

147-895A-2R-1 (Piece 2, 7–10 cm)  
ROCK NAME: Harzburgite  
GRAIN SIZE: Medium  
TEXTURE: Porphyroclastic

OBSERVER: JAY

WHERE SAMPLED:

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	10.1	85.5	to 3		Anhedral	Pervasively serpentinized with relatively low abundance of secondary magnetite. Fresh olivine kernels up to 1 mm across form optically continuous clusters about 3 mm across.
Orthopyroxene	7.8	13.1	to 4		Rounded	Quite fresh, with fragmented and rounded margins, most have bastite overgrowths with irregular boundaries.
Spinel	0.9	0.9	1		Euhedral to interstitial	Red-brown, translucent crystals in diffuse stringers.
Clinopyroxene	0.5	0.5	0.5		Anhedral	Small, rare interstitial crystals occasionally in contact with spinel but often stranded in the middle of serpentine patches.
Sulfide minerals	0.1		0.3		Elongate, subangular	Subangular crystals enclosed in spinel. Rounded pentlandite in serpentine, pyrite in veins.
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Serpentine	72.4	Olivine				Low relief, very light green to very pale brown.
Magnetite	3.0	Olivine				In thin stringers and aggregations of microgranular crystals.
Bastite	5.3	Orthopyroxene				Forms irregular coronas around rounded orthopyroxene.
VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	
Veins	10	Random	<1	Serpentine	Jagged	

COMMENTS: Point count 2013 points, 0.5 mm counting interval. Very fresh orthopyroxene, olivine pervasively serpentinized. Traces of rare clinopyroxene are present, occasionally in contact with spinel. Higher relief, more altered and better developed cleavage than in orthopyroxene. Spinel exhibits distinct alignment in diffuse stringers. Structural comments: Orthopyroxene porphyroclasts contain tilt boundaries perpendicular to (001) plane. Neoblasts of orthopyroxene mantle the porphyroclasts of orthopyroxene. Olivine contains sharp subgrain boundaries.

147-895A-2R-1 (Piece 15, 95–96 cm)

OBSERVER: JAY

WHERE SAMPLED:

ROCK NAME: Aphyric basalt  
GRAIN SIZE: Fine  
TEXTURE: Intersertal, intergranular to subophitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Olivine	Trace	Trace	0.3		Subhedral	Pervasively altered microphenocrysts.
Plagioclase	<1	<1	0.5–0.8		Tabular, euhedral	Fresh, polysynthetically twinned laths.
GROUNDMASS						
Plagioclase	5–50	5–50	0.2		Acicular	Microcrystalline. Some skeletal to hopper shaped crystals in glassy selvage.
Clinopyroxene	0–10	0–20	0.1–0.3		Anhedral	Intergranular texture away from glassy selvage.
Olivine	Trace	0–5	0.2		Anhedral	Only fresh at far end of thin section from glassy selvage.
Spinel	Trace	Trace	0.2		Subhedral	Deep red, translucent small crystals.
Magnetite	5	5	<0.1		Euhedral	Microgranular disseminated grains.
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Clay	20–50	Mesostasis				Also in selvage replacing glass.
Chlorite	5	Olivine, clinopyroxene				Very pale green, low relief, very fine-grained, slightly blue birefringence.
Amphibole	10	Clinopyroxene				Fibrous, very finely crystalline.
Zeolites	<1					Filling vesicles.
VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	
Vesicles	Trace	Sparse	<1	Zeolites	Round	

COMMENTS: Mode visually estimated. Thin section preserves sharp contact between glassy selvage with sparse plagioclase microphenocrysts and intersertal to intergranular to subophitic, somewhat coarser grained basalt. Increasing crystalline and coarser grain size away from selvage. Most of the glass is replaced by clays and microcrystalline amphibole, but occasional intersertal glass is preserved although discolored in coarser grained part of section. Clinopyroxene and olivine in groundmass are pervasively altered to amphibole and only fresh at extreme end of section away from selvage.

147-895B-1R-1 (Piece 9B, 67–70 cm) OBSERVER: SHO WHERE SAMPLED: Unit 1  
 ROCK NAME: Harzburgite  
 GRAIN SIZE: Medium to coarse  
 TEXTURE: Protogranular to porphyroclastic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	35	83	0.4 to 5		Anhedral	Weakly kinked. Rarely has trails of fluid inclusions or their relics. Large porphyroclasts associated with smaller polygonal neoblasts. Small anhedral associated with orthopyroxene porphyroclasts or spinel.
Orthopyroxene	10	15	0.4 to 5		Rounded	
Clinopyroxene	0.5	0.5	0.2 to 0.5		Anhedral	
Spinel	1.5	1.5	Up to 1.2	Cr# 0.5–0.6	Anhedral	Shape is variable, from anhedral (sometimes vermicular) to subhedral. Sometimes associated with clinopyroxene.
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Serpentine	51	Olivine, orthopyroxene				With magnetite.
Talc	1	Orthopyroxene				
Brucite	Trace	Olivine				Acicular. Or possibly clinopyroxene.
Magnetite	Trace	Olivine, orthopyroxene				
Tremolite	1	Orthopyroxene				
Olivine	Trace	Orthopyroxene				

VESICLES/CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Veins	trace	0.1		Brucite, magnetite		

COMMENTS: Orthopyroxene porphyroclasts have two types of lamellae of clinopyroxene; one is sparse relatively thick (0.01–0.03 mm) and the other is dense and much thinner. Orthopyroxene is altered to serpentine +/- talc when strongly altered and to talc + tremolite when slightly altered. Olivine is subgrained and orthopyroxene has minor neoblast development.

147-895C-1R-1 (Piece 17, 105–109 cm) OBSERVER: SHO WHERE SAMPLED: Unit 3  
 ROCK NAME: Harzburgite  
 GRAIN SIZE: Medium to coarse  
 TEXTURE: Protogranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	10	81	1 to 4		Anhedral	Weakly kinked. Rarely has trails of fluid inclusions or their relics. Sometimes elongated and kinked. Small amounts of polygonal neoblasts. Thin (<0.01 mm) lamellae of clinopyroxene are common.
Orthopyroxene	9	18	0.3 to 10		Anhedral	
Clinopyroxene	trace	trace	Up to 0.3		Anhedral	Little altered. Usually associated with orthopyroxene or spinel. Associated with pyroxenes. Sometimes vermicular in shape.
Spinel	1	1	Up to 3	Cr# 0.5–0.6	Anhedral	
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Serpentine	76	Olivine, orthopyroxene				Crysotile/lizardite Often replacing orthopyroxene along grain boundaries and cracks. Sometimes rimming spinel.
Talc	2	Orthopyroxene				
Magnetite		Olivine, orthopyroxene, spinel				Acicular. Interference color is brownish gray.
Tremolite	1	Orthopyroxene				
Chlorite		Orthopyroxene				

VESICLES/CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles						
Veins	2		Up to 0.5	Serpentine, talc, magnetite		Veins are crisscrossing and anastomosing.

COMMENTS: Not point-counted. Orthopyroxene is replaced by talc where slightly altered and by serpentine where pervasively altered. The texture is transitional from protogranular to porphyroclastic.

147-895C-3R-1 (Piece 22, 137–140 cm)  
ROCK NAME: Harzburgite  
GRAIN SIZE: Medium to coarse  
TEXTURE: Porphyroclastic

OBSERVER: JAY

WHERE SAMPLED: Unit 5

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	40	80	to 5		Anhedral	Moderately serpentinized, but at least 50% of the original olivine is left as subangular kernels.
Orthopyroxene	2	18	to 6		Anhedral	Pervasively altered. Cores of pseudomorphed crystals with fresh orthopyroxene are rounded and fractured.
Clinopyroxene	1.5	2	<1		Interstitial	Well-developed, finely laminated cleavage. Often in contact with spinel.
Spinel	<1	<1	1		Interstitial	Deep red-brown, translucent crystals. Margins altered to magnetite. Usually associated with clinopyroxene.
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Serpentine	38	Olivine				As crisscrossing veinlets separating subangular olivine kernels.
Bastite	15	Orthopyroxene				Pseudomorphic, but pervasive alteration is characterized by a change in morphology to irregularly shaped crystals.
Amphibole	3	Orthopyroxene, clinopyroxene				Along the margins and in fractures in orthopyroxene. Minor replacement of clinopyroxene.
Magnetite	2	Olivine				Microgranular inclusions in serpentine.

COMMENTS: Mode visually estimated. Orthopyroxene porphyroclasts appear elongated with a subparallel orientation to long axis. Pseudomorphs of orthopyroxene have been overprinted with an irregularly shaped morphology which has a penetrative relationship to serpentine veinlets which separate fresh olivine kernels. Olivine grain size is estimated from the size of optically continuous clusters of kernels.

147-895C-4R-1 (Piece 3, 10–12 cm)  
ROCK NAME: Harzburgite  
GRAIN SIZE: Medium to coarse  
TEXTURE: Porphyroclastic

OBSERVER: JAY

WHERE SAMPLED: Unit 7

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	17.9	92.2	2 to 5		Irregular	Kernels range from <0.1 to 0.5 mm.
Orthopyroxene	3.2	7.4	to 6		Rounded	As large porphyroclasts. Most pervasively altered. On one end of the thin section, commonly rimmed by secondary magnetite.
Spinel	0.4	0.4	0.5		Interstitial	Translucent deep brown, commonly with magnetite alteration rinds.
Sulfide minerals	0.1		0.1		Irregular	Pentlandite with magnetite.
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Serpentine	66.3	Olivine, orthopyroxene				In crisscrossing veinlets separating kernels of reasonably fresh olivine.
Talc	5	Olivine, orthopyroxene				
Magnetite	7.2	Olivine, orthopyroxene				Microgranular accumulations.
VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Veins	10	Branching to 2		Lizardite, chrysotile chrysotile		Several large veins have a distinct secondary magnetite concentration anastomosing through the vein.

COMMENTS: Mode point counted 1842 points on minerals, 201 on veins, counting interval 0.5 mm. One end of the section is markedly enriched with secondary magnetite. High-temperature porphyroclastic harzburgite, with subgrain development in olivine.

147-895C-4R-1 (Piece 12, 85-88 cm)  
 ROCK NAME: Troctolite  
 GRAIN SIZE: Coarse  
 TEXTURE: Intergranular (spotty)

OBSERVER: FRU

WHERE SAMPLED: Unit 9

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	38-40	90	to 1 cm		Anhedral	Pseudomorphed by serpentine + magnetite and minor yellow-brown clay, forming characteristic mesh texture with relict olivine in cores. Overgrown by colorless, acicular sprays of tremolite along grain boundaries to plagioclase.
Plagioclase	1	6	to 8 mm		Anhedral	Locally intergrown with clinopyroxene, forming patches with irregular, wavy boundaries. Typically have coronitic replacement textures with relict grains in cores, rimmed by colorless chlorite + acicular sprays of tremolite at contacts to olivine.
Clinopyroxene	2	3	to 5 mm		Anhedral	Altered to acicular tremolite at contact to olivine. Locally individual grains branch to form thin (up to 0.5 mm wide), optically continuous rims around plagioclase pseudomorphs.
Spinel	0.3		to 1.5 mm		Elongate, equant, subangular	Black spinel, magnetite rims on spinel.
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Tremolite	2-3	Plagioclase, clinopyroxene				Forms colorless, fibrous, or acicular clusters replacing clinopyroxene along grain edges. Rims chlorite in coronas after plagioclase.
Chlorite	4-5	Plagioclase				Typically colorless with variable birefringence, more Fe-rich varieties at contacts with clinopyroxene. Occurs as coronas or completely pseudomorphing plagioclase.
Serpentine	40-45	Olivine, veins				Multiple generations, replacing primary olivine or as veinlets. Characteristically with magnetite forming mesh texture after olivine or as filling in microfractures in clinopyroxene and plagioclase.
Brown-yellow clays	1-2	Olivine, plagioclase				Forms small patches in mesh serpentine replacement of olivine, or as fine-grained, poorly defined mats (possibly together with hydrogrossular?) in the cores of plagioclase grains.
Magnetite	1-2	Olivine, clinopyroxene, veins				Submicron to micron-sized grains form outlines of mesh texture with serpentine, or occur in centers of serpentine and tremolite veins. Locally stringers of magnetite form discontinuous, straight veinlets, crosscutting mesh texture.
Sulfides	0.4					Pentlandite, native copper, chalcocite, bornite, and violarite occur together with magnetite laths. Maximum size 1 mm. Irregular shaped pyrite in altered patches.
VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Veins			to 0.1 mm	Serpentine + magnetite		Serpentine with fine-grained magnetite grains in the center form subparallel veinlets, crosscutting mesh serpentine texture.
Veins			to 0.5 mm	Chlorite		Colorless, blue birefringent variety. Crosscuts mesh serpentine texture and subparallel serpentine + magnetite veinlets.
Veins			to 0.3 mm	Tremolite +/- magnetite		Occurs as acicular sprays, forming discontinuous, anastomosing veinlets with fine-grained magnetite locally in centers. Crosscuts mesh subparallel serpentine + magnetite veinlets.

COMMENTS: Modes estimated visually.

147-895C-4R-2 (Piece 2, 65–69 cm)

OBSERVER: JAY

WHERE SAMPLED: Unit 9

ROCK NAME: Troctolite

GRAIN SIZE: Medium to coarse

TEXTURE: Protogranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	26.2	86.5	?		Anhedral	Serpentinized fragments, small optically continuous kernels suggest original grain size on the order of 2–4 mm.
Plagioclase	4	8.5	4		Anhedral	Large crystals occurring in irregularly shaped patches with clinopyroxene and serpentine.
Clinopyroxene	4.5	5	2		Anhedral	In patches with plagioclase. Commonly along edges of patches.
Spinel		2			Subequant	Contain inclusions with very fine-grained phlogopite.
SECONDARY MINERALOGY	PERCENT PRESENT	REPLACING/ FILLING				COMMENTS
Serpentine	64.5	Olivine				In anastomosing veinlets through kernels of what were once larger olivine crystals.
Magnetite	3.7	Olivine				In stringers of very fine-grained granular magnetite in serpentine veinlets.
Clay	2	Plagioclase				
VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Voids	26	Spotty	up to 10	Serpentine, plagioclase, clinopyroxene	Irregular	Patches are commonly lined with colorless to very light green serpentine, inside are plagioclase, altered plagioclase, tremolite, and clinopyroxene.

COMMENTS: Mode point counted. 3565 points, 0.5 mm counting interval. Rock was very olivine-rich, with irregular shaped patches of plagioclase and clinopyroxene. The patches are now altered to serpentine, plagioclase, clinopyroxene, and tremolite. The olivine bulk of the rock has been pervasively serpentinized. Rock has overall protogranular texture with fresh kernels of olivine in optic continuity defining medium-grained, anhedral crystals. No distinct fabric apparent. Undulose extinction of plagioclase and subgrain development of olivine. Orthopyroxene porphyroclasts are partially recrystallized.

147-895C-4R-3 (Piece 6, 60–64 cm)

OBSERVER: JAY

WHERE SAMPLED: Unit 11

ROCK NAME: Basalt (amphibolite)

GRAIN SIZE: Medium

TEXTURE: Intergranular to subophitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	0	20	2			Pseudomorphs that may have been olivine phenocrysts.
Plagioclase	20	40	1.5		Bladed	Many dusty and mottled appearing blades, but also well-preserved twinning is common. Very broad (almost undulose) oscillatory zoning common.
Clinopyroxene	0	40	2		Anhedral	Completely altered to amphibole.
Magnetite	0.25		0.2		Laths to subangular	Fine-grained. Uniform distribution. Disseminated.
Ilmenite	0.25		0.2		Laths to subangular	Uniform distribution. Disseminated.
Zircon	Trace		0.2		Subhedral	Significant amount of high relief, occasionally elongate rods with pointed ends. May be some sphene as well with very high dispersion.
SECONDARY MINERALOGY	PERCENT PRESENT	REPLACING/ FILLING				COMMENTS
Plagioclase	20	Plagioclase				Grotty looking altered laths without marked twinning.
Amphibole	60	Clinopyroxene, olivine				Predominantly brown with some minor green amphibole after clinopyroxene. Fibrous mats in pseudomorphs after olivine.
Epidote	Trace	Clinopyroxene				Small anhedral crystals intergrown with amphibole.
VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Veins	Trace	Random	0.3	Chlorite	Irregular	Filled with fanned chlorite books.

COMMENTS: Mode visually estimated. Rounded, fibrous mats of very fine-grained amphibole are suspected to have been olivine phenocrysts. This rock should be called an amphibolite.

147-895D-2R-1 (Piece 4, 17-19 cm) OBSERVER: NAT WHERE SAMPLED: Unit 4  
 ROCK NAME: Highly olivine spinel phyrlic basalt  
 GRAIN SIZE: Fine-grained  
 TEXTURE: Porphyritic intersertal, largely recrystallized

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
<b>PHENOCRYSTS</b>						
Olivine	0	10-15	0.5-2		Skeletal to euhedral	Now replaced by dull brown clays and/or chlorite.
Plagioclase	Tr	Tr	2		Euhedral	A single crystal
Spinel	0.5	0.5	0.1-1		Skeletal to euhedral	A single very large skeletal crystal is 2 mm in length.
<b>GROUNDMASS</b>						
Plagioclase	10	40-45	0.1-1		Acicular	Now largely replaced by clear fibrous amphibole.
Clinopyroxene	20	35-40	0.1-1		Anhedra	Most resistant mineral to alteration; partly replaced by pale brown amphibole.
Titanomagnetite	0	1-2	0.1-0.3		Skeletal-euhedral	Altered to titanite.
<b>SECONDARY MINERALOGY</b>						
	PERCENT	REPLACING/ FILLING				COMMENTS
Tremolite-actinolite	30-35	Plagioclase				Fibrous, radiating, very clear mineral.
Hornblende	10-20	Clinopyroxene plus oxides				Pale brown pleochroic; replaces clinopyroxene at one end of the section adjacent to a small vein. There also is a small patch at the other end.
Clays/chlorite	20-30	Intersertal matrix, acicular plagioclase				This is a generic name for the very fine phyllosilicate that is abundant in the groundmass.
Titanite	Tr	Titanomagnetite				

COMMENTS: Spinels are also altered, to ferritchromite(?). The rock resembles olivine-plagioclase-spinel phyrlic basalts and diabases at Site 894, except it is more olivine-rich and it is strongly metamorphosed to amphibolite facies. The spinels have the same vermicular skeletal rims.

147-895D-2R-1 (Piece 6C, 50-60 cm) OBSERVER: JFA WHERE SAMPLED: Unit 5  
 ROCK NAME: Harzburgite  
 GRAIN SIZE: Medium to coarse  
 TEXTURE: Porphyroclastic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	15-20	75-80	to 5		Anhedra	As fragmented grains heavily serpentinized. Difficult to tell original grain size. Few rounded grains occur as inclusions in orthopyroxene.
Orthopyroxene	15	20-25	to 10		Subhedral to anhedra	As large, fragmented porphyroblasts and crystals have slightly curved exsolution lamellae. In clusters with olivine. Altered to serpentine and talc in patches and veins. Exsolution euhedra of clinopyroxene in a few grains.
Spinel	<1	<1	to 3		Equant, irregular, elongate, interstitial	Red/brown spinel in olivine, also vermicular honey brown spinel. Magnetite interstitial occurs on edge of some grains, replaces spinel in highly altered part of section.
Sulfide Minerals	<<1	<<1	to 0.2		Irregular	Intergrown; include bornite, pentlandite, also native copper. Typically occur with orthopyroxene.
<b>SECONDARY MINERALOGY</b>						
	PERCENT	REPLACING/ FILLING				COMMENTS
Serpentine	50-60	Olivine, orthopyroxene				As fibrous mats, nets, and veins.
Talc	3-5	Olivine, orthopyroxene				As fibrous mats.
Chlorite?	1-5?	Pyroxene, olivine				Fibrous patches, intergrown with serpentine.
Magnetite	<<1	Olivine, spinel				Replaces olivine forming net-like texture (to 0.1 mm); also replaces spinel in more altered part of thin section.
Pyrite	<<1					Occurs in veins, within altered silicates (to 0.2 mm).

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Veins	1	Pervasive	to 0.05 mm	Serpentine, magnetite, pyrite		In one instance, serpentine cuts both orthopyroxene and talc after orthopyroxene patch- is later.

COMMENTS: High-temperature porphyroclastic harzburgite. Orthopyroxene aggregates have tilt boundaries perpendicular to slip planes. Subgrain and neoblast development in olivine.

147-895D-2R-2 (Piece 3A, 43–46 cm)

OBSERVER: JAY

WHERE SAMPLED: Unit 7

ROCK NAME: Harzburgite

GRAIN SIZE: Medium to coarse

TEXTURE: Porphyroclastic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	8.3	86.8	2–5		Anhedral	Groups of optically continuous fresh kernels each less than 1 mm across suggest original grain size average on the order of 4 mm.
Orthopyroxene	7.2	12.5	2–6		Rounded	Fragmented margins, exhibit rare higher birefringent lamellae that may be clinopyroxene exsolution.
Spinel	0.6	0.5	3		Interstitial	Dark brown to black, cut by veins of fibrous material with higher relief and birefringence than serpentine (tremolite?). Secondary magnetite common along rims and cracks.
Sulfide	Trace	0.1			Veins	Pyrite cubes in altered patches. Patches minerals of native Cu with pyrite on the edges of orthopyroxene, adjacent to serpentine.
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Serpentine	72.6	Olivine				
Magnetite	5.9	Olivine				In thin stringers in serpentine veinlets.
Bastite	5.3	Orthopyroxene				Around orthopyroxene fragmented margins and in broad fractures and lamellae.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Veins	15–20	All over	to 2	Serpentine, possible clinopyroxene	Anastomosing	Two classes of veins, distinct small serpentine and secondary magnetite veins that dissect the entire section with a general preferred orientation normal to the long axis of the section, and a second set of thicker, primarily serpentine and clay?

COMMENTS: Mode point counted, 4053 points, 0.5 mm counting interval. Strong directional orientation to anastomosing serpentine veinlets, crosscut by coarser mixed lithology (though far and away still predominantly serpentine) veins. Olivine 90% altered, total section 84% altered. Trace of chlorite? (patchy, light blue-green, moderate relief) present. Serpentine has a distinct dusty brown tinge in plane light around fresh olivine kernels that fades to translucent light green away from fresh olivine. High-temperature porphyroclastic harzburgite. Orthopyroxene porphyroclasts are sheared and olivine is subgrained.

147-895D-3R-1 (Piece 8C, 61–65 cm)

OBSERVER: SHO

WHERE SAMPLED: Unit 7

ROCK NAME: Harzburgite

GRAIN SIZE: Medium to coarse

TEXTURE: Weak porphyroclastic to protogranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	30	74	1 to 4		Anhedral	Weakly kinked. Pervasively replaced by serpentine, brucite, and magnetite.
Orthopyroxene	18	25	Up to 8		Anhedral (sometimes rounded)	Sometimes kinked recrystallized into neoblasts.
Clinopyroxene	<1	<1	0.5		Anhedral	Sometimes intergrown with spinel.
Spinel	1	1	Up to 1	Cr# 0.5	Anhedral	Sometimes vermicular and intergrown with clinopyroxene.
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Tremolite	1	Orthopyroxene				
Serpentine	48	Olivine, orthopyroxene				Often overgrown on primary orthopyroxene and clinopyroxene.
Talc	2	Orthopyroxene, olivine				
Magnetite	trace	Olivine, orthopyroxene, spinel				Sometimes closely associated with brucite.
Brucite	trace	Olivine				Associated with magnetite.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles						
Veins	3		Up to 0.5	Serpentine, talc, magnetite, brucite		Talc is not in contact with brucite.

COMMENTS: Not point-counted. Degree of serpentinization is relatively low. Color of spinel is reddish brown, showing the Cr# is around 0.5. Various-sized sinuous veinlets are abundant, filled by serpentine + talc + magnetite or serpentine + brucite + magnetite. Brucite shows two kinds of mode of occurrence; one is around relict olivine, the other is forming veinlets with magnetite and serpentine cutting olivine. High-temperature porphyroclastic harzburgite, with rounded olivine grains (rarely subgrained). Aggregates of orthopyroxene porphyroclasts with neoblasts of orthopyroxene and olivine.



147-895D-4R-2 (Piece 18, 126-129 cm)

OBSERVER: CL

WHERE SAMPLED: Unit 9

ROCK NAME: Harzburgite

GRAIN SIZE: Medium-grained

TEXTURE: Porphyroclastic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	25-26	85-87	to 12 mm		Anhedral, granular	
Clinopyroxene	<1	<1	to 1.5 mm		Interstitial	Closely associated to spinels.
Orthopyroxene	9-10	13-15	to 4 mm		Subhedral	Numerous diopside exsolutions.
Spinel	<1	<1	to 1 mm	Cr-rich	Anhedral	
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Tremolite	2.5	Orthopyroxene				
Talc	1	Orthopyroxene				
Serpentine	58	Olivine				Lizardite and chrysotile.
Magnetite	1.5	Olivine				Alignments of small grains along the ancient grain boundaries.
Bastite	1.5	Orthopyroxene				

COMMENTS: Dense network of 0.01-0.05 mm wide chrysotile plus magnetite veins. Crack-seal texture can be observed inside a 1 mm serpentine vein. Rare occurrence of low-temperature (secondary) diopside as acicular crystals perpendicular to the margins of the veins. Orthopyroxene has undulose extinction and is possibly twinned. Well-developed subgrains in olivine.

147-895D-4R-3 (Piece 6B, 56-60 cm)

OBSERVER: DCK

WHERE SAMPLED: Unit 9

ROCK NAME: Harzburgite

GRAIN SIZE: Medium

TEXTURE: Porphyroclastic with protogranular elements

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	25.1	80.9	1-7	Forsterite	Anhedral granular	
Enstatite	3.2	16.6	1-5		anhedral granular	
Clinopyroxene	1.1	1.47	0.1-1	Diopside	Intergranular	Clinopyroxene occurs as small intergranular grains in the groundmass olivine, often near enstatite, as granular exsolution along enstatite grain boundaries, as discrete neoblasts of granular exsolution with enstatite neoblasts, and with spinel intergrowths. Small intergranular clots of hydrogrossular are present in one or two places with the characteristic texture of late impregnated plagioclase.
Plagioclase	0	0.05			Intergranular	Occurs as linedated grains of holly-leaf spinel in the olivine groundmass, intergranularly around enstatite, and as complex vermiform intergrowths with diopside.
Chrome Spinel	0.8	0.98	0.05-1		Holly leaf anhedral to vermiform	
Ferritchromite	0.2					Additional secondary mineral. Replaces or partially replaces most of the very fine-grained vermiform spinel, but not the coarser-grained holly leaf spinel.
Magnetite	0.5					Additional secondary mineral replacing olivine intergrown with the mesh textured serpentine and forming very fine-grained vein fillings in compound mesh-texture lizardite veins.
Hydrogrossular	<<1					Two small apparent plagioclase pseudomorphs are characteristically filled by dark high relief aggregates of hydrogrossular.
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Serpentine	65.1	Olivine, Enstatite				Principal serpentine is mesh textured lizardite replacing olivine and as bastite replacing enstatite. Unusual flame textured serpentine in some veins may be antigorite, others contain cross-fiber chrysotile.
Chlorite	1	Olivine, Enstatite				Book-like sheafs and scattered intergrowths with talc and serpentine with blue-gray anomalous birefringence and as white mats of acicular needles.
Diopside	1	Diopside				Granular aggregates of clear secondary diopside occur replacing primary diopside.
Cummingtonite	1	Enstatite, Olivine				Occurs as highly birefringent sheafs of crystals, often radiating into the olivine groundmass. Commonly nucleates around and replaces primary enstatite, but grows out into the olivine groundmass.
Tremolite	3	Enstatite				Occurs with talc and chlorite replacing enstatite, but unlike cummingtonite, has lower birefringence, occurs often in mats, and more perfectly pseudomorphing the original enstatite.
Antigorite	1	Lizardite				Areas of the lizardite are recrystallized to flame textured serpentine which is believed to be characteristically antigorite.
Talc	1	Enstatite, Olivine				Occurs as reaction zones between many enstatite grains and olivine, and as direct pseudomorphs of enstatite. Commonly intergrown with tremolite and chlorite in the latter.
Aragonite	<<1	Enstatite				Found partially replacing a single enstatite grain.

COMMENTS: Relict phases and pseudomorphs point counted separately to provide an estimate of present and original proportions of the primary phases. A total of 2244 points were counted at a 1 mm spacing. The rock is a porphyroclastic harzburgite with strong elements of protogranular texture preserved. The latter is characterized by smooth curved, often deeply embayed and undeformed enstatite grains which often interlock complexly with each other. The enstatites also exhibit strong characteristics of porphyroclastic textures more commonly associated with plastic flow, including grain boundary recrystallization with the formation of small neoblasts of orthopyroxene and clinopyroxene granules. There is enough relict olivine preserved to define the original olivine texture. The olivines show granular texture with smooth curved, often deeply embayed grain boundaries indicative of high-temperature grain boundary migration as a recrystallization and recovery mechanism during and after plastic flow.



147-895D-4R-3 (Piece 12, 113-116 cm)  
ROCK NAME: Harzburgite  
GRAIN SIZE: Coarse grained  
TEXTURE: Granular

OBSERVER: CEM

WHERE SAMPLED: Unit 9

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	43	83	to 5		Anhedral	Granular
Orthopyroxene	10	15	to 4		Anhedral	Forms granular aggregates with clinopyroxene.
Clinopyroxene	1	1	to 1.5		Anhedral granular	Intergranular grains in patches with orthopyroxene.
Spinel	<1	<1	to 1		Anhedral	Grains range from irregular intergranular to rounded granular.
Sulfides	0.2		2.2-8		Stringers and semirounded	Clusters of pentlandite altered to violarite with pyrite with native Cu altered to bornite and Cu oxides. Native Cu intergrown with bornite as a vermicular intergrowth. Secondary pyrite parallel to cleavage of altered orthopyroxene with a little Cu.
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Serpentine	40	Olivine				Mesh textured chrysotile.
Talc	5	Orthopyroxene				Partial to complete replacement of orthopyroxene near several serpentine veins.
Magnetite	1	Olivine				Minute grains occur with serpentine at original grain boundaries between olivine grains but are rare in mesh textured serpentine within original olivine grains.
Amphibole	Trace	Orthopyroxene				Acicular tremolite crystals occur with talc and trace chlorite replacing orthopyroxene in aggregates with clinopyroxene.
Chlorite	Trace	Orthopyroxene				Several pale green partial pseudomorphs near serpentine.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Veins	<1	0.3 mm	Serpentine			

COMMENTS: Note that degree of serpentinization is relatively low. Aggregates of clino- and orthopyroxene define a weak foliation that is subparallel to a train of spinel grains. A good example of high-temperature porphyroclastic harzburgite: rounded olivine grains with subgrain development and partial recrystallization of orthopyroxene.

147-895D-5R-1 (Piece 2, 7-11 cm)

OBSERVER: PED

WHERE SAMPLED: Unit 9

ROCK NAME: Harzburgite  
GRAIN SIZE: Medium to coarse grained  
TEXTURE: Porphyroclastic to protogranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	33.7	81.4	2-6 mm		Anhedral, granular	Some grains are kinked. Partly replaced by serpentine and magnetite that form a mesh texture with fresh olivine in the core.
Orthopyroxene	11.5	17	2-8 mm		Anhedral	Undulatory extinction. Some kinkbands. Locally altered to mats of fibrous amphibole (tremolite?).
Spinel	1.5	1.6	to 1 mm		Anhedral	Reddish brown. Sometimes vermicular forms and intergrowth with clinopyroxene.
Clinopyroxene	<1	<1	to 0.5 mm		Anhedral	Intergrown with spinel.
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Serpentine	45.2	Olivine, orthopyroxene.				
Tremolite	4.1	Orthopyroxene				
Magnetite	1.1	Olivine, orthopyroxene.				Locally as thin stringers in serpentine veinlets.
Talc	<1	Orthopyroxene				In thin veins cutting orthopyroxene.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vein	3.4		0.5	Serpentine		Anastomosing veins.
Vein	Trace			Talc		Thin veins cutting orthopyroxene.

COMMENTS: Mode point counted, 1643 points, 0.5 mm interval. Elongated orthopyroxene grains are aligned. Best example of high-temperature recovery in olivine: rounded olivine grains with triple junctions. Common extinction of olivine grains implies a strong crystallographic fabric.

147-895D-5R-1 (Piece 8, 46–49 cm)  
ROCK NAME: Harzburgite  
GRAIN SIZE: Medium grained  
TEXTURE: Porphyroclastic

OBSERVER: CL

WHERE SAMPLED: Unit 11

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	45	75	to 5 mm		Anhedral, granular	
Orthopyroxene	0	25	to 4 mm		Anhedral	
Spinel	<1	<1	to 2 mm	Cr-rich		
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Serpentine	23–24	Orthopyroxene				Bastite and Chrysotile
Magnetite	0.5–1	Olivine				
Magnetite	1–1.5	Orthopyroxene				
Serpentine	30	Olivine				Lizardite and Chrysotile

COMMENTS: 0.6 mm wide vein of fibrous chrysotile with a 0.01 mm fringe of magnetite in the central part of the vein. Numerous serpentine veins (0.1–0.2 mm) with magnetite grains and overprinting by fibrous brucite. (0.01–0.02 mm) short veins of serpentine with a pale yellow birefringence postdate the main anastomosing network constituted by the low-birefringence veins (blue-gray). High-temperature recovery of olivine exemplified by large, elongate olivine grains with subgrains developed perpendicular to elongations. Smaller olivine grains are rounded.

147-895D-5R-1 (Piece 13, 83–86 cm)  
ROCK NAME: Harzburgite  
GRAIN SIZE: Fine to medium grained  
TEXTURE: Protogranular to porphyroclastic

OBSERVER: MG

WHERE SAMPLED: Unit 11

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	40	83–90	0.24–2.7		Subhedral to anhedral	Granular with abundant silicate inclusions, enclosed by chrysotile groundmass.
Plagioclase	Trace	Trace	0.08–0.2		Anhedral	Altered to low-birefringent, colorless chlorite.
Clinopyroxene	1	1	<0.8		Anhedral to subhedral	
Orthopyroxene	5–8	7–10	0.28–2.4		Subhedral	Minor exsolution lamellae to clinopyroxene, schiller texture, grain boundaries are altered to tremolite.
Spinel	<1	<1			Anhedral	
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Clays	Trace	Olivine				Trace mixed-layer clay, greenish in color.
Chlorite	Trace	Plagioclase				Low first order birefringence, colorless.
Tremolite	2–3	Orthopyroxene				Fine-grained fibrous intergrowths rimming orthopyroxene.
Chrysotile	47	Olivine				Forms mesh texture with rare patches up to 0.4 mm wide.
Oxide Minerals	<1					Pentlandite + pyrite + magnetite intergrowths.
Clinopyroxene	1	?				As partial coronas? rimming olivine, anhedral, and fine-grained.

COMMENTS: Abundant microveinlets of serpentine exhibit a mesh texture and serpentine is commonly associated with fine-grained opaque minerals. High-temperature porphyroclastic harzburgite. Extensive subgrain development of olivine. Orthopyroxene is partially recrystallized. Spinel is commonly elongated in olivine.

147-895D-5R-1 (Piece 18, 113–116 cm)  
ROCK NAME: Harzburgite  
GRAIN SIZE: Coarse  
TEXTURE: Porphyroclastic

OBSERVER: PAS

WHERE SAMPLED: Unit 11

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Orthopyroxene	1–2	20	0.5–5	En90	Subhedral porphyroclastic	Rare cores left. Some sections show good exsolution of clinopyroxene. Some crystals are kinked. There is a weak alignment of crystal cleavages.
Spinel	0.5	0.5	0.1–2	Cr-rich	Anhedral interstitial	Variably shaped grains interstitial to olivine. Red translucent rims, with minor oxide alteration. One patch shows alignment and pull apart texture. All are somewhat fractured.
Olivine	40	80	0.5–4	Fo90-93	Subhedral equant	Cores are left, rimmed by lizardite. (2V approximately 90).
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Clays	5	Olivine				Brown amorphous clay in part after olivine.
Chlorite	10	Orthopyroxene/olivine				Associated with pale-colorless amphibole (tremolite?) and serpentine.
Tremolite	15	Olivine/orthopyroxene				Pale brown to colorless crystals replacing olivine dominantly.
Serpentine	25	Olivine/orthopyroxene				Mixture of fibrous chrysotile and amorphous lizardite dominantly replacing olivine.
Oxide	3	Olivine				Fine-grained in fractures cutting olivine

COMMENTS: The rock is about 60% altered (serpentinized). A possible alignment of orthopyroxene is picked out by cleavage orientation. Minor exsolution of clinopyroxene in orthopyroxene. Spinel is Cr-rich and generally anhedral. Mode is visually estimated.

147-895D-5R-2 (Piece 14, 103–105 cm)

OBSERVER: JAY

WHERE SAMPLED: Unit 11

ROCK NAME: Harzburgite

GRAIN SIZE: Medium to coarse

TEXTURE: Porphyroclastic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine clusters	17.4	83.8	to 5		Anhedral	Kernels of fresh olivine 1 mm across in optically continuous up to 5 mm across. Also marked by accumulations of microgranular magnetite around clusters.
Orthopyroxene	3.7	13.6	to 9		Anhedral	Pervasively but variably altered, some very fresh, others completely altered. Commonly fractured or microveined.
Clinopyroxene	1.7	1.7	to 1		Interstitial	Fresh interstitial clinopyroxene commonly but not ubiquitously intergrown with spinel.
Spinel	0.9	0.9	to 1.5		Interstitial to vermicular	Red brown to very dark brown. Red-brown in elongate irregular patches. Darker brown in vermicular intergrowths commonly with clinopyroxene.
Sulfide minerals	0.1	0.1	0.2		In patches and veins	Pyrite and pentlandite intergrown with magnetite. Pyrite also in veins.
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Talc	2.7	Orthopyroxene				In cracks and around orthopyroxene.
Magnetite	4.2	Olivine				Microgranular aggregates in patches and stringers weaving around in serpentine.
Bastite	7.2	Orthopyroxene				
Serpentine	62.2	Olivine				
Chlorite	Trace	Olivine				Colorless to very light green to tan.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Veins	10	All over	to 1	Serpentine + magnetite	Anastomosing	

COMMENTS: Mode point counted 2713 points, 0.5 mm counting interval. Coarse- to medium-grained, porphyroclastic harzburgite. Moderately fresh to pervasively altered rounded, fractured, and fragmented orthopyroxene in serpentinized olivine matrix. Serpentine crisscrossed by myriad veinlets, with two primary orientations. Most dominant is roughly parallel to the short axis of the section. A secondary set of veinlets is oriented at a high oblique angle to the dominant set. This description is for 90% of the section. Along one end is a 1 mm thick serpentine vein. Along either side of this vein, the specimen is much more pervasively altered and has several smaller veins. Within the main vein are bits of fresh olivine that may have been plucked from the vein wall. Multiple parallel bands suggest several episodes of vein opening and sealing. Orthopyroxene is partially recrystallized. Olivine has curved grain boundaries, with minor subgrain development. Spinel is elongated.

147-895D-7R-1 (Piece 4, 23–27 cm)

OBSERVER: PED

WHERE SAMPLED: Interval 15

ROCK NAME: Gabbro

GRAIN SIZE: Medium to coarse-grained

TEXTURE: Allotriomorphic granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	20	50	to 6 mm		Subhedral to anhedral	Pseudomorphed by chlorite and prehnite. Also locally replaced by brown to yellow clays that may be associated with hydrogrossular.
Clinopyroxene	20	47	2–15 mm		Anhedral	Forms large anhedral crystals that locally include plagioclase and some olivine grains (totally altered) as well as interstitial grains between plagioclase. Show prominent cleavage parallel to (100) which is characteristic of diagenesis.
Olivine	Trace	1–2	to 1.5 mm		Euhedral to subhedral	As inclusions in clinopyroxene. Nearly totally altered to serpentine.
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Chlorite	30	Plagioclase				
Prehnite	10	Plagioclase, clinopyroxene				
Zeolites	5	Plagioclase				
Tremolite	10	Clinopyroxene				Form very fine-grained fibers parallel to cleavage.
Serpentine	3	Olivine				
Clays	Trace	Olivine				
Clinopyroxene	2	Clinopyroxene				Developed along grain boundaries.
Pyrite	Trace	Clinopyroxene				Some places as trails along cleavage plains, locally associated with magnetite.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vein			0.1 mm	Chlorite, clay, trace tremolite		
Vein			0.1 mm	Zeolite, prehnite		Cut veins of chlorite-clay-tremolite veins.

147-895D-7R-1 (Piece 11, 71–74 cm)  
ROCK NAME: Troctolite  
GRAIN SIZE: Medium  
TEXTURE: Meshed

OBSERVER: JAY

WHERE SAMPLED: Unit 16

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	16.8	83.9	4		Anhedral	Thoroughly serpentinized. Original grain size estimate by clusters of optically continuous kernels.
Plagioclase	0	12.6	3		Anhedral	Completely altered to fine-grained, dirty brown to gray minerals
Clinopyroxene	1.1	1.1	<1		Anhedral	As small rims and anhedra in contact with tremolite and altered plagioclase.
Spinel		2.4			Euhedral to interstitial	Commonly but not ubiquitously intergrown with plagioclase.
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Chlorite	1	Olivine				Pale blue anomalous birefringence, in small patches.
Calc-silicate	12.6	Plagioclase				Possibly hydrogrossular and others but too fine-grained to make determination on optic properties.
Tremolite	7.5	Olivine or clinopyroxene				Clusters of radiating and intergrown needles, moderate relief, low odor orange birefringence, colorless.
Serpentine	56	Olivine				Colorless to slightly green brown, very low relief.
Magnetite	8.4	Olivine				Microgranular aggregates in serpentine veinlets
Carbonate	0.3	Olivine				Fine-grained, high birefringence.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE
Veins	20	All over	1	Serpentine	Interconnected

COMMENTS: Mode point counted, 1996 points, 0.5 mm counting interval. Minerals occur in clots. Type 1= serpentine + olivine + magnetite. These contain anastomosing veinlets of serpentine + magnetite subdividing fresh fine-grained olivine crystals. The veinlets in each clot have a strong fabric, but this is not continuous between clots. Type 2 = contain radiating clusters and aggregates of tremolite and rare clinopyroxene mantling serpentine, in turn surrounding altered plagioclase. The patches all have irregular shapes, but the olivine rich patches are subrounded, the plagioclase rich patches are very irregular. The plagioclase rich patches are also interconnected by a series of serpentine veinlets. High-temperature recovery textures include subgrain development in olivine and rounding of olivine grains.

147-895D-7R-1 (Piece 20A, 128–129 cm)  
ROCK NAME: Harzburgite  
GRAIN SIZE: Fine  
TEXTURE: Protogranular to porphyroclastic

OBSERVER: CL

WHERE SAMPLED: Unit 18

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	4	82	3–5		Subhedral	
Clinopyroxene	2.5–3	2.5–3	5–8		Anhedral	Occurs as aggregates
Orthopyroxene	7–8	15	5–15		Subhedral	Occurs as aggregates, contain clinopyroxene exsolutions.
Spinel	0.5	0.5	1	Cr-rich	Anhedral	
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Chlorite	0.5–1	Orthopyroxene				
Tremolite	2–2.5	Orthopyroxene				
Talc	0.5	Orthopyroxene				
Serpentine	76	Olivine				
Magnetite	1.5	Olivine				
Bastite	4	Orthopyroxene				
Brucite	Trace	Olivine				Rimming the olivine relicts

COMMENTS: Numerous 0.05–0.1 mm wide veins of talc cutting or rimming the orthopyroxenes. Dense network of serpentine plus magnetite veins around the olivine grains. 0.1–0.2 mm sinuous veins of gray dark serpentine (free of magnetite) cut the talc veins. High-temperature porphyroclastic harzburgite, with aggregates of porphyroclastic orthopyroxene, with neoblasts and recrystallized olivine and clinopyroxene.

147-895D-7R-2 (Piece 9, 70–75 cm)  
ROCK NAME: Olivine gabbroonorite  
GRAIN SIZE: Medium  
TEXTURE: Equigranular

OBSERVER: JAY

WHERE SAMPLED: Unit 20

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	21.7	33.7	3.5		Anhedral	Fractured, abundant secondary magnetite filling fractures. Commonly partially mantled with radiating clusters of amphibole.
Plagioclase	9.1	25.7	3.5		Anhedral	Irregularly shaped altered patches.
Clinopyroxene	23.8	34	4		Anhedral	Well-developed, finely laminated cleavage, dusty alteration along cleavage planes.
Orthopyroxene	5.1	7	3		Anhedral	Fractured, altered around margins and in fractures. Rare exsolve clinopyroxene anhedral.
Spinel	0.5		0.2		Equant, subangular, subrounded	
Sulfide minerals	0.4		0.4		Equant	Complex pyrrhotite-pyrite intergrowths. Chalcopyrite, chalcocite, bornite, and violarite also present. Rare pentlandite in olivine.
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Amphibole	18	Plagioclase, pyroxene, plagioclase				Fibrous to radiating clusters of needles.
Magnetite	6	Olivine				Along fractures. Dense, anastomosing veinlets of microgranular magnetite.
Plagioclase	5	Plagioclase				Recrystallized grotty looking plagioclase.
Clay	5	Plagioclase				Brown microscopic particles in center of altered plagioclase patches.
Chlorite	5	Plagioclase				Colorless, low relief coronas around clay and altered plagioclase.

COMMENTS: Mode point counted, 1518 points, 0.5 mm counting interval. Reasonably fresh phases, plagioclase appears to be the most altered. Equigranular texture but plagioclase and clinopyroxene appear to be late phases filling intercrystalline spaces between olivine and orthopyroxene. Subcontinuous veins of magnetite are interrupted by plagioclase and its alteration products, then overprinted by later fibrous amphibole veinlets. Undulose extinction of all phases, including olivine.

147-895D-8R-2 (Piece 4, 35–38 cm)  
ROCK NAME: Troctolite  
GRAIN SIZE: Coarse grained  
TEXTURE: Intergranular

OBSERVER: CEM

WHERE SAMPLED: Unit 34

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	30	60	to 5		Anhedral	Equant. Broad oscillatory zoning exhibited by many grains.
Olivine	5	35	to 5		Anhedral	Granular. Abundant fluid inclusions.
Clinopyroxene	3	5	to 7.5		Anhedral	Several large intergranular grains, but mostly coronas between olivine and plagioclase. One large grain has kink bands.
Magnetite	<0.5					With talc and chlorite after olivine. With hornblende and secondary clinopyroxene after clinopyroxene.
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Chlorite	25	Plagioclase and olivine				Colorless. 20% after plagioclase in coronas at plagioclase-olivine grain boundaries. 5% with talc after olivine.
Plagioclase	10	Plagioclase				Probably albite. Forms fine-grained crystal mats with irregular extinction in individual twin lamellae of primary plagioclase.
Epidote	trace	Plagioclase				
Amphibole	5	Olivine and clinopyroxene				Colorless tremolitic amphibole replaces olivine near olivine-clinopyroxene grain boundaries. Green actinolite replaces clinopyroxene coronas. Trace pale brown hornblende with magnetite and secondary clinopyroxene after magmatic clinopyroxene.
Clinopyroxene	trace	Clinopyroxene				With pale brown hornblende and magnetite after magmatic clinopyroxene.
Talc	22	Olivine				
Garnet	trace	Plagioclase				Rare equant euhedral crystal aggregates at interfaces between relict plagioclase and chlorite. No optical anisotropy noted, but its composition is probably hydrogrossular.
Prehnite	trace	Plagioclase				

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Veins	<1		to 0.4 mm			Discontinuous monomineralic veins of green amphibole, talc, chlorite, and prehnite. Green amphibole veins are cut by chlorite alteration of plagioclase suggesting early formation.

COMMENTS: Though incipient rodingitization suggested by trace garnet and prehnite, the dominant alteration is the pseudomorphic replacement of olivine and plagioclase by chlorite and talc. Plagioclase has undulose extinction and rarely deformation twins.

SITE 895

147-895D-8R-2 (Piece 15, 112-114 cm)  
 ROCK NAME: Dunite  
 GRAIN SIZE: Fine  
 TEXTURE: Mesh

OBSERVER: FRU

WHERE SAMPLED: Unit 36

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	1	98	?		Indeterminable	Completely altered to serpentine and magnetite forming characteristic mesh texture. Original grain size and morphology indeterminable. Locally still distinguishable cores are altered to yellowish clay/chlorite (? , possibly after talc).
Spinel	<<1	<1	to 1 mm		Semirounded to equant	Black/brown color, 40% altered to magnetite as overgrowths or as patches with pitted surfaces.
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Serpentine	95	Olivine, veins				Pseudomorphs olivine, together with magnetite, forming mesh texture.
Chlorite	2	Olivine, patches, veins				Occurs with mixed layer clays in centers of poorly preserved olivine cores. Also as irregular patches near veins or part of thicker vein assemblage with serpentine, magnetite, and clay.
Clay	1	Olivine, veins				Yellow-brown color, mixed-layer(?) chlorite? in centers of rare relict olivine grains or as vein filling.
Brucite	<1	Olivine, veins				Very rare individual grains, minor component of veins.
Sulfides	0.2					Pentlandite + pyrite in patches. Pentlandite enclosed by magnetite as laths.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Veins			to 0.7	Serpentine, chlorite, magnetite, clay	Straight or wavy	Irregular network of 0.02 to 0.7 mm wide veins and veinlets crosscut mesh serpentine texture. Wider veins typically lined by fine-grained magnetite with serpentine + chlorite and minor gold-brown clay or brucite in centers.

COMMENTS: Mineral modes are visual estimates. Sample cut by dense irregular vein network. Possibly two sets of veins. Thinner veinlets (0.02-0.03 mm wide) predominantly serpentine and dusty magnetite. Second set has variable filling assemblages and includes thicker (up to 0.7 mm wide) subparallel serpentine + magnetite + chlorite + clay + minor brucite veins. Olivine grains are rounded, but no subgrain boundaries were observed; cumulate texture.

147-895D-8R-2 (Piece 18, 140-149 cm)  
 ROCK NAME: Dunite  
 GRAIN SIZE: Medium  
 TEXTURE: Allotriomorphic granular

OBSERVER: DCK

WHERE SAMPLED: Unit 36

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	5	99	1-3		Anhedral; equigranular	
Chrome Spinel	0	1	0.05-0.5		Subhedral to equant anhedral, rare intergranular	
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Serpentine	91	Olivine				Mesh-textured lizardite.
Brucite	2	veins				White in crossed polars, low relief and birefringece.
Magnetite	1	Olivine				Very fine-grained disseminated in serpentine and concentrated in compound mesh-textured serpentine veins.
Ferritchromite	1	Chrome spinel				Completely pseudomorphs original spinel.

COMMENTS: A few sad little islands of corroded olivine in a gray stagnant sea of mesh-textured serpentine ripped across by stark veins of white serpentine. Pathetically dotted by once lusty red spinel, now ghastly black ferritchromite without a trace of its former glory.

147-895D-9R-1 (Piece 15, 103–105 cm) OBSERVER: SHO WHERE SAMPLED: Unit 44  
 ROCK NAME: Dunite  
 GRAIN SIZE: Medium (possibly)  
 TEXTURE: Equigranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	1	96	2		Polygonal	Includes dusty mineral (possibly iron oxide). Color is dark brown. Interstitial. Completely altered to chlorite.
Spinel	2	2	1	Cr# >0.6	Subhedral	
Plagioclase?	0	2	1		Anhedral	
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Serpentine	89	Olivine				Associated with fine grains of magnetite. Brownish gray interference color.
Chlorite	5	Plagioclase?, Olivine				Mainly as thin veinlets tracing former grain boundaries of olivine. Sometimes occurs as aggregates in the center of olivine pseudomorph.
Brucite	3	Olivine				Usually associated with serpentine or brucite.
Magnetite	1	Olivine, Spinel				

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles						
Veins	3			Serpentine, chlorite, brucite, magnetite		Crisscrossing and anastomosing.

COMMENTS: Characterized by common occurrence of brucite. Chlorite aggregates are interstitial to olivine (now pseudomorph), possibly derived from primary plagioclase. Olivine is full of dusty inclusions of some oxide mineral(s), possibly magnetite or Cr-bearing spinel. Dusty inclusions in olivine are common in Hess Deep dunites.

147-895D-10W-1 (Piece 3, 25–28 cm) OBSERVER: PAS WHERE SAMPLED: Wash core  
 ROCK NAME: Serpentinized dunite  
 GRAIN SIZE: Coarse  
 TEXTURE: Mesh texture replacing olivine

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	1	99	<4 mm	?	Subhedral?	Completely replaced by serpentine. Some oxides on margins. Red translucent color where thin. Fractures and rare pull-apart texture.
Spinel	1	1	0.5–2 mm	Cr-rich	Anhedral	
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Serpentine	93	Olivine				Chrysotile on margins of olivine grains (10%), Lizardite mainly (90%).
Oxides	5	Olivine/spinel				Outlines mesh texture occurring on fractures through olivine. Also rims spinels.

COMMENTS: 99% serpentinized dunite with interstitial spinel (Cr-rich). Mesh texture excellently outlined by oxides.

147-895E-1R-2 (Piece 18B, 110–114 cm) OBSERVER: CL WHERE SAMPLED: Unit 3  
 ROCK NAME: Dunite  
 GRAIN SIZE: Fine  
 TEXTURE: Mesh

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	0	98	0.3–0.5		Subhedral	
Spinel	0.5	2	0.05–0.2		Anhedral	
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Chlorite	trace	Olivine				Magnetite rims the relict olivine crystals. Magnetite and ferritchromite.
Serpentine	83	Olivine				
Magnetite	5	Olivine				
Fe-rich opaque	1.5	Cr-spinel				
Brucite	10	Olivine				

COMMENTS: 1 mm wide veins filled with serpentine + chlorite + clays + magnetite + brucite. Magnetite grains are located along the rims of the veins while brucite overprints the chlorite.



SITE 895

147-895E-1R-3 (Piece 1, 14–17 cm)  
 ROCK NAME: Harzburgite  
 GRAIN SIZE: Medium  
 TEXTURE: Porphyroclastic

OBSERVER: JAY

WHERE SAMPLED: Unit 4

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	1.2	82.7	?		?	Exceedingly rare, very small (less than 0.1 mm) kernels of fresh rounded olivine in serpentine.
Orthopyroxene	0.8	16.5	to 4		Rounded to interstitial	Rare fresh cores to completely altered, pseudomorphed, an overgrown crystals.
Spinel	0.8	0.8			Interstitial	Red-brown Cr spinel with magnetite exsolution.
SECONDARY MINERALOGY	PERCENT PRESENT	REPLACING/ FILLING				COMMENTS
Chlorite	Trace	Olivine, orthopyroxene				Rare, fibrous patches with light blue birefringence.
Amphibole	8.4	Orthopyroxene				Pseudomorphing and grown around margins and in fractures in orthopyroxene.
Talc	3.0	Orthopyroxene				Intergrown with amphibole. In fibrous mats with micaceous extinction.
Serpentine	75.0	Olivine				Network of interconnecting veinlets that completely obscure original olivine crystal size and shape.
Magnetite	6.5	Olivine, orthopyroxene				As microgranular crystals intergrown with amphibole pseudomorphs of orthopyroxene, but most commonly as integral part of serpentine veinlet network.
Bastite	4.2	Orthopyroxene				Pseudomorphing orthopyroxene.

COMMENTS: Mode point counted. 24–28 points, 1 mm counting interval. Relict orthopyroxene has porphyroclastic texture. Often orthopyroxene is mantled with amphibole and talc that interfingers with surrounding serpentine veinlets, partially obscuring the subrounded habit of the original orthopyroxene. Intergrown with the orthopyroxene alteration are rare, microgranular crystals, with moderate relief, which behave pseudoisotropically (serpophite?). Spinel (and their magnetite exsolutions) are commonly intergrown with a low relief alteration product of what may have at one time been plagioclase. Grain boundaries of this altered phase are distinct with an interstitial habit. Relict cleavage is also faintly present.

147-895E-2R-1 (Piece 8, 36–39 cm)  
 ROCK NAME: Olivine gabbro  
 GRAIN SIZE: Medium-coarse  
 TEXTURE: Hypidiomorphic granular

OBSERVER: LOR

WHERE SAMPLED: Unit 10

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	5	15	3–8		Anhedral	Olivine grains are partially to wholly replaced by tremolite and chlorite. Braided fractures in olivine are filled with magnetite.
Plagioclase	30	65	1–8		Anhedral	Plagioclase is commonly rimmed by chlorite. Plagioclase grains are interlocking with no interstitial minerals.
Clinopyroxene	5	10	5–7		Anhedral	Occurs as granular grains, or as thin coronas surrounding olivine.
SECONDARY MINERALOGY	PERCENT PRESENT	REPLACING/ FILLING				COMMENTS
Tremolite	40	Replaces plagioclase and olivine.				Fibrous when replacing olivine. Occurs as fine-grained mats in the groundmass.
Chlorite	20	Replaces olivine and plagioclase.				Commonly rims plagioclase and tremolite pseudomorphs. Rarely pseudomorphs olivine.
Magnetite	<3	Replaces olivine				Occurs in fractures in olivine. Also associated with tremolite.
VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	
Vein				Tremolite	Thin, irregular and discontinuous	

COMMENTS: Section is about 70% altered. Olivine displays undulose extinction and in one grain, has a well-developed subgrain. Plagioclase also has undulose extinction and deformation twins. Aggregates of tremolite (pseudomorphing olivine?) are rimmed with chlorite. Irregular patches of olivine are rimmed by tremolite and clinopyroxene.

147-895E-3R-2 (Piece 4, 40-45 cm)

OBSERVER: SHO

WHERE SAMPLED: Unit 20

ROCK NAME: Dunite

GRAIN SIZE: Medium (possibly)

TEXTURE: Equigranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	0	99	2		Rounded	Totally altered to serpentine, brucite, and magnetite.
Spinel	0.5	0.5	Up to 2	Cr# 0.6	Euhedral to subhedral	Color is brown. Partly altered to ferritchromite (or magnetite) which is associated with chlorite and brucite.
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Serpentine	93	Olivine				Mesh structure.
Brucite	5	Olivine				With magnetite. Brucite aggregates replacing olivine are dusty in appearance.
Magnetite	1	Olivine				Makes trails possibly tracing grain boundaries of primary olivine.
Ferritchromite	0.5	Spinel				With minute inclusions of chlorite (possibly).
VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles						
Veins	2		Up to 2	Brucite + magnetite.		With or without chlorite and serpentine.

COMMENTS: Alteration is complete except for some spinel grains. Brucite is very common both as veins and as pseudomorphs after olivine.

147-895E-4R-3 (Piece 1, 4-8 cm)

OBSERVER: LOR

WHERE SAMPLED: Unit 28

ROCK NAME: Gabbro

GRAIN SIZE: Medium-coarse

TEXTURE: Foliated

PRIMARY MINERALOGY PHENOCRYSTS	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	5	40	1-4		Anhedral	Almost completely altered to tremolite/chlorite. Undulose extinction and deformation twins are common.
Clinopyroxene	30	60	2-7		Anhedral	Altering to tremolite and secondary plagioclase. Undulose extinction is common. One large low-birefringence clinopyroxene has kink banding.
GROUNDMASS						
Apatite			1-2		Subhedral	Trace amounts.
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Prehnite	10	Replaces plagioclase and pyroxene.				Radiating habit. Occurs throughout section. Commonly surrounding clinopyroxene grains.
Zeolite	10	Replaces plagioclase and pyroxene.				Radial habit. Replaces plagioclase along grain boundaries and fractures. Replaces clinopyroxene along cleavage planes and grain boundaries.
Tremolite	25	Replaces plagioclase and pyroxene.				A pervasive, fine-grained, felty background alteration.
Chlorite	5	Replacing plagioclase and pyroxene.				Mixed in with tremolite.
Clay	5	Replaces plagioclase and pyroxene.				Alteration commonly along grain boundaries and fractures.
Clinopyroxene	10	Replaces clinopyroxene.				Clear grains which replace the brownish clinopyroxenes.
VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vein				Prehnite	Thin	Crosscuts large continuous pyroxene grain. Minor veinlets in groundmass.
Vein				Zeolite	Thin, discontinuous	Crosscut large pyroxene grain along cleavage planes. Also, as veinlets in matrix.
Vein				Tremolite	Sinuuous	Fibrous tremolite in a thin, wavy, continuous vein.

COMMENTS: The foliation is defined by elongation of plagioclase and clinopyroxene. Plagioclase displays extensive undulatory extinction and has deformation twins. Clinopyroxene occurs both deformed and undeformed; deformed grains are elongated and partially replaced by tremolite. Deformation is pre-syn metamorphism.

147-895E-6R-3 (Piece 5, 97-100 cm)

OBSERVER: SHO

WHERE SAMPLED: Unit 43

ROCK NAME: Dunite  
GRAIN SIZE: Medium to coarse  
TEXTURE: Equigranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	10	97	1 to 6		Rounded	Enriched with fluid inclusions or their relics.
Clinopyroxene	0	2	Up to 1		Anhedral	Interstitial to olivine.
Spinel	1	1	1	Cr# 0.6	Rounded (subhedral)	Color is brown.

  

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Serpentine	85	Olivine, clinopyroxene	With dusty magnetite.
Brucite	3	Olivine	As rounded aggregates or veins.
Clinopyroxene	1	Clinopyroxene	Acicular.
Magnetite	1	Olivine, clinopyroxene	Dusty, fine-grained.
Ferritchromite	Trace	Spinel	With chlorite.
Chlorite	Trace	Olivine	With altered spinel.

VESICLES/CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles						
Veins	3		0.5 thick	Serpentine, brucite, chlorite magnetite.		Anastomosing (network).

COMMENTS: Small amount of interstitial clinopyroxene (or less possibly plagioclase).

147-895E-7R-2 (Piece 10, 86-89 cm)

OBSERVER: JAY

WHERE SAMPLED: Unit 44

ROCK NAME: Harzburgite  
GRAIN SIZE: Medium to coarse  
TEXTURE: Porphyroclastic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	5	80	?		Anhedral	Pervasively serpentinized. Only a few percent fresh kernels in serpentine matrix. These kernels are subangular to subrounded.
Orthopyroxene	2	20	to 8		Rounded	Fractured and rounded crystals. Several appear to be elongated and imbricated.
Spinel	<1		1		Interstitial to subhedral	Deep red-brown, translucent crystals in diffuse stringers parallel to imbrication in orthopyroxene.

  

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Serpentine	73	Olivine	Mesh textured pale green to pale tan matrix.
Bastite	15	Orthopyroxene	Often have a crenulated appearance.
Amphibole	3	Orthopyroxene	In fractures and around margins of relict crystals.
Magnetite	2	Olivine	Microgranular aggregations in serpentine veinlets and in linear pods.

COMMENTS: Mode visually estimated. Pervasively serpentinized, total alteration greater than 90%. Rare rounded orthopyroxene relicts have distinct amphibole overprints that change porphyroclastic morphology to irregularly shaped patches that protrude into serpentine matrix.

147-895E-7R-4 (Piece 4, 46–50 cm) OBSERVER: PED WHERE SAMPLED: Unit 46  
 ROCK NAME: Harzburgite  
 GRAIN SIZE: Medium to coarse-grained  
 TEXTURE: Porphyroclastic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	15	80–85	to 10 mm		Anhedral granular	Replaced by serpentine and magnetite which form a mesh texture with relict olivine in cores.
Orthopyroxene	Trace	10–15	to 6 mm		Anhedral	Almost totally replaced by tremolite.
Clinopyroxene	Trace	Trace	to 1 m		Anhedral	Locally as small grains that are intergrown with spinel.
Spinel	1–2	to 1mm			Anhedral, locally skeletal	Red-brown translucent with opaque rims of ferritchromite. Some grains contain inclusions of olivine (now totally altered). Locally fractured and fractures are filled with serpentine.
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Serpentine	70	Olivine, orthopyroxene				Several generations: (1) together with magnetite in mesh textured replacement after olivine; (2) as fibrous filling of a 1mm thick vein
Tremolite	15	Orthopyroxene				
Brucite	Trace	Olivine				Replacing olivine or in veins.
Magnetite	1-2	Olivine				
Ferritchromite	Trace	Spinel				As opaque rims around translucent spinel grains.
VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Veins	<1		1 mm	Fibrous serpentine		
Veins	<1		to 0.2 mm	Serpentine and brucite		Crosscut serpentine veins.

147-895E-8R-1 (Piece 12B, 129–132 cm) OBSERVER: CL WHERE SAMPLED: Unit 51  
 ROCK NAME: Dunite  
 GRAIN SIZE: Fine-medium  
 TEXTURE: Mesh

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	1	99	0.5–1			
Cr-spinel	0.5	1	0.05–0.3		Anhedral to subhedral	
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Chlorite	1–3	Olivine				Small patches associated with spinels.
Serpentine	79	Olivine				
Magnetite	5	Olivine				
Ferric oxides	1	Olivine				
Fe-rich opaque	0.5	Cr-spinel				Magnetite and ferritchromite.
Brucite	9–10	Olivine				
VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	
Vesicles						

COMMENTS: Dense network of 0.05 mm wide veins filled with serpentine and a central part of magnetite grains closely associated to fibrous or platy brucite. A first generation of wider veins (0.5–1 mm in width) are filled with antigorite along the rims and chrysotile along the cores.

147-895E-8R-3 (Piece 3, 47–50 cm) OBSERVER: JAY WHERE SAMPLED: Unit 53  
 ROCK NAME: Dunite  
 GRAIN SIZE: Medium?  
 TEXTURE: Mesh

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Olivine	1	99	?		Anhedral?	Completely replaced by serpentine. Traces of fine granules that are partially altered.
Spinel	0.5	1	to 1.5		Anhedral	Alteration to magnetite? particularly round margins. Fractured. Some deep brown, translucent spinel left.
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Serpentine	93	Olivine				Chrysotile on margins of tiny relict olivine fragments. Mainly lizardite throughout.
Magnetite	5	Olivine, spinel				Microgranular stringers along mesh-textured veinlets and as minor accumulations. Intergrown with spinel.

COMMENTS: Almost completely serpentinized dunite with sparse interstitial spinel. Mesh texture defined by magnetite stringers.

147-895F-2R-1 (Piece 15, 124-129 cm)

OBSERVER: JAY

WHERE SAMPLED: Unit 1

ROCK NAME: Harzburgite

GRAIN SIZE: Medium

TEXTURE: Porphyroclastic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	5.8	82.3	?		Anhedral	Small kernels in diffuse clusters in serpentine matrix.
Orthopyroxene	0.2	17.1	to 4		Rounded	Broken and nearly completely altered crystals.
Spinel		0.6	1		Interstitial	Dark brown, translucent spinel intergrown with opaque magnetite.
Sulfide minerals		0.1	0.1		Subangular and fractured	Predominantly pyrite with sparse chalcopyrite.
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Serpentine	74.3	Olivine				In mesh-textured matrix, low relief, very light green to pale tan.
Bastite	10.5	Orthopyroxene				Pseudomorphs orthopyroxene with low relief and birefringence.
Amphibole	4.9	Orthopyroxene				Tends to reshape crystals to very irregular habit.
Magnetite	2.2	Olivine				Orange-yellow birefringence, and higher relief than bastite. Tends to occur along crystal margins and in fractures.
Talc	1.5	Orthopyroxene, olivine				Microgranular. In aggregates and diffuse stringers in serpentine.
						Primarily filling microcracks and intergrown with amphibole, with high birefringence and micaceous extinction.
VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	
Veins	Low	Random	<1mm	Talc, chlorite, amphibole	Irregular	

COMMENTS: Mode point counted. 1359 points, 0.5 mm counting interval. On small section. Olivine occurs in optically continuous clusters up to 2.5 mm across, but so few kernels left in any cluster it is difficult to establish original grain size. Orthopyroxene is altered to primarily bastite with lesser amphibole and talc along margins in microfractures. Amphibole overgrowths impart irregular shape to previously subrounded orthopyroxene pseudomorphs which interdigitate with surrounding serpentine matrix.