THIN SECTION LABEL ID: **399-U1309D-297R-1-W 85/87-TSB-TS 20** TS no.: **20**

Group	Summaries
Igneous petrology:	Coarse-grained olivine-bearing gabbro with ophitic texture. Contains sulfide grains associated with oxides and greenschist minerals.
Metamorphic petrology:	Slightly altered Ol-Opx-gabbro. Olivine is replaced by mesh-forming serpentine-magnetite and near contact with pyroxene, by talc-sulfide. Olivine has tiny opaque lamellae parallel to kink bands. Clino- and orthopyroxene are partially replaced by colorless to green amphibole. Clinopyroxene also has brown amphibole blebs. Plagioclase has microfractures filled with chlorite and/or amphibole.
Structure:	Isotropic magmatic fabric with minor intracrystalline deformation.

Plane-polarized

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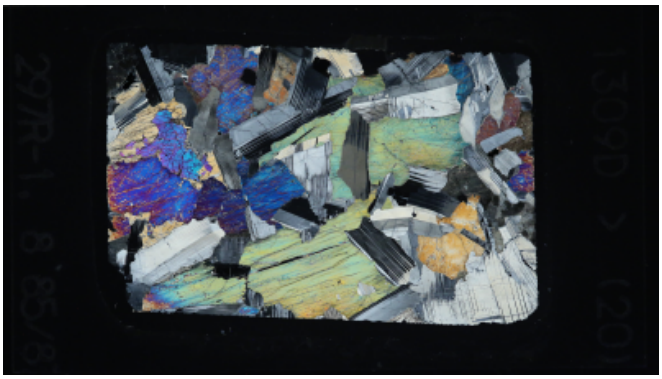
Cross-polarized



69422891

IGNEOUS PETROLOGY

Lithology: **olivine-bearing gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Olivine	4	3.5	0.5	1	8	5	anhedral	subequant	Has kink bands
Plagioclase	46	45	1	2	12	6	anhedral	tabular	Compositional zoning with reversals in some large grains; reaction zones adjacent to olivine
Clinopyroxene	50	40	10	1	17	8	anhedral	ophitic	Fine scale exsollution lamellae, and blebs of second cpx common. Some cpx resorbs olivine and has amoeboid extensions into olivine grains.
Oxide	0.1	0.1					anhedral	subequant	oxide often found adjacent to more abundant sulfide

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Slightly altered Ol-Opx-gabbro. Olivine is replaced by mesh-forming serpentine-magnetite and near contact with pyroxene, by talc and sulfide. Olivine has tiny opaque lamellae parallel to kink bands. Clino- and orthopyroxene are partially replaced by colorless to green amphibole. Clinopyroxene contains brown amphibole blebs. Plagioclase has microfractures filled with chlorite and/or amphibole.

Mineral	Altered (%)	Minerals replacing
Olivine	5	serpentine, talc, amphibole, magnetite, sulfide
Opx	5	amphibole, talc, oxide
Cpx	10	amphibole, oxide, sulfide
Amphibole		N/A
Plagioclase	1	chlorite, amphibole
Oxides		
Other	1	oxide, sulfide, brown amphibole (lamellae in Cpx)

Vein number	Vein fill minerals
Vein 1	chlorite
Vein 2	zeolite

Abundance of fluid inclusions in mineral(s): few

Mineral(s) containing fluid inclusions: Ol, Opx, Cpx

Mineral(s) containing lamellae: olivine,orthopyroxene,clinopyroxene

Comments on lamellae: Tiny opaque lamellae parallel to olivine kink bands; brown amphibole blebs in clinopyroxene.

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
1	weak magmatic fabric	1

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
0	undeformed	1	

Intracrystalline deformation features	Intensity of static recrystallization
plg: undulose extinct., deformation twins; ol: undulose ext., subgrains; cpx: none; opx: undulose	

Recrystallized grain phase	Recrystallized grain AVE size (mm)
none	

Fault rock intensity	Max. fault rock intensity	Rank
	no fracturing	0

Fracture abundance	Rank
no fractures	0

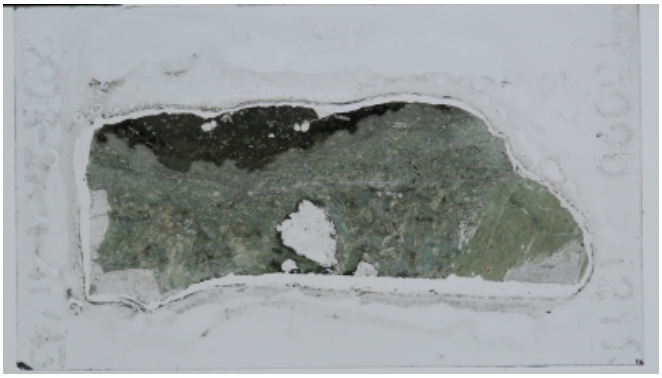
Vein abundance	Rank
No veins	0

General microstructure comment: isotropic magmatic fabric, cpx shows no indication of deformation, ol and opx are undulous, plg has deformation twins; dihedral triple grains and quadruple junctions suggest crystallization form melt with plg crystallized before cpx

THIN SECTION LABEL ID: **399-U1309D-297R-2-W 41/43-TSB-TS 21** TS no.: **21**

Group	Summaries
Igneous petrology:	Greenschist facies metamorphic rock consisting mostly of actinolite. Most original igneous features are obscured, although about 1/3 of the sample is much finer grained than the rest, and likely was a diabase before metamorphism.
Metamorphic petrology:	Almost completely altered basalt and highly altered diorite, and amphibole vein in between. The altered basalt contains pseudomorphs after olivine and plagioclase phenocrysts. Plagioclase in the diorite is completely altered to chlorite, prehnite and secondary plagioclase.The vein consists of relatively large subhedral crystals of amphibole set in a matrix of fine-grained amphibole with a small amount of interstitiall prehnite, and shows porphyritic texture in proximity to the basalt.
Structure:	Diabase chilled margin contact with metagabbro. County rock is dominated by amphibole (actinolite), segregated into a fine, medium and coarse grained bands parallel to dyke margin. Sample is undeformed. In hand sample, this rock looked like a cataclasite. It is possible that intrusion of diabase has thermally and statically overprinted any previous deformation.

Plane-polarized



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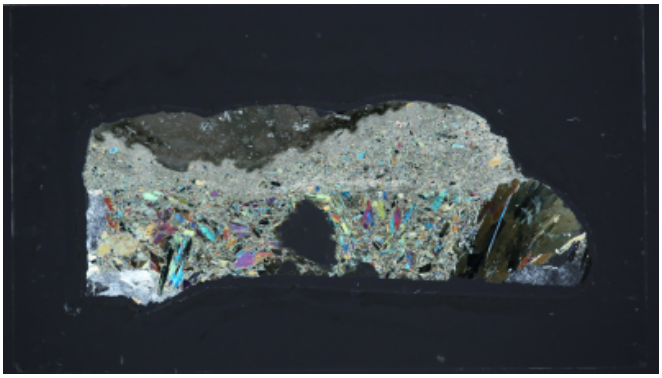
Cross-polarized



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IGNEOUS PETROLOGY

Lithology: Observer: MR

METAMORPHIC PETROLOGY

Interval domain no: 1

Observer(s): TN

Detailed description Almost completely altered basalt with pseudomorphs after olivine and plagioclase phenocrysts.

Mineral	Altered (%)	Minerals replacing
Olivine	100	chlorite
Opx		N/A
Cpx	99	submicroscopic fine-grained minerals
Spinel	50	opaque
Amphibole		N/A
Plagioclase	100	chlorite, prehnite, secondary plagioclase, zeolite, submicroscopic fine-grained minerals

Interval domain no: 2

Observer(s): TN

Detailed description Highly altered diorite and amphibole vein. Plagioclase in the diorite is completely altered to chlorite, prehnite and secondary plagioclase.The vein consists of relatively large subhedral crystals of amphibole set in a matrix of fine-grained amphibole with a small amount of interstitiall prehnite, and shows porphyritic texture in proximity to the basalt.

Mineral	Altered (%)	Minerals replacing
Olivine		N/A
Opx		N/A
Cpx		N/A
Spinel		N/A
Amphibole	0	
Plagioclase	100	chlorite, prehnite, secondary plagioclase

Vein number	Vein fill minerals
Vein 1	amphibole
Vein 2	prehnite

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
amp: undulaose extinction, subgrains	

Fault rock intensity	Max. fault rock intensity	Rank
	no fracturing	0

Fracture abundance	Rank
no fractures	0

Vein abundance	Rank
No veins	0

General microstructure comment: diabase chilled margin contact with metagabbro. County rock is dominated by amphibole (actinolite), segregated into a fine, medium and coarse grained bands parallel to dyke margin. Sample is undeformed. In hand sample, this rock looked like a cataclasite. It is possible that intrusion of diabase has thermally and statically overprinted any previous deformation.

THIN SECTION LABEL ID: **399-U1309D-297R-2-W 97/100-TSB-TS 22** TS no.: **22**

Group	Summaries
Igneous petrology:	Granular gabbro with a fine-grained diabase dike. The dike has a chilled, irregular margin that is marked by cataclastic deformation of gabbro. Diabase contains xenocrysts and fragments of altered gabbro. Some of these fragments serve as nucleation sites for plagioclase.
Metamorphic petrology:	There are two domains in this TS. Domain 1: Moderately altered Opx-bearing Ol gabbro. Opx exsolutions in Cpx. Primary sulfides and oxides in Pl. Overall, Cpx and Ol are more altered than Pl. Cpx is variably altered, from almost pristine to completely altered grains. Secondary silicates after Ol and Cpx, especially talc, are associated with magnetite and sulfides, locally forming polymineral assemblages. Pl is crosscut by abundant fractures filled with secondary Amp (not counted in Pl alteration as no evidence for chemical transformation of Pl to Amp). 3 types of Amp observed: brown, green and white. White Amp seems latter compared to brown and green Amp. Domain 2: Fine-grained diabase intruding the gabbro. The small size of the grains in the matrix makes it difficult the recognition of the mineralogy. The diabase is crosscut by thim Chl/Srp veins. Ol phenocrysts are variably altered to Tlc+Mt+sulfides, from fresh to tatally replaced. In some instances Ol is replaced to Amp and Chl/Srp without association with Tlc.
Structure:	Diabase chilled margin contact with gabbro, significant fracturing and fault breccia: diabase intrusion post-dates fault breccia.

Plane-polarized

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Cross-polarized

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IGNEOUS PETROLOGY

Interval domain no: **1** Domain rel. abundance (%): 40 Domain name: olivine gabbro

Lithology: olivine gabbro Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Olivine	10	4	6	1	3	2	anhedral	subequant	
Plagioclase	45	40	5	1	4	3	subhedral	tabular	Most variations in optical orientation may have resulted from deformation, although some compositonal zoning is possible.
Clinopyroxene	45	20	25	1	6	3	anhedral	interstitial	fine scale exsollution lamellae

Interval domain no: **2** Domain rel. abundance (%): 60 Domain name: diabase with olivine, plagioclase and chromite

Lithology: Observer: MR

Groundmass modal (%)	**Groundmass grain size**	**Groundmass grain size distr.**	**Groundmass constituent(s)**	**Groundmass comments**
85	cryptocrystalline to microcrystalline	seriate	cpx, plag, opaques olivine	cryptocrystalline at chilled margin

METAMORPHIC PETROLOGY

Observer(s): RC

Detailed description

Moderately altered Opx-bearing Ol gabbro. Orthopyroxene exsolutions in clinopyroxene. Primary sulfides and oxides in plagioclase. Overall, clinopyroxene and olivine are more altered than plagioclase. Clinopyroxene is variably altered, from almost pristine to completely altered grains. Secondary silicates after olivine and clinopyroxene, especially talc, are associated with magnetite and sulfides, locally forming polymineral assemblages. Plagioclase is crosscut by abundant fractures filled with secondary amphibole (not counted in plagioclase alteration as no evidence for chemical transformation of plagioclase to amphibole). 3 types of amphibole observed: brown, green and white. White amphibole seems latter compared to brown and green amphibole.

Mineral	Altered (%)	Minerals replacing
Olivine	70	talc, white amphibole, chlorite, magnetite, pyrite/pyrrhotite
Opx	80	talc, green amphibole, brown amphibole, chlorite
Cpx	80	green, brown, and white amphibole, talc, magnetite, pyrite/pyrrhotite
Plagioclase	2	chlorite

Abundance of fluid inclusions in mineral(s): frequent

Mineral(s) containing fluid inclusions: olivine, plagioclase

Mineral(s) containing lamellae: olivine

Comments on lamellae:

Observer(s): RC

Detailed description

Fine-grained diabase intruding gabbro. The small size of the grains in the matrix makes it difficult the recognition of the mineralogy. The diabase is crosscut by thin chlorite/serpentine veins. Olivine phenocrysts are variably altered to talc+magnetite+sulfides, from fresh to totally replaced. In some instances olivine is replaced to amphibole and chlorite/serpentine without association with talc.

Mineral	Altered (%)	Minerals replacing
Olivine	10	talc, amphibole, (chlorite/serpentine?), magnetite, sulfides
Plagioclase	0	

Vein number	Vein fill minerals
Vein 1	chlorite and/or serpentine

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
diabase: weak SPO, gabbro: isotropic	weak magmatic fabric	1

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
0	undeformed	1	

Intracrystalline deformation features	Intensity of static recrystallization
ol + plg: undulose, plg has deformation twins and shows subgrains in fine grained micro fault and fractured zone	

Recrystallized grain phase	Recrystallized grain AVE size (mm)
plg: blg + sgr	0.005-0.015

Fault rock intensity	Max. fault rock intensity	Rank
fault breccia (gabbro only)	well developed fault brecciation	4

Fault rock clast phase	Clasts in fault rock	Clast size (mm)	Fault sense of shear
		0.02-0.2	

Fracture abundance	Rank
abundant fractures	4

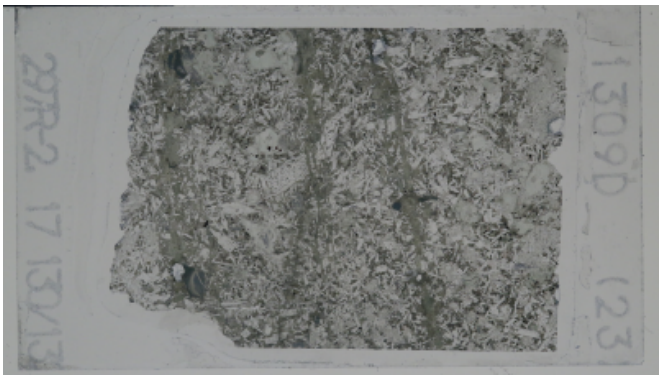
Vein abundance	Rank
Abundant veins	4

General microstructure comment: diabase chilled margin contact with gabbro: diabase intrusion post-dates fault breccia; gabbro: cpx and olvine altered, significant fracturing and fault breccia, fracture network creates pathway for fluid, some regions of fault breccia (along fracture network) recrystallized via subgrain rotation and bulging, aided by fluid?

THIN SECTION LABEL ID: **399-U1309D-297R-2-W 130/132-TSB-TS 23** TS no.: **23**

Group	Summaries
Igneous petrology:	Diabase with phenocrysts of plagioclase and altered olivine. Plagioclase phenocrysts have two textures. One is euhedral and relatively inclusion free. The other is subhedral with abundant inclusions consisting of alteration minerals after glass.
Metamorphic petrology:	Moderately to highly altered diabase. Olivine is psudomorphically replaced by chlorite and a subordinate amount of amphibole. Clinopyroxene are altered to green amphibole particularly in the proximity of amphibole vein. Plagioclase is relatively fresh but partially replaced by secondary plagioclase and zeolite throughout the thin section. Discrete and oxide-replacing titanite is sporadically distributed throughout the thin section.Brown spinel is partially replaced by opaque mineral (possibly magnetite and ferritchromite).
Structure:	Diabase with a set of 3 parallel, undeformed amp veins.

Plane-polarized



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Cross-polarized

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IGNEOUS PETROLOGY

Lithology: **olivine-plagioclase diabase** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Olivine	5	0	5	1	2	2	subhedral	subequant	Entirely altered to chlorite and other secondary minerals. Relict chromite inclusions
Plagioclase	30	25	5	0.1	0.7	0.3	euhedral	tabular	Strong compositional zonation. A few plagioclase phenocrysts are present in the diabase. These phenocrysts have two textures. One is euhedral and relatively inclusion free. The other is subhedral with abundant inclusions consisting of alteration minerals after glass.
Clinopyroxene	25	13	12	0.1	0.6	0.4	subhedral	subequant	
Spinel	0.1	0.1		0.1	0.1	0.1	subhedral	equant	Anhedral grains in groundmass; euhedral inclusions in altered olivine
Oxide	1		1	0.01	0.1	0.05	anhedral	equant	

Groundmass modal (%)	Groundmass grain size	Groundmass grain size distr.	Groundmass constituent(s)	Groundmass comments
49				

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Moderately to highly altered diabase. Olivine is pseudomorphically replaced by chlorite and a subordinate amount of amphibole. Clinopyroxene is altered to green amphibole particularly in the proximity of amphibole vein. Plagioclase is relatively fresh but partially replaced by secondary plagioclase and zeolite throughout the thin section. Discrete and oxide-replacing titanite is sporadically distributed throughout the thin section. Brown spinel is partially replaced by opaque mineral (possibly magnetite and ferritchromite).

Mineral	Altered (%)	Minerals replacing
Olivine	100	chlorite, amphibole
Opx		N/A
Cpx	70	amphibole
Spinel	40	magnetite, ferritchromite
Amphibole		N/A
Plagioclase	10	secondary plagioclase, zeolite
Oxides	80	titanite
Other		N/A

Vein number	Vein fill minerals
Vein 1	amphibole
Vein 2	chlorite
Vein 3	zeolite

MICROSTRUCTURES

Observer: RK

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
0	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
0	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
cpx: undulose; plg: at vein walls undulose and recryst.?	

Recrystallized grain phase	Recrystallized grain AVE size (mm)
none	

Fault rock intensity	Max. fault rock intensity	Rank
	no fracturing	0

Fracture abundance	Rank
no fractures	0

Vein abundance	Rank
Few veins	2

General microstructure comment: diabase with a set of 3 parallel amp veins (opening width:~0.5mm), amp growing in veins grows in different directions indicating no deformation in veins; cpx in diabase is undulose, plg at vein walls is undulose

THIN SECTION LABEL ID: **399-U1309D-297R-3-W 37/40-TSB-TS 24** TS no.: **24**

Group	Summaries
Igneous petrology:	Oxide- and olivine-bearing gabbro with subophitic texture. Multiple generations of clinopyroxene.
Metamorphic petrology:	Slightly altered Ol-bearing gabbro crosscut by Chl-Amp veins with apparent normal sense of slip. Degree of alteration is Ol>Cpx>Pl. At the contact with altered Ol, Pl displays Chl rim. Secondary silicates after Ol display mineralogical zonation from Ol to Srp+/clays to Amp+Tlc in the outter part. Sulfides (Po/Py) are associated with secondary silicates while fractures in Ol are maily filled with Mt.
Structure:	Fault breccia with localized cataclastic zones, microfaults deform host, undeformed chlorite vein is same deformation event as microfaults.

Plane-polarized

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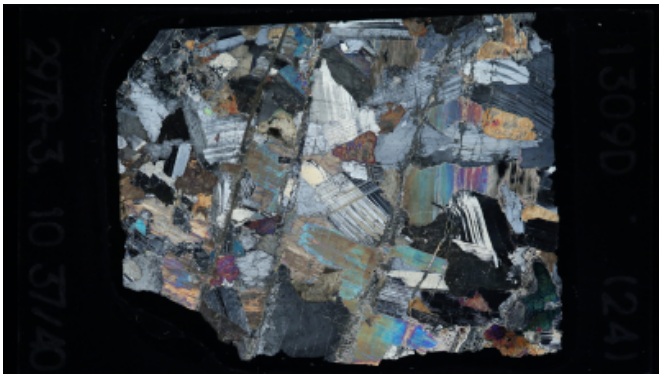
Cross-polarized



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IGNEOUS PETROLOGY

Lithology: **olivine-bearing gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Olivine	4	3	1	2	5	3	anhedral	subequant	One clot of crystals with kink bands
Plagioclase	55	52	3	1	6	3	anhedral	tabular	Compositional zoning with reversals in some large grains
Clinopyroxene	44	29	15	1	6	4	anhedral	interstitial	fine scale exsollution lamellae; clear reaction textures between an older cpx and a younger cpx
Oxide	0.1	0.1					anhedral	subequant	inclusions in plagioclase

METAMORPHIC PETROLOGY

Observer(s): RC

Detailed description Slightly altered Ol-bearing gabbro crosscut by chlorite-amphibole veins. The degree of alteration is olivinec>linopyroxene>plagioclase. At the contact with altered olivine, plagioclase displays chlorite corona. Secondary silicates after olivine display a mineralogical zonation from olivine to serpentine (and possibly clay) to amphibole+talc in the outter part. Sulfides (pyrrhotite or pyrite) are associated with secondary silicates while fractures in olivine are maily filled with magnetite.

Mineral	Altered (%)	Minerals replacing
Olivine	30	talc, white amphibole, serpentine, clays, magnetite, sulfides
Cpx	5	brown, green, and white amphibole, chlorite
Plagioclase	2	chlorite

Vein number	Vein fill minerals
Vein 1	chlorite, amphibole

Abundance of fluid inclusions in mineral(s): few Mineral(s) containing fluid inclusions: olivine

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
1	weak magmatic fabric	1

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
0	undeformed	1	

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, fractures and undulose ext., ol: fractures and subgrains, cpx: undulose ext. , twins, fractures, opx: fractures, undulose ext.	

Recrystallized grain phase	Recrystallized grain AVE size (mm)
none	

Fault rock intensity	Max. fault rock intensity	Rank
microfaults, fault breccia, cataclasite	cataclastic	5

Fault rock clast phase	Clasts in fault rock	Clast size (mm)	Fault sense of shear
plg,px	80	0.1-0.4	

Fracture abundance	Rank
abundant fractures	4

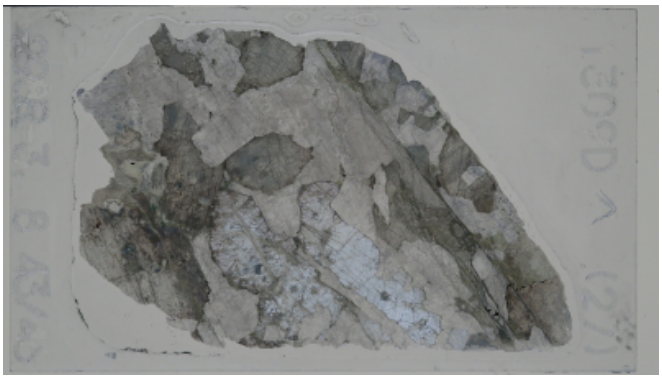
Vein abundance	Rank
Few veins	2

General microstructure comment: Planar and parallel microfaults deform all minerals, wider faults (similar orientation, 0.2-0.5 mm wide, 3.5 mm offset) entrain plg and px into fault zone, creating a zone of fault breccia with plg and px clasts with localized cataclastic zones (cataclastic matrix: 0.01-0.04 mm plg grains) in plg-rich domains, chlorite vein (0.5 mm wide) is parallel to microfault but shows no offset, veining under sam deformatino event as microfaults; along fluid inclusion trails (healed fractures parallel to microfaults) in plg, plg breaks down to clinozoisite

THIN SECTION LABEL ID: **399-U1309D-298R-3-W 43/46-TSB-TS 27** TS no.: **27**

Group	Summaries
Igneous petrology:	Deformed and moderately altered coarse-grained and subophitic gabbro
Metamorphic petrology:	Moderately altered gabbro with advanced alteration along a cataclastic zone and nearby amphibole and chlorite veins.
Structure:	Faulted gabbro, fault wall of piece-end fault, parallel strand of fault breccia, localized zones of cataclasis, reverse sense of motion.

Plane-polarized



69448551

Cross-polarized

69448571

IGNEOUS PETROLOGY

Lithology: **gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	40	30	10	2	12	6	subhedral	tabular	
Clinopyroxene	60	50	10	2	12	6	anhedral	interstitial	
Oxide	0.5	0.5					anhedral	subequant	Secondary - associated with green amphibole (actinolite?)

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Moderately altered gabbro with advanced alteration along a cataclastic zone and nearby amphibole and chlorite veins.

Mineral	Altered (%)	Minerals replacing
Olivine		N/A
Opx		N/A
Cpx	50	amphibole, chlorite
Spinel		N/A
Amphibole		N/A
Plagioclase	5	chlorite, amphibole, secondary plagioclase, prehnite, zeolite
Oxides		N/A

Vein number	Vein fill minerals
Vein 1	amphibole
Vein 2	chlorite
Vein 3	zeolite

Mineral(s) containing lamellae: clinopyroxene Comments on lamellae: brown amphibole blebs in clinopyroxene

MICROSTRUCTURES

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed		

Intracrystalline deformation features	Intensity of static recrystallization
outside of 6mm fault core: plg: undulose, fractures, deformation twins, cpx: fractured, kinked, undulose	

Fault rock intensity	Max. fault rock intensity	Rank
fault breccia + cataclasite	cataclastic	5

Fault rock clast phase	Clasts in fault rock	Clast size (mm)	Fault sense of shear
	80	<25 micron	

Fracture abundance	Rank
abundant fractures	4

Vein abundance	Rank
Few veins	2

General microstructure comment: Faulted gabbro, fault wall of piece-end fault, damage zone is 6mm wide (half width of fault). Parallel strand of fault bound fault breccia of plg and cpx. Localized zones of cataclasis of plg. Cores of fault strands contain chlorite and fibrous mineral(amp? in fault core 5 micron wide). Fault chlorite fibres and offset of plg and cpx , indicate a reverse sense of motion in present orientation. Fault dip is 40 to 270 degrees. Offest is 3-4mm on fault strand.

THIN SECTION LABEL ID: **399-U1309D-298R-3-W 66/69-TSB-TS 28** TS no.: **28**

Group	Summaries
Igneous petrology:	Oxide-bearing olivine gabbro, perhaps with multiple olivine generations. Trace interstitial orthopyroxene is present. Contains rare oxide-sulfide-green amphibole clots.
Metamorphic petrology:	Slightly to moderately altered Ol-Opx-bearing gabbro. Mafic minerals are partially altered around rims and along cleavage planes and microcracks, and intensely altered near amphibole veins. Plagioclase is relatively fresh.
Structure:	Isotropic gabbro with minor intracrystalline deformation and planar chlorite veins.

Plane-polarized

69449901

Cross-polarized

69449921

IGNEOUS PETROLOGY

Lithology: **olivine gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Olivine	5	4	1	1	5	3	anhedral	subequant	Some grains has opaque inclusions and are not kink-banded; others have aligned needle-like opaques (exsolution?) and arekink-banded. Both types may have a cryptocrystalline reaction boundary with plagioclase or may be partially rimmed by opx.
Plagioclase	40	37	3	1	5	3	subhedral	tabular	
Clinopyroxene	51			1	7	4	anhedral	interstitial	Relatively coarse opx exsolution lamellae. Some grains host resorbed olivine. Oxide inclusions are common. Brown amphibole inclusions are rare.
Amphibole	0.1	0.1		0.1	0.4	0.3	anhedral	subequant	Green amphibole with-oxide and sulfide
Oxide	1	1		0.1	0.6	0.5	anhedral	subequant	Some in clot with sulfide and amphibole

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Slightly to moderately altered Ol-Opx-bearing gabbro. Mafic minerals are partially altered around grain boudaries and along cleavage planes and microcracks, and intensely altered near amphibole veins. Plagioclase is relatively fresh.

Mineral	Altered (%)	Minerals replacing
Olivine	5	serpentine, talc, amphibole, opaque,
Opx	50	amphibole
Cpx	40	amphibole
Spinel		N/A
Amphibole		N/A
Plagioclase	1	chlorite, amphibole, secondary plagioclase
Oxides		N/A

Vein number	Vein fill minerals
Vein 1	amphibole
Vein 2	chlorite

Mineral(s) containing lamellae: clinopyroxene,olivine

Comments on lamellae: brown amph blebs in clinopyroxene, opaque lamellae in olivine

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plg undulose extinction, deformation twins, fractures, bent grains. cpx undulose extinction, fractures, subgrains parallel to cleavage. olv fractures, subgrains, undulose extinction	

Fault rock intensity	Max. fault rock intensity	Rank
	no fracturing	0

Fracture abundance	Rank
rare fractures	1

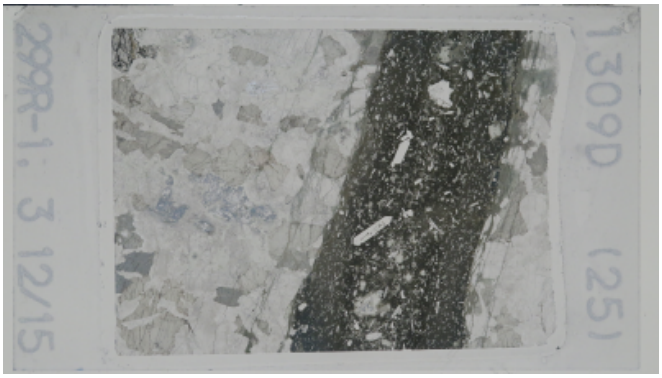
Vein abundance	Rank
Few veins	2

General microstructure comment: undeformed isotropic gabbro. plg has undulose extinction, deformation twins, fractures, and bent grains. cpx has subgrains parallel to cleavage and fractures. olv has undulose extinction, fractures and subgrains. A few 200um wide chl planar veins cut across sample, dipping 20-40deg to 90 (the right).

THIN SECTION LABEL ID: **399-U1309D-299R-1-W 12/15-TSB-TS 25** TS no.: **25**

Group	Summaries
Igneous petrology:	Medium grained olivine gabbro hosting a c. 1 cm thick diabase dike. The dike is fine-grained and porphyritic. Phenocrysts are of plagioclase, mostly euhedral, some rounded. There may also have had subhedral olivine phenocrysts, but these have been replaced by secondary minerals. Altered wallrock fragments that have reacted with melt are present in the dike.
Metamorphic petrology:	Domain1: Moderately altered Ol-gabbro. Olivine is replaced by acicular colorless amphibole with coronitic chlorite fringe, talc, mesh-forming serpentine + opaque, and clay. Chlorite + acicular amphibole aggregates intruded by amph-chl veins near a basaltic intrusion are possibly high-degree alteration products after Ol and Pl. Cpx is relatively fresh but partially replaced by amphibole and probably chlorite; Pl is replaced by chlorite at contact with Ol, and has microfracture filled with chlorite and amphibole. Amphibole veins runs parallel to a basaltic intrusion. Domain 2: Highly altered basalt intruded into Ol-gabbro. Olivine and Cpx is completely altered to amphibole-chlorite and amphibole-titanite, respectively. Pl is relatively fresh but partially altered to a small amount of 2nd Pl, and completely altered to chlorite in proximity to amph-chl pseudomorphs after olivine.
Structure:	Undeformed isotropic gabbro with diabase dyklet which has moderate magmatic foliation parallel to dyke walls.

Plane-polarized



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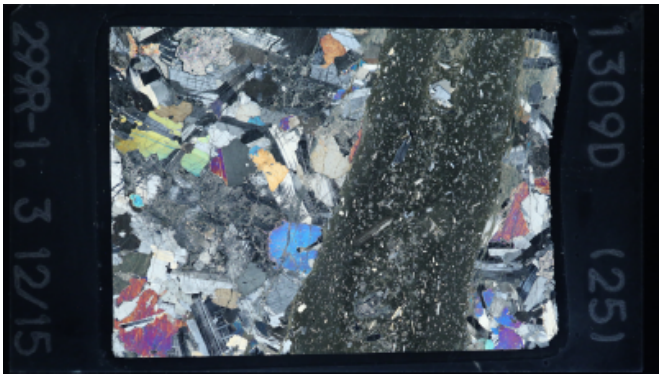
Cross-polarized



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IGNEOUS PETROLOGY

Interval domain no: **1** Domain rel. abundance (%): Domain name: Olivine gabbro

Lithology: olivine gabbro Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Olivine	5	1	4	1	2	4	anhedral	subequant	mostly altered to talc and other secondary minerals; fresh olivine has kink bands
Plagioclase	55	45	10	0.5	5	2	subhedral	tabular	
Clinopyroxene	40	38	2	1	4	2.5	anhedral	interstitial	multiple stages of growth

Interval domain no: **2** Domain rel. abundance (%): Domain name:

Lithology: Observer: MR

Groundmass modal (%)	Groundmass grain size	Groundmass grain size distr.	Groundmass constituent(s)	Groundmass comments
75	cryptocrystalline			

METAMORPHIC PETROLOGY

Interval domain no: 1

Observer(s): TN

Detailed description Moderately altered Ol-gabbro. Olivine is replaced by acicular colorless amphibole with coronitic chlorite fringe, talc, mesh-forming serpentine + opaque, and clay. Chlorite + acicular amphibole aggregates intruded by amphibole-chlorite veins near a basaltic intrusion are possibly high-degree alteration products after olivine and plagioclase. Clinopyroxene is relatively fresh but partially replaced by amphibole and probably chlorite; plagioclase is replaced by chlorite at contact with olivine, and has microfracture filled with chlorite and amphibole. Amphibole veins runs parallel to a basaltic intrusion.

Mineral	Altered (%)	Minerals replacing
Olivine	80	amphibole, talc, serpentine-opaque, clay
Opx		N/A
Cpx	5	amphibole, chlorite
Spinel		N/A
Amphibole		N/A
Plagioclase	10	chlorite, amphibole

Vein number	Vein fill minerals
Vein 1	amphibole
Vein 2	chlorite
Vein 3	zeolite

Abundance of fluid inclusions in mineral(s): few

Mineral(s) containing fluid inclusions: olivine, pyroxene

Mineral(s) containing lamellae: olivine,clinopyroxene

Comments on lamellae: thin opaque lamellae in olivine; orthopyroxene lamellae in clinopyroxene are altered to amphibole

Interval domain no: 2

Observer(s): TN

Detailed description Highly altered basalt intruded into Ol-gabbro. Olivine and clinopyroxene are completely altered to amphibole-chlorite and amphibole-titanite, respectively. Plagioclase is relatively fresh but partially altered to a small amount of secondary plagioclase, and completely altered to chlorite in proximity to amphibole-chlorite pseudomorphs after olivine.

Mineral	Altered (%)	Minerals replacing
Olivine	100	chlorite, amphibole
Opx		N/A
Cpx	100	amphibole
Spinel	95	oxide
Plagioclase	5	chlorite, secondary plagioclase
Oxides	95	titanite

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
gabbro = isotropic. diabase dyke = moderately foliated	moderate magmatic fabric	2

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	2	

Intracrystalline deformation features	Intensity of static recrystallization
plg undulose extinction, deformation twins, fractures. opx+cpx undulose extinction, fractures, subgrains parallel to cleavage.	

Fault rock intensity	Max. fault rock intensity	Rank
	no fracturing	0

Fracture abundance	Rank
few fractures	2

Vein abundance	Rank
Common veins	3

General microstructure comment: undeformed isotropic gabbro intuded by 11 mm wide diabase dyklet with planar dyke walls. plg has undulose extinction, deformation twins, and fractures. opx + cpx has subgrains parallel to cleavage and fractures. Diabase dykelet has moderate magmatic foliation parallel to dyke walls.

THIN SECTION LABEL ID: **399-U1309D-299R-2-W 7/9-TSB-TS 26** TS no.: **26**

Group	Summaries
Igneous petrology:	Medium-grained subophitic olivine gabbro with trace orthopyroxene. Some olivine are rimmed with orthopyroxene or clinopyroxene. Orthopyroxene are interstitial.
Metamorphic petrology:	Orthopyroxene-bearing olivine-gabbro that underwent incipient alteration. The extent of olivine alteration varies from incipient to high. Olivine is altered to either serpentine, magnetite, and sulfide, or to serpentine, talc, magnetite and sulfide. Interstitial orthopyroxene appears unaltered. Clinopyroxene is altered along thin veins and cleavage planes. Plagioclase is mostly unaltered. Fluid inclusions occur in all primary silicates.
Structure:	Undeformed ol gabbro, isotropic, minor intracrystalline deformation.

Plane-polarized

69422831

Cross-polarized

69422851

IGNEOUS PETROLOGY

Lithology: **olivine gabbro** Observer: HL

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Olivine	9	8.8	0.2	0.5	3	1.5	subhedral	equant	Some have orthopyroxene or clinopyroxene films along grain boundaries.
Plagioclase	50	50		1	7	4	subhedral	tabular	
Clinopyroxene	41	41		2	8	4	subhedral	interstitial	Some have second stage pyroxene films along grain boundaries.
Orthopyroxene	0.1								
Oxide	0.1								

METAMORPHIC PETROLOGY

Observer(s): FK

Detailed description Opx-bearing Ol gabbro that underwent incipient alteration. The extent of olivine alteration varies from incipient to high. Olivine is altered to either serpentine, magnetite, and sulfide, or to serpentine, talc, magnetite and sulfide. Interstitial orthopyroxene appears unaltered. Clinopyroxene is altered along thin veins and cleavage planes. Plagioclase is mostly unaltered. Fluid inclusions occur in all primary silicates.

Mineral	Altered (%)	Minerals replacing
Olivine	40	serpentine-talc-sulfide, serpentine-magnetite
Opx	0	none
Cpx	1	amphibole
Plagioclase	1	chlorite
Other	pyrrhotite, chalcopyrite	pyrite

Abundance of fluid inclusions in mineral(s):	Abundant	Mineral(s) containing fluid inclusions:	olivine, clinopyroxene, orthopyroxene

MICROSTRUCTURES

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plg undulose, thin cracks and inclusion trails, deformation twins; cpx: subgrains + undulose features; ol: fractures, subgrains,undulose	

Fracture abundance	Rank
no fractures	0

Vein abundance	Rank
No veins	0

General microstructure comment: undeformed ol gabbro, isotropic, minor intracrystalline deformation

THIN SECTION LABEL ID: **399-U1309D-299R-3-W 56/60-TSB-TS 29** TS no.: **29**

Group	Summaries
Igneous petrology:	Coarse grained olivine- and orthopyroxene-bearing gabbro. Orthopyroxene is late-stage and interstitial.
Metamorphic petrology:	Slightly altered Ol-Opx-bearing gabbro. Olivine has serpentine mesh and no chlorite corona.
Structure:	Undeformed gabbro with weak magmatic foliation defined by SPO.

Plane-polarized

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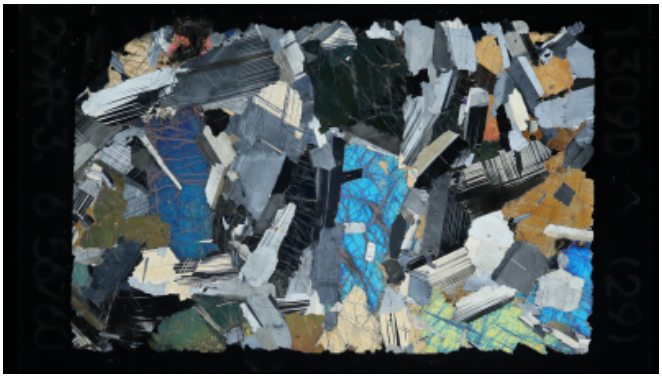
Cross-polarized



69449981

IGNEOUS PETROLOGY

Lithology: **olivine- and orthopyroxene-bearing gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Olivine	3	2	1	1	3	2	anhedral	subequant	
Plagioclase	56	50	1	1	7	4	subhedral	tabular	
Clinopyroxene	40	35	5	1	8	4	anhedral	interstitial	multiple stages of growth
Orthopyroxene	1	1	0	0.5	0.7	1	anhedral	interstitial	

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Slightly altered Ol-Opx-bearing gabbro. Olivine has serpentine mesh and no chlorite corona.

Mineral	Altered (%)	Minerals replacing
Olivine	30	talc, serpentine
Opx	5	talc, amphibole
Cpx	5	amphibole, chlorite
Plagioclase	1	chlorite, zeolite

Abundance of fluid inclusions in mineral(s): few

Mineral(s) containing fluid inclusions: plagioclase

Mineral(s) containing lamellae: clinopyroxene

Comments on lamellae: orthopyroxene lamellae

MICROSTRUCTURES

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
plag + cpx = weakly foliated, defined by SPO	weak magmatic fabric	1

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	1	

Intracrystalline deformation features	Intensity of static recrystallization
plg undulose extinction, deformation twins, fractures. cpx fractures.	

Fault rock intensity	Max. fault rock intensity	Rank
	no fracturing	0

Fracture abundance	Rank
no fractures	0

Vein abundance	Rank
No veins	0

General microstructure comment: undeformed weakly foliated gabbro. foliation defined by spo of elongate cpx + plag. foliation is horizontal. plag grain boundaries vary from amoibiodal+interlocking to straight overlapping/cross cutting boundaries, suggesting both melt textures (amoiboidal) and cummulate textures (straight cross cutting).

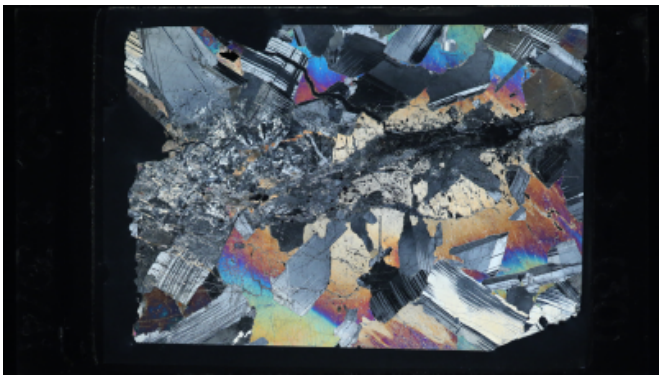
THIN SECTION LABEL ID: **399-U1309D-300R-2-W 39/41-TSB-TS 30** TS no.: **30**

Group	Summaries
Igneous petrology:	Corase-grained gabbro with subophitic texture.
Metamorphic petrology:	Slightly altered gabbro crosscut by Amp+Chl+Gt vein. The overall degree of cataclastic deformation and alteration of primary igneous grains increases towards the vein. Plagioclase is commonly crosscut by Amp veins. Presence of secondary sulfides associated with green amphibole, presumably after Fe-Ti oxides and Mt
Structure:	Undeformed isotropic gabbro with acummulate texture, cut by chlorite vein.

Plane-polarized

69463851

Cross-polarized



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IGNEOUS PETROLOGY

Lithology: **gabbro** Observer: HL

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	55	54.9	0.1	2	12	7	subhedral	subequant	
Clinopyroxene	45	43	2	2	30	15	subhedral	interstitial	Slightly altered
Quartz	0.1	-	-						

METAMORPHIC PETROLOGY

Observer(s): RC

Detailed description Slightly altered gabbro crosscut by amphibole-chlorite-garnet vein. The overall degree of cataclastic deformation and alteration of primary igneous grains increases towards the vein. Plagioclase is commonly crosscut by amphibole veins. Presence of secondary sulfides associated with green amphibole, presumably after Fe-Ti oxide and magnetite

Mineral	Altered (%)	Minerals replacing
Cpx	5	green amphibole
Plagioclase	5	chlorite

Vein number	Vein fill minerals
Vein 1	amphibole, chlorite, garnet

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic, adcummulate	weak magmatic fabric	1

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	1	

Intracrystalline deformation features	Intensity of static recrystallization
plg: undulose extinction, deformation twins, fractures. cpx fractures.	

Fault rock intensity	Max. fault rock intensity	Rank
	no fracturing	0

Fracture abundance	Rank
no fractures	0

Vein abundance	Rank
Few veins	2

General microstructure comment: undeformed isotropic gabbro with adcummulate texture. Gabbro is cut by chlorite vein dipping 20deg to 270 (left) with up to 8mm wide alteration halo. No indication of deformation associated with alteration. Mostly 1 large oikocryst.

THIN SECTION LABEL ID: **399-U1309D-300R-3-W 123/129-TSB-TS 31** TS no.: **31**

Group	Summaries
Igneous petrology:	Coarse-grained oxide-bearing gabbro with an ophitic texture. Contains trace, late-stage brown amphibole.
Metamorphic petrology:	Slightly altered Ol-bearing gabbronorite. Alteration: along grain rim and maicrocracks in olivine; along cleavage planes and fractures in pyroxene; along microcracks inplagioclase. Plagioclase is fresher than mafic minerals.
Structure:	Gabbro with bimodal grain size, plg interpreted to be residual melt after crystallization of large plg.

Plane-polarized

69476531

Cross-polarized

69476551

IGNEOUS PETROLOGY

Lithology: **oxide-bearing gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	40	35	5	2	10	6	subhedral	tabular	Zoning mostly from deformation
Clinopyroxene	58	30	28	2	14	7	anhedral	interstitial	
Amphibole	0.1								Trace of late interstitial brown amphibole
Oxide	2	2		1	3	2	anhedral	subequant	

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Slightly altered Ol-bearing gabbronorite. Alteration is mainly restricted along grain rims and microcracks in olivine; along cleavage planes and fractures in pyroxene; and along microcracks in plagioclase. Plagioclase is fresher than mafic minerals.

Mineral	Altered (%)	Minerals replacing
Olivine	10	amphibole, talc, serpentine, oxide, sulfide
Opx	20	amphibole, talc
Cpx	20	amphibole, chlorite?
Spinel		N/A
Amphibole		N/A
Plagioclase	1	chlorite, amphibole
Oxides	0	

Vein number	Vein fill minerals
Vein 1	amphibole

Mineral(s) containing lamellae:	clinopyroxene,orthopyroxene,olivine	Comments on lamellae:	pyroxene exsolution, brown amphibole in clinopyroxene, opaque in olivine

MICROSTRUCTURES

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins and undulose. cpx: undulose	

Fracture abundance	Rank
no fractures	0

Vein abundance	Rank
No veins	0

General microstructure comment: plg has bimodal grain size: smaller grain fraction forming equant grains with stable 120 degree grain boundaries and triple junctions with large plg laths, is interpreted to be residual melt after crystallization of large plg laths, both fractions are included, with olivine, in chalocrysts in cpx

THIN SECTION LABEL ID: **399-U1309D-301R-2-W 116/121-TSB-TS 32** TS no.: **32**

Group	Summaries
Igneous petrology:	Coarse-grained gabbro with ophitic texture. Trace orthopyroxene. Multiple clinopyroxene generations.
Metamorphic petrology:	Slightly to moderately altered Opx-bearing gabbro. Alteration extent and vein density increase in proximity to a cataclastic zone at the top of the piece.
Structure:	Gabbro with minor intracrystalline deformation with amp-chl-vein and schistose vein core.

Plane-polarized

69476571

Cross-polarized

69476591

IGNEOUS PETROLOGY

Lithology: **gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	60	60		2	12	6	subhedral	tabular	
Clinopyroxene	40	30	10	1	16	5	anhedral	ophitic	Multiple stages of clinopyroxene growth.
Orthopyroxene	0.1	0.05	0.05				anhedral	subequant	Only one confirmed grain

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Slightly altered Opx-bearing gabbro. Alteration extent increases in proximity to a fluid-assisted cataclastic zone (i.e. amphibole vein) at the top of the piece.

Mineral	Altered (%)	Minerals replacing
Olivine		N/A
Opx	20	amphibole, talc
Cpx	10	amphibole, chlorite
Spinel		N/A
Amphibole		N/A
Plagioclase	2	chlorite, amphibole, prehnite, zeolite, secondary plagioclase
Oxides	0	

Vein number	Vein fill minerals
Vein 1	amphibole
Vein 2	chlorite
Vein 3	zeolite

Mineral(s) containing lamellae:	clinopyroxene	Comments on lamellae:	orthopyroxene and brown amphibole in clinopyroxene

MICROSTRUCTURES

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, undulose, bent grains; cpx undulose	

Fracture abundance	Rank
no fractures	0

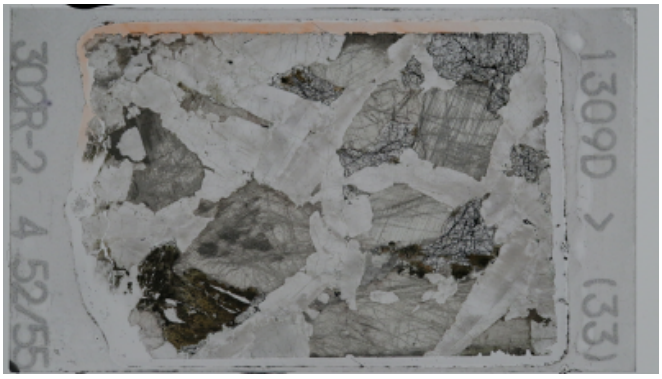
Vein abundance	Rank
Few veins	2

General microstructure comment: gabbro with minor intracrystalline deformation, vein of amp and chl: schistosity developed in core of vein. Fracturing of plg in vein wall, may have accomodated some slip.

THIN SECTION LABEL ID: **399-U1309D-302R-2-W 52/55-TSB-TS 33** TS no.: **33**

Group	Summaries
Igneous petrology:	Coarse-grained olivine gabbro with subophitic texture. Multiple clinopyroxene generations.
Metamorphic petrology:	Slightly to moderately altered Ol-gabbro. Alteration intensity is variable within the thin section. In highly altered portions, olivine is pseudomorphically replaced by clay mineral.
Structure:	Isotropic ol-gabbro. Plg and ol show significant but localized intracrystalline deformation.

Plane-polarized



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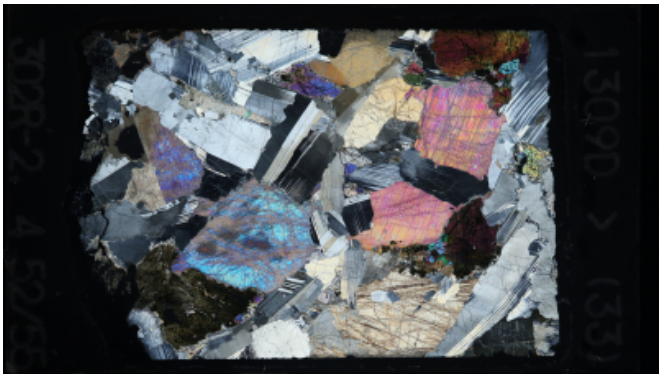
Cross-polarized



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IGNEOUS PETROLOGY

Lithology: **olivine gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Olivine	15	10	5	1	5	3	anhedral	subequant	Kink banded
Plagioclase	40	39	1	1	5	3	subhedral	tabular	
Clinopyroxene	45	40	5	1	8	5	anhedral	interstitial	multiple generations

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Slightly to moderately altered Ol-gabbro. Alteration intensity is variable within the thin section. In highly altered portions, olivine is pseudomorphically replaced by clay mineral.

Mineral	Altered (%)	Minerals replacing
Olivine	30	serpentine, clay, talc, amphibole, oxide, sulfide
Opx		N/A
Cpx	20	amphibole, chlorite
Spinel		N/A
Amphibole		N/A
Plagioclase	1	chlorite, amphibole, zeolite, clay

Vein number	Vein fill minerals
Vein 1	chlorite
Vein 2	prehnite
Vein 3	zeolite

Mineral(s) containing lamellae:	clinopyroxene,olivine	Comments on lamellae:	orthopyroxene and brown amphibole in clinopyroxene; opaque in olivine

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plag subgrains, deformation twins, undulose extinction, fractures. olv subgrains, undulose extinction, fractures. cpx fractures	

Fault rock intensity	Max. fault rock intensity	Rank
	no fracturing	0

Fracture abundance	Rank
no fractures	0

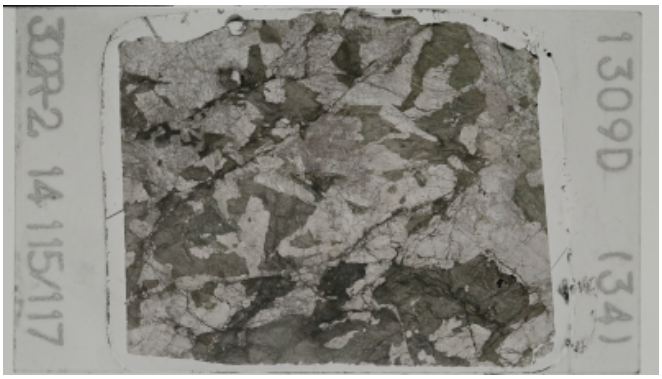
Vein abundance	Rank
No veins	0

General microstructure comment: undeformed isotropic olv gabbro. plag and olv show significant but localized intracrystalline def including subgrains. Some plag grainboundaries have amoiboidal shape.

THIN SECTION LABEL ID: **399-U1309D-302R-2-W 115/117-TSB-TS 34** TS no.: **34**

Group	Summaries
Igneous petrology:	Highly deformed and altered gabbro
Metamorphic petrology:	Highly altered deformed gabbro. Clinopyroxene is altered mainly to amphibole, and plagioclase to prehnite, zeolite and secondary plagioclase. Fractures associated with cataclastic deformation are filled with amphibole, prehnite, and zeolite.
Structure:	Gabbro cut by parallel, inclined micro faults, fault breccia and cataclasite.

Plane-polarized



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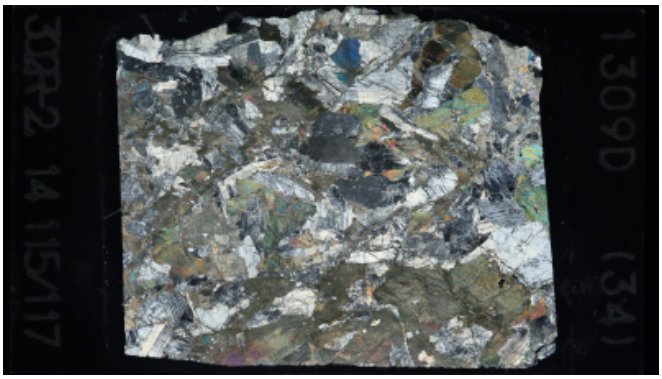
Cross-polarized



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IGNEOUS PETROLOGY

Lithology: **gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	50	40	10	0.5	4	2	subhedral	tabular	
Clinopyroxene	49.9	20	29.9	1	5	3	anhedral	interstitial	highly deformed and altered
Oxide	0.1	0	0.5				anhedral	subequant	probably secondary

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Highly altered and deformed gabbro. Clinopyroxene is altered mainly to amphibole, and plagioclase to prehnite, zeolite and secondary plagioclase. Fractures associated with cataclastic deformation are filled with amphibole, prehnite, and zeolite.

Mineral	Altered (%)	Minerals replacing
Olivine		N/A
Opx		N/A
Cpx	90	amphibole, chlorite, titanite
Spinel		N/A
Amphibole		N/A
Plagioclase	70	secondary plagioclase, zeolite, prehnite, garnet, chlorite, amphibole
Oxides	50	titanite

Vein number	Vein fill minerals
Vein 1	amphibole
Vein 2	prehnite
Vein 3	zeolite

MICROSTRUCTURES

Intracrystalline deformation features	Intensity of static recrystallization
plg: intensely fractured, deformation twins, undulose; cpx/amp: undulose, bent and folded grains	

Fault rock intensity	Max. fault rock intensity	Rank
cataclasitic (probably in core of fault)	cataclastic	5

Fault rock clast phase	Clasts in fault rock	Clast size (mm)	Fault sense of shear
plg	80	<50micrometer	

Fracture abundance	Rank
abundant fractures	4

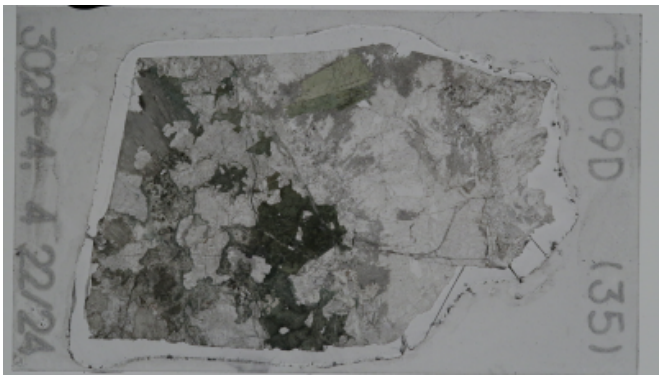
Vein abundance	Rank
Few veins	2

General microstructure comment: cut by parallel, inclined micro faults. plg is brecciated along fault surfaces to <50 micrometer clast size. Faults fan into wider zones of fault breccia, 1-3 mm wide. cpx does not fracture and fragment, instead deforms by bending and folding, and is possibly altered to amp. late stage chl/prehnite alteration is undeformed. Faults and fractured grains cut by epidote ? or chl? veins. Offset unclear, shear sense unknwon due to lack of sample orientation.

THIN SECTION LABEL ID: **399-U1309D-302R-4-W 22/24-TSB-TS 35** TS no.: **35**

Group	Summaries
Igneous petrology:	Highly altered gabbro containing vein with greenschist minerals. Contains one large euhedral green amphibole crystal at contact of vein and wallrock.
Metamorphic petrology:	Domain 1: Highly altered gabbro. Cpx is almost competely altered to prismatic green-brownish green amphibole and locally, to aggregates of acicular pale-green to colorless amphibole.. Plagioclase is pseudomorphically replaced by prehnite. Domain 2: Highly altered leucocratic vein. Plagioclase is intensely altered to prehnite with or without chlorite. A large crystal of amphibole may be of magmatic origin. Small euhedral crystals of clinopyroxene included in prehnite are fresh and seem to be of hydrothermal origin.
Structure:	Altered gabbro with minor intracrystalline deformation features. Dense fracture networks in plagioclase provide pathway for alteration.

Plane-polarized



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Cross-polarized

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IGNEOUS PETROLOGY

Interval domain no: Domain rel. abundance (%): Domain name: Chlorite-prehnite vein

Lithology: gabbro Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	50	20	30	1	4	3	subhedral	tabular	partially pseudomorphed by chlorite
Clinopyroxene	49	20	30	1	5	3	anhedral	interstitial	Altered to green amphibole near vein
Amphibole	1	1		5	5	5	euhedral	tabular	One large grain of green amphibole with simple twin near vein - likely secondary, but could be late-stage magmatic

METAMORPHIC PETROLOGY

Interval domain no: 1

Observer(s): TN

Detailed description Highly altered gabbro. Clinopyroxene is almost competely altered to prismatic green-brownish green amphibole and locally, to aggregates of acicular pale-green to colorless amphibole. Plagioclase is pseudomorphically replaced by prehnite.

Mineral	Altered (%)	Minerals replacing
Olivine		N/A
Opx		N/A
Cpx	95	amphibole
Spinel		N/A
Amphibole		N/A
Plagioclase	50	prehnite, amphibole, garnet? zeolite?

Interval domain no: 2

Observer(s): TN

Detailed description Highly altered leucocratic vein. Plagioclase is intensely altered to prehnite locally associated with chlorite. A large crystal of amphibole of possible magmatic origin is present. Small euhedral crystals of clinopyroxene included in prehnite are fresh and seem to be of hydrothermal origin.

Mineral	Altered (%)	Minerals replacing
Olivine		N/A
Opx		N/A
Cpx	0	
Plagioclase	95	prehnite, chlorite
Oxides		N/A

Vein number	Vein fill minerals
Vein 1	prehnite

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
alteration overprint obscures magmatic fabric		

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed		

Intracrystalline deformation features	Intensity of static recrystallization
plag fractures, deformation twins.	

Fault rock intensity	Max. fault rock intensity	Rank
	minor fracturing	1

Fracture abundance	Rank
common fractures	3

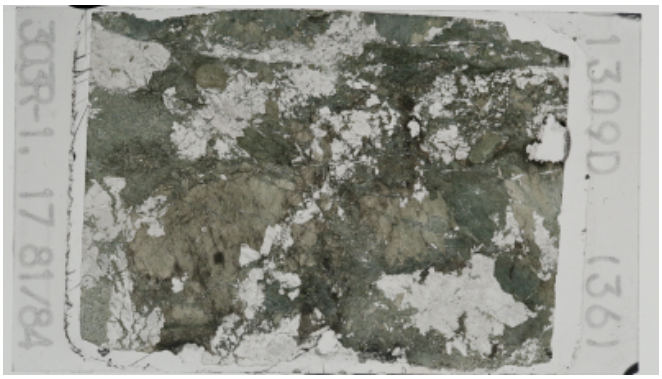
Vein abundance	Rank
Common veins	3

General microstructure comment: Altered gabbro. plagioclase shows deformation twins, undulose extinction, fractures. Dense fracture networks in plagioclase provide pathway for alteration. chlorite and epidote /prehnite alteration products are euhedral and undeformed suggesting alteration was a static overprint after fracturing.

THIN SECTION LABEL ID: **399-U1309D-303R-1-W 81/84-TSB-TS 36** TS no.: **36**

Group	Summaries
Igneous petrology:	Highly altered and fragmented medium-grained gabbro.
Metamorphic petrology:	Strongly altered gabbro. Sequence of alteration indicates green Amp and minor titanite after Cpx (high temperature conditions?) and then alteration of Pl to presumably prehnite and minor garnet (at lower temperatures?). Late veining of Prh+Gt crosscut the former Amp
Structure:	Strongly altered gabbro, top of section shows brecciation and micro faulting.

Plane-polarized



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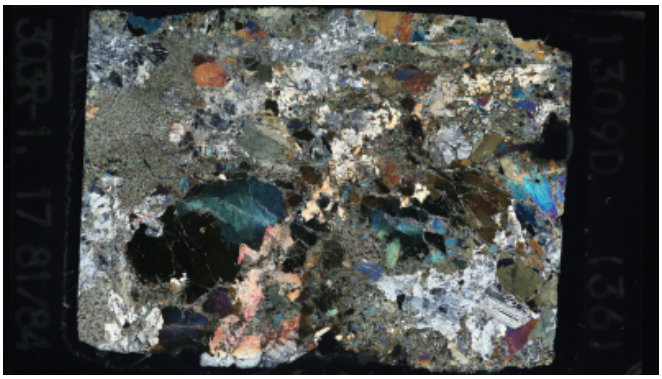
Cross-polarized



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IGNEOUS PETROLOGY

Lithology: **gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	40	10	30						original shapes, sizes and habits obscured
Clinopyroxene	60	0	60	1	8	5	anhedral	interstitial	Entirely replaced by green amphibole and small accessory minerals

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Strongly altered gabbro. Sequence of alteration indicates green amphibole and minor titanite after clinopyroxene (high temperature conditions?) followed by alteration of plagioclase to presumably prehnite and minor garnet (at lower temperatures?). Late veining of prehnite+garnet crosscut the former amphibole

Mineral	Altered (%)	Minerals replacing
Cpx	100	green amphibole, putative minor titanite
Plagioclase	60	prehnite, garnet

Vein number	Vein fill minerals
Vein 1	prehnite, garnet, amphibole?

Abundance of fluid inclusions in mineral(s): few Mineral(s) containing fluid inclusions: plagioclase

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
not visible - overprinted by deformation and alteration		

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed		

Intracrystalline deformation features	Intensity of static recrystallization
plag deformation twins, fractures, undulose extinction. cpx / amp after cpx fractures, subgrains.	

Fault rock intensity	Max. fault rock intensity	Rank
fault breccia	well developed fault brecciation	4

Fault rock clast phase	Clasts in fault rock	Clast size (mm)	Fault sense of shear
plag	98	50-500um	

Fracture abundance	Rank
abundant fractures	4

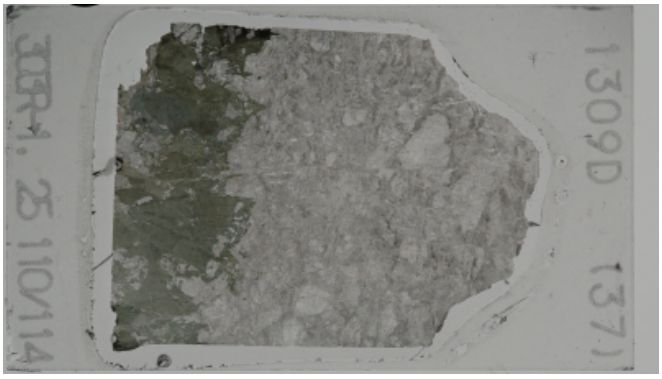
Vein abundance	Rank
Few veins	2

General microstructure comment: Strongly altered gabbro - pervasive fracturing provides pathway for alteration of plag. Top of section (long edge) shows brecciation and micro faulting. rest of sample retains outlines of original magmatic plag and cpx suggesting minimal strain despite fracturing. Alteration appears to be mostly static suggesting that alteration has not promoted deformation, rather deformation promoted alteration.

THIN SECTION LABEL ID: **399-U1309D-303R-1-W 111/114-TSB-TS 37** TS no.: **37**

Group	Summaries
Igneous petrology:	Highly altered and fragmented gabbro with brecciated leucocratic diorite vein consisting almost entirely of plagioclase.
Metamorphic petrology:	Domain 1: Moderately altered gabbro. Cpx is completely replaced to green amphibole, while Pl is almost completely fresh. Domain 2: Fresh felsic vein cutting through gabbro in turn crosscut by secondary Prh+Grt+Amp? veins
Structure:	Gabbro intruded by felsic instrusion which is deformed by microfaults, fault breccia and cataclasite.

Plane-polarized



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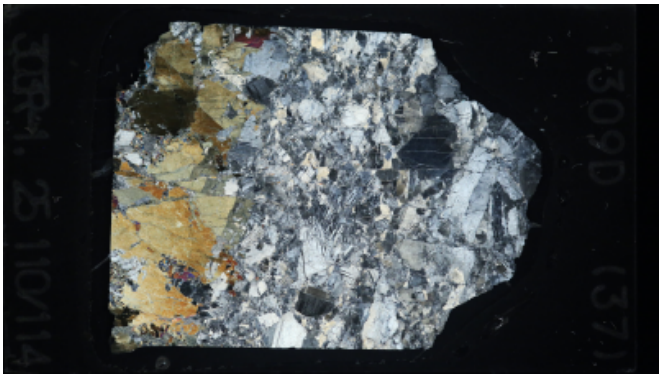
Cross-polarized



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IGNEOUS PETROLOGY

Interval domain no: Domain rel. abundance (%): Domain name: Domain 2: Brecciated leucocratic diorite vein consisting almost entirely of plagioclase

Lithology: **gabbro** Observer: MR

METAMORPHIC PETROLOGY

Interval domain no: 1

Observer(s): TN

Detailed description Moderately altered gabbro. Clinopyroxene is completely replaced by green amphibole, while plagioclase is almost completely fresh.

Mineral	Altered (%)	Minerals replacing
Cpx	100	green amphibole
Plagioclase	2	prehnite

Vein number	Vein fill minerals
Vein 1	prehnite

Interval domain no: 2

Observer(s): TN

Detailed description Fresh felsic vein cutting through gabbro in turn crosscut by secondary prehnite+garnet+amphibole? veins

Mineral	Altered (%)	Minerals replacing
Plagioclase	0	

Vein number	Vein fill minerals
Vein 1	prehnite, garnet, green amphibole?

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
not visible - overprinted by deformation and alteration		

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed		

Intracrystalline deformation features	Intensity of static recrystallization
plag deformation twins, undulose extinction, fractures, bent grains. amp after pyx fractures.	

Fault rock intensity	Max. fault rock intensity	Rank
plag - microfault, fault breccia, localized cataclasite. amp - microfault	well developed fault brecciation	4

Fault rock clast phase	Clasts in fault rock	Clast size (mm)	Fault sense of shear
plag fault breccia - grain size down to 50um. plag cataclasite - <20um.	100	plag fault breccia - grain size down to 50um. plag cataclasite - <20um.	

Fracture abundance	Rank
abundant fractures	4

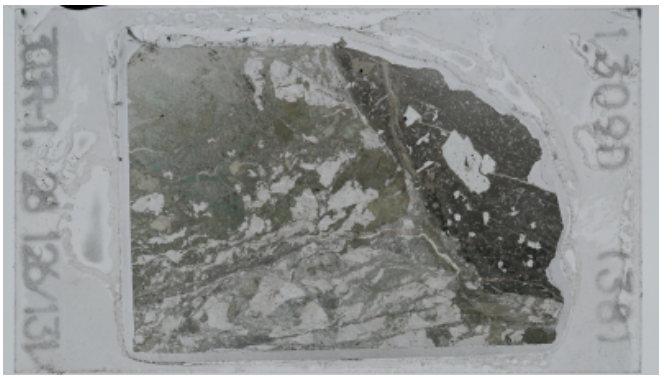
Vein abundance	Rank
Few veins	2

General microstructure comment: deformed felsic intrusion adjacent to gabbro wall rock. Felsic intrusion is deformed into fault breccia with deformed clasts down to 50um size, as well as sub-mm localized zones of cataclasis with <20um grain size. Fault breccia and gabbro wall rock is cut by parallel set of micro faults with mm-sclae offsets, and amp and chl veins. Microfaults cut through felsic intrusion into gabbro wall rock where they have chlorite + amp fault cores.

THIN SECTION LABEL ID: **399-U1309D-303R-1-W 129/131-TSB-TS 38** TS no.: **38**

Group	Summaries
Igneous petrology:	Domain 1: Highly altered and brecciated gabbro. Domain 2: Altered porphyritic diabase. Has a few % serpentinite rock fragments, one with chromium spinel.
Metamorphic petrology:	Highly altered cataclastic gabbro (Domain 1). Clinopyroxene is almost completely altered to green amphibole and plagioclase to secondary one with dusty appearance. Amphibole and plagioclase clasts with variable grain size are set in a matrix composed of fine-graind amphibole and chlorite, and submicroscopic minerals. The gabbro is intruded basalt (Domain 2), which is also highly altered but not deformed unlike the host gabbro. In the basalt, olivine phenocrysts are pseudomorphically replaced by chlorite associated with acicular amphibole. Plagioclase phenocrysts are replaced by prenite, zeolite and secondary plagioclase.
Structure:	Cataclastic and fault brecciated gabbro.

Plane-polarized



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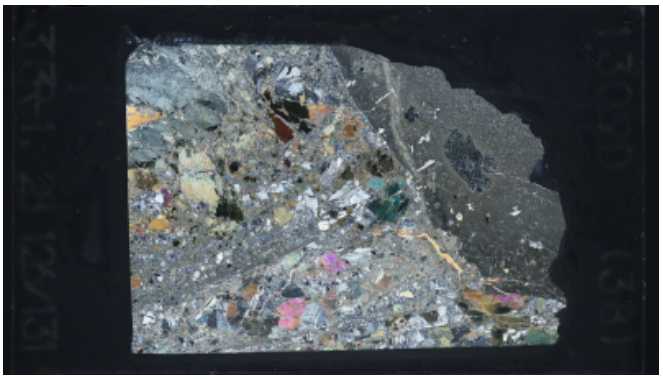
Cross-polarized



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IGNEOUS PETROLOGY

Interval domain no: **1** Domain rel. abundance (%): Domain name:

Lithology: gabbro Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	50	25	25	0.1	2	1	anhedral	subequant,tabular	Comminuted by deformation
Clinopyroxene	50	10	40	1	2	2	anhedral	subequant	Largely replaced by green amphibole and other secondary minerals. Comminuted by deformation.

Interval domain no: **2** Domain rel. abundance (%): Domain name:

Lithology: diabase Observer: MR

Groundmass modal (%)	**Groundmass grain size**	**Groundmass grain size distr.**	**Groundmass constituent(s)**	**Groundmass comments**
85	cryptocrystalline			

METAMORPHIC PETROLOGY

Interval domain no: 1

Observer(s): TN

Detailed description Highly altered cataclastic gabbro. Clinopyroxene is almost completely altered to green amphibole and plagioclase to secondary plagioclase with dusty appearance. Amphibole and plagioclase clasts with variable grain size are set in a matrix composed of fine-graind amphibole and chlorite, and submicroscopic minerals.

Mineral	Altered (%)	Minerals replacing
Olivine		N/A
Opx		N/A
Cpx	95	amphibole
Spinel		N/A
Amphibole		N/A
Plagioclase	95	secondary plagioclase, chlorite, amphibole, prehnite, zeolite
Oxides		N/A

Vein number	Vein fill minerals
Vein 1	amphibole
Vein 2	zeolite

Interval domain no: 2

Observer(s): TN

Detailed description Highly altered basalt. Olivine phenocrysts are pseudomorphically replaced by chlorite associated with acicular amphibole. Plagioclase phenocrysts are replaced by prenite, zeolite and secondary plagioclase.

Mineral	Altered (%)	Minerals replacing
Olivine	100	chlorite, amphibole
Opx		N/A
Cpx		amphibole
Spinel	50	opaque
Amphibole		N/A
Plagioclase	50	prehnite, zeolite, secondary plagioclase
Oxides		N/A

Vein number	Vein fill minerals
Vein 1	chlorite
Vein 2	zeolite

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
gabbro, too deformed. diabase isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, undulose extinction, fractures, bending, subgrains; cpx/amp after cpx: undulose, subgrains, fractures.	

Fault rock intensity	Max. fault rock intensity	Rank
several cataclastic bands in gabbro, serapated by coarser grained domains of fault breccia and fracturing. diabase is undeformed.	cataclastic	5

Fault rock clast phase	Clasts in fault rock	Clast size (mm)	Fault sense of shear
plg, amp	30	50-200um	u ; unknown

Fracture abundance	Rank
common fractures	3

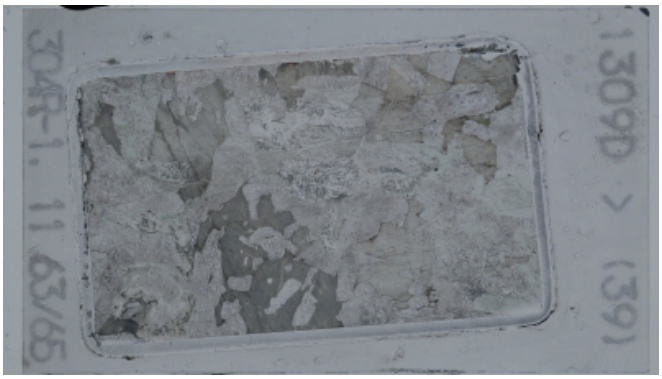
Vein abundance	Rank
Rare veins	1

General microstructure comment: cataclastic and fault breccia fabrics are unaltered.

THIN SECTION LABEL ID: **399-U1309D-304R-1-W 63/65-TSB-TS 39** TS no.: **39**

Group	Summaries
Igneous petrology:	Altered medium grained gabbro with poikilitic clinopyroxene-plagioclase intergrowth.
Metamorphic petrology:	Intensely altered Ol-Opx-bearing gabbro. Olivine and Opx are completely and Cpx is partially altered to amphibole, chlorite, and other minor minerals. Plagioclase replacement by chlorite in this interval is more conspicuous than in other intervals.
Structure:	Altered isotropic gabbro, undeformed, cut by undeformed anastomosing amp+chl veins.

Plane-polarized



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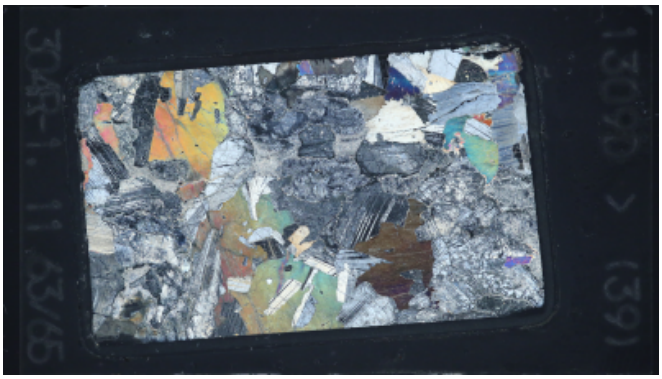
Cross-polarized



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IGNEOUS PETROLOGY

Lithology: **gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	55	30	25	1	7	4	subhedral	tabular	Unusually pervasive alteration
Clinopyroxene	45	35	10	1	6	4	anhedral	ophitic	

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Intensely altered Ol-Opx-bearing gabbro. Olivine and orthopyroxene are completely altered and clinopyroxene is partially altered to amphibole, chlorite, and other minor minerals. Chlorite is the main secondary mineral after primary plagioclase.

Mineral	Altered (%)	Minerals replacing
Olivine	100	acicular amphibole, talc, chlorite, clay, oxide, sulfide
Opx	100	chlorite, acicular amphibole
Cpx	20	amphibole, chlorite?
Spinel		N/A
Amphibole		N/A
Plagioclase	50	chlorite, amphibole, prehnite, zeolite, secondary plagioclase, carbonate

Vein number	Vein fill minerals
Vein 1	amphibole
Vein 2	chlorite
Vein 3	zeolite

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, undulose extinction, fractures; cpx: undulose extinction, fractured	

Fracture abundance	Rank
few fractures	2

Vein abundance	Rank
Few veins	2

General microstructure comment: altered isotropic gabbro, undeformed, cut by undeformed anastomosing amp+chl veins

THIN SECTION LABEL ID: **399-U1309D-304R-1-W 102/104-TSB-TS 40** TS no.: **40**

Group	Summaries
Igneous petrology:	Corase-grained olivine-bearing gabbro with granular texture.
Metamorphic petrology:	Slightly altered Ol-Opx-bearing gabbro crosscut by Amp+Chl veins. The degree of alteration increases close to the veins, forming green Amp after Cpx, Chl after Pl and, Tlc+Amp after putative Ol and Tlc after Opx. The alteration intensity of individual grain of igneous minerals is, therefore variable in the thin section. Away from the veins, the gabbro appears fresh. Secondary sulfides and oxides are locally associated with Amp. Textural relationships suggest that Amp, Chl, and Tlc formation occurred during the same hydrothermal event.
Structure:	Undeformed isotropic gabbro. Cut by a network of chl and amp veins.

Plane-polarized

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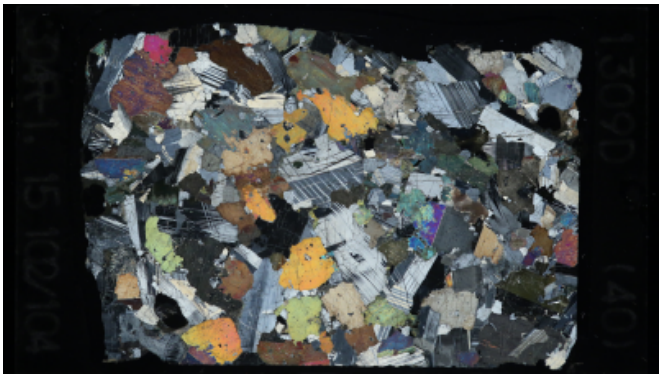
Cross-polarized



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IGNEOUS PETROLOGY

Lithology: **olivine-bearing gabbro** Observer: HL

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Olivine	0.1					1			
Plagioclase	50	49	1	1	7	3	subhedral	tabular	
Clinopyroxene	50	48	2	1	6	3	subhedral	subequant	

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Slightly altered Ol-Opx-bearing gabbro crosscut by amphibole+chlorite veins. The degree of alteration increases close to the veins, forming green amphibole after clinopyroxene, chlorite after plagioclase, talc+amphibole after putative olivne, and talc after orthopyroxene. The alteration intensity of individual grain of igneous minerals is therefore variable in the thin section. Away from the veins, the gabbro appears fresh. Secondary sulfides and oxides are locally associated with amphibole. Textural relationships suggest that amphibole, chlorite, and talc formation occurred during the same hydrothermal event.

Mineral	Altered (%)	Minerals replacing
Olivine	50	talc, amphibole, serpentine, magnetite
Opx	15	talc, chlorite?
Cpx	15	amphibole
Plagioclase	5	chlorite

Vein number	Vein fill minerals
Vein 1	amphibole, chlorite

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plg undulose extinction, deformation twins, bent grains, fractures.	

Fracture abundance	Rank
few fractures	2

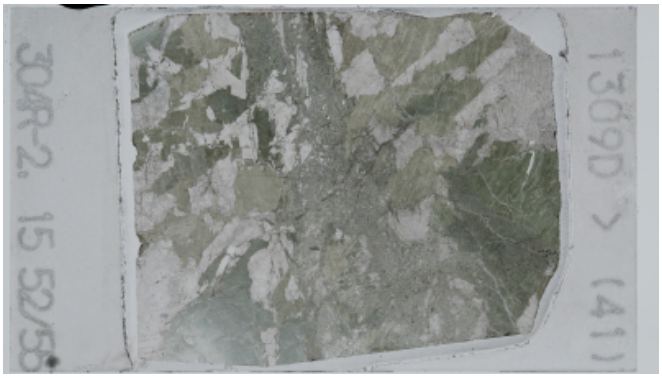
Vein abundance	Rank
Few veins	2

General microstructure comment: undeformed isotropic gabbro. cut by a network of 50-100um wide veins, with subvertical and subhorizontal orientations (in core reference frame), filled with chlorite and amphibole.

THIN SECTION LABEL ID: **399-U1309D-304R-2-W 52/54-TSB-TS 41** TS no.: **41**

Group	Summaries
Igneous petrology:	Highly altered coarse-grained gabbro with a significant shear zone.
Metamorphic petrology:	Deformed gabbro with a high degree of alteration. Cpx is almost completely altered to amphibole. Plagioclase is converted to secondary plagioclase with a dusty appearance. In a cataclastic domain, plagioclase and amphibole clasts are set in a fine-grained matrix composed of acicular amphibole, chlorite, secondary plagioclase and titanite, indicating a greenschist facies condition.
Structure:	Gabbro cut by 5mm wide amp vein (see close up photo of core). Vein has been sheared (shear sense unclear) and comprises a finegrained matrix of amp <50um grainsize, with larger clasts of amp, <250um and clast of plg cataclasite. Amp in vein has weak to no alignment indicating static growth after faulting. Wall rock to vein has fractured, bent grains of plag and amp after cpx, including zones of breccia adjacent to the vein. Wall rock and vein are cross cut by undeformed chlorite +/- amp? veins.

Plane-polarized



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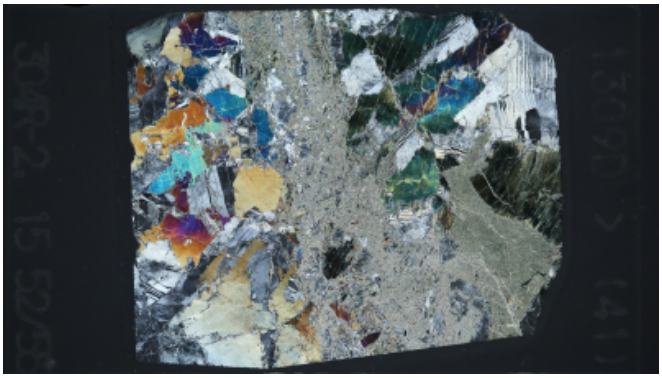
Cross-polarized



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IGNEOUS PETROLOGY

Lithology: **gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	40	25	15	1	6	4	subhedral	tabular	Patchy zoning from deformation
Clinopyroxene	60	0	60	1	8	5	anhedral	ophitic	Replaced by green amphibole

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Deformed gabbro with a high degree of alteration. Clinopyroxene is almost completely altered to amphibole. Plagioclase is converted to secondary plagioclase with a dusty appearance. In a cataclastic domain, plagioclase and amphibole clasts are set in a fine-grained matrix composed of acicular amphibole, chlorite, secondary plagioclase and titanite, indicating a greenschist facies condition.

Mineral	Altered (%)	Minerals replacing
Olivine		N/A
Opx		N/A
Cpx	99	amphibole
Spinel		N/A
Amphibole		N/A
Plagioclase	90	secondary plagioclase, chlorite, amphibole, zeolite
Oxides		N/A
Other		titanite

Vein number	Vein fill minerals
Vein 1	amphibole
Vein 2	chlorite
Vein 3	zeolite

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
too deformed to tell		

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed		

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, undulose extinction, fractures, bent; cpx/amp after cpx: undulose; fractured, bent	amp in faulted vein has no alignment suggesting static growth after deformation

Fault rock intensity	Max. fault rock intensity	Rank
amp vein - phyllonite. plg vein wall - cataclastic. host gabbro rock - fault breccia	cataclastic	5

Fault rock clast phase	Clasts in fault rock	Clast size (mm)	Fault sense of shear
amp	30	<250um	u ; unknown

Fracture abundance	Rank
common fractures	3

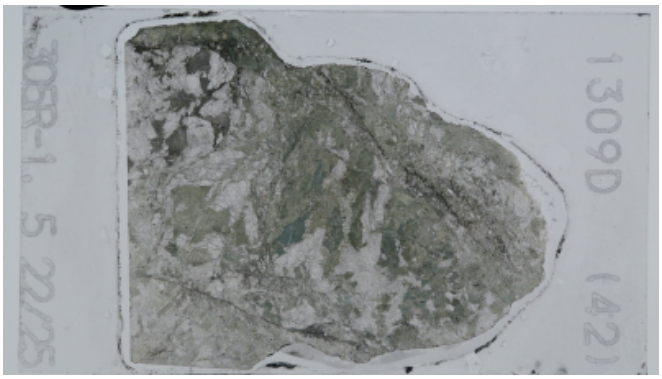
Vein abundance	Rank
Common veins	3

General microstructure comment: gabbro cut by 5mm wide amp vein (see close up photo of core). Vein has been sheared (shear sense unclear) and comprises a finegrained matrix of amp <50um grainsize, with larger clasts aof amp, <250um and clast of plg cataclasite. Amp in vein has weak to no alignmnet indicating static growth after faulting. Wall rock to vein has fractured, bent grains of plag and amp after cpx, including zones of fulat breccia adjacent to the vein. Wall rock and vein are cross cut by undeformed chlorite +/- amp? veins.

THIN SECTION LABEL ID: **399-U1309D-305R-1-W 22/25-TSB-TS 42** TS no.: **42**

Group	Summaries
Igneous petrology:	Highly deformed and thoroughly altered gabbro
Metamorphic petrology:	Highly altered cataclastic gabbro. Breccias of deformed amphibole and plagioclase are cut by cataclastic veins of different generation, and hydrothermal amphibole and zeolite veins. A large portion of matrix is composed of submicroscopic-grained materials.
Structure:	Fault rock with cataclastic bands, fault breccia and microfaulting.

Plane-polarized



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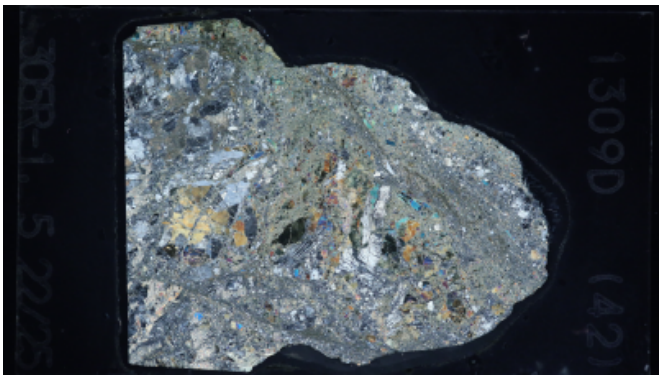
Cross-polarized



69501411

IGNEOUS PETROLOGY

Lithology: **gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	50	42	8	0.1	2	1	subhedral	tabular	Comminuted by deformation
Clinopyroxene	50	5	45	1	3	2			Mostly pseudomorphically replaced by green amphibole. Comminuted by deformation

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Highly altered cataclastic gabbro. Breccias of deformed amphibole and plagioclase are cut by cataclastic veins of different generation, and hydrothermal amphibole and zeolite veins. A large portion of the matrix is composed of submicroscopic-grained materials.

Mineral	Altered (%)	Minerals replacing
Olivine		N/A
Opx		N/A
Cpx	99	green amphibole
Spinel		N/A
Amphibole		N/A
Plagioclase	40	secondary plagioclase, zeolite, chlorite

Vein number	Vein fill minerals
Vein 1	amphibole
Vein 2	zeolite

MICROSTRUCTURES

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
not visible		

Intracrystalline deformation features	Intensity of static recrystallization
pl: deformation twins, bending, fracturing, undulose; cpx: kinked, fractured, bent, undulose; amp (after cpx): undulose	

Fault rock intensity	Max. fault rock intensity	Rank
fault breccia - cataclasite	cataclastic	5

Fault rock clast phase	Clasts in fault rock	Clast size (mm)	Fault sense of shear
amp, plg	50	100-200 micron	

Fracture abundance	Rank
abundant fractures	4

Vein abundance	Rank
No veins	0

General microstructure comment: Fault rock with cataclastic abnds in different orientations. Less intensely deformed zones of fault breccia or microfaulting, show faulted, fractured, kinked and bent grains of plg and amp, later? tremolite shows only minor fractures, and is otherwise undeformed. Some of the cataclastic zones are stanied with an opaque phase.

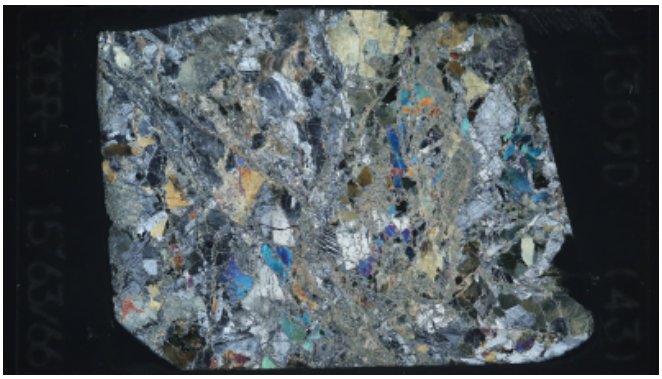
THIN SECTION LABEL ID: **399-U1309D-305R-1-W 63/66-TSB-TS 43** TS no.: **43**

Group	Summaries
Igneous petrology:	Highly deformed and thoroughly altered gabbro
Metamorphic petrology:	Highly altered cataclastic gabbro. Deformed amphibole and plagioclase clasts and amphibole shear bands are cut by fractures and cataclastic veins.
Structure:	Pervasively fractured gabbro. rock is cut by dense network of fractures typically filled with amp+chl. Localised zones of clast supported fault breccia with finer grained matrix of plag and amp. Local domains of calaclastic plag plus cross cutting faults with narrow bands of cataclasite. Whereas deformation is pervasive, total strain is probably very low.

Plane-polarized

69520901

Cross-polarized



69520921

IGNEOUS PETROLOGY

Lithology: **gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	50	40	10	0.1	2	1	anhedral	tabular	Comminution and patchy zoning caused by by deformation
Clinopyroxene	50	0	50	1	4	3	anhedral	subequant	Primary sizes, shapes, habits are obscured by alteration and deformation.

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Highly altered cataclastic gabbro. Deformed amphibole and plagioclase clasts and amphibole shear bands are cut by fractures and cataclastic veins.

Mineral	Altered (%)	Minerals replacing
Olivine		N/A
Opx		N/A
Cpx	100	amphibole
Spinel		N/A
Amphibole		N/A
Plagioclase	40	secondary plagioclase, zeolite, chlorite, amphibole
Oxides		N/A
Other		titanite

Vein number	Vein fill minerals
Vein 1	amphibole
Vein 2	zeolite

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
too deformed to tell		

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed		

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, fractures, undulose extinction; cpx/amp after cpx: undulose extinction, fractured, bent grains	

Fault rock intensity	Max. fault rock intensity	Rank
plg - fault breccia, fracturing, microfaults, localised cataclastic domains	well developed fault brecciation	4

Fracture abundance	Rank
abundant fractures	4

Vein abundance	Rank
Abundant veins	4

General microstructure comment: pervasively fractured gabbro. rock is cut by dense network of fractures typically filled with amp+chl. Localised zones of clast supported fault breccia with finer grained matrix of plag and amp. Local domains of calaclastic plag plus cross cutting faults with narrow bands of cataclastie. Whereas deformation is pervasive, total strain is probably very low.

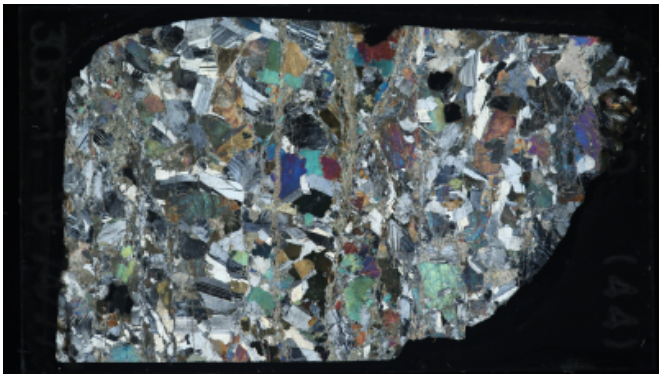
THIN SECTION LABEL ID: **399-U1309D-305R-1-W 74/77-TSB-TS 44** TS no.: **44**

Group	Summaries
Igneous petrology:	Medium-grained granular gabbro. Some clinopyroxene is replaced by amphibole.
Metamorphic petrology:	Moderately altered Opx-bearing gabbro crosscut by Amp and minor Chl veins. Veins have a cataclastic component, leaving clasts of Pl surrounded by Amp crystals.
Structure:	Deformed isotropic gabbro - cut by parallel microfaults and amp veins.

Plane-polarized

69464181

Cross-polarized



69464201

IGNEOUS PETROLOGY

Lithology: **gabbro** Observer: HL

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	50	48	2	1	10	3	subhedral	subequant	
Clinopyroxene	50			1	10	3	subhedral	subequant	Some are replaced by amphibole.

METAMORPHIC PETROLOGY

Observer(s): RC

Detailed description Moderately altered Opx-bearing gabbro crosscut byamphibole and minor chlorite veins. Veins have a cataclastic component, leaving clasts of plagioclase surrounded by amphibole crystals.

Mineral	Altered (%)	Minerals replacing
Olivine	0	NA
Opx	100	talc, green amphibole
Cpx	100	green amphibole, titanite
Spinel	NA	NA
Amphibole	NA	NA
Plagioclase	2	chlorite, amphibole
Oxides	NA	NA
Other	NA	NA

Vein number	Vein fill minerals
Vein 1	green amphibole, chlorite

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plg deformation twins, undulose extinction, intense fracturing, bent grains. cpx fracturing, bent grains	

Fault rock intensity	Max. fault rock intensity	Rank
plg - dense fracturing, localised cataclasite. Amp - fault breccia, shear bands, schistose fault planes (phyllonite)	cataclastic	5

Fault rock clast phase	Clasts in fault rock	Clast size (mm)	Fault sense of shear
			s ; sinistral

Fracture abundance	Rank
abundant fractures	4

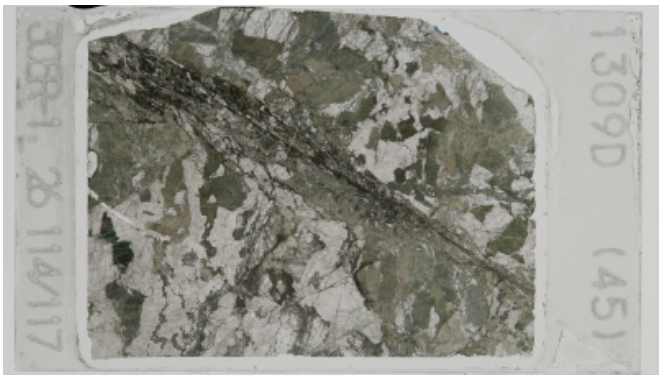
Vein abundance	Rank
Abundant veins	4

General microstructure comment: deformed isotropic gabbro - cut by parallel microfaults and amp veins. along micro faults, plag rich zones form cataclasite, whereas amp rich zones form schistose fault planes. some amp rich fault planes have clasts of plag 100-500um in width, aligned parallel to fault. microfault planes are 0.5-1mm wide. Between fault planes, plag and cpx grains are fractured and bent and cut by amp veins parallel to faults.

THIN SECTION LABEL ID: **399-U1309D-305R-1-W 114/117-TSB-TS 45** TS no.: **45**

Group	Summaries
Igneous petrology:	Medium-grained granular and ophitic gabbro.
Metamorphic petrology:	Moderately altered Ol-bearing gabbro crosscut by sub-parallel Amp and minor Chl veins. The overall degree of alteration increases towards the veins. Cpx is partially to completely replaced to Amp. Pl is slightly altered to Chl along veins
Structure:	Fault breccia in former gabbro. Sample cut by cataclastic fault with sinistral shear sense.

Plane-polarized



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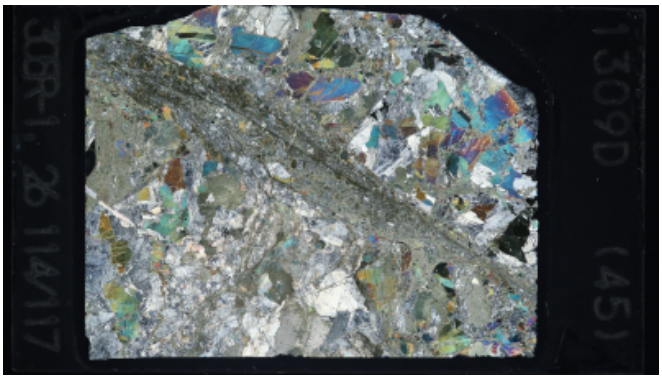
Cross-polarized



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IGNEOUS PETROLOGY

Lithology: **gabbro** Observer: HL

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	50	45	5	0.2	3	1	subhedral	tabular	Primary sizes, shapes, habits, and zoning are obscured by alteration and deformation.
Clinopyroxene	50	25	25						Primary sizes, shapes, habits are obscured by alteration and deformation.

METAMORPHIC PETROLOGY

Observer(s): RC

Detailed description Moderately altered Ol-bearing gabbro crosscut by sub-parallel amphibole and minor chlorite veins. The overall degree of alteration increases towards the veins. Clinopyroxene is partially to completely replaced by amphibole. Plagioclase is slightly altered to chlorite along veins.

Mineral	Altered (%)	Minerals replacing
Olivine	0	NA
Opx	NA	NA
Cpx	70	green amphibole
Spinel	NA	NA
Amphibole	NA	NA
Plagioclase	2	chlorite, amphibole
Oxides	NA	NA
Other	NA	NA

Vein number	Vein fill minerals
Vein 1	green amphibole, chlorite

Abundance of fluid inclusions in mineral(s): few Mineral(s) containing fluid inclusions: plagioclase

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
not visible - whole of section is fault rock		

Intracrystalline deformation features	Intensity of static recrystallization
plg - deformation twins, fractures, undulose extinction, bent grains. amp - fractures, bent grains	

Fault rock intensity	Max. fault rock intensity	Rank
plg + amp wallrock = fault breccia. amp + plg fault core = cataclasite	cataclastic	5

Fault rock clast phase	Clasts in fault rock	Clast size (mm)	Fault sense of shear
plg amp	35	<100um	s ; sinistral

Fracture abundance	Rank
common fractures	3

Vein abundance	Rank
Abundant veins	4

General microstructure comment: fault breccia, former gabbro. cut bycataclastic fault with sinistral shear sense. zone of cataclasis increases from 1mm wide to 5 mm wide. Contains 30-40% clasts of plg and amp, most <100um wide, some 500um wide. matrix separates into irregular domains of plag, or amp, or plg+amp. fault wallrocks are fault breccia, cut by network of amp+chl veins. cataclastis fault cuts veins and is not overprinted by any late stage static alteratoin, therefore deformation is syn- or post- veining. veins are sub-perpendicular to fault.

THIN SECTION LABEL ID: **399-U1309D-306R-1-W 45/48-TSB-TS 46** TS no.: **46**

Group	Summaries
Igneous petrology:	Course-grained gabbro with ophitic texture. Clinopyroxene has more than one growth stage. The thin section is fractured, faulted and folded.
Metamorphic petrology:	Moderately altered gabbro with abundant veins and fractures. Chlorite + amphibole aggregates are possibly formed after Opx. Some plagioclase grains are heavily altered to chlorite.
Structure:	Isotropic gabbro with significant cross-cutting network of fractures with minor offsets creating microfaults in plg and chevron fold style kinks in cpx. Fractures are filled with chlorite, and rare amphibole.

Plane-polarized

69520941

Cross-polarized

69520961

IGNEOUS PETROLOGY

Lithology: **gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	40	35	5	2	6	4	subhedral	tabular	
Clinopyroxene	60	50	10	2	7	5	anhedral	ophitic	Two generations of growth

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Moderately altered gabbro with abundant veins and fractures. Chlorite + amphibole aggreagates are possibly formed after orthopyroxene. Some plagioclase grains are heavily altered to chlorite.

Mineral	Altered (%)	Minerals replacing
Olivine		N/A
Opx	100	chlorite, amphibole
Cpx	70	amphibole, chlorite
Spinel		N/A
Amphibole		N/A
Plagioclase	5	chlorite, amphibole, zeolite, secondary plagioclase

Vein number	Vein fill minerals
Vein 1	amphibole
Vein 2	chlorite
Vein 3	zeolite

Mineral(s) containing lamellae: clinopyroxene Comments on lamellae: orthopyroxene, brown amphibole

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, bent, fractured, undulose extinction; px: undulose, bent-kinked cleavage, fractures	

Fault rock intensity	Max. fault rock intensity	Rank
plg + cpx fractured and microfaulted	moderate fracturing	2

Fracture abundance	Rank
abundant fractures	4

Vein abundance	Rank
Abundant veins	4

General microstructure comment: isotropic gabbro with significant cross-cutting network of fractures with minor offsets creating microfaults in plg and chevron fold style kinks in cpx. fractures are filled with chlorite, and rare amphibole.

THIN SECTION LABEL ID: **399-U1309D-306R-1-W 82/86-TSB-TS 47** TS no.: **47**

Group	Summaries
Igneous petrology:	Medium grained olivine gabbro with subophitic texture.
Metamorphic petrology:	Partially altered olivine gabbro. Some of the sulfide associated with olivine is of primary origin. In the altered portion, sulfide may be recrystallized.
Structure:	Isotropic gabbro with minor intracrystalline deformation.

Plane-polarized

69464301

Cross-polarized

69464321

IGNEOUS PETROLOGY

Lithology: **olivine gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Olivine	5	2	3	1	3	2	anhedral	subequant	
Plagioclase	60	60		1	4	3	subhedral	tabular	
Clinopyroxene	35	30	5	1	4	2	anhedral	interstitial	

METAMORPHIC PETROLOGY

Observer(s): FK,TN

Detailed description Partially altered olivine gabbro. Some of the sulfide associated with olivine is of primary origin. In the altered portion, sulfide may be recrystallized.

Mineral	Altered (%)	Minerals replacing
Olivine	80	talc, sulfide, amphibole, chlorite, clay
Opx	5	talc, amphibole
Cpx	5	amphibole
Spinel		N/A
Amphibole		N/A
Plagioclase	3	chlorite, amphibole

Mineral(s) containing lamellae: clinopyroxene,olivine Comments on lamellae: orthopyroxene in clinopyroxene, opaque in olivine

MICROSTRUCTURES

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
weak magmatic foliation	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformatin twins, undulpse, fractures, bent grains	

Fracture abundance	Rank
rare fractures	1

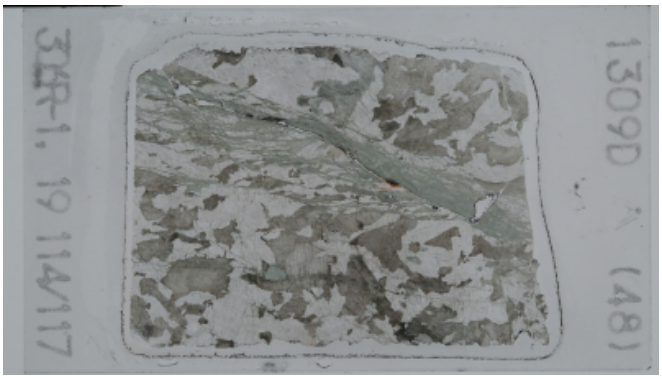
Vein abundance	Rank
No veins	0

General microstructure comment: isotropic gabbro with minor intracrystalline deformation in plg, cpx, opx, ol

THIN SECTION LABEL ID: **399-U1309D-306R-1-W 114/117-TSB-TS 48** TS no.: **48**

Group	Summaries
Igneous petrology:	Highly deformed medium-grained, subophitic gabbro.
Metamorphic petrology:	Moderately altered deformed gabbro. Cpx and plagioclase are plastically deformed and fractured or brecciated. Within cataclastic bands, slip fiber veins of green amphibole run parallel to the bands. Some of polycrystalin amphibole veins also run paralle to the cataclastic bands and bend with plastically deformed Cpx partially replaced by amphibole, whereas the others crosscut the deformed minerals. These observations indicate ductile and brittle deformation took place under amphibolite facies conditions.
Structure:	Gabbro cut by deformed amp vein (see close up image of handsample). Vein has a well developed amp phyllonite texture with ribbons of plag that have well developed cataclastic texture. alignment of ribbons and amp shear bands indicates reverse sense motion. Wall rock is intensely deformed by microfaults, fractures, fault breccia and significantly bent and folded cpx and plg grains. amp veins cross-cutting wall rock are also sheared suggesting fracturing and veining occurred together. No indication of a late static alteration overprint.

Plane-polarized



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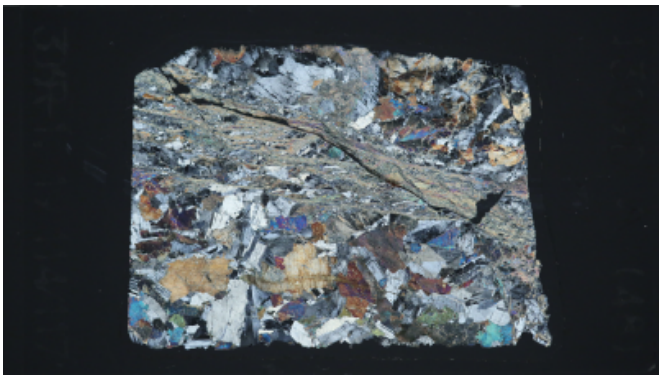
Cross-polarized



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IGNEOUS PETROLOGY

Lithology: Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	60	45	15	1	4	2	subhedral	tabular	Comminuted by deformation. Undulatory extinction
Clinopyroxene	40	30	10	1	4	2	anhedral	interstitial	fractured and folded by deformation

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Moderately altered deformed gabbro. Clinopyroxene and plagioclase are plastically deformed and fractured or brecciated. Within cataclastic bands, slip fiber veins of green amphibole run parallel to the bands. Some of polycrystaline amphibole veins also run parallel to the cataclastic bands and bend with plastically deformed clinopyroxene partially replaced by amphibole, whereas the others crosscut the deformed minerals. These observations indicate ductile and brittle deformation took place under amphibolite facies conditions.

Mineral	Altered (%)	Minerals replacing
Olivine		N/A
Opx		N/A
Cpx	60	amphibole, chlorite
Spinel		N/A
Amphibole		N/A
Plagioclase	2	chlorite, amphibole, secondary plagioclase

Vein number	Vein fill minerals
Vein 1	amphibole
Vein 2	chlorite

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
too deformed to tell		

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed		

Intracrystalline deformation features	Intensity of static recrystallization
plag: deformation twins, undulose extinction, bent grains, fractures. cpx/amp after cpx: undulose extinction, subgrains, bent grains.	

Fault rock intensity	Max. fault rock intensity	Rank
amp vein - phyllonite. plg - cataclasite, fault breccia, fracturing	cataclastic	5

Fault rock clast phase	Clasts in fault rock	Clast size (mm)	Fault sense of shear
amp, plg	30	amp matrix <25um, plg cataclasite matrix <25um, clasts in matrix 50-100um	r ; reverse

Fracture abundance	Rank
abundant fractures	4

Vein abundance	Rank
Abundant veins	4

General microstructure comment: gabbro cut by deformed amp vein (see close up image of handsample). Vein has a well developed amp phyllonite texture with ribbons of plag that have well developed cataclastic texture. alignment of ribbons and amp shear bands indicates reverse sense motion. Wall rock is intensely deformed by microfaults, fractures, fault breccia and significantly bent and folded cpx and plg grains. amp veins cross-cutting wall rock are also sheared suggesting fracturing and veining occurred together. No indication of a late static alteration overprint.

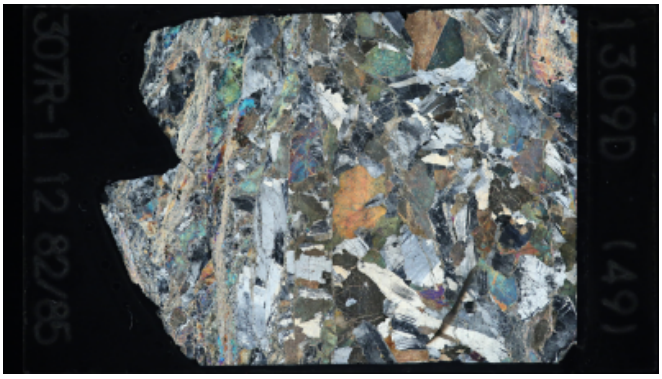
THIN SECTION LABEL ID: **399-U1309D-307R-1-W 82/85-TSB-TS 49** TS no.: **49**

Group	Summaries
Igneous petrology:	Deformed oxide-bearing gabbro. Oxide is likely secondary.
Metamorphic petrology:	Moderately to highly altered deformed gabbro. Cpx is intensely altered to amphibole, whereas plagioclase looks fresh. In a cataclastic zone, brecciated amphibole and plagioclase clasts are set in fine-grained amphibole slip fiber veins.
Structure:	Deformed gabbro with variable fault rock intensity ranging from microfaults to cataclasite.

Plane-polarized

69464341

Cross-polarized



69464361

IGNEOUS PETROLOGY

Lithology: **disseminated oxide gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	49.8	40	10	1	5	2	subhedral	tabular	Deformation has deformed and comminuted grains
Clinopyroxene	50	45	5	1	5	3	anhedral	interstitial	Deformation has deformed and comminuted grains. Altered to green amphibole
Oxide	0.1		0.1						a couple of interstitial grains

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Moderately to highly altered deformed gabbro. Clinopyroxene is intensely altered to amphibole, whereas plagioclase looks fresh. In a cataclastic zone, brecciated amphibole and plagioclase clasts are set in fine-grained amphibole slip fiber veins.

Mineral	Altered (%)	Minerals replacing
Olivine		N/A
Opx		N/A
Cpx	90	amphibole
Spinel		N/A
Plagioclase	2	chlorite, amphibole, secondary plagioclase, zeolite
Oxides	95	titanite

Vein number	Vein fill minerals
Vein 1	amphibole
Vein 2	chlorite
Vein 3	zeolite

MICROSTRUCTURES

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
		0	

Intracrystalline deformation features	Intensity of static recrystallization
intact gabbro: plg: deformation twins, fractured, cpx: bent, kinked, fractured	

Fault rock intensity	Max. fault rock intensity	Rank
microfaults, faultbreccia, cataclasite	cataclastic	5

Fault rock clast phase	Clasts in fault rock	Clast size (mm)	Fault sense of shear
see comments			s ; sinistral

Fracture abundance	Rank
abundant fractures	4

General microstructure comment: brittly deformed gabbro with variable fault rock intensity ranging from microfaults to cataclasite, 3 domains: a) microfaults: plag fractured with ~100 Âµm offset, opx kinked and bent, evidence by offset plg twinsb) fault breccia: thin cataclastic bands between large fragment of plg,px in plg,px,amp? matrix, 95% clasts, clast length up to several mm, c) cataclastic zone with cataclastic bands 1-2mm wide, locally 10% clasts, matrix recrystallization to amp? growing fibres parallel to fault wall; subparallel microfaults define 'weak' foliation at the bottom of the section, moderate to associated grain size alteration, shear sense by apparent 'amphibole' fish

THIN SECTION LABEL ID: **399-U1309D-307R-2-W 24/28-TSB-TS 50** TS no.: **50**

Group	Summaries
Igneous petrology:	Highly deformed and altered gabbro.
Metamorphic petrology:	Highly altered deformed gabbro. Cpx is completely altered to green amphibole. Plagioclase has microcracks filled with amphibole and chlorite and locally replaced by prehnite, zeolite and secondary plagioclase. Deformed and brecciated amphibole and plagioclase clasts with variable size are set in a fine-grained amphibole + chlorite matrix. The cataclastic clasts and amphibole veins are cut by later zeolite, carbonate, or their composite veins.
Structure:	Fault rock, gabbro protolith. Two domains: (1) fault wallrock is fault breccia with intensely fractured plag and amp after cpx. Plag and amp form 1-2mm monomineralic domains representing original outline of igneous grains, now fractured and brecciated to clasts <100-200um in size. Fault breccia is cut by discrete cataclastic faults, 100um wide, sub-perpendicular to main fault core zone of cataclasis. (2) Fault core is 10-15mm wide zone of cataclasis and matrix supported fault breccia. Core has no clearly defined fault plane and is defined by irregular domains of plag, amp, or plag+amp. breccia/cataclasite has 40-50% clasts with <200um clast size and <20um matrix size. No indication of fault sense of motion. Fault core is largely unaltered. Chl-amp mats have no schistosity and appaer undeformed. Faultrock is cut by undeformed amp veins, carbonate veins and +/- chlorite veins. Ths suggest that deformation pre-dated veining and pre- or syn-dated alteration.

Plane-polarized

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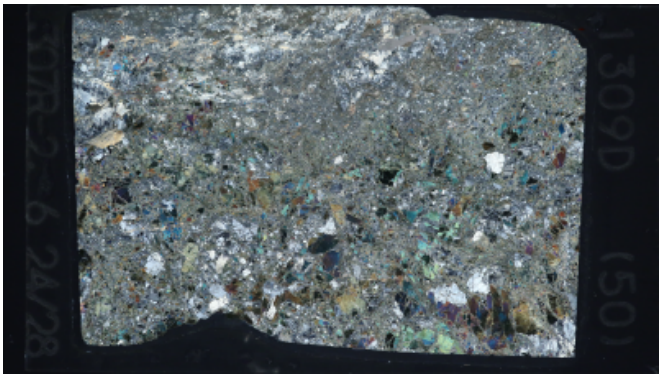
Cross-polarized



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IGNEOUS PETROLOGY

Lithology: **gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	40	25	15				anhedral	subequant	Deformation has deformed and comminuted grains
Clinopyroxene	60	0	60	0.1	2	1	anhedral	subequant	Deformation has deformed and comminuted grains

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Highly altered deformed gabbro. Clinopyroxene is completely altered to green amphibole. Plagioclase has microcracks filled with amphibole and chlorite and locally replaced by prehnite, zeolite and secondary plagioclase. Deformed and brecciated amphibole and plagioclase clasts with variable size are set in a fine-grained amphibole + chlorite matrix. The cataclastic clasts and amphibole veins are cut by later zeolite, carbonate, and their composite veins.

Mineral	Altered (%)	Minerals replacing
Olivine		N/A
Opx		N/A
Cpx	100	green amphibole
Spinel		N/A
Amphibole		N/A
Plagioclase	30	amphibole, chlorite, prehnite, secondary plagioclase, zeolite

Vein number	Vein fill minerals
Vein 1	amphibole
Vein 2	chlorite
Vein 3	prehnite
Vein 4	zeolite
Vein 5	carbonate

Mineral(s) containing lamellae: clinopyroxene

Comments on lamellae: brown amphibole bleb in green amphibole (former clinopyroxene)

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
too deformed to tell		

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed		

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, undulose extinction, fractures, bent grains. amp after cpx: fractures, bent grains	

Fault rock intensity	Max. fault rock intensity	Rank
wall rock: fault breccia, discrete fault planes with cataclasite. Fault core - cataclasite to matrix supported fault breccia.	cataclastic	5

Fault rock clast phase	Clasts in fault rock	Clast size (mm)	Fault sense of shear
plag, amp	45	<200um clasts, <20um matrix	

Fracture abundance	Rank
abundant fractures	4

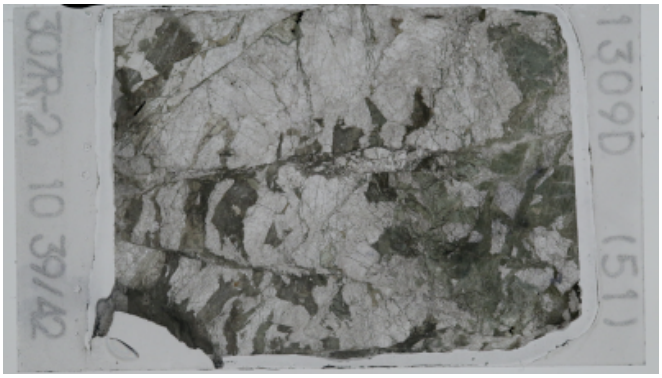
Vein abundance	Rank
Few veins	2

General microstructure comment: Fault rock, gabbro protolith. Two domains: (1) fault wallrock is fault breccia with intensely fractured plag and amp after cpx. Plag and amp form 1-2mm monomineralic domains representing original outline of igneous grains, now fractured and brecciated to clasts <100-200um in size. Fault breccia is cut by discrete cataclastic faults, 100um wide, sub-perpendicular to main fault core zone of cataclasis. (2) Fault core is 10-15mm wide zone of cataclasis and matrix supported fault breccia. Core has no clearly defined fault plane and is defined by irregular domains of plag, amp, or plag+amp. breccia/cataclasite has 40-50% clasts with <200um clast size and <20um matrix size. No indication of fault sense of motion. Fault core is largely unaltered. Chl-amp mats have no schistosity and appaer undeformed. Faultrock is cut by undeformed amp veins, carbonate veins and +/- chlorite veins. Ths suggest that deformation pre-dated veining and pre- or syn-dated alteration.

THIN SECTION LABEL ID: **399-U1309D-307R-2-W 39/42-TSB-TS 51** TS no.: **51**

Group	Summaries
Igneous petrology:	Highly deformed and altered coarse-grained gabbro.
Metamorphic petrology:	Highly altered deformed gabbro. Cpx is almost completely altered to amphibole. Amphibole veins cut by cataclastic veins and by sets of subparallel fractures.
Structure:	Fault rock, gabbro protolith. Gabbro is pervasively deformed by fractures and faults. Faults are 1mm to <200um wide with matrix supported fault breccia (80-95% clasts) in wdier faults and cataclasite in narrower faults. Amp clasts and phyllonite form sections of faults that cross amp wall rock. Wall rock fractures are filled with amp. amp veins cut wall rock but are cross cut by central fault.

Plane-polarized



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Cross-polarized

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IGNEOUS PETROLOGY

Lithology: **gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	75	65	10	1	7	5			Highly deformed, there may be remnant compositional zoning
Clinopyroxene	25	5	20	0.1	4	1	anhedral	subequant	Deformation has deformed and comminuted grains

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Highly altered deformed gabbro. Clinopyroxene is almost completely altered to amphibole. Amphibole veins cut by cataclastic veins and by sets of subparallel fractures.

Mineral	Altered (%)	Minerals replacing
Olivine		N/A
Opx		N/A
Cpx	99	amphibole, chlorite?
Spinel		N/A
Amphibole		N/A
Plagioclase	40	chlorite, amphibole, secondary plagioclase, zeolite

Vein number	Vein fill minerals
Vein 1	amphibole
Vein 2	zeolite

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
too deformed to tell		

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed		

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, undulose extinction, fractures, bent grains. amp after cpx: fractures, bent grains	

Fault rock intensity	Max. fault rock intensity	Rank
wall rock: fault breccia, discrete fault planes with cataclasite. Fault core - cataclasite to matrix supported fault breccia.	cataclastic	5

Fracture abundance	Rank
abundant fractures	4

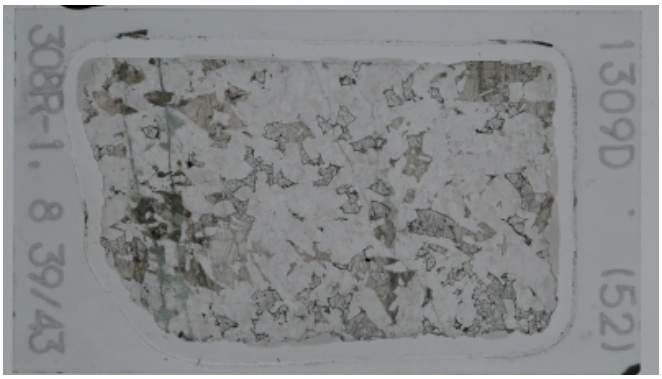
Vein abundance	Rank
Few veins	2

General microstructure comment: Fault rock, gabbro protolith. Gabbro is pervasively deformed by fractures and faults. Faults are 1mm to <200um wide with matrix supported fault breccia (80-95% clasts) in wdier faults and cataclasite in narrower faults. Amp clasts and phyllonite form sections of faults that cross amp wall rock. Wall rock fractures are filled with amp. amp veins cut wall rock but are cross cut by central fault.

THIN SECTION LABEL ID: **399-U1309D-308R-1-W 39/43-TSB-TS 52** TS no.: **52**

Group	Summaries
Igneous petrology:	Medium grained, subophitic olivine gabbro. Relatively fresh
Metamorphic petrology:	Overall alteration degree is slight and increases along green amphibole veins. Near the amphibole veins, olivine is partially to completely altered to amphibole +/- talc aggregates with coronitic chlorite fringes and Cpx is intensely altered to green amphibole, indicating amphibolite facies alteration.
Structure:	Isotropic gabbro, undeformed, cut by straight actinolite-chlorite veins.

Plane-polarized



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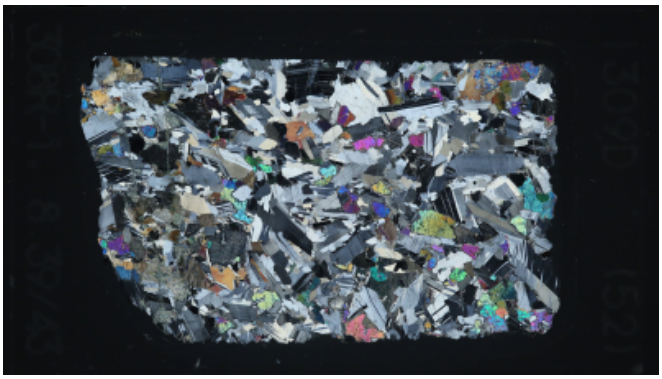
Cross-polarized



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IGNEOUS PETROLOGY

Lithology: **olivine gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Olivine	20	15	5	0.2	3	2	anhedral	subequant	
Plagioclase	64	64		1	4	2	subhedral	tabular	Zoning is largely from deformation, although some compositional zoning is evident
Clinopyroxene	16	12	4	1	3	2	anhedral	interstitial	Appears to have partially replaced earlier plagioclase and olivine. Multiple generations

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Overall alteration degree is slight and increases along green amphibole veins. Near the amphibole veins, olivine is partially to completely altered to amphibole +/- talc aggregates with coronitic chlorite fringes and clinopyroxene is intensely altered to green amphibole, indicating amphibolite facies alteration.

Mineral	Altered (%)	Minerals replacing
Olivine	20	amphibole, talc, serpentine, oxide, sulfide
Opx	2	talc
Cpx	10	amphibole, chlorite?
Spinel		N/A
Amphibole		N/A
Plagioclase	1	chlorite, amphibole, secondary plagioclase

Vein number	Vein fill minerals
Vein 1	amphibole

Abundance of fluid inclusions in mineral(s): few

Mineral(s) containing fluid inclusions: olivine, plagioclase

Mineral(s) containing lamellae: clinopyroxene,olivine

Comments on lamellae: orthopyroxene in clinopyroxene, opaque in olivine

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, fractures, undulose extinction, subgrains. pyx: undulose extinction, fractures; ol: undulose, fractured, subgrains	

Fault rock intensity	Max. fault rock intensity	Rank
	no fracturing	0

Fracture abundance	Rank
no fractures	0

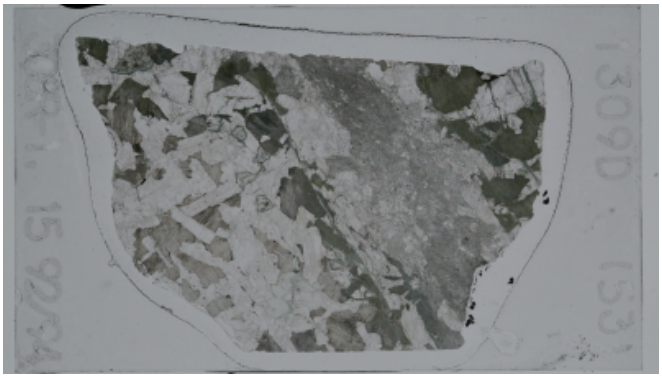
Vein abundance	Rank
Rare veins	1

General microstructure comment: isotropic gabbro, undeformed, cut by straight actinolite-chlorite veins

THIN SECTION LABEL ID: **399-U1309D-308R-1-W 92/94-TSB-TS 53** TS no.: **53**

Group	Summaries
Igneous petrology:	Altered gabbro with clinopyroxenite vein bearing about 5% plagioclase and trace titanite.
Metamorphic petrology:	Moderately altered Ol-gabbro with a thick (~1 cm thick) amphibole vein with prehnite interstitially filling void spaces between amphibole crystals. The thick vein is accompanied by a set of subparallel fractures and thinner amphibole veins. In the host gabbro penetrated by the subparallel amphibole veins, olivine is completely altered to amphibole aggregates with coronitic chlorite fringes, plagioclase is intensely altered to chlorite, and Cpx is replaced by green amphibole, indicateing amphibolite facies alteration. Prehnite partially replacing plagioclase and interstitially filling amphibole vein is probably a product of later-stage alteration.
Structure:	Isotropic gabbro cut by amphibole vein. Wall rock has fractures and microfaults. Large 5-10mm wide amp vein has irregular shape. Smaller parallel straight amp+chl vein cut wall rock. Amp grains in main vein are coarse >400um and subhedral, possibly suggesting static recrystallization after formation. Amp mats replacing cpx have granoblastic texture with equant subhedral grains of amp, rather than acicular fibrous textures, also suggesting late static recrystallization.

Plane-polarized



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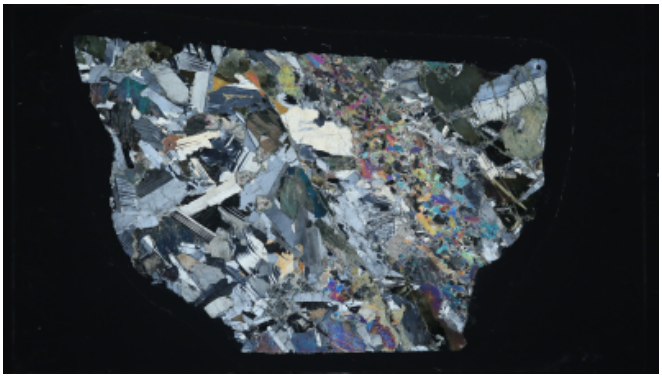
Cross-polarized



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IGNEOUS PETROLOGY

Interval domain no: **1** Domain rel. abundance (%): 80 Domain name: host gabbro

Lithology: gabbro Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	60	45	15	3	10	6	subhedral	tabular	
Clinopyroxene	40	10	30	1	6	4	anhedral	interstitial	Paetially replaced, mostly by green amphibole
Oxide	0.1								may be related to alteration

Interval domain no: **2** Domain rel. abundance (%): 20 Domain name: pyroxenite vein

Lithology: clinopyroxenite Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	5	5		0.1	0.5	0.3	anhedral	subequant	
Clinopyroxene	95	85	10	0.1	0.4	0.3	anhedral	subequant	granular

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description

Moderately altered Ol-gabbro with a thick (~1 cm thick) amphibole vein with prehnite interstitially filling void spaces between amphibole crystals. The thick vein is accompanied by a set of subparallel fractures and thinner amphibole veins. In the host gabbro penetrated by the subparallel amphibole veins, olivine is completely altered to amphibole aggregates with coronitic chlorite fringes, plagioclase is intensely altered to chlorite, and clinopyroxene is replaced by green amphibole, indicating amphibolite facies alteration. Prehnite partially replacing plagioclase and interstitially filling amphibole vein is probably a product of later-stage alteration.

Mineral	Altered (%)	Minerals replacing
Olivine	100	amphibole, oxide, sulfide
Opx		N/A
Cpx	60	amphibole, chlorite?
Spinel		N/A
Plagioclase		chlorite, amphibole, secondary plagioclase, prehnite, zeolite

Vein number	Vein fill minerals
Vein 1	amphibole
Vein 2	chlorite
Vein 3	prehnite

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, undulose extinction, bent; px: undulose extinction, fractures	

Fault rock intensity	Max. fault rock intensity	Rank
plg, moderate fracturing and microfaulting at amp vein margin	moderate fracturing	2

Fracture abundance	Rank
common fractures	3

Vein abundance	Rank
Common veins	3

General microstructure comment:

isotropic gabbro cut by amphibole vein. Wall rock has fractures and microfaults. Large 5-10mm wide amp vein has irregular shape. Smaller parallale straight amp+chl vein cut wall rock. Amp grains in main vein are coarse >400um and subhedral, possibly suggesting static recrystallization after formation. Amp mats replacing cpx have granoblastic texture with equant subhedral grains of amp, rather than acicular fibrous textures, also suggesting late static recrystallization.

THIN SECTION LABEL ID: **399-U1309D-309R-1-W 126/129-TSB-TS 55** TS no.: **55**

Group	Summaries
Igneous petrology:	Medium to coarse grained olivine-bearing gabbro with multiple clinopyroxene generations
Metamorphic petrology:	Slightly altered Opx-bearing olivine gabbro. Alteration is visible at rims, cleavage planes and microcracks of primary minerals.
Structure:	Fault rock, gabbro protolith. fault wallrock is fault breccia, fault core is cataclasite and fault breccia.

Plane-polarized

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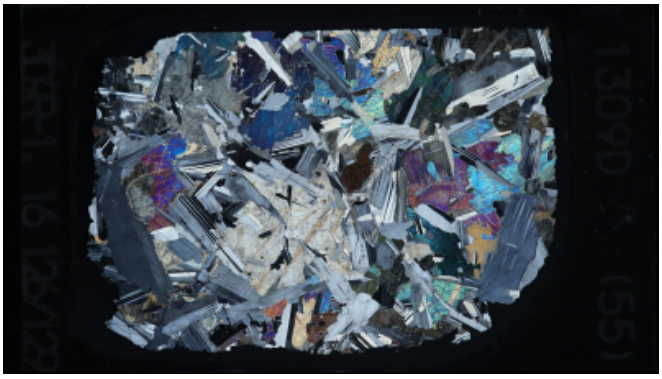
Cross-polarized



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IGNEOUS PETROLOGY

Lithology: **olivine-bearing gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Olivine	4	4	0	1	3	2	anhedral	subequant	kink banded
Plagioclase	46	45	1	1	7	3	subhedral	tabular	
Clinopyroxene	50	40	10	1	6	4	anhedral	ophitic	

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Slightly altered Opx-bearing olivine gabbro. Alteration is visible at grain boudaries, cleavage planes, and microcracks of primary minerals.

Mineral	Altered (%)	Minerals replacing
Olivine	5	amphibole, talc, serpentine, clay, oxide, sulfide
Opx	20	amphibole, talc
Cpx	2	amphibole, chlorite?
Spinel		N/A
Amphibole		N/A
Plagioclase	1	amphibole, chlorite, secondary plagioclase
Oxides		N/A

Vein number	Vein fill minerals
Vein 1	amphibole

Abundance of fluid inclusions in mineral(s): few

Mineral(s) containing fluid inclusions: olivine, plagioclase

Mineral(s) containing lamellae: clinopyroxene,olivine

Comments on lamellae: orthopyroxene in clinopyroxene, opaque in olivine

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, undulose extinction, fracture. cpx: undulose extinction, fractures.	

Fracture abundance	Rank
rare fractures	1

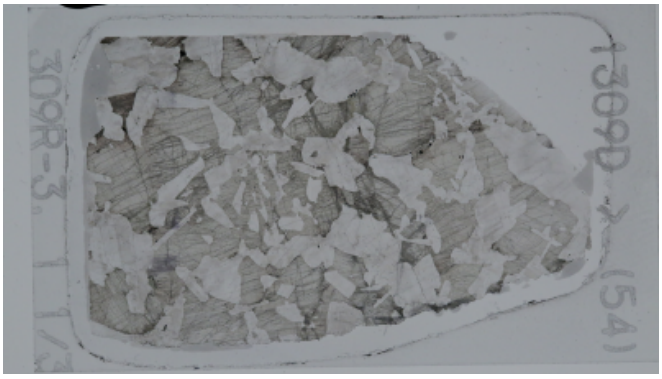
Vein abundance	Rank
Rare veins	1

General microstructure comment: undeformed isotropic gabbro with cpx oikicrysts and plg chadacrysts

THIN SECTION LABEL ID: **399-U1309D-309R-3-W 1/3-TSB-TS 54** TS no.: **54**

Group	Summaries
Igneous petrology:	Olivine gabbro; multiple generations of clinopyroxene; trace late-stage orthopyroxene
Metamorphic petrology:	Slightly altered gabbro. Alteration is visible at rims, cleavage planes and microcracks of primary minerals.
Structure:	Undeformed isotropic gabbro with cpx oikocrysts and plg chadacrysts.

Plane-polarized



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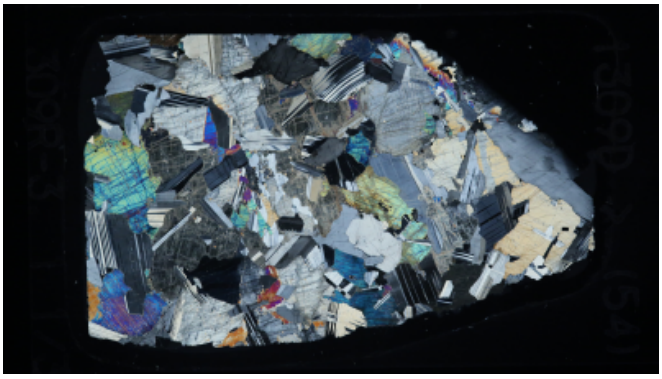
Cross-polarized



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IGNEOUS PETROLOGY

Lithology: **gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	40	40		1	9	4	subhedral	tabular	
Clinopyroxene	60	58	2	2	9	5	anhedral	interstitial	Multiple stages of clinopyroxene growth. Has clearly replaced plagioclase.

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Slightly altered gabbro. Alteration is visible at grain boundaries, cleavage planes, and microcracks of primary minerals.

Mineral	Altered (%)	Minerals replacing
Olivine		N/A
Opx	0	N/A
Cpx	5	amphibole, chlorite? oxide, sulfide
Spinel		N/A
Amphibole		N/A
Plagioclase	<1	amphibole, chlorite, carbonate?
Oxides		N/A

Abundance of fluid inclusions in mineral(s): few

Mineral(s) containing fluid inclusions: plagioclase

Mineral(s) containing lamellae: clinopyroxene

Comments on lamellae: orthopyroxene in clinopyroxene

MICROSTRUCTURES

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, undulose. cpx: undulose, fractures.	

Fracture abundance	Rank
no fractures	0

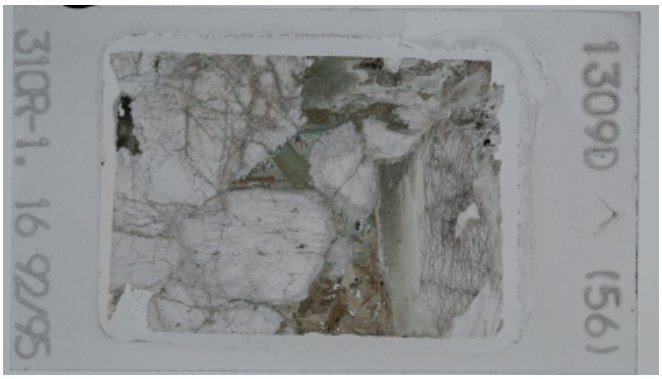
Vein abundance	Rank
No veins	0

General microstructure comment: undeformed isotropic gabbro with cpx oikicrysts and plg chadacrysts

THIN SECTION LABEL ID: **399-U1309D-310R-1-W 92/95-TSB-TS 56** TS no.: **56**

Group	Summaries
Igneous petrology:	The overall mineral proportions for most of the thin-section classify the rock as hornblende diorite. However, it essentially has three domains, one almost entirely consisting of coarse plagioclase. The second consists of anglular patches near a shear zone of intergrown hornblende. The third is gabbro which appears to have one orthopyroxene grain on the oppositie side of the shear zone. All in all, this is a faulted and altered part of the gabbro sequence.
Metamorphic petrology:	Slightly to moderately altered coarse-grained gabbro. Relatively large subhedral crystals of brown-green amphibole seem to be a part of pool or vein crystallized from magmatic/hydrothermal fluid. In host gabbro at the contact with the vein/pool, clinopyroxene is replaced by fine-grained amphibole aggregates and plagioclase has dusty secondary rims. This secondary plagioclase appears milky white in naked eyes.
Structure:	Undeformed isotropic gabbro with cpx oikocrysts and plg chadacrysts.

Plane-polarized



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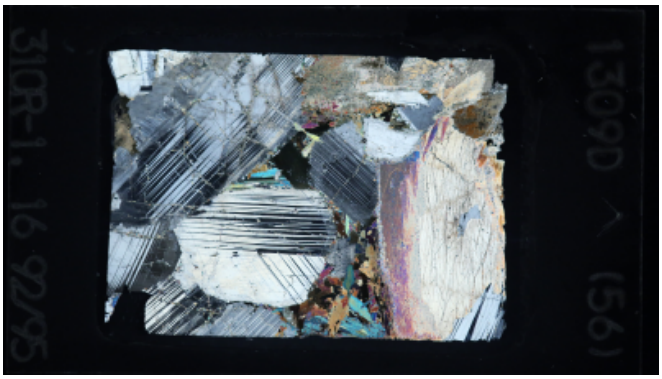
Cross-polarized



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IGNEOUS PETROLOGY

Lithology: **hornblende diorite** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Clinopyroxene	3	3		3	9	13	subhedral	tabular	A couple of grains, one with a large anhedral plagioclase inclusion
Orthopyroxene	1	0.9	0.1	3	3	3	anhedral	subequant	One grain near clinopyroxene
Amphibole	5	3	2	0.01	3	1	subhedral	tabular	Clusters of brown amphibole near and within shear zone. Partially altered to green amphibole
Oxide	0.1			0.05	0.3	0.2	anhedral	elongate	with hornblende

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Slightly to moderately altered coarse-grained gabbro. Relatively large subhedral crystals of brown-green amphibole seem to be a part of pool or vein crystallized from magmatic/hydrothermal fluid. In host gabbro at the contact with the vein/pool, clinopyroxene is replaced by fine-grained amphibole aggregates and plagioclase has dusty secondary rims. This secondary plagioclase appears milky white in naked eyes.

Mineral	Altered (%)	Minerals replacing
Olivine		N/A
Opx		N/A
Cpx	50	amphibole
Spinel		N/A
Amphibole		N/A
Plagioclase	10	secondary plagioclase, chlorite, epidote

Vein number	Vein fill minerals
Vein 1	amphibole
Vein 2	zeolite

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, undulose extinction, fracture. cpx/amp: undulose extinction, fractures.	

Fracture abundance	Rank
no fractures	0

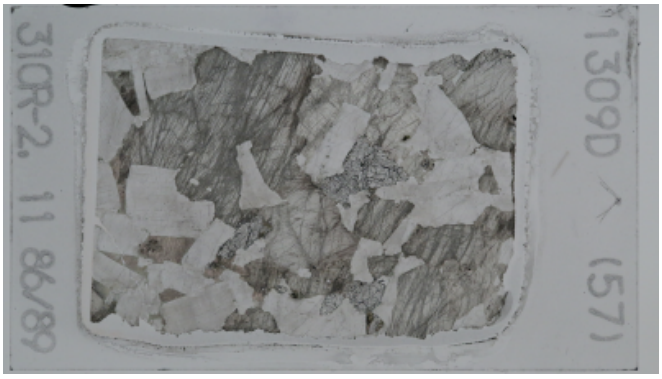
Vein abundance	Rank
Rare veins	1

General microstructure comment: undeformed isotropic gabbro. plagioclase grains are cut by 20-200um wide intragranular amp veins.

THIN SECTION LABEL ID: **399-U1309D-310R-2-W 86/89-TSB-TS 57** TS no.: **57**

Group	Summaries
Igneous petrology:	Medium-grained olivine-bearing gabbro
Metamorphic petrology:	Slightly altered Ol-Opx-bearing gabbro. Alteration is visible at rims, and along cleavage planes and microcracks in primary minerals.
Structure:	Undeformed isotropic gabbro withintragranular amp veins in plg.

Plane-polarized



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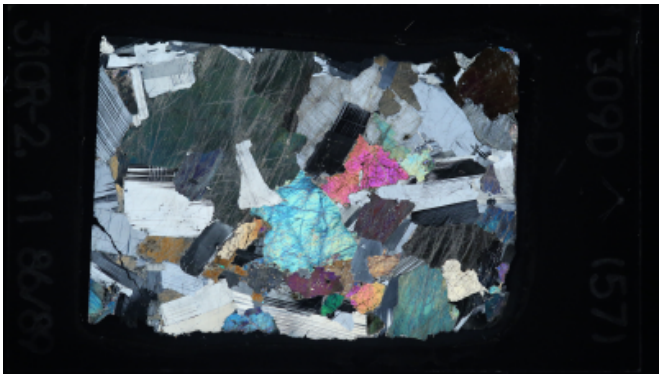
Cross-polarized



69487711

IGNEOUS PETROLOGY

Lithology: **olivine-bearing gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Olivine	4	3	1	1	4	2	anhedral	subequant	
Plagioclase	40	40		1	6	4	subhedral	tabular	
Clinopyroxene	51	36	15	1	6	4	anhedral	interstitial	
Oxide	0.1								inclusions in clinopyroxene

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Slightly altered Ol-Opx-bearing gabbro. Alteration is visible at grain boundaries, along cleavage planes, and microcracks in primary minerals.

Mineral	Altered (%)	Minerals replacing
Olivine	5	amphibole, talc, serpentine, clay, oxide, sulfide
Opx	2	amphibole, talc
Cpx	5	amphibole, chlorite?
Spinel		N/A
Amphibole		N/A
Plagioclase	<1	chlorite, amphibole
Oxides		N/A

Mineral(s) containing lamellae: clinopyroxene,orthopyroxene,oxide Comments on lamellae: orthopyroxene and brown amphibole in clinopyroxene; clinopyroxene in orthopyroxene, opaque in olivine

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, undulose, fractures, subgrains. ol: fractures, undulose, subgrains. cpx+opx: fractures, subgrains	

Fracture abundance	Rank
no fractures	0

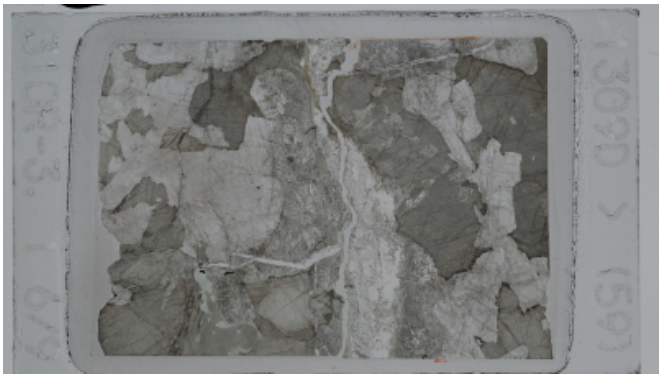
Vein abundance	Rank
No veins	0

General microstructure comment: undeformed isotropic olivine gabbro. All phases show minor low-T plasticity intracrystalline deformation.

THIN SECTION LABEL ID: **399-U1309D-310R-3-W 6/9-TSB-TS 59** TS no.: **59**

Group	Summaries
Igneous petrology:	Coarse-grained gabbro with subophitic texture
Metamorphic petrology:	Moderately to highly altered gabbro with increasing alteration intensity in proximity to prehnite-carbonate-chlorite veins.
Structure:	Isotropic gabbro, undeformed, cut by undeformed vertical calcite-prehnite vein.

Plane-polarized



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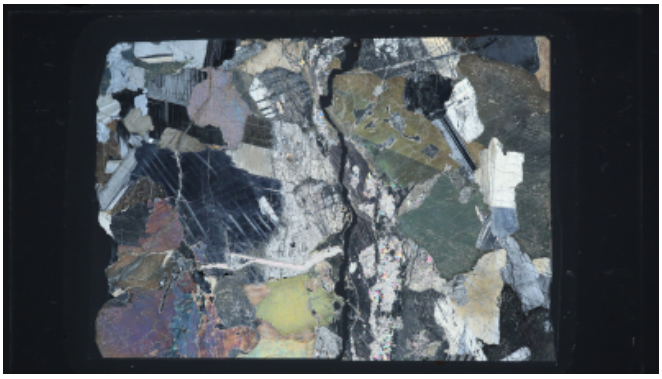
Cross-polarized



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IGNEOUS PETROLOGY

Lithology: **gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	50	45	5	1	7	5	subhedral	tabular	
Clinopyroxene	50	35	15	1	7	5	anhedral	interstitial	

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Moderately to highly altered gabbro with increasing alteration intensity in proximity to prehnite-carbonate-chlorite veins.

Mineral	Altered (%)	Minerals replacing
Olivine		N/A
Opx		N/A
Cpx	60	amphibole, chlorite?
Spinel		N/A
Amphibole		N/A
Plagioclase	30	prehnite, secondary plagioclase, chlorite, amphibole, carbonate

Vein number	Vein fill minerals
Vein 1	amphibole
Vein 2	prehnite
Vein 3	carbonate
Vein 4	chlorite
Vein 5	clay

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, undulose extinction; cpx: undulose extinction; ol: fractured	

Fault rock intensity	Max. fault rock intensity	Rank
	no fracturing	0

Fracture abundance	Rank
rare fractures	1

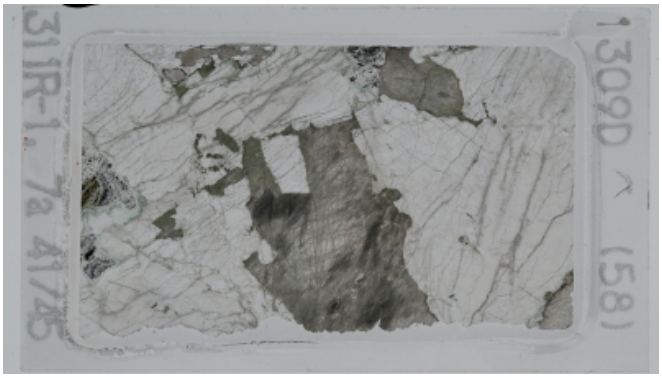
Vein abundance	Rank
Few veins	2

General microstructure comment: isotropic gabbro, undeformed, cut by undeformed vertical calcite-prehnite vein

THIN SECTION LABEL ID: **399-U1309D-311R-1-W 41/45-TSB-TS 58** TS no.: **58**

Group	Summaries
Igneous petrology:	Altered, coarse-grained olivine-bearing gabbro
Metamorphic petrology:	Moderately altered Ol-bearing gabbro. Olivine and Cpx are intensely altered, whereas plagioclase is relatively fresh.
Structure:	Undeformed isotropic olivine gabbro with minor intracrystalline deformation.

Plane-polarized



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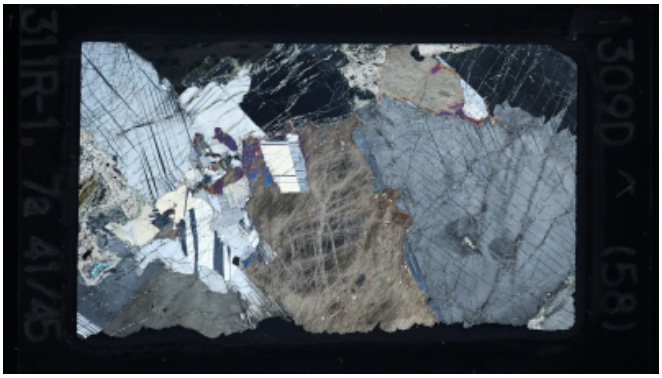
Cross-polarized



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IGNEOUS PETROLOGY

Lithology: **olivine-bearing gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Olivine	4	0.5	3.5	1	3	2	anhedral	subequant	nearly entirely replaced by secondary minerals
Plagioclase	60	50	10	4	9	6	subhedral	tabular	
Clinopyroxene	36	24	12	2	11	6	anhedral	interstitial	

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Moderately altered Ol-bearing gabbro. Olivine and clinopyroxene are intensely altered, whereas plagioclase is relatively fresh.

Mineral	Altered (%)	Minerals replacing
Olivine	97	amphibole, talc, serepntine, oxide, sulfide
Opx		N/A
Cpx	80	amphibole, chlorite
Spinel		N/A
Amphibole		N/A
Plagioclase	5	amphibole, chlorite
Oxides		N/A

Vein number	Vein fill minerals
Vein 1	amphibole
Vein 2	chlorite
Vein 3	zeolite?

MICROSTRUCTURES

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, cpx: kinked, ol:fractured	

Fracture abundance	Rank
few fractures	2

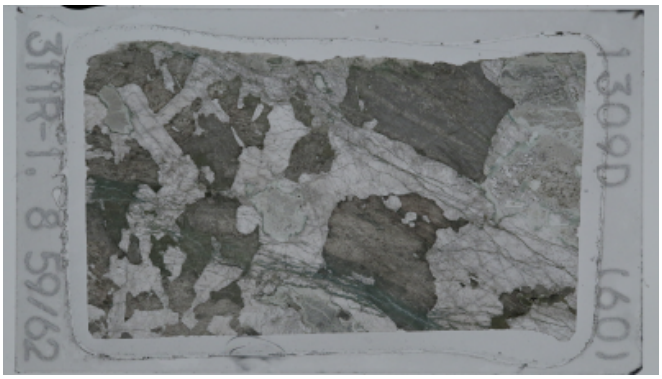
Vein abundance	Rank
Rare veins	1

General microstructure comment: undeformed coarse grained gabbro with a grain size >3cm, fractures in plg filled with amp

THIN SECTION LABEL ID: **399-U1309D-311R-1-W 59/62-TSB-TS 60** TS no.: **60**

Group	Summaries
Igneous petrology:	Altered, coarse-grained olivine-bearing gabbro
Metamorphic petrology:	Highly altered Ol-Opx-bearing gabbro. Olivine is completelt altered to acicular amphibole aggregates with chlorite fringe at the contact with plagioclase. Opx is pseudomorphically replaced by chlorite-amphibole with traces of preexisting cleavage planes and exsolution lamellae. Cpx is altered to amphibole and possibly chlorite, showing dusty appearance. Plagioclase is fresher than mafic minerals within the thin section but more altered than other rocks in the same core section.
Structure:	Undeformed isotopic gabbro. Thin section is cut by a parallel network of branched amphibole veins, 100-200um wide. Some plg has chlorite +/- prehnite alteration halos. Alteration halos and amphibole veins are undeformed.

Plane-polarized



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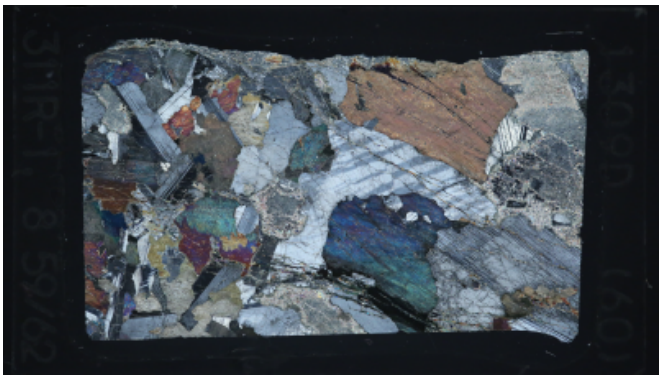
Cross-polarized



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IGNEOUS PETROLOGY

Lithology: **olivine-bearing gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Olivine	3	0	3	1	3	2	anhedral	subequant	entirely replaced by secondary minerals
Plagioclase	48	45	3	1	7	5	subhedral	tabular	
Clinopyroxene	49	39	10	2	8	5	anhedral	interstitial	

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Highly altered Ol-Opx-bearing gabbro. Olivine is completely altered to acicular amphibole aggregates with chlorite fringe at the contact with plagioclase. Orthopyroxene is pseudomorphically replaced by chlorite-amphibole with traces of preexisting cleavage planes and exsolution lamellae. Clinopyroxene is altered to amphibole and possibly chlorite, showing dusty appearance. Plagioclase is fresher than mafic minerals within the thin section but more altered than other rocks in the same core section.

Mineral	Altered (%)	Minerals replacing
Olivine	100	amphibole
Opx	100	chlorite, amphibole
Cpx	95	amphibole, chlorite?
Spinel		N/A
Amphibole		N/A
Plagioclase	20	chlorite, amphibole, secondary plagioclase, zeolite
Oxides		N/A

Vein number	Vein fill minerals
Vein 1	amphibole
Vein 2	zeolite

MICROSTRUCTURES

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, undulose extinction, fractures; px: undulose, fractured	

Fracture abundance	Rank
rare fractures	1

Vein abundance	Rank
Few veins	2

General microstructure comment: undeformed isotopic gabbro. Thin section is cut by a parallel network of branched amphibole veins, 100-200um wide. Some plg has chlorite +/- prehnite alteration halos. Alteration halos and amphibole veins are undeformed

THIN SECTION LABEL ID: **399-U1309D-311R-1-W 82/84-TSB-TS 61** TS no.: **61**

Group	Summaries
Igneous petrology:	This is an olivine gabbro with multiple generations of clinopyroxene. The olivine is entirely replaced by secondary minerals
Metamorphic petrology:	Moderately altered Ol-gabbro. Olivine is completely altered to acicular amphibole, talc, clay and opaque minerals. Possibly Opx pseudomotphs consist of relatively large grains of prismatic amphibole and platy talc with a few amount of opaque minerals. Cpx is partially altered to amphibole at rims and possibly chlorite along cleavage planes and fractures. Plagioclase is relatively fresh.
Structure:	Isotropic gabbro, undeformed, cut by irregular shaped chlorite and prehnite vein.

Plane-polarized

69535851

Cross-polarized

69535881

IGNEOUS PETROLOGY

Lithology: **olivine gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Olivine	20	0	6	1	3	2	anhedral	subequant	
Plagioclase	50	48	2	1	4	3	subhedral	tabular	
Clinopyroxene	30	28	2	1	4	3	anhedral	interstitial	Multiple generations

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Moderately altered Ol-gabbro. Olivine is completely altered to acicular amphibole, talc, clay and opaque minerals. Possibly orthopyroxene pseudomorphs consist of relatively large grains of prismatic amphibole and platy talc with a few amount of opaque minerals. Clinopyroxene is partially altered to amphibole at rims and possibly chlorite along cleavage planes and fractures. Plagioclase is relatively fresh.

Mineral	Altered (%)	Minerals replacing
Olivine	100	amphibole, talc, clay, sulfide
Opx	100	talc, amphibole, chlorite
Cpx	50	amphibole, chlorite?
Spinel		N/A
Amphibole		N/A
Plagioclase	2	chlorite, amphibole, zeolite

Vein number	Vein fill minerals
Vein 1	amphibole
Vein 2	chlorite
Vein 3	zeolite

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, undulose extinction; ol: undulose, fractured	

Fault rock intensity	Max. fault rock intensity	Rank
	no fracturing	0

Fracture abundance	Rank
no fractures	0

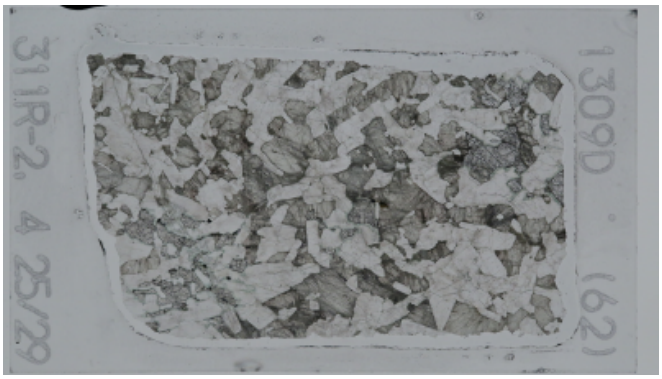
Vein abundance	Rank
Rare veins	1

General microstructure comment: isotropic gabbro, undeformed, cut by irregular shaped chlorite and prehnite vein

THIN SECTION LABEL ID: **399-U1309D-311R-2-W 25/29-TSB-TS 62** TS no.: **62**

Group	Summaries
Igneous petrology:	This is an olivine gabbro with multiple generations of clinopyroxene, and trace late-stage orthopyroxene.
Metamorphic petrology:	Slightly altered Ol-gabbro. Olivine grains have coronitic fringe of amphibole + chlorite + talc. Clinopyroxene is altered at rims, and along cleavage planes and fractures. Plagioclase is fresh except for at the contact with olivine, where it is replaced by clorite and/or amphibole.
Structure:	Undeformed isotropic gabbro.

Plane-polarized



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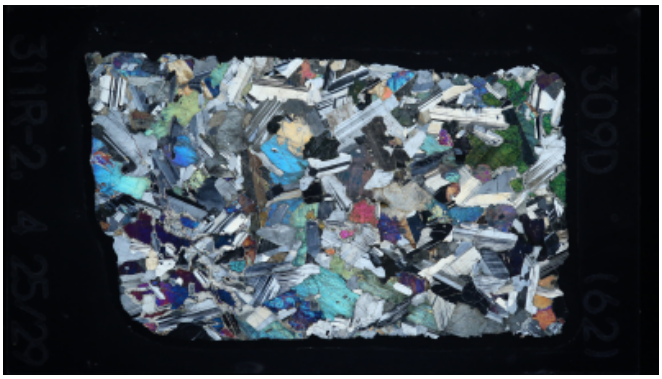
Cross-polarized



69501491

IGNEOUS PETROLOGY

Lithology: **olivine gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Olivine	8	6	2	1	3	2	anhedral	subequant	
Plagioclase	48	46	2	1	4	3	subhedral	tabular	
Clinopyroxene	44	34	10	1	4	3	anhedral	interstitial	Multiple generations
Orthopyroxene	0.2			0.1	0.5	0.3	anhedral	subequant	Late-stage interstitial, near olivine

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Slightly altered Ol-gabbro. Olivine grains have coronitic fringe of amphibole + chlorite + talc. Clinopyroxene is altered at rims, and along cleavage planes and fractures. Plagioclase is fresh except for at the contact with olivine, where it is replaced by chlorite and/or amphibole.

Mineral	Altered (%)	Minerals replacing
Olivine	20	amphibole, talc, serpentine, oxide, sulfide
Opx		N/A
Cpx	10	amphibole, chlorite?
Spinel		N/A
Amphibole		N/A
Plagioclase	5	chlorite, amphibole, secondary plagioclase
Oxides		N/A

Vein number	Vein fill minerals
Vein 1	amphibole

Abundance of fluid inclusions in mineral(s): few

Mineral(s) containing fluid inclusions: olivine

Mineral(s) containing lamellae: clinopyroxene,olivine

Comments on lamellae: orthopyroxene in clinopyroxene, opaque in olivine

MICROSTRUCTURES

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, undulose, minor fractures, ol: fractures, undulose, cpx: fractures	

Fracture abundance	Rank
no fractures	0

Vein abundance	Rank
No veins	0

General microstructure comment: undeformed isotropic olv. gabbro. plag, cpx and olvine have interlocking irregular grain boundaries. May be replacement textures due to late melt infiltraion along grain boundaries.

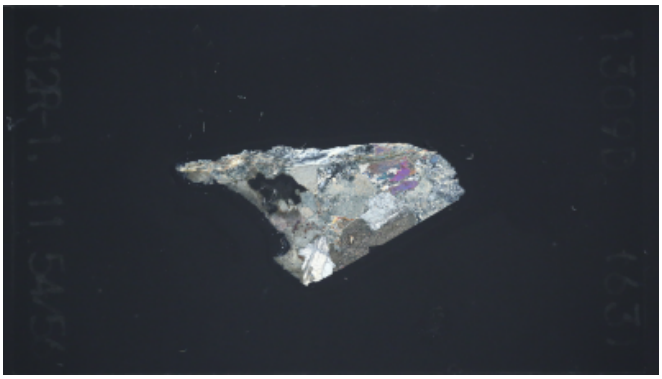
THIN SECTION LABEL ID: **399-U1309D-312R-1-W 54/56-TSB-TS 63** TS no.: **63**

Group	Summaries
Igneous petrology:	Altered and sheared gabbro
Metamorphic petrology:	Highly altered gabbro. Amphibole + chlorite aggregates with parallel arrangement of elongated amphibole crystals are possibly pseudomorphs after Opx. A white to green vein showing a ductile deformation feature with the naked eye is slip-fiber amphibole-chlorite vein.
Structure:	Gabbro with amp vein on edge of sample. Amp vein (tremolite?) has aligned sheared/phyllonitic? texture suggesting that amp vein formed as slicken fibers in a fault.

Plane-polarized

69896231

Cross-polarized



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IGNEOUS PETROLOGY

Lithology: **gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	50	30	20	1	2	2	anhedral	subequant	unusually strongly altered
Clinopyroxene	50	25	25	1	2	2	anhedral	interstitial	

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Highly altered gabbro. Amphibole and chlorite aggregates with parallel arrangement of elongated amphibole crystals are possibly pseudomorphs after orthopyroxene. A white to green vein showing a ductile deformation feature with the naked eye is slip-fiber amphibole-chlorite vein.

Mineral	Altered (%)	Minerals replacing
Opx	100	amphibole, chlorite
Cpx	50	amphibole, chlorite?
Spinel		N/A
Amphibole		N/A
Plagioclase	60	prehnite, chlorite, amphibole, secondary plagioclase, zeolite

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
too deformed to tell		

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed		

Intracrystalline deformation features	Intensity of static recrystallization
plg - deformation twins, fractures, undulose extinction. amp - undulose extinction	

Fault rock intensity	Max. fault rock intensity	Rank
wall rock - fractured. Fault plane/vein - amp slicken fibers		

Fracture abundance	Rank
rare fractures	1

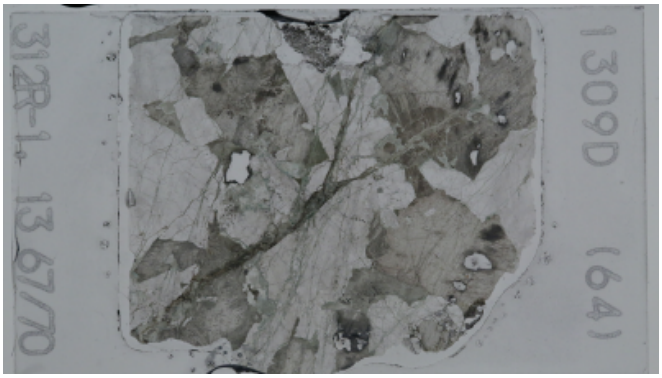
Vein abundance	Rank
Few veins	2

General microstructure comment: gabbro with amp vein on edge of sample. amp vein (tremolite?) has aligned sheared/phyllonitic? texture suggesting that amp vein formed as slicken fibers in a fault

THIN SECTION LABEL ID: **399-U1309D-312R-1-W 67/70-TSB-TS 64** TS no.: **64**

Group	Summaries
Igneous petrology:	Highly altered, coarse grained gabbro.
Metamorphic petrology:	Moderately altered Ol-bearing gabbro with several veins and relatively high degree of alteration. Fine-grained amphibole aggregates with chlorite/green amphibole coronitic fringe are possibly pseudomorphs after olivine. Clinopyroxene is intensely altered along cleavage planes and fractures. Plagioclase has microcracks filled with chlorite, amphibole, prehnite and zeolite. Amphibole veins are cut by amphibole-chlorite polycrystalline or slip-fiber veins.
Structure:	Undeformed gabbro with abundant amphibole-veins.

Plane-polarized



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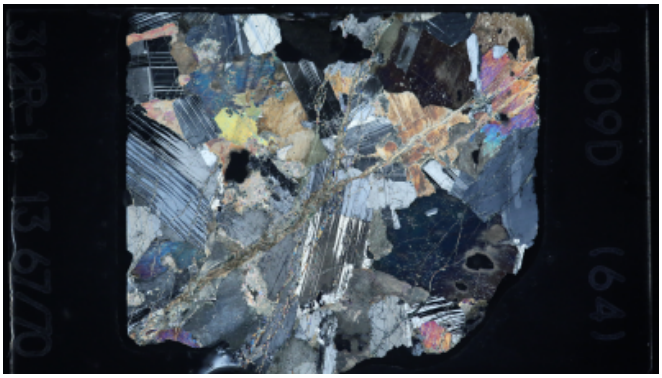
Cross-polarized



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IGNEOUS PETROLOGY

Lithology: **gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	50	45	5	1	7	3	subhedral	tabular	Compositional and deformational zoning
Clinopyroxene	50	20	30	3	7	5	anhedral	interstitial	Many grains are altered to what appears to be tremolite, although secondary clinpyroxene is possible. Multiple generations of clinopyroxene growth.

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Moderately altered Ol-bearing gabbro with several veins and relatively high degree of alteration. Fine-grained amphibole aggregates with chlorite/green amphibole coronitic fringe are possibly pseudomorphs after olivine. Clinopyroxene is intensely altered along cleavage planes and fractures. Plagioclase has microcracks filled with chlorite, amphibole, prehnite and zeolite. Amphibole veins are cut by amphibole-chlorite polycrystalline or slip-fiber veins.

Mineral	Altered (%)	Minerals replacing
Olivine	100	amphibole
Opx		N/A
Cpx	80	amphibole, chlorite, oxide, sulfide
Spinel		N/A
Amphibole		N/A
Plagioclase	5	chlorite, amphibole, secondary plagioclase, prehnite, zeolite

Vein number	Vein fill minerals
Vein 1	amphibole
Vein 2	amphibole-chlorite

MICROSTRUCTURES

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
weak	weak magmatic fabric	1

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	1	

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, px: kinked and bent	

Fracture abundance	Rank
few fractures	2

Vein abundance	Rank
Abundant veins	4

General microstructure comment: undeformed gabbro with abundant amphibole-veins and amp-chl? veins. Fibre growth of amp in multi-phase vein indicates oblique opening.

THIN SECTION LABEL ID: **399-U1309D-312R-1-W 132/136-TSB-TS 65** TS no.: **65**

Group	Summaries
Igneous petrology:	This is a medium grained olivine gabbro with trace orthopyroxene.
Metamorphic petrology:	Slightly altered Ol-gabbronorite. Olivine is replaced at rim by acicular amphibole +/- talc aggregate with chlorite corona. Opx and Cpx is partially replaced by amphibole, and in addition by talc and chlorite, respectively.
Structure:	Undeformed coarse grained gabbro.

Plane-polarized

69501551

Cross-polarized

69501571

IGNEOUS PETROLOGY

Lithology: **olivine gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Olivine	6	3	3	1	2	1.5	anhedral	subequant	kink-banded
Plagioclase	49.5	49.5		1	7	4	subhedral	tabular	
Clinopyroxene	44	29	15	1	7	4	anhedral	interstitial	
Orthopyroxene	0.5	0.5		1	1	1	anhedral	interstitial	between olivine and clinopyroxene

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Slightly altered Ol-gabbronorite. Olivine is replaced along rims by acicular amphibole +/- talc aggregates with chlorite corona. Orthopyroxene and clinopyroxene are partially replaced by amphibole and by amphibole, talc and chlorite, respectively.

Mineral	Altered (%)	Minerals replacing
Olivine	60	amphibole, talc, serpentine, clay, oxide, sulfide
Opx	20	amphibole, talc, sulfide
Cpx	20	amphibole, chlorite?
Spinel		N/A
Amphibole		N/A
Plagioclase	1	chlorite, amphibole
Oxides		N/A

Vein number	Vein fill minerals
Vein 1	amphibole
Vein 2	zeolite? cross-fiber

Abundance of fluid inclusions in mineral(s):	few	Mineral(s) containing fluid inclusions:	olivine, plagioclase
Mineral(s) containing lamellae:	clinopyroxene,orthopyroxene,olivine	Comments on lamellae:	clinopyroxene-orthopyroxene lamellae, opaque in olivine

MICROSTRUCTURES

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, undulose, minor fractures, ol: fractures, undulose, cpx: fractures	

Fracture abundance	Rank
no fractures	0

Vein abundance	Rank
Rare veins	1

General microstructure comment: undeformed isotropic olv. gabbro. plag, cpx and olvine have interlocking irregular grain boundaries. May be replacement textures due to late melt infiltraion along grain boundaries.

THIN SECTION LABEL ID: **399-U1309D-312R-3-W 99/103-TSB-TS 66** TS no.: **66**

Group	Summaries
Igneous petrology:	Medium grained olivine-bearing gabbro. Orthopyroxene rims olivine. Multiple generations of clinopyroxene are evident.
Metamorphic petrology:	Mostly fresh gabbro with minimal alteration along fractures. Cpx shows exsolution lamellae and blebs of Opx that appear unaltered. Inspected with SEM in BSE mode.
Structure:	Weakly foliated gabbro, undeformed.

Plane-polarized

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Cross-polarized

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IGNEOUS PETROLOGY

Lithology: **olivine- and orthopyroxene-bearing gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Olivine	2	1.6	0.4	1	3	2	anhedral	subequant	Opx rims
Plagioclase	47	47		1	5	3	subhedral	tabular	
Clinopyroxene	50	45	5	1	5	3	anhedral	interstitial	multiple generations
Orthopyroxene	1	1		0.2	1	0.4	anhedral	interstitial	rims on olivine

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Mostly fresh gabbro with minimal alteration along fractures. Clinopyroxene shows exsolution lamellae and blebs of orthopyroxene that appears unaltered. Inspected with SEM in BSE mode.

Mineral	Altered (%)	Minerals replacing
Olivine	1	talc, opaque
Opx	<1	amphibole, talc
Cpx	<1	amphibole
Spinel		N/A
Amphibole		N/A

MICROSTRUCTURES

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
weak alignment of plg laths	weak magmatic fabric	1

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	1	

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, undulose, fractures, ol: fractures, undulose, cpx: bent cleavage planes, opx: fractures	

Fracture abundance	Rank
no fractures	0

Vein abundance	Rank
Abundant veins	4

General microstructure comment: weakly magmatically foliated gabbro, undeformed

THIN SECTION LABEL ID: **399-U1309D-313R-1-W 103/106-TSB-TS 67** TS no.: **67**

Group	Summaries
Igneous petrology:	Relatively fresh olivine gabbro with grain sizes between fine and medium.
Metamorphic petrology:	Slightly altered fine-grained Opx-bearing Ol-gabbro. Olivine is partially to completely replaced acicular amphibole aggregates with coronitic fringe of chlorite, with increasing alteration degree near chlorite veins. Pyroxenes are slightly replaced or overgrown by amphibole at rims. Clinopyroxene is replaced by possibly chlorite, and orthopyroxene by talc along cleavage planes and fractures. Plagioclase has microcracks filled with chlorite and locally with amphibole.
Structure:	Contact between coarser (gs~4mm) and finer (gs ~2mm) ol-bearing gabbro, fine grained gabbro has more olivine.

Plane-polarized

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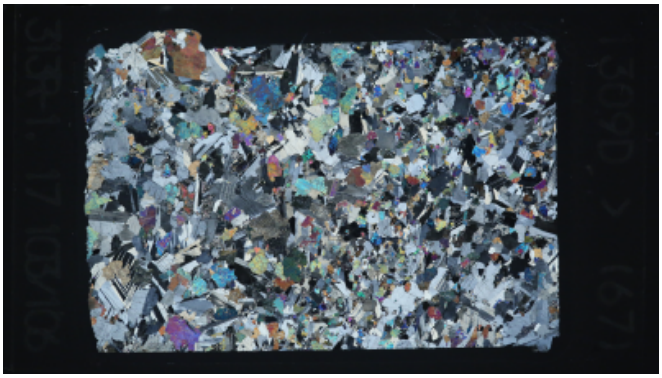
Cross-polarized



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IGNEOUS PETROLOGY

Lithology: **olivine gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Olivine	15	10	5	0.1	2	0.6	anhedral	subequant	
Plagioclase	50	48	2	0.5	3	2	anhedral	subequant	
Clinopyroxene	25	24	1	0.1	2	1	anhedral	subequant	

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Slightly altered fine-grained Opx-bearing Ol-gabbro. Olivine is partially to completely replaced by acicular amphibole aggregates with coronitic fringe of chlorite, with increasing alteration degree near chlorite veins. Pyroxenes are slightly replaced or overgrown by amphibole at rims. Clinopyroxene is replaced by possibly chlorite, and orthopyroxene by talc along cleavage planes and fractures. Plagioclase has microcracks filled with chlorite and locally with amphibole.

Mineral	Altered (%)	Minerals replacing
Olivine	50	amphibole, talc, serpentine, clay, oxide, sulfide
Opx	5	amphibole, talc
Cpx	5	amphibole, chlorite?
Spinel		N/A
Plagioclase	1	chlorite, amphibole
Oxides		N/A

Vein number	Vein fill minerals
Vein 1	chlorite

Abundance of fluid inclusions in mineral(s):	few	Mineral(s) containing fluid inclusions:	olivine, plagioclase
Mineral(s) containing lamellae:	clinopyroxene,orthopyroxene,olivine	Comments on lamellae:	orthopyroxene in clinopyroxene, clinopyroxene in orthopyroxene, opaque in olivine

MICROSTRUCTURES

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, undulose extinction, fractures, bending; cpx: undulose, subgrains, ol: undulose	

Fracture abundance	Rank
common fractures	3

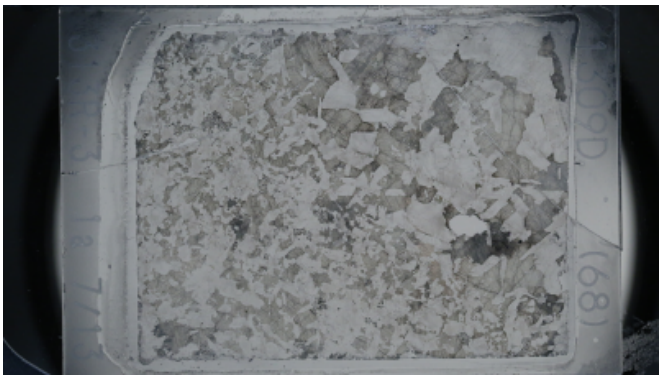
Vein abundance	Rank
No veins	0

General microstructure comment: contact between coarser (gs~4mm) anf finer (gs ~2mm) ol-bearing gabbro, fine grained gabbro has more olivine

THIN SECTION LABEL ID: **399-U1309D-313R-3-W 7/13-TSB-TS 68** TS no.: **68**

Group	Summaries
Igneous petrology:	Two domains: a finer grained and granular-textured olivine gabbro and a coarser grained and subophitic orthopyroxene-bearing gabbro. The contact is sutured.
Metamorphic petrology:	Finer-grained domain (Domain 1): Slightly altered Ol-gabbro. Olivine is cut by serpentine + magnetite mesh-forming veins, partially surrounded by thin layers of amphibole + chlorite, and replaced by talc + sulfide in variable extent. Cpx is surrounded by thin amphibole and replaced by probably chlorite along cleavage planes and microcracks. Plagioclase is fresh, has thin films of chlorite at the contact with Ol, and has microcracks filled with chlorite and amphibole. Coaser-grained domain (Domain 2): slightly altered gabbronorite. Alteration extent is slightly higher than the finer-grained Ol-gabbro domain.
Structure:	Gradual contact between coarse and fine-grained gabbro: melt-rich domain against a coarser gabbro.

Plane-polarized



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Cross-polarized

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IGNEOUS PETROLOGY

Interval domain no: Domain rel. abundance (%): 50 Domain name: Medium grained olivine gabbro with granular texture

Lithology: orthopyroxene-bearing gabbro Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Plagioclase	40	39	1	1	8	5	subhedral	tabular	
Clinopyroxene	50	40	10		1	6	anhedral	interstitial	
Orthopyroxene	4	3	1	1	5	6	anhedral	interstitial	Clinopyroxene exsolution lamellae. Only a couple of grains, one large.

METAMORPHIC PETROLOGY

Interval domain no: 1

Observer(s): TN

Detailed description Finer-grained domain: Slightly altered Ol-gabbro. Olivine is cut by serpentine and magnetite mesh-forming veins, partially surrounded by thin layers of amphibole and chlorite, and replaced by talc and sulfide in variable extent. Clinopyroxene is surrounded by thin amphibole and replaced by probably chlorite along cleavage planes and microcracks. Plagioclase is fresh, has thin films of chlorite at the contact with Ol, and has microcracks filled with chlorite and amphibole.

Mineral	Altered (%)	Minerals replacing
Olivine	5	talc, serpentine, amphibole, oxide, sulfide
Opx		N/A
Cpx	5	amphibole, chlorite?
Spinel		N/A
Plagioclase	1	chlorite, amphibole
Oxides		N/A

Abundance of fluid inclusions in mineral(s): few

Mineral(s) containing fluid inclusions: olivine

Mineral(s) containing lamellae: clinopyroxene,olivine

Comments on lamellae: orthopyroxene in clinopyroxene, opaque lamellae in olivine

Interval domain no: 2

Observer(s): TN

Detailed description Coaser-grained domain: slightly altered gabbronorite. Alteration extent is slightly higher than in the finer-grained Ol-gabbro domain.

Mineral	Altered (%)	Minerals replacing
Olivine		N/A
Opx	20	amphibole, talc
Cpx	10	amphibole, chlorite?
Spinel		N/A
Plagioclase	1	chlorite, amphibole

MICROSTRUCTURES

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, undulose, ol: undulose, subgrains, cpx: undulose	

Fracture abundance	Rank
no fractures	0

Vein abundance	Rank
No veins	0

General microstructure comment: Contact between coarse and fine-grained gabbro, contact gradual, both have the same intracrystalline deformation features. Fine grained domain (ol-gabbro) has unhedral plg, cpx, ol with irregular amoeboid grain boundaries, dihedral triple junctions and quadrupel junctions, suggest this is a melt-rich domain against a coarser gabbro with cpx oikocrysts

THIN SECTION LABEL ID: **399-U1309D-313R-4-W 21/25-TSB-TS 69** TS no.: **69**

Group	Summaries
Igneous petrology:	Medium grained olivine-bearing gabbro with a few late-stage interstitial orthopyroxene grains. One c. 0.1 mm interstitial sulfide grain was observed.
Metamorphic petrology:	Slightly altered Ol-bearing gabbronorite. Alteration is visible at rims, and along cleavage planes and microcracks of primary minerals.
Structure:	Gabbro with minor intracrystalline deformation features.

Plane-polarized

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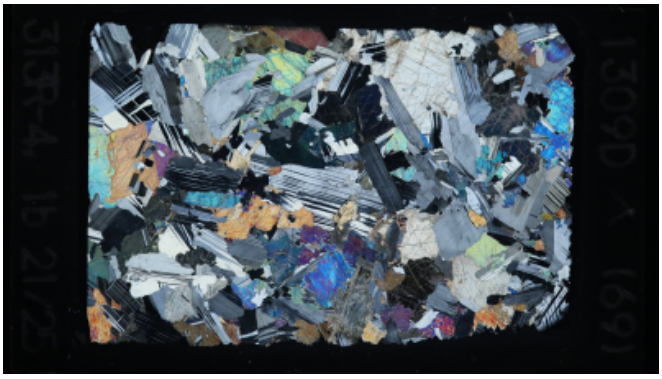
Cross-polarized



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IGNEOUS PETROLOGY

Lithology: **olivine-bearing gabbro** Observer: MR

Mineral	% Mineral	Original (%)	Altered (%)	Size min. (mm)	Size max. (mm)	Size mode (mm)	Shape	Habit	Comments
Olivine	2	1.5	0.5	1	2	1	anhedral	subequant	Kink-banded
Plagioclase	53	52	1	1	5	3	subhedral	tabular	
Clinopyroxene	45	40	5	1	5	3	anhedral	interstitial	
Orthopyroxene	0.2	0.1	0.1	1	1	1	anhedral	interstitial	

METAMORPHIC PETROLOGY

Observer(s): TN

Detailed description Slightly altered Ol-bearing gabbronorite. Alteration is visible at rims, along cleavage planes, and microcracks of primary minerals.

Mineral	Altered (%)	Minerals replacing
Olivine	10	amphibole, talc, serpentine, clay, oxide, sulfide
Opx	5	amphibole, talc
Cpx	5	amphibole, chlorite?
Spinel		N/A
Plagioclase	<1	chlorite, amphibole

Abundance of fluid inclusions in mineral(s): few

Mineral(s) containing fluid inclusions: olivine

Mineral(s) containing lamellae: clinopyroxene,orthopyroxene,olivine

Comments on lamellae: orthopyroxene in clinopyroxene, clinopyroxene in orthopyroxene, opaque lamellae in olivine

MICROSTRUCTURES

Observer: AP

Magmatic fabric intensity	Max. magmatic fabric intensity	Rank
isotropic	isotropic	0

CP fabric intensity	Max. CP fabric intensity	Rank	CPF sense of shear
	undeformed	0	

Intracrystalline deformation features	Intensity of static recrystallization
plg: deformation twins, bent; px: undulose; ol: undulose, fractured	

Fracture abundance	Rank
rare fractures	1

Vein abundance	Rank
No veins	0

General microstructure comment: gabbro with minor intracrystalline deformation features