	up to 0.1	An65-70	euhedral to subhedral	laths to microlites; many in skeletal and swallowtail forms
Olivine	1-2	1-2	up to 0.1		subhedral	mostly isolated crystals
Cr-spinel	tr	tr	0.02		euhedral	in groundmass and partly included in olivine; dark brown
Mesostasis	60-65	60-65	n/a		microphenocrysts interstitial	skeletal quench textures plus clinopyroxene-plagioclase intergrowths plus many very fine complex magnetite granular aggregates
SECONDARY MINERALOGY						
Red-orange hematite	tr	REPLACING/ FILLING	lining vesicles			COMMENTS
						could be hematite/clay aggregates, occur in one corner of the slide lining and perhaps filling some small vesicles; may also have replaced a bit of the groundmass; not common
red/green clays	tr		lining vesicles			
VESICLES/CAVITIES						
Vesicles	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
	10-15	disseminated	0.01-4	none	subrounded to coalescing	larger vesicles erratically distributed

COMMENTS: Very nice, fresh sample. Phenocryst definition for point count was somewhat subjective and accounts for the difference in estimates. Total olivine content is 2.3%, but all could be considered phenocrysts, plagioclase is seriate making distinction between phenocrysts and groundmass rather arbitrary. This accounts for difference between hand sample and thin section descriptions and names. 1069 point count gives: Mesostasis (includes some cpx crystallites) 66.7%; Open vesicles 14.2%; Filled vesicles 0.2%; Plagioclase groundmass 12.1%; Clinopyroxene groundmass 0.8%; Olivine groundmass 1.5%; Opaques 1.8%; Plagioclase phenocrysts 1.8%; Olivine phenocrysts 0.8%; Other (alteration) 0.1%.

SITE 836

135-836B-3R-01 (Piece 11,68-70 cm)

OBSERVER: SHE

WHERE SAMPLED: Unit 4

ROCK NAME: Sparsely phyric plagioclase basalt

GRAIN SIZE: Fine grained

TEXTURE: Vesicular, subophitic, intersertal

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	1-2	1-2	0.4-1.0		subhedral to anhedral	some partially rounded; tabular, equant crystals with oscillatory zoning
GROUNDMASS						
Plagioclase	28-38	30-40	<0.1-0.7	An50-60?	euhedral to anhedral	laths partially enclosed in clinopyroxene and altered mesostasis
Clinopyroxene	15-20	15-20	<0.1-0.8		anhedral	subophitic to granular; zoning, particularly sector zoning, is common
Olivine	1-2	2-3	0.05-0.4		subhedral to anhedral	small grains, isolated in groundmass
Opakes	3-4	3-4	<0.01-0.05	magnetite	subhedral to anhedral	commonly intergranular; skeletal forms common
Mesostasis	0-5	25-35	n/a		interstitial	largely altered to clays; may be some pyroxene crystallites left
SECONDARY MINERALOGY						
	PERCENT	REPLACING/FILLING			COMMENTS	
Aragonite	1-2	replacing mesostasis, filling vesicles			aggregates up to 0.1 to 0.5 mm	
Brownish clays	25-30	replacing mesostasis			fine-grained aggregates replacing mesostasis; some may be vesicle fill but it is hard to separate from altered groundmass	
VESICLES/CAVITIES						
	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles	10-15	throughout	0.05-1	partially with clays	irregular to rounded	largest may form by coalescence of smaller ones

COMMENTS: Section is thin and rather badly plucked; rare sulfide (?) in groundmass and edge of some vesicles. Rock is moderately altered.

135-836B-3R-02 (Piece 5, 32-38 cm)

OBSERVER: SHE

WHERE SAMPLED: Unit 4

ROCK NAME: Aphyric basalt

GRAIN SIZE: Fine to medium grained

TEXTURE: Vesicular, ophitic, intersertal

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	24-29	25-30	<0.1-0.9	An60	anhedral to euhedral	zoned laths enclosed in clinopyroxene or by mesostasis
Clinopyroxene	15-20	15-20	<0.1-2.0		anhedral	ophitic, sector zoned
Olivine	1-2	2-3	0.05-0.2		euhedral to subhedral	single crystals in groundmass
Opaques	2-3	2-3	0.02-0.15		euhedral to anhedral	interstitial magnetite
Mesostasis	0-2	25-30	n/a		interstitial	replaced by clays
SECONDARY MINERALOGY	PERCENT	REPLACING/FILLING				COMMENTS
Brown clays	25-30	replacing groundmass				clearly partially filling groundmass also; in fine-grained radial to fibrous aggregates; some replacement of olivine along fractures
Aragonite	tr-1	filling vesicles, replacing groundmass				crystals to 0.5 mm occur in granular aggregates and fanned bundles of blades; aggregates up to 1.5 mm; largely filling porosity; probably some groundmass and olivine replacement too, but hard to tell

VESICLES/CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles	15-20	throughout	0.1 to 1	clays	irregular	may be significant filling of vesicles by clay but it is hard to tell from groundmass alteration

COMMENTS: Rock is moderately to highly altered.

SITE 836

135-836B-3R-02 (Piece 13,93-94 cm)

OBSERVER: EWE

WHERE SAMPLED: Unit 4

ROCK NAME: Aphyric basalt

GRAIN SIZE: Fine grained

TEXTURE: Vesicular, subphitic to intergranular and intersertal

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	30-35	30-35	0.1-1.6	An60-65	euhedral to subhedral	elongated laths, normally zoned, interlocking and partially enclosed by clinopyroxene
Clinopyroxene	20-25	20-25	0.05-0.8		subhedral to anhedral	intergranular to subophitic; marked zoning including hour glass structure, though core to rim zoning is most common
Olivine	3-5	3-5	0.04-0.8		subhedral to anhedral	frequently interstitial with included plagioclase laths and as isolated crystals in groundmass; can be hard to differentiate from clinopyroxene
Magnetite	3-4	3-4	0.02-0.3		subhedral to anhedral	mainly interstitial, some skeletal grains; in mesostasis some very small (<0.01 mm) rod-like aggregates
Mesostasis	0-5	15-20	n/a		interstitial	microcrystalline chlorite/actinolite fibrous growths plus colorless zeolite (?); main alteration could also be fine-grained clay aggregates
SECONDARY MINERALOGY	PERCENT	REPLACING/FILLING				COMMENTS
Chlorite/actinolite?	10-15	infilling and linings				replacing mesostasis and infilling vesicles; very fine aggregates; SHE has these down as brown clays in radial fine-grained aggregates; proportion of replacement vs. vesicle fill is hard to determine
Zeolite	<1	lining vesicles				fine globular growths, on top of clay/chlorite growths, growing into vesicles
Fe-oxyhydroxides	<1	infilling				red-brown zones in chlorite/actinolite/clay? aggregates
Mixed chlorite/clay?	1	linings				fibrous to radiating greenish-brown aggregates in vesicles
Aragonite	tr	infilling				
VESICLES/CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles	15-20	evenly distributed	0.15 to 2	partial to complete	subrounded to irregular	most common size is 0.4 to 1 mm; many have quench linings; linings are clays and a hematitic material

COMMENTS: Primary minerals are very fresh in spite of extent of mesostasis alteration and vesicle infilling. Continuous variations of grain size with no obvious phenocrystal grains. There are trace sulfides, at least two types, in the groundmass. The dark brown to black groundmass looks like unaltered devitrified mesostasis on first glance but is clearly replaced by small, radial aggregates of clays/actinolite/chlorite. Rock is moderately altered.

135-836B-5R-02 (Piece 2,92-93 cm)

OBSERVER: KRI

WHERE SAMPLED: Unit 4

ROCK NAME: Aphyric basalt

GRAIN SIZE: Medium grained

TEXTURE: Vesicular, diabasic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	tr-1	tr-1	to 1	An75	euhedral	equant to tabular grains; more equant than groundmass; some evidence of incipient alteration; commonly zoned
GROUNDMASS						
Plagioclase	30-35	30-35	<0.8 mm		euhedral	elongate laths to tabular grains, zoned
Clinopyroxene	15-20	15-20	<0.06		subhedral to anhedral	subphitic and interstitial
Olivine	1-2	1-2	<0.4		anhedral	identification is difficult but these are very clear with high interference colors
Magnetite	1-2	1-2	<0.2		equant, skeletal	cruciform grains common, trace ilmenite lamellae in some
Mesostasis	0	10-15	n/a		interstitial	replaced by extremely fine grained green-brown clays
SECONDARY MINERALOGY						
	PERCENT	REPLACING/FILLING			COMMENTS	
Zeolites	<1	filling vesicle walls			rare, radiating zeolites on some vesicle margins	
Mixed clays	10-15	replacing mesostasis			mesostasis is extensively replaced by fine-grained green-brown clays	
calcite	tr	filling vesicles			rare vesicle infillings	
VESICLES/CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles	25-30	throughout to	3 mm	minor	irregular	large, irregular shaped rods as well as small, intergranular voids; the large voids may in part be a product of plucking

COMMENTS: The slide is badly plucked throughout. Many of the original voids have been enlarged and a lot of fine material deposited in the vesicles and veins may be from the breaking and plucking. The vesicle percentages are therefore maximum estimates. A 787 point count (avoiding the worst plucked areas) gave: 16.3% mesostasis, 0.9% plagioclase phenocrysts (larger, blockier grains), 33.3% groundmass plagioclase, 17.8% groundmass clinopyroxene, 1.7% groundmass olivine, 1.1% groundmass opaques, 27.4% open vesicles and 1.5% filled vesicles. Rock is moderately altered.

SITE 836

135-836B-6R-02 (Piece 1C, 59-63 cm)

OBSERVER: EWE

WHERE SAMPLED: Unit 4

ROCK NAME: Moderately to highly phyrlic clinopyroxene-olivine-plagioclase basalt

GRAIN SIZE: Fine grained

TEXTURE: Porphyritic, vesicular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	7-10	7-10	0.5-2.0	An70-75	euhedral to subhedral	some are zoned with sodic rims
Olivine	2	2	0.2-0.6		euhedral to subhedral	isolated crystals, some with large inclusions
Clinopyroxene	<1	<1	0.2-0.4		subhedral to anhedral	partly intergrown with plagioclase
Cr-spinel	tr	tr	0.05		euhedral	not as a phenocryst phase but no room in groundmass field; as inclusions in plagioclase phenocrysts; have narrow magnetite rims possibly developed as the result of mixing; very rare and dark brown
GROUNDMASS						
Plagioclase	35	35	up to 0.5		euhedral to anhedral	tabular microlites and microphenocrysts to anhedral mesostasis grains
Olivine	1-2	1-2	0.04 to 0.2		euhedral to subhedral	most isolated grains; some intergrown in plagioclase
Clinopyroxene	30-35	30-35	up to 0.2		subhedral to anhedral	mostly in granular mesostasis
Magnetite	1-2	1-2	0.002-0.10		euhedral to anhedral	varies from discrete grains to interstitial grains
Sulfides	<1	<1	0.002-0.010		subhedral to anhedral	occurs as interstitial groundmass grains and adjacent to, or in, vesicles
SECONDARY MINERALOGY						
Clays	PERCENT 10	REPLACING/ FILLING filling vesicles			COMMENTS vesicles show beautiful zonation from brown and pale green clays to apple-green clays followed by Fe-oxyhydroxides (?) toward the center of the void. A few are completely infilled, others still show void space.	
Zeolites	tr-1	filling vesicles			colorless acicular zeolites fill center of many vesicles; sulfides also associated with vesicle margins.	
VESICLES/ CAVITIES						
Vesicles	PERCENT 10	LOCATION randomly distributed	SIZE (mm) 0.04-1.0		FILLING partial to complete	SHAPE irregularly shaped COMMENTS brownish-green fibrous infillings; also deep green-brown fibrous material (pleochroic); also acicular zeolites
Fractures	<1	crosscutting 0.1 mm wide			partially infilled	

COMMENTS: This rock is fine-grained but the groundmass has a granular, near granoblastic texture, with coarser and finer grained intimately intermixed patches, apparently the result of internal magma mixing in the flow when the crystallization was incomplete. This mixing presumably also accounts for the granular texture reminiscent of recrystallization textures. Finer grained lithology may be slightly pyroxene richer. Embedded in this granular groundmass are phenocrysts and microphenocryst sized and mainly euhedral to subhedral plagioclase, olivine, and minor clinopyroxene. The distinction in size between phenocrysts and microphenocrysts is arbitrary. Nevertheless, the contrasting size and shape of these crystals, compared to the granular groundmass, gives the rock a distinctly porphyritic texture. Sulfide grains are relatively abundant. Most appear to be associated with vesicles, although not necessarily inside the vesicle infillings. Other grains more rarely occur as interstitial grains.

135-836B-7R-01 (Piece 6,31-32 cm)

OBSERVER: SHE

WHERE SAMPLED: Unit 5

ROCK NAME: Moderately phyrlic clinopyroxene-plagioclase basalt

GRAIN SIZE: Aphanitic to fine grained

TEXTURE: Vesicular, seriate porphyritic, subophitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	3-5	3-5	0.15-0.4		anhedral to euhedral	most in glomerocrysts with or without clinopyroxene; smaller grains occur individually; glass inclusions occur but not common; a few are anhedral and resorbed; phenocrysts are equant, tabular crystals; both reverse and normal zoning in larger grains
Clinopyroxene	1-2	1-2	0.1-0.35		anhedral to subhedral	most commonly subophitically intergrown with plagioclase; also intergranular to plagioclase
Olivine	tr	tr	0.1		euhedral	single crystals near glomerocrysts
GROUNDMASS						
Plagioclase	3-5	3-5	0.01-0.3		euhedral to skeletal	long, skinny laths and quench morphologies
Clinopyroxene	1-3	1-3	to 0.1 mm		subhedral, sheaves	1-3% well-crystallized equant, anhedral grains; much of the groundmass contains sheaflike quench clinopyroxenes
Olivine?	tr	tr	0.02		anhedral	single crystals in groundmass, identification uncertain
Opakes	1-2	1-2	0.002-0.01		anhedral to skeletal	disseminated throughout groundmass; appear to be magnetite
Mesostasis	48-53	50-55	n/a		n/a	common quench morphologies of plagioclase-pyroxene sheaves with disseminated opaques; slight alteration
SECONDARY						
MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Hematite/clays	1-2	replacing groundmass, vesicle linings				occur in vesicle edges and as patches in the groundmass; these patches have a slight reddish to greenish-yellow tinge; probably incipient alteration of mesostasis to clays and hematite
VESICLES/CAVITIES						
Vesicles	PERCENT 30-35	LOCATION throughout	SIZE (mm) 0.1 to 5.0	FILLING none	SHAPE irregular	COMMENTS smaller ones rounded; most are irregular; the largest ones (3 x 5 mm) usually elongate

COMMENTS: The larger pyroxenes are not uncommonly curved with undulose extinction. Plagioclase and pyroxene typically in glomerocrysts of 2 to 15 grains; glomerocrysts tend to be clumped together in portions of the slide. There are unusual gently curved crystal aggregates consisting of 6 to 10 plagioclase and pyroxene crystals strung singly together end-to-end. The chains are 0.3 to 0.6 mm long. There are very thin glassy selvages on the inside of some of the vesicles. Darker, aphyric quench textured material occurs as 2 mm patches and lining vesicles; so abundant around vesicles on one side of slide that it makes up most of the groundmass. A 1112 point count gives 51.6% mesostasis (including crystallites) 3.1 plagioclase phenocrysts; 1.0% clinopyroxene phenocrysts, 3.2 % groundmass opaques; 2.4% groundmass plagioclase; 2.8% groundmass clinopyroxene; 35.7% open vesicles; 0.2% hematitic patches. Rock is fresh to slightly altered.

SITE 836

135-836B-9M-01 (Piece 6,47-48 cm)

OBSERVER: KRI

WHERE SAMPLED: Unit 5

ROCK NAME: Sparsely phyrlic plagioclase basalt

GRAIN SIZE: Fine grained

TEXTURE: vesicular, seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS Plagioclase	1-2	1-2	0.6-1.2		euhedral	seriate texture of sample makes the distinction somewhat arbitrary; equant, blocky grains with zoned rims counted as phenocrysts; melt inclusions common
GROUNDMASS Plagioclase	30-35	30-35	<1mm		euhedral-subhedral	elongate, randomly oriented grains occurs both as equant, isolated
Clinopyroxene	20-25	20-25	<1 mm		subhedral	subophitic grains, and feathery quench crystals
Olivine	1-2	1-2	<0.3		anhedral	many are highly altered and are seen as several optically continuous, yet separate grains, isolated grains also occur
Mesostasis	10-15	10-15	n/a		interstitial	mostly occurs in vesicles filled with quenched material, very fresh
Magnetite	3-4	3-4	<0.1		equant-skeletal	beautiful skeletal and cruciform forms
VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles	25	disseminated	<2	empty	irregular	regions up to 4 mm across are filled with dark, quenched, and highly vesicular material

COMMENTS: Approximately 40-50% of this sample is extremely fine grained, vesicular, quenched material filling vesicles as has been seen in many previous samples. Small amounts of glass are preserved in this material. Sample is extremely fresh.