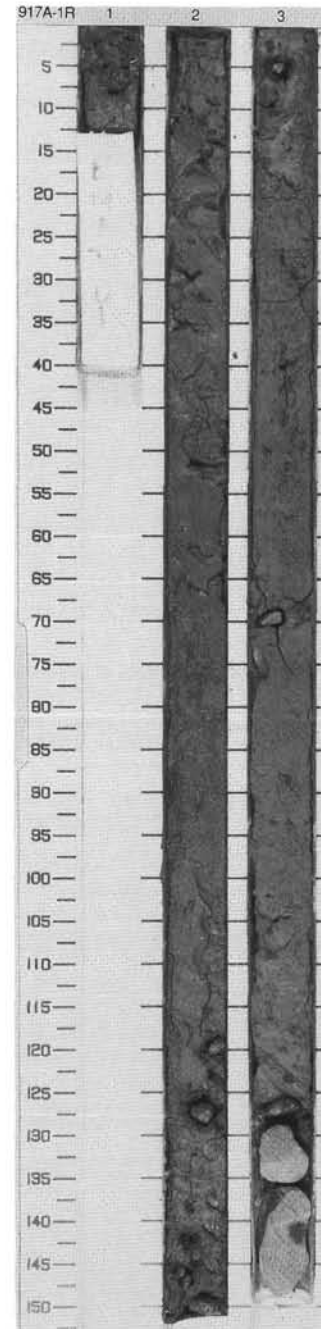


SITE 917 HOLE A CORE 1R

CORED 0.0 - 9.7 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	Description	
1	[Pattern]	1	Quaternary			S	10Y 4/1 To 10Y 4/2	<p><b>NANNOFOSSIL SILT MIXED SEDIMENT and SILT</b></p> <p>Major Lithologies:                      NANNOFOSSIL SILT MIXED SEDIMENT (Section 2, 0 to 70 cm), occurs as a dark gray (10Y 4/1), homogeneous, quartz-rich bed.                      SILT (Section 2, 110 to 129 cm, Section 3, 25 to 110 cm and 118 to 128 cm), occurs as olive gray (10Y 4/2), homogeneous, quartz-rich beds. These beds contain dropstones as follows: Section 2, 120 cm: quartzite (1.5 x 2.0 cm), 128 cm: basalt (2.5 x 2.0 cm), Section 3, 70 cm: basalt (1.3 x 2.7 cm), 126 cm: dolerite (1.5 x 4.5 cm).</p> <p>Minor Lithologies:                      CLAYEY NANNOFOSSIL SILT (Section 1, 0 to 13 cm), dark gray (10Y 4/1), quartz-rich, homogeneous, soft sediment. SANDY SILT WITH NANNOFOSSILS (Section 1, 70 to 110 cm, Section 1, 129 cm to Section 2, 25 cm, Section 3, 110 to 118 cm, and CC) occurs as, quartz-rich, homogeneous, olive gray (10Y 4/2) beds. Nannofossils, foraminifers, and sponge spicules are common. These beds contain dropstones as follows: Section 2, 142 cm: altered basalt (1.0 x 1.8 cm), 146 cm: granite (1.0 x 1.0 cm), 147 cm: basalt (1.9 x 1.0 cm), 150 cm: vein quartz (3.3 x 1.8 x 1.5 cm), Section 3, 5 cm: basalt (1.0 x 2.5 cm). GRAVEL (Section 3, 128 to 149 cm) consists of two clasts of dolerite without matrix (upper; 7 cm long, lower; 15 cm).</p>	
2	[Pattern]	2			◇				S
3	[Pattern]	3			◇				S

917A 2R NO RECOVERY



## SITE 917 HOLE A CORE 3R

CORED 19.7 - 28.7 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	Description
								GRAVEL
								General Description: This core consists of one drilling fragment of dolerite (7 cm long).  Age: Quaternary.



Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	Description
1	[Stippled pattern]	1	middle Eocene	[Symbol: diamond]	[Symbol: circle with dot]	S	5Y 3/2	VOLCANIC SANDY SILT WITH CLAY and VOLCANIC CLAYEY SILT WITH SAND
2							5Y 3/1	
3							10Y 3/1	
CC	[Horizontal lines]	2		[Symbol: diamond]	[Symbol: circle with dot]	S		VOLCANIC CLAYEY SILT WITH SAND (Section 2, 70 cm to CC, 10 cm), occurs as very dark gray (10Y 3/1), massive beds. These beds are bioturbated slightly throughout by burrows filled with silty sand or replaced by pyrite. Calcareous shell fragments (possibly spines of echinoid) and wood fragments are rare. Planar laminae are rare.
	[Horizontal lines]	3		[Symbol: diamond]	[Symbol: circle with dot]	S		Minor Lithology: MUDSTONE WITH SAND (Section 1, 127 to 131 cm and CC, 15 to 25 cm), calcite-cemented, homogeneous, slightly bioturbated, poorly bedded, white (2.5Y 8/0) beds. Compositions of sandy grains are quartz, feldspar, and lithic (mainly basaltic) fragments.
		CC		[Symbol: diamond]	[Symbol: circle with dot]	MS		General Description: This core includes two isolated igneous clasts in a drilling disturbed interval (Section 1, 0 to 5 cm and 42 to 44 cm), probably downhole cavings.

917A 5R NO RECOVERY

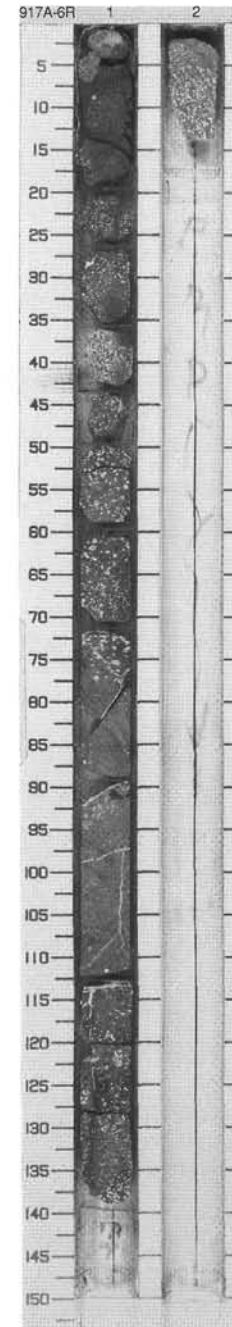


## SITE 917 HOLE A CORE 6R

CORED 41.7 - 46.7 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	Description
0		1	Eocene					<p><b>VOLCANIC CONGLOMERATE and BASALT</b></p> <p>Major Lithologies:  <b>VOLCANIC CONGLOMERATE</b> (Section 1, 8 to 14 cm), occurs as an unconsolidated sediment, with dusky reddish (10R 3/4) clayey matrix, polymict, with rounded sand grains, granules, and pebbles (mainly composed of basalt, &lt;1 cm).  <b>BASALT</b> (Section 1, 15 to 142 cm), occurs as massive lava flow (see igneous description).</p> <p>Minor Lithologies:  <b>GRAVEL</b> (Section 1, 0 to 4 cm), occurs as one subrounded sandstone pebble without matrix, calcite-cemented, the same lithology as Core 4R, CC, 15 to 25 cm.  <b>MUD</b> (Section 1, 5 to 8 cm), occurs as a deformed (probably by drilling disturbance), laminated, dusky red (10R 3/4) bed. An isolated basaltic pebble (4 cm in diameter) is seen in Section 1, 4 to 7 cm.</p>
1		2						

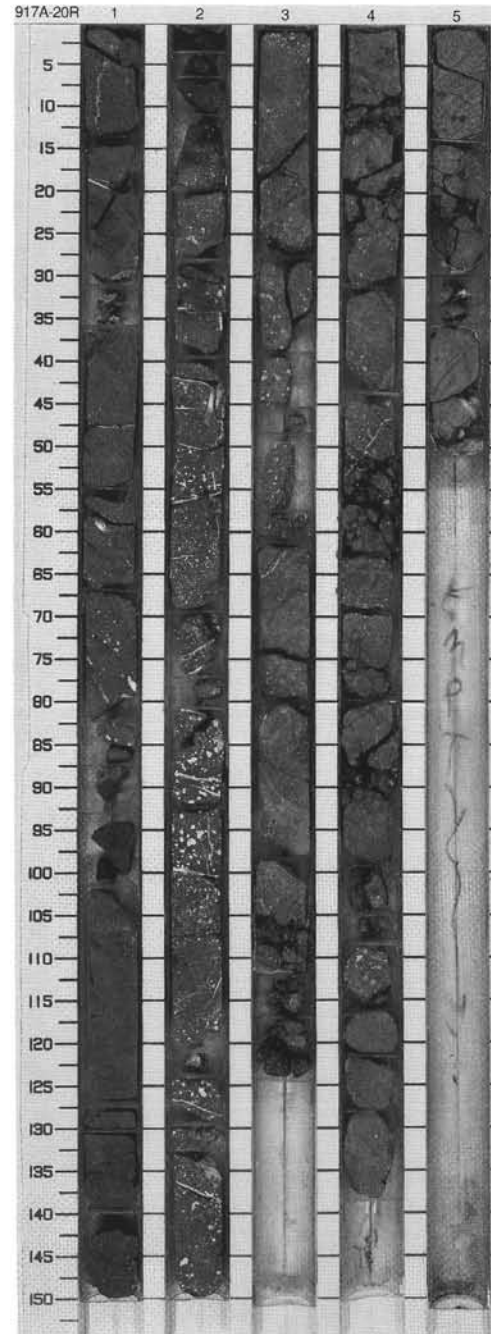
917A 7R THROUGH 19R HARD ROCKS



SITE 917 HOLE A CORE 20R CORED 164.5 - 173.6 mbsf

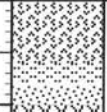
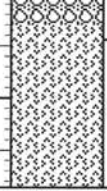
Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	Description
1	[Graphic Lithology: Pattern of dots and dashes representing volcanic sandy siltstone with gravel]	1	late Paleocene-early Eocene		[Disturbance symbols: vertical lines, horizontal dashes]			VOLCANIC SANDY SILTSTONE WITH GRAVEL, VOLCANIC BRECCIA and BASALT
2				5YR 4/4		Major Lithologies: VOLCANIC SANDY SILTSTONE WITH GRAVEL (Section 1, 90 to 131 cm), occurs as a reddish brown (5YR 4/4), poorly sorted bed. This bed is weakly laminated with dips at 30°. The sediment rock includes clasts (up to 2 mm in diameter) of basalt and feldspar. VOLCANIC BRECCIA, Section 1, 131 to 140 cm. Matrix is reddish brown (5YR 4/4) volcanic sandy siltstone. Clasts consist of pebbles of basalt, fresh, angular, gray (N4 to 5G 4/1). BASALT (Section 1, 0 to 90 cm and Section 1, 140 cm to Section 5, 51 cm), occurs as massive lava flow (see igneous description).		
3								
4								
5								

917A 21R HARD ROCK



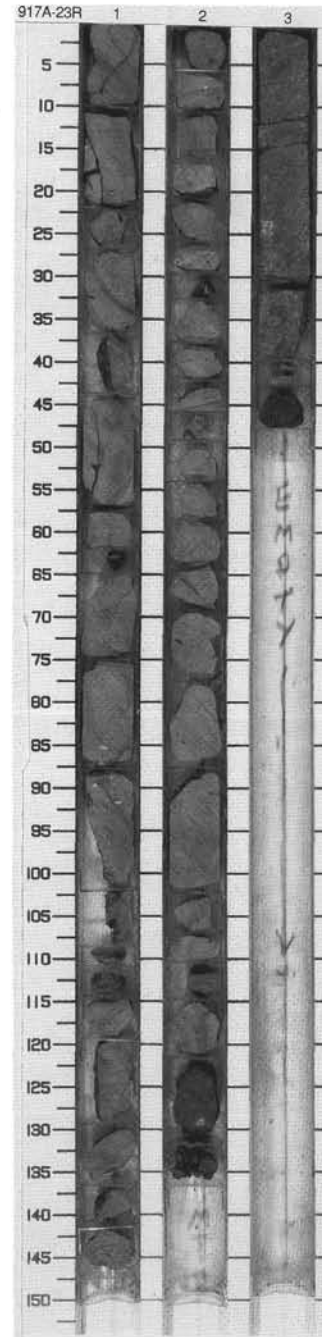
## SITE 917 HOLE A CORE 22R

CORED 182.8 - 191.9 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	Description
1		1	↑ F ↑ F				5YR 3/3	<p>VOLCANIC CONGLOMERATE, VOLCANIC SANDSTONE, VOLCANIC SILTSTONE and VOLCANIC CLAYSTONE</p> <p>Major Lithologies: VOLCANIC CONGLOMERATE, VOLCANIC SANDSTONE, VOLCANIC SILTSTONE, and VOLCANIC CLAYSTONE (Section 1, 60 to 122 cm), occurs as a fining-upward sequence divided into four parts as follows in descending order: i) VOLCANIC CLAYSTONE, dark reddish brown (5YR 2.5/2), homogeneous bed, ii) VOLCANIC SILTSTONE, dark reddish brown (5YR 3/3), parallel-laminated beds, iii) VOLCANIC SANDSTONE, dark reddish brown (5YR 2.5/2 to 5YR 3/3), medium- to very coarse-grained, cross-laminated beds, iv) VOLCANIC CONGLOMERATE, consists of varicolored basaltic fragments (up to 4 mm in diameter), dark reddish brown (5YR 2.5/2 to 5YR 3/3) to pinkish gray (5YR 7/2), massive, clast-supported beds. These rocks dip at 20° to 30°.</p> <p>Minor Lithology: VOLCANIC CLAYSTONE WITH GRAVEL (Section 1, 122 to 127 cm), dark reddish brown (5YR 2.5/2 to 5YR 3/3), with varicolored basaltic fragments (up to 4 mm in diameter) elongated by layer-parallel deformation.</p>
2		2						



Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	Description
1	[Stippled pattern]	1	late Paleocene-early Eocene		◇	X	2.5YR 2.5/4	<p><b>VOLCANIC LAPILLISTONE</b></p> <p>Major Lithology:                      VOLCANIC LAPILLISTONE (HYALOCLASTITE?): (Section 3, 0 to 42 cm; Igneous Unit 35B), dark reddish brown (2.5YR 2.5/4), massive, coarse-grained, indurated. Matrix consists of brown (10YR 5/3) dense material with &lt;1 mm black fragments which appear glassy. Clasts are basaltic, dominantly very dark gray (10YR 3/1), 0.5 to 15 mm across, with white plagioclase feldspar phenocrysts.</p> <p>Minor Lithologies:                      VOLCANIC SANDY SILTSTONE (Section 2, 120 to 138 cm; Pieces 23 and 24; Igneous Unit 35A), dusky red to weak red (2.5YR 3/2 to 10R 4/4 to 10R 2.5/1), indurated. Piece 23 shows parallel layering, with layer thickness 1 mm to 4 cm. Different layers show different colors. This piece contains one angular light gray (5YR 7/1) clast of clastic material and many small black fragments (&lt;0.5 mm), elongated to bedding, possibly wood. Piece 24 consists of drilling breccia of material similar to Piece 23. VOLCANIC SILTSTONE WITH LAPILLI (Section 3, 42-47 cm; Piece 4; Igneous Unit 35C), dark reddish brown (2.5YR 2.5/4), dense, lithified, with fragments up to 5 mm across of crystals, basalt, and sedimentary rock.</p>
2		2						
3		3						

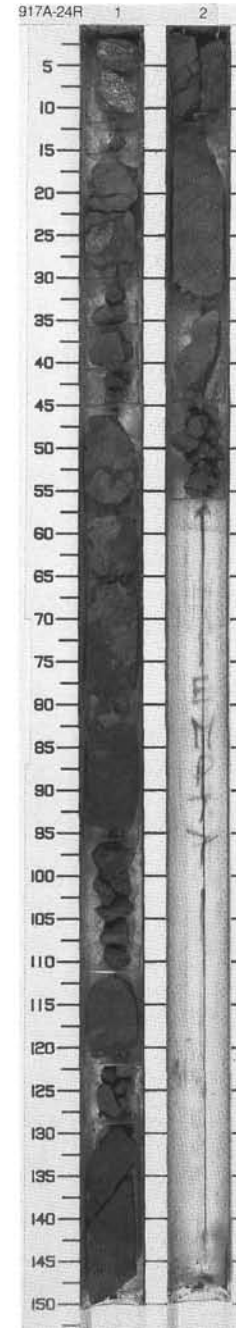


## SITE 917 HOLE A CORE 24R

CORED 201.0 - 206.3 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	Description
1	[Dotted pattern]	1	Paleocene-early Eocene	[Horizontal lines]	[Diagonal lines]			<p><b>VOLCANIC BRECCIA</b></p> <p>Major Lithology:  VOLCANIC BRECCIA (Section 1, 10 to 110 cm; Pieces 3 through 12), dusky red matrix (2.5YR 3/2), grading downward into very dark gray (2.5YR 3/0), polymict angular to subangular fragments up to 6 cm across. Clast size decreases downward to mostly 1 cm. Dark brown (10YR 3/3)</p> <p>SILTSTONE occurs within the breccia in Pieces 8 and 9, with small black angular rock fragments and white and black crystals.</p> <p>Minor Lithologies:  VOLCANIC ASH (Section 1, 0 to 10 cm, Pieces 1 and 2). Finely laminated with color varying from olive (5Y 4/3) to dark brown (10YR 3/2), to dark yellowish brown (10YR 4/4), with 3 mm feldspar crystals and dark mafic minerals. Dark brown (10YR 3/2) clayey laminae are seen in Piece 1.</p>
2		2						

917A 25R THROUGH 55R HARD ROCKS



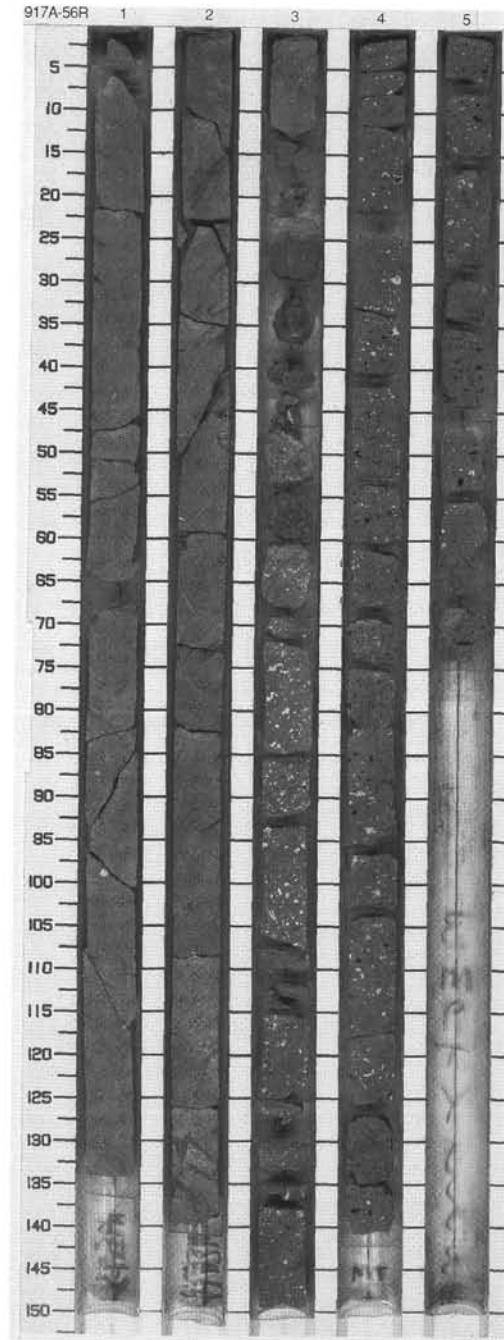


SITE 917 HOLE A CORE 56R

CORED 403.5 - 413.2 mbsf

Meter	Graphic Lith.	Section Age	Structure	Disturb	Sample	Color	Description
1	[Dotted pattern]	1	} < 1		10R 4/8		<p>VOLCANIC CLAYSTONE</p> <p>General Description: VOLCANIC CLAYSTONE (Section 3, 21 to 29 cm; Piece 4; Igneous Unit 61A), red (10R 4/8). Faintly mottled with plagioclase "phenocrysts" and other volcanoclastic particles floating in the bright red matrix. Some clay is injected into the overlying basalt flow and along the contact is a thin vein of yellow and green clay. White alteration mineral-filled veins cut the claystone and enveloping basalts.</p>
2		2					
3		3					
4		4					
5		5					

917A 57R THROUGH 61R HARD ROCKS



## SITE 917 HOLE A CORE 62R

CORED 451.3 - 461.0 mbsf

Meter	Graphic Lith.	Section Age	Structure	Disturb	Sample	Color	Description
1	[Dotted pattern]	1	[Diagonal lines]	[Vertical lines]	[Vertical lines]	10R 4/8	VOLCANIC SILTY CLAYSTONE  General Description: VOLCANIC SILTY CLAYSTONE (Section 2, 111 to 118 cm; Piece 6; Igneous Unit 67), red (10Y 4/8), with small (<1 mm) detrital plagioclase phenocryst and other dark volcaniclastic particles. Some of the red claystone is injected into the overlying basaltic flow. The upper boundary is sharp, but the lower boundary is gradational. This layer dips at 30°.
2		2					
3		3					

917A 63R THROUGH 101R HARD ROCKS



SITE 917 HOLE A CORE 102R

CORED 817.3 - 826.9 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	Description
0-1	[Dotted pattern]	1	late Paleocene-early Eocene					<p><b>BASALT and SANDSTONE</b></p> <p>Major Lithologies:                      BASALT (Section 1, 0 to 137 cm, Section 2, 0 to 129 cm, and Section 3, 0-76 cm).</p> <p>Age: Paleocene.</p> <p>SANDSTONE (Section 3, 76 to 91 cm) occurs as massive, quartz-rich, highly indurated bed. Its color changes, from top to bottom, weak red (2.5YR 4/2) in the upper part, light olive brown (2.5Y 5/4) in the central part, and gray (2.5Y 5/0) at the base. The rock consists of a fine-grained reddish to olive brown clayey matrix, which encloses quartz grains and small gray rock fragments (&lt;0.5 cm). The proportion of these rock fragments increases sharply towards to the base.</p>
1-2	[Dotted pattern]	2						
2-3	[Dotted pattern]	3						

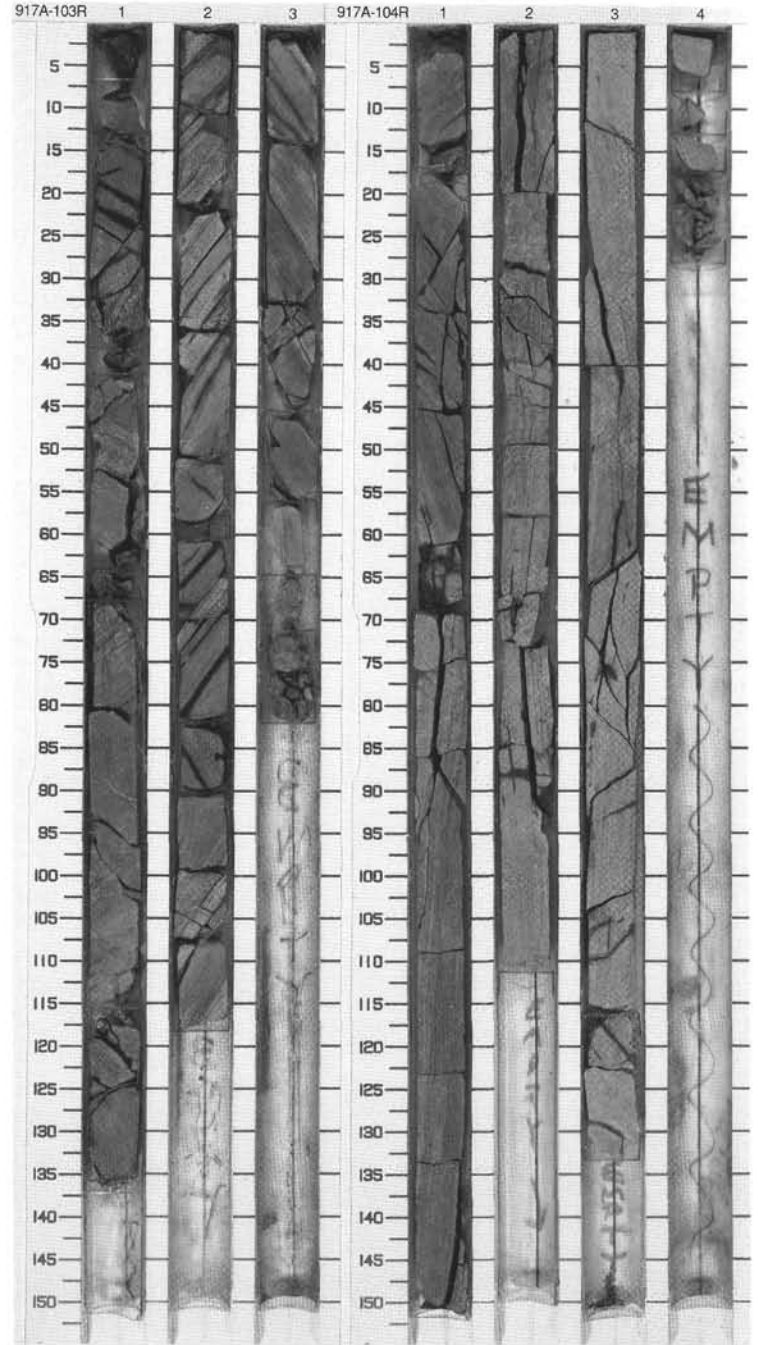


SITE 917 HOLE A CORE 103R CORED 826.9 - 831.5 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	Description
1	[Dotted pattern]	1		[Diagonal lines]	[Vertical line]	T		<p>METACLAYSTONE and METASILTSTONE</p> <p>Major Lithologies: METACLAYSTONE and METASILTSTONE, gray (2.5 YR N6/0) to black (2.5 YR N2.5/0), zeolitized layers, with very thin parallel (1 to 10 mm) laminae of coarser material. Presence of chlorite and zeolites indicates a chlorite metamorphic grade. Possible ghosts of foraminifers are recrystallized by abundant pyrite. Ripples, cut and fill structures, and microfaults occur scattered throughout the core. Laminae dip between 30° (Section 1) and 73° (Section 3).</p> <p>Age: Unknown.</p>
2	[Dotted pattern]	2		[Diagonal lines]	[Vertical line]	T	2.5YR N6/0 To 2.5YR N2.5/0	
3	[Dotted pattern]	3		[Diagonal lines]	[Vertical line]	T		

SITE 917 HOLE A CORE 104R CORED 831.5 - 836.5 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	Description
1	[Dotted pattern]	1		[Diagonal lines]	[Vertical line]	T	2.5Y N2/0 To 2.5Y N6/0	<p>METACLAYSTONE, METASILTSTONE and METASANDSTONE</p> <p>Major Lithologies: METACLAYSTONE, METASILTSTONE, and METASANDSTONE, black (2.5Y N2/0) to gray (2.5Y N6/0) in Section 1, dark gray (2.5Y N4/0) to olive yellow (2.5Y 6/6) in Section 2, and gray (2.5Y N5/0) to light gray (2.5Y N7/0) in Sections 3 and 4. Thin parallel laminae, heavily burrowed (<i>Chondrites</i>), dipping at 55° (upper part of Section 1). Pyrite mineralization and rare recrystallized foraminifers(?) are scattered throughout the core. Microfaults and mineralized microfissures occur along the core.</p> <p>Age: Unknown.</p>
2	[Dotted pattern]	2		[Diagonal lines]	[Vertical line]	T	2.5Y N4/0 To 2.5Y 6/6	
3	[Dotted pattern]	3		[Diagonal lines]	[Vertical line]	T	2.5Y N5/0 To 2.5Y N7/0	
4	[Dotted pattern]	4		[Diagonal lines]	[Vertical line]	T		



SITE 917 HOLE A CORE 105R

CORED 836.5 - 841.2 mbsf

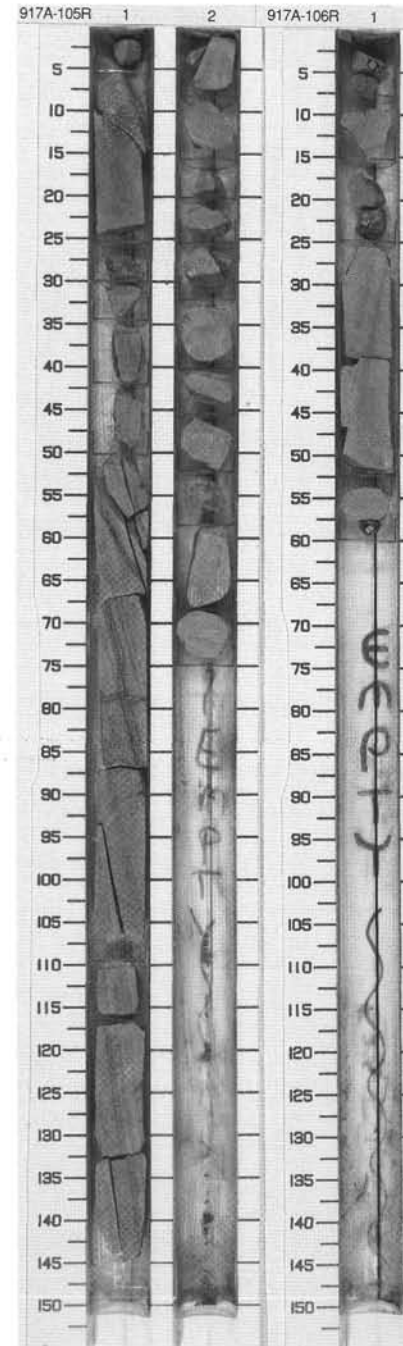
Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	Description
1	[Dotted pattern]	1				T	2.5Y N5/0 To 2.5Y N7/0	METACLAYSTONE and METASILTSTONE
2	[Dotted pattern]	2						Major Lithologies: METASILTSTONE and METACLAYSTONE, showing fine laminae (1 to 10 mm thick), alternating light gray (2.5Y N7/0) and gray (2.5Y N5/0) beds. Color: gray (2.5Y N5/0) to light gray (2.5Y N7/0). Burrowing ( <i>Chondrites</i> ) occurs throughout the core. Pyrite-filled fractures occur in Section 1, 9 to 24 cm.
Age: Unknown.								

SITE 917 HOLE A CORE 106R

CORED 841.2 - 846.2 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	Description
	[Dotted pattern]	1						METACLAYSTONE and METASILTSTONE
Major Lithologies: Five drilling fragments of METACLAYSTONE and METASILTSTONE with a few coarse-grained laminae (1 to 10 mm thick). Burrowing ( <i>Chondrites</i> ) and abundant pyrite occur throughout the core. Color: gray (2.5Y N6/0) to black (2.5Y N2/0).								
Age: Unknown.								

917A 107R NO RECOVERY



## SITE 917 HOLE A CORE 108R

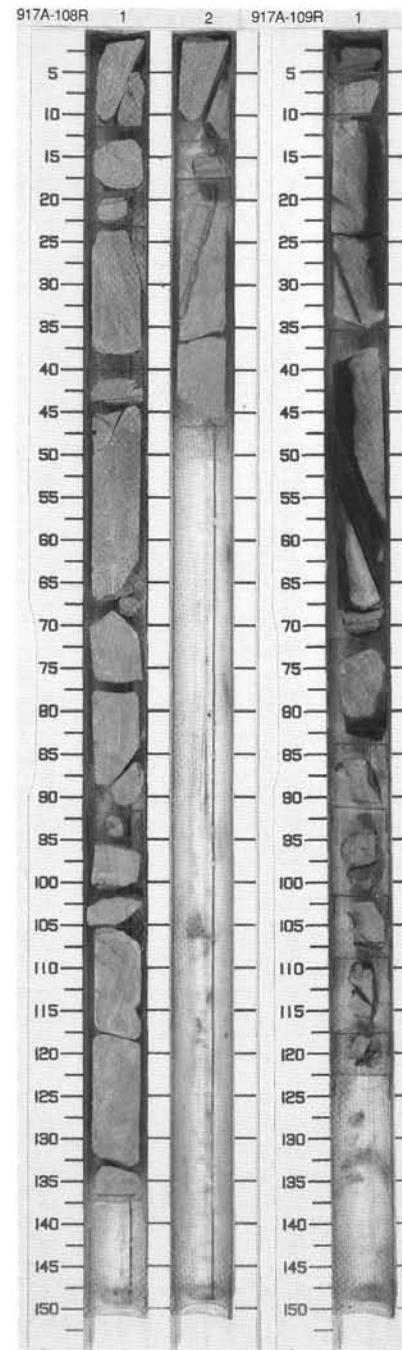
CORED 855.8 - 860.3 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	Description
1		1		≡	∇	T	2.5Y N6/0 To 2.5Y N3/0	METACLAYSTONE and METASILTSTONE  Major Lithologies: METACLAYSTONE and METASILTSTONE Gray (2.5Y N6/0) to very dark gray (2.5Y N3/0), thin (1 to 10 mm), parallel laminae dipping at 70° between 21 to 36 cm depth in Section 1, and at 60° along the rest of the core, highly burrowed ( <i>Chondrites</i> ). Microfracture occurring along a plane of burrowed laminae between 20 to 35 cm, in Section 2. Presence of zeolite spots (<1 mm in diameter) within the claystone.  Age: Unknown.
		2		≡	∇			

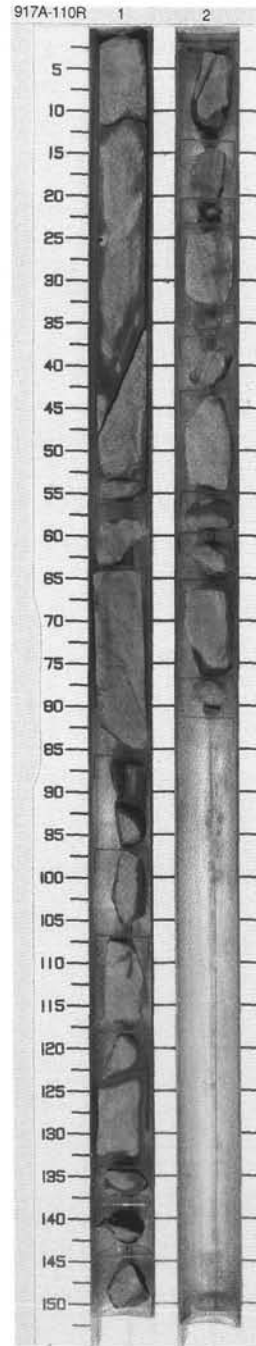
## SITE 917 HOLE A CORE 109R

CORED 860.3 - 865.3 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	Description
1		1		≡	∇		2.5Y N7/0 To 2.5Y N5/0	METACLAYSTONE and METASILTSTONE  Major Lithologies: METACLAYSTONE and METASILTSTONE showing light gray (2.5Y 7N/0) to gray (2.5Y 5N/0) parallel laminae, dipping at 60°, highly burrowed ( <i>Chondrites</i> ).  Age: Unknown.



Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	Description
1	[Dotted pattern]	1		[Horizontal lines]	[Vertical lines]		2.5Y N7/0 To 2.5Y N5/0	<p>METACLAYSTONE and METASILTSTONE</p> <p>Major Lithologies: METACLAYSTONE and METASILTSTONE showing light gray (2.5Y 7N/0) to gray (2.5 5N/0), parallel laminae, dipping at 60° to 65°, highly burrowed (<i>Chondrites</i>). Pyrite and zeolite are observed.</p> <p>Minor Lithology: METASANDSTONE (Section 2, 32 to 40 cm, 42 to 52 cm, and 76 to 79 cm; Pieces 5, 6, 7, and 11), occurs as medium- to coarse-grained, quartz-rich gray beds.</p> <p>Age: Unknown.</p>
2	[Dotted pattern]	2		[Horizontal lines]	[Vertical lines]			



**UNIT 1: OLIVINE-PHYRIC BASALT**

**Pieces 1-10C**

**CONTACTS:** Overlain by soil and reworked gravel.

**PHENOCRYSTS:** Olivine - 5%-7%; 0.5-1 mm; completely replaced by iddingsite.

**GROUNDMASS:** Fine-grained.

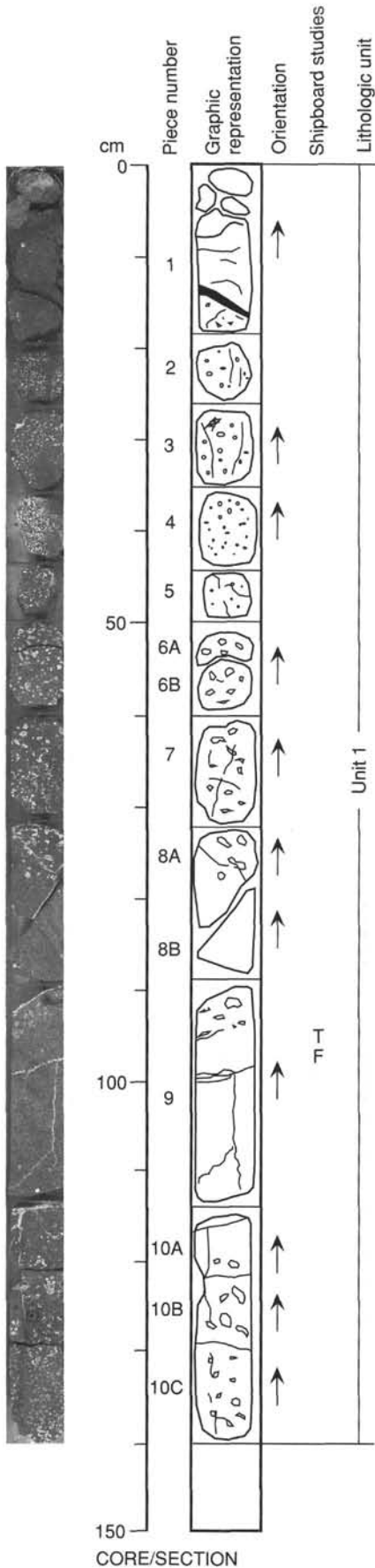
**VESICLES:** 1%-20%; 1-8 mm; irregular; vesicles are most abundant at the top and bottom of the unit and are filled or lined with zeolite.

**COLOR:** Reddish gray (5YR 4/1) to reddish brown (5YR 3/3).

**ALTERATION:** Moderately altered.

**VEINS/FRACTURES:** 1-5 mm wide; veins of calcite in all pieces.

**ADDITIONAL COMMENTS:** Alteration decreases downward through the unit. Vesicles are concentrated at the top and bottom portions.



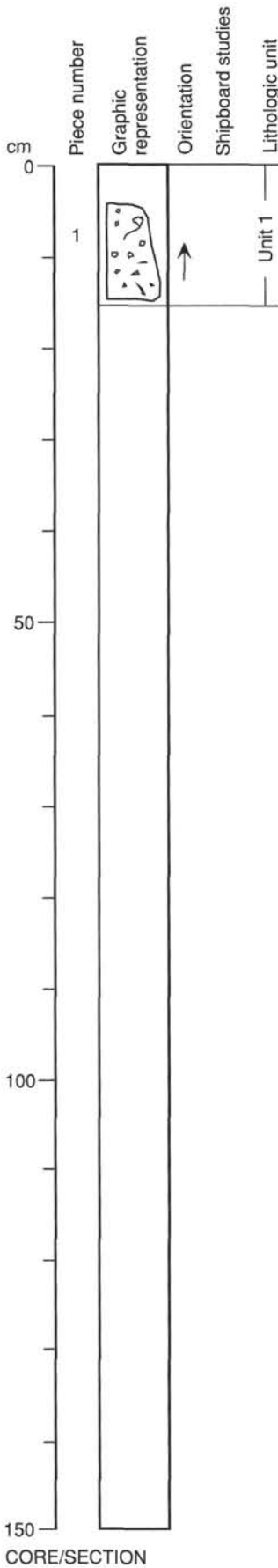


152-917A-6R-2

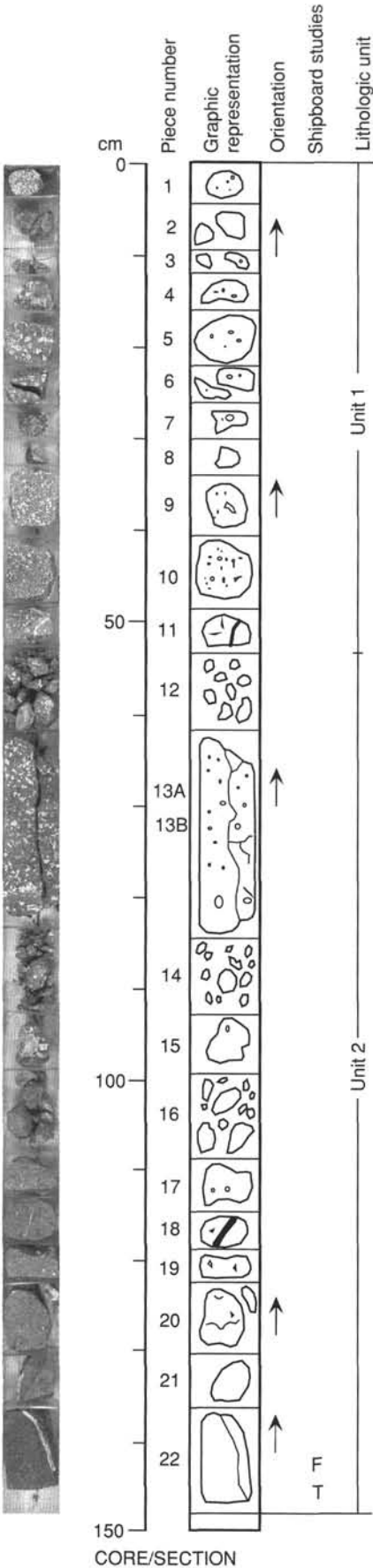
UNIT 1: OLIVINE-PHYRIC BASALT

Piece 1

**PHENOCRYSTS:** Olivine - 5%; 0.5–1 mm; completely replaced by iddingsite.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 15%; 2–5 mm; irregular; filled or lined with zeolite.  
**COLOR:** Reddish gray (5YR 4/1).  
**ALTERATION:** Moderately altered.  
**VEINS/FRACTURES:** 1 mm; one small vein of zeolite.  
**ADDITIONAL COMMENTS:** Appears similar to rock of previous section (152-917A-6R-1).



152-917A-7R-1



**UNIT 1: OLIVINE-PHYRIC BASALT**

**Pieces 1, 3-7, 9-11**

**CONTACTS:** Contact with picrite below Piece 11.

**PHENOCRYSTS:** Olivine - 5%; 0.5-1 mm; completely replaced by iddingsite.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 15%-20%; 1-3 mm; irregular; random; filled with zeolite.

**COLOR:** Reddish brown (5YR 3/3).

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** Some small veins filled with zeolite. Large (5-15 mm) gash in Piece 11 filled with zeolite.

**ADDITIONAL COMMENTS:** Same rock type as Core 152-917A-6R. Pieces 2 and 8 are drill fragments.

**UNIT 2: PICRITE**

**Pieces 12-22**

**CONTACTS:** Contact with Unit 1 well defined.

**PHENOCRYSTS:** Olivine - 40%; 1-3 mm; subhedral but completely altered.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 2%; 1-2 mm; rounded; random; much more abundant at the top of the flow unit (54-94 cm). Filled with zeolites.

**COLOR:** Dark gray and reddish (10YR 3/1).

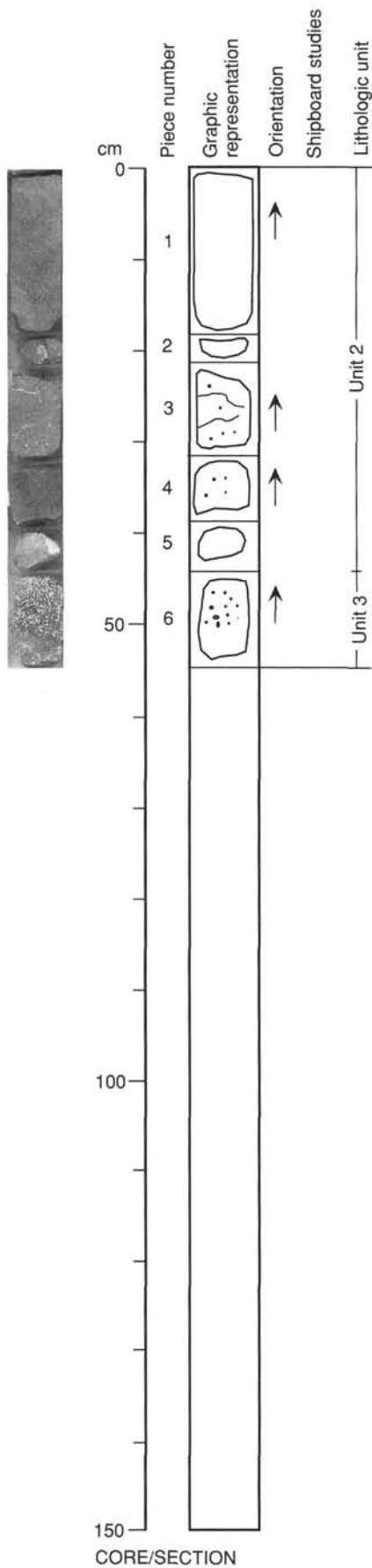
**STRUCTURE:** Massive.

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** 1-5 mm; vertical; filled with carbonate.

**ADDITIONAL COMMENTS:** Same rock unit continues into Section 152-917A-7R-2.

152-917A-7R-2



**UNIT 2: PICRITE**

**Pieces 1-5**

**PHENOCRYSTS:** Size of olivine increases towards base of unit. Olivine - 40%; 1-4 mm; subhedral and completely altered.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 2%; 1-2 mm; rounded; random distribution; more abundant towards the base and filled with green material.

**COLOR:** Dark gray and reddish (10YR 3/1).

**STRUCTURE:** Massive.

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** 1-2 mm; horizontal; filled with carbonate.

**ADDITIONAL COMMENTS:** Piece 5 at the base of the unit is more altered.

**UNIT 3: OLIVINE-PHYRIC BASALT**

**Piece 6**

**PHENOCRYSTS:** Olivine - 5%; 1-2 mm; completely altered.

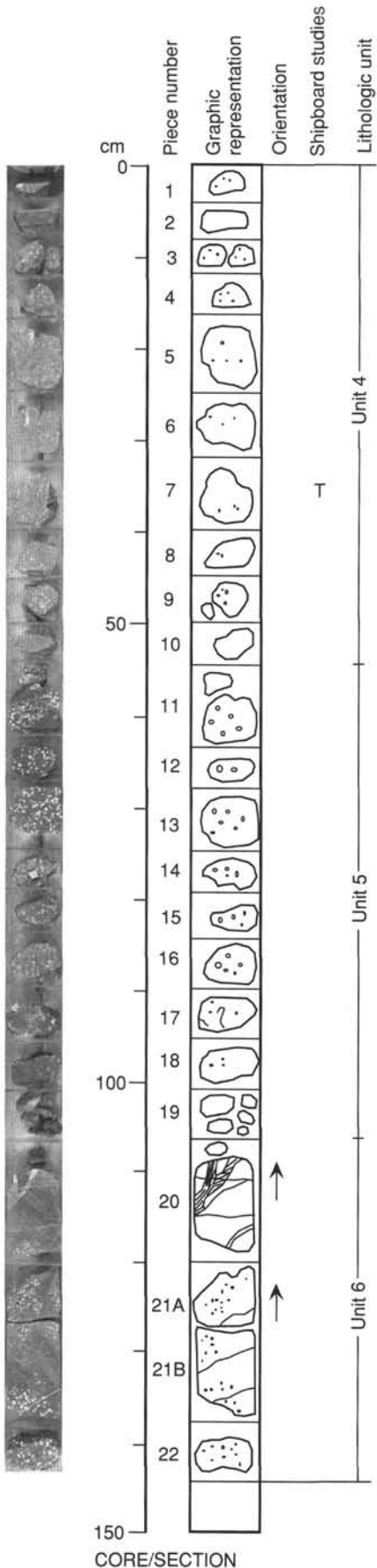
**GROUNDMASS:** Very fine-grained.

**VESICLES:** 25%; 1-3 mm; irregular; disseminated; filled with white minerals.

**COLOR:** Dusky red (10R 3/2).

**ALTERATION:** Strongly altered and oxidized.

CORE/SECTION



**UNIT 4: OLIVINE-PHYRIC BASALT**

**Pieces 1 and 3-10**

**CONTACTS:** Unit 5 below Piece 10.

**PHENOCRYSTS:** Olivine - 5%-10%; 1-2 mm; completely replaced by dark clays.

**GROUNDMASS:** Medium- to fine-grained plagioclase laths, subhedral pyroxene, and olivine altered to iddingsite.

**VESICLES:** 1%-2%; 0.5-2 mm; irregular; filled with zeolite.

**COLOR:** Light gray (5Y 6/1).

**ALTERATION:** Moderate.

**ADDITIONAL COMMENTS:** Piece 2 appears to be a drill fragment.

**UNIT 5: OLIVINE-PHYRIC BASALT**

**Pieces 11-19**

**PHENOCRYSTS:** Olivine - 0-30%; up to 3 mm; completely altered.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 5%-15%; 1-10 mm; round to irregular; disseminated; filled with zeolite in the upper part and filled with yellowish clay further down. Some vesicles contain zeolites of varying shades from white to almost black.

**COLOR:** Dark reddish-brown (5YR 4/1) at the top to reddish-brown (5YR 3/2) further down.

**ALTERATION:** Strong; the rock is thoroughly altered and oxidized.

**VEINS/FRACTURES:** One side of Piece 17 is a vein filled with yellowish brown clay.

**ADDITIONAL COMMENTS:** The amount of olivine increases down through the unit, from almost nil in Pieces 11-16 to very high in Pieces 17-19.

**UNIT 6: APHYRIC OLIVINE BASALT**

**Pieces 20-22**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Extremely fine-grained.

**VESICLES:** 5%; 1-5 mm; round to ameboid; grouped in patches that are 15% vesicles; filled with white zeolite minerals.

**COLOR:** Dark reddish brown (2.5Y 4/2).

**ALTERATION:** The rock is oxidized.

**VEINS/FRACTURES:** 1%; <1 mm; horizontal and 30 degrees; filled with white zeolite; Piece 20 has a 2-cm-wide fracture that splits into two 1 cm branches at the top of the piece and is filled with angular fragments of the basalt in a matrix of white zeolite minerals.

**ADDITIONAL COMMENTS:** Piece 20 is very close to, or may actually be, the flow top for Unit 6.

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UNIT 6: APHYRIC OLIVINE BASALT

Pieces 1-18

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

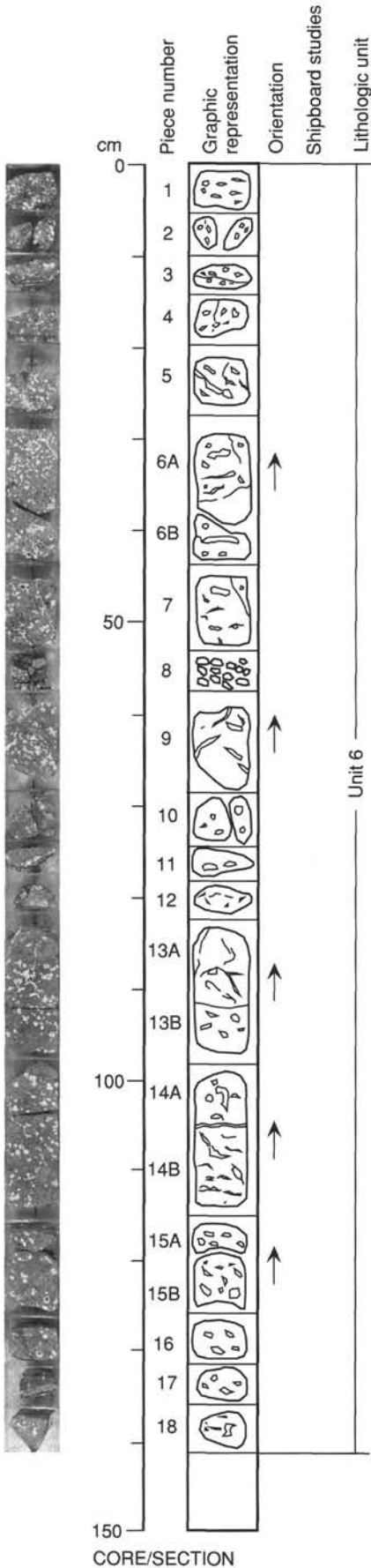
**VESICLES:** 15%; 2 mm to 2.5 cm; round to amoeboid; random; most are filled with white zeolite minerals, a few with pale blue clay; larger vesicles are incompletely filled.

**COLOR:** Reddish brown (10YR 3/2) at the top grading to dark gray (10Y 4/1) at the base.

**ALTERATION:** Pieces 1-12 are oxidized and Pieces 13-18 are fairly fresh.

**VEINS/FRACTURES:** <1%; 1 mm; subvertical; filled with white zeolite minerals.

**ADDITIONAL COMMENTS:** This is the upper to central portions of the lava flow of Unit 6.



**UNIT 6: APHYRIC OLIVINE BASALT**

**Pieces 1–22**

**PHENOCRYSTS:** None.

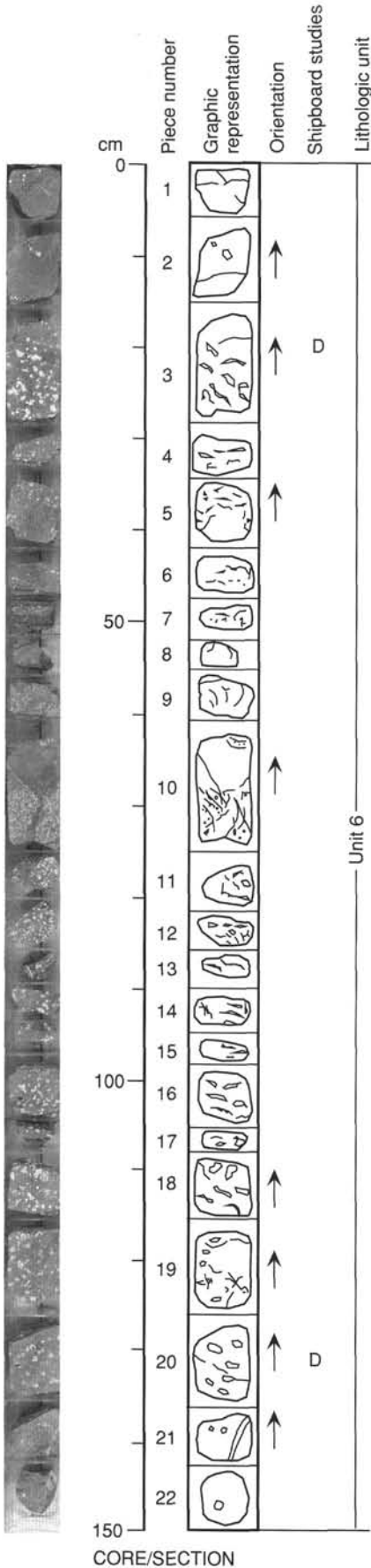
**GROUNDMASS:** Moderately fine-grained.

**VESICLES:** 1 mm–2 cm; round to amoeboid; extremely variable distribution, Pieces 1, 2, 21, and 22 have <1%, whereas the other pieces have 3%–10%; vesicles are filled with white and pink zeolite minerals.

**COLOR:** Dark gray (10Y 4/1).

**ALTERATION:** The rock is fairly fresh; more massive portions (Pieces 1, 2, 21, and 22) appear to be fresher.

**ADDITIONAL COMMENTS:** This is the central portion of the flow of Unit 6.



152-917A-8R-4

UNIT 6: APHYRIC OLIVINE BASALT

Pieces 1-11

**CONTACTS:** The basal contact of the flow of Unit 6 occurs in Piece 11 at 68 cm. The contact slopes 15 degrees. The lower 3 cm of the flow of Unit 6 has 50% vesicles that are 1 mm in diameter, round to slightly flattened in shape, and filled with white zeolite minerals.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Moderately fine-grained in Pieces 1-4; gets finer close to Piece 11.

**VESICLES:** 1 mm to 1 cm; round to ameboid; Pieces 1-4 have <1% vesicles and Pieces 5-10 have 10%.

**COLOR:** Dark gray (N 4/0).

**ALTERATION:** The massive portions appear fairly fresh (Pieces 1-4).

**ADDITIONAL COMMENTS:** This is the lower portion of the flow of Unit 6.

UNIT 7: APHYRIC OLIVINE BASALT

Pieces 11-24

**CONTACTS:** A very well-preserved upper contact is seen in Piece 11 at 69 cm. It is undulating, slightly sloping with a dip of 15 degrees. Zeolites are sparse in the upper 2 cm, but an up to 5-mm-wide zeolite vein sits at the very contact to the overlying flow. 5-13 cm below the top occur some 1-3 cm large irregular-flattened vesicles lined with zeolite and filled with calcite.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained, with plagioclase, pyroxene, altered olivine, and interstitial blue material.

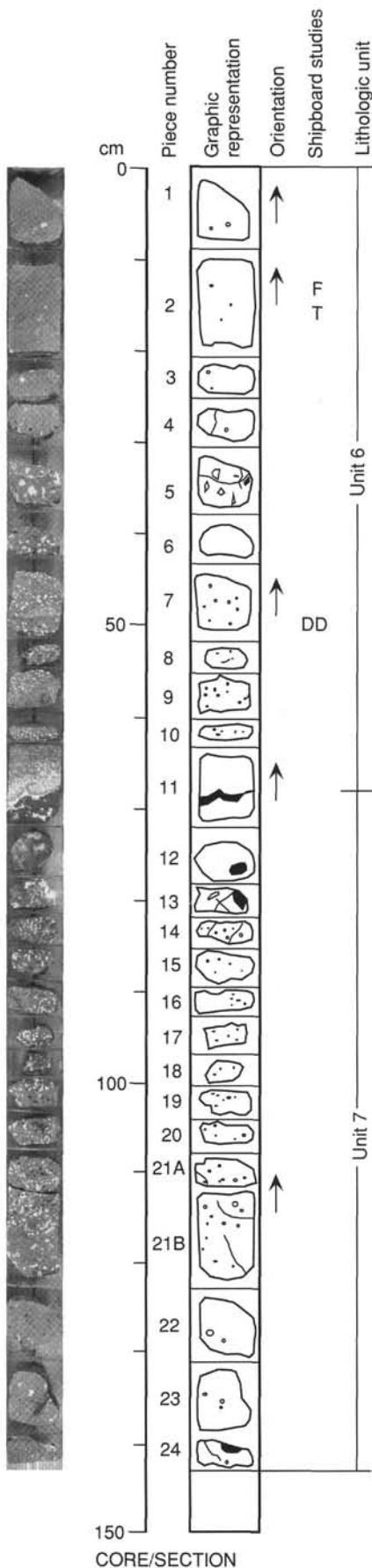
**VESICLES:** 2%-10%; 1-10 mm; rounded to elongated shape; distributed in trains; some vesicles are lined with white zeolite and filled with light brownish chabazite. Other vesicles have a thin lining of blue material and are otherwise empty. Vesicles are frequent (10%) at 109-117 cm (Pieces 21A and 21B) and sparse (2%) at 122-130 cm. Some singular large vesicles occur at 133 and 140 cm; these are 2 cm across, flat, lined with 1-2 mm chabazite and otherwise empty.

**COLOR:** Dark gray (5Y 4/1); reddened flow-top (5YR 3/1).

**STRUCTURE:** Massive except for the vesicles.

**ALTERATION:** The rock is moderately altered; the uppermost 16 cm are oxidized.

**VEINS/FRACTURES:** <1%; up to 1 mm thick and 1-5 cm long; oblique, variable orientation; filled with white zeolite.



**UNIT 7: APHYRIC OLIVINE BASALT**

**Pieces 1A-1C**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained; plagioclase, pyroxene, altered olivine, and interstitial blue material.

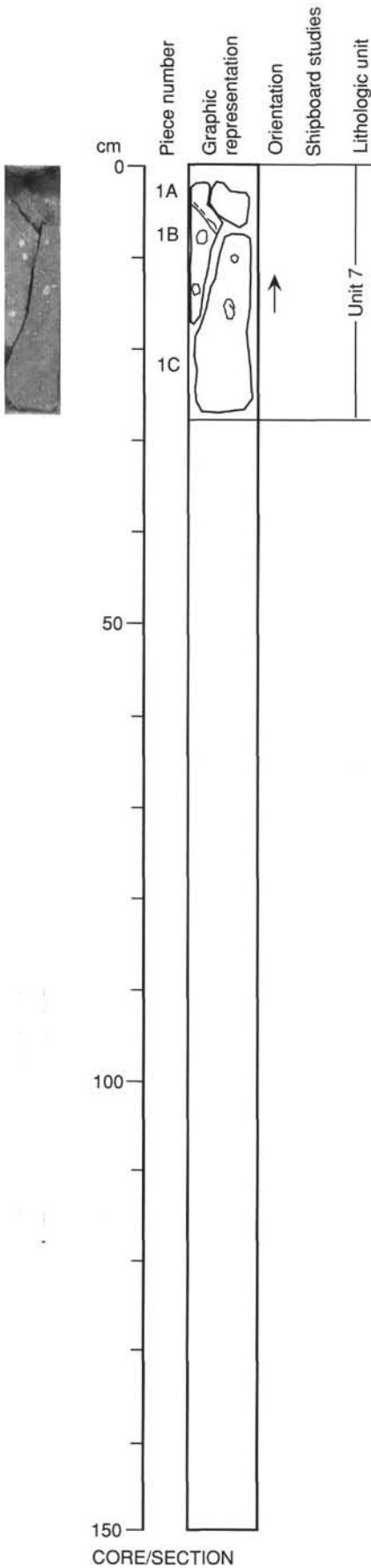
**VESICLES:** 2%; 1 mm and 1 cm; round; disseminated; a few 1-cm-large vesicles are scattered throughout.

**COLOR:** Dark gray (5Y 4/1).

**STRUCTURE:** Massive except for the vesicles.

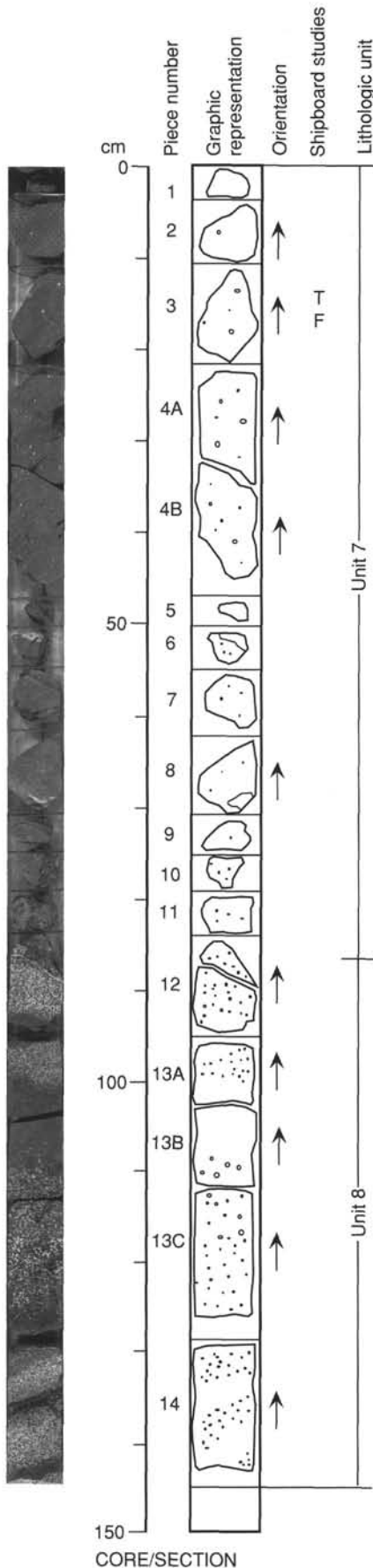
**ALTERATION:** The rock is moderately altered.

**VEINS/FRACTURES:** <1%; 0.5 mm thin, 15 cm long; steep; fractures filled with white zeolite.





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**UNIT 7: APHYRIC OLIVINE BASALT**

**Pieces 1–12**

**CONTACTS:** The basal contact of the flow of Unit 6 is exposed in Piece 12 at 85 cm. The base of the flow is extremely fine-grained and massive and appears to be chilled against the underlying flow (Unit 7). 3 mm from the contact there are a few irregular shaped vesicles (1x3 mm in size) that are filled with white and pink zeolite minerals.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained and composed of plagioclase, pyroxene, altered olivine, and interstitial blue-gray clay.

**VESICLES:** 2%; 0.5–2 mm; round; random; filled with either white zeolite minerals or blue-gray clay; Pieces 6 and 8 each have a 3 cm vug that is filled with a pale pinkish orange zeolite mineral (chabazite?).

**COLOR:** Dark gray (N 4/0) with bluish gray (5B 5/1).

**ALTERATION:** The rock is slightly altered and the olivine is altered to clay.

**UNIT 8: APHYRIC OLIVINE BASALT**

**Pieces 12–14**

**CONTACTS:** The upper contact is preserved at 86 cm in Piece 12. The reddened, highly vesicular top is directly overlain by a gray fine-grained lava.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained; very small plagioclase laths are discernible.

**VESICLES:** 0–50%; 1–3 mm; round shape; irregular distribution; the vesicles are filled with white zeolite; a few are empty except for a thin blue lining.

**COLOR:** Very dark gray (5YR 3/1).

**STRUCTURE:** The vesicles occur in flat-lying, slightly dipping trains with 30%–50% vesicles, separated by nearly vesicle-free areas. The vesicle-rich trains are 8–35 cm wide, and the massive zones are 1–9 cm wide. Massive zones occur at 93–94, 100–109, 136–137, and 142–143 cm.

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** One 2–4-mm-wide flat-lying zeolite-filled vein occurs 2–3 cm below the top surface.

**UNIT 8: APHYRIC OLIVINE BASALT**

**Pieces 1A-10**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained; small plagioclase laths and blue interstitial material are discernible.

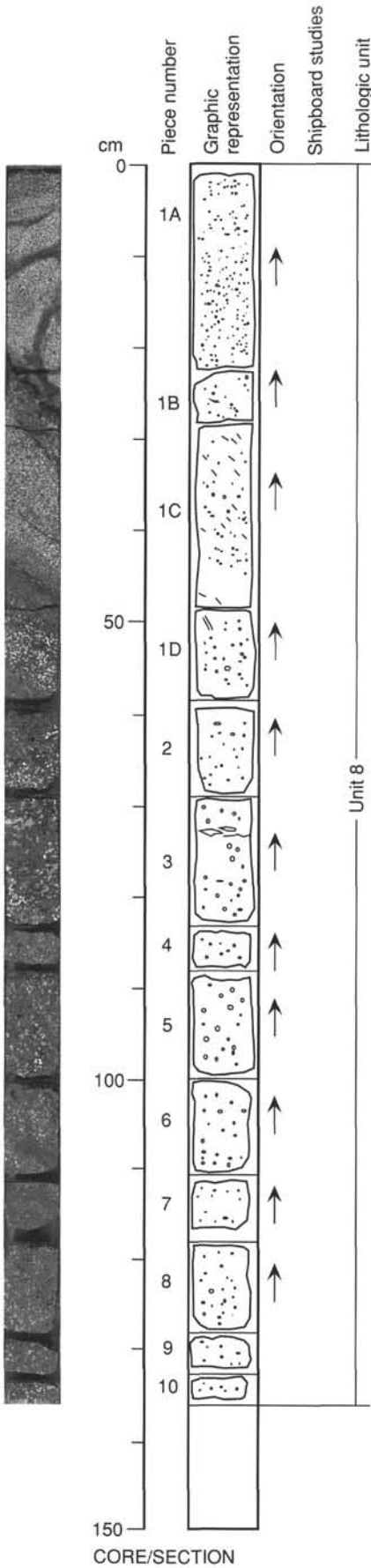
**VESICLES:** 5%-50%; 1-3 mm and up to 3 cm; round or irregular shape; irregular distribution; the vesicles are filled with white zeolite; a few are empty except for a thin blue lining. Large irregular vesicles have light brown centers of chabazite.

**COLOR:** Dark gray (N 4/0).

**STRUCTURE:** At 0-50 cm the vesicles occur in steep swirls 4-12 cm wide separated by 1-cm-wide dark areas where the vesicles are filled with bluish-gray material. Below 50 cm the vesicles are 2-3 mm across and more evenly scattered. Large irregular vesicles occur at 70-80 cm.

**ALTERATION:** Moderate.

**ADDITIONAL COMMENTS:** The swirling pattern probably reflects the original flow structure (with pahoehoe tongues) of the lava.



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UNIT 8: APHYRIC OLIVINE BASALT

Pieces 1-20

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained; stubby plagioclase and blue interstitial material are discernible.

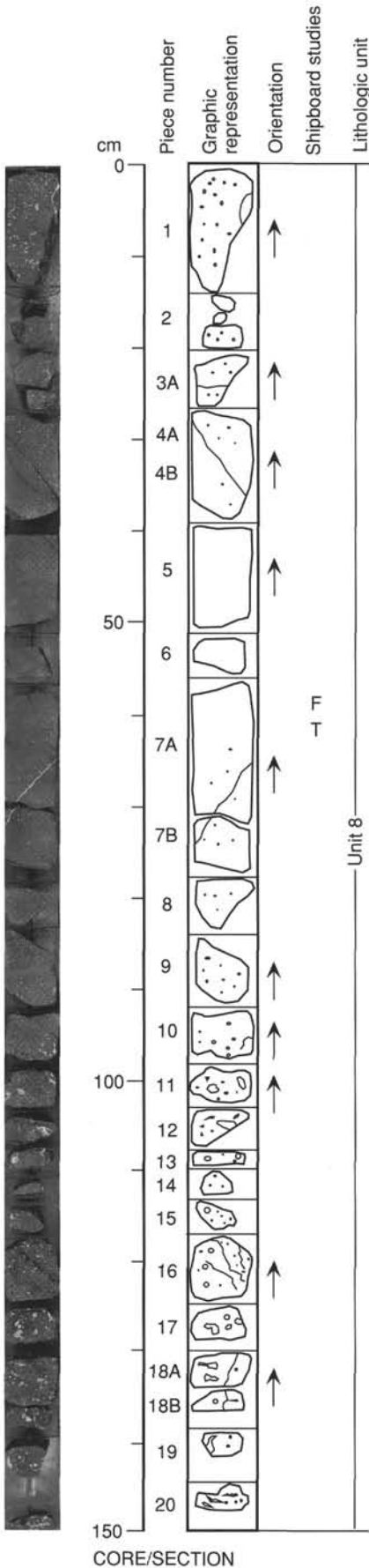
**VESICLES:** 0-10%; 1-10 mm; round or irregular shape; irregular distribution; the vesicles are lined and filled with zeolite.

**COLOR:** Dark gray (N 4/0).

**STRUCTURE:** There are 5% 2-mm-large vesicles at 0-14 cm; at 40-62 mm there are no vesicles; below 100 cm a few large 6-10 mm vesicles are seen among the smaller ones.

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** <1%; 0.1-2 mm wide, up to 10 cm long; steeply inclined; the fractures are filled with white zeolite.



**UNIT 8: APHYRIC OLIVINE BASALT**

**Pieces 1–16B**

**CONTACTS:** The bottom contact is well preserved in Piece 16C at 143 cm. No chill phenomena are seen at the contact, but a 2–4-mm-wide contact zone shows bleaching.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained; plagioclase, pyroxene, altered olivine, and blue interstitial material are discernible.

**VESICLES:** 0–10%; 1–5 mm; round shape; irregular distribution; the vesicles are lined and filled with zeolite.

**COLOR:** Dark gray (N 4/0).

**STRUCTURE:** The upper 54 cm (Pieces 1–8) have 5%–10% of 2–5 mm vesicles; the lower part has considerably fewer vesicles.

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** 1%–2%; 1–10 mm; vertical and steep; a few horizontal; prominent very steep to vertical fractures are seen in the lower part of the flow, at 80–143 cm. These fractures are filled with calcite cement. The lava is unaltered right up to the fractures.

**UNIT 9: APHYRIC OLIVINE BASALT**

**Piece 16C**

**CONTACTS:** The upper contact of the flow of Unit 9 is at 143 cm.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Extremely fine-grained.

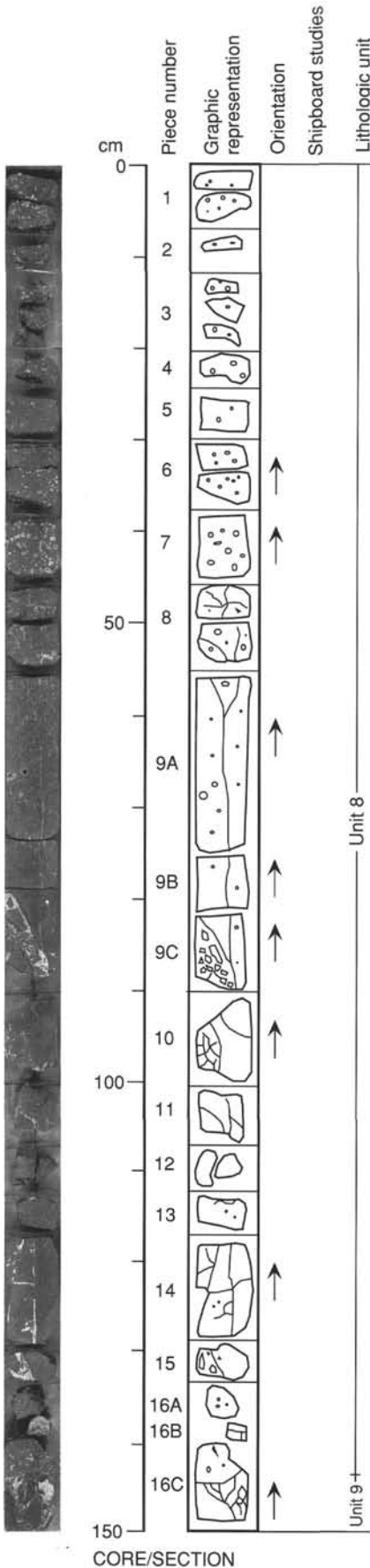
**VESICLES:** None.

**COLOR:** Reddish brown (5YR 3/4) except for the upper 1 cm, which is red (2.5YR 4/8).

**ALTERATION:** The whole rock is oxidized and the top 1 cm appears to be baked.

**VEINS/FRACTURES:** 10%; 1 mm to 2 cm; overall roughly vertical; the rock is slightly brecciated and all the spaces between the fragments are filled with calcite; there are no alteration halos around the calcite-filled fractures.

**ADDITIONAL COMMENTS:** The calcite-filled fractures appear to have been formed much later than the lavas.



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UNIT 9: APHYRIC OLIVINE BASALT

Pieces 1-14

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

**VESICLES:** Vesicles filled with blue-gray clay are 1-5 mm in diameter and are round to amoeboid in shape, and vesicles filled with pink and white zeolite minerals are 1 mm to 1 cm in diameter and round to amoeboid in shape. Pieces 10-12 have 5% vesicles that are mainly clay filled. Piece 13 has 50% vesicles that are filled with white zeolite minerals. The other pieces have 5%-10% vesicles of both types.

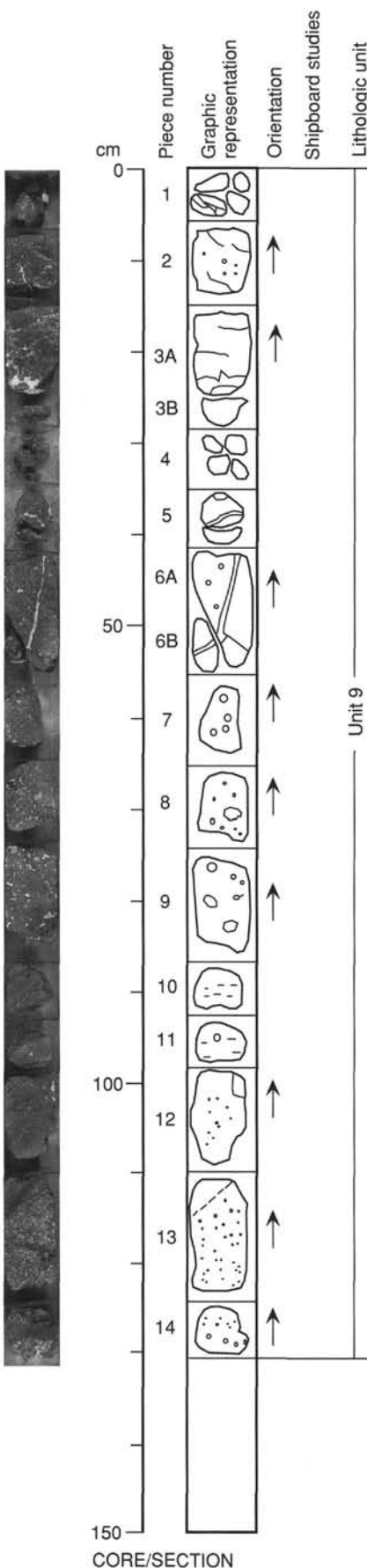
**COLOR:** Pieces 7-11 are dark gray (N 4/0) with bluish gray (5B 5/1), whereas Pieces 1-6 are reddish gray (5YR 4/1).

**STRUCTURE:** Pieces 10, 13, and 14 have banding defined by vesicle trains.

**ALTERATION:** Pieces 1-3 are oxidized; Pieces 4-6 are slightly oxidized; Pieces 7-14 are slightly altered.

**VEINS/FRACTURES:** Pieces 2, 3, 5, and 6 have calcite-filled fractures that are 1 mm to 1.5 cm wide. The basalt in the fractures in Pieces 2 and 3 is brecciated.

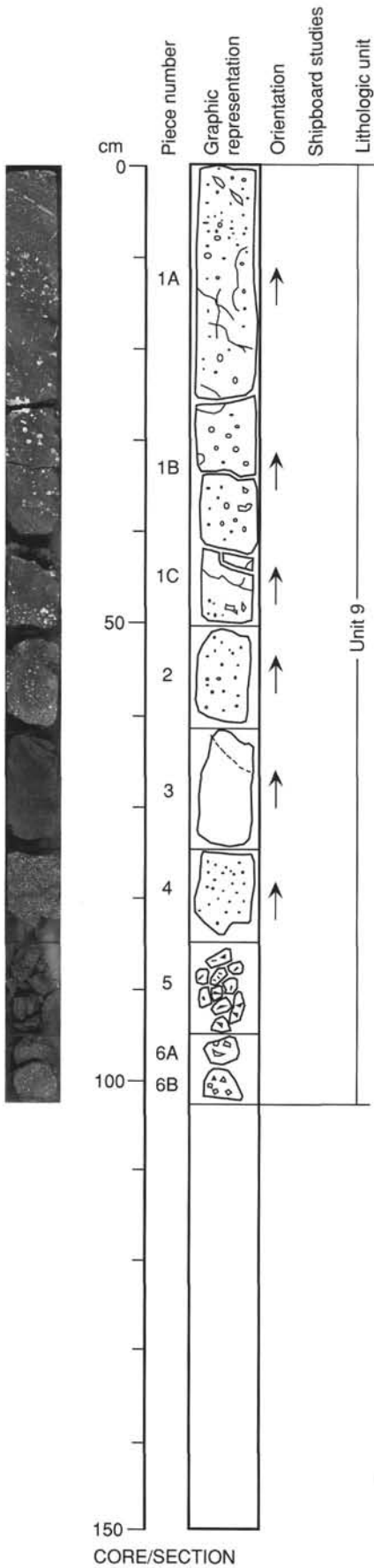
**ADDITIONAL COMMENTS:** This is the upper and central portion of the flow of Unit 9.



**UNIT 9: APHYRIC OLIVINE BASALT**

**Pieces 1A-6B**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 1%-30%; occur in localized bands with abundances varying from piece to piece.  
**COLOR:** Medium gray (N 6/0).  
**ALTERATION:** Light.  
**VEINS/FRACTURES:** There are a few small veins and two 5 mm fractures in Piece 1. All are filled with zeolite.  
**ADDITIONAL COMMENTS:** Three shades of zeolite are evident: white, light green, and tan. The tan is restricted to the larger fractures.



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UNIT 9: APHYRIC OLIVINE BASALT

Pieces 1A-2

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained; plagioclase and blue-green interstitial material are discernible.

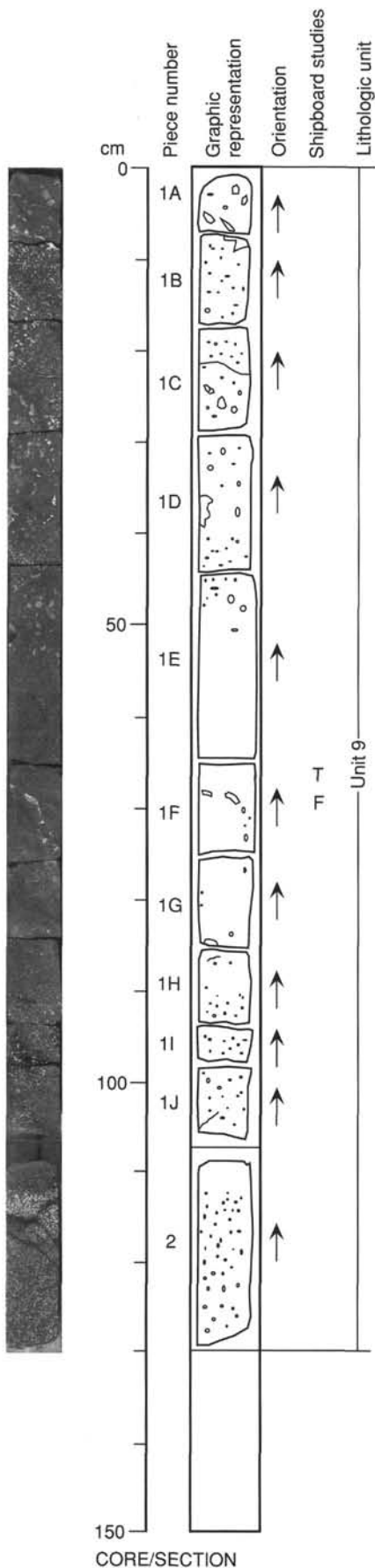
**VESICLES:** 0-50%; 1-6 mm; round to irregular shape; irregular distribution; the vesicles are filled with white zeolite; the larger vesicles (>4 mm) are lined with white and filled with light brownish zeolite.

**COLOR:** Dark greenish gray (5G 4/1) to dark gray (N 4/0).

**STRUCTURE:** The vesicles come in trains at 1-25, 70, 90-105, and 112-129 cm. A large (2 cm) irregular vesicle occurs at 37-38 cm. The rock is relatively vesicle-free at 54-85 cm.

**ALTERATION:** Moderate to strong.

**VEINS/FRACTURES:** One 1-mm-wide horizontal fracture filled with white zeolite occurs at 22 cm.



**UNIT 9: APHYRIC OLIVINE BASALT**

**Pieces 1A-5D**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained; plagioclase and blue-green interstitial material are discernible.

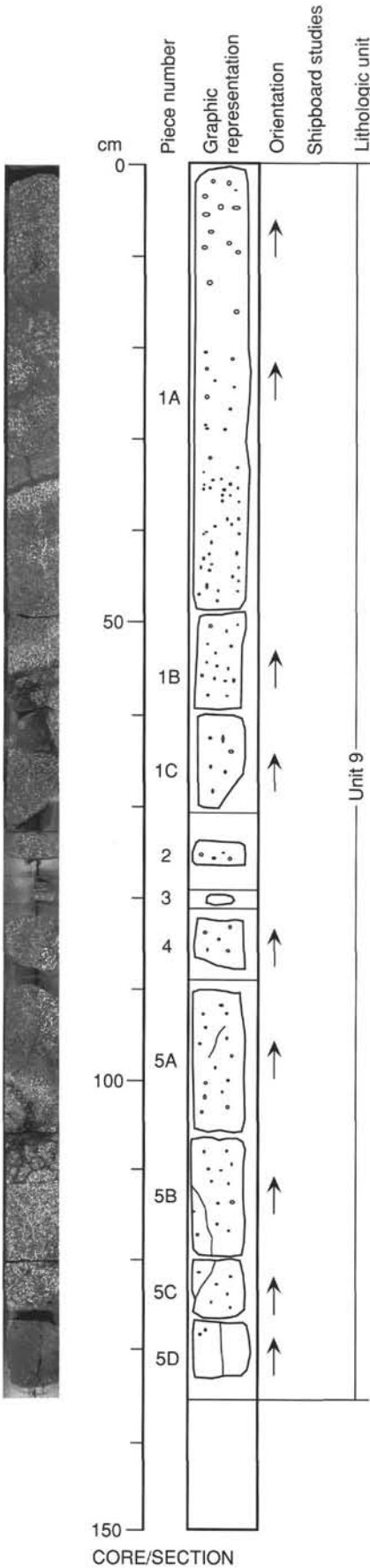
**VESICLES:** 5%-50%; 1-4 mm; rounded shape; irregular distribution; the vesicles are filled with white zeolite.

**COLOR:** The groundmass color is dark gray (N 4/0).

**STRUCTURE:** The vesicles come in flat-lying trains 15-30 cm wide. There are very few vesicle-poor areas.

**ALTERATION:** Moderate to strong.

**VEINS/FRACTURES:** 1-2-mm-wide, zeolite-filled, near-vertical fractures run along the length of the core.





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**UNIT 9: APHYRIC OLIVINE BASALT**

**Pieces 1A–8B**

**CONTACTS:** None. The bottom of Piece 8B is considered to be close to the flow bottom. It is very finely vesicular.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained; plagioclase and blue-green interstitial material are discernible.

**VESICLES:** 0–40%; 1–6 mm; rounded shape; irregular distribution; the vesicles are filled with white zeolite.

**COLOR:** Dark gray (N 4/0).

**STRUCTURE:** The vesicles come in flat-lying trains about 30 cm wide. Only at 70–80 cm is the rock fairly vesicle-free.

**ALTERATION:** Moderate to strong.

**VEINS/FRACTURES:** Several 1–5-mm-wide, calcite-filled, steep to irregular fractures cut the rock. The fracturing has produced cavities filled with calcite crystals. Well-developed dog-tooth-spar crystals are seen at the bottom of Piece 2 and at the top of Piece 3.

**UNIT 10: APHYRIC OLIVINE BASALT**

**Pieces 9A–9B**

**CONTACTS:** None. The top of Piece 9A is reddish and fine-grained and is considered to be close to a flow top.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Very fine-grained.

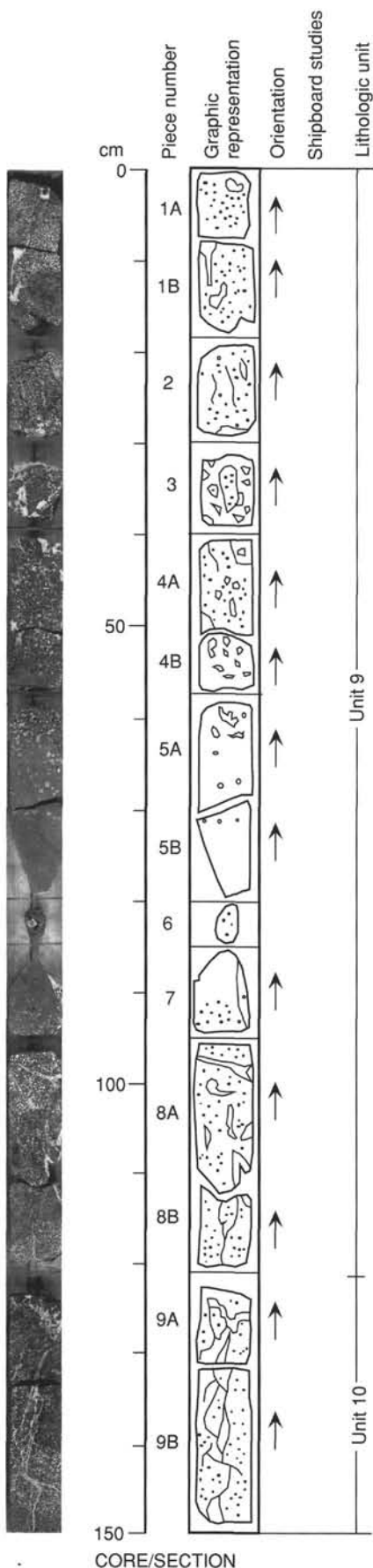
**VESICLES:** 5%–20%; 1–3 mm; rounded shape; irregular distribution; the vesicles are filled with white zeolite.

**COLOR:** Very dark gray (5YR 3/1).

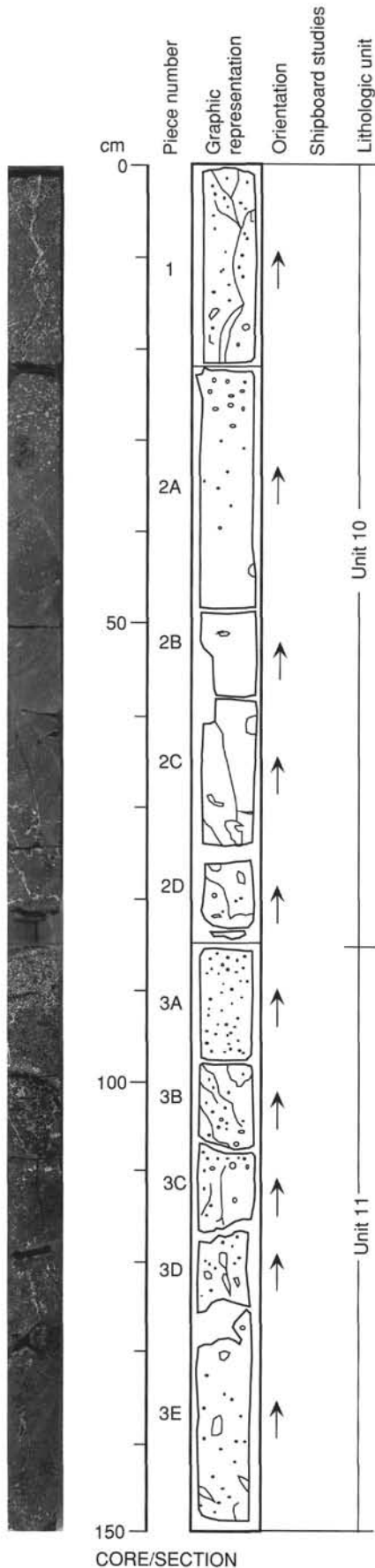
**STRUCTURE:** The amount of vesicles increases down through the piece.

**ALTERATION:** Strong.

**VEINS/FRACTURES:** Several 1–5-mm-wide, calcite-filled, steep to irregular fractures cut the rock.



CORE/SECTION



**UNIT 10: APHYRIC OLIVINE BASALT**

**Pieces 1-2D**

**CONTACTS:** None. The bottom of the piece is considered to be close to a flow-bottom.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 1%-30%; 1-4 mm; rounded shape; irregular distribution; the vesicles are filled with white zeolite.  
**COLOR:** Dark gray (5Y 4/1).  
**STRUCTURE:** There are 20%-30% vesicles in the interval 0-30 cm and 1%-5% vesicles in the interval 30-70 cm.  
**ALTERATION:** Strong.  
**VEINS/FRACTURES:** 1-4-mm-wide, steep, calcite-filled fractures occur in the 0-20 and 60-80 cm intervals. The intervening interval is fracture-free.

**UNIT 11: APHYRIC OLIVINE BASALT**

**Pieces 3A-3E**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained; oxidized throughout upper portion of piece.  
**VESICLES:** 1%-50%; 1-10 mm; rounded; concentrated in the upper portion of the unit. Most are filled with zeolite, though others are lined with bluish clay.  
**COLOR:** Reddish gray (5YR 4/2).  
**ALTERATION:** Light to moderate.  
**VEINS/FRACTURES:** Numerous thin (1 mm) vertical and subvertical veins. One large fracture at 130 cm is filled with euhedral tan zeolite and a fine, feathery white zeolite.

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UNIT 11: APHYRIC OLIVINE BASALT

Pieces 1-5D

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained; plagioclase laths and greenish blue alteration minerals can be discerned.

**VESICLES:** 1%-50%; 1-5 mm; rounded to irregular; variable distribution throughout rock. Most are filled with white and tan zeolite. Larger vesicles are lined with euhedral zeolite crystals.

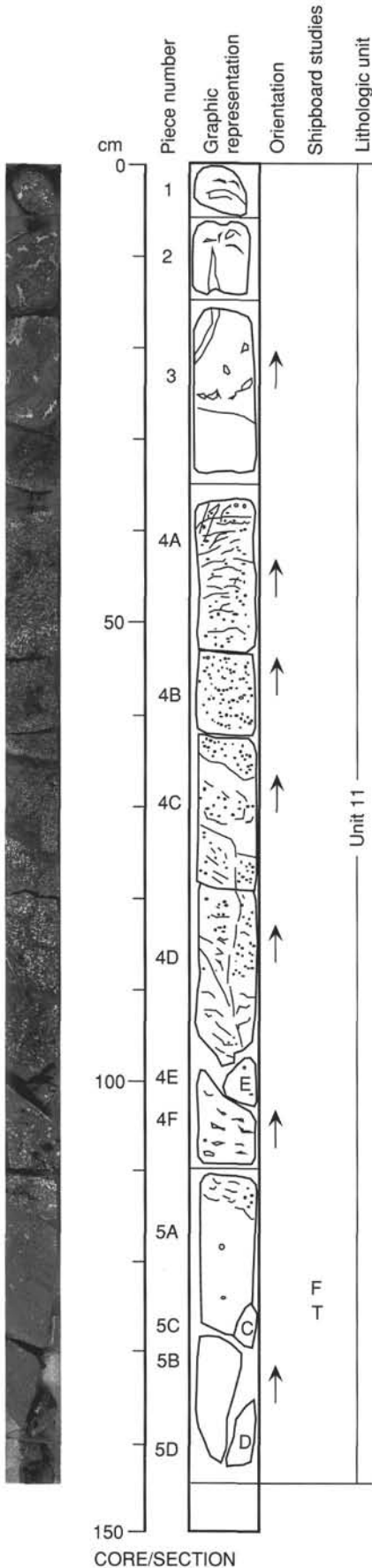
**COLOR:** Light gray to reddish gray.

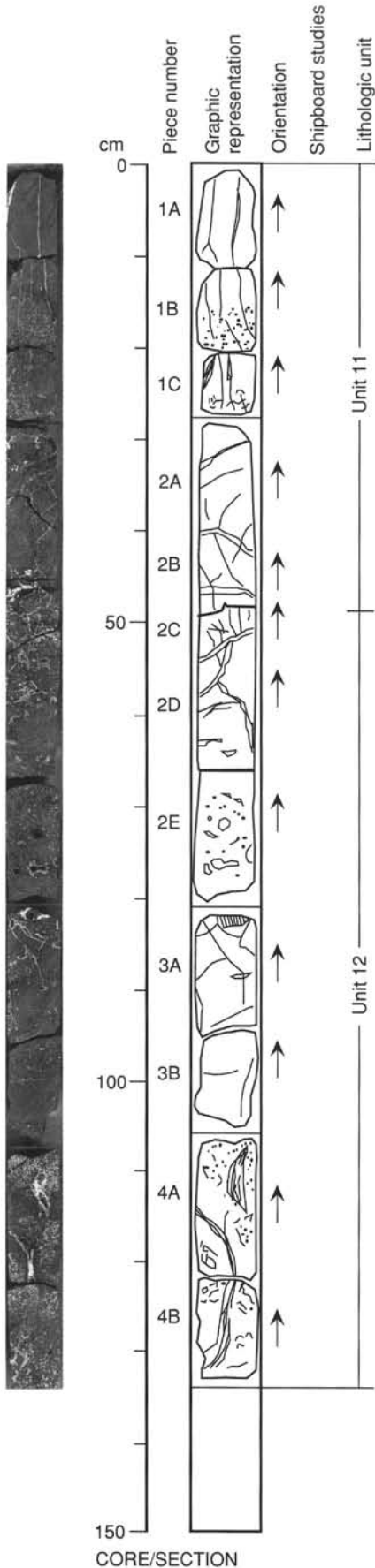
**STRUCTURE:** Pahoehoe lobes can be distinguished.

**ALTERATION:** Moderate; variable oxidation of the groundmass.

**VEINS/FRACTURES:** 15-mm-wide fracture in Pieces 1 and 2 filled with zeolite; smaller veins of zeolite cut most pieces.

**ADDITIONAL COMMENTS:** Piece 5 has the fewest vesicles and is the freshest piece within the section.





**UNIT 11: APHYRIC OLIVINE BASALT**

**Pieces 1A–2C**

**CONTACTS:** Piece 2C exhibits contact with brecciated top of Unit 12.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained; plagioclase laths can be distinguished.

**VESICLES:** 1%–30%; 1–3 mm; rounded to irregular; distinct band of vesicles in Pieces 1B and 1C; very few in Piece 1A; all filled with zeolite.

**COLOR:** Medium gray (N 5/0).

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** Large vertical fracture through Piece 1; numerous veins in all pieces, increasing towards contact with the next unit.

**ADDITIONAL COMMENTS:** Contact in Piece 2C exhibits extensive brecciation with zeolite infilling of interstices.

**UNIT 12: APHYRIC OLIVINE BASALT**

**Pieces 2C–4B**

**CONTACTS:** Contact with Unit 11 exhibited in Piece 2C.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 5%–50%; 1–10 mm; rounded to irregular; variable distribution; filled or lined with zeolite; larger vugs in Piece 2E.

**COLOR:** Reddish gray (5YR 3/2).

**ALTERATION:** Moderate; variable oxidation.

**ADDITIONAL COMMENTS:** Highly brecciated at top of unit, contact with chilled margin of Unit 11; small brecciated areas in Piece 4B; numerous small veins, all zeolite-filled; some calcite in larger fractures.

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UNIT 12: APHYRIC OLIVINE BASALT

Pieces 1A-3

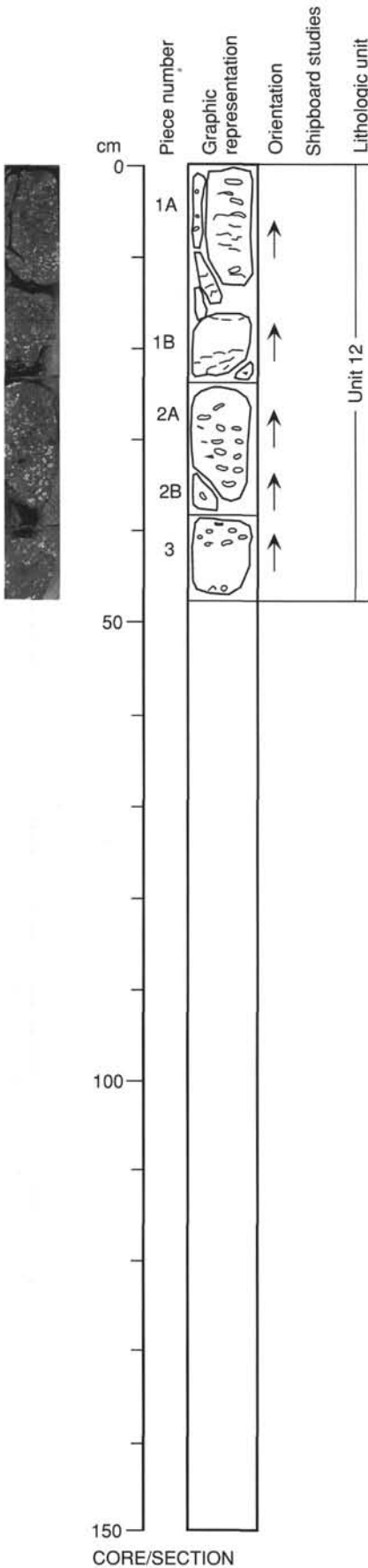
**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained; plagioclase, pyroxene, and olivine (altered to iddingsite).

**VESICLES:** 10%–15%; 5–10 mm; rounded to irregular; even distribution; filled or lined with tan to pink zeolite and clays.

**COLOR:** Medium gray (N 5/0).

**ALTERATION:** Moderate.



**UNIT 12: APHYRIC OLIVINE BASALT**

**Pieces 1-5C**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

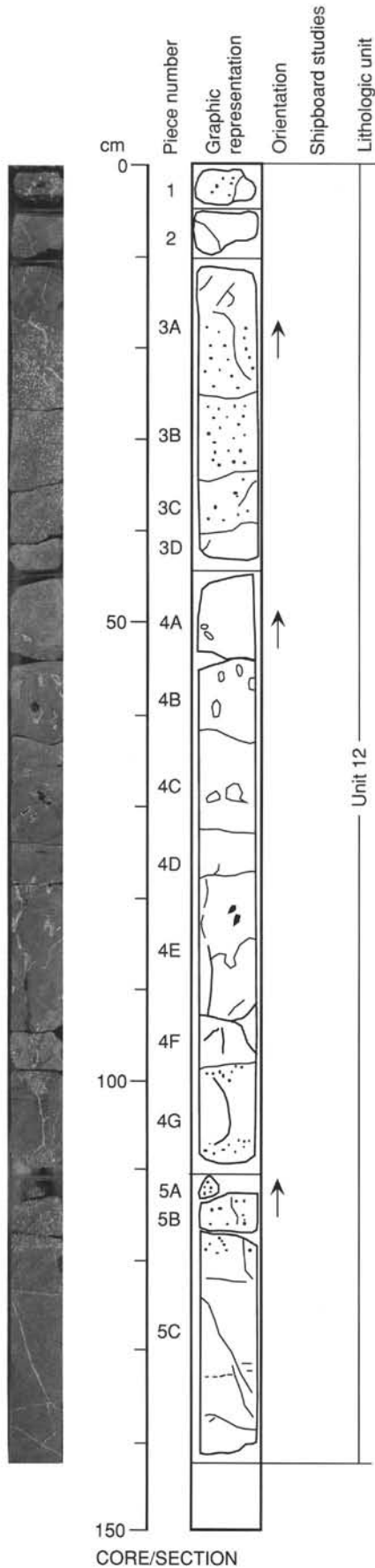
**VESICLES:** 1%-20%; 1-20 mm; rounded to irregular; band of small vesicles in Pieces 3 and 5; large zeolite and calcite-filled cavities in Piece 4.

**COLOR:** Medium gray (N 4/0).

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** Large (5-10 mm) subvertical fractures in Pieces 4 and 5 filled with zeolite and calcite.

**ADDITIONAL COMMENTS:** Calcite appears to have been deposited in the larger cavities after the zeolite.



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UNIT 12: APHYRIC OLIVINE BASALT

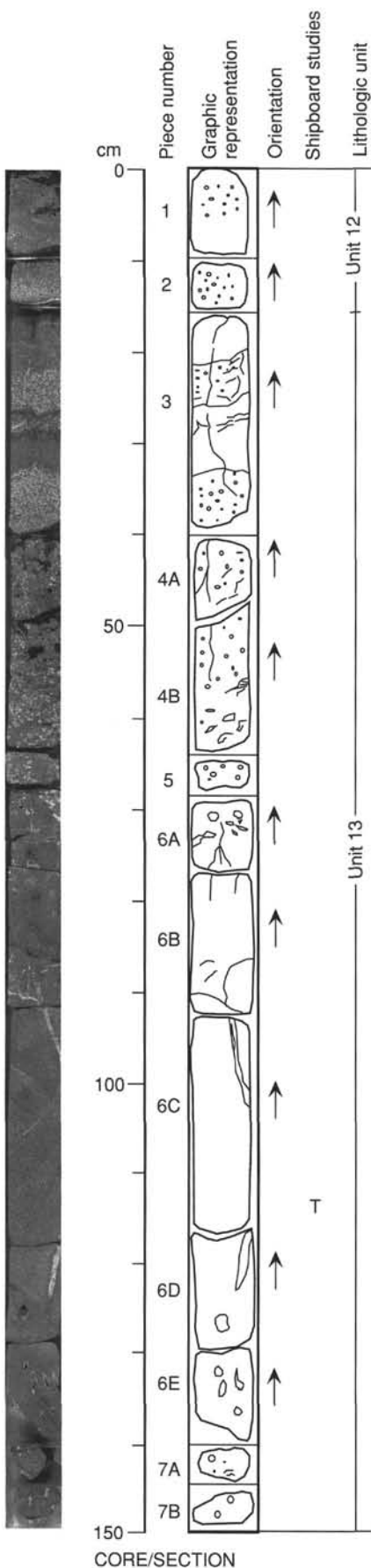
Pieces 1-2

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 20%-30%; 1-3 mm; rounded; evenly distributed; some are filled with white zeolite while the rest are empty.  
**COLOR:** Medium gray (N 4/0).  
**ALTERATION:** Moderate.  
**ADDITIONAL COMMENTS:** Lowest portion of Unit 12, but similar lithology to Unit 13.

UNIT 13: APHYRIC OLIVINE BASALT

Pieces 3-7B

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 1%-50%; 1-10 mm; rounded to irregular; appear as bands or larger vugs; vertical pipe vesicles in Piece 6E; all filled or lined with zeolite.  
**COLOR:** Medium gray (N 4/0).  
**STRUCTURE:** Some pahoehoe flow bands evident in Piece 3.  
**ALTERATION:** Moderate.  
**VEINS/FRACTURES:** 8 mm fracture in Piece 6C, lined with zeolite.  
**ADDITIONAL COMMENTS:** Piece 6C is free of vesicles and is relatively fresh at the 100-115 cm interval.  
 Vesiculation decreases downward through the section.



CORE/SECTION

**UNIT 13: APHYRIC OLIVINE BASALT**

**Pieces 1A-8**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

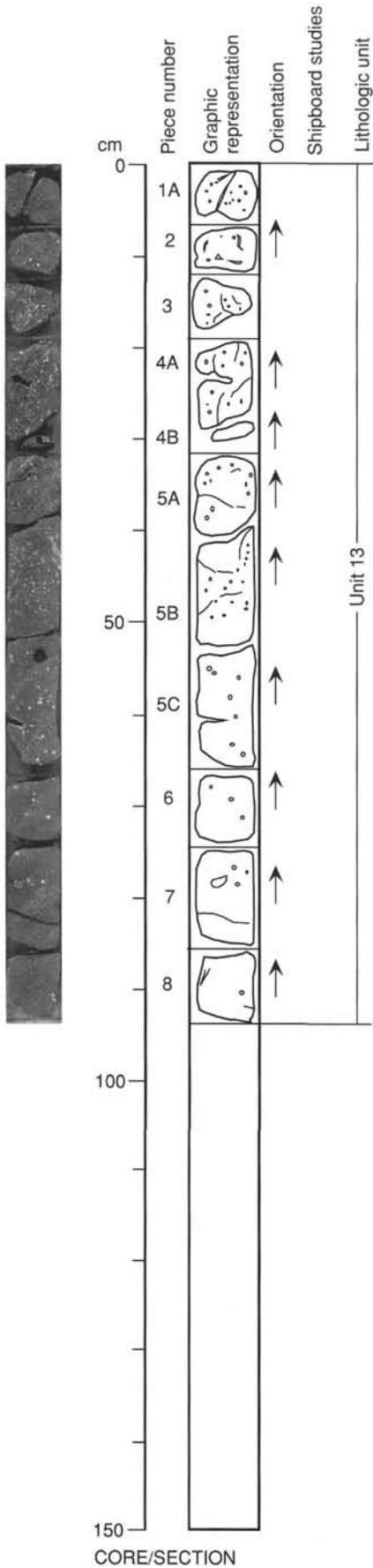
**VESICLES:** 1%-5%; 1-10 mm; rounded to irregular; smaller vesicles filled with light colored zeolite; 2 cm cavities in Pieces 4A and 5C are lined with euhedral tan zeolite crystals.

**COLOR:** Medium gray (N 4/0).

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** Few small zeolite veins in Piece 4.

**ADDITIONAL COMMENTS:** 2 cm kidney-shaped cavity in Piece 7 is lined with tan/yellow zeolite and filled with a bluish green clay or zeolite.





152-917A-11R-4

UNIT 13: APHYRIC OLIVINE BASALT

Pieces 1A-3C

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

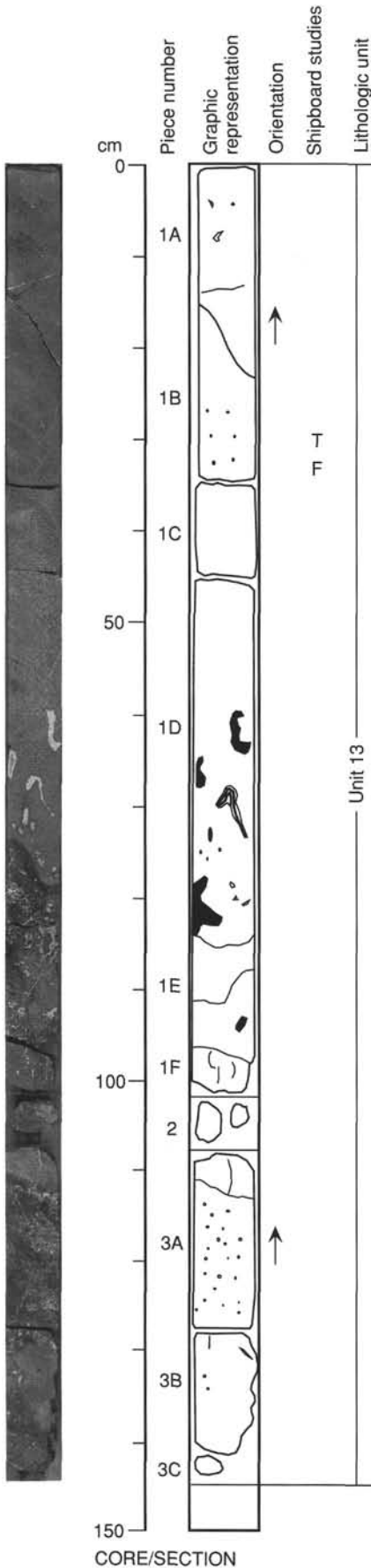
**VESICLES:** 1%-5%; 1-20 mm; rounded to irregular; larger zeolite-filled cavities in Piece 1D; smaller vesicles filled with bluish clay.

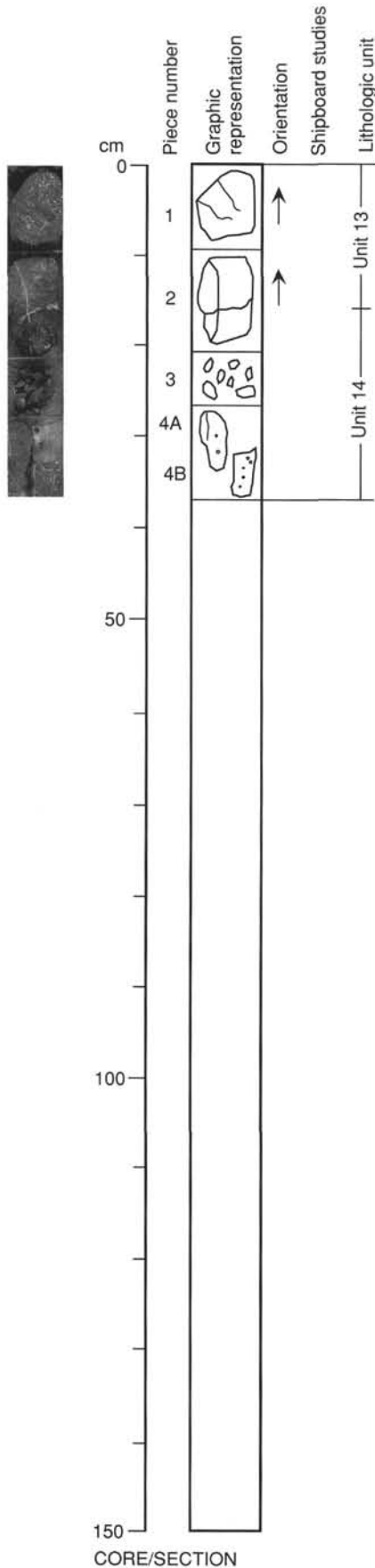
**COLOR:** Medium gray (N 4/0) to reddish brown in brecciated sections.

**STRUCTURE:** Massive to flow-brecciated.

**ALTERATION:** Moderate.

**ADDITIONAL COMMENTS:** Pieces 1 and 3 contain flow-brecciated regions at intervals 80-90 and 110-140 cm, consisting of brownish matrix mixed with zeolite veins and gray basalt fragments.





**UNIT 13: APHYRIC OLIVINE BASALT**

**Pieces 1-2**

**CONTACTS:** Lowermost part of Unit 13 seen in Piece 2.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 1%-10%; 1-5 mm; rounded to irregular; filled with white and tan zeolite.  
**COLOR:** Brownish gray (5YR 4/1)  
**STRUCTURE:** Flow-brecciated.  
**ALTERATION:** Moderate to high.  
**VEINS/FRACTURES:** 1-2 mm; veins of zeolite in all pieces.  
**ADDITIONAL COMMENTS:** Interpreted as the flow-brecciated base of a lava.

**UNIT 14: APHYRIC OLIVINE BASALT**

**Pieces 2-4B**

**CONTACTS:** The top of Unit 14 is seen in Piece 2.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 5%-15%; 1-5 mm; irregular; filled with white and tan zeolite.  
**COLOR:** Brownish gray (5YR 4/1).  
**ALTERATION:** Moderate; parts are highly oxidized.  
**ADDITIONAL COMMENTS:** Piece 3 consists of basaltic rubble.

152-917A-12R-1

UNIT 14: APHYRIC OLIVINE BASALT

Pieces 1-14

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 0-5%; 1-5 mm; irregular; filled with light colored zeolite; restricted to Pieces 1 and 7-14.

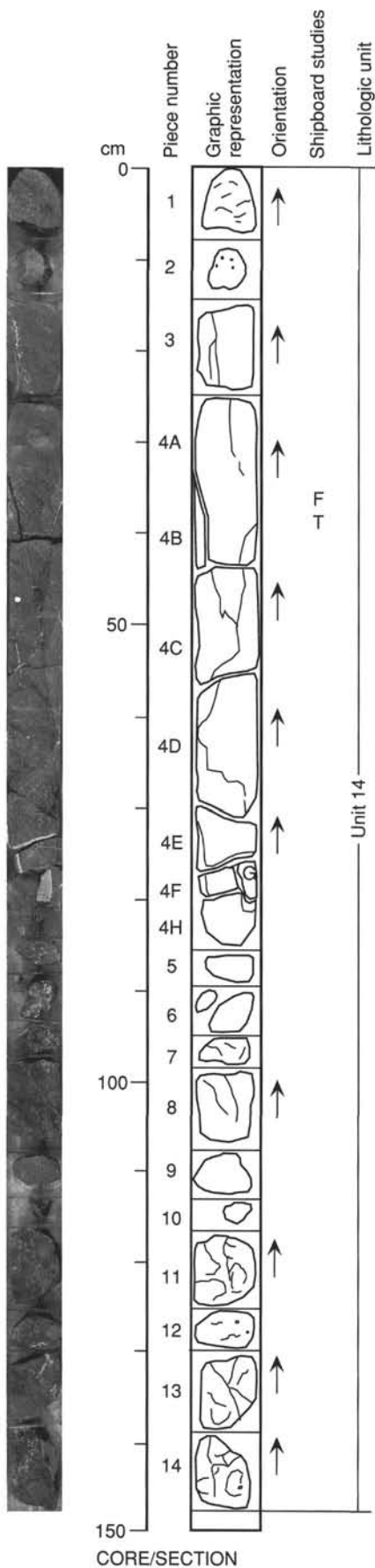
**COLOR:** Greenish gray (5GY 4/1) in massive parts; variable gray to reddish brown in brecciated parts.

**STRUCTURE:** Massive in Pieces 1-6 and 9; flow-brecciated in Pieces 7-8 and 10-14. The brecciated parts consist of 5-60 mm blocks of basalt in a fine matrix of zeolite veinlets and altered material.

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** Thin (2 mm) subvertical veins of white zeolite; 5 mm horizontal calcite vein at 80 cm.

**ADDITIONAL COMMENTS:** The section probably represents the central portion of a flow unit, grading down into the flow-brecciated base.



**UNIT 15: APHYRIC OLIVINE BASALT**

**Pieces 1A-10**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 1%–50%; 1–10 mm; rounded to irregular; filled with light colored zeolite; large cavity in Piece 3 lined with tan zeolite.

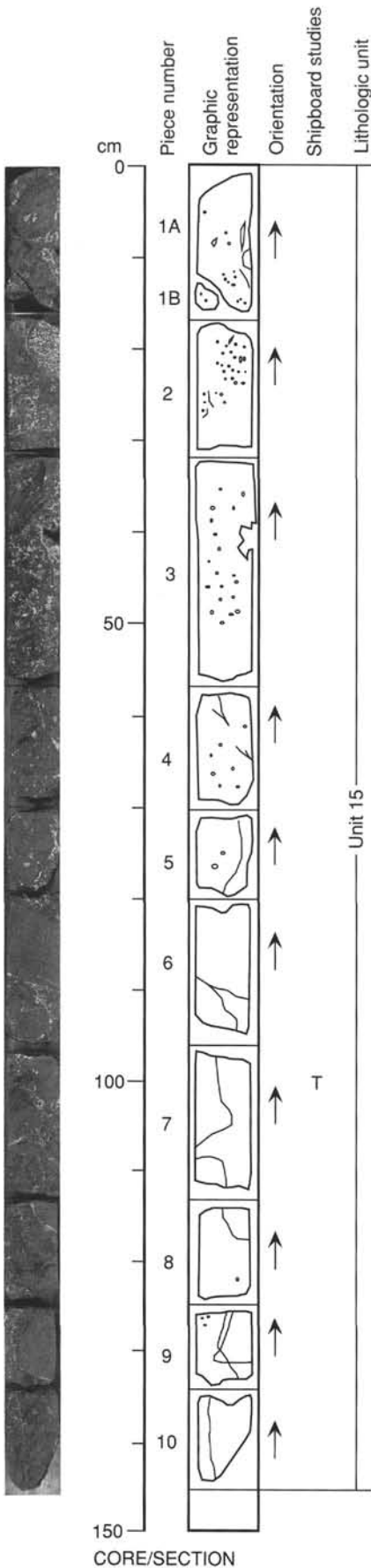
**COLOR:** Variable gray to brownish gray.

**STRUCTURE:** Brecciated.

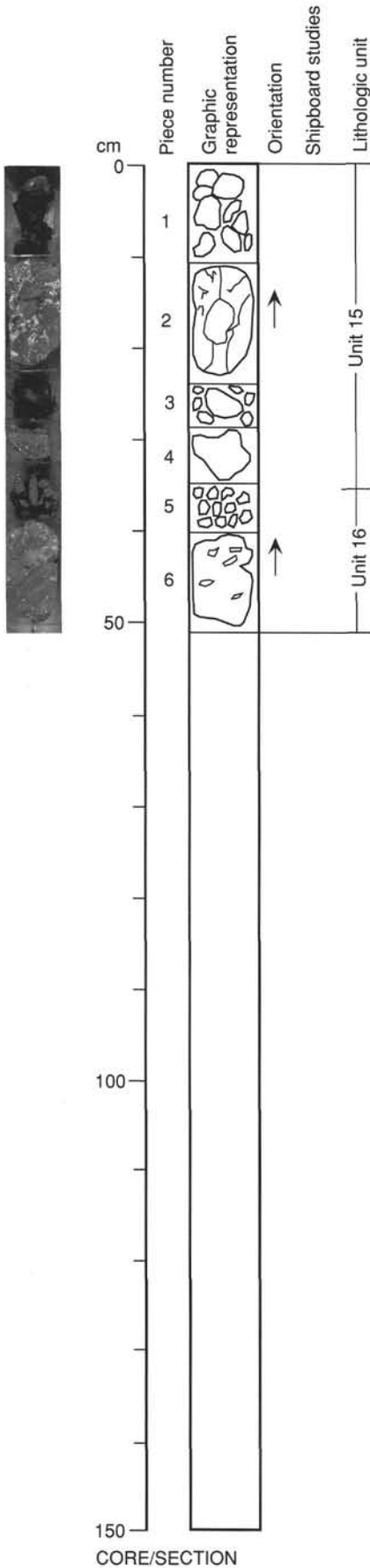
**ALTERATION:** Moderate.

**VEINS/FRACTURES:** Thin veins of calcite and zeolite; calcite veins crosscut the zeolite veins.

**ADDITIONAL COMMENTS:** The rock is composed of 5–60 mm blocks of basalt in a fine matrix of zeolite veinlets and altered material.



152-917A-12R-3



**UNIT 15: APHYRIC OLIVINE BASALT**

**Pieces 1-4**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** Few; filled with light colored zeolite.  
**COLOR:** Variable gray to brownish gray.  
**STRUCTURE:** Brecciated.  
**ALTERATION:** Moderate.  
**VEINS/FRACTURES:** Thin veins of zeolite.  
**ADDITIONAL COMMENTS:** The rock is composed of 5-10 mm blocks of basalt in a fine matrix of zeolite veinlets and altered material; it is the brecciated base of Unit 15.

**UNIT 16: APHYRIC OLIVINE BASALT**

**Pieces 5-6**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 5%; 1-5 mm; rounded to irregular; filled or lined with light colored zeolite.  
**COLOR:** Medium gray (N 4/0).  
**ALTERATION:** Moderate.  
**ADDITIONAL COMMENTS:** Uppermost section of Unit 16.

**UNIT 16: APHYRIC OLIVINE BASALT**

**Pieces 1-4**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained; composed of olivine, plagioclase, and pyroxene(?).

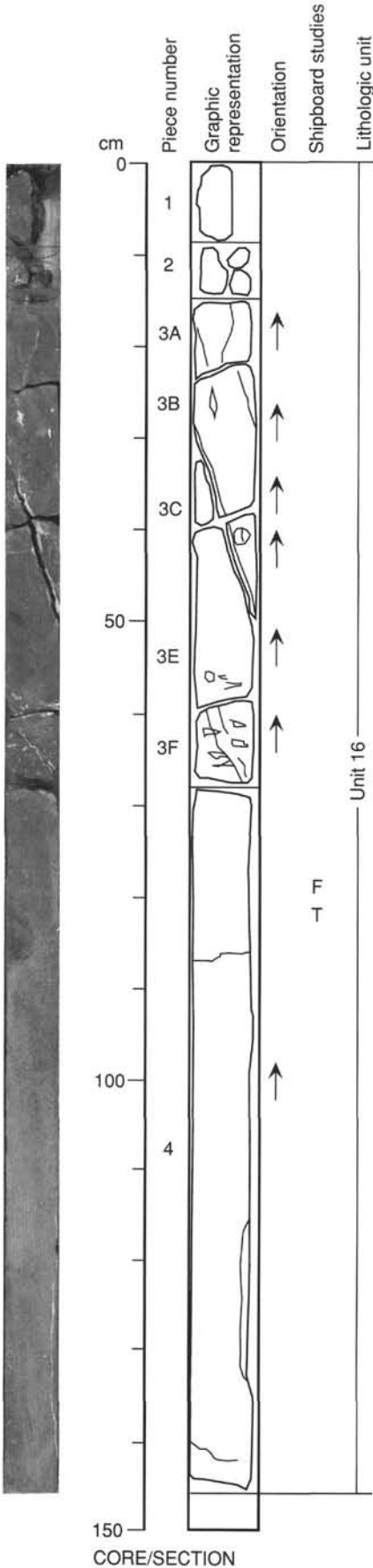
**VESICLES:** 1%; 1-5 mm; irregular; filled with light colored zeolite.

**COLOR:** Light gray (N 6/0).

**STRUCTURE:** Massive.

**ALTERATION:** Slight.

**VEINS/FRACTURES:** A large subvertical fracture through Piece 3 is filled with calcite and zeolite; a smaller vertical fracture filled with calcite cuts Piece 4.



152-917A-13R-2

UNIT 16: APHYRIC OLIVINE BASALT

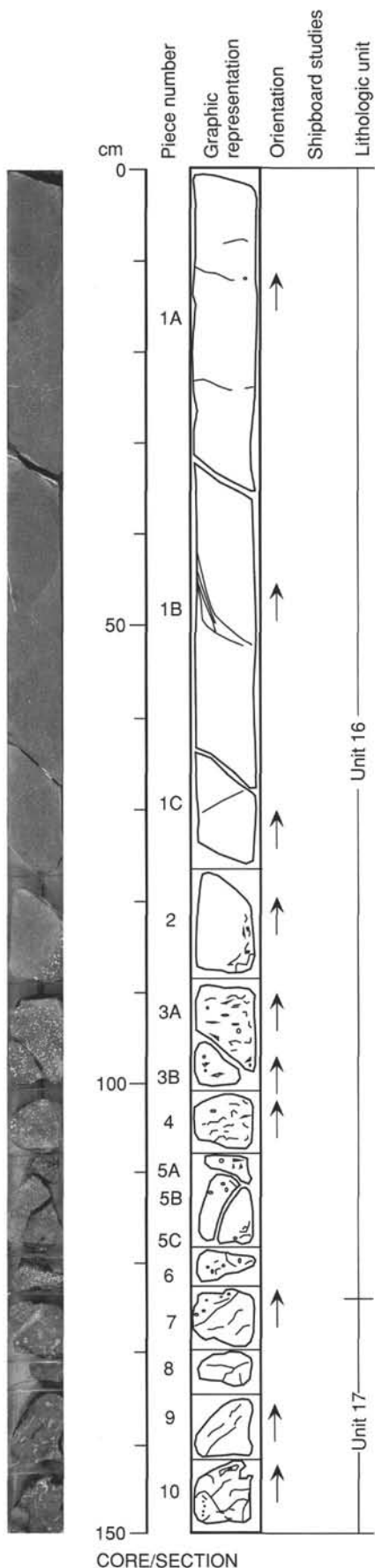
Pieces 1A-7

**CONTACTS:** Piece 7 displays a sharp contact with the flow unit below.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained; composed of olivine, plagioclase, and pyroxene(?).  
**VESICLES:** 0-30%; 1-3 mm; rounded to irregular; filled with light colored zeolite; vesicles restricted to interval 82-125 cm.  
**COLOR:** Light gray (N 6/0).  
**STRUCTURE:** Massive.  
**ALTERATION:** Slight.  
**VEINS/FRACTURES:** A few 1-mm-wide veins filled with zeolite in all pieces.  
**ADDITIONAL COMMENTS:** Gradation from massive central portion to vesiculated flow base and lower contact is easily observed.

UNIT 17: APHYRIC OLIVINE BASALT

Pieces 7-10

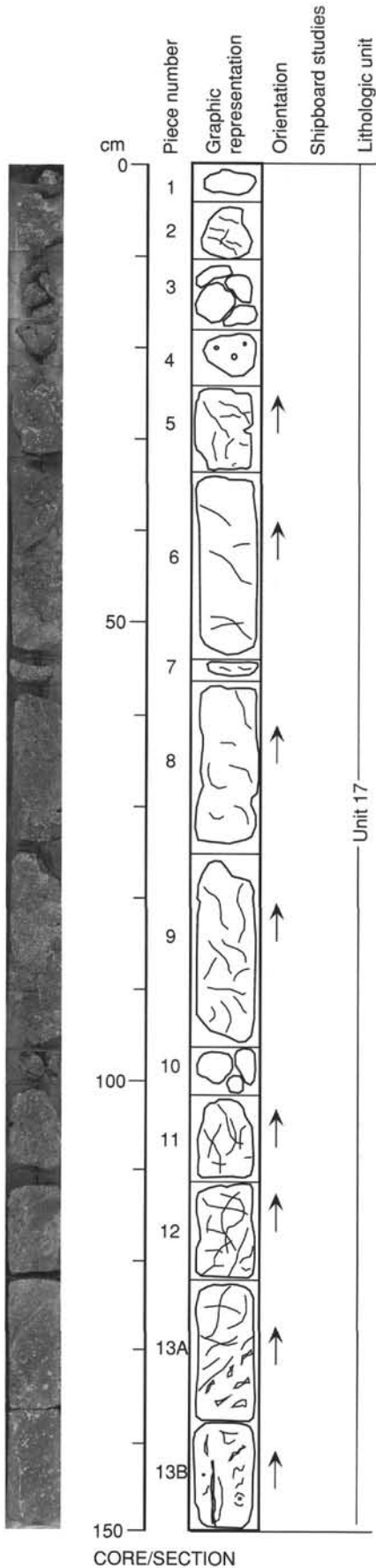
**CONTACTS:** Sharp upper contact with preceding unit.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 5%-10%; 2-10 mm; rounded to elongate; filled with zeolite.  
**COLOR:** Grayish brown (5YR 3/2).  
**STRUCTURE:** Flow-brecciated.  
**ALTERATION:** Highly oxidized.  
**VEINS/FRACTURES:** Veins in Piece 10 near contact give brecciated appearance to the rock.



**UNIT 17: APHYRIC OLIVINE BASALT**

**Pieces 1-13B**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 1%-20%; 1-5 mm; irregular; variable abundance within different basalt clasts; filled with zeolite.  
**COLOR:** Grayish brown (5YR 3/2) at top to medium gray (N 4/0) at bottom.  
**STRUCTURE:** Flow-brecciated lava top. The rock is composed of angular basalt blocks (1-30 mm) in a fine-grained matrix of zeolite veinlets and altered material. Transition to massive flow interior is seen in Piece 13.  
**ALTERATION:** Highly oxidized at top to moderate at bottom of section.





152-917A-13R-4

UNIT 17: APHYRIC OLIVINE BASALT

Pieces 1-12

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained; composed of plagioclase, pyroxene, and oxide minerals.

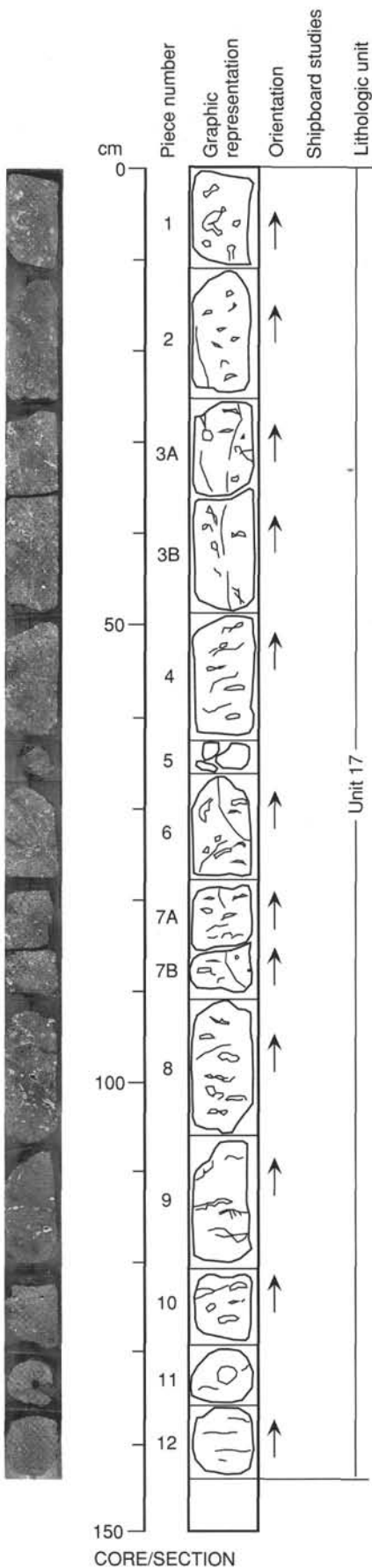
**VESICLES:** 1-10 mm; rounded to irregular; 20%-50% in Pieces 1-8; 1%-5% in Pieces 9-12; vesicles larger than 1 mm are filled with white and tan zeolite and calcite; smaller vesicles are empty. Euhedral analcime in cavity in Piece 11.

**COLOR:** Light gray (N 7/0).

**STRUCTURE:** Highly vesiculated basalt grades into nonvesiculated, massive basalt of flow interior. Pieces 9-12 show distinctive subhorizontal flow-banding.

**ALTERATION:** Slight.

**VEINS/FRACTURES:** Small vertical and subvertical veins filled with calcite and zeolite.



**UNIT 17: APHYRIC OLIVINE BASALT**

**Pieces 1–12**

**PHENOCRYSTS:** None.

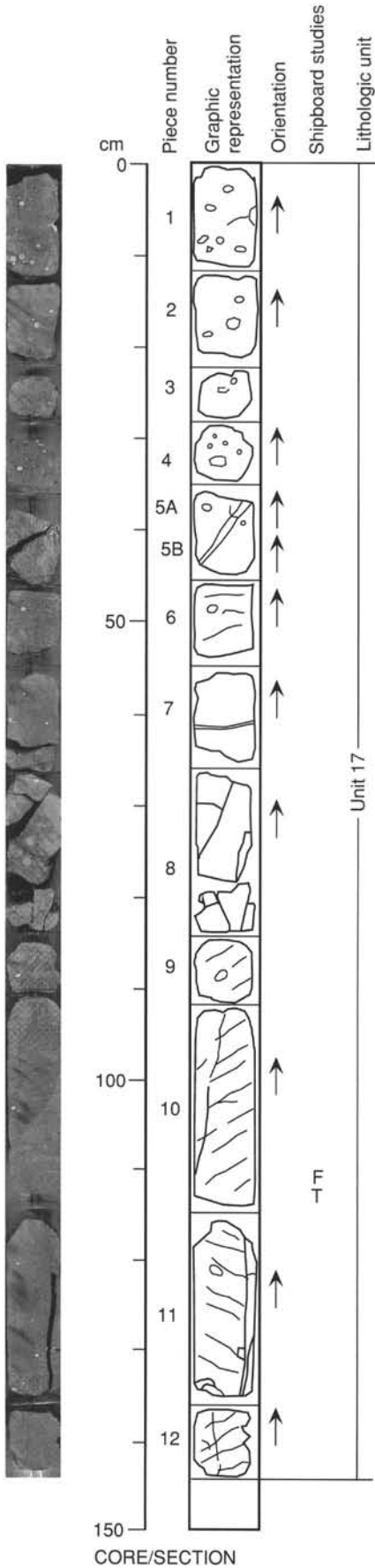
**GROUNDMASS:** Fine-grained; composed of plagioclase, pyroxene, and oxide minerals.

**VESICLES:** 1%; 3–5 mm; rounded; scattered vesicles filled with greenish clay.

**COLOR:** Light gray (N 7/0).

**STRUCTURE:** Distinctive subhorizontal flow-bands spaced 4–5 mm apart, with variable dip directions.

**ALTERATION:** Slight.



152-917A-13R-6

**UNIT 17: APHYRIC OLIVINE BASALT**

**Pieces 1-2**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained; composed of plagioclase, pyroxene, and oxide minerals.

**VESICLES:** 1%-5%; 1-5 mm; rounded; filled with greenish clay; vesicle abundance increases at interval 20-26 cm.

**COLOR:** Light gray (N 7/0).

**STRUCTURE:** Distinctive subhorizontal flow-bands spaced 4-5 mm apart.

**ALTERATION:** Slight.

**VEINS/FRACTURES:** Vertical fracture filled with zeolite cuts Pieces 1-2.

**UNIT 18: APHYRIC OLIVINE BASALT**

**Pieces 3-12**

**PHENOCRYSTS:** None.

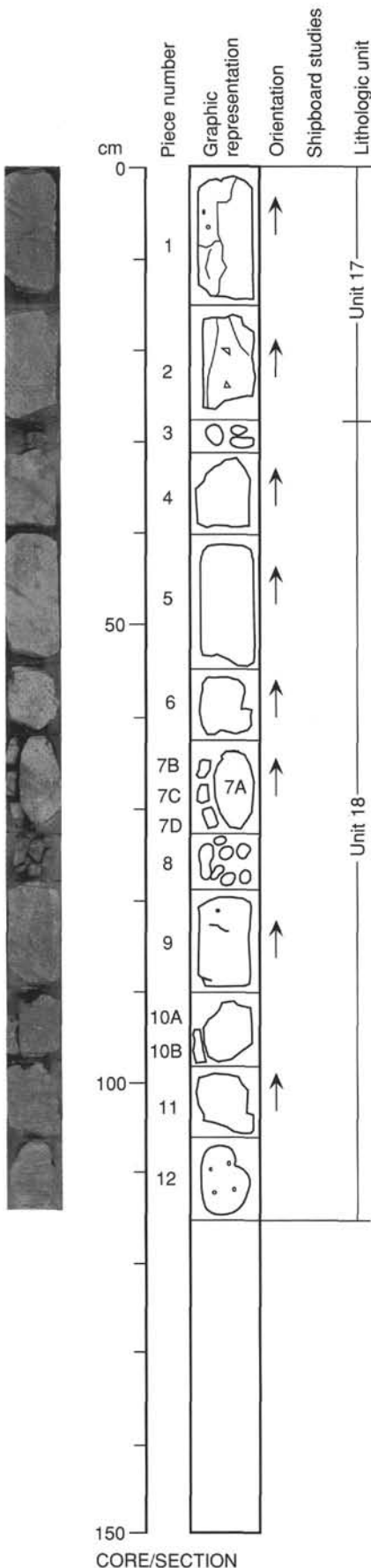
**GROUNDMASS:** Fine-grained.

**VESICLES:** 0-1%; few random vesicles filled with greenish clay.

**COLOR:** Pinkish gray (5R 3/4) to light gray (N 7/0).

**STRUCTURE:** Flow-brecciated in Pieces 3-6; massive with flow-banding in Pieces 7-12.

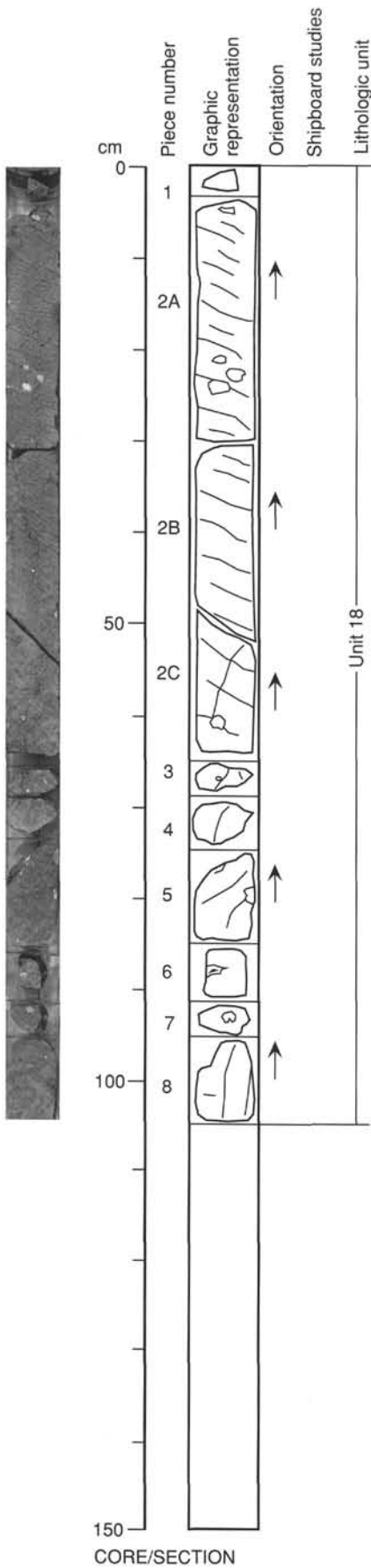
**ALTERATION:** Oxidized groundmass in Pieces 3 and 4, decreasing into Pieces 5 to 12.



**UNIT 18: APHYRIC OLIVINE BASALT**

**Pieces 2-8**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** <1%; 5-10 mm; rounded; a few scattered cavities filled with greenish clay.  
**COLOR:** Light gray (N 7/0).  
**STRUCTURE:** Massive, with distinct flow-banding.  
**ALTERATION:** Slight.  
**VEINS/FRACTURES:** Some small fractures with oxidized edges.  
**ADDITIONAL COMMENTS:** Piece 1 is drilling debris.



152-917A-14R-2

UNIT 18: APHYRIC OLIVINE BASALT

Pieces 1A-9B

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

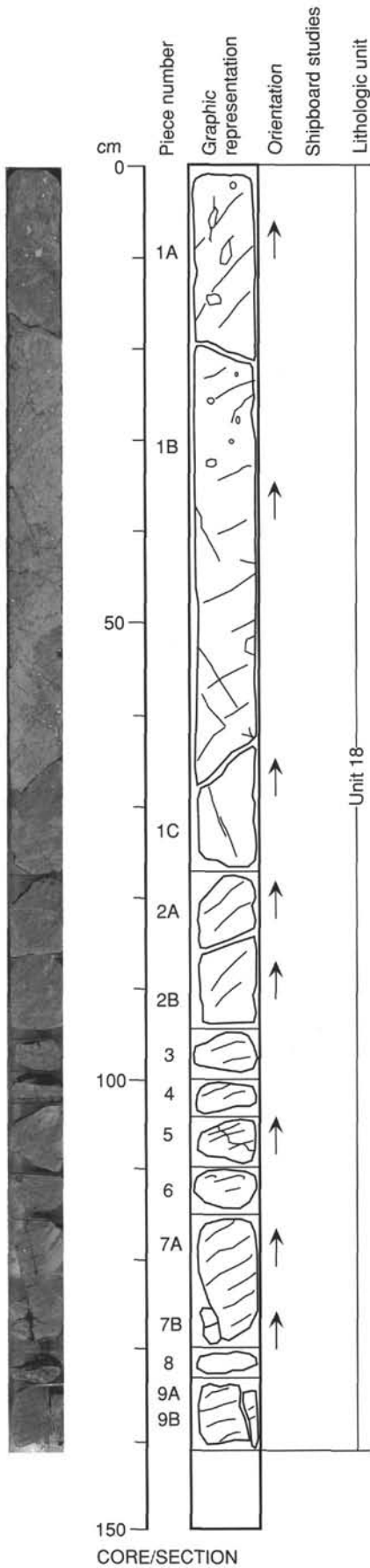
**VESICLES:** <1%; 5-10 mm; rounded; a few scattered cavities filled with greenish clay.

**COLOR:** Light gray (N 7/0).

**STRUCTURE:** Massive, flow-banded.

**ALTERATION:** Light.

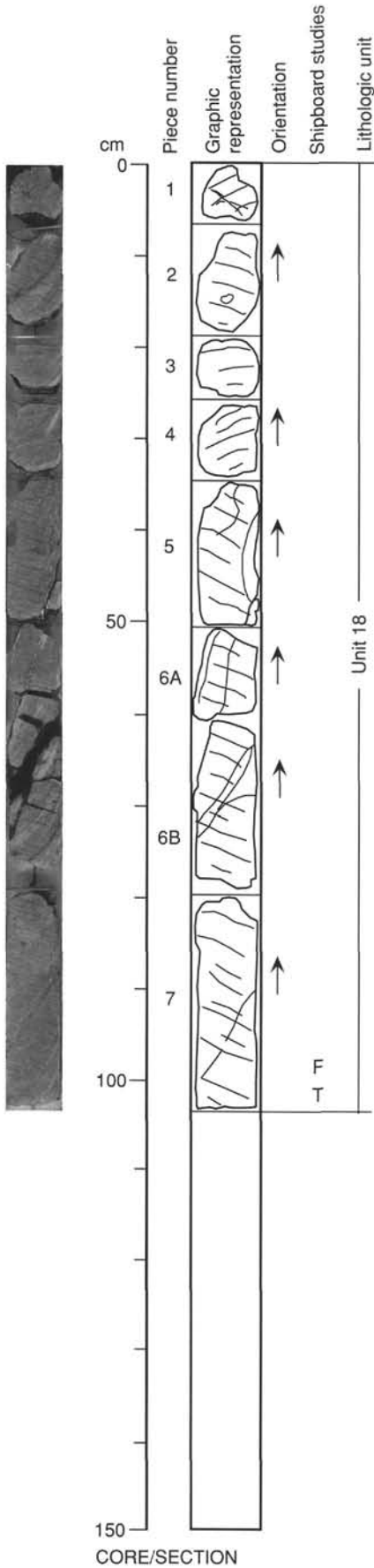
**VEINS/FRACTURES:** One subhorizontal, zeolite-filled fracture in Piece 2B; small fractures throughout all pieces.



**UNIT 18: APHYRIC OLIVINE BASALT**

**Pieces 1-7**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** <1%; 5-10 mm; rounded; a few scattered cavities filled with greenish clay.  
**COLOR:** Light gray (N 7/0).  
**STRUCTURE:** Massive, flow-banded.  
**ALTERATION:** Slight.  
**VEINS/FRACTURES:** Two subvertical veins of zeolite cut Pieces 5 and 6.



152-917A-14R-4

**UNIT 18: APHYRIC OLIVINE BASALT**

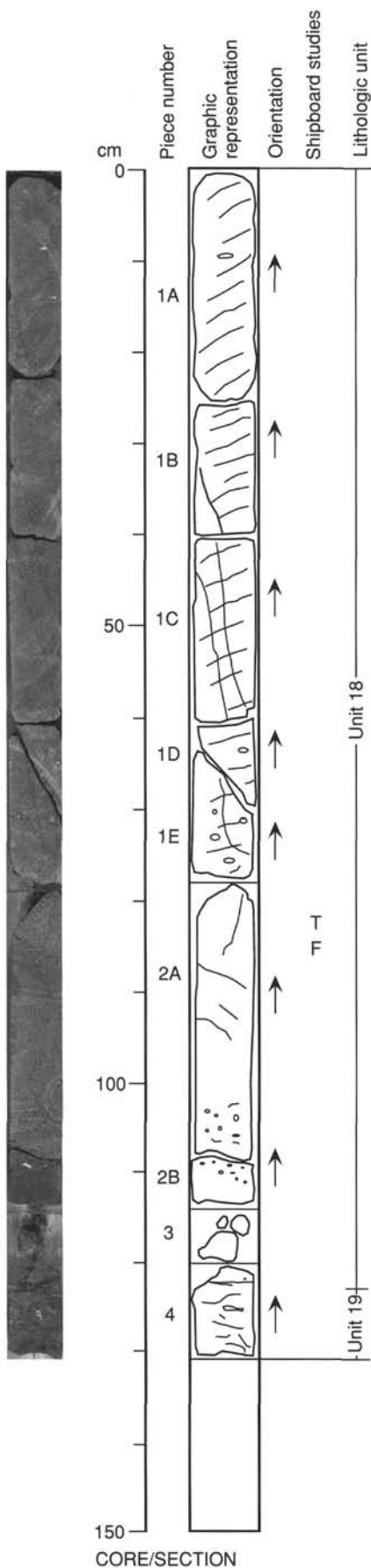
**Pieces 1A-4**

**CONTACTS:** The lower contact is seen in Piece 4.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** <1%; 5-10 mm; rounded; a few scattered cavities filled with greenish clay; increasing abundance of small vesicles near the base of the section.  
**COLOR:** Light gray (N 7/0).  
**STRUCTURE:** Massive with fine flow features, particularly in Piece 2A.  
**ALTERATION:** Slight.

**UNIT 19: APHYRIC OLIVINE BASALT**

**Piece 4**

**CONTACTS:** Sharp contact with upper flow unit.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 5%-10%; 1-10 mm; irregular; larger vesicles are filled with zeolite, smaller ones are empty.  
**COLOR:** Reddish gray (5RP 4/2).  
**STRUCTURE:** Flow-brecciated.  
**ALTERATION:** Moderate; some oxidized portions, particularly along the contact.  
**ADDITIONAL COMMENTS:** The rock is composed of angular basalt fragments in a fine-grained, altered matrix.

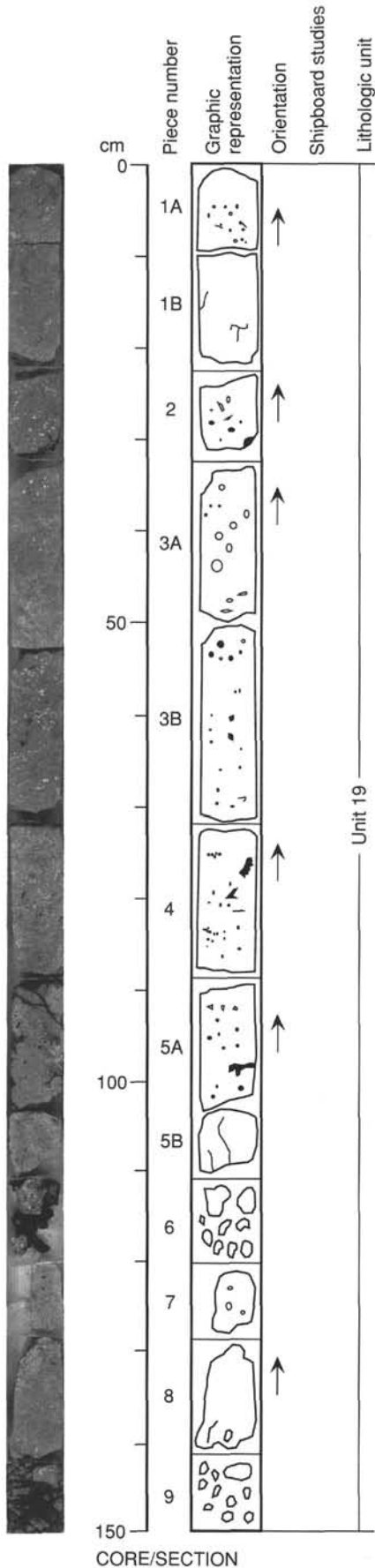


CORE/SECTION

**UNIT 19: APHYRIC OLIVINE BASALT**

**Pieces 1A-9**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 1%–20%; 1–5 mm; irregular; larger vesicles are filled with zeolite, smaller ones are empty.  
**COLOR:** Reddish gray (5RP 4/2) to light gray (N 7/0).  
**STRUCTURE:** Flow-brecciated.  
**ALTERATION:** Piece 1 is oxidized, the degree of oxidation decreases down the section.  
**VEINS/FRACTURES:** A few subvertical veins of calcite.  
**ADDITIONAL COMMENTS:** The rock is composed of angular basalt fragments in an altered matrix.



CORE/SECTION



152-917A-15R-1

UNIT 19: APHYRIC OLIVINE BASALT

Pieces 1-18

**PHENOCRYSTS:** None.

**GROUNDMASS:** Very fine-grained; no plagioclase laths discernible.

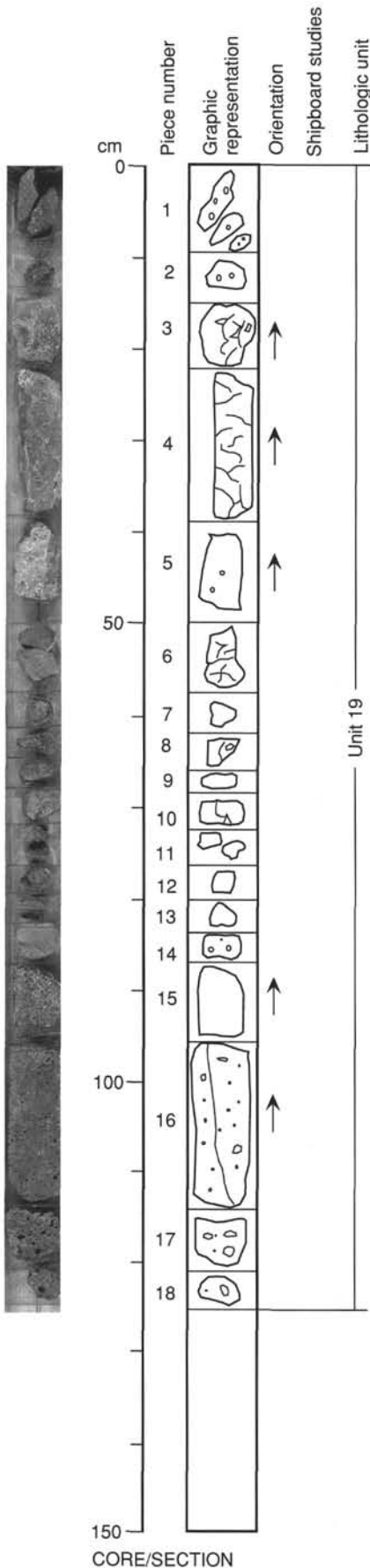
**VESICLES:** 5%-30%; 1-7 mm; rounded; irregular distribution; the vesicularity increases downward in the section.

**COLOR:** Varies with the degree of flow-brecciation from gray (5Y 5/1) to light reddish brown (2.5YR 5/2).

**STRUCTURE:** Pieces 2 and 3 are flow-brecciated, reddish brown in color, and the spaces between the fragments are filled with zeolite and clay minerals. Pieces 4-15 are fairly massive and vesicle-poor. Pieces 16-18 contain up to 30% vesicles, some of which are empty and some of which are partially filled with zeolite minerals.

**ALTERATION:** Moderate to highly altered.

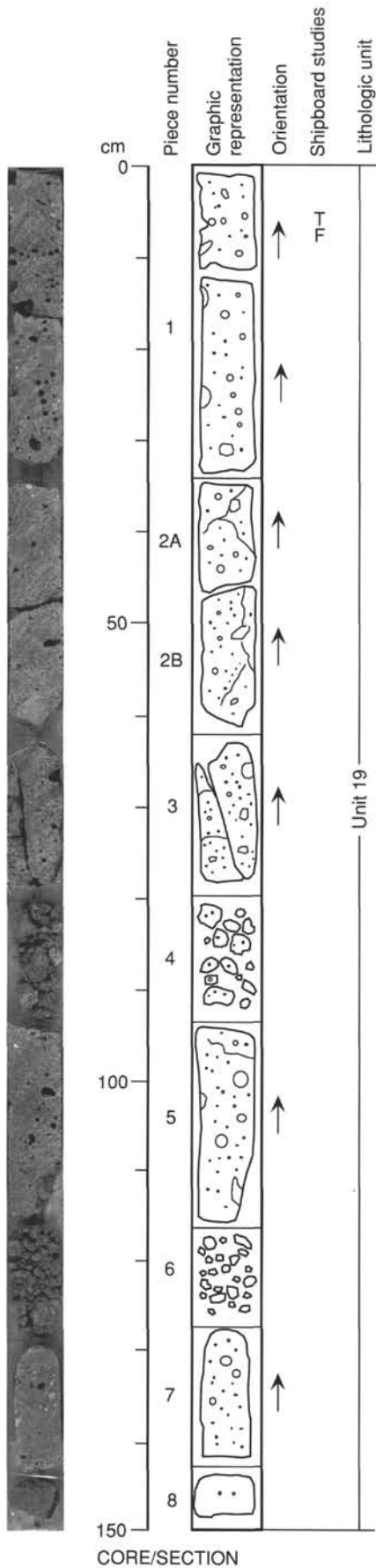
**VEINS/FRACTURES:** Piece 16 has a <1 mm wide, vertically oriented fracture that is filled with zeolite minerals.



**UNIT 19: APHYRIC OLIVINE BASALT**

**Pieces 1-8**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Very fine-grained.  
**VESICLES:** 10%-20%; 1-20 mm; rounded; disseminated; most are empty except for a thin lining of bluish green clay; a few are filled with chabazite.  
**COLOR:** Dark greenish gray (5BG 4/1).  
**STRUCTURE:** None.  
**ALTERATION:** Fairly fresh.  
**VEINS/FRACTURES:** A Y-shaped 0.2-1-mm-wide vein filled with a white mineral crosses the core at 36-42 cm (Piece 2).



152-917A-16R-1

**UNIT 20: APHYRIC OLIVINE BASALT**

**Pieces 1-3A**

**CONTACTS:** The contact with the underlying flow occurs at 35-37 cm in Piece 3A. It is marked by a 1.5-3 cm brick-red layer with a smooth lower boundary and a very wispy upper boundary. This layer may be the lateritized flow top of Unit 21, which has been partially ripped-up into the base of the flow of Unit 20.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 5%; 1-2 mm; round; disseminated; partially filled with pale green clay.

**COLOR:** Gray (5Y 5/1).

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** Piece 2A has two <1-mm-wide vertical fractures. It also has a 2-mm-wide vein across one corner that is filled with brick-red material.

**UNIT 21: PICRITE**

**Pieces 3A-7D**

**CONTACTS:** The top contact occurs in Piece 3A at 35 cm. There is a 2-cm-thick lateritized flow top that has been disturbed by the succeeding flow.

**PHENOCRYSTS:** The phenocrysts are uniformly distributed in the rock right up to the flow top. Olivine - 15%; up to 1 mm; euhedral and often elongated shapes; completely altered.

**GROUNDMASS:** Fine-grained.

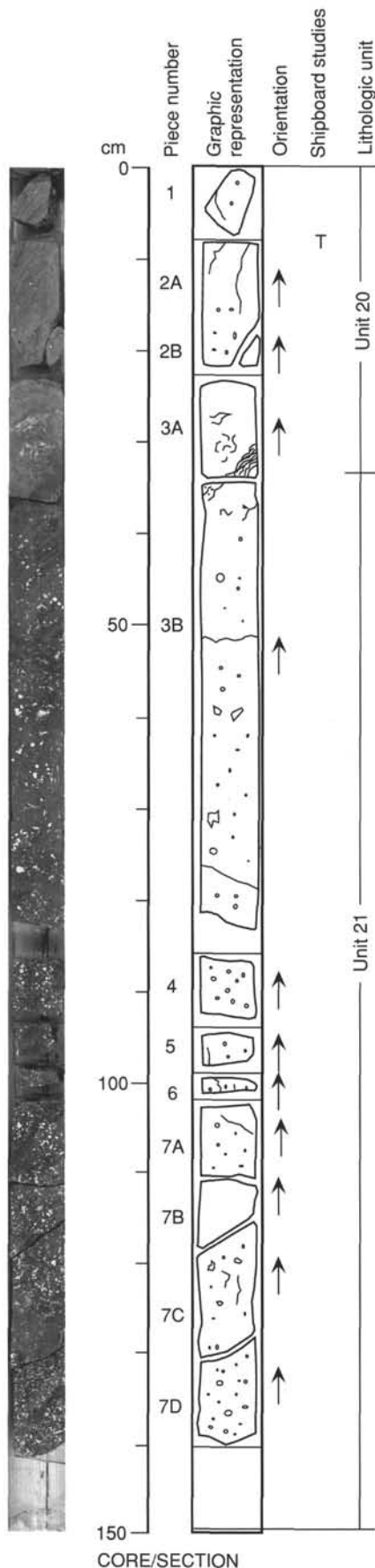
**VESICLES:** 15%; 2-10 mm; irregular shapes; scattered; lined with white zeolite minerals composed of radiating fibers and filled with light gray material.

**COLOR:** Dusky red (10R 3/2) speckled with white spots (vesicles filled with white minerals).

**STRUCTURE:** Massive except for the vesicles.

**ALTERATION:** Strong.

**VEINS/FRACTURES:** There are a few 0.1-1-mm-wide, 2-4-mm-long discontinuous, vertically oriented fractures filled with white zeolite minerals.



CORE/SECTION

**UNIT 21: PICRITE**

**Pieces 1-5**

**PHENOCRYSTS:** Olivine - 15%-20%; up to 2 mm; euhedral, often elongated in shape; completely altered.

**GROUNDMASS:** Fine-grained.

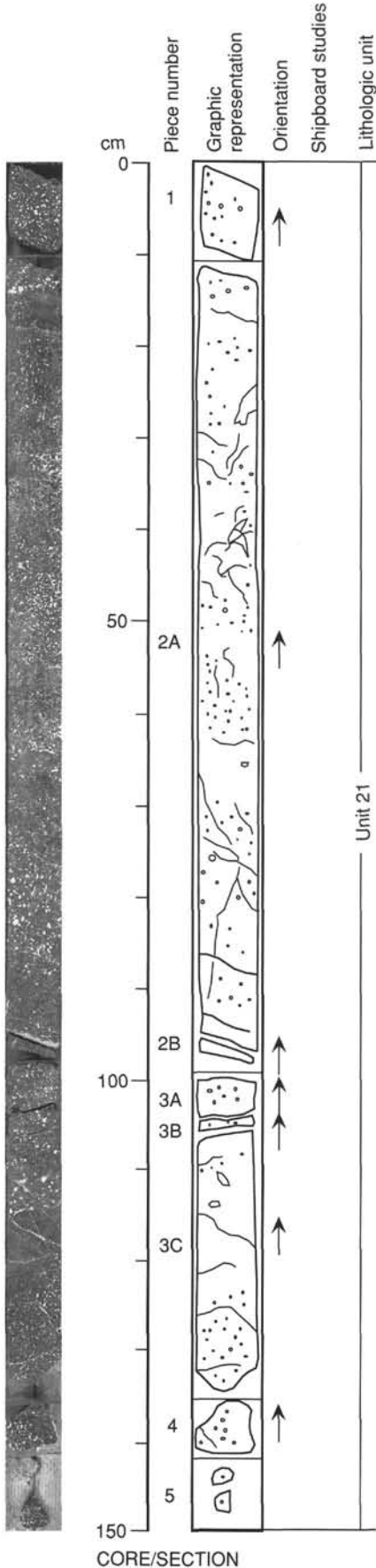
**VESICLES:** 15%; 2-10 mm; irregular shapes; scattered; lined with a white, radiating zeolite mineral and filled with a light gray to white material.

**COLOR:** Dusky red (10R 3/2) at the top of the section grading to dark gray (N 4/0) at the bottom of the section.

**STRUCTURE:** Small scale brecciation occurs between 18 and 64 cm (Piece 2A). Several zones in Piece 2A (such as near 50 cm and 65 cm) have inhomogeneous distribution of olivine phenocrysts on a centimeter scale.

**ALTERATION:** Strong.

**VEINS/FRACTURES:** 0.1-1-mm-wide fractures sloping about 20 degrees are found throughout the section.



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UNIT 21: PICRITE

Pieces 1A-3D

**PHENOCRYSTS:** Olivine - 10%–15%; up to 1 mm; euhedral; completely altered.

**GROUNDMASS:** Fine-grained.

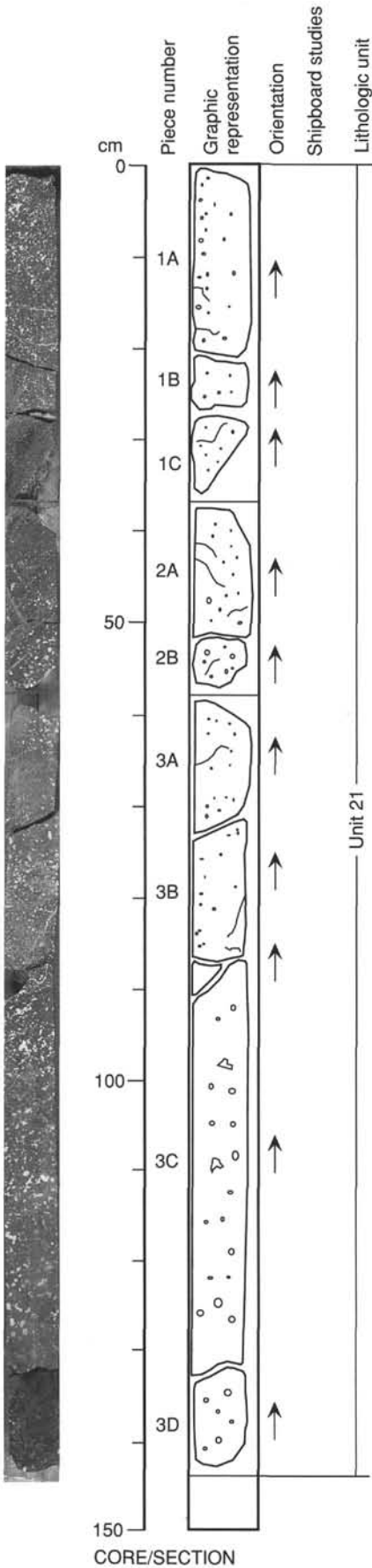
**VESICLES:** 10%–15%; 1–10 mm; irregular shapes; scattered; lined with a white zeolite mineral with radiating fibers and filled with a light gray material.

**COLOR:** Dark gray (N 4/0) at the top of the section grading to dark reddish gray (10R 4/1) at the bottom of the section.

**STRUCTURE:** Massive except for the vesicles.

**ALTERATION:** Strong.

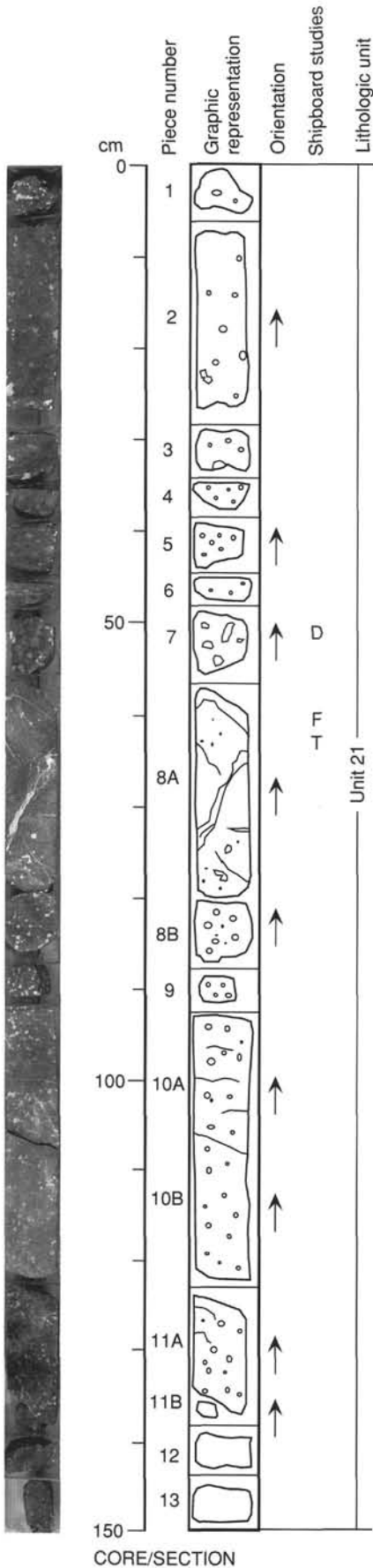
**VEINS/FRACTURES:** A few 0.1–2-mm-wide veins filled with a white zeolite mineral are present.



**UNIT 21: PICRITE**

**Pieces 1-13**

**PHENOCRYSTS:** Olivine - 15%–20%; up to 2 mm; euhedral, often elongated shapes; completely altered.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 5%–10%; 3–10 mm; rounded to irregular shapes; scattered; filled with yellowish gray clay.  
**COLOR:** Dark gray (N 4/0).  
**STRUCTURE:** Massive except for the vesicles.  
**ALTERATION:** Moderate to strong.  
**VEINS/FRACTURES:** A few <1-mm-wide, horizontal fractures filled with white minerals are found. At 65–75 cm (Piece 8) there is a 1–10-mm-wide, steeply dipping, branching vein filled with white zeolite.

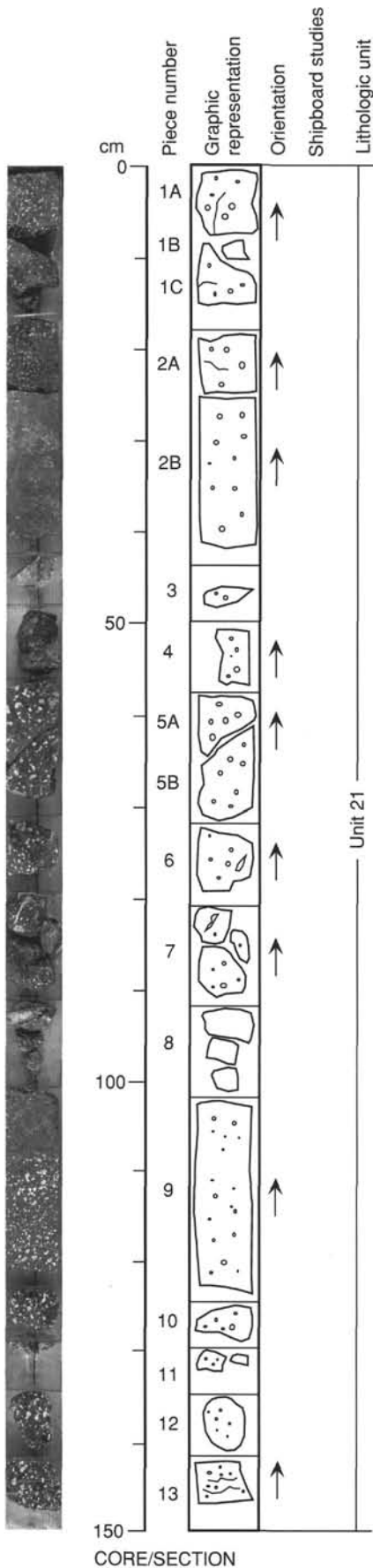


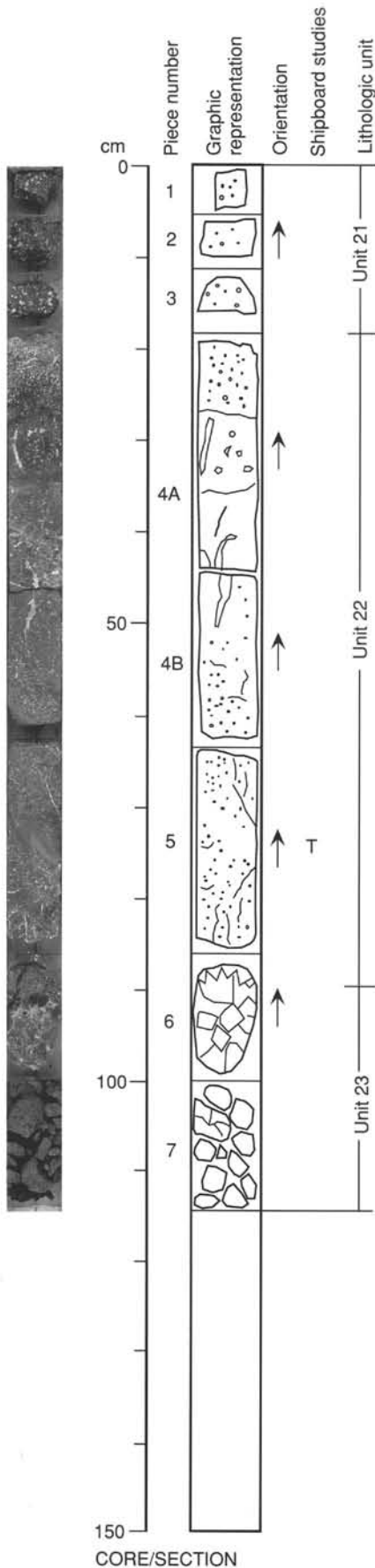
152-917A-16R-5

UNIT 21: PICRITE

Pieces 1A-13

**PHENOCRYSTS:** Olivine - 15%–20%; up to 4 mm; euhedral, often elongated shapes; completely altered.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 5%–10%; 3–10 mm; rounded to irregular shapes; scattered; filled with light greenish gray clay, and a few also have linings of zeolite minerals.  
**COLOR:** Dark gray (N 4/0) but speckled with red (altered olivines) and green (vesicles filled with clay).  
**STRUCTURE:** Local patches have inhomogeneous distribution of olivine phenocrysts.  
**ALTERATION:** Strong.  
**VEINS/FRACTURES:** Very few <1-mm-wide fractures.





**UNIT 21: PICRITE**

**Pieces 1-3**

**PHENOCRYSTS:** Olivine - 15%; up to 1 mm; euhedral; completely altered.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 15%; 1-4 mm; rounded; irregular distribution; filled with light greenish gray clay and a white zeolite mineral.

**COLOR:** Dark reddish gray (5R 3/1).

**STRUCTURE:** Massive except for the vesicles.

**ALTERATION:** Strong.

**UNIT 22: APHYRIC OLIVINE BASALT**

**Pieces 4A-6**

**CONTACTS:** The top of Piece 4 is very close to the flow top of Unit 22 judging by the marked change in lithology between Pieces 3 and 4 and the high density of very small vesicles (50%) at the top (18-26 cm). There is only slight reddening at the top. The bottom contact is seen at 90 cm in Piece 6.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 5%-50%; <1-2 mm; rounded to irregular shapes; inhomogeneous distribution; filled with white zeolite minerals; decrease in abundance towards the base of the unit.

**COLOR:** Dark gray (5YR 4/1).

**STRUCTURE:** Steeply dipping vesicle trains occur in the interval 55-70 cm.

**ALTERATION:** Strong.

**VEINS/FRACTURES:** Two 5-mm-wide, irregular, near vertical, 4-8-cm-long veins filled with white zeolite minerals occur at 29-33 and 44-52 cm.

**UNIT 23: APHYRIC OLIVINE BASALT**

**Pieces 6-7**

**CONTACTS:** The top contact of the flow (Unit 23) occurs at 90 cm in Piece 6. The top 2 cm are oxidized to a brownish red color.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 2%; 0.2-2 mm; round to irregular shapes; scattered; empty or filled with white zeolite minerals.

**COLOR:** Brown (5YR 3/2).

**STRUCTURE:** The rock is very brecciated. Angular rock fragments 1 to 20 mm in size are cemented by a white fibrous mineral (a zeolite mineral?). These infilled zones are <<1 mm to 10 mm in width.

**ALTERATION:** Strongly altered and oxidized.

**ADDITIONAL COMMENTS:** The brecciation apparently occurred much later than the extrusion, judging by the juxtaposition of strongly and less strongly oxidized fragments throughout the brecciated zone in Piece 6.



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UNIT 23: APHYRIC OLIVINE BASALT

Pieces 1-3

**PHENOCRYSTS:** None.

**GROUNDMASS:** Very fine-grained.

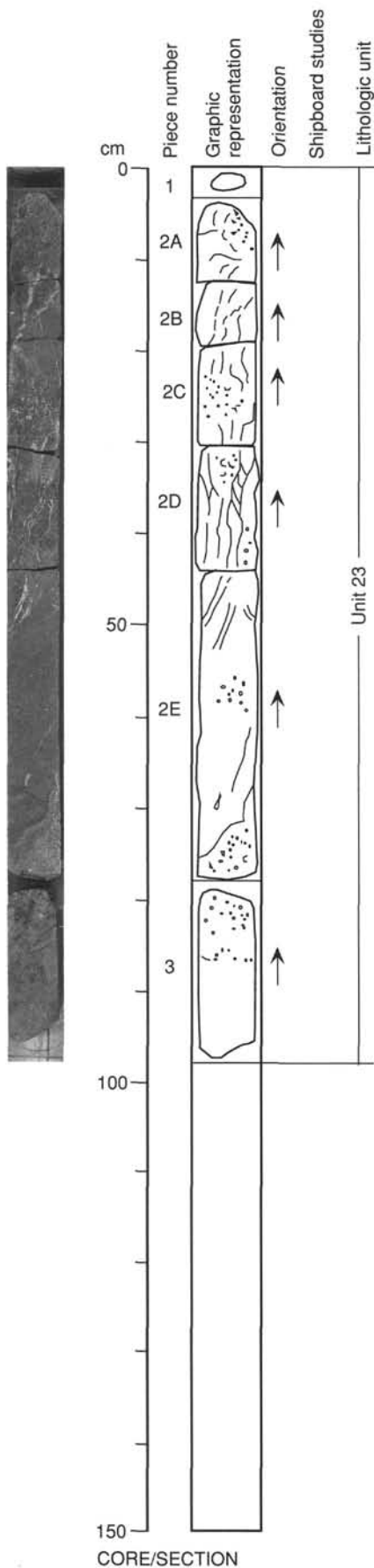
**VESICLES:** 1%-50%; <1 mm to 2 mm; round to irregular shape; very inhomogeneous distribution; filled with white zeolite minerals; in the massive flow parts, many vesicles are empty (Pieces 2E, 3); vesicles are concentrated in small zones at 70-78 cm and in the flow-breccia fragments.

**COLOR:** Dark gray (N 4/0) with bluish gray (5B 5/1) except Piece 2A, which is brown.

**STRUCTURE:** Flow-brecciation occurs in patches from 3 to 35 cm: 1 mm to 20 mm chunks of vesicular lava are found in a matrix of groundmass lava.

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** 1-2-mm-wide, subvertical fractures filled with a white fibrous zeolite mineral and sporadic calcite, are found in the 12-52 cm interval. Sparse, <1-mm-wide, discontinuous, subvertical veins are found throughout.



**UNIT 23: APHYRIC OLIVINE BASALT**

**Pieces 1-3**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

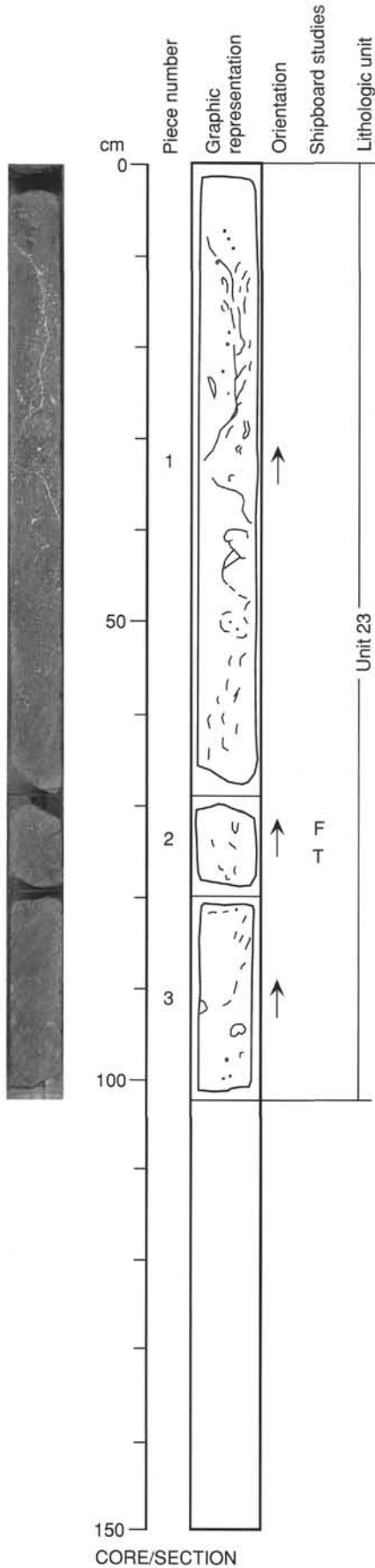
**VESICLES:** 2%–15%; <<1–15 mm; round to irregular shape; inhomogeneous distribution; filled with white and pink zeolite minerals, or empty.

**COLOR:** Dark bluish gray (5B 4/1).

**STRUCTURE:** Flow-brecciation occurs in Piece 2. 1–4 cm subrounded chunks of lava are suspended in a matrix of groundmass lava. The pieces have 15% vesicles that are mainly filled with white zeolite minerals, whereas the matrix has <5% vesicles. These chunks are probably pieces of the flow crust re-entrained in the lava flow.

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** Two 1–2-mm-wide veins filled with white zeolite minerals are found in Piece 1 (8–38 cm). They are subvertically oriented and have a concentration of vesicles around them.



## 152-917A-17R-3

## UNIT 23: APHYRIC OLIVINE BASALT

## Pieces 1A-2

**CONTACTS:** The bottom contact occurs in Piece 2 at 77 cm.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

**VESICLES:** <1%-20%; 1-10 mm; round to irregular shape; very inhomogeneous distribution; most of the rock has few vesicles, but chunks in flow-breccia have lots of small vesicles that are filled with zeolite minerals.

**COLOR:** Ranges from dark bluish gray (5B 4/1) to mottled light brownish gray.

**STRUCTURE:** Flow-brecciation. 1-4 cm chunks of mainly vesicular lava are found floating in a matrix of groundmass lava.

**ALTERATION:** Moderate; the interval 23-53 cm and the left part of the core at 53-73 cm appear to be more altered.

## UNIT 24: APHYRIC OLIVINE BASALT

## Pieces 2-7

**CONTACTS:** The top contact occurs in Piece 2 at 77 cm. Pieces 2 and 3 (77-98 cm) contain a breccia composed of 2-20 mm rock fragments suspended in a variably oxidized (red to dark gray) matrix of basalt.

**PHENOCRYSTS:** None.

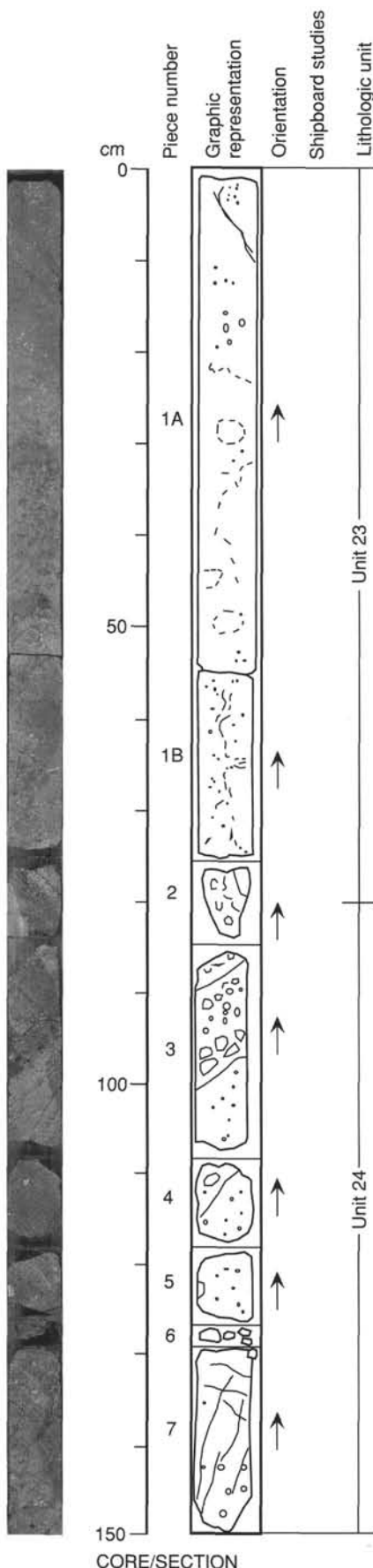
**GROUNDMASS:** Fine-grained.

**VESICLES:** 5%; <1-12 mm; round to slightly flattened; random distribution; most are filled with a bluish gray mineral (clay?); large ones are filled with chabazite and a white zeolite mineral.

**COLOR:** Dark gray (N 4/0).

**ALTERATION:** Moderate. Faintly defined oxidized bands occur in Pieces 4-7. In Piece 5 the band occurs as a halo around a 12 mm vesicle that is filled with calcite and zeolite.

**VEINS/FRACTURES:** Piece 7 has steeply dipping, 1-5-mm-wide fractures filled with zeolite minerals.

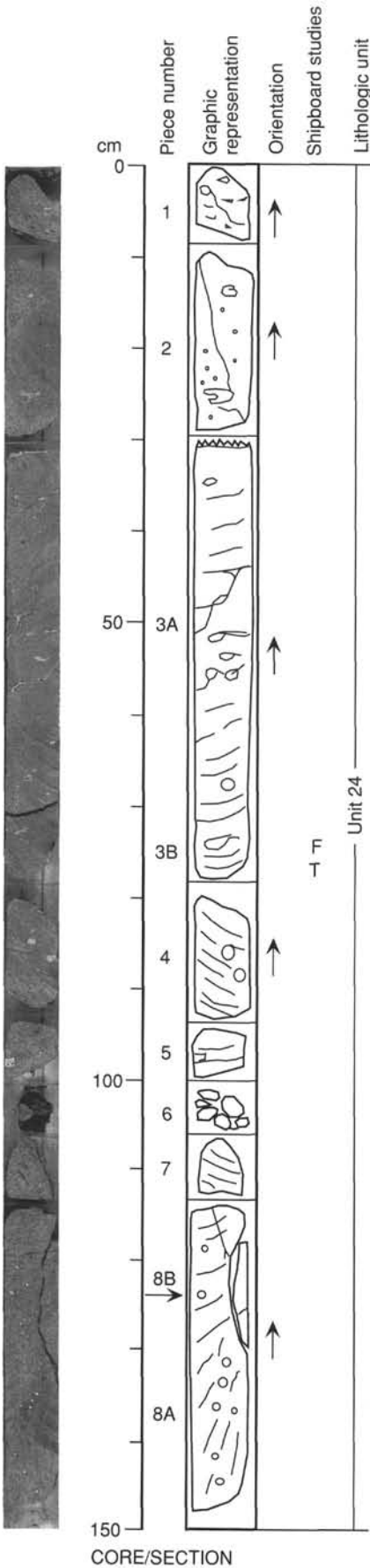


CORE/SECTION

**UNIT 24: APHYRIC OLIVINE BASALT**

**Pieces 1-8A**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 5%; 2-20 mm; subrounded to very irregular shape; often clustered along flow lines; large ones are partially or completely filled with zeolite minerals (chabazite and others); small ones have a green mineral (clay?).  
**COLOR:** Dark gray (N 4/0).  
**STRUCTURE:** Flow-banding is evident in all the pieces. It is defined by discontinuous 1-2-mm-wide wisps of darker material in the groundmass. The banding dips 0-20 degrees.  
**ALTERATION:** Moderate. Oxidized zones occur in Pieces 2, 4, 5, 7, and 8, and often form halos around large vesicles or fractures.  
**VEINS/FRACTURES:** 1 mm wide; horizontal to vertical; filled with zeolite minerals; a horizontal fracture at 32 cm (top of Piece 3) is lined with euhedral analcime crystals.



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UNIT 24: APHYRIC OLIVINE BASALT

Pieces 1A-2

**PHENOCRYSTS:** None.

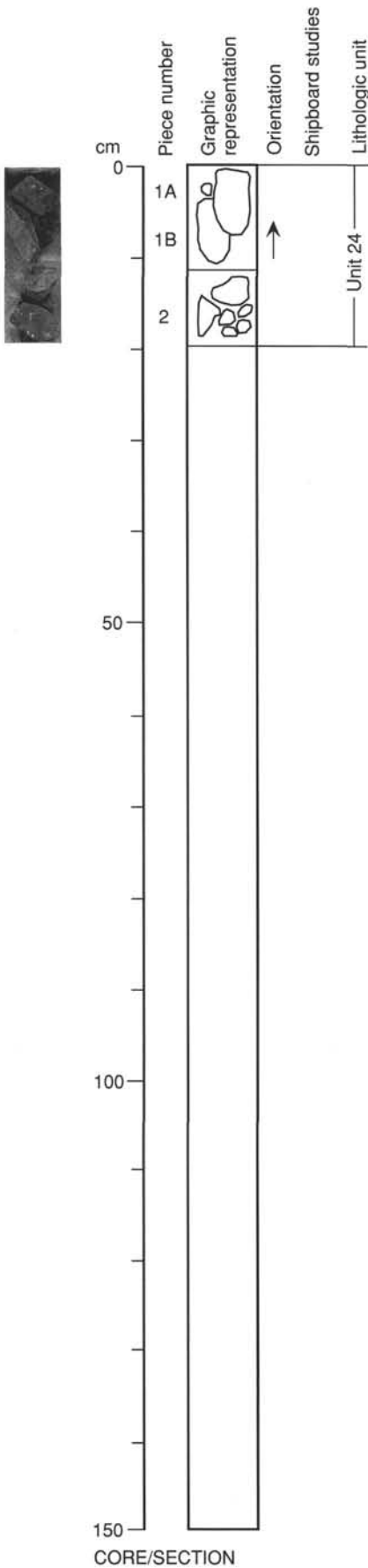
**GROUNDMASS:** Fine-grained.

**VESICLES:** 5%; 1-5 mm; round; random distribution; lined with a dark green mineral and filled with a pale green mineral.

**COLOR:** Dark gray (5Y 4/1).

**ALTERATION:** Strong.

**VEINS/FRACTURES:** A few <1 mm veins.



CORE/SECTION

**UNIT 24: APHYRIC OLIVINE BASALT**

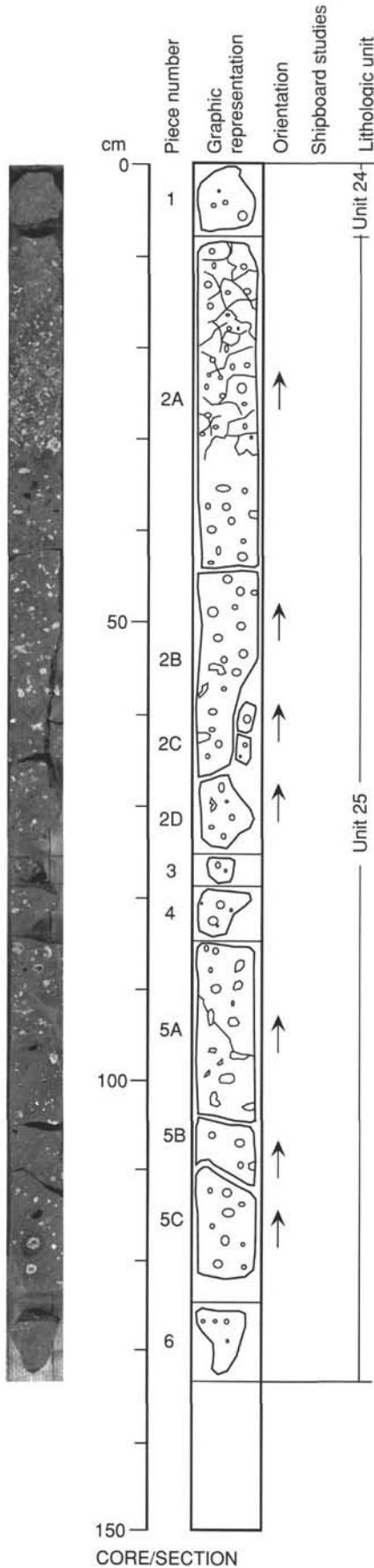
**Piece 1**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 1%; 1–5 mm; spherical; random distribution; dark green linings and pale green fillings.  
**COLOR:** Greenish black (2GY 2/1).  
**ALTERATION:** Moderate.

**UNIT 25: PICRITE**

**Pieces 2A–6**

**PHENOCRYSTS:** Olivine - 5%; 1–5 mm; elongate and skeletal.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 5%–20%; 2–15 mm; irregular; concentrated towards top of unit; most filled with a white platy zeolite; a few with analcime and one with fibrous zeolite.  
**COLOR:** Dark gray (N 2/0).  
**ALTERATION:** Moderate; olivine completely altered to pale green mineral.  
**VEINS/FRACTURES:** <1%; 0.1–1 mm; random; a few thin zeolite-filled veins in top 25 cm of unit.



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UNIT 25: PICRITE

Pieces 1-6B

**PHENOCRYSTS:** Olivine - 5%-10%; 1-5 mm; elongate and skeletal.

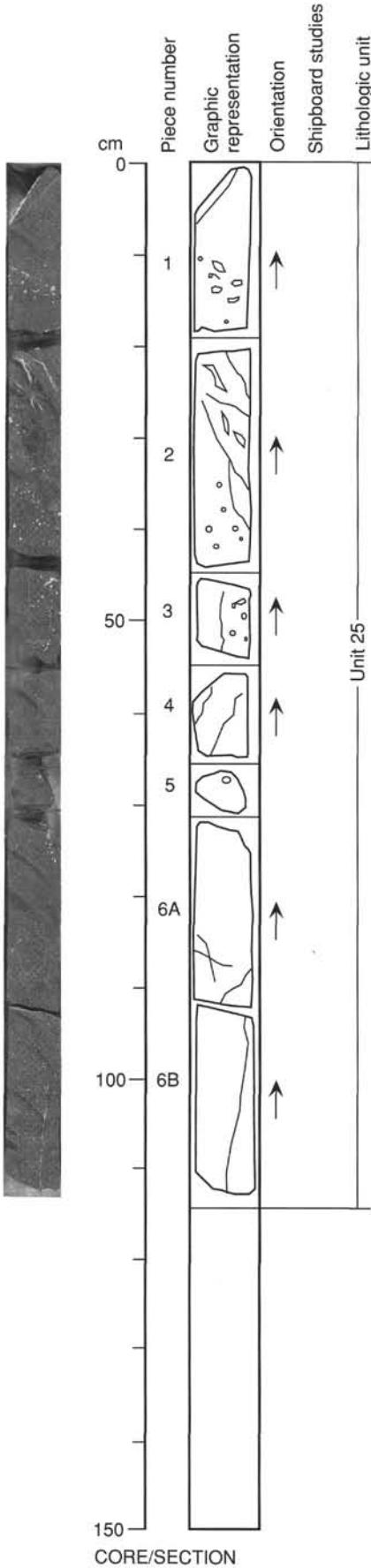
**GROUNDMASS:** Fine-grained.

**VESICLES:** 0-5%; 2-7 mm; irregular; concentrated towards top of section; filled with white zeolite.

**COLOR:** Dark greenish gray (5GY 4/1).

**ALTERATION:** Moderate; olivine completely altered to pale green mineral.

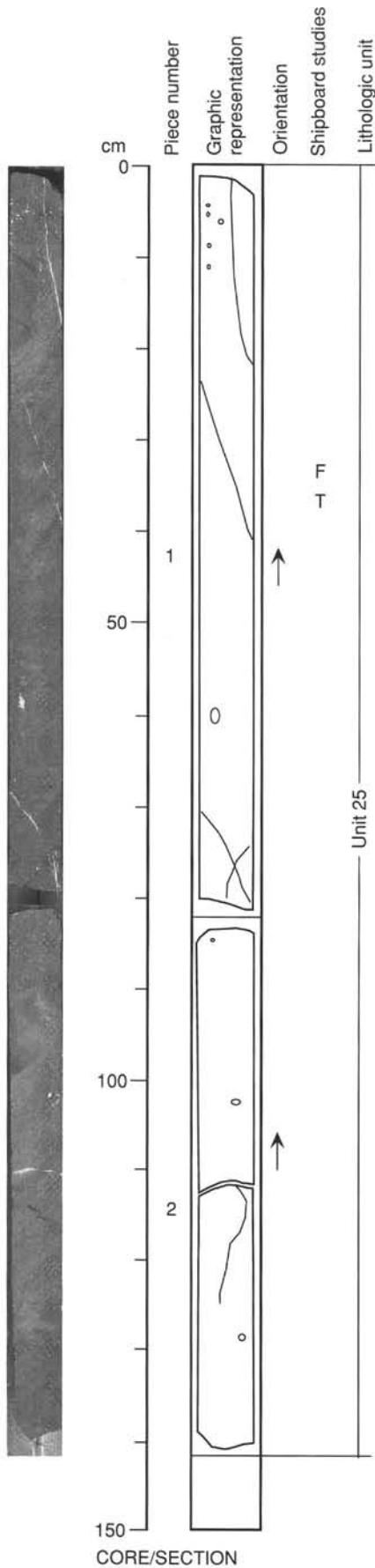
**VEINS/FRACTURES:** 0-5%; 0.5-3 mm; subparallel to core edge; some vertical; mostly in top 25 cm of section; a few in bottom 25 cm; filled with zeolite.



**UNIT 25: PICRITE**

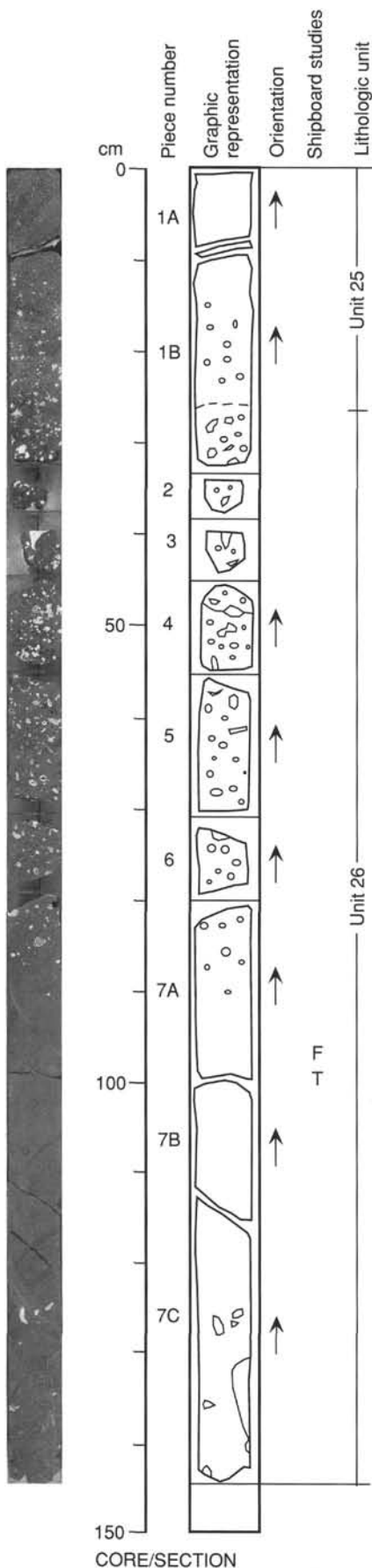
**Pieces 1-2**

**PHENOCRYSTS:** Olivine - 10%–15%; 1–5 mm; elongate and skeletal.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** <1%; 1–10 mm; irregular; filled with white zeolite.  
**COLOR:** Dark greenish gray (5GY 4/1).  
**ALTERATION:** Moderate; olivine completely altered to pale green mineral.  
**VEINS/FRACTURES:** <1%; 0.5–5 mm; mostly inclined; one horizontal; filled with zeolite.





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**UNIT 25: PICRITE**

**Pieces 1A and 1B**

**CONTACTS:** Base of flow at 25 cm.  
**PHENOCRYSTS:** Olivine - 10%; 1-5 mm; elongate and skeletal.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 0-10%; 1-5 mm; spherical; concentrated towards bottom of unit; filled with white zeolite.  
**COLOR:** Dark greenish gray (5GY 4/1).  
**ALTERATION:** Moderate; olivine completely altered to pale green mineral.  
**VEINS/FRACTURES:** <1%; 0.2-1 mm; inclined; filled with zeolite; native copper in one vein.

**UNIT 26: OLIVINE-PHYRIC BASALT**

**Pieces 1B-7C**

**CONTACTS:** Flow top in Piece 1B.  
**PHENOCRYSTS:** Olivine - 5%-10%; 1-5 mm; elongate and skeletal.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 0-20%; 1-20 mm; spherical to irregular; concentrated towards top of flow; vesicle-free between 90 and 125 cm; most filled with white zeolite; some empty and a few coated with a globular green encrustation.  
**COLOR:** Greenish black (5GY 2/1).  
**ALTERATION:** Moderate; olivine completely altered to pale green mineral; oxidized in Pieces 1B to 6.  
**VEINS/FRACTURES:** <<1%; 0.5 mm; vertical to inclined; filled with zeolite.

**UNIT 26: OLIVINE-PHYRIC BASALT**

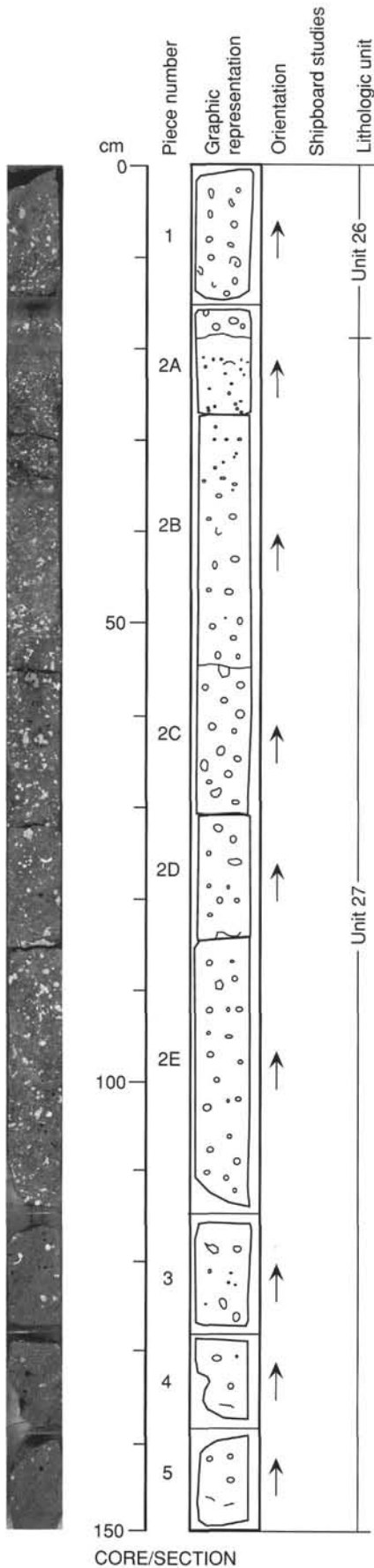
**Pieces 1-2A**

**CONTACTS:** Base of flow in Piece 2A.  
**PHENOCRYSTS:** Olivine - 5%; 1-5 mm; elongate and skeletal.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 10%; 1-10 mm; irregular; concentrated towards bottom of flow; filled with white zeolite.  
**COLOR:** Olive black (5Y 2/1).  
**ALTERATION:** Moderate; olivine completely altered to pale green mineral.  
**VEINS/FRACTURES:** <<1%; 0.1 mm; vertical; filled with zeolite.

**UNIT 27: OLIVINE-PHYRIC BASALT**

**Pieces 2A-5**

**CONTACTS:** Top of flow in Piece 2A.  
**PHENOCRYSTS:** Top of flow appears to be aphyric. Olivine - 0-2%; 1-5 mm; elongate.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 2%-20%; 1-15 mm; spherical to irregular; concentrated towards top of flow; most completely filled with white zeolite; some lined with analcime; one (in Piece 5E) lined with fibrous zeolite; some lined with a globular green encrustation.  
**COLOR:** Olive black (5Y 2/1).  
**ALTERATION:** Moderate at base of section to strong at top; olivine completely altered to pale green mineral; some 1 mm grains of red iron oxide in vesicles in Piece 2.  
**VEINS/FRACTURES:** <<1%; 0.5-1 mm; vertical; filled with zeolite.



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UNIT 27: OLIVINE-PHYRIC BASALT

Pieces 1-9

**PHENOCRYSTS:** Olivine - 2%-5%; 1-5 mm; elongate and skeletal.

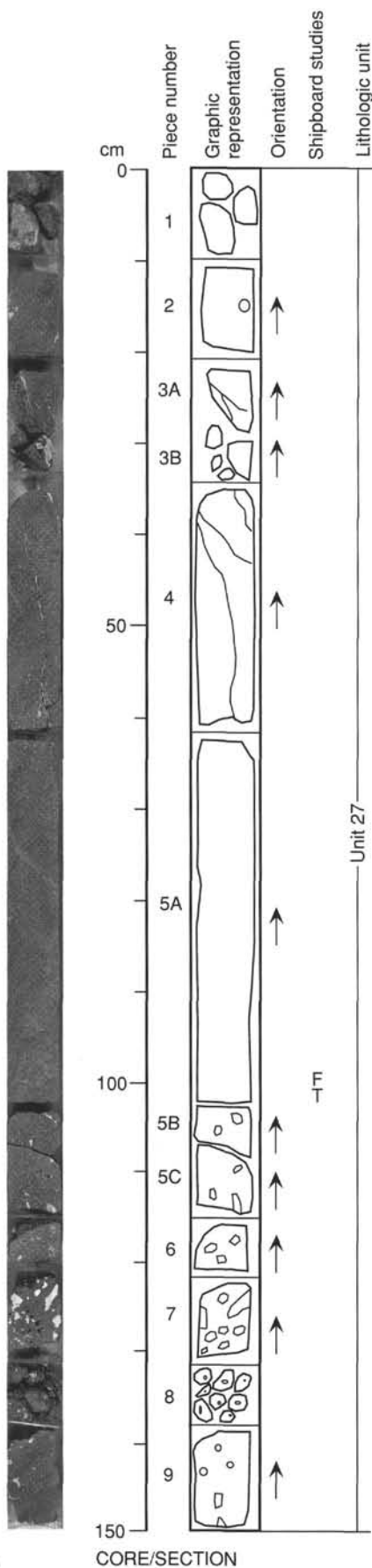
**GROUNDMASS:** Fine-grained.

**VESICLES:** 0-20%; 1-20 mm; spherical to irregular; confined to bottom 35 cm of section; most filled with white zeolite, some empty, some coated with globular green encrustation.

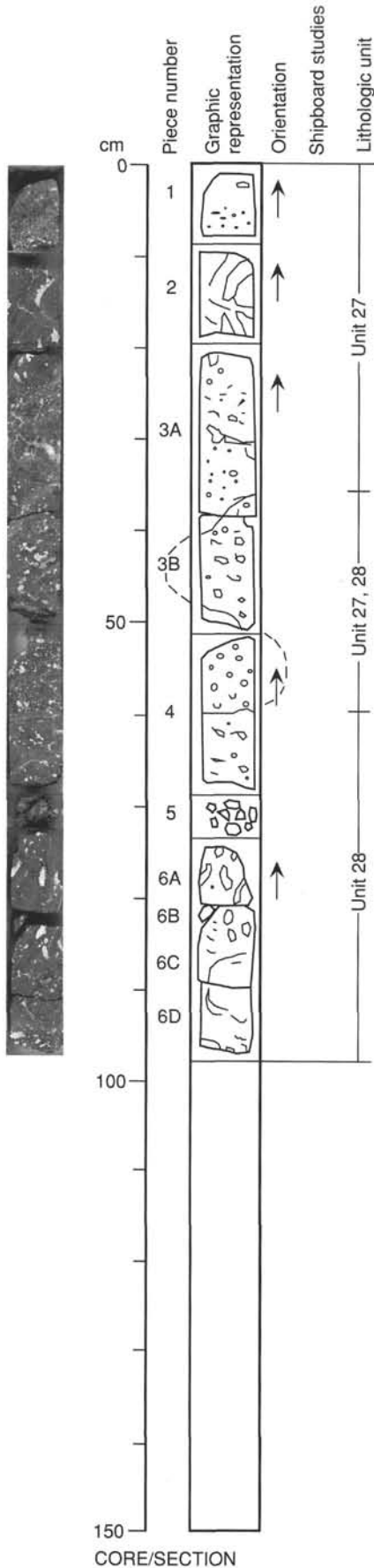
**COLOR:** Dark greenish gray (5GY 4/1).

**ALTERATION:** Moderate; olivine completely altered to pale green mineral.

**VEINS/FRACTURES:** <<1%; 0.2-2 mm; mostly vertical; filled with zeolite, confined to Pieces 1-4.



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**UNIT 27: OLIVINE-PHYRIC BASALT**

**Pieces 1–4**

**CONTACTS:** Irregular flow base in Pieces 3A, 3B, and 4.

**PHENOCRYSTS:** Olivine - 2%; 1–5 mm; elongate.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 10%–20%; 1–20 mm; spherical to irregular; patchy distribution; filled with zeolite; some fibrous.

**COLOR:** Olive black (5Y 2/1) to greenish gray at base (5G 6/1).

**ALTERATION:** Moderate to strong; olivine completely altered to pale green mineral.

**VEINS/FRACTURES:** <1%; 0.2–2 mm; random distribution; filled with zeolite in Pieces 2 and 3A.

**UNIT 28: OLIVINE-PHYRIC BASALT**

**Pieces 3A–6D**

**CONTACTS:** Irregular flow top on Pieces 3A, 3B, and 4.

**PHENOCRYSTS:** Olivine - <1%; 1–5 mm; elongate.

**GROUNDMASS:** Aphanitic.

**VESICLES:** 15%; 1–20 mm; spherical to irregular; random distribution; filled with zeolite.

**COLOR:** Grayish red (5R 4/2).

**ALTERATION:** Strong; olivine completely altered to pale green mineral; groundmass oxidized.

**VEINS/FRACTURES:** <1%; 0.2–2 mm; random distribution; filled with zeolite.

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**UNIT 28: OLIVINE-PHYRIC BASALT**

**Pieces 1A-1D**

**PHENOCRYSTS:** Olivine - 2%-5%; 1-5 mm; elongate.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 0-20%; 1-10 mm; spherical to irregular; concentrated at top and bottom of section; filled with zeolite.

**COLOR:** Grayish black (N 2/0).

**ALTERATION:** Moderate; olivine completely altered to pale green mineral.

**ADDITIONAL COMMENTS:** Brecciated towards top of section.

**UNIT 29: APHYRIC OLIVINE BASALT**

**Pieces 2-3E**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 10%; 1-10 mm; spherical to irregular; concentrated in bands; approximately half filled with zeolite, half empty or lined with dark green mineral; a few lined with analcime.

**COLOR:** Dark gray (N 3/0).

**ALTERATION:** Moderate; groundmass olivine altered to pale green mineral.

**VEINS/FRACTURES:** <1%; 0.2-2 mm; inclined; zeolite-filled; grains of native copper in Pieces 2 and 3A.

**ADDITIONAL COMMENTS:** Complete flow unit.

**UNIT 30: OLIVINE-PHYRIC BASALT**

**Piece 3F**

**PHENOCRYSTS:** Olivine - 1%; barely distinguishable.

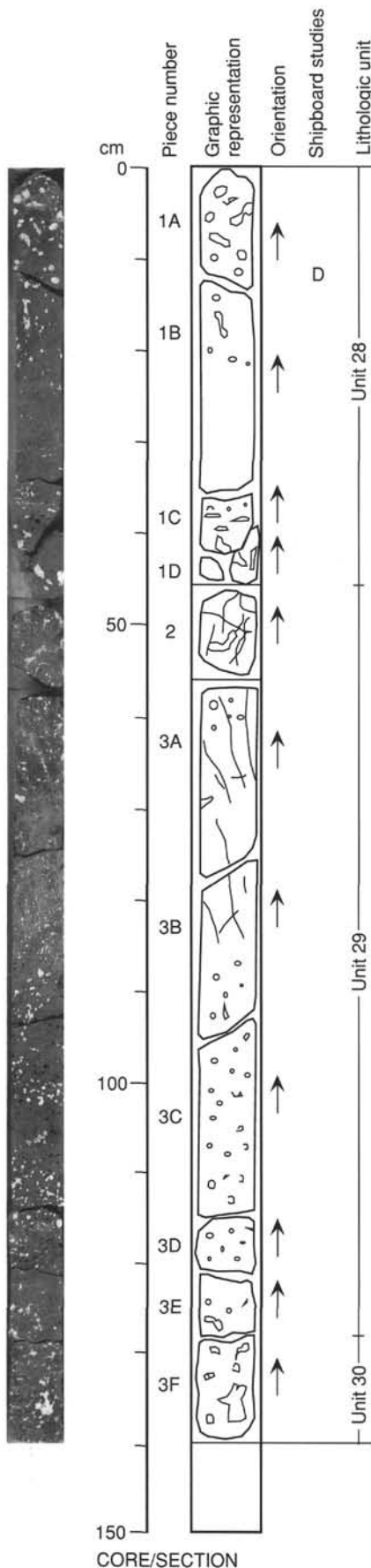
**GROUNDMASS:** Fine-grained.

**VESICLES:** 10%-15%; 3-20 mm; irregular; filled with two generations of zeolite, one gray lining the vesicle and a white variety that fills them; smaller vesicles are either empty or lined with pale green mineral.

**COLOR:** Brownish gray (5YR 4/1).

**ALTERATION:** Moderate; groundmass is oxidized.

**ADDITIONAL COMMENTS:** Oxidized flow top of Unit 30.



**UNIT 30: OLIVINE-PHYRIC BASALT**

**Piece 1A**

**CONTACTS:** Sharp lower contact at 60 cm in Piece 1B.

**PHENOCRYSTS:** Completely replaced by pale green mineral. Olivine - 5%; 0.5–2 mm; elongate.

**GROUNDMASS:** Fine-grained; partially oxidized.

**VESICLES:** 1%–10%; 2–15 mm; rounded to elongate; two elongate cavities in both pieces; all vesicles are filled with light colored zeolite; two small cavities at 17 cm lined with analcime.

**COLOR:** Brownish gray (5YR 4/1).

**ALTERATION:** Moderate.

**ADDITIONAL COMMENTS:** Vesicles are fewest and the amount of olivine greatest in the center of the unit between 35 and 50 cm.

**UNIT 31A: OLIVINE-PHYRIC BASALT**

**Pieces 1B–6B**

**CONTACTS:** Brecciated flow top in Piece 1B.

**PHENOCRYSTS:** Completely replaced by pale green mineral. Olivine - 2%–5%; 0.5–2 mm; elongate to skeletal.

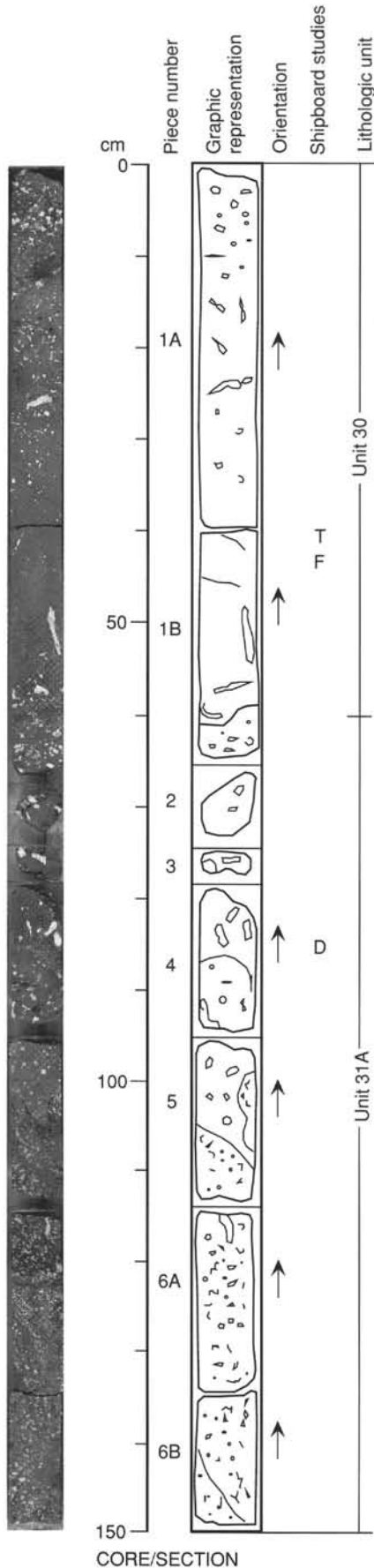
**GROUNDMASS:** Fine-grained; highly oxidized between 85 and 120 cm.

**VESICLES:** 1%–15%; 1–20 mm; rounded to elongate; filled with white zeolite.

**COLOR:** Medium gray (N 4/0) to reddish brown (10R 3/4).

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** Few, small (1 mm) zeolite veins.



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UNIT 31A: OLIVINE-PHYRIC BASALT

Pieces 1-12

**PHENOCRYSTS:** Completely replaced by pale green mineral. Olivine - 2%-5%; 0.5-3 mm; elongate to skeletal.

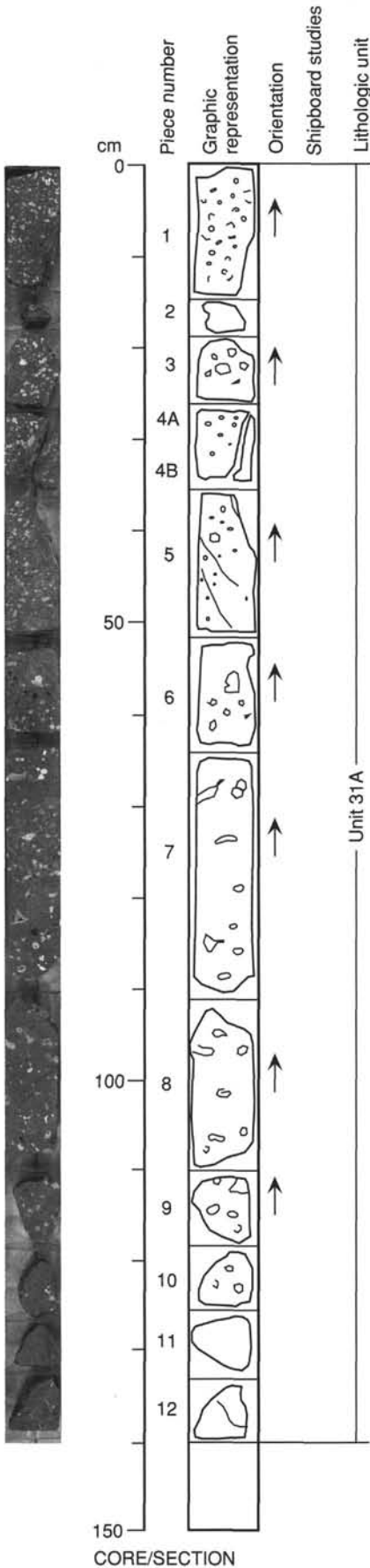
**GROUNDMASS:** Fine-grained; oxidized slightly in Pieces 1-4.

**VESICLES:** 5%-10%; 1-15 mm; irregular; most filled with white zeolite, but some lined with analcime or pale green zeolite.

**COLOR:** Medium gray (N 4/0).

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** Few small (1 mm) zeolite veins.



**UNIT 31A: OLIVINE-PHYRIC BASALT**

**Pieces 1A-5**

**PHENOCRYSTS:** Completely replaced by pale green mineral. Olivine - 5%–10%; 1–5 mm; elongate to skeletal.

**GROUNDMASS:** Fine-grained.

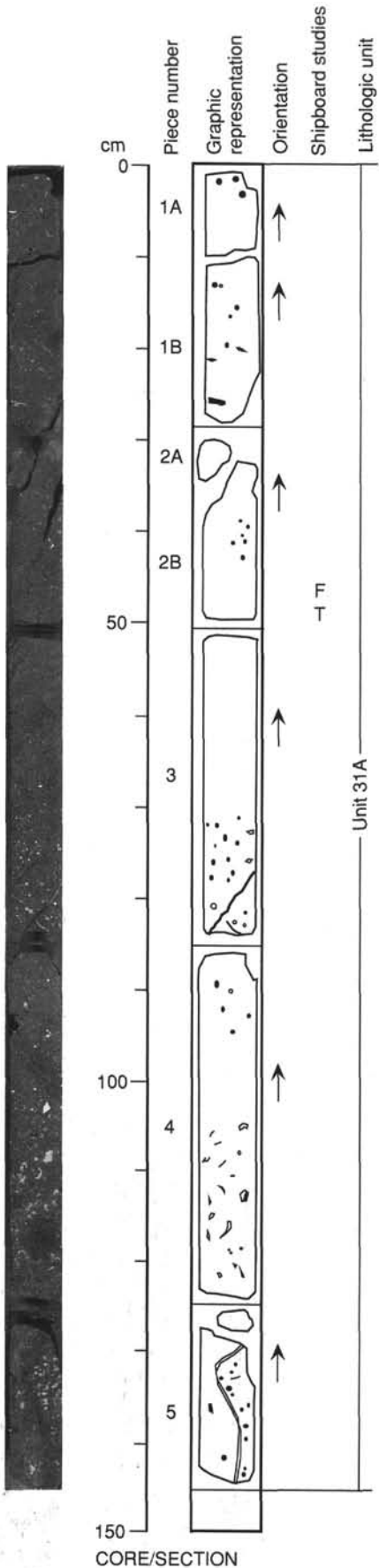
**VESICLES:** 0–20%; 1–15 mm; mostly irregular; most filled with white zeolite, but some with white or green clay, a few lined with analcime or globular green encrustation.

**COLOR:** Grayish black (N 2/0).

**ALTERATION:** Moderate; olivine completely altered to pale green mineral; some olivine phenocrysts have oxidized patches.

**VEINS/FRACTURES:** <<1%; 0.2–1 mm; inclined; zeolite-filled.

**ADDITIONAL COMMENTS:** Unit 31 has chilled contact with included angular block of vesicular basalt in Piece 5.



CORE/SECTION



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**UNIT 31A: OLIVINE-PHYRIC BASALT**

**Pieces 1-9**

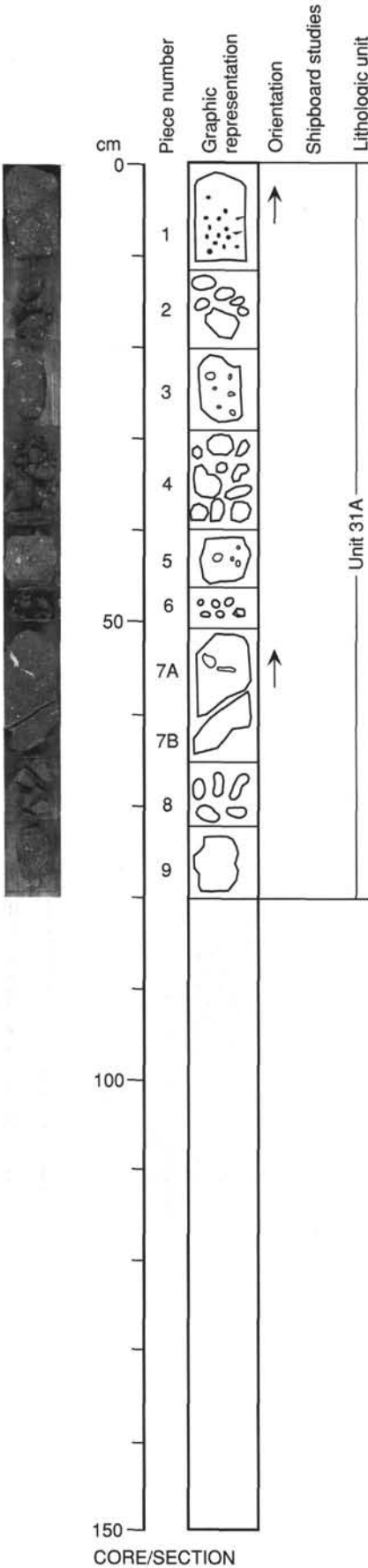
**PHENOCRYSTS:** Completely replaced by pale green mineral. Olivine - 5%; 1-5 mm; elongate to skeletal.  
**GROUNDMASS:** Fine-grained.

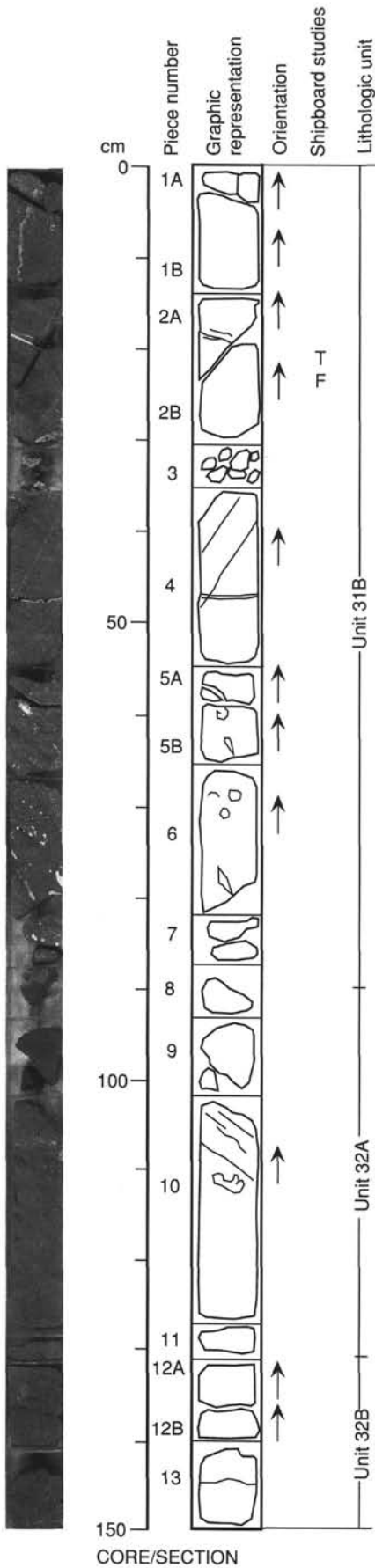
**VESICLES:** 1%-5%; 1-10 mm; spherical to irregular; mostly in upper half of section; most filled with white zeolite, but some empty or lined with analcime.

**COLOR:** Grayish black (N 2/0).

**ALTERATION:** Moderate; olivine completely altered to pale green mineral.

**VEINS/FRACTURES:** <<1%; 0.2-1 mm; inclined; zeolite-filled.





**UNIT 31B: PICRITE**

**Pieces 1A-8**

**CONTACTS:** Piece 8 contains a chilled contact of Unit 31B against an underlying 40 cm laterite and soil horizon (Unit 32A).

**PHENOCRYSTS:** Olivine - 5%-20%; 1-7 mm; elongate to skeletal.

**GROUNDMASS:** Fine-grained.

**VESICLES:** <1%; 1-10 mm; spherical to irregular; at base of section; filled with zeolite and white clay.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Moderate to strong; olivine completely altered.

**VEINS/FRACTURES:** <1%; 0.2-3 mm; inclined to horizontal; zeolite-filled; two large (2-3 mm) subhorizontal veins; inclined veins are thinner.

**UNIT 32B: PICRITE**

**Pieces 12A-13**

**PHENOCRYSTS:** Olivine - 20%; 1-8 mm; some elongate and skeletal, others euhedral.

**GROUNDMASS:** Aphanitic.

**VESICLES:** None.

**COLOR:** Dusky yellowish brown (10YR 2/2) to medium brown (5YR 4/4).

**ALTERATION:** Strong.

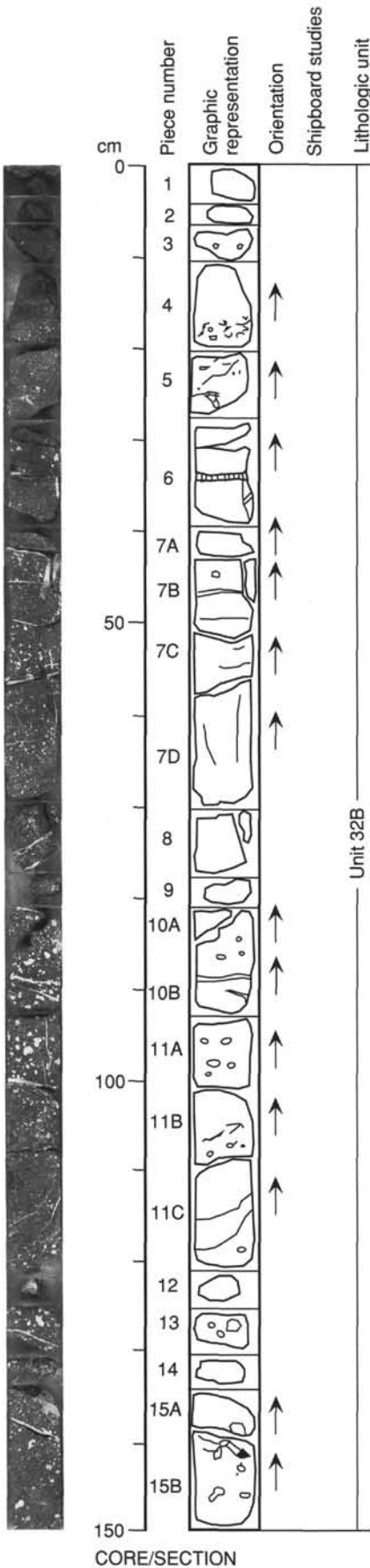
**ADDITIONAL COMMENTS:** Pieces 12A and 12B are from the weathered top of Unit 32B. The flow is overlain by a sediment (Pieces 8-11; Unit 32A).

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UNIT 32B: PICRITE

Pieces 1-15B

**PHENOCRYSTS:** Olivine - 20%; 1-15 mm; some elongate and skeletal, others euhedral.  
**GROUNDMASS:** Aphanitic.  
**VESICLES:** 20%; 0.5-10 mm; spherical to irregular; evenly distributed; smaller vesicles filled with dark green mineral, larger ones with white zeolite.  
**COLOR:** Dark greenish gray (5GY 4/1).  
**ALTERATION:** Strong; olivine completely altered to pale green mineral with oxidized patches.  
**VEINS/FRACTURES:** 5%; 0.5-5 mm; random orientation; zeolite-filled.  
**ADDITIONAL COMMENTS:** Top of section is highly weathered.



CORE/SECTION

**UNIT 32B: PICRITE**

**Pieces 1-11**

**PHENOCRYSTS:** Olivine - 20%-30%; 1-10 mm; mostly euhedral, some elongate.

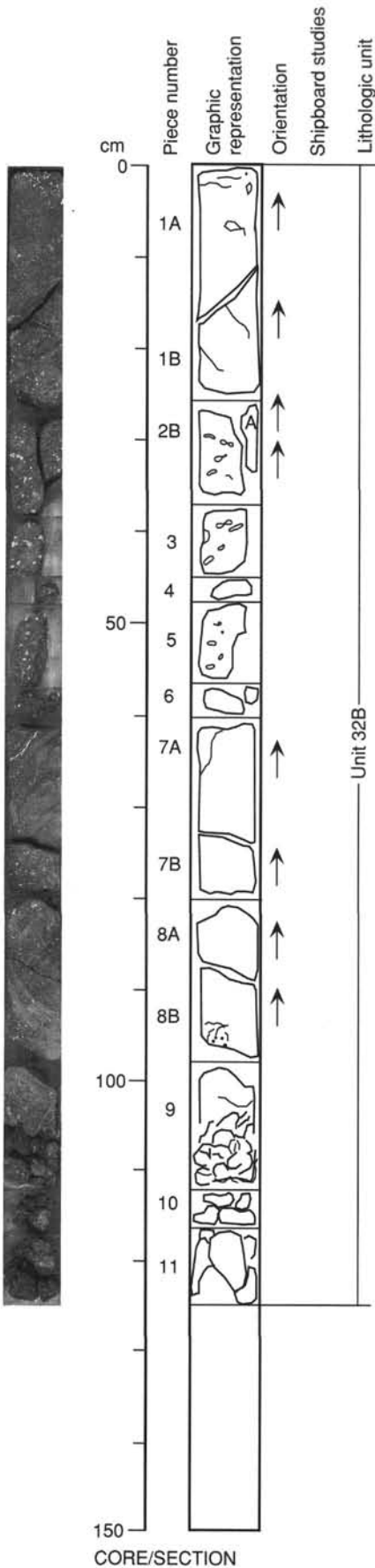
**GROUNDMASS:** Aphanitic.

**VESICLES:** 1%-10%; 1-8 mm; spherical to irregular; evenly distributed; smaller vesicles filled with dark green mineral, larger ones with white zeolite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Strong; olivine completely altered to pale green mineral with oxidized patches.

**VEINS/FRACTURES:** <<1%; 0.2-2 mm; inclined to horizontal; zeolite-filled.



152-917A-20R-4

UNIT 32B: PICRITE

Pieces 1A-11

**PHENOCRYSTS:** Olivine - 20%-30%; 1-8 mm; mostly euhedral, some elongate.

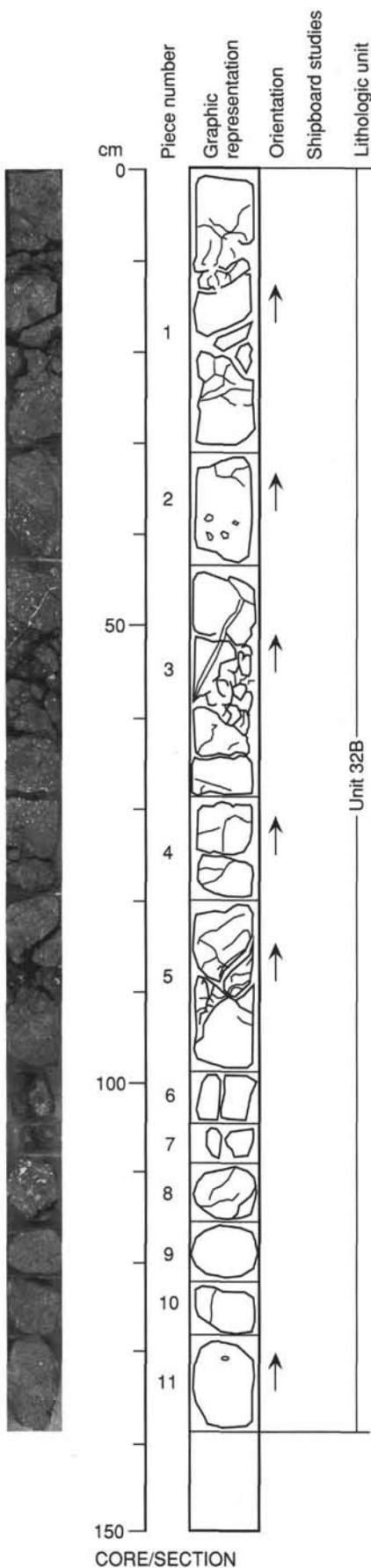
**GROUNDMASS:** Aphanitic.

**VESICLES:** 1%-10%; 1-8 mm; spherical to irregular; random.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Pieces 1-8 strong; olivine completely altered and disintegrating; Pieces 9-11 slight; olivine still mostly fresh.

**VEINS/FRACTURES:** <<1%; 0.2-2 mm; inclined; zeolite-filled in Pieces 3 and 10.



**UNIT 32B: PICRITE**

**Pieces 1-4**

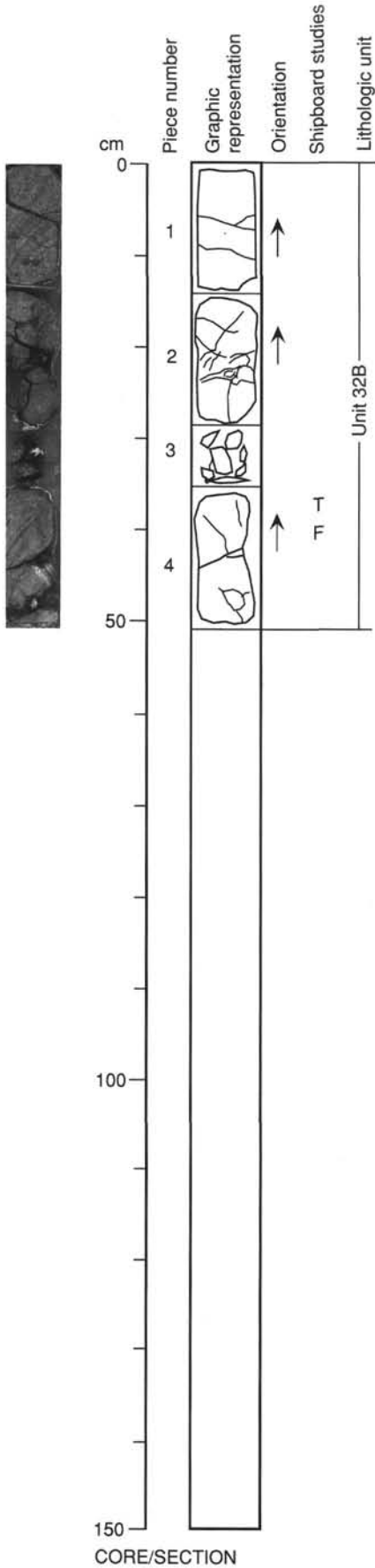
**PHENOCRYSTS:** Olivine - 20%; 1-8 mm; mostly euhedral, some elongate.

**GROUNDMASS:** Aphanitic.

**VESICLES:** <<1%; 1-4 mm; spherical to irregular; in Pieces 2-4; filled with zeolite and white clays.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Strong; olivine completely altered and rock disintegrating; Piece 4 slight; olivine still mostly fresh.



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UNIT 32B: PICRITE

Pieces 1-12

**PHENOCRYSTS:** Olivine - 30%; 1-8 mm; some euhedral, some elongate.

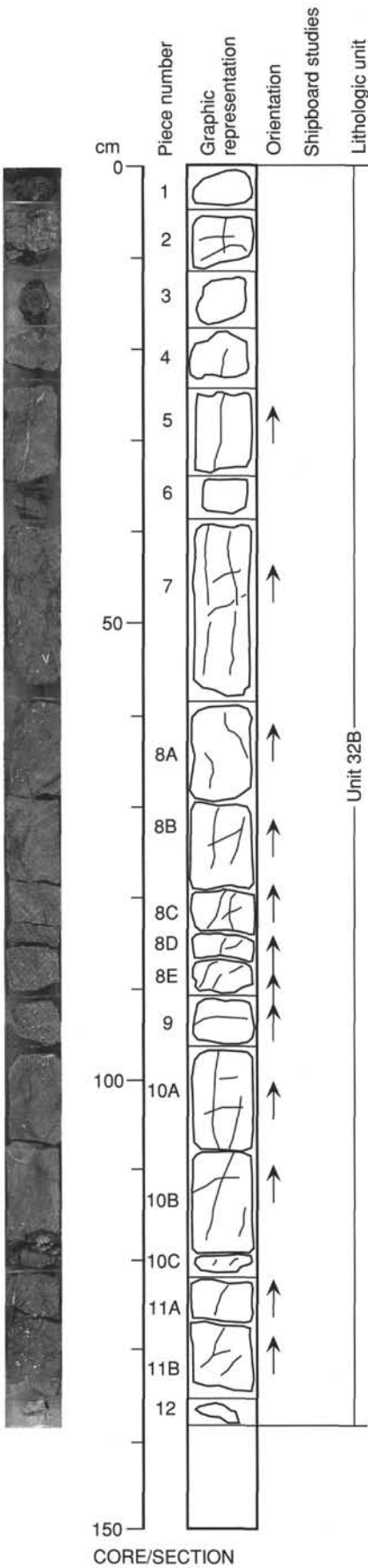
**GROUNDMASS:** Aphanitic.

**VESICLES:** <<1%; 1-8 mm; irregular shapes; random distribution; filled with zeolite minerals.

**COLOR:** Greenish black (5GY 2/1).

**ALTERATION:** Strong; olivine is completely altered.

**VEINS/FRACTURES:** <<1%; 0.2-4 mm; vertical and horizontal; filled with zeolite minerals.



**UNIT 32B: PICRITE**

**Pieces 1A-12**

**PHENOCRYSTS:** Olivine - 30%; 1-10 mm; some euhedral, some elongate.

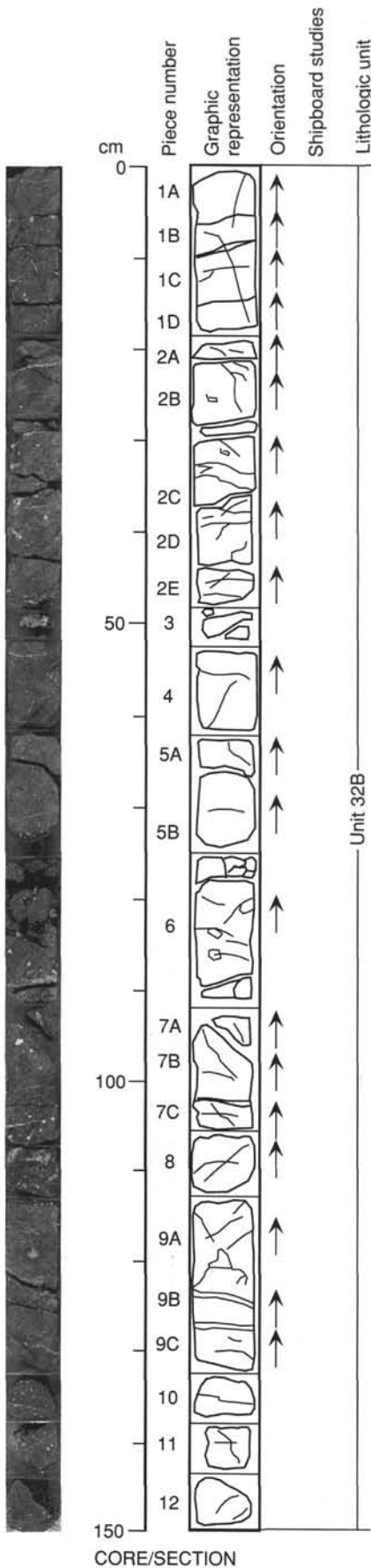
**GROUNDMASS:** Aphanitic.

**VESICLES:** 1%-10%; 1-10 mm; spherical to irregular; patchy distribution; lined with a green mineral and filled with zeolite minerals.

**COLOR:** Greenish black (5GY 2/1).

**ALTERATION:** Strong; olivine completely altered.

**VEINS/FRACTURES:** <1%; 0.2-3 mm; horizontal and vertical; filled with zeolite minerals.





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**UNIT 32B: PICRITE**

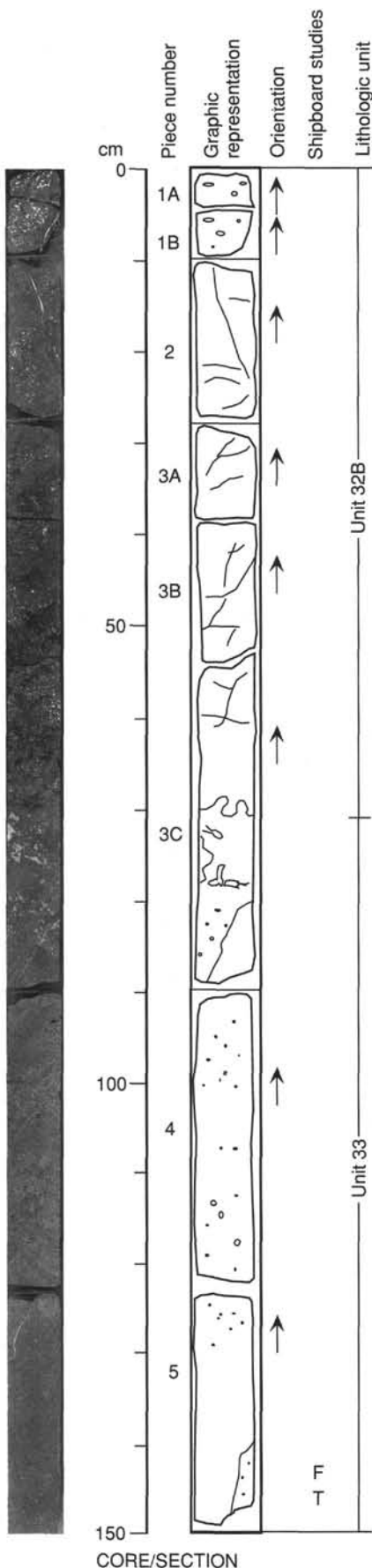
**Pieces 1A-3C**

**CONTACTS:** Base of flow is seen in Piece 3C.  
**PHENOCRYSTS:** Olivine - 20%; 1-10 mm; some euhedral, some platy.  
**GROUNDMASS:** Aphanitic.  
**VESICLES:** 1%-10%; 1-10 mm; spherical to irregular; patchy distribution; filled with zeolite minerals.  
**COLOR:** Greenish black (5GY 2/1).  
**ALTERATION:** Strong; olivine completely altered.  
**VEINS/FRACTURES:** <<1%; 0.2-3 mm; inclined; filled with zeolite minerals.

**UNIT 33: OLIVINE-PHYRIC BASALT**

**Pieces 3C-5**

**CONTACTS:** Top of flow is seen in Piece 3C.  
**PHENOCRYSTS:** Olivine - <<1%; 0.5-2 mm; euhedral to subhedral.  
**GROUNDMASS:** Aphanitic.  
**VESICLES:** <1%-20%; 0.5-10 mm; spherical to irregular; patchy distribution; top of unit has large ones filled with zeolite minerals; base of section has small, empty ones.  
**COLOR:** Olive black (5Y 2/1).  
**STRUCTURE:** Flow-brecciation in lower 55 cm.  
**ALTERATION:** Moderate; olivine phenocrysts completely oxidized.  
**VEINS/FRACTURES:** <<1%; 0.2-1 mm; inclined; filled with zeolite minerals.



**UNIT 33: OLIVINE-PHYRIC BASALT**

**Pieces 1-18**

**PHENOCRYSTS:** Olivine - <<1%; 0.5-2 mm; euhedral to subhedral.

**GROUNDMASS:** Aphanitic.

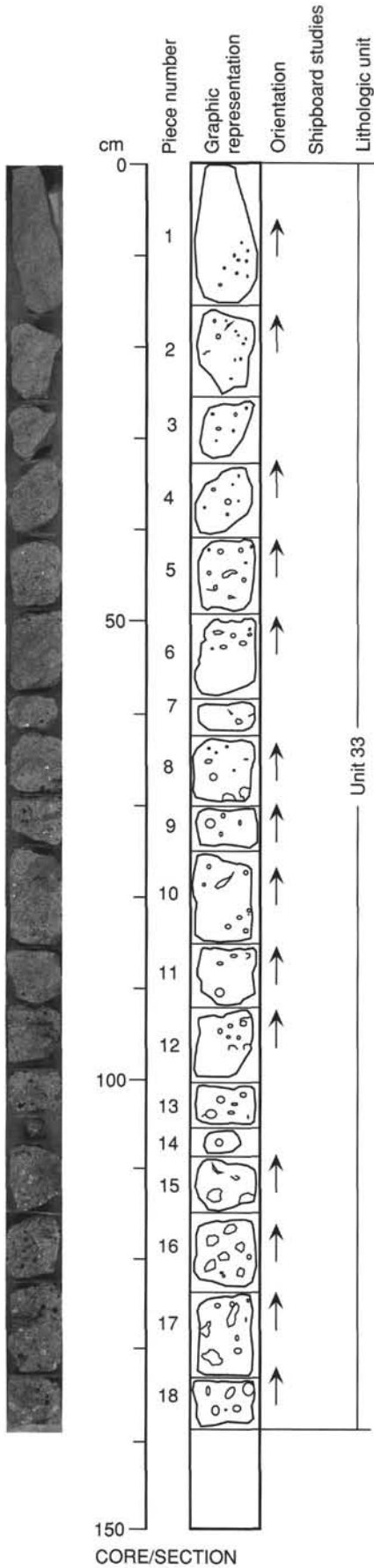
**VESICLES:** <1%-20%; 1-10 mm; spherical to irregular; become larger and more abundant towards the bottom of the section; most are empty; some are filled with zeolite minerals.

**COLOR:** Dark greenish gray (5GY 4/1).

**STRUCTURE:** Finely flow-brecciated in places.

**ALTERATION:** Moderate; olivine completely altered.

**VEINS/FRACTURES:** None.



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UNIT 33: OLIVINE-PHYRIC BASALT

Pieces 1-7

**PHENOCRYSTS:** Olivine - <<1%; 0.5-2 mm; euhedral to subhedral.

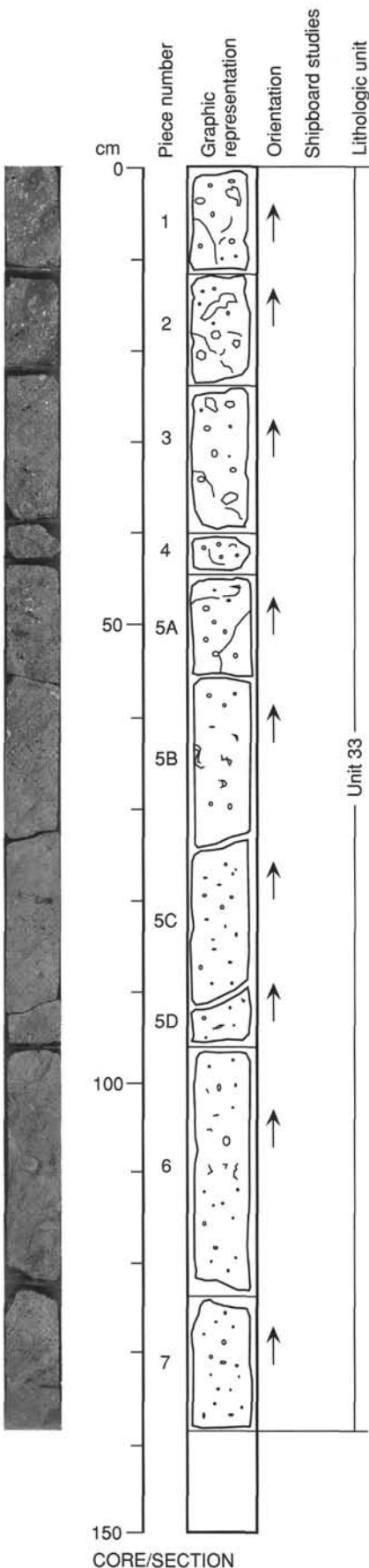
**GROUNDMASS:** Aphanitic.

**VESICLES:** 1%-20%; 1-8 mm; spherical to irregular; more common and larger towards the top of the section; some are empty; some are filled with zeolite minerals.

**COLOR:** Dark greenish gray (5GY 4/1).

**ALTERATION:** Moderate; olivine completely altered.

**VEINS/FRACTURES:** <<1%; 0.2-1 mm; inclined; small fractures filled with zeolite minerals seen in the top part of the section.



**UNIT 33: OLIVINE-PHYRIC BASALT**

**Pieces 1-10**

**PHENOCRYSTS:** Olivine - <<1%; 0.5-2 mm; euhedral to subhedral.

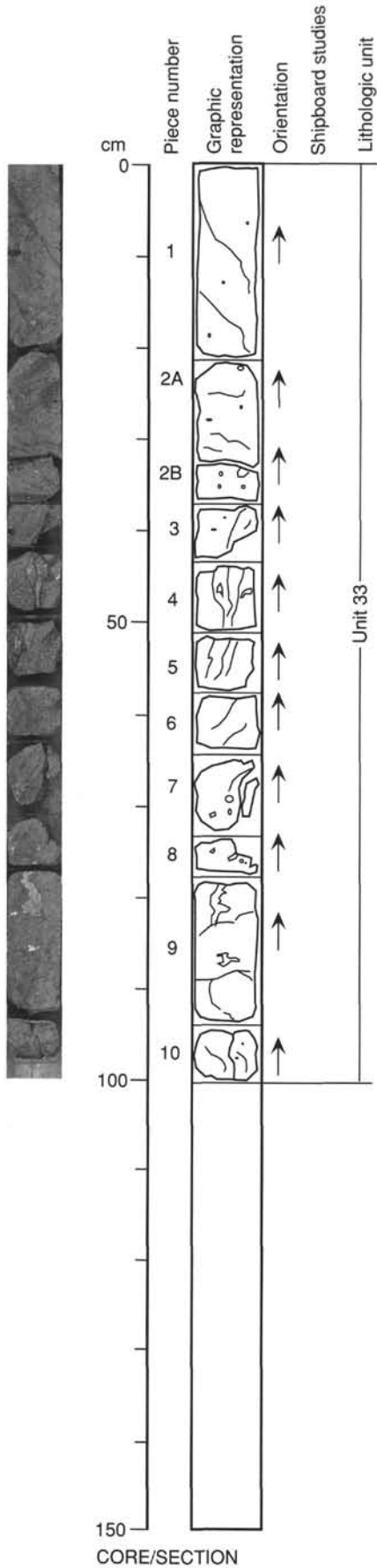
**GROUNDMASS:** Aphanitic.

**VESICLES:** <1%-5%; 1-8 mm; spherical to irregular; patchy distribution; some empty; some filled with globular growths of zeolite minerals; Piece 9 has a 5 cm cavity filled with zeolite minerals.

**COLOR:** Dark greenish gray (5GY 4/1).

**ALTERATION:** Moderate; olivine completely altered.

**VEINS/FRACTURES:** <<1%; 0.2-5 mm; random distribution; filled with zeolite minerals.



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**UNIT 33: OLIVINE-PHYRIC BASALT**

**Pieces 1A-1B**

**CONTACTS:** The bottom contact is seen in Piece 1B at 60-64 cm. Brecciation of the flow bottom and scooping up of the underlying clay is seen in the basal 20 cm (interval 44-64 cm).

**PHENOCRYSTS:** Olivine - <<1%; 0.5 mm; euhedral; altered.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 1%; 1-2 mm; irregular shapes; scattered; some are filled with greenish material and others are empty.

**COLOR:** Light gray (5Y 6/1).

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** <1 mm; vertical; filled with red oxidized material.

**ADDITIONAL COMMENTS:** The flow overlies a brown sedimentary horizon (Unit 34A).

**UNIT 34B: APHYRIC BASALT**

**Pieces 6A-6C**

**CONTACTS:** The upper contact is seen at 128-130 cm. The flow-top is brecciated and cracked; the overlying brown sediment fills steep cracks down to 146 cm.

**PHENOCRYSTS:** None.

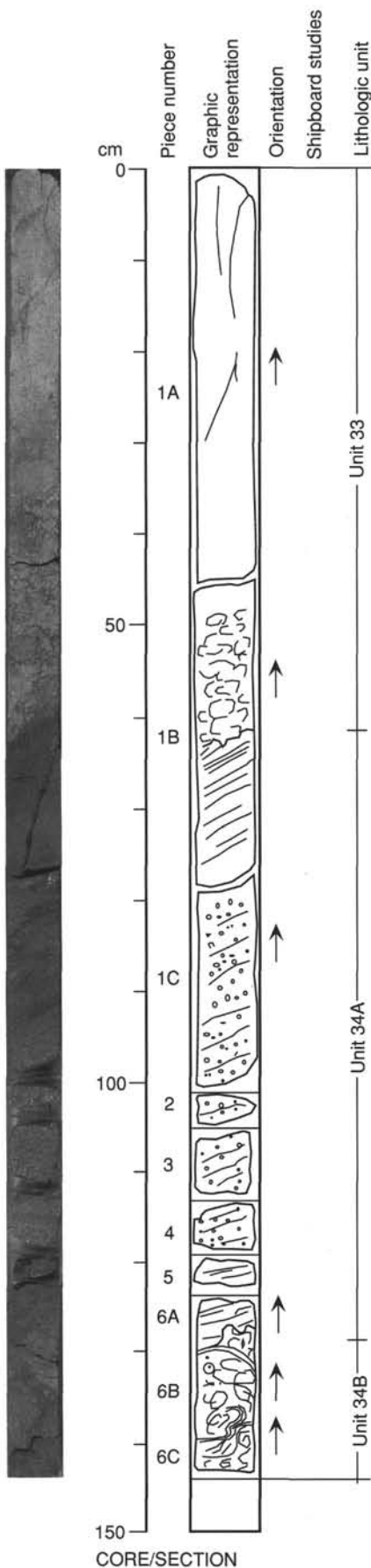
**GROUNDMASS:** Aphanitic.

**VESICLES:** None.

**COLOR:** Dark gray (N 4/0).

**STRUCTURE:** The rock is flow-brecciated on a 1-4 mm scale, but is not oxidized. There is also flow-brecciation on a 3-8 cm scale.

**VEINS/FRACTURES:** 1 cm; vertical; filled with sediment from the overlying Unit 34A.



**UNIT 34B: APHYRIC BASALT**

**Pieces 1-15**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Aphanitic.

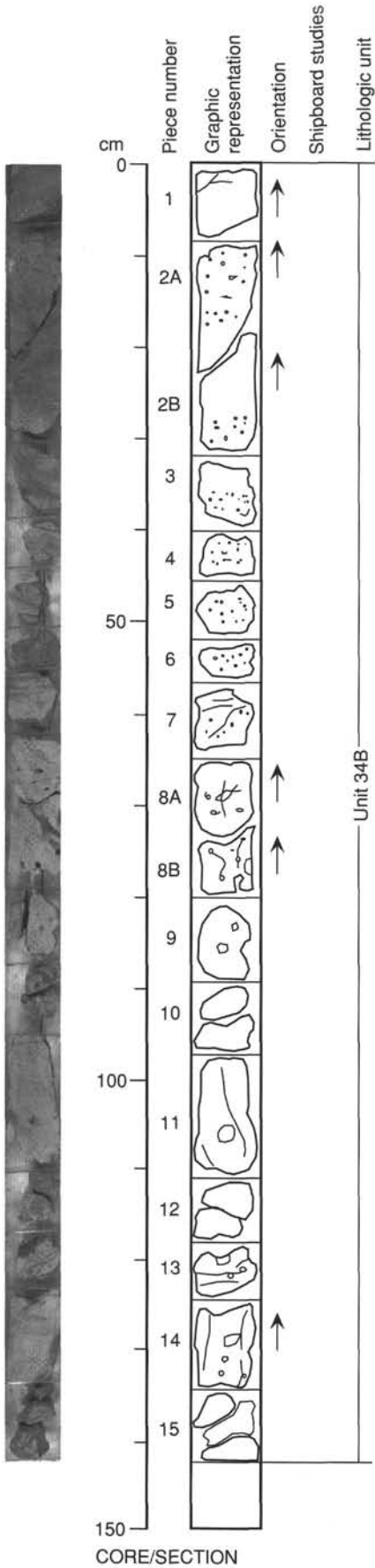
**VESICLES:** 2%-5%; 1-6 mm; rounded to irregular shapes; irregular distribution; trains of small (1 mm) vesicles occur at 10-18 and 28-55 cm.

**COLOR:** Greenish gray (10Y 5/1).

**STRUCTURE:** Some horizontal flow-banding is seen.

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** <1%; <1 mm; vertical; filled with green and brown material.



CORE/SECTION

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UNIT 34B: APHYRIC BASALT

Pieces 1-19

**PHENOCRYSTS:** Very few 2-4 mm diameter glomerocrysts of plagioclase and mafic minerals seen at 72 and 90 cm.

**GROUNDMASS:** Aphanitic.

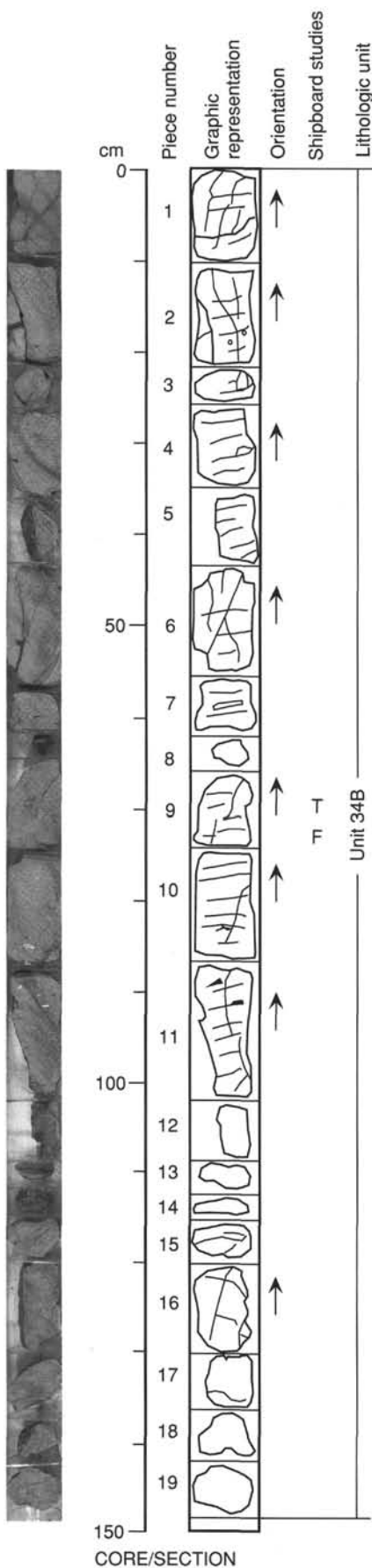
**VESICLES:** 0.5-1 mm; rounded to flattened; scattered; only a few of them.

**COLOR:** Gray (N 5/0).

**STRUCTURE:** Horizontal flow-banding defined by dark lines spaced 2-5 mm apart.

**ALTERATION:** Fresh.

**VEINS/FRACTURES:** <<1%; <<1 mm; vertical.



**UNIT 34B: APHYRIC BASALT**

**Pieces 1–22**

**CONTACTS:** The lower contact is not preserved, but Piece 22 is close to the bottom of the flow. Piece 23 is a redeposited crystal tuff.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Very fine-grained.

**VESICLES:** 0.3–0.5 mm; round and flattened ones; a few large, round ones are scattered through the flow; flattened ones are aligned along the flow lines and constitute 5%–7% of the lowest part of the flow, (Pieces 18–22).

**COLOR:** Gray (N 5/0).

**STRUCTURE:** Horizontal flow-banding occurs in Pieces 1–17. The orientation becomes steeper towards the bottom of the flow.

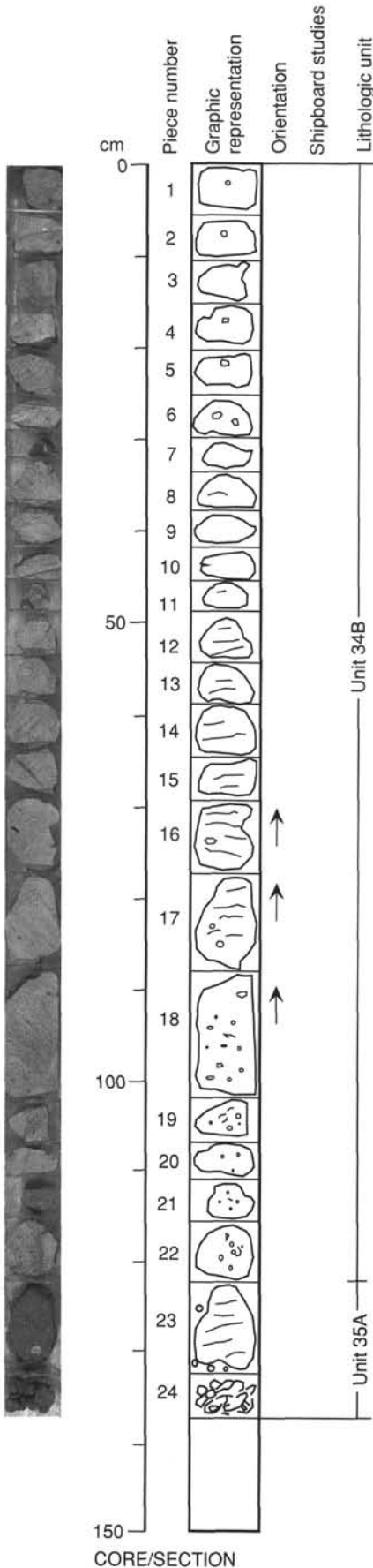
**UNIT 35A: REDEPOSITED CRYSTAL TUFF AND RHYOLITE**

**Pieces 23–24**

**PHENOCRYSTS:** None.

**VESICLES:** None.

**STRUCTURE:** The rock contains 5% of 0.1–1 mm large feldspar crystals and mafic crystals, a few dark rock fragments, and one 1-cm-large fragment of pink rhyolite with feldspar and mafic phases. The matrix consists of crudely laminated, dark red-brown clay.





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UNIT 35B: HYALOCLASTITE TUFF

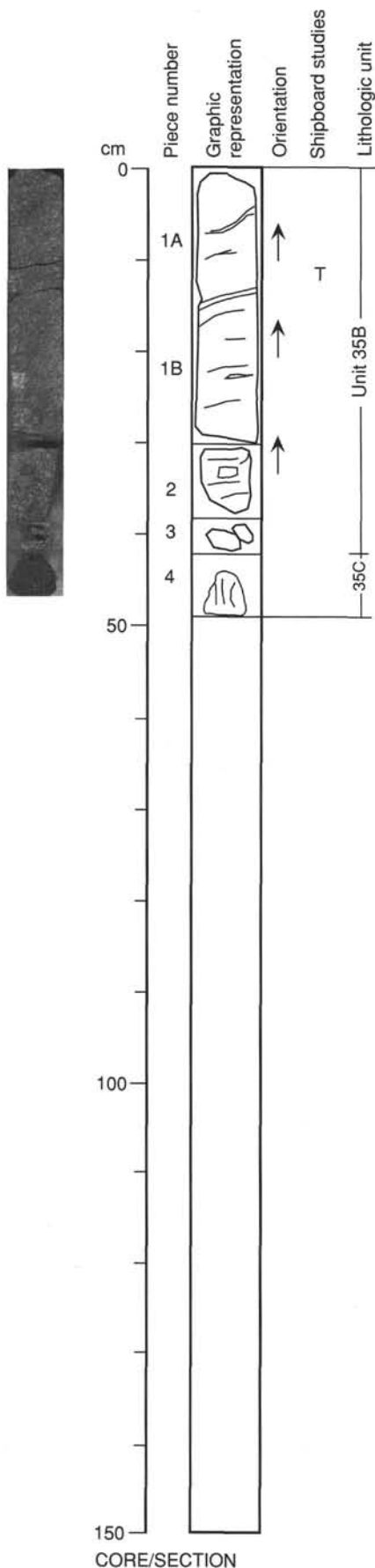
Pieces 1A-3

**PHENOCRYSTS:** None.

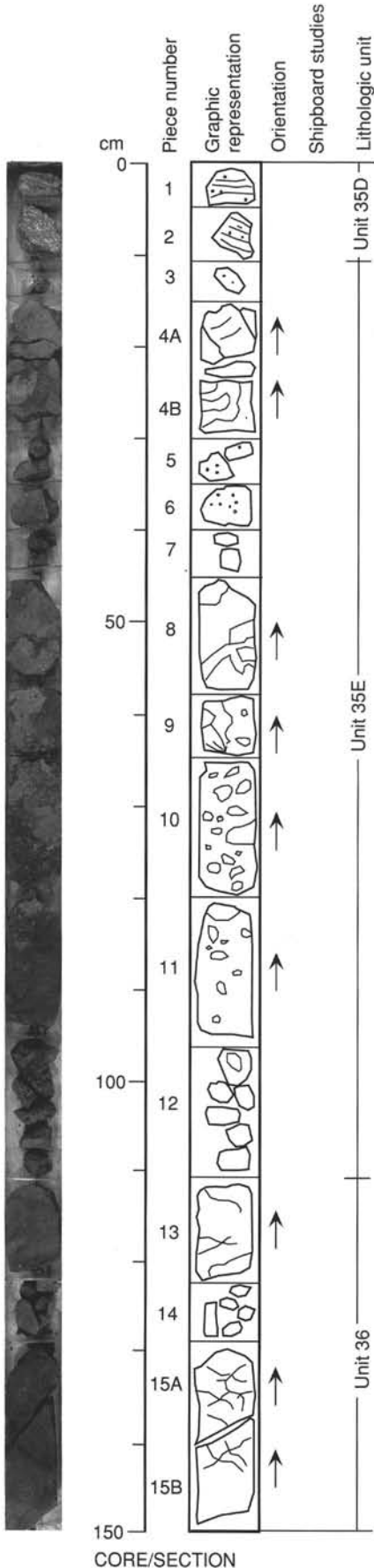
**VESICLES:** None.

**STRUCTURE:** The rock consists of 1-10-mm-large fragments of rock and <1-2 mm euhedral crystals embedded in a dark brown aphanitic nonvesicular matrix. The crystals are mainly white feldspar and there are a few crystals of dark mafic minerals. The rock shows weak near-horizontal bedding and no sorting.

**ADDITIONAL COMMENTS:** Unit 35C is a red sediment described by the sedimentologists.



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**UNIT 35D: CRYSTAL TUFF**

**Pieces 1-2**

**PHENOCRYSTS:** Feldspar - 25%; 0.5-3 mm; subhedral to euhedral. Mafic minerals - <1%; <0.2 mm; equant grains.

**GROUNDMASS:** Aphanitic, finely banded, light yellow-brown vitric tuff matrix.

**VESICLES:** None.

**COLOR:** Mottled white and yellow-brown.

**ADDITIONAL COMMENTS:** The rock is separated from the overlying hyaloclastite tuff by a minimum 5-cm-thick layer of brick-red clay with scattered dark rock and white crystal fragments (Unit 35C).

**UNIT 35E: BASALT BRECCIA/CONGLOMERATE**

**Pieces 3-12**

**CONTACTS:** None. The rock grades downward into a highly brecciated flow top.

**PHENOCRYSTS:** None.

**VESICLES:** None.

**STRUCTURE:** The rock is a polymict breccia/conglomerate of up to 5-cm-large volcanic clasts which range from rounded to very irregular, often scoriaceous. They are embedded in a fine-grained brown matrix. The clast size decreases downward to about 1 cm, and the matrix changes color downward from dark yellowish brown (10YR 3/3) to almost black.

**ADDITIONAL COMMENTS:** The rock probably represents only slightly reworked flow-top rubble.

**UNIT 36: APHYRIC BASALT**

**Pieces 13-15**

**CONTACTS:** The top at 111 cm grades almost imperceptibly into loose top rubble (Unit 35E).

**PHENOCRYSTS:** None.

**GROUNDMASS:** Aphanitic.

**VESICLES:** The rock is very finely vesiculated; the vesicles are barely visible.

**COLOR:** Dark reddish gray (10R 3/1).

**STRUCTURE:** The rock is fine-scale flow-brecciated.

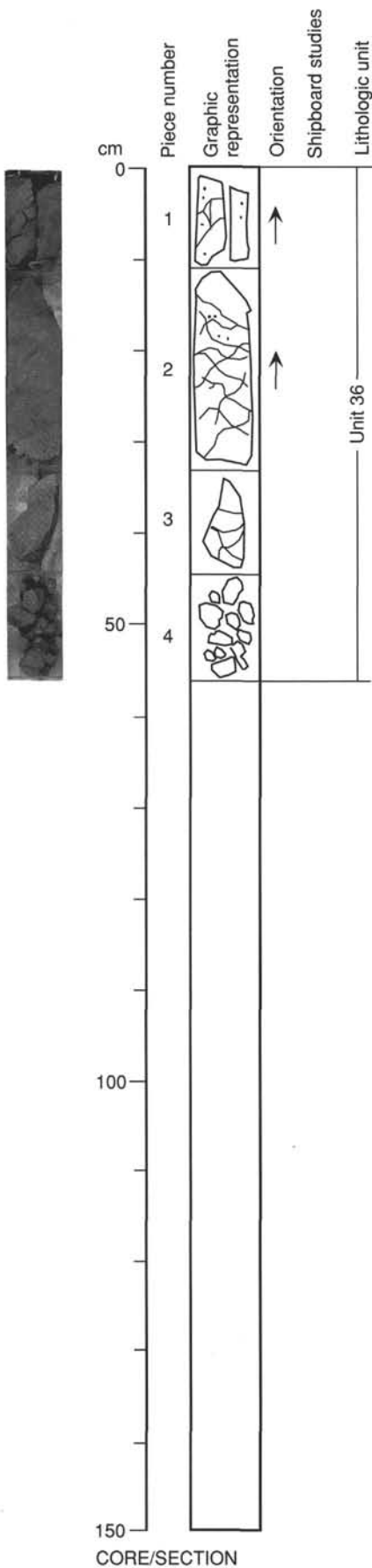
**ALTERATION:** Strong.

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**UNIT 36: APHYRIC BASALT**

**Pieces 1-4**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Aphanitic.  
**VESICLES:** 5%; 0.5-1 mm; round; irregular distribution; filled with greenish material.  
**COLOR:** Dark gray (N 4/0).  
**STRUCTURE:** The rock shows some internal flow-brecciation.  
**ALTERATION:** Strong.



**UNIT 36: PLAGIOCLASE-PHYRIC BASALT**

**Pieces 1-11C**

**PHENOCRYSTS:** Plagioclase - <0.5%; up to 2 mm; lath-shaped.

**GROUNDMASS:** Fine-grained.

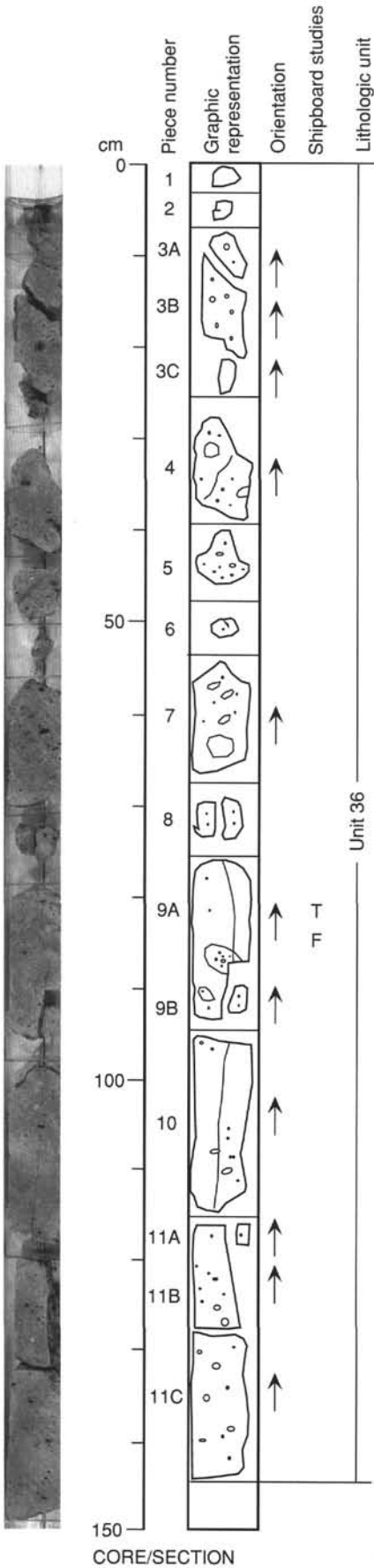
**VESICLES:** 1%-10%; 1-15 mm; round to oval; lined with grayish green material; the centers may be empty, filled with brownish gray expanding clay, or the bottom quarter may be filled with a green mineral. The vesicle abundance is greatest in Pieces 2-8.

**COLOR:** Gray (N 4/0).

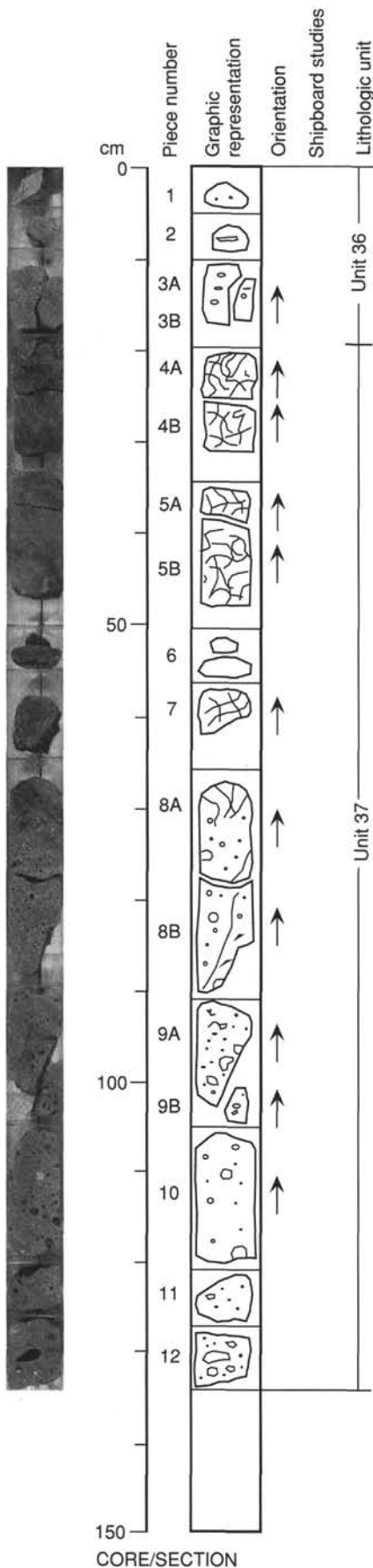
**STRUCTURE:** Re-entrained chunks of vesicular portions of the lava 1-5 cm in diameter are seen at 31, 64, 85, and 90 cm.

**ALTERATION:** Moderate; some larger vesicles have slightly oxidized halos.

**VEINS/FRACTURES:** 1%; <<1 mm; mainly vertical; filled with green or white minerals; some are associated with slight oxidation halos.



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**UNIT 36: PLAGIOCLASE-PHYRIC BASALT**

**Pieces 1-3B**

**PHENOCRYSTS:** Plagioclase - <<0.5%; up to 1 mm; lath-shaped.

**GROUNDMASS:** Aphanitic.

**VESICLES:** 10%-20%; <1-20 mm; very flattened; aligned horizontally in Piece 2 and top 3.5 cm of Piece 3; very tiny in base of Piece 3; lined with green mineral; otherwise filled with expanding clay or empty.

**COLOR:** Gray (N 4/0).

**ALTERATION:** Fairly fresh.

**VEINS/FRACTURES:** <<1%; <<1 mm; vertical; filled with the same green mineral as the vesicles.

**UNIT 37: PLAGIOCLASE-PHYRIC BASALT**

**Pieces 4A-12**

**CONTACTS:** None. Piece 4 is close to the top.

**PHENOCRYSTS:** Plagioclase - <1%; up to 1 mm; lath-shaped.

**GROUNDMASS:** Very fine-grained.

**VESICLES:** 0-10%; 1-30 mm; round to slightly irregular; disseminated; lined and filled with green clay; some are half filled with layered green and black clay whose top surface dips 5 degrees (geopetal).

**COLOR:** Dark gray (N 4/0), with some reddening towards the top.

**STRUCTURE:** Flow-brecciation is seen in Pieces 4-8 (19-72 cm).

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** <1%; 1 mm; subvertical; in Pieces 8B and 9 only.

**UNIT 37: PLAGIOCLASE-PHYRIC BASALT**

**Pieces 1-7**

**PHENOCRYSTS:** Plagioclase - <1%; up to 1 mm; lath-shaped.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 15%-20%; 1-20 mm; round to flattened; disseminated; filled with dark green clay; larger ones are filled with white and dark green clay; the abundance of vesicles increases towards the top of the section.

**COLOR:** Dark gray (N 4/0).

**ALTERATION:** Moderate.

**UNIT 38: PLAGIOCLASE-PHYRIC BASALT**

**Pieces 8-9D**

**CONTACTS:** None. Piece 8 is close to the top.

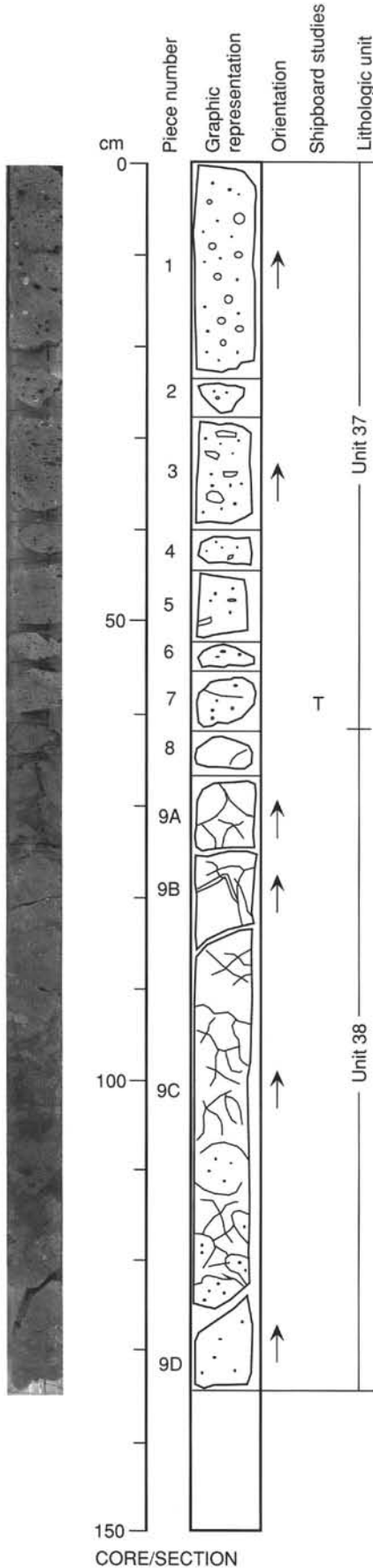
**PHENOCRYSTS:** Plagioclase - <<0.5%; up to 2 mm; lath-shaped.

**GROUNDMASS:** Very fine-grained.

**VESICLES:** 1%-10%; 1-2 mm; variable shapes and distribution in various fragments.

**COLOR:** Dark gray to reddish brown, mottled because of brecciation.

**STRUCTURE:** The rock is a highly brecciated flow top with 1-10 cm chunks of finely vesiculated lava in a fine-grained dark matrix. Brecciation is seen at 62-120 cm under which the rock becomes massive.



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**UNIT 38: PLAGIOCLASE-PHYRIC BASALT**

**Pieces 1-18**

**PHENOCRYSTS:** Plagioclase - 1%; up to 5 mm; lath-shaped.

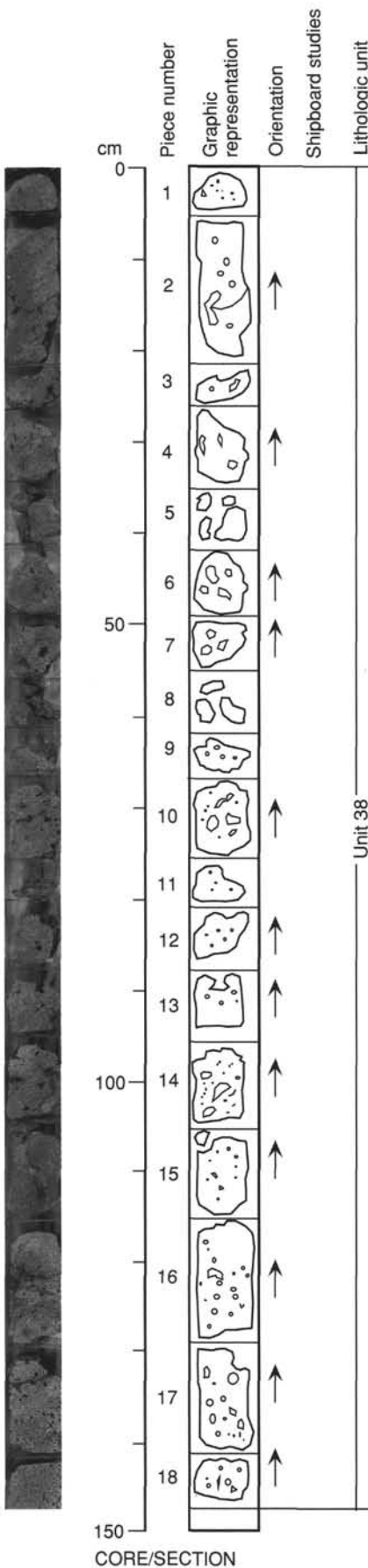
**GROUNDMASS:** Aphanitic.

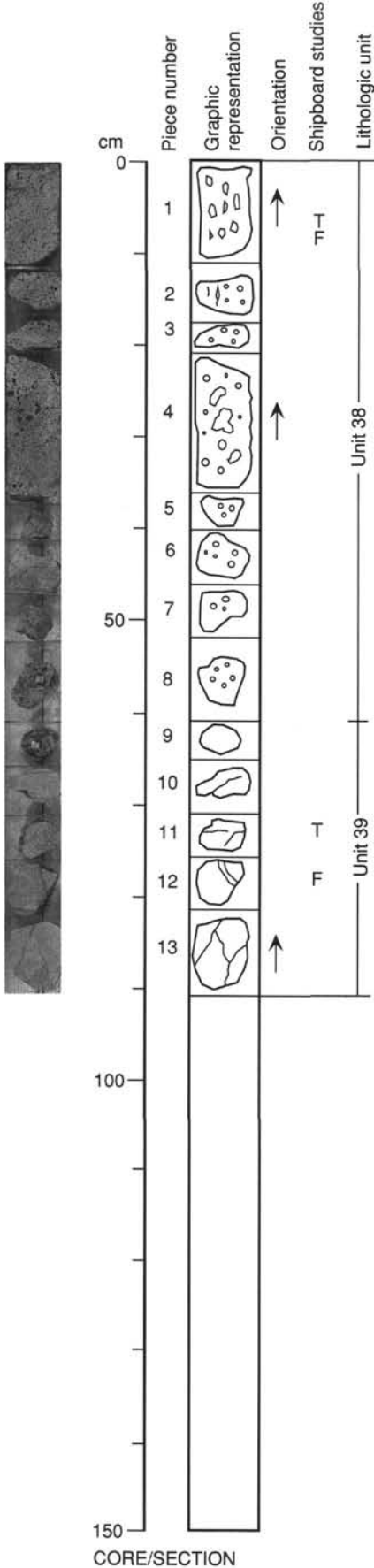
**VESICLES:** 20%-30%; 1-10 mm; round to irregular; disseminated; Pieces 16-18 have the greatest abundance; lined with a very thin lining of gray clay; most are not filled.

**COLOR:** Gray (N 4/0).

**STRUCTURE:** Pieces 14-16 have a re-entrained chunk of lava with 1 mm vesicles filled with green clay.

**ALTERATION:** Fairly fresh.





**UNIT 38: PLAGIOCLASE-PHYRIC BASALT**

**Pieces 1–8**

**PHENOCRYSTS:** Plagioclase - 1%; up to 5 mm; lath-shaped.

**GROUNDMASS:** Aphanitic.

**VESICLES:** 30%; 1–8 mm; round to oval; disseminated; lined with black or gray clay; most are otherwise empty; a few have the bottom half filled with black clay (the top surfaces are very nearly horizontal); in Pieces 1–3 the vesicles are elongated vertically.

**COLOR:** Gray (N 4/0).

**ALTERATION:** Fairly fresh (Pieces 1–6); moderate (Pieces 7–8).

**UNIT 39: APHYRIC BASALTIC DIKE**

**Pieces 9–13**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Varies from medium-grained in Pieces 11–13 to fine-grained in Piece 10 to glassy in parts of Pieces 9 and 10.

**VESICLES:** 1%; up to 1 mm; round; random distribution; filled with a green mineral.

**COLOR:** Greenish black (5GY 2/1).

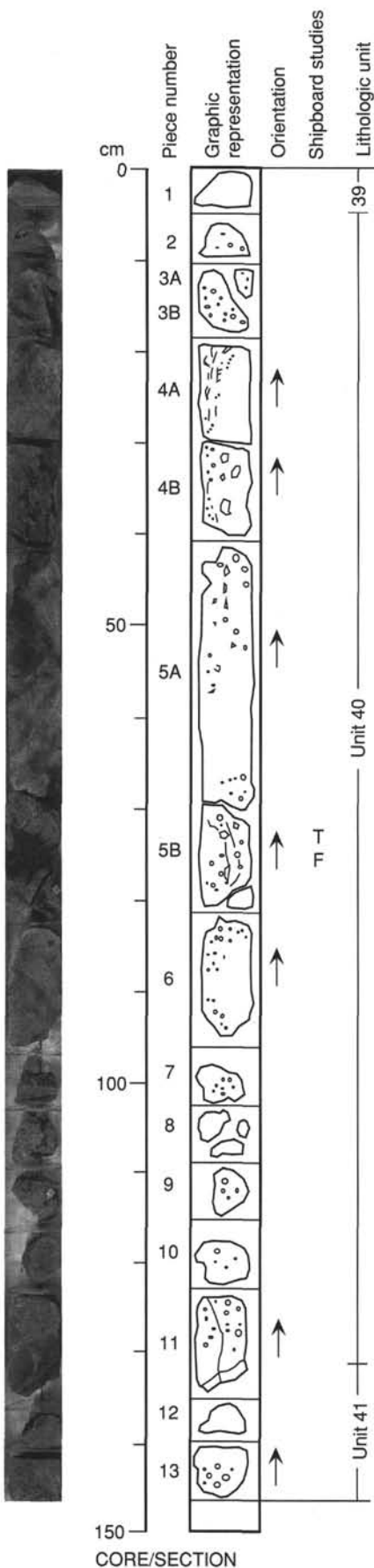
**ALTERATION:** The glass is altered; the rest of the rock is fairly fresh except for oxidation halos around veins.

**VEINS/FRACTURES:** <1–2 mm; variable; filled with a green mineral.

**ADDITIONAL COMMENTS:** Most likely a dike where the glassy portions of Pieces 9 and 10 represent a chilled margin.



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**UNIT 39: APHYRIC BASALTIC DIKE**

**Piece 1**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Medium-grained.  
**VESICLES:** 1%; up to 1 mm; round; random distribution; filled with a green mineral.  
**COLOR:** Greenish black (5GY 2/1).  
**ALTERATION:** Fresh.

**UNIT 40: PLAGIOCLASE-PHYRIC BASALT**

**Pieces 2–11**

**CONTACTS:** Basal contact in Piece 11 at 132–135 cm. The basal 6 mm are gray and free of vesicles; the next 4 cm have many <1 mm vesicles and is dark reddish gray.  
**PHENOCRYSTS:** Plagioclase - 0.5%; 1 mm; lath-shaped.  
**GROUNDMASS:** Aphanitic.  
**VESICLES:** 20%–40%; <1–10 mm; round to very flattened; most are <2 mm; most are empty except for a very thin lining of a green mineral; some are filled with expanding gray clay.  
**COLOR:** Gray (N 5/0).  
**STRUCTURE:** Swirling, often steep zones defined by flattened and aligned vesicles.  
**ALTERATION:** Fairly fresh.

**UNIT 41: PLAGIOCLASE-PHYRIC BASALT**

**Pieces 11–13**

**CONTACTS:** The upper contact is seen in Piece 11.  
**PHENOCRYSTS:** Plagioclase - 0.5%; 1 mm; lath-shaped.  
**GROUNDMASS:** Very fine-grained. Devitrified glass close to contact in Pieces 11 and 12.  
**VESICLES:** 0–5%; 0.5–2 mm; round; irregular distribution; largest in the lower 2 cm of Piece 13.  
**COLOR:** Brown (5YR 4/1).  
**STRUCTURE:** Flow-brecciation with 1–4 mm fragments.  
**ALTERATION:** Oxidized; the glass is completely devitrified.

**UNIT 41: PLAGIOCLASE-PHYRIC BASALT**

**Pieces 1A-14**

**PHENOCRYSTS:** Plagioclase - 2%; up to 4 mm; lath-shaped.

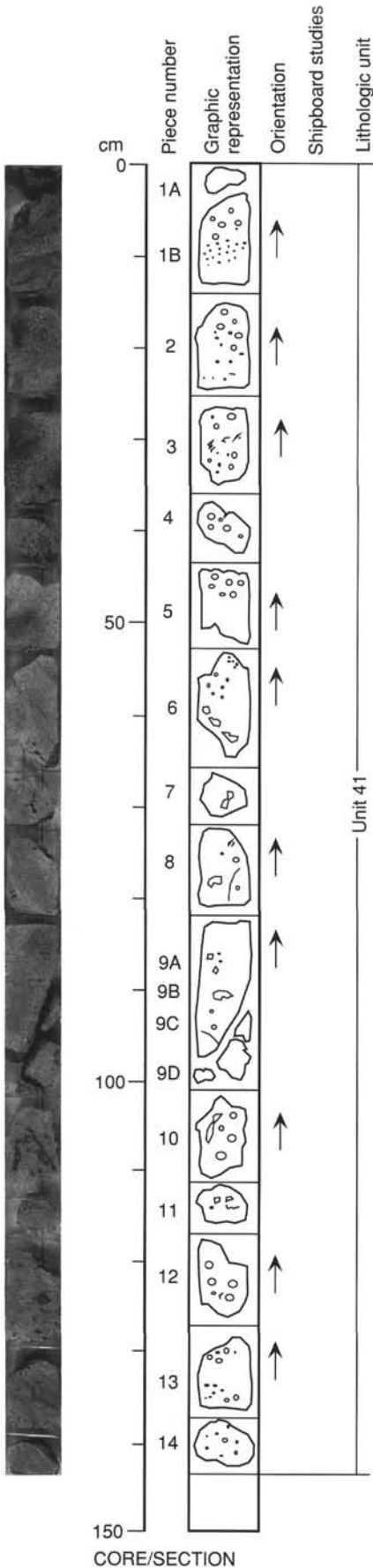
**GROUNDMASS:** Very fine-grained.

**VESICLES:** 10%–50%; <1–3 mm; round to irregular; inhomogeneously distributed; most are empty with only a thin lining of green clay; some are filled with gray clay; those in the flow breccia clasts are filled.

**COLOR:** Gray (N 5/0), except for Pieces 1–3, which are dark brownish gray.

**STRUCTURE:** Flow-brecciation is seen in Pieces 1–3. Piece 1 has an internal flow contact.

**ALTERATION:** Fairly fresh.



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**UNIT 41: PLAGIOCLASE-PHYRIC BASALT**

**Pieces 1-16**

**CONTACTS:** The bottom contact is in Piece 16. The basal 2.5 cm have no vesicles, is extremely fine-grained, and entrains a little bit of the underlying flow top.

**PHENOCRYSTS:** Plagioclase - 1%; up to 3 mm; lath-shaped.

**GROUNDMASS:** Very fine-grained.

**VESICLES:** 0-50%; <1-7 mm; round to flattened; inhomogeneously distributed; most are <3 mm, and most are empty.

**COLOR:** Gray (N 5/0).

**STRUCTURE:** Some flow-brecciation.

**ALTERATION:** Fairly fresh.

**UNIT 42: APHYRIC BASALT**

**Pieces 16-20**

**CONTACTS:** The top contact is seen in Piece 16.

**PHENOCRYSTS:** None.

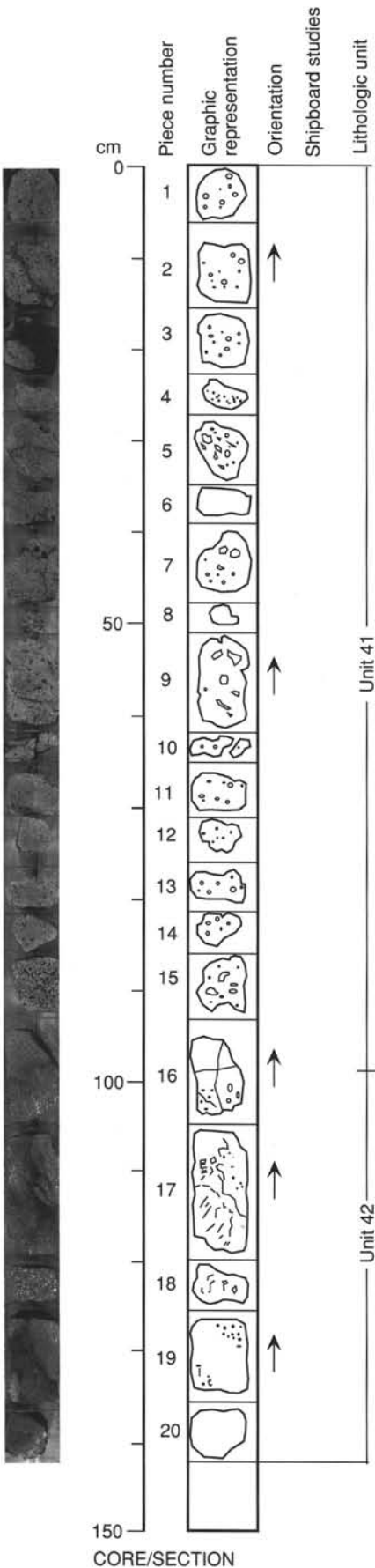
**GROUNDMASS:** Aphanitic.

**VESICLES:** 0-20%; <0.5-5 mm; some parts have <1-mm-round vesicles; others have very elongated up to 5-mm-long vesicles. Most are lined with green or white material and have empty centers.

**COLOR:** Mostly dark reddish gray (10R 3/1) but variable because of brecciation.

**STRUCTURE:** The rock is a brecciated and scoriaceous flow top.

**ALTERATION:** Strong.



CORE/SECTION

**UNIT 42: APHYRIC BASALT**

**Pieces 1-12**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Aphanitic.

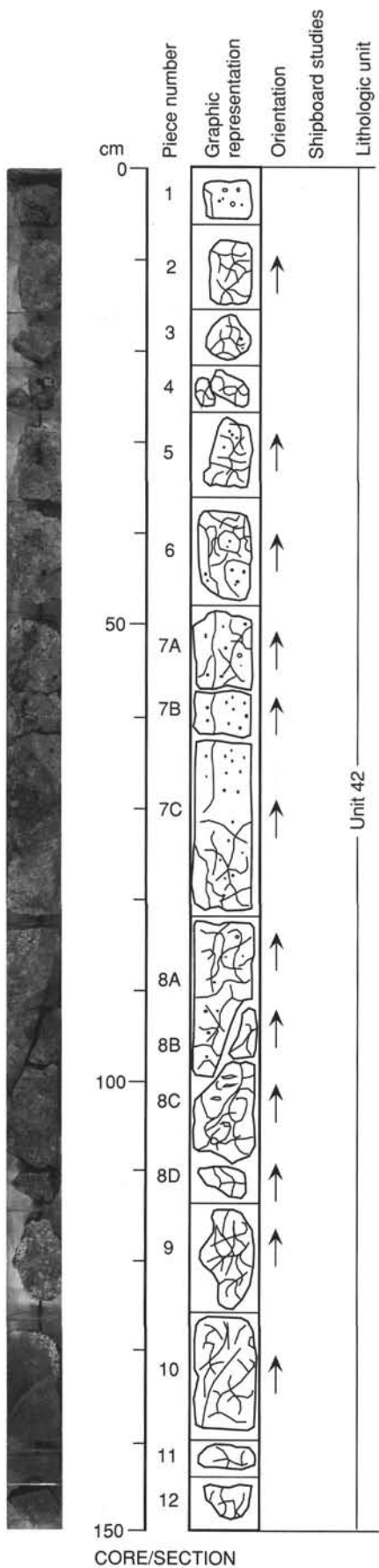
**VESICLES:** 5%-10%; 0.5-5 mm; round to elongated; distributed irregularly; most vesicles are empty except for a thin lining of a gray to white zeolite.

**COLOR:** Dark gray (N 4/0).

**STRUCTURE:** The rock is highly flow-brecciated and many of the fragments are scoriaceous.

**ALTERATION:** Slight.

**VEINS/FRACTURES:** A 1-2-mm-wide, vertical, irregular vein lined with white zeolite is seen at 38-76 cm.

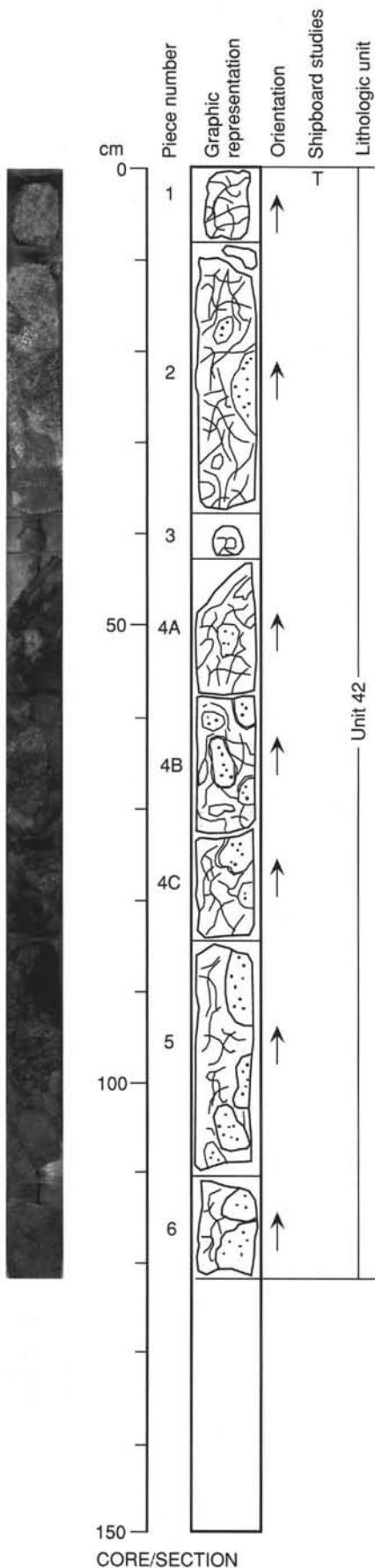


152-917A-28R-2

UNIT 42: APHYRIC BASALT

Pieces 1-6

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Aphanitic.  
**VESICLES:** 5%-10%; 0.5-3 mm; round to elongated; distributed irregularly; empty or with just a thin lining of bluish material.  
**COLOR:** Dark gray (N 4/0) with variable tinges of red in brecciated zones.  
**STRUCTURE:** The rock is highly flow-brecciated with fragments ranging in size from 1 mm to 5 cm. Many fragments are scoriaceous.  
**ALTERATION:** Moderate.



**UNIT 42: APHYRIC BASALT**

**Pieces 1A-6**

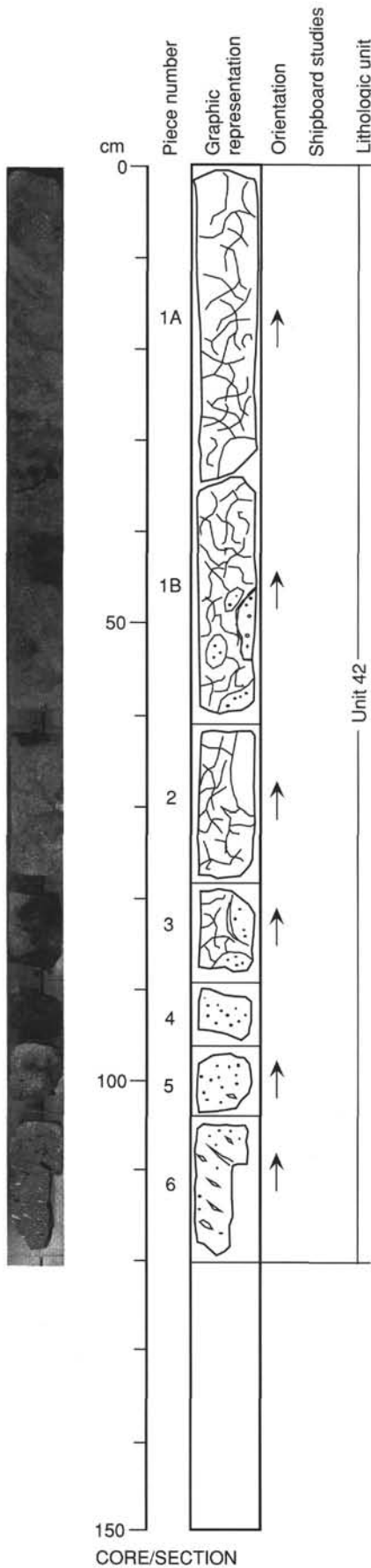
**PHENOCRYSTS:** None.

**GROUNDMASS:** Aphanitic.

**VESICLES:** 5%; 0.5-10 mm; round to flattened; distributed irregularly; empty except for a thin lining of bluish material.

**COLOR:** Dark gray (N 4/0) with variable tinges of red in brecciated zones.

**STRUCTURE:** The rock is highly flow-brecciated with finely vesiculated scoriaceous fragments ranging in size from 1 mm to 6 cm. Piece 6 at 104-119 cm is massive and flow-banded with flattened vesicles.



152-917A-29R-1

**UNIT 42: APHYRIC BASALT**

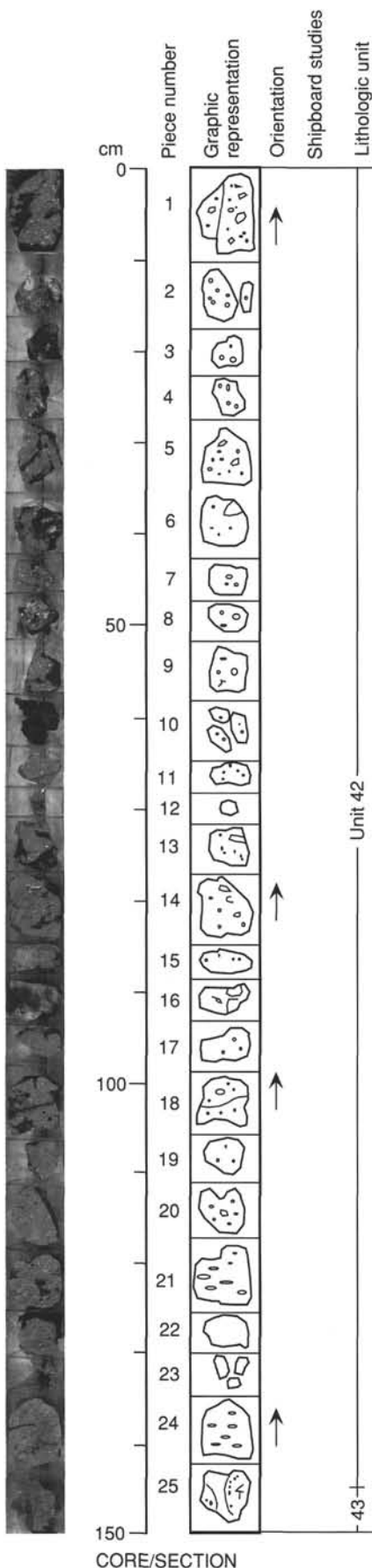
**Pieces 1–25**

**CONTACTS:** The bottom contact is seen in Piece 25. It is irregular.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Very fine-grained.  
**VESICLES:** 2%–7%; 1–10 mm; round to flattened; scattered; empty except for a thin blue lining.  
**COLOR:** Dark gray (N 4/0).  
**STRUCTURE:** The rock shows a weak near-horizontal flow-structure defined by flattened vesicles.  
**ALTERATION:** Slight.

**UNIT 43: PLAGIOCLASE-PHYRIC BASALT**

**Piece 25**

**CONTACTS:** The top contact is seen in Piece 25. The flow top is vesiculated, reddened, and fragmented, and the overlying lava has 'intruded' between the fragments.  
**PHENOCRYSTS:** No phenocrysts are seen in Piece 25.  
**GROUNDMASS:** Aphanitic.  
**VESICLES:** 0–40%; up to 1 mm; round; distributed irregularly; lined with light green material.  
**COLOR:** Dusky red (10R 3/2).  
**STRUCTURE:** Baked flow top.  
**ALTERATION:** Strong.



CORE/SECTION

**UNIT 43: PLAGIOCLASE-PHYRIC BASALT**

**Pieces 1-13**

**PHENOCRYSTS:** Plagioclase - <0.5%; up to 5 mm; lath-shaped.

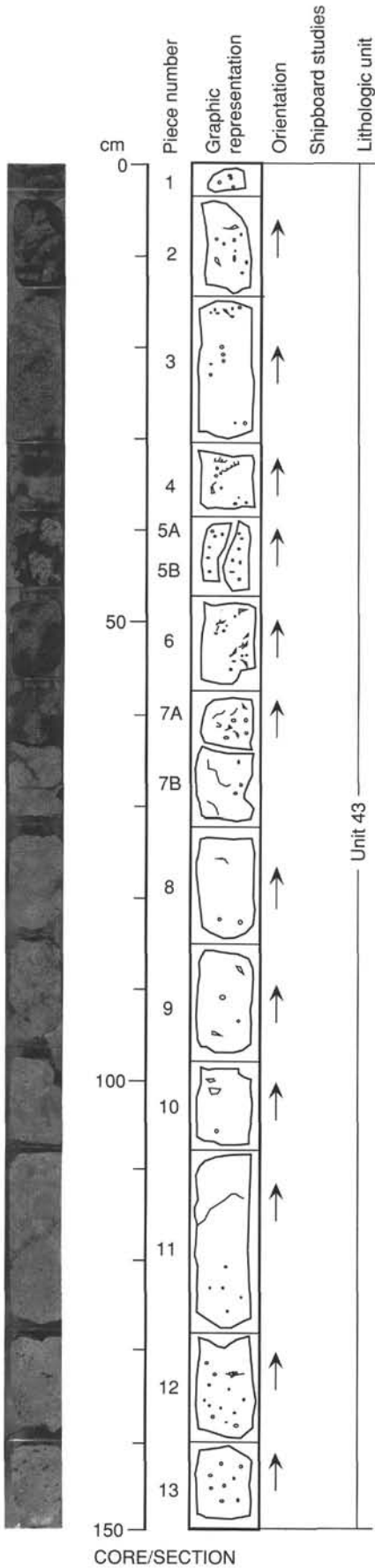
**GROUNDMASS:** Very fine-grained.

**VESICLES:** 5%-20%; 0.5-6 mm; rounded to irregular; uneven distribution; the smaller vesicles tend to be filled whereas the larger ones are empty.

**COLOR:** Dusky red (10R 3/2) in the upper part grading to dark gray (N 4/0) in the lower part.

**STRUCTURE:** The rock is flow-brecciated with scoriaceous 0.5-5 cm fragments. The lower part (below 120 cm) tends to be massive with flattened, swirling vesicles.

**ALTERATION:** High at top, grading to slight at bottom.





152-917A-29R-3

UNIT 43: PLAGIOCLASE-PHYRIC BASALT

Pieces 1A-2

**PHENOCRYSTS:** Plagioclase - <0.5%; up to 2 mm; lath-shaped.

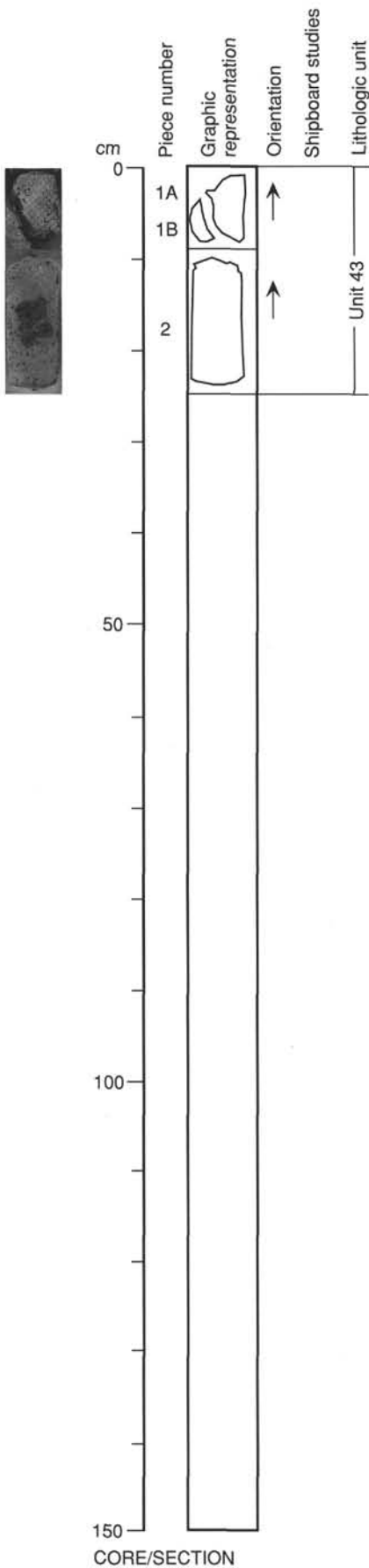
**GROUNDMASS:** Very fine-grained.

**VESICLES:** 10%–15%; 0.5–6 mm; flattened; scattered; empty except for a thin lining of green material.

**COLOR:** Dark gray (N 4/0).

**STRUCTURE:** The rock shows a weak flow-banding defined by flattened vesicles. The banding is steeply dipping and somewhat curved.

**ALTERATION:** Slight.



CORE/SECTION

**UNIT 43: PLAGIOCLASE-PHYRIC BASALT**

**Pieces 1A-17**

**PHENOCRYSTS:** Plagioclase - <0.5%; up to 2 mm; lath-shaped.

**GROUNDMASS:** Aphanitic.

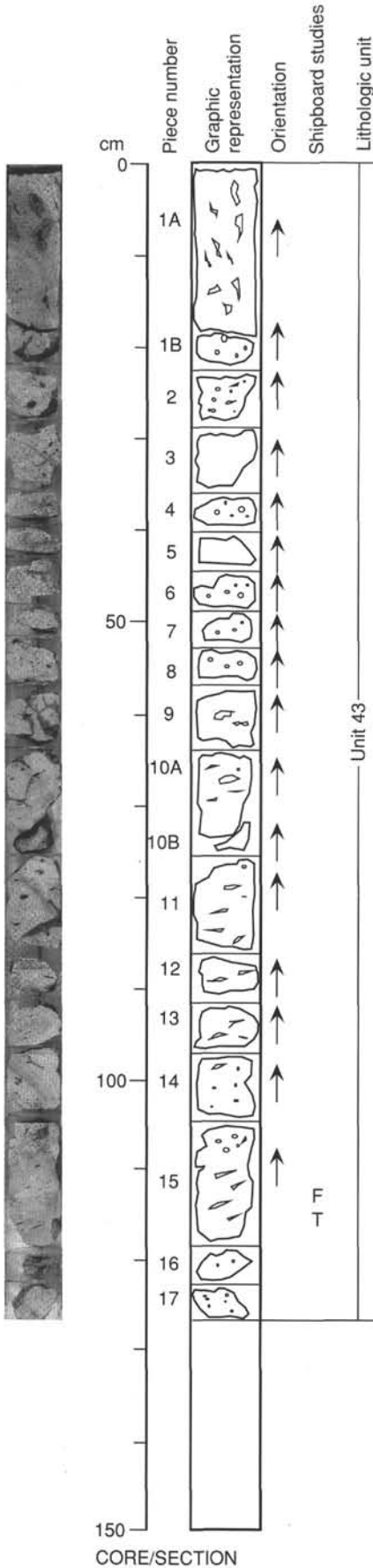
**VESICLES:** 5%-10%; 0.5-10 mm; irregular to flattened; larger irregular vesicles in top half of section; smaller flattened vesicles in bottom half; empty or lined with small zeolite crystals.

**COLOR:** Olive black (5Y 2/1).

**STRUCTURE:** Flow-brecciated in places.

**ALTERATION:** Slight.

**VEINS/FRACTURES:** 0.2-1 mm; random; a few zeolite-filled veins in Pieces 7-11 and 13-16.



152-917A-30R-2

**UNIT 43: PLAGIOCLASE-PHYRIC BASALT**

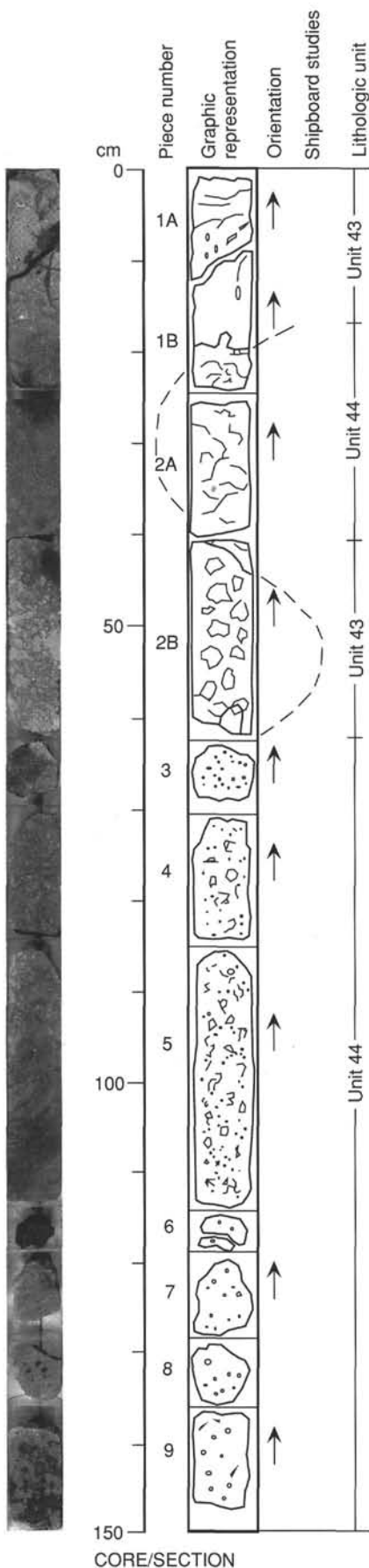
**Pieces 1A-2B**

**CONTACTS:** Irregular base of unit seen in Pieces 1B and 2B.  
**PHENOCRYSTS:** None visible in these pieces.  
**GROUNDMASS:** Aphanitic.  
**VESICLES:** 5%; 0.5-5 mm; spherical to flattened; patchy distribution; pale green linings.  
**COLOR:** Olive black (5Y 2/1).  
**STRUCTURE:** Flow-brecciated at base; breccia filling large voids in top of Unit 44; clasts cemented with dark green, fine-grained material.  
**ALTERATION:** Slight.

**UNIT 44: APHYRIC BASALT**

**Pieces 1B-9**

**CONTACTS:** Top of unit seen in Pieces 1B and 2B.  
**PHENOCRYSTS:** None visible in these pieces.  
**GROUNDMASS:** Aphanitic.  
**VESICLES:** 10%-20%; 0.5-3 mm; mostly irregular; concentrated in lower part of section; empty or lined with zeolite.  
**COLOR:** Olive black (5Y 2/1).  
**STRUCTURE:** Top part of section (Pieces 1B to 5) is scoriaceous.  
**ALTERATION:** Slight at base; scoriaceous top is oxidized.



**UNIT 44: APHYRIC BASALT**

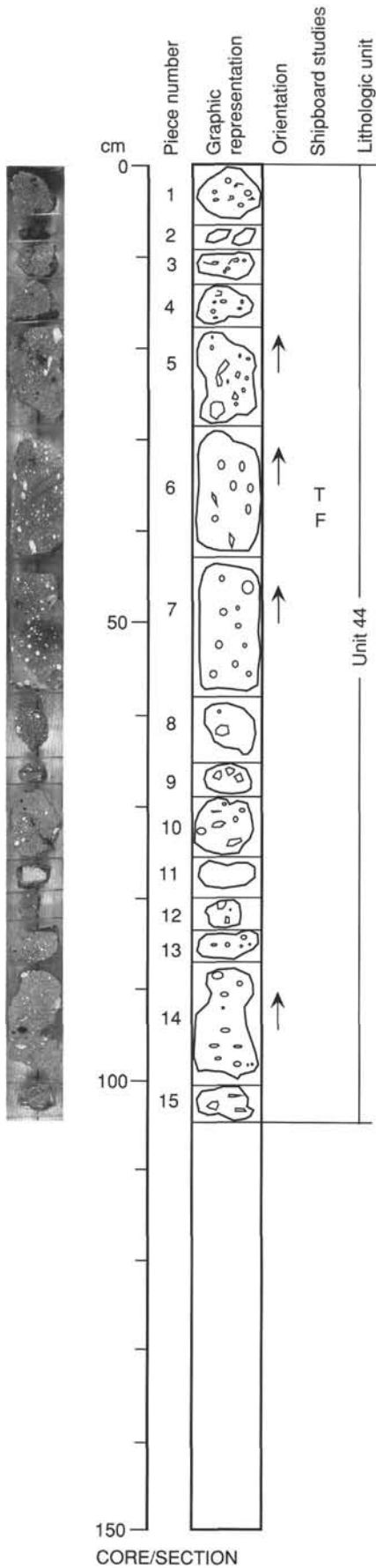
**Pieces 1-15**

**PHENOCRYSTS:** None except for a single plagioclase phenocryst in each of Pieces 4 and 14.

**GROUNDMASS:** Aphanitic.

**VESICLES:** 5%-20%; 0.5-15 mm; spherical to flattened; concentrated in top part of section; lined with white amorphous material.

**COLOR:** Olive black (5Y 2/1).



152-917A-31R-1

**UNIT 44: APHYRIC BASALT**

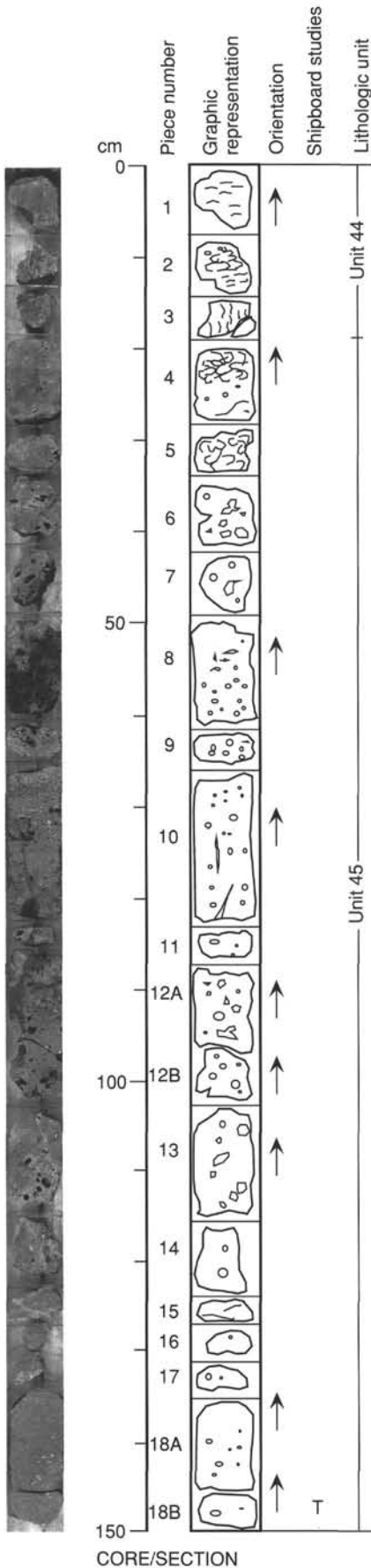
**Pieces 1 and 3**

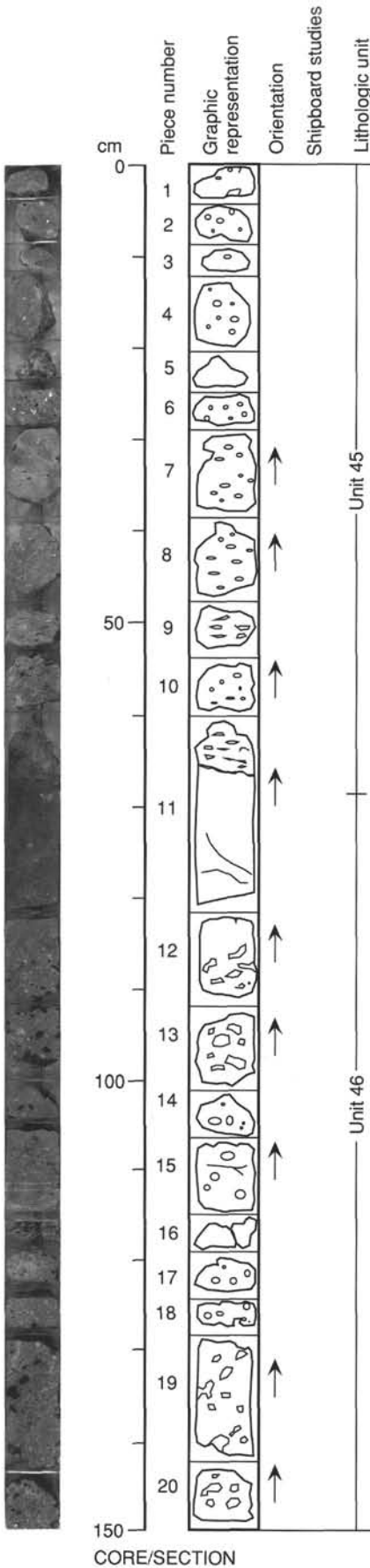
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Aphanitic.  
**VESICLES:** 5%; 0.5–5 mm; flattened; evenly distributed; lined with white amorphous material.  
**COLOR:** Dark gray (N 3/0).  
**ALTERATION:** Slight.  
**ADDITIONAL COMMENTS:** Pieces 2 and 3 probably crossed.

**UNIT 45: APHYRIC BASALT**

**Pieces 2, 4–18B**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Aphanitic.  
**VESICLES:** 0–20%; 0.5–10 mm; spherical to irregular; more abundant in center of section; lined with pale blue gray amorphous material or small zeolite crystals.  
**COLOR:** Brownish black (5YR 2/1).  
**STRUCTURE:** Top of unit is flow-brecciated.  
**ALTERATION:** Slight.





**UNIT 45: APHYRIC BASALT**

**Pieces 1–11**

**CONTACTS:** Base of unit in Piece 11.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Aphanitic.

**VESICLES:** 1%–15%; 0.5–10 mm; spherical to flattened; more abundant at base of unit; lined with white amorphous material or small zeolite crystals; some part-filled geopetal vesicles.

**COLOR:** Brownish black (5YR 2/1).

**ALTERATION:** Slight.

**VEINS/FRACTURES:** <<1%; 0.2 mm; vertical; single small vein in Piece 8.

**UNIT 46: APHYRIC BASALT**

**Pieces 11–20**

**CONTACTS:** Top of unit in Piece 11.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Aphanitic.

**VESICLES:** 0–20%; 1–10 mm; spherical to irregular; absent from top of unit; lined with grayish blue green (5BG 5/2) amorphous material, sometimes forming globular structures.

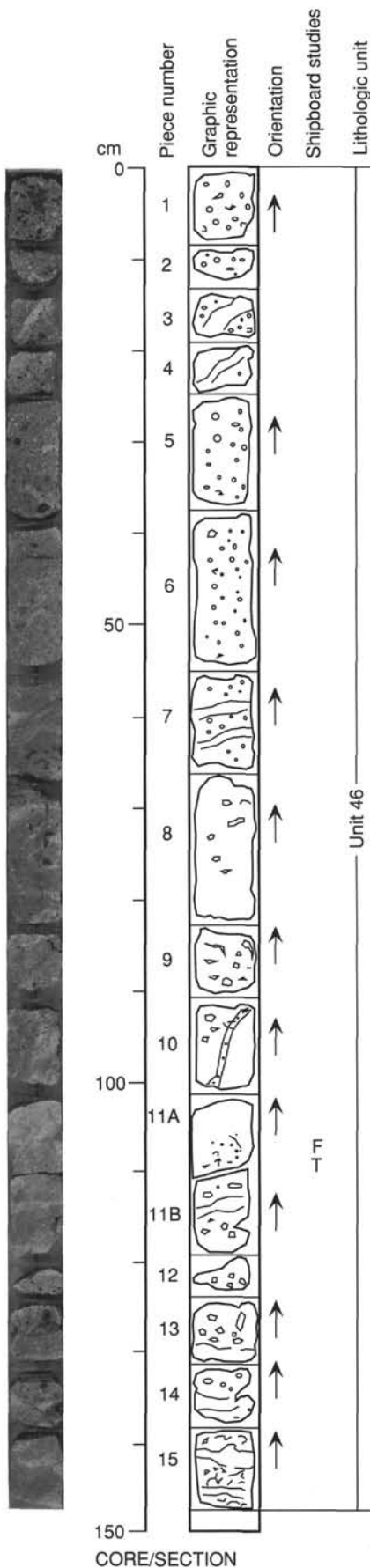
**COLOR:** Greenish black (5G 2/1).

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UNIT 46: APHYRIC BASALT

Pieces 1-15

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 1%–20%; 0.5–10 mm; spherical to irregular; patchy distribution; grayish blue green linings.  
**COLOR:** Greenish black (5G 2/1).  
**ALTERATION:** Moderate; development of green secondary minerals.  
**VEINS/FRACTURES:** <<1%; <0.5 mm; inclined.



**UNIT 46: APHYRIC BASALT**

**Pieces 1-10**

**PHENOCRYSTS:** None.

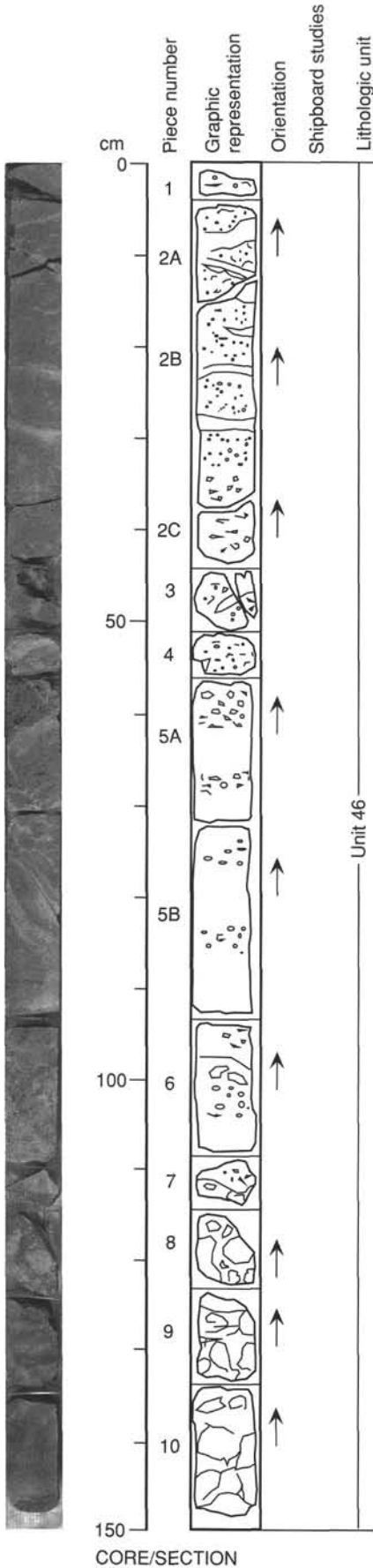
**GROUNDMASS:** Fine-grained.

**VESICLES:** 0-15%; 0.5-8 mm; spherical to irregular; in bands; coated with green-blue fibrous mineral in center of section; filled with green-blue mineral at top and bottom of section.

**COLOR:** Greenish black (5G 2/0).

**STRUCTURE:** Flow-brecciated at bottom of section.

**ALTERATION:** Moderate; green secondary minerals.





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**UNIT 46: APHYRIC BASALT**

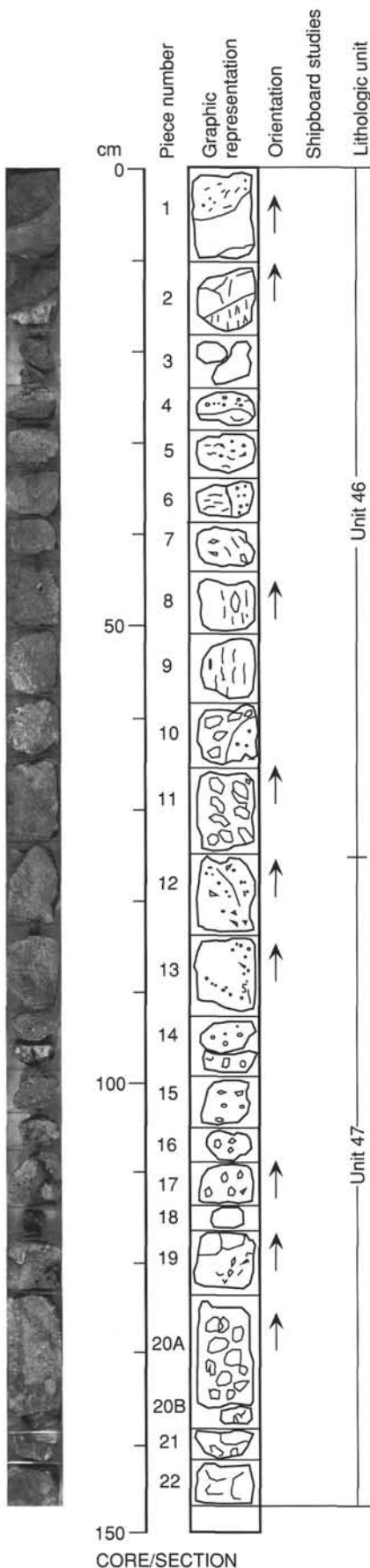
**Pieces 1–11**

**CONTACTS:** Pieces 2–11 contain fragments of Unit 47.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 1%–10%; 0.5–5 mm; mostly flattened; patchy distribution.  
**COLOR:** Greenish black (5GY 2/1).  
**STRUCTURE:** Flow-brecciated base of unit; mixed with fragments of underlying unit.  
**ALTERATION:** Moderate.  
**VEINS/FRACTURES:** <<1%; 0.5 mm; random; zeolite-filled fractures in Piece 3.

**UNIT 47: APHYRIC BASALT**

**Pieces 12–22**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 1%–20%; 0.5–5 mm; spherical to flattened; patchy distribution; empty or lined with pale blue gray amorphous material; some have small zeolite crystals.  
**COLOR:** Grayish black (N 2/0).  
**STRUCTURE:** Flow-breccia forming top of Unit 47.  
**ALTERATION:** Moderate.



CORE/SECTION

**UNIT 47: APHYRIC BASALT**

**Pieces 1A-14**

**CONTACTS:** Contact between flow-breccia and homogeneous basalt seen in Piece 9.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Aphanitic.

**VESICLES:** 1%–20%; 0.5–5 mm; spherical to flattened; patchy distribution; empty or lined with pale blue gray amorphous material; some have small zeolite crystals.

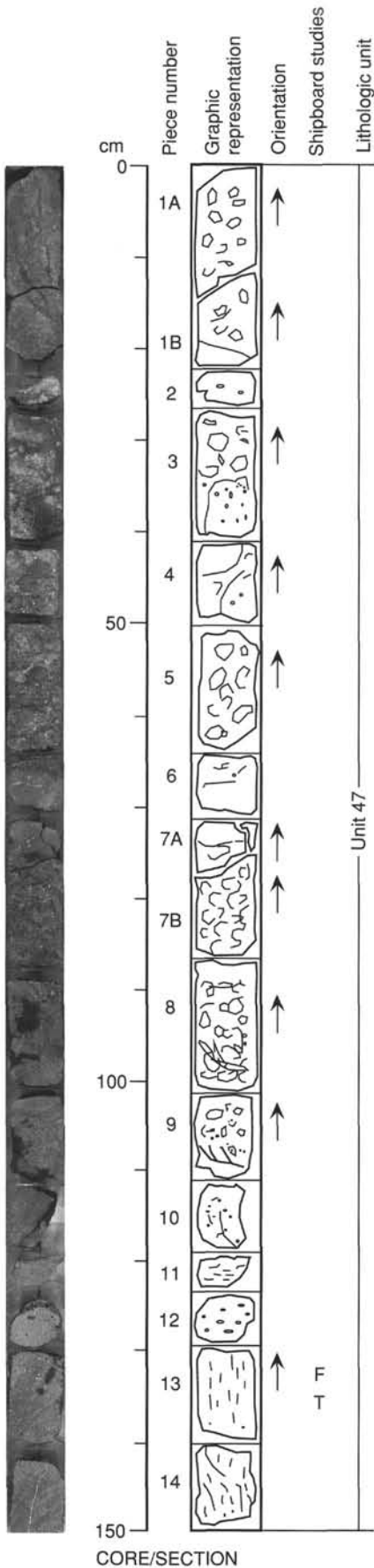
**COLOR:** Grayish black (N 2/0).

**STRUCTURE:** Pieces 1–9 are flow-brecciated.

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** <<1%; 0.2 mm; inclined; rare, very fine grains in Piece 3.

**ADDITIONAL COMMENTS:** Brecciated flow top; Pieces 10–14 are homogenous basalt.



152-917A-32R-4

**UNIT 47: APHYRIC BASALT**

**Pieces 1–14**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Aphanitic.

**VESICLES:** 0–5%; 0.5–5 mm; irregular to flattened; patchy distribution; lined with pale blue gray amorphous material.

**COLOR:** Grayish black (N 2/0).

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** <<1%; up to 0.5 mm; random; a few fine veins in Pieces 8 and 9.

**UNIT 48: APHYRIC BASALT**

**Pieces 15–16**

**PHENOCRYSTS:** None.

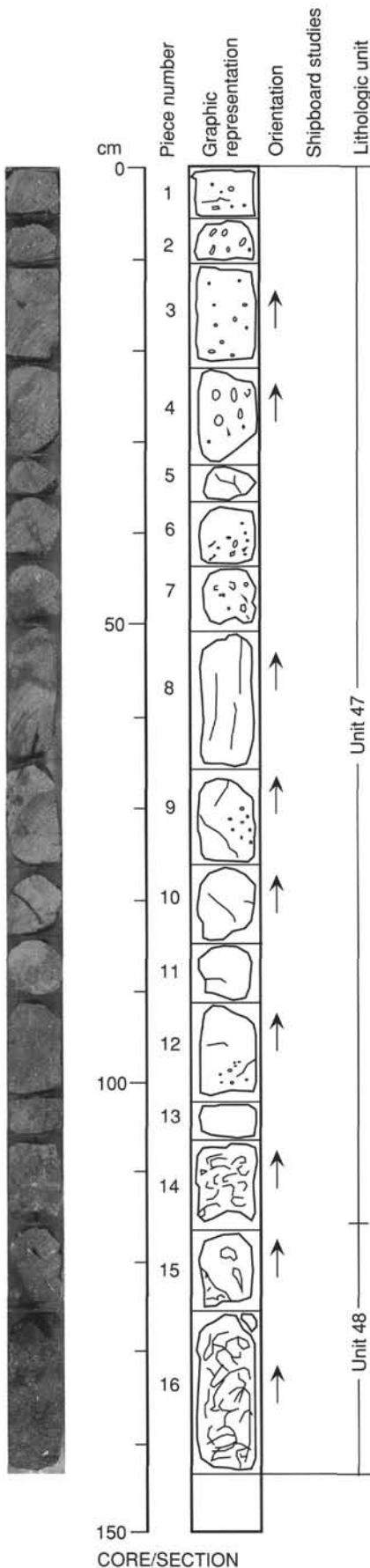
**GROUNDMASS:** Aphanitic.

**VESICLES:** 5%–10%; 0.5–8 mm; irregular to flattened; patchy distribution; lined with pale blue gray amorphous material.

**COLOR:** Grayish black (N 2/0).

**STRUCTURE:** Scoriaceous flow top.

**ALTERATION:** Moderate.

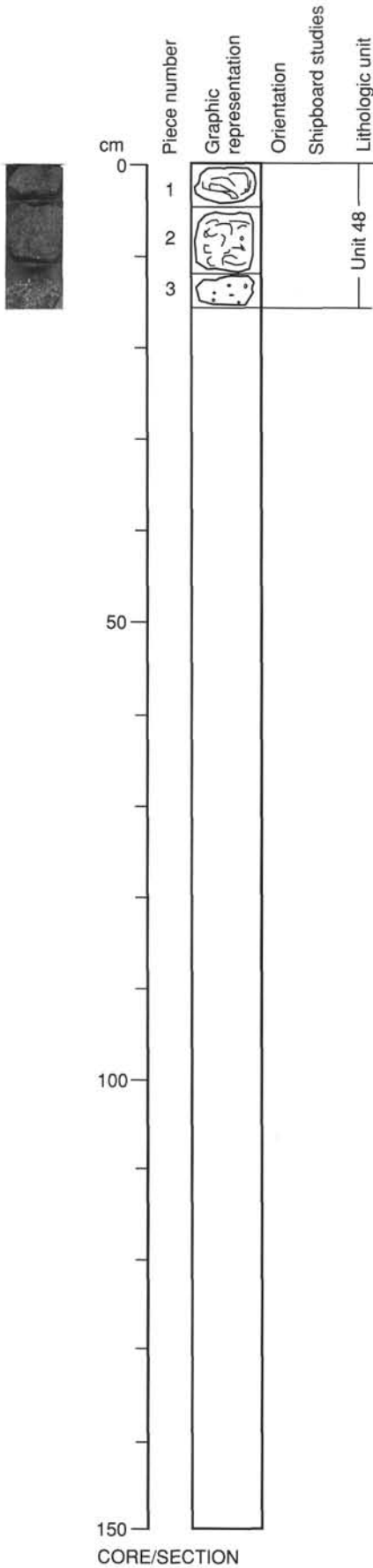


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CORE/SECTION

**UNIT 48: APHYRIC BASALT**

**Pieces 1-3**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Aphanitic.  
**VESICLES:** 5%; 0.5-2 mm; spherical; patchy distribution.  
**COLOR:** Grayish black (N 2/0)  
**STRUCTURE:** Scoriaceous flow top.  
**ALTERATION:** Moderate.

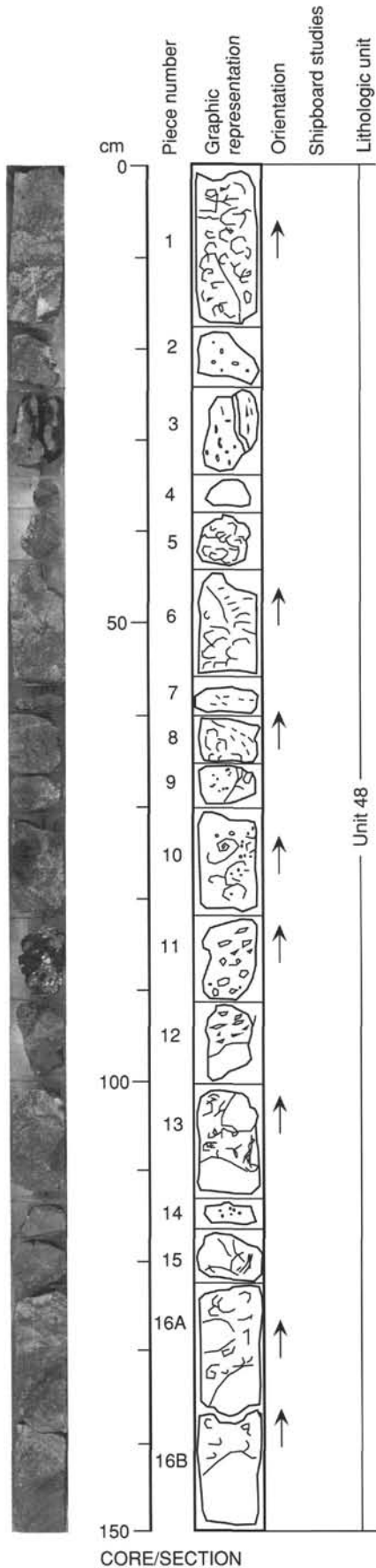


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UNIT 48: APHYRIC BASALT

Pieces 1-16B

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Aphanitic.  
**VESICLES:** 0-30%; 0.5-5 mm; spherical to elongate; patchy distribution; very light gray linings.  
**COLOR:** Grayish black (N 2/0).  
**STRUCTURE:** Scoriaceous.  
**ALTERATION:** Moderate.  
**VEINS/FRACTURES:** <<1%; 0.2-2 mm; inclined to vertical; a few small zeolite-filled veins in Pieces 1 and 16A.

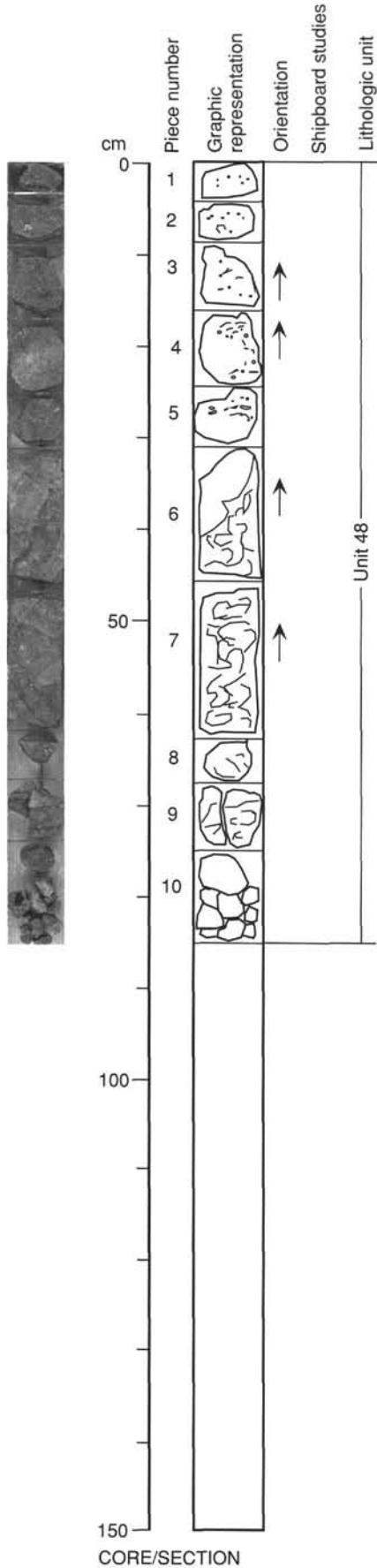


CORE/SECTION

**UNIT 48: APHYRIC BASALT**

**Pieces 1-10**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Aphanitic.  
**VESICLES:** 0-10%; 0.5-2 mm; spherical to irregular; patchy distribution; very light gray linings.  
**COLOR:** Grayish black (N 2/0).  
**STRUCTURE:** Scoriaceous.  
**ALTERATION:** Moderate.



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UNIT 49: APHYRIC BASALT

Pieces 1-22

**PHENOCRYSTS:** None.

**GROUNDMASS:** Aphanitic.

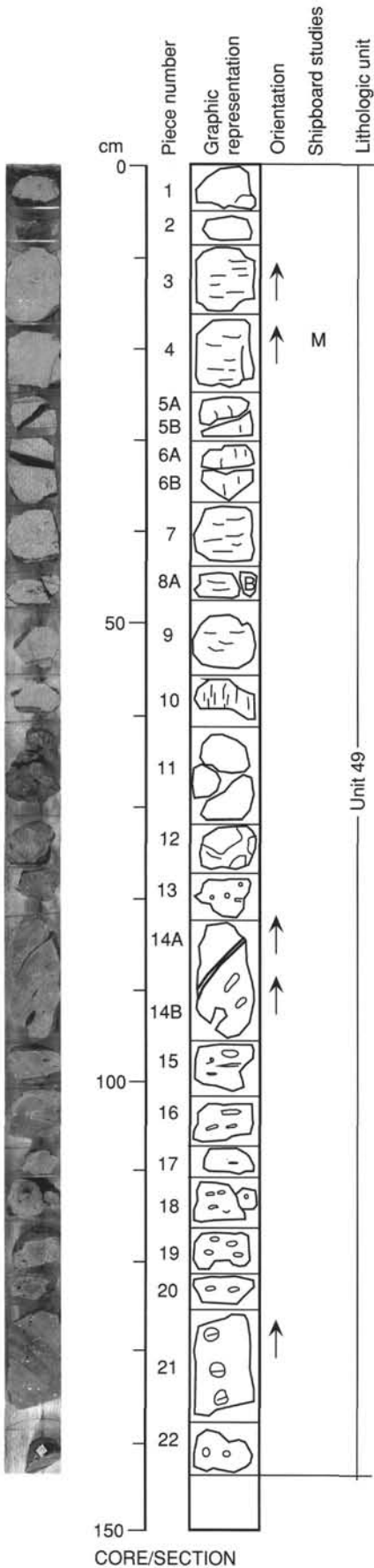
**VESICLES:** 0-5%; 0.5-10 mm; spherical to flattened; random distribution; green coatings; some lined with small zeolite crystals; small vesicles in upper part of section are completely filled with green mineral.

**COLOR:** Grayish black (N 2/0).

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** <<1%; <1 mm; random; filled with zeolite or green mineral.

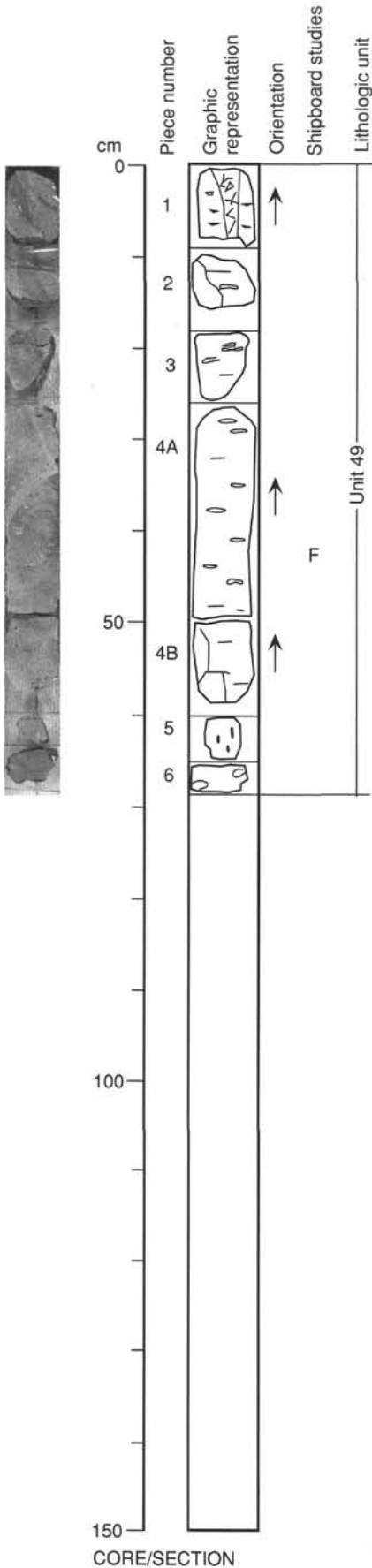
**ADDITIONAL COMMENTS:** Distinguished from Unit 48 by green vesicle and vein filling.



**UNIT 49: APHYRIC BASALT**

**Pieces 1-6**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Aphanitic.  
**VESICLES:** 2%; 0.5-8 mm; flattened; random, aligned; filled with either white zeolite or green mineral.  
**COLOR:** Grayish black (N 2/0).  
**ALTERATION:** Moderate.  
**VEINS/FRACTURES:** <<1%; 0.2-2 mm; inclined to vertical; filled with zeolite or green mineral.





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**UNIT 50: APHYRIC BASALT**

**Pieces 1-19**

**PHENOCRYSTS:** None.

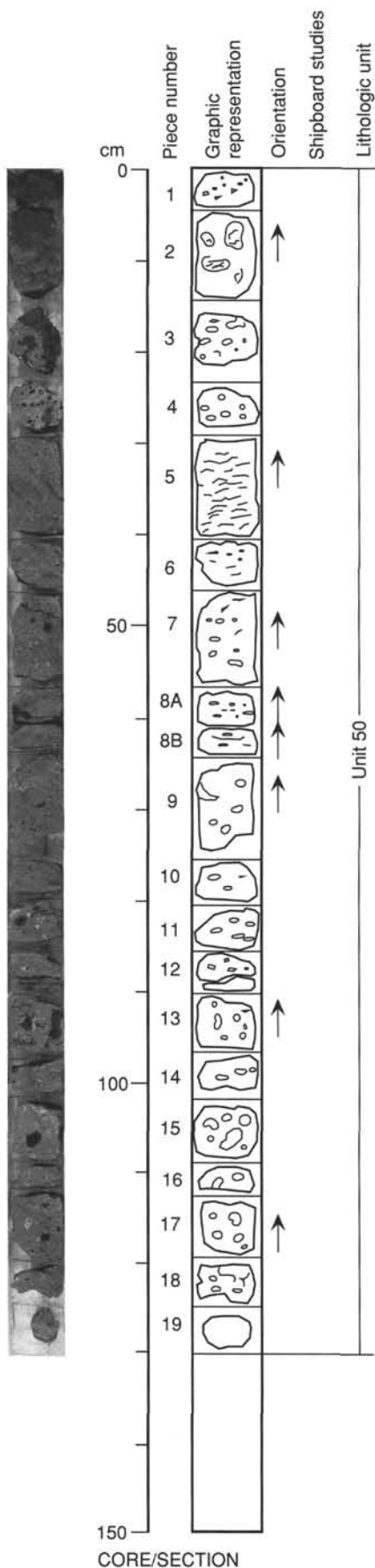
**GROUNDMASS:** Fine-grained.

**VESICLES:** 5%-20%; 1-15 mm; spherical to irregular; patchy distribution; lined with globular pale green mineral; cavity in Piece 15 lined with gray to yellow material.

**COLOR:** Grayish black (N 2/0); slight reddening at top of section.

**STRUCTURE:** Some flow-brecciation between 50 and 75 cm.

**ALTERATION:** Moderate.



**UNIT 50: APHYRIC BASALT**

**Pieces 1A–15**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

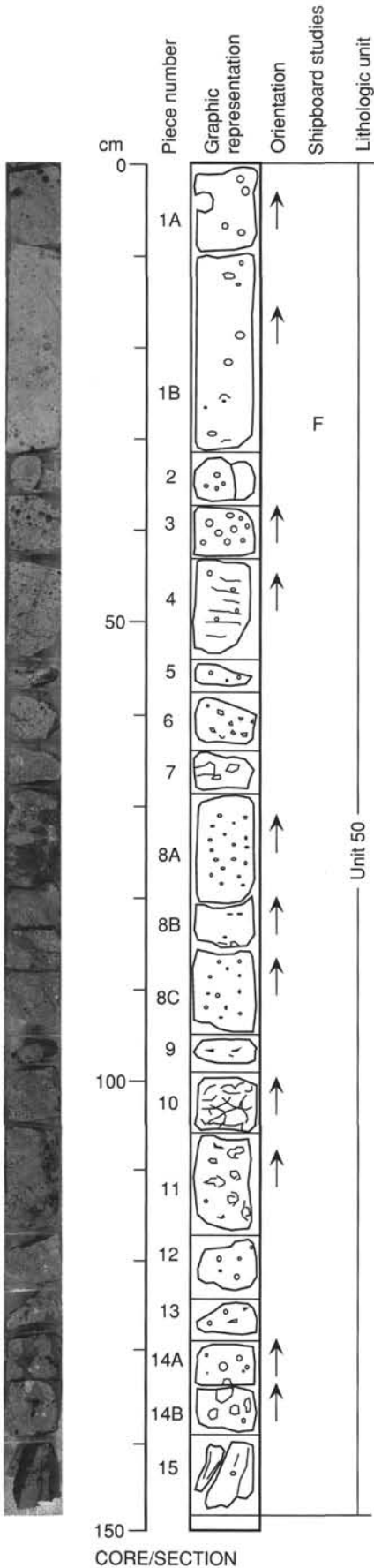
**VESICLES:** 5%–20%; 0.5–15 mm; irregular in lower half of section, spherical in upper half; patchy distribution; lined with pale green mineral in lower half; filled with amorphous grayish green mineral in upper half.

**COLOR:** Grayish black (N 2/0).

**STRUCTURE:** Pieces 8B, 8C, 9–15 are flow-brecciated.

**ALTERATION:** Moderate.

**ADDITIONAL COMMENTS:** Pieces 1–5 are slightly coarser grained and seem less altered than the other pieces.



152-917A-35R-3

**UNIT 50: APHYRIC BASALT**

**Pieces 1-5**

**PHENOCRYSTS:** None.

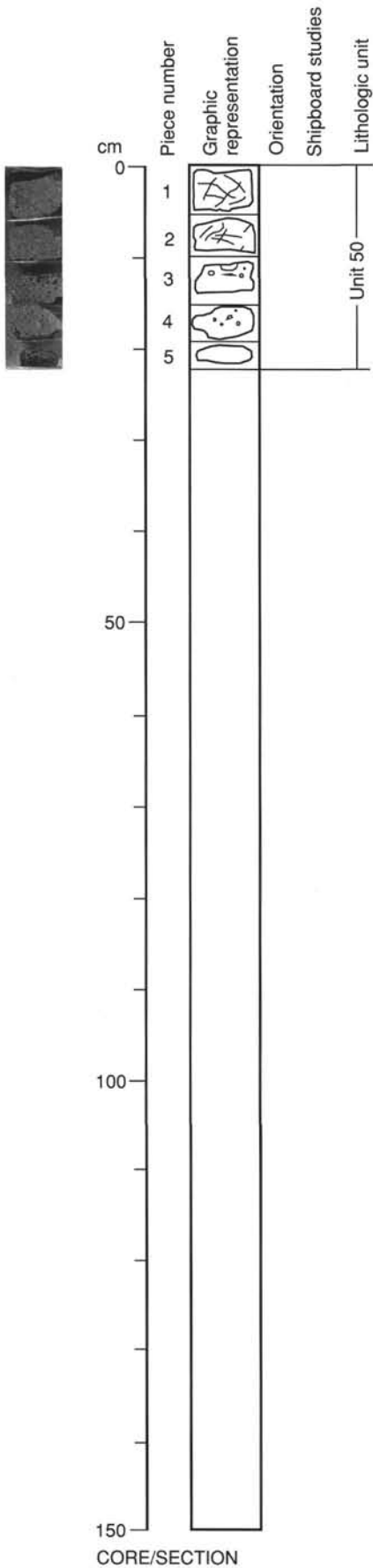
**GROUNDMASS:** Fine-grained.

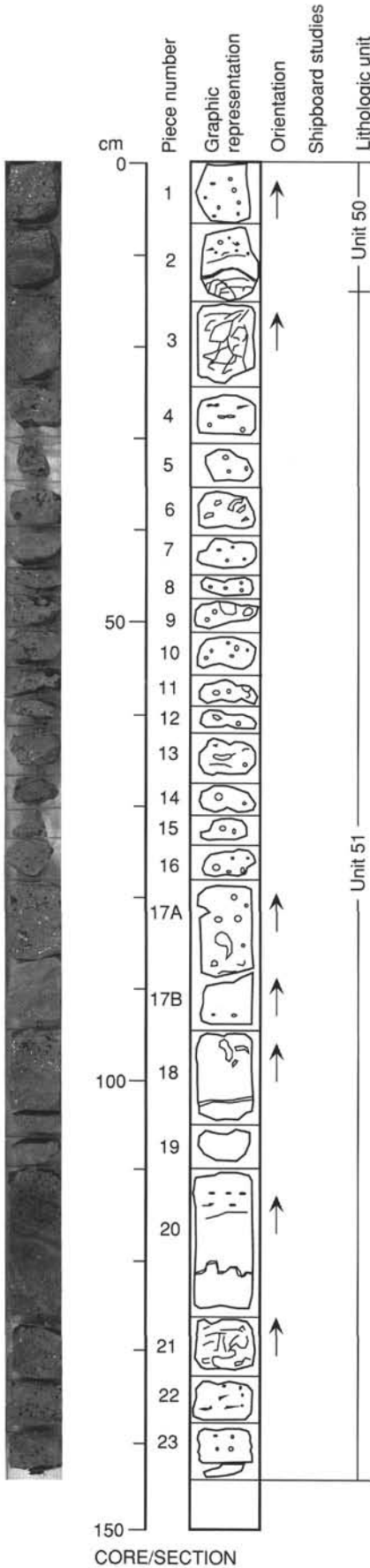
**VESICLES:** <5%; 0.5-5 mm; spherical to flattened; random distribution; lined with dark greenish gray amorphous material.

**COLOR:** Grayish black (N 2/0).

**STRUCTURE:** Flow-brecciated.

**ALTERATION:** Moderate.





**UNIT 50: APHYRIC BASALT**

**Pieces 1-2**

**CONTACTS:** Base of unit seen in Piece 2.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 20%; 0.5-2 mm; spherical to irregular; random distribution; some filled with zeolite.  
**COLOR:** Grayish black (N 2/0).  
**ALTERATION:** Moderate.  
**ADDITIONAL COMMENTS:** Chilled against unit below.

**UNIT 51: APHYRIC BASALT**

**Pieces 2-23**

**CONTACTS:** Top of unit seen in Piece 2.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 1%-20%; 0.5-10 mm; irregular; patchy distribution; dark green linings, some zeolite crystals.  
**COLOR:** Olive black (5Y 2/1); grayish red (5R 4/2) in top 10 cm of unit.  
**ALTERATION:** Moderate.  
**VEINS/FRACTURES:** <<1%; 0.2-0.5 mm; steeply inclined; single vein in Pieces 17A and 17B.

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**UNIT 51: APHYRIC BASALT**

**Pieces 1-17**

**PHENOCRYSTS:** None.

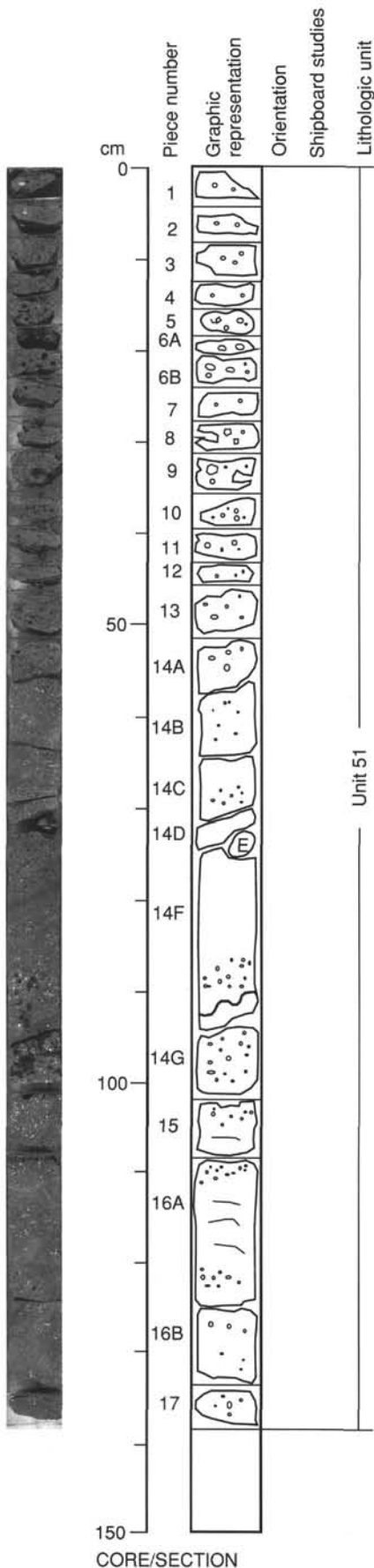
**GROUNDMASS:** Fine-grained.

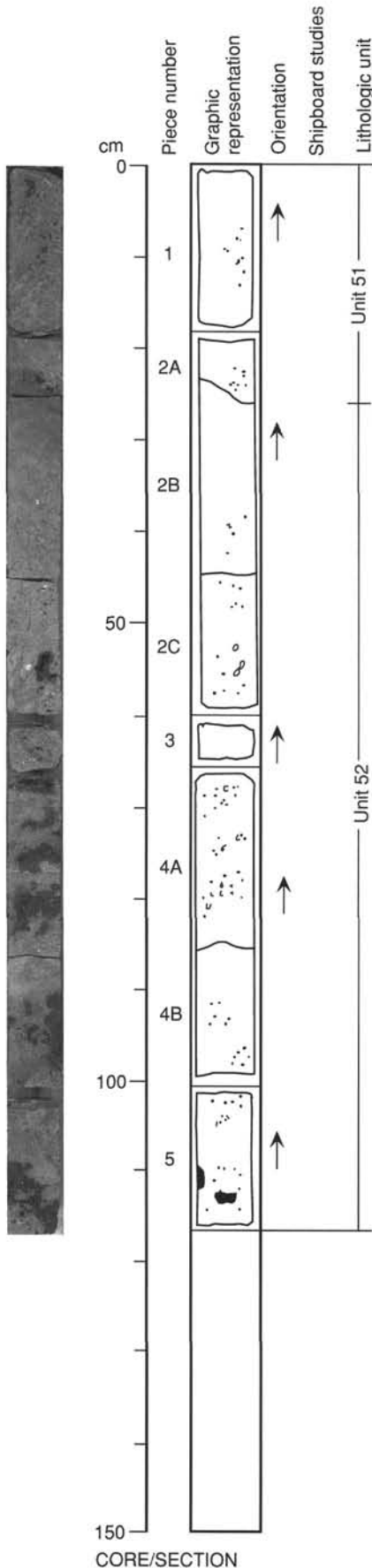
**VESICLES:** 5%–20%; 0.5–15 mm; spherical in upper part, irregular in lower part; patchy distribution; dark green linings in upper part of section, zeolite-filled in lower part.

**COLOR:** Olive black (5Y 2/1) with dark reddish brown (10R 3/4) zones.

**STRUCTURE:** Reddened zones at 80, 96, 110, and 135 cm.

**ALTERATION:** Moderate (upper part) to strong (lower part).





**UNIT 51: APHYRIC BASALT**

**Pieces 1–2A**

**CONTACTS:** Base of unit seen in Piece 2A.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 5%; 0.5–3 mm; spherical to irregular; random distribution; pale gray linings in some, dark green fillings in others.  
**COLOR:** Blackish red (5R 2/2).  
**ALTERATION:** Strong.  
**ADDITIONAL COMMENTS:** Chilled against Unit 52; native copper in contact zone.

**UNIT 52: APHYRIC BASALT**

**Pieces 2A–5**

**CONTACTS:** Contact with Unit 51 in Piece 2A.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 0–20%; 0.5–10 mm; spherical to irregular; patchy distribution; pale gray linings in some; zeolite crystals in cavities at base of section.  
**COLOR:** Dusky red (5R 3/4) to grayish red (10R 4/2).  
**STRUCTURE:** Flow top at 25 cm.  
**ALTERATION:** Strong; oxidized.  
**ADDITIONAL COMMENTS:** Small (8 mm) gabbroic xenolith in Piece 2C.

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**UNIT 52: APHYRIC BASALT**

**Pieces 1A-3C**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

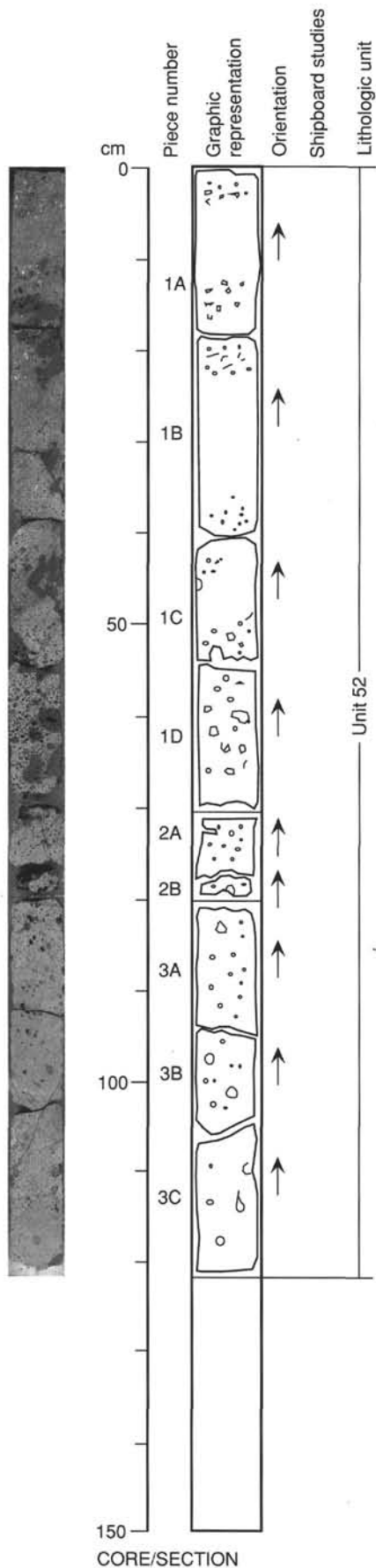
**VESICLES:** 5%-30%; 0.5-20 mm; spherical to irregular; patchy distribution; generally lined with dark green globular encrustations; some zeolite-filled vesicles towards top of section.

**COLOR:** Grayish red (10R 4/2) at the top to brownish gray (5YR 4/1) at the bottom.

**STRUCTURE:** Flow-brecciated at top; flow-banded at bottom.

**ALTERATION:** Strong; oxidized.

**VEINS/FRACTURES:** <<1%; 0.2-1 mm; inclined; filled with dark green mineral.

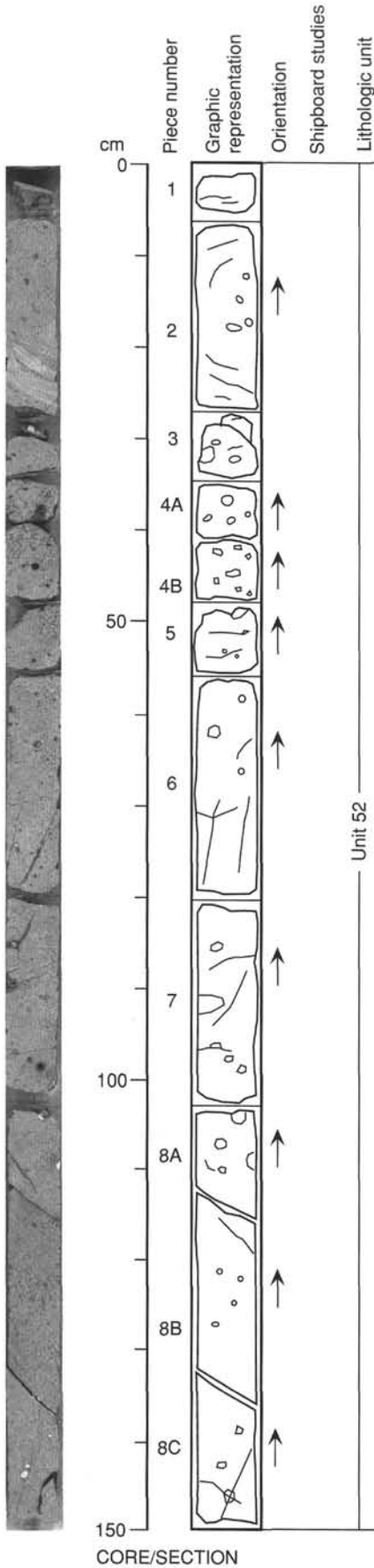


CORE/SECTION

**UNIT 52: APHYRIC BASALT**

**Pieces 1-8C**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 0-10%; 0.5-20 mm; spherical; patchy distribution; lined with globular grayish blue green (5BG 5/2) mineral; some zeolite crystals.  
**COLOR:** Brownish gray (5YR 4/1).  
**STRUCTURE:** Flow-banded.  
**ALTERATION:** Strong; oxidized.  
**VEINS/FRACTURES:** <1%; 0.2-0.5 mm; inclined; generally filled with green mineral; some with zeolite.





152-917A-36R-6

**UNIT 52: APHYRIC BASALT**

**Pieces 1A-10**

**PHENOCRYSTS:** None.

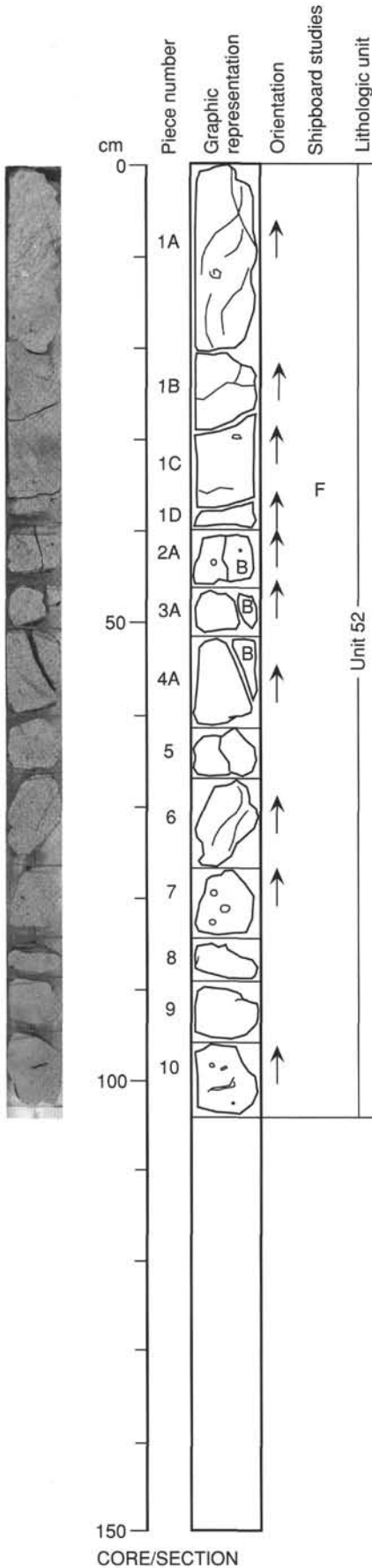
**GROUNDMASS:** Fine-grained.

**VESICLES:** <5%; 0.5-10 mm; spherical to flattened; random distribution; lined with pale green lining; some zeolite-filled vesicles at top of section.

**COLOR:** Dark brownish gray (5R 3/1).

**STRUCTURE:** Slightly flow-banded.

**VEINS/FRACTURES:** <1%; 0.2-1 mm; random; filled with green mineral.



CORE/SECTION

**UNIT 52: APHYRIC BASALT**

**Pieces 1-19**

**CONTACTS:** None.

**PHENOCRYSTS:** None.

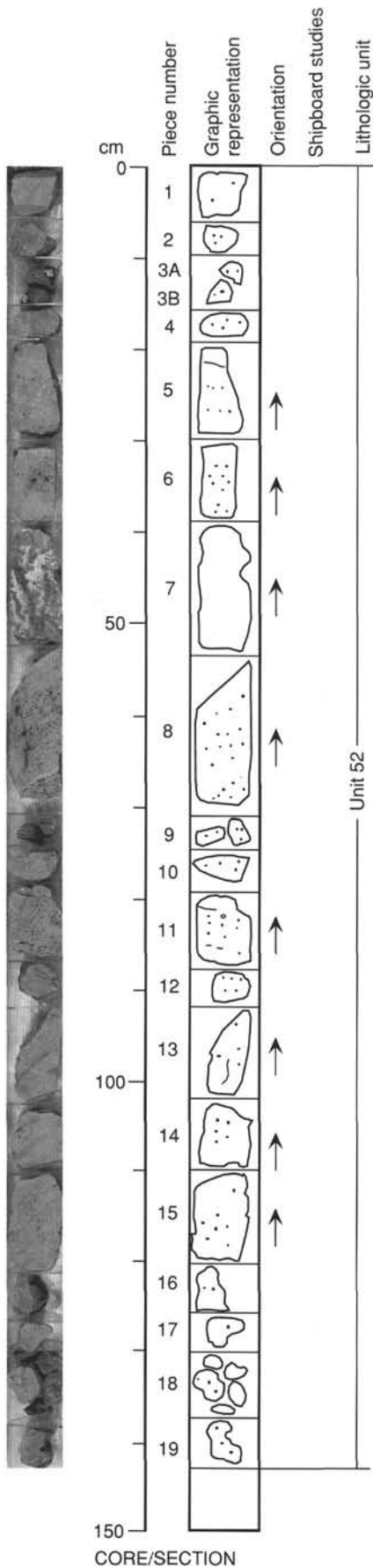
**GROUNDMASS:** Fine-grained.

**VESICLES:** 0-10%; 0.5-6 mm; round to flattened; inhomogeneous distribution; lined with pale green material.

**COLOR:** Dark reddish gray (5R 3/1).

**STRUCTURE:** Horizontal to dipping flow-banding, often with trains of flattened vesicles parallel to banding.

**ALTERATION:** Moderate; some oxidation.

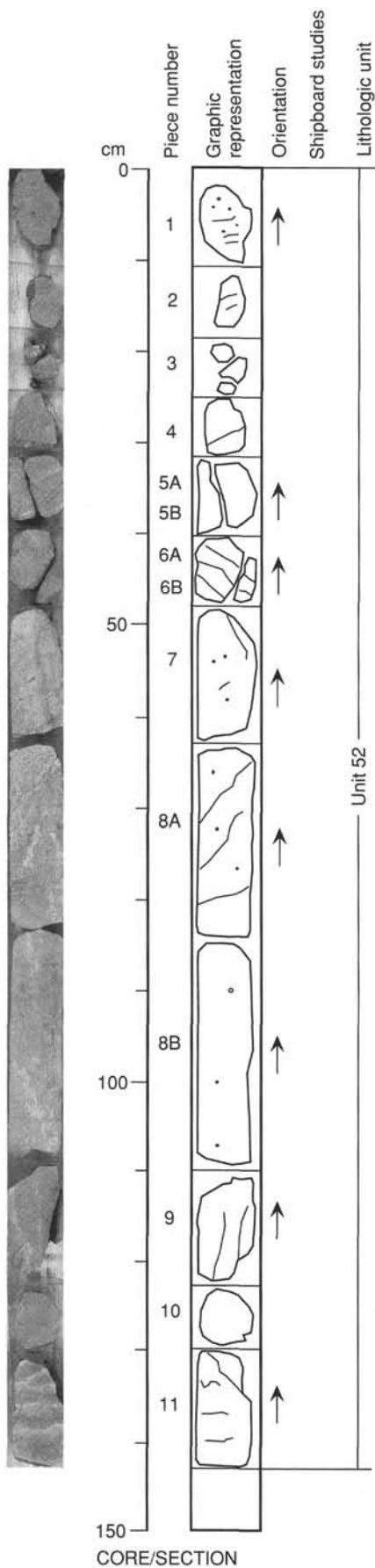


152-917A-37R-2

UNIT 52: APHYRIC BASALT

Pieces 1-11

**CONTACTS:** None.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 0-5%; 0.5-3 mm; flattened; abundance is 5% in Piece 1 and <0.5% in Pieces 2-11; lined or filled with green material.  
**COLOR:** Dark reddish gray (5R 3/1) at top to dark gray (N 4/0) at bottom of section.  
**STRUCTURE:** Horizontal flow-banding in Pieces 1 and 2; steeply inclined, wispy flow-banding in Pieces 5-11.  
**ALTERATION:** Moderate to low; some red oxidation of the whole rock in Pieces 1-5; yellowish brown oxidation halos around fractures and in zones of the rock.  
**VEINS/FRACTURES:** A few near-vertical, 1-mm-wide fractures filled with green material.



**UNIT 52: APHYRIC BASALT**

**Pieces 1-7**

**CONTACTS:** None.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

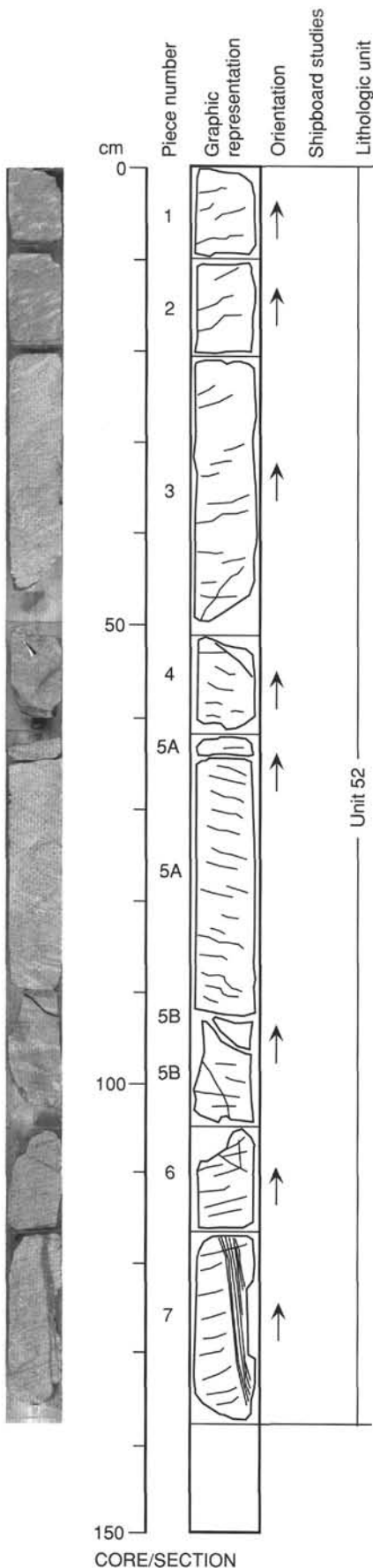
**VESICLES:** 1%; 1 mm; round; scattered; filled with green material.

**COLOR:** Dark gray (N 4/0).

**STRUCTURE:** Wispy flow-banding is seen throughout the section; aligned from near-horizontal to dipping about 30 degrees.

**ALTERATION:** Low; very late yellowish brown oxidation halos are seen around fractures.

**VEINS/FRACTURES:** <1 mm; variable; one 1-cm-wide, vertical, branching fracture occurs in Piece 7 and is filled with a fine-grained intergrowth of black and green materials.

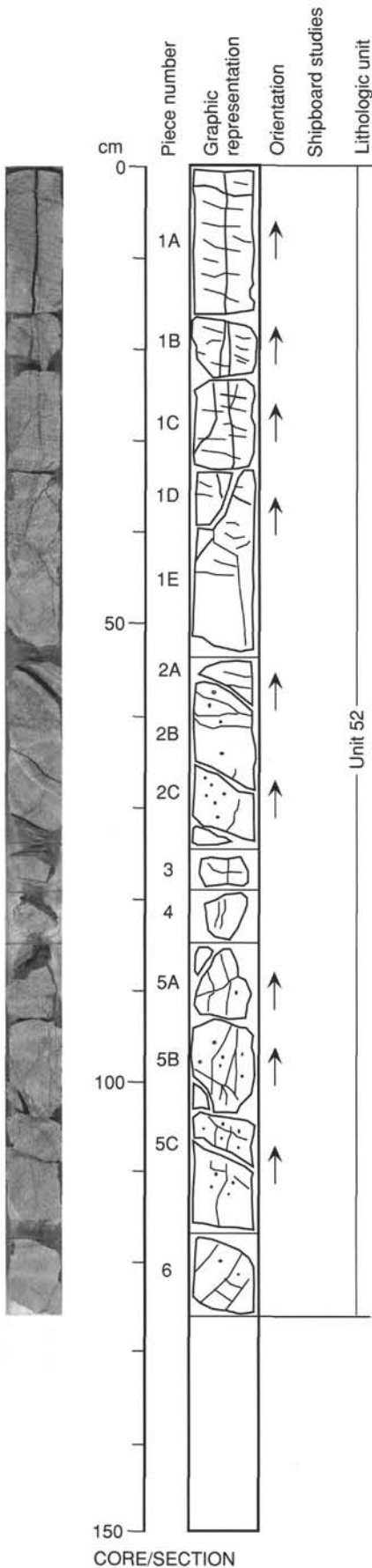


152-917A-38R-1

UNIT 52: APHYRIC BASALT

Pieces 1A-6

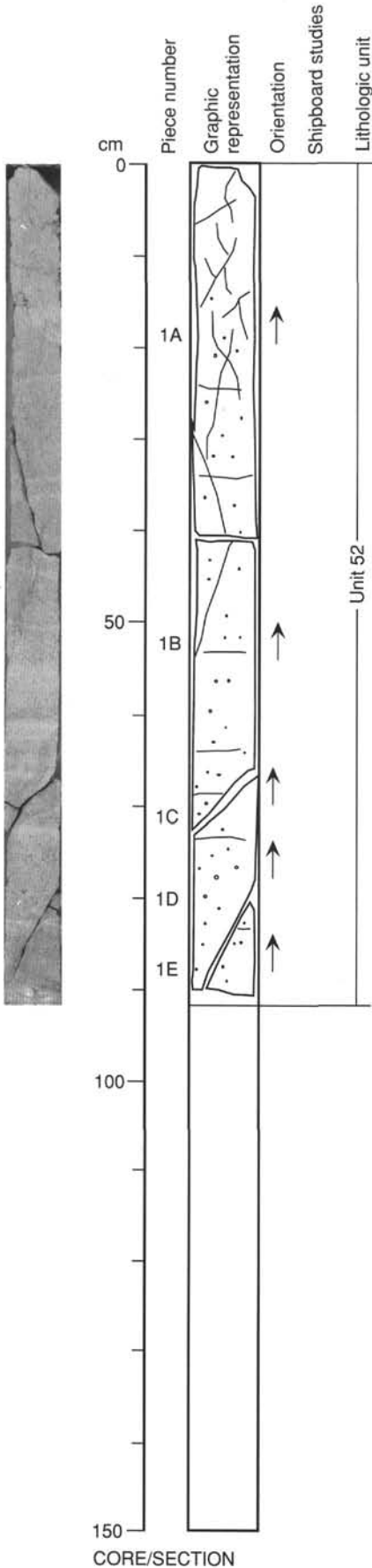
**CONTACTS:** None.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** <1%; 1 mm; round; scattered; filled with green material.  
**COLOR:** Dark gray (N 4/0).  
**STRUCTURE:** Wispy, near-horizontal flow-banding occurs in Pieces 1 and 2.  
**ALTERATION:** Low; very late yellowish brown oxidation halos are seen around fractures.  
**VEINS/FRACTURES:** 2%; <1-3 mm; mostly near-vertical; filled with a fine-grained intergrowth of black and green materials; fractures occur along the whole section.



**UNIT 52: APHYRIC BASALT**

**Pieces 1A-1E**

**CONTACTS:** None.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 3%; 1-2 mm; round to flattened; random; filled with green material.  
**COLOR:** Dark gray (N 4/0).  
**STRUCTURE:** Weak near-horizontal flow banding.  
**ALTERATION:** Low; very late yellowish brown oxidation around fractures and in zones of the rock.  
**VEINS/FRACTURES:** <1%; 1-2 mm; variable orientation, near-vertical; filled with dark green material.

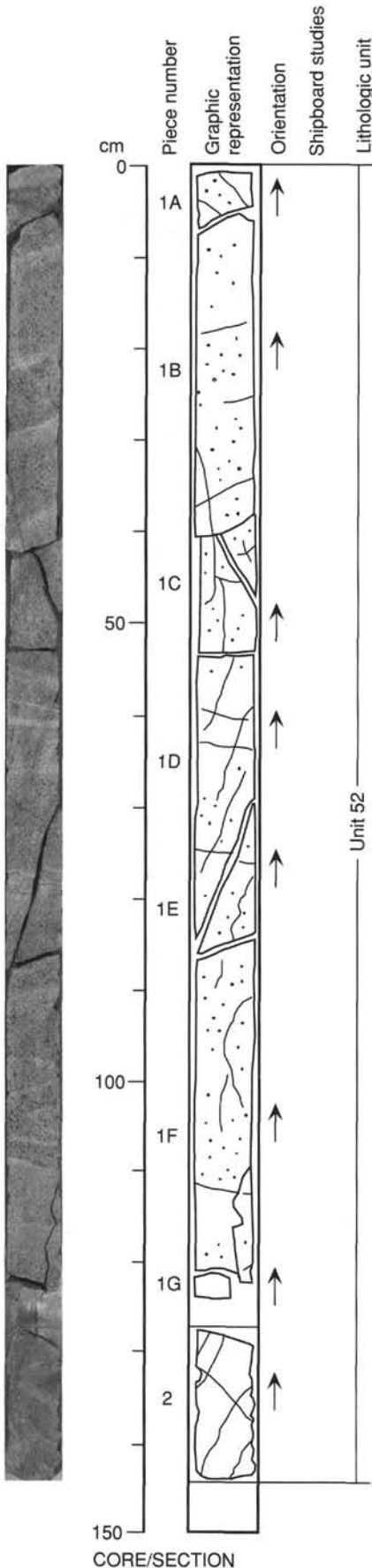


152-917A-38R-3

UNIT 52: APHYRIC BASALT

Pieces 1A-2

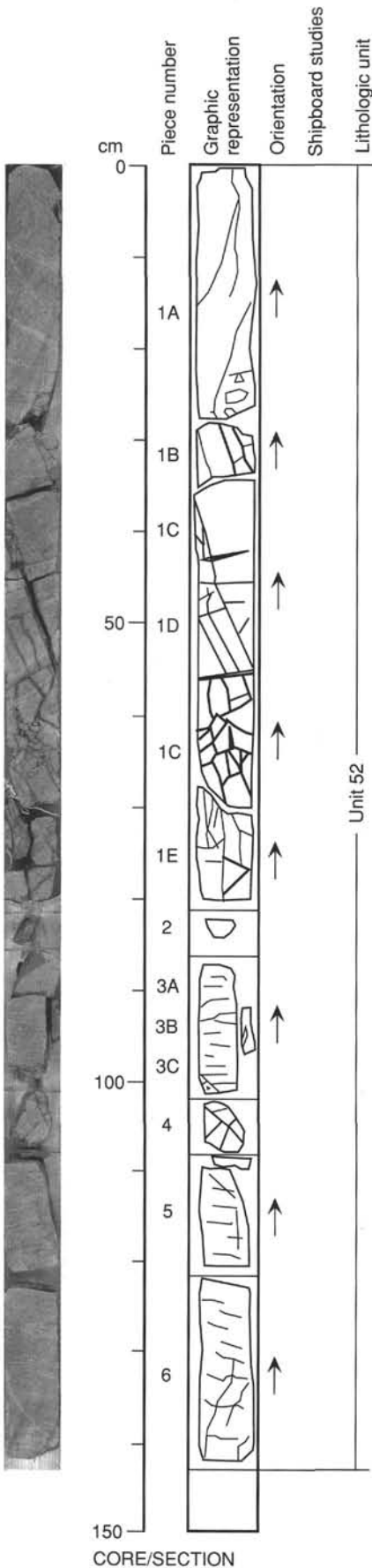
**CONTACTS:** None.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 2%-5%; 1-2 mm; round to flattened; in trains; filled with green material.  
**COLOR:** Dark gray (N 4/0).  
**STRUCTURE:** Horizontal to slightly dipping flow-banding is seen throughout the section.  
**ALTERATION:** Low to moderate. Very late, yellowish brown oxidation is seen along fractures and in large zones of the rock.  
**VEINS/FRACTURES:** <1%; up to 1 mm; variable orientation, near-vertical; filled with dark green material.



**UNIT 52: APHYRIC BASALT**

**Pieces 1A-6**

**CONTACTS:** None.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 1%; 1 mm; round; random distribution; filled with green material.  
**COLOR:** Dark gray (N 4/0).  
**STRUCTURE:** Flow-banding in Pieces 3-6; brecciation associated with late fracturing in Pieces 1C-1E, 3B-3C, and 4.  
**ALTERATION:** Moderate; rock is very fractured with oxidation halos around the fractures.  
**VEINS/FRACTURES:** 1%-10%; 1-3 mm; main system is subvertically oriented; filled with fine-grained green and black material.





152-917A-38R-5

UNIT 52: APHYRIC BASALT

Pieces 1-6

**CONTACTS:** None.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

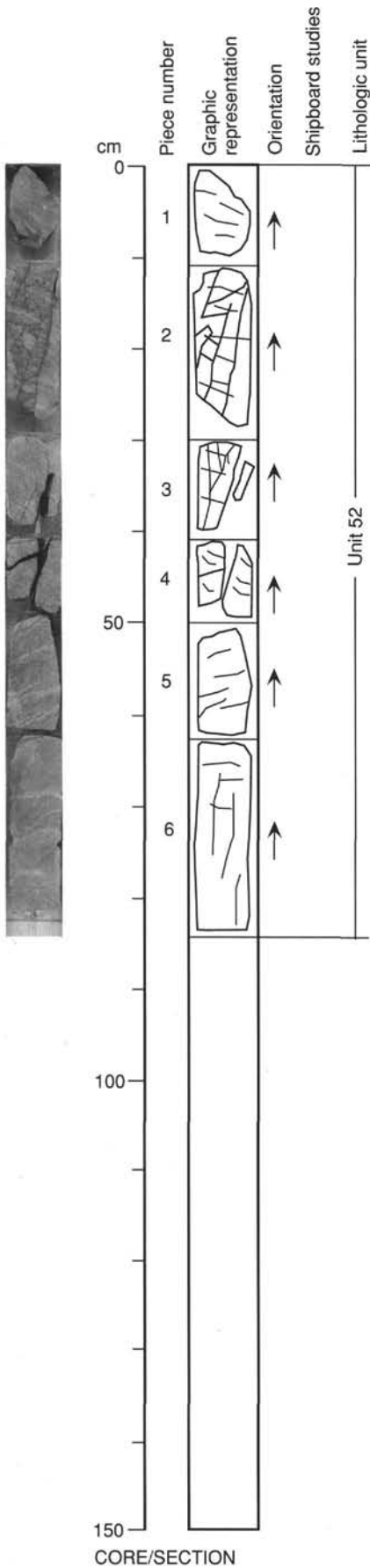
**VESICLES:** 1%; 1 mm; round; random distribution; filled with green material.

**COLOR:** Dark gray (N 4/0).

**STRUCTURE:** Flow-banding; brecciation associated with late fracturing in Piece 2.

**ALTERATION:** Moderate; oxidation associated with fractures.

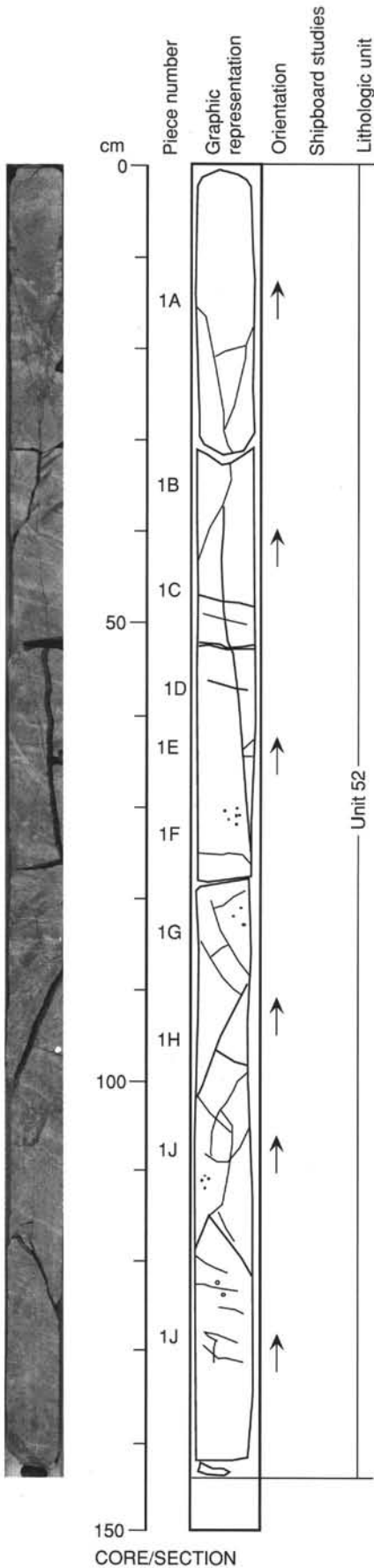
**VEINS/FRACTURES:** 1%-5%; <1-2 mm; main set is vertical; filled with green material.



**UNIT 52: APHYRIC BASALT**

**Pieces 1A-1J**

**CONTACTS:** None.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** None.  
**COLOR:** Dark gray (N 4/0).  
**STRUCTURE:** Nonvesicular, massive; with wispy, near-horizontal flow-banding throughout.  
**ALTERATION:** Low; late yellowish brown oxidation is seen around the fractures and in other zones of the rock.  
**VEINS/FRACTURES:** A few <1-mm-wide, vertical fractures filled with green material showing slickensided surfaces run through the section. At 105 cm is a 5-mm-wide, irregular vein filled with green material.  
**ADDITIONAL COMMENTS:** The rock splits apart along the fractures.



152-917A-39R-2

**UNIT 52: APHYRIC BASALT**

**Pieces 1A-3B**

**CONTACTS:** None.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

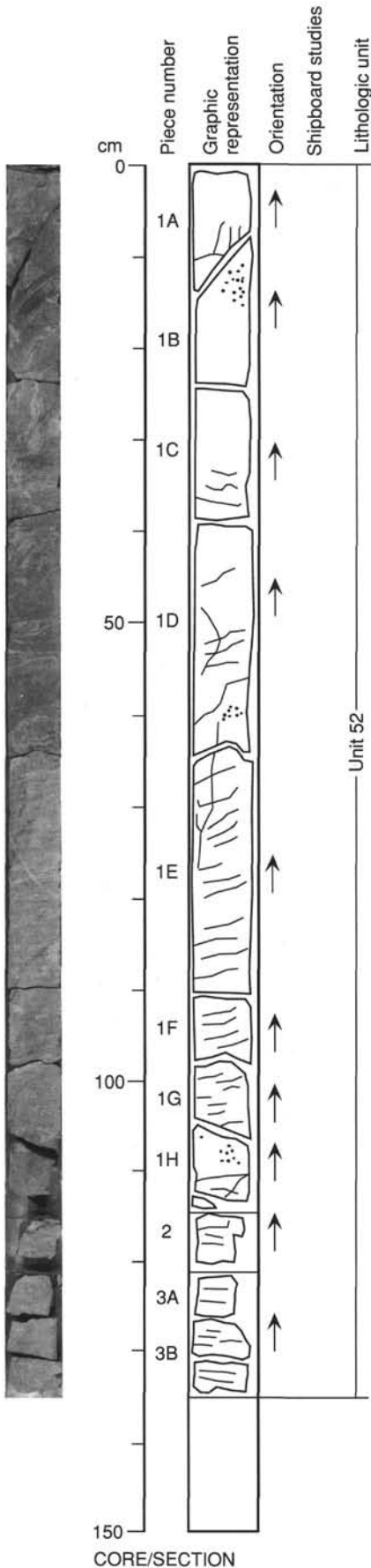
**VESICLES:** None.

**COLOR:** Dark gray (N 4/0) at the top grading downward into dark reddish gray (5R 4/1).

**STRUCTURE:** Nonvesicular, massive, with wispy, near-horizontal flow-banding. A few 2-5 cm chunks of vesicular rock are seen at 5-11, 62, and 109 cm.

**ALTERATION:** Moderate; late yellowish brown oxidation patches cover large zones of the rock.

**VEINS/FRACTURES:** A few <1-mm-wide, near-vertical fractures filled with green material are seen; also a similar horizontal one at 117 cm.



**UNIT 52: APHYRIC BASALT**

**Pieces 1-8B**

**CONTACTS:** None.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

**VESICLES:** None.

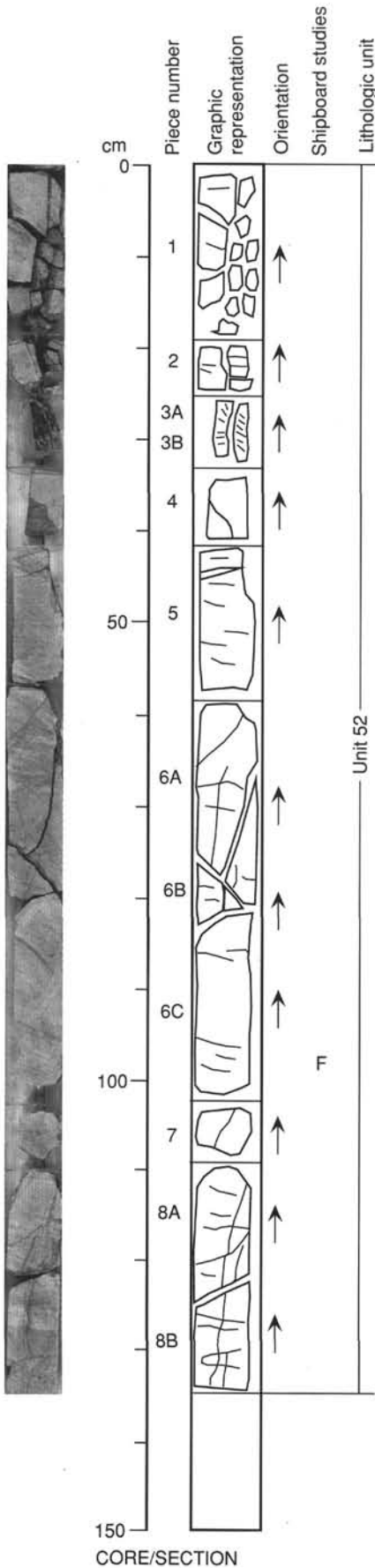
**COLOR:** Dark reddish gray (5R 4/1).

**STRUCTURE:** Nonvesicular, massive, with near-horizontal flow-banding throughout.

**ALTERATION:** Moderate with some red oxidation; late yellowish brown oxidation halos around fractures.

**VEINS/FRACTURES:** 0.5-2-mm-wide, near-vertical fractures filled with green material and with slickensided surfaces occur throughout the section.

**ADDITIONAL COMMENTS:** The rock tends to split apart along the fractures.

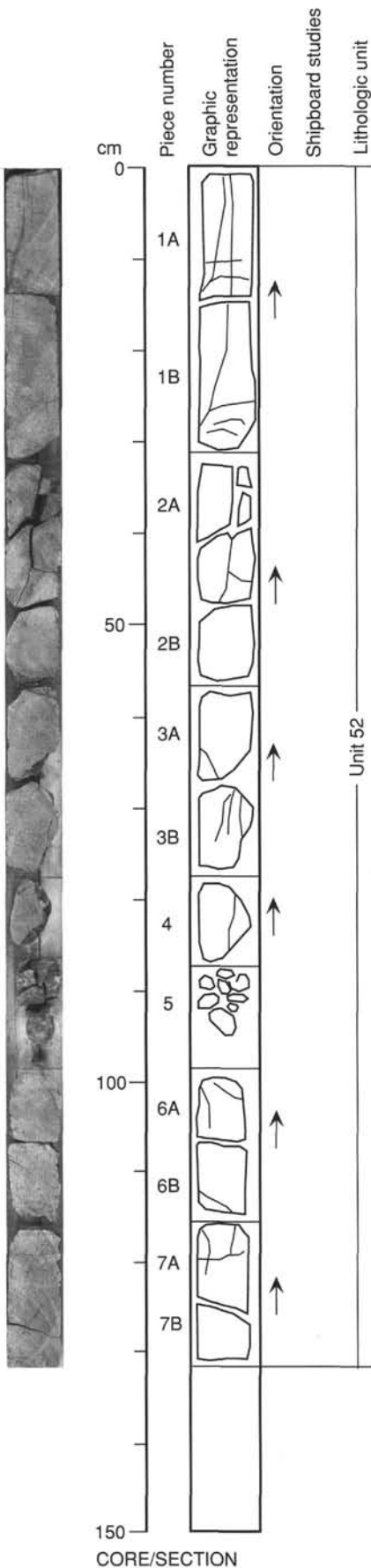


152-917A-39R-4

**UNIT 52: APHYRIC BASALT**

**Pieces 1A-7B**

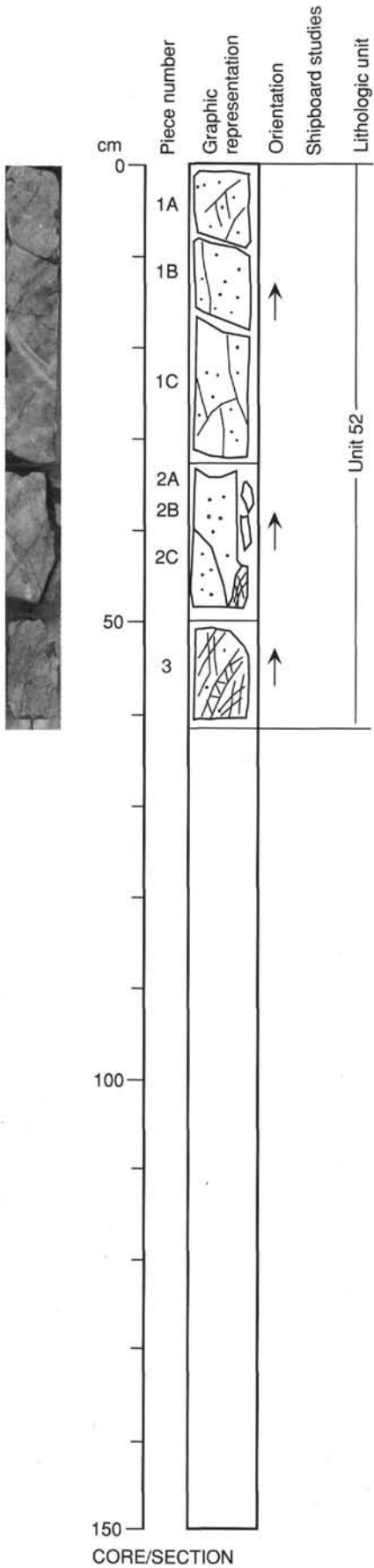
**CONTACTS:** None.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** None.  
**COLOR:** Dark reddish gray (5R 4/1).  
**STRUCTURE:** Nonvesicular, massive, with weak flow-banding in the upper half.  
**ALTERATION:** Moderate with some red oxidation; late yellowish brown oxidation halos occur around fractures.  
**VEINS/FRACTURES:** 1-mm-wide, near-vertical fractures filled with green material occur throughout the section.



**UNIT 52: APHYRIC BASALT**

**Pieces 1A-3**

**CONTACTS:** None.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 2%; 1 mm; elongated; disseminated; increasing in frequency downward through the section.  
**COLOR:** Dark gray (N 4/0).  
**STRUCTURE:** Massive.  
**ALTERATION:** Moderate; late yellowish brown oxidation halos around fractures.  
**VEINS/FRACTURES:** 1-4-mm-wide, near-vertical fractures filled with green material occur throughout the section; Piece 3 is brecciated.



152-917A-40R-1

UNIT 52: APHYRIC BASALT

Pieces 1A-1I

**CONTACTS:** None.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Medium- to fine-grained; contains very rare bits of native copper.

**VESICLES:** None.

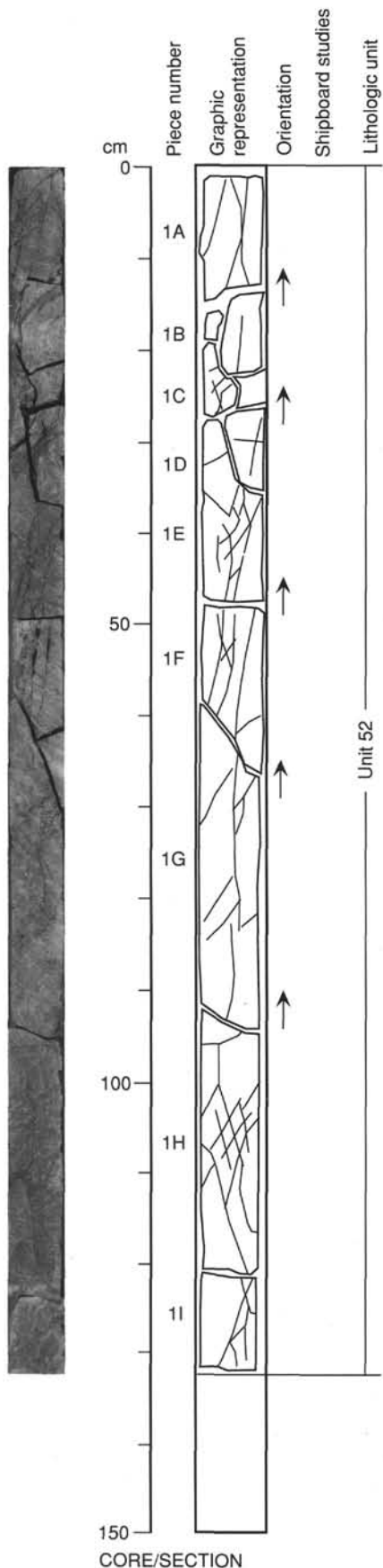
**COLOR:** Dark greenish gray (5GY 4/1).

**STRUCTURE:** Wispy flow-banding.

**ALTERATION:** Moderate; yellowish brown oxidation associated with fractures.

**VEINS/FRACTURES:** 1%-10%; 0.5-2 mm; mainly subvertical; filled with green material and sporadic native copper; slickensides on fracture surfaces.

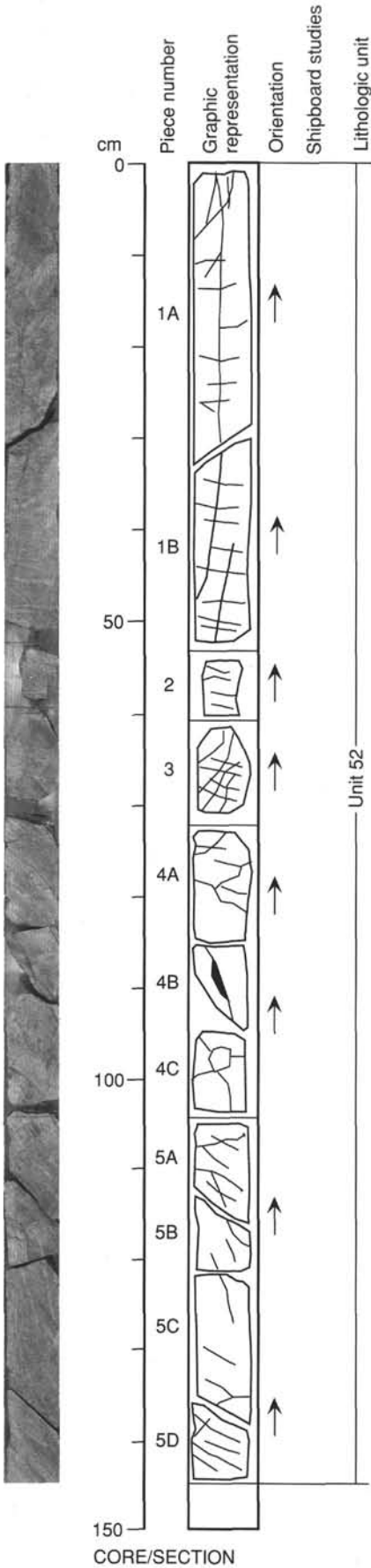
**ADDITIONAL COMMENTS:** The rock is extensively fractured.



**UNIT 52: APHYRIC BASALT**

**Pieces 1A-5D**

**CONTACTS:** None.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Medium- to fine-grained.  
**VESICLES:** None.  
**COLOR:** Dark greenish gray (5GY 4/1).  
**STRUCTURE:** Wispy flow-banding defined by color variation, horizontal to dipping 10 degrees.  
**ALTERATION:** Moderate; oxidation associated with fractures.  
**VEINS/FRACTURES:** 1%-5%; 0.5-2 mm; mainly subvertical; filled with green material; slickensides on fracture surfaces.  
**ADDITIONAL COMMENTS:** The rock is extensively brecciated.



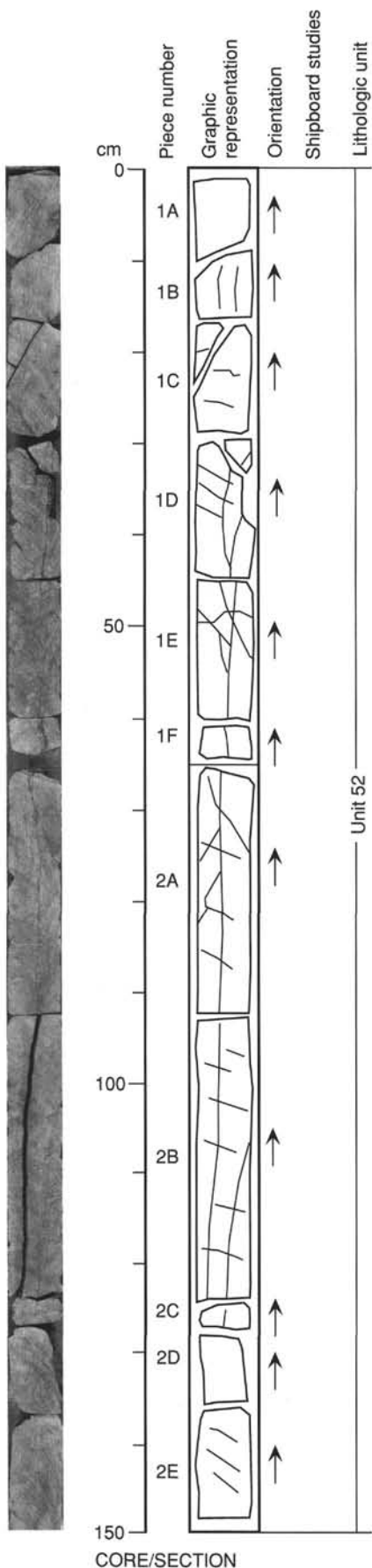


152-917A-40R-3

**UNIT 52: APHYRIC BASALT**

**Pieces 1A–2E**

**CONTACTS:** None.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Medium- to fine-grained.  
**VESICLES:** None.  
**COLOR:** Dark greenish gray (5GY 4/1).  
**STRUCTURE:** Flow-banding defined by 1–5 mm bands with much less mafic minerals.  
**ALTERATION:** Moderate; oxidation associated with fractures.  
**VEINS/FRACTURES:** 0–5%; up to 2 mm; mainly subvertical; filled with green material; slickensides on surfaces.



CORE/SECTION

**UNIT 52: APHYRIC BASALT**

**Pieces 1A-10**

**CONTACTS:** None.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Medium- to fine-grained.

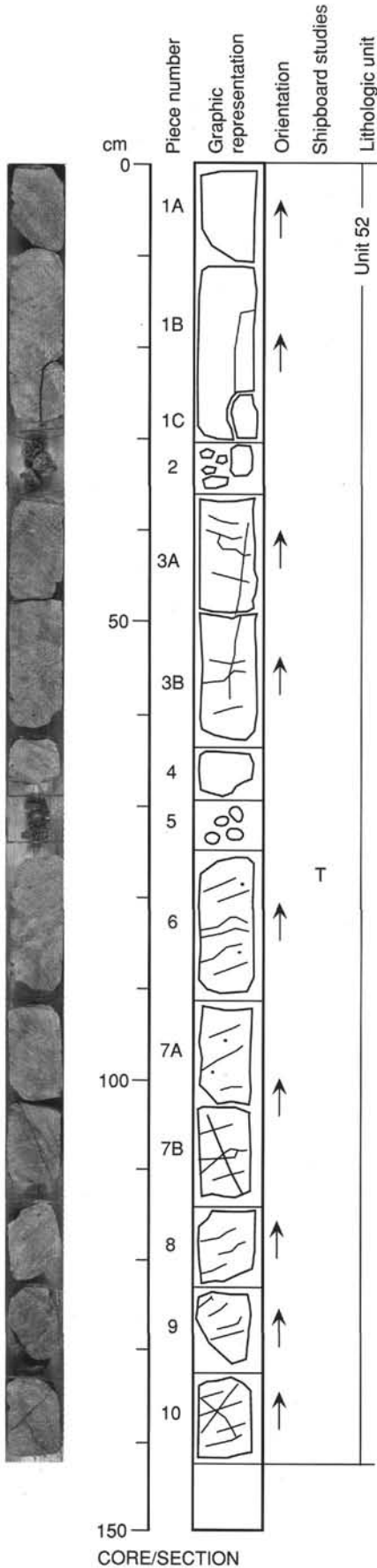
**VESICLES:** 1%; 1 mm; round; random; filled with green material.

**COLOR:** Dark greenish gray (5GY 4/1) to medium gray (N 5/0).

**STRUCTURE:** Flow-banding defined by 1-5 mm bands with much fewer mafic minerals; wavy and horizontal to dipping 45 degrees.

**ALTERATION:** Low except for oxidation associated with fractures.

**VEINS/FRACTURES:** 0-2%; Up to 1 mm; filled with green material.



152-917A-40R-5

**UNIT 52: APHYRIC BASALT**

**Pieces 1A-4**

**CONTACTS:** None.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Medium- to fine-grained.

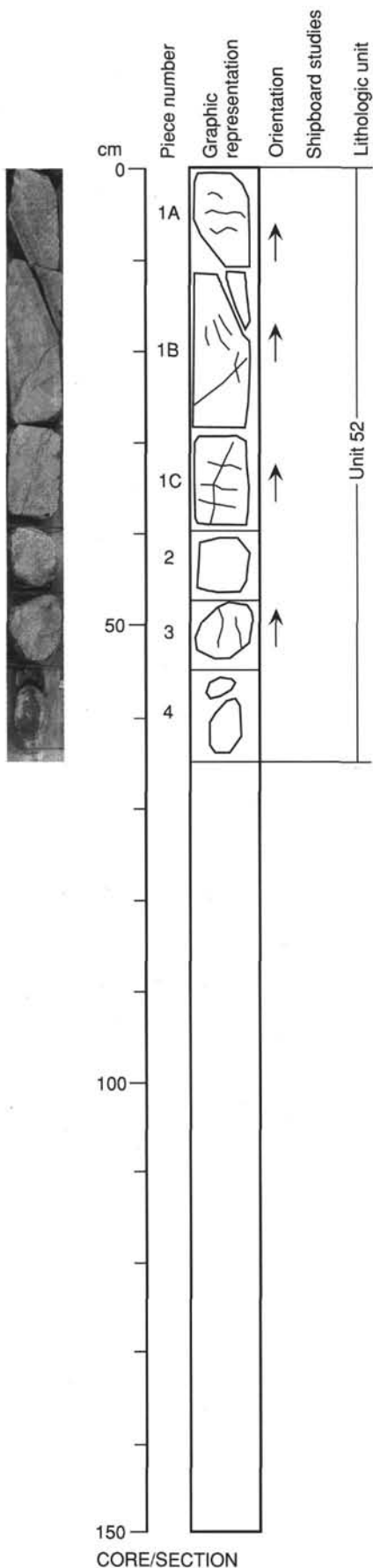
**VESICLES:** None.

**COLOR:** Dark greenish gray (5GY 4/1) to medium gray (N 5/0).

**STRUCTURE:** Flow-banding defined by 1-3-mm-wide bands with fewer mafic minerals; wavy and horizontal to vertical in orientation.

**ALTERATION:** Moderate; oxidation associated with fracture zones.

**VEINS/FRACTURES:** 0-5%; Up to 1 mm; filled with greenish material.



**UNIT 52: APHYRIC BASALT**

**Pieces 1-8G**

**CONTACTS:** None.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Medium- to fine-grained.

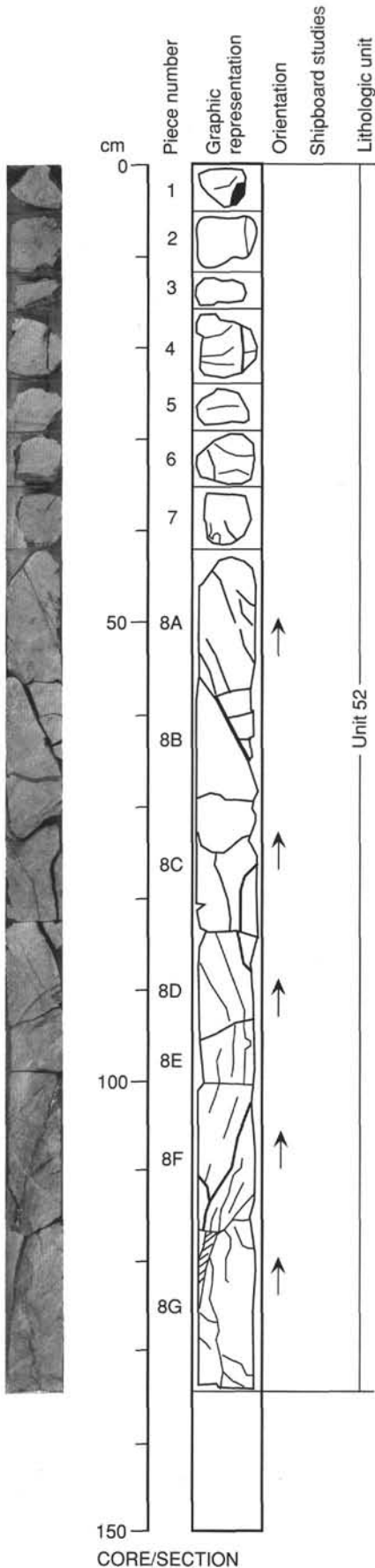
**VESICLES:** 0-5%; up to 2 mm; round to irregular; patchy distribution; filled with green material and rare native copper.

**COLOR:** Greenish gray (5GY 5/1).

**ALTERATION:** Moderate; oxidation around fractures.

**VEINS/FRACTURES:** To 5%; 1-2 mm; subvertical; filled with green material; slickensides on fracture surfaces.

**ADDITIONAL COMMENTS:** The rock is very fractured.



152-917A-41R-2

**UNIT 52: APHYRIC BASALT**

**Pieces 1A-3D**

**CONTACTS:** None.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Medium- to fine-grained.

**VESICLES:** 1%; 0.5-2 mm; round to irregular; filled with green material.

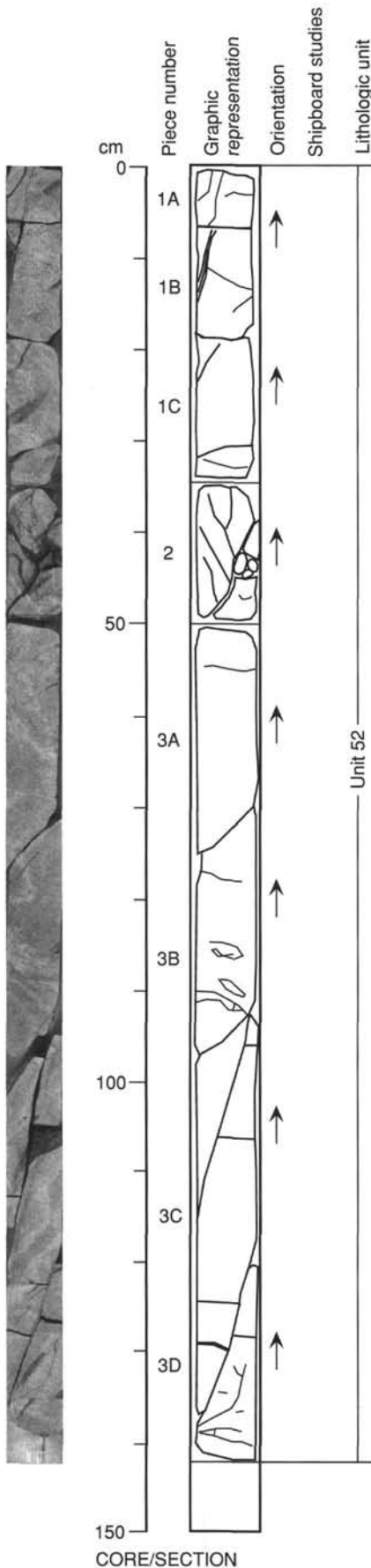
**COLOR:** Dark greenish gray (5GY 5/1).

**STRUCTURE:** Flow-banding defined by 1-3-mm-wide wavy bands with less mafic minerals; horizontal to vertical orientation.

**ALTERATION:** Moderate; oxidation around fractures.

**VEINS/FRACTURES:** 1-2 mm; mainly subvertical; filled with green material; slickensides on fracture surfaces.

**ADDITIONAL COMMENTS:** The rock is very fractured.



**UNIT 52: APHYRIC BASALT**

**Pieces 1A-2I**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

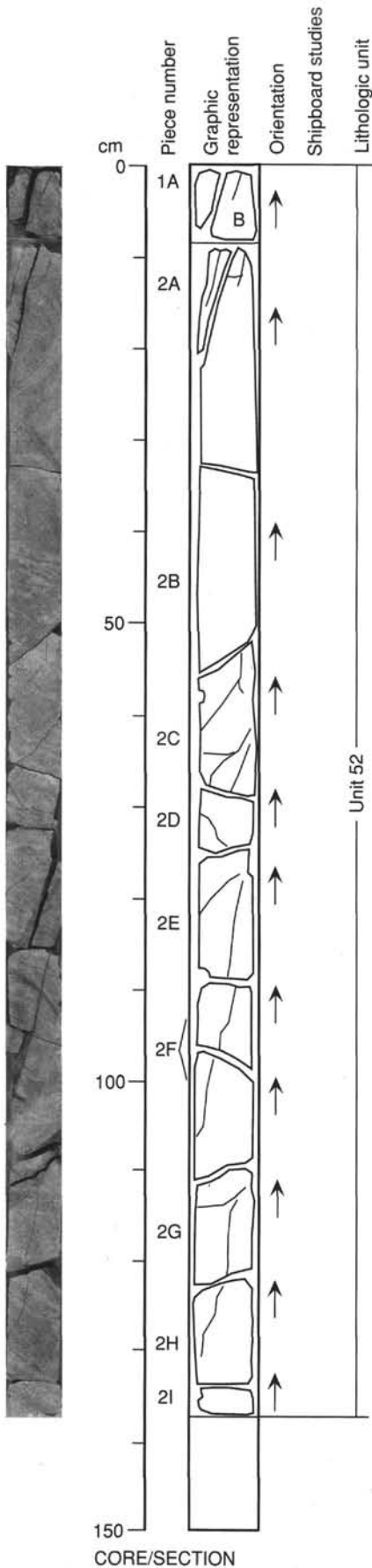
**VESICLES:** None.

**COLOR:** Dark greenish gray (5GY 4/1).

**STRUCTURE:** Faint banding caused by variation in modal proportions of light and dark minerals.

**ALTERATION:** Moderate; oxidation around fractures.

**VEINS/FRACTURES:** 1%; 0.2-1 mm; steeply inclined; filled with green mineral and rare native copper.



152-917A-42R-2

**UNIT 52: APHYRIC BASALT**

**Pieces 1A-2D**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

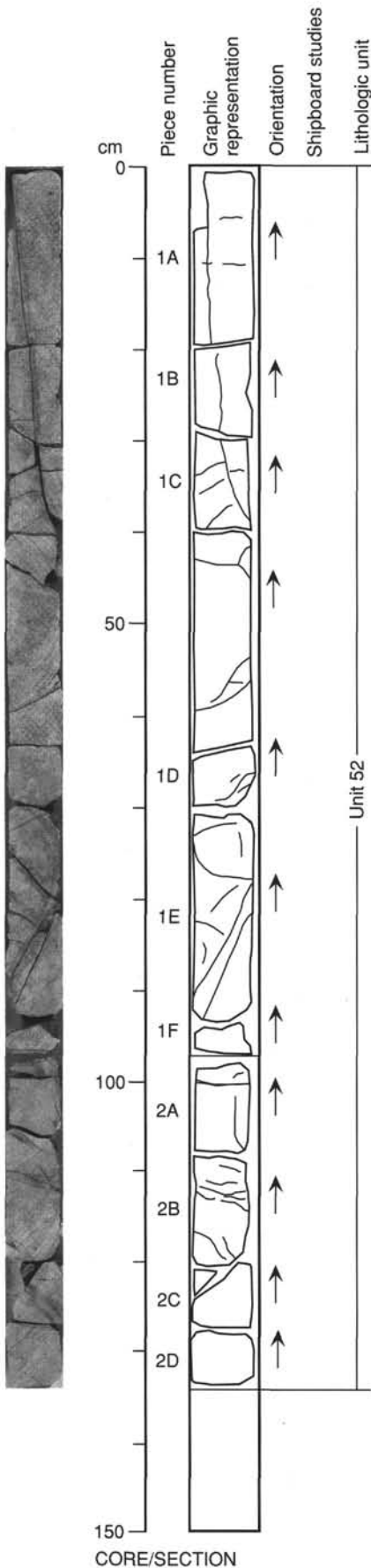
**VESICLES:** None.

**COLOR:** Dark greenish gray (5GY 4/1).

**STRUCTURE:** Faint banding caused by variation in modal proportions of light and dark minerals.

**ALTERATION:** Moderate; oxidation around fractures.

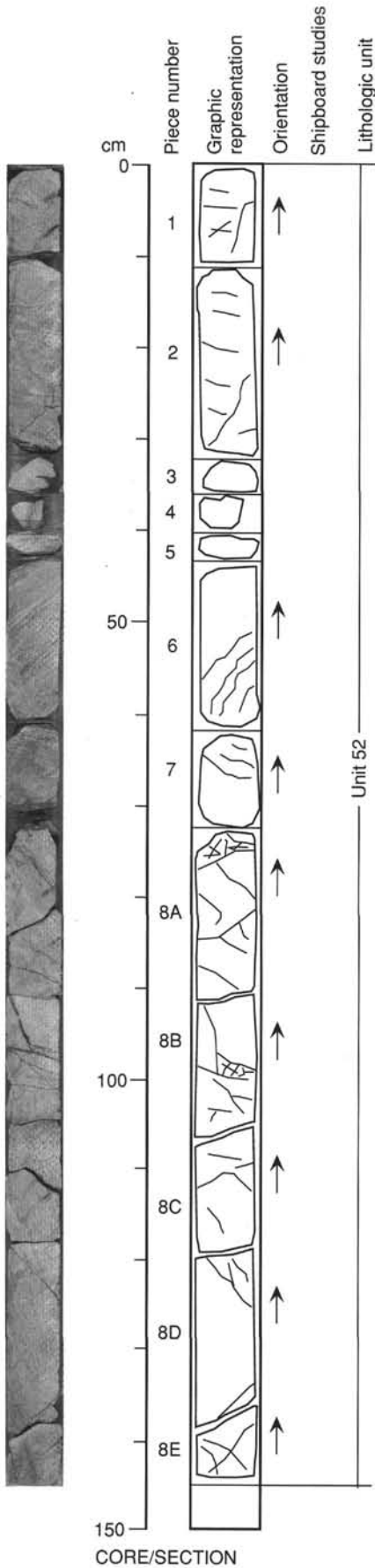
**VEINS/FRACTURES:** 1%; 0.2-2 mm; random distribution; filled with green mineral and rare native copper.



**UNIT 52: APHYRIC BASALT**

**Pieces 1-8E**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** None.  
**COLOR:** Dark greenish gray (5GY 4/1).  
**STRUCTURE:** Inclined (45 degrees) faint banding caused by variation in modal proportions of light and dark minerals.  
**ALTERATION:** Moderate; oxidation around fractures.  
**VEINS/FRACTURES:** 1%; 0.2-3 mm; horizontal to inclined; filled with green mineral; brecciation adjacent to larger fractures; faint near-horizontal slickensides on one fracture surface in Piece 8A.



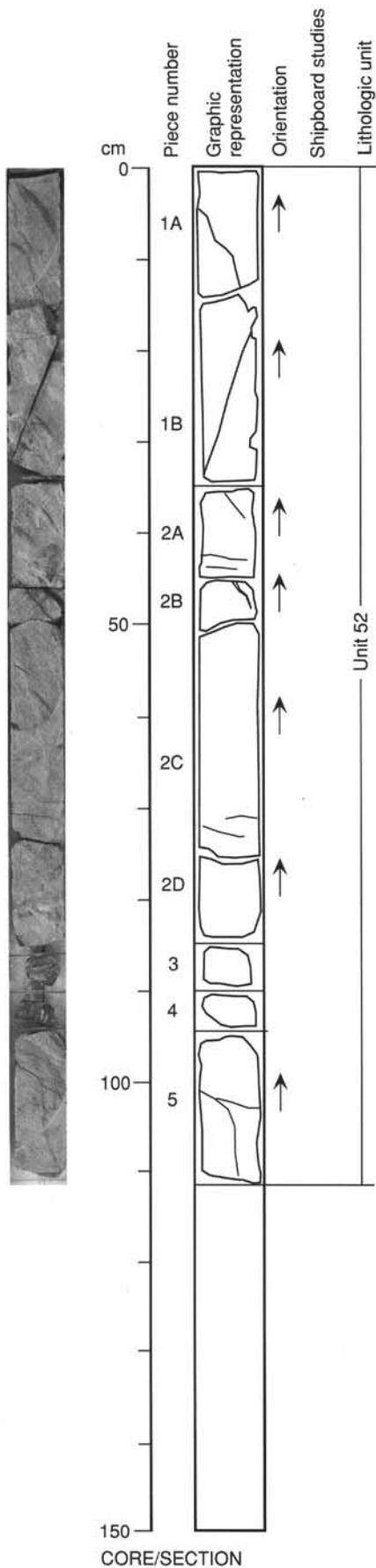


152-917A-42R-4

**UNIT 52: APHYRIC BASALT**

**Pieces 1A-5**

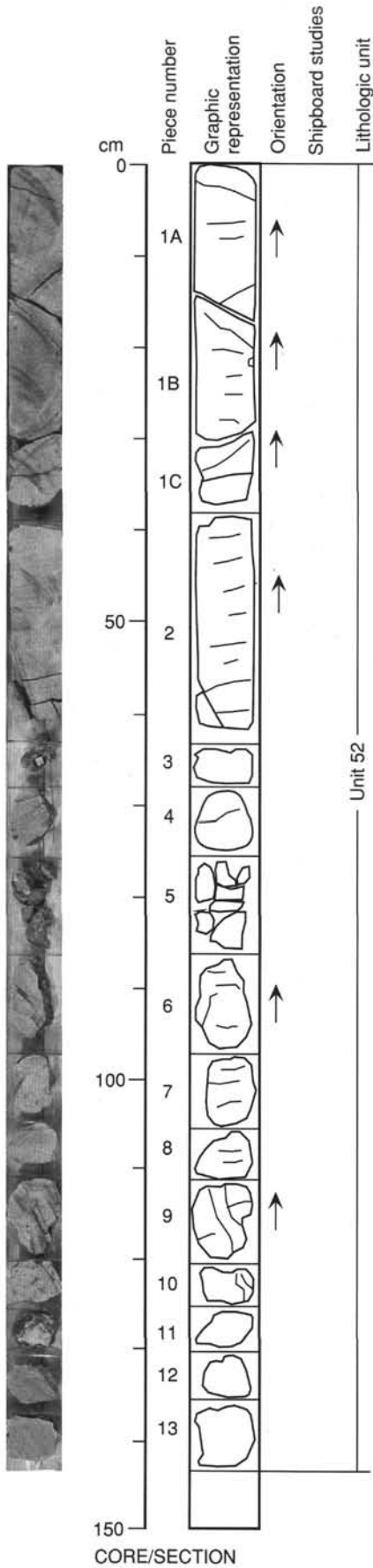
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** None.  
**COLOR:** Dark greenish gray (5GY 4/1).  
**STRUCTURE:** Faint, irregular banding.  
**ALTERATION:** Moderate; oxidation around fractures.  
**VEINS/FRACTURES:** 1%; 0.2-3 mm; horizontal to inclined; filled with green minerals.



**UNIT 52: APHYRIC BASALT**

**Pieces 1A-13**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** <1%; 1-3 mm; spherical; restricted to Pieces 9 and 10; filled with green mineral.  
**COLOR:** Dark greenish gray (5GY 4/1).  
**STRUCTURE:** Faint, near-horizontal flow-banding.  
**ALTERATION:** Moderate; oxidation around fractures.  
**VEINS/FRACTURES:** 1%; 0.2-1 mm; horizontal to inclined; filled with green minerals.

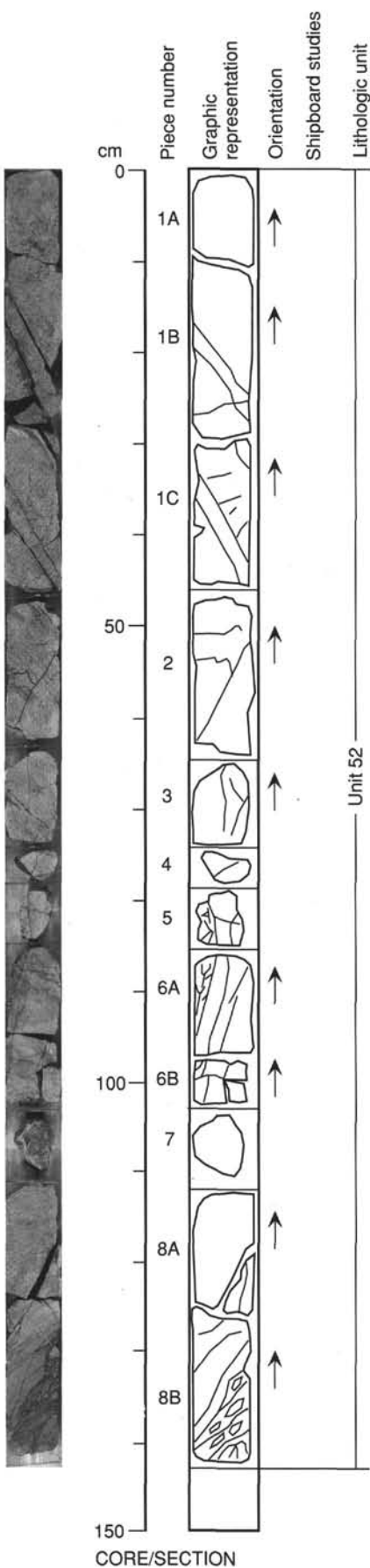


152-917A-43R-2

UNIT 52: APHYRIC BASALT

Pieces 1A-8B

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 0-2%; 0.5-2 mm; spherical to irregular; restricted to Piece 1; filled with green mineral.  
**COLOR:** Olive gray (5Y 4/1).  
**STRUCTURE:** Faint flow-banding.  
**ALTERATION:** Moderate; oxidation adjacent to fractures.  
**VEINS/FRACTURES:** 5%; 0.2-5 mm; steeply inclined; filled with green mineral; Pieces 5-8 brecciated; near-horizontal (10 degrees) slickensides in Piece 1B.



**UNIT 52: APHYRIC BASALT**

**Pieces 1-3**

**PHENOCRYSTS:** None.

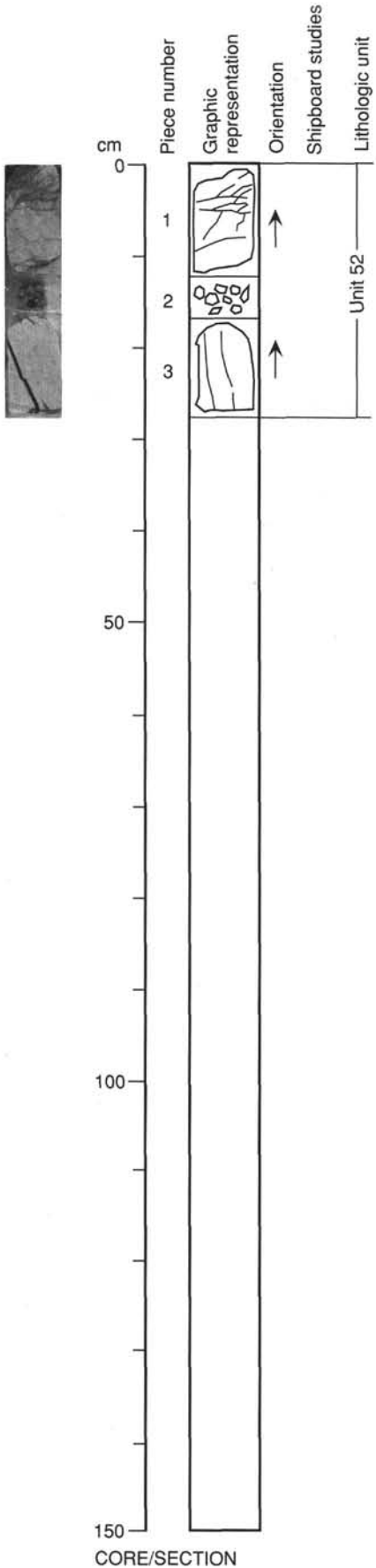
**GROUNDMASS:** Fine-grained.

**VESICLES:** <<1%; 2 mm; elongate; restricted to Piece 3; filled with green mineral.

**COLOR:** Olive gray (5Y 4/1).

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** 5%; 0.2-5 mm; horizontal to steeply inclined; filled with green mineral; brecciated at top of section.



CORE/SECTION

152-917A-44R-1

UNIT 52: APHYRIC BASALT

Pieces 2-6

**PHENOCRYSTS:** None.

**GROUNDMASS:** Aphanitic.

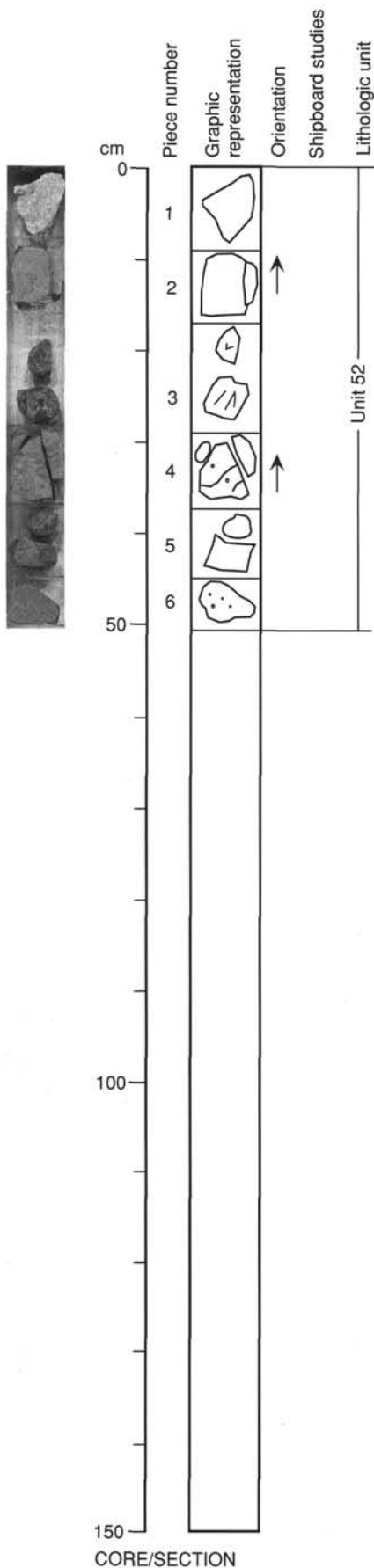
**VESICLES:** 0-5%; 0.5-2 mm; spherical; in Piece 6; lined with green mineral.

**COLOR:** Greenish black (5G 2/1) at top to brownish gray (5YR 4/1) at bottom.

**ALTERATION:** Moderate to strong; oxidized at bottom of section.

**VEINS/FRACTURES:** 0.2-1 mm; random; filled with green mineral.

**ADDITIONAL COMMENTS:** Piece 1 is granite drilling debris; drill bit changed after Core 152-917A-43R.



**UNIT 52: APHYRIC BASALT**

**Pieces 1A-2**

**CONTACTS:** The contact to Unit 53 is seen in Pieces 1 and 2. The rock is bleached up to 7 mm from the contact, and the vesicles are small (<0.5 mm) and flattened along the contact.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Aphanitic.

**VESICLES:** None.

**COLOR:** Weak red (10R 4/2).

**ALTERATION:** Strong.

**VEINS/FRACTURES:** Hair-thin; variable orientation; filled with green material.

**ADDITIONAL COMMENTS:** This is defined as the bottom of Unit 52. However, the underlying Unit 53 may be part of the same large lava flow.

**UNIT 53: APHYRIC BASALT HYALOCLASTITE BRECCIA**

**Pieces 1A-19**

**CONTACTS:** The upper contact to Unit 52 is seen in Pieces 1 and 2. It is sharp, and there is a lot of glass along the contact.

**PHENOCRYSTS:** None.

**GROUNDMASS:** The matrix is glassy.

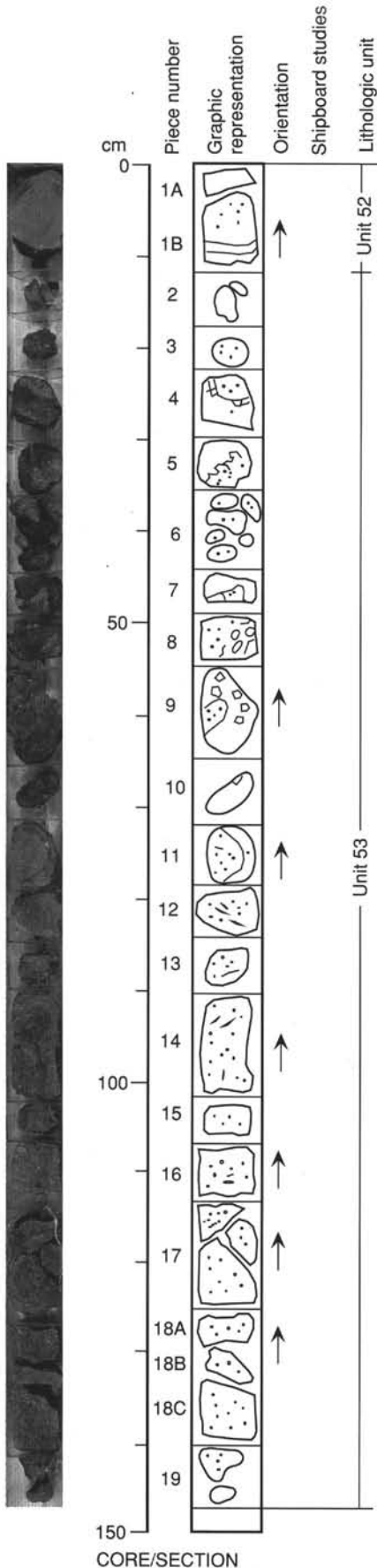
**VESICLES:** The amount of vesicles varies between the different clasts; they are lined with greenish white material, and many are open. The matrix between the clasts is vesicle-free.

**COLOR:** Very dark gray (N 3/0).

**STRUCTURE:** The structure varies through the section. Pieces 3-10 are rich in glassy matrix and contain vesicular scoria fragments up to 5 cm in size. Pieces 11-19 seem to be from one 75-cm-large clast of very vesicular lava with flattened vesicles; Piece 11 shows reddening of the clast's margin.

**ALTERATION:** Low.

**ADDITIONAL COMMENTS:** This rock may be a hyaloclastite facies of the large lava flow that forms Unit 52.



CORE/SECTION

152-917A-45R-2

UNIT 53: APHYRIC BASALT HYALOCLASTITE BRECCIA

Pieces 1-12

**PHENOCRYSTS:** None.

**GROUNDMASS:** The matrix is glassy.

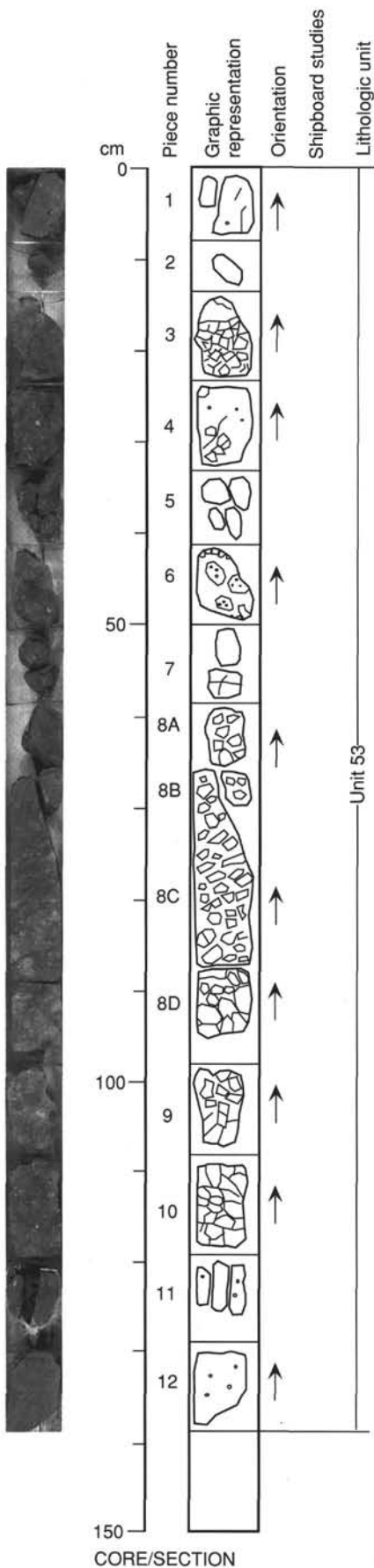
**VESICLES:** The amount of vesicles varies between the different clasts. The matrix is vesicle-free.

**COLOR:** Very dark gray (N 3/0).

**STRUCTURE:** Varies through the section. Pieces 1-2 and parts of 3 are a red lava clast similar to the lowest part of Unit 52; Pieces 3-7 contain vesicular scoria clasts in a glassy matrix; Pieces 8-10 contain angular clasts with a low degree of vesiculation in a glassy matrix; and Pieces 11-12 are from a red lava clast.

**ALTERATION:** Moderate to low. The glass is devitrified.

**ADDITIONAL COMMENTS:** The highly vesicular scoria clasts are probably from the subaerial lava crust, whereas the angular sparsely vesicular clasts were formed in the water.



**UNIT 53: APHYRIC BASALT HYALOCLASTITE BRECCIA**

**Pieces 1–20**

**PHENOCRYSTS:** None.

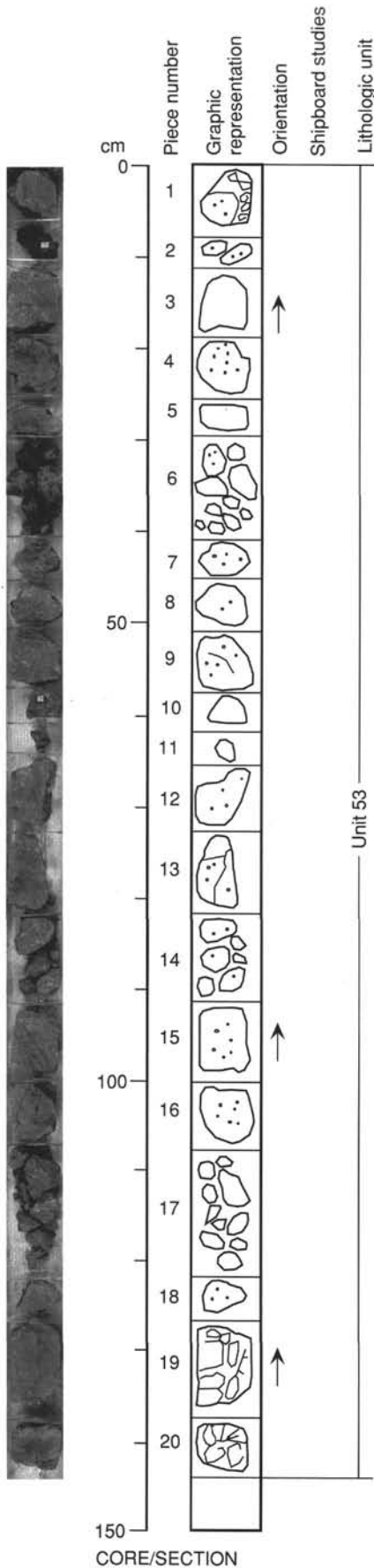
**GROUNDMASS:** Glassy to aphanitic.

**VESICLES:** 1%–5%; 1–7 mm; round to irregular; scattered through the section; lined with green material.

**COLOR:** Very dark gray (N 3/0).

**STRUCTURE:** Many of the smaller pieces (14–18) seem to consist of gray lava clasts with vesicles. Breccia structure is evident in Pieces 12, 13, 19, and 20.

**ALTERATION:** Moderate; the glass is devitrified.





152-917A-46R-2

**UNIT 53: APHYRIC BASALT**

**Piece 1**

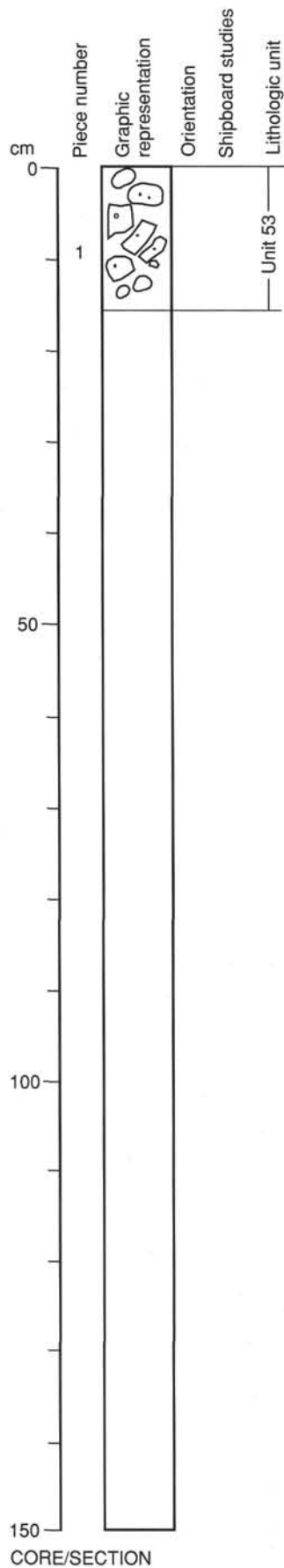
**PHENOCRYSTS:** None.

**GROUNDMASS:** Aphanitic.

**VESICLES:** 2%; 1–3 mm; round; scattered.

**COLOR:** Dark gray (N 4/0).

**ADDITIONAL COMMENTS:** The piece consists of several 1–3-cm-large basalt fragments, probably clasts in the hyaloclastite breccia.



**UNIT 54: PLAGIOCLASE-PYROXENE-PHYRIC DACITE**

**Pieces 1A-5B**

**PHENOCRYSTS:** Plagioclase - 3%; up to 1 mm; euhedral, stubby to platy. Pyroxene - <1%; up to 0.5 mm; euhedral, prismatic.

**GROUNDMASS:** Devitrified glass.

**VESICLES:** 5%-15%; <1-15 mm; very flattened; 1-15 mm ones are aligned giving the rock a fabric dipping 10-30 degrees; lined with a pale greenish gray mineral; a few larger irregular shaped cavities.

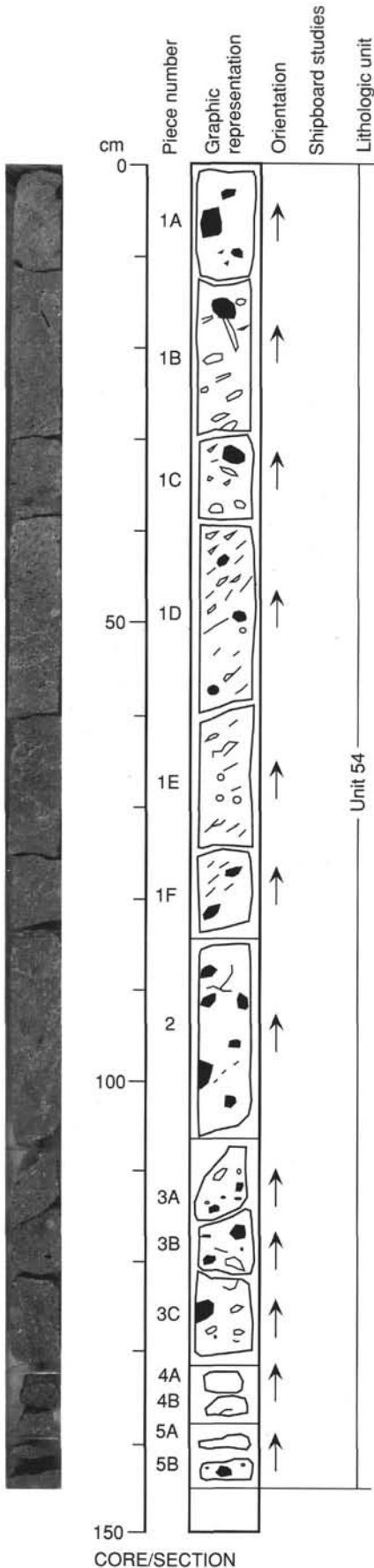
**COLOR:** Dark gray (10YR 4/1 and N 4/0).

**STRUCTURE:** The rock contains 10% lithic clasts 0.5-5 cm across. Clasts range from highly lobate with crenulated margins to subangular. Clast compositions include: gabbro, olivine-pyroxene-phyric basalt, plagioclase-phyric basalt, plagioclase-pyroxene-phyric basalt. There are also isolated megacrysts of olivine with spinel inclusions, and clots composed of plagioclase and pyroxene, which may be from disaggregated clasts.

**ALTERATION:** The glass is devitrified into spherulitic structures 2-3 mm in diameter with often a crystal or a tiny vesicle(?) filled with a green material at the core. Similar devitrification rinds about 0.5 mm thick occur on the margins of the larger vesicles. Spherules form 30% of the rock. The matrix between the spherules is slightly darker and browner in color and appears to be hydrated glass.

**VEINS/FRACTURES:** <1%; <1 mm; random distribution.

**ADDITIONAL COMMENTS:** The lithic clasts are shown in black on the drawing.

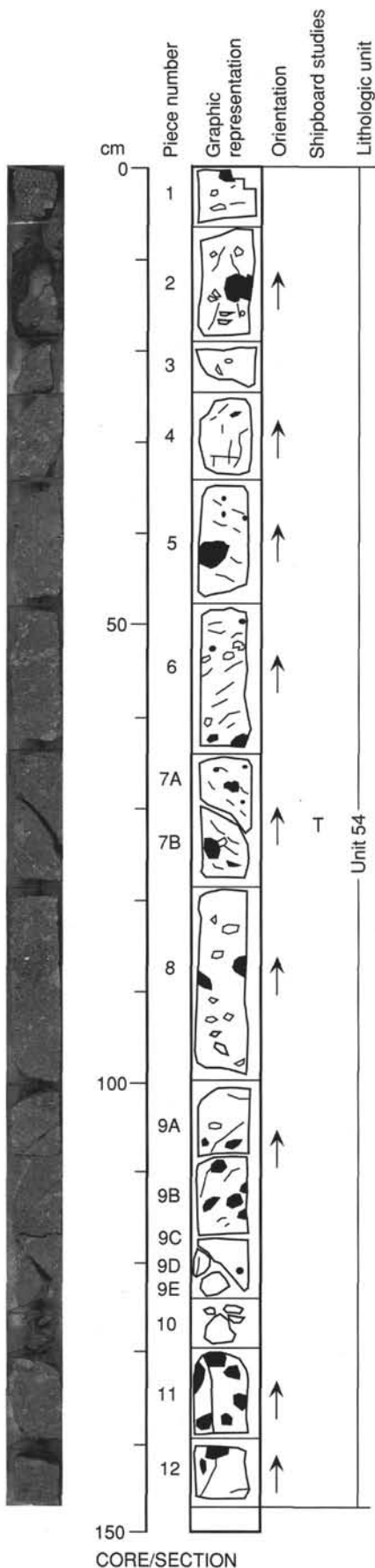


150  
CORE/SECTION

152-917A-47R-2

UNIT 54: PLAGIOCLASE-PYROXENE-PHYRIC DACITE

Pieces 1-12



**PHENOCRYSTS:** Plagioclase - 3%; up to 1 mm; euhedral, stubby to platy. Pyroxene - <1%; up to 0.5 mm; euhedral, prismatic.

**GROUNDMASS:** Devitrified glass.

**VESICLES:** 2%; <1-5 mm; subrounded to flattened; lined with a pale greenish gray mineral.

**COLOR:** Dark gray (10YR 4/1 and N 4/0).

**STRUCTURE:** The rock contains 10% lithic clasts 0.5-5 cm across. Clasts range from highly lobate with crenulated margins to subangular. Clast compositions include: gabbro, olivine-pyroxene-phyric basalt, plagioclase-phyric basalt, plagioclase-pyroxene-phyric basalt. There are also isolated megacrysts of olivine with spinel inclusions, and clots composed of plagioclase and pyroxene, which may be from disaggregated clasts.

**ALTERATION:** The glass is devitrified into spherulitic structures 2-3 mm in diameter with often a crystal or a tiny vesicle(?) filled with a green material at the core. Similar devitrification rinds about 0.5 mm thick occur on the margins of the larger vesicles. Spherules form 30% of the rock. The matrix between the spherules is slightly darker and browner in color and appears to be hydrated glass.

**ADDITIONAL COMMENTS:** The lithic clasts are shown in black in the drawing.

**UNIT 54: PLAGIOCLASE-PYROXENE-PHYRIC DACITE**

**Pieces 1A-9**

**PHENOCRYSTS:** Plagioclase - 3%; up to 1 mm; euhedral, stubby to platy. Pyroxene - <1%; up to 0.5 mm; euhedral, prismatic.

**GROUNDMASS:** Devitrified glass.

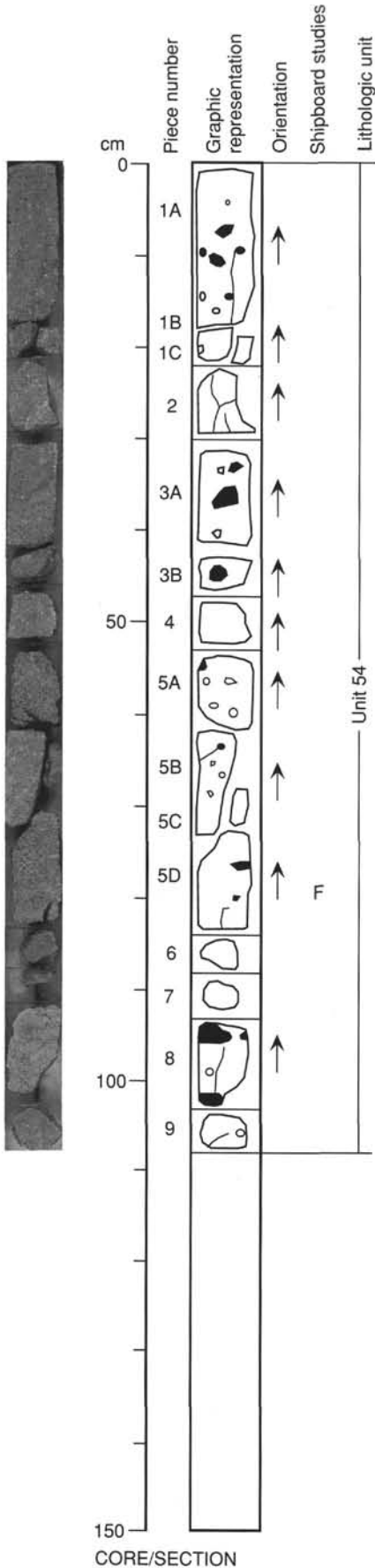
**VESICLES:** 1%; <1-2 mm; round; lined with a pale greenish gray mineral.

**COLOR:** Dark gray (N 4/0).

**STRUCTURE:** The rock contains 10% lithic clasts 0.5-5 cm across. Clasts range from highly lobate with crenulated margins to subangular. Clast compositions include: gabbro, olivine-pyroxene-phyric basalt, plagioclase-phyric basalt, plagioclase-pyroxene-phyric basalt. There are also isolated crystals of olivine with spinel inclusions, and clots composed of plagioclase and pyroxene, which may be from disaggregated clasts.

**ALTERATION:** The glass is devitrified into spherules 3-5 mm in diameter. The spherules often have a crystal or a tiny vesicle(?) filled with green material at the core. Spherules form up to 90% of the rock and meet in triple junctions.

**ADDITIONAL COMMENTS:** The lithic clasts are shown in black on the drawing.



152-917A-48R-1

**UNIT 54: PLAGIOCLASE-PYROXENE-PHYRIC DACITE**

**Piece 1**

**PHENOCRYSTS:** Plagioclase - 3%; up to 1 mm; euhedral, stubby to platy. Pyroxene - <1%; up to 0.5 mm; euhedral, prismatic.

**GROUNDMASS:** Devitrified glass.

**VESICLES:** None.

**COLOR:** Dark gray (N 4/0).

**STRUCTURE:** This piece contains an at least 5 by 2 cm clast of very olivine-plagioclase-phyric basalt.

**ALTERATION:** The glass is devitrified into spherules 3-5 mm in diameter. The spherules often have a crystal or a tiny vesicle(?) filled with green material at the core. Spherules form up to 90% of the rock and meet in triple junctions.

**UNIT 55: PLAGIOCLASE-PYROXENE-PHYRIC DACITE**

**Pieces 2-5**

**PHENOCRYSTS:** Sometimes in glomerocrysts. Plagioclase - 2%; up to 1 mm; euhedral, stubby to platy. Pyroxene - <1%; up to 0.5 mm; euhedral. Oxide - <0.5%; <0.5 mm; equant grains.

**GROUNDMASS:** Devitrified glass.

**VESICLES:** None.

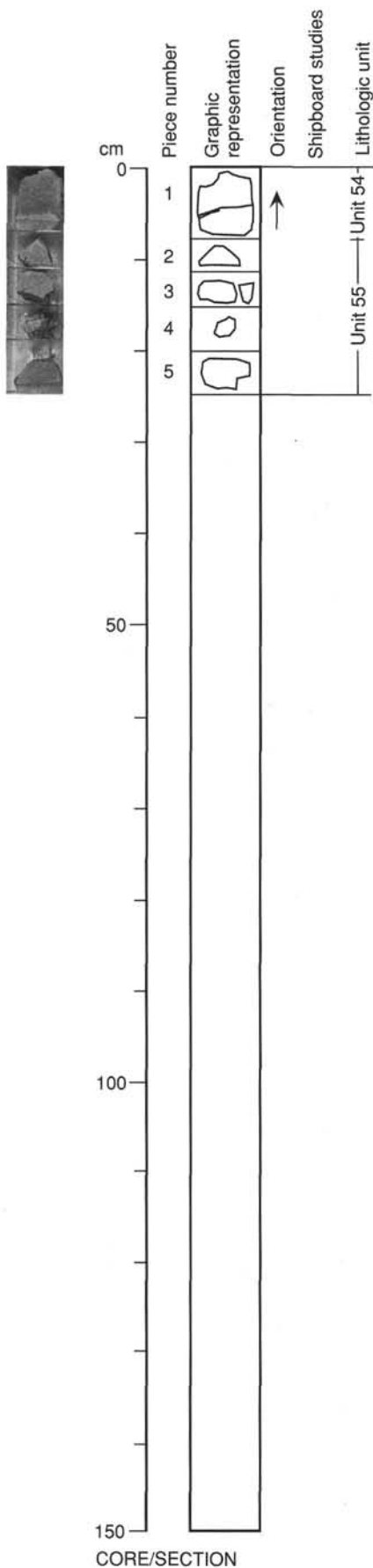
**COLOR:** Dark gray (N 4/0).

**STRUCTURE:** Massive.

**ALTERATION:** The groundmass shows close-lying devitrification spherules.

**VEINS/FRACTURES:** None.

**ADDITIONAL COMMENTS:** This unit appears in many ways very similar to Unit 54, but it is much more massive and has far fewer xenoliths.



152-917A-49R-1

**UNIT 55: PLAGIOCLASE-PYROXENE-PHYRIC DACITE**

**Pieces 1-7**

**PHENOCRYSTS:** Sometimes in glomerocrysts. Plagioclase - 1%; up to 1 mm; euhedral, stubby to platy.  
Pyroxene - <0.5%; up to 1 mm; euhedral.

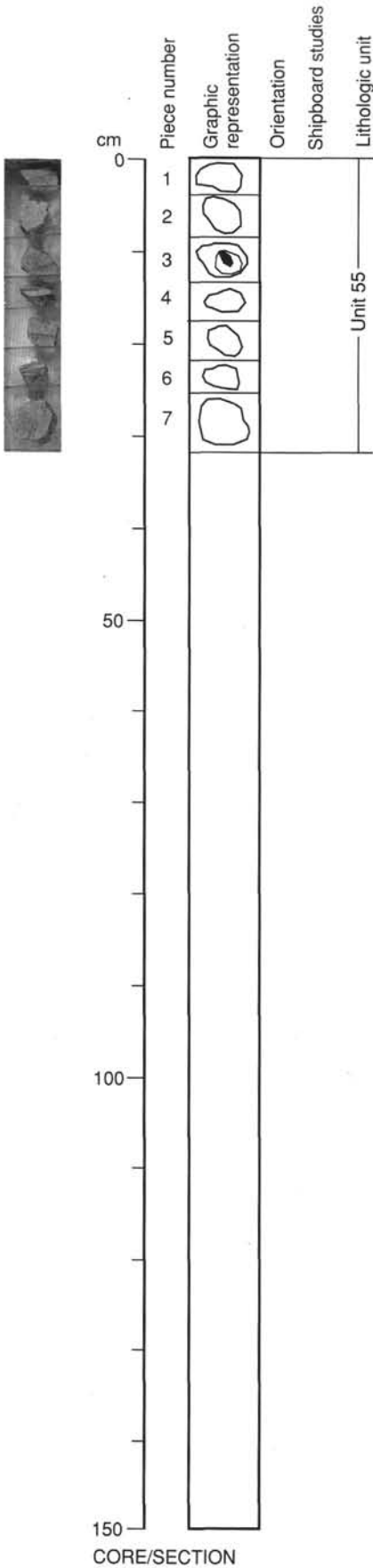
**GROUNDMASS:** Devitrified glass.

**VESICLES:** None.

**COLOR:** Dark gray (N 4/0).

**STRUCTURE:** Massive. Piece 3 has a 2-cm xenolith of slightly coarser grain and with many phenocrysts, up to 1 mm, of plagioclase and pyroxene, and possibly olivine. It has red-oxidized interior.

**ALTERATION:** The groundmass shows close-packed devitrification spherules.



152-917A-50R-1

UNIT 55: PLAGIOCLASE-PYROXENE-PHYRIC DACITE

Pieces 1-11

**PHENOCRYSTS:** Sometimes in glomerocrysts. Plagioclase - 1%; up to 1 mm; euhedral, stubby to platy.  
 Pyroxene - <0.5%; up to 1 mm; euhedral.

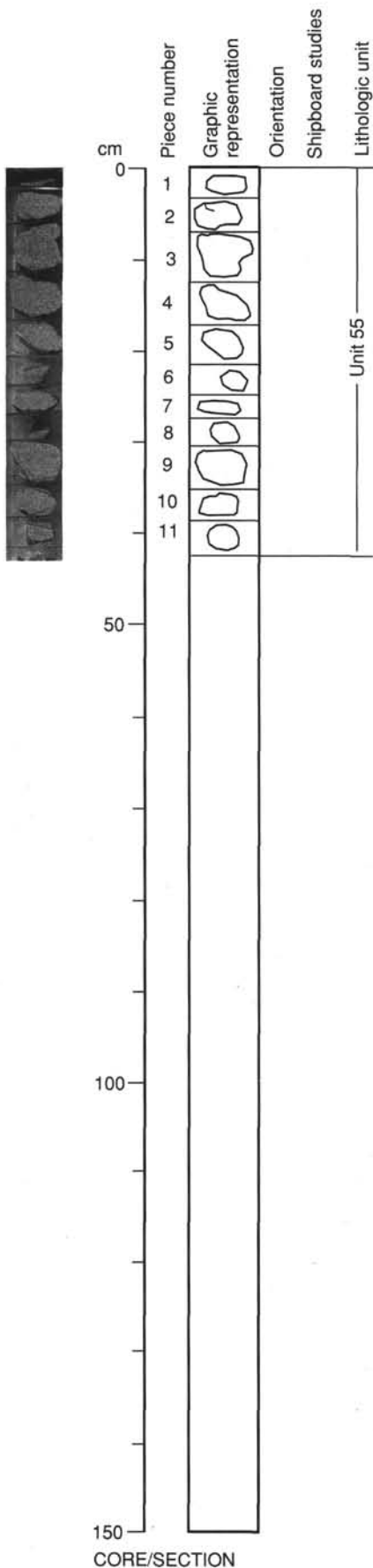
**GROUNDMASS:** Devitrified glass.

**VESICLES:** None.

**COLOR:** Dark gray (N 4/0).

**STRUCTURE:** Massive. Piece 2 has a 4-mm xenocryst(?) of altered olivine with euhedral chromite crystals.  
 Several pieces have up to 5-mm xenoliths with slightly coarser grain.

**ALTERATION:** The groundmass shows close-packed devitrification spherules.



152-917A-51R-1

UNIT 55: PLAGIOCLASE-PYROXENE-PHYRIC DACITE

Pieces 1-15

**PHENOCRYSTS:** Sometimes in glomerocrysts. Plagioclase - 3%; up to 1 mm; euhedral, stubby to platy. Pyroxene - 1%; up to 1 mm; euhedral.

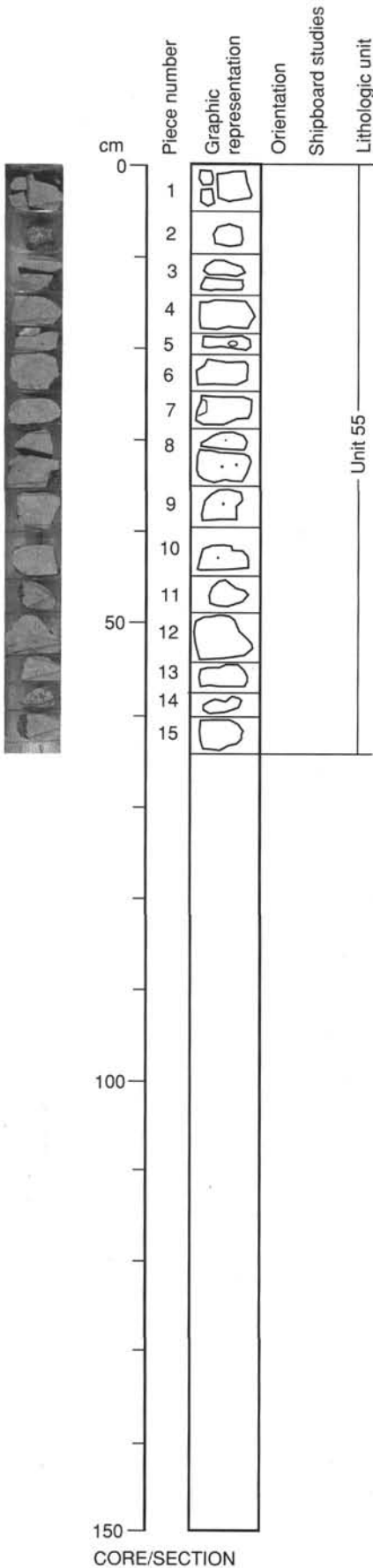
**GROUNDMASS:** Aphanitic.

**VESICLES:** None.

**COLOR:** Dark gray (N 4/0).

**STRUCTURE:** Massive with 5% lithic clasts that are 0.25-1.5 cm across. Clasts have very rounded margins and some are nearly invisible (absorbed into the groundmass?). Clast compositions include olivine-phyric and plagioclase-phyric basalts. In some pieces there are also olivine crystals up to 1.5 mm across that resemble the olivine in the clasts (derived from disaggregated clasts?).

**ALTERATION:** The groundmass may be completely devitrified glass.





152-917A-52R-1

UNIT 55: PLAGIOCLASE-PYROXENE-PHYRIC DACITE

Pieces 1-12

**PHENOCRYSTS:** Pyroxene often occurs as glomerocrysts with plagioclase; 1-3 mm crystals altered to green and brown clay may be xenocrysts. Plagioclase - 1%-2%; 0.5-1.5 mm; subhedral to euhedral; stubby to platy. Pyroxene - 1%; 0.5-2 mm; skeletal to subhedral.

**GROUNDMASS:** Aphanitic.

**VESICLES:** None.

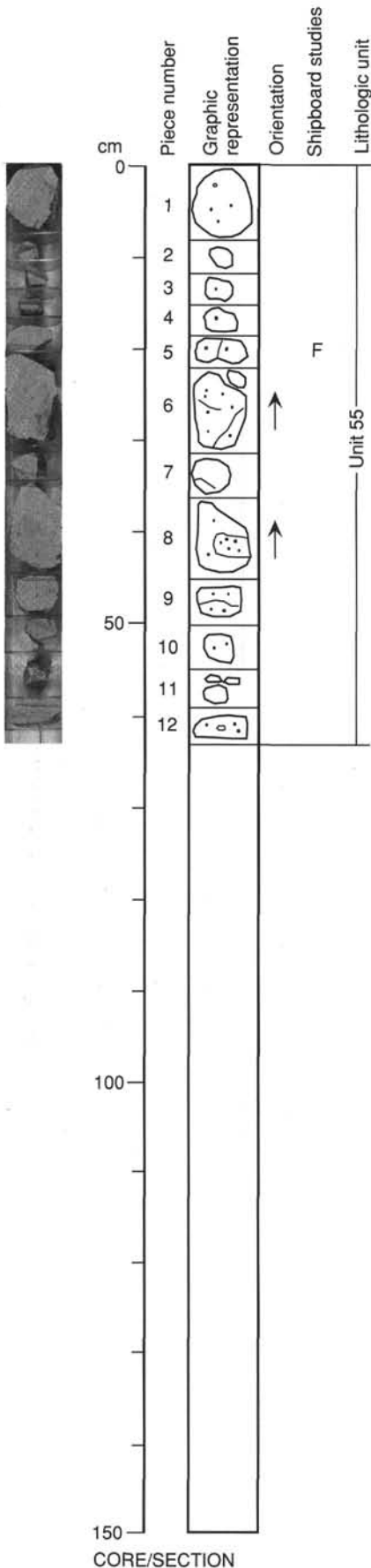
**COLOR:** Light medium gray (N 6/0).

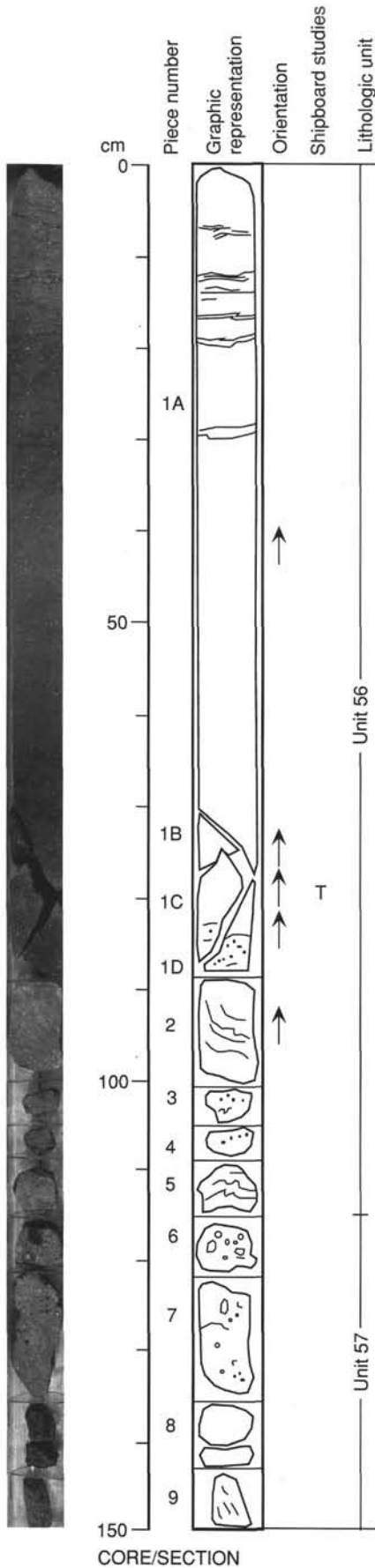
**STRUCTURE:** Massive with some clasts of basaltic material; crenulated margins of the clasts suggest possible magma mixing.

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** <1%; <1 mm; random distribution; small fractures in Pieces 5-9; some are slightly oxidized.

**ADDITIONAL COMMENTS:** 5-mm basaltic fragment in Piece 1; 3-cm rectangular fragment of olivine-plagioclase-pyroxene-phyric basalt in Piece 8; olivine altered to green and brown clay.





**UNIT 56: ASH-FLOW TUFF**

**Pieces 1A–5**

**PHENOCRYSTS:** Feldspar - 2%; 0.2–2 mm; euhedral.

**GROUNDMASS:** Aphanitic.

**VESICLES:** 0–5%; 0.5–1 mm; spherical; confined to Pieces 2–5; empty.

**COLOR:** Dark reddish brown (10R 3/4) with streaks of very dusky red (10R 2/2).

**STRUCTURE:** Good eutaxitic texture between 5 and 20 cm and in Pieces 2 and 5.

**ALTERATION:** Highly oxidized.

**ADDITIONAL COMMENTS:** Partially welded ash-flow unit.

**UNIT 57: PLAGIOCLASE-PHYRIC DACITE**

**Pieces 6–9**

**PHENOCRYSTS:** Plagioclase - 1%; 0.5–2 mm; euhedral.

**GROUNDMASS:** Aphanitic.

**VESICLES:** 20%; 0.5–5 mm; spherical to flattened; patchy distribution; mostly empty, though some are lined with small zeolite crystals.

**COLOR:** Dusky yellowish brown.

**ALTERATION:** Oxidized around vesicles.

152-917A-53R-2

**UNIT 57: PLAGIOCLASE-PHYRIC DACITE**

**Pieces 1-27**

**PHENOCRYSTS:** Plagioclase - 1%; 0.5-2 mm; euhedral.

**GROUNDMASS:** Aphanitic.

**VESICLES:** <1%-10%; 0.5-20 mm; mostly flattened; lined with pale blue green mineral.

**COLOR:** Dark gray.

**ALTERATION:** Moderate.

**UNIT 58: PLAGIOCLASE-OLIVINE-PHYRIC BASALT**

**Pieces 28-29**

**PHENOCRYSTS:** Separate crystals and glomerophyric clusters.

Plagioclase - 3%; 1-8 mm; euhedral; tabular.

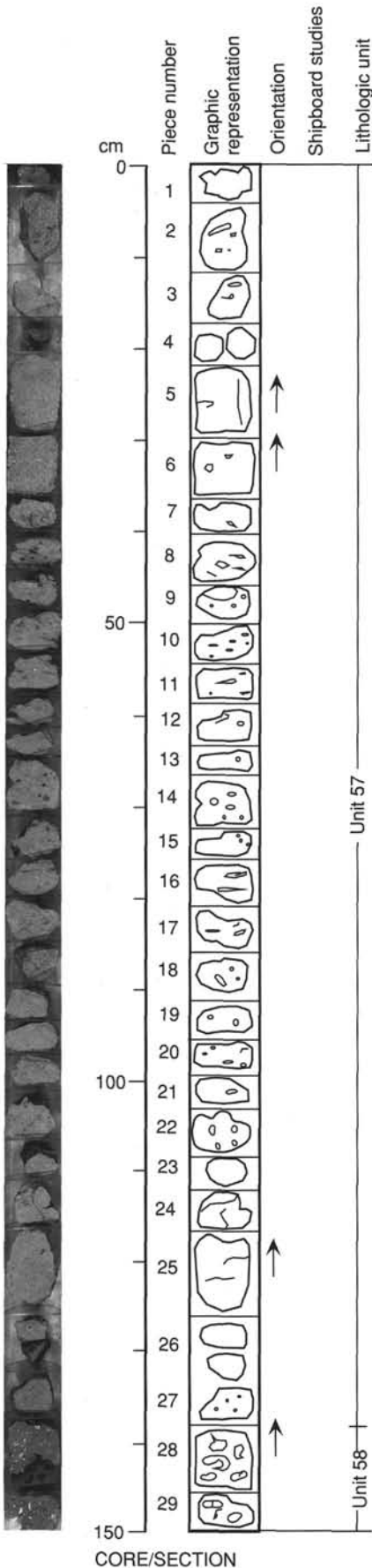
Olivine - 2%; 1-5 mm; euhedral; equant to elongate.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 15%; 0.5-10 mm; spherical to irregular; random distribution; lined with two types of zeolite; colorless monoclinic crystals and cream globular crystals; one vesicle is filled with a pale blue green amorphous mineral.

**COLOR:** Dark brownish gray (5YR 3/1).

**ALTERATION:** Moderate; olivine completely altered to green mineral; groundmass oxidized.



CORE/SECTION

152-917A-53R-3

**UNIT 58: PLAGIOCLASE-OLIVINE-PHYRIC BASALT**

**Pieces 1-4**

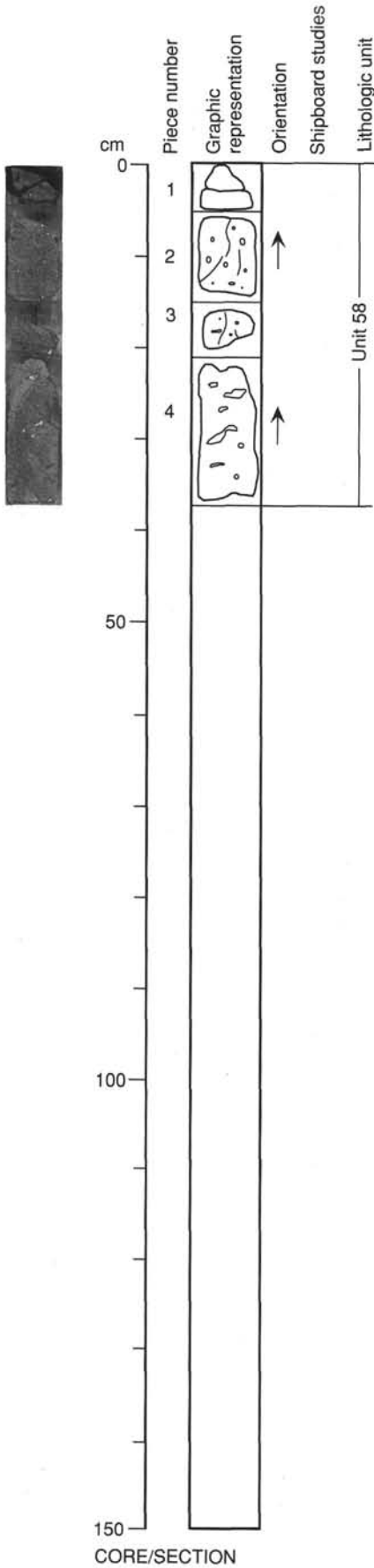
**PHENOCRYSTS:** Separate crystals and glomerophyric clusters. Plagioclase - 3%; 1-8 mm; euhedral; tabular. Olivine - 2%; 1-5 mm; euhedral; equant to elongate.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 10%; 1-10 mm; spherical to irregular; random distribution; filled with zeolite and green mineral.

**COLOR:** Dark brownish gray (5YR 3/1).

**ALTERATION:** Moderate; olivine completely altered to green mineral; groundmass oxidized.



152-917A-54R-1

**UNIT 58: PLAGIOCLASE-OLIVINE-PHYRIC BASALT**

**Pieces 1A–1F**

**PHENOCRYSTS:** Plagioclase - 5%; 1–8 mm; euhedral; tabular. Olivine - 2%; 0.5–5 mm; euhedral; equant to elongate.

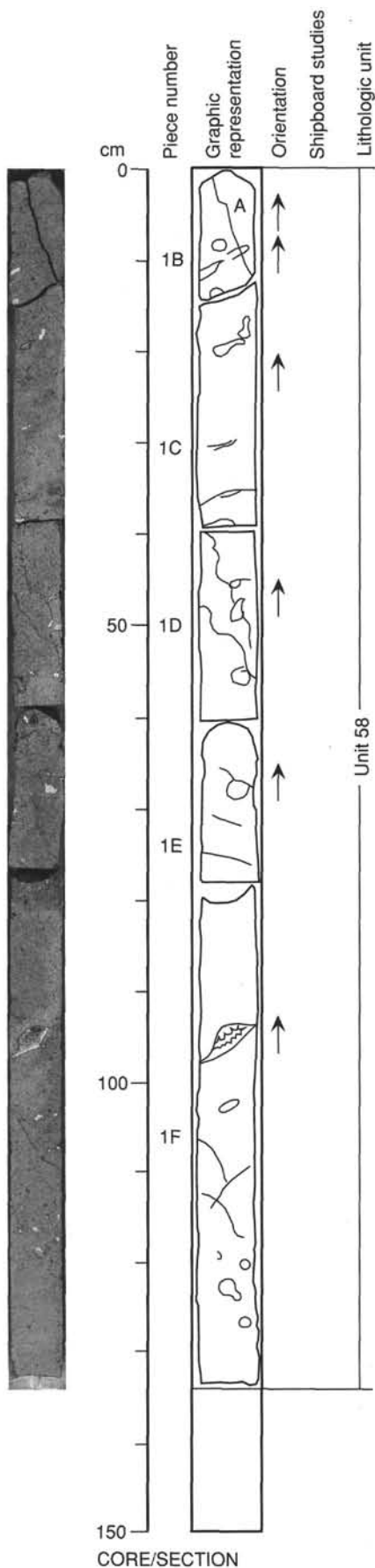
**GROUNDMASS:** Fine-grained.

**VESICLES:** 3%; 1–30 mm; spherical to irregular; random distribution; filled with zeolite and green mineral; large cavity lined with zeolite at 95 cm.

**COLOR:** Dark gray (N 3/0).

**ALTERATION:** Moderate; olivine completely altered to green mineral; groundmass oxidized.

**VEINS/FRACTURES:** <1%; 0.1–1 mm; inclined; filled with green mineral.



CORE/SECTION

**UNIT 58: PLAGIOCLASE-OLIVINE-PHYRIC BASALT**

**Pieces 1A-1B**

**PHENOCRYSTS:** Plagioclase - 5%; 1-8 mm; euhedral; tabular. Olivine - 2%; 0.5-5 mm; euhedral; equant to elongate.

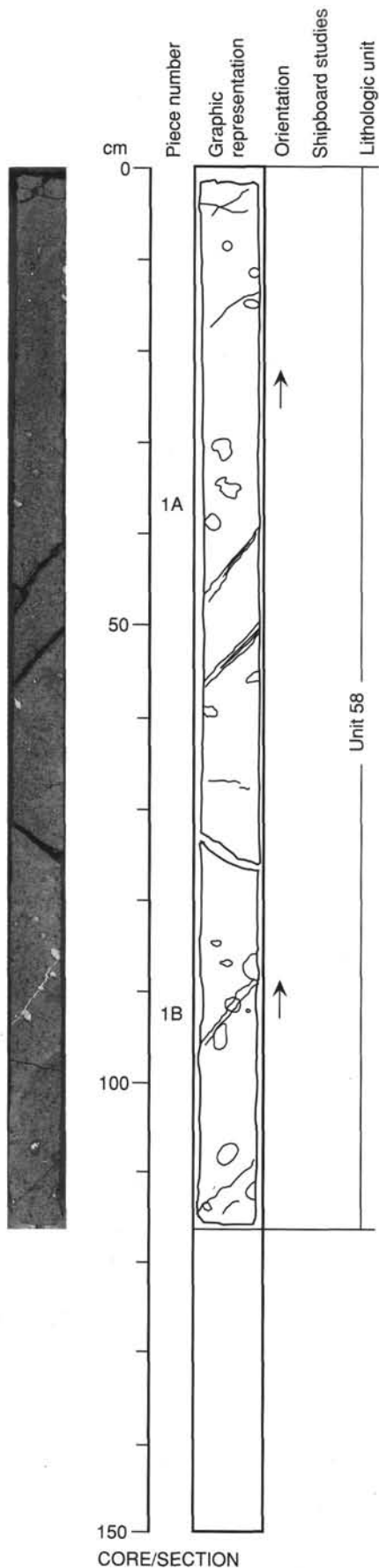
**GROUNDMASS:** Fine-grained.

**VESICLES:** 2%; 1-15 mm; spherical to irregular; random distribution; filled with zeolite and green mineral.

**COLOR:** Dark gray (N 3/0).

**ALTERATION:** Moderate; olivine completely altered to green mineral; groundmass oxidized.

**VEINS/FRACTURES:** <1%; 0.2-3 mm; inclined; filled with green mineral.



152-917A-54R-3

UNIT 58: PLAGIOCLASE-OLIVINE-PHYRIC BASALT

Pieces 1A-1F

**PHENOCRYSTS:** Plagioclase - 5%; 1-8 mm; euhedral; tabular. Olivine - 2%; 0.5-5 mm; euhedral; equant to elongate.

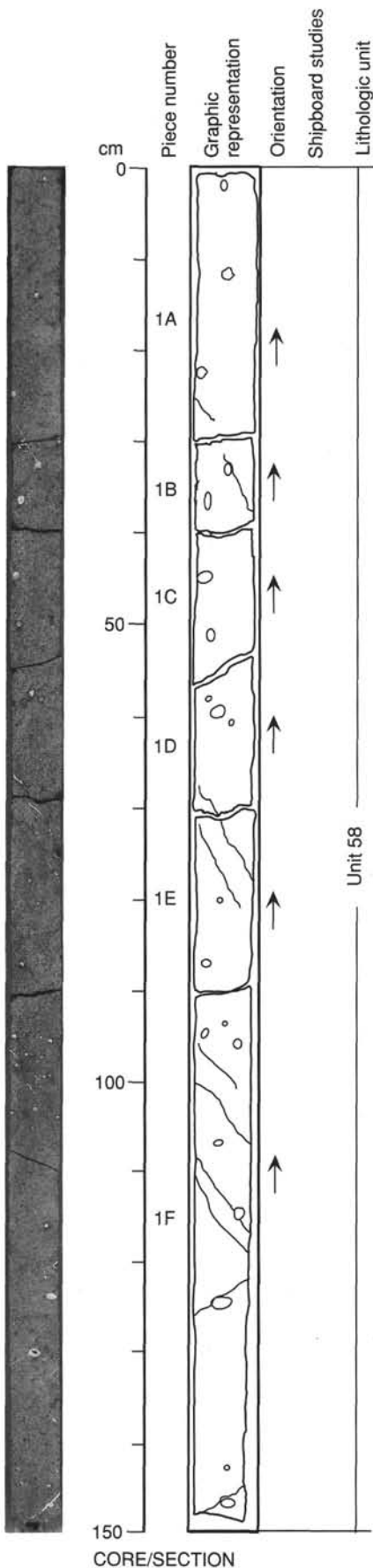
**GROUNDMASS:** Fine-grained.

**VESICLES:** 2%; 1-10 mm; spherical; random distribution; filled with zeolite and green mineral.

**COLOR:** Dark gray (N 3/0).

**ALTERATION:** Moderate; olivine completely altered to green mineral; groundmass oxidized.

**VEINS/FRACTURES:** <1%; 0.2-3 mm; inclined; filled with green mineral.



**UNIT 58: PLAGIOCLASE-OLIVINE-PHYRIC BASALT**

**Pieces 1A-1E**

**PHENOCRYSTS:** Plagioclase - 5%; 1-8 mm; euhedral; tabular. Olivine - 2%; 0.5-5 mm; euhedral; equant to elongate.

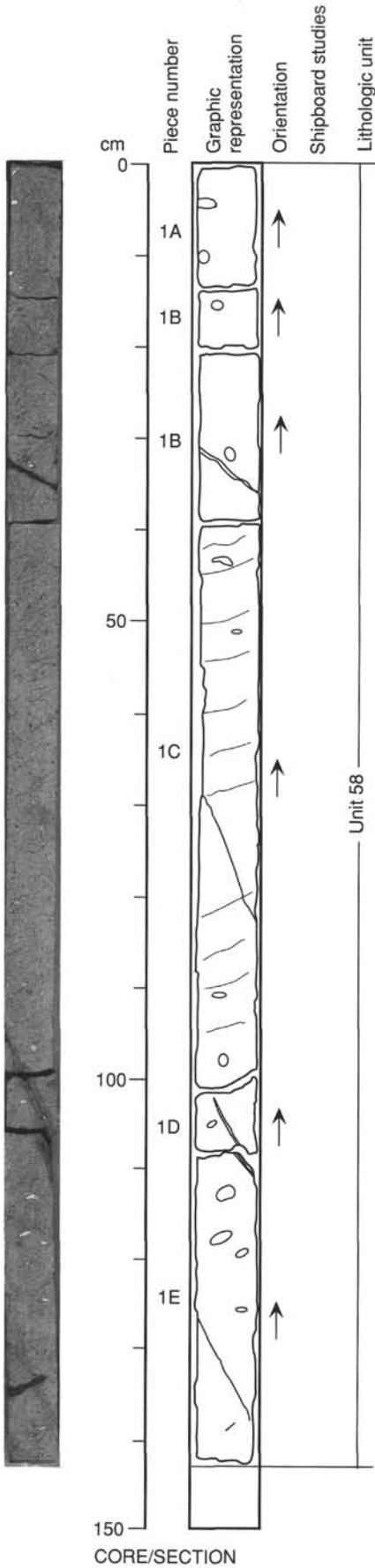
**GROUNDMASS:** Fine-grained.

**VESICLES:** 1%; 1-10 mm; spherical to flattened; random distribution; filled with zeolite and green mineral.

**COLOR:** Dark gray (N 3/0).

**ALTERATION:** Moderate; olivine completely altered to green mineral; groundmass oxidized.

**VEINS/FRACTURES:** <1%; 0.2-1 mm; inclined; filled with green mineral.





152-917A-54R-5

**UNIT 58: PLAGIOCLASE-OLIVINE-PHYRIC BASALT**

**Pieces 1A-1G**

**PHENOCRYSTS:** Plagioclase - 5%; 1-8 mm; euhedral; tabular. Olivine - 2%; 0.5-5 mm; euhedral; equant to elongate.

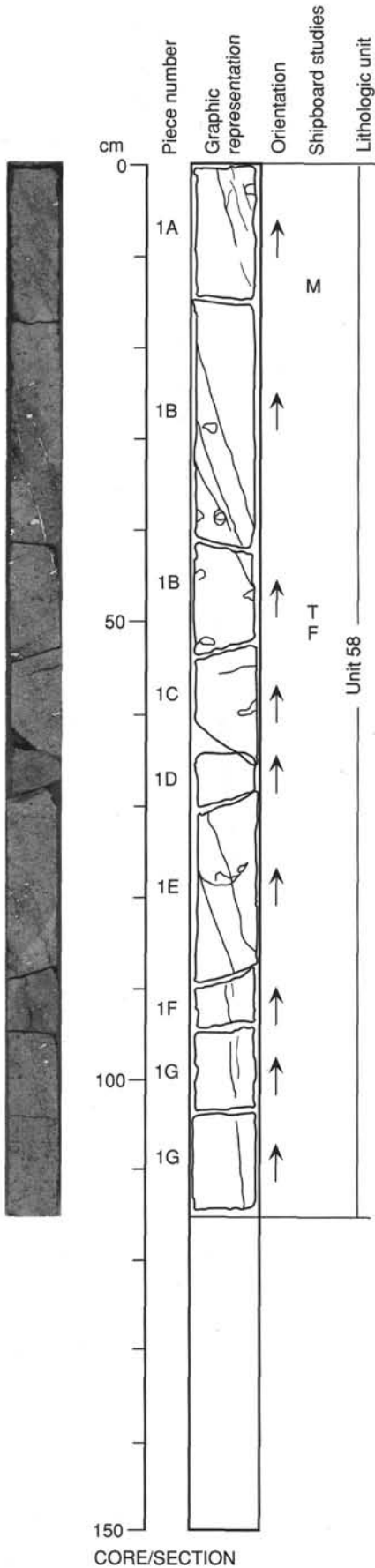
**GROUNDMASS:** Fine-grained.

**VESICLES:** 2%; 1-10 mm; flattened; random distribution; filled with zeolite and green mineral.

**COLOR:** Dark gray (N 3/0).

**ALTERATION:** Moderate; olivine completely altered to green mineral; groundmass oxidized.

**VEINS/FRACTURES:** <1%; 0.2-4 mm; steeply inclined; filled with green mineral.



CORE/SECTION

152-917A-54R-6

**UNIT 58: PLAGIOCLASE-OLIVINE-PHYRIC BASALT**

**Pieces 1A-2**

**PHENOCRYSTS:** Plagioclase - 5%; 1-8 mm; euhedral; tabular. Olivine - 2%; 0.5-5 mm; euhedral; equant to elongate.

**GROUNDMASS:** Fine-grained.

**VESICLES:** <1%; 1-5 mm; irregular; random distribution; filled with zeolite and green mineral.

**COLOR:** Dark gray (N 3/0).

**ALTERATION:** Moderate; olivine completely altered to green mineral; groundmass oxidized.

**VEINS/FRACTURES:** <1%; 0.2-4 mm; steeply inclined; filled with green mineral.

**UNIT 59: PLAGIOCLASE-OLIVINE-PHYRIC BASALT**

**Piece 3A-3D**

**CONTACTS:** None, but Piece 3A is very close to top of the unit.

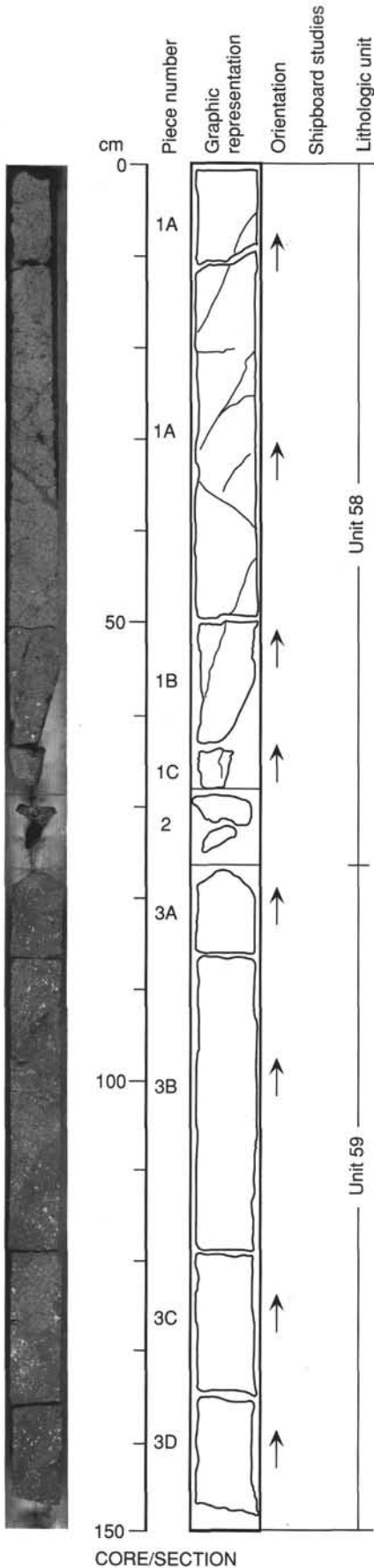
**PHENOCRYSTS:** Plagioclase - 3%; 0.5-5 mm; euhedral; tabular. Olivine - 1%; 0.5-2 mm; euhedral; equant to elongate.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 2%; 0.5-2 mm; spherical to irregular; patchy distribution; white linings; some filled with zeolite.

**COLOR:** Pale brown (5YR 5/2).

**ALTERATION:** Strong; oxidized.



CORE/SECTION

152-917A-54R-7

**UNIT 59: PLAGIOCLASE-OLIVINE-PHYRIC BASALT**

**Pieces 1-2A**

**CONTACTS:** Base of unit seen at 16 cm.

**PHENOCRYSTS:** Plagioclase - 3%; 0.5-5 mm; euhedral; tabular. Olivine - <1%; 0.5-2 mm; euhedral; equant to elongate.

**GROUNDMASS:** Fine-grained.

**VESICLES:** <1%; 0.5-2 mm; irregular; concentrated at base of unit; empty.

**COLOR:** Pale brown (5YR 5/2).

**ALTERATION:** Strong; oxidized.

**UNIT 60: OLIVINE-PLAGIOCLASE-PYROXENE-PHYRIC BASALT**

**Pieces 2A-7D**

**CONTACTS:** Top of unit seen in Piece 2A.

**PHENOCRYSTS:** Olivine - 3%; 0.5-2 mm; euhedral to anhedral. Plagioclase - 1%; 0.5-1 mm; tabular. Pyroxene - <1%; 0.5-2 mm; euhedral.

**GROUNDMASS:** Fine-grained.

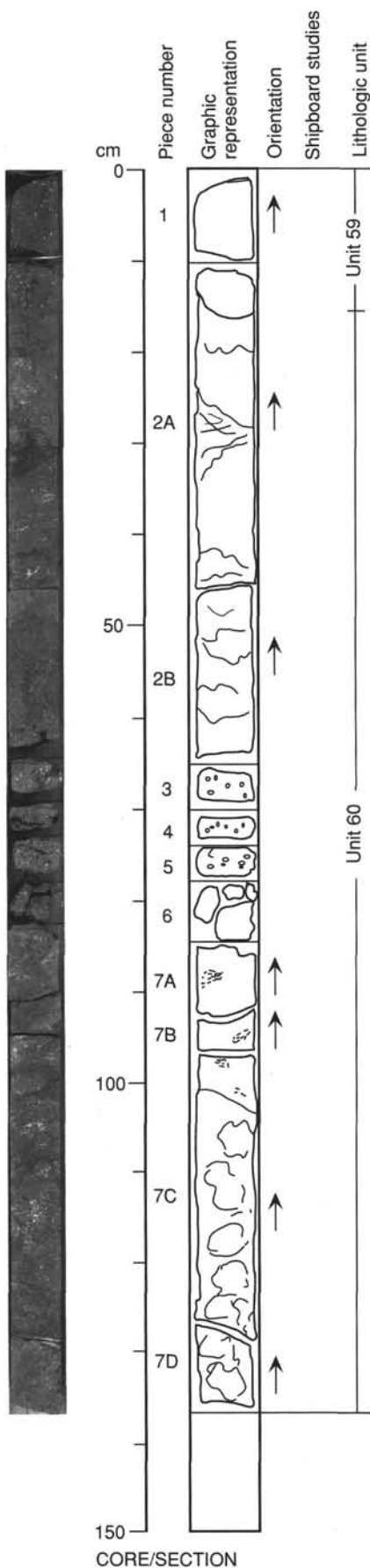
**VESICLES:** 0-10%; 0.5-5 mm; spherical to irregular; patchy distribution; empty or with white linings.

**COLOR:** Brownish gray (5YR 4/1).

**STRUCTURE:** Flow-brecciated.

**ALTERATION:** Strong; oxidized flow top.

**VEINS/FRACTURES:** None.



152-917A-54R-8

**UNIT 60: OLIVINE-PLAGIOCLASE-PYROXENE-PHYRIC BASALT**

**Pieces 1-3B**

**PHENOCRYSTS:** Olivine - 2%-5%; 0.5-5 mm; euhedral, equant to elongate skeletal. Plagioclase - 2%; 0.5-1 mm; tabular. Pyroxene - <1%; 0.5-2 mm; euhedral.

**GROUNDMASS:** Aphanitic.

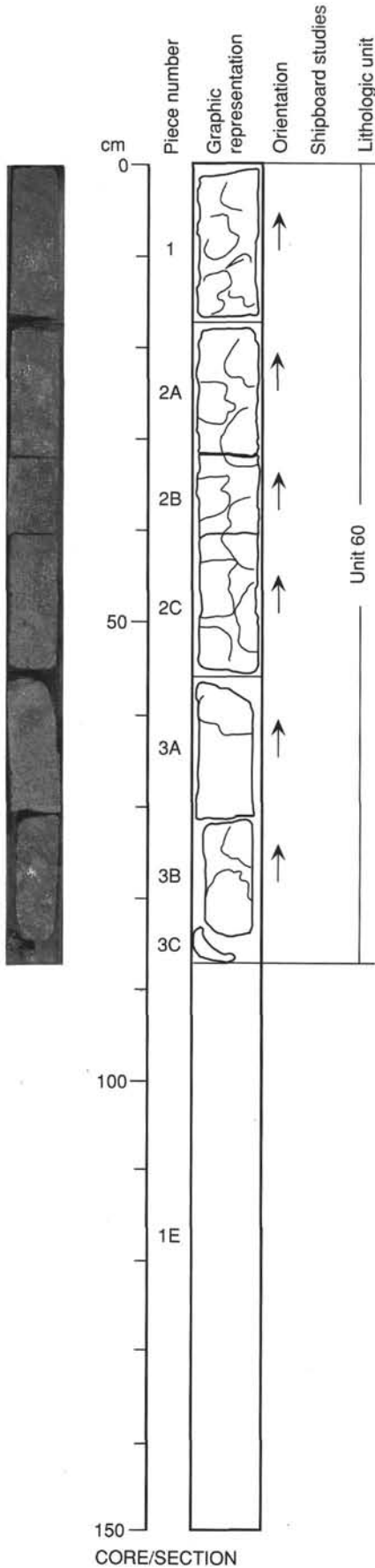
**VESICLES:** 0-10%; 0.5-2 mm; irregular; patchy distribution; filled with zeolite.

**COLOR:** Medium dark gray (N 4/0).

**STRUCTURE:** Flow-brecciated in Pieces 1, 2A, and 3B.

**ALTERATION:** Moderate; olivine altered.

**VEINS/FRACTURES:** <<1%; 0.2-0.5 mm; subvertical; zeolite-filled.

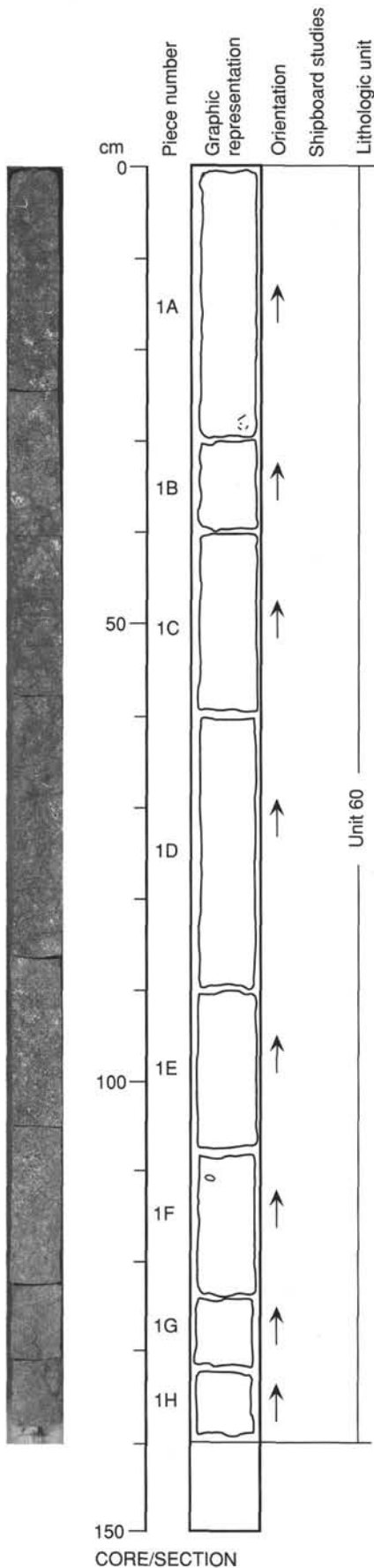


152-917A-55R-1

**UNIT 60: OLIVINE-PLAGIOCLASE-PYROXENE-PHYRIC BASALT**

**Pieces 1A-1H**

**PHENOCRYSTS:** Occasional clusters of phenocryst phases. Olivine - 5%; 0.5-5 mm; euhedral, equant to elongate skeletal. Plagioclase - 2%; 0.5-1 mm; lath-shaped. Pyroxene - <1%; 0.5-2 mm; euhedral.  
**GROUNDMASS:** Aphanitic.  
**VESICLES:** 2%; 1-5 mm; irregular; random distribution; filled with zeolite.  
**COLOR:** Medium dark gray (N 4/0).  
**ALTERATION:** Moderate; olivine altered, zeolite in groundmass.  
**VEINS/FRACTURES:** None.



**UNIT 60: OLIVINE-PLAGIOCLASE-PYROXENE-PHYRIC BASALT**

**Pieces 1A-2**

**PHENOCRYSTS:** Occasional clusters of phenocryst phases. Olivine - 5%; 0.5-5 mm; euhedral, equant to elongate. Plagioclase - 2%; 0.5-1 mm; lath-shaped. Pyroxene - <1%; 0.5-2 mm; euhedral.

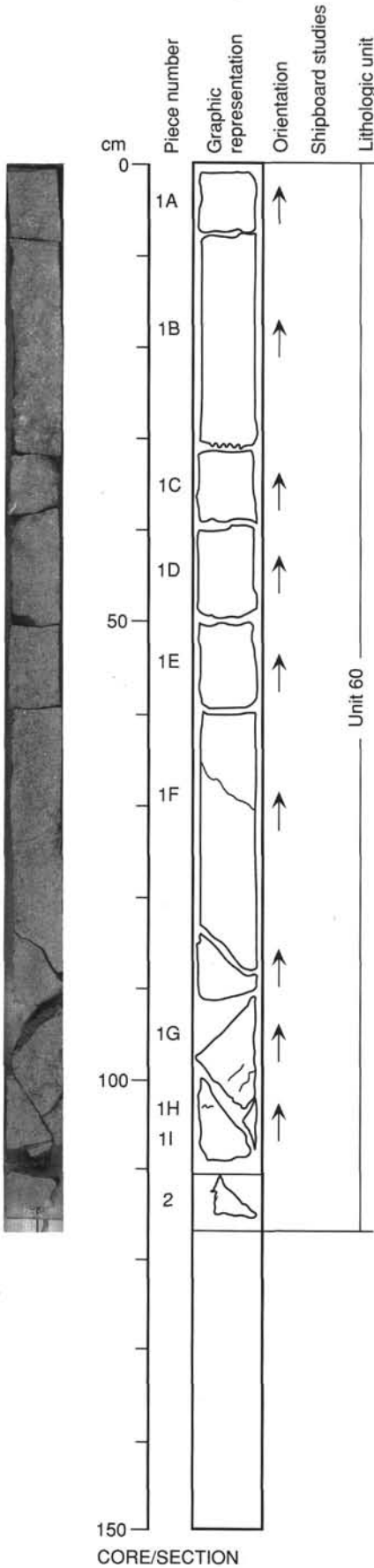
**GROUNDMASS:** Aphanitic.

**VESICLES:** <1%; 0.5-2 mm; irregular; concentrated at top of section; filled with zeolite.

**COLOR:** Medium dark gray (N 4/0).

**ALTERATION:** Moderate; olivine altered, zeolite in groundmass.

**VEINS/FRACTURES:** None.



152-917A-55R-3

UNIT 60: OLIVINE-PLAGIOCLASE-PYROXENE-PHYRIC BASALT

Pieces 1A-1L

**PHENOCRYSTS:** Occasional clusters of phenocryst phases. Olivine - 5%; 0.5-5 mm; euhedral, equant to elongated. Plagioclase - 2%; 0.5-1 mm; lath-shaped. Pyroxene - <1%; 0.5-2 mm; euhedral.

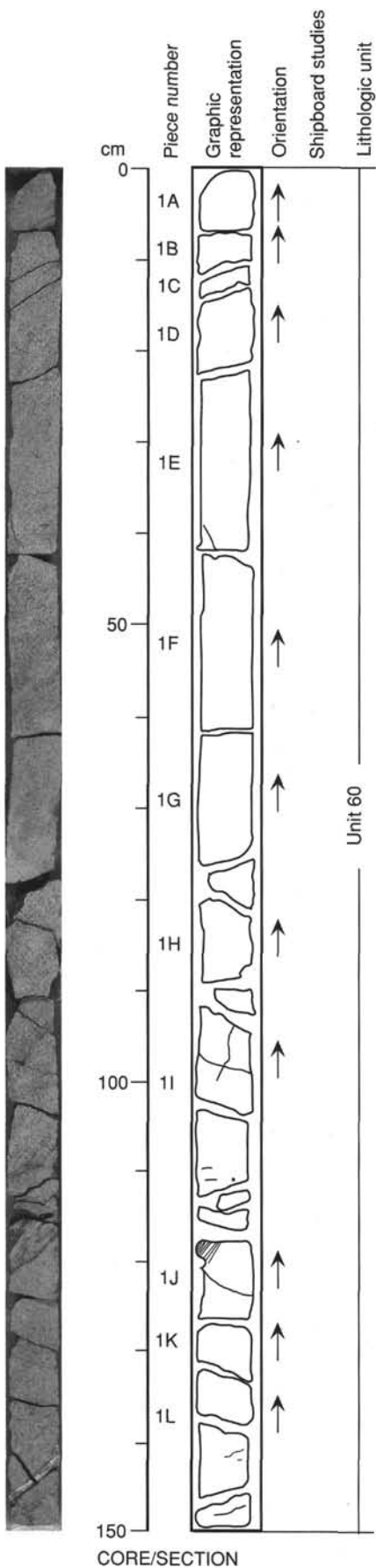
**GROUNDMASS:** Aphanitic.

**VESICLES:** <<1%; 0.5-2 mm; irregular; only in Piece 1F.

**COLOR:** Medium dark gray (N 4/0).

**ALTERATION:** Slight to moderate; some fresh olivine.

**VEINS/FRACTURES:** <1%; 0.2-2 mm; inclined (45 degrees); filled with zeolite and green mineral; confined to bottom 50 cm of section.

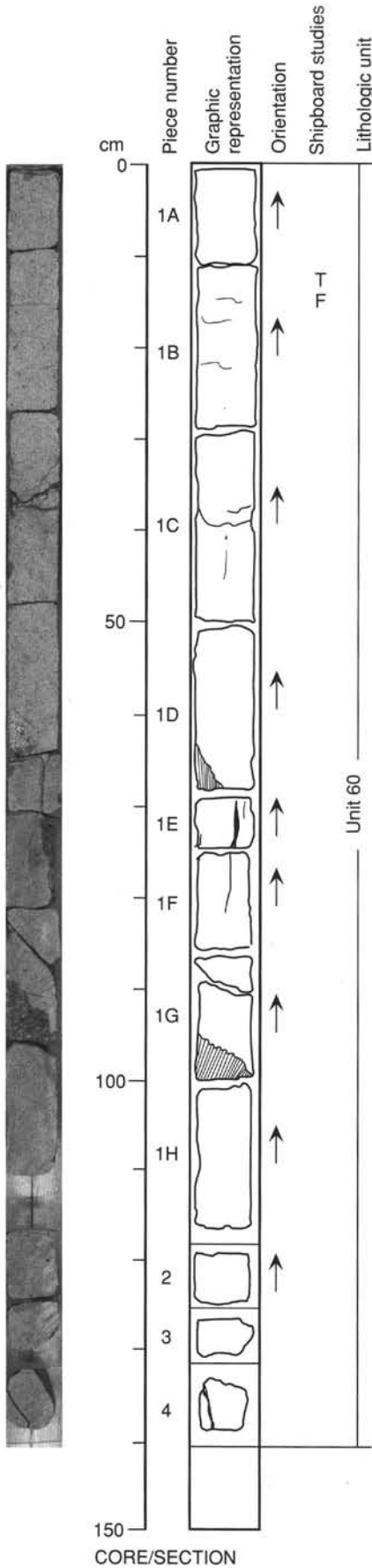


CORE/SECTION

**UNIT 60: OLIVINE-PLAGIOCLASE-PYROXENE-PHYRIC BASALT**

**Pieces 1A-4**

**PHENOCRYSTS:** Occasional clusters of phenocryst phases. Olivine - 5%; 0.5-5 mm; euhedral, equant to elongate. Plagioclase - 2%; 0.5-1 mm; lath-shaped. Pyroxene - <1%; 0.5-2 mm; euhedral.  
**GROUNDMASS:** Aphanitic.  
**VESICLES:** <1%; 1-5 mm; irregular; random distribution; zeolite-filled.  
**COLOR:** Medium dark gray (N 4/0).  
**ALTERATION:** Slight to moderate; some fresh olivine.  
**VEINS/FRACTURES:** <1%; 0.2-5 mm; horizontal to inclined; filled with zeolite and green mineral.





152-917A-55R-5

UNIT 60: OLIVINE-PLAGIOCLASE-PYROXENE-PHYRIC BASALT

Pieces 1-9F

**PHENOCRYSTS:** Occasional clusters of phenocryst phases. Olivine - 5%; 0.5-5 mm; euhedral, equant to elongate. Plagioclase - 2%; 0.5-1 mm; lath-shaped. Pyroxene - <1%; 0.5-2 mm; euhedral.

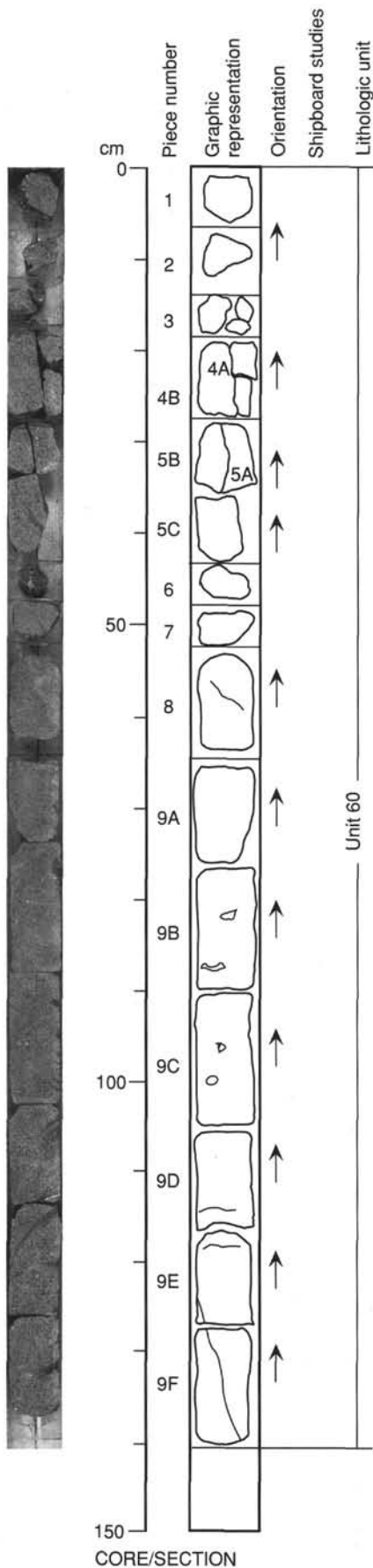
**GROUNDMASS:** Aphanitic.

**VESICLES:** <1%; 1-8 mm; irregular; random distribution; zeolite-filled.

**COLOR:** Medium dark gray (N 4/0).

**ALTERATION:** Moderate; olivine altered.

**VEINS/FRACTURES:** <<1%; 0.2-2 mm; horizontal to inclined; filled with zeolite and green mineral.



152-917A-55R-6

**UNIT 60: OLIVINE-PLAGIOCLASE-PYROXENE-PHYRIC BASALT**

**Pieces 1A-1B**

**PHENOCRYSTS:** Occasional clusters of phenocryst phases. Olivine - 5%; 0.5-5 mm; euhedral, equant to elongate. Plagioclase - 2%; 0.5-1 mm; lath-shaped. Pyroxene - <1%; 0.5-2 mm; euhedral.

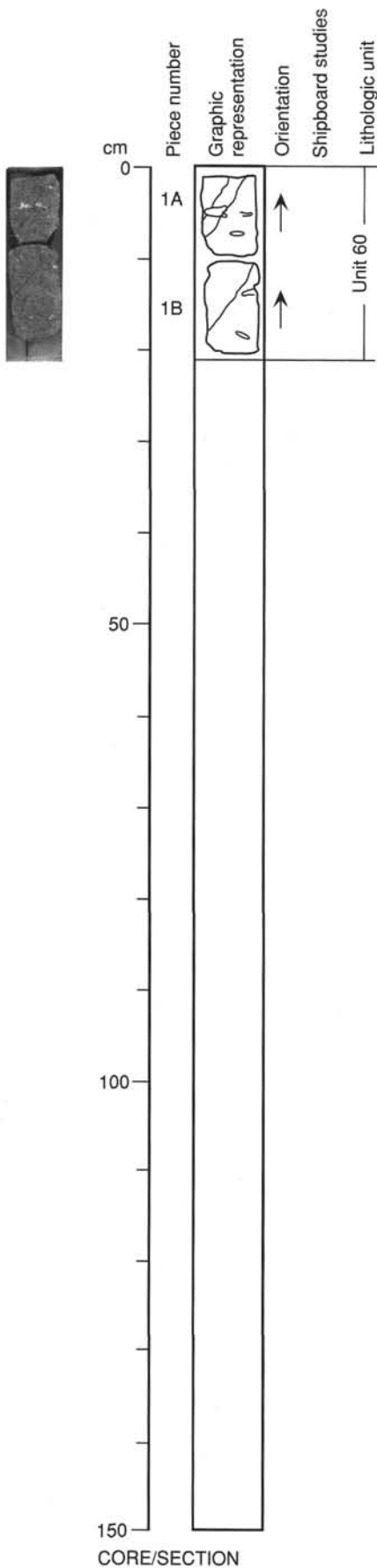
**GROUNDMASS:** Aphanitic.

**VESICLES:** 2%; 1-10 mm; irregular; random distribution; zeolite-filled.

**COLOR:** Medium dark gray (N 4/0).

**ALTERATION:** Moderate; olivine altered.

**VEINS/FRACTURES:** <1%; 0.2-0.5 mm; inclined; filled with zeolite and green mineral.



152-917A-56R-1

UNIT 60: OLIVINE-PLAGIOCLASE-PYROXENE-PHYRIC BASALT

Pieces 1-3D

**PHENOCRYSTS:** Olivine - 5%; up to 4 mm; euhedral, platy and equant. Plagioclase - 2%; up to 1 mm; lath-shaped. Pyroxene - <1%; up to 2 mm; euhedral.

**GROUNDMASS:** Fine-grained.

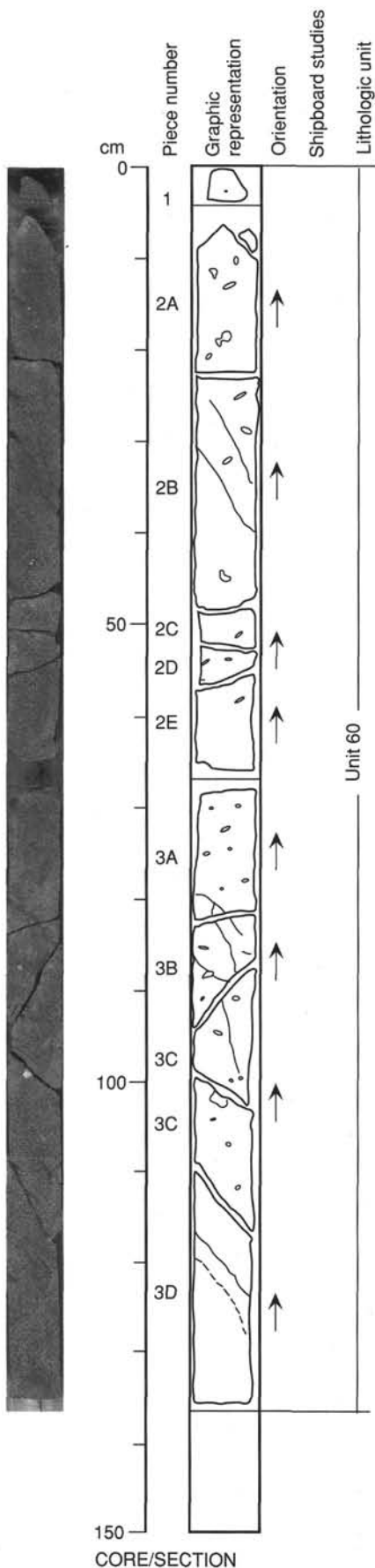
**VESICLES:** 1%-5%; 1-6 mm; round to irregular; random distribution; filled with white, green, and brown material, which is sometimes finely banded (chalcedony?).

**COLOR:** Dark gray (N 4/0).

**STRUCTURE:** Massive.

**ALTERATION:** Moderate; olivine mostly altered to dark green mineral; higher degree of alteration and oxidation in a 3-cm-wide zone on either side of fractures.

**VEINS/FRACTURES:** 1 mm; filled with a pale blue-green mineral; surfaces have slickensides; most common in Pieces 3A-3D.



**UNIT 60: OLIVINE-PLAGIOCLASE-PYROXENE-PHYRIC BASALT**

**Pieces 1A-1I**

**PHENOCRYSTS:** Olivine - 5%; up to 3 mm; euhedral, platy and equant. Plagioclase - 3%; up to 2 mm; lath-shaped. Pyroxene - 2%; up to 5 mm; euhedral.

**GROUNDMASS:** Fine-grained.

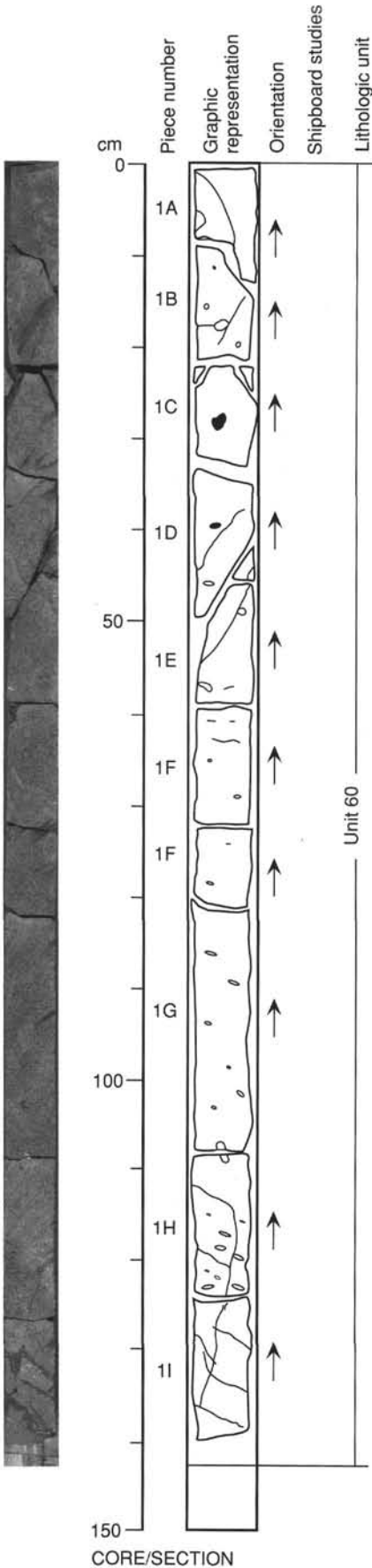
**VESICLES:** 1%-5%; 1-3 mm; round to irregular; random distribution; filled with green material.

**COLOR:** Dark gray (N 4/0) except for Piece 1I, which is dark reddish brown (10Y 4/1).

**STRUCTURE:** Massive; a few rounded chunks of gabbro(?) 2-7 mm across are entrained (for example, at 31 and 42 cm).

**ALTERATION:** Moderate; olivine mostly altered to dark green mineral; higher degree of alteration and oxidation in a 3-cm-wide zone on either side of fractures.

**VEINS/FRACTURES:** 1 mm; filled with a pale blue-green mineral; surfaces have slickensides; found in Pieces 1D, 1E, 1H, and 1I.



152-917A-56R-3

**UNIT 60: OLIVINE-PLAGIOCLASE-PYROXENE-PHYRIC BASALT**

**Pieces 1-4**

**CONTACTS:** Basal contact seen in Piece 4 at 25 cm. Basalt entrains underlying sediment (Unit 61A).  
**PHENOCRYSTS:** Olivine - 4%; up to 2 mm; euhedral, platy and equant. Plagioclase - 2%; up to 2 mm; lath-shaped. Pyroxene - 1%; up to 2 mm; euhedral.  
**GROUNDMASS:** Very fine-grained.  
**VESICLES:** 10%-25%; 0.5-4 mm; round to irregular; filled with white or green material; bottom 1 cm of flow has many tiny vesicles.  
**COLOR:** Dark reddish brown (10Y 4/1).  
**ALTERATION:** Moderate; also slightly oxidized; olivine altered to a white mineral.  
**VEINS/FRACTURES:** <1%; 1-2 mm; vertical; filled with white material.

**UNIT 61A: LATERITIC SOIL**

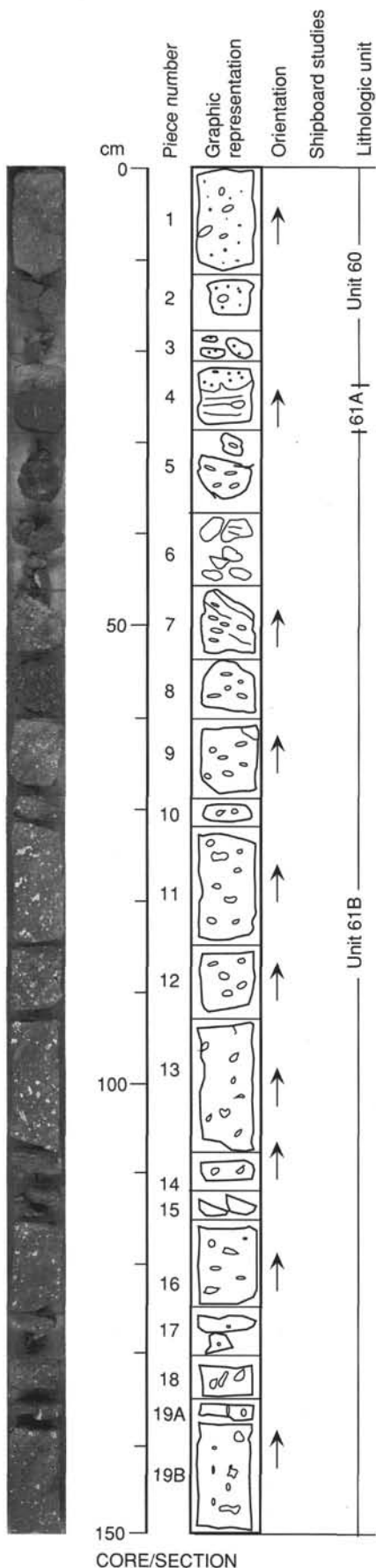
**Piece 4**

**CONTACTS:** The soil horizon is overlain by a lava flow, the base of which can be seen in Piece 4. The lava has produced load casts into the underlying sediment.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Very fine-grained.  
**VESICLES:** None.  
**COLOR:** Reddish brown (2.5YR 4/6) (brick red).  
**STRUCTURE:** The sediment shows faint, wispy, horizontal bedding. It contains a few fragments and one 5-mm euhedral crystal of feldspar, and one 3-mm altered crystal of olivine with oxide inclusions.  
**VEINS/FRACTURES:** A 0.1-1-mm-wide vertical white vein cuts the piece.

**UNIT 61B: PICRITE**

**Pieces 5-19B**

**CONTACTS:** None. Piece 5 is brick-red and close to the top.  
**PHENOCRYSTS:** Olivine - 15%; up to 2 mm; euhedral, equant, completely altered. Plagioclase - 2-3 mm; lath-shaped; only 2 crystals were found.  
**GROUNDMASS:** Moderately fine-grained; plagioclase laths are discernible.  
**VESICLES:** 5%-10%; 1-10 mm; amoeboid; scattered; filled with zeolite often grown in concentric rings with alternating white and brown color; this is especially seen in Piece 11.  
**COLOR:** Dark gray (5Y 4/1), mottled because of large vesicles.  
**STRUCTURE:** Pieces 5-7 are part of the flow-top rubble; further down, the rock is massive except for the vesicles.  
**ALTERATION:** Moderate.



**UNIT 61B: PICRITE**

**Pieces 1A-10B**

**PHENOCRYSTS:** Olivine - 15%; up to 2 mm; euhedral, equant, completely altered.

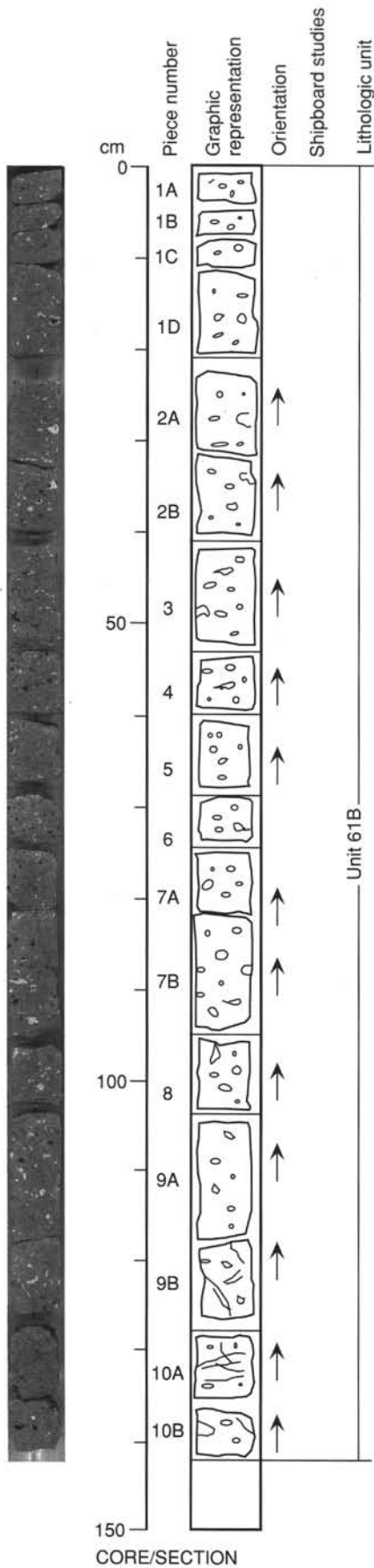
**GROUNDMASS:** Moderately fine-grained; plagioclase laths are discernible.

**VESICLES:** 5%; 1-12 mm; amoeboid; scattered; lined with dark green clay and filled with white zeolite. Some are not filled or are filled with expanding clay.

**COLOR:** Dark gray (5Y 4/1).

**STRUCTURE:** Massive except for the vesicles.

**ALTERATION:** Moderate.



CORE/SECTION

152-917A-56R-5

**UNIT 61B: PICRITE**

**Pieces 1-8**

**PHENOCRYSTS:** Olivine - 15%; up to 2 mm; euhedral, equant, completely altered.

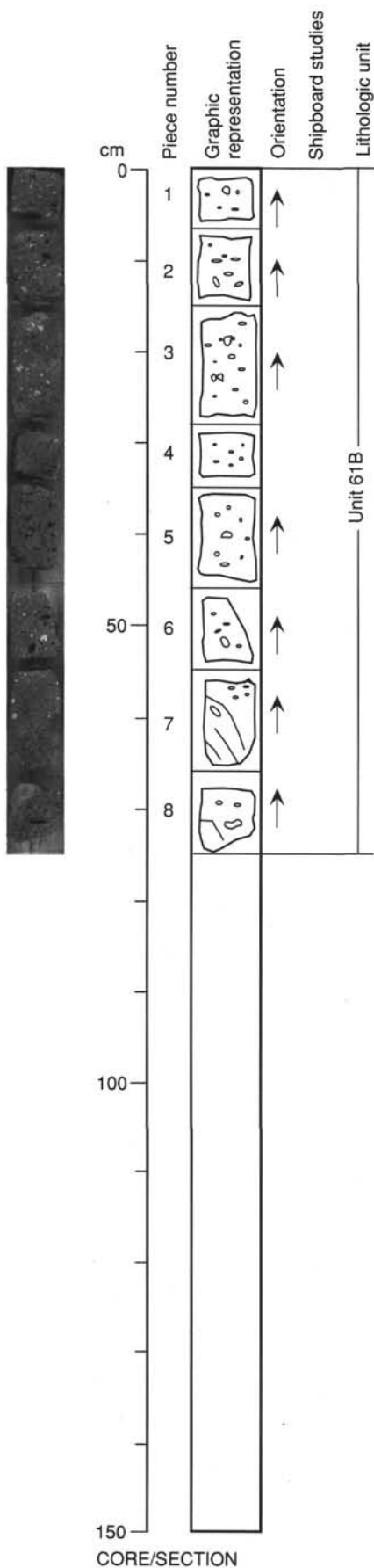
**GROUNDMASS:** Moderately fine-grained; plagioclase laths are discernible.

**VESICLES:** 5%; 1-12 mm; amoeboid; scattered; lined with dark green clay and filled with white zeolite. Some are not filled or filled with expanding clay.

**COLOR:** Dark gray (5Y 4/1).

**STRUCTURE:** Massive except for the vesicles.

**ALTERATION:** Moderate.



**UNIT 61B: PICRITE**

**Pieces 2-7**

**PHENOCRYSTS:** Olivine abundance increases downward through the section. Olivine - 15%-20%; up to 2 mm; euhedral, equant.

**GROUNDMASS:** Moderately fine-grained; mottled due to interstitial bluish zeolite.

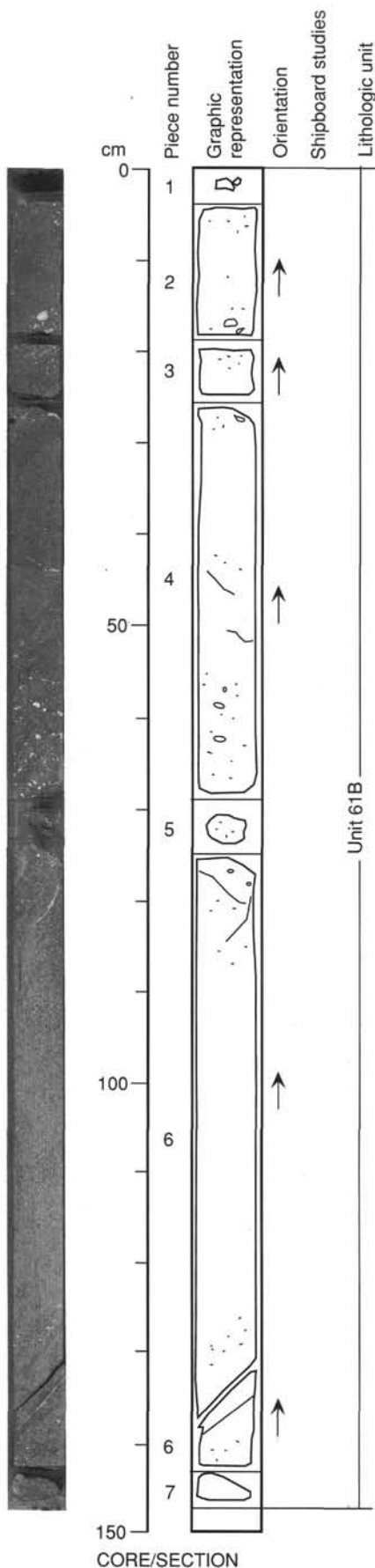
**VESICLES:** 0-5%; up to 10 mm; amoeboid; in trains at 15-22, 55-74, and 125-130 cm; filled with white zeolite.

**COLOR:** Dark gray (5Y 4/1).

**STRUCTURE:** Massive except for the vesicles.

**ALTERATION:** Moderate to slight; below 100 cm there is fresh olivine.

**ADDITIONAL COMMENTS:** Piece 1 is drilling rubble (a bit of vitric tuff).



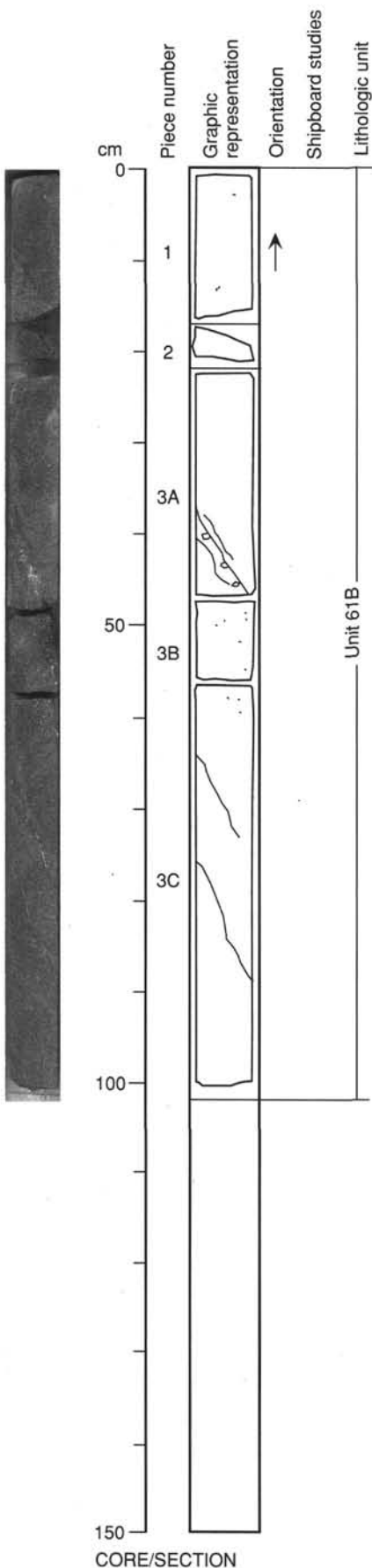


152-917A-57R-2

UNIT 61B: PICRITE

Pieces 1-3C

**PHENOCRYSTS:** Olivine - 20%-25%; up to 2 mm; euhedral, equant.  
**GROUNDMASS:** Moderately fine-grained; mottled due to interstitial bluish zeolite.  
**VESICLES:** None.  
**COLOR:** Dark gray (5Y 4/1).  
**STRUCTURE:** Massive. Olivine accumulation in Piece 3B.  
**ALTERATION:** Slight; lots of fresh olivine.  
**VEINS/FRACTURES:** One 1-2-cm-wide steep vein with dispersed zeolite crosses the core steeply at 38-57 cm.  
**ADDITIONAL COMMENTS:** The amount of olivine increases downward in the flow.



**UNIT 61B: PICRITE**

**Pieces 1A-4**

**CONTACTS:** The lower flow contact is seen in Piece 4 at 126 cm. It is reddened and vesicular.

**PHENOCRYSTS:** Olivine - 20%-25%; up to 2 mm; euhedral, equant.

**GROUNDMASS:** Moderately fine-grained; mottled due to interstitial bluish zeolite.

**VESICLES:** 0-10%; 1-10 mm; amoeboid; Piece 1 (0-100 cm) is vesicle-free; there are 1% vesicles in Piece 2 and 10% in Pieces 3-5. They are filled with white zeolite.

**COLOR:** Dark gray (5Y 4/1) to a more reddish tinge (5YR 4/1) in the lowest 30 cm.

**STRUCTURE:** Massive except for the vesicles.

**ALTERATION:** Slight; lots of fresh olivine.

**ADDITIONAL COMMENTS:** An olivine (0.5 x 1 cm large, subhedral, altered) occurs at 23 cm.

**UNIT 62: PICRITE**

**Pieces 4 and 5**

**CONTACTS:** Top contact seen in Piece 4 at 125 cm.

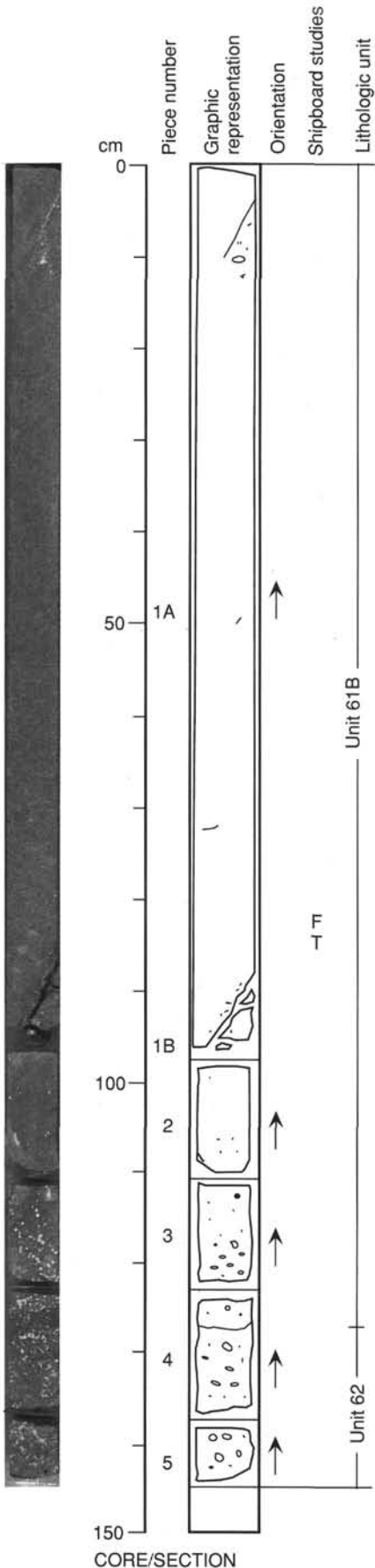
**PHENOCRYSTS:** Olivine - 15%; up to 4 mm; euhedral, equant; altered to a green material and oxidized along cracks.

**GROUNDMASS:** Plagioclase laths in extremely fine-grained matrix (devitrified glass?).

**VESICLES:** 15%; 1-10 mm; round to amoeboid; random; filled with white mineral.

**COLOR:** Dark reddish gray (5R 4/1).

**ALTERATION:** Moderate to strong.



152-917A-57R-4

UNIT 62: PICRITE

Pieces 1-8C

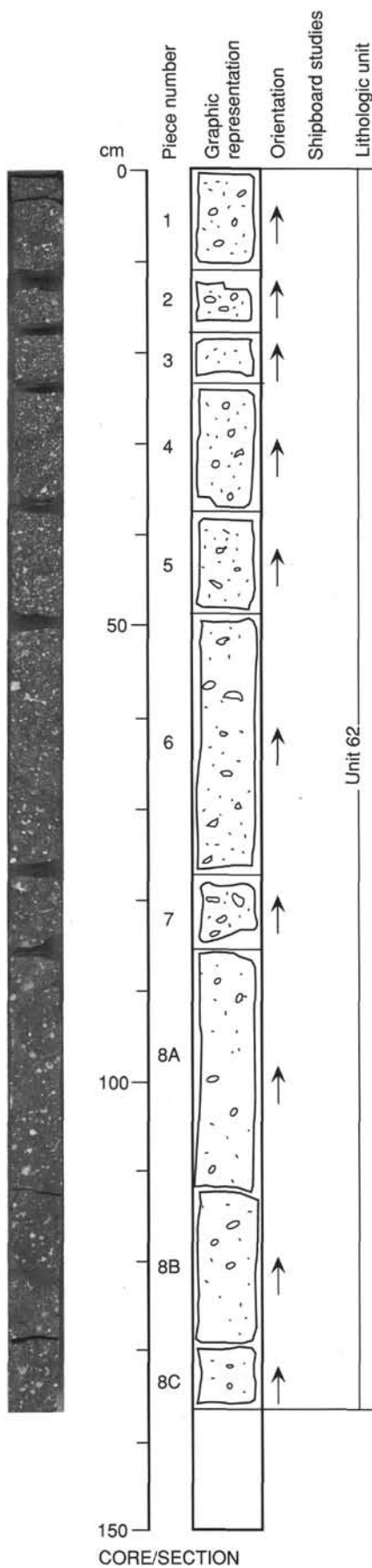
**PHENOCRYSTS:** Olivine - 15%; up to 4 mm; euhedral, equant; altered to a green material and oxidized along cracks.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 10%-20%; 1-20 mm; round to amoeboid; more towards top of section; filled with white and green mineral; slight preferred orientation.

**COLOR:** Dark reddish gray (5R 4/1) at top to dark gray (N 4/0) at base.

**ALTERATION:** Moderate to strong.



**UNIT 62: PICRITE**

**Pieces 1A-7**

**PHENOCRYSTS:** Olivine - 15%; up to 4 mm; euhedral, equant; altered to a green material and oxidized along cracks.

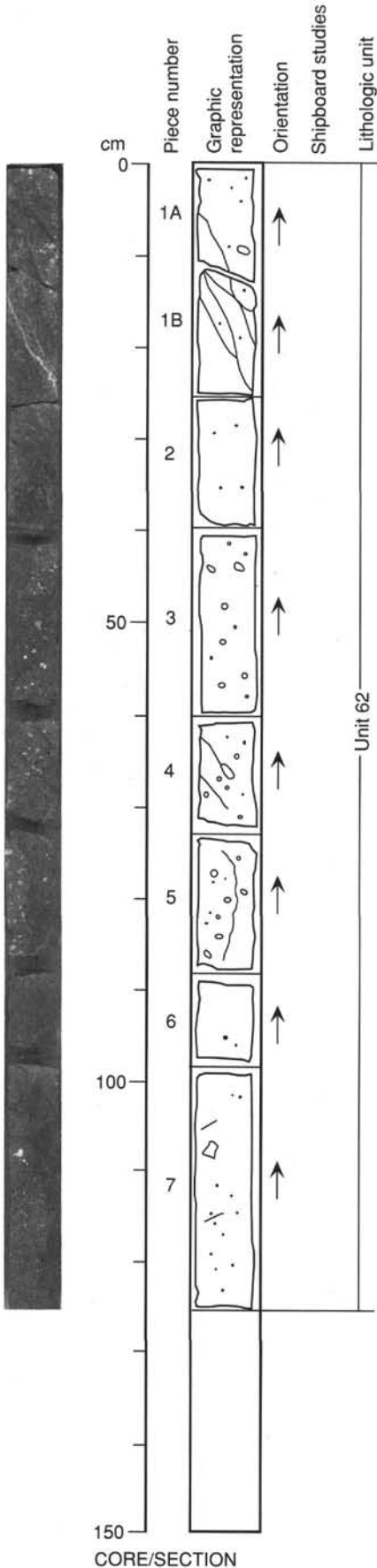
**GROUNDMASS:** Moderately fine-grained.

**VESICLES:** 0-5%; 1-15 cm; amoeboid; inhomogeneous distribution; filled with white and green mineral.

**COLOR:** Dark gray (N 4/0) with red spots.

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** 0-10%; 1-3 mm; the rock is brecciated and filled with a network of fine fractures filled with a dark green mineral; larger fractures are filled with a white mineral.



CORE/SECTION

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UNIT 62: PICRITE

Pieces 1-2E

**PHENOCRYSTS:** Olivine - 15%; up to 5 mm; euhedral, equant; altered to a green material and oxidized along cracks.

**GROUNDMASS:** Medium-grained.

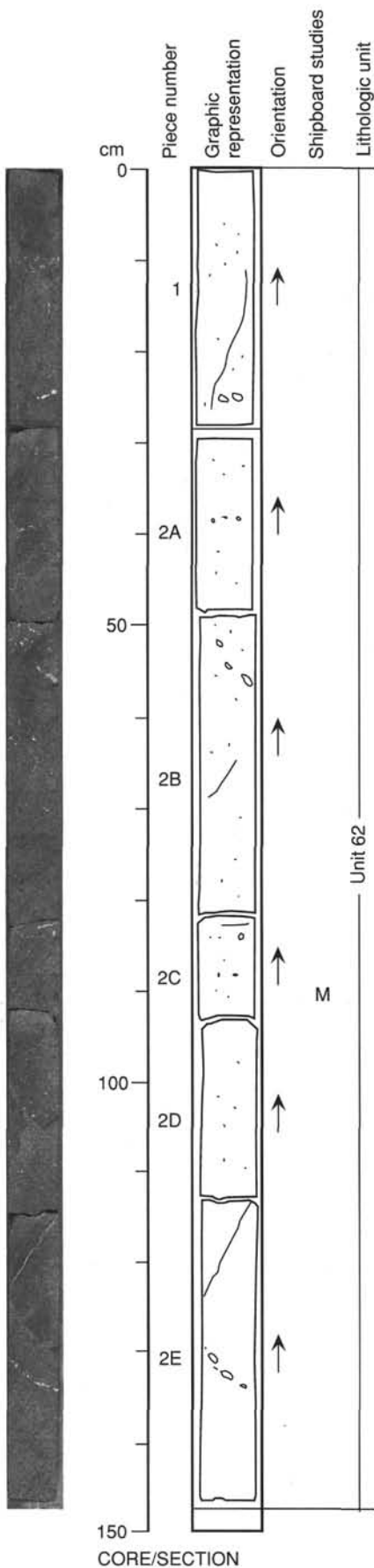
**VESICLES:** 0-5%; 0.5-15 mm; amoeboid; disseminated; less abundant in Piece 2E; filled with white and green mineral.

**COLOR:** Dark gray (N 4/0) with red spots.

**STRUCTURE:** Massive.

**ALTERATION:** Moderate; interstitial blue clay.

**VEINS/FRACTURES:** 1 mm; in Pieces 1, 2B, 2E; filled with white material.



**UNIT 62: PICRITE**

**Pieces 1A-3B**

**PHENOCRYSTS:** Olivine - 15%; up to 5 mm; euhedral, equant; partially fresh.

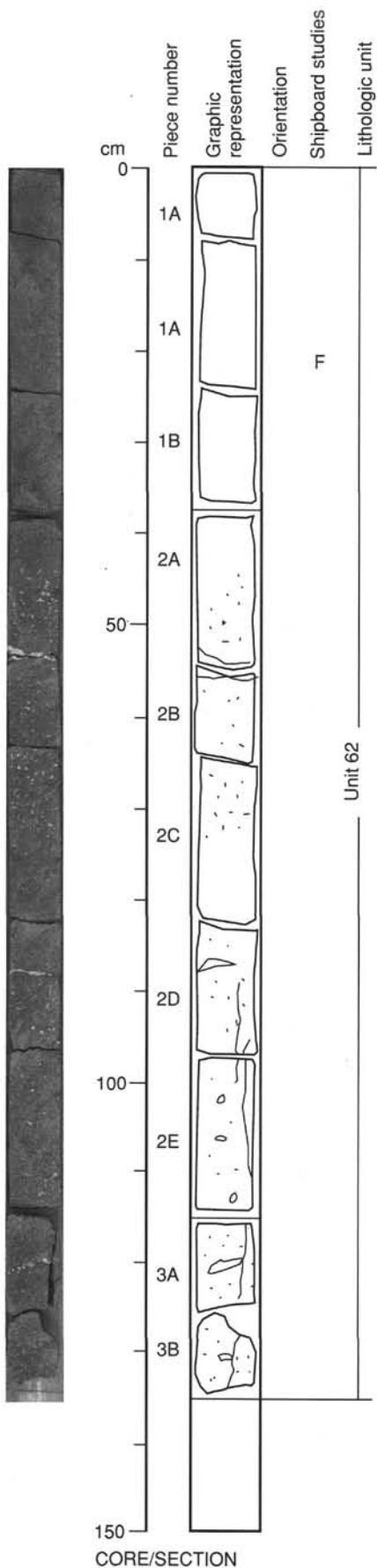
**GROUNDMASS:** Medium-grained.

**VESICLES:** 0-10%; up to 7 mm; amoeboid; concentrated in zones at 45-75 and 88-134 cm; filled with white and green minerals and rare native copper; 4-cm-long horizontal-filled cavities at 89 and 120 cm.

**COLOR:** Dark gray (N 4/0) with red spots.

**STRUCTURE:** Massive.

**ALTERATION:** Low in nonvesicular portions; moderate in vesicular portions.

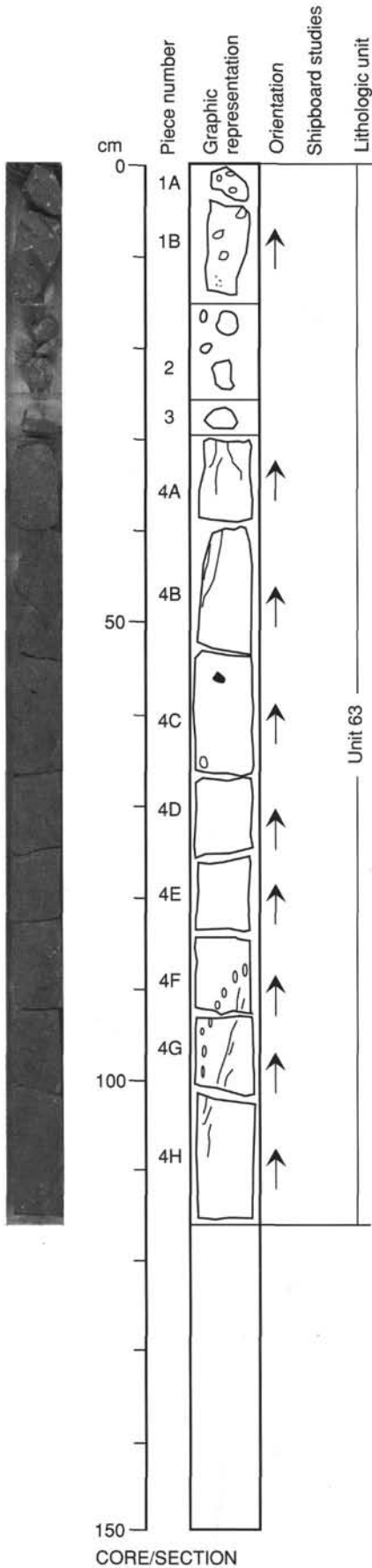


152-917A-58R-1

**UNIT 63: APHYRIC OLIVINE BASALT**

**Pieces 1A-4H**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Medium-grained.  
**VESICLES:** <1%; 0.5-5 mm; spherical to irregular; patchy distribution; cream, red, and pale green fillings.  
**COLOR:** Greenish black (5GY 2/1), pale brown (5YR 5/2) in top 40 cm.  
**STRUCTURE:** Vesicular oxidized flow top grading down to fresher basalt at base of section.  
**ALTERATION:** Moderate to strong.  
**VEINS/FRACTURES:** None.



**UNIT 63: APHYRIC OLIVINE BASALT**

**Pieces 1A-2B**

**PHENOCRYSTS:** None.

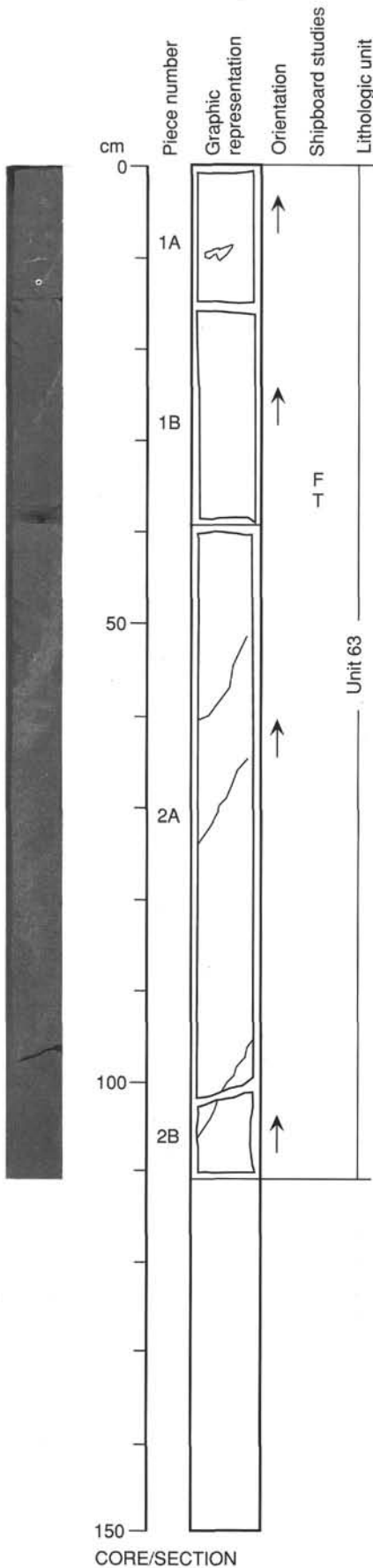
**GROUNDMASS:** Medium-grained.

**VESICLES:** <<1%; 0.5-5 mm; spherical to irregular; at top of section; cream, red, and pale green fillings.

**COLOR:** Greenish black (5GY 2/1).

**ALTERATION:** Moderate; groundmass olivine altered to green mineral.

**VEINS/FRACTURES:** <<1%; 0.2-1 mm; inclined (60 degrees); zeolite-filled.





152-917A-58R-3

**UNIT 63: APHYRIC OLIVINE BASALT**

**Pieces 1A-6**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Medium-grained.

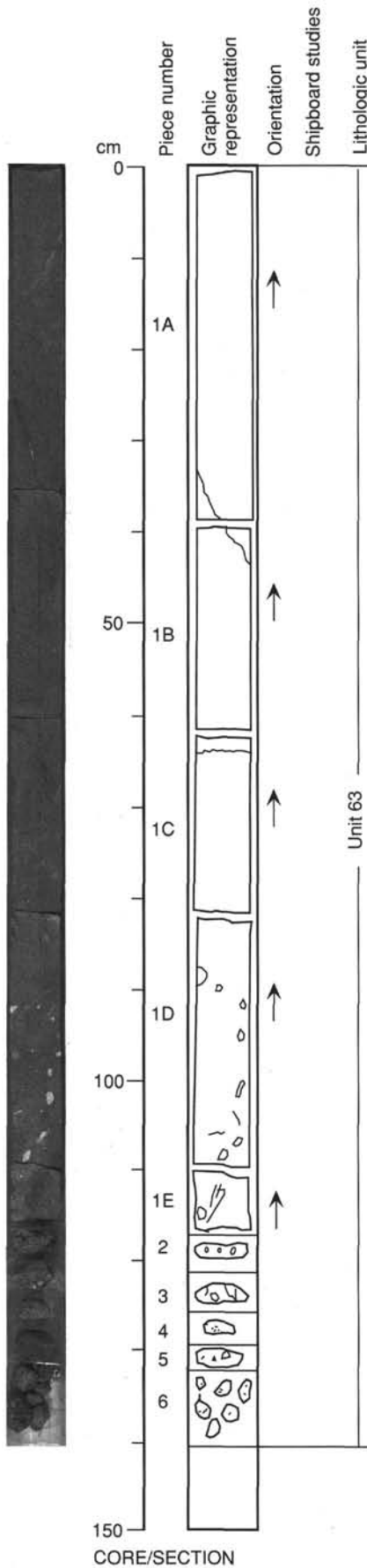
**VESICLES:** 0-20%; 0.5-10 mm; spherical to irregular; mostly in lower part of section; zeolite-filled, empty at base of section.

**COLOR:** Greenish black (5GY 2/1).

**STRUCTURE:** Massive with vesicular base.

**ALTERATION:** Moderate; groundmass olivine altered to green mineral.

**VEINS/FRACTURES:** <<1%; 0.2-3 mm; horizontal to inclined; filled with zeolite and green mineral.



**UNIT 64: APHYRIC OLIVINE BASALT**

**Pieces 1A-2B**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

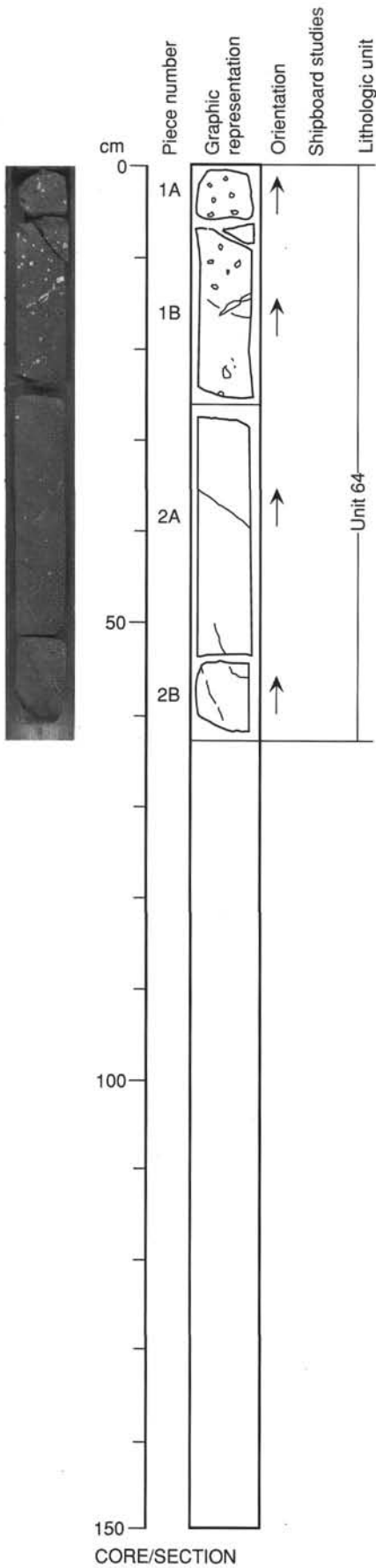
**VESICLES:** <1%-10%; 0.5-5 mm; spherical; concentrated at top of section; zeolite-filled.

**COLOR:** Greenish black (5GY 2/1).

**STRUCTURE:** Vesicular flow-top grading down to vesicle-poor interior.

**ALTERATION:** Moderate; groundmass olivine altered to green mineral.

**VEINS/FRACTURES:** <<1%; 0.2-1 mm; inclined; zeolite-filled.



152-917A-59R-1

**UNIT 64: APHYRIC OLIVINE BASALT**

**Pieces 1-2I**

**PHENOCRYSTS:** None.

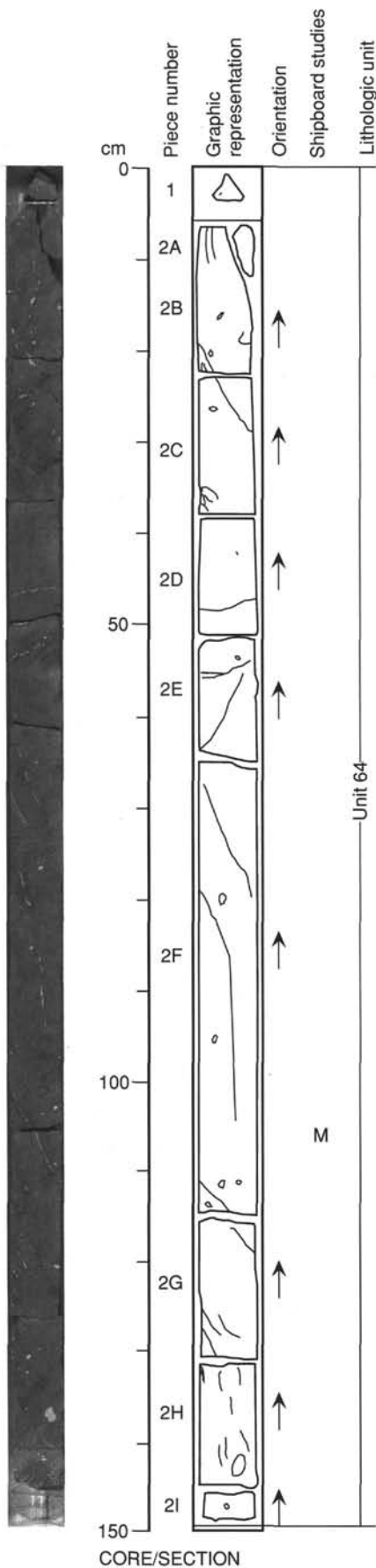
**GROUNDMASS:** Fine-grained.

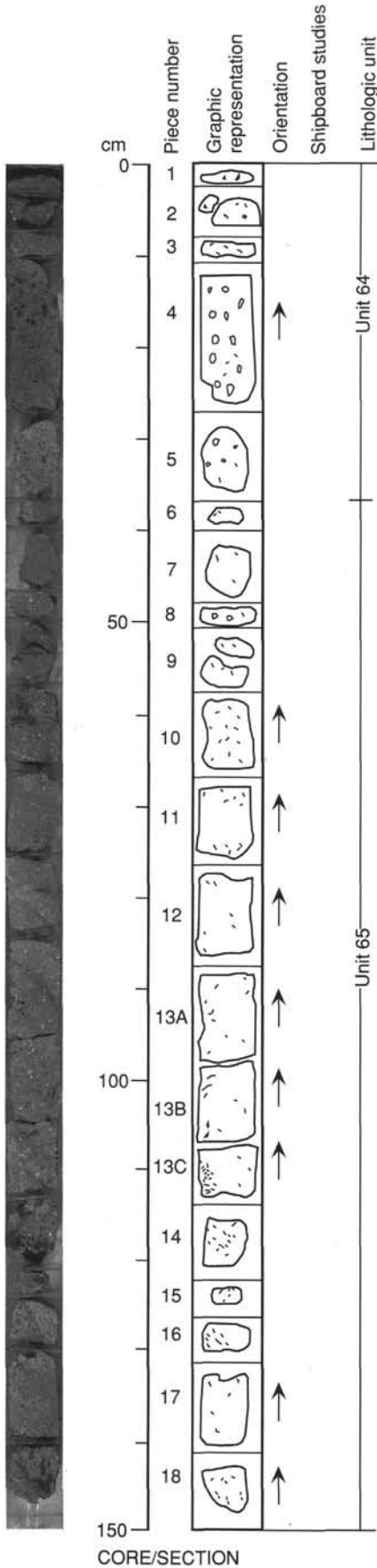
**VESICLES:** <1%; 1-15 mm; spherical to irregular; random distribution; filled with calcite and green mineral; pale green amorphous mineral in Piece 2H.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Moderate; olivine altered.

**VEINS/FRACTURES:** <1%; 0.2-5 mm; subhorizontal to inclined; filled with green mineral and zeolite; oxidation around veins in Piece 2G.





**UNIT 64: APHYRIC OLIVINE BASALT**

**Pieces 1-5**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 15%; 0.5-5 mm; irregular; random distribution; empty or filled with green or banded red and pink minerals.  
**COLOR:** Brownish gray (5YR 4/1).  
**STRUCTURE:** Vesicular flow base.  
**ALTERATION:** Strong.  
**VEINS/FRACTURES:** None.

**UNIT 65: APHYRIC OLIVINE BASALT**

**Pieces 6-18**

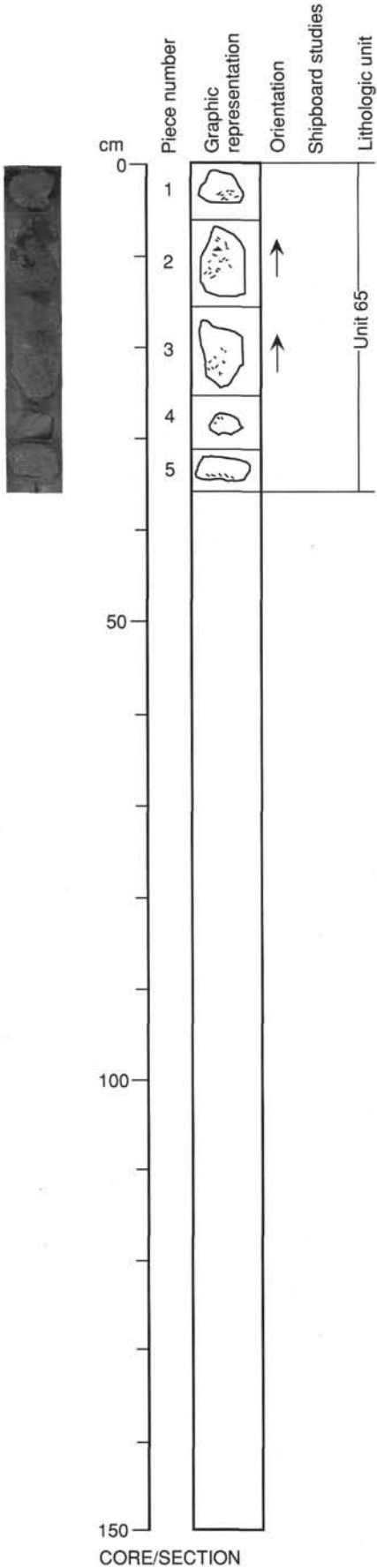
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 2%-20%; 0.5-5 mm; spherical to irregular; patchy distribution; mostly empty with gray linings; some contain zeolite crystals.  
**COLOR:** Grayish red (5R 4/2) at top to dark brownish gray (5YR 3/1) at base.  
**STRUCTURE:** Vesicular flow top.  
**ALTERATION:** Strong; oxidized.  
**VEINS/FRACTURES:** None.

152-917A-59R-3

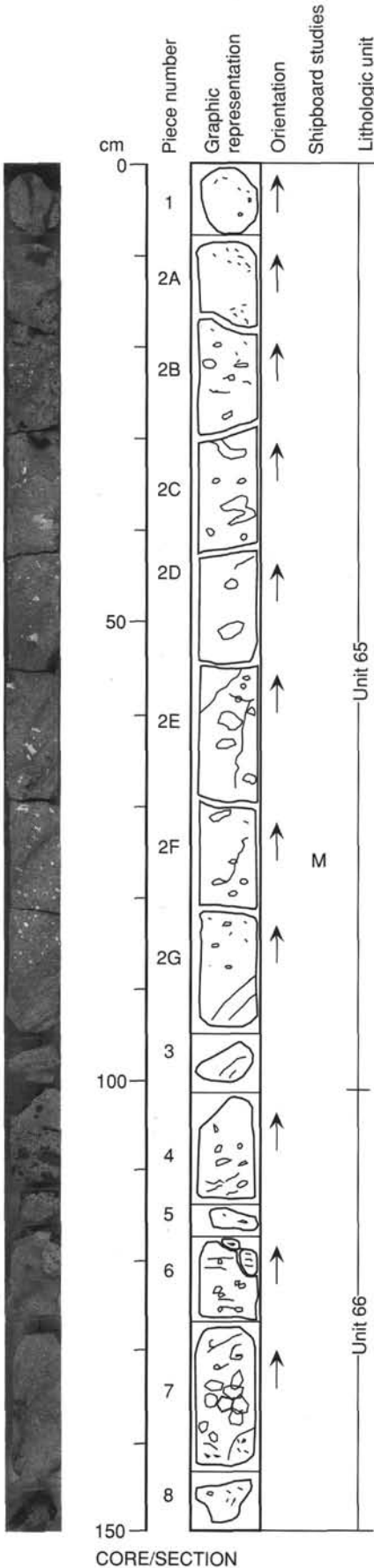
**UNIT 65: APHYRIC OLIVINE BASALT**

**Pieces 1-5**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 5%-10%; 0.5-5 mm; spherical to irregular; patchy distribution; lined with zeolite crystals.  
**COLOR:** Dark brownish gray (5YR 3/1).  
**ALTERATION:** Strong.  
**VEINS/FRACTURES:** None.



CORE/SECTION



**UNIT 65: APHYRIC OLIVINE BASALT**

**Pieces 1A-3**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 5%-10%; 0.5-20 mm; spherical to irregular; patchy distribution; filled with calcite and/or green amorphous mineral; vesicles at top of section empty or with white linings.

**COLOR:** Dark gray (N 3/0).

**STRUCTURE:** Flow-brecciated base of flow.

**ALTERATION:** Moderate to strong.

**VEINS/FRACTURES:** <1%; 0.2-1 mm; random orientation; filled with calcite and green mineral.

**UNIT 66: APHYRIC OLIVINE BASALT**

**Pieces 4-8**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 1%-10%; 0.5-8 mm; spherical to irregular; patchy distribution; empty with white linings.

**COLOR:** Brownish dark gray (5YR 4/1) to very dark red (5R 2/6).

**STRUCTURE:** Flow-brecciated top of flow.

**ALTERATION:** Strong; oxidized in places.

**VEINS/FRACTURES:** None.

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**UNIT 66: APHYRIC OLIVINE BASALT**

**Pieces 1-4B**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

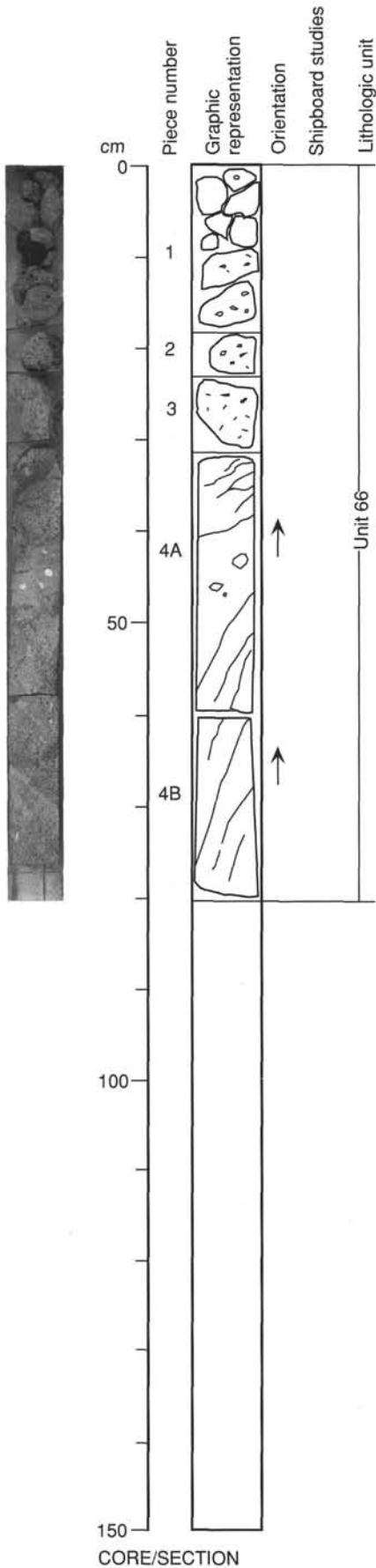
**VESICLES:** 2%-20%; 0.5-10 mm; spherical to irregular; patchy distribution; empty or lined with zeolite crystals in top part; lined or filled with green mineral in Piece 3; calcite-filled in bottom part of section.

**COLOR:** Olive gray (5Y 4/1).

**STRUCTURE:** Piece 4 is flow-brecciated.

**ALTERATION:** Moderate to strong.

**VEINS/FRACTURES:** <1%; 0.2-4 mm; inclined; confined to Piece 3; filled with green mineral and calcite.



**UNIT 66: APHYRIC OLIVINE BASALT**

**Pieces 1-5**

**PHENOCRYSTS:** None.

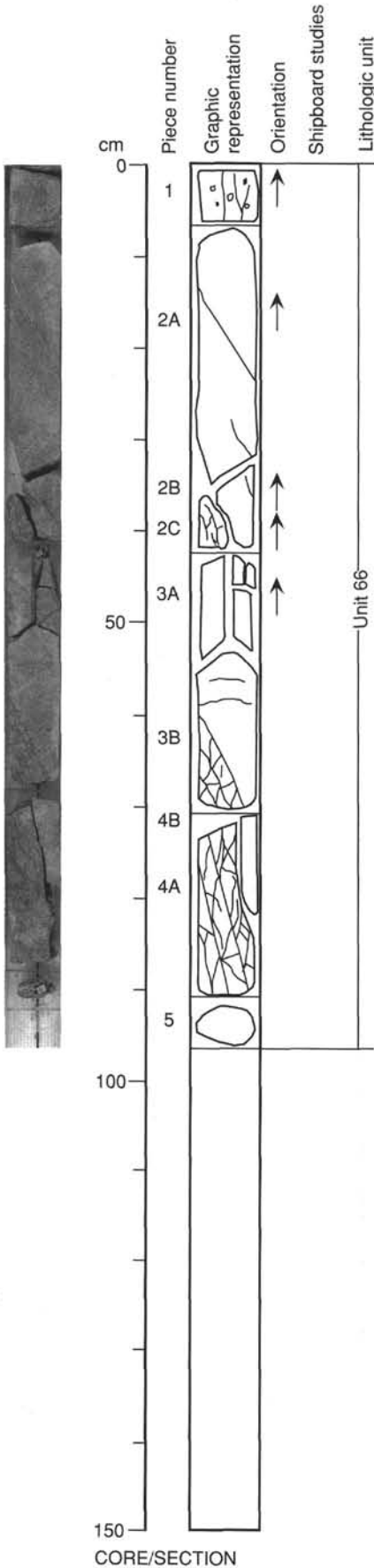
**GROUNDMASS:** Fine-grained.

**VESICLES:** 0-5%; 0.5-3 mm; irregular; restricted to Pieces 1 and 2; filled with calcite or dark green mineral.

**COLOR:** Medium light gray (N 6/0).

**ALTERATION:** Moderate; some oxidation staining in Piece 2B.

**VEINS/FRACTURES:** <1-2 mm; subvertical; numerous fine fractures in Pieces 1, 3B, and 4; larger calcite-filled fractures in Pieces 2A and 4.



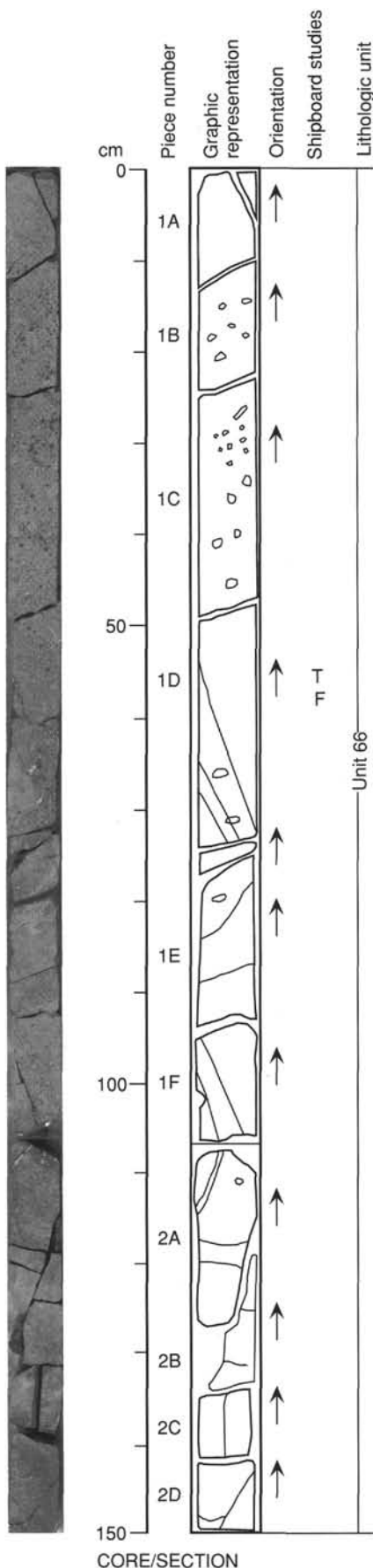


152-917A-61R-2

UNIT 66: APHYRIC OLIVINE BASALT

Pieces 1A-2D

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 0-5%; 1-8 mm; rounded to irregular; concentrated in upper part of section; filled with green material and some calcite.  
**COLOR:** Medium light gray (N 6/0).  
**ALTERATION:** Moderate.  
**VEINS/FRACTURES:** <1-5 mm; random orientation; empty or filled with granular calcite.  
**ADDITIONAL COMMENTS:** Calcite deposited in vesicles after green material.



CORE/SECTION

**UNIT 66: APHYRIC OLIVINE BASALT**

**Pieces 1-5**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

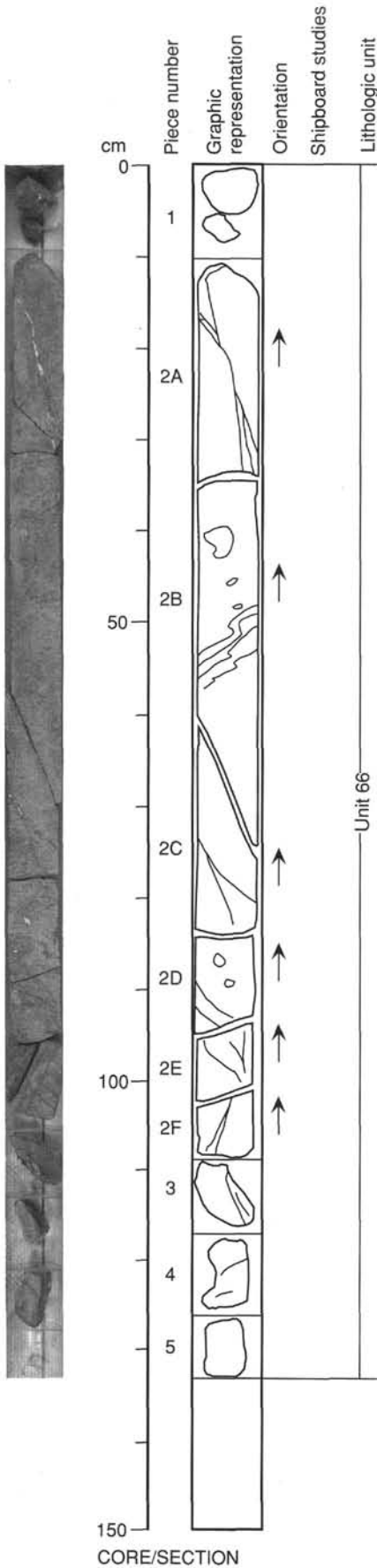
**VESICLES:** <1%; 5-15 mm; irregular; filled with calcite.

**COLOR:** Medium light gray (N 6/0).

**STRUCTURE:** Flow-banding with horizontal to subhorizontal dip in Piece 2.

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** <1%; <1-5 mm; inclined; found in all of section except between 33 and 70 cm; lined with calcite above 90 cm; oxidized edges below 90 cm.



152-917A-62R-1

**UNIT 66: APHYRIC OLIVINE BASALT**

**Pieces 1-6**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

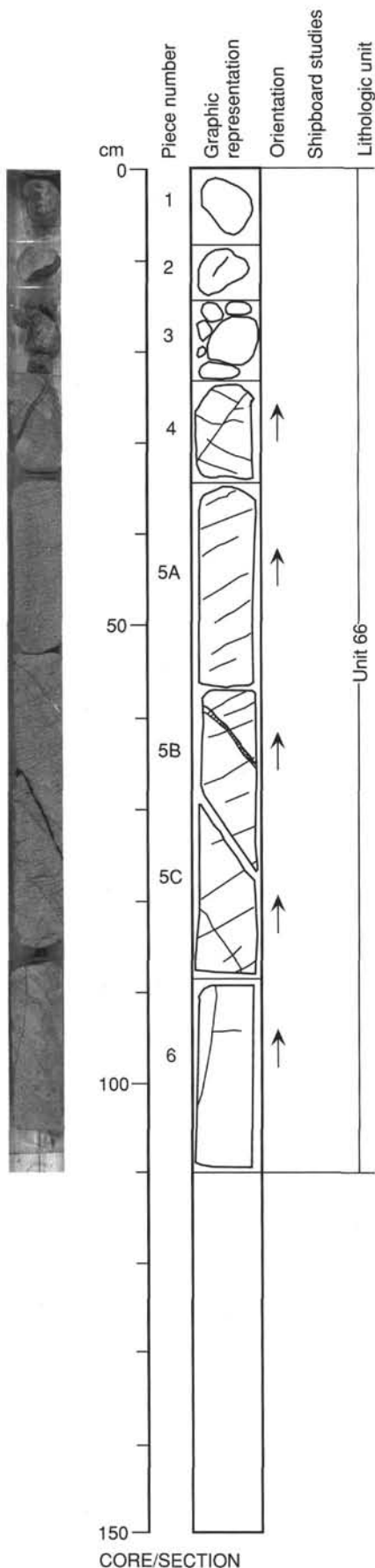
**VESICLES:** <1%; 5-10 mm; irregular; filled with calcite.

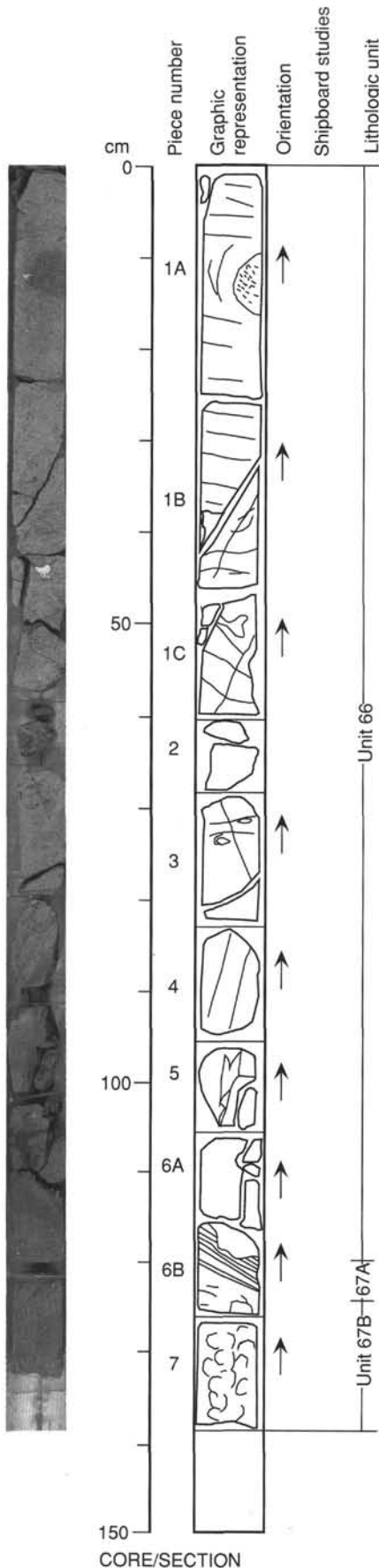
**COLOR:** Medium light gray (N 6/0).

**STRUCTURE:** Flow-banding dipping 20 degrees.

**ALTERATION:** Slight to moderate.

**VEINS/FRACTURES:** <1%; 0.5-5 mm; random orientation; in all pieces except 5A; larger ones are filled with calcite.





**UNIT 66: APHYRIC OLIVINE BASALT**

**Pieces 1A–6B**

**CONTACTS:** Chilled contact in Piece 6B with laterite layer in Unit 67A.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

**VESICLES:** <1%; 1–20 mm; irregular to rounded; a few large, calcite-filled cavities above 50 cm; smaller rounded vesicles below 70 cm filled with green material.

**COLOR:** Medium light gray (N 6/0).

**STRUCTURE:** Flow-banding; brecciated near base of unit.

**ALTERATION:** Moderate; Piece 2C is slightly oxidized.

**VEINS/FRACTURES:** 0.5–1 mm; random orientation; unfilled.

**ADDITIONAL COMMENTS:** 5-cm, rounded, scoriaceous clast in Piece 1A; flow-banding is concentric around clast.

**UNIT 67B: OLIVINE-PLAGIOCLASE-PHYRIC BASALT**

**Pieces 6B–7**

**CONTACTS:** Grades upward into laterite layer (Unit 67 A).

**PHENOCRYSTS:** Olivine - 2%; 0.5–2 mm; euhedral to subhedral, equant. Plagioclase - <1%; 0.5–1 mm; euhedral, tabular.

**GROUNDMASS:** Aphanitic.

**VESICLES:** 1%–2%; 0.5–2 mm; irregular; filled with calcite.

**COLOR:** Brownish gray (5YR 2/1).

**STRUCTURE:** Slightly brecciated.

**ALTERATION:** Moderate; some oxidation.

**ADDITIONAL COMMENTS:** A 3-cm-thick laterite layer (Unit 67A) overlies this unit.

152-917A-62R-3

**UNIT 67B: OLIVINE-PLAGIOCLASE-PHYRIC BASALT**

**Pieces 1-7**

**PHENOCRYSTS:** Olivine - 2%; 0.5-2 mm; equant, euhedral to subhedral. Plagioclase - <1%; 0.5-1 mm; tabular, euhedral.

**GROUNDMASS:** Aphanitic.

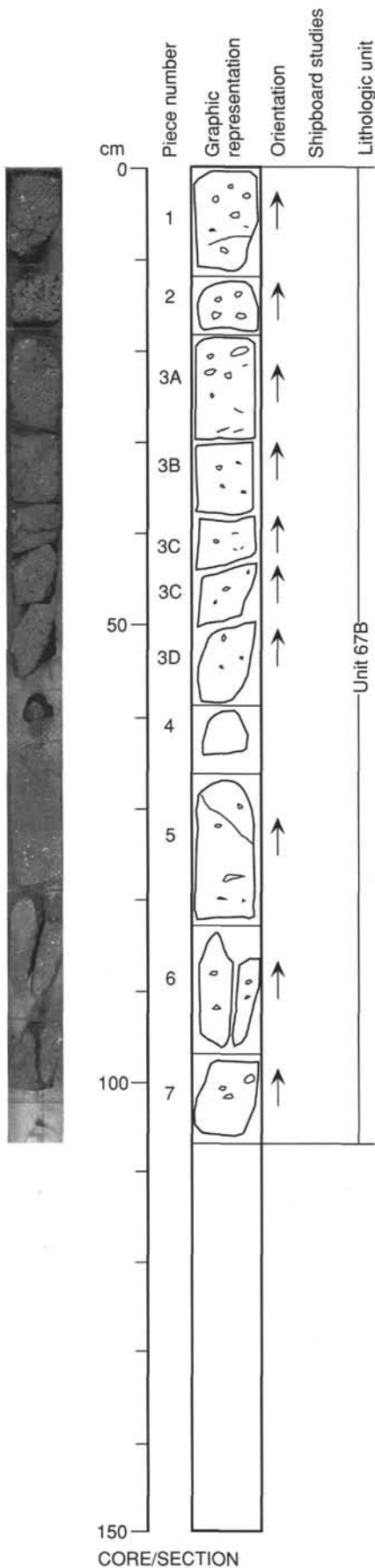
**VESICLES:** 5%-10%; 1-10 mm; spherical to irregular; random distribution; some empty, most filled with calcite, green material, and some clear zeolite (Piece 5).

**COLOR:** Brownish gray (5YR 4/1).

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** <1%; <1 mm; random orientation; oxidation staining around fractures; some lined with calcite.

**ADDITIONAL COMMENTS:** Part of vesicular flow top.



**UNIT 67B: OLIVINE-PLAGIOCLASE-PHYRIC BASALT**

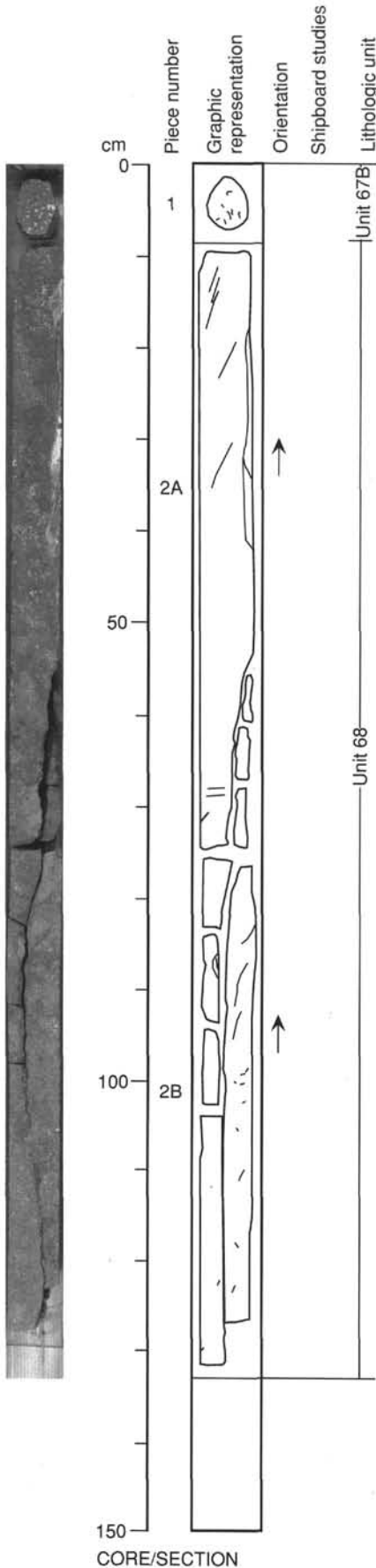
**Piece 1**

**PHENOCRYSTS:** Olivine - 2%; 0.5–2 mm; equant, euhedral to subhedral. Plagioclase - <1%; 0.5–1 mm; tabular, euhedral.  
**GROUNDMASS:** Aphanitic.  
**VESICLES:** 10%; 0.5–5 mm; spherical to irregular; random distribution; lined with green mineral and filled with calcite.  
**COLOR:** Brownish gray (5YR 4/1)  
**ALTERATION:** Strong; olivine completely altered, groundmass oxidized.  
**VEINS/FRACTURES:** None.

**UNIT 68: OLIVINE-PLAGIOCLASE-PHYRIC BASALT**

**Pieces 2A–2B**

**PHENOCRYSTS:** Olivine - 3%; 0.5–5 mm; equant, euhedral to subhedral. Plagioclase - 1%; 0.5–2 mm; tabular, euhedral.  
**GROUNDMASS:** Aphanitic.  
**VESICLES:** 2%–5%; 0.5–5 mm; irregular; concentrated at top of section; zeolite-filled.  
**COLOR:** Grayish red (10R 4/2) with dark red (10R 3/4) patches.  
**STRUCTURE:** Scoriaceous top of flow.  
**ALTERATION:** Completely altered.  
**VEINS/FRACTURES:** 1%; 0.5–10 mm; vertical; single zeolite-filled vein running length of core. Widest part (at 30 cm) filled with calcite.  
**ADDITIONAL COMMENTS:** Top of deeply weathered flow.



152-917A-63R-2

UNIT 68: OLIVINE-PLAGIOCLASE-PHYRIC BASALT

Pieces 1A-1C

**PHENOCRYSTS:** Olivine - 3%; 0.5-5 mm; equant, euhedral to subhedral. Plagioclase - 1%; 0.5-2 mm; tabular, euhedral.

**GROUNDMASS:** Aphanitic.

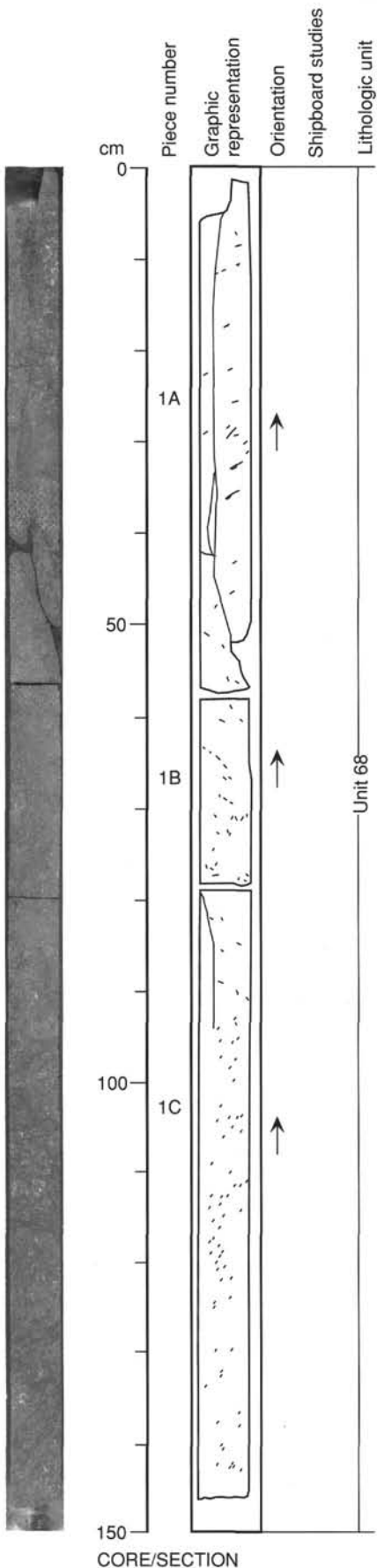
**VESICLES:** 1%-5%; 0.5-5 mm; irregular; patchy distribution; zeolite-filled.

**COLOR:** Grayish red (10R 4/2) to light brownish gray (5YR 6/1).

**STRUCTURE:** Scoriaceous in top 40 cm.

**ALTERATION:** Completely altered.

**VEINS/FRACTURES:** <1%; 0.2-0.5 mm; vertical; zeolite-filled.



152-917A-63R-3

**UNIT 68: OLIVINE-PLAGIOCLASE-PHYRIC BASALT**

**Pieces 1A-1B**

**PHENOCRYSTS:** Olivine - 3%; 0.5-5 mm; equant, euhedral to subhedral. Plagioclase - 1%; 0.5-2 mm; tabular, euhedral.

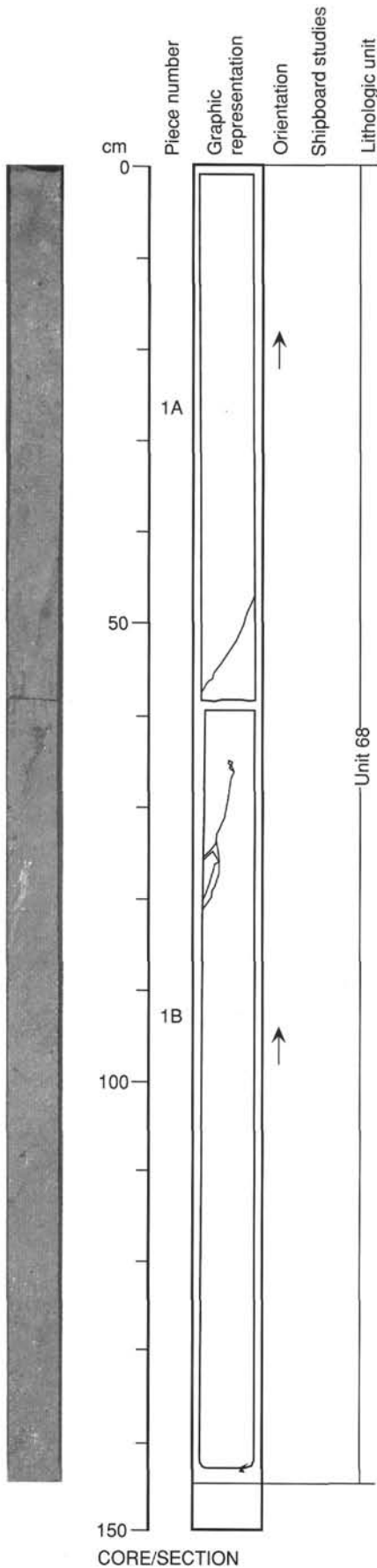
**GROUNDMASS:** Aphanitic.

**VESICLES:** 1%; 0.5-2 mm; irregular; patchy distribution; zeolite-filled.

**COLOR:** Light brownish gray (5YR 6/1).

**ALTERATION:** Completely altered.

**VEINS/FRACTURES:** <1%; 0.2-8 mm; near-vertical; filled with zeolite, with calcite and some epidote in wider parts of veins.





152-917A-63R-4

**UNIT 68: OLIVINE-PLAGIOCLASE-PHYRIC BASALT**

**Pieces 1A-1C**

**PHENOCRYSTS:** Olivine - 3%; 0.5-5 mm; equant, euhedral to subhedral. Plagioclase - 1%; 0.5-2 mm; tabular, euhedral.

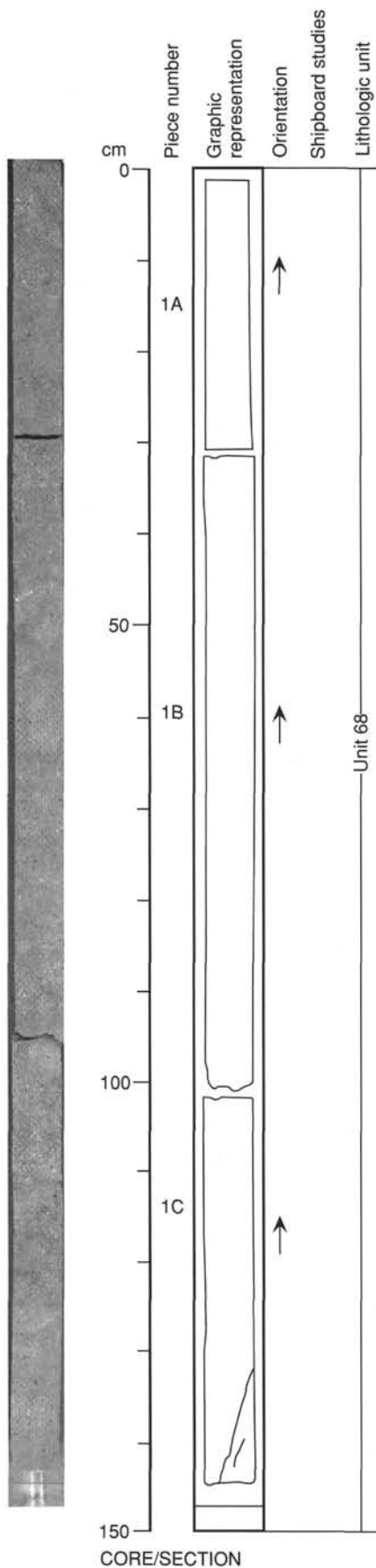
**GROUNDMASS:** Aphanitic.

**VESICLES:** 1%; 0.5-2 mm; irregular; patchy distribution; zeolite-filled.

**COLOR:** Light brownish gray (5YR 6/1).

**ALTERATION:** Completely altered.

**VEINS/FRACTURES:** <<1%; 0.2-2 mm; inclined; two zeolite-filled veins at base of section.



152-917A-63R-5

**UNIT 68: OLIVINE-PLAGIOCLASE-PHYRIC BASALT**

**Pieces 1A-2B**

**PHENOCRYSTS:** Olivine - 3%; 0.5-5 mm; equant, euhedral to subhedral. Plagioclase - 1%; 0.5-2 mm; tabular, euhedral.

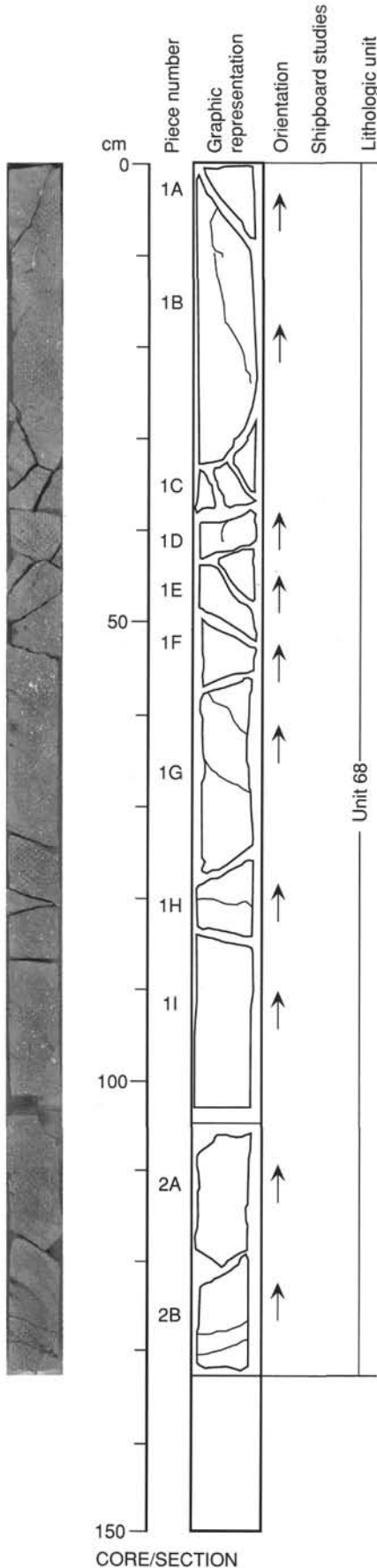
**GROUNDMASS:** Aphanitic.

**VESICLES:** 0-10%; 0.5-8 mm; irregular; patchy distribution; zeolite-filled in Piece 1; filled with green mineral in Piece 2B.

**COLOR:** Light brownish gray (5YR 6/1) at top, olive gray (5Y 4/1) at base of section.

**ALTERATION:** Strongly altered at top of Piece 1, moderately altered in Piece 2B. Sharp transition at 115 cm.

**VEINS/FRACTURES:** <<1%; 0.2-2 mm; subhorizontal to steeply inclined; zeolite-filled at top of section.



152-917A-63R-6

UNIT 68: OLIVINE-PLAGIOCLASE-PHYRIC BASALT

Pieces 1-6

**PHENOCRYSTS:** Olivine - 3%; 0.5-5 mm; equant, euhedral to subhedral. Plagioclase - 1%; 0.5-2 mm; tabular, euhedral.

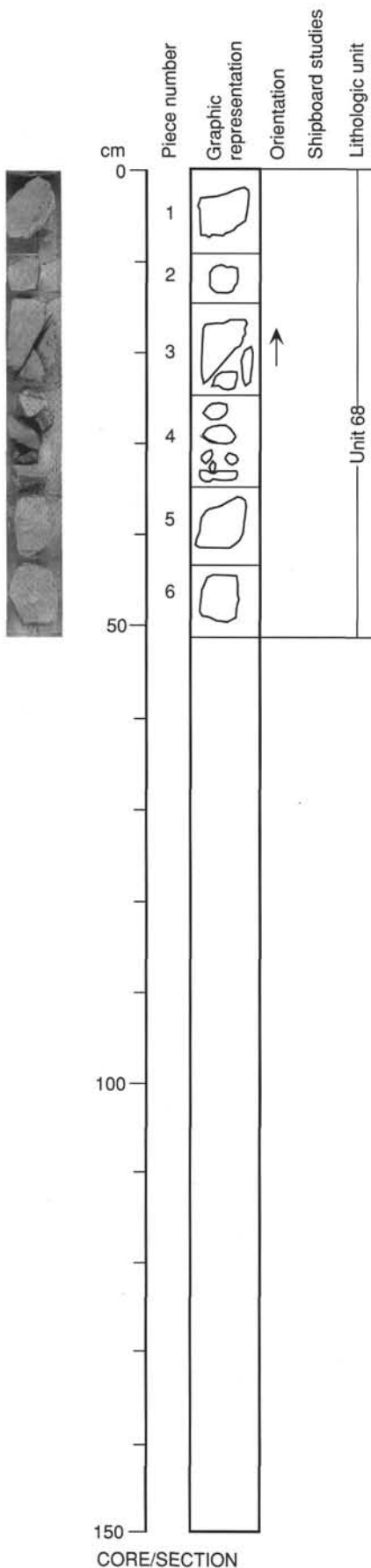
**GROUNDMASS:** Aphanitic.

**VESICLES:** <1%; 0.5-2 mm; spherical to irregular; random distribution; filled with green mineral.

**COLOR:** Dark greenish gray (5GY 4/1).

**ALTERATION:** Moderate; olivine altered.

**VEINS/FRACTURES:** <1%; 1 mm; vertical; single vein filled with green mineral in Piece 3.



CORE/SECTION

**UNIT 68: OLIVINE-PLAGIOCLASE-PHYRIC BASALT**

**Pieces 1-5G**

**PHENOCRYSTS:** Olivine - 3%; 0.5-4 mm; equant, euhedral to subhedral. Plagioclase - 1%; 0.5-2 mm; tabular, euhedral.

**GROUNDMASS:** Fine-grained.

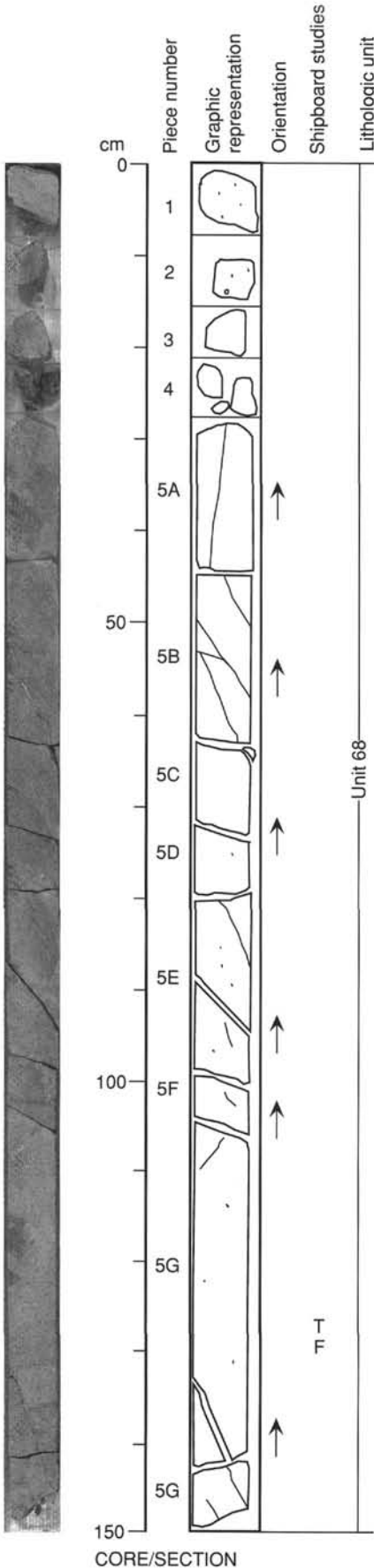
**VESICLES:** <1%; 1-3 mm; round; scattered; filled with white zeolite.

**COLOR:** Dark greenish gray (5GY 4/1).

**STRUCTURE:** Faint flow-banding, horizontal to sloping 40 degrees.

**ALTERATION:** Moderate to low; some fresh olivine.

**VEINS/FRACTURES:** <<1%; 0.2-3 mm; inclined 70 degrees; two fractures at 53-68 and 132-146 cm, filled with green and white material.



152-917A-64R-2

UNIT 68: OLIVINE-PLAGIOCLASE-PHYRIC BASALT

Pieces 1A-3E

**PHENOCRYSTS:** Olivine - 3%; 0.5-4 mm; equant, euhedral to subhedral. Plagioclase - 1%; 0.5-2 mm; tabular, euhedral.

**GROUNDMASS:** Fine-grained.

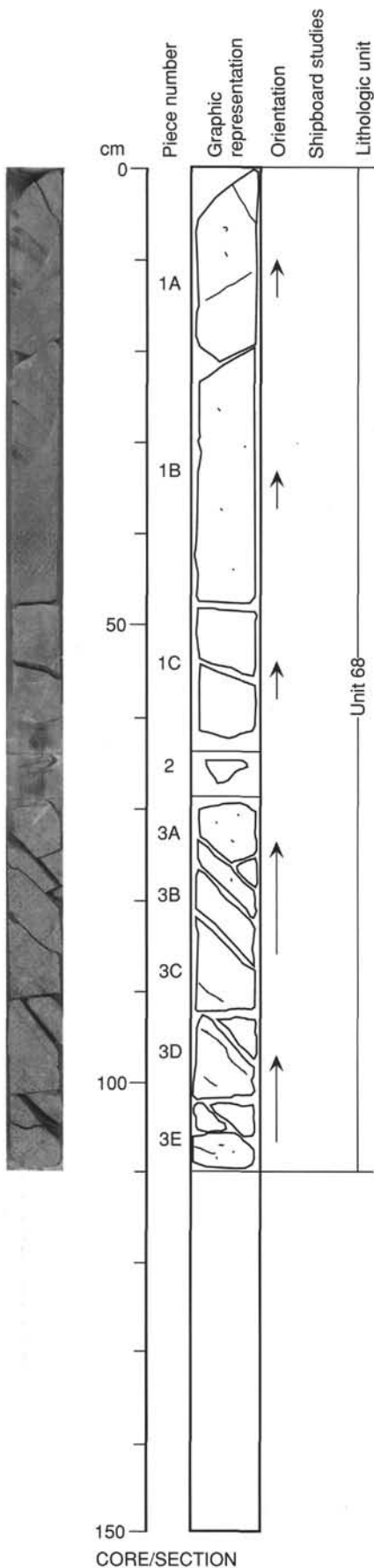
**VESICLES:** <1%; 1-2 mm; round to flattened; scattered; filled with green mineral.

**COLOR:** Dark greenish gray (5GY 4/1).

**STRUCTURE:** Faint horizontal flow-banding in Piece 1. Slightly more olivine in Piece 3.

**ALTERATION:** Moderate to low; some fresh olivine.

**VEINS/FRACTURES:** <<1%; 0.2-1 mm; inclined 50 degrees; several parallel fractures in Piece 3; filled with dark greenish black material.



152-917A-64R-3

**UNIT 68: OLIVINE-PLAGIOCLASE-PHYRIC BASALT**

**Pieces 1A-7**

**CONTACTS:** The lower flow contact is seen in Piece 7 at 134 cm. The lowest 30 cm of the flow is red and scoriaceous.

**PHENOCRYSTS:** Olivine - 3%; 0.5-3 mm; equant, euhedral to subhedral. Plagioclase - 1%; 0.5-2 mm; tabular, euhedral.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 1%-4%; 0.5-12 mm; flattened; scattered through Pieces 1-4B; smaller, more abundant and more irregular in the scoriaceous bottom (Pieces 4D-7); filled with green mineral.

**COLOR:** Dark gray (N 4/0); dusky red (10R 3/2) to red (10R 4/6) through Pieces 4D to 7.

**STRUCTURE:** Faint horizontal flow-structure defined by horizontally aligned flat vesicles in Pieces 1-4A; scoriaceous in Pieces 4D-7.

**ALTERATION:** Moderate (no fresh olivine) in Pieces 1-4B; strong in Pieces 4C-5, and complete in Pieces 6-7.

**VEINS/FRACTURES:** <<1%; 1 mm; inclined 60 degrees; one fracture at 12-21 cm, filled with green and white material.

**UNIT 69: APHYRIC OLIVINE BASALT**

**Piece 7**

**CONTACTS:** Flow-top contact to overlying flow at 134 cm.

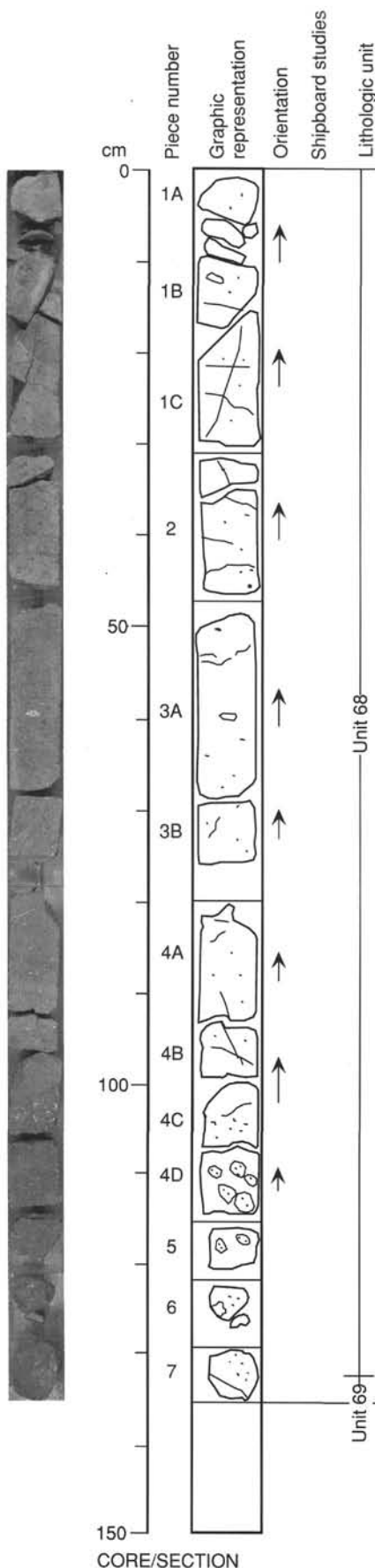
**PHENOCRYSTS:** None.

**VESICLES:** None.

**COLOR:** Red (10R 4/6).

**STRUCTURE:** Baked flow-top; only 1 cm of material.

**ALTERATION:** Complete.



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**UNIT 69: APHYRIC OLIVINE BASALT**

**Pieces 1A-15**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

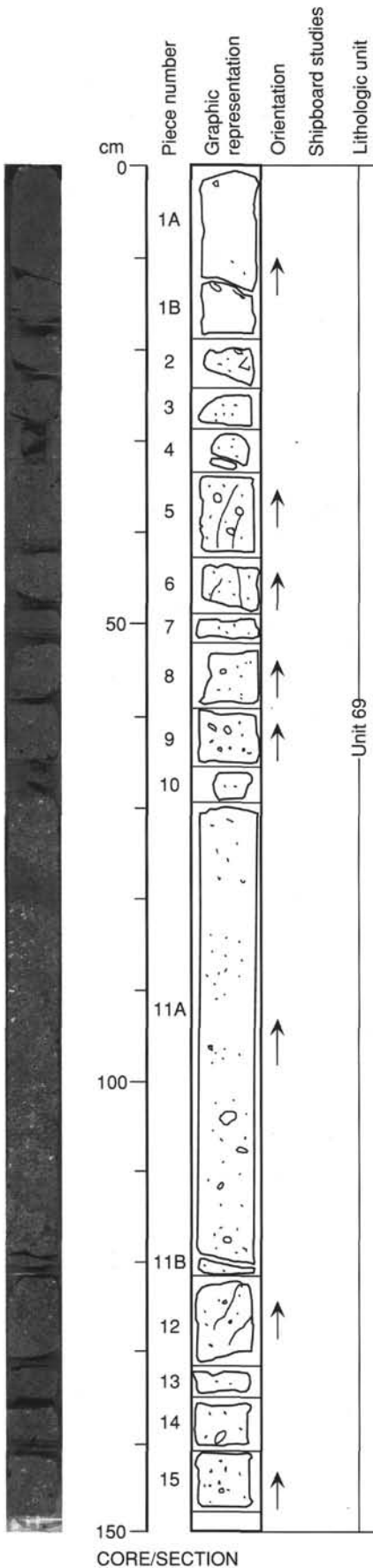
**VESICLES:** 5%–10%; 1–12 mm; round to irregular; disseminated; thin lining of dark green material; filled with calcite or olive green clay; some filled with finely banded material.

**COLOR:** Dark reddish gray (5YR 4/2) at top grading to gray (N 5/0) at base.

**STRUCTURE:** Flow-brecciation.

**ALTERATION:** Strong; oxidized.

**VEINS/FRACTURES:** <1%; <1–2 mm; filled with calcite or green material.



**UNIT 69: APHYRIC OLIVINE BASALT**

**Pieces 1-4**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Medium-grained with stubby plagioclase, pyroxene, and olivine visible.

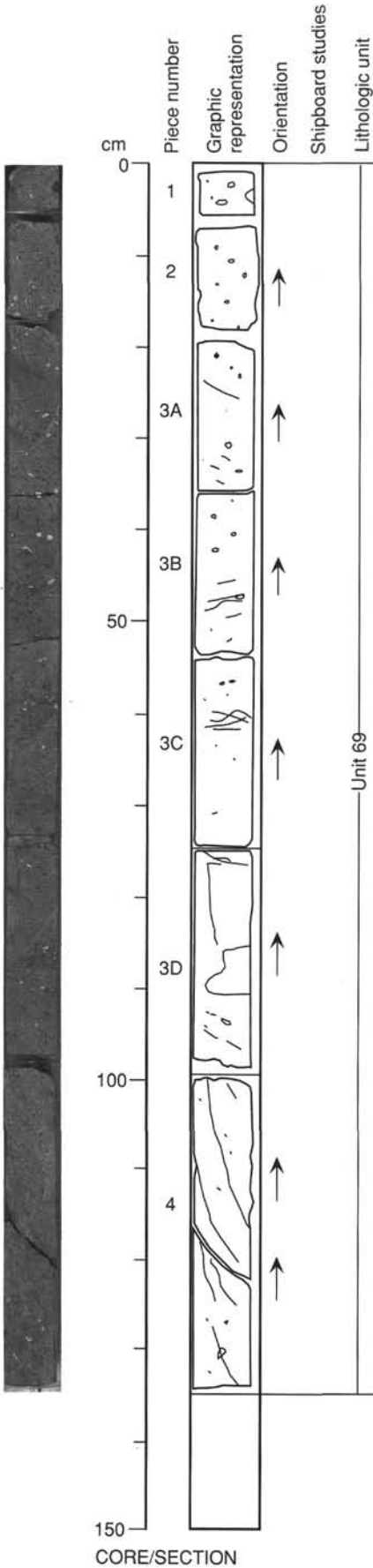
**VESICLES:** 0-5%; 1-10 mm; round to irregular; most abundant in upper 47 cm of section; lined with dark green material and filled with calcite or greenish brown clay.

**COLOR:** Mottled gray (N 5/0).

**STRUCTURE:** Subangular 4-cm chunk of fine-grained vesicular basalt at 86-90 cm.

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** Filled with green material or calcite; mainly localized at 44-50, 58-63, and 90-125 cm, where they are 5%.





152-917A-65R-3

UNIT 69: APHYRIC OLIVINE BASALT

Pieces 1A-3

**PHENOCRYSTS:** None.

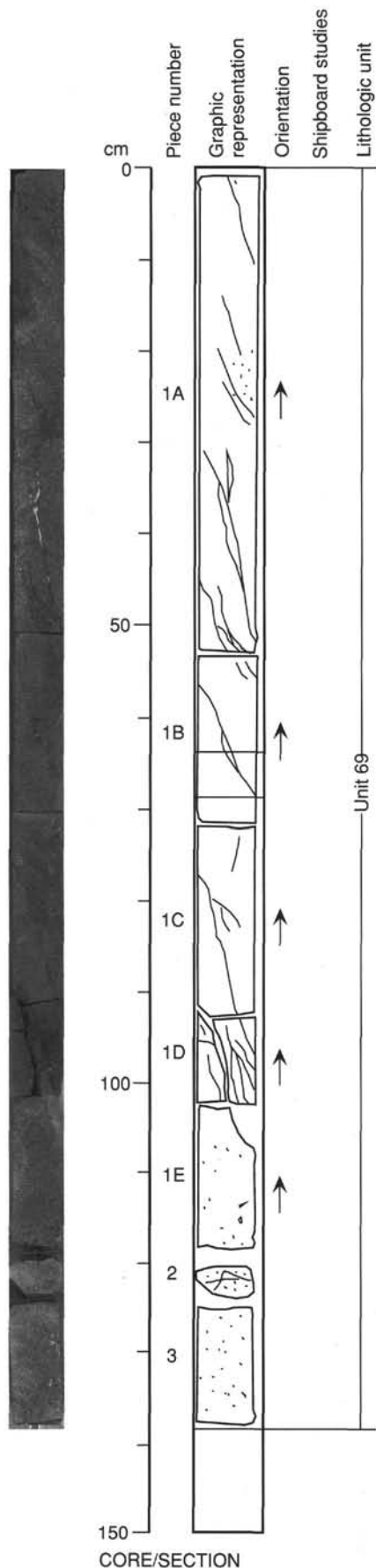
**GROUNDMASS:** Medium-grained in Piece 1A; fine-grained in other pieces.

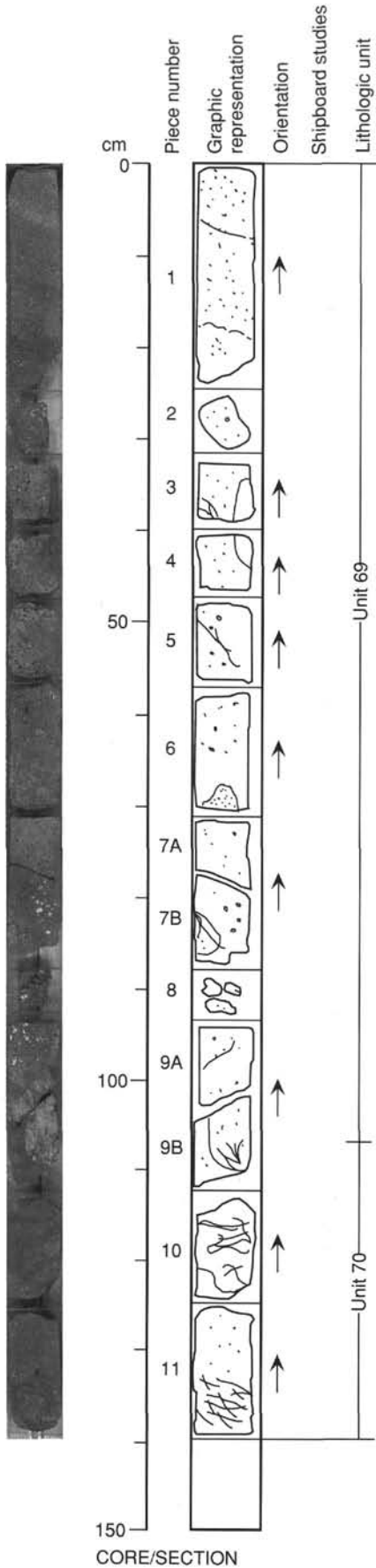
**VESICLES:** 0-5%; 2-5 mm; round; concentrated in Pieces 1E, 2, and 3; filled with green material.

**COLOR:** Dark gray (N 4/0).

**ALTERATION:** Moderate to strong; oxidation around intense fracturing in Piece 1D.

**VEINS/FRACTURES:** <1-3 mm; subvertical; concentrated in Pieces 1A, 1C, 1D, and 2; filled with dark green minerals or calcite; slickensides on surfaces in Piece 1D.





**UNIT 69: APHYRIC OLIVINE BASALT**

**Pieces 1–9B**

**CONTACTS:** Bottom contact in Piece 9B.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained; very fine-grained in Pieces 9A and 9B.  
**VESICLES:** 10%–30%; <1–5 mm; round to amoeboid; Piece 1 has smaller vesicles; Pieces 2–9B have larger ones; vesicles are most abundant in Pieces 1 and 9B.  
**COLOR:** Gray (N 5/0) to dark gray (N 4/0) to dark reddish gray (5YR 4/2) in Piece 1; dark reddish gray and dark gray (5YR 4/1 and 4/2) in Pieces 2–9A; gray (N 5/0) and greenish gray (5GY 5/1) in Piece 9B.  
**STRUCTURE:** Flow-brecciation; subangular 3-cm clast of finer grained vesicular basalt at 84 cm; slight banding due to vesicle orientation in Piece 1.  
**ALTERATION:** Strong.

**UNIT 70: OLIVINE-PLAGIOCLASE-PYROXENE-PHYRIC BASALT**

**Pieces 9B–11**

**CONTACTS:** The flow-top is seen in Piece 9B. It is irregular, reddened, and brecciated.  
**PHENOCRYSTS:** Olivine - 2%; up to 1 mm; equant, subhedral to euhedral. Plagioclase - 1%; up to 2 mm; tabular. Pyroxene - <1%; up to 2 mm; euhedral, prismatic to equant.  
**GROUNDMASS:** Aphanitic.  
**VESICLES:** 1%–3%; up to 1 mm; irregular shape; filled with green and white material.  
**COLOR:** Dusky red (10R 3/2) at the flow-top (Piece 9B) to weak red (10R 4/2) further down (Piece 11).  
**STRUCTURE:** Flow-brecciated, scoriaceous, 0.5–5 cm clasts.  
**ALTERATION:** Strong.

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**UNIT 70: OLIVINE-PLAGIOCLASE-PYROXENE-PHYRIC BASALT**

**Piece 1A-1B**

**PHENOCRYSTS:** Olivine - 2%; up to 1 mm; equant, subhedral to euhedral. Plagioclase - 1%; up to 2 mm; tabular. Pyroxene - <1%; up to 2 mm; euhedral, prismatic to equant.

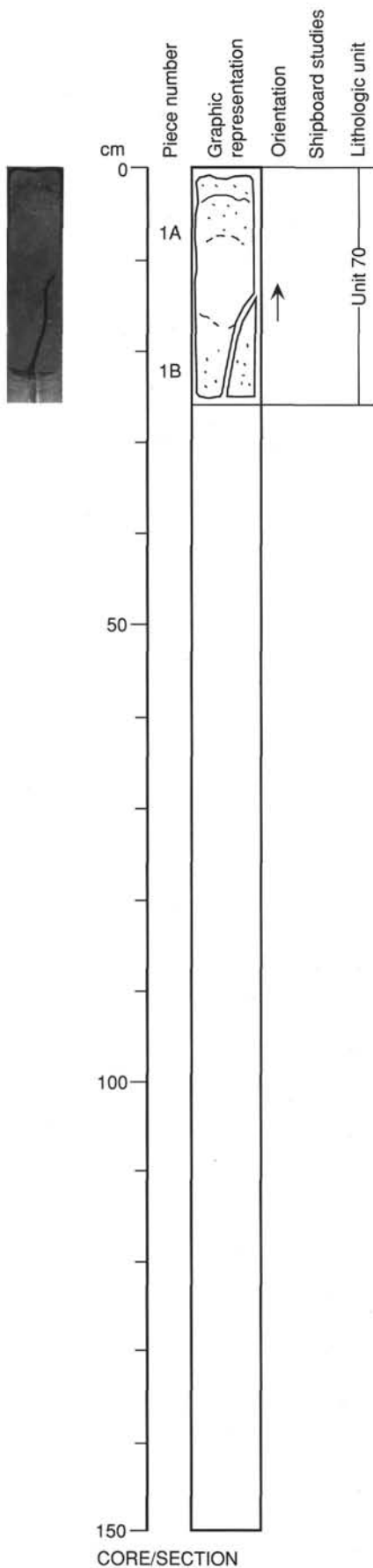
**GROUNDMASS:** Aphanitic.

**VESICLES:** 1%-5%; up to 1 mm; irregular shape; variable due to brecciation; filled with green and white material.

**COLOR:** Weak red (10R 4/2).

**STRUCTURE:** Flow-brecciated; one clast 10 cm large.

**ALTERATION:** Strong.



**UNIT 70: OLIVINE-PLAGIOCLASE-PYROXENE-PHYRIC BASALT**

**Pieces 1-7F**

**PHENOCRYSTS:** Olivine - 2%; up to 1 mm; equant, subhedral to euhedral. Plagioclase - 2%; up to 2 mm; tabular. Pyroxene - 1%; up to 3 mm; euhedral, prismatic to equant.

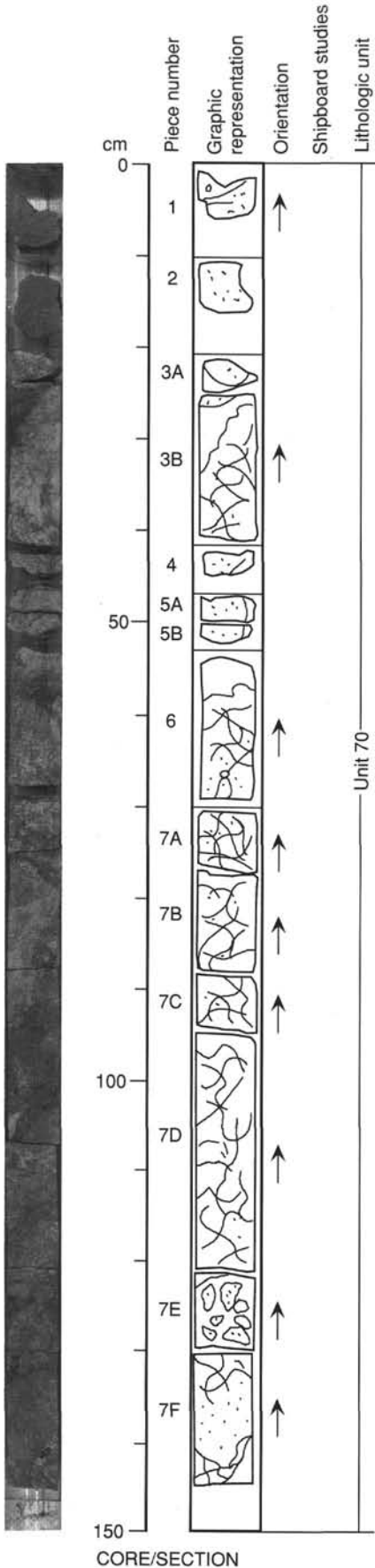
**GROUNDMASS:** Aphanitic.

**VESICLES:** 2%-10%; up to 5 mm; round to irregular shape; variable distribution due to brecciation; filled with green and white material.

**COLOR:** Dark reddish gray (10R 4/1) to dark gray (N 4/0); variable due to brecciation.

**STRUCTURE:** Flow-brecciated; 0.5-10 cm clasts, mostly rounded.

**ALTERATION:** Strong to moderate; no fresh olivine.



CORE/SECTION

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**UNIT 70: OLIVINE-PLAGIOCLASE-PYROXENE-PHYRIC BASALT**

**Pieces 1-2G**

**PHENOCRYSTS:** Olivine - 3%; up to 1 mm; equant, subhedral to euhedral. Plagioclase - 3%; up to 2 mm; tabular. Pyroxene - 1%; up to 4 mm; euhedral, prismatic to equant.

**GROUNDMASS:** Aphanitic.

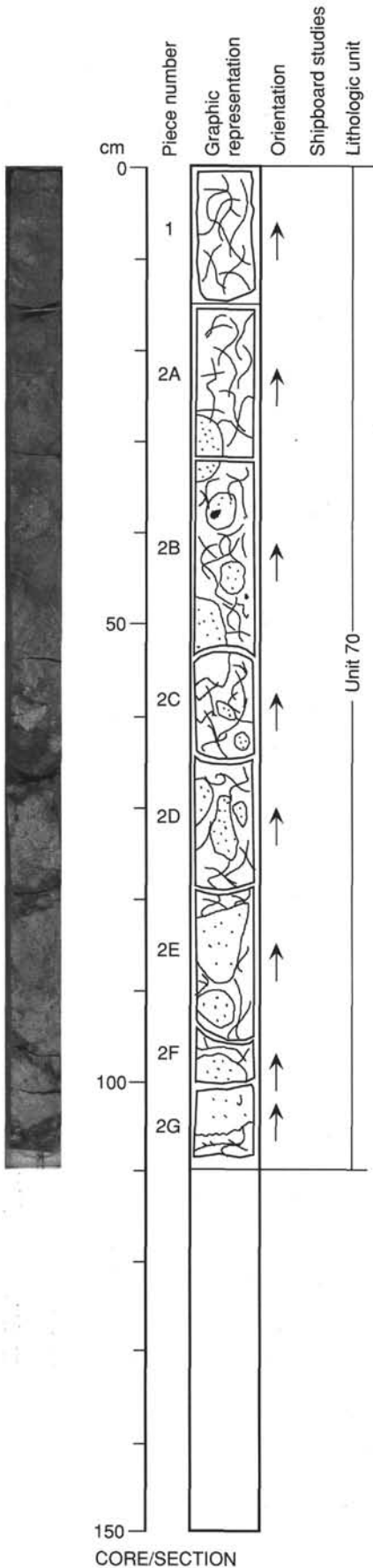
**VESICLES:** 2%-5%; up to 2 mm; irregular shape; variable distribution due to brecciation; filled with green and white material.

**COLOR:** Dark reddish gray (10R 4/1) to dark gray (N 4/0); variable due to brecciation.

**STRUCTURE:** Flow-brecciated; 0.5-15 cm clasts, rounded or lobate.

**ALTERATION:** Strong to moderate; no fresh olivine.

**ADDITIONAL COMMENTS:** Gabbro fragments occur at 40 cm (1.5 cm large) and 46 cm (0.5 cm large).



**UNIT 70: OLIVINE-PLAGIOCLASE-PYROXENE-PHYRIC BASALT**

**Pieces 1A-3B**

**PHENOCRYSTS:** Olivine - 3%; up to 1 mm; equant, subhedral to euhedral. Plagioclase - 3%; up to 2 mm; tabular. Pyroxene - 1%; up to 4 mm; euhedral, prismatic to equant.

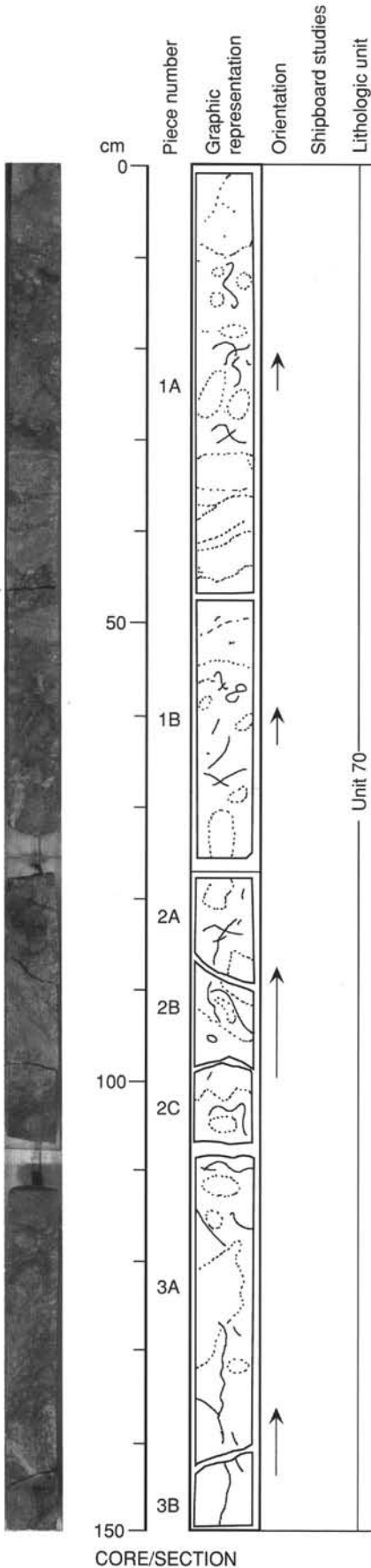
**GROUNDMASS:** Aphanitic.

**VESICLES:** 2%-10%; up to 2 mm; irregular shape; variable distribution due to brecciation; filled with green and white material.

**COLOR:** Dark reddish gray (10R 4/1) to dark gray (N 4/0); variable due to brecciation.

**STRUCTURE:** Flow-brecciated; 0.5-5 cm clasts, rounded and angular.

**ALTERATION:** Strong to moderate; no fresh olivine.

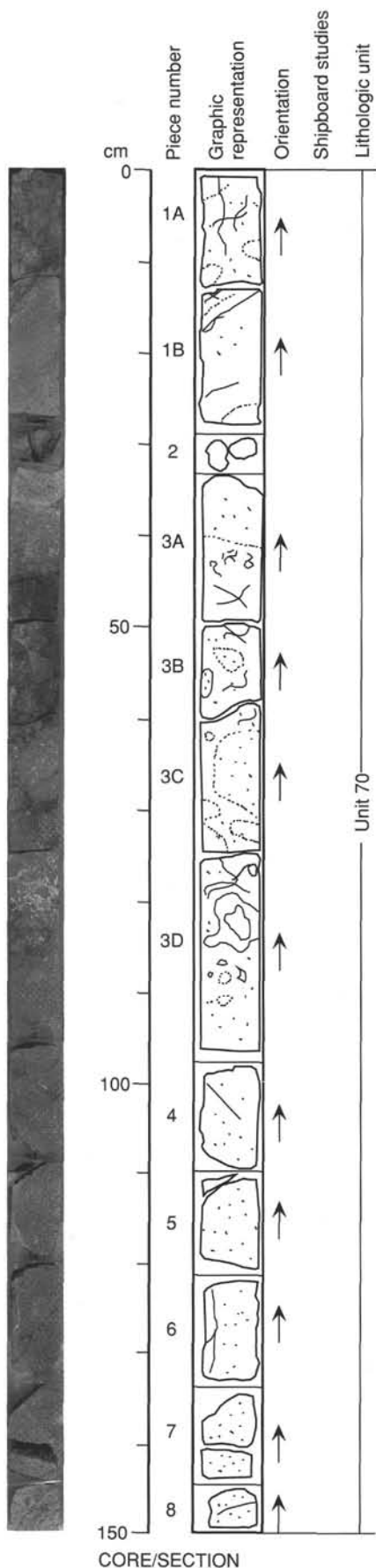


CORE/SECTION

152-917A-66R-4

UNIT 70: OLIVINE-PLAGIOCLASE-PYROXENE-PHYRIC BASALT

Pieces 1A-8



**PHENOCRYSTS:** Olivine - 3%; up to 1 mm; equant, subhedral to euhedral. Plagioclase - 3%; up to 3 mm; tabular. Pyroxene - 1%; up to 4 mm; euhedral, prismatic to equant.

**GROUNDMASS:** Aphanitic.

**VESICLES:** 2%–10%; up to 7 mm; very irregular shape; variable distribution due to brecciation; filled with green and white material.

**COLOR:** Dark reddish gray (10R 4/1) to dark gray (N 4/0); variable due to brecciation.

**STRUCTURE:** Flow-brecciated; 0.5–20 cm clasts, rounded and angular.

**ALTERATION:** Strong to moderate; no fresh olivine.

**VEINS/FRACTURES:** One up to 12-mm-wide, highly irregular vein filled with chalcedony is seen at 76–81 cm.

**ADDITIONAL COMMENTS:** One small (6 mm) gabbro fragment in Piece 5 at 119 cm.

**UNIT 70: OLIVINE-PLAGIOCLASE-PYROXENE-PHYRIC BASALT**

**Pieces 1A-5**

**PHENOCRYSTS:** Olivine - 3%; up to 1 mm; equant, subhedral to euhedral. Plagioclase - 2%; up to 2 mm; tabular. Pyroxene - 1%; up to 4 mm; euhedral, prismatic to equant.

**GROUNDMASS:** Aphanitic.

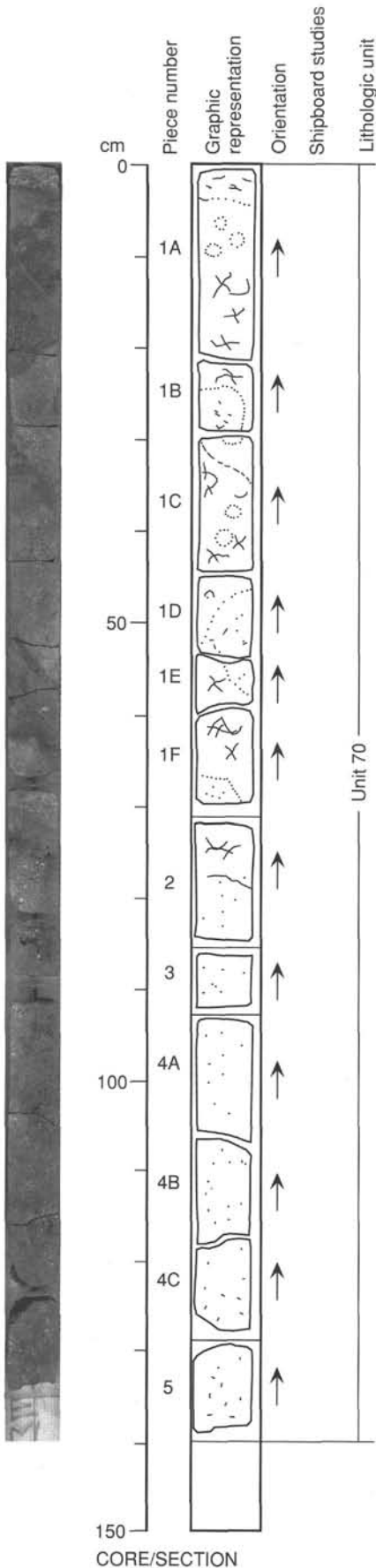
**VESICLES:** 1%-20%; up to 7 mm; round to irregular shape; variable distribution due to brecciation; filled with white material or empty.

**COLOR:** Dark reddish gray (10R 4/1) to dark gray (N 4/0); variable due to brecciation.

**STRUCTURE:** Flow-brecciated; 0.5-5 cm clasts, mostly lobate.

**ALTERATION:** Strong to moderate; no fresh olivine.

**ADDITIONAL COMMENTS:** One cognate?, phenocryst-rich, 12-mm xenolith in Piece 4B at 107 cm.





152-917A-66R-6

UNIT 70: OLIVINE-PLAGIOCLASE-PYROXENE-PHYRIC BASALT

Pieces 1A-3

**PHENOCRYSTS:** Olivine - 3%; up to 1 mm; equant, subhedral to euhedral. Plagioclase - 2%; up to 3 mm; tabular. Pyroxene - 1%; up to 3 mm; euhedral, prismatic to equant.

**GROUNDMASS:** Aphanitic.

**VESICLES:** 2%-10%; up to 4 mm; irregular shape; variable due to brecciation; filled with white material or empty.

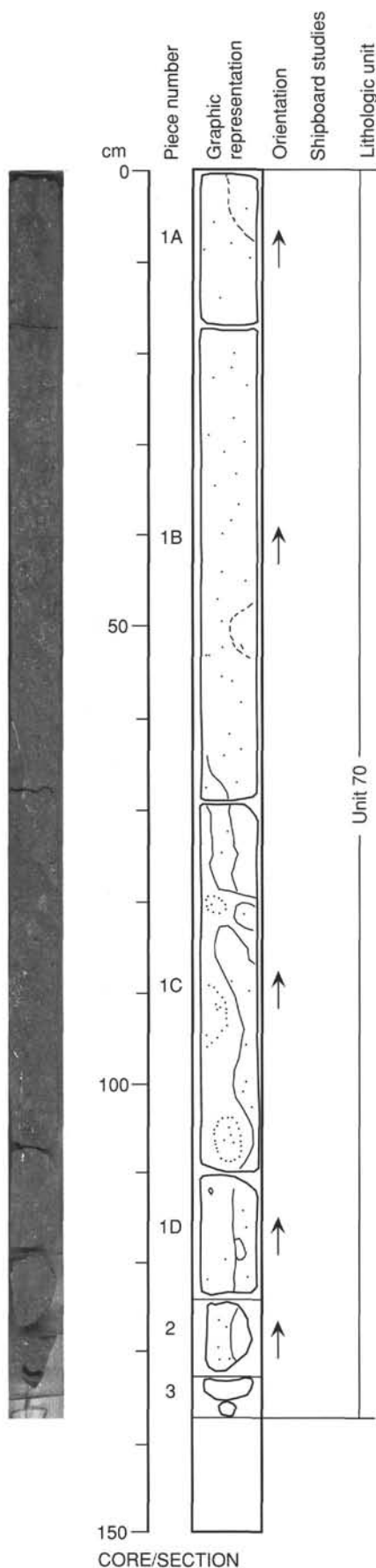
**COLOR:** Dark reddish gray (10R 4/1); matrix patches with red (10R 4/6) in the interval 70-127 cm.

**STRUCTURE:** Flow-brecciated; 0.5-20 cm clasts, mostly lobate.

**ALTERATION:** Strong.

**VEINS/FRACTURES:** One 2-mm-wide vertical vein filled with white and green material is seen at 97-111 cm.

**ADDITIONAL COMMENTS:** One rounded (cognate?) 12 mm xenolith in Piece 1D at 116 cm.



**UNIT 70: PLAGIOCLASE-OLIVINE-PYROXENE-PHYRIC BASALT**

**Pieces 1A-15**

**PHENOCRYSTS:** Plagioclase - 5%; up to 6 mm; tabular. Olivine - 2%; up to 5 mm; equant, euhedral to subhedral. Pyroxene - 1%; up to 2 mm; euhedral, prismatic to equant.

**GROUNDMASS:** Aphanitic.

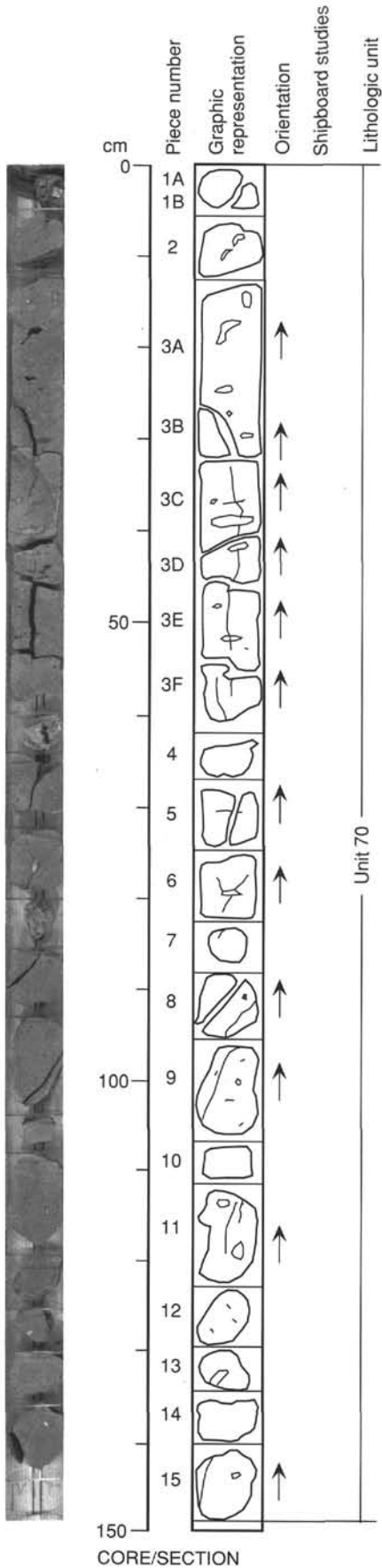
**VESICLES:** 1%; 1-50 mm; irregular; mostly in upper half of section; open or filled with green mineral or chalcedony in top 80 cm. Calcite-filled in bottom 30 cm. Piece 4 is a detached 5-cm chalcedony amygdale.

**COLOR:** Medium gray (N 5/0).

**ALTERATION:** Moderate; olivine completely altered to dark green mineral.

**VEINS/FRACTURES:** <1%; up to 2 mm; steeply inclined to vertical; filled with dark green mineral, with chalcedony adjacent to large amygdale in Piece 3A.

**ADDITIONAL COMMENTS:** 15-mm angular gabbro xenolith in Piece 3A.



152-917A-67R-2

**UNIT 70: PLAGIOCLASE-OLIVINE-PYROXENE-PHYRIC BASALT**

**Pieces 1-10**

**PHENOCRYSTS:** Large (15 mm) prismatic pyroxene phenocryst in Piece 6. Plagioclase - 5%; up to 5 mm; tabular. Olivine - 2%; up to 5 mm; equant, euhedral to subhedral. Pyroxene - 1%; up to 15 mm; euhedral, prismatic to equant.

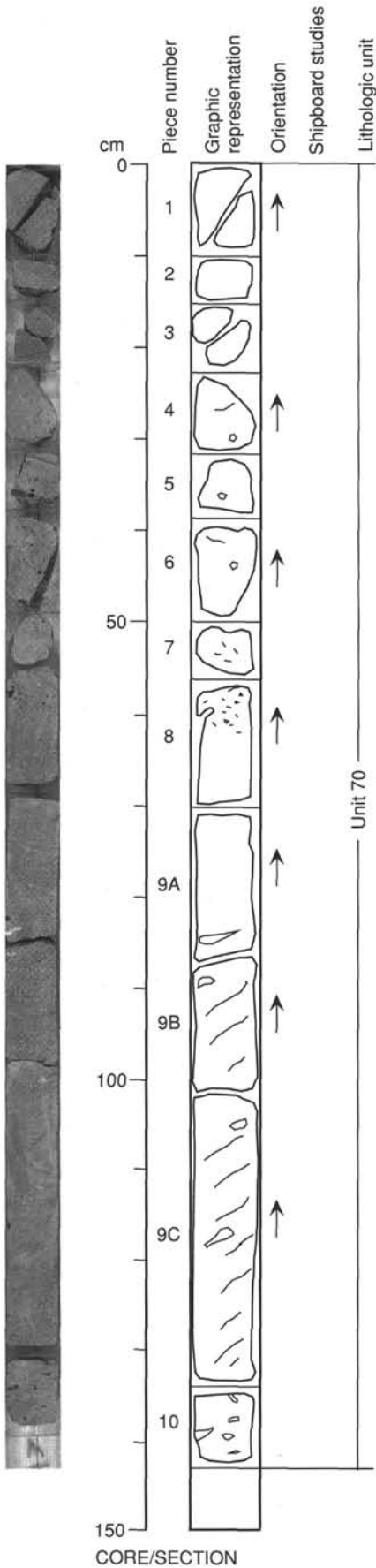
**GROUNDMASS:** Aphanitic.

**VESICLES:** 0-5%; up to 5 mm; spherical to irregular; patchy distribution; lined with green mineral and filled with calcite, or filled with green mineral. Some empty vesicles.

**COLOR:** Dark gray (N 3/0).

**ALTERATION:** Moderate; olivine completely altered to dark green mineral.

**VEINS/FRACTURES:** None.



CORE/SECTION

**UNIT 70: PLAGIOCLASE-OLIVINE-PYROXENE-PHYRIC BASALT**

**Pieces 1-8**

**PHENOCRYSTS:** Plagioclase - 5%; up to 6 mm; tabular. Olivine - 2%; up to 2 mm; equant, euhedral to subhedral. Pyroxene - 1%; up to 2 mm; euhedral, prismatic to equant.

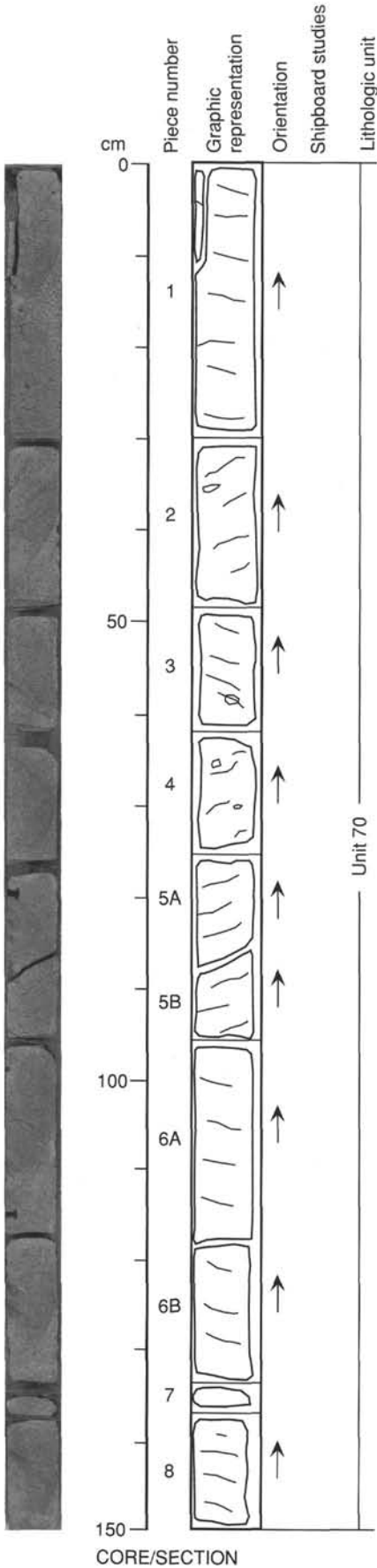
**GROUNDMASS:** Aphanitic.

**VESICLES:** <1%; up to 8 mm; irregular; random distribution; lined with dark green mineral and filled with calcite.

**COLOR:** Dark gray (N 3/0).

**ALTERATION:** Moderate; olivine completely altered to dark green mineral.

**VEINS/FRACTURES:** <1%; up to 2 mm; inclined; filled with dark green mineral and calcite.



CORE/SECTION

152-917A-67R-4

**UNIT 70: PLAGIOCLASE-OLIVINE-PYROXENE-PHYRIC BASALT**

**Pieces 1A-6**

**PHENOCRYSTS:** Plagioclase - 5%; up to 6 mm; tabular. Olivine - 2%; up to 2 mm; equant, euhedral to subhedral. Pyroxene - 1%; up to 2 mm; euhedral, prismatic to equant.

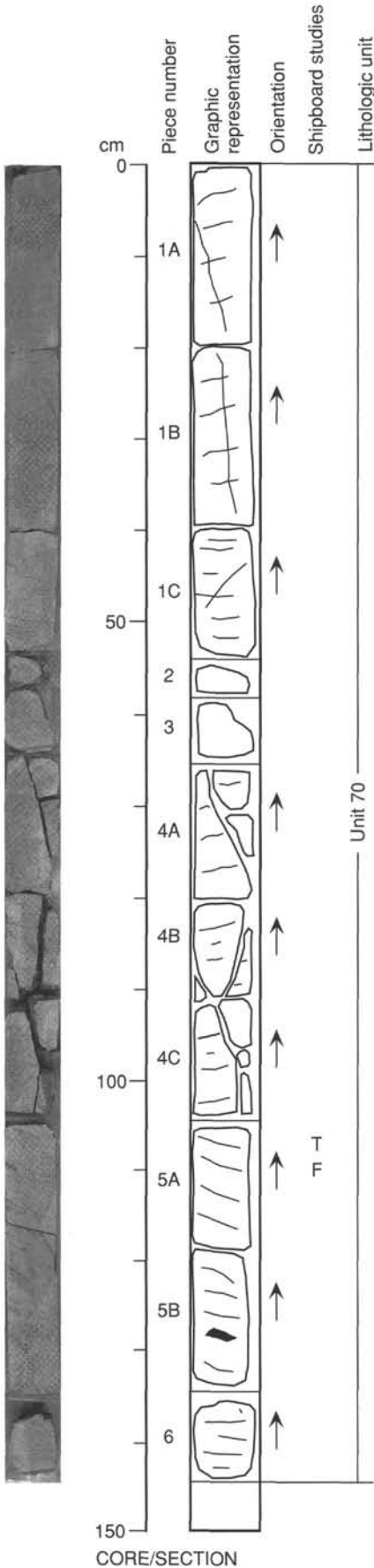
**GROUNDMASS:** Aphanitic.

**VESICLES:** <1%; up to 8 mm; irregular; random distribution; lined with dark green mineral and filled with calcite.

**COLOR:** Dark gray (N 3/0).

**ALTERATION:** Moderate; olivine completely altered to dark green mineral.

**VEINS/FRACTURES:** <<1%; up to 0.5 mm; steeply inclined to vertical; calcite-filled.



**UNIT 70: PLAGIOCLASE-OLIVINE-PYROXENE-PHYRIC BASALT**

**Pieces 1-4**

**PHENOCRYSTS:** Plagioclase - 5%; up to 6 mm; tabular. Olivine - 2%; up to 2 mm; equant, euhedral to subhedral. Pyroxene - 1%; up to 2 mm; euhedral, prismatic to equant.

**GROUNDMASS:** Aphanitic.

**VESICLES:** <1%; up to 4 mm; flattened; filled with dark green mineral and calcite.

**COLOR:** Dark gray (N 3/0).

**ALTERATION:** Moderate; olivine completely altered to dark green mineral.

**VEINS/FRACTURES:** None.

**UNIT 71: APHYRIC OLIVINE BASALT**

**Pieces 5-9**

**PHENOCRYSTS:** None.

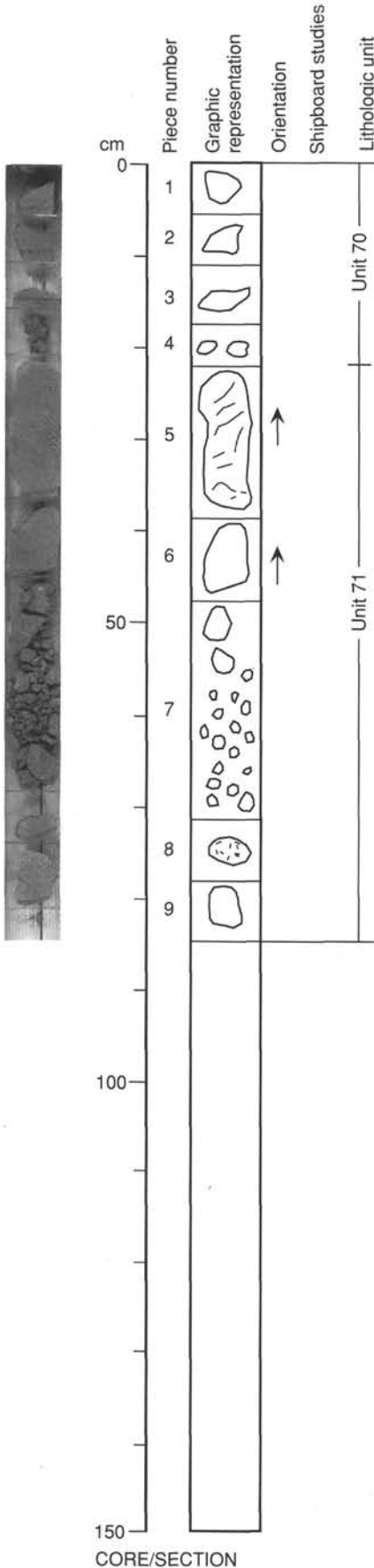
**GROUNDMASS:** Fine-grained.

**VESICLES:** 1%; up to 5 mm; irregular; random distribution; mostly empty with white linings; lined with dark green mineral and filled with calcite in Piece 9.

**COLOR:** Grayish red (10R 4/2); medium dark gray (N 4/0) in Piece 9.

**ALTERATION:** Strong (Pieces 5-8) to moderate (Piece 9).

**VEINS/FRACTURES:** None.

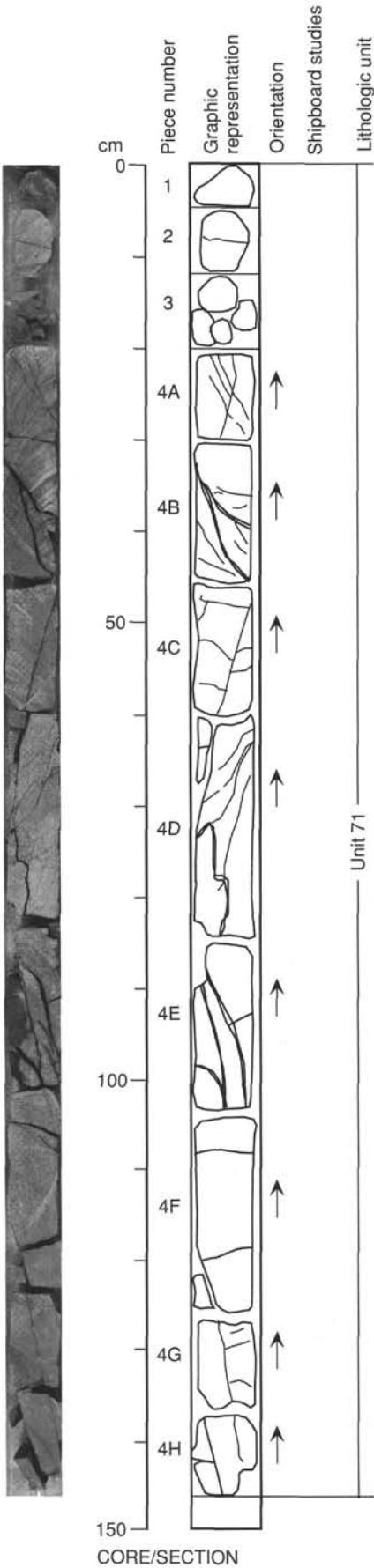


152-917A-69R-1

UNIT 71: APHYRIC OLIVINE BASALT

Pieces 1-4H

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** <1%; 0.5-1 mm; spherical; random distribution; filled with dark green material and minor calcite.  
**COLOR:** Greenish black (5GY 2/1).  
**ALTERATION:** Moderate.  
**VEINS/FRACTURES:** 0-5%; 1 mm; random orientation; Pieces 4A-4D are heavily fractured; some pieces lined with green material and minor calcite.



**UNIT 71: APHYRIC OLIVINE BASALT**

**Pieces 1-4**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

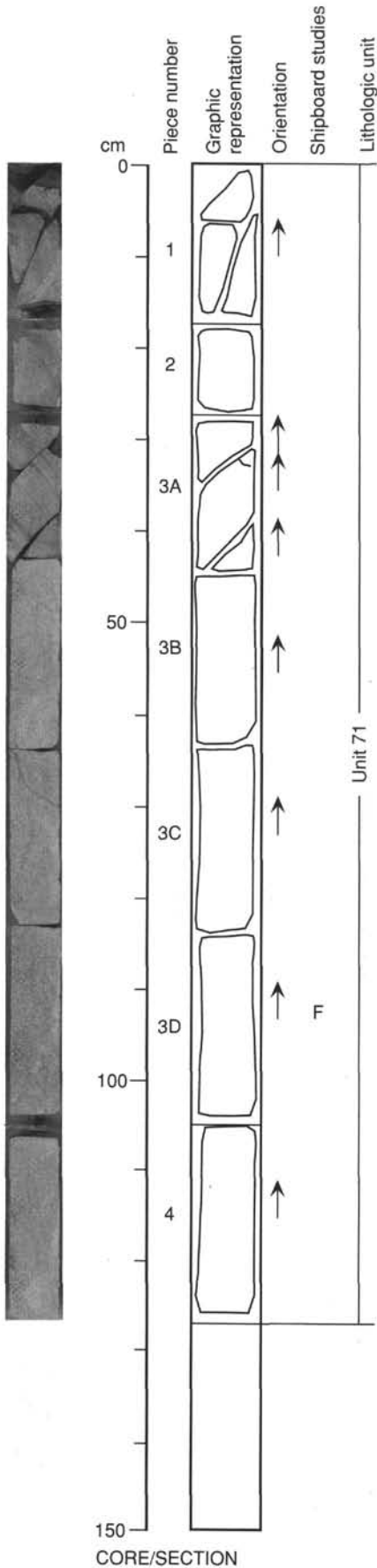
**VESICLES:** <<1%; 0.5-1 mm; spherical; random distribution; filled with calcite.

**COLOR:** Medium dark gray (N 4/0).

**ALTERATION:** Moderate to slight/moderate in central portion of section.

**VEINS/FRACTURES:** 1 mm; random orientation; a few fractures with slickensides in Pieces 1 and 3A.

**ADDITIONAL COMMENTS:** Relatively unfractured part of the flow.



CORE/SECTION

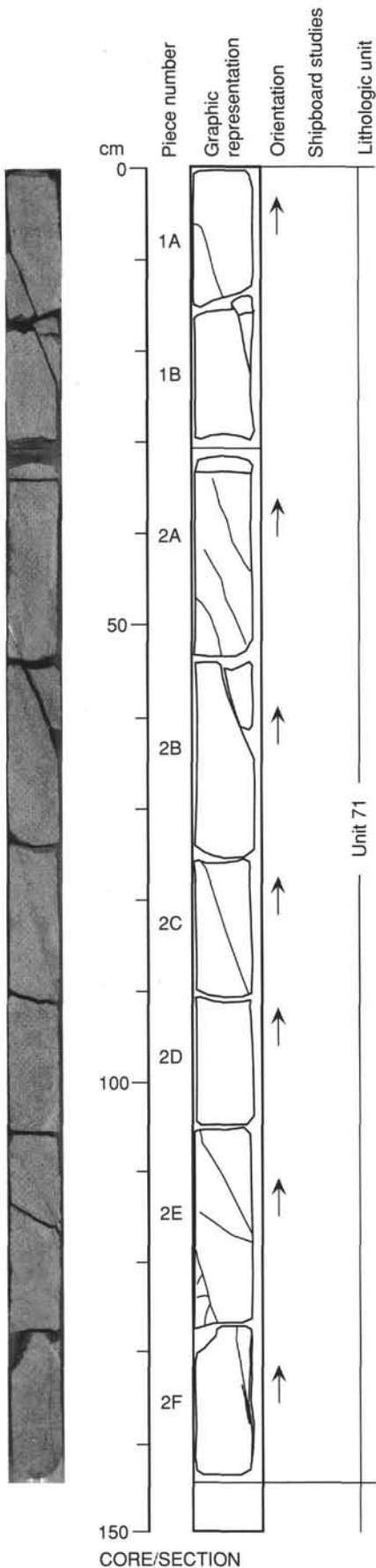


152-917A-69R-3

**UNIT 71: APHYRIC OLIVINE BASALT**

**Pieces 1A-2F**

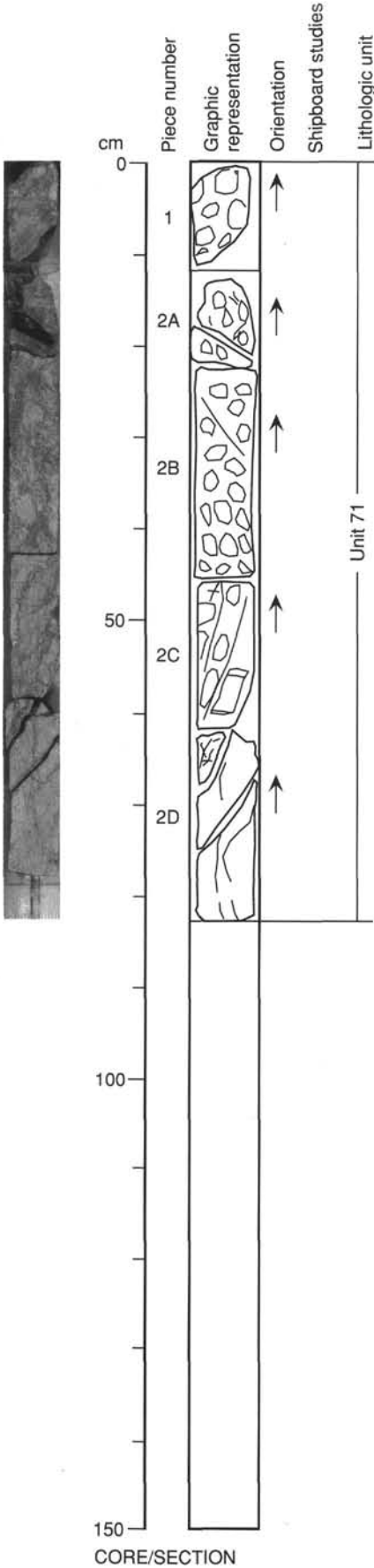
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** <<1%; 0.5-1 mm; spherical; random distribution; filled with calcite.  
**COLOR:** Greenish black (5GY 2/1).  
**STRUCTURE:** Slight brecciation at bottom of section.  
**ALTERATION:** Moderate.  
**VEINS/FRACTURES:** <1%; 1 mm; inclined; in all pieces; filled with calcite; some oxidation along edges; some slickensides.



**UNIT 71: APHYRIC OLIVINE BASALT**

**Pieces 1-2D**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained to aphanitic.  
**VESICLES:** <<1%; 0.5-1 mm; spherical; random distribution; filled with calcite.  
**COLOR:** Greenish black (5GY 2/1).  
**STRUCTURE:** Brecciated in Pieces 1-2C; dark green matrix with some oxidation staining.  
**ALTERATION:** Moderate to strong.  
**VEINS/FRACTURES:** 1%; 1 mm; inclined; in Piece 2D; slickensides on fracture surfaces.  
**ADDITIONAL COMMENTS:** Appears to be a fault within the flow.



152-917A-70R-1

UNIT 71: APHYRIC OLIVINE BASALT

Pieces 1A-1G

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

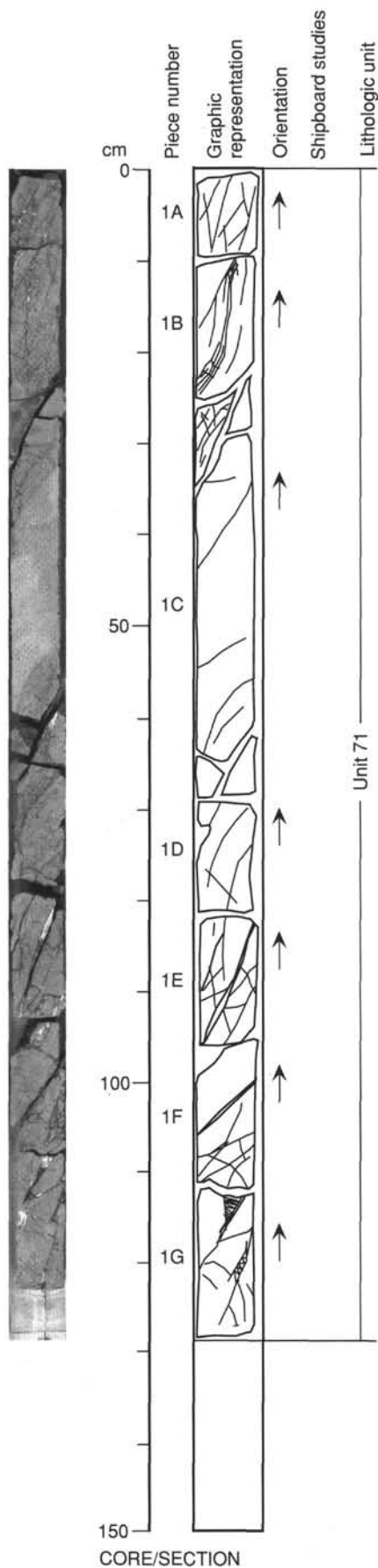
**VESICLES:** <<1%; 0.5-2 mm; spherical; only in Piece 1C; calcite-filled.

**COLOR:** Greenish black (5G 2/1).

**STRUCTURE:** Brecciation associated with steeply inclined fractures, 0-34 and 60-125 cm. Steeply inclined slickensides on fracture surfaces.

**ALTERATION:** Moderate; some oxidation around fractures.

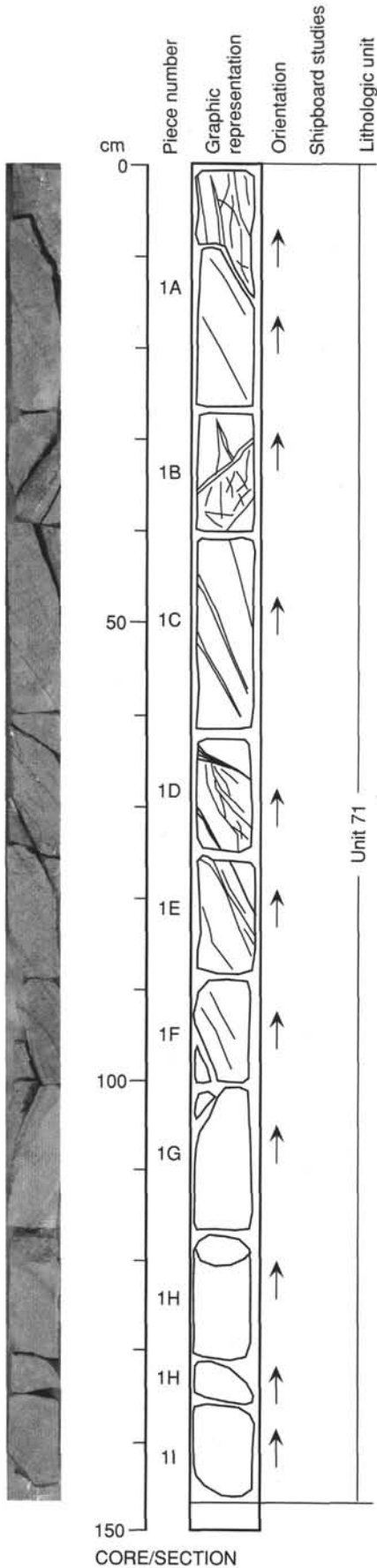
**VEINS/FRACTURES:** 5%; up to 10 mm; steeply inclined; filled with chlorite and calcite.



**UNIT 71: APHYRIC OLIVINE BASALT**

**Pieces 1A-1I**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** None.  
**COLOR:** Greenish black (5G 2/1).  
**STRUCTURE:** Brecciation associated with fractures. Steeply inclined slickensides on fracture surfaces.  
**ALTERATION:** Moderate; some oxidation around fractures.  
**VEINS/FRACTURES:** 3%; up to 5 mm; steeply inclined; filled with chlorite and calcite.

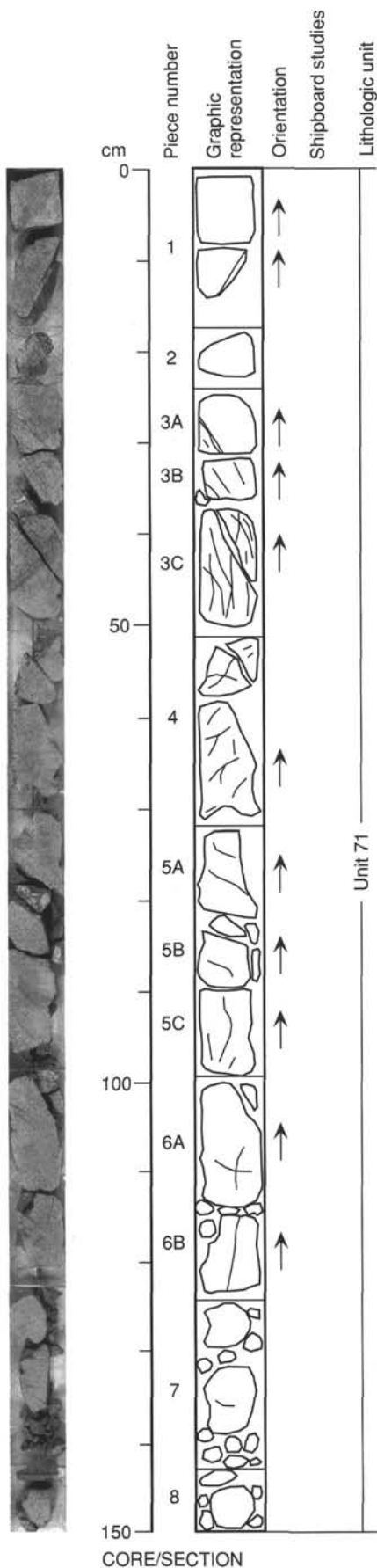


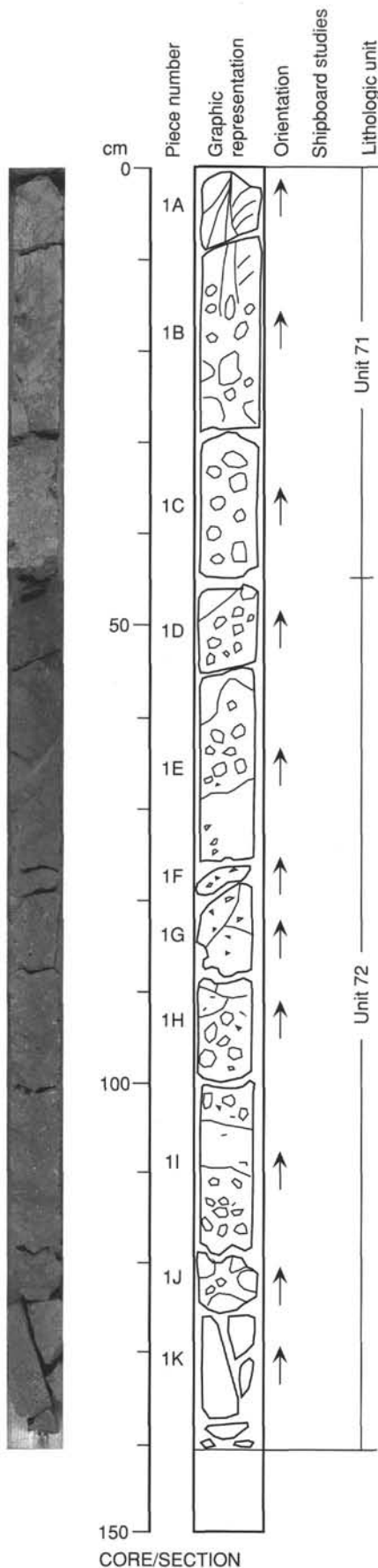
152-917A-70R-3

**UNIT 71: APHYRIC OLIVINE BASALT**

**Pieces 1-8**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** None.  
**COLOR:** Greenish black (5G 2/1).  
**STRUCTURE:** Brecciation associated with fractures.  
**ALTERATION:** Moderate; some oxidation around fractures in top 40 cm.  
**VEINS/FRACTURES:** 2%; up to 2 mm; steeply inclined; filled with chlorite and some calcite.





**UNIT 71: APHYRIC OLIVINE BASALT**

**Pieces 1A-1C**

**CONTACTS:** Faulted contact below Piece 1C.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** None.  
**COLOR:** Greenish gray (5G 6/1).  
**STRUCTURE:** Numerous fractures in Piece 1A grade into intensely brecciated zone at 16 cm.  
**ALTERATION:** Moderate.  
**VEINS/FRACTURES:** 5%; up to 2 mm; inclined to vertical; filled with calcite and chlorite  
**ADDITIONAL COMMENTS:** Hanging wall of fault zone.

**UNIT 72: PLAGIOCLASE-OLIVINE-PYROXENE-PHYRIC BASALT**

**Pieces 1D-1K**

**CONTACTS:** Faulted contacts at top of 1D, and between 1D and 1E.  
**PHENOCRYSTS:** Plagioclase - 5%; up to 5 mm; tabular. Olivine - 2%; up to 2 mm; equant, euhedral to subhedral. Pyroxene - 1%; up to 2 mm; euhedral.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 5%; up to 10 mm; spherical to irregular; random distribution; filled with chlorite, epidote, and calcite.  
**COLOR:** Olive black (5Y 2/1).  
**STRUCTURE:** Intensely brecciated to 124 cm. Part of fault zone; fault plane dips 45 degrees with slickensides dipping 40 degrees (see arrows on log).  
**ALTERATION:** Moderate; olivine completely altered.  
**VEINS/FRACTURES:** 10%; up to 10 mm; random orientation; fractures within fault breccia filled with chlorite and rock fragments.  
**ADDITIONAL COMMENTS:** Footwall of fault zone.

152-917A-71R-2

UNIT 72: PLAGIOCLASE-OLIVINE-PYROXENE-PHYRIC BASALT

Pieces 1-12

**PHENOCRYSTS:** Plagioclase - 6%; up to 4 mm; euhedral, tabular. Olivine - 2%; up to 2 mm; euhedral, equant. Pyroxene - 1%; up to 2 mm; euhedral.

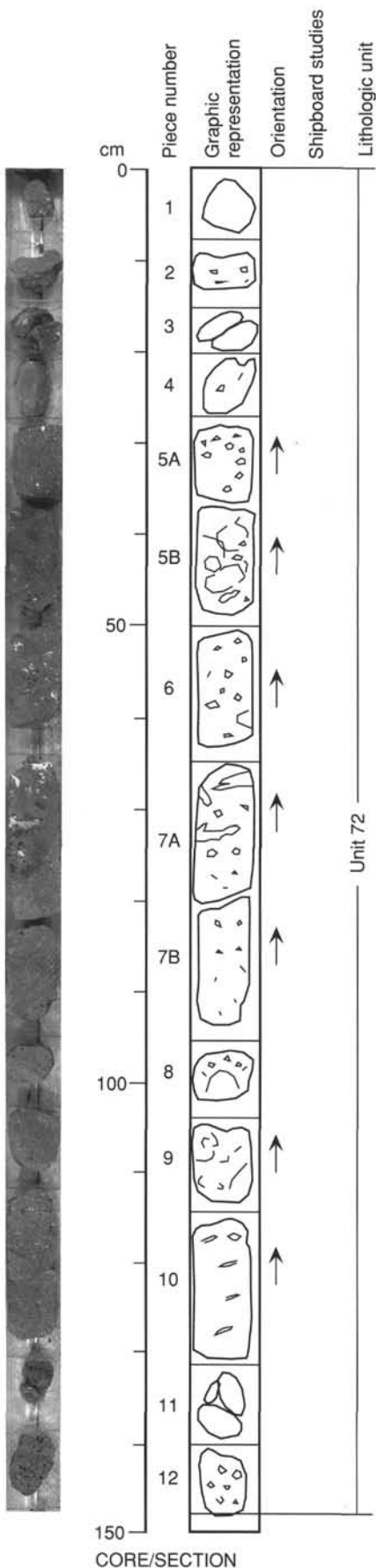
**GROUNDMASS:** Fine-grained.

**VESICLES:** 5%-10%; 1-30 mm; spherical to flattened; lined with a pale greenish yellow mineral; larger ones also filled with calcite.

**COLOR:** Dark gray (5YR 4/1).

**STRUCTURE:** Flow-banding defined by alignment of flattened vesicles in Pieces 9 and 10; flow-brecciation in Pieces 5-7.

**ALTERATION:** Moderate; slightly oxidized.



CORE/SECTION

**UNIT 72: PLAGIOCLASE-OLIVINE-PYROXENE-PHYRIC BASALT**

**Pieces 1-10**

**PHENOCRYSTS:** Plagioclase - 6%; up to 4 mm; euhedral, tabular. Olivine - 2%; up to 2 mm; euhedral, equant. Pyroxene - 1%; up to 2 mm; euhedral.

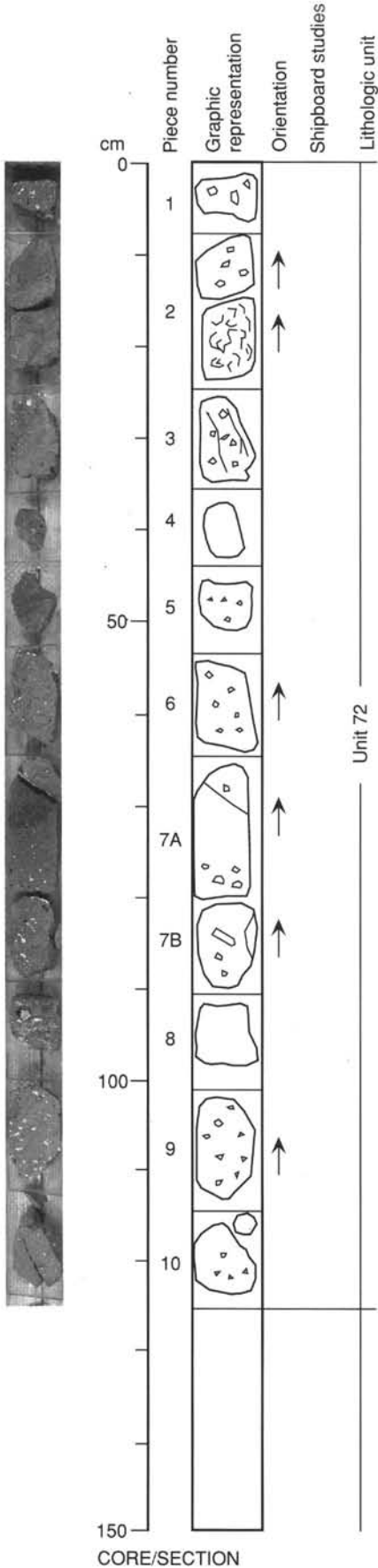
**GROUNDMASS:** Fine-grained.

**VESICLES:** 1%-5%; up to 15 mm; spherical to irregular; inhomogeneous distribution; filled with calcite and a green mineral.

**COLOR:** Dark gray (5YR 4/1).

**STRUCTURE:** Some flow-brecciation.

**ALTERATION:** Moderate; slightly oxidized.





152-917A-71R-4

**UNIT 72: PLAGIOCLASE-OLIVINE-PYROXENE-PHYRIC BASALT**

**Pieces 1A-6**

**PHENOCRYSTS:** Plagioclase - 6%; up to 4 mm; euhedral, tabular to lath shaped. Olivine - 2%; up to 2 mm; euhedral, equant. Pyroxene - 1%; up to 2 mm; euhedral.

**GROUNDMASS:** Fine-grained.

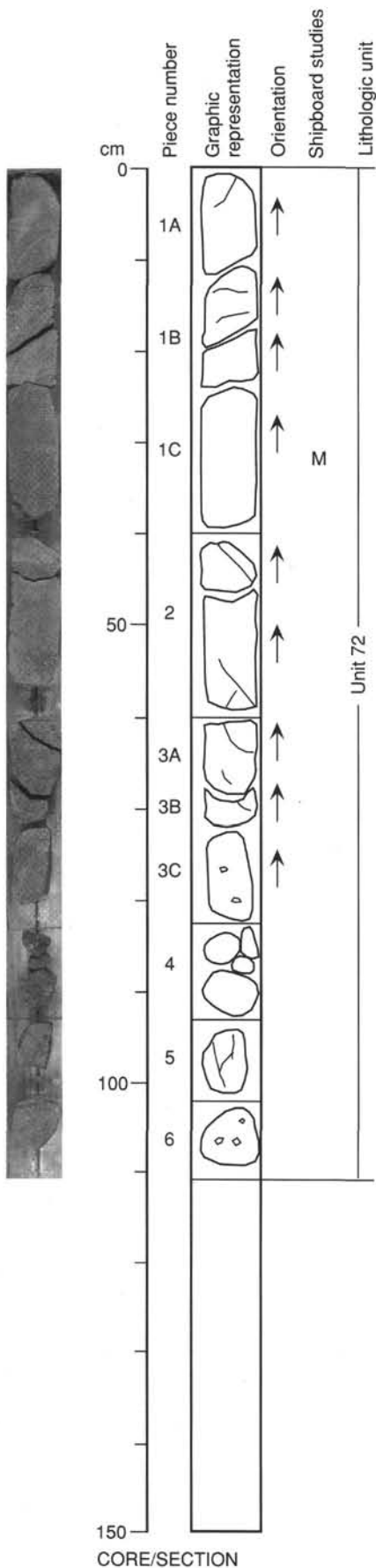
**VESICLES:** 0-2%; up to 2 mm; spherical; random; lined with a green mineral; filled with calcite.

**COLOR:** Dark gray (N 4/0).

**STRUCTURE:** Some flow-brecciation.

**ALTERATION:** Massive.

**VEINS/FRACTURES:** <1%; <1 mm; subhorizontal; filled with green mineral.



**UNIT 73A: OLIVINE-PHYRIC BASALT**

**Pieces 1-3E**

**PHENOCRYSTS:** Olivine - 5%; up to 1.5 mm; euhedral, equant. Plagioclase - up to 1.5 mm; euhedral; seen only in Pieces 1-3B.

**GROUNDMASS:** Fine-grained.

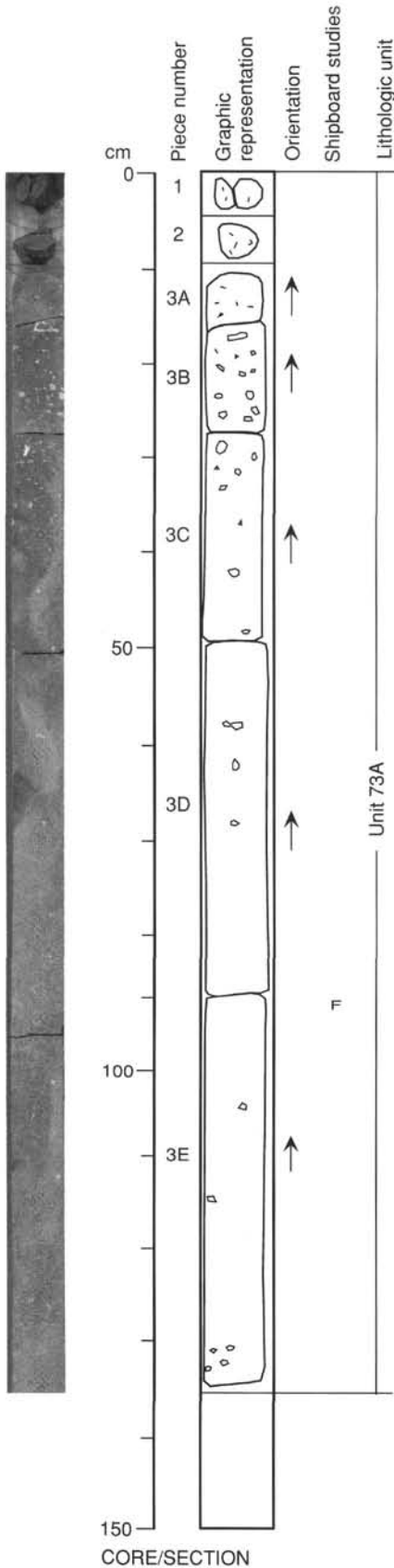
**VESICLES:** 0-10%; 1-7 mm; spherical to irregular; most abundant in 0-40 cm; filled with calcite and a pale bluish green mineral.

**COLOR:** Dark gray (N 4/0) except Pieces 1 and 2, which are brownish gray (5YR 4/1).

**STRUCTURE:** Massive at 0-130 cm.

**ALTERATION:** Low in massive portions; Pieces 1 and 2 are oxidized.

**VEINS/FRACTURES:** <1%; <1 mm; filled with white mineral.



152-917A-72R-2

**UNIT 73A: OLIVINE-PHYRIC BASALT**

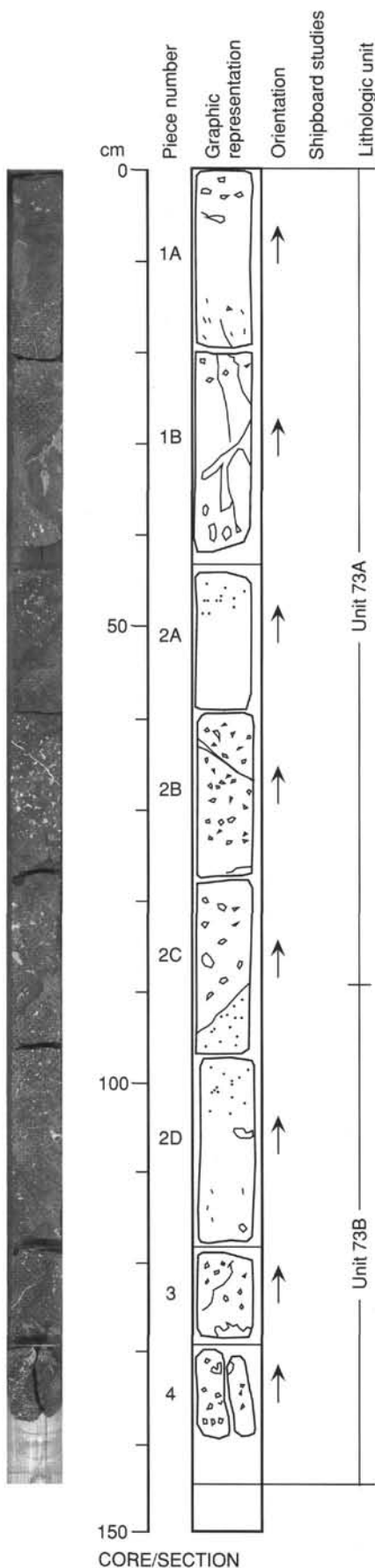
**Pieces 1A–2C**

**CONTACTS:** Bottom contact in Piece 2C at 90–94 cm. Basal 0.5 cm is very fine-grained and greenish gray.  
**PHENOCRYSTS:** Olivine - 5%; up to 1.5 mm; euhedral, equant.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 0–15%; 1–20 mm; spherical to irregular; inhomogeneous distribution; vertically aligned vesicles in Piece 1B; filled with calcite and green material.  
**COLOR:** Dark gray (N 4/0).  
**ALTERATION:** Moderate; no fresh olivine.  
**VEINS/FRACTURES:** 1%; <1–2 mm; filled with calcite and green material.

**UNIT 73B: OLIVINE-PHYRIC BASALT**

**Pieces 2C–4**

**CONTACTS:** Top contact in Piece 2C at 90–94 cm.  
**PHENOCRYSTS:** Olivine - 5%; up to 1 mm; euhedral, equant.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 0–20%; 1–5 mm; round to irregular; patchy distribution; mostly near flow-top and in Piece 4.  
**COLOR:** Dark gray (N 4/0) with reddish tinge.  
**STRUCTURE:** Some slight flow-brecciation.  
**ALTERATION:** Moderate to strong; no fresh olivine.  
**VEINS/FRACTURES:** One 0.5–2 mm calcite vein crosses Piece 3.



**UNIT 73B: OLIVINE-PHYRIC BASALT**

**Pieces 1-3C**

**PHENOCRYSTS:** Olivine - 5%-10%; up to 1 mm; euhedral, equant.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 0-3%; 1-10 mm; round to irregular; patchy distribution; filled with calcite and green material; confined to a few zones within the section.

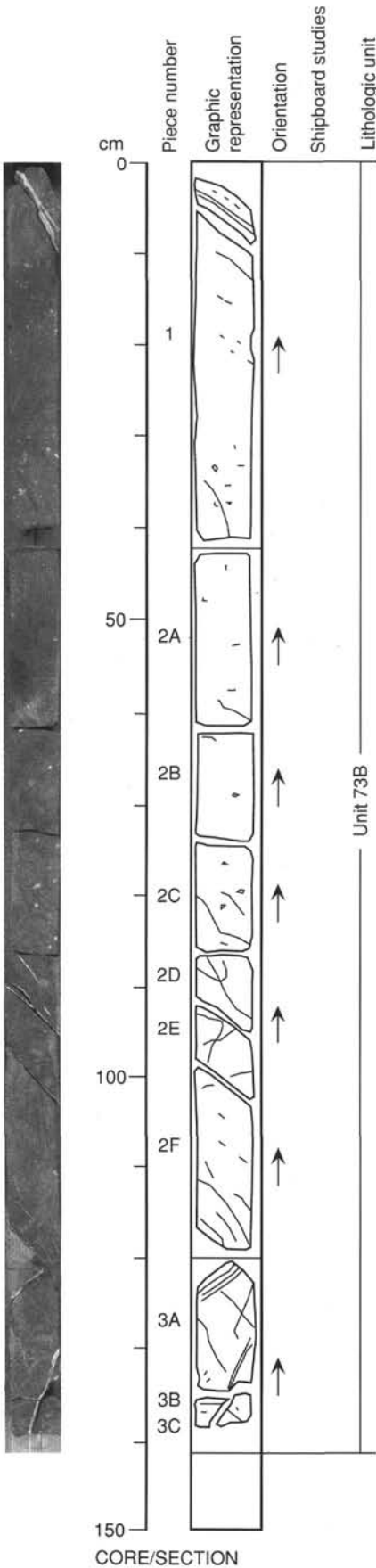
**COLOR:** Dark gray (N 3/0).

**STRUCTURE:** Massive in the nonvesicular zones.

**ALTERATION:** Low; some fresh olivine.

**VEINS/FRACTURES:** 2%; 0.1-10 mm; inclined 60-70 degrees; prominent; filled with calcite and green material.

**ADDITIONAL COMMENTS:** Rock splits along the fractures.



152-917A-72R-4

UNIT 73B: OLIVINE-PHYRIC BASALT

Pieces 1A-7

**PHENOCRYSTS:** Olivine - 5%-10%; up to 1 mm; euhedral, equant.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 0-3%; 1-5 mm; round; only around 70-80 cm; filled with calcite and a green material.

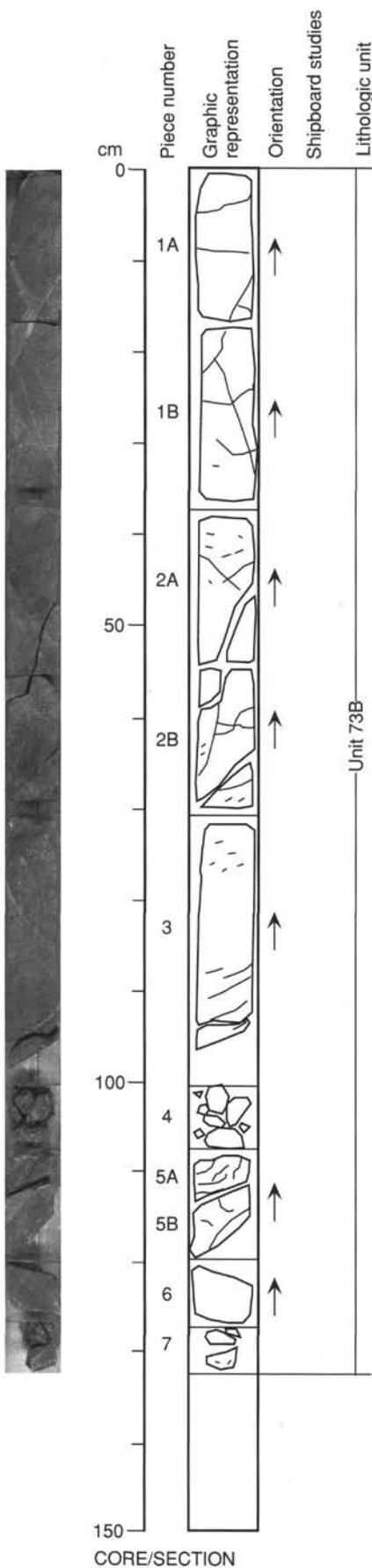
**COLOR:** Dark gray (N 3/0).

**STRUCTURE:** Massive.

**ALTERATION:** Low; some fresh olivine.

**VEINS/FRACTURES:** 1%; 0.1-2 mm; inclined 30-70 degrees.

**ADDITIONAL COMMENTS:** Rock splits along the fractures.



CORE/SECTION

**UNIT 73B: OLIVINE-PHYRIC BASALT**

**Pieces 1–6H**

**PHENOCRYSTS:** Olivine - 5%–10%; up to 2 mm; euhedral, equant to somewhat elongate.

**GROUNDMASS:** Fine-grained.

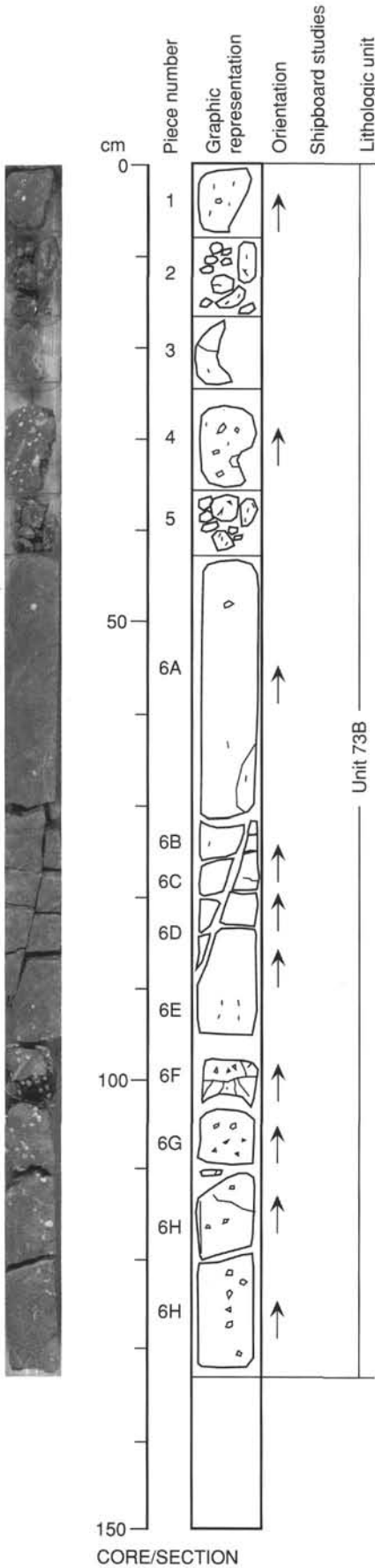
**VESICLES:** 0–10%; 1–10 mm; round to lobate; distribution; mostly in Pieces 1–5 and 6F–6H; filled with calcite, or lined with greenish mineral and filled with expanding clay.

**COLOR:** Dark gray (N 3/0).

**STRUCTURE:** Pieces 6A–6E are massive.

**ALTERATION:** Low; some fresh olivine.

**VEINS/FRACTURES:** <<1%; 1 mm; steeply inclined; one vein at 60–90 cm.



152-917A-72R-6

UNIT 73B: OLIVINE-PHYRIC BASALT

Pieces 1A-2

**PHENOCRYSTS:** Olivine - 5%; up to 1 mm; euhedral, equant.

**GROUNDMASS:** Fine-grained.

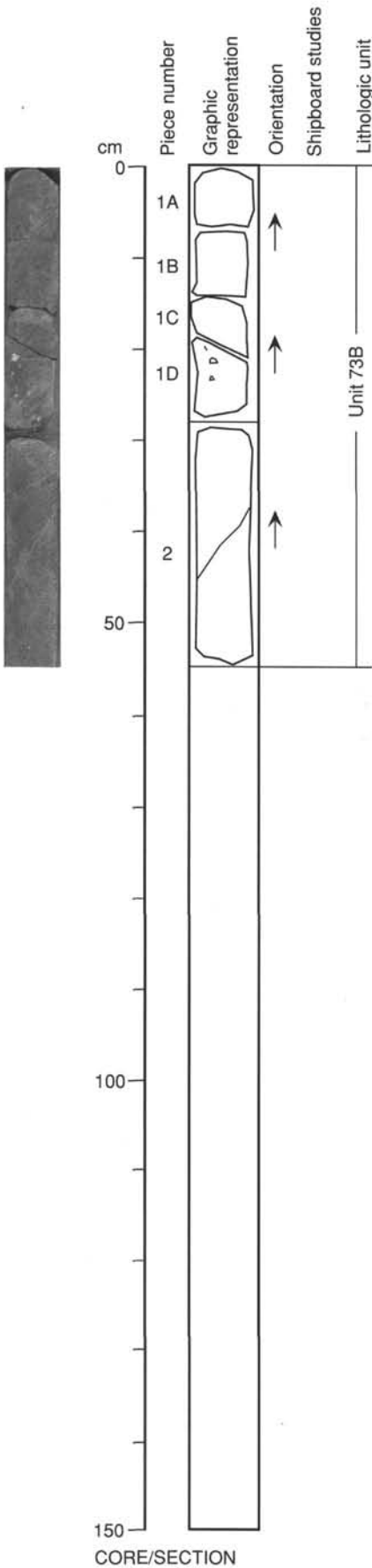
**VESICLES:** 0-5%; 5-8 mm; round; only in Piece 1D; lined with green mineral and filled with expanding clay.

**COLOR:** Dark gray (N 3/0).

**STRUCTURE:** Massive.

**ALTERATION:** Low; some fresh olivine.

**VEINS/FRACTURES:** 0.5 mm; inclined 60 degrees; one greenish vein at 38-46 cm.



CORE/SECTION

**UNIT 74A: APHYRIC BASALT**

**Pieces 1-6C**

**CONTACTS:** None. The flow top itself is probably missing.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Aphanitic in clasts; glassy in matrix.

**VESICLES:** 0-10%; <1-4 mm; irregular; uneven distribution through different clasts in breccia; filled with blackish green material and calcite.

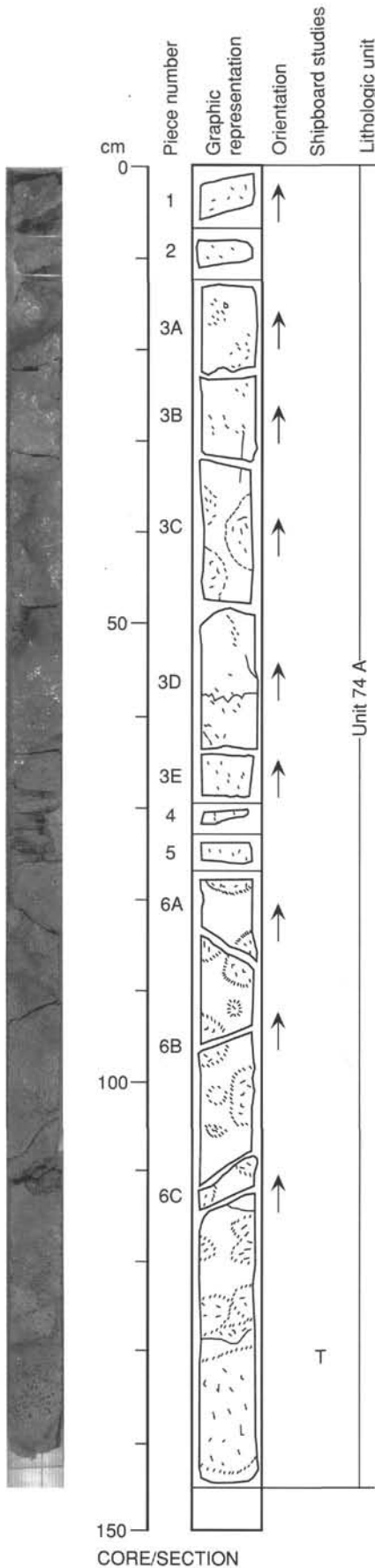
**COLOR:** Dark gray (N 4/0) red and green tinge in matrix.

**STRUCTURE:** Highly flow-brecciated. Vesiculated angular clasts up to 12 cm in size lie in a glass-rich matrix; the clasts have no chilled margins.

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** None.

**ADDITIONAL COMMENTS:** Flow top chilled in water?





152-917A-73R-2

UNIT 74A: APHYRIC BASALT

Pieces 1A-2

**PHENOCRYSTS:** None.

**GROUNDMASS:** Aphanitic in clasts; glassy in matrix.

**VESICLES:** 0-10%; <1-5 mm; irregular; most larger clasts have 10% vesicles; there are much fewer in the smaller clasts; filled with blackish green material and calcite.

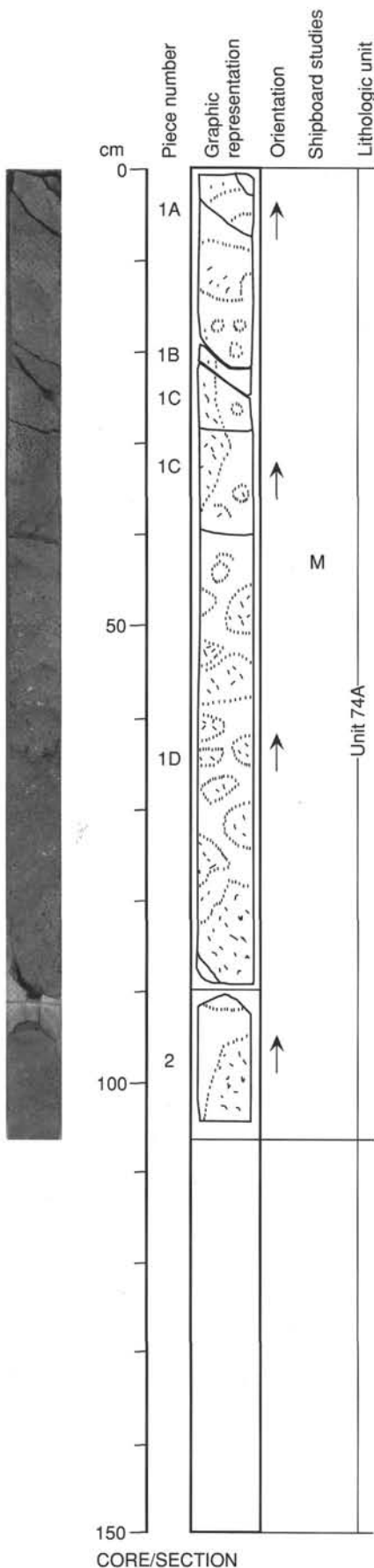
**COLOR:** Dark gray (N 4/0) red and green tinge in matrix.

**STRUCTURE:** Highly flow-brecciated. Vesiculated angular to subrounded clasts up to 15 cm in size lie in a glass-rich matrix; the clasts have no chilled margins.

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** None.

**ADDITIONAL COMMENTS:** Flow top chilled in water?



**UNIT 74A: APHYRIC BASALT**

**Pieces 1A–3D**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Aphanitic in clasts; glassy in matrix.

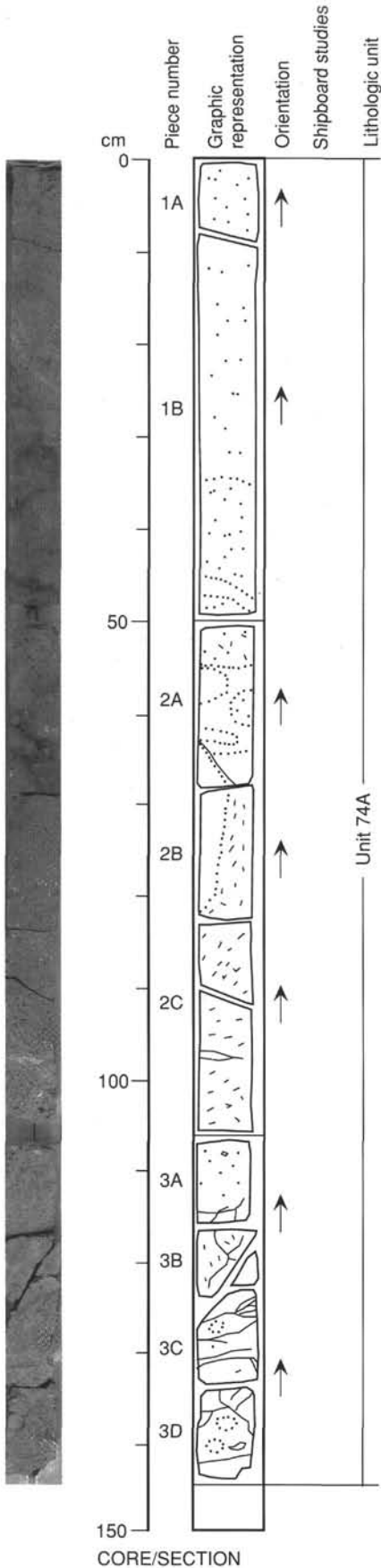
**VESICLES:** 0–10%; <1–5 mm; irregular; most larger clasts have 10% vesicles; there are much less in the smaller clasts; filled with blackish green material and calcite.

**COLOR:** Dark gray (N 4/0) with reddish tinge in matrix. Brick red wisps in matrix at 60–80 cm.

**STRUCTURE:** Flow-brecciated with up to 20-cm-large clasts in the upper half, grading to unbrecciated vesicular lava below 80 cm.

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** One 1-cm irregular vein filled with chalcedony at 98 cm.



152-917A-73R-4

**UNIT 74A: APHYRIC BASALT**

**Pieces 1A-8**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Aphanitic.

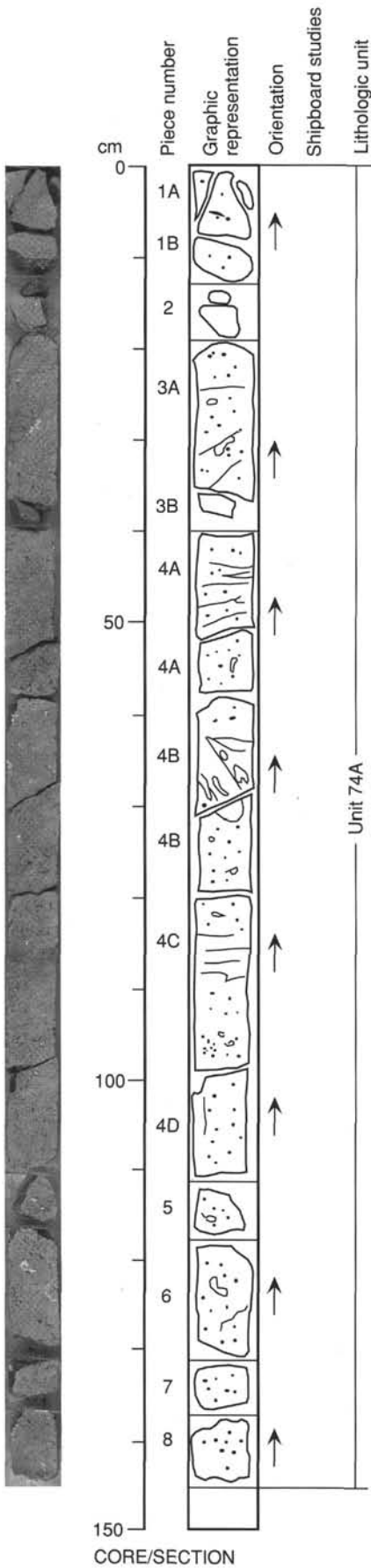
**VESICLES:** 5%; 1-5 mm; irregular; filled with blackish green material and calcite.

**COLOR:** Dark greenish gray (5Y 4/1).

**STRUCTURE:** Some horizontal flow-structure shown in flattened vesicles and finely flow-brecciated bands.

**ALTERATION:** Slight.

**VEINS/FRACTURES:** 1%; 2-12 mm; patchy veins like very large irregular vesicles; filled with first calcite and later chalcedony.



CORE/SECTION

**UNIT 74A: APHYRIC BASALT**

**Pieces 1-18**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Aphanitic.

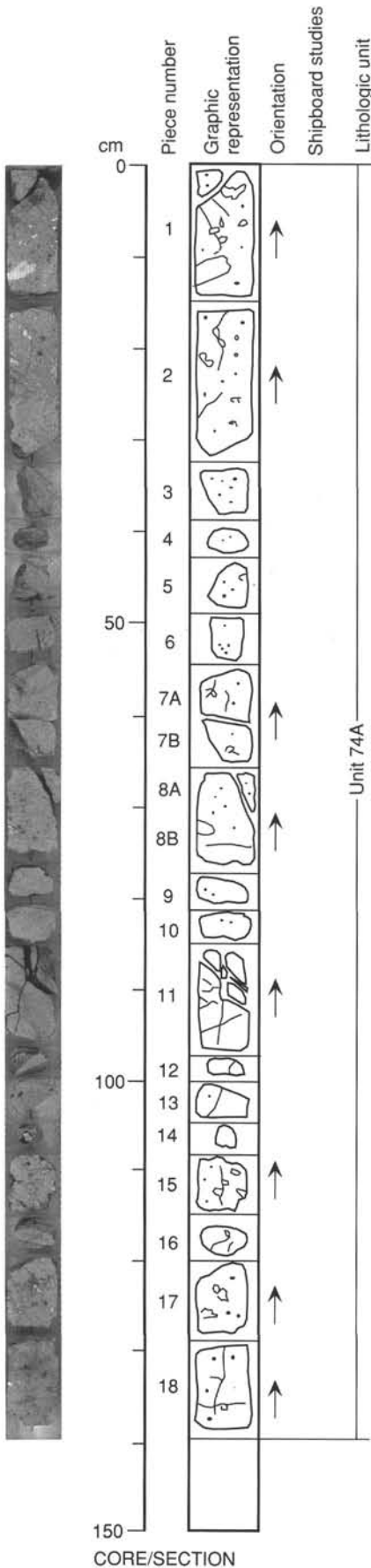
**VESICLES:** 5%; 1-6 mm; irregular; scattered; filled with blackish green material and calcite.

**COLOR:** Dark greenish gray (5Y 4/1).

**STRUCTURE:** Faint flow-structure and fine-scale flow-brecciation.

**ALTERATION:** Slight.

**VEINS/FRACTURES:** 1%; 2-40 mm; patchy veins like very large irregular vesicles; filled with first calcite and later chalcodyony.

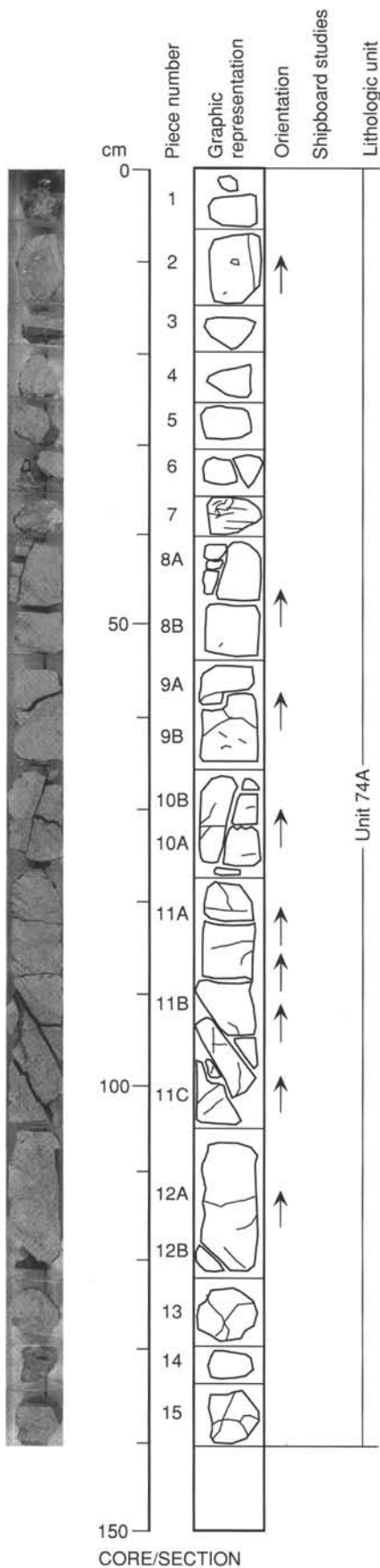


152-917A-74R-1

UNIT 74A: APHYRIC BASALT

Pieces 1-15

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Aphanitic.  
**VESICLES:** <<1%; up to 8 mm; irregular; only in Pieces 2 and 3; lined with chlorite and filled with chalcedony.  
**COLOR:** Dark gray (N 3/0).  
**STRUCTURE:** Piece 7 is flow-brecciated.  
**ALTERATION:** Moderate; some oxidation adjacent to fractures.  
**VEINS/FRACTURES:** <1%; up to 1 mm; random orientation; filled with chlorite and calcite.



CORE/SECTION

**UNIT 74A: APHYRIC BASALT**

**Pieces 1A-12**

**PHENOCRYSTS:** None.

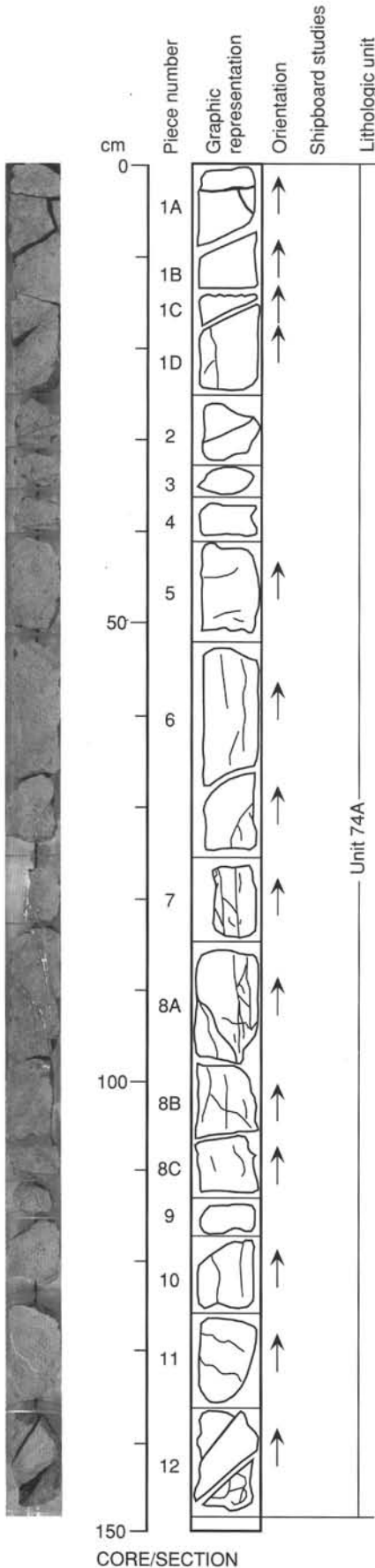
**GROUNDMASS:** Aphanitic.

**VESICLES:** <<1%; up to 2 mm; spherical to flattened; scattered; filled with chlorite and chalcedony.

**COLOR:** Dark greenish gray (5G 4/1).

**ALTERATION:** Moderate; some oxidation adjacent to fractures.

**VEINS/FRACTURES:** 2%; up to 3 mm; mostly inclined to vertical; lined with chlorite and filled with calcite.  
Brecciation between veins in Pieces 7 and 8A.

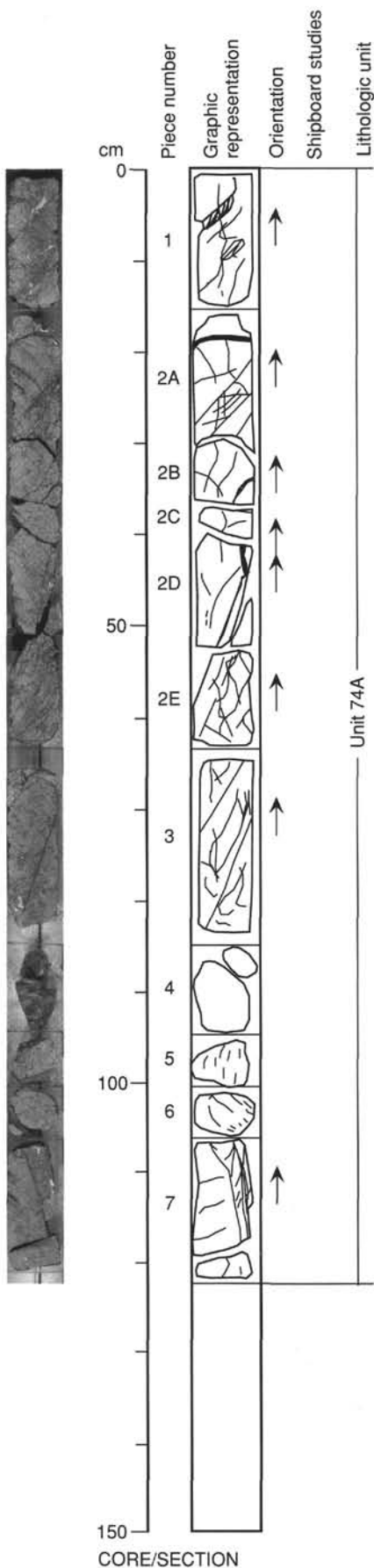


152-917A-74R-3

**UNIT 74A: APHYRIC BASALT**

**Pieces 1-7**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Aphanitic.  
**VESICLES:** None.  
**COLOR:** Dark gray (N 3/0).  
**STRUCTURE:** Flow-banding dipping 20 degrees.  
**ALTERATION:** Moderate; some oxidation adjacent to fractures.  
**VEINS/FRACTURES:** 5%; up to 8 mm; mostly steeply inclined; filled with chlorite, centers of larger veins filled with calcite. Most of the section is brecciated. Slickensides (dipping 30 degrees) on some fracture surfaces.



**UNIT 74A: APHYRIC BASALT**

**Pieces 1-14**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Aphanitic.

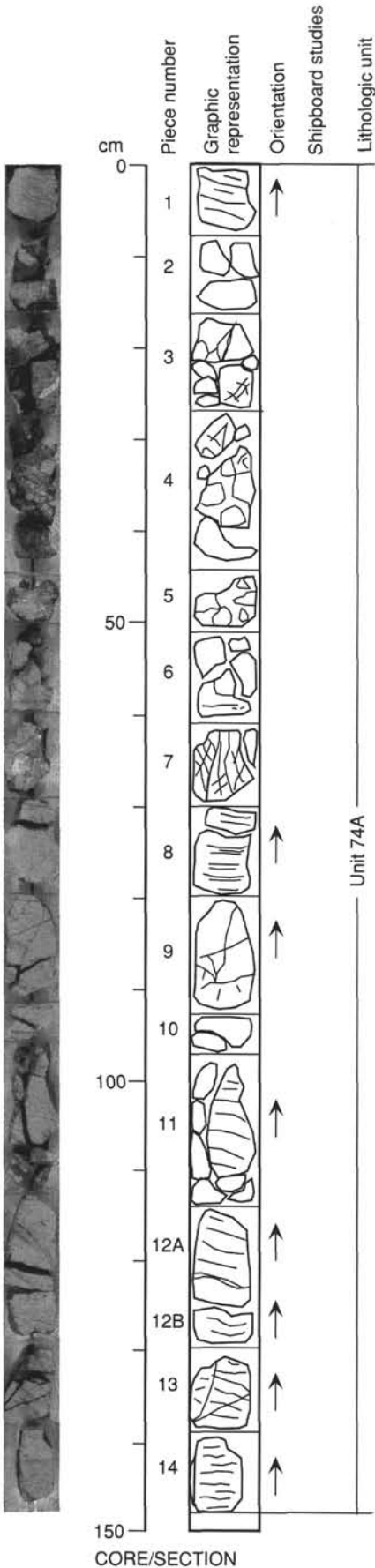
**VESICLES:** None.

**COLOR:** Dark gray (N 3/0).

**STRUCTURE:** Flow-banding dipping 20 degrees.

**ALTERATION:** Moderate; some oxidation adjacent to fractures.

**VEINS/FRACTURES:** 5%; up to 3 mm; random orientation; filled with chlorite and calcite. Strongly brecciated in Pieces 3-7; angular basalt clasts supported in sheared chlorite matrix. Slickensides on fracture surfaces.



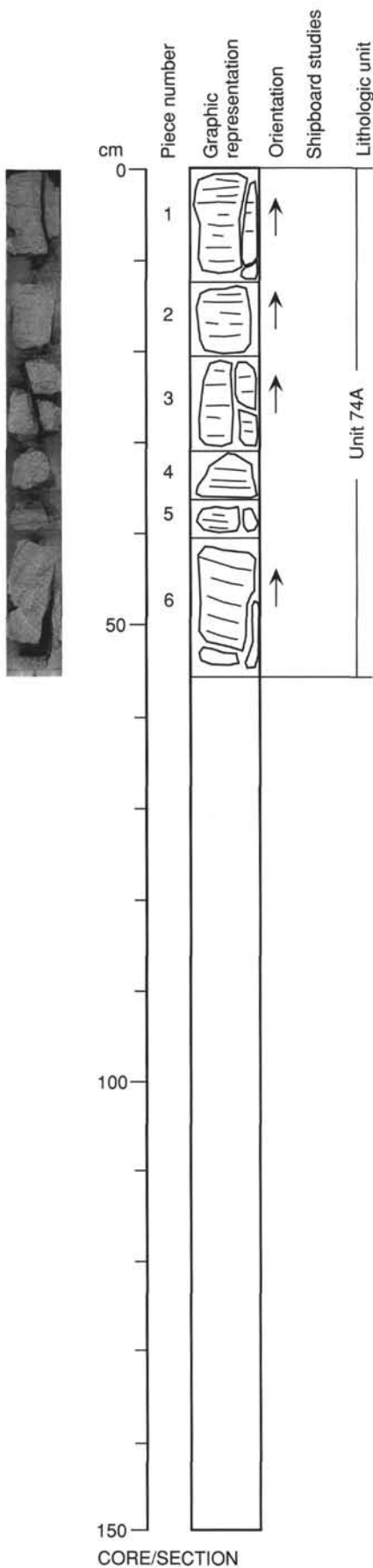


152-917A-74R-5

UNIT 74A: APHYRIC BASALT

Pieces 1-6

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Aphanitic.  
**VESICLES:** None.  
**COLOR:** Dark gray (N 3/0).  
**STRUCTURE:** Flow-banding dipping 20 degrees.  
**ALTERATION:** Moderate; some oxidation adjacent to fractures.  
**VEINS/FRACTURES:** 5%; up to 5 mm; steeply inclined to vertical; filled with chlorite and some calcite.



**UNIT 74B: MYLONITE**

**Pieces 1-7**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Pseudotachylite with a waxy luster and conchoidal fracture.

**VESICLES:** None.

**COLOR:** Blackish red (5R 2/2), dusky brown (5YR 2/2), grayish olive green (5GY 3/2).

**STRUCTURE:** Prominent streaky fabric.

**VEINS/FRACTURES:** <1%; 0.2 mm; subparallel; very thin veins filled with white mineral (not calcite).

**ADDITIONAL COMMENTS:** Zone within Unit 74 aphyric basalt.

**UNIT 74C: APHYRIC BASALT**

**Pieces 8-18**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Aphanitic.

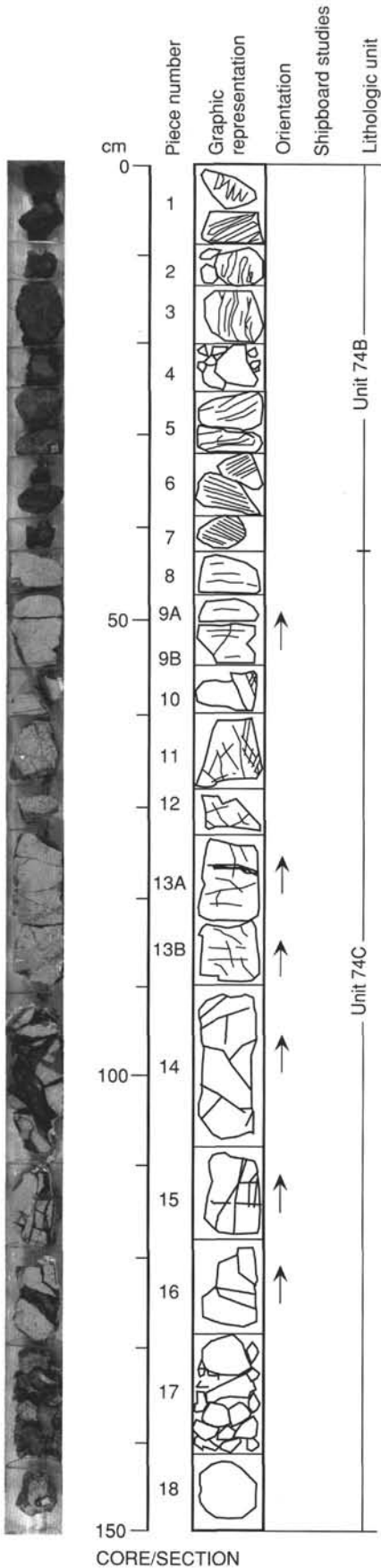
**VESICLES:** None.

**COLOR:** Dark greenish gray (5GY 4/1).

**ALTERATION:** Moderate; some oxidation adjacent to fractures.

**VEINS/FRACTURES:** 5%; up to 2 mm; randomly oriented; filled with chlorite and/or calcite.

**ADDITIONAL COMMENTS:** Indistinguishable in hand specimen from Unit 74A in Core 152-917A-74R.



CORE/SECTION

152-917A-75R-2

**UNIT 74C: APHYRIC BASALT**

**Pieces 1-4A**

**CONTACTS:** Contact with Unit 75 preserved between Pieces 4A and 4B.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Aphanitic.

**VESICLES:** 0-20%; up to 5 mm; spherical to irregular; patchy distribution; lined with chlorite; some filled with calcite.

**COLOR:** Dark greenish gray (5GY 4/1).

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** 2%; up to 2 mm; horizontal to inclined; filled with calcite.

**ADDITIONAL COMMENTS:** Vesicular base of unit.

**UNIT 75A: APHYRIC BASALT**

**Pieces 4B-5**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Aphanitic.

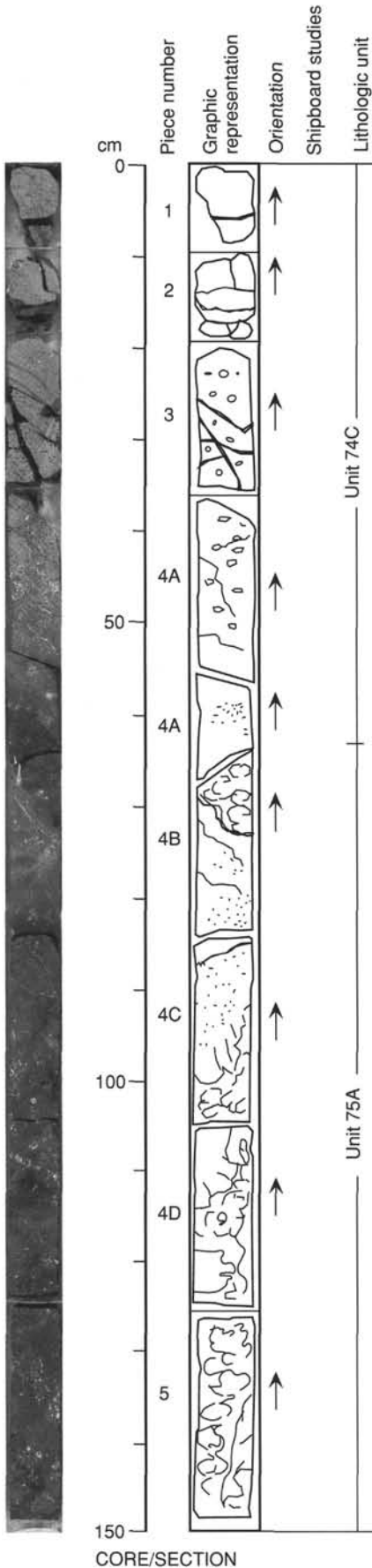
**VESICLES:** 0-20%; up to 5 mm; spherical to irregular; patchy distribution; pale green linings in some, others filled with calcite.

**COLOR:** Grayish black (N 2/0) in dusky red (5R 3/4) matrix.

**STRUCTURE:** Flow-breccia and scoria.

**ALTERATION:** Moderate in basalt clasts, oxidized in matrix.

**VEINS/FRACTURES:** 1%; up to 2 mm; inclined to vertical; filled with calcite.

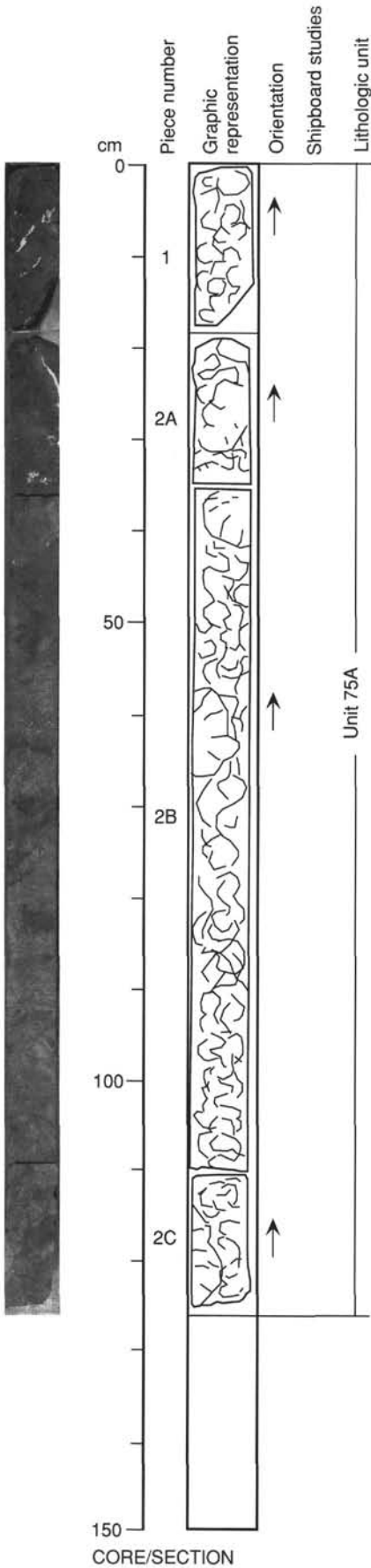


CORE/SECTION

**UNIT 75A: APHYRIC BASALT**

**Pieces 1-2C**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Aphanitic.  
**VESICLES:** <1%; up to 2 mm; spherical; patchy distribution; filled with calcite.  
**COLOR:** Grayish black (N 2/0) in dusky red (5R 3/4) to grayish red (5R 4/2) matrix.  
**STRUCTURE:** Flow-breccia and scoria.  
**ALTERATION:** Moderate in basalt clasts, oxidized in matrix.  
**VEINS/FRACTURES:** <1%; up to 5 mm; inclined; filled with calcite.



152-917A-75R-4

UNIT 75A: APHYRIC BASALT

Pieces 1A-5

**PHENOCRYSTS:** None.

**GROUNDMASS:** Aphanitic.

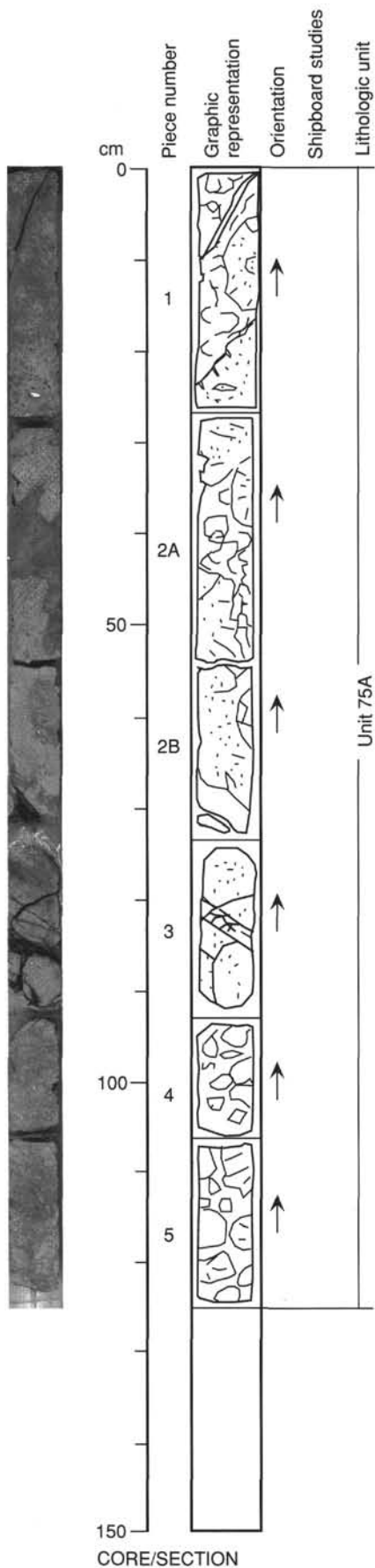
**VESICLES:** 2%; up to 10 mm; irregular to flattened; patchy distribution; filled with calcite.

**COLOR:** Medium olive gray (5Y 5/1).

**STRUCTURE:** Flow-brecciated in Pieces 1 and 2, tectonically brecciated in Pieces 4 and 5.

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** 1%; up to 1 mm; inclined; chlorite-filled fractures in Piece 3 grade into breccia in Pieces 4 and 5.



**UNIT 75A: APHYRIC BASALT**

**Pieces 1A-14**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Aphanitic.

**VESICLES:** <<1%; up to 5 mm; spherical to flattened; lined with chlorite and filled with chalcedony.

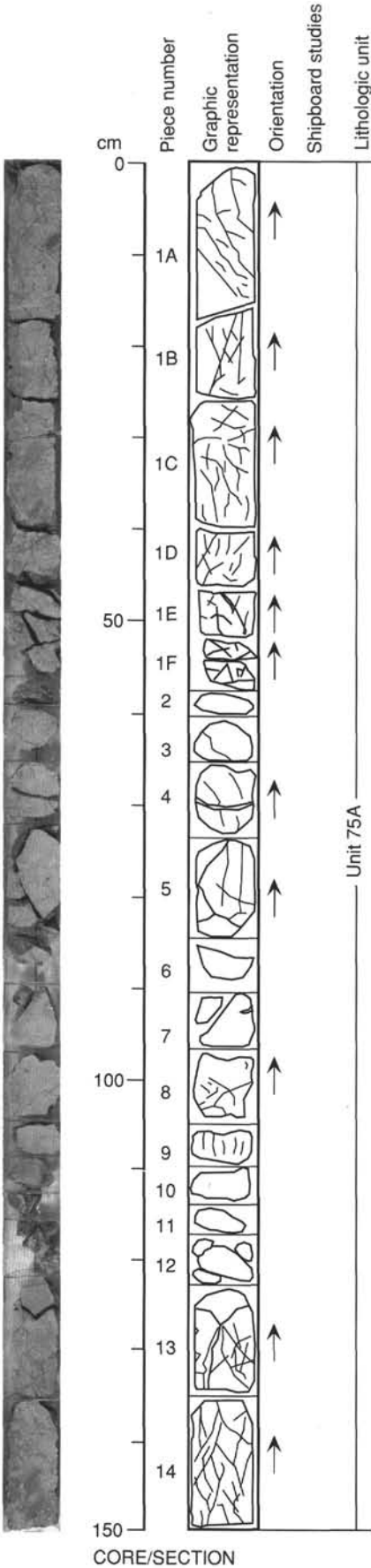
**COLOR:** Dark gray (N 3/0).

**STRUCTURE:** Brecciated.

**ALTERATION:** Moderate in basalt clasts.

**VEINS/FRACTURES:** 20%; up to 6 mm; random orientation; filled with chlorite and small rock fragments.

**ADDITIONAL COMMENTS:** Brecciation related to faulting.

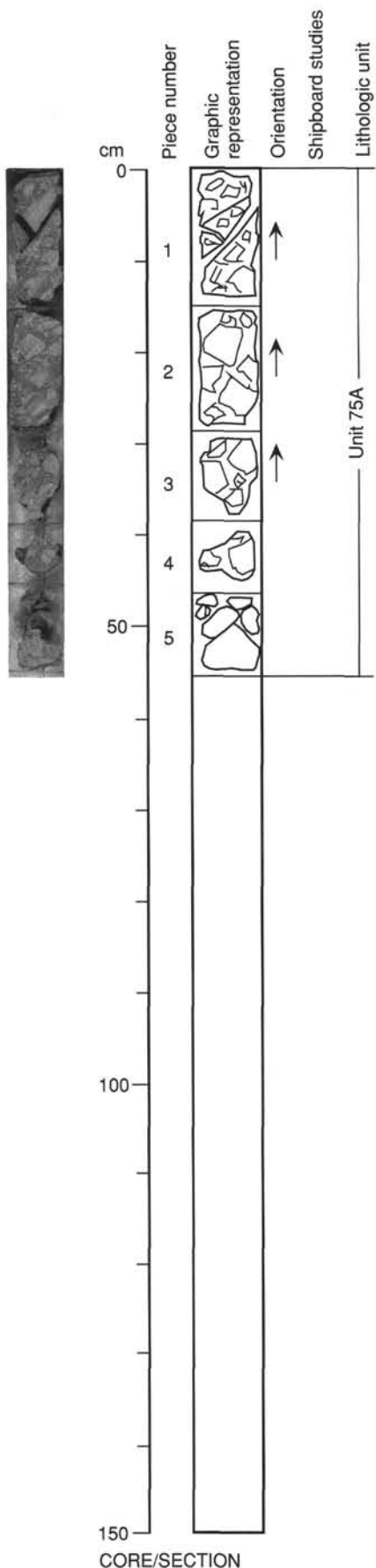


152-917A-76R-2

**UNIT 75A: APHYRIC BASALT**

**Pieces 1-5**

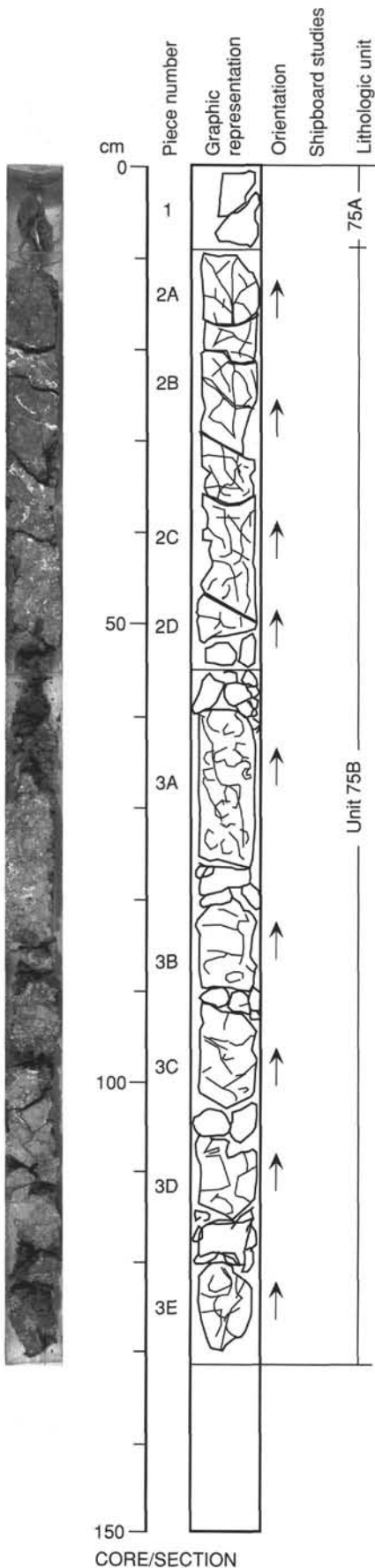
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Aphanitic.  
**VESICLES:** None.  
**COLOR:** Dark gray (N 3/0).  
**STRUCTURE:** Intensely brecciated.  
**ALTERATION:** Moderate in basalt clasts.  
**VEINS/FRACTURES:** 30%; up to 10 mm; random orientation; filled with chlorite and small rock fragments.  
**ADDITIONAL COMMENTS:** Brecciation related to faulting.



**UNIT 75B: BRECCIA**

**Pieces 2A-3E**

**PHENOCRYSTS:** None in clasts.  
**GROUNDMASS:** Fine-grained clasts.  
**VESICLES:** None.  
**COLOR:** Light olive gray (5Y 6/1) clasts in greenish black (5GY 2/1) matrix.  
**STRUCTURE:** Fault breccia.  
**ALTERATION:** Completely altered basalt clasts in chlorite matrix.  
**ADDITIONAL COMMENTS:** Piece 1 comprises small fragments of aphyric basalt from Unit 75A.



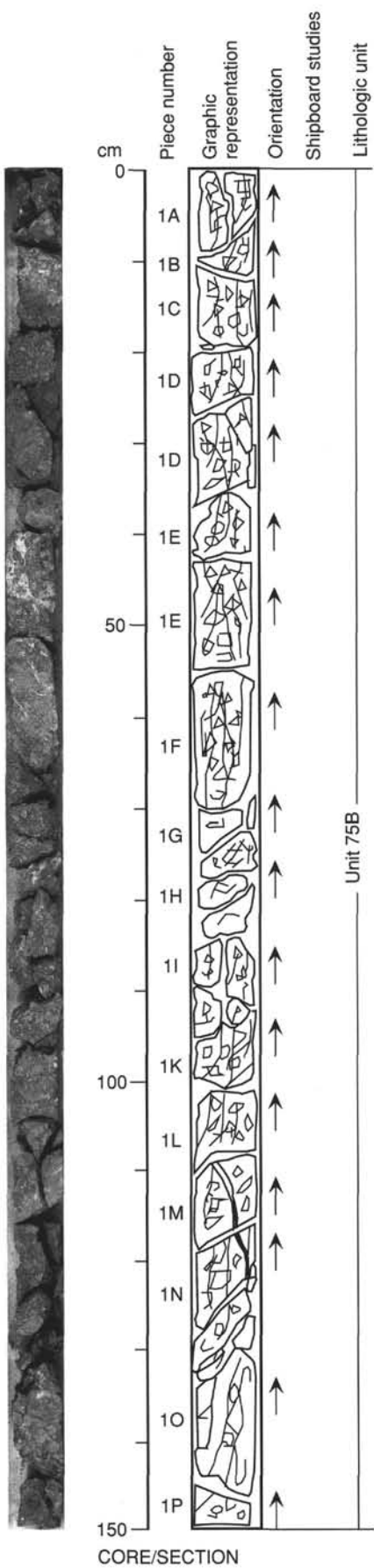


152-917A-77R-2

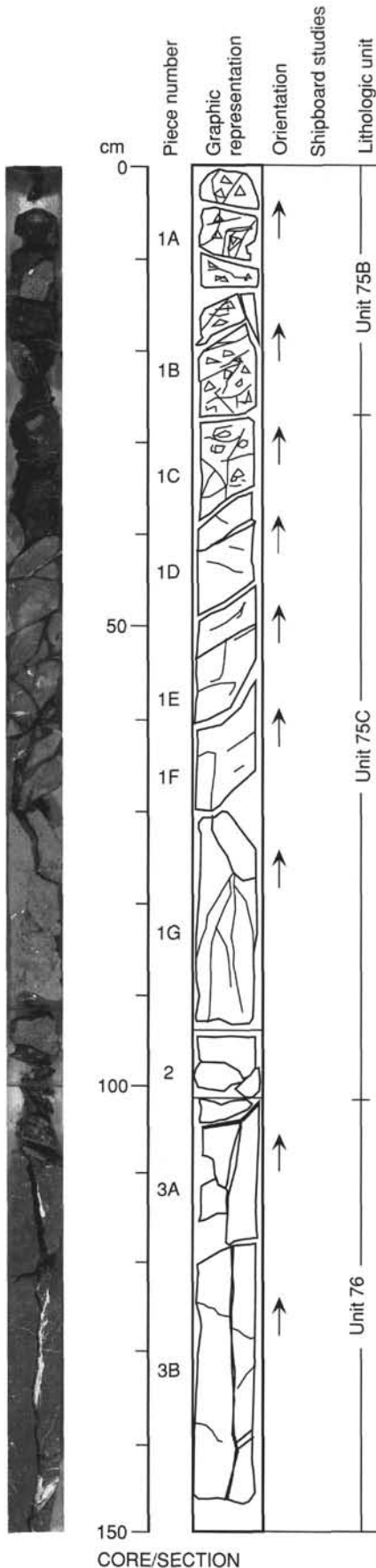
**UNIT 75B: BRECCIA**

**Pieces 1A-1P**

**PHENOCRYSTS:** None in clasts.  
**GROUNDMASS:** Fine-grained clasts.  
**VESICLES:** None.  
**COLOR:** Light olive gray (5Y 6/1) clasts in greenish black (5GY 2/1) matrix.  
**STRUCTURE:** Fault breccia.  
**ALTERATION:** Completely altered basalt clasts in chlorite matrix.



CORE/SECTION



**UNIT 75B: BRECCIA**

**Pieces 1A–1B**

**PHENOCRYSTS:** None in clasts.  
**GROUNDMASS:** Fine-grained clasts.  
**VESICLES:** None.  
**COLOR:** Light olive gray (5Y 6/1) clasts in greenish black (5GY 2/1) matrix.  
**STRUCTURE:** Fault breccia.  
**ALTERATION:** Completely altered basalt clasts in chlorite matrix; clasts becoming altered in Piece 1B.

**UNIT 75C: APHYRIC BASALT**

**Pieces 1C–2**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** None.  
**COLOR:** Dark gray (N 3/0).  
**STRUCTURE:** Brecciated.  
**ALTERATION:** Moderate between fractures.  
**VEINS/FRACTURES:** 5%; up to 3 mm; inclined; filled with chlorite and calcite; slickensides on fracture surfaces.  
**ADDITIONAL COMMENTS:** The boundary between Units 75B and 75C is gradational.

**UNIT 76: APHYRIC OLIVINE BASALT**

**Pieces 3A–3B**

**CONTACTS:** Fault contact with Unit 75C within top part of Piece 3A.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 2%; up to 2 mm; irregular; calcite-filled.  
**COLOR:** Very dusky red (10R 2/2) with dark reddish brown streak.  
**ALTERATION:** Strong.  
**VEINS/FRACTURES:** 5%; up to 10 mm; vertical to steeply inclined; calcite-filled.

152-917A-77R-4

**UNIT 76: APHYRIC OLIVINE BASALT**

**Pieces 1A-1J**

**PHENOCRYSTS:** None.

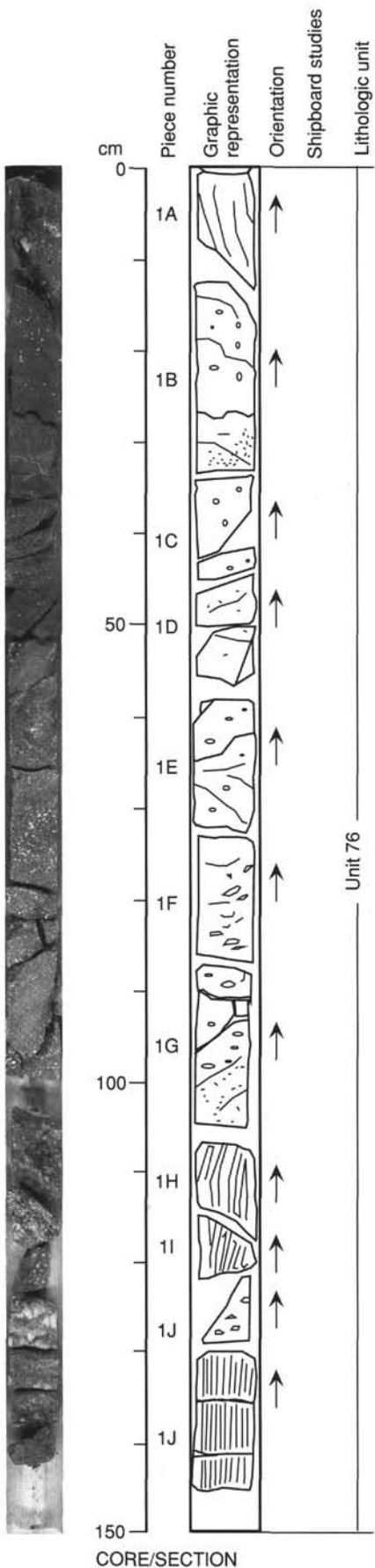
**GROUNDMASS:** Fine-grained.

**VESICLES:** 2%-20%; up to 5 mm; irregular; patchy distribution; lined with chlorite and filled with calcite.

**COLOR:** Very dusky red (10R 2/2) to dusky brown (5YR 3/2).

**ALTERATION:** Strong.

**VEINS/FRACTURES:** 1%; up to 5 mm; random orientation; filled with calcite; slickensides on fracture surfaces.



**UNIT 76: APHYRIC OLIVINE BASALT**

**Piece 1**

**PHENOCRYSTS:** None.

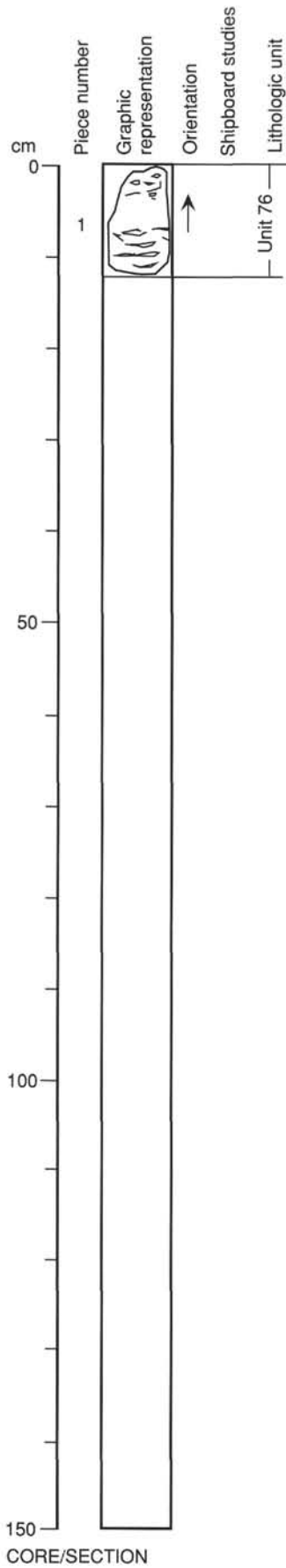
**GROUNDMASS:** Fine-grained.

**VESICLES:** 30%; up to 8 mm; spherical to flattened; patchy distribution; filled with calcite.

**COLOR:** Dusky brown (5YR 3/2).

**ALTERATION:** Strong.

**VEINS/FRACTURES:** <<1%; 0.2 mm; inclined; filled with calcite.

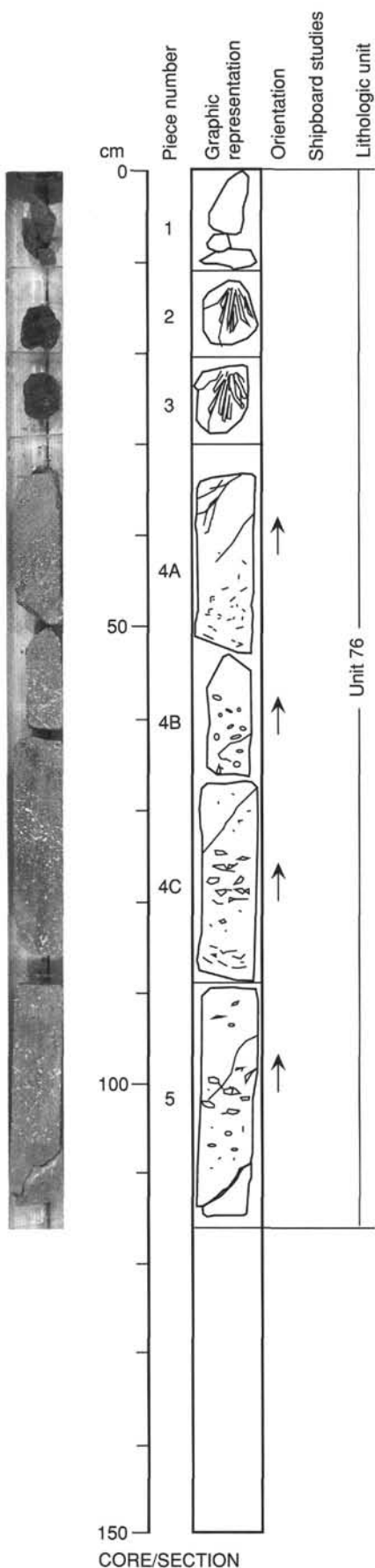


152-917A-78R-1

UNIT 76: APHYRIC OLIVINE BASALT

Pieces 4A-5

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 10%–25%; up to 5 mm; irregular; patchy distribution; filled with calcite.  
**COLOR:** Greenish black (5GY 2/1).  
**ALTERATION:** Moderate.  
**VEINS/FRACTURES:** <<1%; up to 2 mm; inclined; filled with calcite.  
**ADDITIONAL COMMENTS:** Pieces 1–3 are drilling debris from overlying breccia.



**UNIT 76: APHYRIC OLIVINE BASALT**

**Pieces 1A-4C**

**PHENOCRYSTS:** None.

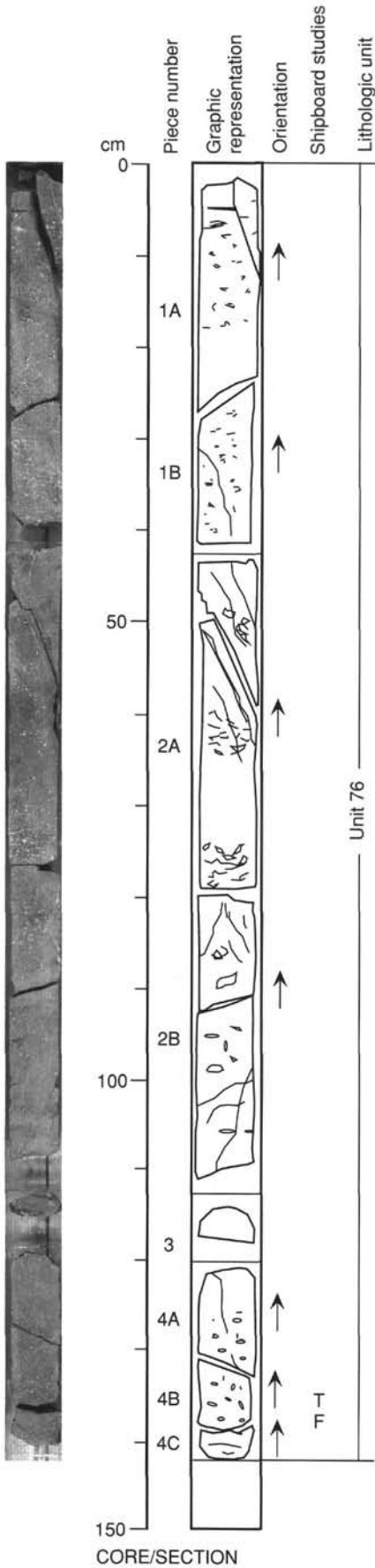
**GROUNDMASS:** Fine-grained.

**VESICLES:** 1%-30%; up to 5 mm; spherical to irregular; patchy distribution; filled with calcite and chlorite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** 1%; up to 2 mm; inclined; filled with calcite.



152-917A-78R-3

**UNIT 76: APHYRIC OLIVINE BASALT**

**Pieces 1A-1G**

**PHENOCRYSTS:** None.

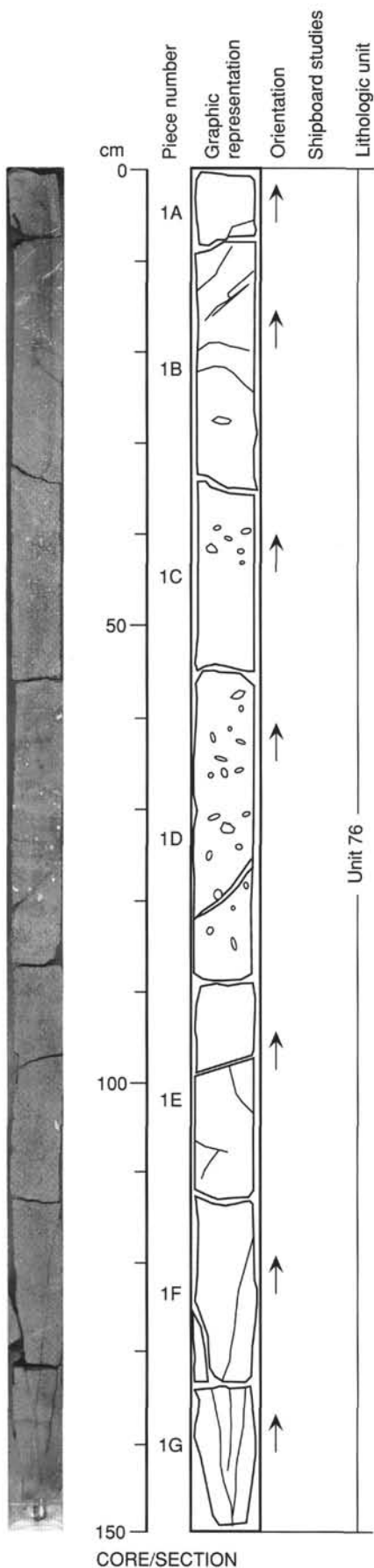
**GROUNDMASS:** Fine-grained.

**VESICLES:** 1%-10%; up to 10 mm; spherical to irregular; patchy distribution; bands at 40 and 70 cm; decreasing in abundance in lower part of section; filled with calcite and zeolite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Moderate; decreases towards lower part of section.

**VEINS/FRACTURES:** 1%; up to 2 mm; random orientation; filled with calcite with zeolite rims.



CORE/SECTION

**UNIT 76: APHYRIC OLIVINE BASALT**

**Pieces 1-6**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

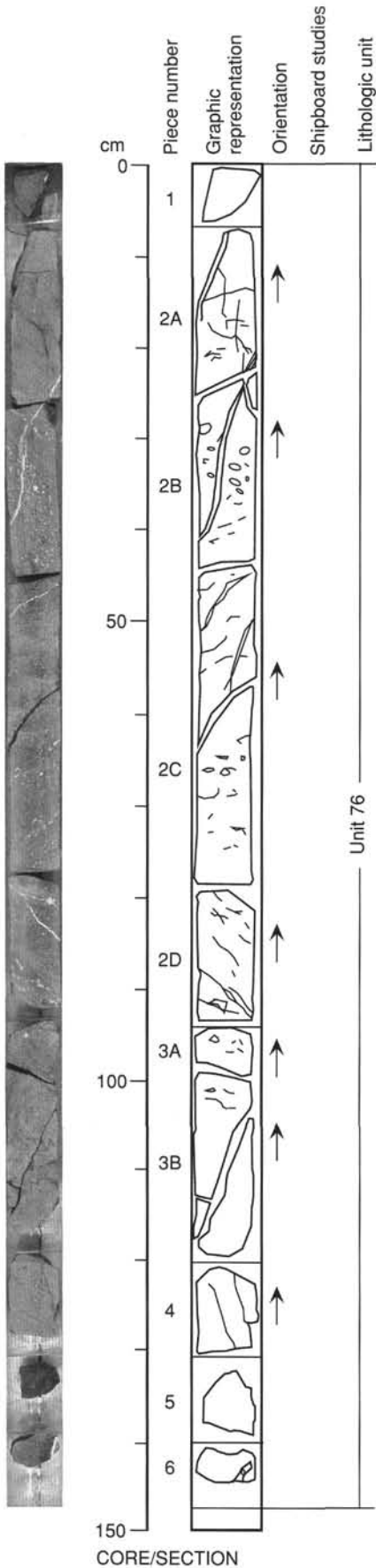
**VESICLES:** 1%-15%; up to 10 mm; flattened; in bands in Pieces 2B-3B; flattened parallel to flow-banding; filled with calcite and zeolite.

**COLOR:** Greenish black (5G 2/1).

**STRUCTURE:** Broad flow-bands dipping 30 degrees between 27 and 117 cm.

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** 1%; up to 3 mm; random orientation; large irregular fracture in Pieces 2A and 2B, smaller fractures in all other pieces; veins filled with calcite and zeolite.





152-917A-78R-5

UNIT 76: APHYRIC OLIVINE BASALT

Pieces 1-6

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

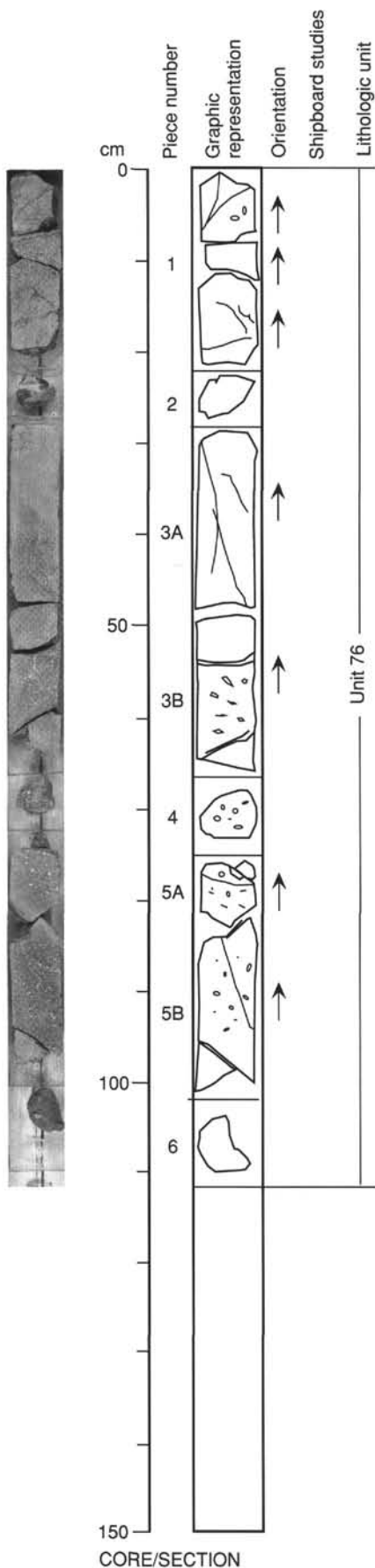
**VESICLES:** 1%-15%; 1-10 mm; spherical to irregular; grouped in bands; filled with white zeolites; larger ones have calcite in the center.

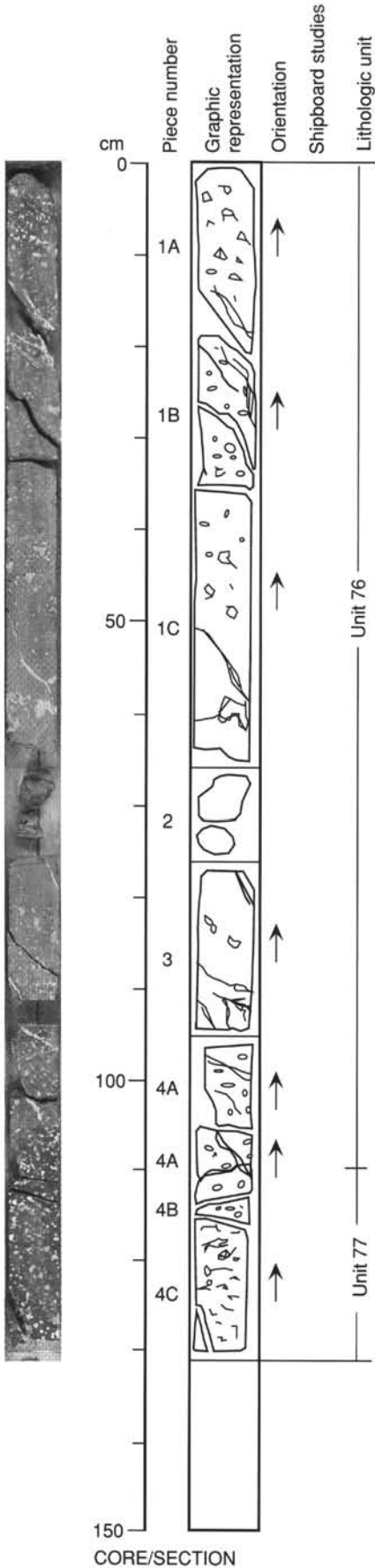
**COLOR:** Dark greenish gray (5G 4/1).

**STRUCTURE:** Slight banding defined by groupings of vesicles.

**ALTERATION:** Moderate to strong.

**VEINS/FRACTURES:** 1 mm; in Pieces 1 and 5; filled with calcite.





**UNIT 76: APHYRIC OLIVINE BASALT**

**Pieces 1A–4A**

**CONTACTS:** Bottom contact in Piece 4A at 107 cm.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 10%; 2–15 mm; spherical to ameboid; random distribution; filled with zeolites and pale green clay.

**COLOR:** Dark reddish gray (5YR 4/2); slightly greenish in bottom 1 cm from contact.

**ALTERATION:** Strong; slightly oxidized.

**VEINS/FRACTURES:** 1–5 mm; Piece 3 has some brecciation; filled with calcite.

**UNIT 77: OLIVINE-PHYRIC BASALT**

**Pieces 4A–4C**

**CONTACTS:** Top contact seen in Piece 4A at 107 cm.

**PHENOCRYSTS:** Often occur in clumps. Olivine - 3%; up to 1.5 mm; euhedral, equant; altered.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 15%; 2–7 mm; round to ameboid; random distribution; filled with calcite.

**COLOR:** Dark reddish brown (5YR 3/2).

**ALTERATION:** Strong; oxidized.

152-917A-78R-7

UNIT 77: OLIVINE-PHYRIC BASALT

Pieces 1A-7

**CONTACTS:** Bottom contact in Piece 7 at 104 cm.

**PHENOCRYSTS:** Often occur in clumps. Olivine - 3%; up to 1.5 mm; euhedral, equant, altered

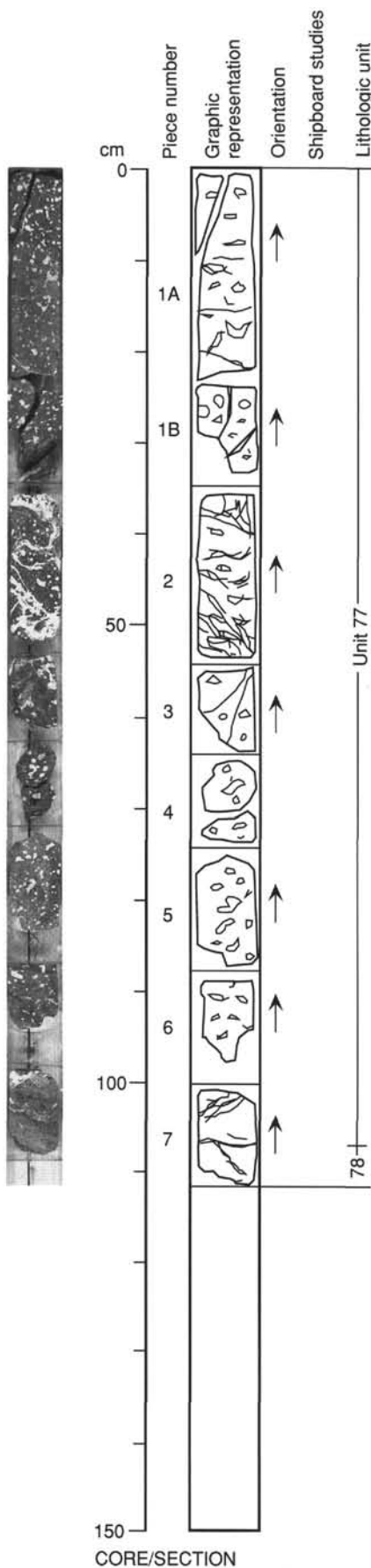
**GROUNDMASS:** Fine-grained.

**VESICLES:** 10%; 1-10 mm; round to irregular; random distribution; filled with calcite and zeolite.

**COLOR:** Dark reddish brown (5YR 3/2) at top to dark gray (N 3/0) at bottom.

**ALTERATION:** Moderate to strong.

**VEINS/FRACTURES:** 1-4 mm; concentrated in Pieces 2 and 3; filled with calcite.



152-917A-79R-1

UNIT 78: OLIVINE-PHYRIC BASALT

Pieces 1-8B

**CONTACTS:** The top contact is in Section 152-917A-78R-7, Piece 7 at 104 cm. It is dark gray (5YR 4/1) with vesicles filled with green and white material.

**PHENOCRYSTS:** Olivine - 3%; up to 2 mm; euhedral, equant to prismatic. Plagioclase - <<1%; up to 2 mm; tabular.

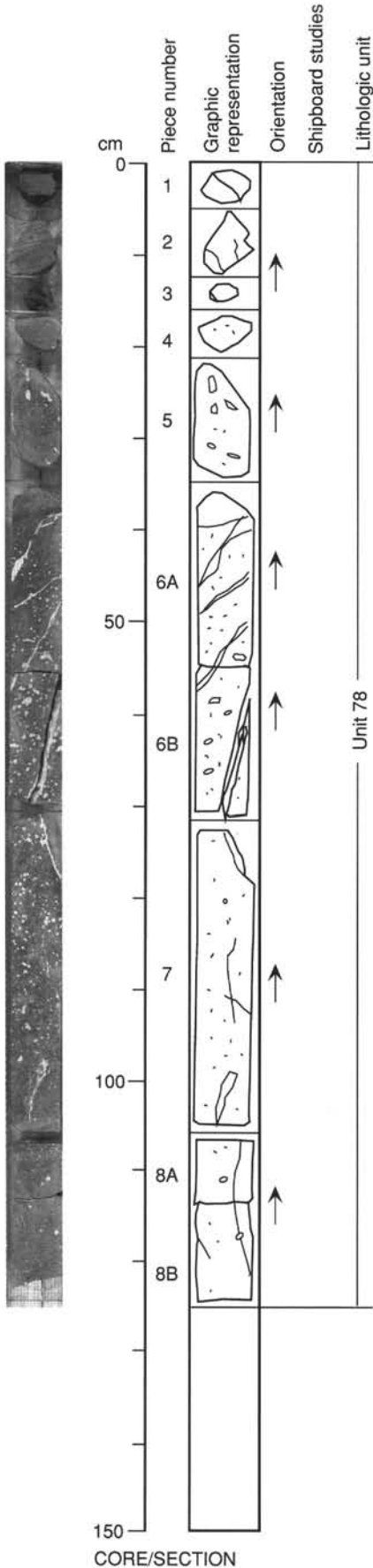
**GROUNDMASS:** Fine-grained.

**VESICLES:** 0-10%; 1-10 mm; mostly rounded; scattered; lined with white zeolite and filled with calcite or greenish white clay.

**COLOR:** Dark gray (2.5YR 4/1).

**ALTERATION:** Moderate; no fresh olivine.

**VEINS/FRACTURES:** 2%; 1-7 mm; inclined 60-80 degrees; filled with calcite; in Pieces 6-7.



152-917A-79R-2

UNIT 78: OLIVINE-PHYRIC BASALT

Pieces 1A-1G

**PHENOCRYSTS:** Accumulation of olivine (10%) at 26-35 cm. Olivine - 3%; up to 4 mm; euhedral, equant to prismatic.

**GROUNDMASS:** Fine-grained.

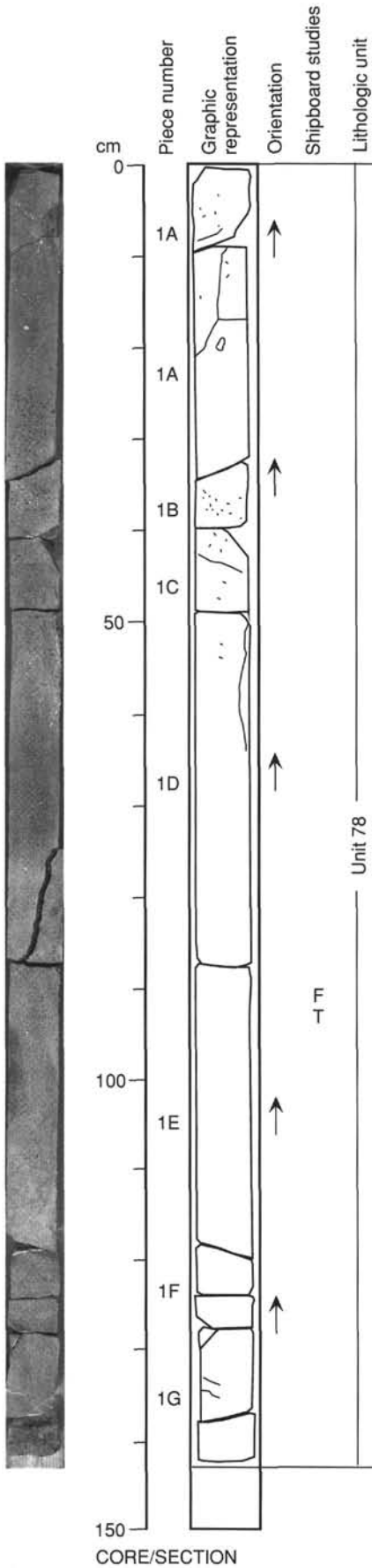
**VESICLES:** Practically no vesicles.

**COLOR:** Dark gray (N 4/0).

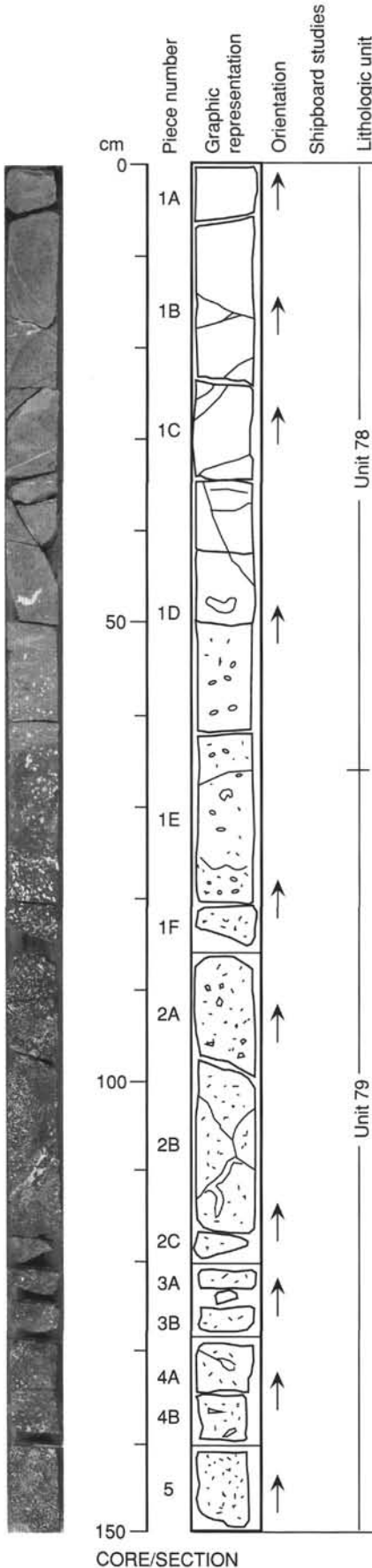
**STRUCTURE:** Massive.

**ALTERATION:** Moderate; no fresh olivine.

**VEINS/FRACTURES:** A few hair-thin, calcite-filled fractures.



CORE/SECTION



**UNIT 78: OLIVINE-PHYRIC BASALT**

**Pieces 1A–1E**

**CONTACTS:** The lower contact is in Piece 1E at 65 cm. There are flow-aligned vesicles, and the rock is bleached up to 2 cm away from the contact.

**PHENOCRYSTS:** Olivine - 3%; up to 3 mm; euhedral, equant to prismatic.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 0–10%; 1–6 mm; round to irregular; only in the lower 20 cm of the flow; lined with white, bladed zeolite and filled with greenish white clay. One 3 x 0.5 cm vesicle at 49 cm is filled with massive zeolite.

**COLOR:** Dark gray (N 4/0).

**ALTERATION:** Moderate; no fresh olivine.

**VEINS/FRACTURES:** 1%; 1–2 mm; horizontal to steep; filled with green mineral and calcite.

**UNIT 79: APHYRIC OLIVINE BASALT**

**Pieces 1E–5**

**CONTACTS:** The flow-top is seen in Piece 1E at 65 cm.

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 10%–20%; 1–3 mm; round to irregular; patchy distribution; lined with white, bladed zeolite and filled with greenish white clay.

**COLOR:** Dusky red (10R 3/2) at flow-top to dark reddish gray (10R 4/1) further down.

**STRUCTURE:** Some flow-brecciation is seen, especially at 108–116 cm. Mostly large clasts in sparse matrix.

**ALTERATION:** Strong.

**VEINS/FRACTURES:** One 2–10-mm-wide brecciated vein at 108–116 cm, filled with calcite.

152-917A-79R-4

UNIT 79: APHYRIC OLIVINE BASALT

Pieces 1A-4B

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

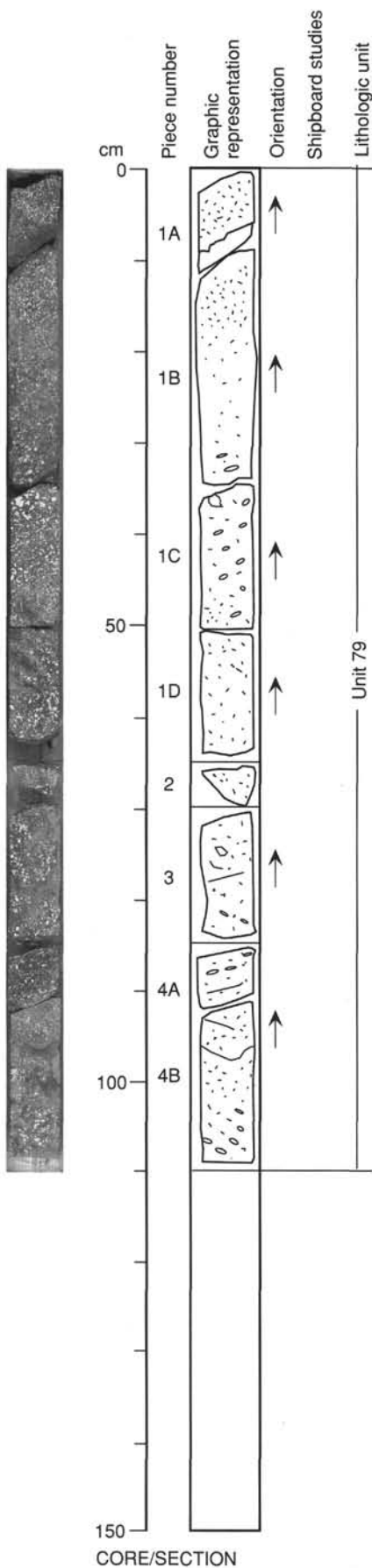
**VESICLES:** 5%–10%; 1–3 mm; round to irregular; scattered; mostly in clasts; lined with white, bladed zeolite and filled with greenish white clay.

**COLOR:** Dark reddish gray (10R 4/1) at top grading to dark gray (N 4/0) at bottom.

**STRUCTURE:** Some flow-brecciation is seen; large clasts in small amounts of matrix.

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** 0.5 mm; inclined 15 degrees; very few fractures filled with white zeolite.



**UNIT 79: APHYRIC OLIVINE BASALT**

**Pieces 1A-2**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

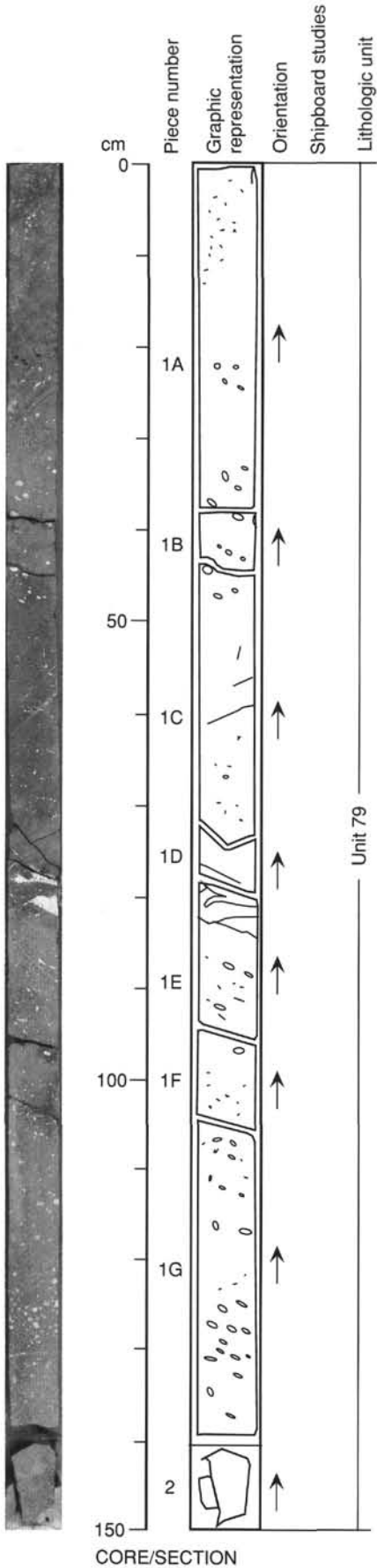
**VESICLES:** 1%-5%; 1-6 mm; round to flattened; scattered; lined and filled with white, bladed zeolite and greenish white clay.

**COLOR:** Dark gray (N 4/0).

**STRUCTURE:** Some flow-brecciation in upper 30 cm of section; massive further down.

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** Two 0.5-1-cm-wide, lensoid, calcite-filled veins at 79-83 cm.





152-917A-79R-6

**UNIT 79: APHYRIC OLIVINE BASALT**

**Pieces 1-10**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

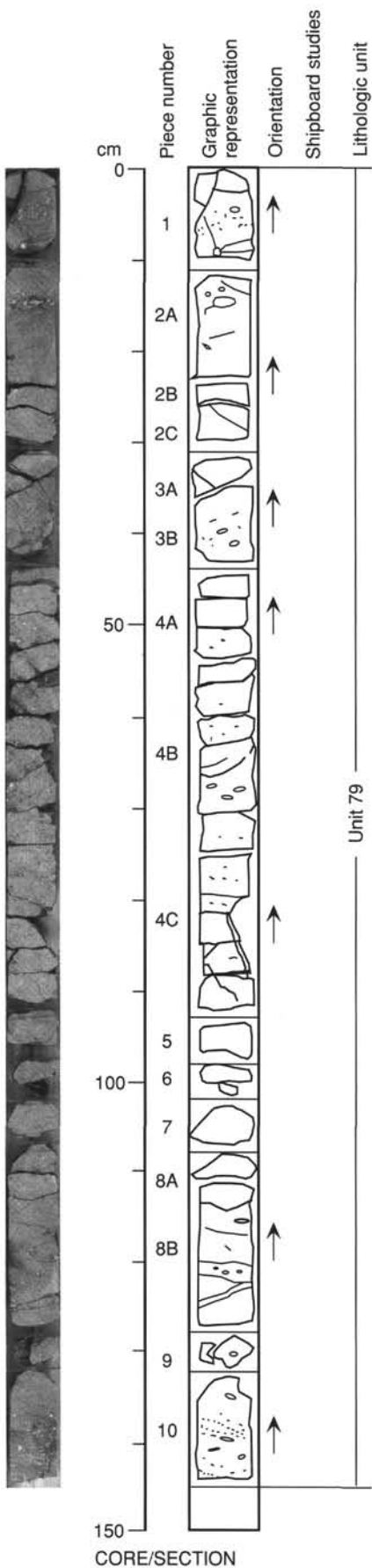
**VESICLES:** 1%-2%; 1-5 mm; round to flattened; scattered; 5%-10% in Pieces 1 and 10; lined with green clay and filled with green clay and calcite.

**COLOR:** Dark gray (N 4/0).

**STRUCTURE:** Faint subhorizontal flow-banding defined by small vesicle trains.

**ALTERATION:** Moderate to low.

**VEINS/FRACTURES:** None.



**UNIT 79: APHYRIC OLIVINE BASALT**

**Pieces 1A-1D**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

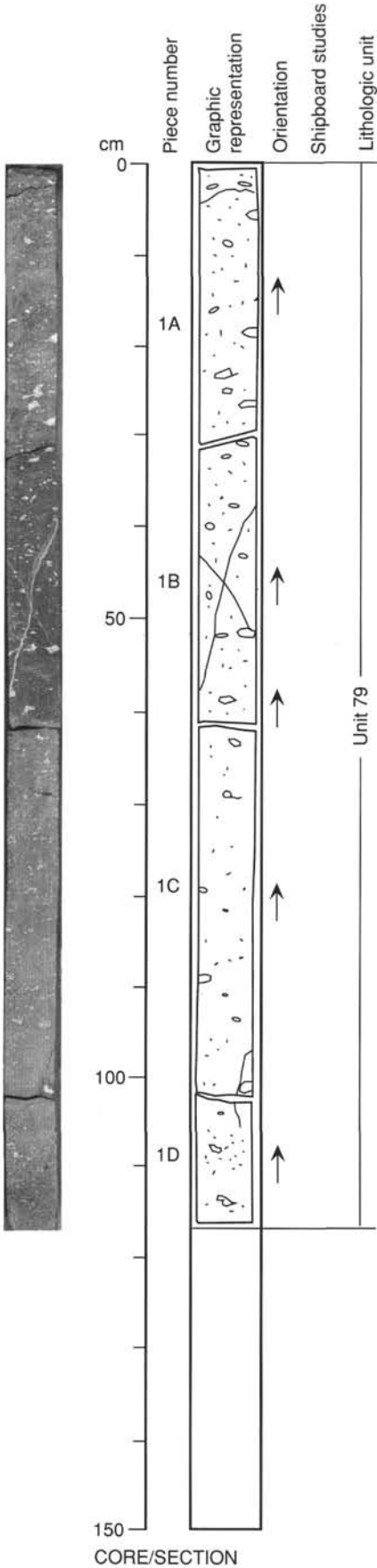
**VESICLES:** 5%; 1-10 mm; round to irregular flattened; in trains; lined with white-bladed zeolite and filled with greenish white clay; larger ones have calcite in the center.

**COLOR:** Dark gray (N 4/0).

**STRUCTURE:** Slightly dipping (10 degrees) flow-banding defined by trains of flattened vesicles.

**ALTERATION:** Moderate to low.

**VEINS/FRACTURES:** Two steep, crossing, 1-2-mm-wide calcite-filled fractures at 40-60 cm.



152-917A-80R-1

UNIT 79: APHYRIC OLIVINE BASALT

Pieces 1A-1H

PHENOCRYSTS: None.

GROUNDMASS: Fine-grained.

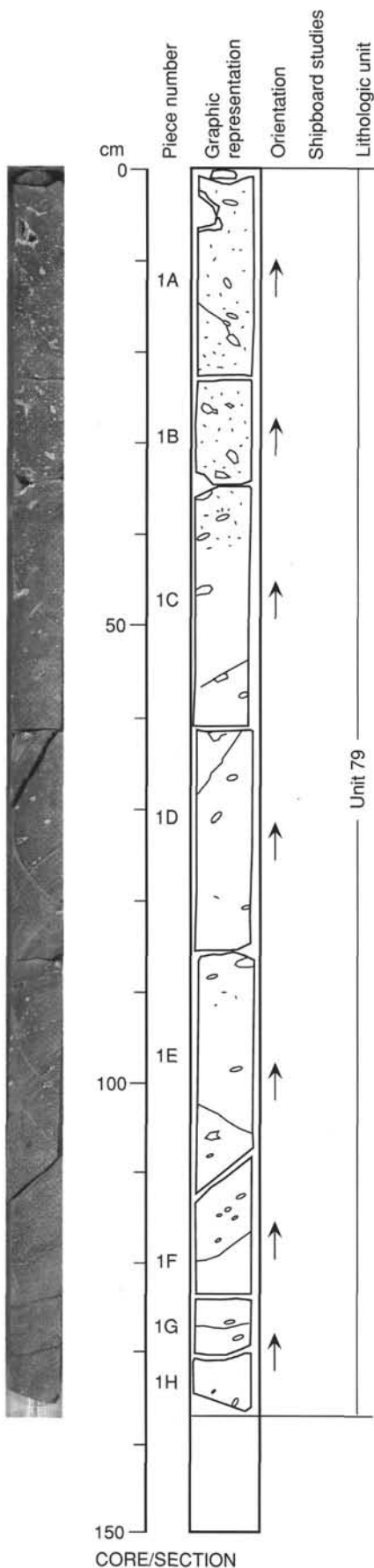
VESICLES: 2%-10%; 1-12 mm; flattened; in trains; lined with white zeolite and filled with grayish green clay; at 6-8 cm there is a 3 x 3 cm vug with euhedral, white, platy zeolite crystals.

COLOR: Dark gray (N 4/0).

STRUCTURE: Flow-banding defined by flattened vesicles oriented horizontal to dipping 20 degrees.

ALTERATION: Low.

VEINS/FRACTURES: A few hair-thin fractures filled with green clay and white zeolite, dipping 45-60 degrees.



CORE/SECTION

**UNIT 79: APHYRIC OLIVINE BASALT**

**Pieces 1A–2D**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

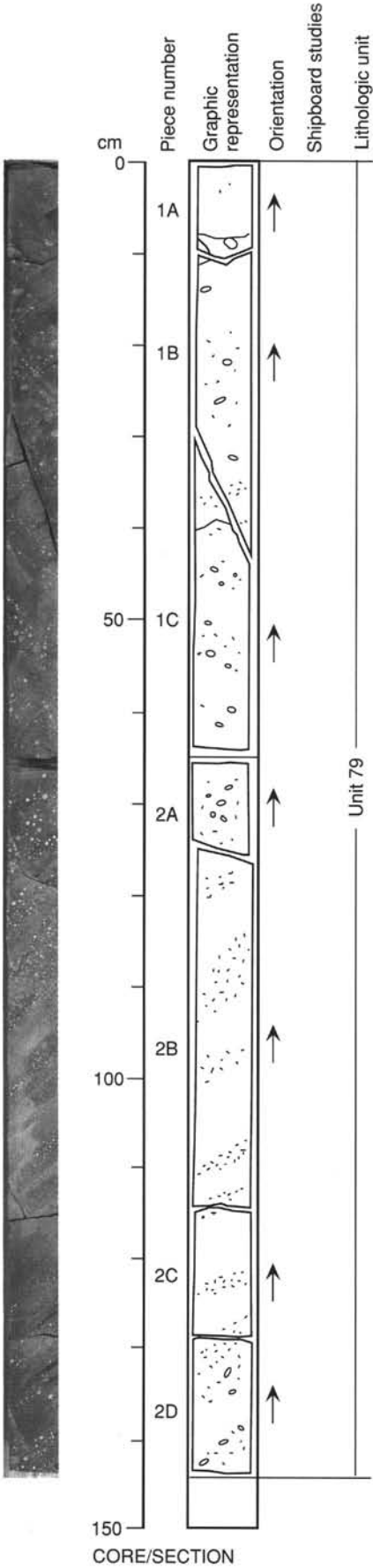
**VESICLES:** 0–10%; 1–8 mm; round; in trains; lined with white zeolite and filled with grayish green clay.

**COLOR:** Dark gray (N 4/0).

**STRUCTURE:** Flow-banding defined by trains of vesicles, oriented horizontal to dipping 50 degrees.

**ALTERATION:** Low.

**VEINS/FRACTURES:** <<1%; 1 mm; inclined 70 degrees; a few fractures filled with green clay.



152-917A-80R-3

UNIT 79: APHYRIC OLIVINE BASALT

Pieces 1A-1D

**PHENOCRYSTS:** None.

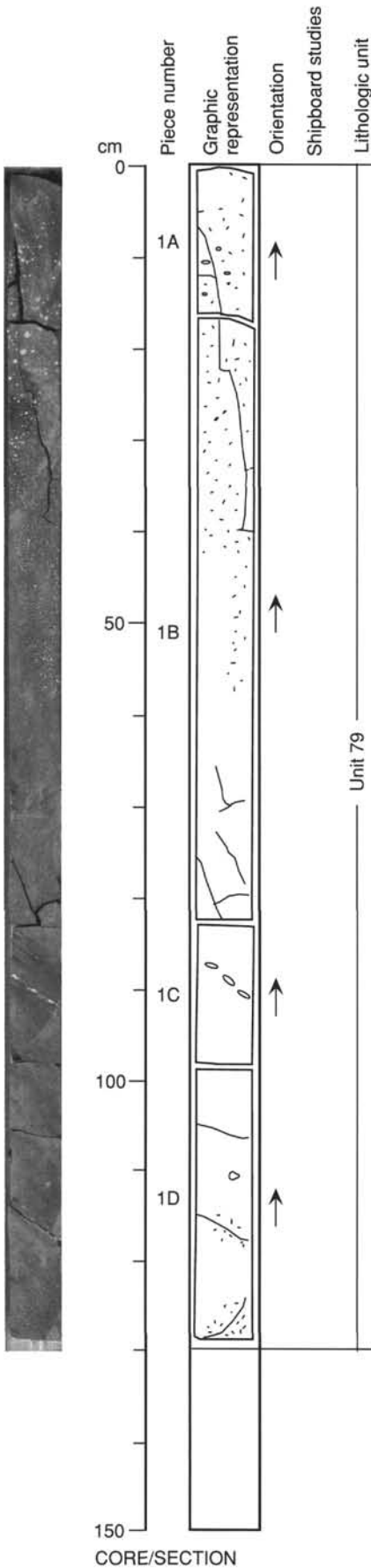
**GROUNDMASS:** Fine-grained.

**VESICLES:** 0-5%; 1-7 mm; round; only in upper part of section (0-60 cm); lined with white zeolite and filled with green clay.

**COLOR:** Dark gray (N 4/0).

**ALTERATION:** Low; some late oxidation in Piece 1C.

**VEINS/FRACTURES:** <<1%; 0.5 mm; inclined 70 degrees; a few fractures filled with green clay; one irregular white vein at 90 cm.



**UNIT 79: APHYRIC OLIVINE BASALT**

**Pieces 1A-1D**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

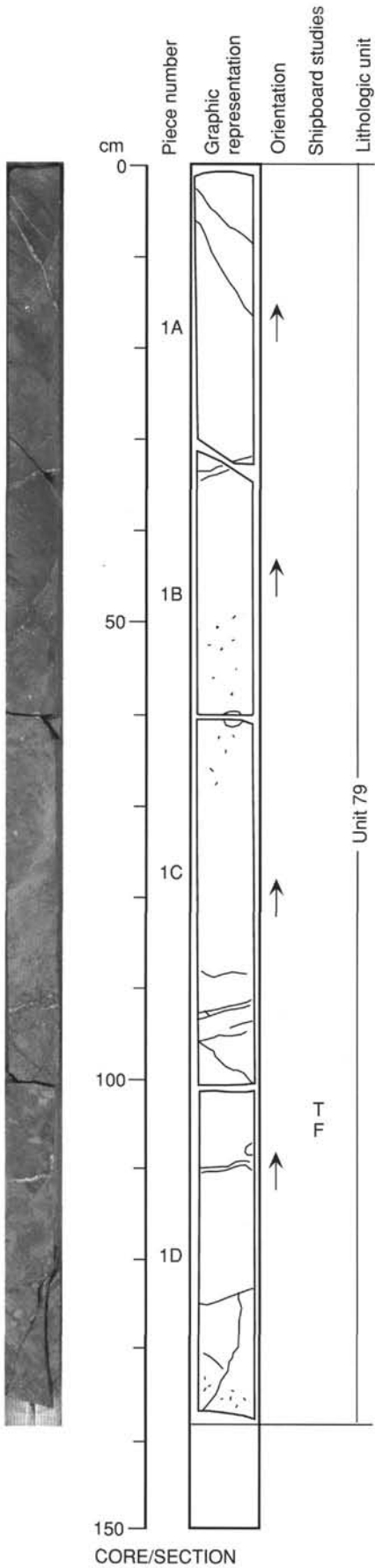
**VESICLES:** 0-3%; 1-3 mm; round; patchy distribution; only at 46-63 and 133-136 cm.

**COLOR:** Dark gray (N 4/0).

**STRUCTURE:** Massive in most parts; faint near-horizontal flow-banding at 85-100 cm.

**ALTERATION:** Low; some late oxidation around fractures and in patches.

**VEINS/FRACTURES:** <<1%; 1-3 mm; inclined 50-70 degrees; filled with green and white material; there are also irregular, near-horizontal, white veins at 35, 92-94, and 113 cm.



152-917A-80R-5

UNIT 79: APHYRIC OLIVINE BASALT

Pieces 1A-1F

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

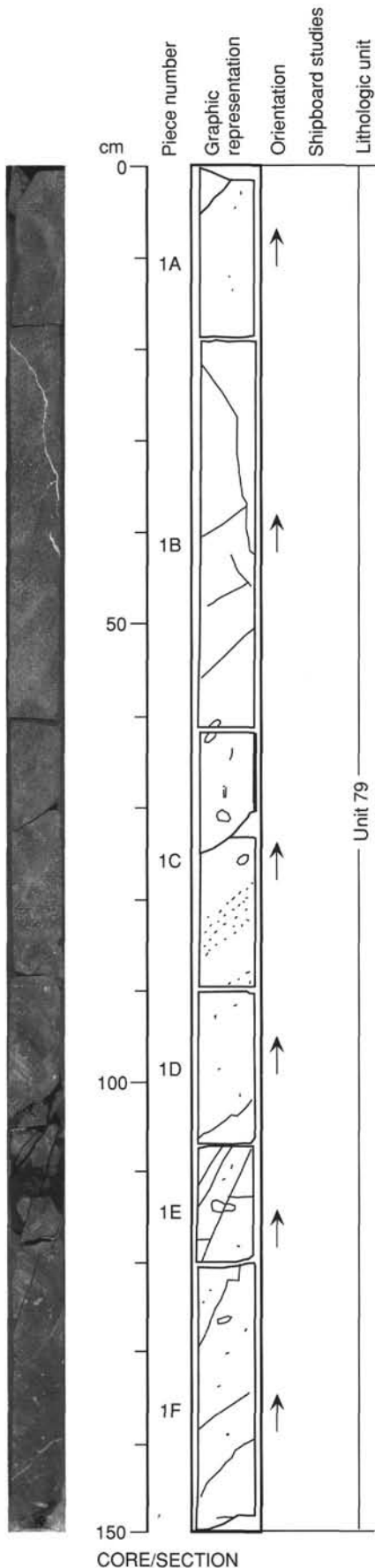
**VESICLES:** 0-5%; 1-3 mm; round; patchy distribution; only at 80-90 cm (5%) and below 120 cm (2%); filled with zeolite and grayish green clay.

**COLOR:** Dark gray (N 4/0).

**STRUCTURE:** Massive outside the vesicular zones.

**ALTERATION:** Low; some late oxidation in patches.

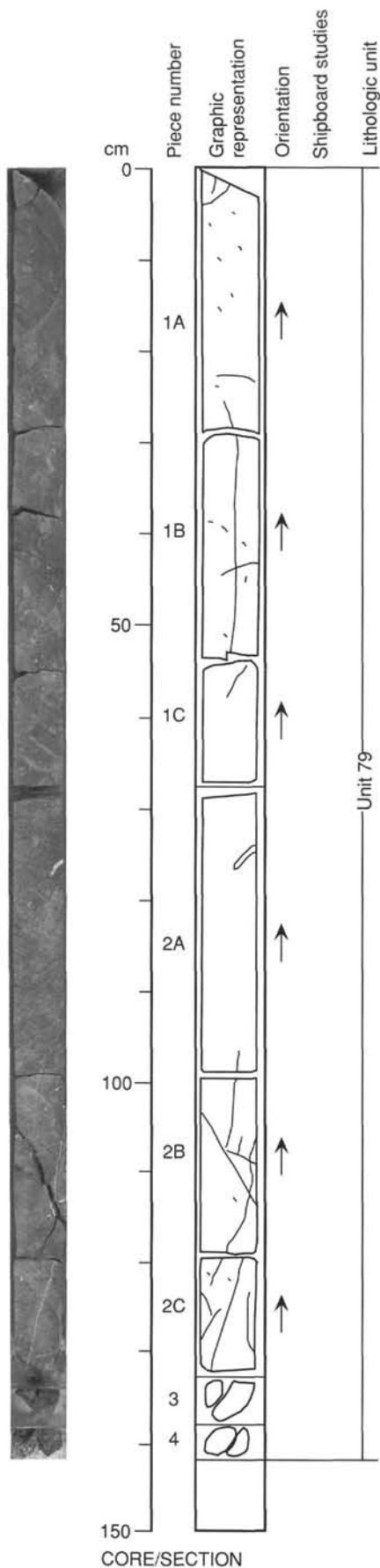
**VEINS/FRACTURES:** <<1%; 1-3 mm; inclined 40-70 degrees; filled with calcite.



**UNIT 79: APHYRIC OLIVINE BASALT**

**Pieces 1A-4**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 0-2%; 1-5 mm; round; patchy distribution; very few; filled with zeolite and grayish green clay.  
**COLOR:** Dark gray (N 4/0).  
**STRUCTURE:** Massive.  
**ALTERATION:** Low; some late oxidation in patches.  
**VEINS/FRACTURES:** <<1%; 0.5-1 mm; subvertical to 70 degrees; at 95-133 cm; filled with calcite.



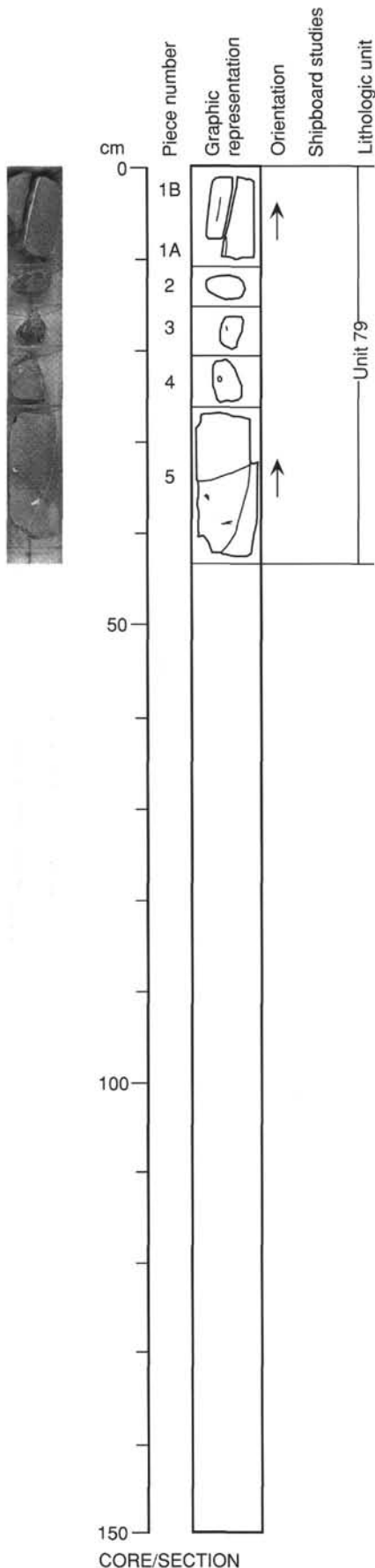


152-917A-80R-7

UNIT 79: APHYRIC OLIVINE BASALT

Pieces 1A-5

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** <<1%; 5-8 mm; round; very few; lined with white zeolite and filled with grayish green clay.  
**COLOR:** Dark gray (N 4/0).  
**STRUCTURE:** Massive.  
**ALTERATION:** Low.  
**VEINS/FRACTURES:** <1%; 0.5-1 mm; steep to near-horizontal; filled with calcite.



**UNIT 79: OLIVINE-PHYRIC BASALT**

**Piece 1A**

**CONTACTS:** Bottom contact at 5–10 cm in Piece 1A.

**PHENOCRYSTS:** Often occur in clumps. Olivine - 10%; up to 2 mm; euhedral.

**GROUNDMASS:** Very fine-grained.

**VESICLES:** 5%; 1–3 mm; round to irregular; lined with quartz; filled with calcite.

**COLOR:** Dusky red (2.5YR 3/1).

**ALTERATION:** Strong; slightly oxidized.

**VEINS/FRACTURES:** 5%; 1–6 mm; filled with calcite.

**ADDITIONAL COMMENTS:** This is the bottom contact of a flow. However, it may not be the same flow as Unit 79 (3 m missing between Cores 152-917A-80R and -81R). If it is the base of Unit 79, then lots of olivine settling occurred.

**UNIT 80: APHYRIC OLIVINE BASALT**

**Pieces 1A–1E**

**CONTACTS:** Top contact at 5–10 cm in Piece 1A.

**PHENOCRYSTS:** None.

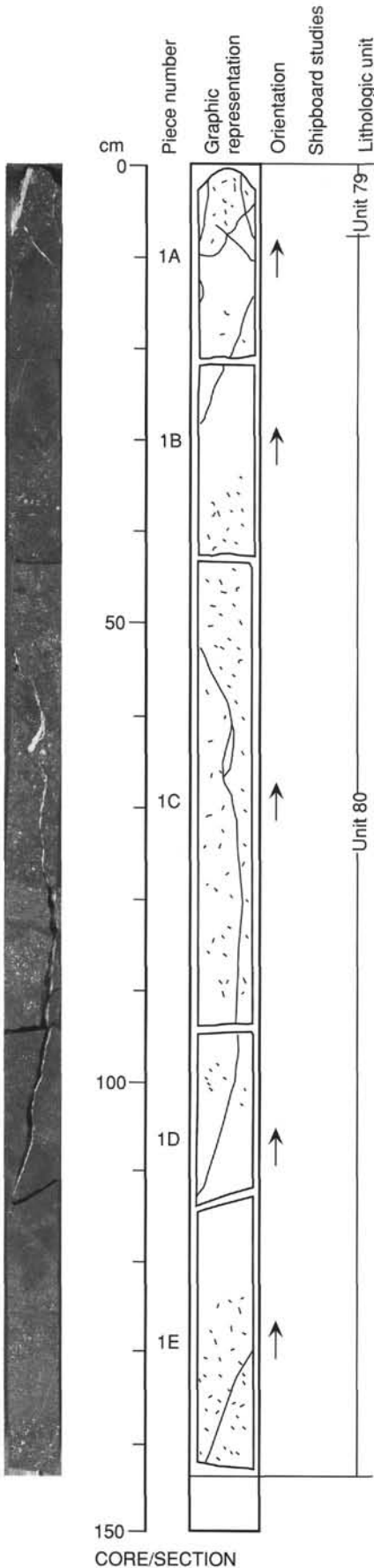
**GROUNDMASS:** Fine-grained.

**VESICLES:** 1%–15%; <1–4 mm; round to irregular; lined with quartz; filled with calcite. **Miaroles:** Concentrated at intervals 30–102 and 123–142 cm.

**COLOR:** Dusky red (10YR 3/4) in Piece 1A grading to dusky red (2.5YR 3/1) in Piece 1E; dark red (10R 3/6) in top 3 mm.

**ALTERATION:** Strong; very oxidized.

**VEINS/FRACTURES:** 1–8 mm; 60 degrees to vertical; filled with calcite.



CORE/SECTION

152-917A-81R-2

**UNIT 80: APHYRIC OLIVINE BASALT**

**Pieces 1-2D**

**PHENOCRYSTS:** None.

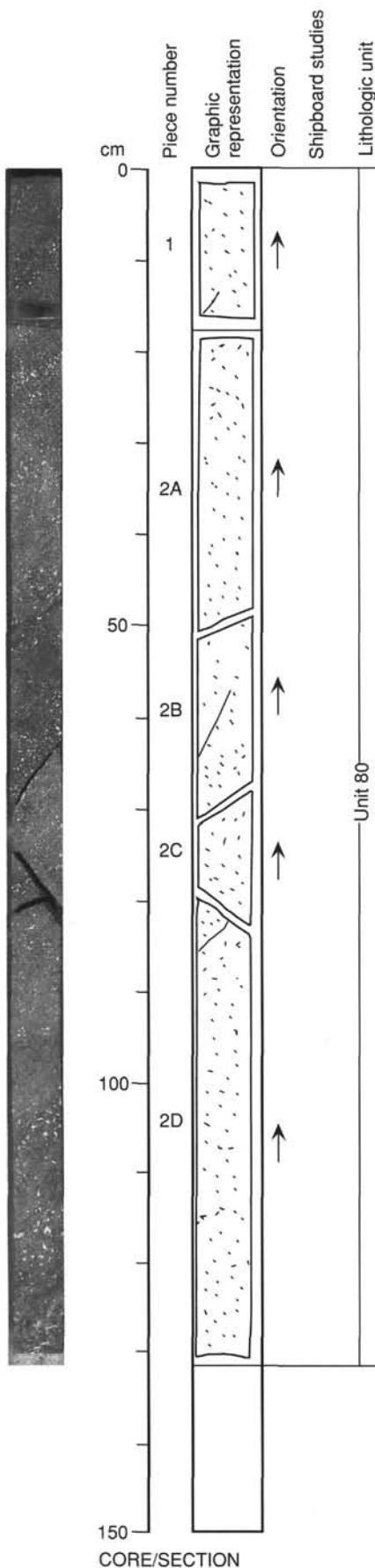
**GROUNDMASS:** Fine-grained.

**VESICLES:** 5%–10%; up to 5 mm; irregular; patchy distribution; lined with quartz; filled with calcite.

**COLOR:** Grayish red (5R 4/2).

**ALTERATION:** Strong; partly oxidized.

**VEINS/FRACTURES:** <<1%; up to 2 mm; horizontal to inclined; filled with calcite.



**UNIT 80: APHYRIC OLIVINE BASALT**

**Pieces 1A–1E**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 5%–20%; up to 8 mm; irregular; patchy distribution; lined with quartz; filled with calcite.

**COLOR:** Brownish gray (5YR 4/1) at top to dark olive gray (5Y 3/1) at base.

**ALTERATION:** Strong; slightly oxidized.

**VEINS/FRACTURES:** <1%; up to 6 mm; inclined; filled with calcite.

**UNIT 81A: CHLORITIC BRECCIA**

**Pieces 2–4**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

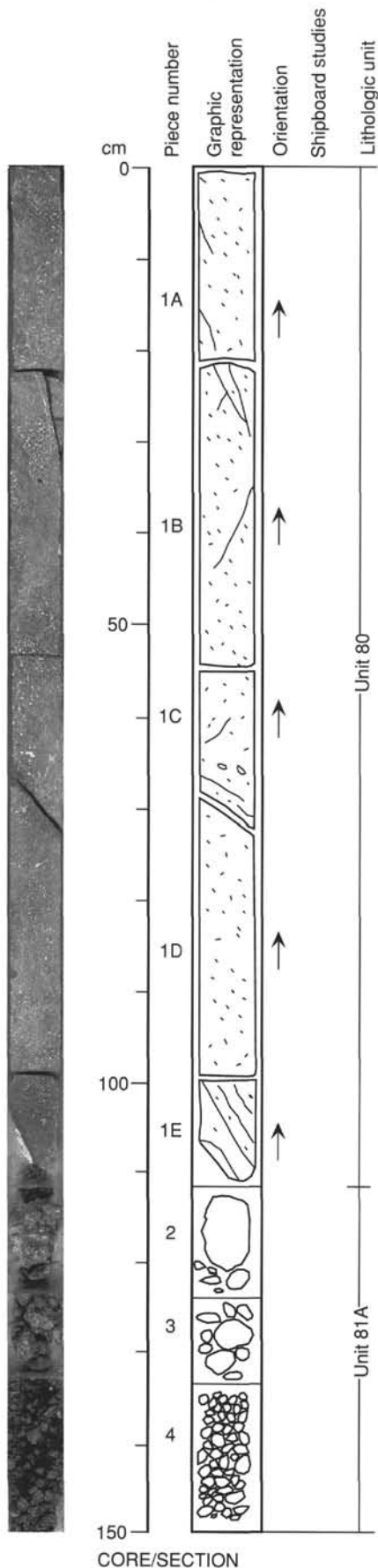
**VESICLES:** None.

**COLOR:** Dusky green (5G 3/2).

**STRUCTURE:** Basalt clasts up to 20 mm across in chloritic matrix.

**ALTERATION:** Clasts completely altered.

**ADDITIONAL COMMENTS:** Fault breccia; appears to be more closely related to Unit 81B than Unit 80.



152-917A-81R-4

UNIT 81B: APHYRIC OLIVINE BASALT

Pieces 1A-7

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

**VESICLES:** <1%; up to 2 mm; spherical; random distribution; filled with pale green mineral.

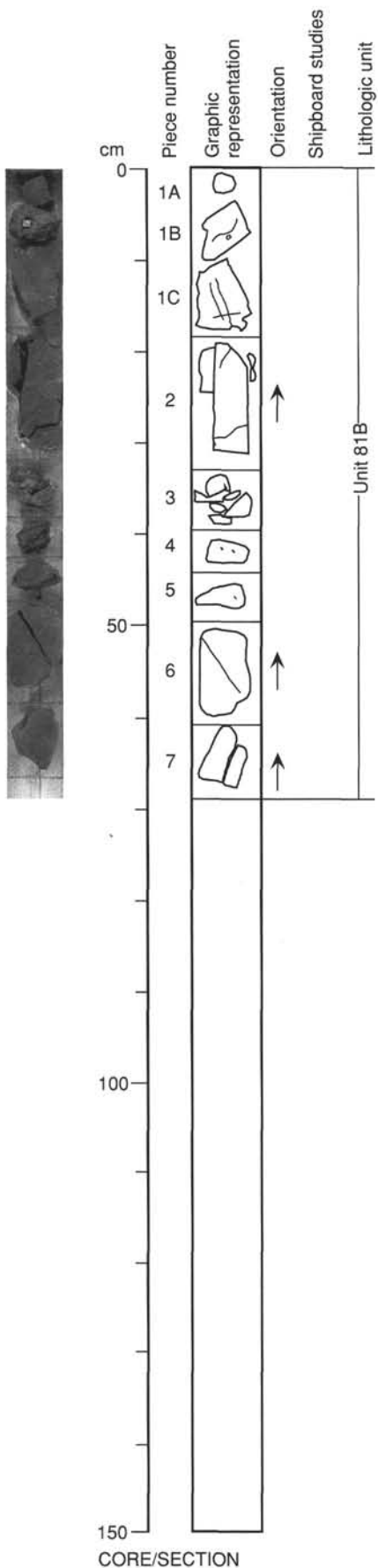
**COLOR:** Greenish black (5GY 2/1).

**STRUCTURE:** Highly fractured and sheared in Pieces 1-3.

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** 1%; up to 0.5 mm; inclined; filled with chlorite and calcite.

**ADDITIONAL COMMENTS:** Top of unit is sheared and brecciated; base is not preserved.



**UNIT 82: APHYRIC OLIVINE BASALT**

**Pieces 2-4D**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

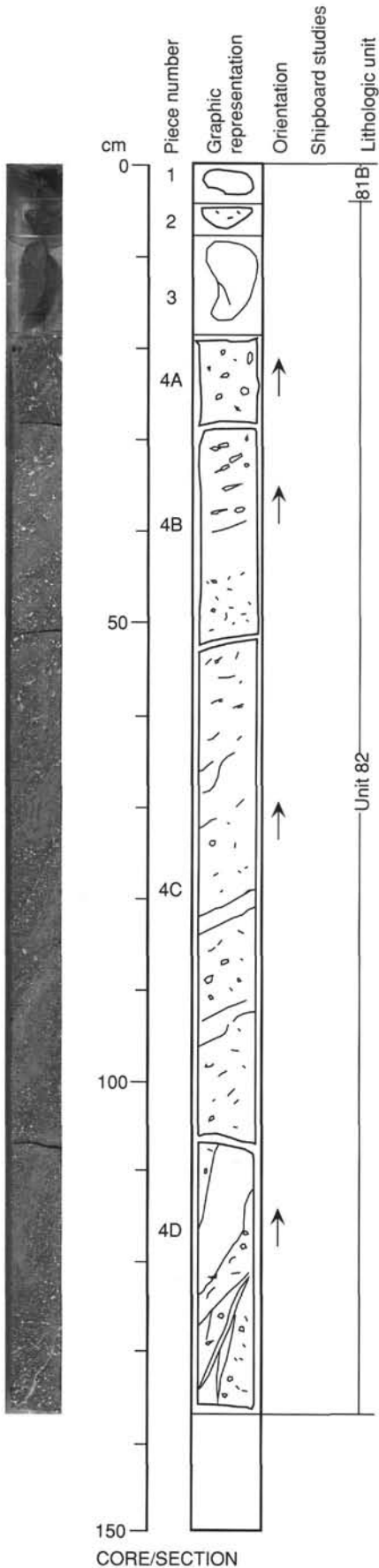
**VESICLES:** 2%-30%; up to 6 mm; irregular; concentrated in 2-10 cm bands; filled with zeolite.

**COLOR:** Greenish brown (5YR 3/2) at top to olive black (5Y 2/1) at base.

**ALTERATION:** Moderate to strong; partly oxidized.

**VEINS/FRACTURES:** 0-5%; up to 3 mm; inclined; confined to bottom 10 cm of section; filled with zeolite, one vein lined with monoclinic crystals.

**ADDITIONAL COMMENTS:** Piece 1 is a fragment of Unit 81B.



152-917A-82R-2

**UNIT 82: APHYRIC OLIVINE BASALT**

**Pieces 1A-1C**

**PHENOCRYSTS:** None.

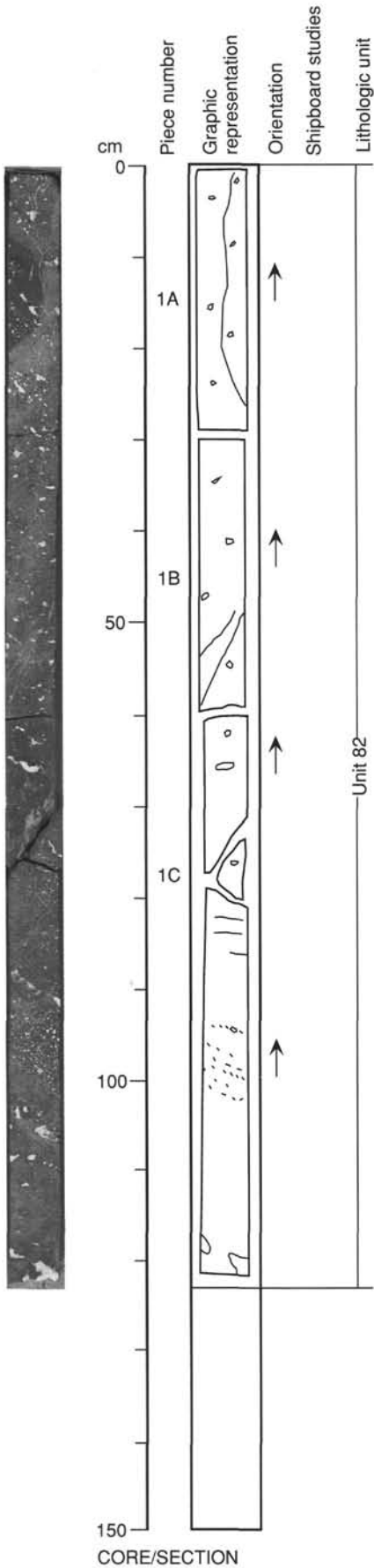
**GROUNDMASS:** Fine-grained.

**VESICLES:** 2%-30%; up to 25 mm; irregular; concentrated in patches and bands; filled with zeolite; large zeolite-filled cavity at base of section.

**COLOR:** Olive black (5Y 2/1).

**ALTERATION:** Moderate.

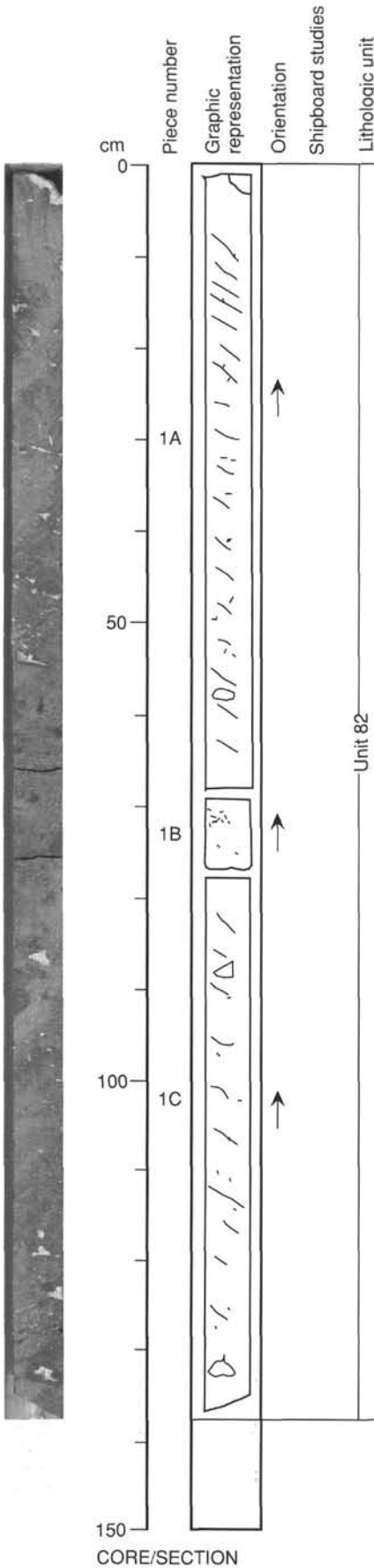
**VEINS/FRACTURES:** 1%; up to 15 mm; inclined; filled with zeolite; slickensides on fracture surface.



**UNIT 82: APHYRIC OLIVINE BASALT**

**Pieces 1A-1C**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 3%; up to 20 mm; irregular; random distribution; filled with zeolite.  
**COLOR:** Greenish black (5G 2/1).  
**STRUCTURE:** Faint, irregular flow-banding.  
**ALTERATION:** Moderate.  
**VEINS/FRACTURES:** <<1%; up to 0.5 mm; subhorizontal; single zeolite-filled vein at 130 cm.





152-917A-82R-4

**UNIT 82: APHYRIC OLIVINE BASALT**

**Pieces 1A-1E**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

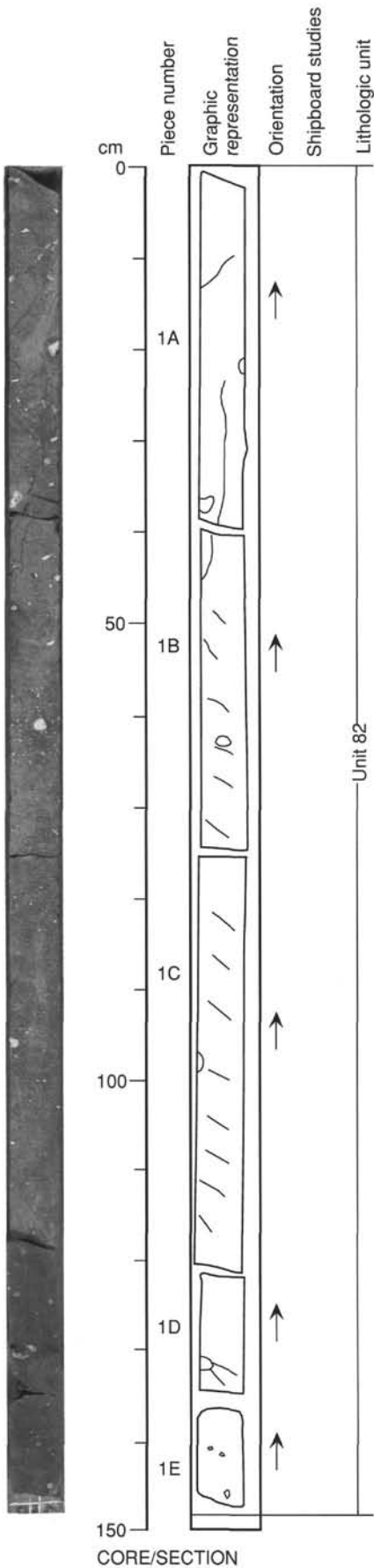
**VESICLES:** 2%; up to 15 mm; spherical to irregular; smaller vesicles concentrated in bands at 60 and 72 cm; filled with zeolite.

**COLOR:** Dark gray (N 3/0).

**STRUCTURE:** Faint, irregular flow-banding.

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** <<1%; up to 3 mm; inclined; filled with zeolite.



CORE/SECTION

**UNIT 82: APHYRIC OLIVINE BASALT**

**Pieces 1A–1E**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

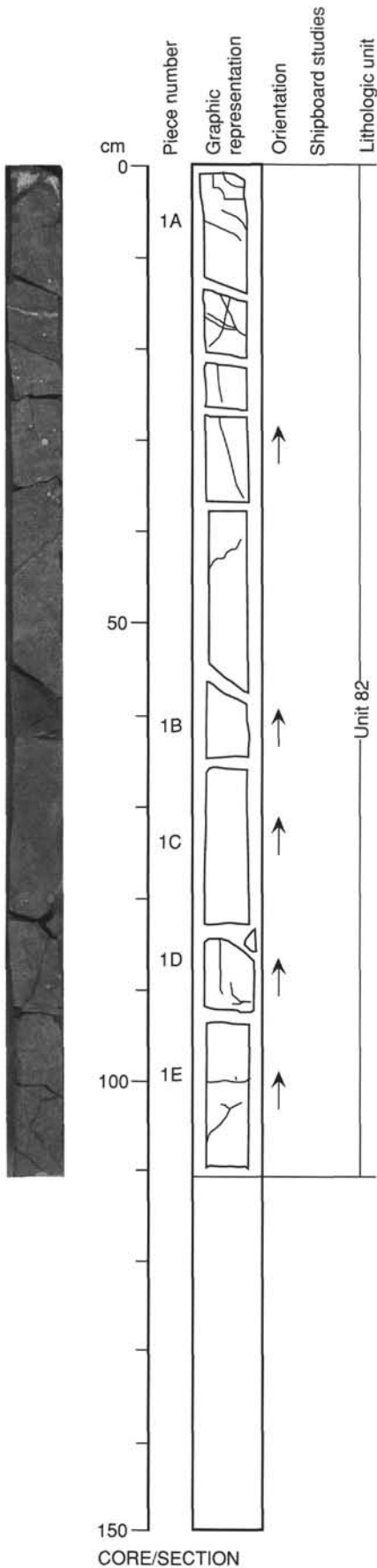
**VESICLES:** 1%; up to 10 mm; spherical; random distribution; filled with zeolite and pale green mineral.

**COLOR:** Dark gray (N 3/0).

**STRUCTURE:** Faint, irregular flow-banding.

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** <1%; up to 5 mm; inclined; filled with zeolite.

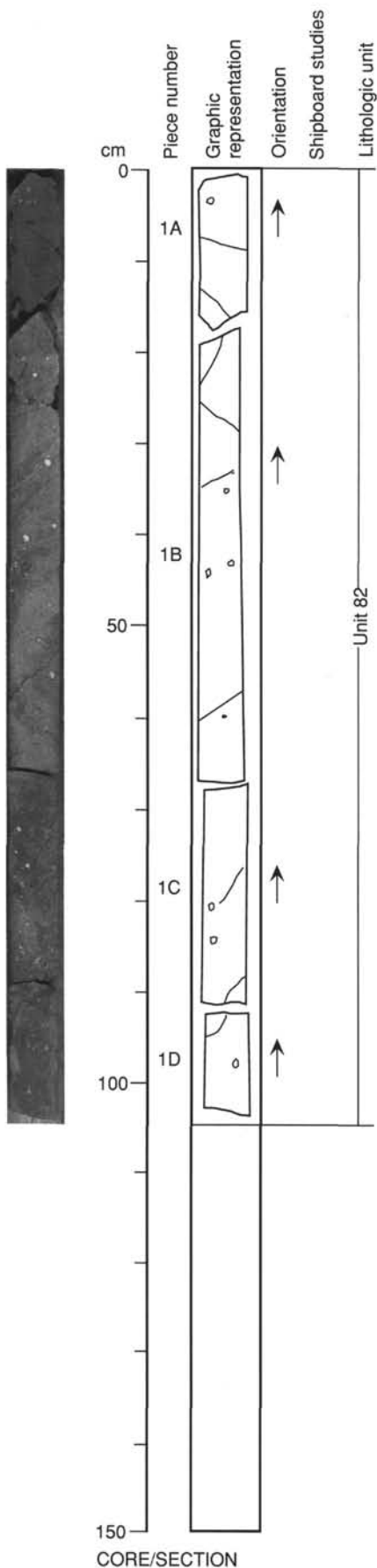


152-917A-82R-6

UNIT 82: APHYRIC OLIVINE BASALT

Pieces 1A-1D

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 1%; up to 7 mm; spherical; random distribution; filled with zeolite.  
**COLOR:** Greenish black (5G 2/1).  
**ALTERATION:** Moderate.  
**VEINS/FRACTURES:** <1%; up to 1 mm; inclined; lined with chlorite and filled with zeolite.



**UNIT 82: APHYRIC OLIVINE BASALT**

**Pieces 1-5C**

**PHENOCRYSTS:** None.

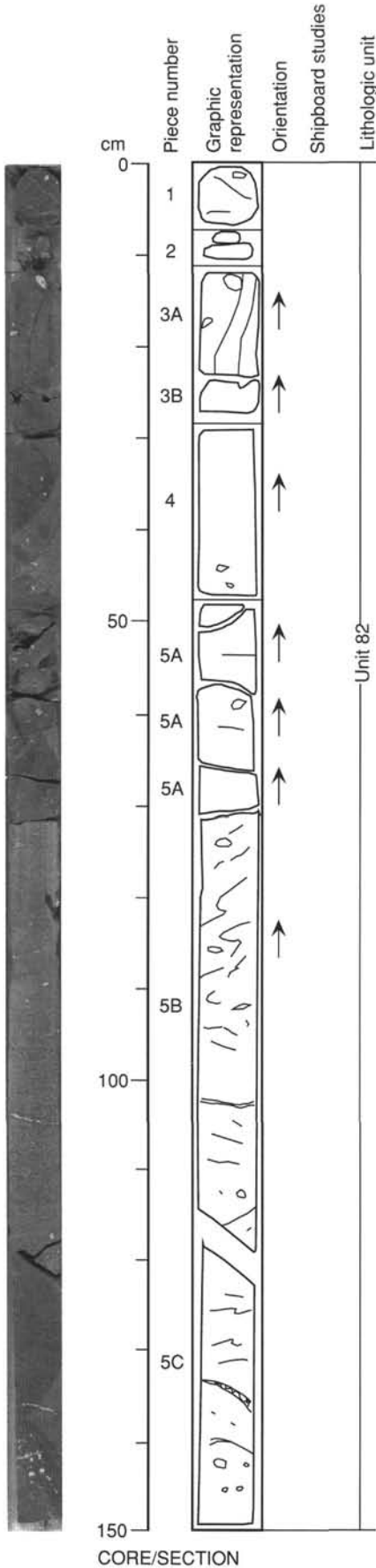
**GROUNDMASS:** Fine-grained.

**VESICLES:** 1%; up to 15 mm; spherical to flattened; random distribution; filled with zeolite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Slight.

**VEINS/FRACTURES:** <<1%; up to 3 mm; horizontal to inclined; filled with zeolite.

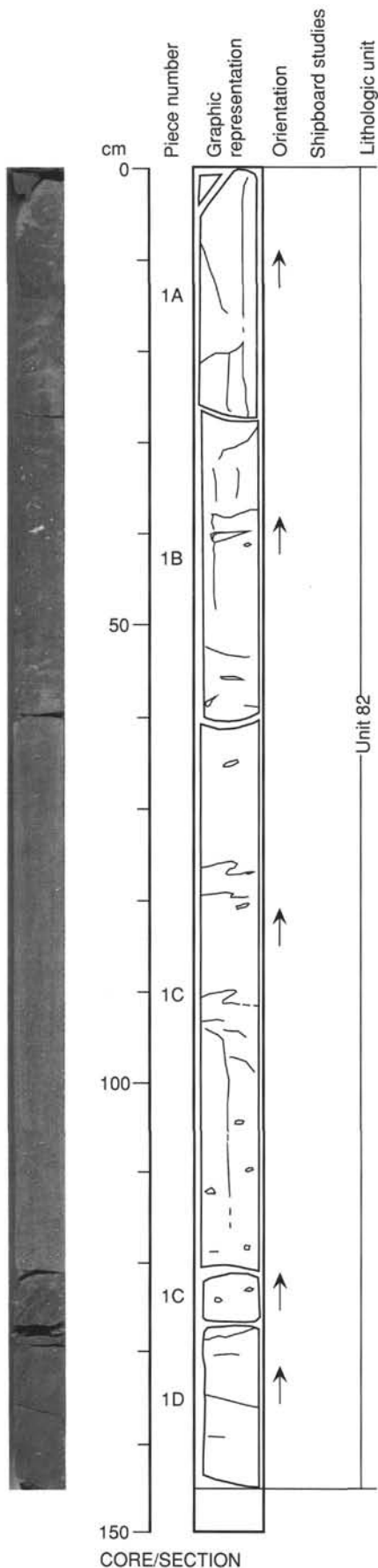


152-917A-83R-2

**UNIT 82: APHYRIC OLIVINE BASALT**

**Pieces 1A-1D**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** <1%; up to 10 mm; spherical to irregular; random distribution; filled with zeolite.  
**COLOR:** Greenish black (5G 2/1).  
**ALTERATION:** Slight.  
**VEINS/FRACTURES:** <<1%; up to 1 mm; random orientation; filled with zeolite.



150  
CORE/SECTION

**UNIT 82: APHYRIC OLIVINE BASALT**

**Pieces 1A-7C**

**PHENOCRYSTS:** None.

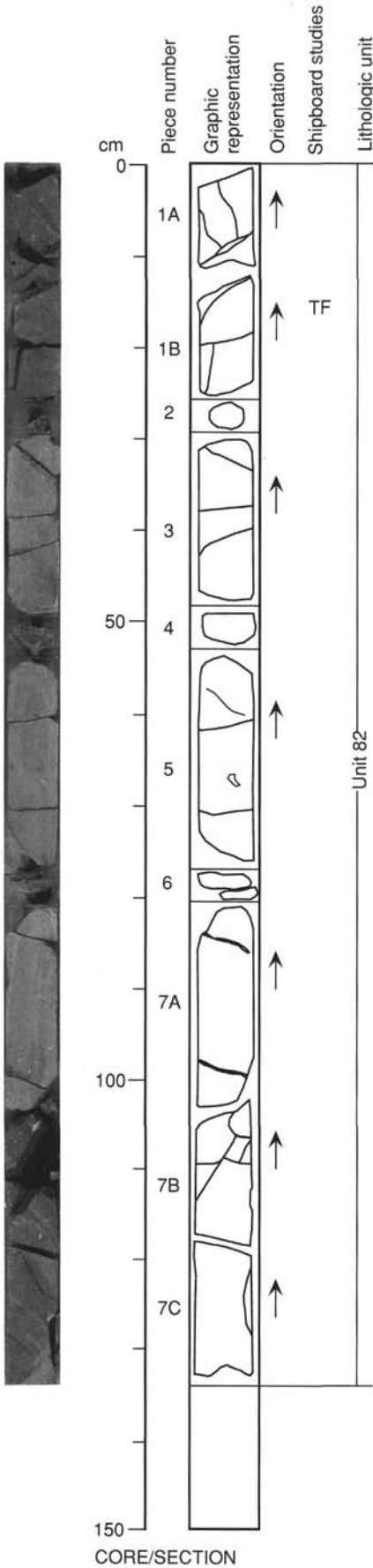
**GROUNDMASS:** Fine-grained.

**VESICLES:** <1%; up to 10 mm; spherical to flattened; random distribution; filled with zeolite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Slight.

**VEINS/FRACTURES:** <<1%; up to 1 mm; inclined; lined with chlorite and filled with zeolite.



152-917A-83R-4

**UNIT 82: APHYRIC OLIVINE BASALT**

**Pieces 1A-5D**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

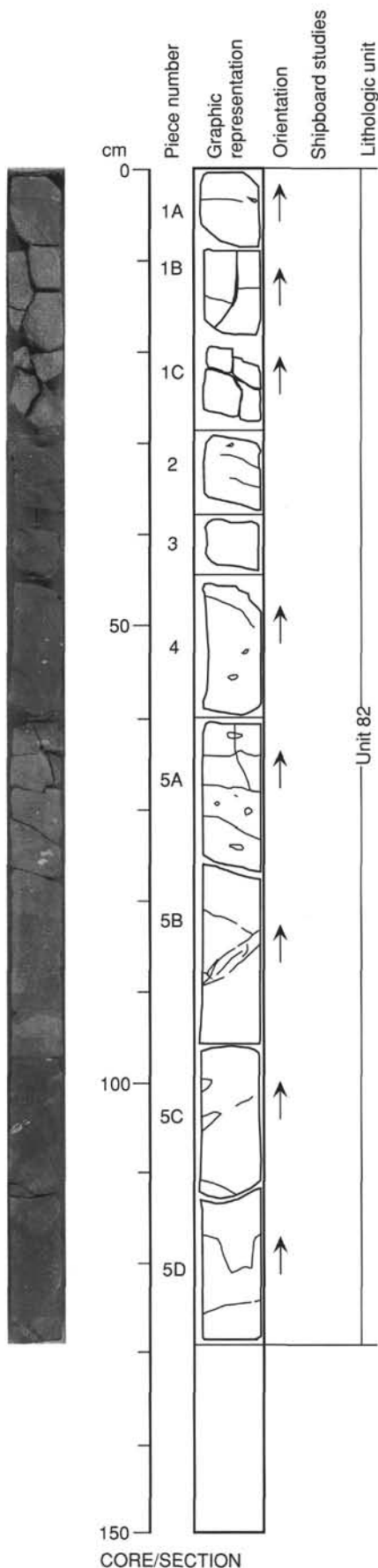
**VESICLES:** 1%-20%; up to 10 mm; spherical to irregular; concentrated at base of section; filled with pale green mineral and zeolite.

**COLOR:** Greenish black (5G 2/1) at top to brownish black (5YR 2/1) with dark reddish brown (10R 3/4) patches at base.

**ALTERATION:** Slight.

**VEINS/FRACTURES:** <<1%; up to 1 mm; random orientation; chlorite-filled fractures in Piece 2.

**ADDITIONAL COMMENTS:** Vesicular base zone of flow below 82 cm.



**UNIT 82: APHYRIC OLIVINE BASALT**

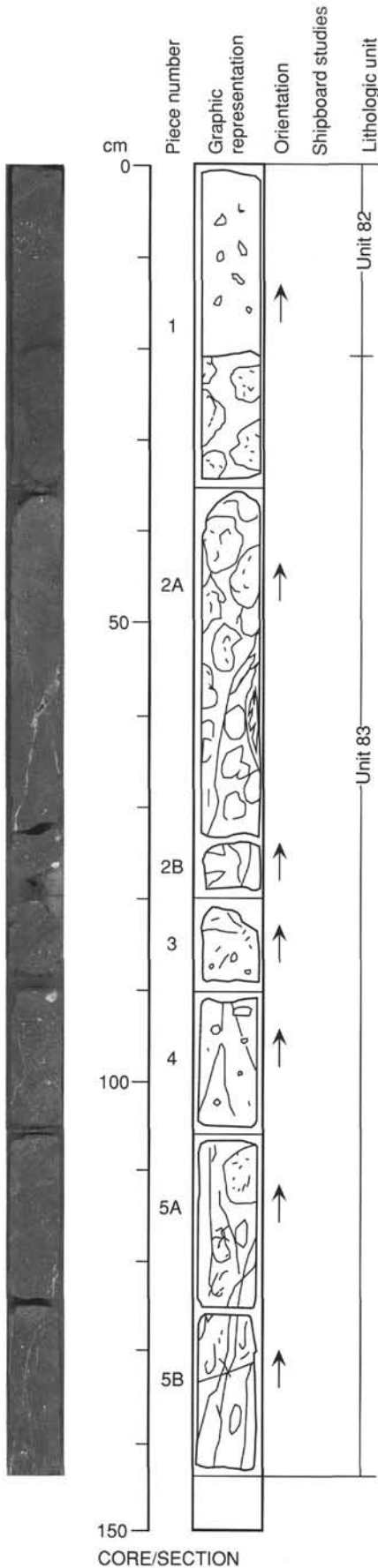
**Piece 1**

**CONTACTS:** Base of flow at 21 cm.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 20%; up to 5 mm; irregular; random distribution; filled with zeolite and chlorite.  
**COLOR:** Dusky yellowish brown (10YR 2/2).  
**ALTERATION:** Strong.

**UNIT 83: PLAGIOCLASE-OLIVINE-PHYRIC BASALT**

**Pieces 1-5B**

**CONTACTS:** Top of flow in Piece 1.  
**PHENOCRYSTS:** Plagioclase - 10%; up to 3 mm; mostly tabular. Olivine - 2%; up to 3 mm; euhedral to subhedral.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 2%-10%; up to 10 mm; spherical to irregular; patchy distribution; filled with zeolite and calcite.  
**COLOR:** Dusky yellowish brown (10YR 2/2) to dark reddish brown (10R 3/4) streaks in upper part.  
**STRUCTURE:** Flow-brecciated.  
**ALTERATION:** Completely altered and oxidized top; strongly altered at base of section.  
**VEINS/FRACTURES:** 1%-5%; up to 10 mm; inclined to vertical; filled with zeolite.





152-917A-83R-6

**UNIT 83: PLAGIOCLASE-OLIVINE-PHYRIC BASALT**

**Pieces 1A-2**

**PHENOCRYSTS:** Plagioclase - 10%; up to 3 mm; mostly tabular. Olivine - 2%; up to 3 mm; euhedral to subhedral.

**GROUNDMASS:** Fine-grained.

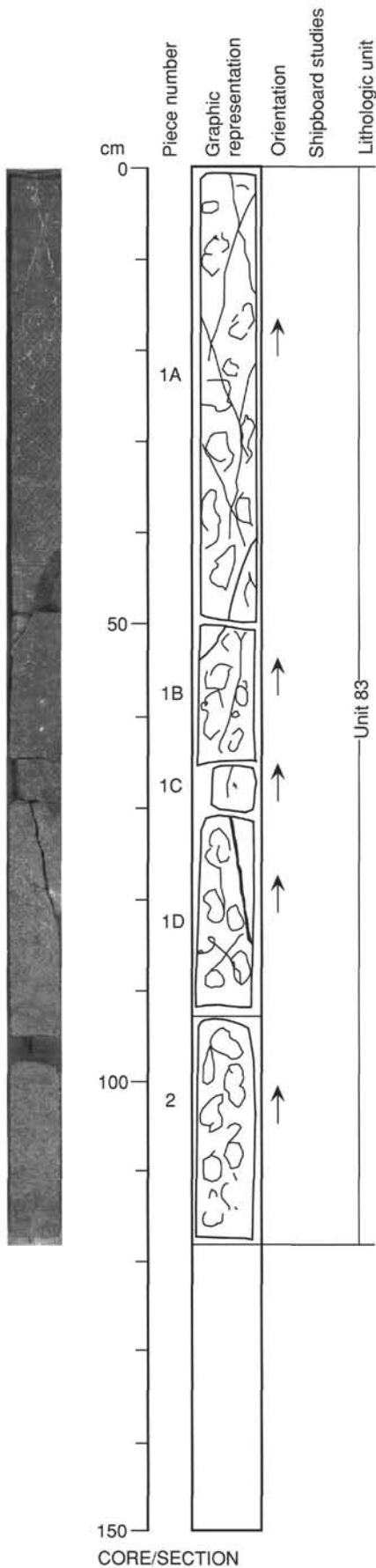
**VESICLES:** 1%-20%; up to 5 mm; irregular; patchy distribution; filled with zeolite; some calcite in larger vesicles.

**COLOR:** Dusky brown (5YR 2/2) with red staining.

**STRUCTURE:** Flow-brecciated.

**ALTERATION:** Strong.

**VEINS/FRACTURES:** 1%; up to 2 mm; inclined to vertical; filled with zeolite.



**UNIT 83: PLAGIOCLASE-OLIVINE-PHYRIC BASALT**

**Pieces 1-5**

**PHENOCRYSTS:** Plagioclase - 10%; up to 3 mm; mostly tabular. Olivine - 2%; up to 3 mm; euhedral to subhedral.

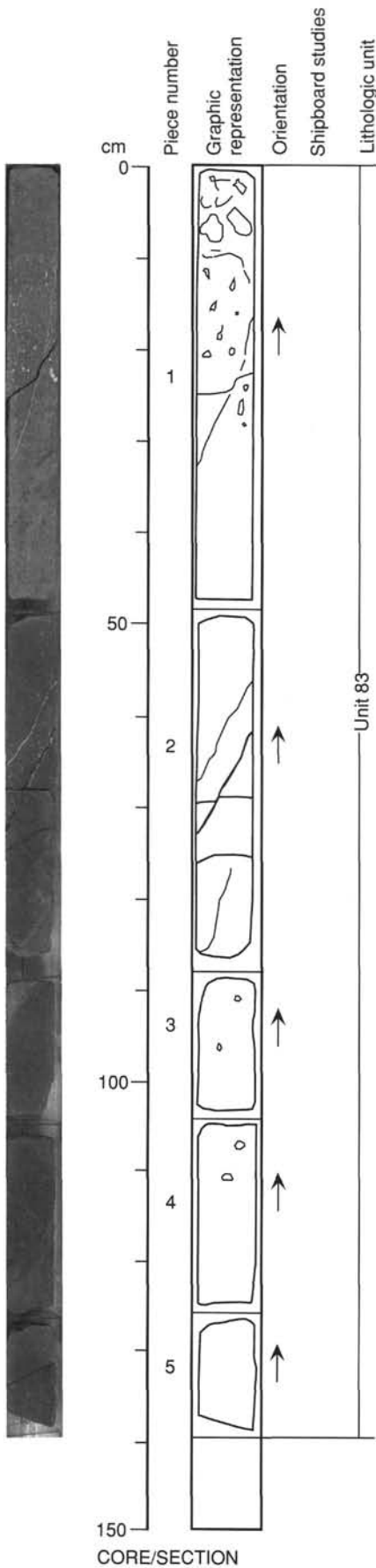
**GROUNDMASS:** Fine-grained.

**VESICLES:** 1%-10%; up to 8 mm; irregular; mostly at top of section; filled with zeolite.

**COLOR:** Dusky yellow brown (10YR 2/2) with red staining at top; greenish black (5G 2/1) at base of section.

**ALTERATION:** Strong at top of section; moderate at base.

**VEINS/FRACTURES:** <1%; up to 2 mm; inclined; lined with chlorite and filled with zeolite.



152-917A-83R-8

**UNIT 83: PLAGIOCLASE-OLIVINE-PHYRIC BASALT**

**Pieces 1A-3**

**PHENOCRYSTS:** Plagioclase - 10%; up to 3 mm; mostly tabular. Olivine - 2%; up to 3 mm; euhedral to subhedral.

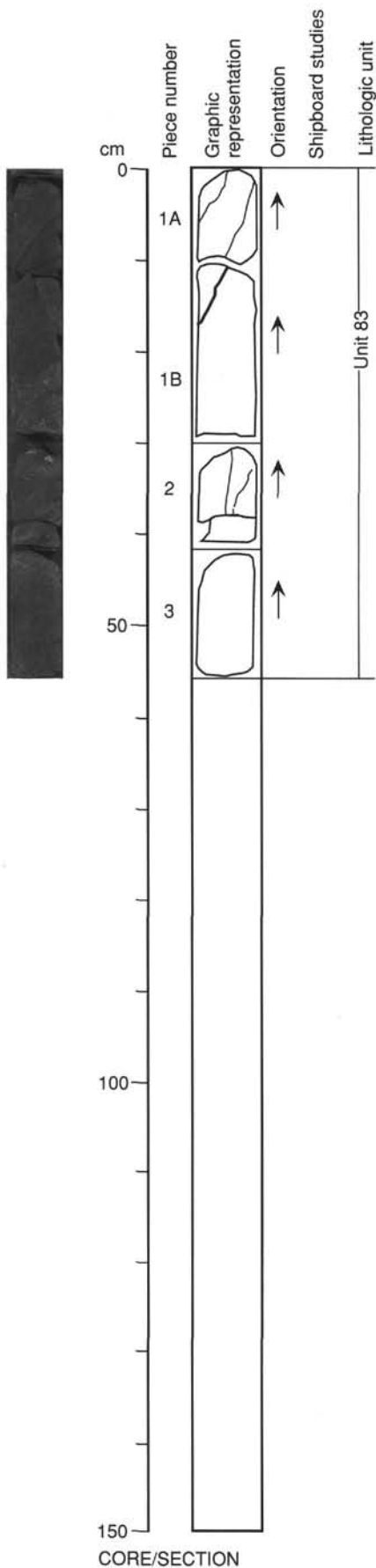
**GROUNDMASS:** Fine-grained.

**VESICLES:** 1%-3%; up to 6 mm; irregular; patchy distribution; filled with zeolite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** <<1%; 0.2 mm; inclined; filled with chlorite and zeolite.



**UNIT 83: PLAGIOCLASE-OLIVINE-PHYRIC BASALT**

**Pieces 1A-2B**

**PHENOCRYSTS:** Plagioclase - 10%; up to 3 mm; mostly tabular. Olivine - 2%; up to 3 mm; euhedral to subhedral.

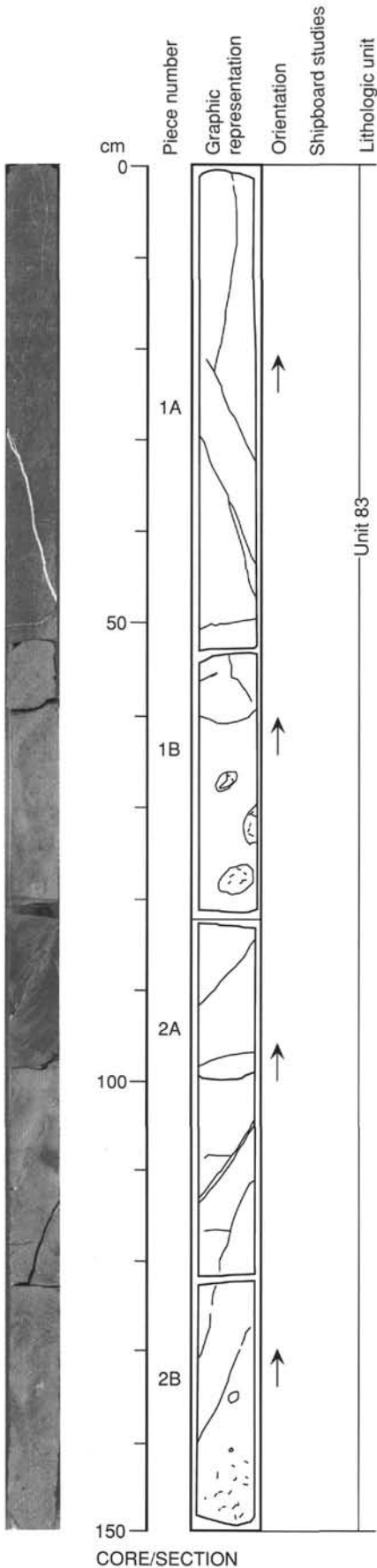
**GROUNDMASS:** Fine-grained.

**VESICLES:** 0-30%; up to 8 mm; irregular; in very small patches; filled with zeolite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Moderate; olivine completely altered.

**VEINS/FRACTURES:** 1%; 0-3 mm; inclined to vertical; lined with chlorite and filled with zeolite.



152-917A-84R-2

UNIT 83: PLAGIOCLASE-OLIVINE-PHYRIC BASALT

Pieces 1A-3E

**PHENOCRYSTS:** One 9 mm, elongate, olivine phenocryst in Piece 3A. Plagioclase - 10%; up to 3 mm; mostly tabular. Olivine - 2%; up to 3 mm; euhedral, equant to elongate.

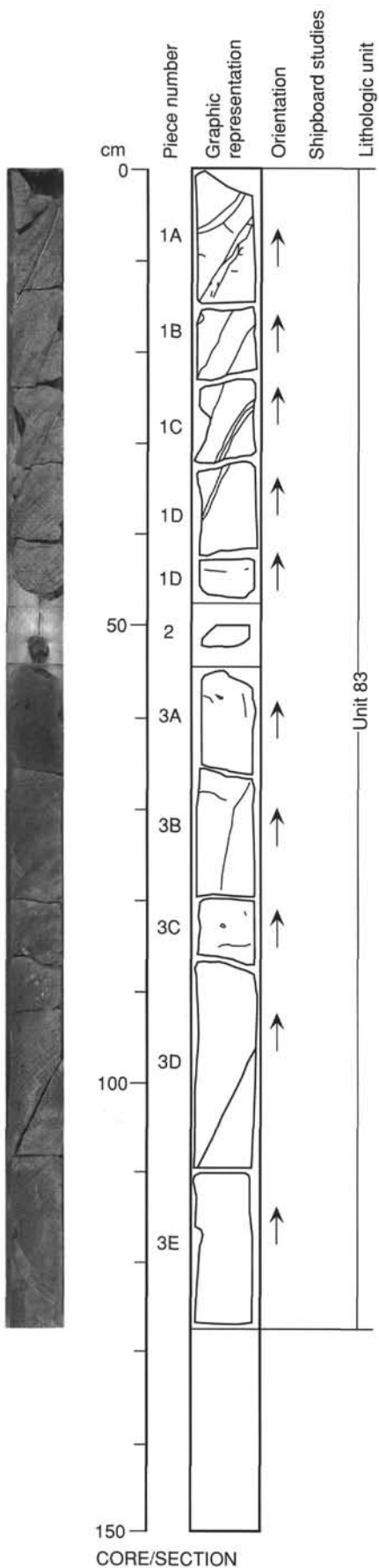
**GROUNDMASS:** Fine-grained.

**VESICLES:** 0-20%; up to 5 mm; irregular; confined to very small patches; filled with calcite and zeolite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Moderate; olivine completely altered.

**VEINS/FRACTURES:** 1%; up to 2 mm; inclined; lined with chlorite and filled with calcite.



152-917A-84R-3

**UNIT 83: PLAGIOCLASE-OLIVINE-PHYRIC BASALT**

**Pieces 1A-7**

**PHENOCRYSTS:** Plagioclase - 10%; up to 3 mm; mostly tabular. Olivine - 2%; up to 5 mm; euhedral, equant to elongate.

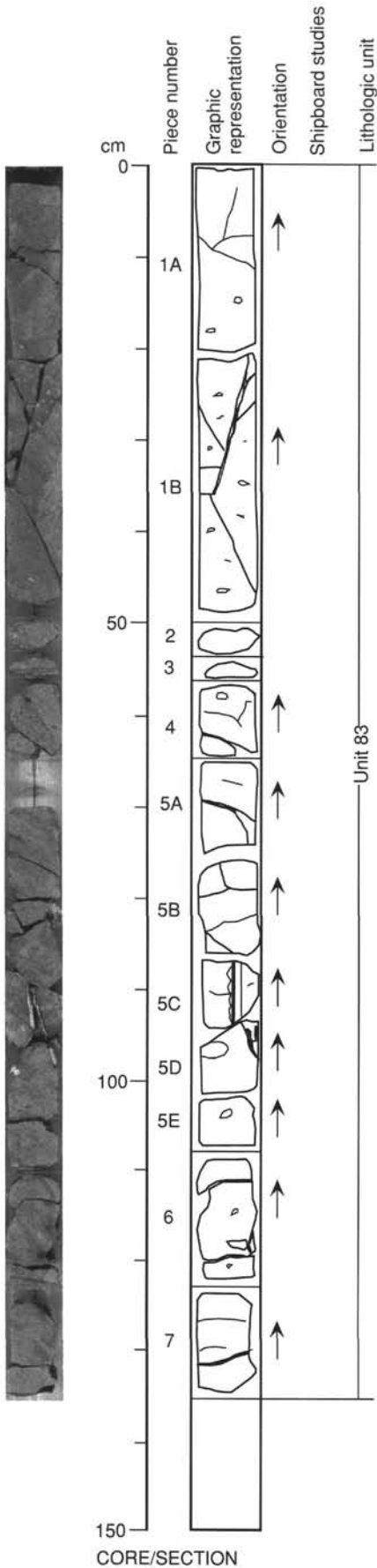
**GROUNDMASS:** Fine-grained.

**VESICLES:** <1%; filled with zeolite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Moderate; olivine completely altered.

**VEINS/FRACTURES:** <1%; up to 5 mm; inclined; lined with chlorite and filled with calcite.



152-917A-84R-4

UNIT 83: PLAGIOCLASE-OLIVINE-PHYRIC BASALT

Pieces 1-12

**PHENOCRYSTS:** Plagioclase - 10%; up to 3 mm; mostly tabular. Olivine - 2%; up to 3 mm; euhedral, equant to elongate.

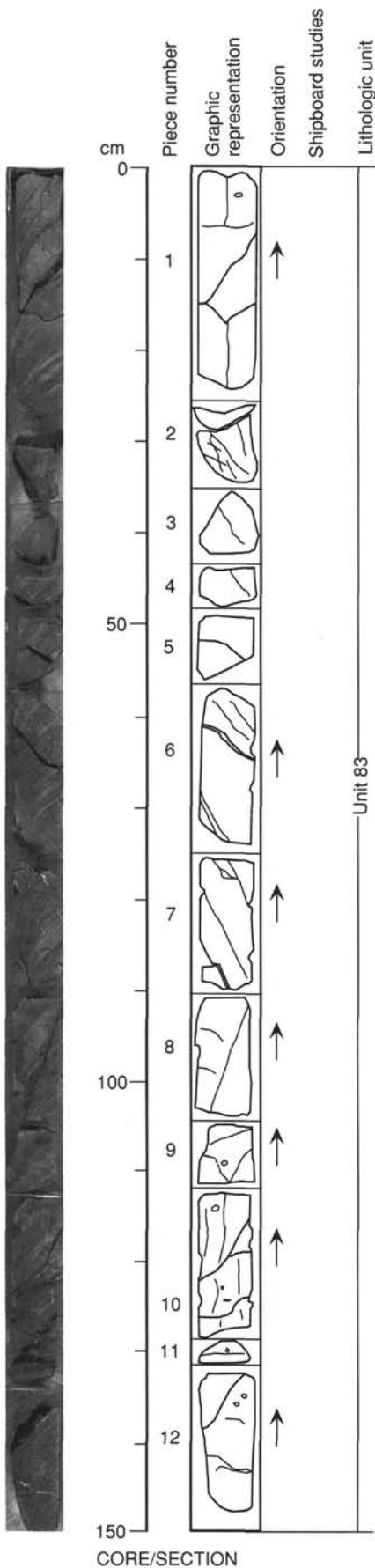
**GROUNDMASS:** Fine-grained.

**VESICLES:** <<1%; up to 4 mm; spherical; filled with chalcedony.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Moderate; olivine completely altered.

**VEINS/FRACTURES:** 1%; up to 3 mm; inclined; lined with chlorite and filled with calcite.



**UNIT 83: PLAGIOCLASE-OLIVINE-PHYRIC BASALT**

**Pieces 1-9B**

**PHENOCRYSTS:** Plagioclase - 10%; up to 3 mm; mostly tabular. Olivine - 2%; up to 5 mm; euhedral, equant to elongate.

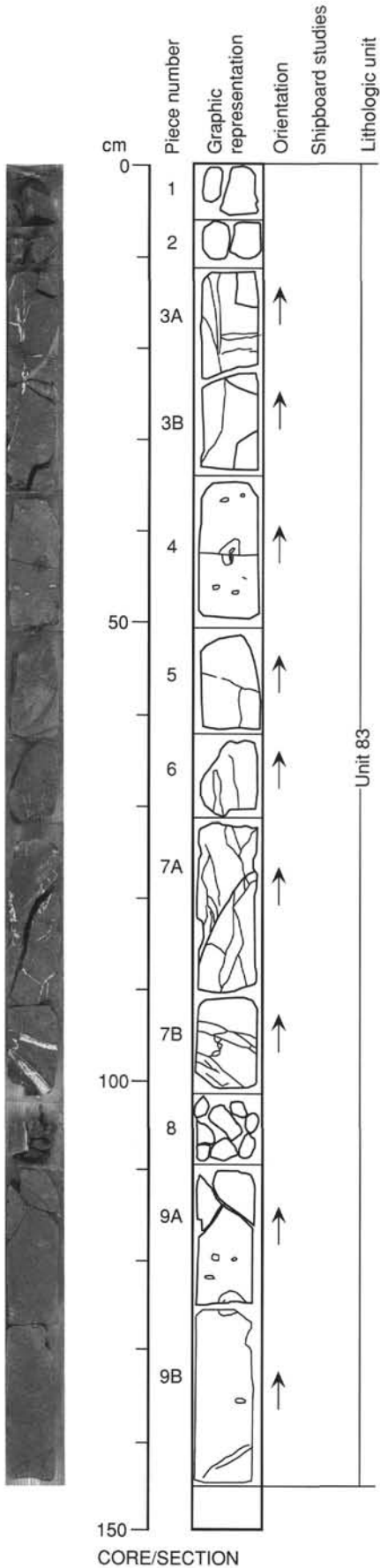
**GROUNDMASS:** Fine-grained.

**VESICLES:** 1%; up to 15 mm; flattened to irregular; filled with chalcedony.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Moderate; olivine completely altered.

**VEINS/FRACTURES:** 2%; up to 10 mm; random orientation; lined with chlorite and filled with calcite.



CORE/SECTION



152-917A-84R-6

UNIT 83: PLAGIOCLASE-OLIVINE-PHYRIC BASALT

Pieces 1-5

**PHENOCRYSTS:** Plagioclase - 10%; up to 3 mm; mostly tabular. Olivine - 2%; up to 3 mm; euhedral, equant to elongate.

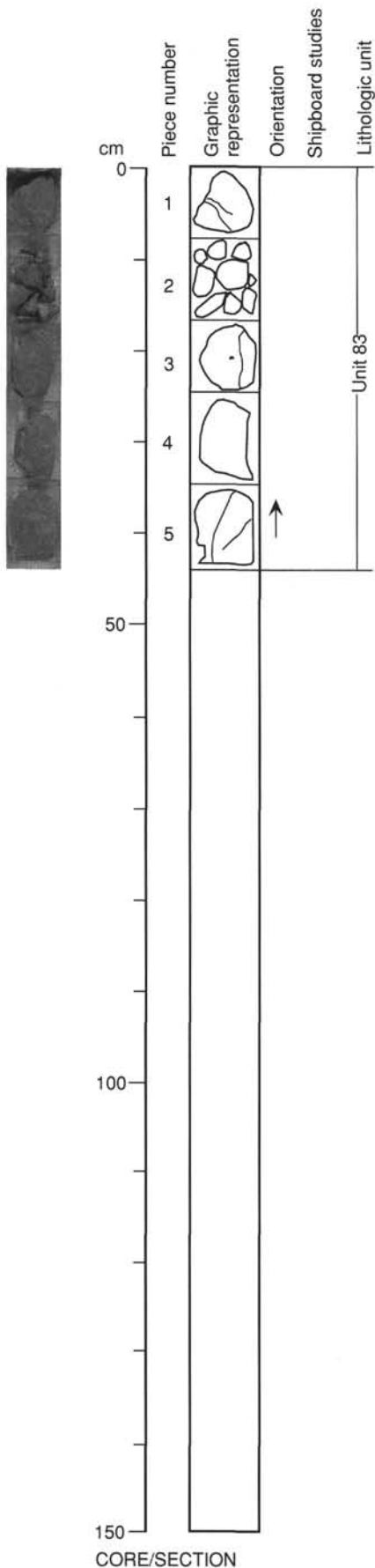
**GROUNDMASS:** Fine-grained.

**VESICLES:** <<1%; up to 2 mm; spherical; filled with calcite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Moderate; olivine completely altered.

**VEINS/FRACTURES:** <1%; up to 1 mm; inclined; lined with chlorite and filled with calcite.

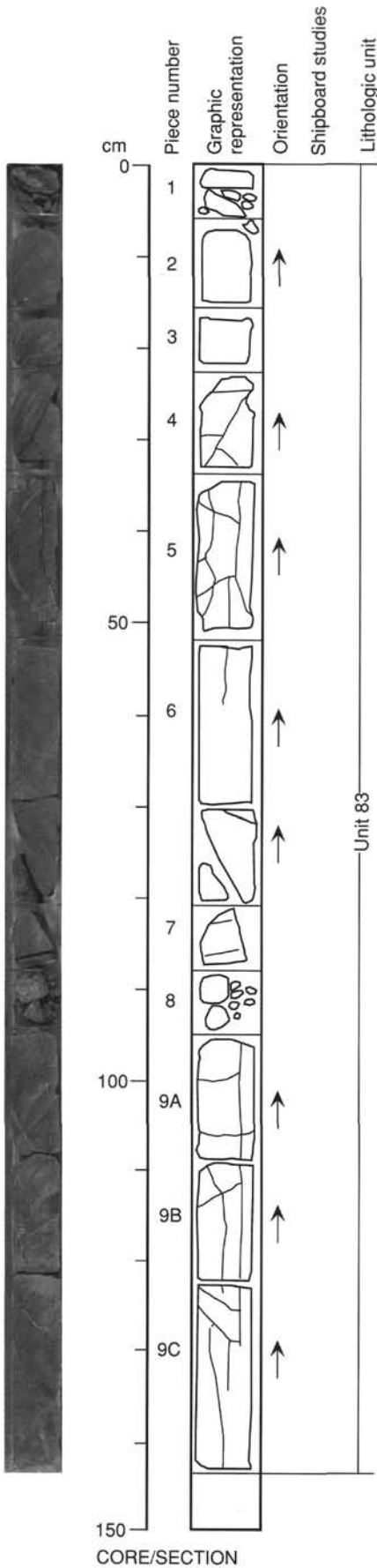


152-917A-85R-1

**UNIT 83: OLIVINE-PLAGIOCLASE-PHYRIC BASALT**

**Pieces 1-9C**

**PHENOCRYSTS:** Olivine - 3%; 1 mm; euhedral, equant. Plagioclase - 2%; 1.5 mm; euhedral, tabular.  
**GROUNDMASS:** Very fine-grained.  
**VESICLES:** <1%; 1-2 mm; rounded to irregular; random distribution.  
**COLOR:** Dark greenish gray (5G 4/1).  
**STRUCTURE:** Massive.  
**ALTERATION:** Moderate; olivine altered.  
**VEINS/FRACTURES:** 0-5%; <1-3 mm; main set is vertical; filled with calcite and a black fine-grained mineral.



152-917A-85R-2

**UNIT 83: OLIVINE-PLAGIOCLASE-PHYRIC BASALT**

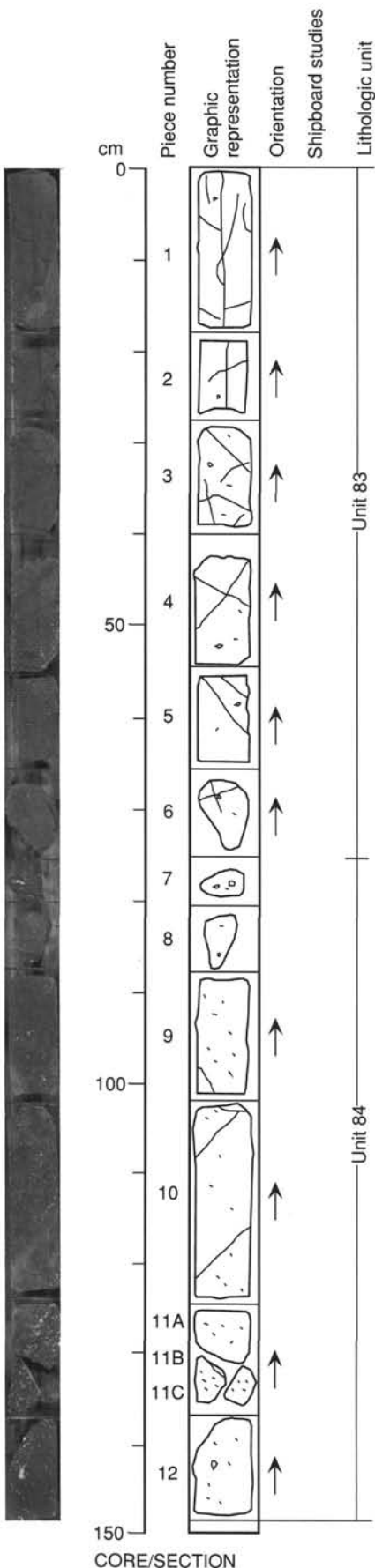
**Pieces 1-6**

**PHENOCRYSTS:** Olivine - 3%; 1 mm; euhedral, equant. Plagioclase - 2%; 1.5 mm; euhedral, tabular.  
**GROUNDMASS:** Very fine-grained.  
**VESICLES:** <1%; 1-5 mm; rounded to flattened; random distribution; filled with green clay.  
**COLOR:** Dark greenish gray (5G 4/1).  
**STRUCTURE:** Massive.  
**ALTERATION:** Moderate to slight.  
**VEINS/FRACTURES:** 2%; <1-1 mm; filled with calcite and a dark greenish black mineral.

**UNIT 84: APHYRIC OLIVINE BASALT**

**Pieces 7-12**

**CONTACTS:** None. Piece 7 is probably near the flow top.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Very fine-grained.  
**VESICLES:** 5%-25%; <1-10 mm; rounded to irregular; inhomogeneously distributed; filled with zeolite and blue clay.  
**COLOR:** Piece 7 is dark gray (5YR 4/1); others are dark greenish gray (5G 4/1).  
**STRUCTURE:** Flow-brecciation.  
**ALTERATION:** Moderate to low; Piece 7 is slightly oxidized.  
**VEINS/FRACTURES:** <1-1 mm; in Pieces 10 and 11; filled with green clay.



CORE/SECTION

**UNIT 84: APHYRIC OLIVINE BASALT**

**Pieces 1-3**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Very fine-grained.

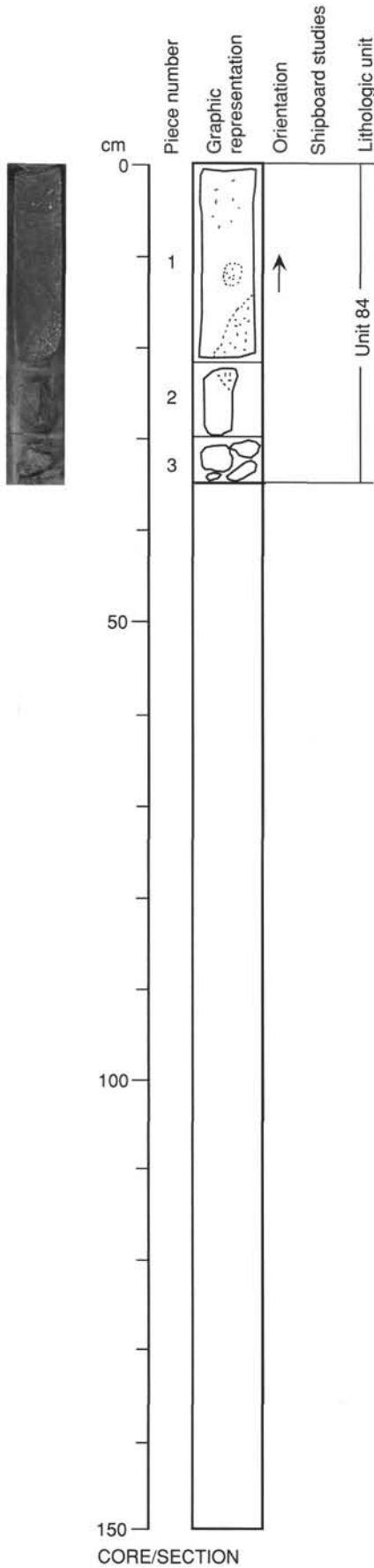
**VESICLES:** 1-3 mm; rounded to irregular; found mainly in the clasts.

**COLOR:** Dark greenish gray (5G 4/1).

**STRUCTURE:** Flow-brecciation; clasts of vesicular basalt 1-5 cm across; some clasts have rinds of dark material (altered glass?).

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** <1-1 mm; in Pieces 10 and 11; filled with green clay.

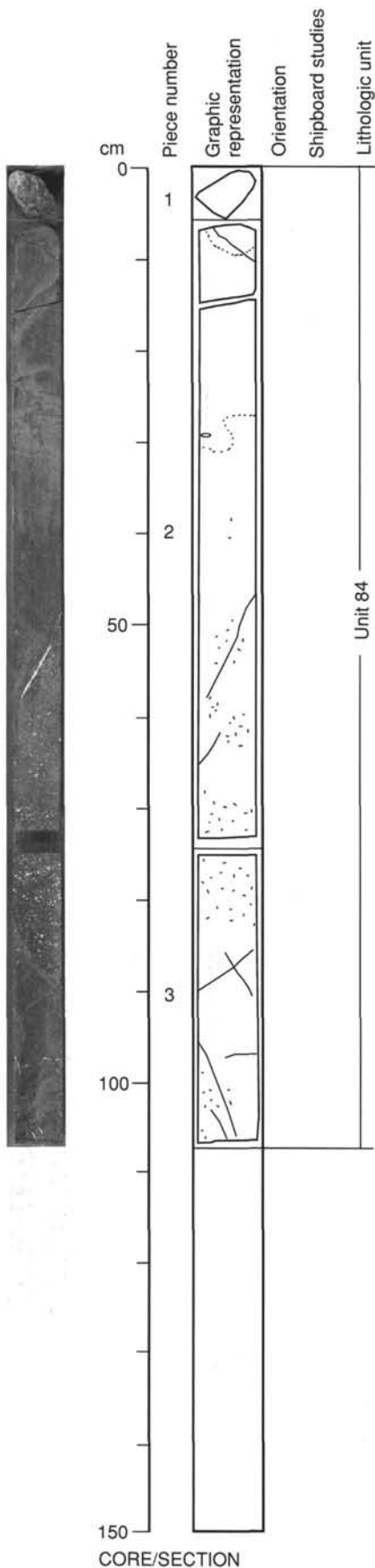


152-917A-86R-1

UNIT 84: APHYRIC OLIVINE BASALT

Pieces 1-3

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 0-20%; up to 5 mm; irregular; patchy distribution; filled with zeolite.  
**COLOR:** Olive black (5Y 2/1).  
**STRUCTURE:** Some flow-brecciation.  
**ALTERATION:** Slight.  
**VEINS/FRACTURES:** <1%; up to 3 mm; inclined; filled with zeolite.  
**ADDITIONAL COMMENTS:** Piece 1 is drilling debris.



**UNIT 84: APHYRIC OLIVINE BASALT**

**Pieces 1A-1D**

**PHENOCRYSTS:** None.

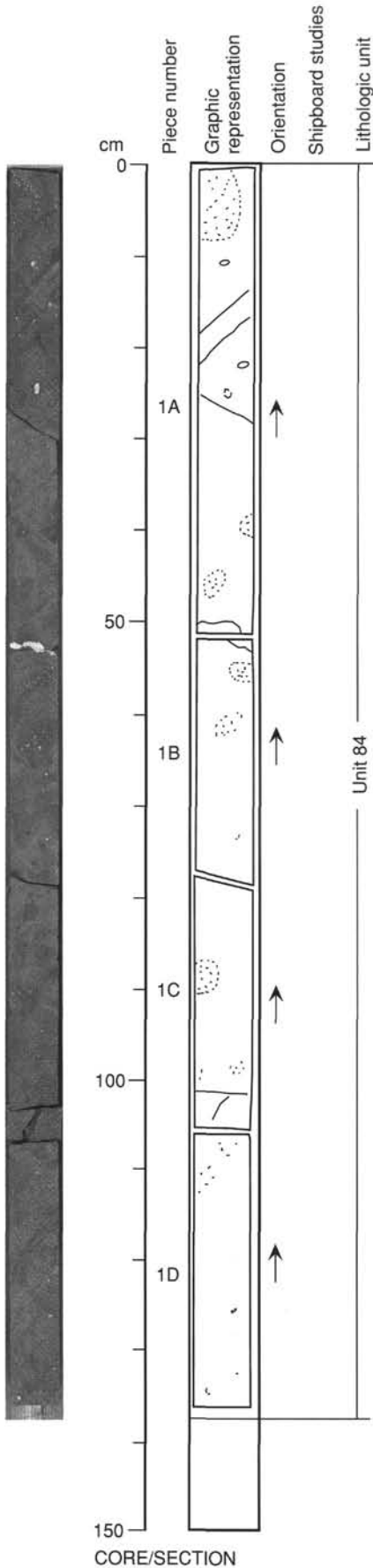
**GROUNDMASS:** Fine-grained, ophitic below 20 cm with pyroxene oikocrysts up to 2 mm across, giving the rock a mottled appearance; some coarser segregations.

**VESICLES:** 0-10%; up to 5 mm; spherical to irregular; patchy distribution; small irregular vesicles are concentrated in segregation patches and larger spherical vesicles are widely scattered; filled with zeolite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Slight.

**VEINS/FRACTURES:** <1%; up to 8 mm; horizontal; single zeolite-filled vein at base of Piece 1B.



152-917A-86R-3

**UNIT 84: APHYRIC OLIVINE BASALT**

**Pieces 1A-1F**

**PHENOCRYSTS:** None.

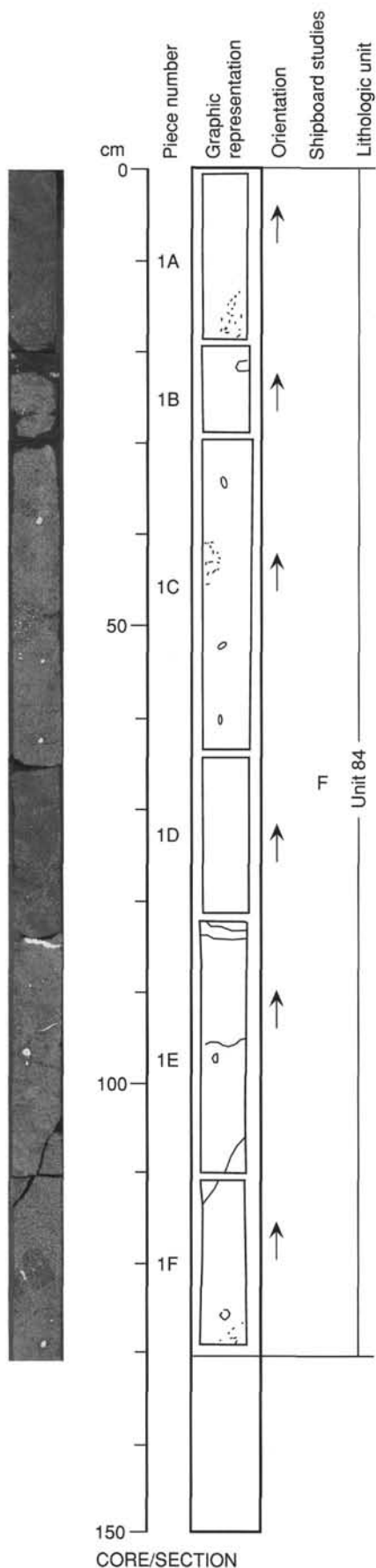
**GROUNDMASS:** Fine-grained, ophitic; some coarser segregations.

**VESICLES:** 0-10%; up to 8 mm; spherical to irregular; patchy distribution; small irregular vesicles are concentrated in segregation patches and larger spherical vesicles are widely scattered; filled with zeolite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Slight.

**VEINS/FRACTURES:** <1%; up to 5 mm; horizontal to inclined; filled with zeolite.



**UNIT 84: APHYRIC OLIVINE BASALT**

**Pieces 1A-1E**

**PHENOCRYSTS:** None.

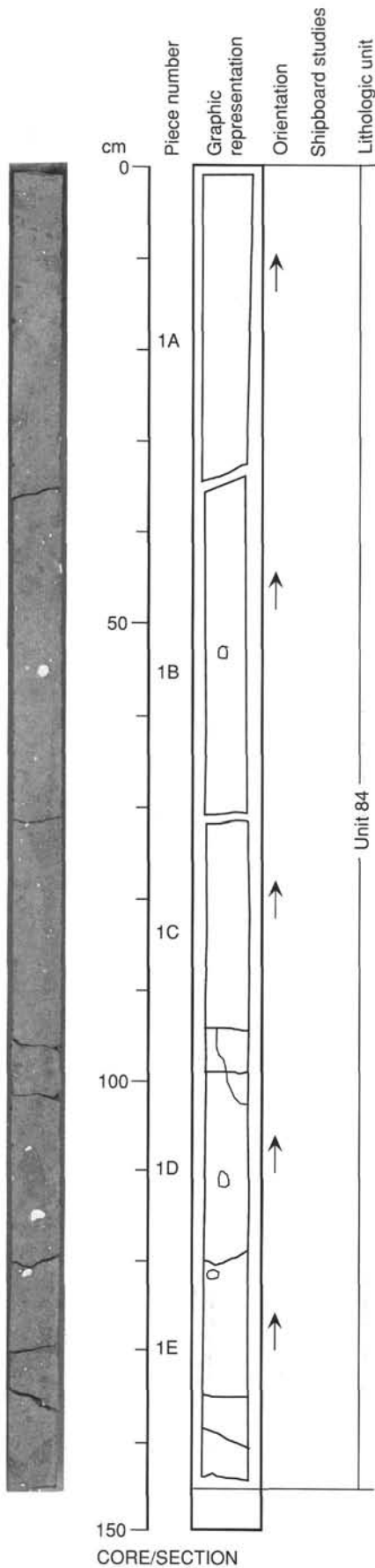
**GROUNDMASS:** Fine-grained, ophitic; some coarser segregations.

**VESICLES:** 0-10%; up to 10 mm; spherical to irregular; patchy distribution; small irregular vesicles are concentrated in segregation patches and larger spherical vesicles are widely scattered; filled with zeolite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Slight.

**VEINS/FRACTURES:** <<1%; up to 0.5 mm; inclined; filled with zeolite.





152-917A-86R-5

UNIT 84: APHYRIC OLIVINE BASALT

Pieces 1A-1B

**PHENOCRYSTS:** None.

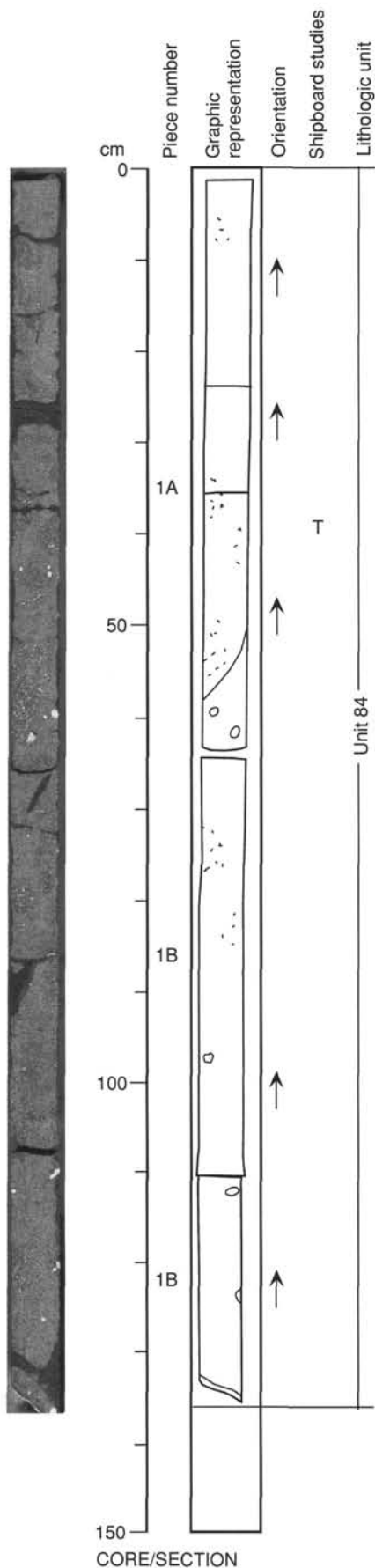
**GROUNDMASS:** Fine-grained, ophitic; some coarser segregations.

**VESICLES:** 0-10%; up to 8 mm; spherical to irregular; patchy distribution; small irregular vesicles are concentrated in segregation patches and larger spherical vesicles are widely scattered; filled with zeolite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Generally slight, but oxidized around vein at base of section.

**VEINS/FRACTURES:** <1%; up to 3 mm; inclined; filled with zeolite.



**UNIT 84: APHYRIC OLIVINE BASALT**

**Pieces 1-3**

**PHENOCRYSTS:** None.

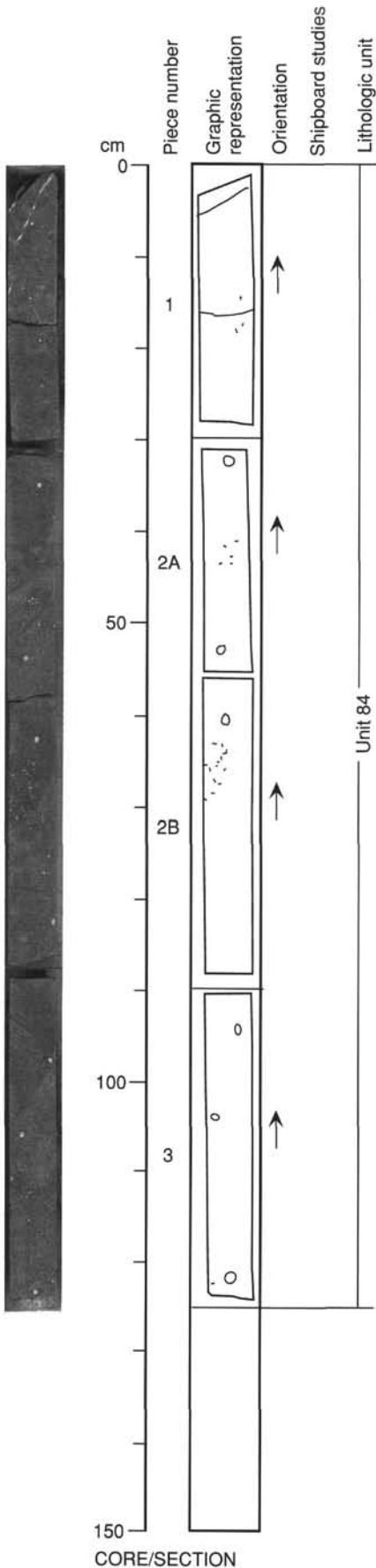
**GROUNDMASS:** Fine-grained, ophitic; some coarser segregations.

**VESICLES:** 0-10%; up to 6 mm; spherical to irregular; patchy distribution; small irregular vesicles are concentrated in segregation patches and larger spherical vesicles are widely scattered; filled with zeolite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Generally slight, but oxidized around vein at top of section.

**VEINS/FRACTURES:** <<1%; up to 2 mm; inclined; filled with zeolite.



152-917A-86R-7

**UNIT 84: APHYRIC OLIVINE BASALT**

**Pieces 1-2**

**PHENOCRYSTS:** None.

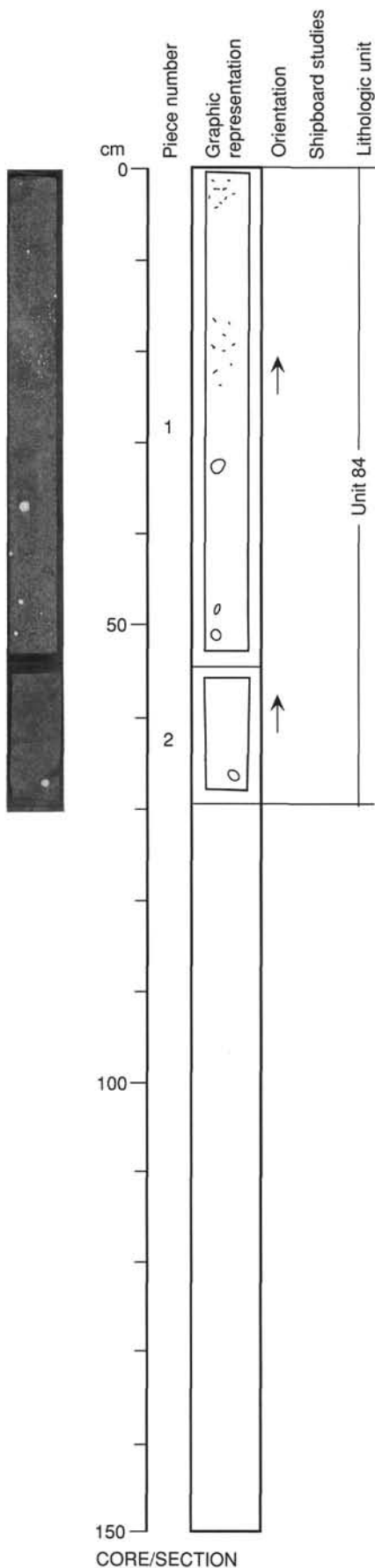
**GROUNDMASS:** Fine-grained, ophitic; some coarser segregations.

**VESICLES:** 2%-10%; up to 10 mm; spherical to irregular; patchy distribution; small irregular vesicles are concentrated in segregation patches and larger spherical vesicles are widely scattered; filled with zeolite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Slight.

**VEINS/FRACTURES:** None.



CORE/SECTION

**UNIT 84: APHYRIC OLIVINE BASALT**

**Pieces 1A-1C**

**PHENOCRYSTS:** None.

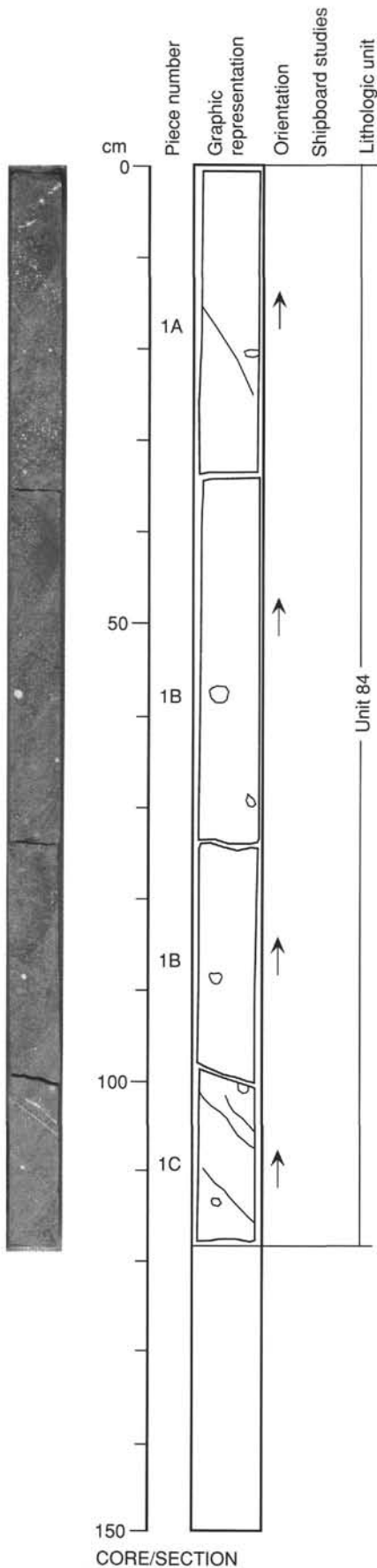
**GROUNDMASS:** Fine-grained, ophitic; some coarser segregations.

**VESICLES:** 1%-10%; up to 8 mm; spherical to irregular; patchy distribution; small irregular vesicles are concentrated in segregation patches and larger spherical vesicles are widely scattered; filled with zeolite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Slight.

**VEINS/FRACTURES:** <1%; up to 2 mm; inclined; filled with zeolite.



152-917A-87R-2

UNIT 84: APHYRIC OLIVINE BASALT

Pieces 1A-1B

**PHENOCRYSTS:** None.

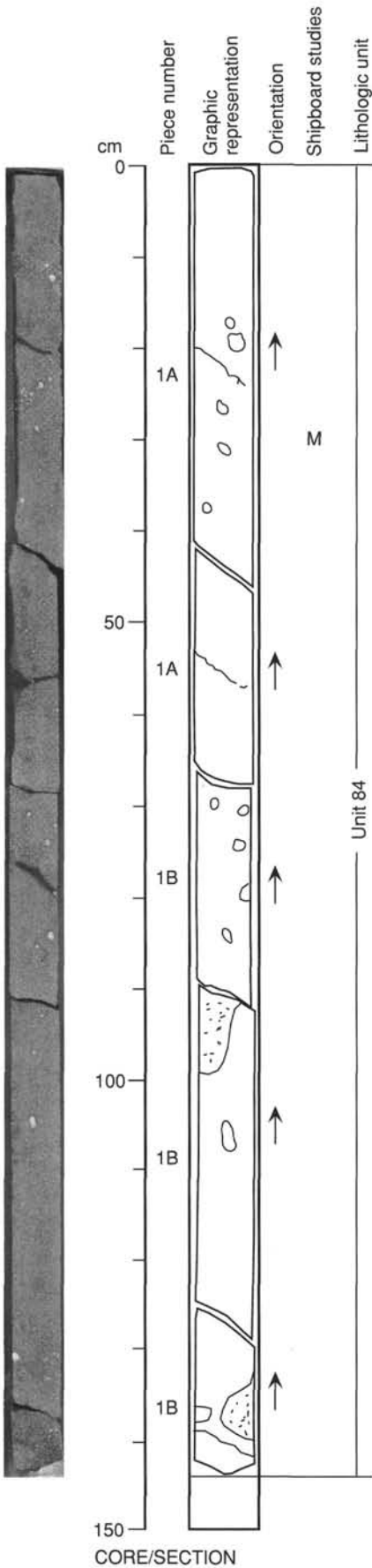
**GROUNDMASS:** Fine-grained, ophitic; some coarser segregations.

**VESICLES:** 1%-5%; up to 6 mm; spherical to irregular; patchy distribution; small irregular vesicles are concentrated in segregation patches and larger spherical vesicles are widely scattered; filled with zeolite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Slight.

**VEINS/FRACTURES:** <<1%; up to 1 mm; inclined; filled with zeolite.



**UNIT 84: APHYRIC OLIVINE BASALT**

**Pieces 1A-1B**

**PHENOCRYSTS:** None.

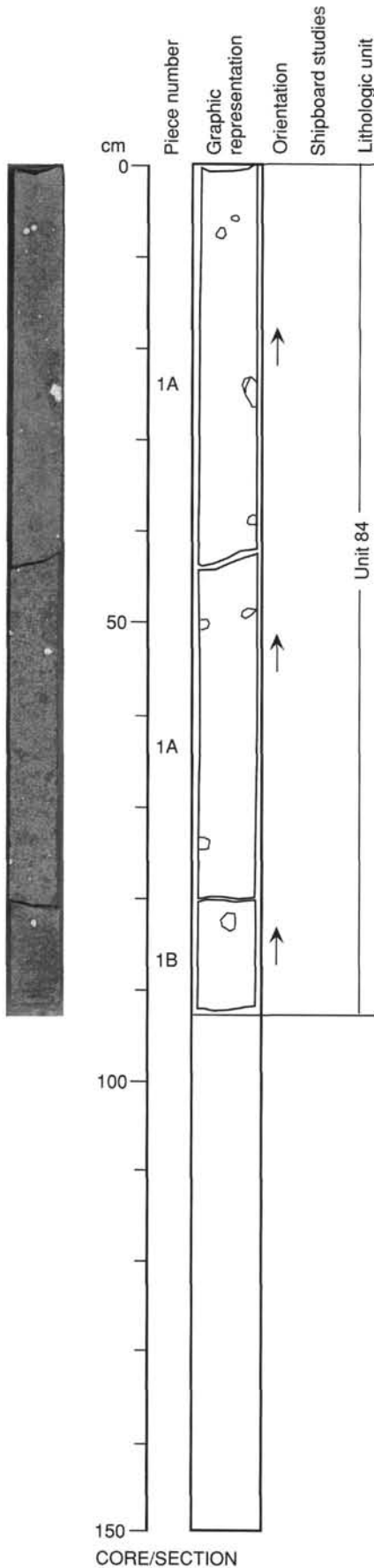
**GROUNDMASS:** Fine-grained, ophitic; some coarser segregations.

**VESICLES:** 1%–5%; up to 10 mm; spherical to irregular; patchy distribution; small irregular vesicles are concentrated in segregation patches and larger spherical vesicles are widely scattered; filled with zeolite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Slight.

**VEINS/FRACTURES:** <<1%; 0.2 mm; inclined; filled with zeolite.



152-917A-87R-4

UNIT 84: APHYRIC OLIVINE BASALT

Pieces 1A-1C

**PHENOCRYSTS:** None.

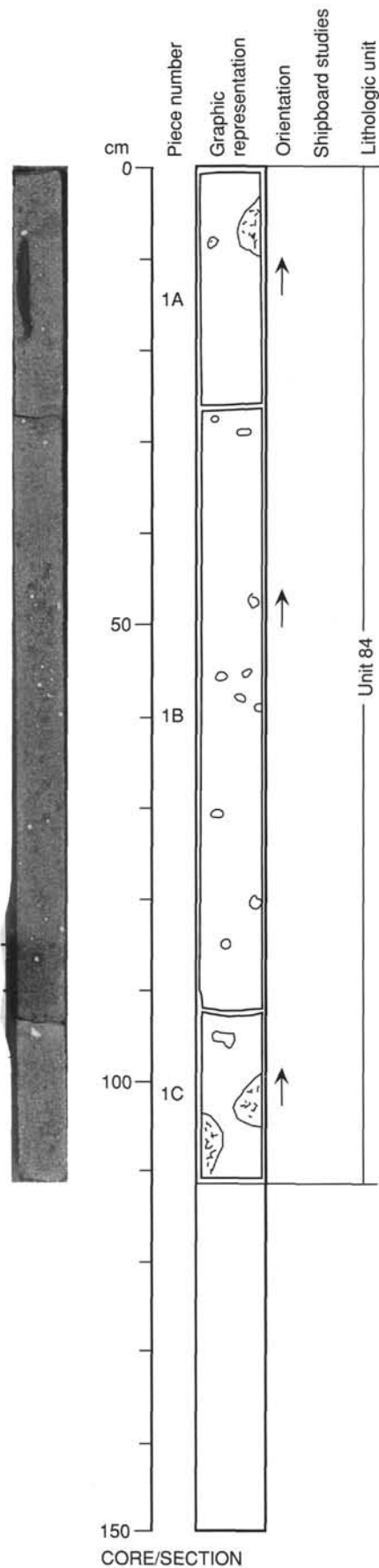
**GROUNDMASS:** Fine-grained, ophitic; some coarser segregations.

**VESICLES:** 1%-5%; up to 8 mm; spherical to irregular; patchy distribution; small irregular vesicles are concentrated in segregation patches and larger spherical vesicles are widely scattered; filled with zeolite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Slight.

**VEINS/FRACTURES:** None.



**UNIT 84: APHYRIC OLIVINE BASALT**

**Pieces 1A-1B**

**PHENOCRYSTS:** None.

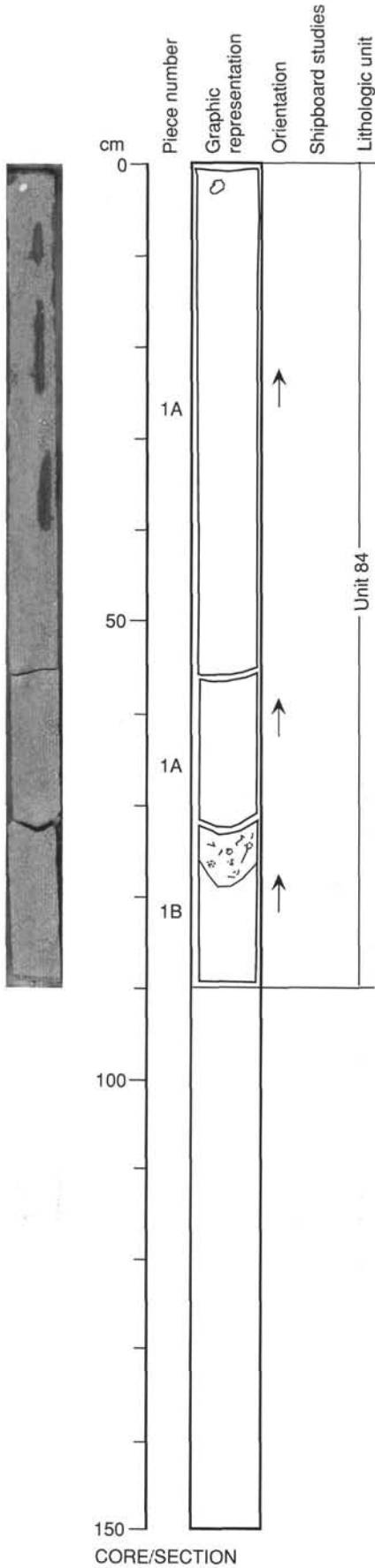
**GROUNDMASS:** Fine-grained, ophitic; some coarser segregations.

**VESICLES:** <1%-5%; up to 8 mm; spherical to irregular; patchy distribution; small irregular vesicles are concentrated in segregation patches and larger spherical vesicles are widely scattered; filled with zeolite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Slight.

**VEINS/FRACTURES:** None.





152-917A-87R-6

UNIT 84: APHYRIC OLIVINE BASALT

Pieces 1A-2

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained, ophitic; some coarser segregations.

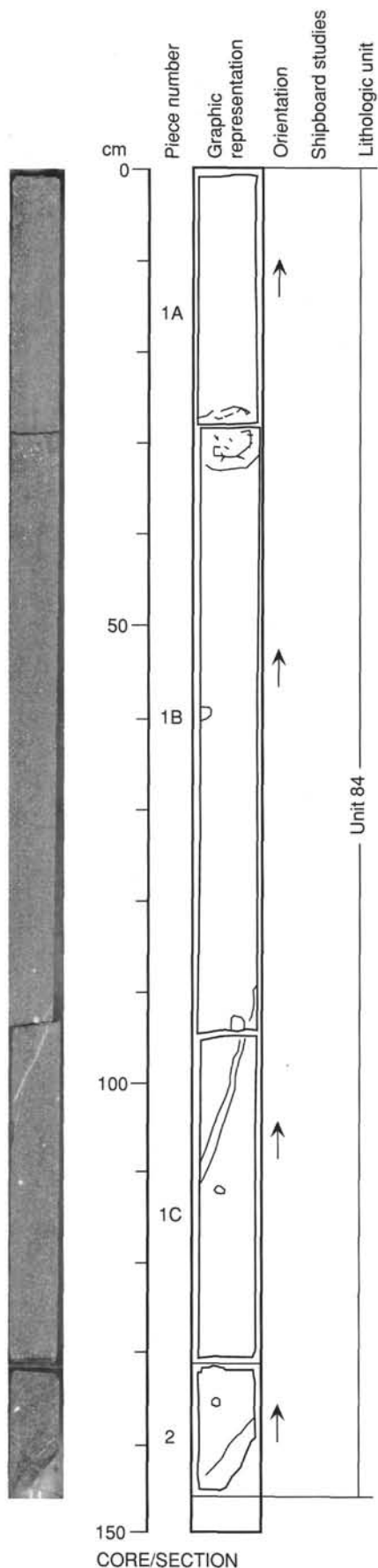
**VESICLES:** <1%-5%; up to 6 mm; spherical to irregular; patchy distribution; small irregular vesicles are concentrated in segregation patches and larger spherical vesicles are widely scattered; filled with zeolite.

**COLOR:** Greenish black (5G 2/1) at top to dusky yellowish brown (10YR 2/2) at base.

**ALTERATION:** Slight at top, oxidized at base.

**VEINS/FRACTURES:** <1%; up to 3 mm; inclined; filled with zeolite.

**ADDITIONAL COMMENTS:** Oikocrysts are gradually increasing in size with depth in the flow and are now up to 5 mm in diameter.



**UNIT 84: APHYRIC OLIVINE BASALT**

**Pieces 1A-6B**

**PHENOCRYSTS:** None.

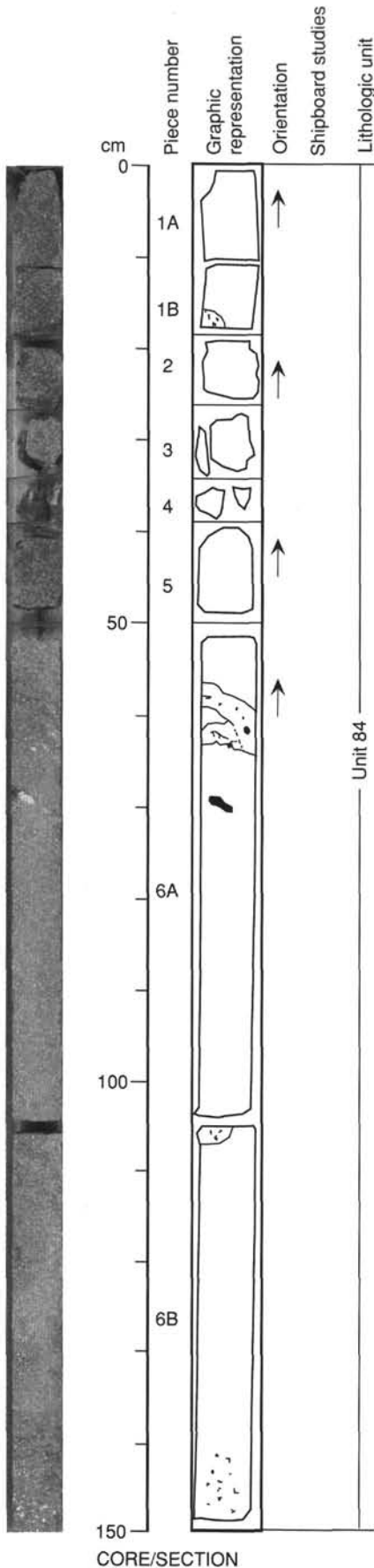
**GROUNDMASS:** Fine-grained, ophitic; some coarser segregations.

**VESICLES:** <1%-5%; up to 10 mm; spherical to irregular; patchy distribution; small irregular vesicles concentrated in segregation patches, larger spherical vesicles widely scattered; filled with zeolite.

**COLOR:** Dusky yellowish brown (10YR 2/2) at top to greenish black (5G 2/1) at base.

**ALTERATION:** Oxidized at top, slightly altered at base of section.

**VEINS/FRACTURES:** <<1%; up to 0.5 mm; inclined; filled with zeolite.



CORE/SECTION

152-917A-88R-2

UNIT 84: APHYRIC OLIVINE BASALT

Pieces 1A-1C

**PHENOCRYSTS:** None.

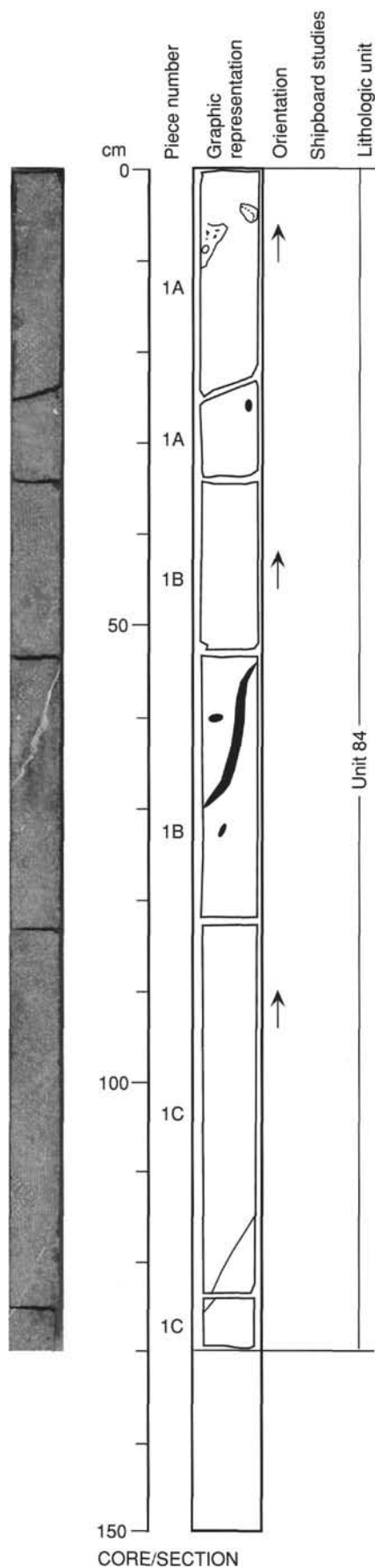
**GROUNDMASS:** Fine-grained, ophitic; some coarser segregations.

**VESICLES:** <<1%-5%; up to 5 mm; spherical to irregular; patchy distribution; small irregular vesicles concentrated in segregation patches, larger spherical vesicles widely scattered; filled with zeolite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Slight; oxidized around large vein at 60 cm.

**VEINS/FRACTURES:** 1%; up to 5 mm; inclined; filled with zeolite.



**UNIT 84: APHYRIC OLIVINE BASALT**

**Pieces 1-2C**

**PHENOCRYSTS:** None.

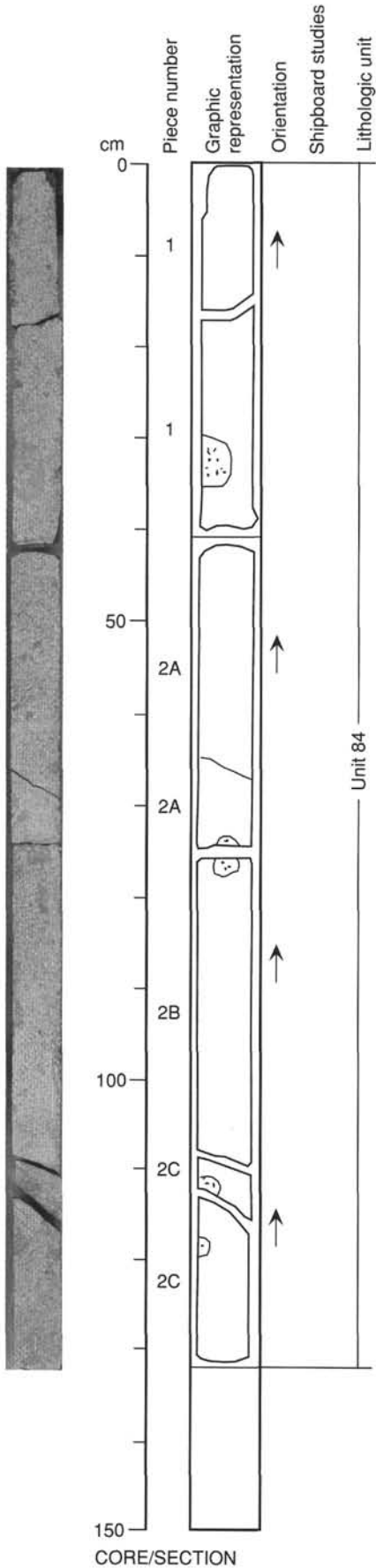
**GROUNDMASS:** Fine-grained, ophitic; some coarser segregations.

**VESICLES:** <1%–5%; up to 3 mm; spherical to irregular; patchy distribution; small irregular vesicles concentrated in segregation patches, larger spherical vesicles widely scattered; filled with chlorite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Slight to moderate.

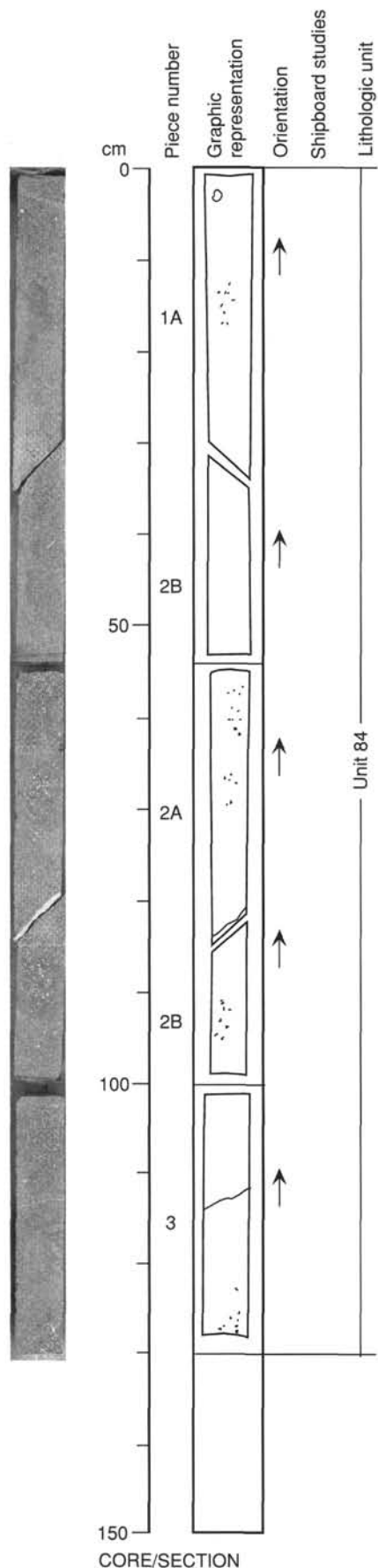
**VEINS/FRACTURES:** <1%; up to 1 mm; inclined; lined with chlorite and filled with zeolite.



152-917A-88R-4

UNIT 84: APHYRIC OLIVINE BASALT

Pieces 1A-3



**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained, ophitic; some coarser segregations.

**VESICLES:** <1%–5%; up to 3 mm; spherical to irregular; patchy distribution; small irregular vesicles concentrated in segregation patches, larger spherical vesicles widely scattered; filled with chlorite.

**COLOR:** Greenish black (5G 2/1) at top of section to very dusky red (10R 2/2) around large fracture at 85 cm.

**ALTERATION:** Moderate, slightly oxidized in Piece 2.

**VEINS/FRACTURES:** 1%; up to 5 mm; inclined; filled with zeolite.

**UNIT 84: APHYRIC OLIVINE BASALT**

**Pieces 1-4**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained, ophitic; some coarser segregations.

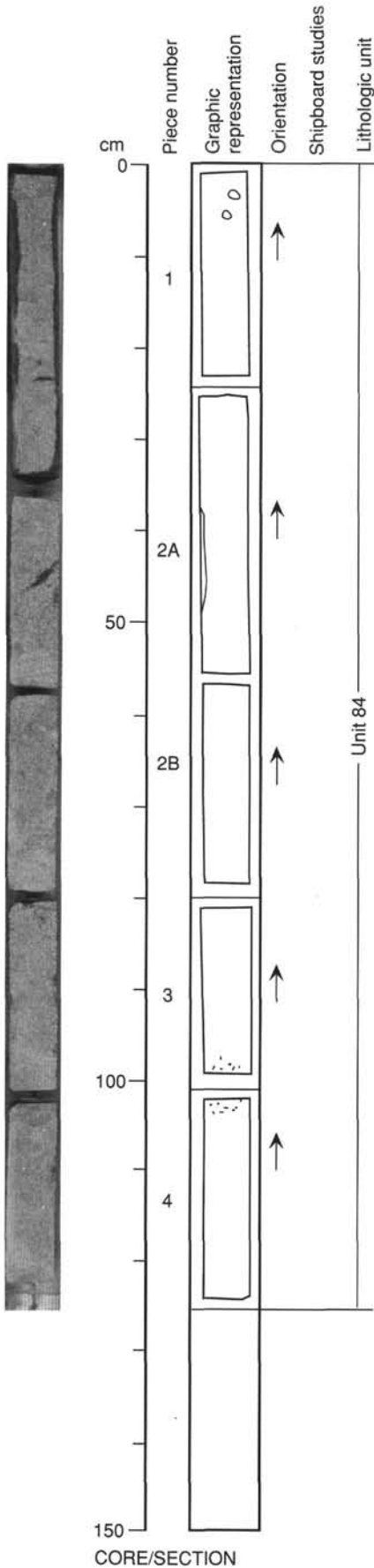
**VESICLES:** <1%-5%; up to 3 mm; spherical to irregular; patchy distribution; small irregular vesicles concentrated in segregation patches, larger spherical vesicles widely scattered; filled with chlorite.

**COLOR:** Dark olive gray (5Y 3/1).

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** None.

**ADDITIONAL COMMENTS:** Oikocrysts getting smaller (up to 3 mm diameter).

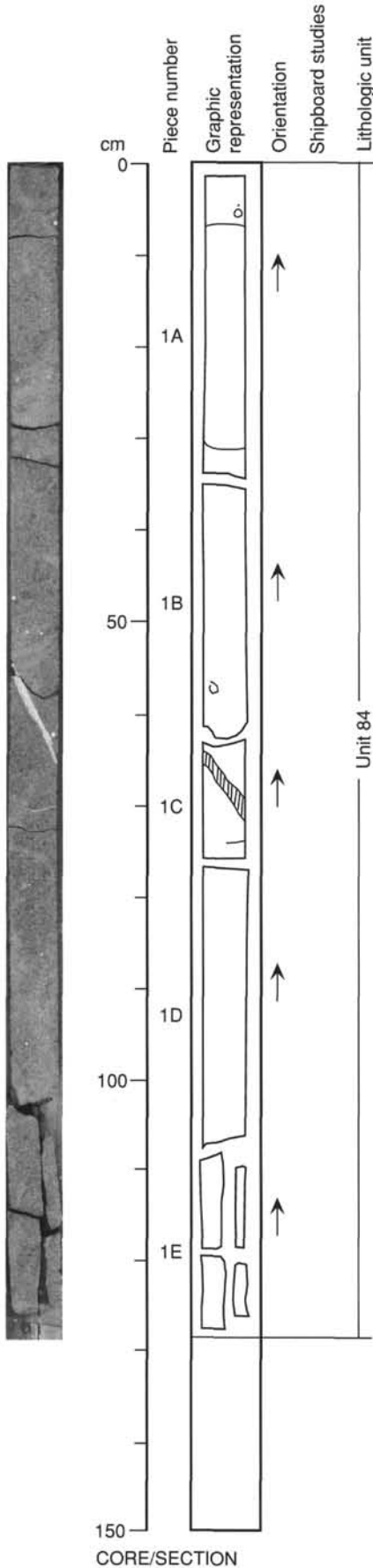


152-917A-88R-6

UNIT 84: APHYRIC OLIVINE BASALT

Pieces 1A-1E

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained, ophitic; some coarser segregations.  
**VESICLES:** <1%-5%; up to 5 mm; spherical to irregular; patchy distribution; small irregular vesicles concentrated in segregation patches, larger spherical vesicles widely scattered; filled with chlorite.  
**COLOR:** Dark olive gray (5Y 3/1).  
**ALTERATION:** Moderate.  
**VEINS/FRACTURES:** 1%; up to 8 mm; horizontal to inclined; filled with zeolite.



**UNIT 84: APHYRIC OLIVINE BASALT**

**Pieces 1A-2**

**PHENOCRYSTS:** None.

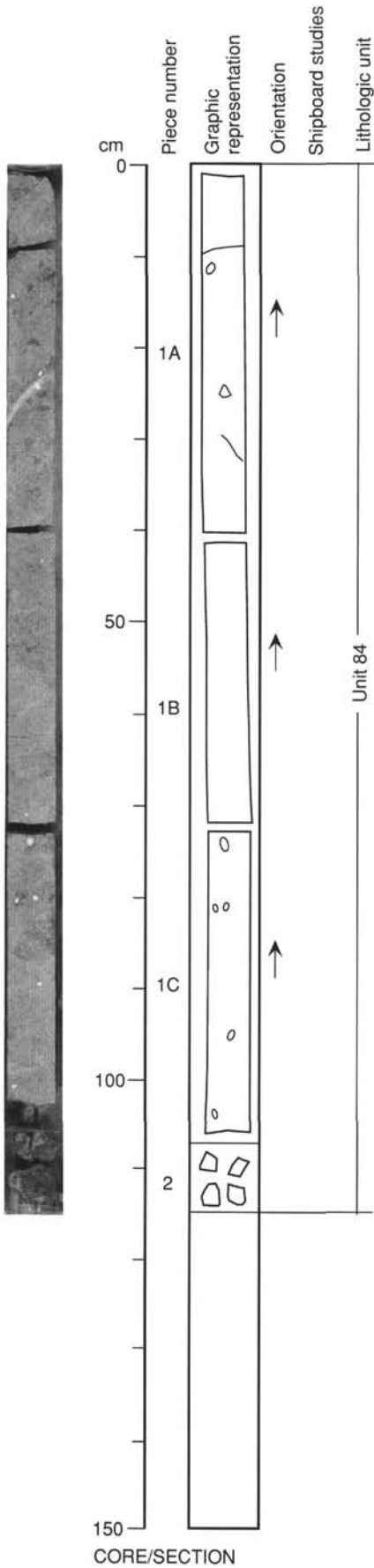
**GROUNDMASS:** Fine-grained, ophitic; some coarser segregations.

**VESICLES:** <1%–5%; up to 8 mm; spherical to irregular; patchy distribution; small irregular vesicles concentrated in segregation patches, larger spherical vesicles widely scattered; filled with chlorite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Slight to moderate.

**VEINS/FRACTURES:** <<1%; up to 1 mm; inclined; filled with zeolite.





152-917A-88R-8

UNIT 84: APHYRIC OLIVINE BASALT

Pieces 1-2

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained, ophitic; some coarser segregations.

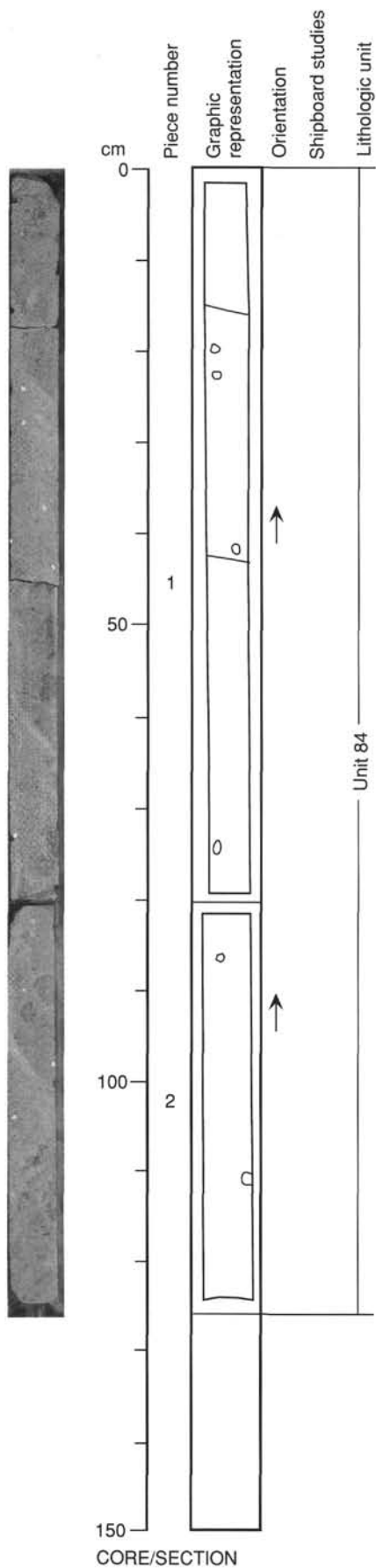
**VESICLES:** <1%–5%; up to 5 mm; spherical to irregular; patchy distribution; small irregular vesicles concentrated in segregation patches, larger spherical vesicles widely scattered; filled with chlorite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Slight to moderate.

**VEINS/FRACTURES:** <<1%; up to 0.5 mm; subhorizontal; filled with zeolite.

**ADDITIONAL COMMENTS:** Oikocrysts up to 2 mm in diameter and less distinct.



152-917A-89R-1

**UNIT 84: APHYRIC OLIVINE BASALT**

**Pieces 1A-1E**

**PHENOCRYSTS:** None.

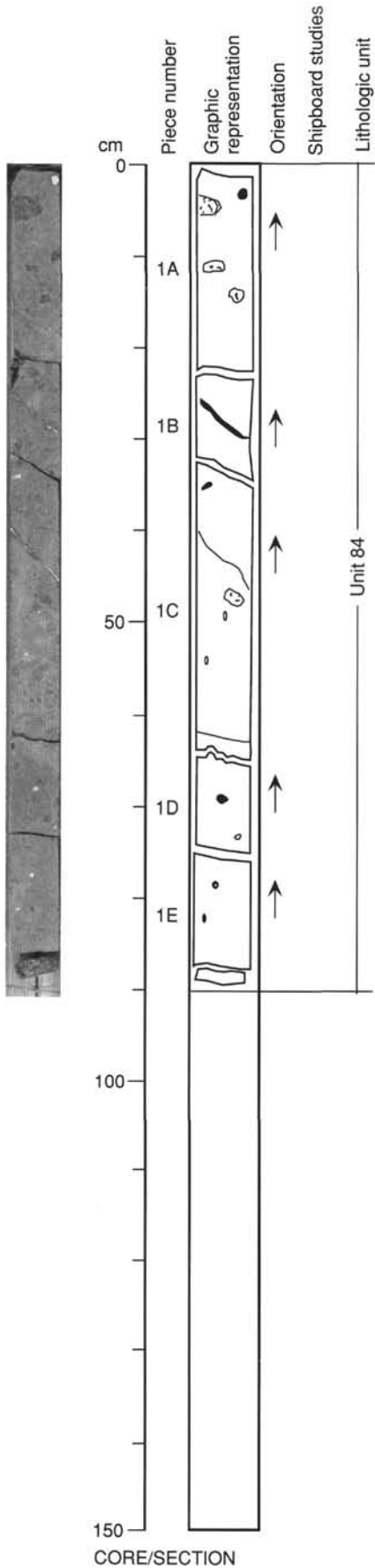
**GROUNDMASS:** Fine-grained with some coarser segregations; ophitic texture less distinct than in Core 152-917A-88R.

**VESICLES:** <1%; up to 8 mm; spherical; scattered; filled with zeolite.

**COLOR:** Dark gray (N 3/0).

**ALTERATION:** Slight.

**VEINS/FRACTURES:** <1%; up to 1 mm; inclined; filled with zeolite.



CORE/SECTION

152-917A-89R-2

**UNIT 84: APHYRIC OLIVINE BASALT**

**Pieces 1A-1D**

**PHENOCRYSTS:** None.

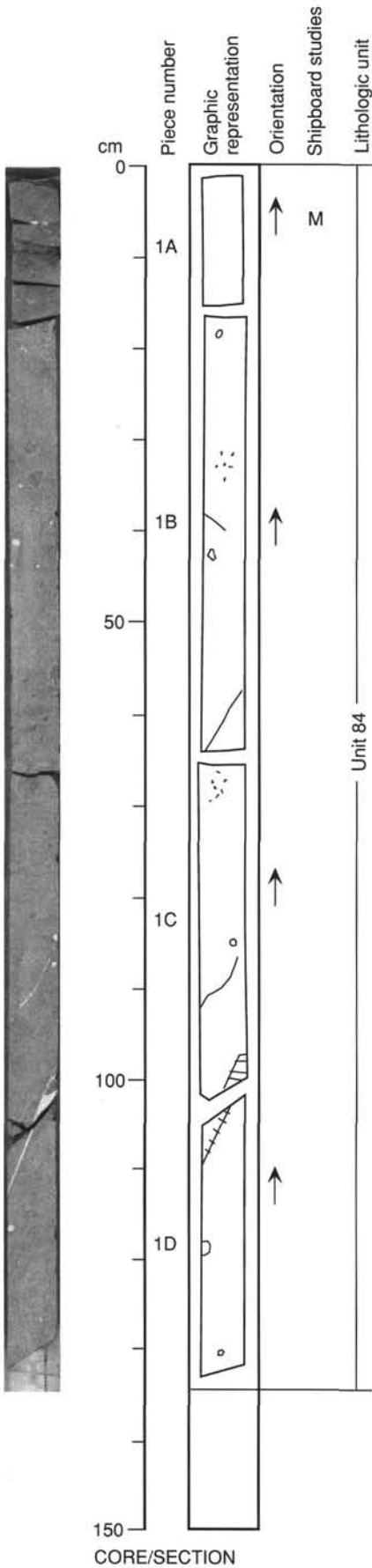
**GROUNDMASS:** Fine-grained with some coarser segregations.

**VESICLES:** 1%; up to 8 mm; spherical; scattered; filled with zeolite.

**COLOR:** Greenish black (5G 2/1) at top of section, grayish brown (5YR 3/2) at base.

**ALTERATION:** Slight at top of section, oxidized at base.

**VEINS/FRACTURES:** 1%; up to 10 mm; inclined; filled with zeolite.



CORE/SECTION

**UNIT 84: APHYRIC OLIVINE BASALT**

**Pieces 1A–1D**

**PHENOCRYSTS:** None.

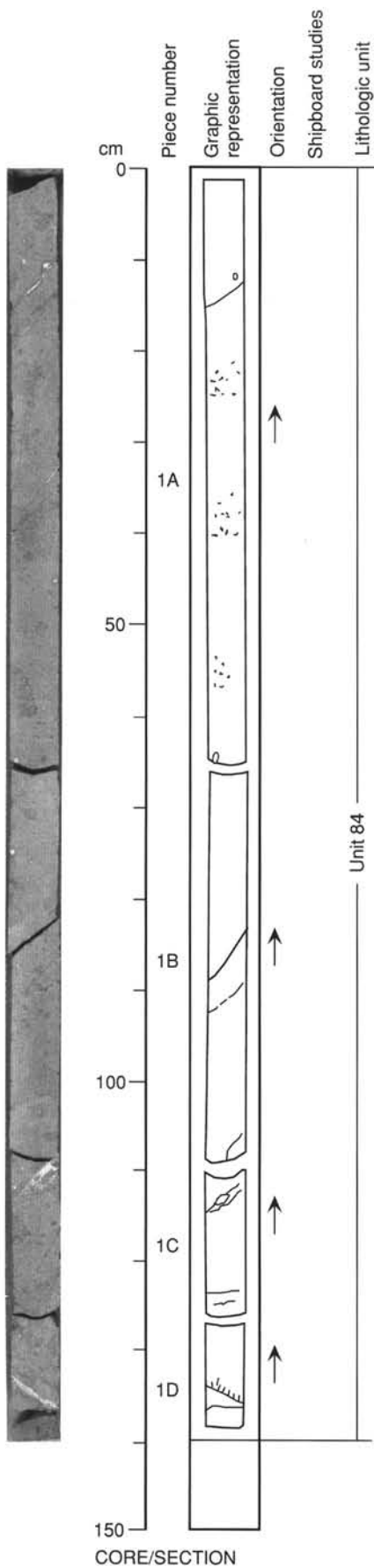
**GROUNDMASS:** Fine-grained with some coarser segregations.

**VESICLES:** <1%; up to 6 mm; spherical; scattered; filled with zeolite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Slight.

**VEINS/FRACTURES:** <1%; up to 8 mm; inclined; filled with zeolite; brecciation in large vein at 110 cm.

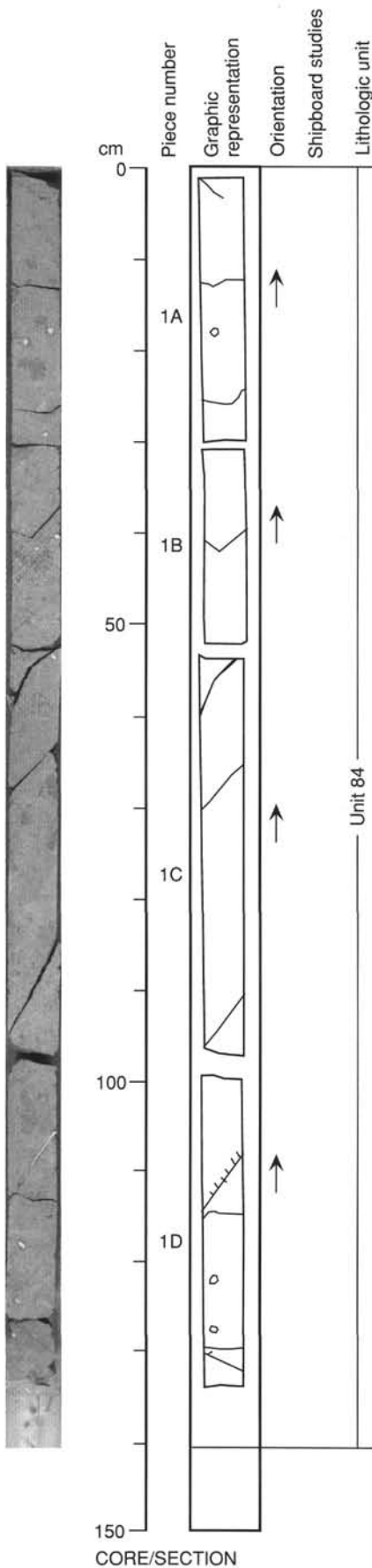


152-917A-89R-4

**UNIT 84: APHYRIC OLIVINE BASALT**

**Pieces 1A-1D**

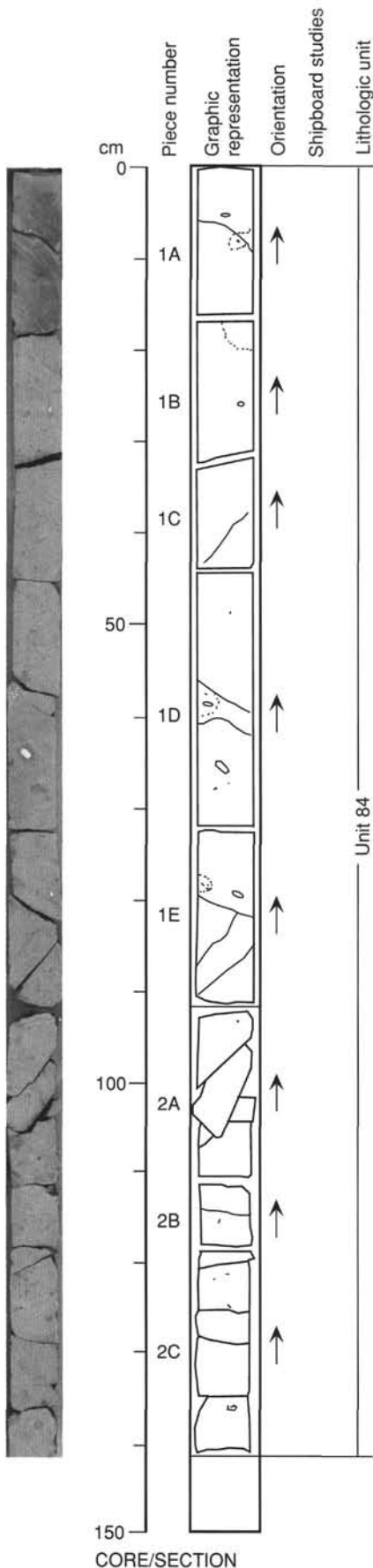
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained with some coarser segregations.  
**VESICLES:** <1%; up to 5 mm; spherical; scattered; filled with zeolite.  
**COLOR:** Greenish black (5G 2/1).  
**ALTERATION:** Slight.  
**VEINS/FRACTURES:** <1%; up to 2 mm; inclined; filled with zeolite.



**UNIT 84: APHYRIC OLIVINE BASALT**

**Pieces 1A-2C**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained with some coarser segregations.  
**VESICLES:** <1%; up to 8 mm; spherical; scattered; filled with zeolite.  
**COLOR:** Greenish black (5G 2/1).  
**ALTERATION:** Slight.  
**VEINS/FRACTURES:** <<1%; 0.2 mm; inclined; filled with zeolite.

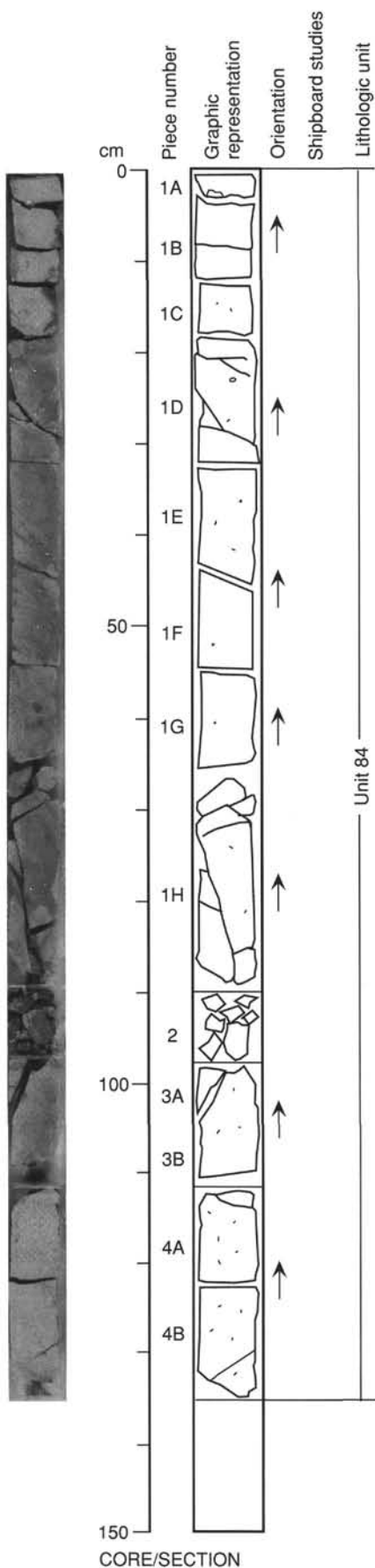


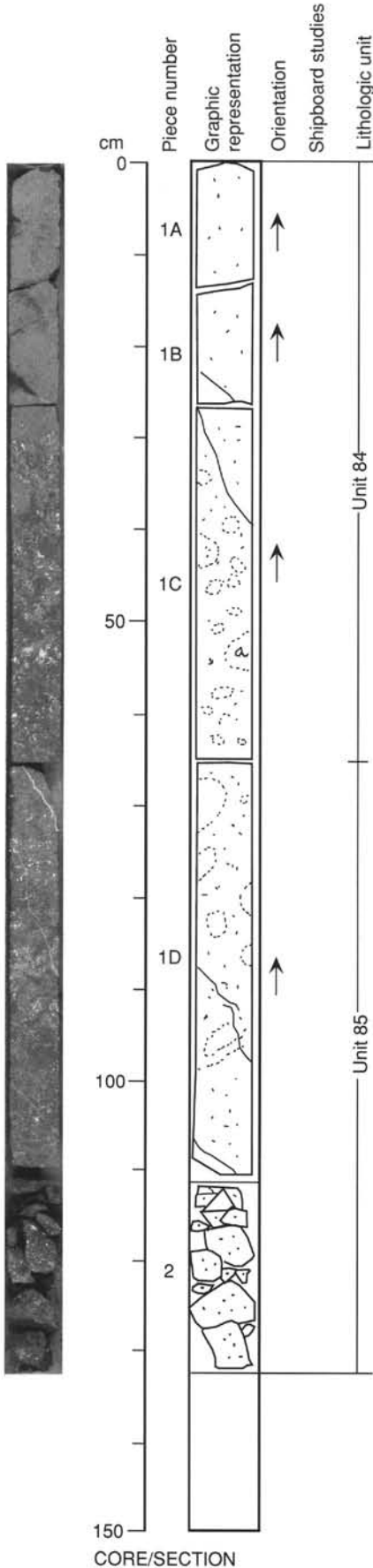
152-917A-89R-6

**UNIT 84: APHYRIC OLIVINE BASALT**

**Pieces 1A-4B**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 1%; 1-5 mm; round to slightly flattened; random; filled with green clay and zeolites.  
**COLOR:** Dark greenish gray (5G 3/1).  
**STRUCTURE:** Massive.  
**ALTERATION:** Slight.





**UNIT 84: APHYRIC OLIVINE BASALT**

**Pieces 1A–1C**

**CONTACTS:** None, but Piece 1C is very close to the bottom of the flow.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 2%–5%; 1–2 mm; round to irregular; filled with green clay in Piece 1A–1B; filled with white zeolite in Piece 1C.

**COLOR:** Dark greenish gray (5G 3/1) in Pieces 1A–1B; dark gray (N 3/0) clasts in dusky red (10R 3/2) matrix in Piece 1C.

**STRUCTURE:** Piece 1C has flow-brecciation; 1–20 mm clasts of aphyric massive or vesicular basalt in an oxidized matrix; also fractures in the breccia filled with zeolite.

**ALTERATION:** Moderate to strong.

**UNIT 85: OLIVINE-PLAGIOCLASE-PHYRIC BASALT**

**Pieces 1D and 2**

**CONTACTS:** None, but Piece 1D is very close to the top of the flow.

**PHENOCRYSTS:** Olivine - 5%; up to 3 mm; euhedral, equant. Plagioclase - <1%; up to 2 mm; euhedral.

**GROUNDMASS:** Fine-grained; contains small olivines.

**VESICLES:** 5%–30%; 1–3 mm; spherical to irregular; clasts are more vesicular than matrix; upper 4 cm of Piece 1D has fewest; filled with white zeolite.

**COLOR:** Dark gray (N 4/0) clasts in weak red (2.5YR 4/2 to 10R 4/3) matrix.

**STRUCTURE:** Flow-brecciation; clasts of vesicular basalt with olivine and plagioclase phenocrysts in an oxidized matrix.

**ALTERATION:** Strong.

**VEINS/FRACTURES:** <1%; 0.5–1.5 mm; dip about 60–70 degrees; filled with calcite.

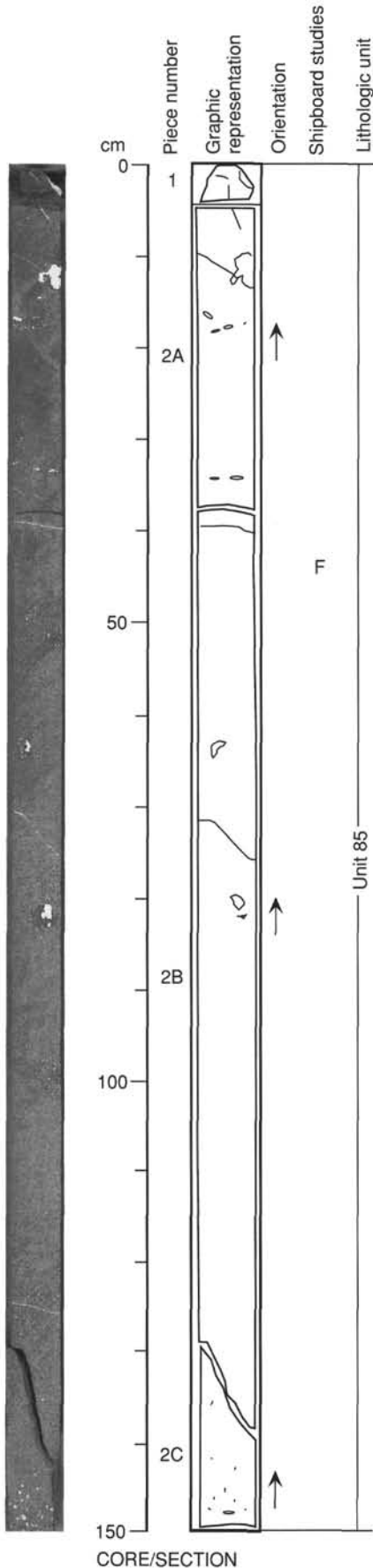


152-917A-90R-1

UNIT 85: OLIVINE-PLAGIOCLASE-PHYRIC BASALT

Pieces 1-2C

**PHENOCRYSTS:** Olivine - 5%; up to 3 mm; euhedral, equant. Plagioclase - <1%; up to 2 mm; euhedral.  
**GROUNDMASS:** Moderately fine-grained; contains small olivines.  
**VESICLES:** 0-10%; 2-30 mm; irregular; concentrated in 145-150 cm interval and in thin bands at 18 and 33 cm; rest of rock is nonvesicular except for isolated large vesicles at 12, 64, and 82 cm.  
**COLOR:** Dark gray (N 4/0).  
**STRUCTURE:** Massive.  
**ALTERATION:** Moderate; olivine oxidized.  
**VEINS/FRACTURES:** <<1%; up to 1 mm; inclined 0-30 degrees; filled with white zeolite.



CORE/SECTION

**UNIT 85: OLIVINE-PLAGIOCLASE-PHYRIC BASALT**

**Pieces 1A–1B**

**CONTACTS:** Bottom contact in Piece 1B at 28–30 cm.

**PHENOCRYSTS:** Olivine - 5%; up to 3 mm; euhedral, equant. Plagioclase - <1%; up to 2 mm; euhedral.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 5%–25%; 1–20 mm; spherical to irregular; greatest abundance at 0–12 cm; ones at 20–23 cm are vertically elongated; filled with white zeolite.

**COLOR:** Dark reddish gray (10R 4/1).

**ALTERATION:** Strong.

**UNIT 86: OLIVINE-PLAGIOCLASE-PHYRIC BASALT**

**Pieces 1B–1F**

**CONTACTS:** Top contact at 28–30 cm in Piece 1B.

**PHENOCRYSTS:** Olivine - 6%; up to 3 mm; euhedral, equant. Plagioclase - 2%; up to 2 mm; euhedral.

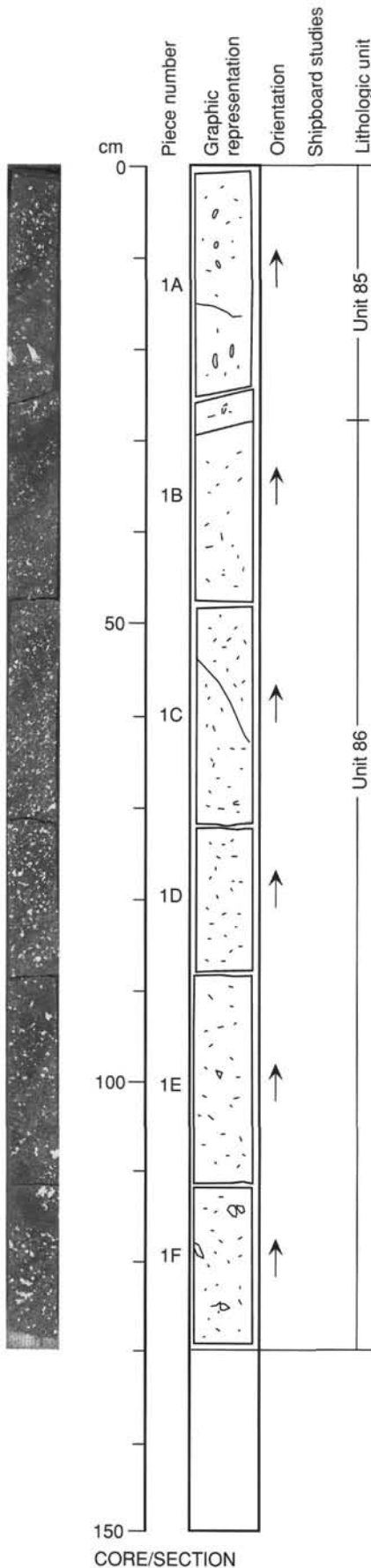
**GROUNDMASS:** Fine-grained.

**VESICLES:** 10%–25%; 1–8 mm; spherical to amoeboid; random distribution; lowest abundance at 30–33 and 111–116 cm; filled with white zeolite.

**COLOR:** Dark red (10R 3/6) in upper 2 cm; dusky red (5R 3/2) at top grading to dark gray (N 4/0) at base of section.

**ALTERATION:** Strong; oxidized.

**VEINS/FRACTURES:** One vein in Piece 1C that is filled with zeolite.



152-917A-90R-3

UNIT 86: OLIVINE-PLAGIOCLASE-PHYRIC BASALT

Pieces 1A-1B

**PHENOCRYSTS:** Olivine - 6%; up to 3 mm; euhedral, equant. Plagioclase - 2%; up to 2 mm; euhedral.

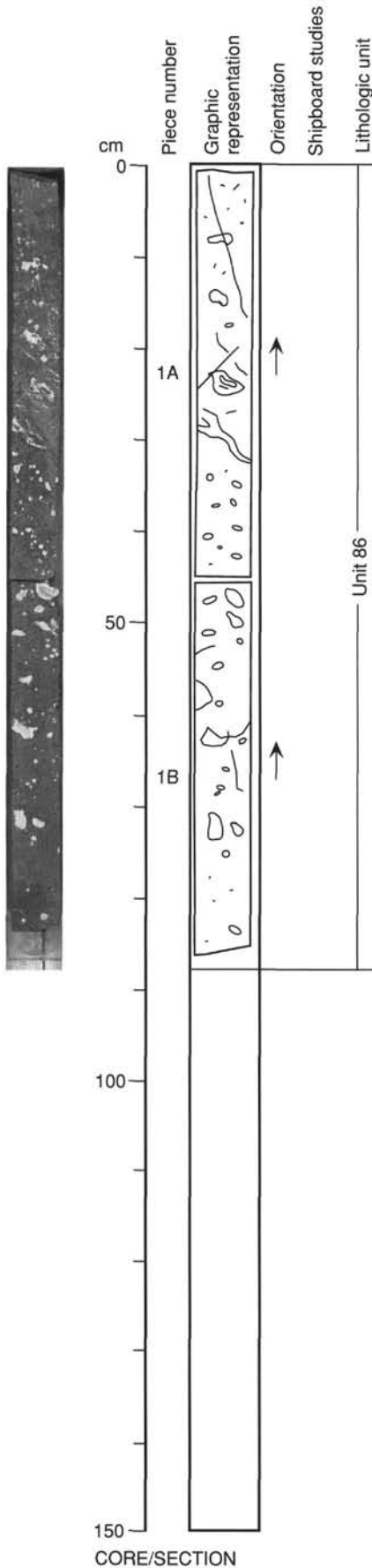
**GROUNDMASS:** Fine-grained.

**VESICLES:** 10%; 1-25 mm; spherical to irregular; random distribution; lined with zeolite and filled with green clay or zeolite.

**COLOR:** Dark gray (N 4/0).

**ALTERATION:** Moderate; olivine oxidized and altered.

**VEINS/FRACTURES:** <1-3 cm; 5% in Piece 1A; associated with slight brecciation; filled with white zeolite.



**UNIT 86: OLIVINE-PLAGIOCLASE-PHYRIC BASALT**

**Piece 1**

**PHENOCRYSTS:** Olivine - 3%; up to 2 mm; euhedral, equant. Plagioclase - 1%; up to 2 mm; euhedral, tabular.

**GROUNDMASS:** Fine-grained, with bluish green interstitial material.

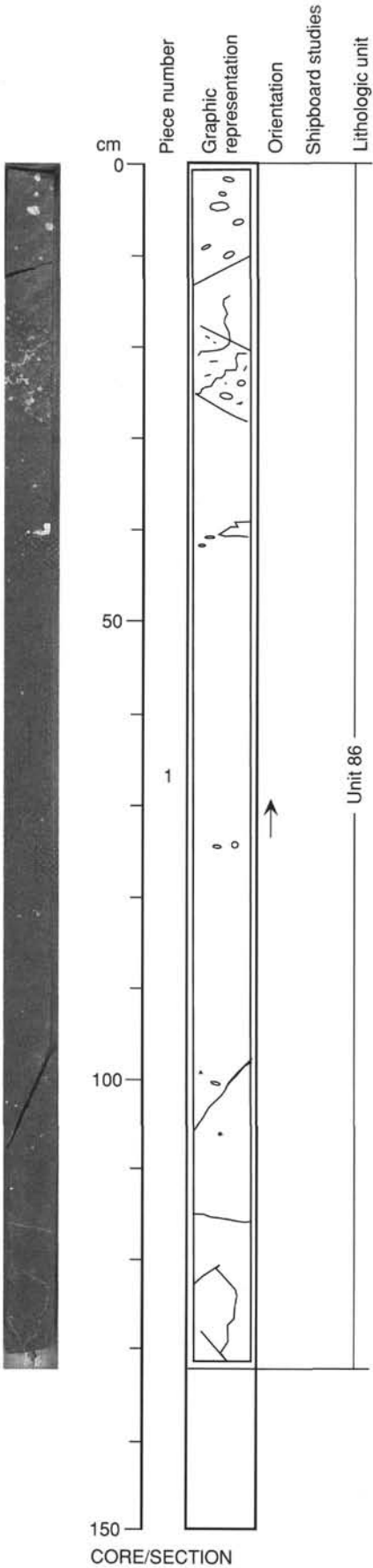
**VESICLES:** 0-5%; 1-12 mm; round to irregular; mostly in band at 16-28 cm; a few large scattered ones; filled with white zeolite.

**COLOR:** Brownish gray (5YR 4/1) at top to dark greenish gray (5G 4/1) further down.

**STRUCTURE:** Massive.

**ALTERATION:** Moderate; all olivine altered.

**VEINS/FRACTURES:** <1%; 1 mm; variable orientation; at 20-24 and 116-130 cm; irregular veins filled with green clay.



152-917A-90R-5

**UNIT 86: OLIVINE-PLAGIOCLASE-PHYRIC BASALT**

**Pieces 1A-3B**

**PHENOCRYSTS:** Olivine - 3%; up to 3 mm; euhedral, equant to elongate. Plagioclase - 1%; up to 2 mm; euhedral, tabular.

**GROUNDMASS:** Fine-grained, with bluish green interstitial material.

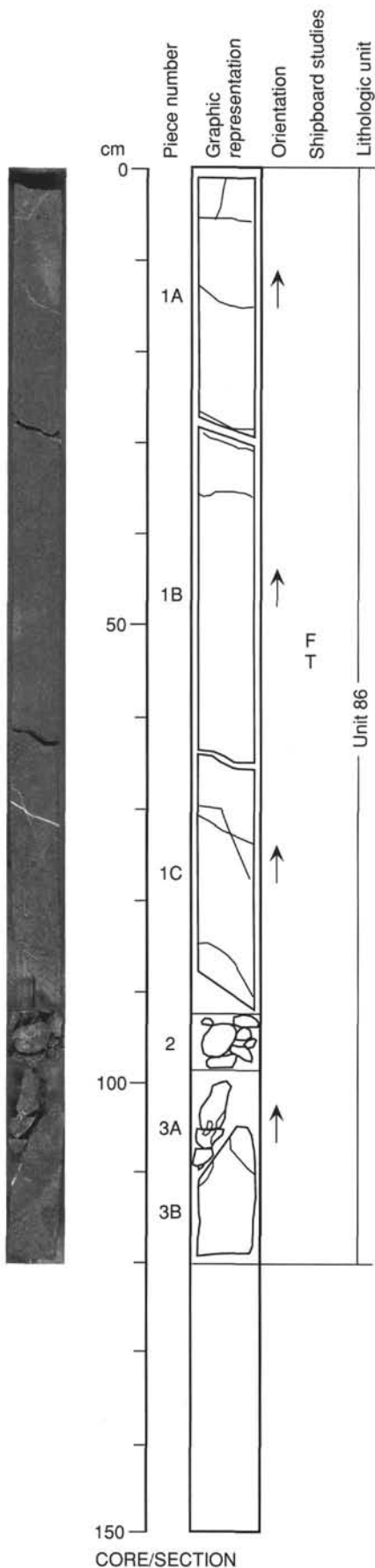
**VESICLES:** None.

**COLOR:** Dark greenish gray (5G 4/1); weak red (10R 4/3) at 18-40 cm due to oxidation around a fracture.

**STRUCTURE:** Massive.

**ALTERATION:** Moderate to strong in oxidized parts.

**VEINS/FRACTURES:** <1%; 1-2 mm; inclined 20-60 degrees; irregular veins filled with green clay and later calcite.



**UNIT 86: OLIVINE-PLAGIOCLASE-PHYRIC BASALT**

**Pieces 1A-6**

**PHENOCRYSTS:** Olivine - 3%; up to 2 mm; euhedral, equant. Plagioclase - 1%; up to 2 mm; euhedral, tabular.

**GROUNDMASS:** Fine-grained, with bluish green interstitial material.

**VESICLES:** 0-5%; 2-12 mm; irregular; patchy distribution; at 15 cm and in Pieces 4-6; filled with white zeolite.

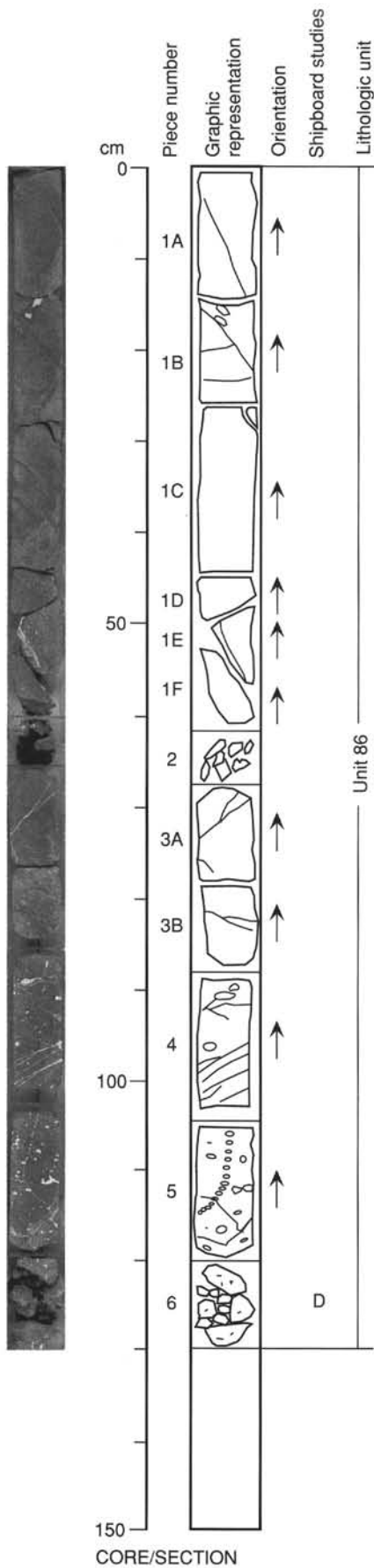
**COLOR:** Brownish gray (5YR 4/1).

**STRUCTURE:** Massive.

**ALTERATION:** Moderate to strong.

**VEINS/FRACTURES:** 1%; 1-2 mm; inclined 20-60 degrees; filled with green clay and later calcite.

**ADDITIONAL COMMENTS:** Piece 6 is reddened rubble and is probably near a flow contact.



152-917A-91R-1

UNIT 87: APHYRIC OLIVINE BASALT

Pieces 1A-1G

**PHENOCRYSTS:** None.

**GROUNDMASS:** Very fine-grained.

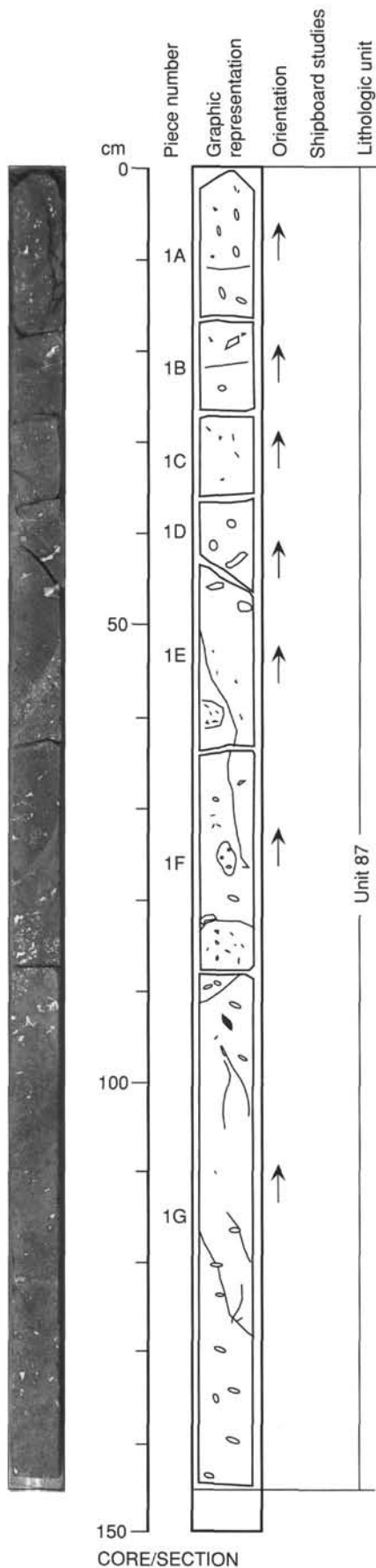
**VESICLES:** 5%; 1-10 mm; elongated to irregular; inhomogeneous distribution; elongated vertically in Pieces 1A-1C; segregation patches have 25% vesicles; filled with white zeolite and green clay.

**COLOR:** Dark gray (N 3/0).

**STRUCTURE:** Flow-brecciation in Pieces 1A-1B; 1-6 cm segregation patches in Pieces 1E-1G.

**ALTERATION:** Low.

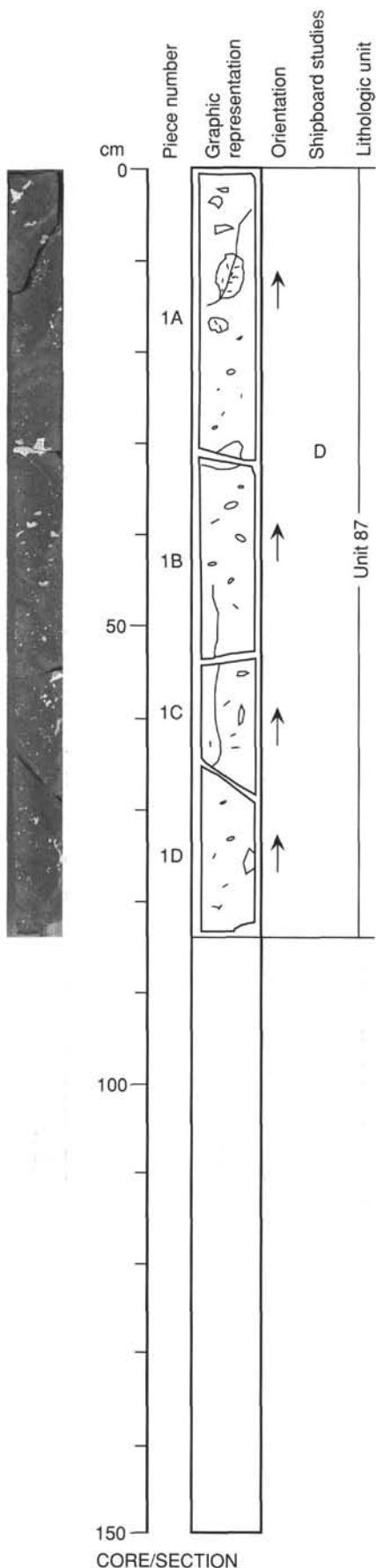
**VEINS/FRACTURES:** <<1%; <1 mm; filled with calcite.



**UNIT 87: APHYRIC OLIVINE BASALT**

**Pieces 1A-1D**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Very fine-grained.  
**VESICLES:** 5%–10%; 1–40 mm; round to ameboid; randomly distributed; filled with zeolite and blue green clay.  
**COLOR:** Dark gray (N 3/0).  
**STRUCTURE:** 1–4 cm segregation patches in Piece 1A.  
**ALTERATION:** Moderate.



CORE/SECTION

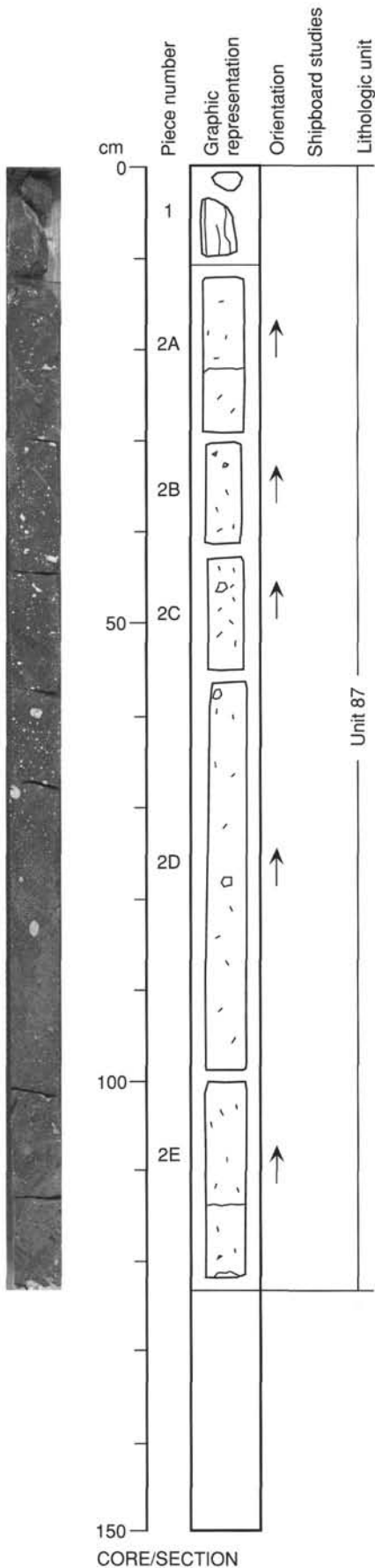


152-917A-92R-1

UNIT 87: APHYRIC OLIVINE BASALT

Pieces 1-2E

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 1%-10%; 1-12 mm; spherical to irregular; concentrated in upper 70 cm of section; filled with zeolite, blue green clay, and minor calcite.  
**COLOR:** Greenish black (5G 2/1).  
**STRUCTURE:** Scattered segregation patches in Piece 2C.  
**ALTERATION:** Moderate; olivine altered to iddingsite.  
**VEINS/FRACTURES:** <1%; 1-2 mm; spherical to irregular; concentrated in upper section; filled with zeolite and minor, late-stage calcite.



**UNIT 87: APHYRIC OLIVINE BASALT**

**Pieces 1A-1C**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

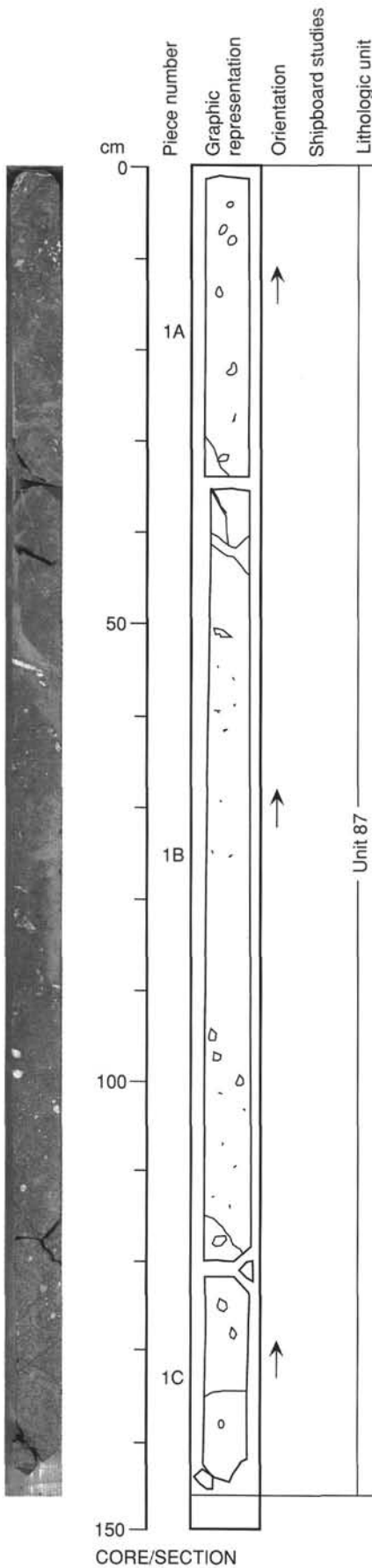
**VESICLES:** 1%-5%; 1-10 mm; spherical to irregular; patchy distribution; filled with zeolite, blue green clay, and minor calcite.

**COLOR:** Greenish black (5G 2/1).

**STRUCTURE:** Some segregation patches in Piece 1C.

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** <1%; 1-5 mm; inclined; large fracture in Piece 1B filled with green material; others filled with green material and zeolite.



152-917A-92R-3

UNIT 87: APHYRIC OLIVINE BASALT

Pieces 1A-8

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

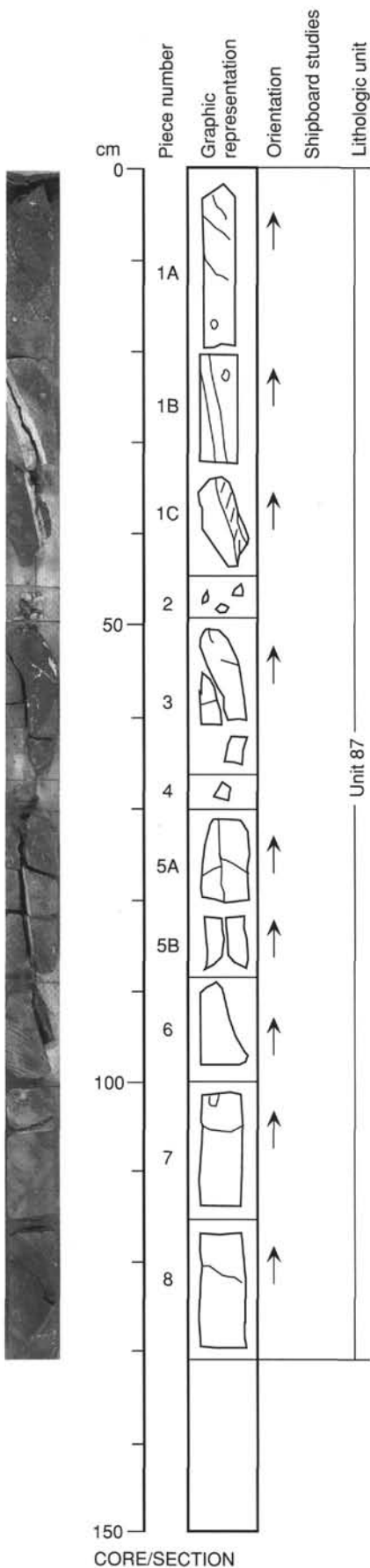
**VESICLES:** <1%; 5-10 mm; spherical; a few cavities in Piece 1 filled with zeolite and green material.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Moderate.

**VEINS/FRACTURES:** 1%; 1-5 mm; inclined; one 20-mm-wide, inclined fracture in Pieces 1B and 1C filled with white (prehnite?) and green material.

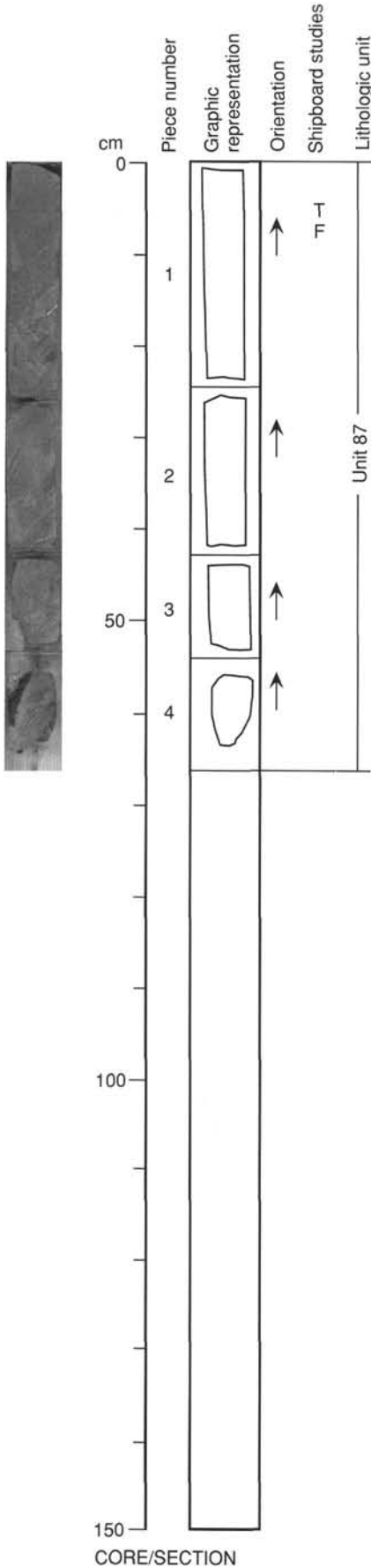
**ADDITIONAL COMMENTS:** Lower portion of the section appears to be slightly less altered.



**UNIT 87: APHYRIC OLIVINE BASALT**

**Pieces 1-4**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** None.  
**COLOR:** Greenish black (5G 2/1).  
**ALTERATION:** Slight to moderate; olivine altered to dark green material.  
**VEINS/FRACTURES:** 1-3 mm; inclined fractures in Pieces 1 and 4; filled with zeolite.

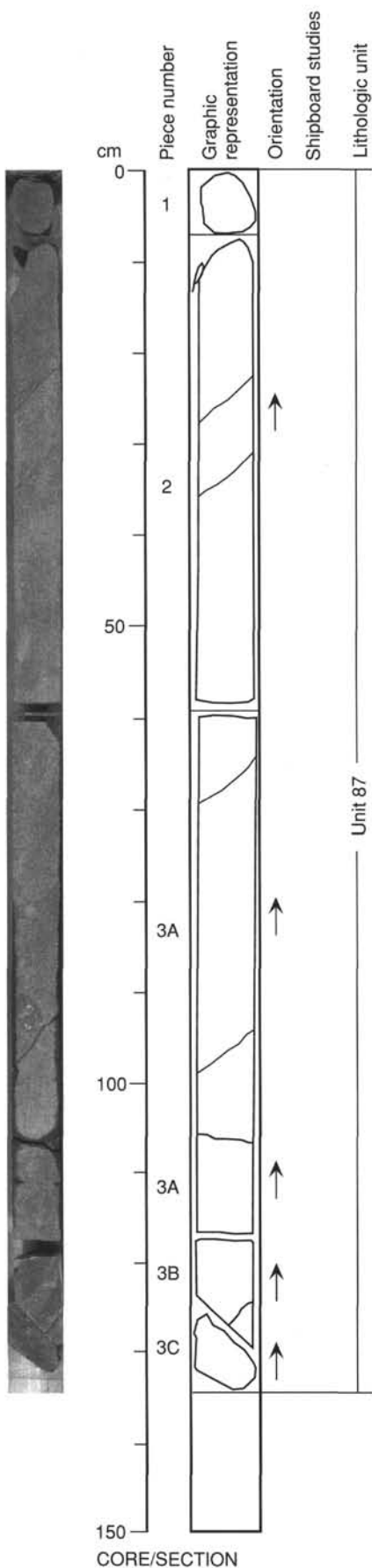


152-917A-93R-1

**UNIT 87: APHYRIC OLIVINE BASALT**

**Pieces 1-3C**

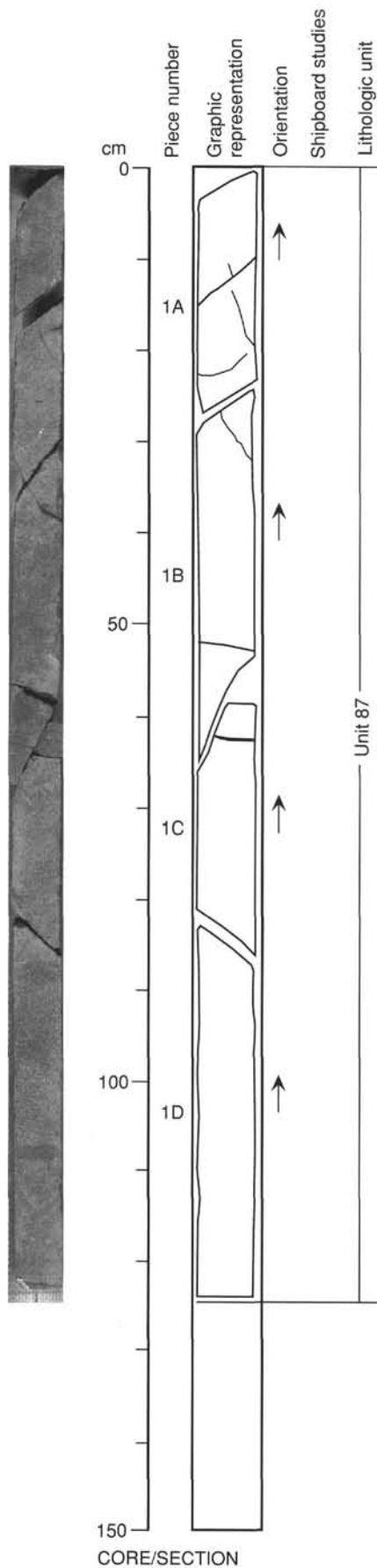
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine- to medium-grained.  
**VESICLES:** None.  
**COLOR:** Greenish black (5G 2/1).  
**ALTERATION:** Moderate; olivine altered to iddingsite and dark green material.  
**VEINS/FRACTURES:** 1%; 1-5 mm; inclined 50 degrees; filled with green material and calcite.



**UNIT 87: APHYRIC OLIVINE BASALT**

**Pieces 1A-1D**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Medium-grained; ophitic clinopyroxene.  
**VESICLES:** None.  
**COLOR:** Greenish black (5G 2/1).  
**ALTERATION:** Slight to moderate; some fresh olivine, most altered to iddingsite.  
**VEINS/FRACTURES:** <1%; 1-3 mm; inclined 40-60 degrees; lined with green material and calcite.

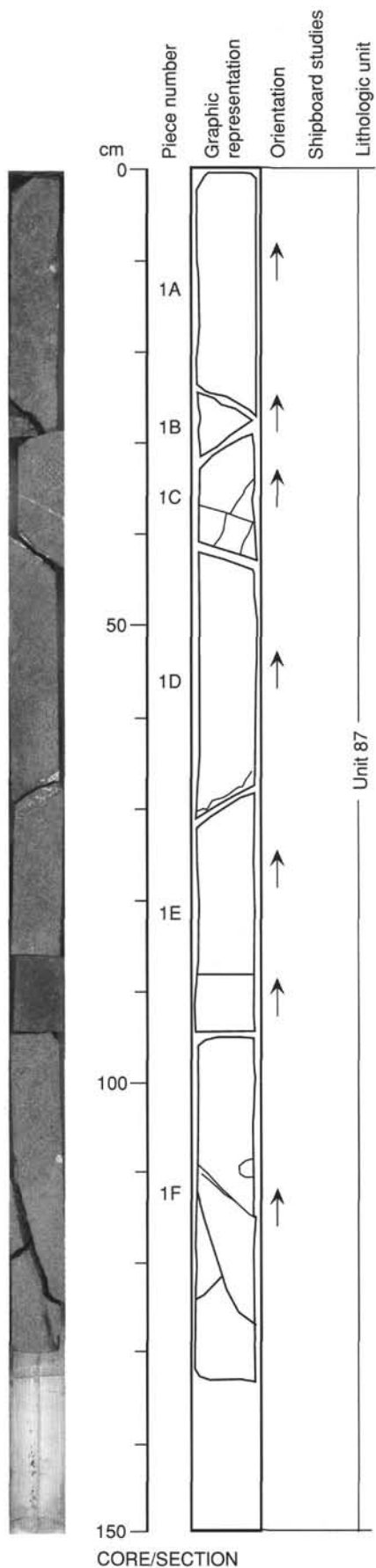


152-917A-93R-3

**UNIT 87: APHYRIC OLIVINE BASALT**

**Pieces 1A-1F**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Medium-grained; ophitic clinopyroxene.  
**VESICLES:** <<1%; zeolite-filled cavities in Pieces 1A and 1F.  
**COLOR:** Blackish red (5R 2/1).  
**ALTERATION:** Moderate; slight oxidation throughout the section.  
**VEINS/FRACTURES:** <1%; 1-3 mm; inclined; filled with zeolite and calcite.



CORE/SECTION

**UNIT 87: APHYRIC OLIVINE BASALT**

**Pieces 1A-1H**

**PHENOCRYSTS:** None.

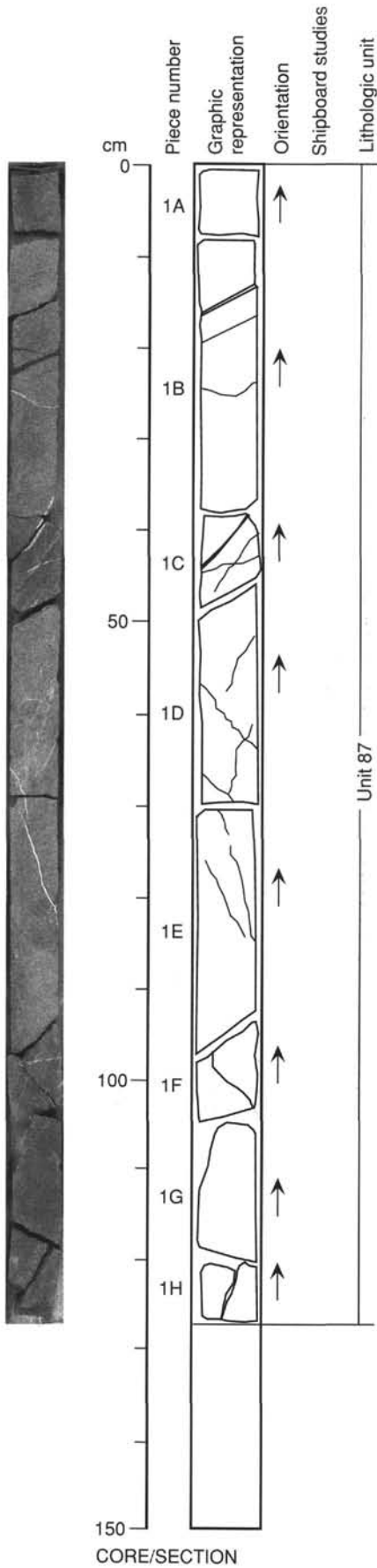
**GROUNDMASS:** Medium-grained; ophitic clinopyroxene.

**VESICLES:** None.

**COLOR:** Blackish red (5R 2/1) to greenish black (5G 2/1).

**ALTERATION:** Moderate; slight oxidation in upper part of section; olivine altered to iddingsite.

**VEINS/FRACTURES:** 1%; 1-3 mm; random orientation; filled with zeolite and calcite.



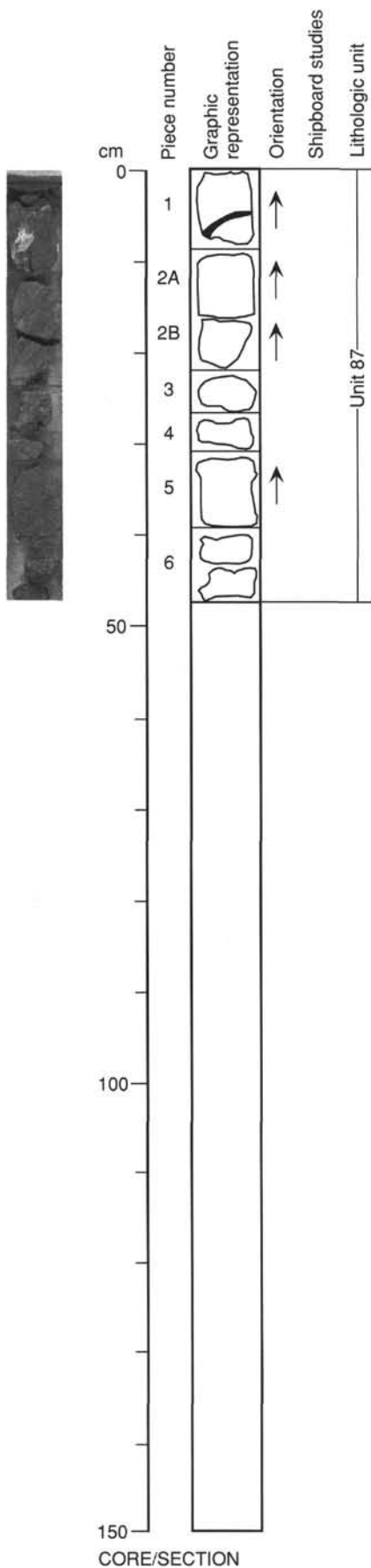


152-917A-93R-5

**UNIT 87: APHYRIC OLIVINE BASALT**

**Pieces 1-6**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** None.  
**COLOR:** Greenish black (5G 2/1).  
**ALTERATION:** Moderate; olivine completely altered.  
**VEINS/FRACTURES:** 1%-2%; 1-2 mm; random orientation; large vein in Piece 1 filled with green material and calcite; faint slickensides.



152-917A-94R-1

**UNIT 87: APHYRIC OLIVINE BASALT**

**Pieces 1A-1C**

**PHENOCRYSTS:** None.

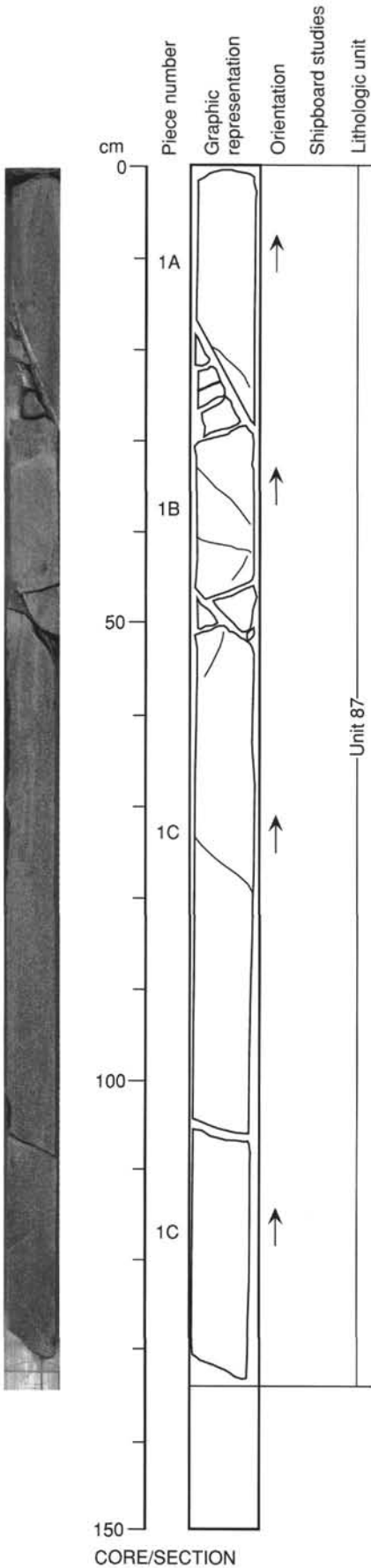
**GROUNDMASS:** Fine-grained; ophitic texture with 3-mm pyroxene oikocrysts.

**VESICLES:** <<1%; up to 2 mm; spherical; scattered; filled with very pale green mineral.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Slight to moderate; some fresh olivine.

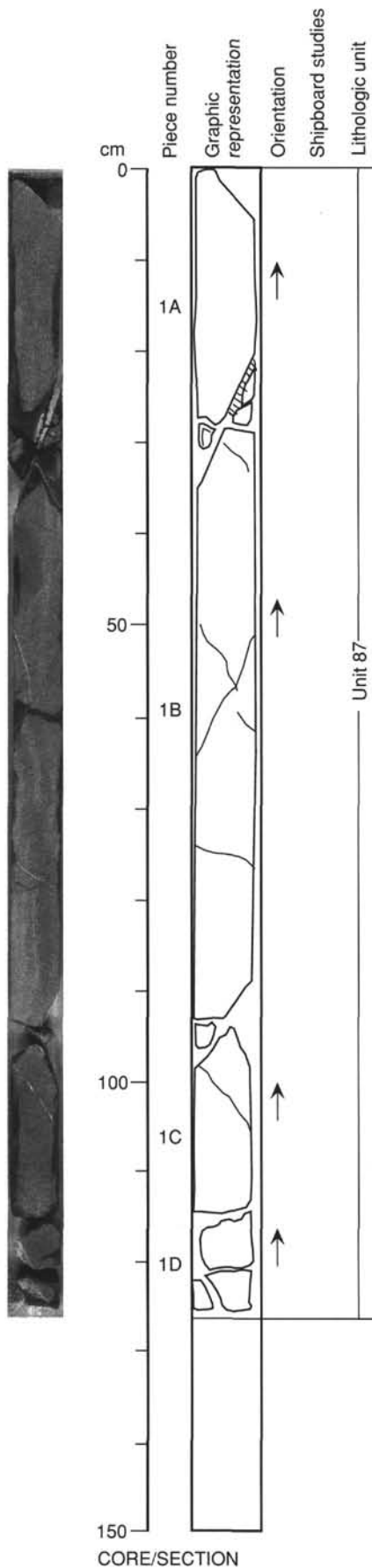
**VEINS/FRACTURES:** <1%; up to 2 mm; inclined; filled with very pale green mineral.



152-917A-94R-2

UNIT 87: APHYRIC OLIVINE BASALT

Pieces 1A-1D



**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained; ophitic texture with 3-mm pyroxene oikocrysts.

**VESICLES:** None.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Slight; some fresh olivine.

**VEINS/FRACTURES:** 1%; up to 8 mm; inclined; filled with very pale green mineral.

**UNIT 87: APHYRIC OLIVINE BASALT**

**Pieces 1-8**

**PHENOCRYSTS:** None.

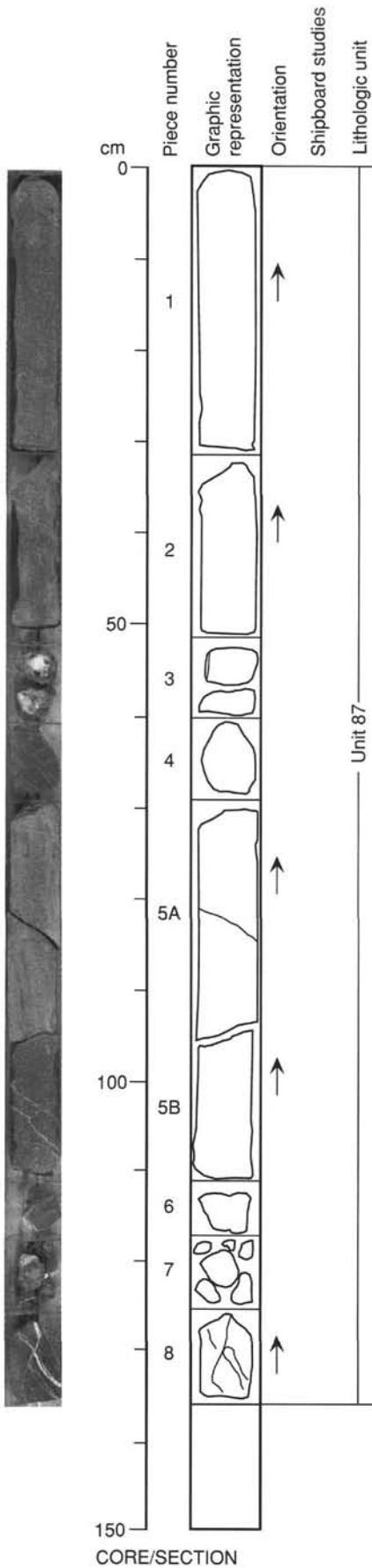
**GROUNDMASS:** Fine-grained; ophitic texture with 3-mm pyroxene oikocrysts.

**VESICLES:** None.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Slight; some fresh olivine.

**VEINS/FRACTURES:** 1%; up to 5 mm; inclined; two intersecting inclined sets; filled with very pale green mineral.

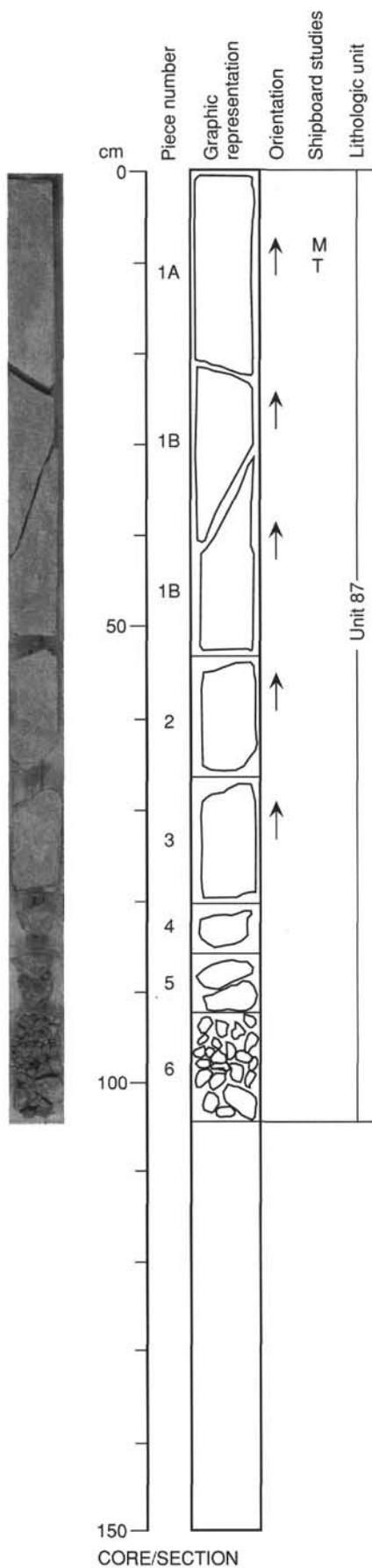


152-917A-94R-4

**UNIT 87: APHYRIC OLIVINE BASALT**

**Pieces 1A-6**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained; ophitic texture with 3-mm pyroxene oikocrysts.  
**VESICLES:** None.  
**COLOR:** Greenish black (5G 2/1).  
**ALTERATION:** Slight; some fresh olivine.  
**VEINS/FRACTURES:** <<1%; up to 0.5 mm; inclined; filled with very pale green mineral.



152-917A-95R-1

UNIT 87: APHYRIC OLIVINE BASALT

Pieces 1A-1J

**PHENOCRYSTS:** None.

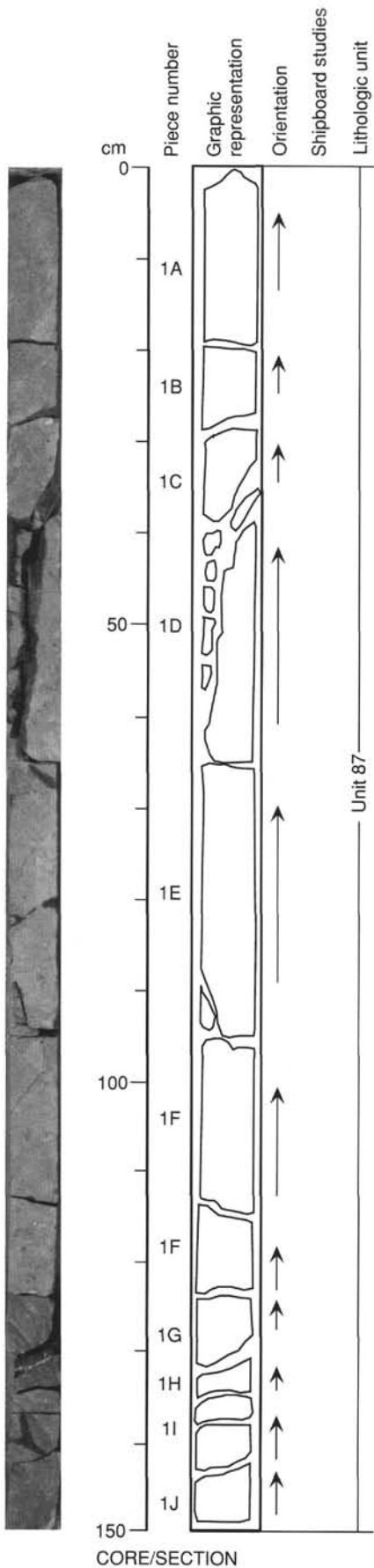
**GROUNDMASS:** Fine-grained; ophitic texture less distinct than in Core 152-917A-94R; grain size decreases toward base of section.

**VESICLES:** <1%; up to 8 mm; spherical; scattered; filled with very pale green mineral.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Slight.

**VEINS/FRACTURES:** <<1%; up to 0.5 mm; inclined; lined with chlorite and filled with very pale green mineral.



152-917A-95R-2

**UNIT 87: APHYRIC OLIVINE BASALT**

**Pieces 1A-4**

**PHENOCRYSTS:** None.

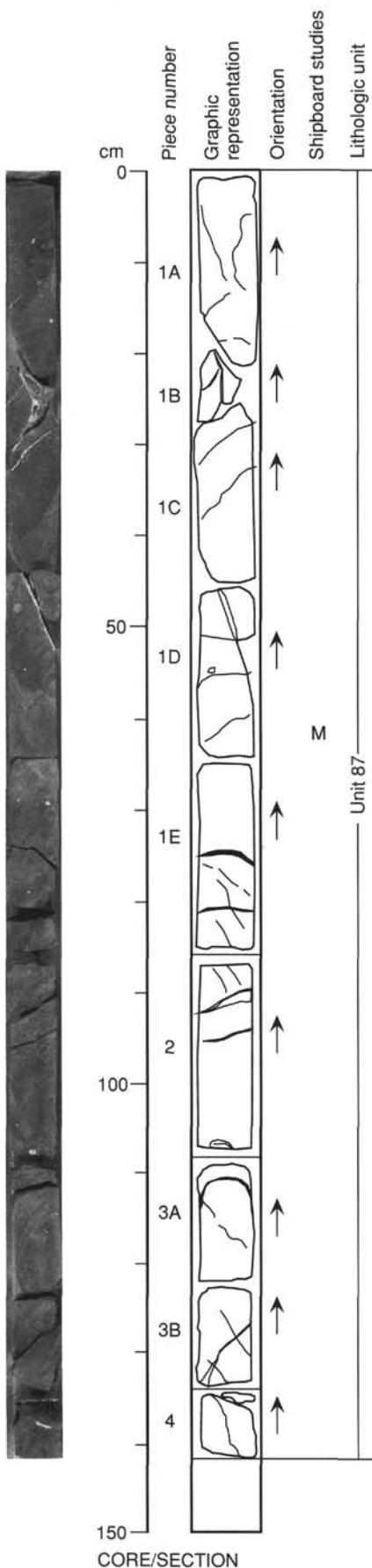
**GROUNDMASS:** Fine-grained.

**VESICLES:** <1%; up to 5 mm; spherical to irregular; scattered; filled with very pale green mineral.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Moderate; chlorite in groundmass.

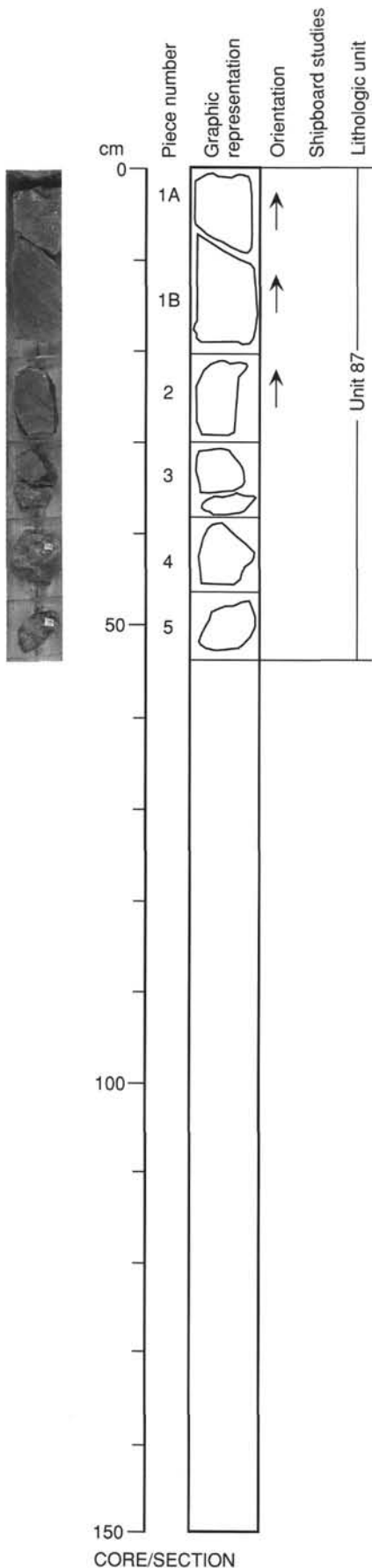
**VEINS/FRACTURES:** 1%; up to 3 mm; horizontal to inclined; lined with chlorite and filled with very pale green mineral.



**UNIT 87: APHYRIC OLIVINE BASALT**

**Pieces 1A-5**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 1%; up to 2 mm; irregular; scattered; filled with very pale green mineral or chlorite.  
**COLOR:** Greenish black (5G 2/1).  
**ALTERATION:** Moderate; chlorite in groundmass.  
**VEINS/FRACTURES:** <1%; up to 0.5 mm; horizontal to inclined; lined with chlorite and filled with very pale green mineral.





152-917A-96R-1

UNIT 88: OLIVINE-PLAGIOCLASE-PHYRIC BASALT

Pieces 1-12

**PHENOCRYSTS:** None. Olivine - 20%; up to 5 mm; euhedral, equant. Plagioclase - 10%; up to 3 mm; tabular.

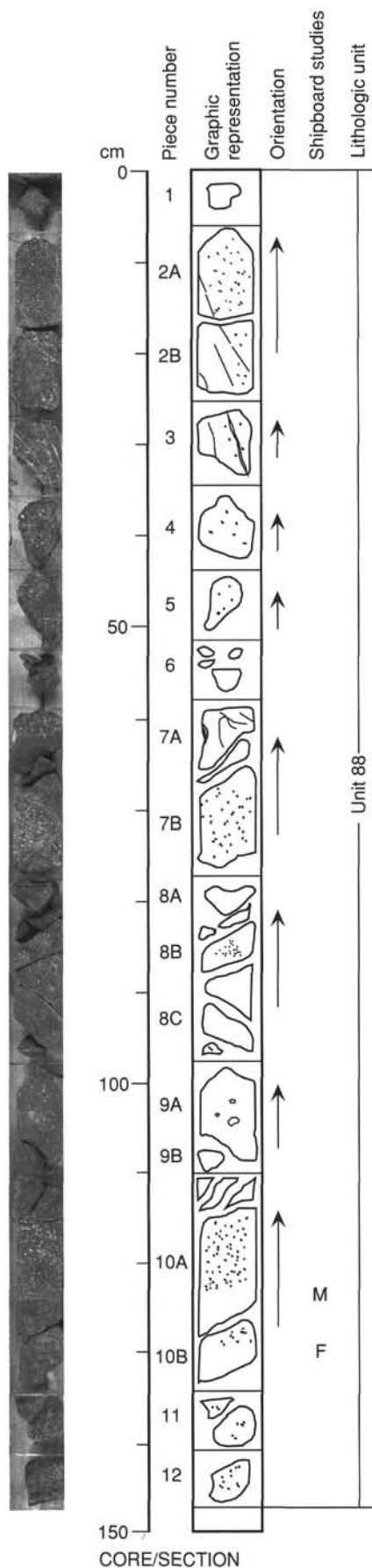
**GROUNDMASS:** Fine-grained.

**VESICLES:** 2%-30%; up to 5 mm; spherical to irregular; in patches; filled with zeolite.

**COLOR:** Dark greenish gray (5G 4/1).

**ALTERATION:** Moderate; olivine altered to greenish gray mineral.

**VEINS/FRACTURES:** 1%; up to 1 mm; inclined; lined with chlorite and filled with zeolite; slickensides on fracture surfaces.



152-917A-96R-2

**UNIT 88: OLIVINE-PLAGIOCLASE-PHYRIC BASALT**

**Pieces 1-4**

**PHENOCRYSTS:** None. Olivine - 20%; up to 5 mm; euhedral, equant. Plagioclase - 10%; up to 3 mm; tabular.

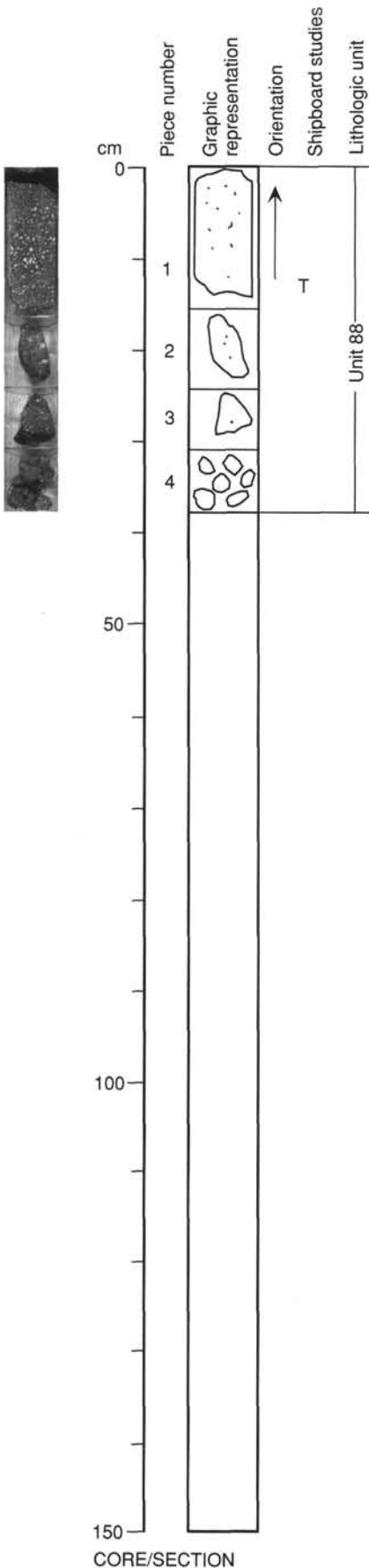
**GROUNDMASS:** Fine-grained.

**VESICLES:** 5%-20%; up to 5 mm; spherical to irregular; in patches; filled with zeolite.

**COLOR:** Dark greenish gray (5G 4/1).

**ALTERATION:** Moderate; olivine altered to greenish gray mineral.

**VEINS/FRACTURES:** <<1%; 0.2 mm; gently inclined; single small zeolite-filled vein in Piece 1.



152-917A-97R-1

**UNIT 88: OLIVINE-PLAGIOCLASE-PHYRIC BASALT**

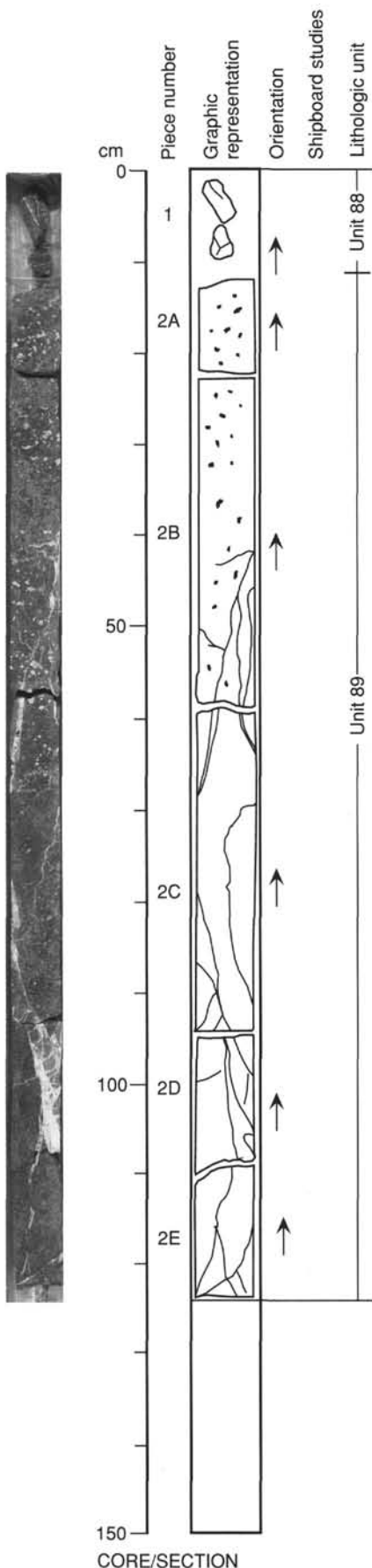
**Piece 1**

**PHENOCRYSTS:** Olivine - 15%; up to 2 mm; euhedral. Plagioclase - 5%; up to 2 mm; euhedral.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** None.  
**COLOR:** Dark greenish gray (5G 4/1).  
**ALTERATION:** Strong.  
**VEINS/FRACTURES:** 10%; 1-2 mm; filled with calcite.

**UNIT 89: OLIVINE-PHYRIC BASALT**

**Pieces 2A-2E**

**PHENOCRYSTS:** Olivine - 2%; 1 mm; euhedral, equant; altered.  
**GROUNDMASS:** Fine-grained; contains olivine.  
**VESICLES:** 2%-15%; 1-8 mm; spherical to ameboid; decrease in abundance towards bottom of section; filled with zeolite.  
**COLOR:** Dark greenish gray (5G 4/1).  
**ALTERATION:** Strong.  
**VEINS/FRACTURES:** 10%; 1-20 mm; vertical to steeply dipping; seen in interval at 37-122 cm; filled with calcite.



**UNIT 89: APHYRIC OLIVINE BASALT**

**Pieces 1A-1F**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained; contains olivine.

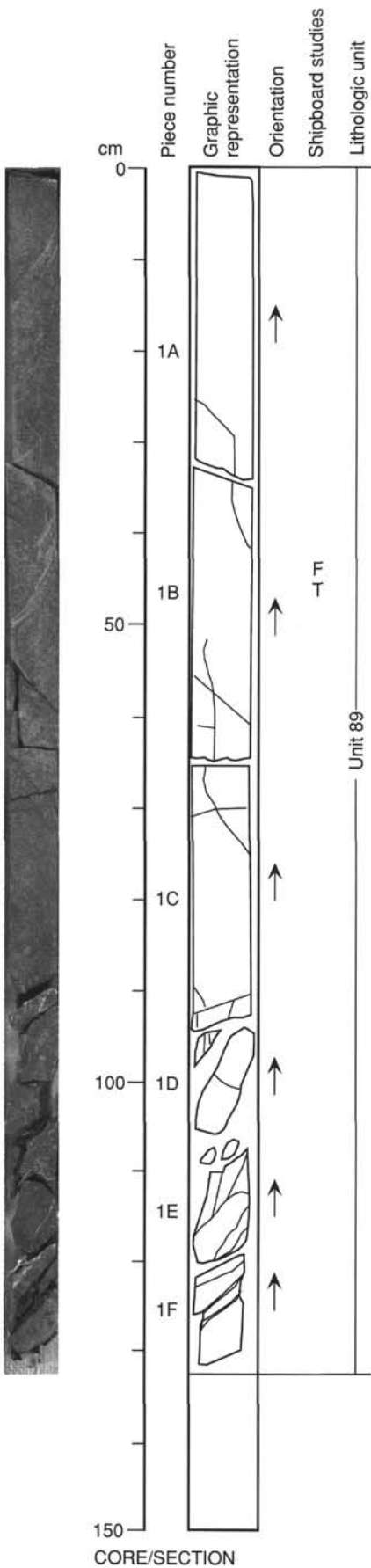
**VESICLES:** None.

**COLOR:** Dark gray (N 4/0) and dark greenish gray (5G 4/1).

**STRUCTURE:** Massive.

**ALTERATION:** Moderate in Pieces 1A-1C and strong in Pieces 1D-1F.

**VEINS/FRACTURES:** 1-10 mm; mainly in Pieces 1D-1F; filled with calcite and a green mineral with slickensides; slickensides are aligned horizontally.



152-917A-97R-3

UNIT 89: APHYRIC OLIVINE BASALT

Pieces 1-8B

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained; contains olivine.

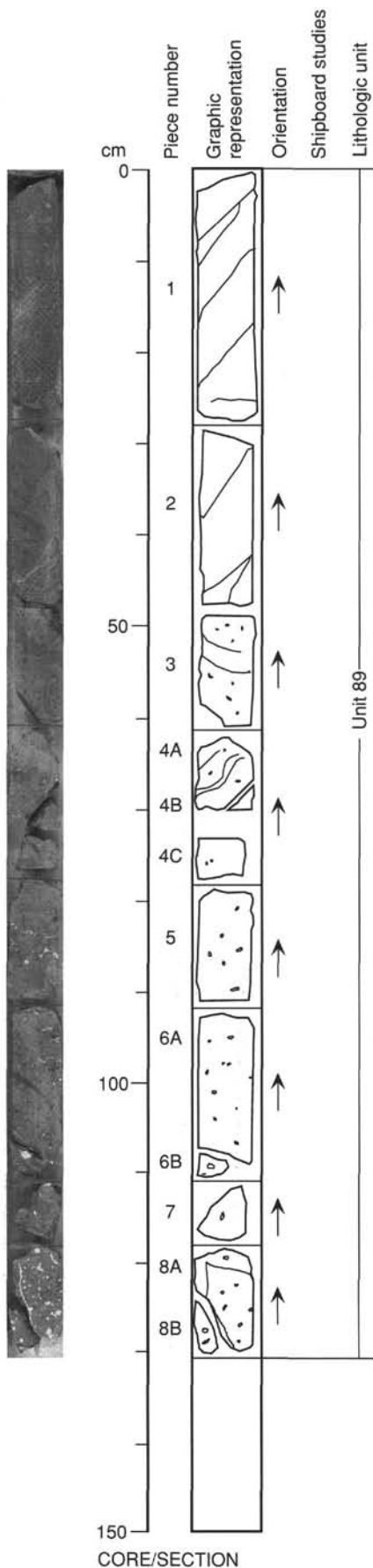
**VESICLES:** 2%-10% in Pieces 3-8 with abundance increasing downsection; filled with zeolite and green clay.

**COLOR:** Dark gray (N 4/0).

**STRUCTURE:** Pieces 1 and 2 are massive; Pieces 3 and 4A each have a 1-2 cm oxidized strip.

**ALTERATION:** Moderate in massive parts; moderately strong in vesicular parts.

**VEINS/FRACTURES:** 1-2 mm; in Pieces 6-8; filled with calcite.



**UNIT 89: APHYRIC OLIVINE BASALT**

**Pieces 1-6**

**PHENOCRYSTS:** None.

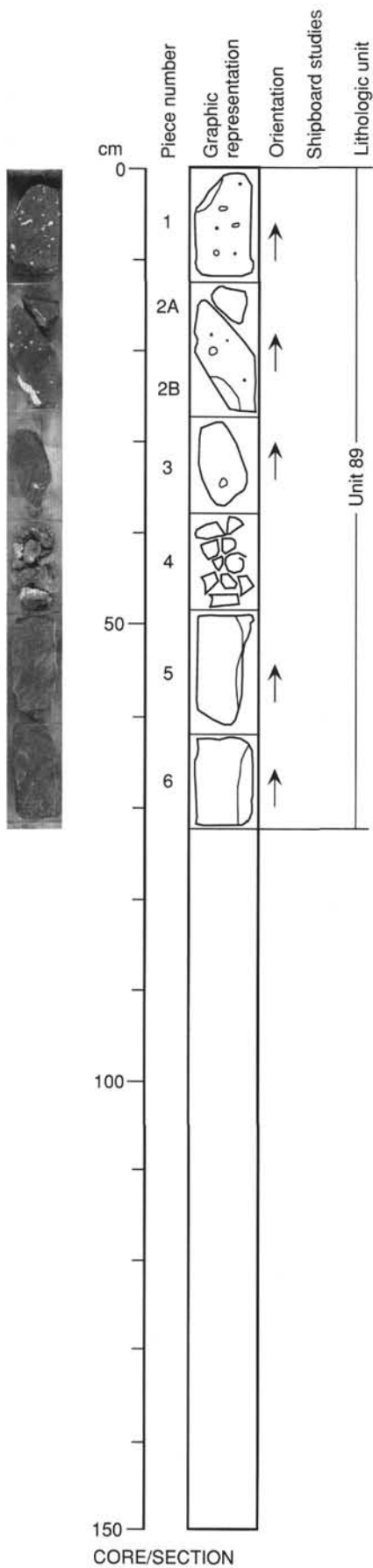
**GROUNDMASS:** Fine-grained; contains olivine; altered to zeolite and clay in Pieces 3-6.

**VESICLES:** 1-5 mm; round to amoeboid; 5% in Pieces 1 and 2; filled with zeolite and blue-green clay.

**COLOR:** Dark greenish gray (5G 4/1).

**ALTERATION:** Moderate to strong.

**VEINS/FRACTURES:** 5%; <1-5 mm; filled with calcite.



152-917A-98R-1

**UNIT 90: APHYRIC OLIVINE BASALT**

**Pieces 3A-4C**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 15%; 1-8 mm; round to irregular; mostly in the clasts; filled with zeolite; larger ones may have calcite in core.

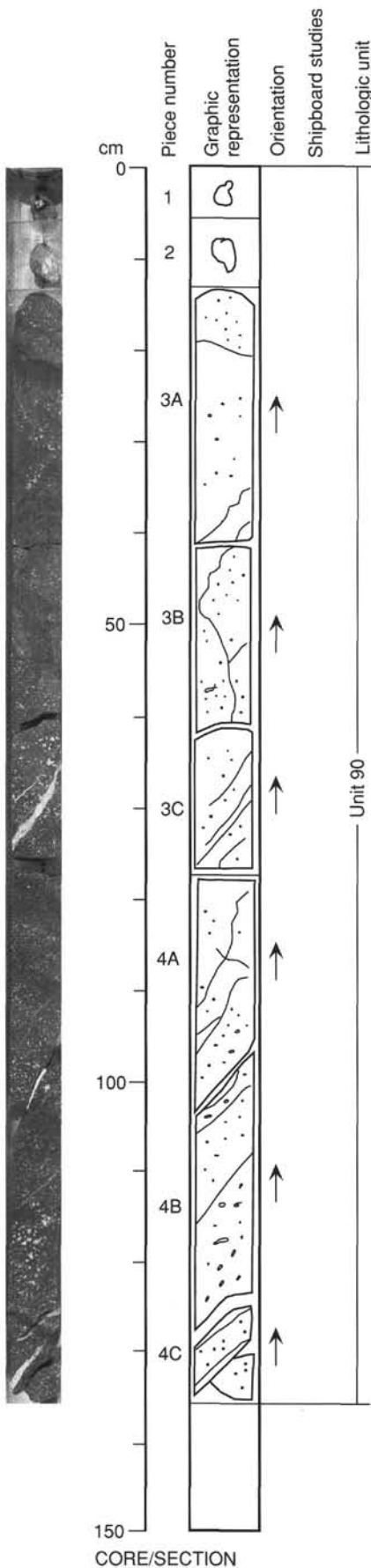
**COLOR:** Dark reddish gray (10R 3/1 and 4/1).

**STRUCTURE:** Flow-brecciation with clasts of vesicular basalt.

**ALTERATION:** Strong; oxidized.

**VEINS/FRACTURES:** 1-10 mm; dip 60 degrees; filled with calcite; larger ones also have thin lining of brown to green material and are associated with slight brecciation of the rock.

**ADDITIONAL COMMENTS:** Pieces 1 and 2 are drilling rubble. They are pieces of highly altered basalt with lots of calcite-filled veins, too altered to discern whether they are part of Unit 89 or 90.



**UNIT 90: APHYRIC OLIVINE BASALT**

**Pieces 1A-6**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 0-25%; 1-3 mm; round to irregular; <1% in Pieces 1B-1C, 3, and 5; 25% in Pieces 1A, 2, 4, and 6; filled with zeolite.

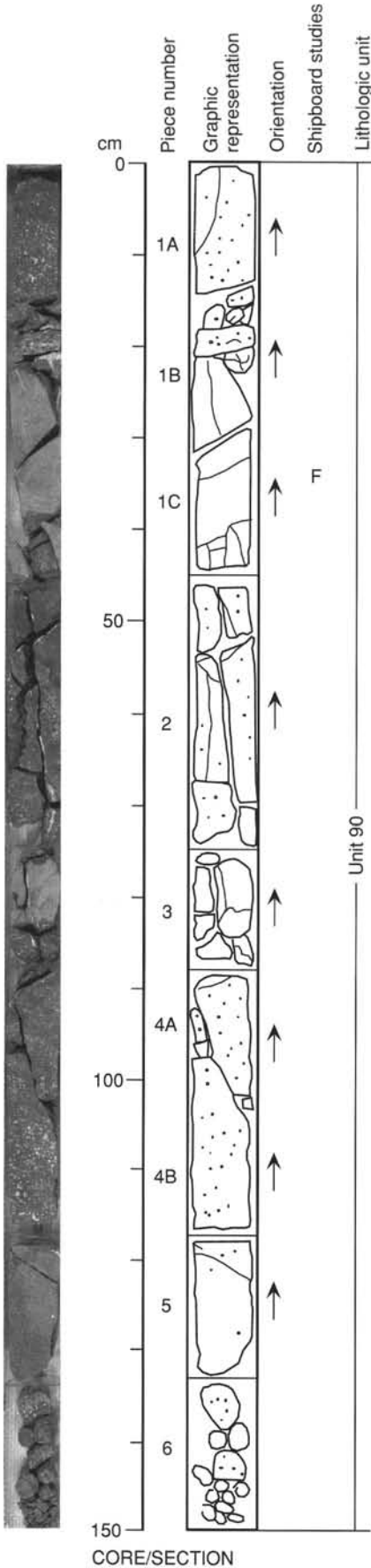
**COLOR:** Dark greenish gray (5G 4/1) in Pieces 1B-1C, 3, and 5; dark reddish gray (10R 4/1) in Pieces 1A, 2, 4, and 6.

**STRUCTURE:** Pieces 1B-1C, 3, and 5 are massive; Pieces 1A and 2 are slightly flow-brecciated.

**ALTERATION:** Moderate in massive pieces; strong in other pieces.

**VEINS/FRACTURES:** 1-3 mm; main set vertical; filled with zeolite.

**ADDITIONAL COMMENTS:** Pieces 1B and 1C, and the top portion of Piece 3 are small intrusive sheets of fine-grained aphyric basalt; chilled margins are preserved in both sheets.





152-917A-99R-1

**UNIT 90: APHYRIC OLIVINE BASALT**

**Pieces 1A-1G**

**PHENOCRYSTS:** None.

**GROUNDMASS:** Fine-grained.

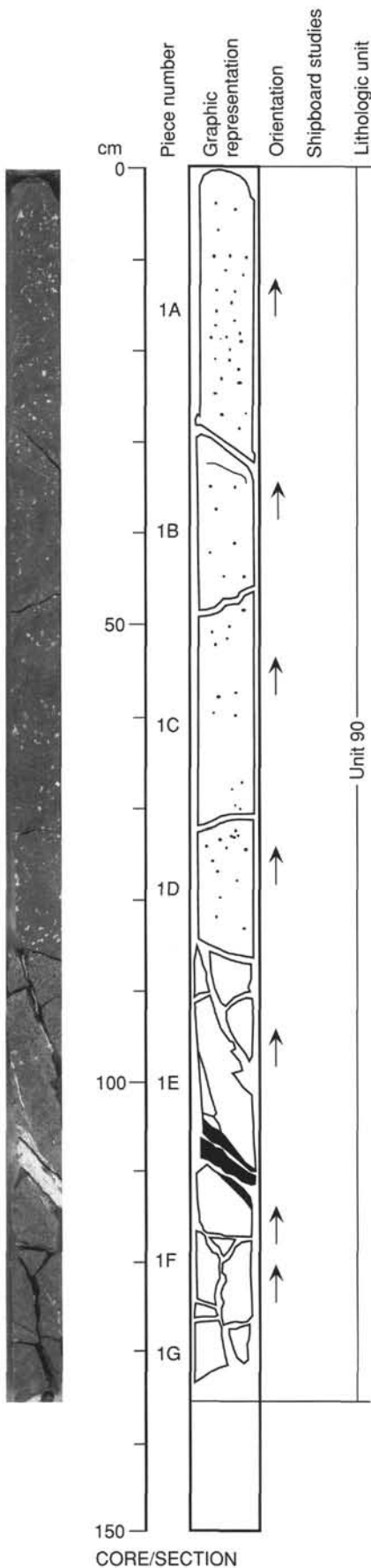
**VESICLES:** 5%; up to 6 mm; spherical to irregular; scattered; filled with zeolite and calcite above 85 cm, chlorite below.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Slight to moderate; some fresh olivine.

**VEINS/FRACTURES:** 3%; up to 30 mm; inclined; lined with chlorite and filled with calcite; slickensides dipping 40-50 degrees on fracture surfaces.

**ADDITIONAL COMMENTS:** Olivine phenocrysts are very difficult to see; only obvious in oxidized parts of other sections.



**UNIT 90: APHYRIC OLIVINE BASALT**

**Pieces 1A-1K**

**PHENOCRYSTS:** None.

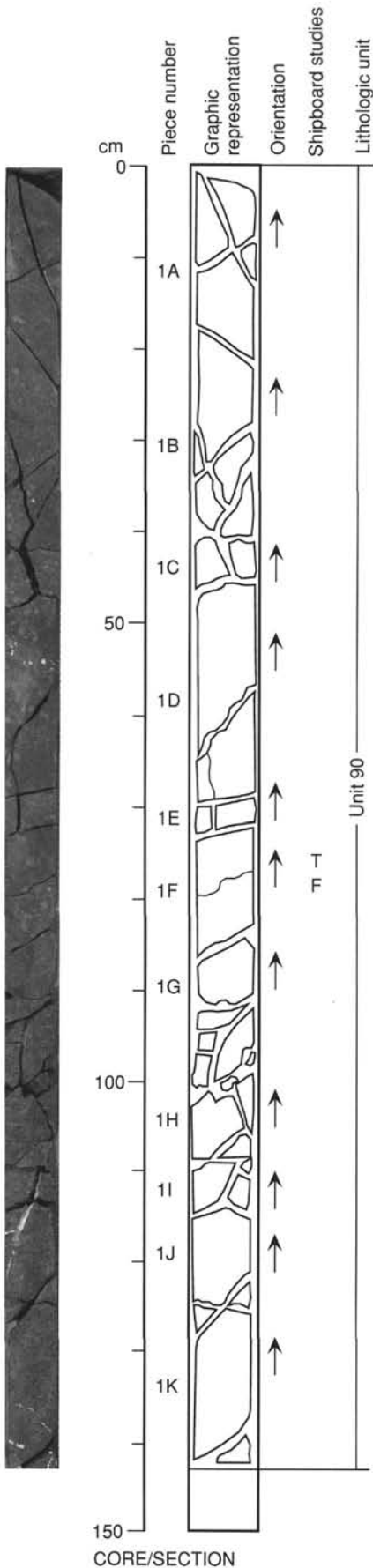
**GROUNDMASS:** Fine-grained.

**VESICLES:** 2%; up to 3 mm; spherical; scattered; filled with chlorite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Slight; some fresh olivine.

**VEINS/FRACTURES:** <1%; up to 2 mm; inclined; lined with chlorite and filled with calcite; two sets of intersecting fractures causing fragmentation of section; slickensides on fracture surfaces.



152-917A-99R-3

UNIT 90: APHYRIC OLIVINE BASALT

Pieces 1A-2D

**PHENOCRYSTS:** None.

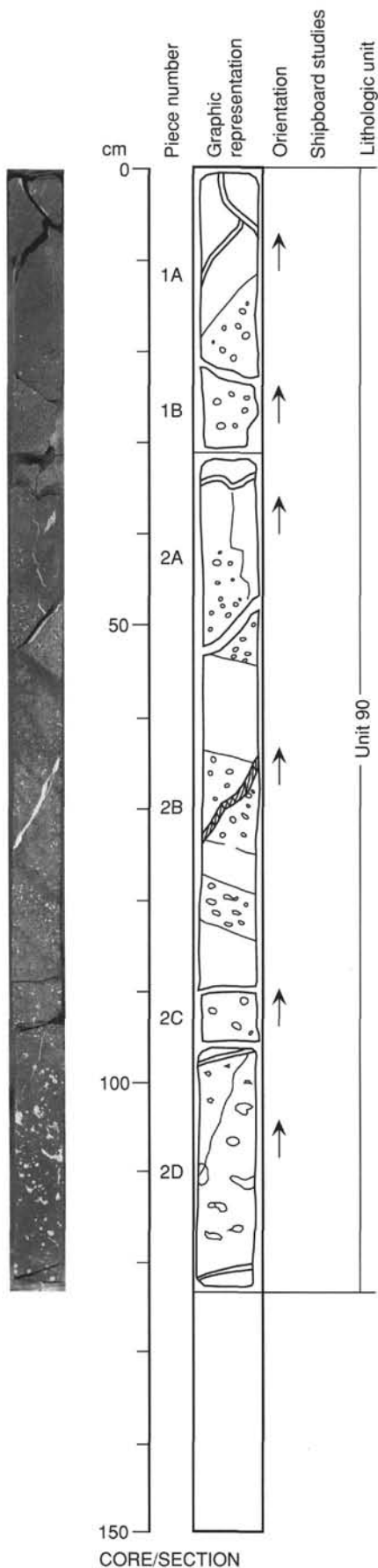
**GROUNDMASS:** Fine-grained.

**VESICLES:** 5%-10%; up to 10 mm; spherical to irregular; concentrated in bands; filled with chlorite above 40 cm, zeolite and calcite below.

**COLOR:** Dark greenish gray (5G 4/1).

**ALTERATION:** Moderate; olivine altered and oxidized in places.

**VEINS/FRACTURES:** 1%; up to 3 mm; mostly inclined to vertical; lined with chlorite and filled with calcite; slickensides on fracture surfaces.



CORE/SECTION

**UNIT 90: APHYRIC OLIVINE BASALT**

**Pieces 1-5**

**PHENOCRYSTS:** None.

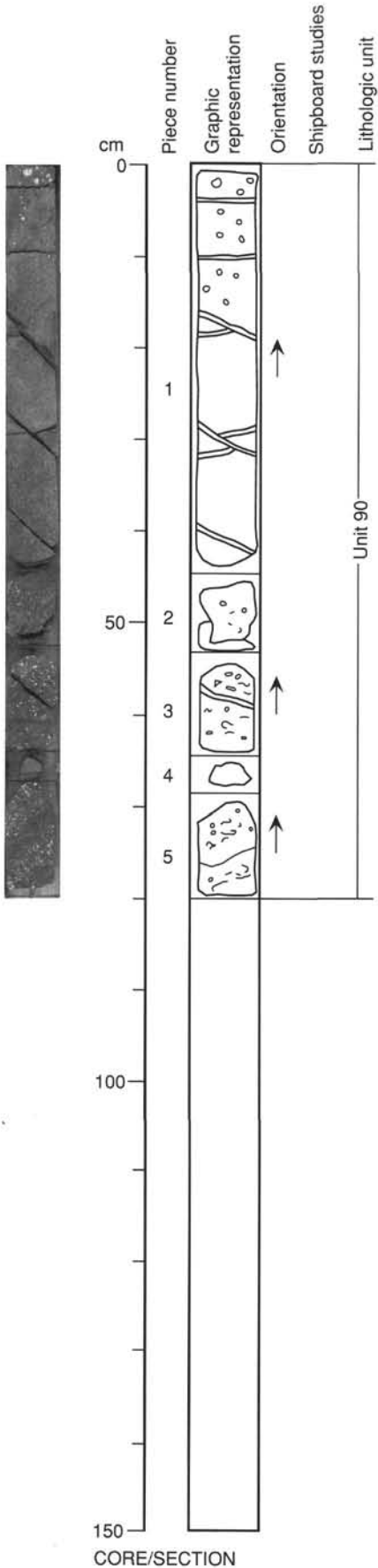
**GROUNDMASS:** Fine-grained.

**VESICLES:** 1%–10%; up to 8 mm; spherical to irregular; patchy distribution; filled with zeolite and calcite.

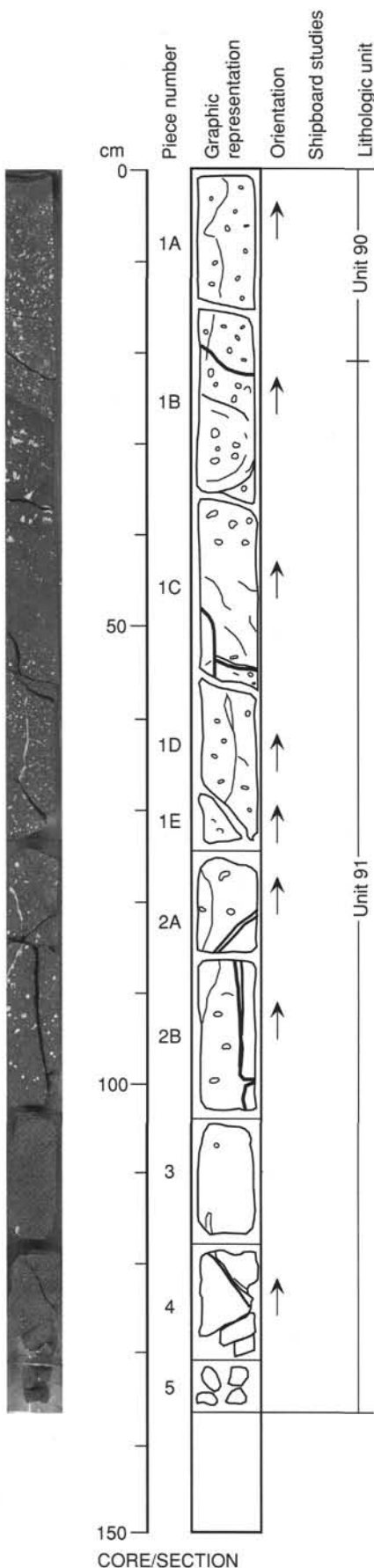
**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Moderate; olivine altered and also oxidized in lower half of section.

**VEINS/FRACTURES:** <1%; up to 0.5 mm; inclined; calcite-filled vein in Piece 5; intersecting sets of chlorite-filled veins in Piece 1; slickensides on fracture surfaces.



152-917A-99R-5



**UNIT 90: APHYRIC OLIVINE BASALT**

**Pieces 1A-1B**

**CONTACTS:** Base of flow in Piece 1B.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 10%; up to 5 mm; irregular; scattered; filled with zeolite and calcite.  
**COLOR:** Brownish black (5YR 2/1).  
**ALTERATION:** Strong; oxidized base of flow.  
**VEINS/FRACTURES:** <1%; up to 0.5 mm; inclined to vertical; filled with calcite; slickensides on fracture surfaces.

**UNIT 91: APHYRIC OLIVINE BASALT**

**Pieces 1B-5**

**CONTACTS:** Top of flow in Piece 1B.  
**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 1%-10%; up to 8 mm; spherical to irregular; filled with zeolite; larger vesicles have calcite in centers.  
**COLOR:** Grayish red (5Y 4/2) at top, medium dark gray at base.  
**ALTERATION:** Strong in oxidized flow top to moderate at base of section.  
**VEINS/FRACTURES:** 1%; up to 4 mm; inclined to vertical; filled with calcite; slickensides on fracture surfaces.

**UNIT 91: APHYRIC OLIVINE BASALT**

**Pieces 1A-1F**

**PHENOCRYSTS:** None.

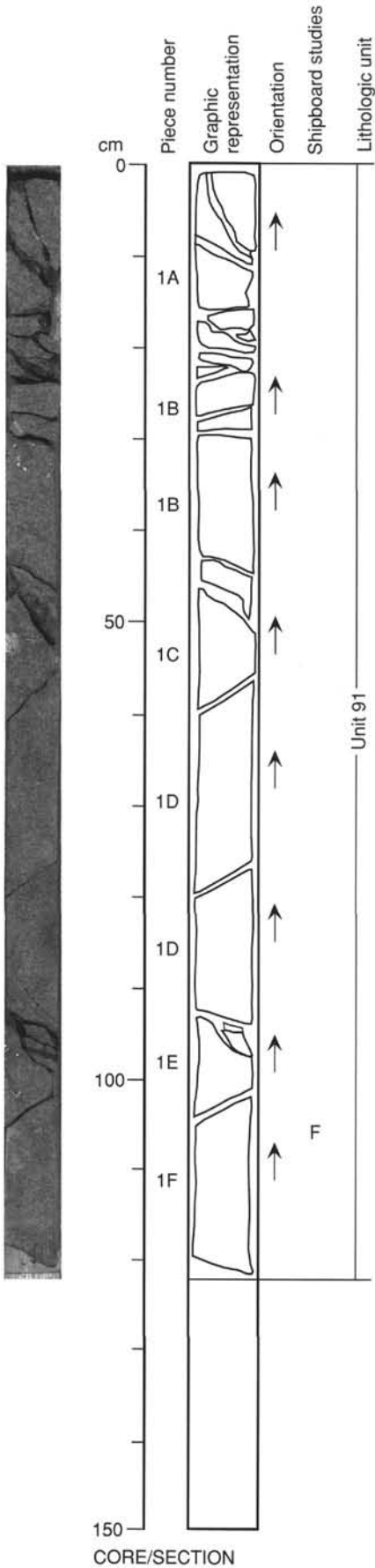
**GROUNDMASS:** Fine-grained.

**VESICLES:** <1%; up to 4 mm; spherical to irregular; scattered; filled with calcite and zeolite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Slight; some fresh olivine.

**VEINS/FRACTURES:** <1%; up to 1 mm; inclined; lined with chlorite; larger veins filled with calcite; slickensides on fracture surfaces.



152-917A-100R-2

UNIT 91: APHYRIC OLIVINE BASALT

Pieces 1A-1G

**PHENOCRYSTS:** None.

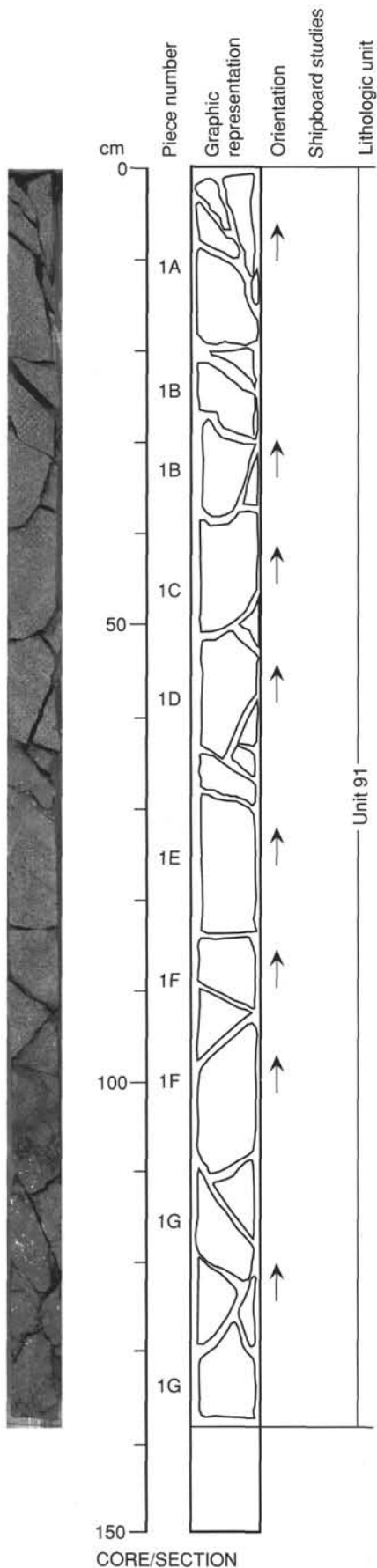
**GROUNDMASS:** Fine-grained.

**VESICLES:** 0-2%; up to 3 mm; spherical to irregular; concentrated towards base of section; lined with chlorite and filled with calcite; vesicles in Piece 1E partly filled with dark reddish brown (10R 3/4) mineral; some vesicles filled with chlorite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Slight to moderate; olivine altered and oxidized in patches.

**VEINS/FRACTURES:** 1%; up to 1 mm; inclined; lined with chlorite and filled with zeolite; slickensides on fracture surfaces; heavily fractured in lower 50 cm of section.



**UNIT 91: APHYRIC OLIVINE BASALT**

**Pieces 1A-2**

**PHENOCRYSTS:** None.

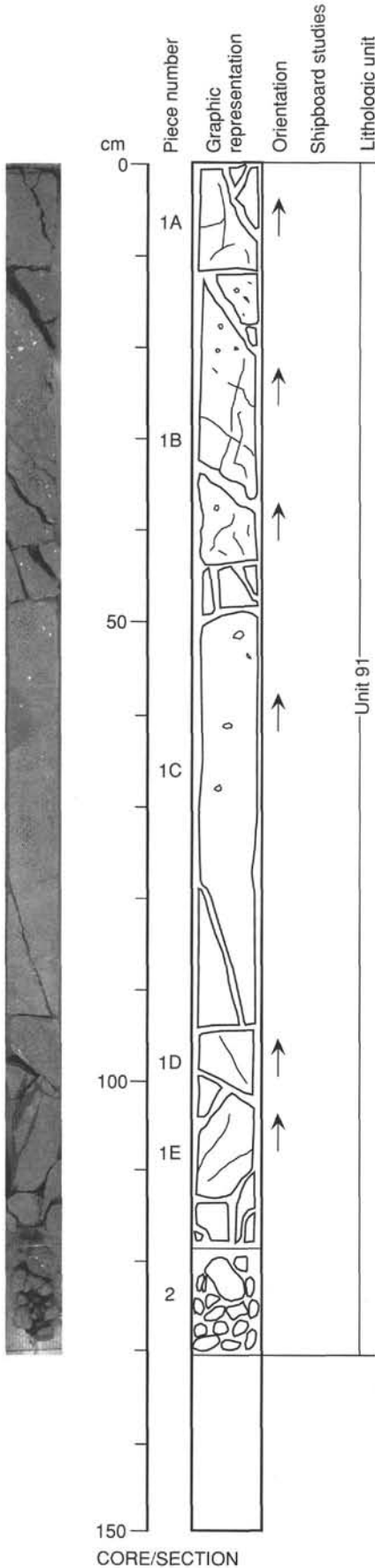
**GROUNDMASS:** Fine-grained.

**VESICLES:** 0-5%; up to 5 mm; spherical to irregular; concentrated towards top of section; lined with chlorite and filled with calcite.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Slight to moderate.

**VEINS/FRACTURES:** 1%; up to 5 mm; inclined; lined with chlorite and filled with calcite; slickensides on fracture surfaces.



CORE/SECTION

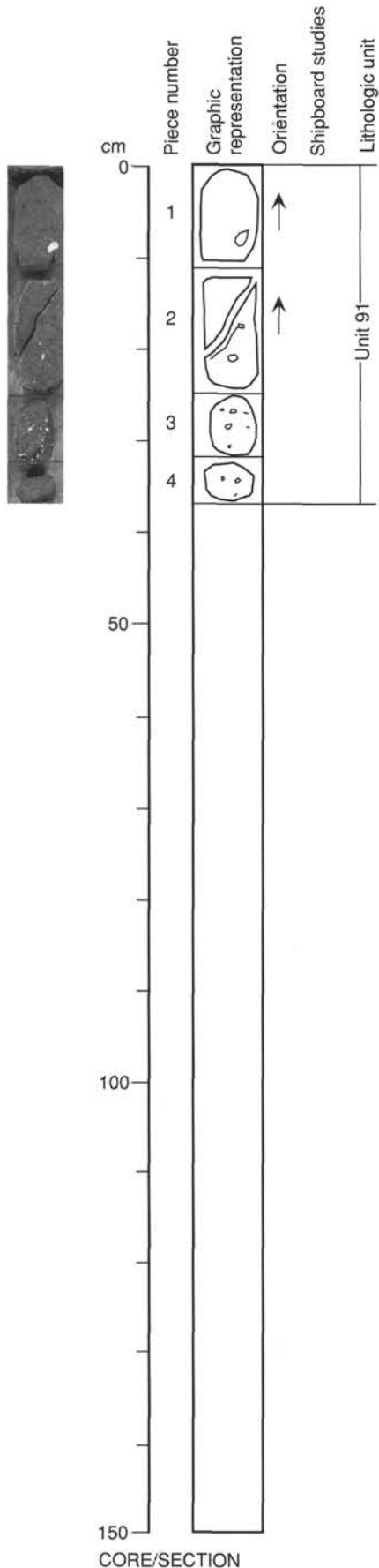


152-917A-100R-4

**UNIT 91: APHYRIC OLIVINE BASALT**

**Pieces 1-4**

**PHENOCRYSTS:** None.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 2%; up to 10 mm; spherical; scattered; lined with chlorite and filled with calcite.  
**COLOR:** Greenish black (5G 2/1).  
**ALTERATION:** Moderate; olivine altered.  
**VEINS/FRACTURES:** <1%; up to 0.5 mm; inclined; single vein in Piece 2B; lined with chlorite and filled with calcite; slickensides on fracture surfaces.



**UNIT 92: OLIVINE-PHYRIC BASALT**

**Pieces 1-6D**

**PHENOCRYSTS:** Olivine - 10%; up to 3 mm; euhedral to subhedral, equant.

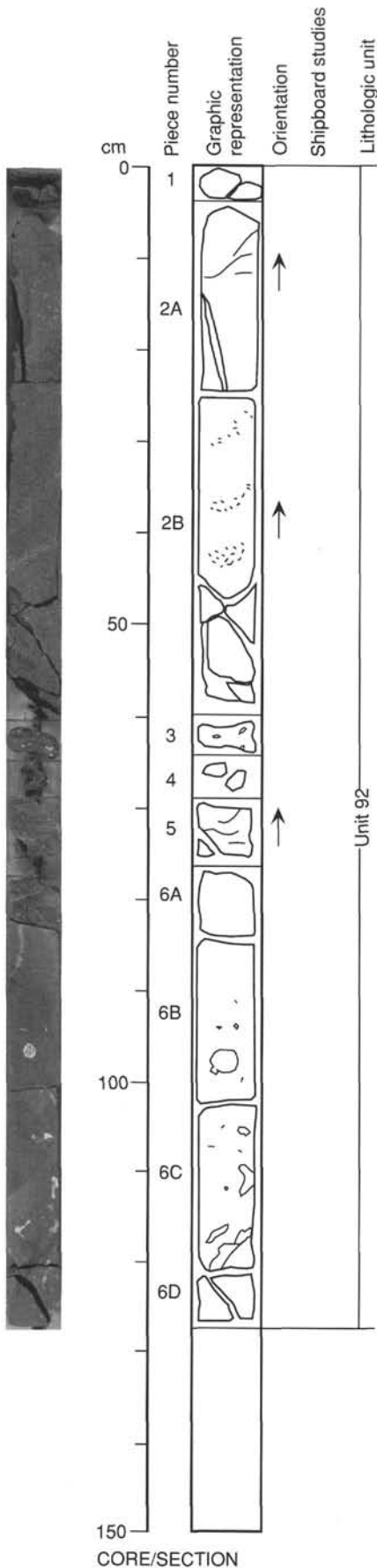
**GROUNDMASS:** Fine-grained.

**VESICLES:** 0-5%; up to 10 mm; spherical to irregular; in patches; most lined with calcite and filled with quartz; pipe vesicle at 115-125 cm filled with green mineral.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Moderate; olivine altered; oxidized at top of section.

**VEINS/FRACTURES:** <1%; up to 0.5 mm; mostly inclined; filled with calcite and green mineral.



152-917A-101R-2

UNIT 92: OLIVINE-PHYRIC BASALT

Pieces 1A-6

**PHENOCRYSTS:** Olivine - 10%; up to 3 mm; euhedral to subhedral, equant.

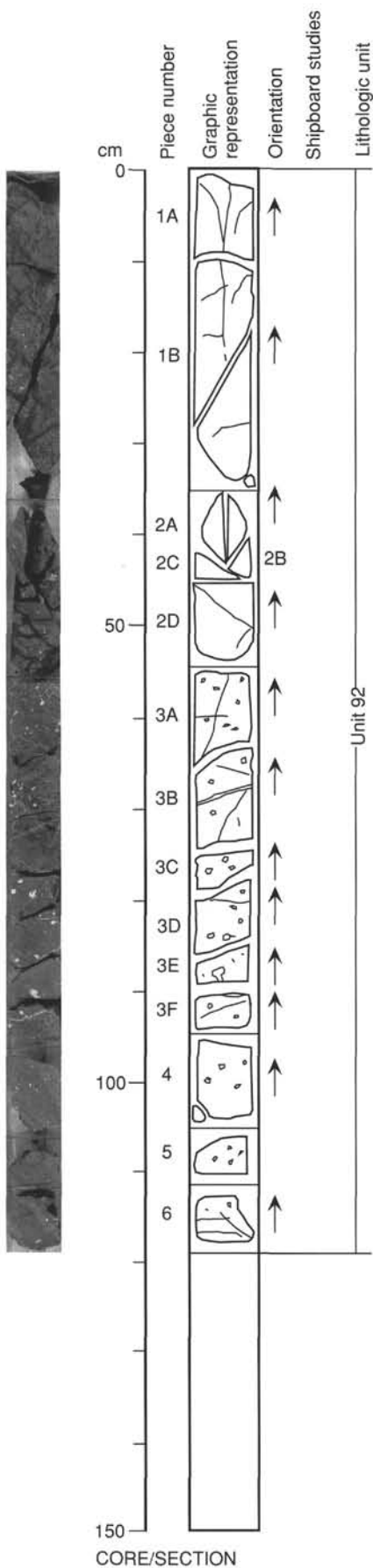
**GROUNDMASS:** Fine-grained.

**VESICLES:** 5%; up to 8 mm; spherical to irregular; scattered; filled with calcite, zeolite, or green mineral.

**COLOR:** Greenish black (5G 2/1).

**ALTERATION:** Moderate to strong.

**VEINS/FRACTURES:** <1%; <0.5 mm; random orientation; filled with calcite; slickensides on fracture surfaces.



**UNIT 92: OLIVINE-PHYRIC BASALT**

**Pieces 1A-8**

**PHENOCRYSTS:** Olivine - 10%; up to 3 mm; euhedral to subhedral, equant.

**GROUNDMASS:** Fine-grained.

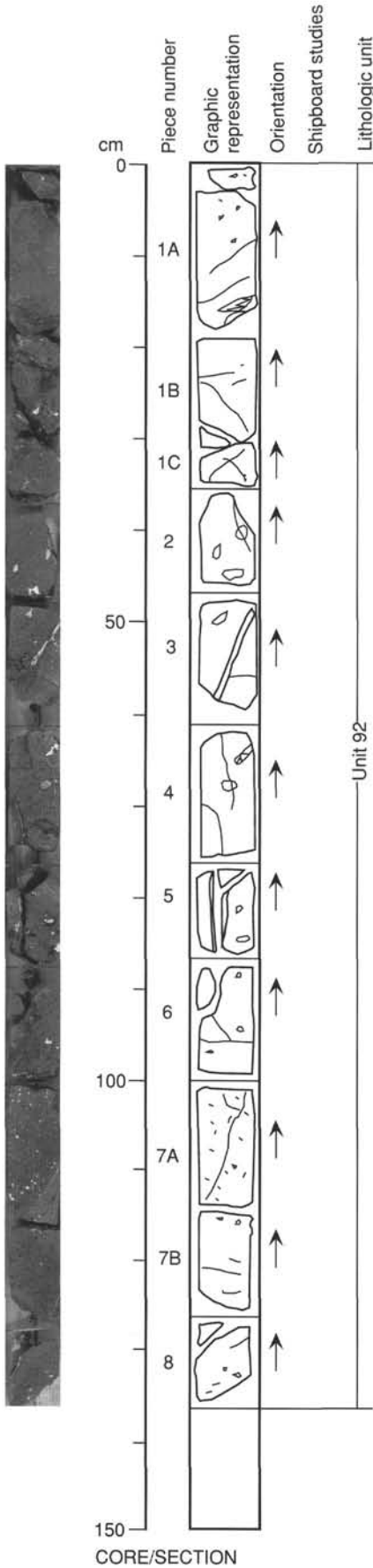
**VESICLES:** 0-5%; up to 10 mm; spherical to irregular; in patches; filled with calcite or green mineral.

**COLOR:** Dark gray (N 3/0).

**STRUCTURE:** Piece 1B is brecciated.

**ALTERATION:** Moderate; olivine mostly altered.

**VEINS/FRACTURES:** 2%; up to 5 mm; mostly steeply inclined; filled with calcite and green mineral; slickensides on fracture surfaces.



152-917A-101R-4

UNIT 92: OLIVINE-PHYRIC BASALT

Pieces 1A-8

**PHENOCRYSTS:** Olivine - 10%; up to 3 mm; euhedral to subhedral, equant.

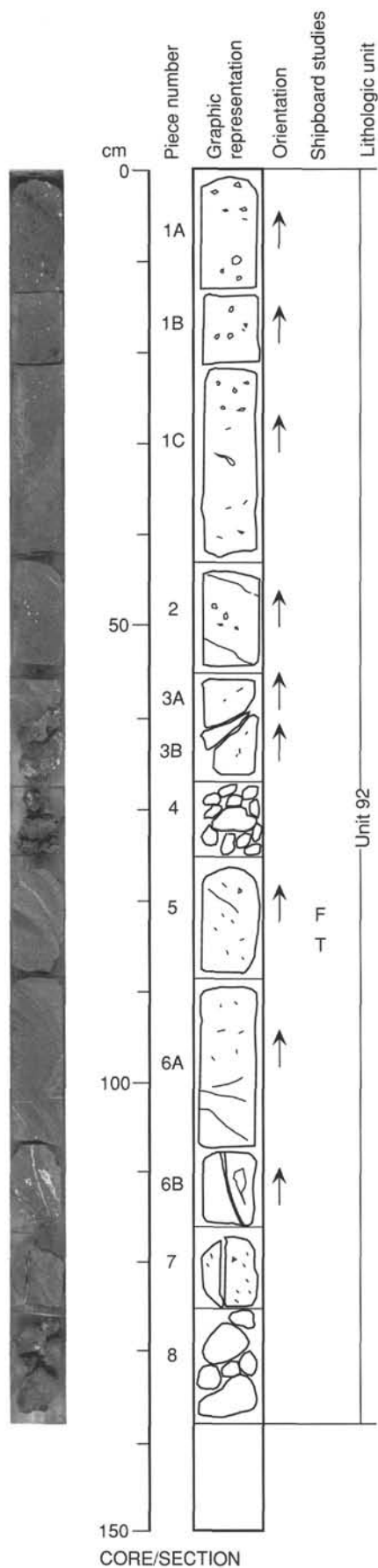
**GROUNDMASS:** Fine-grained.

**VESICLES:** 0-5%; up to 10 mm; spherical to irregular; in patches; lined with calcite and filled with quartz.

**COLOR:** Grayish black (N 2/0).

**ALTERATION:** Moderate; olivine mostly altered.

**VEINS/FRACTURES:** 1%; up to 2 mm; random orientation; filled with calcite and green mineral.



**UNIT 92: OLIVINE-PHYRIC BASALT**

**Pieces 1A-5C**

**PHENOCRYSTS:** Mostly fragmented. Olivine - 10%; up to 3 mm; anhedral.

**GROUNDMASS:** Fine-grained.

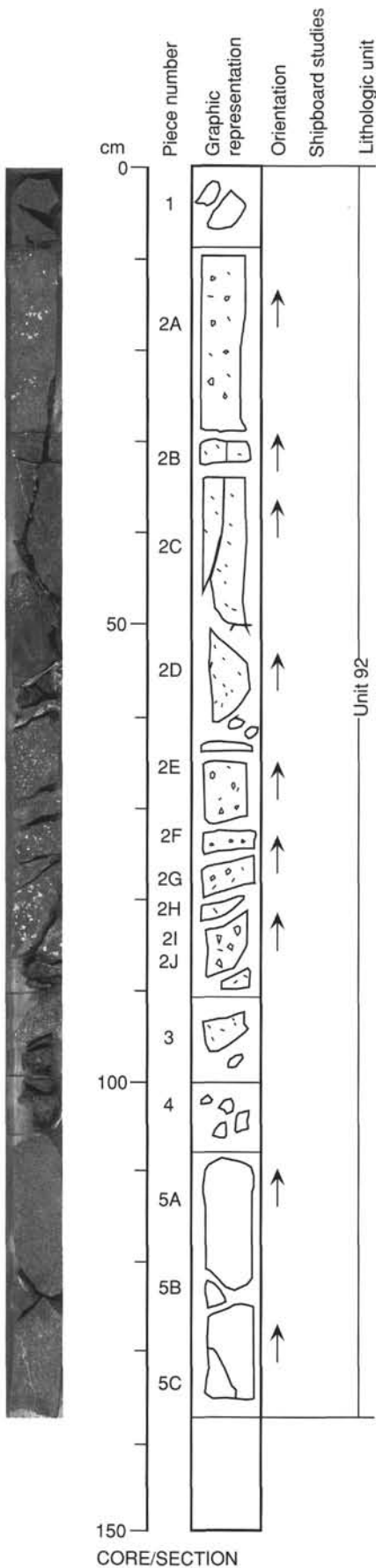
**VESICLES:** 5%-20%; up to 5 mm; irregular shapes; in patches; filled with calcite or green mineral.

**COLOR:** Greenish black (5G 2/1).

**STRUCTURE:** Intense (hyaloclastite?) brecciation of flow base; sheared at 55-58 cm.

**ALTERATION:** Moderate; olivine completely altered.

**VEINS/FRACTURES:** 1%; up to 3 mm; random orientation; filled with calcite and green mineral; slickensides on fracture surfaces.

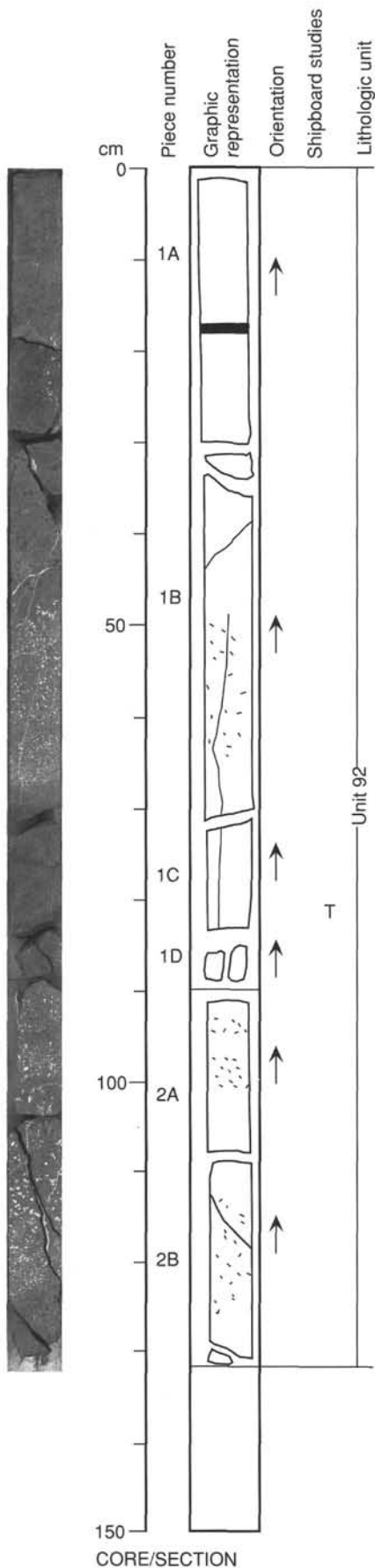


152-917A-102R-2

UNIT 92: OLIVINE-PHYRIC BASALT

Pieces 1A-2B

**PHENOCRYSTS:** Mostly fragmented. Olivine - 10%; up to 3 mm; anhedral.  
**GROUNDMASS:** Fine-grained.  
**VESICLES:** 5%-20%; up to 5 mm; irregular shapes; in patches; filled with calcite or green mineral.  
**COLOR:** Greenish black (5G 2/1).  
**STRUCTURE:** Intense (hyaloclastite?) brecciation of flow base.  
**ALTERATION:** Moderate; olivine completely altered.  
**VEINS/FRACTURES:** 1%; up to 2 mm; mostly inclined; filled with calcite and green mineral; slickensides on fracture surfaces.



**UNIT 92: OLIVINE-PHYRIC BASALT**

**Pieces 1-4**

**PHENOCRYSTS:** Mostly fragmented. Olivine - 10%; up to 3 mm; anhedral.

**GROUNDMASS:** Fine-grained.

**VESICLES:** 10%-20%; up to 5 mm; irregular shapes; in patches; filled with calcite or chlorite.

**COLOR:** Greenish black (5G 2/1).

**STRUCTURE:** Intense (hyaloclastite?) brecciation of flow base; sheared in Piece 1.

**ALTERATION:** Moderate; olivine completely altered.

**VEINS/FRACTURES:** <<1%; <0.5 mm; inclined; filled with calcite and chlorite; slickensides on fracture surfaces.

**ADDITIONAL COMMENTS:** Flow base resting on coarse sandstone (Piece 4); contact not preserved.

