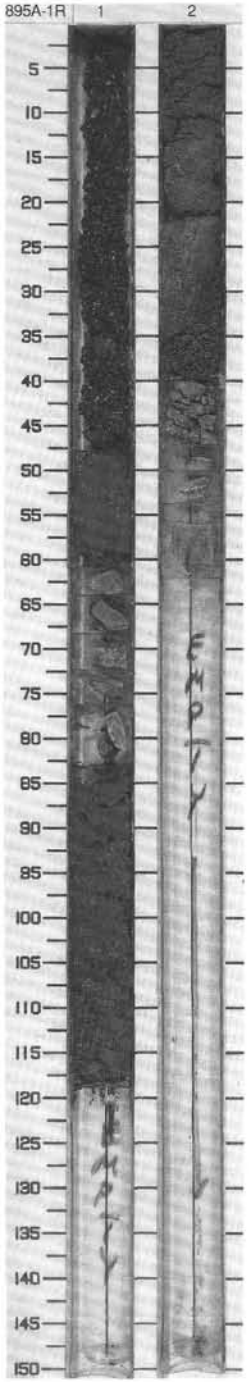
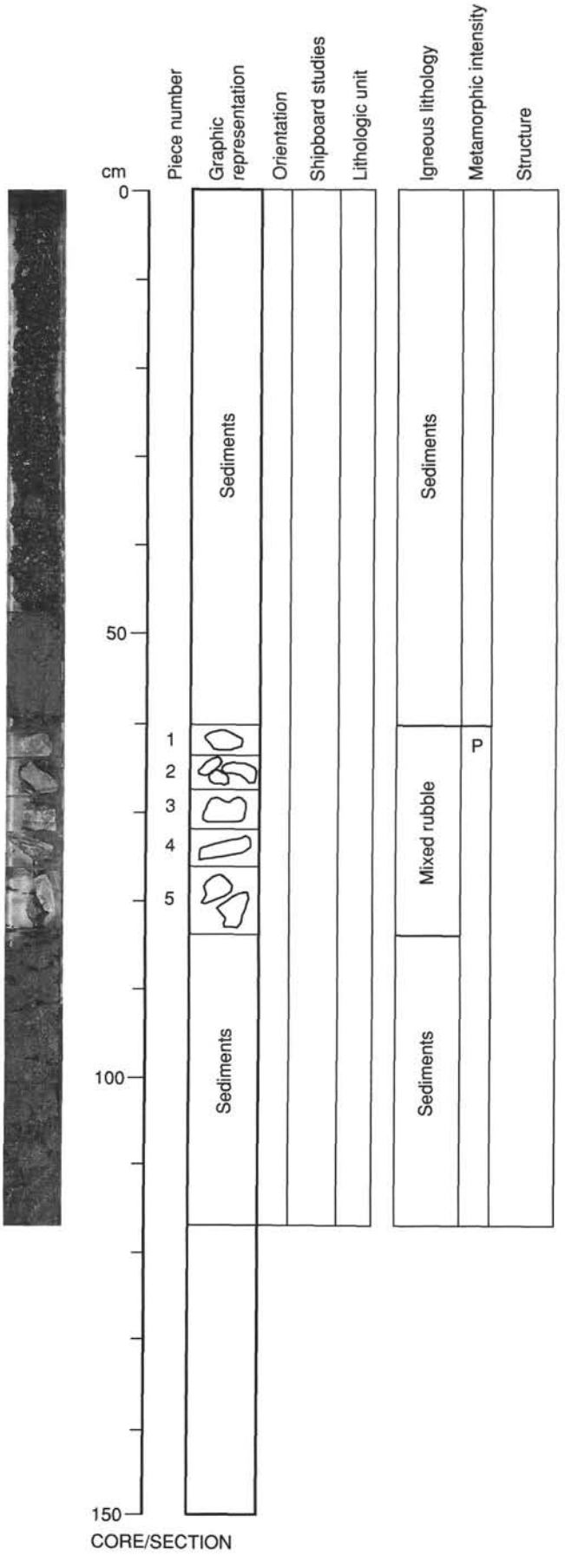
SITE 895 HOLE A CORE 1R CORED 0.0 - 9.2 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	Description
1		1 2			wwww wXXX		5Y 3/2 To 10YR 3/3	FORAMINIFERAL NANNOFOSSIL CLAY, SERPENTINITE DRILLING BRECCIA and SERPENTINITE AND GABBRO CLASTS

Major Lithologies:
FORAMINIFERAL NANNOFOSSIL CLAY: Varies in color (10YR 4/4, dark yellowish brown to 10Y 3/3, dark brown), darker intervals being more clay rich. Sediments extremely disturbed because no core liner was run and material had to be extruded from drillpipe.
SERPENTINITE DRILLING BRECCIA: From 0–47 cm in Section 147-895A-1R-1, varies from 0.1 to 0.5 cm, with clasts to 3 cm. Abundant elongate chrysotile fibers to 1 cm distributed throughout the breccia. Interval was washed from pipe with a hose, and collected into a container with subsequent transfer to the core liner.
SERPENTINITE AND GABBRO CLASTS: From 60–82 cm in Section 147-895A-1R-1, clasts to 6 cm originally embedded in calcareous mud but were collected and placed within interval. They do not represent any original stratigraphic order. From 40–60 cm in Section 147-895A-1R-2, clasts are of similar size and were recovered from the Core Catcher.

Minor Lithology:
YELLOW-GREEN CLAY: In lowermost interval of calcareous clay, there is a highly disturbed sworl of yellow-green clay (serpentinous?) mixed during coring and extrusion.



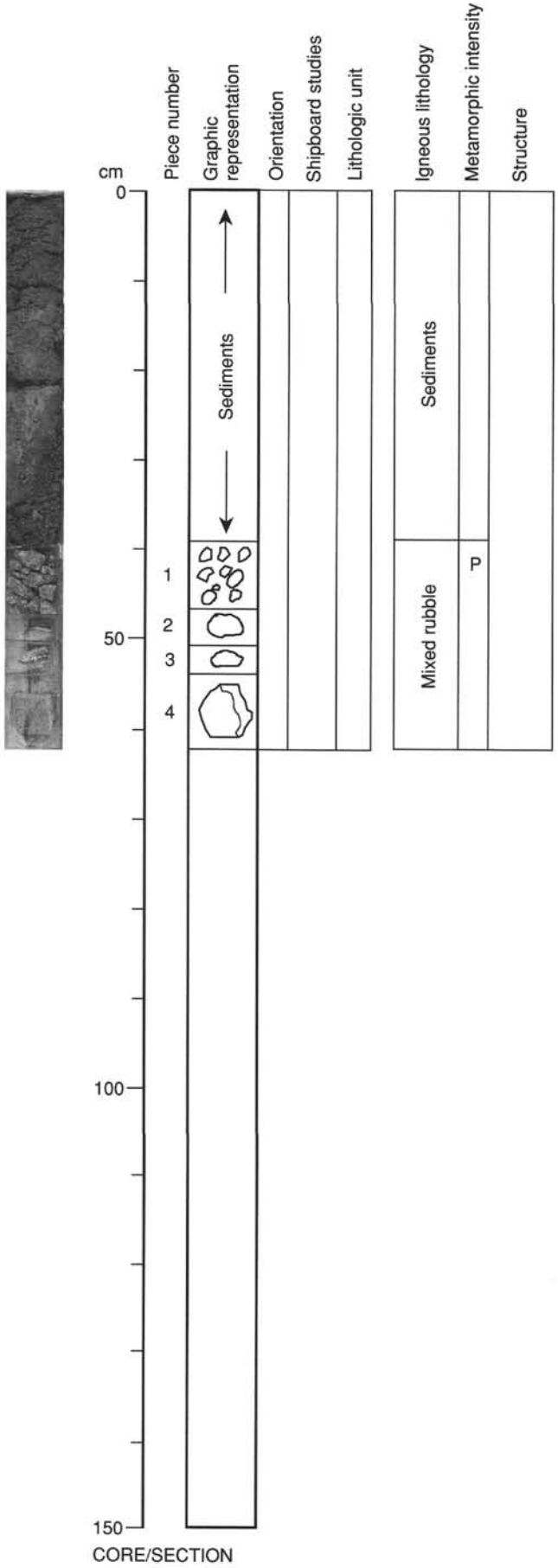


147-895A-1R-1

MIXED RUBBLE: BASALT SERPENTINITE AND GABBRO

Pieces 1–5

COLOR: Light grayish green (metabasalt) light green (rodingite) and mottled gray green (serpentinite).
LAYERING: None.
DEFORMATION: Lower two pieces are sheared serpentinite, almost schistose.
PRIMARY MINERALOGY: Applies to serpentinites only.
Olivine - Mode: 85%–95%.
Percent replacement: 90%–100%.
Comments: Replaced by serpentine.
Orthopyroxene - Mode: 5%–15%.
Percent replacement: 75%–100%.
Cr-spinel - Mode: Trace.
SECONDARY MINERALOGY:
Total percent: 90%+.
Texture: Various, but mainly pseudomorphic replacement of olivine by serpentine.
ADDITIONAL COMMENTS: The rocks are pieces separated from disturbed sediment and placed in compartments in an interval between 61 cm and 82 cm. The pieces are not numbered. The top compartment (61–64 cm) contains sparsely plagioclase-olivine phyric metabasalt, now a greenstone with an obvious olivine pseudomorph. Compartment 2 (64–68 cm) has assorted serpentine clasts. Compartment 3 (68–72 cm) is coarse-grained, rodingitized metagabbro. Compartment 4 (72–75 cm) is sheared soapstone. Compartment 5 (75–82 cm) is two clasts of sheared serpentine, almost schistose in character.

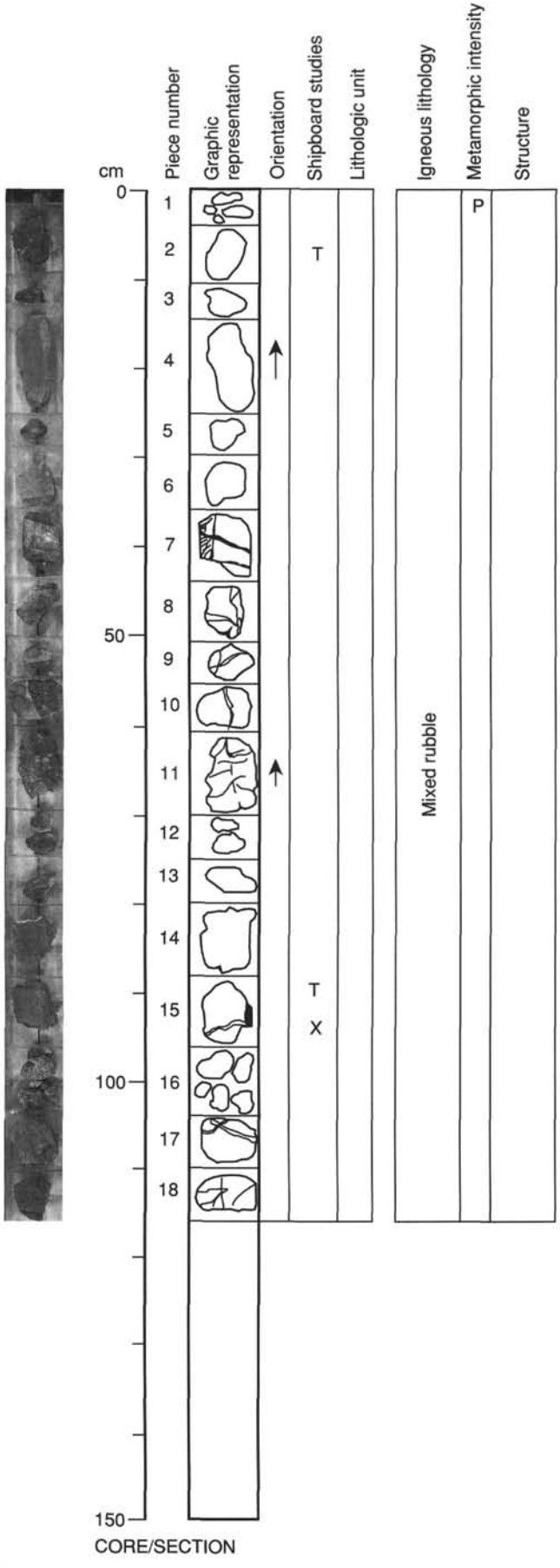


147-895A-1R-2

MIXED RUBBLE: SERPENTINITE, APHYRIC BASALT, AND SERPENTINIZED HARZBURGITE

Pieces 1–4

COLOR: Mottled grayish green (serpentinites).
LAYERING: None.
DEFORMATION: Piece 3 is sheared. Piece 4 has porphyroclastic texture
PRIMARY MINERALOGY: Estimates apply to serpentinized harzburgite (Piece 4) only.
Olivine - Mode: 85%.
Percent replacement: 80%.
Comments: Replaced by serpentine.
Orthopyroxene - Mode: 15%.
Percent replacement: 30%.
Comments: Replaced by bastite.
Cr-spinel - Mode: Trace.
SECONDARY MINERALOGY:
Total percent: 75%–95%.
Texture: Mostly pseudomorphic.
ADDITIONAL COMMENTS: The pieces are from the core catcher and do not represent a stratigraphic sequence. Piece 1 is serpentinite clasts. Piece 2 is fine-grained, fresh, aphyric basalt. Piece 3 is sheared serpentinite. Piece 4 is moderately weathered porphyroclastic harzburgite.

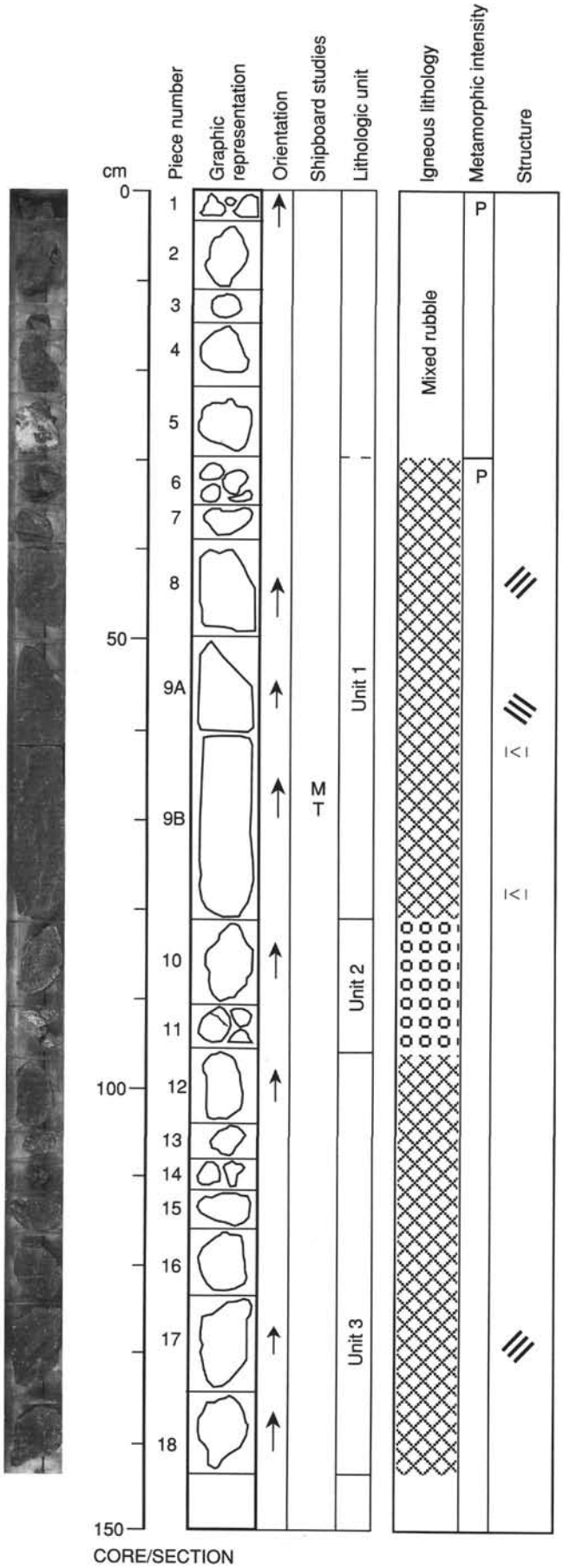


147-895A-2R-1

MIXED RUBBLE: BASALT (PIECES 5 AND 15); HARZBURGITE (REMAINDER)

Pieces 1–18

COLOR: Mottled grayish green (serpentinized harzburgite).
LAYERING: None.
DEFORMATION: Porphyroclastic texture dominant in harzburgites. Porphyroclasts are enstatites 2–5 mm in diameter.
PRIMARY MINERALOGY: Applies to serpentinized harzburgites only.
Olivine - Mode: 85%.
Percent replacement: 75%–85%.
Comments: Replaced by serpentine.
Orthopyroxene - Mode: 15%.
Crystal size: 2–5 mm.
Crystal shape: Rounded.
Percent replacement: 50%.
Comments: Replaced by bastite.
Cr-spinel - Mode: Trace.
SECONDARY MINERALOGY:
Total percent: 80%–90%.
Texture: Mainly pseudomorphic.
ADDITIONAL COMMENTS: 1) SERPENTINIZED PERIDOTITE: Pieces 1–3, 6–14, and 16–18. Pieces 7 and 8 are probably soapstone. Pieces 6, 10, 11, 16, 17, and 18 contain >5% relict olivine. Pieces 2, 3, 6, and 11 contain significant relict orthopyroxene. Piece 14 has about 0.5% spinel (high for peridotite). 2) FINE-GRAINED BASALT (Piece 4): altered to greenstone. 3) APHANITIC FRESH BASALT (Piece 5): Lightly altered around the edge. May be a pillow fragment but lacks glass.



147-895B-1R-1

MIXED RUBBLE: SEDIMENT (PIECE 1); HARZBURGITE (PIECES 2, 4); DUNITE (PIECE 3) AND GABBRO (PIECE 5)

Pieces 1–5

COLOR: Varied.
LAYERING: None.
DEFORMATION: Variably veined and fractured.
ADDITIONAL COMMENTS: Piece 1 is soft sediment dominated by iron oxides and hydroxides. Pieces 2 and 4 are completely serpentinized (80% lizardite/chrysotile) harzburgite with approximately 80%–85% olivine, 15%–20% orthopyroxene and less than 1% chrome spinel. These pieces have porphyroclastic texture and are heavily veined with chrysotile/lizardite veins. Piece 3 is serpentinized dunite with small percentage of orthopyroxene and subhedral (rounded) spinel. Piece 5 is a rodingitized coarse-grained diallage gabbro with a preserved original igneous contact against serpentinized dunite. Fragments of serpentinite occur in the rodingite. Clinopyroxene is likely diopside and plagioclase altered to hydrogrossular and calc-silicates. Plagioclase in oxides of Piece 5.

UNIT 1: HARZBURGITE (INTERVAL 6)

Pieces 6–9B

COLOR: Dark green gray.
LAYERING: None.
DEFORMATION: Very minor fracturing.
PRIMARY MINERALOGY:
Olivine - Mode: 80%.
Crystal size: ?
Crystal shape: ?
Crystal orientation: ?
Percent replacement: 80%–100%.
Orthopyroxene - Mode: 20%.
Crystal size: 1–5 mm.
Crystal shape: Subhedral.
Crystal orientation: None visible.
Percent replacement: 80%–100%.
Comments: Bronzite porphyroclasts with good cleavage.
Spinel - Mode: <0.5%.
Crystal size: 0.2–2.5 mm.
Crystal shape: Subhedral, elongate.
Crystal orientation: Weak foliation visible.
Percent replacement: 25% to magnetite.
Comments: Appears in places in 'stringers' with possible pull apart texture.
SECONDARY MINERALOGY:
Total percent: >80%.
Texture: Pervasive serpentinization. Replacement by lizardite/bastite.
Vein material: Rare veins of carbonate(?) and chrysotile.
ADDITIONAL COMMENTS: Generally more than 80% serpentinized with minor chrysotile filled fractures showing no preferred orientation. Where fractures cut spinel a turquoise blue chrome carbonate (?) is developed. The texture is porphyroclastic with 1–5 mm bastites (after enstatite), showing no preferred orientation. Alteration halos are seen around some bastite crystals as darker green serpentinite. Olivine is replaced by lizardite and oxide. Chrome spinel is fractured and partly replaced by magnetite. In Piece 9 the spinel forms a weakly foliated aggregate. No obvious clinopyroxene is seen in hand specimen.

147-895B-1R-1

UNIT 2: DUNITE

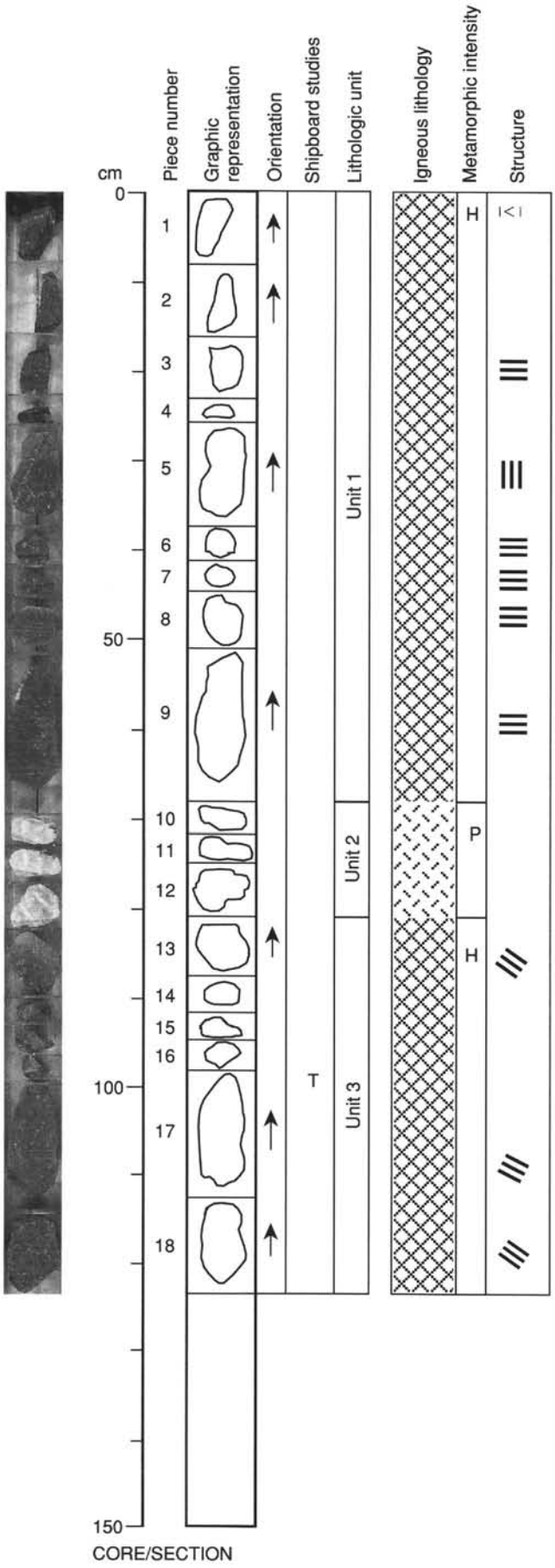
Pieces 10–11

COLOR: Green-brown.
LAYERING: None.
DEFORMATION: Relatively highly sheared with minor fragment rotation. Veining by serpentine and carbonate.
PRIMARY MINERALOGY:
Olivine - Mode: 100%.
Percent replacement: 100%.
Spinel - Mode: <0.5%.
Crystal size: 0.1–1 mm.
Crystal shape: Subhedral.
Crystal orientation: None visible.
Percent replacement: <25% by magnetite.
SECONDARY MINERALOGY:
Total percent: 100%.
Texture: Sheared serpentinite, mesh texture probably of lizardite. In Piece 10 a 0.8 mm wide vein of serpentine and talc. Minor discontinuous serpentinite veins.
Vein material: Piece 11 is partially cut by a 3-mm-wide carbonate band with minor serpentine wall rock fragments.

UNIT 3: HARZBURGITE

Pieces 12–18

COLOR: Dark green to black.
PRIMARY MINERALOGY:
Olivine - Mode: 85%.
Crystal size: 1–3 mm?
Crystal shape: Subhedral?
Crystal orientation: None.
Percent replacement: 80%–100% by lizardite and chrysotile.
Orthopyroxene - Mode: 15%.
Crystal size: 1–6 mm.
Crystal shape: Subhedral.
Crystal orientation: None visible.
Percent replacement: 80%–100% to bastite.
Spinel - Mode: <1%.
Crystal size: <<1–2.5 mm.
Crystal shape: Subhedral.
Crystal orientation: None visible.
Percent replacement: 40% to magnetite.
SECONDARY MINERALOGY:
Total percent: 80%–10%.
Texture: Serpentinite with mesh texture developed.
Vein material: Rare veins of chrysotile, lizardite, and magnetite.

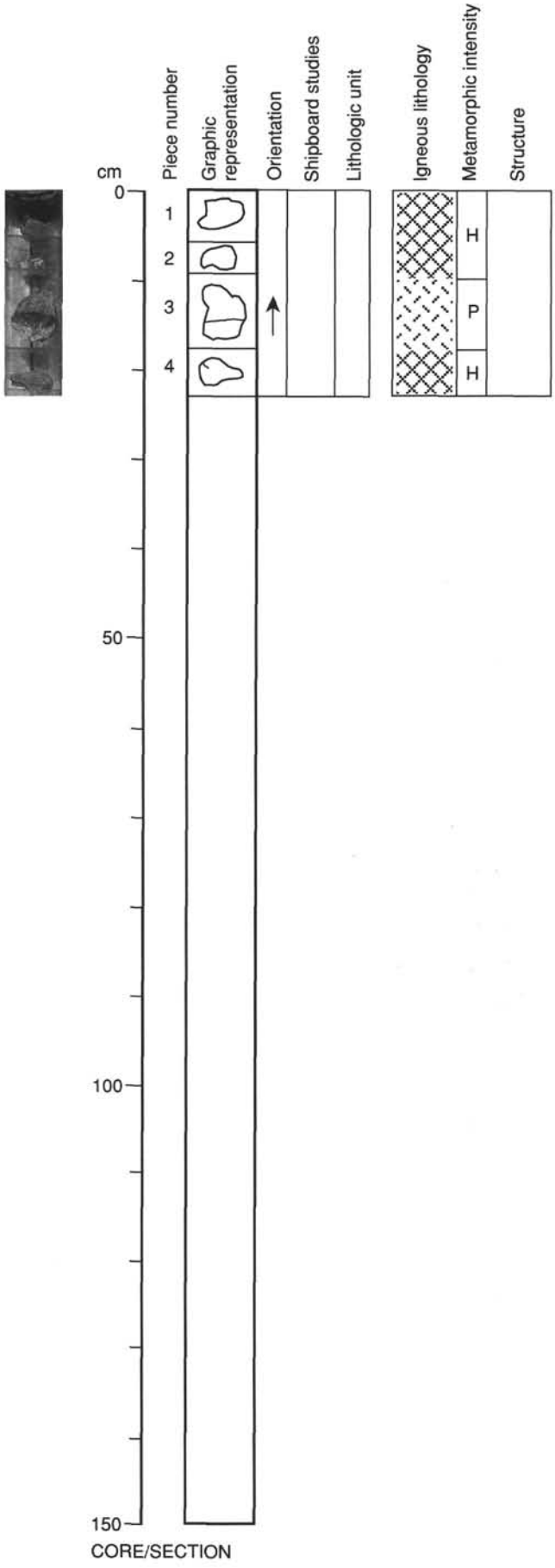


147-895C-1R-1

UNIT 1: HARZBURGITE; UNIT 2: GABBRO; UNIT 3: HARZBURGITE

Pieces 1–18

COLOR: Mottled grayish green (harzburgite); pale green to white (serpentinite).
LAYERING: None.
DEFORMATION: Most rocks are porphyroclastic, with subrounded porphyroclasts of orthopyroxene 2–8 mm.
PRIMARY MINERALOGY: The mode applies to harzburgite.
Olivine - Mode: 80%–85%.
Crystal shape: Anhedral.
Percent replacement: 80%–85%.
Comments: Replaced by serpentine.
Orthopyroxene - Mode: 15%–20%.
Crystal size: 2–8 mm.
Crystal shape: Subrounded.
Percent replacement: 20%–100%.
Comments: Replaced by bastite.
Cr-spinel - Mode: 1.5%.
Crystal size: 1 mm.
Crystal shape: Subrounded.
Crystal orientation: Commonly aligned.
SECONDARY MINERALOGY: Good bastite textures.
Total percent: 75%.
Texture: Pseudomorphic.
Vein material: Lizardite (?) with chrysotile cross fractures.
ADDITIONAL COMMENTS: HARZBURGITE (Pieces 1–9 and 13–18): Original olivine grain size cannot be determined from hand specimens but was probably 2–10 mm. The present grain size reflects serpentinization along microcracks crisscrossing original olivine grains. No pyroxene lineation was seen. Apparent differences in modal abundance of enstatite are mostly due to variable serpentinization on the hand specimen scale. Orthopyroxene in Piece 9 is intensely altered near a vein along one side which creates a zone 2–3 cm wide with no fresh pyroxene, only dark, hard to distinguish, pyroxene pseudomorphs. RODINGITIZED GABBRO (Pieces 10–12). A mixture of cross-fiber serpentine veins and intervening zones of calc-silicates.

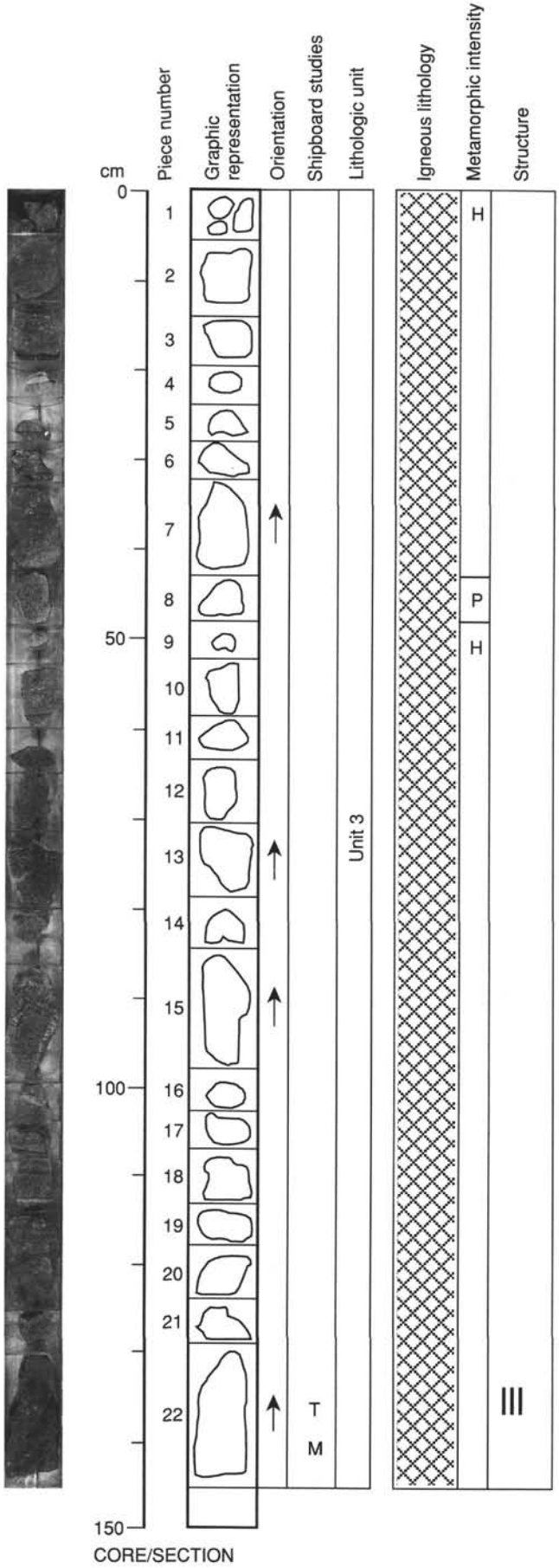


147-895C-2R-1

MIXED RUBBLE: HARZBURGITE (PIECES 1, 2, AND 4) AND GABBRO (PIECE 3),

Pieces 1–4

COLOR: Greenish gray, pale green, greenish white.
LAYERING: None.
DEFORMATION: There is a contact between rodingitized gabbro and harzburgite, crossed by veins, in Piece 3.
PRIMARY MINERALOGY: Estimated mode applies to harzburgites only. In Piece 2, pyroxene pseudomorphs resemble late impregnating clinopyroxene.
Olivine - Mode: 80%–98%.
Crystal size: 1–2 mm.
Crystal shape: Euhedral, subhedral.
Percent replacement: 70%.
Comments: Replaced by serpentine.
Pyroxene - Mode: 1%–20%.
Crystal size: 1–5 mm.
Crystal shape: Anhedral.
Percent replacement: 100%.
Comments: Completely pseudomorphed by black serpentine; has anhedral interstitial texture.
Spinel - Mode: 0.5%–1%.
Crystal size: 0.5–4 mm.
Crystal shape: Euhedral-anhedral, elongate.
SECONDARY MINERALOGY:
Total percent: 65%–75%.
Texture: Pseudomorphic. Alteration of olivine is mainly to serpentine, but also to lesser red-brown clay.
Vein material: In rodingitized gabbro, fine-grained, calc-silicate minerals. They are discontinuous, and only developed in gabbro and adjacent black serpentine. Gabbroic texture has been obliterated.
ADDITIONAL COMMENTS: The short recovery in this core came from the core catcher, and probably represents fill that was cored in the hole. No stratigraphy is implied by the sequencing of the pieces.

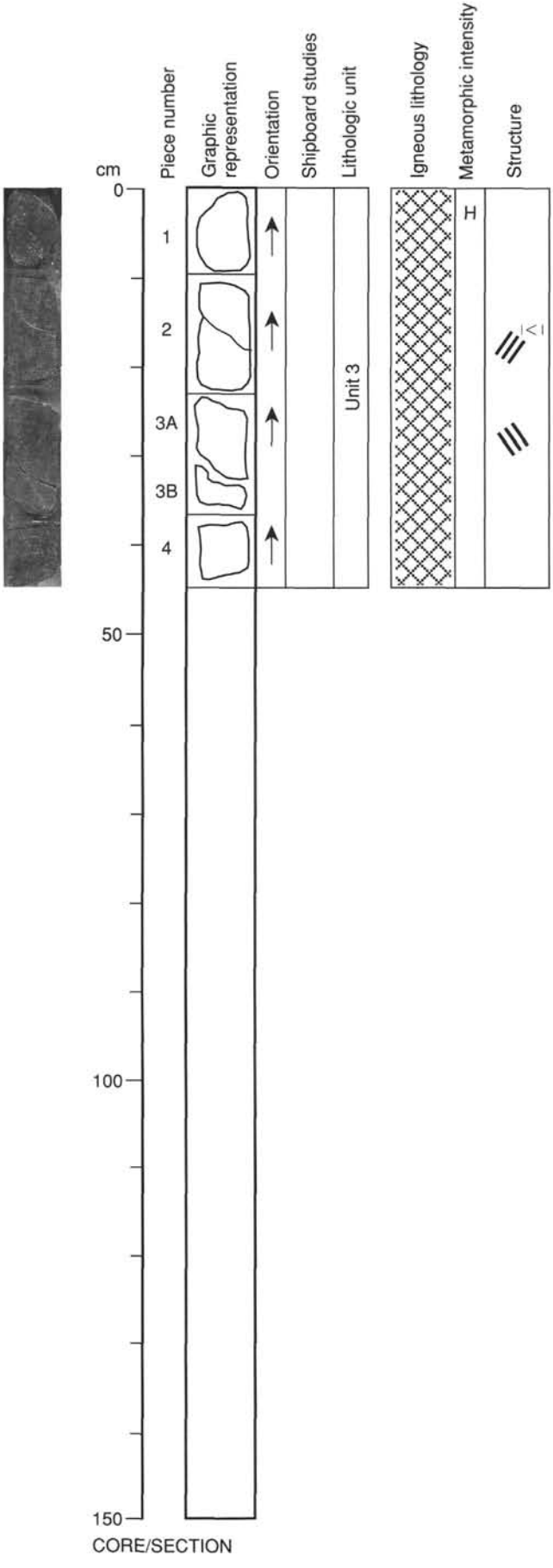


147-895C-3R-1

UNIT 3: HARZBURGITE

Pieces 1–22

COLOR: Dark gray green.
LAYERING: None.
DEFORMATION: Porphyroclastic, with enstatite porphyroclasts up to 6 mm. Pieces 2 and 3 have a sheared fabric. Piece 2, strongly serpentinized, has strongly enhanced microfractures compared with the rest of the core.
PRIMARY MINERALOGY:
Olivine - Mode: 80%–85%.
Crystal shape: Anhedral.
Percent replacement: 50%–100%.
Comments: Replaced by serpentine.
Orthopyroxene - Mode: 15%–20%.
Crystal size: 1–6 mm.
Crystal shape: Subrounded.
Percent replacement: 20%–100%.
Comments: Replaced by bastite.
Spinel - Mode: 1%–6%.
Crystal size: 1–2 mm.
Crystal shape: Elongate or equant and subrounded.
Crystal orientation: In places aligned.
SECONDARY MINERALOGY: Strong variation in the degree of olivine and orthopyroxene alteration. Pieces 2 and 3 are anomalous in that orthopyroxene is 100% altered, and olivine is only partly altered to buff yellow clays.
Total percent: 50%–99%.
Texture: Pseudomorphic.
Vein material: Chrysotile veins. Veins in several pieces have distinct alteration rinds that change the appearance of orthopyroxene from very light to very dark green.
ADDITIONAL COMMENTS: Original olivine grain size is difficult to determine. The rocks are variably altered and metamorphosed. Pieces 7 and 8 have olivine altered to buff yellow clays (much probably is fresh). Piece 4 is a small, rounded cobble (?) of chromite-bearing serpentinite.

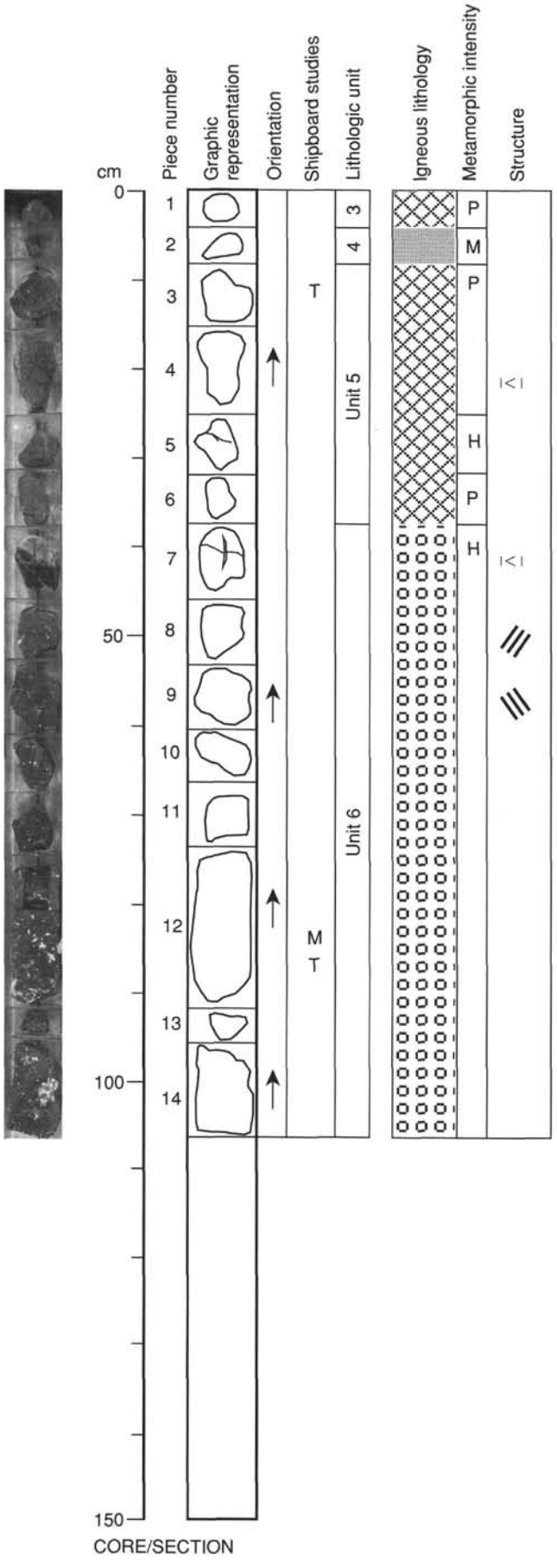


147-895C-3R-2

UNIT 3: HARZBURGITE

Pieces 1–4

COLOR: Dark grayish green, with gray-green porphyroclasts.
LAYERING: None.
DEFORMATION: The rocks have porphyroclastic texture, with 2–5 mm subrounded porphyroclasts of orthopyroxene (enstatite).
PRIMARY MINERALOGY:
Olivine - Mode: 90%–95%.
Crystal size: 1–2 mm.
Crystal shape: Subhedral.
Percent replacement: 75%.
Comments: Replaced by serpentine.
Orthopyroxene - Mode: 5%–10%.
Crystal size: 2–5 mm.
Crystal shape: Semirounded.
Percent replacement: 35%.
Comments: Replaced by bastite.
Cr-spinel - Mode: <1%.
Crystal size: 1–3 mm.
Crystal shape: Equant-anhedral.
Comments: Interstitial.
SECONDARY MINERALOGY: There is a minor clay halo around a serpentine vein in Piece 2. Secondary sulfides are <0.2% and 0.1–0.2 mm in size. They are disseminated and associated with pyroxene pseudomorphs.
Total percent: 75%.
Texture: Pseudomorphic, replaced by black, dark green, and green serpentine.
Vein material: Minor veins, lined with chrysotile and calcite.
ADDITIONAL COMMENTS: Orthopyroxene is present as pale gray porphyroclasts and dark green pseudomorphs. Piece 2 has possible anhedral interstitial black-green pyroxene pseudomorphs near its top. They are 1–4 mm, less than 3% of the rock, and may be after clinopyroxene.



147-895C-4R-1

UNITS 3, 5: HARZBURGITE

Pieces 1 and 3–6

COLOR: Gray-black.
LAYERING: None.
DEFORMATION: Porphyroclastic.
PRIMARY MINERALOGY:
Olivine - Mode: 90%.
Crystal size: 2–5 mm.
Crystal shape: Irregular, subhedral.
Crystal orientation: None.
Percent replacement: 80%.
Orthopyroxene - Mode: 10%.
Crystal size: 1–6 mm.
Crystal shape: Subhedral, rounded.
Crystal orientation: None.
Percent replacement: 60%.
Spinel - Mode: 1%.
Crystal size: 0.5 mm.
Crystal shape: Irregular, anhedral.
Crystal orientation: None visible.
Percent replacement: Minor.
SECONDARY MINERALOGY: Microgranular accumulations of magnetite are fairly common.
Total percent: 75%.
Texture: Mesh texture serpentine. Minor talc replacing olivine.
Vein material: Lizardite-chrysotile veins with secondary magnetite concentrations, making up 2%–3% of rock. Tend to be anastomosing.

UNIT 4: APHYRIC BASALT

Piece 2

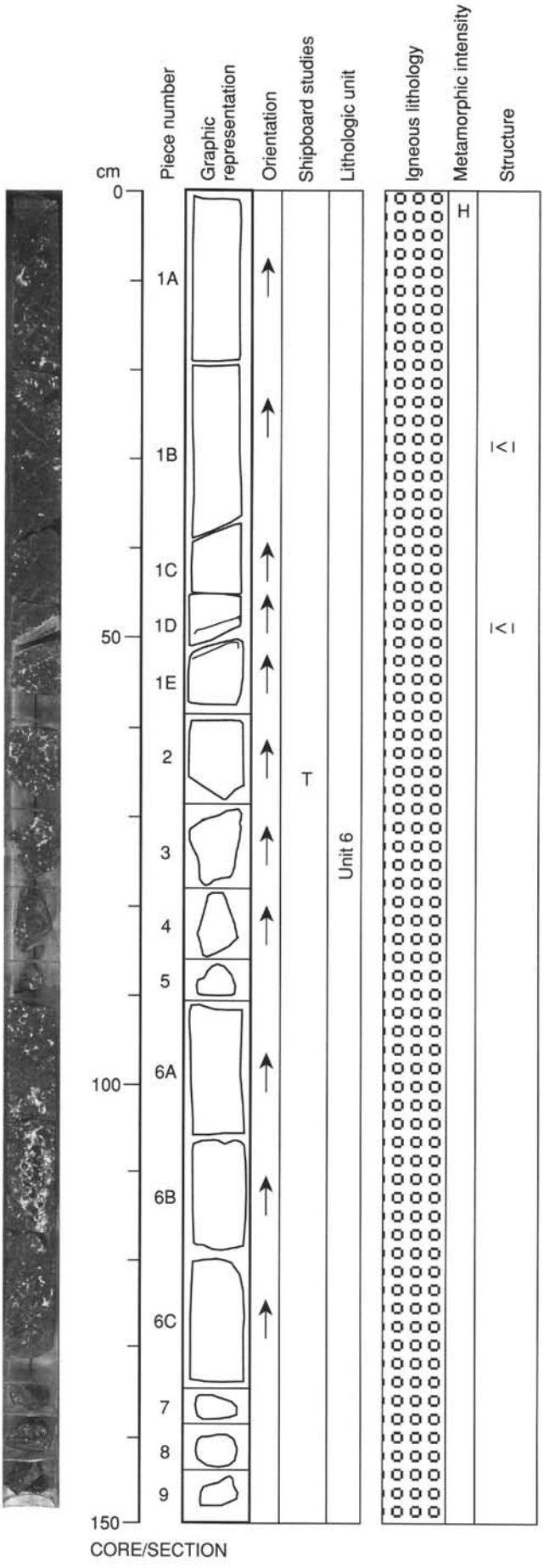
CONTACTS: Missing.
GROUNDMASS: Intersertal, presumably pyroxene and plagioclase.
VESICLES: <1%; 0.1 mm.
COLOR: Light gray.
STRUCTURE: Massive fine-grained.
ALTERATION: Likely alteration is to actinolite and secondary plagioclase but too fine-grained to confirm in hand specimen.
VEINS/FRACTURES: None.

147-895C-4R-1

UNIT 6: DUNITE

Pieces 7–14

COLOR: Greenish black with white patches.
LAYERING: None.
DEFORMATION: Minor veining, possible spinel (and plagioclase) fabric.
PRIMARY MINERALOGY: Plagioclase, clinopyroxene, and spinel appear in patches and minor veins and clearly impregnate the dunite matrix. Plagioclase and spinel often symplectically intergrown.
Olivine - Mode: 85%–95%.
Crystal size: 5–10 mm.
Crystal shape: Subhedral-anhedral.
Crystal orientation: None.
Percent replacement: 30%–100%.
Plagioclase - Mode: 1%–10%.
Crystal size: 3–20 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 80%–100%.
Clinopyroxene - Mode: 1%–5%.
Crystal size: 3–8 mm.
Crystal shape: Subhedral to anhedral.
Crystal orientation: None.
Percent replacement: 80%–100%.
Spinel - Mode: 1%–3%.
Crystal size: 1–4 mm.
Crystal shape: Euhedral to subhedral.
Crystal orientation: None.
Percent replacement: <5%.
Comments: Forms together with plagioclase. Very black and somewhat specular. Rounded silicate inclusions. Cockscomb texture.
SECONDARY MINERALOGY: The rodingitized plagioclases are typically rimmed by 1–2 mm wide actinolite-chlorite reaction rims. Rare sulphide is associated with thin actinolite/chlorite microveinlets that cut the plagioclases.
Total percent: 60%.
Texture: Alteration is dominated by serpentinization and clay alteration of olivine, which forms granular patches enclosed by anastomosing microveinlets of lizardite/chrysotile. Clinopyroxenes are pervasively altered to actinolite. Plagioclases are pseudomorphed by hydrogrossular and prehnite. Rare pyrite.
Vein material: Located in Pieces 7, 8, 9, 13, and 14 as 0.5 to 5 mm width sinuous and irregular veins of chrysotile and lizardite. In Piece 13 a thin vein of carbonate.
ADDITIONAL COMMENTS: The gabbroic patches are interstitial to subhedral, coarse olivines and increase in quantity down section. Piece 7 has significant dunite portion.



147-895C-4R-2

UNIT 6: DUNITE

Pieces 1A–9

COLOR: Greenish black with white patches.
LAYERING: None.
DEFORMATION: Minor veining. 1 cm vein in Piece 1D with angular fragments of dunitic wall rock in carbonate matrix.
PRIMARY MINERALOGY: Dunite matrix is impregnated by gabbroic melt which crystallized clinopyroxene and spinel and plagioclase apparently symplectically.

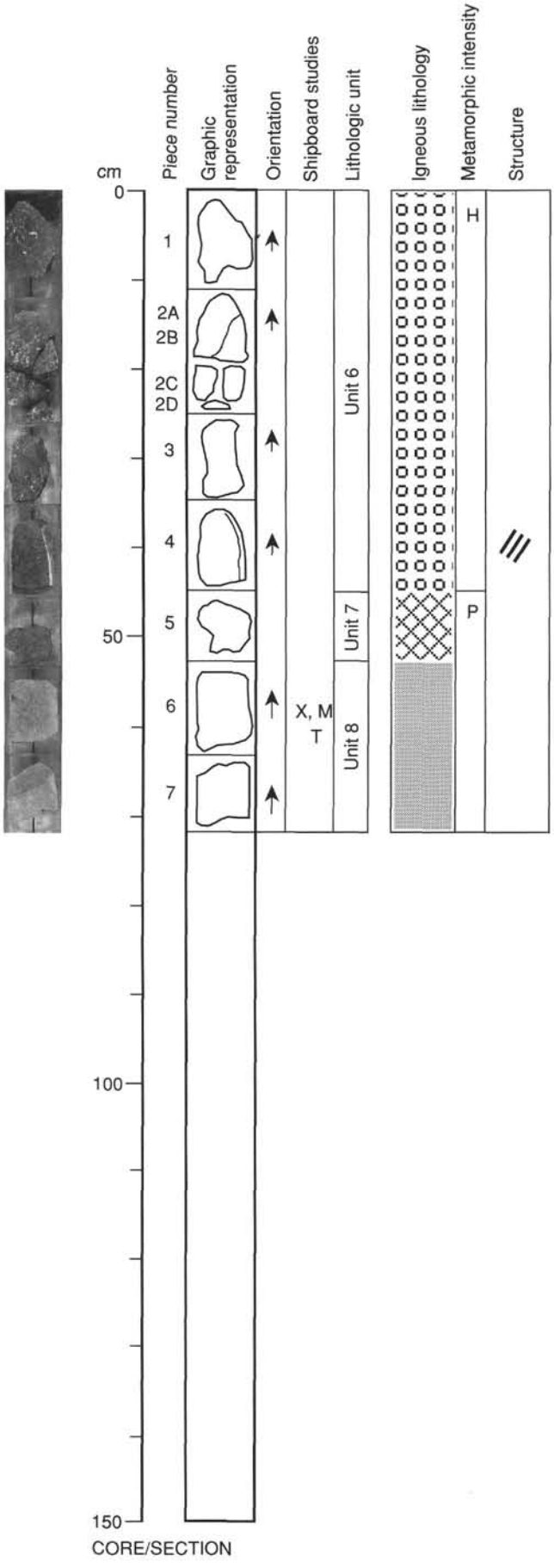
Olivine - Mode: 80%–95%.
- Crystal size: Not discernible.
- Crystal shape: Subhedral?
- Crystal orientation: None visible.
- Percent replacement: 60%–100%.

Plagioclase - Mode: 2%–10%.
- Crystal size: 3–5 mm.
- Crystal shape: Anhedral.
- Crystal orientation: None.
- Percent replacement: 50%.
- Comments: Occurs in patches and veins.

Clinopyroxene - Mode: 2%–8%.
- Crystal size: 3–10 mm.
- Crystal shape: Anhedral.
- Crystal orientation: None.
- Percent replacement: 20%.
- Comments: Generally associated with plagioclase in veins.

Spinel - Mode: 3%.
- Crystal size: up to 3 mm.
- Crystal shape: Euhedral-subhedral.
- Crystal orientation: None.
- Percent replacement: 5%?.
- Comments: Occurs together with plagioclase with which it is intergrown in places.

SECONDARY MINERALOGY:
Total percent: 75%.
Texture: Alteration is the same as in Section 147-895C-4R-1. However, anastomosing actinolitic veinlets are more common and actinolite/chlorite rims around altered plagioclases are better developed. Clinopyroxene in the impregnated gabbroic zones is replaced by dark green fibrous amphibole.
Vein material: In Pieces 1A, 1B, 1C, 1D, 1E, 3, 5, 6, 8, and 9. 1–5 mm wide chrysotile, lizardite, and magnetite veins forming either anastomosing or parallel banded networks.
ADDITIONAL COMMENTS: Variable amounts of gabbroic or plagioclase-rich patches, especially abundant in Pieces 2 and 6. In Piece 6B, the gabbroic material clearly forms an intrusive dike. Gabbroic patches reach a maximum amount in Piece 6B and then decrease downsection.



147-895C-4R-3

UNIT 6: DUNITE

Pieces 1–3

COLOR: Black.
LAYERING: None.
DEFORMATION: Minor veining. Good spinel foliation in Piece 4.
PRIMARY MINERALOGY: Clinopyroxene is interstitial and may be impregnated, as with plagioclase.
Olivine - Mode: 80%–90%.
Crystal size: Not discernible.
Crystal shape: Not discernible.
Percent replacement: 70%.
Plagioclase - Mode: 10%.
Crystal size: 2–5 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 70%.
Clinopyroxene - Mode: 5%–10%.
Crystal size: 1–5 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 50%.
SECONDARY MINERALOGY:
Total percent: 70%–80%.
Texture: Alteration is similar to previous sections. Up to 1% oxide, with the maximum in Piece 1. Oxide is associated with plagioclase in Pieces 1–3. Up to 3 mm diameter crystals with round silicate inclusions showing vermicular texture in spinel.
Vein material: Located in Pieces 2, 3, and 4. 0.1–2 mm wide veins of lizardite and chrysotile. Piece 4 has a 3 mm wide vein of carbonate (magnesite?) on a broken surface.
ADDITIONAL COMMENTS: Gabbroic or plagioclase-rich patches, interstitial to olivine, decrease in amount downsection from Pieces 1 to 4.

UNIT 7: HARZBURGITE (INTERVAL 10)

Piece 5

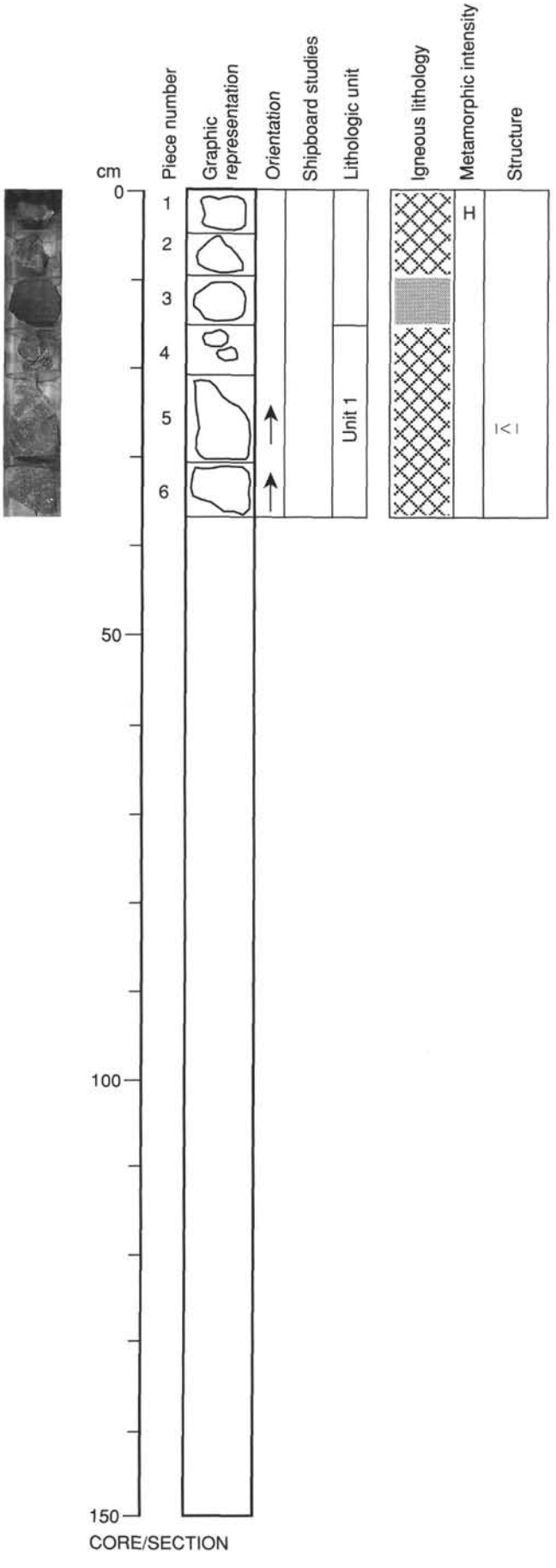
COLOR: Black to yellow brown.
LAYERING: None.
DEFORMATION: Veining.
PRIMARY MINERALOGY: Possibly some minor interstitial clinopyroxene. Spinel (chromian) is rare.
Olivine - Mode: 85%.
Crystal size: Not discernible.
Crystal shape: Not discernible.
Crystal orientation: None.
Percent replacement: 70%–100%.
Orthopyroxene - Mode: 15%.
Crystal size: 2–5 mm.
Crystal shape: Subhedral.
Crystal orientation: Possible very weak foliation.
Percent replacement: 100%.
Comments: Porphyroclastic texture.
SECONDARY MINERALOGY:
Total percent: 100%.
Texture: Alteration is intense with abundant serpentine and alteration of orthopyroxene to serpentine and clay.
Vein material: One 2 mm lizardite/chrysotile vein.

147-895C-4R-3

UNIT 8: BASALT

Pieces 6 and 7

CONTACTS: Missing.
PHENOCRYSTS:
Plagioclase - 30%; 1 mm or less; highly altered.
GROUNDMASS: Probably intersertal-ophitic.
COLOR: Light gray.
STRUCTURE: Massive.
ALTERATION: Plagioclase is altered 80%–90% and pale pink in color. Appears to be secondary plagioclase and clay. Pyroxene is pale green-gray in color and pervasively altered to amphibole. Possible rare olivine may be pseudomorphed by pale brown clay.
VEINS/FRACTURES: <5%; 0.1 mm wide; 4–5 cm long. Located in Piece 6 and filled with clay.
ADDITIONAL COMMENTS: Groundmass pervasively altered to amphibole, chlorite, and clays. Maybe as high as amphibolite grade metamorphism.

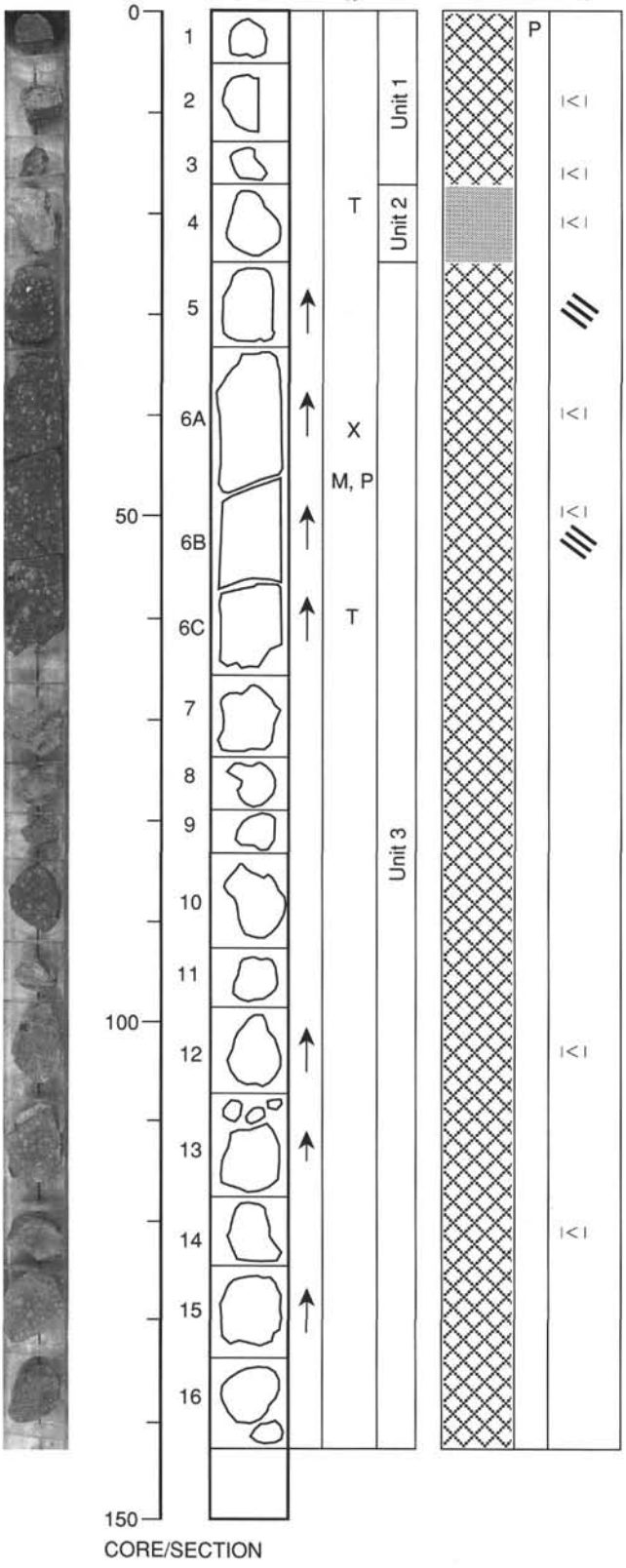


147-895D-1R-1

MIXED RUBBLE: HARZBURGITE AND APHYRIC BASALT (PIECES 1 TO 3)
UNIT 1: HARZBURGITE (PIECES 4 TO 6)

Pieces 1–6

COLOR: Yellowish green.
LAYERING: None.
DEFORMATION: Porphyroclastic. In Piece 5, orthopyroxenes are aligned, defining a high-angle foliation. This is not as apparent in Piece 6.
PRIMARY MINERALOGY:
Olivine - Mode: 80%–85%.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 50%.
Comments: Replaced by serpentine.
Orthopyroxene - Mode: 15%–20%.
Crystal size: to 13 mm.
Crystal shape: Rounded.
Crystal orientation: None.
Percent replacement: 20%.
Spinel - Mode: <1%.
Crystal size: to 1 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
SECONDARY MINERALOGY: Orthopyroxene is altered to colorless amphibole with minor pale gray chlorite patches. Pieces 1 and 2 are weathered to orange-brown clay and perhaps talc.
Total percent: 40%–70%.
Texture: Pseudomorphic.
Vein material: Lizardite and chrysotile.
ADDITIONAL COMMENTS: Piece 3 is fine-grained aphyric pillow basalt with fresh glass on one side. It contains olivine and plagioclase microphenocrysts and is microvesicular. Pieces 1–4 are probably surface rubble. Pieces 1 and 2 have apparent surface weathering (oxidative alteration) to yellow-brown clays. Orthopyroxenes are rounded to irregular, the latter blending into serpentine veinlets and being more altered. Pieces 3–6 are less oxidatively altered than Pieces 1 and 2.



147-895D-2R-1

UNITS 1 AND 3: HARZBURGITE

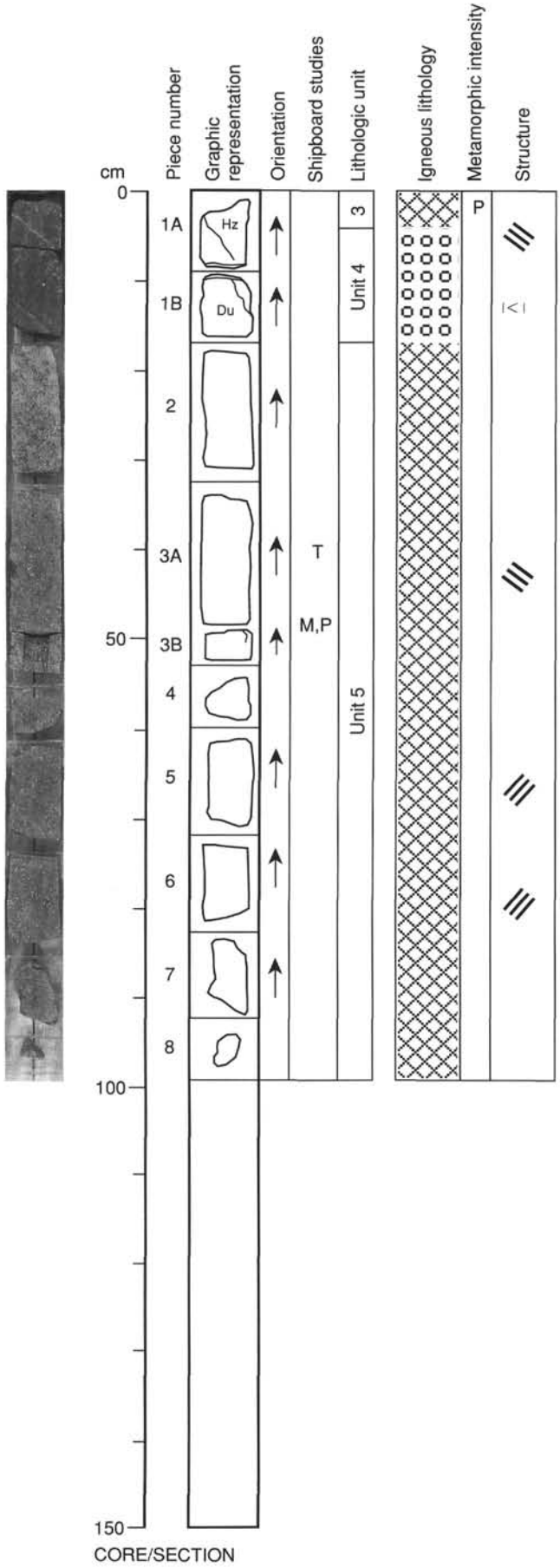
Pieces 1–3 and 5–16

COLOR: Dark green-black.
LAYERING: None.
DEFORMATION: Veining and tectonite foliation.
PRIMARY MINERALOGY: Clinopyroxene (green) anhedra in some places attached to orthopyroxene subhedra. Texture is porphyroclastic. Fine-grained inclusions of brownish spinel in some orthopyroxenes are common.
Olivine - Mode: 80%–90%.
Crystal size: Not discernible.
Crystal shape: Not discernible.
Crystal orientation: Not discernible.
Percent replacement: 80%–100%.
Orthopyroxene - Mode: 10%–20%.
Crystal size: 3–12 mm, average 5 mm.
Crystal shape: Subhedral.
Crystal orientation: Minor foliation (steep?)
Percent replacement: 50%.
Clinopyroxene - Mode: <1%.
Crystal size: <0.5 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 100%.
Spinel - Mode: 1.5%.
Crystal size: up to 4.5 mm.
Crystal shape: Subhedral.
Crystal orientation: Minor pull apart.
Percent replacement: Minor.
SECONDARY MINERALOGY: Degree of serpentinization is variable from less than 80% in some pieces to 100% in others.
Total percent: <100%.
Texture: Olivine pervasively altered to serpentine, talc, and oxides. Orthopyroxenes pervasively replaced by amphibole, serpentine, and talc? Some chlorite developed in Pieces 5 and 6. Chlorite rare in Pieces 7–10. In these a serpentine mesh texture is well developed. Clinopyroxene replaced actinolite/chlorite.
Vein material: Located in Pieces 3, 6B, 7, 11, and 12. Dominantly serpentine veins and minor thin tremolite veins. Pale gray-blue microveinlets of chlorite cut some porphyroclasts.
ADDITIONAL COMMENTS: Orthopyroxene mode is variable, with some minor dunitic patches seen.

UNIT 2: HIGHLY OLIVINE PHYRIC BASALT

Piece 4

CONTACTS: Missing.
PHENOCRYSTS: Olivine is replaced by dull brown clays/chlorite.
Olivine - 10%–15%; 1–2 mm; Altered skeletal-euhedral crystals.
Plagioclase - Trace; 1–2 mm. Rare.
Spinel - <1%; 0.1–2 mm. Size range is from thin section.
GROUNDMASS: Highly altered and patchy gray-white. In thin section, plagioclase is replaced by fibrous, radiating clear amphibole and very fine clays or chlorite. Pyroxene locally is replaced by pale brown pleochroic amphibole.
VESICLES: None.
COLOR: Light gray.
STRUCTURE: Massive with one marked vein.
ALTERATION: The rock is an amphibolite-facies metabasalt, with relict porphyritic-intersertal texture. It also altered to clays and chlorite.
VEINS/FRACTURES: 5%; 2 mm. Has a single vein lined with amphibole(?). In thin section, clinopyroxene adjacent to narrow veins is completely replaced by pale brown pleochroic amphibole.
ADDITIONAL COMMENTS: The rock is strongly metamorphosed, but may originally have been diabasic in texture. It resembles less altered plagioclase-olivine phyric basalt at Site 894, even to the extent of having vermicular skeletal rims on Cr-spinels. However, it is more olivine-rich, has only rare plagioclase phenocrysts, and experienced high-temperature metamorphism.



147-895D-2R-2

UNITS 3 AND 5: HARZBURGITE

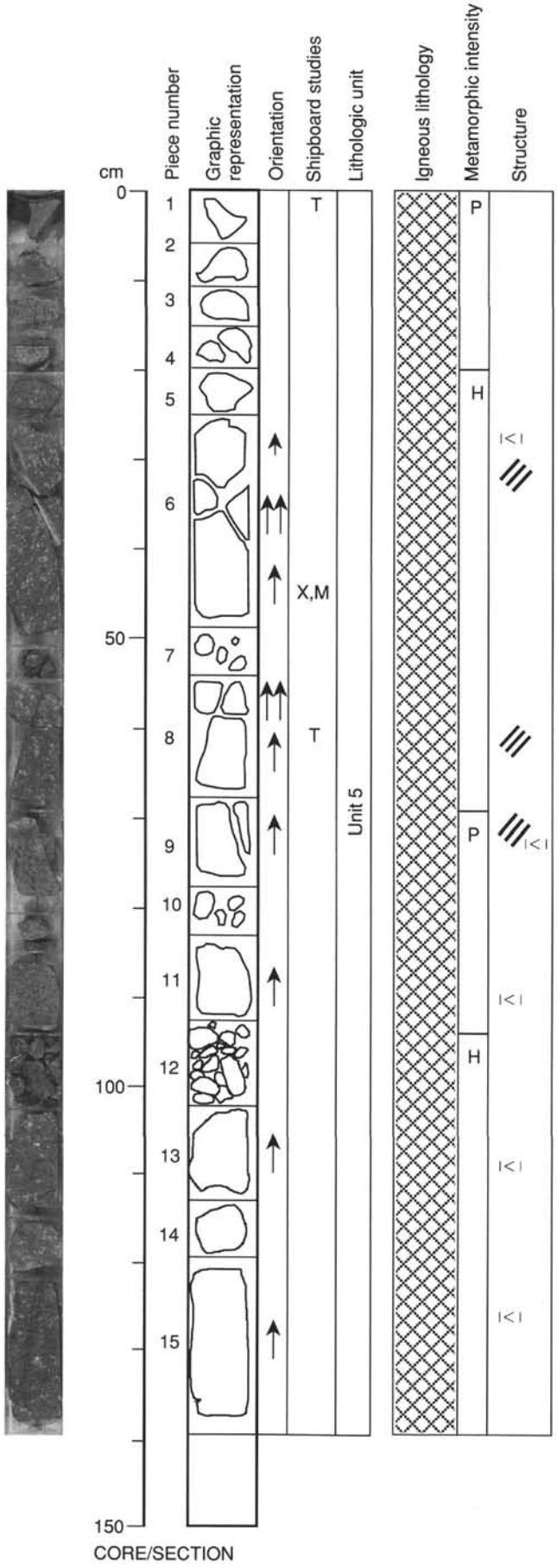
Pieces 1A and 2–8

COLOR: Gray-brown and black.
LAYERING: None.
DEFORMATION: Porphyroclastic, with tectonite fabric defined by elongation of spinels and orthopyroxene. Steep lineation apparent.
PRIMARY MINERALOGY: Minor clinopyroxene? pseudomorphed by chlorite/actinolite.
Olivine - Mode: 80%–90%.
Crystal size: Not discernible.
Crystal shape: Anhedral?
Crystal orientation: None apparent.
Percent replacement: 80%.
Orthopyroxene - Mode: 15%–20%.
Crystal size: 2.5–7 mm.
Crystal shape: Subhedral.
Crystal orientation: Weakly aligned.
Percent replacement: 40%–70%.
Spinel - Mode: 2%.
Crystal size: 1 mm.
Crystal shape: Anhedral.
Crystal orientation: Elongate parallel to spinel trail.
Percent replacement: Minor oxide.
SECONDARY MINERALOGY:
Total percent: 75%.
Texture: Mesh texture serpentine. Granular, fine-grained? relicts of olivine. Some opaque minerals replace olivine in part. Enstatite retains fresh apple green cores, rimmed by diffuse coronas of amphibole, chlorite, and serpentine.
Vein material: Chrysotile and carbonate as minor veins approximately 1 mm wide but up to 2 mm rarely. Located in Pieces 1, 5, and 7. Tremolite may be a rare associated mineral.

UNIT 4: DUNITE

Pieces 1A and 1B

COLOR: Gray-brown.
LAYERING: None.
DEFORMATION: Minor veining.
PRIMARY MINERALOGY:
Olivine - Mode: 95%.
Crystal size: Not discernible.
Crystal shape: Not discernible.
Crystal orientation: None apparent.
Percent replacement: 80%–90%.
Spinel - Mode: <1%.
Crystal size: 0.5–1 mm.
Crystal shape: Anhedral.
Crystal orientation: None apparent.
Percent replacement: Minor.
Orthopyroxene - Mode: <5%.
Crystal size: 2–3 mm.
Crystal shape: Anhedral granular.
Crystal orientation: None.
Percent replacement: 100%.
SECONDARY MINERALOGY:
Total percent: 85%.
Texture: Olivines are moderately to highly altered to brown-orange or more rarely black serpentine plus clay and trace talc. Mesh texture is pervasive.
Vein material: Fine, anastomosing networks of altered pale gray-green serpentine veinlets and one veinlet with an oxide-rich core rimmed by serpentine cut the sample.

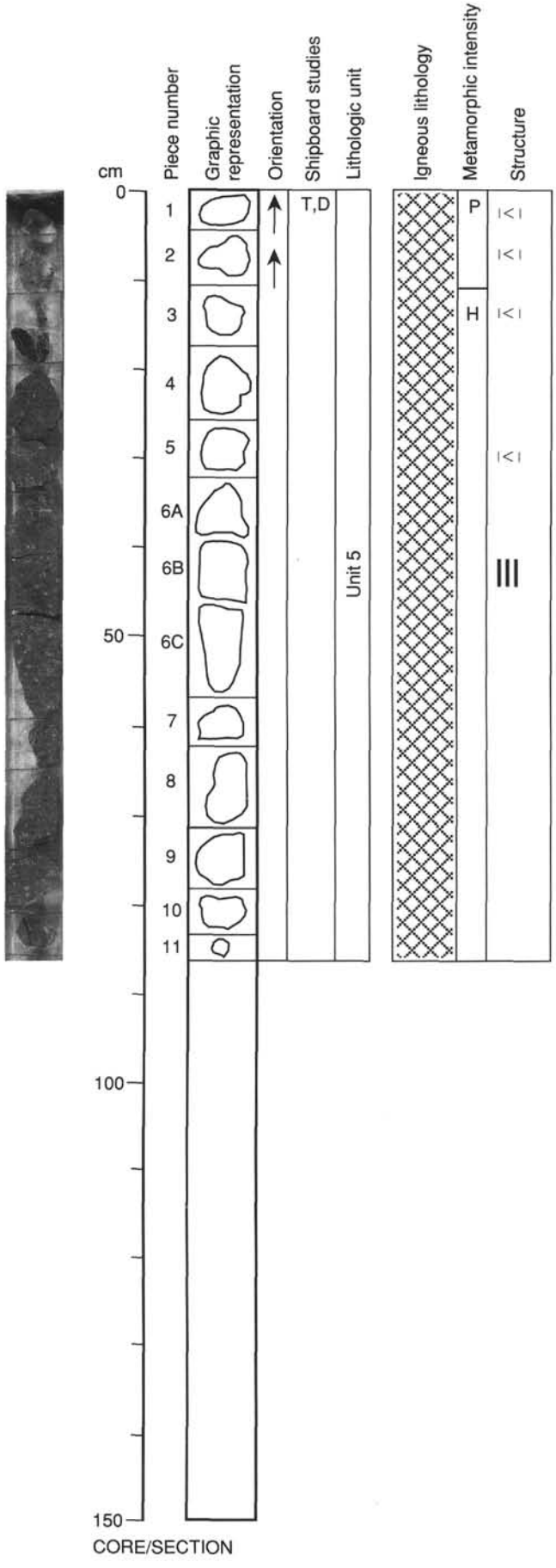


147-895D-3R-1

UNIT 5: HARZBURGITE

Pieces 1–15

COLOR: Mottled green.
LAYERING: None.
DEFORMATION: Minor veining. No apparent tectonite fabric, but minor serpentine foliation in some pieces.
PRIMARY MINERALOGY: In Piece 2 spinel is elongate and in Pieces 14 and 15 forms patches of aligned grains.
Olivine - Mode: 75%.
Crystal size: Not discernible.
Crystal shape: Not discernible.
Crystal orientation: None.
Percent replacement: 60%–100%.
Orthopyroxene - Mode: 25%.
Crystal size: 3–12 mm , average 4 mm.
Crystal shape: Subhedral to anhedral.
Crystal orientation: None.
Percent replacement: 40%.
Clinopyroxene - Mode: <1%.
Crystal size: 1 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 100%.
Spinel - Mode: 1%.
Crystal size: <2.5 mm.
Crystal shape: Equant or elongate.
Crystal orientation: En echelon aligned patches.
Percent replacement: Minor.
SECONDARY MINERALOGY: Pale blue-gray fine patches of chlorite and actinolite after clinopyroxene are partially included in orthopyroxene or as isolated grains.
Total percent: 60%–95%
Texture: Orthopyroxenes pervasively altered to serpentine with minor chlorite. Olivines are altered to serpentine and talc. Irregular aggregates of opaque minerals and minor veinlets of native copper. Rocks are variably weathered to orange-colored serpentine and clay in places.
Vein material: Located in Pieces 6, 9, 11, 13, and 15. Thin veins (<0.1 mm) of tremolite and 0.5 mm–3 mm veins of chrysotile and clays. Some veins have oxide minerals.
ADDITIONAL COMMENTS: Amounts of orthopyroxene are variable. Piece 15 is especially orthopyroxene poor and is almost dunitic. Spinel is anhedral in orthopyroxene-rich parts and more rounded in dunitic parts. The small amount of clinopyroxene is generally associated with orthopyroxene.

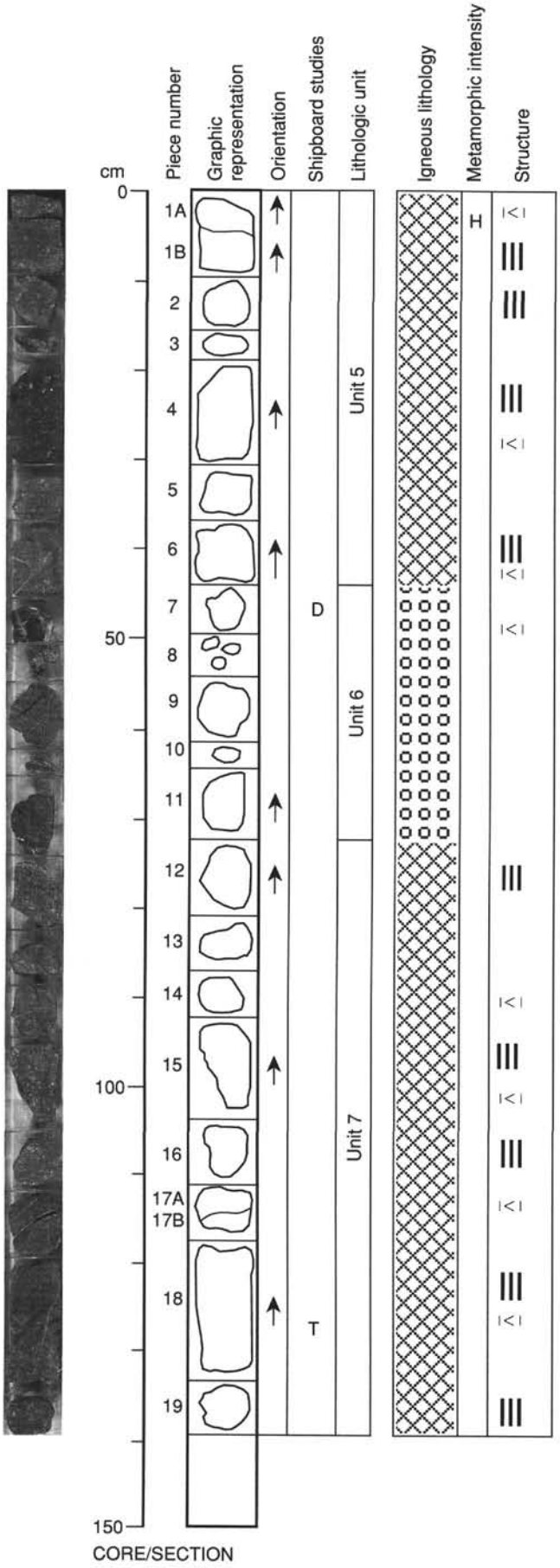


147-895D-4R-1

UNIT 5: HARZBURGITE

Pieces 1–11

COLOR: Dark grayish green, mottled.
LAYERING: None.
DEFORMATION: Porphyroclastic texture. Moderate serpentine veining. Steeply dipping spinel foliation is present in Piece 6.
PRIMARY MINERALOGY:
Olivine - Mode: 80%–85%.
Crystal size: Cannot resolve.
Crystal shape: Anhedral.
Percent replacement: 75%.
Orthopyroxene - Mode: 15%–20%.
Crystal size: to 10 mm.
Crystal shape: Rounded.
Crystal orientation: None.
Percent replacement: 65%–70%.
Spinel - Mode: <1%.
Crystal size: to 1 mm.
Crystal shape: Anhedral.
SECONDARY MINERALOGY: Pieces 1 and 2 are completely serpentinized.
Total percent: 75%.
Texture: Pseudomorphic, mesh serpentine.
Vein material: Serpentine.
ADDITIONAL COMMENTS: NOTE. All pieces in this section fell out of the core barrel. Neither sequence nor orientation are guaranteed. The entire section consists of variably serpentinized harzburgite. In strongly serpentinized Pieces 1, 2, and 10, orthopyroxene is pervasively altered to colorless amphibole and its morphology has a subtle change from subrounded to interfingering (related to amphibole overgrowths?). Some pieces retain fresh relicts of orthopyroxene.



147-895D-4R-2

UNITS 5 AND 7: HARZBURGITE

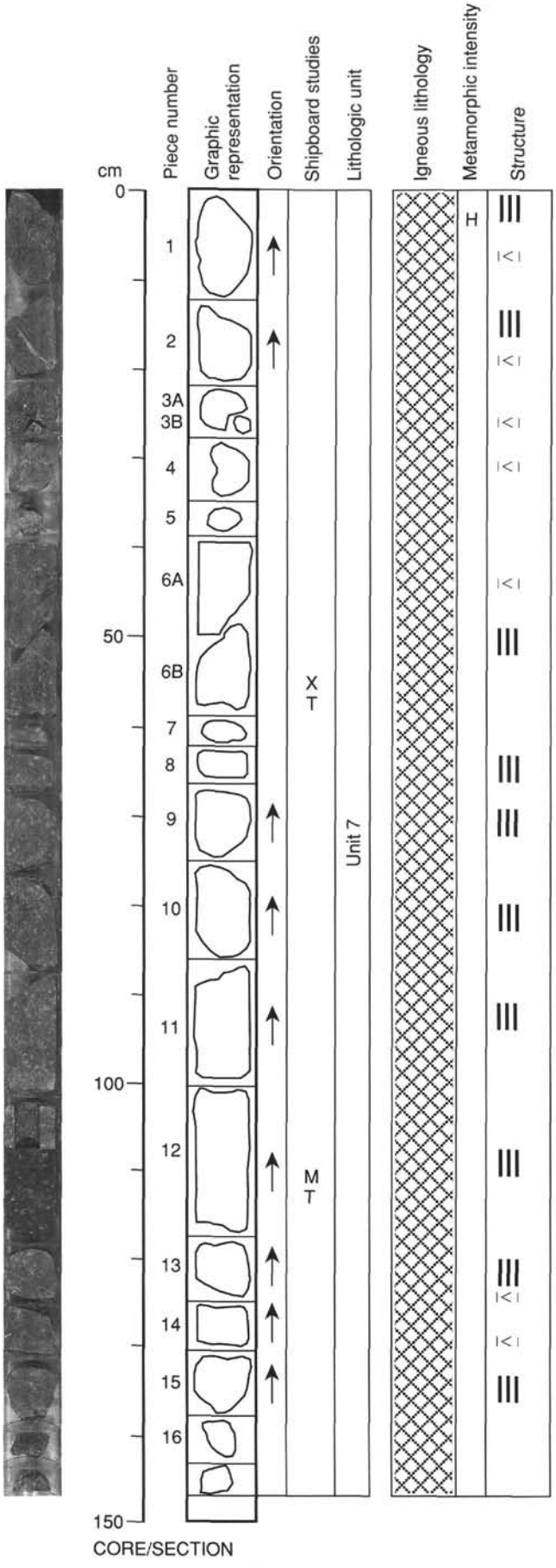
Pieces 1A–6, 12–19

COLOR: Dark grayish green.
LAYERING: None.
DEFORMATION: Porphyroclastic texture. Steeply dipping spinel foliation is well developed. There is little serpentine veining.
PRIMARY MINERALOGY:
Olivine - Mode: 80%–85%.
Crystal size: Cannot resolve.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 60%.
Comments: Replaced by serpentine.
Orthopyroxene - Mode: 15%–20%.
Crystal size: to 8 mm.
Crystal shape: Rounded.
Crystal orientation: None.
Percent replacement: 40%.
Spinel - Mode: <1%.
Crystal size: to 1 mm.
Crystal shape: Anhedral.
Crystal orientation: Aligned with foliation.
SECONDARY MINERALOGY: Orthopyroxene replacement is variable.
Total percent: 75%–85%.
Texture: Mesh serpentine.
Vein material: Serpentine.
ADDITIONAL COMMENTS: Amount of orthopyroxene is variable from piece to piece. Dunite Interval 8 (Pieces 7–11) separates the two harzburgite intervals, but may simply represent a fluctuation to a very low proportion of orthopyroxene.

UNIT 6: DUNITE

Pieces 7–11

COLOR: Dark green.
LAYERING: None.
DEFORMATION: None.
PRIMARY MINERALOGY:
Olivine - Mode: 95%–99%.
Crystal size: Cannot resolve.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 99%.
Comments: Replaced by mesh serpentine.
Orthopyroxene - Mode: 1%–5%.
Crystal size: Cannot resolve.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 100%.
Spinel - Mode: <1%.
Crystal size: to 1 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
SECONDARY MINERALOGY: Low apparent abundance of orthopyroxene may partly be the result of alteration.
Total percent: 99%.
Texture: Mesh serpentine.
Vein material: Serpentine.
ADDITIONAL COMMENTS: The mesh serpentinite matrix of these pieces resembles that of adjoining harzburgite.

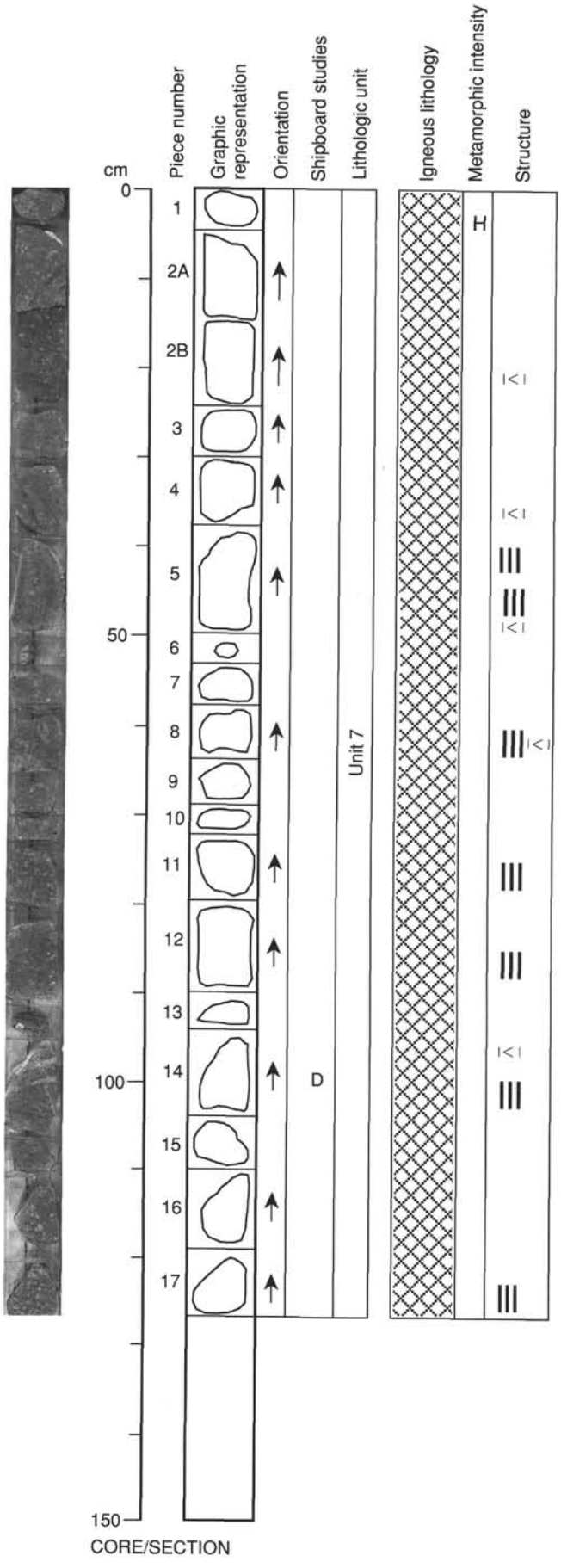


147-895D-4R-3

UNIT 7: HARZBURGITE

Pieces 1–16

COLOR: Dark grayish green.
LAYERING: None.
DEFORMATION: Porphyroclastic textures, with well-developed, steeply to moderately dipping spinel foliation. The rocks are moderately veined with serpentinite.
PRIMARY MINERALOGY:
Olivine - Mode: 50%–85%.
Crystal size: Cannot resolve.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 70%.
Comments: Replaced by serpentine.
Orthopyroxene - Mode: 15%–20%.
Crystal size: to 10 mm.
Crystal shape: Rounded to subangular.
Crystal orientation: None.
Percent replacement: 30%–90%.
Spinel - Mode: <1%.
Crystal size: Anhedral.
SECONDARY MINERALOGY: Orthopyroxene alteration is irregular; it can exceed that of olivine (Pieces 1–3). In Pieces 1–6, orthopyroxene is at least partly pseudomorphed by green, translucent amphibole.
Total percent: 70%–80%.
Texture: Mesh.
Vein material: Serpentine.
ADDITIONAL COMMENTS: This serpentinized harzburgite is relatively fresh. Orthopyroxene has a fibrous sheen on the cut face of the core. The grain size range from 1–10 mm occurs in any piece. Many rounded orthopyroxene crystals have distinct fractures.

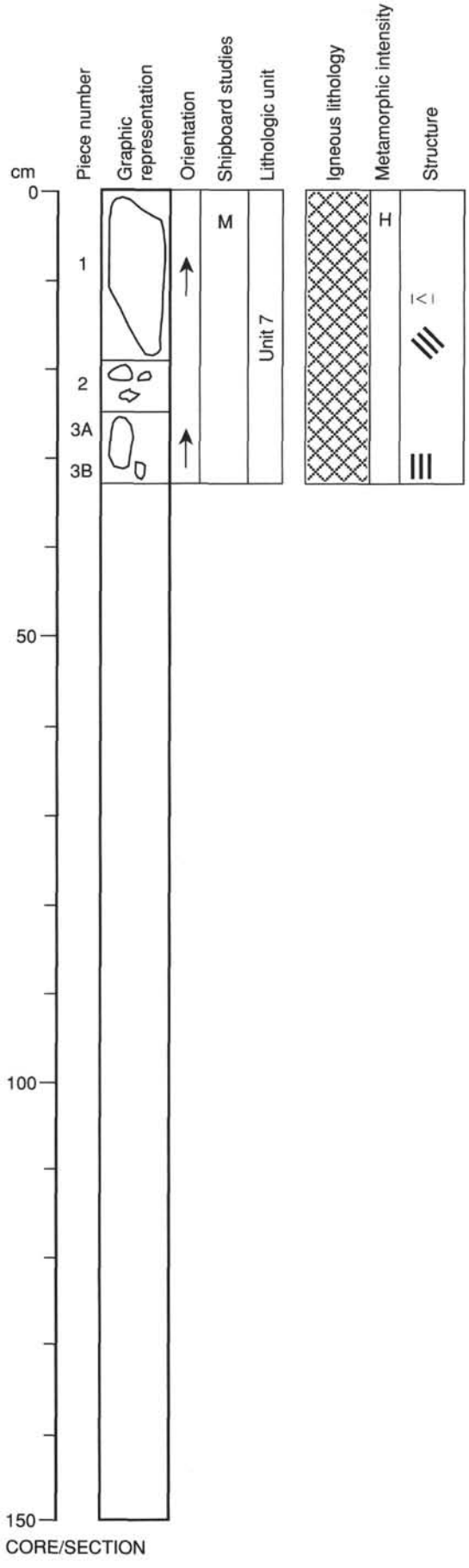


147-895D-4R-4

UNIT 7: HARZBURGITE

Pieces 1–17

COLOR: Dark green.
LAYERING: None.
DEFORMATION: Porphyroclastic texture, with steep to moderately dipping foliation; the rocks are moderately veined with green serpentine and aragonite.
PRIMARY MINERALOGY:
Olivine - Mode: 80%–85%.
Crystal size: Cannot resolve.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 70%.
Comments: Replaced by mesh serpentine.
Orthopyroxene - Mode: 15%–20%.
Crystal size: to 9 mm.
Crystal shape: Rounded to subangular.
Crystal orientation: None.
Percent replacement: 60%–80%.
Spinel - Mode: <1%.
Crystal size: to 1 mm.
Crystal shape: Anhedral.
SECONDARY MINERALOGY:
Total percent: 75%–80%.
Texture: Mesh.
Vein material: Serpentine and aragonite.
ADDITIONAL COMMENTS: The rocks are porphyroclastic harzburgite, with orthopyroxene varying in abundances in individual pieces and throughout the section. There is a large range in orthopyroxene grain size. Its morphology varies from rounded and fractured to subangular. It typically has a sheen on cut surfaces of the core.



147-895D-4R-5

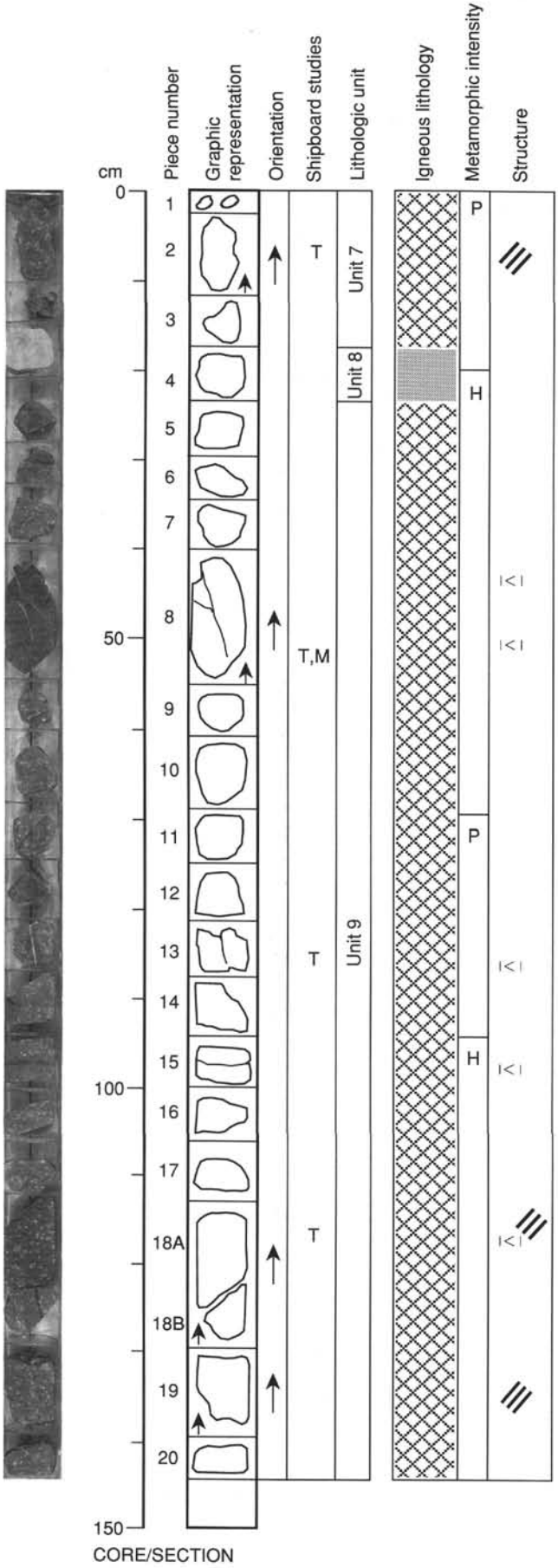
UNIT 7: HARZBURGITE

Pieces 1–3B

COLOR: Dark green.
LAYERING: None.
DEFORMATION: Porphyroclastic. Spinel foliation has a steep to moderate dip.
PRIMARY MINERALOGY:
- Olivine - Mode: 80%–85%.
  - Crystal size: Cannot resolve.
  - Crystal shape: Anhedral.
  - Crystal orientation: None.
  - Percent replacement: 70%.
  - Comments: Replaced by mesh serpentine.
- Orthopyroxene - Mode: 15%–20%.
  - Crystal size: to 7 mm.
  - Crystal shape: Rounded.
  - Crystal orientation: None.
  - Percent replacement: 60%.
- Spinel - Mode: <1%.
  - Crystal size: to 1 mm.
  - Crystal shape: Anhedral.
  - Crystal orientation: Aligned along foliation.

SECONDARY MINERALOGY: The rock has various patches where orthopyroxene has been altered to dark green, translucent amphibole.
- Total percent: 70%.
- Texture: Mesh.
- Vein material: Serpentine and aragonite.

ADDITIONAL COMMENTS: Orthopyroxene is variable in abundance from piece to piece.



147-895D-5R-1

UNITS 7 AND 9 : HARZBURGITE

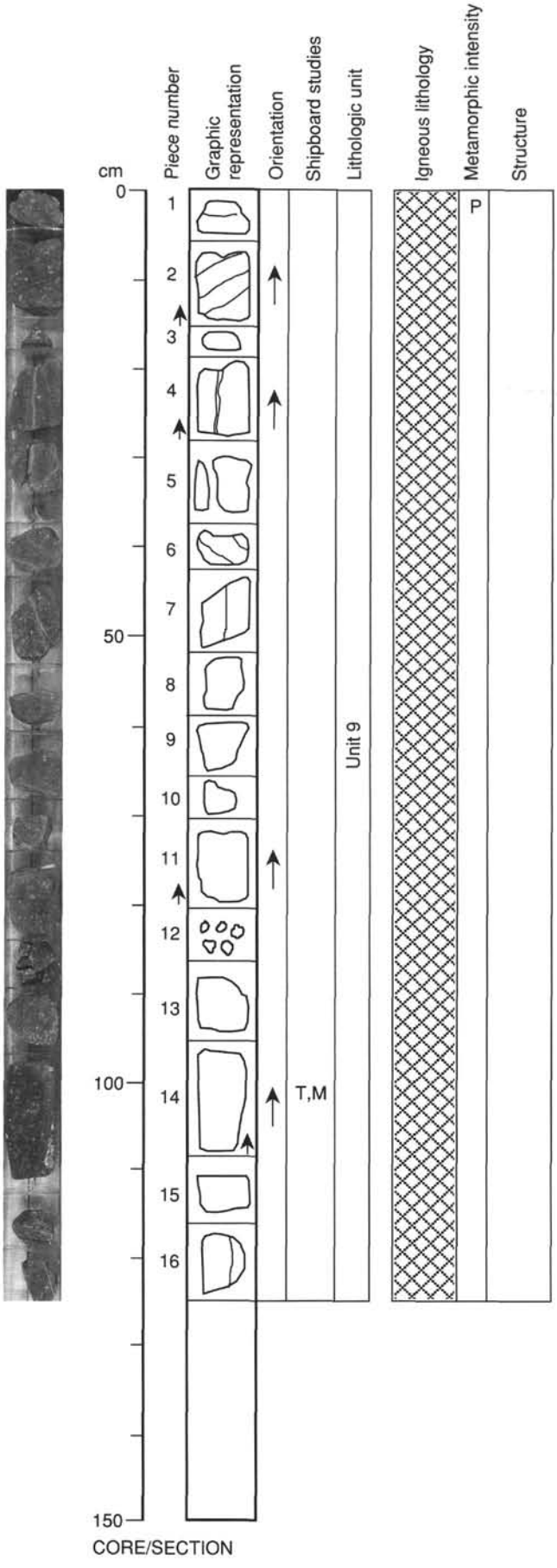
Pieces 1–3 and 5–20

COLOR: Gray to black.
LAYERING: None.
DEFORMATION: Tectonite fabric defined by spinel elongation visible in some pieces. Variable amounts of serpentine veining.
PRIMARY MINERALOGY: Orthopyroxene content is variable on centimeter scale. Size of orthopyroxene can be quite variable even in single piece.
Olivine - Mode: 75%–90%.
Crystal size: Not discernible.
Crystal shape: Not discernible.
Crystal orientation: None apparent.
Percent replacement: 50%.
Orthopyroxene - Mode: 20%.
Crystal size: 1–10 mm, average 4 mm.
Crystal shape: Subhedral-anhedral.
Crystal orientation: Weak foliation in places.
Percent replacement: 50%–90%.
Clinopyroxene - Mode: 1%.
Crystal size: <0.5 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 90%.
Spinel - Mode: 1%.
Crystal size: 1.5 mm.
Crystal shape: Elongate along spinel trails.
Crystal orientation: In echelon patches of aligned spinel percent replacement: minor.
SECONDARY MINERALOGY:
Total percent: 55%–90%.
Texture: Orthopyroxene, often with diffuse boundaries, are 50%–90% altered colorless amphibole, serpentine, and chlorite. Rare pseudomorphs of chlorite and serpentine after clinopyroxene. In Piece 8, abundant wispy patches and diffuse grains have chloritic cores surrounded by brown colored serpentinite halo.
Vein material: Located in Pieces 2, 3, 4, 6, 8, 10, 12, 13, 15, and 18A. Generally 0.2–1 mm wide chrysotile veins (asbestos is common) with tremolite and chlorite in places. Piece 4 has a talc/hydrogrossular vein.

UNIT 8: BASALT

Piece 4

COLOR: Light gray.
LAYERING: None.
DEFORMATION: None.
PRIMARY MINERALOGY: None clearly discernible.
SECONDARY MINERALOGY:
Total percent: 100%.
Vein material: 1-mm-wide vein of talc and 0.5-mm-wide vein of white-pink hydrogrossular.
ADDITIONAL COMMENTS: Pervasively altered, mottled gray to grayish pink, fine-grained rodingite with relict grains of possible pyroxene. Matrix completely replaced by hydrogrossular plus prehnite and maybe epidote/zoisite. The rock was likely a microgabbro before alteration.

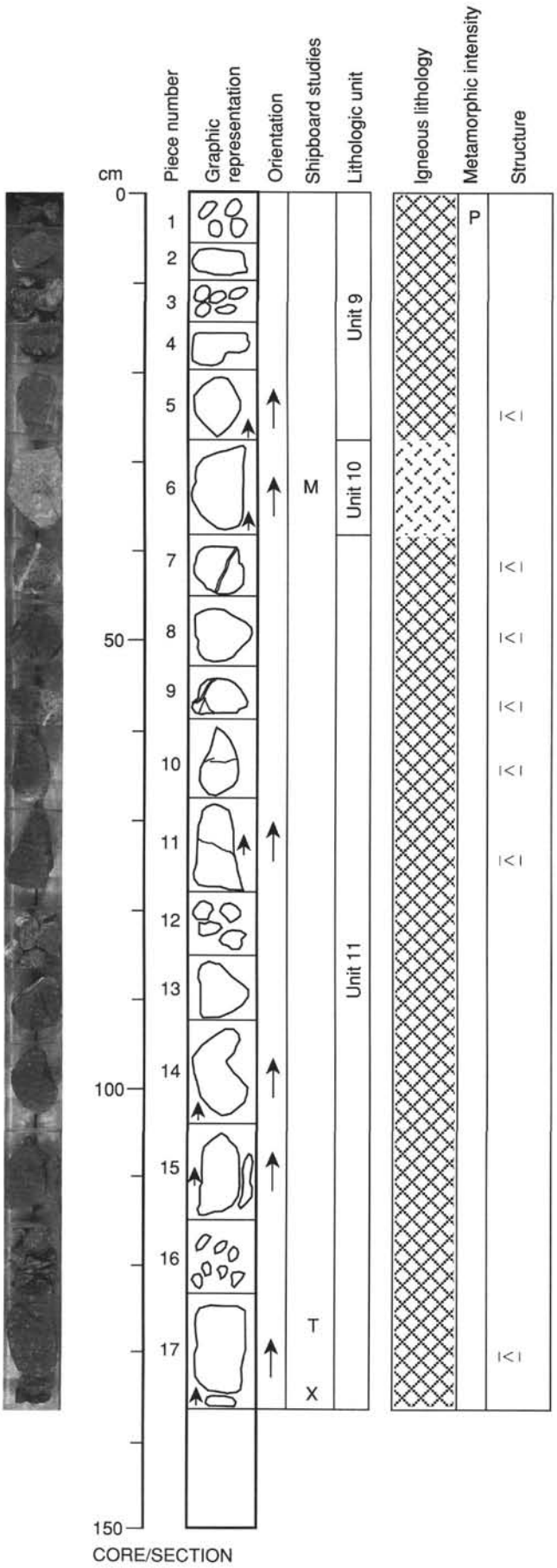


147-895D-5R-2

UNIT 9: HARZBURGITE

Pieces 1–16

COLOR: Gray to black.
LAYERING: None.
DEFORMATION: Minor veining, ranging from subhorizontal with respect to the core axis to 30 degree or 40 degree dip. Foliation defined by aligned spinel.
PRIMARY MINERALOGY: Minor interstitial clinopyroxene as crystal less than 0.5 mm and anhedral habit.
Olivine - Mode: 80%–90%.
Crystal size: Not discernible.
Crystal shape: Not discernible.
Crystal orientation: Not apparent.
Percent replacement: 70%.
Orthopyroxene - Mode: 15%.
Crystal size: 1–7 mm, average 4 mm.
Crystal shape: Subhedral-anhedral.
Crystal orientation: Foliated in some pieces.
Percent replacement: 70%–100%.
Spinel - Mode: 1%.
Crystal size: 2 mm.
Crystal shape: Anhedral.
Crystal orientation: Some alignment and brittle pull apart.
Percent replacement: Minor.
SECONDARY MINERALOGY:
Total percent: 70%.
Texture: Orthopyroxenes pseudomorphs are commonly rimmed by tremolite? and lizardite and composed of serpentine with some chlorite. Mesh texture serpentine replaces olivine. Minor development of secondary oxides and native copper in Pieces 2, 9, and 14.
Vein material: Located in Pieces 1, 2, 4, 5A, 6, 7, and 16 as 0.5–5 mm wide veins of chrysotile with in places talc or chlorite and tremolite. The veins form subparallel networks in places.
ADDITIONAL COMMENTS: Primary lithology is monotonous with only small variations in the modal percentage of orthpyroxene.



147-895D-6R-1

UNITS 9 AND 11: HARZBURGITE

Pieces 1–5 and 7–17

COLOR: Dark green-black.
LAYERING: None.
DEFORMATION: Minor veining. More obviously a tectonite at the base of the section.
PRIMARY MINERALOGY: Porphyroclastic texture.

- Olivine - Mode: 80%.
  - Crystal size: Not discernible.
  - Crystal shape: Not discernible.
  - Percent replacement: 80%.
- Orthopyroxene - Mode: 20%.
  - Crystal size: 1–10 mm, average 4 mm.
  - Crystal shape: Subhedral-anhedral.
  - Crystal orientation: Weak foliation in places.
  - Percent replacement: 90%–100%.
- Clinopyroxene - Mode: 1%.
  - Crystal size: 0.5 mm.
  - Crystal shape: Interstitial and anhedral.
  - Crystal orientation: None.
  - Percent replacement: 100%.
- Spinel - Mode: 1%.
  - Crystal size: 1 mm.
  - Crystal shape: Elongate.
  - Crystal orientation: Weak foliation in some places.
  - Percent replacement: Minor.

SECONDARY MINERALOGY:

Total percent: 65%–95%.
Texture: Orthopyroxene pseudomorphs are white to gray and have rare pale green cores. They are replaced by tremolite?, talc and have halos of pale blue-gray chlorite and serpentine. Clinopyroxene pseudomorphed by green chlorite and serpentine. Pyroxenes enclosed in a highly serpentinized mesh of serpentine.
Vein material: Located in 4, 5, 7, 8, 9, 10, 11, 13, 15B, and 17 as 0.2–5 mm wide veins of chrysotile and tremolite/talc. Piece 9 has a 4 mm carbonate vein as well as chrysotile veins.

UNIT 10: GABBRO

Piece 6

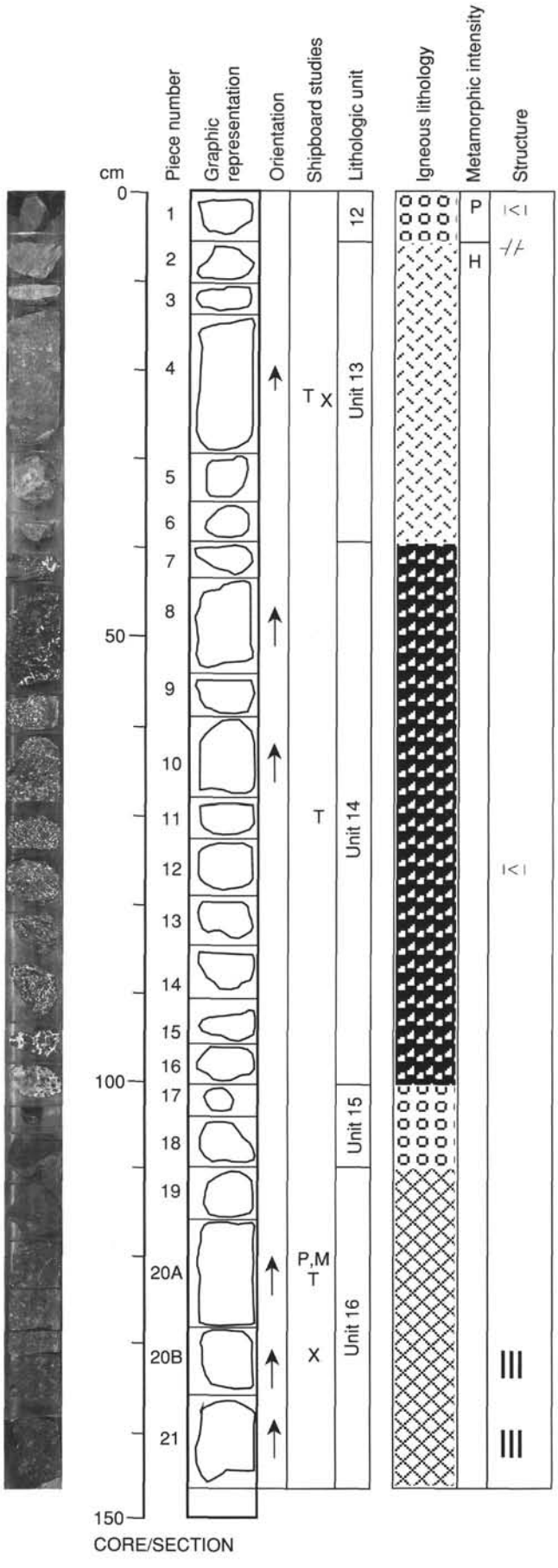
COLOR: Light gray.
LAYERING: None.
DEFORMATION: No identifiable deformation.
PRIMARY MINERALOGY:

- Plagioclase - Mode: 45%.
  - Crystal size: 2–8 mm, average 4 mm.
  - Crystal shape: Subhedral.
  - Crystal orientation: None.
  - Percent replacement: 90%–100%.
- Pyroxenes - Mode: 55%.
  - Crystal size: 1–20 mm, average 20 mm.
  - Crystal shape: Anhedral.
  - Crystal orientation: None.
  - Percent replacement: 100%.
  - Comments: Most clinopyroxenes are diallage. Cleavage clear in large crystals.

SECONDARY MINERALOGY:

Total percent: 90%.
Texture: Orthopyroxene is pervasively altered to amphibole (cummingtonite?) and a fibrous green amphibole. Plagioclase is pervasively altered to secondary plagioclase and hydrogrossular. Clinopyroxenes altered to actinolite and chlorite.
Vein material: 0.2 mm wide vein of pale pink to dark green hydrogrossular and chlorite.

ADDITIONAL COMMENTS: The rock is partially altered to calc-silicate minerals but still exhibits hypidiomorphic texture.



147-895D-7R-1

UNITS 12 AND 15: DUNITE

Pieces 1, 17–18

COLOR: Dark green.
LAYERING: None.
DEFORMATION: No spinel foliation. Pieces 17–18 are crisscrossed by an anastomosing network of serpentine and secondary magnetite veinlets.
PRIMARY MINERALOGY:
Olivine - Mode: 95%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Percent replacement: 100%.
Comments: Replaced by mesh serpentine.
Orthopyroxene - Mode: <5%.
Crystal size: 2 mm.
Crystal shape: Anhedral to subrounded.
Percent replacement: 100%.
Spinel - Mode: <1%.
Crystal shape: Anhedral.
SECONDARY MINERALOGY: Orthopyroxene is difficult to identify because it is completely altered to a dark green, translucent amphibole.
Total percent: 100%.
Texture: Mesh.
Vein material: Ochre clay and serpentine.
ADDITIONAL COMMENTS: The two intervals represent dunites which commonly occur adjacent to intensely altered gabbro in this core, and which - where recovery is sufficient - grade sharply into porphyroclastic harzburgite, as in this case within Piece 19.

UNIT 13: GABBRO

Pieces 2–6

COLOR: Mottled white to green.
LAYERING: None.
DEFORMATION: None.
PRIMARY MINERALOGY:
Plagioclase - Mode: 40%–50%.
Crystal size: 1–3 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 70%.
Comments: Replaced by secondary plagioclase and possibly fine-grained calc-silicates.
Olivine - Mode: 1%–5%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 70%.
Comments: Replaced by talc and chlorite.
Clinopyroxene - Mode: 50%.
Crystal size: 1–20 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 30%–50%.
Comments: Replacement estimate is only if large crystals with diallage are secondary. Then remaining primary clinopyroxene is 30%–40% replaced by amphibole.
SECONDARY MINERALOGY: The extent of alteration is difficult to characterize. Irregularly shaped patches have dark green, translucent coronas around cloudy to milky white to light green amphibole.
Total percent: 50%–60%.
Texture: Pseudomorphic.
Vein material: None.
ADDITIONAL COMMENTS: Variably rodingitized gabbro. Clinopyroxene proportions are variable. Piece 4 has a very high-angle contact between coarse- and medium-grained gabbro. Both have coarse-grained clinopyroxene, but the medium-grained part has less plagioclase. Coarse-grained Pieces 5 and 6 are unoriented, and match better with Pieces 2–4 in the working half.

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UNIT 14: TROCTOLITE

Pieces 7–16

COLOR: White to gray.
LAYERING: None.
PRIMARY MINERALOGY:
- Olivine - Mode: 40%–85%.
  - Crystal size: Cannot determine.
  - Crystal shape: Anhedral.
  - Crystal orientation: None.
  - Percent replacement: 90%.
- Plagioclase - Mode: 10%–60%.
  - Crystal size: <1–5 mm.
  - Crystal shape: Anhedral.
  - Crystal orientation: None.
  - Percent replacement: 100%.
- Spinel - Mode: <1%.
  - Crystal size: <1 mm.
  - Crystal shape: Euhedral
  - Crystal orientation: None.
- Titanomagnetite - Mode: Trace.
  - Crystal size: <1 mm.
  - Crystal shape: Anhedral.
  - Comments: In altered plagioclase.

SECONDARY MINERALOGY:
Total percent: >90%.
Texture: Pseudomorphic. Plagioclase is replaced with fine-grained chalky white minerals in their centers, and green chlorite on their margins. Olivine is replaced with black serpentine.

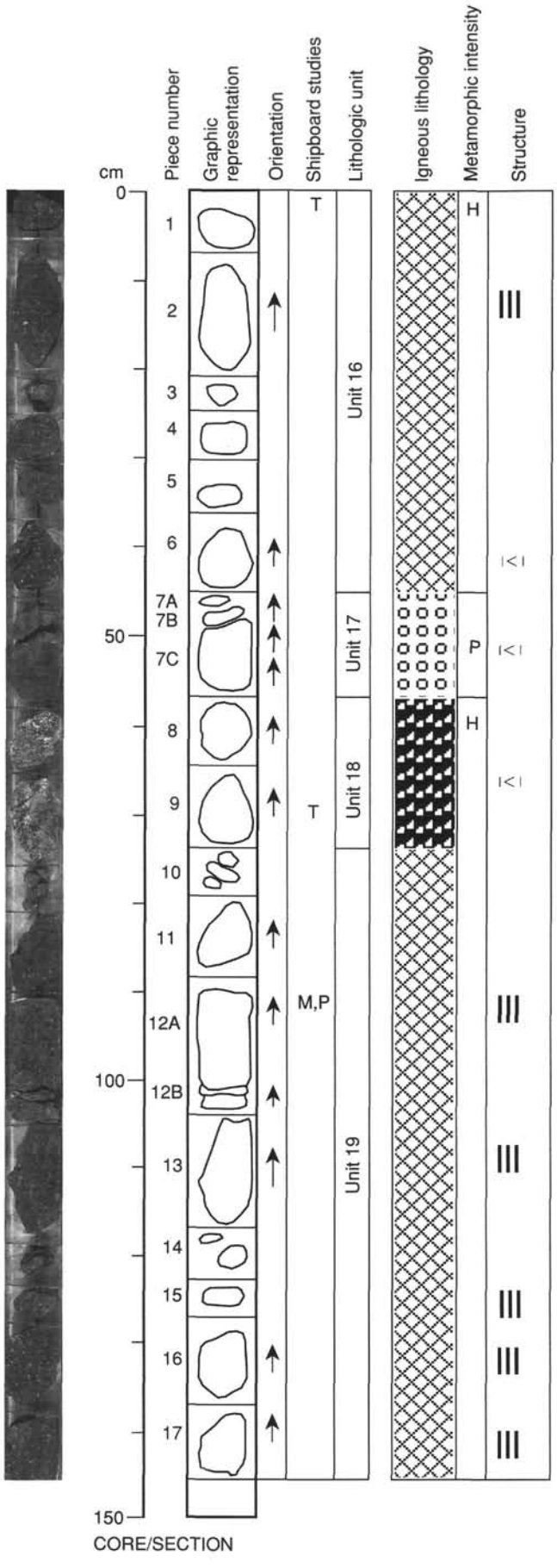
ADDITIONAL COMMENTS: There is a progressive increase in plagioclase content from Piece 7 to Piece 16. Plagioclase is milky white, probably mostly altered except in Piece 16. Patches of plagioclase are larger downsection, and appear to be interconnected in a vein-like network. The plagioclases enclose skeletal spinel. Relict clinopyroxene occurs in contact with plagioclase and amphibole.

UNIT 16: HARZBURGITE (INTERVAL 18)

Pieces 19–21

COLOR: Dark green.
LAYERING: None.
DEFORMATION: Porphyroclastic texture.
PRIMARY MINERALOGY:
- Olivine - Mode: 80%–85%.
  - Crystal size: Cannot determine.
  - Crystal shape: Anhedral.
  - Crystal orientation: None.
  - Percent replacement: 90%.
  - Comments: Replaced by black serpentine.
- Orthopyroxene - Mode: 15%–20%.
  - Crystal size: to 14 mm.
  - Crystal shape: Rounded to subangular.
  - Crystal orientation: None.
  - Percent replacement: 50%.
- Spinel - Mode: <1%.
  - Crystal size: <1 mm.
  - Crystal shape: Anhedral.

SECONDARY MINERALOGY: Orthopyroxene has quite variable grain size, most crystals being fractured and rounded.
Total percent: >85%.
Texture: Pseudomorphic. Olivine is replaced by black serpentine, orthopyroxene by bastite.



147-895D-7R-2

UNITS 16 AND 19: HARZBURGITE

Pieces 1–6 and 10–17

COLOR: Dark green.
LAYERING: None.
DEFORMATION: Porphyroclastic texture with minor veins. Spinel foliation.
PRIMARY MINERALOGY:
Olivine - Mode: 80%–85%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 90%.
Comments: Replaced by dark serpentine.
Orthopyroxene - Mode: 15%–20%.
Crystal size: 1–10 mm.
Crystal shape: Rounded to subangular.
Crystal orientation: None.
Percent replacement: 50%.
Spinel - Mode: <1%.
Crystal size: <1 mm.
Crystal shape: Anhedral.
SECONDARY MINERALOGY: Pieces 1–6 are fresher than Pieces 10–17. Orthopyroxene in Interval 21 are ubiquitously mantled by dark green halos in a lighter green, cloudy to ochre serpentinite matrix.
Total percent: 85%.
Texture: Pseudomorphic.
ADDITIONAL COMMENTS: Porphyroclastic harzburgite. Nearly all orthopyroxene is fractured and subrounded.

UNIT 17: DUNITE

Pieces 7A–7C

COLOR: Gray green.
LAYERING: None.
DEFORMATION: The piece has anastomosing veinlets of serpentine. Spinel may define high-angle foliation as disseminated stringers.
PRIMARY MINERALOGY:
Olivine - Mode: >99%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: >95%.
Comments: Replaced by serpentine.
Spinel - Mode: <1%.
Crystal size: to 1 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Comments: In stringers.
SECONDARY MINERALOGY:
Total percent: >95%.
Texture: Pseudomorphic.
ADDITIONAL COMMENTS: This dunite is between harzburgite and troctolite, thus may represent a reaction zone between peridotite and intrusive (gabbroic) melt.

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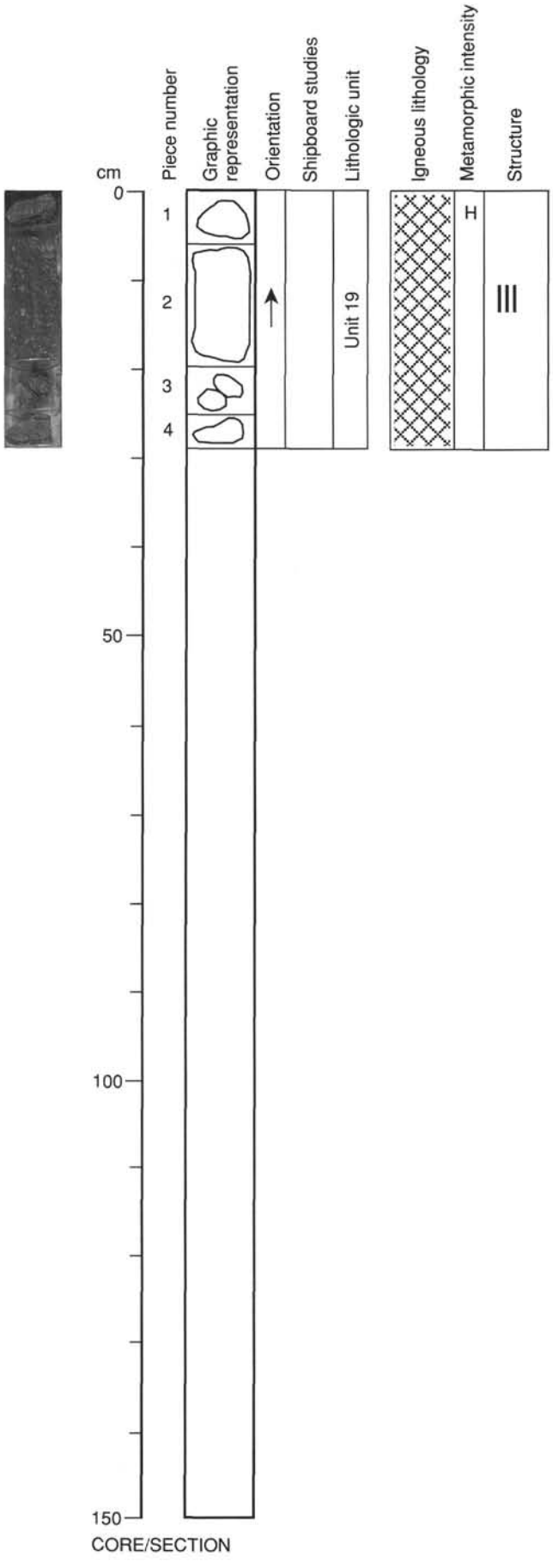
UNIT 18: TROCTOLITE

Pieces 8–9

COLOR: Light gray mottled to gray green.
LAYERING: None.
DEFORMATION: Foliation in troctolites.
PRIMARY MINERALOGY:
Olivine - Mode: 70%–80%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 80%–90%.
Plagioclase - Mode: 15%–20%.
Crystal size: 1–3 mm.
Crystal shape: Anhedral
Crystal orientation: None.
Percent replacement: 50%.
Clinopyroxene - Mode: 5%–10%.
Crystal size: 1–2 mm.
Crystal shape: Anhedral, interstitial.
Crystal orientation: None.
Percent replacement: 30%–35%.
SECONDARY MINERALOGY: Clinopyroxenes are mantled by dark green translucent amphibole.
Total percent: 65%–80%.
ADDITIONAL COMMENTS: The rock is metamorphosed coarse-grained troctolite at the top of Piece 8 which grades into gabbro. All of Piece 9 is gabbro. The troctolites are predominantly olivine and its altered pseudomorphs with patches of altered plagioclase and fresh interstitial clinopyroxene. Olivine kernels are relatively abundant. Clinopyroxene is always in contact with plagioclase.

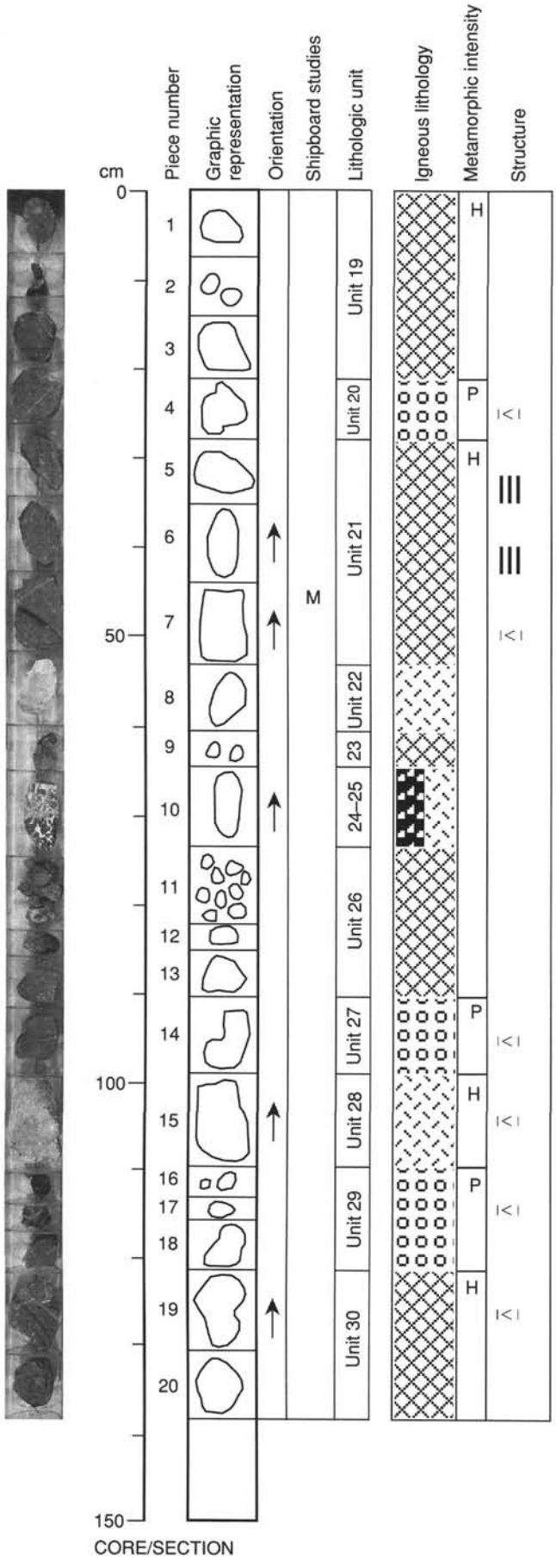


147-895D-7R-3

UNIT 19: HARZBURGITE

Pieces 1–4

COLOR: Green to dark green.
LAYERING: None.
DEFORMATION: The rock has porphyroclastic texture. A crude alignment in stringers of orthopyroxene crystals is evident at 30 degrees to horizontal. The long axis of orthopyroxene is either oriented along this line or imbricated in this direction.
PRIMARY MINERALOGY:
Olivine - Mode: 80%–85%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 90%.
Comments: Replaced by serpentine.
Orthopyroxene - Mode: 15%–20%.
Crystal size: 1–8 mm.
Crystal shape: Rounded.
Crystal orientation: None.
Percent replacement: 50%.
Spinel - Mode: <1%.
Crystal size: <1 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
SECONDARY MINERALOGY: Orthopyroxene has dark haloes in a lighter green, cloudy to ochre serpentine matrix.
Total percent: 85%.
Texture: Pseudomorphic.



147-895D-8R-1

UNITS 19, 21, 23, 26, AND 30: HARZBURGITE

Pieces 1–3, 5–7, 9, 11–13, and 19–20

COLOR: Dark green.
LAYERING: None.
DEFORMATION: Porphyroclastic texture. In fresher pieces, orthopyroxene has a typical sheen and is fractured and rounded.
PRIMARY MINERALOGY:
Olivine - Mode: 85%–90%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 75%–90%.
Comments: Replaced by serpentine.
Orthopyroxene - Mode: 10%–15%
Crystal size: 1–10
Crystal shape: Rounded
Crystal orientation: None.
Percent replacement: 65–70
Comments: Bastite.
Spinel - Mode: <1%
Crystal size: <2
SECONDARY MINERALOGY: Variably altered to light cloudy green and pale ochre. In more altered pieces, relict orthopyroxene is mantled and/or completely replaced by dark green translucent amphibole (?), and takes on an irregular shape, interfingering with serpentine.
Total percent: 75%–90%.
Texture: Mesh.

UNITS 20, 27, AND 29: DUNITE

Pieces 4, 14, and 16–18

COLOR: Ochre to gray green.
LAYERING: None.
PRIMARY MINERALOGY:
Olivine - Mode: >99%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: >95%.
Comments: Replaced by serpentine and clays.
Spinel - Mode: <1%.
Crystal size: <1 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
SECONDARY MINERALOGY: Secondary magnetite is abundant (>5%) in Piece 4. Overall, the pieces are variably altered and serpentinized, with most olivine replaced by serpentine and orange brown clay with or without talc.
Total percent: >95%.
Texture: Mesh; wholesale replacement of olivine by serpentine and some clay.
ADDITIONAL COMMENTS: Three of the four dunites in this section are adjacent to gabbro or troctolite, and may represent a reaction with original peridotite (porphyroclastic harzburgite) in the presence of melt.

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UNITS 22, 24, 26, AND 28: GABBRO

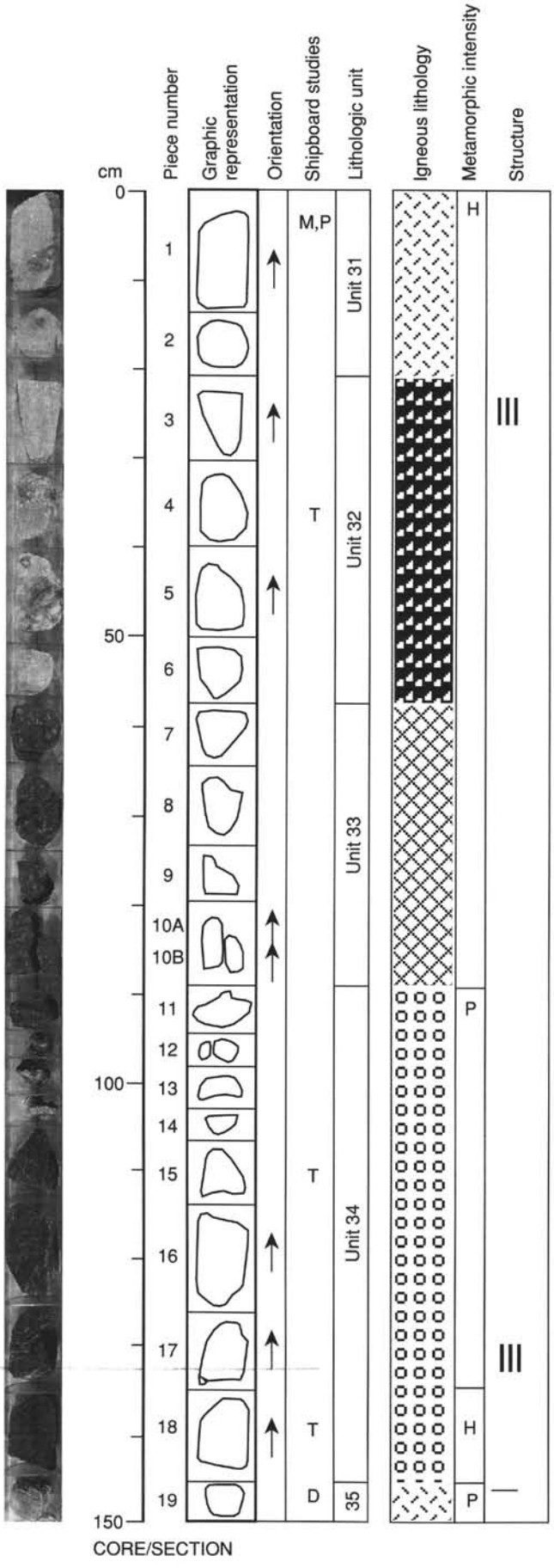
Pieces 8, 10, and 15

COLOR: Mottled white and light to dark green.
LAYERING: None.
DEFORMATION: None.
PRIMARY MINERALOGY:
Plagioclase - Mode: 55%–65%.
Crystal size: 1–3 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 30%–35%.
Comments: Replaced by chalky white material and chlorite.
Olivine - Mode: 10%–20%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 100%.
Comments: Replaced by chlorite and talc.
Clinopyroxene - Mode: 5%–15%.
Crystal size: to 40 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 25%.
Comments: Altered to actinolite.
SECONDARY MINERALOGY: Translucent green chlorite alters all plagioclase at grain boundaries with olivine. Plagioclase is locally chalky white (rodingitized?) in centers. Clinopyroxene is little altered by comparison. Olivine alters to light green chalk (plus chlorite?).
Total percent: 50%.
Texture: Pseudomorphic.
ADDITIONAL COMMENTS: Clinopyroxene content and grain size are variable on a piece scale. Plagioclase is in anhedral patches separated by milky white amphibole with dark green translucent amphibole coronas. Large pyroxene crystals have ophitic texture with included plagioclase. Olivine occurs in irregularly shaped patchy masses.

UNIT 25: TROCTOLITE

Piece 10

COLOR: Patchy white and dark gray.
LAYERING: None.
DEFORMATION: None.
PRIMARY MINERALOGY:
Plagioclase - Mode: 50%.
Crystal size: 1–10 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 65%–70%.
Comments: Replaced by chalky white calc-silicate minerals and translucent green chlorite at grain margins.
Olivine - Mode: 50%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 65%–75%.
Comments: Replaced mainly by serpentine.
SECONDARY MINERALOGY: Plagioclase in the dikelet is translucent to chalky white. Plagioclase in the host rock is 100% altered to chalky white, fine-grained minerals. Patches of light green amphibole to 1 mm across are also present in plagioclase patches. Olivine patches are mantled by dark green translucent chlorite.
Total percent: 65%–75%.
Texture: Pseudomorphic.
Vein material: White prehnite occurs in a subvertical, discontinuous veinlet found only in the 4-cm troctolite dikelet.
ADDITIONAL COMMENTS: The troctolite has coarse plagioclase with subordinate olivine in a distinct 4-cm wide gabbro vein. On one side of the vein is patchy troctolite similar to that in Section 147-895D-4R. The grain size of the dikelet is finer in contact with patchy troctolite.



147-895D-8R-2

UNITS 31 AND 35: GABBRO; UNIT 32: TROCTOLITE

Pieces 1–6 and 19

COLOR: Mottled white to green.
LAYERING: None.
DEFORMATION: Pieces 1–6 have a moderate foliation due to plastic deformation. Piece 19 is pervasively altered at an intact contact with dunite, and has foliation subparallel to the contact.
PRIMARY MINERALOGY: Clinopyroxene decreases from Piece 1 (20%) to Piece 3 (<5%) to Piece 6 (none). Olivine increases from 10%–30%. The sequence may represent a single gabbroic rock with a high concentration of olivine in a stratigraphically lower succession. Some of the olivine in Pieces 4 and 5 may be harzburgite or dunite xenoliths.

Plagioclase - Mode: 40%–60%.
- Crystal size: 1–4 mm.
- Crystal shape: Anhedral.
- Crystal orientation: None.
- Percent replacement: 50%.
- Comments: Replaced by chlorite and pinkish, finer grained, calc-silicate material.

Olivine - Mode: 10%–30%.
- Crystal size: Cannot determine.
- Crystal shape: Anhedral.
- Crystal orientation: None.
- Percent replacement: >75%.
- Comments: Replaced by black serpentine or green talc plus chlorite (?).

Clinopyroxene - Mode: 0%–20%.
- Crystal size: 1–6 mm.
- Crystal shape: Anhedral.
- Crystal orientation: None.
- Percent replacement: 30%–35%.
- Comments: Replaced by actinolite.

SECONDARY MINERALOGY: Plagioclase is replaced by a pinkish mineral in relict cores. Chlorite is abundant at grain boundaries between olivine and plagioclase. Olivine in troctolitic pieces is replaced by talc. In olivine-rich patches, it is replaced by serpentine. There are patches of light gray to milky white amphibole with light green intergrowths mantled by dark green translucent chlorite.
Total percent: 50%–70%.
Texture: Pseudomorphic.
ADDITIONAL COMMENTS: Pieces 1–6 are a succession probably representing the same gabbro or troctolite "intrusive", but with olivine and perhaps partially digested harzburgite/dunite xenoliths concentrated in the lower pieces. One of the olivine-rich patches appears to contain an enstatite bastite pseudomorph. Both plagioclase and olivine have a patchy appearance. The clinopyroxene content is variable as is grain size within a single piece. Piece 19 has a foliated contact between serpentinized dunite (probably above, although the piece is unoriented) and foliated gabbro (below). The gabbro retains shear polyhedra of fine-grained olivine gabbro or troctolite.

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UNIT 33: HARZBURGITE

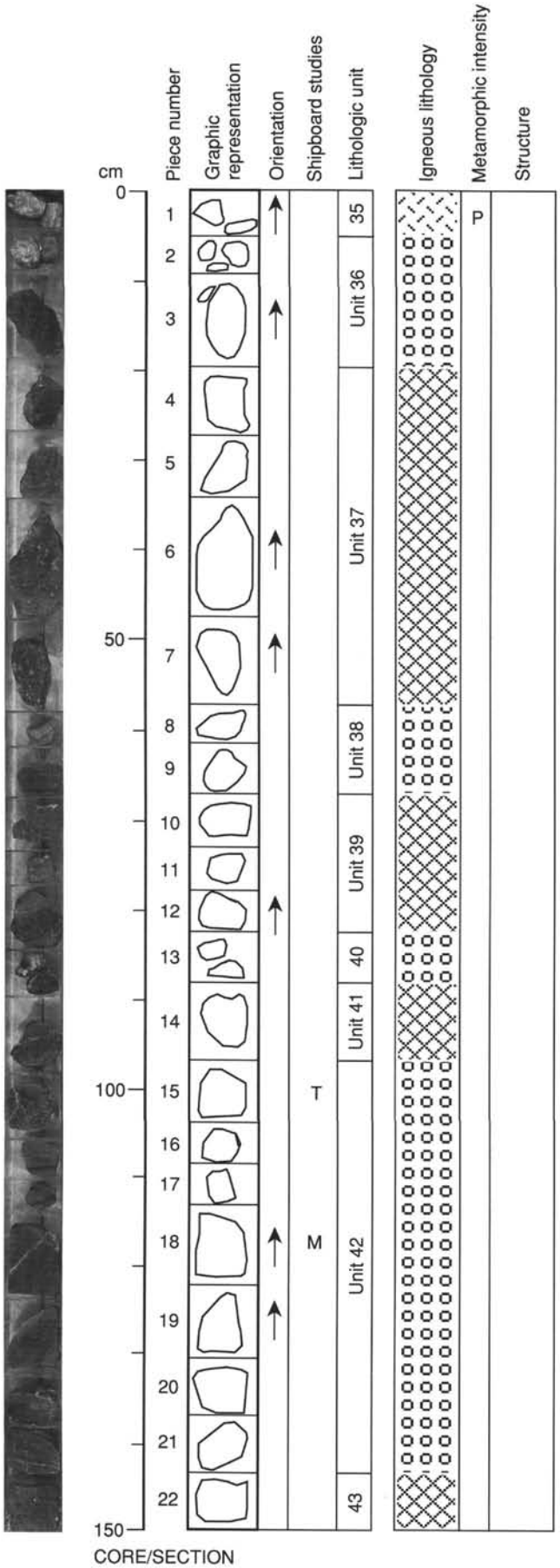
Pieces 7–10B

COLOR: Dark green.
LAYERING: None.
DEFORMATION: Porphyroclastic texture.
PRIMARY MINERALOGY:
Olivine - Mode: 85%–90%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: >90%.
Comments: Replaced by serpentine.
Orthopyroxene - Mode: 10%–15%.
Crystal size: 2–8 mm.
Crystal shape: Rounded.
Crystal orientation: None.
Percent replacement: 65%–70%.
Comments: Pseudomorphed by bastite.
Spinel - Mode: <1%.
Crystal size: <1 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
SECONDARY MINERALOGY:
Total percent: >85%.
Texture: Pseudomorphic mesh replacement of olivine and orthopyroxene by serpentine and talc.
Vein material: Some chrysotile veins.
ADDITIONAL COMMENTS: The rock is porphyroclastic harzburgite, in continuation of alternating sequences of altered gabbro/troctolite, dunite, and harzburgite. The dunite may represent reaction of harzburgite in contact with gabbroic intrusive material.

UNIT 34: DUNITE

Pieces 11–19

COLOR: Gray green.
LAYERING: None.
DEFORMATION: Veined by serpentine.
PRIMARY MINERALOGY:
Olivine - Mode: >99%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: >95%.
Comments: Replaced by serpentine.
Spinel - Mode: <1%.
Crystal size: <1 mm.
Crystal shape: Subhedral.
Crystal orientation: None.
Comments: Altered to ferritchromite.
SECONDARY MINERALOGY: Olivine is intensely serpentinized. Brucite is common in lower pieces.
Total percent: >95%.
Texture: Pseudomorphic replacement of olivine by serpentine.
ADDITIONAL COMMENTS: Has a contact in Piece 19 with intensely altered gabbro, which continues to less altered gabbro in Core 147-895D-9R. As in other cores, dunite here is associated with gabbroic material, and may be a reaction product between melt and original porphyroclastic harzburgite.



147-895D-9R-1

UNIT 35: GABBRO

Piece 1

COLOR: Light-medium gray.
LAYERING: None.
DEFORMATION: Minor veining.
PRIMARY MINERALOGY: Olivine cannot be clearly identified. All primary minerals pervasively altered.
Pyroxene - Mode: 45%.
Crystal size: 5 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 100%.
Plagioclase - Mode: 50%.
Crystal size: 5 mm.
Crystal shape: Subhedral.
Crystal orientation: None.
Percent replacement: 100%.
Olivine(?) - Mode: 5%.
Crystal size: 3 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 100%.
SECONDARY MINERALOGY:
Total percent: 100%.
Texture: Pyroxenes are completely pseudomorphed containing tremolite/actinolite cores with chloritic rims. Plagioclase is completely replaced by hydrogrossular and microveinlets of actinolite. Olivine altered to cores of minor talc, clay minerals, and rims of amphibole and chlorite.

UNITS 36, 38, 40, AND 42: DUNITE

Pieces 2, 3, 8, 9, 13, 15–21

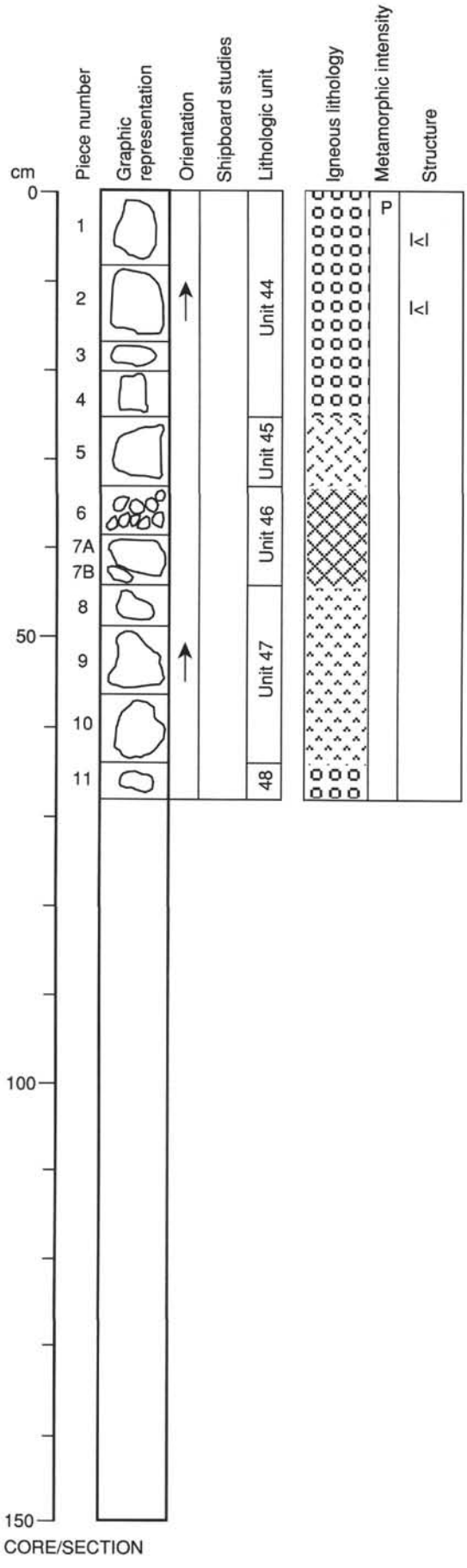
COLOR: Black.
LAYERING: None.
DEFORMATION: Minor veining.
PRIMARY MINERALOGY: Elongate spinels are in places aligned along elongation direction; possibly pull apart texture.
Olivine - Mode: 95%–99%.
Crystal size: 3 mm, maximum 5 mm.
Crystal shape: Subhedral, polygonal.
Crystal orientation: None.
Percent replacement: 100%.
Pyroxene - Mode: 1%–5%.
Crystal size: 1 mm.
Crystal shape: Anhedral, interstitial.
Crystal orientation: None.
Percent replacement: 100%.
Spinel - Mode: 1%.
Crystal size: 1 mm.
Crystal shape: Euhedral to elongate anhedral.
Crystal orientation: Elongate and aligned.
SECONDARY MINERALOGY:
Total percent: 99%.
Texture: Orthopyroxene pseudomorphed by serpentine, clay, and talc. Olivine completely replaced by serpentine, clay and talc, and possible brucite. Mesh texture exhibited by these minerals. Rare chlorite and actinolite.
Vein material: Microscopic sinuous, discontinuous veins of chrysotile, talc and chlorite, from 0.1–0.8 mm wide. Talc is relatively rare.

147-895D-9R-1

UNITS 37, 39, 41, AND 43: HARZBURGITE

Pieces 4–7, 10–12, 14, 22

COLOR: Black.
LAYERING: None.
DEFORMATION: Considerable thin veins. Minor foliation.
PRIMARY MINERALOGY: Amount of orthopyroxene is variable, orthopyroxene poor harzburgite being transitional to dunite. Orthopyroxene appears to increase downward from Pieces 3 to 7, and from Pieces 8 to 12.
Olivine - Mode: 80%–90%.
Crystal size: Not discernible.
Crystal shape: Not discernible.
Crystal orientation: None apparent.
Percent replacement: 90%–100%.
Orthopyroxene - Mode: 10%–20%.
Crystal size: 2–10 mm, average 4 mm.
Crystal shape: Subhedral (rounded).
Crystal orientation: None apparent.
Percent replacement: 50%–90%.
Comments: Porphyroclastic.
Spinel - Mode: 1%.
Crystal size: 1 mm.
Crystal shape: Anhedral, elongate in places.
Crystal orientation: Some vague alignment, in places.
SECONDARY MINERALOGY:
Total percent: 90%–95%.
Texture: Porphyroclasts of enstatite completely replaced by green amphibole, chlorite, and serpentine. Some grains exhibit schillern texture. Relict olivine is rare, being completely replaced by brown serpentine, clay, and talc.
Vein material: Numerous 0.1–0.5 mm wide veins filled with chrysotile. Only rare talc.



147-895D-9R-2

UNITS 44 AND 48: DUNITE

Pieces 1–4, 11

COLOR: Black.
LAYERING: None.
DEFORMATION: Minor veining. Porphyroclastic in parts where orthopyroxene visible.
PRIMARY MINERALOGY: Shape of spinel is much more equant than in adjacent harzburgite.
Olivine - Mode: 95%–98%.
Crystal size: Average 3 mm, maximum 6 mm.
Crystal shape: Subhedral, polygonal.
Crystal orientation: None.
Percent replacement: 95%–100%.
Spinel - Mode: 1%–2%.
Crystal size: Average 1 mm, maximum 2 mm.
Crystal shape: Subhedral to anhedral-elongate.
Crystal orientation: Aligned parallel to elongation direction.
Pyroxene - Mode: 0%–3%.
Crystal size: 2 mm.
Crystal shape: Anhedral, interstitial in places.
Crystal orientation: None visible.
Percent replacement: 100%.
SECONDARY MINERALOGY:
Total percent: 100%.
Texture: Serpentine, clay, and brucite replace olivine with minor talc. These minerals exhibit a mesh texture.
Vein material: In Pieces 1 and 4 there are 0.3–1 mm wide veins of chrysotile and talc or chrysotile and chlorite.

UNIT 45: GABBRO; UNIT 47: OLIVINE GABBRO

Pieces 5, 8–10

COLOR: Light gray with light green patches.
LAYERING: None.
DEFORMATION: Piece 5 is moderately sheared.
PRIMARY MINERALOGY: Grain size is variable. Rock is so highly altered that difficult to recognize primary mineralogy, e.g., Olivine content is variable. Trails of possible chrome spinel are present in Pieces 5 and 8.
Pyroxene - Mode: 50%.
Crystal size: Average 6 mm, maximum 30 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 100%.
Plagioclase - Mode: 45%.
Crystal size: Average 5 mm, maximum 10 mm.
Crystal shape: Subhedral.
Crystal orientation: None.
Percent replacement: 60%–100%.
SECONDARY MINERALOGY:
Total percent: 90%–99%.
Texture: Rare coarse-grained, green gray metamorphic diopsides (diallage) are only slightly altered. Not clear what they replaced. Plagioclase is chalk white to gray in color and pervasively altered to hydrogrossular, epidote, and prehnite. Pseudomorphs after olivine, clinopyroxene of chlorite and tremolite.

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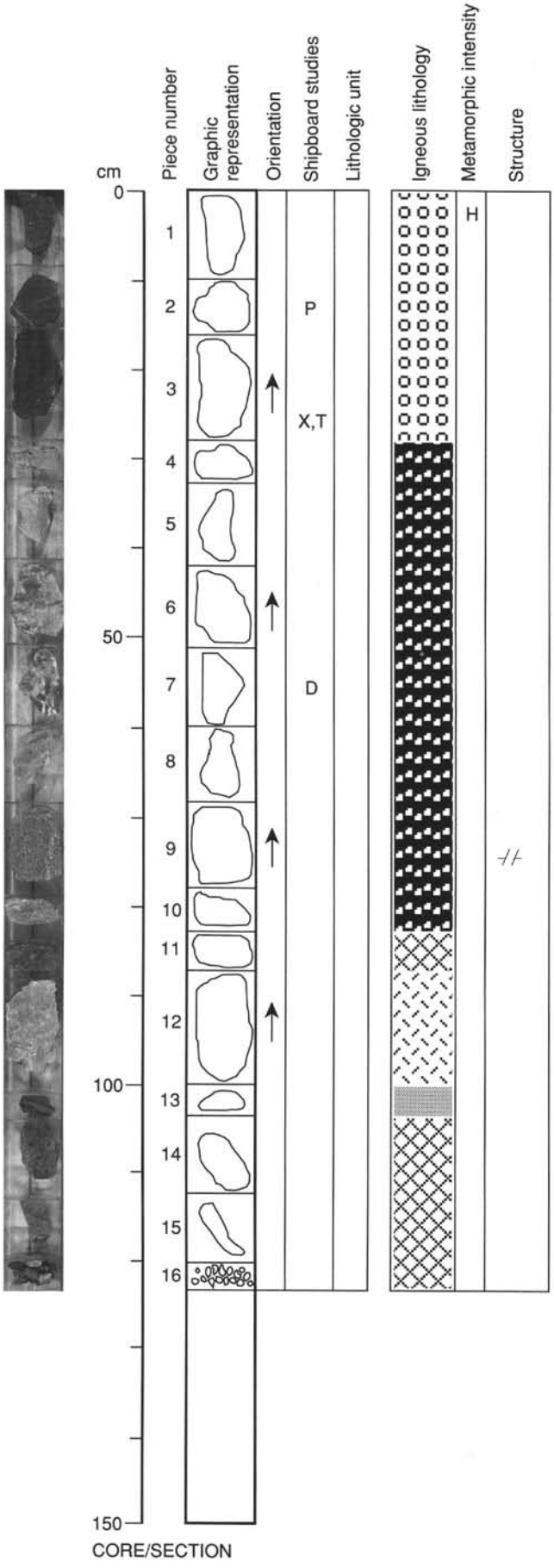
UNIT 46: HARZBURGITE

Pieces 6–7

COLOR: Black.
LAYERING: None.
DEFORMATION: Weak spinel foliation and minor veining.
PRIMARY MINERALOGY:
Olivine - Mode: 85%.
Crystal size: Not discernible.
Crystal shape: Not discernible.
Crystal orientation: None visible.
Percent replacement: 90%.
Pyroxene - Mode: 15%.
Crystal size: Average 3 mm, maximum 6 mm.
Crystal shape: Subhedral, rounded.
Percent replacement: 100%.
Spinel - Mode: 0.5%.
Crystal size: 1.5 mm.
Crystal shape: Anhedral, elongate.
Crystal orientation: Weak alignment.
Percent replacement: Minor.
SECONDARY MINERALOGY: Primary silicates are all highly altered.
Total percent: 90%.
Texture: Olivine pervasively altered to serpentine, clay, and chlorite. Mesh texture developed. Orthopyroxene pseudomorphed by serpentine, chlorite, clay, and trace oxides. Rare relict olivine still preserved. Minor talc.
Vein material: In Piece 7A, a 0.4 mm wide chrysotile vein.

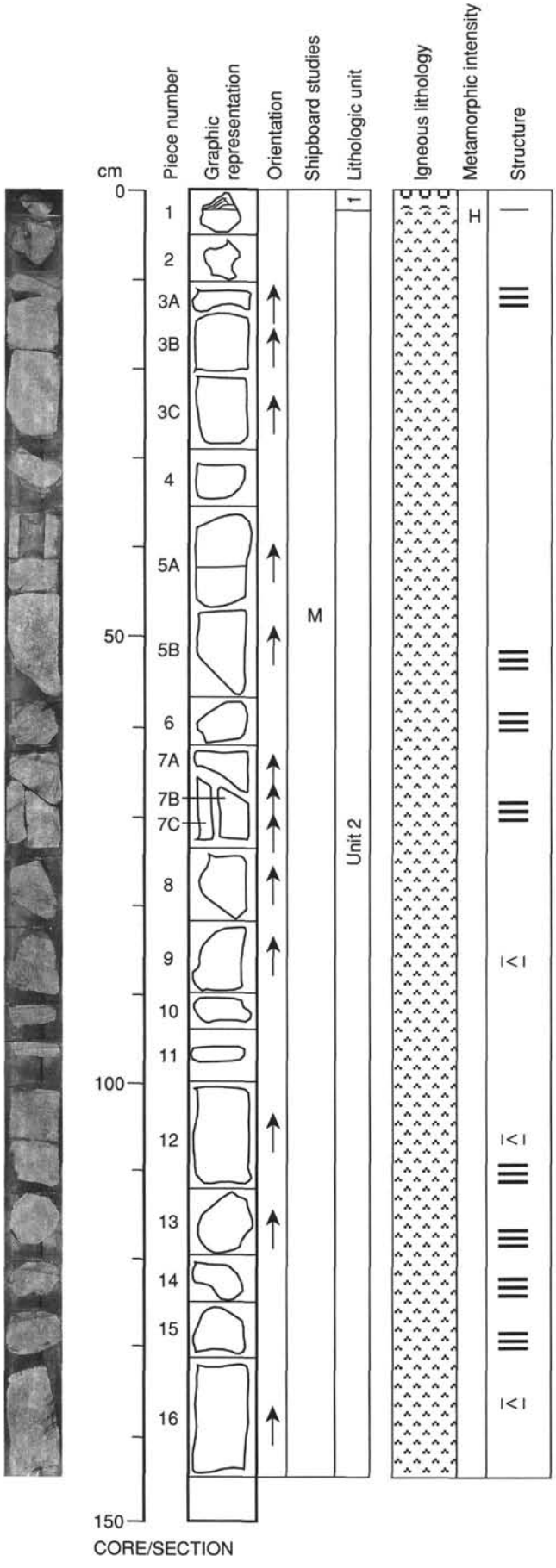


147-895D-10W-1

MIXED ULTRAMAFIC AND GABBROIC LITHOLOGIES

Pieces 1–15

COLOR: Variably green (ultramafic rocks) and whitish gray (gabbroic rocks).
LAYERING: None.
DEFORMATION: None.
PRIMARY MINERALOGY: None.
SECONDARY MINERALOGY: Pieces are generally altered as in previous cores, with ultramafic rocks largely transformed to dunite, and gabbroic rocks to rodingite.
ADDITIONAL COMMENTS: PIECES 1–3: DUNITES. Part of Piece 1 has orthopyroxene but grades to dunite over the 6 m length of the piece. PIECE 4–10: TROCTOLITE, with little or no clinopyroxene and variably fresh olivine patches. PIECES 11 AND 14–16: PORPHYROCLASTIC HARZBURGITE, variably transformed to serpentinite. PIECE 12: GABBRO, resembles 147-895D-8R-1, Piece 15. It has coarse clinopyroxene in patchy altered plagioclase and amphibole. PIECE 13: RELATIVELY FRESH BASALT (from regolith at top of hole); grain size is too small to characterize alteration. All are wash core pieces.



147-895E-1R-1

UNIT 1: DUNITE

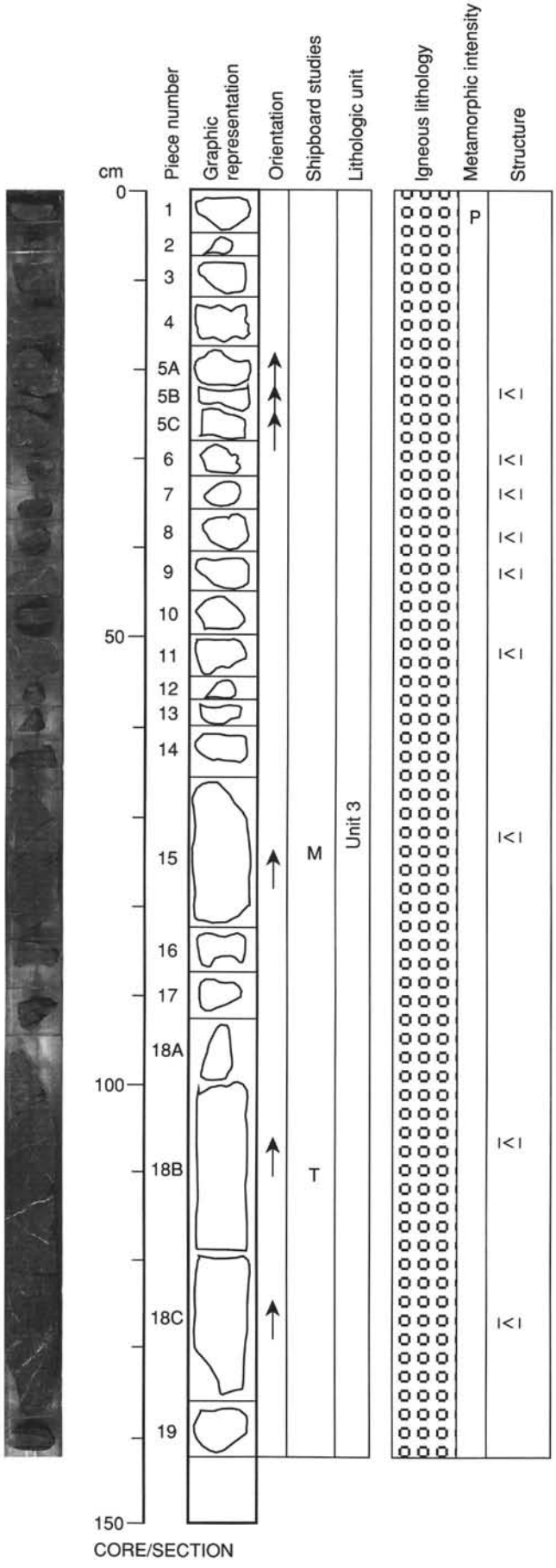
Piece 1

COLOR: Dark green.
LAYERING: None.
DEFORMATION: Somewhat sheared along sharp contact with olivine gabbro. The rock (Piece 1) is unoriented, but presumably the gabbro is that of Unit 2, which continues below.
PRIMARY MINERALOGY:
Olivine - Mode: 99%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: Cannot determine.
Percent replacement: 100%.
Comments: Replaced by serpentine.
Spinel - Mode: <1%.
Crystal size: <<1 mm.
Crystal shape: Anhedral.
ADDITIONAL COMMENTS: The serpentinized dunite of Piece 1 is about 0.5 cm wide. Within its spaced dividers, it is assigned a 2-cm thickness for the purpose of logging the core.

UNIT 2: OLIVINE GABBRO

Pieces 2–16

COLOR: Mottled white to pinkish white, and light green to dark green.
LAYERING: None.
DEFORMATION: Variably foliated olivine gabbro with little veining. Pieces 2, 3A, and 6 are somewhat sheared, with stretched looking patches of plagioclase.
PRIMARY MINERALOGY:
Plagioclase - Mode: 50%–60%.
Crystal size: 1–5 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: >75%.
Comments: Altered to chlorite.
Olivine - Mode: 40%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 95%.
Clinopyroxene - Mode: 0%–10%.
Crystal size: 1–2 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 75%.
Comments: Altered to actinolite.
Spinel - Mode: 0%–1%.
Crystal size: <1 mm.
Crystal shape: Euhedral.
Comments: As inclusions in plagioclase.
SECONDARY MINERALOGY: Translucent green chlorite occurs as haloes between olivine pseudomorphs and plagioclase. Central portions of olivine grains are altered to white to light green serpentinite. Plagioclase is milky white and no cleavage is present. Patches of Pieces 9 and 12–14 have somewhat fresher olivine (only about 85% altered). In these patches, the serpentine is black, not green.
Total percent: 85%.
Texture: Pseudomorphic.
Vein material: Green and white serpentine.
ADDITIONAL COMMENTS: Irregular patches of altered plagioclase next to coronas of serpentine. Plagioclase is sometimes intergrown with amoeboid clinopyroxene. Pieces 1, 2, 5B, 7, 9, 12, and 13 have less altered olivines (kernels in serpentine). Spinel abundance fluctuates; it is high in Pieces 7 and 8 and in a coarser vein (?) that cuts Piece 16 at a high angle. In most pieces, no fresh olivine remains. Pieces 7 and 8 are also finer grained than most.



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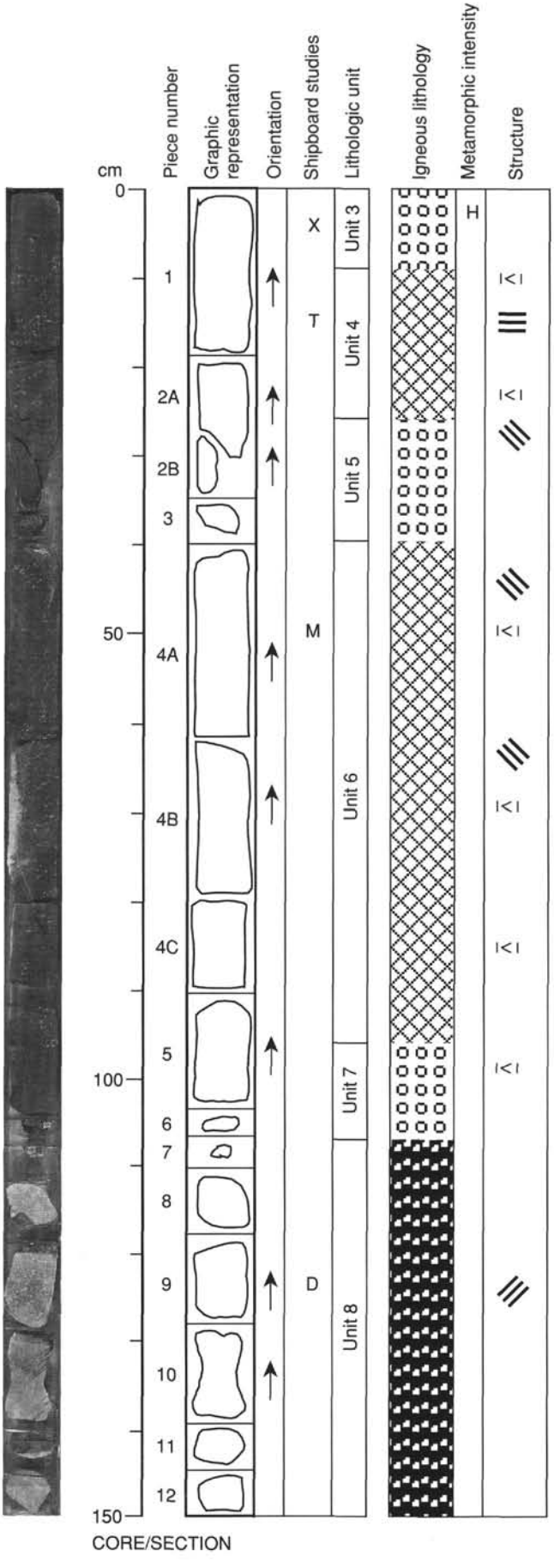
UNIT 3: DUNITE

Pieces 1–19

COLOR: Gray.
LAYERING: None.
DEFORMATION: Abundant serpentine veinlets; no fabric.
PRIMARY MINERALOGY:
Olivine - Mode: >99%.
Crystal size: Undetermined.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: >95%.
Comments: Replaced by serpentine.
Spinel - Mode: <1%.
Crystal size: 0–1 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
SECONDARY MINERALOGY: Pieces are cut by a dense network of thin black serpentine veins that connect with thicker green chrysotile veins. Talc and serpentine in the matrix are suggested by slippery cut surfaces.
Total percent: >95%.
Texture: Pseudomorphic. Serpentine, magnetite, talc, and brucite after olivine to form mesh serpentine texture.
Vein material: Chrysotile.
ADDITIONAL COMMENTS: In oriented pieces, there is a strong horizontal to subhorizontal preferred orientation to the main serpentine veinlets. Spinel is common along some larger veins. Upper pieces appear more "weathered" (oxidized) to light orange brown. There is no obvious orthopyroxene except a couple of crystals in Piece 11. The bottom of Piece 15 has some irregular patches along veins that may have been either orthopyroxene or perhaps plagioclase, but now are translucent green serpentine. Anhedral spinel tends to occur along irregular veins that crosscut strong preferred orientation of serpentine veinlets.



147-895E-1R-3

UNITS 3, 5, and 7: DUNITE

Pieces 1, 2B–3, 5–6

COLOR: Dark green.
LAYERING: None.
DEFORMATION: Fairly massive rocks, somewhat veined.
PRIMARY MINERALOGY:
Olivine - Mode: >99%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 95%–99%.
Comments: Serpentine.
Spinel - Mode: <1%.
Crystal size: 0–1 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
SECONDARY MINERALOGY: Serpentinization is pervasive.
Total percent: 95%–99%.
Texture: Pseudomorphic.
Vein material: Some thin chrysotile veins are present.
ADDITIONAL COMMENTS: Dunite in Piece 1 continues that from the previous section. Dunite interval 5 is a gradational and somewhat foliated contact with harzburgite above. Dunite interval 7 similarly is within Piece 5, and adjoins troctolite at its base, although no contact was recovered.

UNITS 4 AND 6: HARZBURGITE

Pieces 1–2A, 4A–5

COLOR: Dark grayish green.
LAYERING: None.
DEFORMATION: The rocks are porphyroclastic, with serpentine veining. Spinel foliation parallel to pervasive subhorizontal serpentinization. There is a hint of subhorizontal alignment of orthopyroxene along an axis roughly parallel to subhorizontal primary orientation of serpentine veinlets. Spinel does not have a coincident orientation.
PRIMARY MINERALOGY:
Olivine - Mode: 85%–90%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 95%.
Comments: Replaced by serpentine.
Orthopyroxene - Mode: 10%–15%.
Crystal size: 0.6–6 mm.
Crystal shape: Rounded.
Crystal orientation: None.
Percent replacement: 60%.
Spinel - Mode: <1%.
Crystal size: 0.5–2.5 mm.
Crystal shape: Equant and anhedral.
Crystal orientation: Some spinel foliation.
SECONDARY MINERALOGY: Olivine is mainly altered to serpentine with perhaps minor talc because of a slightly slippery feel. Variations in orthopyroxene abundance are primary, reaching an extreme low in Units 3, 5, and 7.
Total percent: 85%–90%.
Texture: Mesh.
Vein material: Veins of serpentine and chrysotile.

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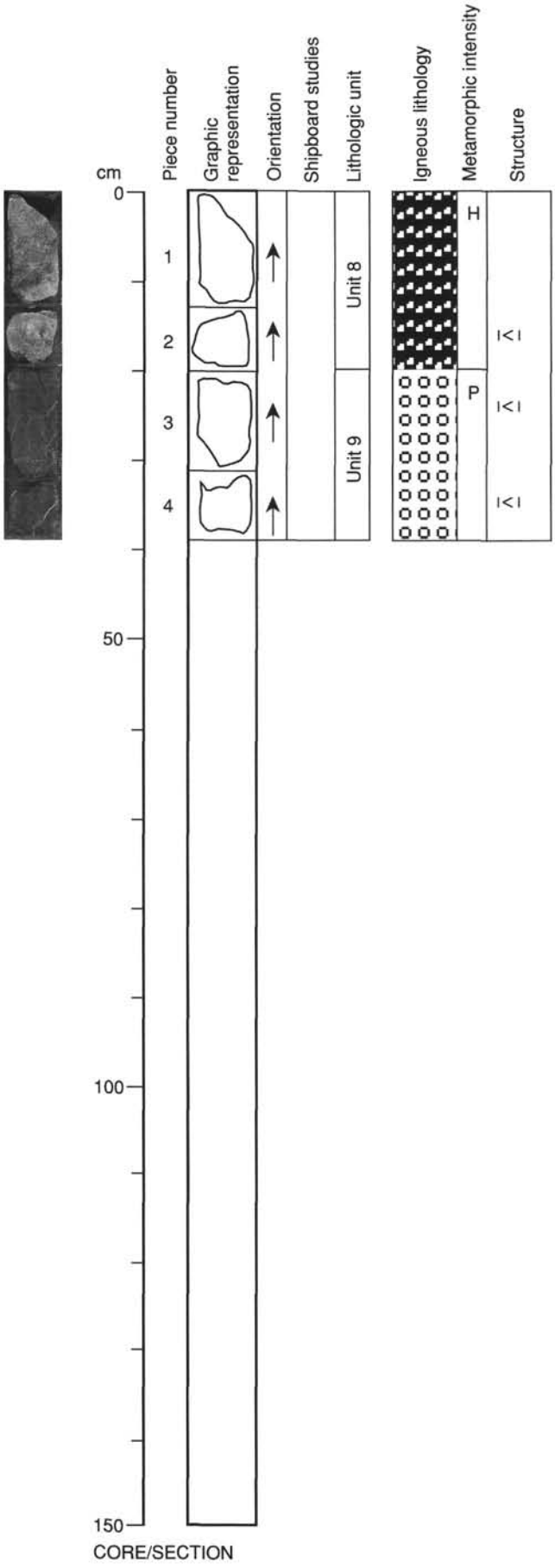
UNIT 8: TROCTOLITE

Pieces 7–12

COLOR: White and greenish gray.
LAYERING: None.
DEFORMATION: The rocks are irregularly foliated at a gentle dip. There is mineral zoning in Pieces 10 and 12.
PRIMARY MINERALOGY:
Olivine - Mode: 50%–80%.
Crystal size: Cannot determine.
Crystal shape: Irregular.
Crystal orientation: None.
Percent replacement: >90%.
Comments: Replaced by serpentine.
Plagioclase - Mode: 20%–50%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: >75
Spinel - Mode: <1%.
Crystal size: 0.6–1 mm.
Crystal shape: Anhedral, equant.
Crystal orientation: None.
SECONDARY MINERALOGY: Mostly altered to calc-silicates and chloritized. Black serpentine occurs after olivine in dunite restite. Olivine crystallized from gabbroic melt (i.e, intrusive lithology) is altered to green talc, and rimmed by translucent green serpentine where in contact with plagioclase. Plagioclase is altered to a milky white to fine green material.
Total percent: 85%.
Texture: Pseudomorphic.
Vein material: None.
ADDITIONAL COMMENTS: The interval was evidently produced by melt permeation of fragmental peridotite. Patches of plagioclase-rich troctolite are interconnected within a blocky network of residual ultramafic material on a centimeter scale or less. The lithology overall is troctolite, but the penetrating gabbroic material is strongly felsic. Piece 10 has some fresh olivine in irregularly shaped patches of serpentine. Spinel is disseminated.



147-895E-1R-4

UNIT 8:TROCTOLITE

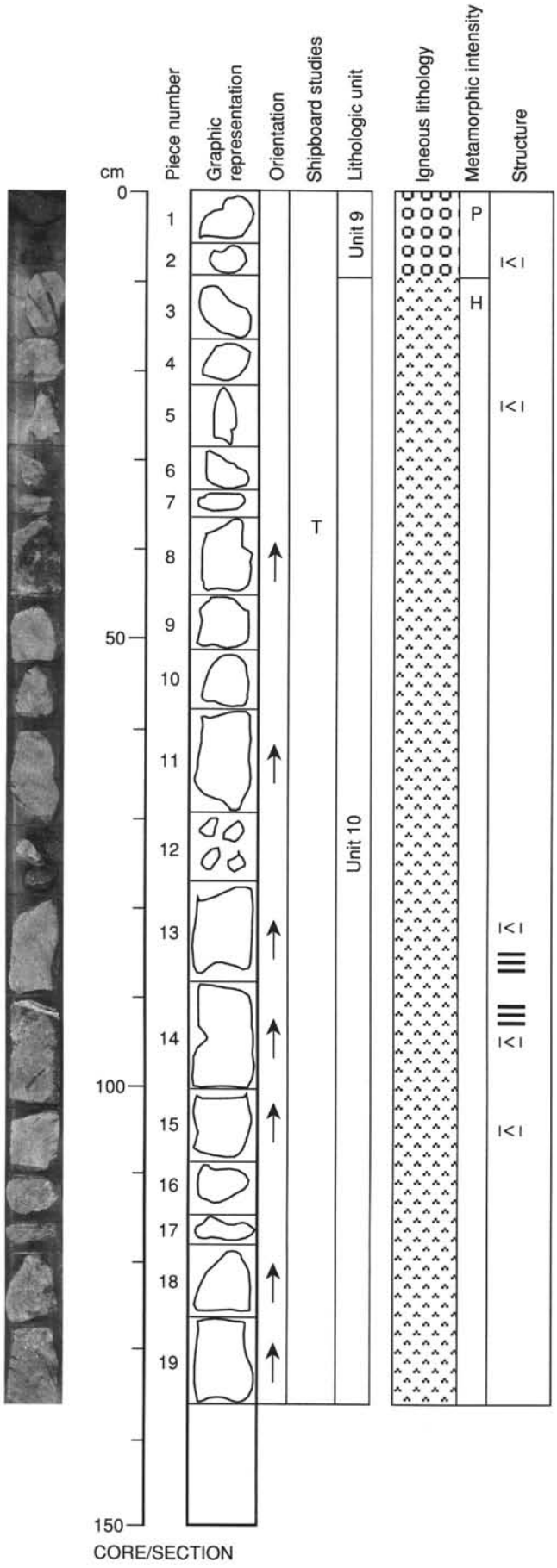
Pieces 1–2

COLOR: White, alternating with dark gray green in a patchy fabric.
LAYERING: None.
DEFORMATION: Mineral zoning. There is a coarse-fine igneous contact with an apparent dip of 27 degrees in Piece 2.
PRIMARY MINERALOGY:
Olivine - Mode: 50%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 95%.
Comments: Replaced by serpentine.
Plagioclase - Mode: 50%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: >75%.
Spinel - Mode: <1%.
Crystal size: <1 mm.
Crystal shape: Euhedral.
Crystal orientation: None.
SECONDARY MINERALOGY: Black serpentine replaces dunite in restite. Green talc replaces olivine in plagioclase-rich patches. Most olivine is replaced by serpentine and talc. Locally plagioclase tends to have coronitic reaction rims on dark green chlorite and amphibole. Centers are milky white, perhaps representing incomplete alteration to clays, hydrogrossular, and prehnite.
Total percent: >85%.
Texture: Pseudomorphic.
Vein material: No veins.
ADDITIONAL COMMENTS: Medium to coarse grained with 55%–60% plagioclase and a few small olivine-rich pods in Piece 1.

UNIT 9: DUNITE

Pieces 3–4

COLOR: Dark gray green.
LAYERING: None.
DEFORMATION: No fabric or veining.
PRIMARY MINERALOGY:
Olivine - Mode: 99%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 99%.
Comments: Replaced by serpentine.
Spinel - Mode: 1%.
Crystal size: 0.3–0.5 mm.
Crystal shape: Equant anhedral.
Crystal orientation: None.
SECONDARY MINERALOGY: Serpentine and talc after olivine.
Total percent: >95%.
Texture: Pseudomorphic, mesh.
ADDITIONAL COMMENTS: There is a distinct subhorizontal alignment of serpentine veinlets, and no obvious orthopyroxene.



147-895E-2R-1

UNIT 9: DUNITE

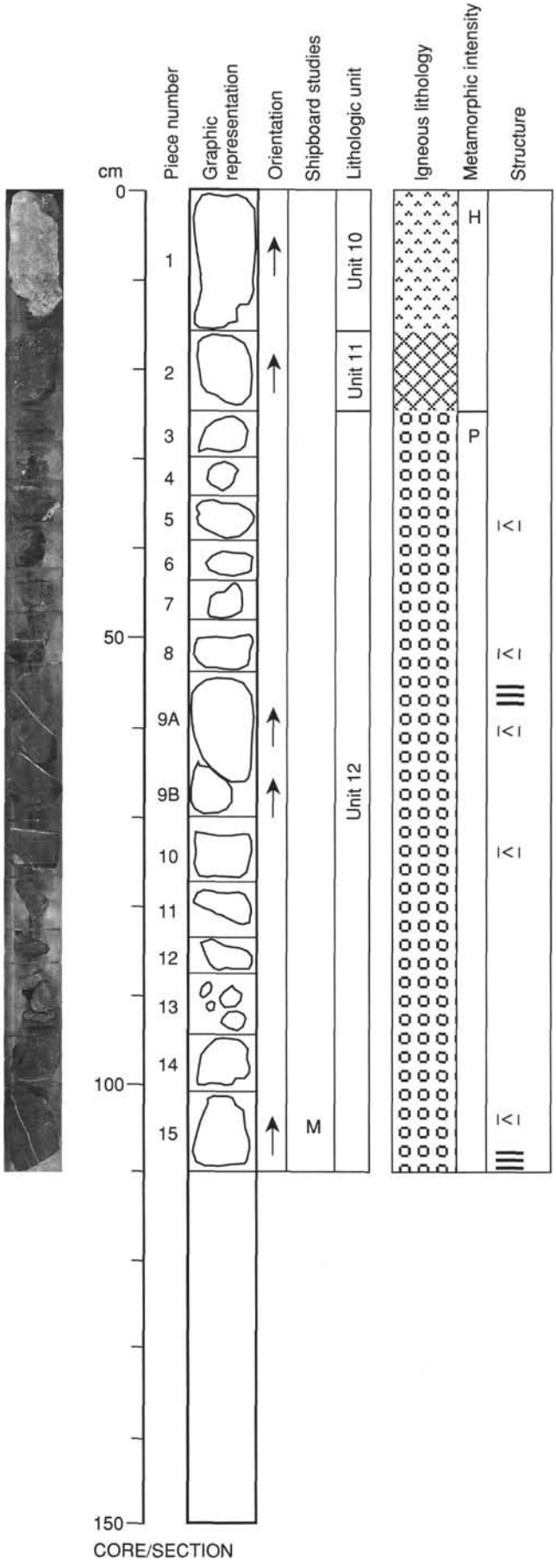
Pieces 1–2

COLOR: Dark grayish green.
LAYERING: None.
DEFORMATION: Moderate serpentine veining, no fabric.
PRIMARY MINERALOGY:
Olivine - Mode: 99%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 100%.
Comments: Replaced by serpentine, talc, magnetite, and brucite.
Cr-spinel - Mode: 1%.
Crystal size: <1 mm.
Crystal shape: Anhedral.
SECONDARY MINERALOGY: Serpentine, talc, and magnetite, with or without brucite, replace olivine. Brucite pseudomorphs after olivine occur in a few patches and parallel orientation of serpentine veins. Pieces 3 and 4 are strongly serpentinized. No fresh olivine is left. It is now replaced by light to gray green serpentine minerals.
Total percent: 100%.
Texture: Mesh.
Vein material: Some serpentine veins.

UNIT 10: OLIVINE GABBRO

Pieces 3–19

COLOR: Patchy white to gray green.
LAYERING: None.
DEFORMATION: No deformation in Pieces 5–11 nor in Pieces 15–19; Foliation is present in Pieces 13 and 14, dipping at about 15 degrees.
PRIMARY MINERALOGY: Olivine occurs in black and green patches, and is fresher in the black patches.
Plagioclase - Mode: 65%.
Crystal size: to 10 mm.
Crystal shape: Anhedral.
Crystal orientation: None, except in foliated Pieces 13–14.
Percent replacement: 50%.
Olivine - Mode: 15%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 60%.
Comments: Replaced by serpentine.
Clinopyroxene - Mode: 10%.
Crystal size: 1–2 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 50%.
SECONDARY MINERALOGY:
Total percent: 80%.
Texture: Local dunite patches are altered to black serpentine and magnetite. Otherwise, olivine is altered to green serpentine.
ADDITIONAL COMMENTS: There is a broad range of crystal sizes and modal compositions. The abundances above are an average for the entire interval. Pieces 13 and 14 have patches of serpentine plus talc up to 5 mm across. Plagioclase patches are up to 20 mm across. In Piece 13, the average patch size is 1 mm. Pieces 13, 18, and 19 are plagioclase rich. There are probable fresh olivine kernels in serpentinized patches.



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UNIT 10: OLIVINE GABBRO

Piece 1

COLOR: Patchy white to greenish gray.
LAYERING: None.
DEFORMATION: Undeformed.
PRIMARY MINERALOGY:
Olivine - Mode: 45%.
Crystal size: to 5 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 80%.
Plagioclase - Mode: 45%.
Crystal size: 1–5 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: >80%.
Comments: To fine white material.
Clinopyroxene - Mode: 10%.
Crystal size: to 10 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 65%–70%.
Comments: Altered to white clays.
SECONDARY MINERALOGY: Local dunite patches are altered to black serpentine and magnetite; otherwise, olivine is altered to green serpentine. In black patches, olivine is less altered. Clinopyroxene is altered to white clays.
Total percent: 80%.
Vein material: Prehnite plus zeolite.
ADDITIONAL COMMENTS: Patches of white to gray serpentine are mantled by green granslucent serpentine. There are separate patches of plagioclase. One end of the piece has small patches of serpentinized olivine, surrounded by white to gray serpentine with green translucent coronas. Large pyroxenes have alteration halos of talc (?).

UNIT 11: HARZBURGITE

Piece 2

COLOR: Yellow orange-brown (ochre).
LAYERING: None.
DEFORMATION: Porphyroclastic texture.
PRIMARY MINERALOGY:
Olivine - Mode: 85%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 100%.
Comments: Replaced by serpentine and clays.
Orthopyroxene - Mode: 15%.
Crystal size: to 5 mm.
Crystal shape: Anhedral to rounded.
Crystal orientation: None.
Percent replacement: 65%–70%.
Spinel - Mode: <1%
Crystal size: 1–5 mm.
Crystal shape: Irregular.
Crystal orientation: Some parallel fabric.
SECONDARY MINERALOGY:
Total percent: 95%.
Texture: Pseudomorphic. Oxidative alteration to serpentine and yellow-orange-brown clays. Olivine is completely replaced.
Vein material: None.
ADDITIONAL COMMENTS: Intensely altered, but still has fresh orthopyroxene.

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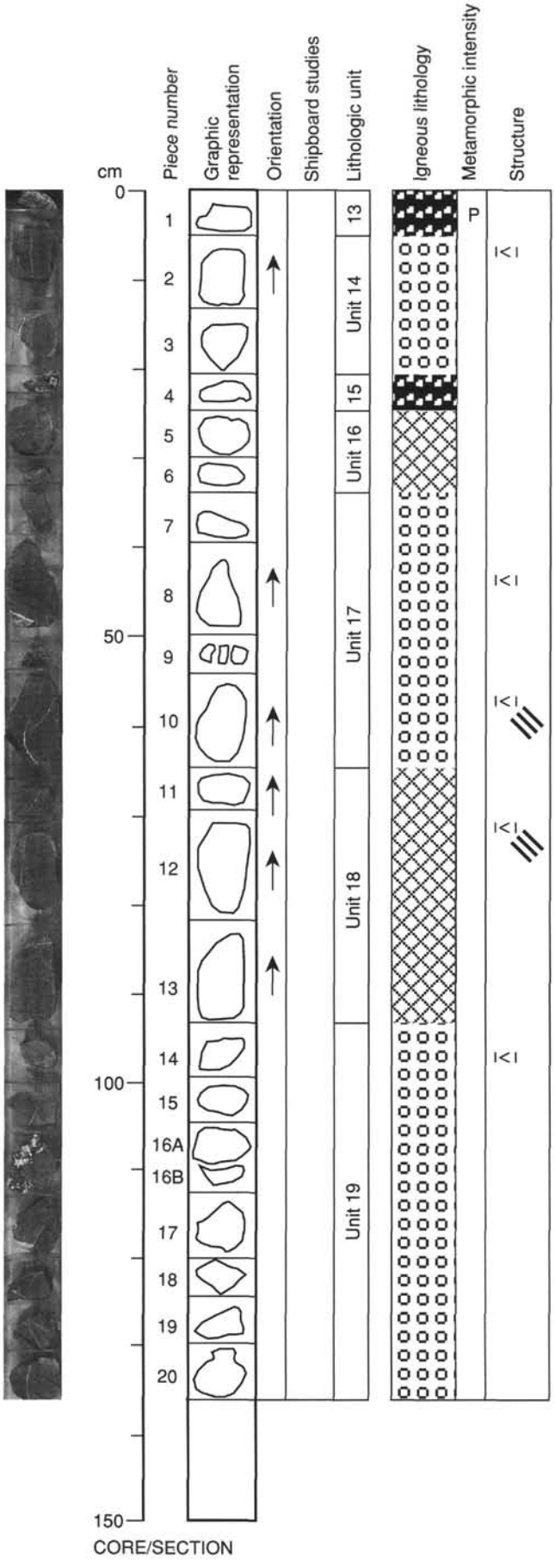
UNIT 12: DUNITE

Pieces 3–15

COLOR: Ochre to gray.
LAYERING: None.
DEFORMATION: Pervasive serpentinization, moderate serpentine veining, and spinel foliation in Pieces 9 and 15. There are roughly subhorizontal serpentine veinlets in oriented pieces.
PRIMARY MINERALOGY:
Olivine - Mode: >99%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: >95%.
Comments: Replaced by serpentine and clays.
Spinel - Mode: <1%.
Crystal size: 0.5–1 mm.
Crystal shape: Anhedra to equant.
Crystal orientation: None except in Pieces 9 and 15.
Comments: One spinel aggregate = 4 mm diameter.
SECONDARY MINERALOGY: Secondary minerals after olivine are variable and may represent an oxidative alteration profile. Ochre clays are in Pieces 3–8, brucite in Pieces 9 and 10, and background serpentine and talc below this.
Total percent: >95%.
Texture: Pseudomorphic, with serpentine and orange-brown clays replacing olivine.
Vein material: Some aragonite veins.



147-895E-3R-1

UNITS 13 AND 15: TROCTOLITE

Pieces 1 and 4

COLOR: White to green.
LAYERING: None.
DEFORMATION: Discrete veins.
PRIMARY MINERALOGY:
Plagioclase - Mode: 40%–50%.
Crystal size: 2–4 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Olivine - Mode: 50%–60%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 90%.
Comments: Replaced by serpentine.
Clinopyroxene - Mode: <5%.
Crystal size: 1 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Spinel - Mode: <<1%.
Crystal size: 0.2–0.3 mm.
Crystal shape: Equant.
Crystal orientation: None.
Comments: Enclosed in plagioclases.
SECONDARY MINERALOGY: Olivine altered to serpentine. Texture: Pseudomorphic.
ADDITIONAL COMMENTS: Multicrystal plagioclase patches are 6–15 mm aggregates. Olivine (serpentine) is about the same size. There are traces of clinopyroxene, to 1 mm, light yellow green with cleavage, in contact with plagioclase. Unit 13 (Piece 1) is medium grained and undeformed with about 60% plagioclase enclosing small 0.2 mm equant spinels. Unit 15 (Piece 4) is coarse grained with about 60% plagioclase, and a sharp intrusive-looking (micro-) contact on one edge with harzburgite, but no chill zone. A single 0.2 mm equant spinel was seen in a plagioclase. Piece 16A contains a coarse-grained vein irregularly from 1–2 cm wide. It contains about 50% plagioclase. The contact is sutured, with no evidence of a chill zone. A single 0.3 mm equant spinel was seen in a plagioclase.

UNITS 14, 17, AND 19 : DUNITE

Pieces 2–3, 7–10, 14–20

COLOR: Ochre to greenish gray.
LAYERING: None.
DEFORMATION: Spinel foliation, shallow-dipping
PRIMARY MINERALOGY: No orthopyroxene is present.
Olivine - Mode: >99%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 99%.
Comments: Replaced by serpentine and brucite. Little fresh olivine is left.
Spinel - Mode: <1%.
Crystal size: 0.5–1.5 mm.
Crystal shape: Equant to anhedral.
Crystal orientation: None.
Comments: Content is variable.
SECONDARY MINERALOGY: Primary orientation of serpentine veins is at about 30 degrees to normal to the axis of the core. Oxidative alteration (to ochre colors) is less in Piece 3 than in other pieces. Pieces 8–10 particularly contain brucite after olivine.
Total percent: 95%.
Texture: Pseudomorphic; mesh.
Vein material: 0.1–0.3 mm veins of serpentine and talc (of brucite?) cut by common 1–2 mm veins of aragonite.
ADDITIONAL COMMENTS: Plagioclase rich patch in Piece 16A.

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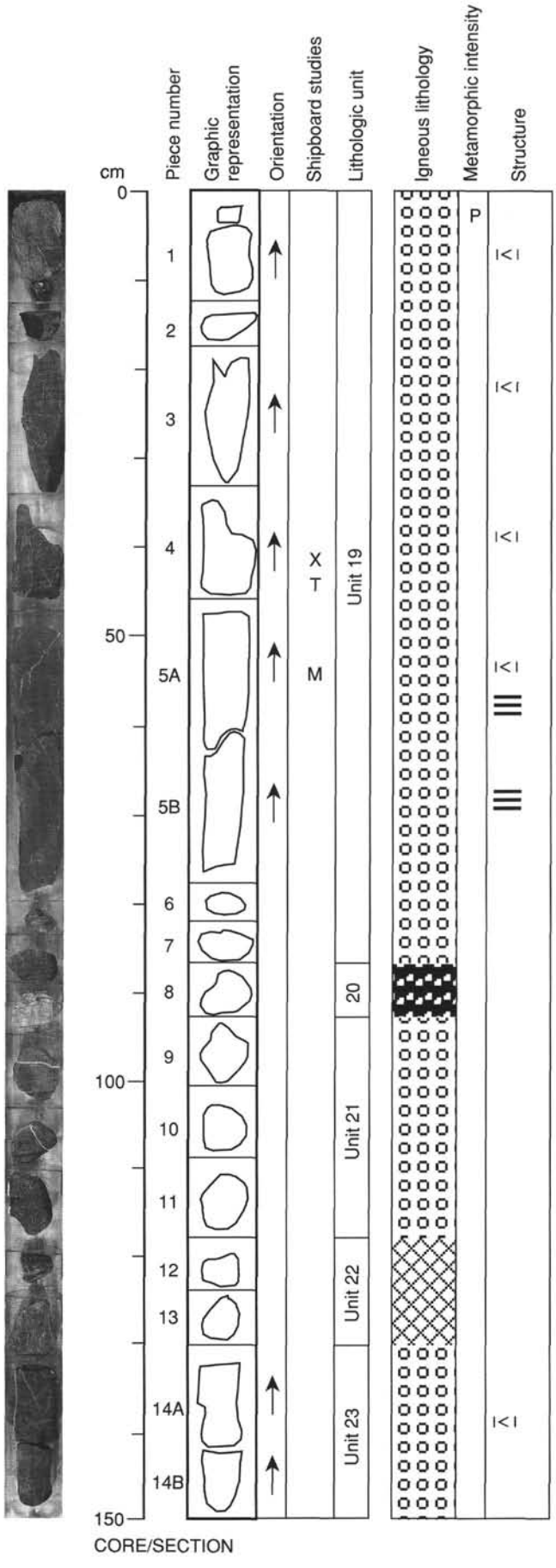
UNITS 16 AND 18: SERPENTINIZED HARZBURGITE

Pieces 5–6 and 11–13

COLOR: Yellow green.
LAYERING: None.
DEFORMATION: Porphyroclastic texture. The rocks have shallow-dipping spinel foliation.
PRIMARY MINERALOGY: Spinel occurs in discontinuous patches and stringers.
Olivine - Mode: 85%–95%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 90%.
Comments: Replaced by serpentine and clays.
Orthopyroxene - Mode: 5%–15%.
Crystal size: 1–5 mm.
Crystal shape: Anhedral to rounded.
Crystal orientation: None.
Percent replacement: 50%.
SECONDARY MINERALOGY: Piece 5 has thicker than usual magnetite-rich veins (up to 0.25 mm wide) roughly subparallel but in an unoriented piece. Alteration decreases downsection from Pieces 11 to 13. There is fresh rounded orthopyroxene in Piece 13.
Total percent: 85%–90%.
Texture: Pseudomorphic.
Vein material: 0.1–0.5 mm irregular veins of serpentine and magnetite.



147-895E-3R-2

UNITS 19, 21, AND 23: DUNITE

Pieces 1–7, 9–11, 14A, and 14B

COLOR: Light grayish green.
LAYERING: None.
DEFORMATION: Numerous aragonite veins; no fabric.
PRIMARY MINERALOGY: Spinel has a silvery luster and occurs in irregular discontinuous stringers and patches that do not follow the dominant serpentine stringer fabric, which contains high angle serpentine veins.
Olivine - Mode: 99%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 90%–100%.
Comments: Replaced by serpentine.
Spinel - Mode: 1%.
Crystal size: to 2.5 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
SECONDARY MINERALOGY: Abundant secondary magnetite is present in veins.
Total percent: 90%–99%.
Texture: Pseudomorphic.
Vein material: Numerous aragonite veins 0.5–1 mm wide in Pieces 9–11. Also anastomosing and discontinuous veins of serpentine with talc, 0.1–1 mm wide. Brucite may be present as well. There are also a few 0.5–3 mm wide veins of serpentine.

UNIT 20: TROCTOLITE

Piece 8

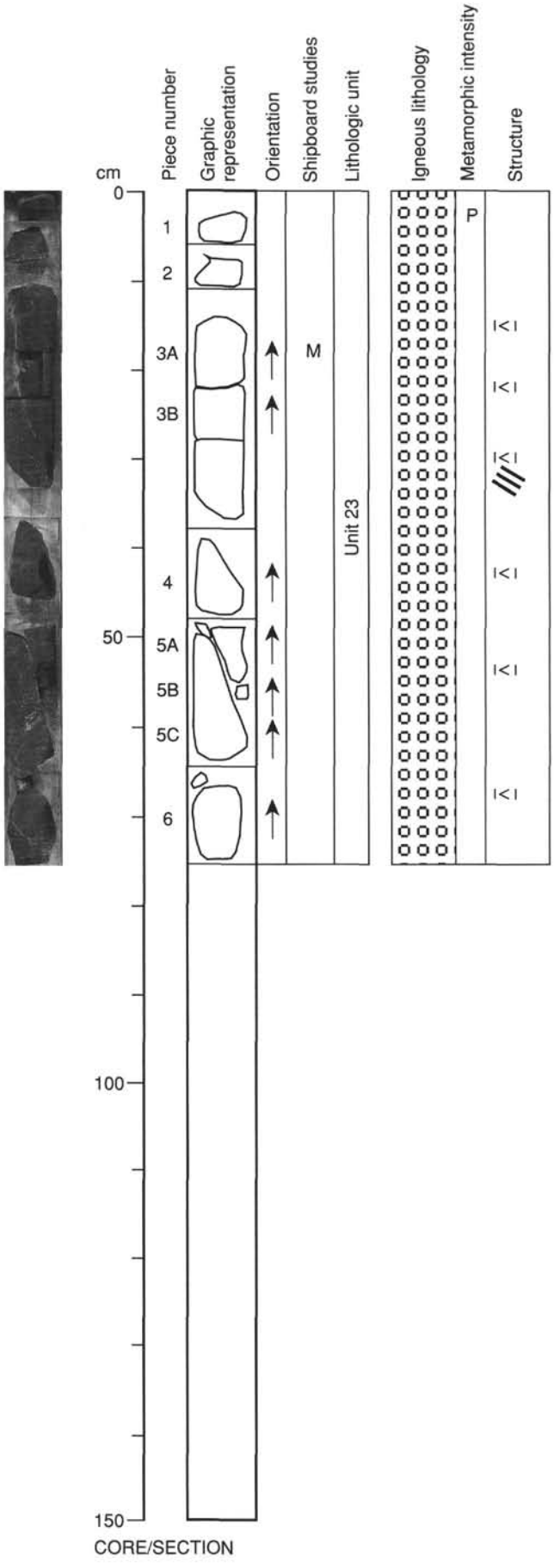
COLOR: Mottled white, gray, and dark green.
LAYERING: None.
DEFORMATION: None.
PRIMARY MINERALOGY:
Plagioclase - Mode: 40%.
Crystal size: 1–5 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 75%.
Olivine - Mode: 55%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 100%.
Comments: Replaced by serpentine.
Clinopyroxene - Mode: 5%.
Crystal size: 1–3 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 100%.
Spinel - Mode: <<1%.
Crystal size: 0.2–0.5 mm.
Crystal shape: Equant.
Comments: In olivine patches.
SECONDARY MINERALOGY:
Total percent: 90%.
Texture: Pseudomorphic.
ADDITIONAL COMMENTS: Piece 8 contains a 5-cm wide troctolite zone with a coarse pegmatitic zone in the middle parallel to the troctolite-dunite contact. The piece is unoriented, but there is a sharp contact with dunite on one side. Plagioclase is white, altered to hydrogrossular, prehnite, tremolite, and chlorite. Olivines are pervasively altered with well-developed coronas of talc and tremolite, and dark chloritic rims. Tremolite and chlorite form fine intergrown mats pseudomorphing clinopyroxene.

147-895E-3R-2

UNIT 22: HARZBURGITE

Pieces 12–13

COLOR: Gray to gray green.
LAYERING: None.
DEFORMATION: Porphyroclastic texture. Foliation is marked by spinel with a shallow dip in half-cut core. There is also discrete serpentine veining.
PRIMARY MINERALOGY:
Olivine - Mode: 95%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 95%.
Comments: Replaced by serpentine.
Orthopyroxene - Mode: 5%.
Crystal size: to 2 mm.
Crystal shape: Rounded.
Crystal orientation: None.
Percent replacement: 75%.
Spinel - Mode: <1%.
Crystal size: <0.5 mm.
Crystal shape: Irregular.
Crystal orientation: Aligned in foliation.
SECONDARY MINERALOGY: Enstatite grains, white to pale green in color, commonly exhibit dark black cores (chlorite or serpentine?) and are pervasively altered to serpentine, talc (?), and minor amphibole.
Total percent: 90%.
Texture: Pseudomorphic.
ADDITIONAL COMMENTS: There are small rounded orthopyroxene crystals in Piece 12 and more in Piece 13. All have alteration haloes and alteration along fractures. Alteration probably masks a higher abundance of orthopyroxene.



147-895E-3R-3

UNIT 23: DUNITE

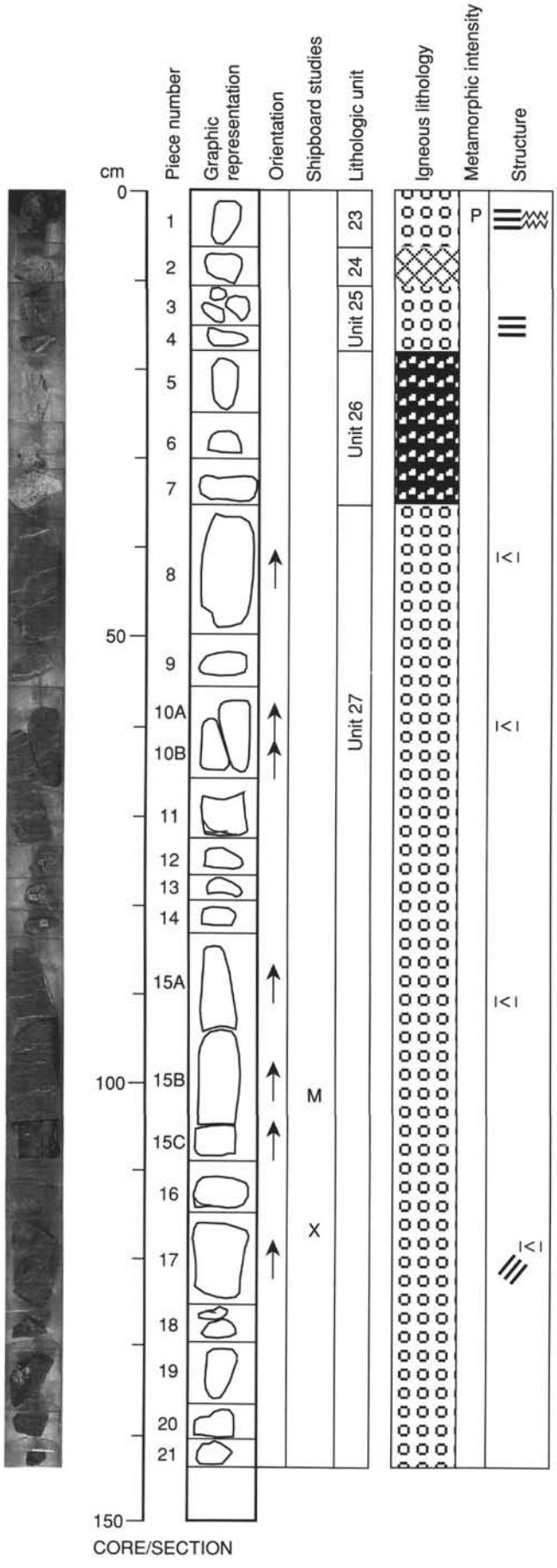
Pieces 1–6

COLOR: Dark greenish gray.
LAYERING: None.
DEFORMATION: The rocks are veined. Serpentine veinlets define a foliation.
PRIMARY MINERALOGY:

Olivine - Mode: 98%.
- Crystal size: Cannot determine.
- Crystal shape: Anhedral.
- Crystal orientation: None.
- Percent replacement: 100%.
- Comments: Replaced by serpentine.

Spinel - Mode: 2%.
- Crystal size: 0.5–1.5 mm.
- Crystal shape: Equant to anhedral.
- Crystal orientation: None.

SECONDARY MINERALOGY: Pseudomorphs of olivine commonly contain radiating fine white cores of serpentine (?) or talc, surrounded by light brown serpentine veined by dark black serpentine-magnetite microveinlets.
Total percent: 98%.
Texture: Pseudomorphic; *mesh*.
Vein material: There are a few veins 0.1–1 mm wide of serpentine, talc(?), and brucite (?).



147-895E-4R-1

UNITS 23, 25, 27: DUNITE
UNIT 24: HARZBURGITE

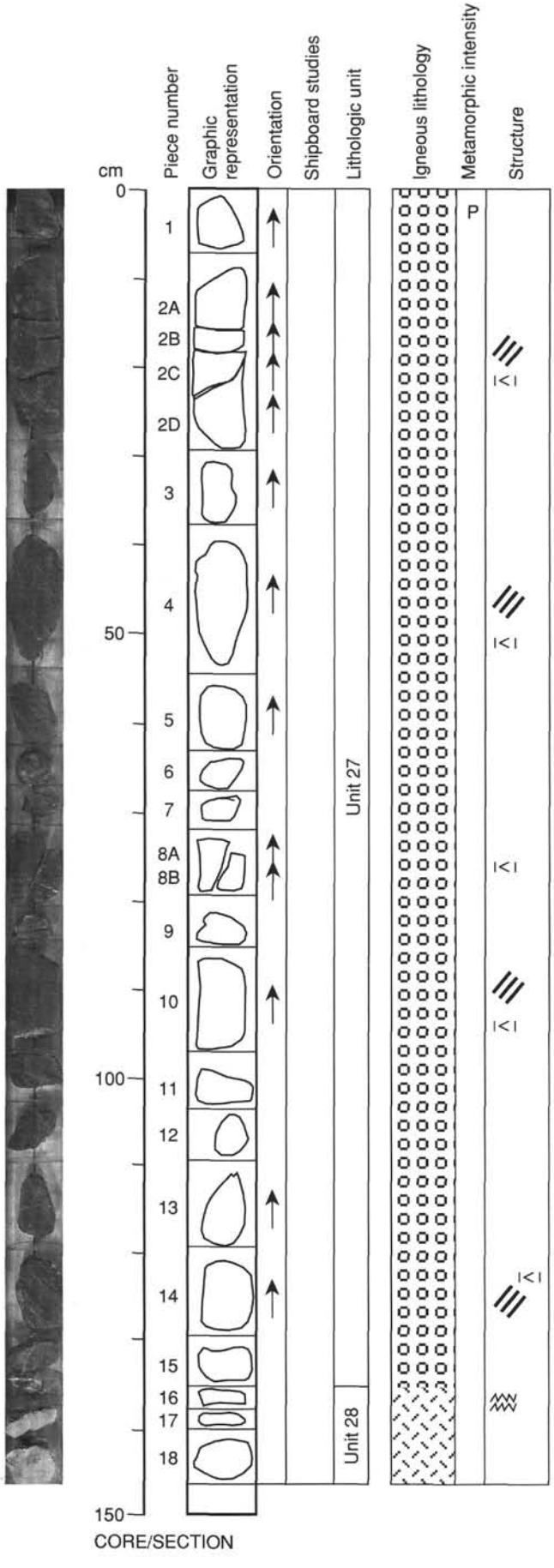
Pieces 1–4, 8–21

COLOR: Dark greenish gray.
LAYERING: None.
DEFORMATION: There is a thin sheared interval in Piece 1. Otherwise, pieces have steep spinel foliation
PRIMARY MINERALOGY:
Olivine - Mode: 98%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 98%–100%.
Comments: Replaced by serpentine.
Spinel - Mode: 2%.
Crystal size: 0.5–1.5 mm.
Crystal shape: Equant to anhedral.
Crystal orientation: Aligned along a steep foliation.
SECONDARY MINERALOGY: Mesh textured serpentine, pale green to dark brown in color. Serpentine and clay pseudomorphs after olivine are enclosed by anastomosing networks of dark brown serpentine and very fine oxides. Dark serpentine microveinlets may contain orange-colored oxide, and are rimmed by white fibrous serpentine.
Total percent: 98%.
Texture: Pseudomorphic; mesh.
Vein material: There is a regular network of 0.1–0.5 mm veins of serpentine and brucite (?). The orientation of the network is perpendicular to the long axis of the core.
ADDITIONAL COMMENTS: Piece 2 is porphyroclastic harzburgite, largely serpentinized. The several small pieces at the top of the core may have been redrilled from higher in the hole.

UNIT 26: TROCTOLITE

Pieces 5–7

COLOR: Gray to pale green.
LAYERING: None.
DEFORMATION: Incipient foliation in all pieces, more marked in Piece 5.
PRIMARY MINERALOGY:
Olivine - Mode: 55%–60%.
Crystal size: 1–2 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 100%.
Plagioclase - Mode: 40%–45%.
Crystal size: 1–2 mm.
Crystal shape: Anhedral.
Crystal orientation: Defines foliation.
Percent replacement: 100%.
Spinel - Mode: <0.5%.
Crystal size: 0.2–0.5 mm.
Crystal shape: Equant to anhedral.
SECONDARY MINERALOGY: Pervasively altered. Plagioclase is chalk white and replaced by fine fibrous minerals (tremolite-prehnite intergrowths, pale green amphibole, orange clay, a soft brown mineral). Olivines are replaced by talc (?) amphibole, chlorite, and serpentine and are dark green in color. Native copper is very abundant in the pseudomorphs after olivine. Secondary sulfides are more abundant here (to 0.5% and up to 0.5 mm across) than anywhere else in the rocks of this hole.
Total percent: 100%.
Texture: Pseudomorphic.
ADDITIONAL COMMENTS: The three pieces are medium- to coarse-grained troctolite with about 60% plagioclase and a weak to moderate foliation. There is a small olivine-rich pod in Piece 7.



147-895E-4R-2

UNIT 27: DUNITE

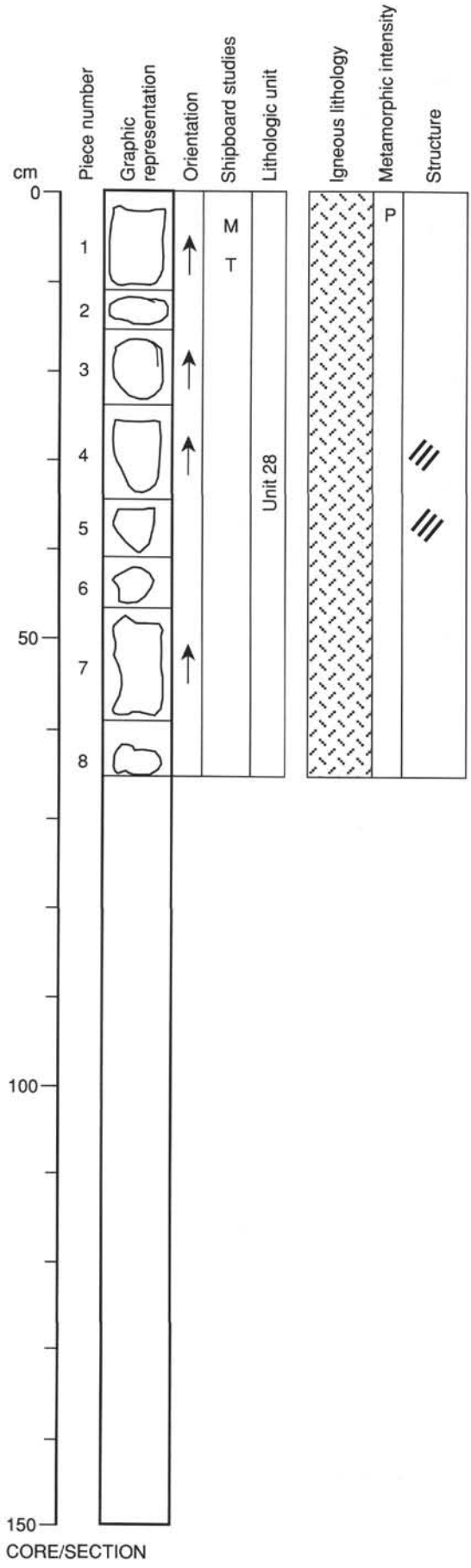
Pieces 1–15

COLOR: Dark greenish gray.
LAYERING: None.
DEFORMATION: There is a trace of foliation defined by spinel trains, and minor serpentine veining.
PRIMARY MINERALOGY:
Olivine - Mode: 98%–99%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 100%.
Comments: Completely replaced by serpentine.
Spinel - Mode: 1%–2%.
Crystal size: 0.5–1.5 mm.
Crystal shape: Equant to anhedral.
Crystal orientation: Aligned along foliation.
SECONDARY MINERALOGY: Completely serpentinized dunite, with olivines transformed to pale brownish green serpentine plus talc. Cores are rimmed by brown serpentine enclosed by very fine microveinlets of darker brown serpentine plus magnetite.
Total percent: 98%–99%.
Texture: Pseudomorphic; mesh serpentine.

UNIT 28: GABBRO

Pieces 16–18

COLOR: Mottled green to gray and white.
LAYERING: None.
DEFORMATION: Sheared in Piece 17, but not oriented.
PRIMARY MINERALOGY:
Plagioclase - Mode: 40%–45%.
Crystal size: Difficult to determine.
Crystal shape: Anhedral.
Crystal orientation: None, except in sheared Piece 17.
Percent replacement: 90%.
Clinopyroxene - Mode: 40%–45%.
Crystal size: to 25 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 90%.
Olivine - Mode: Variable.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 100%.
SECONDARY MINERALOGY: Pervasively altered. Plagioclase is chalk white and replaced by fine fibrous white minerals (tremolite-prehnite intergrowths?). Olivines exhibit well-developed coronas, and are completely replaced by talc (?), amphibole, and serpentine, with dark green rims of chlorite. Piece 18 contains very coarse-grained (metamorphic) clinopyroxene oikocrysts, which are apple green in color, and replaced by minor brown-white amphibole-tremolite.
Total percent: 90%–95%.
Texture: Pseudomorphic.
ADDITIONAL COMMENTS: See description of continuation of this gabbro in Section 147-895E-4R-3.



147-895E-4R-3

UNIT 28: GABBRO

Pieces 1–8

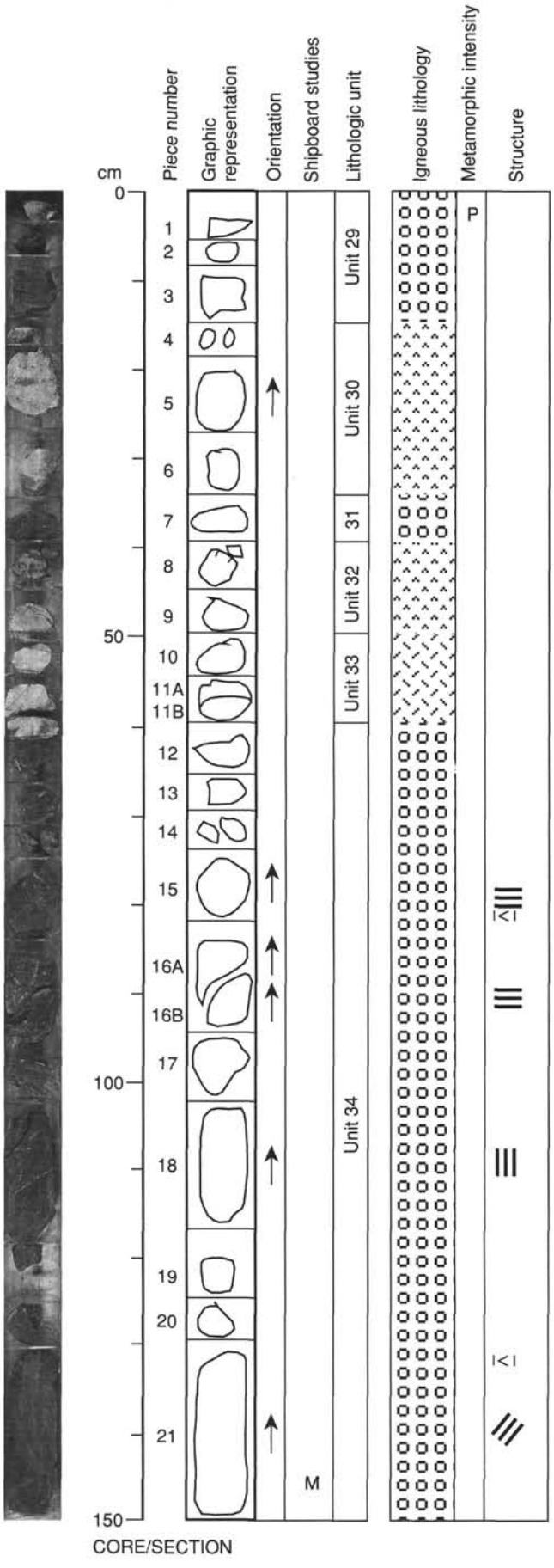
COLOR: Mottled yellow green and dark green to grayish white.
LAYERING: None.
DEFORMATION: Pieces 4 and 5 are foliated.
PRIMARY MINERALOGY: Plagioclase occurs in variably sized patches from 1 mm to 1 cm across. Clinopyroxene ranges up to 12 mm across. Olivine (now altered) also occurs in patches. Cleavage in clinopyroxene is very wavy, imparting a reflective sheen to cut pieces. Altered plagioclase contains stringers of a green mineral often aligned parallel to the long axes of crystal clusters.

Plagioclase - Mode: 25%–50%.
Crystal size: 1–10 mm.
Crystal shape: Anhedral.
Crystal orientation: None.

Clinopyroxene - Mode: 40%–70%.
Crystal size: to 12 mm.
Crystal shape: Anhedral.
Crystal orientation: None.

Olivine - Mode: 0%–5%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.

SECONDARY MINERALOGY: Metamorphic clinopyroxene, with pervasive secondary diallage, exhibits a very heterogeneous grain size, ranging from pegmatitic (11.5 X 4.5 mm) to fine-medium grained. It is pale olive green, usually fibrous. Plagioclase is white gray to chalk white, and replaced by hydrogrossular and prehnite, and discontinuous amphibole microveinlets. Finer grained clinopyroxenes are replaced by fibrous mats of green amphibole and perhaps minor chlorite.
Texture: Pseudomorphic.
ADDITIONAL COMMENTS: Highly variable grain size, medium-pegmatoidal patches, with diallage greater than 7 cm in Piece 7. Overall, plagioclase is about 50%, though there are some very diallage-rich zones. There is an internal sharp planar sutured igneous contact between coarse and medium-grained gabbro in Piece 1, dipping 70 degrees. A weak foliation parallel to the contact may be present locally. There is no spinel in Pieces 4–8, but there may be a flake of native iron on the cut face of Piece 6.



147-895E-5R-1

UNITS 29 AND 31: DUNITE
UNITS 30 AND 32: OLIVINE GABBRO
UNIT 33: GABBRO

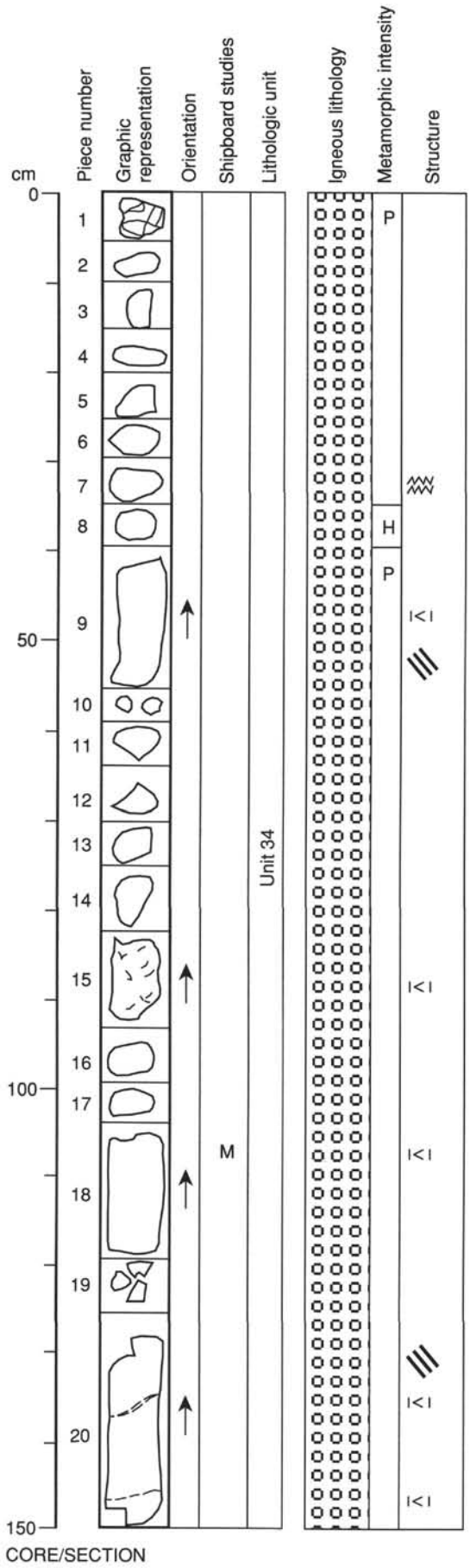
Pieces 1–11B

COLOR: Dark grayish green (dunites) and speckled white to green (gabbros).
LAYERING: None.
DEFORMATION: Minor veining in these small rock fragments. Spinel foliation occurs in larger pieces of dunite.
SECONDARY MINERALOGY:
Texture: Pseudomorphic in all lithologies.
ADDITIONAL COMMENTS: DUNITES (Pieces 1–3 and 7): Variably, but nearly completely serpentinized. Minor spinel foliation. Spinel is up to 2 mm across and occurs in aligned patches or stringers. OLIVINE GABBROS (Pieces 4–6 and 8–9): Serpentinized. Olivine is 60%, plagioclase 20%, and clinopyroxene 20% of the rocks, mostly altered. Clinopyroxene has altered plagioclase inclusions (milky white). Piece 9 has no recognizable olivine, plagioclase is 60% and altered clinopyroxene 40% of the rocks.

UNIT 34: DUNITE

Pieces 12–21

COLOR: Dark gray green.
LAYERING: None.
DEFORMATION: Minor veining.
PRIMARY MINERALOGY:
Olivine - Mode: 98%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: >95%.
Comments: Altered to serpentine.
Spinel - Mode: 2%.
Crystal size: 0.5–1.5 mm.
Crystal shape: Equant to anhedral.
Crystal orientation: Somewhat aligned.
SECONDARY MINERALOGY: Olivine is replaced by talc and greenish black mesh serpentine. Distribution of ochre-colored material suggests later alteration of olivine granules. They are now 75% serpentine and 25% ochre-colored clayed.
Total percent: >95%.
Texture: Pseudomorphic, mesh serpentine.
Vein material: 0.1–0.2 mm blue dark serpentine veins cut by 0.5–1 mm white to pale green veins of serpentine and sometimes brucite.
ADDITIONAL COMMENTS: Piece 2 has mesh-textured serpentine that looks like complete replacement of plagioclase. It may have had up to 5% plagioclase.

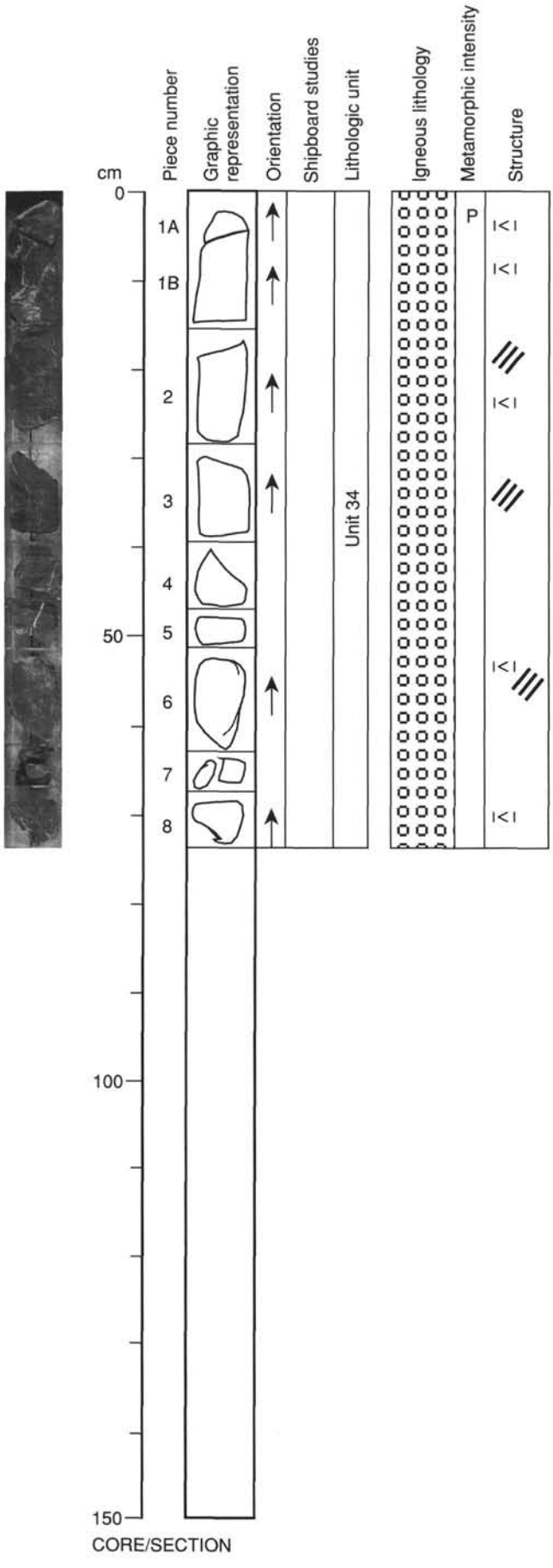


147-895E-5R-2

UNIT 34: DUNITE

Pieces 1–20

COLOR: The dunite is dark grayish green.
LAYERING: None.
DEFORMATION: Spinel elongation or alignment of grains in Pieces 19 and 20. Variable serpentine veining with evidence for minor normal displacement in Piece 20. Piece 7 is sheared, possibly with some tremolite.
PRIMARY MINERALOGY:
Olivine - Mode: 98%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Percent replacement: >95%.
Comments: Replaced by serpentine.
Spinel - Mode: 2%
Crystal size: 0.5–1.5 mm.
Crystal shape: Equant to anhedral.
Crystal orientation: Some elongation into stringers.
SECONDARY MINERALOGY: Dark green serpentine and talc are in a mesh texture. Ochre clay (?) appears to replace granular olivine suggesting that it may postdate serpentinization.
Total percent: >95%.
Texture: Pseudomorphic; mesh serpentine.
Vein material: In Piece 7, there is a centimeter-size asbestos patch. Elsewhere, there are numerous veins of pale green serpentine (chrysotile?) and overprinting by millimeter-sized brucite.
ADDITIONAL COMMENTS: Piece 8 is a small, apparently undeformed, gabbro pebble with a 2-cm pegmatitic clinopyroxene on its side. It was not split.

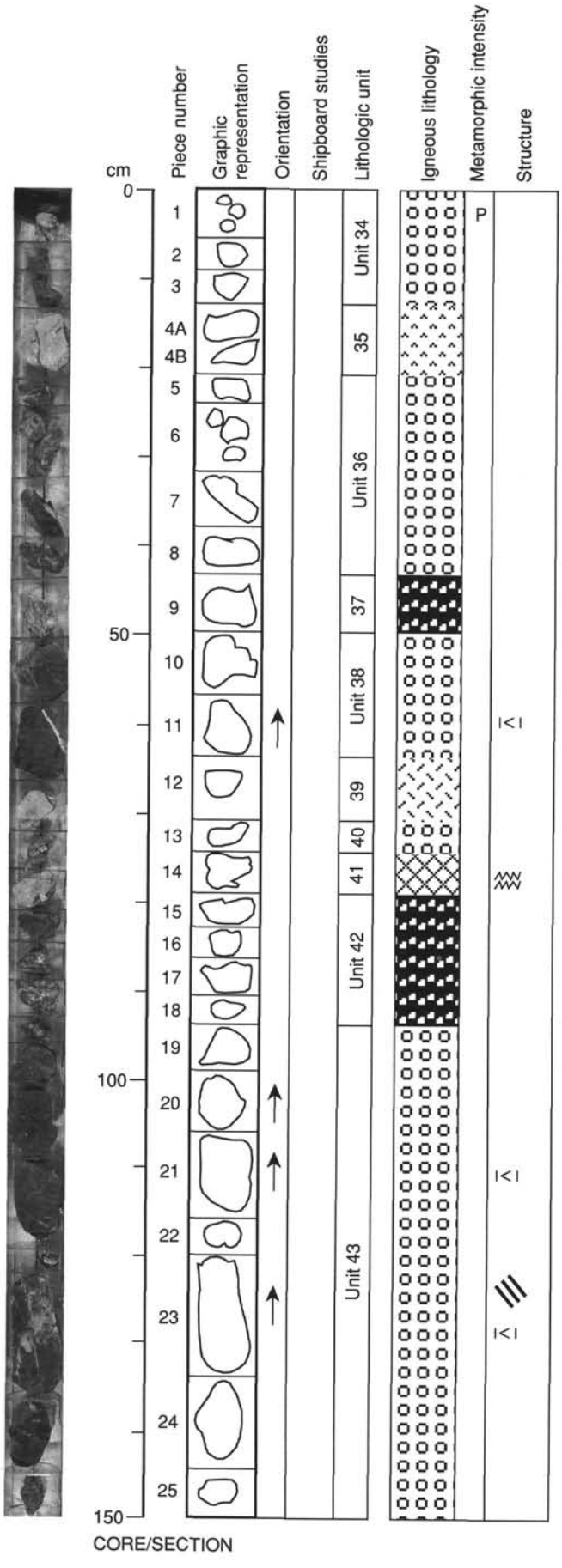


147-895E-5R-3

UNIT 34: DUNITE

Pieces 1A–8

COLOR: Dark grayish green.
LAYERING: None.
DEFORMATION: The section has shallow-dipping spinel foliation. There is a vein network in Piece 1.
PRIMARY MINERALOGY:
Olivine - Mode: 98%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: >95%.
Comments: Replaced by mesh serpentine.
Spinel - Mode: 2%.
Crystal size: 0.5–1.5 mm.
Crystal shape: Equant to anhedral.
Crystal orientation: Stringers define a foliation.
SECONDARY MINERALOGY: The general alteration is to dark green serpentine and talc in a mesh texture. Ochre clay (?) appears to replace olivine granules suggesting that it may postdate serpentinization.
Total percent: >95%.
Texture: Pseudomorphic replacement of olivine by mesh serpentine.
Vein material: Piece 1 has abundant centimeter-sized veins or patches of asbestos. Other pieces have numerous 0.2–3 mm pale green veins of serpentine, brucite, and magnetite (visible as black dots).



147-895E-6R-1

UNITS 34, 36, 38, 40, AND 43: DUNITE
UNIT 41: HARZBURGITE

Pieces 1–3, 5–8, 10–11, 13–14, 19–25

COLOR: Dark grayish green, shaded toward ochre in some pieces.
LAYERING: None.
DEFORMATION: Few pieces are oriented. Spinel foliation with shallow dip occurs in Piece 23. Most pieces have discrete veining.
PRIMARY MINERALOGY:
Olivine - Mode: 99%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: >95%
Comments: Replaced by mesh serpentine.
Spinel - Mode: 1%.
Crystal size: <1 mm.
Crystal shape: Anhedral
Crystal orientation: Stringers define foliation.
SECONDARY MINERALOGY: PIECES 1–3: Variable development of ochre clay in serpentinite. PIECES 5–8: Several patches with minor olivine granules remaining in serpentine. PIECES 10–11: Numerous 0.1–5 mm pale green veins of serpentine and locally brucite.
Total percent: >95%.
Texture: Pseudomorphic replacement of olivine by mesh serpentine.
Vein material: PIECES 1–3: 0.5–1 mm serpentine veins with exsolution of iron (?). Pieces 5–8: 0.1–0.3 mm irregular and sinuous pale green veins of serpentine. There are also thick crosscutting serpentine veins with bits of serpentinized olivine entrained. PIECE 11: 4 mm vein of Ca-carbonate.
ADDITIONAL COMMENTS: Pieces 1–3: Pervasively altered to dull orange brown. Piece 1 is three very serpentinized pebbles. Pieces 5–7: Dunite has very little spinel. Some parts altered to ochre clays. Piece 13: A dunite pebble. Piece 14: A pebble of porphyroclastic serpentinized harzburgite, partly sheared. Pieces 19–25: Dark grayish green thoroughly serpentinized dunite with rare spinel and rare patches of translucent serpentine, all lacking distinct fabric.

147-895E-6R-1

UNIT 35: OLIVINE GABBRO
UNITS 37 AND 42: TROCTOLITE
UNIT 39: GABRO

Pieces 4A, 4B, 9, 12, and 15–18

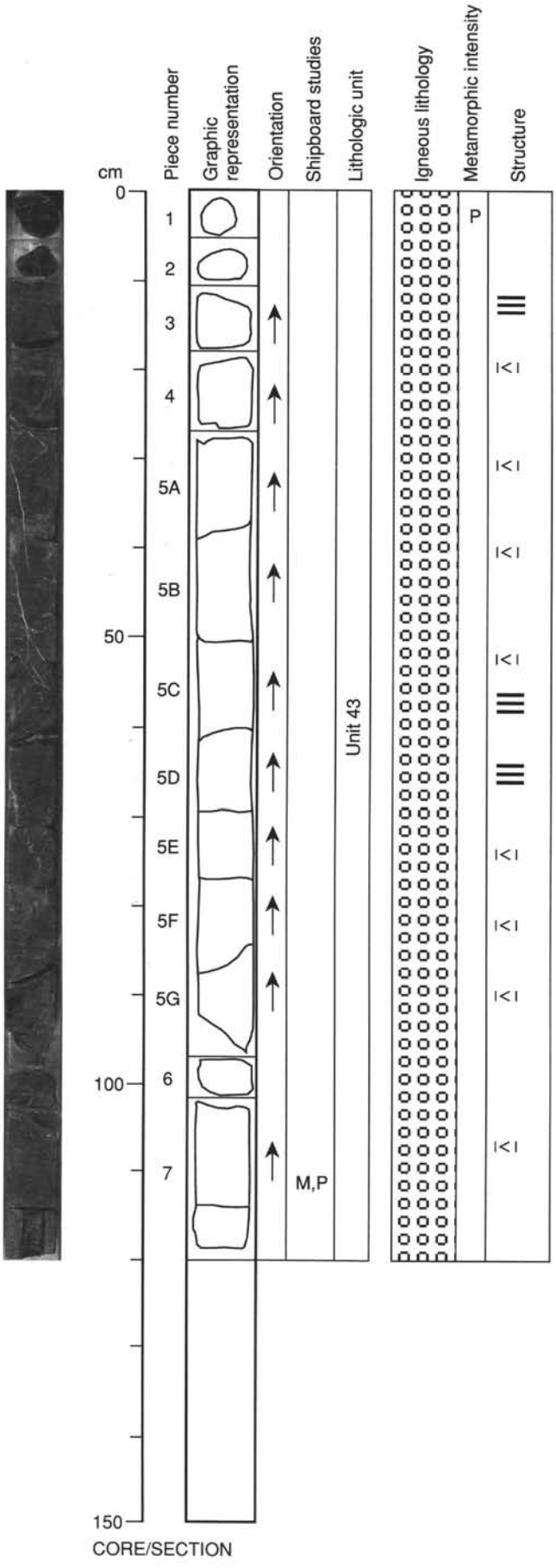
COLOR: White and gray green.
LAYERING: None.
DEFORMATION: Veined, but otherwise not deformed.
PRIMARY MINERALOGY:

Plagioclase - Mode: 30%–60%.
Crystal size: 2–3 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 50%.
Comments: Replaced by secondary plagioclase and clays.

Clinopyroxene - Mode: 0%–10%.
Crystal size: 1–3 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 75%.
Comments: Replaced by tremolite.

Olivine - Mode: 0%–70%.
Crystal size: 1–3 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 100%.
Comments: Replaced by serpentine.

SECONDARY MINERALOGY: Origin of the clinopyroxene in Piece 12 is uncertain. It has classic diallage texture. Kinked cleavages are evident in hand specimen. The mineral may be metamorphic; alternatively, it was originally magmatic, but is now altered.
Total percent: 9%.
Texture: Pseudomorphic. In troctolites, patches of olivine are replaced with white to light green serpentine or chlorite with mantles of dark green translucent separated by irregularly shaped patches of plagioclase. Plagioclase is replaced by fine-grained translucent or chalky material.
Vein material: There are no macroscopic veins.

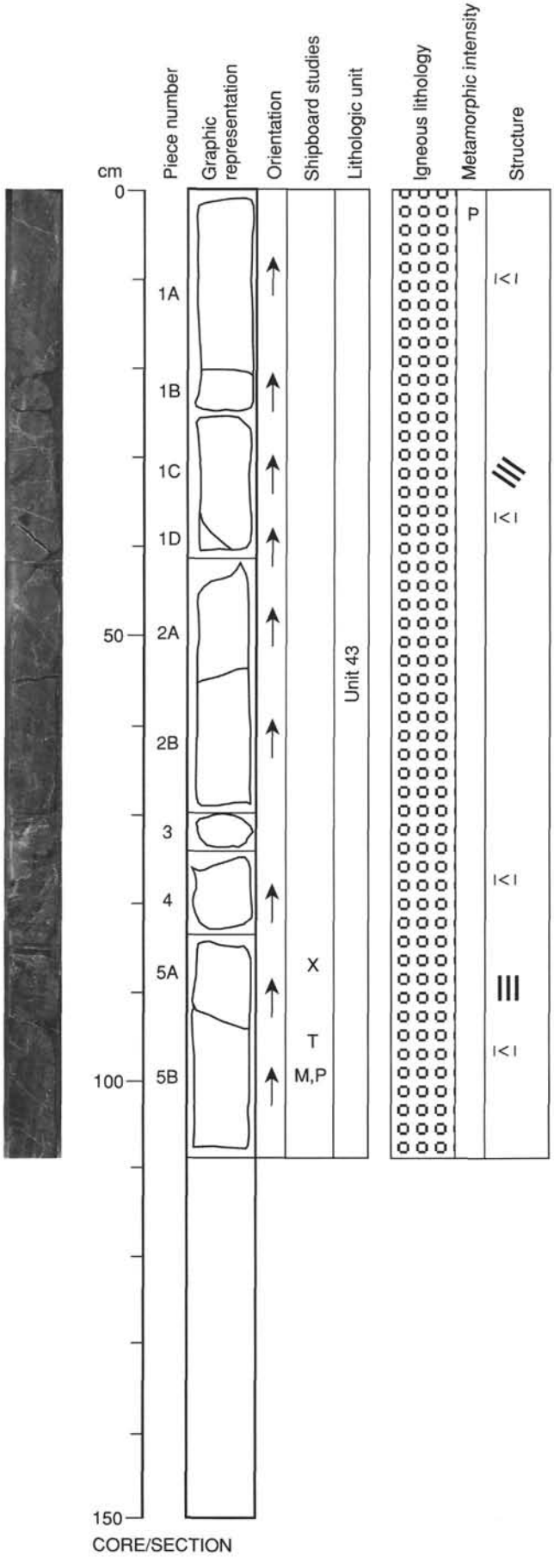


147-895E-6R-2

UNIT 43: DUNITE

Pieces 1–7

COLOR: Dark grayish green.
LAYERING: None.
DEFORMATION: Little fabric in this dunite. There are shallow-dipping spinel alignments in Piece 5, and discrete serpentine veining throughout.
PRIMARY MINERALOGY: Piece 5E has a large 0.5 mm
Cr-spinel.
Olivine - Mode: 98%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 98%.
Comments: Replaced by mesh serpentine.
Spinel - Mode: 2%.
Crystal size: 0.5–1.5 mm.
Crystal shape: Equant-anhedral.
Crystal orientation: Faint alignment in Piece 5.
SECONDARY MINERALOGY: Serpentine and talc replace olivine. Serpentinization is stronger near green serpentine veins.
Total percent: 95%.
Texture: Pseudomorphic replacement of olivine by mesh-textured serpentine.
Vein material: 0.5–1 mm blue green veins of serpentine wend sinuous, discontinuous paths through the rock. They have a highly variable width and are cut by regular 0.5–1 mm white to pale green veins of serpentine, brucite, and magnetite.

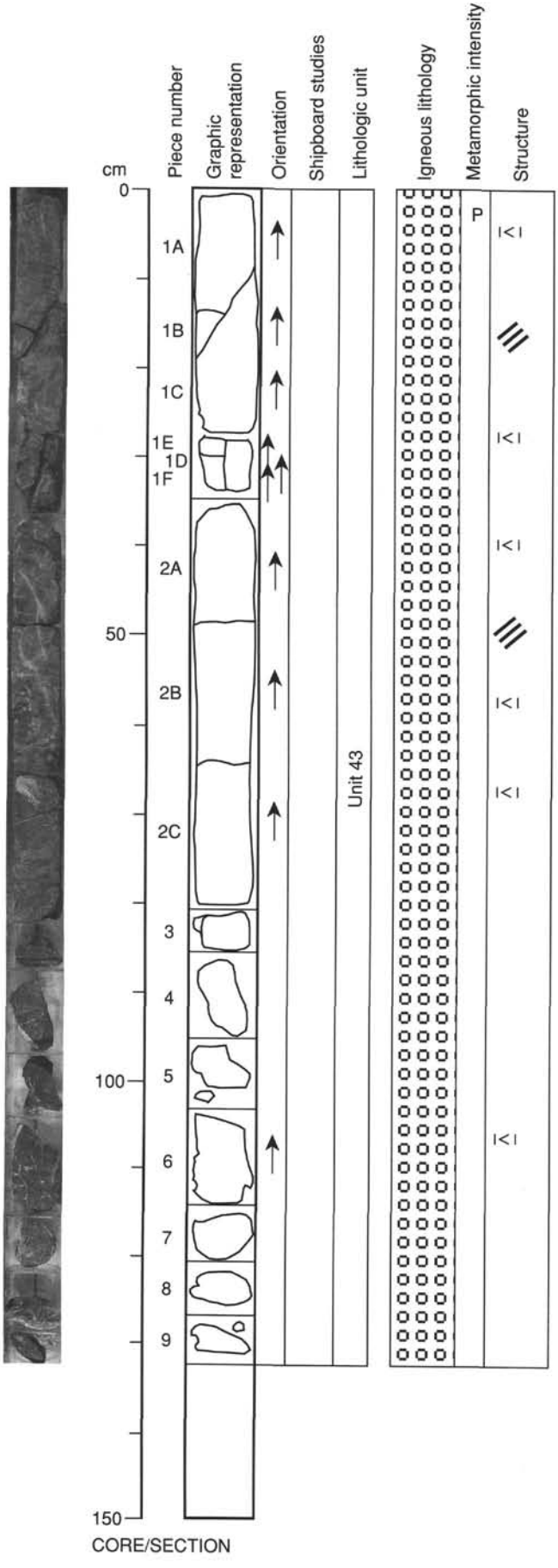


147-895E-6R-3

UNIT 43: DUNITE

Pieces 1A–5B

COLOR: Dark grayish green.
LAYERING: None.
DEFORMATION: Spinel foliation (elongation and alignment of grains) in several pieces. Discrete serpentine veining.
PRIMARY MINERALOGY:
Olivine - Mode: 98%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: >95%.
Comments: Replaced by mesh-textured serpentine.
Spinel - Mode: 2%.
Crystal size: 0.5–1.5 mm.
Crystal shape: Equant to anhedral.
Crystal orientation: Some elongation and alignment of grains.
SECONDARY MINERALOGY: Olivine is replaced by serpentine and minor chalk.
Serpentinization is stronger near serpentine veins.
Total percent: >95%.
Texture: Pseudomorphic replacement of olivine by mesh-textured serpentine.
Vein material: 1–4 mm irregular, sinuous and commonly disrupted veins of pale green to blue green serpentine cross the core. They are cut by a network of parallel regular and straight white to pale greenish gray veins of serpentine, brucite, and magnetite.

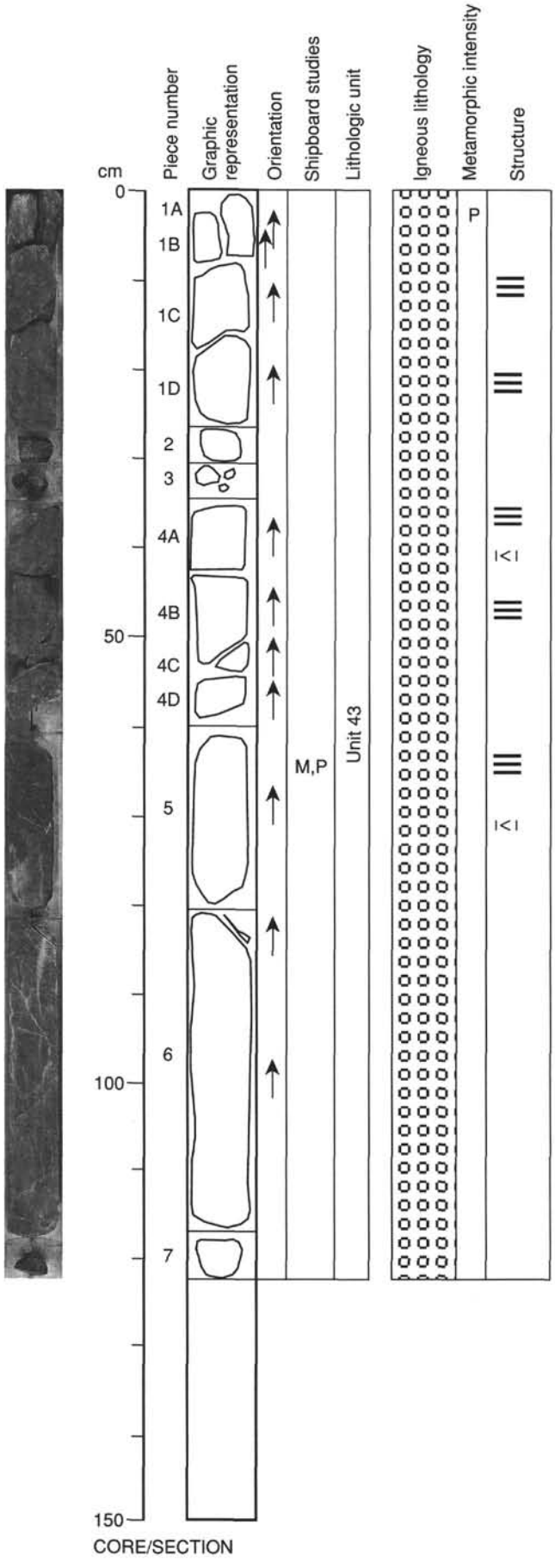


147-895E-6R-4

UNIT 43: DUNITE

Pieces 1A–9

COLOR: Dark grayish green.
LAYERING: None.
DEFORMATION: Some rocks have moderately dipping spinel foliation, and moderate serpentine veining.
PRIMARY MINERALOGY:
Olivine - Mode: 98%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: >95%.
Comments: Replaced by mesh-textured serpentine.
Spinel - Mode: 2%.
Crystal size: 0.5–1.5 mm.
Crystal shape: Equant to anhedral.
Crystal orientation: Aligned along foliation.
SECONDARY MINERALOGY: There is local development of ochre clays around some veins. Olivine is altered to serpentine, minor talc, and magnetite. There is a sheared serpentine vein with dunite clasts in Piece 8. Interlayered white material near surfaces is probably aragonite (fizzes in HCl).
Total percent: >95%.
Texture: Pseudomorphic replacement of olivine by mesh-textured serpentine.
Vein material: The rocks contain 2–5 mm-wide veins, blue gray at vein rims with pale green cores. The veins are irregular and disrupted, made up of two *generations of serpentine. They are cut by white-gray veins of serpentine,* brucite, and magnetite.

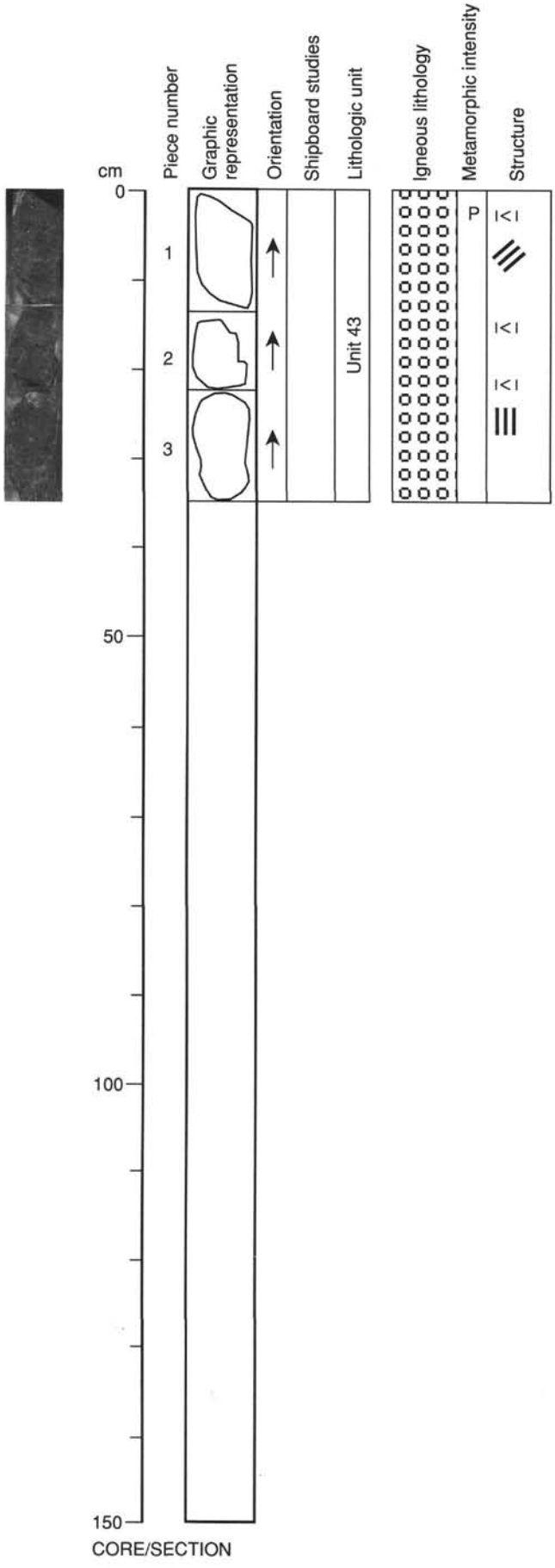


147-895E-6R-5

UNIT 43: DUNITE

Pieces 1A–7

COLOR: Dark grayish green.
LAYERING: None.
DEFORMATION: Some pieces have shallow-dipping spinel foliation. Discrete serpentine veining occurs throughout.
PRIMARY MINERALOGY:
Olivine - Mode: >99%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: >95%.
Comments: Replaced by mesh-textured serpentine.
Spinel - Mode: <1%.
Crystal size: 1–2 mm.
Crystal shape: Equant-anhedral.
Crystal orientation: Aligned in foliation of the rock.
SECONDARY MINERALOGY: *The rocks are pervasively serpentinized.* Pieces 1–4 contain patches along veins of translucent green serpentine that may once have been orthopyroxene (very rare patches have a slightly different color and hints of preserved cleavage), but these are still <<5% of the rock, which therefore makes the rocks dunites.
Total percent: 95%.
Texture: Pseudomorphic, with olivine replaced by mesh-textured serpentine.
Vein material: Blue-pale green serpentine veins form an anastomosing network, but are less abundant than in Section 147-895E-6R-3. They are cut by 0.5–1 mm white-gray veins of serpentine, brucite, and magnetite.



147-895E-6R-6

UNIT 43: DUNITE

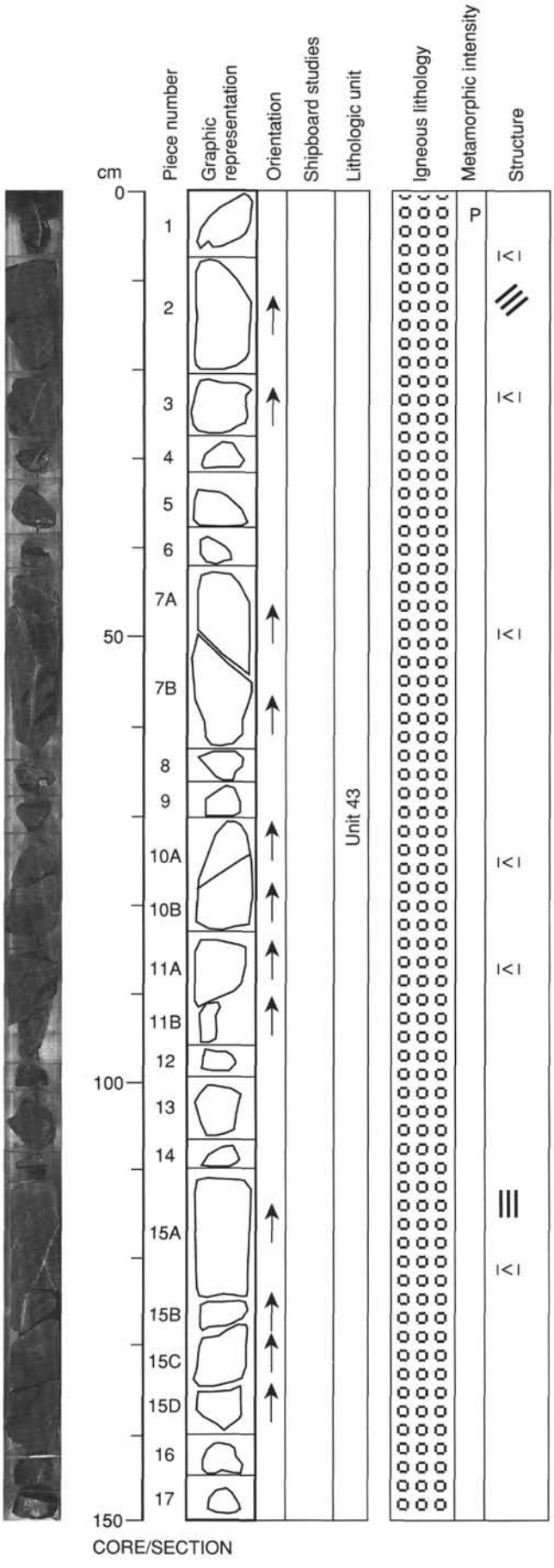
Pieces 1–3

COLOR: Dark gray to grayish green.
LAYERING: None.
DEFORMATION: The rocks are veined with serpentine, and have steep spinel foliation.
PRIMARY MINERALOGY: Two spinels, one brownish (chromite), one with a distinct silvery luster (ferritchromite) occur as sparse individual anhedral crystals. The rocks contain no obvious orthopyroxene.

Olivine - Mode: >99%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: >95%.
Comments: Replaced by mesh-textured serpentine.

Spinel - Mode: <1%.
Crystal size: 0.5–1.5 mm.
Crystal shape: Equant to anhedral.
Crystal orientation: Aligned in direction of foliation.

SECONDARY MINERALOGY: Translucent green serpentine veins crosscut pervasively serpentinized dunite. Brucite is present, but rare. There is no distinct orientation to serpentine veinlets.
Total percent: >95%.
Texture: Pseudomorphic replacement of olivine by mesh-textured serpentine.
Vein material: There are diffuse and irregular 0.3–0.5 mm blue-green to pale green veins of serpentine cut by 0.1–0.3 mm wide white veins of serpentine and brucite.

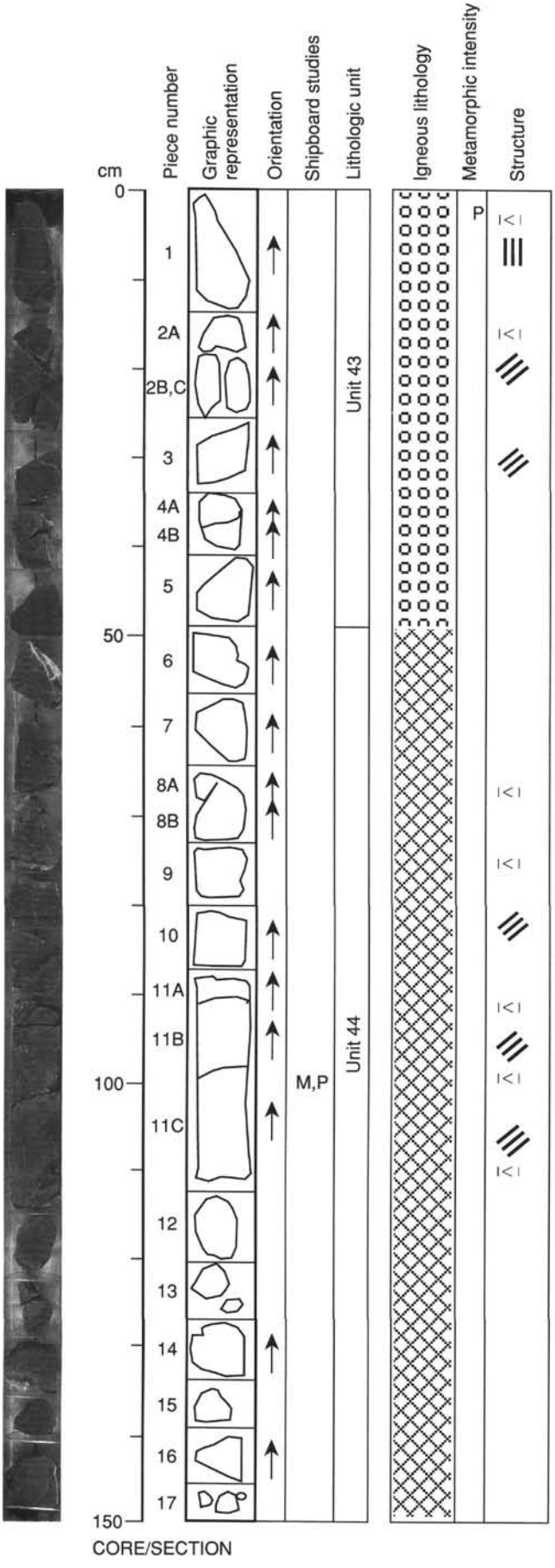


147-895E-7R-1

UNIT 43: DUNITE

Pieces 1–17

COLOR: Dark grayish green.
LAYERING: None.
DEFORMATION: Steep spinel foliation. Moderate serpentine veining.
PRIMARY MINERALOGY: Spinel tends to occur in patches, some elongate.
There is no evident orthopyroxene.
Olivine - Mode: >99%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: >95%.
Comments: Replaced by mesh-textured serpentine.
Spinel - Mode: <1%.
Crystal size: 0.5–1.5 mm.
Crystal shape: Equant to anhedral.
Crystal orientation: Defines foliation.
SECONDARY MINERALOGY: Strongly serpentinized. There are rare fresh olivine kernels. Along coarser veins are patches of green translucent serpentine, irregularly shaped. There are wispy magnetite segregations in Piece 10. Olivine is altered to blackish green serpentine, with cores altered to light yellowish green talc (?) and serpentine. Alteration is locally stronger near high-angle veins in Piece 15.
Total percent: >95%.
Texture: Pseudomorphic replacement of olivine by mesh-textured serpentine.
Vein material: There are a few mm-size microscopic veins, pale green to white, serpentine and talc with some brucite. These generally branch. There are also 1–2 mm dark green veins of serpentine and magnetite.



147-895E-7R-2

UNIT 43: DUNITE

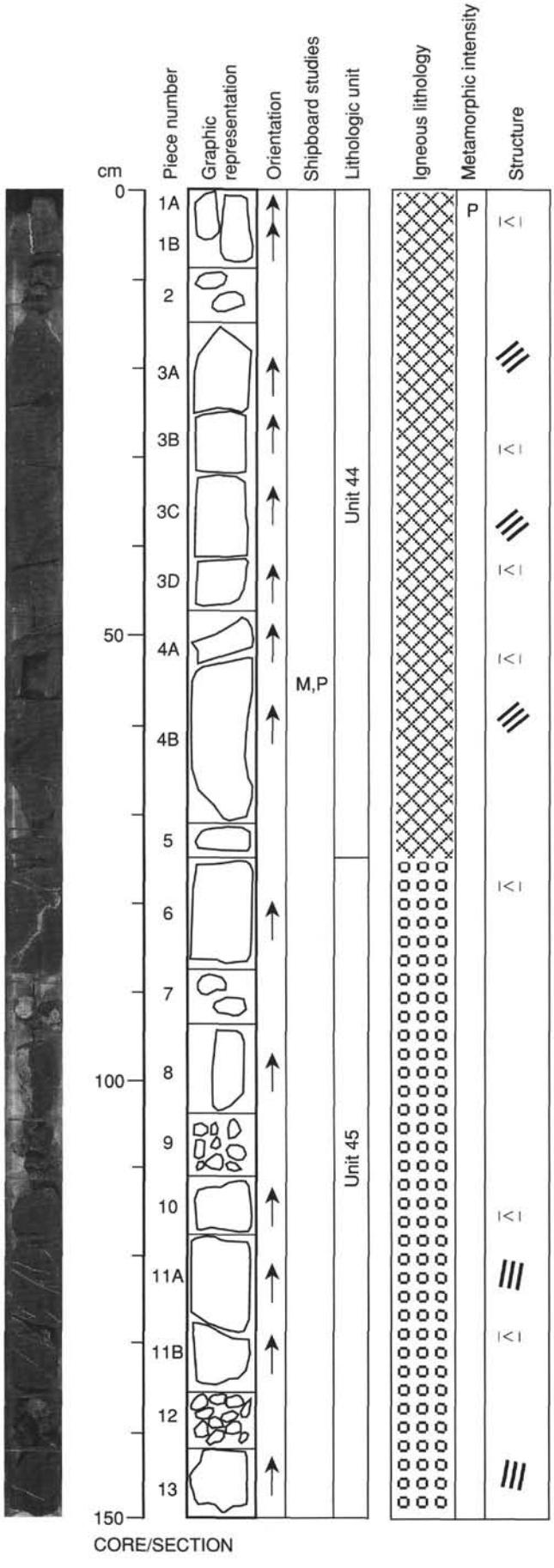
Pieces 1–5

COLOR: Dark grayish green.
LAYERING: None.
DEFORMATION: Spinel foliation has vertical dips on half-cut surfaces. The rocks also have discrete serpentine veining
PRIMARY MINERALOGY: Spinel tends to occur in patches and along coarser veins.
Olivine - Mode: >99%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: >95%.
Comments: Replaced by mesh-textured serpentine.
Spinel - Mode: <1%.
Crystal size: 0.5–1.5 mm.
Crystal shape: Anhedral.
Crystal orientation: Near vertical alignment; gives foliation.
SECONDARY MINERALOGY: Variably but pervasively serpentinized dunite. Some kernels of fresh olivine are visible. Some magnetite is also present. Brucite is present but not abundant.
Total percent: >95%.
Texture: Pseudomorphic replacement of olivine by serpentine.

UNIT 44: HARZBURGITE

Pieces 6–17

COLOR: Green.
LAYERING: None.
DEFORMATION: Porphyroclastic texture.
PRIMARY MINERALOGY:
Olivine - Mode: 85%–90%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 75%–90%.
Comments: Replaced by serpentine.
Orthopyroxene - Mode: 10%–15%.
Crystal size: 1–5 mm.
Crystal shape: Anhedral to rounded.
Crystal orientation: None.
Percent replacement: 50%.
Comments: Replaced by dark green amphibole or bastite.
Spinel - Mode: <1%.
Crystal size: <1 mm.
Crystal shape: Subhedral to anhedral.
Crystal orientation: None.
SECONDARY MINERALOGY: Variably serpentinized. Piece 7 and below have irregularly shaped blotches that rarely exhibit poor cleavage (originally orthopyroxene). Pieces 6, 8B, and 14 have fibrous serpentine bands along one side. Olivine granules are replaced by light yellowish green talc (?), especially in Piece 11C.
Total percent: 80%–90%.
Texture: Pseudomorphic.
Vein material: Piece 6 has a centimeter-sized vein and patch of asbestos. Piece 16 has a 0.5 mm-wide vein of carbonate, likely magnesite or aragonite. There are abundant 0.1–1 mm veins of serpentine, some with brucite.



147-895E-7R-3

UNIT 44: HARZBURGITE

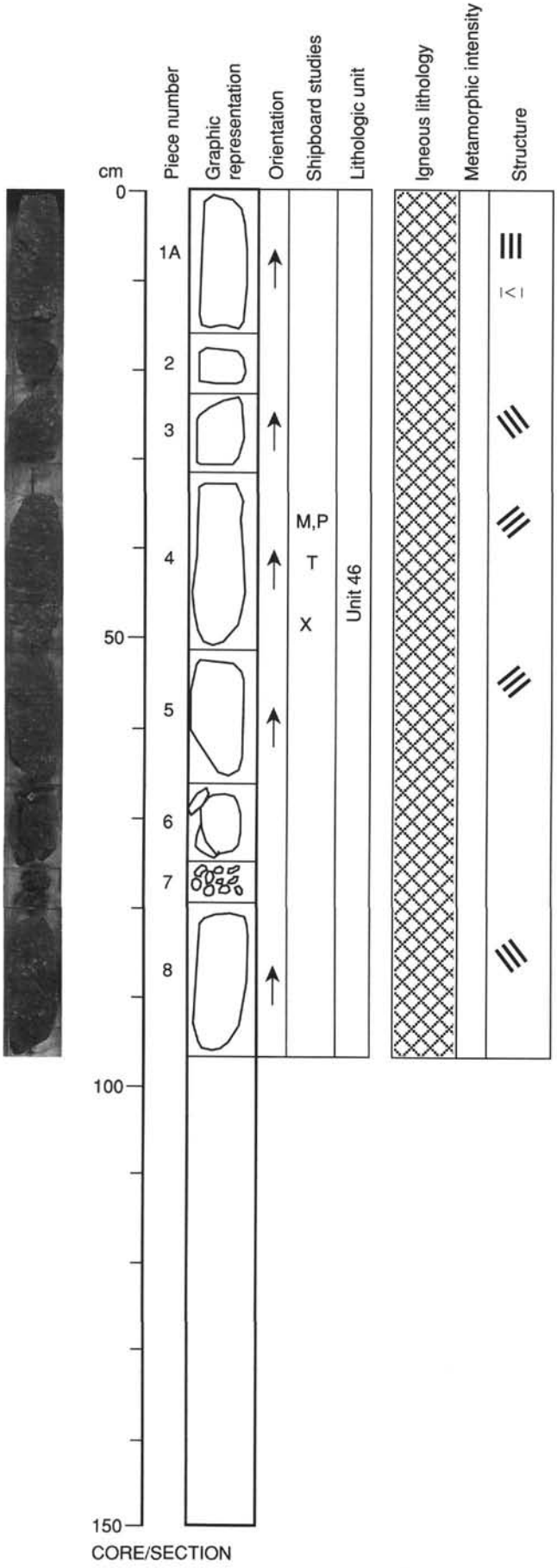
Pieces 1A–5

COLOR: Green.
LAYERING: None.
DEFORMATION: The rocks are porphyroclastic. They have well-delineated spinel foliation, moderately to steeply dipping.
PRIMARY MINERALOGY: Very little orthopyroxene left. Most is altered. Pieces 2–4 have the most orthopyroxene remaining.
Olivine - Mode: 85%–90%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 75%–90%.
Comments: Replaced by serpentine.
Orthopyroxene - Mode: 10%–15%
Crystal size: 1–5 mm.
Crystal shape: Rounded to irregular
Crystal orientation: None.
Percent replacement: 75%.
Comments: Replaced by dark green amphibole and/or bastite.
Spinel - Mode: <1%.
Crystal size: <1 mm.
Crystal shape: Subhedral.
Crystal orientation: Aligned, defining foliation.
SECONDARY MINERALOGY:
Total percent: 75%–90%.
Texture: Pseudomorphic replacement of olivine by serpentine and of orthopyroxene by bastite and green amphibole.
Vein material: The rocks are crossed by irregular to steeply dipping veins of pale green serpentine. Pieces 1–3 have 0.5–2 mm carbonate veins.

UNIT 45: DUNITE

Pieces 6–13

COLOR: Grayish green.
LAYERING: None.
DEFORMATION: Moderately to steeply dipping spinel foliation; moderate serpentine veining.
PRIMARY MINERALOGY: Spinel is patchy.
Olivine - Mode: 99%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 95%.
Comments: Replaced by mesh-textured serpentine.
Spinel - Mode: 1%.
Crystal size: 0.5–2 mm.
Crystal shape: Equant to anhedral.
Crystal orientation: Aligned, forming foliation.
Orthopyroxene - Mode: Trace.
SECONDARY MINERALOGY:
Total percent: 95%.
Texture: Pseudomorphic, with olivine replaced by mesh-textured serpentine.
Vein material: Piece 6 has a 7 mm wide serpentine vein, with a blue gray rim and a green core. These are two generations of serpentine filling the vein. There are also 0.1–0.5 mm white veins of serpentine and brucite commonly present in most of the pieces.
ADDITIONAL COMMENTS: Serpentinized dunite with no distinct fabric to serpentinite veins. Some pieces have rare irregularly shaped patches of green translucent serpentine that might occupy space vacated by orthopyroxene.



147-895E-7R-4

UNIT 46: SERPENTINIZED HARZBURGITE

Pieces 1A–8

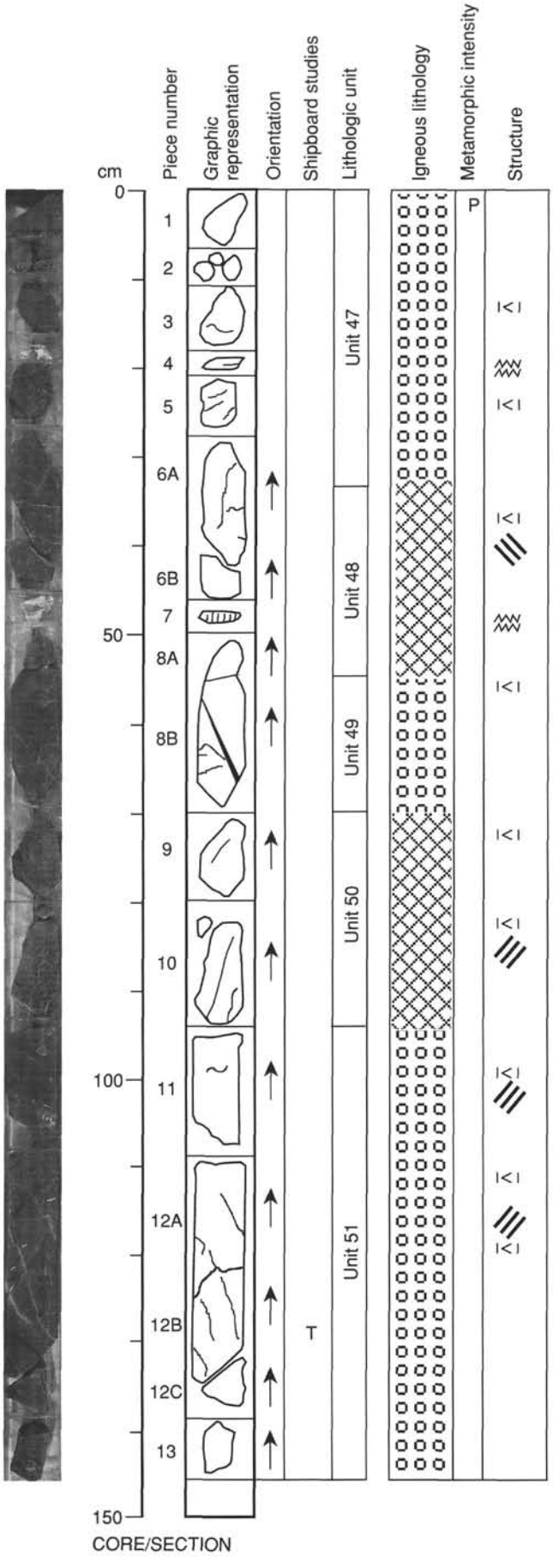
COLOR: Dark gray green.
LAYERING: None.
DEFORMATION: Porphyroclastic texture. The rocks have variably dipping spinel foliation, no serpentine veining except in Pieces 1 and 5.
PRIMARY MINERALOGY: Some olivine relicts are preserved as granules.

Olivine - Mode: 80%–90%.
- Crystal size: Cannot determine.
- Crystal shape: Anhedral.
- Crystal orientation: None.
- Percent replacement: 85%.
- Comments: Replaced by serpentine.

Orthopyroxene - Mode: 10%–20%.
- Crystal size: 0.5–6 mm.
- Crystal shape: Anhedral to rounded.
- Crystal orientation: None.
- Percent replacement: 80%–90%.
- Comments: Replaced by bastite and translucent green amphibole.

Spinel - Mode: <1%.
- Crystal size: 0.5–1.5 mm.
- Crystal shape: Equant to anhedral.
- Crystal orientation: Aligned, defining foliation.

SECONDARY MINERALOGY:
Total percent: 80%–90%.
Texture: Pseudomorphic replacement of olivine by serpentine and minor talc, and of orthopyroxene by bastite and green amphibole.
Vein material: Piece 5 has a 0.3–1 mm pale blue vein of serpentine and magnetite. Macroscopic veins are very rare in this harzburgite interval.



147-895E-8R-1

UNITS 47, 49, AND 51: DUNITE

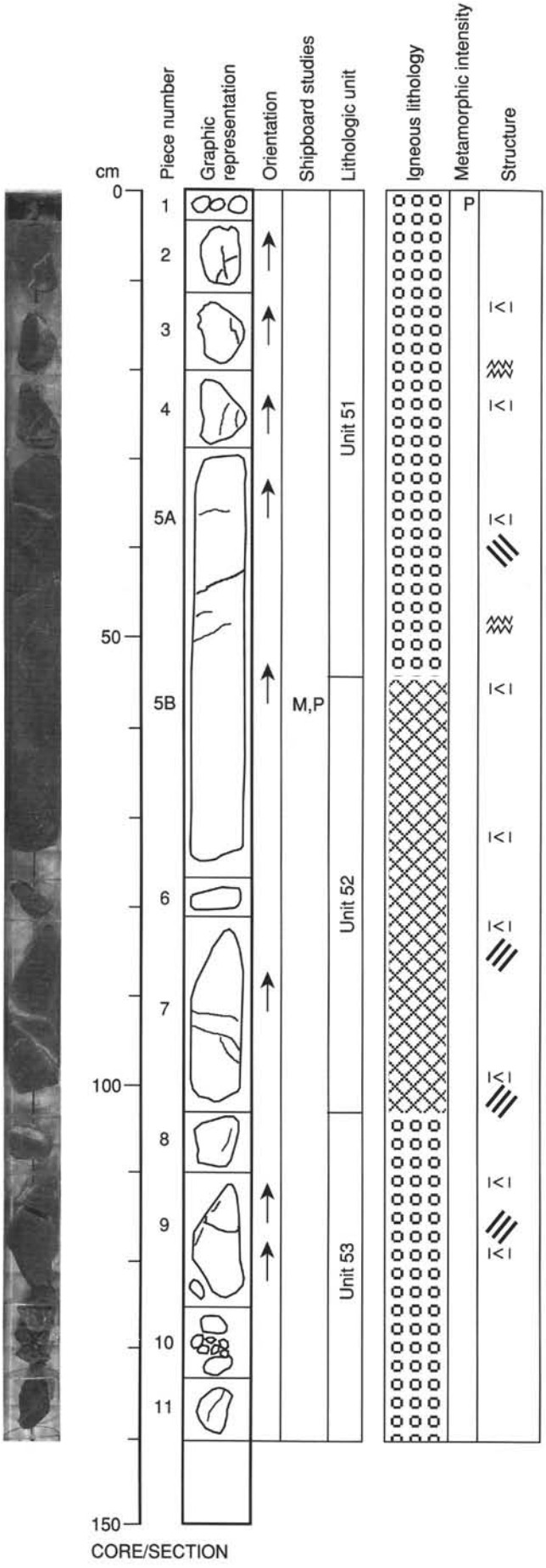
Pieces 1–6A, 8B, 11–13

COLOR: Gray to black.
LAYERING: None.
DEFORMATION: Regular set of veining. Poorly developed spinel foliation. Piece 4 is sheared nephrite/pectolite/ serpentine rock.
PRIMARY MINERALOGY: Spinel is likely Cr-rich. Gradual change from dunite into harzburgite in Piece 6A. Spinel much more equant than in harzburgite. Dunites in Piece 8B has sharp contact with harzburgite.
Olivine - Mode: 90%–98%.
Crystal size: 2 mm.
Crystal shape: Subhedral, rounded.
Crystal orientation: None visible.
Percent replacement: 90%–100%.
Spinel - Mode: 1%–2%.
Crystal size: 1–2 mm.
Crystal shape: Euhedral-subhedral.
Crystal orientation: Weak foliation in places.
Percent replacement: Minor.
Orthopyroxene - Mode: 0%–10%.
Crystal size: 1–4 mm.
Crystal shape: Subhedral.
Crystal orientation: None.
Percent replacement: 80%–100%.
SECONDARY MINERALOGY:
Total percent: 95%.
Texture: Olivine is completely serpentinized with brown/green cores +/- talc rimmed by pale brown serpentine, enclosed by microveinlets of dark brown to black serpentine. Rare olivine pseudomorphs contain white (talc?) cores. Vein material: 1–3 sinuous and disrupted pale blue green veins of serpentine. Some are zoned with blue rims and green cores. They are commonly cut by 0.1–0.2 mm gray-white veins of serpentine, talc, brucite, and magnesite. Piece 4 represents a 5 mm wide tremolite (nephrite), pectolite?, fibrous serpentine vein.
ADDITIONAL COMMENTS: Dunite Unit 49 has an upper inclined contact from 55 cm to 67 cm across the core (apparent dip = 81 degrees), and a lower contact from 71 cm to 80 cm across the core (apparent dip = 67 degrees). Piece 4 has a mineralogy of nephrite/serpentine/pectolite? which may replace a gabbroic vein. The piece is highly sheared.

UNITS 48 AND 50: HARZBURGITE

Pieces 6A–8B, 9–10

COLOR: Gray.
LAYERING: None.
DEFORMATION: Veining and weak spinel foliation. Piece 7 is a sheared serpentine/nephrite?/pectolite vein.
PRIMARY MINERALOGY:
Olivine - Mode: 80%–90%.
Crystal size: Not discernible.
Crystal shape: Not discernible.
Percent replacement: 95%–100%.
Orthopyroxene - Mode: 10%–20%.
Crystal size: Average 2.5 mm, maximum 5 mm.
Crystal shape: Subhedral, rounded.
Crystal orientation: None.
Percent replacement: 60%–100%.
Spinel - Mode: 1%.
Crystal size: 1 mm.
Crystal shape: Anhedral.
Crystal orientation: Weak foliation in places.
Percent replacement: Minor.
Comments: Cr-rich.
SECONDARY MINERALOGY:
Total percent: 95%.
Texture: Olivine replacement is pervasive to serpentine with brown cores (talc?) rimmed by paler brown serpentine, enclosed in microveinlets of black serpentine. Pale blue-green to green pseudomorphs after orthopyroxene contain amphibole and serpentine +/- talc, forming small aggregates.
Vein material: Pale blue-green veins of serpentine cut by thinner white-gray veins of serpentine, talc, brucite, and magnesite.
ADDITIONAL COMMENTS: Gradational to dunite even within a single piece. Less altered than dunite. Primary olivine and orthopyroxene preserved in Pieces 6 and 8.



147-895E-8R-2

UNITS 51 AND 53: DUNITE

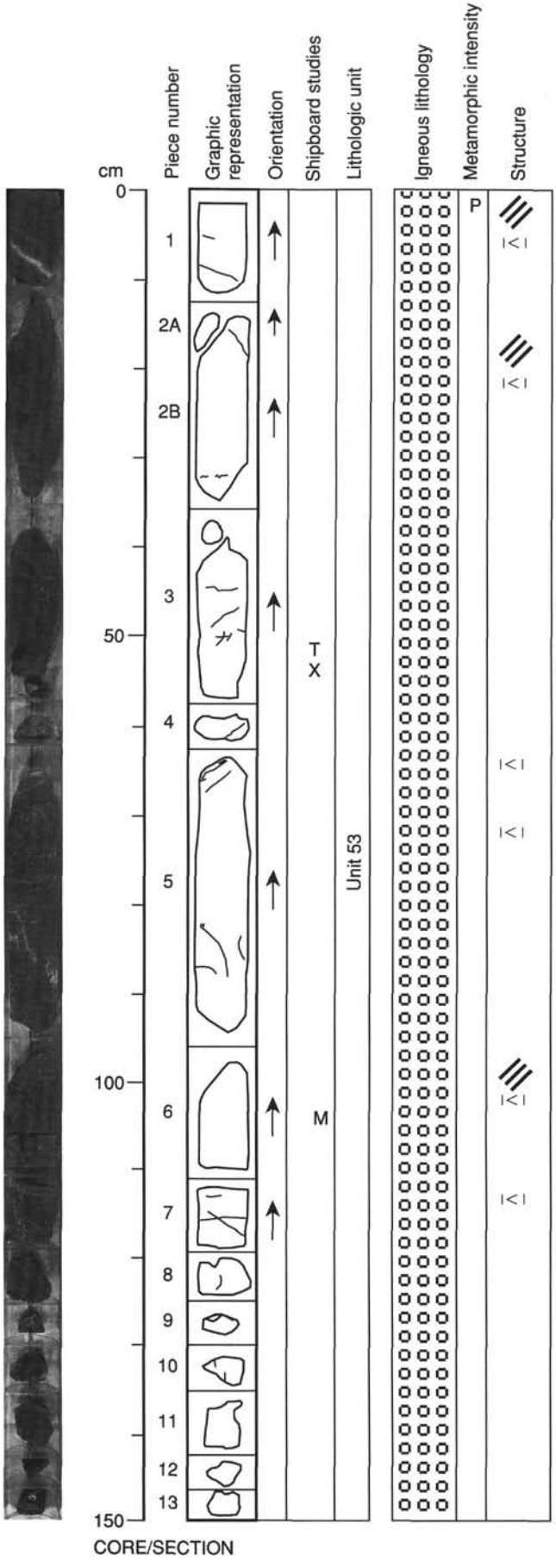
Pieces 1–5B, 8–11

COLOR: Black.
LAYERING: None.
DEFORMATION: Veining and a steeply dipping (with respect to the core axis) vein network.
PRIMARY MINERALOGY:
Olivine - Mode: 98%.
Crystal size: 2 mm.
Crystal shape: Subhedral, rounded.
Crystal orientation: None.
Percent replacement: 95%.
Spinel - Mode: 0.5–2%.
Crystal size: 1 mm.
Crystal shape: Subhedral to euhedral.
Crystal orientation: None visible.
Percent replacement: Minor.
Comments: Cr-rich.
SECONDARY MINERALOGY:
Total percent: 100%.
Texture: Olivine is pervasively serpentinized to serpentine (=brucite and talc?) with green-brown cores rimmed by pale serpentine and enclosed by microveinlets of dark brown to black serpentine.
Vein material: Few macroscopic veins of serpentine in Pieces 2, 3, 4, 5B, 8, 9, and 11. Pale green to bluish gray serpentine veins (2–3 mm) commonly disrupted by 0.1–0.2 mm white veins of serpentine, brucite, and magnesite.
ADDITIONAL COMMENTS: There is an inclined contact from 46 cm to 55 cm in Pieces 5A and 5B. It is irregular in thin section, but planar on the scale of the core. It strikes 323 degrees, and dips 62 degrees NE in core coordinates.

UNIT 52: HARZBURGITE

Pieces 5B–7

COLOR: Black.
LAYERING: None.
DEFORMATION: Veining. Well-developed spinel foliation and serpentine vein network.
PRIMARY MINERALOGY: Orthopyroxene is relatively concentrated in the lower half of Piece 7.
Olivine - Mode: 85%–90%.
Crystal size: Not discernible.
Crystal shape: Not discernible.
Percent replacement: 90%–100%.
Spinel - Mode: 0.5%.
Crystal size: 1 mm.
Crystal shape: Anhedral.
Crystal orientation: Foliate, pull-apart texture in places.
Percent replacement: Minor.
Comments: Cr-rich.
Orthopyroxene - Mode: 10%–15%.
Crystal size: 2–5 mm.
Crystal shape: Anhedral.
Percent replacement: 75%–100%.
SECONDARY MINERALOGY:
Total percent: 95%.
Texture: Dunite patches less than 5 mm across are commonly present. Light blue-green to brown enstatite grains are completely replaced by serpentine and clay. Orthopyroxene survives in Piece 6.
Vein material: Piece 7 has pale green to blue-gray serpentine veins of 2–3 mm width, cut by 0.1–0.2 mm white veins with serpentine, talc, brucite, and magnesite.
ADDITIONAL COMMENTS: Dunite patches are in places present within the harzburgite. The top of interval 56 has an inclined contact (see comments on the previous description sheet for Intervals 55 and 57).

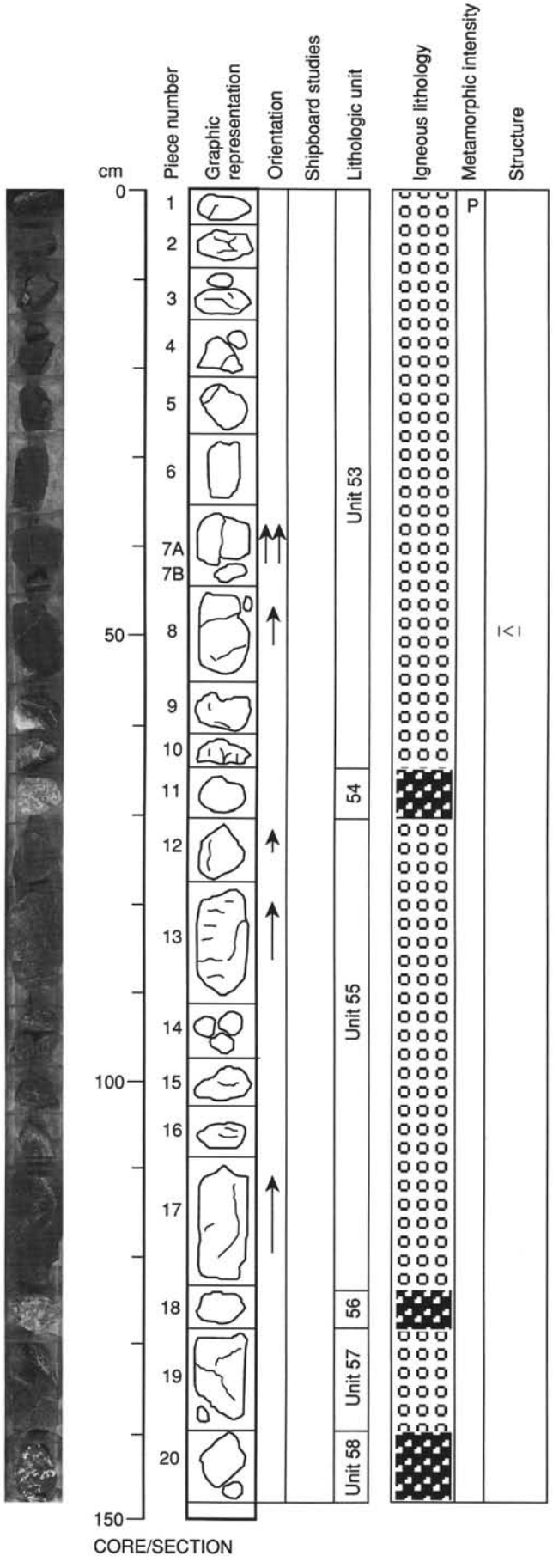


147-895E-8R-3

UNIT 53: DUNITE

Pieces 1–13

COLOR: Black.
LAYERING: None.
DEFORMATION: Veining. Moderate to strong spinel foliation.
PRIMARY MINERALOGY:
Olivine - Mode: 99%.
Crystal size: 2 mm.
Crystal shape: Rounded, subhedral.
Crystal orientation: None visible.
Percent replacement: 95%–100%.
Spinel - Mode: 0.5%–1%.
Crystal size: 1 mm.
Crystal shape: Euhedral to anhedral.
Crystal orientation: Some alignment and pull-apart texture.
Percent replacement: Minor.
Comments: Cr-rich.
SECONDARY MINERALOGY:
Total percent: 100%.
Texture: Total alteration to mesh textures dark brown serpentine with minor brucite and talc.
Vein material: 0.5 cm zoned veins with blue serpentine rim and green serpentine cores. Rims are diffuse. In most of the pieces the veins are discontinuous and are cut by white-gray veins (0.1–0.3 mm) of serpentine and talc +/- brucite.
ADDITIONAL COMMENTS: Pervasively serpentinized dunite in which a minimal trace of relict olivine occurs. Brucite is relatively common.



147-895E-8R-4

UNITS 53, 55, AND 57: 1: DUNITE

Pieces 1–10, 12–17, 19

COLOR: Black.
LAYERING: None.
DEFORMATION: Veining.
PRIMARY MINERALOGY:
Olivine - Mode: 99%.
Crystal size: 1–2 mm.
Crystal shape: Subhedral, rounded.
Crystal orientation: None.
Percent replacement: 98%–100%.
Spinel - Mode: 1%.
Crystal size: <2 mm.
Crystal shape: Euhedral-subhedral
Crystal orientation: None visible.
Percent replacement: Minor.
Comments: Cr-rich.
SECONDARY MINERALOGY: Common brucite.
Total percent: 98%.
Texture: Pervasively serpentinized with only a trace relict olivine. Alteration to dark brown to green serpentine, talc, and brucite. Piece 9 is intensely altered, containing dark brown serpentine-rich zone, bounded by light blue alteration halo which grades into green-white zone of talc?, tremolite, oxides. Vein material: Piece 2 has anastomosing blue serpentinite veins of 0.5 mm width occurring connected to patches of similar mineralogy in the matrix. 0.1–0.5 mm white serpentine, talc, magnesite, and brucite veins are somewhat irregular.
ADDITIONAL COMMENTS: Relatively spinel-poor dunite.

UNIT 54: TROCTOLITE

Piece 11

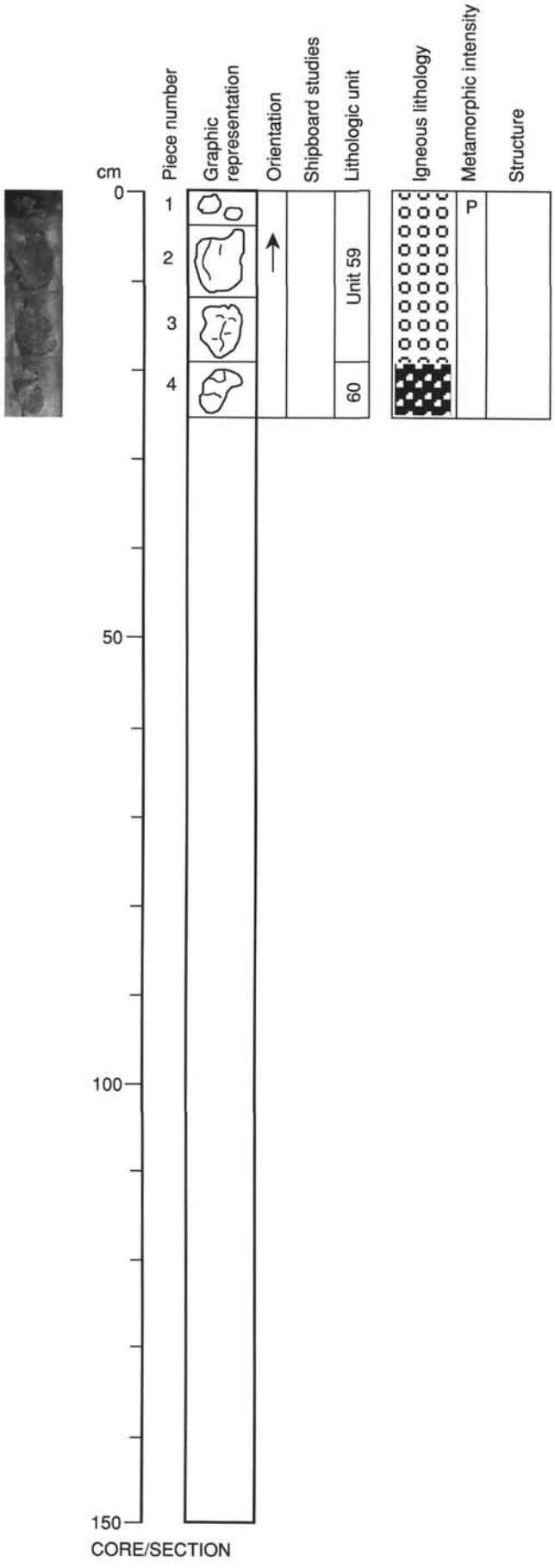
COLOR: Greenish gray.
LAYERING: None.
DEFORMATION: Minor veining.
PRIMARY MINERALOGY:
Olivine - Mode: 48%.
Crystal size: 2–6 mm.
Crystal shape: Subhedral.
Crystal orientation: None.
Percent replacement: 100%.
Plagioclase - Mode: 50%.
Crystal size: 3–6 mm.
Crystal shape: Subhedral.
Crystal orientation: None.
Percent replacement: 100%.
Clinopyroxene - Mode: 2%.
Crystal size: 1–2 mm.
Crystal shape: Anhedral, intergranular.
Crystal orientation: None.
Percent replacement: 100%.
Spinel - Mode: Trace.
Crystal size: <<1 mm.
Crystal shape: Equant.
Crystal orientation: None.
Comments: Enclosed in altered olivine and plagioclase.
SECONDARY MINERALOGY:
Total percent: 100%.
Texture: Plagioclase is chalk white in color and pervasively replaced by hydrogrossular, tremolite and chlorite, and cut by green amphibole microveinlets. Olivines are pseudomorphed by radiating mats of green amphibole, rimmed by chlorite.

147-895E-8R-4

UNITS 56 AND 58: TROCTOLITE

Pieces 18 and 20

COLOR: Greenish gray and white.
LAYERING: None.
PRIMARY MINERALOGY: Grain size is quite variable. Euhedral chromian spinel is a minor accessory.
Olivine - Mode: 80%–90%.
Crystal size: 3–10 mm.
Crystal shape: Subhedral.
Crystal orientation: None.
Percent replacement: 100%.
Plagioclase - Mode: 20%–30%.
Crystal size: 2–10 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 95%.
Pyroxene - Mode: 0%–5%.
Crystal size: 3–8 mm.
Crystal shape: Anhedral-subhedral.
Crystal orientation: None.
Percent replacement: 100%.
SECONDARY MINERALOGY:
Total percent: 95%.
Texture: Plagioclase is chalk white in color and pervasively altered to hydrogrossular, tremolite, and chlorite, cut by abundant microveinlets of green amphibole. Olivines exhibit well-developed coronas and talc-serpentine cores rimmed by fibrous green amphibole and serpentine, chlorite, and tremolite.



147-895E-8R-5

UNIT 59: DUNITE

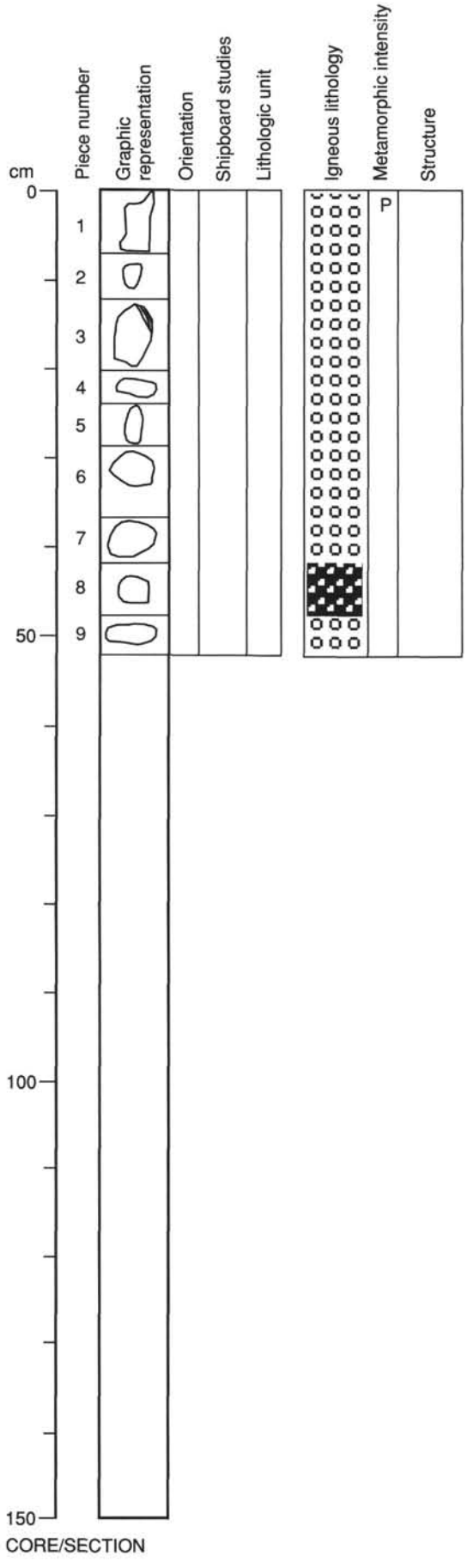
Pieces 1–3

COLOR: Dark gray.
LAYERING: None.
DEFORMATION: Minor veining.
PRIMARY MINERALOGY:
Olivine - Mode: 99%.
Crystal size: Not discernible.
Crystal orientation: Not discernible.
Percent replacement: 100%.
Spinel - Mode: 0.5%–1%.
Crystal size: 1–2 mm.
Crystal shape: Euhedral-subhedral.
Crystal orientation: None.
Percent replacement: Minor.
Comments: Cr-rich.
SECONDARY MINERALOGY:
Total percent: 100%.
Texture: Pervasively altered. Olivines pseudomorphed by brown serpentine and commonly contain whitish cores of talc?
Vein material: Pieces 2–3 have anastomosing network of blue-green serpentine veins of 0.3–0.7 mm width with some white patches of possible brucite or talc.

UNIT 60: TROCTOLITE

Piece 4

COLOR: Dark gray and greenish gray.
LAYERING: None.
DEFORMATION: None.
PRIMARY MINERALOGY: The mineralogy of Piece 4 is not evenly distributed but divides the piece into a plagioclase-rich portion and an olivine-rich portion.
Olivine - Mode: 80%.
Crystal size: 1–10 mm, average 2 mm.
Crystal shape: Subhedral-anhedral.
Crystal orientation: None.
Percent replacement: 90%.
Plagioclase - Mode: 20%.
Crystal size: 1–3 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 100%.
Spinel - Mode: 0.5%.
Crystal size: 0.5 mm.
Crystal shape: Euhedral.
Crystal orientation: None.
Percent replacement: Minor.
SECONDARY MINERALOGY:
Total percent: 95%.
Texture: Plagioclase is chalk white in color and pervasively replaced by hydrogrossular?, tremolite, and chlorite. It is cut by abundant microveinlets of green amphibole. Coarse-grained olivines exhibit well-developed coronas with serpentine and clay cores rimmed by amphibole, serpentine, and chlorite.



147-895E-9W-1

DUNITE

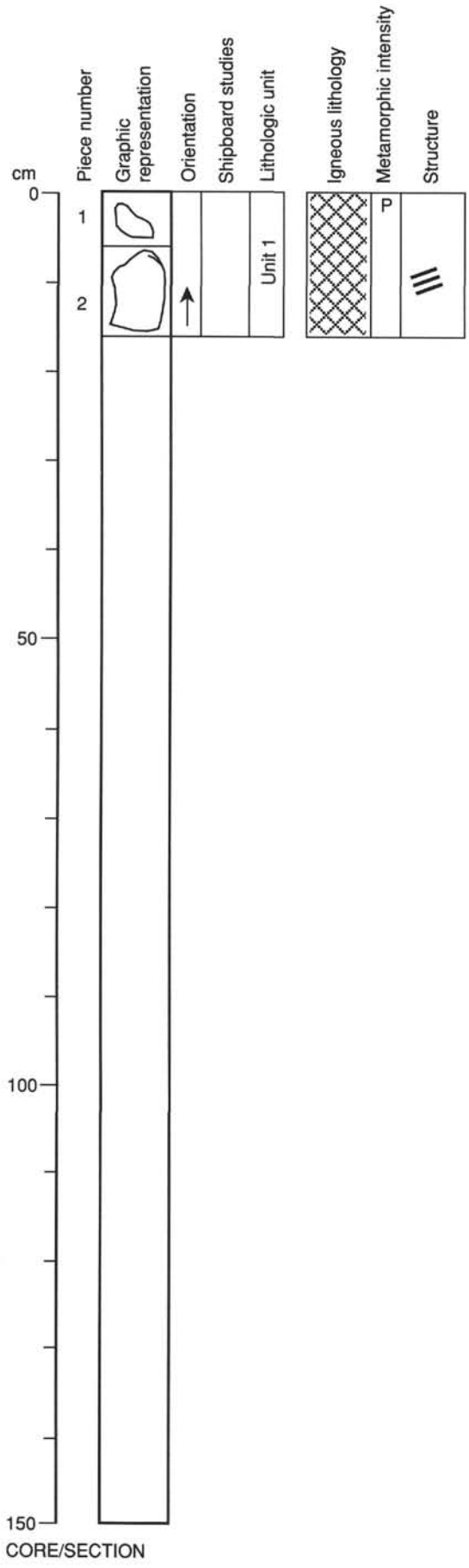
Pieces 1–7, 9

COLOR: Dark gray-dark green.
LAYERING: None.
DEFORMATION: Minor veining.
PRIMARY MINERALOGY: Small amounts of interstitial pyroxene and maybe plagioclase present in primary rock type. Shape of spinel is variable but relatively equant compared to spinels in harzburgites.
Olivine - Mode: 98%.
Crystal size: 2 mm.
Crystal shape: Subhedral, rounded.
Crystal orientation: None.
Percent replacement: 100%.
Spinel - Mode: 1%.
Crystal size: 1 mm.
Crystal shape: Euhedral to anhedral, equant.
Crystal orientation: None.
Percent replacement: Minor.
Pyroxene - Mode: 1%.
Crystal size: 2 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 100%.
SECONDARY MINERALOGY:
Total percent: 100%.
Texture: Pervasively serpentinized olivines pseudomorphed by brown to pale green serpentine + talc? and are rimmed by dark brown to black serpentine and oxide-rich microveinlets, forming a mesh texture. Piece 3 contains an oxidized area near one edge.
Vein material: Located in Pieces 1, 2, 3, 4, 6, 7, and 9 as 0.1–0.5 mm wide veins of serpentine and brucite, cut by 0.1–0.2 mm wide veins of chlorite and clays. 2–3 mm wide veins of carbonate in Piece 6.

TROCTOLITE

Piece 8

COLOR: Light greenish gray.
LAYERING: None.
DEFORMATION: None visible.
PRIMARY MINERALOGY: Fresh, euhedral Cr-rich spinel is included within plagioclase.
Olivine - Mode: 40%.
Crystal size: 1–5 mm.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 100%.
Plagioclase - Mode: 60%.
Crystal size: 1–5 mm.
Crystal shape: Subhedral.
Crystal orientation: None.
Percent replacement: 100%.
Spinel - Mode: 1%.
Crystal size: 0.2 mm.
Crystal shape: Euhedral.
Crystal orientation: None.
Percent replacement: Minor.
SECONDARY MINERALOGY:
Total percent: 100%.
Texture: Plagioclase is chalky white to gray in color, and pervasively replaced by hydrogrossular?, prehnite, tremolite, and chlorite. Cut by abundant microveinlets of green amphibole. Pyroxenes exhibit well-developed coronas with green fibrous amphibole cores rimmed by chlorite.
ADDITIONAL COMMENTS: The piece is small but is heterogeneous in mineralogy, comprising a plagioclase-rich half and an olivine-rich half.



147-895F-1R-1

UNIT 1: HARZBURGITE

Pieces 1–2

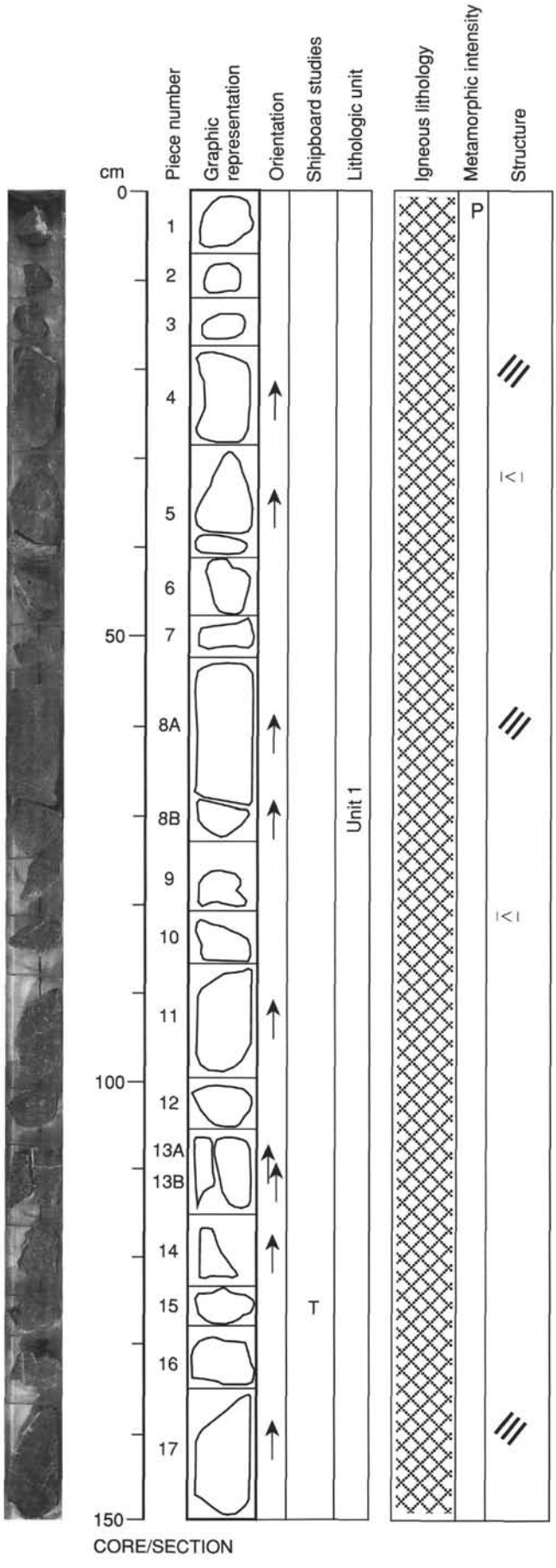
COLOR: Dark grayish green.
LAYERING: None.
DEFORMATION: Porphyroclastic texture, with spinel foliation.
PRIMARY MINERALOGY: Orthopyroxene is reasonably fresh, with a characteristic sheen on cut faces. Olivine grain size is undetermined because of the extent of alteration.

Olivine - Mode: 80%.
- Crystal size: Cannot determine.
- Crystal shape: Anhedral.
- Crystal orientation: None.
- Percent replacement: 60%–70%.
- Comments: Replaced by serpentine and minor talc.

Orthopyroxene - Mode: 20%.
- Crystal size: 1–11 mm.
- Crystal shape: Anhedral to rounded.
- Crystal orientation: None.
- Percent replacement: 50%–60%.
- Comments: Replaced by bastite with amphibole rims.

Spinel - Mode: <1%.
- Crystal size: 0.5–1.5 mm.
- Crystal shape: Anhedral.
- Crystal orientation: Aligned, defining foliation.

SECONDARY MINERALOGY: Piece 1 is strongly veined and sheared. Total alteration is 100%.
Total percent: 65%.
Texture: Pseudomorphic, with mesh-textured serpentine and magnetite after olivine, and orthopyroxene replaced by bastite serpentine and with amphibole rims. Locally, white fibrous amphibole (tremolite?) pseudomorphs orthopyroxene.

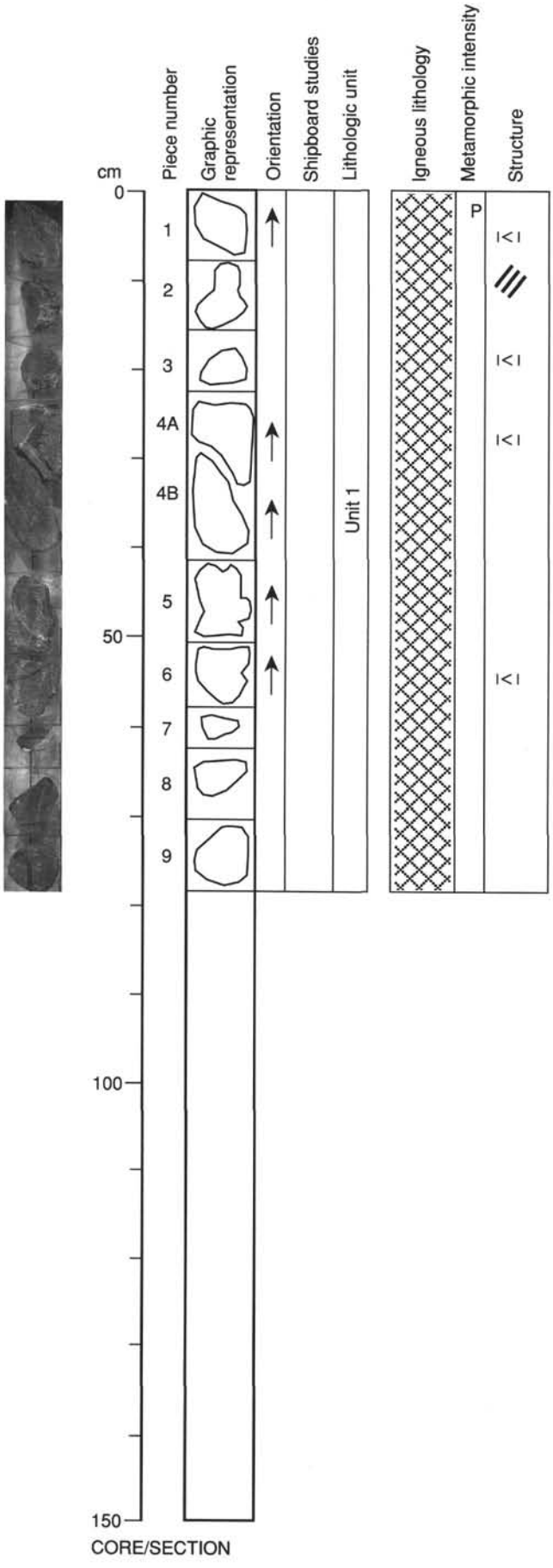


147-895F-2R-1

UNIT 1: HARZBURGITE

Pieces 1–17

COLOR: *Grayish green.*
LAYERING: None.
DEFORMATION: Porphyroclastic texture. The rocks have steeply dipping spinel foliation and discrete serpentine veining.
PRIMARY MINERALOGY: Spinels tend to occur in patches rather than being uniformly disseminated.
Olivine - Mode: >85%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 85%–100%.
Comments: Replaced by serpentine.
Orthopyroxene - Mode: <15%.
Crystal size: 1–8 mm.
Crystal shape: Anhedral to rounded.
Crystal orientation: None.
Percent replacement: 90%.
Comments: Replaced by bastite or fibrous white amphibole (*tremolite?*).
Spinel - Mode: <1%.
Crystal size: 0.2–2 mm.
Crystal shape: Equant to anhedral.
Crystal orientation: Aligned along foliation.
SECONDARY MINERALOGY: Locally, fine-grained magnetite forms up to 0.3 mm wide subparallel wavy stringers (Pieces 4 and 5). Chrysotile veins with aragonite occur on subparallel, high-angle (about 60 degree) fracture surfaces.
Total percent: 85%–95%.
Texture: Pseudomorphic. The degree of serpentinization varies from about 85% (Pieces 12–17) to 95%–100% (Pieces 1–11). Brown to light green serpentine and magnetite form a mesh texture after olivine. Orthopyroxene is pervasively replaced by green bastite and/or milky white fibrous amphibole (tremolite?).
Vein material: The section is densely veined. Mesh serpentine is cut by light green chlorite (?) and serpentine diffuse zones (up to 8 mm wide), with cross-cutting, white subparallel sigmoidal chrysotile veinlets (to 1 mm wide). Fibrous green chrysotile forms veins up to 2 mm wide together with aragonite.
ADDITIONAL COMMENTS: *Mineral modes vary from piece to piece. Orthopyroxene* is variably altered to milky white or dark green amphibole. Milky white pseudomorphs tend to reproduce the subrounded habit of fresh orthopyroxene. Deep green alteration tends to be interconnected by veins, and imparts an irregular shape that interfingers into surrounding serpentinized olivine.



147-895F-2R-2

UNIT 1: HARZBURGITE

Pieces 1–9

COLOR: Dark grayish green.
LAYERING: None.
DEFORMATION: Moderately veined, with some spinel foliation.
PRIMARY MINERALOGY: Spinel occurs in disseminated patches. It is not uniformly distributed.
Olivine - Mode: 85%–90%.
Crystal size: Cannot determine.
Crystal shape: Anhedral.
Crystal orientation: None.
Percent replacement: 80%–90%.
Comments: Replaced by serpentine.
Orthopyroxene - Mode: 10%–15%.
Crystal size: 1–10 mm.
Crystal shape: Anhedral to rounded.
Crystal orientation: None.
Percent replacement: 50%–60%.
Comments: replaced by bastite and amphibole.
Spinel - Mode: <1%.
Crystal size: 0.1–1.5 mm.
Crystal shape: Anhedral
Crystal orientation: Aligned in foliation.
SECONDARY MINERALOGY: Pieces 8 and 9 are slightly less altered than the others, and have some relict orthopyroxene in porphyroclasts. Magnetite is common in pieces with veinlets up to 0.5 mm wide.
Total percent: 80%– 90%.
Texture: Pseudomorphic replacement of olivine by mesh-textured serpentine and magnetite. Orthopyroxene is replaced by bastite serpentine and locally milky white fibrous amphibole (tremolite?).
Vein material: Locally, the rocks are intensely veined. There are multiple generations of serpentine veins. Aragonite and green fibrous chrysotile occurs on fracture surfaces.
ADDITIONAL COMMENTS: All pieces contain fresh orthopyroxene or its alteration products. Alteration of orthopyroxene is either to milky white or deep green, translucent minerals. Both types are very soft. Pieces with lots of veins tend to have much less fresh orthopyroxene and more green translucent amphibole or chlorite.