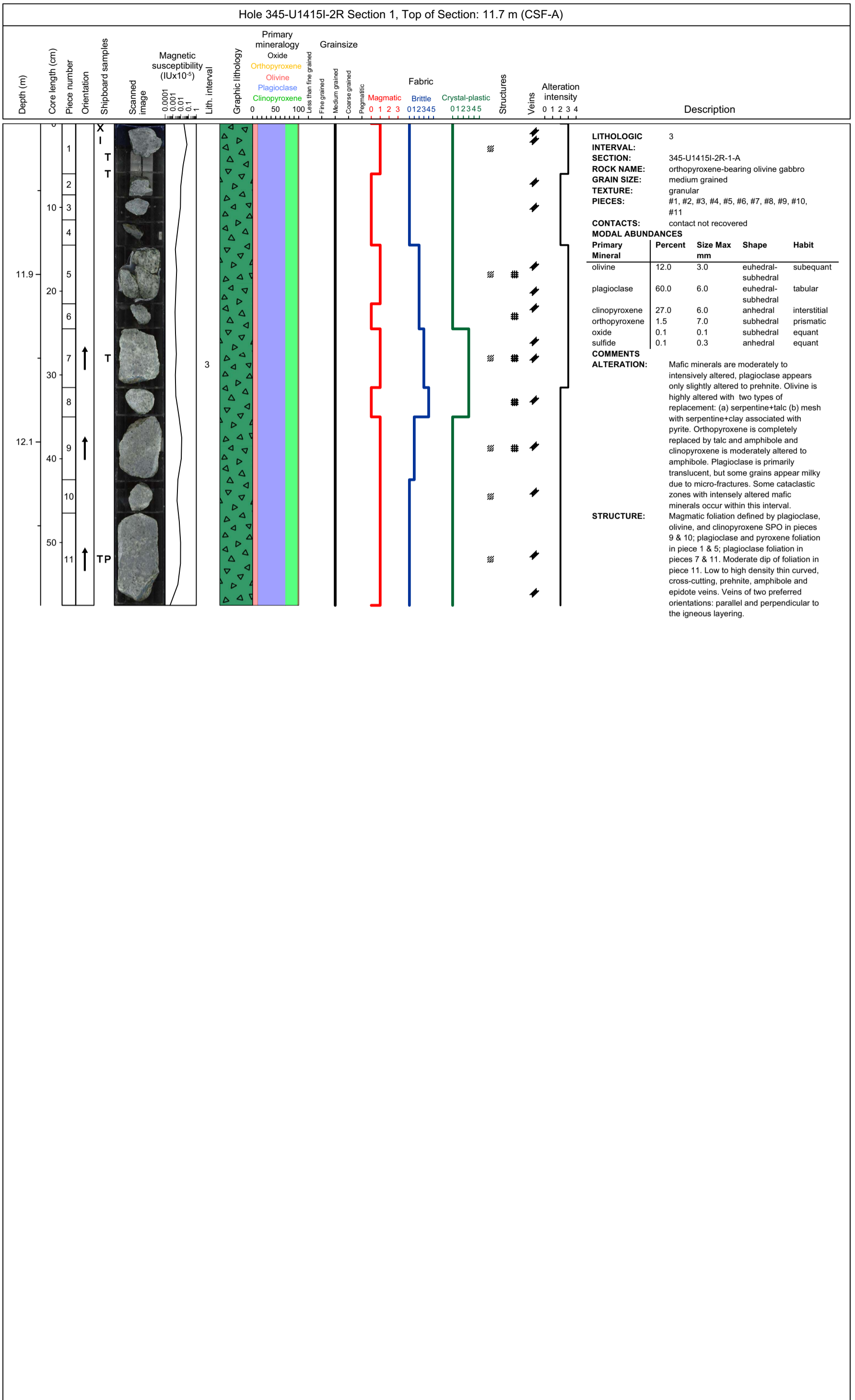
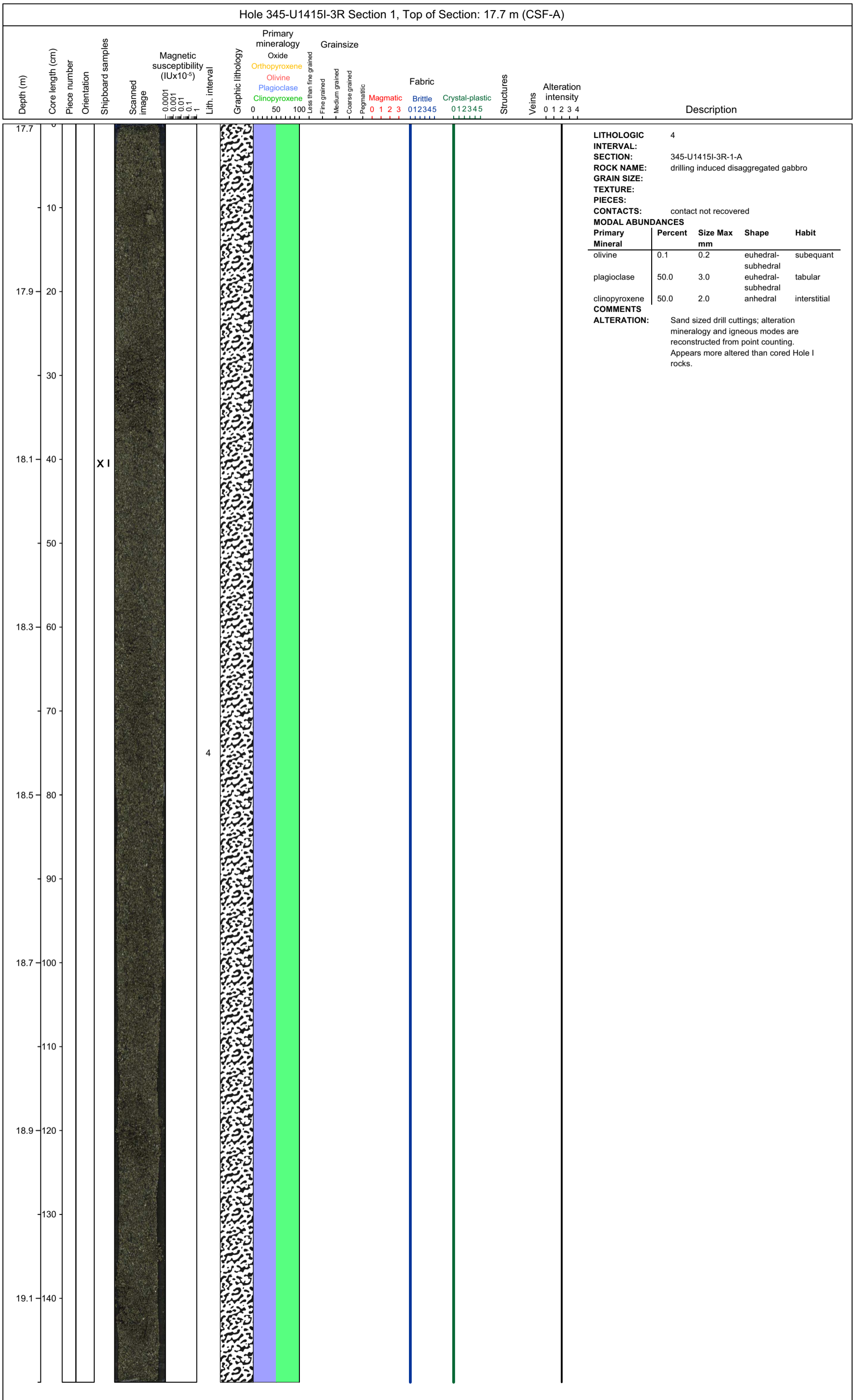
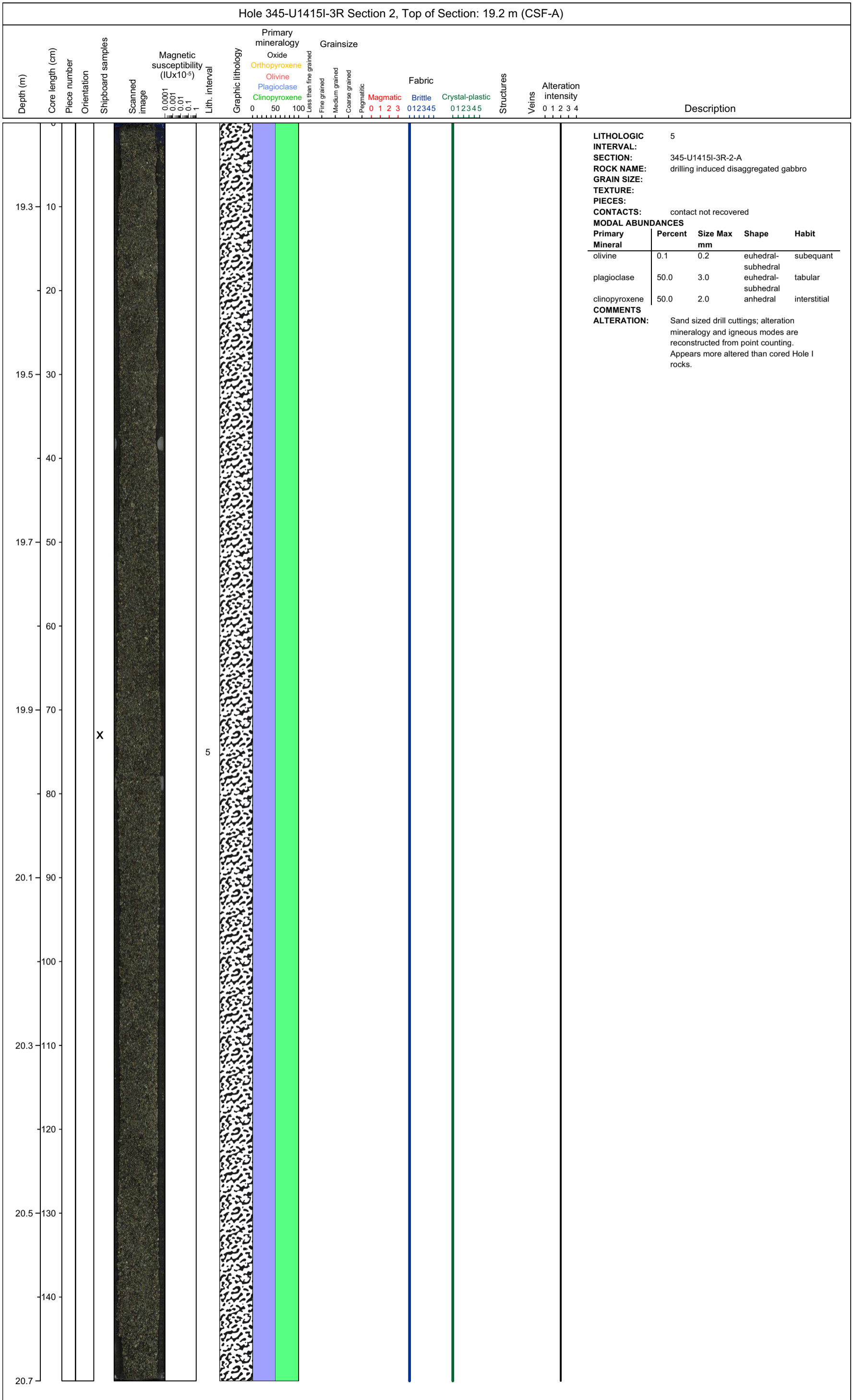
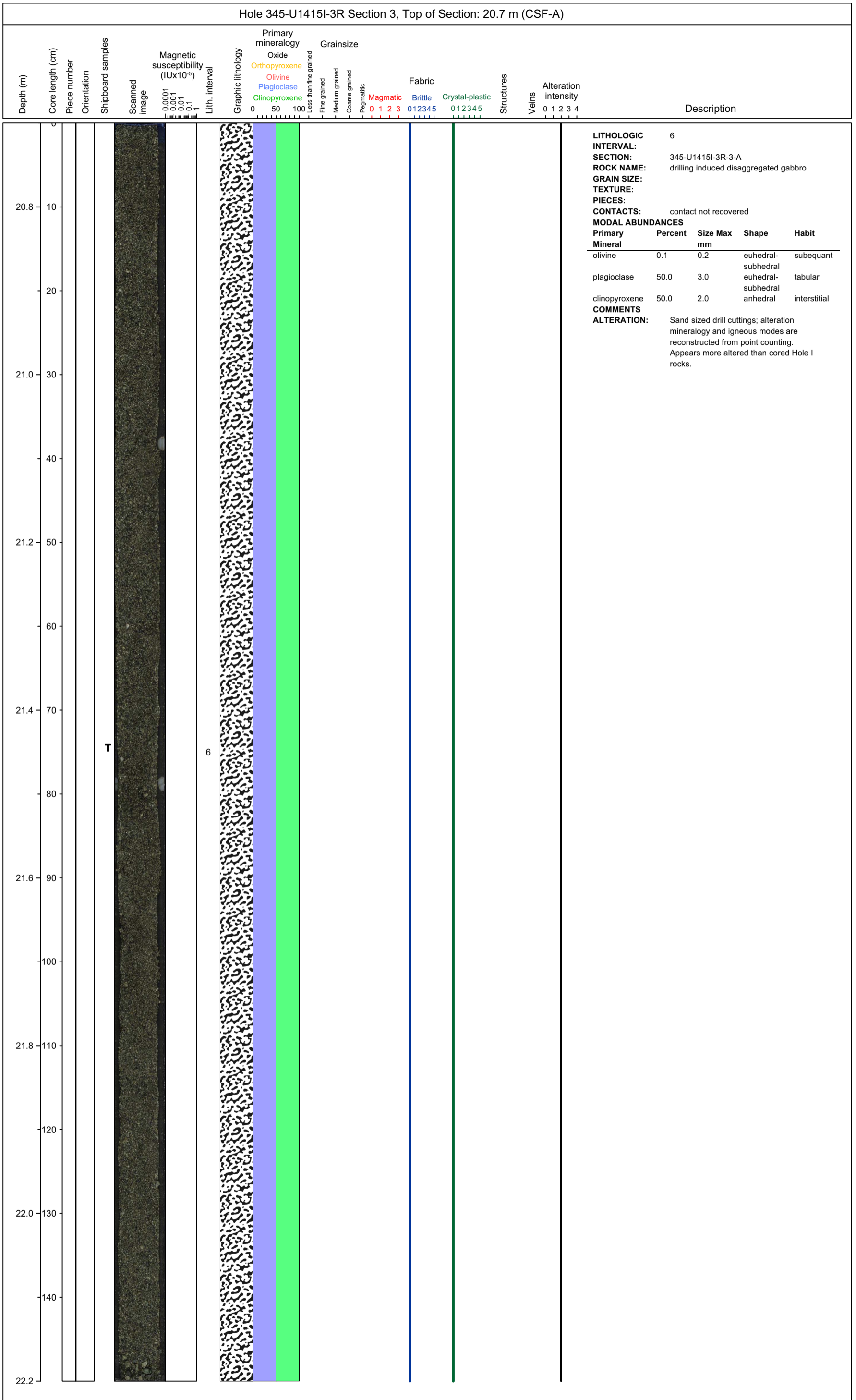


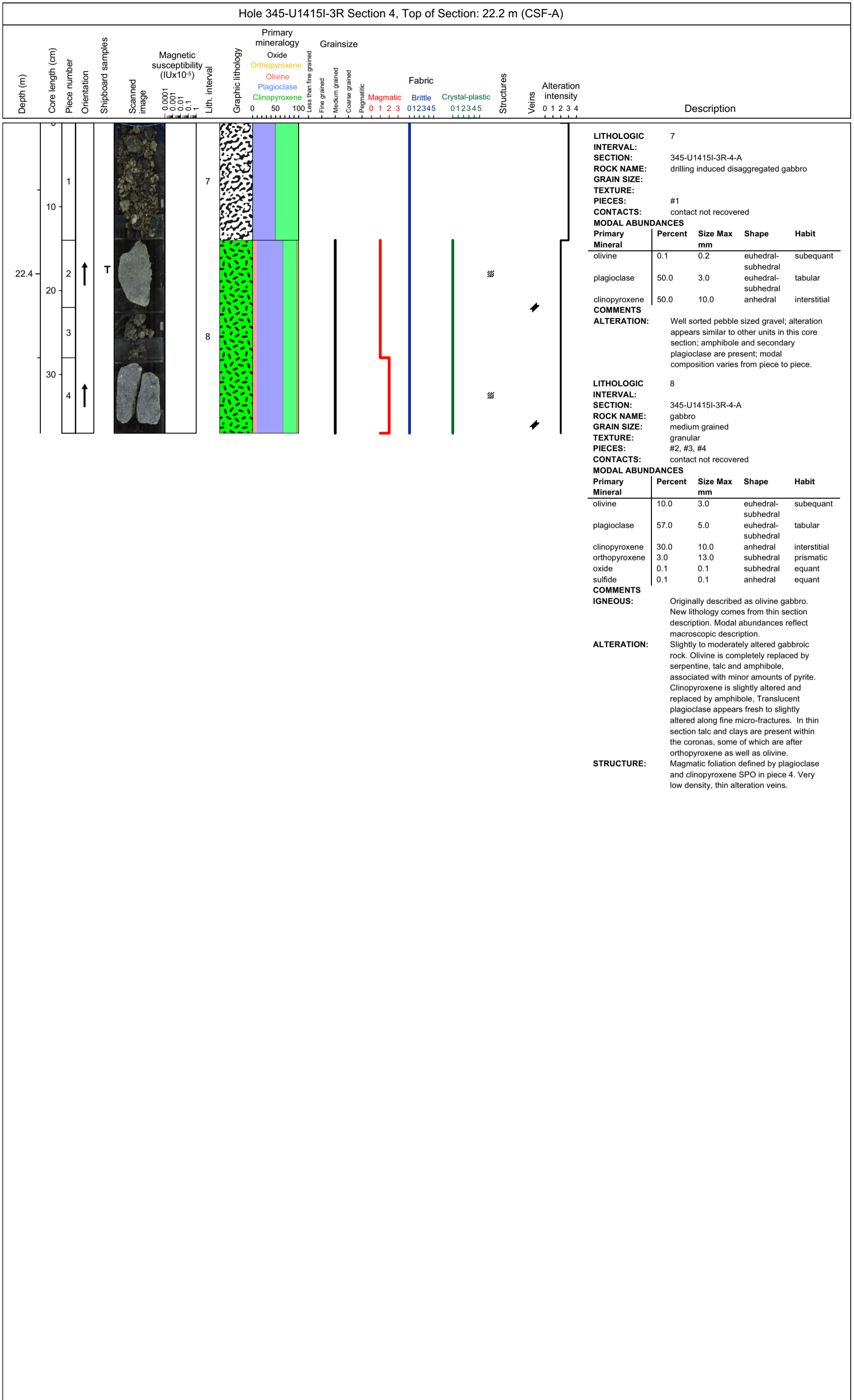
Hole 345-U14151-1R Section 1, Top of Section: 0.0 m (CSF-A)																																																							
Depth (m)	Core length (cm)	Piece number	Orientation	Shipboard samples	Scanned image	Magnetic susceptibility (IUx10 ⁻⁵)	Lith. interval	Graphic lithology	Primary mineralogy		Grainsize				Fabric			Structures	Veins	Alteration intensity	Description																																		
									Oxide	Olivine	Orthopyroxene	Plagioclase	Clinopyroxene	Less than fine grained	Fine grained	Medium grained	Coarse grained					Pegmatitic	Magmatic	Brittle	Crystal-plastic																														
0.0	0	1					1													<p>LITHOLOGIC INTERVAL: 1</p> <p>SECTION: 345-U14151-1R-1-A</p> <p>ROCK NAME: orthopyroxene-bearing gabbro</p> <p>GRAIN SIZE: medium grained</p> <p>TEXTURE: granular</p> <p>PIECES: #1, #2, #3</p> <p>CONTACTS: contact not recovered</p> <p>MODAL ABUNDANCES</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>7.0</td> <td>3.0</td> <td>euhedral-subhedral</td> <td>subequant</td> </tr> <tr> <td>plagioclase</td> <td>70.0</td> <td>6.0</td> <td>euhedral-subhedral</td> <td>tabular</td> </tr> <tr> <td>clinopyroxene</td> <td>20.0</td> <td>4.0</td> <td>anhedral</td> <td>interstitial</td> </tr> <tr> <td>orthopyroxene</td> <td>3.0</td> <td>5.0</td> <td>subhedral</td> <td>prismatic</td> </tr> <tr> <td>oxide</td> <td>0.1</td> <td>0.5</td> <td>subhedral</td> <td>equant</td> </tr> <tr> <td>sulfide</td> <td>0.3</td> <td>2.0</td> <td>anhedral</td> <td>equant</td> </tr> </tbody> </table> <p>COMMENTS</p> <p>IGNEOUS: Originally described as olivine gabbro. New lithology comes from thin section description. Modal abundances reflect macroscopic description.</p> <p>ALTERATION: Slightly to moderately altered. Olivine is completely replaced by talc and serpentine, associated with minor amounts of pyrite, often with coronae of talc and a thin rim of chlorite after plagioclase. In some olivine grains, the core is completely replaced by talc. Pyroxene is slightly altered and replaced by amphibole, rarely associated with pyrite. Plagioclase is rather fresh, but appears milky due to micro-fractures. Thin veins of prehnite cross cut many phases and lack an alteration halo.</p> <p>STRUCTURE: Magmatic foliation defined by plagioclase, olivine, and clinopyroxene SPO in piece 1, cut by minor fractures. Low density thin curved, cross-cutting, prehnite veins.</p>	Primary Mineral	Percent	Size Max mm	Shape	Habit	olivine	7.0	3.0	euhedral-subhedral	subequant	plagioclase	70.0	6.0	euhedral-subhedral	tabular	clinopyroxene	20.0	4.0	anhedral	interstitial	orthopyroxene	3.0	5.0	subhedral	prismatic	oxide	0.1	0.5	subhedral	equant	sulfide	0.3	2.0	anhedral	equant
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sulfide	0.3	2.0	anhedral	equant																																																			
	10	2					2													<p>LITHOLOGIC INTERVAL: 2</p> <p>SECTION: 345-U14151-1R-1-A</p> <p>ROCK NAME: gabbro</p> <p>GRAIN SIZE: medium grained</p> <p>TEXTURE: granular</p> <p>PIECES: #4</p> <p>CONTACTS: contact not recovered</p> <p>MODAL ABUNDANCES</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>plagioclase</td> <td>50.0</td> <td>2.0</td> <td>euhedral-subhedral</td> <td>tabular</td> </tr> <tr> <td>clinopyroxene</td> <td>50.0</td> <td>5.0</td> <td>anhedral</td> <td>interstitial</td> </tr> </tbody> </table> <p>COMMENTS</p> <p>ALTERATION: Very fresh, olivine is moderately altered to serpentine and pyrite, plagioclase and clinopyroxene are primarily fresh, rock contains disseminated pyrite and oxides.</p>	Primary Mineral	Percent	Size Max mm	Shape	Habit	plagioclase	50.0	2.0	euhedral-subhedral	tabular	clinopyroxene	50.0	5.0	anhedral	interstitial																				
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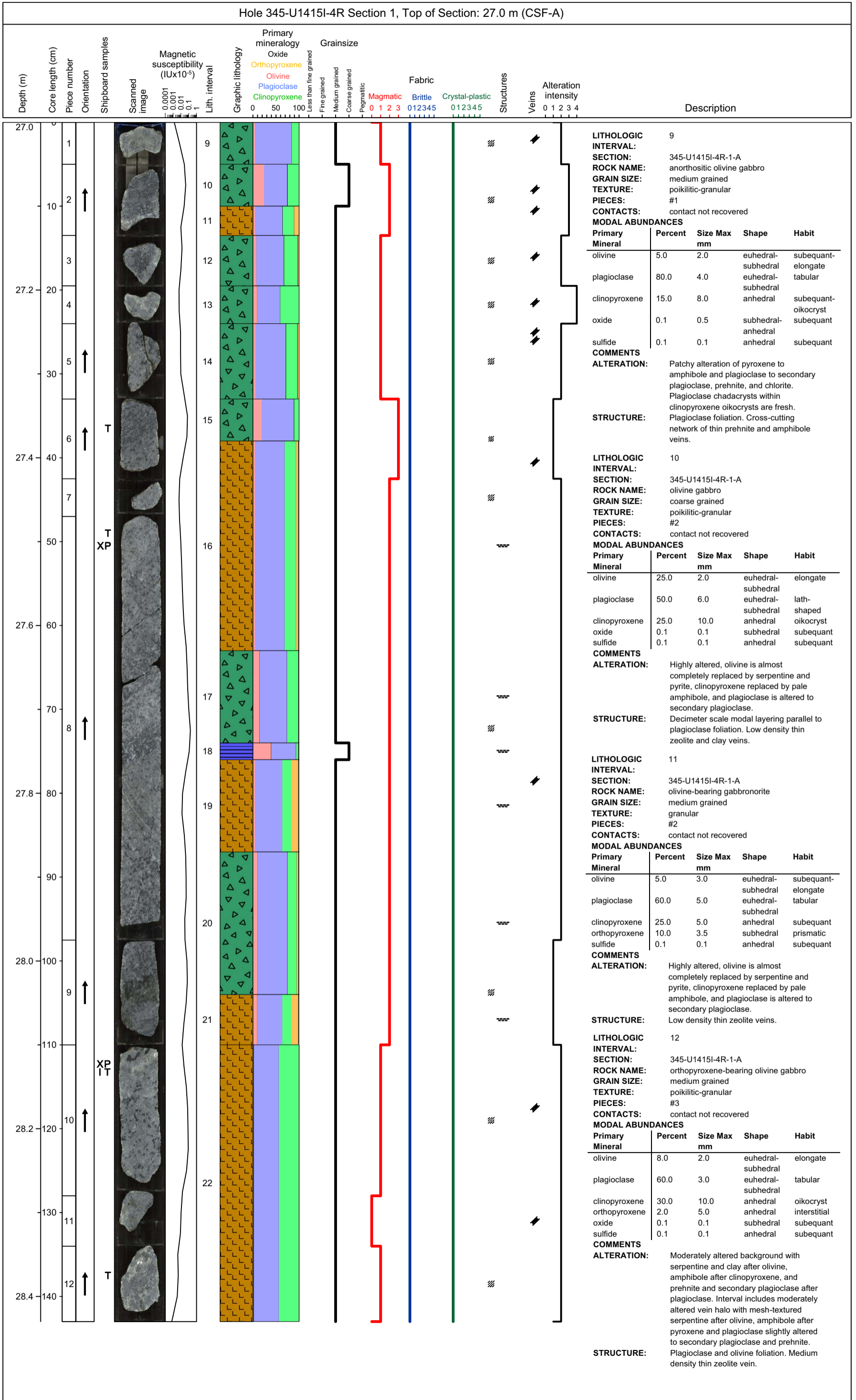


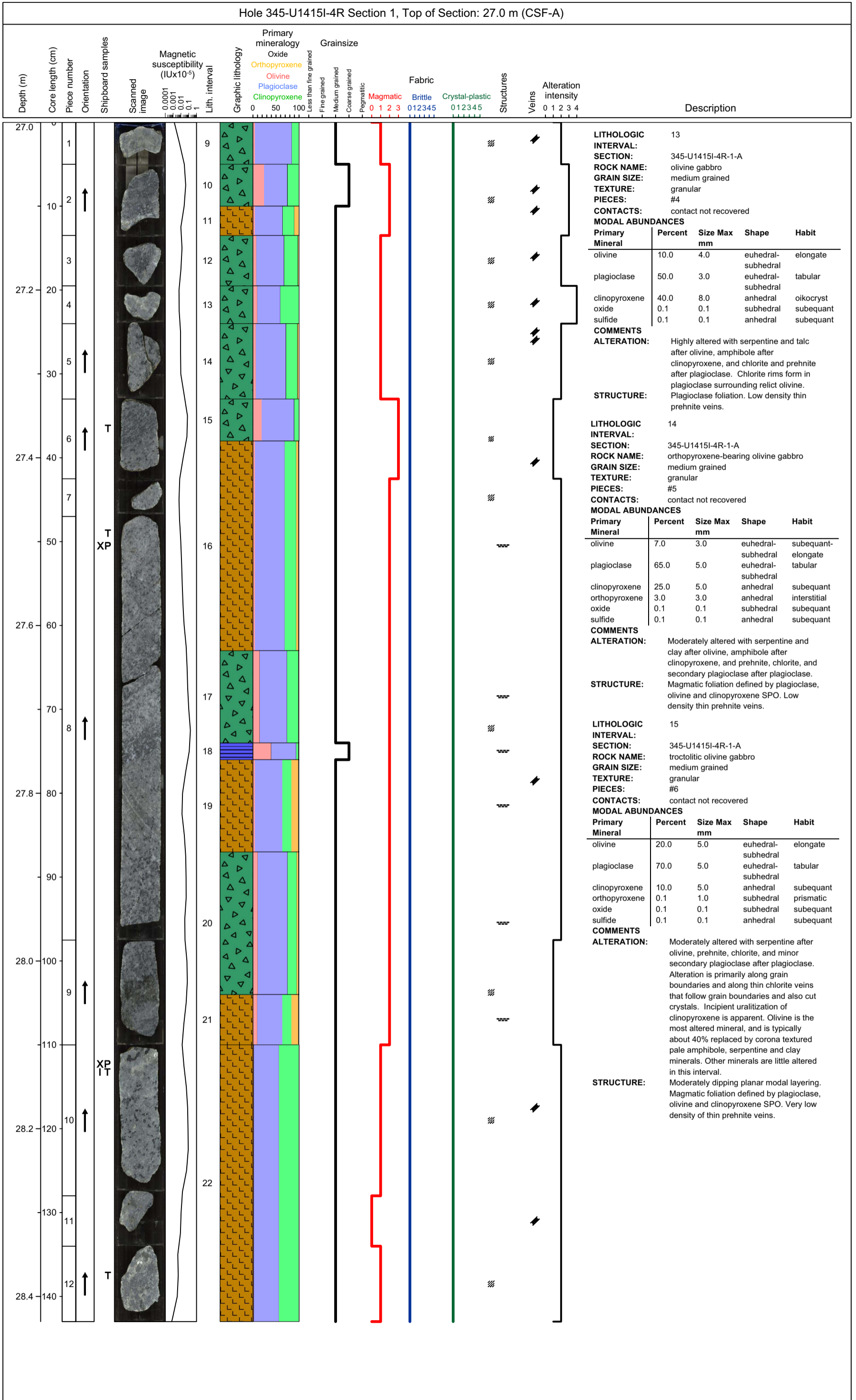


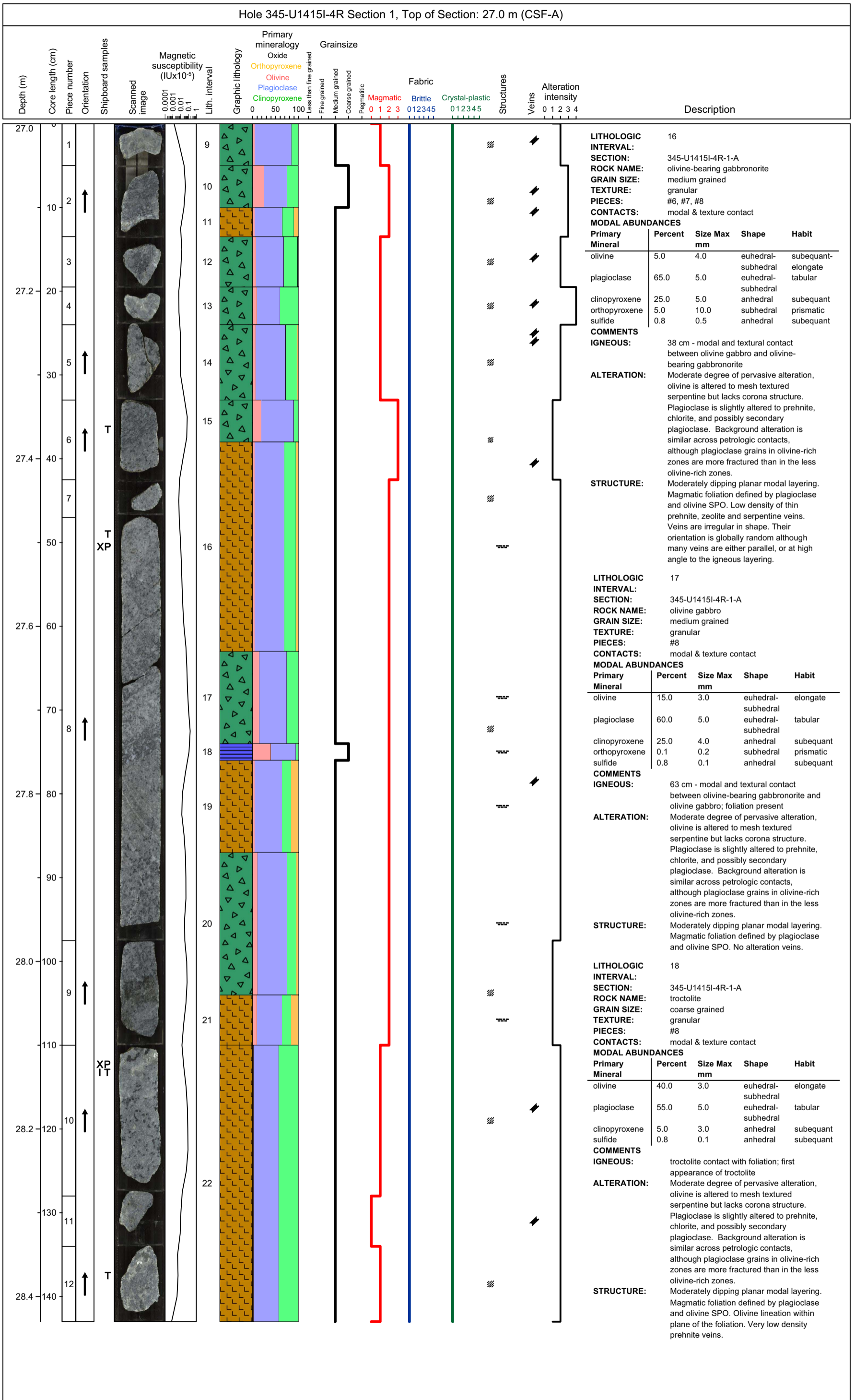


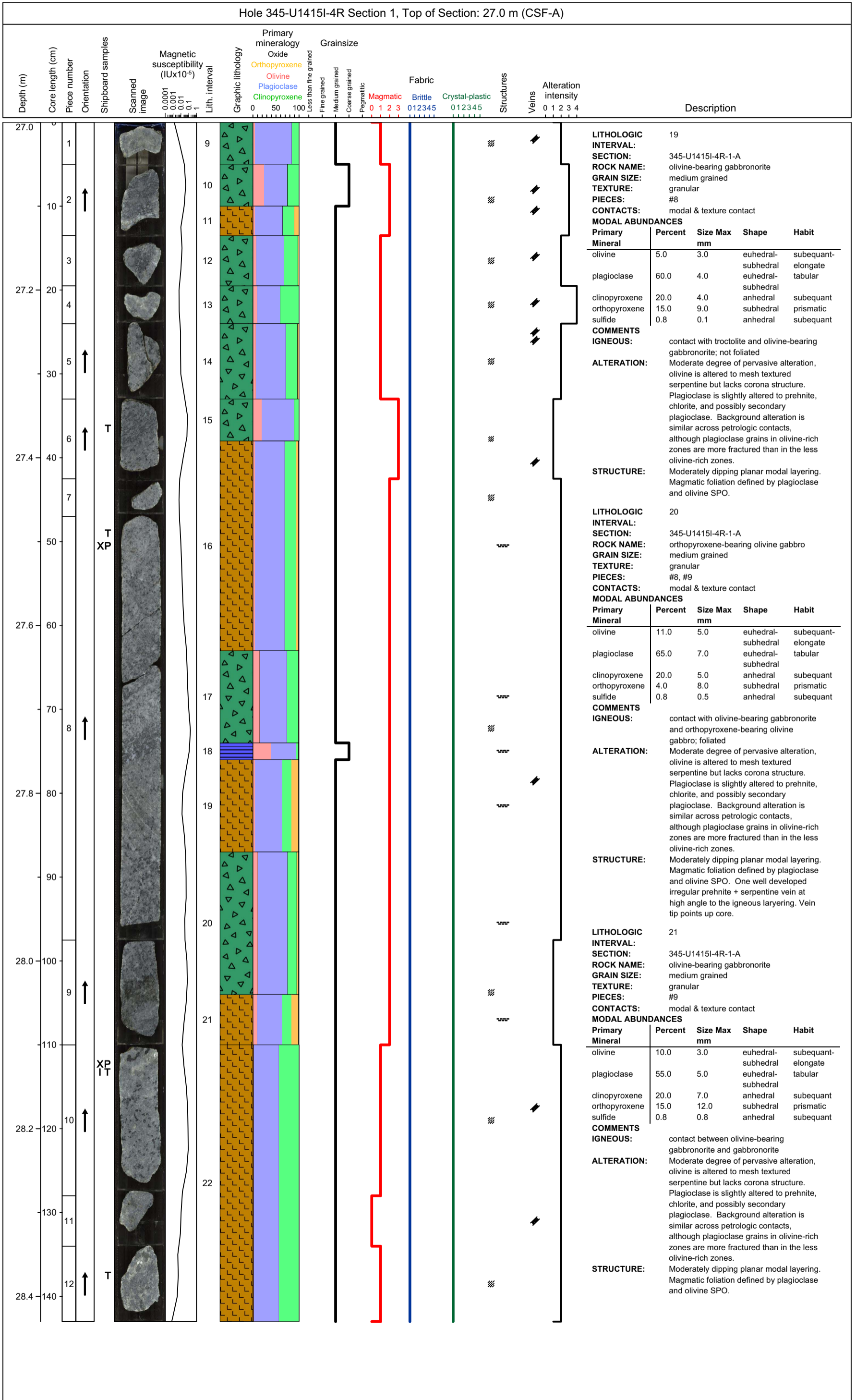


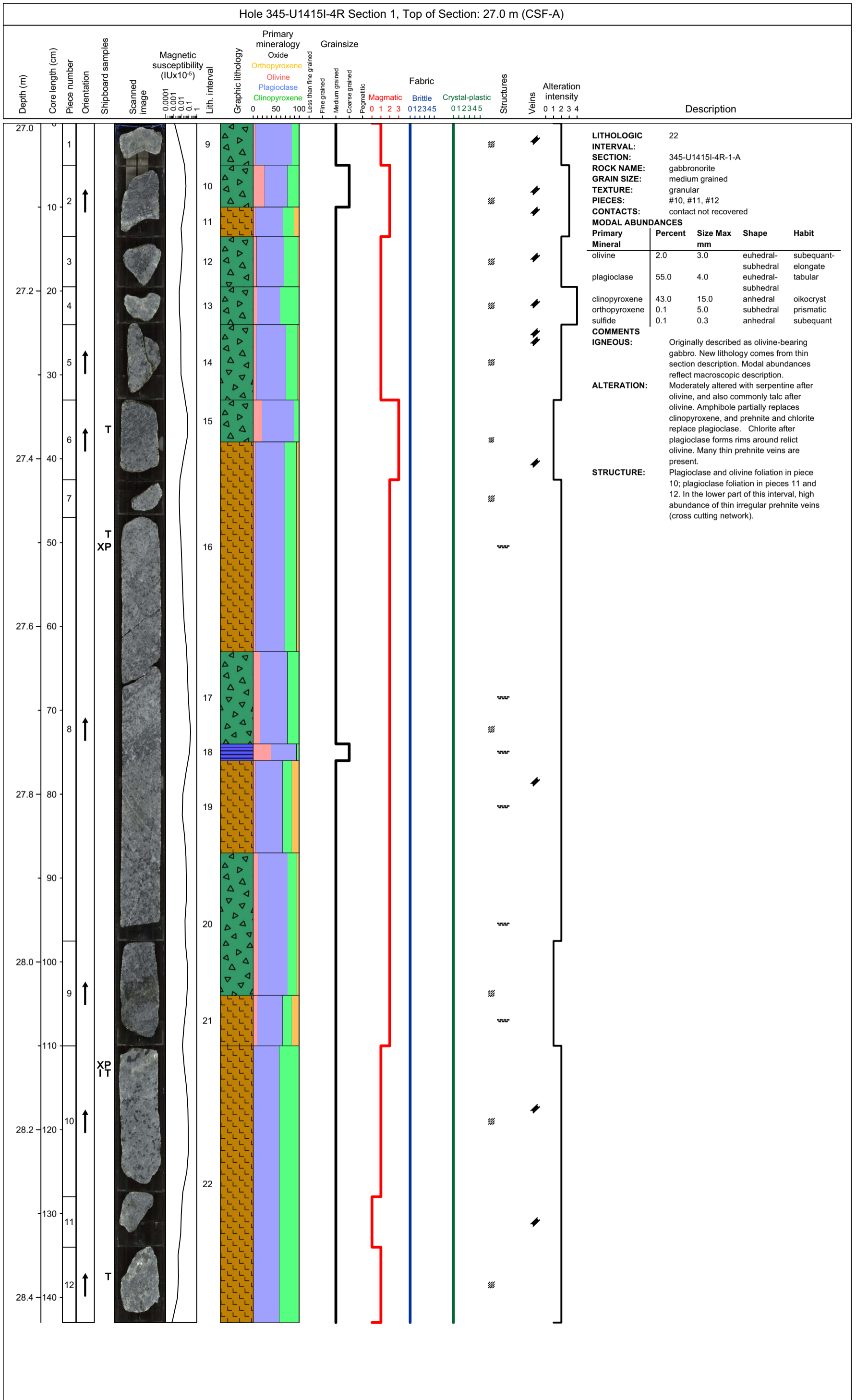


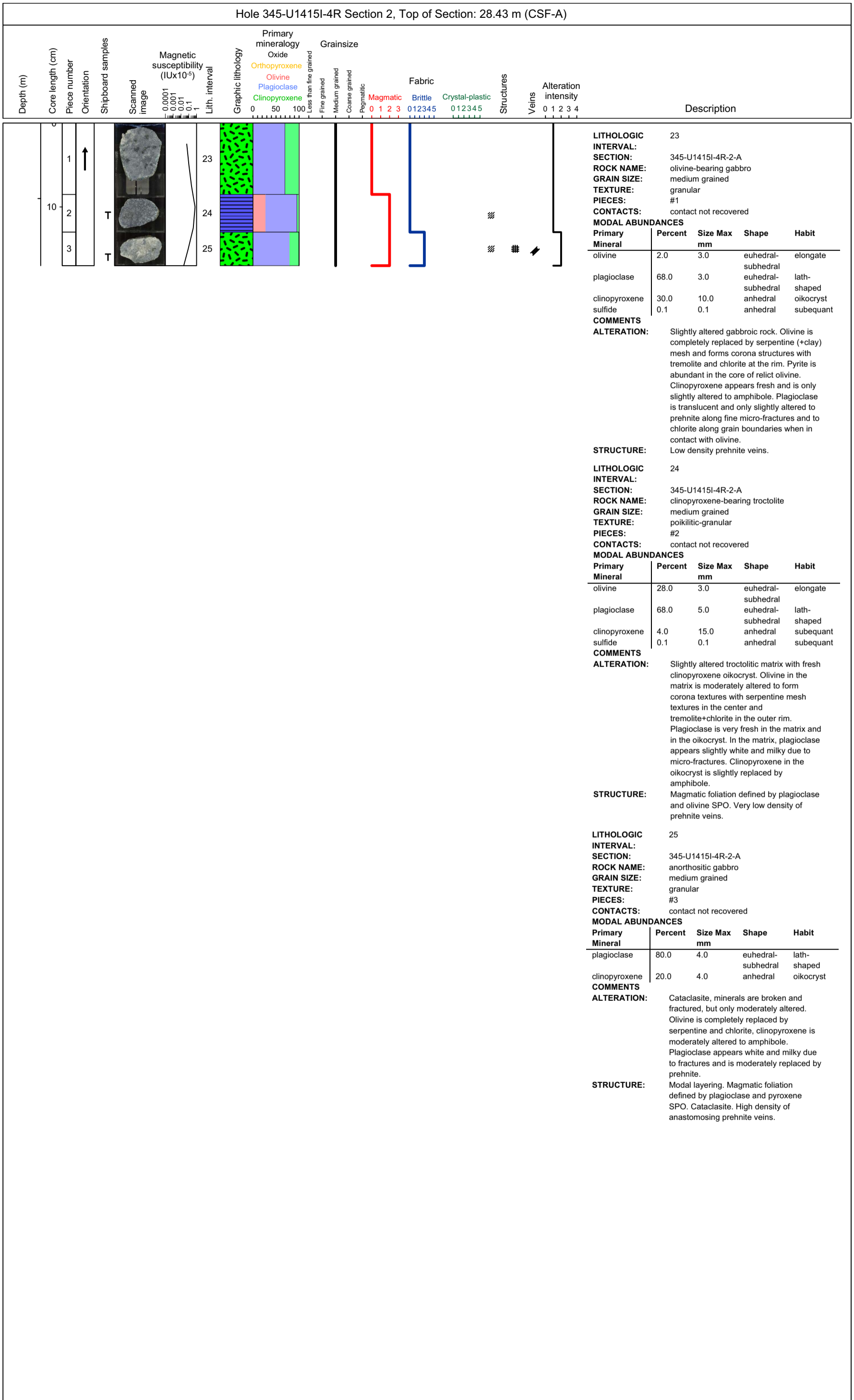


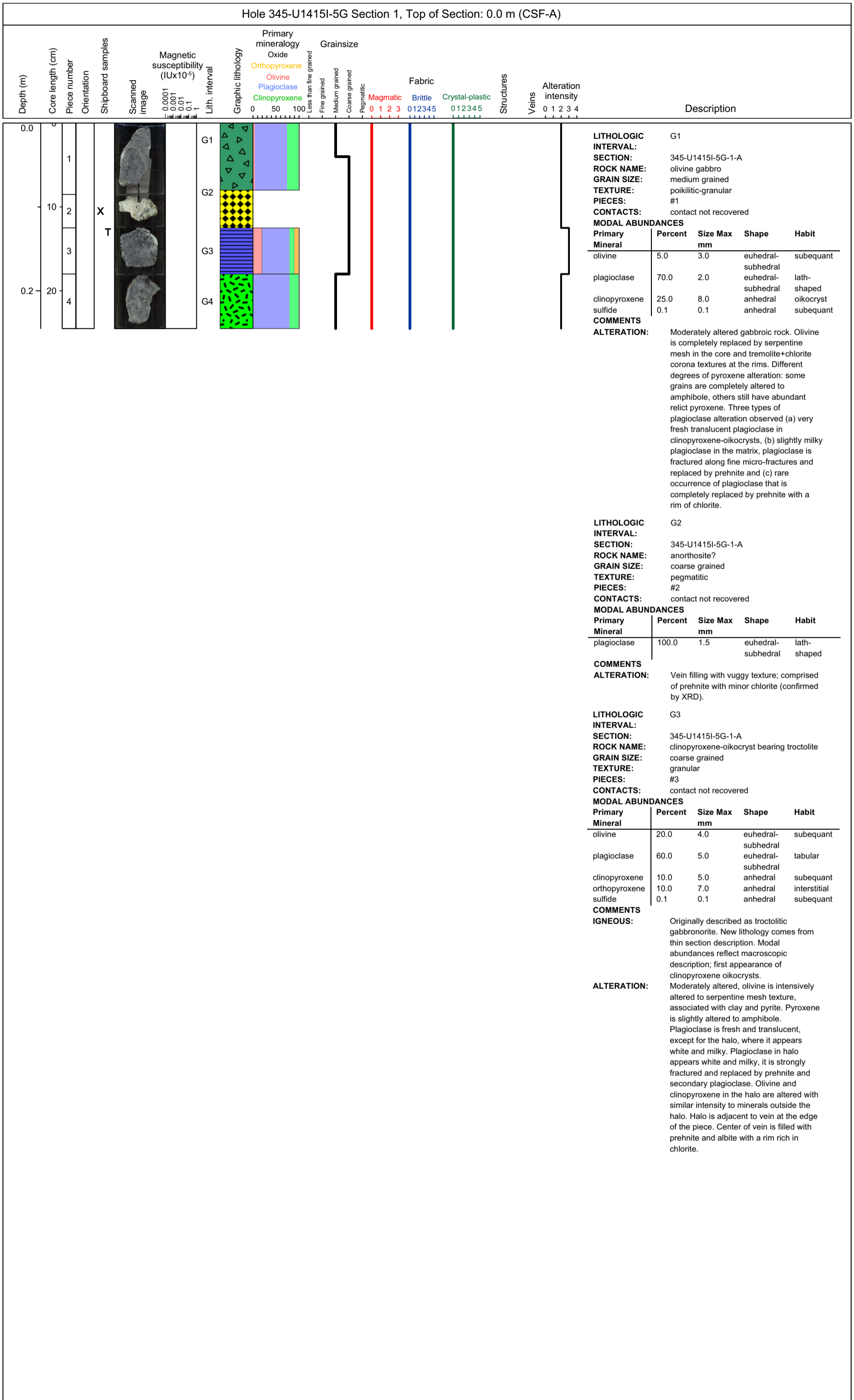


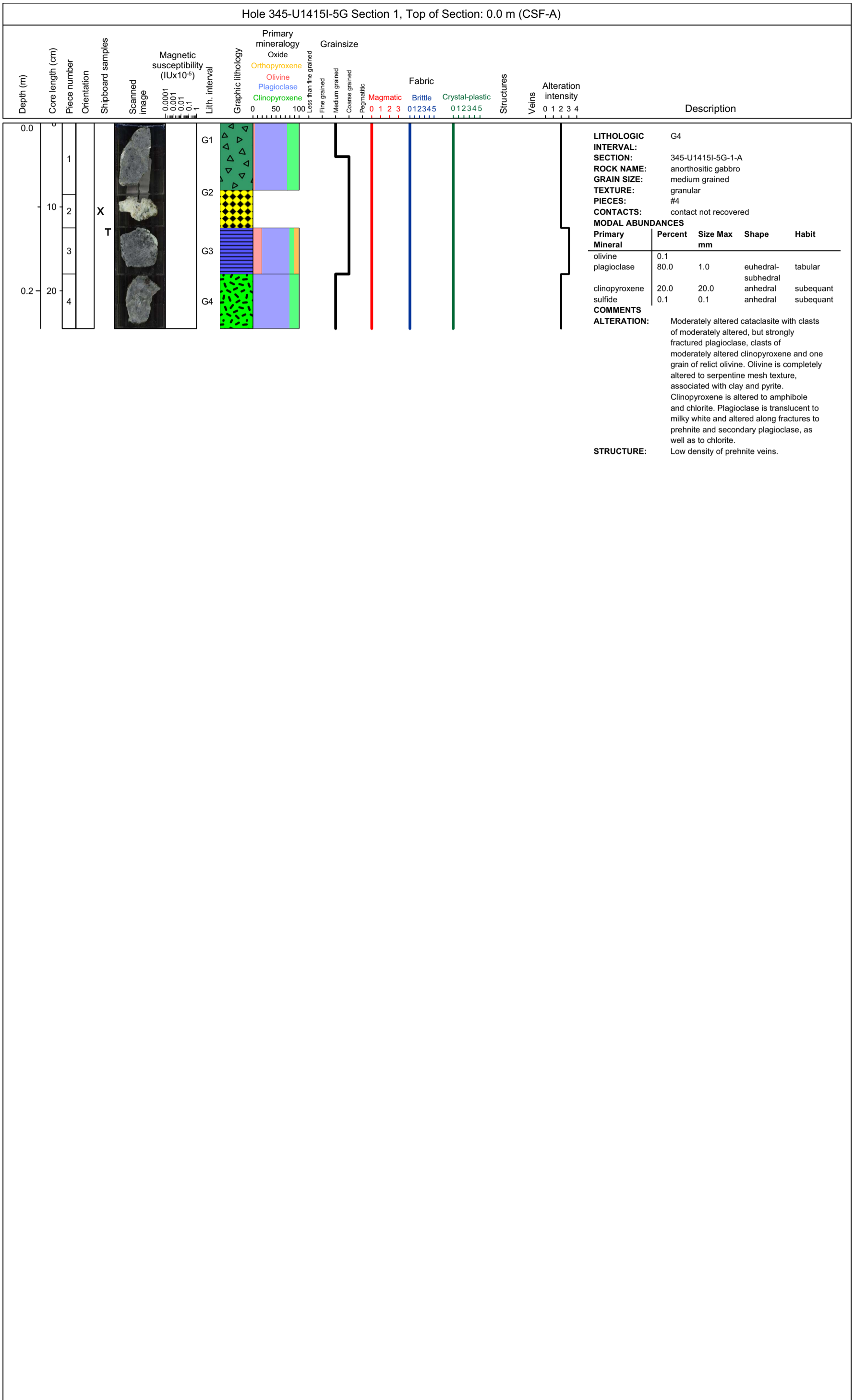












THIN SECTION: 345-U14151-1R-1-W 1/4-TSB_Piece_1-TS_11
Rock name: orthopyroxene- and olivine-bearing gabbro
Rock comment: weakly altered, moderate magmatic foliation
Lithologic interval: 1
Piece No.: #1
Billet request comment: Ig. Pet. primary mineralogy

Thin Section no.: 11
Authors: TF, 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: **Domain lithology:** orthopyroxene- and olivine-bearing gabbro
Grain size distribution: equigranular
Relative abundance (%): 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	0	2	2	1	subhedral - euhedral	subequant				
Plagioclase	68	70	2	1	anhedral - subhedral	tabular	continuous			
Clinopyroxene	25	25	0	1.5	anhedral	irregular		pale green	subophitic	
Orthopyroxene	2	3	1	2	anhedral	irregular		pinkish brown	inclusion-bearing	

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	1.3	olivine 1.3%	Olivine	5	100	pale/colorless amphibole 50%, chlorite 25%, clay minerals 20%, oxide 1%, sulfide 4%	Well developed corona texture surrounding relict olivine.
clay minerals	1	olivine 1%	Plagioclase	65	5	prehnite 80%, secondary plagioclase 20%	
green amphibole	2.5	clinopyroxene 2.5%	Clinopyroxene	25	10	green amphibole 98%, sulfide 2%	Incipient uraltization in some grains particularly near vein margins.
oxide	0.1	olivine 0.1%	Orthopyroxene	5	5	pale/colorless amphibole 100%	
pale/colorless amphibole	2.8	olivine 2.5%, orthopyroxene 0.3%					
prehnite	2.6	plagioclase 2.6%					
secondary plagioclase	0.7	plagioclase 0.7%					
sulfide	0.3	olivine 0.2%, clinopyroxene 0.1%					
domain total alteration %:	11.3						

Vein summary
 vein 1 Thin, anastomosing chlorite and actinolite filled vein.

ALTERATION COMMENT: Low degree of alteration except near vein margin where prehnite, amphibole, and secondary plagioclase are common replacement phases. Sulfide (up to 350 micron) is mainly seen in talc replacements after olivine, but not in serpentine or clay.

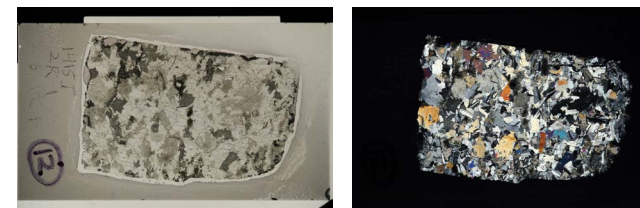
STRUCTURE COMMENT: Magmatic: Moderate magmatic foliation defined by SPO of plagioclase, with annealed grain boundaries. Subequant plagioclase inclusions in clinopyroxene oikocrysts. Very rare submagmatic deformation twins and/or bent grains of plagioclase.
 Crystal Plastic: Rare straight subgrain boundaries in plagioclase.
 Brittle: Fracture network with minor grain size reduction, oriented roughly normal to the magmatic foliation. Locally with up to 70% matrix, 30% clasts showing rotation.
 Veins/alteration: Chlorite + actinolite.
 Cross-cutting Relationships (as apparent in thin section):
 1) Magmatic foliation development.
 2) Static alteration at amphibolite facies.
 3) Veining.

PHOTOMICROGRAPHS: 345-U14151-1R-1_TS11.JPG
 345-U14151-1R-1_TS11-2.JPG

THIN SECTION: 345-U14151-2R-1-W 2/6-TSB_Piece_1-TS_12
Rock name: orthopyroxene-bearing olivine gabbro
Rock comment: moderately altered, weak magmatic foliation
Lithologic interval: 1
Piece No.: #1
Billet request comment: lg. Pet. primary mineralogy

Thin Section no.: 12
Authors: AB, TN

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 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	0	6	6	0.8	anhedral	equant			corona	completely altered
Plagioclase	50	59	9	1.2	anhedral	tabular	continuous		chadacrysts	some included in clinopyroxene oikocrysts; triple junction is common
Clinopyroxene	17	32	15	3	anhedral	subequant		colorless	poikilitic	commonly include rounded plagioclase chadacrysts; occasionally replaced by amphibole
Orthopyroxene	0.1	3	2.9	0.5	anhedral	subequant		colorless		
Oxide	0.4	0.5	0.1	0.1	anhedral - subhedral	subequant			inclusions	

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	11.2	olivine 1%, clinopyroxene 5%, plagioclase 5.2%	Olivine	10	100	pale/colorless amphibole 40%, chlorite 10%, clay minerals 4%, oxide 1%, sulfide 3%, serpentine 4%, talc 38%	
clay minerals	4.9	olivine 0.4%, clinopyroxene 4%, orthopyroxene 0.5%	Plagioclase	65	10	green amphibole 10%, chlorite 80%, prehnite 5%, secondary plagioclase 5%	
green amphibole	0.7	plagioclase 0.7%	Clinopyroxene	20	50	pale/colorless amphibole 10%, chlorite 50%, clay minerals 40%	Intense alteration along cleavage surfaces to form chlorite and/or clay minerals.
oxide	0.1	olivine 0.1%	Orthopyroxene	5	90	pale/colorless amphibole 30%, clay minerals 10%, talc 60%	Locally forms coronitic texture.
pale/colorless amphibole	6.4	olivine 4%, clinopyroxene 1%, orthopyroxene 1.4%					
prehnite	0.3	plagioclase 0.3%					
secondary plagioclase	0.3	plagioclase 0.3%					
serpentine	0.4	olivine 0.4%					
sulfide	0.3	olivine 0.3%					
talc	6.5	olivine 3.8%, orthopyroxene 2.7%					
domain total alteration %:	31.1						

Vein summary
 vein 1 Branched chlorite veins.

ALTERATION COMMENT: Mafic minerals, especially olivine and orthopyroxene, are intensely altered, whereas plagioclase is relatively fresh. Orthopyroxene alteration locally shows similarity in texture and mineralogy to the coronas around olivine. Sulfides occur in talc and amphibole parts of olivine replacement, more rarely in chlorite rims replacing plagioclase, and as small shards in amphibole replacing clinopyroxene along cleavages.

STRUCTURE COMMENT: Magmatic: Weak magmatic foliation defined by pyroxene and plagioclase SPO, with annealed grain boundaries. Common deformation twins and/or bent grains of plagioclase. Rare subgrains in plagioclase and clinopyroxene.
 Crystal Plastic: No recognizable crystal plastic deformation.
 Brittle: Well-developed fracture network without grain size reduction normal to layering.
 Veins/alteration: Minor curved to irregular chlorite veins parallel the magmatic layering, cut fractures.
 Cross-cutting Relationships (as apparent in thin section):
 1) Magmatic foliation development.
 2) Minor cracking and serpentinization.
 3) Chlorite vein fill.

PHOTOMICROGRAPHS: 345U14151_2R_1_TSB_Piece_1.JPG
 345U14151_2R_1_TSB_Piece_1-2.JPG

THIN SECTION: 345-U14151-2R-1-W 25/31-TSB_Piece_7-TS_13
Rock name: olivine gabbro
Rock comment: strongly altered, weak magmatic foliation, localized cataclasis
Lithologic interval: 3
Piece No.: #7
Billet request comment: IgPet: Primary mineralogy; MetPet: veins; Struct: Plastic def/brittle. Large Format

Thin Section no.: 13

Authors: JK, 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: rock shows zones of strong cataclasis/alteration; these were excluded for the mode estimation

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	0	5	5	2	anhedral to subhedral	irregular				100% altered
Plagioclase	10	60	50	2	anhedral to subhedral	tabular	continuous zoning			
Clinopyroxene	20	35	15	2	anhedral	irregular		colorless	poikilitic to interstitial	form up to 8mm sized larger poikilitic cluster; some grains show crystal plastic deformation

ALTERATION / METAMORPHISM

Alteration domain number: 1
No. of alteration domains: 2
Domain type: cataclastic zone
Domain rel. abund %: 15
Estimated total % alteration: 75

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	4.8	plagioclase 4.8%	Plagioclase	60	80	chlorite 10%, prehnite 60%, secondary plagioclase 30%	Secondary plagioclase comes first, then prehnite.
green amphibole	19.6	clinopyroxene 19.6%	Clinopyroxene	40	70	green amphibole 70%, other 30%	Some of the prehnite must replace comminuted clinopyroxene
prehnite	28.8	plagioclase 28.8%					
secondary plagioclase	14.4	plagioclase 14.4%					
other	8.4	clinopyroxene 8.4%					
domain total alteration %:	76						

Vein summary

vein 1 Some of the prehnite may be vein material. One thick prehnite vein turns into zeolite and chlorite in domain 2.
 vein 2 Zeolite: 1-2mm zeolite veins cut across cataclastic fabric and undeformed prehnite.

ALTERATION / METAMORPHISM

Alteration domain number: 2
No. of alteration domains: 2
Domain type: background
Domain rel. abund %: 85
Estimated total % alteration: 53

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	9.9	olivine 6%, plagioclase 3.9%	Olivine	10	100	green amphibole 15%, chlorite 60%, clay minerals 25%	Irregular to euhedral patches of chlorite plus tremolite + (smectite?) are after either olivine or orthopyroxene.
clay minerals	2.5	olivine 2.5%	Plagioclase	55	70	chlorite 10%, prehnite 30%, secondary plagioclase 60%	Irregular extinction of plagioclase indicates secondary plagioclase, chlorite replaces plagioclase along thin chlorite overgrowths.
green amphibole	8.5	olivine 1.5%, clinopyroxene 7%	Clinopyroxene	35	20	green amphibole 100%	
prehnite	11.6	plagioclase 11.6%					
secondary plagioclase	23.1	plagioclase 23.1%					
domain total alteration %:	55.6						

Vein summary

vein 1 cross-fiber chlorite-smectite, cut by other vein types.
 vein 2 prehnite with or without zeolite cut by zeolite veins; also late zeolite that cut other veins.

ALTERATION COMMENT:

Lenses of relatively unaltered cataclastic gabbro which appear to be being replaced by prehnite, leaving larger clinopyroxene grains as clasts. The few grains of sulfide that are present appear to be small clasts in cataclasis.

STRUCTURE COMMENT:

Magmatic: Weak magmatic foliation defined by plagioclase SPO, with annealed grain boundaries. Rare deformation twins in plagioclase.
 Crystal Plastic: Bent clinopyroxene grains.
 Brittle: Localized zones of cataclasis (cataclasis to ultracataclasis) and grain size reduction, with chlorite, cut by well-developed fracture network hosting prehnite veins; cut by open fractures.
 Veins/alteration: Prehnite and chlorite as background alteration and veins. Cut by zeolite veins. Some veins zoned, with brownish clay in the center and chlorite overgrowths at the vein walls. Prehnite veins clearly cut chlorite veins.
 Cross-cutting Relationships (as apparent in thin section): Cataclastic vein replaced by prehnite and cross cut by zeolite veins, prehnite veins and chlorite veins. Vein filling material undeformed.
 1) Magmatic foliation development.
 2) Minor semi-brittle deformation/bending of clinopyroxene.
 3) Grain size reduction via cataclasis, chlorite alteration.
 4) Chlorite vein fill.
 5) Prehnite vein fill.
 6) Open fracture formation.

PHOTOMICROGRAPHS:

345_U14151_2R_1_TS_13.JPG
 345_U14151_2R_1_TS_13-2.JPG

THIN SECTION: 345-U14151-2R-1-W 51/53-TSB_Piece_11-TS_14
Rock name: olivine-bearing gabbro
Rock comment: moderately altered, weak magmatic foliation, localized cataclasis
Lithologic interval: 3
Piece No.: #11
Billet request comment: IgPet: Primary mineralogy: MetPet: veins
Thin Section no.: 14
Authors: AB, MP

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



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	0	4	4	1.5	anhedral	equant			corona	completely altered
Plagioclase	60	70	10	1	anhedral to subhedral	tabular	continuous		chadacrysts	some included in clinopyroxene oikocrysts; triple junction is common
Clinopyroxene	15	26	11	2	anhedral	subequant		colorless	poikilitic	commonly include rounded plagioclase chadacrysts; occasionally replaced by amphibole
Oxide	0.1	0.1	0	0.1	anhedral	subequant			inclusions	

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	11.2	olivine 3%, clinopyroxene 5.3%, plagioclase 2.9%	Olivine	5	100	pale/colorless amphibole 40%, chlorite 60%	Olivine altered to felted assemblages of chlorite & talc needles.
clay minerals	2.9	plagioclase 2.9%	Plagioclase	65	30	chlorite 15%, clay minerals 15%, prehnite 20%, zeolite 50%	
green amphibole	2.3	clinopyroxene 2.3%	Clinopyroxene	25	30	green amphibole 30%, chlorite 70%	Clinopyroxene is fresh with rare reaction coronae at contact with plagioclase, transformation into a fine grain aggregate of chlorite & talc.
pale/colorless amphibole	2	olivine 2%	Orthopyroxene	2	10	talc 100%	
prehnite	3.9	plagioclase 3.9%					
talc	0.2	orthopyroxene 0.2%					
zeolite	9.8	plagioclase 9.8%					
domain total alteration %:	32.3						

Vein summary
 vein 1 Thin zeolite vein cross-cutting mainly plagioclase and sometimes clinopyroxene. Massive veins with relatively large minerals occupying the whole width of the vein. May form networks in plagioclase pluricrystalline zones. Variable thickness, up to 50 microns.
 vein 2 Massive polycrystalline prehnite vein with radiating prehnite grains. The vein cross cuts all minerals and zeolite veins.

ALTERATION COMMENT: Pervasive alteration background with numerous thin prehnite veins & zeolite veins. Very rare sulfides mainly in secondary plagioclase.
STRUCTURE COMMENT: Magmatic: Weak magmatic foliation defined by plagioclase SPO, with annealed grain boundaries. Rare deformation twins in plagioclase.
 Crystal Plastic: No recognizable crystal plastic deformation preserved.
 Brittle: Localized zones of cataclasis with intense grain size reduction, network of irregular, subparallel low-temperature veins.
 Veins/alteration: Replacement of olivine and pyroxene by chlorite + amphibole needles. Thin zeolite vein network. One prehnite vein cuts all other minerals through the thin section.
 Cross-cutting Relationships (as apparent in thin section):
 1) Magmatic foliation development.
 2) Localized zones of cataclasis, and background alteration including chlorite, actinolite, and serpentine.
 3) Prehnite vein emplacement.

PHOTOMICROGRAPHS: 345-U14151-2R-1_TS14.JPG
 345U14151_2R_1_TSB_Piece_11-4.JPG

THIN SECTION: 345-U14151-3R-1-W 38/43-TSB_Grain_Mount-TS_15
Rock name: olivine-bearing gabbro
Rock comment: grain mount of drill cuttings; fragments are strongly altered and cataclased
Lithologic interval: 4
Piece No.: N/A
Billet request comment: sand; grain mount
Thin Section no.: 15
Authors: AM, AM

PRIMARY MINERALOGY
No. of igneous domains: 1
Nature of ign. domains:
Domain lithology:
Domain grain size: grain mount also contains 2.3% volcanic clasts, and cataclasis assumed to be 70% plagioclase
Domain texture:
Domain comment:



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	0	4	4							probably underestimated due to loss of clay, serpentine and talc in cuttings
Plagioclase	30	64	34							
Clinopyroxene	19	29	10							
Orthopyroxene	3	3	0							probably underestimated

ALTERATION / METAMORPHISM
Alteration domain number: 1
No. of alteration domains: 1
Domain type: background
Domain rel. abund %: 100
Estimated total % alteration: 48

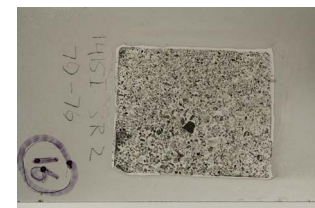
SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	3.8	olivine 0.9%, plagioclase 2.9%	Olivine	4.4	100	pale/colorless amphibole 50%, chlorite 20%, clay minerals 30%	probably underestimated due to loss of clay minerals, serpentine and talc in cuttings
clay minerals	1.3	olivine 1.3%	Plagioclase	64	50	chlorite 9%, prehnite 27%, zeolite 22%, secondary plagioclase 42%	
green amphibole	9.6	clinopyroxene 9.6%	Clinopyroxene	29	33	green amphibole 100%	probably underestimated due to loss of fine amphibole and clay
pale/colorless amphibole	2.2	olivine 2.2%	Orthopyroxene	3			extent of orthopyroxene alteration is unknown - modal % represents the minimum amount of fresh orthopyroxene
prehnite	8.6	plagioclase 8.6%					
secondary plagioclase	13.4	plagioclase 13.4%					
zeolite	7	plagioclase 7%					
domain total alteration %:		45.9					

ALTERATION COMMENT: This is a grain mount of drill cuttings, fragments are strongly altered and cataclastic. Alteration mineralogy and primary mineralogy were reconstructed from point counting these grain mounts. 500 points were counted for each slide. Details of point counting (raw counts, point classes, etc.) are provided in the U14151 Site Report. Grain mount with extensive cataclasis and alteration, strong cataclasis in some recovered grains. Sulfides are seen in clasts of cataclasis, and in chlorite and secondary plagioclase alteration.

STRUCTURE COMMENT: point count estimate 19% cataclasis - generally quite intense

PHOTOMICROGRAPHS: 345_U14151_3R_1_TS_15.JPG
 345_U14151_3R_1_TS_15-2.JPG

THIN SECTION: 345-U14151-3R-2-W 70/76-TSB_Grain_Mount-TS_16
Rock name: olivine gabbro
Rock comment: grain mount of drill cuttings; fragments are strongly altered and cataclased
Lithologic interval: 5
Piece No.: N/A
Billet request comment: sand; grain mount
Thin Section no.: 16
Authors: AM, AM
PRIMARY MINERALOGY No. of igneous domains: 1 Nature of ign. domains:
Igneous domain number: Domain grain size: Domain texture: Domain comment: grain mount also contains 2.9% volcanic clasts, and cataclasite assumed to be 70% plagioclase
Domain lithology: Olivine
Grain size distribution: Relative abundance (%):



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	3	11.5	8.5							probably underestimated due to loss of clay, serpentine and talc in cuttings
Plagioclase	38	57	19							
Clinopyroxene	18	28	10							
Orthopyroxene	3	3	0							probably underestimated

ALTERATION / METAMORPHISM No. of alteration domains: 1 Domain type: background Domain rel. abund %: 100 Estimated total % alteration: 58

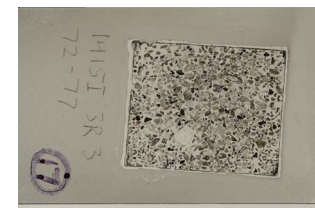
ALTERATION / METAMORPHISM	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	8	olivine 1.4%, plagioclase 6.7%	Olivine	11.5	98	pale/colorless amphibole 60%, chlorite 12%, clay minerals 26%, serpentine 2%	probably underestimated due to loss of clay minerals, serpentine and talc in cuttings
clay minerals	2.9	olivine 2.9%	Plagioclase	57	78	chlorite 15%, prehnite 38%, zeolite 10%, secondary plagioclase 37%	
green amphibole	14	clinopyroxene 14%	Clinopyroxene	28	50	green amphibole 100%	probably underestimated due to loss of fine amphibole and clay
pale/colorless amphibole	6.8	olivine 6.8%	Orthopyroxene	3			extent of orthopyroxene alteration is unknown - modal % represents the minimum amount of fresh orthopyroxene
prehnite	16.9	plagioclase 16.9%					
secondary plagioclase	16.5	plagioclase 16.5%					
serpentine	0.2	olivine 0.2%					
zeolite	4.4	plagioclase 4.4%					
domain total alteration %:	69.7						

ALTERATION COMMENT: This is a grain mount of drill cuttings, fragments are strongly altered and cataclastic. Alteration mineralogy and primary mineralogy were reconstructed from point counting these grain mounts. 500 points were counted for each slide. Details of point counting (raw counts, point classes, etc.) are provided in the U14151 Site Report. Grain mount, strong cataclasis in some recovered grains. A few sulfides in cataclasite and secondary plagioclase one 170 micron grain is net veined by magnetite.

STRUCTURE COMMENT: point count estimate 13% cataclasite - generally quite intense

PHOTOMICROGRAPHS: 345_U14151_3R_2_TS_16.JPG
345_U14151_3R_2_TS_16-2.JPG

THIN SECTION: 345-U14151-3R-3-W 72/77-TSB_Grain_Mount-TS_17
Rock name: olivine gabbro
Rock comment: grain mount of drill cuttings; fragments are strongly altered and cataclased
Lithologic interval: 6
Piece No.: N/A
Billet request comment: sand; grain mount
Thin Section no.: 17
Authors: AM, AM
PRIMARY MINERALOGY
No. of igneous domains: 1
Nature of ign. domains:
Igneous domain number:
Domain grain size:
Domain texture:
Domain comment: grain mount also contains 2.9% volcanic clasts, and cataclasite assumed to be 70% plagioclase
Domain lithology:
Grain size distribution:
Relative abundance (%):



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	0	7	7							probably underestimated due to loss of clay, serpentine and talc in cuttings
Plagioclase	32	63	31							
Clinopyroxene	18	30	12							
Orthopyroxene	3	3	0							probably underestimated

ALTERATION / METAMORPHISM
Alteration domain number: 1
No. of alteration domains: 1
Domain type: background
Domain rel. abund %: 100
Estimated total % alteration: 47

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	4.3	olivine 1%, plagioclase 3.3%	Olivine	6.8	100	pale/colorless amphibole 43%, chlorite 15%, clay minerals 42%	probably underestimated due to loss of clay minerals, serpentine and talc in cuttings
clay minerals	2.9	olivine 2.9%	Plagioclase	63	33	chlorite 16%, prehnite 36%, zeolite 10%, secondary plagioclase 38%	
green amphibole	9.5	clinopyroxene 9.5%	Clinopyroxene	27	35	green amphibole 100%	probably underestimated due to loss of fine amphibole and clay
pale/colorless amphibole	2.9	olivine 2.9%	Orthopyroxene	3			extent of orthopyroxene alteration is unknown - modal % represents the minimum amount of fresh orthopyroxene
prehnite	7.5	plagioclase 7.5%					
secondary plagioclase	7.9	plagioclase 7.9%					
zeolite	2.1	plagioclase 2.1%					
domain total alteration %:		37.1					

ALTERATION COMMENT: This is a grain mount of drill cuttings, fragments are strongly altered and cataclastic. Alteration mineralogy and primary mineralogy were reconstructed from point counting these grain mounts. 500 points were counted for each slide. Details of point counting (raw counts, point classes, etc.) are provided in the U14151 Site Report. Grain mount, strong cataclasis in some recovered grains. Rare irregularly shaped pyrite grains, associated with altered clinopyroxene.

STRUCTURE COMMENT: point count estimate 18% cataclasite - generally quite intense

PHOTOMICROGRAPHS: 345_U14151_3R_3_TS_17.JPG
 345_U14151_3R_3_TS_17-2.JPG

THIN SECTION: 345-U14151-3R-4-W 16/19-TSB_Piece_2-TS_18
Rock name: gabbro
Rock comment: weakly altered
Lithologic interval: 8
Piece No.: #2
Billet request comment: Ig. Pet: oikocrysts; MetPet: green alteration

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

Thin Section no.: 18
Authors: TF, KF

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



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Plagioclase	60	60	0	1	anhedral to subhedral	tabular	patchy zoning			
Clinopyroxene	35	40	5	4	anhedral	irregular		pale green	poikilitic	clinopyroxene forms large oikocrysts with numerous corroded plagioclase chadacrysts
Orthopyroxene	0.1	0.1	0	1	subhedral	equant		colorless		only 1 grain present in the thin section

ALTERATION / METAMORPHISM No. of alteration domains: 1
Alteration domain number: 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	5.4	clinopyroxene 3.8%, orthopyroxene 0.7%, plagioclase 1%	Plagioclase	65	10	chlorite 15%, prehnite 15%, secondary plagioclase 70%	Plagioclase mainly fractured, not so strongly metamorphically altered. Metamorphic alteration often along fractures, alteration to chlorite and prehnite along grain boundaries.
clay minerals	0.9	orthopyroxene 0.9%	Clinopyroxene	30	25	green amphibole 50%, chlorite 50%	Some clinopyroxene grains completely replaced by chlorite, others only slightly altered to amphibole along cleavage plains. Possible paragenesis: first alteration to amphibole, then amphibole is altered to chlorite.
green amphibole	3.8	clinopyroxene 3.8%	Orthopyroxene	5	90	chlorite 15%, clay minerals 20%, oxide 3%, sulfide 2%, talc 60%	Orthopyroxene altered mainly altered to talc, with some relict orthopyroxene in core. Rim of chlorite around orthopyroxene in contact with plagioclase.
oxide	0.1	orthopyroxene 0.1%					
prehnite	1	plagioclase 1%					
secondary plagioclase	4.6	plagioclase 4.6%					
sulfide	0.1	orthopyroxene 0.1%					
talc	2.7	orthopyroxene 2.7%					
domain total alteration %:	18.6						

Vein summary
 vein 1 Thin, irregularly shaped carbonate filled crack.

ALTERATION COMMENT: Pervasive, homogeneous degree of alteration. Irregularly shaped grains of pyrite are associated with the replacement of plagioclase by chlorite. Rare abundance of disseminated pyrite associated with the replacement of orthopyroxene by talc and clay.

STRUCTURE COMMENT: Magmatic: Isotropic fabric with annealed grain boundaries. Rare elongate and wedge-shaped plagioclase grains, or aligned skeletal plagioclase in clinopyroxene oikocrysts. Crystal Plastic: Rare deformation twins in plagioclase. Rare undulose extinction and subgrain formation in orthopyroxene. Brittle: Fine, subparallel open fractures. Veins/alteration: Minor, very thin irregular low-temperature veins (carbonate). Moderate replacement of pyroxene and olivine by serpentine and chlorite. Cross-cutting Relationships (as apparent in thin section):
 1) Deformation of plagioclase before full crystallization.
 2) Very weak crystal plastic deformation of orthopyroxene.
 3) Veining.
 4) Open fracture formation.

PHOTOMICROGRAPHS: 345_U14151_3R_4_TS_18.JPG
 345_U14151_3R_4_TS_18-2.JPG

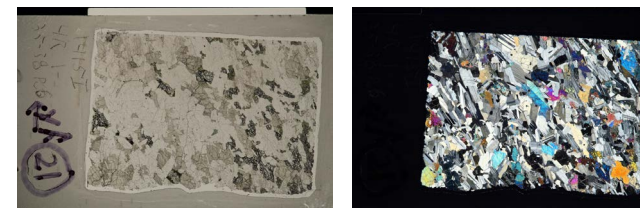
THIN SECTION: 345-U14151-4R-1-W 35/38-TSB_Piece_6-TS_21
Rock name: contact between troctolitic olivine gabbro and olivine-bearing gabbro
Rock comment: contact between lithological interval 15 and 16, weakly altered
Lithologic interval: 15/16
Piece No.: #6
Billet request comment: Ig. Pet: Primary mineralogy, contact; MetPet: alt. across ig. layers; Struct: Mag. Layers

Thin Section no.: 21
Authors: JK, KF

PRIMARY MINERALOGY **No. of igneous domains:** 2 **Nature of ign. domains:** contact between two lithological intervals

Igneous domain number: 1
Domain grain size: medium grained
Domain texture: granular
Domain comment: lithological interval 15

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



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	18	20	2	1.5	anhedral	irregular			undulose extinction	some grains form aggregates; elongated grains follow foliation
Plagioclase	52	55	3	1.5	anhedral to subhedral	tabular	discontinuous zoning		some crystals are bent	mosaic-like patterns of plagioclase showing triple junctions indicating annealing process
Clinopyroxene	24	25	1	2	anhedral	irregular		colorless	twinnings; some are poikilitic	tendency to form oikocrysts; form aggregates aligned parallel to the foliation
Oxide	0.1	0.1	0	0.1	anhedral	equant			inclusions in plagioclase	not clear whether these are really primary

Igneous domain number: 2
Domain grain size: medium grained
Domain texture: granular
Domain comment: lithological interval 16

Domain lithology: olivine-bearing gabbro
Grain size distribution: equigranular
Relative abundance (%): 60

	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	4	4	0	2	anhedral	irregular			undulose extinction; sub grains structure	
Plagioclase	66	70	4	2	anhedral to subhedral	tabular	discontinuous zoning			mosaic-like patterns of plagioclase
Clinopyroxene	25	26	1	2	anhedral	prismatic		colorless	twinnings; some are poikilitic enclosing plagioclase	tendency to form oikocrysts; prismatic crystals are aligned parallel to the foliation
Orthopyroxene	0.1	0.1	0	1.5	anhedral	equant		colorless		only one grain

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

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	1.8	plagioclase 1.8%	Olivine	10	40	green amphibole 60%, clay minerals 10%, oxide 7%, sulfide 3%, serpentine 20%	Olivine altered to serpentine mesh texture in core, surrounded by green amphibole.
clay minerals	0.4	olivine 0.4%	Plagioclase	70	5	chlorite 50%, prehnite 50%	Plagioclase altered to fine grained prehnite and chlorite along fractures.
green amphibole	2.4	olivine 2.4%	Clinopyroxene	20	10	pale/colorless amphibole 100%	Clinopyroxene mainly altered along fractures.
oxide	0.3	olivine 0.3%					
pale/colorless amphibole	2	clinopyroxene 2%					
prehnite	1.8	plagioclase 1.8%					
serpentine	0.8	olivine 0.8%					
sulfide	0.1	olivine 0.1%					
domain total alteration %:	9.6						

ALTERATION COMMENT: Low degree of pervasive alteration. Pyrite is associated with green amphibole in olivine alteration textures. Irregularly shaped grains of pyrite and chalcopyrite are associated with the replacement of plagioclase by chlorite along grain boundaries and fractures. Rare abundance of disseminated pyrite along cleavage planes in clinopyroxene. Magnetite occurs along serpentine mesh after olivine.

STRUCTURE COMMENT: Magmatic: Strong magmatic foliation defined by plagioclase, olivine and clinopyroxene SPO, with annealed grain boundaries. Weak modal layering subparallel to the foliation. Common, conspicuous deformation twins and/or bent grains of plagioclase; twinning in clinopyroxene. Tabular olivine, locally with subgrain boundaries. Minor subgrains in plagioclase.
 Crystal Plastic: No recognizable crystal plastic deformation.
 Brittle: No significant brittle deformation.
 Veins/alteration: Some serpentinization of olivine. Minor curved and irregular fractures hosting chlorite veins at 30 degrees to the magmatic foliation, over the width of thin section.
 Cross-cutting Relationships (as apparent in thin section):
 1) Magmatic foliation development, concurrent with subgrain and deformation twin formation.
 2) Cracking and vein formation.

PHOTOMICROGRAPHS: 345_U14151_4R_1_TS_21.JPG
 345_U14151_4R_1_TS_21-2.JPG

THIN SECTION: 345-U14151-4R-1-W 48/50-TSB_Piece_8a-TS_22
Rock name: olivine-bearing gabbro
Rock comment: weakly altered, moderate magmatic foliation
Lithologic interval: 16
Piece No.: #8
Billet request comment: Ig. Pet. primary mineralogy

Thin Section no.: 22
Authors: MMJ, 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: It was macroscopically described as olivine-bearing gabbro with foliation; in TS foliation not as strong

Domain lithology: olivine-bearing gabbro
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	2	anhedral to subhedral	equant			overgrowth	mesh-texture
Plagioclase	52	57	5	1	subhedral to euhedral	lath-shaped	continuous zoning			sometimes chadacryst
Clinopyroxene	20	25	5	1.5	anhedral to subhedral	equant		pale green	twinnings	one clinopyroxene grain with complex intergrowths with another clinopyroxene grain
Orthopyroxene	6	8	2	0.8	anhedral to subhedral	subequant		pinkish green		occurs with clinopyroxene
Other										Macro description had 0.8 modal% sulfides

ALTERATION / METAMORPHISM
Alteration domain number: 1
No. of alteration domains: 1
Domain type: background
Domain rel. abund %: 100
Estimated total % alteration: 8

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	1.9	olivine 0.2%, plagioclase 1.7%	Olivine	5	40	chlorite 10%, clay minerals 29%, oxide 1%, serpentine 20%, talc 40%	No coronas - low temperature alteration.
clay minerals	1.5	olivine 0.6%, clinopyroxene 0.3%, orthopyroxene 0.6%	Plagioclase	55	5	chlorite 60%, prehnite 20%, epidote/zoisite 20%	
epidote/zoisite	0.6	plagioclase 0.6%	Clinopyroxene	30	5	pale/colorless amphibole 80%, clay minerals 20%	
oxide	0	olivine <0.1%	Orthopyroxene	10	20	pale/colorless amphibole 40%, clay minerals 30%, talc 30%	
pale/colorless amphibole	2	clinopyroxene 1.2%, orthopyroxene 0.8%					
prehnite	0.6	plagioclase 0.6%					
serpentine	0.4	olivine 0.4%					
talc	1.4	olivine 0.8%, orthopyroxene 0.6%					
domain total alteration %:	8.4						

Vein summary

vein 1 Thin veins of zeolite and clay.

ALTERATION COMMENT: Weakly altered. No corona textures but olivine is partially altered to talc, chlorite, serpentine and clay minerals. Pyroxenes are slightly altered to amphibole, and plagioclase to chlorite and prehnite. Irregularly shaped grains of pyrite and chalcopyrite are associated with the replacement of plagioclase by chlorite along grain boundaries and fractures. Rarely, pyrite is associated with green amphibole in olivine alteration textures.

STRUCTURE COMMENT: Magmatic: Moderate magmatic foliation defined by plagioclase, olivine and clinopyroxene SPO, with moderately annealed grain boundaries. Common, conspicuous deformation twins and/or bent grains of plagioclase; rare twinning in clinopyroxene. Tabular olivine, locally with undulose extinction. Minor subgrains in plagioclase.
 Crystal Plastic: No recognizable crystal plastic deformation.
 Brittle: Minor, but pervasive cracking, locally offset by zeolite veins roughly orthogonal to magmatic foliation, over the width of thin section.
 Veins/alteration: Irregular fractures hosting serpentine and chlorite veins roughly orthogonal to magmatic foliation, over the width of the thin section. The mineralogy of the vein clearly varies according to the nature of host minerals.
 Cross-cutting Relationships (as apparent in thin section):
 1) Magmatic foliation development, concurrent with subgrain and deformation twin formation.
 2) Crack formation.
 3) Vein formation.

PHOTOMICROGRAPHS: 345_U14151_4R_1_TS_22.JPG
 345_U14151_4R_1_TS_22-2.JPG

THIN SECTION: 345-U14151-4R-1-W 112/114-TSB_Piece_10-TS_44
Rock name: clinopyroxene oikocryst-bearing troctolite
Rock comment: oikocryst and matrix were described as two different domains
Lithologic interval: 22
Piece No.: #10
Billet request comment: Ig: Primary minerals to compare with ICP analysis

Thin Section no.: 44

Authors: TH, RW

PRIMARY MINERALOGY
No. of igneous domains: 2
Nature of ign. domains:
Igneous domain number: 1
Domain grain size: medium grained
Domain texture: granular
Domain comment: this domain describes the matrix rock

Domain lithology: troctolite
Grain size distribution: equigranular
Relative abundance (%): 72



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	0	16	16	4.5	anhedral	irregular				completely altered
Plagioclase	84	84	0	2	anhedral to subhedral	tabular	oscillatory			
Oxide	0.1	0.1	0	0.1	subhedral	equant				

Igneous domain number: 2
Domain grain size: medium grained
Domain texture: poikilitic
Domain comment: this domain only describes the clinopyroxene oikocrysts

Domain lithology: clinopyroxene oikocryst
Grain size distribution: seriate
Relative abundance (%): 28

	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Plagioclase	10	10	0	1.2	subhedral	tabular				only relatively few plagioclase chadacrysts in clinopyroxene oikocrysts
Clinopyroxene	90	90	0	9	anhedral	subequant		colorless	poikilitic	clinopyroxene oikocrysts show deformation features (kinked)
Oxide	0.1	0.1	0	0.1	subhedral	equant				

ALTERATION / METAMORPHISM
Alteration domain number: 1
No. of alteration domains: 1
Domain type: background
Domain rel. abund %: 19
Estimated total % alteration: 24

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	4	plagioclase 4%	Olivine	15	100	pale/colorless amphibole 30%, talc 70%	Olivine is replaced by euhedral amphibole needles radiating generally inward toward the grain, but not with a strong preferred orientation. Talc fills the interior of the grain and the interstices between the needles. Its interior position in the structure suggests that talc follows amphibole in the replacement sequence.
pale/colorless amphibole	5	olivine 4.5%, clinopyroxene 0.5%	Plagioclase	40	10	chlorite 100%	
talc	10.5	olivine 10.5%	Clinopyroxene	45	1	pale/colorless amphibole 100%	
domain total alteration %:		19.5					

Vein summary
 vein 1 Thin, irregular, branching and anastomosing chlorite+/- prehnite veins.

ALTERATION COMMENT: This olivine-bearing gabbro is weakly altered except for olivine, which is completely altered to talc and amphibole. Locally the margins of some grains of clinopyroxene and plagioclase are altered to amphibole and chlorite, respectively. Significant amounts of pyrite and magnetite are associated with relict serpentine mesh after olivine. Pyrite and chalcopyrite are present where olivine is completely altered to amphibole and talc.

STRUCTURE COMMENT: Magmatic: Isotropic. Rare deformation twins of plagioclase, locally with annealed grain boundaries. Minor subgrain development in plagioclase and clinopyroxene.
 Crystal Plastic: No recognizable crystal plastic deformation.
 Brittle: Minor cracking.
 Veins/alteration: Cut by branching and anastomosing veins; cut fractures.
 Crosscutting Relationships (as apparent in thin section):
 1) Magmatic fabric development.
 2) Minor fracturing, and vein formation.

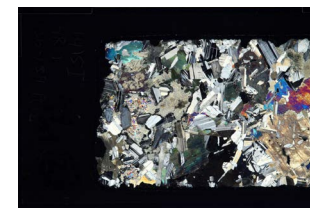
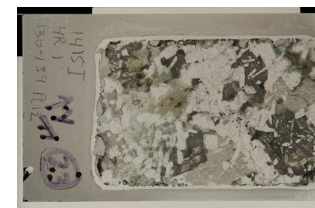
PHOTOMICROGRAPHS: 345_U14151_4R_1_TS_44.JPG
 345_U14151_4R_1_TS_44-2.JPG

THIN SECTION: 345-U14151-4R-1-W 136/139-TSB_Piece_12-TS_23
Rock name: gabbro
Rock comment: moderately altered, weak magmatic foliation
Lithologic interval: 22
Piece No.: #12
Billet request comment: IgMet: Primary mineralogy, MetPet: Alt. halos and coronas

Thin Section no.: 23
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: gabbro
Grain size distribution: seriate
Relative abundance (%): 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Plagioclase	47	50	3	4.5	subhedral to euhedral	tabular	continuous zoning			Weak bending of twinning lamella. Chladacrytic grains of subhedral to anhedral shape and subequant to lath-shaped habit (minimum grain size 0.5 mm, maximum 2 mm, average 1 mm) enclosed in poikilitic clinopyroxene.
Clinopyroxene	7	40	33	5	anhedral	irregular		colorless	in part poikilitic	tend to form oikocrysts
Orthopyroxene	0	10	10	2.5	anhedral	irregular				although severely altered with "altered olivine-like corona texture", relict cleavage can be observed
Oxide	0	0.1	0.1	0.1	anhedral	equant			cluster of tiny grains	

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

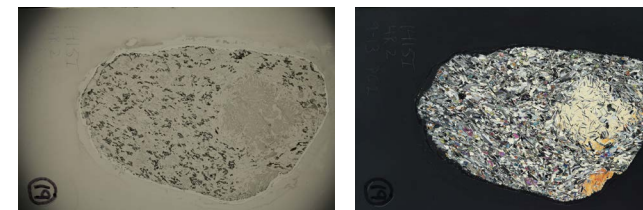
SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	5.4	clinopyroxene 3.2%, orthopyroxene 0.8%, plagioclase 1.5%	Plagioclase	50	10	green amphibole 5%, chlorite 30%, clay minerals 10%, prehnite 30%, garnet 3%, secondary plagioclase 20%, other 2%	other: calcite; secondary plagioclase looks dusty due to tiny inclusions of garnet, calcite and others (difficult to identification because of small grain size)
clay minerals	1.3	orthopyroxene 0.8%, plagioclase 0.5%	Clinopyroxene	35	90	green amphibole 20%, pale/colorless amphibole 70%, chlorite 10%	Altered from rim and along cleavage surfaces.
garnet	0.2	plagioclase 0.2%	Orthopyroxene	15	100	green amphibole 10%, pale/colorless amphibole 70%, chlorite 5%, clay minerals 5%, talc 10%	Fine-grained aggregate of tremolite surrounded by chlorite.
green amphibole	8.1	clinopyroxene 6.3%, orthopyroxene 1.5%, plagioclase 0.3%					
pale/colorless amphibole	32.6	clinopyroxene 22.1%, orthopyroxene 10.5%					
prehnite	1.5	plagioclase 1.5%					
secondary plagioclase	1	plagioclase 1%					
talc	1.5	orthopyroxene 1.5%					
other	0.1	plagioclase 0.1%					
domain total alteration %:	51.7						

ALTERATION COMMENT: Tremolite + chlorite pseudomorph after orthopyroxene shows similar appearance to coronas after olivine. Clinopyroxene and plagioclase show dusty appearance due to tiny alteration minerals. Disseminated pyrite and chalcocopyrite is present in tremolite+chlorite pseudomorphs after orthopyroxene. Irregularly shaped grains of pyrite and chalcocopyrite are associated with chlorite replacing plagioclase.

STRUCTURE COMMENT: Magmatic: Coarse-grained gabbro with a weak magmatic foliation, and moderately annealed grain boundaries. Common deformation twins and/or bent grains of plagioclase. Undulose extinction and subgrains in plagioclase.
 Crystal Plastic: No recognizable crystal plastic deformation.
 Brittle: Minor fracturing in two orientations at roughly 90° to each other.
 Veins/alteration: Static alteration, with minor chlorite veins.
 Cross-cutting Relationships (as apparent in thin section):
 1) Magmatic foliation development, concurrent with subgrain and deformation twin formation.
 2) Cracking and vein formation.

PHOTOMICROGRAPHS: 345_U14151_4R_1_TS_23.JPG
 345_U14151_4R_1_TS_23-2.JPG

THIN SECTION: 345-U14151-4R-2-W 9/13-TSB_Piece_2-TS_19
Rock name: clinopyroxene oikocyst-bearing troctolite
Rock comment: contains a 2 cm sized clinopyroxene oikocyst, weakly altered, moderate magmatic foliation
Lithologic interval: 24
Piece No.: #2
Billet request comment: Ig. Pet. Oikocysts; MetPet: Secondary alt. of oikocysts; Large Format
Thin Section no.: 19
Authors: TH, TN
PRIMARY MINERALOGY
No. of igneous domains: 2
Nature of ign. domains: oikocysts/ matrix
Igneous domain number: 1
Domain grain size: medium grained
Domain texture: granular
Domain comment: In troctolite matrix, two large clinopyroxene oikocysts with plagioclase chadacrysts is present. The oikocyst and chadacrysts are excluded from the calculation of mineral volume. Strong foliation mainly due to parallel alignment
Domain lithology: troctolite
Grain size distribution: equigranular
Relative abundance (%): 80



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	18	23	5	1	anhedral	amoeboid				large olivine sometimes includes plagioclase crystals. Thin clinopyroxene films sometimes occur between plagioclase and olivine.
Plagioclase	75	75	0	1	anhedral to subhedral	tabular	continuous zoning			some deformation twins occur; 120° triple junctions are common
Clinopyroxene	2	2	0	0.6	anhedral	irregular		colorless	interstitial	Altered mafic minerals occur in clinopyroxene oikocysts. Altered olivine crystals are included in the outermost part of clinopyroxene oikocyst
Orthopyroxene	0.1	0.1	0	0.3	anhedral	subequant		colorless		
Other										Calcite sometimes occurs in triple junctions or interboundary of plagioclase crystals.

Igneous domain number: 2
Domain grain size: coarse grained
Domain texture: poikilitic
Domain comment:
Domain lithology: clinopyroxene oikocyst
Grain size distribution: inequigranular
Relative abundance (%): 20

	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	0	1	1			subequant				completely altered
Plagioclase	39	39	0	1.8	subhedral to euhedral	elongated				some are deformed
Clinopyroxene	60	60	0	15		equant			poikilitic	

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
carbonate	0	olivine <0.1%	Olivine	15	40	pale/colorless amphibole 40%, chlorite 5%, clay minerals 4%, oxide 0.5%, sulfide 0.2%, serpentine 10%, talc 40%, carbonate 0.3%	Intense alteration near chlorite vein to form coronitic aggregate of tremolite +/- talc; local replacement by clay.
chlorite	3.2	olivine 0.3%, clinopyroxene 0.1%, plagioclase 2.8%	Plagioclase	70	5	green amphibole 10%, chlorite 80%, prehnite 5%, secondary plagioclase 3%, other 2%	Other: calcite along grain boundary; fracture filled by chlorite, which is locally cut by green amphibole.
clay minerals	0.3	olivine 0.2%, clinopyroxene 0.1%	Clinopyroxene	15	10	green amphibole 70%, pale/colorless amphibole 20%, chlorite 5%, clay minerals 5%	Hornblende at contact with plagioclase, chlorite and clay along cleavage surface.
green amphibole	1.4	clinopyroxene 1.1%, plagioclase 0.4%					
oxide	0	olivine <0.1%					
pale/colorless amphibole	2.7	olivine 2.4%, clinopyroxene 0.3%					
prehnite	0.2	plagioclase 0.2%					
secondary plagioclase	0.1	plagioclase 0.1%					
serpentine	0.6	olivine 0.6%					
sulfide	0	olivine <0.1%					
talc	2.4	olivine 2.4%					
other	0.1	plagioclase 0.1%					
domain total alteration %:	11						

Vein summary
 vein 1 Chlorite branched.
 vein 2 Clay cross-fiber.

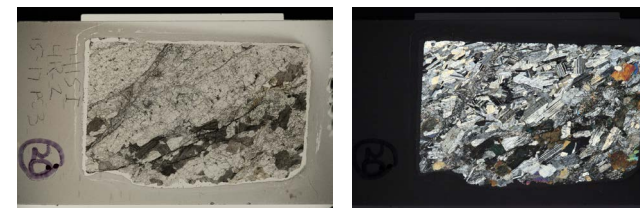
ALTERATION COMMENT: Background and vein halo, corona and clay pseudomorphs after olivine are localized near chlorite veins; corona and green amphibole formed possibly under high-temperature conditions, whereas clay and carbonate formation suggests low-temperature alteration. Very rare disseminated pyrite.

STRUCTURE COMMENT: Magmatic: Moderate magmatic foliation subparallel to layering, defined by olivine and plagioclase SPO, with ubiquitous annealed grain boundaries. Olivine locally rimmed by clinopyroxene. Plagioclase with deformation common throughout entire section. Skeletal plagioclase grains with deformation twins hosted and bent around exterior of clinopyroxene oikocyst. Elsewhere, plagioclase foliation wraps around the oikocyst.
 Tabular olivine possibly re-equilibrated into isolated grains in optical continuity between plagioclase.
 Crystal Plastic: Minor undulose extinction and subgrain formation of olivine.
 Brittle: Minor localized fracture network normal to foliation.
 Veins/alteration Coronas of chlorite +/- amphibole rimming all olivine grains. Olivine grains partly replaced by chlorite + amphibole needles + carbonate in some former olivine grains. Rare, tiny veins of chlorite.
 Cross-cutting Relationships (as apparent in thin section):
 1) Magmatic foliation development; subgrain formation in olivine. Oikocyst rotation and bending of plagioclase.
 2) Minor low temperature cracking and alteration/vein formation.

PHOTOMICROGRAPHS: 345_U14151_4R_2_TS_19.JPG
 345_U14151_4R_2_TS_19-2.JPG

THIN SECTION: 345-U14151-4R-2-W 15/17-TSB_Piece_3-TS_20 **Thin Section no.:** 20
Rock name: anorthositic gabbro
Rock comment: moderately altered, weak modal and grain size layering, moderate magmatic foliation, brecciation
Lithologic interval: 25
Piece No.: #3
Billet request comment: IgPet: Primary mineralogy; MetPet: alteration; Structure: cataclastic **Authors:** JM, MP

PRIMARY MINERALOGY **No. of igneous domains:** 1 **Nature of ign. domains:**
Igneous domain number: 1 **Domain lithology:** anorthositic gabbro
Domain grain size: medium grained **Grain size distribution:** seriate
Domain texture: granular **Relative abundance (%):** 100
Domain comment: This thin-section consists of gabbroic and anorthositic parts. Apparent rapid grain-size variation may be partly resulted from displacement due to cataclastic deformation.



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Plagioclase	75	80	5	2	subhedral	tabular	continuous zoning			Long axes of tabular grains are strongly aligned
Clinopyroxene	2	20	18	2	anhedral	subequant		colorless	interstitial	

ALTERATION / METAMORPHISM **Alteration domain number:** 1 **No. of alteration domains:** 2 **Domain type:** background **Domain rel. abund %:** 50 **Estimated total % alteration:** 15

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
green amphibole	2	clinopyroxene 2%	Plagioclase	98	15	prehnite 80%, zeolite 10%, secondary plagioclase 10%	Alteration along cracks in plagioclase
prehnite	11.8	plagioclase 11.8%	Clinopyroxene	2	100	green amphibole 100%	Small patches of pleochroic green amphibole that were probably after clinopyroxene.
secondary plagioclase	1.5	plagioclase 1.5%					
zeolite	1.5	plagioclase 1.5%					
domain total alteration %:	16.8						

Vein summary
 vein 1 One cataclastic zone separating the two domains rich in plagioclase and in clinopyroxene. Branched vein with a black filling, probably clay minerals.

ALTERATION / METAMORPHISM **Alteration domain number:** 2 **No. of alteration domains:** 2 **Domain type:** background **Domain rel. abund %:** 50 **Estimated total % alteration:** 15

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	1.4	plagioclase 1.4%	Plagioclase	70	10	chlorite 20%, prehnite 60%, zeolite 20%	
green amphibole	3.6	clinopyroxene 3.6%	Clinopyroxene	30	20	green amphibole 60%, oxide 10%, other 30%	Partial replacement by talc.
oxide	0.6	clinopyroxene 0.6%					
prehnite	4.2	plagioclase 4.2%					
zeolite	1.4	plagioclase 1.4%					
other	1.8	clinopyroxene 1.8%					
domain total alteration %:	13						

Vein summary
 vein 1 Cataclastic branched network of veins formed of relatively large remnants of primary plagioclase with a fine grained background of secondary plagioclase, zeolite, probable (minor) prehnite and clay minerals. The fine grained background appears black in thin section (open polars) and white in hand specimen.

ALTERATION COMMENT: Zone rich in plagioclase with totally altered pyroxene and plagioclase rather fresh. Alteration in plagioclase is pervasive with transformation along cracks and veins into a fine grained mix of prehnite and zeolite. Irregularly shaped grains of pyrite are associated with the replacement of plagioclase by chlorite.

STRUCTURE COMMENT: Magmatic: Weak modal and grain size layering defined by horizons of clinopyroxene within plagioclase. Moderate magmatic foliation parallel to layering, defined by plagioclase and clinopyroxene SPO, with moderately annealed grain boundaries.
 Crystal Plastic: Undulose extinction in plagioclase and clinopyroxene; deformation twins in plagioclase.
 Brittle: Dense anastomosing fracture network and incipient brecciation (<20% matrix). Rare thin zones of cataclastic/ultracataclastic.
 Veins/alteration Pyroxene partly replaced by amphibole and minor chlorite. Some very thin veins filled with very fine-grained alteration products (serpentine, chlorite?). Most vein-like features likely clay-filled cataclastic.
 Cross-cutting Relationships (as apparent in thin section):
 1) Magmatic layering and foliation development.
 2) Cataclastic deformation
 3) Very few thin, undeformed veins of chlorite cut all primary minerals and cataclastics.

PHOTOMICROGRAPHS: 345_U14151_4R_2_TS_20.JPG
 345_U14151_4R_2_TS_20-2.JPG

THIN SECTION: 345-U14151-SG-1-W 12/14-TSB_Piece_3-TS_24b
Rock name: troctolitic, orthopyroxene-bearing gabbro
Rock comment: with CPX oikocrysts, moderately altered, localized cataclastic deformation
Lithologic interval: G3
Piece No.: #3
Billet request comment: Ig. Pet: primary mineralogy; MetPet: vein and halo texture and comp; Structure

Thin Section no.: 24b
Authors: JK, NM

PRIMARY MINERALOGY
No. of igneous domains: 1
Nature of ign. domains:
Igneous domain number: 1
Domain grain size: medium grained
Domain texture: granular to subophitic
Domain comment: section show a mm- to 1 cm wide zone with 100% alteration; this was excluded for the primary mode estimation

Domain lithology: troctolitic, orthopyroxene-bearing 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	3	anhedral	elongate, amoeboid				
Plagioclase	65	69	4	4	subhedral	tabular	patchy zoning			bent plagioclases; equilibrated texture with triple junctions
Clinopyroxene	5	5	0	10	anhedral	irregular		colorless	poikilitic	plagioclases at the rim of the oikocryst show embayed surfaces indicating dissolution (image)
Orthopyroxene	1	1	0	1	anhedral	equant		pale pinkish brown		in part interstitial surrounding olivine as small rim

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
clay minerals	4	olivine 4%	Olivine	25	80	clay minerals 20%, serpentine 80%	
pale/colorless amphibole	0.2	clinopyroxene 0.2%	Plagioclase	69	10	prehnite 100%	Minor alteration of plagioclase to prehnite along cracks within the minerals, particularly adjacent to cataclasite zone.
prehnite	6.9	plagioclase 6.9%	Clinopyroxene	5	5	pale/colorless amphibole 90%, other 10%	Prehnite ~10% of alteration of clinopyroxene.
serpentine	16	olivine 16%	Orthopyroxene	1	0		
other	0	clinopyroxene <0.1%					
domain total alteration %:		27.1					

Vein summary
 vein 1 5-7 mm cataclasite zone replaced by prehnite and carbonate.

ALTERATION COMMENT: Troctolitic gabbro cut by prehnite-carbonate altered cataclasite. Minor prehnite filled radial cracks into plagioclase around serpentinized olivine. Irregularly shaped grains of pyrite are associated with the replacement of plagioclase along grain boundaries. Magnetite occurs along serpentine mesh after olivine.

STRUCTURE COMMENT: Magmatic: Isotropic. Rare deformation twins and/or bent grains of plagioclase, locally with annealed grain boundaries. Minor subgrains in plagioclase, with straight grain boundaries. Crystal Plastic: Weak undulose extinction in plagioclase and olivine. Brittle: Cut by well-developed zones (curved/irregular) of localized cataclastic deformation up to 6 mm thick; host to extensive alteration of plagioclase to prehnite, locally carbonate and clay. Some alteration appears to post-date cracking. Minor rotation of clasts (up to 20%). Veins/alteration: Prehnite overprints zones of cataclasis. Cross-cutting Relationships (as apparent in thin section): 1) Magmatic deformation with subgrain and deformation twin formation. 2) Low temperature cracking, and cataclasis with grain rotation. 3) Prehnite alteration of plagioclase. 4) Open fractures.

PHOTOMICROGRAPHS: 345_U14151_5G_1_TS24b.JPG
 345_U14151_5G_1_TS24b-2.JPG