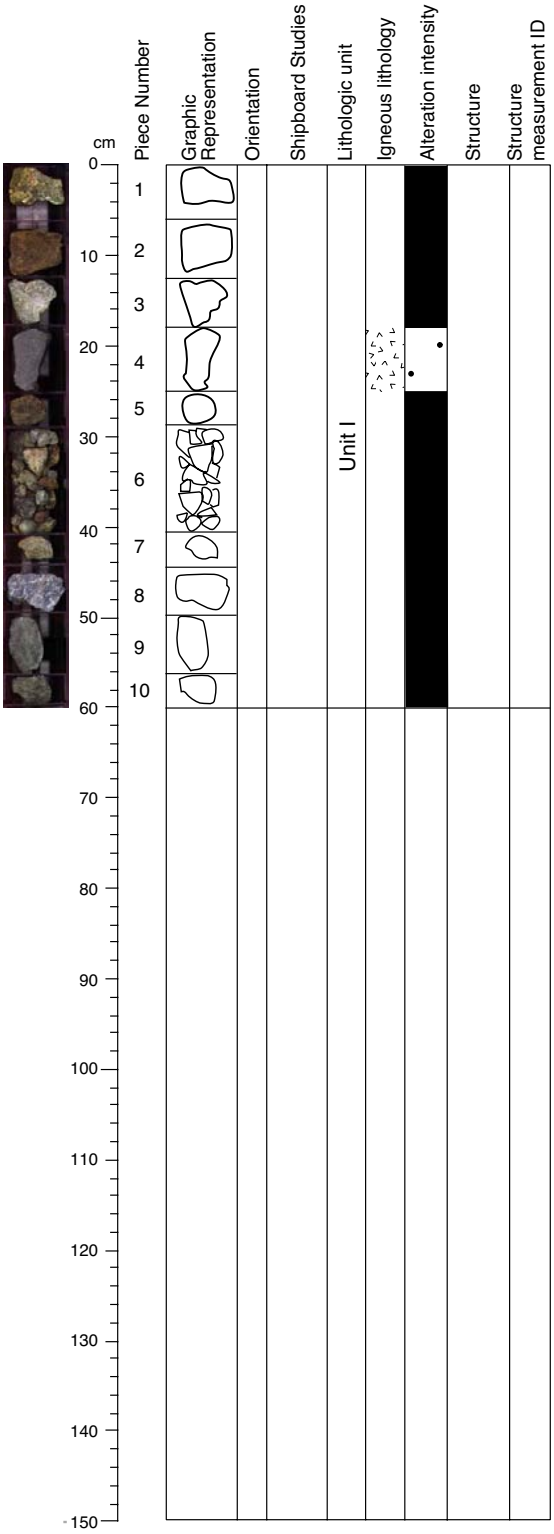
Core Photo



209-1268A-1R-1 (Section top: 0.00 mbsf)

UNIT-I: Harzburgite and Dunite

Pieces 1–10

COLOR: Variable

PRIMARY MINERALOGY:

Olivine	Mode 80%
Orthopyroxene	Mode 20%
	Size 1–6 mm
	Shape/Habit Anhedral
Spinel	Mode <1%

COMMENTS: Core recovery in this section was poor and the diversity of material recovered suggests that rocks drilled were not bedrock. Pieces 1-3, 5-6, 8-9 are altered Harzburgite with a protogranular texture. Piece 7 probably was a similar Harzburgite but has been converted to talc and so appears distinct. Piece 4 is a relatively fresh aphyric basalt.

SECONDARY MINERALOGY:

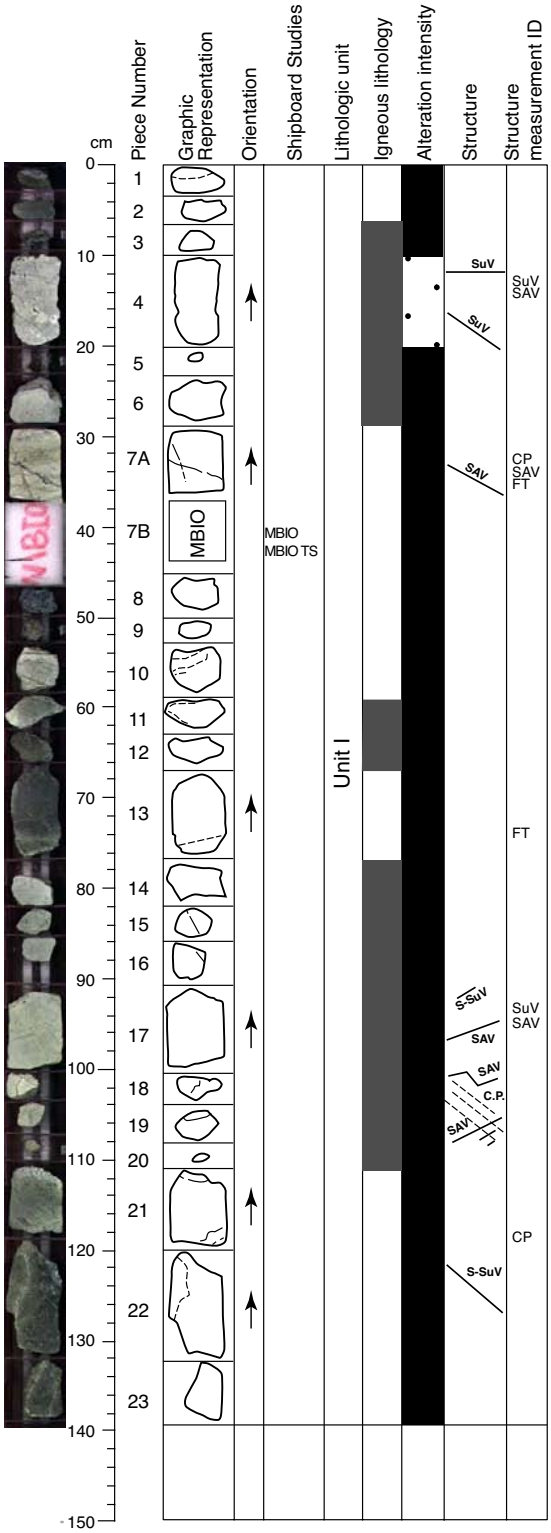
COMMENTS: This section consists mainly of completely altered pebbles of serpentinized Harzburgite with variable mineral assemblages replacing the primary phases. Relict olivine in Pieces 2 and 5 is highly clay altered. Pieces 3, 6, 7 and 8 may be described as talc-rich 'soapstones' whereas alteration of Pieces 2 and 5 appears to be clay dominated. Pieces 1, 9 and 10 are serpentine-rich. An exception is Piece 4, which is a slightly altered basalt. Serpentine-sulfide veins are present in Pieces 1, 9, and 10, however sulfide in piece 1 is oxidized

VEIN ALTERATION: Piece 1 is a jigsaw breccia with a vein network consisting of talc and oxidized sulfides. In Piece 3, a talc-rich soapstone, there is a ca. 1-cm wide zone with en echelon sigmoidal veinlets filled with crosscutting fibers of talc. Pieces 9 and 10 have early serpentine-magnetite veins cut by later talc-sulfide veins, which have a well developed, 1 to 2 cm wide halo.

STRUCTURE:

Mixed assemblage of unoriented pieces or pebbles of serpentinized Harzburgite with very weak (most samples) to strong crystal plastic deformation textures and foliations (e.g., Piece 2) Most Harzburgite have protogranular textures. Pieces 1 and 2 have undergone moderate cataclastic deformation. Piece 4 is a basalt or diabase and shows no deformation. No orientations are possible in the core.

Core Photo



209-1268A-2R-1 (Section top: 14.00 mbsf)

UNIT-I: Harzburgite and Dunite

Pieces 1–23

COLOR: Green to gray

PRIMARY MINERALOGY:

Olivine	Mode 80%–95%
Orthopyroxene	Mode 5–20%
	Size 1–7 mm
	Shape/Habit Anhedral
Spinel	Mode <1%

COMMENTS: Altered Harzburgite and Dunite alternate in this core with harzburgite representing the bulk of the material. Pieces 3-6, 11-12, and 14-20 are interpreted as altered dunite although alteration has completely obscured the original fabric. The surrounding harzburgite has also been completely converted to talc and serpentine but the original protogranular texture and grain size of the orthopyroxene is preserved.

SECONDARY MINERALOGY:

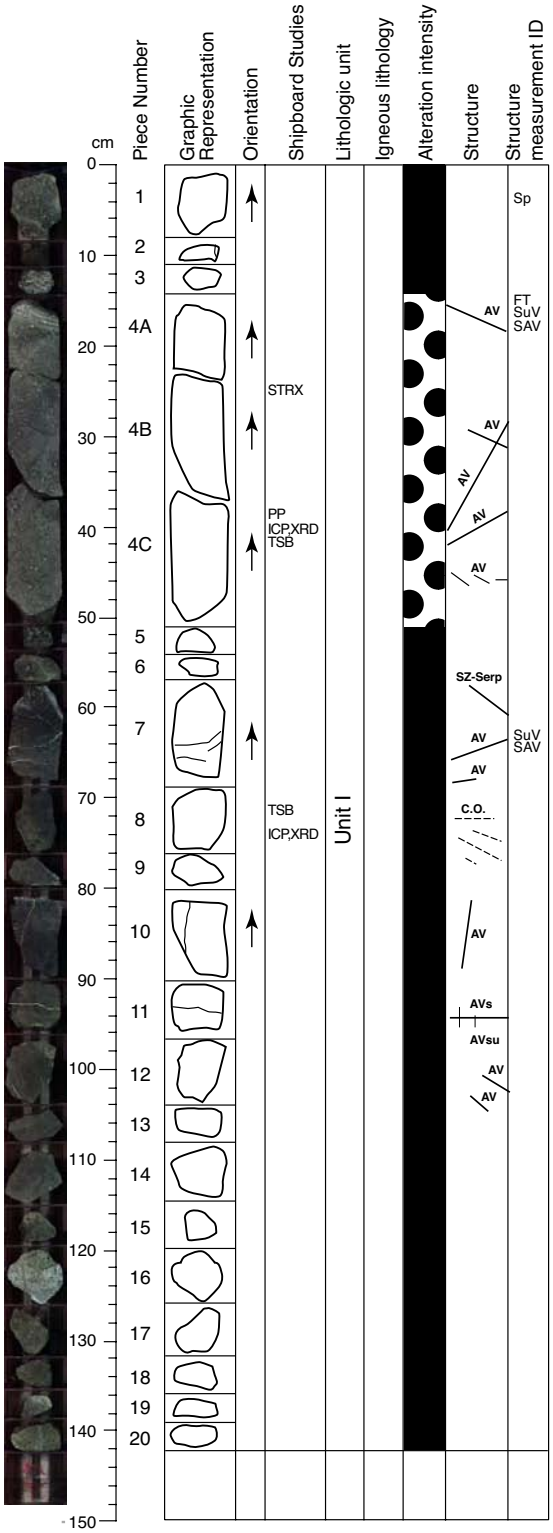
COMMENTS: The section consists of a sequence of completely serpentinized dunite and harzburgite. Traces of disseminated oxides and sulfides are common. In thin section (Piece 7) a substantial proportion of the serpentine (ca. 50 %) is replaced by fine grained aggregates of talc (+clays?). A relict mesh texture is overprinted by a network of talc veinlets. Traces of hematite, sulfide and magnetite are also present.

VEIN ALTERATION: This section consists mainly of serpentine veins and minor talc and sulfide-rich veins. Veining is especially prominent in Pieces 4, 7A, 10, 11, and 21 in the light greenish serpentinized harzburgite in which mainly serpentine veins occur.

THIN SECTIONS: Sample 1268A-2R-1, 44-46 cm

STRUCTURE
Textures defined in serpentinized Harzburgite (Pieces 1,2,3, 4, and 22) show weak porphyroclastic to protogranular textures. Crystal-plastic foliations can be observed in Piece 22 defined by the preferred-dimensional orientation of pyroxene. Serpentinized dunites lack deformation indicators except for a single spinel rich shear zone in Piece 17. Narrow subhorizontal zones of talc-rich cataclastic breccia are present in Pieces 7, 18, and 19. Serpentine-talc and sulfide veins are present in most pieces. Crosscutting relationships in serpentine-talc alteration veins (SAV), serpentine-talc–sulfide composite veins (S-SuV), and sulfide veins (SuV) are present in Pieces 4, 7, 10, 11, 21, and 22, and show at least two distinct generations of SAV in individual pieces (e.g., SAV1 and SAV2 in Piece 7). All veins in the section are post-kinematic with respect to the crystal-plastic foliations. Crosscutting relationships demonstrate Cp>SAV1> SAV2>S-SuV >SuV.

Core Photo



209-1268A-2R-2 (Section top: 15.4 mbsf)

UNIT-I: Harzburgite and Dunite

Pieces 1–20

COLOR: Green to gray

PRIMARY MINERALOGY:

Olivine	Mode 85%
Orthopyroxene	Mode 10%
	Size 1–7 mm
	Shape/Habit Subequant
Spinel	Mode 3%

COMMENTS: This section consists of altered harzburgites with protogranular to porphyroclastic texture. The top of Piece 3A is sheared and completely recrystallized harzburgite. Pieces 12, 13, 22, and 23 are strained such that the orthopyroxene occurs as porphyroclasts.

SECONDARY MINERALOGY:
COMMENTS: The section consists of very highly to completely serpentinized harzburgite. Pieces 1 to 6 locally contain minor relict olivine (<2%). Pieces 6 to 15 have notable amounts of magnetite and sulfide in mesh rims. Orthopyroxene pseudomorphs with bastite kernels are common. Piece 16 is the first occurrence of the "vuggy talc alteration" in Hole 1268A. This alteration is characterized by a gray soft, talc-rich groundmass ("soapy" aspect) spotted with ghosts of orthopyroxene. These ghosts are usually vuggy and consist primarily of talc, as indicated by aggregates of interpenetrating blades of white talc that are preserved in places.

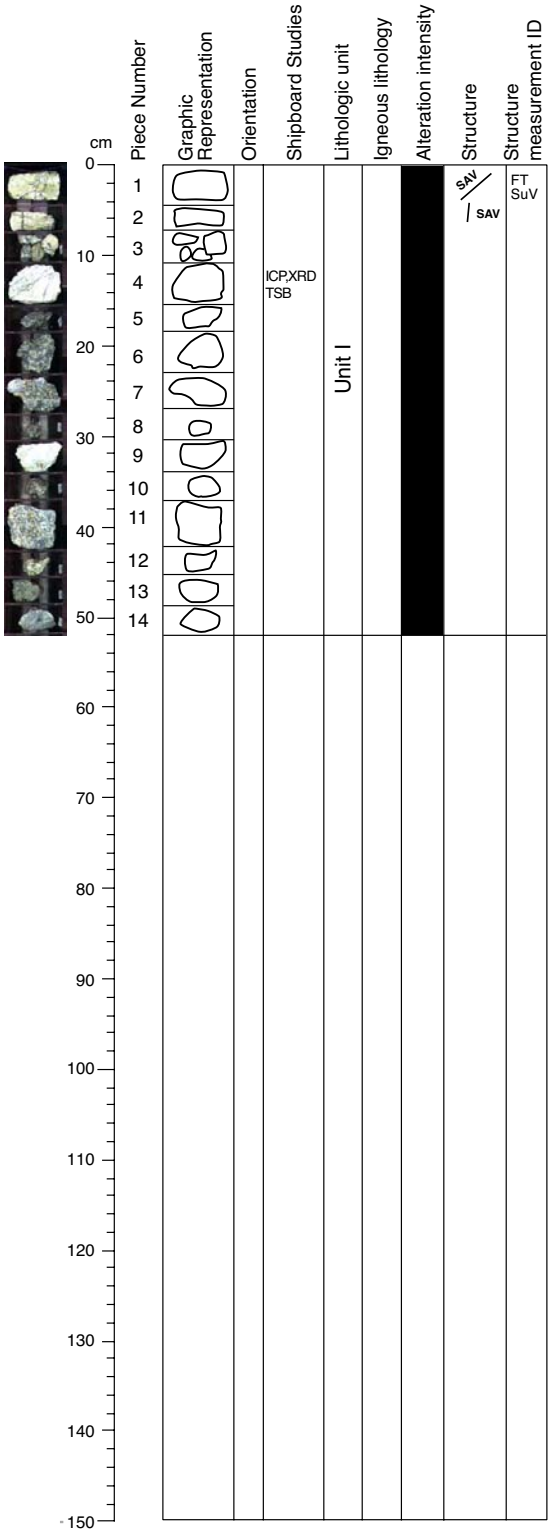
A thin section from Piece 4 shows that the primary phases are replaced by serpentine (>90%) and minor talc (<10%). Traces of magnetite, pyrite, hematite and green amphibole are also present. A XRD analysis of the same piece confirms that the rock consists dominantly of serpentine (lizardite) with minor amounts of talc and magnetite. In a thin section from Piece 8 some of the serpentine is replaced by talc.

VEIN ALTERATION: The section is extensively veined comprising up to 4 generations of veins with varying frequency. Two vein types are present throughout most of the core (Pieces 7, 11, 12, 14, and 17-20). White, sigmoidal serpentine veins are common within these pieces which are crosscut by a network of sulfide veins (pyrite/marcasite) with up to 35% hematite. This anastamosing network is also present within the haloes of the veins observed in Pieces 1 and 6, which are composed of talc and serpentine respectively. Structures interpreted to be transitional between veining and intensive background network textures are present in Pieces 4A and 4B. Mineralogically they comprise 50% iron oxides and 50% sulfide, which appear identical to the composition of the background alteration in these pieces.

THIN SECTIONS: Samples 1268A-2R-2, 40-43 cm and 1268A-2R-2, 70-73 cm

STRUCTURE:
Most samples appear to have protogranular textures and show no visible crystal-plastic foliation. There is no significant brittle deformation in this section. Weak crystal-plastic (CP) deformed porphyroclastic harzburgites are observed in some pieces (e.g., 1, 10, 14, 15, and 17). The CP foliation is defined by the preferred-dimensional orientation of pyroxene. Crosscutting alteration vein relations are present in Pieces 3, 4, 7, 9, 10, 11, 12, 13, and 14. They indicate that there are several generations of veins including at least two generations of serpentine-talc alteration veins (SAV1 and SAV2) and later generations of composite serpentine-talc alteration veins and sulfide veins (S-SuV) and later thin sulfide veins (SuV). Many of the SAV show the development of cross-fibered serpentine indicating the dilational extension direction. All of the veins are post-kinematic with respect to the CP foliations. A serpentine "brittle" shear zone is present at the top of Piece 7. Crosscutting relationships demonstrate Cp>SAV1> SAV2>S-SuV >SuV.

Core Photo



209-1268A-2R-3 (Section top: 16.83 mbsf)

UNIT-I: Harzburgite and Dunite

Pieces 1–14

COLOR: Green to gray

PRIMARY MINERALOGY:

Olivine	Mode 80%
Orthopyroxene	Mode 20%
	Size 1–10 mm
	Shape/Habit Anhedral
Spinel	Mode 1%–2%

COMMENTS: This highly broken-up section of core is composed of variably altered harzburgite with a protogranular texture. In thin section spinel locally poikiolitically encloses olivine.

SECONDARY MINERALOGY:

COMMENTS: Pieces 1 to 3 consist of completely serpentinized dunites. Pieces 4 to 14 are overprinted by vuggy talc alteration. The vuggy appearance is due to preferential dissolution (or plucking) of orthopyroxene alteration products leaving behind white orthopyroxene ghosts that may have some relict talc forming interpenetrating plates. Where areas of vuggy talc alteration are present the former serpentine alteration is completely overprinted.

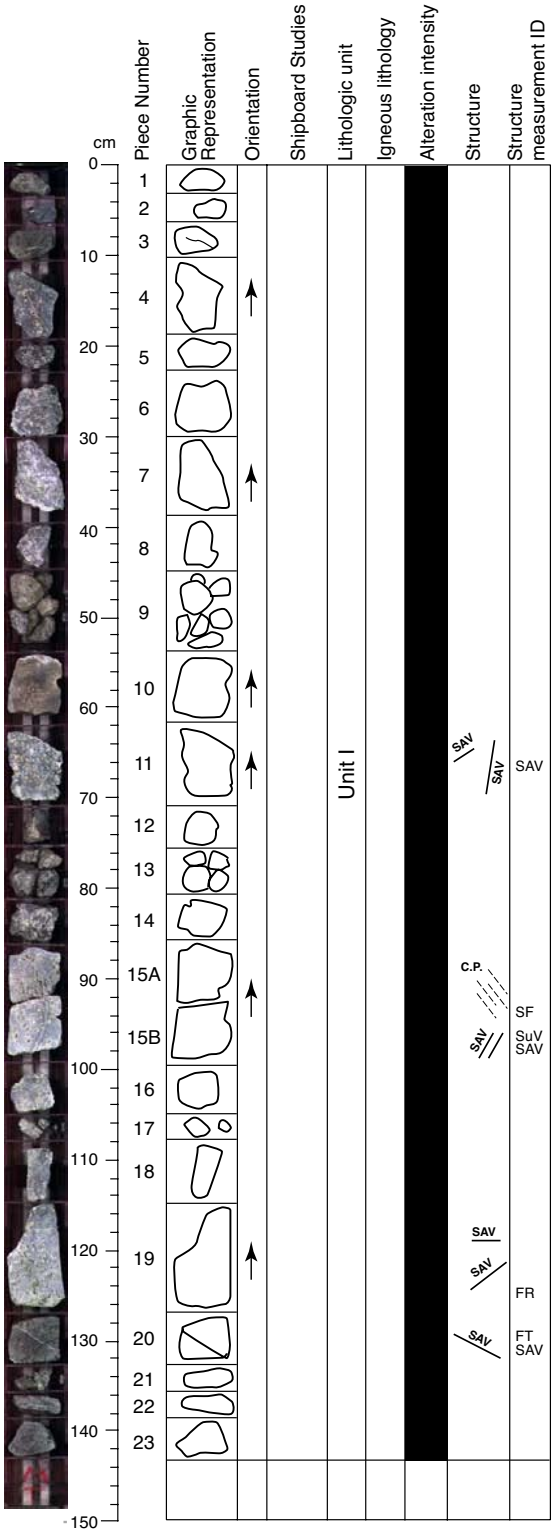
VEIN ALTERATION: Iron oxide/serpentine veins mostly occur in serpentinized dunites. They are occasionally cut by massive talc veins with disseminated sulfides (e.g., Piece 1). Serpentine and talc veins without sulfides occur in the vuggy talc alteration (VTA).

THIN SECTIONS: 1Sample 1268A-2R-3, 11-13 cm

STRUCTURE:

Harzburgite ranging from undeformed protointergranular harzburgite to weakly crystal-plastic (CP) foliated porphyroclastic harzburgite. The CP foliation is defined by the preferred-dimensional orientation of pyroxene. Dunite to lack of crystal-plastic deformation indicators. The only brittle deformation present in this section is fine anastomosing shear fractures within a narrow zone of Piece 1. Crosscutting alteration vein relations are present in Pieces 1, 2 and 4 and consist of at least two generations of serpentine-talc veins (SAV1 and SAV2) and thin sulfide veins. All of the veins are postkinematic with respect to the CP deformations. Crosscutting relationships demonstrate Cp>SAV1>SAV2>SuV.

Core Photo



209-1268A-3R-1 (Section top: 20.20 mbsf)

UNIT-I: Harzburgite and Dunite

Pieces 1–23

COLOR: Green to gray

PRIMARY MINERALOGY:

Olivine	Mode 80%–85%
Orthopyroxene	Mode 10%–20%
	Size 1–3 mm
	Shape/Habit Anhedral
Spinel	Mode 1%–2%

COMMENTS: This core is composed of variably altered harzburgite with a protogranular texture. Porphyroclastic textures are developed in Pieces 1 to 3.

SECONDARY MINERALOGY:

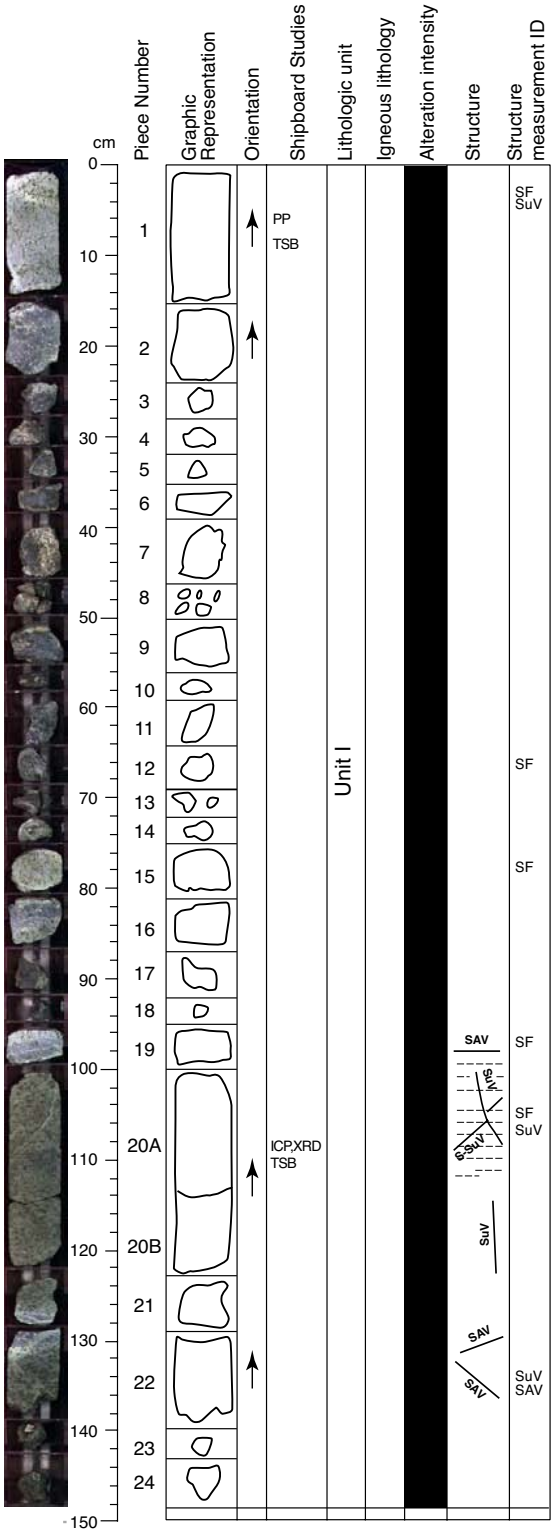
COMMENTS: This section comprises green serpentinites (Pieces 1 to 3 and 19 to 23) and gray, vuggy, talc altered harzburgite with talc and sulfide veins (Pieces 5 to 9 and 11 to 19). Piece 15 and the top of Piece 16 marks a transition between serpentinized and vuggy talc alteration with serpentine-chlorite pseudomorphs after orthopyroxene in a talc-serpentine groundmass. vuggy talc alteration in Pieces 5 to 9, 11, and 14 show dissolved talc pseudomorphs after orthopyroxene. Piece 10 is a gray serpentinite with patchy development of talc + sulfide and dark green serpentine veins.

VEIN ALTERATION: Talc-sulfide veins are common in this section. Prominent halos along such veins are developed in Pieces 7 and 15. Serpentine veins are more common in the lower part of the section and locally are clearly overprinted by talc-sulfide veins (Piece 19). Piece 21 contains a ca. 1-cm wide, exceptionally complex vein, which consists mainly of massive talc, and black, stubby to elongated crystals pseudomorphed by serpentine and magnetite.

STRUCTURE:

Moderately to weakly crystal-plastic deformed protointergranular (e.g., Pieces 10, 16, and 18) to porphyroclastic (e.g., Pieces 4, 6, 7, 8, 15, 19, and 20) harzburgite with deformation intensity varying throughout the section. Large cross-fibered serpentine-talc veins (SAV) common in Pieces 6, 11, 20 and 21. Typically these veins are cut by later sulfide veins (SuV). Crosscutting alteration vein relations are present in Pieces 4, 6,7, 15, 16,19, and 20. Sinistral, normal offset of serpentine veins in Piece 22. Strong fracturing and incipient brecciation (cataclasis-CC) in Pieces 10, 20, and 21 occurred during greenschist-grade alteration based on fracture filling metamorphic phases. All of the veins are postkinematic with respect to the CP deformations. Crosscutting relationships demonstrate Cp>SAV1>SuV>CC.

Core Photo



209-1268A-3R-2 (Section top: 21.63 mbsf)

UNIT-I: Harzburgite and Dunite

Pieces 1–24

COLOR: Green to gray

PRIMARY MINERALOGY:

Olivine	Mode 75%–80%
Orthopyroxene	Mode 15%–20%
	Size 2–6 mm
	Shape/Habit Anhedral
Clinopyroxene	Mode <2% (as observed in thin section)
Spinel	Mode 1%-2%

COMMENTS: The upper portion of the core is composed of variably altered harzburgite with a protogranular texture. Porphyroclastic textures are partially developed in Piece 19. The rest of the section consists of harzburgite with a well developed porphyroclastic texture. Pieces 20 and 21 contain small amounts of altered clinopyroxene so they are classified as harzburgite/lherzolite indicating that they are less depleted than the rest of the core and may be lherzolites sensu stricto. In two thin sections (Samples 1268A-3R-2, 7-10 cm and 1268A-3R-2, 109-112 cm) clinopyroxene is present at orthopyroxene subgrain boundaries or interstitial with spinel, with a modal composition as high as 2%.

SECONDARY MINERALOGY:

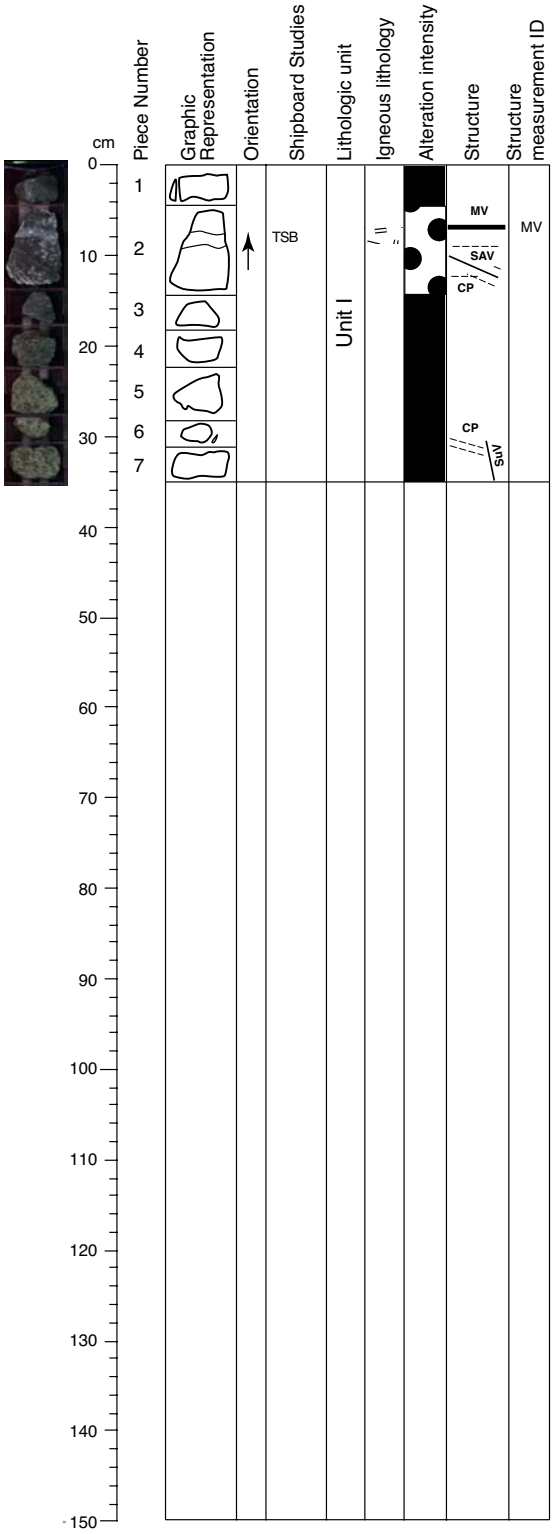
COMMENTS: Serpentinites in this section are variably overprinted by vuggy talc alteration. Pieces 5 to 9 appear metasomatized with patchy development of white and brown pseudomorphs after pyroxene. Thin sections of Pieces 1 and 20A show extensive (about 70%) replacement of serpentine by talc and minor amounts of amphibole (after orthopyroxene), magnetite, pyrite and hematite (disseminated in the rock).

VEIN ALTERATION: The core has two distinctive generations of veins, each associated with a characteristic style of background alteration. Talc/chlorite alteration hosts veins with pyrite cores and iron oxide rims within a talc matrix. These are occasionally crosscut by talc veins containing disseminated pyrite (e.g., Piece 20A). When veins hosted by talc/chlorite alteration approach areas of vuggy talc alteration (VTA) the pyrite/hematite mineralogy is no longer apparent (e.g., Piece 19A). Veins within areas of VTA, when well developed, are parallel to the orientation of the background alteration (e.g., Piece 19A), and are dominated by serpentine and talc and contain no sulfide.

THIN SECTIONS: Samples 1268A-3R-2, 7-10 cm and 1268A-3R-2, 109-112 cm

STRUCTURE:
Weakly to moderately strong porphyroclastic harzburgite (e.g., Pieces 19, 20, 21, and 22) with local protointergranular intervals (e.g., Pieces 1, 2, 15, and 16). There is strong shear fracturing and incipient brecciation parallel to cross-fiber serpentinization foliation in Piece 12. Crosscutting serpentine-talc (SAV), serpentine-talc-sulfide composite veins (S-SuV) and sulfide veins (SuV) with crosscutting relationships are present in Pieces 12, 14, 19, 20, 21, and 22. All of the veins are post-kinematic with respect to the CP deformation. Crosscutting relationships demonstrate Cp> SAV2>S-SuV >SuV ~CC.

Core Photo



209-1268A-3R-3 (Section top: 23.13 mbsf)

UNIT-I: Harzburgite and Dunite

Pieces 1–7

COLOR: Green to gray

PRIMARY MINERALOGY:

Olivine	Mode 80%
Orthopyroxene	Mode 20%
	Size 3–6 mm
	Shape/Habit Anhedral
Clinopyroxene	Mode <1.5% (as observed in thin section)
	Size 1–2 mm
	Shape/Habit Anhedral
Spinel	Mode 2%

COMMENTS: This core is composed of variably altered harzburgite with a granular to porphyroclastic texture. Plagioclase-pyroxene-olivine dike (1 cm thick) in Piece 2 (7 cm). Piece 2 contains ~2% modal altered clinopyroxene and so is classified as harzburgite/lherzolite indicating that it is less depleted than the rest of the core and may be lherzolites sensu stricto. The clinopyroxene in this piece is not uniformly distributed and may represent relict layering or later melt impregnation. In thin section (Sample 1268A-3R-3, 6-9 cm) clinopyroxene is at grain boundaries of recrystallized orthopyroxene and olivine.

SECONDARY MINERALOGY:

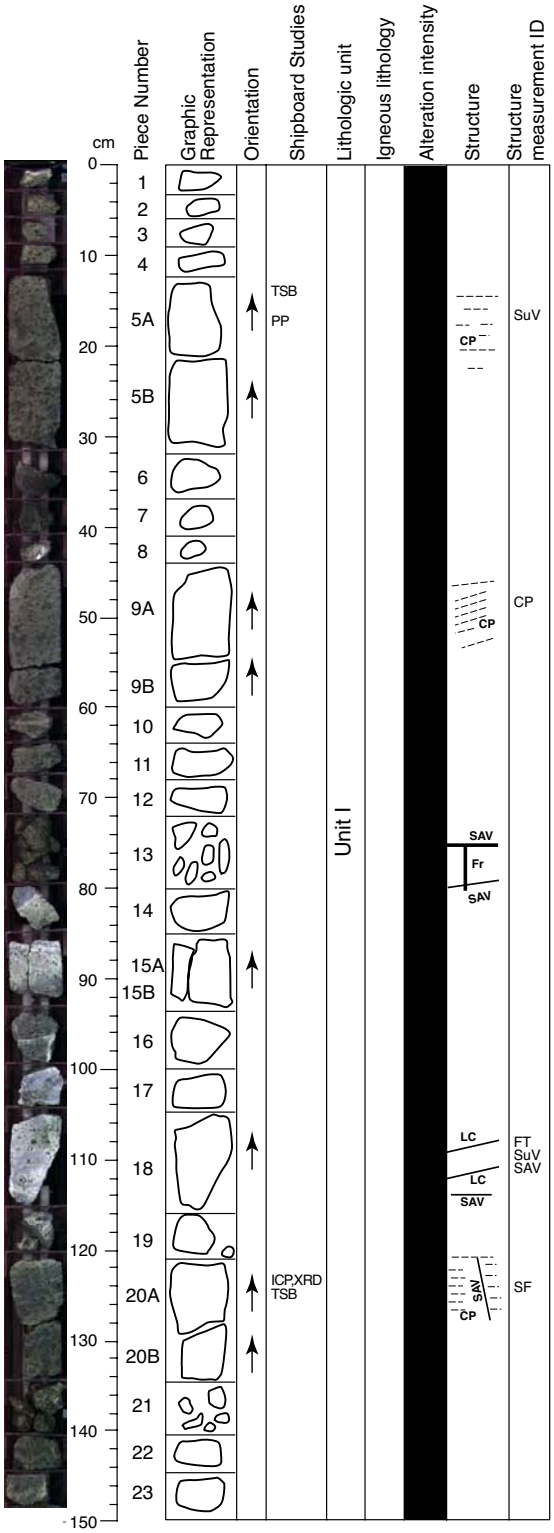
COMMENTS: Piece 2 contains a very highly altered plastically deformed amphibolite bordered by incompletely (ca. 60%) serpentinized harzburgite with relict olivine and abundant protogranular orthopyroxene. Piece 2 also contains a highly altered gabbro veinlet, in which plagioclase is completely altered, probably to hydrogarnet and prehnite. Pieces 3 to 7 are green, completely serpentinized harzburgite.

VEIN ALTERATION: The core is dominated by styles of veining found in talc/chlorite background alteration elsewhere in Core 1268-3R with the exception of Piece 2 which is much less altered and exhibits a different style of veining. Two styles of veining are consistently present throughout the talc/chlorite background alteration. The first generation of veins comprises pyrite (possibly marcasite) cores with subsidiary hematite rims. Their red color is clearly visible against the green background alteration. The second generation, a talc rich vein type, has only small amounts of disseminated pyrite and hematite. However, the modal % of pyrite increases dramatically when these transgranular veins crosscut orthopyroxene veins. Within Piece 2, which appears much less altered than the rest of this section, veining is predominated by massive bands of light and dark serpentine. A prominent halo of pyrite, which pseudomorphs the background mesh texture alteration, is also evident in Piece 2.

THIN SECTIONS: Sample 1268A-3R-3, 6-9 cm

STRUCTURE:
Porphyroclastic harzburgite has a weak to moderate crystal-plastic foliation inclined in the cut face of the core by ~30°. There is no significant brittle deformation in this section. A pyroxenite magmatic vein (PMV) cuts Piece 2 and appears horizontal in the cut face of the core. Alteration veins (serpentine-talc and sulfide vein) show limited crosscutting relationships in Pieces 2, and 4-7. All of the veins are post-kinematic with respect to the CP foliations. Crosscutting relationships demonstrate only Cp>Mv, Cp>SAV, Cp>SuV.

Core Photo



209-1268A-4R-1 (Section top: 24.80 mbsf)

UNIT-I: Harzburgite and Dunite

Pieces 1–23

COLOR: Green

PRIMARY MINERALOGY:

Olivine	Mode 70%–85%
Orthopyroxene	Mode 15%–30%
	Size 1-10 mm
	Shape/Habit Anhedral
Spinel	Mode 1%–2%

COMMENTS: This core is composed of variably altered harzburgite with a texture that in most of the core is porphyroclastic with an interval (in Pieces 14-19) where the harzburgite is protogranular. Pieces 1 and 2 are strongly sheared and all primary igneous features destroyed. Pieces 3-13 and 20-23 contain much more orthopyroxene than do Pieces 14-19.

SECONDARY MINERALOGY:

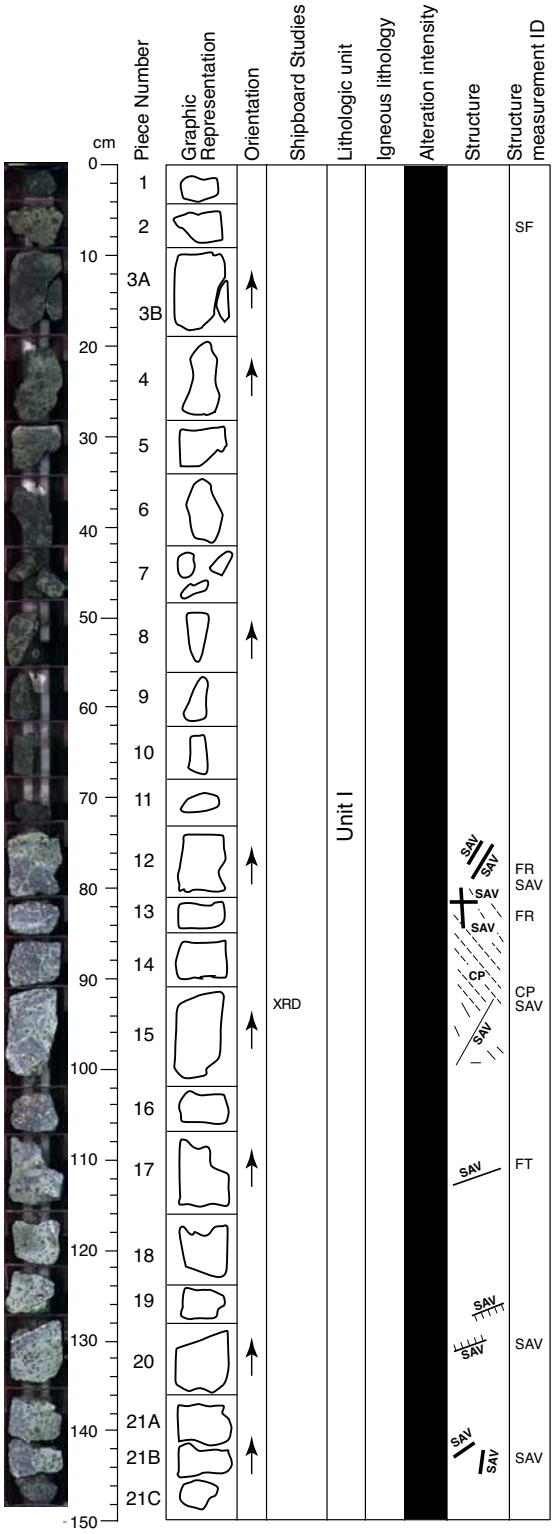
COMMENTS: This section is dominated by green serpentinite, which locally contains up to 1% disseminate pyrite (Piece 5) associated with hematite. Orthopyroxene is pseudomorphed by bastite in the centers and presumed chlorite and amphibole in the rims yielding dark green coronas. Thins sections from Pieces 5A and 20A reveal that these dark coronas are green serpentine. Pieces 14, 17, and 18 are partly to completely overprinted by vuggy talc alteration.

VEIN ALTERATION: Veining throughout the section is complex with certain vein types more dominant than others. Sulfide (pyrite/marcasite) and iron oxide rich veins occur throughout the section regardless of background alteration style (Pieces 3-7, 10-13, and 18-23). Talc becomes more abundant close to areas of vuggy talc alteration (VTA). The connectivity of the sulfide/iron oxide network also becomes less cohesive near to areas of VTA especially in the area of Pieces 21 to 23. White and green talc veins with up to 20% of disseminated sulfide (Piece 20) are also present throughout the length of the section.

THIN SECTIONS: Samples 1268A-4R-1, 12-15 cm and 1268A-4R-1, 124-127 cm

STRUCTURE:
Porphyroclastic harzburgite with a weak crystal-plastic foliation in Pieces 5, 6, 9, 20. The foliation is subhorizontal to gently inclined in the cut face of vertically oriented core pieces. Other intervals with weakly crystal-plastic deformed protointergranular harzburgite occur in Pieces 14-18. Piece 18 shows modal variation from harzburgite at the top to an enstatite-bearing dunite and back to harzburgite. The upper and lower lithologic contacts (LC) of the gently inclined dunite band are indicated. Strong sub-horizontal shear fracturing in the top 1 cm of Piece 15 is associated with serpentine-talc alteration. Sub-parallel massive sulfide veins and thin crosscutting hematized sulfide veins (SuV) occur in Piece 2. Serpentine-talc (SAV) alteration vein crosscutting relationships are present in Pieces 9, 15, 16, 18, and 20 and obvious sulfide veins occur in Pieces 2, 5, and 12. A large gently inclined cross-fibered serpentine vein occurs in Piece 15. Unfilled steep fractures occur in Pieces 11 and 15, but show no shear displacements. All of the veins are post-kinematic with respect to the CP foliations. Crosscutting relationships demonstrate Cp>SAV~CC and Cp>SuV.

Core Photo



209-1268A-4R-2 (Section top: 26.29 mbsf)

UNIT-I: Harzburgite and Dunite

Pieces 1–21

COLOR: Green

PRIMARY MINERALOGY:

Olivine	Mode 75%–82%
Orthopyroxene	Mode 15%–24%
	Size 0.1–10 mm
	Shape/Habit Subequant
Spinel	Mode 1%–2%

COMMENTS: The upper half of this core (Pieces 1-11) is composed of altered Harzburgite with a porphyroclastic texture while the lower half (Pieces 12-21) has a protogranular texture.

SECONDARY MINERALOGY:

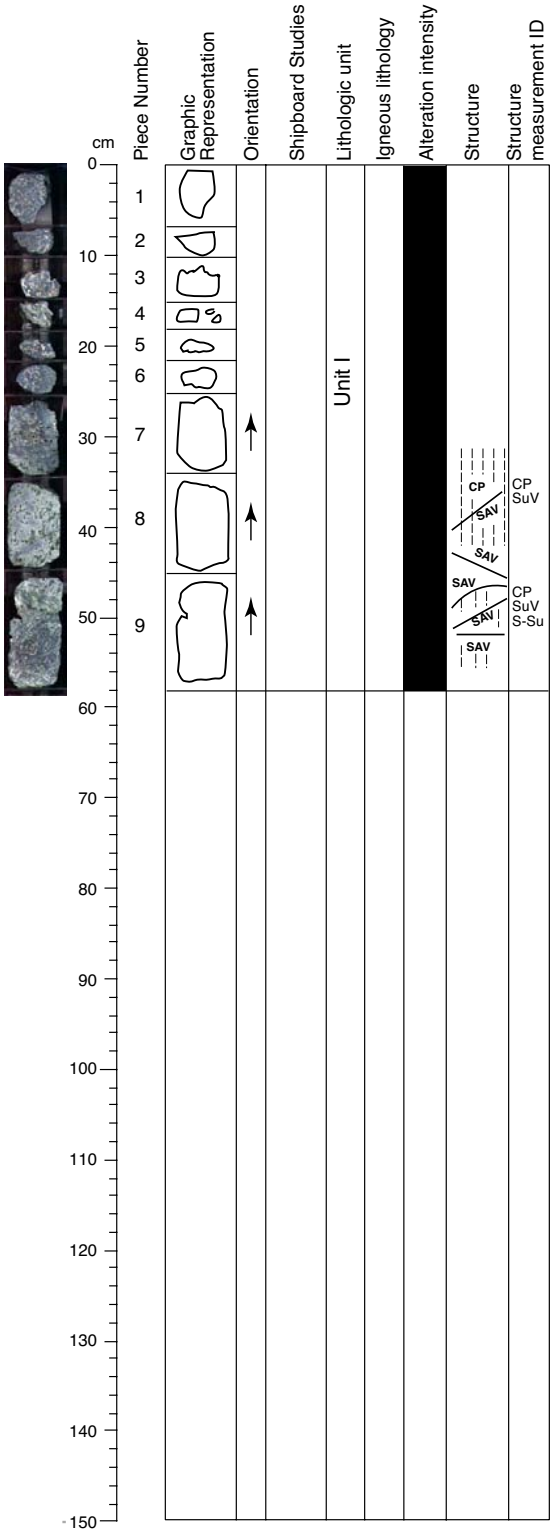
COMMENTS: Pieces 1 to 11 are green, completely serpentinized harzburgites. Pieces 12 to 21 are variably overprinted by vuggy talc alteration. In contrast to vuggy talc alteration in Core 1268A-3R, plucking/dissolution of orthopyroxene alteration products is less pronounced and serpentine replaces orthopyroxene along with talc.

VEIN ALTERATION: The distribution of the dominant vein types in the section is closely associated with the type of background alteration. The areas comprising green serpentinized harzburgite (Pieces 1-10) host sulfide (probably pyrite/marcasite) and iron oxide veins (up to 100% combined modal %) with varying degrees of talc. In areas where the background alteration style is transitional between greenish serpentinized harzburgite and vuggy talc alteration (VTA) serpentine veins oblique to the fabric of VTA are present (Piece 15). They become sub-parallel to the VTA margins as the veins become better developed. Talc-rich veins with as much as 20% disseminated sulfide are present throughout the section (Pieces 5, 12, 13, 14, and 18-21B) and crosscut both the green serpentinized harzburgite background texture and the VTA. Dark green serpentine veins with cross-fibers are present in Pieces 17 and 21B.

STRUCTURE:

Weak crystal-plastic (CP) deformation with protointergranular-textured harzburgite throughout the section. Two generations of serpentine-talc alteration veins (SAV) are in Piece 13. Prominent steeply to gently inclined SAV occur in Pieces 12, 13, 14, 15,17, 19, 20, and 21. The large gently and similarly inclined portions of a cross-fibered serpentine vein at the base of Piece 19 and top of Piece 20 are likely part of the same vein. There is a 1-cm wide zone of talc-rich breccia in Piece 17 dipping at 35∞. Crosscutting alteration vein relations are present in Pieces 5, 12, 13, 20, and 21. All of the veins are post-kinematic with respect to the CP foliations. Crosscutting relationships demonstrate Cp >SAV.

Core Photo



209-1268A-4R-3 (Section top: 27.78 mbsf)

UNIT-I: Harzburgite and Dunite

Pieces 1–9

COLOR: Green to gray

PRIMARY MINERALOGY:

Olivine	Mode 70%
Orthopyroxene	Mode 25%
	Size 2–15 mm
	Shape/Habit Anhedral
Spinel	Mode 2%

COMMENTS: This core is composed primarily of altered harzburgite with a protogranular texture although the last piece in the core (Piece 9) has an elongated porphyroclastic texture.

SECONDARY MINERALOGY:

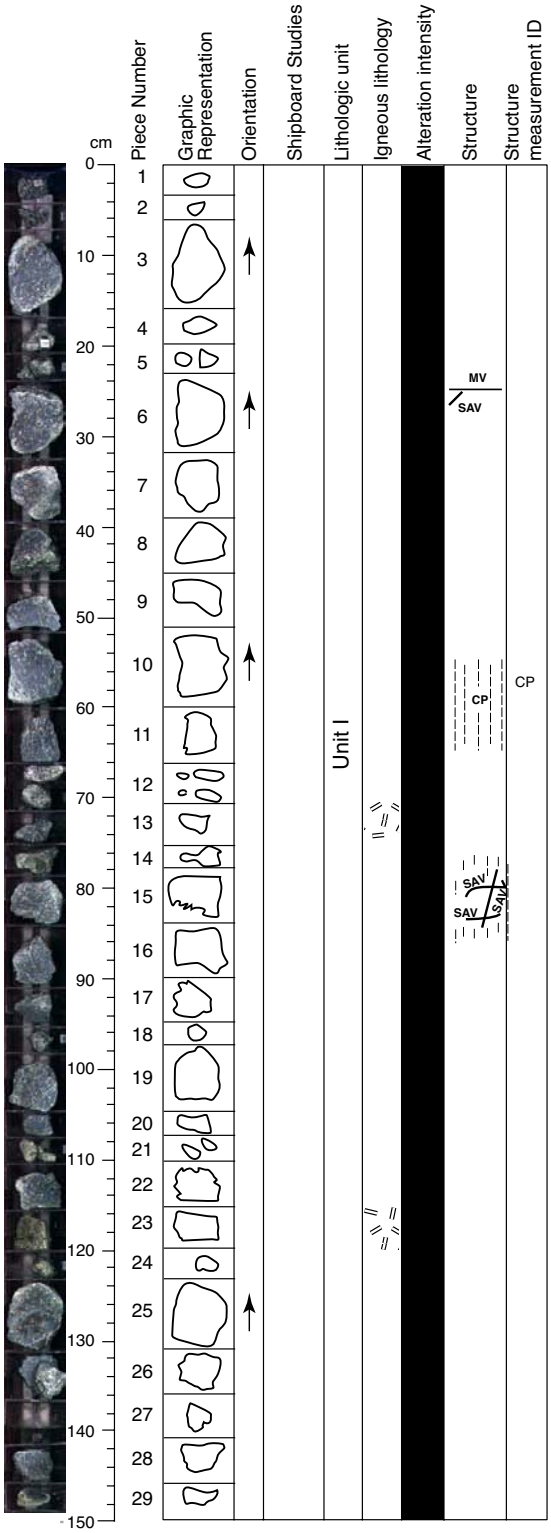
COMMENTS: Pieces 1 to 7 are talc altered, similar to Pieces 12 to 21 of Section 2. Piece 8 is talc altered grading into serpentinite. Piece 9 contains a transition from serpentinite to vuggy talc altered rock with serpentine and talc rich patches developed at the intersection of talc and serpentine veins.

VEIN ALTERATION: The distribution of the dominant vein types in the section is closely associated with the type of background alteration. The areas comprising green serpentinized harzburgite host sulfide (probably pyrite/marcasite) and iron oxide veins (as high as 100% combined modal %) with varying degrees of talc. In areas where the background alteration style is transitional between greenish serpentinized harzburgite and vuggy talc alteration (VTA) serpentine veins oblique to the fabric of VTA are present. They become sub-parallel to the VTA margins as the veins become better developed. Talc-rich veins with as high as 20% disseminated sulfide are present throughout the section and crosscut both the green serpentinized harzburgite background texture and the VTA. Dark green serpentine veins with cross-fibers are also present.

STRUCTURE:

Weak crystal plastic (CP) deformation in Pieces 1-7 with no significant preferred dimensional orientation of pyroxene and well-developed protointergranular textures. Fabric development increases with depth and Pieces 8 and 9 show sub-vertical CP foliations and a weak porphyroclastic texture. Pieces 8 and 9 show prominent serpentine and/or talc alteration veins (SAV). There is no significant brittle deformation in this section. Crosscutting alteration vein relations are present in Pieces 8 and 9 with at least two generations. All of the veins are post-kinematic with respect to the CP foliations. Crosscutting relationships demonstrate Cp >SAV.

Core Photo



209-1268A-5R-1 (Section top: 29.80 mbsf)

UNIT-I: Harzburgite and Dunite

Pieces 1–29

COLOR: Green to gray

PRIMARY MINERALOGY:

Olivine	Mode 80%
Orthopyroxene	Mode 15%–20%
	Size 1–7 mm
	Shape/Habit Anhedral
Spinel	Mode 1%–2%

COMMENTS: This core is composed primarily of altered harzburgite with a protogranular texture (Pieces 1-8, 11-22, and 24-29) or with a lineated porphyroclastic texture (Pieces 9 and 10). An altered pyroxene-spinel segregation (3 cm thick) is in Piece 4 (77 cm). Piece 23 preserves evidence that it was once a coarse-grained gabbroic lithology. Unfortunately the piece contains no contacts with surrounding harzburgites and is too small and altered to assign a definitive rock name.

SECONDARY MINERALOGY:

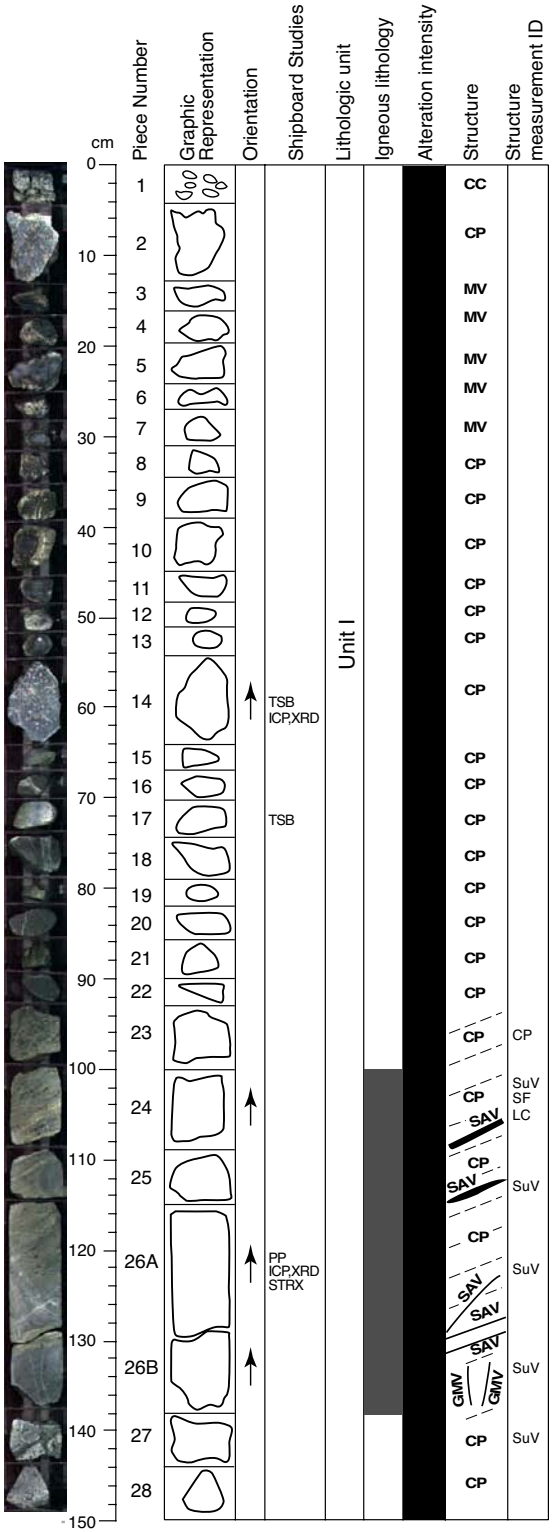
COMMENTS: This section consists almost entirely of typical vuggy talc alteration. Locally the gray vuggy talc alteration is overprinted by a serpentine-rich vein halos as wide as 2 cm (Pieces 7 and 8). Some pieces (Pieces 14, 23, and 29) have light green, talc-rich groundmass with gray orthopyroxene pseudomorphs (bastite).

VEIN ALTERATION: In this section there are three types of veins present. One generation is composed of talc veins with disseminated pyrite, the other consists of talc-chlorite-serpentine veins. Chrysotile veins are sigmoidal and parallel to the vuggy talc alteration (VTA) texture.

STRUCTURE:

Protointergranular textures with weak crystal plastic foliations (Pieces 1-9) to porphyroclastic harzburgite with well-developed crystal-plastic foliations (e.g., Pieces 10, 11, 15, and 19). There is no significant brittle deformation in this section. An altered gabbroic magmatic vein (G-MV) cuts Piece 6. Prominent serpentine and/or talc alteration veins (SAV) are present in Pieces 3, 6, 15, 19, 25, 28, and 29. Crosscutting alteration and magmatic vein relationships are present in Pieces 3, 6, 7, 15, and 16. All magmatic and alteration veins are post-kinematic with respect to the CP foliations. Crosscutting relationships demonstrate Cp >MV>SAV.

Core Photo



209-1268A-5R-2 (Section top: 31.30 mbsf)

UNIT-I: Harzburgite and Dunite

Pieces 1–28

COLOR: Green to gray

PRIMARY MINERALOGY:

Olivine	Mode 80%–98%
Orthopyroxene	Mode 4 %–20%
	Size 1–10 mm
	Shape/Habit Anhedral
Spinel	Mode 1%–3%

COMMENTS: This core is composed primarily of altered harzburgite with a protogranular to slightly porphyoclastic texture. Piece 24 contains a relatively sharp transition from harzburgite to dunite although a band of orthopyroxene and the extent of alteration of the sample make the nature of this contact somewhat ambiguous. Pieces 25 and 26 are altered dunite with sparse orthopyroxene (1%-2%) that is cut by at least four discrete shear bands. Piece 27 is a serpentinite cemented breccia of serpentinized harzburgite that is similar to that above the dunite and to Piece 28 just below.

SECONDARY MINERALOGY:

COMMENTS: This section consists predominantly of serpentinite with minor occurrences of vuggy talc alteration (Pieces 1, 2, 14, 27, and 28). Pieces 3 to 13 are strongly veined with prominent, talc-rich, halos. Thin section observations confirm partial to complete replacement of serpentine by talc.

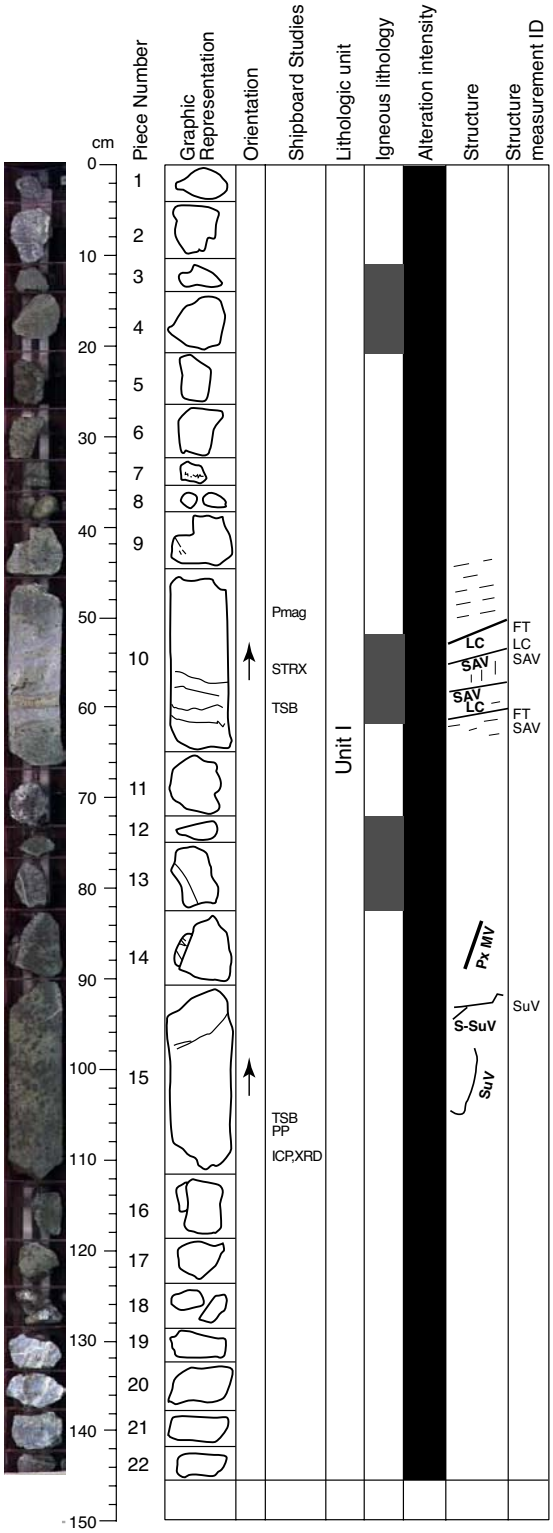
VEIN ALTERATION: Veins within the vuggy talc alteration (VTA) are talc and chrysotile with no pyrite-hematite (dissolved in VTA). Talc veins cross cut VTA and serpentinized harzburgite. Interesting crosscutting relationships are observed in the serpentinized dunite (Pieces 24-26). Several anastamozing sigmoidal veins (shear bands?) are younger (crosscut) or synchronous to the pyrite-iron oxide and talc veins. Iron oxide veins also crosscut these bands suggesting a synchronous to late origin of iron oxide-pyrite veins.

THIN SECTIONS: Samples 1268A-5R-2, 58-61 cm, 1268A-5R-2, 71 -73 cm and 1268A-5R-2, 122-124 cm

STRUCTURE:

Cp>SAV1>SAV2>SuV
Well foliated protointergranular to porphyroclastic harzburgite. Local rounding of spinel in dunites indicates crystal-plastic grade 1+ deformation. Gabbro veins appear undeformed. There is a 2cm wide zone of talc-rich cataclastic breccia in Piece 26 dipping at approximately 20°. Crosscutting alteration vein relations are present in Pieces 2, 14, 24, 25, and 26.

Core Photo



209-1268A-6R-1 (Section top: 34.40 mbsf)

UNIT-I: Harzburgite and Dunite

Pieces 1-22

COLOR: Dark green to gray

PRIMARY MINERALOGY:

Olivine	Mode 80%–98%
Orthopyroxene	Mode 2%–20%
	Size 1–12 mm
	Shape/Habit Anhedral
Spinel	Mode 1%–3%

COMMENTS: This core contains a mixture of altered harzburgite (Pieces 1-2, 5-9,11, and 14-22) and altered dunite (Pieces 3-4, 10, and 12-13). The texture of the harzburgite varies from protogranular top porphyroclastic. The contacts of the upper- and lowermost altered dunites in Pieces 3-4 and 12-13 were not recovered; however, contacts preserved in Piece 10 are gradational for the upper contact and sharp for the lower contact which is also marked by a shear zone. The orthopyroxene in the altered dunite in Piece 10 is not uniformly distributed but does not define layers. A large (5-mm) spinel grain is present in the altered dunite in Piece 10.

SECONDARY MINERALOGY:

COMMENTS: Part of this section is a dark green completely serpentinized harzburgite (Pieces 3 to 17) with locally developed talc-serpentine halos along amphibole-chlorite-pyrite altered gabbroic veinlets (Pieces 14 and 16). Pieces 1, 2, and 18 to 22 show vuggy talc alteration. Here, pseudomorphs after orthopyroxene are either white and vuggy (talc replacement) or dark green (green bastite replacement).

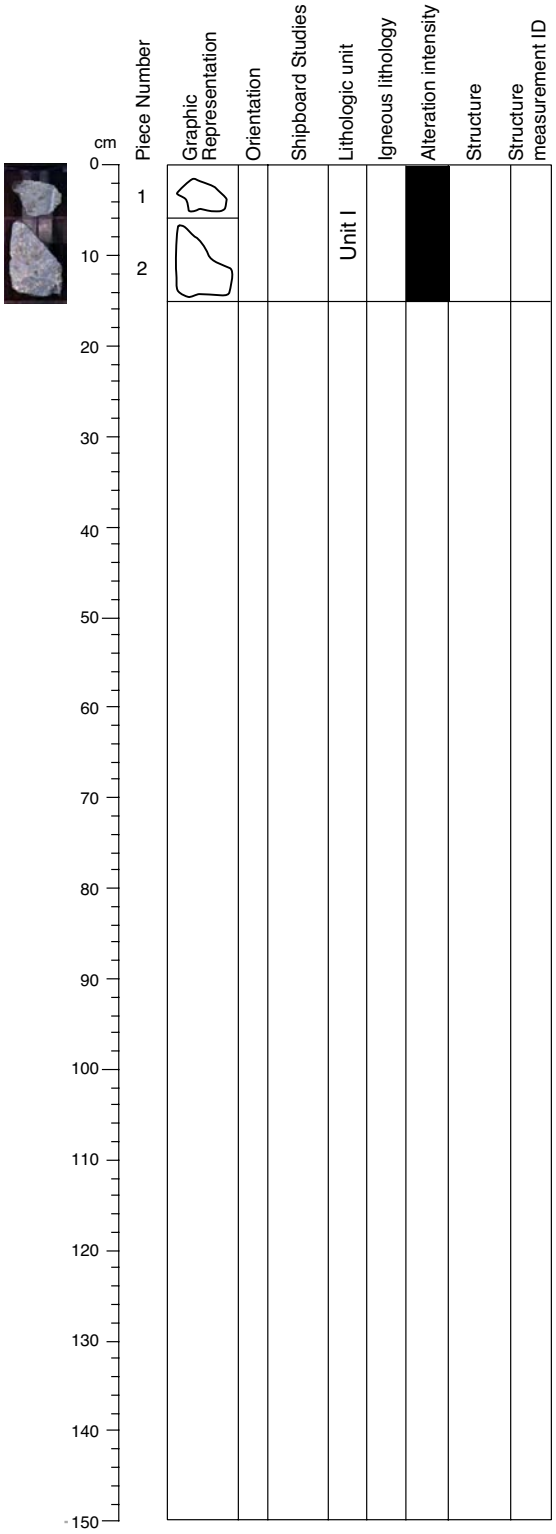
VEIN ALTERATION: The section consists up to four generations of veins, which are distributed according to the background alteration that hosts them. Veins within the vuggy talc alteration, VTA, (Pieces 1, 2, 3, 11, and 18-22) and some pieces where background alteration is transitional to VTA (Pieces 3 and 4) are talc dominated +/- disseminated sulfide (as high as 10%). Areas of talc/chlorite background alteration display two vein types – (i) anastamosing fine grained networks of varying proportions of sulfide (pyrite/marcasite) and iron oxides, and (ii) a generation dominated by varying proportions of talc with as much as 10% disseminated sulfide. This is also the veining style for Pieces 9 and 10, which exhibit a transitional texture. Piece 13 is particularly complex with up to four generations of veins.

THIN SECTIONS: Sample 1268A-6R-1, 58-61 and 1268A-6R-1, 106-108 cm

STRUCTURE:

Weak crystal-plastic foliations in porphyroclastic textured harzburgites (e.g., Pieces 5, 6, 9, 10, 15, 21, and 22) and protointergranular harzburgite (e.g., Pieces 1, 2, 13, 14). A dunite band with lithologic gradational contacts (LC) occurs in Piece 10 is parallel to the gently inclined crystal-plastic (CP) foliation. Pyroxenite magmatic veins (PMV) crosscut harzburgite in Pieces 13, 14, and 16. Prominent crosscutting alteration serpentine and/or talc veins (SAV) are present in Pieces 2, 5, 6, 7, 9, 10, 14, 15, 19, 20, 21, and 22. Cross-fibered serpentine veins are obvious in Pieces 5, 6, 7, 21, and 22. Composite serpentine/talc-sulfide veins (S-SuV) cut Pieces 10, 14. And 15) and sulfide veins (SuV) are present Pieces 10 and 15. Thin zones of anastomosing fracturing and incipient brecciation in Pieces 3-5, 9, 10, and 19. All magmatic and alteration veins are post-kinematic with respect to the CP foliations. Crosscutting relationships demonstrate Cp >MV>SAV>S-SuV>Sv>CC.

Core Photo



209-1268A-6R-2 (Section top: 35.86 mbsf)

UNIT-I: Harzburgite and Dunite

Pieces 1–2

COLOR: Gray

PRIMARY MINERALOGY:

Olivine	Mode 80%
Orthopyroxene	Mode 20%
	Size 1–4 mm
	Shape/Habit Anhedral
Spinel	Mode 1%

COMMENTS: This short core contains altered harzburgite with a protogranular texture.

SECONDARY MINERALOGY:

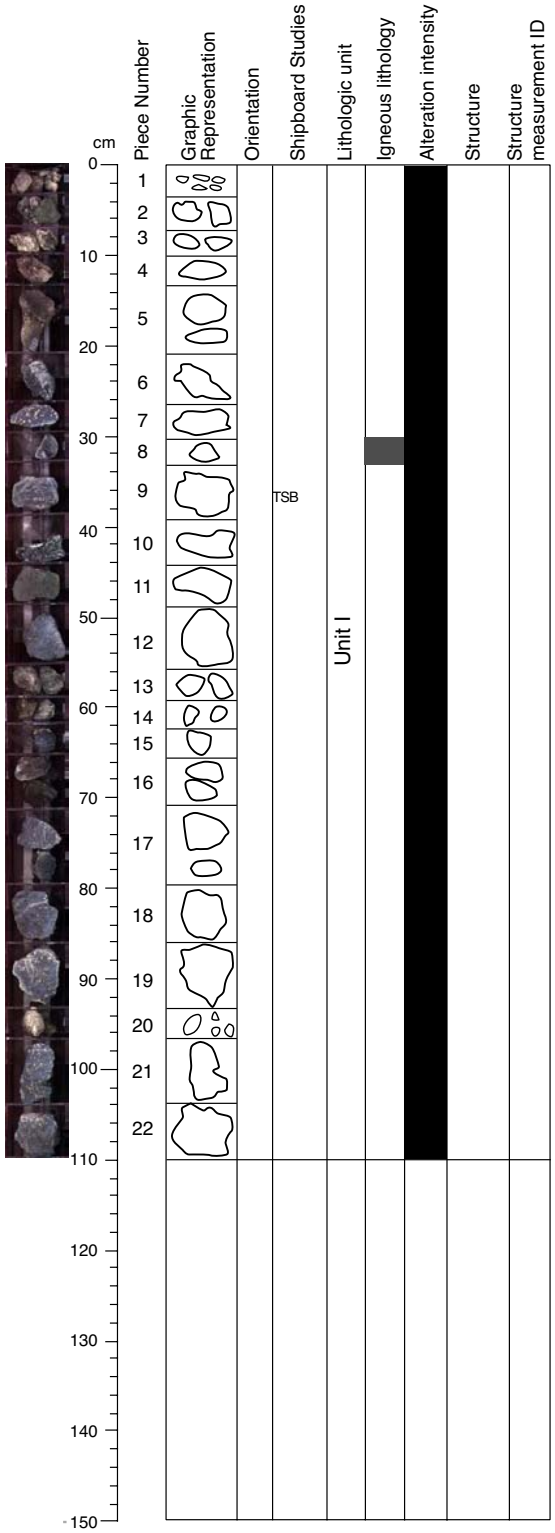
COMMENTS: This section consists of two gray pieces showing vuggy talc alteration.

VEIN ALTERATION: Piece 1 contains a small talc vein.

STRUCTURE:

Harzburgites show a weak crystal-plastic (CP) foliation and protointergranular texture. A cross-fibered serpentine vein (SAV) cuts Piece 2. The SAV is postkinematic with respect to the CP foliation (Cp>SAV).

Core Photo



209-1268A-7R-1 (Section top: 39.40 mbsf)

UNIT-I: Harzburgite and Dunite

Pieces 1–22

COLOR: Green to gray

PRIMARY MINERALOGY:

Olivine	Mode 80%–85%
Orthopyroxene	Mode 15%–20%
	Size 1–10 mm
	Shape/Habit anhedral
	Crystal orientation Primary lineation defined by orthopyroxene layers
	(see thin section, Sample 1268A-7R-1, 34-37 cm)
Spinel	Mode 1%

COMMENTS: Altered harzburgite dominates the lithology of this highly broken-up core with subordinate altered dunite in Piece 8. Despite the complete alteration the original protogranular texture is preserved. Piece 9 (Sample 1268A-7R-1, 34-37 cm) has porphyroclastic elongated texture. Flattened spinel grains commonly in trains run parallel to the orthopyroxene layering. This is an indication that the former high temperature foliation is preserved.

SECONDARY MINERALOGY:

COMMENTS: The section contains heavily talc overprinted, completely altered harzburgite (Pieces 6-9, 12, 17-22) and green, completely serpentinized harzburgite. Piece 10 is a bifurcating gabbro veinlet that is completely rodingitized. Orthopyroxene in the talc-altered rock is altered chiefly to serpentinite with only minor talc.

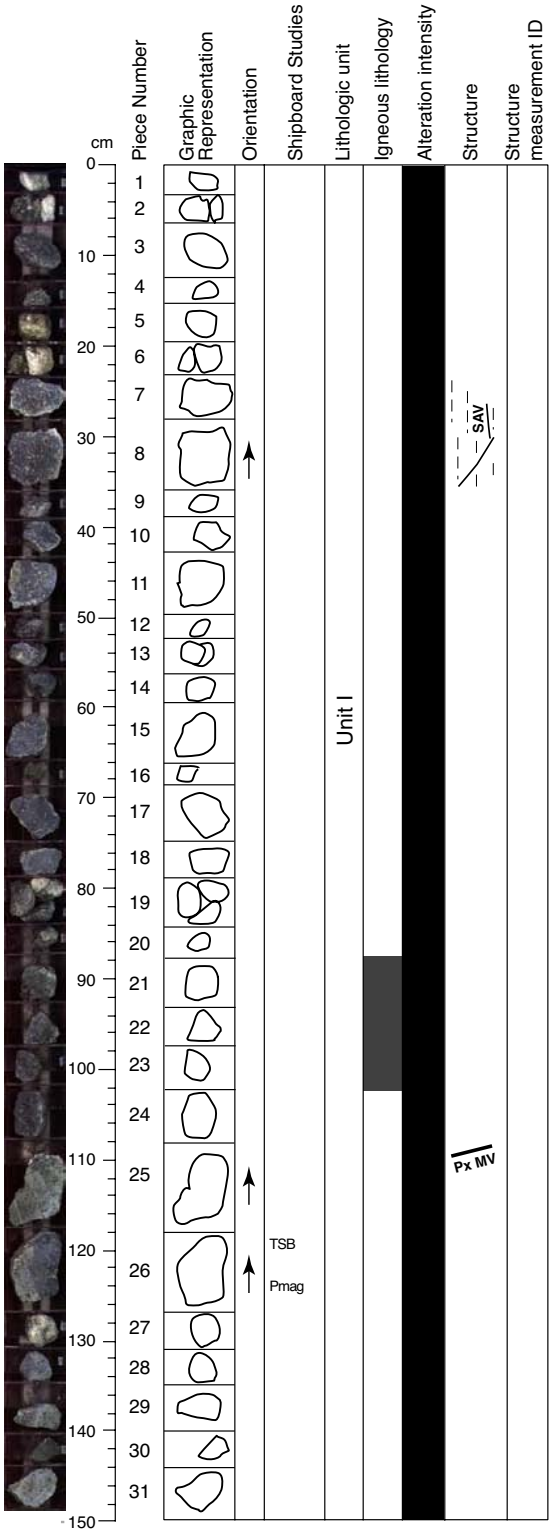
VEIN ALTERATION: This section is only sparsely veined. Where present two vein types dominate: talc-rich veins are common in areas of vuggy talc alteration (VTA) (Pieces 6-9 and 17-22). A talc-chlorite-chrysotile vein is present in Piece 2. Elsewhere, occasional small serpentine veins are present (Pieces 9 and 11, 13, and 14).

THIN SECTIONS: Sample 1268A-7R-1, 34-37 cm

STRUCTURE:

All pieces in the section were unoriented. Weak crystal-plastic foliations and protointergranular textures characterize harzburgite with a local mylonite zone (Piece 9) with one metagabbro (Piece 10). Incipient brecciation in serpentine-rich portions of Pieces 13, 16, and 20. Prominent crosscutting serpentine/talc alteration veins (SAV) cut Pieces 10, 18, 19, 21, and 22. Veins are postkinematic with respect to the crystal plastic deformation. (Cp>SAV).

Core Photo



209-1268A-8R-1 (Section top: 44.00 mbsf)

UNIT-I: Harzburgite and Dunite

Pieces 1–31

COLOR: Dark green to gray

PRIMARY MINERALOGY:

Olivine	Mode 85%
Orthopyroxene	Mode 15%
	Size 1–10 mm
	Shape/Habit Subequant
Spinel	Mode 1%

COMMENTS: Altered harzburgite dominates the lithology of this highly broken-up core with subordinate altered dunite in Pieces 21-23. Despite the complete alteration the original protogranular texture is preserved. Segregations of spinel and altered pyroxene are present in the dunite.

SECONDARY MINERALOGY:

COMMENTS: Most of this section is dominated by vuggy talc alteration. Pieces 25 to 31 are serpentinized with patches of vuggy talc alteration (VTA). Here, orthopyroxene pseudomorphs consist mostly of dark green completely serpentinized harzburgite; however, some are replaced by talc in domains of VTA. Pieces 5-6, 21-24, and part of Piece 25 show peculiar mottled texture and may represent completely altered gabbro.

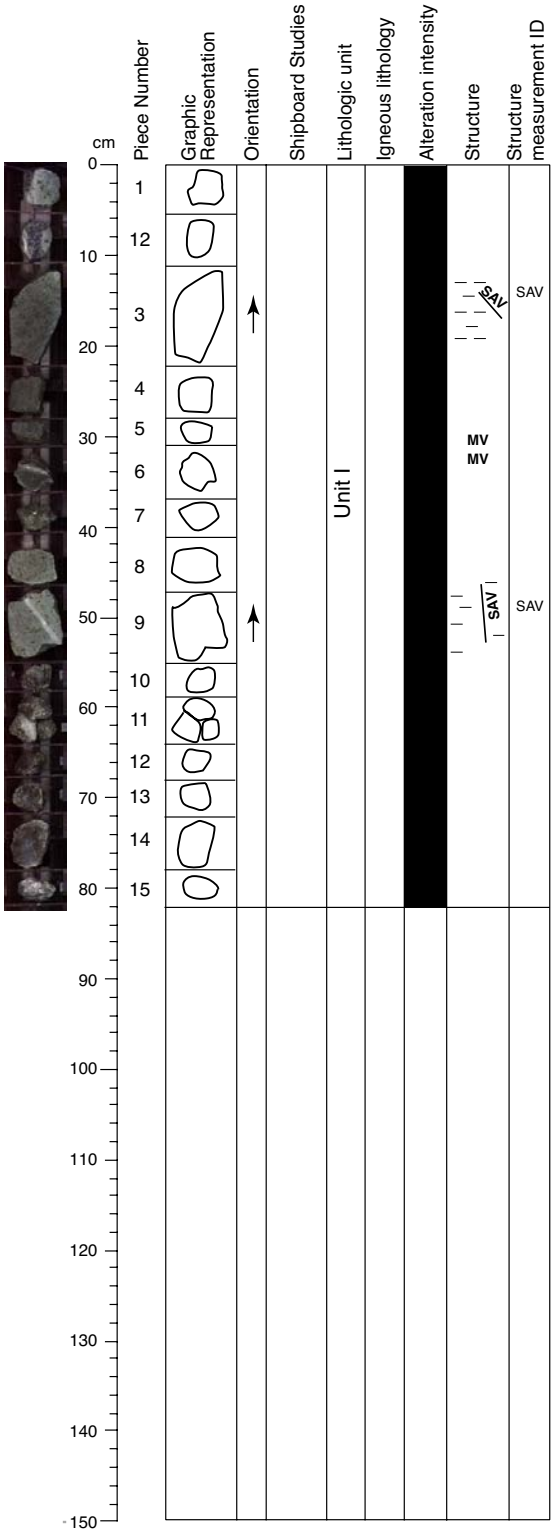
VEIN ALTERATION: Veining is not particularly prominent in this section. Poorly developed networks of talc veins are present in Pieces 3, 7-15, 17-20, 29 and 30. Small serpentine veins are similarly poorly developed (Pieces 7, 13 and 23-28) and disseminated sulfide is rare (as much as 10% in talc veins). Piece 30 contains a chlorite-chrysotile-talc vein with sulfide similar to that seen in Section 1268A-7R1, Piece 2.

THIN SECTIONS: Sample 1268A-8R-1, 117-119 cm

STRUCTURE:

Harzburgite generally shows protointergranular textures without obvious foliations. Weak near-vertical crystal CP foliation and weak porphyroclastic texture can be defined by the preferred dimensional orientation of pyroxene in Piece 7, the only orientable piece in the section. Pieces 20, 21, and 22 are metagabbros that have generally been statically metamorphosed, although Piece 20 shows mild CP deformation. Pieces 10 and 24 are cut by highly altered pyroxenite magmatic veins (P-MV). Prominent crosscutting alteration veins are present in Pieces 6, 7, 9, 14, 19, 23, 24, 25, 28, and 30. There is no significant brittle deformation in this section. All magmatic and alteration veins are post-kinematic with respect to the CP foliations. Crosscutting relationships demonstrate Cp >MV>SAV.

Core Photo



209-1268A-8R-2 (Section top: 45.50 mbsf)

UNIT-I: Harzburgite and Dunite

Pieces 1–15

COLOR: Green to gray

PRIMARY MINERALOGY:

Olivine	Mode 85%–89%
Orthopyroxene	Mode 5 –15%
	Size 2–6 mm
	Shape/Habit Anhedral
Spinel	Mode 1%

COMMENTS: Altered harzburgite dominates the lithology of this highly broken-up core with subordinate altered dunite in Pieces 10-15. Despite the complete alteration the original protogranular texture is preserved. Segregations of spinel and altered pyroxene are present in the lower part of the section.

SECONDARY MINERALOGY:

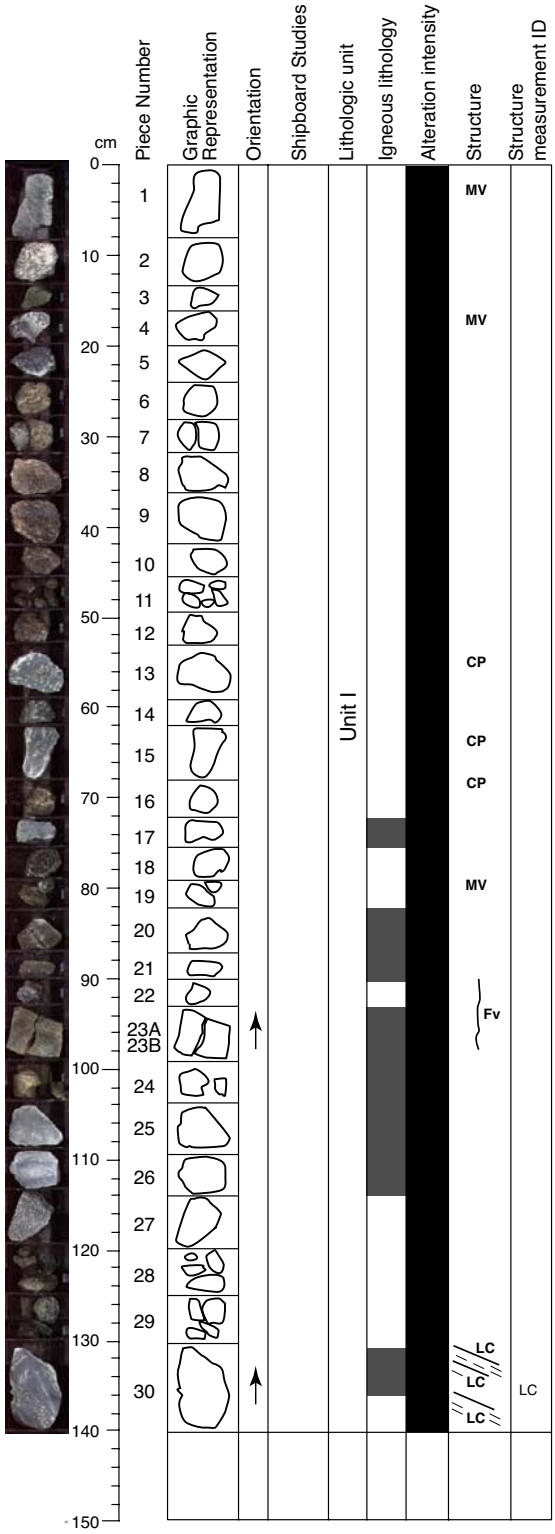
COMMENTS: The upper part of the section (Pieces 1 to 9) is green, completely serpentinized harzburgite. The lower part (Pieces 10 to 14) consists of a completely altered rock with a clastic appearance. Brown orthopyroxene pseudomorphs and dark green, irregular serpentinite nodules are hosted in a white, speckled groundmass. A rock with similar appearance but still recognizable plagioclase pseudomorphs in Section 1268A-7R-1 (Pieces 21 to 23) has been interpreted as a completely altered metasomatized gabbro.

VEIN ALTERATION: This section of core is particularly poorly veined (absent or <1% in most pieces). Only Pieces 6 and 9 show any greater proportion of veining. Serpentine veins are present in Pieces 3-6 and 9-14 (although in Pieces 10-14 these amount to much less than 1%).

STRUCTURE:

Weak crystal-plastic (CP) foliations throughout harzburgite Pieces 1-9, and 15. Weak porphyroclastic to dominantly protointergranular textures characterize the serpentinized harzburgites. Pieces 10-14 are metagabbros which have been statically metamorphosed and are post-kinematic with respect to the CP deformation in the harzburgite. Piece 6 contains two highly altered gabbroic veins cutting harzburgites, which are also postkinematic and may be related to the intrusion of gabbroic rocks (Pieces 10-14). Serpentine/talc alteration veins (SAV) and sulfide alteration veins (SuV) cut Piece 9 in a steeply inclined zone. All magmatic and alteration veins are post-kinematic with respect to the CP foliations. Crosscutting relationships demonstrate Cp>SAV>SuV

Core Photo



209-1268A-9R-1 (Section top: 49.00 mbsf)

UNIT-I: Harzburgite and Dunite

Pieces 1–30

COLOR: Green to gray

PRIMARY MINERALOGY:

Olivine	Mode 80%–85%
Orthopyroxene	Mode 5%–15%
	Size 1–10 mm
	Shape/Habit Anhedral
Spinel	Mode 1%

COMMENTS: This core is a mixture of altered harzburgite and less amount of altered dunite (Pieces 17, 20-21, 23-26, and 30). Despite the complete alteration the original protogranular texture is preserved. Segregations of spinel and altered pyroxene are found in the dunite.

SECONDARY MINERALOGY:

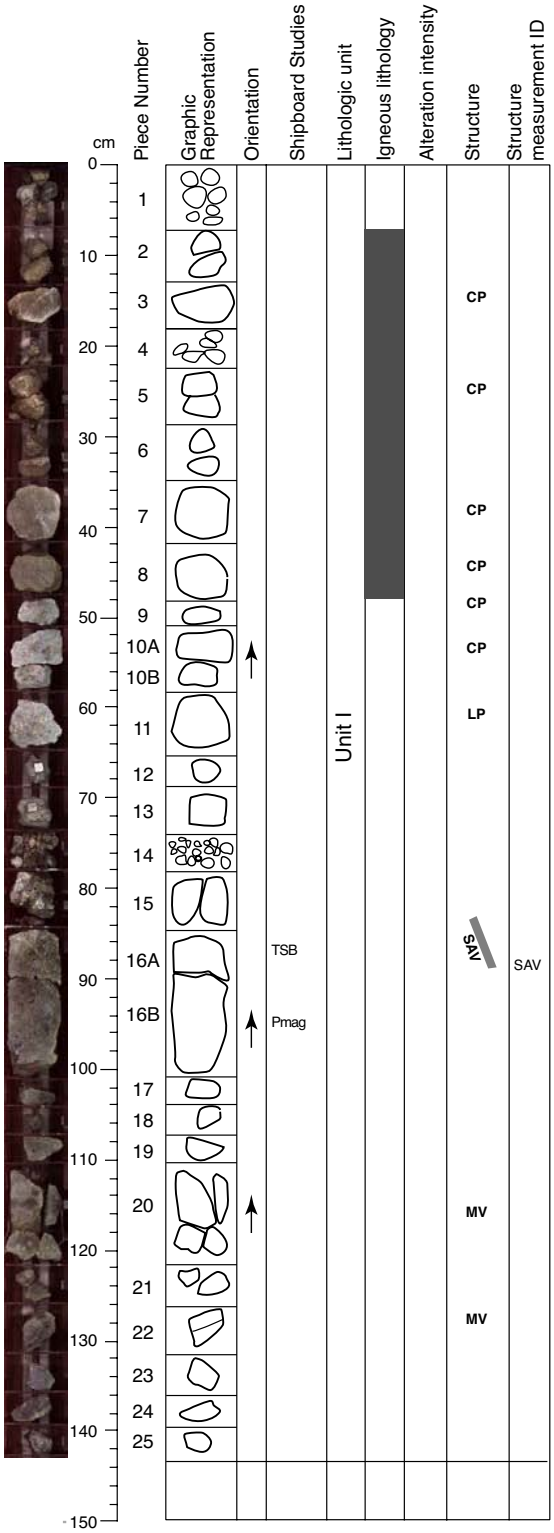
COMMENTS: This section is completely altered with serpentinization prevailing in Pieces 3, 6 to 12, 16, 18, 19, and 20 to 24 and vuggy talc alteration predominating in Pieces 1, 2, 4, 5, 13 to 15, 17, and 25 to 30. Pieces 16, 18, 19 and 22 have whitish to brownish (mica?) mm-sized spots and plagioclase pseudomorphed by talc (Piece 16). These could represent completely altered gabbro (similar to Core 1268A-8R-1, Pieces 21 to 24) but a clear identification of plagioclase pseudomorphs was impossible and the rock is named serpentinite. Pieces 6 to 12 are green completely serpentinized harzburgite with notable amounts of talc.

VEIN ALTERATION: This section is particularly poorly veined (<1% in most pieces), with the exception of Piece 20, which has a particularly large straight serpentine vein. Veining generally takes the form of branching networks of minute talc veins (Pieces 4, 5, 13-15, 29, and 30). Otherwise, veining comprises serpentine (chrysotile identified by its obvious fibrous texture). Other than small clusters of sulfide within talc veins in Pieces 29 and 30, it is only present in trace amounts (e.g. Piece 25).

STRUCTURE:

Altered weakly deformed protointergranular harzburgite at top of section (Pieces 1-7) and give way to Pieces13–15, 22, and 27-30 are serpentinized harzburgites with weak crystal-plastic (CP) foliations and porphyroclastic textures. Harzburgites are interrupted by highly altered metagabbro (Pieces 8-12) that have been statically metamorphosed and highly altered metagabbros (Pieces 16, 18 and 19) that have porphyroclastic textures and have been dynamically metamorphosed. Pieces 14, 20, 21, and 23-30 contain dunite and Piece 30 contains a harzburgite band sandwiched by dunite above and below and parallel to the CP foliation and Piece 14 contains a harzburgite-dunite contact (lithologic contacts indicated –LC). There is strong brittle fracturing and brecciation of gabbro and harzburgite in Pieces 6-12 and 16. Dense anastomosing fracturing and incipient brecciation is present on both margins of a serpentine vein in Piece 20. Magmatic veins (MV) of altered pyroxenite and gabbro are present in Pieces 1 and 2, and a composite gabbroic/pyroxenitic vein is present in Piece 20. Distinctive chrysotile-filled tapering extensional fractures perpendicular to a pyroxene vein in Piece 1 and 4. Prominent crosscutting serpentine/talc alteration veins (SAV) are also present in Pieces 12 and 27. All magmatic and alteration veins are post-kinematic with respect to the CP foliations, although individual pieces of porphyroclastic metagabbro are likely synkinematic with the CP foliations within the harzburgite. Crosscutting relationships demonstrate Cp>PG>MV>SAV>CC.

Core Photo



209-1268A-10R-1 (Section top: 53.60 mbsf)

UNIT-I: Harzburgite and Dunite

Pieces 1–25

COLOR: Green to gray

PRIMARY MINERALOGY:

Olivine	Mode 80%–98%
Orthopyroxene	Mode <20%
	Size 1–7 mm
	Shape/Habit Anhedral
Spinel	Mode <1%
	Size <1 mm

COMMENTS: The first part of the section from 7 to 48 cm consists of dunite where the olivine mode is more than 95%. Spinel is present in very little grains dispersed in the rock. The rest of the section consists of serpentinized harzburgite with protogranular to porphyroclastic texture. Pieces 1 and 14 are little pebbles of serpentinite probably after harzburgite.

SECONDARY MINERALOGY:

COMMENTS: The first eight pieces of this section are completely serpentinized dunite (SDu). Pieces 9 to 15 are vuggy talc alteration. Pieces 16 to 22 are green serpentinite with some talc alteration with associated talc +/- sulfide veins. Patchy development of pyrite, after spinel, is present in Piece 16. Pieces 16 to 22 have a clastic appearance similar to Section 1268A- 9R-1, Pieces 6 to 12. Pieces 23 to 25 are predominantly vuggy talc alteration.

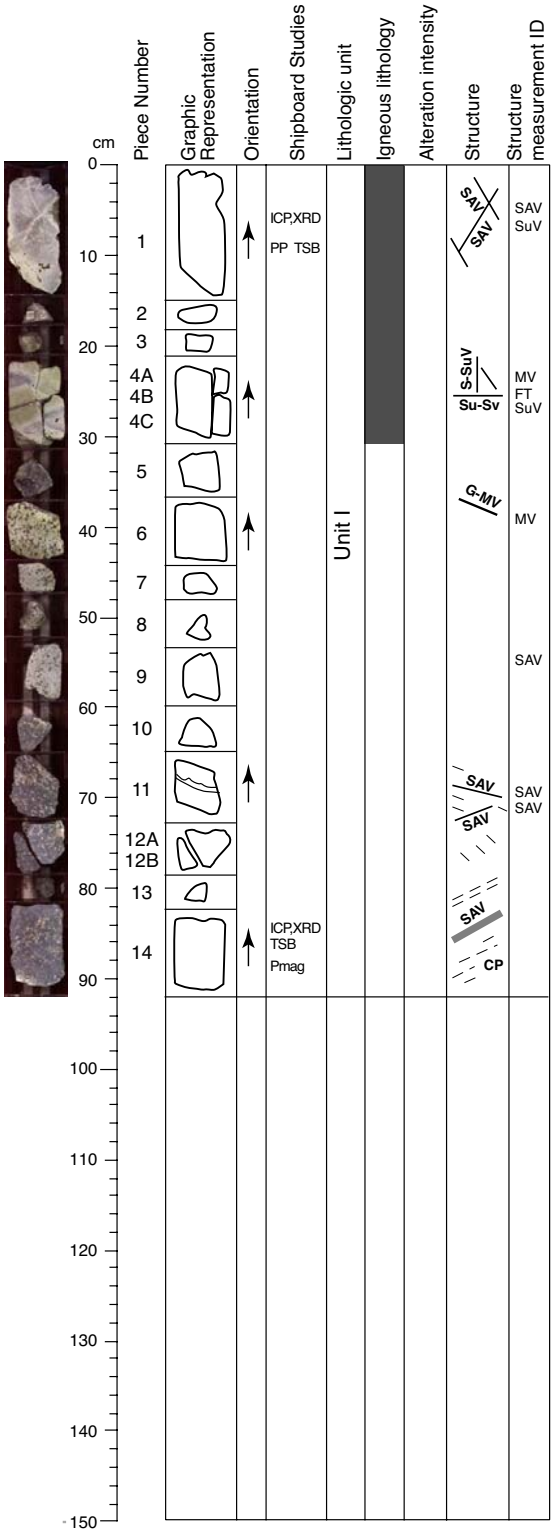
VEIN ALTERATION: The veining in this section is not particularly intense i.e., it approaches a maximum intensity of 5% in Pieces 16A and 16B. Talc veins in Pieces 2, 3, 5-8, 16A, 16B, 20 and 22 are present within serpentinized harzburgite (SHz), whereas talc veins are hosted within Pieces 10-13 and 23-24 in the vuggy talc alteration (VTA).

THIN SECTIONS: Sample 1268A-10R-1, 85-88 cm

STRUCTURE:

The section consists of serpentinized harzburgite (Pieces 1, 9-15, and 23-25) displaying porphyroclastic textures and a strong crystal-plastic (CP) foliation, which is subhorizontal to gently inclined in the cut face of the core. Pieces 2-8 consist of gneissic metagabbro with a strong CP foliation that is inclined ~45 degrees in the cut face of the core. Pieces 16-22 consists of highly altered metapyroxenite, which appears to lack a crystal plastic fabric, but may be mildly deformed. The pyroxenites are also cut by small gabbroic magmatic veins (GMV) in Pieces 20 and 22 that cut postkinematically. Prominent serpentine/talc alteration veins occur in Pieces 2, 3, 5, 7, 8,10,and 16. Pieces 10 and 16 show well-developed, cross-fiber serpentine perpendicular to the vein walls. All magmatic and alteration veins are postkinematic with respect to the CP deformations, however the metagabbroic rocks in Pieces 2-8 are pre- or synkinematic with respect to the CP deformation and development of the local penetrative foliation. Crosscutting relationships demonstrate Cp>Metagabbro>Pyroxenite>GMV>SAV.

Core Photo



209-1268A-10R-2 (Section top: 55.04 mbsf)

UNIT-I: Harzburgite and Dunite

Pieces 1–14

COLOR: Green to gray

PRIMARY MINERALOGY:

Olivine	Mode 80-98%
Orthopyroxene	Mode 2-20%
	Size 1–7 mm
	Shape/Habit Anhedral
Spinel	Mode 1%
	Size <1 mm

COMMENTS: The first 30 cm of core consists of altered dunite with a few dispersed large individual grains of orthopyroxene up to 1 cm. The rest of the core consists of altered harzburgite with a protogranular texture.

SECONDARY MINERALOGY:

COMMENTS: Pieces 1 to 4 are talc-altered dunite with talc-sulfide-iron oxide veins and light-green serpentinization, similar to the alteration style in Section 1268A-2R-1. Pyrite and oxide are disseminated in these vein halos, which are 3 to 4 cm wide. Piece 5 is a green serpentinite that appears impregnated with iron oxide-sulfide rich gabbro. Pieces 6 to 9 are light green serpentinized harzburgite. Pieces 9 to 14 are vuggy talc altered harzburgite with talc veins.

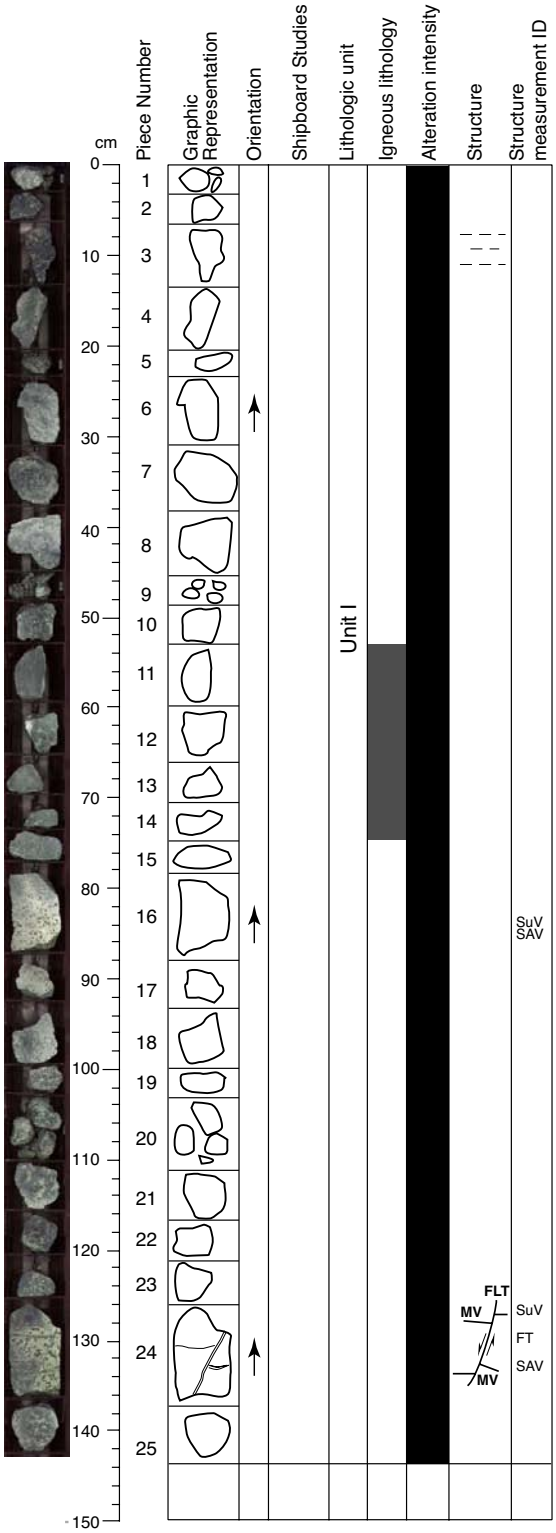
VEIN ALTERATION: Veining is not prominent in this section. Talc veins predominate (Pieces 1-4, 9, and 11-13) but never exceed 1% of the volume. Piece 4 contains a possible metamorphic overprint of an igneous vein. Relict plagioclase may be present within a composite, banded vein comprising narrow iron oxide rims and sulfide and talc rich bands.

THIN SECTIONS: Samples 1268A-10R-2, 8-10 cm and 1268A-10R-2, 82-85 cm

STRUCTURE:

The section consists of serpentinized dunite (Pieces 1-4), metagabbro (Piece 5), serpentinized harzburgite (Pieces 6-15). Serpentinized dunites lack deformation indicators, whereas serpentinized harzburgites show well-defined foliations in Pieces 11 and 15. The foliation is defined by the preferred dimensional orientation of pyroxene and is gently inclined in the core face. The harzburgite textures vary from protointergranular to weakly porphyroclastic. Part of a metagabbro vein cutting harzburgite is in Piece 6 and may represent the remnants of a once larger vein incorporating the adjacent metagabbro (Piece 5). Prominent serpentine/talc alteration veins occur in Pieces 1,4, 8, 10, 11, 12, and 15, composite serpentine/talc-sulfide veins in Pieces 4, 8 and 9, and sulfide veins in Pieces 1. All magmatic and alteration veins are postkinematic with respect to the CP deformations. Crosscutting relationships demonstrate Cp>GMV>SAV>S-SuV>SuV.

Core Photo



209-1268A-11R-1 (Section top: 58.60 mbsf)

UNIT-I: Harzburgite and Dunite

Pieces 1–25

COLOR: Gray to green

PRIMARY MINERALOGY:

Olivine	Mode ~90%
Orthopyroxene	Mode 10%
	Size 1–4 mm
	Shape/Habit Anhedral
Spinel	Mode 1%
	Size <1 mm

COMMENTS: This core consists mostly of serpentinized harzburgite with a medium protogranular texture. A short interval of about 20 cm (Pieces 11 to 14) is dunite. There is no evident contact between the two units.

SECONDARY MINERALOGY:

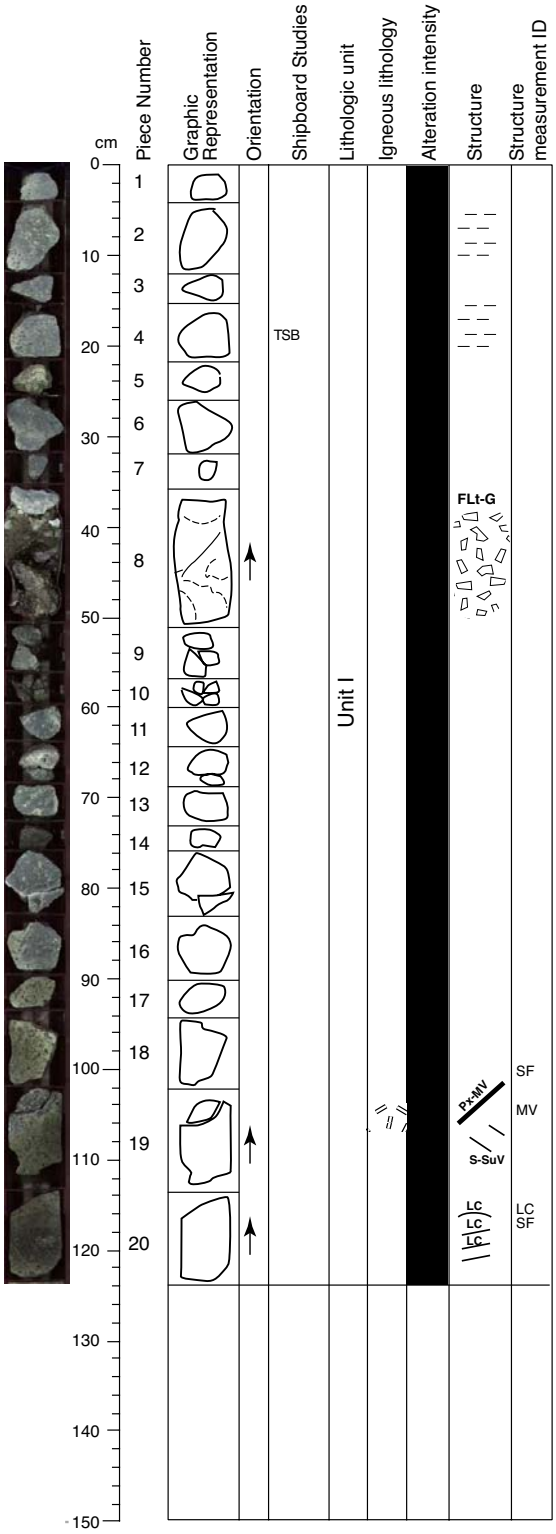
COMMENTS: This section is dominated by gray vuggy talc alteration of harzburgite and dunite (Pieces 11, 12, and 13). Whereas olivine is almost uniformly altered to gray talc-serpentine the alteration of orthopyroxene is complex. Dark green pseudomorphs after orthopyroxene consist of chlorite-serpentine-pyrite aggregates, which may be partially replaced along margins, and internal fractures by talc (Pieces 6, 7, 8, 18, 24, and 25).

VEIN ALTERATION: This section contains different types of veins in vuggy talc alteration (VTA) very similar to previous cores. Iron oxide-pyrite veins are present in the serpentinized harzburgite (SHz) that fade out in vuggy talc alteration (VTA). In the lower section (Piece 24), pyrite-talc veins are clearly crosscut by a serpentine vein without sulfides.

STRUCTURE:

The section consists of serpentinized harzburgite (Pieces 1-10, and 14-25) with generally weak crystal-plastic fabrics and protointergranular textures, with the exception of Piece 3 which is porphyroclastic and shows a strong crystal plastic foliation. Pieces 12 and 13 are dunites that do not display fabric evidence. Magmatic veins cut Pieces 4 and 24. Prominent serpentine/talc alteration veins occur in Pieces 2, 3, 6, 12, 16, and 25. There is a small normal fault (FLT), which offsets two magmatic veins with a 0.5-cm offset in Piece 24. Slip-parallel serpentine fibers are present within the fault zone. All magmatic and alteration veins are postkinematic with respect to the CP deformations, MV veins are expectedly prekinematic with respect to movement along the small normal fault. Crosscutting relationships demonstrate CP>MV>SAV>Ft.

Core Photo



209-1268A-11R-2 (Section top: 60.03 mbsf)

UNIT-I: Harzburgite and Dunite

Pieces 1–20

COLOR: Green to gray

PRIMARY MINERALOGY:

Olivine	Mode 85%–89%
Orthopyroxene	Mode 10%–15%
	Size 1–6 mm
	Shape/Habit Anhedral
Spinel	Mode 1%

COMMENTS: This core is composed primarily of altered harzburgite with a medium grained protogranular texture. Piece 8 is breccia made of serpentinized harzburgite. Piece 19 contains a gabbroic dike with former pyroxene now altered in amphibole. Piece 20 is cut by a gabbroic segregation completely altered.

SECONDARY MINERALOGY:

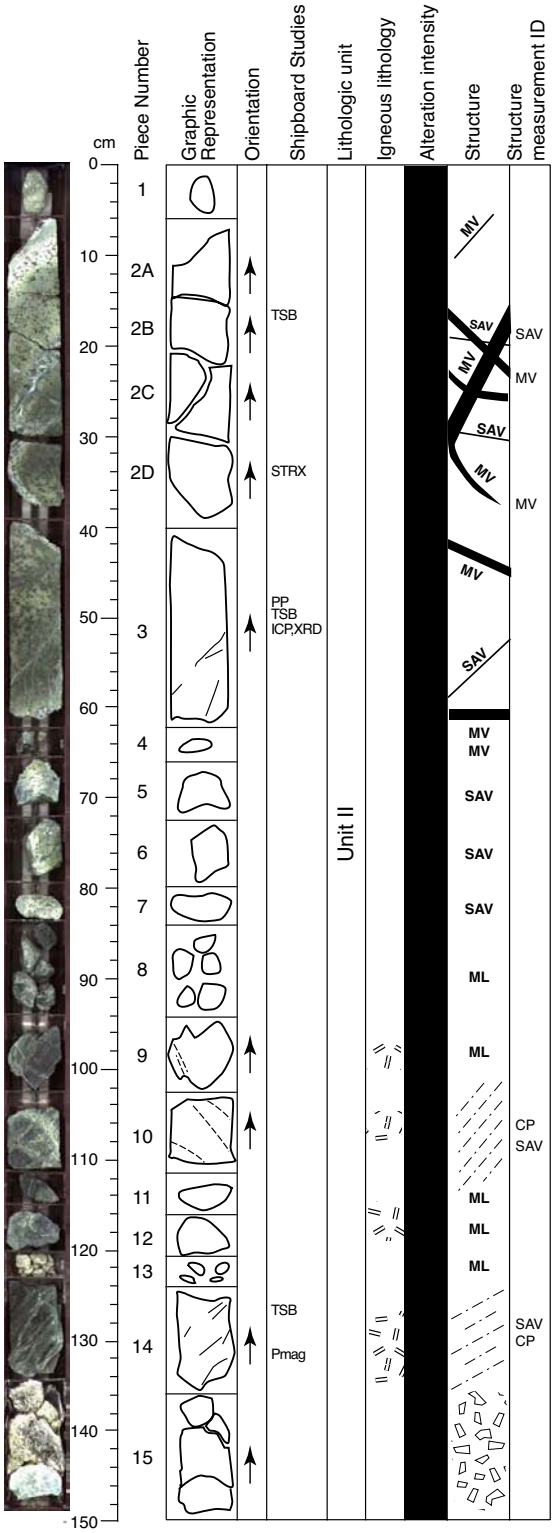
COMMENTS: The upper part of this section is vuggy talc alteration, however, pseudomorphs after orthopyroxene consist frequently of serpentine-chlorite-pyrite with talc replacement confined to margins and internal fractures. The lower part of the section is green serpentinite (Pieces 17 to 20). The gradational contact is documented in Piece 16. Pieces 17 and 18 are light green whereas Pieces 19 and 20 are dark green. A serpentinite breccia in Piece 15 may represent a fracture zone. Piece 15 is a serpentinized ultramafic rock of uncertain primary composition similar to suspected completely altered gabbro described in Section 1268A-8R-2 and elsewhere.

VEIN ALERATION: This section is similar to Section 1268A-11R-1. Talc veins crosscut vuggy talc alteration (VTA) and serpentinized harzburgite (SHz). Serpentine veins are dispersed in throughout the VTA.

THIN SECTIONS: Sample 1268A-11R-2, 17-20 cm

STRUCTURE:
Serpentinized harzburgite with protontergranular to porphyroclastic textures. Pieces 1-3 show the best developed foliation that is generally has a subhorizontal trace in the cut face of the core. Protointergranular textured pieces show a general depletion in enstatite (e.g., Piece 13). Subtle modal layering or banding is preserved in Piece 20. It is subhorizontal and parallel to the crystal-plastic foliation. Pieces 14 and 19 are cut by altered pyroxene or gabbroic magmatic veins. Prominent crosscutting serpentine and/or talc alteration veins are present in Pieces 6, 16 and 19. Serpentine-sulfide veins are found in Pieces 15 and 19. Piece 8 consists of a vuggy fault gouge composed of angular to subangular clasts of serpentinite ranging from 0.1 cm to 3 cm in diameter within a clay-rich matrix, which includes serpentine fibers. The matrix also has been mineralized dominantly with coarse pyrite. A small talc-rich brittle shear zone is present in Piece 16. Increased serpentine veining is along the margin of an altered pyroxenite vein in Piece 19. All magmatic and alteration veins are postkinematic with respect to the CP deformation. Crosscutting relationships demonstrate CP>MV>SAV> S-SuV>CC-Ft.

Core Photo



209-1268A-12R-1 (Section top: 63.20 mbsf)

UNIT-II: Injection Breccia

Pieces 1–15

COLOR: Green to gray

PRIMARY MINERALOGY:

Olivine	Mode 85%–90%
Orthopyroxene	Mode 10%–15%
	Size 2–10 mm
	Shape/Habit Anhedral
	Crystal Orientation In some places the primary lineation is defined by orthopyroxene layers.
Spinel	Mode 1%

COMMENTS: This core is composed primarily of serpentinized harzburgite with a medium grained protogranular to porphyroclastic texture. Lower part of the core is mylonitic with large well-preserved spinel grains. Piece 15 is an injection breccia with pieces of harzburgite in a matrix of mostly gabbroic material. Fine-grained gabbroic dike and dikelets cut the sequence at 18, 30, 41 and 77 cm. A coarse-grained (~1 cm wide), boudinaged orthopyroxene layer is present in Piece 7, parallel to the general layering.

SECONDARY MINERALOGY:

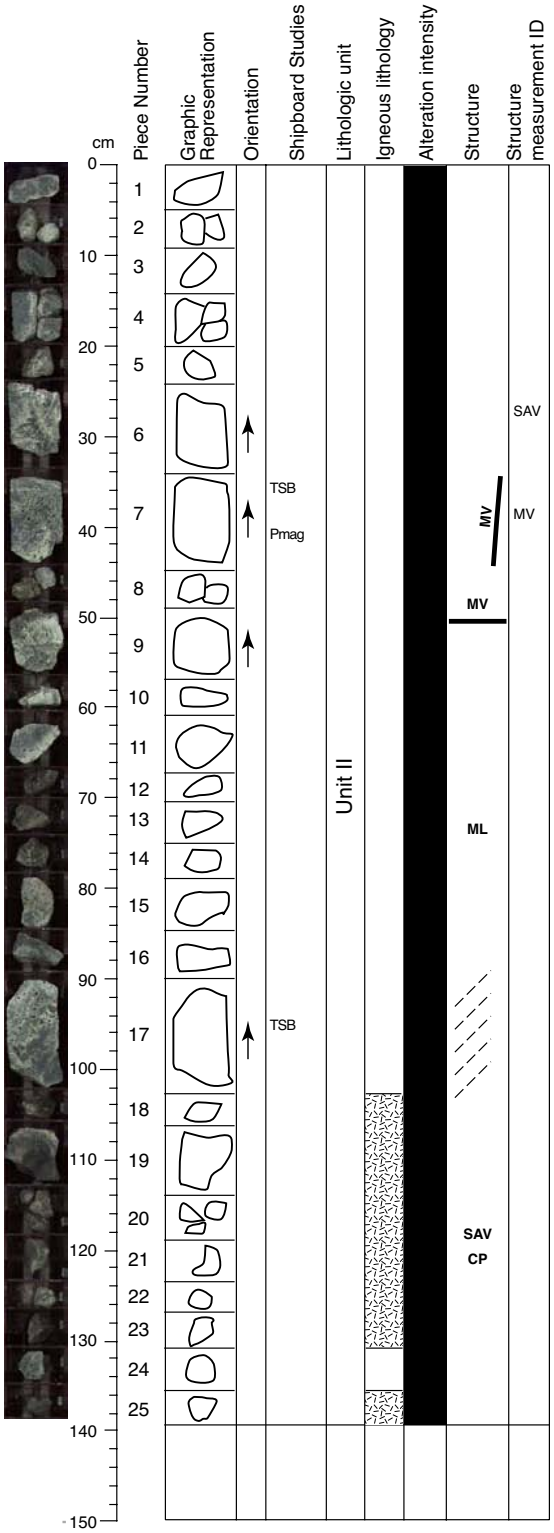
COMMENTS: The section includes gabbro-vein serpentinized harzburgite (Pieces 2-7), mylonitized gabbro (Pieces 8-14) and a serpentine and cemented breccia with talc altered gabbro and harzburgite. Sulfide is noticeable in mylonites and near gabbro veins.

VEIN ALTERATION: This section shows dispersed iron oxide-pyrite and talc veins. A thick talc-chlorite-serpentine vein cuts most of the section. This vein is branched at the bottom of the section in the serpentinized mylonite.

THIN SECTIONS: Samples 1268A-12R-1, 16-18 cm, 1268A-12R-1, 47-49 cm, and 1268A-12R-1, 125-127 cm

STRUCTURE:
Very weak crystal-plastic deformation in protointergranular harzburgite (Pieces 1-8) abruptly overlies a thick steeply-dipping mylonitized harzburgite that is intensely deformed (Pieces 9-15). The contact is not exposed. Below the mylonite, a fault gouge is present in Piece 16 and is composed of 0.1 cm to 15 cm diameter, subrounded to angular clasts of serpentine and talc altered serpentinite in a clay-rich matrix. The serpentinized harzburgite clasts are not mylonitized. Pyroxenitic and gabbroic magmatic veins (MV) cut Pieces 2 and 4. Distinctive chrysotile filled cross-fibered extensional fractures (or tension gashes) perpendicular to a composite meta-gabbro-pyroxenite veins in Pieces 2B and 7 are generally wide in the center of the vein and taper into the harzburgite. Prominent sulfide veins appear to cut serpentine-talc veins where crosscutting relationships can be observed. Serpentine-talc veins (SAV) are present in Pieces 2, 3, 7, 8, 10, 11, 13, and 15. There is a mylonitic fabric in Piece 15 cut by later serpentine and sulfide veins. Crosscutting alteration vein relations are present in Pieces 2B, 4, and 10. All magmatic and alteration veins are postkinematic with respect to the CP deformations, however, only SAV and no MV are observed within the mylonite. Crosscutting relationships demonstrate Cp>Myl>/=Mv>SAV>SuV-CC-FT

Core Photo



209-1268A-12R-2 (Section top: 64.70 mbsf)

209-1268A-12R-2 (Section top 64.70 mbsf)

UNIT-II: Injection Breccia

Pieces 1–25

COLOR: Green to gray

PRIMARY MINERALOGY:

Olivine	Mode >75%
Orthopyroxene	Mode 10%–25% Size 1–10 mm Shape/Habit Equant Crystal Orientation: Primary lineation defined by orthopyroxene layers and trains of spinels, locally.
Spinel	Mode 1%

COMMENTS: This core consists of altered harzburgite with a coarse grained to medium grained protogranular texture. Piece 17 contains a boudin of very coarse recrystallized orthopyroxene (Sample 1268A-12R-2, 35-37 cm). The orthopyroxene-rich harzburgite (orthopyroxene as high as 35%) still displays a high temperature lineation defined by the orthopyroxene layering and trains of flattened spinel grains. Lower part of the core is made of microgabbro with orthopyroxene, clinopyroxene, and plagioclase. A coarse-grained (>1 cm), boudinaged, orthopyroxene layer is in Piece 17, parallel to the general layering.

SECONDARY MINERALOGY:

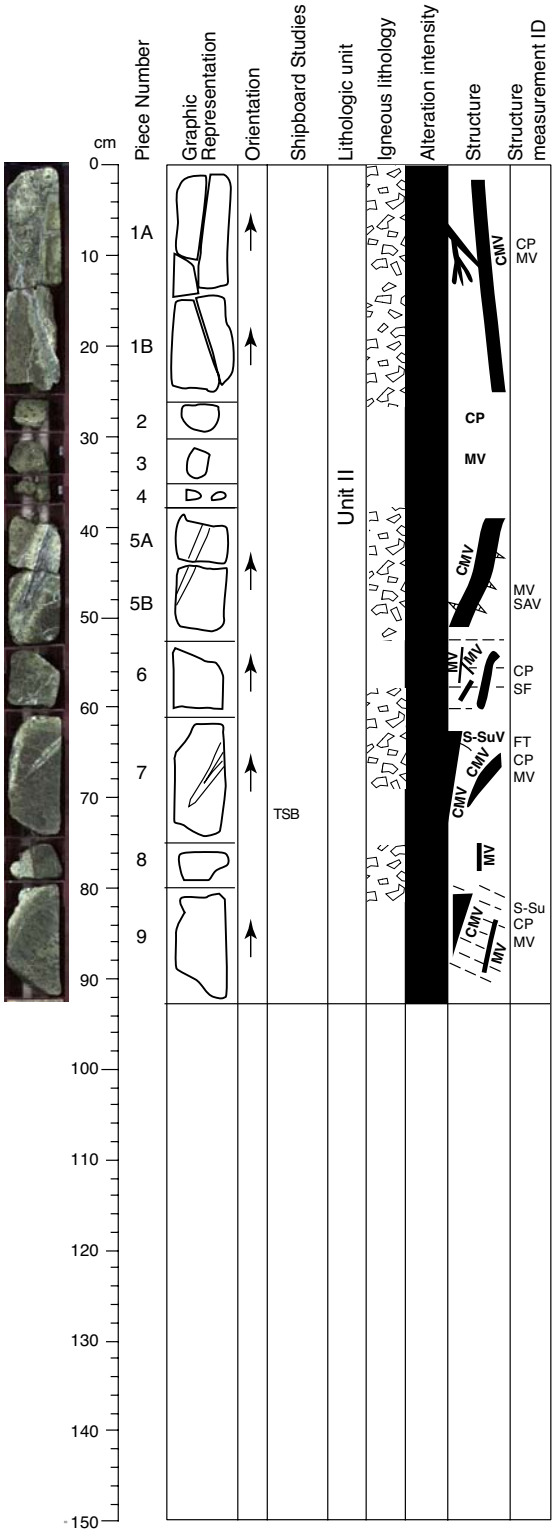
COMMENTS: The section consists mostly of vuggy talc alteration harzburgite with completely altered (variably serpentinized and talc altered) microgabbro in Pieces 13, 18-23, and 25.

VEIN ALTERATION: This section is complex. Vuggy talc alteration (VTA) has been imposed upon a harzburgite and gabbroic vein network. The gabbroic protolith contains veins of serpentine (Piece 6). The more massive serpentinized gabbro does not contain major veins. VTA after harzburgite contains relics of pyrite-iron oxide veins.

THIN SECTIONS: Samples 1268A-12R-2, 35-37 cm and 1268A-12R-2, 93-98 cm

STRUCTURE:
Section includes weakly porphyroclastic to protointergranular harzburgite (Pieces 1-17, 20, and 21) and weak to moderately deformed metagabbro. (Pieces 18, 19, 23, and 25). Piece 17 contains coarse orthopyroxenite stringers (or layering) subparallel to the crystal plastic foliation. Piece 13 contains a porphyroclatic mylonite. Metagabbro in Piece 18 is a tectonite with strong crystal plastic fabric. Pieces 7 and 9 are cut by pyroxenitic magmatic veins. Dense fractures with random orientations occur in Pieces 5-9. Pieces 6, 9, and 21 are cut by prominent serpentine talc veins. All magmatic and alteration veins are post-kinematic with respect to the crystal-plastic deformation, although no veins crosscut the mylonitic rocks. Crosscutting relationships demonstrate that Cp>>ML>Mv>SAV

Core Photo



209-1268A-12R-3 (Section top: 66.10 mbsf)

UNIT-II: Injection Breccia

Pieces 1–9

COLOR: Green

PRIMARY MINERALOGY:

Olivine	Mode 70%–80%
Orthopyroxene	Mode 15%–20%
	Size 1–5 mm
	Shape/Habit Equant to Subequant
Clinopyroxene	Mode 5% (totally replaced by tremolite)
Spinel	Mode 1%–2%

COMMENTS: This section consists of altered harzburgite to lherzolite with medium grained protogranular to porphyroclastic texture. Clinopyroxene has been recognized as an interstitial phase because of its typical alteration to tremolite. Pieces 1, 5, 7, and 8 are intruded by gabbroic dikes, which give a brecciated appearance (intrusion breccia) to the ultramafic section.

SECONDARY MINERALOGY:

COMMENTS: Green, completely serpentinized harzburgite (SHz) is cut by a network of gabbroic veins with talc/ sulfide rich halos. These gabbroic veins are completely altered mostly to prehnite, amphibole and chlorite, contain abundant sulfide and iron oxides and are cross cut by serpentine veins.

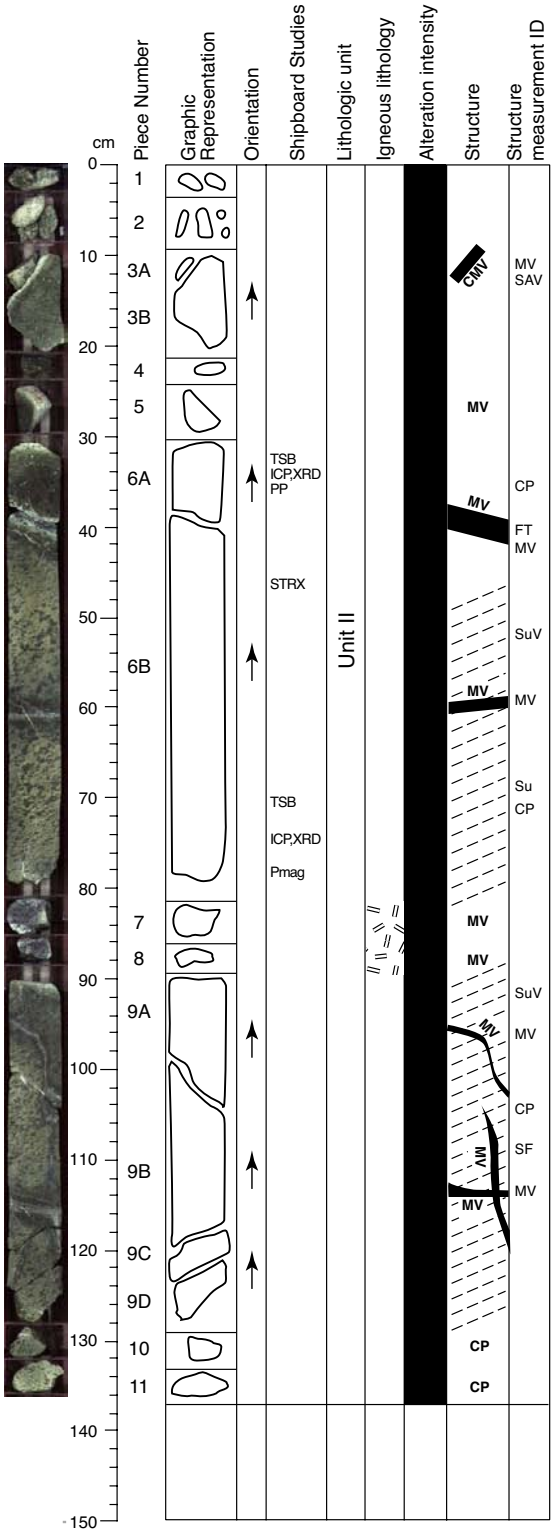
VEIN ALTERATION: Talc veins with disseminated sulfides occur in serpentinized harzburgite (SHz). They cut a previous generation of poorly developed serpentine veins. The talc veins do not cross cut the gabbro, but tend to be parallel to SHz and be mixed with serpentine veins throughout the serpentinized gabbro. Veins within the gabbro show complex relationships, with talc veins mixed with serpentine veins and rimmed by sulfides. Massive serpentine veins are cross cut by light green chrysotile veins.

THIN SECTIONS: Sample 1268A-12R-3, 71-74 cm

STRUCTURE:

Weakly to moderately foliated coarse porphyroclastic harzburgite with a steep crystal-plastic foliation in Piece 1 and flat to gently dipping foliation in Pieces 6 to 9. Pyroxenitic and pyroxenite-gabbroic composite magmatic veins cut Pieces 1, 3, 5, 6, 7, 8, and 9. Increased serpentine veining along margin of composite pyroxenite-metagabbro vein in Pieces 1A, 1B, 5, 6, 7, and 9. Distinctive chrysotile-filled extensional fractures perpendicular to the meta-gabbro-pyroxenite veins in Pieces 5 and 9. Prominent serpentine-talc-sulfide veins are present in Piece 7. All magmatic and alteration veins are post-kinematic with respect to the crystal-plastic deformation. There is no significant brittle deformation in this section. Crosscutting relationships show that CP>MV>SAV>S-SuV.

Core Photo



209-1268A-13R-1 (Section top: 68.20 mbsf)

UNIT - II: Intrusion Breccia

Pieces 1–11

COLOR: Green with small darker green patches.

PRIMARY MINERALOGY:

Olivine	Mode 80%
Orthopyroxene	Mode 20%
	Size 1–10 mm
	Shape/Habit Equant to Subequant
	Crystal Orientation High temperature lineation defined by elongated orthopyroxene
Spinel	Mode 2%

COMMENTS: This section consists mostly of serpentinized harzburgite with average of 78% olivine and 20% orthopyroxene with granular to porphyroclastic texture. Pieces 7 and 8 are gabbros that probably are part of an intruding dike. Gabbroic dikes cut the sequence at 39, 61, 99 and 115 cm but no primary magmatic mineralogy is preserved.

SECONDARY MINERALOGY:

COMMENTS: The section comprises completely serpentinized harzburgite with gabbroic veins and pyroxenite veins along which dark green, pyrite-bearing halos are developed. Thin (3 to 6 mm) gabbroic veins are completely altered to talc + chlorite ± tremolite ± sulfide ± oxide. Pyroxenites show bastite after orthopyroxene and clinopyroxene appears mostly altered to amphibole + chlorite, although some clinopyroxene may be preserved. Green serpentinized harzburgite has pronounced dark coronas of serpentine surrounding cores of serpentine ± sulfide ± oxide.

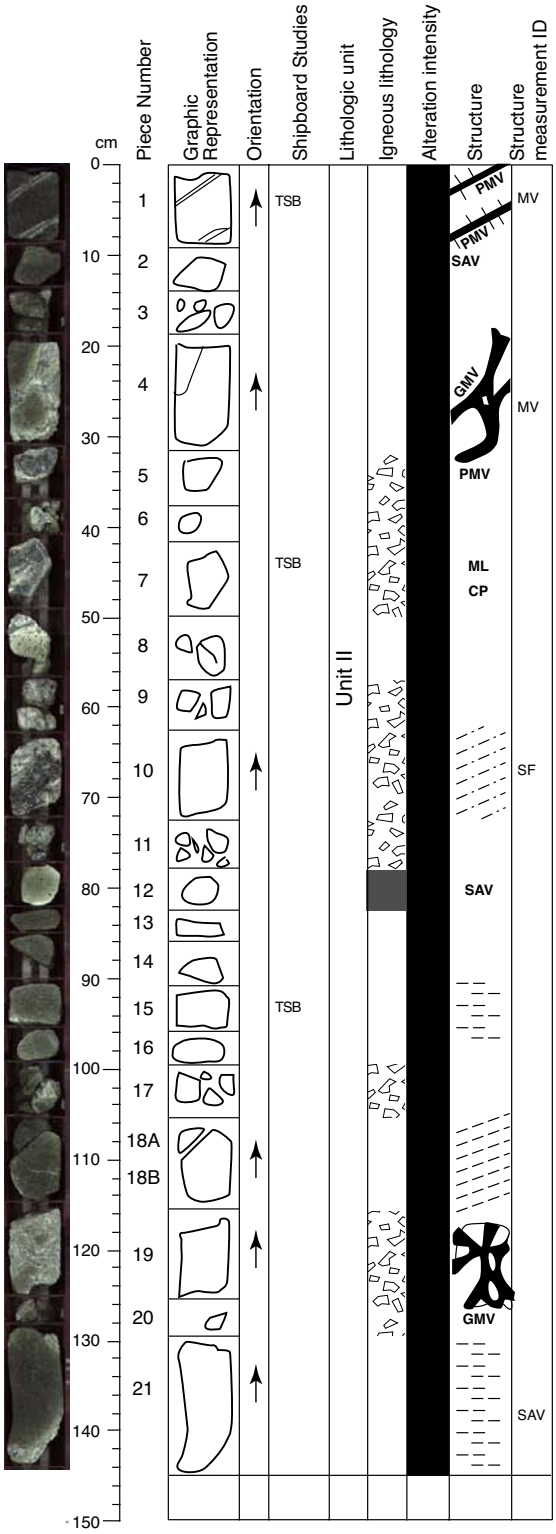
VEIN ALTERATION: Different generations of veins are distinguished by their respective sulfide content. Varying proportions of talc (60-90%) accompany clustered sulfide mineralization ± iron oxides, which is concentrated in areas where the veins cross orthopyroxene grains (Pieces 3, 5-6B and 9). Veins predominantly comprising sulfide (pyrite/marcasite) ± iron oxides form a network adjacent to the halo of the former pyroxenite vein of Piece 6B and within Piece 9. They comprise mainly sulfide (±10% iron oxide) and crosscut the former pyroxenite halo in Piece 9.

THIN SECTIONS: Samples 1268A-13R-1, 68-71 cm and 1268A-13R-1, 33-35 cm

STRUCTURE:

Weakly to moderately foliated porphyroclastic serpentinized harzburgite shows increase in fabric intensity toward the base of the section, especially in Pieces 6B to 11. The foliation is defined by the preferred dimensional orientation of pyroxene. The foliation is inclined ~24 degrees in the cut core face. Magmatic veins are typically pyroxenitic, pyroxenitic/gabbroic or gabbroic veins that cut Pieces 3, 5, 6, and 9. Pieces 7 and 8 are altered pyroxenite, which may represent vein material. All magmatic and alteration veins are post-kinematic with respect to the crystal-plastic deformation, although the composite vein at 40 cm in Piece 6 may have a slight foliation. There is a moderate brittle overprint around the margins of the ductile shear zone in Piece 6. Crosscutting relationships demonstrate that Cp>Mv>SAV>CC

Core Photo



209-1268A-13R-2 (Section top: 69.57 mbsf)

UNIT-II: Intrusion Breccia

Pieces 1–21

COLOR: Green. Patchy gray where gabbroic veins are present.

PRIMARY MINERALOGY:

Olivine	Mode 65%–87%
Orthopyroxene	Mode 12%–35%
	Size 1–10 mm
	Shape/Habit Anhedral
Spinel	Mode <2%

COMMENTS: This section consists of serpentinized harzburgite with granular to porphyroclastic texture. From 1 to 91 cm, the harzburgite has less orthopyroxene than the harzburgite in Section 1268A-13R-1, with an average of 12% (e.g., Section 1268A-13R-2, Piece 1). From 91 cm to the end of the core the percentage of orthopyroxene increases to as high as 30%-35% (Pieces 15 and 16). Several pieces in the section are brecciated harzburgite enriched in interstitial sulfides.

SECONDARY MINERALOGY:

COMMENTS: Green, completely serpentinized harzburgite with dunite (Piece 12) cut by a network of gabbroic veins that are completely altered to talc, chlorite, and serpentine. Harzburgite clasts in this intrusion breccia are rotated.

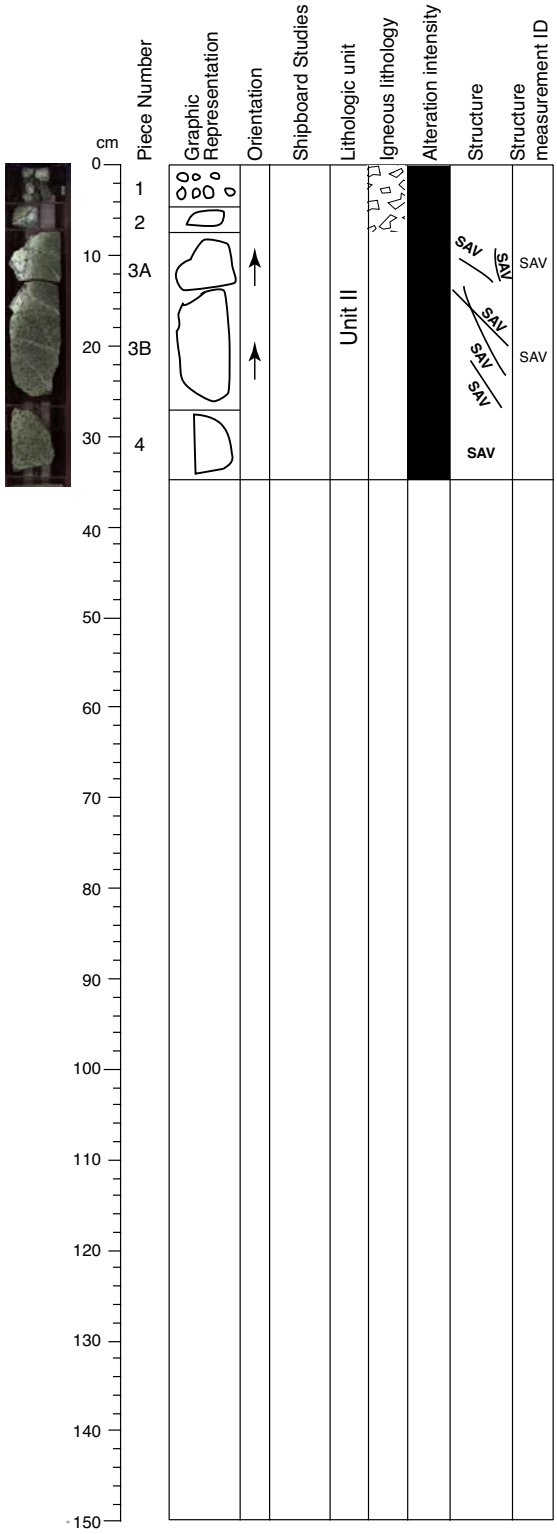
VEIN ALTERATION: Veining in this section, where present, varies according to the mineralogy of the background alteration. Intensity of veining is low (maximum <3% in former igneous texture of Pieces 19 and 20). Two vein types are typical of the serpentinized harzburgite (SHz) background material. One generation of white serpentine veins with (no sulfide/iron oxide) is closely associated with a second generation of sulfide/iron oxide veins which crosscut the serpentine (Pieces 13-18, and 21). In areas adjacent to the dunite/gabbro transition (Pieces 4, 12, 19, and 20) small, sigmoidal green chrysotile veins are subparallel to the contacts.

THIN SECTIONS: Samples 1268A-13R-2 3-6cm, 1268A-13R-2, 42-45cm and 1268A-13R-2, 92-95cm

STRUCTURE:

Moderately to strongly foliated porphyroclastic serpentinized harzburgite and altered pyroxenite make up the section. The foliation is defined by the preferred dimensional orientation of pyroxene. Piece 1 contains magmatic veins of pyroxenite and Pieces 4 and 19 appear to be part of an intrusion breccia with serpentinized harzburgite clasts within a gabbroic intrusive net veined matrix surrounding rotated clasts. Piece 10 is a mylonitized pyroxenite and Piece 15 contains a highly foliated pyroxenite. Piece 18 contains an unfilled fracture. All magmatic and alteration veins are post-kinematic with respect to the crystal-plastic deformation, although if Pieces 10 and 15 (pyroxenites without contact relationships) represent vein material, they would, in part, be pre- or synkinematic with respect to the mylonitic CP foliation. The intrusion breccias are postkinematic and undeformed.

Core Photo



209-1268A-13R-3 (Section top: 71.01 mbsf)

UNIT-II: Intrusion Breccia

Pieces 1–4

COLOR: Green. Gray where gabbroic veining is prominent.

PRIMARY MINERALOGY:

Olivine	Mode 80%
Orthopyroxene	Mode 19%
	Size 1–6 mm
	Shape/Habit Equant
Spinel	Mode 1%

COMMENTS: This section consists of serpentinized harzburgite with medium grained protogranular texture similar to the second part of Core 1268A-13R-2. Pieces 1 and 2 are breccias.

SECONDARY MINERALOGY:

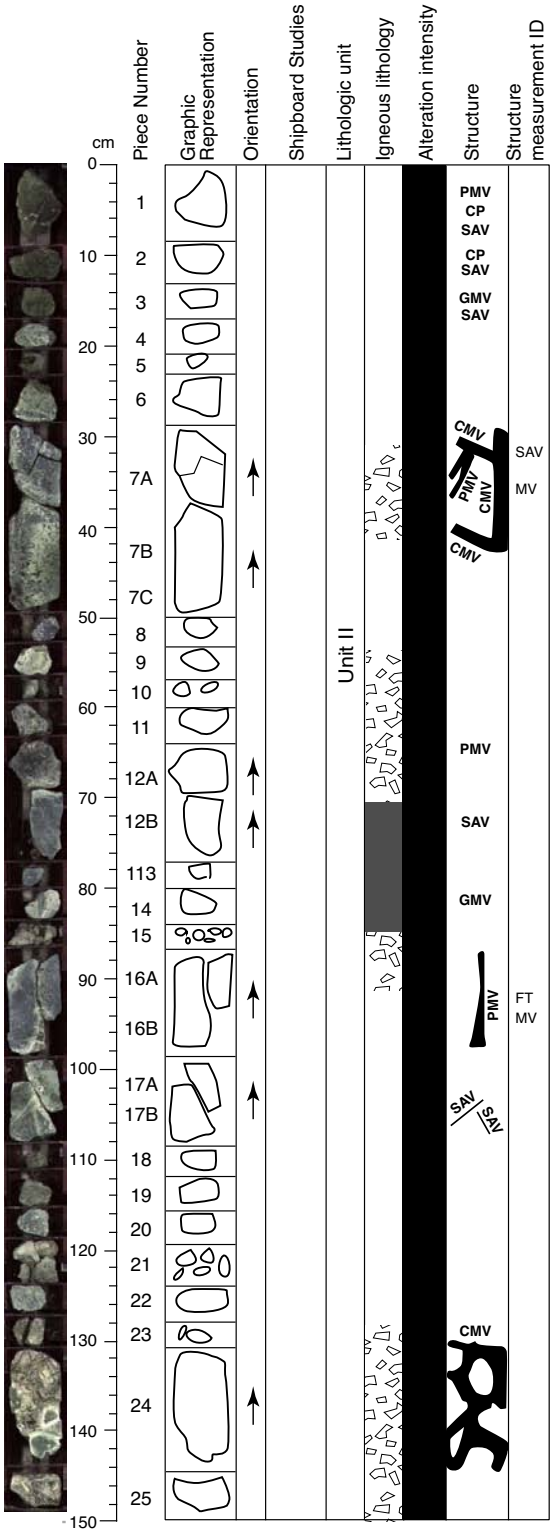
COMMENTS: Green, completely serpentinized harzburgite exhibit rare gabbroic veins with light green halos. Gabbroic veins are completely altered to talc, chlorite and serpentine. A chlorite +/- sulfide vein is developed in Piece 3 (could by splayed off gabbroic vein?) and is cut by a late serpentine vein. Pyrite veinlets are present in Piece 3. Well developed coronas of serpentine are present around orthopyroxene.

VEIN ALTERATION: This section has three types of veins present, but is not generally intensively veined. A dark green serpentine vein is present in Pieces 2-4 that in places (e.g., Piece 2) can comprise as much as 5% of the volume of the core. Also present is a small, talc dominated vein with sulfide and iron oxide rims (Pieces 4 and 3) and a poorly developed banded vein of white talc with up to 10% clustered sulfide (which may be of the same generation as the first talc vein).

STRUCTURE:

Weakly foliated to non-foliated protogranular serpentinized harzburgite with equant pyroxene. Prominent serpentine-talc alteration veins (SAV) are present in Pieces 1-4 and sulfide veins (SuV) are present in Piece 4. All alteration veins are postkinematic with respect to the crystal-plastic deformation.

Core Photo



209-1268A-14R-1 (Section top: 72.80 mbsf)

UNIT-II: Intrusion Breccia

Pieces 1–25

COLOR: Green in areas of harzburgite and dunite. Gray in areas of talc alteration.

PRIMARY MINERALOGY:

Olivine	Mode 75%–85%
Orthopyroxene	Mode 15%–25%
	Size 1–10 mm
	Shape/Habit Equant
Spinel	Mode 1%

COMMENTS: This section consists mainly of serpentinized harzburgite. The upper harzburgite is similar to Section 1268A-13R-3, with rather low orthopyroxene content (15%) and granular to porphyroclastic texture. Locally the peridotite is mylonitized with gabbroic impregnation (or segregation). A dunitic layer with 10% orthopyroxene cuts the middle of the section between 69 and 84 cm. A gabbroic dike cuts the sequence at about 35 cm. The whole section, and especially the lower, is characterized by intrusion breccias.

SECONDARY MINERALOGY:

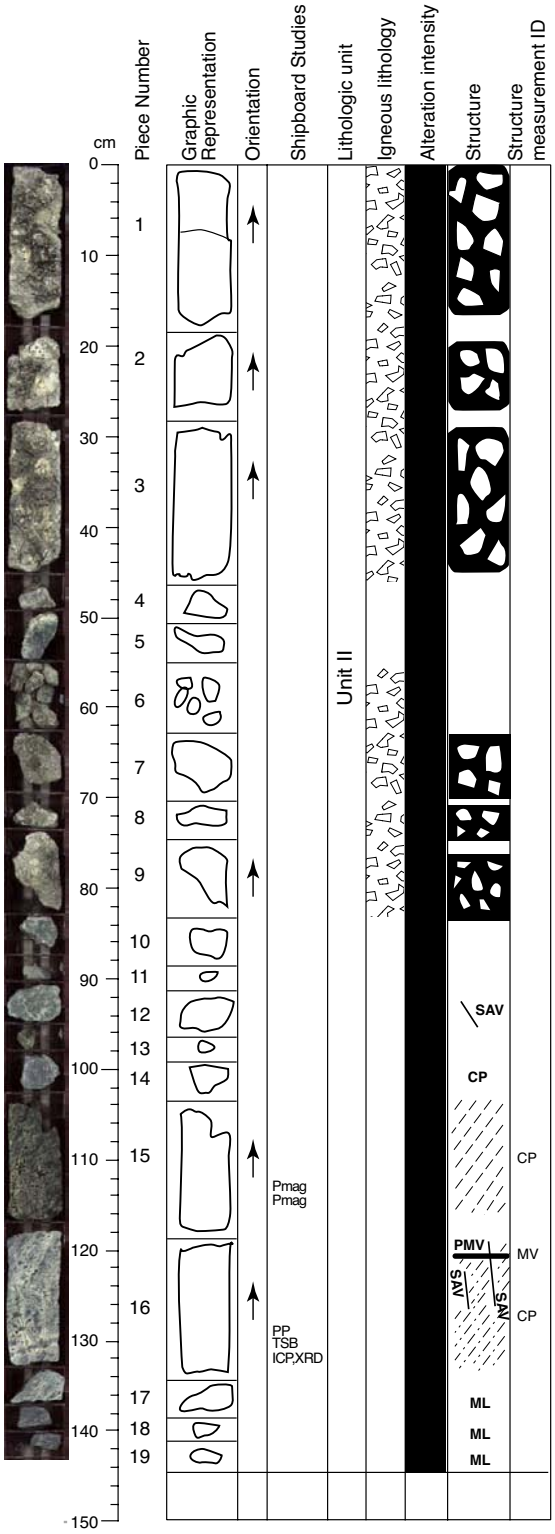
COMMENTS: This section is composed of harzburgites and rare dunites that are serpentinized, intruded and brecciated by a gabbro vein network, and variably talc altered. The lower part of the section (Pieces 15, 18, 19, and 23-25) has been intensely talc overprinted giving the gabbroic material a mottled texture and brownish to pinkish-white colors. Talc altered clasts in this intrusion breccia have whitish alteration haloes. Talc altered gabbro veins have rare pyrhotite.

VEIN ALTERATION: The top of the section is mostly serpentinized harzburgite (SHz) with talc veins occasionally running parallel to gabbro veinlets. Serpentinized gabbro veinlets contain cross-fractures filled with serpentine veins. At the bottom of the section is an igneous breccia made up of microgabbro matrix and clasts of orthopyroxene-poor harzburgite. Serpentine veins occur in the micrograbbro mostly as cross-fractures, but occasionally are parallel to the trend of the gabbroic margin. Serpentine veins in gabbros never cut peridotite clasts. Talc veins cut clasts of gabbros. The relationship between the generations of veins is well demonstrated in Piece 24.

STRUCTURE:

Weakly foliated protointergranular to porphyroclastic serpentinized harzburgite. Porphyroclastic pieces cannot be oriented. Protointergranular textured pieces show low modal pyroxene content (e.g., Pieces 16 and 17). Pieces 1, 11, 12, and 16 are cut by pyroxenite magmatic veins (PMV) and Pieces 1, 2, 11, 12, and 16 are cut by gabboic magmatic veins (GMV). Pieces 24 and 25 are magmatic intrusion breccias (IB) with a gabbroic matrix surrounding rotated harzburgite clasts. Piece 12 contains a contact between pyroxenite and a harzburgite. Prominent serpentine-talc alteration veins are present in Pieces 1, 2, 6, 12, and 17. All magmatic and alteration veins are post-kinematic with respect to the crystal-plastic deformation. Crosscutting relationships demonstrate that Cp >Mv>IB>SAV.

Core Photo



209-1268A-14R-2 (Section top: 74.29 mbsf)

UNIT-II: Intrusion Breccia

Pieces 1–19

COLOR: Green where harzburgite is present. Gray in areas of talc alteration and intrusion breccia

PRIMARY MINERALOGY:

Olivine	Mode 80%
Orthopyroxene	Mode 20%
	Size 1–7 mm
	Shape/Habit Anhedral to Interstitial
	Crystal Orientation Anhedral; elongated in Pieces 5 and 15 to 19
Spinel	Mode 1%

COMMENTS: This section consists mainly of serpentinized harzburgite with medium grained protogranular to porphyroclastic texture. The top portion of the section and between 55 and 83 cm is strongly brecciated by gabbroic intrusions. Locally the peridotite is mylonitized and gabbroic material is included in this mylonite. In the lower part of the section a primary high T foliation may be preserved.

SECONDARY MINERALOGY:

COMMENTS: This section begins with a talc altered intrusion breccia similar to Section 1268A-14R-1 (110 to 149 cm). Pieces 10 to 19 are vuggy talc altered harzburgite with serpentine after orthopyroxene becoming more abundant near the bottom of the section.

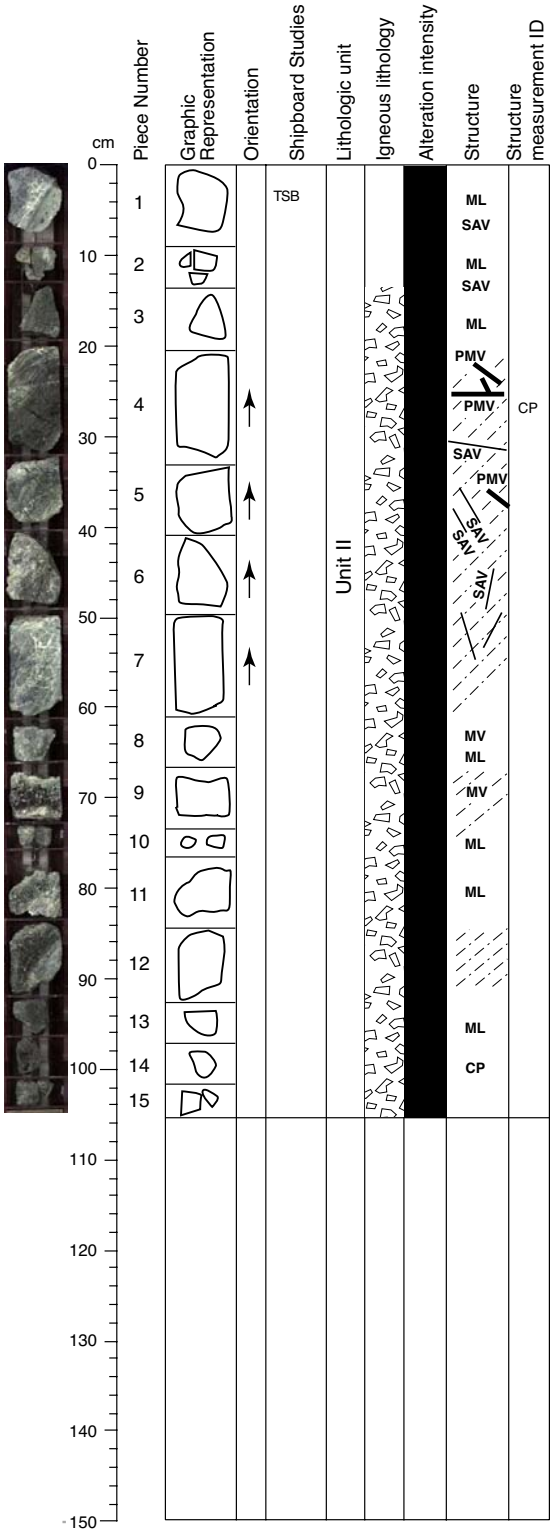
VEIN ALTERATION: The top of this section (Pieces 1-9) is similar to bottom of Section 1268A-14R-1. A gabbro breccia contains serpentine-chlorite cross-fractures. The bottom of the section (Pieces 10-19) is a serpentinized harzburgite (SHz) increasingly mylonitized towards the bottom. The alteration mostly comprises two generations of talc veins with sulfides that are locally overprinted by vuggy talc alteration (VTA). Talc veins are clearly later than the mylonite.

THIN SECTIONS: Sample 1268A-14R-2, 130-135 cm

STRUCTURE:

Pieces 1-4, 7-9, are intrusion breccias (IB) with angular to subrounded rotated clasts of harzburgite enclosed in an altered gabbroic matrix. Gabbroic matrix can show thick dark green serpentine-talc veins or tension gashes that appear to radiate from the harzburgite clasts, which may indicate a post-solidification volume expansion and hydration within the harzburgite clast. The rims of the harzburgite clasts are also talc altered, postdating these veins. Below the intrusion breccias, serpentinized harzburgite is found in Pieces 10 through 19. The crystal plastic fabric is weak in Pieces 9-12, but then quickly intensifies to a strong porphyroclastic foliation in Pieces 10-16 and increases to porphyroclastic mylonite at the base of Piece 16 to the base of the section (Piece 19). Piece 16 is also cut by a post-kinematic pyroxenite vein PMV that is subhorizontal and which is, in turn, cut by serpentinite-talc alteration veins (SAV). Prominent serpentine-talc alteration veins are present in Pieces 1-3, 12, and 16. All magmatic and alteration veins are post-kinematic with respect to the crystal-plastic deformation. Crosscutting relationships demonstrate that Cp>MV>IB>SAV.

Core Photo



209-1268A-14R-3 (Section top: 75.73 mbsf)

UNIT-II: Intrusion Breccia

Pieces 1–15

COLOR: Green where harzburgitic. Increasingly gray with greater intensity of intrusion breccia

PRIMARY MINERALOGY:
The section is too severely altered and deformed to recognize original mineralogy and grain size except for the uppermost short interval of harzburgite.

COMMENTS: This section consists mainly of variably deformed. intrusion breccia. The top of the section consists of 10-cm thick interval of harzburgite with a medium protogranular texture with 20% medium grained orthopyroxene and a 1% fine-grained spinel (see Sample 1268A-14R-3, 3-5 cm). Mylonitized material from this section is a mixture of ultramafic and gabbroic materials.

SECONDARY MINERALOGY:

COMMENTS: This section is mainly composed of an intrusion breccia of gabbro into harzburgite. Pieces 2 to 6 are part of a mylonitic shear zone as is Piece 1 that lacks gabbroic material. Piece 7 is also not affected by gabbro veining and is only weakly deformed. Pieces 8 to 15 are weakly deformed, highly talc altered, intrusion breccia.

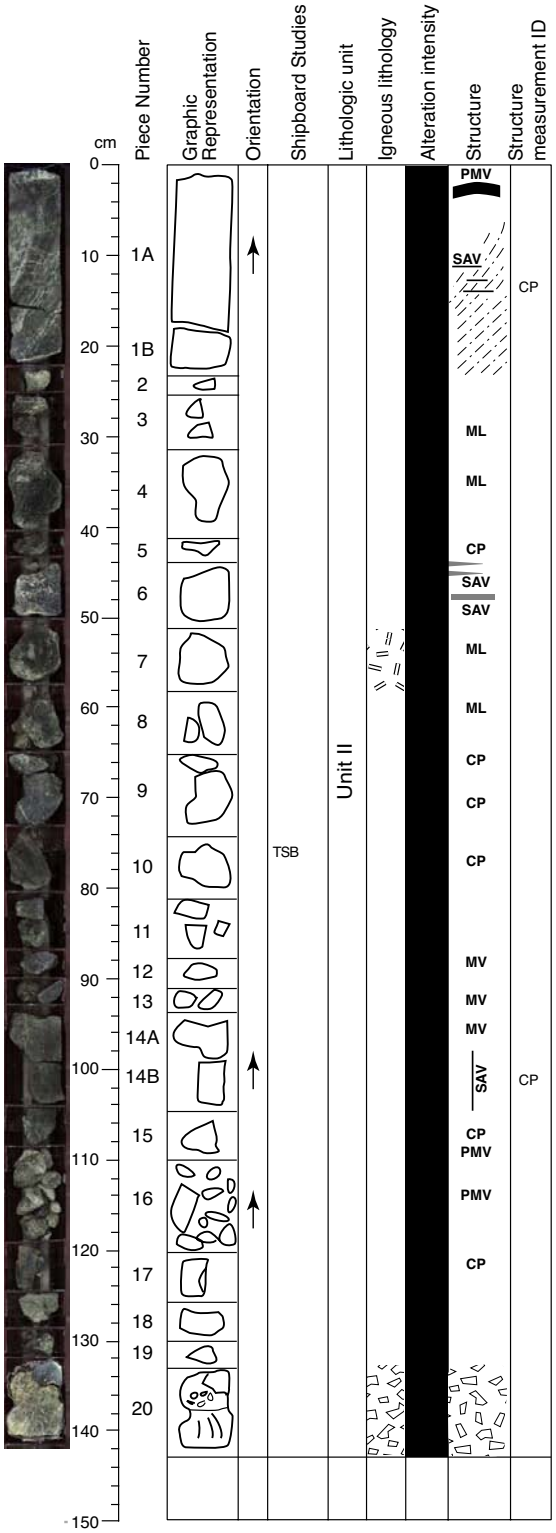
VEIN ALTERATION: This whole section is a mylonite containing pieces of vuggy talc alteration (VTA) after serpentinized harzburgite (SHZ) and serpentinized gabbro (SGB). Serpentine veins whose composition strongly depends on the background alteration style cut the whole section. In the VTA the veins consist mainly of chrysotile and in SGB mainly of massive serpentine-talc-chlorite veins. These veins are similar to those described in SGB of Sections 1268A-14R-1 and 14R-2. Piece 1 demonstrates the compositional variability of this section well.

THIN SECTIONS: Sample 1268A-14R-3, 3-5 cm

STRUCTURE:

Strongly foliated porphyroclastic mylonite (ML) to ultramylonites dominantly serpentinized harzburgite in Pieces 1-12. Certain Pieces (4, 8, 9-11, and 13) contain pyroxenites which have been mylonitized and/or strongly deformed. Pieces 12 - 14 show a weaker porphyroclastic foliation. The mylonite foliation is inclined by 45 degrees in the cut face of the core. Porphyroclast kinematic indicators show a reverse sense of motion in Piece 4. The foliation is defined by the preferred dimensional orientation of pseudomorphed pyroxene. Coarse-grained magmatic pyroxenitic (PMV2) and gabbroic (GMV2) veins crosscut the mylonite foliation and are undeformed demonstrating their post-kinematic nature. Pyroxenite zones within the mylonites are also transposed as schlieren parallel to the foliation. This may indicate an earlier vein episode prior to mylonitization (MV1). Prominent serpentinite veins also cut post-kinematically across the mylonite foliation. Thin section shows that serpentinization and talc alteration is a static overprint of the high temperature deformation textures. Prominent serpentine-talc alteration veins are present in Pieces 1, 4, 5, 6, and 7. Straight crosscutting magmatic and alteration veins are post-kinematic with respect to the crystal-plastic deformation, although transposed pyroxenites may represent a pre- to syn- kinematic episode of magmatic veining. Crosscutting relationships demonstrate that MV1>ML>MV2>SAV.

Core Photo



209-1268A-15R-1 (Section top: 77.80 mbsf)

UNIT-II: Intrusion Breccia

Pieces 1–20

COLOR: Greenish brown

PRIMARY MINERALOGY:

Olivine	Mode 85%
Orthopyroxene	Mode 15%
	Size 1–7 mm
	Shape/Habit Anhedral
Spinel	Mode 1%

COMMENTS: This section is similar in character to Core 1268A-14R. It consists mainly of mylonitized and brecciated harzburgite with gabbroic material included in the mylonitic bands. Otherwise, the texture is medium grained protogranular. Possibly fresh olivine is present in mylonitic bands. Piece 2 is a little pebble of gabbro. Piece 7 seems to include a gabbro orthopyroxene-porphyroclast. A variably deformed breccia ends the section and marks the end of Unit II.

SECONDARY MINERALOGY:

COMMENTS: This section represents a zone of complex interfingering of completely altered harzburgite and another completely altered rock type tentatively classified as a microgabbro. This rock is brown with locally abundant white pseudomorphs probably after plagioclase. The section shows prominent foliation and may represent an altered shear zone.

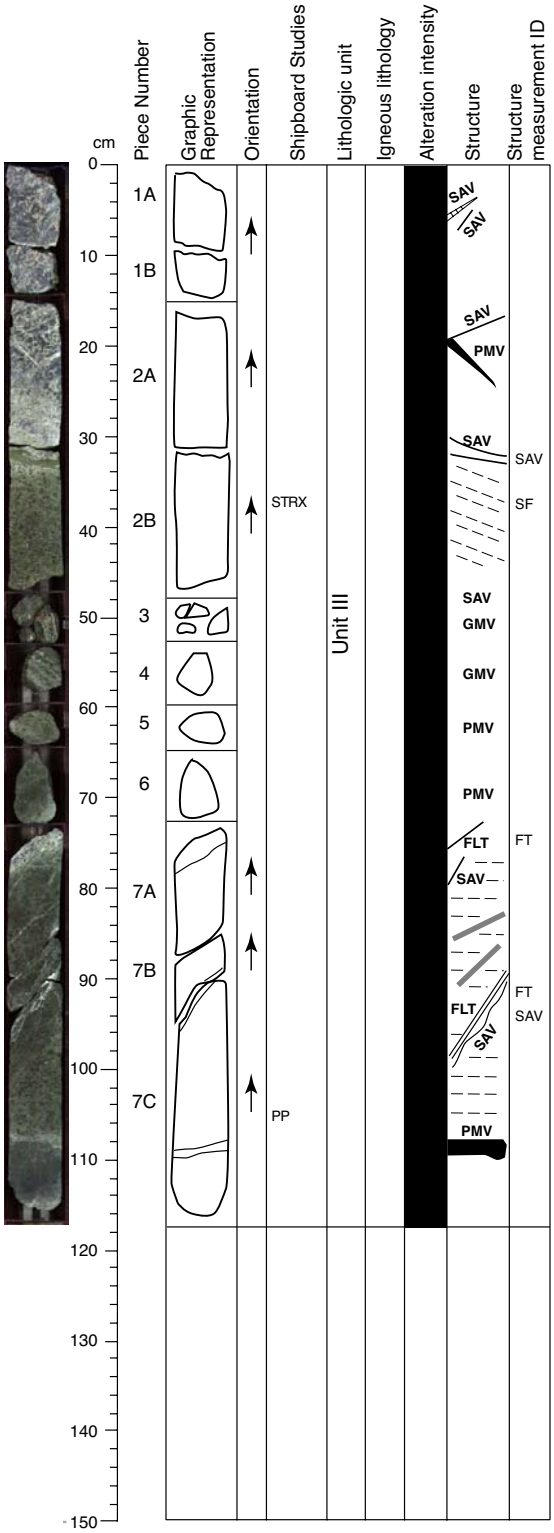
VEIN ALTERATION: This section is veined by small branching talc veins that contain little sulfide (<20% sulfide in Piece 1, <5% in Pieces 9-14). Chlorite may be present in small amounts in the dark green serpentine veins. Occasional white and green fibrous chrysotile veins are present in Pieces 15-18.

THIN SECTIONS: 1268a-15R-1 75-77cm

STRUCTURE:

Pieces 1-8 consist of mylonitic harzburgite (Pieces 1-6) and mylonitic pyroxenite. (Pieces 4, 7, and 8). Piece 1 contains the upper edge of the mylonite and the top left edge of the core is only mildly deformed. The weak foliation is near vertical at the top of the piece and becomes increasingly shallower toward the base within the zone of most intense foliation and grain size reduction (foliation inclined ~65 degrees in the core cut face). This finite strain gradient can be used as a kinematic indicator in tandem with porphyroclast pressure shadow tails. Both indicate a reverse sense of motion in the ductile shear zone represented by the mylonite. Two postkinematic pyroxenite veins (MV2) that post-date the crystal-plastic deformation in the Piece 1. Pieces 9-19 have less intense coarser porphyroclastic textures, but include at least highly foliated meta-pyroxenite (Pieces 10-17). Pieces 18 and 19 are porphyroclastic harzburgites, which may represent an earlier generation of magmatic veins (MV1). Prominent serpentine-talc (SAV) cut the mylonite or porphyroclastic foliations in Pieces 1, 4, 6, 9, and 14. Piece 20 consists of a fault gouge with larger clasts of serpentinized harzburgite and clay to serpentine fibers in the matrix. This inferred cataclastic fault rock. marks the base of the section. Straight crosscutting magmatic and alteration veins are post-kinematic with respect to the crystal-plastic (CP) deformation and mylonitization (ML), although deformed pyroxenites may represent a pre- to synkinematic episode of magmatic veining. Crosscutting relationships demonstrate that MV1?>CP-ML1>MV2>SAV>CC.

Core Photo



209-1268A-15R-2 (Section top: 79.22 mbsf)

UNIT-III: Harzburgite/Dunite

Pieces 1-–7

COLOR: Green in serpentinized harzburgite. Grey in areas of talc alteration.

PRIMARY MINERALOGY:

Olivine	Mode 80%
Orthopyroxene	Mode 20%
	Size 1–10 mm
	Shape/Habit Anhedral to interstitial
Spinel	Mode 1%

COMMENTS: This section consists of serpentinized harzburgite with porphyroclastic texture, similar to those of Cores 1268A-12R and 13R. Mylonitic bands are very few. In detail, it varies from coarse-grained and orthopyroxene rich (see Section 1268A-15R-2 at 40 cm) to more porphyroclastic with smaller grains (see Section 1268A-15R-2 at 81 cm). Gabbroic dikes cut the sequence at 50 and 75 cm.

SECONDARY MINERALOGY:

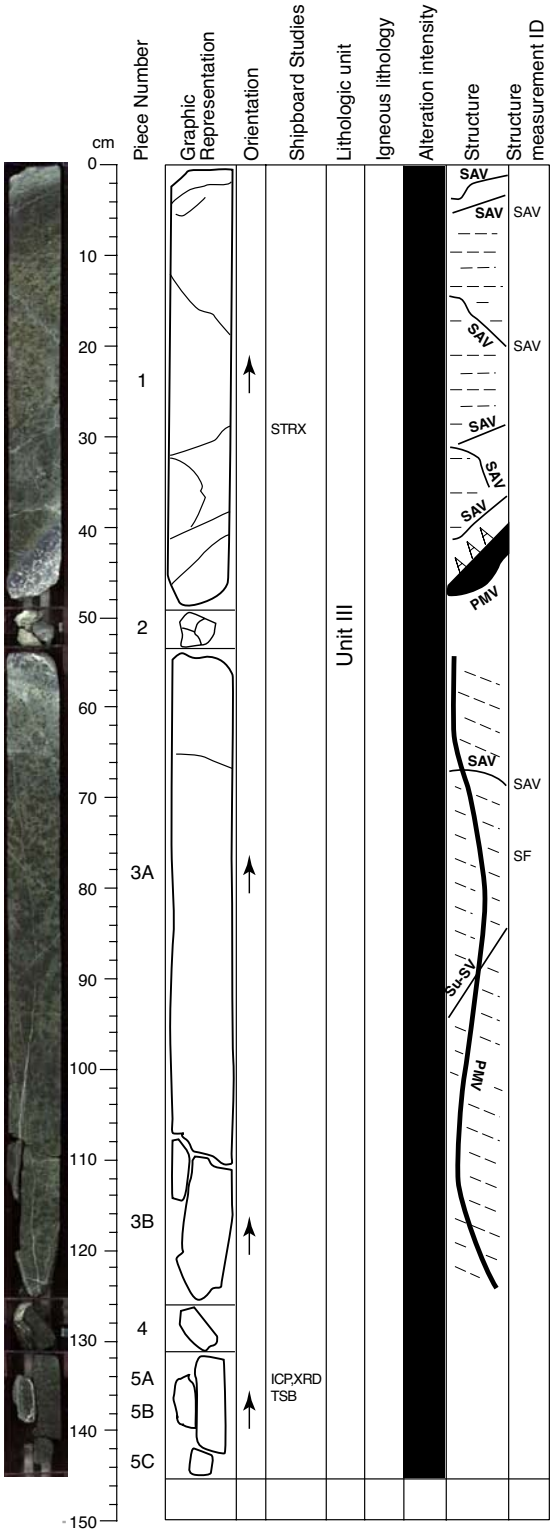
COMMENTS: The lower part is completely serpentinized harzburgite with locally developed halos along serpentine veins as wide as 1 cm. Piece 2 shows a gradient from serpentinization to vuggy talc alteration over ca. 10 cm of the section. In this interval, orthopyroxenes are pseudomorphed by dark green serpentine and chlorite. Piece 2B contains peculiar sub-mm ribbons, which are preferentially preserved in orthopyroxene pseudomorphs and are largely situated in the serpentinized olivine rich matrix.

VEIN ALTERATION: Three styles of veining are seen throughout the whole length of this section. Small chrysotile veins ranging in color from white through light to dark green are commonly sub-parallel to former igneous veins and larger serpentine veins, (Pieces 2A, 2B, 4, and 7). Two further vein types can be identified; large, single serpentine veins that contain no sulfide and finer branching talc veins that contain varying amounts of sulfide (e.g., can completely fill the vein in Piece 7).

STRUCTURE:

The section consists of porphyroclastic harzburgite (Pieces 1- 3, 6, and 7,) and vein pyroxenite (Pieces 4, 5, and 6). Pieces 2-7 contain pyroxenitic (PMV) and gabbroic magmatic veins (GMV). In Piece 4 a gabbroic magmatic vein cuts pyroxenitic vein material. At least two brittle shear zones cut Piece 7. A serpentine slickenfibered fault surface is found at the top of the piece at 75-78 cm. and at 88-97 cataclastic shear zones (CC) cut the piece and contains serpentine fibers parallel to the cataclastic shear direction. Pieces 1, 2 and 4 contain prominent serpentine/talc veins (SAV). All magmatic and alteration veins are post-kinematic with respect to the crystal-plastic deformation. Crosscutting relationships demonstrate that Cp>Mv>SAV=CC.

Core Photo



209-1268A-15R-3 (Section top: 80.40 mbsf)

UNIT-III: Harzburgite/Dunite

Pieces 1–5

COLOR: Green in areas of serpentinized harzburgite. Grey in areas of talc alteration.

PRIMARY MINERALOGY:

Olivine	Mode 80%
Orthopyroxene	Mode 20%
	Size 2–10 mm
	Shape/Habit Equant to anhedral
Spinel	Mode 1%

COMMENTS: This section consists of serpentinized harzburgite with medium granular to porphyroclastic texture, which is the continuation of Section 1268A-15R-2 (similar in texture and modal composition).

SECONDARY MINERALOGY:

COMMENTS: This section consists of completely serpentinized harzburgite divided by a ca. 15-cm wide zone of vuggy talc alteration (Pieces 2 and 3). The contact between completely serpentinized harzburgite and the vuggy talc alteration is gradational over ca. 1cm. The completely serpentinized harzburgite shows a homogeneous appearance except for the lower part of Piece 2 and the upper part of Piece 3. Orthopyroxene is black commonly with bastite cores.

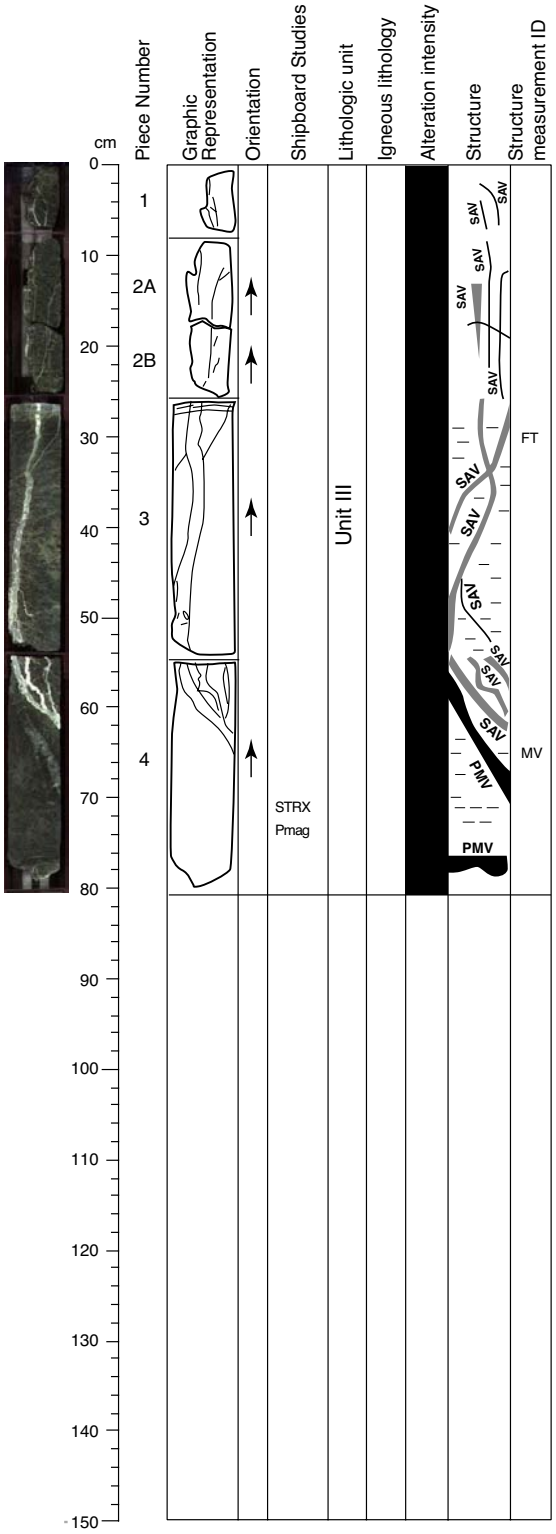
VEIN ALTERATION: Up to four generations of veins are present in this section of core with the most complex relations seen in Piece 3. Sigmoidal, white and dark green chrysotile veins are subparallel to the margins of vuggy talc alteration (VTA). Within the serpentinized harzburgite (SHz), a branching talc vein with <10% disseminated sulfide and iron oxide/chlorite (?) runs for most of the length of Piece 3. This is subsequently crosscut by talc veins with as much as 10% of clustered sulfide. The final generation is comprised entirely of sulfide and appears to have been the last generation to be emplaced.

THIN SECTIONS: Sample 1268A-15R-3, 135-137 cm

STRUCTURE:

Serpentinized harzburgite with weak to moderate foliation defined by the defined by the preferred dimensional orientation of pyroxene. Texture is porphyroclastic and the foliation becomes less intense with depth in the section. Piece 1 contains pyroxenitic magmatic veins (PMV) at its base and Piece 3 has a long longitudinal pyroxenitic vein that runs the length of its left side. Small pieces in Pieces 4 and 5 contain pyroxinitic and harzburgite fragments. Prominent serpentine-talc alteration veins (SAV) and serpentine-talc sulfide composite veins (S-SuV) are present in Pieces 1 and 3. All magmatic and alteration veins are post-kinematic with respect to the crystal-plastic deformation. Crosscutting relationships demonstrate that CP>PMV>SAV and CP>PMV>S-SuV.

Core Photo



209-1268A-15R-4 (Section top: 81.86 mbsf)

UNIT-III: Harzburgite/Dunite

Pieces 1–4

COLOR: Green where serpentinized harzburgite.

PRIMARY MINERALOGY:

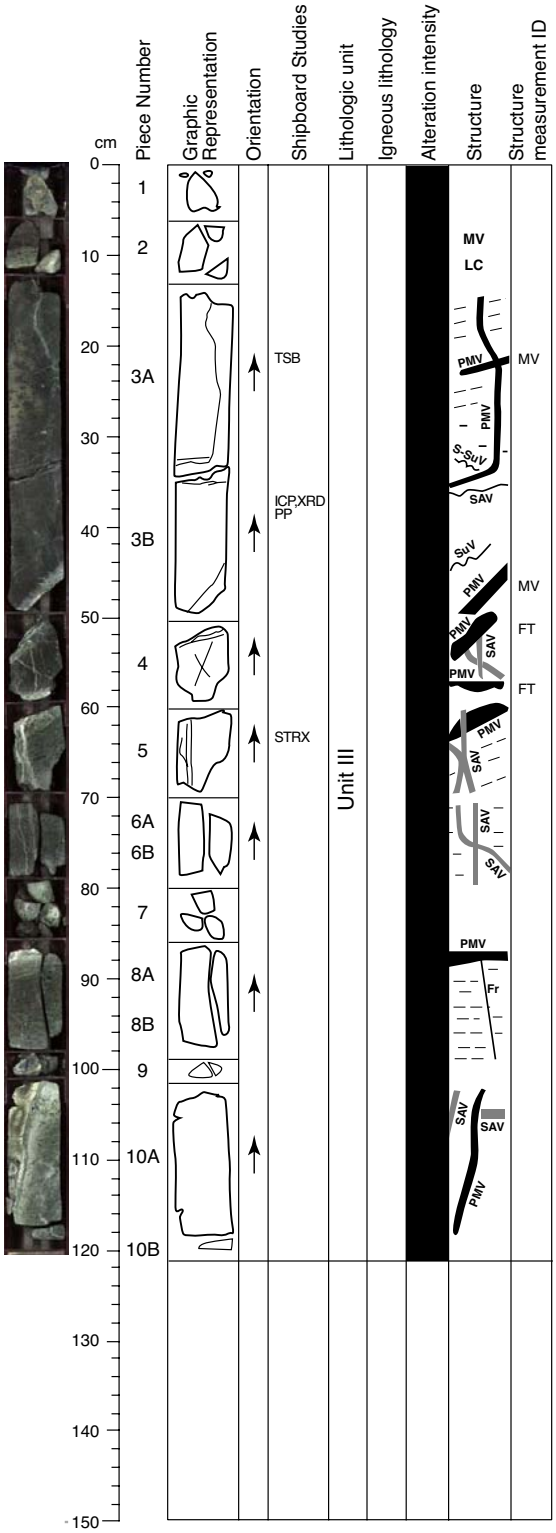
Olivine	Mode 84%
Orthopyroxene	Mode 15%
	Size 1–7 mm
	Shape/Habit Anhedral
Spinel	Mode 1%

COMMENTS: This section is very similar to the previous Core 1268A-15R-3. It still consists of serpentinized harzburgite but the texture is mainly porphyroclastic and orthopyroxene is less abundant. A gabbroic dike cuts the sequence at around 64 cm.

SECONDARY MINERALOGY:

COMMENTS: This section consists of homogeneous, dark green, completely serpentinized harzburgite. Some orthopyroxenes contain bastite cores. There is a major ca. 1cm wide transgranular serpentine vein that is sub-parallel to the walls that crosscuts half of the section.

Core Photo



209-1268A-16R-1 (Section top: 82.40 mbsf)

UNIT-III: Harzburgite/Dunite

Pieces 1–10
COLOR: Green in serpentinized harzburgite. Gray in talc altered gabbroic dikelets.

PRIMARY MINERALOGY:

Olivine	Mode 82%
Orthopyroxene	Mode 18%
	Size 3–10 mm
	Shape/Habit Anhedral
Spinel	Mode 1%

COMMENTS: This section consists of serpentinized harzburgite with porphyroclastic texture. Gabbroic segregations characterized by large spinel grains are present at 24 cm and 109 cm. A gabbroic dike cuts the sequence at 50 cm. Locally, mylonitic bands are associated with dikelets and segregations.

SECONDARY MINERALOGY:

COMMENTS: This section consists of green, completely serpentinized harzburgite (SHz) with local occurrences of crosscutting, completely chlorite-talc altered gabbroic dikelets (Pieces 3, 4, 8, and 10). Typically these dikelets have black and green alteration halos. Late serpentine veins cut across and splice the dikelets. The lower part of Piece 2 is a completely altered pyroxenite.

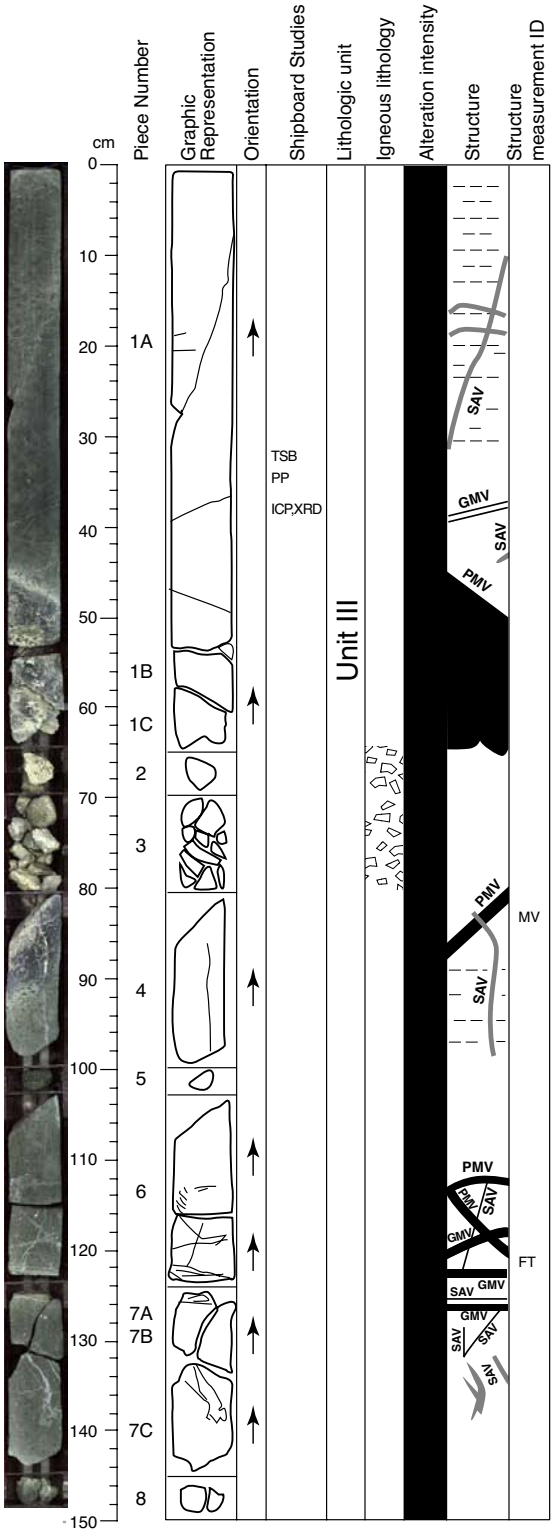
VEIN ALTERATION: This section contains three generations of veins. An earlier generation of wispy serpentine veins is well developed in the green serpentinized harzburgite (SHZ). This generation cuts across magmatic features and offsets them (e.g., Piece 3A). Associated with this generation are also massive pyrite-iron oxide veinlets. Perpendicular thick serpentine-talc veins crosscut these two generations of veins. These veins run parallel to the gabbro layer. Thicker gabbroic veins display cross-fracture of chrysotile-talc veins.

THIN SECTIONS: 1268A-16R-1 21-24cm

STRUCTURE:

The section is characterized by weakly foliated porphyroclastic serpentinized harzburgite. The crystal-plastic foliation has a nearly horizontal trace in core cut face. Pieces 2 –4, 6, 8, and 10 are cut by a altered pyroxenitic magmatic veins (PMV) and Piece 8 is cut by an altered pyroxenitic-gabbroic composite vein (CMV). Darker to light green serpentine alteration veins (SAV1) or tension gashes cut the PMV perpendicular to its vein wall. The gashes are widest in the center of the vein and taper and terminate in the serpentinized harzburgite accommodating volume expansion in the altered olivine-rich rock. Prominent white and light green non-differentiated serpentine/talc veins (SAV2) in turn cut the MV, the orthogonal tension gashes and each other. Sulfide veins (SuV) appear to cut many of the SAV2 or earlier veins. All magmatic and alteration veins are post-kinematic with respect to the crystal-plastic deformation. Crosscutting relationships demonstrate that CP>MV>SAV1>SAV2>SuV.

Core Photo



209-1268A-16R-2 (Section top: 83.61 mbsf)

UNIT-III: Harzburgite/Dunite

Pieces 1–8

COLOR: Green where serpentinized harzburgite. Gray where talc altered.

PRIMARY MINERALOGY:

Olivine	Mode 80%–85%
Orthopyroxene	Mode 15%–20%
	Size 1-10 mm
	Shape/Habit Anhedral
	Crystal Orientation No distinctive igneous fabric discerned
Spinel	Mode 1%

COMMENTS: This section consists of serpentinized harzburgite with medium protogranular to porphyroclastic texture. Gabbroic dike cuts the sequence at 58 cm. There is a low temperature brecciated layer between 64 and 81 cm.

SECONDARY MINERALOGY:

COMMENTS: The top and the bottom of this section are massive, completely serpentinized harzburgite with up to 1 cm wide serpentine veins. This unit is disrupted by a completely talc altered gabbro and there is a heavy talc overprint of the hosting harzburgite in Pieces 1B, 1C, and 4.

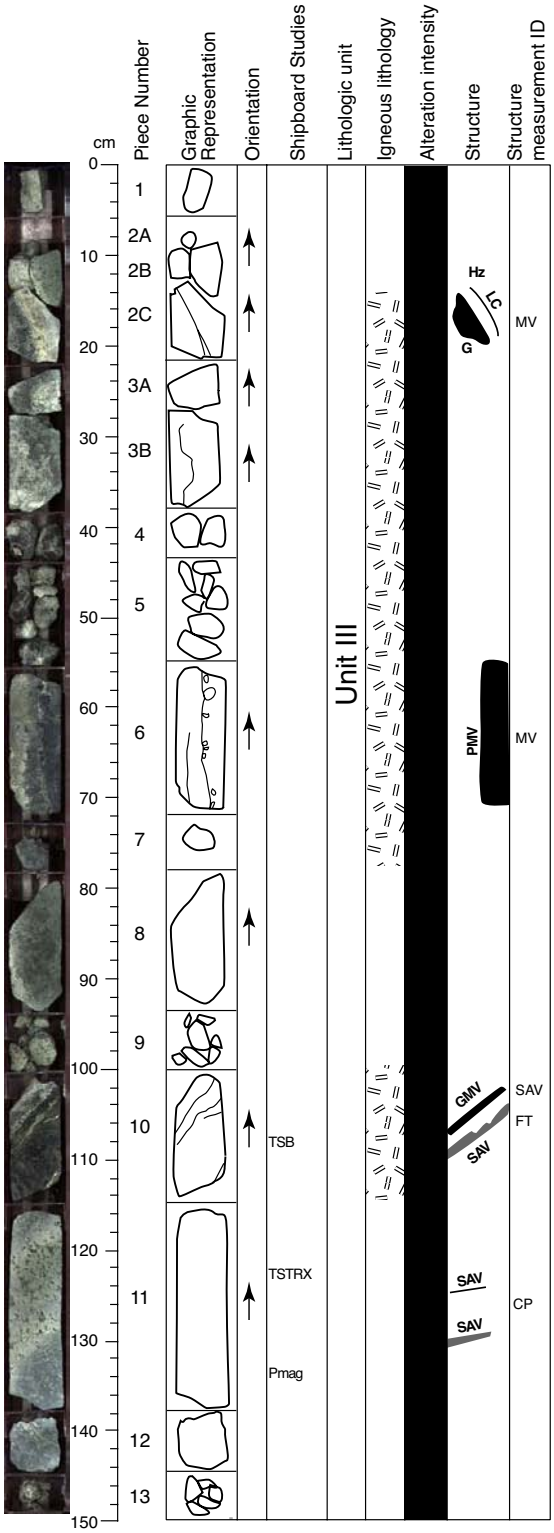
VEIN ALTERATION: The section shows a first generation of serpentine and serpentine-talc-sulfide veins that are very well developed in the serpentinized harzburgite (SHz). They do not occur in vuggy talc alteration (VTA) as they fade out as they approach this lithology. A late generation of thick serpentine-talc veins runs from the top to bottom of the core crosscutting SHz and VTA. VTA hosts chrysotile cross-fiber veins and serpentine veins subparallel to the SHz-VTA contact (see bottom of Piece 1A). Veins in serpentinized gabbro are mostly dark green talc-serpentine veins that do not occur in peridotites.

THIN SECTIONS: Sample 1268A-16R-2, 31-34 cm

STRUCTURE:

The section is characterized by weakly foliated porphyroclastic serpentinized harzburgite with a crystal-plastic foliation that is inclined subhorizontal in core cut face and best displayed in Pieces 1 and 6. Piece 1, 4, and 7 are cut by pyroxenitic magmatic veins (PMV), and Pieces 1, 6, and 7 are cut by gabbroic magmatic veins (GMV). Piece 1 is characterized by a thick pyroxenitic vein at its base. Several generations of undifferentiated and prominent green and later white serpentine/talc veins (SAV) in turn cut the MV. All magmatic and alteration veins are post-kinematic with respect to the crystal-plastic deformation. Crosscutting relationships demonstrate that CP>MV>SAV.

Core Photo



209-1268A-16R-3 (Section top: 85.11 mbsf)

UNIT-III: Harzburgite/Dunite

Pieces 1–2, 8–9, 11–13

COLOR: Green where serpentinized harzburgite. Gray where talc altered.

PRIMARY MINERALOGY:

Olivine	Mode 80%–85%
Orthopyroxene	Mode 15%–20% Crystal Orientation: Orthopyroxene seems to define primary lineation, locally.
Spinel	Mode 1%

COMMENTS: This section consists of serpentinized harzburgite with medium protogranular texture. Pieces 8, 9, and 11 to 13 show a high-temperature foliation.

Pieces 2 to 7 and 10

PRIMARY MINERALOGY:

This rock is too altered to reliably identify the mineralogy.

COMMENTS: Pieces 2 to 7 is a continuous gabbroic dike that cuts the harzburgite. Primary magmatic mineralogy is not preserved.

SECONDARY MINERALOGY:

COMMENTS: This section includes gabbro (Pieces 2 to 5, and Piece 10) and pyroxenite (Pieces 6 and 7) embedded in serpentinized harzburgite. The harzburgite is talc-overprinted at the contacts with the gabbro units and chlorite-rich near the almost vertical pyroxenite dikelet. At the bottom of the section the harzburgite is heavily talc overprinted close to the underlying gabbro (seen in the rubble at the end of the section and in the following section, 16R-4).

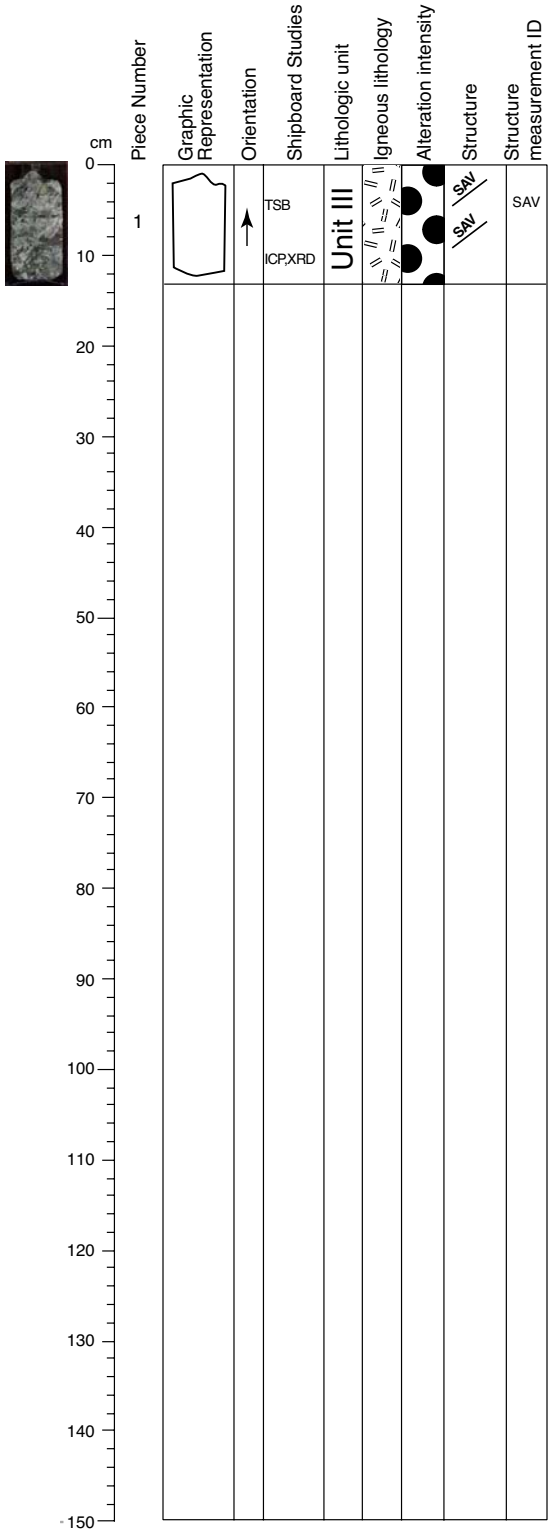
VEIN ALTERATION: There are different types of veins in serpentinized harzburgite (SHz), vuggy talc alteration (VTA) and serpentinized gabbro (SGb) which are similar in type and distribution to Section 16R-2.

THIN SECTIONS: Sanple 1268A-16R-3, 107-110 cm

STRUCTURE:

The section is characterized by weakly foliated protointergranular serpentinized harzburgite (Pieces 1, 2, 4, 5, and 7-13), undeformed, but altered metagabbro (Pieces 2 and 3), and pyroxenitic and gabbroic veins. The crystal-plastic foliation is not well defined. Piece 2 contains the contact between an undeformed medium to fine grained gabbro intrusion and peridotite and Piece 3 is a patchy fine to medium undeformed gabbro without harzburgite. Piece 6 shows the near vertical contact between a pyroxenite magmatic vein (PMV-right) and harzburgite (left). Piece 10 is a pyroxenite cut by gabbroic magmatic veins (GMV). Darker to light green serpentine alteration veins (SAV) or tension gashes cut the PMV perpendicular to its vein wall. The gashes are widest in the center of the vein and taper and terminate in the serpentinized harzburgite apparently accommodating volume expansion in the altered olivine-rich rock. Prominent white and light green non-differentiated serpentine/talc veins occur in Pieces 10 and 12. All magmatic and alteration veins are postkinematic with respect to the crystal-plastic deformation. Crosscutting relationships demonstrate that CP>MV>SAV.

Core Photo



209-1268A-16R-4 (Section top: 86.61 mbsf)

UNIT-III: Harzburgite/Dunite

Piece 1

COLOR: Greenish gray.

PRIMARY MINERALOGY:

Clinopyroxene	Mode 35% Size 4–10 mm Shape/Habit Euhedral
Plagioclase	Mode 65% Size 3–20 mm Shape/Habit Anhedral to subhedral

COMMENTS: This section consists of one single Piece of coarse-grained gabbro that is texturally similar to that found at the top of the following Section 1268A-17R-1. This coarse grained gabbro has undergone limited high T deformation manifest in plagioclase grain size reduction.

SECONDARY MINERALOGY:

COMMENTS: This section consists of a coarse grained, highly altered gabbro with complete replacement of pyroxene by serpentine, amphibole, chlorite and talc and limited alteration of plagioclase.

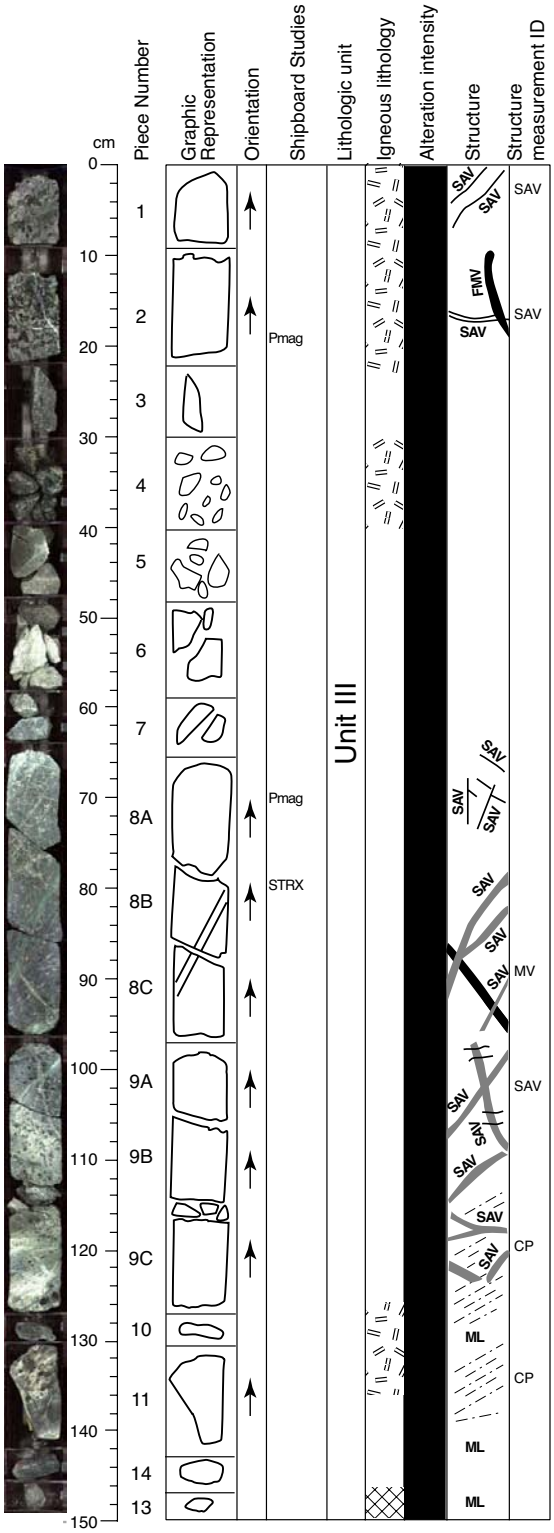
VEIN ALTERATION: Where they crosscut pyroxene dark green veins of talc with some chlorite, and possibly amphibole, are present.

THIN SECTIONS: Sample 1268A-16R-4, 3-9 cm

STRUCTURE:

The section consist of one piece of coarse grained gabbro with dark green alteration vein (SAV) and possible mild cataclasis, but little crystal plastic deformation.

Core Photo



209-1268A-17R-1 (Section top: 87.40 mbsf)

UNIT-III: Harzburgite/Dunite

Piece 1–6, 10–11 and 13

COLOR: Green where serpentinized harzburgite. Gray where gabbroic.

PRIMARY MINERALOGY:

Plagioclase	Mode 60%–70% Size 2–7 mm Shape/Habit Euhedral
Clinopyroxene	Mode 25%–40% Size 2–7 mm Shape/Habit Subhedral to euhedral

COMMENTS: Gabbro and altered harzburgite occur throughout this section but gabbro makes up the bulk of it. The grain size of the gabbro decreases from Piece 1 (maximum grain size 23 mm), which is pegmatitic, to Piece 3 which has a poorly defined contact between medium grained gabbro and microgabbro. Piece 4 is medium grained gabbro and Pieces 5 and 6 (40 – 54 cm) are microgabbro. The grain size variation might correspond to rapid heat loss to the country rock below but the abrupt change from medium to very fine grain sizes along with pegmatitic material suggests that the change in grain size could be related to a pressure quench from a volatile-rich system. Piece 10 is a gabbroic gneiss indicating high temperature deformation occurred after gabbro emplacement.

SECONDARY MINERALOGY:

COMMENTS: This section consists of a complex, completely altered harzburgite-gabbro association. An intimate interfingering of altered harzburgite and microgabbro is present in the lower part of the section (Pieces 9 to 13). Alteration of gabbro in Pieces 1 to 6 has generated serpentine pseudomorphs of the clinopyroxene whereas plagioclase is replaced by prehnite, clay minerals and secondary plagioclase. Pieces 7 to 9 show gray vuggy talc alteration, however orthopyroxene is pseudomorphed by serpentine-talc assemblages lacking the characteristic hollow aspect.

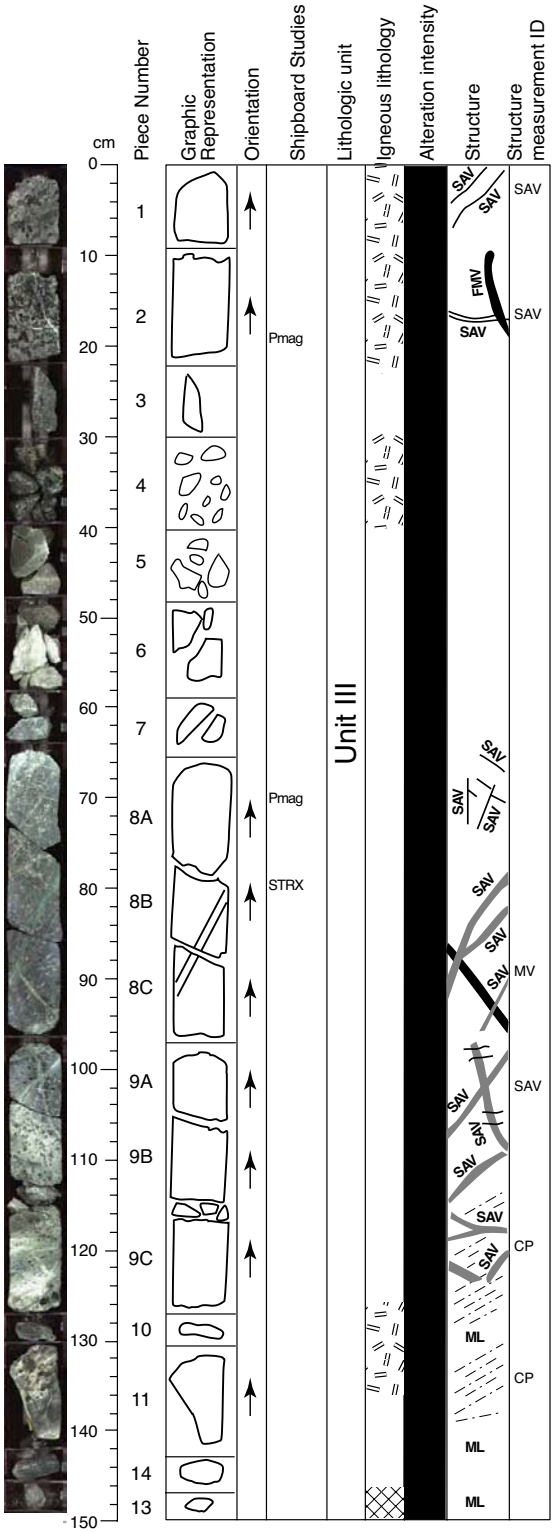
VEIN ALTERATION: Two types of veining are present throughout this section of the core. The first is dark green cross-fibered chrysotile veining which constitutes up to 5% in Pieces 1 and 2 but elsewhere accounts for only 1%-2% of the volume of the core (Pieces 5-10). The other dominant vein types comprise solely talc and are seen throughout the section. Very fine disseminated networks of serpentine veins are seen in Pieces 9A to 9C.

STRUCTURE:

The section consists of metagabbro (G) in Pieces 1-5 in which the grain size progressively decreases from coarse grained in Piece 1 to very fine-grained metagabbro in Piece 5. Piece 6 is a mixture of rock fragments consisting of fine-grained gabbro and serpentinized harzburgite. The progression has the appearance of a chilled margin against the harzburgite, which continues from Piece 6 through 8. The metagabbro in Pieces 1-5 has not experienced crystal-plastic deformation. Piece 9 is again a metagabbro that appears undeformed in the upper part of the piece, whereas below 117 cm it becomes mylonitized (ML) over a very short interval. Pieces 10-13 are all porphyroclastic mylonites and ultramylonite with the same gabbroic protolith. Piece 11 contains a porphyroclast with a pressure shadow tail of recrystallized pyroxene that indicates a reverse sense of shear on the foliation plane inclined at 30° on the cut face of the core. Green serpentine alteration veins (SAV) cut Pieces 1 and 2 and undifferentiated serpentine-talc alteration veins (SAV) are prominent in Pieces 8 and 9. A gabbroic mgamatic vein (GMV) cuts Piece 8. All magmatic and alteration veins are post-kinematic with respect to the crystal-plastic deformation. The metagabbro in the upper part of the core appears to have postdated CP deformation in the harzburgite, whereas the metagabbro at the base of the section has been mylonitized, in part by localized deformation. Crosscutting relationships demonstrate that CP>MV>G>ML>SAV1.

Continued on next page.

Core Photo



209-1268A-17R-1 (Section top: 87.40 mbsf)

(Continued)

Piece 6–9 and 12

COLOR: Green where serpentinized harzburgite. Gray where gabbroic.

PRIMARY MINERALOGY:

Olivine	Mode 80%–82%
Orthopyroxene	Mode 15%–20%
	Size 4 mm
	Shape/Habit Anhedral to euhedral
Spinel	Mode 2%–3%

COMMENTS: Altered harzburgite with a protogranular to porphyroclastic texture is sandwiched between gabbroic rocks in this section. The upper portion of the altered harzburgite is now fault gouge in Pieces 6 (54 - 58 cm).

SECONDARY MINERALOGY:

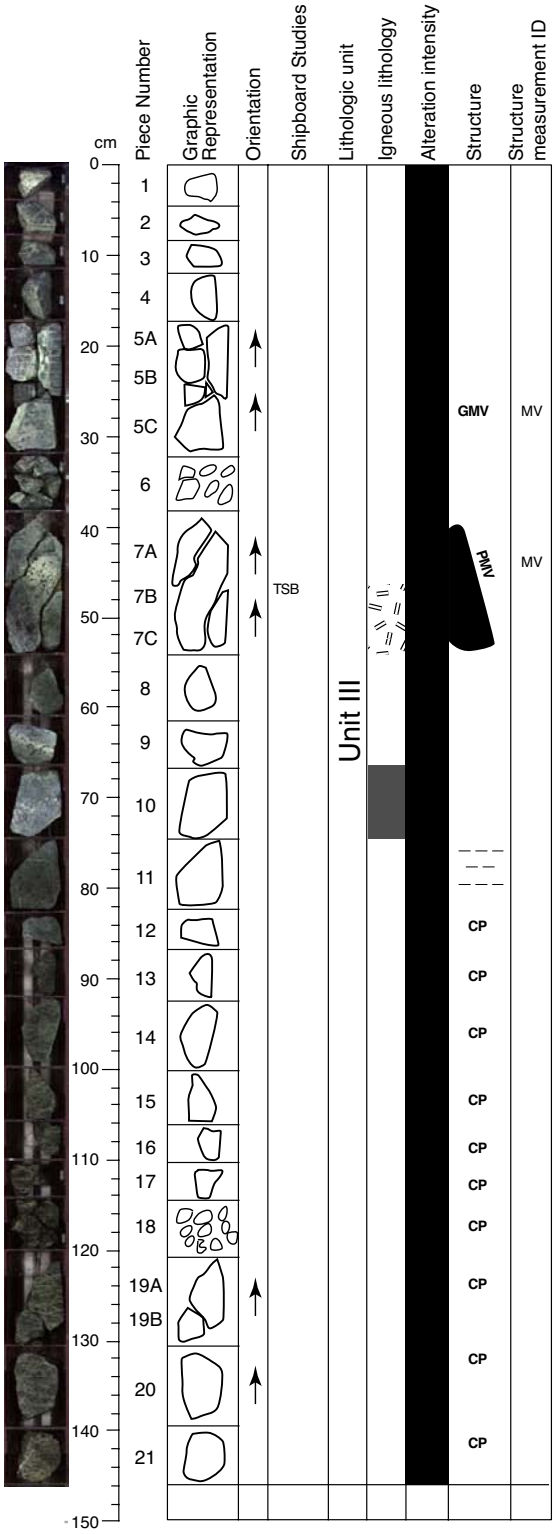
COMMENTS: This section consists of a complex, completely altered harzburgite-gabbro association. An intimate interfingering of altered harzburgite and microgabbro is present in the lower part of the section (Pieces 9 to 13). Alteration of gabbro in Pieces 1 to 6 has generated serpentine pseudomorphs of the clinopyroxene whereas plagioclase is replaced by prehnite, clay minerals and secondary plagioclase. Pieces 7 to 9 show gray vuggy talc alteration, however orthopyroxene is pseudomorphed by serpentine-talc assemblages lacking the characteristic hollow aspect.

VEIN ALTERATION: Two types of veining are present throughout this section of the core. The first is dark green cross-fibered chrysotile veining which constitutes up to 5% in Pieces 1 and 2 but elsewhere accounts for only 1%-2% of the volume of the core (Pieces 5-10). The other dominant vein types comprise solely talc and are seen throughout the section. Very fine disseminated networks of serpentine veins are seen in Pieces 9A to 9C.

STRUCTURE:

The section consists of metagabbro (G) in Pieces 1-5 in which the grain size progressively decreases from coarse grained in Piece 1 to very fine-grained metagabbro in Piece 5. Piece 6 is a mixture of rock fragments consisting of fine-grained gabbro and serpentinized harzburgite. The progression has the appearance of a chilled margin against the harzburgite, which continues from Piece 6 through 8. The metagabbro in Pieces 1-5 has not experienced crystal-plastic deformation. Piece 9 is again a metagabbro that appears undeformed in the upper part of the piece, whereas below 117 cm it becomes mylonitized (ML) over a very short interval. Pieces 10-13 are all porphyroclastic mylonites and ultramylonite with the same gabbroic protolith. Piece 11 contains a porphyroclast with a pressure shadow tail of recrystallized pyroxene that indicates a reverse sense of shear on the foliation plane inclined at 30° on the cut face of the core. Green serpentine alteration veins (SAV) cut Pieces 1 and 2 and undifferentiated serpentine-talc alteration veins (SAV) are prominent in Pieces 8 and 9. A gabbroic mgamatic vein (GMV) cuts Piece 8. All magmatic and alteration veins are post-kinematic with respect to the crystal-plastic deformation. The metagabbro in the upper part of the core appears to have postdated CP deformation in the harzburgite, whereas the metagabbro at the base of the section has been mylonitized, in part by localized deformation. Crosscutting relationships demonstrate that CP>MV>G>ML>SAV1.

Core Photo



209-1268A-17R-2 (Section top: 88.90 mbsf)

UNIT-III: Harzburgite/Dunite

Pieces 1–21

COLOR: Green where serpentinized harzburgite. Gray when talc altered.

PRIMARY MINERALOGY:

Olivine	Mode 84%–90%
Orthopyroxene	Mode 10%–15%
	Size 1 – 5 mm
	Shape/Habit Anhedral
Spinel	Mode 1%–2%

COMMENTS: This section is comprised of serpentinized harzburgite that has a protogranular in the upper portions of the core but is porphyroclastic in the lower portion. The amount of orthopyroxene is variable leading to orthopyroxene-poor harzburgite to dunite with no clear boundary. The modest modal variations noted may be related differing styles of alteration. A 2-cm thick gabbroic dike cuts Piece 7 displaying sharp contacts and no evidence of interaction with the wallrock.

SECONDARY MINERALOGY:

COMMENTS: This section shows a transition from gray, talc-rich alteration to dark green serpentinization of harzburgite. Serpentinization (Pieces 11 to 21) has generated a green macroscopic mesh texture with black/dark green cores, which include orthopyroxene pseudomorphs. The orthopyroxene in talc-rich alteration (Pieces 1 to 6 and 10) is mainly replaced by serpentine-talc.

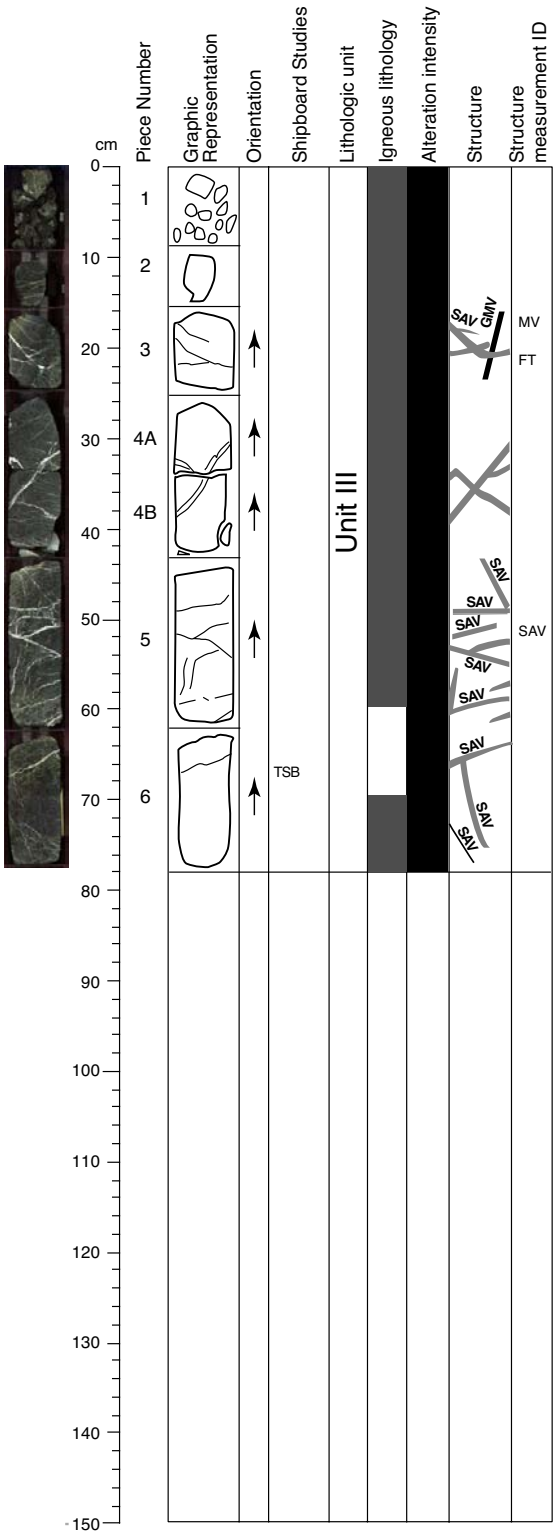
VEIN ALTERATION: This section of the core is particularly poorly veined. Occasional branching talc veins are present down to Piece 13. Dark green sigmoidal chrysotile veins are also present throughout the section until Piece 13, which then intensify to such an extent that they become part of the background textures from Pieces 14-21. Talc veins with small amounts of irregularly clustered sulfide (<10% in Pieces 11-13) are present in very small amounts (<<1%).

THIN SECTIONS: Sample 1268A-17R-2, 3-5 cm

STRUCTURE:

The section is characterized by weak to moderately foliated porphyroclastic serpentinized harzburgite. The crystal-plastic foliation has a nearly horizontal trace in core cut face and is best displayed in Pieces 11-21. The crystal-plastic fabric becomes stronger with depth in the section. A serpentine foliation mimics the crystal plastic foliation in many pieces, especially where the pyroxene content increases. Pieces 5 and 7 are cut by altered thick pyroxenitic magmatic veins (PMV). Light green serpentine alteration veins (SAV) or tension gashes cut the PMV perpendicular to its vein wall (Pieces 5 and 7). The gashes are widest in the center of the vein and taper and terminate in the serpentinized harzburgite, apparently accommodating volume expansion in the altered olivine-rich rock. There is a paucity of prominent non-differentiated serpentine/talc veins (SAV). All magmatic and alteration veins are post-kinematic with respect to the crystal-plastic deformation. Crosscutting relationships demonstrate that CP>MV>SAV.

Core Photo



209-1268A-17R-3 (Section top: 90.36 mbsf)

UNIT-III: Harzburgite/Dunite

Pieces 1–6

COLOR: Dark green to black

PRIMARY MINERALOGY:

Olivine	Mode 83%–94%
Orthopyroxene	Mode 5%–15%
	Size 1 – 5 mm
	Shape/Habit Anhedral
Spinel	Mode 1%–2%

COMMENTS: Altered dunite with a small amount of serpentinized harzburgite (Pieces 6 and 7) comprises this section. The contact between the two lithologies is marked by a sharp increase in modal orthopyroxene and increase in orthopyroxene grain size from 1 to 3 mm. The upper section of serpentinized dunite has a granular texture but the serpentinized harzburgite and lower serpentinized dunite are porphyroclastic.

SECONDARY MINERALOGY:

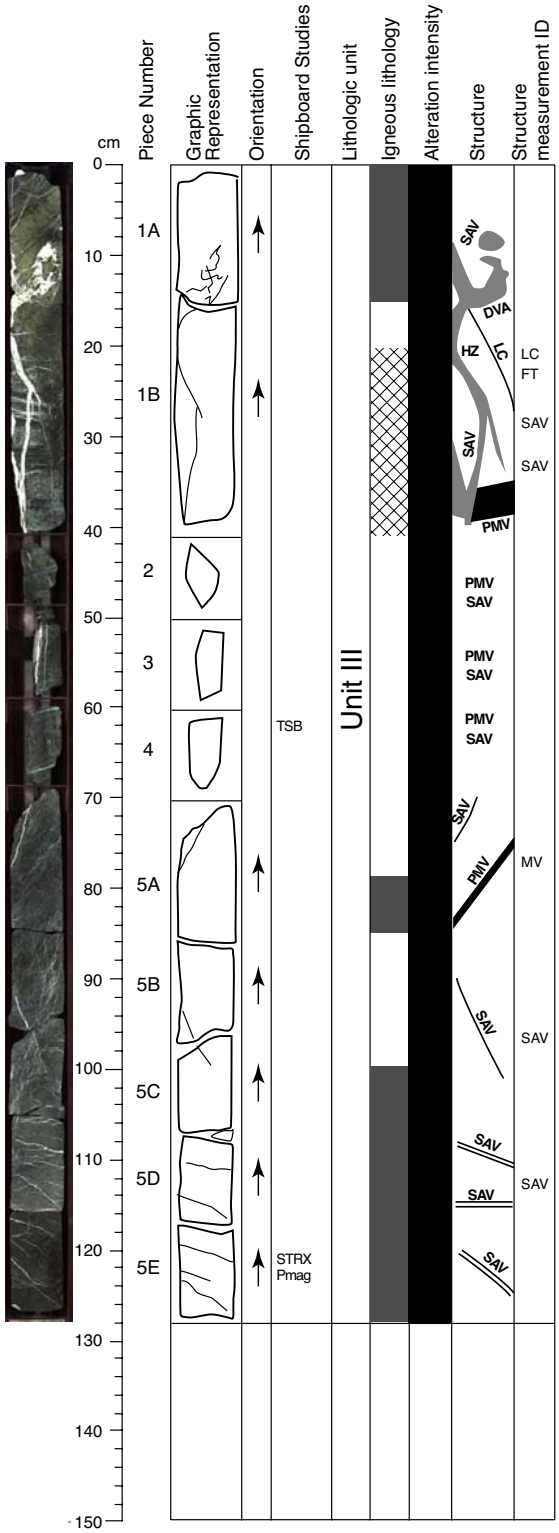
COMMENTS: This section consists of dark green to black serpentinized dunite and harzburgite. Black domains contain serpentine-magnetite, generating a significant response in the susceptibility measurements.

VEIN ALTERATION: This section of the core is quite intensely veined (<10% throughout) with two generations of veins present. The dominant vein types probably comprise talc (with a trace of sulfide). Although this mineral originally appears to have been chrysotile due to the occasional appearance of fibrous aggregates they are not seen throughout the vein and the veining in general appears powdery and weathered. The second vein type comprises dark green sigmoidal chrysotile veins throughout the section, although this generation is much less frequent (<1%).

THIN SECTIONS: Sample 1268A-17R-3, 66-68 cm

STRUCTURE:
The section is characterized by weakly foliated porphyroclastic serpentinized harzburgite (Piece 1) and dunite (Pieces 2-6). The crystal-plastic foliation cannot be determined because of the lack of pyroxene strain markers in the section. There are no magmatic veins in the section. Prominent white to light or dark green non-differentiated serpentine/talc veins (SAV) are numerous throughout the section, especially in Pieces 3-6. Many of these veins are cross-fibered.

Core Photo



209-1268A-18R-1 (Section top: 92.00 mbsf)

UNIT-III: Harzburgite/Dunite

Piece 1–5

COLOR: Dark green to black

PRIMARY MINERALOGY:

Olivine	Mode 83%–94%
Orthopyroxene	Mode 5%–15%
	Size 1–20 mm
	Shape/Habit Anhedral
Spinel	Mode 1%–2%

COMMENTS: The top of this section is the continuation of the dunite from Section 1268A-17R-3, grading to altered harzburgite. Large variations in the modal proportion of orthopyroxene define lithologies ranging from altered dunite (Pieces 1A, 5A, and 5C - 5E) and altered harzburgite (Pieces 1B, 2, and 5B–5C) to altered websterite (Pieces 3-5A) and orthopyroxenite (Piece 1B from 20 to 41 cm). Average grain sizes of orthopyroxene increase with increasing modal abundance from 4 mm in the altered dunite to 8 mm in the orthopyroxenite. Plagioclase segregations occur in altered dunite and can be found in Piece 1A. A gabbroic dike cuts the section in Piece 5A from 79 to 85 cm. The very bottom of the section consists of true dunites (orthopyroxene <8%)

SECONDARY MINERALOGY:

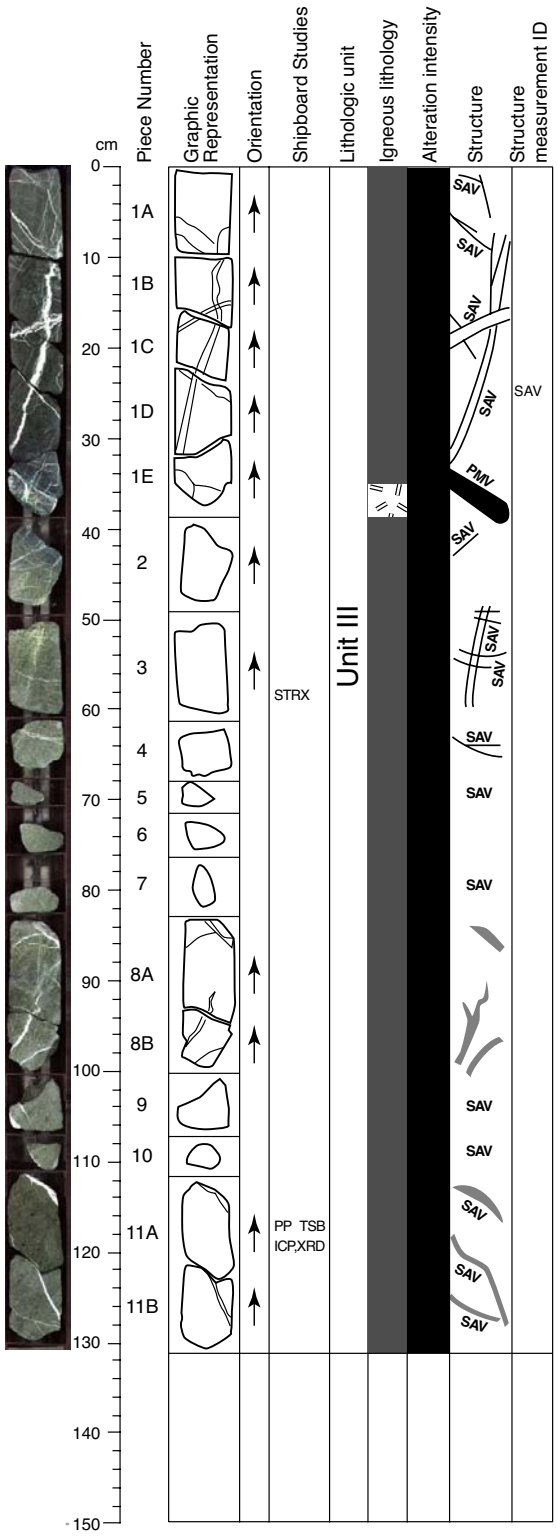
COMMENTS: The orthopyroxene content of this section is highly variable. The sharp contact of completely altered, black orthopyroxenite (Pieces 1B to 4) to green, serpentinized harzburgite/dunite is exposed in Piece 1B. Piece 5 is a green, completely serpentinized harzburgite/dunite. The section shows intense white to light green serpentine veining.

VEIN ALTERATION: This section contains chrysotile, talc-chrysotile-pyrite and serpentine-chrysotile veins. Wispy veins of chrysotile in harzburgite become more linear in dunite (e.g., Piece 5). A vein of talc-chrysotile-pyrite crosscuts the entire section and all lithologies. Picrolite-chrysotile veins crosscut pyroxenite but do not occur in peridotite.

THIN SECTIONS: Sample 1268A-18R-1, 61-63 cm

STRUCTURE:
The section is characterized dunite and pyroxenite magmatic vein (PMV) material. Pieces 1 is a dunite cut by a large pyroxenite vein in excess of 12 cm in thickness (only one contact is exposed in Piece 1 midway in the Piece). The contact is inclined 70 degrees in the core cut face. Pieces 2-4 are all pyroxenites, which are probably pieces of the same vein. At the top of Piece 5 pyroxenite is exposed and appears to grade into pyroxene rich dunite with a few centimeters. The bulk of the piece is dunite. Darker to light green serpentine alteration veins (SAV1) or tension gashes cut the thick PMV perpendicular to its vein wall. The gashes are widest in the center of the vein and taper and terminate in the serpentinized dunite, apparently accommodating volume expansion in the altered olivine-rich rock. These orthogonal veins persist in Pieces 2-4. Prominent white and light green non-differentiated serpentine/talc veins (SAV2) in turn cut the PMV, the orthogonal tension gashes (SAV1) and each other. All magmatic and alteration veins are post-kinematic with respect to the crystal-plastic deformation observed in the harzburgites. Crosscutting relationships demonstrate that CP>PMV>SAV1>SAV2.

Core Photo



209-1268A-18R-2 (Section top: 93.28 mbsf)

UNIT-III: Harzburgite/Dunite

Piece 1–11

COLOR: Green to dark green.

PRIMARY MINERALOGY:

Olivine	Mode 97%–98%
Orthopyroxene	Mode 1%–2%
	Size 1–5 mm
	Shape/Habit Anhedral
Spinel	Mode 1%

COMMENTS: Serpentinized dunite with minor amounts of orthopyroxene (maximum 3% in parts of Piece 3) makes up the bulk of this section. This dunite is a continuation of the dunite that makes almost all the Section 1268A-18R-1. A gabbroic dike cuts Piece 1E from 33 to 39 cm.

SECONDARY MINERALOGY:

COMMENTS: This section consists of completely serpentinized dunite of homogeneous appearance. Olivine shows a mesh texture and is replaced by serpentine; however, some fresh olivine is present locally in cores. Occasionally orthopyroxene are pseudomorphed by serpentine and chlorite(?).

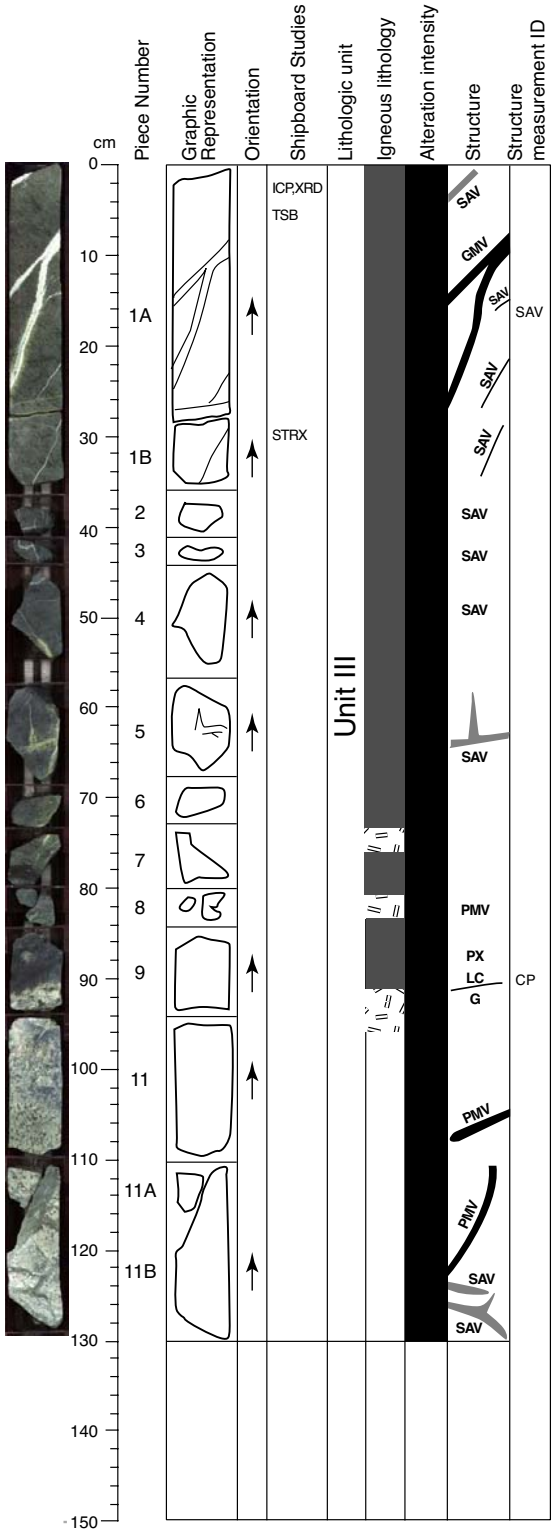
VEIN ALTERATION: In this section two types of veins are common. A set of thin wispy chrysotile veins is parallel to the harzburgite contact and crosscut a thick talc/pyrite vein running parallel to the core across the whole section. Chrysotile veins may locally contain magnetite and merge into background magnetite-serpentine dark alteration, very similar to Section 1268A-18R-1. Sulfides present in the large vein are pyrite and magnetic sulfide (pyrhotite?). The proportions of chrysotile/talc in the large vein are uncertain.

THIN SECTIONS: Sample 1268A-18R-2, 118-121 cm

STRUCTURE:

The section is characterized by dunite cut by a pyroxenite magmatic vein (PMV) at the base of Piece 1. Numerous prominent white and light green non-differentiated serpentine/talc veins (SAV), in turn, cut the PMV. All magmatic and alteration veins are post-kinematic with respect to the general crystal-plastic deformation in harzburgite. There are no pyroxene mesoscopic strain markers to assess the crystal plastic deformation of the adjacent dunites.

Core Photo



209-1268A-18R-3 (Section top: 94.59 mbsf)

UNIT-III: Harzburgite/Dunite

Piece 1–11

COLOR: Green to dark green where harzburgite and dunite. Gray where mylonitized gabbro.

PRIMARY MINERALOGY:

Olivine	Mode 85%–98%
Orthopyroxene	Mode 1%–15%
	Size 0.1–10 mm
	Shape/Habit Anhedral
Spinel	Mode 1%

COMMENTS: This section consists of altered dunite in its upper half (Pieces 1 – 6). This is the continuation of the altered dunite of the previous core (Section 1268A-18R-2) with patches of plagioclase and spinel at ~53 cm and altered harzburgite (Pieces 8 –11). Pieces 7-9 (74 –85 cm) consist of a mixture of mylonitized gabbro and dunite and Piece 9 also contains some mylonitized gabbro (92-95 cm). Minor altered clinopyroxene was tentatively identified in Piece 10.

SECONDARY MINERALOGY:

COMMENTS: The upper part of this section consists of completely serpentinized dunite with rarely preserved olivine relicts. In the lower portion (Pieces 10 and 11) a transition to more talc-rich alteration of harzburgite can be observed. An exceptional chalcopyrite 'nugget' is present as part of a serpentine vein on the lower edge of Piece 9 (at 94 cm).

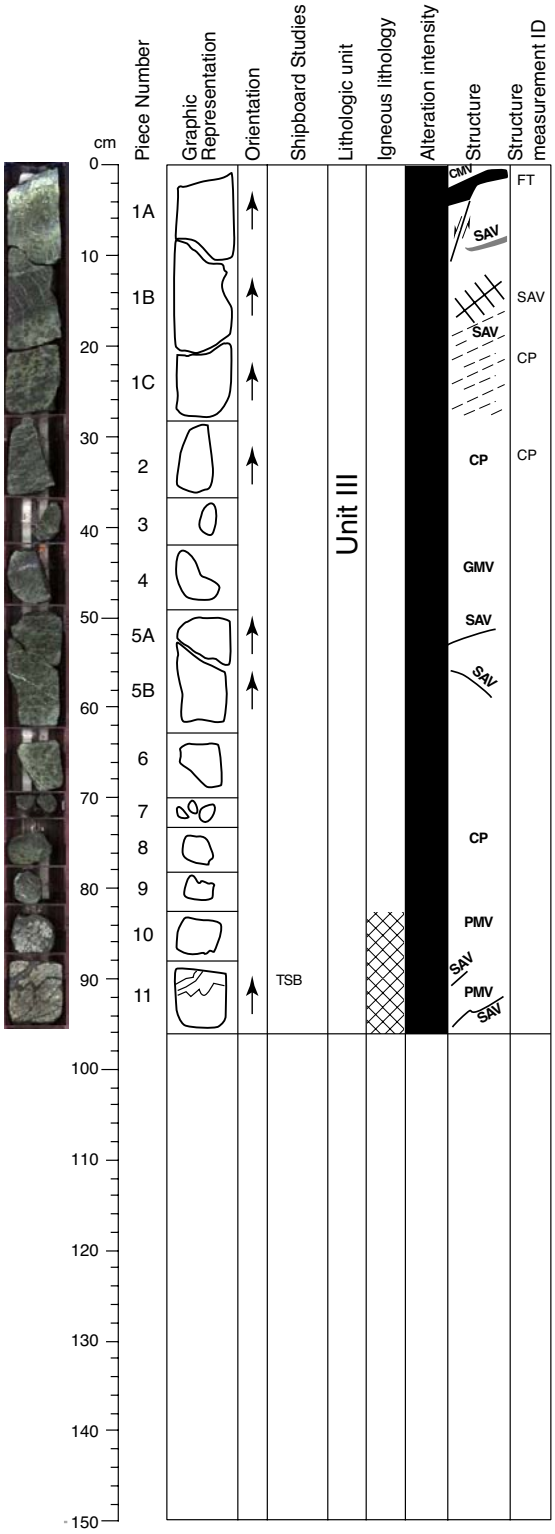
VEIN ALTERATION: The top of the section is dunite with thick chlorite talc veins that pinch out down section toward the harzburgite contact. Occasionally cross-fibers of chrysotile are developed in the center of the section. A dense system of serpentine veins is developed towards a serpentinized gabbro. These veins contain chalcopyrite. The bottom of the section is composed of a thick system of branched talc veins.

THIN SECTIONS: Sample 1268A-18R-3, 5-7 cm

STRUCTURE:

The section consists of dunite (Pieces 1-7), followed by altered pyroxenite vein material (Pieces 8 and 9), metagabbro vein material in igneous contact with pyroxenite of Piece 9, and finally serpentinized harzburgite in Pieces 11 and 12. The pyroxenite and matagabbro in Piece 9 are severely altered, but do not have a crystal-plastic fabric and appear undeformed. The harzburgite has a protointergranular texture and weak fabric. It is not possible to assess the crystal-plastic fabric in the dunite at a mesoscopic scale. Altered pyroxenite veins cut serpentinized harzburgite in Pieces 10 and 11. Prominent white and light green non-differentiated serpentine/talc alteration veins (SAV) cut all pieces, but Piece 1 and 11 are severely effected by alteration veining. All magmatic and alteration veins are post-kinematic with respect to the crystal-plastic deformation. Crosscutting relationships demonstrate that CP>MV>SAV in harzburgite.

Core Photo



209-1268A-18R-4 (Section top: 95.89 mbsf)

UNIT-III: Harzburgite/Dunite

Piece 1–11

COLOR: Green

PRIMARY MINERALOGY:

Olivine	Mode 60%–89%
Orthopyroxene	Mode 11%–40%
	Size 1–8 mm
Spinel	Mode 1.5%

COMMENTS: This section consists of altered harzburgite. The proportion of orthopyroxene increases down section in this core ranging from only 11% in the uppermost altered harzburgite in the upper part of Piece 1 (0–9 cm) to ~40% in altered harzburgites in Pieces 1–9 (18–83 cm). This progression culminates in the last lithology sampled in the core, an orthopyroxenite (with probably less than 1% clinopyroxene) found in Pieces 10 and 11 (83–96 cm) that also contains up to 5% oxide minerals. Locally the altered harzburgite is mylonitized and brecciated. The deformation is associated with gabbro dikes. Gabbroic dikes at 6–10 cm in piece 1 and at 45 cm in piece 4. The former has a stair-step appearance generated by en echelon faults that cut it.

SECONDARY MINERALOGY:

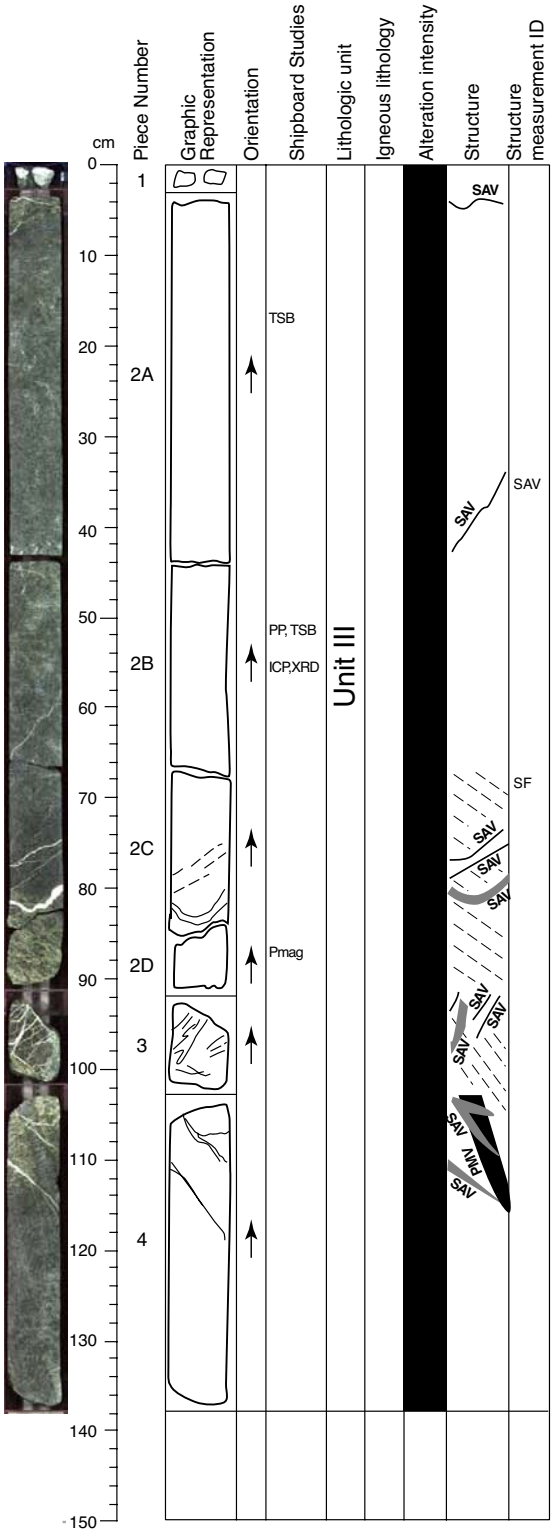
COMMENTS: This section consists mainly of completely serpentinized harzburgite with minor disseminated sulfide. In the lower part, Pieces 10 and 11 are completely altered orthopyroxenite.

VEIN ALTERATION: This section contains very few veins. Serpentine veins cut across the serpentinized gabbro. Wispy chlorite veins are hosted in the serpentinized dunite. A network of serpentine-chlorite-amphibole veins is developed in the pyroxenite.

THIN SECTIONS: Sample 1268A-18R-4, 88-91 cm

STRUCTURE:
The section is characterized by weakly to strongly foliated porphyroclastic serpentinized harzburgite with a crystal plastic foliation inclined ~20 degrees in the cut face of the core. The foliation is defined by the preferred dimensional orientation of pyroxene. Piece 1 is cut at its top by composite gabbro-pyroxenite veins. This vein and contacts with the harzburgite below and the internal vein contact between gabbro and overlying pyroxenite is offset in a normal sense by a fault inclined at ~70° on the cut face of the core. The fault (FT) is lined with serpentine which have fibrous character, with the fibers aligned in the shear direction (slickenfibers). Piece 4 is cut by an altered gabbroic vein material and the base of the section is cut by a pyroxenite vein (probably websterite). The contact between the vein and the harzburgite is exposed in Piece 10. Piece 11 is pyroxenite. Prominent white and light green non-differentiated serpentine/talc veins (SAV) cut Pieces 1, 5, 10, and 11. Sulfide veins (SuV) cut Piece 5 and SAV. All magmatic and alteration veins are post-kinematic with respect to the crystal-plastic deformation. Crosscutting relationships demonstrate that CP>MV>SAV>SuV>FT.

Core Photo



209-1268A-19R-1 (Section top: 97.00 mbsf)

UNIT-III: Harzburgite/Dunite

Piece 1–4

COLOR: Light to dark green

PRIMARY MINERALOGY:

Olivine	Mode 80%
Orthopyroxene	Mode 15%–20%
	Size 2 mm
	Shape/Habit Anhedral
Spinel	sMode 1%

COMMENTS: The entire length of this core consists of altered harzburgite a small amount of it with fresh olivine. Aside from minor modal variations the only heterogeneous parts of the core are defined by patches of coarse-grained orthopyroxene at 15–19 cm in Piece 1A and 61 – 62 cm in Piece 1B. The lower portion of the core has trace amount of interstitial plagioclase.

SECONDARY MINERALOGY:

COMMENTS: This section of the core comprises massive, dark green serpentinite with noticeable amounts of magnetite and sulfide as part of the mesh texture and replacement of orthopyroxene. The rock is lighter green due to lower oxide content in intervals (60-67 cm and 92-112 cm) where pale serpentine veins are developed. Traces of olivine are present in patches.

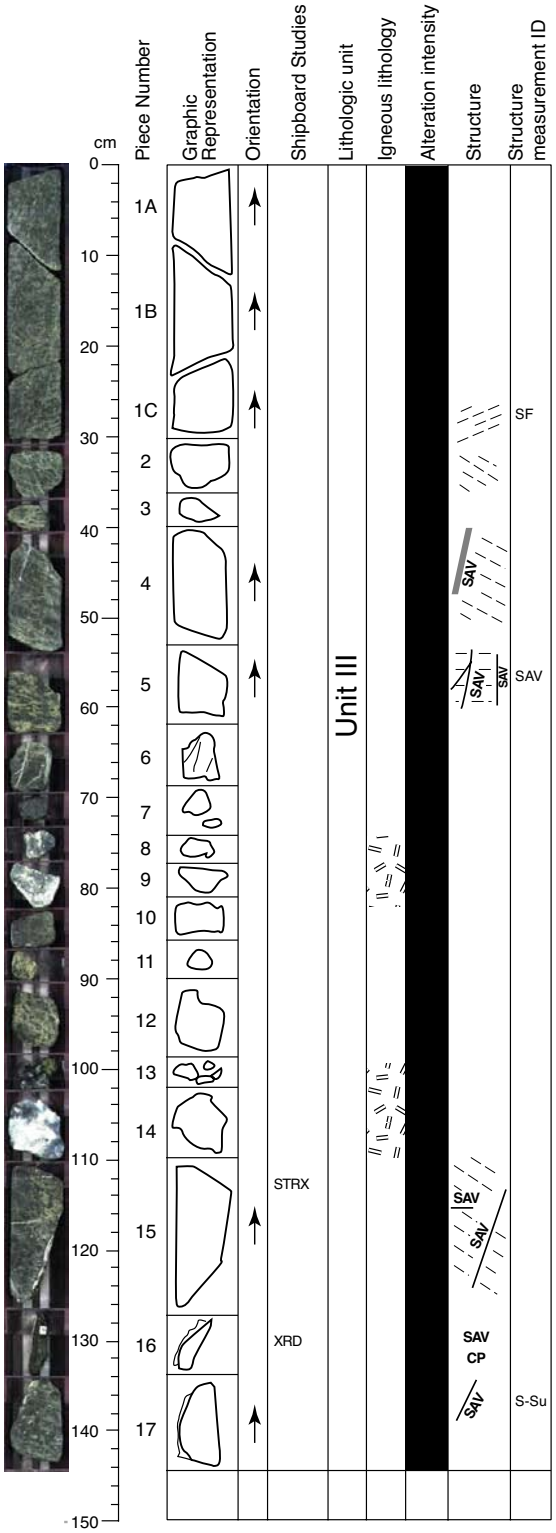
VEIN ALTERATION: Two poorly developed sets of veins are seen throughout this section, although in many places these are transitional between veining and background alteration. They vary between an iron oxide/sulfide rich, fine grained anastamosing network (Pieces 2A, 2B, and 2C) and a sulfide dominated network of similar morphology with as much as 10% talc (Piece 2D). The vein network that dominates this section of core comprises cm scale serpentine veins that appear to have brecciated their surroundings (mostly in Pieces 2C and 3-4). The mineralogy of these veins has been confirmed by XRD analysis.

THIN SECTIONS: Samples 1268A-19R-1, 1-16cm and 1268A-19R-1, 51-53cm

STRUCTURE:

The section consists of porphyroclastic to coarse protogranular harzburgite. Piece 2 is has a weak foliation in the upper part and grades somewhat abruptly in the lower 15 cm of the piece into a strongly foliated porphyroclastic texture (CP). The preferred-dimensional orientation of pyroxene defines the foliation, which is inclined approximately 30° in the cut face of the core. In Piece 3 the foliation intensifies further until, at its base, it appears as a porphyroclastic mylonite (ML). Piece 4 is without a strong fabric and appears protogranular, but is crosscut by a pyroxenite ~2 cm in thickness between 104 and 117 cm. The pyroxenite is cut by a set of orthogonal tension gashes filled with green serpentine (SAV1). The gashes are thicker in the center of the vein and taper towards its edge, but can cross the boundary into the harzburgite. They appear to be the response to the volume expansion in the adjacent olivine-rich and easily altered harzburgite. Finally, white to green undifferentiated serpentine/talc alteration veins (SAV2) crosscut the magmatic veins and the earlier generation of serpentine tension gashes (SAV1). Pieces 1-4 are cut by prominent white to green serpentine/talc veins (SAV2), including many which crosscut Piece 3 and the mylonitic rocks at its base. All of the veins are post-kinematic with respect to the crystal-plastic deformation. Crosscutting relationships indicate CP>ML>SAV1>SAV2 and CP>PMV>SAV1>SAV2.

Core Photo



209-1268A-19R-2 (Section top: 98.38 mbsf)

UNIT-III: Harzburgite/Dunite

Piece 1–16

COLOR: Green where serpentinized harzburgite. Gray where altered gabbro.

PRIMARY MINERALOGY:

Olivine	Mode 80%–85%
Orthopyroxene	Mode 15%–20%
	Size 0.1–10 mm
	Shape/Habit Anhedral
Spinel	Mode 1%

COMMENTS: Most of this section is altered harzburgite with a small amount of fresh olivine, similar in character to that of Section-1268A-19R-1 but with slightly less orthopyroxene. Pieces 8–9 (73–83 cm) and 13-14 (9 –111 cm) are coarse-grained altered gabbros (grain size ~1.5 cm). However, no contact relations with the surrounding core were recovered. A small (3 mm wide and 7 cm long) gabbroic dike cuts Piece 4 (41–49 cm) with sharp boundaries and no evidence of reaction.

SECONDARY MINERALOGY:

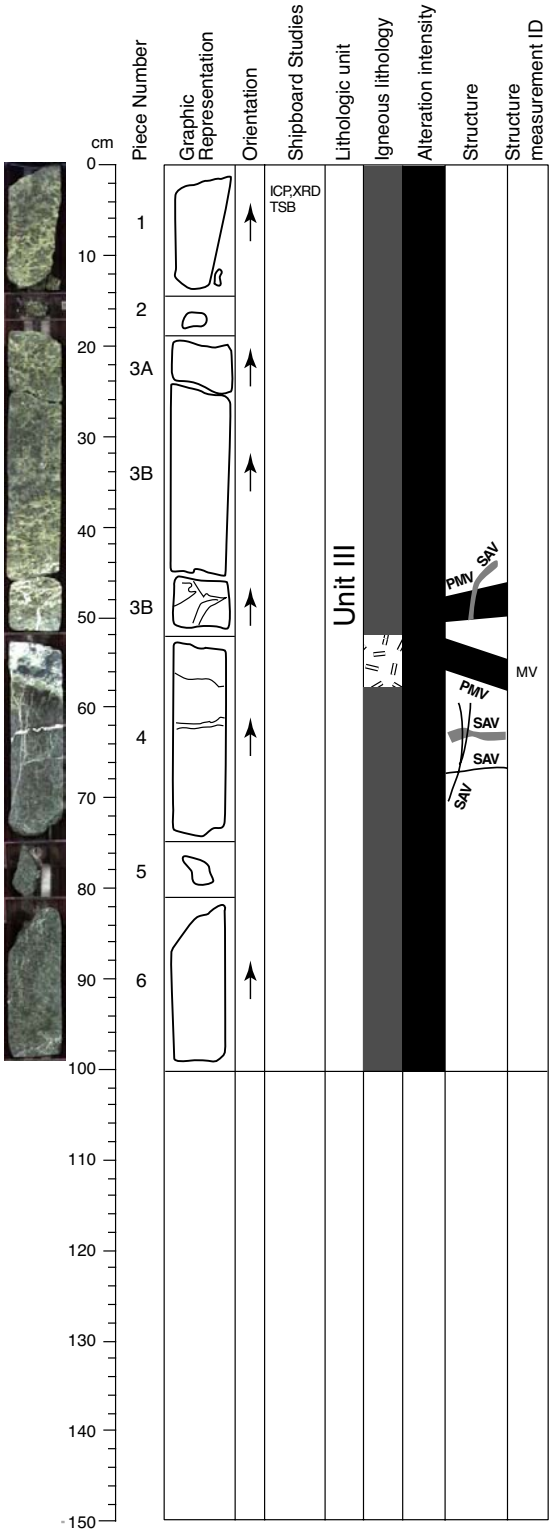
COMMENTS: The section comprises dark green serpentinized harzburgite with sparse relict olivine. Abundant magnetite is present in transgranular black serpentine-magnetite bands. Two gabbro units (Pieces 8 to 9 and 13 to 14) are intercalated. The lowermost three pieces contain noticeable amounts of relict olivine and orthopyroxene.

VEIN ALTERATION: Veining in this section is not particularly well developed. In many case veining appears to be transitional to the background alteration texture particularly in the serpentinized harzburgites and dunites (Pieces 1-5 and 15-17). The only prominent veining can be seen on the margins of Pieces 15-17 where veins of talc, iron oxides, and sulfide (as much as 10%) are present.

STRUCTURE:

The section consists of weak to strongly porphyroclastic serpentinized harzburgite and highly altered gabbro (Pieces 9, 10, and 15). The preferred-dimensional orientation of pyroxene defines a foliation that is inclined approximately 30 degrees in the cut face of the core. The foliation is strongest in Pieces 1-6, 16, and 17. Piece 5 is cut by a small hornblende-plagioclase magmatic vein (MV). Gabbroic.Pieces 9, 10, and 15, although highly altered, did not undergo crystal plastic deformation. Prominent serpentine-talc veins are observed in Pieces 5, 7, and 14-18. All magmatic and alteration veins are post-kinematic with respect to the crystal-plastic deformation. Crosscutting relationships demonstrate that CP>MV>SAV

Core Photo



209-1268A-19R-3 (Section top: 99.82 mbsf)

UNIT-III: Harzburgite/Dunite

Piece 1–6

COLOR: Green to dark green in harzburgite and dunite. Gray in areas of gabbroic veining.

PRIMARY MINERALOGY:

Olivine	Mode 90%
Orthopyroxene	Mode 5%–10%
	Size 1–7 mm
	Shape/Habit Anhedral
Spinel	Mode 2%

COMMENTS: The decrease in modal orthopyroxene seen in Sections 1268A-19R-1 and 1268A-19R-2 altered harzburgite is continued in this section. The upper most part of the core (Pieces 1-3, 0 – 50 cm) is a mixture of altered harzburgite and altered dunite. Plagioclase associated with spinel is found sporadically through Pieces 1-3 and plagioclase interpreted to have formed by melt injection is found in Piece 2C (44 - 45 cm). The lower portion of the section is altered dunite with 5% or less modal orthopyroxene. A gabbroic dike cuts the top of Piece 4 (50 – 57 cm).

SECONDARY MINERALOGY:

COMMENTS: Section consists of green to dark green dunite with a 5 cm thick gabbro vein at the top of Piece 4. Relict olivine in dark patches of Piece 3B is present.

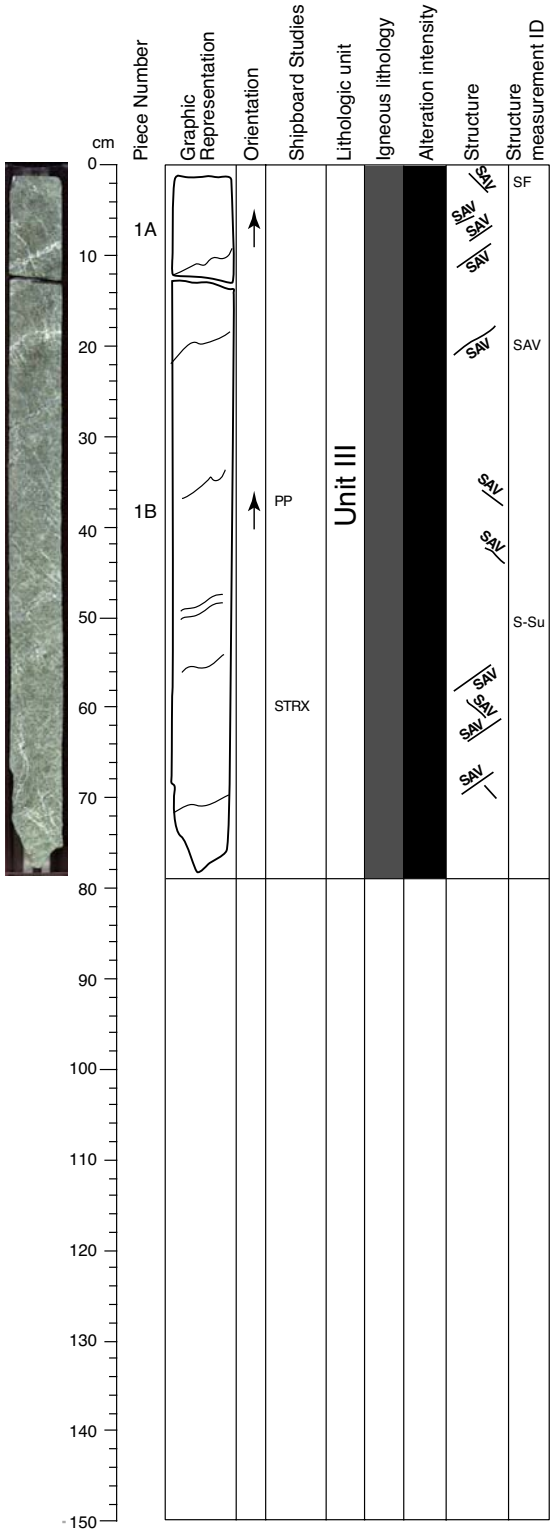
VEIN ALTERATION: This section contains a talc vein with occasional sulfide in serpentinized harzburgite. In the contact with the serpentinized gabbro (Piece 3C) the vein runs into gabbro and seems to crosscut it. Further down the gabbro a network of thin branching talc veins crosscut an earlier generation of talc vein with higher sulfide contents. This system fades out down section.

THIN SECTIONS: Sample 1268A-19R-3, 3-6 cm

STRUCTURE:

The section consists of protogranular harzburgite. The preferred-dimensional orientation of pyroxene defines a weak foliation, which is inclined approximately 20 degrees in the cut face of the core. Modal variation from pyroxene-poor to pyroxene-rich harzburgite and dunitic bands persist in Pieces 3 and 4. The bands have gradational boundaries inclined ~20 degrees and appear parallel to a weak crystal plastic (CP) foliation. A pyroxenitic magmatic vein (PMV) cuts the base of Piece 3 and the top of Piece 4 at an angle to the foliation. The harzburgite below is more dunitic at the contact. Prominent serpentine/talc alteration veins (SAV) cut Pieces 3 and 4. All of the veins are post-kinematic with respect to the crystal-plastic deformation. Crosscutting relationships indicate CP>PMV>SAV.

Core Photo



209-1268A-19R-4 (Section top: 100.81 mbsf)

UNIT-III: Harzburgite/Dunite

Piece 1A–1B

COLOR: Green

PRIMARY MINERALOGY:

Olivine	Mode ≥ 95%
Orthopyroxene	Mode ~3%
	Size 1–4 mm
	Shape/Habit Anhedral
Spinel	Mode 1.5%

COMMENTS: In this last section of Core 1268A-19R, the altered dunite continues with very little modal orthopyroxene. There is a gabbroic segregation in Piece 1B between 17 and 21 cm.

SECONDARY MINERALOGY:

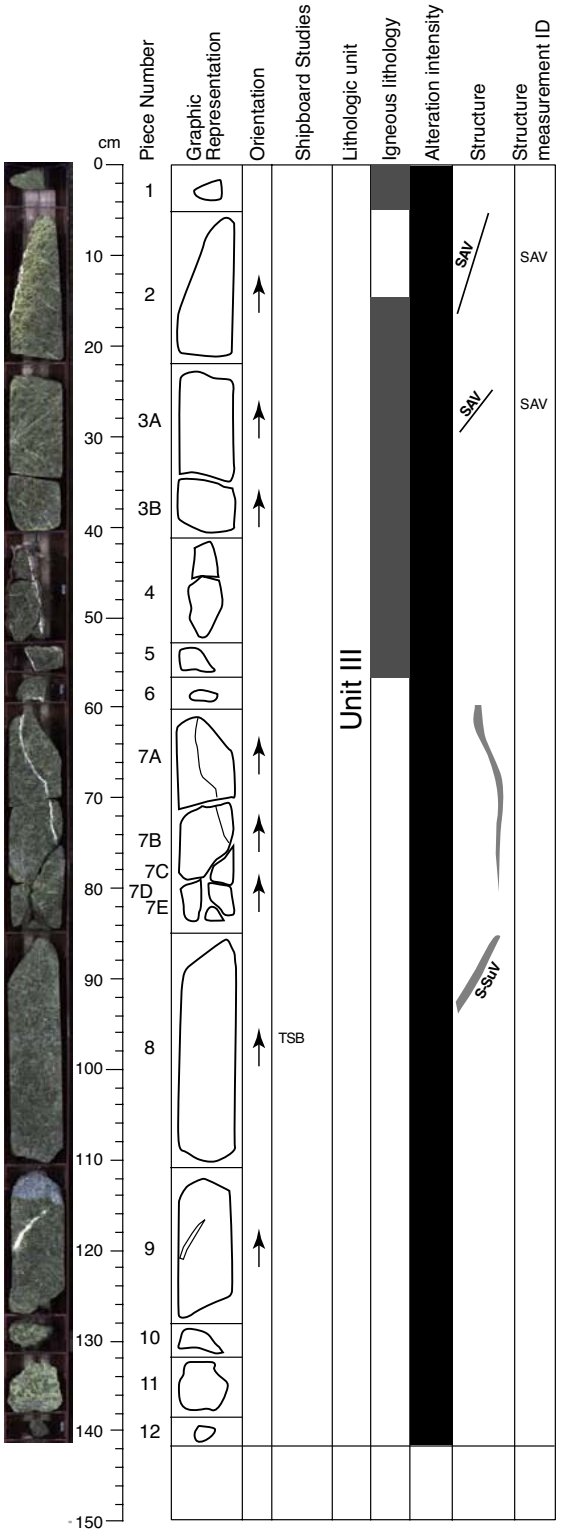
COMMENTS: This section comprises massive serpentinized dunite with black serpentine + iron oxide bands. Subparallel and crosscutting chrysotile veins are present.

VEIN ALTERATION: This section is rather uniform in terms of the veining. The serpentinized harzburgite contains pyrite and iron oxide veins cutting across the section. These veins are then crosscut by a background network of wispy chrysotile veins that in places crosscut iron oxide rich veins (e.g., at the bottom of the section) and in others run parallel to the background alteration prior to fading out.

ADDITIONAL COMMENTS:

The section consists of dunite and enstatite-bearing dunite with an anastamosing serpentine vein set defining a foliation (SAV1) subparallel to a very weak crystal plastic fabric and inclined at ~30° in the cut face of the core. A series of white en echelon serpentine (alteration veins SAV2) inclined at 45° in the opposite direction persist through the piece. A third set of irregular serpentine veins (SAV3) also cut the first two generations. No magmatic veins were observed. Crosscutting relationships indicate CP>SAV1>SAV2>SAV3.

Core Photo



209-1268A-20R-1 (Section top: 101.60 mbsf)

UNIT-III: Harzburgite/Dunite

Piece 1–12

COLOR: Green to dark green

PRIMARY MINERALOGY:

Olivine	Mode 83 - 99%
Orthopyroxene	Mode 4%–16%
	Size 1 – 8 mm
	Shape/Habit Anhedral
Spinel	Mode 1%

COMMENTS: Altered dunite and altered harzburgite comprise this section. The contact between two lithologies is marked by a sharp increase in modal orthopyroxene as observed in Piece 2 although the grain size is almost constant through both lithologies. The altered harzburgite has a texture between granular and porphyroclastic.

SECONDARY MINERALOGY:

COMMENTS: This section consists of completely serpentinized (serpentine-magnetite) harzburgite/dunite of homogenous appearance. Locally, mesh textured olivine is weakly altered and minor fresh olivine may be preserved in some cores. Fine, wispy chrysotile veining is present.

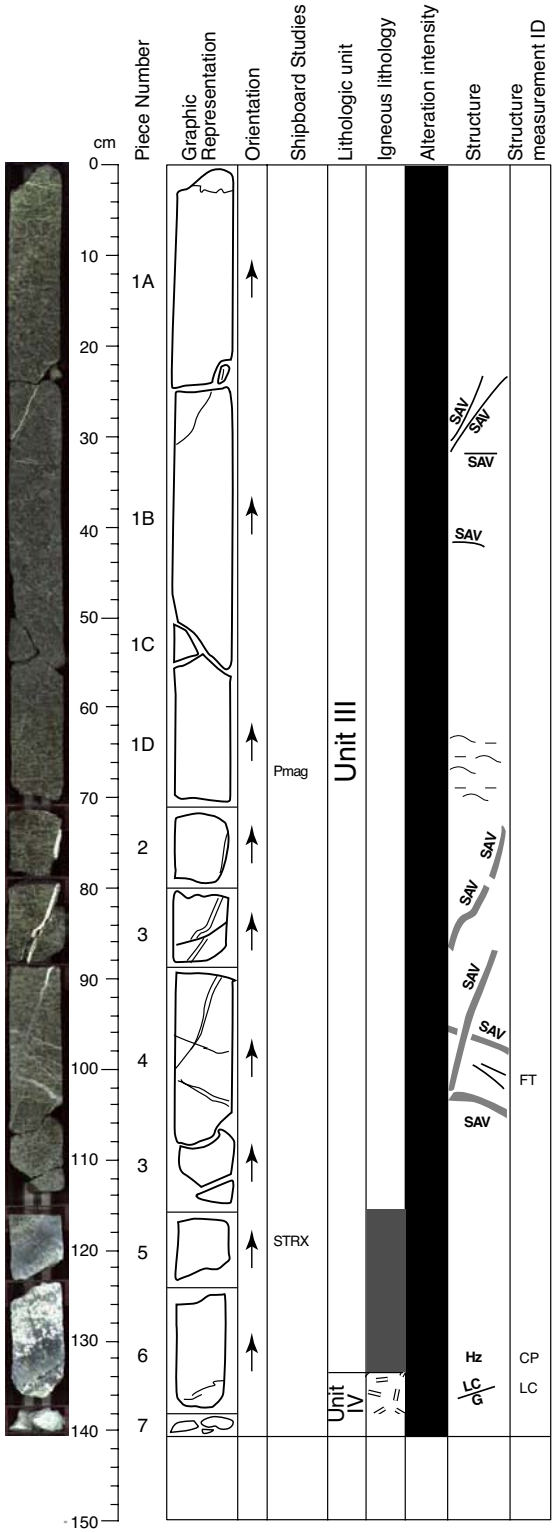
VEIN ALTERATION: This section is very uniform in terms of veining. There is poorly developed veining of chrysotile subparallel to the dunites and wispy in the harzburgites. The intensity of this is variable but generally weak. A serpentine vein of variable thickness cuts along the length of the section. The mineralogy of this vein is confirmed by XRD analysis. Sulfides occur as euhedral pyrite (and magnetic sulfides). The wispy background set of veins sometimes fade in the background alteration of serpentine and magnetite. In general the veining is similar to Core 1268A-18R.

THIN SECTIONS: Sample 1268A-20R-1, 96-99cm

STRUCTURE:

The section consists of weakly foliated harzburgite and dunite. A weak anastomosing serpentine foliation is present in Pieces 1-5. Prominent serpentine/talc alteration veins occur in Pieces 2,3, 5-7, 9, and 11. A serpentine-sulfide composite vein cuts Piece 9. No magmatic veins were observed. Crosscutting relationships indicate CP>SAV

Core Photo



209-1268A-20R-2 (Section top: 103.02 mbsf)

UNIT-III: Harzburgite/Dunite

Piece 1–6

COLOR: Green in harzburgite, gray in talc alteration.

PRIMARY MINERALOGY:

Olivine	Mode 80%–90%
Orthopyroxene	Mode 8%–19%
	Size 1 – 8 mm
	Shape/Habit Anhedral
Spinel	Mode 1%–2%

COMMENTS: This section mostly consists of massive altered harzburgite with small amount of altered dunite and gabbro dike. The altered dunite in Pieces 5 and 6 is located between altered harzburgite in Piece 1 to 4 and gabbro dike in Piece 6 and includes orthopyroxene segregates parallel to the upper and lower contacts. Spinel trains in the altered dunite cut across the orthopyroxene segregates at orthogonal angle. The altered harzburgite has a texture between granular and porphyroclastic. A fault gouge is present at the end of the core in Piece 7. The boundary between lithologic Units III and IV has been placed at the contact between the altered dunite and gabbro in Piece 6 at 135 cm.

SECONDARY MINERALOGY:

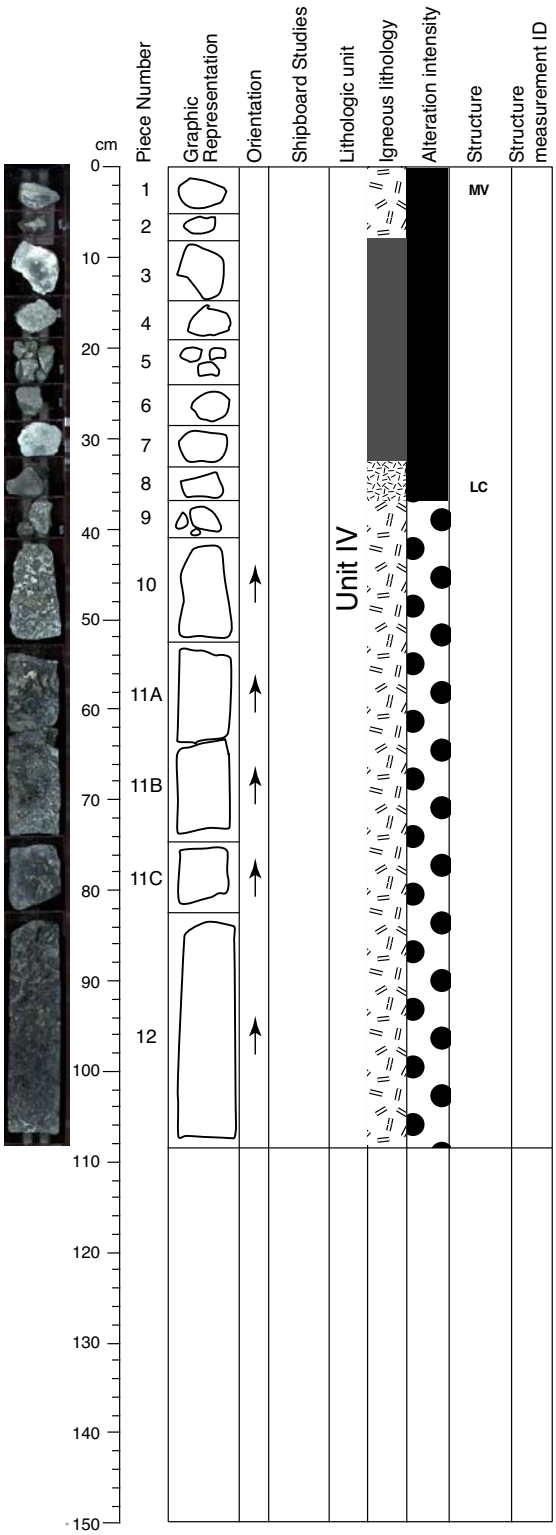
COMMENTS: This section consists of completely serpentinized (serpentine-magnetite) harzburgite/dunite of homogenous appearance. Locally, mesh textured olivine is weakly altered and minor fresh olivine may be preserved in some cores. Fine, wispy chrysotile veining is prevalent. In the lower part of the section (Pieces 5 and 6) a domain of talc alteration with gradational contacts appears to be overprinting serpentinization.

VEIN ALTERATION: The upper and middle part of the section (Pieces 1-4) show different generations of serpentine veins. A thick serpentine/talc vein cuts across all pieces of the section. Piece 3A shows a well developed internal structure composed of cross-fiber chrysotile with sulfides growing perpendicular to walls. This part of the section also shows wispy veinlets of chrysotile and pyrite best developed in Piece 2. Piece 4 shows two generations of chrysotile veins. The first generation is perpendicular to the section and is crosscut by the chrysotile-pyrite vein. The bottom of the section has vuggy talc alteration (VTA) close to the gabbro wall rock. The veins here are light green talc-serpentine that cut across the gabbro.

STRUCTURE:

The section consists of protogranular to porphyroclastic harzburgite with a weak crystal plastic foliation. Where it can be defined, it is subhorizontal. Locally, an early anastomosing serpentine foliation is subparallel to the crystal-plastic foliation. Pieces 1 and 4 are cut by gabbroic magmatic veins at 28 and 31 cm. Piece 4 contains a pyroxene-rich band (LC) approximately parallel to the foliation between 105 and 109 cm. Piece 6 contains a magmatic intrusive contact at its base that is coarse grained. The contact shows comb-textured pyroxene (or amphibole), now highly altered, that has grown downward from the contact with a prismatic habit. The gabbroic rock has suffered essentially no crystal plastic deformation. The dimensions of this body cannot be determined from this section as a small piece of serpentinite is the next piece. The contact is inclined approximately 30 degrees. Serpentine/talc alteration veins cut Pieces 1, 2, 4, and serpentine. All of the veins are post-kinematic with respect to the crystal-plastic deformation. Crosscutting relationships indicate CP>LC>GMV>SAV.

Core Photo



209-1268A-20R-3 (Section top: 104.44 mbsf)

UNIT-IV: Gabbronorite/Harzburgite

Pieces 1–2, 8–12

COLOR: Green where dunite. Gray where gabbro.

PRIMARY MINERALOGY:

Plagioclase	Mode 65%
	Size 2–10 mm
	Shape/Habit Euhedral
Clinopyroxene	Mode 35%
	Size 2–12 mm
	Shape/Habit Euhedral

COMMENTS: Gabbros and very altered dunite alternate in this core. The altered dunite has variable orthopyroxene content The upper part of the core consists of gabbro pebbles in Pieces 1-2 and dunite in Piece 3-7. The middle to lower part of the core comprises of microgabbro in Piece 8 and coarse-grained gabbro in Pieces 9-13. No contact is preserved between altered dunite and microgabbro. Foliation is parallel at the top of Piece 11B, while it becomes wormy in Pieces 11B to 13 where the grain size of gabbro gradually becomes finer grained. The finer grained gabbro may have recrystallized at high temperature.

Piece 3–7

COLOR: Green where dunite. Gray where gabbro.

PRIMARY MINERALOGY:

Olivine	Mode 85%
Orthopyroxene	Mode 15%
	Size 1–4 mm
	Shape/Habit Anhedral
Spinel	Mode 1%
	Size 0.1–1.5 mm
	Shape/Habit Anhedral

COMMENTS: Altered dunite with modest amount of orthopyroxene with protogranular texture in Piece 3-7.

SECONDARY MINERALOGY:

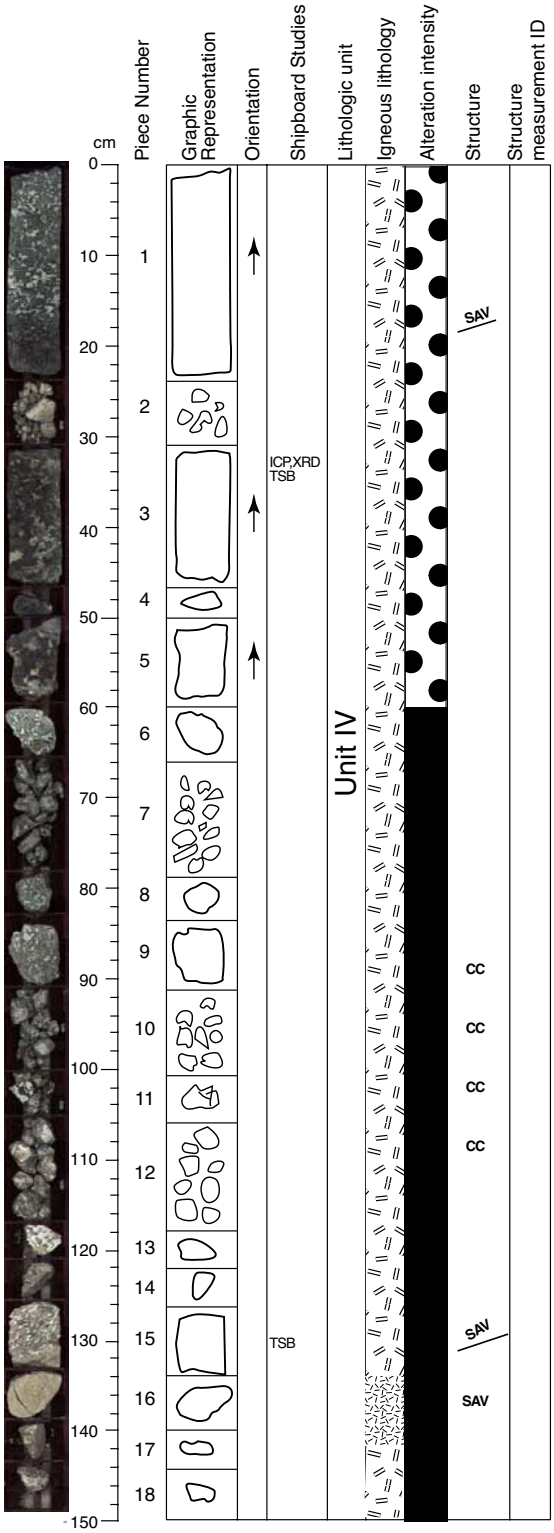
COMMENTS: The lower part of the section consists of coarse-grained completely altered gabbro with cm-sized vuggy pyroxenes, replaced by amphibole + talc (talc patches). Plagioclase has been partly altered to chlorite and tremolite. The upper part of the section consists of talc altered harzburgite/dunite. The microgabbro in Piece 8 may represent a more rapidly cooled margin of the gabbro body below. Chalcopyrite is present in veinlets and replaces clinopyroxene in gabbro. Olivine appears to be replaced by chlorite and serpentine. Pronounced dark coronas consisting of chlorite and amphibole are developed around xenomorphs of plagioclase crystals that appear largely fresh.

VEIN ALTERATION: The upper part of the section (Pieces 1-7) is vuggy talc alteration (VTA) with occasional talc-serpentine veins. The rest of the section is gabbro. The gabbro close to VTA (Pieces 9-12) has complex anastamosing veins of chlorite-amphibole-serpentine. A veinlet of sulfides likely composed of pyrite + chalcopyrite + hematite occurs.

STRUCTURE:

The section consists of pyroxenite (Pieces 1 and 2), highly altered porphyroclastic serpentinized harzburgite or dunite (Pieces 3-7) and gabbroic rocks (Pieces 8 – 12). Pieces 3 and 7 are highly talc altered. Piece 8 consists of a fine-grained micrograbbo (possibly a chilled margin of coarser grained gabbroic rocks below). Coarse-grained gabbro in Pieces 9-12 grades to a coarse grained metagabbro at the base of Piece 12. No crosscutting relationships were observed.

Core Photo



209-1268A-21R-1 (Section top: 106.60 mbsf)

UNIT-IV Gabbronorite/Harzburgite

Piece 1–18

COLOR: Gray

PRIMARY MINERALOGY:

Plagioclase	Mode 50%–70% Size 4–12 mm Shape/Habit euhedral
Clinopyroxene	Mode 25%–35% Size 1–23 mm Shape/Habit euhedral – subhedral

COMMENTS: This core consists of gabbro in Pieces 1-14 and 17 and 18, microgabbro in Pieces 15-17. Mode, texture and grain-size systematically change in Piece 1 and 3 showing layered structure. Pieces 10-12 are brecciated. A gabbro in Piece 15 shows sheared texture with lineation and contacts to microgabbro in Piece 15 that may be a mylonitized gabbro. Plagioclase is mostly recrystallized to small equant grains with 120-degree triple grain junctions in these gabbros.

SECONDARY MINERALOGY:

COMMENTS: This section begins with the highly altered gabbro described in Section 1268A-20R-3 and grades into completely altered gabbro with increasing proportions of talc into talc-altered microgabbro and gabbro.

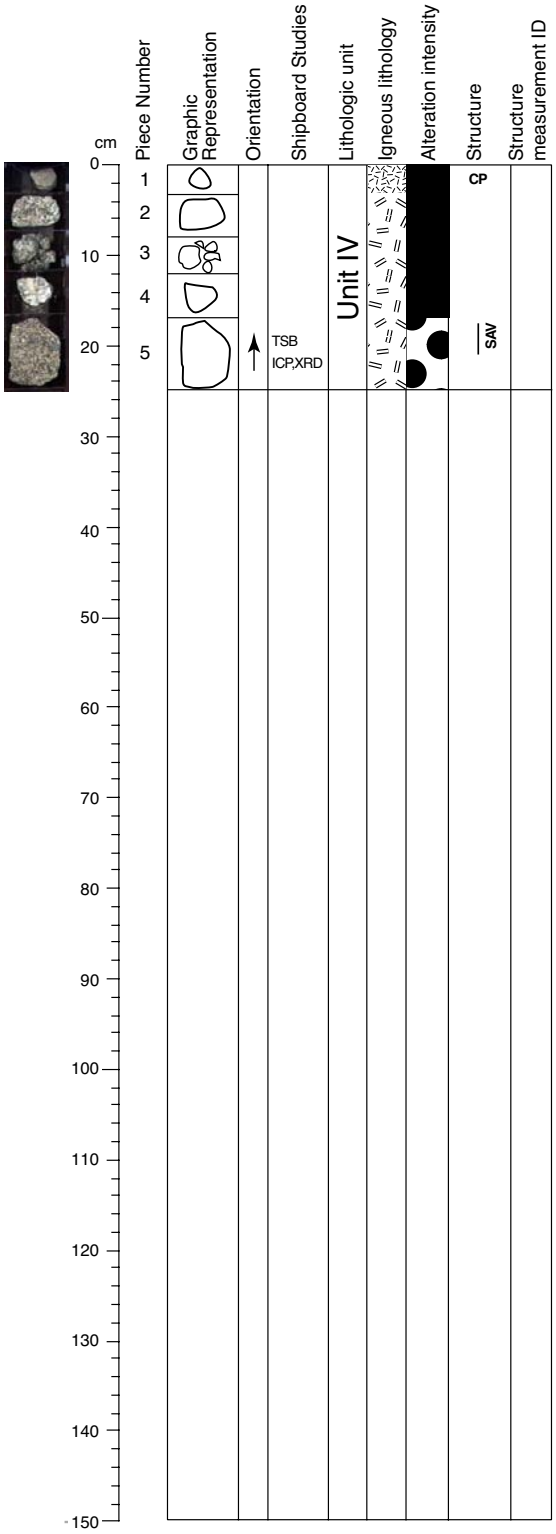
VEIN ALTERATION: The veining is insignificant in this section. Pieces 1, 7, and 8 have occasional small dark green veins that resemble, and are closely associated with, the alteration rims of the background mineralization. Elsewhere, (Pieces 13 and 15-16) infrequent, small, soft dark green veins are present. These are possibly talc with a small amount (<10%) of magnetic sulfides (possibly pyrrhotite?).

THIN SECTIONS: Samples 1268A-21R-1 37-39 cm, and 1268A-21R-1 129-131 cm

STRUCTURE:

The core consists of gabbroic rocks with igneous texture (GIT). A contact between fine and coarse-grained gabbro occurs in Piece 17. Prominent alteration veins are present in Pieces 1 and 16. No crosscutting relationships were observed.

Core Photo



209-1268A-21R-2 (Section top: 108.10 mbsf)

UNIT-IV Gabbronorite/Harzburgite

Piece 1–5

COLOR: Gray to greenish gray.

PRIMARY MINERALOGY:

Plagioclase	Mode 65% Size 2–7 mm Shape/Habit Subhedral
Clinopyroxene	Mode 35% Size 1–23 mm Shape/Habit Subhedral

COMMENTS: This core consists of altered microgabbro in Piece 1 and altered coarse-grained gabbro in Piece 2-5. Because of the broken up nature of the core recovery the primary relationships among these pieces cannot be resolved. Thin section Sample 1268A-21R-2, 18-21 cm) has a foliation defined clinopyroxene and somewhat by plagioclase. The plagioclase however is too altered to determine the strain history (or lack thereof).

SECONDARY MINERALOGY:

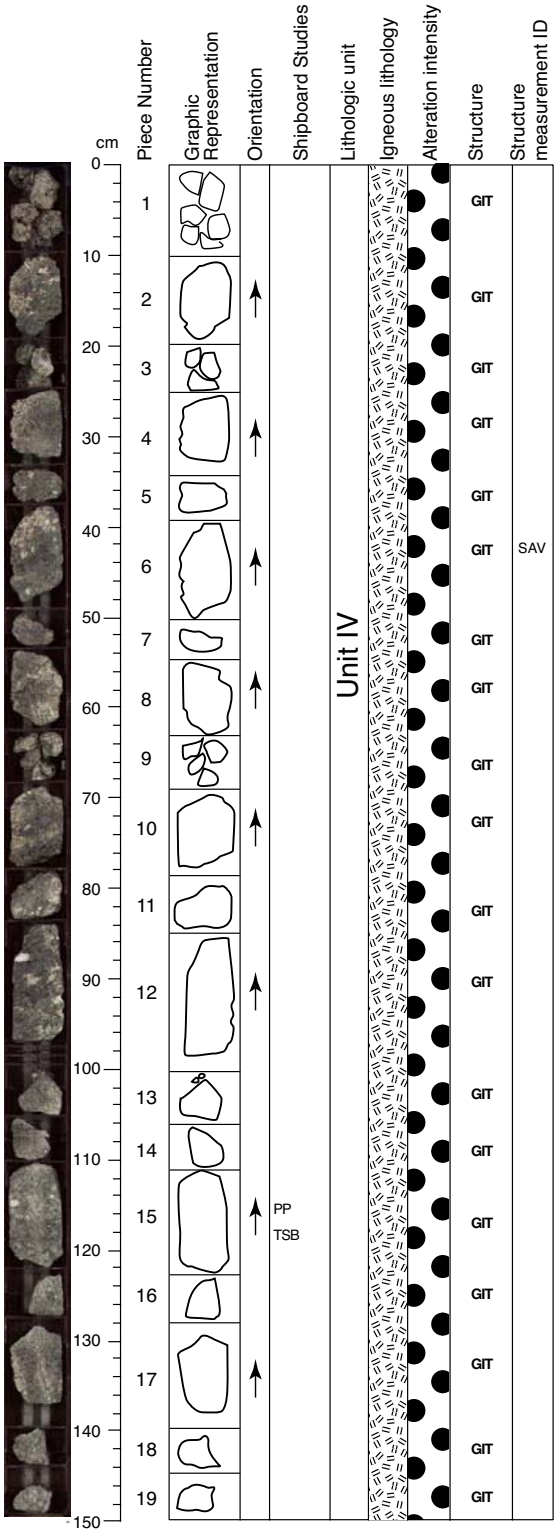
COMMENTS: This section begins with a continuation of the completely altered, talc-rich microgabbro and gabbro and grades into a highly altered gabbro with notable amounts of relic plagioclase in a soft, talc-serpentine altered matrix.

VEIN ALTERATION: There is only a small amount of veining in this section. Veining is present in Pieces 2 and 5 and appears to be dominated by chrysotile with possibly a small amount (<10%) of chlorite.

THIN SECTIONS: Sample 1268A-21R-2, 18-21 cm

STRUCTURE:
The core consists dominantly of gabbroic rocks with igneous texture (GIT), however Piece 1 consists of a gabbro with a strong crystal plastic fabric. A contact between fine and coarse-grained gabbro occurs in Piece 17. Prominent alteration veins are present in Pieces 1 and 5. No crosscutting relationships were observed.

Core Photo



209-1268A-22R-1 (Section top: 111.20 mbsf)

UNIT-IV: Gabbronorite/Harzburgite

Piece 1–19

COLOR: Greenish gray.

PRIMARY MINERALOGY:

Plagioclase	Mode 55%–60% Size 1–20 mm Shape/Habit Anhedral-subhedral
Clinopyroxene	Mode 25%–30 % Size 1–13 mm Shape/Habit Euhedral
Orthopyroxene	Mode 5%-10 % Size 1–13 mm Shape/Habit Euhedral

COMMENTS: Gabbronorite with a variable grain size and foliation comprises this core. Most of the core is coarse-grained except for Piece 13 which is fine-grained. A discernable magmatic foliation is present in Pieces 5, 11, and 13.

SECONDARY MINERALOGY:

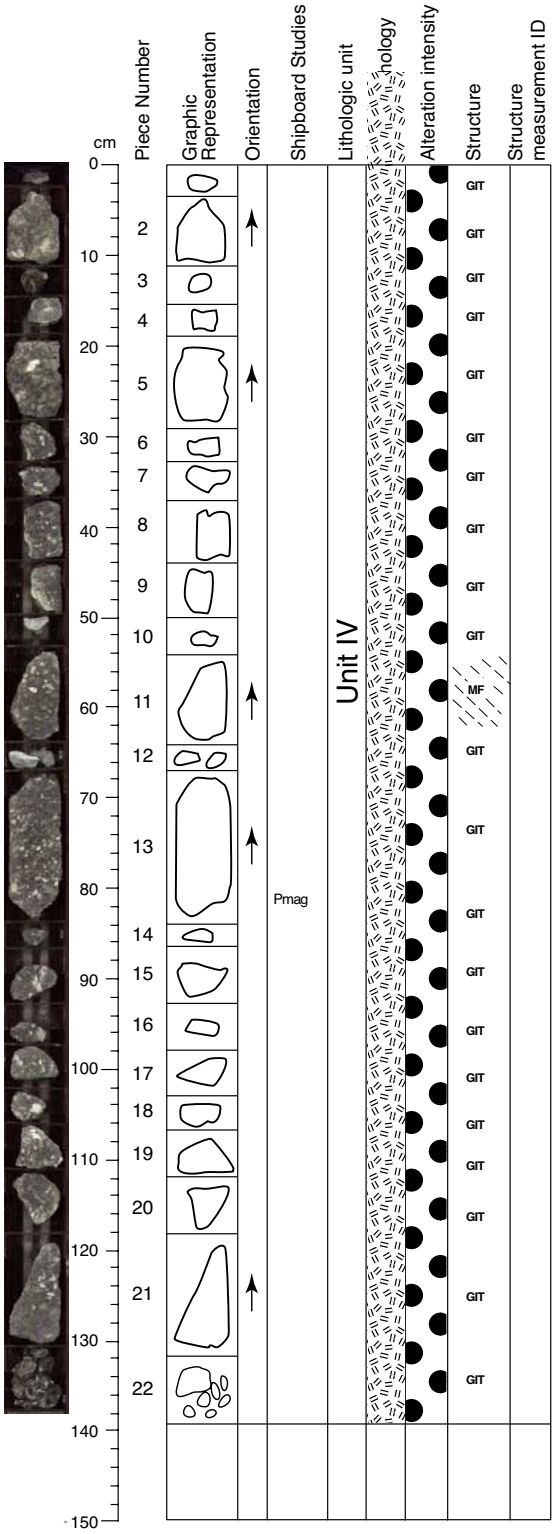
COMMENTS: This section shows a continuation of the gabbro unit of the previous section (Section 1268A-22R-1). The degree of alteration appears to decrease slightly. The abundance of serpentine is clearly decreasing. Green amphibole after clinopyroxene becomes more abundant. Talc-altered pyroxene (orthopyroxene?) is still present. Plagioclase appears to be mostly fresh.

VEIN ALTERATION This gabbroic section contains only insignificant traces of veins mostly composed of talc. Very thin sulfide veins occur in Piece 13.

STRUCTURE:

The core consists of gabbroic rocks with igneous texture (GIT). Piece 11 contains a magmatic lamination defined by the preferred dimensional orientation of elongate plagioclase and clinopyroxene. Prominent alteration veins are present in Piece 13 and 15. No crosscutting relationships are present.

Core Photo



209-1268A-22R-2 (Section top: 112.70 mbsf)

UNIT-IV: Gabbronorite/Harzburgite

Piece 1–19

COLOR: Greenish gray.

PRIMARY MINERALOGY:

Plagioclase	Mode 55%–60% Size 1–20 mm Shape/Habit Anhedral to subhedral
Clinopyroxene	Mode 25%–30 % Size 1–13 mm Shape/Habit Euhedral
Orthopyroxene	Mode 5%–10 % Size 1–13 mm Shape/Habit Euhedral

COMMENTS: Gabbronorite with a variable grain size and foliation comprises this core. Most of the core is coarse-grained except for Piece 13 which is fine-grained. A discernable magmatic foliation is present in Pieces 5, 11, and 13.

SECONDARY MINERALOGY:

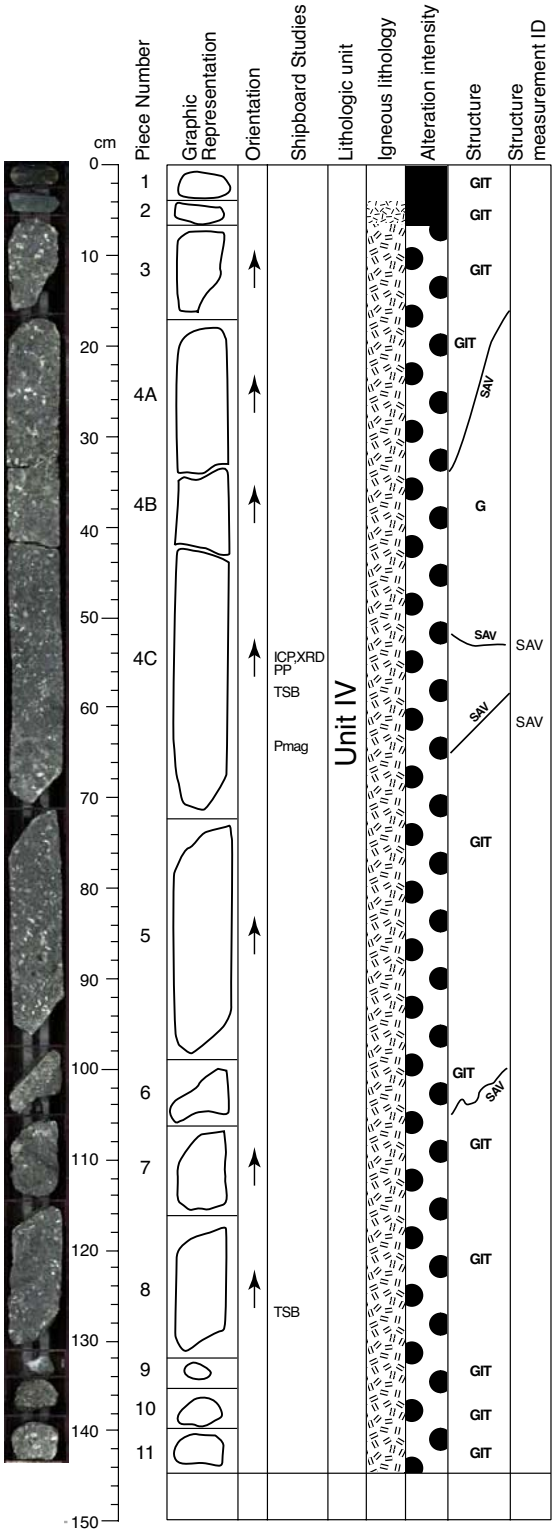
COMMENTS: This section shows a continuation of the gabbro unit of the previous section (Section 1268A-22R-1). The degree of alteration appears to decrease slightly. The abundance of serpentine is clearly decreasing. Green amphibole after clinopyroxene becomes more abundant. Talc-altered pyroxene (orthopyroxene?) is still present. Plagioclase appears to be mostly fresh.

VEIN ALTERATION This gabbroic section contains only insignificant traces of veins mostly composed of talc. Very thin sulfide veins occur in Piece 13.

STRUCTURE:

The core consists of gabbroic rocks with igneous texture (GIT). Piece 11 contains a magmatic lamination defined by the preferred dimensional orientation of elongate plagioclase and clinopyroxene. Prominent alteration veins are present in Piece 13 and 15. No crosscutting relationships are present.

Core Photo



209-1268A-23R-1 (Section top: 116.20 mbsf)

UNIT IV: Gabbronorite/Harzburgite

Piece 1

COLOR: Dark green.

PRIMARY MINERALOGY:

Olivine	Mode 88%
Orthopyroxene	Mode 10%
	Size 1–6 mm
	Shape/Habit Anhedral
Spinel	Mode 2%

COMMENTS: Altered small piece of harzburgite with medium granular to porphyroclastic texture.

Pieces 2–11

COLOR: Greenish gray.

PRIMARY MINERALOGY:

Plagioclase	Mode 55%
	Size 3–14 mm
	Shape/Habit Euhedral
Clinopyroxene	Mode 30%
	Size 1–12 mm
	Shape/Habit Eeuhedral
Orthopyroxene	Mode 10%
	Size 2–13 mm
	Shape/Habit Euhedral

COMMENTS: The top of this section is a small piece of microgabbro and the rest of the core is gabbronorite with modest variations in grain size downhole.

SECONDARY MINERALOGY:

COMMENTS: The first 2 pieces of completely altered harzburgite and microgabbro are small and may have fallen down the hole. Pieces 3 to 12 represent a continuation of the gabbro unit described in Core 1268A-22R however, the gabbro in this section appears somewhat less altered. Green amphibole after clinopyroxene is abundant. There is only minor serpentine alteration apart from small serpentine veins.

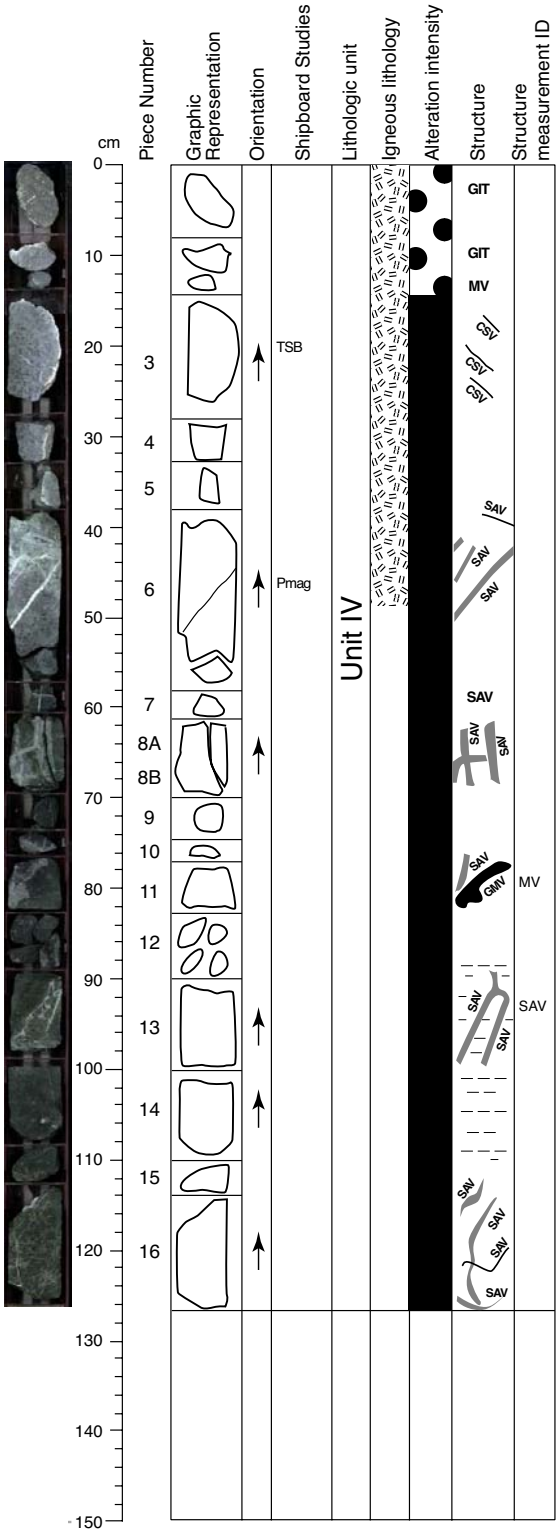
VEIN ALTERATION: Volumetrically, the amount of veining present in this section is insignificant. Where present, (Pieces 4A, 4B, 4C, 7, 9 and 11) the veins are small, irregular, unbranched chrysotile veins. They account for less than 1 volume% of the section.

THIN SECTIONS: Samples 1268A-23R-1, 57-60cm and 1268A-23R-1, 126-128 cm

STRUCTURE:

The core consists of dominantly gabbroic rocks with igneous texture (GIT), although Piece 1 is a porphyroclastic serpentinized harzburgite and Piece 2 is a micrograbbro. Piece 3 contains a slight magmatic lamination defined by the preferred dimensional orientation of elongate plagioclase and clinopyroxene. Prominent alteration veins are present in Piece 4, 6, and 8. No crosscutting relationships are present.

Core Photo



209-1268A-23R-2 (Section top: 117.64 mbsf)

UNIT IV: Gabbronorite/Harzburgite

Pieces 1–6

COLOR: Gray

PRIMARY MINERALOGY:

Plagioclase	Mode 60% Size 5 mm average Shape/Habit Anhedral to subhedral
Clinopyroxene	Mode 30% Size 1–15 mm Shape/Habit euhedral
Orthopyroxene	Mode 10% Size 1–15 mm Shape/Habit Euhedral

COMMENTS: The first portion of the section is a coarse grained gabbronorite (Piece 1) followed by very altered gabbro (Pieces 2-5).

Pieces 6–16

COLOR: Green to dark green.

PRIMARY MINERALOGY:

Olivine	Mode 80%-82%
Orthopyroxene	Mode 17%–20% Size 1–10 mm Shape/Habit Anhedral
Spinel	Mode 1%

COMMENTS: The lower part of this section consists of altered harzburgite with medium granular texture grading to porphyroclastic texture downhole. Small plagioclase patches were tentatively identified. Numerous gabbro dikes cut the peridotite sequence.

SECONDARY MINERALOGY:

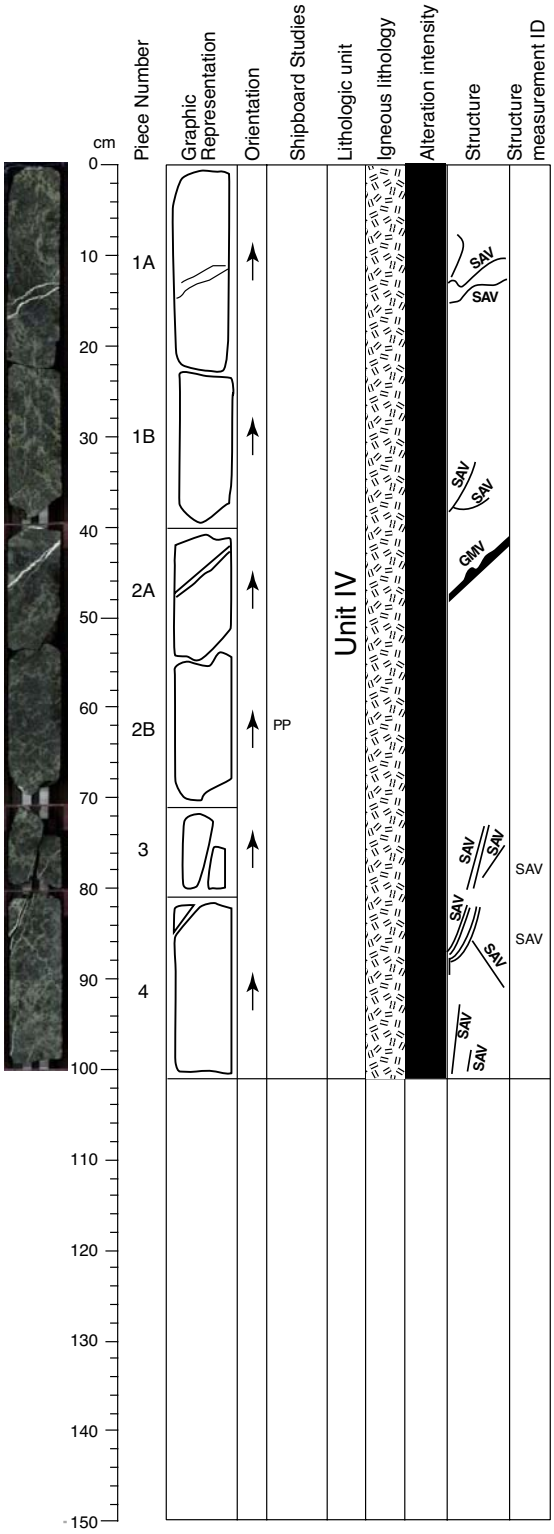
COMMENTS: This section consists mainly of strongly veined and completely serpentinized harzburgite (Pieces 7 to 16). The upper two pieces are gabbro identical to Section 1268A-23R-1. Pieces 3 to 6 are partially talc altered, serpentinized harzburgite marking a particular zone of alteration of serpentinized harzburgite bordering the lower margin of the overlying gabbro.

VEIN ALTERATION: The middle of the section is quite intensively veined with cm scale serpentine veins (the mineralogy of which is confirmed by XRD analysis), which comprise as much as 20% of the volume of the section (particularly intense in Piece 8). Elsewhere, small fibrous chrysotile veins are present in Pieces 2, 5, and 6 but they are volumetrically insignificant. Within the harzburgite of Piece 11 are two small veins that are the metamorphic overprint of a former igneous (gabbroic) vein associated with a small pocket of gabbro.

STRUCTURE:

The section consists if highly altered gabbro with igneous texture (GIT, Piece 1 and 2) and highly talc altered harzburgite (Pieces 2-6) and porphyroclastic harzburgite (Pieces 7-16) and dunite (Piece 7). Harzburgites have a weak to moderate subhorizontal crystal plastic foliation. Piece 2 has a small gabbroic magmatic vein within a gabbro and Piece 11 has small clot or vein (GMV) of undeformed altered gabbro in harzburgite. Prominent serpentine/talc alteration veins (SAV) are present in Pieces 3, 6-8, 10, 13-14, and 16 and sulfide veins (S-SuV) in Piece 11. All magmatic and alteration veins are post-kinematic with respect to the crystal-plastic deformation in harzburgite. Crosscutting relationships demonstrate that CP>GMV>SAV and CP>GMV>SuV.

Core Photo



209-1268A-23R-3 (Section top: 118.91 mbsf)

UNI-IV: Gabbronorite/Harzburgite

Pieces 1–4

COLOR: Green to dark green.

PRIMARY MINERALOGY:

Olivine	Mode 74%
Orthopyroxene	Mode 25%
	Size 1–10 mm
	Shape/Habit Anhedral
Spinel	Mode 1%

COMMENTS: this section consists of serpentinized harzburgite with medium granular to porphyroclastic texture. At 14 cm and 44 cm in this section there are coarse-grained orthopyroxene-rich layers. This section likely contains fresh olivine.

SECONDARY MINERALOGY:

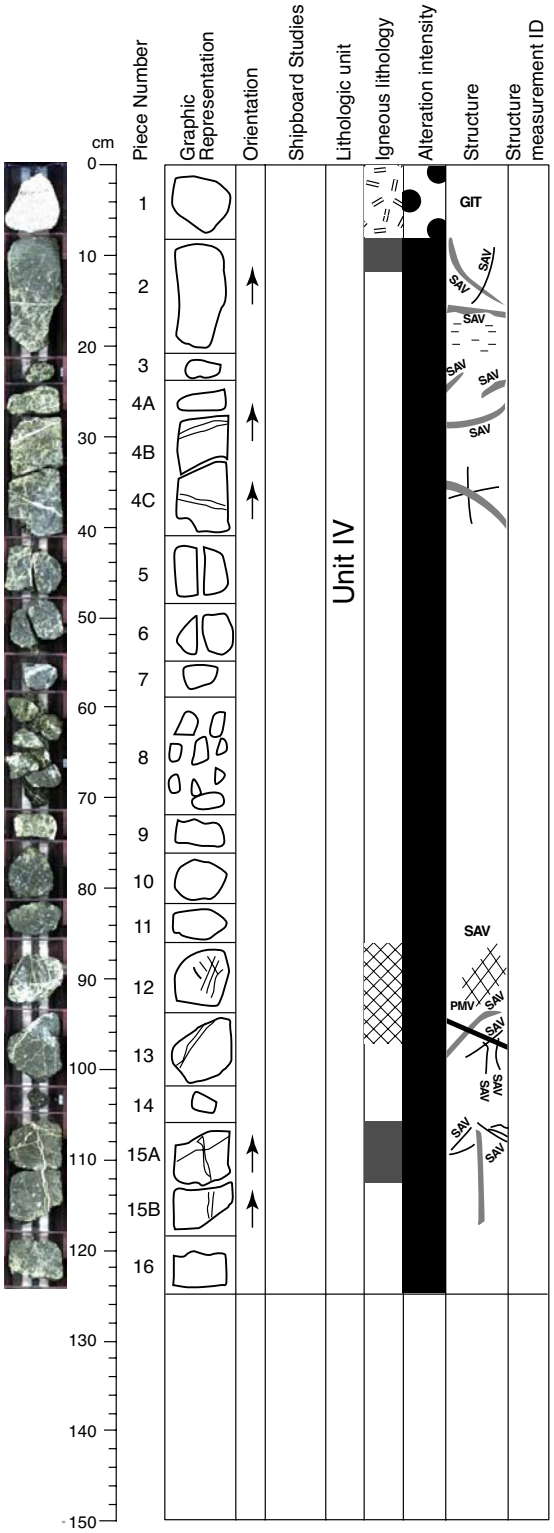
COMMENTS: This section consists of completely altered harzburgite with well-developed mesh texture in the olivine matrix. Cores of fresh olivine are rarely preserved.

VEIN ALTERATION: Throughout the section small serpentine veins are present and particularly evident in Pieces 1A, 2A and 4. The mineralogy of these veins is confirmed by XRD analysis. Elsewhere, minor amounts of sigmoidal fibrous chrysotile veins are present (Pieces 1 and 2, <1%) and possibly two generations of very low intensity talc veins with variable sulfide contents.

STRUCTURE:

The section consists of serpentinized protogranular harzburgite with subtle pyroxene-rich banding and very weak crystal-plastic foliation inclined 45° in the core face. A gabbroic magmatic vein (GMV) cuts Piece 2. Prominent serpentinite/talc alteration veins (SAV) cut all pieces and sulfide veins (SuV) cut Pieces 1 and 2. All of the veins are post-kinematic with respect to the crystal-plastic deformation. Crosscutting relationships indicate CP>GMV>SAV>SUV.

Core Photo



209-1268A-24R-1 (Section top: 120.80 mbsf)

UNIT-IV: Gabbronorite/Harzburgite

Pieces 1–16

COLOR: Green to dark green.

PRIMARY MINERALOGY:

Olivine	Mode 80%-90%
Clinopyroxene	Mode 10%-15%
	Size 1–6 mm
	Shape/Habit Euhedral
Spinel	Mode 1%

COMMENTS: A small pebble at the top of the section (Piece 1) is a gabbronorite similar to those found above and therefore is likely to have spalled from the hole wall. The peridotite sequence starts with an 8-cm thick interval of dunite with about 5% orthopyroxene (Piece 2). The rest of the section consists of harzburgite with porphyroclastic texture. There is a plagioclase patch at 18 cm, a pyroxene-rich segregation between 86 and 98 cm, and another interval of dunite between 106-112 cm.

SECONDARY MINERALOGY:

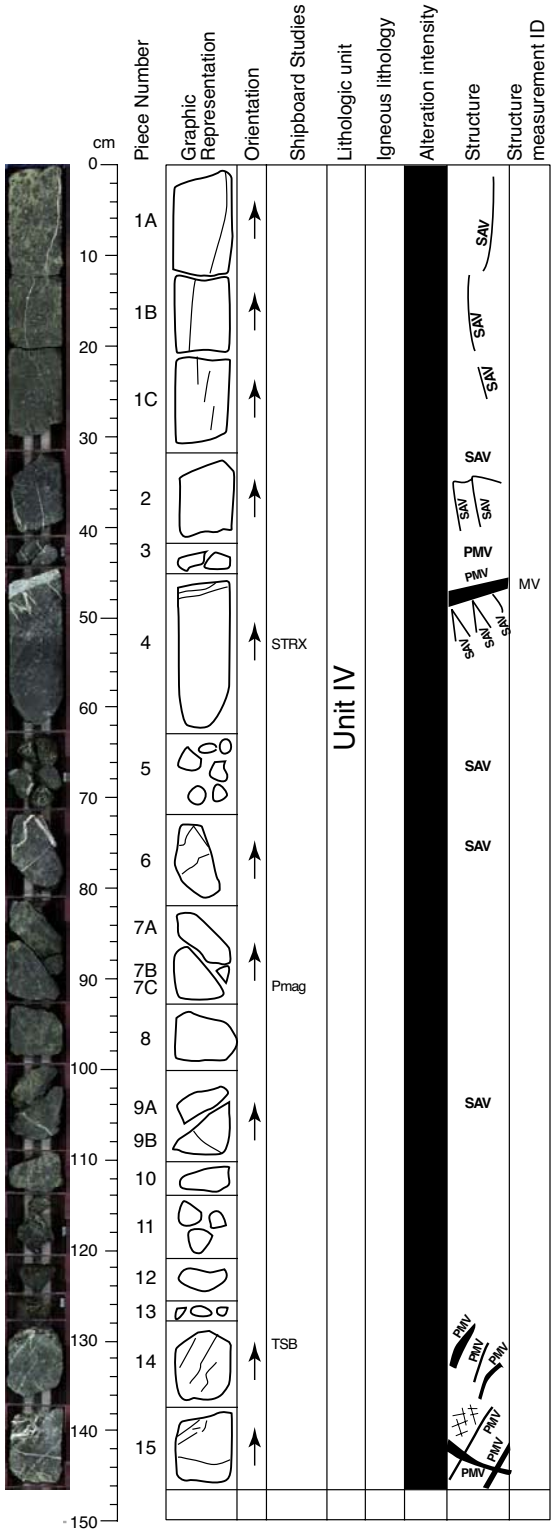
COMMENTS: This section consists of intensely veined, completely serpentinized harzburgite. Olivine alteration is strongly dominated by serpentine but includes traces of hematite and minor amounts of green, fine clays or chlorite. Rarely, fresh olivine remnants remain within cores of the well-developed mesh texture. Piece 1 is completely altered gabbro similar to occurrences in sections above and below.

VEIN ALTERATION: This section is highly veined by crosscutting veins of serpentine (confirmed by XRD analysis) and sulfides (pyrite + iron oxides). Pieces 4, 12, 13 and 14 show a higher intensity of veining. The thicker veins cut an earlier generation of thin talc veins containing a higher volume % of sulfides. The thick veins form anastamosing systems and containing sharp-edged clasts of serpentinized harzburgite (brittle fault). This scenario is especially developed in Piece 12.

STRUCTURE:

The section is characterized by weakly foliated porphyroclastic serpentinized harzburgite, except for Piece 1 which consists of an altered by undeformed gabbroic rock similar in texture to gabbro in Cores 1268A- 22R and -23R. The crystal-plastic foliation has a nearly horizontal trace in core cut face in harzburgite. Piece 13 is cut by an altered pyroxenitic magmatic veins (PMV). Serpentine/talc alteration veins (SAV) cut most of the pieces and Piece 12 is net veined. All magmatic and alteration veins are post-kinematic with respect to the crystal-plastic deformation. Crosscutting relationships demonstrate that CP>MV>SAV.

Core Photo



209-1268A-24R-2 (Section top: 122.05 mbsf)

UNIT-IV: Gabbronorite/Harzburgite

Pieces 1–15

COLOR: Green to dark green.

PRIMARY MINERALOGY:

Olivine	Mode 80%–85%
Clinopyroxene	Mode 15%-20%
	Size 1–6 mm
	Shape/Habit Euhedral
Spinel	Mode <1%

COMMENTS: This section consists of altered harzburgite with porphyroclastic texture. Orthopyroxene abundance alternates in layers a few centimeters thick.

SECONDARY MINERALOGY:

COMMENTS: This section consists of completely serpentinized harzburgite similar to Section 1268A-24R-1)

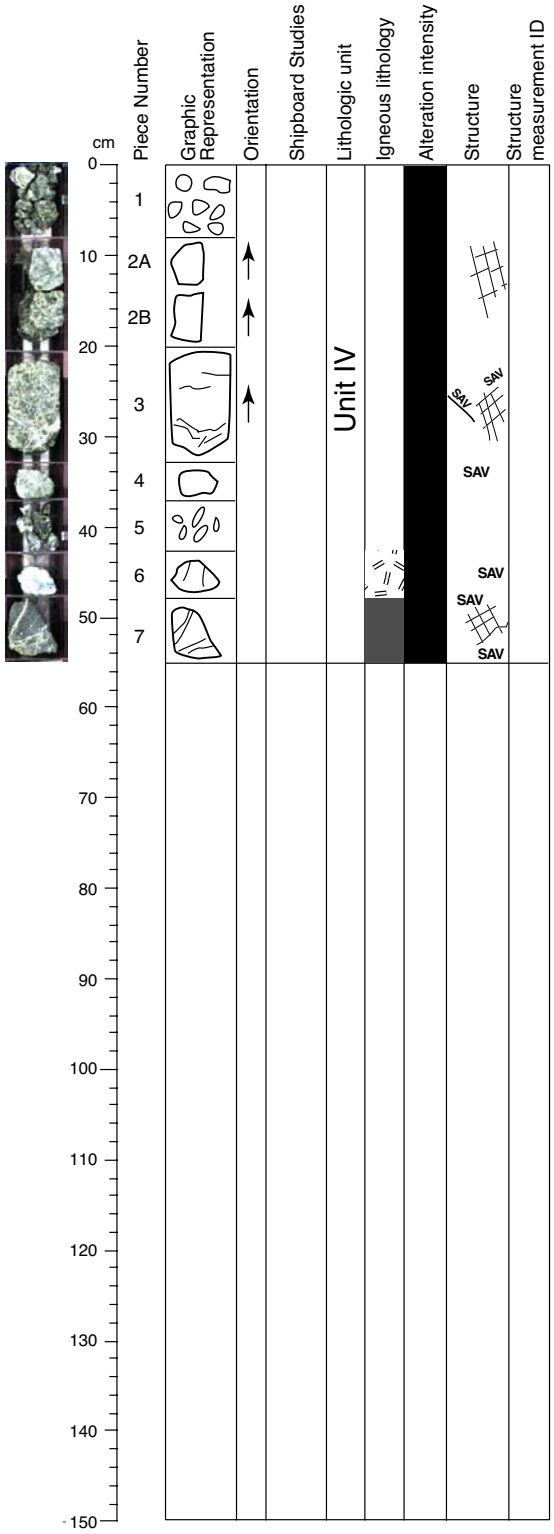
VEIN ALTERATION: The top of the section is weakly veined by talc-pyrite veins running parallel to the walls. In Piece 4, they crosscut a serpentinized gabbro and veins become richer in talc, serpentine and chlorite. At the bottom of the section gabbro veins show a well developed talc-pyrite halo. In Pieces 5, 6, and 15 cataclastic chrysotile veins appear again which contain sharp edged clasts of serpentinized harzburgite (see 1268A-24R-1). In Piece 6 this generation clearly crosscuts an earlier generation of massive fresh talc with high contents of ore minerals (pyrite, hematite, millerite(?)).

THIN SECTIONS: Sample 1268A-24R-2, 130-133 cm

STRUCTURE:

The section is characterized by protogranular serpentinized harzburgite with no well defined crystal plastic foliation. Pieces 4, 14, and 15 are cut by a highly altered pyroxenitic magmatic veins (PMV). Prominent serpentine/talc alteration veins (SAV) cut most of the pieces, except Pieces 7 and 8. Piece 15 is net veined with serpentine-talc. All magmatic and alteration veins are undeformed with respect to crystal plastic deformation Crosscutting relationships indicate that PMV>SAV.

Core Photo



209-1268A-24R-3 (Section top: 123.52 mbsf)

UNIT-IV: Gabbronorite/Harzburgite

Pieces 1–7

COLOR: Green to dark green.

PRIMARY MINERALOGY:

Olivine	Mode 70%–85%
Clinopyroxene	Mode 15%-25%
	Size 1–8 mm
	Shape/Habit Euhedral
Spinel	Mode <1%

COMMENTS: This section consists of altered harzburgite with a porphyroclastic texture. Piece 6 is a small pebble of gabbro. The sequence ends with a 10-cm thick layer of dunite.

SECONDARY MINERALOGY:

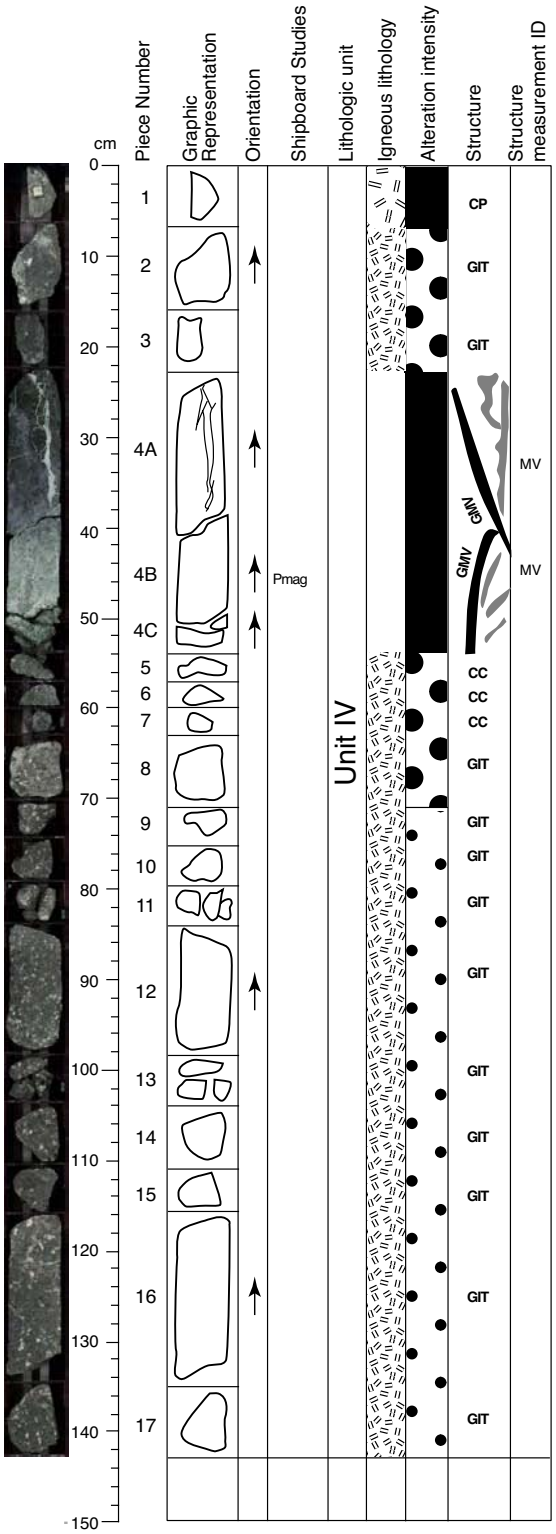
COMMENTS: This section consists of completely serpentinized harzburgite similar to Sections 1268A-24R-1 and 24R-2). However, Piece 6 (44 to 47 cm) has a mixed, clastic appearance and may represent a completely altered intrusive breccia related to impregnation with sub-mm gabbroic dikelets. In Piece 6 alteration of harzburgite is talc-rich.

VEIN ALTERATION: Except for the vuggy talc alteration (VTA) in Pieces 5-6 the rest of the section is similar to Sections 1268A-24R-1 and 24R-2. An earlier generation of talc veins with sulfides crosscut by a chrysotile-cemented breccia with clasts of serpentinized harzburgite is present. The composition of these veins is confirmed by XRD analysis.

STRUCTURE:

The section is characterized by protogranular serpentinized harzburgite with no well-defined crystal plastic foliation. Prominent serpentine/talc alteration veins (SAV) cut all of the pieces. Pieces 3 and 4 are partially net veined with serpentine-talc. There are no magmatic veins and alteration veins are undeformed with respect to crystal-plastic deformation

Core Photo



209-1268A-25R-1 (Section top: 125.80 mbsf)

UNIT-IV: Gabbronorite/Harzburgite

Piece 4A–4C

COLOR: Green where serpentinized harzburgite. Gray where gabbronorite.

PRIMARY MINERALOGY:

Olivine	Mode 89%
Orthopyroxene	Mode 10%
	Size 4–8 mm
	Shape/Habit Anhedral to euhedral
Spinel	Mode 1%

COMMENTS: This section contains altered harzburgite with a protogranular to porphyroclastic texture sandwiched between gabbronoritic rocks. The lower portion of the altered harzburgite is now fault gouge and alteration associated with deformation obscures the fabrics in Pieces 4B and 4C (41-54 cm).

Piece 1–3, and 5–17

COLOR: Greenish gray.

PRIMARY MINERALOGY:

Plagioclase	Mode 60%
	Size 6-10 mm
	Shape/Habit Euhedral
Clinopyroxene	Mode 30%–32%
	Size 2–8 mm
	Shape/Habit Subhedral to euhedral
Orthopyroxene	Mode 10%
	Size 2 mm
	Shape/Habit Anhedral to euhedral

COMMENTS: Gabbro makes up the bulk of this section. The gabbro in Piece 1 (0 – 7 cm) is mylonitized and that in Pieces 5-8 (55 – 70 cm) is a cataclasite. Pieces 2 and 3 (7 – 23 cm) are coarse-grained (average plagioclase grain size 8 – 10 mm) with euhedral plagioclase and pyroxenes. The rest of the core (Pieces 9 – 17, 70 – 144 cm) is modally similar but medium grained (average plagioclase 6 mm).

SECONDARY MINERALOGY:

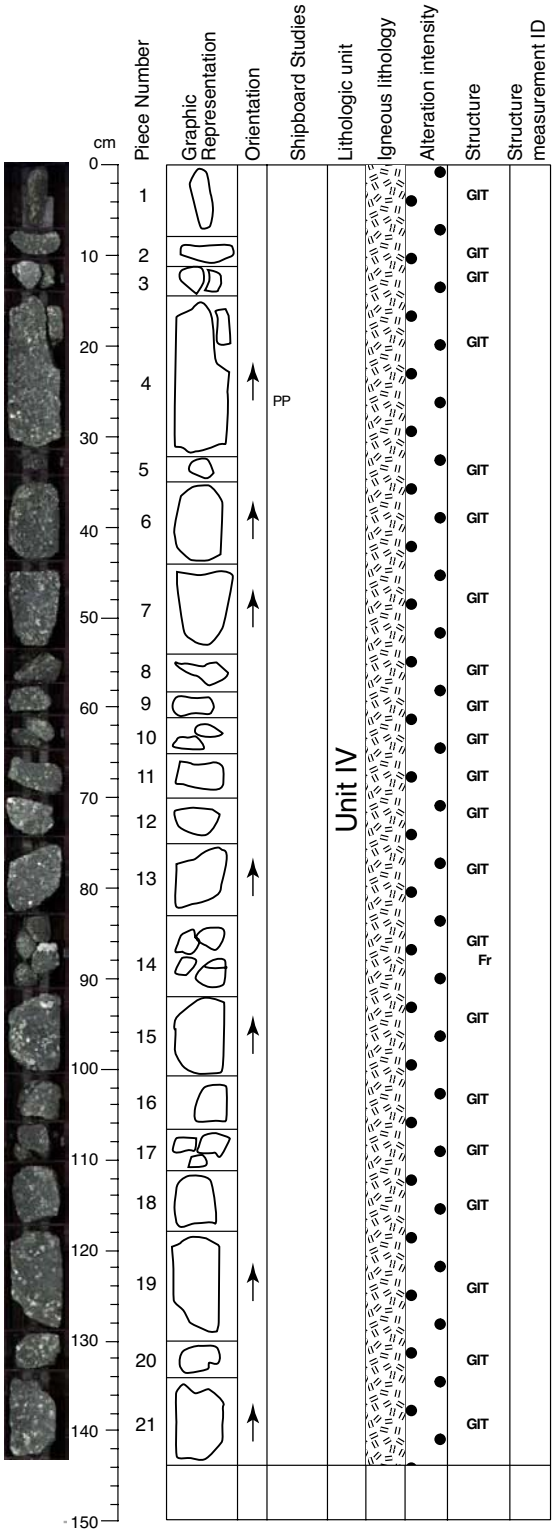
COMMENTS: Pieces 1 and 3 are highly to completely altered gabbro. Piece 2 is oriented, so it appears that this unit is in-situ. Piece 4 is a harzburgite with a gabbro vein and serpentine veining grading into completely talc-altered gabbro through a zone of talc-altered harzburgite. Pieces 5 to 17 are gabbro and the intensity of alteration is decreasing with depth. The contact between the harzburgite and the gabbro is between 42 and 45 cm where primary textures are obscured by complete talc alteration.

VEIN ALTERATION: In this section veining is restricted to Piece 4A which comprises anastamosing network of altered chrysotile (possibly microporous sepiolite after chrysotile) which comprise up to 10% of Piece 4A. Pieces 2, 3 and 4 contain only very small amounts of tiny veins.

STRUCTURE:

The section is characterized generally by statically altered gabbroic rocks with the exception of Pieces 4, which is, in part, a protogranular serpentinized harzburgite with no well-defined crystal-plastic foliation. Pieces 1, 5, 6, and the base of Piece 4B are heavily cataclasized (CC) and altered. Piece 4 contains two gabbroic magmatic veins (GMV) and appears to be in contact with gabbro, which is part of the piece at its base. The gabbros within and at the base of the harzburgite are medium- to coarse-grained. The base of Piece 4 is also cut by a subhorizontal brittle shear zone and the gabbro is cataclasized. Gabbroic rocks did not undergo crystal-plastic deformation, but have a gabbroic igneous texture (GIT). They did experience cataclastic deformation proximal to the harzburgite contact. Felsic veins cut gabbroic Pieces 12 and 13. Prominent serpentine/talc alteration veins (SAV) cut Piece 4. All magmatic and alteration veins are undeformed with respect to crystal plastic (CP) deformation Crosscutting relationships in harzburgite indicate that GMV>SAV>CC.

Core Photo



209-1268A-25R-2 (Section top: 127.23 mbsf)

UNIT-IV: Gabbronorite/Harzburgite

Piece 1–21

COLOR: Gray

PRIMARY MINERALOGY:

Plagioclase	Mode 60% Size 6 –10 mm Shape/Habit Euhedral
Clinopyroxene	Mode 32% Size 2–8 mm Shape/Habit Subhedral to euhedral
Orthopyroxene	Mode 10% Size 4-8 mm Shape/Habit Anhedral to euhedral

COMMENTS: Limited modal variation and gradational textural changes characterize this gabbronoritic section. The upper section (Pieces 1-11, 0-91 cm) is medium-grained with average pyroxene and plagioclase ~4 mm and the lower section (Piece 12 – 21, 91-144 cm) is coarse-grained (~7 mm).

SECONDARY MINERALOGY:

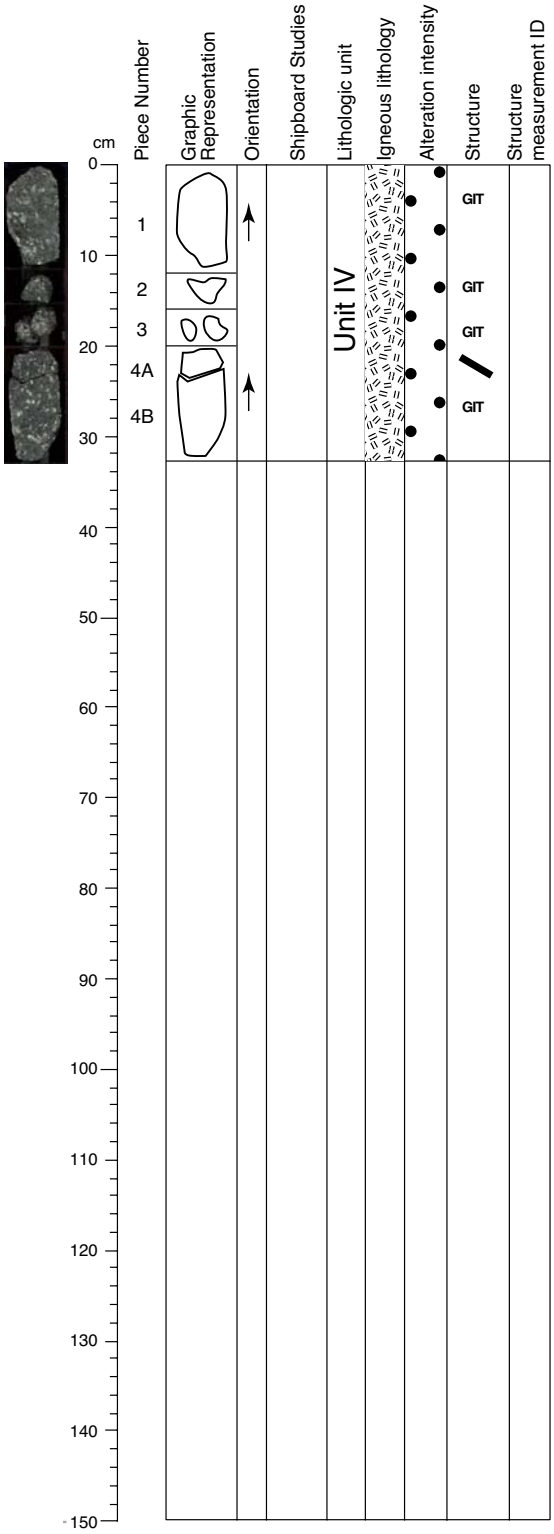
COMMENTS: Uniformly amphibole-chlorite-talc altered gabbro with prehnite + zeolite vein in Piece 14. Plagioclase in the halo has been partially transformed to prehnite.

VEIN ALTERATION: This section has no significant veining.

STRUCTURE:

The section is characterized medium grained statically-altered gabbro with igneous texture (GIT). Felsic veins cut Pieces 13 and 14.

Core Photo



209-1268A-25R-3 (Section top: 128.67 mbsf)

UNIT-IV: Gabbronorite/Harzburgite

Piece 1–4

COLOR: Gray

PRIMARY MINERALOGY:

Plagioclase	Mode 60% Size 7 mm Shape/Habit Euhedral
Clinopyroxene	Mode 32% Size 2–8 mm Shape/Habit Subhedral to euhedral
Orthopyroxene	Mode 10% Size 4-8 mm Shape/Habit Anhedral to euhedral

COMMENTS: The gabbronorite of this section is coarse-grained with average pyroxene and plagioclase ~7 mm. It is modally and texturally indistinguishable from the lower portion of 1268A-25R-2.

SECONDARY MINERALOGY:

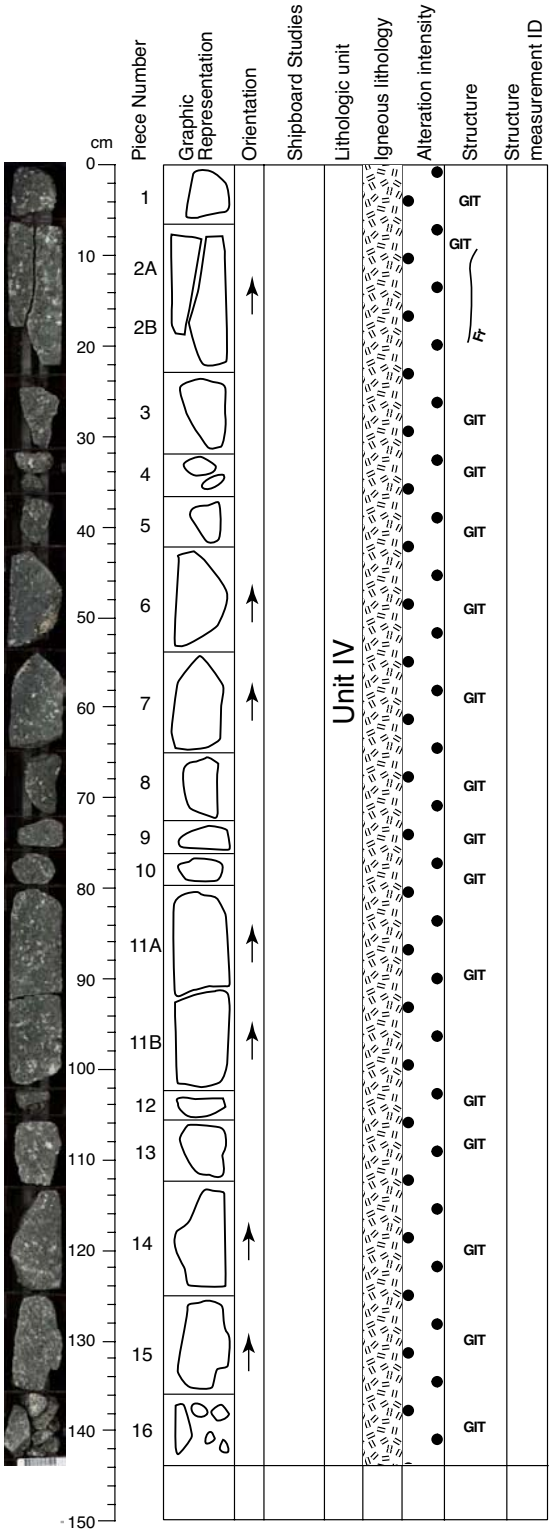
COMMENTS: Uniformly amphibole-chlorite-talc altered gabbro as in previous Section 1268A-25R-2

VEIN ALTERATION: No veins

STRUCTURE:

The section is characterized medium grained statically-altered gabbro with igneous texture (GIT). A felsic vein cuts Piece 4.

Core Photo



209-1268A-26R-1 (Section top: 130.50 mbsf)

UNIT-IV: Gabbronorite/Harzburgite

Piece 1–16

COLOR: Gray and green

PRIMARY MINERALOGY:

Plagioclase	Mode 60% Size 4- 0 mm Shape/Habit Subhedral to euhedral
Clinopyroxene	Mode 30%–32% Size 1–10 mm Shape/Habit Euhedral
Orthopyroxene	Mode 10% Size 2 mm Shape/Habit Euhedral

COMMENTS: There is limited modal variation in this gabbronoritic section but significant textural variations. Pieces 1 and 2 (0 – 24 cm) is medium-grained and the pyroxene is predominantly interstitial. Pieces 3 – 11 (24 – 102 cm) is medium grained with subequant euhedral pyroxene. Pieces 12 – 16 (102 – 144 cm) are fine grained and the pyroxene has a higher aspect ratios (2:1 to 3:1) and is predominantly subhedral.

SECONDARY MINERALOGY:

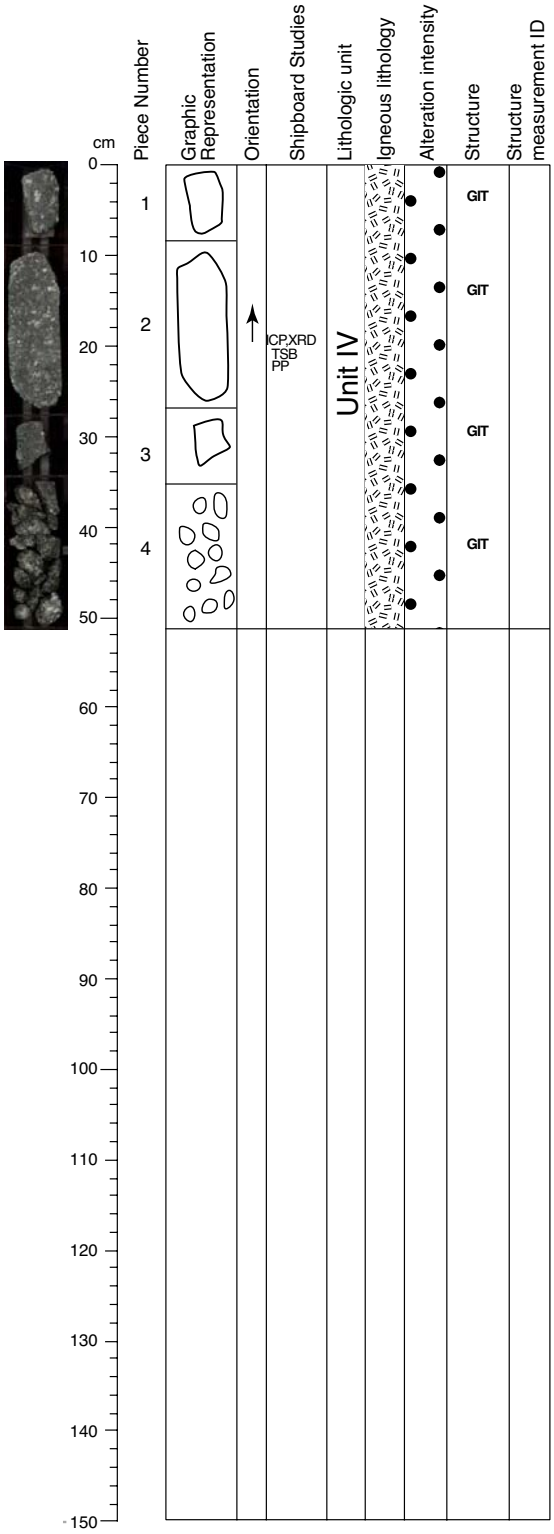
COMMENTS: Uniformly amphibole-chlorite-talc altered gabbro as in previous core.

VEIN ALTERATION: Piece 1 contains a narrow talc vein along its length and several small subsidiary late veins. Pieces 6 and 7 contain small, volumetrically insignificant talc veins.

STRUCTURE:

The section is characterized medium-grained statically-altered gabbro with igneous texture (GIT).

Core Photo



209-1268A-26R-2 (Section top: 131.94 mbsf)

UNIT-IV: Gabbronorite/Harzburgite

Piece 1–4

COLOR: Gray

PRIMARY MINERALOGY:

Plagioclase	Mode 65% Size 4–10 mm Shape/Habit Subhedral to euhedral
Clinopyroxene	Mode 25% Size 2 – 10 mm Shape/Habit Euhedral
Orthopyroxene	Mode 10% Size 4-8 mm Shape/Habit Euhedral

COMMENTS: The gabbronorite of this section is fine-grained and the pyroxene has an aspect ratios of 2:1 to 3:1 and is predominantly subhedral. It is modally and texturally indistinguishable from the lower portion of Section 1268A-26R-1.

SECONDARY MINERALOGY:

COMMENTS: Uniformly amphibole-chlorite-talc altered gabbro as in previous section.

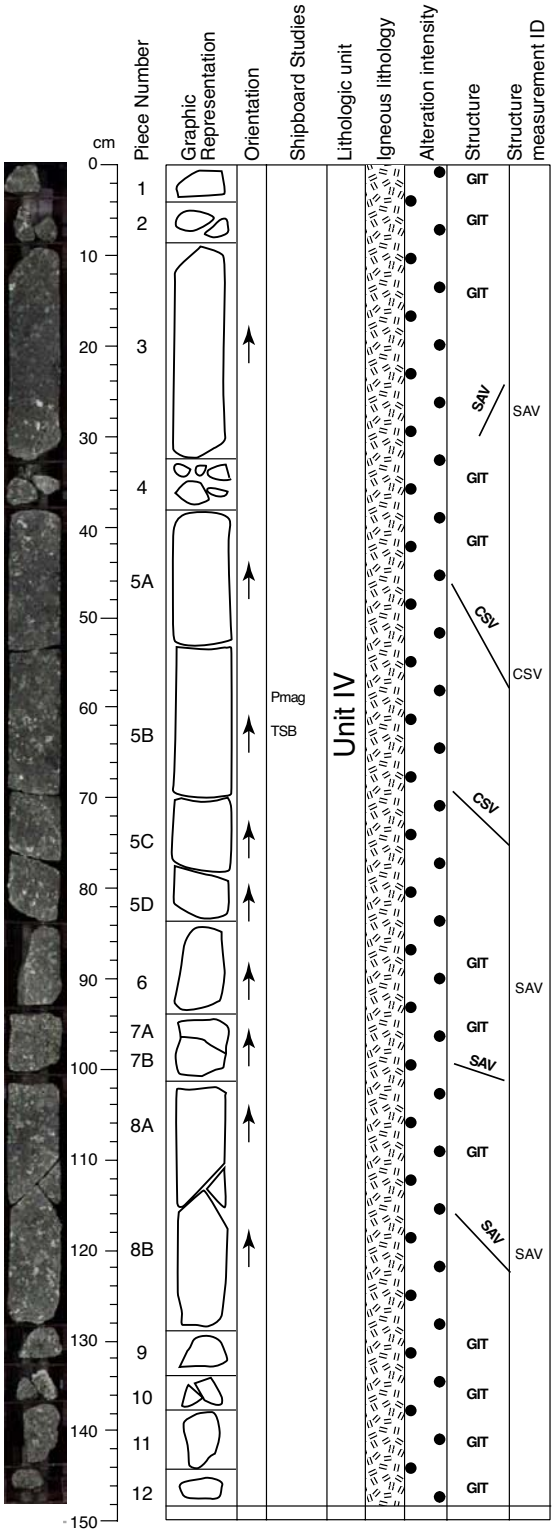
VEIN ALTERATION: No veins.

THIN SECTIONS: Sample 1268A-26R-2, 18-20 cm

STRUCTURE:

The section is characterized medium grained statically-altered gabbro with igneous texture (GIT).

Core Photo



209-1268A-27R-1 (Section top: 135.50 mbsf)

UNIT-IV: Gabbronorite/Harzburgite

Piece 1–12

COLOR: Gray to brown

PRIMARY MINERALOGY:

Plagioclase	Mode 65% Size 4–10 mm Shape/Habit Subhedral to euhedral
Clinopyroxene	Mode 25% Size 1–13 mm Shape/Habit Euhedral
Orthopyroxene	Mode 10% Size 4–8 mm Shape/Habit Euhedral

COMMENTS: This section is composed of granular textured gabbronorite that is fine- to medium-grained in the upper 0 – 54 cm of the core. In this section the pyroxene habit is subophitic and crystal sizes can be as large as 14 mm. This texture grades into a coarse-grained texture with subhedral to euhedral pyroxenes, which is well defined in Piece 5B. A 1-cm thick synmagmatic shear zone cuts the core at 116 cm (Piece 8C). It shows no alteration but significant grain-size reduction and much more abundant plagioclase than the surrounding gabbronorite.

SECONDARY MINERALOGY:

COMMENTS: This section consists of moderately altered gray to brown gabbro. The cm-sized pyroxenes have partially replaced by amphibole, chlorite and talc. Plagioclase is largely unaltered, however, they contain minor chlorite-smectite, amphibole and prehnite. The light gray color in the lower part of the section is due to more talc-rich alteration of pyroxene and slightly more intense plagioclase alteration.

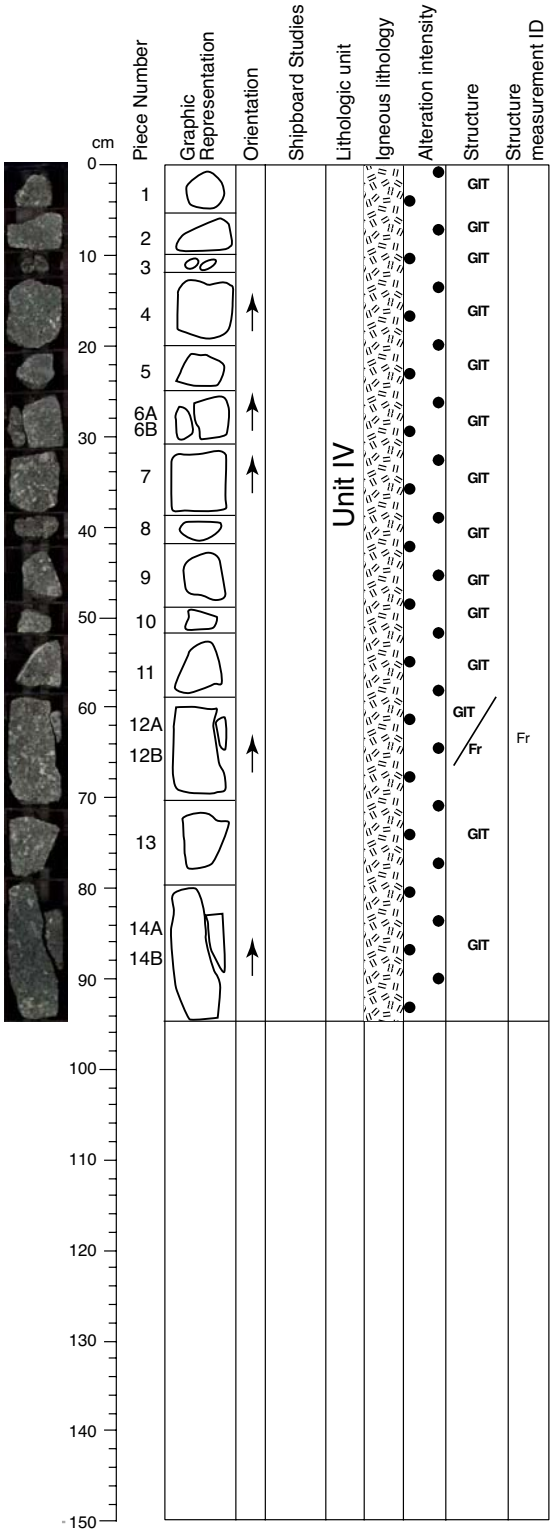
VEIN ALTERATION: Veins of talc occur in piece 5B, 5C, 6, 7 and 8. The veins are straight and cross cut the gabbro and are mostly composed of talc but locally where they cross cut pyroxene they may contain varying amounts of chlorite and amphibole.

THIN SECTIONS: 1Sample 1268A-27R-1, 64-66 cm

STRUCTURE:

The section is characterized medium-grained statically-altered gabbro with igneous texture (GIT). Prominent calcsilicate (CSV) and serpentine-talc alteration veins (SAV) cut Pieces 3, 5, and 6-8.

Core Photo



209-1268A-27R-2 (Section top: 136.98 mbsf)

UNIT-IV: Gabbronorite/Harzburgite

Piece 1–14

COLOR: Brownish gray

PRIMARY MINERALOGY:

Plagioclase	Mode 65% Size 4–10 mm Shape/Habit Subhedral to euhedral
Clinopyroxene	Mode 25% Size 1–8 mm Shape/Habit Euhedral
Orthopyroxene	Mode 10% Size 4–8 mm Shape/Habit Euhedral

COMMENTS: This entire section is composed of fine-grain gabbronorite with subhedral to anhedral pyroxene. Amphibole is present locally and in Piece 4 (13–20 cm) it defines a downward branching structure that is interpreted to have formed during the escape of juvenile fluids from the crystallizing gabbronorite.

SECONDARY MINERALOGY:

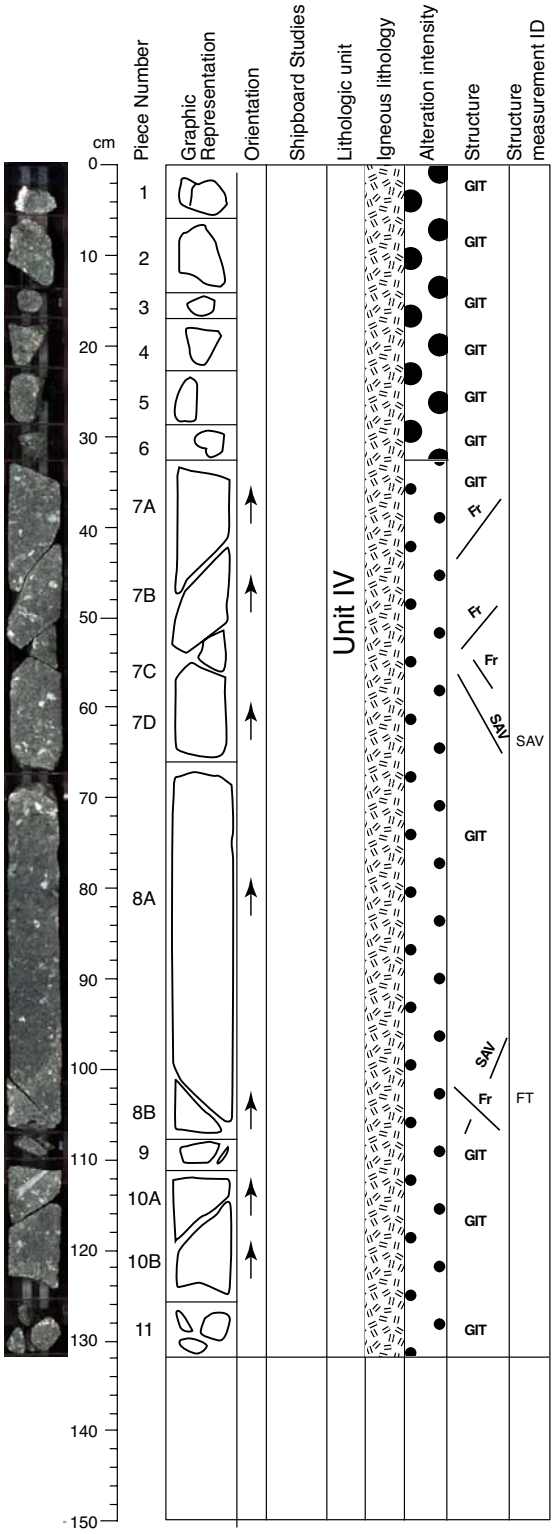
COMMENTS: This section consists of moderately altered gray to brown gabbro, similar to the previous 1268A-27R-1. The cm-sized pyroxenes have been partially replaced by amphibole, chlorite and talc. Plagioclase is largely unaltered, however, they contain minor chlorite-smectite, amphibole and prehnite. The light gray color in the upper part of the section is due to more talc-rich alteration of pyroxene and slightly more intense plagioclase alteration.

VEIN ALTERATION: Same as section 1268A-27R-1. Talc veins occur in Pieces 7, 11, 12, and 13.

STRUCTURE:

The section is characterized medium grained statically-altered gabbro with igneous texture (GIT). Prominent serpentine-talc alteration veins (SAV) cut Pieces 7 and 11. An inclined fracture cuts Piece 12 at ~60 degrees in the cut face of the core.

Core Photo



209-1268A-28R-1 (Section top: 140.10 mbsf)

UNIT-IV: Gabbronorite/Harzburgite

Piece 1–11

COLOR: Light gray to gray

PRIMARY MINERALOGY:

Plagioclase	Mode 65% Size 4–10 mm Shape/Habit Subhedral to euhedral
Clinopyroxene	Mode 25% Size 1–11 mm Shape/Habit Euhedral
Orthopyroxene	Mode 15% Size 4–8 mm Shape/Habit Euhedral

COMMENTS: The entire section is composed of gabbronorite with a relatively uniform mode but textural changes that occur on the scale of centimeters throughout. Most of the gabbronorite is fine-grained (up to 4 mm grain size) and granular with subhedral to euhedral pyroxenes and plagioclase. However, aggregates of coarse-grained gabbronorite as large as 8 cm (e.g., 70 – 77 cm in Piece 8A) and as small as a few grains stuck together (e.g., 57–58 cm in Piece 5D).

SECONDARY MINERALOGY:

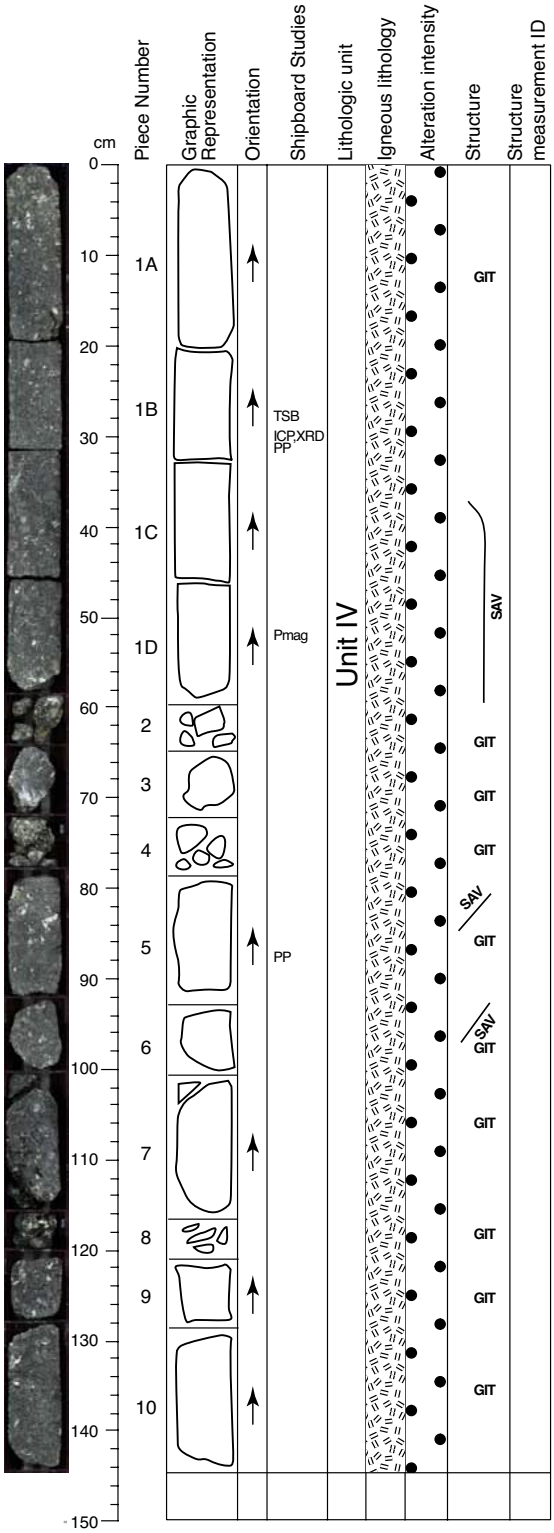
COMMENTS: This section consists of gray to light gray gabbro which is highly altered in the upper portion (Pieces 1 to 6) and moderately altered in the lower part (Pieces 7 to 11). The pyroxenes are largely pseudomorphed by amphibole, chlorite and talc. In the upper part, about half of the plagioclase is replaced prehnite, amphibole and chlorite-smectite. In the lower part most of the plagioclase in unaltered.

VEIN ALTERATION: A small, volumetrically insignificant talc vein is present in Pieces 7D, 8A, and 8B.

STRUCTURE:

The section is characterized medium grained statically-altered gabbro with igneous texture (GIT). A felsic vein cuts Piece 1. Prominent serpentine-talc alteration veins (SAV) cut Pieces 7 and 8. Inclined fractures cut Pieces 7, 9, and 10.

Core Photo



209-1268A-28R-2 (Section top: 141.42 mbsf)

UNIT-IV: Gabbronorite/Harzburgite

Piece 1–10

COLOR: Light gray to gray.

PRIMARY MINERALOGY:

Plagioclase	Mode 65% Size 4–10 mm Shape/Habit subhedral-euhedral
Clinopyroxene	Mode 25% Size 2–6 mm Shape/Habit euhedral
Orthopyroxene	Mode 10%–12% Size 4–8 mm Shape/Habit euhedral

COMMENTS: The entire section is composed of gabbronorite with a relatively uniform mode, but textural changes that occur on the scale of centimeters throughout. Most of the gabbronorite is fine-grained (up to 4-mm grain size) and granular with subhedral to euhedral pyroxenes and plagioclase. However, aggregates of coarse-grained gabbronorite occur throughout.

SECONDARY MINERALOGY:

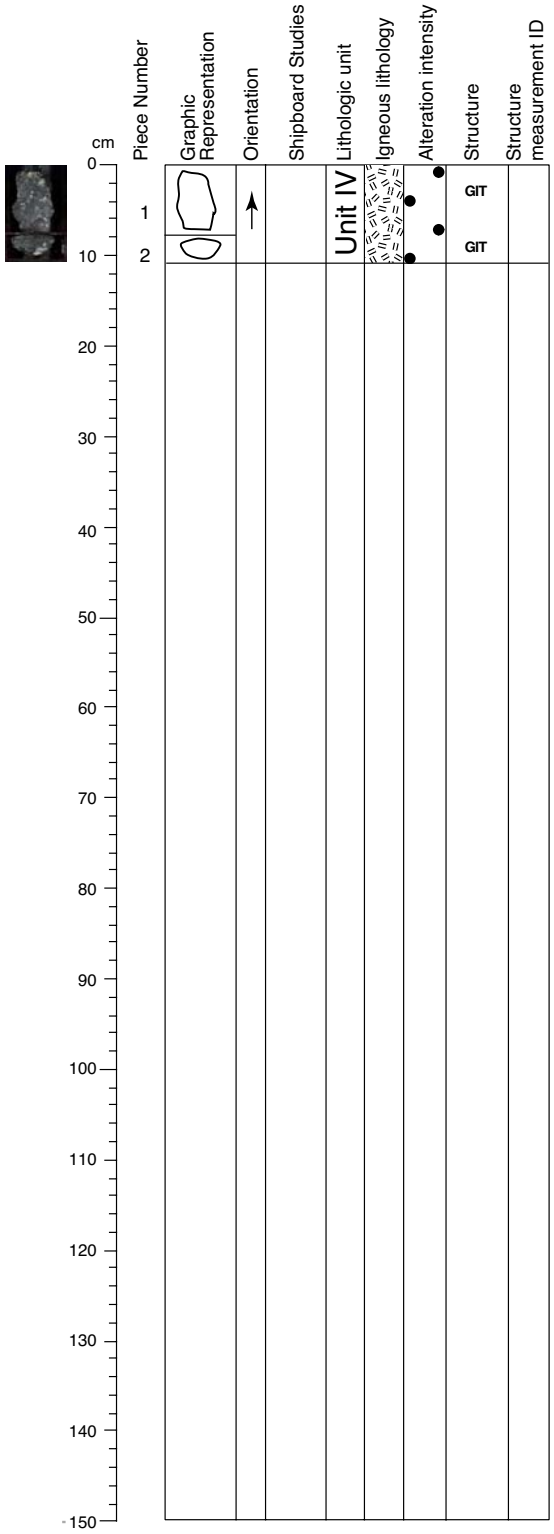
COMMENTS: This section consists of gray, moderately to highly altered gabbro. The pyroxenes are largely pseudomorphed by amphibole, chlorite and talc. The plagioclase is unaltered or partially replaced by prehnite, amphibole and chlorite-smectite.

VEIN ALTERATION: Small, volumetrically insignificant talc veins are present.

THIN SECTIONS: Sample 1268A-28R-2, 64-66 cm

STRUCTURE:
The section is characterized medium grained statically-altered gabbro with igneous texture (GIT). Prominent serpentine-talc alteration veins (SAV) cut Pieces 1, 5, and 6.

Core Photo



209-1268A-28R-3 (Section top: 142.87 mbsf)

UNIT-IV: Gabbronorite/Harzburgite

Piece 1–2

COLOR: Gray

PRIMARY MINERALOGY:

Plagioclase	Mode 65% Size 4–10 mm Shape/Habit Subhedral to euhedral
Clinopyroxene	Mode 25% Size 2–6 mm Shape/Habit Euhedral
Orthopyroxene	Mode 10% Size 4–8 mm Shape/Habit Subhedral to euhedral

COMMENTS: The entire section is composed of gabbronorite with a relatively uniform mode, but textural changes that occur on the scale of centimeters throughout. Most of the gabbronorite is fine-grained (up to 4-mm grain size) and granular with subhedral to euhedral pyroxenes and plagioclase. However, aggregates of coarse-grained gabbronorite occur throughout.

SECONDARY MINERALOGY:

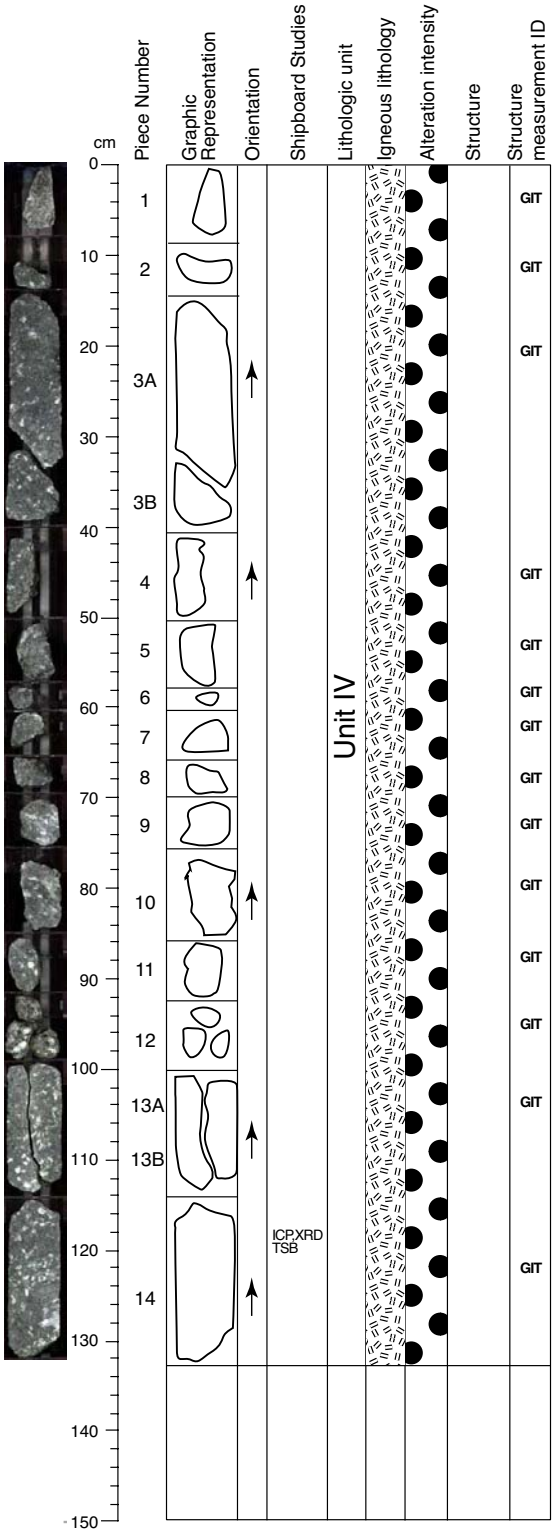
COMMENTS: This section consists of two pieces of moderately altered gabbro as observed at the end of Section 1268A-28R-2. The pyroxenes are largely pseudomorphed by amphibole, chlorite, and talc. The plagioclase is unaltered or partially replaced by prehnite, amphibole and chlorite-smectite.

VEIN ALTERATION: Piece 1 contains a small talc vein.

STRUCTURE:

The section is characterized medium grained statically-altered gabbro with igneous texture (GIT).

Core Photo



209-1268A-29R-1 (Section top: 145.1 mbsf)

UNIT-IV: Gabbronorite/Harzburgite

Piece 1–14

COLOR: Gray

PRIMARY MINERALOGY:

Plagioclase	Mode 65% Size 4–10 mm Shape/Habit Equant
Clinopyroxene	Mode 25% Size 1–11 mm Shape/Habit Euhedral
Orthopyroxene	Mode 10% Size 6–8 mm Shape/Habit Anhedral

COMMENTS: The gabbronorite of this section is medium- to coarse-grained with subhedral to euhedral pyroxenes locally with interstitial overgrowths.

SECONDARY MINERALOGY:

COMMENTS: The gabbro in this section is highly altered. The pyroxenes are largely pseudomorphed by amphibole, chlorite and talc. Prehnite, amphibole and chlorite-smectite replace about half of the plagioclase.

VEIN ALTERATION: Talc veins crosscut Pieces 1, 2, 3, 5, and 13. Other Pieces of the gabbro seem to be broken along the talc veins.

THIN SECTIONS: Sample 1268A-29R-1, 118-121 cm

STRUCTURE: The section is characterized medium grained statically-altered gabbro with igneous texture (GIT).

THIN SECTION:	**209-1268A-2R-1, Piece 7B, 44-46 cm**	**TS# 1**	**Observer: MS,WB**
ROCK NAME:	**COMPLETELY ALTERED DUNITE**		
GRAIN SIZE:	**Medium to coarse**		
TEXTURE:	**Granular**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	95	?	Anhedral	
Orthopyroxene	0	5	>5	Anhedral / rounded	**Too altered to be certain.**
Clinopyroxene	0	0			
Spinel	0	0		Anhedral	

GENERAL COMMENTS Totally altered. Original grain boundary between olivine and orthopyroxene is not observable. Only 4 orthopyroxene pseudomorph cores are recognizable.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Sepentine	25	Olivine	Fibrous, serrate veins	Relict mesh texture overprinted by network of talc veinlets.
Talc	15	Serpentine	Fibrous	
Brown clay (probably dirty talc)	50	Serpentine		Macroscopically whitish.
Green clay	10	Serpentine		Forms cm-sized rounded patches, mostly plucked.
Hematite	Trace		>0.8 mm	
Sulfide	Trace			
Magnetite	Trace	Spinel		

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc				0.25-mm-wide vein cuts chrysotile veinlets.
Hematite				
Sulfide				
Chysotile	in Chrysotile vein			0.1 mm. Cut by talc veinlet.

STRUCTURE

No significant structural deformation is visible in thin section

Crosscutting Relationships:
1) Serpentinization
2) Formation of serpentine veins
3) Static talc alteration
4) Formation of shear fractures

THIN SECTION:	**209-1268A-2R-3, Piece 4, 11-13 cm**	**TS# 2**	**Observer: MS,WB**
ROCK NAME:	**COMPLETELY ALTERED HARZBURGITE**		
GRAIN SIZE:	**Medium**		
TEXTURE:	**Granular interstitial**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	90 to 95	?	Anhedral	
Orthopyroxene	0	10 to 15	3	Anhedral to interstitial	
Clinopyroxene	0				
Spinel	1.5	2	0.02	Euhedral to oval	Some poikilitic, enclosing olivine.

GENERAL COMMENTS Totally altered. Original grain boundary between olivine and orthopyroxene not observable.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc	60	Serpentine		
Brown clay (probably dirty talc)	35	Serpentine	Patchy, macroscopically white	May pseudomorph orthopyroxene
Serpentine	5	Olivine	Fibrous where still present	
Hematite	Trace			
Magnetite	Trace	Spinel	0.25 mm wide	

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc				Talc/hematite/pyrite veins.
Pyrite			0.5 mm wide	Cut chrysotile veins.
Hematite				
Chrysotile	in chrysotile veins		Cross fibers	Cut by talc veins.

STRUCTURE
Thin secion contains no significant deformation textures

Crosscutting Relationships:
1) Serpentinization
2) Formation of serpentine veins
3) Static talc alteration

THIN SECTION: 209-1268A-2R-2, Piece 4C, 40-43 cm **TS# 3** **Observer: MS,WB**
ROCK NAME: COMPLETELY SERPENTINIZED HARZBURGITE
GRAIN SIZE:
TEXTURE: Granular to porphyroclastic

PRIMARY MINERALOGY	MODE (Visual estimate) PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	MORPHOLOGY	COMMENTS
Olivine	0	87	?	Granular	
Orthopyroxene	0	12	2 to 5	Porphyroclasts	
Clinopyroxene	0	0			
Spinel	<1	1	<0.01-0.2	Euhedral to oval	

GENERAL COMMENTS Totally altered except some spinel. Boundaries between former olivine and orthopyroxene have been preserved.

SECONDARY MINERALS	PERCENT PRESENT	REPLACING	MORPHOLOGY	COMMENTS
Serpentine	92	Olivine, orthopyroxene	Bastite after orthopyroxene	Transitional texture.
Talc	7	Olivine, orthopyroxene		
Magnetite	Trace	Olivine, spinel		
Green amphibole	Trace	Orthopyroxene		
Pyrite	Trace	Olivine, orthopyroxene		
Hematite	Trace	Olivine, orthopyroxene		

VEIN / FRACTURE FILLING	PERCENT PRESENT	REPLACING	MORPHOLOGY	COMMENTS
Chrysotile (gamma-serpentine, cross-fiber) + magnetite veins up to 0.25 mm wide are cross-cut by talc vein network, including a 1 mm wide irregular talc vein near the top of the thin section				

STRUCTURE
Ductile
Very minor ductile deformation; kink bands in two pseudomorphed former pyroxene grains

Brittle:
Several late fractures cut serpentine mesh texture and serpentine veins; Some have small shear offset

Crosscutting Relationships:
1) Minor ductile deformation
2) Serpentinization
3) Static talc alteration

THIN SECTION:	**209-1268A-2R-2, Piece 8, 70-73 cm**	**TS# 4**	**Observer: MS,JH**
ROCK NAME:	**COMPLETELY SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Medium**		
TEXTURE:	**Porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	85	?	Granular	
Orthopyroxene	1	11	5-6	Porphyroclasts	Orthopyroxene neoblasts at the margins.
Clinopyroxene	0		1?	Anhedral(?)	Possible but totally altered.
Spinel	Trace	1	<0.001-0.03	Euhedral to oval	Disseminated; one orthopyroxene-spinel intergrowth.

GENERAL COMMENTS
Orthopyroxene irregularly distributed throughout the section (no orthopyroxene in a quarter)
Limit between former orthopyroxene and olivine still observable.
Some orthopyroxene recrystallized with no oriented deformation

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Serpentine	89	Olivine	Chrysotile rims with hourglass texture cores.	
Bastite	5	Orthopyroxene	Pseudomorphic core where present.	
Magnetite	3	Olivine and spinel	Concentrated in former grain boundaries in olivine alteration and euhedral - subhedral grains after spinel.	
Chlorite	<1	Orthopyroxene	Occasional breakdown product of orthopyroxene with chlorite, may also fringe clay alteration in olivine cores.	
Talc	<2	Orthopyroxene	Occasional breakdown product of orthopyroxene with talc.	

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Serpentine			Fibrous	Cross fibers in sigmoidal veins
Sulfide			Patchy, clustered, occasional euhedral pyrite grains	Present in talc/chlorite veins, some very fine grained exsolution of a second gray opaque mineral in reflected light
Talc?			Small amount, extremely fine grained	
Chlorite			Fibrous, to irregular	Intimately mixed with talc(?)

STRUCTURE
Crystal Plastic:
Minor ductile deformation; small kink bands in several pseudomorphed pyroxene grains and possible recrystallized neoblasts in one pseudomorphed pyroxene grain
Foliation:
Weak foliation defined by ribbon texture serpentinite

Crosscutting Relationships (as are apparent in thin section):
1) Minor ductile deformation
2) Pyroxene altered to amphibole
3) Serpentinization
4) Formation of serpentine veins

THIN SECTION: 209-1268A-3R-3, Piece 2, 6-9 cm TS# 5 Observer: MS,WB
ROCK NAME: HIGHLY SERPENTINIZED HARZBURGITE CUT BY VERY HIGHLY ALTERED AMPHIBOLITE
GRAIN SIZE: Fine to medium
TEXTURE: Granular to porphyroclastic

PRIMARY MINERALOGY	MODE (Visual estimate) PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	MORPHOLOGY	COMMENTS
Olivine	30	60	0.02-5	Anhedral	Porphyroclasts + neoblasts.
Orthopyroxene	30	35	0.3-6	Porphyro/granular	Porphyroclasts with 0.5-1 mm subgrains and small neoblasts.
Clinopyroxene	1.5	1-2	1-2	Interstitial	At grain boundaries of recrystallized orthopyroxene and olivine.
Spinel	1.8	2	0.1-1.5	Variable	Oval; anhedral elongated; holly leaf shaped; intergrowth with pyroxene.
AMPHIBOLITE					
Amphibole	10	?	3-10	Subhedral	Primary brown amphibole?
Plagioclase		?			Totally altered.

GENERAL COMMENTS 1.5-cm-wide band of amphibolite in the middle of the TS; both sides are very fresh harzburgite (65% serpentinization)?

SECONDARY MINERALS	PERCENT PRESENT	REPLACING	MORPHOLOGY	COMMENTS
Serpentine	30	Orthopyroxene		Mesh texture with fresh olivine in the centers and patch complete replacement by serpentine and magnetite.
Talc	10	Olivine + orthopyroxene	In patches and along fractures and grain boundaries	
Bastite	10	Orthopyroxene	Pseudomorphic	
Magnetite	1	Olivine	Anhedral	
Tremolite	1	Orthopyroxene		

VEIN / FRACTURE FILLING	PERCENT PRESENT	MORPHOLOGY	COMMENTS
Serpentine/talc		Transgranular cross fibers	Veinlet; gamma serpentine; with 98% serpentine and 2% talc.
Talc		Irregular transgranular	Veinlet; gamma serpentine; with 98% serpentine and 2% talc.
Very highly altered amphibolite			

SECONDARY MINERALS	PERCENT PRESENT	REPLACING	MORPHOLOGY	COMMENTS
Green amphibole	60	Brown amphibole	Pseudomorphic and in fibrous patches	
Chlorite	10	Plagioclase		
Serpentine	20	Brown amphibole	Pseudomorphic	
White mica	5	Plagioclase		

VEIN / FRACTURE FILLING MINERALS	PERCENT PRESENT	MORPHOLOGY	COMMENTS
Serpentine/pyrite			Veinlet; 99%serpentine and 1% pyrite.
Talc			Veinlet
Carbonate			Calcite?

STRUCTURE
Rock was weakly ductilely deformed under granulite-facies conditions; formed minor kink bands in several olivine grains, no other deformation fabrics are present

Crosscutting Relationships (as are apparent in thin section):
1) Minor ductile deformation
2) Intrusion of gabbro vein
3) Serpentinization
4) Low temperature alteration of gabbro vein
5) Talc veins fill anastomosing fractures

THIN SECTION:	**209-1268A-3R-2, Piece 1, 7-10 cm**	**TS# 6**	**Observer: MS,JH**
ROCK NAME:	**COMPLETELY ALTERED HARZBURGITE**		
GRAIN SIZE:	**Medium to coarse**		
TEXTURE:	**Granular to porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	70	?	Anhedral	Seems to be mostly recrystallized coarse grains(?).
Orthopyroxene	0	30	2-10	Anhedral to interstitial	Also small porphyroclasts.
Clinopyroxene	0	?			
Spinel	0.7	1	<0.1-2	Oval or anhedral	Trains of holly leaf shaped spinels.

GENERAL COMMENTS Totally altered harzburgite that appears to have been very rich in orthopyroxene.
Boundaries between former olivine and orthopyroxene is poorly preserved, difficult to estimate modal composition.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Serpentine	30	Olivine	Relict olivine cores with undulose extinction	
Talc	60	Serpentine/orthopyroxene	Dense granular network after serpentine, fibrous and elongate after orthopyroxene.	
Magnetite	2	Olivine	Anhedral, irregular	Along former grain boundaries
Bastite	7	Orthopyroxene	Only remains in cores of orthopyroxenes, some have thick serpentine rims	

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Chrysotile		Cross fibers in sigmoidal veins	
Magnetite		Anhedral	Intergrowths with chrysotile in sigmoidal veins
Talc		Fibrous, some replacement after fibrous chrysotile in serrate and sigmoidal veins	Seems to retain some of the former cross-fiber nature of the chrysotile.

STRUCTURE

Crystal Plastic:
Weak ductile deformation; kink bands, bent cleavage and possible neoblasts in pseudomorphed pyroxenes

Foliation:
Weak foliation defined by ribbon texture serpentinite

Crosscutting Relationships (as are apparent in thin section):
1) Weak ductile deformation
2) Pryoxene altered to amphibole
3) Serpentinization
4) Talc veining

THIN SECTION:	**209-1268A-3R-2, Piece 20A, 109-112 cm**	**TS# 7**	**Observer: MS**
ROCK NAME:	**COMPLETELY ALTERED HARZBURGITE**		
GRAIN SIZE:	**Medium to coarse**		
TEXTURE:	**Porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	75		Anhedral	
Orthopyroxene	0	20	3-10	Anhedral	Some recrystallized in subgrains.
Clinopyroxene	1	2	0.2.05	Anhedral to interstitial	At some orthopyroxene subgrains boundaries or interstitial with spinel.
Spinel	0.9	1	<0.2	Oval; anhedral	Mostly at orthopyroxene border; trains of elongated grains.

GENERAL COMMENTS Orthopyroxene locally replaced by amphibole
3 photomicrographs

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Serpentine	62	Olivine	Undulose extinction in hourglass texture subgrains, some chrysotile in serrate veins.	
Magnetite	<1	Olivine	Irregular anhedral grains in grain boundaries and serrate veins	
Talc	25	Olivine/orthopyroxene	Fibrous/lath-like in orthopyroxene	Replaces orthopyroxene along cleavage plains.
Amphibole	Trace	Orthopyroxene	Lath-like	Occasional on margins of orthopyroxene.
Bastite	10	Orthopyroxene	Pseudomorphic after orthopyroxene	Breaking down to talc in many grains

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Pyrite		Subhedral	Irregularly distributed in talc/pyrite/hematite veins.
Hematite		Anhedral	Closely associated with pyrite margins
Talc		Anhedral	Sometimes coarser grained in larger veins.
Serpentine		Fibrous, massive	Distributed throughout larger talc veins.

STRUCTURE

Crystal Plastic:
Ductile deformation; weak to moderate kink banding in pseudomorphed pyroxene

Brittle:
Disjointed hourglass texture serpentinite suggest minor brittle deformation during serpentinization

Foliation:
Very weak foliation defined by ribbon texture serpentinite

Crosscutting Relationships (as are apparent in thin section):
1) Ductile deformation
2) Serpentinization
3) Formation of serpentine veins

THIN SECTION:	**209-1268A-4R-1, Piece 5A, 12-15 cm**	**TS# 8**	**Observer: MS,WB**
ROCK NAME:	**COMPLETELY ALTERED HARZBURGITE**		
GRAIN SIZE:	**Medium to coarse**		
TEXTURE:	**Porphyroclastic**		

	MODE Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	70	?		
Orthopyroxene	0	25	0.5-6	Anhedral to interstitial	Locally recrystallized into subgrains and neoblasts.
Clinopyroxene	0	?			
Spinel	0.5	1	0.2	Anhedral	Associated with pyroxene.

GENERAL COMMENTS

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Serpentine	70	Olivine + orthopyroxene	Transitional texture	
Talc	20	Olivine + orthopyroxene	Fibrous	Partly replaces serpentine mesh-rim texture and serpentine veins and the bastite.
Bastite	10	Orthopyroxene	Pseudomorphic	Bastite is colorless, low-birefringent in centers and green, high-birefringent in rims.
Magnetite	Trace	Olivine + orthopyroxene	Anhedral	
Pyrite	Trace	Olivine + orthopyroxene	Anhedral	

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Pyrite/serpentine/ hematite			Proportion 85:13:2

STRUCTURE

Crystal Plastic:
Very weak ductile deformation; minor kink bands in pseudomorphed pyroxenes

Brittle:
Disjointed hourglass texture serpentinite suggests minor brittle deformation during serpentinization; No brittle deformation post serpentinization.

Foliation:
Weak foliation defined by ribbon texture serpentinite and serpentine veins parallel to ribbons

Crosscutting Relationships (as are apparent in thin section):
1) Weak ductile deformation
2) Pyroxene altered to amphbibole
3) Serpentinization
4) Formation of serpentine veins

THIN SECTION:	**209-1268A-4R-1, Piece 20A, 124-127 cm**	**TS #9**	**Observer: MS,WB**
ROCK NAME:	**COMPLETELY SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Medium to coarse**		
TEXTURE:	**Protogranular**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	70		Anhedral	
Orthopyroxene	0	28	1-10	Anhedral to interstitial	Some recrystallized in subgrains.
Clinopyroxene	0	?			
Spinel	1.5	2	0.1-1.5	Anhedral	Trains of holly leaf shaped and elongated grains; intergrowths with orthopyroxene.

GENERAL COMMENTS Totally (except spinel) altered harzburgite; high temperature foliation; orthopyroxene layering

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Serpentine	75	Olivine + orthopyroxene	Transitional texture	Ribbon texture.
Talc	10	Olivine + orthopyroxene	Fibrous	Partly replaces serpentine mesh-rim texture and serpentine veins and the bastite.
Bastite	15	Orthopyroxene	Pseudomorphic	Bastite is colorless, low-birefringent in centers and green, high-birefringent in rims.
Magnetite	Trace	Olivine + orthopyroxene	Anhedral	
Pyrite	Trace	Olivine + orthopyroxene	Anhedral	

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Talc			With some pyrite.
Pyrite			Veinlets cut talc vein.

STRUCTURE

Crystal Plastic:
Very weak ductile deformation; kink bands in pseudomorphed former pyroxene grains

Brittle:
Dense networks of anastomosing fractures cut serpentine and veins; These have very little to no shear offset
Anastomosing fractures are typically subparallel to ribbon serpentinite foliation or intersect it at angles up to 30 degrees

Foliation:
Moderate foliation defined by ribbon texture serpentinite and serpentine veins parallel to ribbons

Crosscutting Relationships (as are apparent in thin section):
1) Minor crystal plastic deformation of pyroxene
2) Serpentinization
3) Serpentine veining
4) Formation of anastomosing shear fractures

THIN SECTION:	**209-1268A-5R-2, Piece14, 58-61 cm**	**TS# 10**	**Observer: MS,JH**
ROCK NAME:	**COMPLETELY ALTERED HARZBURGITE**		
GRAIN SIZE:	**Medium to coarse**		
TEXTURE:	**Protogranular**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	83	?		
Orthopyroxene	0	15	1-10	Anhedral to interstitial	Mainly interstitial(?); very elongated.
Clinopyroxene	0	?			
Spinel	1	1.5	Subhedral		

GENERAL COMMENTS Totally (except spinel) altered harzburgite; modal composition difficult to evaluate

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc	93	Serpentine/bastite		
Serpentine	5	Olivine/orthopyroxene		
Magnetite	<1	Olivine		
Pyrite	<1			

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Talc		Granular but elongate in center of larger veins	
pyrite		Very fine veinlets	
Magnetite		Subhedral	Remaining after talc overprint of chrysotile in serrate veins.

STRUCTURE

No structural deformation visible in thin section

Crosscutting Relationships (as are apparent in thin section):

1) Serpentinization
2) Formation of serpentine veins
3) Pervasive talc alteration

THIN SECTION:	**209-1268A-5R2, Piece 17, 71-73 cm**	**TS#11**	**Observer: MS,WB**
ROCK NAME:	**COMPLETELY ALTERED HARZBURGITE**		
GRAIN SIZE:	**Fine to medium**		
TEXTURE:	**Granular to porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	82	0.2-0.5	Granular polygonal	Neoblasts.
Orthopyroxene	0	17	1-5	Anhedral to interstitial	Commonly deformed and recrystallized in subgrains.
Clinopyroxene	0				
Spinel	0.8	1	0.1-1	Euhedral and anhedral	Small euhedral to oval disseminated; larger, anhedral with orthopyroxene; some spinel grains are elongated.

GENERAL COMMENTS
Totally altered (except some spinel) harzburgite
Although 100% serpentinized, the shape of the olivine grains can be observed, corresponding to recrystallized neoblasts; the size of the original grains cannot be determined

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc	75	Serpentine + olivine + orthopyroxene	Fibrous	After serpentine and bastite.
Green bastite	17	Orthopyroxene	Pseudomorphic	Forming coronas around talc or pale bastite cores.
Serpentine	5	Olivine + orthopyroxene	Fibrous	Relics.
Pale bastite	3	Orthopyroxene	Pseudomorphic	Relics surrounded by green bastite.
Magnetite	Trace	Olivine + orthopyroxene	Anhedral	
Pyrite	Trace	Olivine + orthopyroxene	Anhedral	

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Serpentine		Fibrous	Cut by pyrite and talc veins.
Talc			

GENERAL COMMENTS
In the upper 80% of the TS serpentine is almost completely replaced by talc. Lower 20% of the TS is rich in green bastite after orthopyroxene with pale bastite cores.
The contact between the two different domains is graditional and runs parallel to a phlogopite-amphibole-talc vein that is partly preserved at the bottom of the TS.
This vein has a mm-wide talc rich halo.

STRUCTURE
Minor ductile deformation; kink bands in pseudomorphed former pyroxene crystals

Crosscutting Relationships (as are apparent in thin section):
1) Weak ductile deformation
2) Serpentinization
3) Pervasive talc alteration

THIN SECTION:	**209-1268A-5R-2, Piece26A, 122-124 cm**	**TS# 12**	**Observer: MS,JH**
ROCK NAME:	**SERPENTINIZED DUNITE**		
GRAIN SIZE:	**Fine- to medium-grained (recrystallized)**		
TEXTURE:	**Granular**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	97	?	Anhedral	
Orthopyroxene	0	?		Anhedral	
Clinopyroxene	0	0			
Spinel	0.5	1	0.2	Euhedral to oval	So altered that may be confused with magnetite.

GENERAL COMMENTS Totally altered; no orthopyroxene observable with certainty

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Serpentine	50	Olivine	Ribbon texture in places	Extensively altered to talc.
Talc	50	Orthopyroxene	Microgranular after serpentine, Fibrous like after orthopyroxene	
Magnetite	<1	Spinel	Partially replaces spinel	

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Pyrite		Massive	Forms network of thread like veins with a trace of hematite at the margins.
Talc		Fibrous	Replacing chrysotile in serrate veins.
Chrysotile		Fibrous	In serrate veins.
Chlorite?		Fibrous/acicular	Occasionally parallel to talc/chrysotile in serrate veins.

STRUCTURE

No significant structural deformation of sample is visible in thin section

Crosscutting Relationships (as are apparent in thin section):

1) Serpentinization
2) Formation of serpentine veins
3) Formation of talc veins
4) Formation of shear fractures filled with opaque mineral

THIN SECTION:	**209-1268A-6R-1, Piece 10, 58-61 cm**	**TS# 13**	**Observer: MS,JH**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Fine to medium**		
TEXTURE:	**Porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	88	?		
Orthopyroxene	0	12	1-5	Porphyroclast	
Clinopyroxene	0	?			
Spinel	<<1	1	0.1	Euhedral to oval	

GENERAL COMMENTS Totally altered except spinel; altered orthopyroxene is difficult to distinguish from altered olivine; some orthopyroxene ghosts are present and modal amount of orthopyroxene can be higher than estimated

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Serpentine	30	Olivine	Only ragged cores remain	Extremely altered by talc ingrowth.
Talc	68	Serpentine / orthopyroxene	Microgranular / elongate laths after orthopyroxene	Large scale replacement/overprinting of core/rim texture serpentine.
Bastite	2	Orthopyroxene	Pseudomorphic after orthopyroxene	Mostly replaced by talc.
Pyrite	Trace		Subhedral	Finely disseminated throughout background.

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Pyrite		Massive	Some small chalcopyrite patches and hematite rims.
Chrysotile		Fibrous	In tiny serrate/sigmoidal veins subparallel to large (2 cm) vein margins.
Serpentine		Poorly developed core /rim structures	
Bastite		Pseudomorphic	After orthopyroxene.
Talc		Fibrous in serrate veins after chrysotile	
		Microgranular after serpentine core/rim alteration.	

GENERAL COMMENTS Vein comprises mineralogy broadly similar to that of the surrounding talc altered background although the material in the vein tends to be less intensely talc altered

STRUCTURE

No significant structural deformation visible in thin section

Crosscutting Relationships (as are apparent in thin section):

1) Serpentinization
2) Pervasive talc alteration

THIN SECTION:	**209-1268-7R-1, Piece 9, 34-37 cm**	**TS# 14**	**Observer:MS**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Medium to coarse**		
TEXTURE:	**Porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	78			
Orthopyroxene	0	20		Porphyroclasts	
Clinopyroxene	0				
Spinel	0.7	1	<0.1-0.5	Anhedral, subhedral flattened	Intergrowths with orthopyroxene borders, in the serpentine matrix.

GENERAL COMMENTS
Totally altered harzburgite, except spinel
Ghosts of orthopyroxene suggest that the former orthopyroxene were anhedral, elongated, forming a layering
Flattened spinel grains, commonly in trains parallel to the above layering, suggest a former high temperature lineation

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc	90	Serpentine		Preserving mesh texture; coarse-grained in patches.
Serpentine	5	Olivine		Relict.
Bastite	4	Orthopyroxene		
Magnetite	Trace	Spinel, orthopyroxene, olivine		
Pyrite	Trace	Orthopyroxene, olivine		

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc			Fibrous	Vein network.

STRUCTURE

Crystal Plastic:
None visible in thin section
Parallel structure across center of section may have been a magmatic vein or mylonitic shear zones, but relations are obscured by pervasive talc alteration

Brittle:
Brittle shear fractures with minor (<0.03 cm offset) filled with talc veins

Crosscutting Relationships (as are apparent in thin section):
1) Serpentinization
2) Talc veins with shear offset
3) Pervasive talc alteration

THIN SECTION:	**209-1268-10R-1, Piece 16A, 85-88 cm**	**TS# 15**	**Observer: MS,JH**
ROCK NAME:	**COMPLETELY ALTERED HARZBURGITE**		
GRAIN SIZE:	**Coarse**		
TEXTURE:	**Granular?**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	70-80	?		
Orthopyroxene	0	>20	?-1.2		Rounded relict.
Clinopyroxene	0	?			Uncertain.
Spinel	0.5	1	0.1-0.5		

GENERAL COMMENTS

Totally altered; a few ghosts of orthopyroxene, but orthopyroxene too altered to be distinguished from serpentinized olivine;
Some of very altered pyroxene could have been clinopyroxene
These orthopyroxene are irregularly distributed: about 30% in a part of the section, 2-5% in the other part
a vein or dike cuts through the rock; no igneous mineral is identifiable

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc	99	Serpentine	Generally microgranular	Pervasive alteration of serpentine - practically complete.
		Bastite	Lath like in former orthopyroxene cores	Complete alteration of former orthopyroxene.
		Orthopyroxene	Lath like in former orthopyroxene cores	Complete alteration of former orthopyroxene
		Amphibole	Micro laths	Alteration after amphibole after orthopyroxene.
Chlorite	<1	Serpentine	Acicular	Micro-fibrous needles at margins of talc alteration.

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Talc		Fibrous	Cross fibers intergrown with small amounts of chlorite in 5-mm vein.
Chlorite		Fibrous/Acicular	Intergrown with talc in 5-mm vein.

STRUCTURE

Texture of pseudomorphed pyroxenes suggests ductile deformation and possible neoblast formation, but alteration obscures high temperature deformation textures
No brittle deformation visible in thin section

Crosscutting Relationships (as are apparent in thin section):

1) Ductile deformation
2) Serpentinization
3) Pervasive talc alteration

THIN SECTION:	**209-1268A-10R-2, Piece 14, 82-85 cm**	**TS#16**	**Observer: MS,JH**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Medium to coarse**		
TEXTURE:			

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	78	0.2-0.5	Polygonal	Neoblasts.
Orthopyroxene	0	17	1-5	Anhedral	
Clinopyroxene	0	1?	<0.5	Anhedral	Associated with spinel.
Spinel	1.5	2	0.1-6	Euhedral to oval, anhedral	Spinel-orthopyroxene intergrowths.

GENERAL COMMENTS Totally altered except spinel
High temperature lineation is defined by elongation of orthopyroxene and by a layer of elongated spinel grains

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc	99	Serpentine	Microgranular after olivine	Completely replaced.
		Bastite	Laths	Completely replaced.
		Orthopyroxene	Laths	Completely replaced.
Chlorite	<1	Serpentine	Acicular to lath shaped	Occasional small patches adjacent to serrate veins.
Pyrite	Trace			Finely disseminated throughout.
Magnetite	Trace			

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Chlorite		Cross fibers	Cross fibers in serrate veins with talc after chrysotile.
Magnetite		Micro-fibrous	Relict magnetite in serrate veins remaining after chrysotile replacement by talc and chlorite.
Talc		Cross fibers	Replacement after chrysotile in serrate veins.

STRUCTURE
Sample is undeformed

Crosscutting Relationships (as are apparent in thin section):
1) Serpentinization
2) Formation of serpentine veins
3) Pervasive talc alteration

THIN SECTION:	**209-1268-12R-1, Piece 2B, 16-18 cm**	**TS# 17**	**Observer: MS,JH**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Fine to coarse**		
TEXTURE:	**Granular to porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	87	0.2-0.5	Polygonal	Neoblasts.
Orthopyroxene	0	12	1-10	Anhedral	Porphyroclasts.
Clinopyroxene	0	0			
Spinel	0.9	1	0.1-1	Euhedral-oval, anhedral	Intergrowths with orthopyroxene or olivine; small disseminated grains.

GENERAL COMMENTS Totally altered except spinel.
Altered orthopyroxene and serpentinized olivine are often difficult to distinguish.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Serpentine	55	Olivine	Irregular core/rim structure	Extensive talc overprint.
Talc	40	Serpentine	Microgranular/dusty	Extensively overprinting serpentinization of olivine.
Bastite	5	Orthopyroxene	Pseudomorphic after orthopyroxene	Starting to break down along cleavage planes and rims.
Magnetite	Trace		Sub-euhedral	Finely disseminated throughout background.
Pyrite	Trace		Sub-euhedral	Finely disseminated throughout background.

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Magnetite		Anhedral	Forms discontinuous margins up to 5-mm vein.
Pyrite		Euhedral / massive	Forms discontinuous margins up to-5mm vein.
Serpentine		Interpenetrating fibers / occasional hourglass textures	Varying degrees of talc overprint.
Amphibole(?)		Ragged, subhedral	Possibly tremolite after bastite/orthopyroxene, uncertain identity.

STRUCTURE
Crystal Plastic:
Pyroxene displays minor neoblasts and recrystallization textures through amphibole and talc alteration, suggests weak to moderate crystal plastic deformation

Cross Cutting Relationships (as are apparent in thin section):
1) Ductile deformation
2) Serpentinization
3) Talc vening
4) Pervasive alteration to talc and opaque minerals

THIN SECTION:	**209-1268A-12R-1, Piece 14, 125-127 cm**	**TS# 18**	**Observer: MS,WB**
ROCK NAME:	**MYLONITE**		
GRAIN SIZE:	**Medium to fine grained**		
TEXTURE:	**?**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine					
Orthopyroxene					
Clinopyroxene					
Spinel					

GENERAL COMMENTS No primary mineralogy is preserved.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc	80	Olivine, pyroxene, amphibole, plagioclase(?)	Fibrous	
Amphibole	5	Pyroxene(?)	Prismatic	
Serpentine	7	Olivine		
Chlorite	2	Plagioclase(?)		
Pyrite	4	Olivine, pyroxene		
Magnetite	Trace	Olivine		
Quartz	1	Plagioclase(?)	Equant	
Hematite	1	Plagioclase(?)		

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**

Talc-altered amphibole-quartz-hematite vein cut by a 7-mm-wide talc vein.
Serpentine veins (cyclic, cross-fiber) are partly pseudomorphed by talc and cut by talc veins. Late foliation-parallel talc-pyrite vein.

STRUCTURE

Crystal Plastic:
Peridotite mylonite; Alternating bands of former pyroxene and olivine neoblasts meet at common triple juctions, suggesting strong crystal plastic deformation and dynamic recrystallization
Olivine neoblasts from 0.05 to 0.1 mm
Ilmenite and apatite are concentrated into distinct bands parallel to mylonitic foliation

Brittle:
Minor shear fractures with low offset, no apparent brittle overprint of ductile deformation fabric

Foliation:
Strong foliation defined by mineral alignment and bands of mineral segregations

Crosscutting Relationships (as are apparent in thin section):
1) Dutile deformation/mylonitization likely occurred concurrently with infusion of ilmenite and apatite
2) Pyroxene altered to amphibole
3) Serpentinization
4) Pervasive talc alteration

THIN SECTION:	**209-1268-11R-2, Piece 4, 17-20 cm**	**TS# 19**	**Observer: MS,WB**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Medium to coarse**		
TEXTURE:	**Granular to porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	79	?		
Orthopyroxene	0	20	0.5-7	Anhedral interstitial	
Clinopyroxene	0	0			
Spinel	0.7	1	<0.1-0.5	Oval, interstitial, anhedral	Anhedral, poikilitic grains associated with orthopyroxene, small oval grains disseminated.

GENERAL COMMENTS
Totally altered except spinel
Altered orthopyroxene are elongated, forming orthopyroxene layers (high temperature lineation)

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Serpentine	38	Olivine, orthopyroxene		About 25% as bastite after orthopyroxene.
Talc	60	Olivine, orthopyroxene, serpentine		Replacing serpentine and bastite.
Pyrite	2	Olivine, orthopyroxene		Common as lamellae in altered orthopyroxene, truncated by talc alteration.
Magnetite	Trace	Olivine, spinel		
Hematite	Trace	Olivine		

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Small discontinuous serpentine veins, talc veins, and pyrite veins.				

STRUCTURE
Crystal Plastic:
Pyroxene displays minor kink banding through amphibole and talc alteration, suggests weak crystal plastic deformation

Cross Cutting Relationships (as are apparent in thin section):
1) Minor ductile deformation
2) Serpentinization
3) Pervasive talc alteration

THIN SECTION:	**209-1268-12R-2, Piece 17, 93-98 cm**	**TS# 20**	**Observer: MS,WB**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Medium to coarse**		
TEXTURE:	**Porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	65			
Orthopyroxene	0	34	1-15	Porphyroclast	Recrystallized in subgrains; size of the original grains is 10-15 mm.
Clinopyroxene	0				
Spinel	0.7	1	<0.1-0.5	Anhedral, subhedral flattened	Intergrowths with orthopyroxene borders, in the serpentinite matrix.

GENERAL COMMENTS

Totally altered harzburgite, except spinel.
Contains a thicker layer of orthopyroxene, boudined and recrystallized, that is interpreted as a coarser orthopyroxene layer in a orthopyroxene-rich harzburgite.
The harzburgite still displays a high temperature lineation defined by the orthopyroxene layering and trains of flattened spinel grains.
In a part of the thin section, orthopyroxene is interstitial to olivine.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc	90	Olivine, orthopyroxene, serpentine		Pseudomorphs orthopyroxene after serpentine
Serpentine	9	Olivine		Mostly replaced by talc.
Pyrite	1	Olivine, thopyroxene		
Hematite	Trace	Olivine, orthopyroxene		
Magnetite	Trace	Olivine, orthopyroxene		

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
A single small talc-pyrite-hematite vein			

STRUCTURE

Very minor ductile deformation slight distortion of pyroxene crystal lattice in several talc pseudomorphed grains

Crosscutting Relationships (as are apparent in thin section):

1) Minor ductile deformation
2) Serpentinization
3) Serpentine veins
4) Pervasive talc alteration

THIN SECTION:	**209-1268A-12R-3, Piece 7, 71-74 cm**	**TS# 21**	**Observer: MS**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Medium**		
TEXTURE:	**Granular to porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	76	?		
Orthopyroxene	0	22?	1-5	Anhedral to interstitial	Rather large amount of interstitial altered pyroxenes (images #017 and 018).
Clinopyroxene	0	?			
Spinel	1.5	2	<0.1-1	Oval, interstitial, anhedral	Small interstitial grains disseminated; larger anhedral with orthopyroxene.

GENERAL COMMENTS

Totally altered harzburgite, except some spinel.
Poikilitic altered pyroxenes could be clinopyroxene?? If correct, clinopyroxene is about 2% and this amount should be subtracted from the orthopyroxene mode.
High temperature lineation defined by elongated pyroxene and spinel.
Orthopyroxene often recrystallized in sub-grains.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Serpentine	55	Olivine, orthopyroxene		
Chrysotile	15	Olivine		
Pleochroic Serpentine	10	Orthopyroxene		Amphibole coronas around core of altered orthopyroxene transformed to bastite.
Talc	20	Orthopyroxene		

VEIN / FRACTURE FILLING	**PERCENT PRESENT**		**MORPHOLOGY**	**COMMENTS**
Vein type 1 - Talc and Clays	80 talc / 10 clays	Olivine, orthopyroxene		
Vein type 1 - Pyrite	5	Orthopyroxene along cleavages		
Vein type 1 - Hematite	3	Orthopyroxene along cleavages		
Vein type 1 - Maghemite	2	Orthopyroxene along cleavages		
Vein type 2 - Chrysotile	100	Olivine, orthopyroxene		

STRUCTURE

Brittle:
Disjointed hourglass texture serpentinite suggests minor brittle deformation or fracturing during serpentinization

Crosscutting Relationships (as are apparent in thin section): 1) Serpentinization

THIN SECTION:	**209-1268A-13R-1, Piece 6B, 68-71 cm**	**TS# 22**	**Observer: MS**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Coarse**		
TEXTURE:	**Granular to porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	78	?		
Orthopyroxene	0	20	1-15	Anhedral interstitial	Frequently kinked.
Clinopyroxene	0	0			

THIN SECTION:	**209-1268A-13R-1, Piece 6B, 68-71 cm**	**TS# 22**		**Observer: MS**	
ROCK NAME:	**SERPENTINIZED HARZBURGITE**				
GRAIN SIZE:	**Coarse**				
TEXTURE:	**Granular to porphyroclastic**				
Spinel	1.5	2	<0.1-1	Oval, interstitial, anhedral	Small interstitial grains disseminated; larger anhedral with orthopyroxene.

GENERAL COMMENTS Totally altered harzburgite, except spinel.
High temperature lineation defined by elongated orthopyroxene.

SECONDARY MINERALS	PERCENT PRESENT	REPLACING	MORPHOLOGY	COMMENTS
Talc and clays	75	Olivine, orthopyroxene		Pseudomorphic talc after chrysotile. Also replacing orthopyroxene cores.
Serpentine	18	Olivine, orthopyroxene		Chrysotile after olivine and bastite after orthopyroxene.
Pleochroic serpentine	7	Orthopyroxene	Coronas	Amphibole coronas around core of altered orthopyroxene transformed to bastite.

VEIN / FRACTURE FILLING	PERCENT PRESENT		MORPHOLOGY	COMMENTS
Vein type 1 - Pyrite	28	Olivine, orthopyroxene along cleavages	Euhedral	Cut earlier generations of chrysotile-talc veins.
Vein type 1 - Hematite	50	Olivine, orthopyroxene along cleavages		Cut earlier generations of chrysolite-talc veins
Vein type 1 - Maghemite	20	Olivine, orthopyroxene along cleavages		Cut earlier generations of chrysolite-talc veins.
Vein type 1 - Chalcopyrite	2	Olivine, orthopyroxene along cleavages	Euhedral	Cut earlier generations of chrysolite-talc veins.
Vein type 2 - Talc after chrysotile	100	Olivine, orthopyroxene		Pseudomorphic after former chrysotile cross-fiber veins.

STRUCTURE
Fracturing during serpentinization is suggested by disjointed hourglass and ribbon texture serpentinite.

THIN SECTION:	**209-1268A-13R-2, Piece 1, 3-6 cm**	**TS# 23**	**Observer: MS.WB**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Medium to coarse**		
TEXTURE:	**Granular to porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	85			
Orthopyroxene	0	12?	1-6	Anhedral interstitial	
Clinopyroxene	0	3?	0.3-1	Anhedral	In a cluster.
Spinel	0.8	1	<0.1-1	Oval, interstitial, anhedral	Small interstitial grains disseminated; larger anhedral with orthopyroxene.
DIKE					
Plagioclase	0	60			
Clinopyroxene	0	40			
Others	0	?			

GENERAL COMMENTS
Totally altered except some spinel; high temperature lineation defined by orthopyroxene elongation.
Some altered interstitial pyroxenes have poikilitic habit (former clinopyroxene(?)).
A cluster of altered pyroxenes can be former clinopyroxene because they differ from altered orthopyroxene by their shapes and cleavages.
A 0.7-cm-wide dike, totally altered and deformed.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Serpentine	90	Olivine, orthopyroxene		Relic mesh texture, rims of orthopyroxene.
Talc	10	Orthopyroxene, olivine		Pseudomorphing cores of orthopyroxene, most talc in vein halo.
Magnetite	Trace	Olivine, orthopyroxene		
Pyrite	Trace	Olivine, orthopyroxene		

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**

A cm-thick talc-amphibole-biotite vein with 1%-2% of each quartz, hematite, and pyrite, with talc-rich halos, is probably a completely altered late magmatic vein.
Serpentine-magnetite veins are cut by talc+pyrite veins that are cut by green amphibole+pyrite veins.
Early pyrite veins preserved in orthopyroxene pseudomorphs(?)

STRUCTURE
Crystal Plastic:
Minor distorted cleavage and kink banding in pseudomorphed pyroxene grains suggest minor crystal plastic deformation.
Ductile deformation appears near margins of magmatic veins.

Brittle:
Disjointed hourglass texture serpentinite suggests minor brittle deformation or fracturing during serpentinizatoin

Crosscutting Relationships (as are apparent in thin section):
1) Magmatic vein intrusion/ductile deformation
2) Serpentinization
3) Serpentine veins
4) Talc alteration

THIN SECTION:	**209-1268A-13R-2, Piece 7, 42-45 cm**	**TS# 24**	**Observer: MS,JH**
ROCK NAME:	**POSSIBLE FORMER GABBRO**		
GRAIN SIZE:	**Originally medium(?)**		
TEXTURE:	**?**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine					
Orthopyroxene					
Clinopyroxene					
Spinel					

GENERAL COMMENTS No igneous minerals are recognizable.
Totally altered and brecciated.

SECONDARY MINERAL	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Serpentine	20	Olivine	Microgranular, interpenetrating, fibrous.	Extremely fine-grained. Remnants of net /core/rim textures virtually eliminated.
Talc	70	Serpentine/bastite	Microgranular clusters and patches	Former bastite pseudomorphs heavily corroded in places.
Chlorite	<<1	Serpentine	Irregular patches	Found within the fine-grained remnants of serpentine.
Amphibole	<1	Orthopyroxene	Acicular	Possibly tremolite/actinolite after orthopyroxene.
Bastite	10	Orthopyroxene	Pseudomorphous	Varies from corroded edges to completely talc replaced.
Pyrite	**<1**		Sub-euhedral	Disseminated through the background alteration.

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
No veins			

STRUCTURE

Crystal Plastic:
Foliation and neoblast formation in plagioclase suggests moderate crystal plastic deformation.

Brittle:
Shape of talc-pseudomorphed porphyroclasts suggest possible brecciation. Pervasive alteration inhibits full identification of textures.

Crosscutting Relationships (as are apparent in thin section):
1) Ductile deformation
2) Possible brittle deformation
3) Serpentinization
4) Talc alteration

THIN SECTION:	**209-1268A-13R-2, Piece 15, 92-95 cm**	**TS# 25**	**Observer: MS,WB**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Medium**		
TEXTURE:	**Porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	70	0.4	Polygonal	Neoblasts.
Orthopyroxene	0	29	1-7	Anhedral	Porphyroclasts frequently recrystallized in subgrains.
Clinopyroxene	0				
Spinel	0.8	1	<0.1-1.5	Oval, interstitial, anhedral	Small interstitial grains disseminated; larger anhedral grains with orthopyroxene.

GENERAL COMMENTS Totally altered harzburgite, except some spinel

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc	80	Olivine, orthopyroxene		Replacing serpentine and in orthopyroxene centers.
Serpentine	19	Olivine, orthopyroxene		Largely replaced by talc.
Chlorite	1	Olivine, orthopyroxene		Rare at olivine-orthopyroxene boundaries.
Pyrite	Trace	Olivine, orthopyroxene		
Magnetite	Trace	Olivine, orthopyroxene		Common after orthopyroxene.

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**

A pyrite-hematite veinlet, in which hematite is partly replaced by a mineral with higher reflectivity (maghemite(?)).

STRUCTURE

Crystal Plastic:
Minor ductile deformation distorted crystal lattice and caused very minor recrystallization in pseudomorphed pyroxene porphyroclasts.
Other ductile deformation features are totally obscured by pervasive alteration.

Brittle:
Disjointed hourglass serpentinite texture suggests minor brittle fracturing during serpentinization

Crosscutting Relationships (as are apparent in thin section):
1) minor high temperature ductile deformation
2) serpentinization
3) pervasive talc alteration
4) shear fractures filled with talc veins

THIN SECTION:	**1268A-14R-3, Piece 1, 3-5 cm**	**TS# 26**	**Observer: MS**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Fine to medium**		
TEXTURE:	**Porphyroclastic to mylonitic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	78			
Orthopyroxene	0	20	1-5	Porphyroclasts	
Clinopyroxene	0				
Spinel	0.7	1	0.1	Rounded	

GENERAL COMMENTS The harzburgite was too severely altered and deformed to recognize the original fabrics, texture, and grain sizes.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc	80	Olivine, orthopyroxene		Mostly dirty talc replacing serpentine and orthopyroxene. Locally pseudomorphic talc replaces pyroxenes.
Serpentine	15	Olivine, orthopyroxene		Chrysotile after olivine and bastite after orthopyroxene.
Pleochroic Serpentine	3	Orthopyroxene	Coronas	Coronas around core of altered orthopyroxene transformed to bastite.
Maghemite	2	Hematite?		Ghost of former pyrite veins.

VEIN / FRACTURE FILLING	**PERCENT PRESENT**		**MORPHOLOGY**	**COMMENTS**
Vein type 1 - Chrysotile	70	Olivine, pyroxene	Arborescent	
Vein type 1 - Talc	30	Olivine, pyroxene		Pseudomorph after former chrysotile cross-fiber veins. Also occur as dirty talc replacing chrysotile.
Igneous Vein - Amphibole	5	Pyroxene		
Igneous Vein - Talc	85	Pyroxene		Talc is pseudomorphic replacing amphibole pseudomorphs after pyroxene.
Igneous Vein - Serpentine	10	Olivine		

STRUCTURE

Crystal Plastic:
Peridotite protomylonite; alternating bands of former pyroxene and olivine neoblasts meet at common triple junctions, suggesting crystal plastic deformation and dynamic recrystallization.
Schistose alignment of amphibole replacing pyroxene suggests ductile deformation accommodated by diffusive mass transfer at amphibolite facies

Brittle:
Minor shear fractures with low offset, no apparent brittle overprint of ductile deformation fabric.

Crosscutting Relationships (as are apparent in thin section):
1) Dutile deformation/mylonitization likely occurred concurrently with infusion of ilmenite and apatite
2) Pyroxene altered to amphibole during continued deformation
3) Serpentinization
4) Serpentine veins
5) Talc alteration

THIN SECTION:	**1268A-15R-1, Piece 10, 75-77 cm**	**TS# 27**	**Observer: MS, JH**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Fine to medium**		
TEXTURE:	**Mylonitic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	>80			
Orthopyroxene	0	15	<1-7	Porphyroclasts	
Clinopyroxene	0				
Spinel	0	<1?		Rounded	Spinel is oxidized

GENERAL COMMENTS The harzburgite was too severely altered and deformed to recognize the original fabrics, texture, and grain sizes.
Modal composition may be wrong

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Amphibole	35	Pyroxenes	Pseudomorphic / subhedral	Forms bands with talc after pyroxenite.
Talc	55	Orthopyroxene	Microgranular pseudomorphs	Former orthopyroxene grain boundaries still evident.
Serpentine	10	Olivine	Microgranular patchy	Many areas completely replaced by talc.
Pyrite	<1	Olivine	Subhedral	Disseminated throughout sample.
Magnetite	<1		Subhedral	Disseminated throughout sample.
Hematite	trace		Anhedral	Disseminated throughout sample.

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Chrysotile		Fibrous	Serrate/sigmoidal with small amounts of magnetite overprinted by talc in places.
Talc		Fibrous/granular	Replacing fibrous chrysotile in serrate/sigmoidal veins, granular in larger veins.
Magnetite			
Chlorite		Acicular	Forms radiating clusters of acicular needles in largest veins.

STRUCTURE

Crystal Plastic:
Strong ductile deformation visible through pervasive alteration.
Pseudomorphed pyroxene porphyroclasts range from 0.5 to 2 mm and have occasional distorted crystal lattice.
Alternating bands of former pyroxene and olivine neoblasts with recrystallized grain size ranging from 0.05 to 0.2 mm.
Common triple junctions between neoblasts are evident through pseudomorphs of original grains.
Sample also contains abundant fine-grained apatite and ilmenite (0.01 to 0.03 mm) concentrated into bands parallel to the foliation.
Ductile deformation appears to be partitioned away from gabbro clasts of intrusion breccia into peridotite matrix.

Brittle:
No brittle deformation is visible in thin section

Impregnation Textures:
Sharp margins of former gabbro clasts of magmatic breccia. Relations are obscured by intense ductile deformation

Crosscutting Relationships (as are apparent in thin section):
1) Magmatic brecciation
2) Ductile deformation/mylonitization
3) Pyroxene is altered to amphibole
4) Serpentinization
5) Pervasive talc and chlorite alteration

THIN SECTION:	**1268-16R-1, Piece3A, 21-24 cm**	**TS# 28**	**Observer: MS, WB**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Medium**		
TEXTURE:	**Granular to porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	80			
Orthopyroxene	0	18-20	1-15	Anhedral interstitial	Recrystallized in subgrains.
Clinopyroxene	0	1-2?	0.2-0.5	Interstitial	Possible former clinopyroxene, with small anhedral grains of spinel.
Spinel	0.7	1	<0.1-0.8	Anhedral, subhedral flattened	Intergrowths with orthopyroxene borders, in the serpentinite matrix.

GENERAL COMMENTS Totally altered harzburgite except spinel; initial texture is still recognizable in a part of the section

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Serpentine	95	Olivine, orthopyroxene		
Talc	5	Olivine, orthopyroxene, serpentine		
Pyrite	Trace	Olivine, orthopyroxene		
Magnetite	Trace	Olivine, orthopyroxene		

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**

A network of phlogopite-chlorite-amphibole veins with splayed-off chlorite-amphibole veins that turn into amphibole veins before they terminate is cut by gamma-serpentine veins.
Both vein types are cut by late pyrite veinlets

STRUCTURE
Sample is not significantly deformed

Crosscutting Relationships (as are apparent in thin section):
1) Serpentinization
2) Phlogopite/chlorite vein cuts serpentinite
3) Shear fractures filled with serpentine veins
4) Shear fractures filled with sulfide

THIN SECTION:	**1268A-16R-3, Piece 10, 107-110 cm**	**TS# 29**	**Observer: WM,JH**
ROCK NAME:	**GABBRO**		
GRAIN SIZE:			
TEXTURE:			

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine					
Orthopyroxene					
Clinopyroxene					
Spinel					

GENERAL COMMENTS This rock is too altered to reliably identify the mineralogy. Altered clinopyroxene (~8 mm) lines one side of the section suggesting a contact.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Chlorite	15	Serpentine	Patchy, acicular	Patchy in areas of background serpentine alteration, acicular in fringes around amphibole.
Amphibole	10	Pyroxenes	Acicular/lath-like	Actinolite(?) forms acicular clusters on former pyroxene margins and distributed through former pyroxenes.
Talc	30	Serpentine/Bastite pseudo-morphs	Microgranular	
Serpentine	45	Olivine/Orthopyroxene	Microgranular	Remnants of serpentine before complete overprinting of talc/chlorite.

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Talc		Fibrous	Replacing chrysotile in serrate/sigmoidal veins. Intergrown with chlorite where replacing more massive veins.
Chlorite		Acicular	Intergrowth with talc in massive veins.

STRUCTURE

Brittle:

Very minor late brittle shear fractures filled with syntaxial serpentine.

Crosscutting Relationships (as are apparent in thin section):

1) Serpentinization
2) Pervasive talc alteration
3) Shear fracturing

THIN SECTION:	**1268A-16R-4, Piece 1, 3-9 cm**	**TS# 30**	**Observer: WM**
ROCK NAME:	**GABBRO**		
GRAIN SIZE:	**Fine to coarse**		
TEXTURE:	**Massive**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Clinopyroxene	2	35	10	Euhedral	Some fresh material in a few grains.
Plagioclase	60	65	3-20	Anhedral-subhedral	

GENERAL COMMENTS This coarse-grained gabbro has undergone limited high-T deformation manifest in plagioclase grain-size reduction. The plagioclase twins are mostly uniform and the grain boundaries smooth indicating substantial recovery after deformation.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Albite	15	Plagioclase		Along grain boundaries and cracks.
Green amphibole	30	Plagioclase + orthopyroxene		Euhedral grains interstitial between altered orthopyroxene crystals.
Chlorite	2	Plagioclase + orthopyroxene		Along with amphibole.
Talc	Trace			Rare along with albite.

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Chlorite-green amphibole			

GENERAL COMMENTS Large TS

STRUCTURE

Joints:
Several unfilled late shear fractures are present cutting plagioclase.

THIN SECTION:	**1268A-17R-2, Piece 7B,47-49 cm**	**TS# 31**	**Observer: WM**
ROCK NAME:	**HARZBURGITE/PYROXENITE**		
GRAIN SIZE:			
TEXTURE:			

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine					
Orthopyroxene					
Clinopyroxene					
Spinel					

GENERAL COMMENTS

This section contains the contact between an altered harzburgite(?) and an altered pyroxenite.
The pyroxenite is coarse grained (7-12 mm) and so altered that no modal estimates can be made.
Interstitial patches between large grains are interpreted to have been olivine.
Some fresh clinopyroxene is present in one grain.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc	70	Olivine, orthopyroxene		In pyroxenes occur mostly as pseudomorphic talc, partly replaced by serpentine minerals. Dirty non-pseudomorphic talc replaces serpentine minerals after olivine.
Serpentine	25	Olivine, orthopyroxene		Mostly in bottom of the thin section.
Sulfides	3			Pyrite, chalcopyrite(?), maghemite(?)
Amphibole	2			Some relict in former pyroxene cores now transformed to pseudomorphic talc.

VEIN / FRACTURE FILLING MINERALS	**PERCENT PRESENT**		**MORPHOLOGY**	**COMMENTS**
Vein type 1 - Chrysotile	70	Olivine, pyroxene	Arborescent	
Vein type 1 - Talc	30	Olivine, pyroxene		Pseudomorphic after former chrysotile cross-fiber veins. Also occur as dirty talc replacing chrysotile.
Vein type 2 - Talc	97	Olivine, pyroxene		Massive non-pseudomorphic talc.
Vein type 2 - Pyrite-Chalcopyrite-Maghemite	3	Olivine, pyroxene		
Vein type 3 - Chrysotile	100	Olivine, pyroxene	Cross-fiber	

STRUCTURE

Brittle:
Brittle shear fractures are filled with syntaxial serpentine veins; fibers grown at angles of 40-50 degrees from vein walls, suggesting oblique opening of fractures.

Foliation:
Weak foliation is defined by ribbon texture serpentine; serpentine late serpentine-filled shear fractures cutting talc alteration are parallel to ribbon serpentinite foliation.

Crosscutting Relationships (as are apparent in thin section):

1) Serpentinization
2) Pervasive Talc Alteration
3) Shear fractures filled with syntaxial serpentine fibers
4) Talc veins

THIN SECTION:	**1268A-17-R3, Piece 6, 66-68 cm**	**TS# 32**	**Observer: MS,JH**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Medium**		
TEXTURE:	**Granular to porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	85			
Orthopyroxene	0	15	1-7	Anhedral interstitial	Recrystallized in subgrains.
Clinopyroxene	0				
Spinel	0.7	1	<0.1-1	Anhedral, subhedral flattened	Intergrowths with orthopyroxene borders, in the serpentinite matrix.

GENERAL COMMENTS Totally altered harzburgite, except spinel.
High temperature lineation defined by elongated orthopyroxene and flattening of some spinel grains.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Serpentine	95	Olivine, orthopyroxene	Massive, isotropic	Forms ribbon texture and hour glass cores in former olivine, bastite pseudomorphs of orthopyroxene.
Magnetite	3	Olivine, spinel	Subhedral	Pick out former olivine grain boundaries after serpentinization.
Amphibole	2	Orthopyroxene	Lath-like	Partially replacing former pyroxenes.

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Serpentine		Cross fibers	Mostly replaced by amphibole and talc.
Magnetite		Amorphous/anhedral	Occurs with chrysotile in serrate/sigmoidal veins.
Amphibole		Fibrous	Forms cross fibers in serrate/sigmoidal veins after chrysotile (possibly actinolite(?)).

STRUCTURE
Sample is not significantly deformed.

Crosscutting Relationships (as are apparent in thin section):
1) Serpentinization
2) Minor shear fracturing and serpentine vein formation

THIN SECTION:	**1268A-18R-1, Piece 4, 61-63 cm**	**TS# 33**	**Observer: MS**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Medium to coarse**		
TEXTURE:	**Protogranular to interstitial**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine					
Orthopyroxene					
Clinopyroxene					
Spinel					

GENERAL COMMENT: No primary mineralogy preserved.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Serpentine minerals	97	Olivine, orthopyroxene		Serpentine may be altered to clays. In orthopyroxene are bastite pseudomorphs.
Sulfides	1			Pyrite(?)

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Vein 1 - Chrysotile	90		
Vein 1 - Talc	10		Pseudomorphic after chrysotile.
Vein 2 - Chrysotile	100		Cross-cut Vein 1 and is not replaced by pseudomorphic talc.

STRUCTURE

Crystal Plastic:
Minor distortion of pyroxene crystal lattice in one grain.

Joints:
Late shear fractures are filled with cross syntaxial serpentine veins.

Foliation:
Moderate foliation in a band across the center of the thin section defined by ribbon texture serpentinite.
This may have been the trace of a ductile or brittle shear zone prior to serpentinization.

Crosscutting Relationships (as are apparent in thin section):
1) Minor ductile deformation
2) Serpentinization
3) Late serpentine veins

THIN SECTION:	**1268A-18R-3, Piece 1A, 5-7 cm**	**TS# 34**	**Observer: MS**
ROCK NAME:	**SERPENTINIZED DUNITE**		
GRAIN SIZE:	**Fine to medium**		
TEXTURE:	**Granular -porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	97	?		
Orthopyroxene	0	2	1-5		Ghosts.
Clinopyroxene	0	0			
Spinel	0.1	0.1	0.2	Subhedral-anhedral	Anhedral with orthopyroxene.

GENERAL COMMENTS Totally altered dunite.
A contact with harzburgite at one border of the section.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Serpentine minerals	99	Olivine, orthopyroxene		Hourglass texture.
Magnetite	1	Olivine		
Pyrite	Trace	Olivine		

GENERAL COMMENTS Light green patches in the thin section are made up chrysotile -possibly after lizardite- with rare magnetite.

VEIN / FRACTURE FILLING	**PERCENT PRESENT**		**MORPHOLOGY**	**COMMENTS**
Vein 1 - Serpentine		Olivine		
Vein 1 - Magnetite		Olivine		
Vein 2 - Chrysotile		Olivine		Vein 2 cuts Vein 1 and is made up of talc-chrysotile with large magnetite crystals.
Vein 2 - Talc		Olivine		
Vein 2 - Magnetite		Olivine		

STRUCTURE

Crystal Plastic:
Minor distortion of pyroxene crystal lattice in one grain.

Joints:
Late shear fractures are filled with cross syntaxial serpentine veins.

Foliation:
Moderate foliation in a band across the center of the thin section defined by ribbon texture serpentinite.
This may have been the trace of a ductile or brittle shear zone prior to serpentinization.

Cross Cutting Relationships (as are apparent in thin section):
1) Minor ductile deformation
2) Serpentinization
3) Late serpentine veins

THIN SECTION:	**1268A-18R-4, Piece 11, 88-91 cm**	**TS# 35**	**Observer: NA, MS**
ROCK NAME:	**Orthopyroxenite**		
GRAIN SIZE:	**Coarse**		
TEXTURE:	**Granular-polygonal**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	5	8	0.5-1	Anhedral to interstitial	
Orthopyroxene	85	86	0.2-12	Anhedral to polygonal	
Clinopyroxene	1.5	2	0.05-0.2	Interstitial	Inclusions in orthopyroxene and as interstitial grains.
Spinel	3.5	4	0.1-5.0	Euhedral to anhedral	Inclusions in orthopyroxene and as interstitial grains.

GENERAL COMMENTS

Fresh orthopyroxenite.
Texture results from high temperature recrystallization, varying from granular to polygonal.
Orthopyroxene grains are various in size and shape; most crystals are anhedral, equant with curvilinear boundaries (image#037).
Evolving toward textural equilibrium with polygonal grains (image #036).
Recrystallized small orthopyroxene grains exist in large orthopyroxenes.
Olivine is interstitial or forms small equant anhedral grains between orthopyroxene (image #038).
Clinopyroxene occurs as tiny interstitial crystals, at the orthopyroxene triple junctions or along grain boundaries(image #036).
Spinel forms euhedral to subhedral grains enclosed in orthopyroxene (image # 037) or anhedral grains along grain boundaries.
or, also occurs as larger equant grains with tiny vermicular boundaries with orthopyroxene.
One altered vein cut orthopyroxene and spinel grains. One large sulfide grain (2 mm).
Olivine, clinopyroxene and most spinel are formed during subsolidus recrystallization of a former very coarse-grained orthopyroxenite

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Serpentine	7	Olivine, orthopyroxene		Mostly replacing olivine and orthopyroxene along cracks.
Magnetite	Trace	Olivine, orthopyroxene		
Millerite	Trace	Pentlandite		Millerite replaces pentlandite along cleavages.
Talc		Orthopyroxene		
Tremolite		Orthopyroxene		

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Chrysotile			Up to 3 mm thick composite talc-chrysotile veins.
Tremolite			

STRUCTURE

Brittle:
Several late brittle shears in one area of thin section with less than 0.01 cm offset.

Crosscutting Relationships (as are apparent in thin section):

1) Serpentinization
2) Serpentine veins cut pyroxene and olivine
3) Late brittle shear fractures

THIN SECTION:	**1268A-19R-1, Piece 2A, 16-18 cm**	**TS# 36**	**Observer: MS**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Medium**	**GENERAL COMMENTS**	
TEXTURE:	**Porphyroclastic**		

MODE (Visual estimate)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	MORPHOLOGY	COMMENTS
Olivine	0	85			
Orthopyroxene	0	12	1-5		Recrystallized in subgrains.
Clinopyroxene	0	2-3?	0.2-1	Interstitial, rounded	
Spinel	0.7	1	<0.1-0.5	Anhedral, subhedral flattened	Intergrowths with orthopyroxene borders, in the serpentinite matrix.

GENERAL COMMENTS

Totally altered harzburgite, except spinel; the original texture cannot be determined.
The shapes and aspect of some, small-sized, altered pyroxenes recall those typical of clinopyroxene.
(3 photos)

SECONDARY MINERALS	PERCENT PRESENT	REPLACING	MORPHOLOGY	COMMENTS
Serpentine	95.7	Olivine, pyroxenes		Bastite pseudomorphs replace orthopyroxene and clinopyroxne.
Magnetite	3	Olivine		Small crystals disseminated along the olivine mesh texture.
Ferritchromite	0.5	Chromite		Alteration rims on chromites.
Sulfides	0.5			Pyrite
Talc	1			

VEIN / FRACTURE FILLING	PERCENT PRESENT	MORPHOLOGY	COMMENTS
Chrysotile	90		Chrysotile veins with magnetite.
Serpentine	10		

STRUCTURE

Sample is not significantly deformed.

Crosscutting Relationships (as are apparent in thin section):

1) Serpentinization
2) Minor shear fracturing

THIN SECTION:	**1268a-19R-1, Piece 2B, 51-53 cm**	**TS# 37**	**Observer: MS**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Medium**		
TEXTURE:	**Porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	85			
Orthopyroxene	0	15	1-5	Anhedral interstitial	Recrystallized in subgrains.
Clinopyroxene	0	1-2?	0.3	Interstitial	
Spinel	0.7	1	<0.1-0.5	Anhedral, subhedral flattened	Intergrowths with orthopyroxene borders, in the serpentinte matrix.

GENERAL COMMENTS

Totally altered harzburgite, except spinel; the original texture cannot be determined.
The original texture has been better preserved (locally) than in Piece 2A.
The shapes and aspect of some, small-sized, altered pyroxenes recall those typical of clinopyroxene.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Serpentine	98	Olivine		Brown color in polarized light.
Magnetite	2	Olivine, spinel		Spinel mostly fresh.
Pyrite	trace	Olivine		Alteration rims in chromites.

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
No veins			

STRUCTURE

Sample is undeformed.

Crosscutting Relationships (as are apparent in thin section):

1) Serpentinization

THIN SECTION:	**1268A-20R1, Piece 8, 96-99 cm**	**TS# 38**	**Observer: MS,WB**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Medium**		
TEXTURE:	**Granular to porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	80-85			
Orthopyroxene	0	15	1-8	Anhedral interstitial	Recrystallized in subgrains.
Clinopyroxene	0				
Spinel	0.7	1	<0.1-1.5	Anhedral, subhedral flattened	Intergrowths with orthopyroxene borders, in the serpentinte matrix.

GENERAL COMMENTS Totally altered harzburgite, except spinel.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Serpentine	99	Olivine, orthopyroxene		
Magnetite	1	Olivine		
Pyrite	Trace	Olivine		
Heazlewoodite(?)				Whitish, slightly anisotropic phase associated with magnetite (as trace).

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Cross-fiber gamma-serpentine veins.			

STRUCTURE

Crystal Plastic:
Very minor ductile deformation caused bending of pyroxene cleavage.

Brittle:
Minor brittle deformation offsets pyroxene and serpentine crystals across serpentine veins.

Joints:
Late shear fractures are filled with serpentine veins.

Foliation:
Very weak foliation defined by ribbon texture serpentine.

Crosscutting Relationships (as are apparent in thin section):
1) Minor ductile deformation
2) Serpentinization
3) Shear fracture and serpentine vein formation

THIN SECTION:	**1268A-21R-1, Piece 3, 37-39 cm**	**TS# 39**	**Observer: WM**
ROCK NAME:	**GABBRO**		
GRAIN SIZE:	**Variable see below**		
TEXTURE:	**Massive**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine					
Orthopyroxene					
Clinopyroxene	0	30	12	Euhedral	
Spinel					
Plagioclase	45	70	2 – 5	Anhedral	

GENERAL COMMENTS Alteration separates clinopyroxene and plagioclase and may reflect an original magmatic reaction relation.
Plagioclase is mostly recrystallized to small equant grains with 120 degree triple grain junctions.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Chlorite	30	Clinopyroxene, Plagioclase	Coronas	
Albite	3	Plagioclase		Along cracks and grain boundaries.
Quartz	1	Clinopyroxene, Plagioclase		Associated everywhere to chlorite.
Amphibole	11	Pyroxene		Pseudomorphic after orthopyroxene(?).
Talc	1	Pyroxene		Pseudomorphic after clinopyroxene.

GENERAL COMMENTS Alteration coronas around pyroxene crystals are mainly composed of chlorite with rare quartz and possibly some prehnite.
These coronas represent metamorphic reaction rims between pyroxene and plagioclase.

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**

STRUCTURE
Crystal Plastic:
Minor ductile deformation caused deformation twins, undulose extinction and minor recrystallization of plagioclase and kink banding of several pyroxene grains.

Crosscutting Relationships (as are apparent in thin section):
1) Minor ductile deformation
2) Greenschist-grade chlorite alteration

THIN SECTION:	**1268A-21R-1, Piece 15, 129 - 131 cm**	**TS#40**	**Observer: WM,WB**
ROCK NAME:	**COMPLETELY ALTERED GABBRO**		
GRAIN SIZE:			
TEXTURE:			

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine					
Orthopyroxene					
Clinopyroxene					
Spinel					
Plagioclase					

GENERAL COMMENTS This section is likely to be of a gabbro (some clinopyroxene relics survive) but it is completely altered.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Chlorite	30	Plagioclase, clinopyroxene	Fibrous	
Albite	10	Plagioclase	Subhedral	
Quartz	10	Plagioclase (clinopyroxene)	Anhedral	Contains (two-phase) fluid inclusions with about 30% vapor.
Amphibole	10	Clinopyroxene	Acicular	
Talc	39	Pyroxenes, Plagioclase		
Serpentine	1	Pyroxenes		

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**

STRUCTURE
Sample is undeformed.

Crosscutting Relationships (as are apparent in thin section): 1) Greenschist-grade alteration

THIN SECTION:	**1268A-21R-2, Piece 5, 18-21 cm**	**TS#41**	**Observer: WM,WB**
ROCK NAME:	**GABBRO**		
GRAIN SIZE:	**5 - 13 mm**		
TEXTURE:	**Foliated**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine					
Orthopyroxene					
Clinopyroxene	0	65			
Spinel					
Plagioclase	15	35			

GENERAL COMMENTS
This samples has a foliation defined clinopyroxene and somewhat by plagioclase.
The plagioclase is too altered to determine the strain history (or lack thereof) in this sample.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc	35	Pyroxenes, Plagioclase		
Chlorite	12	Pyroxenes, Plagioclase		
Albite	1	Plagioclase		
Quartz	3	Plagioclase		Quartz has two-phase fluid inclusions with about 30% vapor.
Amphibole	32	Pyroxenes		
Serpentine	2	Serpentine		Replacing pyroxene along veins(?).

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**

STRUCTURE

Crystal Plastic:
Very minor ductile deformation caused bending of pyroxene cleavage, and deformation twins and undulose extinction in plagioclase.
Most ductile deformation fabrics obscured by greenschist alteration.

Brittle:
Minor; Late brittle fractures with little or no shear offset cut plagioclase.

Crosscutting Relationships (as are apparent in thin section):
1) Minor ductile deformation
2) Greenschist alteration
3) Late brittle fracturing

THIN SECTION:	**1268A-22R-1, Piece 15, 117-120 cm**	**TS#42**	**Observer: WM,WB**
ROCK NAME:	**GABBRONORITE**		
GRAIN SIZE:	**2 - 5 mm**		
TEXTURE:	**Massive**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine					
Orthopyroxene	0	10		Euhedral	
Clinopyroxene	3	30		Euhedral	
Spinel					
Plagioclase	45	60		Anhedral-subhedral	

GENERAL COMMENTS Euhedral clinopyroxene and orthopyroxene are surrounded by moderately recrystallized plagioclase.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc	20	Pyroxene, plagioclase	Pseudomorphic after pyroxene	
Amphibole	30	Pyroxene, plagioclase	Pseudomorphic after pyroxene	
Chlorite	1	Plagioclase	Fibrous	In patches.
Albite	8	Plagioclase		Along cracks.
Quartz	1	Plagioclase		Along cracks.

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
No veins			

STRUCTURE

Crystal Plastic:
Very minor ductile deformation caused bending of pyroxene cleavage, and undulose extinction and deformation twins and minor grain boundary migration recrystallization in plagioclase.

Brittle:
Minor brittle deformation along late shear fractures with minor offset cut plagioclase crystals.

Crosscutting Relationships (as are apparent in thin section):
1) Minor ductile deformation
2) Greenschist alteration
3) Late shear fractures

THIN SECTION:	**1268A-23R-1, Piece 4C, 57-60 cm**	**TS#43**	**Observer: WM,WB**
ROCK NAME:	**GABBRONORITE**		
GRAIN SIZE:	**1 - 3 mm**		
TEXTURE:	**Weakly foliated**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine					
Orthopyroxene	0	15		Euhedral	
Clinopyroxene	22	30		Euhedral	
Spinel					
Plagioclase	52	55		Anhedral-subhedral	

GENERAL COMMENTS
This sample experienced modest high temperature strain.
A weak foliation is defined by the pyroxene and plagioclase crystallographic alignment and a shape fabric predominately by the pyroxenes.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Amphibole	9	Pyroxenes and plagioclase		
Talc	10	Pyroxenes and plagioclase		
Albite	1	Pyroxenes and plagioclase		
Chlorite	6	Pyroxenes and plagioclase		

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Talc vein			

STRUCTURE

Crystal Plastic:
Minor ductile deformation caused deformation twins, kink bands and minor recrystallization of plagioclase.

Brittle:
Thin section contains zones of dense brittle fractures with minor offset; Incipient brecciation in some locations.

Crosscutting Relationships (as are apparent in thin section):
1) Minor ductile deformation
2) Brittle fracturing

THIN SECTION;	**1268A-23R-1, Piece 8, 126-128 cm**	**TS#44**	**Observer: WM,WB**
ROCK NAME:	**GABBRONORITE**		
GRAIN SIZE:	**1 - 3 mm**		
TEXTURE:	**Weakly foliated**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine					
Orthopyroxene	0	15		Euhedral	
Clinopyroxene	22	30		Euhedral	
Spinel					
Plagioclase	52	55		Anhedral-subhedral	

GENERAL COMMENTS
This sample experienced modest high temperature strain.
A weak foliation is defined by the pyroxene and plagioclase crystallographic alignment and a shape fabric predominately by the pyroxenes.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Amphibole	7	Pyroxenes		Along plagioclase-pyroxene grain boundaries and pseudomorphing pyroxenes.
Talc	7	Pyroxenes		Patchy pseudomorph after pyroxenes.
Chlorite	7	Plagioclase, Pyroxenes		Along grain boundaries.
Albite	5	Plagioclase		Replacing plagioclase along cracks.
Quartz	Trace			Rare and associated to chlorite.

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
No veins			

STRUCTURE
Crystal Plastic:
Minor ductile deformation caused deformation twins, kink bands and minor recrystallization of plagioclase.
Shear sense indicator in ductile zone suggests normal shear.

Brittle:
Thin section contains zones of dense brittle fractures with minor offset; Incipient brecciation in some locations.

Crosscutting Relationships (as are apparent in thin section):
1) Minor ductile deformation
2) Brittle fracturing

THIN SECTION:	**1268A-23R-2, Piece 3, 18-21 cm**	**TS#45**	**Observer: CG**
ROCK NAME:	**COMPLETELY ALTERED HARZBURGITE**		
GRAIN SIZE:			
TEXTURE:			

	MODE (Visual estimate or Point counting)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine					
Orthopyroxene					
Clinopyroxene					
Spinel	0.5	1			

GENERAL COMMENTS

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc	75	Olivine, orthopyroxene		
Serpentine	25	Orthopyroxene		Bastite pseudomorphs.
Pyrite	Trace			
Iron oxides	Trace	Former pyrite veins		

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Former chrysotile veins are replaced by non-pseudomorphic and pseudomorphic talc.			

STRUCTURE
Sample is undeformed

Crosscutting Relationships (as are apparent in thin section):
1) serpentinization
2) pervasive talc alteration

THIN SECTION	**1268A-24R-2, Piece 14, 129-132 cm**	**TS#46**	**Observer: CG**
ROCK NAME:	**COMPLETELY ALTERED HARZBURGITE**		
GRAIN SIZE:			
TEXTURE:			

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine					
Orthopyroxene					
Clinopyroxene					
Spinel	0.9	1			

GENERAL COMMENTS

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc	50	Olivine, orthopyroxene		Pseudomorphing bastite pseudomorph after orthopyroxene. Replaces core of serpentine mesh textures after olivine.
Serpentine	48	Orthopyroxene		Bastite pseudomorphs. Mesh textures.
Pyrite	0.5	Olivine		Along boundaries of mesh texture and veinlets.
Iron oxides	0.5			Possibly hematite and maghemite in veins.
Ferro-chromite	0.1	Spinel		Rims around spinels.

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Vein 1- Chrysotile		Cross-fiber	
Vein 2-Talc		Fibrous	Crosscutting previous vein generations and orthopyroxene porphyroclasts.

STRUCTURE

Crystal Plastic:
Very minor ductile deformation caused kink banding in pyroxene.

Brittle:
No brittle deformation visible in thin section.

Joints:
Late shear fractures are filled with talc veins.

Foliation:
Very weak foliation defined by ribbon texture serpentine.

Crosscutting Relationships (as are apparent in thin section):
1) Minor ductile deformation
2) Serpentinization
3) Shear fracture and talc vein formation
4) Pervasive talc alteration

THIN SECTION:	**1268A-26R-2, Piece 2, 18-20 cm**	**TS#47**	**Observer: WM,WB**
ROCK NAME:	**GABBRONORITE**		
GRAIN SIZE:	**2 - 4 mm**		
TEXTURE:	**Foliated**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine					
Orthopyroxene	0	10		Euhedral	
Clinopyroxene	18	25		Euhedral	
Spinel					
Plagioclase	61	65		Subhedral-euhedral	

GENERAL COMMENTS The foliation in this sample is well defined by tabular plagioclase in part of the slide but take a bend near one end. There is a patch of smaller randomly oriented grains that separate the two domains of aligned crystals.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Amphibole	6	Clinopyroxene	Prismatic	
Chlorite/Talc	14	Pyroxenes	Pseudomorphic	Interference colors cannot be determined greenish-brown phyllosilicate.
Albite	1	Plagioclase		

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
No veins.			

STRUCTURE

Crystal Plastic:
Very minor ductile deformation caused deformation twins and bent cleavage of several plagioclase; most plagioclase grains preserve igneous textures.

Brittle:
No Brittle Deformation.

Crosscutting Relationships (as are apparent in thin section): 1) Minor ductile deformation

THIN SECTION: 1268A-27R-1, Piece 5B, 64-66 cm TS#48 Observer: WM,WB
ROCK NAME: GABBRONORITE
GRAIN SIZE: 2 - 4 mm
TEXTURE: Foliated

PRIMARY MINERALOGY	MODE (Visual estimate) PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	MORPHOLOGY	COMMENTS
Olivine					
Orthopyroxene	0	10		Euhedral	
Clinopyroxene	18	25		Euhedral	
Spinel					
Plagioclase	61	65		Subhedral-euhedral	

GENERAL COMMENTS The foliation in this sample is well defined by tabular plagioclase in part of the slide but take a bend near one end. There is a patch of smaller randomly oriented grains that separate the two domains of aligned crystals.

SECONDARY MINERALS	PERCENT PRESENT	REPLACING	MORPHOLOGY	COMMENTS
Talc	16	Pyroxenes and plagioclase	Pseudomorphic and along crack	
Chlorite	2	Clinopyroxene and plagioclase	Between plagioclase-pyroxene grain boundaries	
Amphibole	2	Clinopyroxene and plagioclase	Between plagioclase-pyroxene grain boundaries	
Albite	1	Plagioclase	Along cracks	

VEIN / FRACTURE FILLING	PERCENT PRESENT	MORPHOLOGY	COMMENTS
No veins			

STRUCTURE

Minor ductile deformation caused deformation twins, kink bands and minor recrystallization of plagioclase, and bent cleavage in pyroxene.
Thin section contains zones of dense brittle fractures with minor offset; incipient brecciation in some locations.

THIN SECTION:	**1268A-28R-2, Piece 1B, 26-28 cm**	**TS#49**	**Observer: WM,WB**
ROCK NAME:	**GABBRONORITE**		
GRAIN SIZE:	**2 - 4 mm**		
TEXTURE:	**Massive**		

MODE (Visual estimate)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	MORPHOLOGY	COMMENTS
Olivine					
Orthopyroxene	0	15	4 - 8 mm	Subhedral-euhedral	
Clinopyroxene	15	25	2 - 4 mm	Euhedral	
Spinel					
Plagioclase	55	60	2 - 5 mm	Subhedral-euhedral	

GENERAL COMMENTS The plagioclase records very little evidence of high T strain even for lath shape grains with high aspect ratios.

SECONDARY MINERALS	PERCENT PRESENT	REPLACING	MORPHOLOGY	COMMENTS
Amphibole	10	Pyroxenes and Plagioclase		
Chlorite	3	Pyroxenes and Plagioclase		
Talc	13	Pyroxenes and Plagioclase		
Albite	4	Plagioclase		

VEIN / FRACTURE FILLING	PERCENT PRESENT	MORPHOLOGY	COMMENTS
No veins.			

STRUCTURE

Crystal Plastic:
Very minor ductile deformation caused deformation twins and kink bands of plagioclase.

Brittle:
Thin section contains zones of dense brittle fractures with minor offset; incipient brecciation in some locations.

Crosscutting Relationships (as are apparent in thin section):
1) Minor ductile deformation
2) Brittle fracturing

THIN SECTION:	**1268A-29R-1, Piece 14, 118-120 cm**	**TS#50**	**Observer: WM,CG**
ROCK NAME:	**GABBRONORITE**		
GRAIN SIZE:	**3-7 mm**		
TEXTURE:	**Massive**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine					
Orthopyroxene	0	10	6 – 8	Subhedral-euhedral	
Clinopyroxene	15	20	2 – 4	Euhedral	
Spinel					
Plagioclase	68	70	2 – 7	Subhedral-euhedral	

GENERAL COMMENTS The plagioclase in this sample is extremely equant with few grains having aspect ratio > 1:1.5. The plagioclase records very little evidence of high T strain.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc	12	Pyroxenes		
Chlorite	7	Pyroxenes, plagioclase		Rims around plagioclase. Possibly metamorphic reaction rims with pyroxenes. Along cleavages of pyroxenes.
Amphibole	3	Pyroxenes		
Albite	Trace	Plagioclase		
Iron oxides	Trace			

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**

STRUCTURE

Crystal Plastic:
Very minor ductile deformation caused deformation twins and kink bands in plagioclase.

Brittle:
Thin section contains zones of dense brittle fractures with minor offset; incipient brecciation in some locations.

Crosscutting Relationships (as are apparent in thin section):
1) Minor ductile deformation
2) Brittle fracturing

THIN SECTION:	**1268A-6R-1, Piece 15, 106-108 cm**	**TS#51**	**Observer: MS**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Medium**		
TEXTURE:	**Granular-porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	80	?		
Orthopyroxene	0	18	1-5	Porphyroclast	
Clinopyroxene	0				
Spinel	0.8	1	0.1	Euhedral to oval	

GENERAL COMMENTS Totally altered harzburgite, except spinel.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Serpentine	96	Olivine, orthopyroxene		15% as bastite; hourglass to ribbon texture.
Talc	3	Olivine, orthopyroxene		
Magnetite	Trace	Olivine, spinel		
Pyrite	1	Olivine, orthopyroxene		

VEIN / FRACTURE FILLINGS	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Discontinuous network of pyrite veinlets that cut bastite and serpentinized olivine.			

GENERAL COMMENTS In talc-altered rocks, relicts of pyrite veins are preserved only in the orthopyroxene pseudomorphs. This indicates that talc alteration took place after the early pyrite veining of the serpentinite.

STRUCTURE

Crystal Plastic:
Minor ductile deformation caused kink banding of pyroxene.

Brittle:
Disjointed hourglass and ribbon texture serpentine suggests minor brittle deformation during serpentinization.

Crosscutting Relationships (as are apparent in thin section):
1) Ductile deformation
2) Serpentinzation during minor brittle deformation
3) Serpentine veins

THIN SECTION:	**1268A_8R-1, Piece 26, 117-119 cm**	**TS#52**	**Observer: MS**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Medium to coarse**		
TEXTURE:	**Granular-porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	84	?		
Orthopyroxene	0	15	0.5-10	Porphyroclast	
Clinopyroxene	0				
Spinel	0.8	1	0.1	Euhedral to oval	

GENERAL COMMENTS Totally altered harzburgite, except spinel.
High temperature lineation defined by elongated orthopyroxene grains and flat spinel grains.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc	95	Serpentine		Pseudomorphic serpentinite texture.
Serpentine	5	Orthopyroxene		Green rims on orthopyroxene.
Magnetite	Trace	Olivine		Tiny, disseminated crystal in talc matrix.
Pyrite	Trace	Olivine		Tiny, disseminated crystal in talc matrix.

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
No veins.			

STRUCTURE
Sample is not deformed.

Crosscutting Relationships (as are apparent in thin section):
1) Serpentinization
2) Pervasive talc alteration

THIN SECTION:	**1268A_10R-2, Piece 1, 8-10 cm**	**TS#53**	**Observer: MS**
ROCK NAME:	**SERPENTINIZED DUNITE**		
GRAIN SIZE:	**?**		
TEXTURE:	**Granular?**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	98			
Orthopyroxene	0	2			
Clinopyroxene	0				
Spinel	0.5	<1		Euhedral to anhedral	

GENERAL COMMENTS Totally altered dunite.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc	98	Serpentine		50% is brown clay, serpentinite texture partly preserved.
Serpentine	2	Orthopyroxene		
Magnetite	tr.	Olivine, spinel		Tiny crystals, disseminated in talc matrix.
Pyrite	tr.	Olivine		Tiny crystals, disseminated in talc matrix.

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Talc cross-fiber veins cut by microfibrous talc veins.			
Cross-fiber chrysotile veins.			
Pyrite veins, crosscutting chrysotile veins.			

STRUCTURE
Sample is not deformed.

Crosscutting Relationships (as are apparent in thin section):
1) Serpentinization
2) Pervasive talc alteration

THIN SECTION:	**1268A_12R-1, Piece 3, 47-49 cm**	**TS#54**	**Observer: MS**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Medium to coarse**		
TEXTURE:	**Granular-porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	85	?		
Orthopyroxene	0	12	0.5-10	Porphyroclast	
Clinopyroxene	0				
Spinel	0.8	1	0.1	Euhedral to oval	

GENERAL COMMENTS Totally altered harzburgite, except spinel

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc	7	Serpentine		
Serpentine	90	Olivine, orthopyroxene		10% as bastite.
Magnetite	1	Olivine, orthopyroxene, spinel		Forming lamellae in bastite.
Pyrite	2	Olivine, orthopyroxene		Forming lamellae in bastite.
Hematite	Trace	Olivine, orthopyroxene		Forming lamellae in bastite.

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
One branched talc+pyrite+magnetite+hematite vein			

STRUCTURE

Crystal Plastic:
Minor ductile deformation caused kink banding of pyroxene.

Crosscutting Relationships (as are apparent in thin section):
1) Ductile deformation
2) Serpentinzation during minor brittle deformation
3) Serpentine veins

THIN SECTION:	**1268A_12R-2, Piece 7, 35-37 cm**	**TS#55**	**Observer: MS**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Medium to coarse**		
TEXTURE:	**Granular-porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	84	?		
Orthopyroxene	0	15	0.5-10	Porphyroclast	
Clinopyroxene	0				
Spinel	0.8	1	0.1	Euhedral to oval	

GENERAL COMMENTS Totally altered harzburgite, except spinel.
There is a mylonitic band in the middle of the section.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc	98	Serpentine		Virtual complete replacement of serpentine.
Serpentine	1	Olivine		Rare relicts.
Pyrite	1	Olivine		Dispersed in matrix, in tiny veinlets.
Magnetite	Trace	Olivine		

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Talc+pyrite veins			

GENERAL COMMENTS Rock is completely talc-altered. Most of the serpentinite texture is destroyed. Coarse-grained talc recrystallized in patches.
Green serpentinite rims that are preserved in most thin sections are also completely altered to talc.

STRUCTURE

Crystal Plastic:
Polygonal talc grains the likely pseudomorphed olivine meet at triple junctions and define faint foliation.
Rock likely suffered weak to moderate crystal plastic deformation, but textures completely obscured by talc alteration.

Foliation:
Faint crystal plastic foliation obscured by talc alteration.

Crosscutting Relationships (as are apparent in thin section):
1) Ductile deformation
2) Serpentinization
3) Serpentine veins
4) Pervasive talc alteration

THIN SECTION:	**1268A_13R-1, Piece 6A, 33-35 cm**	**TS#56**	**Observer: MS**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Coarse**		
TEXTURE:	**Granular to porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	78	?		
Orthopyroxene	0	20	1-15	Anhedral interstitial	Frequently kinked.
Clinopyroxene	0	0			
Spinel	1.5	2	<0.1-1	Oval, interstitial, anhedral	Small interstitial grains disseminated; larger anhedral with orthopyroxene.

GENERAL COMMENTS Totally altered harzburgite, except spinel.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc	10	Serpentine		Hourglass and ribbon textures.
Serpentine	89	Olivine, orthopyroxene		
Pyrite	1	Olivine, orthopyroxene		
Magnetite	Trace	Olivine, orthopyroxene, spinel		

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Cross-fiber chrysotile vein cut by talc veins.			

STRUCTURE
Brittle

Crosscutting Relationships (as are apparent in thin section): 1) Serpentinization

THIN SECTION:	**1268A_14R-2, Piece16, 130-133 cm**	**TS#57**	**Observer: MS**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Medium**		
TEXTURE:	**Porphyroclastic-mylonitic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	80	?		
Orthopyroxene	0	20	0.3-0.7	Porphyroclast	
Clinopyroxene	0				
Spinel	0.5	<1	0.1		

GENERAL COMMENTS Totally altered and very deformed harzburgite.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc	80	Serpentine		
Serpentine	20	Olivine, orthopyroxene		
Magnetite	Trace	Olivine, orthopyroxene		
Pyrite	Trace	Olivine, orthopyroxene		

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Fibrous talc veins perpendicular to the foliation.			

STRUCTURE

Crystal Plastic:
Minor to moderate crystal plastic foliation is suggested by remnant foliation and partially recrystallized pyroxene; textures obscured by serpentinzation and talc alteration.

Crosscutting Relationships (as are apparent in thin section):
1) Ductile deformation
2) Serpentinization
3) Pervasive talc alteration

THIN SECTION:	**1268A_15R-3, Piece 5A, 135-137cm**	**TS#58**	**Observer: MS**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Medium to coarse**		
TEXTURE:	**Porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	80	?		
Orthopyroxene	0	20	0.2-1	Porphyroclast	
Clinopyroxene	0				
Spinel	0.5	<1	0.1	Euhedral to oval	

GENERAL COMMENTS Totally altered harzburgite, except spinel

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc	3	Serpentine		Along cracks.
Serpentinite	97	Olivine, orthopyroxene		Serrate veins, ribbon and interlocking textures.
Magnetite	Trace	Olivine, orthopyroxene		Disseminated.
Pyrite	Trace	Olivine, orthopyroxene		Disseminated.

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Discontinuous chrysotile veins perpendicular to ribbon texture.			
Talc+pyrite+hematite vein.			

STRUCTURE

Crystal Plastic:
None visible in thin section.

Brittle:
Weak brittle deformation is suggested by disjointed hourglass and ribbon texture serpentinite with asymmetric vein fibers.

Joints:
Shear fractures are filled with serpentine veins.

Foliation:
Faint foliation defined by ribbon texture serpentinite.

Crosscutting Relationships (as are apparent in thin section):
1) Serpentinization during minor brittle deformation
2) Serpentine veins fill shear fractures

THIN SECTION:	**1268A_16R-2, Piece 1, 31-34 cm**	**TS#59**	**Observer: MS**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Medium to coarse**		
TEXTURE:	**Granular-porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	80	?		
Orthopyroxene	0	20	0.5-10	Anhedral	Recrystallized porphyroclasts.
Clinopyroxene	0				
Spinel	0.5	<1	0.1	Euhedral to oval	

GENERAL COMMENTS Totally altered harzburgite, except spinel.
Relicts of high temperature lineation; secondary recrystallization.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc	15	Serpentine		Along invasive vein network.
Serpentine	85	Olivine, orthopyroxene		Green bastite after orthopyroxene.
Magnetite	Trace	Olivine, orthopyroxene		Disseminated.
Pyrite	Trace	Olivine, orthopyroxene		Disseminated.

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**

Early chrysotile+magnetite veins are cut by late chrysotile veins that are cut by the talc vein network.
A mm-wide talc vein is developed in the upper left corner of the thin section.

STRUCTURE

Crystal Plastic:
Very minor ductile deformation caused distorted crystal lattice in pyroxene porphyroclasts.

Crosscutting Relationships (as are apparent in thin section):
1) Minor ductile deformation
2) Serpentinzation
3) Partial talc alteration and talc veining

THIN SECTION:	**1268A_18R-2, Piece 11A, 118-121cm**	**TS#60**	**Observer: MS**
ROCK NAME:	**SERPENTINIZED DUNITE**		
GRAIN SIZE:	**?**		
TEXTURE:	**Granular(?)**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	98			
Orthopyroxene	0	2	0.2-0.5	One large ghost of orthopyroxene, rounded	
Clinopyroxene	0				
Spinel	0.5	<1	<0.5	Subhedral to anhedral	

GENERAL COMMENTS Totally altered dunite.

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Talc	1	Serpentine		
Serpentine	98	Olivine, orthopyroxene		
Pyrite	1	Olivine, orthopyroxene		
Magnetite	Trace	Olivine, orthopyroxene		

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Cross-fiber chrysotile veinlets.			

STRUCTURE

Foliation:
Faint foliation defined by elongate mesh cells and aligned magnetite veins.

Crosscutting Relationships (as are apparent in thin section): 1) Serpentinization

Sample is undeformed

THIN SECTION:	**1268A_19R-3, Piece 1, 3-6 cm**	**TS#61**	**Observer: MS**
ROCK NAME:	**SERPENTINIZED HARZBURGITE**		
GRAIN SIZE:	**Medium**		
TEXTURE:	**Porphyroclastic**		

	MODE (Visual estimate)				
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm)**	**MORPHOLOGY**	**COMMENTS**
Olivine	0	90	?		
Orthopyroxene	0	10	0.1-0.7	Porphyroclast	
Clinopyroxene	0				
Spinel	0.5	<1	0.1	Euhedral to oval	

GENERAL COMMENTS
Totally altered harzburgite, except spinel
A small segregation of orthopyroxene porphyroclasts (< 1 cm wide)

SECONDARY MINERALS	**PERCENT PRESENT**	**REPLACING**	**MORPHOLOGY**	**COMMENTS**
Serpentine	99	Olivine, orthopyroxene		10% bastite.
Magnetite	1	Olivine, orthopyroxene, spinel		
Pyrite	Trace	Olivine, orthopyroxene		

VEIN / FRACTURE FILLING	**PERCENT PRESENT**	**MORPHOLOGY**	**COMMENTS**
Serpentine veins			

STRUCTURE
Joints:
Late shear fractures filled with serpentine veins

Foliation:
Faint foliation defined by elongate mesh cells and ribbon texture serpentinite.

Crosscutting Relationships (as are apparent in thin section):
1) Serpentinzation
2) Late shear fractures filled with serpentine veins

Sample is undeformed