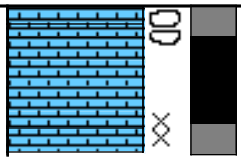
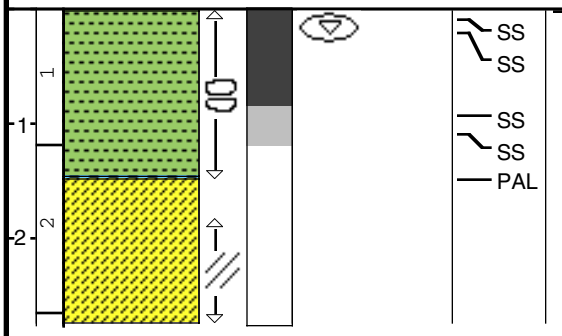
Core Photo

Site 1187 Hole A Core 1W Cored 0.0-365.5 mbsf

METERS	SECTION	GRAPHIC LITH.	DISTURB.	BIOTURB.	STRUCTURE	ACCESSORIES	SAMPLE	DESCRIPTION
1	1						SS	NANNOFOSSIL CHALK, RADIOLARIAN NANNOFOSSIL CHALK, and LIMESTONE Age: Paleogene This wash core contains pieces of four calcareous lithologies. Major Lithologies: Section 1, 0-14 cm, is homogeneous white (2.5Y 8/1) NANNOFOSSIL CHALK with scattered foraminifers. Section 1, 15-28 cm, is homogeneous white (N9) RADIOLARIAN NANNOFOSSIL CHALK with scattered foraminifers. The RADIOLARIAN NANNOFOSSIL CHALK has a very subtle bluish hue, and there is a light greenish gray band at 26 cm. Section 1, 28-106 cm, is NANNOFOSSIL CHALK with bioturbation mottles of white (N9) and light yellow white (2.5Y 8/1). Burrows include Zoophycus (at Sect. 1, 60-70 cm) and Planolites. Section 1, 106-129 cm, is very pale brown (10YR 8/2) LIMESTONE containing irregular patches of light yellowish brown (10YR 6/4) PORCELLANITE.

Core Photo

Site 1187 Hole A Core 2R Cored 365.5-374.5 mbsf



CLAYSTONE

Age: Aptian-Albian

Major Lithology:

Section 1, 0-85 cm, is CLAYSTONE, brown (10YR 4/3) with mottles of light brown (7.5YR 6/4). The CLAYSTONE is pervasively bioturbated and contains Chondrites. Composition in smear slide is clay and brown semi-opaque particles (Fe-oxyhydroxides?) with 5% transparent isotropic grains (zeolite) and traces of carbonate. A large irregular light brown mottle at Section 1, 16-30 cm; has higher abundance of zeolites (about 15%) in smear slide.
The brown CLAYSTONE grades downward in Section 1, 85-119 cm, to CLAYSTONE, very dark brown (10YR 2/2) with laminae of black (N2) and brown (10YR 5/4). Some laminae are cut by burrows < 3 mm diameter. The dark CLAYSTONE contains about 10% zeolites and abundant fish debris. A patch of reddish yellow (7.5YR 6/6) CLAYSTONE in Section 1, 88-91 cm is rich in zeolites (about 20%).

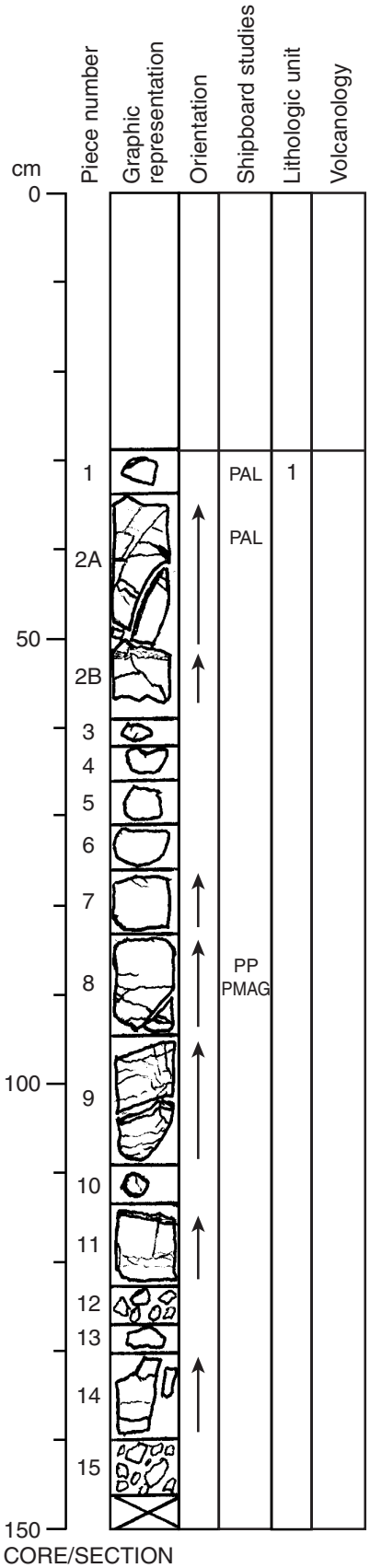
Minor Lithology:

A piece of CHERT, brown (10YR 4/3), is present in Section 1 at 0-2 cm. The fragment may be matrial that was displaced downhole.

Section 2, 28-30 cm, is a layer of white CHALK that was removed for micropaleontology.

Below Section 2, 30 cm, is basalt.

Core Photo



192-1187A-2R-2 **Section Top: 366.68 mbsf**

UNIT 1: APHYRIC TO SPARSELY OLIVINE-PHYRIC BASALT

Pieces: 1–15

CONTACTS: Not recovered. The contact between brown claystone of lithologic Unit III and basalt of basement Unit 1 is inferred to be above Piece 1.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	<<1	1	0.5	0.8	Subhedral, stubby laths
Olivine:	<1–2	1	0.2	0.3	Subhedral to euhedral

GROUNDMASS: Aphanitic. Coalesced spherulites are present in Pieces 1 and 2; larger spherulites are present toward the bottom of the section. Some spherulites have equant olivine crystals (~1 mm) at their centers.

VESICLES: Nonvesicular. Rare round vesicles (<0.5 mm) are filled with white carbonate.

COLOR: Mottled; medium gray (N5) and medium light gray (N6) at the bottom to light brownish gray (5YR 6/1) in the middle to reddish yellow (7.5YR 7/8) at the top.

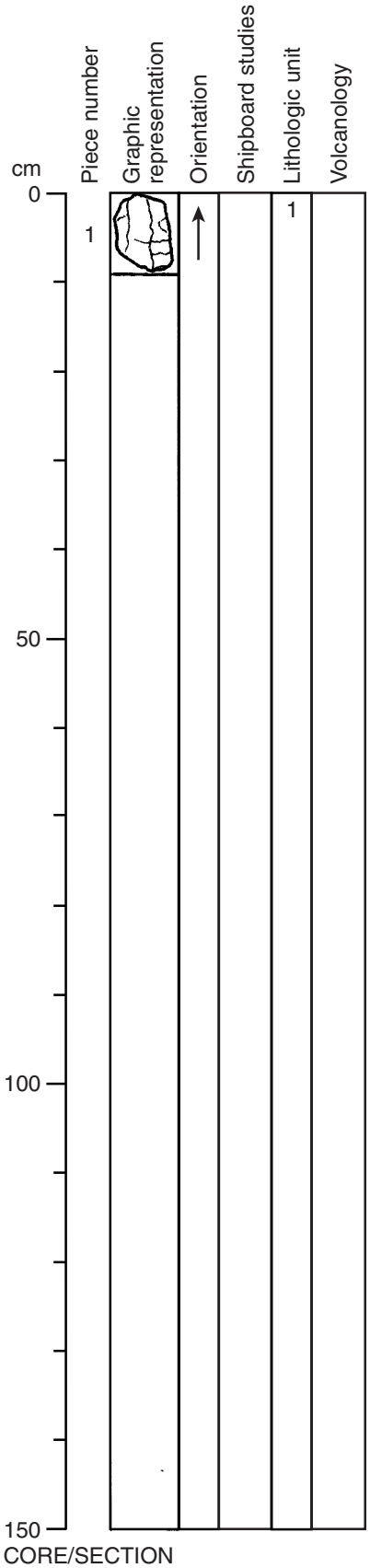
STRUCTURE: Pillowed. Pillows are inferred from grain size variations.

ALTERATION: Moderate to very high. Alteration is highest at the top of the section, where it highlights the olivine crystals and spherulites. Olivine phenocrysts are replaced by orange-brown clay, Fe oxyhydroxide, and green clay.

VEINS/FRACTURES: Moderately to highly veined. Pieces 2A, 2B and 9 have the highest abundance of veins. Veins are <1–9 mm wide and are filled with white carbonate, green clay, and Fe oxyhydroxide.

COMMENTS: Miarolitic cavities (<0.5 mm) are present in Piece 1; they are usually interconnected.

Core Photo



192-1187A-2R-3 **Section Top: 368.14 mbsf**

UNIT 1: SPARSELY OLIVINE-PHYRIC BASALT

Piece: 1

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	2	1	<0.5	0.5	Euhedral to subhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic with spherulitic texture toward the glassy rim.

VESICLES: Nonvesicular.

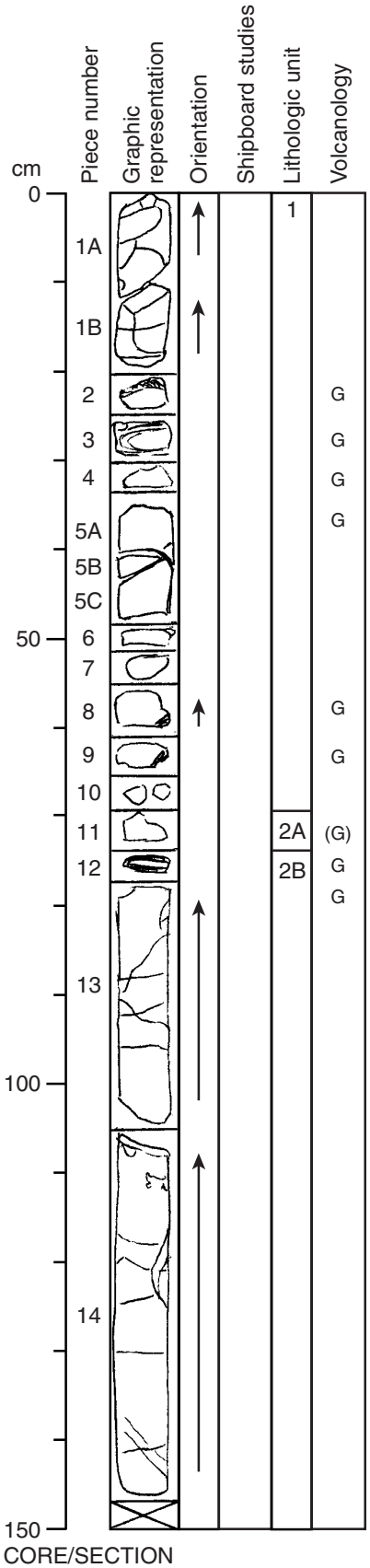
COLOR: Light olive brown (2.5Y 5/3) to light yellowish brown (2.5Y 6/4).

STRUCTURE: Pillowed. An unaltered glassy margin is present at the top of Piece 1.

ALTERATION: Slight to moderate. Fe oxyhydroxide replaces olivine phenocrysts and stains the groundmass.

VEINS/FRACTURES: Moderately veined. Veins are ≤1 mm wide and are filled with white carbonate.

Core Photo



192-1187A-3R-1 **Section Top: 374.50 mbsf**

UNIT 1: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–10

CONTACTS: Not recovered. The contact between Units 1 and 2A is inferred to be between Pieces 10 and 11.

PHENOCRYSTS:

	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	3	~1	<0.5	0.5	Subhedral to euhedral

GROUNDMASS: Aphanitic.

VESICLES: Nonvesicular.

COLOR: Greenish black (5GY 2/1) and light olive brown (2.5Y 5/3).

STRUCTURE: Pillowed. Unaltered glassy margins are present in Pieces 2–5, 8, and 9.

ALTERATION: Moderate. Fe oxyhydroxide replaces olivine phenocrysts and stains the groundmass.

VEINS/FRACTURES: Sparsely to highly veined. Veins are most abundant in Piece 3. Veins are <1–6 mm wide and are filled with white carbonate.

UNIT 2A: RECRYSTALLIZED LIMESTONE

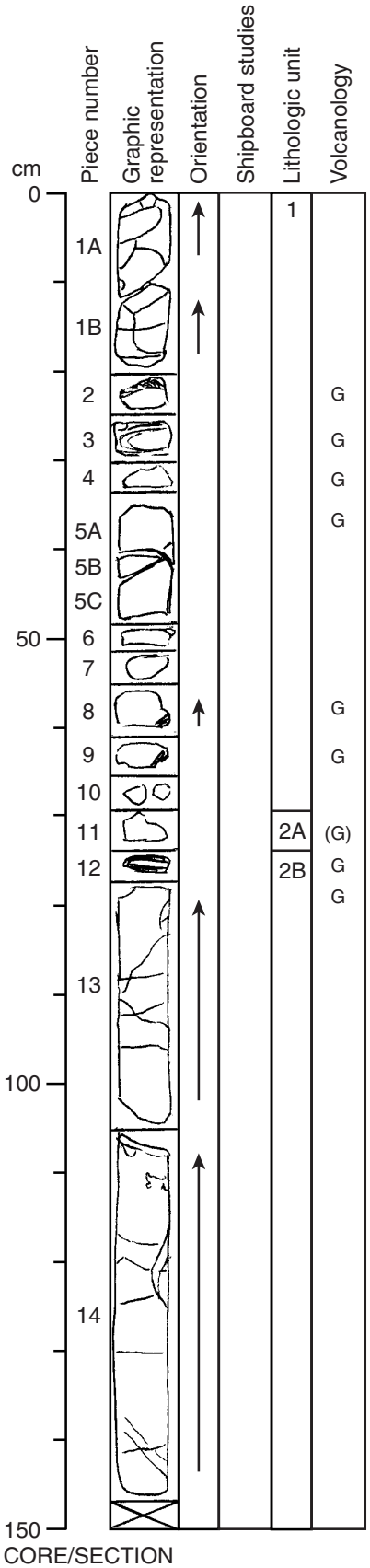
Piece: 11

CONTACTS: Not recovered. The contact between Units 1 and 2A is inferred to be between Pieces 10 and 11, and the contact between Units 2A and 2B is inferred to be between Pieces 11 and 12.

COLOR: Light red (10R 6/6); glass clasts are greenish black (5GY 2/1).

COMMENTS: Minor angular glass clasts (≤1 cm) are altered.

Core Photo



192-1187A-3R-1 **Section Top: 374.50 mbsf**

UNIT 2B: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 12–14

CONTACTS: Not recovered. The contact between Units 2A and 2B is inferred to be between Pieces 11 and 12.

PHENOCRYSTS:

	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	3–5	1.5	<0.5	0.8	Subhedral to euhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture.

VESICLES: Nonvesicular.

COLOR: Light yellowish brown (2.5Y 6/4), medium gray (N5), medium light gray (N6), and light gray (10YR 7/1).

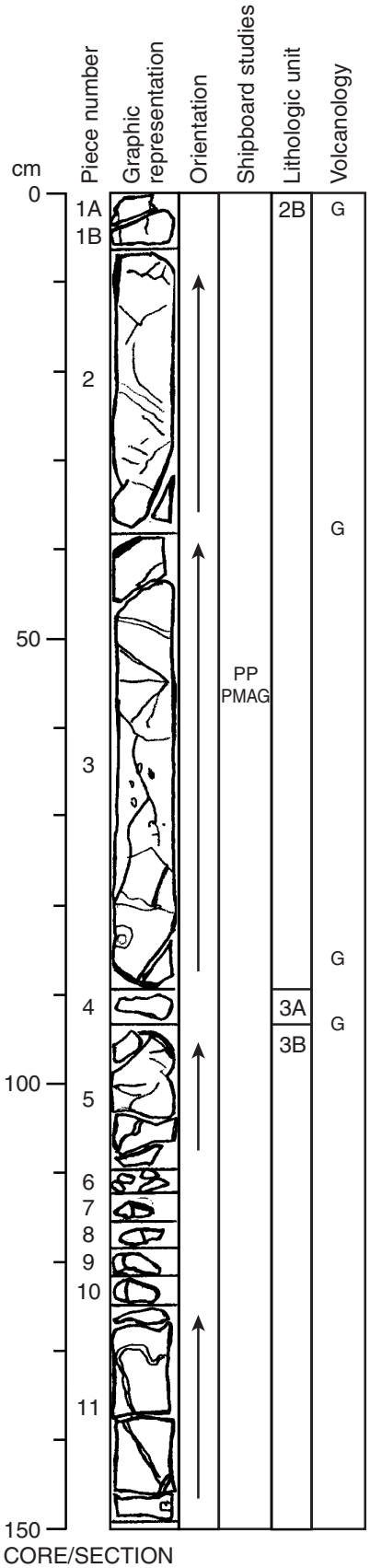
STRUCTURE: Pillowed. Altered glass is present in Piece 12 and at the top of Piece 13.

ALTERATION: Moderate. The top of Piece 13 is stained by Fe oxyhydroxide. Olivine phenocrysts are replaced by Fe oxyhydroxide.

VEINS/FRACTURES: Moderately to highly veined. Veins are <1–2 mm wide and are filled with carbonate.

COMMENTS: Miarolitic cavities at the top of Piece 14 are filled with carbonate.

Core Photo



192-1187A-3R-2 **Section Top: 375.96 mbsf**

UNIT 2B: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–3

CONTACTS: Not recovered. The contact between Units 2B and 3A is inferred to be between Pieces 3 and 4.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	<<1	1.5			Subhedral laths
Olivine:	~1–5	1	<0.5	~0.7	Subhedral to euhedral; rarely in glomerocrysts

GROUNDMASS: Aphanitic with spherulitic texture near glassy margins.

VESICLES: Nonvesicular.

COLOR: Gray (2.5Y 6/1) in pillow interiors to yellow (10YR 7/6) beneath pillow rims.

STRUCTURE: Pillowed. Piece 3 is a complete section through a pillow, with glassy margins at the top and bottom.

ALTERATION: Moderate to high near glassy margins. Olivine phenocrysts are replaced by Fe oxyhydroxide and brown, green and black clay.

VEINS/FRACTURES: Highly veined. Pieces 2 and 3 have the most veins. Veins are <1–3 mm wide and are filled with white carbonate and green clay.

COMMENTS: Large (≤5 mm) subequant and angular miarolitic cavities are present in the interior of a pillow (Pieces 2 and 3); they are filled with white carbonate and dark green clay.

UNIT 3A: RECRYSTALLIZED LIMESTONE

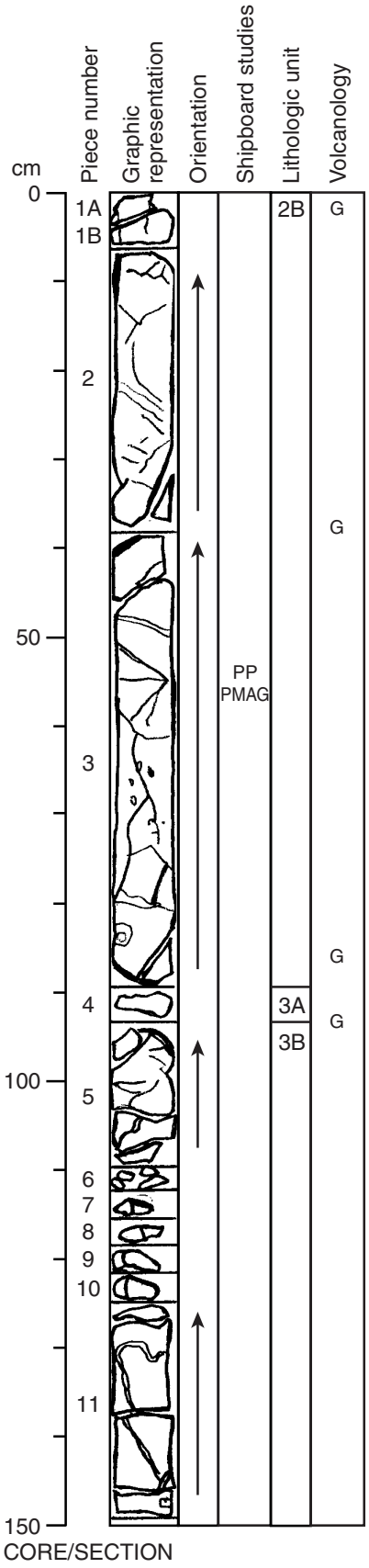
Piece: 4

CONTACTS: Not recovered. The contact between Units 2B and 3A is inferred to be between Pieces 3 and 4 and the contact between Units 3A and 3B is inferred to be between Pieces 4 and 5.

COLOR: Light reddish brown (2.5YR 6/3); glass clasts are greenish black (5GY 2/1).

COMMENTS: Minor angular glass clasts (≤2 cm) are altered.

Core Photo



192-1187A-3R-2 **Section Top: 375.96 mbsf**

UNIT 3B: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 5–11

CONTACTS: Not recovered. The contact between Units 3A and 3B is inferred to be between Pieces 4 and 5.

PHENOCRYSTS:	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	~1–5	1.2	<0.5	0.5	Subhedral to euhedral; rarely in glomerocrysts

GROUNDMASS: Aphanitic; spherulitic near glassy margins.

VESICLES: Nonvesicular.

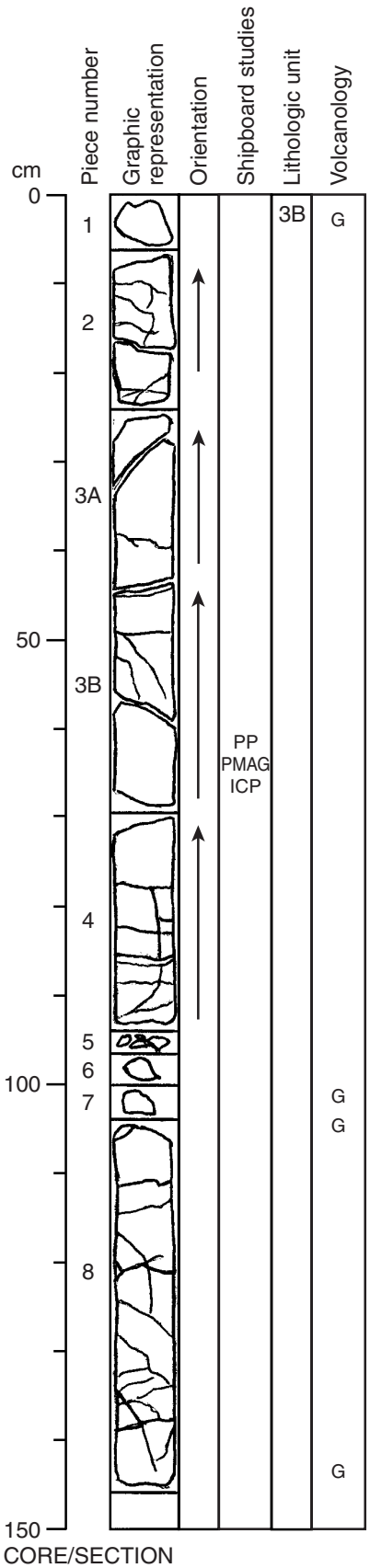
COLOR: Light gray (N6) to yellow (10YR 7/6) adjacent to glassy margins.

STRUCTURE: Pillowed. Glassy margins are present and grain size variations are consistent with pillow structure.

ALTERATION: Moderate. Alteration highlights olivine and spherulitic zones. Olivine phenocrysts are replaced by clay and Fe oxyhydroxide.

VEINS/FRACTURES: Sparsely veined. Veins are <1–6 mm wide and are filled with white carbonate and dark green clay.

Core Photo



192-1187A-3R-3 **Section Top: 377.44 mbsf**

UNIT 3B: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–8

CONTACTS: None.

PHENOCRYSTS:

	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	2–5	0.8	0.1	0.3	Euhedral to subhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Spherulitic in aphanitic regions; in Pieces 1 and 8, spherulites are coalesced, giving the rock a polygonal texture.

VESICLES: Nonvesicular. Rare round vesicles (<0.5 mm) are filled with white carbonate.

COLOR: Medium gray (N5) to medium light gray (N6) in least altered regions to yellowish brown (10YR 5/6).

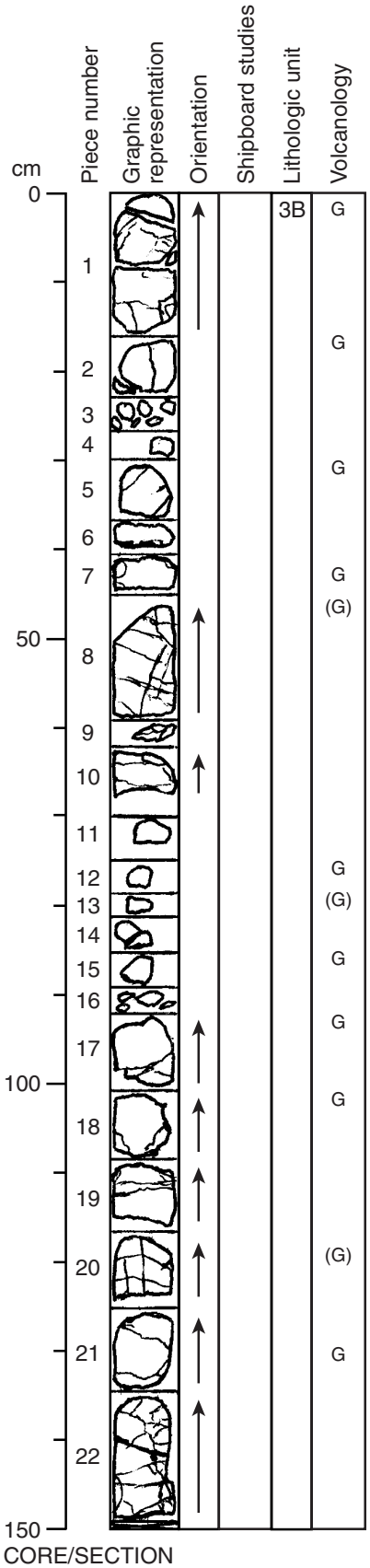
STRUCTURE: Pillowed. Glassy margins are present in Pieces 1, 2, 7, and 8. Piece 8 is a complete section through a pillow, with glassy margins at the top and bottom.

ALTERATION: Moderate to high. Olivine phenocrysts are replaced by Fe oxyhydroxide. Spherulites are highlighted by alteration to Fe oxyhydroxide.

VEINS/FRACTURES: Highly to moderately veined. Veins are <1 mm wide and are filled with white carbonate and green clay.

Whole-rock ICP-AES data

Core Photo



192-1187A-3R-4 **Section Top: 378.89 mbsf**

UNIT 3B: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–22

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	2–7	0.6	<0.1	0.2	Euhedral to subhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic. Spherulitic adjacent to glassy margins. Elongate olivine crystals are present.

VESICLES: Nonvesicular.

COLOR: Light yellowish brown (2.5Y 6/4), medium gray (N5) to medium dark gray (N4); the glass is black (N1).

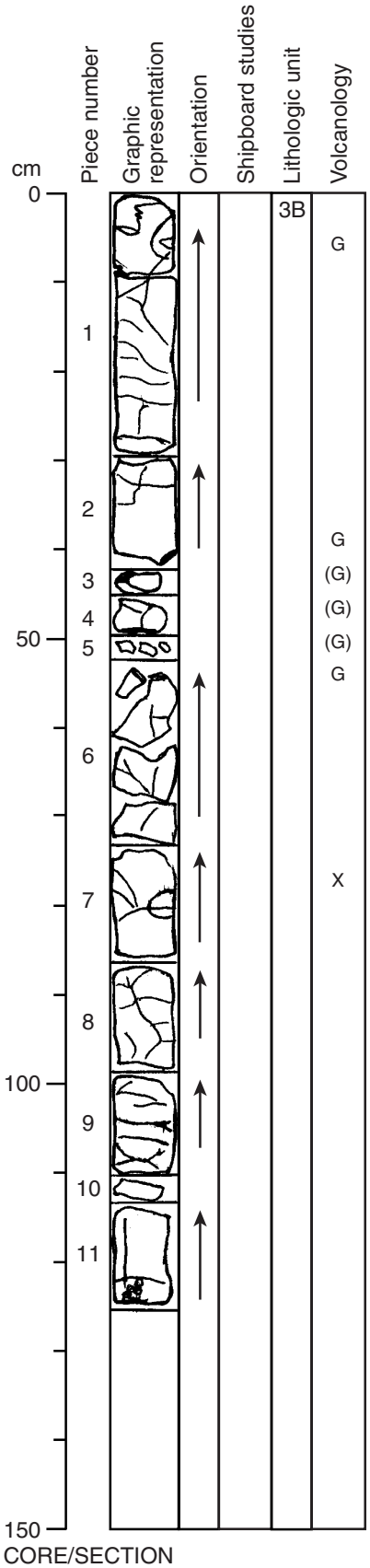
STRUCTURE: Pillowed. Abundant glassy margins (Pieces 1, 2, 5, 7, 8, 12, 13, 15, 17, 18, 20, and 22).

ALTERATION: Highly altered. Spherulites are highlighted by alteration to Fe oxyhydroxide. Olivine phenocrysts are replaced by black clay and Fe oxyhydroxide.

VEINS/FRACTURES: Highly veined. Veins are <1–3 mm wide and are filled with calcite, green and brown clay, and Fe oxyhydroxide.

COMMENTS: Rare miarolitic cavities are filled with calcite and green and black clay.

Core Photo



192-1187A-3R-5 **Section Top: 380.38 mbsf**

UNIT 3: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–11

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	<<1	1	0.5	~0.7	Subhedral laths
Olivine:	<1–5	1.2	~0.2	~0.5	Subhedral to euhedral; rarely in glomerocrysts

GROUNDMASS: Aphanitic; coalesced spherulites are present near glassy margins.

VESICLES: Nonvesicular. Rare round vesicles (<0.5 mm) are filled with zeolite(?).

COLOR: Medium light gray (N6) to brownish yellow (10YR 6/6) adjacent to glassy rims.

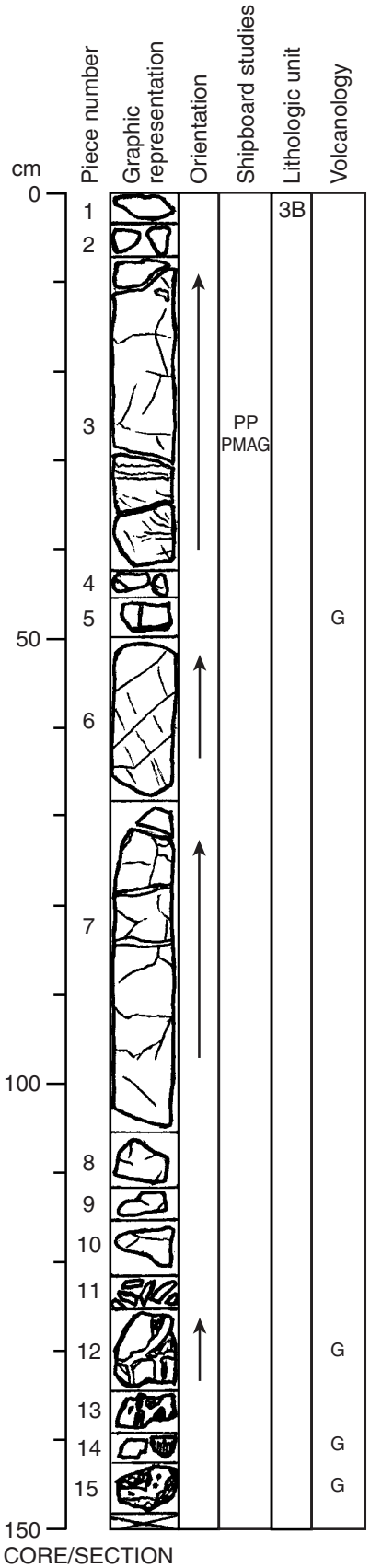
STRUCTURE: Pillowed. Glassy margins are present and grain size variations are consistent with pillow structure.

ALTERATION: Moderate. Olivine phenocrysts are replaced by brown clay and Fe oxyhydroxide. Alteration highlights olivine and spherulitic zones.

VEINS/FRACTURES: Highly veined. Piece 1 has the most veins. Veins are <1–3 mm wide and are filled with white carbonate, dark green clay, and Fe oxyhydroxide.

COMMENTS: Large (~1 cm) interconnected miarolitic cavities are present at the bottom of Piece 11; they are filled with white carbonate and dark green clay. Piece 1 has sparse miarolitic cavities. A plagioclase-rich xenolith (15 x 25 mm) is present in Piece 7 at 78 cm.

Core Photo



192-1187A-4R-1 **Section Top: 384.20 mbsf**

UNIT 3B: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–15

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	5	1.5	0.3	0.5	Euhedral to subhedral

GROUNDMASS: Aphanitic to glassy.

VESICLES: Nonvesicular.

COLOR: Light gray (N7) to medium light gray (N6).

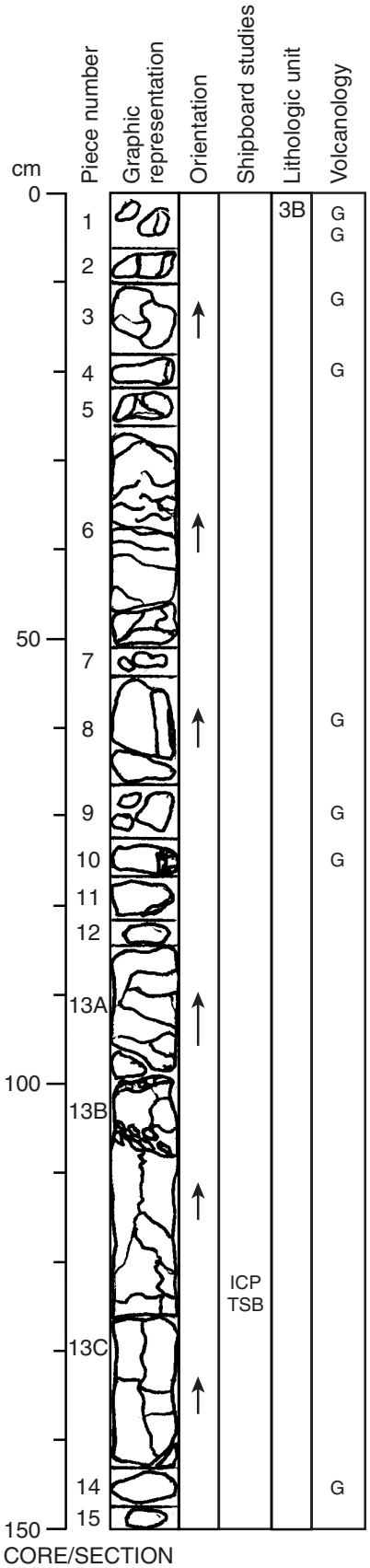
STRUCTURE: Pillowed. Glassy margins are present on Pieces 5, 12, 14, and 15.

ALTERATION: Moderate to high. Alteration is high in Pieces 3–6, 9, and 10. Olivine phenocrysts are replaced by Fe oxyhydroxide and green clay.

VEINS/FRACTURES: Highly veined. Veins are <1–12 mm wide and are filled with carbonate and green and yellow-brown clay. Pieces 13 and 15 are hyaloclastite.

COMMENTS: Angular miarolitic cavities (2–10 mm) in Piece 3 are filled with carbonate.

Core Photo



192-1187A-4R-2 **Section Top: 385.69 mbsf**

UNIT 3B: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–15

CONTACTS: None.

PHENOCRYSTS:	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	2–5	2	0.3	0.8	Euhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Fine-grained regions have variolitic texture. Spherulites are present in the aphanitic margins.

VESICLES: Sparsely vesicular. Round to elongate vesicles (<1 mm in size) are present in the aphanitic margins.

COLOR: Medium light gray (N6) to medium yellowish brown (10YR 6/4).

STRUCTURE: Pillowed. Glassy margins are present on Pieces 1–4, 8–10, and 14.

ALTERATION: Highly altered. Alteration halos associated with the veins are present throughout the section. Olivine phenocrysts are replaced by Fe oxyhydroxide; some of the glass is replaced by green clay.

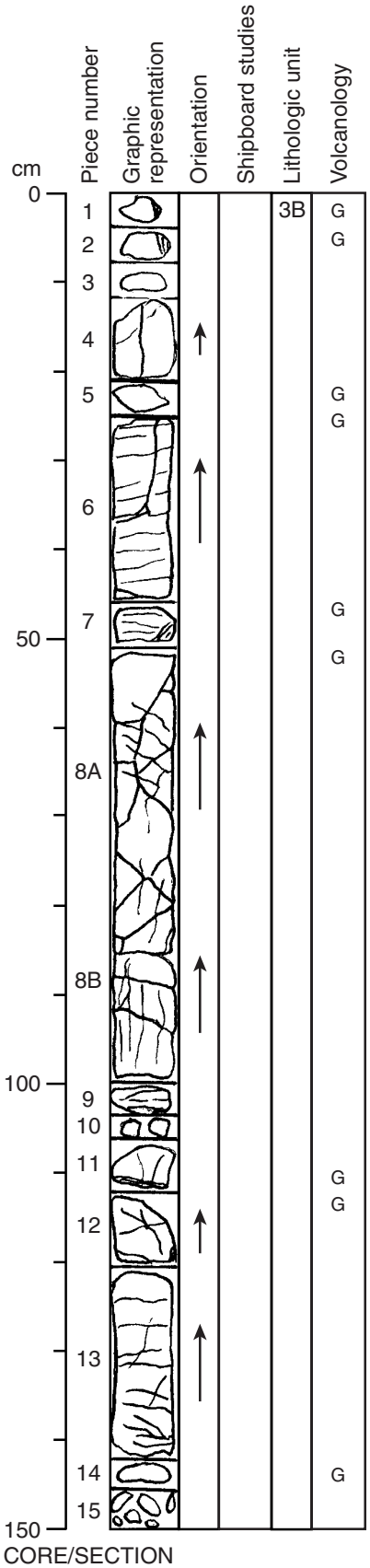
VEINS/FRACTURES: Highly veined. Veins are <1–10 mm wide and are filled with carbonate, zeolite, and green clay.

COMMENTS: Pieces 1, 9, and 10 contain brecciated basalt and glass fragments (hyaloclastite) in a carbonate matrix.

Description of thin section at 122-124 cm

Whole-rock ICP-AES data

Core Photo



192-1187A-4R-3 **Section Top: 387.19 mbsf**

UNIT 3B: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–15

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	2–4	1.2	0.5	0.8	Euhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Fine-grained regions have variolitic texture. Spherulites, highlighted by alteration, are present as bands in the aphanitic areas.

VESICLES: Generally nonvesicular. Rare round vesicles (~1 mm in diameter) are filled with carbonate and green clay.

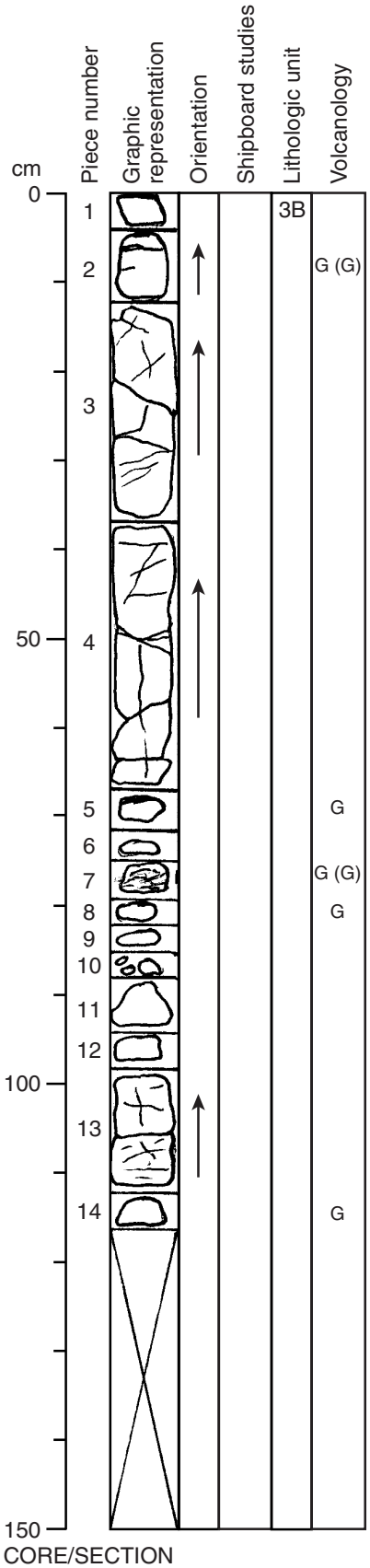
COLOR: Light yellowish brown (2.5Y 6/4) to medium gray (N5).

STRUCTURE: Pillowed. Glassy margins are present in Pieces 1–2, 5–8A, 11–12, and 14.

ALTERATION: Moderate to high. Brown alteration halos are present throughout the section. Olivine phenocrysts are replaced by Fe oxyhydroxide and green clay.

VEINS/FRACTURES: Highly veined. Veins are <1–3 mm wide and are filled with carbonate, zeolite, and green clay.

Core Photo



192-1187A-4R-4 **Section Top: 388.69 mbsf**

UNIT 3B: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–14

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	2–7	1.5	0.2	0.5	Euhedral to subhedral

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture, commonly with olivine phenocrysts at the centers of the spherulites, and fine-grained regions have variolitic texture.

VESICLES: Generally nonvesicular. Rare round vesicles (≤1 mm) are present in the aphanitic regions adjacent to pillow margins and are filled with carbonate.

COLOR: Medium gray (N5) to light gray (N7) and light brownish gray (10YR 6/2).

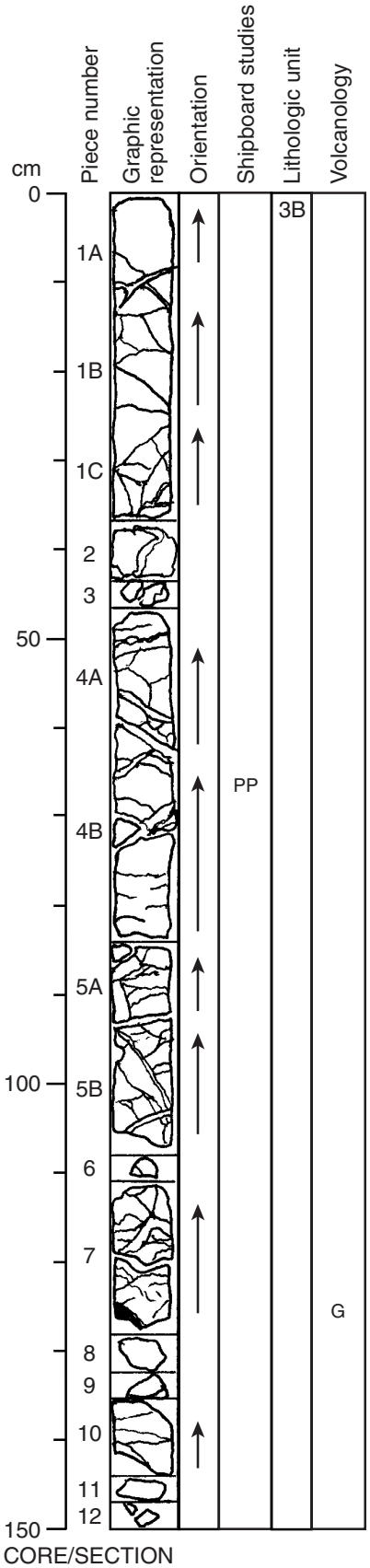
STRUCTURE: Pillowed. Unaltered glass is present on Pieces 5, 7, and 8. Piece 7 is a hyaloclastite or pillow margin breccia containing white and pink carbonate and altered glass (now green clay).

ALTERATION: Slight to high. Glassy margins and aphanitic regions are slightly altered. Fine-grained pillow interiors and regions adjacent to veins are highly altered. Olivine phenocrysts are replaced by Fe oxyhydroxide and dark green clay.

VEINS/FRACTURES: Moderately veined. Veins are <1–5 mm wide and are filled with carbonate and dark green clay.

COMMENTS: Interconnected irregular miarolitic cavities (1–5 mm diameter) filled with carbonate are present in Pieces 3 and 4.

Core Photo



192-1187A-4R-5 **Section Top: 389.86 mbsf**

UNIT 3B: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–12

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	2–5	1.6	0.3	0.6	Euhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions adjacent to pillow margins have spherulitic texture; fine-grained pillow interiors have variolitic texture. Olivine phenocrysts are commonly at the centers of spherulites in the aphanitic regions.

VESICLES: Nonvesicular. Rare, round to elongate vesicles (≤1.5 mm) close to pillow margins are filled with carbonate (e.g., Piece 7).

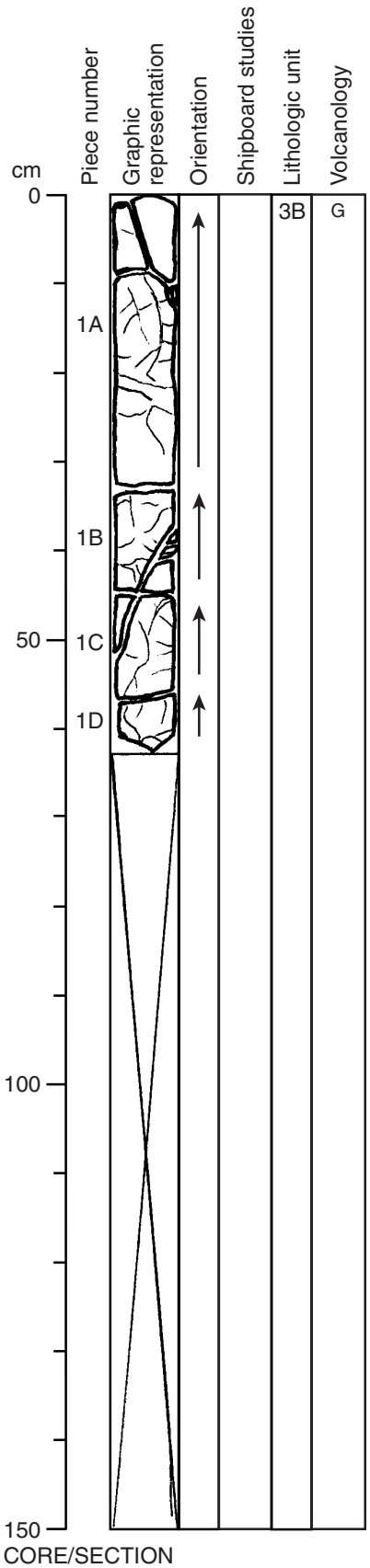
COLOR: Medium gray (N5) in aphanitic regions; greenish gray (5G 6/1) to very pale brown (10YR 7/4) in highly altered regions.

STRUCTURE: Pillowed. A glassy margin is present on the base of Piece 7.

ALTERATION: Slight to high. The glassy margin and aphanitic regions adjacent to pillow margins are slightly altered. Fine-grained pillow interiors are highly altered. The color suggests that Fe oxyhydroxide is an abundant groundmass alteration product. Fe oxyhydroxide also replaces olivine phenocrysts.

VEINS/FRACTURES: Moderately to highly veined. Veins are <1–4 mm wide and are filled with carbonate and green clay.

Core Photo



192-1187A-4R-6 **Section Top: 391.36 mbsf**

UNIT 3B: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–1D

CONTACTS: None.

PHENOCRYSTS:

	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	3	1.0	0.3	0.5	Euhedral to subhedral

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture.

VESICLES: Nonvesicular.

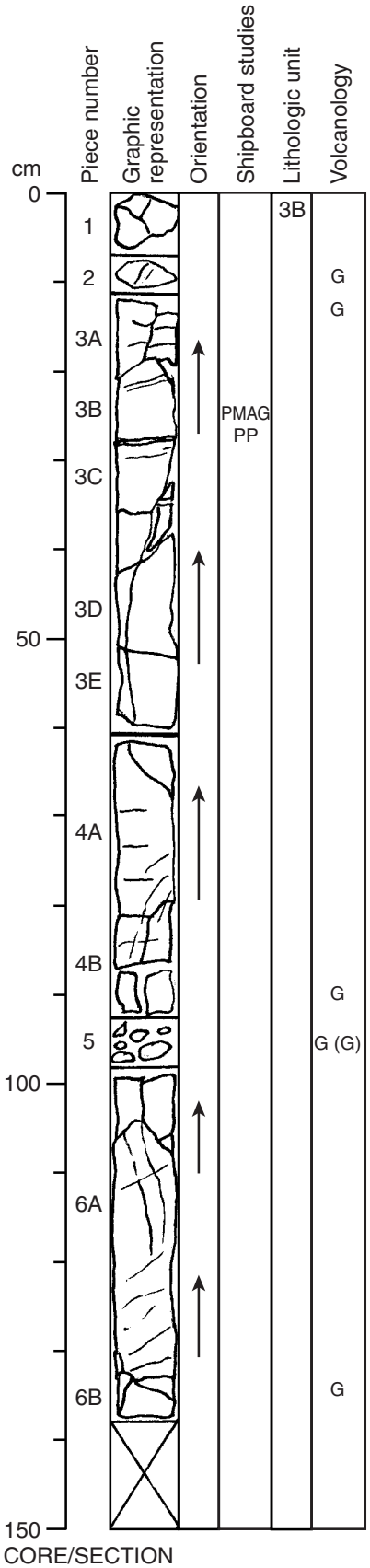
COLOR: Light gray (N7) to medium light gray (N6).

STRUCTURE: Pillowed. A glassy margin is present at the top of Piece 1A.

ALTERATION: Moderate. Olivine phenocrysts are replaced by green and yellow-brown clay.

VEINS/FRACTURES: Highly veined. Veins are <1–3 mm wide and are filled with carbonate.

Core Photo



192-1187A-5R-1 **Section Top: 393.80 mbsf**

UNIT 3B: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–6B

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	2–6	2	0.3	0.6	Euhedral to subhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture. Olivine phenocrysts are present at the centers of some spherulites.

VESICLES: Nonvesicular.

COLOR: Medium gray (N6) to light yellowish brown (10YR 6/4).

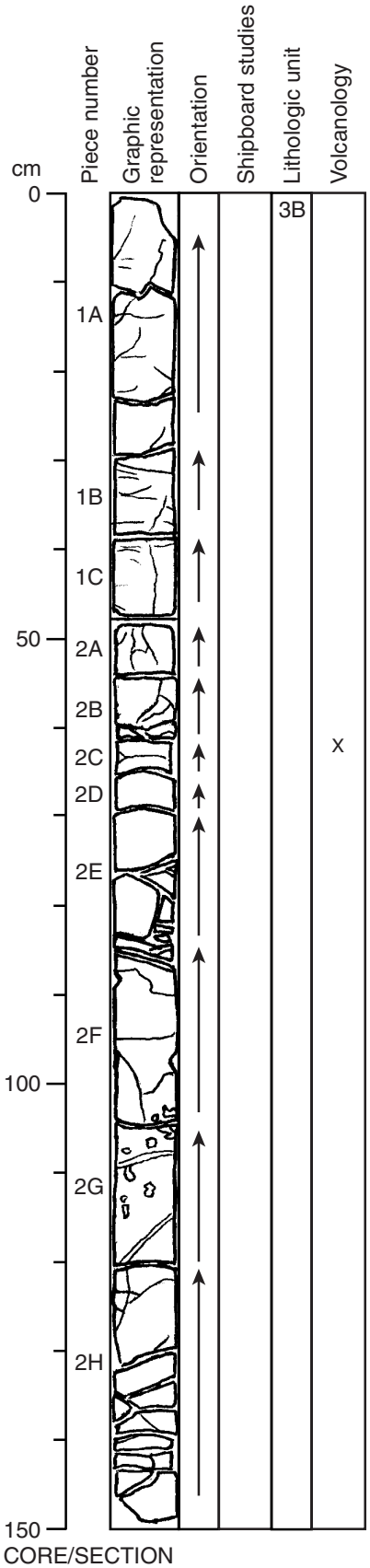
STRUCTURE: Pillowed. Glassy margins are present on Pieces 2, 3A, 4B, 5, and 6B. Piece 5 is fragments of inter pillow hyaloclastite containing unaltered glass in a carbonate matrix.

ALTERATION: Moderate. Brown alteration halos are associated with veins. Alteration highlights spherulites. Olivine phenocrysts are replaced by Fe oxyhydroxide and green clay.

VEINS/FRACTURES: Highly veined. Veins are <1–4 mm wide and are filled with green-black clay, carbonate, zeolite, and Fe oxyhydroxide.

COMMENTS: Irregular, interconnected miarolitic cavities (3–4 mm) in Piece 3E are filled with green clay and carbonate.

Core Photo



192-1187A-5R-2 **Section Top: 395.65 mbsf**

UNIT 3B: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–2H

CONTACTS: None.

PHENOCRYSTS:	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	2–7	1.1	0.2	0.5	Euhedral to subhedral

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture. Olivine phenocrysts are present at the centers of some spherulites.

VESICLES: Nonvesicular. Rare subround, elongate vesicles (≤1.5 mm) adjacent to the pillow margins are filled with carbonate.

COLOR: Yellowish brown (10YR 5/4) to pale brown (10YR 6/3) and medium light gray (N6).

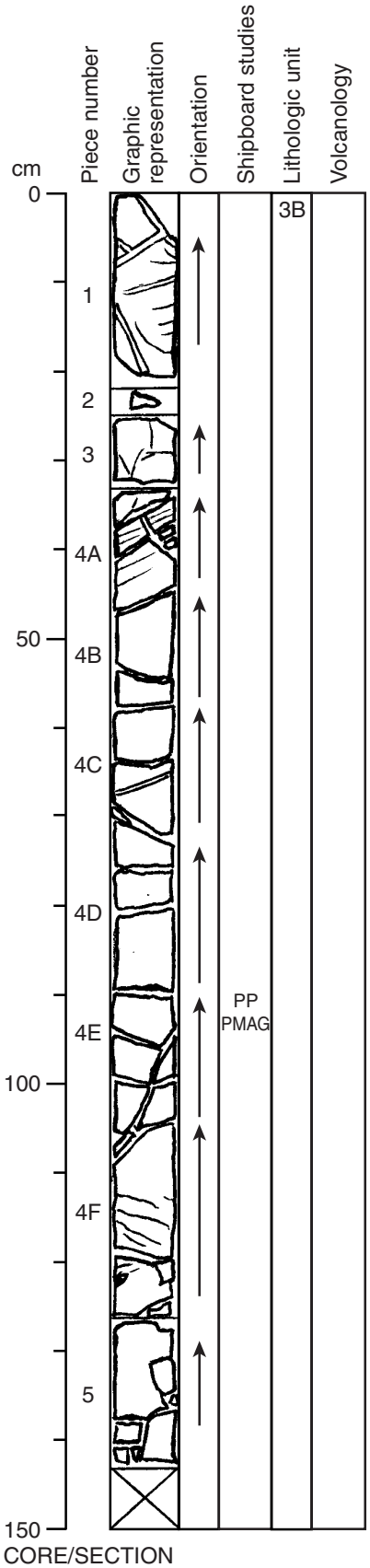
STRUCTURE: Pillowed. Altered glass is present at the top of Pieces 1A, 1C, and 2A.

ALTERATION: Slight at the pillow margins to high in the fine-grained pillow interiors. Olivine phenocrysts are replaced by dark brown clay and Fe oxyhydroxide.

VEINS/FRACTURES: Moderately veined. Veins are <1–6 mm wide and are filled with carbonate and green clay.

COMMENTS: Irregular miarolitic cavities (≤1 cm) in Pieces 2F and 2G are filled with white and pink carbonate. A xenolith (1 x 1.2 cm) is present in Piece 2C at 62–63 cm (working half only).

Core Photo



192-1187A-5R-3 **Section Top: 396.65 mbsf**

UNIT 3B: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–5

CONTACTS: None.

PHENOCRYSTS:

	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	3–5	1	0.3	0.8	Euhedral to subhedral

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture.

VESICLES: Nonvesicular.

COLOR: Medium light gray (N6) to brownish yellow (10YR 6/6).

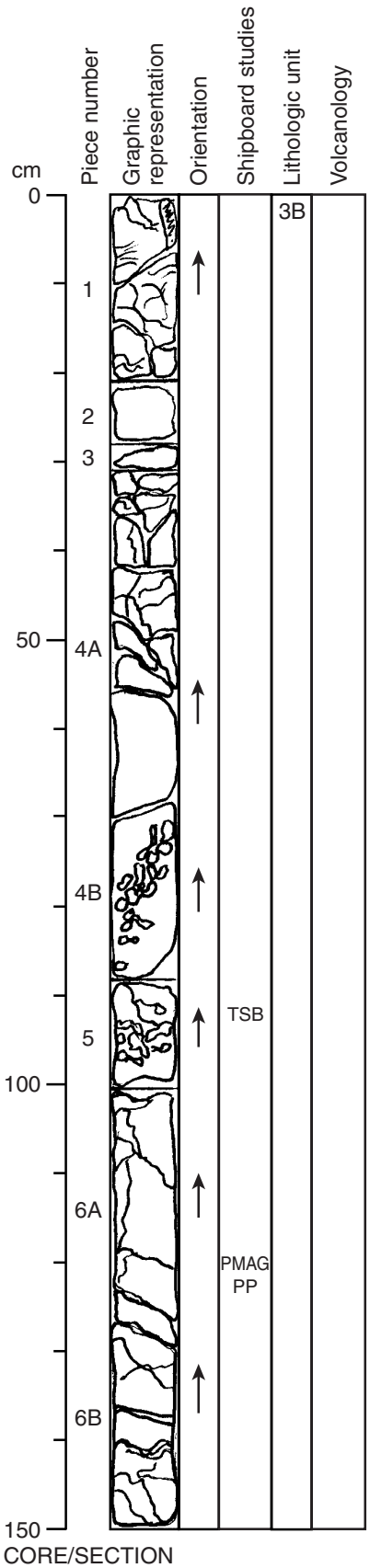
STRUCTURE: Pillowed. Pillows inferred on the basis of groundmass grain size variations and the presence of a small fragment of hyaloclastite in Piece 2.

ALTERATION: Moderate to high. Olivine phenocrysts are replaced by Fe oxyhydroxide.

VEINS/FRACTURES: Moderately veined. Veins are <1–3 mm wide and are filled with carbonate and Fe oxyhydroxide.

COMMENTS: Piece 2 is hyaloclastite that contains altered glass in a white and pink carbonate matrix.

Core Photo



192-1187A-5R-4 **Section Top: 398.08 mbsf**

UNIT 3B: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–6B

CONTACTS: None.

PHENOCRYSTS:

	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	3–5	1	0.3	0.5	Euhedral to subhedral; commonly in glomerocrysts

GROUNDMASS: Fine grained with variolitic texture.

VESICLES: Nonvesicular.

COLOR: Medium gray (N5) to yellowish brown (10YR 6/4).

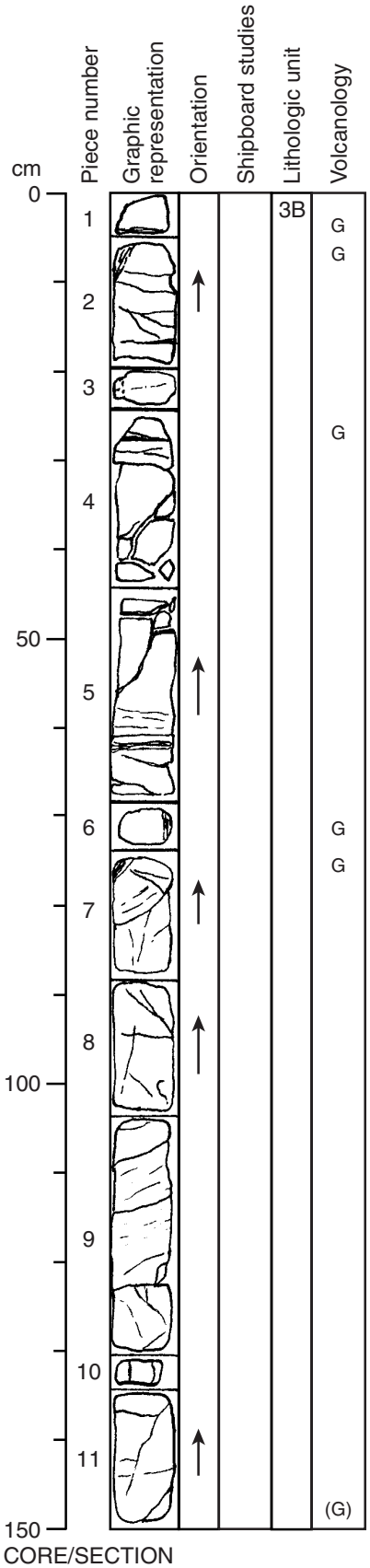
STRUCTURE: Pillowed. A glassy margin is present at the top of Piece 4A (working half only).

ALTERATION: Moderate. Olivine phenocrysts are replaced by Fe oxyhydroxide.

VEINS/FRACTURES: Moderately veined. Veins are <1–3 mm wide and are filled with carbonate.

COMMENTS: Irregular miarolitic cavities (~1 cm) in Pieces 4B and 5 are filled with Fe oxyhydroxide and carbonate.

Core Photo



192-1187A-5R-5 **Section Top: 399.58 mbsf**

UNIT 3B: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–11

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	2–6	1.2	0.4	0.6	Euhedral to subhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture.

VESICLES: Generally nonvesicular. Rare round vesicles (≤1 mm) are present in the aphanitic pillow margins.

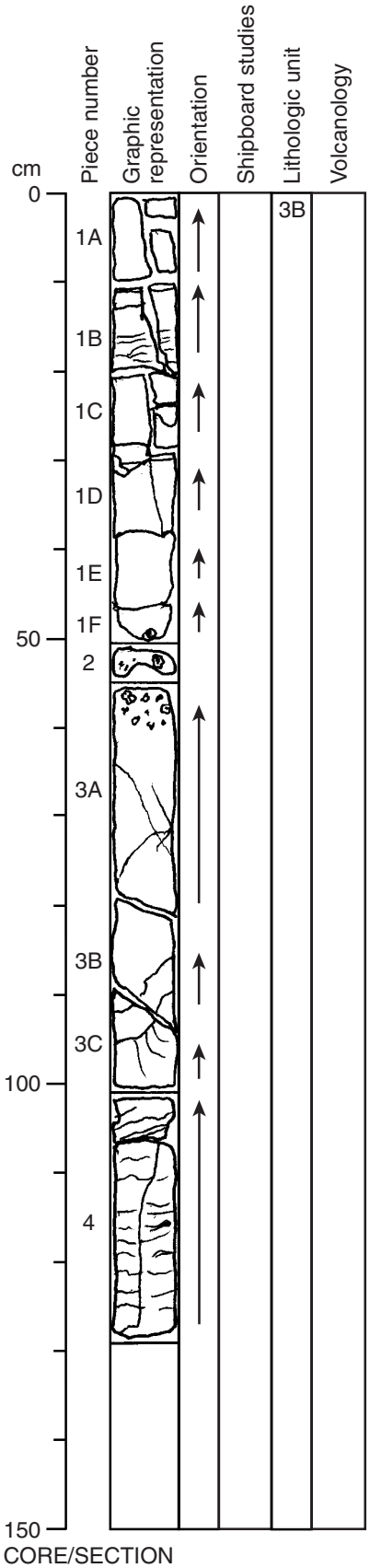
COLOR: Medium light gray (N6) to yellowish brown (10YR 5/4).

STRUCTURE: Pillowed. Glassy margins are present on Pieces 1, 2, 4, 6, 7, and 11.

ALTERATION: Moderate. Brown halos are present adjacent to veins. Alteration highlights the spherulites. Olivine phenocrysts are replaced by Fe oxyhydroxide.

VEINS/FRACTURES: Moderately veined. Veins are <1–4 mm wide and are filled with zeolite, green clay, and carbonate.

Core Photo



192-1187A-5R-6 **Section Top: 401.08 mbsf**

UNIT 3B: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–4

CONTACTS: None.

PHENOCRYSTS:

	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	2–7	1.2	0.2	0.5	Euhedral

GROUNDMASS: Aphanitic to fine grained. Plagioclase laths ≤2 mm long are present in the fine-grained regions.

VESICLES: Nonvesicular. Rare, elongate vesicles (≤1.5 mm) are present in the aphanitic regions and are filled with carbonate and dark green clay.

COLOR: Brownish yellow (10YR 6/6) to light yellowish brown (10YR 6/4) and medium light gray (N6).

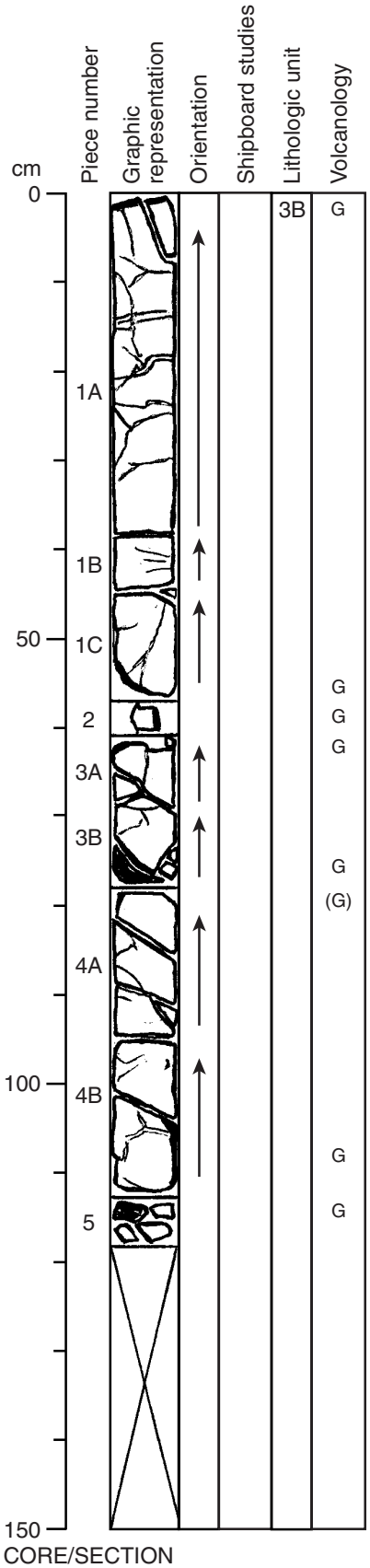
STRUCTURE: Pillowed. This section appears to be one large pillow on the basis of groundmass grain size variations (aphanitic at the top of Piece 1A and the base of Piece 4).

ALTERATION: Moderate to high. Fe oxyhydroxide is present in the aphanitic regions and dark green clay is replacing groundmass in the fine-grained regions. Olivine is replaced by dark green clay and Fe oxyhydroxide.

VEINS/FRACTURES: Sparsely to moderately veined. Veins are <1–4 mm wide and are filled with white and pink carbonate and dark green clay.

COMMENTS: Irregular miarolitic cavities (1.5–5 mm) in Pieces 1F and 2 are filled with carbonate and dark green clay.

Core Photo



192-1187A-5R-7 **Section Top: 402.34 mbsf**

UNIT 3B: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–5

CONTACTS: None.

PHENOCRYSTS:

	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	3	0.5	0.2	0.3	Euhedral to subhedral

Unaltered olivine phenocrysts are present in the glassy margins.

GROUNDMASS: Glassy to aphanitic. Aphanitic regions have spherulitic texture.

VESICLES: Nonvesicular.

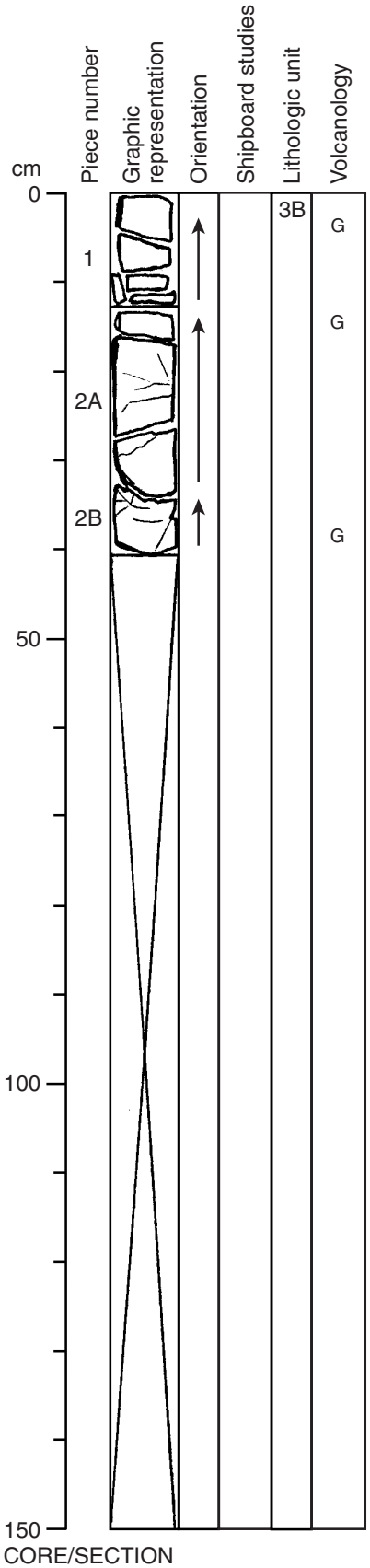
COLOR: Light gray (N7) to yellow (10YR 7/6).

STRUCTURE: Pillowed. Glassy margins are present on Pieces 1A, 1C, 2, 3A, 4A, 4B, and 5.

ALTERATION: Moderate to high. Olivine phenocrysts are replaced by green and yellow-brown clay, except in the glassy pillow margins.

VEINS/FRACTURES: Moderately veined. Veins are <1–5 mm wide and are filled with carbonate and green clay.

Core Photo



192-1187A-5R-8 **Section Top: 403.53 mbsf**

UNIT 3B: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–2B

CONTACTS: None.

PHENOCRYSTS:	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	2–7	1.0	0.2	0.5	Euhedral to subhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture. Olivine phenocrysts are present in the centers of some spherulites.

VESICLES: Nonvesicular. Rare irregular vesicles (≤1 mm) are present adjacent to the glassy margin at the top of Piece 2A.

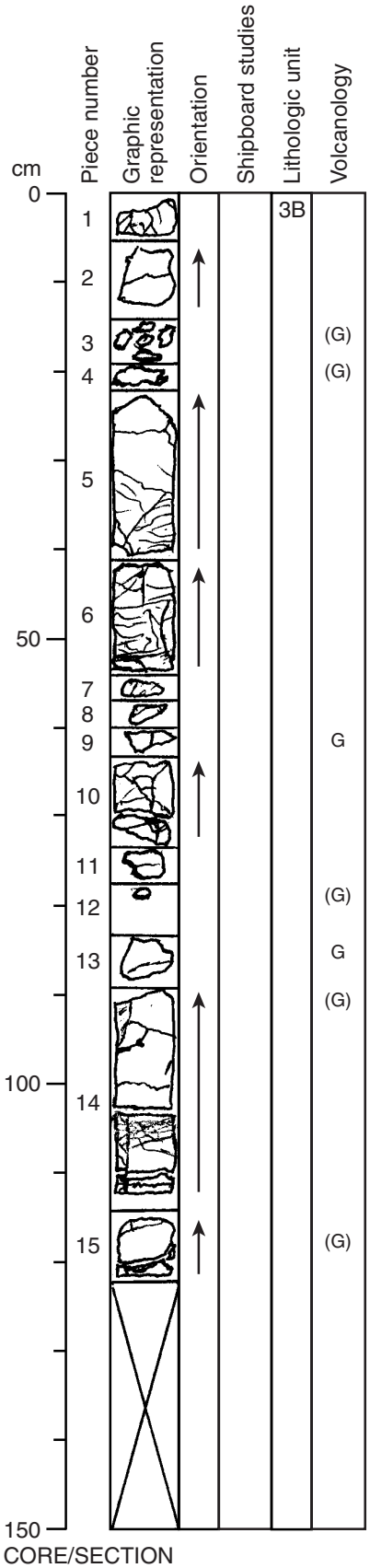
COLOR: Light yellowish brown (10YR 6/4) to light gray (N7).

STRUCTURE: Pillowed. Glassy margins are present on Pieces 1, 2A, and 2B.

ALTERATION: Slight to high. Aphanitic regions and the glassy margins are the least altered. Olivine is replaced by Fe oxyhydroxide and rarely by dark green clay.

VEINS/FRACTURES: Sparsely to moderately veined. Veins are <1–1.5 mm wide and are filled with carbonate and green clay.

Core Photo



192-1187A-6R-1 **Section Top: 403.40 mbsf**

UNIT 3B: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–15

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	1–6	0.7	<0.1	0.2	Euhedral to subhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic with spherulitic texture; Piece 2 has spherulite-rich bands.

VESICLES: Nonvesicular.

COLOR: Medium light gray (N6), reddish yellow (7.5YR 6/6), and brownish yellow (10YR 6/6).

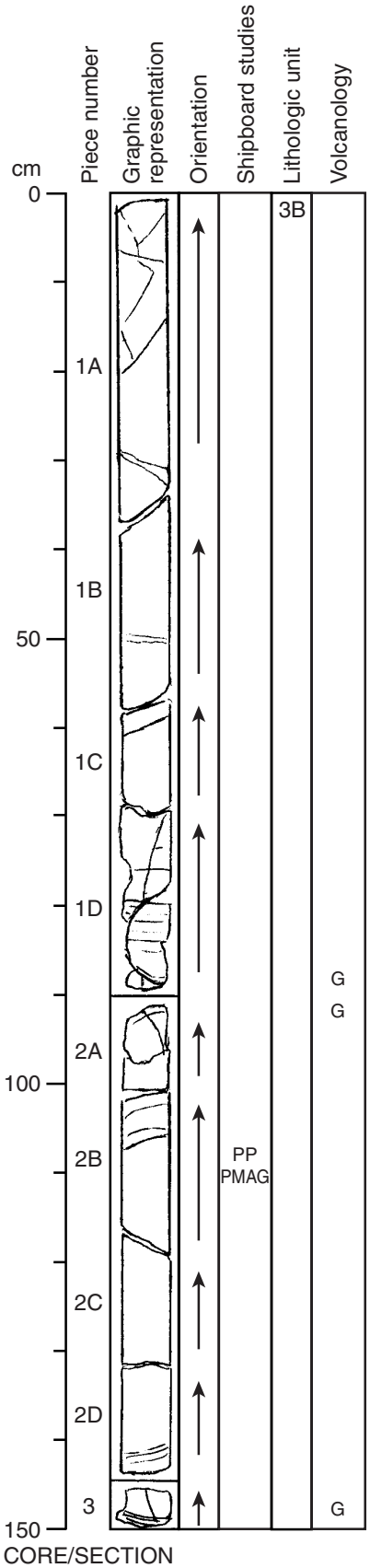
STRUCTURE: Pillowed. Glassy margins are present in Pieces 9, 13, and 15. Hyaloclastite with white carbonate and Fe oxyhydroxide cement is present in Pieces 3, 4, 12, and 14.

ALTERATION: High. Olivine is replaced by Fe oxyhydroxide, black clay, and white carbonate. Spherulites are highlighted by alteration.

VEINS/FRACTURES: Highly veined. Veins are <1–3 mm wide and are filled with white carbonate, green and brown clay, and Fe oxyhydroxide.

COMMENTS: Rare irregular miarolitic cavities (<0.5–2 mm in diameter) are filled with white carbonate.

Core Photo



192-1187A-6R-2 **Section Top: 404.63 mbsf**

UNIT 3B: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–3

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	3–5	1	0.2	0.4	Euhedral to subhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions near pillow margins have spherulitic texture.

VESICLES: Nonvesicular.

COLOR: Medium light gray (N6) to light gray (2.5Y 7/2) to light yellowish brown (2.5Y 6/4).

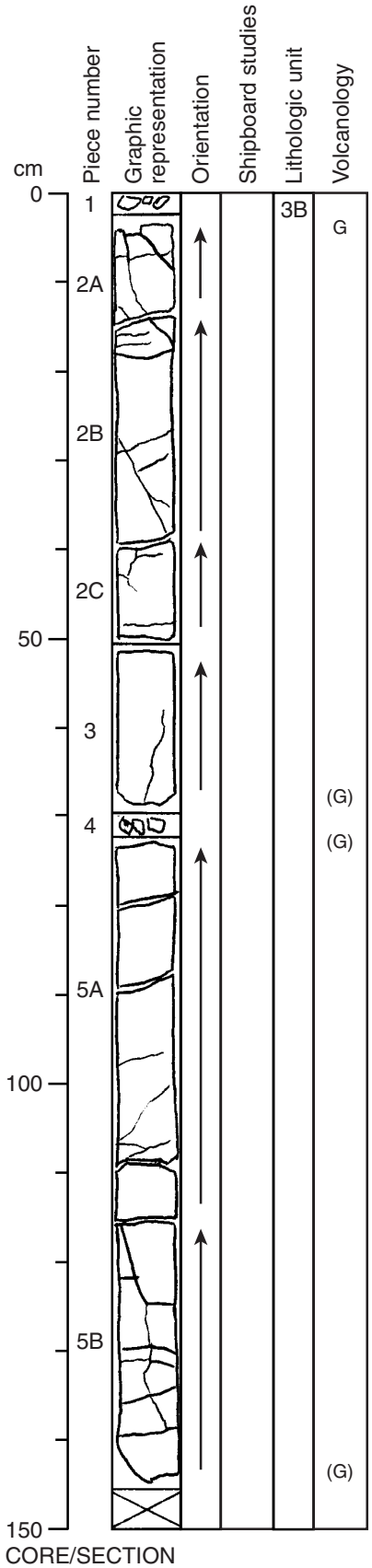
STRUCTURE: Pillowed. Unaltered glass is present in Pieces 1D, 2A, and 3. Pieces 2 and 3 are a section through a single pillow; glassy margins are present at the top and bottom and the interior is fine grained.

ALTERATION: Moderate; high near veins. Fe oxyhydroxide stains the rock adjacent to veins and in some aphanitic regions. Olivine is replaced by dark green clay in fine-grained regions and by Fe oxyhydroxide in aphanitic regions.

VEINS/FRACTURES: Moderately to highly veined. Veins are <1–2.5 mm wide and are filled mostly with white carbonate and less abundant brown and green clay.

COMMENTS: Rare irregular miarolitic cavities (2.5–4 mm in diameter) in Piece 2D (pillow interior) are filled with light green clay.

Core Photo



192-1187A-6R-3 **Section Top: 406.13 mbsf**

UNIT 3B: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–5B

CONTACTS: None.

PHENOCRYSTS:	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	3–6	0.8	0.1	0.2	Subhedral to euhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Fine-grained regions have variolitic texture. Aphanitic regions are spherulitic; some spherulites have olivine phenocrysts at their centers.

VESICLES: Nonvesicular.

COLOR: Medium light gray (N6) to light gray (N7) in least altered regions; brownish yellow (10YR 6/6) where altered.

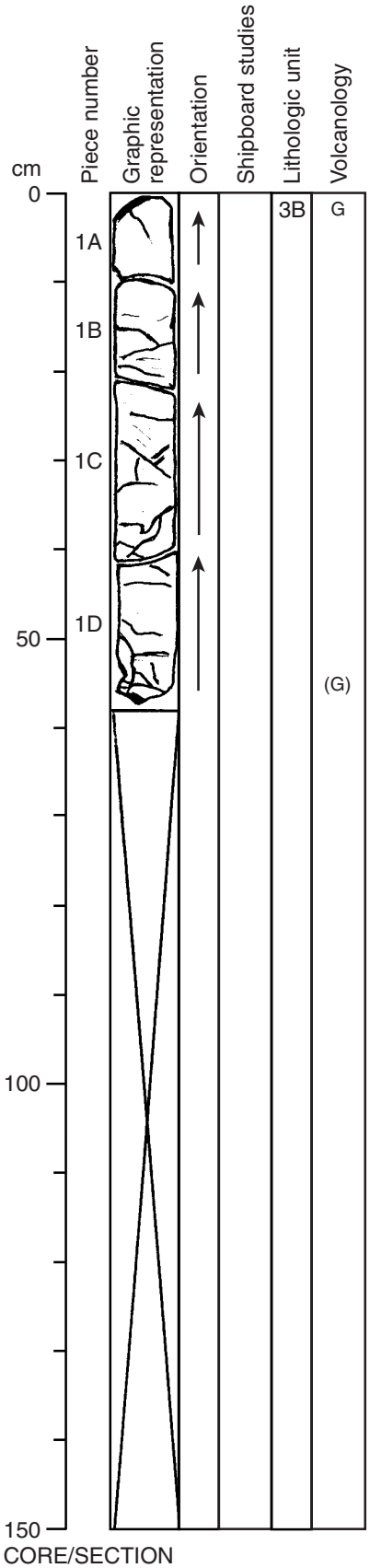
STRUCTURE: Pillowed. Glass is present at the bottom of Piece 5B; grain size variations define two pillows (Pillow 1: Pieces 2A–3; Pillow 2: Pieces 5A–5B).

ALTERATION: Moderate to high. Olivine phenocrysts are replaced by Fe oxyhydroxide. Spherulitic zones are highlighted by alteration.

VEINS/FRACTURES: Sparsely to highly veined. Veins are <1–3 mm wide and are filled with white carbonate and green clay.

COMMENTS: Rare irregular miarolitic cavities (≤1 mm) are filled with white carbonate.

Core Photo



192-1187A-6R-4 **Section Top: 407.58 mbsf**

UNIT 3B: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–1D

CONTACTS: None.

PHENOCRYSTS:

	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	2–5	1.5	<0.5	~0.4	Subhedral to euhedral

GROUNDMASS: Aphanitic to fine grained. Spherulitic near pillow margins grading to variolitic in fine-grained pillow interiors. Spherulites commonly have olivine phenocrysts at their centers.

VESICLES: Nonvesicular.

COLOR: Light brownish gray (10YR 6/2) in fine-grained regions to yellow (10YR 7/6) in aphanitic regions.

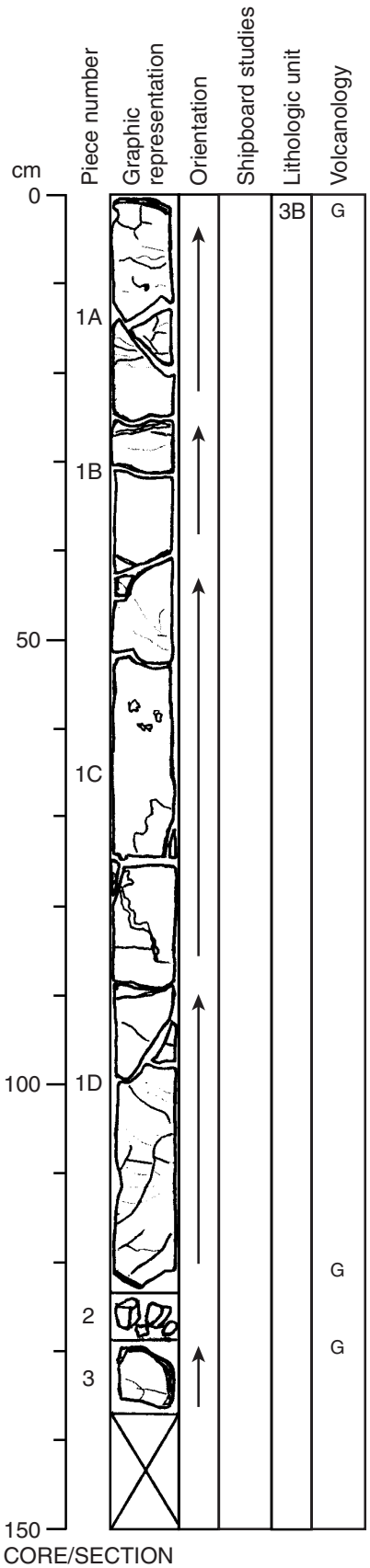
STRUCTURE: Pillowed. Pieces 1A–1D are bounded by two curved glassy margins; grain size increases toward the center of the pillow.

ALTERATION: High. Alteration highlights olivine and spherulitic regions. Olivine phenocrysts are replaced by brown clay, Fe oxyhydroxide, and white carbonate.

VEINS/FRACTURES: Moderately to highly veined. Veins are <1–2 mm wide and are filled with white carbonate and green clay.

COMMENTS: Rare isolated angular and irregular miarolitic cavities (<1.5 mm) are filled with white carbonate; they are present near the lower pillow margin at the base of the section.

Core Photo



192-1187A-6R-5 **Section Top: 408.17 mbsf**

UNIT 3B: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–3

CONTACTS: None.

PHENOCRYSTS:	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	1–4	1	<0.1	0.2	Euhedral to subhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture.

VESICLES: Nonvesicular.

COLOR: Yellowish brown (10YR 5/4) and medium light gray (N6).

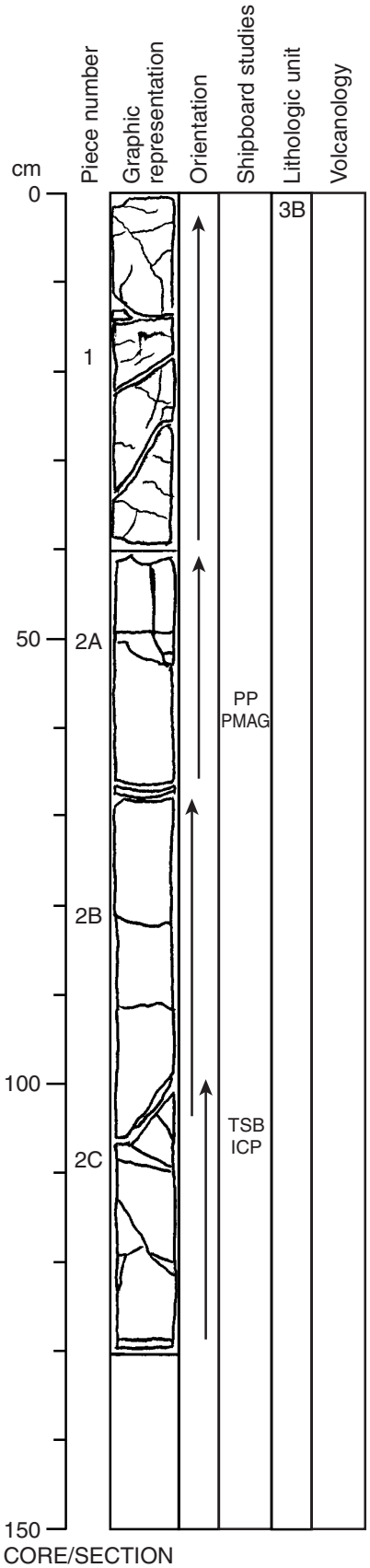
STRUCTURE: Pillowed. Pieces 1A and 1D are the top and bottom, respectively, of a 1.2-meter pillow. Piece 2 represents fragments of a pillow margin, and Piece 3 has a glassy margin.

ALTERATION: High. Olivine phenocrysts are replaced by Fe oxyhydroxide, black clay, and zeolite(?).

VEINS/FRACTURES: Sparsely to highly veined. Veins are <1–14 mm wide and are filled with white carbonate, green and brown clay, Fe oxyhydroxide, and zeolite(?).

COMMENTS: Rare irregular miarolitic cavities (~1 mm in diameter) are filled with Fe oxyhydroxide, white carbonate, green and black clay, celadonite, and zeolite; some miarolitic cavities are interconnected.

Core Photo



192-1187A-6R-6 **Section Top: 409.53 mbsf**

UNIT 3B: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–2C

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	3–5	0.3	<0.1	0.2	Euhedral to subhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture.

VESICLES: Nonvesicular.

COLOR: Medium gray (N5) to medium light gray (N6) in the least altered regions; brownish yellow (10YR 6/6) in spherulitic zones.

STRUCTURE: Pillowed. The presence of spherulitic zones at the top and bottom of Piece 1 suggests that it is a section through one pillow. Piece 2A is aphanitic at the top, becoming massive and fine grained downsection.

ALTERATION: Slight in fine-grained regions; moderate to high in aphanitic regions. Olivine phenocrysts are replaced by black clay in fine-grained regions and by Fe oxyhydroxide in aphanitic regions.

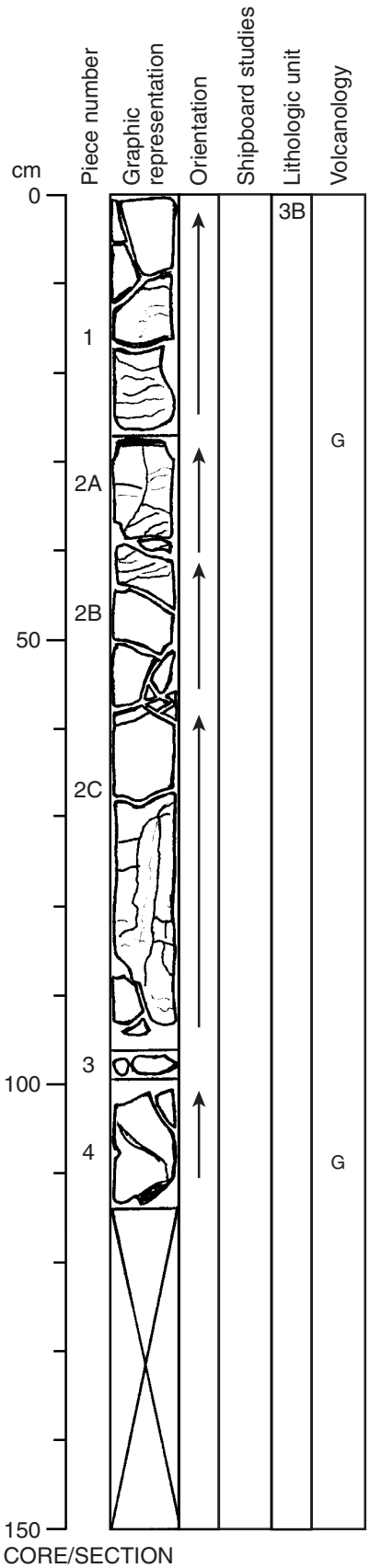
VEINS/FRACTURES: Highly veined in aphanitic regions; sparsely veined in massive fine-grained regions. Veins are <1–10 mm wide and are filled with white carbonate, green clay, and Fe oxyhydroxide. Some veins in Piece 1 are filled with red carbonate.

COMMENTS: Rare irregular miarolitic cavities in fine-grained regions are <1 mm in diameter and are filled with black clay or pale green clay; in aphanitic regions miarolitic cavities are ≤2 mm in diameter and are filled with white carbonate.

Description of thin section at 105-107 cm

Whole-rock ICP-AES data

Core Photo



192-1187A-6R-7 **Section Top: 410.84 mbsf**

UNIT 3B: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–4

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	1–4	0.5	0.1	<0.5	Subhedral to euhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture. Spherulites commonly have small olivine phenocrysts at their centers.

VESICLES: Nonvesicular.

COLOR: Medium light gray (N6) to light yellowish brown (10YR 6/4).

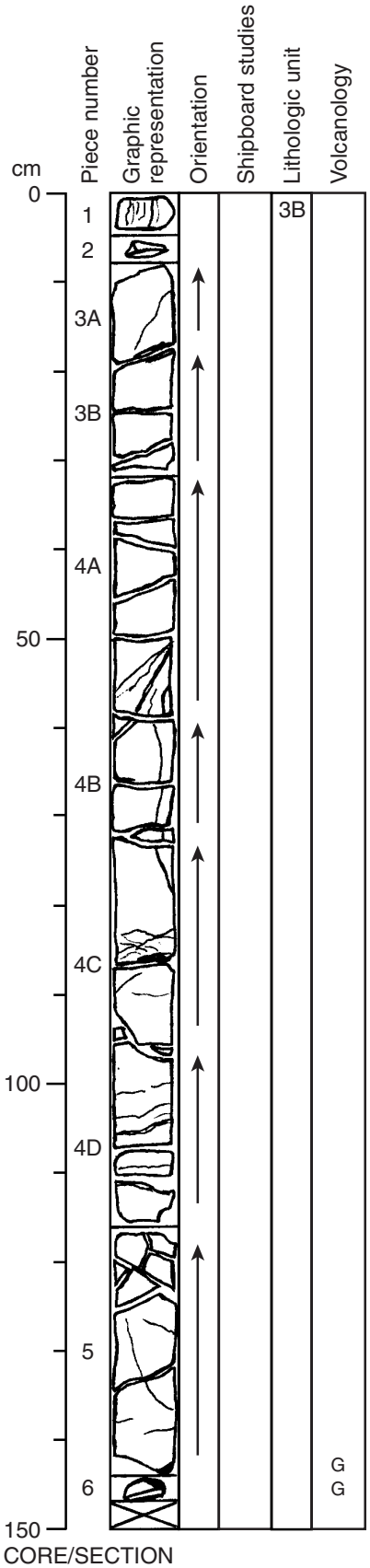
STRUCTURE: Pillowed. Pieces 2A–4 represent a section through a pillow, with glassy margins at the top and bottom.

ALTERATION: Moderate to high. Spherulitic zones adjacent to the glassy margins are the most altered. Olivine is replaced by brown clay and Fe oxyhydroxide.

VEINS/FRACTURES: Sparsely to moderately veined. Pieces 2A, 2B and the base of 2C have the most veins. Veins are <1–4 mm wide and are filled with white carbonate, dark green clay, and Fe oxyhydroxide.

COMMENTS: Rare irregular miarolitic cavities (<0.2 mm) are filled with white carbonate and green clay; some miarolitic cavities are interconnected.

Core Photo



192-1187A-7R-1 **Section Top: 413.00 mbsf**

UNIT 3B: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–6

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	1–4	1.0	<0.5	≤0.5	Subhedral to euhedral; rarely in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic areas adjacent to glassy margins have spherulitic texture (e.g., Pieces 1, 4D, 5, and 6). Some spherulites have olivine phenocrysts at their centers.

VESICLES: Nonvesicular.

COLOR: Medium light gray (N6) in less altered regions to brownish yellow (10YR 6/6) in more altered regions (e.g., Piece 5).

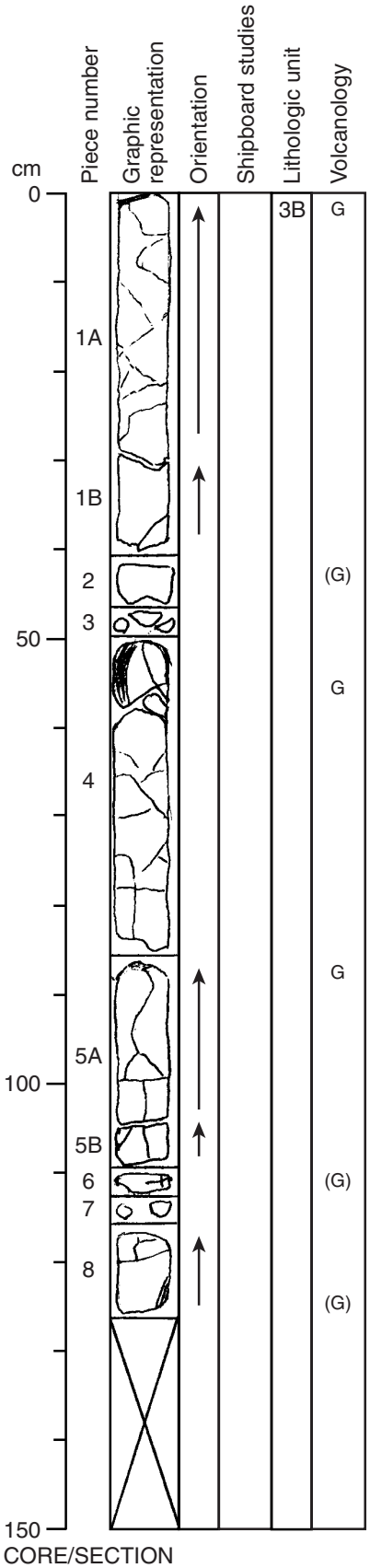
STRUCTURE: Pillowed. Glassy margins are present in Pieces 5 and 6.

ALTERATION: Moderate to high, especially adjacent to veins. Piece 5 is the most altered. Olivine is replaced by brown and dark green clay and Fe oxyhydroxide.

VEINS/FRACTURES: Sparsely to moderately veined. Veins are <1–3 mm wide and are filled with white carbonate, dark green clay, and Fe oxyhydroxide. Veins are most abundant in Piece 5.

COMMENTS: Isolated irregular miarolitic cavities (<1 mm) are present at the bottom of Piece 5 adjacent to the glassy pillow margin. Interconnected miarolitic cavities (<1 mm) are present in Piece 4C. Miarolitic cavities are filled with white carbonate and dark green clay.

Core Photo



192-1187A-7R-2 **Section Top: 414.47 mbsf**

UNIT 3B: MODERATELY OLIVINE- PHYRIC BASALT

Pieces: 1A–8

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	3–4	1.2	<0.1	0.2	Subhedral to euhedral

GROUNDMASS: Aphanitic.

VESICLES: Nonvesicular.

COLOR: Light yellowish brown (2.5Y 6/4) to grayish brown (2.5Y 5/2 and 2.5Y 6/3). Hyaloclastite in Piece 2 is greenish black (5G 2/1) to very light gray (N8).

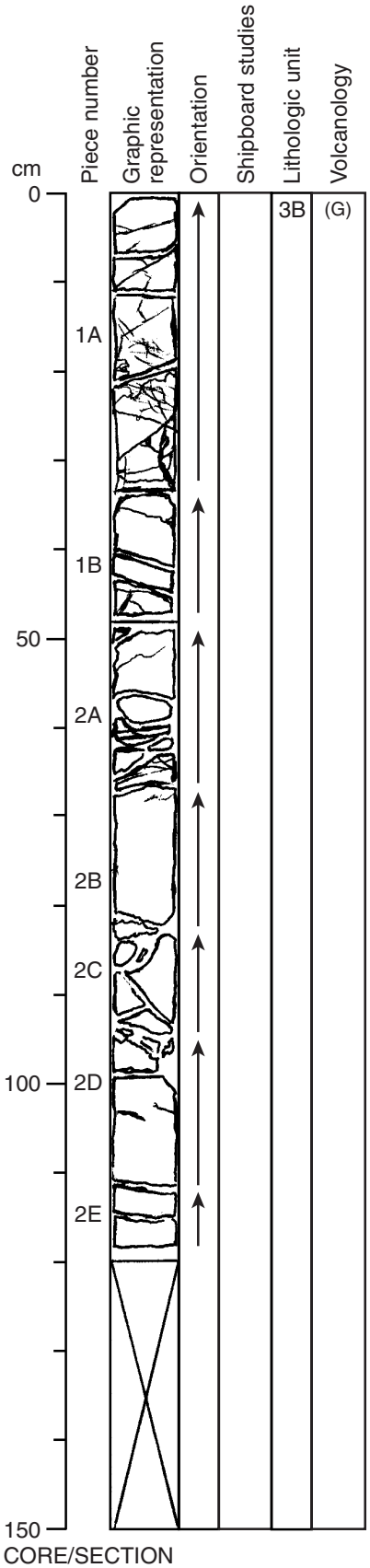
STRUCTURE: Pillowed. Unaltered glass is present in Pieces 1A, 3, 4, 5, 6, and 8.

ALTERATION: Moderate to high. Olivine phenocrysts are replaced by Fe oxyhydroxide.

VEINS/FRACTURES: Moderately veined. Veins are <1–2 mm wide and are filled with carbonate and brown and black clay.

COMMENTS: Piece 2 is a hyaloclastite consisting of altered glass fragments cemented by carbonate.

Core Photo



192-1187A-7R-3 **Section Top: 415.73 mbsf**

UNIT 3B: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–2E

CONTACTS: None.

PHENOCRYSTS:

	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	1–5	1	<0.1	0.2	Euhedral to subhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions (Piece 1A) have spherulitic texture. From Piece 1B downward the section is fine grained.

VESICLES: Nonvesicular.

COLOR: Medium light gray (N6) to medium gray (N5); light yellowish brown (2.5Y 6/3).

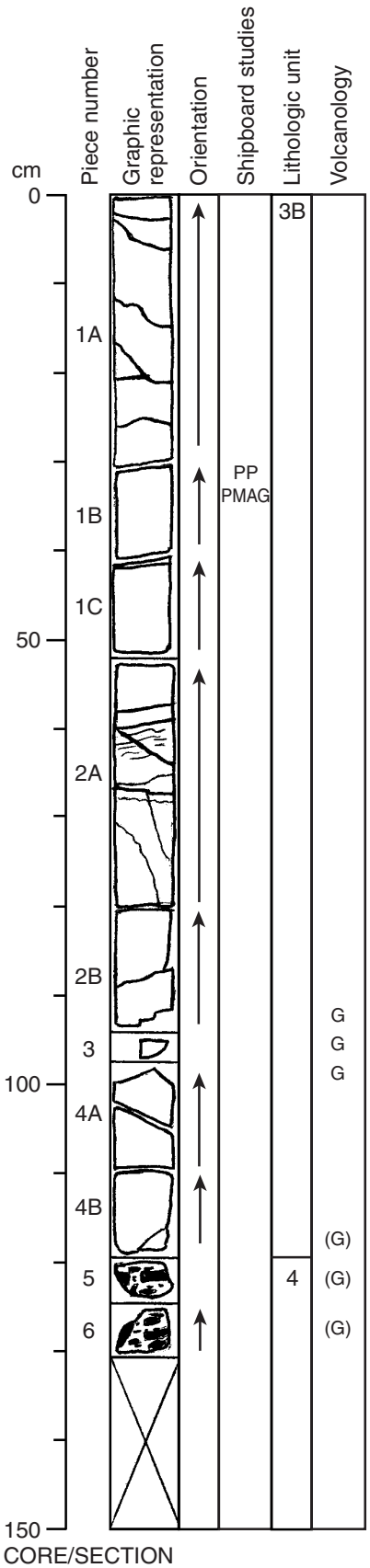
STRUCTURE: Pillowed. A glassy margin is present in Piece 1A. The base of this pillow is not present in this section.

ALTERATION: Slight to high. Alteration decreases downsection, away from the pillow margin. Olivine is replaced by green and black clay and Fe oxyhydroxide. Fe oxyhydroxide defines curved bands in Pieces 2B and 2D.

VEINS/FRACTURES: Sparsely to highly veined. Piece 1A is highly veined; others are sparsely veined. Veins are <1–8 mm wide and are filled with white carbonate, Fe oxyhydroxide, and green and black clay.

COMMENTS: Rare irregular miarolitic cavities (up to 4 x 5 mm in size) are filled with green clay, white carbonate, and Fe oxyhydroxide (e.g., Piece 2B).

Core Photo



192-1187A-7R-4 **Section Top: 416.92 mbsf**

UNIT 3B: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–4B

CONTACTS: Not recovered. The contact between Units 3B and 4 is inferred to be between Pieces 4B and 5.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	2–3	0.8	<0.1	0.2	Subhedral to euhedral; rarely in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Spherulites in aphanitic areas are commonly coalesced. Fine-grained regions have variolitic texture.

VESICLES: Nonvesicular.

COLOR: Medium gray (N5) in least altered regions to light yellowish brown (10YR 6/4).

STRUCTURE: Pillowed. Glassy margins are present in Pieces 2B, 3, 4A, and 4B. Pieces 4A and 4B are a section through a single pillow.

ALTERATION: Moderate to high. Spherulites are highlighted by alteration. Olivine phenocrysts are replaced by Fe oxyhydroxide.

VEINS/FRACTURES: Sparsely to highly veined. Veins are <1–5 mm wide and are filled with white carbonate, green and brown clay, and Fe oxyhydroxide.

UNIT 4: HYALOCLASTITE

Pieces: 5–6

CONTACTS: Not recovered. The contact between Units 3B and 4 is inferred to be between Pieces 4B and 5.

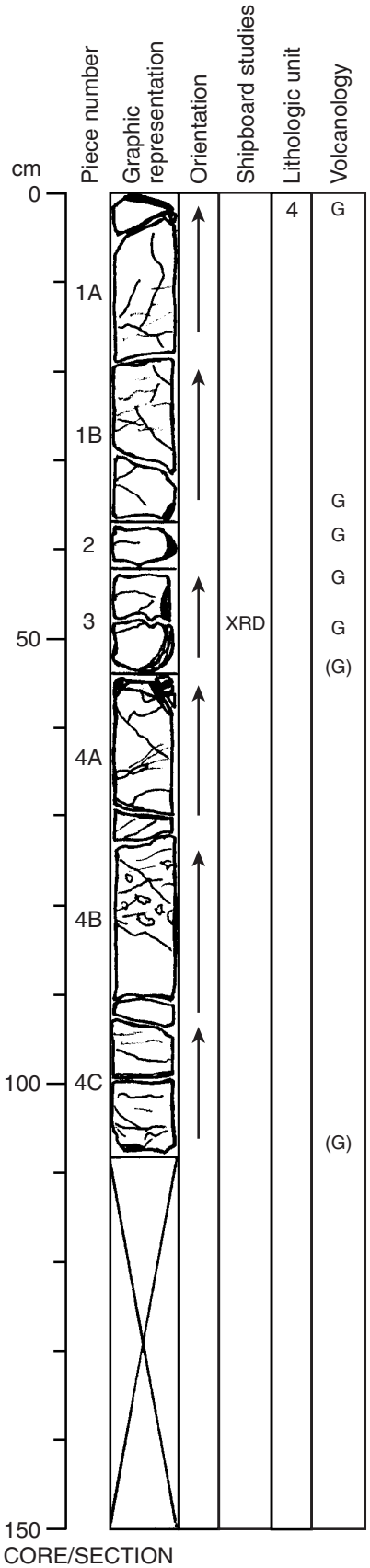
PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	~1	0.5	<0.1	0.1	Subhedral to euhedral

COLOR: Glass is greenish black (5GY 2/1) to dark greenish gray (5GY 4/1); carbonate cement is white (N9).

STRUCTURE: Angular glass clasts in white carbonate cement.

ALTERATION: Glass is completely altered and shows concentric alteration zones. Euhedral olivine phenocrysts within the glass clasts are replaced by Fe oxyhydroxide; some olivine appears unaltered.

Core Photo



192-1187A-7R-5 **Section Top: 418.22 mbsf**

UNIT 4: SPARSELY TO MODERATELY OLIVINE PHYRIC BASALT

Pieces: 1A–4C

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	1–6	1.5	<0.5	<0.5	Subhedral to euhedral; rarely as glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture. Spherulites commonly have olivine phenocrysts at their centers.

VESICLES: Nonvesicular.

COLOR: Medium gray (N5) to medium light gray (N6) in least altered regions; light yellowish brown (10YR 6/4) in spherulitic regions.

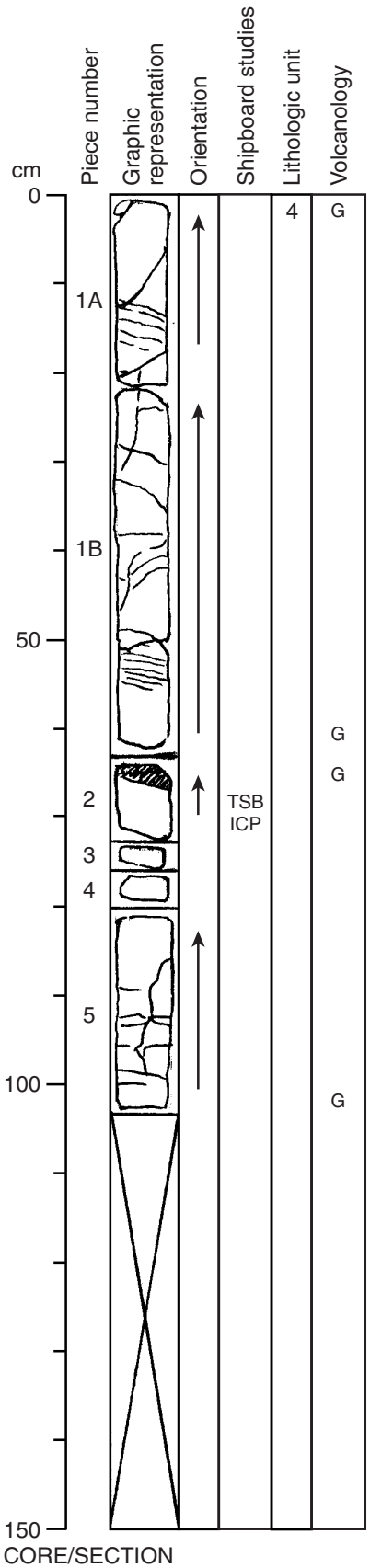
STRUCTURE: Pillowed. Curved glassy margins are abundant (e.g., Pieces 2, 3, and 4A).

ALTERATION: Moderate to high. Alteration highlights spherulitic zones adjacent to glassy margins (e.g., Pieces 2, 3, 4A, and 4C). Olivine is replaced by brown and dark green clay and Fe oxyhydroxide.

VEINS/FRACTURES: Moderately to highly veined. Pieces 1B and 4B have the most veins. Veins are <1–3 mm wide and are filled with white carbonate and dark green clay.

COMMENTS: Large (~3 mm) miarolitic cavities in a pillow interior (Piece 4B) are commonly interconnected (Pieces 4A and 4C). They are filled with white carbonate and dark green clay.

Core Photo



192-1187A-7R-6 **Section Top: 419.30 mbsf**

UNIT 4: MODERATELY OLIVINE PHYRIC BASALT

Pieces: 1A–5

CONTACTS: None.

PHENOCRYSTS:	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	3–5	1	<0.5	0.6	Euhedral to subhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic to fine grained.

VESICLES: Nonvesicular to slightly vesicular at the top and bottom of Piece 1. Vesicles (<1 mm) are irregular and elongate.

COLOR: Light yellowish brown (2.5 Y 6/3) to medium gray (N5) to light brownish gray (5 Y 6/1).

STRUCTURE: Pillowed. Unaltered glass is present at the top of Pieces 1A and 2 and at the bottom of Pieces 1B and 5.

ALTERATION: Moderate. Olivine is replaced by Fe oxyhydroxide and brown clay.

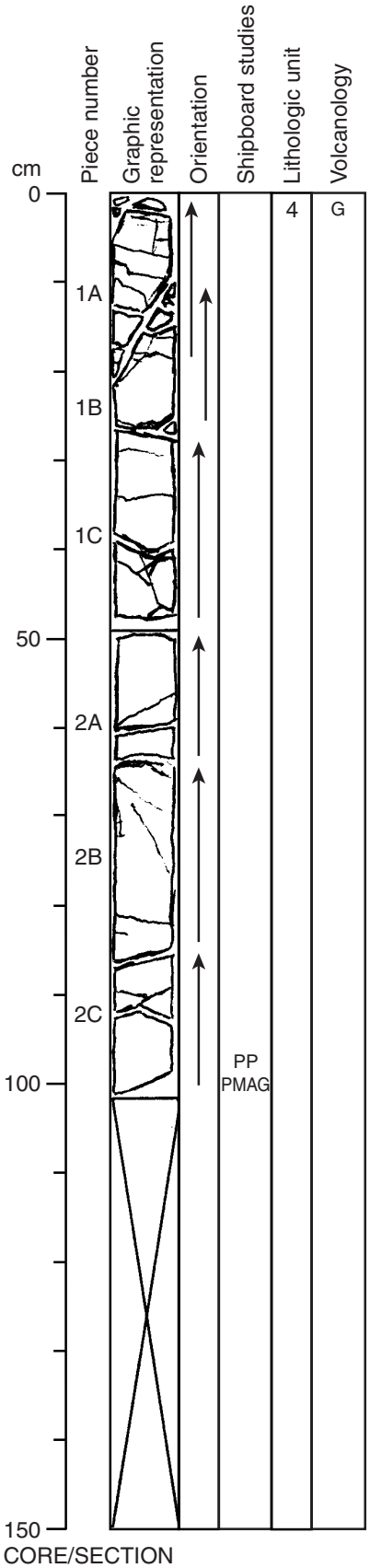
VEINS/FRACTURES: Moderately veined. Veins are <1–3 mm wide and are filled with white carbonate ± brown and green clay.

COMMENTS: Miarolitic(?) cavities (≤5 mm in diameter) associated with veins at the top of Piece 5 and the bottom of Piece 4 are filled with white carbonate ± brown and green clay.

Description of thin section at 66-70 cm

Whole-rock ICP-AES data

Core Photo



192-1187A-7R-7 **Section Top: 420.33 mbsf**

UNIT 4: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–2C

CONTACTS: None.

PHENOCRYSTS:	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	2–7	0.8	<0.1	0.2	Euhedral to subhedral; commonly in glomerocrysts

Olivine phenocryst abundance generally increases downsection.

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture adjacent to glassy margins (e.g., Piece 1A). Grain size increases downsection.

VESICLES: Nonvesicular.

COLOR: Medium gray (N5) to medium light gray (N6) to light yellowish brown (2.5Y 6/4).

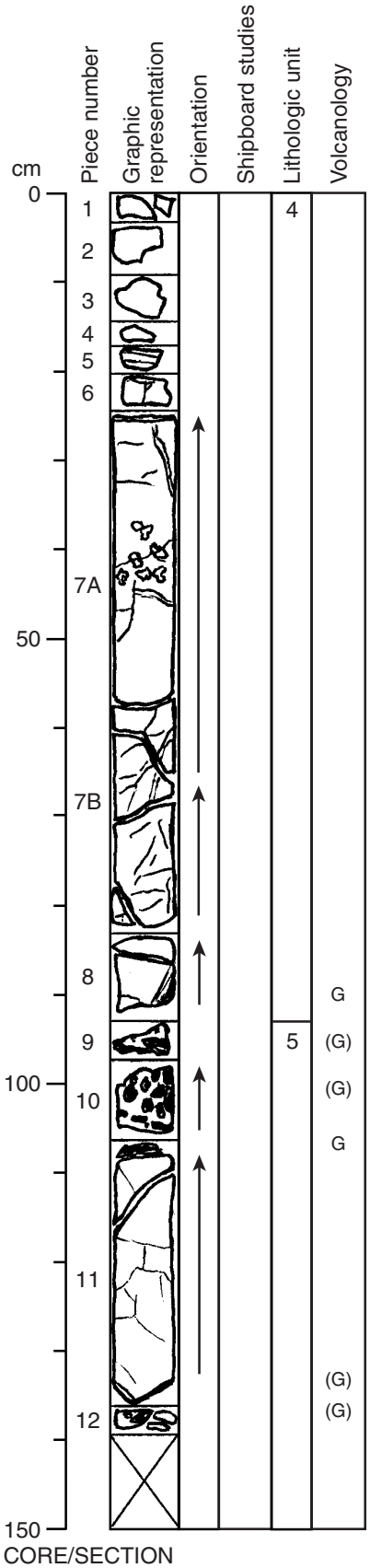
STRUCTURE: Pillowed. A glassy margin is present in Piece 1A.

ALTERATION: Slight to high. The base of Piece 2C is the least altered. Olivine is replaced by Fe oxyhydroxide and black and green clay. Alteration to Fe oxyhydroxide ceases abruptly below 90 cm in Piece 2C; below this, alteration is slight.

VEINS/FRACTURES: Sparsely to moderately veined. Veins are <1–5 mm wide and are filled with white carbonate, green and black clay, and Fe oxyhydroxide.

COMMENTS: Large irregular cavities (up to 2.5 x 1 cm in size) are associated with veins; the cavities are filled with white carbonate, green clay, and Fe oxyhydroxide.

Core Photo



192-1187A-8R-1 **Section Top: 422.60 mbsf**

UNIT 4: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–8

CONTACTS: Not recovered. The contact between Units 4 and 5 is inferred to be between Pieces 8 and 9.

PHENOCRYSTS:	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	7	0.8	0.3	0.5	Subhedral to euhedral

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture.

VESICLES: Nonvesicular.

COLOR: Light gray (N6) to yellow (10YR 7/6).

STRUCTURE: Pillowed. A glassy margin is present at the base of Piece 8.

ALTERATION: Moderate to high. Alteration is highest adjacent to veins. Olivine phenocrysts are replaced by Fe oxyhydroxide and green clay.

VEINS/FRACTURES: Moderately veined. Veins are <1–10 mm wide and are filled with carbonate, Fe oxyhydroxide, and green clay.

COMMENTS: Irregular miarolitic cavities (3–6 mm diameter) in Piece 7A are filled with carbonate.

UNIT 5: MODERATELY OLIVINE-PHYRIC BASALT AND HYALOCLASTITE

Pieces: 9–12

CONTACTS: Not recovered. The contact between Units 4 and 5 is inferred to be between Pieces 8 and 9.

PHENOCRYSTS:	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	5	0.8	0.3	0.5	Euhedral to subhedral

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture.

VESICLES: Nonvesicular.

COLOR: Brownish yellow (10YR 6/8) to dark greenish gray (5G 4/1).

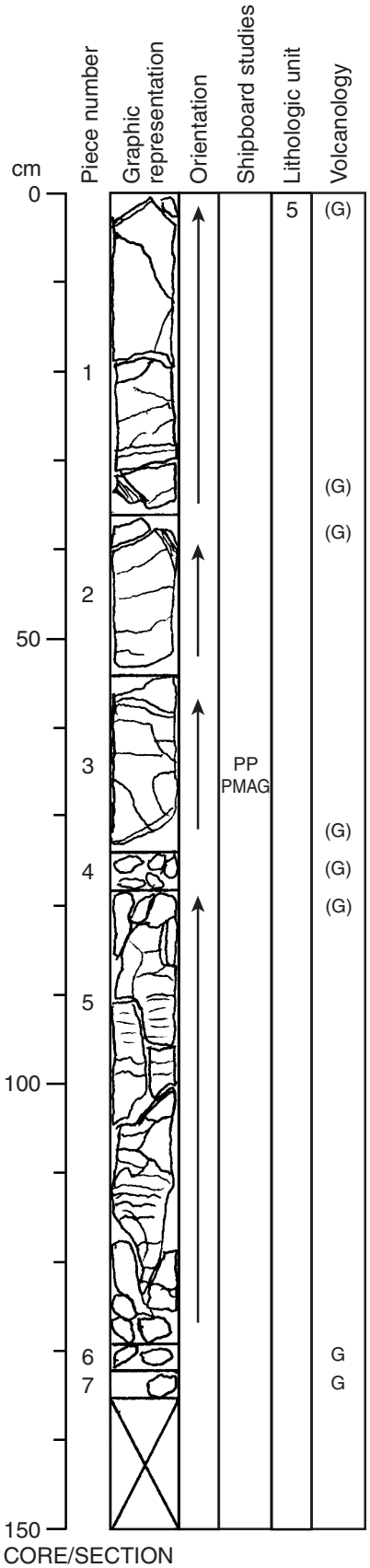
STRUCTURE: Pillowed. Altered glassy margins are present at the top and bottom of Piece 11. Pieces 9 and 10 are hyaloclastite.

ALTERATION: High. Brown oxidation halos are present. Olivine phenocrysts are replaced by brown-yellow clay.

VEINS/FRACTURES: Moderately veined. Veins are (≤1 mm wide and are filled with carbonate.

COMMENTS: Pieces 9 and 10 are hyaloclastite containing aphanitic basalt and altered glass fragments in a carbonate and green and red clay matrix.

Core Photo



192-1187A-8R-2 **Section Top: 423.99 mbsf**

UNIT 5: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–7

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	2–7	1.2	0.2	0.5	Euhedral to subhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture, commonly with olivine phenocrysts at the centers of spherulites. Fine-grained regions have variolitic texture.

VESICLES: Nonvesicular. Rare, subround to irregular vesicles (≤1.5 mm) in aphanitic pillow margins are filled with carbonate.

COLOR: Dark yellowish orange (10YR 6/6) to medium light gray (N6).

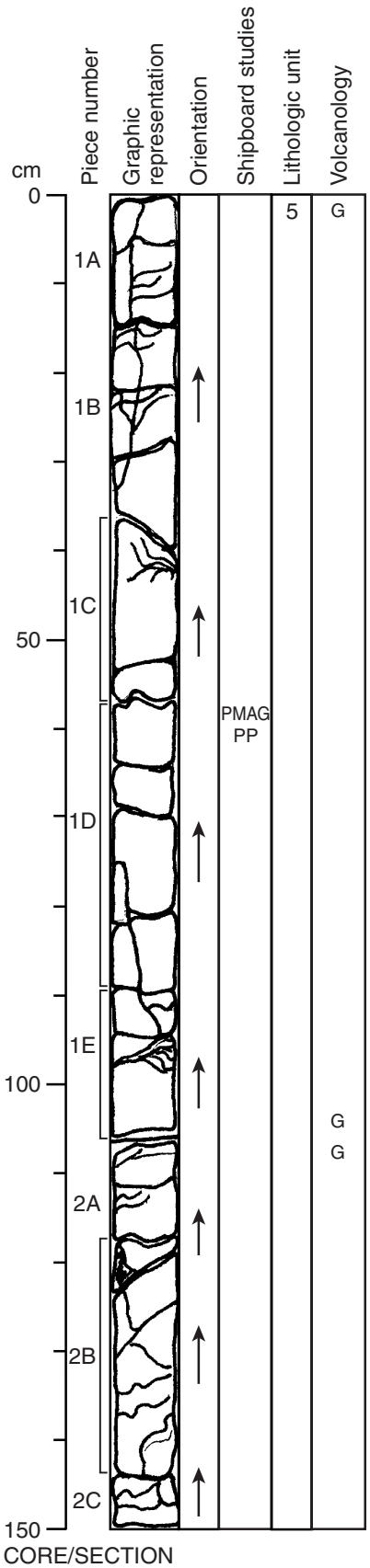
STRUCTURE: Pillowed. Unaltered glassy margins are present on Pieces 6 and 7. Altered glassy margins are present at the top of Pieces 1, 2 and 5 and the base of Piece 3. Pieces 4, 6 and 7 are inter pillow breccia.

ALTERATION: Slight to complete. The aphanitic regions adjacent to glassy margins are pervasively replaced by Fe oxyhydroxide; the mesostasis in the fine-grained pillow interiors is replaced by dark green clay. Fe oxyhydroxide highlights the spherulites in the aphanitic regions. Olivine phenocrysts are replaced by dark green clay and Fe oxyhydroxide.

VEINS/FRACTURES: Sparsely to moderately veined. Veins are <1–4 mm wide and are filled with white carbonate and green clay.

COMMENTS: Rare, irregular miarolitic cavities (≤1 mm) in the fine-grained pillow interiors are filled with carbonate.

Core Photo



192-1187A-8R-3 **Section Top: 425.34 mbsf**

UNIT 5: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–2C

CONTACTS: None.

PHENOCRYSTS:

	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	3–5	0.8	0.2	0.6	Euhedral to subhedral; commonly in glomerocrysts

GROUNDMASS: Fine grained with variolitic texture.

VESICLES: Nonvesicular.

COLOR: Bluish gray (5B 6/1) to brownish yellow (10YR 6/6).

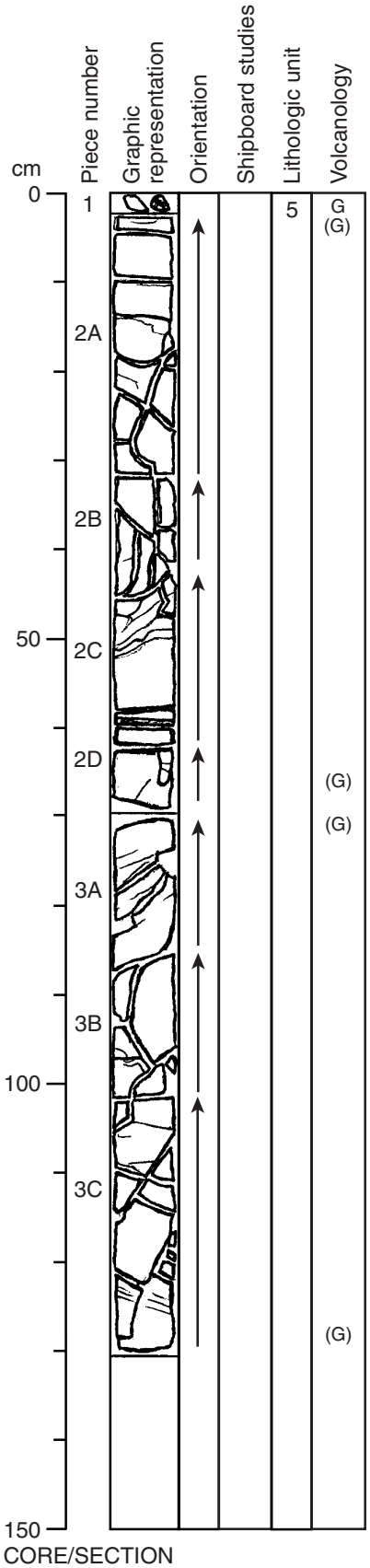
STRUCTURE: Pillowed. Glassy margins are present on Pieces 1A, 1E and 2A.

ALTERATION: Moderate. Olivine phenocrysts are replaced by Fe oxyhydroxide and dark green clay.

VEINS/FRACTURES: Moderately to highly veined. Veins are <1–3 mm wide and are filled with carbonate.

COMMENTS: Irregular miarolitic cavities (≤1 mm) in the fine-grained pillow interiors are filled with green clay.

Core Photo



192-1187A-8R-4 **Section Top: 426.83 mbsf**

UNIT 5: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–3C

CONTACTS: None.

PHENOCRYSTS:

	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	5	1.0	0.3	0.5	Euhedral to subhedral

A large (1 mm) skeletal olivine phenocryst is present in Piece 3C.

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture.

VESICLES: Nonvesicular.

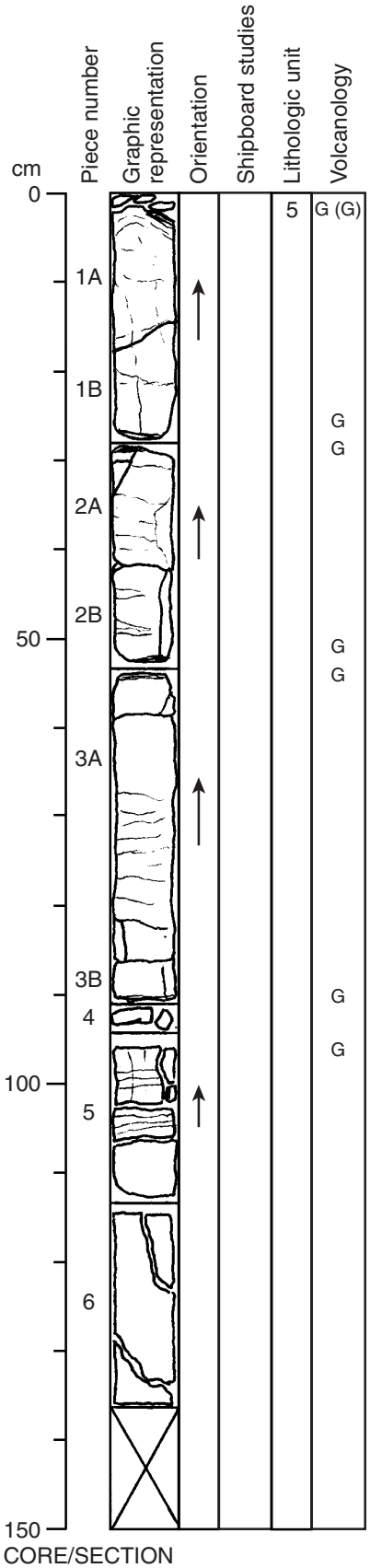
COLOR: Medium light gray (N6) to yellow (10YR 7/6).

STRUCTURE: Pillowed. Glassy margins are present on Pieces 1, 2A, 2D, 3A, and 3C.

ALTERATION: Generally moderate. Alteration is more intense adjacent to veins. Olivine phenocrysts are replaced by green clay and Fe oxyhydroxide.

VEINS/FRACTURES: Moderately veined. Veins are <1–3 mm wide and are filled with carbonate and black clay.

Core Photo



192-1187A-8R-5 **Section Top: 428.14 mbsf**

UNIT 5: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–6

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	2–6	1.3	0.3	0.7	Euhedral to subhedral; rarely in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture.

VESICLES: Nonvesicular. Rare, irregular to subround vesicles (<1–2 mm) in the aphanitic regions are filled with carbonate.

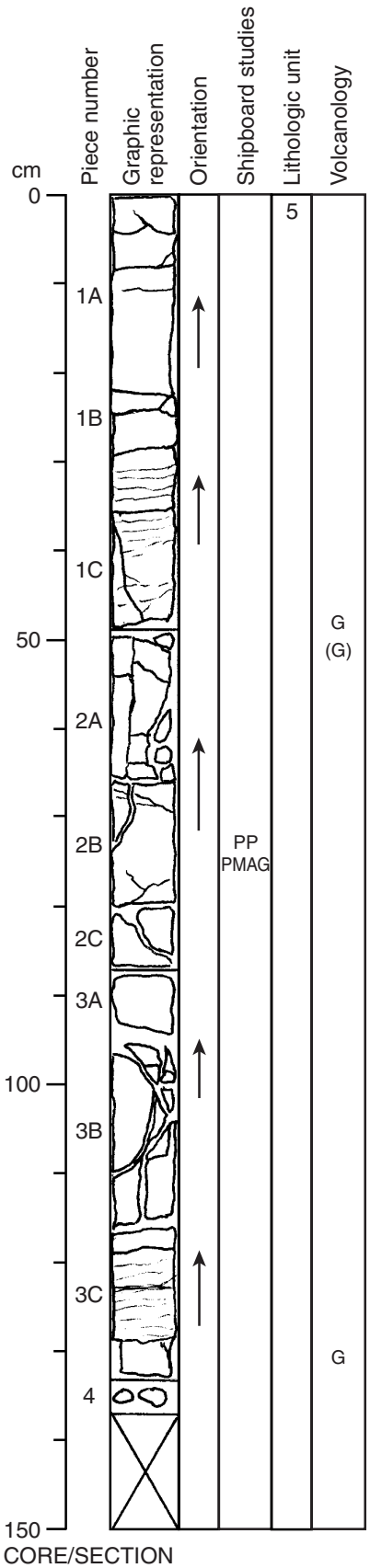
COLOR: Medium light gray (N6) to light yellowish brown (10YR 6/4).

STRUCTURE: Pillowed. Glassy margins are present on Pieces 1A–3B and Piece 5.

ALTERATION: Moderate to high. Groundmass is pervasively altered to Fe oxyhydroxide in fine-grained pillow interiors; groundmass in the aphanitic regions is replaced by dark green clay. Olivine phenocrysts are replaced by Fe oxyhydroxide and green clay.

VEINS/FRACTURES: Moderately veined. Veins are <1–2 mm wide and are filled with zeolite, white carbonate, and black clay.

Core Photo



192-1187A-8R-6 **Section Top: 429.50 mbsf**

UNIT 5: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–4

CONTACTS: None.

PHENOCRYSTS:	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	2–5	1.3	0.3	0.8	Euhedral to subhedral; rarely in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture.

VESICLES: Nonvesicular.

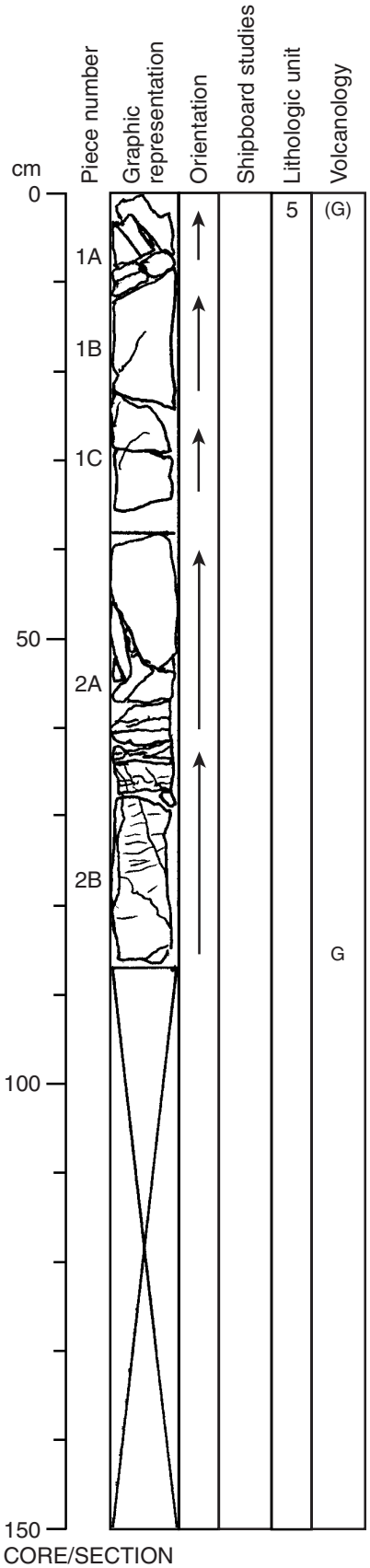
COLOR: Yellowish brown (10YR 5/6) to medium light gray (N6).

STRUCTURE: Pillowed. Glassy margins are present on Pieces 1C, 2A, and 3C.

ALTERATION: Moderate to high. Alteration is more intense adjacent to veins. Olivine phenocrysts are replaced by green clay in the fine-grained pillow interiors and by Fe oxyhydroxide in the aphanitic regions.

VEINS/FRACTURES: Moderately veined. Veins are <1–3 mm wide and are filled with carbonate, zeolite, and green clay.

Core Photo



192-1187A-8R-7 **Section Top: 430.87 mbsf**

UNIT 5: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–2B

CONTACTS: None.

PHENOCRYSTS:	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	2–7	1.1	0.2	0.6	Euhedral to subhedral; rarely in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture. Olivine phenocrysts are present at the centers of some spherulites.

VESICLES: Nonvesicular. Rare, subround to elongate, carbonate-filled vesicles (≤1 mm) are present in the aphanitic regions adjacent to the pillow margins.

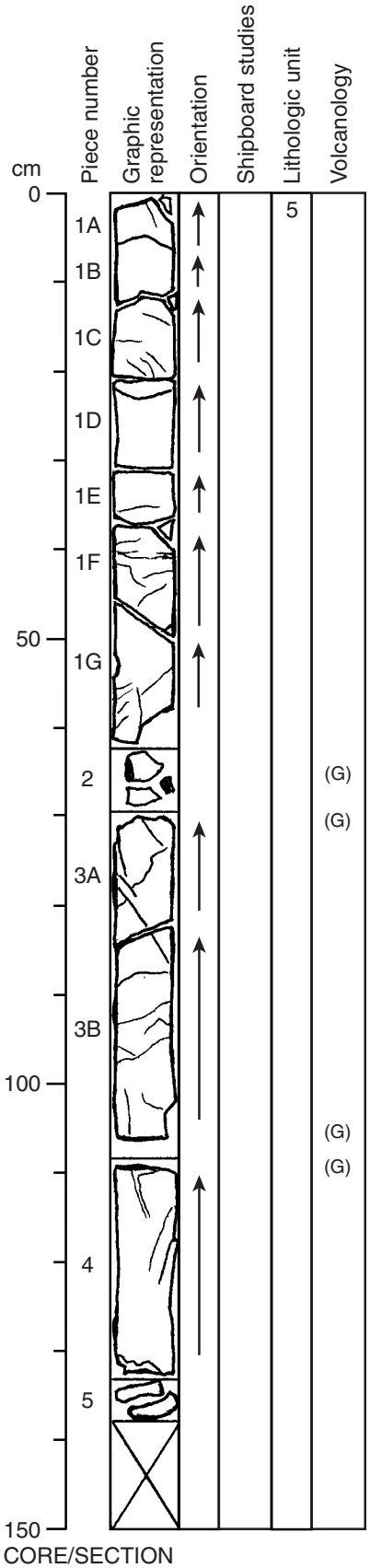
COLOR: Medium light gray (N6) to light yellowish brown (10YR 6/4).

STRUCTURE: Pilowed. Glassy margins are present on Piece 1A (altered) and Piece 2B (unaltered).

ALTERATION: Slight to complete. The groundmass in the aphanitic regions is pervasively replaced by Fe oxyhydroxide; the groundmass in the fine-grained regions is replaced by dark green clay. Olivine phenocrysts are replaced by green clay and Fe oxyhydroxide.

VEINS/FRACTURES: Sparsely to moderately veined. Veins are most abundant in Pieces 1A and 2B. Veins are <1–3 mm wide and are filled with carbonate, green clay, and minor Fe oxyhydroxide.

Core Photo



192-1187A-9R-1 **Section Top: 432.30 mbsf**

UNIT 5: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–5

CONTACTS: None.

PHENOCRYSTS:

	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	1–5	0.5	0.2	0.3	Euhedral to subhedral

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture.

VESICLES: Nonvesicular.

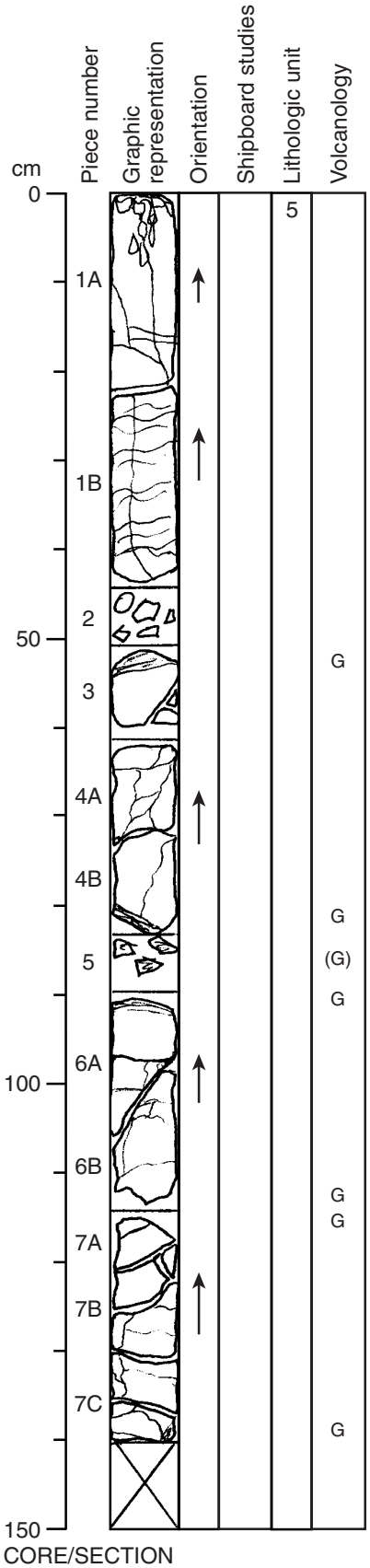
COLOR: Light gray (N7) to yellow (10YR 7/8).

STRUCTURE: Pillowed. Altered glassy margins are present on Pieces 1 (working half only), 2, and 3A–4.

ALTERATION: Moderate to high. Alteration is high adjacent to veins. Olivine phenocrysts are replaced by Fe oxyhydroxide and dark green clay.

VEINS/FRACTURES: Moderately to highly veined. Veins are <1–2 mm wide and are filled with carbonate, black and green clay, zeolite, quartz, and analcite.

Core Photo



192-1187A-9R-2 **Section Top: 433.68 mbsf**

UNIT 5: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–7C

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	3–5	1	0.3	0.8	Euhedral to subhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture.

VESICLES: Nonvesicular. Rare round vesicles (<1 mm) are present in the aphanitic regions.

COLOR: Medium light gray (N6) to light yellowish brown (10YR 6/4).

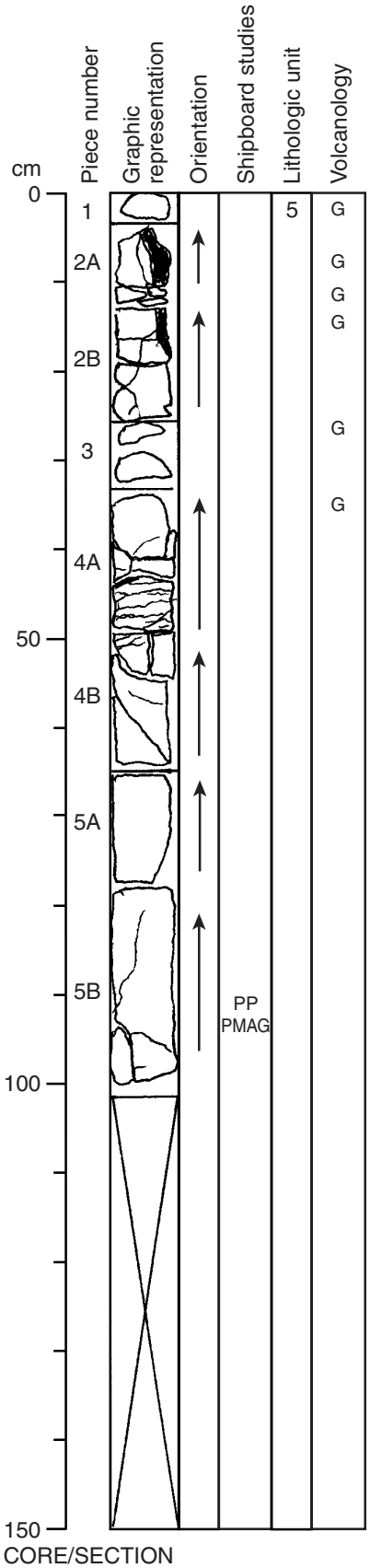
STRUCTURE: Pillowed. Glassy margins are present on Pieces 3, 4B–7A, and 7C.

ALTERATION: Moderate to high. Olivine phenocrysts are replaced by Fe oxyhydroxide and green clay.

VEINS/FRACTURES: Highly veined. Veins are <1–2 mm wide and are filled with Fe oxyhydroxide, green clay, and white carbonate.

COMMENTS: Irregular miarolitic cavities (2–13 mm diameter) in Piece 1A are filled with carbonate and green clay.

Core Photo



192-1187A-9R-3 **Section Top: 435.09 mbsf**

UNIT 5: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–5B

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	4–8	1.5	0.3	0.6	Euhedral to subhedral; commonly in glomerocrysts

Unaltered olivine is present in the unaltered glassy margins.

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture.

VESICLES: Nonvesicular. Rare, elongate and subround vesicles (≤1.5 mm) in the aphanitic regions are filled with carbonate.

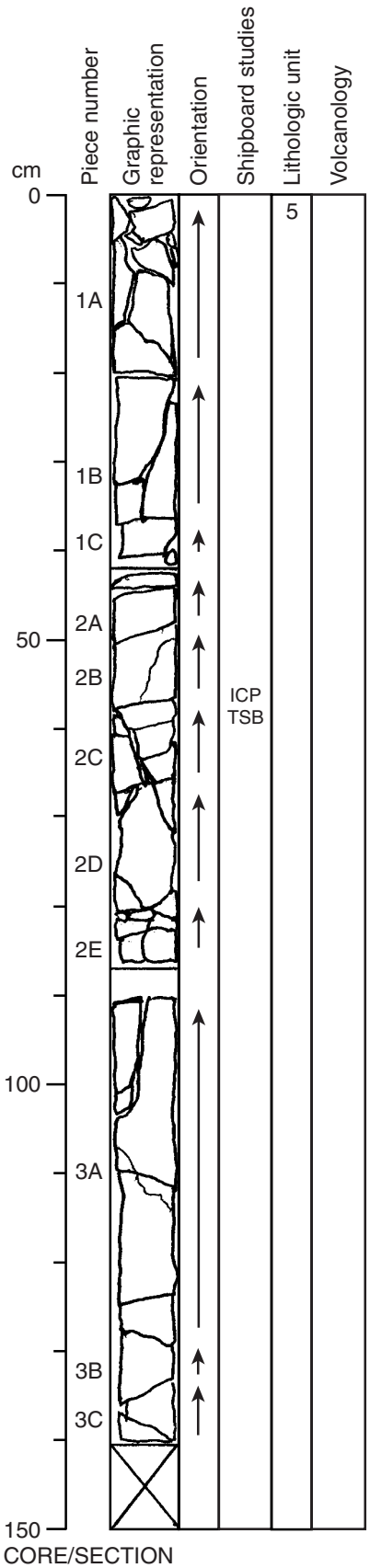
COLOR: Light yellowish brown (10YR 6/4) to medium light gray (N6).

STRUCTURE: Pillowed. Glassy margins are present on Pieces 1, 2A–2B, 3, and 4A.

ALTERATION: Slight to moderate. Some glass on the pillow margins is replaced by green clay. Groundmass and olivine phenocrysts in the aphanitic regions are replaced by Fe oxyhydroxide; groundmass and olivine phenocrysts in the fine-grained regions are replaced by dark green clay.

VEINS/FRACTURES: Sparsely to moderately veined (base of Piece 4A). Veins are <1–2 mm wide and are filled with carbonate and green clay.

Core Photo



192-1187A-9R-4 **Section Top: 436.10 mbsf**

UNIT 5: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–3C

CONTACTS: None.

PHENOCRYSTS:

	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	3–10	0.9	0.3	0.5	Euhedral to subhedral; commonly in glomerocrysts

Some unaltered olivine is present in regions away from the veins.

GROUNDMASS: Fine grained with variolitic texture. Plagioclase laths are ≤1.5 mm long.

VESICLES: Nonvesicular.

COLOR: Medium light gray (N6).

STRUCTURE: Massive. Appears to be the massive interior of a large pillow.

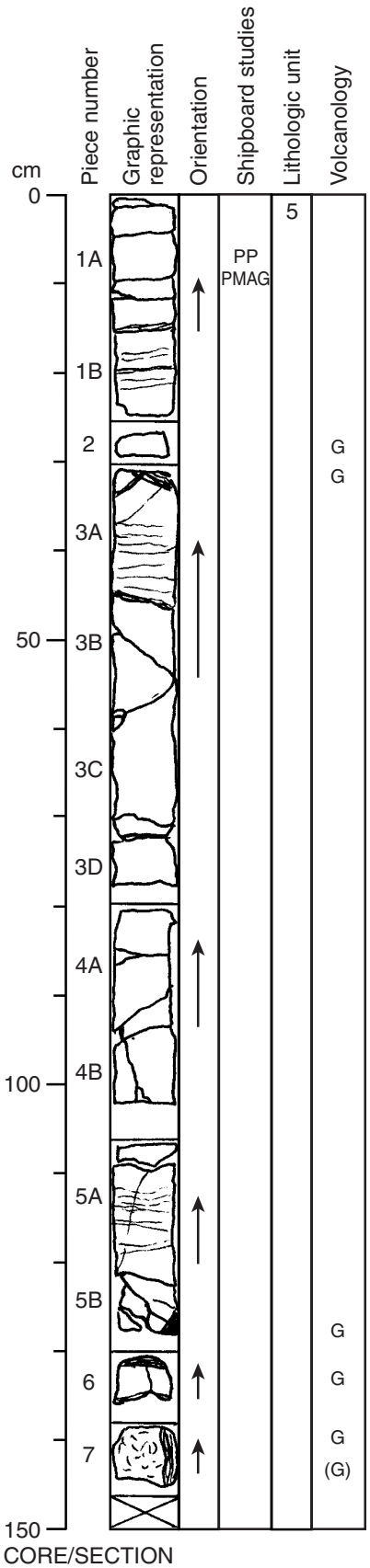
ALTERATION: Moderate. Groundmass and olivine phenocrysts are replaced by dark green clay.

VEINS/FRACTURES: Moderately veined. Veins are <1–3 mm wide and are filled with carbonate and green clay. Red-brown carbonate is present in the vein at the top of Piece 1A.

Description of thin section at 56-58 cm

Whole-rock ICP-AES data

Core Photo



192-1187A-9R-5 **Section Top: 437.51 mbsf**

UNIT 5: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–7

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	2–8	1.1	0.3	0.7	Euhedral to subhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture.

VESICLES: Nonvesicular. Rare, subround vesicles (≤1.5 mm) in the aphanitic regions are filled with carbonate and green clay.

COLOR: Medium light gray (N6) to brownish yellow (10YR 5/6).

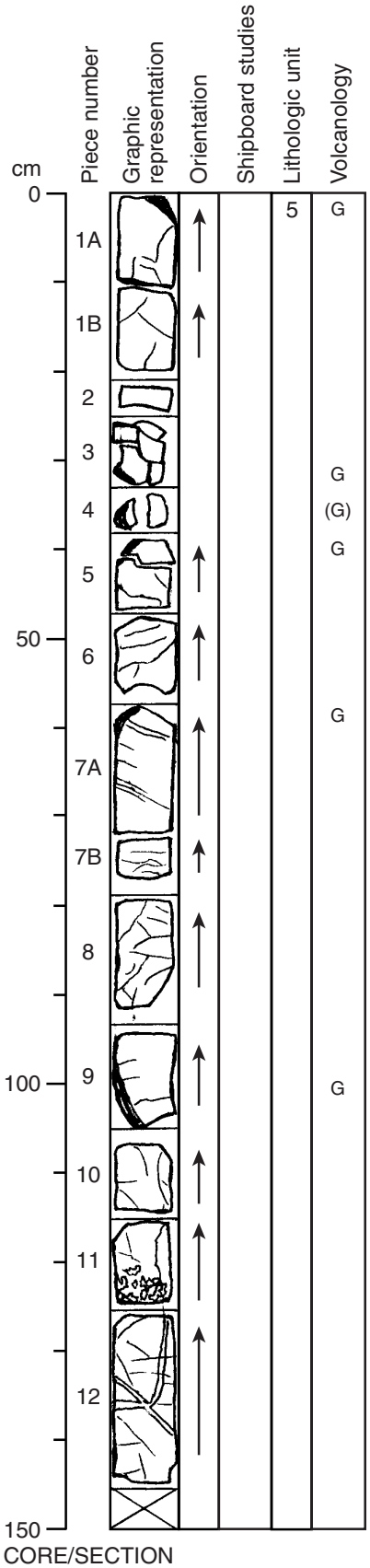
STRUCTURE: Pillowed. Glassy margins are present on Pieces 2, 3A, 5B, 6, and 7.

ALTERATION: Moderate. Olivine phenocrysts and groundmass in the aphanitic regions are replaced by green clay; olivine phenocrysts and groundmass in the fine-grained regions are replaced by Fe oxyhydroxide.

VEINS/FRACTURES: Moderately veined. Veins are concentrated in aphanitic regions. Veins are <1–4 mm wide and are filled with carbonate, green clay, and Fe oxyhydroxide.

COMMENTS: Piece 7 is hyaloclastite consisting of altered glass in a green clay, zeolite (?), and carbonate matrix.

Core Photo



192-1187A-9R-6 **Section Top: 438.97 mbsf**

UNIT 5: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–12

CONTACTS: None.

PHENOCRYSTS:	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	5	1.0	0.3	0.5	Euhedral to subhedral

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture.

VESICLES: Nonvesicular.

COLOR: Light gray (N7) to brownish yellow (10YR 6/6).

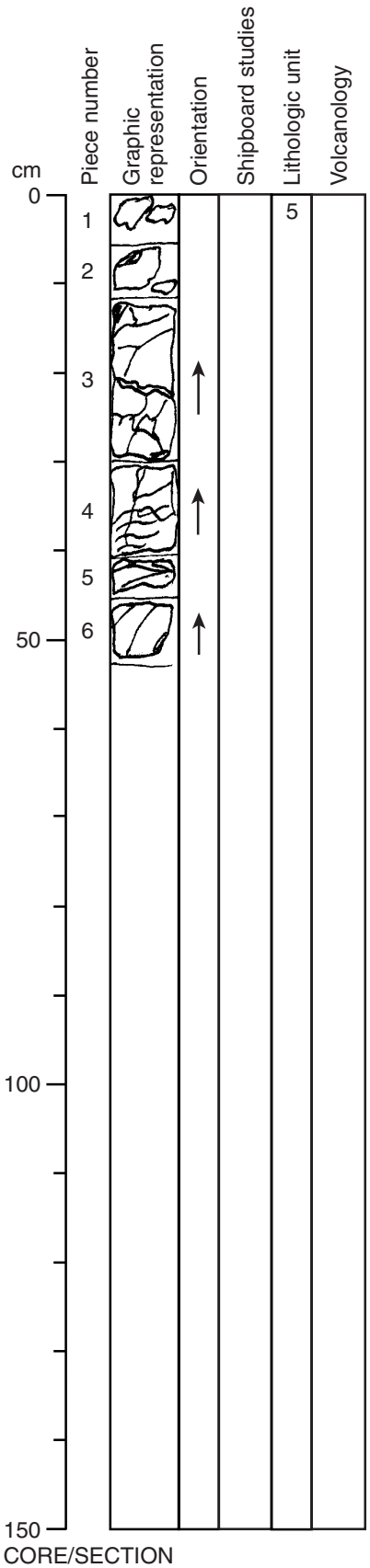
STRUCTURE: Pillowed. Glassy margins are present on Pieces 1A, 3, 4, 5, 7A, and 9.

ALTERATION: Moderate to high. The groundmass and olivine phenocrysts are completely replaced by Fe oxyhydroxide and green clay.

VEINS/FRACTURES: Moderately veined. Veins are <1–3 mm wide and are filled with carbonate.

COMMENTS: Irregular miarolitic cavities in Piece 11 (1–5 mm diameter) are filled with carbonate.

Core Photo



192-1187A-9R-7 **Section Top: 440.43 mbsf**

UNIT 5: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–6

CONTACTS: None.

PHENOCRYSTS:

	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	3–5	1	0.3	0.8	Subhedral to euhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic with spherulitic texture.

VESICLES: Nonvesicular.

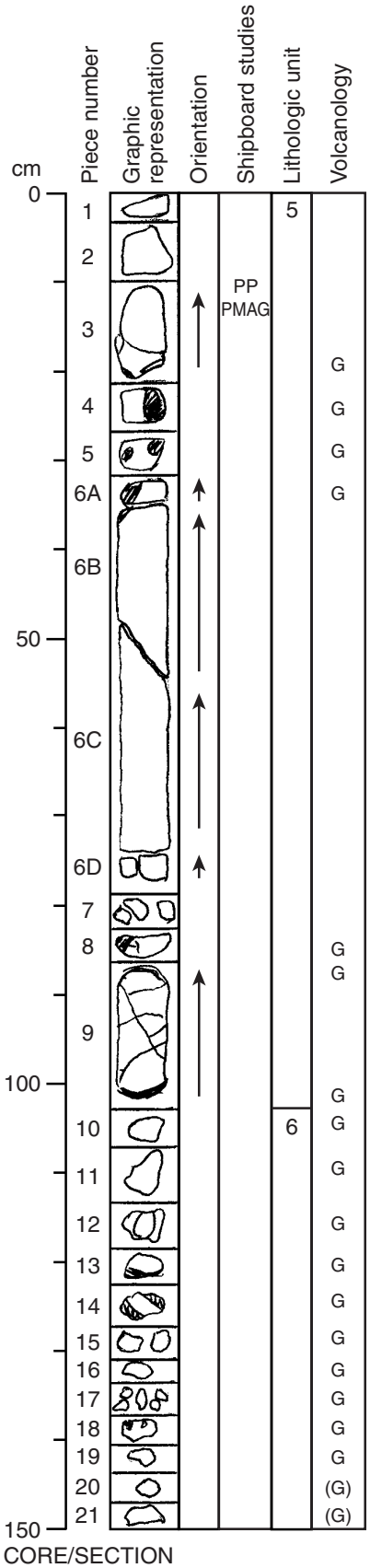
COLOR: Light yellowish brown (10YR 6/4).

STRUCTURE: Pillowed. Pillows inferred on the basis of similar texture and alteration to overlying sections where glassy margins are present.

ALTERATION: Moderate to high. Pervasive Fe oxyhydroxide staining highlights spherulites and olivine phenocrysts.

VEINS/FRACTURES: Highly veined. Veins are <1–2 mm wide and are filled with carbonate.

Core Photo



192-1187A-10R-1 **Section Top: 441.90 mbsf**

UNIT 5: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–9

CONTACTS: Not recovered. The contact between Unit 5 and Unit 6 is inferred to be between Pieces 9 and 10.

PHENOCRYSTS:	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	3–5	1	<0.5	0.5	Subhedral to euhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture.

VESICLES: Generally nonvesicular. Rare vesicles (<0.5 mm) are elongated parallel to glassy margins.

COLOR: Gray (2.5YR 6/1) to pale yellow (2.5YR 7/4).

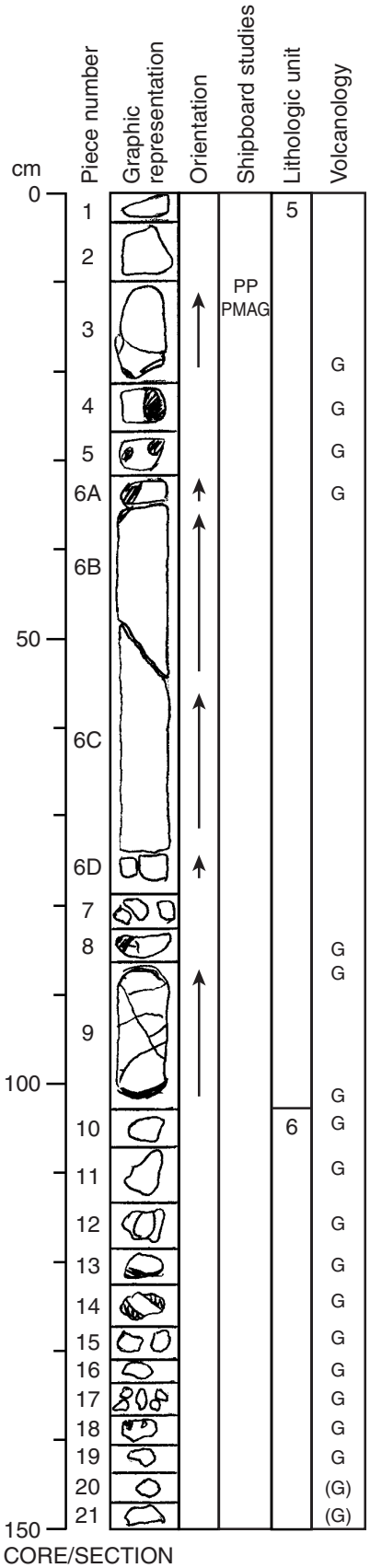
STRUCTURE: Pillowed. Fresh glass is present at the bottom of Piece 3, on Piece 4, at the top of Piece 6, on Piece 8, and at the top and bottom of Piece 9. Piece 9 is a section through a complete 16-cm pillow.

ALTERATION: Slight to moderate. Olivine phenocrysts are replaced by Fe oxyhydroxide and dark green clay.

VEINS/FRACTURES: Moderately veined. Veins are <1–3 mm wide and are filled with white carbonate.

COMMENTS: Equant, irregular miarolitic cavities (1–5 mm) are present toward the pillow interiors (Pieces 6C and 9). Piece 5 is hyaloclastite breccia consisting of altered glass (some with unaltered interiors) in a carbonate matrix.

Core Photo



192-1187A-10R-1 **Section Top: 441.90 mbsf**

UNIT 6: HYALOCLASTITE BRECCIA AND SPARSELY OLIVINE-PHYRIC BASALT

Pieces: 10–21

CONTACTS: Not recovered. The contact between Units 5 and 6 is inferred to be between Pieces 9 and 10.

PHENOCRYSTS:

	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	2	0.8	<0.5	<0.5	Subhedral

GROUNDMASS: Aphanitic (basalt).

VESICLES: Basalt is sparsely vesicular. The vesicles are <0.5–1.5 mm wide, irregular and elongate, and are filled with white carbonate and dark green clay.

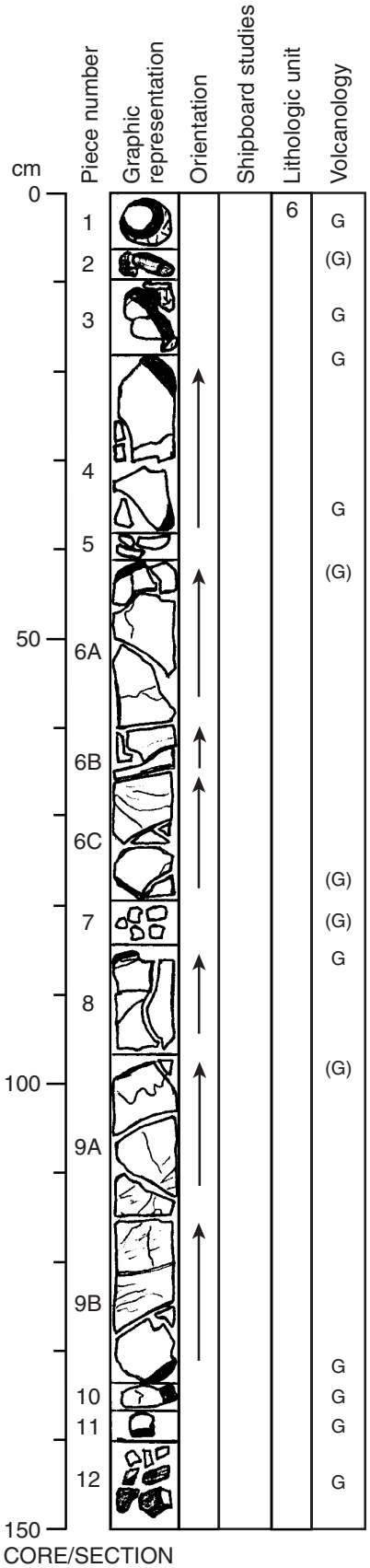
COLOR: Hyaloclastite is greenish black (5GY 2/1) to black (N1) with very light gray (N8) carbonate cement. Basalt is light yellowish brown (2.5 Y 6/4).

STRUCTURE: Pieces 10–18 are hyaloclastite consisting of angular glass clasts cemented by carbonate; Pieces 19–21 are glassy to aphanitic pillow margins.

ALTERATION: Moderate to high. Olivine phenocrysts are replaced by brown clay and Fe oxyhydroxide. Basalt pieces are stained by Fe oxyhydroxide.

VEINS/FRACTURES: Sparsely veined (Pieces 19–21). Veins are ≤1 mm wide and are filled with white carbonate and dark green clay.

Core Photo



192-1187A-10R-2 **Section Top: 443.40 mbsf**

UNIT 6: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–12

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase	<<1			0.5	Subhedral, stubby laths
Olivine:	1–4	2	<0.5	~0.5	Euhedral to subhedral; rarely in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture.

VESICLES: Nonvesicular.

COLOR: Medium dark gray (N4) in Piece 1 to very pale brown (10YR 7/4) in pillow interiors to brownish yellow (10 YR 6/6) near pillow margins.

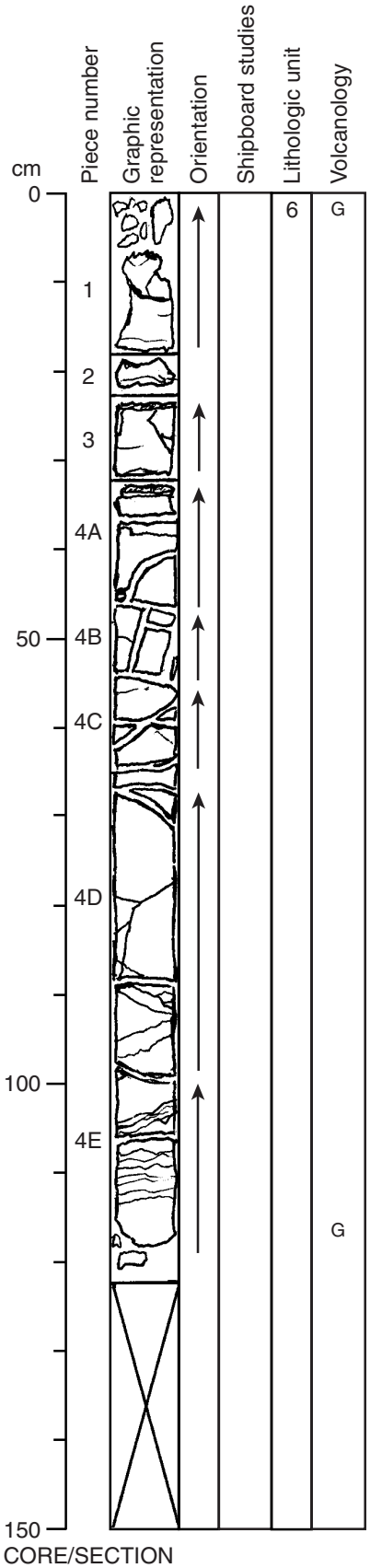
STRUCTURE: Pillowed. Glass is present in all pieces. Pieces 1, 2 and 7 are hyaloclastite breccia consisting of glass cemented by white carbonate.

ALTERATION: Moderate to high; some glass is unaltered. Olivine phenocrysts are replaced by Fe oxyhydroxide and brown clay in aphanitic regions and by dark green clay in fine-grained pillow interiors.

VEINS/FRACTURES: Moderately to sparsely veined. Pieces 9A and 9B have the most veins. Veins are <1–3 mm wide and are filled with white carbonate, dark green clay, and Fe oxyhydroxide.

COMMENTS: Rare miarolitic cavities (<2 mm diameter) filled with white carbonate are present in bands that are subparallel to pillow margins in Piece 9A.

Core Photo



192-1187A-10R-3 **Section Top: 444.90 mbsf**

UNIT 6: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–4E

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	1–3	0.7	<0.1	0.2	Subhedral to euhedral; commonly in glomerocrysts

The least altered region (in the pillow interior) may contain some unaltered olivine.

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture.

VESICLES: Nonvesicular.

COLOR: Medium gray (N5) to medium light gray (N6); glassy margins are black (N1). Spherulitic regions are brownish yellow (10YR 6/6).

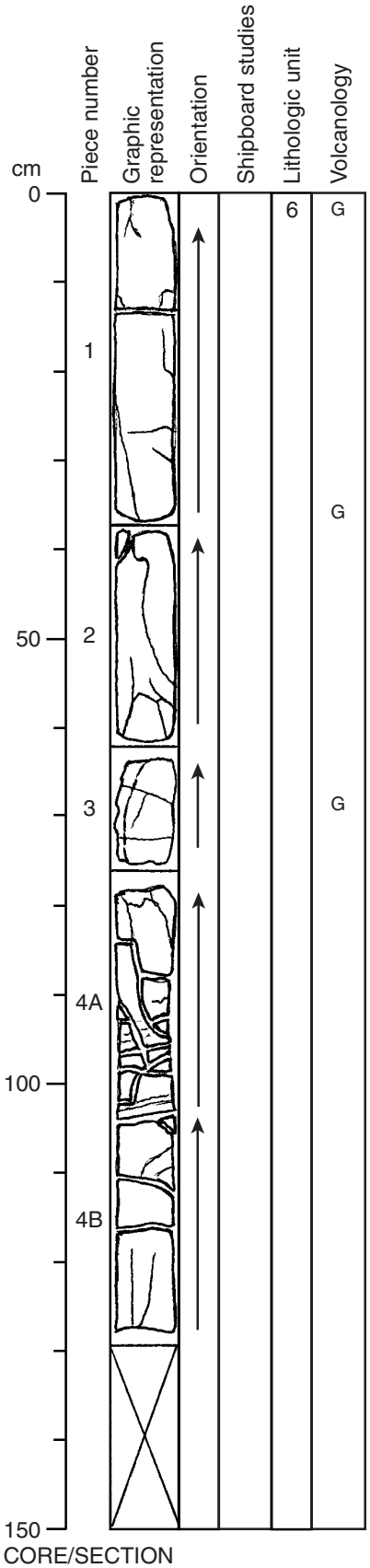
STRUCTURE: Pillowed. The top of Piece 1 and the bottom of Piece 4E have glassy margins; a section through one complete pillow is present.

ALTERATION: Slight in the pillow interior to high near the pillow margins. Olivine is replaced by Fe oxyhydroxide in the spherulitic regions and by black and green clay in the fine-grained pillow interior.

VEINS/FRACTURES: Sparsely veined in the pillow interior; highly veined near pillow margins. Veins are <1–8 mm wide and are filled with white carbonate, green and black clay, and Fe oxyhydroxide.

COMMENTS: Rare irregular miarolitic cavities (≤2 mm) in Piece 1 are filled with white carbonate and green clay.

Core Photo



192-1187A-10R-4 **Section Top: 446.12 mbsf**

UNIT 6: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–4B

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	1–4	0.5	0.1	0.2	Subhedral to euhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Spherulites in aphanitic regions are commonly coalesced; fine-grained regions have variolitic texture.

VESICLES: Nonvesicular.

COLOR: Medium light gray (N6) to brownish yellow (10YR 6/6).

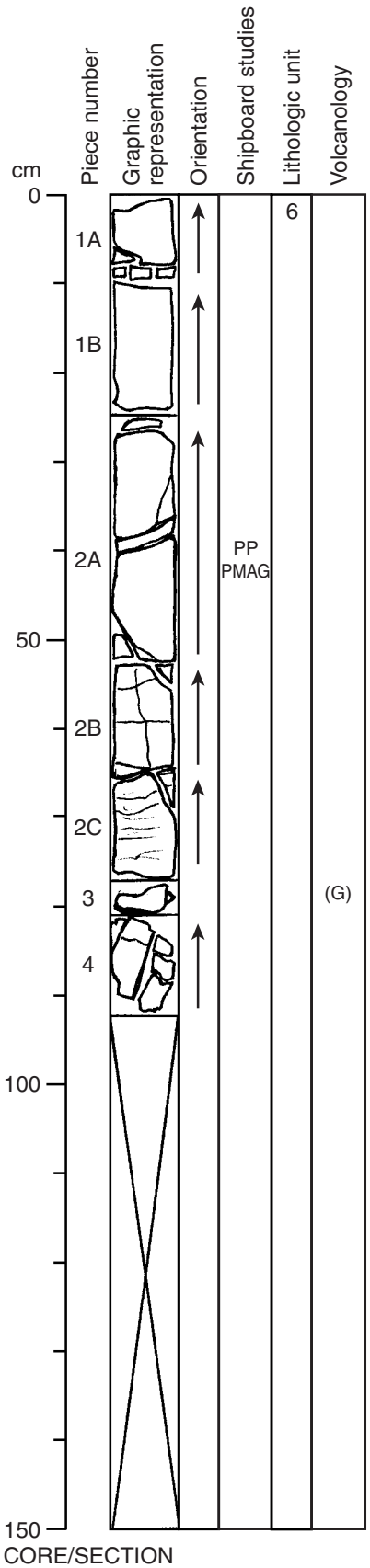
STRUCTURE: Pillowed. Glassy margins and grain size variations suggest that each piece represents a single pillow. The pillow in Piece 4 is incomplete.

ALTERATION: Slight to high. Olivine phenocrysts are replaced by Fe oxyhydroxide and black clay. The groundmass is stained by Fe oxyhydroxide.

VEINS/FRACTURES: Sparsely to highly veined. Piece 4B has the least veins. Veins are <1–5 mm wide and are filled with white carbonate and black oxides.

COMMENTS: Irregular miarolitic cavities (≤5 mm in diameter) are locally abundant in pillow interiors (Pieces 1B and 2); some miarolitic cavities are interconnected.

Core Photo



192-1187A-10R-5 **Section Top: 447.41 mbsf**

UNIT 6: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–4

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	1–3		<0.5		Subhedral to euhedral

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture.

VESICLES: Nonvesicular.

COLOR: Light gray (N7) in least altered regions to brownish yellow (10YR 6/6) near pillow margins.

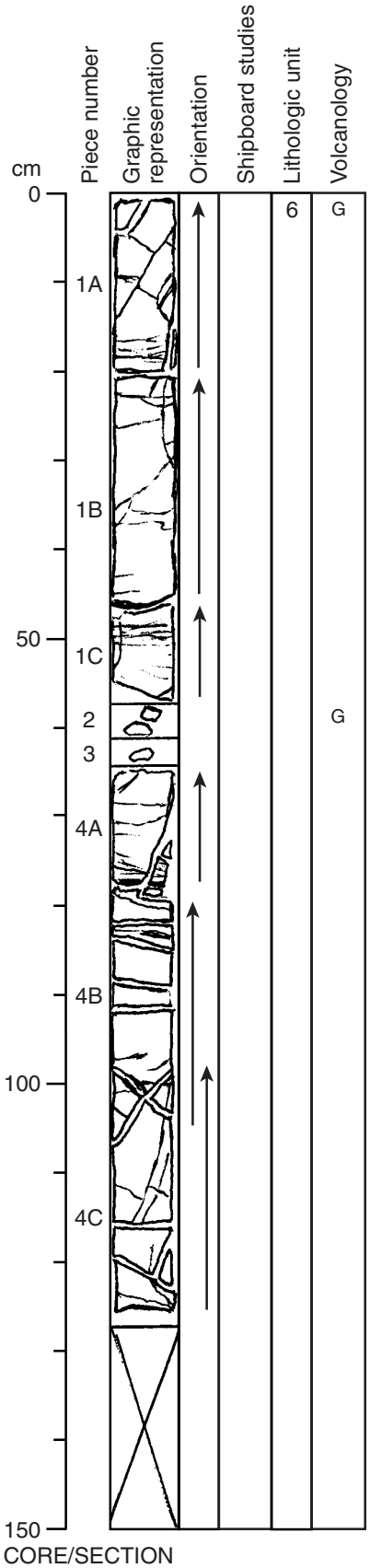
STRUCTURE: Pillowed. A glassy margin is present in Piece 3, and grain size variations are consistent with a pillowed sequence.

ALTERATION: Slight; high near pillow margins. Olivine is replaced by brown clay and Fe oxyhydroxide near pillow margins and by dark green clay in fine-grained pillow interiors.

VEINS/FRACTURES: Sparsely to moderately veined. Piece 2C has the most veins. Veins are <1–2 mm wide and are filled with white carbonate and dark green clay.

COMMENTS: Elongate (maximum size 2 x 15 mm) subangular miarolitic cavities are present at the base of Piece 1B.

Core Photo



192-1187A-10R-6 **Section Top: 448.32 mbsf**

UNIT 6: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–4C

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	1–3	1	<0.5	~0.5	Euhedral to subhedral

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture.

VESICLES: Nonvesicular. Sparsely vesicular in aphanitic margins. Vesicles (<1 to 2 mm wide) are elongate to equant and are filled with white carbonate.

COLOR: Medium gray (N5) to brownish yellow (10YR 6/6) near pillow margins.

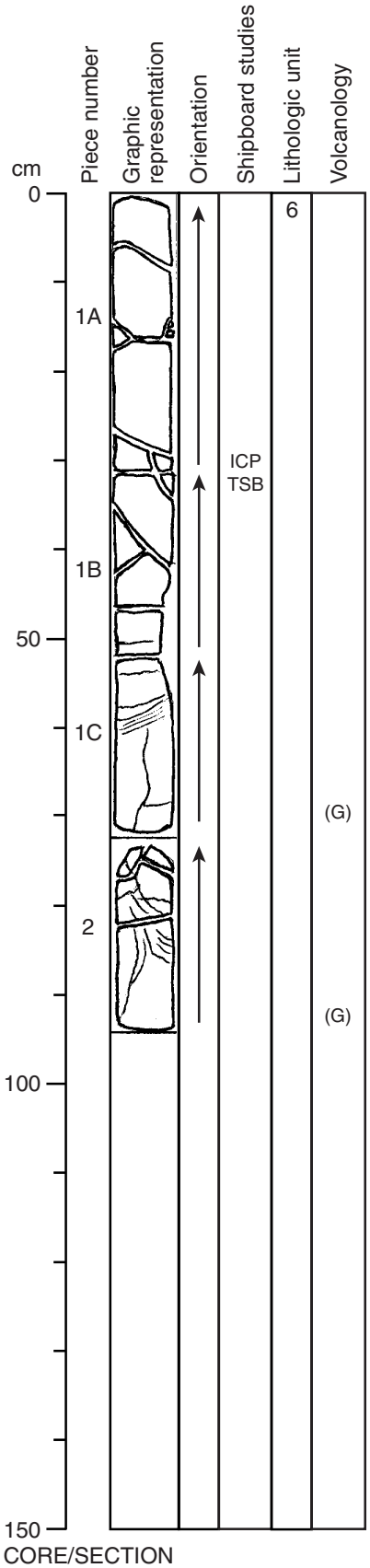
STRUCTURE: Pillowed. Unaltered glass is present at the top of Piece 1A and in Piece 2.

ALTERATION: Slight to moderate. Aphanitic regions are stained by Fe oxyhydroxide. Olivine phenocrysts are replaced by Fe oxyhydroxide and brown clay in aphanitic margins and by dark green clay in fine-grained pillow interiors.

VEINS/FRACTURES: Sparsely to moderately veined. Veins are <1–2 mm wide and are filled with white carbonate ± dark green, black, and brown clay.

COMMENTS: Miarolitic cavities (1–12 mm diameter) in pillow interiors (Pieces 1B and 4C) are filled with white carbonate.

Core Photo



192-1187A-10R-7 **Section Top: 449.59 mbsf**

UNIT 6: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–2

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	1–4	2	<0.5	<0.5	Subhedral to euhedral; rarely in glomerocrysts

Unaltered olivine phenocrysts are present in the least altered regions (e.g., Piece 1A). Olivine phenocrysts are unevenly distributed.

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture.

VESICLES: Nonvesicular.

COLOR: Medium light gray (N6) to brownish yellow (10YR 6/6) near pillow margins.

STRUCTURE: Pillowed. A glassy margin is present at the base of Pieces 1C and 2, and grain size variations are consistent with a pillowed sequence.

ALTERATION: Slight to high near pillow margins. Olivine is replaced by brown clay and Fe oxyhydroxide in aphanitic pillow margins and by dark green clay in less altered regions.

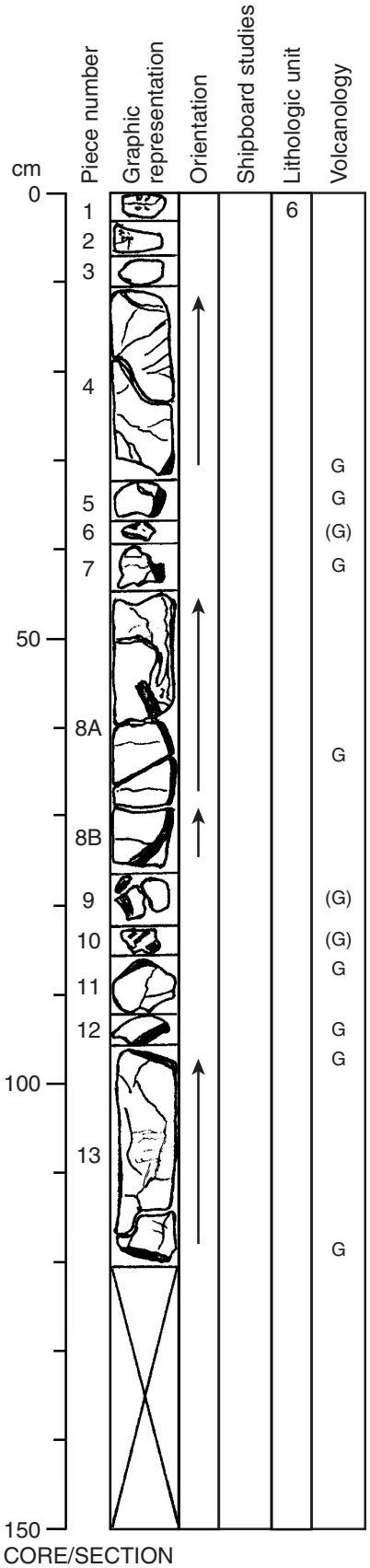
VEINS/FRACTURES: Sparsely to highly veined. Piece 1C has the most veins. Veins are <1–10 mm wide and are filled with white carbonate, dark green clay, and pink carbonate.

COMMENTS: Rare, isolated miarolitic cavities (<1 mm) are present adjacent to the glassy margin at the base of Piece 2.

Description of thin section at 30-32 cm

Whole-rock ICP-AES data

Core Photo



192-1187A-11R-1 **Section Top: 451.50 mbsf**

UNIT 6: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–13

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	1–3	0.8	<0.1	0.2	Subhedral to euhedral

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture.

VESICLES: Nonvesicular. Rare round vesicles (<1 mm) are filled with pale green clay.

COLOR: Medium gray (N5) and yellowish brown (10YR 5/6) to very pale brown (10YR 7/4).

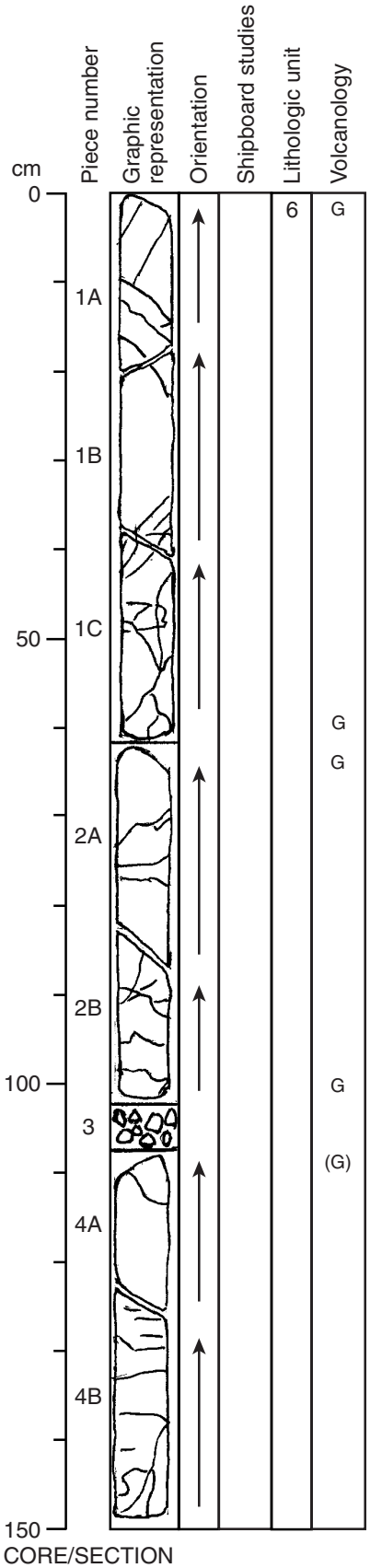
STRUCTURE: Pillowed. Pieces 4–13 contain glass. Pieces 6 and 10 are hyaloclastite consisting of altered olivine-phyric glass cemented by crystalline white carbonate and minor pink clay. Pieces 8A and 8B contain a curved pillow margin. In Piece 8A, aphanitic basalt is present on both sides of a finger of glass that extends into the center of the core; this represents a new pillow 'breaking out' from the lower pillow.

ALTERATION: Moderate to high. Olivine is replaced by Fe oxyhydroxide and yellow-green clay. Spherulites are stained by Fe oxyhydroxide.

VEINS/FRACTURES: Moderately to highly veined. Veins are <1–5 mm wide and are filled with white carbonate and yellow clay.

COMMENTS: Pieces 1 and 2 contain abundant irregular miarolitic cavities (≤4 mm) that are filled with white carbonate; some miarolitic cavities are interconnected.

Core Photo



192-1187A-11R-2 **Section Top: 452.70 mbsf**

UNIT 6: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–4B

CONTACTS: None.

PHENOCRYSTS:

	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	3–5	0.8	<0.5	0.5	Subhedral to euhedral; rarely in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture.

VESICLES: Nonvesicular. Rare round vesicles (<1 mm) are present near the glassy margin.

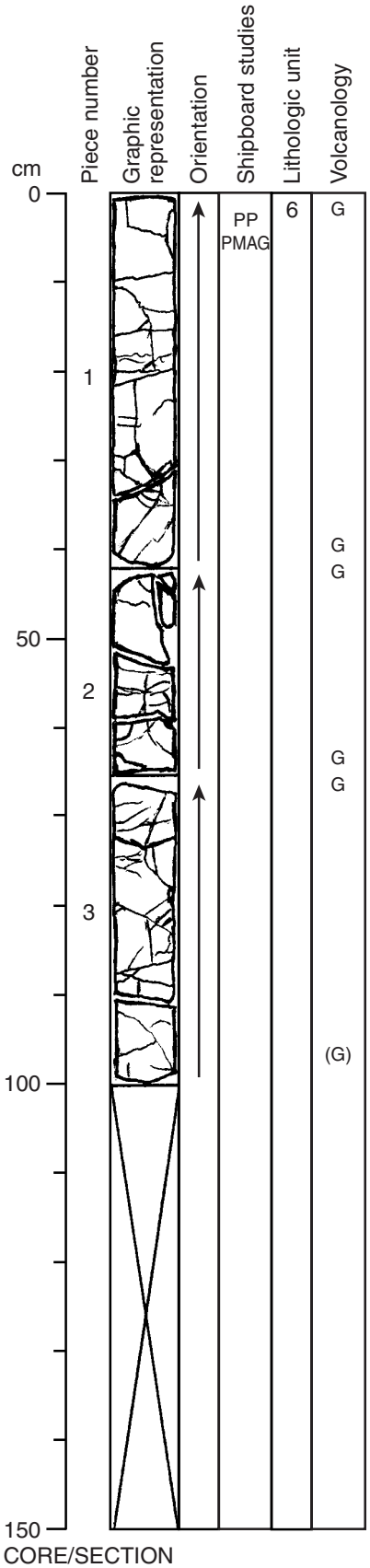
COLOR: Light yellowish brown (2.5Y 6/3) to medium light gray (N6).

STRUCTURE: Pillowed. Unaltered glass is present at the top and bottom of each of Pieces 1 and 2. Altered glass is present at the top of Piece 4B. One fragment of Piece 3 is hyaloclastite.

ALTERATION: Moderate. Fe oxyhydroxide stains the spherulites near pillow margins. Olivine is replaced by brown clay and Fe oxyhydroxide in the aphanitic pillow margins and by green clay and Fe oxyhydroxide in fine-grained pillow interiors.

VEINS/FRACTURES: Moderately veined. Veins are <1–5 mm wide and are filled with white carbonate ± black, brown, and green clay.

Core Photo



192-1187A-11R-3 **Section Top: 454.20 mbsf**

UNIT 6: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–3

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	1–3	1	<0.1	0.1	Subhedral to euhedral; commonly in glomerocrysts

GROUNDMASS: Mostly aphanitic, with spherulitic texture. Parts of Pieces 1 and 3 are fine grained.

VESICLES: Nonvesicular.

COLOR: Light yellowish brown (2.5Y 6/4) and medium light gray (N6).

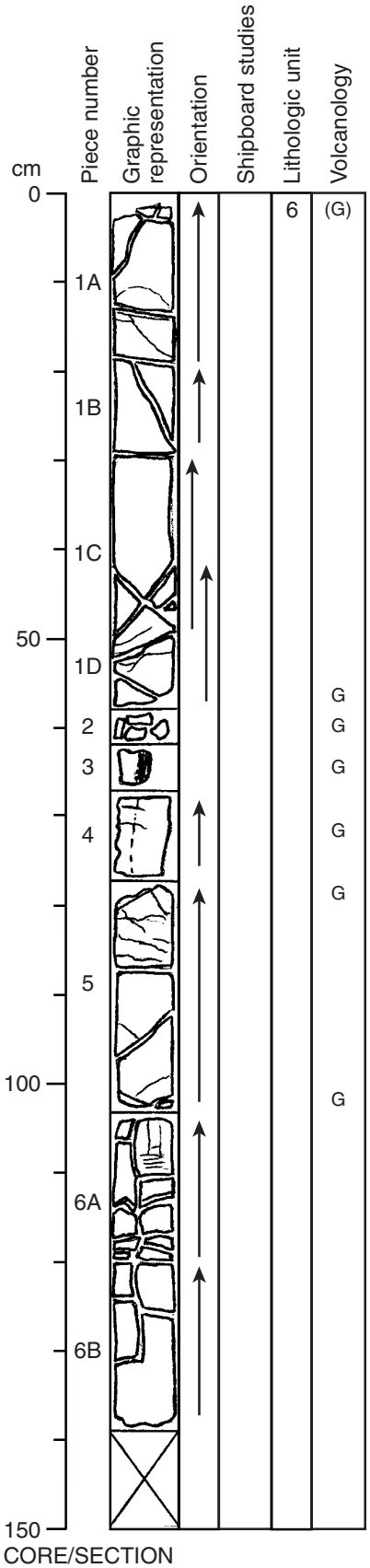
STRUCTURE: Pillowed. Each of Pieces 1, 2, and 3 is a distinct pillow with a glassy upper and lower margin.

ALTERATION: High. Olivine is replaced by green clay and Fe oxyhydroxide.

VEINS/FRACTURES: Highly veined. Veins are <1–2 mm wide and are filled with green and black clay, white carbonate, and Fe oxyhydroxide.

COMMENTS: Rare irregular miarolitic cavities (≤1 mm) are filled with white carbonate; the miarolitic cavities are more common in spherulitic regions.

Core Photo



192-1187A-11R-4 **Section Top: 455.20 mbsf**

UNIT 6: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–6B

CONTACTS: None.

PHENOCRYSTS:	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	2–3	0.6	<0.1	0.2	Euhedral to subhedral

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture.

VESICLES: Nonvesicular.

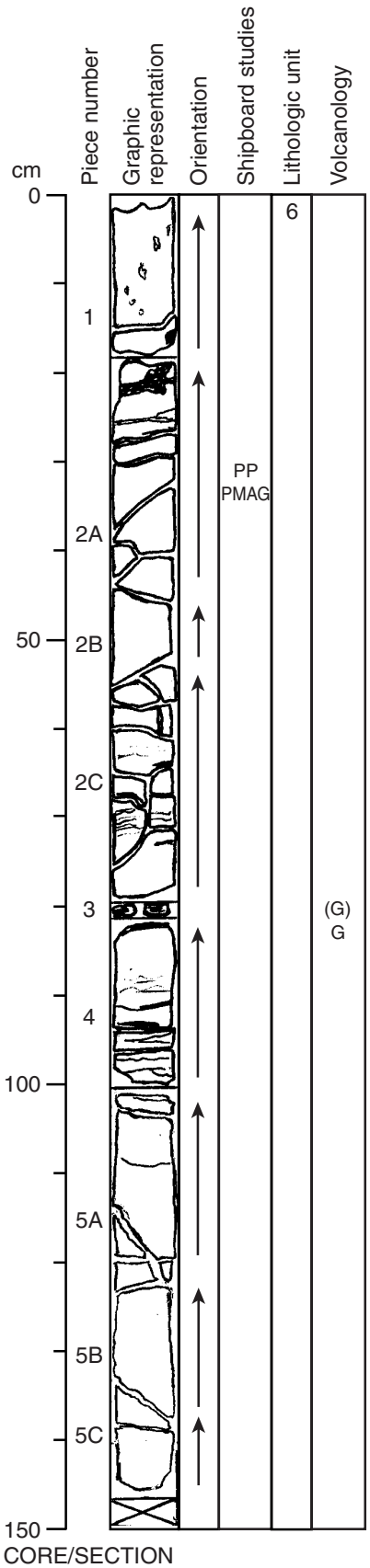
COLOR: Medium gray (N5) to brownish yellow (10YR 6/6).

STRUCTURE: Pillowed. Glassy margins are present in Pieces 1A, 1D, and 2–5. Pieces 1 and 5 are complete sections through pillows.

ALTERATION: Slight to high. Spherulites are highlighted by Fe oxyhydroxide. Olivine phenocrysts are replaced by Fe oxyhydroxide or black clay.

VEINS/FRACTURES: Sparsely to highly veined. Veins are <1–3 mm wide and are filled with white carbonate. A vein in Piece 1A cuts the altered glassy margin and is filled with pink and white carbonate.

Core Photo



192-1187A-11R-5 **Section Top: 456.60 mbsf**

UNIT 6: SPARSELY OLIVINE-PHYRIC BASALT

Pieces: 1–5C

CONTACTS: None.

PHENOCRYSTS:

	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	2	0.8	<0.5	0.5	Subhedral to euhedral

GROUNDMASS: Aphanitic.

VESICLES: Nonvesicular. Rare vesicles are present near glassy margins; they are <0.5 mm in diameter and are filled with white carbonate.

COLOR: Medium light gray (N6) to light yellowish brown (10YR 6/4).

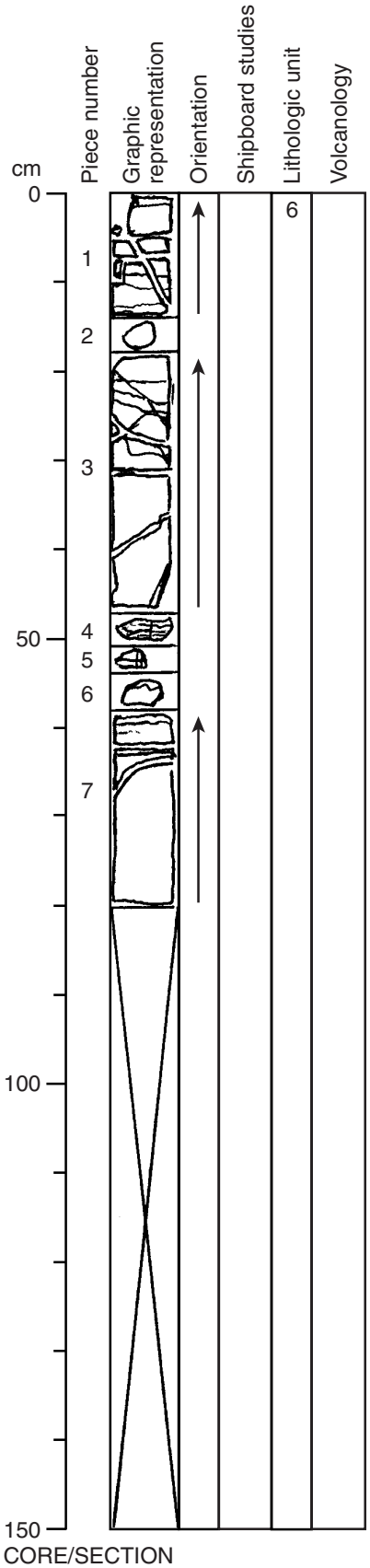
STRUCTURE: Pillowed. Unaltered glass is present at the top of Piece 4. Piece 3 is a hyaloclastite consisting of altered glass cemented by white crystalline carbonate.

ALTERATION: Slight to moderate. Groundmass is stained by Fe oxyhydroxide near veins and in pillow margins. Olivine is replaced by brown clay and Fe oxyhydroxide.

VEINS/FRACTURES: Sparsely to moderately veined. Veins are <1 mm wide and are filled with white carbonate and brown and dark green clay.

COMMENTS: Miarolitic cavities (1–2.5 mm) are locally abundant in Piece 1 and are filled with white carbonate, Fe oxyhydroxide, and light and dark green clay.

Core Photo



192-1187A-11R-6 **Section Top: 458.04 mbsf**

UNIT 6: APHYRIC TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–7

CONTACTS: None.

PHENOCRYSTS:

	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	<1–3	0.4	<0.1	0.1	Subhedral to euhedral; commonly in glomerocrysts

GROUNDMASS: Mainly fine grained with poorly developed variolitic texture. Pieces 2 and 6 are aphanitic with spherulitic texture.

VESICLES: Nonvesicular.

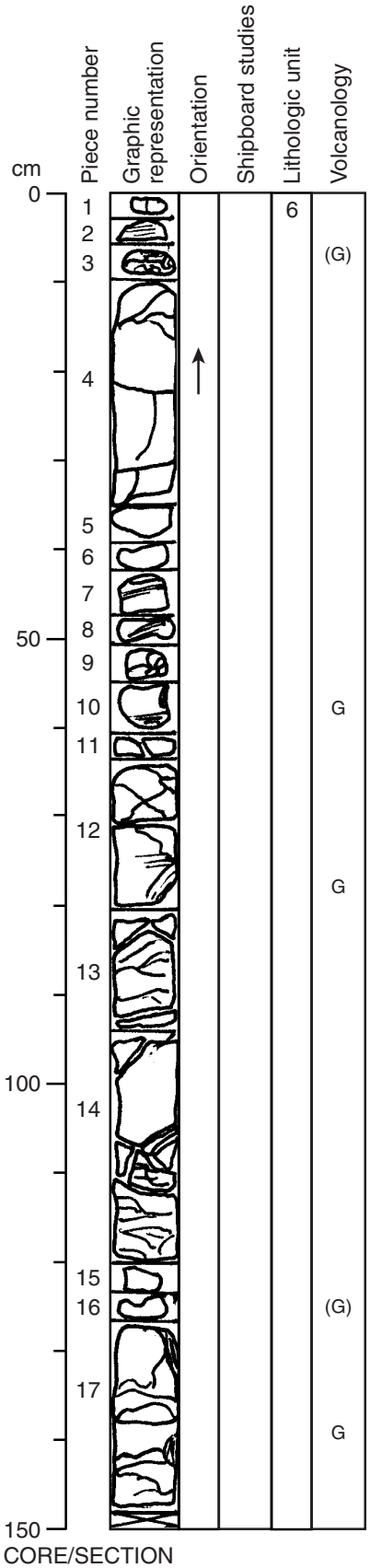
COLOR: Medium gray (N5) to medium light gray (N6) and pale brown (10YR 6/3).

STRUCTURE: Pillowed. Piece 1 (fine-grained) is probably a continuation of a pillow from Section 192-1187A-11R-5. No glassy margins are present.

ALTERATION: Slight; moderate near veins. Olivine is replaced by green and black clay and Fe oxyhydroxide.

VEINS/FRACTURES: Sparsely to moderately veined. Veins are <1–4 mm wide and are filled with white carbonate, Fe oxyhydroxide, green and black clay, and zeolite(?).

Core Photo



192-1187A-12R-1 **Section Top: 461.10 mbsf**

UNIT 6: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–17

CONTACTS: None.

PHENOCRYSTS:	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	2–4	1.2	0.3	0.6	Euhedral to subhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have poorly developed variolitic texture. Plagioclase laths ≤1.3 mm long are present.

VESICLES: Nonvesicular. Rare, subround, irregular vesicles adjacent to glassy margins are filled with carbonate.

COLOR: Medium gray (N5) to yellowish brown (10YR 5/4).

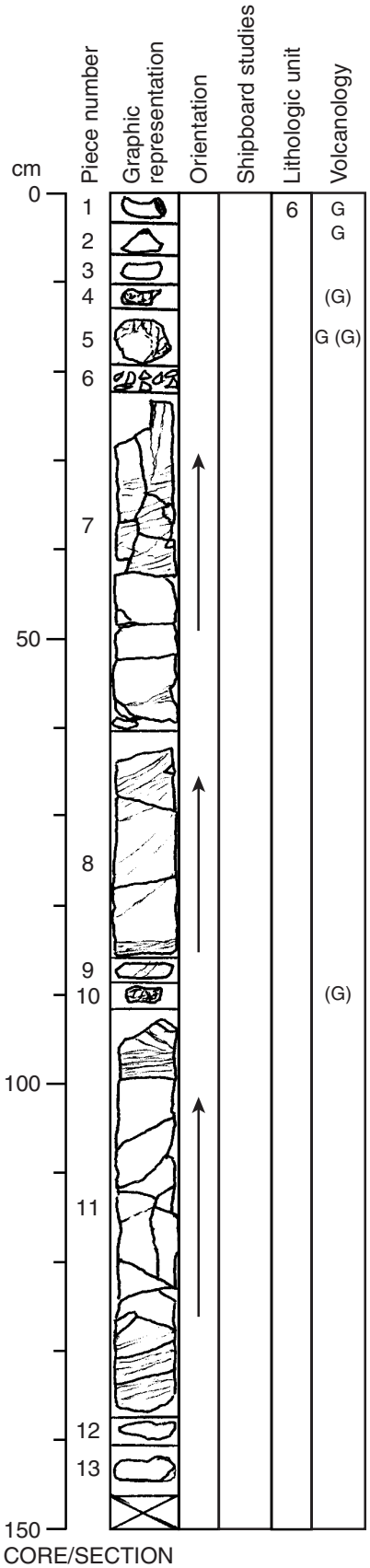
STRUCTURE: Pillowed. Glassy margins are present on Pieces 10, 12, and 17.

ALTERATION: Slight to high. Groundmass and olivine phenocrysts are replaced by Fe oxyhydroxide in aphanitic regions, and by dark green clay in fine-grained regions.

VEINS/FRACTURES: Sparsely to moderately veined. Veins are <1–3 mm wide and are filled with carbonate and green clay.

COMMENTS: Pieces 3 and 16 are small fragments of inter pillow hyaloclastite consisting of altered glass (now green and red clay) in a carbonate matrix.

Core Photo



192-1187A-12R-2 **Section Top: 462.58 mbsf**

UNIT 6: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–13

CONTACTS: None.

PHENOCRYSTS:	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	1–3	0.9	0.3	0.5	Subhedral to euhedral; commonly in glomerocrysts

Fine-grained regions have rare olivine phenocrysts with unaltered cores.

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture.

VESICLES: Nonvesicular. Rare, subround vesicles (≤1 mm) in aphanitic margins are filled with carbonate.

COLOR: Medium light gray (N6) to yellowish brown (10YR 5/4).

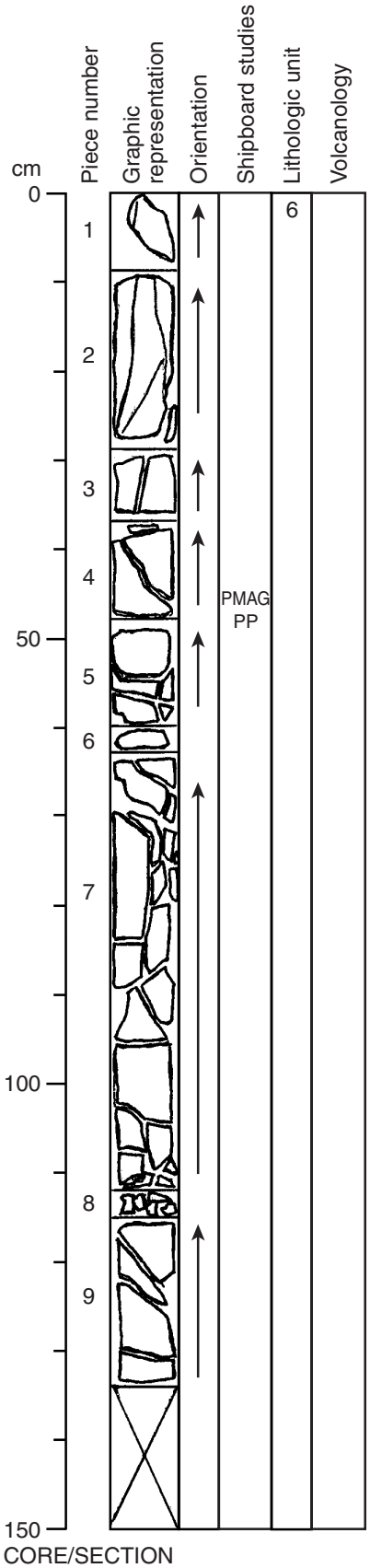
STRUCTURE: Pillowed. Glassy margins are present on Pieces 1, 2, and 5.

ALTERATION: Moderate to high. Brown oxidation halos are present adjacent to veins. Olivine phenocrysts are replaced by Fe oxyhydroxide and green clay.

VEINS/FRACTURES: Moderately veined. Veins (<1–3 mm wide) are parallel to pillow margins and are filled with black clay and calcite.

COMMENTS: Pieces 4 and 10 are hyaloclastite consisting of glass fragments (altered to green and red clay) in a carbonate matrix.

Core Photo



192-1187A-12R-3 **Section Top: 464.04 mbsf**

UNIT 6: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–9

CONTACTS: None.

PHENOCRYSTS:

	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	1–5	0.7	0.3	0.5	Euhedral to subhedral

Olivine phenocrysts are unevenly distributed.

GROUNDMASS: Fine grained. Piece 1 has variolitic texture.

VESICLES: Nonvesicular.

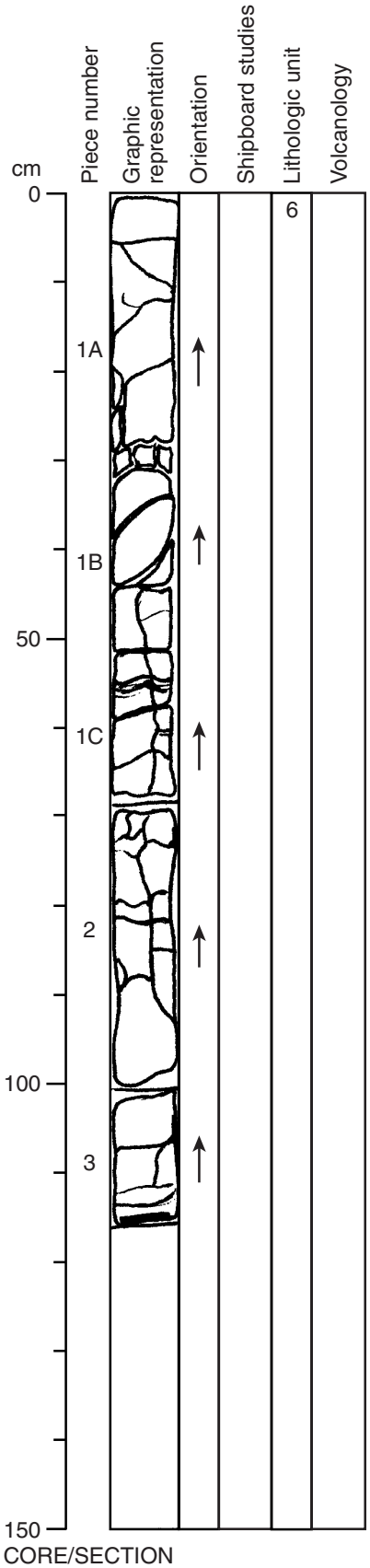
COLOR: Medium light gray (N6) to medium gray (N5).

STRUCTURE: Massive.

ALTERATION: Moderate. Olivine phenocrysts are replaced by green clay adjacent to veins.

VEINS/FRACTURES: Sparsely veined. Veins are <1–7 mm wide and are filled with carbonate, sulfide, and black clay.

Core Photo



192-1187A-12R-4 **Section Top: 465.39 mbsf**

UNIT 6: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–3

CONTACTS: None.

PHENOCRYSTS:

	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	1–3	2	0.5	0.8	Euhedral; commonly in glomerocrysts

GROUNDMASS: Fine grained, with variolitic texture.

VESICLES: Nonvesicular.

COLOR: Medium light gray (N6).

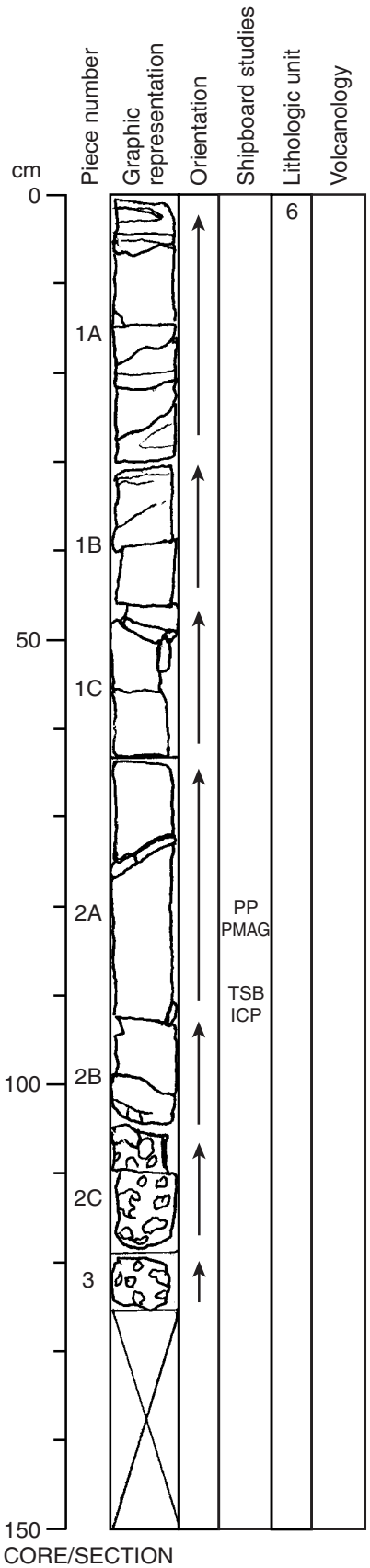
STRUCTURE: Massive.

ALTERATION: Slight to moderate. Olivine phenocrysts are replaced by Fe oxyhydroxide and green clay.

VEINS/FRACTURES: Sparsely veined. Veins are <1–10 mm wide and are filled with Fe oxyhydroxide and carbonate.

COMMENTS: Rare, irregular miarolitic cavities (1–5 mm) are filled with zeolite and green clay.

Core Photo



192-1187A-12R-5 **Section Top: 466.55 mbsf**

UNIT 6: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–3

CONTACTS: None.

PHENOCRYSTS:

	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	3–5	1.2	0.2	0.5	Euhedral to subhedral

Unaltered olivine may be present away from veins.

GROUNDMASS: Fine grained, with poorly developed variolitic texture.

VESICLES: Nonvesicular.

COLOR: Medium gray (N5).

STRUCTURE: Massive.

ALTERATION: Slight to moderate. Brown alteration halos are present adjacent to veins. Olivine phenocrysts are highlighted by alteration and are replaced by dark green clay.

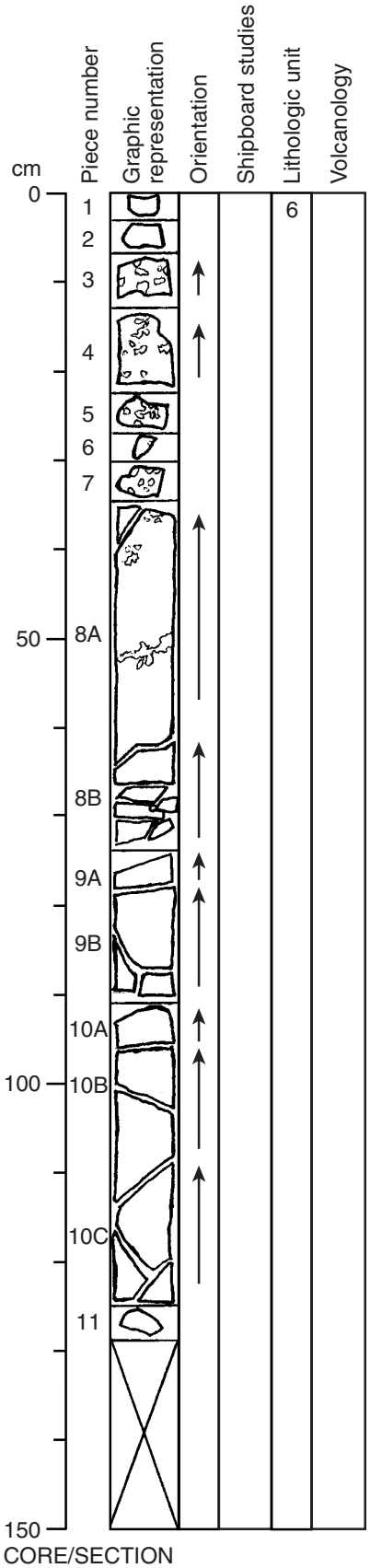
VEINS/FRACTURES: Sparsely veined. Veins are <1–8 mm wide and are filled with zeolite, carbonate and green clay.

COMMENTS: Large (≤2 x 1 cm), irregular miarolitic cavities in Pieces 2B, 2C, and 3 are filled with white carbonate and zeolite.

Description of thin section at 90-93 cm

Whole-rock ICP-AES data

Core Photo



192-1187A-13R-1 **Section Top: 470.70 mbsf**

UNIT 6: MODERATELY OLIVINE–PHYRIC BASALT

Pieces: 1–11

CONTACTS: None.

PHENOCRYSTS:	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	2–7	1.0	0.2	0.5	Euhedral to subhedral; commonly in glomerocrysts

Unaltered olivine is present in Pieces 10A–C. Olivine phenocrysts are most abundant near miarolitic cavities.

GROUNDMASS: Fine grained, with variolitic texture. Plagioclase laths ≤1.5 mm long are present.

VESICLES: Nonvesicular.

COLOR: Medium light gray (N6) to light gray (N7).

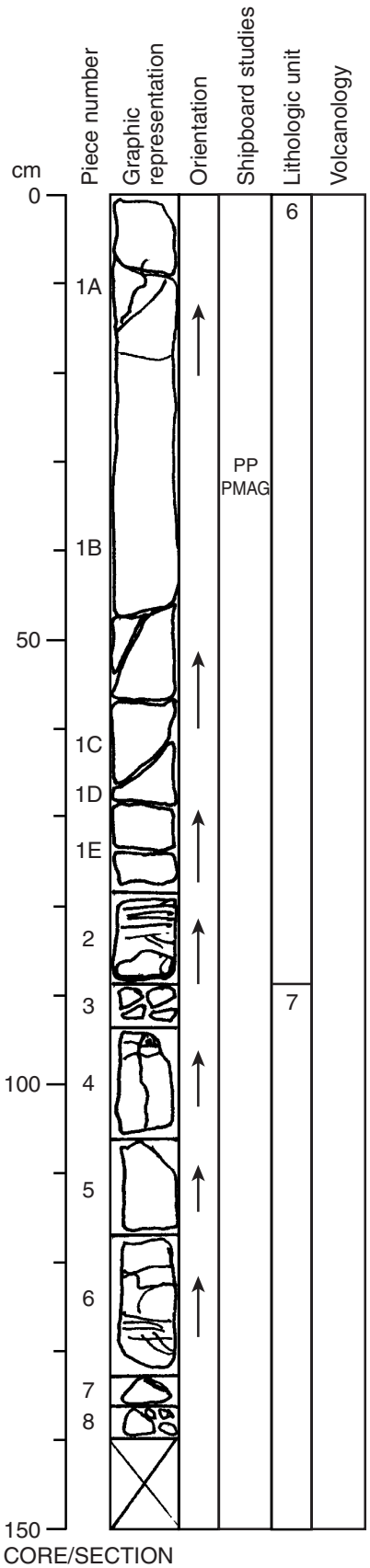
STRUCTURE: Massive.

ALTERATION: Complete in Pieces 1 and 2; slight in Pieces 3–11 except adjacent to veins and miarolitic cavities, where alteration is moderate. Olivine phenocrysts adjacent to veins are replaced by green clay.

VEINS/FRACTURES: Sparsely veined. Veins are <1–3 mm wide and are filled with carbonate and green clay.

COMMENTS: Irregular miarolitic cavities (≤10 mm) are moderately abundant in Pieces 3–6 and 7A and are filled with carbonate, Fe oxyhydroxide, and minor zeolite.

Core Photo



192-1187A-13R-2 **Section Top: 471.99 mbsf**

UNIT 6: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–2

CONTACTS: Not recovered. The contact between Units 6 and 7 is inferred to be between Pieces 2 and 3.

PHENOCRYSTS:	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	2–6	1.5	0.2	0.6	Euhedral to subhedral; commonly in glomerocrysts

Unaltered olivine is present away from veins.

GROUNDMASS: Fine grained to aphanitic. Aphanitic near the chilled base of Unit 6. Fine-grained regions have poorly developed variolitic texture.

VESICLES: Nonvesicular.

COLOR: Medium light gray (N6).

STRUCTURE: Massive.

ALTERATION: Slight; moderate adjacent to veins. Olivine phenocrysts adjacent to veins are replaced by dark green clay.

VEINS/FRACTURES: Sparsely to moderately veined. Veins are <1–2 mm wide and are filled with carbonate, zeolite, green clay, and Fe oxyhydroxide.

UNIT 7: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 3–8

CONTACTS: Not recovered. The contact between Units 6 and 7 is inferred to be between Pieces 2 and 3.

PHENOCRYSTS:	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	1–3	1	0.3	0.5	Euhedral; commonly in glomerocrysts

GROUNDMASS: Fine grained, with variolitic texture.

VESICLES: Nonvesicular.

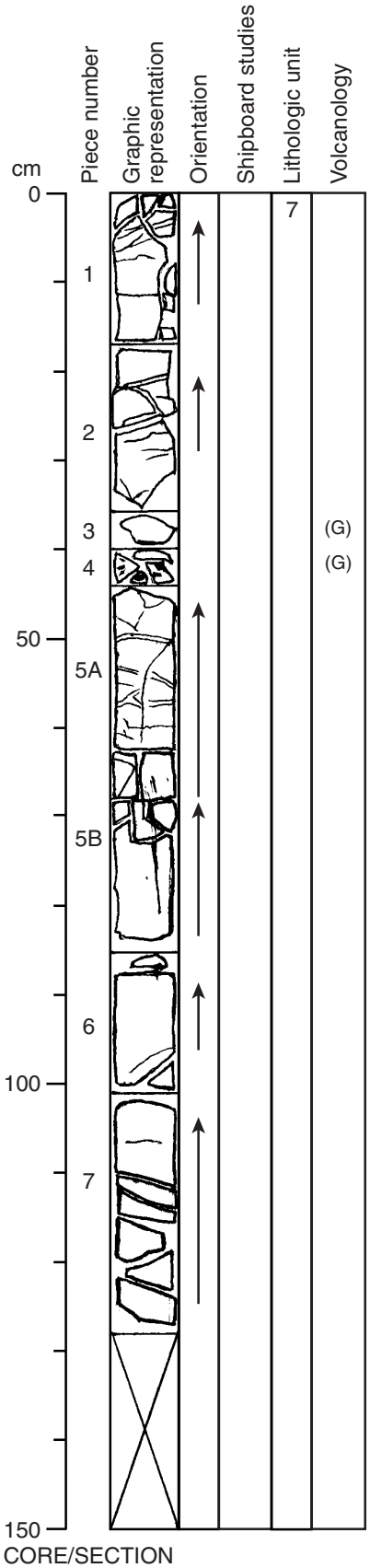
COLOR: Medium gray (N5) to medium light gray (N6).

STRUCTURE: Pillowed. No glassy margins are present, but groundmass grain size variations are consistent with pillow structure.

ALTERATION: Slight to moderate. Olivine phenocrysts are replaced by dark green clay.

VEINS/FRACTURES: Slightly to moderately veined. Veins are <1–2 mm wide and are filled with carbonate, green clay, and Fe oxyhydroxide.

Core Photo



192-1187A-13R-3 **Section Top: 473.38 mbsf**

UNIT 7: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–7

CONTACTS: None.

PHENOCRYSTS:

	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	5	0.8	0.3	0.5	Euhedral to subhedral

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have poorly developed variolitic texture.

VESICLES: Nonvesicular.

COLOR: Medium light gray (N6) to brownish yellow (10YR 6/6).

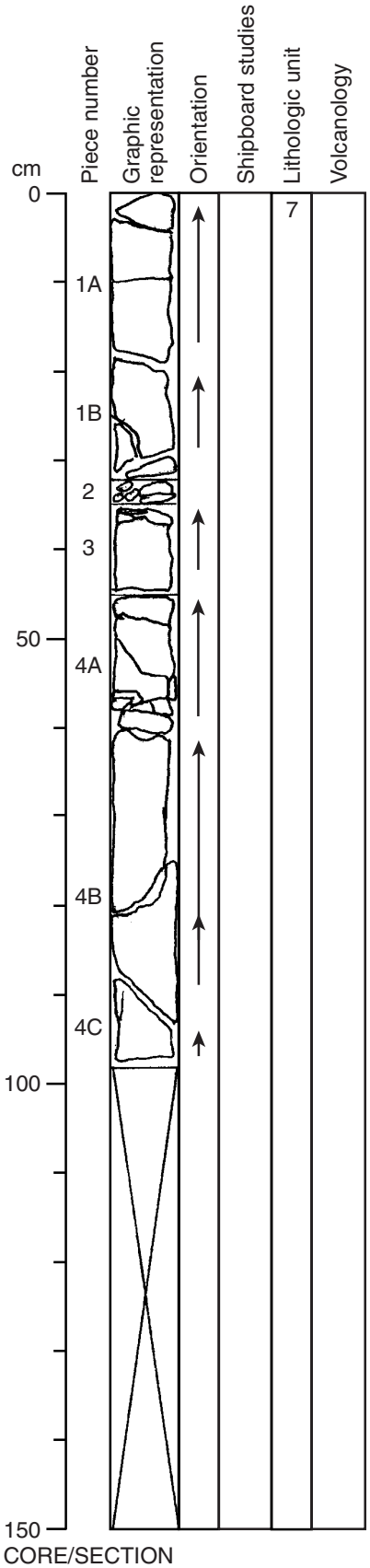
STRUCTURE: Pillowed. Glassy margins are present on Pieces 3 and 4.

ALTERATION: Slight to high. Olivine phenocrysts are replaced by Fe oxyhydroxide and green clay.

VEINS/FRACTURES: Pieces 1–5A are highly veined; Pieces 5B–7 are sparsely veined. Veins are <1–2 mm wide and are filled with carbonate, Fe oxyhydroxide, and green clay.

COMMENTS: Piece 4 is hyaloclastite consisting of altered glass and aphanitic basalt clasts in a carbonate matrix.

Core Photo



192-1187A-13R-4 **Section Top: 474.67 mbsf**

UNIT 7: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–4C

CONTACTS: None.

PHENOCRYSTS:

	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	3–7	1	0.2	0.5	Euhedral to subhedral; commonly in glomerocrysts

Unaltered olivine is present away from veins.

GROUNDMASS: Fine grained, with poorly developed variolitic texture.

VESICLES: Nonvesicular.

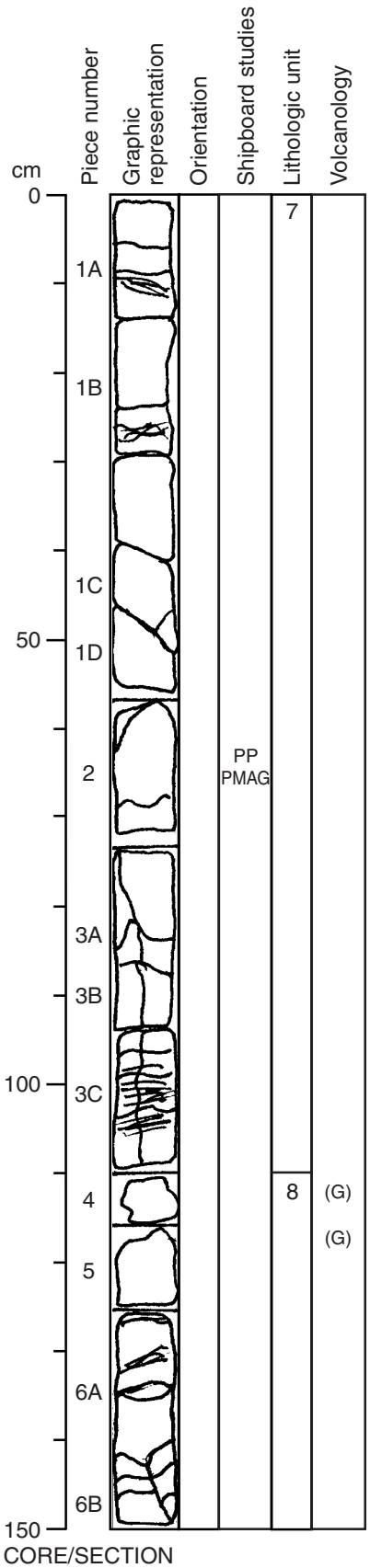
COLOR: Medium light gray (N6).

STRUCTURE: Massive.

ALTERATION: Slight to moderate. Alteration is moderate within brown halos. Olivine phenocrysts are replaced by dark green clay adjacent to veins.

VEINS/FRACTURES: Sparsely veined. Veins are <1–4 mm wide and are filled with carbonate, zeolite, dark green clay, and Fe oxyhydroxide.

Core Photo



192-1187A-13R-5 **Section Top: 475.67 mbsf**

UNIT 7: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–3C

CONTACTS: Not recovered. The contact between Units 7 and 8 is inferred to be between Pieces 3C and 4.

PHENOCRYSTS:	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	1–3	1	0.3	0.8	Euhedral; commonly in glomerocrysts

GROUNDMASS: Fine grained, with variolitic texture.

VESICLES: Nonvesicular.

COLOR: Medium light gray (N6) to light yellowish brown (10YR 6/4).

STRUCTURE: Massive.

ALTERATION: Moderate. Olivine phenocrysts are replaced by dark green clay.

VEINS/FRACTURES: Moderately veined. Veins are <1–3 mm wide and are filled with carbonate.

UNIT 8: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 4–6B

CONTACTS: Not recovered. The contact between Units 7 and 8 is inferred to be between Pieces 3C and 4.

PHENOCRYSTS:	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	3–5	1	0.3	0.8	Euhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have poorly developed variolitic texture.

VESICLES: Nonvesicular.

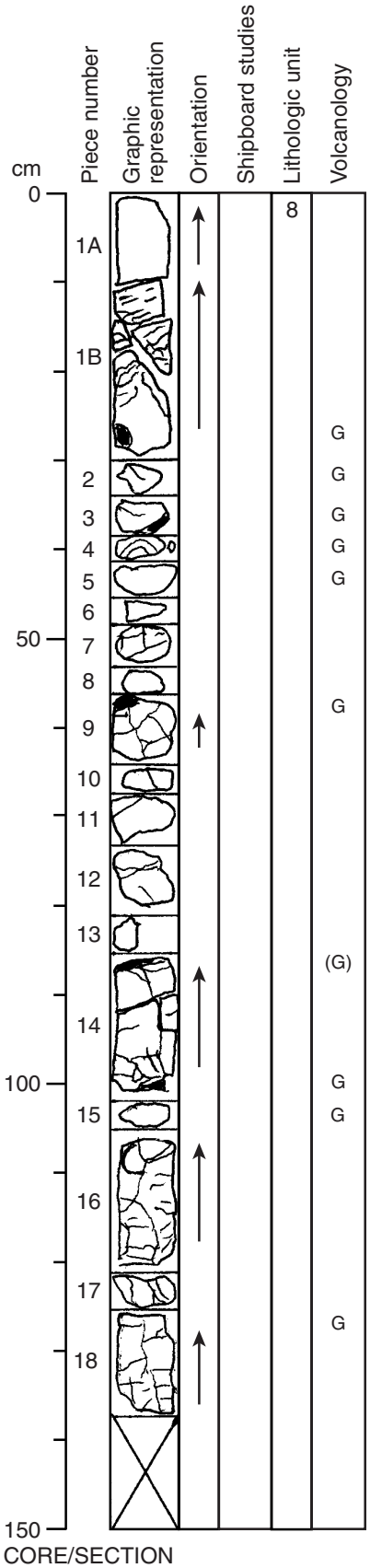
COLOR: Brownish yellow (10YR 6/6) to medium light gray (N6).

STRUCTURE: Pillowed. Altered glassy margins are present on Pieces 4 and 5.

ALTERATION: Moderate. Staining by Fe oxyhydroxide is extensive. Olivine phenocrysts are replaced by dark green clay.

VEINS/FRACTURES: Moderately veined. Veins are <1–2 mm wide and are filled with carbonate.

Core Photo



192-1187A-13R-6 **Section Top: 477.17 mbsf**

UNIT 8: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–18

CONTACTS: None.

PHENOCRYSTS:	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	2–5	1	0.2	0.5	Euhedral to subhedral; commonly in glomerocrysts

Unaltered olivine phenocrysts may be present in Piece 1A.

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture.

VESICLES: Nonvesicular.

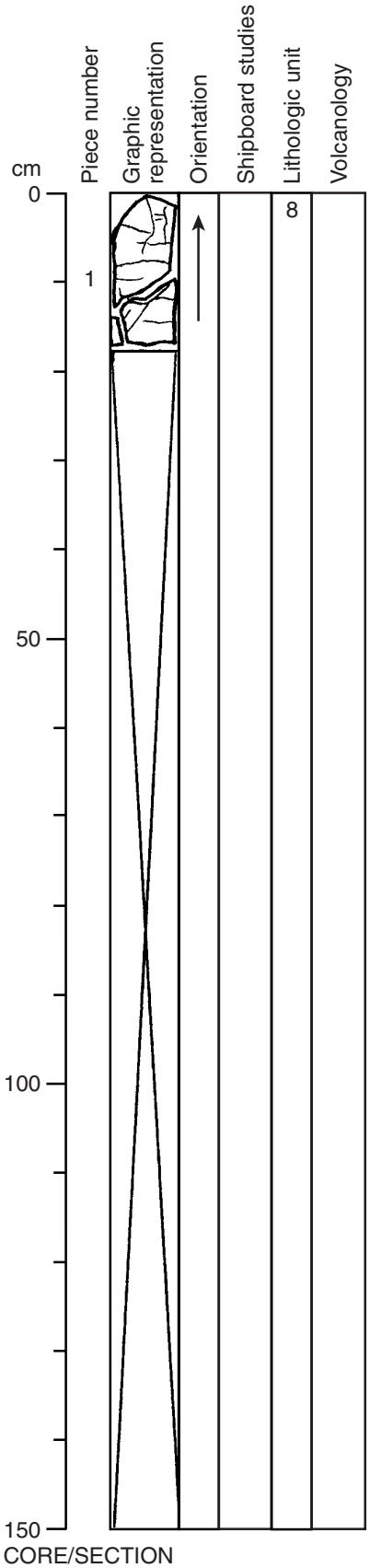
COLOR: Medium light gray (N6) to yellowish brown (10YR 5/4).

STRUCTURE: Pillowed. Glassy margins are present on Pieces 1B–5, 9, 12–14, 15, and 18.

ALTERATION: Slight to complete. Fe-oxyhydroxide highlights spherulites in aphanitic regions. Olivine phenocrysts are replaced by Fe-oxyhydroxide in aphanitic regions and by dark green clay in fine-grained regions.

VEINS/FRACTURES: Sparsely to moderately veined. Veins are <1 to >5 mm wide (one margin is missing for largest vein) and are filled with carbonate, zeolite, Fe-oxyhydroxide and green clay.

Core Photo



192-1187A-13R-7 **Section Top: 478.54 mbsf**

UNIT 8: MODERATELY OLIVINE-PHYRIC BASALT

Piece: 1

CONTACTS: None.

PHENOCRYSTS:

	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	5	0.8	0.3	0.5	Euhedral to subhedral

GROUNDMASS: Fine grained, with variolitic texture.

VESICLES: Nonvesicular.

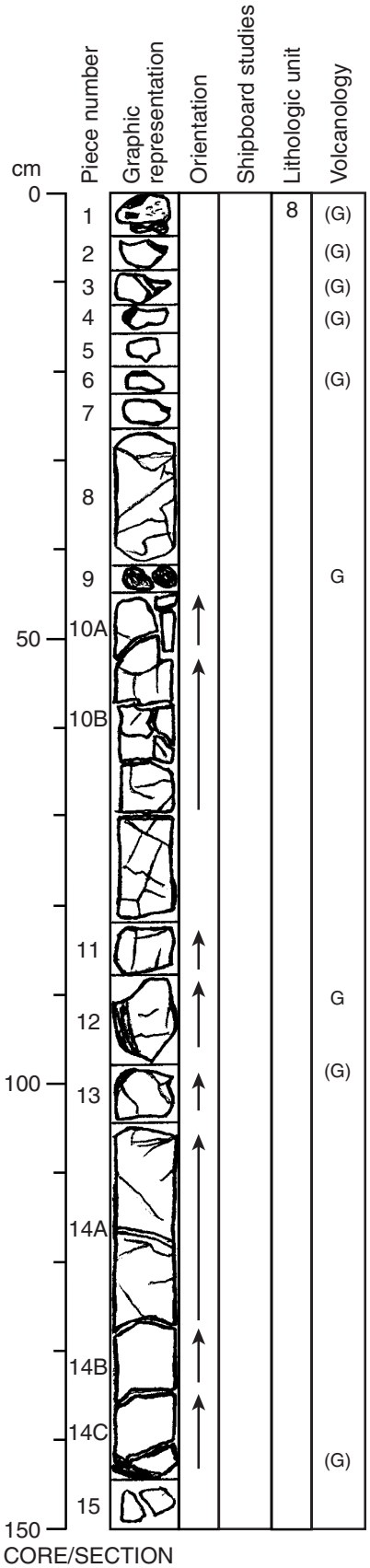
COLOR: Medium gray (N5) to light yellowish brown (10YR 6/4).

STRUCTURE: Massive.

ALTERATION: High. Olivine phenocrysts are replaced by Fe oxyhydroxide.

VEINS/FRACTURES: Highly veined. Veins are ≤1 mm wide and are filled with carbonate.

Core Photo



192-1187A-14R-1 **Section Top: 480.30 mbsf**

UNIT 8: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–15

CONTACTS: None.

PHENOCRYSTS:

	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	1–3	1	<0.2	0.4	Euhedral to subhedral

GROUNDMASS: Aphanitic, with spherulitic texture.

VESICLES: Generally nonvesicular. Rare elongate vesicles (<1 mm) adjacent to glassy pillow margins are filled with carbonate.

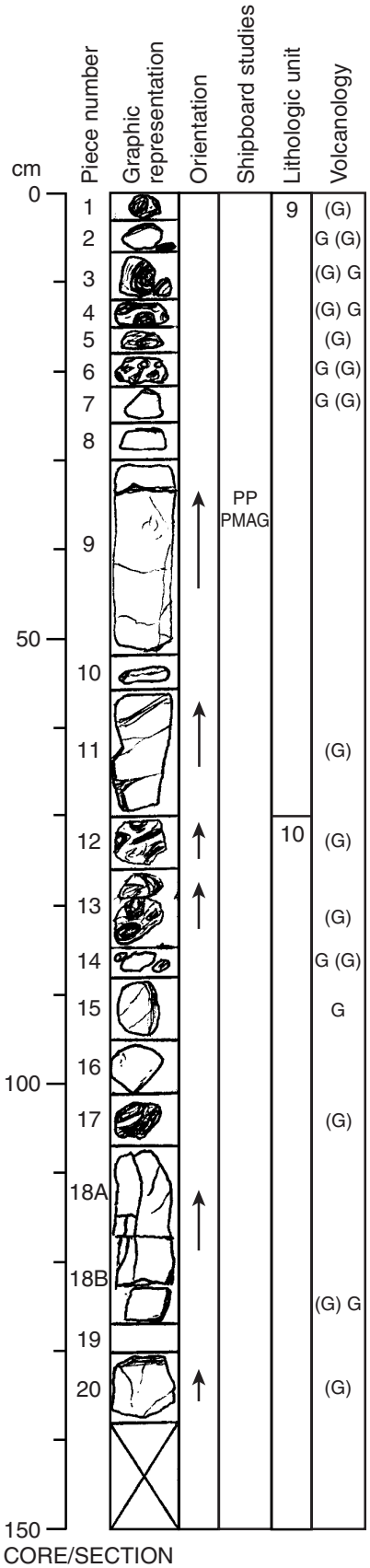
COLOR: Brownish yellow (10YR 6/8) to light yellowish brown (2.5Y 6/3). Glass and altered glass are black (N1) to greenish black (5GY 2/1). Carbonate matrix of Piece 1 is very light gray (N8).

STRUCTURE: Pillowed. Glassy margins are present in Pieces 2–4, 6, 9–10 and 12–15. Piece 1 is hyaloclastite consisting of altered glass clasts in a carbonate matrix.

ALTERATION: Moderate. Olivine is replaced by brown clay and Fe oxyhydroxide in pillow margins and, additionally, by dark green clay toward pillow interiors.

VEINS/FRACTURES: Moderately veined. Veins are <1–6 mm wide and are filled with white carbonate and red clay.

Core Photo



192-1187A-14R-2 **Section Top: 481.80 mbsf**

UNIT 9: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–11

CONTACTS: Not recovered. The contact between Units 8 and 9 is inferred to be at the top of Section 192-1187A-14R-2. The contact between Units 9 and 10 is inferred to be between Pieces 11 and 12. Both contacts are defined by the presence of a significant interval of hyaloclastite.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	1–3	0.8	<0.1	~0.1	Subhedral to euhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic; some regions near pillow margins have spherulitic texture.

VESICLES: Nonvesicular. Rare elongate vesicles (≤1 mm) in the least altered part of the glass and in aphanitic regions are filled with carbonate and green and brown clay.

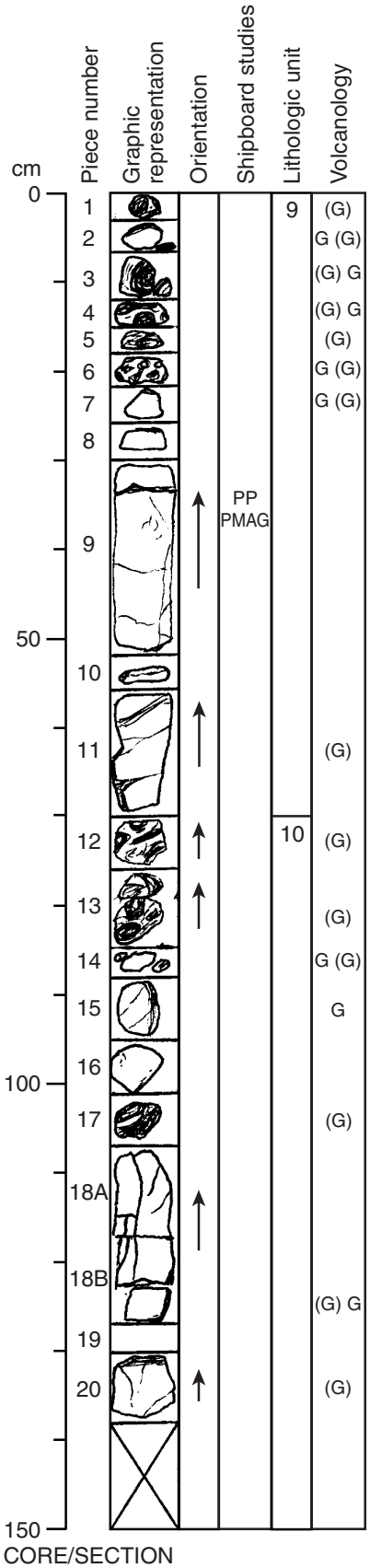
COLOR: Greenish black (5GY 2/1 and 5G 2/1) and light yellowish brown (10YR 6/4).

STRUCTURE: Pillowed. Altered glassy margins are present on Pieces 7 and 11. Pieces 1–6 are hyaloclastite consisting of altered glass fragments cemented by calcite.

ALTERATION: High to complete. Glass is altered to green and black clay; pyrite is associated with the black clay. Olivine is replaced by Fe oxyhydroxide and green clay.

VEINS/FRACTURES: Moderately to highly veined. Veins are <1–12 mm wide and are filled with calcite, green and brown clay, and Fe oxyhydroxide. Native copper is present in Piece 11 near a vein.

Core Photo



192-1187A-14R-2 **Section Top: 481.80 mbsf**

UNIT 10: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 12–20

CONTACTS: Not recovered. The contact between Units 9 and 10 is inferred to be between Pieces 11 and 12 and is defined by the presence of a significant interval of hyaloclastite.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	1–3	0.8	<0.1	0.1	Subhedral to euhedral

GROUNDMASS: Aphanitic, with spherulites near pillow margins.

VESICLES: Nonvesicular. Rare elongate vesicles (<1 mm) near the glassy margins are filled with carbonate.

COLOR: Greenish black (5GY 2/1 and 5G 2/1), light yellowish brown (10YR 6/4), and dark grayish brown (10YR 4/2).

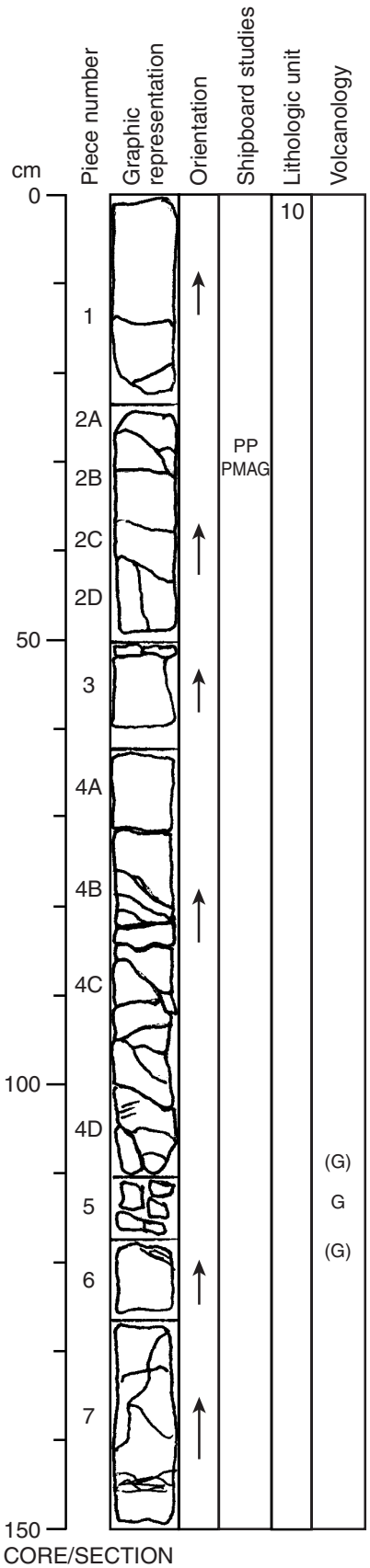
STRUCTURE: Pillowed. Glassy margins are present in Pieces 14, 15, 18, and 20. Pieces 12, 13, and 17 are hyaloclastite consisting of altered glass clasts cemented by carbonate; minor red clay is present Piece 13.

ALTERATION: Moderate to high. Glass is altered to green and black clay. Olivine is replaced by Fe oxyhydroxide and green clay.

VEINS/FRACTURES: Moderately veined. Veins are <1–2.5 mm wide and are filled with calcite, Fe oxyhydroxide, and green and black clay.

COMMENTS: Rare, irregular miarolitic cavities (≤ 1.5 x 2.5 mm) are filled with calcite, green clay and Fe oxyhydroxide (e.g., Piece 18).

Core Photo



192-1187A-14R-3 **Section Top: 483.18 mbsf**

UNIT 10: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–7

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	2–5	0.8	<0.5	<0.5	Subhedral to euhedral; rarely in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture. Euhedral sulfide crystals (1.5 mm) are present in the groundmass (e.g., Piece 3).

VESICLES: Generally nonvesicular. A subround 3-mm vesicle and some <2-mm irregular vesicles in Piece 6 are filled with white carbonate.

COLOR: Medium light gray (N6) in least altered regions to brownish yellow (10YR 6/6) near pillow margins.

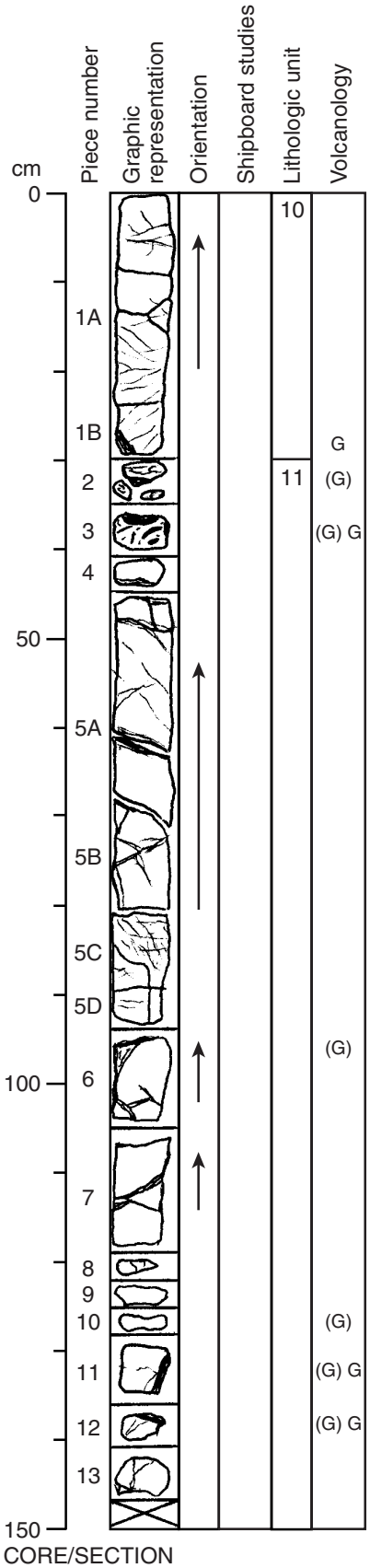
STRUCTURE: Pillowed. Glassy margins are present on Pieces 4D and 6, and grain size variations are consistent with pillow structure.

ALTERATION: Moderate; high near veins and pillow margins. Olivine is replaced by brown clay and Fe oxyhydroxide in aphanitic regions and by dark green clay in fine-grained pillow interiors.

VEINS/FRACTURES: Moderately to highly veined. Pieces 1, 4B, and 4C have the most veins. Veins are <1–2 mm wide and are filled with white carbonate and dark green clay.

COMMENTS: Rare miarolitic cavities (≤1 mm) in Pieces 2C, 2D, 3, and 7 are commonly interconnected.

Core Photo



192-1187A-14R-4 **Section Top: 484.68 mbsf**

UNIT 10: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–1B

CONTACTS: Not recovered. The contact between Units 10 and 11 is inferred to be between Pieces 1B and 2, and is defined by the presence of a significant interval of hyaloclastite.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	1–5	1.0	<0.5	<0.5	Subhedral to euhedral; rarely in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture.

VESICLES: Nonvesicular.

COLOR: Medium light gray (N6) to brownish yellow (10YR 6/6).

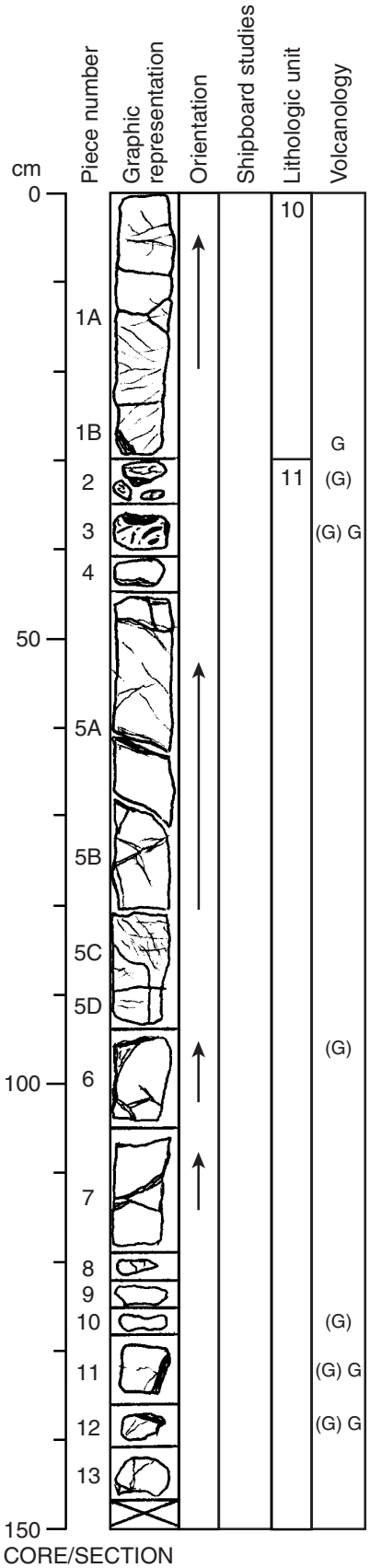
STRUCTURE: Pillowed. A glassy margin is present at the base of Piece 1B, and grain size variations are consistent with pillow structure.

ALTERATION: Moderate; high near pillow margins. Olivine is replaced by brown clay and Fe oxyhydroxide in aphanitic areas and by dark green clay in fine-grained pillow interiors.

VEINS/FRACTURES: Moderately veined. Veins are <1–3 mm wide and are filled with white carbonate and dark green clay.

COMMENTS: Interconnected miarolitic cavities (<1 mm) in Piece 1A are filled with dark green clay.

Core Photo



192-1187A-14R-4 **Section Top: 484.68 mbsf**

UNIT 11: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 2–13

CONTACTS: Not recovered. The contact between Units 10 and 11 is inferred to be between Pieces 1B and 2, and is defined by the presence of a significant interval of hyaloclastite.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	1–3	1.5	<0.5	<0.5	Subhedral to euhedral; rarely in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture.

VESICLES: Nonvesicular.

COLOR: Medium gray (N5) in least altered regions to brownish yellow (10YR 6/6) near pillow margins.

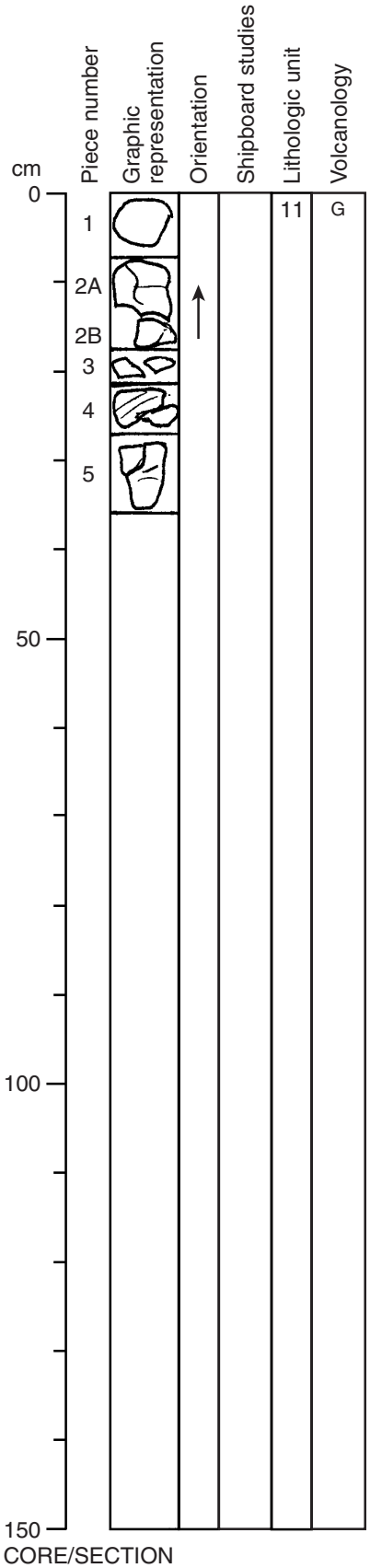
STRUCTURE: Pillowed. Glassy margins are present in Pieces 6 and 10–12, and grain size variations are consistent with pillow structure. Pieces 2 and 3 are hyaloclastite consisting of altered glass clasts in a white carbonate matrix.

ALTERATION: Moderate; high near pillow margins. Olivine is replaced by brown clay and Fe oxyhydroxide in aphanitic regions and by dark green clay in fine-grained regions.

VEINS/FRACTURES: Moderately veined. Piece 5C has the most veins. Veins are <1–4 mm wide and are filled with white carbonate and green clay.

COMMENTS: Interconnected (≤4 mm) miarolitic cavities in Piece 5A are filled with white carbonate and dark green clay.

Core Photo



192-1187A-14R-5 **Section Top: 486.18 mbsf**

UNIT 11: SPARSELY OLIVINE-PHYRIC BASALT

Pieces: 1–5

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	1–2	0.8	<0.5	<0.5	Subhedral; rarely in glomerocrysts

GROUNDMASS: Aphanitic with spherulitic texture.

VESICLES: Generally nonvesicular. Rare, elongate vesicles (long axis perpendicular to pillow margin) are present in Piece 1; in Piece 2, elongate vesicles have the long axis parallel to the pillow margin. The vesicles are <1 to 3 mm in diameter and are filled with white carbonate and dark clay.

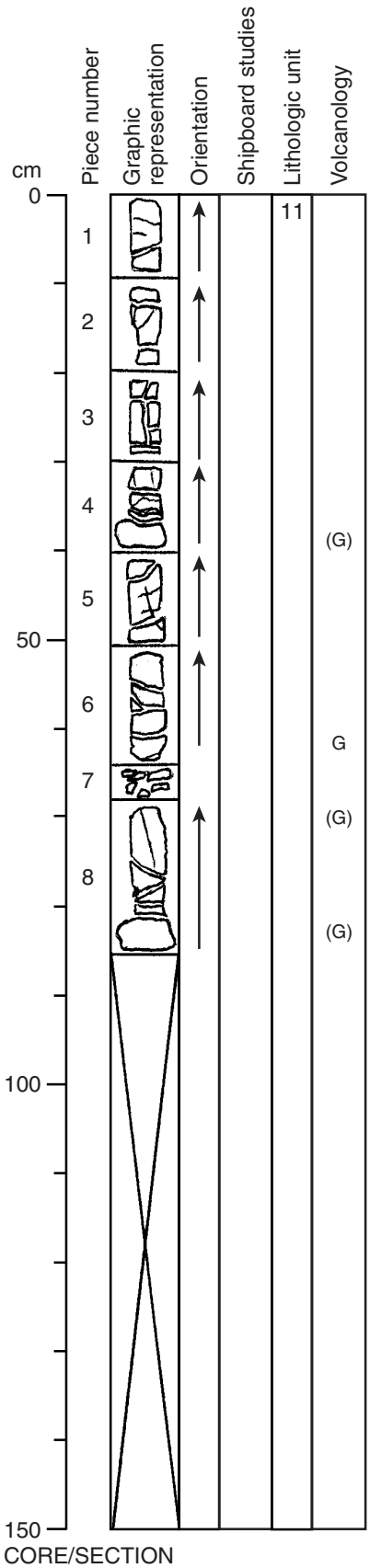
COLOR: Grayish black (N2) to light yellowish brown (2.5Y 6/3) and light olive brown (2.5Y 5/3).

STRUCTURE: Pillowed. Glassy margins are present on Pieces 1 and 2A. Piece 3 is hyaloclastite consisting of altered glass clasts in a white carbonate matrix.

ALTERATION: Moderate. Fe oxyhydroxide stains the groundmass, and olivine is replaced by Fe oxyhydroxide and brown smectite.

VEINS/FRACTURES: Sparsely veined. Veins are <1 mm wide and are filled with white carbonate and dark clay.

Core Photo



192-1187A-15R-1 **Section Top: 490.00 mbsf**

UNIT 11: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–8

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	2–4	0.7	0.1	0.2	Euhedral to subhedral; rarely in glomerocrysts

GROUNDMASS: Aphanitic with spherulitic texture.

VESICLES: Generally nonvesicular. Rare irregular vesicles (<1 mm) in aphanitic regions are filled with white carbonate.

COLOR: Olive yellow (2.5Y 6/6) to light olive brown (2.5Y 5/4).

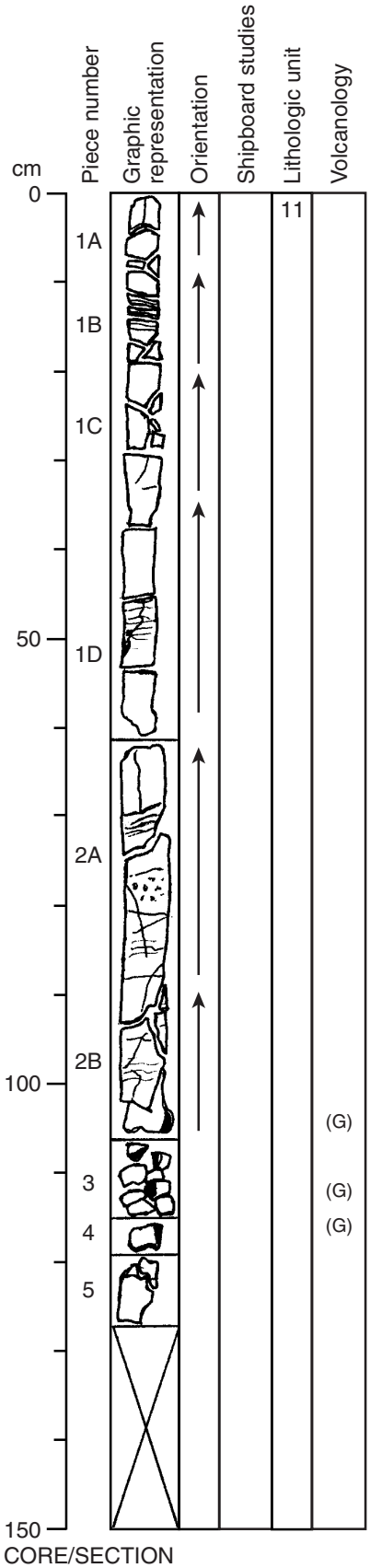
STRUCTURE: Pillowed. Glassy margins are present at the bottom of Pieces 4 and 6, and on the top and bottom of Piece 8.

ALTERATION: High. Fe oxyhydroxide replaces olivine phenocrysts and stains the groundmass.

VEINS/FRACTURES: Moderately to highly veined. Veins are <1–2 mm wide and are filled with white carbonate and brown clay.

COMMENTS: Rare irregular miarolitic cavities (<1 mm) are filled with green clay (e.g., Piece 2).

Core Photo



192-1187A-15R-2 **Section Top: 490.85 mbsf**

UNIT 11: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–5

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	1–4	1.0	<0.5	<0.5	Subhedral to euhedral; rarely in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture.

VESICLES: Nonvesicular.

COLOR: Medium gray (N5) in pillow interiors to light yellowish brown (10YR 6/4) near pillow margins.

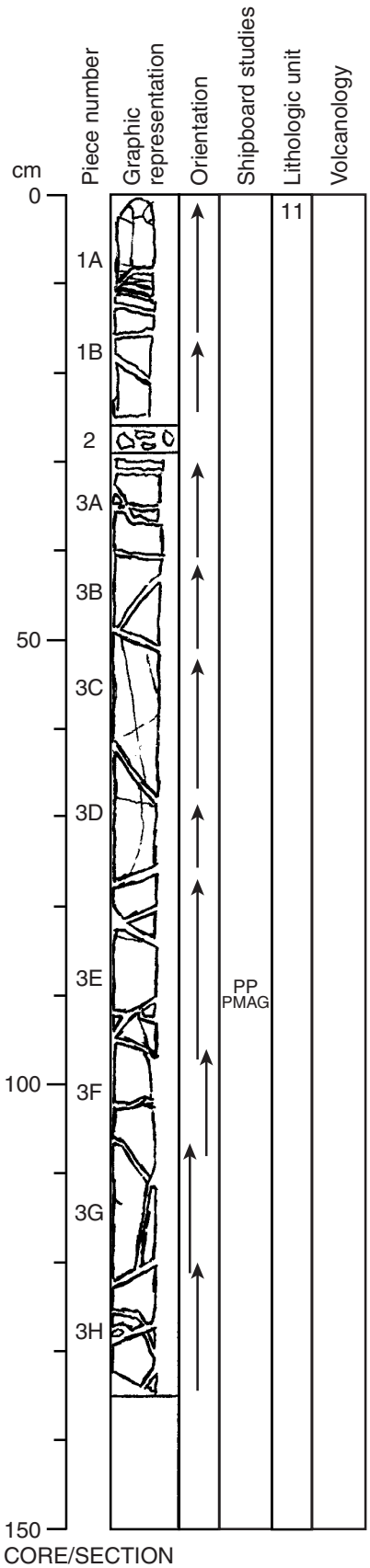
STRUCTURE: Pillowed. Glassy margins are present in Pieces 2B and 4, and grain size variations are consistent with pillow structure.

ALTERATION: Moderate; high near pillow margins. Olivine phenocrysts are replaced by brown clay and Fe oxyhydroxide near pillow margins and by dark green clay in pillow interiors.

VEINS/FRACTURES: Moderately to highly veined. Pieces 1D and 2A have the most veins. Veins are <1–4 mm wide and are filled with white carbonate and dark green clay.

COMMENTS: Interconnected miarolitic cavities (≤3 mm) in pillow interiors (Pieces 1C and 2A) are filled with white carbonate and dark green clay.

Core Photo



192-1187A-15R-3 **Section Top: 492.12 mbsf**

UNIT 11: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–3H

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	1–4	0.8	<0.1	~0.1	Subhedral to euhedral; commonly in glomerocrysts

Unaltered olivine may be present in the fine-grained region, away from veins.

GROUNDMASS: Aphanitic to fine grained. Piece 1A is aphanitic with spherulitic texture.

VESICLES: Nonvesicular.

COLOR: Medium gray (N5), medium light gray (N6), and light yellowish brown (2.5Y 6/3 and 2.5Y 6/4).

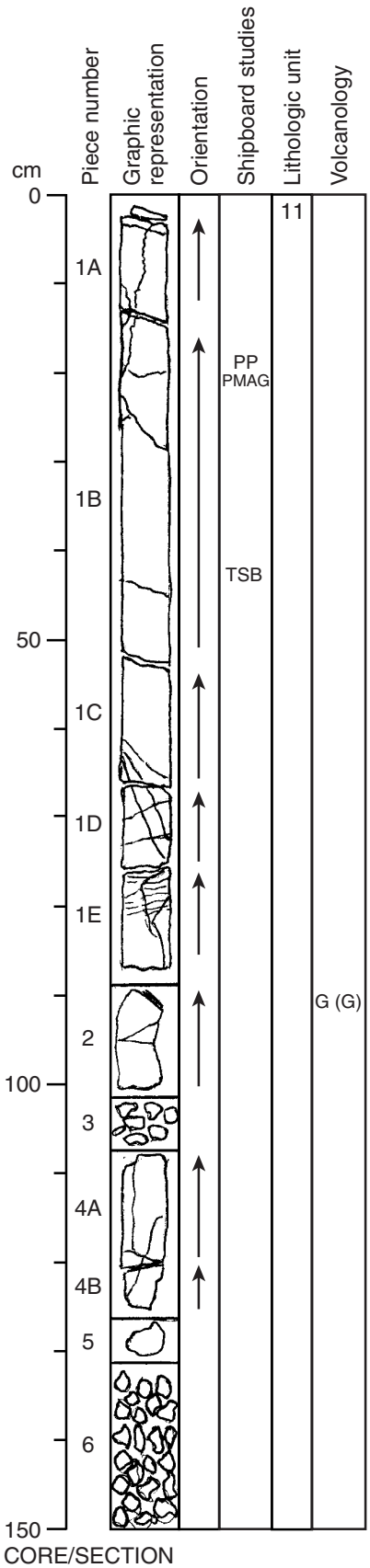
STRUCTURE: Pillowed. Pillow structure is inferred from the presence of the spherulitic zone in Piece 1A; the rest of the section is fine grained.

ALTERATION: Slight to high (Piece 1A). Olivine is replaced by Fe oxyhydroxide in the spherulitic region and by black clay in the fine-grained region.

VEINS/FRACTURES: Sparsely to highly veined. Piece 1A has the most veins. Veins are <1–3 mm wide and are filled with white carbonate, green clay, and Fe oxyhydroxide.

COMMENTS: Rare irregular miarolitic cavities (≤8 x 2 mm) in Pieces 3C and 3D are filled with white carbonate and green and gray clay.

Core Photo



192-1187A-15R-4 **Section Top: 493.47 mbsf**

UNIT 11: SPARSELY OLIVINE-PHYRIC BASALT

Pieces: 1A–6

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	1–2	0.8	<0.2	<0.5	Subhedral to euhedral

GROUNDMASS: Aphanitic to fine grained.

VESICLES: Nonvesicular.

COLOR: Medium light gray (N6) to light brownish gray (2.5Y 6/3).

STRUCTURE: Pillowed. Glass is present at the top of Piece 2.

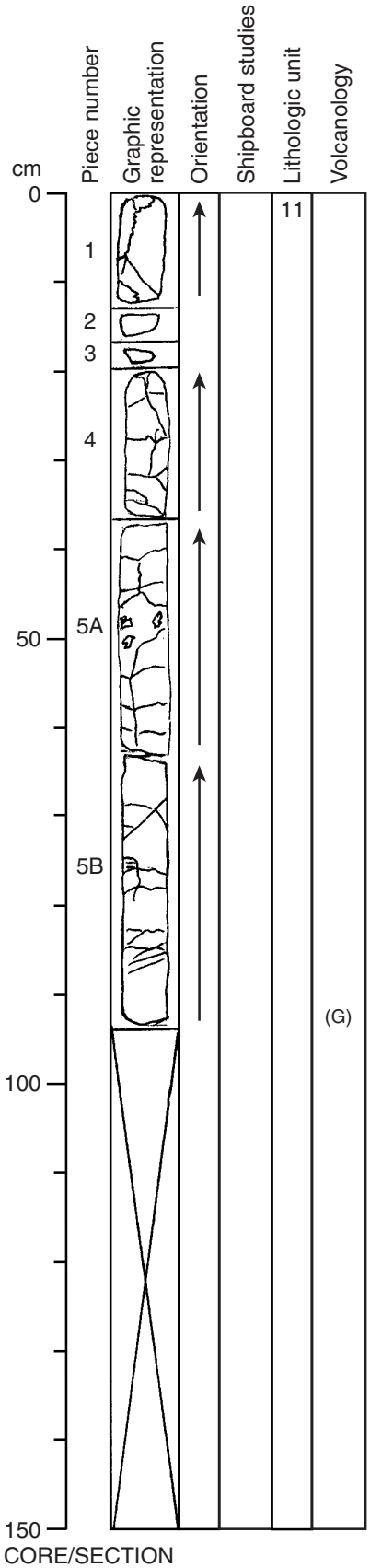
ALTERATION: Slight to moderate. Olivine is replaced by brown clay and Fe oxyhydroxide in pieces that are stained by Fe oxyhydroxide.

VEINS/FRACTURES: Sparsely to moderately veined. Veins are <1–1.5 mm wide and are filled with white carbonate and light green clay.

COMMENTS: Irregular miarolitic cavities (1–5 mm) are locally abundant in Piece 1B and are filled with white carbonate and green clay.

Description of thin section at 42-44 cm

Core Photo



192-1187A-16R-1 **Section Top: 499.70 mbsf**

UNIT 11: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–5B

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	2–6	1.5	0.4	0.8	Euhedral to subhedral; commonly in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture.

VESICLES: Nonvesicular.

COLOR: Medium light gray (N6) to brownish yellow (10YR 6/6).

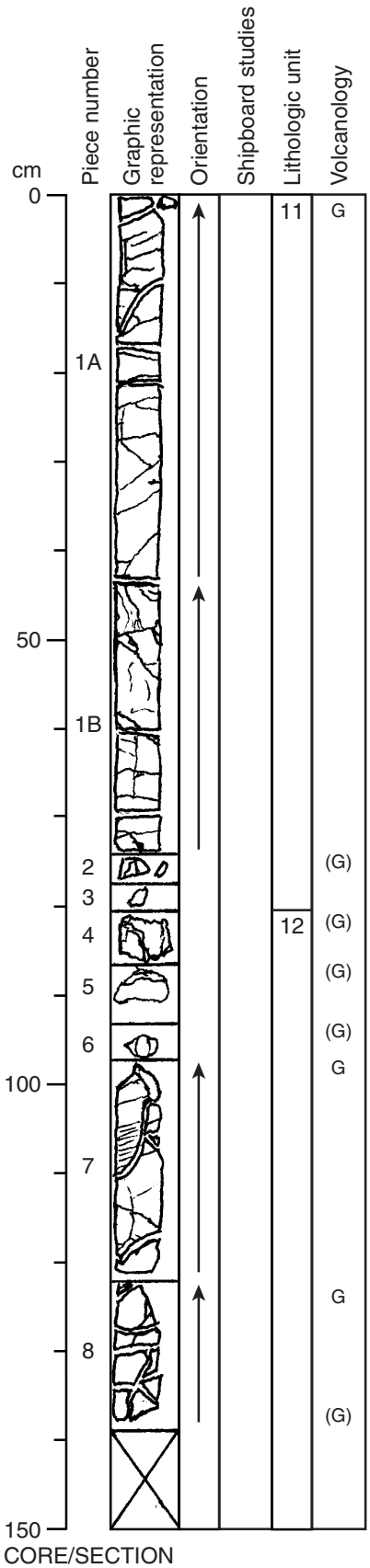
STRUCTURE: Pillowed. A glassy margin is present on Piece 5B, and grain size variations are consistent with pillow structure.

ALTERATION: Moderate. Olivine phenocrysts are replaced by Fe oxyhydroxide.

VEINS/FRACTURES: Moderately veined. Veins are <1–4 mm wide and are filled with carbonate, zeolite, and black clay.

COMMENTS: Irregular miarolitic cavities (2–8 mm) in Piece 5A are filled with green clay and carbonate.

Core Photo



192-1187A-16R-2 **Section Top: 500.64 mbsf**

UNIT 11: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1A–3

CONTACTS: Not recovered. The contact between Units 11 and 12 is inferred to be between Pieces 3 and 4.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	2–5	1.2	0.2	0.8	Euhedral; rarely in glomerocrysts

GROUNDMASS: Aphanitic, with spherulitic texture.

VESICLES: Generally nonvesicular. A sparsely vesicular zone 1.5 cm from the glassy margin on Piece 1A has vesicles (≤1.5 mm wide) filled with carbonate.

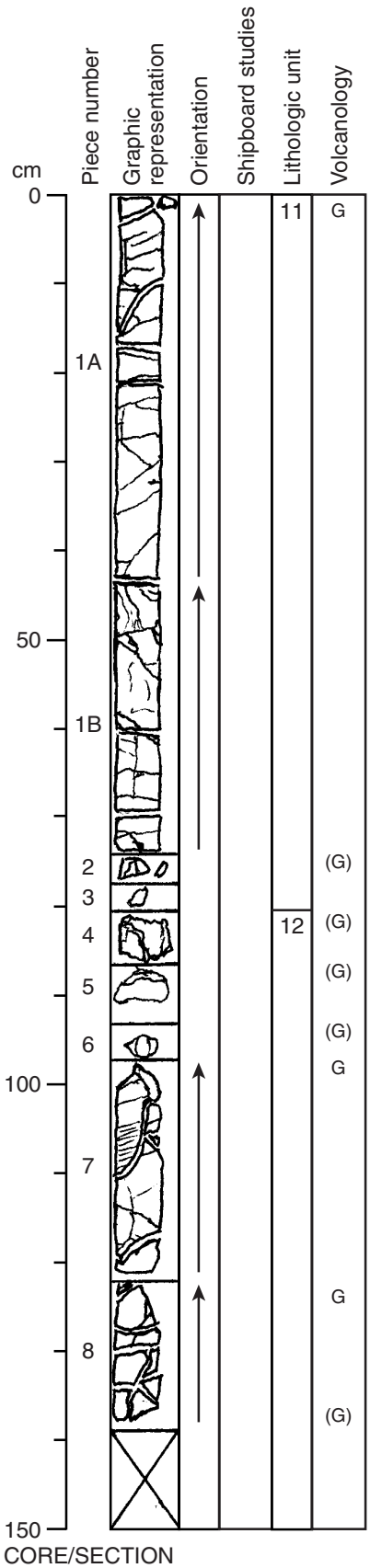
COLOR: Pale brown (10YR 6/3).

STRUCTURE: Pillowed. A glassy margin is present on Piece 1A, and grain size variations are consistent with pillow structure.

ALTERATION: Slight to complete. Some unaltered glass is present at the top of Piece 1A; glass is completely altered in Piece 2. Olivine phenocrysts and groundmass are replaced by Fe oxyhydroxide.

VEINS/FRACTURES: Sparsely to moderately veined. Veins are <1–3 mm wide and are filled with carbonate and Fe oxyhydroxide.

Core Photo



192-1187A-16R-2 **Section Top: 500.64 mbsf**

UNIT 12: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 4–8

CONTACTS: Not recovered. The contact between Units 11 and 12 is inferred to be between Pieces 3 and 4.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	2–4	0.8	0.2	0.5	Euhedral to subhedral; rarely in glomerocrysts

GROUNDMASS: Aphanitic, with spherulitic texture.

VESICLES: Nonvesicular. Rare, elongate and subround vesicles (≤1.5 mm) adjacent to glassy margins in Pieces 7 and 8 are filled with carbonate.

COLOR: Clasts in Pieces 4–6 are greenish black (5G 2/1) and brownish gray (5YR 4/1); Pieces 7–8 are grayish brown (10YR 5/2).

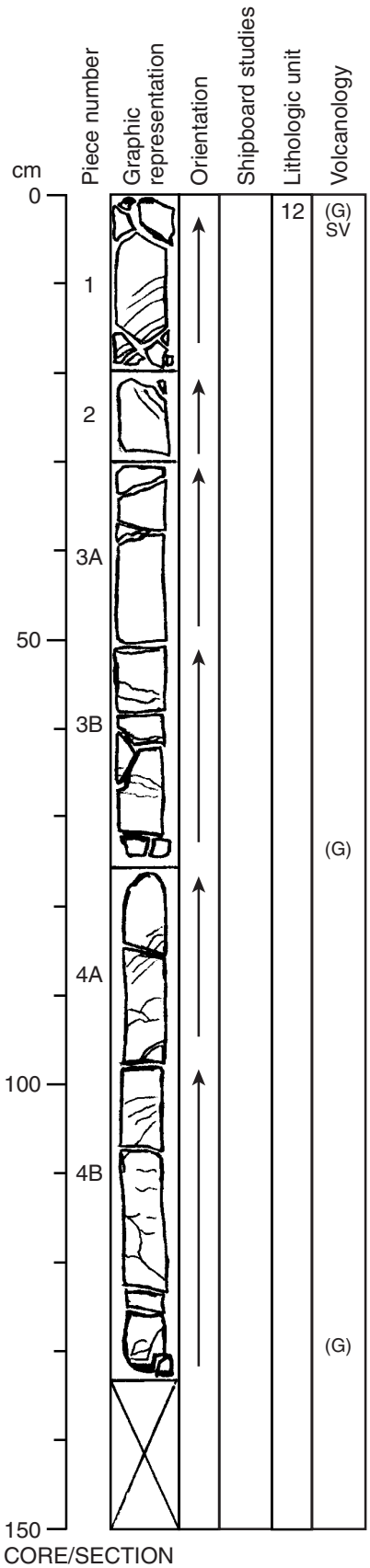
STRUCTURE: Brecciated and pillowed. Pieces 4–6 are hyaloclastite and Pieces 7–8 are pillowed. Glassy margins are present on Pieces 7 and 8, each of which is a section through an individual pillow.

ALTERATION: Slight to complete. Olivine phenocrysts and groundmass are replaced by Fe oxyhydroxide. Some unaltered glass is present on Pieces 7 and 8.

VEINS/FRACTURES: Sparsely to moderately veined. Veins are <1–2 mm wide and are filled with carbonate, green clay, and Fe oxyhydroxide.

COMMENTS: Pieces 4–6 are hyaloclastite consisting of unaltered and altered glass clasts (now dark green and olive green clay) in a carbonate matrix.

Core Photo



192-1187A-16R-3 **Section Top: 502.03 mbsf**

UNIT 12: MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–4B

CONTACTS: None.

PHENOCRYSTS:

	%	Grain Size (mm):			
	Mode	Max	Min	Avg.	Shape/Habit
Olivine:	3	0.8	0.3	0.5	Euhedral to subhedral; rarely in glomerocrysts

Unaltered olivine may be present in Piece 3A.

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture.

VESICLES: Nonvesicular.

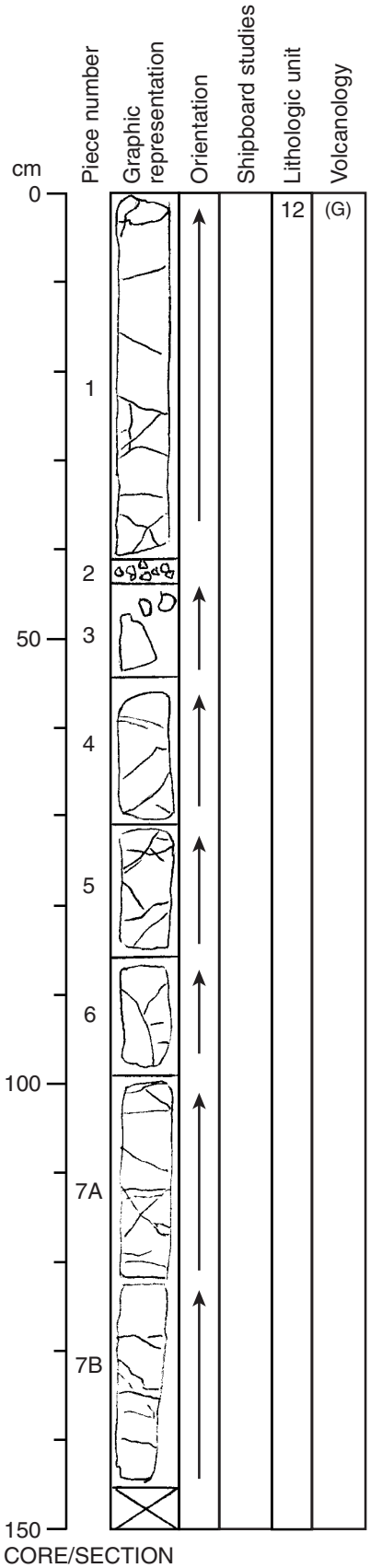
COLOR: Medium gray (N5) to yellow (10YR 7/6).

STRUCTURE: Pillowed. Glassy margins are present on Pieces 1, 3B, and 4B.

ALTERATION: Moderate. Olivine phenocrysts are replaced by green clay and Fe oxyhydroxide.

VEINS/FRACTURES: Highly veined. Veins are <1–3 mm wide and are filled with carbonate, Fe oxyhydroxide, and green clay.

Core Photo



192-1187A-16R-4 **Section Top: 503.36 mbsf**

UNIT 12: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–7B

CONTACTS: None.

PHENOCRYSTS:

	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	1–3	1.1	0.2	0.5	Euhedral to subhedral

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture.

VESICLES: Nonvesicular.

COLOR: Very pale brown (10YR 7/4) to medium light gray (N6).

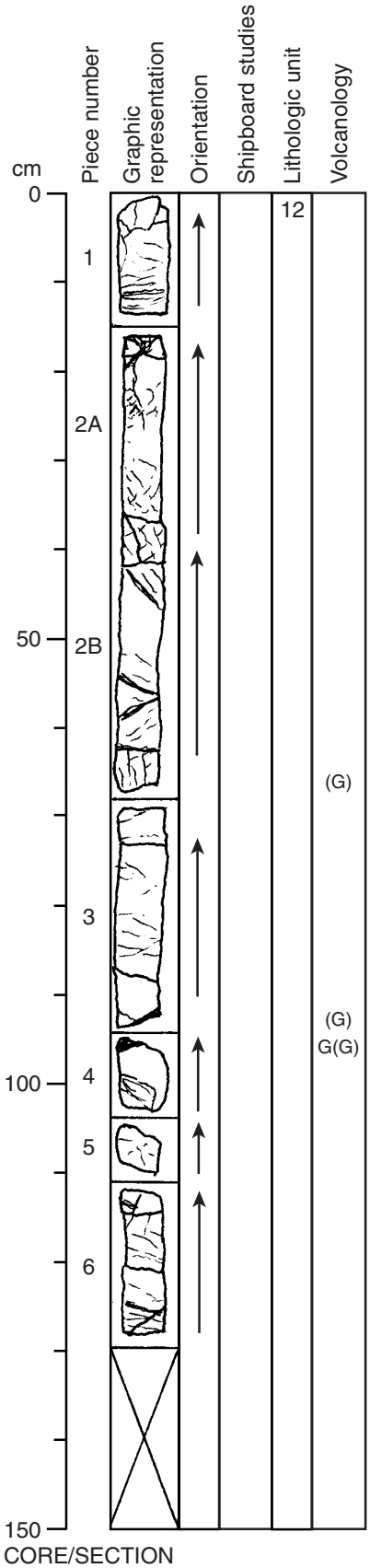
STRUCTURE: Pillowed. A glassy margin is present on Piece 1, and grain size variations are consistent with pillow structure.

ALTERATION: Moderate to complete. Olivine phenocrysts are replaced by Fe oxyhydroxide and dark green clay. The glass on Piece 1 is replaced by green clay.

VEINS/FRACTURES: Sparsely to moderately veined. Veins are <1–3 mm wide and are filled with carbonate and Fe oxyhydroxide.

COMMENTS: Irregular and elongate miarolitic cavities (≤2 mm) in Piece 7B are filled with carbonate, Fe oxyhydroxide, and green clay.

Core Photo



192-1187A-16R-5 **Section Top: 504.82 mbsf**

UNIT 12: SPARSELY TO MODERATELY OLIVINE-PHYRIC BASALT

Pieces: 1–6

CONTACTS: None.

PHENOCRYSTS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Olivine:	1–3	0.8	0.3	0.6	Subhedral to euhedral; rarely in glomerocrysts

GROUNDMASS: Aphanitic to fine grained. Aphanitic regions have spherulitic texture; fine-grained regions have variolitic texture.

VESICLES: Nonvesicular.

COLOR: Medium light gray (N6) to yellowish brown (10YR 5/6).

STRUCTURE: Pillowed. Glassy margins are present on Pieces 2B, 3, and 4.

ALTERATION: Moderate to high. Olivine phenocrysts are replaced by Fe oxyhydroxide.

VEINS/FRACTURES: Moderate to high. Veins are <1–5 mm wide and are filled with Fe oxyhydroxide, zeolite, and carbonate.

COMMENTS: Irregular miarolitic cavities (3–10 mm) in Piece 2A are filled with carbonate and green clay.

Site 1187 Smear Slides

Site	Hole	Core	Type	Section	Top (cm)	Depth (mbsf)	Lithology	T-Sand	T-Silt	T-Clay	M-Biotite	M-Calcite	M-Carbonate	M-Clay	M-Feldspar	M-Glauconite	M-Opaques	M-Plagioclase	M-Pyrite	M-Pyroxene	M-Quartz	M-Unspecified Minerals	M-Volcanic Glass	M-Zeolite	B-Diatoms	B-Ebridians	B-Foraminifers	B-Nannofossils	B-Radiolarians	B-Siliceous Sponge Spicules	B-Silicoflagellates	B-Sponge Spicules	B-Organic debris	R-Lithic Fragments	Comments
1187	A	1	W	1	20	0.2	D	0	0	100																		100							White-colored part
1187	A	1	W	1	65	0.65	D	17	26	57																		62	30			8			Darker-colored part
1187	A	2	R	1	7	365.57	D	0	5	95			1	91										7				1							Zeolite?
1187	A	2	R	1	17	365.67	M	4	11	85			1	83										15				1							Reddish-color part
1187	A	2	R	1	90	366.4	M	7	15	78				77										22				1							Reddish-color part
1187	A	2	R	1	105	366.55	D	4	8	88				87										12				1							Zeolite?

TS# 197 192-1187A-4R-2, 122-124 cm, Piece 13B **Unit 1** **OBSERVER:** **PRC, CRN, LMC, TS, JH**

ROCK NAME: **Moderately olivine-phyric basalt.**
WHERE SAMPLED: **Pillow interior.**
GRAIN SIZE: **Cryptocrystalline.**
TEXTURE: **Variolitic to intersertal; porphyritic.**

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	APPROX. COMP.	MORPHOLOGY	COMMENTS
PHENOCRYSTS								
Olivine	0	4-5	~0.05	0.5	0.15		Subhedral to euhedral	Also present as glomerocrysts.
GROUNDMASS								
Plagioclase	20	20	<0.01	0.1	0.05		Feathery, skeletal, acicular, and subhedral	Cross sections show elongate morphology with hollow interior.
Clinopyroxene	~2	~2		<0.02			Anhedral	With radiating fibrous crystallites with wavy extinction.
Devitrified glass	63	74					Fibrous to feathery	Quench textured.
OPAQUE/ OXIDE MINERALS								
Titanomagnetite	<1	<1	<0.01	<0.05	0.01		Skeletal to subhedral	
Cr spinel	<<1	<<1	<0.01	0.08	0.01		Subhedral to euhedral	Occurs both as isolated crystals and as inclusions in olivine.

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Brown smectite	12				Olivine and cryptocrystalline groundmass	
Calcite	~1				Olivine	
Green smectite	2				Cryptocrystalline groundmass	

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	FILLING / MORPHOLOGY	COMMENTS
None							

VEINS	PERCENT	LOCATION	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	FILLING / MORPHOLOGY	COMMENTS
Yes			0.5	1.1		Sparry calcite and rare celadonite	Right side of the slide; branching.

COMMENTS : This section has a bimodal groundmass size: cryptocrystalline and microcrystalline plagioclase (+/- clinopyroxene).

TS# 199 192-1187A-6R-6, 105-107 cm, Piece 2C **Unit 3B** **OBSERVER:** **MG, LMC, CRN, TS, JH**

ROCK NAME: **Moderately olivine-phyric basalt.**
WHERE SAMPLED: **Typical pillow interior.**
GRAIN SIZE: **Microcrystalline.**
TEXTURE: **Variolitic to intersertal; porphyritic.**

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	APPROX. COMP.	MORPHOLOGY	COMMENTS
PHENOCRYSTS								
Olivine	2	5-7	0.08	0.7	0.3		Subhedral to euhedral	Mostly as glomerocrysts; some crystals have glass inclusions.
Plagioclase	<<1	<<1	0.12	0.3	0.3		Tabular	
GROUNDMASS								
Plagioclase	38	38	0.04	0.1	0.05		Skeletal, acicular, feathery and subhedral	Generally radiate from olivine glomerocrysts.
Clinopyroxene	20	20	0.03	0.12	0.06		Subhedral to anhedral	
Devitrified glass	28	33					Fibrous to feathery	
OPAQUE/ OXIDE MINERALS								
Cr spinel	<1	0	<0.01	0.04	0.01		Subhedral	Associated with olivine phenocrysts.
Titanomagnetite	2	2	<0.01	0.02	0.01		Subhedral to skeletal	
Sulfide	Trace	Trace	<0.0.1				Bleb	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Brown smectite	10				Olivine and devitrified glass	Some of the olivine are unaltered with only the rims replaced by brown smectite.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	FILLING / MORPHOLOGY	COMMENTS
None							

VEINS	PERCENT	LOCATION	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	FILLING / MORPHOLOGY	COMMENTS
None							

COMMENTS : Analyzed by ICP-AES.
See **Chapter 7, Figure F16**; see photomicrographs **1187A-236**, **1187A-237**

TS# 200 1187A-7R-6, 66-70 cm, Piece 2 | **Unit: 4** | **OBSERVER:** | **RVW, LMC, CRN, TS, JH**

ROCK NAME: **Moderately olivine-phyric basalt.**
WHERE SAMPLED: **Pillow margin.**
GRAIN SIZE: **Microcrystalline to cryptocrystalline.**
TEXTURE: **Porphyritic with spherulitic groundmass.**

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	APPROX. COMP.	MORPHOLOGY	COMMENTS
PHENOCRYSTS								
Olivine	0	3	<0.1	0.3	0.1		Euhedral to subhedral	Commonly in glomerocrysts.
GROUNDMASS								
Olivine	0	2			0.02		Elongate	Identified only by comparison with elongate extensions protruding from corners of some olivine phenocrysts.
Plagioclase	<1	<1			0.01		Elongate	Radiating from centers of spherulites.
Devitrified glass	95	95					Fibrous to cryptocrystalline	Fibrous crystals radiate from centers of spherulites; very fine-scale dendrites present within cryptocrystalline (non-spherulitic) regions.
OPAQUE/ OXIDE MINERALS								
Titanomagnetite		<<1	<0.01	0.05	<0.01			
Cr spinel		<<1	<0.01	0.02	<0.01			Inclusions in olivine phenocrysts.

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Calcite	1				Olivine	
Fe oxyhydroxide	4				Replacing olivine and staining groundmass	

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	FILLING / MORPHOLOGY	COMMENTS
Irregular cavities						Calcite	

VEINS	PERCENT	LOCATION	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	FILLING / MORPHOLOGY	COMMENTS
Three		Base of slide	0.01	0.3	0.1	Calcite	

COMMENTS : This thin section was taken primarily for alteration.
See **Chapter 7, Figure F15**

TS# 201 1187A-9R-4, 56-58 cm, Piece 2C **Unit: 5** **OBSERVER:** **RVW, LMC, CRN, TS, JH**

ROCK NAME: **Moderately olivine phyric basalt.**
WHERE SAMPLED: **Typical pillow interior.**
GRAIN SIZE: **Fine grained.**
TEXTURE: **Variolitic, subophitic and intrafasciculate.**

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	APPROX. COMP.	MORPHOLOGY	COMMENTS
PHENOCRYSTS								
Olivine	3	7	0.05	0.3	0.1		Euhedral to subhedral	Commonly in glomerocrysts; some have glass inclusions.
GROUNDMASS								
Plagioclase	44	44	<0.01	0.3	0.05		Euhedral elongate laths, commonly hollow; feathery in variolitic patches	Some laths are up to 4 mm long.
Clinopyroxene	40	40	<0.01	0.3	0.1		Equant and anhedral; feathery in variolitic patches	
Glass	0	8						
OPAQUE/ OXIDE MINERALS								
Cr spinel	<<1	<<1	<0.01	0.03	0.01		Euhedral	Inclusions in olivine.
Titanomagnetite	1	1	<0.01	0.04	0.02		Euhedral or skeletal	
Sulfide	Trace	Trace			0.05		Blebs	Inclusions in groundmass and silicates.

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Brown smectite	12				Olivine and glass	

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	FILLING / MORPHOLOGY	COMMENTS
None							

VEINS	PERCENT	LOCATION	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	FILLING / MORPHOLOGY	COMMENTS
One		Top right			0.1	Brown smectite and calcite	

COMMENTS : Close to the vein, olivine is completely altered; alteration decreases away from the vein.
See **Chapter 7, Figure F18**; see photomicrograph **1187A-241**

TS# 202 192-1187A-10R-7, 30-32 cm, Piece 1B — **Unit 6** — **OBSERVER:** **PRC, CRN, LMC, TS, JH**

ROCK NAME: **Moderately olivine-phyric basalt.**
WHERE SAMPLED: **Pillow margin.**
GRAIN SIZE: **Cryptocrystalline to hypocrystalline.**
TEXTURE: **Variolitic to intersertal; porphyritic.**

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	APPROX. COMP.	MORPHOLOGY	COMMENTS
PHENOCRYSTS								
Olivine	~2	8-10	<0.1	0.8	~0.2		Subhedral to euhedral	Some of the remnant olivine have devitrified glass inclusions; majority of the olivine crystals are small.
GROUNDMASS								
Plagioclase	25	25	<0.01	0.15	0.08		Feathery and skeletal to subhedral	Seriate; some have swallow-tail terminations.
Clinopyroxene	15	15	<0.01	0.02	<0.01		Feathery to anhedral	Interstitial.
Devitrified glass	45	49					Fibrous	
OPAQUE/ OXIDE MINERALS								
Titanomagnetite	~1	~1	<0.01	0.09	0.02		Skeletal and anhedral to subhedral	One skelatal grain is 0.5 mm long.
Cr spinel	<1	<1	<0.01	0.03	<0.01		Subhedral to euhedral	Occurs both as solitary crystals or as inclusion in olivine.
Sulfide	Trace	Trace		<0.01			Blebs	Inclusions in silicates and also present in glass.

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Brown and green smectite	12	0			**Olivine and glass**	

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	FILLING / MORPHOLOGY	COMMENTS
None							

VEINS	PERCENT	LOCATION	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	FILLING / MORPHOLOGY	COMMENTS
Yes						Smectite	Lower left corner

COMMENTS :

See **Chapter7, Figure F25**; see photomicrographs **1187A-239**, **1187A-242**, **1187A-245**

TS# 203 192-1187-12R-5, 90-93 cm, Piece 2A **Unit 6** **OBSERVER:** **PRC, TS, LMC, CRN, JH**

ROCK NAME: **Moderately olivine-phyric basalt.**
WHERE SAMPLED: **Massive base of Unit 6.**
GRAIN SIZE: **Fine grained.**
TEXTURE: **Subophitic to intersertal; porphyritic with variolitic patches.**

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	APPROX. COMP.	MORPHOLOGY	COMMENTS
PHENOCRYSTS								
Olivine	0	5	~0.05	0.25	0.15		Subhedral to euhedral	
GROUNDMASS								
Plagioclase	52	52	<0.01	0.25	0.15		Feathery and anhedral to subhedral and elongate	
Clinopyroxene	36	36	<0.01	0.2	0.1		Feathery and anhedral to subhedral and elongate	
Devitrified glass	0	5						
OPAQUE/ OXIDE MINERALS								
Titanomagnetite	2	2	<0.01	0.04	0.01		Skeletal to subhedral	Interstitial.
Cr spinel	<<1	<<1		~0.01			Subhedral to euhedral	Occurs both as isolated crystals or as inclusions in olivine.

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Brown and green smectite	10				**Olivine and glass**	

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	FILLING / MORPHOLOGY	COMMENTS
None							

VEINS	PERCENT	LOCATION	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	FILLING / MORPHOLOGY	COMMENTS
None							

COMMENTS :

See **Chapter 7, Figure F19**, **Figure F26**; see photomicrograph **1187A-256**

TS# 204 192-1187A-15R-4,42-44 cm, Piece 1B **Unit 11** **OBSERVER:** **TS, LMC, CRN, JH**

ROCK NAME: **Moderately olivine-phyric basalt.**
WHERE SAMPLED: **Pillow interior.**
GRAIN SIZE: **Fine grained.**
TEXTURE: **Variolitic to subophitic.**

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	APPROX. COMP.	MORPHOLOGY	COMMENTS
PHENOCRYSTS								
Olivine	3	5	0.08	0.4	0.2		Euhedral to subhedral	Many crystals have devitrified glass inclusions; rarely present as glomerocrysts.
GROUNDMASS								
Plagioclase	43	43	0.01	0.3	0.08		Subhedral to anhedral, lath to elongate	Some crystals have swallow tails. Variolitic texture with clinopyroxene.
Clinopyroxene	10	10	<0.01	0.1	0.03		Anhedral, feathery	
Devitrified glass	35	40						
OPAQUE/ OXIDE MINERALS								
Titanomagnetite	1-2	1-2	<0.01	0.04	0.01		Euhedral to skeletal	
Cr spinel	<<1	<<1	<0.01	0.04	0.01		Euhedral	Mainly exsist as inclusions in olivine.
Sulfide	Trace	Trace	<0.01	0.02	<0.01		Bleb	In glass and inclusions in silicates.

SECONDARY MINERALOGY	PERCENT		SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Brown smectite	7	0				Olivine and devitrified glass	
Marcasite	<<1	0				Devitrified glass	

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	FILLING / MORPHOLOGY	COMMENTS
None							

VEINS	PERCENT	LOCATION	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	FILLING / MORPHOLOGY	COMMENTS
None							

COMMENTS : Patchy texture of relatively fine-grained and coarser-grained regions.
See **Chapter 7, Figure F17**, **Figure F30**; see photomicrographs **1187A-249**, **1187A-250**, **1187A-251**