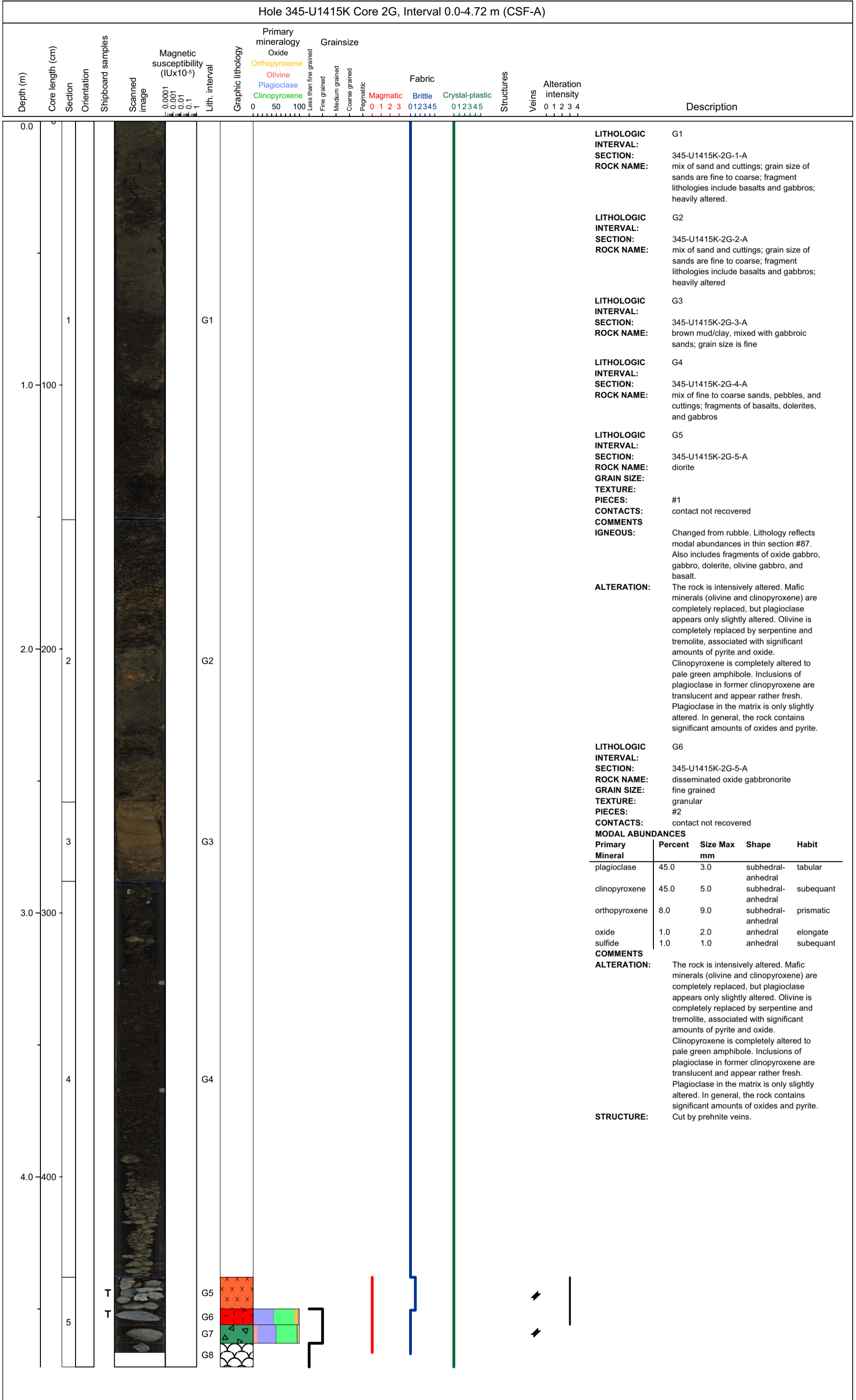
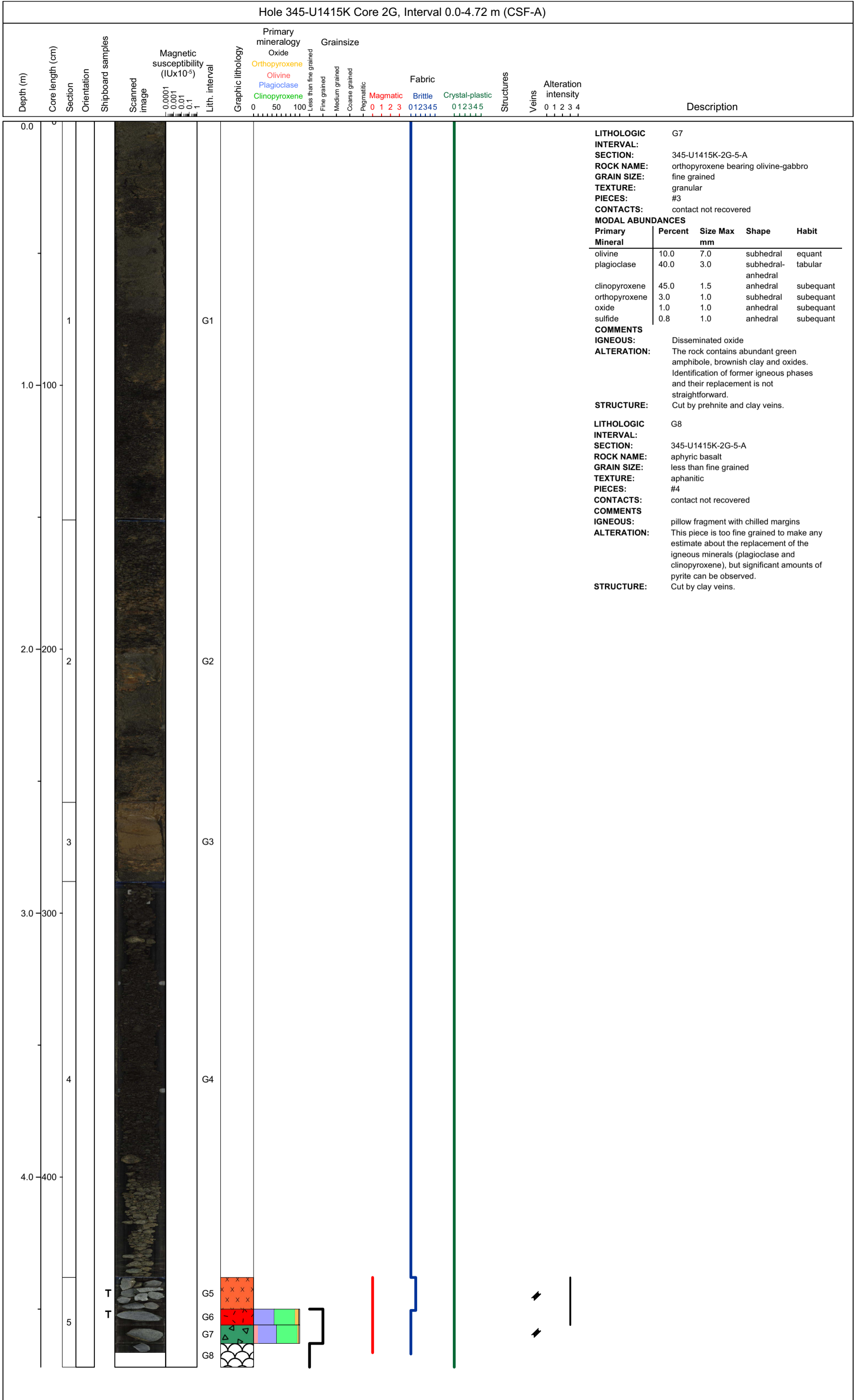


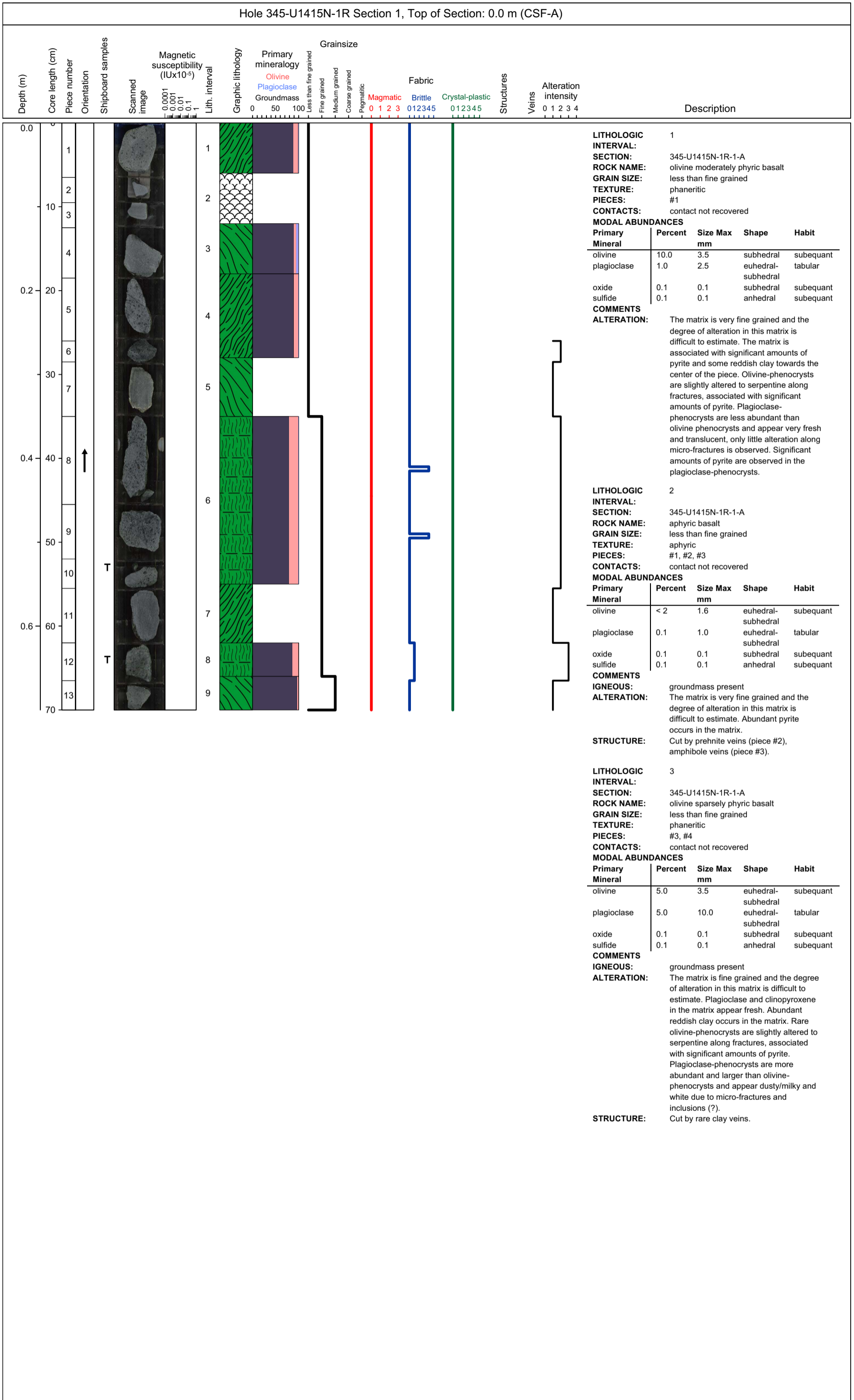
U1415K-11 Drilled interval

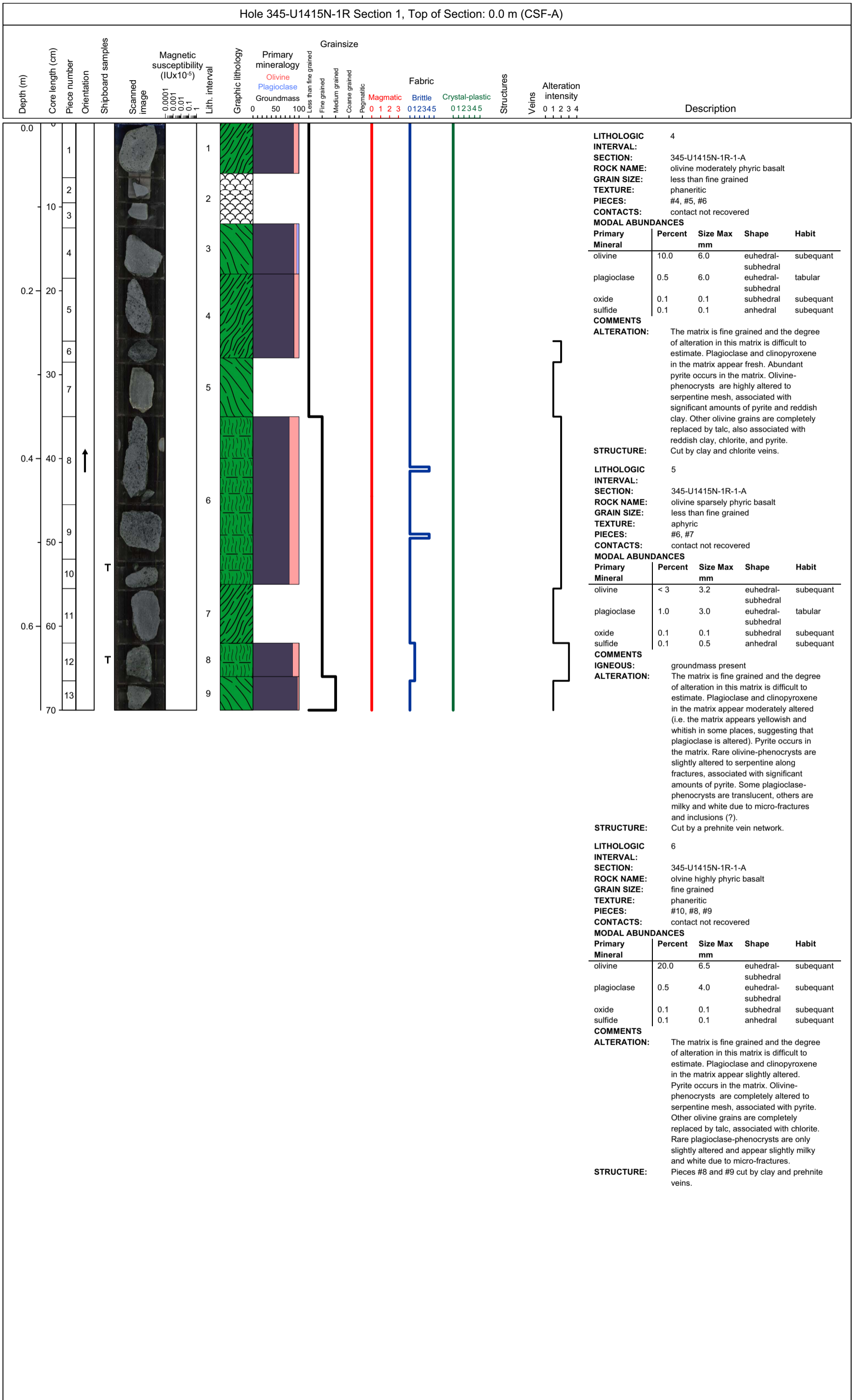


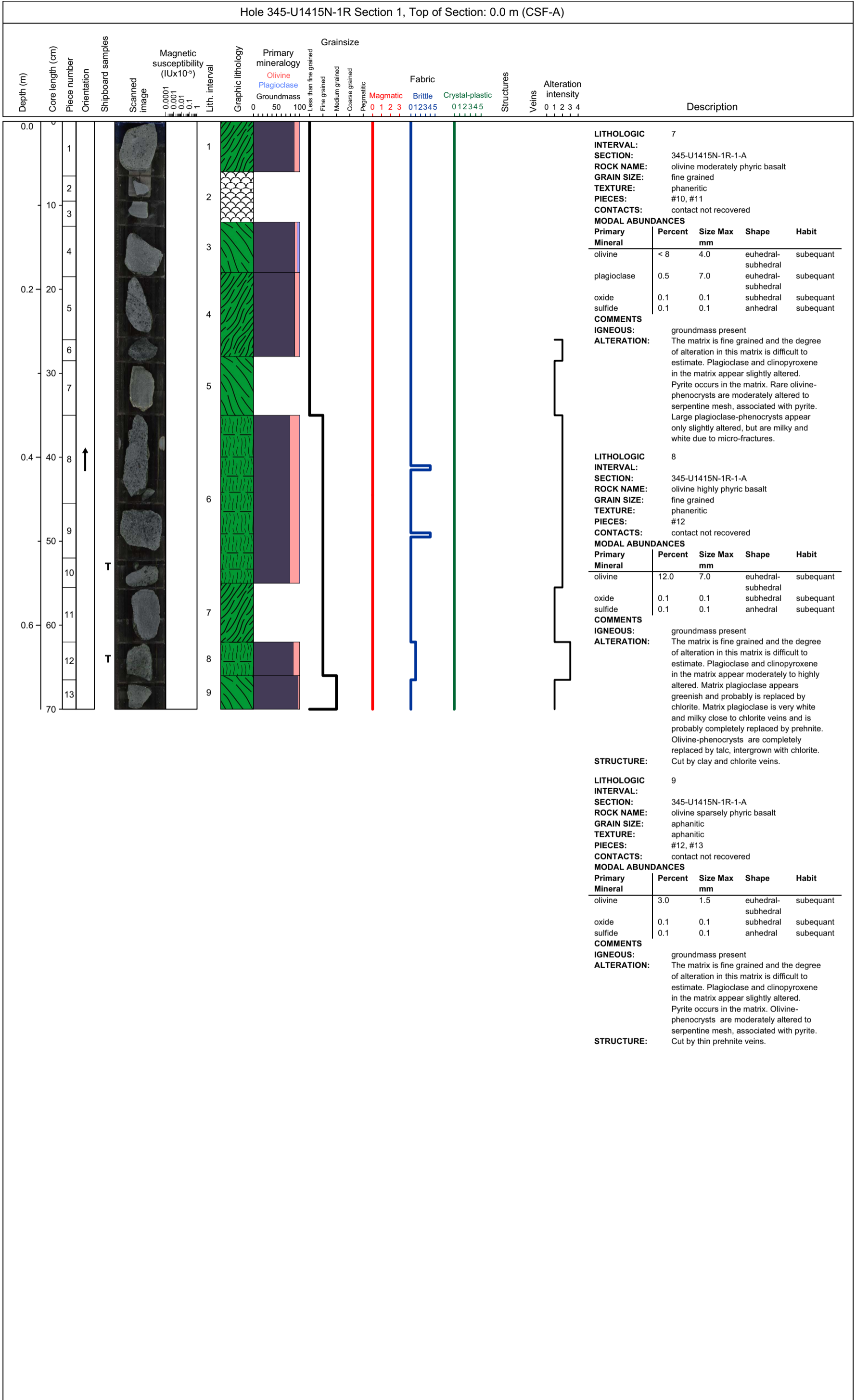


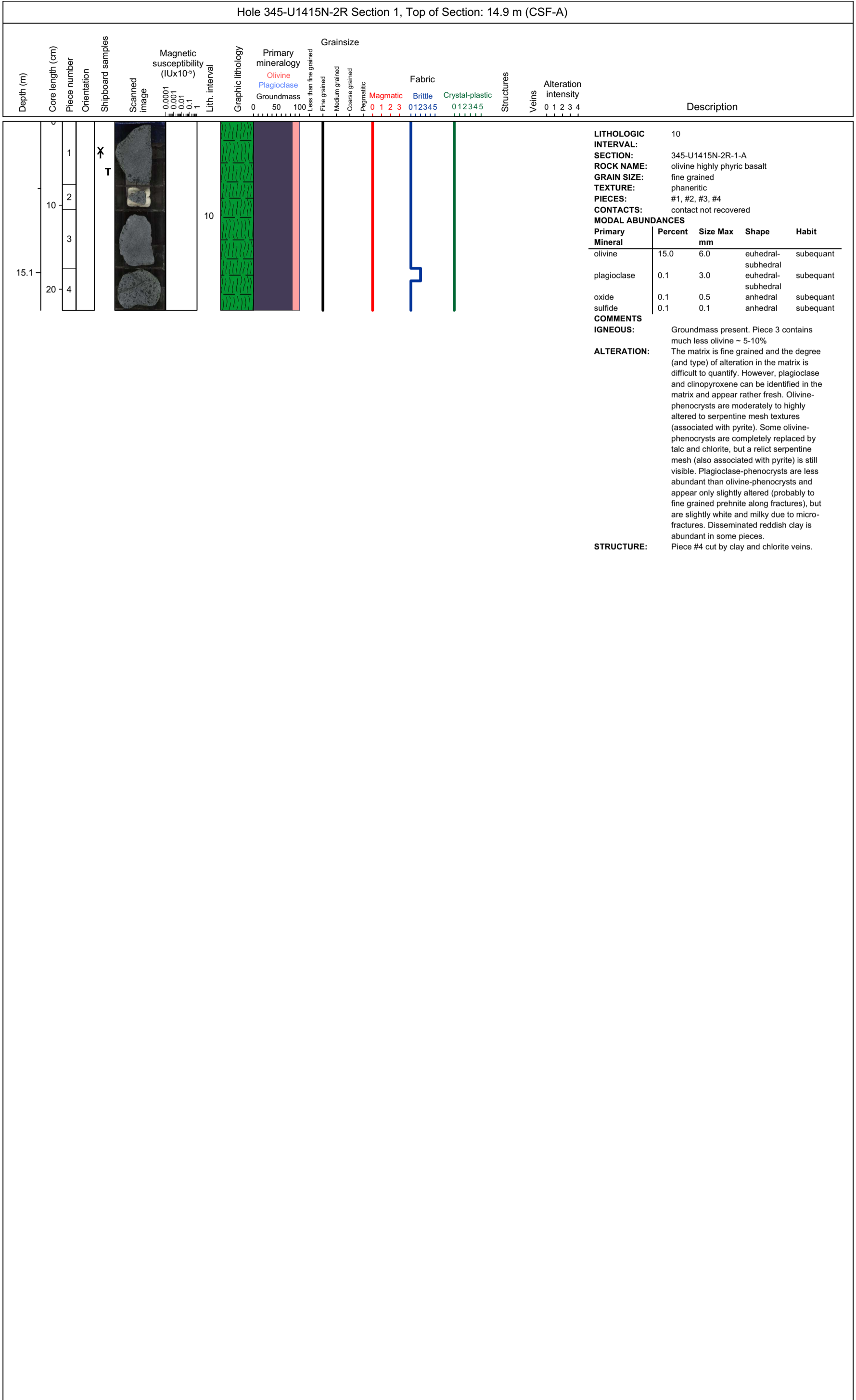
U1415L-11 Drilled interval
U1415M-11 Drilled interval

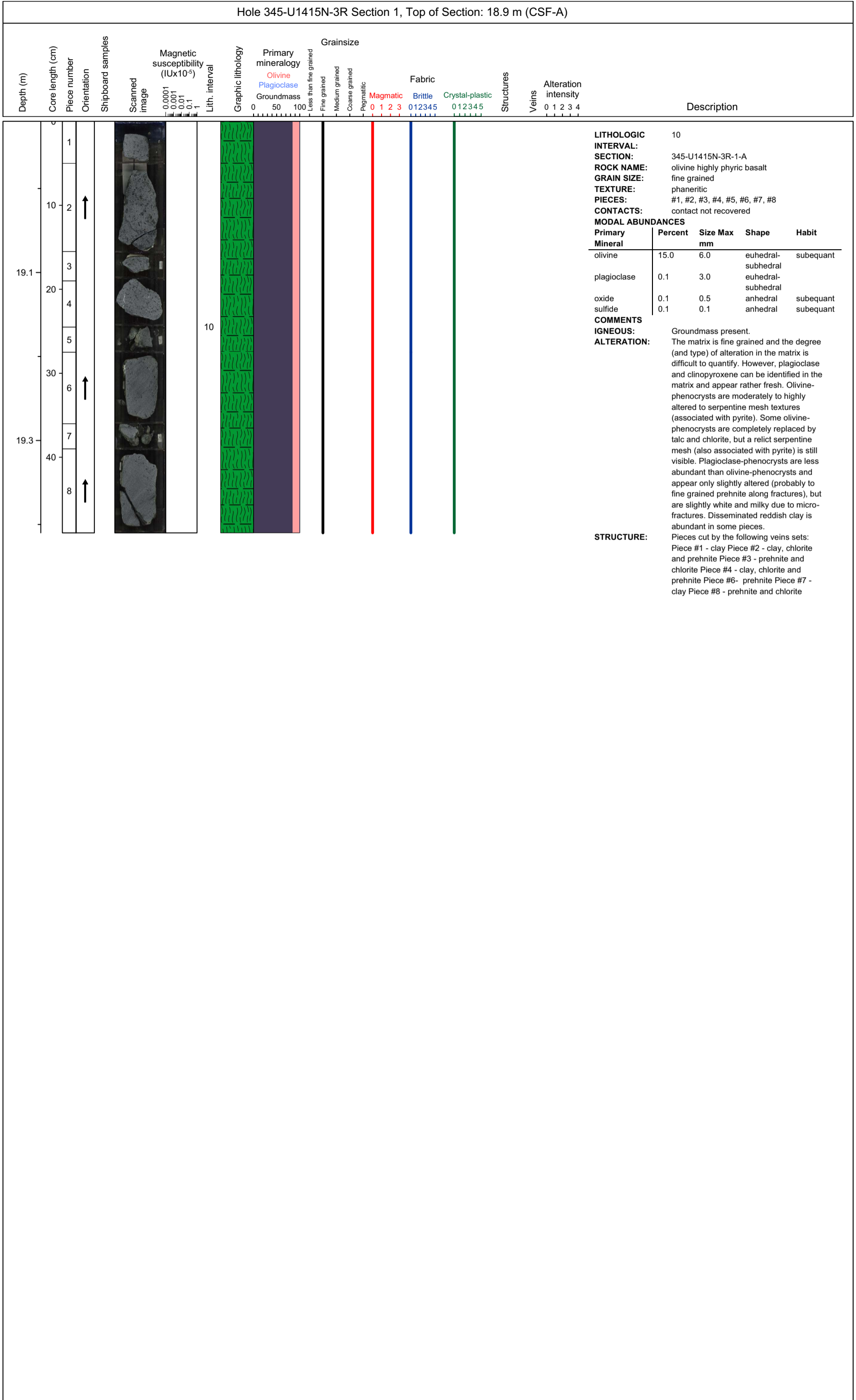
Hole 345-U1415M Core 2G, Interval 0.0-5.87 m (CSF-A)																			
Depth (m)	Core length (cm)	Section	Orientation	Shipboard samples	Scanned image	Magnetic susceptibility (IUx10 ⁻⁵)	Lith. interval	Graphic lithology	Primary mineralogy			Grainsize			Fabric	Structures	Veins	Alteration intensity	Description
									Oxide	Orthopyroxene	Olivine	Plagioclase	Clinopyroxene	Less than fine grained					
0.0	0																		<p>LITHOLOGIC INTERVAL: G1</p> <p>SECTION: 345-U1415M-2G-1-A</p> <p>ROCK NAME: sand</p> <p>GRAIN SIZE: very fine (less than 1 mm in diameter)</p> <p>COMMENTS:</p> <p>IGNEOUS: Color is 5GY 4/1 (dark greenish gray) from Munsell color chart.</p> <p>ALTERATION: Fine to very fine sand, olive green. Degree of alteration is difficult to asses.</p>
1.0	100	1					G1												<p>LITHOLOGIC INTERVAL: G1</p> <p>SECTION: 345-U1415M-2G-2-A</p> <p>ROCK NAME: sand</p> <p>GRAIN SIZE: very fine (less than 1 mm in diameter)</p> <p>COMMENTS:</p> <p>IGNEOUS: Color is 5GY 2/1 (greenish black), using Munsell color chart. A gradient in grain size; very fine at the top of section to coarser grained.</p> <p>ALTERATION: Poorly sorted fine to coarse gabbroic sand, olive green. Degree of alteration is difficult to asses.</p>
2.0	200	2	M				G1												<p>LITHOLOGIC INTERVAL: G1</p> <p>SECTION: 345-U1415M-2G-3-A</p> <p>ROCK NAME: sand</p> <p>GRAIN SIZE: very fine to medium</p> <p>COMMENTS:</p> <p>IGNEOUS: Gradient in grain size; downward coarsening.</p> <p>ALTERATION: Well graded coarse sand to fine gravel, olive green. Some fresh plagioclase crystals 1.5-2 mm in length. Alteration intensity appears low, although it is difficult to asses in such fine grained material.</p>
3.0	300	3					G1												<p>LITHOLOGIC INTERVAL: G2</p> <p>SECTION: 345-U1415M-2G-4-A</p> <p>ROCK NAME: sand</p> <p>GRAIN SIZE: fine to medium</p> <p>COMMENTS:</p> <p>IGNEOUS: Color is 5G 2/1 (Greenish black)</p> <p>ALTERATION: Very fine gravel, well sorted, olive green. Fine grain size makes assessment of alteration difficult.</p>
4.0	400	4					G1												<p>LITHOLOGIC INTERVAL: G3</p> <p>SECTION: 345-U1415M-2G-4-A</p> <p>ROCK NAME: sand</p> <p>GRAIN SIZE: very fine</p> <p>CONTACTS: color contact</p> <p>COMMENTS:</p> <p>ALTERATION: Clayey sand to very fine sand, well sorted, brownish red. Fine grain size makes assessment of alteration difficult.</p>
5.0	500	4	M				G2												<p>LITHOLOGIC INTERVAL: G4</p> <p>SECTION: 345-U1415M-2G-4-A</p> <p>ROCK NAME: pebbly sand</p> <p>GRAIN SIZE: coarse to very coarse. Includes cuttings from basalt.</p> <p>CONTACTS: color contact</p> <p>COMMENTS:</p> <p>ALTERATION: Well sorted very fine to fine gravel. Alteration intensity is slight.</p>
							G3												<p>LITHOLOGIC INTERVAL: G5</p> <p>SECTION: 345-U1415M-2G-CC-A</p> <p>ROCK NAME: aphyric basalt</p> <p>GRAIN SIZE: less than fine grained</p> <p>TEXTURE: aphyric</p> <p>PIECES:</p> <p>CONTACTS: contact not recovered</p> <p>COMMENTS:</p> <p>ALTERATION: Moderately altered with abundant disseminated sulfides, as well as sulfides in veins.</p> <p>STRUCTURE: Individual pieces cut by rare fractures.</p>
							G4												
							G5												

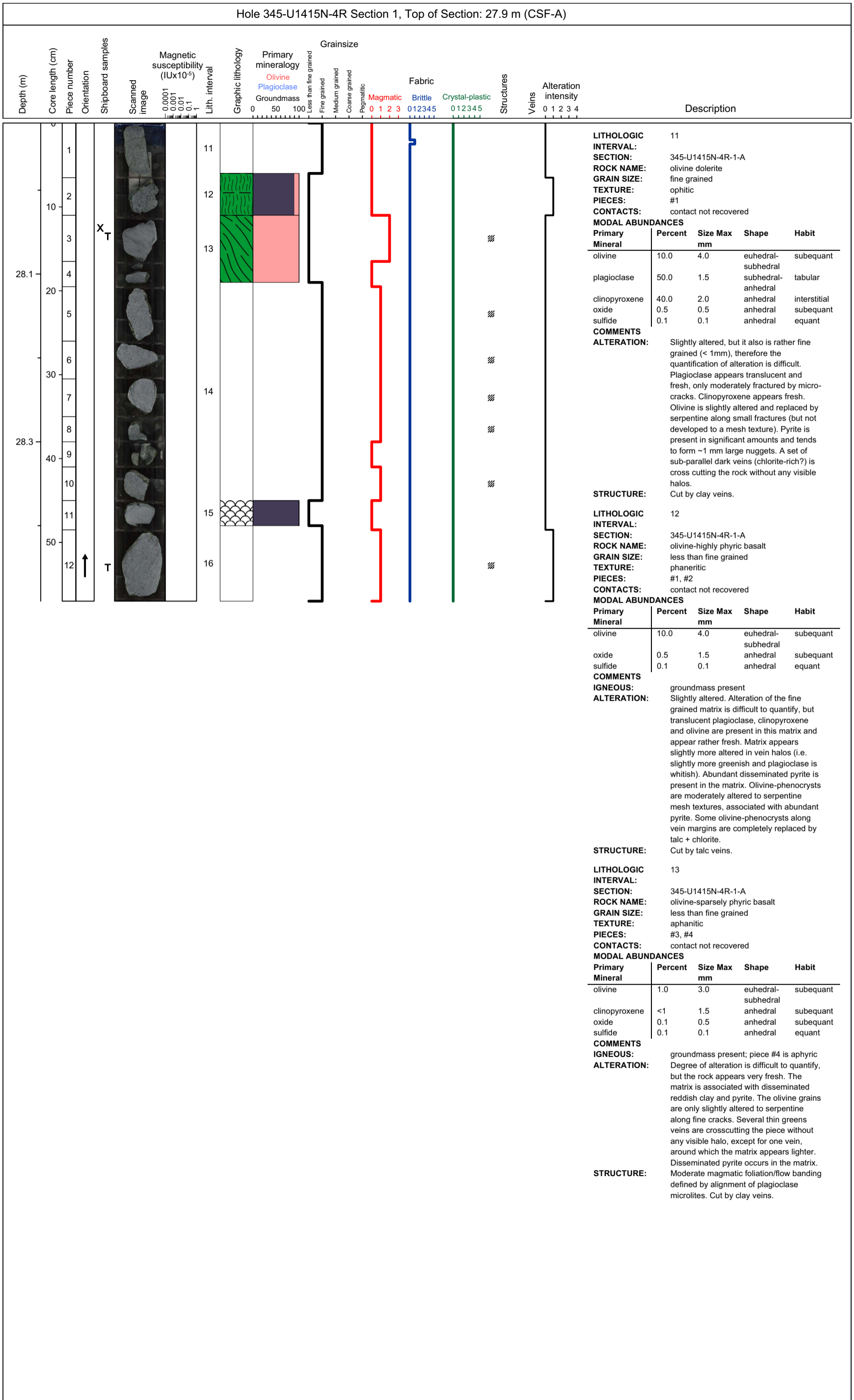


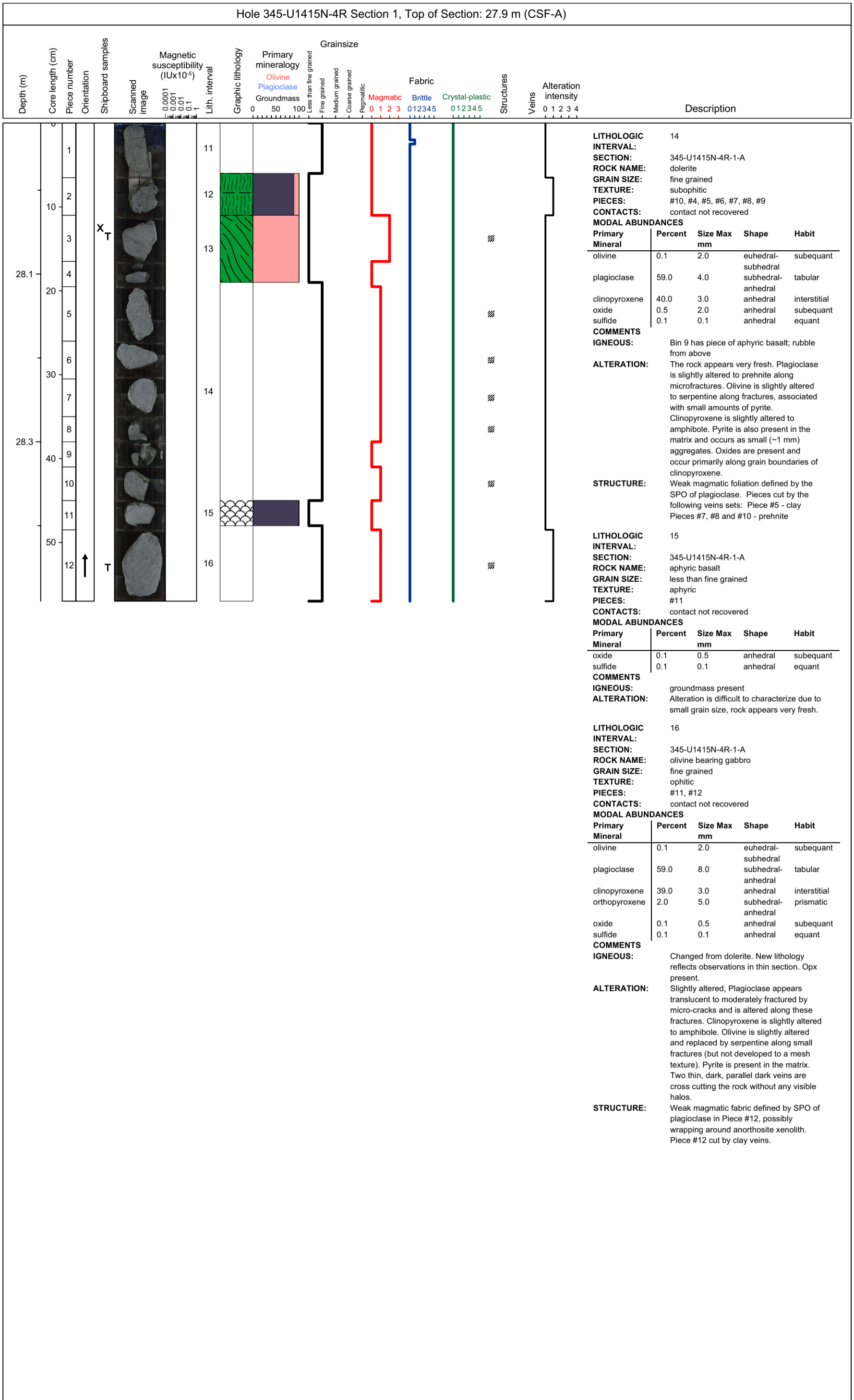


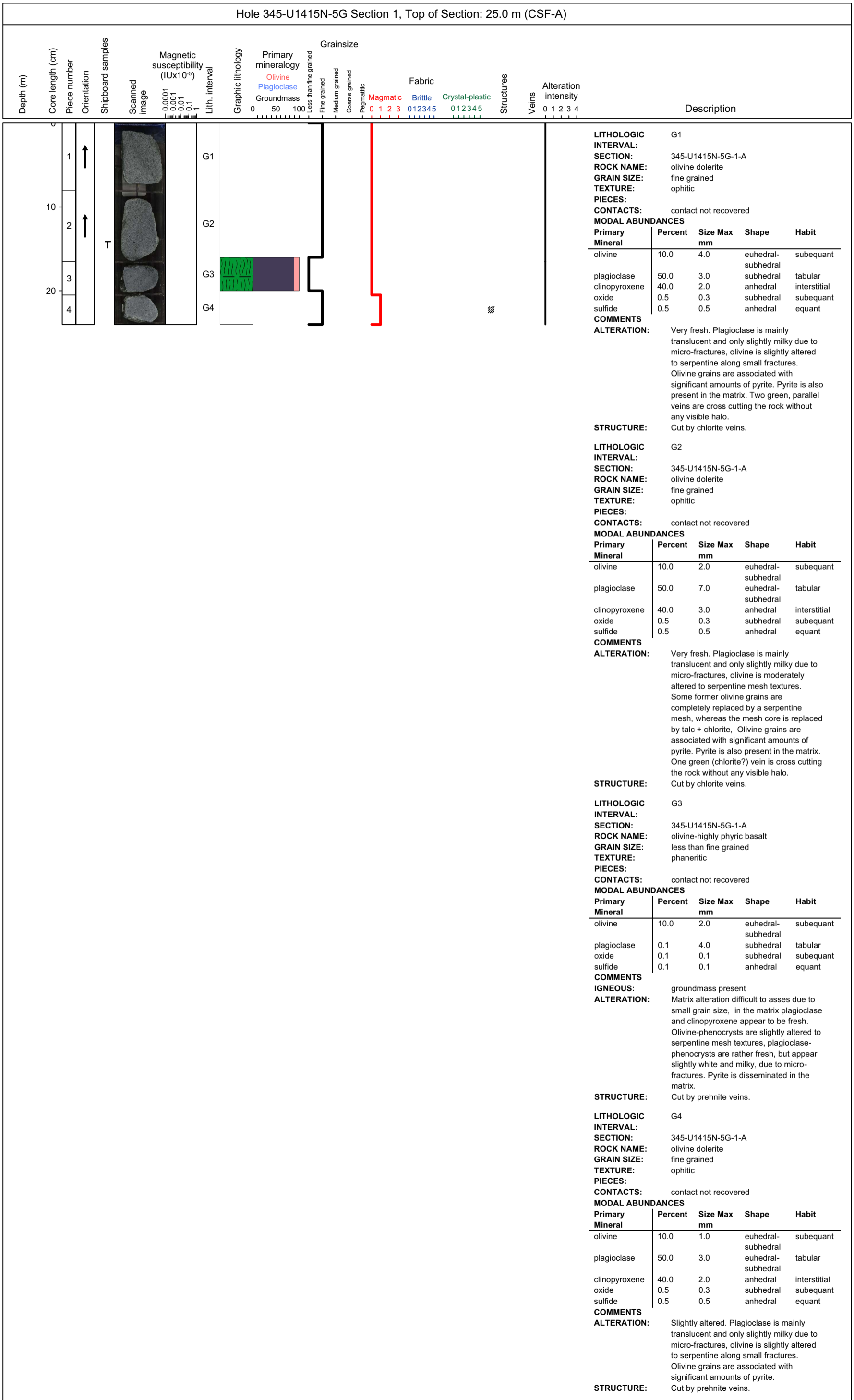








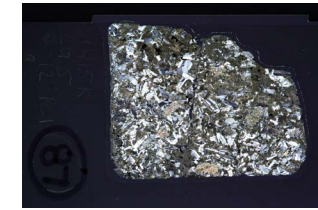




Hole U1415K, U1415L, U1415M,
and U1415N core descriptions

Thin sections

THIN SECTION: 345-U1415K-2G-5-W 0/12-TSB_Piece_1-TS_87
Rock name: diorite
Rock comment:
Lithologic interval: G5
Piece No.: #1
Billet request comment: Ig Pet: Primary minerals
Thin Section no.: 87
Authors: JM, TN
PRIMARY MINERALOGY
No. of igneous domains: 1
Nature of ign. domains: 1
Igneous domain number: 1
Domain grain size: medium grained
Domain texture: granular
Domain comment: very rough estimation of modal amounts of mafic minerals due to severe alteration
Domain lithology: diorite
Grain size distribution: seriate
Relative abundance (%): 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Plagioclase	50	60	10	1	subhedral to euhedral	tabular	continuous zoning			fractured and veined
Clinopyroxene	0.2	30	29.8	1	subhedral to anhedral	subequant		colorless		almost completely altered; completely altered magmatic amphibole of interstitial-shape may be included?
Orthopyroxene	0	4	4	2	anhedral to subhedral	subequant				completely altered
Amphibole	0.1	0.1	0	0.1	anhedral	irregular		green to brown	overgrowth	overgrowth on clinopyroxene; difficult to confirm magmatic or metamorphic in origin
Oxide	3	3	0	0.3	anhedral	equant			interstitial	magnetite
Quartz	3	3	0	0.2	anhedral	irregular			interstitial, undulatory extinction	secondary quartz also observed
Apatite (no. of grains)	50	N/A	N/A	0.02	subhedral to euhedral	elongated				

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
brown amphibole	1.8	clinopyroxene 1.8%	Plagioclase	40	20	green amphibole 10%, chlorite 80%, secondary plagioclase 10%	
chlorite	13.4	orthopyroxene 7%, plagioclase 6.4%	Clinopyroxene	40	90	green amphibole 40%, secondary clinopyroxene 55%, brown amphibole 5%	Most clinopyroxene grains are replaced by high-relief materials with dusty appearance, which are assigned to secondary clinopyroxene.
green amphibole	17.2	clinopyroxene 14.4%, orthopyroxene 2%, plagioclase 0.8%	Orthopyroxene	10	100	green amphibole 20%, chlorite 70%, other 10%	other: dusty high-relief material and brown amphibole, both of which may be alteration products of clinopyroxene within large orthopyroxene grains.
secondary clinopyroxene	19.8	clinopyroxene 19.8%	Oxide	5	10	other 100%	other: fringing opaque phases, probably secondary oxide.
secondary plagioclase	0.8	plagioclase 0.8%					
other	1.5	orthopyroxene 1%, oxide 0.5%					
domain total alteration %:	54.5						

ALTERATION COMMENT: Pyroxenes are highly altered, plagioclase is relatively fresh. Although no relict orthopyroxene is found in this thin section, chlorite-dominant large pseudomorphic aggregates, which show obviously different appearance from clinopyroxene-replacing aggregates, are assigned to alteration products after orthopyroxene.

STRUCTURE COMMENT #1: Magmatic: Isotropic. Zoning in plagioclase.
 Crystal Plastic: Rare undulose extinction in plagioclase.
 Brittle: Open fracture.
 Veins/alteration: Alteration of mafic minerals.
 Cross-cutting Relationships (as apparent in thin section):
 1) Cracking and static alteration.

STRUCTURE COMMENT #2: Magmatic: No magmatic fabric. See well developed myrmekite, free quartz, very elongate plagioclase (aspect ratio of 15:1), aligned magnetite,
 Crystal Plastic: Rare undulose extinction in plagioclase.
 Brittle: No brittle deformation; static cracking.
 Veins/alteration: Alteration of mafic minerals (clinopyroxene altered to amphibole and clay ?)
 Cross-cutting Relationships (as apparent in thin section):
 1) Cracking and static alteration

PHOTOMICROGRAPHS: 345_U1415K_2G_5_TS_87.JPG
 345_U1415K_2G_5_TS_87-2.JPG

Hole U1415K, U1415L, U1415M,
and U1415N core descriptions

Thin sections

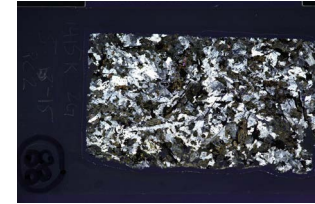
THIN SECTION: 345-U1415K-2G-5-W 13/15-TSB_Piece_2-TS_88
Rock name: oxide quartz diorite
Rock comment: with granophyric plagioclase-quartz intergrowth
Lithologic interval: G6
Piece No.: #2
Billet request comment: Ig Pet: Primary minerals

Thin Section no.: 88
Authors: JM, TN

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

Igneous domain number: 1
Domain grain size: medium grained
Domain texture: granular
Domain comment: very rough estimation of modal amounts of mafic minerals due to severe alteration; very elongated/dendritic grains of plagioclase, magnetite and apatite and granophyric intergrowth of quartz and albite plagioclase suggesting rapid crystallization.

Domain lithology: oxide quartz diorite
Grain size distribution: seriate
Relative abundance (%): 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Plagioclase	40	60	20	1.4	subhedral to euhedral	tabular	continuous zoning			fractured, veined and replaced by alteration minerals; a very elongated (8 x 0.2 mm) grain suggesting rapid growth; feather-like shaped albite plagioclase in granophyric intergrowth with quartz suggesting rapid growth
Clinopyroxene	1	25	24	1.2	anhedral	subequant		colorless		severely altered
Amphibole	0.1	0.1	0	0.2	anhedral	subequant		green to brown		difficult to confirm magmatic or metamorphic in origin
Oxide	5	5	0	1	anhedral	subequant to elongated			interstitial to disseminated	magnetite; two populations, subequant grains and very elongated dendritic grains (4 x 0.1 mm) with parallel alignment, the latter suggesting rapid growth
Quartz	10	10	0	0.3	anhedral	irregular			interstitial and granophyric intergrowth with albite plagioclase	
Apatite (no. of grains)	100	N/A	N/A		subhedral to euhedral	elongated and				two populations, subequant - tabular grains and very elongated/hopper-shaped grains (up to 2 x 0.05 mm) especially in granophyric intergrowth, the latter suggesting rapid growth
Zircon (no. of grains)	1	N/A	N/A	0.05	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: 70

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
brown amphibole	1.4	clinopyroxene 1.4%	Plagioclase	60	60	green amphibole 10%, chlorite 30%, secondary plagioclase 60%	
chlorite	10.8	plagioclase 10.8%	Clinopyroxene	30	95	green amphibole 40%, secondary clinopyroxene 55%, brown amphibole 5%	Most clinopyroxene grains are replaced by high-relief materials with dusty appearance, which are assigned to secondary clinopyroxene.
ferric oxyhydroxide	0.3	oxide 0.3%	Oxide	5	10	ferric oxyhydroxide 50%, other 100%	other: fringing opaque and brown translucent phases, which is probably secondary oxide and clay minerals, respectively.
green amphibole	15	clinopyroxene 11.4%, plagioclase 3.6%					
secondary clinopyroxene	15.7	clinopyroxene 15.7%					
secondary plagioclase	21.6	plagioclase 21.6%					
other	0.5	oxide 0.5%					
domain total alteration %:	65.3						

ALTERATION COMMENT: Clinopyroxene and plagioclase of this differentiated granoritic rock are altered in a higher degree than those of more primitive gabbros or troctolite from the other holes. It is difficult to identify secondary minerals due to tiny grain size.

STRUCTURE COMMENT: Magmatic: No magmatic fabric. See well developed myrmekite, free quartz, very elongate plagioclase (aspect ratio of 15:1), aligned magnetite, clinopyroxene replaced. Crystal Plastic: Rare undulose extinction in plagioclase. Brittle: No brittle deformation; static cracking. Veins/alteration: Alteration of mafic minerals. Cross-cutting Relationships (as apparent in thin section): 1) Cracking and static alteration

PHOTOMICROGRAPHS: 345_U1415K_2G_5_TS_88.JPG
345_U1415K_2G_5_TS_88-2.JPG

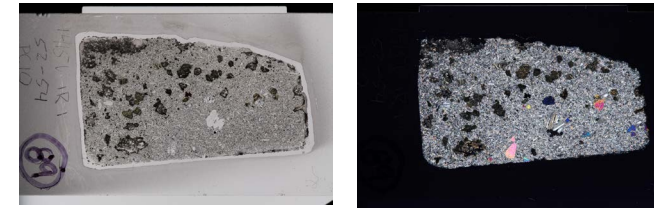
Hole U1415K, U1415L, U1415M,
and U1415N core descriptions

Thin sections

THIN SECTION: 345-U1415N-1R-1-W 52/54-TSB_Piece_10-TS_89
Rock name: highly olivine phyric basalt
Rock comment: moderately altered
Lithologic interval: 6
Piece No.: #10
Billet request comment: IgPet: Primary mineralogy; MetPet: Background Alteration

Thin Section no.: 89
Authors: MMJ, TN

PRIMARY MINERALOGY
No. of igneous domains: 1
Nature of ign. domains:
Igneous domain number: 1
Domain grain size: less than fine grained
Domain texture: porphyritic
Domain comment:
Domain lithology: highly olivine phyric basalt
Grain size distribution: unimodal
Relative abundance (%): 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	5	20	15	1.5	subhedral to euhedral	equant			corroded	description is for phenocrysts; olivine is also present in groundmass
Plagioclase	1	1.5	0.5	1.5	subhedral to euhedral	lath-shaped	continuous zoning		sieve-texture	description is for phenocrysts; plagioclase is also present in groundmass
Oxide	1	1	0	0.4	euhedral	isometric				oxides are spinels; sometimes associated with olivine; melt inclusions

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	0.2	clinopyroxene 0.2%	Olivine	20	80	clay minerals 90%, oxide 2%, sulfide 1%, serpentine 7%	brownish green clay minerals form pseudomorphs after olivine; relatively fresh olivine is partially replaced by serpentine and opaque minerals showing incipient mesh texture; tiny grains of pyrite are associated with serpentine
clay minerals	15	olivine 14.4%, plagioclase 0.6%	Plagioclase	55	1	clay minerals 100%	clay minerals fill micro-cracks in groundmass plagioclase
oxide	0.3	olivine 0.3%	Clinopyroxene	20	1	chlorite 100%	a few clinopyroxene grains in groundmass are partially altered to chlorite
serpentine	1.1	olivine 1.1%	Oxide	5	5	other 100%	other; secondary magnetite fringing brown spinel
sulfide	0.2	olivine 0.2%					
other	0.3	oxide 0.3%					
domain total alteration %:	17.1						

ALTERATION COMMENT: Olivine shows a high variation in degree of alteration, which may be caused by weathering; brownish green clay minerals form pseudomorphs after olivine; relatively fresh olivine is partially replaced by serpentine and opaque minerals showing incipient mesh texture; tiny grains of pyrite are associated with serpentine.

STRUCTURE COMMENT: Magmatic: Isotropic. Includes xenoliths of zoned plagioclase, olivine, and rounded spinel. Plagioclase microlites defining a weak foliation, wrap around olivine phenocrysts.
 Crystal Plastic: No crystal plastic deformation.
 Brittle: Open fracture.
 Veins/alteration: Local alteration of mafic minerals.
 Cross-cutting Relationships (as apparent in thin section):
 1) Minor static alteration.

PHOTOMICROGRAPHS: 345_U1415N_1R_1_TS_89.JPG
 345_U1415N_1R_1_TS_89-2.JPG

Hole U1415K, U1415L, U1415M,
and U1415N core descriptions

Thin sections

THIN SECTION: 345-U1415N-1R-1-W 62/66-TSB_Piece_12-TS_90
Rock name: moderately olivine phyric basalt
Rock comment: moderately to highly altered
Lithologic interval: 8
Piece No.: #12
Billet request comment: IgPet: Primary mineralogy; MetPet: Veins and Phenocryst Alteration

Thin Section no.: 90
Authors: NA, TN

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

Domain lithology: moderately olivine phyric basalt
Grain size distribution: unimodal
Relative abundance (%): 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	0	7	7	0.5	subhedral	subequant			inclusion-bearing	description is for phenocrysts; olivine is also present in groundmass
Oxide	0.1	0.1	0	0.1	euhedral-subhedral	equant				isometric oxides are spinels, with globular melt inclusions; other oxides are probably due to alteration

ALTERATION / METAMORPHISM
Alteration domain number: 1
No. of alteration domains: 2
Domain type: background
Domain rel. abund %: 50
Estimated total % alteration: 25

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	5.4	plagioclase 5.4%	Olivine	10	100	clay minerals 95%, oxide 4%, sulfide 1%	brownish green clay minerals form pseudomorphs after olivine
clay minerals	15.2	olivine 9.5%, clinopyroxene 0.2%, plagioclase 5.5%	Plagioclase	55	20	chlorite 49%, clay minerals 50%, other 1%	chlorite and clay minerals fill micro-cracks in plagioclase; other: pyrite
oxide	0.6	olivine 0.4%, clinopyroxene 0.2%	Clinopyroxene	30	1	clay minerals 50%, oxide 50%	clinopyroxene with dust appearance may be partially replaced by clay and oxide mixture
sulfide	0.1	olivine 0.1%	Oxide	5	5	other 100%	other; secondary magnetite and/or ferrite-chromite fringing brown spinel
other	0.4	plagioclase 0.1%, oxide 0.3%					
domain total alteration %:		21.7					

ALTERATION COMMENT: Olivine is completely altered to clay, oxide and sulfide, clinopyroxene and plagioclase are

ALTERATION / METAMORPHISM
Alteration domain number: 2
No. of alteration domains: 2
Domain type: halo
Domain rel. abund %: 50
Estimated total % alteration: 65

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	20.4	olivine 4%, clinopyroxene 1.5%, plagioclase 14.9%	Olivine	10	100	chlorite 40%, clay minerals 55%, oxide 4%, sulfide 1%	chlorite or chlorite-clay mixtures form pseudomorphs after olivine
clay minerals	16.2	olivine 5.5%, clinopyroxene 0.8%, plagioclase 9.9%	Plagioclase	55	90	chlorite 30%, clay minerals 20%, prehnite 20%, garnet 30%	Pseudomorphic plagioclase-replacing minerals with dusty appearance probably are mixtures of chlorite, garnet and prehnite/clay.
garnet	14.9	plagioclase 14.9%	Clinopyroxene	30	10	chlorite 50%, clay minerals 25%, oxide 25%	clinopyroxene is partially replaced by chlorite and probably by clay-oxide mixture
oxide	1.2	olivine 0.4%, clinopyroxene 0.8%	Oxide	5	20	other 100%	other; secondary magnetite and/or ferrite-chromite fringing brown spinel
prehnite	9.9	plagioclase 9.9%					
sulfide	0.1	olivine 0.1%					
other	1	oxide 1%					
domain total alteration %:		63.7					

Vein summary
vein 1 massive chlorite vein

ALTERATION COMMENT: Plagioclase is intensely altered to fine-grained mixture of secondary minerals, showing a contrast to relatively fresh plagioclase outside the halo; a small amount of pyrite is associated with plagioclase-replacing minerals.

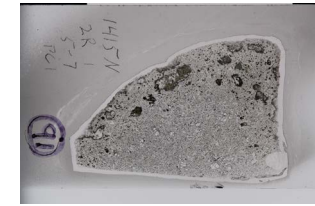
STRUCTURE COMMENT: Magmatic: Isotropic, with local alignment of plagioclase. Rare interstitial clinopyroxene oikocrysts hosting very elongate plagioclase crystals. Undulose extinction and deformation twins in larger plagioclase; rare grains bent and overgrown by new plagioclase? Clinopyroxene phenocrysts.
Crystal Plastic: No crystal plastic deformation.
Brittle: Cut by fracture network, locally filled with veins.
Veins/alteration: Vein set cut entire section.
Cross-cutting Relationships (as apparent in thin section):
1) Fracture and chlorite veining.

PHOTOMICROGRAPHS: 345_U1415N_1R_1_TS_90.JPG
345_U1415N_1R_1_TS_90-2.JPG

Hole U1415K, U1415L, U1415M,
and U1415N core descriptions

Thin sections

THIN SECTION: 345-U1415N-2R-1-W 5/7-TSB_Piece_1-TS_91
Rock name: moderately olivine phyric basalt
Rock comment: moderately altered
Lithologic interval: 10
Piece No.: #1
Billet request comment: IgPet: Primary mineralogy; MetPet: Phenocrysts on the outside
Thin Section no.: 91
Authors: TF, TN
PRIMARY MINERALOGY
No. of igneous domains: 1
Nature of ign. domains:
Igneous domain number: 1
Domain grain size: less than fine grained
Domain texture: porphyritic
Domain comment:
Domain lithology: moderately olivine phyric basalt
Grain size distribution: unimodal
Relative abundance (%): 100



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	5	10	5	0.5	euhedral to subhedral	equant to subequant			inclusion-bearing	cr-spinel and melt inclusions: description is for phenocrysts; olivine is also present in groundmass
Plagioclase	0.1	0.1	0	4	subhedral to anhedral	tabular	oscillatory zoning			one strongly zoned and resorbed phenocryst present as well as one grain of granular cluster (cumulate?); description is for phenocrysts; plagioclase is also present in groundmass
Oxide	0.1	0.1	0	0.1	euhedral	equant				chromian spinel; occurs as microphenocryst and as inclusions in olivine phenocrysts; also contains melt inclusions

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	1.3	plagioclase 1.3%	Olivine	20	50	clay minerals 90%, oxide 2%, sulfide 1%, serpentine 7%	brownish green clay minerals form pseudomorphs after olivine; relatively fresh olivine is partially replaced by serpentine and opaque minerals showing incipient mesh texture; tiny grains of pyrite are associated with serpentine
clay minerals	10.5	olivine 9%, clinopyroxene 0.1%, plagioclase 1.4%	Plagioclase	55	5	chlorite 49%, clay minerals 50%, other 1%	chlorite and clay minerals fill micro-cracks in plagioclase; other: pyrite
oxide	0.3	olivine 0.2%, clinopyroxene 0.1%	Clinopyroxene	20	1	clay minerals 50%, oxide 50%	clinopyroxene with dust appearance may be partially replaced by clay and oxide mixture
serpentine	0.7	olivine 0.7%	Oxide	5	5	other 100%	other; secondary magnetite and/or ferrite-chromite fringing brown spinel
sulfide	0.1	olivine 0.1%					
other	0.3	plagioclase < 0.1%, oxide 0.3%					
domain total alteration %:	13.2						

ALTERATION COMMENT: Olivine shows a high variation in degree of alteration, which may be caused by weathering; brownish green clay minerals form pseudomorphs after olivine; relatively fresh olivine is partially replaced by serpentine and opaque minerals showing incipient mesh texture; tiny grains of pyrite are associated with serpentine and plagioclase-replacing chlorite.

STRUCTURE COMMENT: Magmatic: Isotropic, with local alignment of plagioclase. Large, skeletal olivine xenocrysts/anticroysts? Oscillatory zoned plagioclase xenocryst with 'feathery' margins against groundmass plagioclase. 'hopper'-ca spinel. Subgrains and twinning in olivine. Groundmass plagioclase, olivine, clinopyroxene, and oxide.
 Crystal Plastic: No crystal plastic deformation.
 Brittle: Very minor fracture.
 Veins/alteration: No vein formation.
 Cross-cutting Relationships (as apparent in thin section):
 1) Minor fracturing.

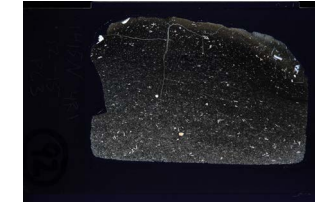
PHOTOMICROGRAPHS: 345_U1415N_2R_1_TS_91.JPG
 345_U1415N_2R_1_TS_91-2.JPG

Hole U1415K, U1415L, U1415M,
and U1415N core descriptions

Thin sections

THIN SECTION: 345-U1415N-4R-1-W 12/15-TSB_Piece_3-TS_92
Rock name: olivine- and plagioclase sparsely phyrlic basalt
Rock comment: moderately to highly altered; contains a chilled margin
Lithologic interval: #3
Piece No.: 13
Billet request comment: Ig. Pet: Primary mineralogy; MetPet: Chilled margin and background alt.
Thin Section no.: 92
Authors: MMJ, AM

PRIMARY MINERALOGY
No. of igneous domains: 1
Nature of ign. domains:
Igneous domain number: 1
Domain grain size: less than fine grained
Domain texture: porphyritic
Domain comment: Altered glass present in groundmass; chilled margin at one side of the section; here, the groundmass is glass (now altered)
Domain lithology: olivine- and plagioclase sparsely phyrlic basalt
Grain size distribution: unimodal
Relative abundance (%): 80



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	0.5	5	4.5	0.3	subhedral to euhedral	equant				occur as microphenocrysts; includes glomerocrysts
Plagioclase	7	8	1	0.4	subhedral to euhedral	lath-shaped	continuous zoning			occur as microphenocrysts
Oxide	0.1	0.1	0	0.1	subhedral to euhedral	subequant				

ALTERATION / METAMORPHISM
Alteration domain number: 1
No. of alteration domains: 2
Domain type: background
Domain rel. abund %: 15
Estimated total % alteration: 80

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	1	olivine 1%,	Olivine	5	100	green amphibole 20%, chlorite 20%, clay minerals 60%,	green alteration sometimes shows pleochroism
clay minerals	7	olivine 3%, plagioclase 4%	Plagioclase	20	50	clay minerals 40%, zeolite 50%, secondary plagioclase 10%,	plagioclase laths show variable alteration
green amphibole	1	olivine 1%,					
secondary plagioclase	1	plagioclase 1%					
zeolite	5	plagioclase 5%					
domain total alteration %:		15					

Vein summary
 vein 1 thin fibrous smectite/clay veins

ALTERATION COMMENT: Most of the marginal zone of the slide is irresolvable green groundmass, probably originally glass, now clay minerals and chlorite. Contains partially resorbed plagioclase which is altering to zeolite and green clay minerals. Some pyrite grains and possibly tiny disseminated oxides.

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

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	3	olivine 1%, clinopyroxene 2%	Olivine	5	100	green amphibole 20%, chlorite 20%, clay minerals 60%	
clay minerals	11.8	olivine 3%, clinopyroxene 4.8%, plagioclase 4%	Plagioclase	40	20	clay minerals 50%, zeolite 20%, secondary plagioclase 30%	
green amphibole	4	olivine 1%, clinopyroxene 3%	Clinopyroxene	20	50	green amphibole 30%, chlorite 20%, clay minerals 48%, oxide 1%, sulfide 1%	
oxide	0.1	clinopyroxene 0.1%					
secondary plagioclase	2.4	plagioclase 2.4%					
sulfide	0.1	clinopyroxene 0.1%					
zeolite	1.6	plagioclase 1.6%					
domain total alteration %:		23					

Vein summary
 vein 1 fibrous smectite/clay veins

ALTERATION COMMENT: Fine grained crystalline basalt, gradational change in grain size. Plagioclase is quite fresh, but olivine and pyroxene are highly altered to green mineral, sometimes pleochroic and amphibole, chlorite and clay. Tiny oxide grains and larger (50 micron) sulfide grains are disseminated throughout.

STRUCTURE COMMENT: Magmatic: Moderate magmatic fabric/flow banding defined by alignment of plagioclase microlites (some with swallow tail morphology). Glomerocrysts of plagioclase and clinopyroxene. Xenocrysts of resorbed plagioclase, altered amphibole. Groundmass plagioclase, clinopyroxene, and oxide.
 Crystal Plastic: No crystal plastic deformation.
 Brittle: Minor fracture.
 Veins/alteration: Cut by rare chlorite/clay veins.
 Cross-cutting Relationships (as apparent in thin section):
 1) Incorporation of clinopyroxene and plagioclase xenocrysts in the lava; crystallization of plagioclase and clinopyroxene microlites.
 2) Fracture and minor chlorite-clay vein fill.

PHOTOMICROGRAPHS:
 345_U1415N_4R_1_TS_92.JPG
 345_U1415N_4R_1_TS_92-2.JPG
 345_U1415N_4R_1_TS_92-3.JPG

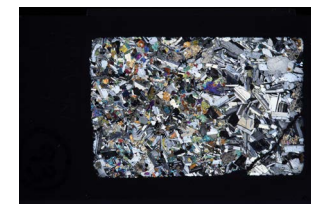
THIN SECTION: 345-U1415N-4R-1-W 52/54-TSB_Piece_12-TS_93
Rock name: olivine- and orthopyroxene-bearing gabbro
Rock comment: contains anorthosite patch
Lithologic interval: 16
Piece No.: #12
Billet request comment: Ig. Pet: Primary mineralogy; Struct: magmatic foliation

Thin Section no.: 93
Authors: JM, AM

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: principal lithology

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



	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	1.5	2.5	1	0.8	anhedral to subhedral	equant				
Plagioclase	60	60	0	1.2	subhedral to euhedral	tabular	oscillatory zoning			
Clinopyroxene	32	35	3	1	anhedral	subequant		colorless	interstitial, poikilitic, twinning	interstitial to tabular plagioclase
Orthopyroxene	1.5	2	0.5	1.5	anhedral	prismatic		pinkish green	interstitial	interstitial within a framework of tabular plagioclase
Oxide	0.5	0.5	0	0.5	anhedral	irregular			interstitial	

Igneous domain number: 2
Domain grain size: medium grained
Domain texture: granular
Domain comment: patch of anorthosite contained in orthopyroxene-olivine-bearing gabbro

Domain lithology: anorthositic patch
Grain size distribution: seriate
Relative abundance (%): 40

	Present (%)	Original (%)	Vol. repl. (%)	Size mode (mm)	Shape	Habit	Zoning	Color	Special features	Comment
Olivine	0	0.5	0.5	0.5	anhedral to subhedral	equant				
Plagioclase	92	92	0	2	subhedral to euhedral	tabular	continuous zoning			
Clinopyroxene	2	7	5	0.8	anhedral	irregular		colorless	interstitial	interstitial to tabular plagioclase
Oxide	0.5	0.5	0	0.2	anhedral	irregular			interstitial	

ALTERATION / METAMORPHISM **No. of alteration domains:** 2 **Domain rel. abund %:** 70 **Estimated total % alteration:** 40
Alteration domain number: 1 **Domain type:** background

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
brown amphibole	0.3	clinopyroxene 0.3%	Olivine	4	60	green amphibole 10%, clay minerals 17%, sulfide 3%, talc 70%	
chlorite	5.4	plagioclase 5.4%	Plagioclase	55	15	chlorite 65%, secondary plagioclase 35%	
clay minerals	0.4	olivine 0.4%	Clinopyroxene	30	90	green amphibole 70%, sulfide 1%, secondary clinopyroxene 28%, brown amphibole 1%	possible secondary clinopyroxene(?)
ferric oxyhydroxide	1	oxide 1%	Orthopyroxene	5	70	pale/colorless amphibole 10%, talc 90%	
green amphibole	19.1	olivine 0.2%, clinopyroxene 18.9%	Oxide	5	20	ferric oxyhydroxide 100%	
pale/colorless amphibole	0.4	orthopyroxene 0.4%					
secondary clinopyroxene	7.6	clinopyroxene 7.6%					
secondary plagioclase	2.9	plagioclase 2.9%					
sulfide	0.3	olivine 0.1%, clinopyroxene 0.3%					
talc	4.8	olivine 1.7%, orthopyroxene 3.2%					
domain total alteration %:	42.2						

Vein summary
 vein 1 networks of chlorite +/- amphibole veins cutting plagioclase
 vein 2 fibrous amphibole

ALTERATION COMMENT: Olivine is altered to talc predominantly ± sulfide. Clinopyroxene is replaced by abundant green amphibole and possible secondary clinopyroxene, with a few sulfide grains. Plagioclase contains chlorite veins (± amphibole) and patches, and weakly developed chlorite rims around olivine and orthopyroxene.

ALTERATION / METAMORPHISM **No. of alteration domains:** 2 **Domain rel. abund %:** 30 **Estimated total % alteration:** 20
Alteration domain number: 2 **Domain type:** background

SECONDARY MINERALOGY	%	REPLACING / FILLING	PRIMARY MINERAL REPLACED	% ORIGINAL	% ALTERED	REPLACEMENT MINERAL	ALTERATION COMMENTS
chlorite	5.1	plagioclase 5.1%	Plagioclase	85	10	chlorite 60%, secondary plagioclase 40%	
ferric oxyhydroxide	0.5	oxide 0.5%	Clinopyroxene	15	90	green amphibole 70%, oxide 1%, secondary clinopyroxene 29%	
green amphibole	9.5	clinopyroxene 9.5%	Oxide	1	50	ferric oxyhydroxide 100%	
oxide	0.1	clinopyroxene 0.1%					
secondary clinopyroxene	3.9	clinopyroxene 3.9%					
secondary plagioclase	3.4	plagioclase 3.4%					
domain total alteration %:	22.5						

Vein summary
 vein 1 green amphibole and then chlorite along grain boundaries

ALTERATION COMMENT: Olivine is altered to talc predominantly ± sulfide. Clinopyroxene is replaced by abundant green amphibole and possible secondary clinopyroxene, with a few sulfide grains. Plagioclase contains chlorite veins (± amphibole) and patches, and weakly developed chlorite rims around olivine and orthopyroxene.

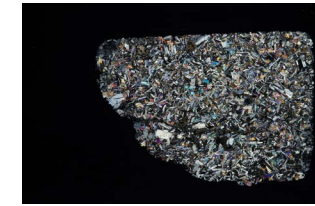
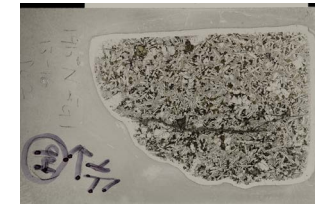
STRUCTURE COMMENT: Magmatic: Boundary between anorthositic and medium grained, olivine- and orthopyroxene-bearing gabbro
 Olivine- and orthopyroxene-bearing gabbro: Medium- to fine-grained plagioclase with a weak magmatic foliation defined by plagioclase SPO, subparallel to the boundary with anorthosite. Host to undeformed interstitial oxides along grain boundaries. Bent plagioclase grains with rare undulose extinction. Rarely zoned plagioclase, commonly scalloped against plagioclase and clinopyroxene.
 Anorthositic horizon (possible xenolith): Medium grained, isotropic, host to olivine, and very little clinopyroxene. Weakly zoned plagioclase, with deformation twins in smallest grains.
 Crystal Plastic: No crystal plastic deformation.
 Brittle: Conjugate fractures, with vein fill.
 Veins/alteration: Chlorite crack-seal veins.
 Cross-cutting Relationships (as apparent in thin section):
 1) Formation of magmatic fabric (or flow around xenolith).
 2) Conjugate fracture and chlorite crack-seal veining.

PHOTOMICROGRAPHS: 345_U1415N_4R_1_TS_93.JPG
 345_U1415N_4R_1_TS_93-2.JPG

Hole U1415K, U1415L, U1415M,
and U1415N core descriptions

Thin sections

THIN SECTION: 345-U1415N-SG-1-W 13/16-TSB_Piece_2-TS_94
Rock name: olivine dolerite
Rock comment:
Lithologic interval: G2
Piece No.:
Billet request comment: Met Pet: background alteration; Struct: magmatic fabric
Thin Section no.: 94
Authors: MMJ, TN
PRIMARY MINERALOGY
No. of igneous domains: 1
Nature of ign. domains:
Igneous domain number:
Domain grain size: fine grained
Domain texture: subophitic
Domain comment:
Domain lithology: olivine dolerite
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	0.8	anhedral to subhedral	elongate				
Plagioclase	55	60	5	1	euheral	lath-shaped	continuous zoning		fast crystal growth	tabular plagioclase has more zoning than lath-shaped plagioclase
Clinopyroxene	20	25	5	0.4	anhedral to subhedral	irregular		colorless	interstitial	interstitial to plagioclase and olivine; in part dendritic intergrowth with plagioclase
Oxide	0.5	0.5	0	0.1	anhedral	aggregates			associated with olivine	

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	0.3	plagioclase 0.3%	Olivine	10	100	clay minerals 95%, oxide 2%, sulfide 3%	Olivine is completely altered to greenish clay mineral and small amounts of magnetite and pyrite.
clay minerals	11.3	olivine 9.5%, clinopyroxene 1.5%, plagioclase 0.3%	Plagioclase	58	1	chlorite 50%, clay minerals 48%, other 2%	Other: tiny grains of oxide. Many fractures are filled by chlorite or clay minerals.
oxide	1.7	olivine 0.2%, clinopyroxene 1.5%	Clinopyroxene	30	10	clay minerals 50%, oxide 50%	Clinopyroxene grains are partially replaced by dusty parts, which are inferred to be mixture of clay and oxide.
sulfide	0.3	olivine 0.3%	Oxide	2	5	other 100%	other: opaque rime, possibly ferrite-chromite, fringing brown spinel
other	0.1	plagioclase < 0.1%, oxide 0.1%					
domain total alteration %:	13.7						

Vein summary
 vein 1 cross-fiber clay veins

ALTERATION COMMENT: Olivine is completely altered to greenish clay mineral and small amounts of magnetite and pyrite. Clinopyroxene grains are partially replaced by mixture of clay and oxides. Microfractures in plagioclase grains are filled by chlorite or clay minerals. Pyrite is associated with clay minerals replacing olivine.

STRUCTURE COMMENT: Magmatic: Isotropic olivine gabbro, with variable grain size plagioclase including glomerocrysts, radiating clusters of elongate grains (with up to 8:1 axial ratios) in a finer grained, subophitic matrix of elongate plagioclase surrounding clinopyroxene. Larger plagioclase zoned, host deformation twins. Small clinopyroxene intergrowth/host elongate plagioclase. Spinel and oxide present.
 Crystal Plastic: No crystal plastic deformation.
 Brittle: Fractures with vein fill.
 Veins/alteration: Chlorite (?) crack seal, compound with clay veins.
 Cross-cutting Relationships (as apparent in thin section):
 1) Fracture and chlorite crack seal veining.

PHOTOMICROGRAPHS: 345_U1415N_SG_1_TS_94.JPG
 345_U1415N_SG_1_TS_94-2.JPG