147-894A-1R-2 (Piece 1, 55–57 cm) OBSERVER: TRE WHERE SAMPLED: Clast in sediment
ROCK NAME: Aphyric basalt
GRAIN SIZE: Microcrystalline
TEXTURE: Variolitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	Trace	Trace	to 1		Subhedral	Single crystal.
Clinopyroxene	Trace	Trace	0.3		Euhedral	Single crystal attached to plagioclase phenocryst.
GROUNDMASS						
Magnetite	5	5	to 0.1		Euhedral	Equant, skeletal octahedra, laths, lattice exsolution of ilmenite in some grains. Partial alteration to Ti-maghemite along cracks.
Sulfide	0.1	0.1	0.1		Anhedral	90% pyrite and 10% chalcopyrite.
Plagioclase	45–50	50	to 0.2		Anhedral	
Clinopyroxene	30–35	35	to 0.3		Anhedral	Typically plumose, some anhedral blocky grains.
Mesostasis	5–10	10				Includes some plumose clinopyroxene.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Chlorite	2–4	Plagioclase	Always at the contact with magnetite grains.
Clays	10	Clinopyroxene, plagioclase, mesostasis	Probably smectite.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles	<0.1			Carbonate		Calcite

147-894A-1R-2 (130–135 cm) OBSERVER: NAT WHERE SAMPLED: Coarse sediment fraction (0.7–1 mm)
ROCK NAME: Basaltic lithic breccia
GRAIN SIZE: Microcrystalline
TEXTURE: Microlitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	60	60	0.1–0.3		Tabular, euhedral, microlitic	
Clinopyroxene	5	10	0.05–0.1		Euehdral to subhedral	Partly replaced by green hornblende as subhedral well as chlorite.
Ti-Magnetite	10	10	0.01–0.05		Skeletal, euhedral	Exsolved ilmenite; some Ti-maghemite
Ilmenite	Trace	Trace	0.01–0.02		Rounded, tabular	Primary, not exsolved from Ti-magnetite. Intergrown with Ti-magnetite
Mesostasis	0	20				Chloritized.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Chlorite	15	Clinopyroxene, mesostasis	
Hornblende	10	Clinopyroxene	Green.
Pyrite	Trace		

COMMENTS: Sand-sized (coarse) separate from breccia. Most grains (97%) conform to this general description. Some are finer grained, from quenched margins of flows or dikes, and have microlitic/spherulitic crystallites of plagioclase and titanomagnetite. The abundance and size of oxides suggests grains are derived from ferrobasalt. All grains have the same metamorphic grade (lower amphibolite).

147-894A-1R-5 (42–47 cm) OBSERVER: NAT WHERE SAMPLED: Coarse sediment fraction (0.07–1.0 mm)
ROCK NAME: Basaltic lithic breccia
GRAIN SIZE: Microcrystalline
TEXTURE: Microlitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	60	60	0.1–0.3		Tabular, euhedral	Microlitic
Clinopyroxene	5	10	0.05–0.1		Euhedral to subhedral	
Ti-magnetite	10	10	0.1		Skeletal, euhedral	Exsolved ilmenite; some Ti-magnetite
Ilmenite	Trace	Trace	0.01–0.02		Rounded, tabular	Primary, not exsolved from Ti-magnetite. Intergrown with Ti-magnetite.
Mesostasis	0	20				Chloritized.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Chlorite	15	Clinopyroxene, mesostasis	
Hornblende	10	Clinopyroxene	Green
Pyrite	Trace		

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE

COMMENTS: This grain mount is essentially identical to that from 147-894A 1R-2, 130–135 cm. The coarse lithic breccia is homogeneous in lithic components throughout the 6 m recovered.

147-894A-1R-5 (Piece 2, 48–50 cm) OBSERVER: TRE WHERE SAMPLED: Lithic clasts in sediment
ROCK NAME: Aphyric basalt
GRAIN SIZE: Fine
TEXTURE: Intergranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	52.4		to 1		Subhedral	
Clinopyroxene	35.5	8.16	to 0.5		Anhedral	
Oxide	12.1	to 0.2			Anhedral	Magnetite equant, skeletal, irregular, lattice exsolution.
Sulfide		0.1	to 0.2		Anhedral	90% pyrite and 10% chalcopyrite. Chalcopyrite and pyrite occur together.

COMMENTS: Total alteration = 20% consisting of clay, partial transformation of plagioclase to secondary plagioclase and clays, especially along microfractures. Partial transformation of clinopyroxene to clays. Ti-rich magnetite has ilmenite exsolution lamallae transformed to a weakly reflective mineral (sphene? pseudobrookite?) and a highly reflective Ti-mineral.

147-894B-1R-1 (Piece 1, 0–2 cm) OBSERVER: MG WHERE SAMPLED: Unit 1
ROCK NAME: Gabbro
GRAIN SIZE: Variable
TEXTURE: Cataclastic (hypidiomorphic granular in less deformed zones)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	5–10	?	to 2.0		Subhedral to anhedral, tabular	Some grains are well zoned. In less deformed zones, relict grain boundaries are preserved and may be rimmed by clay with or without oxides.
Clinopyroxene	2	?	to 1.6		Anhedral	
Oxides	1	?	to 0.7		Anhedral	One disaggregated patch and small laths with lattice exsolutions. Oxides are associated with amphibole and in patches.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Chlorite	1–2	?	Forms rare pods, also intergrown with fibrous amphibole
Plagioclase	10–15	After plagioclase	Ragged and turbid due to abundant clay.
Epidote	Trace		
Clinopyroxene	2	After clinopyroxene	
Amphibole	10–15	After clinopyroxene	Amphibole is heterogeneous from fibrous pale yellow-green to coarse grained, green with well-developed cleavage.
Clays	30–40	Matrix	
Clays	20	After plagioclase	

COMMENTS: Structural comments: Intense grain size reduction of all phases accompanied by pervasive alteration, resulting in a matrix-supported cataclastic rock. Homogeneously deformed except for a thin (2 mm) cataclasite shear zone, possessing a slight foliation and clasts of variable size and shape. Undulose extinction of plagioclase and pyroxene.

147-894B-1R-1 (Piece 2, 2–8 cm) OBSERVER: MG WHERE SAMPLED: Unit 1
ROCK NAME: Gabbro
GRAIN SIZE: Medium
TEXTURE: Hypidiomorphic granular and cataclastic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	25	50	0.6–2.5		Anhedral-subhedral	Plagioclase crystals are zoned, and patches of mixed clays and veins of amphibole cut plagioclase.
Clinopyroxene	4	44.6	0.4–2.5		Anhedral	Heavily altered to green and brown amphibole.
Orthopyroxene	0	5	0.4–2.5		Anhedral	Completely replaced by chlorite and clay.
Oxides	0.3	0.4	0.1–1.32		Semirounded-elongate	Interstitial, original 4:1 ilmenite to magnetite ratio. Magnetite now altered. Lattice and mottled exsolution.
Chalcopyrite?	0.01		0.01		Irregular	Disseminated in both primary and secondary silicate phases.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Plagioclase	25	Plagioclase	Albitic. Well developed near cataclastic shear zones.
Amphibole	10	Clinopyroxene, orthopyroxene	Virtually all green or pale green in color, though several pale brown grains may be found with secondary clinopyroxene after magmatic clinopyroxene. Trace cummingtonite after orthopyroxene.
Chlorite	5	Orthopyroxene	
Clinopyroxene	<1	Clinopyroxene	
Clay	31	Clinopyroxene	Appears to postdate amphibole alteration of clinopyroxene

COMMENTS: Sample is deformed by 0.2 to 0.6 mm wide cataclastic shear zones. Strong comminution of plagioclase and pyroxene grains in these zones.

147-894B-1R-1 (Piece 3, 8–12 cm) OBSERVER: MG WHERE SAMPLED: Unit 1
ROCK NAME: Gabbro
GRAIN SIZE: Medium
TEXTURE: Hypidiomorphic granular in the least deformed parts; otherwise cataclastic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	10	45–55	0.8–4		Subhedral, tabular	Highly fragmented with abundant grain size reduction in local anastomosing shear zones. Altered to green amphibole, clay, and secondary plagioclase.
Clinopyroxene	1–3	40–50	0.9–3		Anhedral	Pervasively altered to to intergrown mats of pale green to yellow-green amphibole and oxides, and a fine-grained brownish material (clay?)
Total Opaques	1.4		0.3–2			Most are Fe-Ti oxides.
Apatite	Trace		0.1–0.2		Euhedral	

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Plagioclase	23.7	Plagioclase	
Epidote	0.2		
Clinopyroxene	0.1	Clinopyroxene	
Amphibole	35.6	Clinopyroxene	
Amphibole	2.9	Plagioclase	
Oxide	1.0		
Clay	27.5	Clinopyroxene, plagioclase, matrix	Some question as to identification of clay replacing pyroxene (1.9%), 7.6% mixed layer (?) clay replacing plagioclase with yellow veinlets in plagioclase, and 7.8% matrix clay without a definable progenitor.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Veins						Abundant fine veinlets of fine-grained pleochroic material is abundant.

COMMENTS: Section contains several thin, irregular shear zones with development of a protocataclasite texture. Contains deformed fragments of plagioclase, clinopyroxene, amphibole etc. of variable size, shape, and fracture intensity. No foliation within or adjacent to shear zones and no kinematic indicators. Away from shear zones rock is fractured with isolated patches of cataclastic material. Veinlets of pleochroic yellow material present.

147-894E-3R-1 (Piece 4, 19–21 cm) OBSERVER: MG WHERE SAMPLED: Unit 3
ROCK NAME: Oxide Gabbro
GRAIN SIZE: Medium
TEXTURE: Varitextured; ophitic, subophitic, hypidiomorphic granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	46.2	47.4	0.2–2.5		Subhedral-Anhedral	Albite and Carlsbad twinned. Often contains inclusions of rounded clinopyroxene. Cut by fine veinlets of chlorite? Partially replaced by secondary plagioclase. Minor fracturing and undulatory extinction. Crude alignment of plagioclase.
Clinopyroxene	7.2	44.3	0.5–4		Anhedral	Pervasively altered to secondary clinopyroxene, amphibole, and clay.
Magnetite	3–4	3–4	0.1-5		Anhedral	As interstitial patches. Has a pitted surface.
Ilmenite	3–4	3–4	to 3		Subrounded	As interstitial patches. Associated with magnetite.
Pyrite	<1	<1	to 0.6		Subrounded-irregular	Altered nearly completely to marcasite; relict pyrite in cores of grains. Occurs in patches in amphibole. Minor chalcopyrite is associated with it.
Apatite	Trace	Trace	0.05		Euhedral	

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Chlorite	4.0	Amphibole, plagioclase	Intergrown with yellow-green to pale green amphibole.
Plagioclase	10.6	Primary plagioclase	As irregular replacement.
Clinopyroxene	4.5	Clinopyroxene	
Amphibole	19.9	Clinopyroxene	
Amphibole	3.2	Plagioclase	
Clays	1.1	Plagioclase	

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vein	<<1	Across section	0.4 mm wide	Chlorite		Has core of fine-grained brown mineral (sphene?)

COMMENTS: Total alteration from 1500 point counts is 55.8%. Possible development of magmatic flow fabric developed by crude alignment of plagioclase. Three domains are seen in the thin section. 1) Randomly arranged, small (0.4 mm) plagioclase crystals enclosed within an altered clinopyroxene oikocryst. 2) Larger plagioclase laths partially or totally enclosed in Fe/Ti oxides (to 3 mm). 3) Hypidiomorphic granular texture with 2–3 mm grain size.

147-894E-3R-1 (Piece 8, 50–53 cm) OBSERVER: MG WHERE SAMPLED: Unit 5
ROCK NAME: Gabbro
GRAIN SIZE: Medium
TEXTURE: Hypidiomorphic granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	37.6	53.1	2–3		Sub-anhedral, tabular	In less altered areas, feldspars are clean with 2%–10% secondary plagioclase and minor clay.
Clinopyroxene	9.4	44.9	2–3		Anhedral	
Oxides	1.7	1.7	to 1.2		Anhedral; semirounded	Interstitial or in lines parallel to foliation.
Sulfides	0.3		to 0.2		Semirounded, elongate	Associated with amphibole. Most is pyrite; chalcopyrite occurs as smaller grains (to 0.08 mm) associated with pyrite or loose.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Chlorite	2	After clinopyroxene and amphibole	Local abundances and very low birefringence.
Plagioclase	19.7	After plagioclase	In highly fractured areas, plagioclase is turbid in appearance, with brown clay.
Epidote	Trace	After plagioclase	0.05 mm granular grains.
Clinopyroxene	3.4	After clinopyroxene	
Amphibole	26.8	After clinopyroxene	Pale brown to green amphibole.
Amphibole	2.6	After plagioclase	Blue green to green amphibole.
Magnetite	2.3	After clinopyroxene	
Clays	5.8	After clinopyroxene	Fine-grained and brown. 4.5 % more clay is altered after plagioclase.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Veins			0.1 mm wide	Chlorite, amphibole, clay and magnetite	Thin, discontinuous	Minor abundance.

COMMENTS: Modes by point count (>1500 points). Alteration is very heterogeneous (50%–90%). Thin fractures are continuous across secton, with minor to moderate microfracturing of grains.

147-894E-3R-1 (Piece 10, 70–73 cm) OBSERVER: MG WHERE SAMPLED: Unit 5
ROCK NAME: Gabbro
GRAIN SIZE: Medium
TEXTURE: Hypidiomorphic granular; allotriomorphic, ophitic, subophitic, intergranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	27.1	49.7	to 2.8		Euhedral-anhedral	Some are zoned and locally turbid, especially when cut by microveins. Twins typically undeformed. Many contain small, subhedral inclusions of clinopyroxene.
Clinopyroxene	5.0	49.3	to 1.9		Anhedral	Large oikocrysts include both plagioclase and clinopyroxene. Pervasively altered to fine-grained, brown clay?, oxides, rare brown amphibole, fine pale green fibrous amphibole, and minor hydrothermal clinopyroxene.
Magnetite	<1	<1	To 2		Irregular anhedral	
Ilmenite	<1	<1	To 1?		Laths?	Mottles in magnetite?
Pyrite	<1	<1	to 0.5		Semirounded, spongy, irregular	
Chalcopyrite	<<1	<<1	to 0.5?		Semirounded	Smaller grain size than pyrite

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Chlorite	1.6	In 0.01 mm veins in plagioclase	Also intergrown with actinolite in brecciated plagioclase grains
Plagioclase	22.6	Primary Plagioclase	Liquid-dominated fluid inclusions common.
Epidote	0.8	?	
Clinopyroxene	6.4	After clinopyroxene	Liquid-dominated fluid inclusions common.
Amphibole	30.8	After clinopyroxene	
Amphibole	1.1	After plagioclase	
Magnetite	Trace	After clinopyroxene	
Clay	5.0	After clinopyroxene, plagioclase	6.5% after clinopyroxene, 3.6% after plagioclase

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vein	<1	Across section	0.45 mm wide	Prehnite bounded by chlorite		Locally bounded by low biotite-chlorite.
Vein	<<1	Across section	0.16 mm wide	Calcite, chlorite, +/- amphibole		

COMMENTS: Undeformed with the exception of scarce microfracturing. One microfracture with 2 mm displacement turns laterally into the prehnite vein, which bifurcates into the calcite/chlorite vein. Minor microfracturing of grains adjacent to veins. 1500 metamorphic point counts-separate igneous point count.

147-894F-1R-1 (Piece 1, 2–9 cm) OBSERVER: LAK WHERE SAMPLED: Unit 1
ROCK NAME: Gabbro
GRAIN SIZE: Ultra-fine-grained matrix with prophyroclasts of varying sizes
TEXTURE: Cataclastic, foliated

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Clinopyroxene	<5.0					Essentially no igneous mineralogy remaining; clinopyroxene is almost completely altered to a fibrous green amphibole and clay.
Plagioclase	<5.0		up to 1.5			Plagioclase is deformed by grain size reduction and the development of subgrains; thus the grain size is commonly less than 0.2 mm. It is most abundant away from the shear zones. Has a brown, ragged, turbid appearance. Almost completely altered.
Oxide Minerals	5.0	?	up to 2.0			Typically deformed parallel to shear zones and within foliations. Stretched in appearance; likely very mobile. Section not polished, therefore no identification possible.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Chlorite	10	Filling irregular pods	
Plagioclase	20	After plagioclase	Almost 100% replacement of igneous plagioclase, although it is difficult to judge accurately percent altered due to abundance of clay.
Amphibole	15	Replacing pyroxene	Light green fibrous and coarse grained, darker green amphibole with cleavage.
Clays	45	Replacing plagioclase and pyroxene	Clays of variable color form an ultra-fine matrix to shear zones; lesser amounts outside of sheared areas. Mixed layer clays pseudomorph minerals of unknown identity.
Clinopyroxene	5	Replacing pyroxene	Fluid inclusion enriched.
Quartz	1–2		Very clean. Typically less than 1 mm. Found in highly sheared zones.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles	None					
Vein	5.0	Shear zones	<1 cm	Chlorite?	Thin	Discontinous, syn-post shear, found parallel, perpendicular and at about a 30 angle to shear boundaries.

COMMENTS: Section is almost completely altered. Structural comments: Foliation defined by anastamosing shear zones of alternating ultracataclasites and cataclasites. Ultracataclasites are extremely fine-grained, whereas cataclasites are porphyroclastic (secondary plagioclase, secondary clinopyroxene, amphibole, opaques), and possess a well-developed Reidel shear geometry. Plagioclase displays intense undulose extinction, a possible subgrain development. Kinematic indicators: sigmoidal clasts, Reidel geometry - normal sense of shear.

147-894F-2R-1 (Piece 1, 5–7 cm) OBSERVER: MG WHERE SAMPLED: Unit 1
ROCK NAME: Gabbro
GRAIN SIZE: Medium to coarse
TEXTURE: Hypidiomorphic granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	46.6	51.1	to 7.8		Subhedral to anhedral, tabular	Fresh tabular laths, broad oscillatory zoning common. Margins partially altered particularly where in contact with altered pyroxene.
Clinopyroxene	10	46.6	to 5.6		Anhedral	Pervasively altered. Some of pyroxene (few%) may have originally been orthopyroxene, but alteration makes identification difficult.
Magnetite	1.4	1.4	1		Irregular, laths	Interstitial. One main patch, lattic exsolution, with amphiboles.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Chlorite	1.4	Clinopyroxene	At least 90% in wall rock near vein.
Plagioclase	2.5	Plagioclase	
Clinopyroxene	4.1	Clinopyroxene	
Amphibole	30.9	Clinopyroxene	Green and blue-green amphibole.
Brown Amphibole	1.8	Clinopyroxene	Includes pale olive green amphibole.
Green Amphibole	2.1	Plagioclase	
Unknown	2.2	Clinopyroxene	
Magnetite	0.5	Clinopyroxene	

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vein 1			1 mm	Actinolite and chlorite		Actinolite and chlorite vein and associated chlorite alteration in wall rock is later than pyroxene alteration.
Vein 2			0.1 mm	Actinolite		Crosscuts Vein 1.
Fractures			<0.05 mm			In wall rock around veins.

COMMENTS: Trace zircon observed as inclusion in pyroxene. Trace sphene is also observed, but neither in point count (1500 points). Metamorphic paragenesis is secondary clinopyroxene to brown or olive green amphibole to green amphibole. Strong alteration of clinopyroxene to secondary secondary clinopyroxene and brown amphibole suggests that initial static metamorphism in amphibolite facies. Amphibole vein is continuous across section, with less that 1 mm of displacement.

147-894F-2R-1 (Piece 3, 32–35 cm) OBSERVER: MG WHERE SAMPLED: Unit 1
ROCK NAME: Gabbro
GRAIN SIZE: Medium
TEXTURE: Cataclastic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	20	55	0.6–3		Subhedral to anhedral, tabular	Zoned.
Clinopyroxene	40	0.3–3.5			Anhedral	Note: mode is estimated from a small, less deformed portion of the slide; not necessarily representative.
Magnetite	1.2	2			Anhedral	
Ilmenite	0.8				Subrounded	As lamellae in magnetite grains.
Pyrite	0.2				Interstitial, spongy	50% altered to marcasite.
Chalcopyrite	<0.1					

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Chlorite	3	Clinopyroxene	
Plagioclase	15	Plagioclase	Secondary plagioclase nearly completely masks original grains.
Clinopyroxene	5	Clinopyroxene	
Amphibole	20	Clinopyroxene	Clinopyroxene is replaced by rounded grains of yellow-brown amphibole and by fibrous pale green amphibole.
Clays	30	Matrix, and after plagioclase	Clays are most abundant in the more cataclastic portions of slide.

COMMENTS: There are two zones to this section: 1) altered and fractured, 2) cataclastic, with severe grain size reduction. Approximately 30% clay forming a matrix to angular-subangular fragments of variable size. Undulose extinction of plagioclase.

147-894F-2R-1 (Piece 7, 54–56 cm) OBSERVER: MG WHERE SAMPLED: Unit 1
ROCK NAME: Gabbro
GRAIN SIZE: Medium
TEXTURE: Brecciated, cataclastic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	53					Estimated from least deformed part of section.
Clinopyroxene	45					Estimated from least deformed part of section.
Magnetite	0.35	0.2 to 1.7			Subrounded	Interstitial patches, parallel to foliation in shear.
Ilmenite	0.15					
Pyrite	1.4				Subrounded to subangular	Altered to marcasite.
Pyrrhotite	0.1					One lath observed intergrown with pyrite.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Amphibole		Clinopyroxene	
Chlorite		Clinopyroxene	
Plagioclase		Plagioclase	
Sphene		Oxide minerals	

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Veins			1	Chlorite		Crosscut aggregates of oxide minerals and plagioclase but not matrix.

COMMENTS: Intense grain size reduction due to cataclasis in 90% of the section. 2 distinct shear zone: 1) 2–3.5 mm wide, sharp shear zone-wall rock boundaries, ultracataclastic zone. Has clay matrix with rounded to subrounded clasts of plagioclase, clinopyroxene, amphibole, and opaque minerals. 2) Well defined zone 2 mm wide with a more diffuse shear zone-wall rock boundaries. Outside of shear zones are angular to subrounded grains in a clayey matrix.

147-894F-3R-1 (Piece 5, 30–33 cm) OBSERVER: MG WHERE SAMPLED: Unit 1
ROCK NAME: Gabbro
GRAIN SIZE: Medium to coarse
TEXTURE: Hypidiomorphic granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	35.6	50.6	to 3.1		Subhedral to anhedral, tabular	Oscillatory zoned. Highly fractured; cut by irregular patches of inclusion- and clay-rich secondary plagioclase.
Clinopyroxene	29.7	48.0	to 10.3		Anhedral	Bent cleavages; moderately to highly altered to abundant secondary clinopyroxene and complex, heterogenous amphiboles.
Magnetite	1.4	1.4	to 2.5		Skeletal	Interstital patches. Occur in one large cluster; larger grains contain no exsolution. Smaller grains are uniformly distributed, often associated with amphibole, and may be exsolved.
Ilmenite	Trace	Trace			Anhedral	
Pyrite	0.1	0.1	to 0.2		Anhedral	With amphibole; mainly altered to marcasite.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Chlorite	0.1	Actinolite	
Plagioclase	15.9	Plagioclase	Na-rich plagioclase replacing Ca-rich plagioclase. Alteration equal to 39.8% of initial phase (out of sync with ign comments). Commonly turbid.
Amphibole	16.5	Clinopyroxene	Alteration equals 35.8% of initial phase (similar to igneous comments). Complex, heterogenous; brown-green to blue-green. Rare patches of green to pale yellow amphiboles may completely replace clinopyroxene. Fine-grained amphibole may rim plagioclase.
Clinopyroxene		Clinopyroxene	Fluid-inclusion-rich; mode not estimated.
Calcite	Trace	In thin, discontinuous veinlets	

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Veinlets	Trace		Micro	Calcite	Thin	Discontinuous

COMMENTS: IGNEOUS: Mode is point counted. 1680 points, counting interval 0.5 mm. Phaneritic, with ophitic to subophitic textures. METAMORPHIC: point count is 1225 points. Counting interval 0.5 mm. Total alteration is 30%–35%. STRUCTURAL: Local microshearing with little displacement and local grain size reduction of plagioclase.

147-894F-3R-1 (Piece 17, 103–105 cm) OBSERVER: VAR WHERE SAMPLED: Unit 1
ROCK NAME: Olivine gabbro
GRAIN SIZE: Medium
TEXTURE: Poikilitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	1.8	8.0	to 0.75		Subhedral	Pervasively altered.
Plagioclase	45.5	46.1	to 2.5		Subhedral-anhedral	Well-zoned, albite and polysynthetic twinning common.
Clinopyroxene	36.2	44.3	to 6		Anhedral	Exsolution lamellae parallel to (100).
Orthopyroxene	0.6	0.8	2		Anhedral	
Magnetite	0.7	0.5			Semirounded	Interstitial patches, laths and needles in amphibole.
Pyrite	0.09	0.1			Anhedral	Relict pyrite in marcasite patches.
Chalcopyrite	0.01	0.1			Semirounded, irregular, spongy	

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Chlorite	1	Plagioclase	
Plagioclase	2.5	Plagioclase	
Clinopyroxene	0.8	Clinopyroxene	
Amphibole	9.6	Clinopyroxene; orthopyroxene; olivine	6.3% after clinopyroxene; 0.5% after orthopyroxene, 2.8% after amphibole.
Cummingtonite	0.1	Olivine	
Talc	0.8	Olivine	
Oxide	1.4	Olivine; clinopyroxene	1.3 after olivine, 0.1 after clinopyroxene.
Clays	0.1	Olivine	

COMMENTS: IGNEOUS: Poikilitic textured gabbro with clinopyroxene and orthopyroxene oikocrysts enclosing unoriented plagioclase. METAMORPHIC: Alteration is patchy, some complete alteration of olivine, some fresh olivine. Rare secondary clinopyroxene and brown amphibole. Transitional greenschist-amphibolite facies. STRUCTURE: No orientation of idiomorphic plagioclase, no fabric. Very minor deformation and sparse microfractures.

147-894G-2R-1 (Piece 2, 8–10 cm) OBSERVER: JAY WHERE SAMPLED: Unit 1
ROCK NAME: Olivine gabbro
GRAIN SIZE: Medium
TEXTURE: Varitextured

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	2.8	7.4	to 2.1		Euhedral-subhedral	Commonly pervasively altered with relict cores.
Plagioclase	52.3	53.5	to 2.9		Subhedral-anhedral	Commonly broadly zoned and twinned.
Clinopyroxene	29.8	36.2	to 3.5		Anhedral	Forms oikocrysts, commonly exhibits exolution lamellae.
Orthopyroxene	2.2	2.2			Anhedral	Forms large oikocrysts. Occurs exclusively in contact with olivine.
Magnetite		0.25	0.6		Subrounded	Interstitial
Ilmenite		0.25	0.6		Laths	Intergrown with magnetite
Pyrite		0.1	0.5		Spongy, subrounded, irregular	Commonly altered to marcasite.
Chalcopyrite		0.1	0.5		Irregular	With amphibole.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Amphibole	8	Clinopyroxene, orthopyroxene, plagioclase	
Plagioclase	2	Plagioclase	
Chlorite	2	Olivine, plagioclase	
Clinopyroxene	Trace	Clinopyroxene	
Oxide minerals	Trace	Olivine, pyroxene	

COMMENTS: Mode point counted. >1500 points, 0.5 mm counting interval. Phaneritic, ophitic to subophitic. Apatite is also present as a trace component. No deformation, minor fracturing. Reported weak magmatic foliation exhibited by aligned plagioclase, textural type M1 (see explanatory notes).

147-894G-2R-1 (Piece 9, 68–71 cm) OBSERVER: JFA WHERE SAMPLED: Unit 2
ROCK NAME: Highly plagioclase olivine phyric basalt
GRAIN SIZE: Fine
TEXTURE: Porphyritic, sub-ophitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	5.6	6.1	0.5–5		Subhedral	Resorbed on margins; incipient alteration to clays along cracks; some with melt inclusions parallel to 010 (to 0.1 mm); size break is different from coarser groundmass grains.
Olivine	1.7	3.9	0.6–2.7		Euhedral-subhedral	Partially to completely replaced by clays and more occasionally amphibole.
GROUNDMASS						
Plagioclase	43.0	45.7	to 1.2		Laths and anhedral	Lathlike; slightly altered to clays and amphibole.
Clinopyroxene	26.0	39.1	to 1.2		Anhedral	As ophitic oikocrysts, subophitic grains, and blocky and interstitial grains. Heavily altered to clays and fibrous amphibole.
Magnetite	1.4	1.4	to 0.1		Skeletal	Vermicular incipient maghemite? alteration to several percent of each grain.
Spinel	0.3	0.3	0.03–0.32		Euhedral	Resorbed, vermicular scalloped and oxidized margins, some with magnetite on margins. As groundmass grains and inclusions in olivine - these inclusions may be unoxidized (were armored).
Mesostasis	0	3.2				Completely altered to pale green clays and fibrous amphiboles.

COMMENTS: Groundmass also contains <1% (about 0.3% in point count) of sulfides, consisting principally of anhedralpyrite (to 0.1 mm) that occurs in the groundmass as well as rimming and within cracks of altered olivine. Traces of anisotropic pentlandite? (to 0.06mm) that occur as anhedral blebs within or attached to pyrite. Rock is moderately altered (21.2%), with alteration consisting of very pale green clays and fibrous actinolite replacing much of clinopyroxene and a small amount of plagioclase in groundmass- is not always apparent what it is replacing. Sulfide point count is suspect as is done from shape alone; total point counts were 1500.

147-894G-2R-2 (Piece 11, 73–75 cm) OBSERVER: VAR WHERE SAMPLED: Unit 2
ROCK NAME: Moderately plagioclase phyric basalt
GRAIN SIZE: Fine
TEXTURE: Porphyritic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	3–5	3–5	to 5		Subhedral-euhedral	All phenocrysts are plagioclase.
GROUNDMASS						
Plagioclase	60	60	<1		Laths	Interlocking, unoriented network.
Clinopyroxene	20	35	1		Anhedal	Some subophitic textures as plagioclase laths are partially engulfed by clinpyroxene.
Olivine	2	5		<1	Subrounded	
Spinel	2	<1			Euhedral	
Opaque minerals	0.5	0.2			Subrounded, laths, irregular	Includes magnetite, ilmenite, pyrite, and chalcopyrite.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Amphibole	15	Clinopyroxene, olivine	Degree of replacement higher near veins.
Talc	Trace	Olivine	
Chlorite	Trace	Olivine	
Magnetite	Trace	Olivine	

COMMENTS: Two morphologies of spinel present, tiny octahedra and larger crystals with silicate inclusions. Possibly three vein types in mutually crosscutting relationship. No deformation or obvious alignment of groundmass phases or phenocrysts.

147-894G-2R-2 (Piece 15, 104–105 cm) OBSERVER: PED WHERE SAMPLED: Unit 2
ROCK NAME: Highly plagioclase olivine phyric basalt
GRAIN SIZE: Fine
TEXTURE: Glomeroporphyritic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Olivine	0.9					
Plagioclase	11.5					
GROUNDMASS						
Spinel	1.7	0.1			Tiny octahedra	Uniformly distributed throughout the section.
Magnetite	0.6	0.1			Subrounded to equant	
Ilmenite	0.6				Laths	
Plagioclase	47.4	0.1–0.6				
Clinopyroxene	16.3	36.7	0.2–0.7			

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Amphibole	25	Clinopyroxene, olivine	Actinolite. Anastomosing networks of thin veins made of chlorite and actinolite.
Talc	Trace	Olivine	Talc appears to be the first mineral to replace olivine, followed by actinolite then chlorite. Magnetite possibly with chlorite.
Chlorite	Trace	Olivine	
Magnetite	Trace	Olivine	

COMMENTS: Consists of glomeroporphyritic aggregates of plagioclase with sparse olivine in a fine-grained matrix of primarily plagioclase with some clinopyroxene and opaque minerals. Glomerophenocrysts range in size up to 5.5 mm. Matrix is unoriented plagioclase microlites with intergranular pyroxene and miniscule opaque minerals. Undeformed, unlayered but contains some fracturing with alteration rinds of brown zeolites.

147-894G-2R-2 (Piece 15, 110–113 cm) OBSERVER: JFA WHERE SAMPLED: Unit 2
ROCK NAME: Highly plagioclase olivine phyric basalt
GRAIN SIZE: Fine
TEXTURE: Porphyritic, subophitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	10.5	10.8	0.6-3.5		Subhedral	Resorbed on edges, contain inclusions of plagioclase (to 0.8 mm); melt inclusions are abundant in some crystals (to 0.3 mm); are slightly altered to clays and amphiboles along cracks.
Olivine	0.4	1.0	1-2		Euhedral-subhedral	Partially to completely altered to clays.
GROUNDMASS						
Plagioclase	45.2	48.7	to 2		Lathlike; Anhedral	Some are blocky anhedral. Some are partially altered to clays and actinolite.
Clinopyroxene	23.4	35.8	to 2		Anhedral	Ophitic and subophitic texture; other grains are blocky and interstitial. Are heavily altered to clays and actinolite.
Cr-Spinel	Trace	Trace	0.1		Euhedral	Single inclusion in olivine.
Magnetite	1.5	1.5	to 0.1		Skeletal	Get vermicular incipient alteration to maghemite? in some-varies grain to grain but is typically 1% or less of grains.
Mesostasis	0	2.1				Completely altered to pale green clays and fibrous amphibole (actinolite).

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE
Vesicles	None				

COMMENTS: Pyrite grains in groundmass are anhedral (to 0.02 mm); also occur on rims and in cracks of altered olivine. Pentlandite? may occur as very small (to 0.004 mm) blebs within or associated with pyrite-is a slightly more pale yellow and is anisotropic. Sulfides in transmitted light point count were 0.1%, likely an undercount due to counting by shape; are less than <1%. Rock is moderately altered (16.8%); 1500 point counts taken. Metamorphic alteration of very pale green clays and fibrous actinolite replaces much of clinopyroxene and a small amount of plagioclase in groundmass. Not always sure what secondary minerals are replacing.

147-894G-2R-3 (Piece 3, 11–14 cm) OBSERVER: FRU WHERE SAMPLED: Unit 3
ROCK NAME: Gabbro
GRAIN SIZE: Medium
TEXTURE: Hypidiomorphic granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	0	1.5	0.6–2.0		Subhedral	Totally altered.
Plagioclase	5–15	52.1	1–5		Euhedral to subhedral	Some crystals are zoned.
Clinopyroxene	8–10	45.6	1–6		Anhedral	
Magnetite	0.45				Equant, semirounded	Mottled exsolution. Interstitial.
Ilmenite	0.05				Laths	Exsolution etched.
Total sulfide	0.4	1.0			Spongy, Irregular	0.08% sp pyrite, 0.12% chalcopyrite as altered of hematite(?) and 0.2% sphalerite in veins with prehnite. Sphalerite is hexagonal, euhedral, zones are lime green, orange, and honey yellow. Occurs with pyrite and chalcopyrite.
Apatite	0.1					Contains abundant liquid-dominated and vapor-rich to vapor-dominated fluid inclusions which are probably CO2 filled.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Chlorite	8	Pyroxene, microfractures	4% after pyroxene, 1% after olivine, 3% filling fractures.
Plagioclase	35–45	Plagioclase	Heterogeneously altered, locally primary plagioclase only 20%–40% altered. Plagioclase grains commonly fractured with undualtory and patchy extinction.
Clinopyroxene	0.6	Clinopyroxene	Contains fluid inclusions.
Calcic	27	Clinopyroxene, orthopyroxene, olivine	25% after clinopyroxene, 1% after olivine, 2% after amphibole orthopyroxene. Commonly as light green fibrous grains and radiating clusters, more abundant near prehnite veins.
Cummingtonite	<1	Orthopyroxene	Fibrous to bladed, colorless
Prehnite	2	Veins	Locally filling up to 5 mm wide brecciated zone.
Oxide, sulfide minerals	0.5	Clinopyroxene, olivine	
Clay	3.5	Plagioclase, clinopyroxene and orthopyroxene	2% after plagioclase, 1.5% after pyroxene, locally in veinlets.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Veins			to 5 wide	Prehnite, chlorite		Complex branching net of composite veins. Chlorite typically rims prehnite. Locally cut by veinlets of green-brown clay.

COMMENTS: Highly altered and locally deformed gabbro, cut by net of composite prehnite-chlorite veins. Clinopyroxene is highly altered to fine-grained intergrown mats of pale-green fibrous amphibole rimmed by darker, blue-green amphibole and minor brown amphibole and secondary clinopyroxene. Prehnite-filled breccia zone (up to 5 mm wide) rimmed by 0.2 mm wide discontinuous seam of prehnite with a 0.2 mm wide continuous rim of chlorite. Prehnite encloses individual clasts of chlorite, clinopyroxene, sphalerite with associated pyrite and gabbro fragments and minerals. Brittle fracturing of plagioclase and clinopyroxene grains in wall rock associated with prehnite-vein formation. Prehnite veins locally cut by 0.1–0.4mm wide veinlets, dominantly greenish brown clay, but vary mineralogically depending on mineral which is being cut.

147-894G-2R-3 (Piece 5, 32–35 cm) OBSERVER: FRU WHERE SAMPLED: Unit 3
ROCK NAME: Olivine gabbro
GRAIN SIZE: Medium
TEXTURE: Hypidiomorphic granular, ophitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	0	7	0.04–2.0		Subhedral	Pseudomorphed by chlorite in cores and fibrous amphibole along rims.
Plagioclase	1.2	48	0.4–5.0		Euhedral to subhedral	Undulatory extinction. Altered to secondary plagioclase and clay, giving dusty appearance. Microcracks filled with chlorite. Overgrown by green amphibole or chlorite at grain boundaries to clinopyroxene.
Clinopyroxene	8.4	44	0.6–6		Euhedral to subhedral subhedral	Heterogeneously altered to fibrous green amphibole, locally chlorite.
Magnetite	0.1		to 1.0		Subrounded	Interstitial. Mottled exsolution.
Ilmenite	0.4		to 1.0		Laths	Exsolution etched to leave laths.
Total sulfide	0.2				Subrounded, irregular	50% pyrite, 50% chalcopyrite. Sphalerite occurs with pyrite. In veins with amphibole.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Chlorite	24.8	Olivine, clinopyroxene, unknown	Commonly in patches with amphibole.
Plagioclase	33.1	Plagioclase	
Epidote	Trace		
Clinopyroxene	<1	Clinopyroxene	Clear blocky grains.
Green amphibole	25.5	Clinopyroxene, olivine, unknown	Commonly as fibrous mats or clusters of radiating cystals, with chlorite as replacement of olivine.
Prehnite	0.5		
Sulfide	0.2	Olivine, clinopyroxene, veins	Pyrite, chalcopyrite, sphalerite
Clay and zeolite	3.9	Clinopyroxene, plagioclase	Dark, dusty alteration of primary minerals. Zeolites occur as botryoidal crystals along vein walls and as radiating clusters in vein center.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Veins			to 1.5	Chlorite, prehnite, green amphibole		Discontinuous, sinuous.

COMMENTS: Mode determined by point counting (1500 points, 3 point spacing). Green amphibole replaces primary pyroxene and also occurs as fibrous mats with chlorite in oval and rectangular patches, commonly around clinopyroxene and plagioclase. Rounder occurrences are typically zoned pseudomorphs of primary olivine and are associated with opaques. Chlorite occurs in the centers and amphibole forms rims. Chlorite also occurs in thin mm-wide bands which may be discontinuous veins or an incipient foliation. Sample is cut by discontinuous prehnite + zeolite veins. Minor brittle deformation, characterized by undulatory extinction or cracked relict plagioclase or clinopyroxene with chlorite fillings.

147-894G-2R-3 (Piece 6, 49–52 cm) OBSERVER: MAN WHERE SAMPLED: Unit 3
ROCK NAME: Gabbro
GRAIN SIZE: Medium
TEXTURE: Cataclastic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	8	50	to 15		Subhedral	
Clinopyroxene	8	50	to 15		Anhedral	
Magnetite	0.1	1.0		Semirounded, parallel to foliation.		In lines with amphibole. Mottled exsolution. Etched in shear zone
Ilmenite	0.3	1.0				
Pyrite	0.4	1.0				

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Plagioclase	32	Plagioclase	
Clinopyroxene	3	Clinopyroxene	
Amphibole	29	Clinopyroxene	Minor brown and blue-green. Most is green.
Prehnite	3.7		In late veins.
Oxide	0.4		
Sulfide	0.4		Pyrite in shear zones. Trace sphalerite in prehnite veins.
Zeolite	0.5		In prehnite veins.
Unknown	15		Fine-grained material in shear zones.

COMMENTS: Pervasively altered, cataclastically deformed metagabbro. Amphibole and albite in shear zone suggest some alteration of gabbro predates shearing. Most minerals in shear zone are so highly comminuted that they can not be identified optically. Prehnite + zeolite + sphalerite veins crosscut shear zone. Rock is locally foliated. Foliation is defined by alternating ultracataclasite/cataclasite layers and alignment of clasts within layers. Well-developed Reidel shear geometries. Severe grain size reduction of all phases in shear zones. Kinematic indicators: asymmetric clasts, Riedel geometries, rotation of foliations.

147-894G-2R-3 (Piece 11, 78–80 cm) OBSERVER: FRU WHERE SAMPLED: Unit 3
ROCK NAME: Gabbro
GRAIN SIZE: Medium
TEXTURE: Cataclastic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	2	55	to 4		Subhedral to anhedral, tabular	
Clinopyroxene	15	45	to 3		Anhedral	
Magnetite	0.35	0.4			Subrounded	Interstitial.
Ilmenite	0.35	0.4			Subrounded	
Pyrite	0.4	1.0			Elongate, patchy	Parallel to foliation, with amphibole and chlorite.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Chlorite	10–15	Olivine, orthopyroxene, clinopyroxene?	7%–8% after olivine; 1%–2% after orthopyroxene; 2%–5% after clinopyroxene. Intergrown with fibrous green amphibole and less commonly as patches with zeolite rimmed by fibrous, pale green amphibole.
Plagioclase	30–35	Plagioclase	
Amphibole	29–33	Clinopyroxene, orthopyroxene?, olivine	25%–27% after clinopyroxene; 3%–4% after orthopyroxene; 1%–2% after olivine. Mostly green to blue-green and fibrous. Minor brown and light green grains.
Prehnite	1–2		Also occurs in veins.
Oxide	0.3	Olivine, Clinopyroxene	
Clay	5–10	Plagioclase, clinopyroxene	Up to 80% occurs as matrix in ultra-cataclastic zones. Also occurs as discontinuous veins.
Zeolite	0.5		

COMMENTS: Modes are visual estimates. Very heterogeneous grain sizes and degree of alteration and deformation. Away from shear zones, clinopyroxene and plagioclase form rounded to subangular porphyroclasts. Close to shear zones, clast size decreases and degree of alteration and clay content increase. Prehnite veins crosscut cataclastic zones at high and low angles. Two zones of localized shearing have ultracataclastic to cataclastic textures and well-developed Riedel shear fabric. Chlorite veins are syn- to post-shearing. Two prehnite veins post-date shear zone development. Alteration of igneous mineralogy predates shearing. Kinematic indicators: sigmoidal clasts, Riedel shear fabrics.

147-894G-2R-3 (Piece 14, 118–120 cm) OBSERVER: JAY WHERE SAMPLED: Unit 3
ROCK NAME: Olivine gabbro
GRAIN SIZE: Medium to coarse
TEXTURE: Varitextured

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	2.0	11.4	<0.5–1.6		Anhedral	Pervasively altered and fractured. Alteration haloes common. Occasionally mantled by orthopyroxene.
Plagioclase	42.3	48.7	<1 to 2.7		Subhedral-anhedral	Lath-shaped. Variable grain size, small crystals common as inclusions in clinopyroxene, large crystals with no interstitial material form interlocking network. Alteration common where in contact with altered olivine.
Clinopyroxene	21.4	39.2	<1–9		Anhedral	Moderately to pervasively altered. Ophitic and subophitic textures common. Rare opaque inclusions.
Orthopyroxene	0.2	0.3	2		Anhedral	Occurs exclusively in contact with and as mantles around olivine.
Magnetite	0.12	0.12	0.7		Semirounded/irregular	Interstitial with amphibole.
Ilmenite	0.12	0.12			Laths	Larger than magnetite.
Pyrite	0.10	0.10	0.3			Sphalerite intergrown with pyrite.
Chalcopyrite	0.06	0.06	0.3			Patches with amphibole.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Chlorite	2	Clinopyroxene/olivine	In a few patches, may be replacing actinolite after clinopyroxene. 0.2% replacing clinopyroxene, 1.8% replacing olivine.
Plagioclase	6		Dusty, pinkish patches.
Clinopyroxene	<0.5		
Amphibole	18.1	Clinopyroxene/olivine/plagioclase	Minor amphibole replacing olivine. Trace replacing plagioclase in contact with olivine.
Cummingtonite	Trace	Olivine	
Talc	4.5	Olivine	
Magnetite	1.8	Olivine	

COMMENTS: IGNEOUS: Mode is point counted, 1500 points, counting interval 0.5 mm. Phaneritic, varitextured olivine gabbro.Variable grain size, predominantly medium-grained, but with large ophitic to subophitic pyroxenes up to 9 mm across. Plagioclase also exhibits variable grain size. Plagioclase appears to be the least altered primary phase, clinopyroxene somewhat less altered and olivine pervasively altered. METAMORPHIC: Total alteration >30%. 85% of olivine replaced by 20% magnetite, 20% chlorite (cores of crystals), 10% actinolite (crystal rims in contact with plagioclase) and 50% talc. 45% of clinopyroxene altered to actinolite with minor brown and blue-green amphibole. Minor actinolite also replaces plagioclase. Minor chlorite replaces actinolite. STRUCTURAL: No evident fabric. Plagioclase occasionally exhibits undulose extinction.

147-894G-4R-1 (Piece 5, 24–26 cm) OBSERVER: TRE WHERE SAMPLED: Drilling Rubble
ROCK NAME: Moderately plagioclase olivine clinopyroxene phyric basalt
GRAIN SIZE: Medium
TEXTURE: Coarsely porphyritic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	0	1	2–6		Euhedral	Occurs as discrete crystals and with plagioclase together forming glomerocrysts. Completely replaced by green clay and minor serpentine.
Plagioclase	5	5	2–10		Subhedral to	Occurs as discrete euhedral glomerocrysts with euhedral olivine as well as large glomerocrysts by itself. Plagioclase glomerocrysts contain abundant melt inclusions and have resorbed margins.
Clinopyroxene	1	1	2–4		Anhedral	Zoned, strongly resorbed.
Plagioclase	36	36	2–6		Subhedral	Intergranular to clinopyroxene.
Clinopyroxene	36	36	2–6		Subhedral to anhedral	Displays an intergranular texture with plagioclase, some clinopyroxene shows subophitic textures.
Olivine	0	10	1–3		Subhedral	Completely replaced by green clay.
Magnetite	5	5	0.15–0.3 mm		Skeletal to equant	
Sulfide minerals	1	1	0.15–0.3 mm		Anhedral	80% pyrite 20% chalcopyrite. Nets of sulfide minerals in veins.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Clay	63	Olivine and interstitial melt	
Chlorite	31	Interstitial melt	
Serpentine	6	Olivine phenocrysts	

COMMENTS: Modes visual estimation only. The rock contains about 5% melt now replaced completely by chlorite and clay. The melt occurs interstitially to plagioclase and clinopyroxene in the groundmass as well as in discrete 'patches'. The total alteration present in the rock is estimated to be approximately 15%.

147-894G-4R-1 (Piece 16, 113–120 cm) OBSERVER: JAY WHERE SAMPLED: Unit 4
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium to coarse
TEXTURE: Varitextured

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	55	55	1–3.6		Subhedral	Tabular laths form interlocking network with no interstitial material.
Clinopyroxene	15	30	1–4.4		Anhedral	Moderately to pervasively altered, large range in grain size.
Orthopyroxene	10	15	3–8		Anhedral	Poikilitic including plagioclase. Generally appears less altered than clinopyroxene.
Magnetite	0.8	2			Subrounded	95% igneous, 5% in altered clinopyroxene. Lattice exsolution.
Ilmenite	0.1	<2			Subrounded	
Pyrite	0.068	0.4				In cracks in plagioclase.
Chalcopyrite	0.03	0.4				In amphibole.
Pyrrhotite	0.002					In amphibole.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Plagioclase	3	Plagioclase	Dusty appearing, commonly in contact with other altered phases.
Amphibole	20	Pyroxene	Minor brown amphibole, mostly green.
Clinopyroxene	2	Clinopyroxene	
Oxide minerals	1	Pyroxene	Fine-grained blebs with secondary clinopyroxene and amphibole.

COMMENTS: IGNEOUS: : Modal % estimated. Actual point count- 1511 points, counting interval 0.5 mm. Plagioclase-885 (58.3%); altered plagioclase 10 (0.4%); clinopyroxene-226 (14.7%); altered clinopyroxene-133 (8.8%); orthopyroxene-124 (7.8%); altered orthopyroxene-136 (8.9%); opaques-12 (0.8%). Phaneritic, inequigranular, poikilitic (ophitic) to intergranular, varitextured gabbronorite. Sulfides have subrounded, subangular, spongy to elogate habits and occur in patches. METAMORPHIC: Moderately altered, mode is visual estimate. Pyroxene alteration represents most of secondary assemblage. Orthopyroxene 40%–50% altered, clinopyroxene 20%–25%. Paragenesis after clinopyroxene is secondary clinopyroxene to brown amphibole to green amphibole. STRUCTURAL: No fabric or preferred orientation of minerals. No deformation.

147-894G-4R-2 (Piece 10, 67–71 cm) OBSERVER: LAK WHERE SAMPLED: Unit 4
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium
TEXTURE: Hypidiomorphic granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	50.6	59.7	1–5		Euhedral-subhedral	Portions of plagioclase grains are dirty in appearance. Twinned, well-developed zoning. Moderately fractured, with alteration along grain boundaries and fractures.
Clinopyroxene	3.8	30.5	2–5		Anhedral	Heavily altered, poikilitic, enclosing plagioclase.
Orthopyroxene	1.4	7.2	2–3		Anhedral	Heavily altered.
Magnetite	0.3					Interstitial, patchy.
Ilmenite	1.1					Interstitial, patchy.
Pyrite	0.1					Irregular, equant, subangular.
Chalcopyrite	0.1					Associated with amphibole.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Plagioclase	4.5	After plagioclase	
Epidote	1	After plagioclase	Not included in point count.
Amphibole	11.9	After clinopyroxene	Fibrous, light green amphibole, and as coarser, dark green amphibole with cleavage.
Amphibole	1.2	After plagioclase	Commonly along grain boundaries.
Amphibole	1.6	After orthopyroxene	
Oxide	1.6	After clino and orthopyroxene	Inclusions within amphibole.
Clays	13.5	After pyroxene	Both clinopyroxene and orthopyroxene, typically along cleavage planes.
Clays	2	After plagioclase	Commonly along grain boundaries and fractures.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Fractures					Thin, continuous	Tensile fracture, rimmed with a light yellow alteration clay.

COMMENTS: Moderately developed magmatic foliation, dipping steeply to core coordinate east (Textural type M2). Slight undulose extinction of plagioclase. Mode percents are point counted; 1500 points.

147-894G-5R-1 (Piece 5, 28–30 cm) OBSERVER: TRE WHERE SAMPLED: Unit 6
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium
TEXTURE: Hypidiomorphic granular

147-894G-5R-1 (Piece 5, 28–30 cm) OBSERVER: TRE WHERE SAMPLED: Unit 6
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium
TEXTURE: Hypidiomorphic granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	0	0.4	1		Anhedral	Rimmed by opx and alteration products of opx. completely replaced by secondary oxide, green clay, and serpentine.
Plagioclase	43.5	55.6	0.24–2.4	An45	Subhedral, anhedral	Tabular, slightly altered to brown clay along cleavage planes and fractures. Green amphibole forming along fractures.
Clinopyroxene	3.8	36.9	0.48–3.12		Anhedral	Secondary oxides forming along cleavages and exsolution lamallae, replaced by green amphibole.
Orthopyroxene	0.1	6.5	1.4–4		Anhedral	Replaced by pale green amphinole and secondary oxides.
Opaque minerals	0.1	0.1	0.24–1.8		Spongy	Magnetite, ilmenite, sphalerite, chalcopyritte, and pyrite.
Apatite	<0.01	<0.01	0.8		Euhedral	
Zircon	<0.01	<0.01	0.6		Euhedral	

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Green amphibole	33.1	Clinopyroxene, plagioclase	
Pale green amphibole	6.4	Orthopyroxene	
Serpentine	0.4	Olivine	
Clays	12.1	Plagioclase	

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE

COMMENTS: Primary silicate mode based on point counting (n=1500, counting interval 0.5 mm). Secondary mineralogy mode visual estimation only. Plagioclase composition by optical estimation.

147-894G-6R-1 (Piece 4A, 26–28 cm) OBSERVER: JFA WHERE SAMPLED: Unit 6
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium
TEXTURE: Ophitic, hypidiomorphic granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	45–50	50–60	to 3.2		Subhedral to anhedral	As blocky laths and smaller subhedral grains. Slight dusting of brown clay. Altered to green amphibole on edges; altered to amphibole and clays along cracks and in patches. Contain inclusions of clinopyroxene to 0.6 mm.
Clinopyroxene	10–15	20–25	to 5		Anhedral	Many grains exhibit strong exsolution-are locus of alteration. Heavily altered to green amphibole.
Orthopyroxene	10–15	20–25	to 4		Anhedral	As oikocrysts enclosing plagioclase and clinopyroxene, and as interstitial grains. Heavily altered to green amphibole, perhaps more altered than clinopyroxene.
Fe-Ti Oxide minerals	<1	<1	to 1.5		Anhedral, irregular	Is nearly all ilmenite (bireflectant) with exsolved laminae of magnetite. As interstitial grains or inclusion in plagioclase and pyroxene.
Sulfide minerals	<<1	<<1	to 0.4		Anhedral	As inclusions in plagioclase and pyroxene. Most is pyrite, with substantial chalcopyrite and associated pentlandite. Intergrown chalcopyrite/pentlandite grains commonly occur independently of pyrite.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Brown clays	<1	Plagioclase	As brown dusting on some crystals.
Clays	<1	Plagioclase, vein	Smectitic? Fibrous in large vein.
Brown amphibole	<<1	Pyroxene	Few patches associated with green amphibole.
Green amphibole	20–25	Pyroxene, plagioclase	Fibrous, light green.
Plagioclase	1–2	Primary plagioclase	Replacing plagioclase in most heavily altered parts of rock.
Clinopyroxene	<1	Primary pyroxene	In small patches associated with amphibole.
Magnetite	<1	Pyroxene	Disseminated throughout amphibole; typically <0.2 mm in size and anhedral.
Pyrite	<<1	Pyroxene	Disseminated throughout amphibole; difficult to differentiate from primary pyrite.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Veins	<1	Across thin section	0.2–0.3	Clays		Most of infilling minerals are plucked.

COMMENTS: All minerals in zones near crosscutting vein are heavily to pervasively altered. Thin section is heavily plucked and poorly polished.

147-894G-6R-1 (Piece 4A, 26–28 cm) OBSERVER: NAT WHERE SAMPLED: Unit 6
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium-grained; 1–6 mm
TEXTURE: Subhedral granular; poikilitic to subophitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	50	55	1–3		Euhedral to subhedral	Subhedral in granular parts of section. Euhedral where enclosed in orthopyroxene.
Clinopyroxene	15	30	1–3		Subhedral, anhedral	Commonly twinned, locally with orthopyroxene exsolution lamellae.
Orthopyroxene	10	15	1–6		Anhedral	Some are oikocrysts enclosing euhedral plagioclase and, rarely, subhedral clinopyroxene.
Total opaques	<1	<1	0.1–1.5		Irregular	Interstitial, mainly ilmenite with narrow exsolved rutile; intergrown with magnetite which has blade-like trellis exsolution of ilmenite.
Pyrite	Tr	Tr			Anhedral, in clumps with other sulfides	Secondary
Pyrrhotite	Tr	Tr				Secondary with bent cleavage.
Chalcopyrite	Tr	Tr			Irregular within	Solely within intergrowths with pyrite intergrowths and secondary pyrrhotite.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Plagioclase	5	Plagioclase	Secondary plagioclase is pitted, mottled, and somewhat discolored.
Green amphibole	20	Pyroxenes	
Brown amphibole	Tr		Small amounts present in patches of green amphibole.
Sulfides	Tr		Associated with green amphibole. See comments above.
Magnetite	Tr		Forms along fibers of green amphibole in secondary pseudomorphs of clinopyroxene.

COMMENTS: IGNEOUS. Thin section is thin on one side. Orthopyroxene is mostly in one part of the thin section, mainly as oikocrysts enclosing euhedral plagioclase and some subhedral clinopyroxene. Locally, plagioclase-orthopyroxene intergrowths are almost symplectic. Clinopyroxene has distinctive cleavage and sometimes exsolution lamellae. METAMORPHIC. Most of the alteration is as green amphibole after both pyroxenes and penetrating along grain boundaries and cracks in plagioclase. Amphibole is fine, fibrous, locally bluish green. It has some minor brown amphibole and small crystals of secondary magnetite. Sulfides are intergrowths of secondary pyrrhotite with pyrite and chalcopyrite. Small amounts are distributed along cracks and disseminated in amphibole. Some intergrowths are partly surrounded and penetrated by secondary magnetite in veinlets and in secondary amphiboles. The rock has a 0.2 mm vein mainly plucked, but retaining some clear fibrous amphibole. STRUCTURE. One vein.

147-894G-6R-1 (Piece 8A, 86–89 cm) OBSERVER: LEC WHERE SAMPLED: Unit 6
ROCK NAME: Gabbronorite
GRAIN SIZE: Coarse (2–10 mm)
TEXTURE: Subhedral granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	40	50	1–10		Subhedral	
Clinopyroxene	10–15	35	1–7		Anhedral	
Orthopyroxene	0	15	1–3		Anhedral	Completely replaced, but there is strong relict exsolution.
Total oxides	<1	<1	0.1–2		Irregular	Interstitial, conforms to grain boundaries. Mainly ilmenite with rutile exsolution.
Sulfides	Tr	Tr	<0.1		Irregular	See secondary mineralogy below.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Clays	15	Clinopyroxene	Dull brown to pale reddish brown in color.
Chlorite	5	Plagioclase	
Albite	10	Plagioclase	Most plagioclase replaced by secondary plagioclase, and criss-crossed by fractures with amphiboles.
Sulfides	Tr		Mainly secondary pyrite, irregular in shape, intergrown with chalcopyrite.
Magnetite	Tr		Tiny crystals along fibers of green amphibole.
2nd clinopyroxene	1.5–2	Clinopyroxene	Small clear grains clinopyroxene
Brown amphibole	1.5–2	Clinopyroxene	Small grains
Cummingtonite	15	Orthopyroxene	Much of this is altered to clays

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE
Vesicles					

COMMENTS: The section is poorly polished. The rock is uniformly coarse grained and without foliation. Microscopic smectite and chlorite veins cut the plagioclases. Relative proportions of secondary products of the two pyroxenes are difficult to estimate.

147-894G-6R-2 (Piece 6, 82–85 cm) OBSERVER: JFA WHERE SAMPLED: Unit 6
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium to coarse
TEXTURE: Ophitic, intergranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	40–45	40–45	to 6		Tabular subhedral to anhedral	Slight alteration to green amphibole along cracks and edges with dusting of some with brown clay. Some are poikilitic enclosing clinopyroxene.
Clinopyroxene	25–30	30–40	to 5		Anhedral	Partially to completely altered to fibrous green amphibole.
Orthopyroxene	15–20	2–25	to 10		Anhedral	As large, irregular ophitic grains or interstitial grains. Partially to altered to fibrous green amphibole.
Oxide minerals	1	1	to 2		Anhedral	As interstitial grains of exsolved, intergrown and attached magnetite and ilmenite.
Sulfide minerals	<1	<1	to 0.4		Rounded, anhedral	Most is pyrite; commonly with oxides. Interstitial or within primary silicate phases. Chalcopyrite (to 0.1 mm) occurs as blebs associated with pyrite; lighter yellow blebs within chalcopyrite (to 0.03 mm) are likely pentlandite.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Amphibole	15–20	Pyroxene, plagioclase	Fibrous, light green; some intergrowth with patchy, greatly subordinate brown amphibole.
Chlorite	1–2	Pyroxene	Intergrown with amphibole.
Clays	<1	Plagioclase	Fine-grained, brown dusting on a few plagioclase grains.
Magnetite	<<1	Pyroxene	Small (<0.1 mm), anhedral, disseminated grains in amphibole replacing pyroxene.
Sulfide	<<1	Pyroxene	As small, irregular (<0.1 mm) grains disseminated in amphibole.

COMMENTS: No magmatic structural features present. Rock is moderately metamorphosed.

147-894G-7R-1 (Piece 13, 75–77 cm) OBSERVER: JFA WHERE SAMPLED: Unit 6
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium to coarse
TEXTURE: Hypidiomorphic granular, ophitic to subophitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	55–60	60–65	to 10		Tabular, subhedral	Patchy extinction. Incipient alteration along cracks to green amphibole; incipient alteration to brown clays? in some crystal areas.
Clinopyroxene	10	20	to 5		Anhedral	Heavily altered to brown and green amphibole and magnetite. Exsolution lamallae preserved in secondary minerals.
Orthopyroxene	7	15	to 8		Anhedral	Large oikocrysts and ophitic/subophitic grains. Heavily altered to brown and green amphiboles. Cleavage more visible than in clinopyroxene; exsolution is relatively minor. Some grains enclose clinopyroxene. Pink to green pleochroism.
Magnetite	1	1	to 5		Anhedral	As interstitial grains. Small (to 0.05 mm) elongate blebs of exsolved ilmenite.
Quartz	<<1	<<1	to 0.7		Anhedral	Loaded with fluid inclusions between plagioclase laths.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Green Clinopyroxene	20–25	Clinopyroxene, brown amphibole, plagioclase	Fibrous, pale green; replaces clinopyroxene and earlier brown amphibole.
Brown	3	Clinopyroxene, orthopyroxene	Green-brown pleochroism; some is subhedral; 60/120 degree clinopyroxene cleavage. Earlier forming amphibole phase-is being replaced by later green amphibole, with two sometimes intimately intermixed.
Brown clays	3	Plagioclase	Very fine, patchy, dusty overprint on plagioclase.
Magnetite	<1	Pyroxene	Anhedral grains to 0.03 mm; disseminated.
Sulfide	<<1	Pyroxene	Anhedral grains to 0.005 mm. Think are pyrite (isotropic).

COMMENTS: Alteration increases towards upper left hand corner of section; increasing diagonally up core (section is oriented). Rock is moderately metamorphosed (about 30% metamorphic minerals). Visual estimates are given. Rough flow alignment in three bands of plagioclase tabular crystals in direction parallel to core elongation (textural type M1).

147-894G-7R-2 (Piece 4, 35–38 cm) OBSERVER: DSK WHERE SAMPLED: Unit 6
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium
TEXTURE: Hypidiomorhic; ophitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	4.6	50.5	0.4–3.2		Subhedral-anhedral	Pervasively altered, weak and patchy zoning.
Clinopyroxene	0.4	32.1	0.41–2.8		Subhedral	Dusty brown in plane light due to fine-grained opaque inclusions, clay and amphibole.
Orthopyroxene	12.4	16.5	0.45–8.0		Anhedral to subhedral	Oikocrysts, ophitic.
Magnetite	0.2				Anhedral	Rimmed by green amphibole.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Clay	2.2	After plagioclase	
Clay	17.1	After clinopyroxene	Very fine intergrowths of amphibole?, microfracture-related oxides, and clay?
Zeolites	7.7	After plagioclase	Fibrous pale-brown pods (0.18 mm in size).
Plagioclase	35.9	After plagiocalse	Turbid, dusty, fluid inclusion filled, cut by very fine pale green to green amphibole veinlets.
Actinolite	0.4	Cutting plagiolcase	Veinlets in plagioclase and rimming grain boundaries.
Amphibole	6.3	Clinopyroxene	Green to pale yellow green, fibrous, heterogeneous alteration, intergrown with secondary clinopyroxene.
Clinopyroxene	8.3	After clinopyroxene	Optically continuous, pale green, commonly mottled.
Amphibole	3.4	After orthopyroxene	Fine-grained, pale gray green mats and coarser grained bladed (cummingtonite?) + 0.7% oxides after clinopyroxene and orthopyroxene.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vein			0.4	Zeolite	Irregular	
Patch			1.8	Prehnite + zeolite		Intergown patch.

COMMENTS: Sample is cut by irregular 0.4 mm wide zeolite vein and a patch of intergrown zeolite and prehnite. Rare coarse-grained oikocrysts of altered orthopyroxene enclose plagioclase.

147-894G-8R-1 (Piece 5A, 39–42 cm) OBSERVER: DSK WHERE SAMPLED: Unit 6
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium
TEXTURE: Hypidiomorphic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	15	55	0.2–5.2		Anhedral to subhedral	Minor subgrain development.
Clinopyroxene	0.5	29.5	0.6–4		Anhedral to subhedral	Brown in plane light due to abundant oxide inclusions, amphibole, and clay?
Othopyroxene	0	15	0.3–4.5		Anhedral to subhedral	Brown dusty in plane light.
Magnetite	0.5		0.1–0.8		Anhedral	Interstitial

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Clay	20	After plagioclase	Brown, fine-grained.
Clay	10	After orthopyroxene	Intergrown with amphibole and very fine oxides.
Clay	15	After clinopyroxene	Intergrown with amphibole, very fine oxides along fractures, and clay?
Clinopyroxxene	7	After clinopyroxene	Clear to inclusion-filled and mottled.
Actinolite	2	After plagioclase	Pale green, also trace epidote.
Amphibole	5	After orthopyroxene	Colorless to pale green (cummingtonite?), rimmed by pale green amphibole.
Plagioclase	18	After plagioclase	Clear to dusty and turbid.
Amphibole	7	After clinopyroxene	Associated with trace pyrite, is pale yellow green, fibrous to well developed.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vein			3	Prehnite		Rimmed by chlorite (0.6 mm in width), and contains selvages of pale green chlorite and radiating sprays of epidote.

COMMENTS: Cut by chlorite rimmed prehnite vein with contains selvages of pale-green chlorite, radiating sprays of pale yellow epidote. Vein forms a network with inclusions of wall rock gabbro. Prehnite vein crosscuts very fine chlorite veinlets.

147-894G-8R-1 (Piece 10, 126–130 cm) OBSERVER: PED WHERE SAMPLED: Unit 6
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium, significant grain size variations on the scale of a thin section
TEXTURE: Hypidiomorphic granular, ophitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	45	55	0.5–5	Labradorite	Euhedral-subhedral, tabular	Well zoned often undulatory. Altered to green amphibole, some crystals contain a dusty brown material (clay?)
Clinopyroxene	5	34	0.5–3	Augite	Anhedral	Present partly as oikocrysts. Altered to fibrous green amphibole. Oxides have formed along exsolution lamellaes and cleavage planes, and this results in a brown dull appearance.
Orthopyroxene	1	10	2–6		Anhedral	Present as oikocrysts or smaller interstitial grains. Altered to green fibrous amphibole, oxides have formed along cleavage planes.
Magnetite	<1				Anhedral	Occur as interstitial grains. Contain some exsolved ilmenite

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Plagioclase	2	Plagioclase	
Clinopyroxene	5	Clinopyroxene	
Amphibole	18	Clinopyroxene	Fibrous green, may form intergrown mats.
Amphibole	8	Plagioclase	Anastomosing fibrous green microveinlets.
Amphibole	6	Orthopyroxene	Fibrous colorless.
Amphibole	3	Orthopyroxene	Fibrous green, rimming orthopyroxene.
Clays	3	Clinopyroxene	
Magnetite	Trace	Clinopyroxene, orthopyroxene	Occur mainly along exsolution lamellaes and cleavage planes.

COMMENTS: The thin section is taken from a part of the core where patches, stringers and veins of medium- to coarse-grained gabbronorite occur within a medium-grained gabbronorite. The thin section shows some of the large variability in grain size seen in the core. The variation on the scale of the thin section is gradational, but one relatively abrupt change can be seen. Along this boundary there seems to be a magmatic foliation represented by a crude orientation of plagioclase laths (Textural Type M1). On the relatively more coarse-grained side of the contact there is a 5–10 mm thick plagioclase-enriched zone. The texture of the rock is mainly hypidiomorphic granular but a few oikocryst of orthopyroxene that enclose plagioclase chadacrysts are present. Alteration is heterogeneous, with some zones being pervasively altered.

147-894G-9R-3 (Piece 4, 48–52 cm) OBSERVER: FRU WHERE SAMPLED: Unit 6
ROCK NAME: Gabbro
GRAIN SIZE: Coarse, bimodal
TEXTURE: Intergranular to pegmatitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	20–25	45–50	to 6		Subhedral, tabular to anhedral	Twinned and zoned, locally complex zoning. Altered to secondary plagioclase and clay in patches and along fractures, giving dusty and patchy appearance.Locally fibrous, light green amphibole along grain boundaries.
Clinopyroxene	5–8	35–40	to 6		Subhedral to andhedral	Commonly twinned, very highly altered to secondary pyroxene and green to brown amphibole and oxides, giving patchy, spotted appearance. Locally brownish clay and Fe-oxihydroxides along rims or in microfractures.
Zircon	1	1	to 0.8		Euhedral prismatic	Late magmatic?
Apatite	<1	<1	to 0.5		Subhedral, short prisms	Contain very abundant primary, fluid inclusions.
Oxides/sulfides	1	2	to 2.5		Irregular	Predominantly ilmenite with exsolution lamellae of magnetite and altered to sphene. Variable grain size, commonly forming ring-like aggregates (the centers of which are now holes in the thin section).

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Plagioclase	18–20	Plagioclase	Patchy and irregular replacement along rims and in microfractures of primary plagioclase. Modal percent of secondary plagioclase difficult to estimate in thin section.
Clinopyroxene	18–22	Clinopyroxene	Clear blocky grains with optically continuous extinction, together with green or brown amphibole and minor oxides and clay, giving spotty appearance to primary clinopyroxene in less pegmatitic zones. Characteristically with abundant fluid inclusions.
Amphibole	3–6		Strongly zoned, green to brown pleochroic. Abundant in irregular pegmatitic zones, with ilmenite altered to sphene. May be late magmatic or represent 100% replacement of primary clinopyroxene. About 1% as irregular patches in cores of clinopyroxene.
Green Amphibole	5–10	Pyroxene, plagioclase, brown amphibole	After clinopyroxene 3%–5%, after plagioclase 2%–3%, after amphibole 1%–2%. As rims or individual, fibrous crystals (to3mm long) or as radiating clusters at grain boundaries. Associated with zircon-rich patches of ilmenite altering to sphene.
Sphene	1	Ilmenite	In fractured centers or rimming ilmenite, locally subhedral rhombic crystals, associated with zircon-rich patches.
Oxides/sulfides	1	Clinopyroxene, plagioclase	Very fine-grained, disseminated throughout altered clinopyroxene or along previous exsolution planes. Dark red-brown Fe oxihydroxides replacing rims of amphibole after clinopyroxene.
Clay	3–5	Plagioclase, clinopyroxene	Very fine-grained, patchy occurrence, typically in cores of plagioclase giving dusty appearance. 1%–2% after clinopyroxene, 2%–3% after plagioclase.
Epidote	<1	Plagioclase, clinopyroxene	Minor patches, or as individual suhbhedral, bladed or fibrous crystals.

COMMENTS: Less coarse-grained areas of rock were intergranular, but clinopyroxene are completely replaced by amphibole. Distinctly 2 (possibly 3) generations of amphibole formation. It is difficult to determine origin of very coarse (up to 10 mm long) clusters of green amphibole with clear brown amphibole cores or zircon. These appear to be late stage magmatic (deuteric?), but could also be due to complete hydrothermal replacement. Igneous and secondary modes estimated visually.

147-894G-9R-3 (Piece 5C, 71–77 cm) OBSERVER: TRE WHERE SAMPLED: Unit 6
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium
TEXTURE: Hypidiomorphic granular, but contains ophitic, subophitic, and intergranular textures.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	60	60	0.28 to 2.8		Subhedral, anhedral	Slightly altered to brownish clay, strongly zoned
Clinopyroxene	10	30	1.2 to 6.4		Anhedral	Altered to green amphibole.
Orthopyroxene	5	10	1.2 to 6.4		Anhedral	Altered and replaced by green amphibole. Oikocrysts enclosing plagioclase as well as intergranular crystals with clinopyroxene and plagioclase
Oxide minerals	<1	<1	0.2 to 1.6		Anhedral	

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Clay	1–2	Plagioclase	Brown, patchy incipient alteration of plagioclase
Green amphibole	25	Pyroxene	Pleochroic blue-green to pale green and fibrous
Oxide minerals	<1		Disseminated within green amphibole or forming along former cleavage planes in pyroxene.
Sulfide minerals	<<1	Anhedral	

COMMENTS: Medium-grained part of large thin section cut of Piece 5C. Visual estimation of all modes.

147-894G-9R-3 (Piece 5C, 74–77 cm) OBSERVER: TRE WHERE SAMPLED: Unit 6
ROCK NAME: Oxide gabbro
GRAIN SIZE: Coarse
TEXTURE: Hypidiomorphic granular to subophitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	45	45	0.28–6		Subhedral, anhedral	Complexly zoned, partly subophitic to pyroxene. Incipient alteration to brown clay.
Pyroxene	0	45	1–13		Subhedral, anhedral	Subhedral granular to subophitic, completely replaced by green amphibole.
Oxide minerals	10	10	0.2–2.4		Subhedral, anhedral	Ilmenite and magnetite, dominantly Ilmenite
Apatite	<0.1	<0.1	0.4		Euhedral	
Zircon	<1					Euhedral and subhedral intergrown with ilmenite, average size 0.3 mm.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING		COMMENTS
Oxide minerals	<2	Pyroxene		Associated with secondary green amphobole.
Sphene	<1		Ilmenite	Anhedral replacing ilmenite along fractures.
Sulfide minerals	<1			
Green amphibole	45	Pyroxene, plagioclase		
Clay	<2	Plagioclase		

COMMENTS: Coarse-grained part of large thin section of Piece 5C.

147-894G-9R-3 (Piece 11, 138–142 cm) OBSERVER: PAS WHERE SAMPLED: Unit 7
ROCK NAME: Olivine gabbronorite
GRAIN SIZE: Fine to medium
TEXTURE: Poikilitic/subophitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	5	5–10	0.5–2	Fo85–90	Anhedral	Olivine kernels relatively fresh, but reaction rims of orthopyroxene altered to amphibole. Some oxide on fractures. Some olivines altered to talc and clay with minor iddingsite. Some olivines replaced by carbonate.
Plagioclase	45–50	50	0.5–4	And-Lab. An50	Subhedral, tabular	Plagioclase laths relatively fresh. Some sector twinning and some normal zoning. Many crystals are partly or wholly enclosed in pyroxene oikocrysts. No observed preferred orientation. Inclusions of clay minerals and zeolite?
Clinopyroxene	10	30	0.2–5	?	Anhedral	Forms large oikocrysts enclosing plagioclase and rarely, olivine. Oxide developed along cleavage planes. Altered to amphibole (pale green pleochroic), actinolite, minor chlorite, clays and a colorless amphibole, maybe tremolite.
Orthopyroxene	5	15	0.2–5	?	Anhedral	Slightly pink pleochroic oikocrsts altered to green amphibole in most places, especially where forming reaction rims to olivine.
Oxides	<1	<1	0.5–1	Magnetite	Anhedral	Rare interstitial primary magnetite-some alteration to hematite. Occurs close to unaltered olivine and clinopyroxene kernels.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Clays	5	Olivine and pyroxene	Widely distributed, brown to green-brown. Occurs in clots often with oxides.
Oxides	1	Olivine and pyroxene	Widely distributed on fractures and cracks especially in olivines
Carbonate	<<1	Olivine	Associated with secondary magnetite.
Zeolites	<<0.1	Plagioclase	Occurs as very minor inclusions in some plagioclases.
Chlorite	10	Pyroxenes	Some minor chlorite in unidentified clots together with clays
Actinolite	25	Pyroxenes and olivine	Slightly blue-green fibrous actinolite replaces orthopyroxene and clinopyroxene dominantly perhaps with minor tremolite.
Chalcopyrite	<<0.1		Minor phase as small rounded blebs (0.01 mm) in clinopyroxene.
Plagioclase	<<1	Primary plagioclase	Some minor turbid secondary feldspar.

COMMENTS: Medium-grained gabbronorite shows patchy alteration. In some patches, pyroxenes are completely altered to fine mesh of acicular actinolite with minor chlorite: elsewhere bluish green amphibole replaces both orthopyroxene and clinopyroxene. Olivines appear relatively magnesian where cores are preserved, and show altered orthopyroxene reaction rims. Fresh feldspar laths are less Ca-rich than is expected with these olivine compositions.

147-894G-9R-4 (Piece 11, 133–135 cm) OBSERVER: JAY WHERE SAMPLED: Unit 7
ROCK NAME: Olivine gabbronorite
GRAIN SIZE: Medium
TEXTURE: Poikilitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	50	55	to 2		Subhedral	Broad oscillatory to subundulose zoning common.
Clinopyroxene	10	30	to 10		Anhedral	Large, ameoboid crystals with inclusions of rounded olivine and tabular plagioclase.
Olivine	5	10	to 2		Rounded	Fractured, and ubiquitously mantled by alteration haloes.
Orthopyroxene	3	5	to 5		Anhedral	Commonly in contact with olivine.
Opaques	1.1		to 1		Subrounded to interstitial	Opaques include magnetite, pyrite, chalcopyrite, pentlandite, and pyrrhotite. (In that order of abundance).

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Amphibole	25	Pyroxene, plagioclase, olivine	Clinopyroxene about 60%–70% replaced with light green to blue-green amphibole.
Chlorite	2	Olivine	Common along fractures and with amphibole and talc as mantles around olivine.
Talc	5	Olivine	Commonly intergrown in reaction rims around olivine.
Magnetite	<1	Olivine	Common along fractures and marking original crystal margins of olivine.

COMMENTS: IGNEOUS: Mode estimate. Point counted mode- 1897 points, counting interval 0.5 mm. Plagioclase 918 (48.4%); altered plagioclase 176 (9.2%); clinopyroxene 174 (9.2%); altered clinopyroxene 338 (17.8%); olivine (72 (3.8%); altered olivine 107 (5.6%); orthopyroxene 58 (3.1%); altered orthopyroxene 34 (1.8%); opaques 20 (1.1%). Phaneritic, poikilitic to ophitic. METAMORPHIC: Clinopyroxene pervasively altered. One distinct vein with extensive amphibole replacing clinopyroxene along either side. STRUCTURAL: Poorly developed magmatic foliation, marked by coarser grains of plagioclase (Textural type M1). Small plagioclase included in oikocrysts of pyroxene. No fabric. No lateral displacement along vein filled fracture.

147-894G-10R-1 (Piece 10, 47–50 cm) OBSERVER: FRU WHERE SAMPLED: Unit 8
ROCK NAME: Gabbro
GRAIN SIZE: Medium
TEXTURE: Equigranular to hypidiomorphic granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	0.5	3–5	to 2		Rounded, subhedral to anhedral	Occurs in clusters. Relicts in cores of larger grains, pseudomorphed by magnetite, light green fibrous amphibole, talc, chlorite, and clay along cracks. Minor chlorite + clay inpatches.
Plagioclase	20–25	50–55	to 4		Subhedral, tabular	Encloses up to 0.8 mm sized grains ofanhedral clinopyroxene. Heterogeneously altered, locally with fresh twinned, broadly zoned crystals in patches away from densely veined areas. Light green, fibrous amphibole along grain boundaries and in patches.
Clinopyroxene	10–13	35–40	to 2.5		Anhedral	Altered to fine-grained fibrous amphibole at grain boundaries and along cracks, or to clay in exsolution planes, giving dusty appearance.
Orthopyroxene	1	3–5	to 3		Subhedral to subhedral, tabular	Locally as oikocrysts enclosing anhedral plagioclase, and as intergranular grains. Altered to very fine-grained fibrous light green amphibole.
Magnetite	<1	1	to 1.2		Rounded to irregular	Contain exsolution lamellae of illmenite.
Sulfide minerals	<1	<1				

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Chlorite	2	Olivine, orthopyroxene, plagioclase	Locally as early vein-filling with prehnite and in alteration haloes, or in patches after olivine.
Plagioclase	10–15	Plagioclase	More abundant in areas of dense veining. Occurs with brown clay, giving dusty appearance, and fibrous amphibole inalteration haloes.
Clinopyroxene	5–8	Clinopyroxene	
Green amphibole	13–15	Clinopyroxene	Predominantly light green, locally blue-green pleochroic, fibrous crystals or as fibrous mats. Minor brown amphibole. Away from dense veins, replaces pyroxene in patches, along grain boundaries and in microcracks.
Green amphibole	6-8	Plagioclase, orthopyroxene, olivine	2%–3% after plagioclase, 4%–5% after olivine and orthopyroxene. In plagioclase as fibrous clusters along grain boundaries and in cracks. After orthopyroxene, as very fine-grained fibrous clusters and light green fibrous mats, possibly after talc?
Talc	1–2	Olivine	As fine-grained, slightly green radiating fibrous clusters.
Sulfide/oxide minerals	<1	Olivine, plagioclase, pyroxene	Sulfides predominantly pyrite, less chalcopyrite. Oxides magnetite or ilmenite. Submicron-sized magnetite grains dispersed along cleavage planes in pyroxenes.
Clays	5-6	Plagioclase, pyroxene, olivine, in veins	In cracks and patches, or typically along exsolution planes in clinopyroxene. Late filling in veins. 3%–4% afterplagioclase, 1%–2% after pyroxene, <1% after olivine or in veins.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Veins	2–3		1–3	Prehnite, chlorite, green amphibole clay		First generation, often discontinuous, pinch and swell, forming dense network. Filling of thinner veinlets often depends on mineral which is being crosscut. Minor green-brown clay in center of prehnite and as 0.1–0.5 mm veinlets cutting prehnite veins.

COMMENTS: Bimodal grain size of plagioclase. Major set with grains averaging 1.5–2 mm, second set averages 3–3.5 mm. Heterogeneous alteration associated with dense vein net. Diffuse haloes, characterized by increased replacement of plagioclase by radiating clusters of light green amphibole, chlorite, secondary plagioclase and clays, and replacement of pyroxene by bright green to blue pleochroic amphibole, clays, and minor chlorite. Mineralogy of thinner veins changes depending on adjacent grain: prehnite adjacent to plagioclase; chlorite or colorless, fibrous amphibole near pyroxene; and fine-grained clay, chlorite, and amphibole associated with oxides. Very minor epidote after plagioclase near prehnite veins. Both igneous and secondary mineral modes estimated visually.

147-894G-10R-1 (Piece 13A, 85–87 cm) OBSERVER: AG WHERE SAMPLED: Unit 8
ROCK NAME: Gabbro
GRAIN SIZE: Medium
TEXTURE: Hypidiomorphic granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	53	55	1 to 3		Euhedral-subhedral	Albite and polysynthetically twinned, broad oscillatory zoning common. Dusty appearance common.
Clinopyroxene	28	39	1 to 3		Anhedral	Dusty brown, cleavage very prominant, alteration haloes pervasive.
Orthopyroxene	3	4–5	to 5		Anhedral	Poikilitic, large crystals with included, small tabular to equant plagioclase.
Magnetite		0.4	to 2		Interstitial	Uniform distribution.
Ilmenite		0.1			Interstitial	Commonly as laths intergrown with magnetite.
Sulfide	0.2	0.2			Subrounded, subangular rounded	Occur together. Pyrite filled veins in minerals, plagioclase
Apatite	Trace				Euhedral	As high relief, tabular crystals, fluid inclusion rich.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Amphibole	15	Plagioclase, clinopyroxene, orthopyroxene	Light green to slightly blue-green, orthopyroxene replacement appears somewhat finer-grained.
Clinopyroxene	1	Clinopyroxene	Colorless, fragments particularly near margins of altered clinopyroxene.
Magnetite	1	Clinopyroxene, orthopyroxene	

COMMENTS: Mode visual estimate. Phaneritic, roughly equigranular. Clinopyroxene is moderately altered, with rare subophitic textures present. Orthopyroxene is red-green pleochroic, fractures more prominant than cleavage. Section cut close to foliation plane. Exhibits good orientation of euhedral plagioclase, which imparts a steeply dipping (relative to axis of core) lineation (Textural type M3). No evident deformation.

147-894G-11R-2 (Piece 5, 42–44 cm) OBSERVER: MG WHERE SAMPLED: Unit 9
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium
TEXTURE: Ophitic, hypidiomorphic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	36	50	0.2–3.2		Subheral-anhedral	Rounded due to resorption?, moderately zoned with well-developed twinning, heterogeneous alteration from fresh to highly altered.
Clinopyroxene	5–25	40	0.4–2.5		Anhedral to	Heterogeneous alteration from 10 to subhedral 100%, ophitic and commonly brown in plain light.
Orthopyroxene	3	10	1.6–2.8		Anhedral to subheral	Brown in plain light due to abundant fine-grained fracture-hosted oxides with very fine amphibole and clay? alteration.
Magnetite		<1.0	0.2–0.8		Anhedral	Cut by minor calcite vein which changes to albitic composition in enclosing plagioclase.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Clay	4	Plagioclase	
Clay	3	Clinopyroxene	Very fine-grained intergrowths with fine-grained oxides and amphibole.
Chlorite	1–2	Orthopyroxene	Fine-grained mats pseudomorph ophitic pyroxene.
Epidote	Trace	Plagioclase	Fine-grained, granular.
Actinolite	3	Plagioclase	As fine veinlets and as rimming grain boundaries.
Amphibole	12	Pyroxenes	10% after clinopyroxene, 2% after orthopyroxene.
Pyrite	Trace	Clinopyroxene	Irregular fine moth-eaten grains.
Magnetite?	1–2	Pyroxene minerals	Very fine-grained.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE
Vein			1	Prehnite and composite prehnite + chlorite	Pinch and swell.
Vein			0.38	Chlorite	Irregular.

COMMENTS: Plagioclase is rounded in shape locally due to resorption? Fine veinlets of amphibole and plagioclase change mineralogy when cutting clinopyroxene to plagioclase respectively.

147-894G-11R-2 (Piece 10, 97–100 cm) OBSERVER: JAY WHERE SAMPLED: Unit 9
ROCK NAME: Gabbro
GRAIN SIZE: Medium
TEXTURE: Hypidiomorphic granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	48.1	49.8	2–5		Euhedral to subhedral	Fresh, tabular laths. Broad oscillatory zoning common. Only minor alteration.
Clinopyroxene	36.7	49.8	3–4		Anhedral	Reasonably fresh but more altered than plagioclase. Roughly the same average grain size as plagioclase. Alters particularly around margins, cleavage planes, and cracks.
Magnetite	0.35	to 1.5			Interstitial	Uniformly distributed.
Ilmenite	0.05	<1			Blebs and laths	Intergrown with magnetite
Sulfide minerals	0.1	0.2			Spongy, subangular	Mostly pyrite, minor chalcopyrite, trace pyrrhotite.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Green amphibole	14	Plagioclase, clinopyroxene	Around margins, between crystals, along cleavage, and occasionally entire crystals
Brown amphibole	1	Clinopyroxene	
Magnetite	Trace	Olivine?	In one small patch.
Talc	Trace	Olivine?	In one small patch intergrown with secondary magnetite.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE
Veins	Trace	Crosscutting	<1	Green amphibole	

COMMENTS: Mode point counted, 1500 points, 0.5 mm counting interval. Phaneritic, Very fresh gabbro. No orthopyroxene, but one crystal of what may have been olivine, now completely altered to secondary magnetite and talc. Clinopyroxene is the most altered phase, plagioclase much less so. Crude subparallel alignment of plagioclase laths imparts incipient fabric to specimen (Textural type M1).

147-894G-11R-3 (Piece 2, 12–14 cm) OBSERVER: JFA WHERE SAMPLED: Unit 9
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium
TEXTURE: Hypidiomorphic granular; also ophitic, subophitic, intergranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	40–45	45–50	to 5		Tabular subhedral	Incipient, patchy alteration to green amphibole along cracks, in former melt inclusions; patchy areas dusted with brown clay alteration.
Clinopyroxene	7	30	to 5		Anhedral	Heavily altered to green amphibole and oxides as well as relatively clear, anhedral secondary clinopyroxene.
Orthopyroxene	5	20	to 4		Anhedral to subhedral	As oikocrysts enclosing plagioclase and tabular and intergranular grains. Heavily altered to green amphibole and oxides, especially along fractures. Pink to green pleochroism.
Magnetite	1–2	1–2	to 2.5		Anhedral, skeletal	As interstitial grains. Elongate, exsolved ilmenite blebs to 0.08 mm.
Sulfide	<<1	<<1	to 0.03		Anhedral rounded	As rounded grains within plagioclase-likely pyrite

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Green amphibole	40–45	Pyroxene, plagioclase	Two generations. First (50% of total) is pleochroic green-brown, with recognizable crystal margins- these crystals are up to 2.5 mm. The second, later type is pale green and fibrous, replacing first amphibole, pyroxenes, and plagioclase.
Clinopyroxene	1	Clinopyroxene	Secondary, quite clear, relatively unaltered, replacing original clinopyroxene.
Brown clays	1–2	Plagioclase	Brown, patchy dusting of plagioclase.
Quartz	<<1		Anhedral, fluid-inclusion rich interstitial grains (to 0.3 mm).
Magnetite	<1	Pyroxene	Irregular anhedral grains disseminated in green amphibole or concentrated along margins of altering pyroxene. Some are large (to 0.8 mm), and are difficult to tell from primary magnetite.
Sulfide	<<1	Pyroxene	Irregular grains to 0.15 mm, often associated with magnetite. Most is pyrite, attached and intergrown with minor chalcopyrite and trace pentlandite.
Apatite?	<<1		Small (to 0.02 mm), euhedral needles and prismatic crystals in fribrous amphibole-very high relief; nearly colorless.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Fractures	<<1	Across section	To 0.05 mm	Fibrous green amphibole	Orientation unknown	Groups of fractures extend across thin section through crystals of plagioclase and pyroxene.

COMMENTS: Crude orientation of tabular plagioclase-unoriented section (Textural type M1). Rock is highly metamorphosed.

147-894G-11R-3 (Piece 6A, 45–49 cm) OBSERVER: PED WHERE SAMPLED: Unit 10
ROCK NAME: Olivine gabbronorite
GRAIN SIZE: Medium
TEXTURE: Hypidiomorphic granular, poikilitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	40	45–50	to 6		Tabular, subhedral, anhedral	Strong and partly undulatory zoning. Replaced partly by green fibrous amphibole.
Olivine	<1	5–10	to 3		Euhedral/subhedral	Included in orthopyroxene or by plagioclase. Almost totally altered to talc and magnetite.
Clinopyroxene	25	30	to 2		Anhedral	Partly altered to green fibrous amphibole. Oxides (probably magnetite) have formed along exsolution lamellae giving the crystals a brown dull color.
Orthopyroxene	5	15	to 10		Anhedral	As oikocrysts or as intergranular grains. Pleochroic from pale green to pale red. Replaced by green fibrous amphibole. Oxides have formed along cleavage and/or exsolution lamellae.
Magnetite	1		to 2		Anhedral, skeletal	As interstital grains. Exsolution of ilmenite.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Talc	2	Olivine	
Green amphibole	20	Plagioclase, clinopyroxene, orthopyroxene, olivine	Possibly two generations - an early green and a later more pale green.
Magnetite	5	Olivine, clinopyroxene, orthopyroxene	In clinopyroxene and orthopyroxene. Occur along exolution lamellae or along cleavage planes where they possibly may be associated with clay.
Clinopyroxene	2	Clinopyroxene	

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vein	<1			Fibrous green amphibole.		Several veins that run across the thin section.

147-894G-12R-2 (Piece 4E, 42–44 cm) OBSERVER: JFA WHERE SAMPLED: Unit 11
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium to coarse
TEXTURE: Hypidiomorphic granular, also ophitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	55–60	60–65	to 6.5		Subhedral, tabular	Ubiquitous dusting of brown clay-difficult to estimate percentage alteration. Also have incipient alteration to fibrous green amphibole in cracks and within crystals.
Clinopyroxene	8–10	15–20	to 3.5		Anhedral	Extensively altered to green amphiboles, giving a mottled appearence. Predominantly interstitial.
Orthopyroxene	8–10	15–20	to 6.5		Subhedral to anhedral	As oikocrysts enclosing plagioclase. Somewhat less altered than clinopyroxene. Pleochroic pink to green; 2V=50–55 degrees, negative.
Magnetite	<1	<1	to 0.6		Blocky anhedral; skeletal	Crystals clustered in thin section. See thin ilmenite exsolution lamallae (to 0.006X 0.01 mm in size).
Sulfide	<1	<1	to 0.02		Irregular to round	In interstices, and as inclusions within plagioclase. Larger grains are pyrite; some smaller grains (to 0.03 mm) are chalcopyrite.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Brown Amphibole	2–3	Pyroxene	Green-brown pleochroism, 60/120 degree cleavage; some crystal margins present; to 1 mm in size. Is being replaced by later fibrous, green clinopyroxene.
Green	15–20	Pyroxene, plagioclase, amphibole.	Light green, finely fibrous; is second generation of clinopyroxene amphibole. Can be intimately intergrown with earlier brown amphibole.
Brown clay	1–5	Plagioclase	Hard to tell extent as is only fine brown dusting.
Clinopyroxene	<1	Clinopyroxene	Anhedral and clear; occurs as patches typically surrounded by fibrous green amphibole.
Magnetite	<1	Pyroxene	Anhedral grains to 0.1 mm; disseminated.
Sulfide	<<1	Pyroxene	Is mostly pyrite (to 0.4 mm).

COMMENTS: Difficult to estimate extent of pyroxene alteration, as alteration is often intimately intermixed with unaltered pyroxene. A flow fabric of plagioclase tabular crystals is parallel to the core elongation. Textural type M3.

147-894G-12R-2 (Piece 4F, 56–58 cm) OBSERVER: DSK WHERE SAMPLED: Unit 11
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium
TEXTURE: Hypidiomorphic granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	50	60	0.4–8.4		Subhedral to anhedral	Moderately well-developed zoning and twinning, patchy and undulatory extinction.
Clinopyroxene	2	25	1.1–6		Subhedral to anhedral	Brown "dusty" in plane light.
Orthopyroxene	3	15	1.2–6		Subhedral	Rimmed by sprays of amphibole and fine-grained magnetite.
Magnetite	0.2	0.5–0.52			Anhedral	

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Clay	3	After plagioclase	
Clinopyroxene	4	After clinopyroxene	Optically continous and clean, to filled with fluid inclusions.
Chlorite	Trace	After plagioclase	Rimming grain boundaries.
Epidote	Trace	After plagioclase	Very fine-grained, granular.
Actinolite	1	After plagioclase	Along grain boundaries.
Amphibole	3	After clinopyroxene	Pale green, rare brown ampibole grains in core.
Amphibole+clay	16	After clinopyroxene	Associated with very fine fracture-related oxides, give brown color in plane light.
Amphibole	5	After orthopyroxene	Highly birefringent (cummingtonite?).

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vein			2.1	Prehnite, chlorite, zeolite		Rimmed by 0.4 mm wide band of chlorite.
Vein			1.1	Mixed layer clay	Discontinuous.	

COMMENTS: Sample also includes 6% secondary plagioclase (dusty and turbid to clean albite), trace oxides after clinopyroxene and orthopyroxene, and 8% amphbiole, clay?, oxide intergrowths after orthopyroxene. Well-developed olive green amphibole rims interstitial magnetite. Moderately well-developed magmatic fabric. Textural type M2.

147-894G-12R-2 (Piece 9A, 91–96 cm) OBSERVER: PED WHERE SAMPLED: Unit 11
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium to coarse
TEXTURE: Hypidiomorphic granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	50	50–55	to 10		Tabular. Euhedral-subhedral	Well zoned. Locally replaced by green fibrous amphibole. Some grains contian very fine-grained opaque mineral that give the crystal a brown dusty appearence.
Clinopyroxene	15	20	to 6		Subhedral-anhedral	Partly altered to a green fibrous amphibole. Magnetite along exsolution lamellaes and cleavage planes give crystal a brownish dull color.
Orthopyroxene	15	20	to 6		Subhedral-anhedral	Pleochroism from pale green to pale red. Birefringence up to sceond order blue. Some grains include small lath and tabular shaped plagioclases. Altered to fibrous amphibole. Oxides has locally formed along cleavage planes.
Magnetite	2–4		to 3		Anhedral	As intergranular grains.
Apatite	Trace		to 0.2		Euhedral needles	

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Amphibole	20	Plagioclase, clinopyroxene, and orthopyroxene	Early generation of green amphibole which seems to be replaced by a later pale green amphibole.
Clinopyroxene	2	Clinopyroxene	
Magnetite	<1	Clinopyroxene and orthopyroxene	Mainly as very fine-grained crystals forming along exsolution lamellae and cleavage planes.
Sulfides	<1		Often situated along grain boundaries.

COMMENTS: The rock exhibits a 2 cm wide band of coarse-grained gabbronorite in medium-grained gabbronorite. Fine-grained portion of section, with textural type M3, has a strong foliation evident in plagioclase alignment oblique to the orientation of the coarse-grained band.

147-894G-12R-3 (Piece 8, 142–148 cm) OBSERVER: PED WHERE SAMPLED: Unit 11
ROCK NAME: Gabbro with a patch of gabbronorite
GRAIN SIZE: Medium (the gabbronorite is coarser grained than the gabbro)
TEXTURE: Hypidiomorphic granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	45	50	to 2		Lath shaped and tabular, subhedral	Crystals are twinned and some show zoning; replaced by green amphibole and some grains contain a dusty brown material- which may be fine-grained oxide.
Clinopyroxene	32	44	to 2		Anhedral	Crystals show good cleavage, exsolution of oxides along the cleavage plane give crystal a brownish dull color. Crystal are also locally replaced by green amphibole, and by secondary clinopyroxene.
Orthopyroxene	3	5	to 4		Anhedral	Present only in the coarser grained parts. Altered to green amphibole. Exsolution of oxides along cleavage planes give crystal locally a brown color.
Magnetite	1	1	to 2		Anhedral	As interstitial grains. Exsolved ilmenite grains.
Sulfide minerals	<1	<1	to 0.05		Anhedral rounded	Pyrite and chalcopyrite.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Green Amphibole	15	Plagioclase, clinopyroxene, orthopyroxene	
Secondary Clinopyroxene	2	Clinopyroxene	
Oxide minerals	2	Clinopyroxene, orthopyroxene	Occurs along cleavage planes of the pyroxenes.

COMMENTS: Most of the section is made up of a medium-grained granular gabbro with a well-developed magmatic foliation, which is defined by alignment of lath-shaped plagioclase. A 1 cm wide patch (or vein) of coarser-grained gabbronorite runs through the section. Orthopyroxene is not present in the strongly foliated rock, but constitutes around 50% of the pyroxenes in the coarser grained patch. The boundaries between the two rock types are gradational and the gabbronorite does not show the prominent magmatic foliation seen in the gabbro. The orientation of the magmatic foliation differs by about 20 degrees on each side of the gabbronorite patch. Textural type M3.

147-894G-12R-4 (Piece 13, 122–126 cm) OBSERVER: AG WHERE SAMPLED: Unit 11
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium to coarse
TEXTURE: Hypidiomorphic granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	0	2	2		Rounded	Completely altered to magnetite, serpentine and a red colored, very fine-grained mineral.
Plagioclase	48	50	1 to 3		Euhedral to subhedral	Twinned and commonly broadly zoned.
Clinopyroxene	10	40	1 to 3		Anhedral	Pervasively altered, although some fresh clinopyroxene is present, it is dusty brown with well-developed cleavage where alteration is enhanced.
Orthopyroxene	1-2	7.5			Anhedral	90% altered to fine-grained green amphibole with secondary magnetite.
Magnetite	0.2	0.6			Interstitial, subrounded	Intergrown with ilmenite laths.
Ilmenite		0.1	0.5		Laths	Intergrown with magnetite.
Sulfide minerals		0.2	0.2		Elongate, spongy	80% pyrite, 15% chalcopyrite, 5% pyrrohtite. Also contains a few grains of hexagonal sphalerite, intergrown with pyrite in amphibole.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Amphibole	40	Clinopyroxene,orthopyroxene,plagioclase	Light green to slightly blue-green, coarser grained after clinopyroxene and plagioclase.
Magnetite	2	Olivine, pyroxene	Very fine-grained, commonly aggregates. Pseudomorphs original olivine shape.
Serpentine	1	Olivine	

COMMENTS: Modes visually estimated. Moderately to pervasively altered. Olivine pseudomorphs are apparent but no fresh olivine left. A diffuse contact exists between medium- and coarser grained parts of the thin section. Weak preferred orientation of plagioclase laths. No deformation.

147-894G-12R-5 (Piece 9, 84–88 cm) OBSERVER: JAY WHERE SAMPLED: Unit 11
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium to coarse
TEXTURE: Hypidiomorphic granular, with ophitic to subophitic textures.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	40	45	1–5		Subhedral	Tabular, broad oscillatory zoning is common. Replaced by fibrous green amphibole along grain boundaries and in microfractures. More highly altered near veinlets.
Clinopyroxene	10	27	1–6		Anhedral	Some tabular, some ophitic to subophitic. Heterogeneously altered, varying locally from 20% to 80% total replacement by green amphibole, with very fine-grained, dispersed magnetite and minor pyrite and clay along exsolution and/or cleavage planes.
Orthopyroxene	5	15	1–6		Euhedral to subhedral	Tabular, mantled by alteration rims of talc and fine-grained fibrous mats of green amphibole (possibly after talc).
Opaques	3					
Magnetite	0.5		to 3		Interstitial	Uniform distribution. Magnetite intergrown with ilmenite laths.
Ilmenite	0.5				Lath	Intergrown in magnetite.
Pyrite	0.25		0.4		Spongy	Occurs with chalcopyrite at junctions of amphibole and pyroxene, also as elongate stringers.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Green amphibole	20–23	Clinopyroxene, plagioclase	Blue-green pleochroic. As fine-grained fibrous mats, in patches or filling microcracks. (18%–20% after clinopyroxene, 2%–3% after plagioclase). Locally with well-developed large crystals. Minor brown-green amphibole in patches or intergranular.
Green amphibole	4–5	Orthopyroxene	As distinct rims, together with (possibly replacing) talc.
Talc	3–4	Orthopyroxene	Colorless to slightly green. Forms very fine-grained, fibrous mats rimmed by light green amphibole.
Plagioclase	1–2	Plagioclase	
Clinopyroxene	1	Clinopyroxene	Clear blocky patches in altered igneous clinopyroxene. Locally with fluid inclusions.
Brown-green	5–7	Pyroxene, plagioclase	More abundant in areas cut by chlorite-clay veinlets. (4%–5% clay after clinopyroxene, 1% after orthopyroxene, 1% after plagioclase)
Oxide/sulfide minerals	1	Pyroxene	Predominantly magnetite, minor pyrite. Commonly submicron in size, dispersed along exsolution and cleavage planes, and locally outlining alteration rims of orthopyroxene.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Veinlets	1		0.2–0.3	Chlorite, brown-green clay		Anastomosing fine net, local occurrence. Associated with higher degree of alteration.

COMMENTS: IGENOUS: Mode visually estimated. Point counted mode-1707 points, 0.5 mm counting interval. Plagioclase 747 (43.9%), altered plagioclase 58 (3.3%); clinopyroxene 129 (7.5%); altered clinopyroxene 429 (25.3%); orthopyroxene 83 (4.8%); altered orthpyroxene 214 (12.5%); opaques 47 (2.7%). Phaneritic, subequigranular. Section is too thick, so orthopyroxene has anomalously high interference colors, but has distinct red-green pleochroism, typical orthopyroxene alteration rims, and lacks clinopyroxene dusty type alteration and cleavage. METAMORPHIC: Heterogeneous alteration, related to local, anastomising, 0.2–0.3 mm wide, brown-green clay and chlorite veinlets. Higher degree of alteration characterized by replacement of pyroxene by brownish clay and Fe-oxihydroxides, giving dark dirty appearance, and by a higher density of green amphibole-filled microfractures in plagioclase. Well-developed steeply dipping magmatic foliation (Textural type M3).

147-894G-13R-1 (Piece 14, 132–136 cm) OBSERVER: JAY WHERE SAMPLED: Unit 11
ROCK NAME: Oxide gabbronorite
GRAIN SIZE: Medium
TEXTURE: Ophitic to subophitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	40	50	1–8		Subhedral	Only reasonably fresh phase. Broad oscillatory zoning common.
Clinopyroxene	1	30	2–6		Anhedral	Completely shot. Huge alteration rinds consuming adjacent plagioclase.
Orthopyroxene	3	12	2–6		Anhedral	Pervasively altered.
Ilmenite	6.4		to 4		Subrounded	Interstitial. (see comments)
Magnetite	1.6		to 4		Subrounded	Interstitial (see comments)
Pyrite	trace		0.2		Subrounded	In patches.
Pyrrhotite	trace		0.2		Subrounded	In patches.
Chalcopyrite	trace		0.2			In patches.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Green amphibole	35	Clinpyroxene, orthopyroxene, plagioclase	Mostly light yellow to dark green pleochroic
Blue-green amphibole	6	Clinopyroxene	Small dark patches in lighter green amphibole.
Brown clay	6	Orthopyroxene, clinopyroxene	Prevalent in orthopyroxene.
Magnetite	2	Orthopyroxene, clinopyroxene	Very fine-grained, subequant crystals.

COMMENTS: IGNEOUS: Mode visually estimated. Point count 2000 points, counting interval 0.5 mm. Plagioclase 798 (39.9); altered plagioclase 259 (12.9%); clinopyroxene 23 (1.2%); altered clinopyroxene 526 (26.3%); orthopyroxene 51 (2.6%); altered orthopyroxene 189 (9.4%); opaques 154 (7.7%). Also present in trace quantities are apatite with abundant fluid inclusions, sphene (after ilmenite), rutile, and zircon. Phaneritic inequigranular. Large grain size variation in plagioclase. Inclusion of plagioclase in altered pyroxene suggests original ophitic to subophitic texture. Primary opaques are ilmenite and magnetite. Lower 1/3 of thin section has >15% ilmenite with a distinct upper limit dipping at 40 degrees to thin section orientation. Above this band primary opaque is magnetite with minor ilmenite laths and subrounded intergrowths. METAMORPHIC: Pervasive alteration. Pyroxene almost completely altered to green and minor brown amphibole. STRUCTURE: Weak fabric not apparent in core. Textural type M1.

147-894G-13R-2 (Piece 1,10–13 cm) OBSERVER: DCK WHERE SAMPLED: Unit 11
ROCK NAME: Gabbronorite
GRAIN SIZE: Coarse
TEXTURE: Hypidiomorphic Granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	61	61.8	1–8		Subhedral to anhedral	Reliable estimate of proportion anhedral originally in thin section from modal analysis. Only weakly to moderately zoned.
Clinopyroxene	0	14.4	1–3		Anhedral	Treat amount as a rough estimate only.
Orthopyroxene	4.6	18.6	2–12		Euhedral to subhedral	Treat amount as a rough estimate only.
Magnetite	0.6	0.6	0.01–1		Anhedral	Irregularly distributed in patches.
Ilmenite	Trace					
Pyrite	0.1					Pyrite occurs along grain boundaries.
Chalcopyrite	Trace	0.2				

VESICLES/ CAVITIES	SIZE PERCENT	LOCATION	(mm)	FILLING	SHAPE
Vesicles					

COMMENTS: Point counted 1637 points at a 0.5 mm interval which can be used only as an estimate of the mode of the thin section for this coarse-grained sample, not the rock from which it came. Due to the extensive alteration of orthopyroxene and complete alteration of clinopyroxene, the modes for these minerals are only an estimate. The rock consists of large euhedral to subhedral orthopyroxene crystals mutually interfering with coarse to medium plagioclase laths at their margins. The orthopyroxenes also enclose occasional small plagioclase laths. Clinopyroxene is granular anhedral to subophitic to the plagioclase and orthopyroxene. Oxides are very irregularly distributed, occuring in a few relatively coarse intergranular patches, often enclosing small anhedral plagioclase grains, and as volumetrically trivial small isolated grains scattered through the thin section.

147-894G-13R-2 (Piece 8, 88–90 cm) OBSERVER: TRE WHERE SAMPLED: Unit 11
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium
TEXTURE: Hypidiomorphic granular, with ophitic, subophitic, intergranular texture present.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	46.1	49.4	0.4–4.4		Tabular subhedral	Incipient patchy alteration to brown clay. Green amphibole along cracks.
Clinopyroxene	11.3	29.2	0.2–12		Anhedral	Altered to green amphibole.
Orthopyroxene	9	21	0.2–12		Euhedral to anhedral	Pleochroic, high relief, forms large oikocrysts. Also present as small euhedra. Altered to fibrous pale green amphibole.
Oxide minerals	0.3	0.3	0.09		Semirounded	60% magnetite 40% ilmenite, exsolution laths of ilmenite common in magnetite.
Apatite	<0.1	<0.1	0.4		Euhedral	

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Clay	3.3	Plagioclase	
Sulfide minerals	0.2		90% pyrite 10% chalcopyrite, spongy semirounded. Chalcopyrite laths, pyrite, and chalcopyrite are intergrown, pyrite fills cracks to give long stringers.
Green amphibole	29.9	Pyroxene, plagioclase	Blue-green to pale green pleochroic, fibrous.

COMMENTS: Mode point counted (>1500 points). Weak magmatic fabric. Textural type M1.

147-894G-13R-3 (Piece 1B, 13–15 cm) OBSERVER: TRE WHERE SAMPLED: Unit 11
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium
TEXTURE: Hypidiomorphic granular, with ophitic, subophitic, intergranular textures present.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	53	55.1	0.72–3.6		Tabular subhedral	Altered to brown clay.
Clinopyroxene	21.8	30.6	0.4–4		Subhedral, anhedral	Altered to green amphibole.
Orthopyroxene	7.6	13.2	1–5.8		Euhedral subhedral	Ophitic, pleochroic, alteration halos of pale green pleochroic amphibole and minor oxide.
Oxide minerals	0.9	0.9	0.6		Anhedral	60% magnetite 40% ilmenite, exsolution laths common in magnetite.
Apatite	<0.1	<0.1	0.4		Euhedral	

SECOND MINERALOGY	ARY PERCENT	REPLACING/ FILLING	COMMENTS
Clay	2	Plagioclase	Incipient patchy alteration of plagioclase.
Sulfide minerals	<0.2		Spongy, elongate, semirounded pyrite, chalcopyrite.
Green amphibole	29.9	Pyroxene, plagioclase	Blue-green to pale green pleochroic, fibrous

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE

COMMENTS: Mode point counted (>1500 points, spacing 0.5 mm). Thin section parallel to foliation plane, exhibits foliation. Weak fabric, textural type M1.

147-894G-14R-1 (Piece 11, 70–72 cm) OBSERVER: CL WHERE SAMPLED: Unit 11
ROCK NAME: Gabbro/gabbronorite
GRAIN SIZE: Coarse
TEXTURE: Intergranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	40	50	to 10		Subhedral to anhedral	
Clinopyroxene	20	50	to 6		Subhedral	Orthopyroxene may be present, but alteration prevents recognizing it from clinopyroxene.
Fe Oxide minerals	0.5	0.5	to 2		Anhedral	

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Clays	17–18	Pyroxene	Smectites, hydrogrossular?
Albite	5	Plagioclase	Small grains.
Actinolite	2.5	Plagioclase	Small aggregates.
Clinopyroxene	1	Clinopyroxene	
Green Amphibole	10	Pyroxene	
Fe Oxide	2.5	Plagioclase	Hematite, goethite.
Fe Oxide	1.5	Pyroxene	Magnetite.

147-894G-15R-1 (Piece 12, 77–80 cm) OBSERVER: CL WHERE SAMPLED: Unit 11
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium
TEXTURE: Ophitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	40	50	to 3		Subhedral-anhedral	
Clinopyroxene	34–35	40	to 4		Anhedral	
Orthopyroxene	7	10	to 8		Anhedral	Big oikocrysts.
Fe Oxides	0.5	0.5	to 2		Anhedral	

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Clays	12	Clinopyroxene	Clays (smectite) plus hydrogrossular?
Actinolite	8	Clinopyroxene	Fibrous patches.
Clinopyroxene	1–1.5	Clinopyroxene	
Cummingtonite	2	Orthopyroxene	With traces of actinolite overprinting cummingtonite.
Fe Oxide	1	Plagioclase	Hematite.
Fe Oxide	0.5	Orthopyroxene	Magnetite, along cleavages.
Fe Oxide	0.5–1	Clinopyroxene	Magnetite, along cleavages.
Green amphibole	1.5	Plagioclase	Small patches and isolated fibers.

147-894G-17R-1 (Piece 10, 52–54 cm) OBSERVER: JAY WHERE SAMPLED: Unit 11
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium
TEXTURE: Hypidiomorphic granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	44	45	to 4	An 40–45	Subhedral-anhedral	Broad oscillatory zoning common. Also occurs as small, rounded inclusions in clinopyroxene.
Clinopyroxene	48	50	to 3		Anhedral	Dusty looking but still very fresh.
Orthopyroxene	2	5	10		Anhedral	Coarse grained oikocrysts.
Magnetite	0.4		<0.5		Interstitial	Bulk of accessory opaques.
Ilmenite	0.2		<0.5		Laths to interstitial	Intergrown with magnetite.
Pyrite	Trace		0.2		Subangular to subrounded	Very small, as inclusions in clinopyroxene.
Chalcopyrite	Trace		0.2		Subangular-subrounded	
Pyrrhotite	Trace		0.1		Subangular-subrounded	

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Amphibole	3–4	Clinopyroxene, orthopyroxene, plagioclase	Along crystal margins, light green.

COMMENTS: Mode visually estimated. Point count-1795 points, counting interval 0.5 mm. Plagioclase 762 (42.3%); altered plagioclase 12 (0.6%); clinopyroxene 894 (49.6%); altered clinopyroxene 56 (3.1%); orthopyroxene 28 (1.5%); altered orthopyroxene 41 (2.3%); opaques 12 (0.6%). Practically unmetamorphosed, no fabric, no deformation. Only moderately altered phase is orthopyroxene. Few small fractures without filling or apparent offset. Overall texture is hypidiomorphic granular but contains sparse poikilophitic orthopyroxenes. Structural group recognizes weak to moderate magmatic fabric and textural type M2.

147-894G-17R-1 (Piece 14, 116–118 cm) OBSERVER: LAK WHERE SAMPLED: Unit 11
ROCK NAME: Gabbro
GRAIN SIZE: Medium
TEXTURE: Subequigranular-hypidiomorphic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	50	60	1–3		Sub-euhedral	Simple, multiple and albite twins are common; zoning is rare. Incipient alteration to pale green amphibole.
Clinopyroxene	5	35	0.5–3		Anhedral	Brown in appearance due to clay/opaque minerals; this is most pronounced in cleavage planes and fractures. Rimmed by pale green, fibrous amphibole. Clinopyroxene is rarely more than 60% replaced by amphibole.
Orthopyroxene	1	3	2–4		Anhedral	Occurs primarily in one patch. Highly fractured and altered to a dark brown/red clay (?). Up to 80% replaced by pale green amphibole. Oikocrystic, with clinopyroxene and plagioclase chadocrysts.
Pyrite	0.18		1.0		Subrounded, spongy	Associated with amphibole.
Pyrrhotite	0.12		1.0		Subrounded, spongy	Associated with amphibole
Chalcopyrite	0.10	1.0	1.0			Associated with amphibole.
Magnetite	2.0		5.0			Large and small oxide are interstitial, coarser oxides occur in patches where silicate is coarser, alteration is also greater in this layer. Ilmenite and magnetite occur together with many short blebby laths in ilmenite, secondary magnetite with amphibole.
Ilmentite	1.0		5.0			

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Clay	25	After clino-orthopyroxene	Gives a brown appearance to clinopyroxene; clinopyroxene 90%–95% altered.
Clay	5	After plagioclase	Probably a mixture of clay and opaque minerals.
Amphibole	10	After clino-orthopyroxene	Fibrous-massive green amphibole rims clinopyroxene and partially-totally replaces orthopyroxene. Also found along plagioclase grain boundaries. Found in patches in the section; not evenly distributed.
Clinopyroxene	<5.0	After clinopyroxene	Very clear. Typically associated with amphibole alteration in clinpoyroxene, although appears to predate this.

COMMENTS: Alteration 35%–40%. The fine clay/opaque dusting of plagioclase is less dense in twinned areas. Clinopyroxene commonly occurs as aggregates of 3 or more grains; however it also occurs as small(<0.5mm) rounded blebs, distributed throughout the section. A course-grained patch of gabbronorite is located at the base of the section. This is composed of orthopyroxene (20%), plagioclase (35%), clinopyroxene (5%), amphibole (20), and opaques (10%), with minor talc associated with the opaque minerals. Veinlets originating from this coarse area tend to terminate in pods of amphibole. This pocket of gabbronorite appears to have 'formed' coeval with the development of a magmatic foliation; plagioclase laths tend to rotate away from this area, or the plagioclase may be aligned subparallel to the main magmatic foliation. This foliation is moderately well developed and steeply dipping, textural type M2.

147-894G-18R-1 (Piece 10, 65–70 cm) OBSERVER: LAK WHERE SAMPLED: Unit 11
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium to coarse
TEXTURE: Varitextured

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	50	60	1–6		Sub-anhedral	Ubiquitous fine dusting of opaque/clay mineral mixture; this is more noticeable in fractures and along grain boundaries. Also, incipient alteration to a fine-grained green alteration product, possibly amphibole. Simple and multiple twins common.
Clinopyroxene	5	25	0.5–3		Anhedral	Oikocrystic, with plagioclase chadacrysts. Brown in appearance due to alteration. Commonly rimmed with a pale green amphibole. Forms a 'blebby' texture with plagioclase.
Orthopyroxene	5	15	5–7		Anhedral	Heavily fractured and altered to a brown/black alteration clay(?)/opaque mixture. Fractures within orthopyroxene are filled with a reddish oxide.
Magnetite	0.65		3		Equant	One large lath. Ilmenite and magnetite occur together.
Ilmenite	0.35		3		Equant	
Pyrite	0.18		0.6		Subangular, interstitial	Pyrite occurs along silicate boundaries. Marcasite with pyrite relict centers. Marcasite occurs in one vein filling between two plagioclase crystals.
Pyrrhotite	Trace		0.6			Pyrrhotite occurs in clinopyroxene and plagioclase.
Chalcopyrite	Trace					

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Clay	5	After plagioclase	Fine-grained, dark brown dusting of plagioclase grains.
Clay	15–20	After clinopyroxene and orthopyroxene	Pervasive brown alteration of clinopyroxene; enhanced in fractures and cleavage planes. Less pervasive in orthopyroxene, concentrated along cleavage and fracture planes.
Clinopyroxene	5–10	After clinopyroxene	Commonly associated with the dark brown alteration; up to 60% of grain may be secondary clinopyroxene.
Amphibole	10–15	After clinopyroxene and orthopyroxene	Pale green amphibole typically rims clinopyroxene and also occurs within grains, especially along cleavage planes. Less commonly, amphibole replaces up to 90% of grain. Forms an alteration rim around orthopyroxene.

COMMENTS: Lower portion of section contains all of the orthopyroxene and is much coarser than upper portion of section. Clinopyroxene and plagioclase 'blebby' texture occurs in both parts of section. Minor microfractures filled with clay and oxide minerals transect the slide. Section is about 40% altered. The brown coloration/alteration of clinopyroxenes appears to predate alteration to amphibole. No discernable magmatic foliation.

147-894G-18R-2 (Piece 4A, 23–26 cm) OBSERVER: AG WHERE SAMPLED: Unit 11
ROCK NAME: Gabbro
GRAIN SIZE: Medium
TEXTURE: Hypidiomorphic granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	48	55	0.4–2.5		Subhedral to anhedral	Zoned, dusty crystals.
Clinopyroxene	30	42	0.2–2.5		Anhedral	
Orthopyroxene	1	3	0.2–2.5		Anhedral, tabular	Intergranular oikocrysts.
Magnetite	0.035		to 0.8		Anhedral	Interstitial.
Ilmenite	0.065		to 0.8		Anhedral	Interstitial.
Pyrite	0.080		to 0.2		Anhedral	Spongy and elongate.
Chalcopyrite	0.017		to 0.2		Subhedral	Subangular.
Pyrrhotite	0.003				Anhedral	In fresh clinopyroxene.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Plagioclase	5	Plagioclase	Well developed along some fluid inclusion planes.
Amphibole	15	Clinopyroxene, orthopyroxene, plagioclase	Pale brown and green amphibole after clinopyroxene; blue green to green amphibole after plagioclase; pale green amphibole and trace cummingtonite after orthopyroxene.
Clinopyroxene	1	Clinopyroxene	

COMMENTS: Coarse-grained portion at edge of section consists of subhedral to anhedral tabular plagioclase to 5 mm long that are typically rimmed by secondary plagioclase. Clinopyroxene in this portion of the sample is completely replaced by equant, subhedral to anhedral olive-green amphibole 0.02 to 2 mm in size.

147-894G-18R-2 (Piece 14, 97–99 cm) OBSERVER: FRU WHERE SAMPLED: Unit 11
ROCK NAME: Gabbro
GRAIN SIZE: Very fine to medium
TEXTURE: Cataclastic, locally intergranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	5	55–60	to 3.5		Euhedral-subhedral	Patchy dusty appearance, locally distinguishable twinning and zoning. Fractured and altered to secondary plagioclase and clay, minor prehnite, and amphibole near prehnite veins. Some clear albitic plagioclase cutting grains and in microfractures.
Pyroxene	10–15	40–45	to 2		Subhedral-anhedral	Predominantly clinopyroxene. Minor orthopyroxene (<4%). Modes difficult to estimate due to alteration and cataclastic grain size reduction. Heterogeneously altered (20%–85%) to amphibole, clay and micron-sized oxides in exsolution and cleavage planes.
Oxide minerals	1	1	to 5		Interstitial, semirounded, rounded	Ilmenite (0.4%) and magnetite (0.6%) occur together, lattice and sandwich rounded exsolution, interstitial oxide is slightly to completely crushed with rounded grains. Secondary oxides after pyroxene <1%.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Green amphibole	15–18	Pyroxene, plagioclase, cataclastic zones	Light green, heterogeneously distributed, weakly developed fibrous habit. 2%–3% after plagioclase, 10%–13% after pyroxene, 2%–3% as fine-grained angular to rounded clasts and as part of matrix in cataclastic patches. Very minor brown amphibole.
Plagioclase	35–40	Plagioclase	Commonly with clay. Local albitic plagioclase as irregular "veinlets" cutting through and filling microcracks in original plagioclase grains.
Clay	6–10	Plagioclase, cataclastic zones	Dark brown clay forms matrix of cataclastic zones (3%–5%). Brown-green clay as alteration of plagioclase (3%–5%).
Clay	1–2	Pyroxene	Commonly along exsolution and cleavage planes, together with sub-micron-sized magnetite grains, giving dark, dirty appearance.
Clinopyroxene	2–3	Clinopyroxene	Clear, blocky grains. Variable amounts, locally abundant in pyroxenes in oxide-rich parts of thin section. Contain fluid inclusions.
Chlorite	2–5	Pyroxene, plagioclase, patches, veinlets	Colorless to light green, occurs in patches and filling microcracks in pyroxene and plagioclase or veinlets. In thicker veins fibrous, blue birefringence.
Carbonate	<1	Patches, veinlets	Predominantly in discontinuous, polymineralogic veins, locally interstitial in patches.
Zeolites	<1	Veinlets	Fine-grained, radiating fibrous habits.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Veins	3-4	Cataclastic	0.1–3.2	Variable mineralogies		Dense network, variably thick, discontinuous, associated zones with cataclastic grain-size reduction. Mineralogy highly variable and chronology often ambiguous: prehnite- and chlorite filled veins only rarely crosscut by clay, calcite, and zeolite veinlets.

COMMENTS: Grain size, shape, density of microfractures and modal % highly variable due to dense veining, brittle grain size reduction and associated alteration. All modes given are visual estimates. Original igneous textures locally preserved in isolated lens-shaped patches between 0.2–2mm wide cataclastic zones. Original modes based on these patches. In cataclastic zones pyroxene and plagioclase are fine-grained and often rounded and highly fractured. Amphibole after pyroxene concentrated along grain boundaries and in microfractures or as patches in grain centers and in interstices. Veining very irregular, locally follows microcracks in individual grains. Mineralogy of thin veinlets often changes depending on adjacent phases. Local brecciation and sheared, imbricated fibrous chlorite in thicker prehnite veins. Interestingly, cataclastic deformation and dense veining is not apparent macroscopically.

147-894G-19R-1 (Piece 12, 77–79 cm) OBSERVER: JFA WHERE SAMPLED: Unit 12
ROCK NAME: Moderately olivine plagioclase phyric basalt
GRAIN SIZE: Microcrystalline
TEXTURE: Porphyritic, Seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Olivine	0	2–3	to 3		Euhedral	Totally altered to chlorite, some fibrous serpentine, and acicular to fibrous amphibole?
Plagioclase	2–3	2–3	to 5.6		Euhedral to subhedral	Contain abundant recrystallized, altered melt inclusions to 0.3 mm. Slightly to moderately altered to clays, especially near contact.
GROUNDMASS						
Plagioclase	5–22	5–25	to 0.7		Lathlike to acicular	Abundance varies between quench near contact (5%) to coarser groundmass (to 25%). Don't see smaller microlites (0.2 mm or less) in finer grained quench.
Olivine	0	2–5	to 0.5		Euhedral	Totally altered to same minerals as phenocrysts. Seriate nature; more abundant in coarser groundmass.
Clinopyroxene	1–2	5?	to 0.1		Anhedral	Only see in coarsest groundmass; difficult to tell abundance.
Spinel	Trace	Trace	0.01–0.3		Euhedral	Light reddish brown; some of the larger ones are quite fresh; others resorbed and oxidized at margins, especially in coarser groundmass. As inclusions in olivine or more commonly as loose crystals in groundmass.
Sulfide	Trace	Trace	to 0.02		Anhedral to rounded	Pyrite as inclusions in plagioclase and minerals in groundmass.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Clays	60–85	Mesostasis	Undifferentiated clays replace nearly all of mesostasis.
Chlorite	5–7	Olivine, clinopyroxene?	Low (10 degrees or less), negative 2V; low birefringence; fibrous to sheetlike and very pale green.
Amphibole?	1–3	Olivine	Fibrous, elongate, higher order colors than chlorite; pale green and nonpleochroic.
Serpentine?	<1	Olivine	In fibrous veins.
Sulfide	<1	Mesostasis, veins	Irregular pyrite grains in groundmass or in thicker veins-minerals difficult to tell from primary sulfides.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Veins	<1		to 0.4 mm	Clays, zeolites, and pyrite		Many small veins (0.01 to 0.10 mm) filled with fibrous clays and zeolites; larger veins contain pyrite. Largest vein is 0.4 mm wide and filled with fibrous clays cutting through fine quench near contact with gabbronorite.

COMMENTS: Thin section shows sharp, intrusive contact between highly altered gabbronorite and basaltic dike. Basalt at contact was initially glassy to spherulitic; away from contact coarsens substantially to felty spherulitic and then to microlitic. There is a flow orientation of plagioclase laths and microlites parallel to the contact. The mesostasis is completely to mostly replaced by undifferentiated clays, and represents altered glass to interstitial material- the secondary phases replacing it are difficult to identify and quantify. Rock is highly to pervasively altered.

147-894G-19R-1 (Piece 13, 92–95 cm) OBSERVER: NAT WHERE SAMPLED: Unit 11 fragment with Unit 12
ROCK NAME: Oxide-bearing gabbronorite
GRAIN SIZE: Coarse
TEXTURE: Subhedral granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	15	60	3–10		Subhedral	Largely replaced by secondary plagioclase and clays.
Clinopyroxene	5	25–30	3–10		Anhedral	Relict clinopyroxene retains well-developed cleavage.
Orthopyroxene	0	5–10	3–5		Anhedral	
Opaques	5	5	3–10		Irregular	Ilmenite-magnetite intergrowths, Ilmenite has rutile exsolution, later oxidation to hematite and pseudobrookite(?)

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Second plagioclase	20	Plagioclase	Occurs as networks of anastomosing cracks through fresher plagioclase, and as completely altered patches filled with inclusions.
Clear amphibole	15	Pyroxenes	
Green amphibole	20	Pyroxenes	Also occurs along grain boundaries of plagioclase with itself and other primary silicates.
Clays	20	Pyroxenes, plagioclase, cavities	Dull brown to yellow brown in pyroxenes and microfractures. Clear in plagioclases.
Magnetite	<1		Aligned between fibers and grains of amphibole pseudomorphs after pyroxenes. Also occurs as very tiny dust-like grains in altered plagioclase.
Sulfides	Tr		In narrow veinlets along grain boundaries and in amphibole cleavage. Also as small patches. Mainly pyrite with lesser chalcopyrite.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles	5	Two or three	3–5	Clays	Round	Cavities filled with clays, now partially plucked.

COMMENTS: The thin section is poorly polished. It is difficult to estimate original pyroxene proportions because of alteration. Oxides are concentrated in one part of the section, and are intergrown with plagioclase and pyroxenes.

147-894G-20R-1 (Piece 4, 19–22 cm) OBSERVER: JAY WHERE SAMPLED: Unit 13
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium
TEXTURE: Hypidiomorphic granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	45	50	to 3.5		Subhedral-euhedral	Variable grain size. Broad oscillatory zoning common.
Clinopyroxene	25	40	to 3.5		Anhedral	Moderately altered to predominantly light blue-green amphibole. Rare subophitic textures.
Orthopyroxene	5	10	to 5		Anhedral	Ophitic to subophitic.
Opaques	Trace					Uniform distribution in amphibole.
Magnetite	Trace		0.5		Subrounded to interstitial	Bulk of oxide minerals (80%) interstitial
Ilmenite	Trace		0.3		Laths	Intergrown with magnetite.
Pyrite	Trace		<0.3		Spongy	Altered mostly to marcasite.
Chalcopyrite	Trace		<0.3		Subangular	

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Amphibole	15	Clinopyroxene, orthopyroxene, plagioclase	Light blue-green, fibrous rare acicular patches.
Magnetite	2	Pyroxene	Marks original grain boundaries and cleavage planes.

COMMENTS: Mode visually estimated. Point count 1570 points, 0.5 mm counting interval. Clinopyroxene 402 (25.7%), altered clinopyroxene 184 (11.7%); orthopyroxene 71 (4.5%); altered orthopyroxene 49 (3.1%); plagioclase 814 (51.9%); altered plagioclase 50 (3.1%); opaques 3 (trace). Phaneritic, equigranular with sparse subophitic clinopyroxene and ophitic orthopyroxene. Slightly to moderately altered, predominantly along grain boundaries except in pervasively altered clinopyroxene. No deformation or fabric apparent.

147-894G-20R-1 (Piece 10, 56–59 cm) OBSERVER: AG WHERE SAMPLED: Unit 13
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium to coarse
TEXTURE: Poikilitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	43	45	2 to 3		Euhedral to subhedal	Somewhat cloudy in parts, twinning and zoning common.
Clinopyroxene	10	25	2		Anhedral	Section is thin so these have anomalously low birefringence, but typical well-developed parallel cleavage and common alteration to amphibole.
Orthopyroxene	10	30	to 8		Anhedral	Large, ameoboid oikocrysts with inculsions of smaller, tabular plagioclase.
Magnetite		1.2	2		Interstitial, laths, equant	Lattice exsolution, with ilmenite.
Ilmenite		0.3	2		Laths	Intergrown with magnetite.
Pyrite		0.5	0.6		Spongy	In patches with a small amount of sphalerite
Chalcopyrite		0.1	0.5		Irregular	In altered patches

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Amphibole	37	Plagioclase,clinopyroxene,orthopyroxene	Light green mostly, some blue-green patches.
Clay	5	Orthopyroxene	Orthopyroxene pervasively altered, clay imparts grotty appearance.
Magnetite	1	Pyroxene	Very fine-grained, granular.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Fractures		Random		Green amphibole or none	Various	A lot of fractures, many localized to single grain, or adjacent grains. Few are laterally continuous.

COMMENTS: Modes visually estimated. This sample is very fractured, but has no apparent preferred direction. No orientation of silicates. No deformation.

147-894G-20R-2 (Piece 2, 14–16 cm) OBSERVER: JAY WHERE SAMPLED: Unit 13
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium
TEXTURE: Hypidiomorphic granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	50.2	53.7	1–3		Euhedral to subhedral	Tabular to subequant crystals. Oscillatory zoning common.
Clinopyroxene	14.9	33.3	1–3		Anhedral	Moderately to pervasively altered. Occasional subophitic intergrowths with plagioclase.
Orthopyroxene	2.8	9.8	to 5		Anhedral to subhedral	Large oikocysts where plagioclase % is greater than orthopyroxene %. Also as large tabular subhedral crystals.
Magnetite	1.8		1		Interstitial	Occur in patches of high oxide mineral density.
Ilmenite	1.2		<1		Laths and blebs	Intergrown with magnetite.
Pyrite	Trace		0.2		Spongy	Altered to marcasite.
Chalcopyrite	Trace		0.2		Subangular	

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Amphibole	23	Clinopyroxene, orthopyroxene, plagioclase	Predominantly light blue-green with lesser brown, fibrous to patchy.
Clinopyroxene	3	Clinopyroxene	
Clay	2	Pyroxene	
Magnetite	1	Pyroxene	Microgranular.

COMMENTS: Mode point counted, 1357 points, 0.5 mm counting interval. Phaneritic, roughly equigranular. Possible very weak foliation evident in plagioclase close to contact with coarser grained band across section. Foliation is at high oblique angle to band. No deformation. *Note: Other half of this section is described as 147-894G-20R-02-16-19 (2), since modal mineralogy and grainsize are markedly different. Contact marked by coarse grained band 1cm wide with pervasively altered coarse-grained, euhedral laths of plagioclase, and amphibole (altered pyroxene).

147-894G-20R-2 (Piece 2, 16–19 cm) OBSERVER: JAY WHERE SAMPLED: Unit 13
ROCK NAME: Gabbro
GRAIN SIZE: Medium to coarse
TEXTURE: Intergranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase	73.2	75.7	to 5		Subhedral to euhedral	Tabular to subequant crystals. Oscillatory zoning common.
Clinopyroxene	2.9	23.4	to 3		Anhedral	Pervasively altered, intergranular.
Magnetite	0.45		to 3		Blebs	Interstitial
Ilmenite	0.45		to 3		Blebs and laths	Interstitial
Pyrite	Trace		0.2		Spongy	95% of sulfide minerals, pervasively altered to marcasite.
Chalcopyrite	Trace					

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Amphibole	21.5	Clinopyroxene, plagioclase	Light-green, pleochroic patchy to fibrous.
Epidote	1	Plagioclase	Intergrown with exsolved oxide minerals.
Clay	1	Clinopyroxene	
Magnetite	1		

COMMENTS: Point counted mode, 1537 points, 0.5 mm counting interval. Phaneritic, intergranular. Opaque minerals have common exsolution to sphene with hematite (red-brown color and red internal reflections). Often intergrown with interstitial epidote (yellow, pleochroic, high relief). Plagioclase rich. No fabric or deformation evident. *Note: The other part of this section is described as 147-894G-20R-02-14-16 (2), since modal mineralogy and grain size are markedly different. Contact described in that report as well.

147-894G-20R-3 (Piece 9, 59–62 cm) OBSERVER: TRE WHERE SAMPLED: Unit 13
ROCK NAME: Gabbronorite
GRAIN SIZE: Medium
TEXTURE: Hypidiomorphic granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Olivine	0	1.8	1		Anhedral	Rimmed by orthopyroxene and associated alteration products. Completely replaced by secondary oxides (magnetite), green clay and serpentine.
Plagioclase	45.3	51.3	0.2–5.6	An48-50	Subhedral	Plagioclase tabular, slightly altered to brown clay along cleavage planes and fractures.
Clinoproxene	8	32.8	0.2–4		Anhedral	Secondary oxides forming along cleavage and exsolution lamellae replaced by green amphibole.
Orthopyroxene	2.1	12.1	1.6–6		Subhedral, anhedral	Replaced by pale green amphibole and secondary oxides.
Magnetite	0.975	0.975	0.2–2.6		Semirounded	Interstitial, patchy.
Ilmenite	0.325	0.325	0.2–2.6		Semirounded	Interstitial, patchy.
Pyrite	0.15	0.15	0.4		Semirounded, rounded	
Pyrrhotite	0.04	0.04	0.4		Semirounded, rounded	
Chalcopyrite	0.01	0.01	0.4		Semirounded, patchy	

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Green amphibole	24.8	Plagioclase, clinopyroxene	
Pale green	9	Orthopyroxene amphibole	
Serpentine	1.8	Olivine	
Oxide minerals	2	Orthopyroxene, clinopyroxene, olivine	
Clays	5	Plagioclase	

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE

COMMENTS: Primary silicate mode based on point counting (n=1500, counting interval 0.5mm). Proportion of oxide/sulfide minerals visually estimated. Plagioclase composition estimated by optical techniques. Secondary mineralogy mode, visual estimation only.