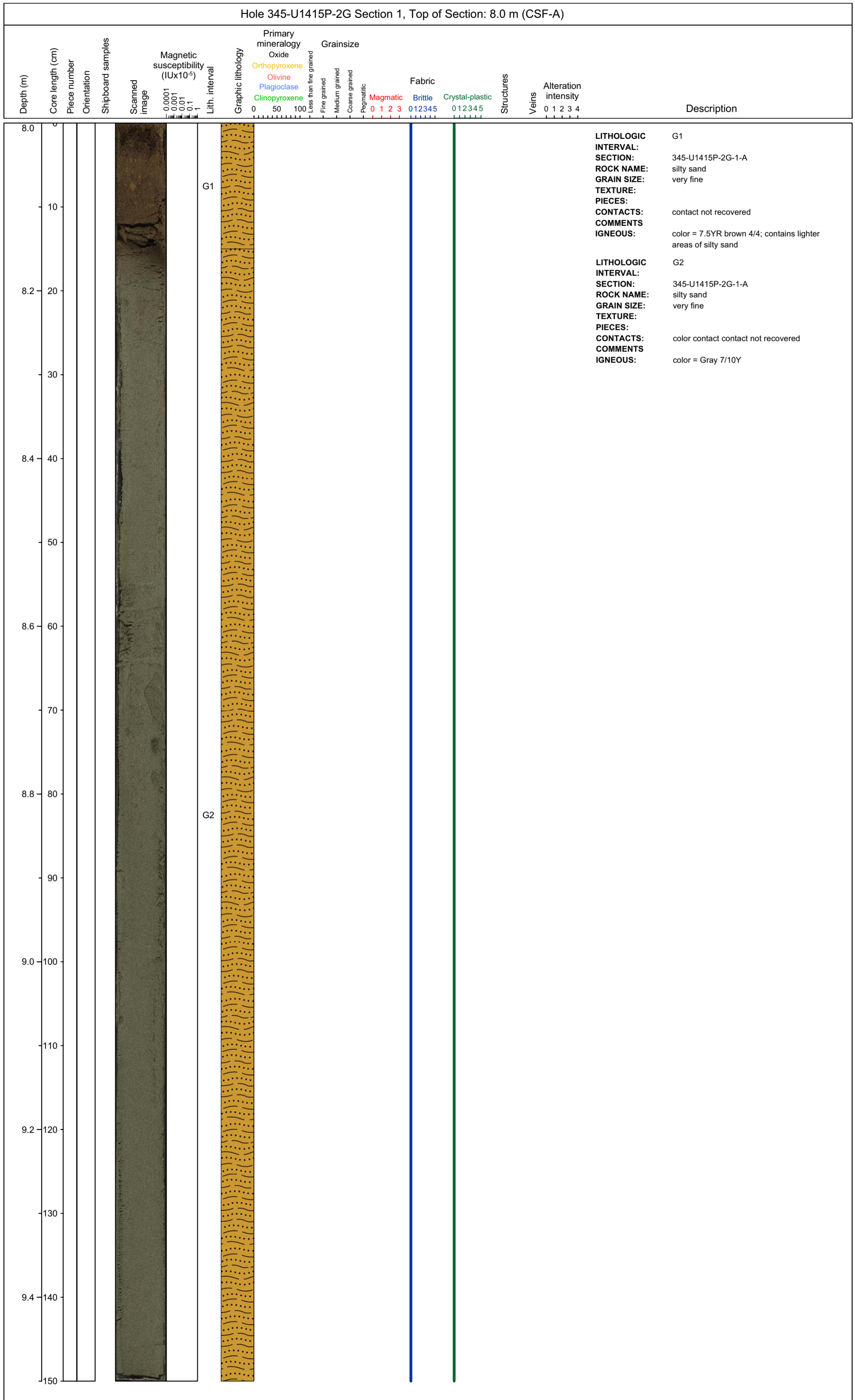
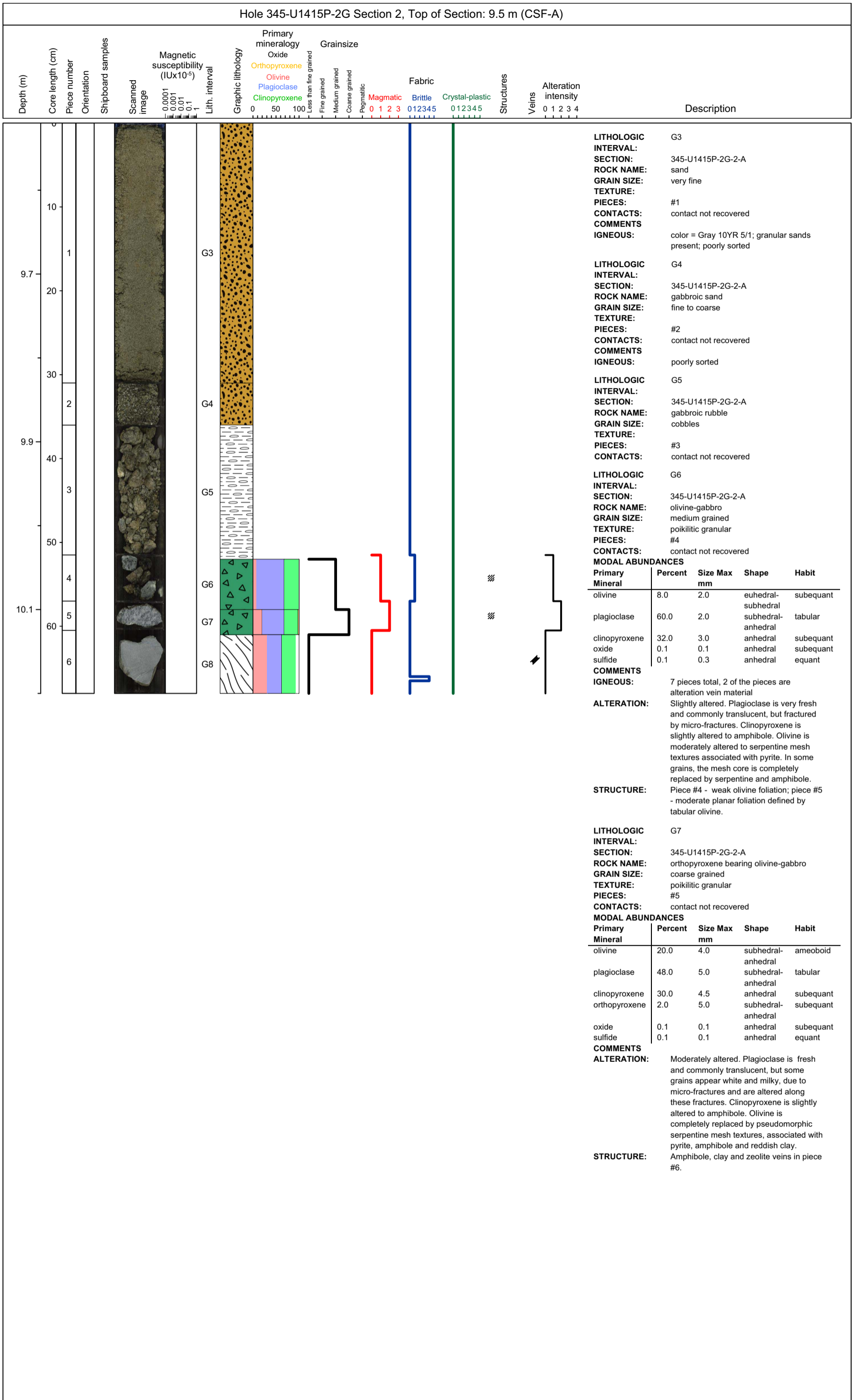
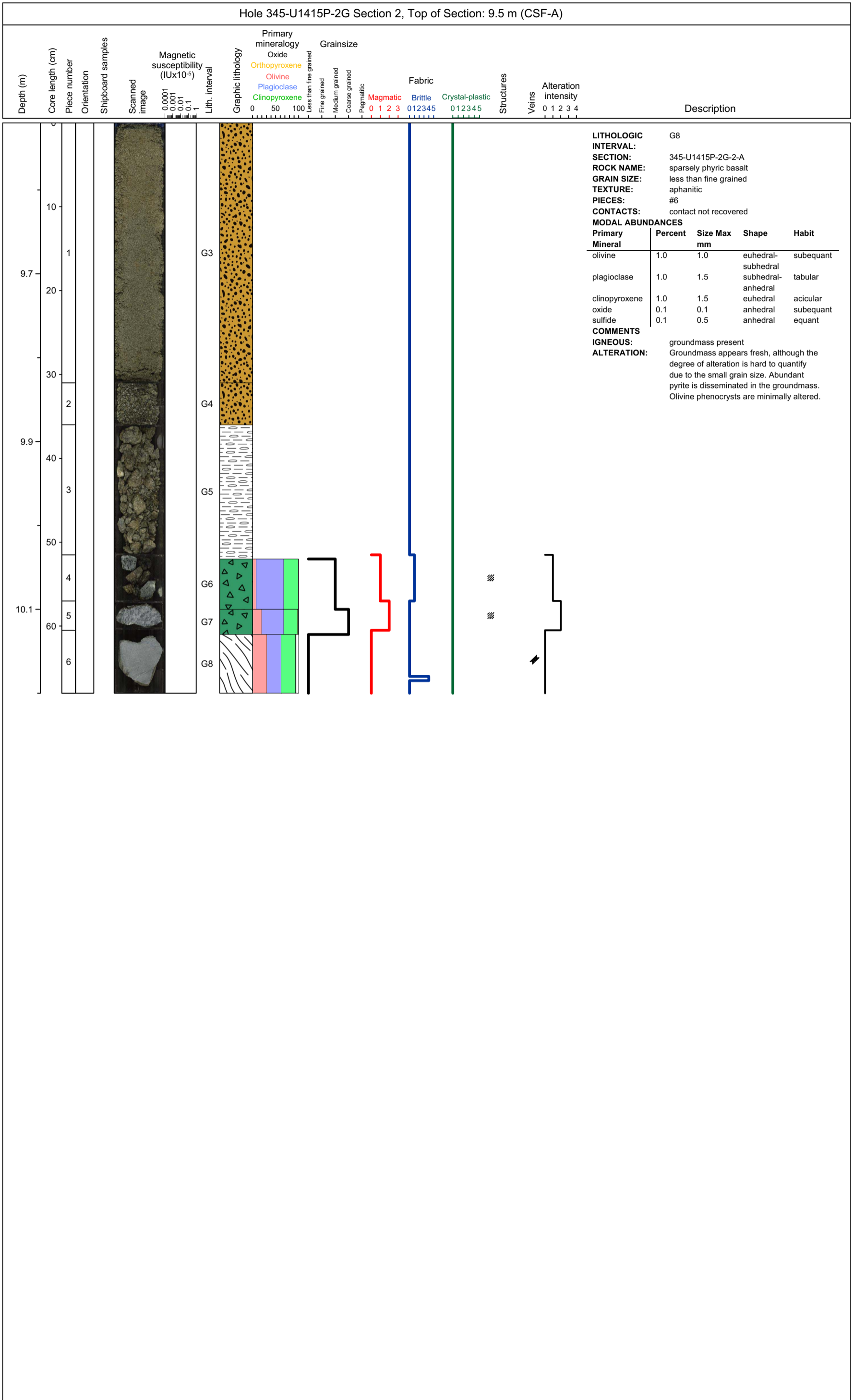
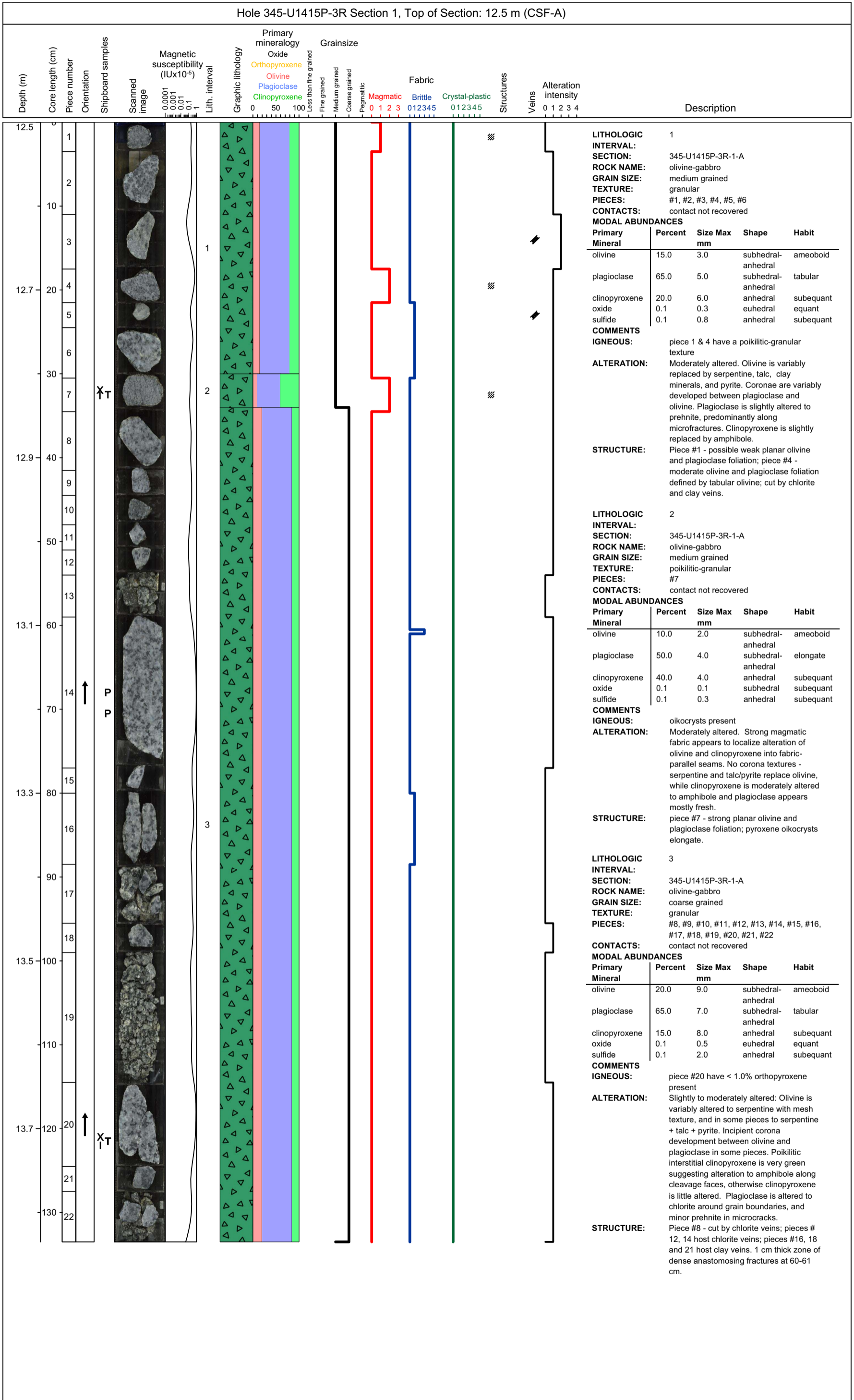


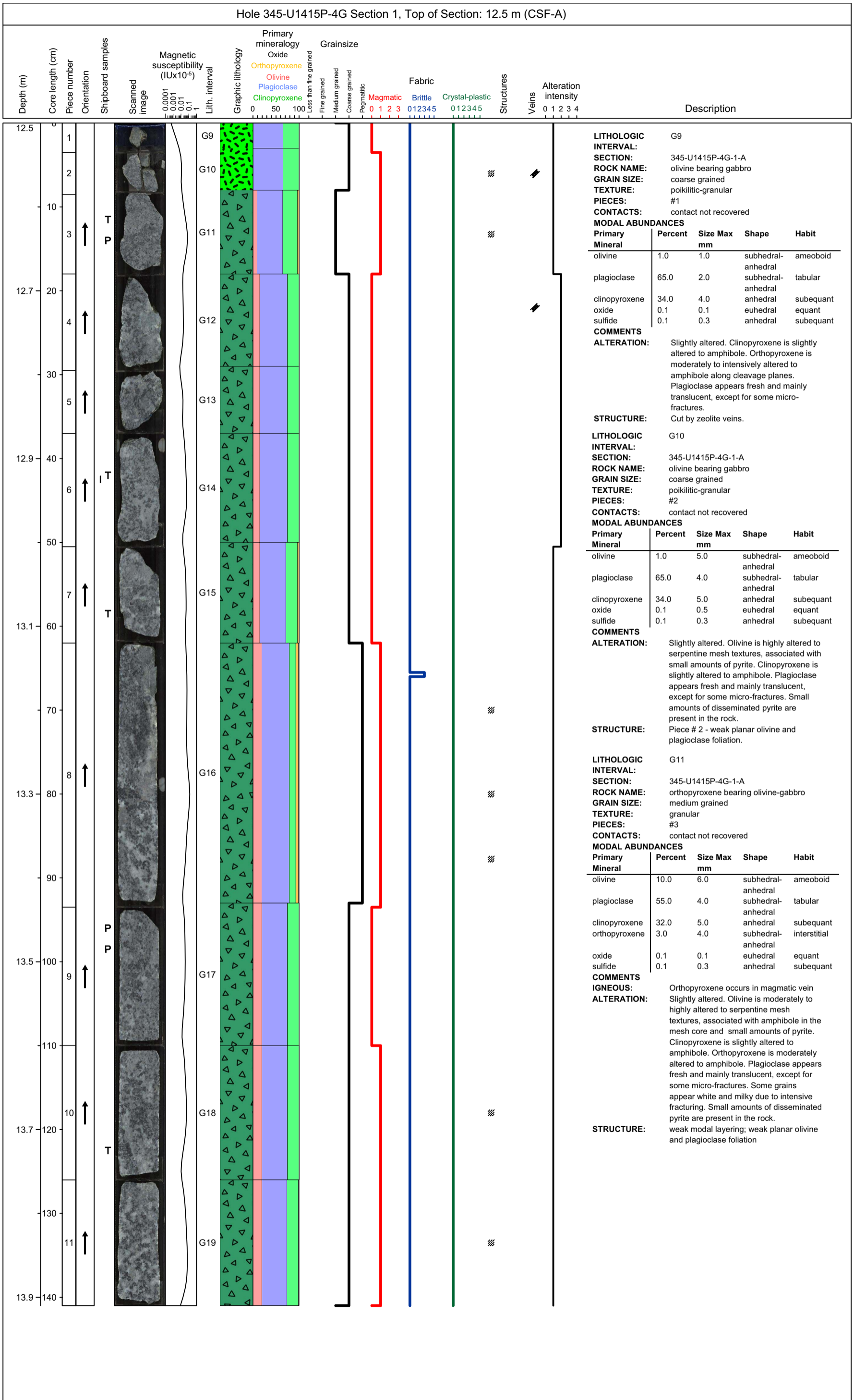
U1415P-11 Drilled interval

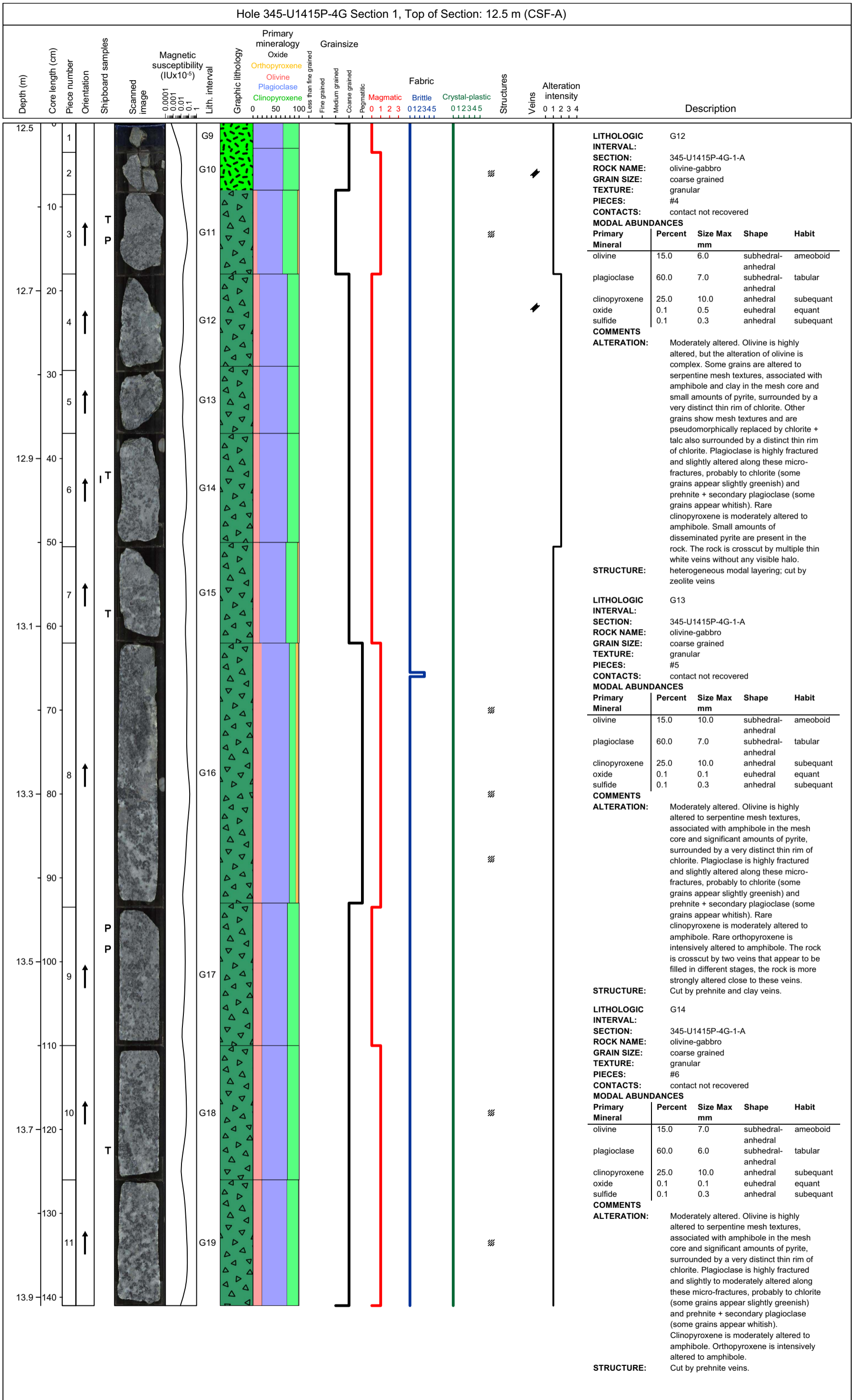


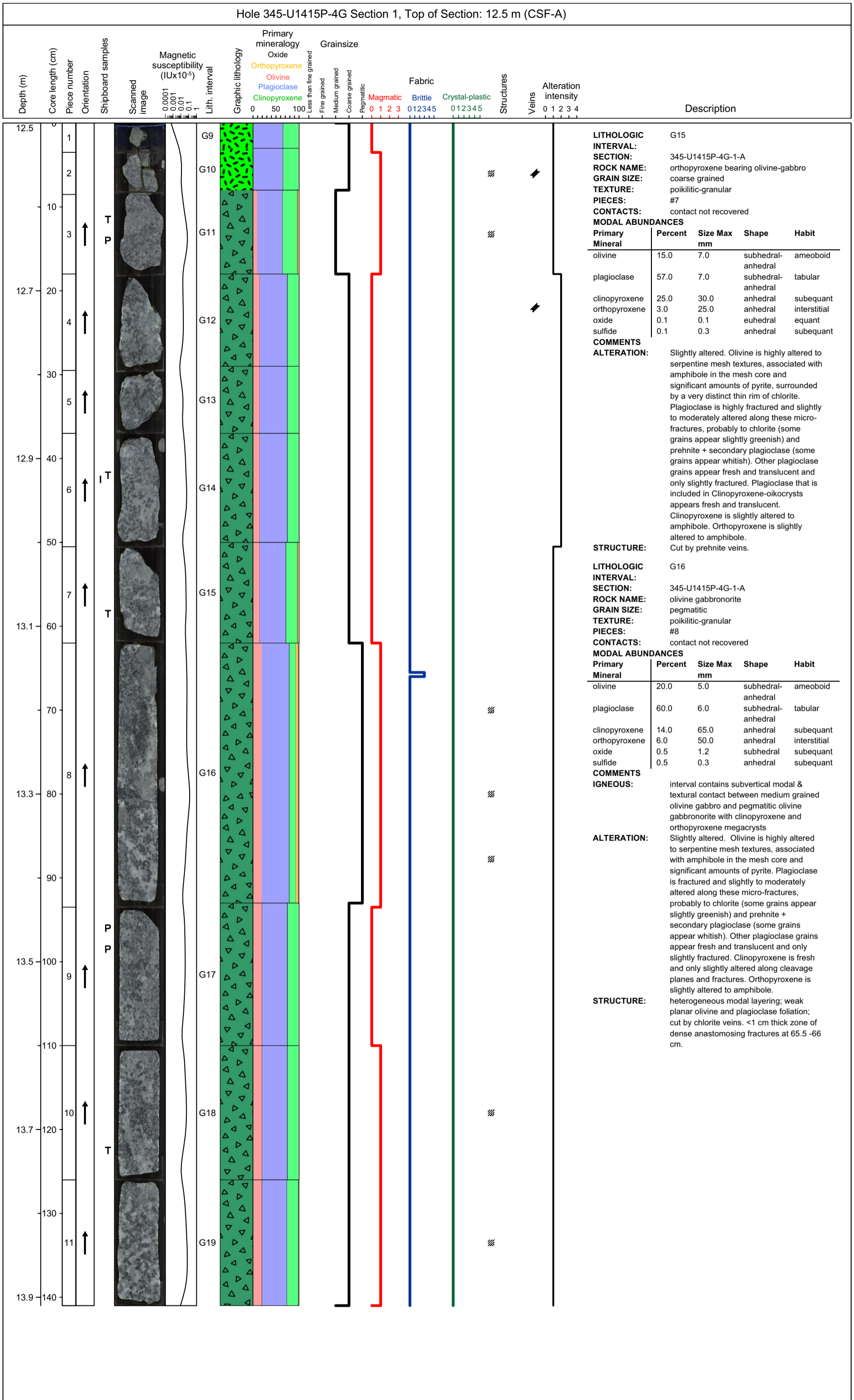


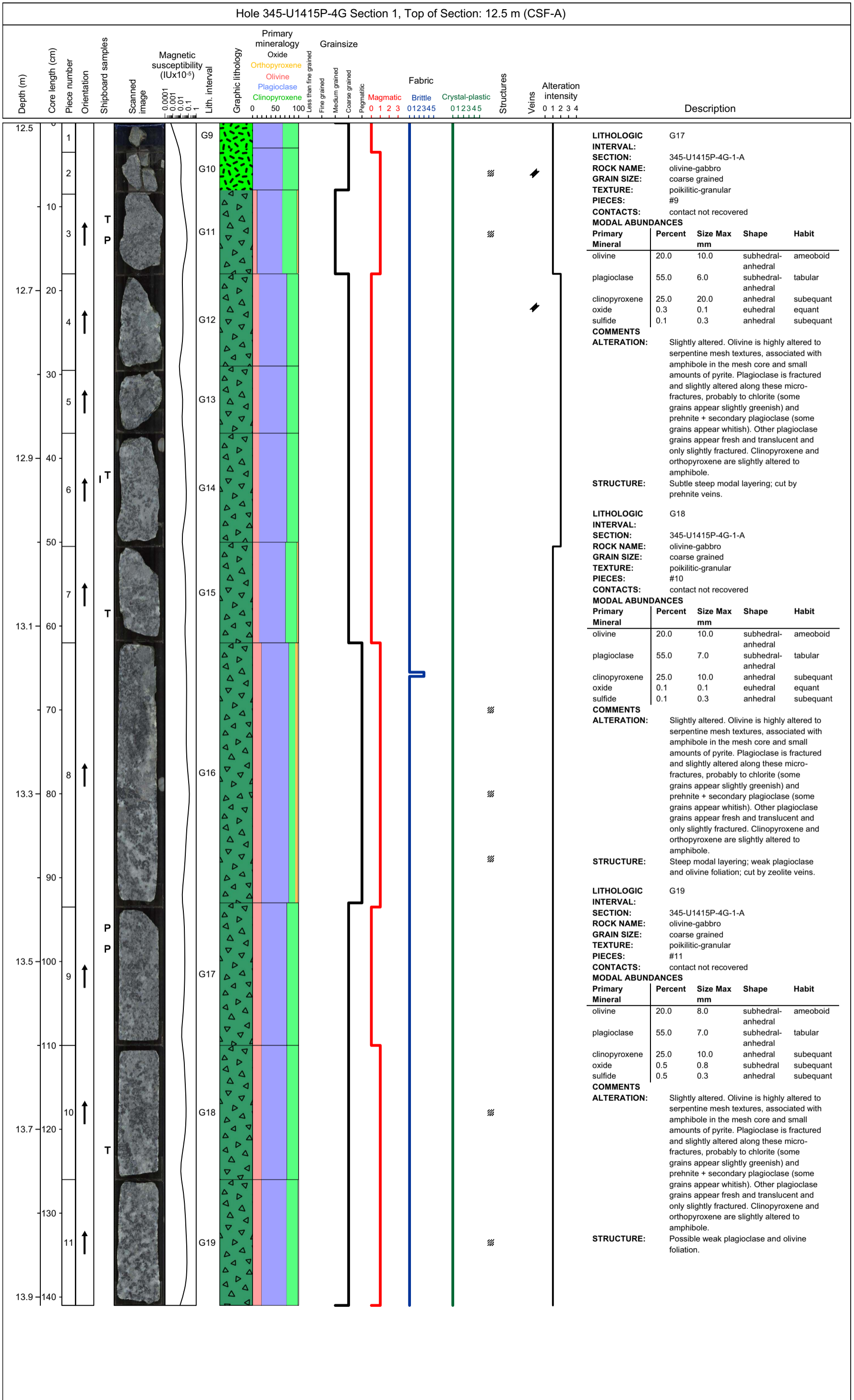






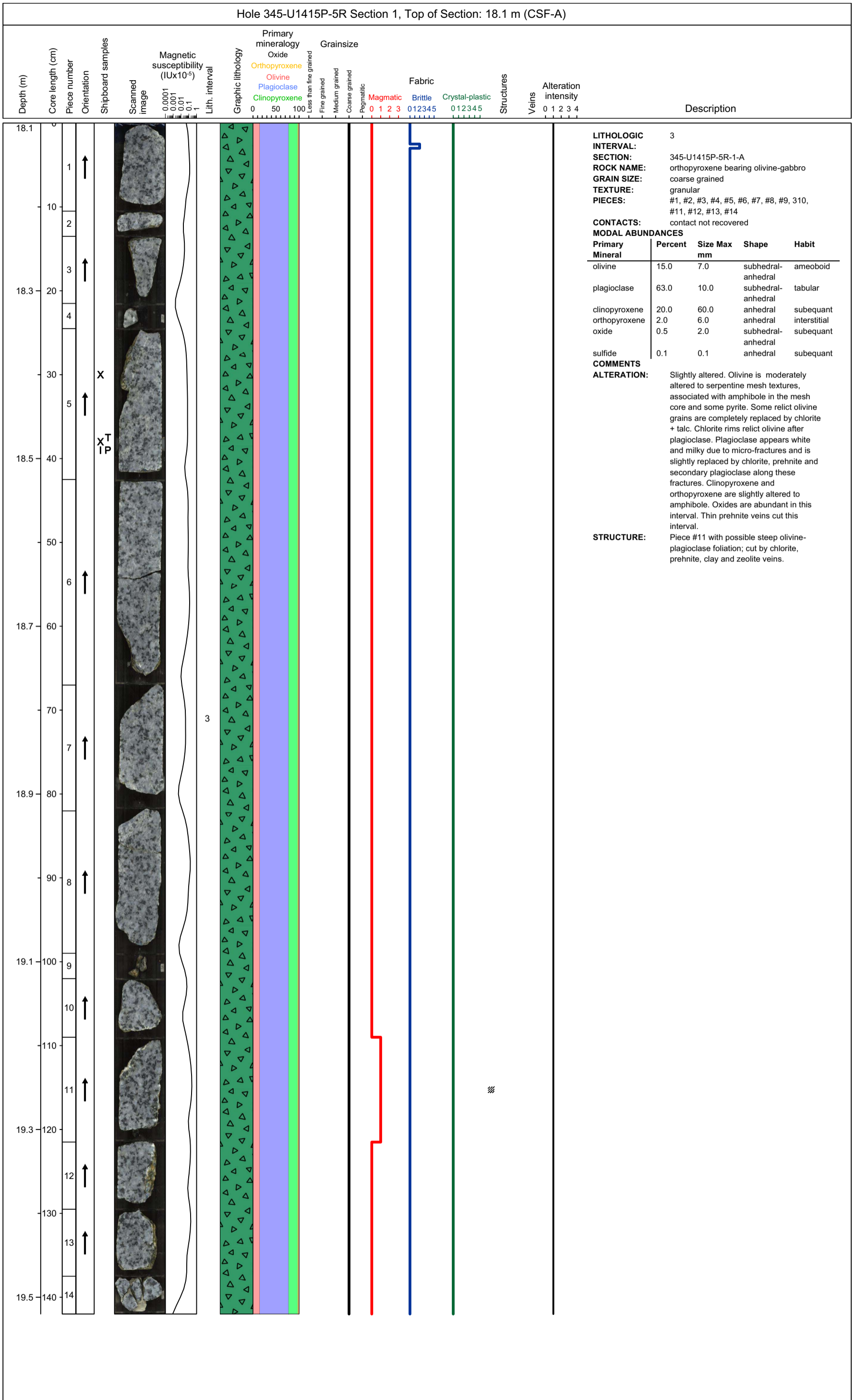


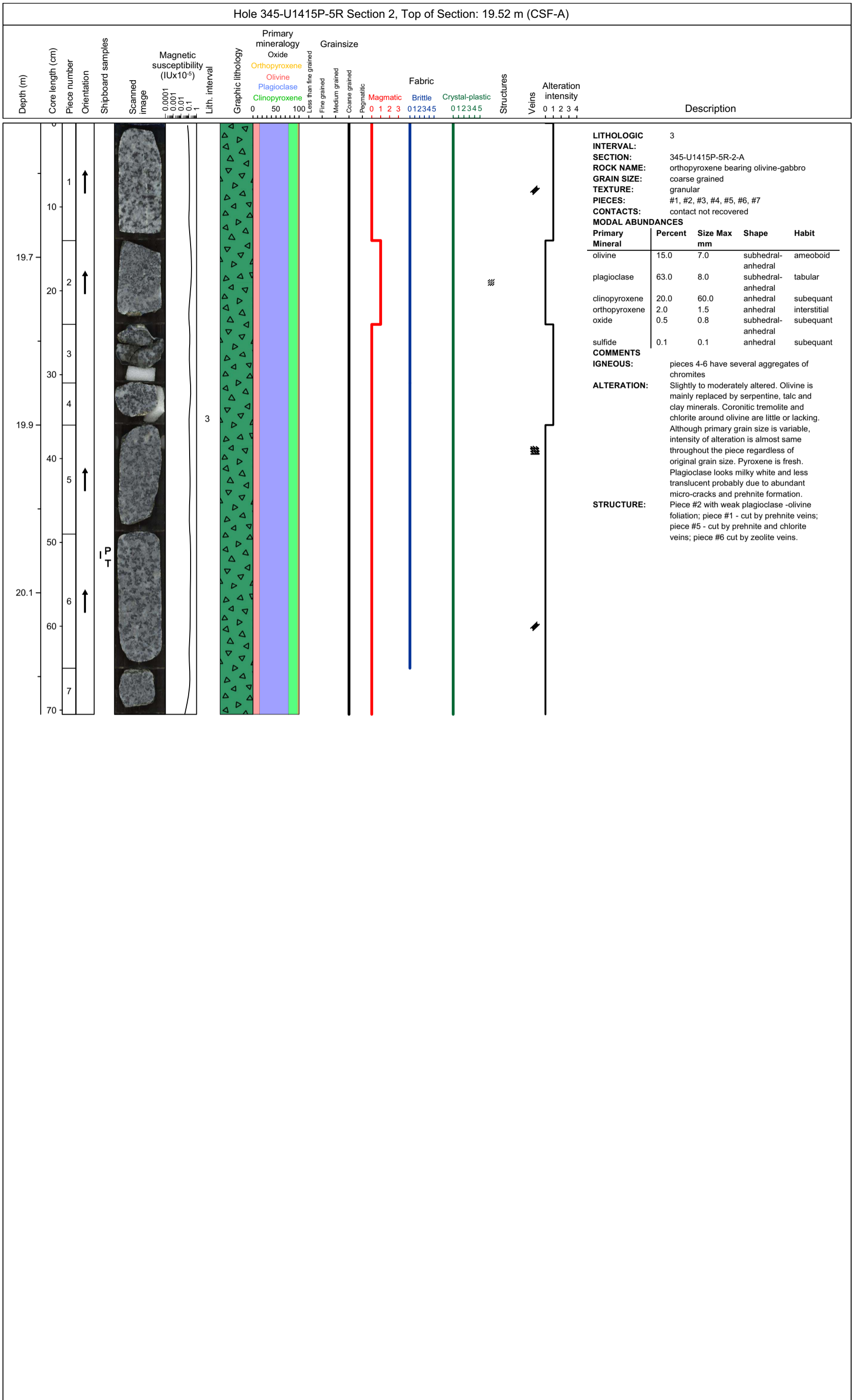


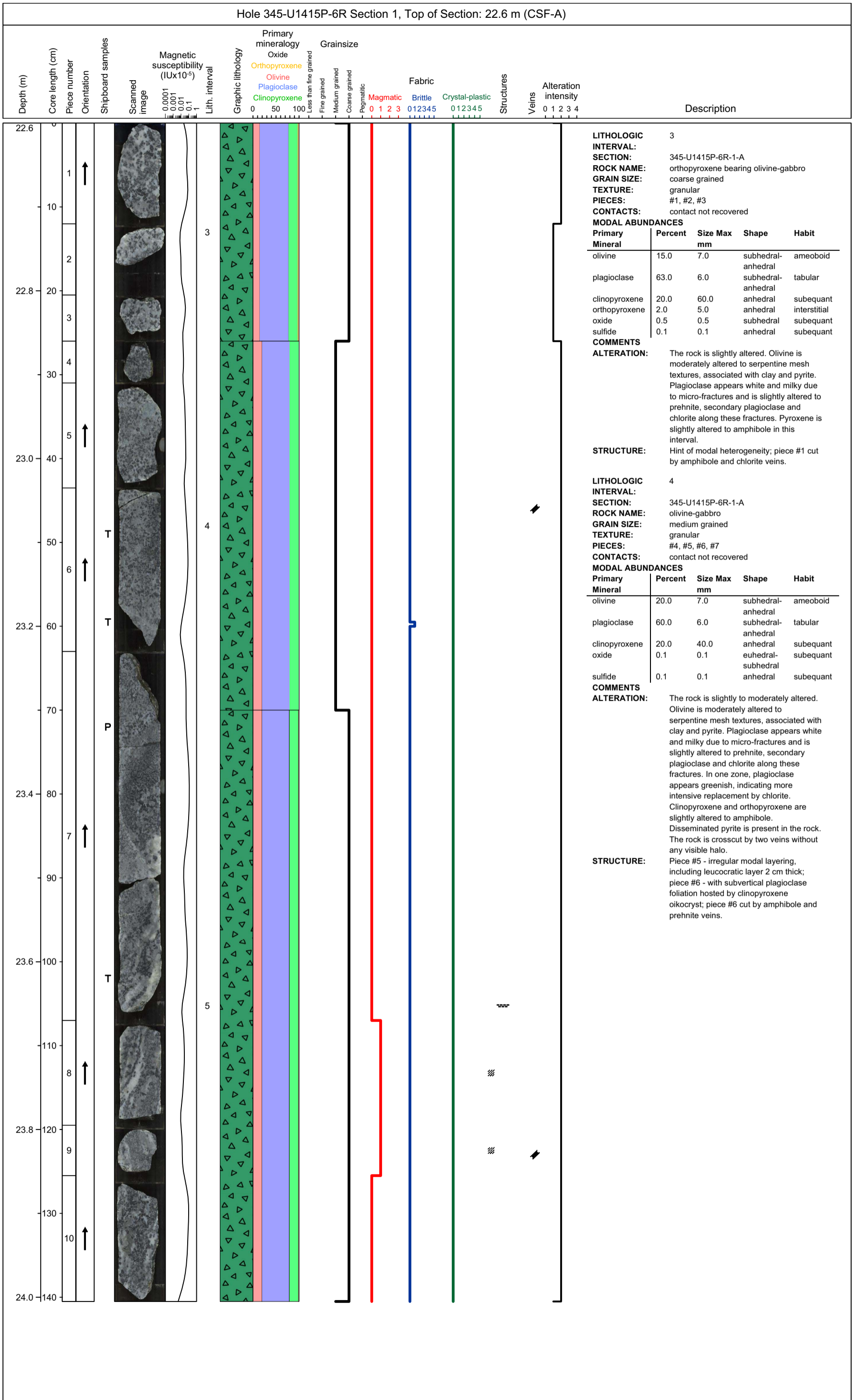




Hole 345-U1415P-4G Section 2, Top of Section: 13.91 m (CSF-A)																																																
Depth (m)	Core length (cm)	Piece number	Orientation	Shipboard samples	Scanned image	Magnetic susceptibility (IUx10 <sup>-5</sup> )	Lith. interval	Graphic lithology	Primary mineralogy	Grainsize	Fabric	Alteration intensity	Description																																			
						0.0001 0.001 0.01 0.1 1			Oxide Orthopyroxene Olivine Plagioclase Clinopyroxene	Less than fine grained Fine grained Medium grained Coarse grained	Magmatic Brittle Crystal-plastic	0 1 2 3 0 1 2 3 4																																				
10	1			T P			G20						<p><b>LITHOLOGIC INTERVAL:</b> G20</p> <p><b>SECTION:</b> 345-U1415P-4G-2-A</p> <p><b>ROCK NAME:</b> olivine-gabbro</p> <p><b>GRAIN SIZE:</b> coarse grained</p> <p><b>TEXTURE:</b> granular</p> <p><b>PIECES:</b> #1</p> <p><b>CONTACTS:</b> contact not recovered</p> <p><b>MODAL ABUNDANCES</b></p> <table border="1"> <thead> <tr> <th>Primary Mineral</th> <th>Percent</th> <th>Size Max mm</th> <th>Shape</th> <th>Habit</th> </tr> </thead> <tbody> <tr> <td>olivine</td> <td>10.0</td> <td>5.0</td> <td>subhedral-anhedral</td> <td>ameoboid</td> </tr> <tr> <td>plagioclase</td> <td>65.0</td> <td>7.0</td> <td>subhedral-anhedral</td> <td>tabular</td> </tr> <tr> <td>clinopyroxene</td> <td>25.0</td> <td>13.0</td> <td>anhedral</td> <td>subequant</td> </tr> <tr> <td>orthopyroxene</td> <td>0.1</td> <td>1.2</td> <td>subhedral-anhedral</td> <td>subequant</td> </tr> <tr> <td>oxide</td> <td>0.5</td> <td>1.0</td> <td>subhedral</td> <td>subequant</td> </tr> <tr> <td>sulfide</td> <td>0.1</td> <td>0.5</td> <td>anhedral</td> <td>subequant</td> </tr> </tbody> </table> <p><b>COMMENTS</b></p> <p><b>ALTERATION:</b> Olivine is commonly replaced by serpentine to form mesh texture. Abundance of clay, talc and coronitic tremolite + chlorite is variable. Clinopyroxene alteration is heterogeneous. Plagioclase is relatively fresh.</p> <p><b>STRUCTURE:</b> Modal variation from 0-10 cm; cut by zeolite veins.</p>	Primary Mineral	Percent	Size Max mm	Shape	Habit	olivine	10.0	5.0	subhedral-anhedral	ameoboid	plagioclase	65.0	7.0	subhedral-anhedral	tabular	clinopyroxene	25.0	13.0	anhedral	subequant	orthopyroxene	0.1	1.2	subhedral-anhedral	subequant	oxide	0.5	1.0	subhedral	subequant	sulfide	0.1	0.5	anhedral	subequant
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20	2						G21						<p><b>LITHOLOGIC INTERVAL:</b> G21</p> <p><b>SECTION:</b> 345-U1415P-4G-2-A</p> <p><b>ROCK NAME:</b> olivine-gabbro</p> <p><b>GRAIN SIZE:</b> coarse grained</p> <p><b>TEXTURE:</b> granular</p> <p><b>PIECES:</b> #2</p> <p><b>CONTACTS:</b> contact not recovered</p> <p><b>MODAL ABUNDANCES</b></p> <table border="1"> <thead> <tr> <th>Primary Mineral</th> <th>Percent</th> <th>Size Max mm</th> <th>Shape</th> <th>Habit</th> </tr> </thead> <tbody> <tr> <td>olivine</td> <td>10.0</td> <td>5.0</td> <td>subhedral-anhedral</td> <td>ameoboid</td> </tr> <tr> <td>plagioclase</td> <td>65.0</td> <td>7.0</td> <td>subhedral-anhedral</td> <td>tabular</td> </tr> <tr> <td>clinopyroxene</td> <td>25.0</td> <td>13.0</td> <td>anhedral</td> <td>subequant</td> </tr> <tr> <td>orthopyroxene</td> <td>0.1</td> <td>1.2</td> <td>subhedral-anhedral</td> <td>subequant</td> </tr> <tr> <td>oxide</td> <td>0.1</td> <td>0.1</td> <td>euhedral</td> <td>equant</td> </tr> <tr> <td>sulfide</td> <td>0.1</td> <td>0.3</td> <td>anhedral</td> <td>subequant</td> </tr> </tbody> </table> <p><b>COMMENTS</b></p> <p><b>ALTERATION:</b> Olivine is commonly replaced by serpentine to form mesh texture. Abundance of clay, talc and coronitic tremolite + chlorite is variable. Clinopyroxene alteration is heterogeneous. Plagioclase is relatively fresh. Alteration intensity is variable between pieces.</p>	Primary Mineral	Percent	Size Max mm	Shape	Habit	olivine	10.0	5.0	subhedral-anhedral	ameoboid	plagioclase	65.0	7.0	subhedral-anhedral	tabular	clinopyroxene	25.0	13.0	anhedral	subequant	orthopyroxene	0.1	1.2	subhedral-anhedral	subequant	oxide	0.1	0.1	euhedral	equant	sulfide	0.1	0.3	anhedral	subequant
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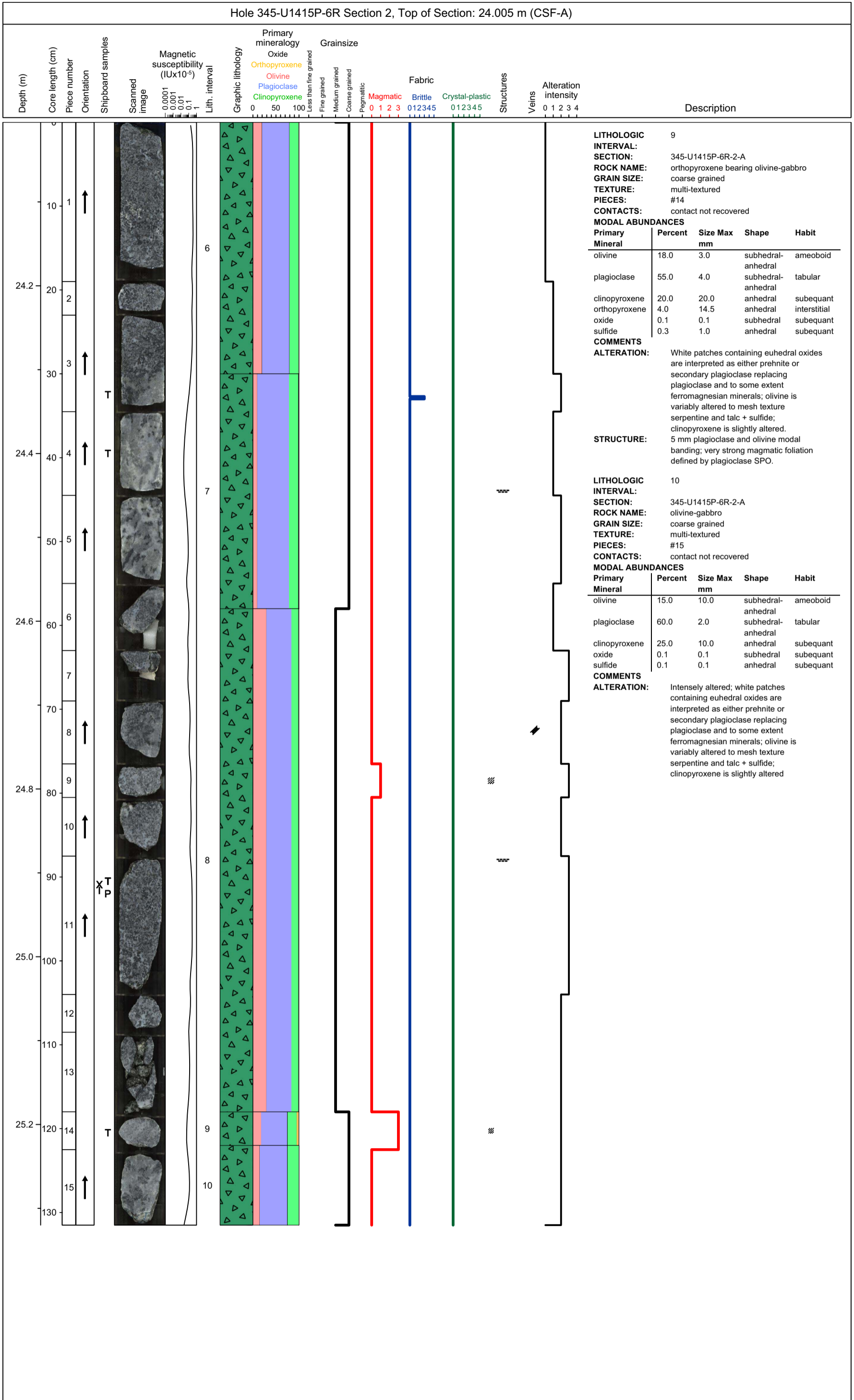


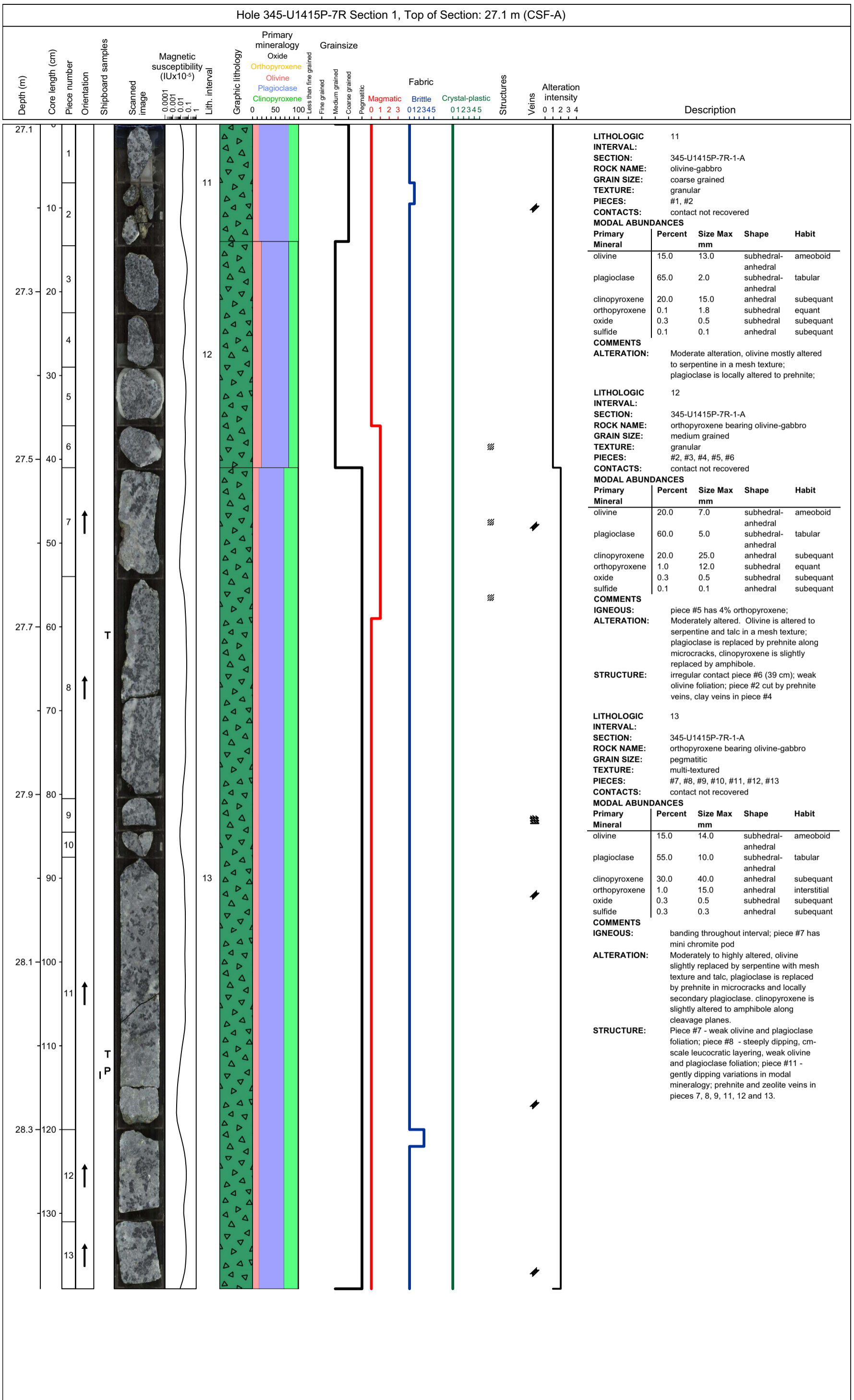




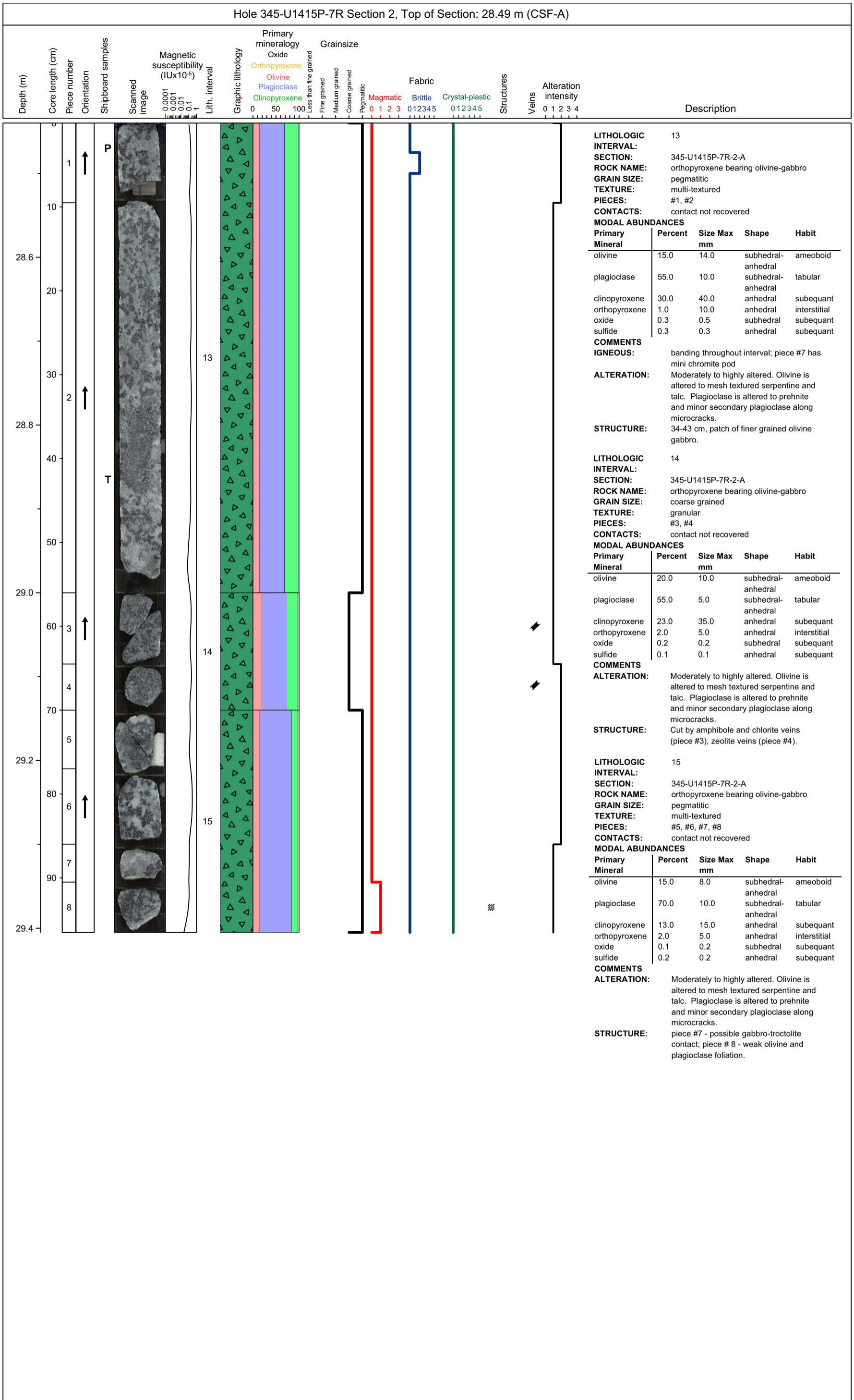


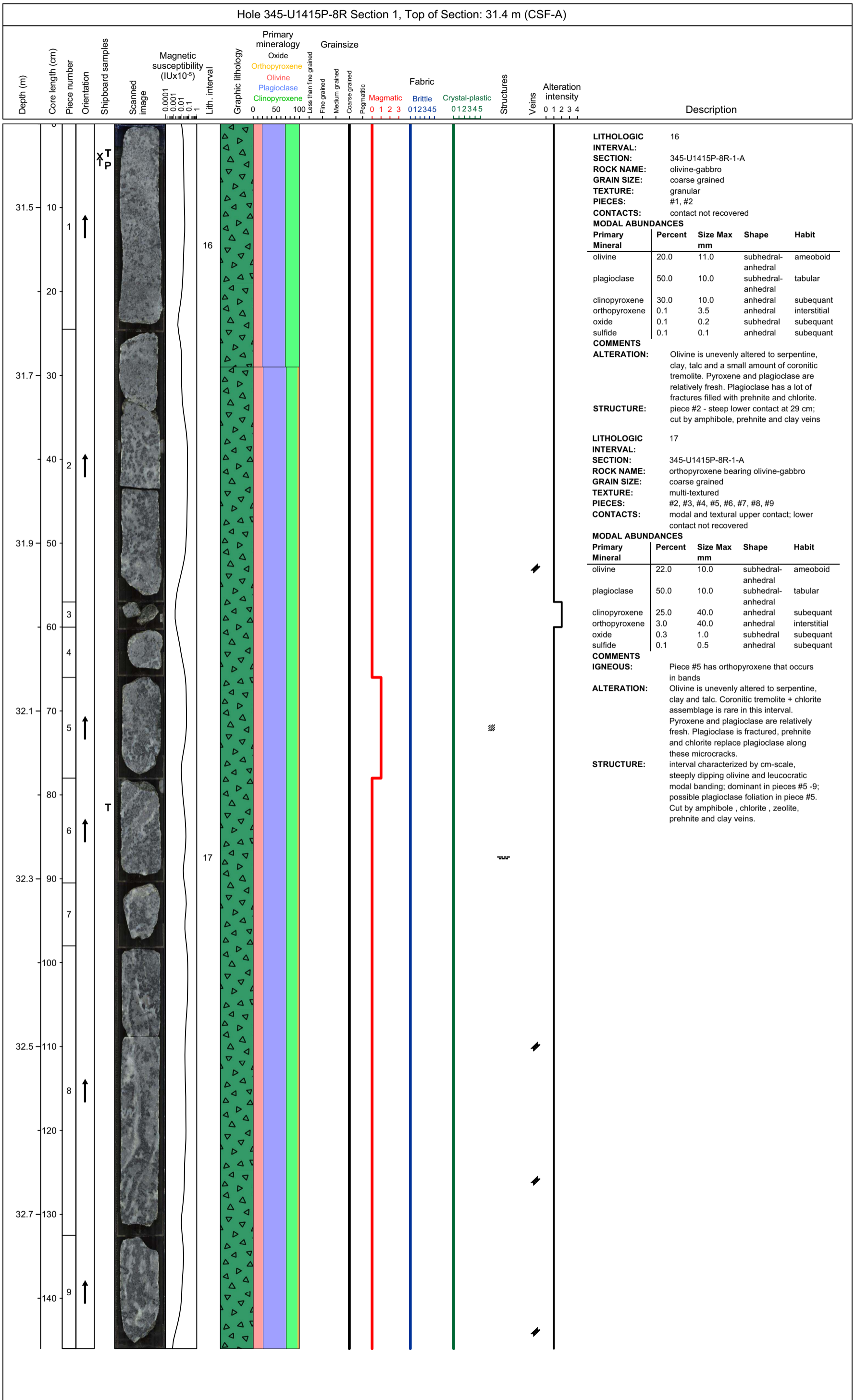


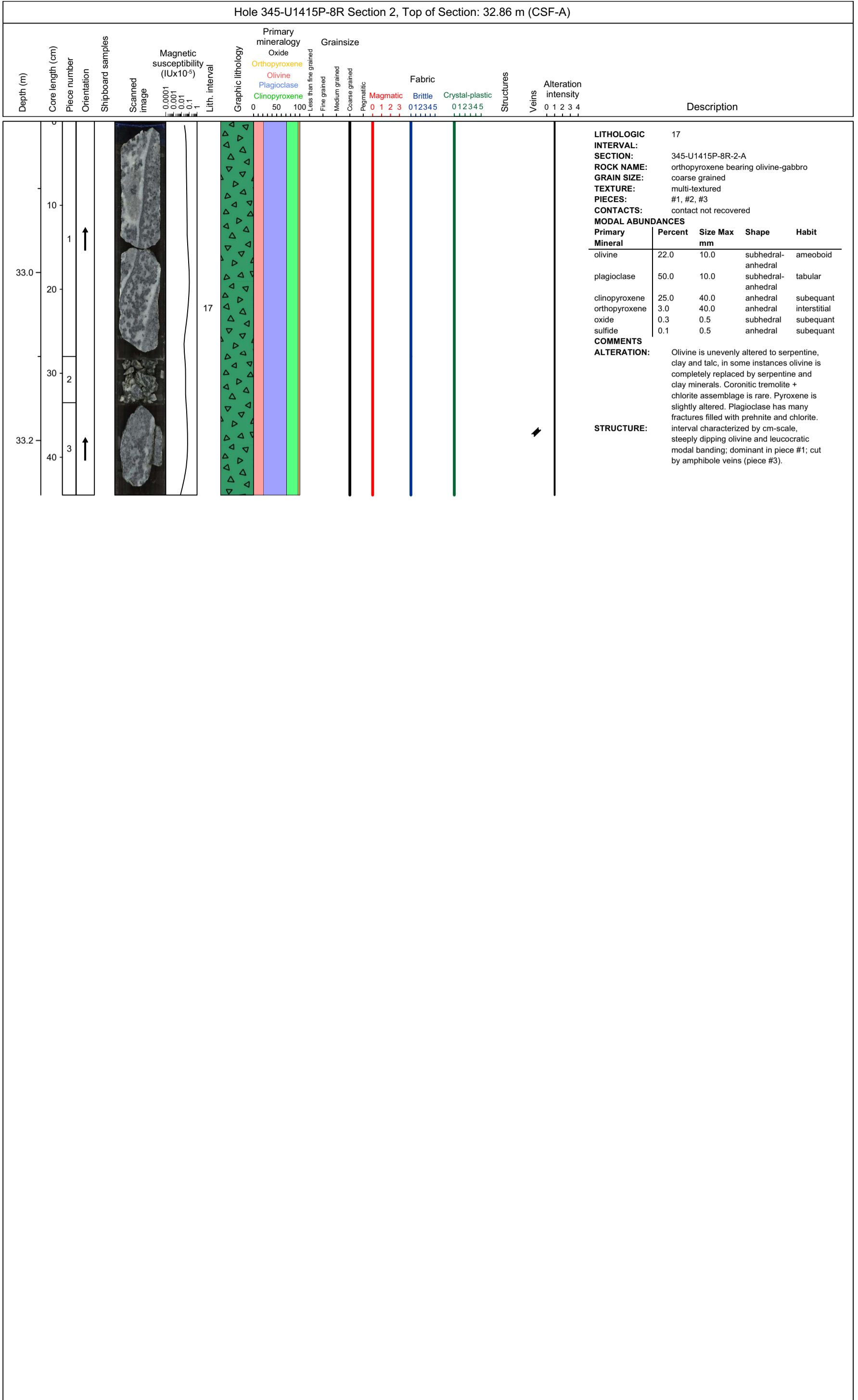


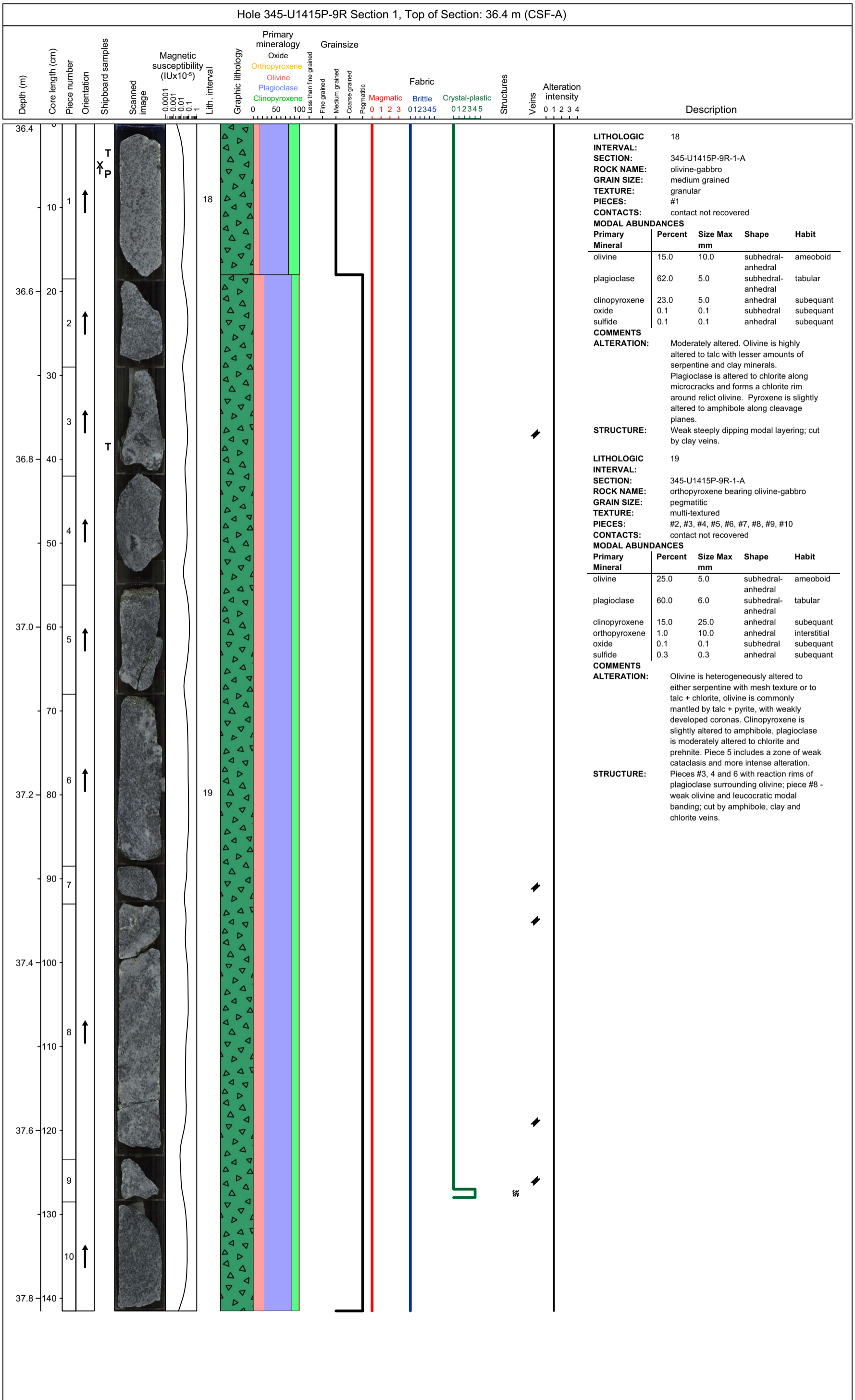


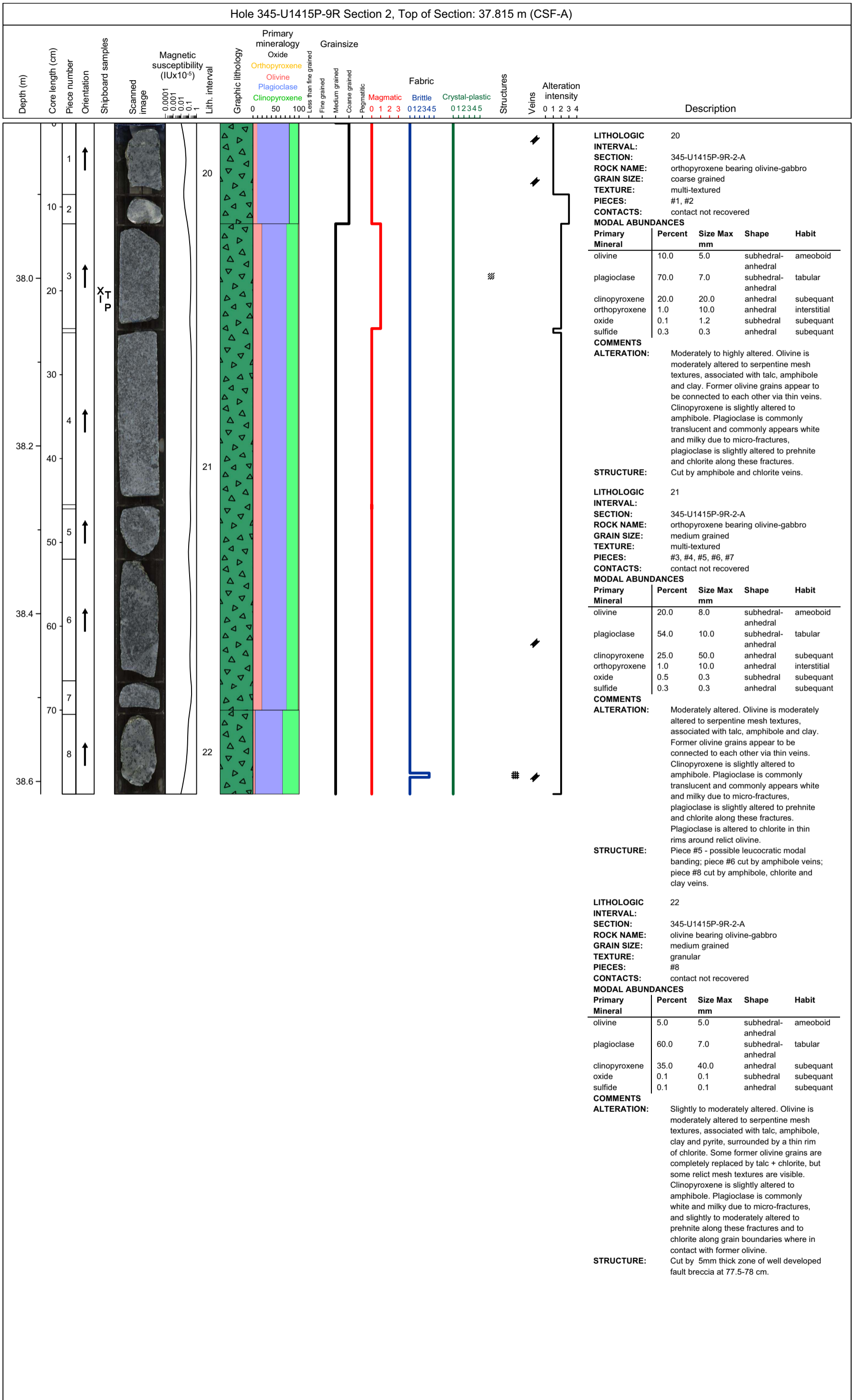


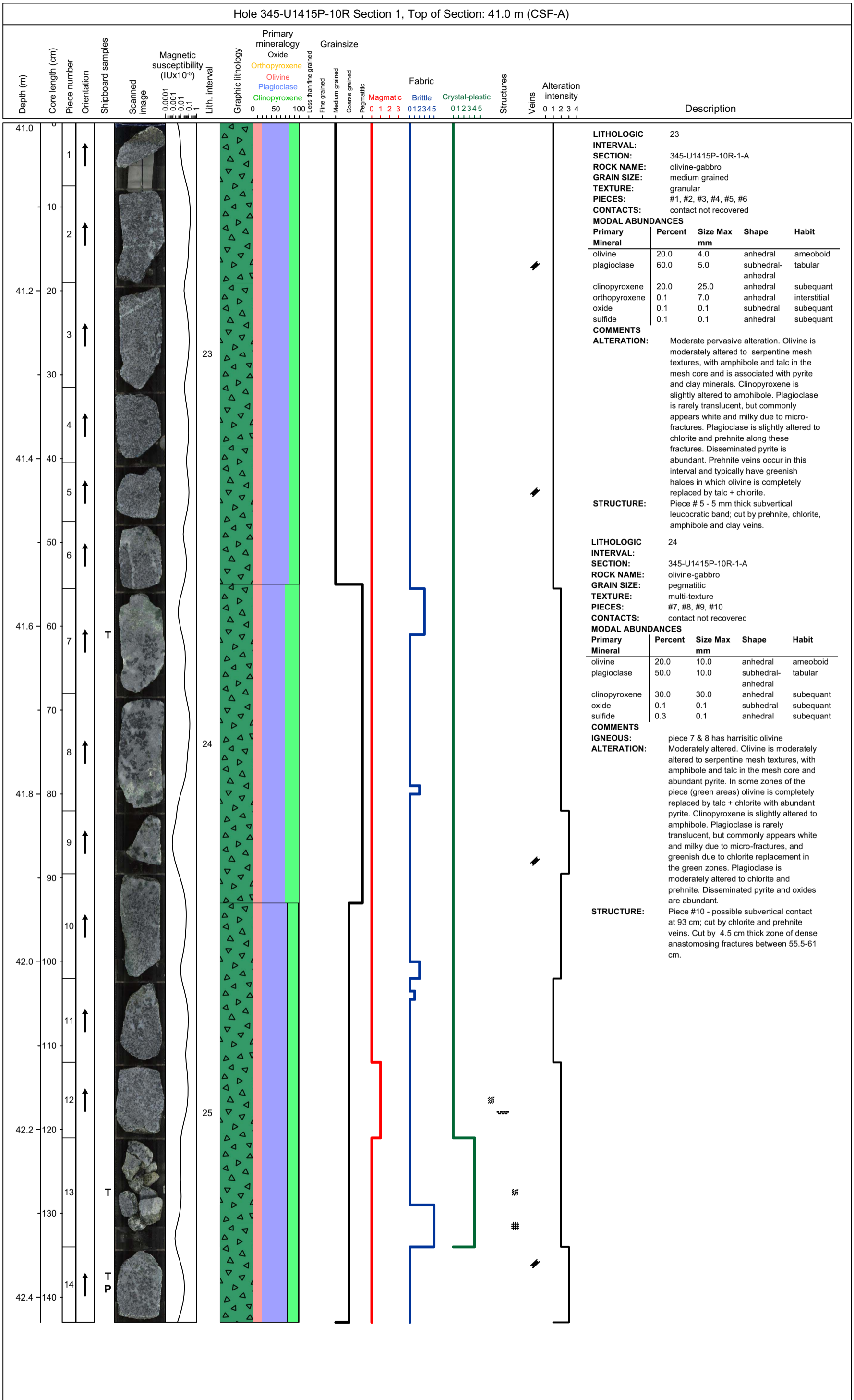


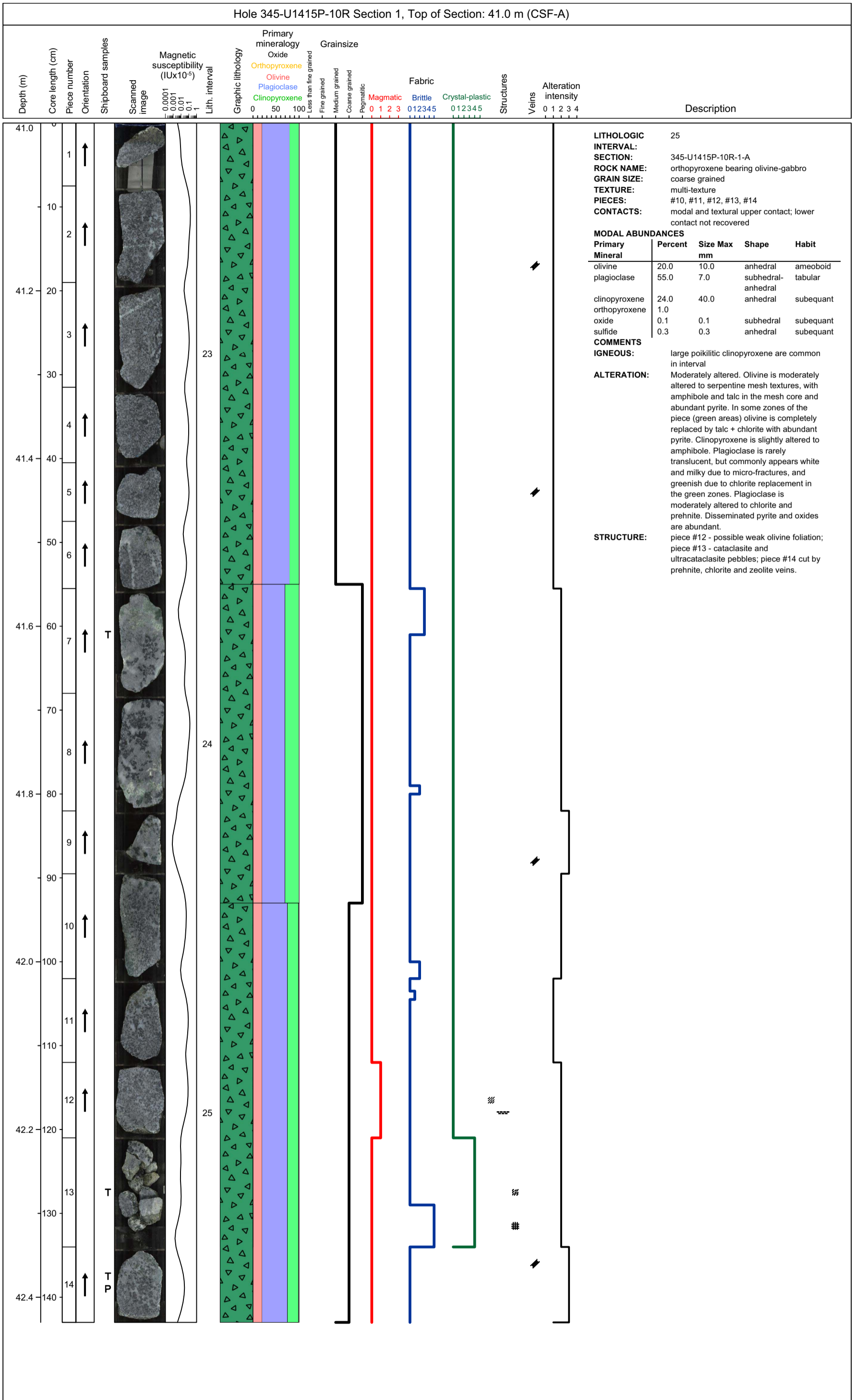


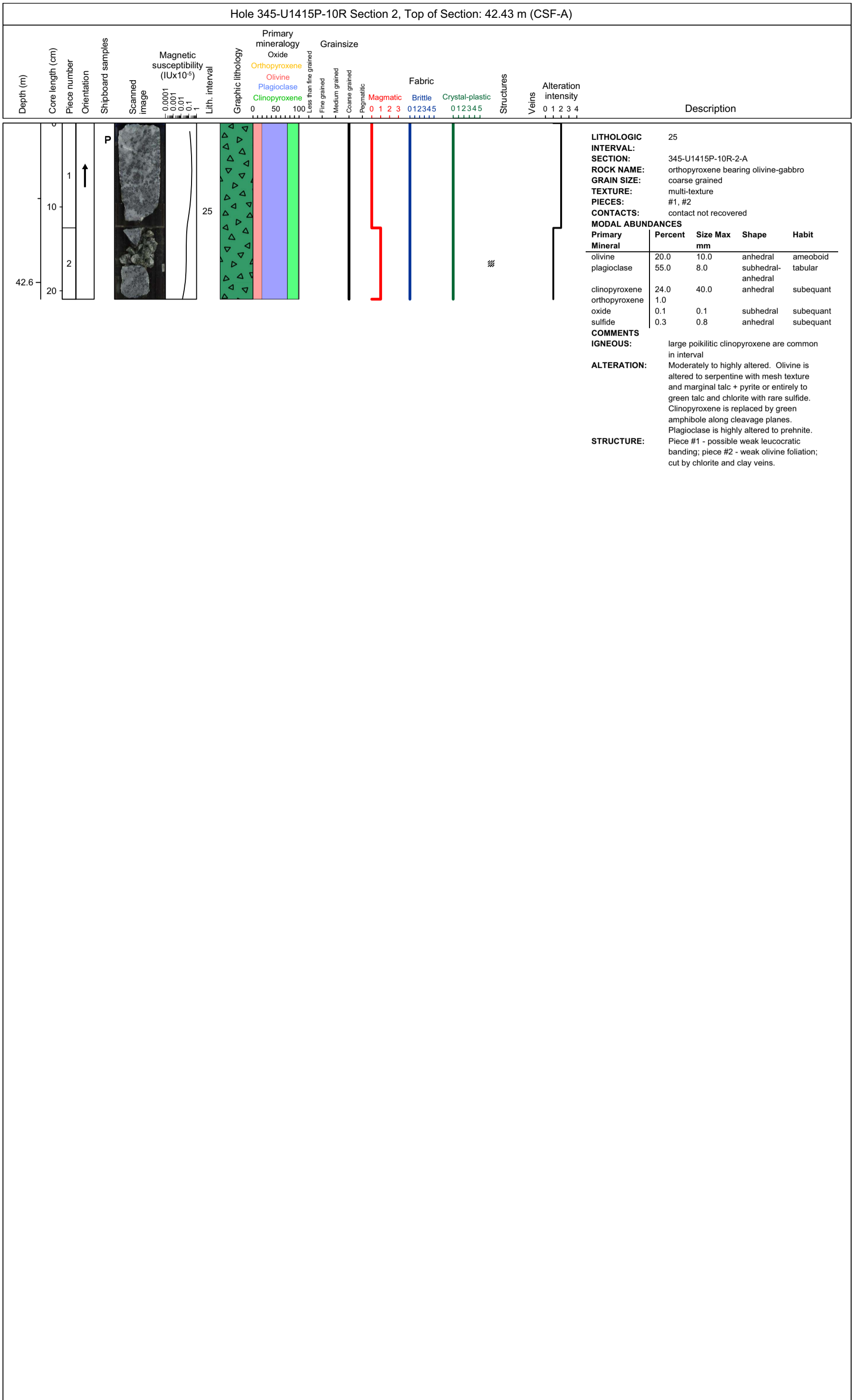




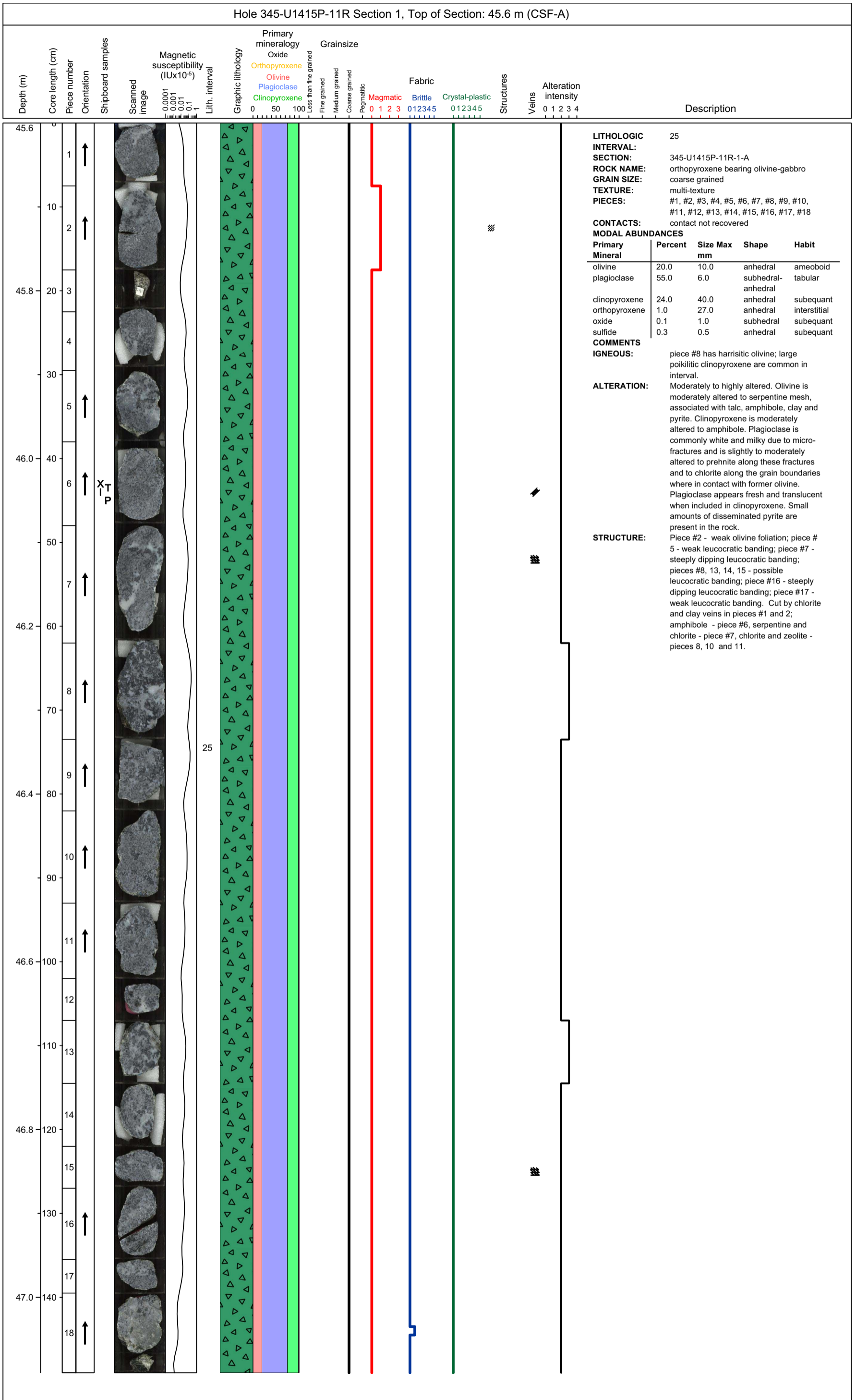


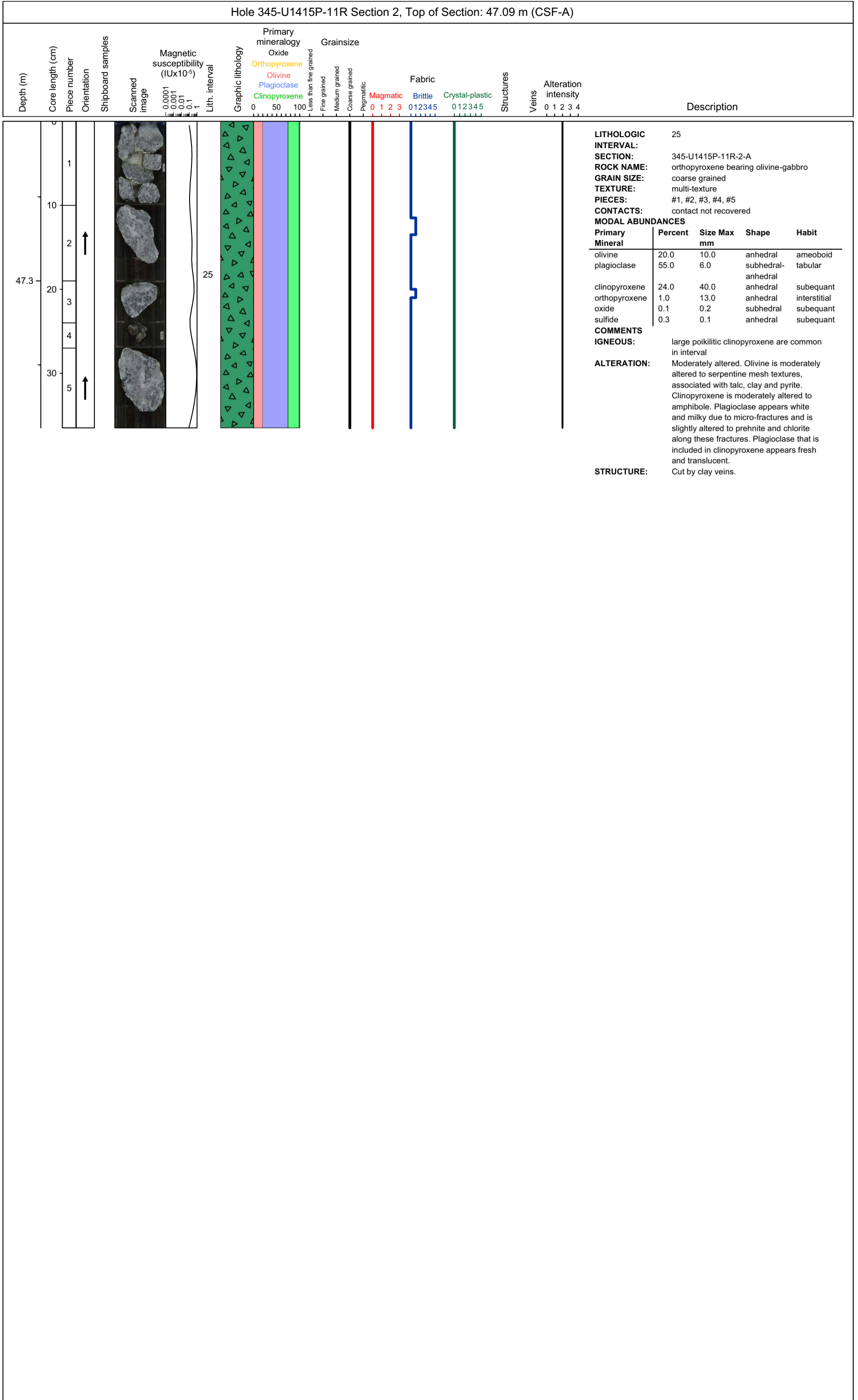


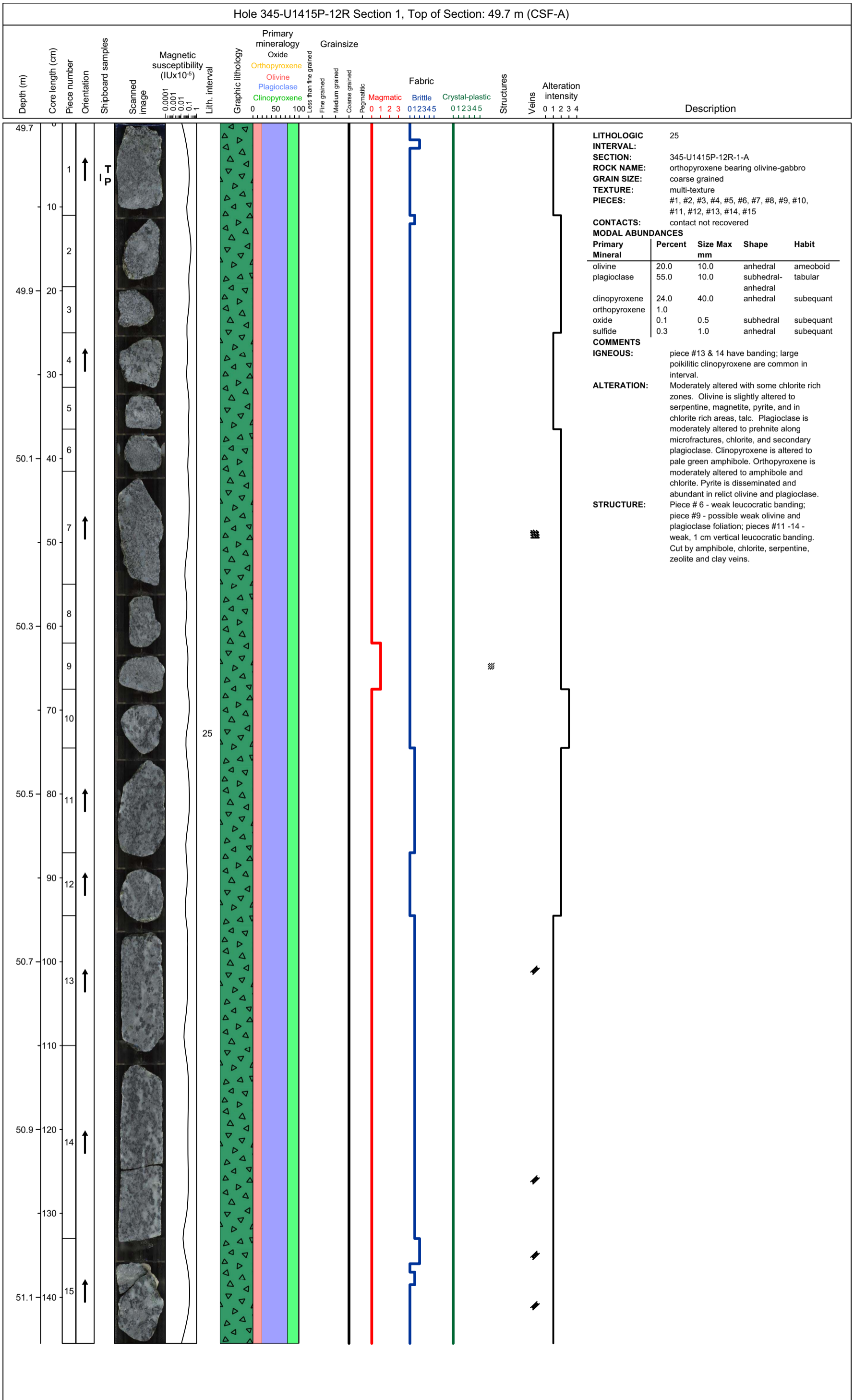


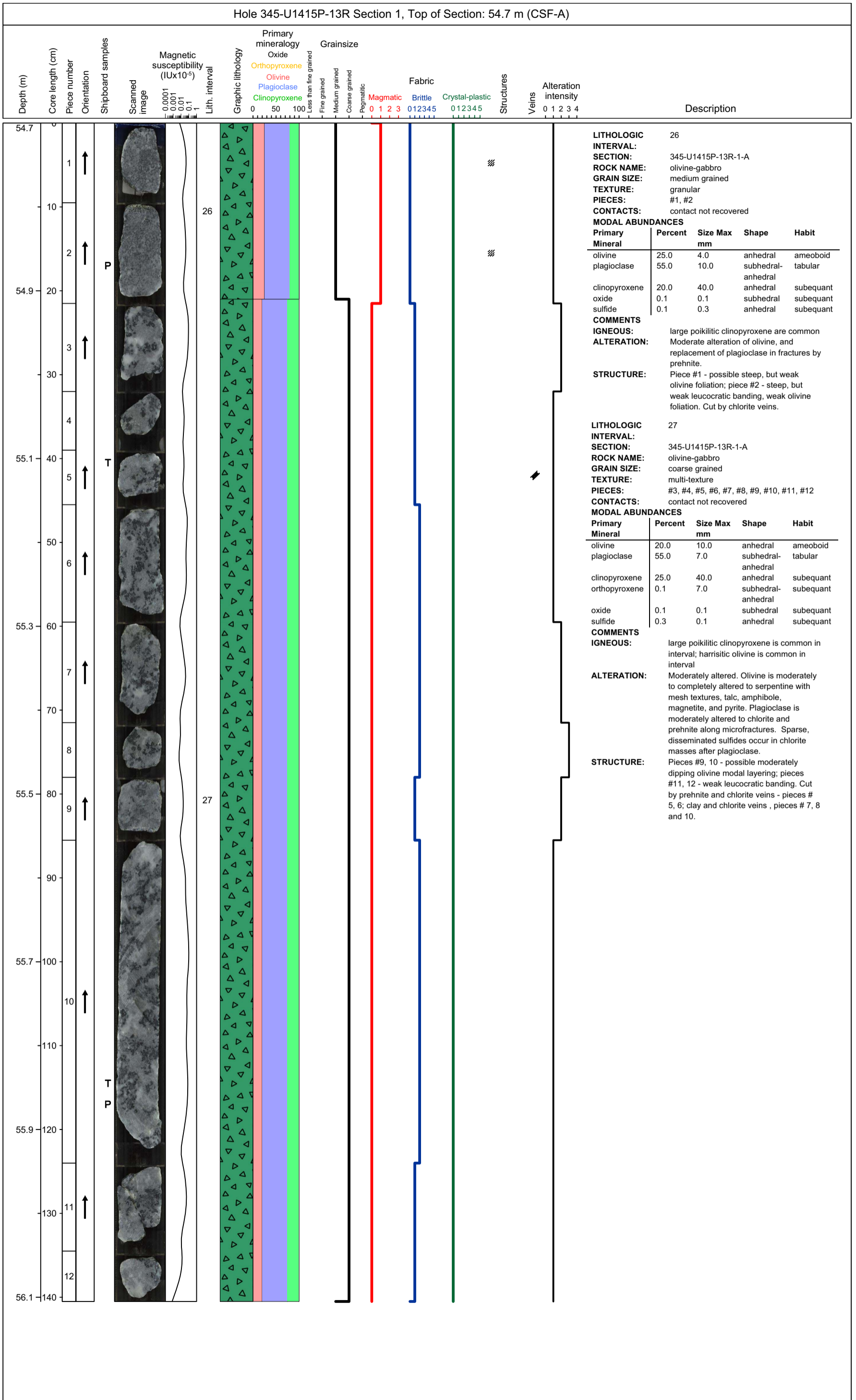


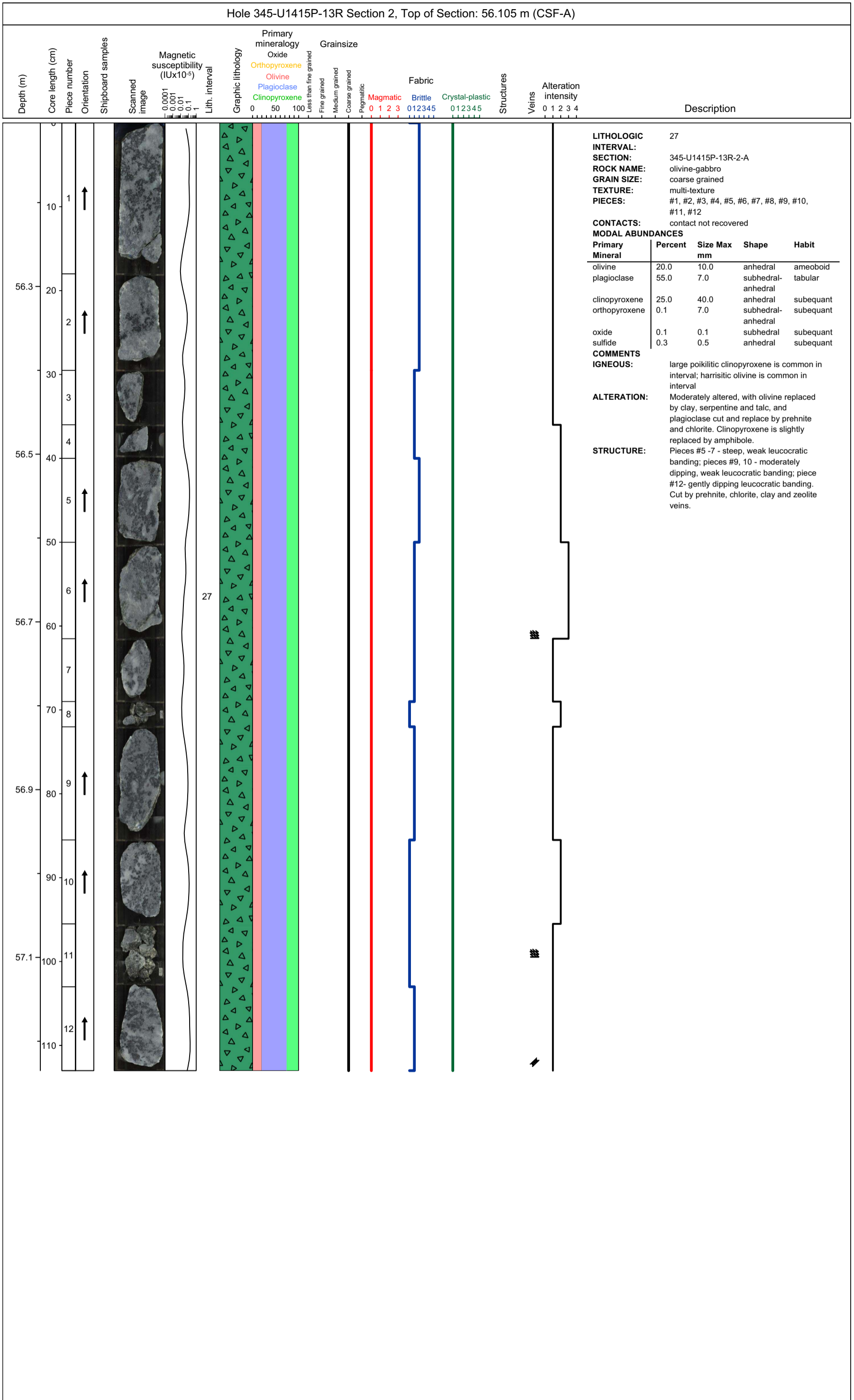


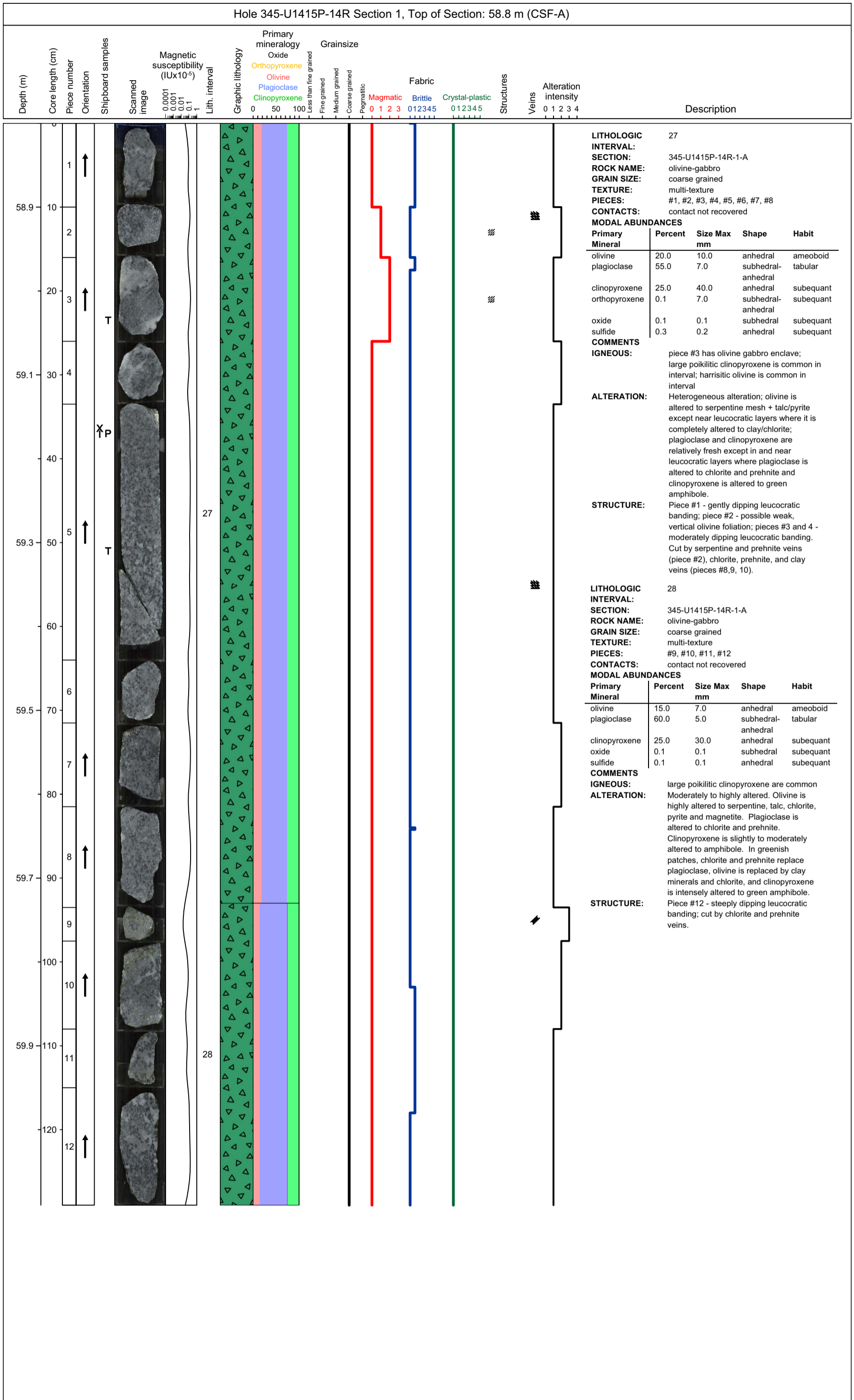


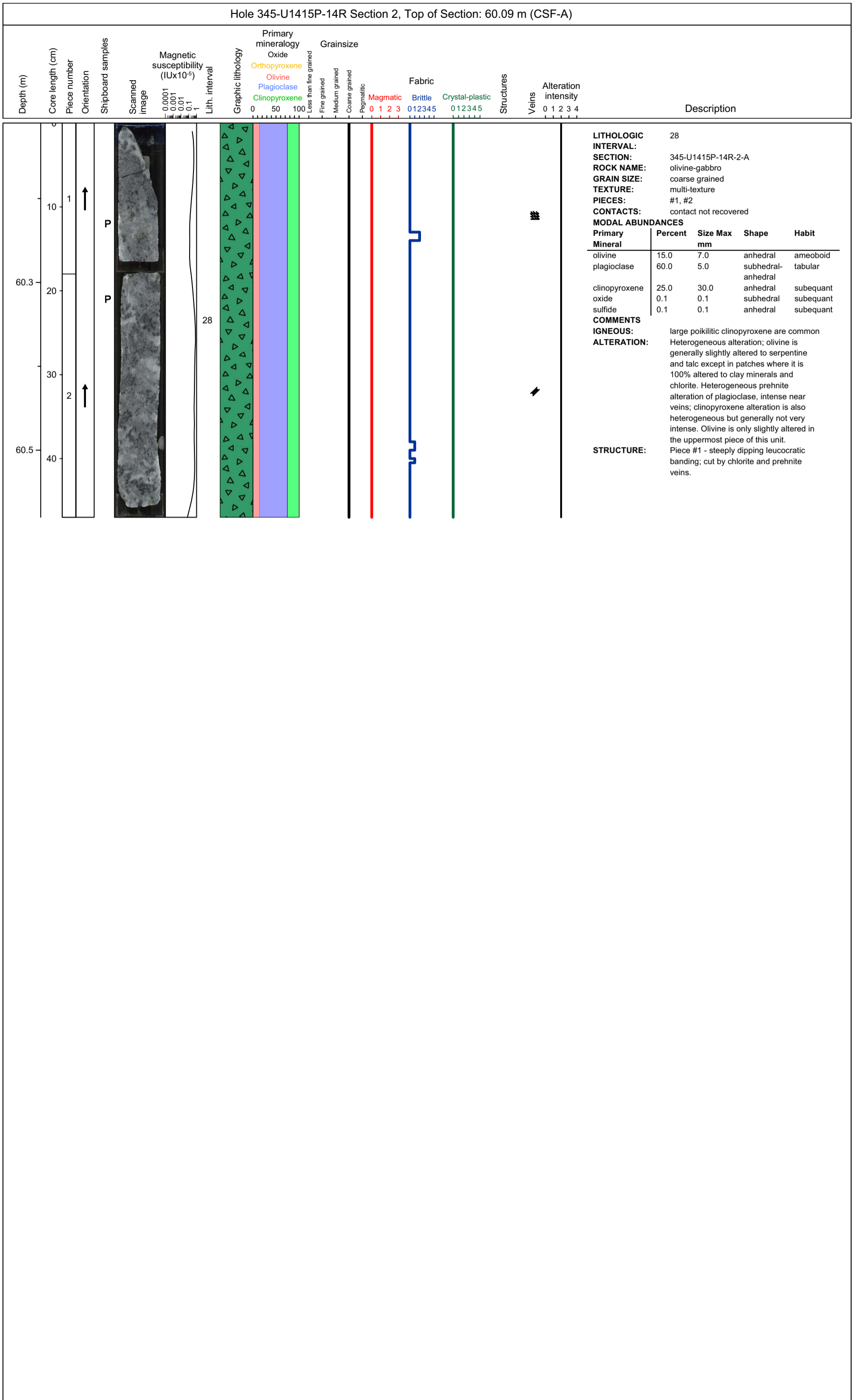


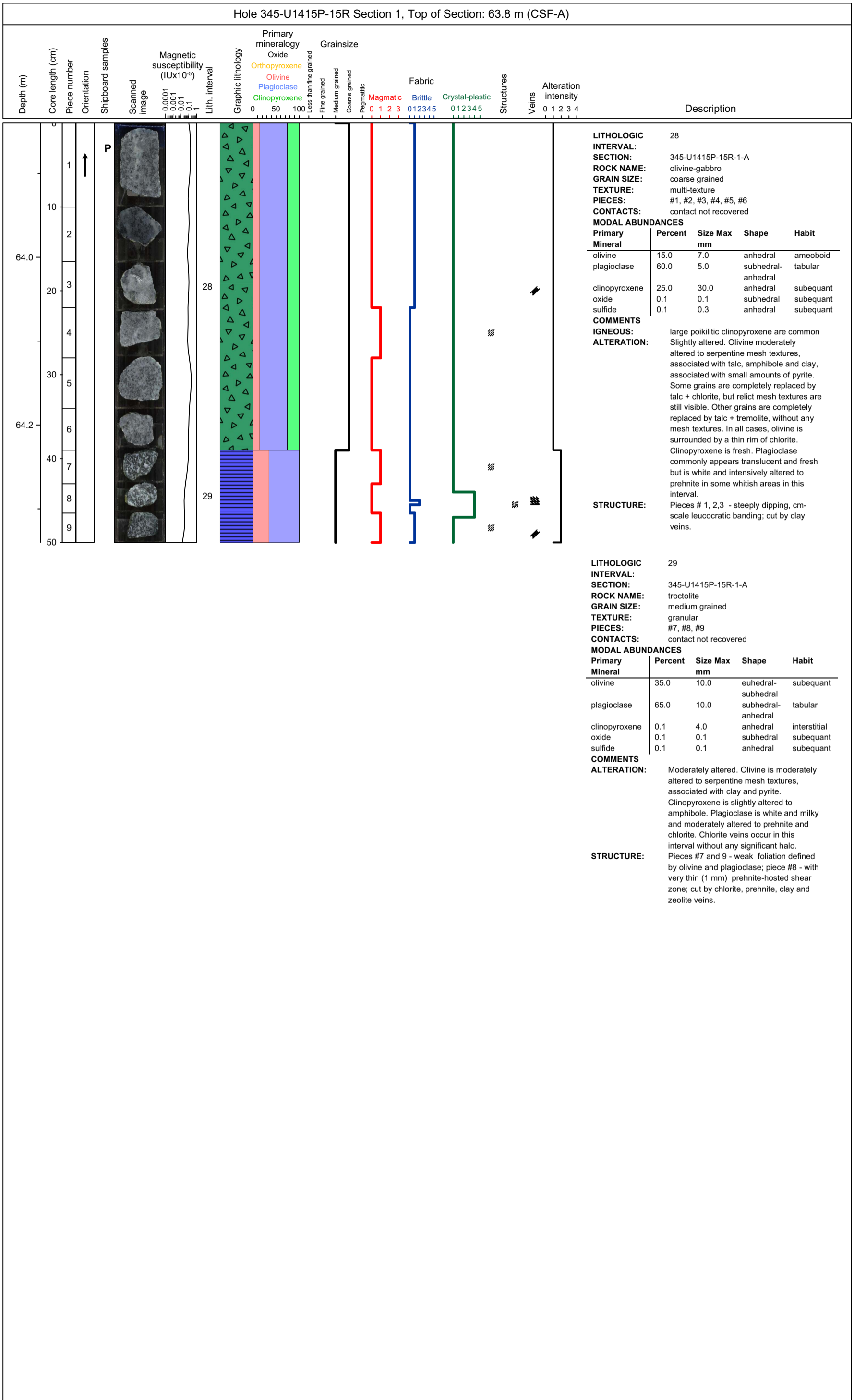




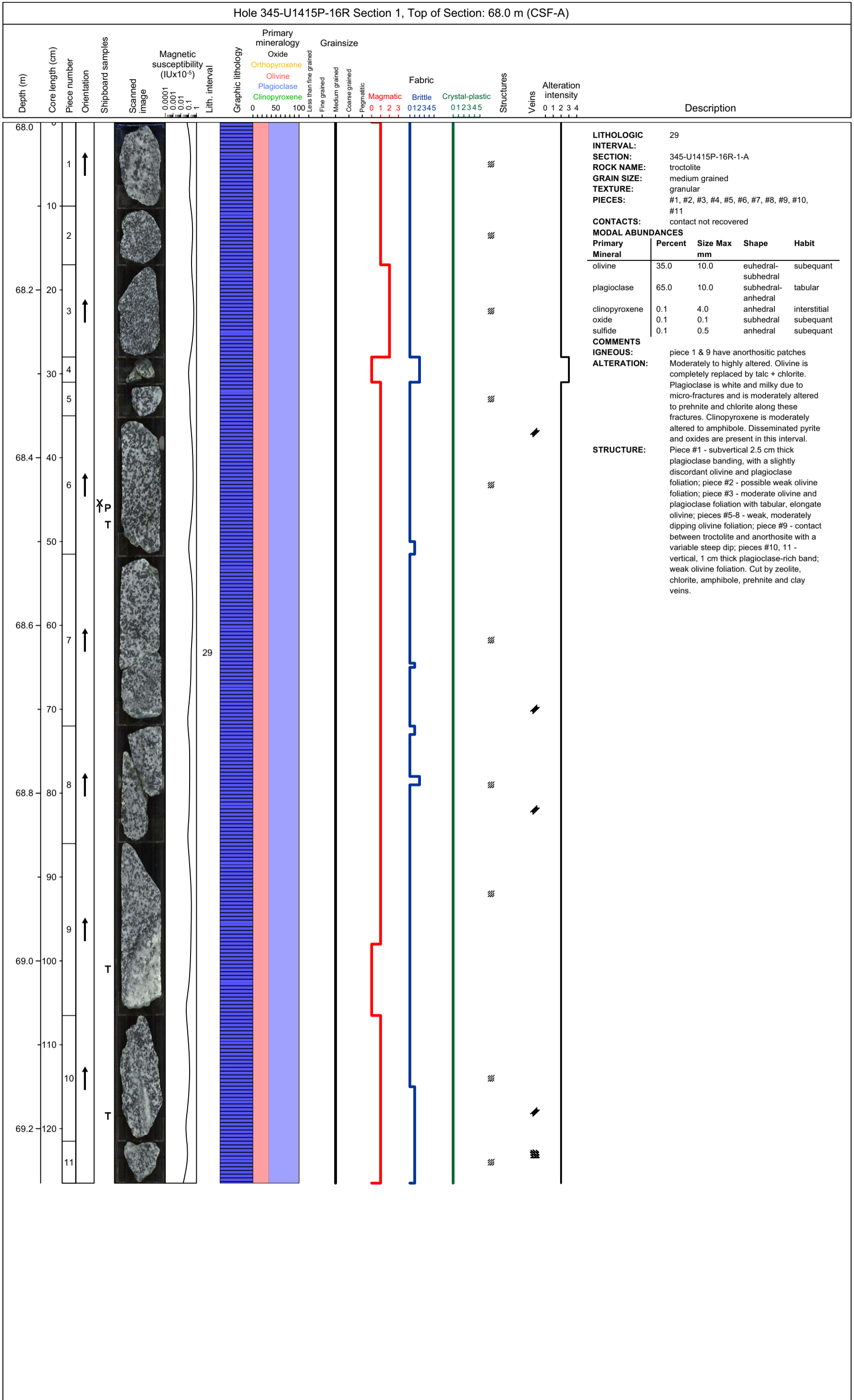


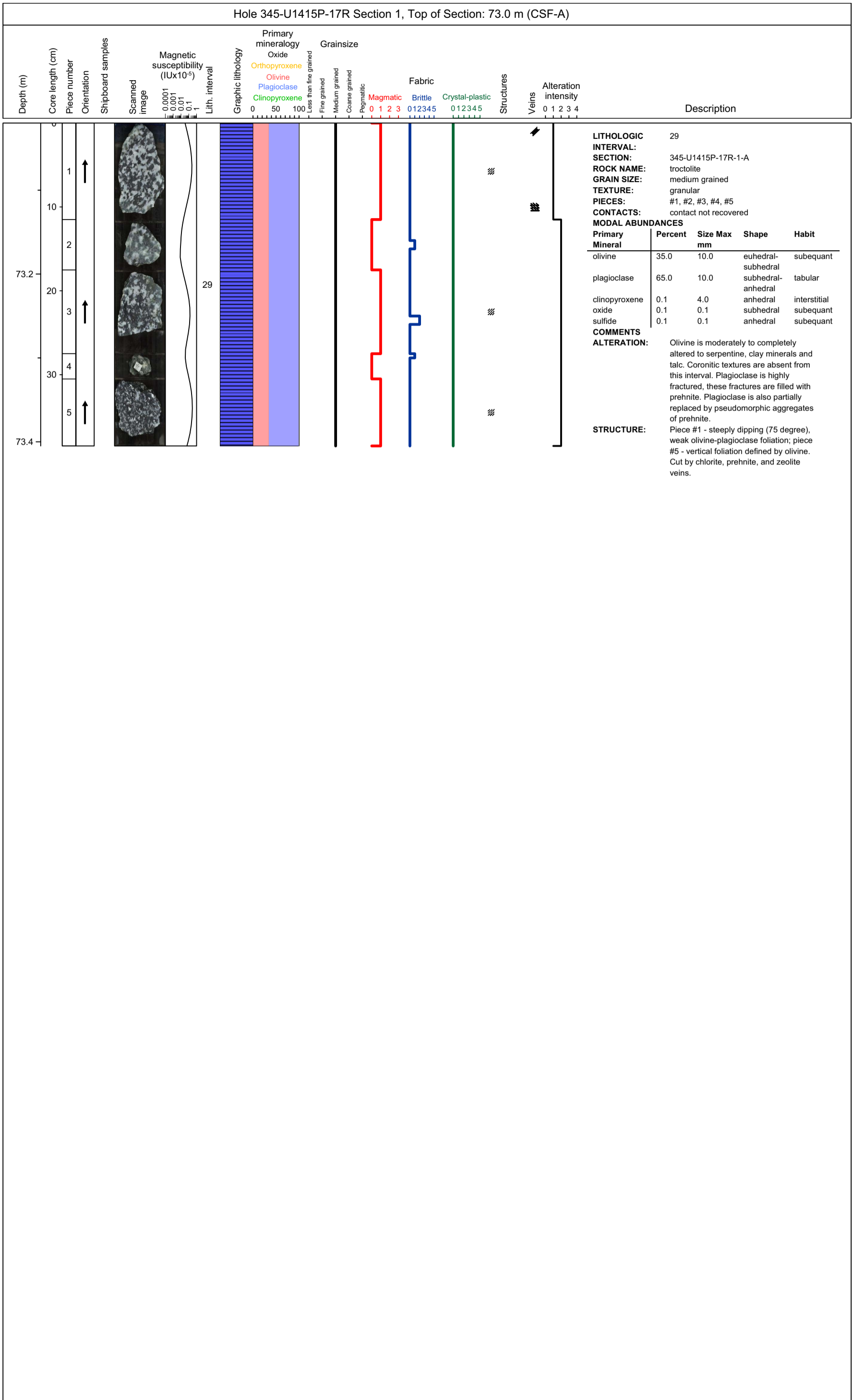


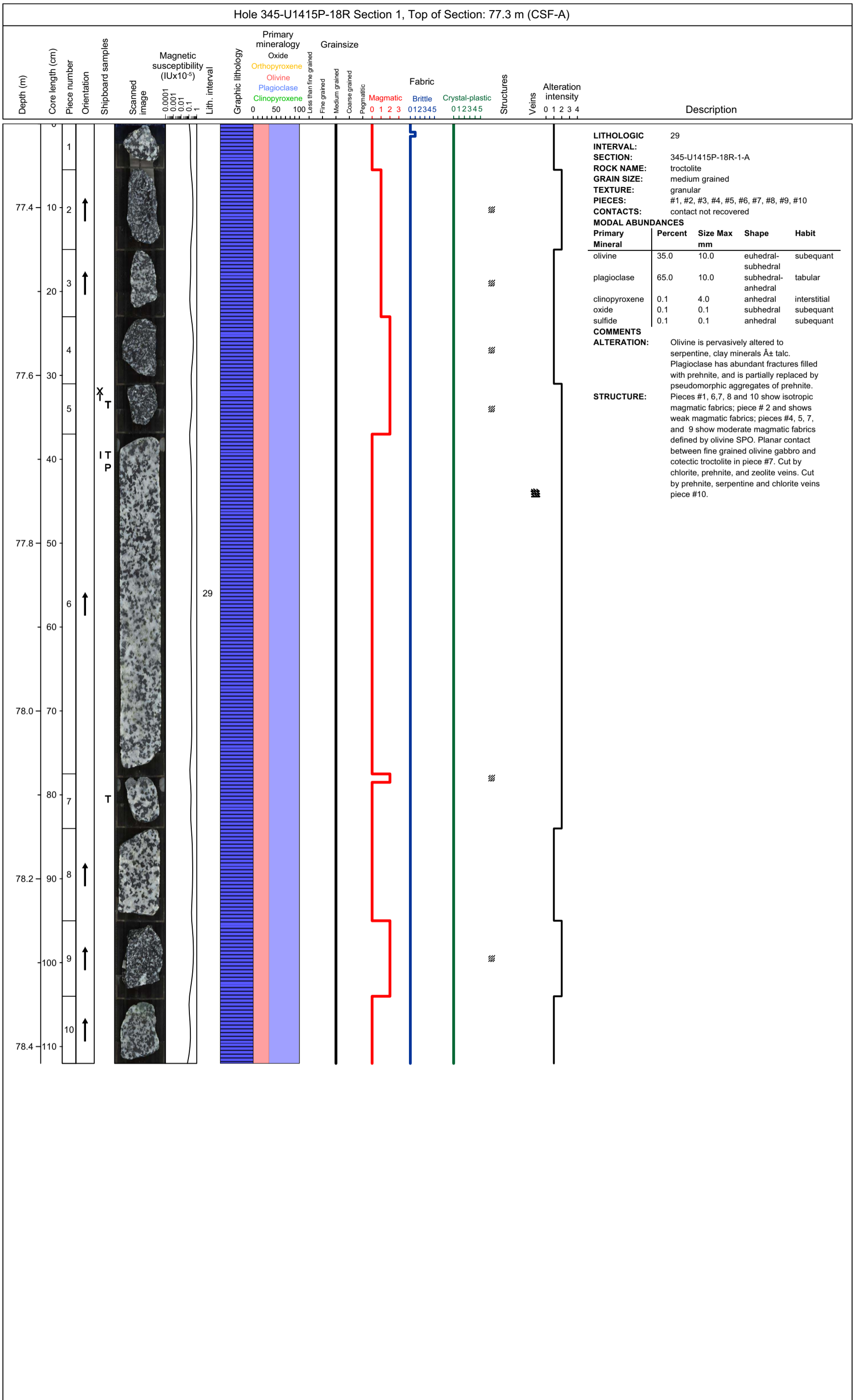


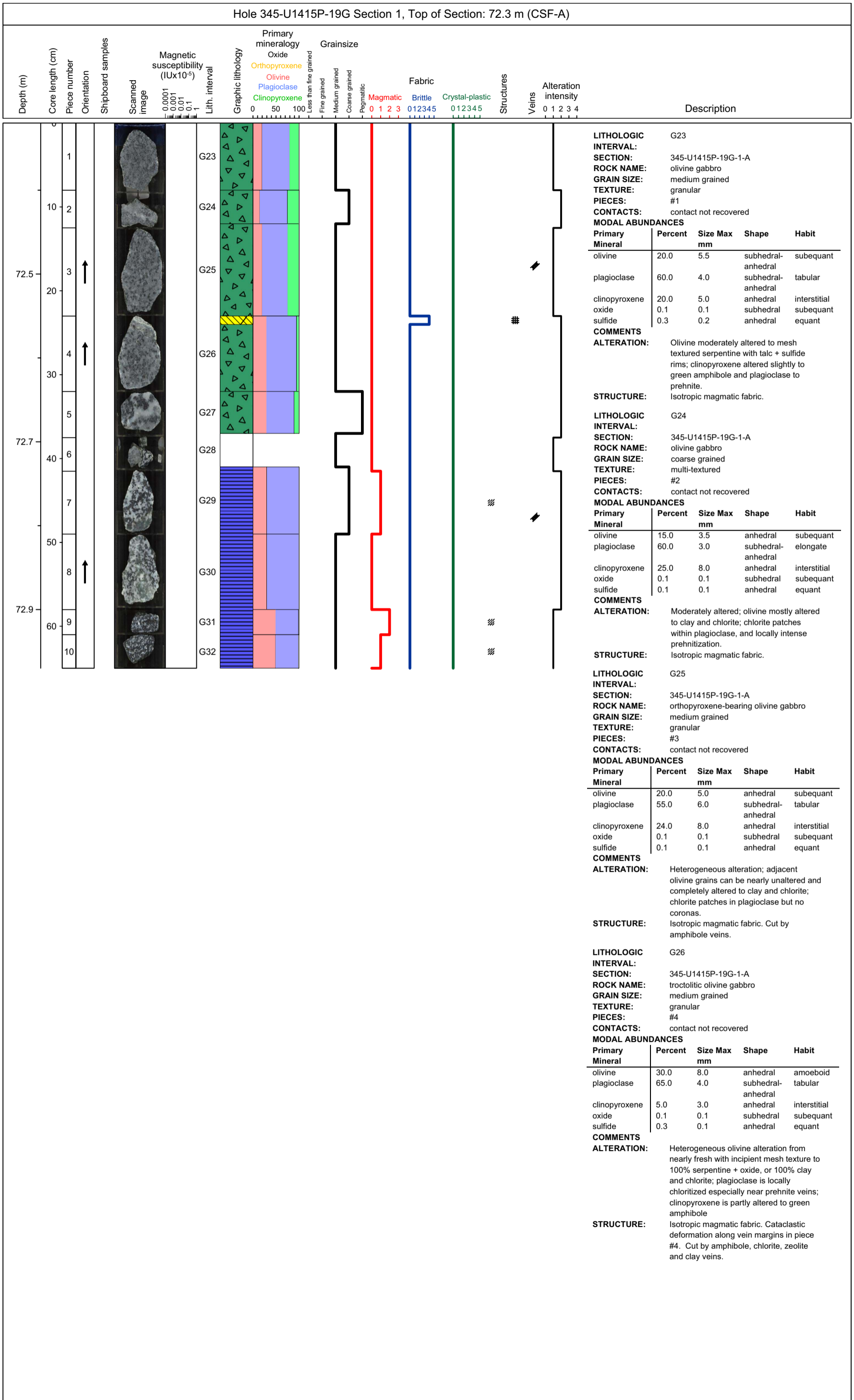


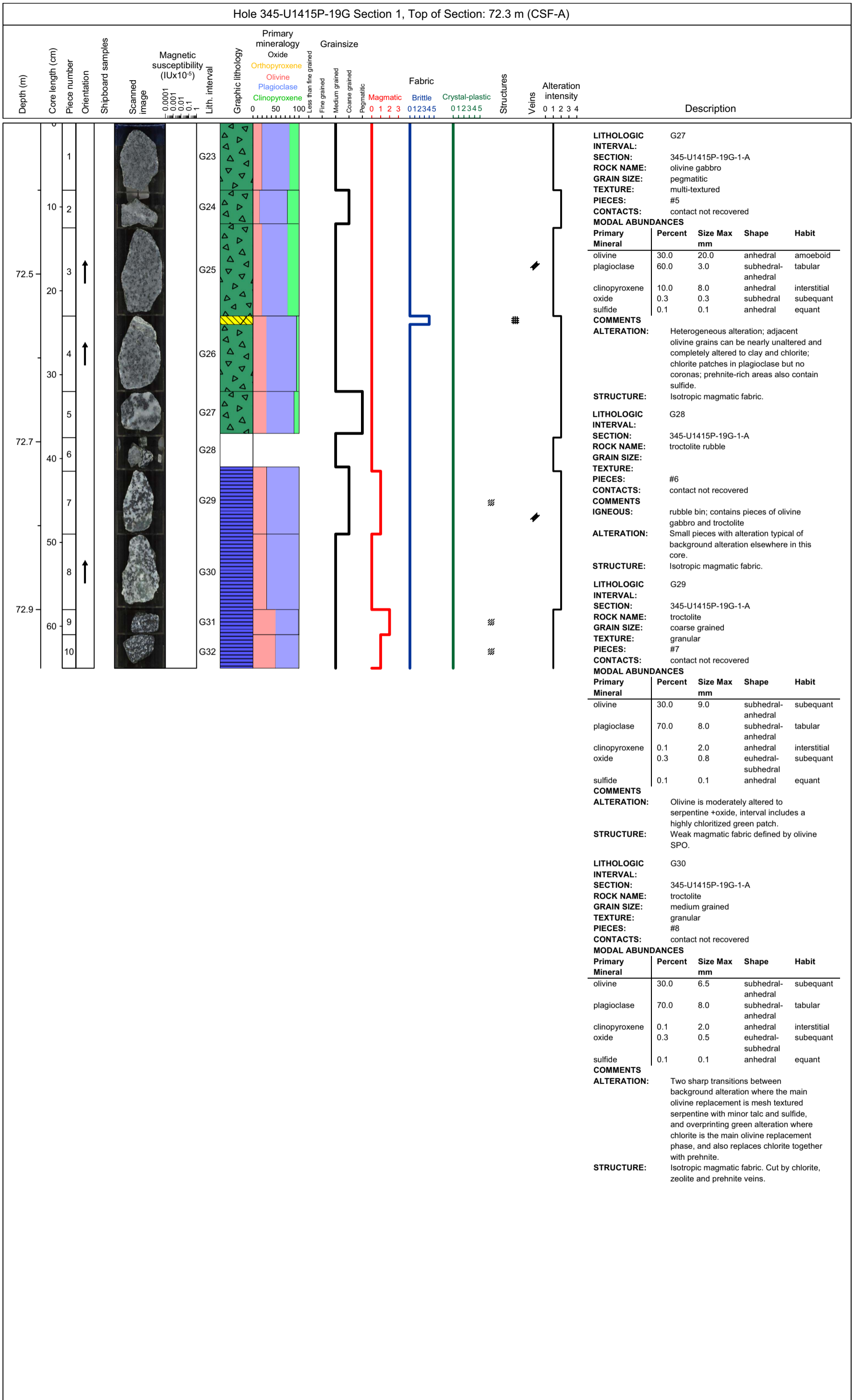


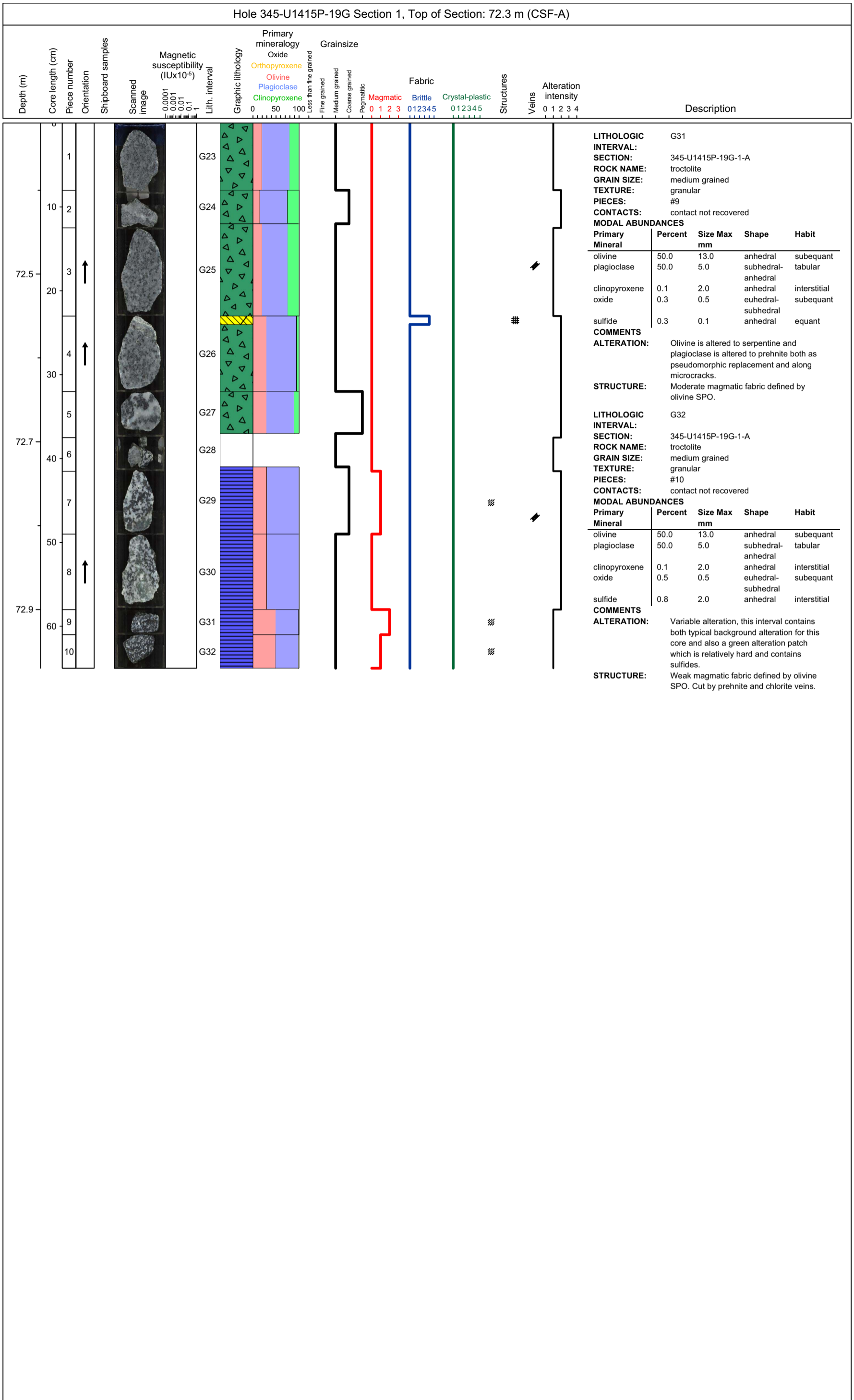


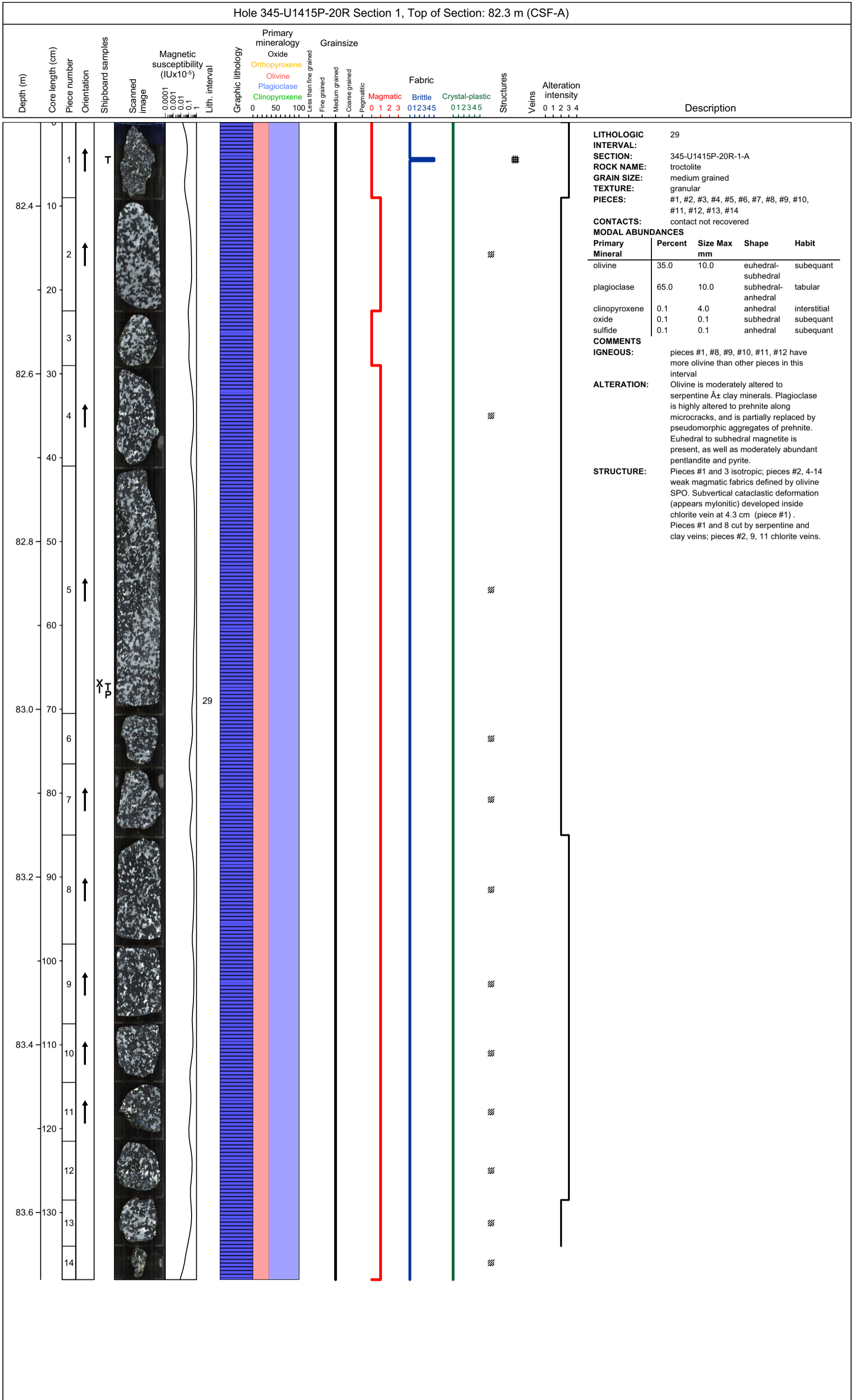


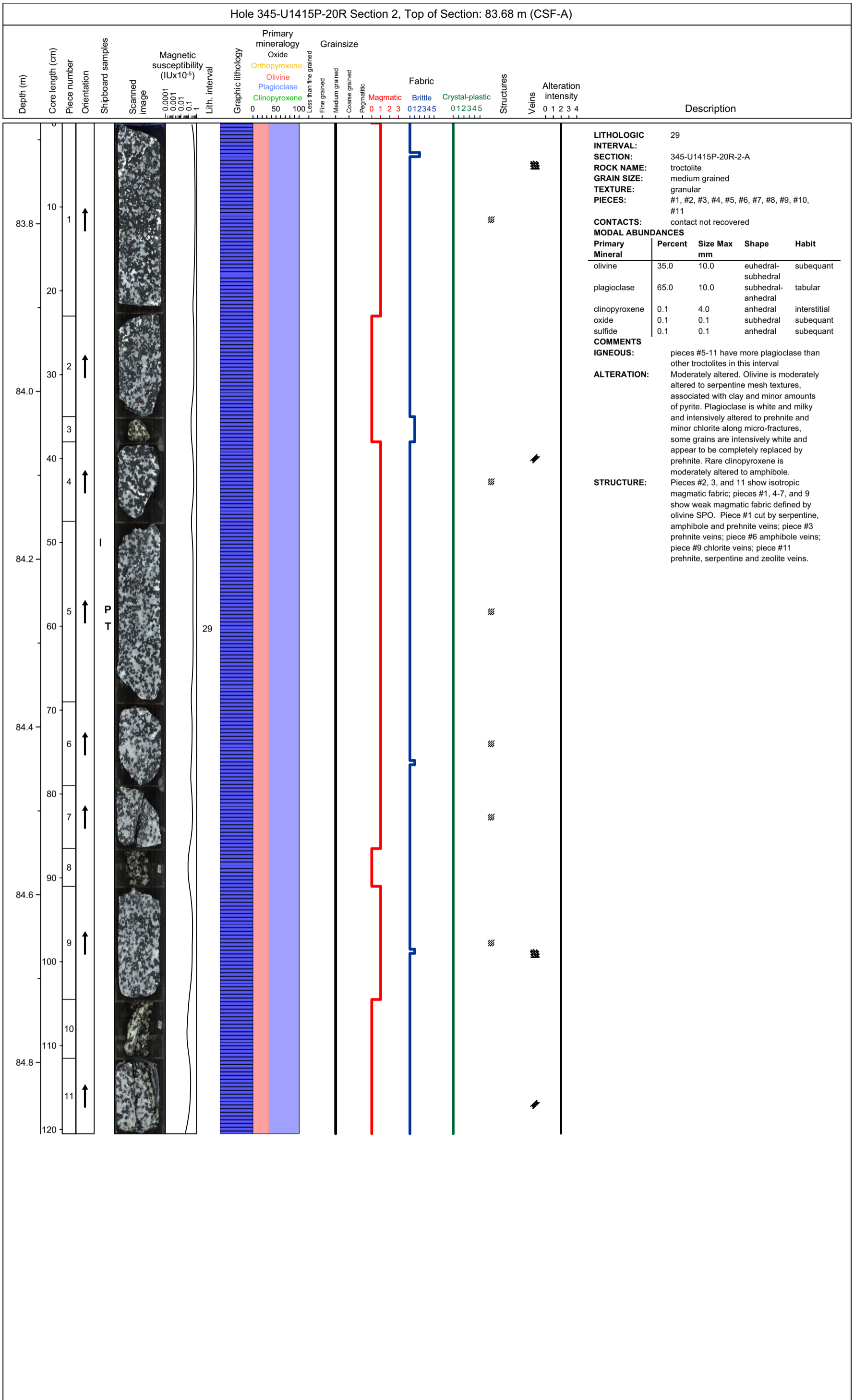




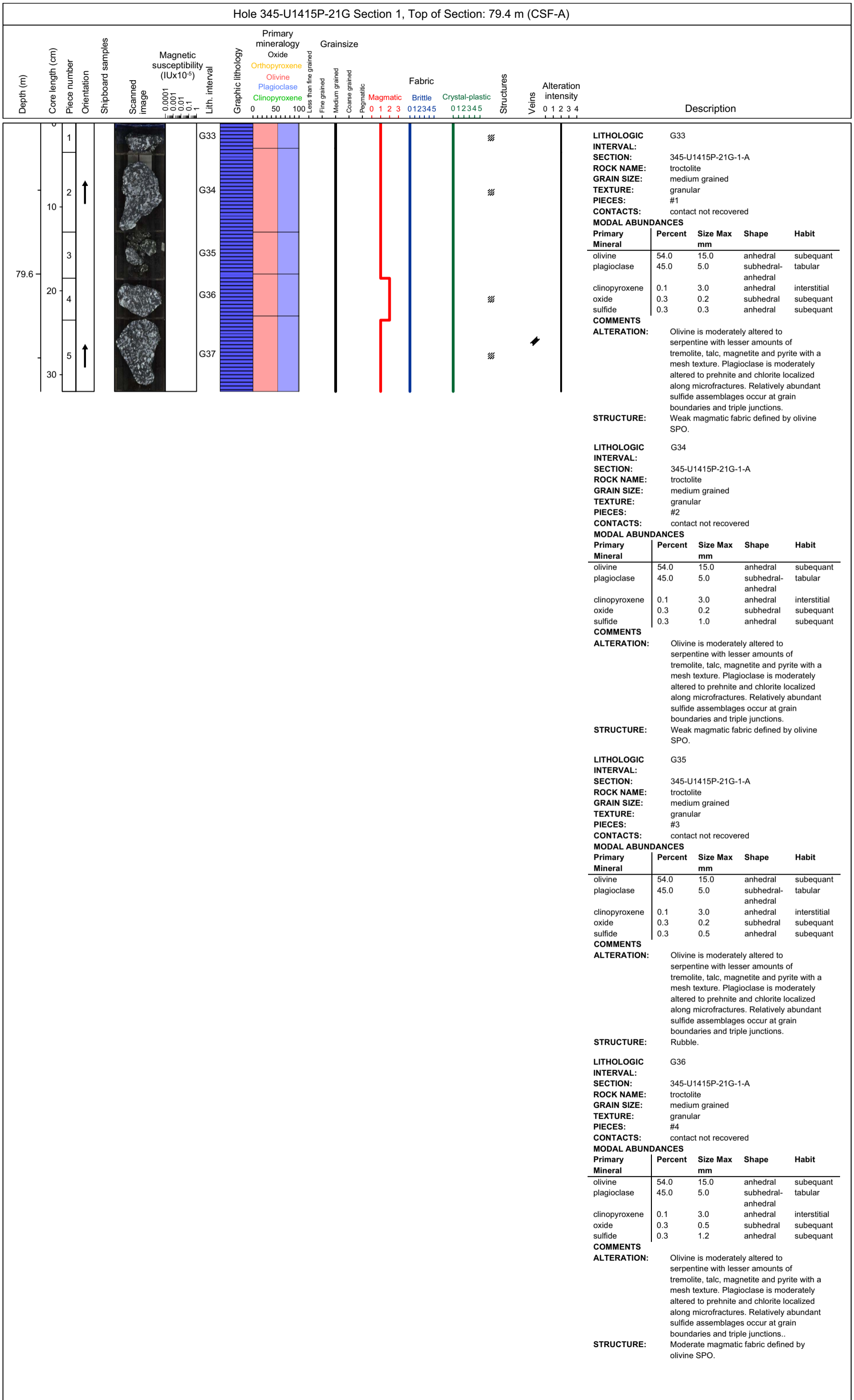


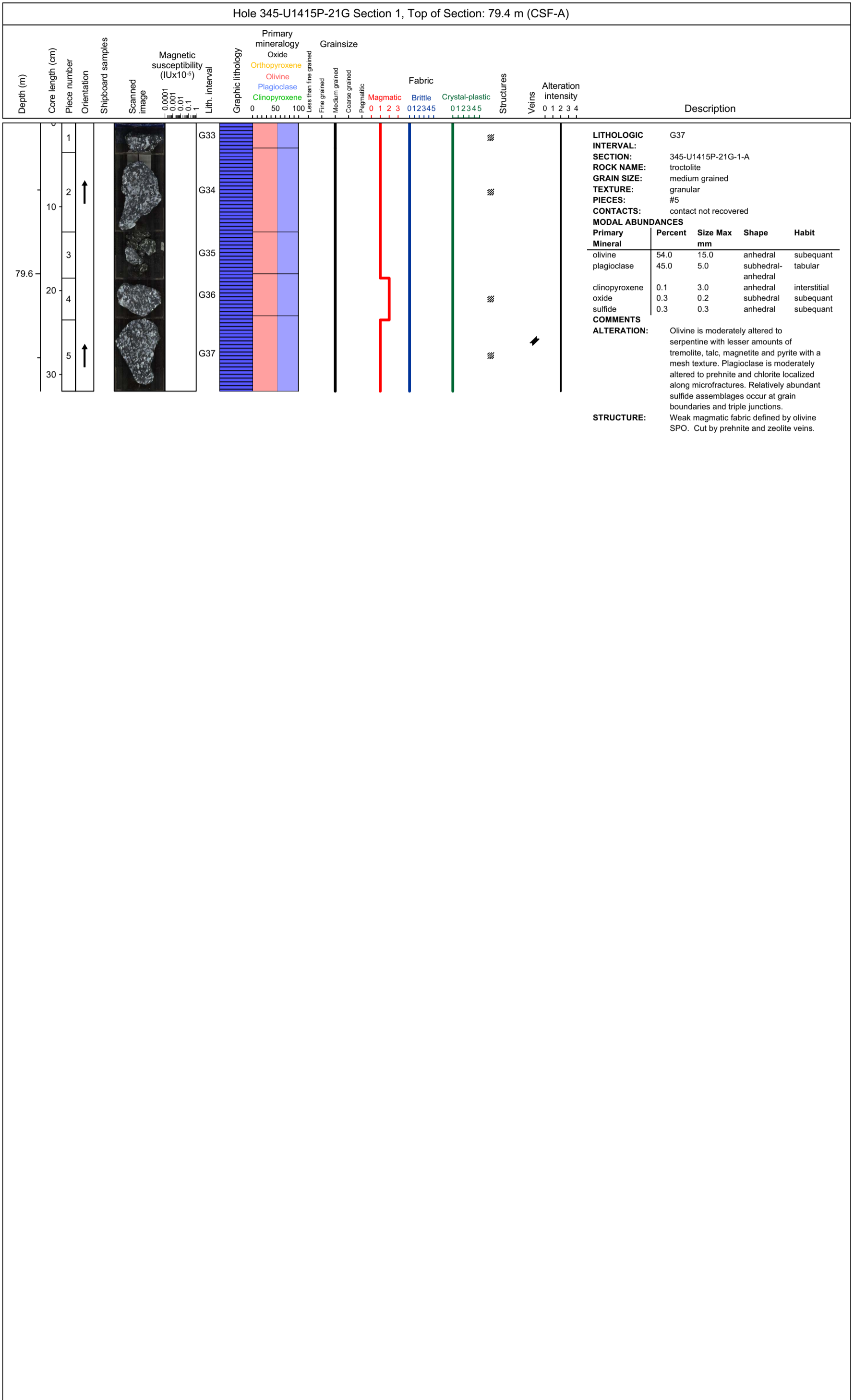


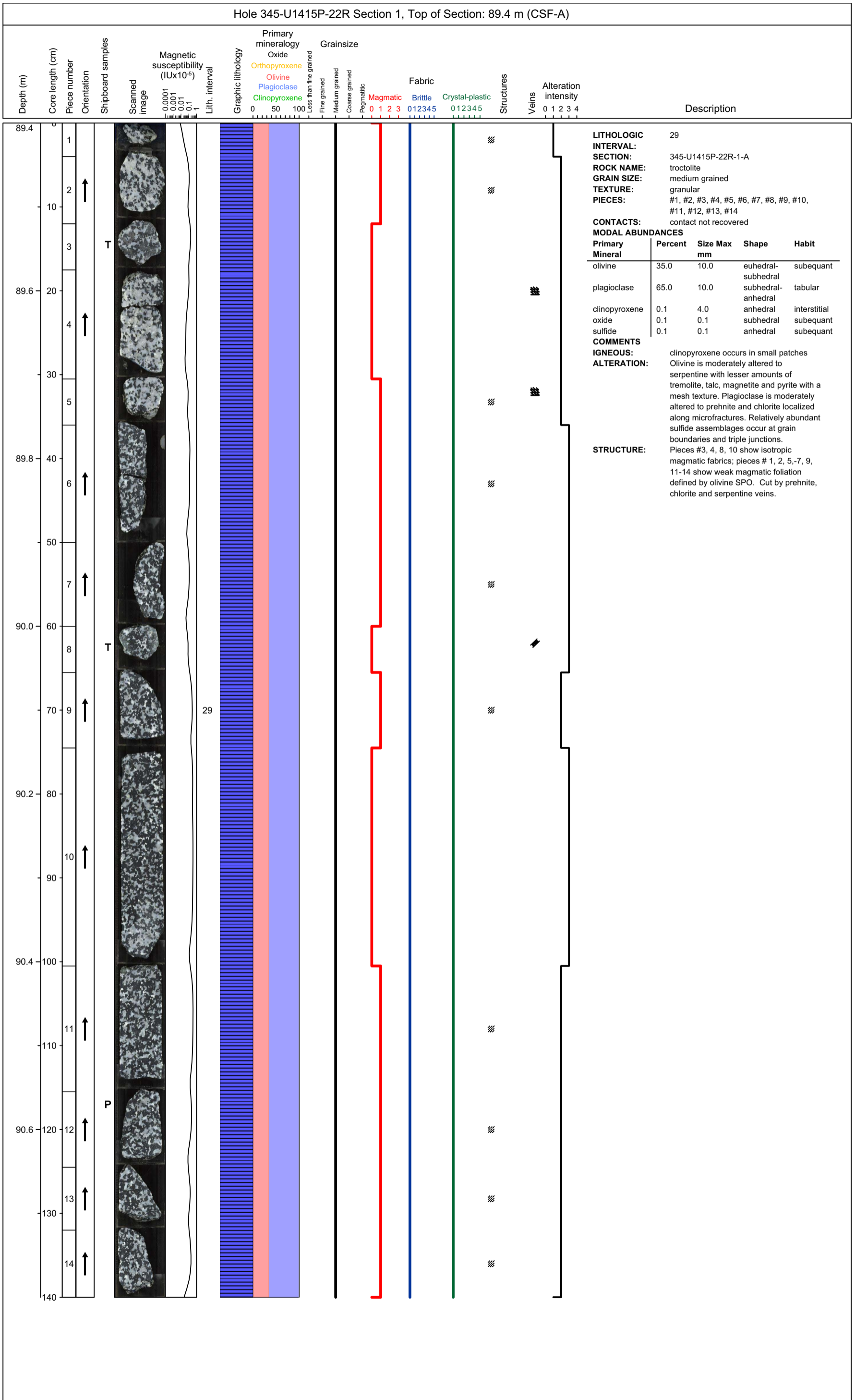


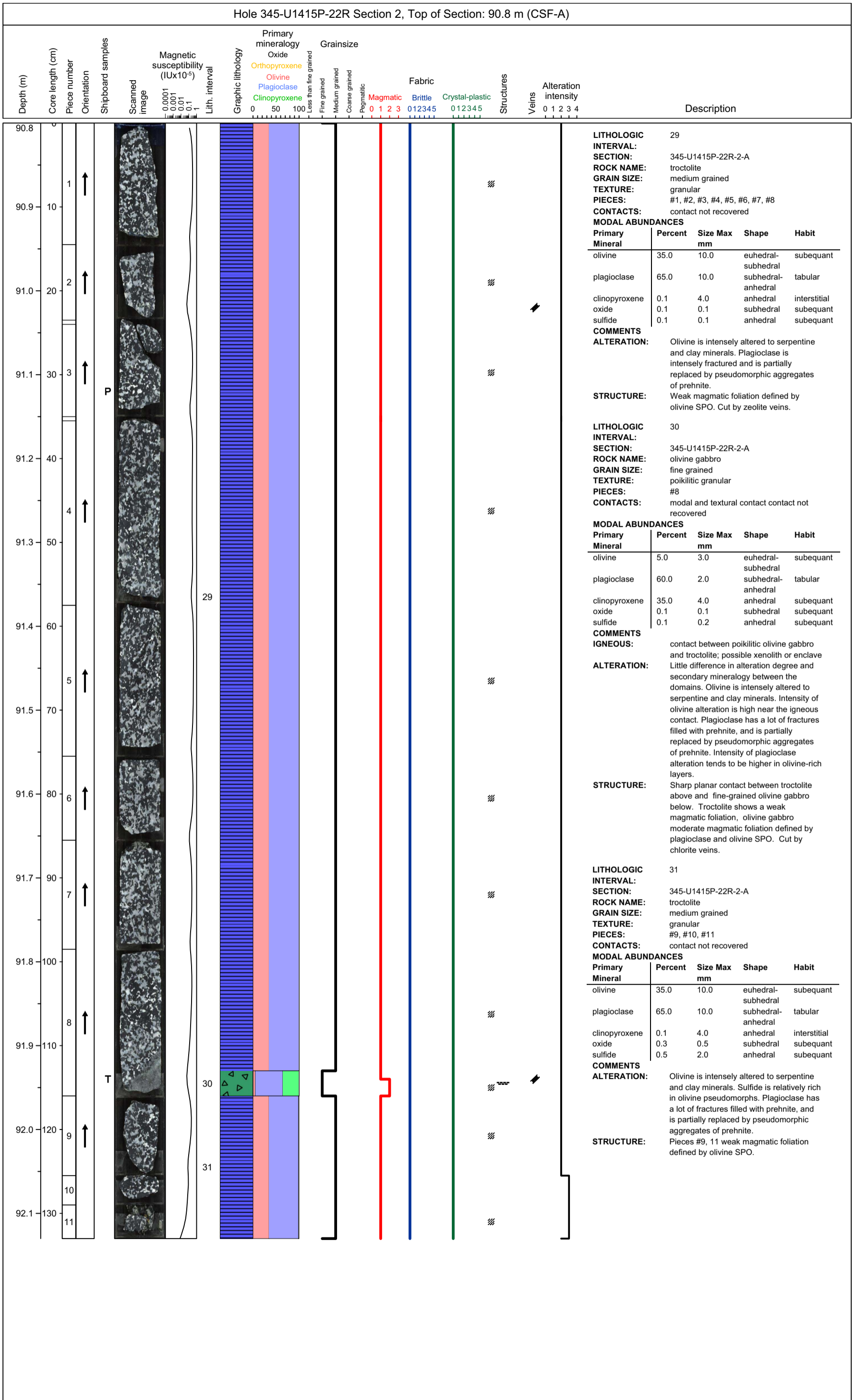


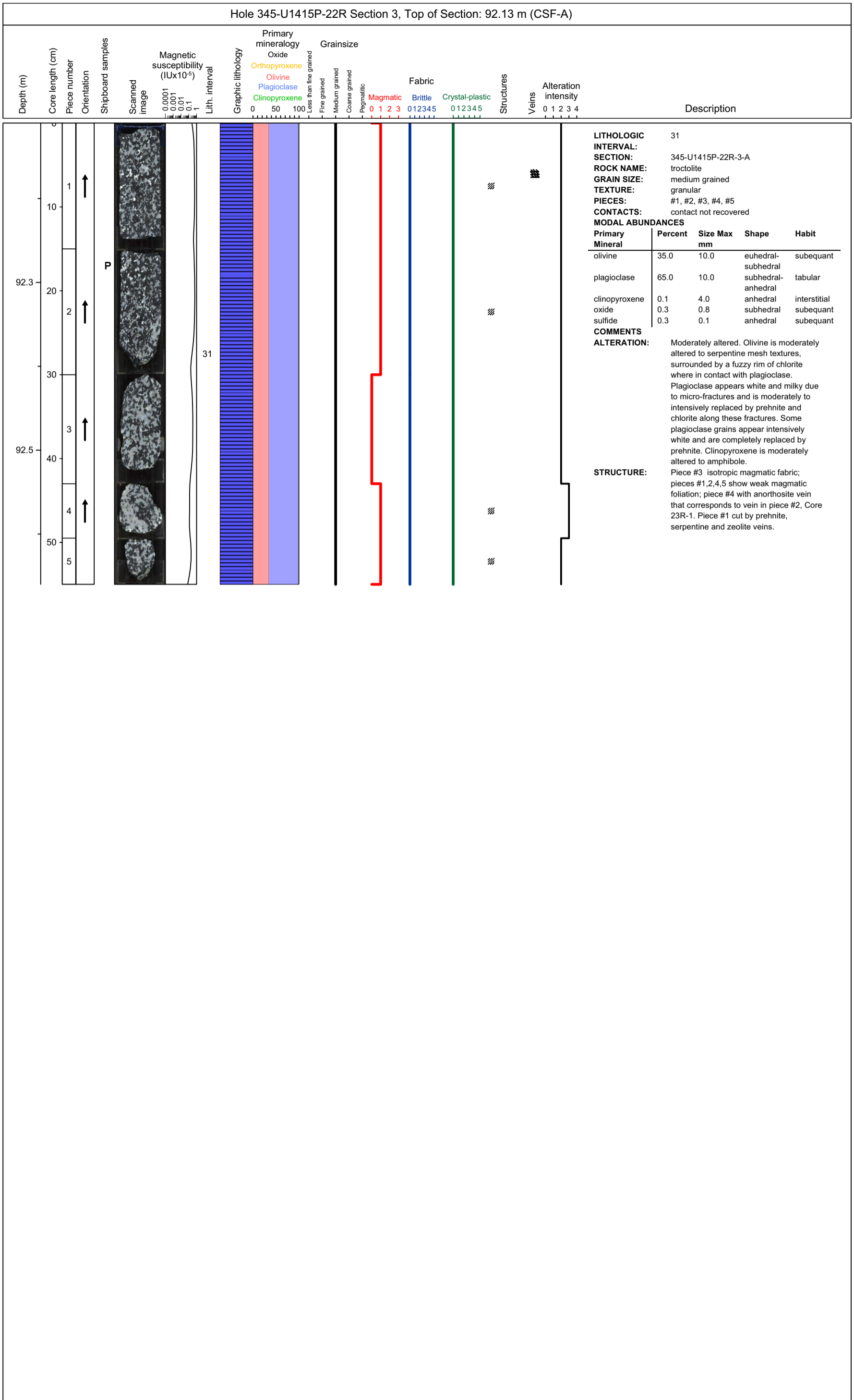


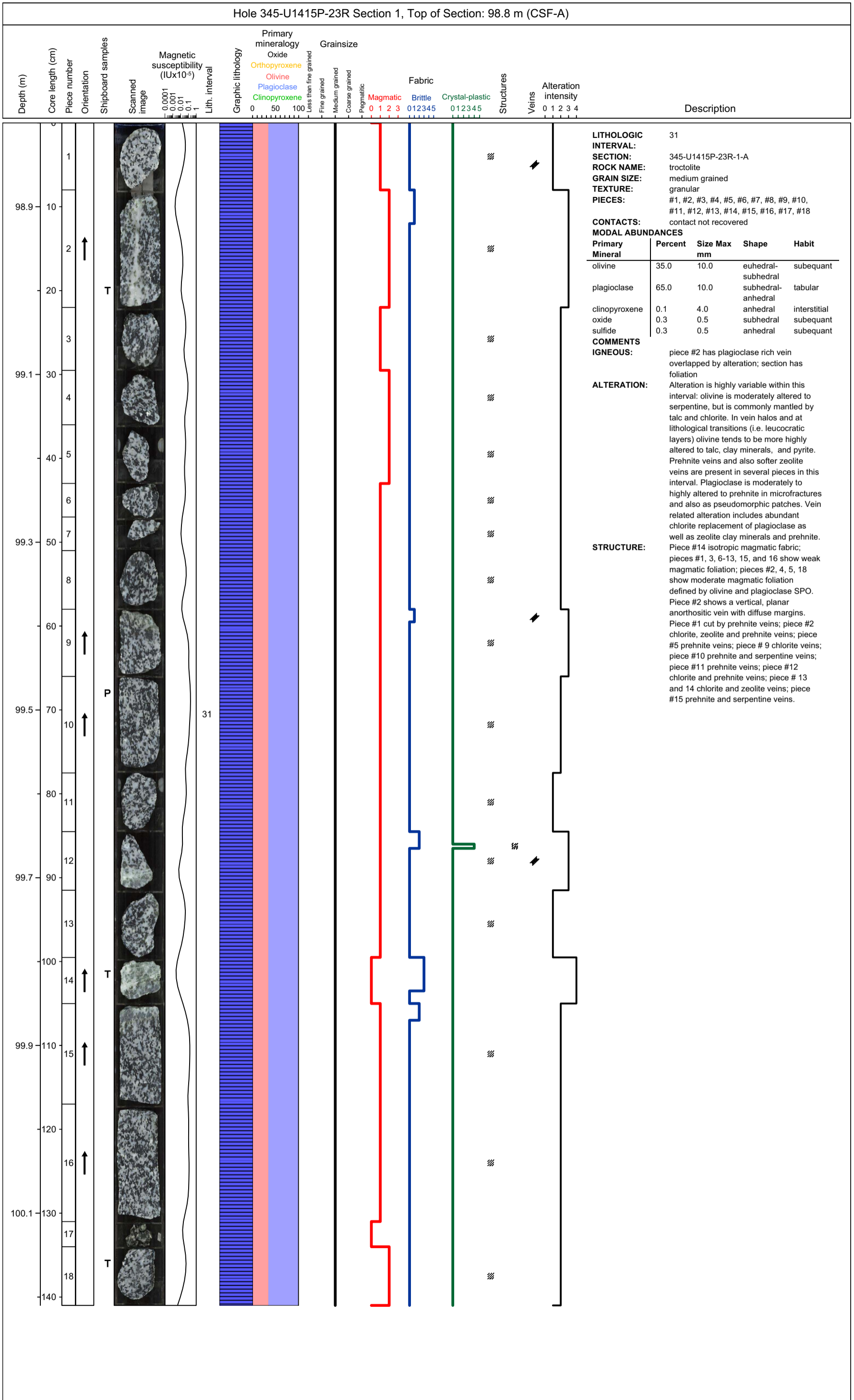


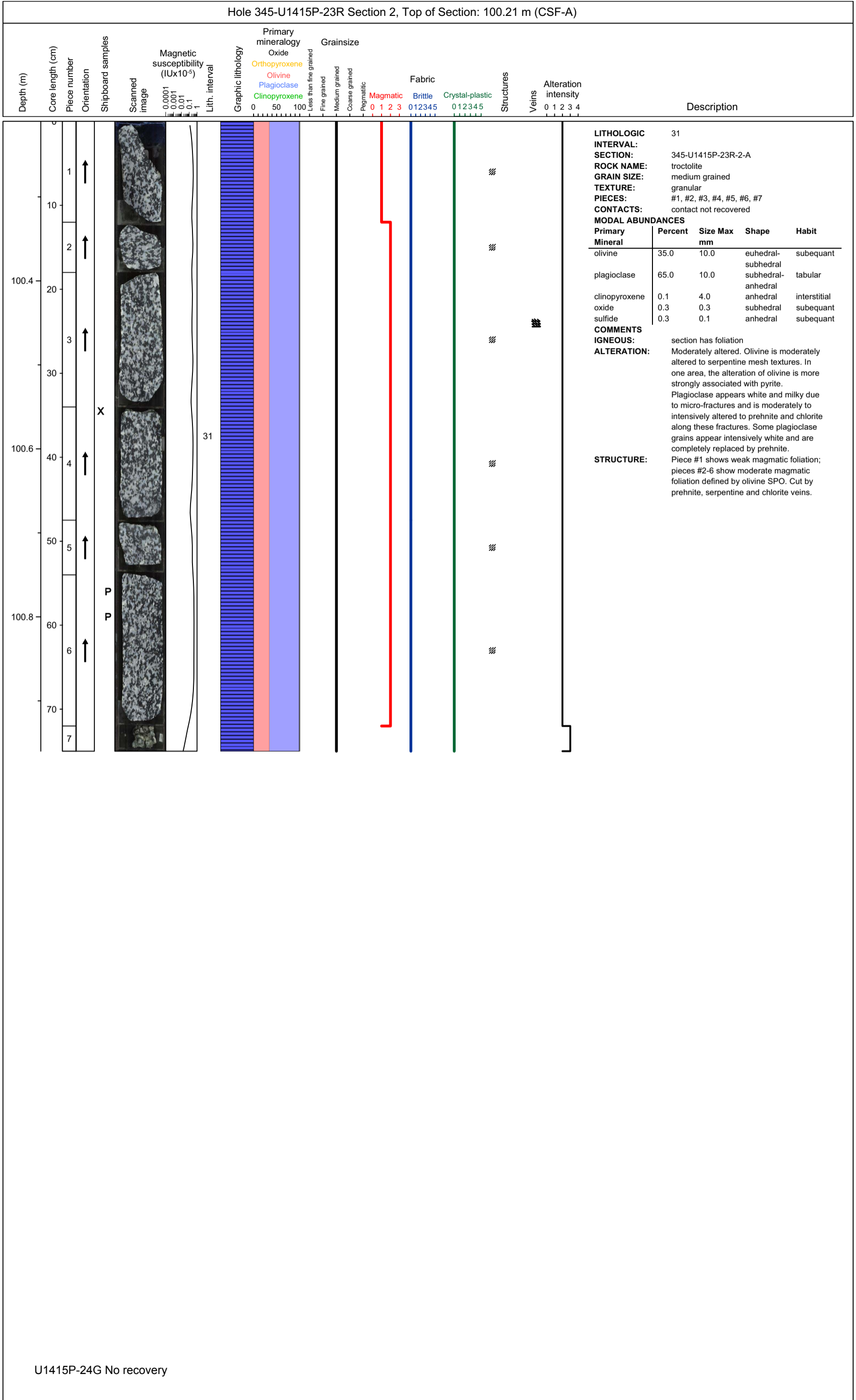


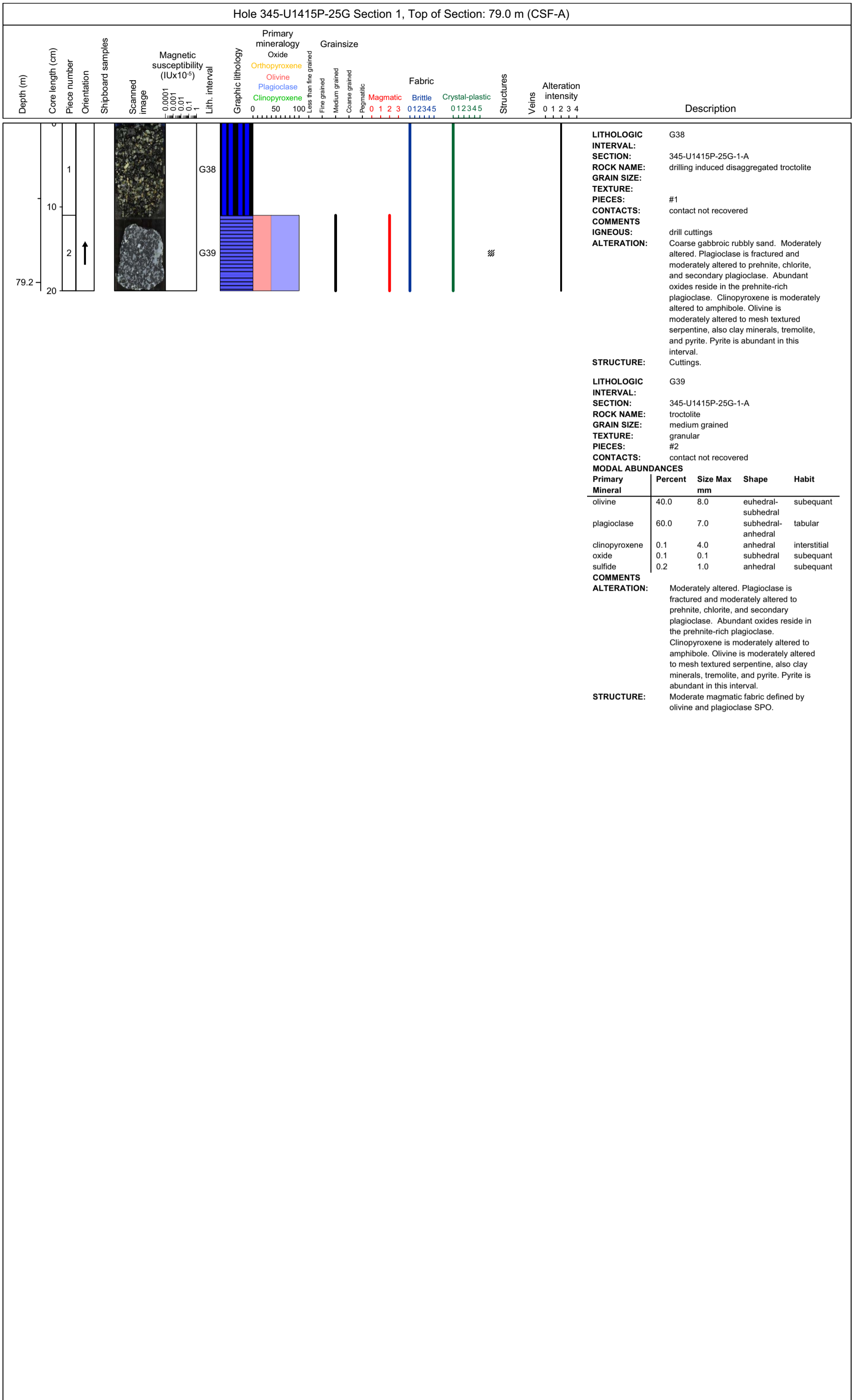










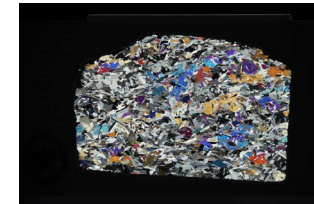
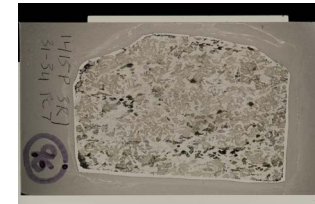




**THIN SECTION:** 345-U1415P-3R-1-W 31/34-TSB\_Piece\_7-TS\_96  
**Rock name:** olivine gabbro  
**Rock comment:** moderately altered  
**Lithologic interval:** 2  
**Piece No.:** #7  
**Billet request comment:** IgPet: Primary Min.; MetPet: Bkgnd Alt; Struct: Magmatic Fabric

**Thin Section no.:** 96  
**Authors:** TF, KF

**PRIMARY MINERALOGY**  
**No. of igneous domains:** 1  
**Nature of ign. domains:**  
**Igneous domain number:** 1  
**Domain lithology:** olivine gabbro  
**Domain grain size:** medium  
**Domain texture:** granular  
**Domain comment:**  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	2	5	3	0.5	anhedral	elongate				
Plagioclase	55	55	0	0.74	euhedral to subhedral	tabular				
Clinopyroxene	40	40	0	1	subhedral to anhedral	subequant		colorless	poikilitic	

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 1  
**No. of alteration domains:** 1  
**Domain type:** background  
**Domain rel. abund %:** 100  
**Estimated total % alteration:** 15

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	4.7	olivine 2.4%, plagioclase 2.3%	Olivine	15	80	chlorite 20%, clay minerals 18%, oxide 2%, serpentine 20%, talc 40%	Most olivine grains are completely replaced pseudomorphically by serpentine mesh textures, where the mesh cores are replaced by talc, chlorite and clay, surrounded by thin rims of chlorite. Some grains are almost unaltered and just replaced by some serpentine along fractures.
clay minerals	2.2	olivine 2.2%	Plagioclase	45	5	chlorite 100%	Plagioclase is very fresh and only slightly altered to chlorite along grain boundaries and microfractures.
oxide	0.2	olivine 0.2%	Clinopyroxene	30	5	pale/colorless amphibole 100%	Clinopyroxene is slightly altered to amphibole along cleavage planes and fractures.
pale/colorless amphibole	2	clinopyroxene 1.5%, orthopyroxene 0.5%	Orthopyroxene	10	5	pale/colorless amphibole 100%	Orthopyroxene is slightly altered to amphibole along cleavage planes and fractures.
serpentine	2.4	olivine 2.4%					
talc	4.8	olivine 4.8%					
<b>domain total alteration %:</b>	<b>16.3</b>						

**Vein summary**  
 vein 1 thin chlorite veins

**ALTERATION COMMENT:** Plagioclase and pyroxene (both ortho- and clinopyroxene) are almost unaltered. Olivine is almost completely pseudomorphically replaced by serpentine mesh, talc and clay, although some olivine grains are almost unaltered. Small amounts of magnetite are associated with pseudomorphs after olivine. Grains of pyrite are associated with chlorite after plagioclase.

**STRUCTURE COMMENT:** Magmatic: Moderate magmatic foliation defined by plagioclase SPO. Plagioclase shows common deformation twins, undulose extinction and rare subgrains showing curved grain boundaries (inside elongate clinopyroxene oikocrysts). Moderately annealed grain boundaries. Clinopyroxene oikocrysts show a skeletal character, locally show subgrain development, and kinked cleavage with interfingering grain boundaries. Foliation locally wraps around clinopyroxene that is locally bent. Altered olivine.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Irregular fracture system cuts normal to and subparallel to the magmatic foliation.  
 Veins/alteration: Carbonate veins associated with the fracture system.  
 Cross-cutting Relationships (as apparent in thin section):  
 1) Magmatic fabric development.  
 2) Fracture and vein formation.

**PHOTOMICROGRAPHS:** 345\_U1415P\_3R\_1\_TS\_96.JPG  
 345\_U1415P\_3R\_1\_TS\_96-2.JPG

**THIN SECTION:** 345-U1415P-3R-1-W 120/123-TSB\_Piece\_20a-TS\_97  
**Rock name:** olivine gabbro  
**Rock comment:**  
**Lithologic interval:** 3  
**Piece No.:** #20  
**Billet request comment:** IgPet: Primary Min; Struct: Magmatic Fabric  
**Thin Section no.:** 97  
**Authors:** MMJ, AM

**PRIMARY MINERALOGY**  
**No. of igneous domains:** 1  
**Nature of ign. domains:**  
**Igneous domain number:**  
**Domain grain size:** coarse grained  
**Domain texture:** granular  
**Domain comment:**  
**Domain lithology:** olivine gabbro  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	10	20	10	4	anhedral to subhedral	irregular-amoeboid			overgrowth	
Plagioclase	50	60	10	1	subhedral to euhedral	tabular	continuous zoning			
Clinopyroxene	15	19	4	5	subhedral to euhedral	prismatic		pale green	interstitial	
Orthopyroxene	0.4	0.5	0.1	4	subhedral	prismatic		pale green		
Oxide	0.1	0.1	0	0.1	euhedral	isometric				

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 1  
**No. of alteration domains:** 1  
**Domain type:** background  
**Domain rel. abund %:** 100  
**Estimated total % alteration:** 27

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	7.6	olivine 1.3%, clinopyroxene 0.6%, plagioclase 5.8%	Olivine	25	50	pale/colorless amphibole 20%, chlorite 10%, clay minerals 32%, oxide 1%, sulfide 2%, serpentine 15%, talc 20%	
clay minerals	4	olivine 4%	Plagioclase	55	15	chlorite 70%, prehnite 10%, secondary plagioclase 19%, epidote/zoisite 1%	Patches of chlorite surrounded by secondary plagioclase with fluid inclusions and tiny zoisite, associated with chlorite-carbonate veins
epidote/zoisite	0.1	plagioclase 0.1%	Clinopyroxene	20	30	green amphibole 60%, pale/colorless amphibole 29%, chlorite 10%, sulfide 1%	Clinopyroxene altered along cleavages and as larger grains of green amphibole
green amphibole	3.6	clinopyroxene 3.6%					
oxide	0.1	olivine 0.1%					
pale/colorless amphibole	4.2	olivine 2.5%, clinopyroxene 1.7%					
prehnite	0.8	plagioclase 0.8%					
secondary plagioclase	1.6	plagioclase 1.6%					
serpentine	1.9	olivine 1.9%					
sulfide	0.3	olivine 0.3%, clinopyroxene 0.1%					
talc	2.5	olivine 2.5%					
<b>domain total alteration %:</b>	<b>26.7</b>						

**Vein summary**  
 vein 1 chlorite + prehnite filled vein  
 vein 2 thin clay veins

**ALTERATION COMMENT:** Olivine shows variable development of corona textures but is mainly altered to serpentine + magnetite mesh in grain centers, with talc, clay minerals, and pyrite at the grain edge. Chlorite +/- amphibole +/- calcite patches replace plagioclase. Clinopyroxene is partially replaced by green amphibole. Sulfides occur within talc and sometimes clay minerals replacing olivine, in amphibole replacements of clinopyroxene and sometimes in plagioclase.

**STRUCTURE COMMENT:** Magmatic: Isotropic. Plagioclase shows variable grain size from large (up to 5 mm) to < 1mm, with common deformation twins, undulose extinction, and locally developed subgrains. Weakly annealed. Common poikilitic clinopyroxene, other grains interstitial. Altered olivine. Crystal Plastic: No crystal plastic deformation. Brittle: Minor local cataclasis. Veins/alteration: Chlorite (possibly two generations) and prehnite veins; serpentine cuts amphibole. Rare carbonate veins. Cross-cutting Relationships (as apparent in thin section):  
 1) Magmatic fabric development.  
 2) Fracture and vein formation.

**PHOTOMICROGRAPHS:** 345\_U1415P\_3R\_1\_TS\_97.JPG  
 345\_U1415P\_3R\_1\_TS\_97-2.JPG

**THIN SECTION:** 345-U1415P-4G-1-W 10/13-TSB\_Piece\_3-TS\_98  
**Rock name:** olivine gabbro  
**Rock comment:** with gabbroitic band; moderately altered  
**Lithologic interval:** G11  
**Piece No.:** #3  
**Billet request comment:** IgPet: Primary Min; Struct: Magmatic Fabric  
**Thin Section no.:** 98  
**Authors:** TF, TN

**PRIMARY MINERALOGY** No. of igneous domains: 2 Nature of ign. domains: two lithologies  
**Igneous domain number:** 1 Domain grain size: medium grained Domain texture: granular Domain comment:  
**Domain lithology:** olivine gabbro  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 60



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	12	15	3	2	anhedral	amoeboid				
Plagioclase	55	55	0	1.5	euohedral to subhedral	tabular				
Clinopyroxene	30	30	0	3	anhedral	subequant		colorless	poikilitic	

**Igneous domain number:** 2 Domain grain size: medium grained Domain texture: granular Domain comment:  
**Domain lithology:** gabbro (band)  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 40

	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Plagioclase	49	50	1	1.5	euohedral to subhedral	tabular				
Clinopyroxene	25	25	0	3	anhedral	subequant		colorless	poikilitic	
Orthopyroxene	25	25	0	3	anhedral	prismatic				

**ALTERATION / METAMORPHISM** Alteration domain number: 1 No. of alteration domains: 2 Domain type: background Domain rel. abund %: 40 Estimated total % alteration: 10

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	1.8	plagioclase 1.8%	Olivine	15	30	pale/colorless amphibole 2%, clay minerals 40%, oxide 2%, sulfide 1%, serpentine 50%, talc 5%	
clay minerals	3.4	olivine 1.8%, plagioclase 1.6%	Plagioclase	70	5	chlorite 50%, clay minerals 45%, other 5%	other: carbonate
oxide	0.1	olivine 0.1%	Clinopyroxene	15	10	pale/colorless amphibole 95%, sulfide 5%	Clinopyroxene is altered to amphibole along fractures and cleavage surfaces. Pyrite is unevenly and sporadically distributed in clinopyroxene.
pale/colorless amphibole	1.5	olivine 0.1%, clinopyroxene 1.4%					
serpentine	2.3	olivine 2.3%					
sulfide	0.1	olivine < 0.1%, clinopyroxene 0.1%					
talc	0.2	olivine 0.2%					
other	0.2	plagioclase 0.2%					
<b>domain total alteration %:</b>		<b>9.6</b>					

**ALTERATION COMMENT:** Olivine is unevenly altered to serpentine, clay, talc and tremolite. Clinopyroxene is slightly altered to amphibole along fractures or cleavage surfaces. Fractures in plagioclase of this domain are more abundant than in that of gabbroite domain, and are filled by chlorite, clay or carbonate. Pyrite is associated with serpentine/talc/clay replacing olivine, and is unevenly distributed within clinopyroxene crystals.

**ALTERATION / METAMORPHISM** Alteration domain number: 2 No. of alteration domains: 2 Domain type: background Domain rel. abund %: 60 Estimated total % alteration: 5

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	0.7	plagioclase 0.7%	Plagioclase	65	2	chlorite 50%, clay minerals 45%, other 5%	other: carbonate
clay minerals	0.6	plagioclase 0.6%	Clinopyroxene	20	10	pale/colorless amphibole 95%, sulfide 5%	Clinopyroxene is altered to amphibole along fractures and cleavage surfaces. Pyrite is unevenly and sporadically distributed in clinopyroxene.
pale/colorless amphibole	2.6	clinopyroxene 1.9%, orthopyroxene 0.7%	Orthopyroxene	15	5	pale/colorless amphibole 99%, other 1%	other: carbonate
sulfide	0.1	clinopyroxene 0.1%					
other	0.1	orthopyroxene < 0.1%, plagioclase 0.1%					
<b>domain total alteration %:</b>		<b>4.1</b>					

**ALTERATION COMMENT:** Clinopyroxene is slightly altered to amphibole along fractures or cleavage surfaces. Orthopyroxene is relatively fresh except for near fractures, cleavage surfaces, and a portion where amphibole and carbonate

**STRUCTURE COMMENT:** Magmatic: Boundary gabbro and olivine-bearing gabbro layers. Irregular, wavy boundary defined by modal variation.

Gabbro: Isotropic. Zoned plagioclase, with common deformation twins, undulose extinction, commonly bent, and locally developed subgrains with curved boundaries. Weakly annealed.

Olivine-bearing gabbro: Weak magmatic foliation defined by plagioclase SPO. Common deformation twins, undulose extinction, commonly bent, with rare subgrains. Moderately annealed. Olivine shows subgrain development. Serrate orthopyroxene grain boundaries, host to stubby and rounded plagioclase inclusions.

Crystal Plastic: No crystal plastic deformation.

Brittle: Minor local fracture.

Veins/alteration: Serpentine and sigmoidal amphibole crack seal veins.

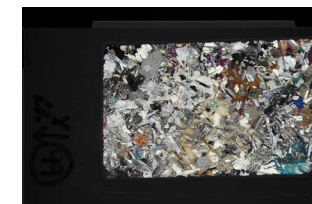
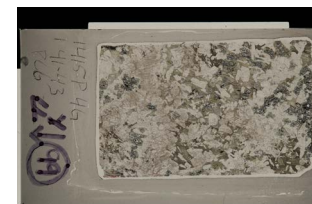
Cross-cutting Relationships (as apparent in thin section):

- 1) Magmatic fabric development.
- 2) Fracture and vein formation.

**PHOTOMICROGRAPHS:** 345\_U1415P\_4G\_1\_TS\_98.JPG  
345\_U1415P\_4G\_1\_TS\_98-2.JPG

**THIN SECTION:** 345-U1415P-4G-1-W 41/43-TSB\_Piece\_6-TS\_99  
**Rock name:** olivine gabbro  
**Rock comment:** moderately altered  
**Lithologic interval:** G14  
**Piece No.:** #6  
**Billet request comment:** Met. Pet: Sulfide Identification  
**Thin Section no.:** 99  
**Authors:** TF, RW

**PRIMARY MINERALOGY**      **No. of igneous domains:** 1      **Nature of ign. domains:**  
**Igneous domain number:** 1      **Domain lithology:** olivine gabbro  
**Domain grain size:** coarse grained      **Grain size distribution:** equigranular  
**Domain texture:** granular      **Relative abundance (%):** 100  
**Domain comment:**



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	5	10	5	2	anhedral	amoeboid				
Plagioclase	55	60	5	1	euhedral to subhedral	tabular				
Clinopyroxene	29	30	1	4	anhedral	subequant		colorless	poikilitic	

**ALTERATION / METAMORPHISM**      **No. of alteration domains:** 1      **Domain rel. abund %:** 100      **Estimated total % alteration:** 12  
**Alteration domain number:** 1      **Domain type:** background

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	3.2	plagioclase 3.2%	Olivine	7	20	pale/colorless amphibole 50%, clay minerals 5%, oxide 3%, sulfide 2%, serpentine 25%, talc 15%	
clay minerals	0.1	olivine 0.1%	Plagioclase	79	10	chlorite 40%, prehnite 20%, other 40%	other mineral is calcite
oxide	0	olivine < 0.1%	Clinopyroxene	12	10	pale/colorless amphibole 100%	
pale/colorless amphibole	3.7	olivine 0.7%, clinopyroxene 1.2%, orthopyroxene 1.8%	Orthopyroxene	2	90	pale/colorless amphibole 100%	
prehnite	1.6	plagioclase 1.6%					
serpentine	0.4	olivine 0.4%					
sulfide	0	olivine < 0.1%					
talc	0.2	olivine 0.2%					
other	3.2	plagioclase 3.2%					

**domain total alteration %:** 12.4

**Vein summary**  
 vein 1 chlorite cross-fiber vein  
 vein 2 prehnite-chlorite-zeolite-carbonate composite vein

**ALTERATION COMMENT:** Olivine is extensively altered to amphibole, with lesser serpentine, talc, with oxides. Sulfides are associated with talc after olivine. Plagioclase is primarily replaced by chlorite along grain boundaries, especially those facing olivine, and by calcite and prehnite in many fractures that cut the slide. Amphibole locally replaces clinopyroxene.

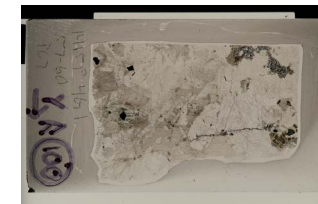
**STRUCTURE COMMENT:** Magmatic: Heterogeneous and isotropic, with a wide range of grain sizes. Plagioclase shows common deformation twins, undulose extinction, some bent grains, and locally developed subgrains with curved boundaries. Intimately intergrown with olivine, implying skeletal textures. Diffuse oikocrysts of clinopyroxene host plagioclase and olivine inclusions.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Pervasive irregular curved fractures.  
 Veins/alteration: Prehnite-chlorite-zeolite-carbonate composite vein.  
 Cross-cutting Relationships (as apparent in thin section):  
 1) Magmatic fabric development.  
 2) Fracture and vein formation.

**PHOTOMICROGRAPHS:** 345\_U1415P\_4G\_1\_TS\_99.JPG  
 345\_U1415P\_4G\_1\_TS\_99-2.JPG

**THIN SECTION:** 345-U1415P-4G-1-W 57/60-TSB\_Piece\_7-TS\_100  
**Rock name:** olivine gabbro  
**Rock comment:** moderately altered  
**Lithologic interval:** G15  
**Piece No.:** #7  
**Billet request comment:** IgPet: Primary mineralogy

**Thin Section no.:** 100  
**Authors:** TH, KF

**PRIMARY MINERALOGY**  
**No. of igneous domains:** 1  
**Nature of ign. domains:**  
**Igneous domain number:** 1  
**Domain grain size:** medium-coarse  
**Domain texture:** ophitic  
**Domain comment:**  
**Domain lithology:** olivine gabbro  
**Grain size distribution:** seriate  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	4	13	9	3	anhedral	subequant				small olivine is included in large plagioclase
Plagioclase	58	61	3	2	subhedral	tabular	discontinuous			tiny olivine, orthopyroxene, clinopyroxene, and oxide inclusions within plagioclase.
Clinopyroxene	21	25	4	5	anhedral	irregular		pale brown	interstitial	orthopyroxene blebs occur in clinopyroxene
Oxide	0.5	0.5	0	0.5	anhedral	subequant				

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 1  
**No. of alteration domains:** 1  
**Domain type:** background  
**Domain rel. abund %:** 100  
**Estimated total % alteration:** 25

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	8.3	clinopyroxene 0.5%, plagioclase 7.8%	Olivine	10	60	pale/colorless amphibole 30%, clay minerals 20%, sulfide 5%, serpentine 15%, talc 30%	Olivine is moderately altered. Some grains are only slightly altered to serpentine mesh textures in the core and completely replaced by talc, amphibole and clay minerals at the outside. Other grains are completely replaced by talc, amphibole and clay minerals. In both cases, former olivine is surrounded by a thin chlorite rim.
clay minerals	1.2	olivine 1.2%	Plagioclase	65	30	chlorite 40%, prehnite 60%	Plagioclase is moderately altered to prehnite and chlorite along micro-fractures and grain boundaries. Where plagioclase is in contact with former olivine, it is altered to chlorite.
pale/colorless amphibole	2.6	olivine 1.8%, clinopyroxene 0.8%	Clinopyroxene	25	5	pale/colorless amphibole 60%, chlorite 40%	Clinopyroxene is slightly altered along cleavage planes and fractures. Grains are more altered near chlorite/prehnite vein.
prehnite	11.7	plagioclase 11.7%					
serpentine	0.9	olivine 0.9%					
sulfide	0.3	olivine 0.3%					
talc	1.8	olivine 1.8%					
<b>domain total alteration %:</b>	<b>26.8</b>						

**Vein summary**  
 vein 1 amphibole veins with oblique fibres and often chlorite margins appear to have pull-apart geometries but also appear to be partly replacive when crossing clinopyroxene  
 vein 2 thin prehnite veins cut the amphibole veins at a high angle

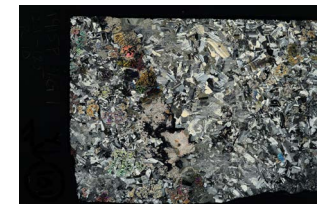
**ALTERATION COMMENT:**  
 Olivine is moderately replaced by serpentine mesh textures in the core and talc, amphibole and clay at the outside. Some grains are completely replaced by talc, amphibole and clay. A large orthopyroxene-olivine is very fresh. Plagioclase is moderately altered to prehnite and chlorite along micro-fractures and grain boundaries. The thin section contains a patch of chlorite, associated with some carbonate. The patch itself is associated with a chlorite and prehnite filled vein. Some 1mm large grains of oxide are present in the olivine and appear to be related to higher degrees of alteration (e.g. the chlorite patch and a highly prehnitized plagioclase). Disseminated pyrite is associated with the alteration of olivine.

**STRUCTURE COMMENT:**  
 Magmatic: Heterogeneous and isotropic, with a wide range of grain sizes. Plagioclase shows common deformation twins, undulose extinction, and rare bent grains. Large clinopyroxene enclosing rounded plagioclase chadocrysts.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Minor set of parallel unfilled fractures.  
 Veins/alteration: Cut by amphibole-chlorite pull-apart, and composite veins. Clay veins cut fracture set. Local carbonate.  
 Cross-cutting Relationships (as apparent in thin section):  
 1) Magmatic fabric development.  
 2) Fracture, open porosity formation, and vein formation.

**PHOTOMICROGRAPHS:**  
 345\_U1415P\_4G\_1\_TS\_100.JPG  
 345\_U1415P\_4G\_1\_TS\_100-2.JPG

**THIN SECTION:** 345-U1415P-4G-1-W 120/125-TSB\_Piece\_10-TS\_101  
**Rock name:** olivine gabbro  
**Rock comment:** with bands, troctolitic character; slightly altered  
**Lithologic interval:** G18  
**Piece No.:** #10  
**Billet request comment:** Lg. Fmt: IgPet: Primary Min; MetPet: Alt. Across Igneous Boundary; Struct: Magmatic Fabric

**Thin Section no.:** 101  
**Authors:** Nori, RW



**PRIMARY MINERALOGY**  
**No. of igneous domains:** 2  
**Nature of ign. domains:** two lithologies

**Igneous domain number:** 1  
**Domain grain size:** medium  
**Domain texture:** granular  
**Domain comment:** heterogeneous in olivine grain size distribution; large aggregates of olivine at the domain boundaries

**Domain lithology:** Troctolite  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 65

	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	8	15	7	3.5	anhedral	subequant				
Plagioclase	70	84	14	4	anhedral to subhedral	tabular				
Clinopyroxene	1	1	0	2	anhedral	irregular		colorless	interstitial	
Orthopyroxene	0.2	0.2	0	1	anhedral	irregular				
Oxide	0.1	0.1	0	0.1	anhedral-subhedral	irregular				

**Igneous domain number:** 2  
**Domain grain size:** medium  
**Domain texture:** granular  
**Domain comment:**

**Domain lithology:** olivine-bearing gabbro  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 35

	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	< 0.1	2	2	2	anhedral	irregular				
Plagioclase	70	83	13	4	anhedral to subhedral	tabular				
Clinopyroxene	13	15	2	3	anhedral	irregular		colorless	interstitial	
Oxide	0.1	0.1	0	0.1	anhedral to subhedral	subequant				

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 1  
**No. of alteration domains:** 1  
**Domain type:** background  
**Domain rel. abund %:** 100  
**Estimated total % alteration:** 10

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	1.7	olivine 0.2%, plagioclase 1.5%	Olivine	12	20	pale/colorless amphibole 20%, chlorite 10%, clay minerals 25%, oxide 2%, sulfide 1%, serpentine 32%, talc 10%	
clay minerals	0.6	olivine 0.6%	Plagioclase	79	5	chlorite 37%, prehnite 60%, other 3%	3% replacement by carbonate
oxide	< 0.1	olivine < 0.1%	Clinopyroxene	3	20	pale/colorless amphibole 100%	
pale/colorless amphibole	1.1	olivine 0.5%, clinopyroxene 0.6%	Oxide	< 0.1			
prehnite	2.4	plagioclase 2.4%					
serpentine	0.8	olivine 0.8%					
sulfide	0	olivine < 0.1%					
talc	0.2	olivine 0.2%					
other	0.1	plagioclase 0.1%					
<b>domain total alteration %:</b>	<b>6.9</b>						

**Vein summary**  
 vein 1 Cross-fiber chlorite ± clay minerals veins appear to localise chloritization.  
 vein 2 prehnite veins cut other secondary minerals

**ALTERATION COMMENT:** Plagioclase in this troctolite is pervasively altered to prehnite along cracks by a small amount, and completely in rims along interfaces with olivine. Olivine is variably altered to amphibole, talc and serpentine. Oxides are associated with serpentine, sulfides are associated with talc.

**STRUCTURE COMMENT:** Magmatic: Boundary between troctolite and leucocratic gabbro to olivine gabbro.

Troctolite - Heterogeneous and isotropic, with a wide range of grain sizes. Olivine very skeletal up to 1 cm across, showing undulose extinction, and subgrains. Plagioclase inside skeletal olivine < 0.5 mm; annealed. Plagioclase grain size increases away from olivine up to 3 mm. Large plagioclase grains show common deformation twins, undulose extinction, and rare bent grains. Coarse olivine with branching olivine growing away from leucocratic gabbro, might represent base of new replenishment?

Leucocratic gabbro: Heterogeneous and isotropic, with a wide range of grain sizes. Orthopyroxene oikocryst hosts chadocrysts of plagioclase. Plagioclase grains show common deformation twins, undulose extinction, and rare subgrains. Orthopyroxene intercumulus around olivine in the adjacent troctolite.

Crystal Plastic: No crystal plastic deformation.

Brittle: Minor open fractures.

Veins/alteration: Cut by subparallel chlorite, clay, carbonate, and prehnite veins.

Cross-cutting Relationships (as apparent in thin section):

- 1) Magmatic fabric development.
- 2) Fracture and vein formation.

**PHOTOMICROGRAPHS:** 345\_U1415P\_4G\_1\_TS\_101.JPG  
 345\_U1415P\_4G\_1\_TS\_101-2.JPG  
 345\_U1415P\_4G\_1\_TS\_101-3.JPG  
 345\_U1415P\_4G\_1\_TS\_101-4.JPG

**THIN SECTION:** 345-U1415P-4G-2-W 2/3-TSB\_Piece\_1-TS\_102  
**Rock name:** troctolite  
**Rock comment:** moderately altered  
**Lithologic interval:** G20  
**Piece No.:** #1  
**Billet request comment:** IgPet: Primary Min; MelPet: Bkgnd mineralogy

**Thin Section no.:** 102

**Authors:** TH, NM

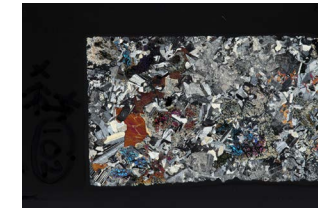
**PRIMARY MINERALOGY**

**No. of igneous domains:** 1

**Nature of ign. domains:**

**Igneous domain number:** 1  
**Domain grain size:** medium grained  
**Domain texture:** granular  
**Domain comment:** Orthopyroxene occurs next to olivine and also interstitially in plagioclase-rich domains

**Domain lithology:** troctolite  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	5	10	5	6	anhedral	irregular			skeletal	
Plagioclase	83	85	2	1.8	anhedral to subhedral	tabular	continuous		chadacryst	
Clinopyroxene	4	4	0	6	anhedral	irregular		pale brown	interstitial	
Orthopyroxene	0.4	1	0.6	2	anhedral	irregular		colorless		orthopyroxene occurs interstitially in plagioclase-rich domain.
Oxide	0.1	0.1	0	0.3	anhedral	subequant				

**ALTERATION / METAMORPHISM**

**Alteration domain number:** 1

**No. of alteration domains:** 1

**Domain type:** background

**Domain rel. abund %:** 100

**Estimated total % alteration:** 30

**SECONDARY MINERALOGY**

	%	REPLACING / FILLING
chlorite	4.9	olivine 0.7%, plagioclase 4.3%
clay minerals	0.5	olivine 0.5%
oxide	0.1	olivine 0.1%
pale/colorless amphibole	2.4	olivine 1.6%, clinopyroxene 0.4%, orthopyroxene 0.4%
prehnite	17	plagioclase 17%
serpentine	3.6	olivine 3.3%, orthopyroxene 0.3%
sulfide	0.1	olivine 0.1%
talc	0.3	olivine 0.3%
other	0.1	orthopyroxene 0.1%

PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
Olivine	10	65	pale/colorless amphibole 25%, chlorite 10%, clay minerals 8%, oxide 1%, sulfide 1%, serpentine 50%, talc 5%	serpentine has mesh texture, no chlorite rims observed
Plagioclase	85	25	chlorite 20%, prehnite 80%	
Clinopyroxene	4	10	pale/colorless amphibole 100%	
Orthopyroxene	1	80	pale/colorless amphibole 50%, serpentine 40%, other 10%	other: clay minerals

**domain total alteration %:** 29

**ALTERATION COMMENT:**

Plagioclase is variably altered to prehnite along microfractures and locally to chlorite. Chlorite rims between plagioclase and olivine are generally absent. Orthopyroxene is highly altered to amphibole, serpentine, and clay minerals. Olivine is moderately altered to serpentine with mesh textures (+minor magnetite in the chlorite seams) and also to tremolite and talc. Chlorite appears to replace talc after olivine. At least two sulfides, pyrite and pentlandite (?) are overgrown by magnetite in relict olivine.

**STRUCTURE COMMENT:**

Magmatic: Heterogeneous and isotropic, with a wide range of grain sizes. Olivine very skeletal up to 5-6 mm across, showing undulose extinction. Plagioclase inside skeletal olivine < 0.5 mm; annealed. Plagioclase grain size increases away from olivine up to 3 mm. Large plagioclase grains show common deformation twins, undulose extinction, and rare bent grains. Clinopyroxene shows no strain, implying late crystallization relative to deformed plagioclase and olivine.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Minor open fractures.  
 Veins/alteration: Cut by serpentine veins.

Crosscutting Relationships (as apparent in thin section):  
 1) Magmatic fabric development.  
 2) Fracture and vein formation.

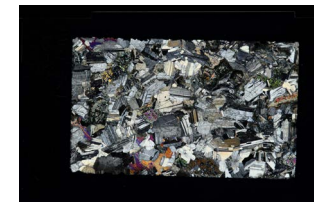
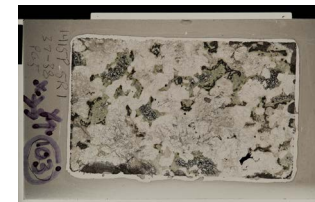
**PHOTOMICROGRAPHS:**

345\_U1415P\_4G\_2\_TS\_102.JPG  
 345\_U1415P\_4G\_2\_TS\_102-2.JPG

**THIN SECTION:** 345-U1415P-SR-1-W 37/38-TSB\_Piece\_5-TS\_103  
**Rock name:** orthopyroxene-bearing olivine gabbro  
**Rock comment:** moderately altered  
**Lithologic interval:** 3  
**Piece No.:** #5  
**Billet request comment:** IgPet: Prim. mineralogy; MelPet: Bknd Alteration; Struct: Mag. Fabric

**Thin Section no.:** 103  
**Authors:** TF, TN

**PRIMARY MINERALOGY**  
**No. of igneous domains:** 1  
**Nature of ign. domains:**  
**Igneous domain number:** 1  
**Domain grain size:** coarse  
**Domain texture:** granular  
**Domain comment:**  
**Domain lithology:** orthopyroxene-bearing olivine gabbro  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	5	20	15	2	subhedral to anhedral	ameboid				
Plagioclase	60	68	8	1	euhedral to subhedral	tabular				
Clinopyroxene	10	10	0	20	anhedral	irregular		colorless	interstitial	
Orthopyroxene	2	2	0	1	anhedral	irregular		pinkish brown	interstitial	
Oxide	0.1	0.1	0	1	anhedral	subequant			interstitial	associated with opx and olivine

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 1  
**No. of alteration domains:** 1  
**Domain type:** background  
**Domain rel. abund %:** 100  
**Estimated total % alteration:** 17

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	4.1	orthopyroxene 0.1%, plagioclase 4%	Olivine	15	50	pale/colorless amphibole 1%, clay minerals 40%, oxide 5%, sulfide 2%, serpentine 50%, talc 2%	
clay minerals	3	olivine 3%	Plagioclase	80	10	chlorite 50%, prehnite 50%	
oxide	0.4	olivine 0.4%	Clinopyroxene	3	30	pale/colorless amphibole 95%, sulfide 5%	
pale/colorless amphibole	1.3	olivine 0.1%, clinopyroxene 0.9%, orthopyroxene 0.4%	Orthopyroxene	1	50	pale/colorless amphibole 70%, chlorite 10%, talc 20%	
prehnite	4	plagioclase 4%	Oxide	1			
serpentine	3.8	olivine 3.8%					
sulfide	0.2	olivine 0.2%, clinopyroxene <0.1%					
talc	0.3	olivine 0.2%, orthopyroxene 0.1%					
<b>domain total alteration %:</b>	<b>17.1</b>						

**ALTERATION COMMENT:** Olivine is altered mainly to serpentine and clay, and to small amounts of talc and tremolite. Orthopyroxene and clinopyroxene is partially replaced by colorless or pale green amphibole. Plagioclase has many fractures filled with prehnite and chlorite. Pyrite is associated with serpentine/clay replacing olivine and amphibole replacing pyroxene.

**STRUCTURE COMMENT:** Magmatic: Isotropic. Olivine very skeletal up to 5-6 mm across, showing rare undulose extinction. Plagioclase inside olivine rounded, and fine grained. Poorly annealed. Plagioclase shows common deformation twins, and undulose extinction. Interstitial clinopyroxene shows no strain. Crystal Plastic: No crystal plastic deformation. Brittle: Open fractures. Veins/alteration: Static alteration of olivine. Crosscutting Relationships (as apparent in thin section): 1) Fracture and alteration.

**PHOTOMICROGRAPHS:** 345\_U1415P\_SR\_1\_TS\_103.JPG  
 345\_U1415P\_SR\_1\_TS\_103-2.JPG



**THIN SECTION:** 345-U1415P-5R-2-W 52/53-TSB\_Piece\_6-TS\_104  
**Rock name:** orthopyroxene-bearing olivine gabbro  
**Rock comment:** highly altered  
**Lithologic interval:** 3  
**Piece No.:** #6  
**Billet request comment:** IgPet: Primary Mineralogy

**Thin Section no.:** 104  
**Authors:** TF, KF

**PRIMARY MINERALOGY**  
**No. of igneous domains:** 1  
**Nature of ign. domains:**  
**Igneous domain number:** 1  
**Domain grain size:** coarse  
**Domain texture:** granular  
**Domain comment:**

**Domain lithology:** orthopyroxene-bearing olivine gabbro  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	10	20	10	2	subhedral to anhedral	ameboid				
Plagioclase	50	58	8	1	euhedral to anhedral	tabular				
Clinopyroxene	20	20	0	10	anhedral	irregular		colorless	interstitial-poikilitic	
Orthopyroxene	2	2	0	1	anhedral	irregular		pinkish brown	interstitial	
Oxide	0.1	0.1	0	1	anhedral	subequant			interstitial	

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 1  
**No. of alteration domains:** 1  
**Domain type:** background  
**Domain rel. abund %:** 100  
**Estimated total % alteration:** 45

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	6.6	plagioclase 6.6%	Olivine	15	40	pale/colorless amphibole 10%, clay minerals 25%, oxide 3%, sulfide 2%, serpentine 40%, talc 20%	Olivine is moderately altered to serpentine mesh textures, surrounded by clay, amphibole and small amounts of talc. The mesh is associated with small amounts of disseminated magnetite and pyrite. Rarely some chlorite is formed where olivine is in contact with plagioclase, but not at every contact between these minerals.
clay minerals	1.5	olivine 1.5%	Plagioclase	55	40	chlorite 30%, prehnite 70%	Plagioclase is fractured and moderately to intensively altered to fine grained prehnite and chlorite along these fractures.
green amphibole	10.8	clinopyroxene 10.8%	Clinopyroxene	30	60	green amphibole 60%, pale/colorless amphibole 40%	Clinopyroxene is moderately to intensively altered to amphibole along cleavage planes and grain boundaries.
oxide	0.2	olivine 0.2%					
pale/colorless amphibole	7.8	olivine 0.6%, clinopyroxene 7.2%					
prehnite	15.4	plagioclase 15.4%					
serpentine	2.4	olivine 2.4%					
sulfide	0.1	olivine 0.1%					
talc	1.2	olivine 1.2%					
<b>domain total alteration %:</b>	<b>46</b>						

**ALTERATION COMMENT:** Olivine is moderately replaced by serpentine mesh textures, with clay, amphibole and talc at the outside. Clinopyroxene is moderately to intensively altered to amphibole along cleavage planes. Plagioclase is fractured and moderately replaced by prehnite and chlorite along these fractures. Disseminated pyrite and magnetite are associated with the alteration of olivine. One larger magnetite grain is observed between olivine and clinopyroxene (but may be primary).

**STRUCTURE COMMENT:** Magmatic: Isotropic. Skeletal olivine up to 1 cm across, showing rare undulose extinction, and small subgrains. Plagioclase shows rare deformation twins, subgrain formation, and undulose extinction in large grains. Locally annealed. Plagioclase inside skeletal olivine rounded, and fine grained; locally bent and fractured. Interstitial clinopyroxene oikocrysts up to at least 6 cm across (in hand sample).  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Open fractures, questionably associated with alteration of olivine.  
 Veins/alteration: Static alteration of olivine.  
 Crosscutting Relationships (as apparent in thin section):  
 1) Fracture and alteration.

**PHOTOMICROGRAPHS:** 345\_U1415P\_5R\_2\_TS\_104.JPG  
 345\_U1415P\_5R\_2\_TS\_104-2.JPG

**THIN SECTION:** 345-U1415P-6R-1-W 47/51-TSB\_Piece\_6-TS\_105  
**Rock name:** olivine gabbro  
**Rock comment:** moderately altered  
**Lithologic interval:** 4  
**Piece No.:** #6  
**Billet request comment:** Lg. Fmt. IgPet. Prim. Mineralogy; Struct. Mag. Fabric

**Thin Section no.:** 105

**Authors:** TF, TN

**PRIMARY MINERALOGY**

**No. of igneous domains:** 1

**Nature of ign. domains:**

**Igneous domain number:** 1  
**Domain grain size:** medium-coarse  
**Domain texture:** granular  
**Domain comment:**

**Domain lithology:** olivine gabbro  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	10	20	10	3	subhedral to anhedral	ameboid				
Plagioclase	45	50	5	0.5	euohedral to anhedral	tabular				
Clinopyroxene	27	30	3	20	anhedral	subequant		colorless	poikilitic	

**ALTERATION / METAMORPHISM**

**Alteration domain number:** 1

**No. of alteration domains:** 1  
**Domain type:** background

**Domain rel. abund %:** 100

**Estimated total % alteration:** 25

**SECONDARY MINERALOGY**

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	4	plagioclase 4%	Olivine	15	50	pale/colorless amphibole 5%, clay minerals 30%, oxide 5%, sulfide 1%, serpentine 54%, talc 5%	
clay minerals	3.3	olivine 2.3%, plagioclase 1%	Plagioclase	50	20	chlorite 40%, clay minerals 10%, prehnite 50%	
green amphibole	0.4	clinopyroxene 0.4%	Clinopyroxene	35	20	green amphibole 5%, pale/colorless amphibole 70%, sulfide 4%, secondary clinopyroxene 20%, other 1%	other: carbonate in amphibole; amphibole occurs in patchy domains and along cleavage surfaces; secondary clinopyroxene surrounds patchy amphibole.
oxide	0.4	olivine 0.4%					
pale/colorless amphibole	5.3	olivine 0.4%, clinopyroxene 4.9%					
prehnite	5	plagioclase 5%					
secondary clinopyroxene	1.4	clinopyroxene 1.4%					
serpentine	4.1	olivine 4.1%					
sulfide	0.4	olivine 0.1%, clinopyroxene 0.3%					
talc	0.4	olivine 0.4%					
other	0.1	clinopyroxene 0.1%					
<b>domain total alteration %:</b>	<b>24.8</b>						

**Vein summary**

vein 1 prehnite veins branch into clay+chlorite veins  
 vein 2  
 vein 3 clay cross-fiber vein

**ALTERATION COMMENT:**

Olivine is unevenly altered to serpentine, talc, clay and tremolite. Coronitic assemblage tremolite + chlorite is rare. Clinopyroxene is replaced by colorless or greenish amphibole in patchy manner or along cleavage surfaces. Surrounding the patchy amphibole, secondary clinopyroxene contains opaque inclusions. Plagioclase has many fractures filled with prehnite, or is replaced by prehnite + chlorite aggregates. In clinopyroxene oikocryst near prehnite veins, single or a few crystals of prehnite form pseudomorphs after plagioclase. Pyrite is associated with serpentine/talc/clay replacing olivine, with secondary clinopyroxene or amphibole replacing clinopyroxene, and chlorite patches or veins in plagioclase.

**STRUCTURE COMMENT:**

Magmatic: Possible magmatic foliation defined by SPO in fine-grained plagioclase hosted by clinopyroxene oikocrysts. Plagioclase shows rare deformation twins, subgrain formation, undulose extinction, and locally bent in clinopyroxene oikocrysts. Plagioclase inside skeletal olivine rounded, fine-grained, annealed, and locally bent. Interstitial clinopyroxene oikocrysts up to at least 6 cm across (in hand sample), showing some undulose extinction and subgrain development. Skeletal olivine up to 1 cm across, showing rare undulose extinction, and small subgrains.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Curved, subparallel open fracture set.  
 Veins/alteration: Prehnite vein branches into chlorite-clay veins. Rare carbonate.  
 Crosscutting Relationships (as apparent in thin section):  
 1) Magmatic foliation development. Possible hypersolidus deformation of plagioclase, crystallization of clinopyroxene oikocrysts, possibly of two generations.  
 2) Fracture and vein formation.

**PHOTOMICROGRAPHS:**

345\_U1415P\_6R\_1\_TS\_105.JPG  
 345\_U1415P\_6R\_1\_TS\_105-2.JPG

**THIN SECTION:** 345-U1415P-6R-1-W 58/61-TSB\_Piece\_6-TS\_106  
**Rock name:** olivine gabbro  
**Rock comment:** highly altered  
**Lithologic interval:** 4  
**Piece No.:** #6  
**Billet request comment:** IgPet: Prim. Mineralogy; MetPet: Vein Characterization

**Thin Section no.:** 106

**Authors:** TF, AM

**PRIMARY MINERALOGY**

**No. of igneous domains:** 1

**Nature of ign. domains:**

**Igneous domain number:** 1  
**Domain grain size:** medium-coarse  
**Domain texture:** granular  
**Domain comment:**

**Domain lithology:** olivine gabbro  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	10	15	5	3	subhedral to anhedral	ameboid				
Plagioclase	40	45	5	0.5	euohedral to anhedral	tabular				
Clinopyroxene	40	40	0	20	anhedral	subequant		colorless	poikilitic	

**ALTERATION / METAMORPHISM**

**No. of alteration domains:** 2

**Domain rel. abund %:** 30

**Estimated total % alteration:** 54

**Alteration domain number:** 1

**Domain type:** halo

**SECONDARY MINERALOGY**

**%** **REPLACING / FILLING**

**PRIMARY MINERAL REPLACED**

**% ORIGINAL** **% ALTERED**

**REPLACEMENT MINERAL**

**ALTERATION COMMENTS**

chlorite	32.1	olivine 5.1%, clinopyroxene 9%, plagioclase 18%	Olivine	15	85	pale/colorless amphibole 20%, chlorite 40%, clay minerals 14%, oxide 0.6%, sulfide 0.4%, serpentine 5%, talc 20%	chlorite replaces talc
clay minerals	1.8	olivine 1.8%	Plagioclase	45	50	chlorite 80%, prehnite 5%, secondary plagioclase 5%, other 10%	other = carbonate
green amphibole	6.3	clinopyroxene 6.3%	Clinopyroxene	30	70	green amphibole 30%, pale/colorless amphibole 20%, chlorite 42.7%, oxide 0.2%, sulfide 0.1%, secondary clinopyroxene 5%, other 2%	other = carbonate; possible secondary clinopyroxene near amphibole veins
oxide	0.1	olivine 0.1%, clinopyroxene <0.1%					
pale/colorless amphibole	6.8	olivine 2.6%, clinopyroxene 4.2%					
prehnite	1.1	plagioclase 1.1%					
secondary clinopyroxene	1.1	clinopyroxene 1.1%					
secondary plagioclase	1.1	plagioclase 1.1%					
serpentine	0.6	olivine 0.6%					
sulfide	0.1	olivine 0.1%, clinopyroxene <0.1%					
talc	2.6	olivine 2.6%					
other	2.7	clinopyroxene 0.4%, plagioclase 2.3%					
<b>domain total alteration %:</b>	<b>56.4</b>						

**Vein summary**

vein 3 thin clay/chlorite veins cut the amphibole veins at a high angle

**ALTERATION COMMENT:**

Halo to two amphibole-chlorite veins which intersect at an oblique angle. Chlorite replaces olivine (and its replacements), clinopyroxene and plagioclase; corona textures are locally developed and green and colorless amphibole replaces clinopyroxene and (in part) olivine, sulfides and oxides occur in replacements of all minerals, but are not abundant.

**ALTERATION / METAMORPHISM**

**No. of alteration domains:** 2

**Domain rel. abund %:** 70

**Estimated total % alteration:** 12

**Alteration domain number:** 2

**Domain type:** background

**SECONDARY MINERALOGY**

**%** **REPLACING / FILLING**

**PRIMARY MINERAL REPLACED**

**% ORIGINAL** **% ALTERED**

**REPLACEMENT MINERAL**

**ALTERATION COMMENTS**

chlorite	0.3	plagioclase 0.3%	Olivine	15	15	oxide 0.1%, sulfide 0.1%, serpentine 79.8%, talc 20%	mesh texture
oxide	0	olivine <0.1%	Plagioclase	45	15	chlorite 5%, prehnite 95%	
pale/colorless amphibole	1.5	clinopyroxene 1.5%	Clinopyroxene	30	5	pale/colorless amphibole 100%	
prehnite	6.4	plagioclase 6.4%					
serpentine	1.8	olivine 1.8%					
sulfide	0	olivine <0.1%					
talc	0.5	olivine 0.5%					
<b>domain total alteration %:</b>	<b>10.5</b>						

**Vein summary**

vein 1 The larger vein is filled with chlorite alternating with prehnite.  
 vein 2 The smaller vein is filled mostly with prehnite.

**ALTERATION COMMENT:**

Olivine has developed a serpentine mesh texture with minor chlorite, clinopyroxene slightly altered to amphibole along cleavages, and plagioclase is slightly altered to prehnite along micro veins. Small amounts of oxide and sulfide occur in olivine replacement.

**STRUCTURE COMMENT:**

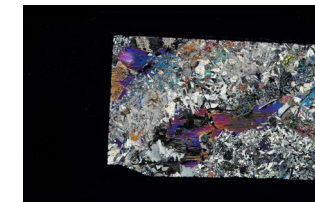
Magmatic: Possible magmatic foliation defined by SPO in fine-grained plagioclase hosted by clinopyroxene oikocrysts. Heterogeneous grain size in plagioclase shows rare deformation twins, subgrain formation, undulose extinction, and locally bent in clinopyroxene oikocrysts. Plagioclase inside skeletal olivine rounded, fine-grained, annealed, and locally bent. Interstitial clinopyroxene oikocrysts up to at least 6 cm across (in hand sample), showing some undulose extinction and subgrain development. Skeletal olivine up to 1 cm across, showing rare undulose extinction, and small subgrains. Crystal Plastic: No crystal plastic deformation. Brittle: Curved, subparallel open fracture set. Veins/alteration: Light brown, dusty chlorite-amphibole vein, cut by late prehnite veins. Carbonate. Cross-cutting Relationships (as apparent in thin section): 1) Magmatic foliation development. Possible hypersolidus deformation of plagioclase, crystallization of clinopyroxene oikocrysts, possibly of two generations. 2) Fracture and vein formation.

**PHOTOMICROGRAPHS:**

345\_U1415P\_6R\_1\_TS\_106.JPG  
 345\_U1415P\_6R\_1\_TS\_106-2.JPG

**THIN SECTION:** 345-U1415P-6R-1-W 101/103-TSB\_Piece\_7c-TS\_107  
**Rock name:** olivine gabbro  
**Rock comment:** highly altered with 1% of former spinels  
**Lithologic interval:** 5  
**Piece No.:** #7  
**Billet request comment:** IgPet: Prim. Mineralogy; MetPet: Alt. Mineralogy; Struct: Mag. Fabric  
**Thin Section no.:** 107  
**Authors:** MMJ, AM

**PRIMARY MINERALOGY**  
**No. of igneous domains:** 1  
**Nature of ign. domains:**  
**Igneous domain number:** 1  
**Domain grain size:** pegmatic  
**Domain texture:** multi-textured  
**Domain comment:** multiple domains are present; however, too complex to outline each domain; modal abundances reflect whole thin section  
**Domain lithology:** olivine gabbro  
**Grain size distribution:** seriate  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	12	20	8	2.5	anhedral to subhedral	irregular-amoeboid			corroded	display mesh texture
Plagioclase	45	59	14	1	subhedral	tabular	continuous zoning			plag "pockets" have 120 degree grain boundaries
Clinopyroxene	15	20	5	5	subhedral to euhedral	elongate		pale green	interstitial	poikilitic
Oxide	1	1	0	0.4	subhedral to euhedral	isometric			associated with olivine	probably former spinels; Ilmenite lamellae present

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 1  
**No. of alteration domains:** 1  
**Domain type:** background  
**Domain rel. abund %:** 100  
**Estimated total % alteration:** 50

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	17.7	clinopyroxene 1.8%, plagioclase 15.9%	Olivine	10	30	clay minerals 38%, oxide 1.9%, sulfide 0.1%, serpentine 40%, talc 20%	
clay minerals	1.1	olivine 1.1%	Plagioclase	53	50	chlorite 60%, prehnite 30%, other 10%	other=carbonate
green amphibole	9.6	clinopyroxene 9.6%	Clinopyroxene	35	50	green amphibole 55%, chlorite 10%, oxide 3%, sulfide 2%, secondary clinopyroxene 30%	definite secondary clinopyroxene
oxide	0.6	olivine 0.1%, clinopyroxene 0.5%	Oxide	2	0		spinel - alteration uncertain
prehnite	8	plagioclase 8%					
secondary clinopyroxene	5.3	clinopyroxene 5.3%					
serpentine	1.2	olivine 1.2%					
sulfide	0.4	olivine <0.1%, clinopyroxene 0.4%					
talc	0.6	olivine 0.6%					
other	2.7	plagioclase 2.7%					
<b>domain total alteration %:</b>	<b>47.2</b>						

**Vein summary**  
 vein 1 Vein is lined with chlorite, and evolves from zeolite to prehnite across the slide.

**ALTERATION COMMENT:** Intensely altered with notable development of secondary clinopyroxene on boundaries between primary clinopyroxene and pale amphibole. Olivine is very variably altered to serpentine mesh, talc and clay minerals. Plagioclase is altered to prehnite and chlorite, with chloritized plagioclase inside clinopyroxene showing alignments of altered grains. Spinel is locally abundant as inclusions inside olivine and plagioclase; secondary oxides occur in secondary clinopyroxene and serpentine after olivine, and minor sulfides are associated with olivine alteration.

**STRUCTURE COMMENT:** Magmatic: Heterogeneous/asymmetric boundary between troctolite and leucocratic gabbro to olivine gabbro.  
 Troctolite - Heterogeneous and isotropic, with a wide range of grain sizes. Olivine skeletal up to 1 cm across, showing undulose extinction, and subgrains. Plagioclase inside skeletal olivine >0.1 mm; strongly annealed. Plagioclase grain size increases away from olivine up to 2 mm. Larger plagioclase grains show common deformation twins, undulose extinction, subgrain formation, and rare bent grains. Common spinel. Interstitial clinopyroxene invades both rock types.  
 Leucocratic gabbro - Heterogeneous and isotropic, with medium grain size. Plagioclase grains show rare deformation twins, undulose extinction, and partial annealing. Likely similar to the magmatic structure seen in TS #101.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Curved, subparallel open fracture set.  
 Veins/alteration: Chlorite-clay, and prehnite veins, all cut zeolite. Local secondary clinopyroxene and amphibole after clinopyroxene.  
 Crosscutting Relationships (as apparent in thin section):  
 1) Mixing of melt with partially solidified magma, some reaction.  
 2) Fracture and vein formation.

**PHOTOMICROGRAPHS:** 345\_U1415P\_6R\_1\_TS\_107.JPG  
 345\_U1415P\_6R\_1\_TS\_107-2.JPG

**THIN SECTION:** 345-U1415P-6R-2-W 31/34-TSB\_Piece\_3-TS\_108  
**Rock name:** olivine gabbro  
**Rock comment:** moderately altered with 0.5% of former spinels  
**Lithologic interval:** 6  
**Piece No.:** #3  
**Billet request comment:** IgPet: Prim. Mineralogy; MetPet: Vein Mineralogy and Alt.

**Thin Section no.:** 108  
**Authors:** MMJ, RW

**PRIMARY MINERALOGY**  
**No. of igneous domains:** 1  
**Nature of ign. domains:**  
**Igneous domain number:** 1  
**Domain grain size:** medium grained  
**Domain texture:** subophitic  
**Domain comment:** poikilitic clinopyroxene spans entire thin section (optically continuous)  
**Domain lithology:** olivine gabbro  
**Grain size distribution:** seriate  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	10	20	10	2	anhedral	irregular-amoeboid			corroded	
Plagioclase	40	50	10	0.5	subhedral	tabular	discontinuous zoning		chadacrysts	
Clinopyroxene	20	30	10	30	anhedral	irregular		pale green	ophitic	
Oxide	0.5	0.5	0	0.4	subhedral to euhedral	subequant			associated with secondary amphibole	probably former spinels; Ilmenite lamellae present

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 1  
**No. of alteration domains:** 1  
**Domain type:** background  
**Domain rel. abund %:** 100  
**Estimated total % alteration:** 29

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	10.7	clinopyroxene 1.8%, plagioclase 9%	Olivine	8	60	pale/colorless amphibole 3%, clay minerals 10%, oxide 1%, sulfide 1%, serpentine 70%, talc 15%	
clay minerals	0.5	olivine 0.5%	Plagioclase	56	40	chlorite 40%, prehnite 60%	
oxide	0	olivine <0.1%	Clinopyroxene	35	5	chlorite 100%	
pale/colorless amphibole	0.1	olivine 0.1%	Oxide	1	0		
prehnite	13.4	plagioclase 13.4%					
serpentine	3.4	olivine 3.4%					
sulfide	0	olivine <0.1%					
talc	0.7	olivine 0.7%					
<b>domain total alteration %:</b>	<b>28.8</b>						

**Vein summary**  
 vein 1 composite veins changing mineralogy along their length from prehnite to chlorite and clay minerals, and to carbonate

**ALTERATION COMMENT:** Plagioclase is altered to chlorite and prehnite, olivine is altered primarily to serpentine. Large cubic oxides occur randomly distributed throughout the slide. Stringers of oxide are intergrown with serpentine replacing olivine. Sulfides are sparingly distributed among grains of talc and clay minerals replacing olivine.

**STRUCTURE COMMENT:** Magmatic: Very heterogeneous, isotropic oikocryst-bearing norite, with a wide range of grain sizes. Coarser plagioclase (1 mm) has subgrains, undulose extinction, and deformation twins. Local very fine-grained <0.1 mm patches of plagioclase interior to pyroxene oikocrysts, show twinning, rounded margins, and curved grain boundaries. Skeletal olivine encloses plagioclase. Common spinel, with hollow centers.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Cut by a set of subparallel and conjugate fractures at one end.  
 Veins/alteration: Cut by chlorite, prehnite, compound clay-chlorite and zeolite veins.

Crosscutting Relationships (as apparent in thin section):  
 1) Fracture and vein formation.

**PHOTOMICROGRAPHS:** 345\_U1415P\_6R\_2\_TS\_108.JPG  
 345\_U1415P\_6R\_2\_TS\_108-2.JPG

**THIN SECTION:** 345-U1415P-6R-2-W 38/41-TSB\_Piece\_4-TS\_109  
**Rock name:** anorthositic olivine gabbro  
**Rock comment:** highly altered  
**Lithologic interval:** 7  
**Piece No.:** #4  
**Billet request comment:** IgPet: Prim. Mineralogy; Struct: Subsolidus Deformation

**Thin Section no.:** 109

**Authors:** TH, KF

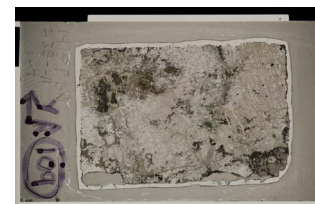
**PRIMARY MINERALOGY**

**No. of igneous domains:** 1

**Nature of ign. domains:**

**Igneous domain number:** 1  
**Domain grain size:** fine grained  
**Domain texture:** granular  
**Domain comment:**

**Domain lithology:** anorthositic olivine gabbro  
**Grain size distribution:** seriate  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	0	11	11	10	anhedral	prismatic				
Plagioclase	55	82	27	0.4	anhedral to subhedral	subequant	continuous		chadacryst	Both large plagioclase (~2mm) and small plagioclase (~0.1mm) are coexisted
Clinopyroxene	5	7	2	6	anhedral	interstitial		brown	poikilitic	
Oxide	0.1	0.1	0	0.2	anhedral	subequant			associated sulfides	sulfide inclusions are included

**ALTERATION / METAMORPHISM**

**Alteration domain number:** 1

**No. of alteration domains:** 1

**Domain type:** background

**Domain rel. abund %:** 100

**Estimated total % alteration:** 45

**SECONDARY MINERALOGY**

**%**

**REPLACING / FILLING**

**PRIMARY MINERAL REPLACED**

**% ORIGINAL % ALTERED**

**REPLACEMENT MINERAL**

**ALTERATION COMMENTS**

chlorite	11.4	clinopyroxene 3.6%, plagioclase 7.8%	Olivine	5	100	pale/colorless amphibole 10%, clay minerals 17%, oxide 3%, serpentine 50%, talc 20%	Olivine is completely replaced by serpentine mesh textures, associated with clay, talc and amphibole.
clay minerals	0.9	olivine 0.9%	Plagioclase	65	40	chlorite 30%, prehnite 70%	Plagioclase is moderately altered. In some areas, plagioclase is highly fractured and replaced by fine grained prehnite and chlorite along these fractures. In other areas, where plagioclase is less fractured, it is rather fresh.
green amphibole	8.4	clinopyroxene 8.4%	Clinopyroxene	30	40	green amphibole 70%, chlorite 30%	Clinopyroxene is moderately altered to green amphibole along cleavage planes and grain boundaries. Some former clinopyroxene grains are completely replaced by fine grained green amphibole and chlorite.
oxide	0.2	olivine 0.2%					
pale/colorless amphibole	0.5	olivine 0.5%					
prehnite	18.2	plagioclase 18.2%					
serpentine	2.5	olivine 2.5%					
talc	1	olivine 1%					

**domain total alteration %:** 43.1

**ALTERATION COMMENT:**

Olivine is completely replaced by serpentine mesh textures, associated with talc, clay and amphibole. Clinopyroxene is moderately altered along cleavage planes and grain boundaries, but some grains are completely replaced by fine grained green amphibole and chlorite. Plagioclase is highly fractured and moderately to highly altered to fine grained prehnite and chlorite along these fractures. Where it is less fractured, plagioclase is rather fresh. The rock is fractured and prehnite + clay + chlorite veins follow these fractures. Small amounts of pyrite and magnetite are present in the highly fractured plagioclase.

**STRUCTURE COMMENT:**

Magmatic: Heterogeneous, isotropic anorthosite and gabbro, with a wide range of grain sizes. Local patches of strongly annealed plagioclase with little twinning, or zoning, commonly intergrown with clinopyroxene, and very fine grained <0.05 mm. Coarser grained plagioclase locally with axial ratios up to 6:1, showing deformation twins. Common spinel.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Cut by a set of curved, subparallel shear fractures on one end.  
 Veins/alteration: Cut by prehnite, chlorite, chlorite-clay veins.

Crosscutting Relationships (as apparent in thin section):  
 1) Mixing of melt with partially solidified magma, some reaction.  
 2) Fracture and vein formation.

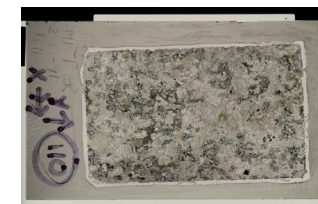
**PHOTOMICROGRAPHS:**

345\_U1415P\_6R\_2\_TS\_109.JPG  
 345\_U1415P\_6R\_2\_TS\_109-2.JPG

**THIN SECTION:** 345-U1415P-6R-2-W 90/91-TSB\_Piece\_11-TS\_110  
**Rock name:** olivine gabbro  
**Rock comment:** moderately altered  
**Lithologic interval:** 8  
**Piece No.:** #11  
**Billet request comment:** IgPet: Prim. Mineralogy

**Thin Section no.:** 110  
**Authors:** JM, RW

**PRIMARY MINERALOGY** No. of igneous domains: 1 Nature of ign. domains:  
**Igneous domain number:** 1  
**Domain grain size:** medium grained  
**Domain texture:** granular  
**Domain comment:**  
**Domain lithology:** olivine gabbro  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	16	20	4	3	anhedral	irregular				
Plagioclase	55	60	5	3	subhedral	tabular	continuous			
Clinopyroxene	18	20	2	13	anhedral	subequant		colorless	interstitial	two large interstitial grains
Oxide		0.1		0.1	subhedral	equant				chromian spinel

**ALTERATION / METAMORPHISM** No. of alteration domains: 1 Domain type:  
**Alteration domain number:** 1  
**Domain rel. abund %:** 100  
**Estimated total % alteration:** 14

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	1.5	plagioclase 1.5%	Olivine	20	20	pale/colorless amphibole 5%, clay minerals 15%, oxide 1%, serpentine 75%, talc 4%	
clay minerals	0.6	olivine 0.6%	Plagioclase	60	10	chlorite 25%, prehnite 75%	
oxide	0	olivine <0.1%	Clinopyroxene	20	20	pale/colorless amphibole 100%	
pale/colorless amphibole	4.2	olivine 0.2%, clinopyroxene 4%	Oxide	1	0		
prehnite	4.5	plagioclase 4.5%					
serpentine	3	olivine 3%					
talc	0.2	olivine 0.2%					
<b>domain total alteration %:</b>	<b>14</b>						

**Vein summary**  
 vein 1 thin chlorite veins

**ALTERATION COMMENT:** Plagioclase is altered to prehnite along micro cracks. Olivine is variably altered to serpentine with lesser amounts of tremolite, talc. Oxides are associated with serpentine, but sulfides are not present.

**STRUCTURE COMMENT:** Magmatic: Heterogeneous, isotropic oikocryst-bearing gabbro. Skeletal olivine (up to 6 mm), encloses plagioclase. Spinel, with hollow centers. Plagioclase (1 mm) with subgrains, undulose extinction, and deformation twins. Orthopyroxene encloses olivine and plagioclase, unstrained. Clinopyroxene shows no strain. Orthopyroxene rims around olivine. Crystal Plastic: No crystal plastic deformation. Brittle: Cut by curved open fractures. Veins/alteration: Thin chlorite veins.

Crosscutting Relationships (as apparent in thin section):  
 1) Open fractures.

**PHOTOMICROGRAPHS:** 345\_U1415P\_6R\_2\_TS\_110.JPG  
 345\_U1415P\_6R\_2\_TS\_110-2.JPG

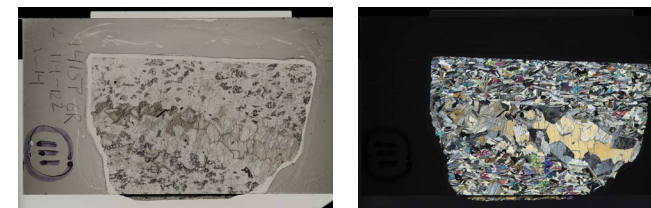
**THIN SECTION:** 345-U1415P-6R-2-W 119/122-TSB\_Piece\_14-TS\_111  
**Rock name:** troctolite  
**Rock comment:** with a patch of coarse grained "gabbronorite" (only a few mineral grains)  
**Lithologic interval:** 9  
**Piece No.:** #14  
**Billet request comment:** IgPet: Prim. Mineralogy

**Thin Section no.:** 111  
**Authors:** TH, TN

**PRIMARY MINERALOGY** No. of igneous domains: 2 Nature of ign. domains: two lithologies

**Igneous domain number:** 1  
**Domain grain size:** fine grained  
**Domain texture:** granular  
**Domain comment:**

**Domain lithology:** troctolite  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 60



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	24	26	2	0.8	anhedral	irregular			skeletal	
Plagioclase	73	74	1	0.9	anhedral to subhedral	elongated	continuous			foliated
Clinopyroxene	0.1	0.1	0	1	anhedral	irregular		colorless	interstitial	
Oxide	0.1	0.1	0	0.2	anhedral	subequant				

**Igneous domain number:** 2  
**Domain grain size:** medium grained  
**Domain texture:** comb structure  
**Domain comment:**

**Domain lithology:** olivine-bearing gabbronorite  
**Grain size distribution:** inequigranular  
**Relative abundance (%):** 40

	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	2	4	2	1.7	anhedral	irregular				
Plagioclase	67	67	0	2.2	subhedral	tabular	continuous			
Clinopyroxene	6	6	0	6	anhedral	irregular		colorless	interstitial	orthopyroxene blebs occurs in clinopyroxene
Orthopyroxene	19	23	4	7	anhedral	irregular		colorless		Brown colored exsolution lamella (spinel?). Some orthopyroxene occurs around olivine.
Oxide	0.1	0.1	0	0.02	anhedral to subhedral	subequant			associated with amphibole	tiny oxide grains occur around secondary amphibole

**ALTERATION / METAMORPHISM** Alteration domain number: 1 No. of alteration domains: 2 Domain type: background Domain rel. abund %: 70 Estimated total % alteration: 8

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
carbonate	0	olivine <0.1%	Olivine	20	20	pale/colorless amphibole 5%, clay minerals 10%, oxide 3%, sulfide 1%, serpentine 70%, talc 10%, carbonate 1%	
chlorite	1.6	plagioclase 1.6%	Plagioclase	79	5	chlorite 40%, clay minerals 35%, prehnite 20%, other 5%	other: carbonate
clay minerals	1.8	olivine 0.4%, plagioclase 1.4%	Clinopyroxene	1			
oxide	0.1	olivine 0.1%					
pale/colorless amphibole	0.2	olivine 0.2%					
prehnite	0.8	plagioclase 0.8%					
serpentine	2.8	olivine 2.8%					
sulfide	0	olivine <0.1%					
talc	0.4	olivine 0.4%					
other	0.2	plagioclase 0.2%					
<b>domain total alteration %:</b>	<b>7.9</b>						

**ALTERATION COMMENT:** Olivine is altered mainly to serpentine, and to small amounts of talc, clay and tremolite. Plagioclase has many fractures filled with clay, prehnite, chlorite and locally carbonate. Fractures cut the troctolite-gabbro contact with high intersection angles. Pyrite is associated with serpentine/clay/talc replacing olivine.

**ALTERATION / METAMORPHISM** Alteration domain number: 2 No. of alteration domains: 2 Domain type: background Domain rel. abund %: 30 Estimated total % alteration: 10

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	2.8	clinopyroxene 0.4%, plagioclase 2.4%	Plagioclase	60	10	chlorite 40%, clay minerals 35%, prehnite 20%, other 5%	other: carbonate
clay minerals	2.1	plagioclase 2.1%	Clinopyroxene	40	10	green amphibole 90%, chlorite 9%, sulfide 1%	
green amphibole	3.6	clinopyroxene 3.6%					
prehnite	1.2	plagioclase 1.2%					
sulfide	0	clinopyroxene <0.1%					
other	0.3	plagioclase 0.3%					
<b>domain total alteration %:</b>	<b>10</b>						

**Vein summary**  
 vein 1 several small chlorite veins

**ALTERATION COMMENT:** Clinopyroxene is partially replaced by colorless or pale-green amphibole. Plagioclase has many fractures filled with clay, prehnite, chlorite and locally carbonate. Fractures cut the troctolite-gabbro contact with high intersection angles. Pyrite is associated with amphibole replacing clinopyroxene.

**STRUCTURE COMMENT:** Magmatic: Very strong magmatic foliation defined by plagioclase SPO. Plagioclase locally bent, shows deformation twins, and rare subgrain formation. Weakly annealed, with scalloped grain boundaries. Skeletal olivine locally with subgrains; coarser grained on one side of the orthopyroxene-plagioclase vein than the other. Single orthopyroxene crystal slightly kinked. Associated coarser grained vein plagioclase apparently truncates finer host plagioclase. Minor interstitial clinopyroxene.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Cut by curved open fractures.  
 Veins/alteration: Thin chlorite veins.  
 Cross-cutting Relationships (as apparent in thin section):  
 1) Development of magmatic foliation.  
 2) Intrusion of orthopyroxene-plagioclase vein.

**PHOTOMICROGRAPHS:** 345\_U1415P\_6R\_2\_TS\_111.JPG  
 345\_U1415P\_6R\_2\_TS\_111-2.JPG



**THIN SECTION:** 345-U1415P-7R-1-W 60/62-TSB\_Piece\_8a-TS\_112  
**Rock name:** orthopyroxene-bearing olivine gabbro  
**Rock comment:** highly altered  
**Lithologic interval:** 13  
**Piece No.:** #8  
**Billet request comment:** IgPet: Primary Mineralogy; Orthopyroxene

**Thin Section no.:** 112  
**Authors:** MMJ, KF

**PRIMARY MINERALOGY**  
**No. of igneous domains:** 1  
**Nature of ign. domains:**  
**Igneous domain number:** 1  
**Domain grain size:** pegmatitic  
**Domain texture:** centimeter-sized clinopyroxene, orthopyroxene, plagioclase, and olivine occur in a pegmatitic patch  
**Domain comment:**  
**Domain lithology:** orthopyroxene-bearing olivine gabbro  
**Grain size distribution:** seriate  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	12	20	8	8	anhedral	irregular-amoeboid			corroded	former olivine also observed
Plagioclase	35	50	15	1	subhedral	tabular	discontinuous zoning			
Clinopyroxene	17	25	8	18	subhedral to euhedral			pale green	interstitial	
Orthopyroxene	4	5	1	6	subhedral to euhedral	elongate		pinkish green	interstitial	
Oxide	0.1	0.1	0	0.1	subhedral to euhedral	subequant				

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 1  
**No. of alteration domains:** 1  
**Domain type:** background  
**Domain rel. abund %:** 100  
**Estimated total % alteration:** 50

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	12.1	orthopyroxene 2.1%, plagioclase 10%	Olivine	10	20	pale/colorless amphibole 10%, clay minerals 10%, oxide 4%, sulfide 1%, serpentine 55%, talc 20%	Olivine is slightly altered to serpentine mesh textures, associated with amphibole, clay and talc towards the rim, surrounded by a thin rim of coronitic chlorite.
clay minerals	5.8	olivine 0.2%, clinopyroxene 4.2%, orthopyroxene 1.4%	Plagioclase	50	40	chlorite 50%, prehnite 50%	Plagioclase is highly fractured and moderately altered to fine grained prehnite and chlorite along these micro-fractures. Some plagioclase grains that were included in pyroxene are completely altered to chlorite.
oxide	0.1	olivine 0.1%	Clinopyroxene	30	70	pale/colorless amphibole 80%, clay minerals 20%	Clinopyroxene is intensively altered to amphibole and clay along cleavage planes.
pale/colorless amphibole	20.5	olivine 0.2%, clinopyroxene 16.8%, orthopyroxene 3.5%	Orthopyroxene	10	70	pale/colorless amphibole 50%, chlorite 30%, clay minerals 20%	Orthopyroxene is intensively altered to amphibole and clay along cleavage planes and grain boundaries. In one area, orthopyroxene is intensively altered to chlorite.
prehnite	10	plagioclase 10%					
serpentine	1.1	olivine 1.1%					
sulfide	0	olivine <0.1%					
talc	0.4	olivine 0.4%					
<b>domain total alteration %:</b>	<b>50</b>						

**Vein summary**  
 vein 1 chlorite veins surrounded by chlorite alteration  
 vein 2 ragged dark green amphibole replacement veins cutting chloritized plagioclase and olivine

**ALTERATION COMMENT:** Olivine is moderately altered to serpentine mesh textures, associated with some amphibole, clay, talc and coronitic chlorite at the outside. Pyroxene is intensively altered to amphibole and clay along cleavage planes. Plagioclase is highly fractured and moderately altered to fine grained prehnite and chlorite along these fractures. Disseminated magnetite and rare pyrite are associated with the alteration of olivine.

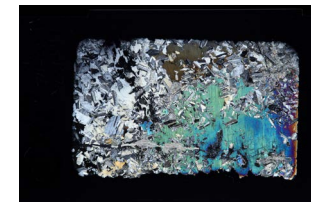
**STRUCTURE COMMENT:** Magmatic: Heterogeneous, isotropic magmatic fabric. Plagioclase shows deformation twins, and rare subgrain formation. Small patches locally annealed. Very coarse-grained clinopyroxene, orthopyroxene, plagioclase clots. Skeletal olivine locally hosts small plagioclase, locally shows undulose extinction. Spinels in host to clots.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Cut by subparallel set of finely-spaced fractures, hosting prehnite. Open fractures.  
 Veins/alteration: Cut by fibrous chlorite, dark green amphibole and prehnite. Carbonate in open pores.

Crosscutting Relationships (as apparent in thin section):  
 1) Intrusion of coarse clinopyroxene, orthopyroxene, plagioclase segregation.  
 2) Fracture and veining.

**PHOTOMICROGRAPHS:** 345\_U1415P\_7R\_1\_TS\_112.JPG  
 345\_U1415P\_7R\_1\_TS\_112-2.JPG

**THIN SECTION:** 345-U1415P-7R-1-W 110/112-TSB\_Piece\_11c-TS\_113  
**Rock name:** olivine-bearing gabbro  
**Rock comment:** moderately altered  
**Lithologic interval:** 13  
**Piece No.:** #11  
**Billet request comment:** IgPet: Prim. Mineralogy; MetPet: Oliv. Alt.; Struct.  
**Thin Section no.:** 113  
**Authors:** JM, RW

**PRIMARY MINERALOGY**  
**No. of igneous domains:** 1  
**Nature of ign. domains:**  
**Igneous domain number:** 1  
**Domain grain size:** Coarse grained  
**Domain texture:** poikilitic  
**Domain comment:**  
**Domain lithology:** olivine-bearing gabbro  
**Grain size distribution:** inequigranular  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	0	2	2	1	anhedral	irregular				enclosed in poikilitic clinopyroxene
Plagioclase	33	35	2	2	subhedral to euhedral	tabular				plagioclase in poikilitic clinopyroxene is smaller in size; distribution of chadacrystic grains in poikilitic clinopyroxene is heterogeneous
Clinopyroxene	50	63	13	20	anhedral	subequant		pale green	poikilitic	three large poikilitic grains

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 1  
**No. of alteration domains:** 1  
**Domain type:**  
**Domain rel. abund %:** 100  
**Estimated total % alteration:** 11

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	0.6	plagioclase 0.6%	Olivine	2	100	green amphibole <0.1%, pale/colorless amphibole 40%, clay minerals 10%, serpentine 50%	
clay minerals	0.2	olivine 0.2%	Plagioclase	38	5	chlorite 30%, prehnite 70%	
green amphibole	0	olivine <0.1%	Clinopyroxene	60	15	pale/colorless amphibole 100%	Clinopyroxene alteration includes trace amounts of oxides, and even less common sulfides.
pale/colorless amphibole	9.8	olivine 0.8%, clinopyroxene 9%					
prehnite	1.3	plagioclase 1.3%					
serpentine	1	olivine 1%					
<b>domain total alteration %:</b>		<b>12.9</b>					

**Vein summary**  
 vein 1 prehnite veins cut cataclasis and are also brecciated

**ALTERATION COMMENT:** Olivine completely replaced largely by serpentine, clinopyroxene locally replaced by amphibole, and plagioclase replaced by prehnite and chlorite along fractures. Clinopyroxene alteration includes trace amounts of oxides, and even less common sulfides.

**STRUCTURE COMMENT:** Magmatic: Heterogeneous, isotropic magmatic fabric. Plagioclase shows rare deformation twins, and subgrain formation. Coarse-grained orthopyroxene and clinopyroxene oikocrysts - plagioclase show minor undulose extinction as inclusions. Plagioclase hosted by orthopyroxene oikocrysts are of variable grain sizes, show good zoning, relatively little annealed.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Cut by open fractures, local cataclasis.  
 Veins/alteration: Cut by prehnite-chlorite veins. Clinopyroxene altered to blue amphibole.  
 Crosscutting Relationships (as apparent in thin section):  
 1) Cracking and vein intrusion.

**PHOTOMICROGRAPHS:** 345\_U1415P\_7R\_1\_TS\_113.JPG  
 345\_U1415P\_7R\_1\_TS\_113-2.JPG

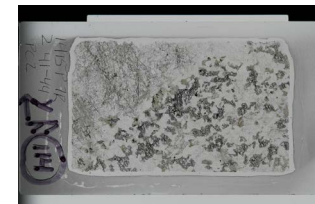
**THIN SECTION:** 345-U1415P-7R-2-W 41/44-TSB\_Piece\_2-TS\_114  
**Rock name:** contact between orthopyroxene bearing olivine gabbro and an "enclave"  
**Rock comment:** slightly altered  
**Lithologic interval:** 13  
**Piece No.:** #2  
**Billet request comment:** IgPet: Primary Mineralogy

**Thin Section no.:** 114  
**Authors:** TH, RW

**PRIMARY MINERALOGY** **No. of Igneous domains:** 2 **Nature of ign. domains:** two lithologies

**Igneous domain number:** 1  
**Domain grain size:** medium grained  
**Domain texture:** granular  
**Domain comment:** part of a ~ 10 cm sized, diffuse "enclave"

**Domain lithology:** orthopyroxene-bearing troctolite  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 72



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	25	35	10	1.5	anhedral	amoeboid				
Plagioclase	60	61.5	1.5	1.5	subhedral	tabular	continuous			
Clinopyroxene	0.4	0.5	0.1	1	anhedral	irregular		colorless	interstitial	
Orthopyroxene	2.5	3	0.5	1	anhedral	irregular		colorless	interstitial	often associated with olivine
Oxide	0.1	0.1	0	0.2	anhedral to subhedral	subequant				

**Igneous domain number:** 2  
**Domain grain size:** medium-coarse  
**Domain texture:** granular  
**Domain comment:** host rock, which is orthopyroxene-bearing olivine gabbro; thin section presents a domain very rich plagioclase which is therefore named anorthosite

**Domain lithology:** anorthosite  
**Grain size distribution:** inequigranular  
**Relative abundance (%):** 28

	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Plagioclase	96	98	2	0.8	anhedral to subhedral	subequant	continuous			120 degree triple junction; some aggregates are fine grained
Clinopyroxene	2	2	0	4	anhedral	irregular		colorless	interstitial	occurs only at the boundary of the two domains

**ALTERATION / METAMORPHISM** **No. of alteration domains:** 1 **Domain type:** **Domain rel. abund %:** 100 **Estimated total % alteration:** 10

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	ALTERATION		REPLACEMENT MINERAL	ALTERATION COMMENTS
				% ORIGINAL	% ALTERED		
chlorite	7.5	plagioclase 7.5%	Olivine	15	10	pale/colorless amphibole 18%, oxide 1%, sulfide 1%, serpentine 50%, talc 30%	
oxide	0	olivine <0.1%	Plagioclase	83	10	chlorite 90%, other 10%	10 % of plagioclase is replaced by calcite.
pale/colorless amphibole	0.5	olivine 0.3%, clinopyroxene 0.2%	Clinopyroxene	2	10	pale/colorless amphibole 100%	
serpentine	0.8	olivine 0.8%	Oxide	1	20	other 100%	larger grains are locally altered to another oxide, or to the same oxide with a slightly different texture.
sulfide	0	olivine <0.1%					
talc	0.5	olivine 0.5%					
other	1	plagioclase 0.8%, oxide 0.2%					
<b>domain total alteration %:</b>		<b>10.3</b>					

**ALTERATION COMMENT:** Olivine is moderately altered to serpentine, talc, and amphibole, with oxide seams associated with the serpentine mesh texture, and sulfides associated with the talc. Plagioclase is altered pervasively to chlorite in small cracks, and irregularly to larger grains of chlorite and calcite.

**STRUCTURE COMMENT:** Magmatic: Boundary between anorthosite and orthopyroxene-bearing troctolite (enclave)  
 Anorthosite - Heterogeneous grain size; isotropic magmatic fabric. Plagioclase zoned, shows rare deformation twins, and subgrain formation, locally annealed in finer-grained patches. Interstitial clinopyroxene along boundary.  
 Orthopyroxene-bearing troctolite - Heterogeneous, isotropic magmatic fabric. Olivine skeletal (up to 3mm), locally show subgrain development. See wedges-shaped plagioclase crystal growth beyond olivine grain boundaries, indicating simultaneous plagioclase and olivine growth. Plagioclase shows strong zonation, rare deformation twins, subgrain formation, and minor annealing. Locally bent plagioclase.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Cut by a set of subparallel fractures, some open porosity.  
 Veins/alteration: Cut by prehnite, carbonate, chlorite, clay veins. Open porosity locally hosts carbonate.  
 Crosscutting Relationships (as apparent in thin section):  
 1) Cracking and vein intrusion.

**PHOTOMICROGRAPHS:** 345\_U1415P\_7R\_2\_TS\_114.JPG  
 345\_U1415P\_7R\_2\_TS\_114-2.JPG

**THIN SECTION:** 345-U1415P-BR-1-W 3/4-TSB\_Piece\_1-TS\_115  
**Rock name:** olivine gabbro  
**Rock comment:** moderately altered  
**Lithologic interval:** 16  
**Piece No.:** #1  
**Billet request comment:** IgPet: Prim. Mineralogy; MetPet: Bkgnd Alteration

**Thin Section no.:** 115  
**Authors:** MMJ, AM

**PRIMARY MINERALOGY**  
**No. of igneous domains:** 1  
**Nature of ign. domains:**

**Igneous domain number:**  
**Domain grain size:** medium grained  
**Domain texture:** granular  
**Domain comment:** Hand sample sample modal grain size was described as coarse, however, interval in from thin section is medium grained

**Domain lithology:** olivine gabbro  
**Grain size distribution:** seriate  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	12	20	8	3.5	subhedral	equant			overgrowth	display mesh texture
Plagioclase	40	50	10	1	subhedral	tabular	patchy zoning			
Clinopyroxene	20	30	10	1	subhedral to euhedral	prismatic		pale green	interstitial	interstitial clinopyroxene could be part of large poikilitic clinopyroxene

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 1  
**No. of alteration domains:** 1  
**Domain type:** background  
**Domain rel. abund %:** 100  
**Estimated total % alteration:** 20

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	1	plagioclase 1%	Olivine	15	50	pale/colorless amphibole 10%, clay minerals 15%, oxide 1%, sulfide 1%, serpentine 20%, talc 53%	
clay minerals	1.1	olivine 1.1%	Plagioclase	65	15	chlorite 10%, prehnite 90%	
green amphibole	1	clinopyroxene 1%	Clinopyroxene	20	5	green amphibole 100%	
oxide	0.1	olivine 0.1%					
pale/colorless amphibole	0.8	olivine 0.8%					
prehnite	8.8	plagioclase 8.8%					
serpentine	1.5	olivine 1.5%					
sulfide	0.1	olivine 0.1%					
talc	4	olivine 4%					
<b>domain total alteration %:</b>	<b>18.4</b>						

**Vein summary**  
 vein 1 chlorite/smectite - prehnite-carbonate composite veins are present with prehnite probably replacing chlorite, and carbonate a late fill

**ALTERATION COMMENT:** Olivine alteration shows kernels of serpentine mesh texture with oxide surrounded largely by talc + sulfide, with patches of clay probably replacing relict olivine; locally there are some pale amphiboles; plagioclase is heterogeneously altered to prehnite with a few patches of chlorite and weakly developed corona rims.

**STRUCTURE COMMENT:** Magmatic: Heterogeneous, magmatic layering, with an isotropic fabric. Plagioclase shows rare deformation twins, and subgrain formation. Small local patches of annealed plagioclase adjacent to olivine. Coarse-grained orthopyroxene oikocrysts - plagioclase show minor undulose extinction as inclusions. Minor spinel. Crystal Plastic: No crystal plastic deformation. Brittle: Cut by subparallel set of fractures. Open fractures. Veins/alteration: Chlorite-smectite and prehnite-carbonate composite veins. Late carbonate fill.

Crosscutting Relationships (as apparent in thin section):  
 1) Cracking and vein intrusion.

**PHOTOMICROGRAPHS:** 345\_U1415P\_BR\_1\_TS\_115.JPG  
 345\_U1415P\_BR\_1\_TS\_115-2.JPG

**THIN SECTION:** 345-U1415P-8R-1-W 80/83-TSB\_Piece\_6-TS\_116  
**Rock name:** olivine gabbro with a "noritic" band  
**Rock comment:** moderately altered  
**Lithologic interval:** 17  
**Piece No.:** #6  
**Billet request comment:** IgPet: Prim. Mineralogy; Struct: Magmatic Fabric

**Thin Section no.:** 116  
**Authors:** NA, AM



**PRIMARY MINERALOGY**      **No. of igneous domains:** 2      **Nature of ign. domains:** two lithologies

**Igneous domain number:** 1      **Domain lithology:** troctolite  
**Domain grain size:** medium      **Grain size distribution:** equigranular  
**Domain texture:** granular      **Relative abundance (%):** 55  
**Domain comment:** this domain is "troctolitic", but the whole rock is very heterogeneous corresponding to olivine gabbro

	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	15	25	10	2.5	anhedral	irregular				
Plagioclase	70	75	5	1.5	anhedral	tabular				
Clinopyroxene	0.1	0.1	0	0.5	anhedral	interstitial				
Orthopyroxene	0.1	0.1	0	0.5	anhedral	interstitial				
Oxide	0.1	0.1	0	0.1	subhedral	subequant			interstitial	chromian spinel

**Igneous domain number:** 2      **Domain lithology:** norite  
**Domain grain size:** coarse      **Grain size distribution:** seriate  
**Domain texture:** granular      **Relative abundance (%):** 45  
**Domain comment:** a band showing a "noritic" composition

	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Plagioclase	30	35	5	3	anhedral	tabular	oscillatory zoning			some plagioclases are deformed
Clinopyroxene	3	3	0	2.5	anhedral	interstitial				
Orthopyroxene	55	62	7	4.5	anhedral	irregular				
Oxide	0.1	0.1	0	0.1	anhedral	subequant			interstitial	chromian spinel

**ALTERATION / METAMORPHISM**      **No. of alteration domains:** 1      **Domain rel. abund %:** 100      **Estimated total % alteration:** 20  
**Alteration domain number:** 1      **Domain type:** background

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	5.5	olivine 0.5%, orthopyroxene 0.8%, plagioclase 4.2%	Olivine	7	70	pale/colorless amphibole 10%, chlorite 10%, clay minerals 10%, oxide 0.2%, sulfide 1%, serpentine 10%, talc 58.8%	
clay minerals	0.5	olivine 0.5%	Plagioclase	70	15	chlorite 40%, prehnite 40%, secondary plagioclase 20%	
oxide	0	olivine <0.1%	Clinopyroxene	3	10	pale/colorless amphibole 100%	
pale/colorless amphibole	4	olivine 0.5%, clinopyroxene 0.3%, orthopyroxene 3.2%	Orthopyroxene	20	20	pale/colorless amphibole 80%, chlorite 20%	
prehnite	4.2	plagioclase 4.2%					
secondary plagioclase	2.1	plagioclase 2.1%					
serpentine	0.5	olivine 0.5%					
sulfide	0	olivine <0.1%					
talc	2.9	olivine 2.9%					
<b>domain total alteration %:</b>	<b>19.7</b>						

**Vein summary**  
 vein 1 several chlorite veins, crosscutting all primary minerals, sometimes overprinted by prehnite in former plagioclase, but sometime crosscutting prehnite.

**ALTERATION COMMENT:** Orthopyroxene is altered along cleavage and along veins to pale amphibole; olivine alteration is dominated by talc + sulfide with kernels of serpentine mesh texture, and some amphibole from the corona reaction; plagioclase is moderately altered to corona rim chlorite, patchy chlorites with carbonate and net veins of prehnite, with areas of inclusion-rich secondary plagioclase

**STRUCTURE COMMENT:** Magmatic: Troctolite with norite band/lens.  
 Troctolite - Isotropic. Larger plagioclase grains show zoning, subgrains, undulose extinction, and deformation twins especially adjacent to clinopyroxene. Patches of finer-grained annealed plagioclase (~0.5 mm), adjacent to olivine. Skeletal olivine.  
 Norite - Isotropic. Plagioclase and orthopyroxene band. Plagioclase shows deformation twins, and rare subgrain formation.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Cut by a set of subparallel fractures.  
 Veins/alteration: Cut by composite prehnite, chlorite, zeolite, clay and carbonate veins.  
 Cross-cutting Relationships (as apparent in thin section):  
 1) Cracking and vein intrusion.

**PHOTOMICROGRAPHS:** 345\_U1415P\_8R\_1\_TS\_116.JPG  
 345\_U1415P\_8R\_1\_TS\_116-2.JPG

**THIN SECTION:** 345-U1415P-9R-1-W 3/4-TSB\_Piece\_1-TS\_117  
**Rock name:** orthopyroxene-bearing olivine gabbro  
**Rock comment:** moderately altered  
**Lithologic interval:** 18  
**Piece No.:** #1  
**Billet request comment:** IgPet: Primary Mineralogy

**Thin Section no.:** 117

**Authors:** JM, KF

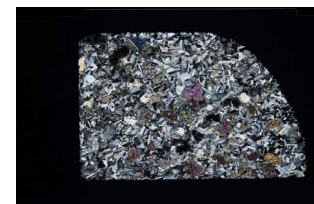
**PRIMARY MINERALOGY**

**No. of igneous domains:** 1

**Nature of ign. domains:**

**Igneous domain number:** 1  
**Domain grain size:** medium grained  
**Domain texture:** granular  
**Domain comment:**

**Domain lithology:** orthopyroxene-bearing olivine gabbro  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	15	20	5	2	anhedral	irregular				enclosing/surrounding tabular plagioclase
Plagioclase	63	65	2	1.5	subhedral	tabular	continuous zoning			
Clinopyroxene	8	10	2	8	anhedral	subequant		colorless	interstitial	
Orthopyroxene	4	5	1	1	anhedral	irregular		pinkish brown	interstitial	
Oxide	0.1	0.1	0	0.1	anhedral to subhedral	equant				

**ALTERATION / METAMORPHISM**

**No. of alteration domains:** 1

**Domain rel. abund %:** 100

**Estimated total % alteration:** 30

**Alteration domain number:** 1

**Domain type:** background

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	9.8	plagioclase 9.8%	Olivine	20	50	pale/colorless amphibole 10%, clay minerals 58%, sulfide 2%, serpentine 20%, talc 10%	Olivine is moderately altered. Some grains are slightly altered to serpentine mesh textures, and clay+colorless amphibole at the outside, associated with clay and pyrite. Other grains are completely replaced by amphibole and talc, but relict serpentine mesh textures are still visible. In both cases, former olivine grains are surrounded by a thin rim of chlorite when in contact with plagioclase.
clay minerals	5.8	olivine 5.8%	Plagioclase	70	20	chlorite 70%, prehnite 30%	Plagioclase is fractured by micro-fractures and the slightly to moderately altered to fine grained chlorite and prehnite along these fractures and the grain boundaries.
green amphibole	1.8	clinopyroxene 0.8%, orthopyroxene 1%	Clinopyroxene	5	30	green amphibole 50%, pale/colorless amphibole 50%	Clinopyroxene is moderately altered to amphibole along cleavage planes and grain boundaries.
pale/colorless amphibole	2.8	olivine 1%, clinopyroxene 0.8%, orthopyroxene 1%	Orthopyroxene	5	40	green amphibole 50%, pale/colorless amphibole 50%	Orthopyroxene is moderately altered to amphibole along cleavage planes and grain boundaries.
prehnite	4.2	plagioclase 4.2%					
serpentine	2	olivine 2%					
sulfide	0.2	olivine 0.2%					
talc	1	olivine 1%					
<b>domain total alteration %:</b>	<b>27.6</b>						

**ALTERATION COMMENT:**

Olivine is moderately altered to serpentine mesh textures, with clay and amphibole at the outside, other grains are completely replaced by amphibole, clay and talc. Pyroxene is moderately altered to amphibole along cleavage planes and grain boundaries. Plagioclase is fractured and altered to fine grained chlorite and prehnite along micro-fractures and along grain boundaries. Pyrite is associated with the alteration of olivine.

**STRUCTURE COMMENT:**

Magmatic: Heterogeneous with isotropic magmatic fabric; host to a wide range of grain sizes. Skeletal/hopper olivine up to 1 cm across, showing common subgrains and undulose extinction. Plagioclase ranges in grain size down to 0.1 mm; locally strongly annealed. Larger plagioclase grains near olivine show common deformation twins, undulose extinction, subgrain formation, and rare bent grains. Between skeletal olivine "fingers" @ ca. see bent/broken plagioclase, or individual grains wrapping around olivine. Interstitial clinopyroxene.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Cut by a set of subparallel fractures.  
 Veins/alteration: Cut by thin prehnite, clay, and chlorite veins.  
 Crosscutting Relationships (as apparent in thin section):  
 1) Cracking and vein intrusion.

**PHOTOMICROGRAPHS:**

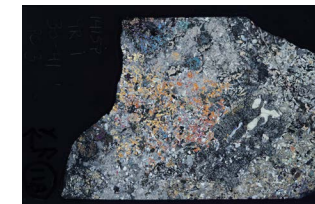
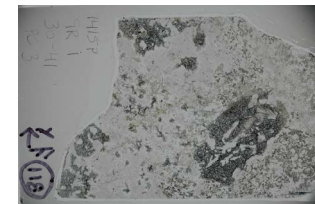
345\_U1415P\_9R\_1\_TS\_117.JPG  
 345\_U1415P\_9R\_1\_TS\_117-2.JPG

**THIN SECTION:** 345-U1415P-9R-1-W 36/41-TSB\_Piece\_3-TS\_118  
**Rock name:** orthopyroxene-bearing olivine gabbro  
**Rock comment:** moderately altered  
**Lithologic interval:** 19  
**Piece No.:** #3  
**Billet request comment:** Lg. Fmt; IgPet: Prim. Mineralogy; Struct: Hurrisitc Olivine

**Thin Section no.:** 118  
**Authors:** MMJ, RW

**PRIMARY MINERALOGY**  
**No. of igneous domains:** 1  
**Nature of ign. domains:**  
**Igneous domain number:**  
**Domain grain size:** pegmatitic  
**Domain texture:** granular to poikilitic  
**Domain comment:** white patches in hand sample are a combination of altered clinopyroxene/plagioclase

**Domain lithology:** orthopyroxene-bearing olivine gabbro  
**Grain size distribution:** seriate  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	10	20	10	11	anhedral to subhedral	irregular-amoeboid			harrasitic	display mesh texture
Plagioclase	39	58	19	1	subhedral	tabular	oscillatory zoning			some chadacrysts
Clinopyroxene	10	20	10	10	subhedral	irregular		pale green	interstitial	contains large poikilitic clinopyroxene (optically continuous)
Orthopyroxene	1.5	2	0.5	4	anhedral	irregular		pinkish green	corroded	chadacryst in olivine

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 1  
**No. of alteration domains:** 1  
**Domain type:**  
**Domain rel. abund %:** 100  
**Estimated total % alteration:** 11

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	2	olivine 0.2%, plagioclase 1.8%	Olivine	20	20	pale/colorless amphibole 15%, chlorite 5%, clay minerals 30%, oxide 2%, sulfide 1%, serpentine 42%, talc 5%	
clay minerals	1.2	olivine 1.2%	Plagioclase	59	10	chlorite 30%, prehnite 50%, other 20%	20% of the plagioclase is altered to calcite
green amphibole	1	clinopyroxene 1%	Clinopyroxene	20	5	green amphibole 100%	
oxide	0.1	olivine 0.1%	Oxide	1			
pale/colorless amphibole	0.6	olivine 0.6%					
prehnite	3	plagioclase 3%					
serpentine	1.7	olivine 1.7%					
sulfide	0	olivine <0.1%					
talc	0.2	olivine 0.2%					
other	1.2	plagioclase 1.2%					
<b>domain total alteration %:</b>	<b>11</b>						

**Vein summary**  
 vein 1 Vein 2 cm long syntaxial vein filled with chlorite on the margins, and zeolite, or prehnite, or calcite in the core.  
 vein 2 fine grained randomly oriented chlorite

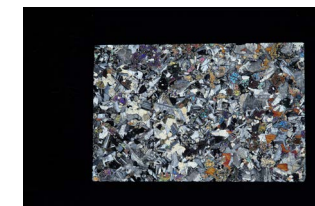
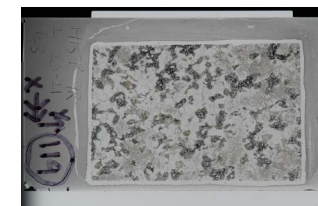
**ALTERATION COMMENT:** Most of the alteration is caused by the replacement of olivine by serpentine and clay minerals, with lesser amphibole, talc and chlorite. Plagioclase is altered to prehnite, chlorite and calcite, and clinopyroxene is slightly altered to amphibole. Oxides are associated with serpentine, and sulfides are associated with talc.

**STRUCTURE COMMENT:** Magmatic: Heterogeneous with isotropic magmatic fabric; host to a wide range of plagioclase grain sizes. Plagioclase away from olivine hopper ranges in grain size down to 0.1 mm; locally annealed in olivine. Elongate plagioclase grains show subgrain formation in orthopyroxene oikocryst. Plagioclase at the margins of orthopyroxene that fills open space in olivine hoppers. Locally see clinopyroxene 'infiltrating' olivine hopper between plagioclase and orthopyroxene. Late interstitial clinopyroxene throughout section. Crystal Plastic: No crystal plastic deformation. Brittle: Cut by a set of subparallel fractures. Veins/alteration: Cut by one carbonate-prehnite vein. Multiple generations of thin chlorite and clay veins.

Crosscutting Relationships (as apparent in thin section):  
 1) Cracking and vein intrusion.

**PHOTOMICROGRAPHS:** 345\_U1415P\_9R\_1\_TS\_118.JPG  
 345\_U1415P\_9R\_1\_TS\_118-2.JPG

**THIN SECTION:** 345-U1415P-9R-2-W 20/21-TSB\_Piece\_3-TS\_119 **Thin Section no.:** 119  
**Rock name:** orthopyroxene-bearing olivine gabbro  
**Rock comment:** patchy distribution of different lithologies in a macroscopically homogeneous rock, moderately altered.  
**Lithologic interval:** 21  
**Piece No.:** #3 **Authors:** TF, KF  
**Billet request comment:** IgPet: Primary Mineralogy



**PRIMARY MINERALOGY** **No. of igneous domains:** 2 **Nature of ign. domains:** two lithologies

**Igneous domain number:** 1  
**Domain grain size:** medium  
**Domain texture:** poikilitic  
**Domain comment:** one large optically continuous clinopyroxene

**Domain lithology:** olivine gabbro  
**Grain size distribution:** seriate  
**Relative abundance (%):** 60

	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	10	20	10	2	subhedral to anhedral	ameboid				
Plagioclase	50	65	15	0.75	euohedral to subhedral	tabular				
Clinopyroxene	15	15	0	20	anhedral	irregular		interstitial		poikilitic

**Igneous domain number:** 2  
**Domain grain size:** medium  
**Domain texture:** granular  
**Domain comment:**

**Domain lithology:** olivine gabbro  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 40

	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	10	20	10	2	subhedral to anhedral	ameboid				
Plagioclase	50	70	20	0.75	euohedral to subhedral	tabular				
Clinopyroxene	5	5	0	20	anhedral	irregular		interstitial		
Orthopyroxene	5	5	0	3	anhedral	irregular		interstitial		poikilitic

**ALTERATION / METAMORPHISM** **No. of alteration domains:** 1 **Domain rel. abund %:** 100 **Estimated total % alteration:** 25

**Alteration domain number:** 1 **Domain type:** background

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	8.4	plagioclase 8.4%	Olivine	25	40	pale/colorless amphibole 50%, clay minerals 10%, oxide 2%, sulfide 3%, serpentine 20%, talc 15%	Olivine is moderately altered to serpentine mesh textures with amphibole, clay and coronitic chlorite at the outside. Some olivine grains are completely replaced by amphibole and talc. Disseminated magnetite is associated with the serpentine, pyrite also is related to the alteration of olivine.
clay minerals	1	olivine 1%	Plagioclase	70	20	chlorite 60%, prehnite 40%	Plagioclase is slightly fractured and slightly to moderately altered to fine grained prehnite and chlorite along these micro-fractures. When in contact with olivine, plagioclase is altered to coronitic chlorite rims around the olivine.
oxide	0.2	olivine 0.2%	Clinopyroxene	5	40	pale/colorless amphibole 100%	Interstitial clinopyroxene is moderately altered to amphibole along cleavage planes and grain boundaries.
pale/colorless amphibole	7	olivine 5%, clinopyroxene 2%					
prehnite	5.6	plagioclase 5.6%					
serpentine	2	olivine 2%					
sulfide	0.3	olivine 0.3%					
talc	1.5	olivine 1.5%					
<b>domain total alteration %:</b>	<b>26</b>						

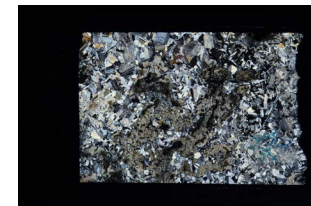
**ALTERATION COMMENT:** Olivine is moderately altered to serpentine mesh textures with amphibole, clay and coronitic chlorite at the outside. Some relict olivine grains are pseudomorphically replaced by amphibole + talc. Interstitial clinopyroxene is moderately altered to amphibole along cleavage planes and grain boundaries. Plagioclase is slightly fractured and slightly to moderately altered to fine grained prehnite and chlorite along micro-fractures. When in contact with olivine, plagioclase is altered to coronitic chlorite rims around the olivine. Disseminated magnetite and pyrite are associated with the alteration of olivine.

**STRUCTURE COMMENT:** Magmatic: Heterogeneous with isotropic magmatic fabric. Skeletal olivine up to 5 mm. Plagioclase near olivine annealed in olivine. Plagioclase grains show weak zoning, undulose extinction, common deformation twins, and local bent grains. Patches of small, annealed plagioclase. Orthopyroxene locally shows undulose extinction. Late interstitial clinopyroxene throughout section.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Cut by open fractures.  
 Veins/alteration: Cut by a zeolite vein. Minor carbonate.  
 Crosscutting Relationships (as apparent in thin section):  
 1) Cracking and vein intrusion.

**PHOTOMICROGRAPHS:** 345\_U1415P\_9R\_2\_TS\_119.JPG  
 345\_U1415P\_9R\_2\_TS\_119-2.JPG



**THIN SECTION:** 345-U1415P-10R-1-W 60/62-TSB\_Piece\_7-TS\_120  
**Thin Section no.:** 120  
**Rock name:** olivine gabbro  
**Rock comment:** moderately altered  
**Lithologic interval:** 24  
**Piece No.:** #7  
**Authors:** JM, RW  
**Billet request comment:** IgPet: Prim. Mineralogy; MetPet: Oliv. Alt.and Sulfides; Struct: Skeletal Oliv.  
**PRIMARY MINERALOGY**  
**No. of igneous domains:** 1  
**Nature of ign. domains:**  
**Igneous domain number:** 1  
**Domain grain size:** Coarse grained  
**Domain texture:** granular  
**Domain comment:**  
**Domain lithology:** olivine gabbro  
**Grain size distribution:** seriate  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	0	25	25	6	anhedral	irregular				containing many sulfide grains; surrounded by poikilitic to interstitial large clinopyroxene
Plagioclase	50	50	0	1	subhedral	tabular	continuous zoning			smaller grain size (~1 mm) of chadacrystic grains in poikilitic clinopyroxene
Clinopyroxene	23	25	2	8	anhedral	subequant		colorless	poikilitic to interstitial	

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 1  
**No. of alteration domains:** 1  
**Domain type:** background  
**Domain rel. abund %:** 100  
**Estimated total % alteration:** 27

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	3.8	plagioclase 3.8%	Olivine	18	100	pale/colorless amphibole 10%, clay minerals 48%, oxide 1%, sulfide 1%, serpentine 30%, talc 10%	
clay minerals	8.6	olivine 8.6%	Plagioclase	76	10	chlorite 50%, prehnite 50%	
oxide	0.2	olivine 0.2%	Clinopyroxene	6	20	pale/colorless amphibole 100%	
pale/colorless amphibole	3	olivine 1.8%, clinopyroxene 1.2%	Oxide	1			
prehnite	3.8	plagioclase 3.8%					
serpentine	5.4	olivine 5.4%					
sulfide	0.2	olivine 0.2%					
talc	1.8	olivine 1.8%					
<b>domain total alteration %:</b>		<b>26.8</b>					

**ALTERATION COMMENT:** Olivine is completely altered primarily to clay minerals but also to amphibole and talc. Plagioclase is slightly altered to prehnite and chlorite, primarily along fractures, and clinopyroxene is slightly altered to amphibole. Oxides that define a mesh texture are associated with serpentine or with clay minerals, and sulfides are associated with talc.

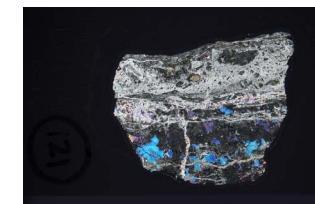
**STRUCTURE COMMENT:** Magmatic: Heterogeneous grain size; isotropic magmatic fabric. Plagioclase locally shows elongate aspect ratio, oscillatory zoning, deformation twins, and bending in orthopyroxene oikocrysts. Patches of strongly annealed fine-grained plagioclase. Hopper olivine now altered.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Cut by a fracture system.  
 Veins/alteration: Cut by chlorite-clay, and prehnite veins.

Crosscutting Relationships (as apparent in thin section):  
 1) Cracking, alteration, and vein formation.

**PHOTOMICROGRAPHS:** 345\_U1415P\_10R\_1\_TS\_120.JPG  
 345\_U1415P\_10R\_1\_TS\_120-2.JPG

**THIN SECTION:** 345-U1415P-10R-1-W 121/134-TSB\_Piece\_13-TS\_121  
**Rock name:** cataclasite with gabbroic clasts  
**Rock comment:** protolith was gabbroic  
**Lithologic interval:** 25  
**Piece No.:** #13  
**Billet request comment:** IgPet: Prim. Mineralogy; MetPet: Cataclastic; Struct: Cataclastic Texture  
**Thin Section no.:** 121  
**Authors:** JK, AM

**PRIMARY MINERALOGY**  
**No. of igneous domains:** 1  
**Nature of ign. domains:**  
**Igneous domain number:** 1  
**Domain grain size:** medium grained to less than fine grained  
**Domain texture:** due to very strong cataclastic overprint, estimation of primary mode not possible; presence of clasts of oikocrystic clinopyroxene  
**Domain lithology:** cataclasite with gabbroic clasts  
**Grain size distribution:**  
**Relative abundance (%):**



ALTERATION / METAMORPHISM		No. of alteration domains: 2		Domain rel. abund %:		Estimated total % alteration:	
Alteration domain number:	1	Domain type:	cataclasite zone		30		90

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	37	olivine 16%, clinopyroxene 3%, plagioclase 18%	Olivine	20	100	pale/colorless amphibole 20%, chlorite 80%	
pale/colorless amphibole	17	olivine 4%, clinopyroxene 7%, plagioclase 6%	Plagioclase	60	100	pale/colorless amphibole 10%, chlorite 30%, prehnite 60%	
prehnite	36	plagioclase 36%	Clinopyroxene	20	50	pale/colorless amphibole 70%, chlorite 30%	
<b>domain total alteration %:</b>		<b>90</b>					

**Vein summary**  
 vein 1 Chlorite-zeolite-carbonate composite vein

**ALTERATION COMMENT:** Cataclastic zone overprinted by prehnite with variable degrees of alteration; a few sulfides in secondary plagioclase and amphibole clasts, but very sparse and no oxides.

ALTERATION / METAMORPHISM		No. of alteration domains: 2		Domain rel. abund %:		Estimated total % alteration:	
Alteration domain number:	2	Domain type:	background		70		85

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	49.2	olivine 16%, clinopyroxene 0.8%, plagioclase 32.4%	Olivine	20	100	pale/colorless amphibole 20%, chlorite 80%	
green amphibole	5.4	plagioclase 5.4%	Plagioclase	60	90	green amphibole 10%, pale/colorless amphibole 10%, chlorite 60%, prehnite 10%, zeolite 5%, secondary plagioclase 5%	
pale/colorless amphibole	11.5	olivine 4%, clinopyroxene 2.1%, plagioclase 5.4%	Clinopyroxene	20	15	pale/colorless amphibole 70%, chlorite 25%, secondary clinopyroxene 5%	
prehnite	5.4	plagioclase 5.4%					
secondary clinopyroxene	0.2	clinopyroxene 0.2%					
secondary plagioclase	2.7	plagioclase 2.7%					
zeolite	2.7	plagioclase 2.7%					
<b>domain total alteration %:</b>		<b>77.1</b>					

**Vein summary**  
 vein 3 prehnite veins, undeformed

**ALTERATION COMMENT:** Clinopyroxene is the least altered phase, with local alteration to secondary clinopyroxene, green amphibole and some chlorite; olivine is completely pseudomorphed by vermicular chlorite and needles of pale amphibole, with green amphibole locally superimposed on this; plagioclase is almost completely replaced, with relics often being secondary plagioclase or possibly zeolite; it is replaced by complex mixtures of chlorite and green amphibole similar to that seen in the veins; there is very little sulfide or oxide

**STRUCTURE COMMENT:**  
 Magmatic: No magmatic structure.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Cataclastic texture consists of clasts (clinopyroxene, amphibole, plagioclase, altered material, fine-grained aggregate) and fine-grained matrix (mainly prehnite, and minor chlorite and clay), which include ultracataclasite zone. Ultracataclasite has rounded-shape clasts and clay-filled matrix.  
 Veins/alteration: Cut by chlorite-clay, and prehnite veins. Those veins also cut by cataclastic deformation.  
 Crosscutting Relationships (as apparent in thin section):  
 1) Cataclastic deformation, and vein formation.

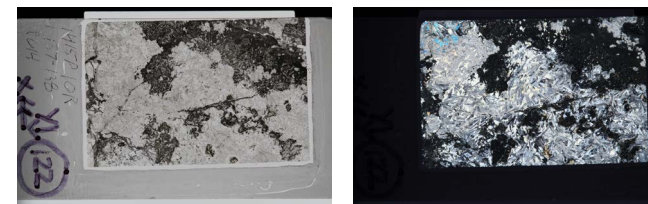
**PHOTOMICROGRAPHS:**  
 345\_U1415P\_10R\_1\_TS\_121.JPG  
 345\_U1415P\_10R\_1\_TS\_121-2.JPG

**THIN SECTION:** 345-U1415P-10R-1-W 137/138-TSB\_Piece\_14-TS\_122  
**Rock name:** olivine gabbro  
**Rock comment:** highly altered  
**Lithologic interval:** 25  
**Piece No.:** #14  
**Billet request comment:** IgPet: Primary Mineralogy

**Thin Section no.:** 122  
**Authors:** TH, AM

**PRIMARY MINERALOGY**  
**No. of igneous domains:** 1  
**Nature of ign. domains:**  
**Igneous domain number:** 1  
**Domain grain size:** medium grained  
**Domain texture:** granular  
**Domain comment:**

**Domain lithology:** olivine gabbro  
**Grain size distribution:** poikilitic  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	0	10	10	2.5	anhedral	subequant				
Plagioclase	50	75	25	1.5	subhedral to euhedral	tabular	continuous		chadacryst	
Clinopyroxene	13	15	2	20	anhedral	irregular		colorless	poikilitic	

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 1  
**No. of alteration domains:** 1  
**Domain type:** background  
**Domain rel. abund %:** 100  
**Estimated total % alteration:** 50

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	28.7	olivine 11.9%, clinopyroxene 0.6%, plagioclase 16.3%	Olivine	15	100	pale/colorless amphibole 10%, chlorite 79%, sulfide 1%, talc 10%	
pale/colorless amphibole	5.2	olivine 1.5%, clinopyroxene 2.1%, plagioclase 1.6%	Plagioclase	65	50	pale/colorless amphibole 5%, chlorite 50%, prehnite 40%, other 5%	other= carbonate
prehnite	13	plagioclase 13%	Clinopyroxene	20	15	pale/colorless amphibole 70%, chlorite 20%, secondary clinopyroxene 10%	
secondary clinopyroxene	0.3	clinopyroxene 0.3%					
sulfide	0.2	olivine 0.2%					
talc	1.5	olivine 1.5%					
other	1.6	plagioclase 1.6%					
<b>domain total alteration %:</b>	<b>50.5</b>						

**Vein summary**  
 vein 1 prehnite/clay (or chlorite, or fibrous zeolite/carbonate replacement vein)  
 vein 2 fibrous amphibole cuts other alteration

**ALTERATION COMMENT:** Plagioclase-rich domain largely altered to prehnite and an olivine-rich domain largely altered to chlorite and/or clay. Prehnite forms rosettes and may have been in part porosity filling. Green to colorless amphibole is presents as elongate clots within the prehnite. Carbonate is also common. The chlorite-rich domain contains some talc and amphibole bearing olivine pseudomorphs but most are completely chloritized apart from some amphibole needles. Poikilitic clinopyroxene is largely unaffected by the alteration. Minor sulfides are present in former olivines.

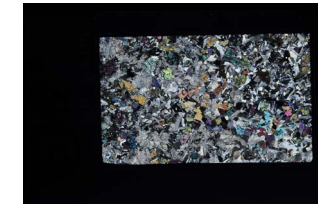
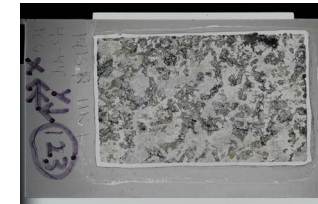
**STRUCTURE COMMENT:** Magmatic: Isotropic magmatic fabric. Elongate plagioclase (aspect ratios 8:1-10:1). Zoned host deformation twins, subgrain development, with local bent grains. Pyroxene oikocrysts host to rounded plagioclase chadocrysts. No annealing. Crystal Plastic: No crystal plastic deformation. Brittle: Cut by a fracture system, with open porosity. Veins/alteration: Cut by compound zeolite, chlorite-clay, prehnite/clay and carbonate veins. Crosscutting Relationships (as apparent in thin section): 1) Cracking, alteration, and vein formation.

**PHOTOMICROGRAPHS:** 345\_U1415P\_10R\_1\_TS\_122.JPG  
 345\_U1415P\_10R\_1\_TS\_122-2.JPG

**THIN SECTION:** 345-U1415P-11R-1-W 43/44-TSB\_Piece\_6-TS\_123  
**Rock name:** orthopyroxene-bearing olivine gabbro  
**Rock comment:** highly altered  
**Lithologic interval:** 25  
**Piece No.:** #6  
**Billet request comment:** IgPet: Primary Mineralogy

**Thin Section no.:** 123  
**Authors:** JM, KF

**PRIMARY MINERALOGY**  
**No. of igneous domains:** 1  
**Nature of ign. domains:**  
**Igneous domain number:** 1  
**Domain grain size:** medium grained  
**Domain texture:** granular  
**Domain comment:**  
**Domain lithology:** orthopyroxene-bearing olivine gabbro  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	0	20	20	1	anhedral	irregular				enclosing/surrounding tabular plagioclase
Plagioclase	50	60	10	1	subhedral	tabular	continuous zoning			
Clinopyroxene	18	19	1	20	anhedral	subequant		colorless	interstitial	
Orthopyroxene	1	1	0	1	anhedral	irregular			interstitial	
Oxide	0.1	0.1	0	0.1	subhedral	equant				eventually former chromian spinel

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 1  
**No. of alteration domains:** 1  
**Domain type:** background  
**Domain rel. abund %:** 100  
**Estimated total % alteration:** 50

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	9.8	plagioclase 9.8%	Olivine	15	30	clay minerals 33%, sulfide 2%, serpentine 60%, talc 5%	Olivine is slightly to moderately altered to serpentine mesh textures with clay towards the outside.
clay minerals	2.5	olivine 1.5%, clinopyroxene 0.8%, orthopyroxene 0.3%	Plagioclase	65	50	chlorite 30%, prehnite 70%	Plagioclase is fractured and moderately altered to fine grained prehnite and chlorite along these micro-fractures. The degree of fracturing and alteration of plagioclase varies locally within the thin section.
pale/colorless amphibole	9	clinopyroxene 6.8%, orthopyroxene 2.3%	Clinopyroxene	15	50	pale/colorless amphibole 90%, clay minerals 10%	Clinopyroxene is moderately altered to amphibole along cleavage planes.
prehnite	22.8	plagioclase 22.8%	Orthopyroxene	5	50	pale/colorless amphibole 90%, clay minerals 10%	Orthopyroxene is moderately altered to amphibole along cleavage planes.
serpentine	2.7	olivine 2.7%					
sulfide	0.1	olivine 0.1%					
talc	0.2	olivine 0.2%					
<b>domain total alteration %:</b>	<b>47.1</b>						

**Vein summary**  
 vein 1 several chlorite veins, crosscutting all primary minerals, sometimes overprinted by prehnite in former plagioclase, but sometime crosscutting prehnite.

**ALTERATION COMMENT:** Olivine is slightly to moderately altered to serpentine mesh textures with clay at the outside. Pyroxene is moderately altered to amphibole along cleavage planes and grain boundaries. Plagioclase is fractured and moderately altered to fine grained prehnite and chlorite along these micro-fractures. Small amount of pyrite are associated with the alteration of olivine.

**STRUCTURE COMMENT:** Magmatic: Heterogeneous with isotropic magmatic fabric. Skeletal olivine up to 5 mm, locally with subgrains. Plagioclase varies in texture from very elongate to equant, large and small grain size, partially annealed especially adjacent to olivine. Plagioclase shows undulose extinction, and rare deformation twins. Orthopyroxene locally shows undulose extinction. Interstitial clinopyroxene throughout section. Spinel. Crystal Plastic: No crystal plastic deformation. Brittle: Cut by a fracture system, with open porosity. Veins/alteration: Cut by chlorite and prehnite veins.

Crosscutting Relationships (as apparent in thin section):  
 1) Cracking, alteration, and vein formation.

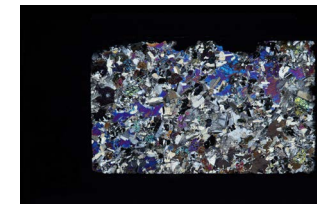
**PHOTOMICROGRAPHS:** 345\_U1415P\_11R\_1\_TS\_123.JPG  
 345\_U1415P\_11R\_1\_TS\_123-2.JPG

**THIN SECTION:** 345-U1415P-12R-1-W 5/6-TSB\_Piece\_1-TS\_124  
**Rock name:** orthopyroxene-bearing olivine gabbro  
**Rock comment:** moderately altered  
**Lithologic interval:** 25  
**Piece No.:** #1  
**Billet request comment:** IgPet: Primary Mineralogy

**Thin Section no.:** 124  
**Authors:** TF, KF

**PRIMARY MINERALOGY**      **No. of igneous domains:** 1      **Nature of ign. domains:**

**Igneous domain number:** 1      **Domain lithology:** orthopyroxene-bearing olivine gabbro  
**Domain grain size:** medium      **Grain size distribution:** seriate  
**Domain texture:** granular to poikilitic      **Relative abundance (%):** 100  
**Domain comment:**



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	10	20	10	2	subhedral to anhedral	ameoboid				
Plagioclase	45	50	5	0.5	euhedral to subhedral	tabular				
Clinopyroxene	28	28	0	20	anhedral	irregular		interstitial	poikilitic	
Orthopyroxene	2	2	0	12	anhedral	irregular		interstitial		
Oxide	0.1	0.1	0	0.2	anhedral	irregular				probably former chromian spinel

**ALTERATION / METAMORPHISM**      **No. of alteration domains:** 1      **Domain rel. abund %:** 100      **Estimated total % alteration:** 35  
**Alteration domain number:** 1      **Domain type:** background

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	10.5	plagioclase 10.5%	Olivine	15	40	pale/colorless amphibole 10%, clay minerals 25%, serpentine 40%, talc 25%	Olivine is moderately altered to serpentine mesh textures with amphibole, clay and talc at the outside. Some olivine grains are completely replaced by amphibole and talc.
clay minerals	1.5	olivine 1.5%	Plagioclase	70	30	chlorite 50%, prehnite 50%	Plagioclase is fractured and moderately altered to fine grained prehnite and chlorite along these micro-fractures. The degree of fracturing and alteration of plagioclase varies locally within the thin section.
green amphibole	4.5	clinopyroxene 4.5%	Clinopyroxene	15	60	green amphibole 50%, pale/colorless amphibole 50%	Clinopyroxene is moderately altered to amphibole along cleavage planes. Patches of clinopyroxene are completely replaced by amphibole.
pale/colorless amphibole	5.1	olivine 0.6%, clinopyroxene 4.5%					
prehnite	10.5	plagioclase 10.5%					
serpentine	2.4	olivine 2.4%					
talc	1.5	olivine 1.5%					
<b>domain total alteration %:</b>	<b>36</b>						

**ALTERATION COMMENT:** Olivine is moderately altered to serpentine mesh textures with clay, amphibole and talc at the outside. Some former olivine grains are pseudomorphically replaced by amphibole + talc. Clinopyroxene is moderately altered to amphibole. Plagioclase is slightly fractured and moderately altered to fine grained prehnite and chlorite along micro-fractures. Small amounts of pyrite are associated with chlorite after plagioclase.

**STRUCTURE COMMENT:** Magmatic: Heterogeneous with isotropic magmatic fabric. Skeletal olivine up to 1 cm, locally with subgrains. Plagioclase shows some variation in grain size from large and small, partially annealed especially adjacent to olivine, and fine grained. Plagioclase zoned, shows undulose extinction, subgrains, deformation twins, and bent grains. Orthopyroxene locally shows undulose extinction. Pervasive interstitial clinopyroxene throughout section. Spinel.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Cut by a fracture system, with open porosity.  
 Veins/alteration: Cut by a chlorite veins; local carbonate.

Crosscutting Relationships (as apparent in thin section):  
 1) Cracking, alteration, and vein formation.

**PHOTOMICROGRAPHS:** 345\_U1415P\_12R\_1\_TS\_124.JPG  
 345\_U1415P\_12R\_1\_TS\_124-2.JPG

**THIN SECTION:** 345-U1415P-13R-1-W 39/42-TSB\_Piece\_5-TS\_125  
**Rock name:** olivine gabbro  
**Rock comment:** moderately altered  
**Lithologic interval:** 27  
**Piece No.:** #5  
**Billet request comment:** IgPet: Prim. Mineralogy; MetPet: Bimodal Vein  
**PRIMARY MINERALOGY**  
**Igneous domain number:** 1  
**Domain grain size:** medium  
**Domain texture:** granular to poikilitic  
**Domain comment:**

**Thin Section no.:** 125

**Authors:** TF, TN

**Nature of ign. domains:**  
**Domain lithology:** olivine gabbro  
**Grain size distribution:** seriate  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	0	15	15	2	subhedral to anhedral	ameboid				
Plagioclase	45	50	5	0.75	euhedral to subhedral	tabular				
Clinopyroxene	35	35	0	15	anhedral	irregular		interstitial		poikilitic
Oxide	0.1	0.1	0	0.1	subhedral	irregular				probably former chromian spinel

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 1  
**No. of alteration domains:** 1  
**Domain type:** background  
**Domain rel. abund %:** 100  
**Estimated total % alteration:** 15

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	3.2	plagioclase 3.2%	Olivine	5	100	pale/colorless amphibole 20%, clay minerals 70%, sulfide 1%, talc 9%	
clay minerals	4.3	olivine 3.5%, plagioclase 0.8%	Plagioclase	75	10	green amphibole 2%, chlorite 43%, clay minerals 10%, prehnite 5%, zeolite 30%, other 10%	other: carbonate
green amphibole	1.5	clinopyroxene 1.4%, plagioclase 0.2%	Clinopyroxene	20	10	green amphibole 68%, pale/colorless amphibole 30%, sulfide 1%, other 1%	other: carbonate
pale/colorless amphibole	1.6	olivine 1%, clinopyroxene 0.6%					
prehnite	0.4	plagioclase 0.4%					
sulfide	0.1	olivine 0.1%, clinopyroxene <0.1%					
talc	0.5	olivine 0.5%					
zeolite	2.3	plagioclase 2.3%					
other	0.8	clinopyroxene <0.1%, plagioclase 0.8%					
<b>domain total alteration %:</b>	<b>14.7</b>						

**Vein summary**

- vein 1 zeolite syntaxial vein
- vein 2 zeolite-chlorite/clay composite vein
- vein 3 chlorite/clay cross-fiber or massive vein

**ALTERATION COMMENT:** Olivine is completely altered primarily to clay, and subordinately to tremolite and talc. Clinopyroxene is replaced by amphibole in patchy manner or along cleavage surfaces; secondary clinopyroxene with tiny opaque inclusions surrounds the patchy amphibole. Plagioclase locally has many fractures filled with chlorite, zeolite, prehnite, clay mineral and carbonate. Small grains of green amphibole locally cross cut the chlorite veinlets in plagioclase. Pyrite is associated with clay, talc and tremolite replacing olivine, and with secondary clinopyroxene and amphibole replacing pyroxene.

**STRUCTURE COMMENT:** Magmatic: Heterogeneous with isotropic magmatic fabric. Plagioclase shows significant variation in grain size from large and small, partial annealing especially interior to clinopyroxene oikocyst. Plagioclase zoned, shows undulose extinction, subgrains, deformation twins, and local bent grains. Pervasive interstitial clinopyroxene throughout section. Spinel.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Cut by two zones of cataclasis hosting chlorite, and open porosity.  
 Veins/alteration: Cut by two curved vein sets: pull-apart of chlorite-clay, and zeolite, chlorite, clay composite veins.  
 Cross-cutting Relationships (as apparent in thin section):  
 1) Cracking, alteration, and vein formation.

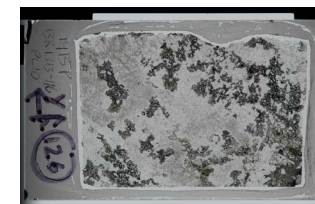
**PHOTOMICROGRAPHS:** 345\_U1415P\_13R\_1\_TS\_125.JPG  
 345\_U1415P\_13R\_1\_TS\_125-2.JPG

**THIN SECTION:** 345-U1415P-13R-1-W 113/116-TSB\_Piece\_10-TS\_126  
**Rock name:** olivine gabbro  
**Rock comment:** moderately altered  
**Lithologic interval:** 27  
**Piece No.:** #10  
**Billet request comment:** IgPet: Prim. Mineralogy; MetPet: Struct: Magmatic Fabric

**Thin Section no.:** 126  
**Authors:** TF, TN

**PRIMARY MINERALOGY**  
**No. of igneous domains:** 1  
**Nature of ign. domains:**  
**Igneous domain number:** 1  
**Domain grain size:** medium  
**Domain texture:** granular to poikilitic  
**Domain comment:**

**Domain lithology:** olivine gabbro  
**Grain size distribution:** seriate  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	10	25	15	2	subhedral to anhedral	ameboid				
Plagioclase	55	64	9	0.5	euhedral to subhedral	tabular				
Clinopyroxene	10	10	0	10	anhedral	irregular		interstitial		poikilitic
Orthopyroxene	0.9	0.9	0	3	anhedral	irregular		interstitial		
Oxide	0.1	0.1	0	0.1	subhedral	irregular				probably former chromian spinel

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 1  
**No. of alteration domains:** 1  
**Domain type:** background  
**Domain rel. abund %:** 100  
**Estimated total % alteration:** 35

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	8.5	clinopyroxene 0.1%, plagioclase 8.4%	Olivine	25	50	pale/colorless amphibole 10%, clay minerals 30%, oxide 3%, sulfide 2%, serpentine 50%, talc 5%	
clay minerals	12.2	olivine 3.8%, plagioclase 8.4%	Plagioclase	70	30	chlorite 40%, clay minerals 40%, prehnite 15%, other 5%	other: carbonate
oxide	0.4	olivine 0.4%	Clinopyroxene	5	50	pale/colorless amphibole 70%, chlorite 5%, sulfide 3%, secondary clinopyroxene 20%, other 2%	other: carbonate
pale/colorless amphibole	3	olivine 1.3%, clinopyroxene 1.8%					
prehnite	3.2	plagioclase 3.2%					
secondary clinopyroxene	0.5	clinopyroxene 0.5%					
serpentine	6.3	olivine 6.3%					
sulfide	0.3	olivine 0.3%, clinopyroxene 0.1%					
talc	0.6	olivine 0.6%					
other	1.1	clinopyroxene 0.1%, plagioclase 1.1%					
<b>domain total alteration %:</b>	<b>36.1</b>						

**ALTERATION COMMENT:** Olivine is unevenly altered in variable degree to coronitic tremolite + chlorite, talc, serpentine and clay minerals. Clinopyroxene is replaced by amphibole in patchy manner or along cleavage surfaces. Secondary clinopyroxene occurs surrounding patchy amphibole and contains tiny opaque minerals. Plagioclase has many fractures filled with chlorite, prehnite or clay minerals. In some domains, plagioclase shows granoblastic texture. Pyrite is associated with serpentine/talc/clay replacing olivine, and with secondary clinopyroxene or amphibole replacing clinopyroxene.

**STRUCTURE COMMENT:** Magmatic: Heterogeneous with isotropic magmatic fabric. Skeletal olivine up to 1.5 cm, locally with subgrains. Plagioclase shows significant variation in grain size. Large plagioclase zoned, shows undulose extinction, and rare deformation twins. Annealed texture dominant. Interstitial clinopyroxene and limited orthopyroxene. Spinel.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Minor fracturing.  
 Veins/alteration: Cut by chlorite veins.

Crosscutting Relationships (as apparent in thin section):  
 1) Cracking, and vein formation.

**PHOTOMICROGRAPHS:**  
 345\_U1415P\_13R\_1\_TS\_126.JPG  
 345\_U1415P\_13R\_1\_TS\_126-2.JPG

**THIN SECTION:** 345-U1415P-14R-1-W 22/25-TSB\_Piece\_3-TS\_127 **Thin Section no.:** 127  
**Rock name:** contact between very heterogeneous olivine gabbro and an "enclave" of orthopyroxene-bearing olivine gabbro  
**Rock comment:** part of a very heterogeneous, multi-textured gabbro  
**Lithologic interval:** 27  
**Piece No.:** #3 **Authors:** MMJ, TN  
**Billet request comment:** IgPet: Primery Mineralogy

**PRIMARY MINERALOGY** **No. of igneous domains:** 2 **Nature of ign. domains:** two lithologies

**Igneous domain number:** 1 **Domain lithology:** orthopyroxene-bearing olivine gabbro  
**Domain grain size:** coarse grained **Grain size distribution:** seriate  
**Domain texture:** granular **Relative abundance (%):** 65  
**Domain comment:** this domain is the "enclave"



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	15	25	10	1	anhedral to subhedral	irregular				skeletal olivine present
Plagioclase	35	55	20	0.9	subhedral to euhedral	tabular	oscillatory zoning			
Clinopyroxene	5	16	11	1.2	subhedral	irregular		pale green	interstitial	
Orthopyroxene	2	4	2	1	subhedral	irregular		pale pinkish brown		
Oxide	0.1	0.1	0	0.1	subhedral to euhedral	granular				probably former chromian spinel

**Igneous domain number:** 2 **Domain lithology:** gabbro  
**Domain grain size:** medium grained **Grain size distribution:** equigranular  
**Domain texture:** granular **Relative abundance (%):** 35  
**Domain comment:** this domain hosts the "enclave"

	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Plagioclase	35	65	30	0.7	subhedral	tabular	continuous zoning			
Clinopyroxene	25	35	10	1	subhedral	irregular		pale green	interstitial	clinopyroxene in domain 2 could be part of centimeter diameter poikilitic clinopyroxene; more or less optically continuous

**ALTERATION / METAMORPHISM** **No. of alteration domains:** 2 **Domain rel. abund %:** 60 **Estimated total % alteration:** 25  
**Alteration domain number:** 1 **Domain type:** background

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	3.3	plagioclase 3.3%	Olivine	20	50	pale/colorless amphibole 10%, clay minerals 30%, oxide 2%, sulfide 1%, serpentine 30%, talc 27%	
clay minerals	3	olivine 3%	Plagioclase	65	10	green amphibole 5%, chlorite 50%, prehnite 20%, secondary plagioclase 5%, other 20%	other: carbonate
green amphibole	6	clinopyroxene 4.9%, orthopyroxene 0.8%, plagioclase 0.3%	Clinopyroxene	10	70	green amphibole 70%, pale/colorless amphibole 25%, oxide 3%, sulfide 2%	
oxide	0.5	olivine 0.2%, clinopyroxene 0.2%, orthopyroxene 0.1%	Orthopyroxene	5	40	green amphibole 40%, oxide 3%, sulfide 2%, talc 55%	
pale/colorless amphibole	2.8	olivine 1%, clinopyroxene 1.8%					
prehnite	1.3	plagioclase 1.3%					
secondary plagioclase	0.3	plagioclase 0.3%					
serpentine	3	olivine 3%					
sulfide	0.3	olivine 0.1%, clinopyroxene 0.1%, orthopyroxene <0.1%					
talc	3.8	olivine 2.7%, orthopyroxene 1.1%					
other	1.3	plagioclase 1.3%					
<b>domain total alteration %:</b>	<b>25.6</b>						

**ALTERATION COMMENT:** Olivine is unevenly altered in variable degree to tremolite, talc, serpentine and clay minerals. Clinopyroxene is replaced by green amphibole to a considerable extent. Orthopyroxene is partially replaced by talc and green amphibole. Plagioclase has fractures filled with chlorite, prehnite and carbonate. Green amphibole forms in some chlorite veins in plagioclase. Pyrite is associated with tremolite/serpentine/talc/clay replacing olivine, and with amphibole replacing pyroxene.

**ALTERATION / METAMORPHISM** **No. of alteration domains:** 2 **Domain rel. abund %:** 40 **Estimated total % alteration:** 17  
**Alteration domain number:** 2 **Domain type:** background

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	7	plagioclase 7%	Plagioclase	70	20	chlorite 50%, prehnite 50%	
pale/colorless amphibole	3	clinopyroxene 3%	Clinopyroxene	30	10	pale/colorless amphibole 100%	
prehnite	7	plagioclase 7%					
<b>domain total alteration %:</b>	<b>17</b>						

**Vein summary**  
 vein 1 Chlorite-zeolite-carbonate composite vein

**ALTERATION COMMENT:** Clinopyroxene is partially replaced pale brownish amphibole. Plagioclase has many fractures filled with chlorite and prehnite.

**STRUCTURE COMMENT:** Magmatic: Boundary between gabbro and orthopyroxene-bearing olivine gabbro.

Gabbro - Moderate magmatic foliation defined by plagioclase SPO. Plagioclase shows significant grain size variation, larger grains zoned, rare undulose extinction, and deformation twins. Annealed texture dominant. Orthopyroxene interstitial.

Orthopyroxene-bearing olivine gabbro - Weak magmatic foliation defined by plagioclase SPO. Skeletal olivine locally with subgrains. Plagioclase shows significant grain size variation; large clusters show undulose extinction, subgrains, and deformation twins. Annealed plagioclase typically finer grained. Interstitial orthopyroxene. Spinel.

Crystal Plastic: No crystal plastic deformation.

Brittle: Minor fracturing.

Veins/alteration: Cut by a composite chlorite-zeolite-carbonate vein.

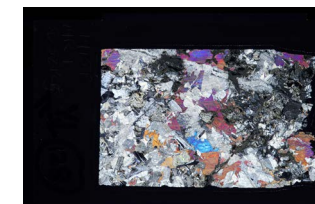
Crosscutting Relationships (as apparent in thin section):  
 1) Cracking, and vein formation.

**PHOTOMICROGRAPHS:** 345\_U1415P\_14R\_1\_TS\_127.JPG  
 345\_U1415P\_14R\_1\_TS\_127-2.JPG



**THIN SECTION:** 345-U1415P-14R-1-W 50/52-TSB\_Piece\_5-TS\_128  
**Rock name:** olivine gabbro  
**Rock comment:** moderately altered  
**Lithologic interval:** 27  
**Piece No.:** #5  
**Billet request comment:** IgPet: Prim. Mineralogy; MetPet: Vein mineralogy and Bkgnd. Alt.  
**Thin Section no.:** 128  
**Authors:** NA, AM

**PRIMARY MINERALOGY**  
**No. of igneous domains:** 1  
**Nature of ign. domains:**  
**Igneous domain number:** 1  
**Domain grain size:** medium grained  
**Domain texture:** subophitic  
**Domain comment:**  
**Domain lithology:** olivine gabbro  
**Grain size distribution:** poikilitic  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	2	7	5	2.5	anhedral	irregular				
Plagioclase	38	68	30	3	anhedral to subhedral	tabular			chadacryst	
Clinopyroxene	25	25	0	20	anhedral	interstitial		colorless	poikilitic	
Oxide	0.1	0.1	0	0.2	anhedral	irregular			interstitial	chromian spinels present

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 1  
**No. of alteration domains:** 1  
**Domain type:** background  
**Domain rel. abund %:** 100  
**Estimated total % alteration:** 45

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	5.2	plagioclase 5.2%	Olivine	15	90	pale/colorless amphibole 5%, clay minerals 10%, oxide 1%, sulfide 1%, serpentine 10%, talc 73%	Fresh olivine only occurs >1.5cm from the prehnite vein
clay minerals	6.6	olivine 1.4%, plagioclase 5.2%	Plagioclase	65	40	chlorite 20%, clay minerals 20%, prehnite 60%	
oxide	0.1	olivine 0.1%	Clinopyroxene	20	30	pale/colorless amphibole 100%	
pale/colorless amphibole	6.7	olivine 0.7%, clinopyroxene 6%					
prehnite	15.6	plagioclase 15.6%					
serpentine	1.4	olivine 1.4%					
sulfide	0.1	olivine 0.1%					
talc	9.9	olivine 9.9%					
<b>domain total alteration %:</b>	<b>45.6</b>						

**Vein summary**  
 vein 1 prehnite/clay (or chlorite, or fibrous zeolite/carbonate) replacement vein  
 vein 2 fibrous amphibole cuts other alteration

**ALTERATION COMMENT:**  
 Alteration in this section is dominated by a vein-like structure and its halo, which appears to affect most of the slide. The vein-like structure contains alternating zones of prehnite and a low birefringence fibrous mineral, possibly clay, chlorite or zeolite - both replace primarily plagioclase. Olivine is primarily replaced by talc. Carbonate is present in patches within both parts of the vein. Far from the vein, relict olivine shows mesh texture serpentine, some amphibole from the corona reaction, and talc-sulfide rims. Close to the vein the proportion of talc increases. Veins that appear to be fibrous amphibole also cut both primary and secondary minerals. Sulfide and oxide are found mainly within talc after olivine

**STRUCTURE COMMENT:**  
 Magmatic: Isotropic magmatic fabric. Plagioclase zoned, shows undulose extinction, subgrains, and rare deformation twins. Local annealed patches. Altered skeletal olivine. Interstitial clinopyroxene. Spinel.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Fracturing and vein formation.  
 Veins/alteration: Cut by chlorite, zeolite, and prehnite/clay and carbonate veins.

Crosscutting Relationships (as apparent in thin section):  
 1) Cracking, and vein formation.

**PHOTOMICROGRAPHS:**  
 345\_U1415P\_14R\_1\_TS\_128.JPG  
 345\_U1415P\_14R\_1\_TS\_128-2.JPG

**THIN SECTION:** 345-U1415P-16R-1-W 47/49-TSB\_Piece\_6-TS\_129  
**Rock name:** troctolite  
**Rock comment:** moderately altered  
**Lithologic interval:** 29  
**Piece No.:** #6  
**Billet request comment:** IgPet: Prim. Mineralogy; MetPet: Vein and Halo

**Thin Section no.:** 129  
**Authors:** MMJ, RW

**PRIMARY MINERALOGY**  
**No. of igneous domains:** 1  
**Nature of ign. domains:**  
**Igneous domain number:** 1  
**Domain grain size:** medium grained  
**Domain texture:** granular  
**Domain comment:** macroscopic description observed only moderate alteration for interval 29, however this thin section is moderate to high

**Domain lithology:** troctolite  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	10	30	20	2.5	subhedral	equant				size of former olivine not assessed for maximum size
Plagioclase	45	68	23	1.5	subhedral to euhedral	tabular				
Clinopyroxene	1	2	1	5	anhedral	irregular		colorless	interstitial	occurs as ribbons interstitial to plagioclase and clinopyroxene; size of the whole crystal could be coarser than 10 mm

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 1  
**No. of alteration domains:** 1  
**Domain type:**  
**Domain rel. abund %:** 100  
**Estimated total % alteration:** 16

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	3	plagioclase 3%	Olivine	14	70	pale/colorless amphibole 5%, clay minerals 54%, oxide 1%, serpentine 40%	
clay minerals	5.3	olivine 5.3%	Plagioclase	86	10	chlorite 35%, prehnite 65%	
oxide	0.1	olivine 0.1%	Oxide	1	< 0.1		
pale/colorless amphibole	0.5	olivine 0.5%					
prehnite	5.6	plagioclase 5.6%					
serpentine	3.9	olivine 3.9%					
<b>domain total alteration %:</b>	<b>18.4</b>						

**Vein summary**  
 vein 1 fibrous chlorite

**ALTERATION COMMENT:** Olivine is altered to serpentine and clay minerals, with lesser amphibole. Plagioclase is altered to chlorite and prehnite. Oxides are associated with serpentine, and sulfides are associated with amphibole.

**STRUCTURE COMMENT:** Magmatic: Weak magmatic foliation defined by coarse plagioclase SPO. Plagioclase zoned, shows undulose extinction, subgrains, and rare deformation twins. Skeletal olivine locally with subgrains. Intercumulus clinopyroxene around olivine.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Fracturing and vein formation.  
 Veins/alteration: Cut by a massive chlorite vein.  
 Cross-cutting Relationships (as apparent in thin section):  
 1) Cracking, and vein formation.

**PHOTOMICROGRAPHS:** 345\_U1415P\_16R\_1\_TS\_129.JPG  
 345\_U1415P\_16R\_1\_TS\_129-2.JPG

**THIN SECTION:** 345-U1415P-16R-1-W 100/102-TSB\_Piece\_9-TS\_131  
**Rock name:** troctolite  
**Rock comment:** moderately altered  
**Lithologic interval:** 29  
**Piece No.:** #9  
**Billet request comment:** IgPet: Prim. Mineralogy; Struct: Magmatic Fabric

**Thin Section no.:** 131  
**Authors:** TH, AM

**PRIMARY MINERALOGY** No. of igneous domains: 1 Nature of ign. domains:  
**Igneous domain number:** 1  
**Domain grain size:** medium grained  
**Domain texture:** granular  
**Domain comment:**

**Domain lithology:** troctolite  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	12	16	4	2	anhedral	irregular				
Plagioclase	81	83	2	2.6	anhedral to subhedral	tabular				
Clinopyroxene	1	1	0	3.5	anhedral	irregular		colorless	interstitial	
Oxide	0.1	0.1	0	0.15	subhedral	equant				

**ALTERATION / METAMORPHISM** No. of alteration domains: 1 Domain rel. abund %: 100 Estimated total % alteration: 35  
**Alteration domain number:** 1 **Domain type:** background

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	4	olivine 1%, plagioclase 3%	Olivine	20	50	chlorite 10%, clay minerals 25%, oxide 1%, sulfide 1%, serpentine 48%, talc 15%	
clay minerals	2.5	olivine 2.5%	Plagioclase	75	20	pale/colorless amphibole 5%, chlorite 20%, prehnite 60%, secondary plagioclase 5%, epidote/zoisite 10%	
epidote/zoisite	1.5	plagioclase 1.5%	Clinopyroxene	5	0		
oxide	0.1	olivine 0.1%					
pale/colorless amphibole	0.8	plagioclase 0.8%					
prehnite	9	plagioclase 9%					
secondary plagioclase	0.8	plagioclase 0.8%					
serpentine	4.8	olivine 4.8%					
sulfide	0.1	olivine 0.1%					
talc	1.5	olivine 1.5%					
<b>domain total alteration %:</b>	<b>25.1</b>						

**Vein summary**  
 vein 1 cross-fiber chlorite veins

**ALTERATION COMMENT:** Olivine shows mesh texture serpentine mantled by talc, or locally complete replacement by chlorite or talc/clay intergrowths; plagioclase is heterogeneously altered to chlorite and prehnite with intergrown clinzoisite/epidote together with secondary plagioclase. Blue-green amphibole is developed on some grain boundaries. Tiny pyrite disseminated in talc and clay replacements of olivine. Magnetite occurs as stringers in the serpentine mesh replacements after olivine.

**STRUCTURE COMMENT:** Magmatic: Boundary between troctolite and anorthosite. Troctolite - Isotropic. Skeletal olivine locally with subgrains. Coarse plagioclase with deformation twins. Interstitial clinopyroxene. Serpentine mesh texture after olivine. Anorthosite - Isotropic. Plagioclase shows subgrains, deformation twins, and local patches of annealing. Interstitial clinopyroxene. Common spinel. Crystal Plastic: No crystal plastic deformation. Brittle: Cut by open fractures, small veins. Veins/alteration: Cut by chlorite, and prehnite-chlorite veins. Cross-cutting Relationships (as apparent in thin section): 1) Cracking, and vein formation.

**PHOTOMICROGRAPHS:** 345\_U1415P\_16R\_1\_TS\_131.JPG  
 345\_U1415P\_16R\_1\_TS\_131-2.JPG

**THIN SECTION:** 345-U1415P-16R-1-W 117/120-TSB\_Piece\_10-TS\_130  
**Rock name:** troctolite  
**Rock comment:** with a subvertical anorthositic vein  
**Lithologic interval:** 29  
**Piece No.:** #10  
**Billet request comment:** IgPet: Prim. Mineralogy; MetPet: Vein and Halo

**Thin Section no.:** 130  
**Authors:** NA, AM



**PRIMARY MINERALOGY**      **No. of igneous domains:** 2      **Nature of ign. domains:** two lithologies

**Igneous domain number:** 1      **Domain lithology:** anorthosite  
**Domain grain size:** medium grained      **Grain size distribution:** seriate  
**Domain texture:** granular      **Relative abundance (%):** 60  
**Domain comment:** vein within troctolite

	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	0	1	1	0.3	anhedral	subequant				
Plagioclase	40	93	53	1	anhedral	tabular	continuous zoning			
Clinopyroxene	0.5	4	3.5	3	anhedral	interstitial		colorless		in the center of vein; thin ribbons on grain boundaries; size of the whole crystal could be coarser than 3 mm
Oxide	2	2	0	0.2	subhedral to euhedral	equant			chromian spinel	concentrated at domain boundary

**Igneous domain number:** 2      **Domain lithology:** troctolite  
**Domain grain size:** medium grained      **Grain size distribution:** seriate  
**Domain texture:** granular      **Relative abundance (%):** 40  
**Domain comment:** troctolite hosting the vein

	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	18	38	20	2	anhedral	subequant				
Plagioclase	10	60	50	2	anhedral	tabular	continuous zoning			
Clinopyroxene	0	0.8	0.8	0.5	anhedral	interstitial		colorless		
Oxide	1	1	0	0.1	subhedral to euhedral	equant			chromian spinel	concentrated at domain boundary

**ALTERATION / METAMORPHISM**      **No. of alteration domains:** 1      **Domain rel. abund %:** 100      **Estimated total % alteration:** 30  
**Alteration domain number:** 1      **Domain type:** background

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	7.1	olivine 2.1%, plagioclase 5%	Olivine	15	70	chlorite 20%, clay minerals 20%, oxide 1%, sulfide 1%, serpentine 20%, talc 38%	
clay minerals	2.1	olivine 2.1%	Plagioclase	80	25	chlorite 25%, prehnite 75%	
oxide	0.1	olivine 0.1%	Clinopyroxene	6	5	pale/colorless amphibole 100%	
pale/colorless amphibole	0.3	clinopyroxene 0.3%					
prehnite	15	plagioclase 15%					
serpentine	2.1	olivine 2.1%					
sulfide	0.1	olivine 0.1%					
talc	4	olivine 4%					
<b>domain total alteration %:</b>	<b>30.8</b>						

**Vein summary**  
 vein 1 clay-chlorite-prehnite composite vein with cross-fiber chlorite/smectite overprinted by radiating sprays of prehnite; cuts earlier chlorite veins  
 vein 2 diffuse chlorite veins and replacements are cut by later composite veins

**ALTERATION COMMENT:** Heterogeneously altered rock; olivine is variably altered to serpentine mesh with magnetite, often mantled by talc + sulfide, or to mainly talc, or to mainly chlorite or mainly clay; plagioclase is patchily altered to prehnite either along microfractures or in coarser 100% replacements; alteration of all sorts is concentrated near the composite vein; sulfides and oxides occur mainly in olivine pseudomorphs

**STRUCTURE COMMENT:** Magmatic: Boundary between troctolite and subvertical anorthosite.  
 Troctolite - Isotropic. Skeletal olivine locally with subgrains. Plagioclase zoned, shows undulose extinction, rare deformation twins, and partial annealing. Interstitial clinopyroxene.  
 Anorthosite - Weak magmatic fabric defined by plagioclase SPO. Plagioclase shows annealing, rare deformation twins. Interstitial clinopyroxene. Common spinel.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Fracturing and vein formation.  
 Veins/alteration: Cut by a massive clay-chlorite-prehnite composite vein. Cut older chlorite veins. Carbonate.  
 Cross-cutting Relationships (as apparent in thin section):  
 1) Cracking, and vein formation.

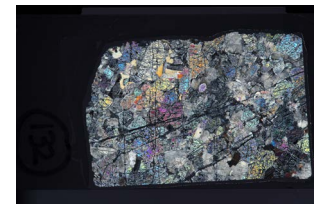
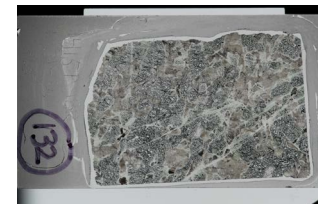
**PHOTOMICROGRAPHS:** 345\_U1415P\_16R\_1\_TS\_130.JPG  
 345\_U1415P\_16R\_1\_TS\_130-2.JPG

**THIN SECTION:** 345-U1415P-18R-1-W 31/36-TSB\_Piece\_5-TS\_132  
**Rock name:** troctolite  
**Rock comment:** highly altered  
**Lithologic interval:** 29  
**Piece No.:** #5  
**Billet request comment:** IgPet: Prim. Mineralogy

**Thin Section no.:** 132  
**Authors:** TH, KF

**PRIMARY MINERALOGY**  
**No. of igneous domains:** 1  
**Nature of ign. domains:**  
**Igneous domain number:** 1  
**Domain grain size:** medium grained  
**Domain texture:** granular  
**Domain comment:**

**Domain lithology:** troctolite  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	50	60	10	3	anhedral to subhedral	subequant				
Plagioclase	17	37	20	2.5	anhedral	tabular		interstitial		
Clinopyroxene	3	3	0	3	anhedral	irregular		colorless	interstitial	
Oxide	0.1	0.1	0	0.12	subhedral	subequant				

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 1  
**No. of alteration domains:** 1  
**Domain type:** background  
**Domain rel. abund %:** 100  
**Estimated total % alteration:** 55

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	6.3	plagioclase 6.3%	Olivine	50	40	oxide 1%, sulfide 1%, serpentine 98%	Olivine is moderately altered to serpentine mesh textures. Small amounts of sulfide (pyrite and chalcocopyrite) and magnetite are associated with the alteration of olivine.
clay minerals	3.2	plagioclase 3.2%	Plagioclase	45	70	chlorite 20%, clay minerals 10%, prehnite 70%	Plagioclase is fractured and intensively altered to fine grained prehnite and chlorite along these fractures. Some plagioclase grains are completely replaced by coarse-grained prehnite.
green amphibole	0.8	clinopyroxene 0.8%	Clinopyroxene	5	30	green amphibole 50%, pale/colorless amphibole 50%	Clinopyroxene is moderately altered to amphibole along cleavage planes.
oxide	0.2	olivine 0.2%					
pale/colorless amphibole	0.8	clinopyroxene 0.8%					
prehnite	22.1	plagioclase 22.1%					
serpentine	19.6	olivine 19.6%					
sulfide	0.2	olivine 0.2%					
<b>domain total alteration %:</b>	<b>53.2</b>						

**ALTERATION COMMENT:** Olivine is moderately altered to serpentine mesh textures. Rare clinopyroxene is moderately altered to amphibole along cleavage planes. Plagioclase is fractured and intensively altered to fine grained prehnite and chlorite along these fractures. Some plagioclase grains are completely replaced by coarse-grained prehnite. Small amounts of sulfide (pyrite and chalcocopyrite) and magnetite are associated with the alteration of olivine.

**STRUCTURE COMMENT:** Magmatic: Weak magmatic fabric defined by olivine SPO. Weakly skeletal olivine with common subgrains. Coarse plagioclase with deformation twins, and subgrains. Interstitial clinopyroxene. Crystal Plastic: Serpentine mesh texture after olivine. Brittle: Cut by open fractures, and rare veins. Veins/alteration: Cut by serpentine-chlorite veins. Cross-cutting Relationships (as apparent in thin section): 1) Cracking, and vein formation.

**PHOTOMICROGRAPHS:** 345\_U1415P\_18R\_1\_TS\_132.JPG  
 345\_U1415P\_18R\_1\_TS\_132-2.JPG

**THIN SECTION:** 345-U1415P-18R-1-W 39/40-TSB\_Piece\_6-TS\_133  
**Rock name:** troctolite  
**Rock comment:** highly altered  
**Lithologic interval:** 29  
**Piece No.:** #6  
**Billet request comment:** IgPet: Prim. Mineralogy; Struct: Magmatic Fabric

**Thin Section no.:** 133  
**Authors:** TF, KF

**PRIMARY MINERALOGY** **No. of igneous domains:** 1 **Nature of ign. domains:**  
**Igneous domain number:** 1 **Domain lithology:** troctolite  
**Domain grain size:** medium grained **Grain size distribution:** equigranular  
**Domain texture:** granular **Relative abundance (%):** 100  
**Domain comment:**



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	15	36	21	4	subhedra to anhedral	subequant				
Plagioclase	30	60	30	1.5	euhedral to subhedral	tabular				
Clinopyroxene	4	4	0	12	anhedral	irregular		colorless	interstitial	
Oxide	0.1	0.1	0	0.1	subhedral	subequant				

**ALTERATION / METAMORPHISM** **No. of alteration domains:** 1 **Domain rel. abund %:** 100 **Estimated total % alteration:** 70  
**Alteration domain number:** 1 **Domain type:** background

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	9.1	plagioclase 9.1%	Olivine	30	70	clay minerals 30%, serpentine 60%, talc 10%	Olivine is intensively altered to serpentine mesh textures, associated with clay and talc towards the rims.
clay minerals	11.3	olivine 6.3%, clinopyroxene 0.4%, plagioclase 4.6%	Plagioclase	65	70	chlorite 20%, clay minerals 10%, prehnite 70%	Plagioclase is fractured and intensively altered to fine grained prehnite and chlorite along these fractures. Some plagioclase grains are completely replaced by coarse-grained prehnite.
green amphibole	0.8	clinopyroxene 0.8%	Clinopyroxene	5	40	green amphibole 40%, pale/colorless amphibole 40%, clay minerals 20%	Clinopyroxene is moderately altered to amphibole along cleavage planes.
pale/colorless amphibole	0.8	clinopyroxene 0.8%					
prehnite	31.9	plagioclase 31.9%					
serpentine	12.6	olivine 12.6%					
talc	2.1	olivine 2.1%					
<b>domain total alteration %:</b>	<b>68.6</b>						

**ALTERATION COMMENT:** Olivine is highly altered to serpentine mesh textures, associated with clay and talc towards the rims. Rare clinopyroxene is moderately altered to amphibole along cleavage planes. Plagioclase is fractured and intensively altered to fine grained prehnite and chlorite along these fractures. Some plagioclase grains are completely replaced by coarse-grained prehnite.

**STRUCTURE COMMENT:** Magmatic: Isotropic. Weakly skeletal olivine with common undulose extinction, and subgrains. Coarse plagioclase with rare deformation twins, and subgrains. Interstitial clinopyroxene. Crystal Plastic: Serpentine mesh texture after olivine. Brittle: Cut by open fractures, and rare veins. Veins/alteration: Prehnite veins.

Crosscutting Relationships (as apparent in thin section):  
 1) Cracking, and vein formation.

**PHOTOMICROGRAPHS:** 345\_U1415P\_18R\_1\_TS\_133.JPG  
 345\_U1415P\_18R\_1\_TS\_133-2.JPG

**THIN SECTION:** 345-U1415P-18R-1-W 78/83-TSB\_Piece\_7-TS\_134  
**Rock name:** contact between troctolite and orthopyroxene-bearing olivine gabbro  
**Rock comment:** troctolite with a patch (enclave?) of another lithology  
**Lithologic interval:** 29  
**Piece No.:** #7  
**Billet request comment:** IgPet: Prim. Mineralogy; Struct: Igneous contact  
**Thin Section no.:** 134  
**Authors:** TF, RW

**PRIMARY MINERALOGY**      **No. of igneous domains:** 2      **Nature of ign. domains:** two lithologies

**Igneous domain number:** 1  
**Domain grain size:** medium grained  
**Domain texture:** granular  
**Domain comment:** although this domain is named as anorthositic troctolite, the whole rock is troctolite

**Domain lithology:** anorthositic troctolite  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 50



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	0	10	10	4	subhedral to anhedral	subequant				
Plagioclase	45	90	45	1	euhedral to subhedral	tabular				
Clinopyroxene	0.1	0.1	0	1	anhedral	irregular		colorless	interstitial	

**Igneous domain number:** 2  
**Domain grain size:** medium grained  
**Domain texture:** granular  
**Domain comment:** patch (enclave?) within troctolite

**Domain lithology:** orthopyroxene-bearing gabbro  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 40

	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	5	10	5	0.25	subhedral to euhedral	ameiboid				
Plagioclase	69	69	0	0.5	euhedral to subhedral	tabular				
Clinopyroxene	20	20	0	1	subhedral to anhedral	subequant		colorless	poikilitic granular	
Orthopyroxene	1	1	0	0.5	anhedral	irregular			interstitial	

**ALTERATION / METAMORPHISM**      **No. of alteration domains:** 1      **Domain rel. abund %:** 100      **Estimated total % alteration:** 31  
**Alteration domain number:** 1      **Domain type:**

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	4.1	plagioclase 4.1%	Olivine	12	90	pale/colorless amphibole 5%, clay minerals 65%, serpentine 25%, talc 5%	
clay minerals	7	olivine 7%	Plagioclase	81	25	chlorite 20%, prehnite 80%	
pale/colorless amphibole	1.2	olivine 0.5%, clinopyroxene 0.7%	Clinopyroxene	7	10	pale/colorless amphibole 100%	
prehnite	16.2	plagioclase 16.2%	Oxide	< 0.1			
serpentine	2.7	olivine 2.7%					
talc	0.5	olivine 0.5%					
<b>domain total alteration %:</b>		<b>31.7</b>					

**Vein summary**  
 vein 1 fibrous chlorite

**ALTERATION COMMENT:** Olivine is altered to clay minerals and serpentine, with lesser amphibole and talc. Plagioclase is altered to prehnite with lesser chlorite, both along fractures. Oxides are absent, while sulfides are associated with talc and amphibole replacing olivine.

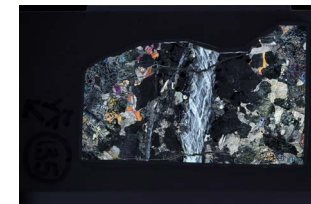
**STRUCTURE COMMENT:** Magmatic: Boundary between troctolite and orthopyroxene-bearing gabbro.  
 Troctolite - Coarse-grained isotropic. Coarse plagioclase with deformation twins, undulose extinction, and subgrain development.  
 Orthopyroxene-bearing olivine gabbro - Moderate magmatic foliation defined by plagioclase SPO. Plagioclase shows common subgrains, deformation twins, bent grains, and local patches of annealing. Cumulus orthopyroxene and clinopyroxene (hosting elongate and deformed plagioclase), interstitial clinopyroxene. Tabular olivine locally shows undulose extinction. Plagioclase foliation in the fine-grained gabbro parallels the irregular contact between the two units, suggesting the gabbro intrudes troctolite.  
 Crystal Plastic: No crystal plastic fabric.  
 Brittle: Cut by open fractures, and rare veins.  
 Veins/alteration: Cut by chlorite-clay, and prehnite veins.  
 Cross-cutting Relationships (as apparent in thin section):  
 1) Cracking, and vein formation.

**PHOTOMICROGRAPHS:** 345\_U1415P\_18R\_1\_TS\_134.JPG  
 345\_U1415P\_18R\_1\_TS\_134-2.JPG

**THIN SECTION:** 345-U1415P-20R-1-W 3/6-TSB\_Piece\_1-TS\_135  
**Rock name:** olivine-rich troctolite  
**Rock comment:** highly altered troctolite with prominent serpentine vein and vein halo  
**Lithologic interval:** 29  
**Piece No.:** #1  
**Billet request comment:** IgPet: Prim. Mineralogy; MetPet: Ladder Vein

**Thin Section no.:** 135  
**Authors:** NA, RW

**PRIMARY MINERALOGY**  
**No. of igneous domains:** 1  
**Nature of ign. domains:**  
**Igneous domain number:** 1  
**Domain grain size:** medium grained  
**Domain texture:** granular  
**Domain comment:**  
**Domain lithology:** olivine-rich troctolite  
**Grain size distribution:** equigranular  
**Relative abundance (%):**



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	6	71	65	2.5	anhedral	subequant				
Plagioclase	5	22	17	3	anhedral	tabular				
Clinopyroxene	3	4.8	1.8	1.5	anhedral	interstitial		colorless		
Oxide	1	2	1	0.5	anhedral to subhedral	subequant			chromian spinel	some elongated adjacent to olivine

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 1  
**No. of alteration domains:** 1  
**Domain type:** background  
**Domain rel. abund %:** 100  
**Estimated total % alteration:** 59

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	6.8	clinopyroxene 1.8%, plagioclase 5.1%	Olivine	32	75	pale/colorless amphibole 3%, clay minerals 50%, oxide 3%, serpentine 45%, talc 2%	
clay minerals	12	olivine 12%	Plagioclase	45	75	pale/colorless amphibole 5%, chlorite 15%, prehnite 80%	
oxide	0.8	olivine 0.7%, clinopyroxene 0.1%	Clinopyroxene	23	10	pale/colorless amphibole 20%, chlorite 77%, oxide 3%	
pale/colorless amphibole	2.9	olivine 0.7%, clinopyroxene 0.5%, plagioclase 1.7%	Oxide	1			
prehnite	27	plagioclase 27%					
serpentine	10.8	olivine 10.8%					
talc	0.5	olivine 0.5%					
<b>domain total alteration %:</b>	<b>60.8</b>						

**Vein summary**  
 vein 1 50mm thick deformed fibrous serpentine vein cuts the middle of the slide, thinner serpentine veins run parallel to the major serpentine vein.  
 vein 2 two clay veins cut the large serpentine vein at right angles, forming a ladder vein with the serpentine vein.

**ALTERATION COMMENT:** Background alteration of olivine is characterized by moderate to nearly complete replacement by serpentine and magnetite in mesh textures. In the background, clinopyroxene is partially replaced by amphibole and sparingly by chlorite, and plagioclase is highly to completely pseudomorphically replaced by prehnite. Fine grained euhedral pyrite grains are abundantly disseminated in the serpentine pseudomorphs, and are also found along serpentine veinlets. Euhedral to subhedral magnetite are common in the vein halo and within serpentine after olivine. The major serpentine vein has a wide halo of ~50 mm on either side of the vein. In this halo, olivine is altered to clay minerals, and plagioclase is more completely altered to prehnite.

**STRUCTURE COMMENT:** Magmatic: Isotropic. Olivine shows subgrains; plagioclase shows deformation twins. Intercumulus clinopyroxene. Spinel. Crystal Plastic: No crystal plastic fabric. Brittle: Cut by perpendicular fracture sets hosting veins. Veins/alteration: Cut by deformed serpentine, and chlorite-clay veins.

Crosscutting Relationships (as apparent in thin section):  
 1) Cracking, and vein formation.

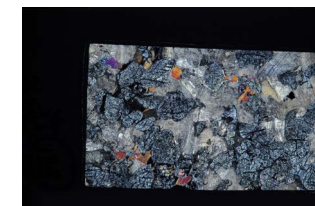
**PHOTOMICROGRAPHS:** 345\_U1415P\_20R\_1\_TS\_135.JPG  
 345\_U1415P\_20R\_1\_TS\_135-2.JPG



**THIN SECTION:** 345-U1415P-20R-1-W 67/68-TSB\_Piece\_5-TS\_136  
**Rock name:** troctolite  
**Rock comment:** highly altered  
**Lithologic interval:** 29  
**Piece No.:** #5  
**Billet request comment:** IgPet: Prim. Mineralogy; Struct: Magmatic Fabric

**Thin Section no.:** 136  
**Authors:** NA, KF

**PRIMARY MINERALOGY** No. of igneous domains: 1 Nature of ign. domains:  
**Igneous domain number:** 1  
**Domain grain size:** medium grained  
**Domain texture:** granular  
**Domain comment:**  
**Domain lithology:** troctolite  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	4	30	26	3	anhedral	subequant				
Plagioclase	3	65	62	4	anhedral	tabular				
Clinopyroxene	3	4	1	2	anhedral	interstitial		colorless		
Oxide	1	1	0	0.2	subhedral	subequant			chromian spinel	

**ALTERATION / METAMORPHISM** Alteration domain number: 1 No. of alteration domains: 1 Domain type: background Domain rel. abund %: 100 Estimated total % alteration: 80

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	8.1	clinopyroxene 0.4%, plagioclase 7.7%	Olivine	40	90	clay minerals 25%, sulfide 5%, serpentine 70%	Olivine is highly altered to serpentine mesh textures, associated with clay and disseminated pyrite.
clay minerals	13.6	olivine 9%, clinopyroxene 0.7%, plagioclase 3.9%	Plagioclase	55	70	chlorite 20%, clay minerals 10%, prehnite 70%	Plagioclase is fractured and intensively altered to fine grained prehnite and chlorite along these fractures. Some plagioclase grains are completely replaced by prehnite.
green amphibole	1.1	clinopyroxene 1.1%	Clinopyroxene	5	70	green amphibole 30%, pale/colorless amphibole 30%, chlorite 10%, clay minerals 20%, serpentine 10%	Clinopyroxene is moderately to intensively altered to amphibole along cleavage planes. When clinopyroxene is included in former olivine it is intensively altered to serpentine or chlorite (not clear).
pale/colorless amphibole	1.1	clinopyroxene 1.1%					
prehnite	27	plagioclase 27%					
serpentine	25.6	olivine 25.2%, clinopyroxene 0.4%					
sulfide	1.8	olivine 1.8%					
<b>domain total alteration %:</b>	<b>78.3</b>						

**ALTERATION COMMENT:** Olivine is highly altered to serpentine mesh textures, associated with clay and talc towards the rims. Rare clinopyroxene is moderately altered to amphibole along cleavage planes. Plagioclase is fractured and intensively altered to fine grained prehnite and chlorite along these fractures. Some plagioclase grains are completely replaced by prehnite.

**STRUCTURE COMMENT:** Magmatic: Isotropic. Macroscopic magmatic subvertical foliation; microscopic observations suggest grain size too coarse to determine. Plagioclase shows undulose extinction, deformation twins, and locally bent. Olivine shows undulose extinction and subgrains. Intercumulus clinopyroxene. Crystal Plastic: Serpentine foliation in olivine. Brittle: Limited fractures. Veins/alteration: Cut by thin prehnite and chlorite veins.

Crosscutting Relationships (as apparent in thin section):  
 1) Cracking, and vein formation.

**PHOTOMICROGRAPHS:** 345\_U1415P\_20R\_1\_TS\_136.JPG  
 345\_U1415P\_20R\_1\_TS\_136-2.JPG

**THIN SECTION:** 345-U1415P-20R-2-W 59/61-TSB\_Piece\_6-TS\_137  
**Rock name:** troctolite  
**Rock comment:** highly altered  
**Lithologic interval:** 29  
**Piece No.:** #5  
**Billet request comment:** IgPet: Prim. Mineralogy; Struct: Magmatic Texture

**Thin Section no.:** 137  
**Authors:** JM, KF

**PRIMARY MINERALOGY** No. of igneous domains: 1 Nature of ign. domains:  
**Igneous domain number:** 1  
**Domain grain size:** medium grained  
**Domain texture:** granular  
**Domain comment:**

**Domain lithology:** troctolite  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	2	25	23	4	anhedral	equant				
Plagioclase	2	74	72	4	anhedral	tabular				
Clinopyroxene	1	1	0	1	anhedral	irregular		colorless	interstitial	
Oxide	0.1	0.1	0	0.1	anhedral to subhedral	equant				chromian spinel

**ALTERATION / METAMORPHISM** No. of alteration domains: 1 Domain type: background Domain rel. abund %: 100 Estimated total % alteration: 80

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	10.8	clinopyroxene 0.4%, plagioclase 10.4%	Olivine	30	80	clay minerals 20%, oxide 3%, sulfide 2%, serpentine 75%	Olivine is intensively altered to serpentine mesh textures, associated with clay and disseminated pyrite and magnetite. However, a few olivine grains are remarkably fresh.
clay minerals	10.7	olivine 4.8%, clinopyroxene 0.7%, plagioclase 5.2%	Plagioclase	65	80	chlorite 20%, clay minerals 10%, prehnite 70%	Plagioclase is intensively altered to fine grained prehnite and minor chlorite.
oxide	0.7	olivine 0.7%	Clinopyroxene	5	70	pale/colorless amphibole 70%, chlorite 10%, clay minerals 20%	Clinopyroxene is intensively altered to amphibole, clay and chlorite.
pale/colorless amphibole	2.5	clinopyroxene 2.5%					
prehnite	36.4	plagioclase 36.4%					
serpentine	18	olivine 18%					
sulfide	0.5	olivine 0.5%					
<b>domain total alteration %:</b>	<b>79.6</b>						

**ALTERATION COMMENT:** Olivine is intensively altered to serpentine mesh textures, associated with clay and disseminated pyrite and magnetite. A few olivine grains are remarkably fresh. Clinopyroxene is intensively altered to amphibole, clay and chlorite. Plagioclase is intensively altered to fine grained prehnite and minor chlorite.

**STRUCTURE COMMENT:** Magmatic: Isotropic. Macroscopic magmatic subvertical foliation; microscopic observations suggest grain size too coarse to determine. Plagioclase shows undulose extinction, and deformation twins. Olivine shows undulose extinction and subgrains. Intercumulus clinopyroxene. Crystal Plastic: No crystal plastic fabric. Brittle: Limited fracturing. Veins/alteration: Cut by thin prehnite and chlorite veins.

Crosscutting Relationships (as apparent in thin section):  
 1) Cracking, and vein formation.

**PHOTOMICROGRAPHS:** 345\_U1415P\_20R\_2\_TS\_137.JPG  
 345\_U1415P\_20R\_2\_TS\_137-2.JPG

**THIN SECTION:** 345-U1415P-22R-1-W 12/17-TSB\_Piece\_3-TS\_138  
**Rock name:** troctolite  
**Rock comment:** highly altered  
**Lithologic Interval:** 29  
**Piece No.:** #3  
**Billet request comment:** IgPet: Prim. Mineralogy; MetPet: Olivine Alteration

**Thin Section no.:** 138

**Authors:** JM, KF

**PRIMARY MINERALOGY**

**No. of Igneous domains:** 1

**Nature of ign. domains:**

**Igneous domain number:** 1  
**Domain grain size:** coarse grained  
**Domain texture:** granular  
**Domain comment:**

**Domain lithology:** troctolite  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	15	55	40	5	anhedral	irregular				
Plagioclase	15	45	30	4	anhedral	tabular				
Clinopyroxene	1	1	0	1	anhedral	irregular		colorless	interstitial	
Oxide	0.1	0.1	0	0.1	anhedral to subhedral	equant				chromian spinel

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 1  
**No. of alteration domains:** 1  
**Domain type:** background  
**Domain rel. abund %:** 100  
**Estimated total % alteration:** 70

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	12	plagioclase 12%	Olivine	40	70	clay minerals 15%, sulfide 5%, serpentine 80%	Olivine is intensively altered to serpentine mesh textures, associated with clay and disseminated pyrite (and rarely chalcopyrite) along the mesh net and some clay in the mesh core towards the outside, surrounded by a thin rim of chlorite when in contact with plagioclase.
clay minerals	4.5	olivine 4.2%, clinopyroxene 0.3%	Plagioclase	57	70	chlorite 30%, prehnite 70%	Plagioclase is fractured and intensively altered to fine grained prehnite and minor chlorite along these micro-fractures. Some grains are completely replaced by prehnite. When in contact with olivine, plagioclase is altered to form chlorite rims around former olivine grains.
pale/colorless amphibole	1.2	clinopyroxene 1.2%	Clinopyroxene	3	50	pale/colorless amphibole 80%, clay minerals 20%	Rare interstitial clinopyroxene is moderately altered to amphibole and clay along cleavage planes and grain boundaries.
prehnite	27.9	plagioclase 27.9%					
serpentine	22.4	olivine 22.4%					
sulfide	1.4	olivine 1.4%					
<b>domain total alteration %:</b>	<b>69.4</b>						

**ALTERATION COMMENT:** Olivine is highly altered to serpentine mesh textures, associated with clay and disseminated pyrite (and rarely chalcopyrite) along the mesh net and some clay in the mesh core towards the outside, surrounded by a thin rim of chlorite when in contact with plagioclase. Rare interstitial clinopyroxene is moderately altered to amphibole and clay along cleavage planes and grain boundaries. Plagioclase is fractured and intensively altered to fine grained prehnite and minor chlorite along these micro-fractures. Some plagioclase grains are completely replaced by prehnite.

**STRUCTURE COMMENT:** Magmatic: Isotropic. Plagioclase shows undulose extinction, and deformation twins. Skeletal olivine shows undulose extinction and subgrains. Thin rims of intercumulus clinopyroxene surrounding olivine adjacent to plagioclase.  
 Crystal Plastic: No crystal plastic fabric.  
 Brittle: Minor cracking.  
 Veins/alteration: Cut by thin chlorite and clay veins.  
 Crosscutting Relationships (as apparent in thin section):  
 1) Cracking, and vein formation.

**PHOTOMICROGRAPHS:** 345\_U1415P\_22R\_1\_TS\_138.JPG  
 345\_U1415P\_22R\_1\_TS\_138-2.JPG

**THIN SECTION:** 345-U1415P-22R-1-W 60/65-TSB\_Piece\_8-TS\_139  
**Rock name:** troctolite  
**Rock comment:** highly altered  
**Lithologic interval:** 29  
**Piece No.:** #8  
**Billet request comment:** IgPet: Prim. Mineralogy; MetPet: Pinkish Alteration

**Thin Section no.:** 139

**Authors:** TH, AM

**PRIMARY MINERALOGY**

**Igneous domain number:** 1  
**Domain grain size:** medium grained  
**Domain texture:** granular  
**Domain comment:**

**No. of igneous domains:** 1

**Nature of ign. domains:**

**Domain lithology:** troctolite  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	5	53	48	4	anhedral to subhedral	subequant				
Plagioclase	10	45	35	3.5	anhedral	irregular				
Clinopyroxene	2	2	0	20	anhedral	irregular		interstitial		

**ALTERATION / METAMORPHISM**

**Alteration domain number:** 1

**No. of alteration domains:** 2

**Domain type:** background

**Domain rel. abund %:** 50

**Estimated total % alteration:** 85

**SECONDARY MINERALOGY**

**%**

**REPLACING / FILLING**

**PRIMARY MINERAL REPLACED**

**% ORIGINAL % ALTERED**

**REPLACEMENT MINERAL**

**ALTERATION COMMENTS**

chlorite	34.1	olivine 17.5%, clinopyroxene 1%, plagioclase 15.6%	Olivine	25	100	pale/colorless amphibole 10%, chlorite 70%, clay minerals 10%, oxide 1%, serpentine 9%	
clay minerals	2.5	olivine 2.5%	Plagioclase	65	80	pale/colorless amphibole 10%, chlorite 30%, prehnite 30%, garnet 5%, epidote/zoisite 25%	
epidote/zoisite	13	plagioclase 13%	Clinopyroxene	10	20	pale/colorless amphibole 50%, chlorite 50%	
garnet	2.6	plagioclase 2.6%					
oxide	0.3	olivine 0.3%					
pale/colorless amphibole	8.7	olivine 2.5%, clinopyroxene 1%, plagioclase 5.2%					
prehnite	15.6	plagioclase 15.6%					
serpentine	2.3	olivine 2.3%					

**domain total alteration %:** 79.1

**Vein summary**

vein 1 composite fibrous chlorite-clay-prehnite veins branch and follow serpentine mesh veins as they die out in the slide within the troctolitic layer

**ALTERATION COMMENT:**

Heterogeneously altered: plagioclase is entirely altered to prehnite in one area, and to epidote/clinozoisite and chlorite in another; olivine is extensively replaced by chlorite and amphibole needles, while clinopyroxene is fresh apart from some narrow rims which are chloritized. oxide and minor sulfide are present in olivine pseudomorphs.

**ALTERATION / METAMORPHISM**

**Alteration domain number:** 2

**No. of alteration domains:** 2

**Domain type:** background

**Domain rel. abund %:** 50

**Estimated total % alteration:** 95

**SECONDARY MINERALOGY**

**%**

**REPLACING / FILLING**

**PRIMARY MINERAL REPLACED**

**% ORIGINAL % ALTERED**

**REPLACEMENT MINERAL**

**ALTERATION COMMENTS**

chlorite	2.1	plagioclase 2.1%	Olivine	70	95	pale/colorless amphibole 1%, oxide 1%, sulfide 0.1%, serpentine 96.9%, talc 1%	
garnet	3.2	plagioclase 3.2%	Plagioclase	30	70	chlorite 10%, prehnite 75%, garnet 15%	
oxide	0.7	olivine 0.7%					
pale/colorless amphibole	0.7	olivine 0.7%					
prehnite	15.8	plagioclase 15.8%					
serpentine	64.4	olivine 64.4%					
sulfide	0.1	olivine 0.1%					
talc	0.7	olivine 0.7%					

**domain total alteration %:** 87.7

**ALTERATION COMMENT:**

Olivine is almost completely altered to mesh textured serpentine, while plagioclase is extensively altered to prehnite and minor hydrogarnet, with small chlorite rims from the corona reaction with olivine; oxide is common in the mesh texture which also contains some pyrite.

**STRUCTURE COMMENT:**

Magmatic: Isotropic. Very altered. Skeletal olivine shows mesh texture. Thin rims of intercumulus clinopyroxene surrounding olivine, and against plagioclase.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Minor cracking.  
 Veins/alteration: Cut by composite fibrous chlorite, clay, prehnite, and clinozoisite (?) veins normal to contact.

Crosscutting Relationships (as apparent in thin section):  
 1) Cracking, and vein formation.

**PHOTOMICROGRAPHS:**

345\_U1415P\_22R\_1\_TS\_139.JPG  
 345\_U1415P\_22R\_1\_TS\_139-2.JPG

**THIN SECTION:** 345-U1415P-22R-2-W 113/115-TSB\_Piece\_8-TS\_140  
**Rock name:** contact between troctolite and olivine gabbro  
**Rock comment:** moderately altered  
**Lithologic interval:** 29/30  
**Piece No.:** #8  
**Billet request comment:** IgPet: Prim. Mineralogy; Struct: Magmatic Fabric

**Thin Section no.:** 140

**Authors:** TH, KF

**PRIMARY MINERALOGY** **No. of igneous domains:** 2 **Nature of ign. domains:** two lithologies  
**Igneous domain number:** 1 **Domain lithology:** troctolite  
**Domain grain size:** medium grained **Grain size distribution:** equigranular  
**Domain texture:** granular **Relative abundance (%):** 50  
**Domain comment:** this domain (troctolite) is the main lithology within this long interval 29



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	15	40	25	3	anhedral	subequant				
Plagioclase	5	60	55	3	anhedral	irregular				
Clinopyroxene	0.1	0.1	0	1.4	anhedral	irregular			interstitial	
Oxide	0.1	0.1	0	0.1	anhedral	subequant				

**Igneous domain number:** 2 **Domain lithology:** olivine gabbro  
**Domain grain size:** medium grained **Grain size distribution:** poikilitic  
**Domain texture:** granular **Relative abundance (%):** 50  
**Domain comment:** minor lithology; was interpreted as new interval

	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	5	10	5	0.45	subhedral	equant				
Plagioclase	25	40	15	0.8	anhedral to subhedral	tabular	continuous		chadacrysts	
Clinopyroxene	50	50	0	3	anhedral	irregular			poikilitic	
Orthopyroxene	0.1	0.1	0	0.1	anhedral to subhedral	prismatic		colorless		

**ALTERATION / METAMORPHISM** **No. of alteration domains:** 2 **Domain rel. abund %:** 60 **Estimated total % alteration:** 40  
**Alteration domain number:** 1 **Domain type:** background

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	5.1	olivine 2.4%, plagioclase 2.7%	Olivine	20	60	chlorite 20%, clay minerals 45%, sulfide 5%, serpentine 30%	The degree of alteration of olivine is very heterogeneous. Some grains are very fresh and only slightly altered to serpentine mesh textures. Other grains are completely replaced by clay and chlorite, but sometime relict serpentine mesh textures are still visible. The alteration of olivine is associated with small amounts of disseminated pyrite and chalcocopyrite.
clay minerals	9.4	olivine 5.4%, clinopyroxene 4%	Plagioclase	30	30	chlorite 30%, prehnite 50%, secondary plagioclase 20%	Plagioclase is fractured and altered to fine grained prehnite and chlorite along these micro-fractures. Some plagioclase grains that are included in clinopyroxene are completely replaced by prehnite and secondary plagioclase.
pale/colorless amphibole	16	clinopyroxene 16%	Clinopyroxene	50	40	pale/colorless amphibole 80%, clay minerals 20%	Clinopyroxene is moderately altered to amphibole along cleavage planes.
prehnite	4.5	plagioclase 4.5%					
secondary plagioclase	1.8	plagioclase 1.8%					
serpentine	3.6	olivine 3.6%					
sulfide	0.6	olivine 0.6%					
<b>domain total alteration %:</b>	<b>41</b>						

**ALTERATION COMMENT:** Olivine alteration is heterogeneous. Some grains are very fresh and only slightly altered to serpentine mesh textures. Other grains are completely replaced by clay and chlorite, but locally relict serpentine mesh textures are still visible. The alteration of olivine is associated with small amounts of disseminated pyrite and chalcocopyrite. Clinopyroxene is moderately altered to amphibole along cleavage planes. Plagioclase is fractured and altered to fine grained prehnite and chlorite along these micro-fractures.

**ALTERATION / METAMORPHISM** **No. of alteration domains:** 2 **Domain rel. abund %:** 40 **Estimated total % alteration:** 85  
**Alteration domain number:** 2 **Domain type:** background

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
clay minerals	16.3	olivine 10.4%, clinopyroxene 0.2%, plagioclase 5.7%	Olivine	40	70	clay minerals 37%, sulfide 3%, serpentine 60%	The degree of alteration of olivine is very heterogeneous. Some grains are very fresh and only slightly altered to serpentine mesh textures, associated with some clay towards the outside. Other grains are completely replaced by serpentine and amphibole.
pale/colorless amphibole	1	clinopyroxene 1%	Plagioclase	57	100	clay minerals 10%, prehnite 90%	Plagioclase is completely replaced by fine grained prehnite, in some areas close to prehnite+carbonate veins also by larger grained prehnite.
prehnite	51.3	plagioclase 51.3%	Clinopyroxene	3	40	pale/colorless amphibole 80%, clay minerals 20%	Rare interstitial clinopyroxene is moderately altered to amphibole along cleavage planes.
serpentine	16.8	olivine 16.8%					
sulfide	0.8	olivine 0.8%					
<b>domain total alteration %:</b>	<b>86.2</b>						

**Vein summary**  
 vein 1 prehnite+carbonate veins

**ALTERATION COMMENT:** Olivine alteration is heterogeneous. Some grains are very fresh and only slightly altered to serpentine mesh textures, associated with some clay towards the outside. Other grains are completely replaced by serpentine and clay. Plagioclase is completely replaced by fine grained prehnite, in some areas close to prehnite + carbonate veins also by larger grained prehnite.

**STRUCTURE COMMENT:** Magmatic: Boundary between troctolite and olivine gabbro.  
 Troctolite - Weak magmatic foliation defined by olivine and plagioclase SPO. Skeletal olivine locally shows undulose extinction and subgrain development. Plagioclase altered. Interstitial clinopyroxene.  
 Olivine gabbro - Isotropic. Plagioclase shows common undulose extinction, deformation twins, and local patches of annealing. Interstitial orthopyroxene and clinopyroxene  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Set of two sets of fractures filled with veins.  
 Veins/alteration: Cut prehnite, carbonate and chlorite veins.  
 Crosscutting Relationships (as apparent in thin section):  
 1) Cracking, alteration, and vein formation.

**PHOTOMICROGRAPHS:** 345\_U1415P\_22R\_2\_TS\_140.JPG  
 345\_U1415P\_22R\_2\_TS\_140-2.JPG

**THIN SECTION:** 345-U1415P-23R-1-W 19/21-TSB\_Piece\_2-TS\_141  
**Rock name:** anorthositic troctolite  
**Rock comment:** highly altered  
**Lithologic interval:** 31  
**Piece No.:** #2  
**Billet request comment:** IgPet: Prim. Mineralogy; MetPet: Alt. along vein; Struct: Magmatic Fabric

**Thin Section no.:** 141  
**Authors:** JM, TN

**PRIMARY MINERALOGY**  
**No. of igneous domains:** 1  
**Nature of ign. domains:**  
**Igneous domain number:** 1  
**Domain grain size:** medium grained  
**Domain texture:** granular  
**Domain comment:**  
**Domain lithology:** anorthositic troctolite  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	0	20	20	3	anhedral	equant				
Plagioclase	5	80	75	3	anhedral	tabular				
Clinopyroxene	0.2	0.2	0	0.1	anhedral	irregular		colorless	interstitial	thin film between olivine and plagioclase
Oxide	0.1	0.1	0	0.1	anhedral to subhedral	equant				chromian spinel

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 1  
**No. of alteration domains:** 2  
**Domain type:** background  
**Domain rel. abund %:** 30  
**Estimated total % alteration:** 70

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	13.8	plagioclase 13.8%	Olivine	40	100	pale/colorless amphibole 10%, clay minerals 40%, oxide 1%, sulfide 1%, serpentine 38%, talc 10%	
clay minerals	16	olivine 16%	Plagioclase	55	50	chlorite 50%, prehnite 50%	
oxide	0.4	olivine 0.4%	Clinopyroxene	5	20	pale/colorless amphibole 100%	
pale/colorless amphibole	5	olivine 4%, clinopyroxene 1%					
prehnite	13.8	plagioclase 13.8%					
serpentine	15.2	olivine 15.2%					
sulfide	0.4	olivine 0.4%					
talc	4	olivine 4%					
<b>domain total alteration %:</b>		<b>68.6</b>					

**Vein summary**  
 vein 1 Prehnite massive vein  
 vein 2 Chlorite branching vein  
 vein 3 Chlorite/clay cross-biber vein

**ALTERATION COMMENT:** Olivine is altered primarily to serpentine and clay, and partially to tremolite and talc. Interstitial clinopyroxene looks to be replaced by pale amphibole along cleavage surfaces. Plagioclase is partially intensely altered to prehnite and chlorite. Pyrite is associated with serpentine/clay/tremolite replacing olivine.

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 2  
**No. of alteration domains:** 2  
**Domain type:** background  
**Domain rel. abund %:** 70  
**Estimated total % alteration:** 80

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	43	olivine 7.8%, plagioclase 35.2%	Olivine	10	100	pale/colorless amphibole 10%, chlorite 78%, oxide 1%, sulfide 1%, serpentine 10%	
oxide	0.1	olivine 0.1%	Plagioclase	88	80	chlorite 50%, prehnite 50%	
pale/colorless amphibole	1.6	olivine 1%, clinopyroxene 0.6%	Clinopyroxene	2	30	pale/colorless amphibole 100%	
prehnite	35.2	plagioclase 35.2%					
serpentine	1	olivine 1%					
sulfide	0.1	olivine 0.1%					
<b>domain total alteration %:</b>		<b>81</b>					

**Vein summary**  
 vein 1 Prehnite massive vein  
 vein 2 Chlorite branching vein  
 vein 3 Chlorite/clay cross-biber vein

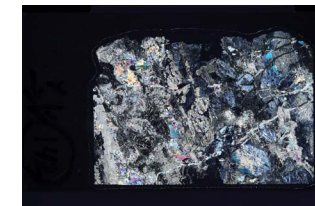
**ALTERATION COMMENT:** Olivine is altered primarily to chlorite with subordinate amounts of acicular tremolite/actinolite and serpentine, showing a difference from serpentine/clay dominant pseudomorphs after olivine of host troctolite. Interstitial clinopyroxene is replaced and overgrown by pale amphibole. Plagioclase is intensely altered to prehnite and chlorite. Pyrite is associated with chlorite replacing olivine.

**STRUCTURE COMMENT:** Magmatic: Boundary between troctolite and anorthosite vein.  
 Troctolite - Weak magmatic foliation defined by plagioclase SPO. Clinopyroxene rims around altered olivine. Plagioclase shows deformation twins, and weak annealing.  
 Anorthosite - Plagioclase shows deformation twins.  
 Crystal Plastic: No crystal plastic fabric.  
 Brittle: Cut by fractures, and veins.  
 Veins/alteration: Cut by prehnite, chlorite-clay, and thin chlorite veins.  
 Crosscutting Relationships (as apparent in thin section):  
 1) Cracking, and vein formation.

**PHOTOMICROGRAPHS:** 345\_U1415P\_23R\_1\_TS\_141.JPG  
 345\_U1415P\_23R\_1\_TS\_141-2.JPG

**THIN SECTION:** 345-U1415P-23R-1-W 100/103-TSB\_Piece\_14-TS\_142  
**Rock name:** troctolite  
**Rock comment:** completely altered  
**Lithologic interval:** 31  
**Piece No.:** #14  
**Billet request comment:** IgPet: Prim. Mineralogy; MetPet: Alt. and vein  
**Thin Section no.:** 142  
**Authors:** JM, AM

**PRIMARY MINERALOGY**  
**No. of igneous domains:** 1  
**Nature of ign. domains:**  
**Igneous domain number:** 1  
**Domain grain size:** medium grained  
**Domain texture:** granular  
**Domain comment:**  
**Domain lithology:** troctolite  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	0	50	50	3	anhedral	equant				
Plagioclase	0	50	50	3	anhedral	tabular				
Clinopyroxene	0.2	0.2	0	0.1	anhedral	irregular		colorless	interstitial	thin film between olivine and plagioclase

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 1  
**No. of alteration domains:** 1  
**Domain type:** background  
**Domain rel. abund %:** 100  
**Estimated total % alteration:** 90

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	35.2	olivine 18%, clinopyroxene 1%, plagioclase 16.2%	Olivine	30	100	pale/colorless amphibole 20%, chlorite 60%, serpentine 10%, other 10%	other may be pumpellyite
green amphibole	1	clinopyroxene 1%	Plagioclase	60	90	pale/colorless amphibole 10%, chlorite 30%, prehnite 40%, other 20%	other = pumpellyite or secondary clinopyroxene
pale/colorless amphibole	11.4	olivine 6%, plagioclase 5.4%	Clinopyroxene	10	50	green amphibole 20%, chlorite 20%, other 60%	other = high relief fibrous mineral possibly pumpellyite
prehnite	21.6	plagioclase 21.6%					
serpentine	3	olivine 3%					
other	16.8	olivine 3%, clinopyroxene 3%, plagioclase 10.8%					
<b>domain total alteration %:</b>	<b>89</b>						

**Vein summary**  
 vein 1 composite fibrous vein containing chlorite, some prehnite, pale amphibole and high relief inclined extinction mineral possibly pumpellyite or secondary clinopyroxene. Prehnite appears to overprint other phases and it is hard to distinguish vein from halo  
 vein 2 late prehnite veins often show pull-apart geometries and relict porosity

**ALTERATION COMMENT:** Intensely altered such that primary minerals are hard to identify with confidence; chloritized domains with variable amounts of amphibole were probably mainly olivine, while zones of prehnite (often coarse grained) were most likely plagioclase; pumpellyite (or secondary clinopyroxene?) replaces other phases in vein margins; minor sulfides present in serpentine after olivine and in veins.

**STRUCTURE COMMENT:** Magmatic: Very altered. Rims of interstitial clinopyroxene locally preserved.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Two sets of mutually perpendicular fractures filled with veins.  
 Veins/alteration: Cut by composite fibrous chlorite, amphibole and prehnite veins, and late prehnite.  
 Crosscutting Relationships (as apparent in thin section):  
 1) Cracking, alteration, and vein formation.

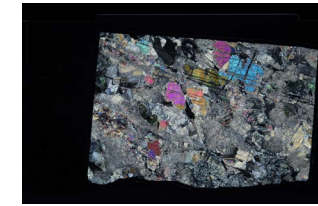
**PHOTOMICROGRAPHS:** 345\_U1415P\_23R\_1\_TS\_142.JPG  
 345\_U1415P\_23R\_1\_TS\_142-2.JPG

**THIN SECTION:** 345-U1415P-23R-1-W 134/138-TSB\_Piece\_18-TS\_143  
**Rock name:** troctolite  
**Rock comment:** highly altered  
**Lithologic interval:** 31  
**Piece No.:** #18  
**Billet request comment:** IgPet: Prim. Mineralogy

**Thin Section no.:** 143  
**Authors:** TF, TN

**PRIMARY MINERALOGY**  
**No. of igneous domains:** 1  
**Nature of ign. domains:**  
**Igneous domain number:** 1  
**Domain grain size:** medium  
**Domain texture:** granular  
**Domain comment:**

**Domain lithology:** troctolite  
**Grain size distribution:** equigranular  
**Relative abundance (%):** 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	15	35	20	4	euohedral to subhedral	subequant				
Plagioclase	30	65	35	1	euohedral to subhedral	tabular				
Clinopyroxene	0.1	0.1	0	0.5	anhedral	irregular			interstitial	

**ALTERATION / METAMORPHISM**  
**Alteration domain number:** 1  
**No. of alteration domains:** 1  
**Domain type:** background  
**Domain rel. abund %:** 100  
**Estimated total % alteration:** 65

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	24.5	plagioclase 24.5%	Olivine	25	50	clay minerals 48%, oxide 1%, sulfide 1%, serpentine 50%	
clay minerals	6	olivine 6%	Plagioclase	70	70	chlorite 50%, prehnite 50%	
oxide	0.1	olivine 0.1%	Clinopyroxene	5	50	pale/colorless amphibole 100%	
pale/colorless amphibole	2.5	clinopyroxene 2.5%					
prehnite	24.5	plagioclase 24.5%					
serpentine	6.3	olivine 6.3%					
sulfide	0.1	olivine 0.1%					
<b>domain total alteration %:</b>	<b>64</b>						

**Vein summary**  
 vein 1 Prehnite massive vein  
 vein 2 Chlorite branching vein

**ALTERATION COMMENT:** Olivine is altered mainly to serpentine with subordinate amounts of clay. Interstitial clinopyroxene is replaced by pale amphibole along cleavage surfaces. Plagioclase is intensely altered to prehnite and chlorite. Pyrite is associated with serpentine/clay replacing olivine.

**STRUCTURE COMMENT:** Magmatic: Very altered. Weak magmatic foliation defined by olivine SPO. Skeletal olivine shows undulose extinction and subgrain development. Plagioclase shows deformation twins. Rims of intercumulus clinopyroxene around olivine.  
 Crystal Plastic: No crystal plastic deformation.  
 Brittle: Set of subparallel fractures filled with veins.  
 Veins/alteration: Cut by a massive prehnite vein; cut by chlorite and prehnite veins.

Crosscutting Relationships (as apparent in thin section):  
 1) Cracking, alteration, and vein formation.

**PHOTOMICROGRAPHS:** 345\_U1415P\_23R\_1\_TS\_143.JPG  
 345\_U1415P\_23R\_1\_TS\_143-2.JPG