Appendix 3

Petrographic Reports

PETROGRAPHIC REPORT

MINER MOUNTAIN PROJECT:
BRITISH COLUMBIA, CANADA

October 20, 2009

Prepared for:
Chris Sampson, P.Eng
President
Sego Resources Inc.
#211-744 West Hastings St.
Vancouver, B.C.
Canada V6C 1A5

Prepared by:
Kathryn Dunne, M.Sc. P.Geo.
Bag 9000, # 207
190B Trans Can Hwy NE
Salmon Arm, BC
Canada V1E 1S3

phone: 250-804-0729
kgeo@telus.net

Background

Five drill core samples and six hand samples were received from Chris Sampson on behalf of Sego Resources Inc. on August 28, 2009 for petrographic analysis. The samples were taken from the Zymo property, B.C. The goal of the work was basic transmitted and reflected light observations, including description of lithologies, alteration and mineralization. Eleven polished thin sections were prepared from the samples at Vancouver Petrographics Ltd. Kathryn Dunne, P.Geo. carried out the petrographic analysis at her office in Salmon Arm, B.C. All percentages in the descriptions are approximate based on visual estimation.

Conventions used in this report

The following grain size conventions are used in this report:

coarse-grained > 5mm
medium-grained 1-5 mm
fine-grained < 1 mm
very fine-grained < 0.05mm

The use of brackets in mineral lists indicates that the mineral occurs in trace amounts (< 1%).

Examples:

1) **Mineralization:** Chalcopyrite, (pyrite)
2) chlorite-carbonate-(epidote) alteration

The following abbreviations are used:

Fe-ox = Fe-oxides or Fe-oxyhydroxides

Summary

Samples examined in this report are listed below and summarized briefly in the next pages and in the summary table following.

GRANBY Zone (drill core samples)

Sample	Petrographic Description - Page #
MM-08-04 58.65-58.84m	5
MM-08-04 83.72-83.76m	12
MM-08-04 82.90-83.01m	20
MM-08-09 76.09-76.19m	77
MM-08-09 56.39-56.49m	85

SOUTH Zone (rock samples from trenches)

Sample	Petrographic Description - Page #
TR80-C1	28
TR80-C3	36
TR80-C9	43
TR80-C11	51
TR80-C85	60
TR80-C96	69

SUMMARY TABLE: SOUTH AND GRANBY ZONE SAMPLES FROM THIS REPORT

ZONE	*GRANBY*		
LITHOLOGIES	*syenite*	*?andesite*	*porphyritic rock*
ALTERATION	*epidote, calcite (?garnet-may be primary?)*	*K-feldspar, sericite or illite, , carbonate or calcite chlorite ± rutile ± albite*	*illite/seriate, carbonate*
MINERALIZATION -hypogene	*(bornite), (chalcopyrite)*	*bornite ± chalcopyrite*	*chalcopyrite, bornite*
MINERALIZATION -supergene	*(chalcocite) (covellite)*	*chalcocite, covellite*	*(chalcocite), (covellite)*
VEINLETS/ FRACTURE INFILL	*calcite±(bornite ±chalcopyrite)*	*calcite or chlorite ±bornite ±hematite ±(chalcocite-covellite) ± rutile quartz±chlorite±(sericite±chalcopyrite-bornite, chalcocite, covellite) late Fe-ox*	*carbonate (many varieties), chlorite ±(bornite ± chalcopyrite)*

ZONE	*SOUTH*			
LITHOLOGIES	*intrusive breccia*	*porphyritic micro-diorite breccia*	*fragmental and porphyritic rock*	*Micro-quartz diorite*
ALTERATION	*K-feldspar, calcite chlorite magnetite hematite albite ± actinolite ± epidote*	*K-feldspar, calcite chlorite magnetite illite*	*K-feldspar carbonate chlorite biotite hematite*	*K-feldspar chlorite magnetite illite actinolite rutile*
MINERALIZATION -hypogene	*chalcopyrite*	*pyrrhotite (chalcopyrite) (pyrite)*	*(pyrite) (chalcopyrite)*	*Pyrrhotite*
MINERALIZATION -supergene	*(malachite)*			
VEINLETS/ FRACTURE INFILL	*calcite ±chlorite± chalcopyrite ± hematite ± (malachite±rutile ± pyrite) calcite late Fe-ox*	*calcite/carbonate ±chlorite± (epidote ± magnetite /hematite ±rutile ± chalcopyrite) calcite±hematite late Fe-ox*	*chlorite-(rutile) calcite-carbonate (hematite) late Fe-ox*	*K-feldspar chlorite-epidote-calcite-(rutile) or chlorite-pyrrhotite-hematite calcite late Fe-ox*

GRANBY Zone

Samples from the Granby zone include the following:

- patchy epidote-calcite-(?garnet) altered fine to medium-grained *syenite* cut by sub-mm wide calcite-(bornite-chalcopyrite) veinlets and vug infill with coarse-grained calcite
- pervasively K-feldspar, sericite or illite, chlorite, carbonate or calcite± rutile ± albite altered porphyritic rock *(?andesite*) cut by fractures infilled with 1) calcite ± bornite ± hematite (±chlorite ± chalcocite-covellite), 2) chlorite ± bornite ± (chalcocite -covellite) and/or 3) quartz ± chlorite ± (sericite ± chalcopyrite-bornite, chalcocite, covellite)
- pervasively illite/sericite, carbonate altered former *porphyritic rock* cut by numerous fractures filled with carbonate (colourless, hematitic and brown) and chlorite± (bornite ± chalcopyrite). Note carbonate with abundant hematite inclusions appears purple in hand sample.

Magnetite is not observed in samples from this zone. However, disseminated hematite (likely after magnetite) occurs in one sample.

Hypogene mineralization includes variably disseminated and fracture-controlled fine to very fine-grained bornite (trace to major amounts) and chalcopyrite (trace to minor amounts). Bornite is partly replaced by trace to minor amounts of chalcocite which is sequentially partly replaced by covellite.

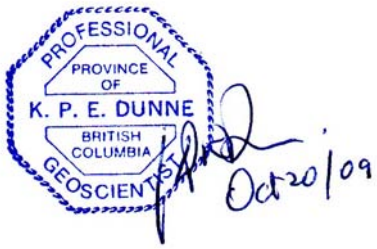
SOUTH Zone

Samples from the South zone include the following:

- *intrusive breccia* with angular to subangular fragments (1-5 cm size) of equigranular to sub-porphyritic, fine to medium-grained rock set in a fine to medium-grained matrix rich in K-feldspar, chlorite, magnetite, hematite and locally patchy chalcopyrite and malachite.
- strongly fractured and pervasively K-feldspar, illite, chlorite-magnetite-calcite-pyrrhotite altered *micro-diorite breccia* comprising fine to medium-grained porphyritic micro-diorite rock fragments in matrix of similar composition. Fracture infill by chlorite- carbonate-magnetite/ hematite -rutile± chalcopyrite. Fe-ox filled fractures are latest infill.
- strongly fractured and pervasively carbonate altered and to a lesser extent patchy biotite, K-feldspar, chlorite, hematite (after magnetite) altered former vaguely *fragmental and porphyritic rock*. Fracture infill by chlorite-(rutile) aggregate. Veinlets of calcite and hematitic carbonate (purple colour in hand sample). Fe-ox filled fractures are latest infill.
- strongly fractured and locally brecciated actinolite-K-feldspar-chlorite-magnetite-illite-rutile altered *micro-quartz diorite* with early K-feldspar veinlets crosscut by later chlorite-epidote-calcite-(rutile) or chlorite- pyrrhotite-hematite filled fractures and late Fe-ox filled fractures.

Major magnetite, variably replaced by hematite, occurs disseminated in all samples.

Hypogene mineralization includes, in some samples, disseminated and fracture-controlled fine to very fine-grained chalcopyrite (trace to minor amounts) and rare traces of pyrite (in some of the samples with chalcopyrite). In other samples, trace to minor pyrrhotite occurs disseminated and as stringers.



Zone: GRANBY
Sample: MM-08-04 58.65-58.84m **Offcut #T-1**

view of hand sample


view of stained section offcut, scale in mm

Hand Sample Test Results:
No reaction of sample to magnet. Strong reaction of fractures and green patchy alteration to cold, dilute HCl. Positive test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Patchy pink and green fine to medium-grained intrusive rock comprising dominantly pink K-feldspar, approximately 30% green patchy aggregates (epidote + calcite) and traces of disseminated brown garnet (2-3mm size). The rock is cut by sub-mm wide veinlets of calcite and calcite occurs filling a cavity in the rock.

Zone: GRANBY
Sample: MM-08-04 58.65-58.84m **Offcut #T-1**


view of stained offcut, scale in mm

LITHOLOGY:	Syenite
ALTERATION:	Epidote, calcite, (?garnet-may be primary)
MINERALIZATION:	(Bornite, chalcopyrite, chalcocite, covellite)
VEINLET/ INFILL:	Calcite

Polished Thin Section Description:
This section is a patchy epidote-calcite, (?garnet) altered fine to medium-grained syenite cut by sub-mm wide calcite-(bornite-chalcopyrite) veinlets and a vug infilled with coarse-grained calcite. The syenite comprises fine to medium-grained seriate inequigranular-textured alkali feldspar (microperthite) with patchy radiating intergrowths of ?nepheline and alkali-feldspar. Traces of fine-grained garnet occur though the section partly replaced by epidote. It is unclear whether the garnet is primary or hydrothermal. The section is partly replaced by patchy very fine-grained epidote and lesser calcite aggregates. Traces of fine to very fine-grained bornite and chalcopyrite occur within calcite veinlets (see below) and disseminated associated with epidote-calcite alteration. Bornite is rarely partly replaced by chalcocite and covellite.

The section is cut by fine-grained anhedral calcite aggregate as fracture infill and in sub-mm wide veinlets with traces of chalcopyrite and bornite. A portion of a vug infilled by coarse-grained calcite (no sulphides) occurs at the top right side of the section (see photo above).

Zone: GRANBY
Sample: MM-08-04 58.65-58.84m **Offcut #T-1**

HOST ROCK:
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
K-feldspar, microperthite	45	fine to medium-grained (< 5mm), anhedral to tabular aggregates, seriate inequigranular	*simple twinning*
radiating aggregates of K-feldspar/ ?nepheline	15	fine to very fine-grained, radiating aggregates of possibly intergrown ?nepheline and K-feldspar	
Epidote	25	very fine-grained, anhedral aggregates, occurs as replacement of garnet, occurs with calcite as patchy replacement of syenite	*yellow*

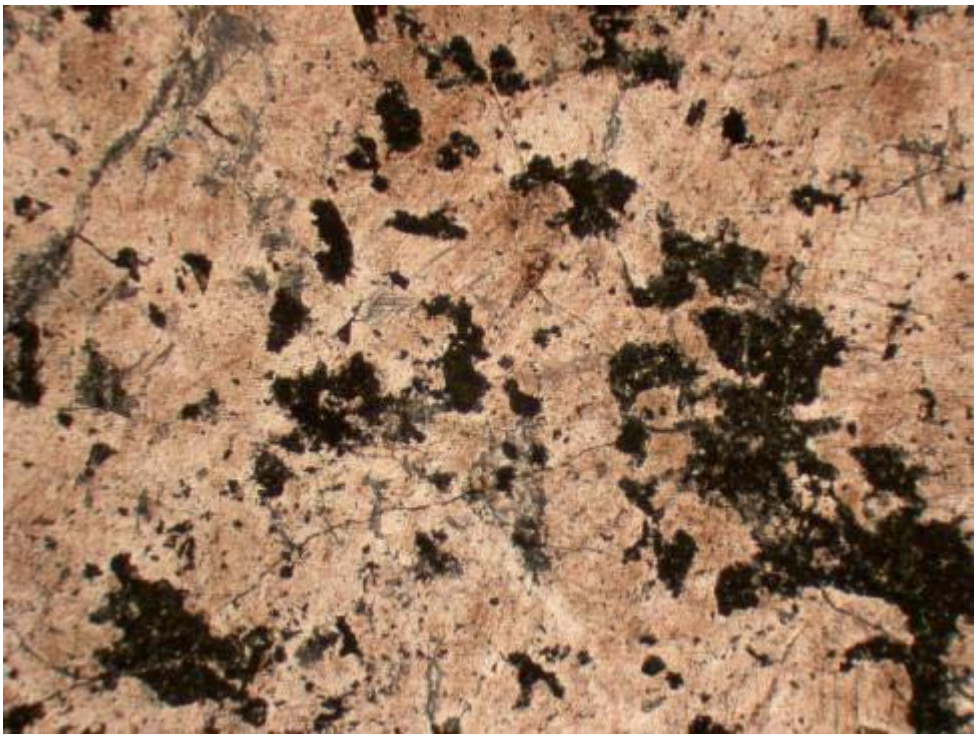
MINOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Calcite	4	very fine-grained, occurs with epidote as patchy replacement of rock	
Garnet	tr	fine-grained (< 0.6 mm), anhedral grains and aggregates, fractured, selectively replaced by epidote	*pale brown*
Bornite	tr	fine to very fine-grained (< 0.3 mm), anhedral aggregates, occurs in calcite veinlets and disseminated associated with epidote alteration, locally rimmed and partly replaced by chalcocite	
Chalcopyrite	tr	fine to very fine-grained, (< 0.2 mm), anhedral grains, occurs in calcite veinlets and disseminated, locally associated with bornite	
Chalcocite	tr	very fine-grained, occurs rarely partly replacing bornite	
Covellite	tr	very fine-grained, occurs rarely partly replacing bornite	

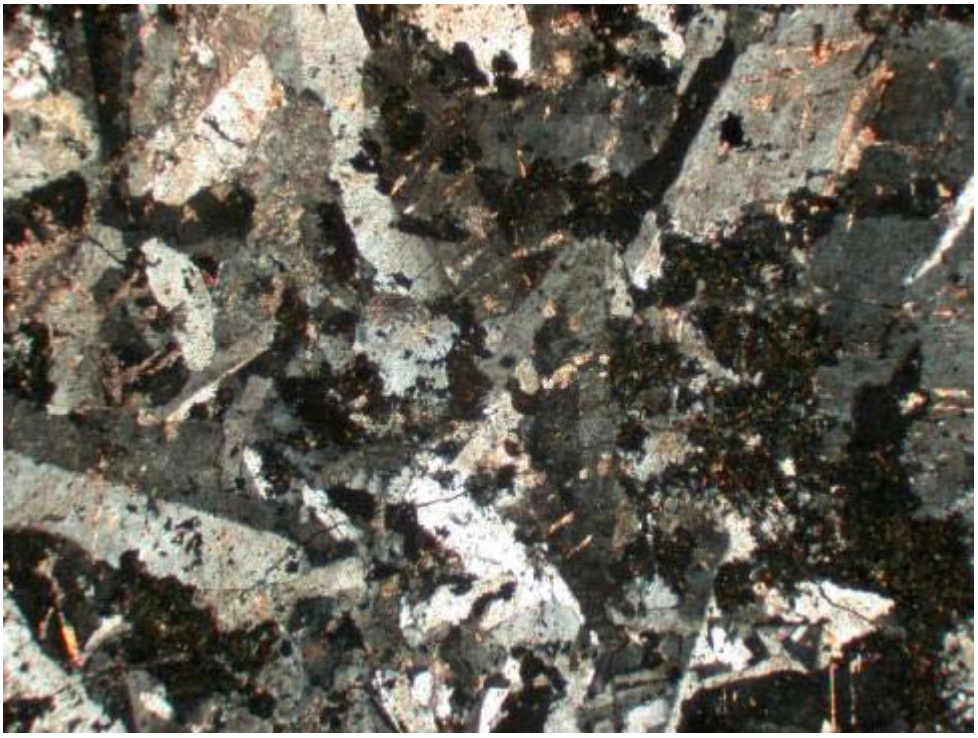
VEINLETS/ FRACTURE INFILL:

Mineral	%	Distribution & Characteristics*	Optical
Calcite	10	-fine to medium-grained (< 0.2 mm), occurs as fracture infill -coarse-grained, occurs as vug infill	

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm

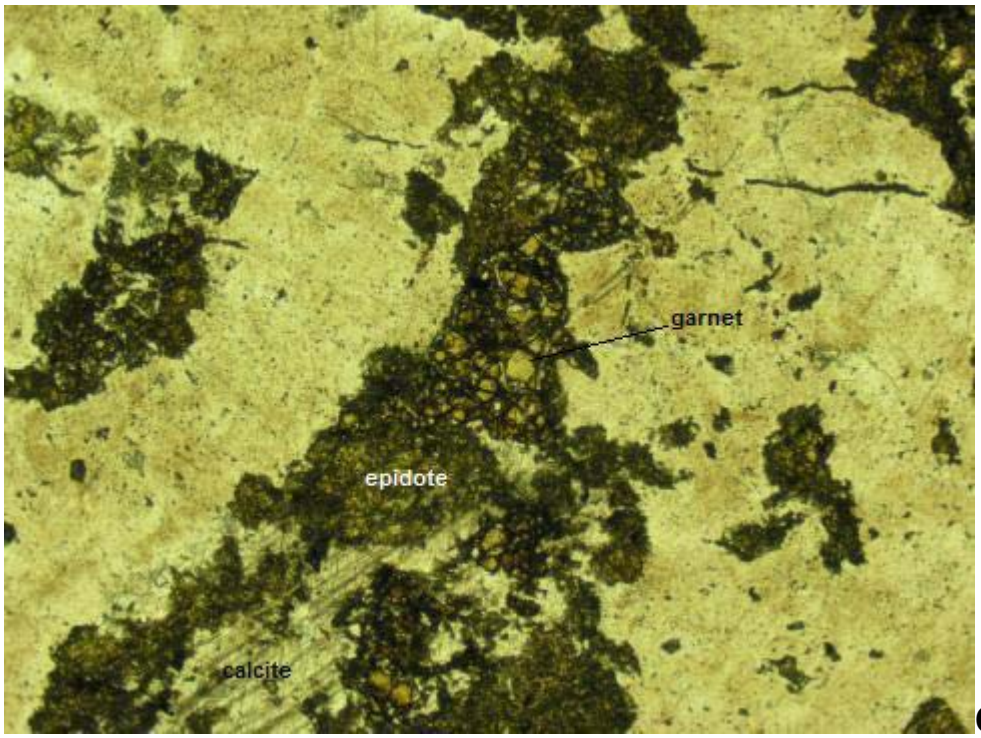


A



B

Sample: MM-08-04 58.65-58.84m
A & B) Overview of sample shows fine to medium-grained syenite partly replaced by patchy epidote-calcite aggregates. A) PPL, B) XPL, FOV = ~ 4.5 mm.



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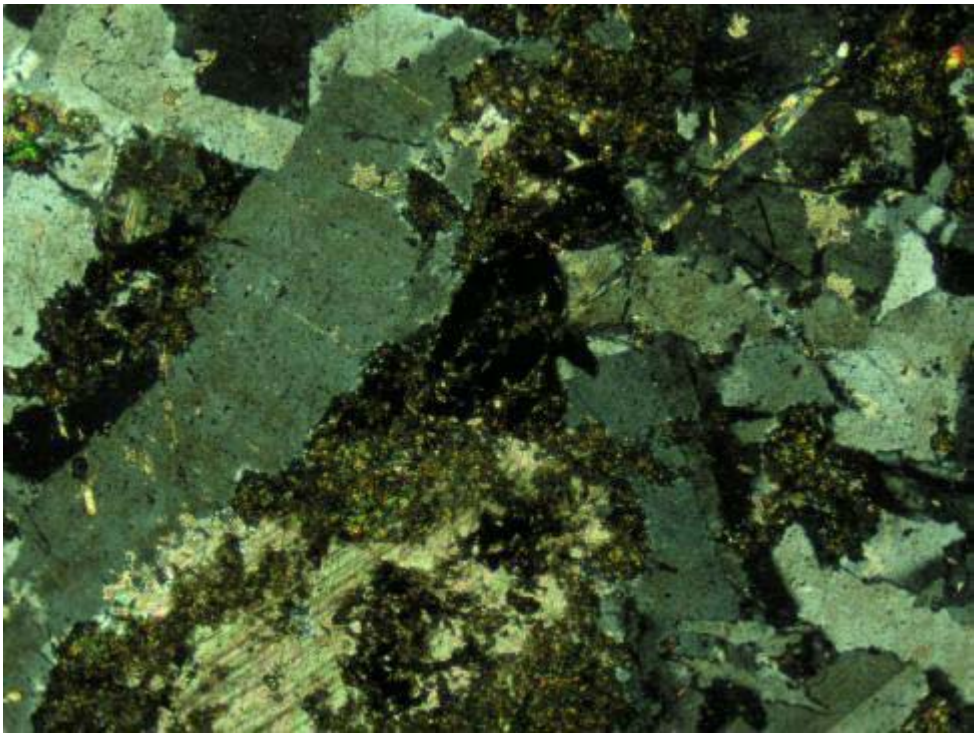
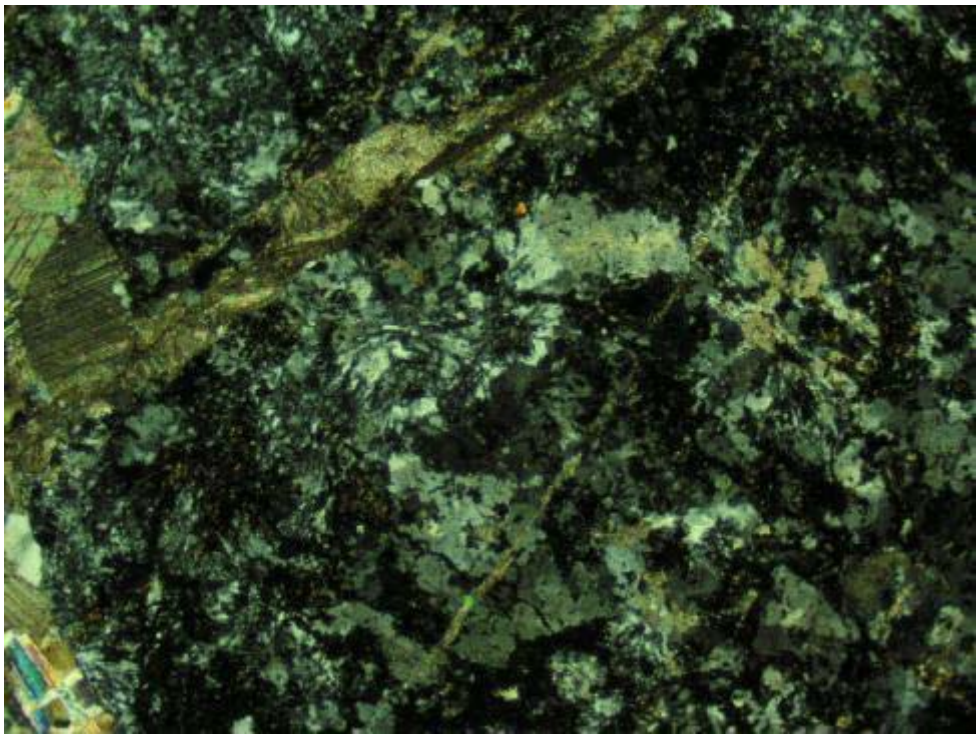


D

Sample: MM-08-04 58.65-58.84m
C & D) Detailed view of patchy epidote-calcite altered syenite. Note relict garnet (centre) partly replaced by epidote aggregates. C) PPL, D) XPL, FOV = ~ 2.6 mm.



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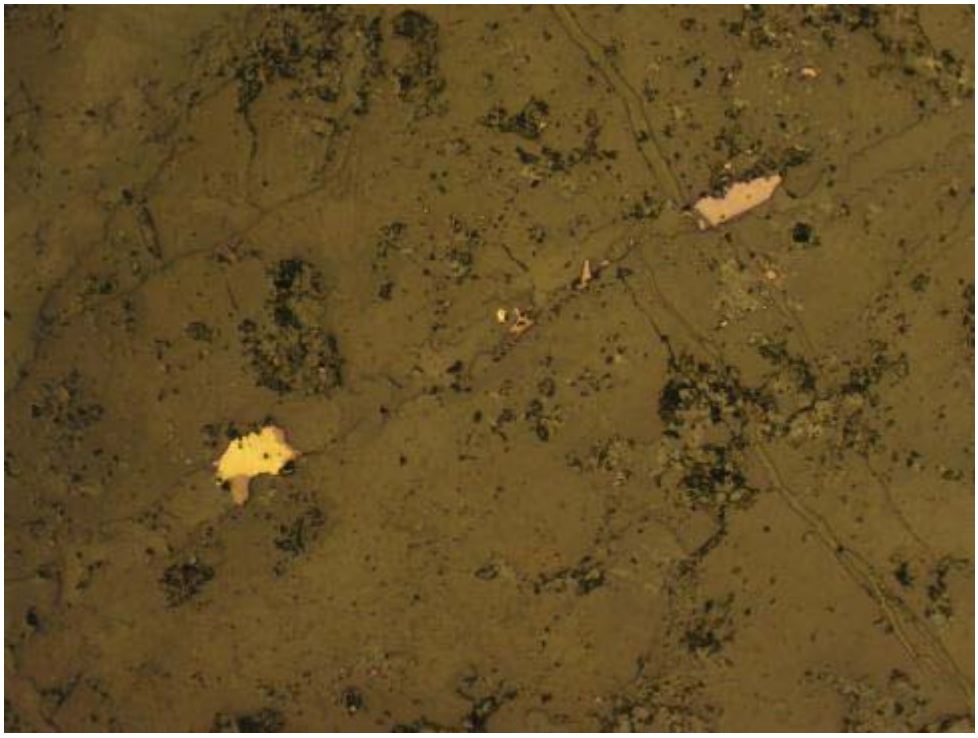
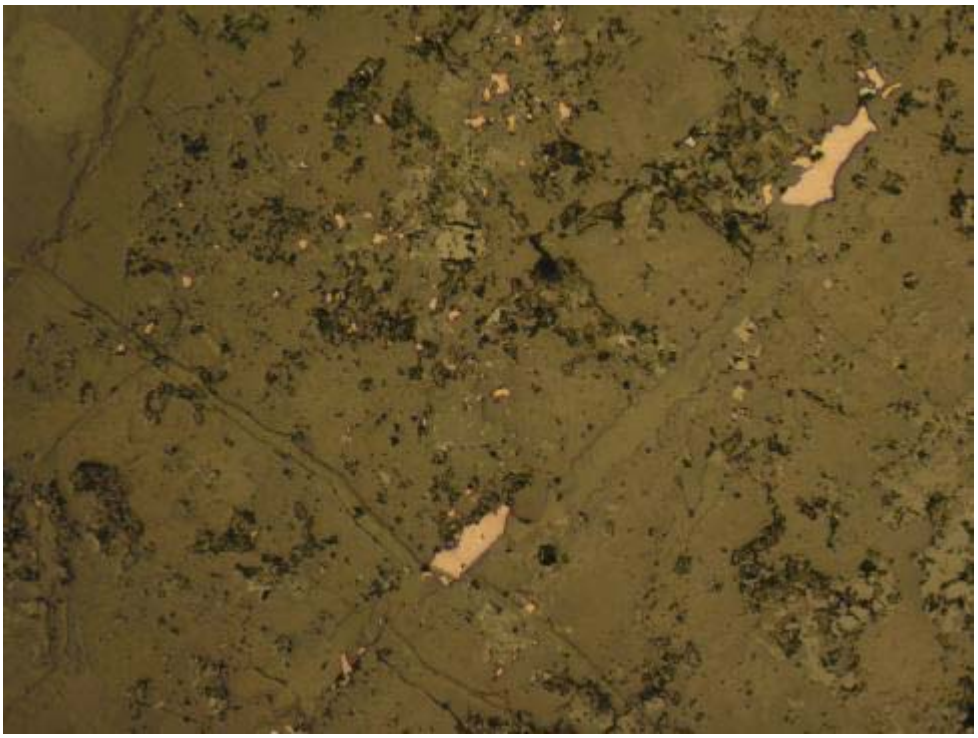


F

Sample: MM-08-04 58.65-58.84m
E) View of patchy radiating intergrowths of ?nepheline and K-feldspar. XPL, FOV = ~ 1.3 mm. F) View of calcite veinlets with traces of chalcopyrite and bornite. RL, FOV = ~ 2.6 mm.



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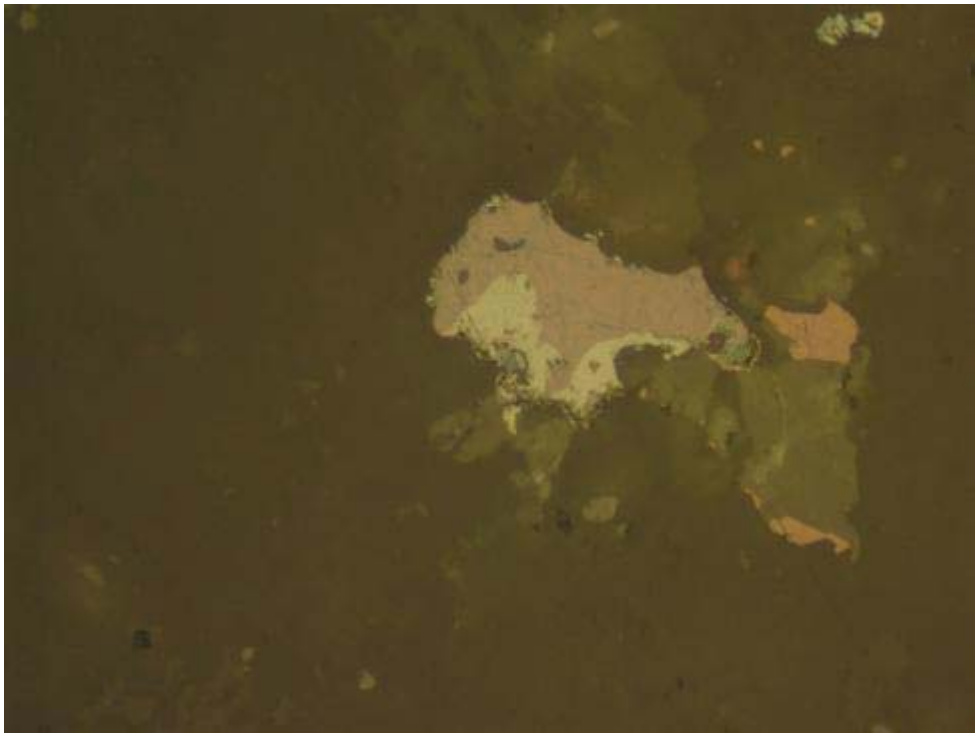


H

Sample: MM-08-04 58.65-58.84m
G) Bornite grains within calcite veinlet and disseminated associated with epidote alteration of host rock. RL, FOV = ~ 2.6 mm. H) View of disseminated bornite grain partly replaced by chalcocite (gray) and very fine trace of covellite (dark blue). RL, FOV = ~ 0.3 mm.

Zone: GRANBY
Sample: MM-08-04 83.72-83.76m **Offcut #T-2**

view of hand sample


view of stained section offcut, scale in mm

Hand Sample Test Results:
No reaction of sample to magnet. Strong reaction of fractures and patches within rock to cold, dilute HCl. Positive test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Porphyritic dark green ?andesite with approximately 30% fine-grained tabular altered plagioclase phenocrysts (partly replaced by K-feldspar over part of the section –based on stain) and 30% altered mafic phenocrysts in a very fine-grained groundmass.

Zone: GRANBY
Sample: MM-08-04 83.72-83.76m **Offcut #T-2**


view of stained offcut, scale in mm

LITHOLOGY:	Pervasively altered porphyritic rock (?andesite)
ALTERATION TYPE:	K-feldspar, sericite-chlorite, calcite
MINERALIZATION:	Bornite, chalcocite, covellite (chalcopyrite)
FRACTURES/VEINLETS:	Calcite±bornite±hematite±(chalcocite-covellite)
	Chlorite±bornite±(chalcocite-covellite)
	Fe-ox

Polished Thin Section Description:
This section is a pervasively K-feldspar, sericite-chlorite, calcite altered porphyritic rock (?andesite) cut by fractures infilled with calcite ± bornite ± hematite ± (chalcocite-covellite) and chlorite ± bornite ± (chalcocite -covellite). Relict fine to medium-grained plagioclase phenocrysts are locally preserved. Plagioclase is selectively replaced by very fine-grained K-feldspar and overprinted by patchy anhedral calcite, sericite and chlorite aggregate. Former mafic phases are replaced by aggregates of chlorite, rutile and patchy bornite. Very fine-grained chlorite-sericite± patchy calcite aggregates occur as pervasive replacement of rock. Major fine to very fine-grained bornite occurs disseminated associated with the chlorite-sericite±calcite alteration and fracture-controlled (see below). Traces of chalcopyrite are rarely observed associated with bornite. Bornite is typically partly replaced by minor chalcocite which is in turn partly replaced by minor covellite. Traces of fine-grained apatite occur disseminated.

The section is cut by numerous fractures filled with calcite ± bornite ± hematite ± (chalcocite-covellite), chlorite ± bornite ± (chalcocite -covellite) and by late brown Fe-ox. Minor bornite occurs as fine to very fine-grained anhedral aggregates typically at the margins of calcite filled fractures but locally within some calcite and chlorite-filled fractures. Bornite is locally partly replaced by traces of chalcocite and covellite and minor aggregates of hematite.

Zone: GRANBY
Sample: MM-08-04 83.72-83.76m **Offcut #T-2**

HOST ROCK:
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Plagioclase	20	fine to medium-grained (< 1.5 mm), tabular, occurs as phenocrysts, partly replaced by K-feldspar, calcite, sericite and chlorite -very fine-grained, occurs as groundmass, pervasively replaced by K-feldspar, calcite, sericite and chlorite	*polysynthetic twinning*
Sericite	20	very fine-grained, anhedral aggregates, occurs with chlorite and rutile as patchy replacement of rock	
Chlorite	15	very fine-grained, anhedral aggregates, occurs with sericite, calcite and rutile as patchy replacement of rock	
K-feldspar	15	fine-grained, tabular, occurs as rarely preserved phenocrysts, very fine-grained, anhedral aggregates, occurs as patchy replacement of plagioclase phenocrysts and groundmass	
Calcite	10	very fine-grained, anhedral aggregates, partly replaces plagioclase phenocrysts, patchy replacement of rock, occurs with sericite-chlorite alteration	*colourless*

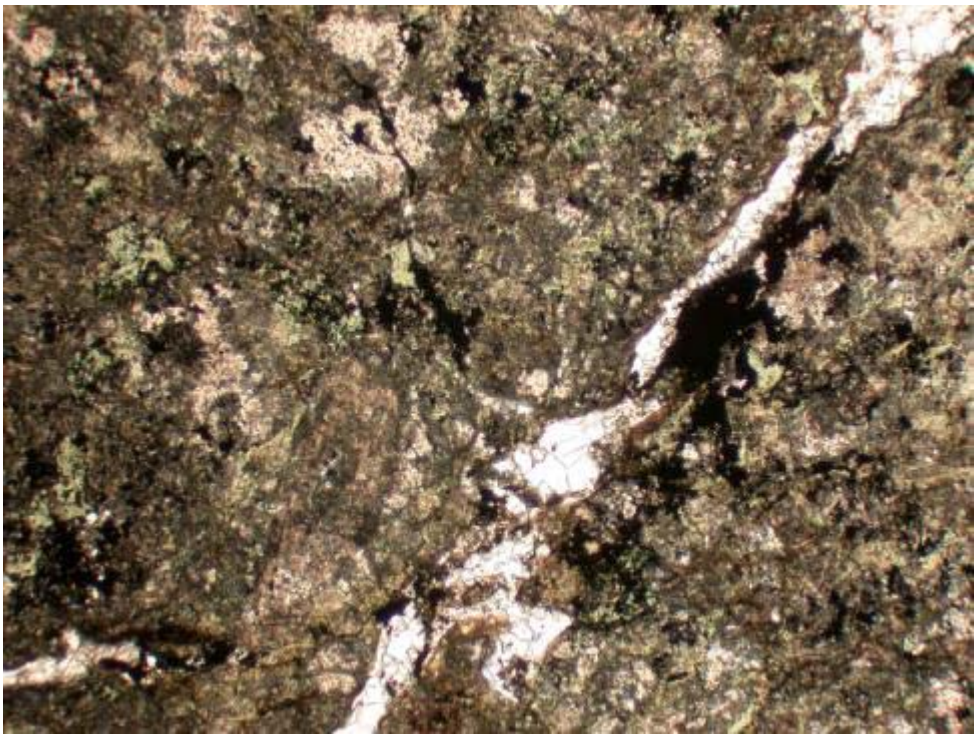
MINOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Bornite	2	fine to very fine-grained (< 0.2 mm), anhedral aggregates, occurs disseminated and as replacement of former mafic phenocrysts, partly replaced by chalcocite and covellite	
Rutile	2	very fine-grained, sub-anhedral aggregates, occurs with chlorite as replacement of fine-grained former mafic forms and as patchy aggregates	*yellow-brown*
Chalcocite	1	very fine-grained, occurs as replacement of bornite	
Covellite	1	very fine-grained, occurs as replacement of chalcocite	
Apatite	tr	fine-grained (< 0.1 mm), hexagonal forms, disseminated	*high relief*
Chalcopyrite	tr	very fine-grained, rare patchy aggregates associated with disseminated bornite	

VEINLETS/ FRACTURE INFILL:

Mineral	%	Distribution & Characteristics*	Optical
Calcite	8	fine-grained (< 0.5 mm), occurs as fracture infill	
Chlorite	2	very fine-grained, anhedral aggregates, occurs with bornite as fracture infill	
Bornite	2	fine to very fine-grained (< 0.4 mm), occurs at margins and locally within calcite and chlorite-filled fractures	
Hematite	1	very fine-grained, anhedral aggregates, occurs rimming and replacing bornite	
Fe-ox	tr	very fine-grained, anhedral aggregates, occurs as late fracture infill, infills margins of calcite filled fractures	*brown*
Chalcocite	tr	very fine-grained, occurs as replacement of bornite	
Covellite	tr	very fine-grained, occurs as replacement of chalcocite	

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm



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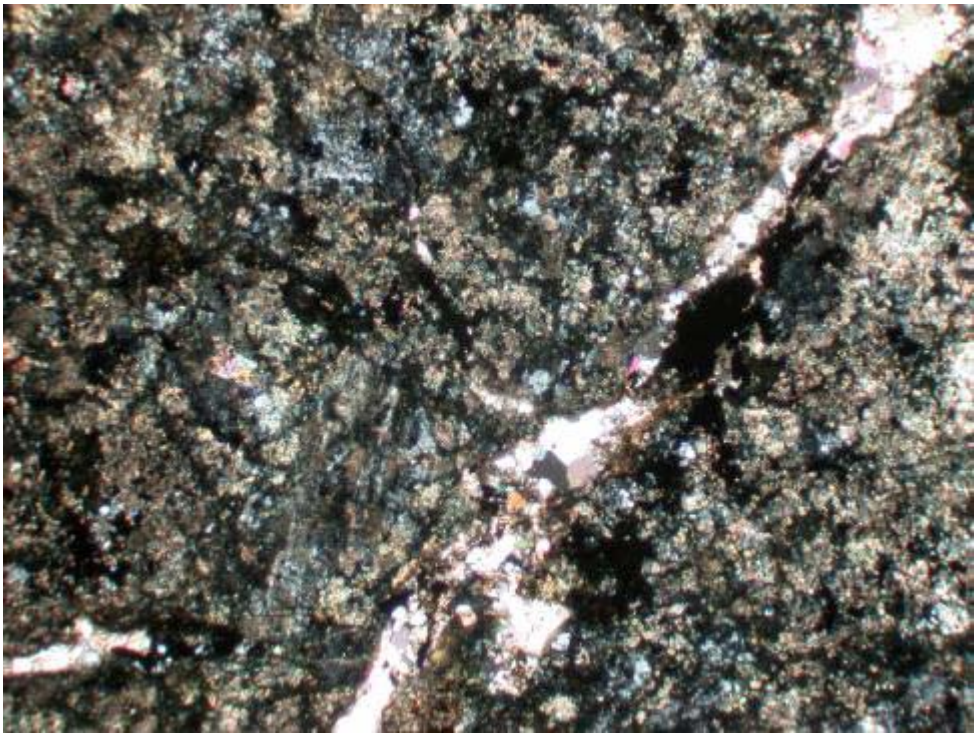
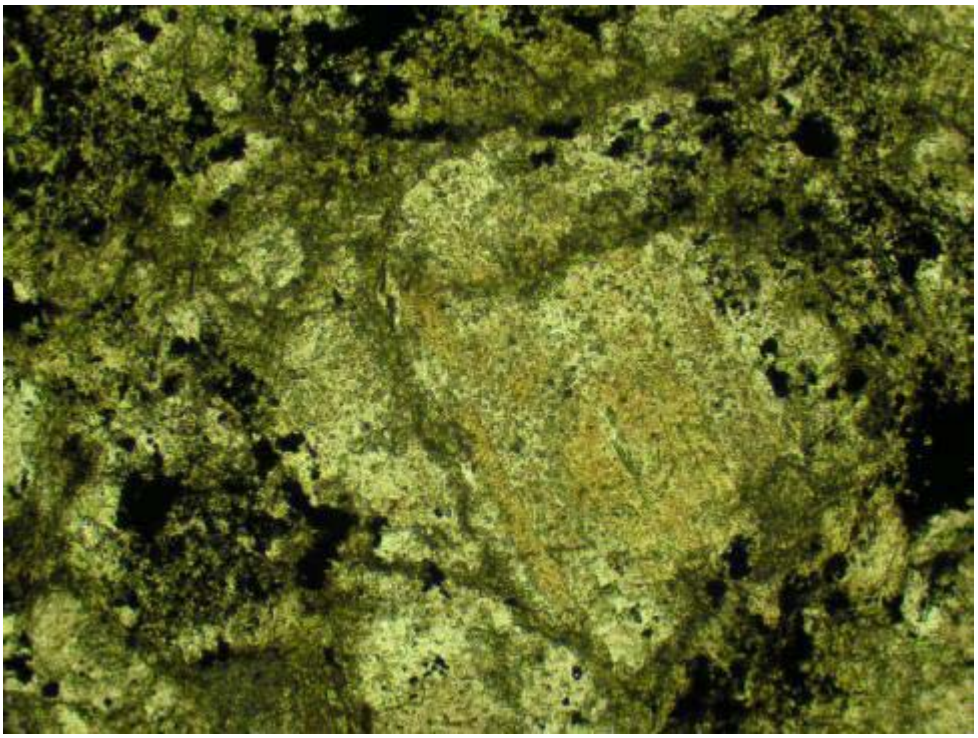


B

Sample: MM-08-04 83.72-83.76m
A & B) Overview of sample shows pervasively K-feldspar, sericite-chlorite, calcite altered porphyritic rock (?andesite) cut by fractures infilled with calcite and opaques (bornite ± hematite ± chalcocite-covellite). A) PPL, B) XPL, FOV = ~ 4.5 mm.



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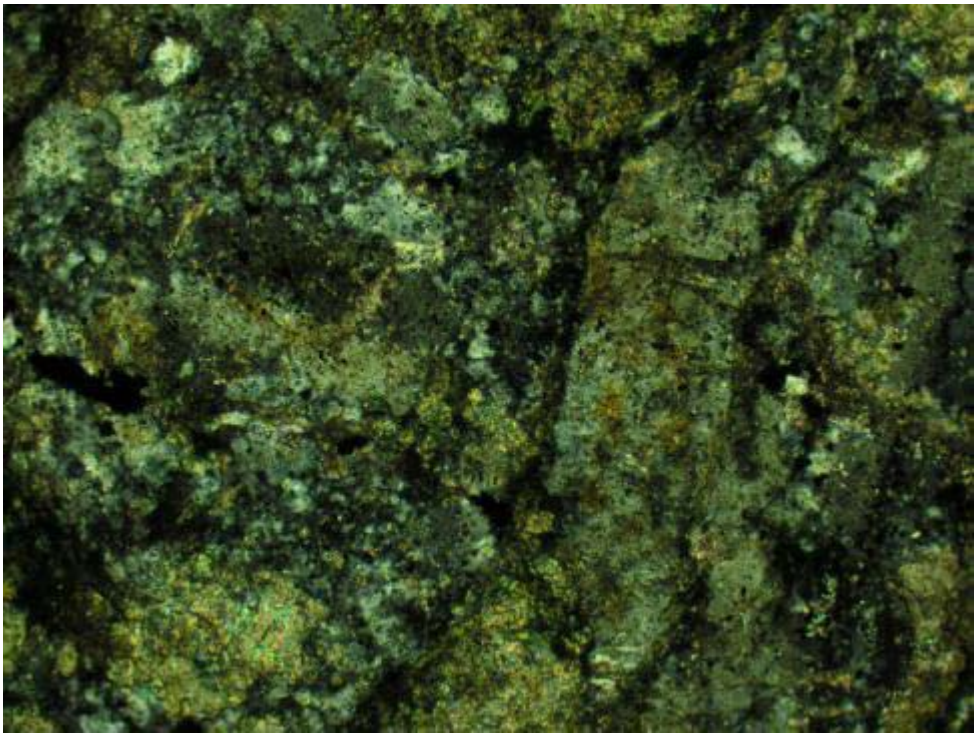
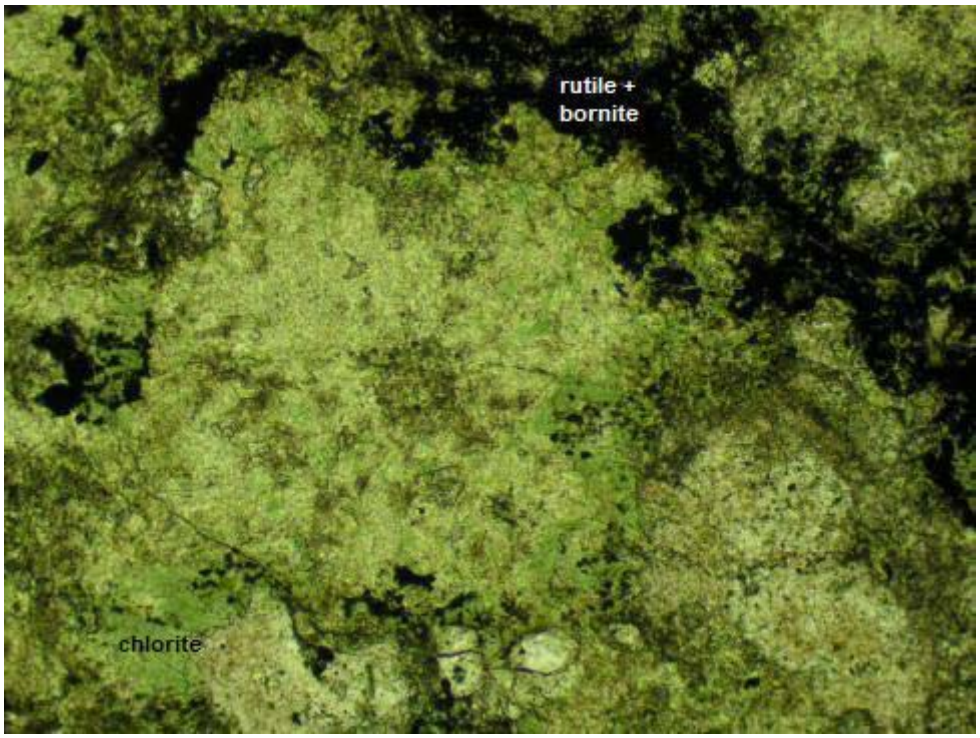


D

Sample: MM-08-04 83.72-83.76m

C) Detailed view of plagioclase with patchy K-feldspar replacement and rimmed by very fine-grained calcite aggregate. PPL, FOV = ~ 1.3 mm. D) View of altered plagioclase phenocrysts in a very fine-grained matrix. XPL, FOV = ~ 1.3 mm.



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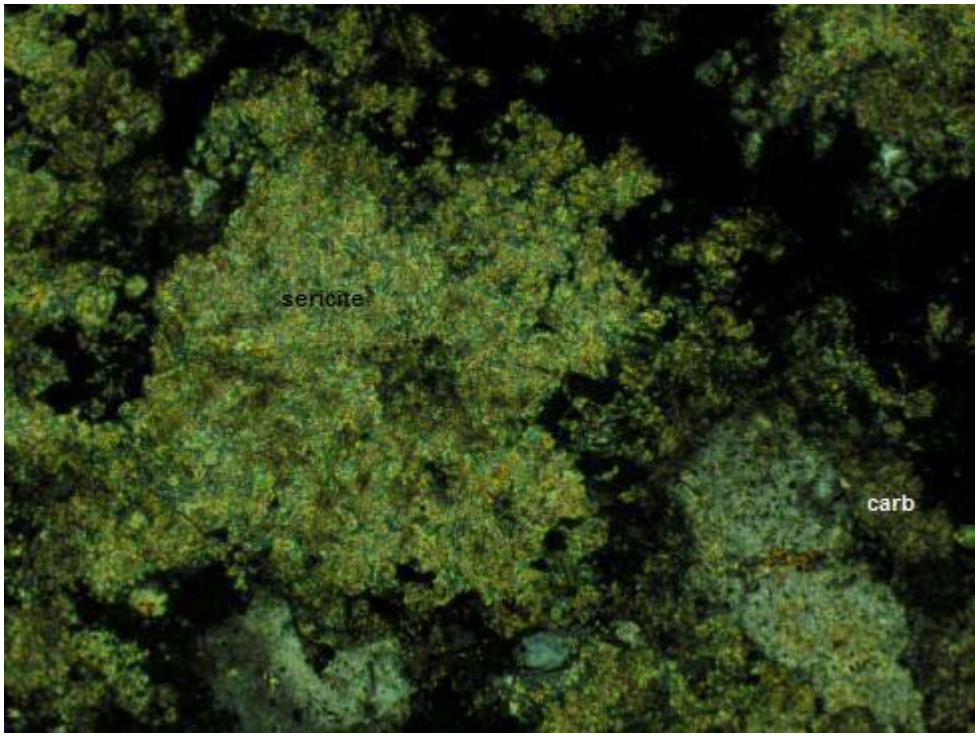
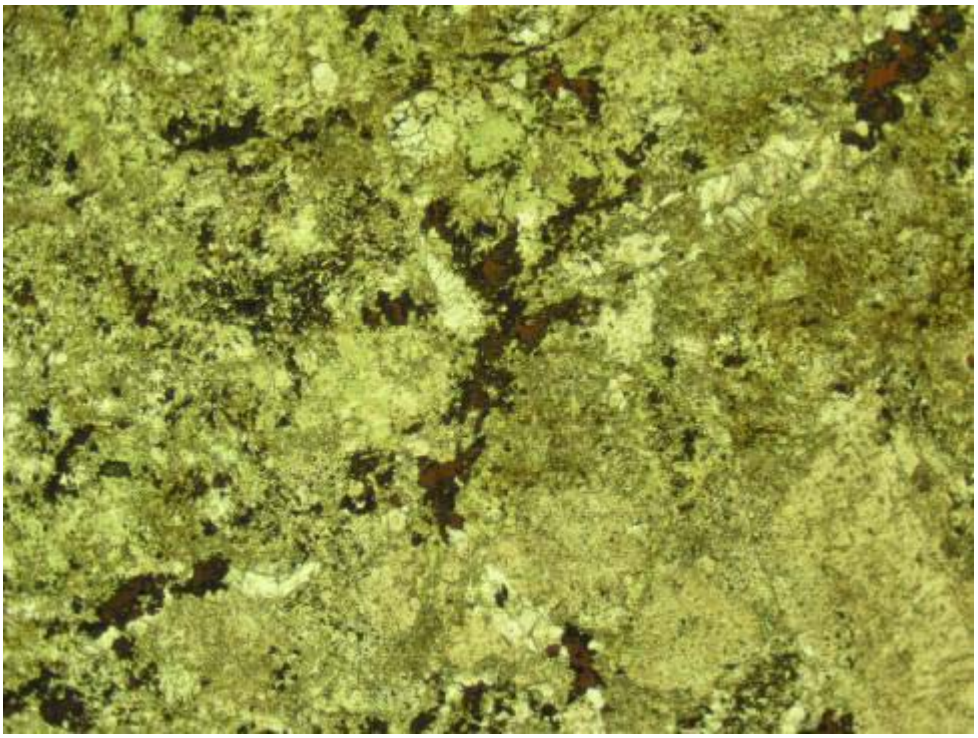


F

Sample: MM-08-04 83.72-83.76m
E&F) Representative views of very fine-grained pervasive sericite-chlorite-rutile-bornite (opaque)-calcite (carb) altered rock. E) PPL, F) XPL, FOV = ~ 1.3 mm.



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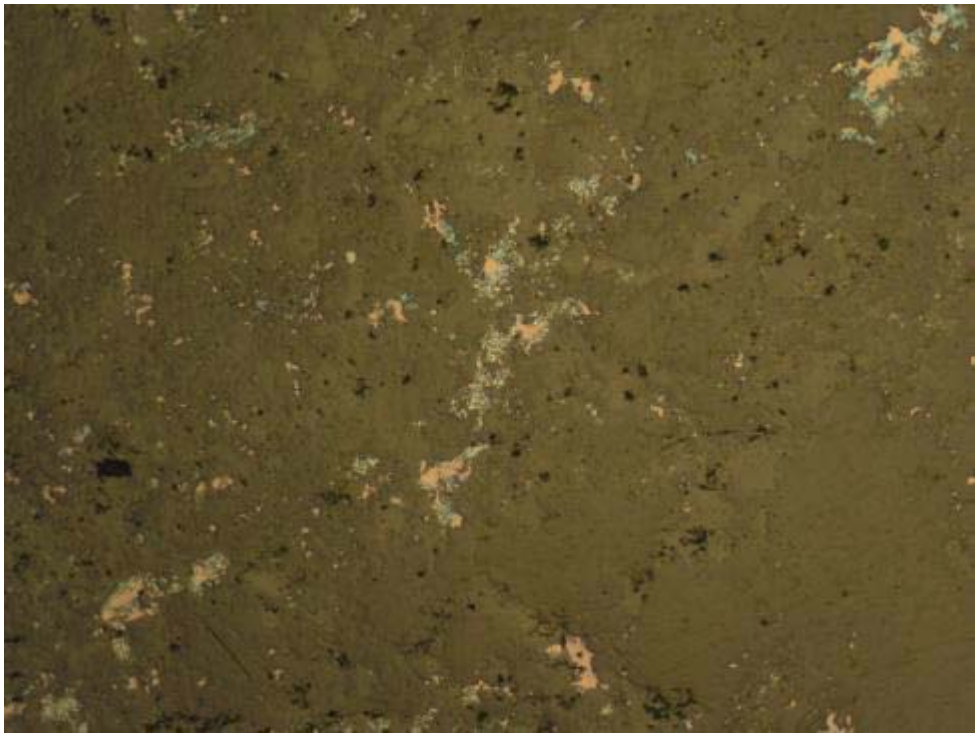
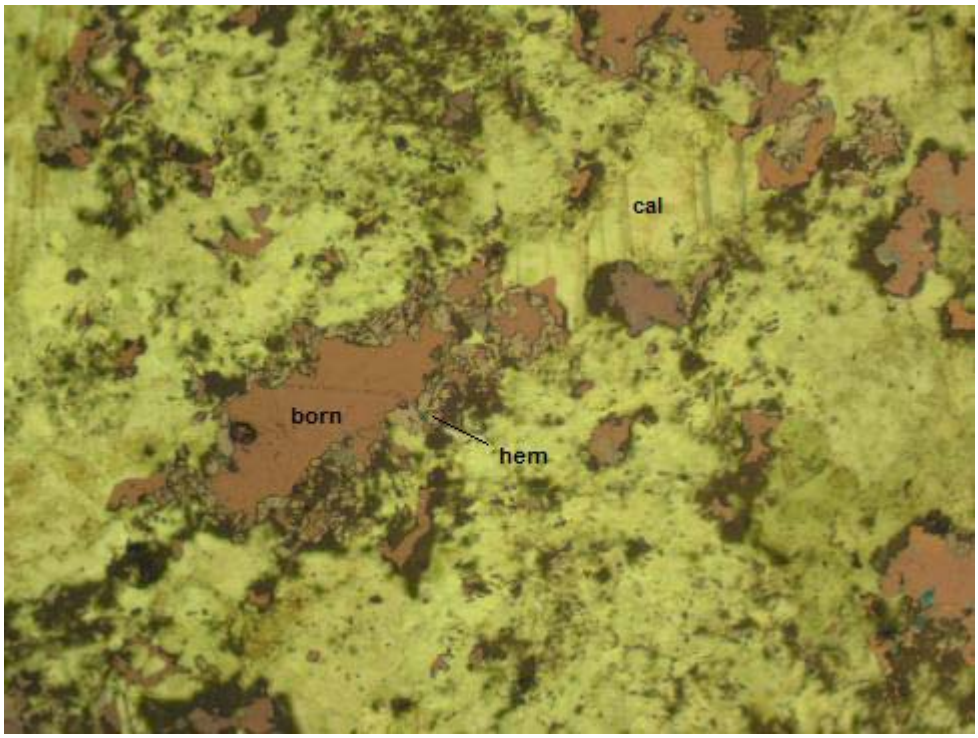


H

Sample: MM-08-04 83.72-83.76m
G&H) Representative views of fracture-controlled and disseminated bornite. Note bornite partly replaced by chalcocite and covellite. E) PPL + RL, F) RL, FOV = ~ 2.6 mm.



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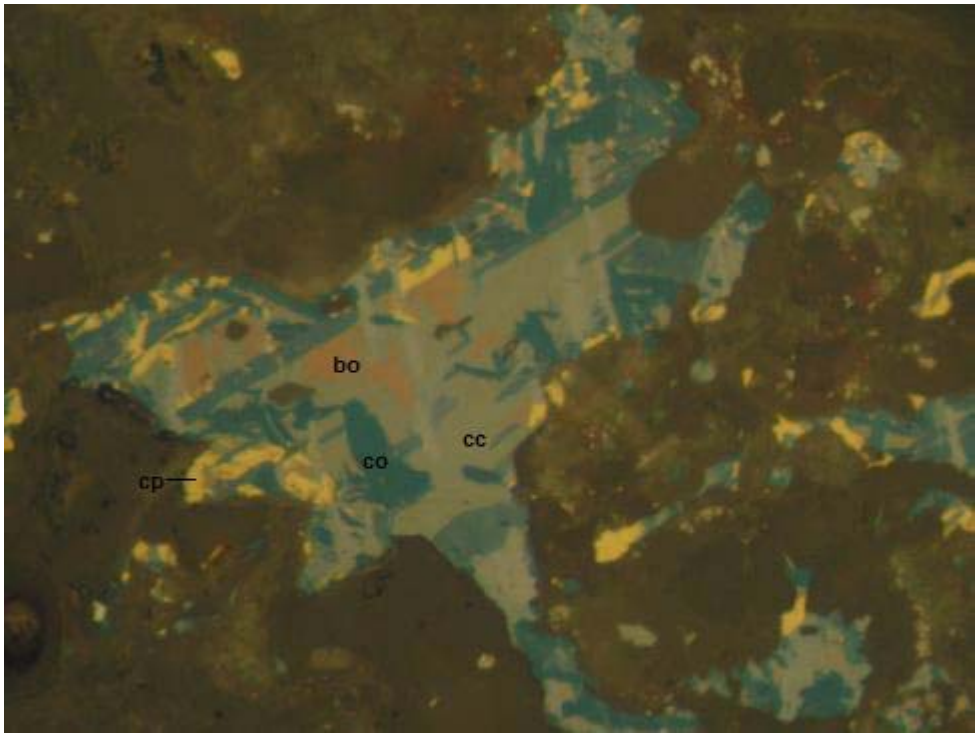


J

Sample: MM-08-04 83.72-83.76m

I) Bornite partly replaced by hematite within calcite-filled fracture. Note fracture crosses photo from lower left to top right. PPL + RL, FOV = ~ 0.7 mm. J) Bornite associated with chalcopyrite . Bornite is partly replaced by chalcocite which is subsequently partly replaced by covellite. RL, FOV = ~ 0.3 mm.

Zone: GRANBY
Sample: MM-08-04 82.90-83.01m **Offcut #T-3**

view of hand sample


view of stained section offcut, scale in mm

Hand Sample Test Results:
No reaction of sample to magnet. No reaction to cold, dilute HCl. Positive test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Strongly fractured, pinkish-cream and dark green coloured altered porphyritic rock with vague tabular pink coarse-grained phenocryst forms in a fine-grained groundmass with approximately 30% green patchy aggregates. The rock is cut by sub-mm wide quartz and calcite filled fractures. The rock is cut by sub-mm wide chlorite and carbonate filled fractures and by 2-3 m wide lenses of purple and colourless material.

Zone: GRANBY
Sample: MM-08-04 82.90-83.01m **Offcut #T-3**


view of stained offcut, scale in mm

LITHOLOGY:	Pervasively altered porphyritic rock
ALTERATION TYPE:	Illite/sericite, carbonate
MINERALIZATION:	Chalcopyrite, bornite (chalcocite, covellite)
FRACTURES/VEINLETS:	Carbonate-*hematitic*
	Carbonate-*colourless*
	Chlorite-carbonate – *very fine-grained*

Polished Thin Section Description:
This section is a pervasively illite/sericite, carbonate altered former porphyritic rock cut by numerous fractures filled with carbonate and chlorite. The rock comprises minor fine to medium-grained plagioclase and K-feldspar phenocrysts in a fine to very fine-grained matrix. The section is extensively replaced by patchy very fine-grained illite/sericite aggregate and overprinted by very fine-grained carbonate aggregate. Traces of fine to very fine-grained bornite and chalcopyrite occur within fractures (see below) and minor chalcopyrite and bornite occur disseminated. Bornite is rarely partly replaced by chalcocite and covellite.

The section is cut by numerous fractures filled with chlorite and several varieties of carbonate: colourless, hematitic and very fine-grained brown. Radiating hematitic carbonate (purple colour in hand sample) occurs as open space filling. The carbonate is partly replaced by specular hematite aggregate which imparts a purple colour in hand sample. Radiating hematitic carbonate is infilled by colourless prismatic carbonate aggregates which also occur as fracture infill. Colourless carbonate is partly replaced by very fine-grained brown carbonate aggregates that occur locally with fine-grained platy to radiating chlorite aggregate as fracture infill. Traces of chalcopyrite and bornite occur disseminated in the very fine-grained carbonate-chlorite fractures.

Zone: GRANBY
Sample: MM-08-04 82.90-83.01m **Offcut #T-3**

HOST ROCK:
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
K-feldspar	35	-fine to medium-grained, tabular, occurs as phenocrysts -fine to very fine-grained (< 0.5 mm), anhedral aggregates, occurs as matrix	
Illite/sericite	20	very fine-grained, anhedral aggregates, occurs as patchy replacement of K-feldspar and former tabular phases	
Carbonate	10	very fine-grained, anhedral aggregates, occurs as patchy replacement of rock, overprints illite/sericite	

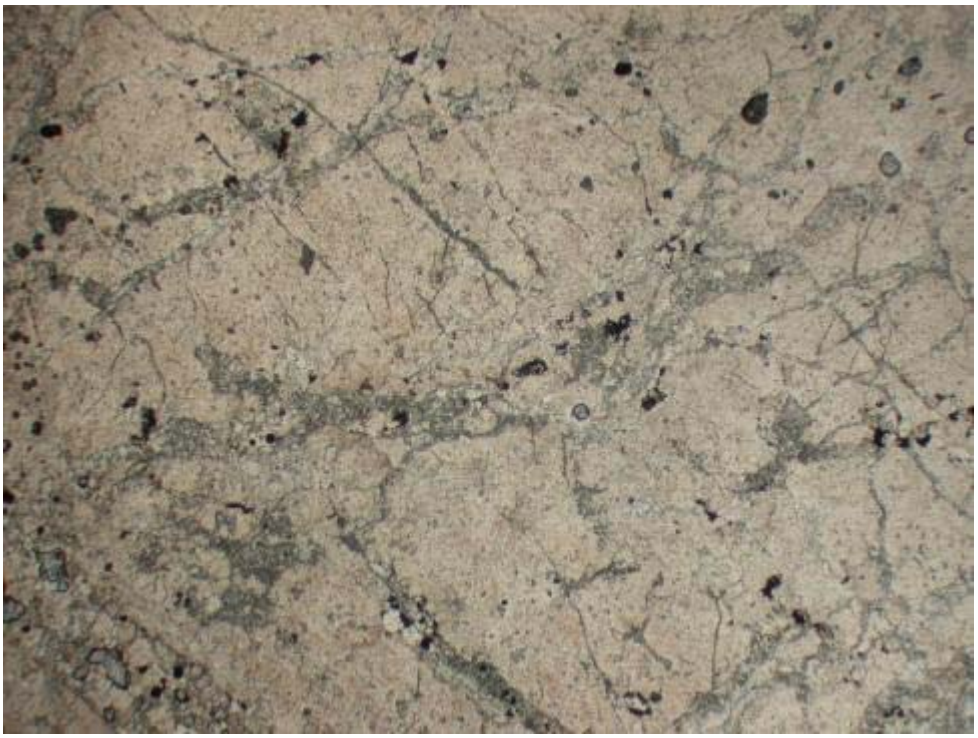
MINOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Plagioclase	4	fine to medium-grained (< 2 mm), tabular, occurs as relict phenocrysts	
Chalcopyrite	1	fine to very fine-grained (< 0.1 mm), anhedral aggregates, occurs disseminated, locally associated with bornite	
Bornite	1	very fine-grained, occurs disseminated, locally associated with chalcopyrite, partly replaced by chalcocite	
Rutile	1	very fine-grained, anhedral aggregates, occurs associated with illite/sericite alteration	*brown*
Apatite	tr	fine-grained (< 0.1 mm), hexagonal forms, dissemianted	*high relief*
Covellite	tr	very fine-grained, occurs partly replacing chalcocite	
Chalcocite	tr	very fine-grained, occurs rarely partly replacing bornite	

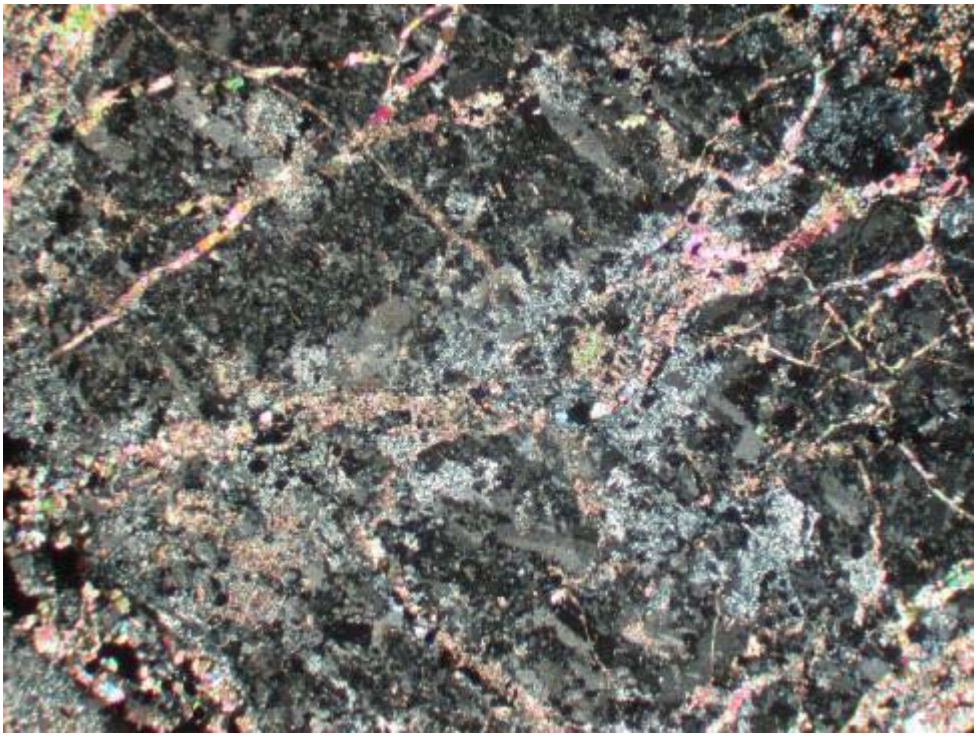
VEINLETS/ FRACTURE INFILL:

Mineral	%	Distribution & Characteristics*	Optical
Carbonate, hematitic	13	fine-grained (< 0.8 mm), radiating and anhedral aggregates, occurs as open space fill, infilled by late prismatic colourless carbonate, partly replaced by very fine-grained hematite aggregate imparting purple colour	*cloudy with inclusions of hematite*
Carbonate, brown	7	Very fine-grained, anhedral aggregates, occurs as fracture infill, occurs with bornite and chalcopyrite	*brown*
Carbonate, colourless	3	fine-grained, anhedral aggregates, occurs as fracture infill, partly replaced by very fine-grained carbonate aggregate	*colourless*
Chlorite	2	fine-grained, anhedral to radiating platy aggregates, occurs as fracture infill, occurs with bornite and chalcopyrite	
Hematite	2	very fine-grained, specular aggregates, occurs as replacement of hematitic (purple) carbonate infill, gives purple colour	*red*
Chalcopyrite	tr	fine to very fine-grained (< 0.1 mm), anhedral grains and aggregates, occurs disseminated with chlorite and very fine-grained brown carbonate fracture infill	
Bornite	tr	very fine-grained, occurs associated with chalcopyrite	
Rutile	tr	very fine-grained, anhedral aggregates, occurs with chlorite as fracture infill	*brown*

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm

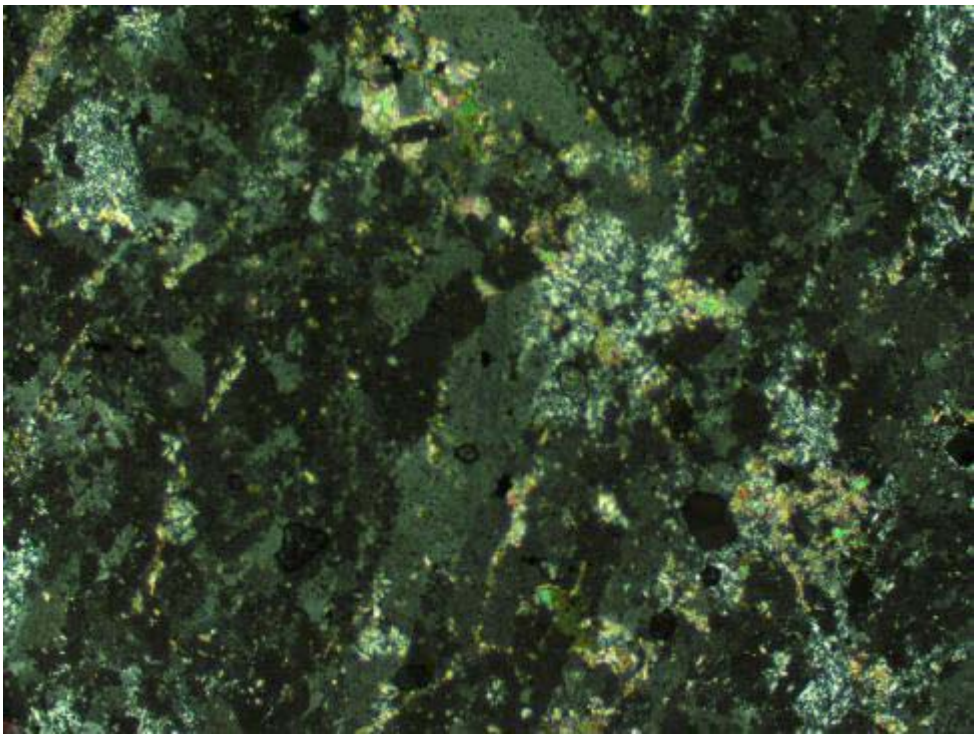


A

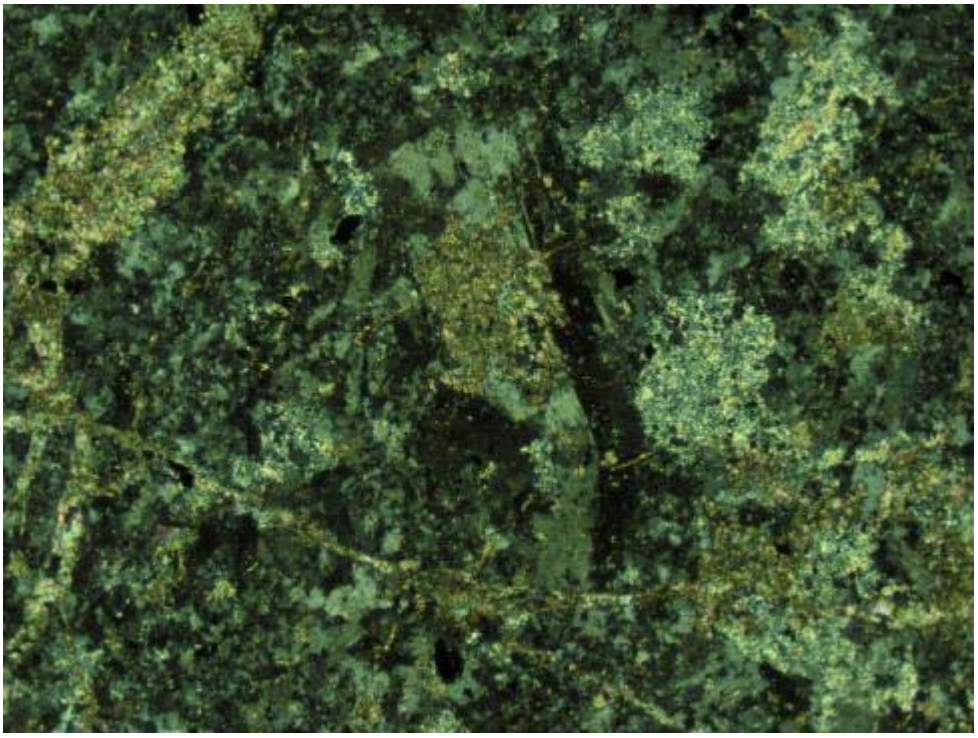


B

Sample: MM-08-04 82.90-83.01m
A & B) Overview of sample shows pervasively illite/sericite, carbonate-altered porphyritic rock cut by numerous fractures filled with carbonate and chlorite. T. A) PPL, B) XPL, FOV = ~ 4.5 mm.

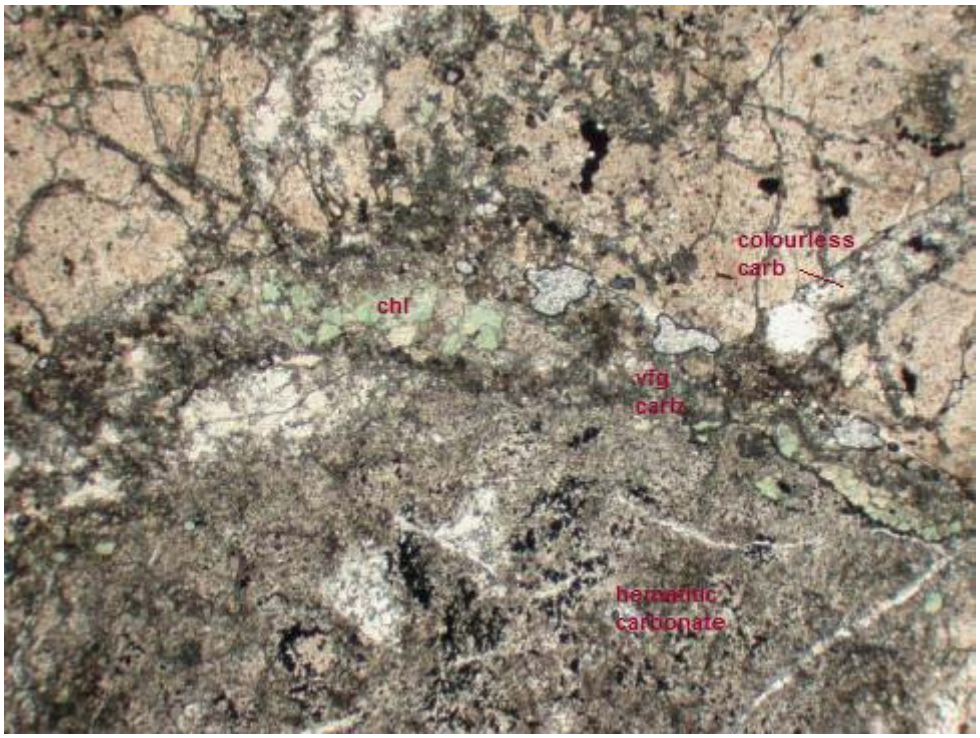


C

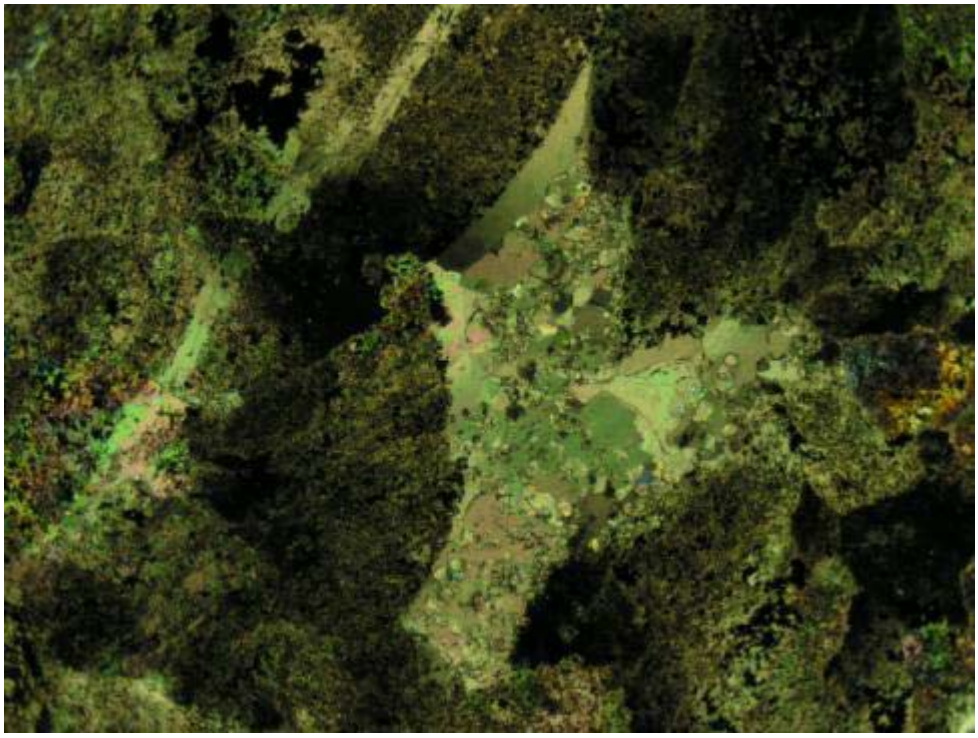


D

Sample: MM-08-04 82.90-83.01m
C& D) Detailed views of pervasively illite/sericite and carbonate altered porphyritic rock. Note relict plagioclase phenocrysts at centre of photo D. C) XPL, FOV = ~ 1.3 mm, D) XPL, FOV = 2.6 mm.



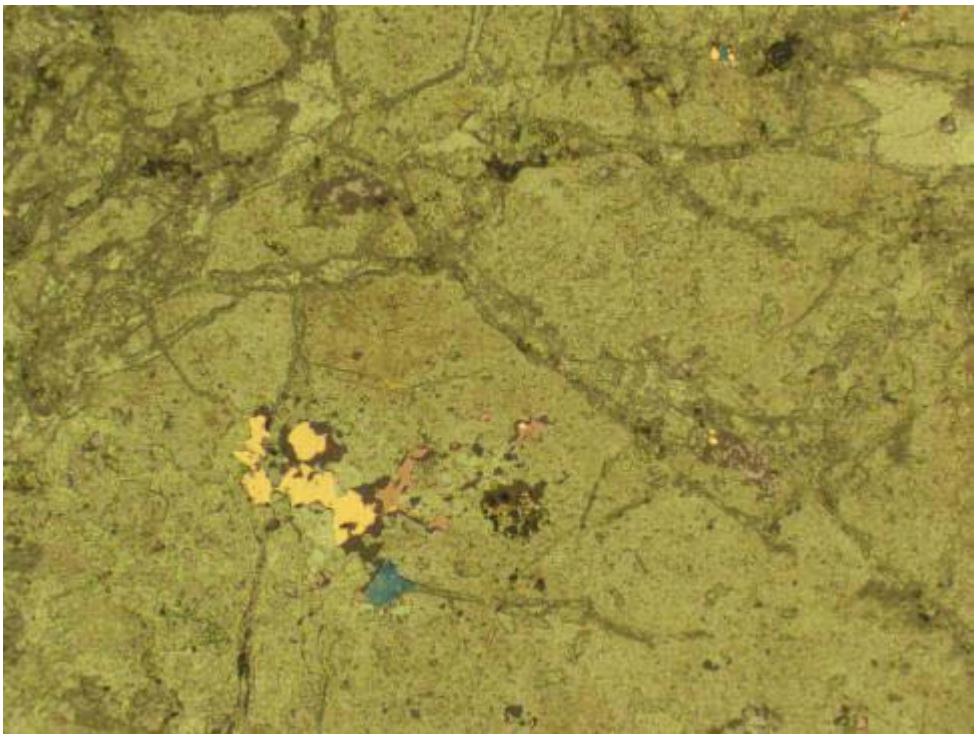
E



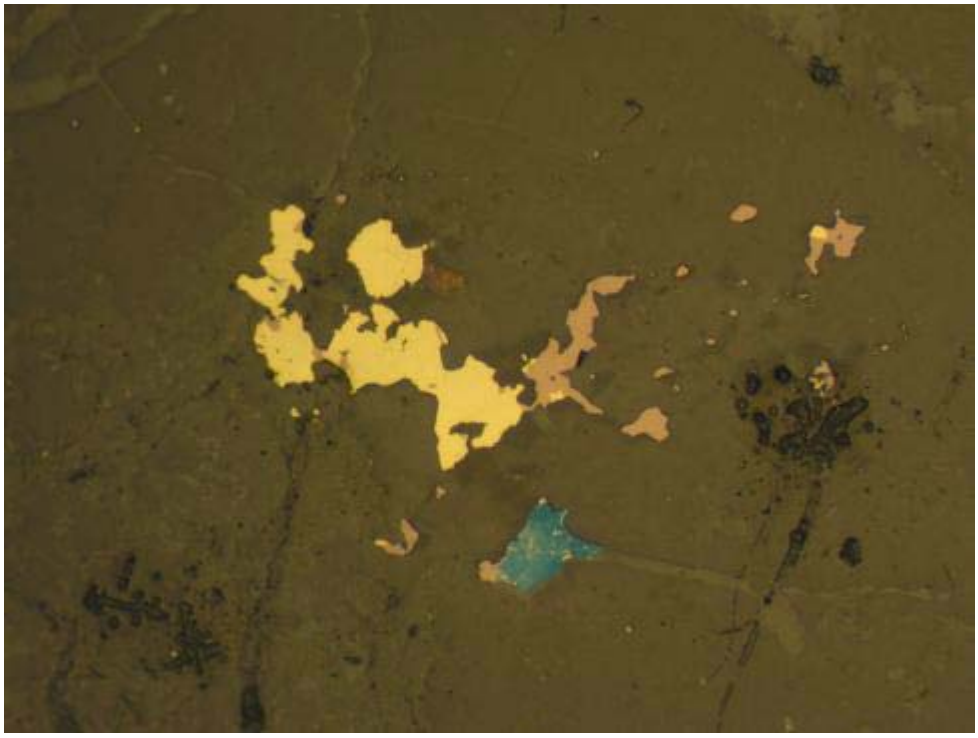
F

Sample: MM-08-04 82.90-83.01m

E) Overview of fractured rock with chlorite (chl) and various types of carbonate (carb) infill. Note: vfg carb = very fine-grained carbonate. PPL, FOV = ~ 4.5 mm. F) Detailed view of radiating aggregates of hematitic carbonate with colourless carbonate infill. XPL, FOV = ~ 2.6 mm.



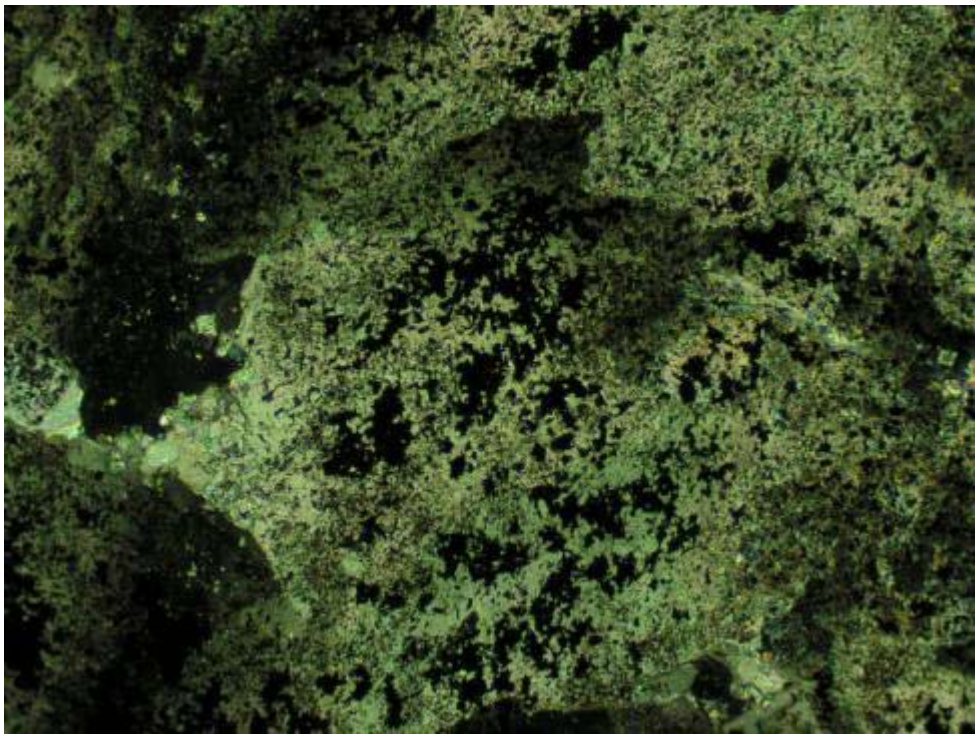
G



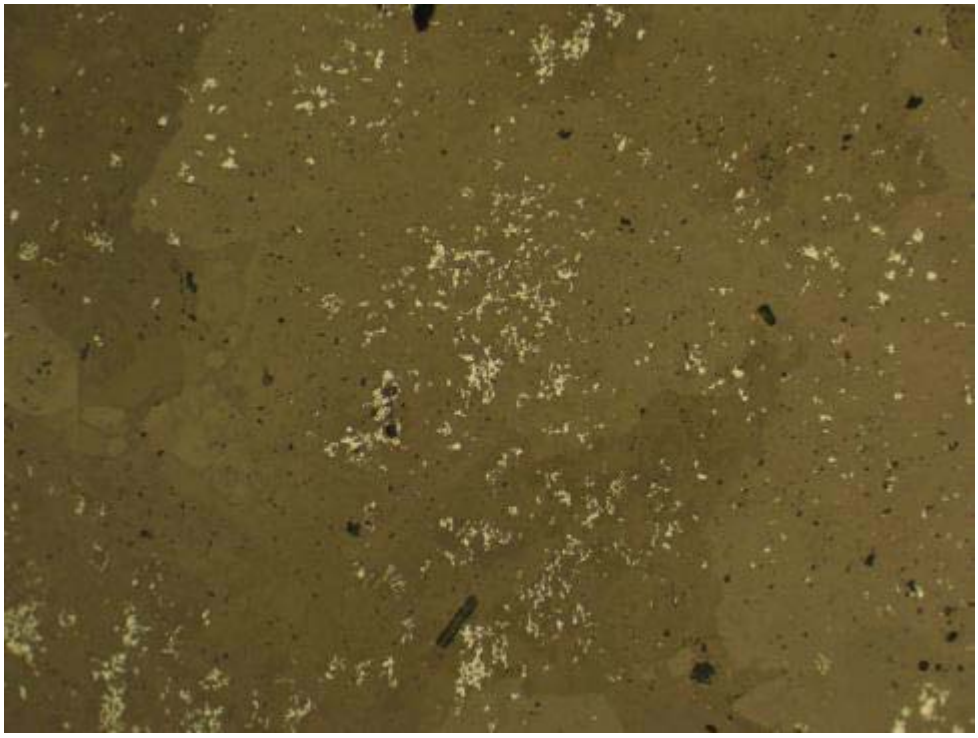
H

Sample: MM-08-04 82.90-83.01m

G) Detailed views of disseminated chalcopyrite associated with bornite. Note bornite partly replaced by chalcocite which in turn is virtually completely replaced by covellite (dark blue). G) RL+PPL, FOV = ~ 1.3 mm, H) RL, FOV = ~ 0.7 mm.



I

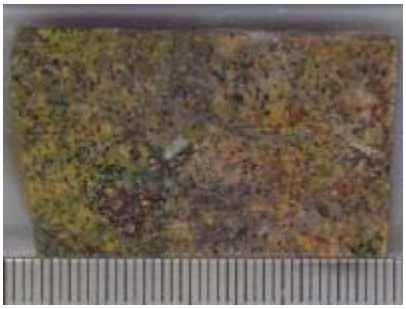


J

Sample: MM-08-04 82.90-83.01m
I &J) Detailed views of hematitic carbonate. G) XPL, H) RL, same FOV = ~ 1.3 mm

Zone: SOUTH
Sample: TR80C1 **Offcut #T-4**

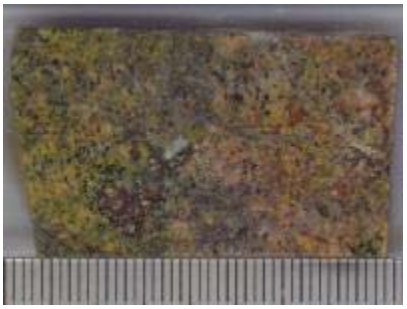
view of hand sample


view of stained section offcut, scale in mm

Hand Sample Test Results:
Spotty reaction of sample to magnet. Strong reaction of rock and fractures to cold, dilute HCl. Positive test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Intrusive breccia with angular to subangular fragments (2-5 cm size) of equigranular to sub-porphyritic, fine to medium-grained pink intrusive rock set in a fine to medium-grained black intrusive rock matrix rich in chlorite, magnetite, hematite and patchy chalcopyrite. Minor chalcopyrite occurs disseminated in some fragments but is mostly fracture-controlled and occurs as patches and stringers in the matrix. Traces of malachite occur locally associated with chalcopyrite and fracture-controlled. Calcite occurs as sub-mm wide veinlets filling a network of fine fractures cutting the rock. Patchy calcite occurs partly replacing breccia fragments (based on reaction to HCl). Orange-brown Fe-ox occurs locally rimming chalcopyrite aggregates and as a late fracture coating.

Zone: SOUTH
Sample: TR80C1 **Offcut #T-4**


view of stained section offcut, scale in mm

LITHOLOGY:	Pervasively altered and mineralized intrusive breccia (?monzonite)
ALTERATION TYPE:	K-feldspar, calcite chlorite, magnetite, hematite
MINERALIZATION:	Chalcopyrite (malachite)
FRACTURES/VEINLETS:	Calcite, chalcopyrite-chlorite-rutile-(malachite)

Polished Thin Section Description:
This section covers the contact between the pink fine to medium-grained intrusive breccia fragment (right side of stained offcut photo above) and the intrusive breccia matrix (left side of photo above). Both fragment and matrix have similar compositions but varying alteration. The rock is a fine to medium-grained equigranular to subporphyritic ?monzonite comprising almost equal proportions of plagioclase and K-feldspar. In thin section, the breccia fragment is extensively calcite-chlorite altered. The breccia matrix is partly K-feldspar altered and fractured. Fracture-controlled chalcopyrite, magnetite, rutile, chlorite and locally malachite occur dominantly in the intrusive breccia matrix giving the hand sample a dark green/black colour. Patchy calcite alteration is absent in the intrusive breccia matrix. Locally, the margins of the breccia fragment are fractured and infilled by chalcopyrite, calcite and chlorite. Calcite-filled fractures are abundant in the breccia fragment and less common but locally associated with chalcopyrite in the breccia matrix.

Zone: SOUTH
Sample: TR80C1 **Offcut #T-4**

HOST ROCK:
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
K-feldspar	30	fine to very fine-grained (< 0.4 mm), occurs as anhedral aggregates, intergrown with plagioclase throughout section, also occurs as very fine-grained patchy aggregates, partly replacing plagioclase particularly in matrix	
Plagioclase albite/ oligoclase	25	fine to medium (< 1.5 mm), eu-subhedral crystals, composition of An_{0-25} (based on 3 estimates), occurs throughout section, locally patchy replacement by K-feldspar	*polysynthetic twinning-albite*
Calcite	10	fine to very fine-grained, anhedral aggregates, occurs locally as patchy replacement of breccia fragment	
Chlorite	7	very fine-grained, anhedral to radiating aggregates, patchy aggregates, locally associated with calcite and magnetite	
Magnetite	5	fine-grained (< 0.4mm), eu-subhedral grains and aggregates, occurs associated with patchy chlorite, also occurs disseminated, commonly rimmed by hematite	

MINOR MINERALS

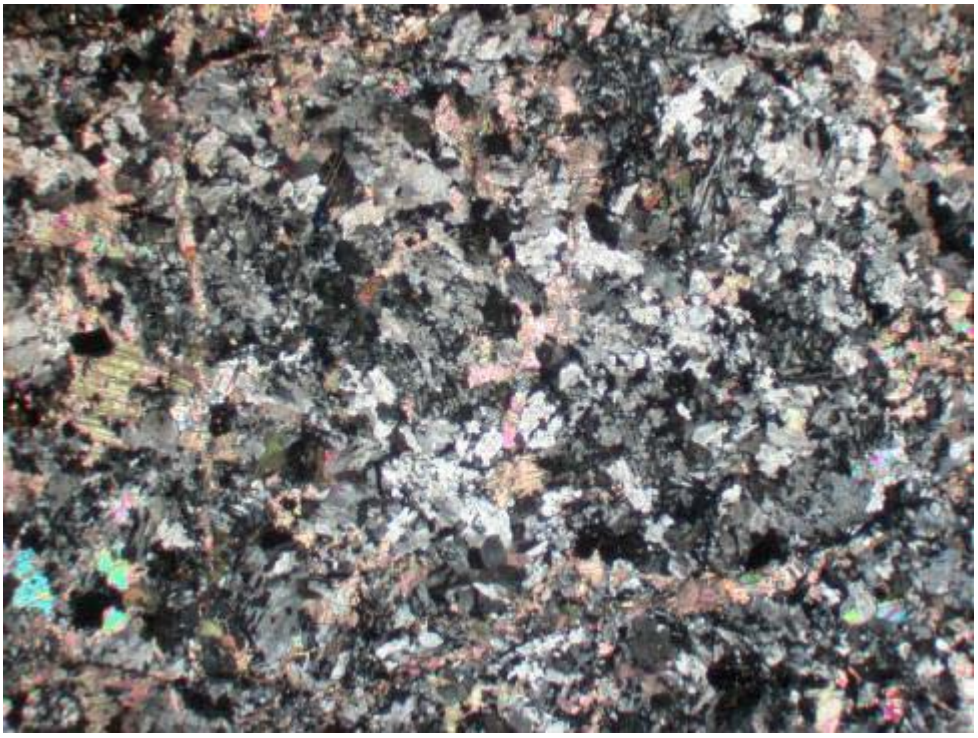
Mineral	%	Distribution & Characteristics*	Optical
Hematite	1	very fine-grained, occurs rimming and partly replacing magnetite	
Apatite	tr	fine-grained (< 0.4 mm), disseminated	*high relief*
Rutile	tr	very fine-grained, anhedral aggregates, occurs disseminated	*brown*

VEINLETS/ FRACTURE INFILL:

Mineral	%	Distribution & Characteristics*	Optical
Carbonate, mostly calcite	12	fine to medium-grained (< 3 mm), occurs as fracture infill, occurs locally with chalcopyrite, locally partly replaced by Fe-ox	
Chalcopyrite	4	fine-grained (< 0.5 mm), anhedral aggregates, fracture-controlled, associated with calcite and chlorite, enclosed magnetite	
Chlorite	3	very fine-grained, anhedral aggregates, occurs as fracture infill associated with calcite and chalcopyrite	
Hematite	2	very fine-grained, occurs rimming and partly replacing chalcopyrite	*red*
Malachite	tr	very fine-grained, anhedral aggregates, occurs with chlorite, rutile, chalcopyrite and hematite as fracture infill in matrix	*bright green*
Rutile	tr	very fine-grained, anhedral aggregates, occurs with chlorite as fracture infill	*brown*
Pyrite	tr	fine-grained, anhedral grains, occurs enclosed by chalcopyrite within fractures in breccia matrix	
Fe-ox	tr	very fine-grained, anhedral aggregates, occurs as late fracture infill, locally replaces carbonate in fractures	*orange-brown*

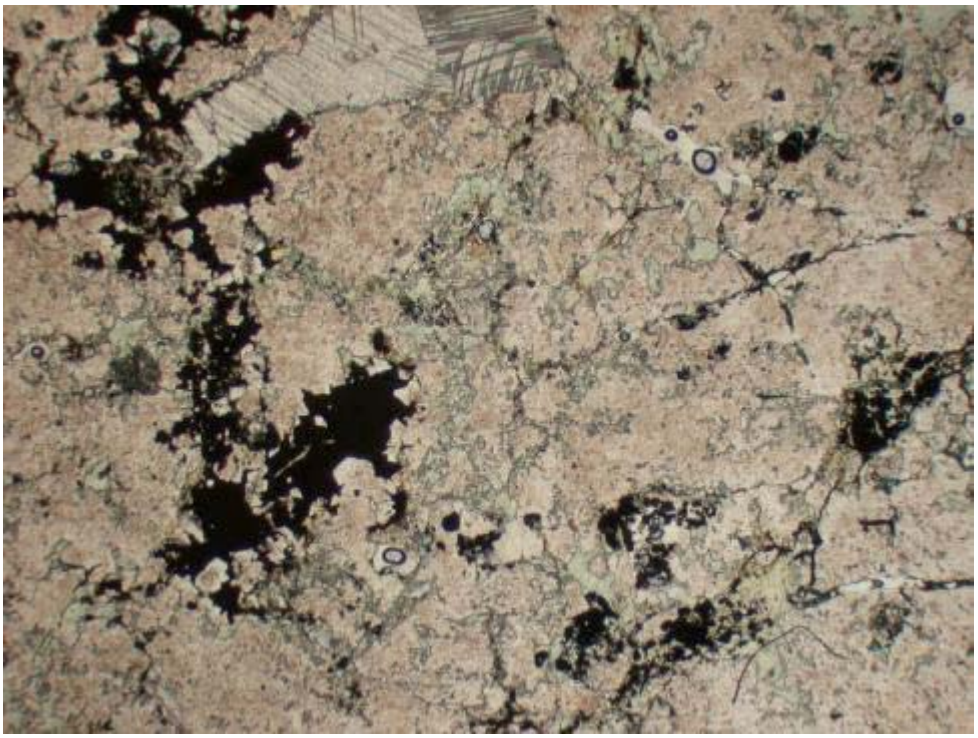
*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm

A

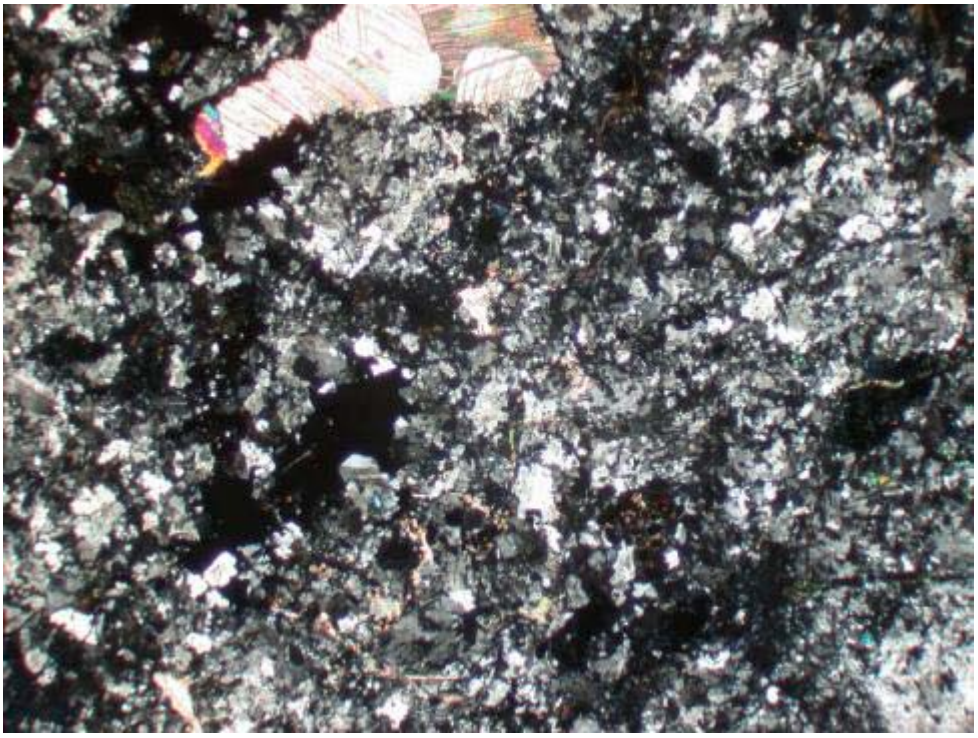


B

Sample: TR80C1
A & B) Overview of breccia fragment shows extensively calcite-chlorite altered former fine to medium-grained intrusive rock. A) PPL, B) XPL, FOV = ~ 4.5 mm.



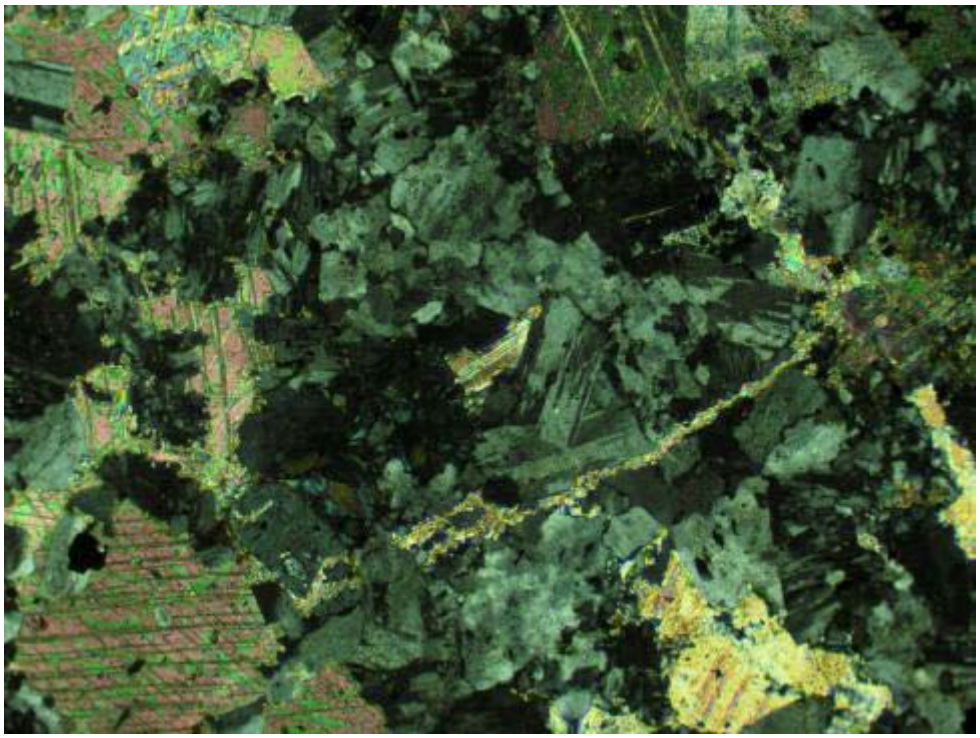
C



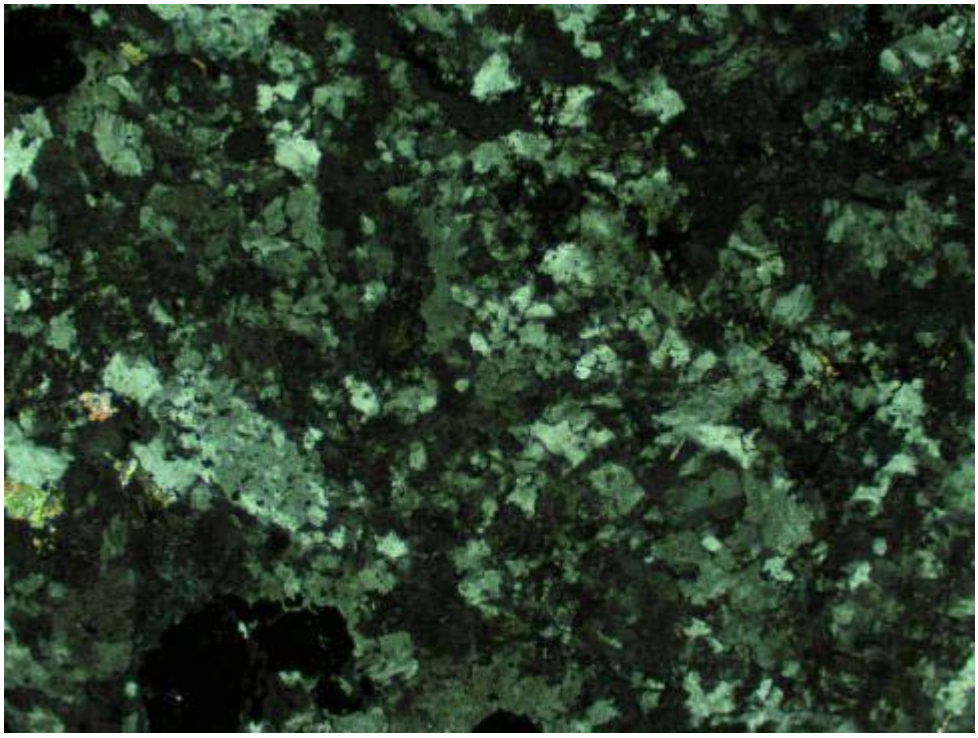
D

Sample: TR80C1

C & D) Overview of breccia matrix shows patchy K-feldspar-altered and fractured rock. Fractures are filled with chlorite, opaques (chalcopyrite, magnetite), rutile and locally calcite. C) PPL, D) XPL, FOV = ~ 4.5 mm.



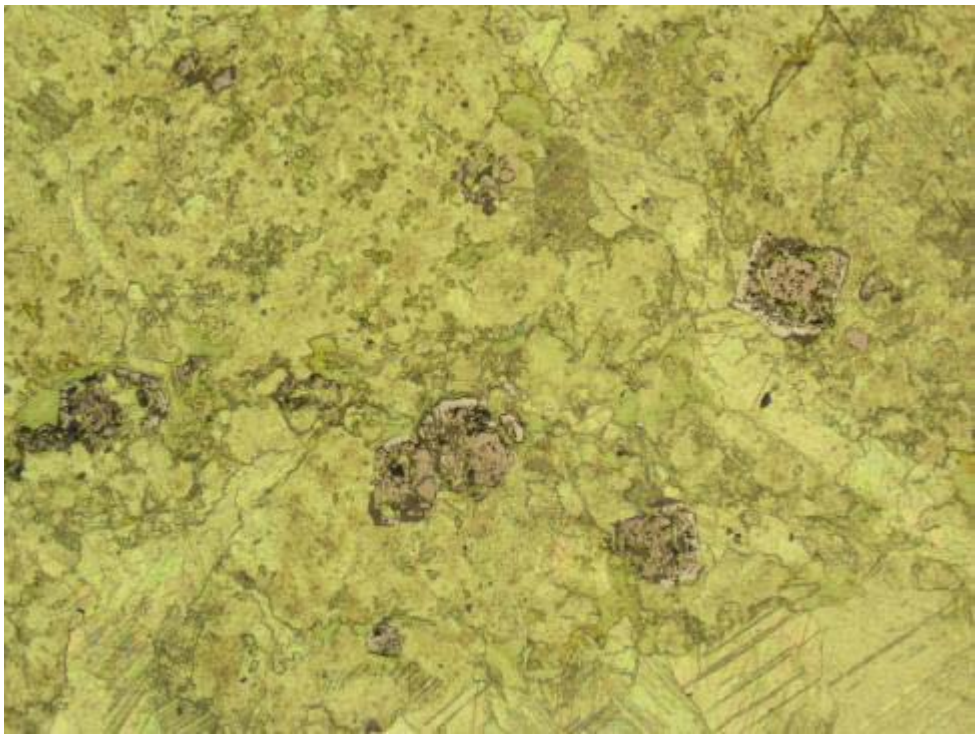
E



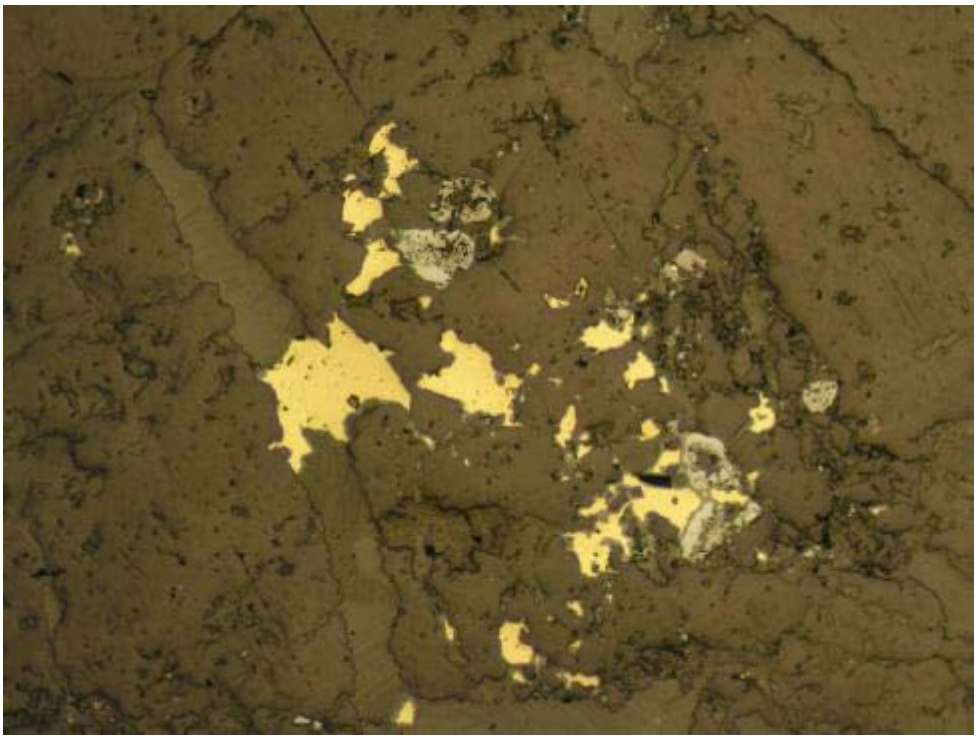
F

Sample: TR80C1

E & F) Detailed comparison of breccia fragment (photo E) and breccia matrix (photo F). Note extensive calcite alteration of fragment; absence of calcite alteration of matrix. Note very fine-grained K-feldspar alteration of matrix. E) XPL, F) XPL, FOV = ~ 1.3 mm.



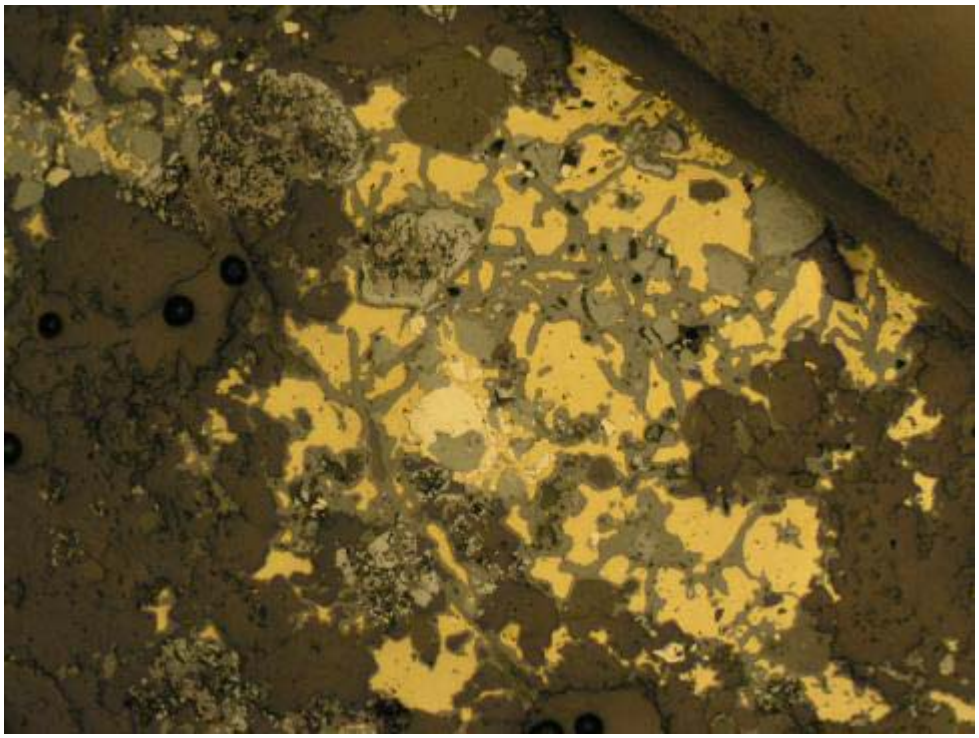
G



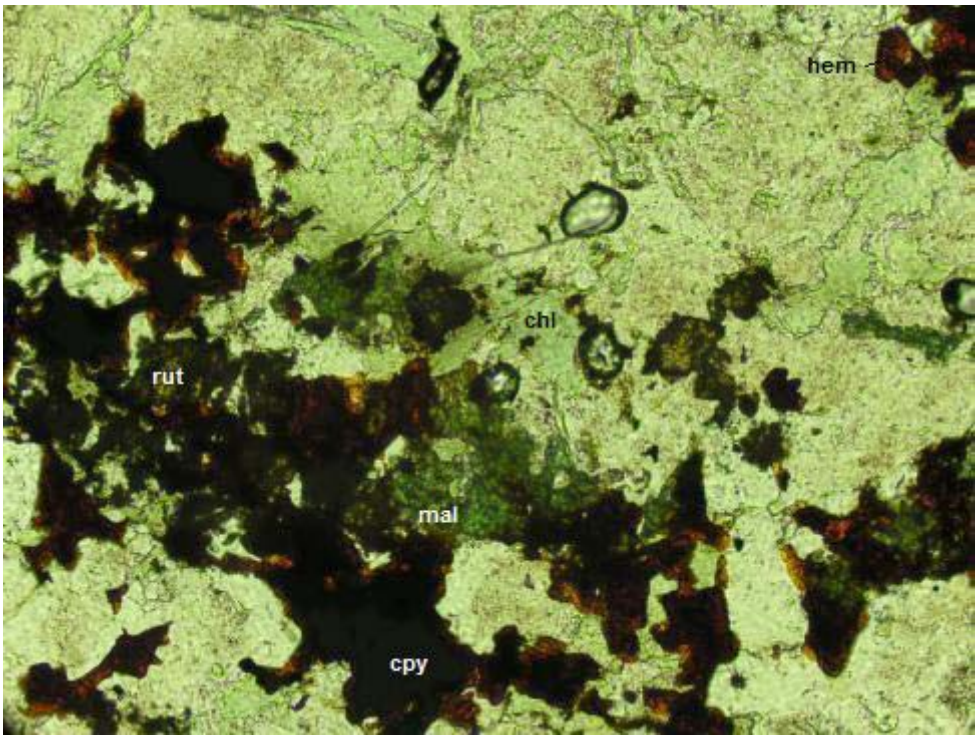
H

Sample: TR80C1

G) View of disseminated euhedral magnetite and magnetite associated with chlorite alteration. Note magnetite partly replaced by hematite. PPL+ RL, FOV = ~ 2.6 mm. H) View of fracture-controlled chalcopyrite enclosing magnetite (partly replaced by hematite). Note chalcopyrite within calcite veinlet (left). RL, FOV = ~ 2.6 mm.



I

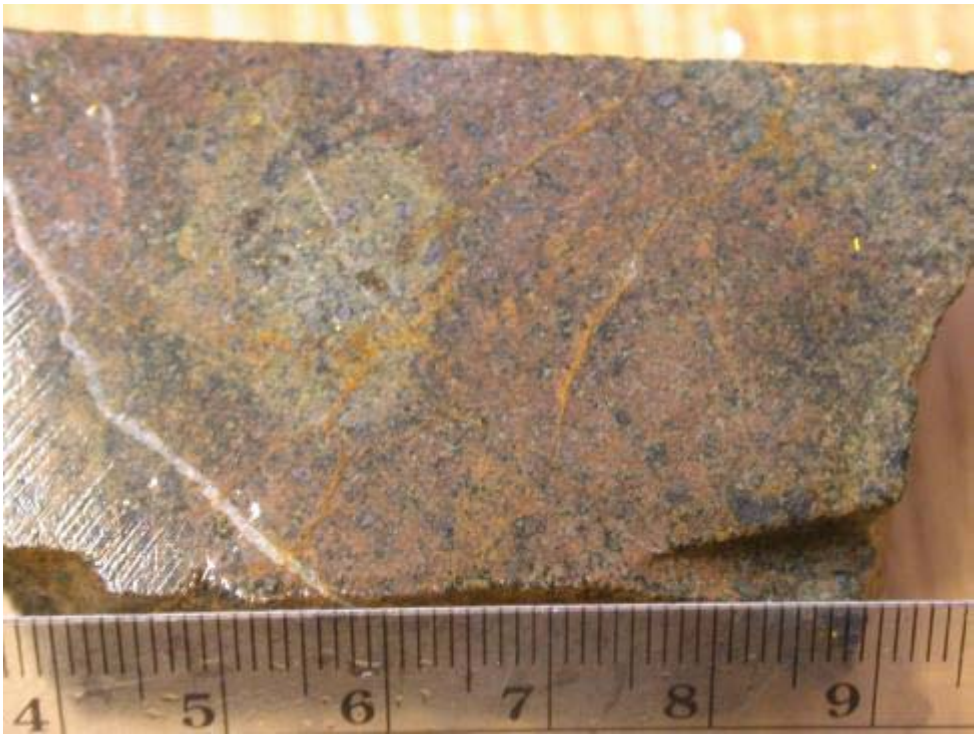


J

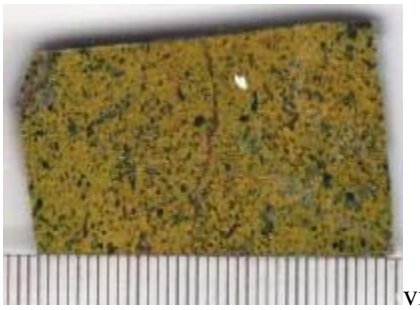
Sample: TR80C1

G) View of chalcopyrite enclosing magnetite and pyrite within fractures in breccia matrix. Note extensive replacement of chalcopyrite rims by hematite. RL, FOV = ~ 2.6 mm. H) View of fracture-controlled chalcopyrite rimmed by hematite and associated with malachite (bright green), chlorite and rutile (yellow-brown) in breccia matrix. PPL, FOV = ~ 0.7 mm.

Zone: SOUTH
Sample: TR80-C3 **Offcut #T-5**



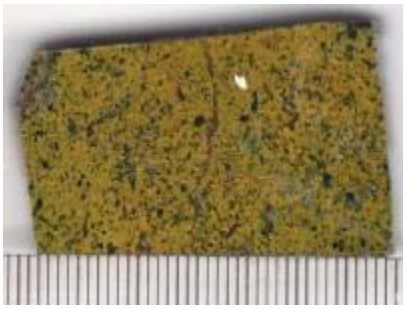
view of hand sample


view of stained section offcut, scale in mm

Hand Sample Test Results:
Reaction of sample to magnet. Patchy reaction of mafic phases within rock and fractures to cold, dilute HCl. Positive test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Fragmental intrusive rock with outlines of angular to subangular fragments (1-3 cm size) of porphyritic fine to medium-grained yellowish-green intrusive rock set in a pink-brown porphyritic fine to medium-grained intrusive rock matrix. The fragmental intrusive rock comprises approximately 30-40% dark green chlorite-calcite-epidote altered prismatic former mafic phenocrysts (< 5 mm size) in a fine-grained K-feldspar-dominant matrix. Traces of chalcopyrite occur as replacement of altered mafic phenocrysts. The rock is fractured with fractures filled with calcite and Fe-ox.

Zone: SOUTH
Sample: TR80-C3 **Offcut #T-5**


view of stained offcut, scale in mm

LITHOLOGY: Porphyritic intrusive breccia
ALTERATION TYPE: K-feldspar, ?actinolite-chlorite-magnetite-epidote-calcite, hematite, epidote-albite-calcite
VEINLETS/ FRACTURES: Calcite, Fe-ox

Polished Thin Section Description:
This section covers mostly the pink-brown, porphyritic fine to medium-grained matrix of the intrusive breccia. One corner of the section (top left of photo above) is unstained and is likely a portion of an intrusive breccia fragment. The intrusive breccia matrix is a fractured and pervasively K-feldspar, ?actinolite-chlorite-magnetite-epidote-calcite, hematite altered porphyritic rock with approximately 30% former fine to medium-grained, altered mafic phenocrysts (ferromagnesian minerals), K-feldspar and locally minor former fine-grained plagioclase phenocrysts in a very fine-grained pervasively K-feldspar altered matrix. Former plagioclase (minor vague relict polysynthetic twinning) is selectively replaced by K-feldspar and locally patchy anhedral chlorite aggregate. Aphanitic hematite aggregates occur as a cloudy stain rimming and partly replacing former plagioclase. Former mafic phases are completely replaced by aggregates of ?actinolite, chlorite (after actinolite), calcite, magnetite, epidote and rutile. Major magnetite occurs disseminated and as replacement of mafic phenocrysts. Minor apatite occurs disseminated. Traces of hematite occur partly replacing magnetite. The small unstained portion of the section (see photo above) comprises mostly carbonate-chlorite-epidote altered fine-grained intrusive rock. Epidote-albite-calcite occur as fine to very fine-grained patchy aggregates in lower right portion of photo above.

The section is cut by discontinuous calcite-filled fractures. Late orange-brown Fe-ox-filled fractures occur as infill at margins of calcite fractures.

Zone: SOUTH
Sample: TR80-C3 **Offcut #T-5**

HOST ROCK:
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
K-feldspar	50	-fine-grained, tabular, occurs as phenocrysts and matrix -very fine-grained, occurs as pervasive replacement of plagioclase phenocrysts and matrix throughout section	
Chlorite	10	very fine-grained, anhedral aggregates, occurs as replacement of actinolite and locally as patchy replacement of plagioclase	
Hematite	8	-aphanitic aggregates, occur as a cloudy stain forming patchy aggregates and rims replacing former fine-grained plagioclase phenocrysts and matrix, forms strong pink colour	
	1	-very fine-grained, occurs partly replacing magnetite	
Epidote	7	-very fine-grained aggregates, occurs with actinolite/chlorite, calcite and magnetite as replacement of former ferromagnesian minerals	
	1	-very fine-grained, occurs with calcite and albite as patchy altered aggregates	
Magnetite	7	fine-grained (< 0.3mm), subhedral grains and aggregates, occurs as replacement of former mafic phenocrysts, also occurs disseminated	
Calcite	3	-fine-grained, anhedral aggregates, occurs locally as patchy replacement of former mafic phases	
	3	-fine-grained, occurs with epidote and albite as patchy altered aggregates	

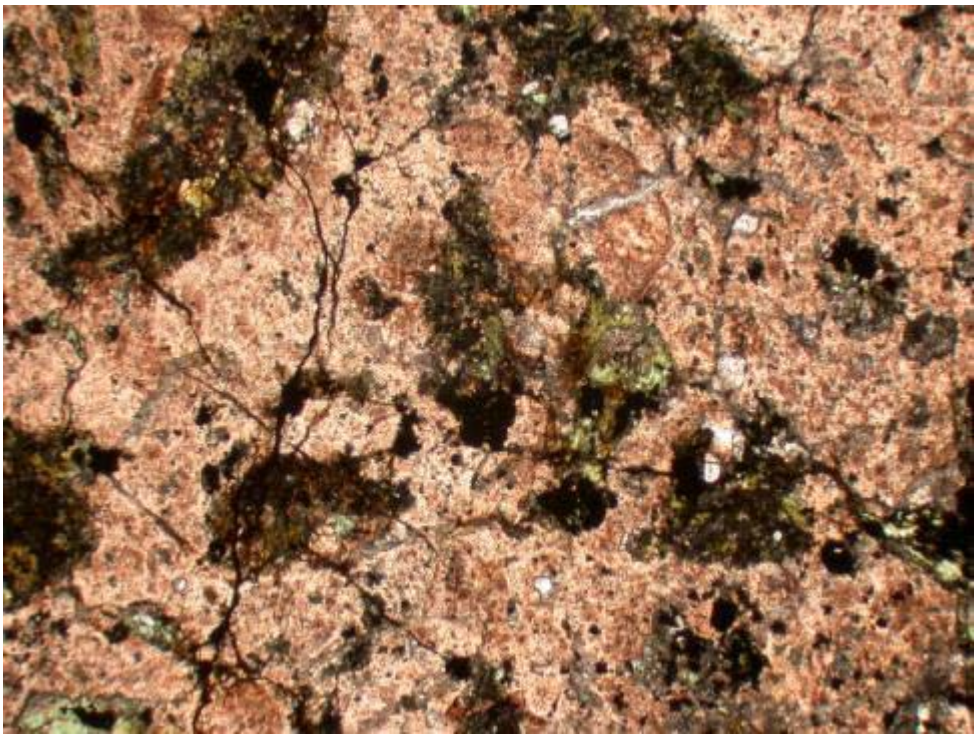
MINOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
?Actinolite	3	fine-grained, anhedral aggregates, occurs with calcite, magnetite and epidote as replacement of former mafic (ferromagnesian mineral) phenocrysts, partly replaced by chlorite	*green*
Plagioclase	1	fine-grained (< 0.8 mm), eu-subhedral crystals, occurs as relict phenocrysts, pervasively replaced by K-feldspar and locally patchy chlorite and calcite	*relict polysynthetic twinning*
Apatite	1	fine-grained (< 0.3 mm), disseminated	*high relief*
Albite	tr	fine-grained (< 0.2 mm), subhedral aggregates, occurs with epidote and calcite as patchy aggregates	
Rutile	tr	very fine-grained, anhedral aggregates, occurs with chlorite partly replacing former mafic phenocrysts	

VEINLETS/ FRACTURE INFILL:

Mineral	%	Distribution & Characteristics*	Optical
Calcite	2	fine to very fine-grained (< 0.3 mm), occurs as fracture infill	
Fe-ox	2	very fine-grained, anhedral aggregates, occurs as late fracture infill, crosscuts and infills margins of calcite filled fractures	*orange-brown*

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm



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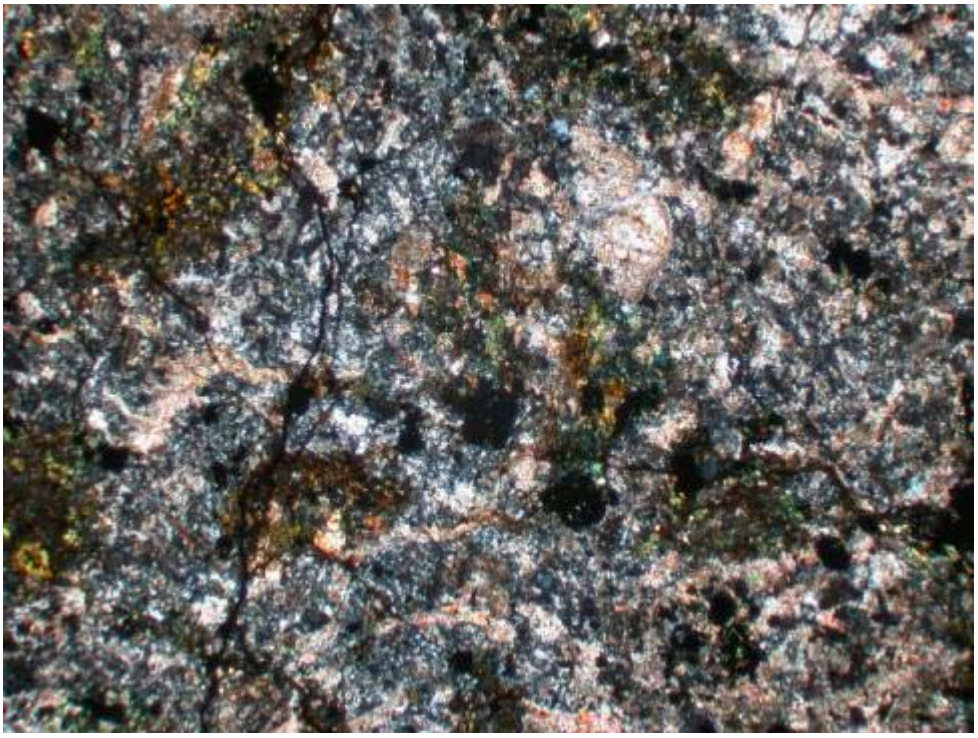
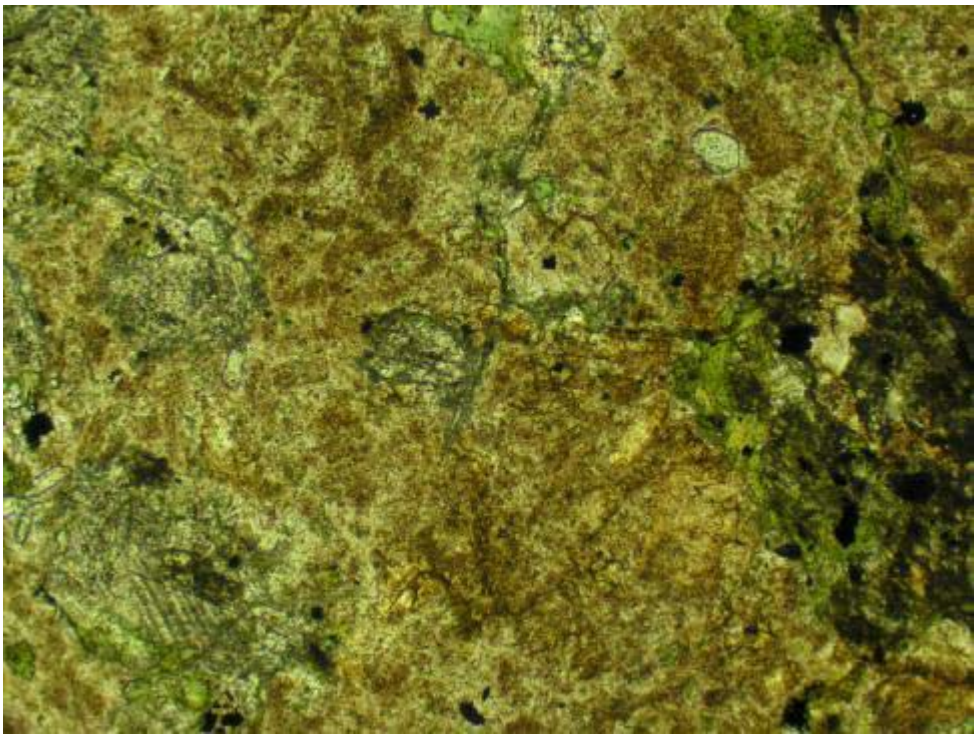


B

Sample: TR80-C3
A & B) Overview of sample shows former fine to medium-grained, ?actinolite/chlorite-carbonate-epidote-magnetite (opaques) altered mafic (ferromagnesian minerals) phenocrysts in a very fine-grained pervasively K-feldspar altered and partly hematite-stained matrix. . A) PPL, B) XPL, FOV = ~ 4.5 mm.



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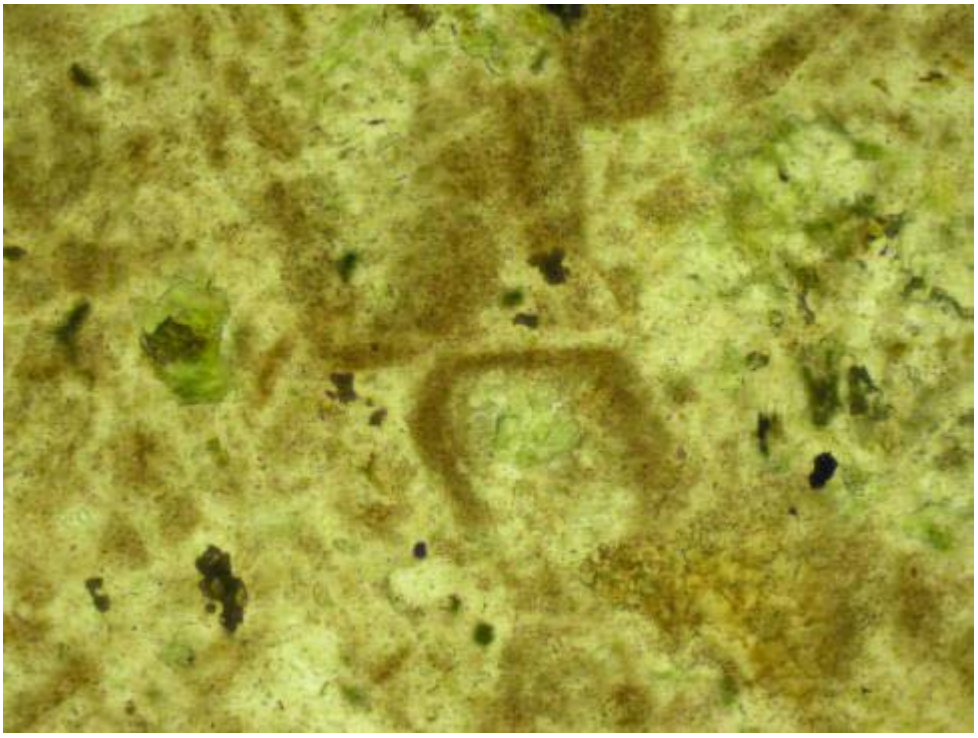
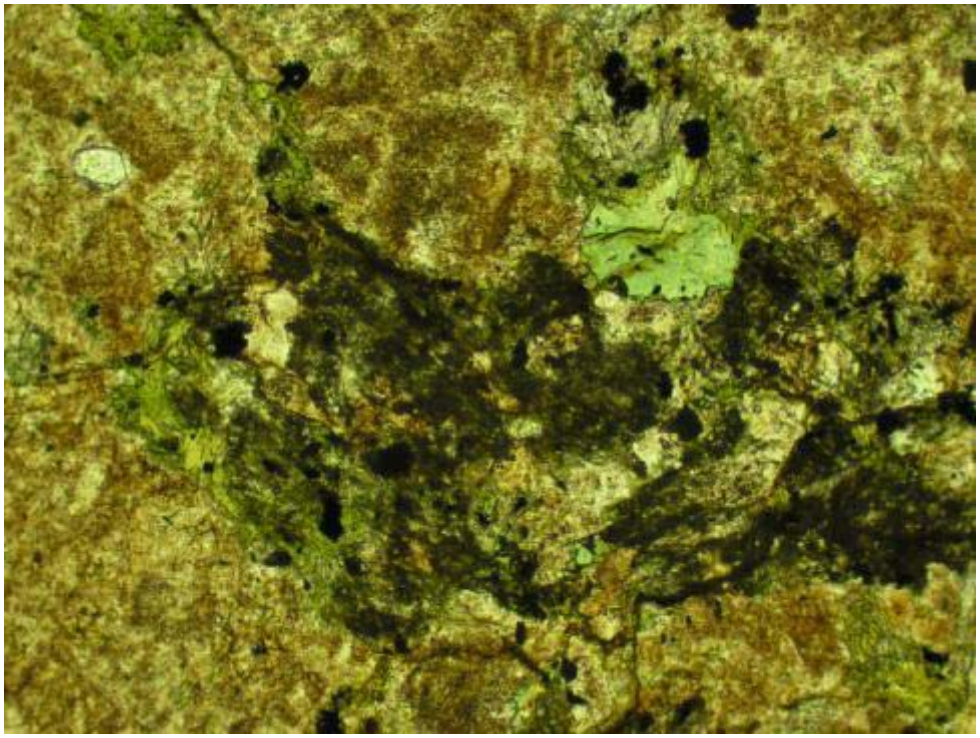


D

Sample: TR80-C3
C&D) Views of intrusive breccia matrix shows extensive K-feldspar alteration and aphanitic hematite aggregates as a cloudy stain forming patchy aggregates and rims replacing former fine-grained plagioclase phenocrysts and matrix. C) PPL , FOV = ~ 1.3 mm, D) PPL, FOV = 0.7 mm.



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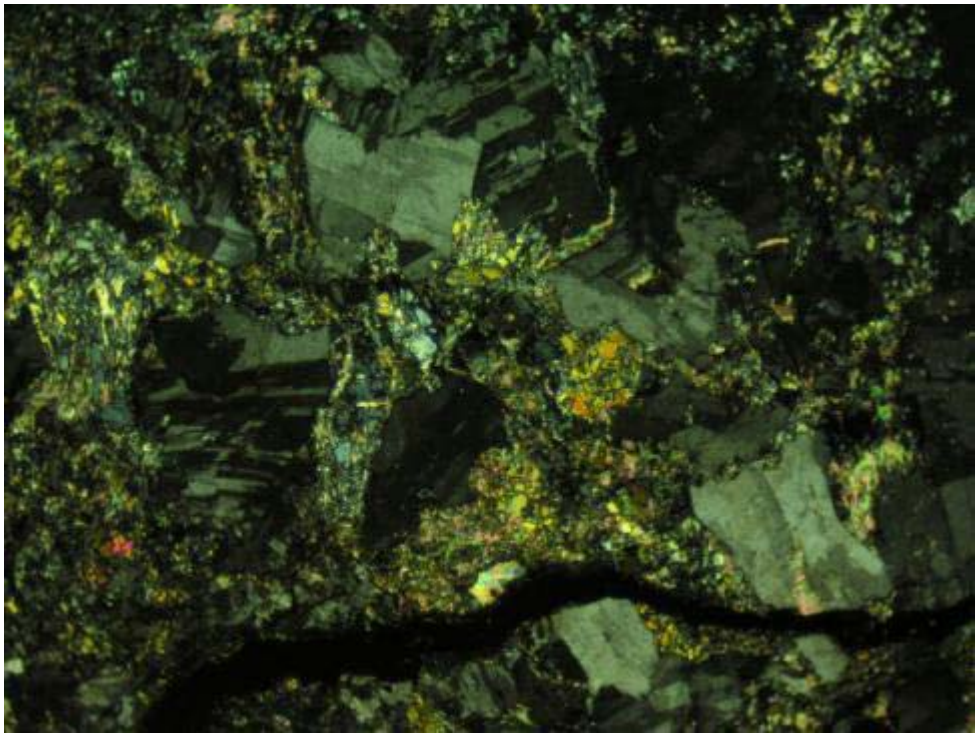
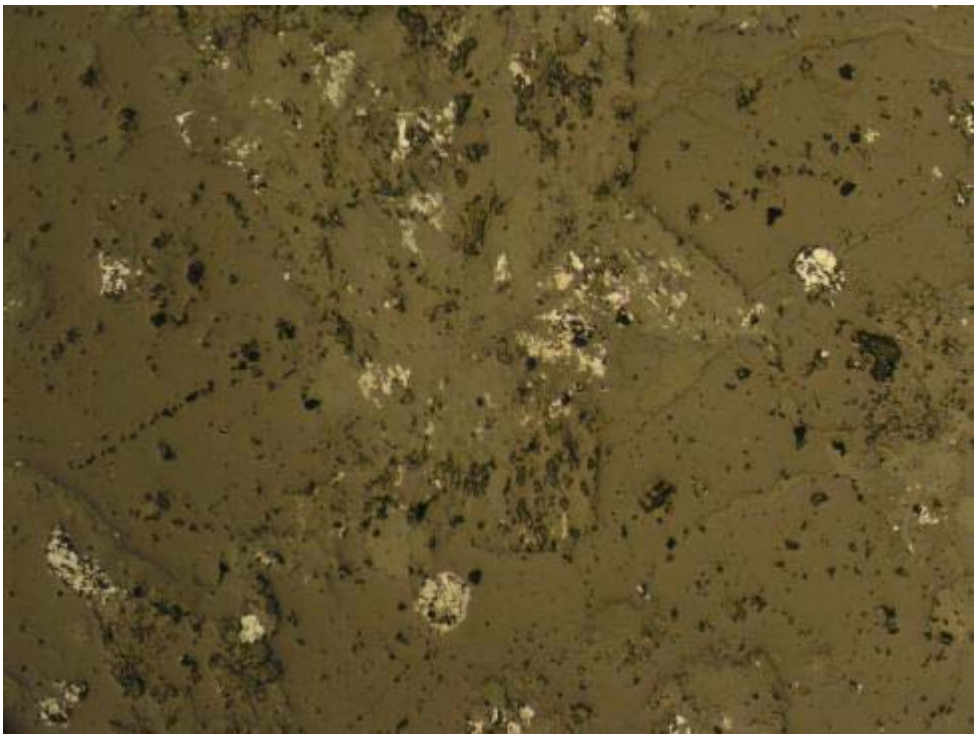
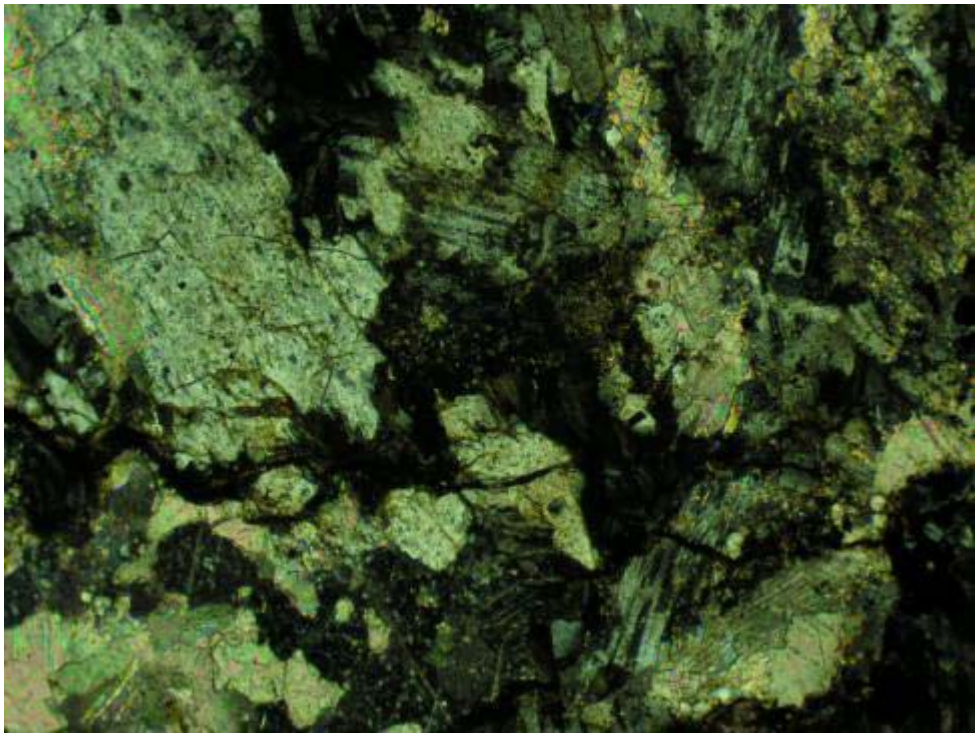


F

Sample: TR80-C3
E) Detailed view of former mafic phenocryst replaced by ?actinolite-chlorite (replacing ?actinolite)-epidote-magnetite (opaque)-calcite. PPL, FOV = ~ 1.3 mm. F) Detailed view of patchy epidote-albite-calcite aggregate. XPL, FOV = ~ 2.6 mm.



G



H

Sample: TR80-C3

G) View of disseminated magnetite and magnetite as replacement of former mafic phenocrysts in intrusive breccia matrix. RL, FOV = ~ 2.6 mm. H) View of unstained portion of section – breccia fragment – comprising mostly carbonate-chlorite-epidote altered fine-grained intrusive rock. XPL, FOV = ~ 1.3 mm.

Zone: SOUTH
Sample: TR80-C9 **Offcut #T-6**

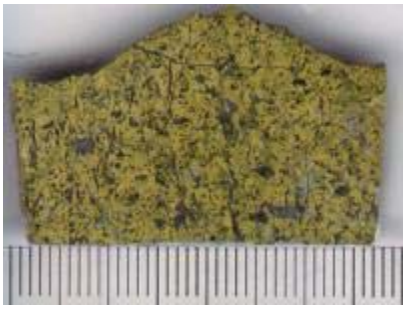
view of hand sample


view of stained section offcut, scale in mm

Hand Sample Test Results:
Strong reaction of sample to magnet. Strong reaction of mafic phases within rock and fractures to cold, dilute HCl. Positive test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Fragmental intrusive rock with vague outlines of angular to subangular fragments (3-4 cm size) of porphyritic fine to medium-grained (< 3mm) dark greenish-gray intrusive rock set in matrix of similar composition. The rock comprises approximately 30% altered former tabular plagioclase phenocrysts (< 2 mm size) and approximately 25% dark green chlorite-calcite altered tabular former mafic phenocrysts (< 3 mm size) with a fine-grained K-feldspar-altered matrix. The rock is strongly fractured with fractures filled with chlorite, calcite and Fe-ox.

Zone: SOUTH
Sample: TR80-C9 **Offcut #T-6**



view of stained offcut, scale in mm

LITHOLOGY:	Porphyritic micro-diorite breccia
ALTERATION TYPE:	K-feldspar, illite, chlorite-magnetite-calcite
MINERALIZATION:	(chalcopyrite, pyrite)
VEINLETS/ FRACTURES:	Calcite, calcite-chlorite (±magnetite/hematite±chalcopyrite±pyrite), Fe-ox

Polished Thin Section Description:
This section is strongly fractured and pervasively K-feldspar, illite, chlorite-magnetite-calcite altered micro-diorite breccia comprising fine to medium-grained porphyritic micro-diorite rock fragments in a matrix of similar composition. The micro-diorite comprises phenocrysts of fine to medium-grained altered plagioclase and former fine to medium-grained, altered mafic phases with interstitial fine-grained altered plagioclase, K-feldspar and chlorite. Plagioclase is selectively replaced by K-feldspar with cores replaced by very fine-grained illite and locally overprinting by patchy anhedral calcite, chlorite and locally epidote aggregate. Former mafic phases are completely replaced by aggregates of chlorite, carbonate, magnetite, and rutile. Major magnetite occurs disseminated and as replacement of mafic phenocrysts. Traces of pyrite and chalcopyrite occur disseminated. Traces of apatite occur disseminated. Traces of hematite occur partly replacing magnetite and locally chalcopyrite.

The section is cut by discontinuous calcite veinlets and calcite-chlorite± (epidote ±magnetite/hematite ±chalcopyrite) filled fractures. Traces of albite occur as selvages to some calcite veinlets. Late orange-brown Fe-ox-filled fractures crosscut the calcite-filled fractures and veinlets.

Zone: SOUTH
Sample: TR80-C9 **Offcut #T-6**

HOST ROCK:
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
K-feldspar	30	fine to very fine-grained aggregates, occurs interstitial to plagioclase and as selective replacement of plagioclase, overprinted by illite, calcite and chlorite	
Plagioclase	15	fine to medium-grained (< 2 mm), relict eu-subhedral crystals, locally zoned, occurs as phenocrysts, composition of An $_{27-30}$ (based on 3 measurements) and matrix, selectively replaced by K-feldspar and subsequently by illite and locally patchy chlorite and calcite	*Polysynthetic twinning-albite*
Chlorite	15	very fine-grained, anhedral aggregates, occurs with calcite, magnetite and rutile aggregate as replacement of former mafic phenocrysts, occurs as patchy replacement of plagioclase	
Magnetite	7	fine-grained (< 0.3mm), subhedral grains and aggregates, occurs as replacement of former mafic phenocrysts, also occurs disseminated	
Illite	5	very fine-grained, anhedral to flaky aggregates, occurs as selective replacement of plagioclase cores	
Calcite	5	very fine-grained, anhedral aggregates, occurs locally as patchy replacement of feldspars, overprints illite alteration	

MINOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Rutile	tr	very fine-grained, anhedral aggregates, occurs with chlorite partly replacing former mafic phenocrysts	
Epidote	tr	very fine-grained aggregates, occurs with chlorite as replacement of plagioclase	
Apatite	tr	fine-grained (< 0.3 mm), disseminated	*high relief*
Pyrite	tr	fine-grained, subhedral aggregates, occurs disseminated, locally partly enclosed by chalcopyrite	
Hematite	tr	very fine-grained, occurs rarely partly replacing magnetite and commonly rimming and partly replacing pyrrhotite	
Chalcopyrite	tr	very fine-grained, anhedral, occurs disseminated and as replacement of mafic phasees	

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm

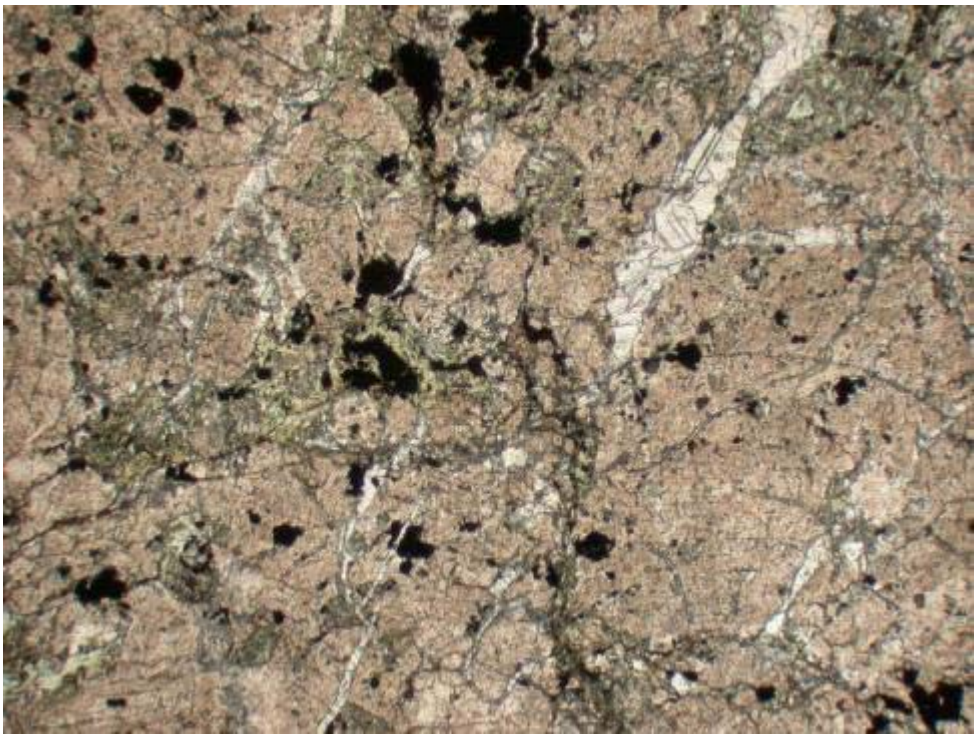
Please see over for VEINLETS/ FRACTURES

Zone: SOUTH
Sample: TR80-C9 **Offcut #T-6**

VEINLETS/ FRACTURE INFILL:

Mineral	%	Distribution & Characteristics*	Optical
Calcite	2	fine-grained (0.2 to 1 mm), anhedral aggregates, occurs as locally discontinuous veinlets	
	12	-fine to very fine-grained (< 0.3 mm), occurs as fracture infill, locally with albite vein selvages, cut by Fe-ox filled fractures	
Chlorite	6	occurs in fractures with calcite	
Fe-ox	2	very fine-grained, anhedral aggregates, occurs as late fracture infill, crosscuts and infills margins of calcite filled fractures	*orange-brown*
Epidote	tr	very fine-grained aggregates, occurs as fracture infill with chlorite	
Rutile	tr	very fine-grained, anhedral aggregates, occurs with chlorite within fractures	
Magnetite	tr	very fine-grained, anhedral grains, partly replaced by hematite	
Hematite	tr	very fine-grained, locally rims and replaces chalcopyrite	*red*
Chalcopyrite	tr	very fine-grained, anhedral aggregates, occurs in fractures with hematite and chlorite, locally partly encloses pyrite, locally partly replaced by hematite	
Albite	tr	very fine-grained, anhedral aggregates, occurs as selvages to some calcite filled fractures	

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm



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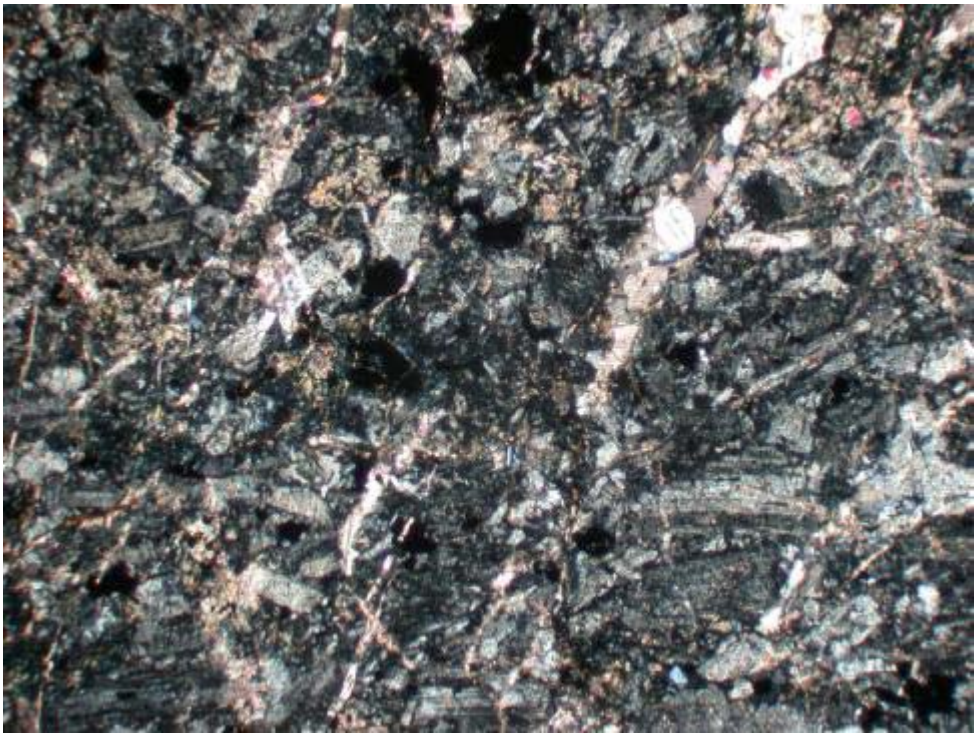
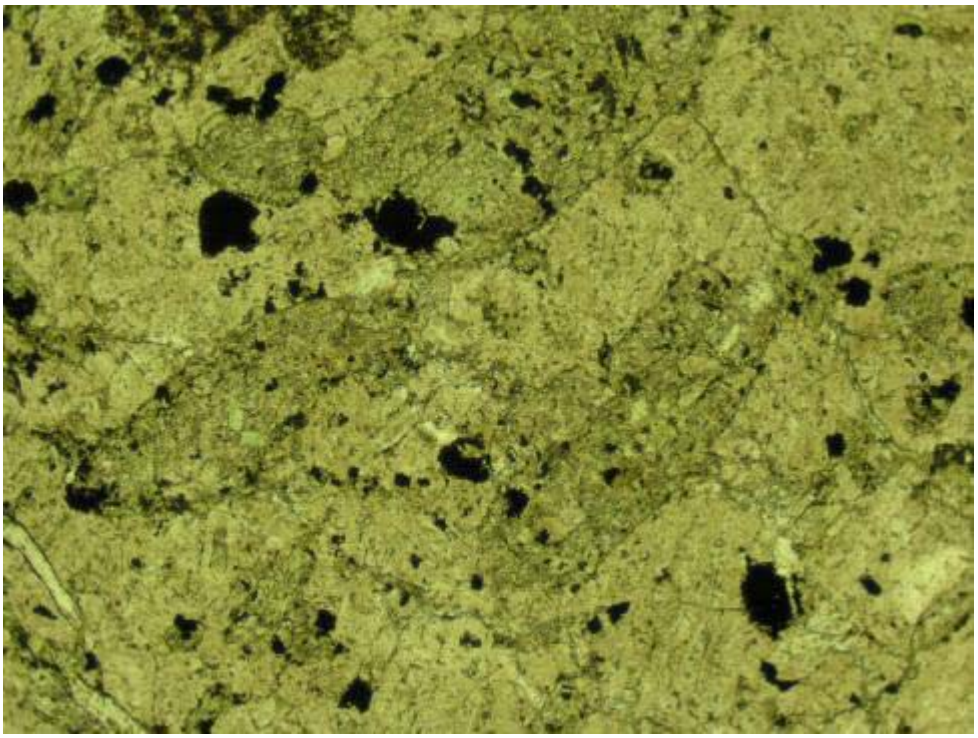


B

Sample: TR80-C9
A & B) Overview of sample shows strongly fractured and pervasively K-feldspar, illite, chlorite-magnetite-calcite altered micro-diorite. A) PPL, B) XPL, FOV = ~ 4.5 mm.



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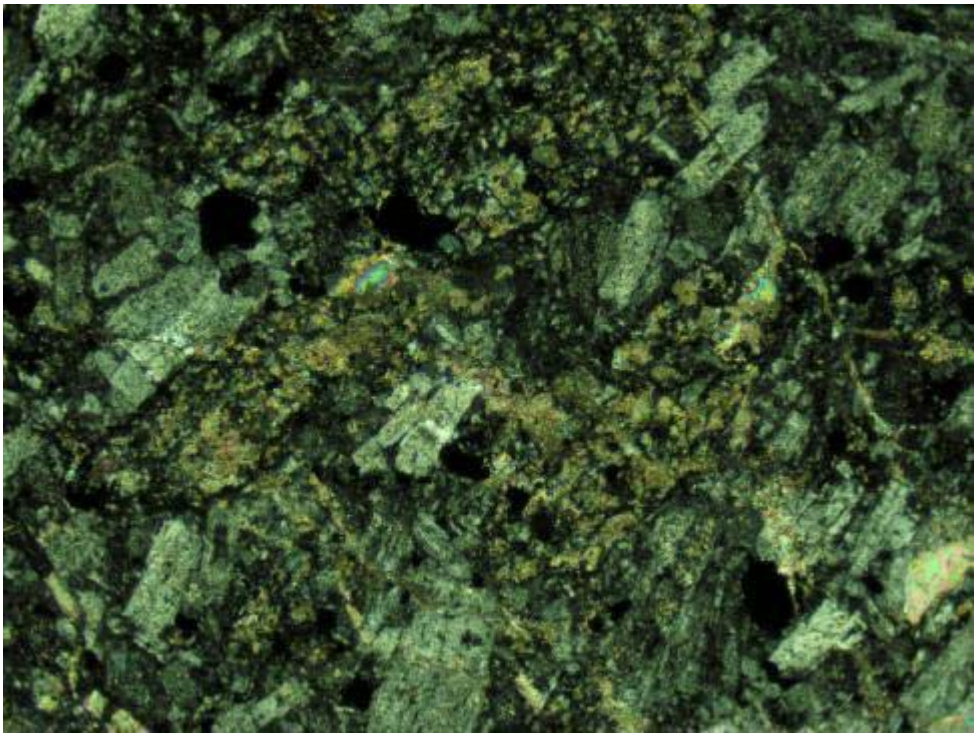
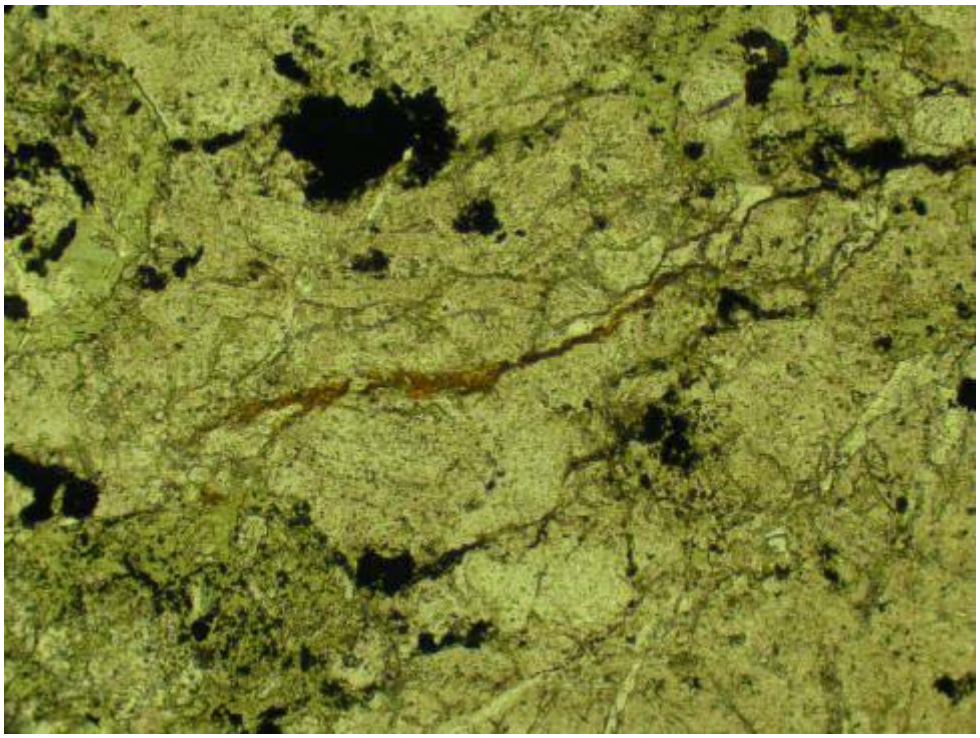
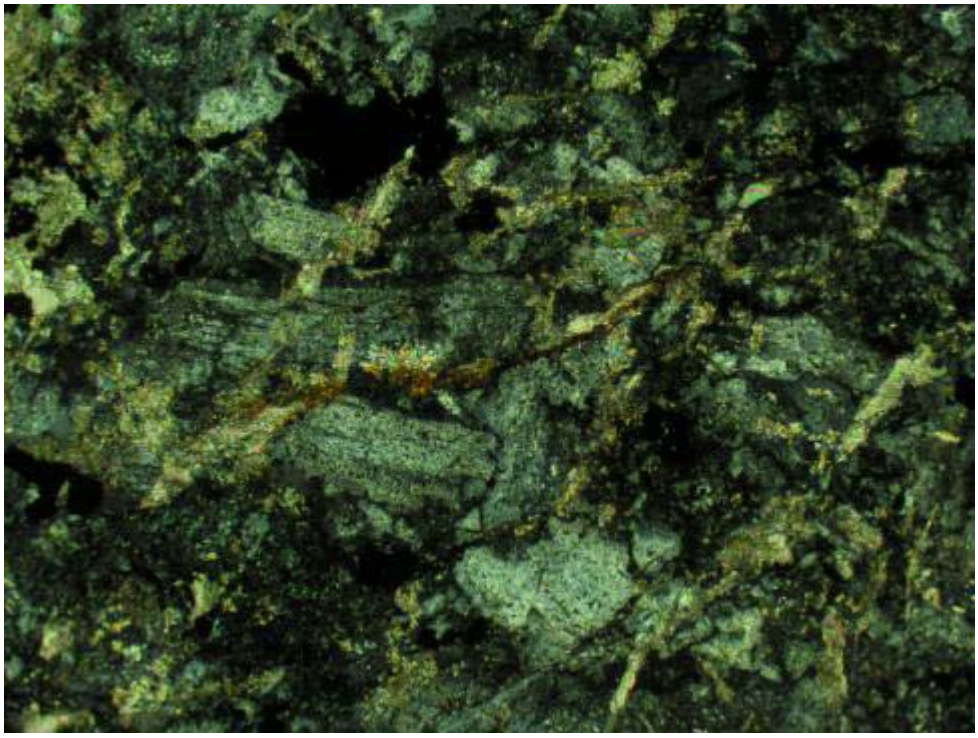


D

Sample: TR80-C9
C & D) Former prismatic mafic phenocrysts replaced by aggregates of chlorite, carbonate, magnetite, and rutile. C) PPL, D) XPL, FOV = ~2.6 mm.

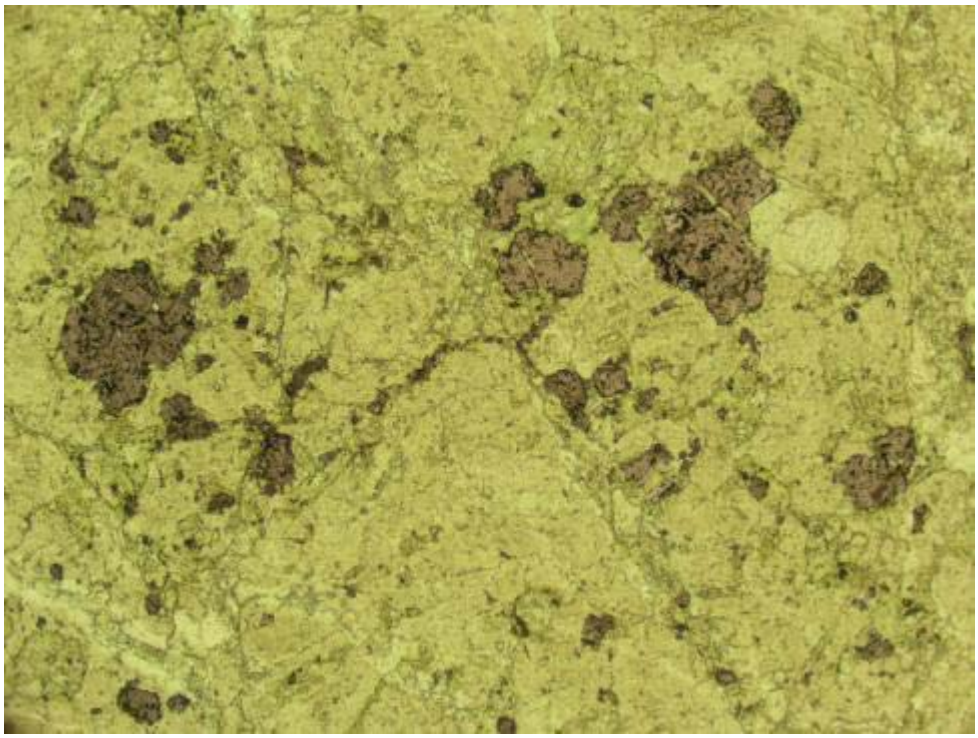


E

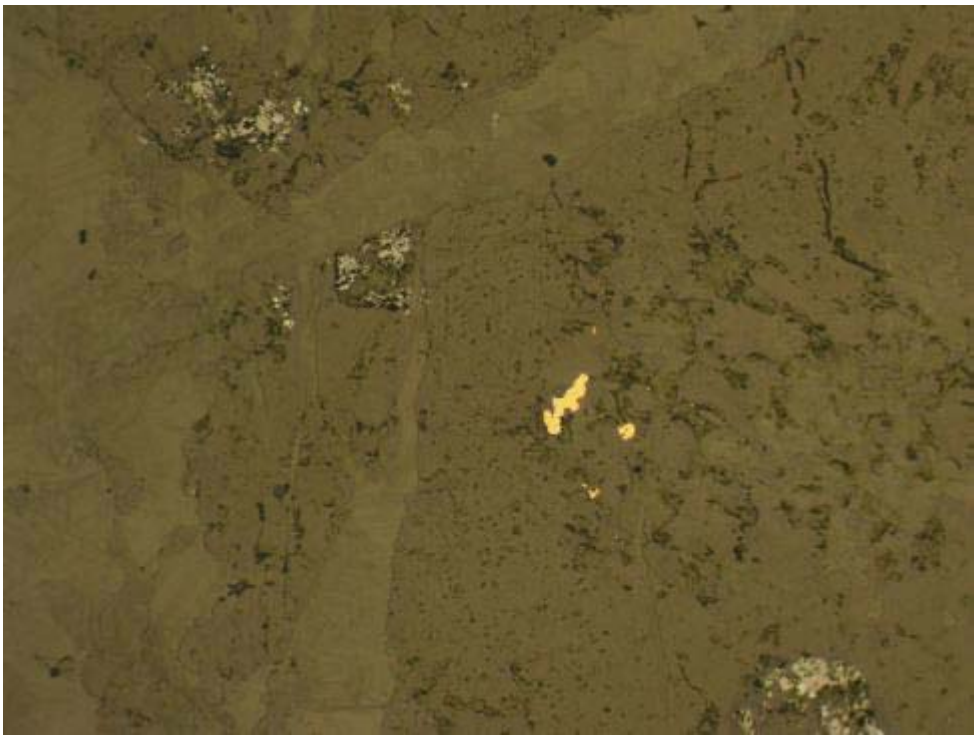


F

Sample: TR80-C9
E & F) Detailed view discontinuous calcite-chlorite filled fractures and late orange-brown Fe-ox-filled fractures. E) PPL, F) XPL, FOV = ~ 1.3 mm.



G

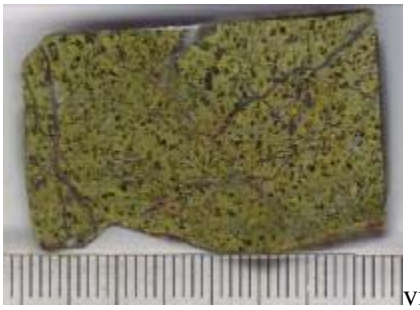


H

Sample: TR80-C9
G) View of disseminated and fracture-controlled magnetite. PPL+RL, FOV = ~ 2.6 mm. H) View of disseminated chalcopyrite and magnetite within microdiorite. RL, FOV = ~ 1.3 mm.

Zone: SOUTH
Sample: TR80-C11 **Offcut #T-7**

view of hand sample

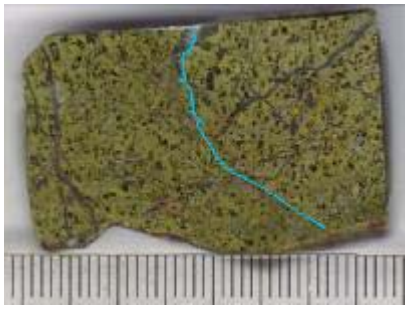

view of stained section offcut, scale in mm

Hand Sample Test Results:
Strong reaction of sample to magnet. Strong reaction of mafic phases within rock and fractures to cold, dilute HCl. Positive test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Fragmental intrusive rock with vague outlines of angular to subangular fragments (3-4 cm size) of porphyritic fine to medium-grained (< 3mm) dark greenish-gray intrusive rock set in matrix of similar composition. The rock composition is approximately 30% tabular plagioclase phenocrysts (< 2 mm size) and approximately 25% dark green chlorite-calcite altered tabular former mafic phenocrysts (< 2 mm size) with a fine-grained K-feldspar-dominant matrix. The rock is strongly fractured with fractures filled with chlorite, calcite and Fe-ox.

Zone: SOUTH
Sample: TR80-C11 **Offcut #T-7**


view of stained offcut, scale in mm


same view of offcut with slightly coarse-grained fragment outlined in blue, note calcite fracture terminates at fragment boundary

LITHOLOGY:	Porphyritic micro-diorite breccia
ALTERATION TYPE:	K-feldspar, illite, chlorite-magnetite-calcite-pyrrhotite
MINERALIZATION:	Pyrrhotite
VEINLETS/ FRACTURES:	Calcite-(hematite), calcite, calcite-chlorite, Fe-ox

Polished Thin Section Description:
This section is strongly fractured and pervasively K-feldspar, illite, chlorite-magnetite-calcite-pyrrhotite altered micro-diorite breccia comprising fine to medium-grained porphyritic micro-diorite rock fragments in matrix of similar composition. The micro-diorite comprises phenocrysts of fine to medium-grained altered plagioclase and former fine to medium-grained, altered mafic phases with interstitial fine-grained altered plagioclase, K-feldspar and chlorite. Plagioclase is selectively replaced by K-feldspar with cores replaced by very fine-grained illite and locally overprinted by patchy anhedral calcite and chlorite aggregate. Former mafic phases are completely replaced by aggregates of chlorite, carbonate, magnetite, rutile and locally pyrrhotite. Major magnetite occurs disseminated and as replacement of mafic phenocrysts. Minor pyrrhotite occurs enclosing magnetite as replacement of former mafic phases. Traces of apatite occur disseminated. Traces of hematite occur partly replacing magnetite.

The section is strongly fractured and with locally breccia texture developed. Fractures include discontinuous calcite and calcite-chlorite filled fractures and sub-mm wide calcite-(hematite) veinlets. Traces of albite occur as selvages to some calcite veinlets. Locally brittle-fractured and brecciated areas of the section are infilled by chlorite-magnetite-rutile and carbonate aggregates. Late orange-brown Fe-ox-filled fractures crosscut the calcite-filled fractures and veinlets.

Zone: SOUTH
Sample: TR80-C11 **Offcut #T-7**

HOST ROCK:
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
K-feldspar	30	fine to very fine-grained aggregates, occurs interstitial to plagioclase and as selective replacement of plagioclase, overprinted by illite, calcite and chlorite	
Plagioclase	20	fine to medium-grained (< 2 mm), eu-subhedral crystals, locally zoned, occurs as phenocrysts, composition of An_{25-28} (based on 3 measurements) and matrix, selectively replaced by K-felspar and subsequently by illite and locally patchy chlorite and calcite	*Polysynthetic twinning-albite*
Chlorite	10	very fine-grained, anhedral aggregates, occurs with calcite, magnetite and rutile aggregate as replacement of former mafic phenocrysts, occurs as patchy replacement of feldspars	
Illite	8	very fine-grained, anhedral to flaky aggregates, occurs as selective replacement of feldspars	
Magnetite	7	Fine-grained (< 0.3mm), subhedral grains and aggregates, occurs as replacement of former mafic phenocrysts, also occurs disseminated	
Calcite	5	very fine-grained, anhedral aggregates, occurs locally as patchy replacement of feldspars, overprints illite alteration	

MINOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Pyrrhotite	1	fine-grained (< 0.6 mm), eu-subhedral grains and aggregates, occurs disseminated and replacing former mafic phenocrysts, commonly rimmed and partly replaced by hematite	
Rutile	tr	very fine-grained, anhedral aggregates, occurs with chlorite partly replacing former mafic phenocrysts	
Epidote	tr	very fine-grained to aphanitic aggregates, occurs as patchy aggregates, replacing breccia matrix	
Apatite	tr	fine-grained (< 0.3 mm), hexagonal forms, disseminated	*high relief*
Hematite	tr	very fine-grained, occurs rarely partly replacing magnetite and commonly rimming and partly replacing pyrrhotite	

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm

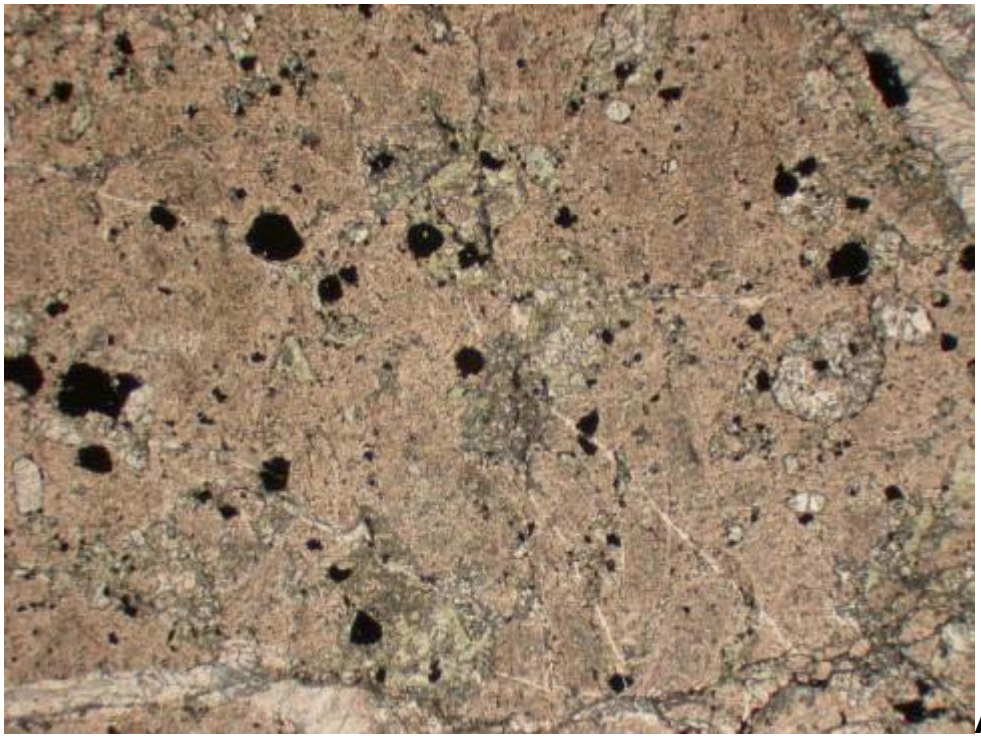
Please see over for VEINLETS/ FRACTURES

Zone: SOUTH
Sample: TR80-C11 **Offcut #T-7**

VEINLETS/ FRACTURE INFILL:

Mineral	%	Distribution & Characteristics*	Optical
Calcite	2	fine-grained (< 0.3 mm), anhedral aggregates, occurs as sub-mm veinlets with hematite	
	10	-fine to very fine-grained (< 0.3 mm), occurs as fracture infill, locally with albite vein selvages, cut by Fe-ox filled fractures	
Chlorite	4	occurs in fractures with calcite	
Fe-ox	2	very fine-grained, anhedral aggregates, occurs as late fracture infill, crosscuts and infills margins of calcite filled fractures	*orange-brown*
Rutile	tr	very fine-grained, anhedral aggregates, occurs with chlorite within fractures	
Hematite	tr	fine -grained (< 1 mm), subhedral aggregates, occurs in sub-mm wide veinlets with calcite	
Albite	tr	very fine-grained, anhedral aggregates, occurs as selvages to some calcite filled fractures	

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm



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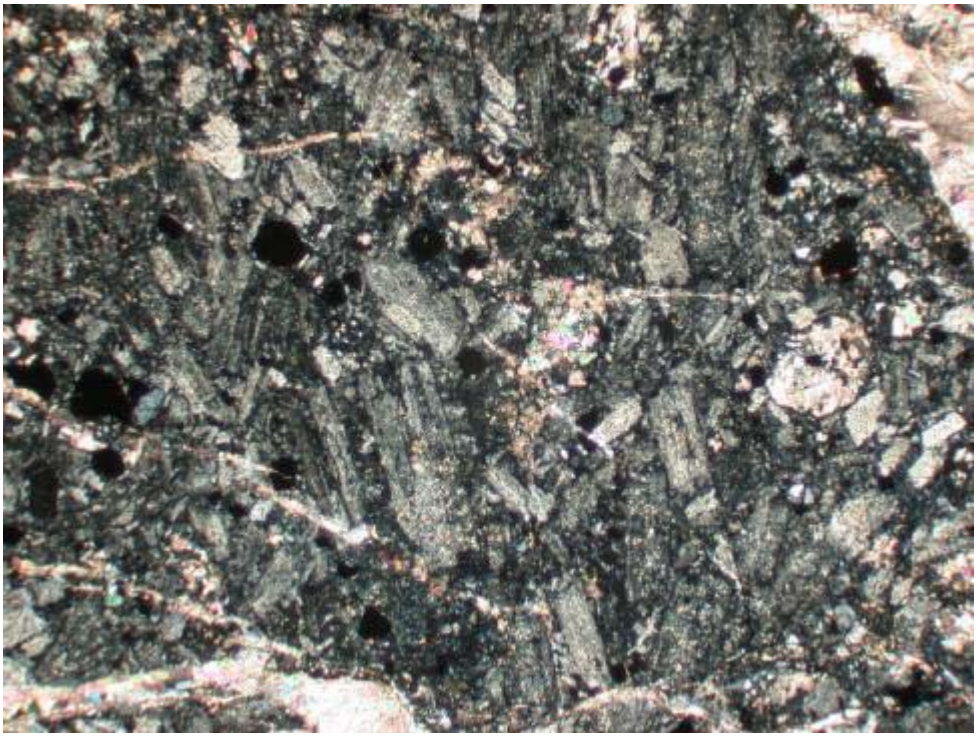
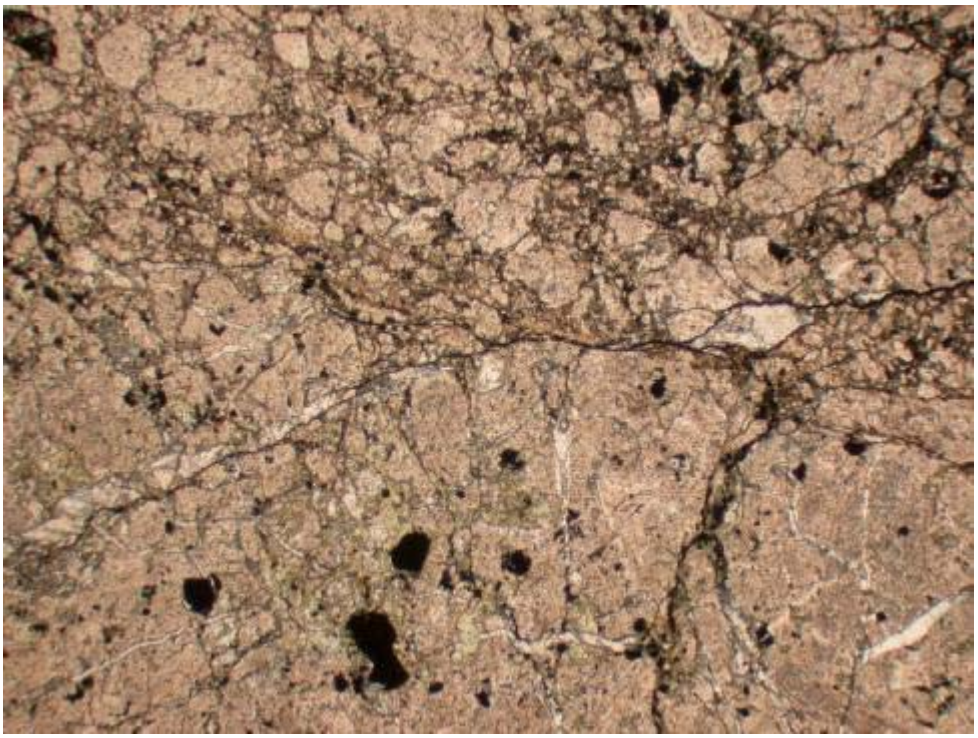


B

Sample: TR80-C11
A & B) Overview of sample shows fractured and pervasively K-feldspar, illite, chlorite-magnetite-calcite altered micro-diorite. Note disseminated magnetite (opaque). A) PPL, B) XPL, FOV = ~ 4.5 mm.



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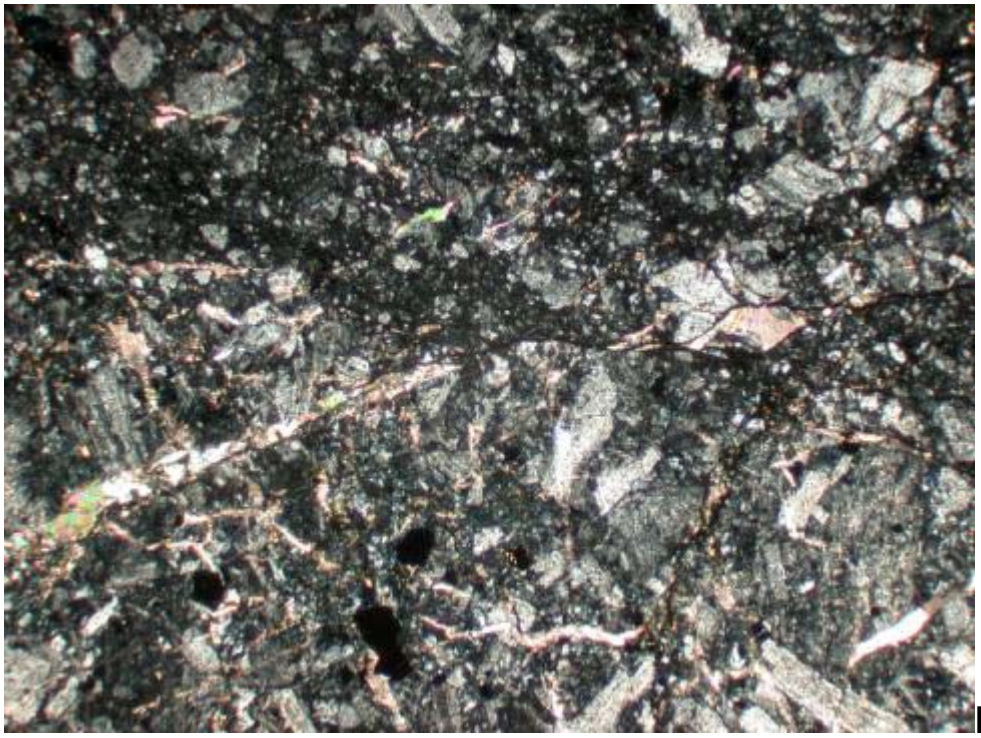
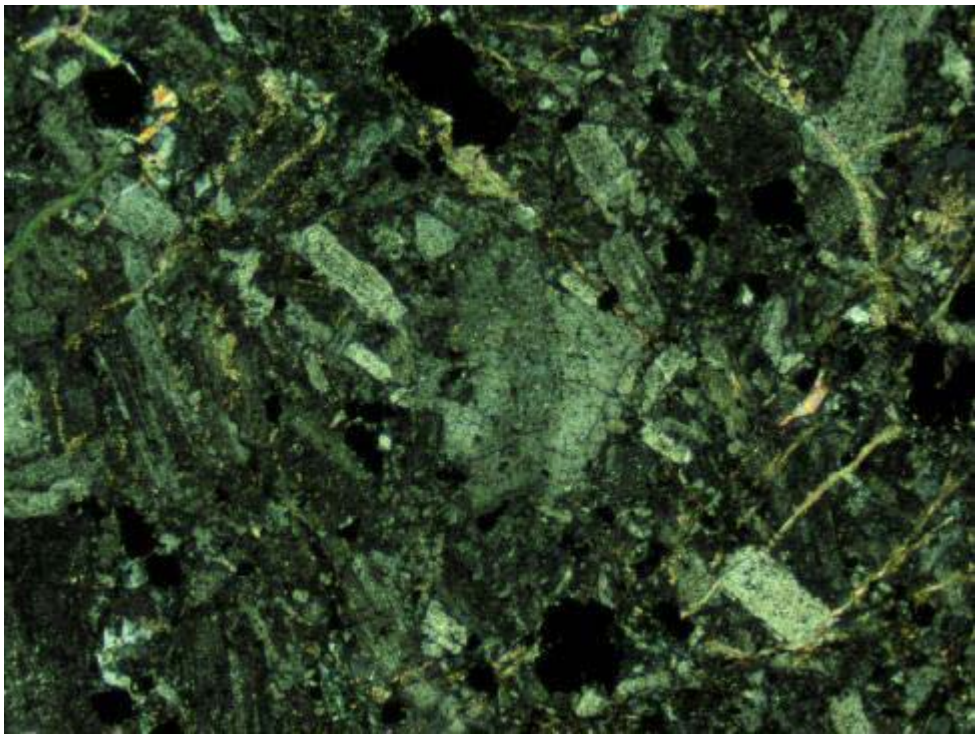
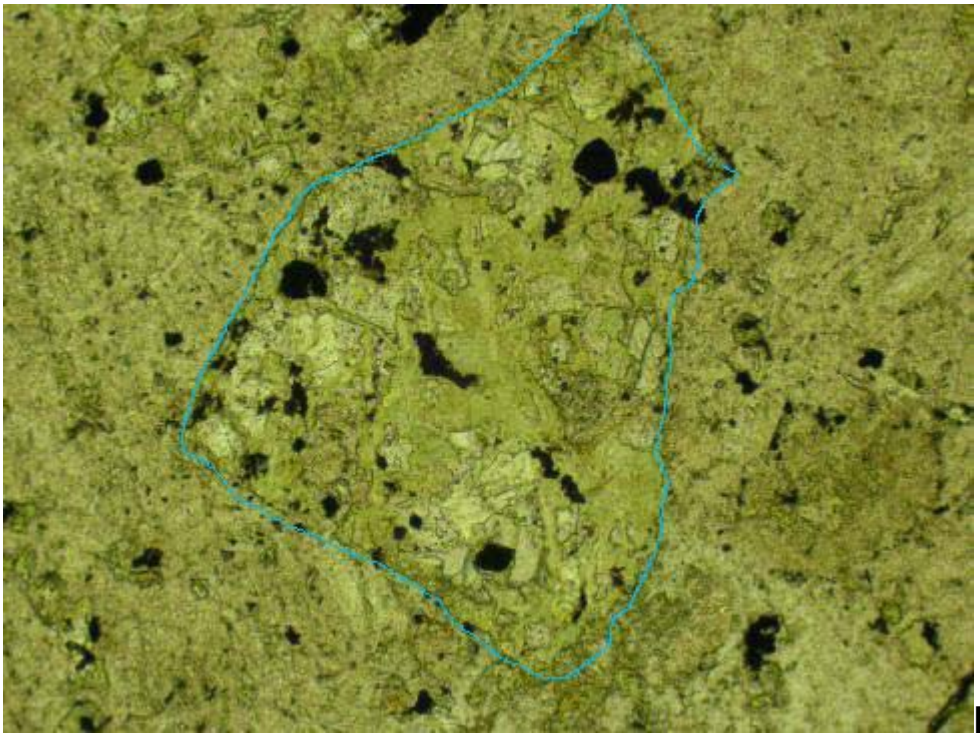


D

Sample: TR80-C11
C & D) View of strongly brittle fractured and brecciated area of host rock. Breccia infill is dominantly chlorite-magnetite-rutile and carbonate. A) PPL, B) XPL, FOV = ~ 4.5 mm.

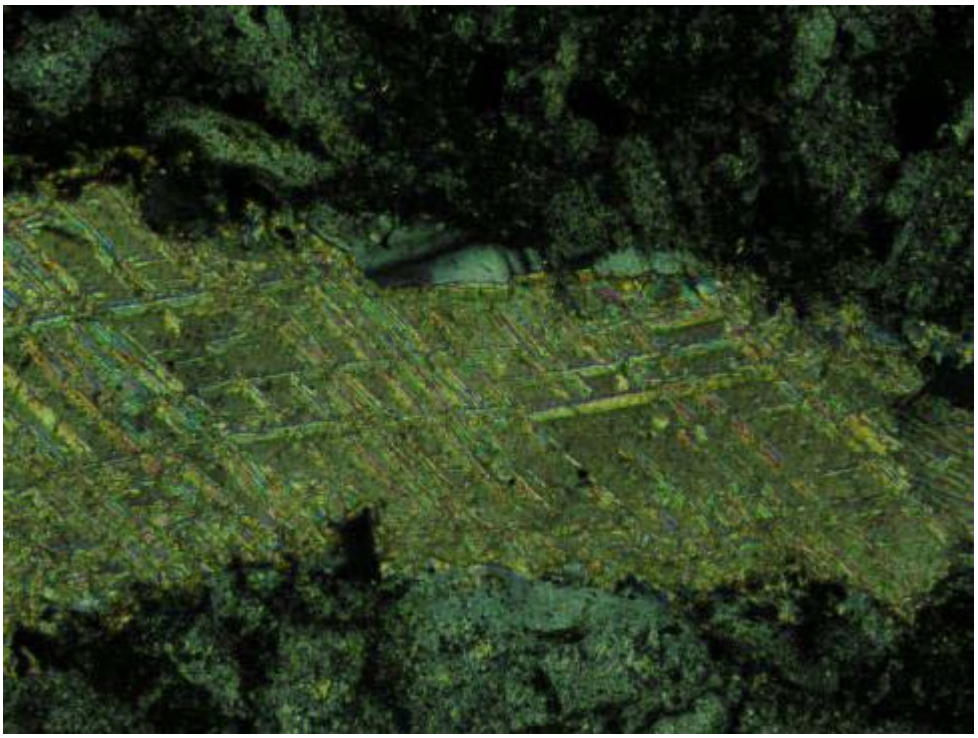


E



F

Sample: TR80-C11
E) Detailed view of altered micro-diorite. XPL, FOV = ~ 2.6 mm. F) Detailed view of former mafic phenocryst (outlined in blue) replaced by chlorite, carbonate, magnetite and rutile aggregates. PPL, FOV = ~ 1.3 mm.



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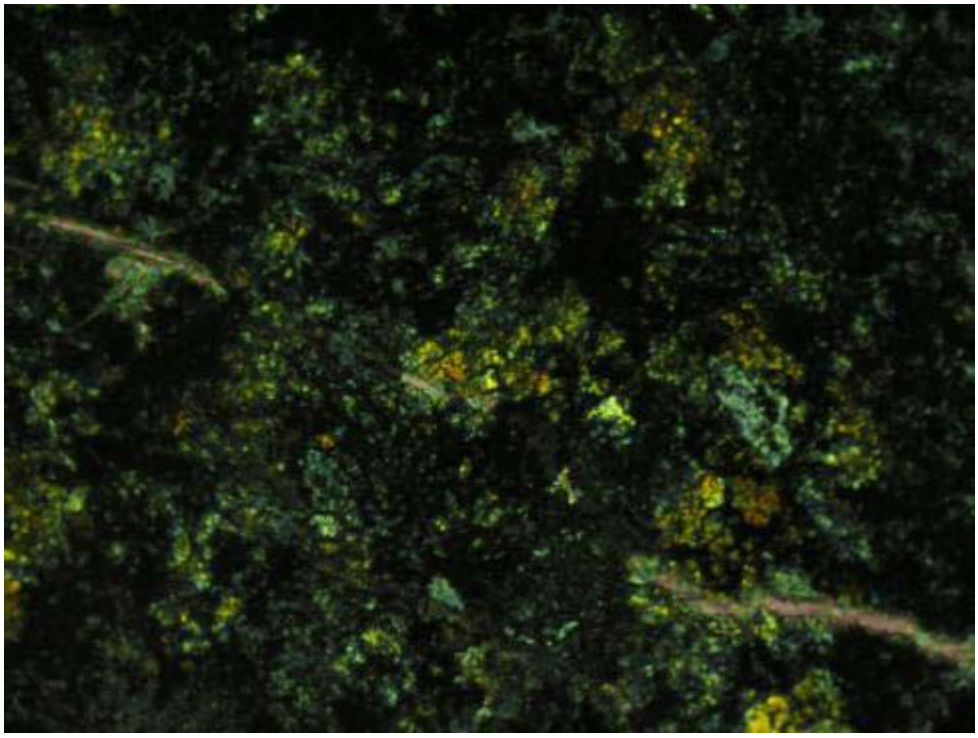
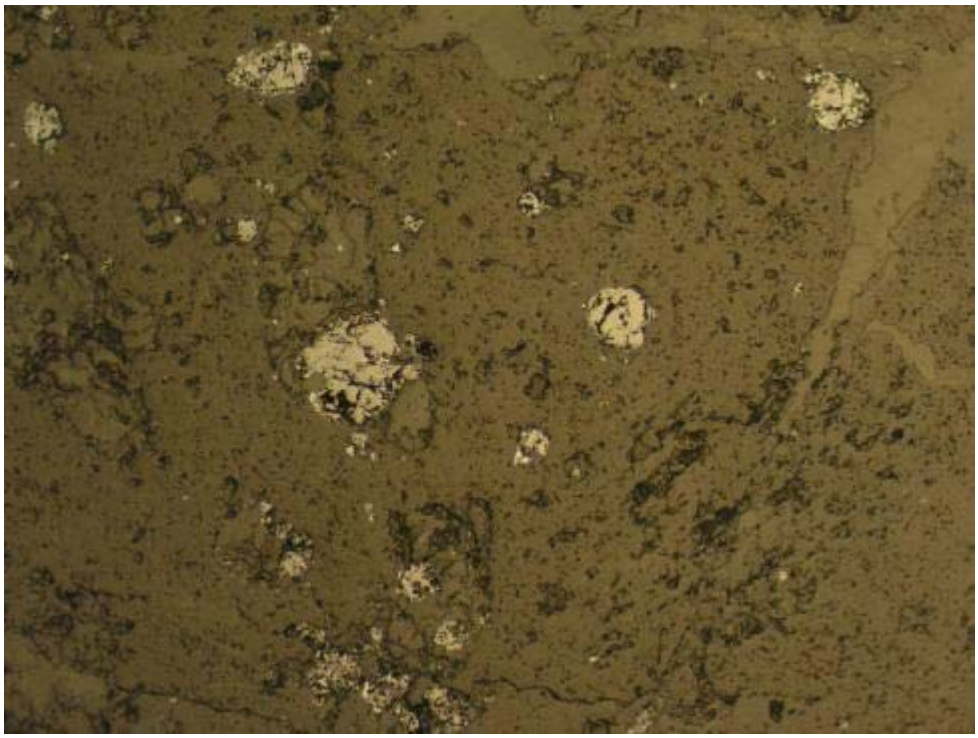


H

Sample: TR80-C11
G) View of patchy albite as selvages to calcite veinlet. XPL, FOV = ~ 1.3 mm. H) View of patchy epidote replacement of breccia matrix. XPL, FOV = ~ 0.7 mm.



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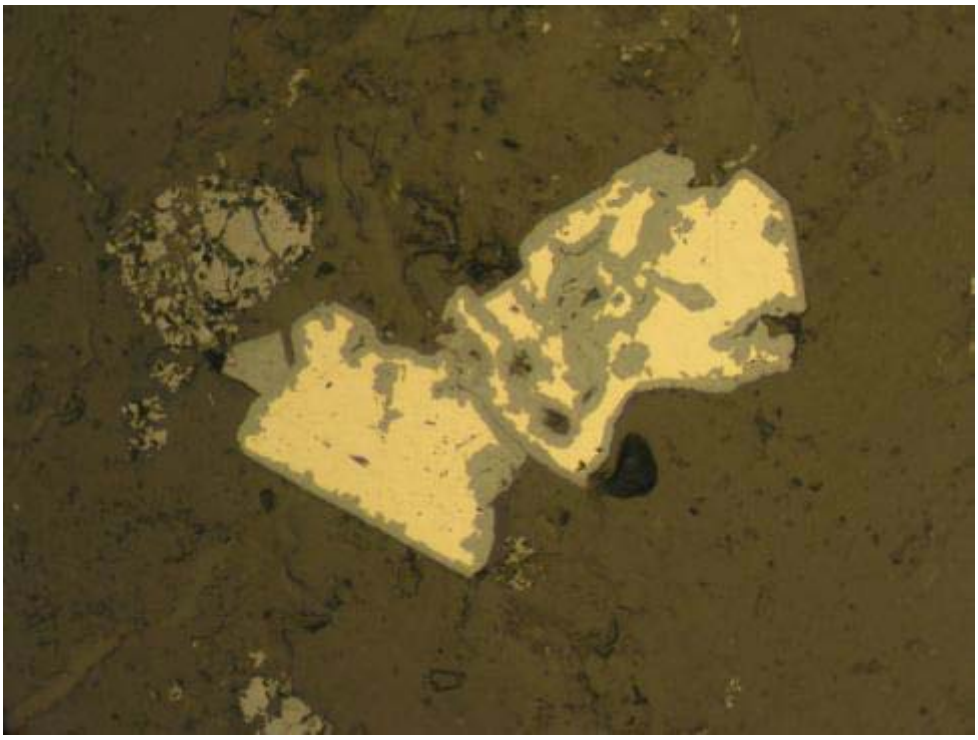


J

Sample: TR80-C11

I) View of magnetite as replacement of former mafic phases and disseminated magnetite. RL, FOV = ~ 2.6mm. J) Pyrrhotite aggregate rimmed and partly replaced by very fine-grained hematite. RL, FOV = ~ 0.7 mm.

Zone: SOUTH
Sample: TR80-C85 **Offcut #T-8**

view of hand sample


view of stained section offcut, scale in mm

Hand Sample Test Results:
Reaction of sample to magnet. Strong reaction of fractures and veinlets to cold, dilute HCl. Positive test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Typically fine-grained, dark green vaguely fragmental rock. Fragments to 3.5cm size are similar composition to matrix and more apparent on weathered surface. The rock has abundant fine-grained white tabular crystals and major fine to medium-grained mafic forms. Patchy K-feldspar occurs throughout the rock (approximately 10% based on stain). Traces of disseminated pyrite. Calcite and locally a purple stained phase occur as 2-5 mm wide discontinuous lenses filling a network of open fractures cutting the rock. Orange-brown Fe-ox occurs as a late fracture coating.

Zone: SOUTH
Sample: TR80-C85 **Offcut #T-8**


view of stained section offcut, scale in mm

LITHOLOGY:	Pervasively altered fragmental and porphyritic rock
ALTERATION TYPE:	Carbonate-chlorite, biotite, K-feldspar, hematite (after magnetite)
MINERALIZATION:	(Pyrite, chalcopyrite)
FRACTURES/VEINLETS:	Chlorite-(rutile)
	Calcite, carbonate-hematite
	Fe-ox

Polished Thin Section Description:
This section is a strongly fractured and pervasively carbonate altered and to a lesser extent patchy biotite, K-feldspar, chlorite, hematite (after magnetite) altered former vaguely fragmental and porphyritic rock. Relict fine to medium-grained plagioclase phenocrysts are locally preserved. Plagioclase is selectively replaced by very fine-grained K-feldspar and overprinted by patchy anhedral carbonate and chlorite aggregate. Carbonate is the dominant alteration occurring as very fine-grained anhedral aggregates that pervasively replace the rock. Secondary K-feldspar and biotite occur throughout the rock as very fine-grained anhedral patchy aggregates. Former mafic phases are completely replaced by aggregates of biotite, chlorite, rutile and hematite (after magnetite). Major hematite (after magnetite) occurs disseminated and as replacement of mafic phenocrysts. Traces of very fine-grained pyrite and chalcopyrite occur disseminated. Chalcopyrite is locally rimmed by chalcocite-covellite or Fe-ox. Traces of fine-grained apatite occur disseminated.

The section is strongly fractured and veined. Fractures are infilled by chlorite-(rutile) aggregate. Discontinuous veinlets of calcite and lenses of hematitic carbonate (purple colour in hand sample) occur as open space filling. Calcite is fine to medium-grained and occurs as interlocking aggregates and brecciated fragments. Traces of very fine-grained pyrite occur rarely in the calcite veinlets. Hematitic carbonate is fine-grained and partly replaced by specular hematite aggregate which imparts a purple colour in hand sample. Late orange-brown Fe-ox filled fractures are abundant.

Zone: SOUTH
Sample: TR80-C85 **Offcut #T-8**

HOST ROCK:
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Carbonate	50	very fine-grained, anhedral aggregates, occurs with chlorite as patchy to pervasive replacement of rock	
Biotite	10	very fine-grained, shreddy aggregates, secondary, partly replaced by chlorite	*green*
Chlorite	5	very fine-grained, anhedral aggregates, occurs as patchy replacement of former mafic phases including biotite	
K-feldspar	8	very fine-grained, anhedral aggregates, secondary, overprinted by chlorite and carbonate aggregates	

MINOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Hematite	4	fine-grained (< 0.3mm), anhedral fractured grains and aggregates, occurs as replacement of magnetite	
Plagioclase	1	fine to medium-grained (< 3 mm), relict phenocrysts, partly replaced by chlorite and carbonate aggregates	*polysynthetic twinning*
Fe-ox	tr	very fine-grained, occurs as rims to rare chalcopyrite grains, occurs locally as stain to chlorite-alteration	*brown*
Magnetite	tr	fine-grained, occurs rarely as relict anhedral fractured grains, virtually completely replaced by hematite	
Pyrite	tr	fine-grained (< 0.3 mm), eu-subhedral grains and aggregates, cubic forms, disseminated, rims partly replaced by Fe-ox	
Apatite	tr	fine-grained (< 0.3 mm), high relief, disseminated grains	
Chalcopyrite	tr	very fine-grained, anhedral aggregates, occurs disseminated, partly rimmed and replaced by Fe-ox or by chalcocite and covellite	
Chalcocite	tr	very fine-grained, occurs as rims to rare chalcopyrite grains	
Covellite	tr	very fine-grained, occurs as rims to rare chalcopyrite grains	

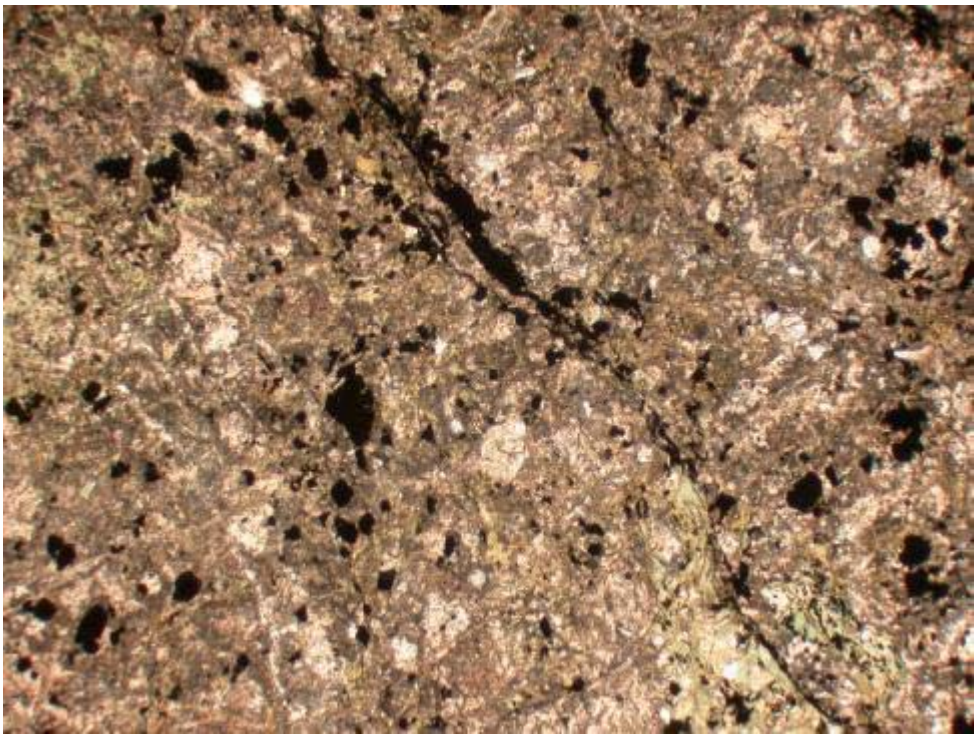
See over for VEINLETS/ FRACTURE INFILL

Zone: SOUTH
Sample: TR80-C85 **Offcut #T-8**

VEINLETS/ FRACTURE INFILL:

Mineral	%	Distribution & Characteristics*	Optical
Calcite	13	fine to medium grained (< 2 mm), anhedral aggregates, occurs interlocking grains and brecciated fragments in veinlets	
Fe-ox	3	very fine-grained, anhedral aggregates, occurs as late fracture infill, crosscuts carbonate veinlets	*orange-brown*
Carbonate, hematitic	3	fine-grained (< 0.2 mm), anhedral aggregates, occurs as discontinuous lenses within calcite veinlets, partly replaced by very fine-grained hematite aggregate imparting purple colour	
Chlorite	1	very fine to fine-grained, anhedral to radiating platy aggregates, occurs as fracture infill, crosscut by calcite veinlets	
Actinolite	1	fine-grained, radiating aggregates, occurs as fracture infill, partly replaced by chlorite	
Hematite	tr	very fine-grained, specular aggregates, occurs as replacement of carbonate lenses, gives purple colour	*red*
Pyrite	tr	fine-grained (< 0.3 mm), eu-subhedral grains and aggregates, cubic forms, disseminated, rims partly replaced by Fe-ox	
Rutile	tr	very fine-grained, anhedral aggregates, occurs with chlorite as fracture infill	*brown*

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm



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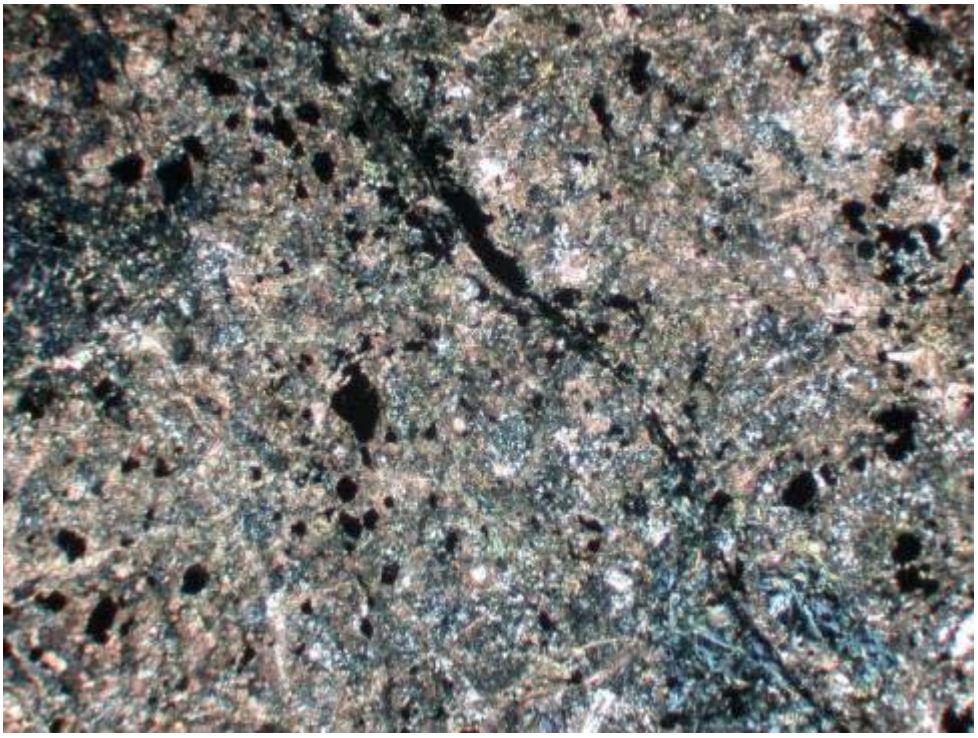
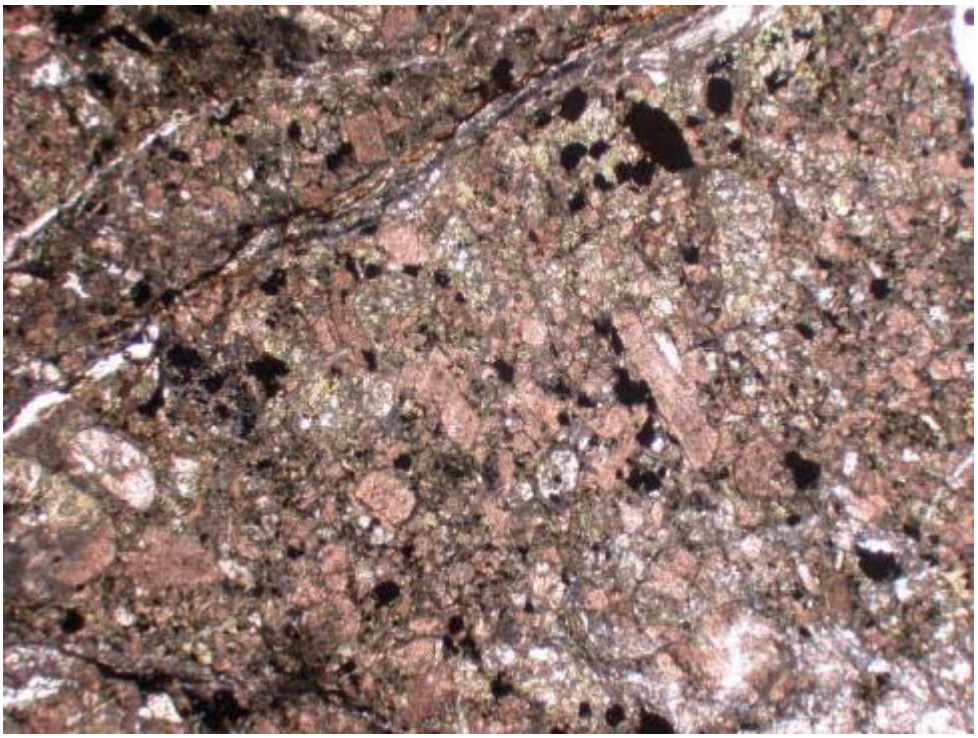


B

Sample: TR80-C85
A & B) Overview of strongly fractured and pervasively carbonate altered and to a lesser extent patchy biotite, K-feldspar, chlorite, hematite (after magnetite) altered rock. A) PPL, B) XPL, FOV = ~ 4.5 mm.



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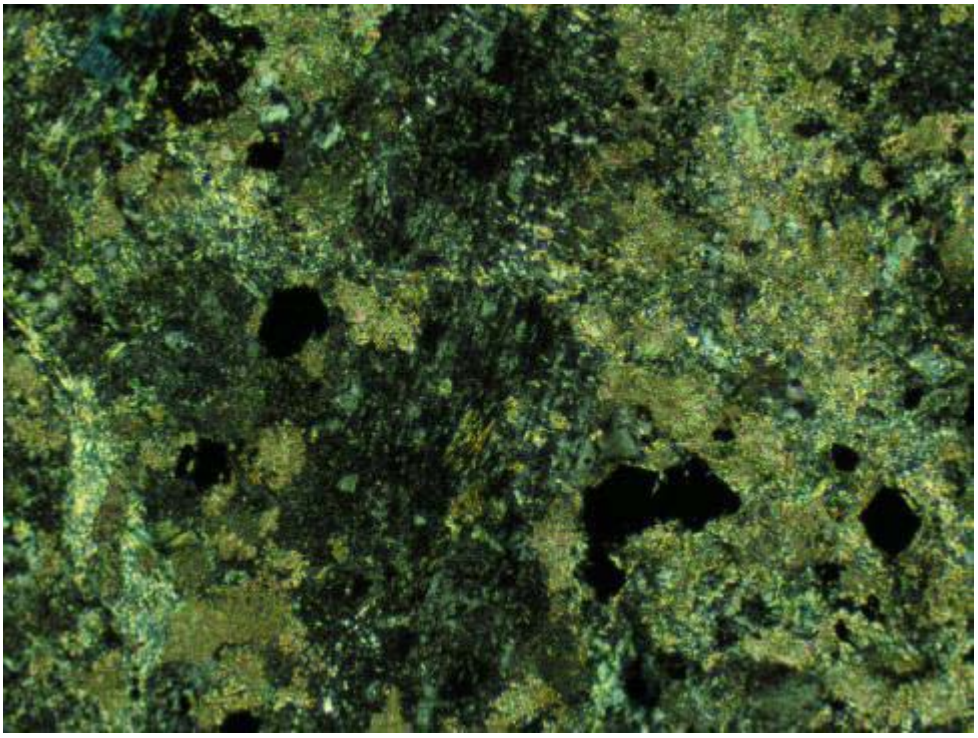
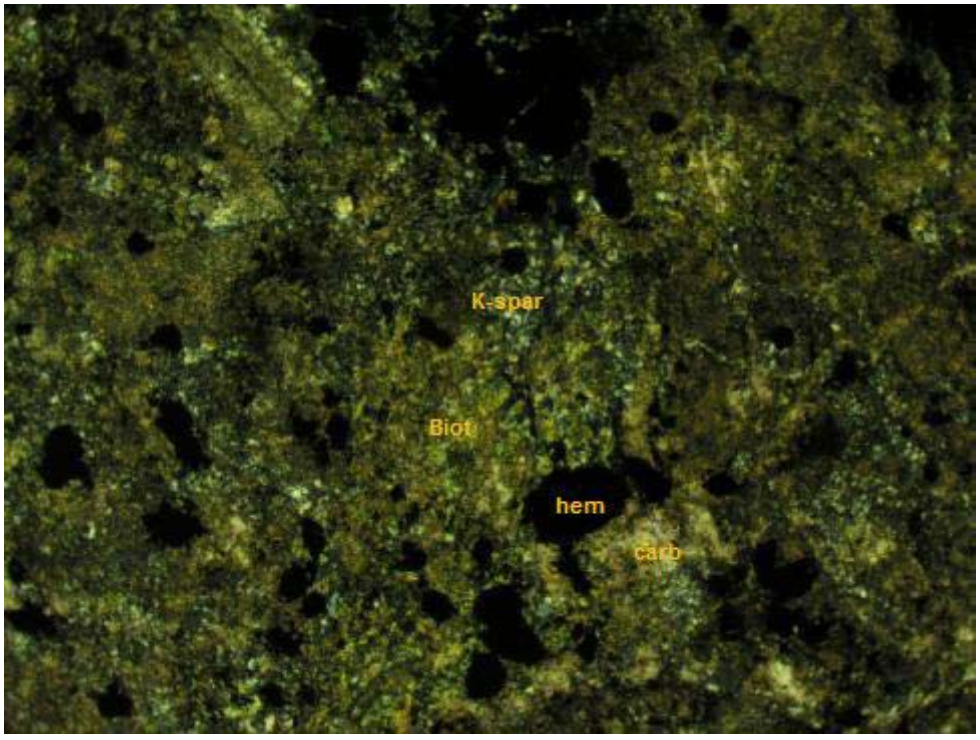


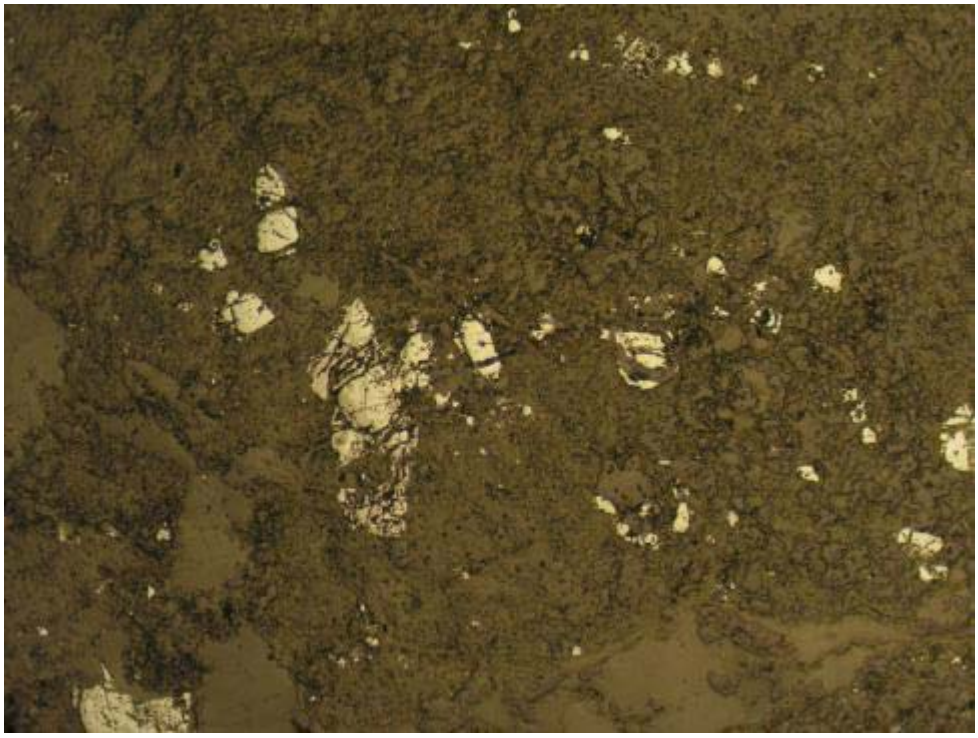
D

Sample: TR80-C85

C) Views of portion of section where porphyritic texture is preserved. PPL, FOV = ~ 4.5 mm. D) View of relict plagioclase phenocryst partly replaced by biotite, chlorite and carbonate. XPL, FOV = ~ 1.3 mm.

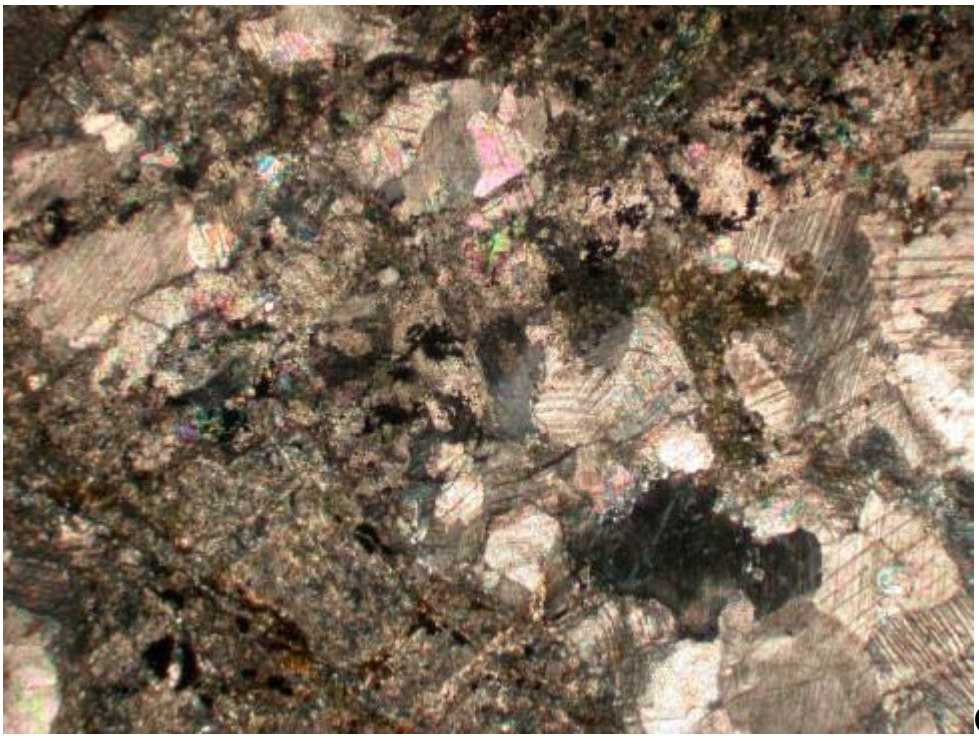


E

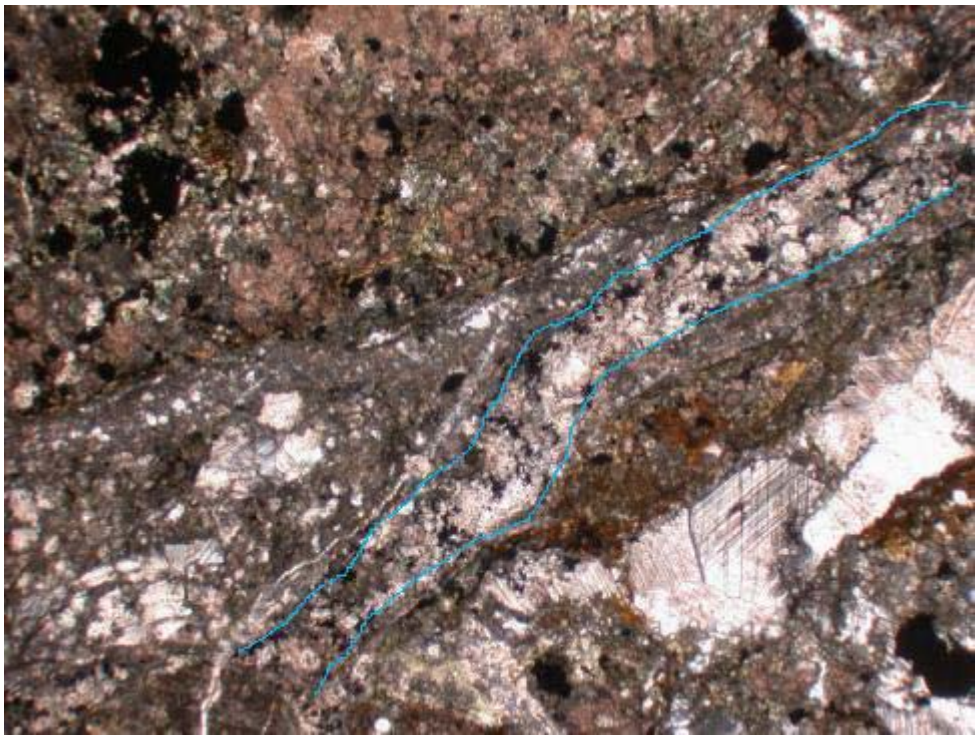


F

Sample: TR80-C85
E) Detailed view of pervasively K-feldspar (K-spar), biotite (Biot), hematite (opaque, replacing magnetite) and carbonate (carb) altered rock. XPL, FOV = ~ 2.6 mm. F) Disseminated hematite (after fine-grained magnetite). RL, FOV = ~ 2.6 mm.



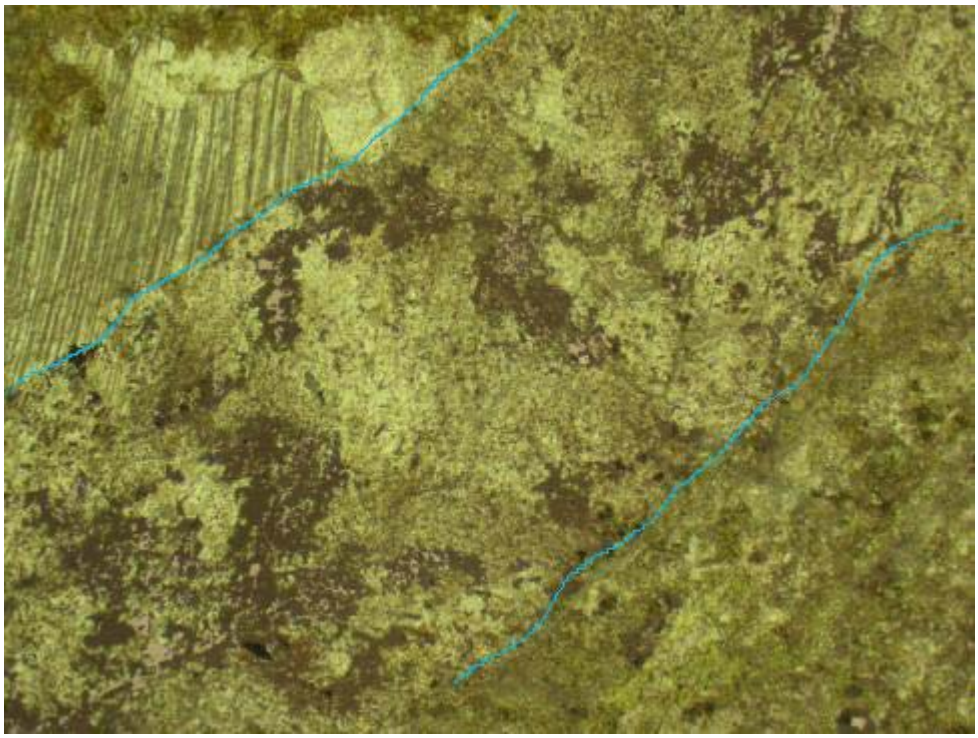
G



H

Sample: TR80-C85

G) View of carbonate-hematite lens and calcite infill forming veinlets. Carbonate lens may predate calcite infill. XPL, FOV = ~ 4.5 mm. H) View of fine-grained carbonate-hematite lens within brecciated carbonate veinlet. PPL, FOV = ~ 4.5 mm.



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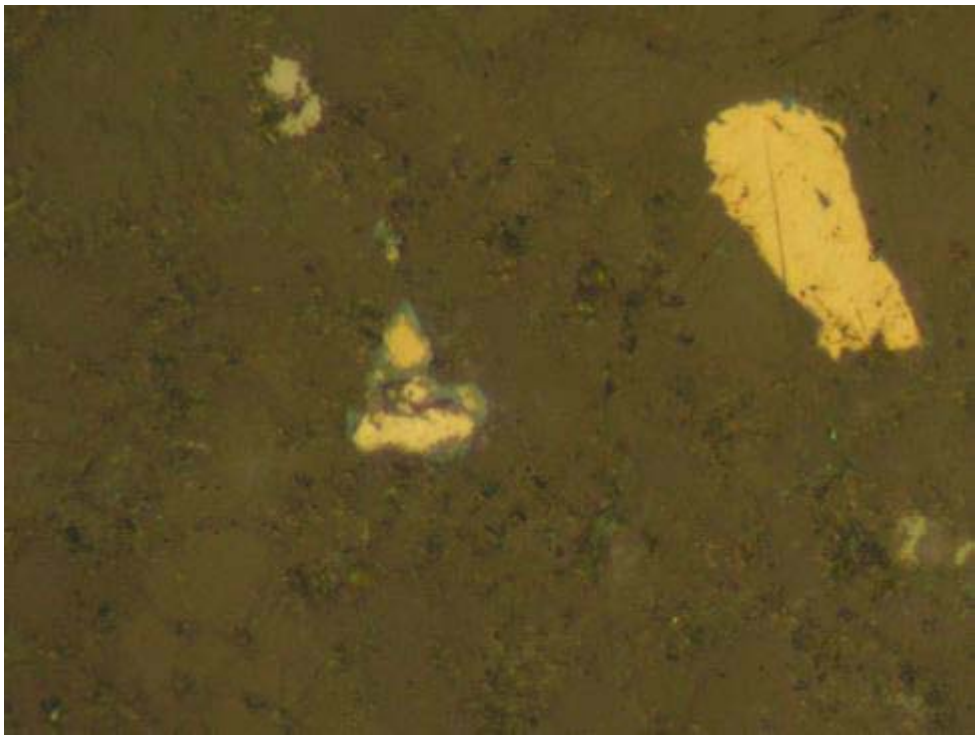


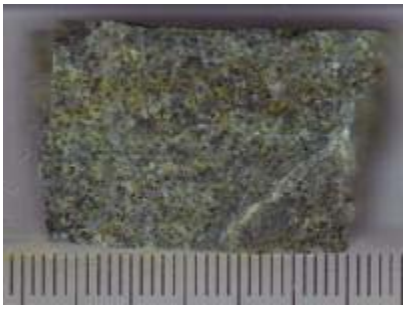
J

Sample: TR80-C85

I) Detailed view of carbonate-hematite lens within calcite veinlet. PPL+RL, FOV = ~ 1.3 mm. J) View of disseminated chalcopyrite and pyrite. Note chalcopyrite rimmed and partly replaced by chalcocite-covellite. RL, FOV = ~ 0.1 mm.

Zone: SOUTH
Sample: TR80-C96 **Offcut #T-9**

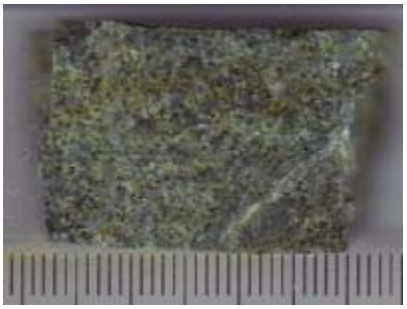
view of hand sample


view of stained section offcut, scale in mm

Hand Sample Test Results:
Reaction of sample to magnet. Strong reaction of fractures to cold, dilute HCl. Positive test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Fine-grained dark greenish-white intrusive rock comprising dominantly plagioclase and approximately 25% altered former mafic phases. Minor K-feldspar occurs as patchy distribution replacing plagioclase and veinlets. Calcite occurs as fracture infill (based on reaction to HCl).

Zone: SOUTH
Sample: TR80-C96 **Offcut #T-9**


view of stained section offcut, scale in mm

LITHOLOGY:	Fractured and locally brecciated micro-quartz diorite
ALTERATION TYPE:	?Actinolite, K-feldspar, chlorite, magnetite, illite, rutile
MINERALIZATION:	Pyrrhotite
FRACTURES/VEINLETS:	K-feldspar
	Chlorite-epidote-calcite-(rutile)
	Pyrrhotite-hematite-chlorite
	Calcite
	Fe-ox

Polished Thin Section Description:
This section is strongly fractured and locally brecciated ?actinolite-K-feldspar-chlorite-magnetite-illite-rutile altered micro-quartz diorite. The micro-quartz diorite comprises crystals of fine-grained locally zoned plagioclase and former fine-grained altered mafic phases with interstitial fine-grained quartz and minor K-feldspar. Plagioclase is selectively replaced by very fine-grained illite and locally overprinted by patchy anhedral calcite and chlorite aggregate. K-feldspar occurs locally partly replacing plagioclase. Former mafic phases are completely replaced by aggregates of ?actinolite, chlorite, rutile and magnetite. Major magnetite occurs disseminated and as replacement of mafic phenocrysts. Rarely traces of hematite occur partly replacing magnetite. Rare traces of zircon occur disseminated.

The section is strongly fractured and locally brecciated. K-feldspar veinlets appear to be early and are crosscut by later chlorite-bearing fractures. Fractures and patches of brecciated quartz diorite are infilled by very fine-grained chlorite-epidote-calcite±(rutile) aggregates. Pyrrhotite occurs as fracture-controlled stringers with chlorite. Pyrrhotite is mostly replaced by hematite. The section is cut by late sub-mm wide calcite veinlets and by late brown Fe-ox filled fractures.

Zone: SOUTH
Sample: TR80-C96 **Offcut #T-9**

HOST ROCK:
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Plagioclase, oligoclase	45	fine-grained (< 1 mm), eu-subhedral crystals, locally zoned composition of An_{26-28} (based on 3 estimates), interstitial quartz and minor K-feldspar, partly replaced by illite and locally K-feldspar, chlorite and calcite aggregates	*polysynthetic twinning-albite*
Chlorite	15	very fine-grained, anhedral aggregates, occurs as replacement of former mafic phases including actinolite	
Quartz	10	fine-grained (< 0.2 mm), anhedral, primary, occurs interstitial to plagioclase	
?Actinolite	5	fine-grained (< 0.4 mm), anhedral aggregates, occurs as replacement of former mafic phases, partly replaced by chlorite and rutile aggregates	
Magnetite	5	fine-grained (< 0.2mm), anhedral fractured grains and aggregates, occurs associated with patchy actinolite/chlorite, also occurs disseminated, rarely partly replaced by hematite	

MINOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
K-feldspar	3	fine to very fine-grained, occurs interstitial to plagioclase and locally as patchy replacement of plagioclase	
Illite	2	very fine-grained, anhedral aggregates, occurs partly replacing plagioclase	
Rutile	2	very fine-grained, anhedral aggregates, occurs with chlorite as replacement of former mafic phases	*brown*
Hematite	tr	very fine-grained, occurs rarely partly replacing magnetite	
Calcite	tr	very fine-grained, anhedral aggregates, occurs locally as patchy replacement of plagioclase	
Epidote	tr	very fine-grained, anhedral aggregates, occurs as patchy replacement of plagioclase in part of the section	
Zircon	tr	very fine-grained, high relief, disseminated grains	

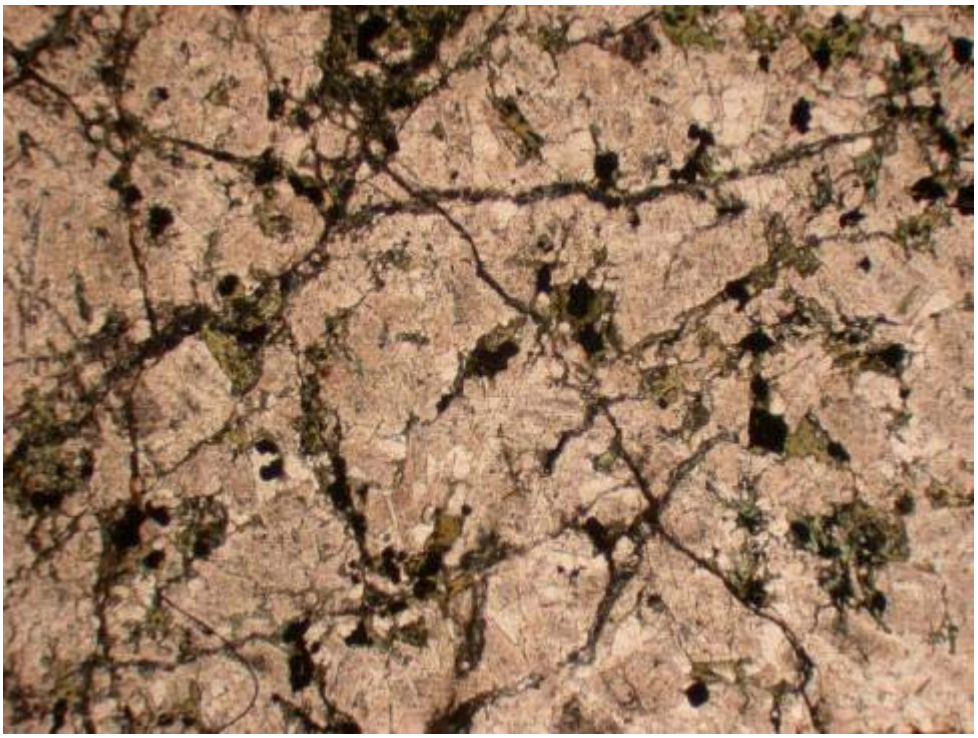
See over for VEINLETS/ FRACTURE INFILL

Zone: SOUTH
Sample: TR80-C96 **Offcut #T-9**

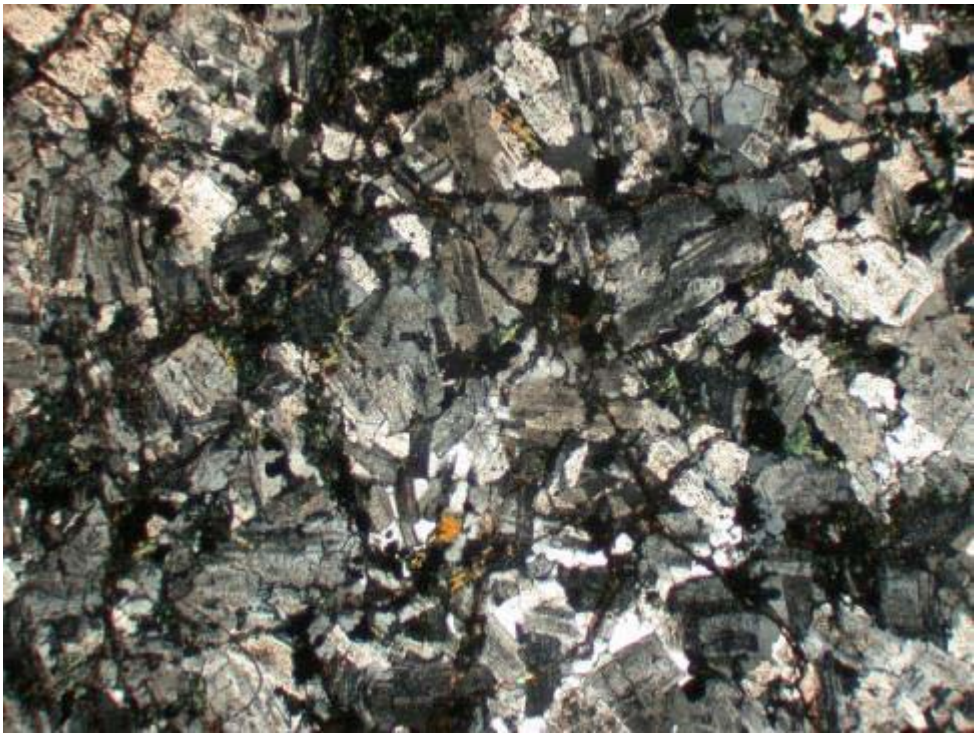
VEINLETS/ FRACTURE INFILL:

Mineral	%	Distribution & Characteristics*	Optical
Fe-ox	3	very fine-grained, anhedral aggregates, occurs as late fracture infill, locally replaces carbonate in fractures	*brown*
Chlorite	3	very fine-grained, anhedral aggregates, occurs as fracture infill associated with hematite and pyrrhotite, occurs as breccia infill with epidote	
Calcite	2	fine-grained (< 0.3 mm), aggregates, occurs veinlet with Fe-ox vein margins and infill -very fine-grained, aggregates, occurs with epidote and chlorite as breccia infill	
Pyrrhotite	1	fine-grained (< 0.2 mm), anhedral aggregates, occurs as stringers, fracture-controlled, rims replaced by hematite	
K-feldspar	1	fine-grained (< 0.2 mm), anhedral aggregates, occurs as irregular veinlets, crosscut bychlorite-filled fractures	
Hematite	1	very fine-grained, occurs as replacement of pyrrhotite	*red*
Epidote	1	Very fine-grained aggregates, occurs with calcite and chlorite as breccia infill	
Magnetite	tr	fine-grained, anhedral aggregates, occurs locally with chlorite, epidote and calcite as breccia infill	
Rutile	tr	very fine-grained, anhedral aggregates, occurs with chlorite as fracture infill	*brown*
?Gypsum	tr	fine to very fine-grained, partly plucked from section, occurs as fracture infill with carbonate	

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm

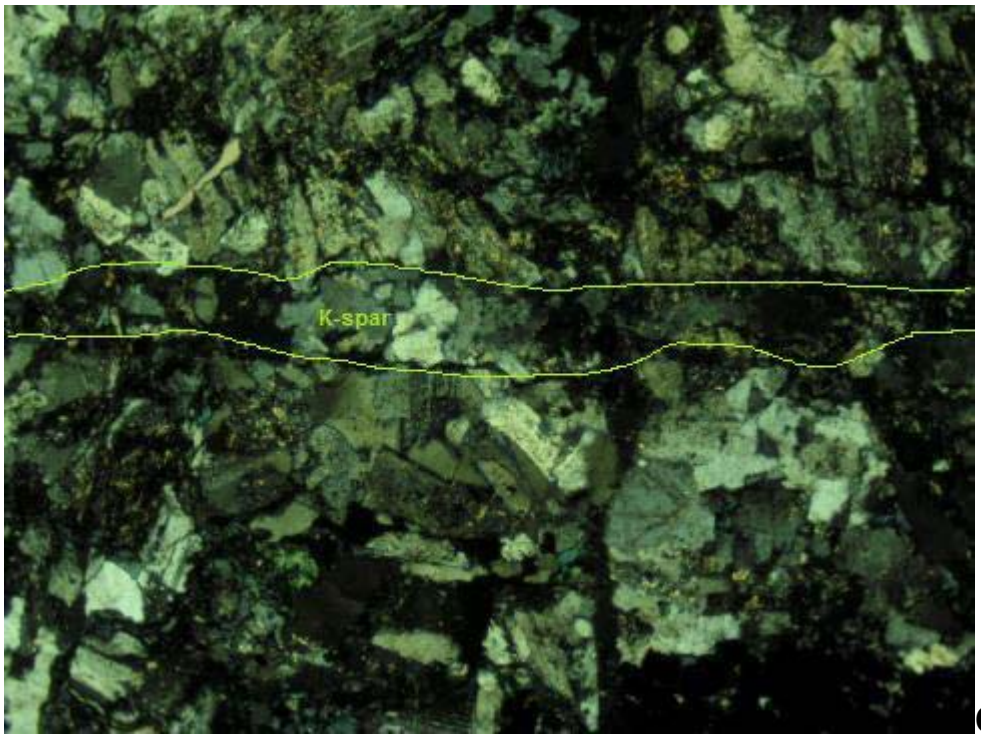


A



B

Sample: TR80-C96
A & B) Overview of strongly fractured quartz diorite. A) PPL, B) XPL, FOV = ~ 4.5 mm.



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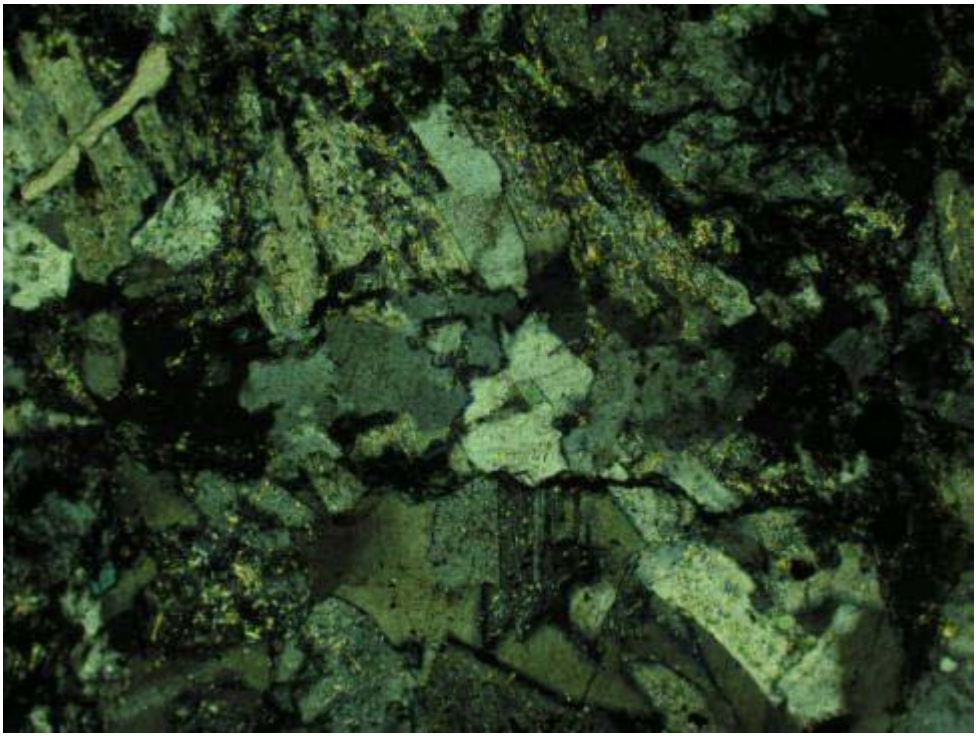
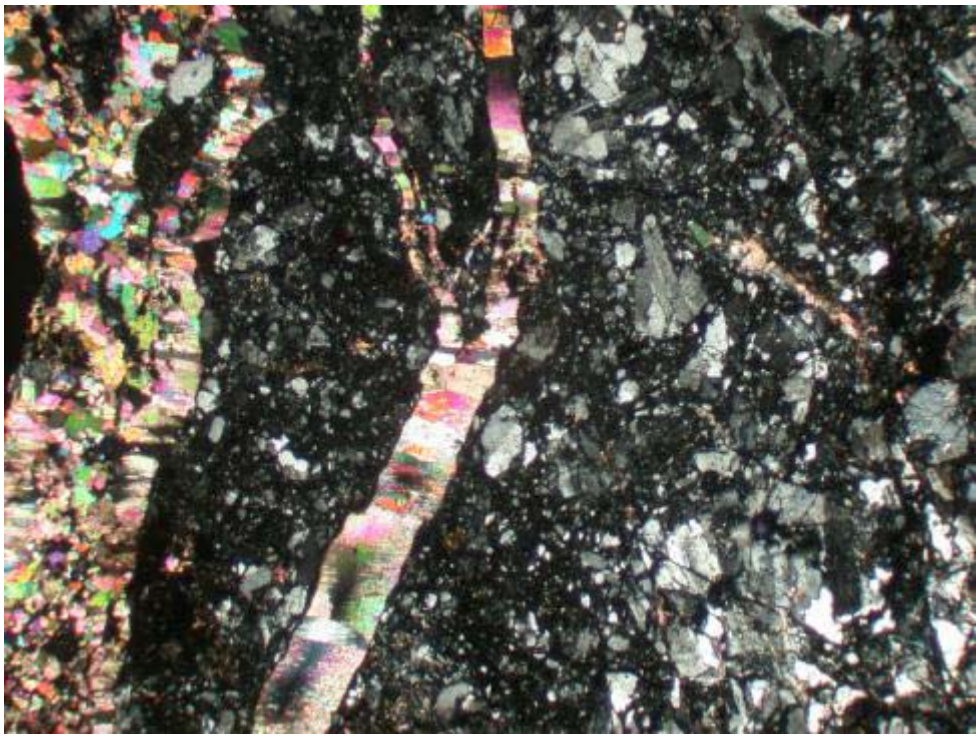


D

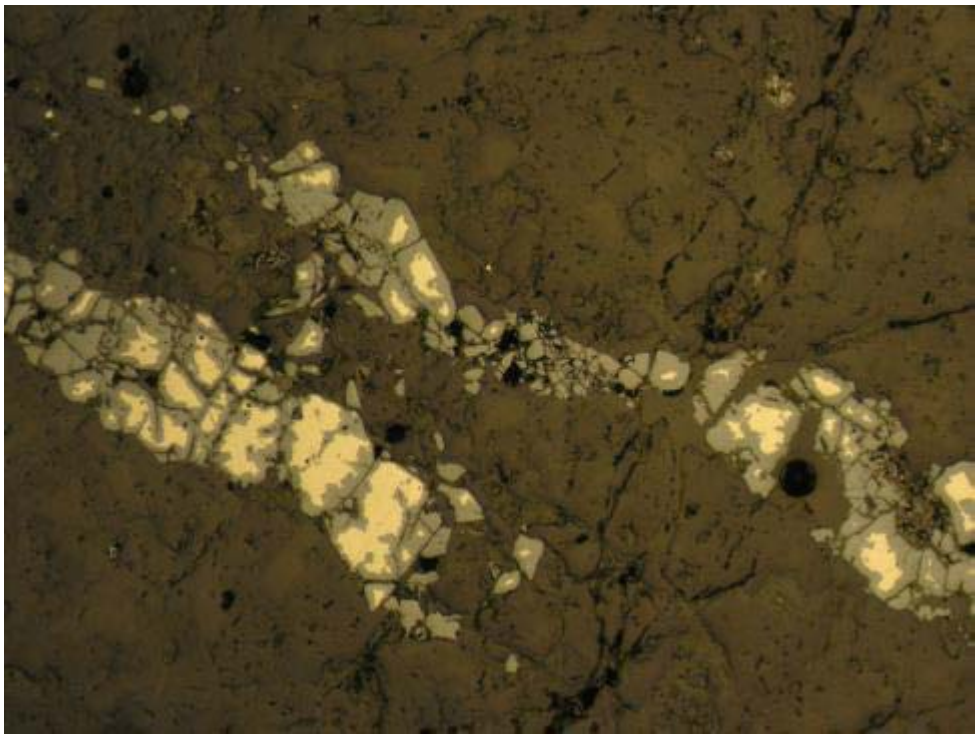
Sample: TR80-C96
C & D) Views of K-feldspar veinlet cutting quartz diorite. K-feldspar veinlet crosscut by later chlorite filled fractures. C) XPL, FOV = 2.6 mm, D) XPL, FOV = ~ 1.3 mm.



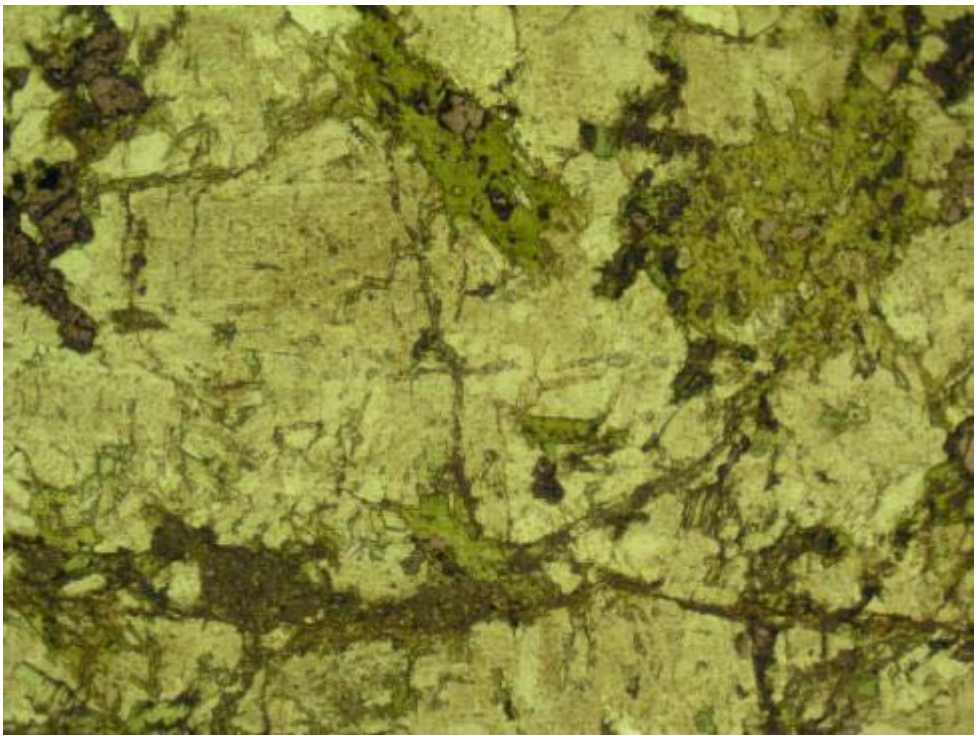
E

F

Sample: TR80-C96
E & F) Detailed views of locally brecciated quartz diorite with infill by very fine-grained chlorite-epidote and calcite. Note late calcite veinlet cuts across breccia in photo E. E) XPL, F) PPL, FOV = ~ 4.5 mm.



G



H

Sample: TR80-C96

G) Fracture-controlled stringer of pyrrhotite mostly replaced by hematite. RL, FOV = ~ 2.6 mm. H) View of fine-grained magnetite associated with patchy actinolite and chlorite (after former mafic phases). PPL+RL, FOV = ~ 2.4 mm.

Zone: GRANBY
Sample: MM-08-09 76.09-76.19m **Offcut #T-10**

view of hand sample


view of stained section offcut, scale in mm

Hand Sample Test Results:
No reaction of sample to magnet. Spotty reaction of fractures and patches within rock to cold, dilute HCl. Positive test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Porphyritic dark green ?andesite with approximately 10% fine-grained white tabular phenocrysts and 30% altered mafic phenocrysts in a very fine-grained, mottled K-feldspar altered groundmass.

Zone: GRANBY
Sample: MM-08-09 76.09-76.19m **Offcut #T-10**


view of stained offcut, scale in mm

LITHOLOGY:	Pervasively altered porphyritic rock (?andesite)
ALTERATION TYPE:	K-feldspar, chlorite, carbonate, rutile, illite, albite
MINERALIZATION:	Bornite, chalcocite, covellite
FRACTURES/VEINLETS:	Calcite ±bornite±(chlorite ±chalcocite-covellite±rutile±hematite)

Polished Thin Section Description:
This section is a pervasively K-feldspar, chlorite-carbonate-rutile-albite, illite altered porphyritic rock (?andesite) cut by fractures filled with calcite±bornite±(chlorite ±chalcocite-covellite±rutile±hematite). Relict fine to medium-grained plagioclase phenocrysts are locally preserved. Plagioclase is selectively replaced by very fine-grained K-feldspar with cores partly replaced by illite and locally overprinted by patchy anhedral carbonate and chlorite aggregate. Carbonate is colourless and likely mostly calcite based on reaction to HCl. Aggregates of chlorite-carbonate-rutile-albite and bornite occur as irregular patches, likely as replacement of former mafic phases. Major fine to very fine-grained bornite occurs disseminated and fracture controlled (see below). Bornite is typically partly replaced by chalcocite which is in turn partly replaced by covellite. Traces of fine-grained apatite occur disseminated.

The section is cut by numerous fractures filled with calcite±bornite±(chlorite ±chalcocite-covellite ± rutile ± hematite). Minor bornite occurs as fine to very fine-grained anhedral aggregates typically at the margins of calcite filled fractures but locally within some calcite-filled fractures. Bornite is locally partly replaced by traces of chalcocite and covellite and minor aggregates of hematite.

Zone: GRANBY
Sample: MM-08-09 76.09-76.19m **Offcut #T-10**

HOST ROCK:
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
K-feldspar	40	very fine-grained, anhedral aggregates, occurs as replacement of plagioclase phenocrysts and groundmass	
Chlorite	17	very fine-grained, anhedral aggregates, occurs with carbonate and rutile as patchy replacement of rock	
Carbonate, includes calcite	17	very fine-grained, anhedral aggregates, partly replaces plagioclase phenocrysts, patchy replacement of rock, occurs overprinting illite alteration	*colourless*
Rutile	5	very fine-grained, anhedral aggregates, occurs as patchy aggregates associated with chlorite, calcite and bornite alteration	*red-brown*

MINOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Bornite	4	fine to very fine-grained (< 0.1 mm), anhedral aggregates, occurs disseminated, partly replaced by chalcocite and covellite	
Plagioclase	3	fine to medium-grained (< 1.5 mm), tabular, occurs as relict phenocrysts, partly replaced by K-feldspar, calcite, sericite and chlorite	*polysynthetic twinning*
Illite	3	very fine-grained, occurs as patchy aggregates replacing plagioclase, overprinted by carbonate aggregate	
Albite	3	very fine-grained anhedral aggregates, occurs with patchy chlorite, rutile and carbonate alteration	
Covellite	1	very fine-grained, occurs as replacement of chalcocite	
Chalcocite	1	very fine-grained, occurs as replacement of bornite	
Apatite	tr	Fine-grained (< 0.1 mm), high relief, disseminated	

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm

See over for VEINLETS/ FRACTURE INFILL

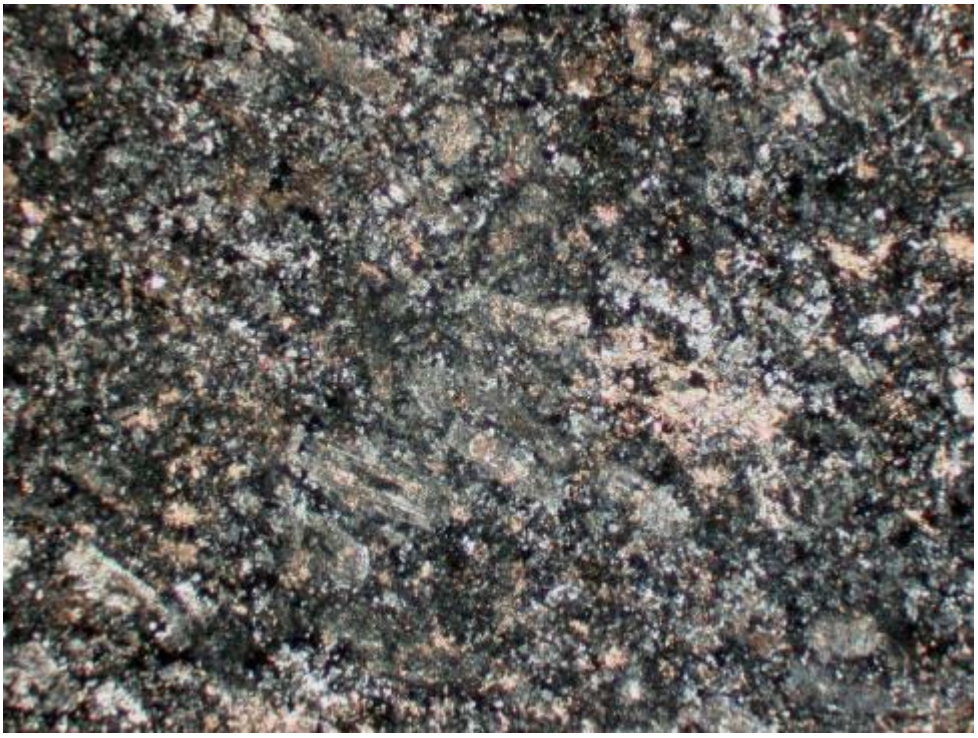
Zone: GRANBY
Sample: MM-08-09 76.09-76.19m **Offcut #T-10**

VEINLETS/ FRACTURE INFILL:

Mineral	%	Distribution & Characteristics*	Optical
Calcite	3	fine to very fine-grained (< 0.1 mm), occurs as veinlets and fracture infill, locally margins lined with chlorite and bornite aggregate	
Bornite	2	fine to very fine-grained, partly replaced by chalcocite, covellite and hematite, occurs within calcite-filled fractures and at the margins of calcite veinlets	
Chlorite	tr	very fine-grained, anhedral aggregates, occurs with at margins of calcite veinlets	
Rutile	tr	very fine-grained, anhedral aggregates, occurs locally with bornite in calcite-filled fractures	*red-brown*
Hematite	tr	very fine-grained, anhedral aggregates, occurs locally replacing bornite	
Chalcocite	tr	very fine-grained, occurs as replacement of bornite, mostly replaced by covellite	
Covellite	tr	very fine-grained, occurs as replacement of chalcocite	

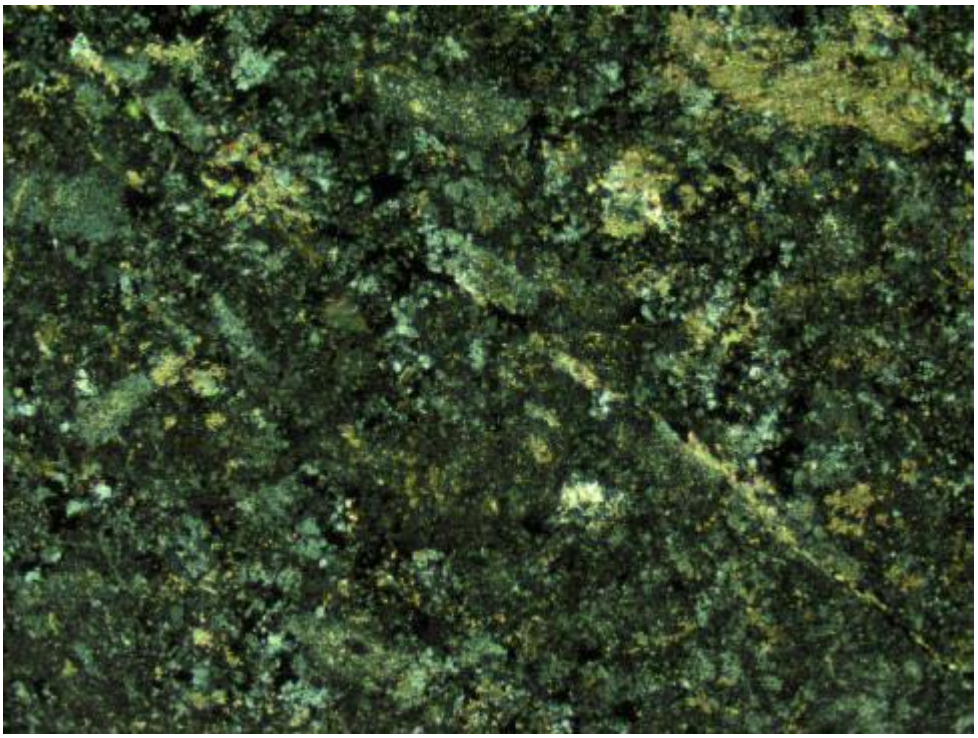
*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm

A

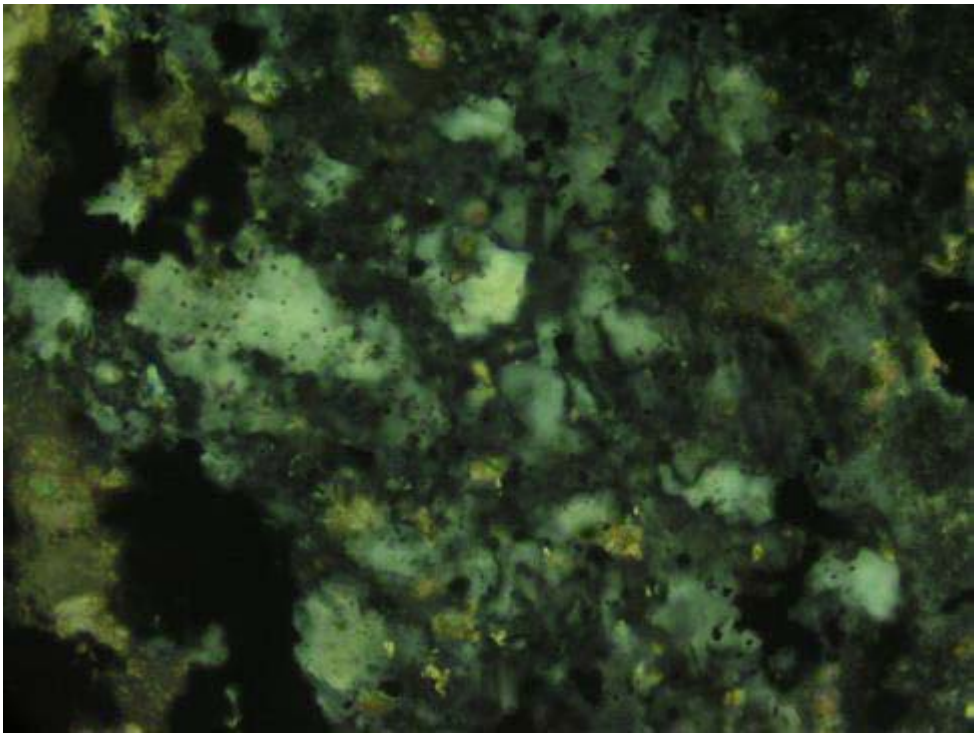


B

Sample: MM-08-09 76.09-76.19m
A & B) Overview of sample shows pervasively K-feldspar, chlorite-carbonate-rutile-albite, illite altered porphyritic rock (?andesite) with major disseminated opaque phases. A) PPL, B) XPL, FOV = ~ 4.5 mm.



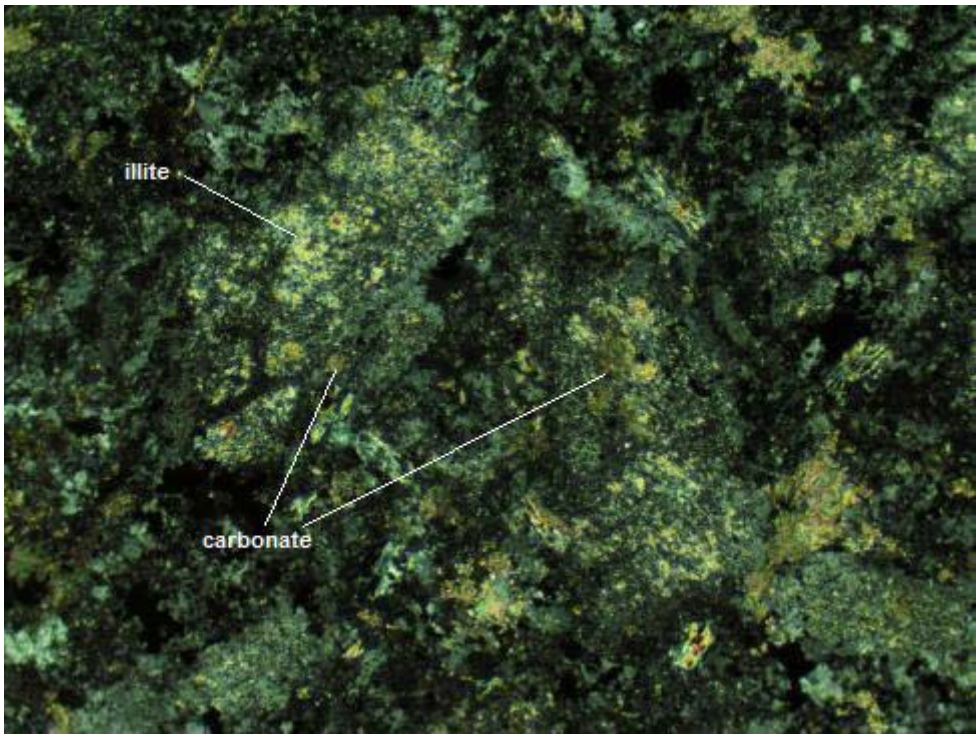
C



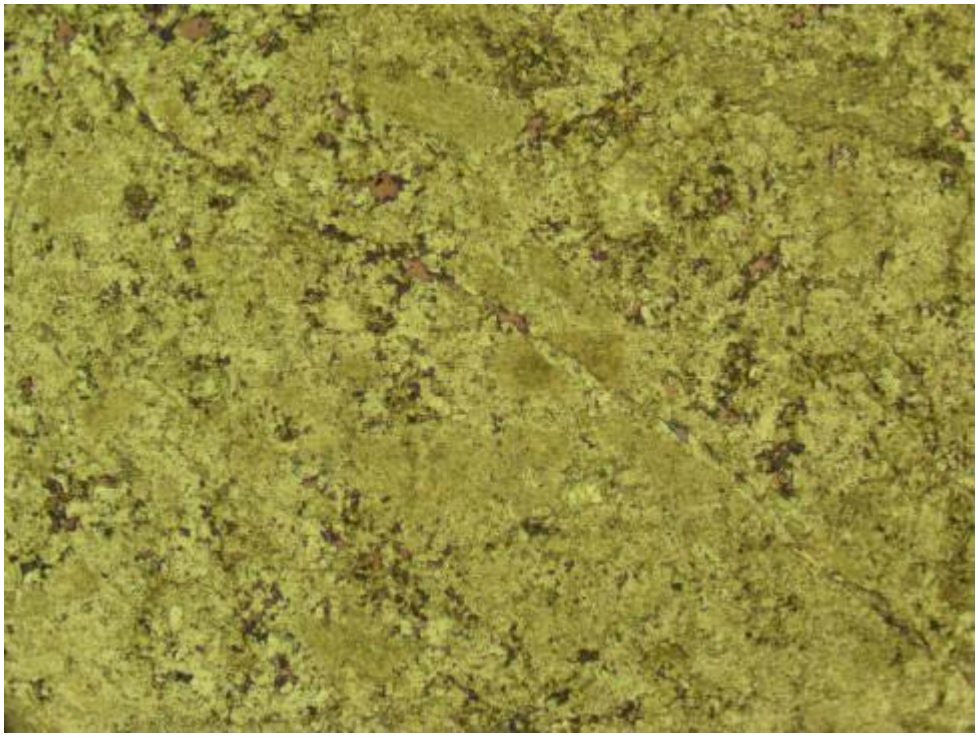
D

Sample: MM-08-09 76.09-76.19m

C) View of porphyritic rock with disseminated and fracture-controlled opaques (same view as photos F & G). XPL, FOV = ~ 2.6 mm. D) Detailed view of very fine-grained albite alteration associated with carbonate, chlorite (low birefringence) and opaques (bornite-rutile). XPL, FOV = ~ 0.7 mm.



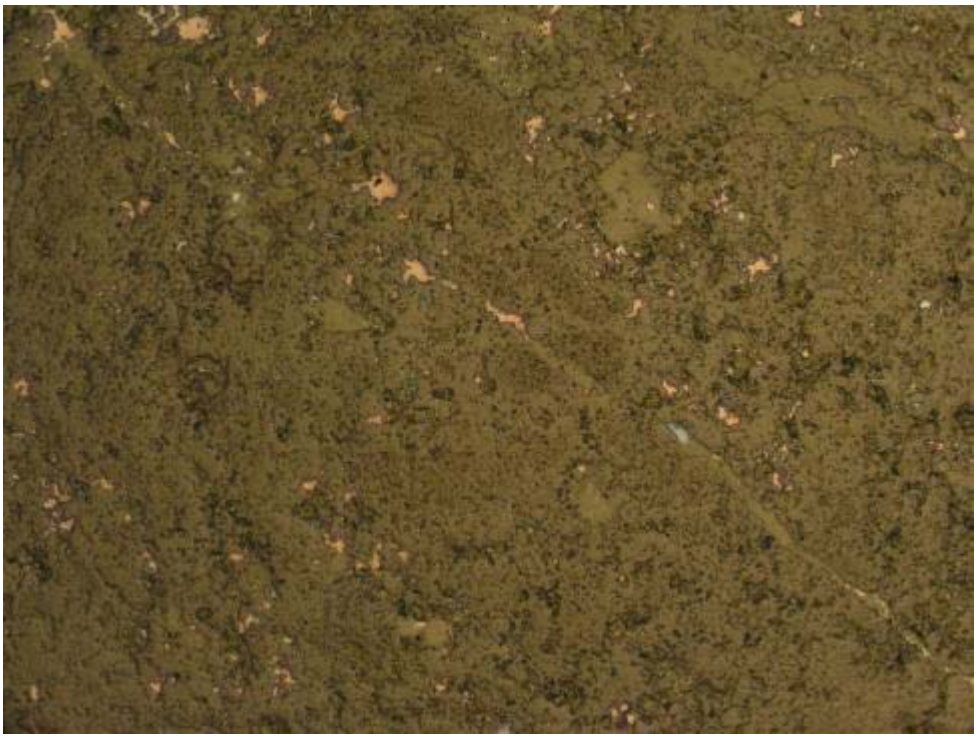
E



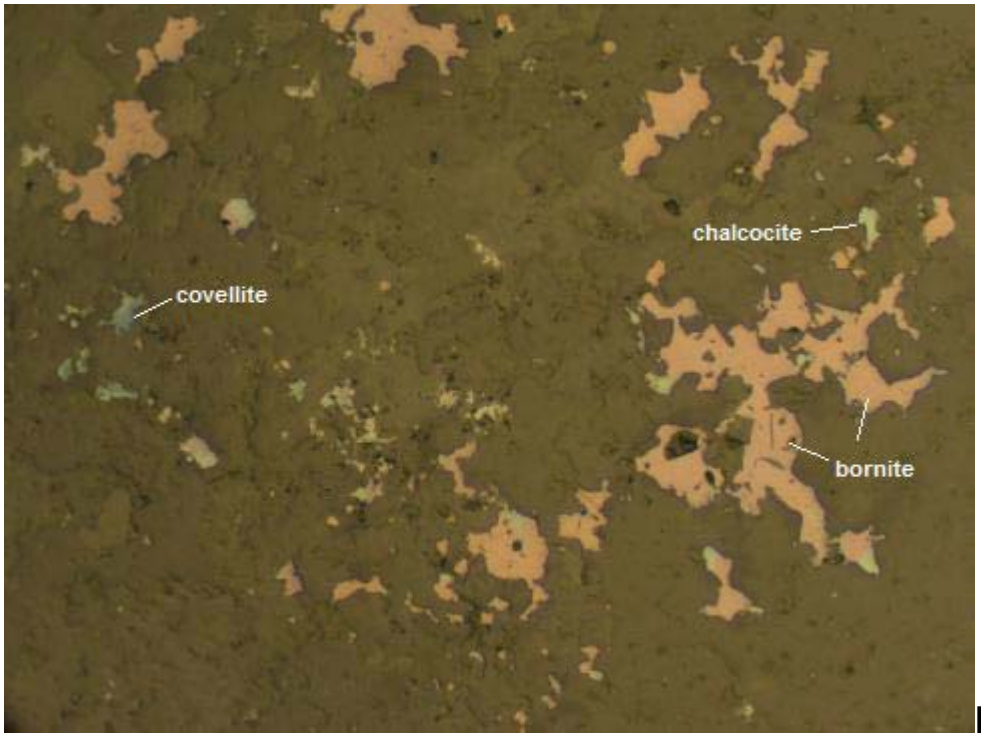
F

Sample: MM-08-09 76.09-76.19m

E) Former plagioclase phenocrysts selectively replaced by K-feldspar with cores replaced by illite aggregate and overprinted by patchy carbonate. XPL, FOV = ~ 1.3 mm. G) View of porphyritic rock with disseminated and fracture-controlled bornite (same view as photos G & C). PPL+RL, FOV = ~ 2.6 mm.



G



H

Sample: MM-08-09 76.09-76.19m

G) Representative view of disseminated and fracture-controlled bornite locally replaced by minor chalcocite and covellite (same view as photos F & C). RL, FOV = ~ 2.6 mm. H) Detailed view of disseminated bornite partly replaced by chalcocite (grey) and covellite (dark blue). RL, FOV = ~ 0.7 mm.

Zone: GRANBY
Sample: MM-08-09 56.39-56.49m **Offcut #T-11**

view of hand sample


view of stained section offcut, scale in mm

Hand Sample Test Results:
No reaction of sample to magnet. Spotty reaction of fractures and patches within rock to cold, dilute HCl. Positive test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Strongly fractured, pinkish brown and dark green coloured, fine to medium-grained pervasively K-feldspar altered porphyritic rock with approximately 30% green patchy aggregates. The rock is cut by sub-mm wide quartz and calcite filled fractures.

Zone: GRANBY
Sample: MM-08-09 56.39-56.49m **Offcut #T-11**


view of stained offcut, scale in mm

LITHOLOGY:	Pervasively altered porphyritic rock (?andesite/?latite)
ALTERATION TYPE:	K-feldspar, chlorite, calcite, sericite
MINERALIZATION:	Chalcopyrite, covellite (bornite, chalcocite)
FRACTURES/VEINLETS:	Quartz±chlorite±(sericite±chalcopyrite-bornite, chalcocite, covellite) Calcite±chlorite±hematite Calcite±(chalcopyrite-bornite, chalcocite, covellite)

Polished Thin Section Description:
This section is a pervasively K-feldspar, sericite-chlorite, calcite altered porphyritic rock (?andesite/?latite) cut by fractures and veinlets filled with dominantly quartz or calcite (details below). Plagioclase phenocrysts are selectively replaced by fine to very fine-grained secondary K-feldspar, calcite, sericite and chlorite which occurs as pervasive replacement of the rock. Numerous fine-grained K-feldspar phenocrysts are preserved, approximately 10%. Aggregates of major very fine-grained chlorite, sericite, patchy calcite and hematite (after ?magnetite) occur overprinting K-feldspar as patchy replacement of the rock. Minor fine-grained chalcopyrite occurs disseminated associated with the chlorite-sericite±calcite alteration and fracture-controlled (see below). Traces of bornite occur associated with chalcopyrite. Bornite is typically partly replaced by traces of chalcocite which is in turn is mostly replaced by minor covellite. Traces of fine-grained apatite occur disseminated.

The section is cut by quartz veinlets and numerous fractures filled with calcite. Quartz veinlets occur with sericite and chlorite margins and traces of disseminated chalcopyrite±bornite. Bornite is partly replaced by chalcocite which is mostly replaced by covellite. Quartz veinlets are typically cut by calcite-filled fractures. The calcite-filled fractures are commonly lined with hematite, chlorite and rutile and locally contain disseminated chalcopyrite± bornite± chalcocite± covellite. Locally sericite occurs as alteration envelopes to these fractures

Zone: GRANBY
Sample: MM-08-09 56.39-56.49m **Offcut #T-11**

HOST ROCK:
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
K-feldspar	45	-fine-grained (< 0.6 mm) occurs as phenocrysts, very fine-grained, anhedral aggregates, occurs as matrix, selective replacement of plagioclase phenocrysts and groundmass	
Chlorite	15	very fine-grained, anhedral aggregates, occurs with sericite, calcite and rutile as patchy replacement of rock	
Calcite	12	very fine-grained, anhedral aggregates, partly replaces plagioclase phenocrysts, patchy replacement of rock, occurs with sericite-chlorite alteration	*colourless*
Sericite	10	very fine-grained, occurs as patchy aggregates thoughout rock, associated with chlorite aggregate, also occurs as alteration envelopes to hematite-chlorite-calcite-rutile filled fractures	

MINOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Plagioclase	1	fine to medium-grained (< 1.5 mm), tabular, occurs as phenocrysts, partly replaced by K-feldspar, calcite, sericite and chlorite	*polysynthetic twinning*
Hematite	3	fine-grained (< 0.2mm), anhedral grains and aggregates, likely replacement of magnetite, occurs with chlorite, locally partly enclosed by covellite (after bornite)	
Rutile	2	very fine-grained, sub-anhedral aggregates, occurs as patchy aggregates associated with sericite alteration	*yellow-brown*
Chalcopyrite	1	fine-grained (< 0.2 mm), anhedral grains and aggregates occurs disseminated and with patchy chlorite-sericite-calcite aggregates, associated with bornite	
Covellite	1	very fine-grained, occurs as replacement of chalcocite	
Apatite	tr	fine-grained (< 0.1 mm), disseminated	*high relief*
Bornite	tr	fine-grained (< 0.2 mm), anhedral aggregates, occurs disseminated and with patchy chlorite-sericite-calcite aggregates, partly replaced by chalcocite and covellite	
Chalcocite	tr	very fine-grained, occurs as replacement of bornite	

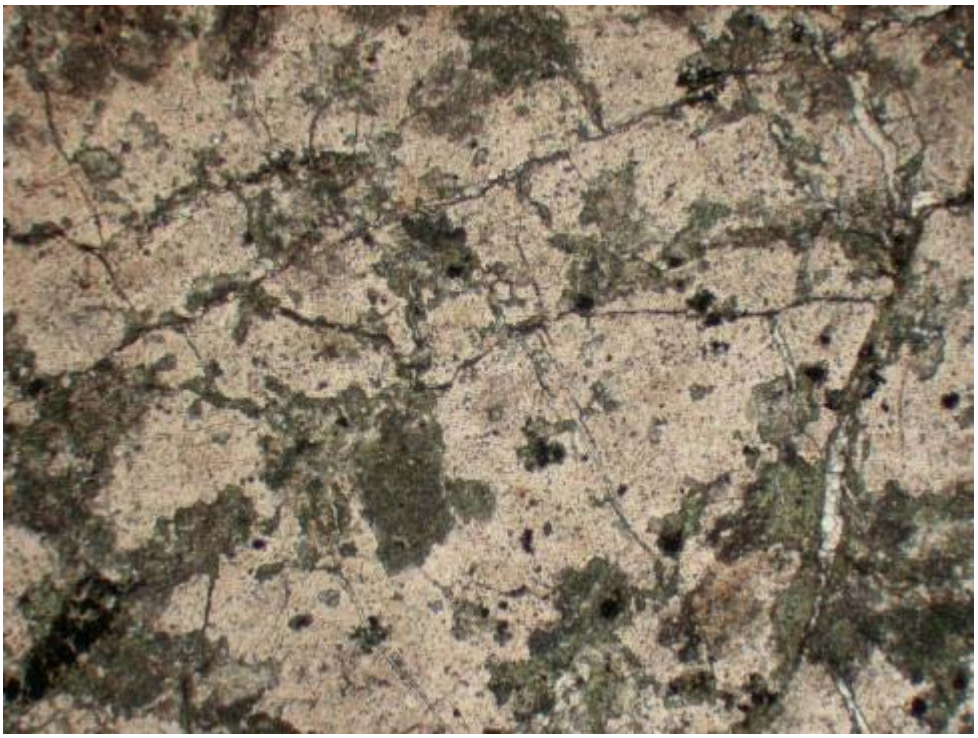
See over for VEINLETS/ FRACTURE INFILL:

Zone: GRANBY
Sample: MM-08-09 56.39-56.49m **Offcut #T-11**

VEINLETS/ FRACTURE INFILL:

Mineral	%	Distribution & Characteristics*	Optical
Calcite	5	fine-grained (< 0.4 mm), occurs as fracture infill, locally margins lined with chlorite and hematite aggregate	
Chlorite	2	very fine-grained, anhedral aggregates, occurs with calcite and quartz as fracture infill	
Quartz	1	fine-grained (< 0.3 mm), anhedral aggregates, occurs as veinlets with sericite and chlorite margins and locally with calcite and disseminated chalcopyrite	
Hematite	1	fine-grained (< 0.2 mm), anhedral pitted aggregates, likely replacement of magnetite, occurs in veinlets with chlorite, calcite and rutile aggregates, sericite alteration envelopes	
Sericite	tr	very fine-grained, occurs at margins of quartz veinlets	
Fe-ox	tr	very fine-grained, anhedral aggregates, occurs as stain at margins of some calcite veinlets	*brown*
Chalcopyrite	tr	fine-grained, occurs in veinlets with quartz -very fine-grained, occurs at margins of and within some calcite-filled fractures	
Bornite	tr	Very fine-grained, occurs locally with chalcopyrite in quartz veinlets and calcite filled fractures	
Chalcocite	tr	very fine-grained, occurs as replacement of bornite, mostly replaced by covellite	
Covellite	tr	very fine-grained, occurs as replacement of chalcocite	

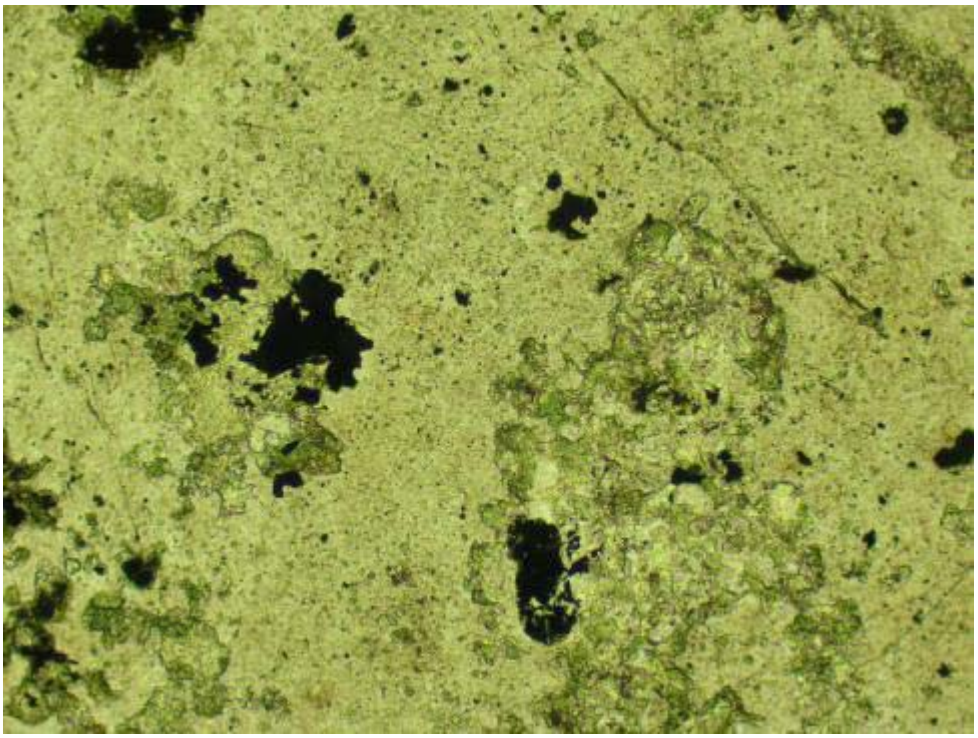
*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm



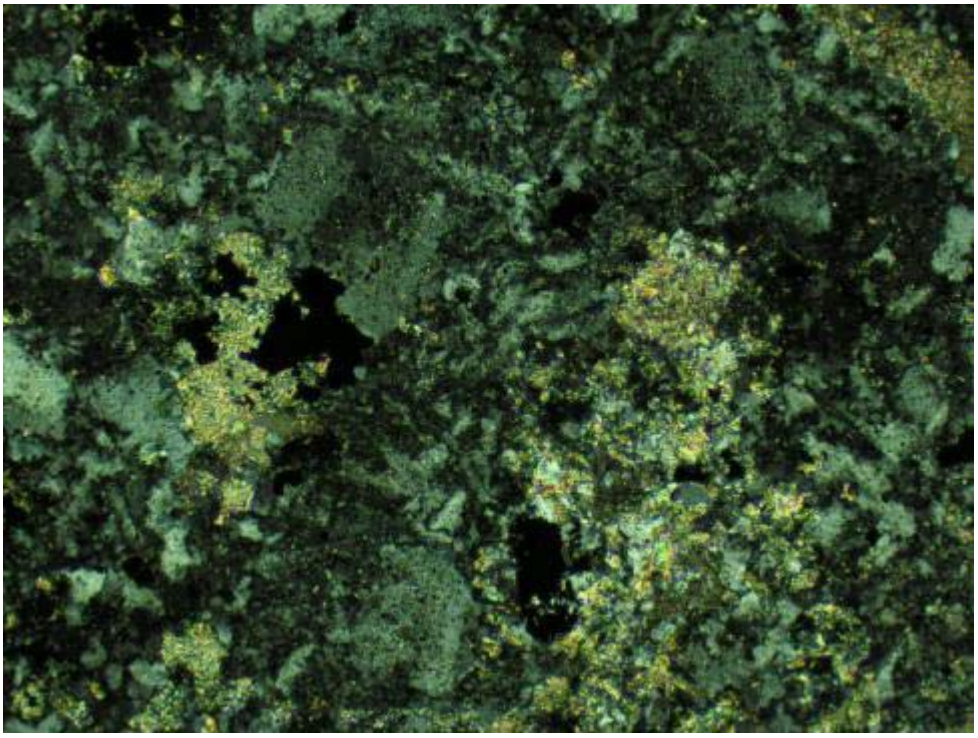
A

B

Sample: MM-08-09 56.39-56.49m
A & B) Overview of sample shows pervasively K-feldspar, sericite-chlorite, calcite altered porphyritic rock cut by cut by fractures and veinlets filled with dominantly quartz or calcite. A) PPL, B) XPL, FOV = ~ 4.5 mm.

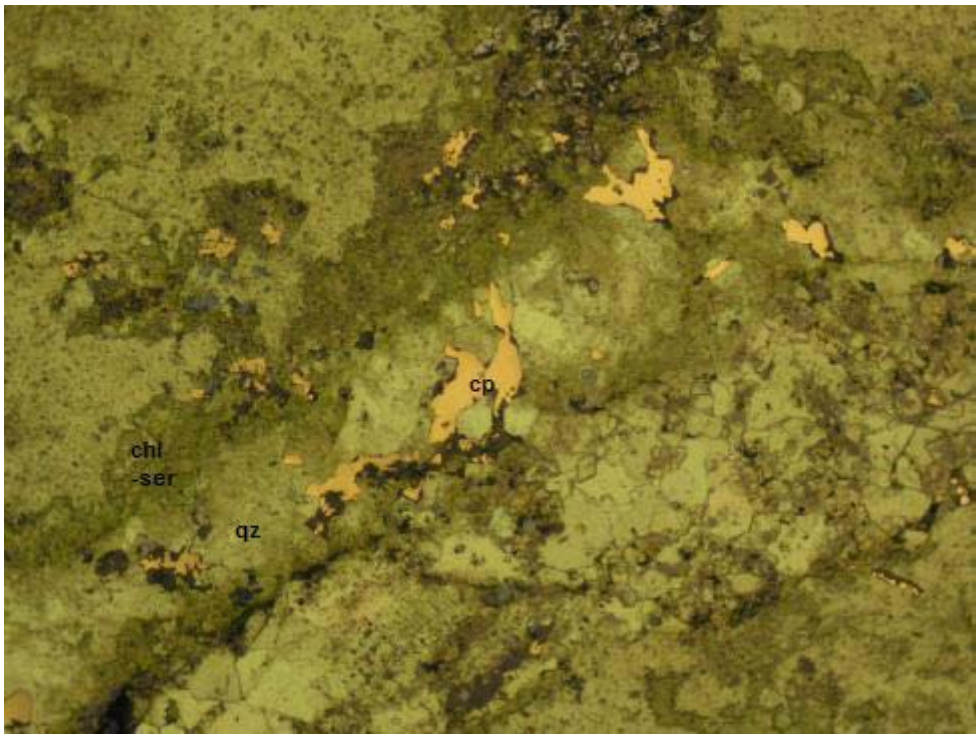


C

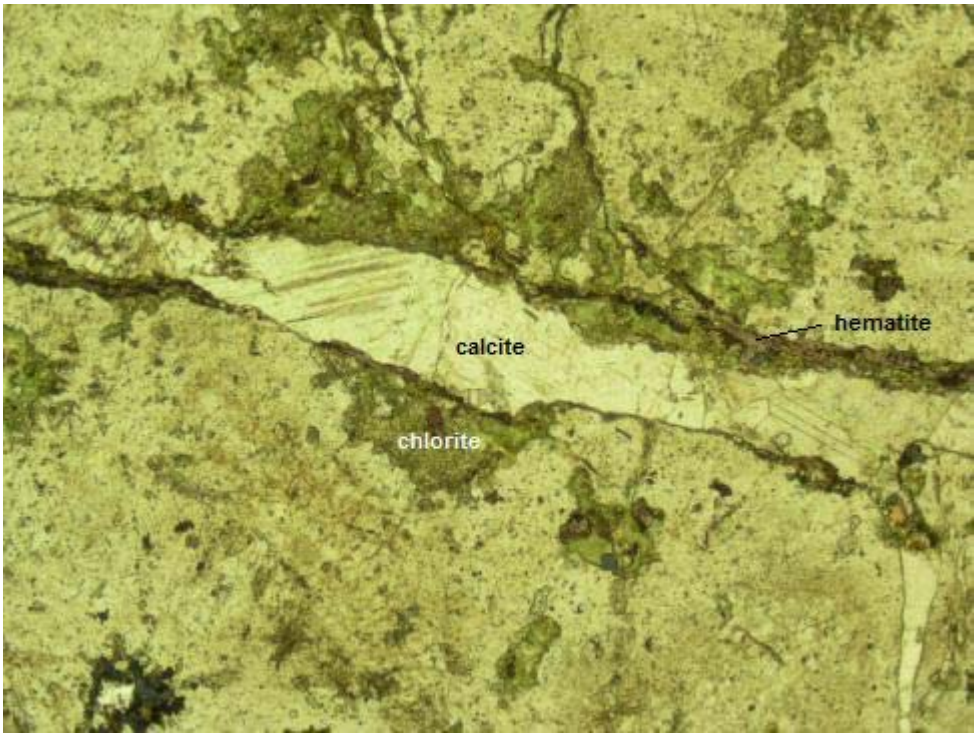


D

Sample: MM-08-09 56.39-56.49m
C&D) Detailed view of pervasively K-feldspar, sericite-chlorite, calcite altered porphyritic rock. C) PPL, D) XPL, FOV = ~ 1.3 mm.



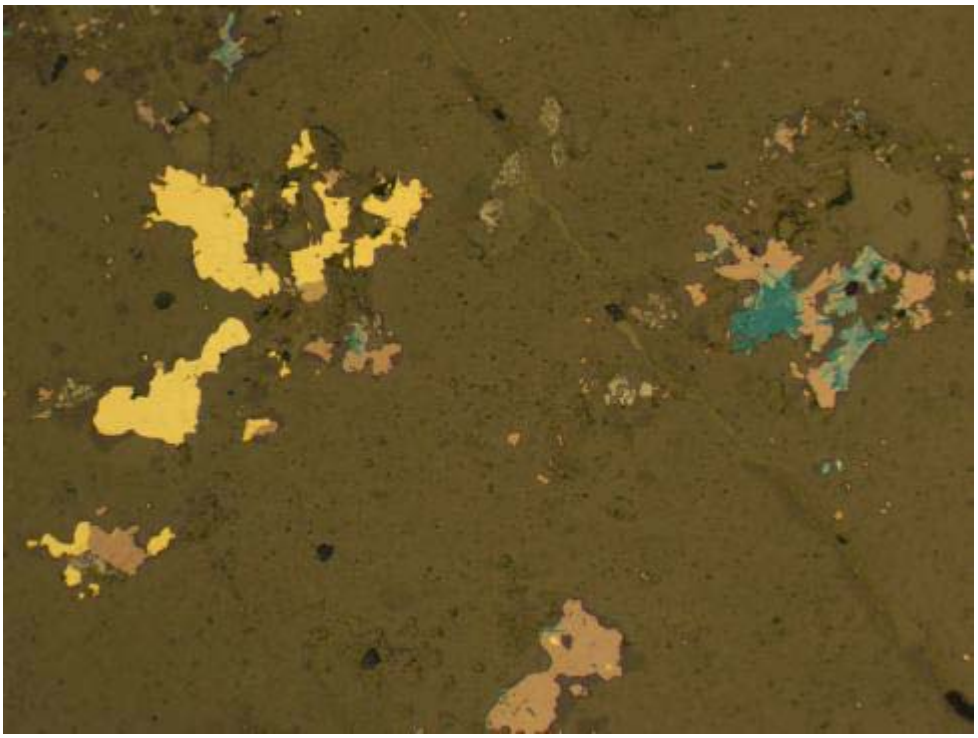
E



F

Sample: MM-08-09 56.39-56.49m

E) Quartz vein with chlorite-sericite at vein margins and disseminated chalcopyrite. PPL+RL, FOV = ~ 2.6 mm. F) Calcite-filled fracture lined with hematite and chlorite. PPL, FOV = ~ 2.6 mm.



G

Sample: MM-08-09 56.39-56.49m
G) Disseminated chalcopyrite associated with bornite. Note bornite (right) replaced sequentially by chalcocite and covellite. RL, FOV = ~ 1.3 mm.

Statement of qualifications: Kathryn P.E. Dunne

I, Kathryn P.E. Dunne, of the city of Salmon Arm, province of British Columbia, do hereby certify that:

1. I am an independent consulting geologist, with a business office at 4610 Lakeshore Road NE, Salmon Arm, B.C., Canada. My business mailing address is: Bag 9000, # 207, 190B Trans Can Hwy NE, Salmon Arm, BC, V1E 1S3.

2. I am a graduate in geology, with a BSc in geology from The University of British Columbia (1985).

3. I received my Masters degree in geology from The University of British Columbia, Vancouver, B.C. in 1988.

4. I am a registered member of the Association of Professional Engineers and Geoscientists of the Province of British Columbia (No. 18674).

5. I am a fellow of the Geological Association of Canada and a member of the Society of Economic Geologists.

6. I have practiced my profession as a geologist for approximately 20 years: 4 years as geologist with the British Columbia Geological Survey Branch, 3 years as research coordinator at the Mineral Deposit Research Unit housed within the Department of Earth and Ocean Sciences at the University of British Columbia, and 13 years as an independent consultant. From mid-2002 to mid-2007 I was an associate of Petrascience Consultants Inc.

7. The petrographic data of this report was collected by me in October 2009.

……..……
Kathryn P.E. Dunne, M.Sc., P.Geo.
Consulting Geologist
October 20, 2009

PETROGRAPHIC REPORT

MINER MOUNTAIN PROJECT:
BRITISH COLUMBIA, CANADA

May 7, 2010

Prepared for:
Chris Sampson, P.Eng
President
Sego Resources Inc.
#211-744 West Hastings St.
Vancouver, B.C.
Canada V6C 1A5

Prepared by:
Kathryn Dunne, M.Sc. P.Geo.
Bag 9000, # 207
190B Trans Can Hwy NE
Salmon Arm, BC
Canada V1E 1S3

phone: 250-804-0729
kgeo@telus.net

Background

Seventeen drill core samples were received from Andrew Watson on behalf of Sego Resources Inc. on February 15, 2010 for petrographic analysis. The samples were taken from the Miner Mountain property, B.C. The goal of the work was basic transmitted and reflected light observations, including description of lithologies, alteration and mineralization. Seventeen polished thin sections were prepared from the samples at Vancouver Petrographics Ltd. Kathryn Dunne, P.Geo. carried out the petrographic analysis at her office in Salmon Arm, B.C. All percentages in the descriptions are approximate based on visual estimation.

At the request of Kathryn Dunne, PIMA spectral analysis on 4 samples from this report was undertaken by Kim Heberlein on April 30, 2010 (Appendix). This type of analysis is useful for the determination of typically very fine-grained minerals that contain hydroxyls (OH groups) such as phyllosilicates (including clay, chlorite and serpentine), hydroxylated silicates (such as epidote and amphiboles), sulphates (alunite, jarosite and gypsum) and carbonates.

Conventions used in this report

The following grain size conventions are used in this report:
coarse-grained > 5mm; medium-grained 1-5 mm; fine-grained < 1 mm; very fine-grained < 0.05mm

The use of brackets in mineral lists indicates that the mineral occurs in trace amounts (< 1%).

Examples: 1) **Mineralization:** Chalcopyrite, (pyrite)
2) chlorite-carbonate-(epidote) alteration

The following abbreviations are used:

Fe-ox = Fe-oxides or Fe-oxyhydroxides

Summary

Samples examined in this report are listed below and summarized briefly in the next pages and in the summary table following.

GRANBY Zone (drill core samples) ***SOUTH Zone (drill core samples)***

T.S. #	DDH MM-09-11	Petrographic Description - Page #	T.S. #	DDH MM-09-12	Petrographic Description - Page #
1	MM-09-11 29.74-29.8m	7	12	MM-09-12 9.95-10.04m	86
2	MM-09-11 46.65-46.7m	15	13	MM-09-12 10.08-10.15m	95
3	MM-09-11 68.4-68.5m	21	14	MM-09-12 52.14-52.2m	104
4	MM-09-11 77.4-77.46m	27	15	MM-09-12 62.19-62.26m	113
5	MM-09-11 93.34-93.4m	35	16	MM-09-12 71.64-71.71m	121
6	MM-09-11 114.91-115.03m	43	17	MM-09-12 89.91-89.98m	129
7	MM-09-11 125.36-125.43m	50			
8	MM-09-11 153.02-153.12m	57			
9	MM-09-11 192.09-192.18m	64			
10	MM-09-11 224.81-224.9m	71			
11	MM-09-11 241.25-241.36m	78			

SUMMARY TABLE: DDH MM09-11 (GRANBY ZONE)

TS #	FROM (m)	LITHOLOGY	ALTERATION*	MINERALIZATION*	VEINLETS/ FRACTURE INFILL
1	29.74	fragmental volcanic rock; ?volcanic breccia	**K-feldspar** **actinolite** **carbonate** **epidote** **chlorite** magnetite	(bornite) (chalcocite) (chalcopyrite)	actinolite-epidote-carbonate-magnetite calcite
2	46.65	?alkali feldspar microsyenite	Ti-oxide chlorite carbonate	chalcopyrite (bornite) (chalcocite)	carbonate-calcite
3	68.4	?micro quartz diorite	**chlorite** **carbonate** **illite/sericite** **magnetite** Ti-oxide	(pyrite) (covellite)	carbonate-calcite
4	77.4	extensively fractured porphyritic rock; crackle breccia	**K-feldspar** **carbonate** Ti-oxide	bornite (chalcocite) (covellite) (chalcopyrite)	carbonate±bornite –(chalcocite-covellite-chalcopyrite) calcite gypsum
5	93.34	porphyritic andesite	**chlorite** **Ti-oxide** K-feldspar carbonate	pyrite chalcopyrite	carbonate-pyrite-chalcopyrite-(quartz) carbonate
6	114.91	fragmental andesite; ?volcanic breccia	**illite** **pyrite** chlorite Ti-oxide	**pyrite**	gypsum±carbonate
7	125.36	fractured and brecciated ?andesite	**pyrite** **chlorite** **gypsum** clay-kaolinite & smectite carbonate Fe-ox Ti-oxide	**pyrite**	gypsum±carbonate Fe-ox
8	153.02	fractured ?andesite	**biotite** **clay-smectite & kaolinite** K-feldspar carbonate Ti-oxide	pyrite	clay carbonate±pyrite ?jarosite Fe-ox

*minerals in **bold** = major amounts > 5%

Summary table continued (over)

SUMMARY TABLE: DDH MM09-11 (GRANBY ZONE) cont.

T S #	FROM (m)	LITHOLOGY	ALTERATION*	MINERALIZATION*	VEINLETS/ FRACTURE INFILL
9	192.09	amygdaloidal andesite	**carbonate** **clay-smectite & kaolinite** **illite/smectite** Fe-Ti oxide	pyrite	gypsum-(anhydrite)-calcite calcite±carbonate-Fe-ox carbonate-Fe-ox
10	224.81	fragmental volcanic rock; ?volcanic breccia	**carbonate** **pyrite** **illite** Ti-oxide	pyrite	carbonate
11	241.25	crystal-rich coarse ?tuff/ fine ?tuff	**chlorite** **carbonate** **Ti-oxide** ?K-feldspar illite	pyrite (chalcopyrite)	K-feldspar carbonate-*hematitic* calcite±(chalcopyrite) chlorite-carbonate ± (chalcopyrite)

*minerals in **bold** = major amounts > 5%

GRANBY Zone (DDH MM09-11)

Lithologies from DDH MM09-11 at the Granby zone include the following igneous rocks:

- fragmental volcanic rock (?volcanic breccia)
- ?alkali feldspar microsyenite
- ?micro quartz diorite
- porphyritic andesite/?andesite
- amygaloidal andesite
- crystal-rich coarse ?tuff/ fine ?tuff

The samples have been fractured and altered including in particular T.S. #4.

Alteration of the igneous rocks typically includes carbonate±chlorite and Ti-oxide. Illite or clays (smectite/kaolinite) occur as patchy alteration in many sections. Secondary K-feldspar occurs in some sections. Major epidote and actinolite occur in section T.S. 1. Magnetite is observed in two samples near the top of the drill hole (T.S. 1 & 3).

Bornite occurs in trace to minor amounts in 3 samples near the top of the drill hole (T.S. 1, 2 and 4). Bornite is partly replaced by trace to minor amounts of chalcocite which is sequentially partly replaced by covellite. Chalcopyrite occurs in trace to minor amounts near the top of the drill hole (T.S. 1, 2, 4, 5) locally associated with bornite and disseminated in T.S. 2. Traces of chalcopyrite also occur in section T.S. 11. Pyrite occurs in trace to major amounts in samples from the drill hole. Pyrite occurs in sections T.S. 5 through T.S. 11 (with the exception of trace amount of pyrite partly replaced by covellite in section T.S. 3). Major pyrite occurs in sections T.S. 6 and 7.

Fracture infill is typically by calcite or brown carbonate. Hematitic carbonate occurs as infill in section T.S. 11. Gypsum occurs as fracture infill in sections T.S. 4, 6, 7 and 9. K-feldspar occurs as hairline fracture infill in section T.S. 11.

SUMMARY TABLE: DDH MM09-12 (SOUTH ZONE)

T S #	FROM (m)	LITHOLOGY	ALTERATION*	MINERALIZATION*	VEINLETS/ FRACTURE INFILL
12	9.95	porphyritic rock	**K-feldspar** **chlorite** **carbonate** **Ti-oxide** **magnetite** illite	pyrite (chalcopyrite)	quartz-pyrite-(chalcopyrite) calcite-carbonate ±pyrite±(chalcopyrite)
13	10.08	porphyritic rock	**K-feldspar** **chlorite** **carbonate** **magnetite** **clay-kaolinite** Ti-oxide	pyrite (chalcopyrite)	quartz-pyrite-(chalcopyrite) quartz-carbonate-chlorite— pyrite-(chalcopyrite) calcite-carbonate
14	52.14	porphyritic microdiorite	**chlorite** **magnetite** carbonate ?clay K-feldspar	pyrite (chalcopyrite)	?albite carbonate-(hematite) calcite±(chlorite)
15	62.19	crystal-rich coarse tuff	**chlorite** **carbonate** **K-feldspar** Ti-oxide	(pyrite)	?albite calcite carbonate-(pyrite)
16	71.64	crystal-rich lapilli tuff	**chlorite** **carbonate** **K-feldspar** **Ti-oxide** illite	pyrite (chalcopyrite)	hematite calcite±quartz±(pyrite) carbonate
17	89.91	crystal-rich coarse tuff	**epidote** **chlorite** **carbonate** **K-feldspar**	(chalcopyrite)	hematite-(chalcopyrite) calcite

*minerals in **bold** = major amounts > 5%

SOUTH Zone (DDH MM09-12)

Lithologies from DDH MM09-12 at the South zone include the following igneous rocks:

- porphyritic rock
- porphyritic microdiorite
- crystal-rich coarse tuff
- crystal-rich lapilli tuff

The samples have been fractured and altered.

Alteration of the igneous rocks typically includes K-feldspar, chlorite and carbonate . Ti-oxide occurs in minor to major amounts in some sections. Illite or clays (kaolinite) occur as patchy alteration in a few sections. Major epidote occurs in section T.S. 17. Magnetite is observed in three samples near the top of the drill hole (T.S. 12, 13 & 14).

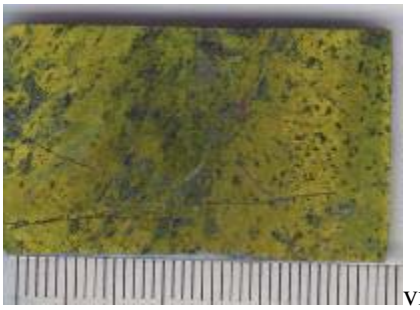
SOUTH Zone (DDH MM09-12) cont.

Chalcopyrite occurs in veinlets and disseminated in trace amounts in most sections (except T.S. 15). Pyrite occurs in trace to amounts in most samples (except T.S. 17).

Quartz veinlets with minor disseminated pyrite and traces of chalcopyrite occur in sections T.S. 12 and 13. Very fine-grained ?albite partly replaced by calcite occurs in veinlets in sections T.S. 14 and 15. Fracture infill is typically by calcite and brown carbonate. Hematite occurs as infill in sections T.S. 14, 16 and 17.

Zone: GRANBY
Sample: MM-09-11 29.74-29.8m **Offcut #AP-1**

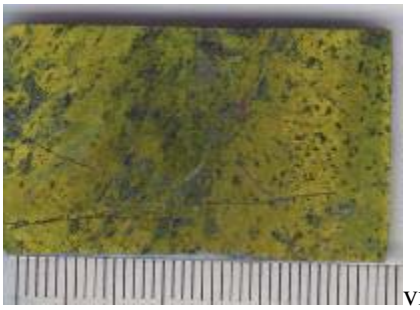
view of hand sample
Note: rock fragment (left side of photo) and rock matrix between yellow lines (right side of photo)


view of stained section offcut, scale in mm
Note: rock fragment (left side of photo) and rock matrix (right side of photo)

Hand Sample Test Results:
Strong reaction of fragments in sample to magnet. Strong reaction of fractures to cold, dilute HCl. Positive test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Fragmental volcanic rock with vague outlines of subangular fragments (up to 7 cm size) set in an olive-grey fine-grained granular rock matrix. The fragments comprise vaguely porphyritic fine to medium-grained dark-green/olive-grey igneous rock. Fragments are strongly magnetic. The rock has abundant K-feldspar (based on stain). The rock is fractured with fractures filled with calcite.

Zone: GRANBY
Sample: MM-09-11 29.74-29.8m **Offcut #AP-1**


view of stained offcut, scale in mm

LITHOLOGY:	Pervasively altered and mineralized fragmental volcanic rock ?volcanic breccia
ALTERATION TYPE:	K-feldspar, actinolite, carbonate, epidote, chlorite, magnetite
MINERALIZATION:	(Bornite, chalcocite, chalcopyrite)
FRACTURES/VEINLETS:	Actinolite-epidote-carbonate-magnetite Calcite

Polished Thin Section Description:
This section covers the contact between a vaguely porphyritic fine to medium-grained volcanic rock fragment (left side of stained offcut photo above) and a fine-grained granular breccia matrix (right side of photo above). In thin section, the breccia matrix is a fine to medium-grained (< 2 mm size) equigranular to subporphyritic rock comprising K-feldspar, altered plagioclase and former mafic phases. Plagioclase is selectively replaced by brown secondary K-feldspar and both primary feldspars are partly replaced by very fine-grained actinolite, epidote and carbonate. Former mafic phases are replaced by actinolite-epidote-carbonate±chlorite aggregates. The breccia fragment is vaguely porphyritic with fine-grained actinolite-epidote-carbonate-magnetite±chlorite aggregate as replacement of former fine to medium-grained mafic phases and extensive very fine-grained K-feldspar-actinolite-epidote-carbonate replacement of matrix (possibly former tabular phases). Traces of very fine-grained bornite partly replaced by chalcocite occur associated with actinolite-epidote-carbonate±magnetite alteration of the breccia and within fractures filled with the same minerals. Rarely chalcopyrite occurs associated with bornite.

Zone: GRANBY
Sample: MM-09-11 29.74-29.8m **Offcut #AP-1**

HOST ROCK MATRIX (~40%):
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
K-feldspar	25	-fine-grained (< 1 mm), occurs as subhedral granular aggregates, overprinted by very fine-grained actinolite, carbonate and epidote aggregate -very fine-grained, secondary aggregates, replace plagioclase	*brown*
Actinolite	4	-fine-grained (< 0.2 mm), fibrous to prismatic aggregates, occurs as replacement of former mafic phases -very fine-grained, occurs overprinting primary feldspar and associated with secondary K-feldspar	
Epidote	3	very fine-grained, anhedral aggregates, occurs associated with carbonate and actinolite as patchy replacement	
Carbonate, brown	3	very fine-grained, aggregateees occurs associated with epidote, actinolite and chlorite	*brown*
Carbonate, likely mostly calcite	3	fine to very fine-grained, anhedral aggregates, occurs as patchy aggregates, associated with epidote and actinolite	*colourless*
Plagioclase	2	fine to medium-grained (< 2 mm), subhedral crystals, locally phenocrysts, intergrown with K-feldspar, extensive replacement by secondary K-feldspar, actinolite, epidote and carbonate	*relict polysynthetic twinning*
Chlorite	tr	very fine-grained, anhedral aggregates, patchy, occurs with actinolite and epidote	
Bornite	tr	very fine-grained, anhedral, occurs associated with actinolite and epidote, partly replaced by chalcocite	
Chalcocite	tr	very fine-grained, anhedral, partly replaces bornite	
Apatite	tr	very fine-grained, disseminated	*high relief*

HOST ROCK FRAGMENT (~50%):

Mineral	%	Distribution & Characteristics*	Optical
K-feldspar	25	fine to very fine-grained (< 0.1 mm), anhedral aggregates, occurs as pervasive replacement of rock, occurs associated with actinolite, epidote and carbonate aggregates	
Actinolite	10	-fine-grained (< 0.2 mm), fibrous to prismatic aggregates, occurs as replacement of former mafic phases -very fine-grained, occurs with K-feldspar as pervasive alteration of rock	
Carbonate, likely mostly calcite	7	fine to very fine-grained, anhedral aggregates, occurs as patchy aggregates, associated with epidote and actinolite	*colourless*
Epidote	3	very fine-grained, anhedral aggregates, occurs associated with carbonate and actinolite as patchy replacement	

(continued next page)

Zone: GRANBY
Sample: MM-09-11 29.74-29.8m

Offcut #AP-1

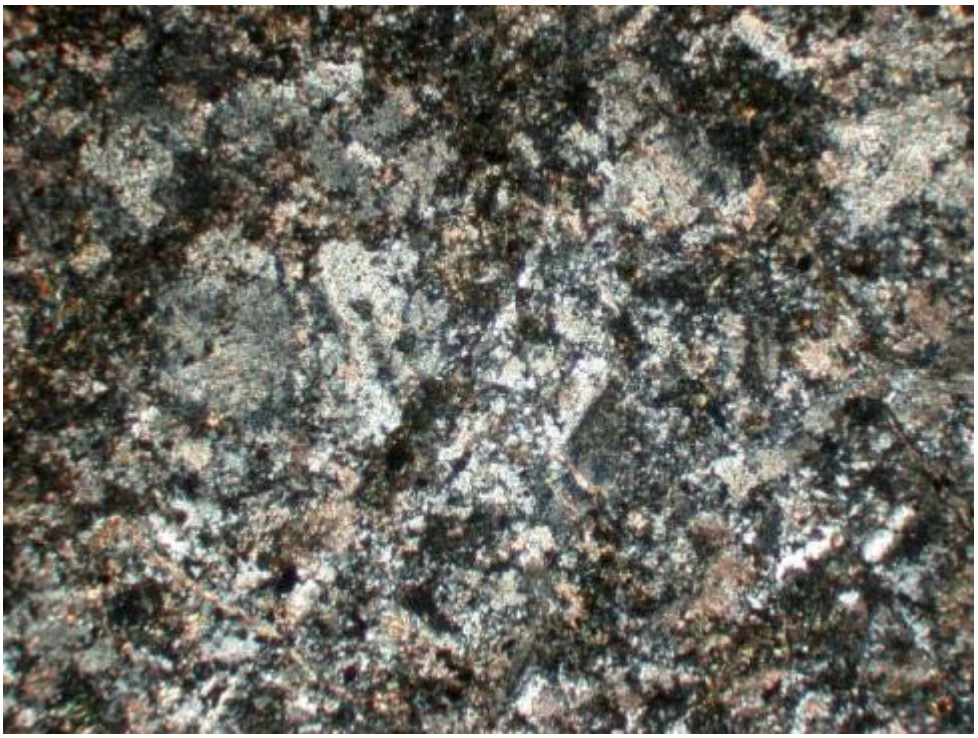
HOST ROCK FRAGMENT cont. (~50%):

Mineral	%	Distribution & Characteristics*	Optical
Magnetite	4	fine-grained (< 1 mm), anhedral grains and fractured aggregates, occurs disseminated and associated with actinolite as replacement of former mafic phases, rarely partly replaced by hematite	
Chlorite	tr	very fine-grained, anhedral aggregates, patchy, occurs with actinolite and epidote	
Hematite	tr	very fine-grained, occurs rarely partly replacing magnetite	
Apatite	tr	fine to very fine-grained (< 0.1 mm), disseminated	*high relief*
Bornite	tr	very fine-grained, anhedral, occurs associated with actinolite and epidote, partly replaced by chalcocite	
Chalcocite	tr	very fine-grained, anhedral, partly replaces bornite	
Chalcopyrite	tr	very fine-grained, occurs rarely associated with bornite	

VEINLETS/ FRACTURE INFILL (~10%):

Mineral	%	Distribution & Characteristics*	Optical
Actinolite	3	fine to very fine-grained (< 0.1 mm), anhedral aggregates, occurs as fracture infill with epidote, carbonate (brown), magnetite and traces of bornite-chalcocite	
Carbonate, mostly calcite	3	fine to very fine-grained (< 0.2 mm), occurs as fracture infill	*colourless*
Magnetite	2	fine-grained (< 1 mm), anhedral grains and fractured aggregates, occurs associated with actinolite in veinlets	
Epidote	1	very fine-grained, occurs as fracture infill with chlorite and carbonate	
Carbonate, brown	tr	very fine-grained, occurs as fracture infill with epidote, actinolite	*brown*
Chlorite	tr	very fine-grained, anhedral aggregates, occurs as fracture infill associated with carbonate, epidote and actinolite	
Bornite	tr	very fine-grained, anhedral, occurs rarely associated with epidote, partly replaced by chalcocite	
Chalcocite	tr	very fine-grained, anhedral, partly replaces bornite	
Fe-ox	tr	very fine-grained, anhedral aggregates, occurs as late fracture infill	*brown*

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm



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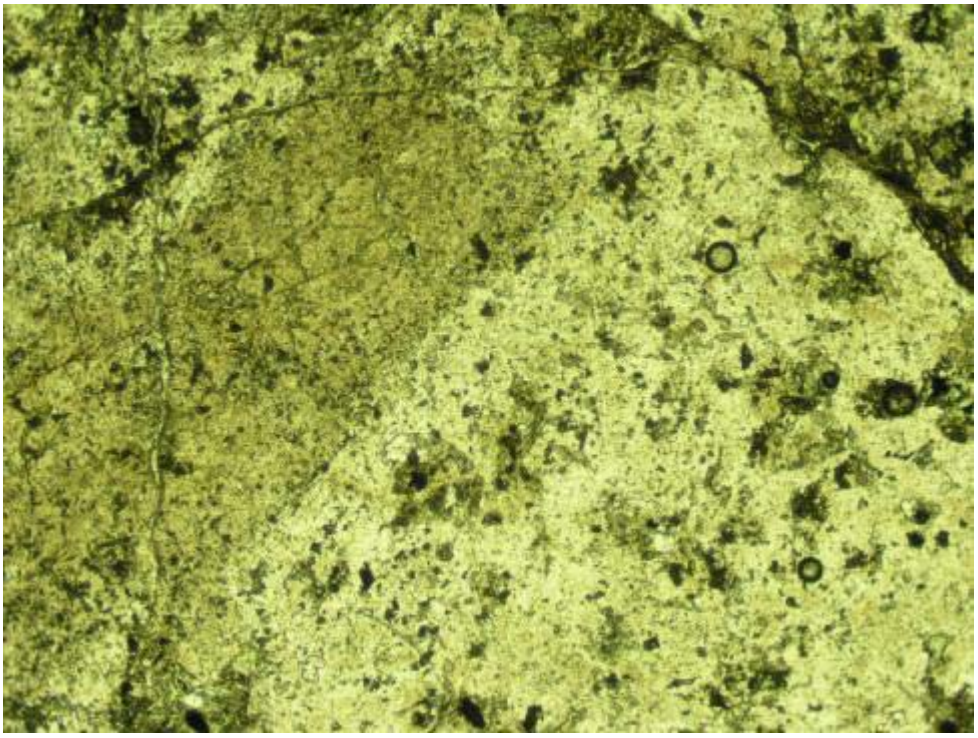
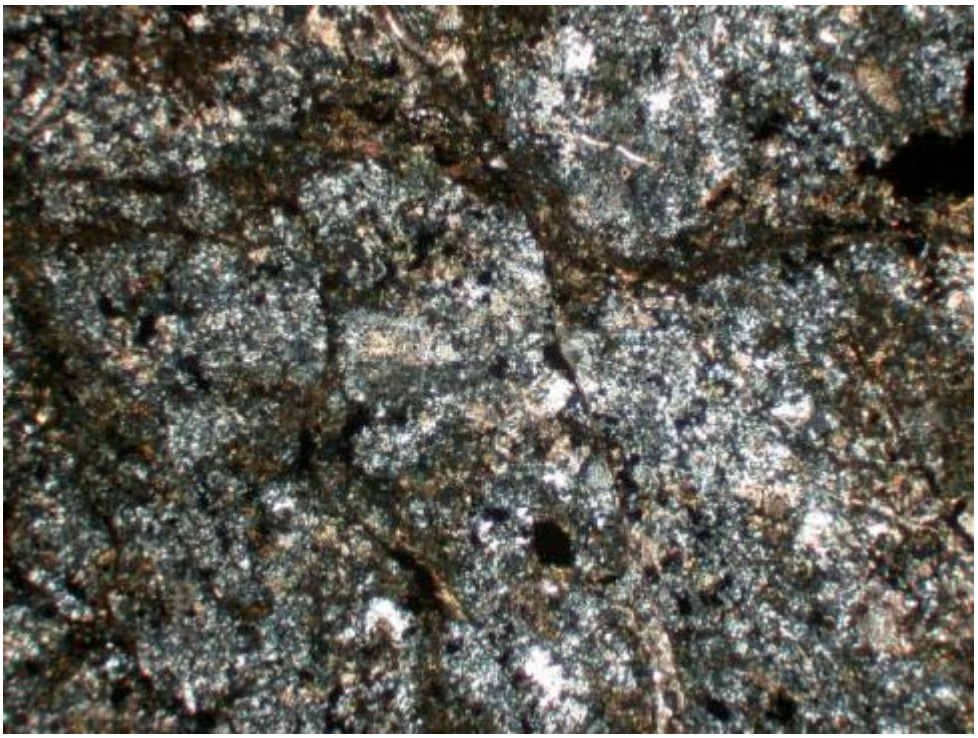


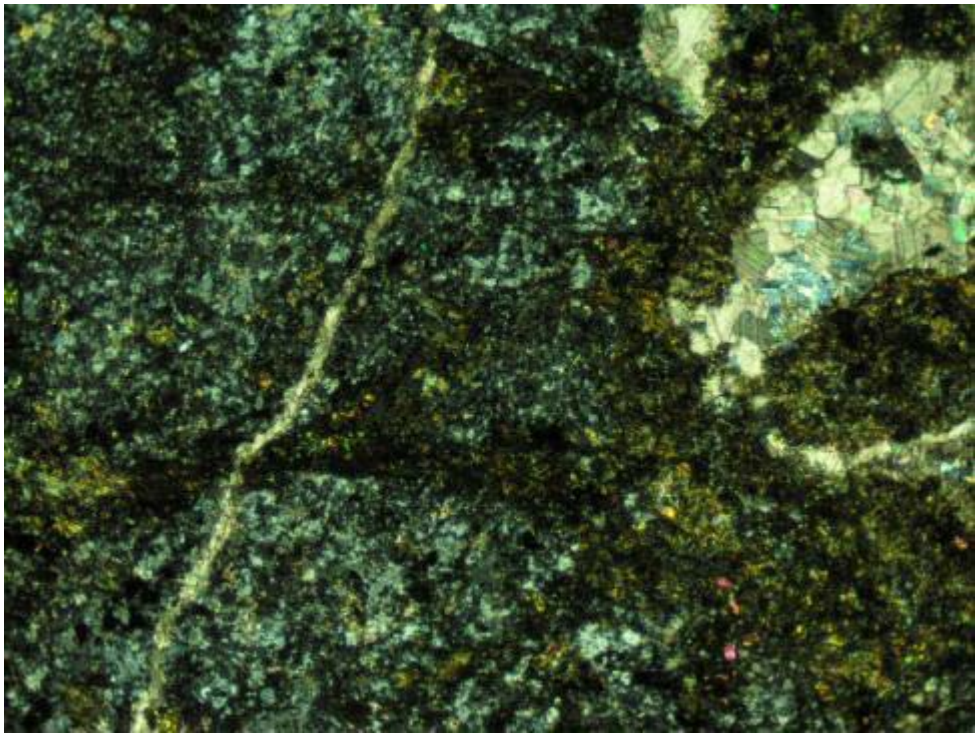
B

Sample: MM-09-11 29.74-29.8m

A) Overview of fine-grained granular matrix. XPL, FOV = ~ 4.5 mm. B) Detailed view of tabular plagioclase (left) partly replaced by very fine-grained secondary K-feldspar (brown). Note clear fine-grained igneous K-feldspar (right). Note patchy replacement of both feldspars by actinolite-epidote-carbonate aggregates. PPL, FOV = ~ 4.5 mm.

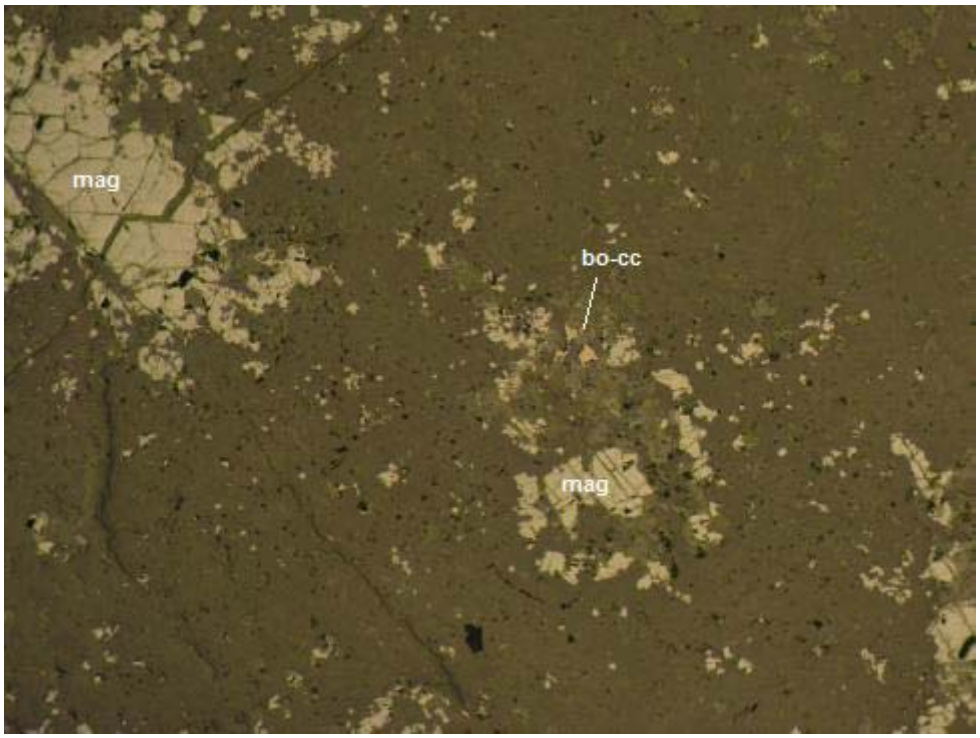


C

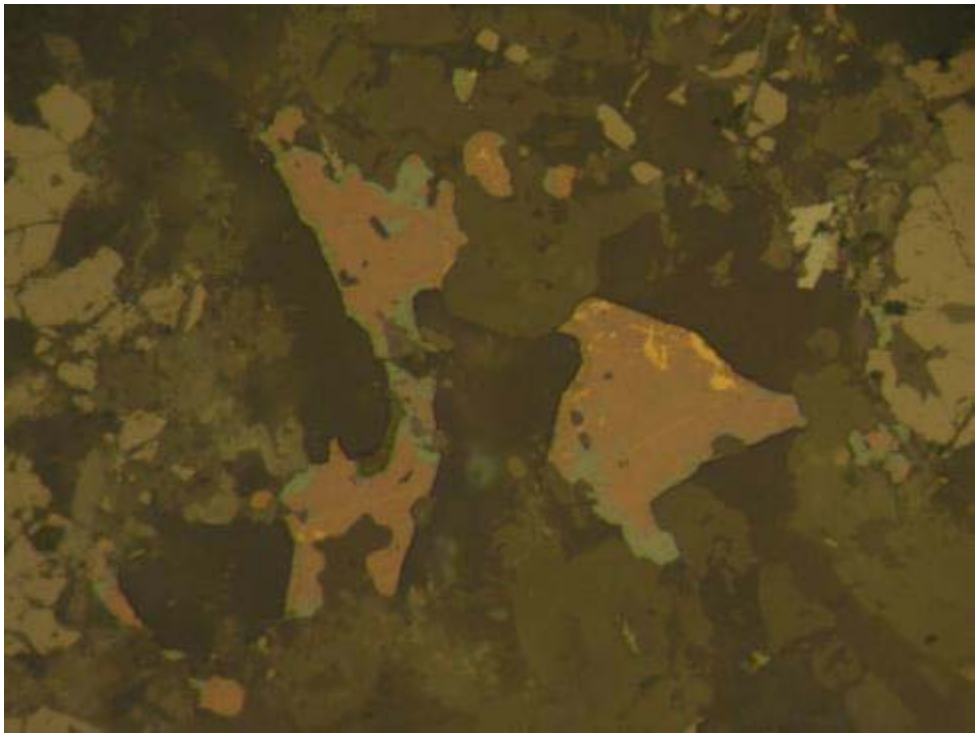


D

Sample: MM-09-11 29.74-29.8m
A) Overview of vaguely porphyritic fine to medium-grained fragment. XPL, FOV = ~ 4.5 mm. B) Detailed view of actinolite-epidote- carbonate-magnetite filled fractures and replacement and late calcite fracture infill. XPL, FOV = ~ 2.6 mm.



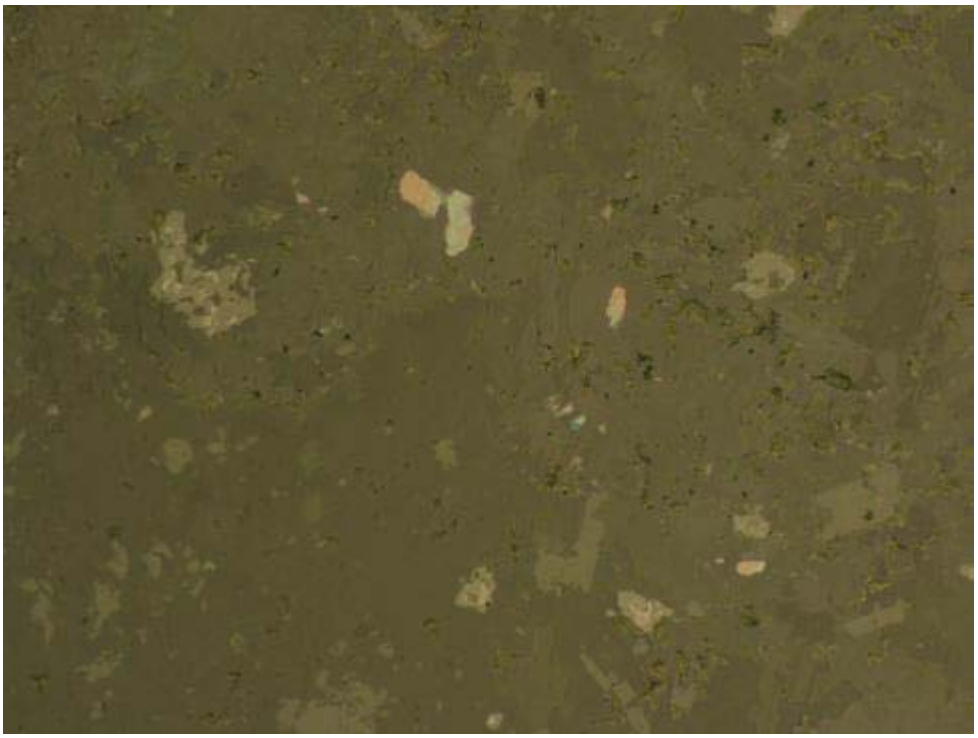
E



F

Sample: MM-09-11 29.74-29.8m

E) View of magnetite (mag) and traces of bornite-chalcocite (bo-cc) as replacement of former tabular mafic phases. RL, FOV = ~ 2.6 mm. F) Detailed view of centre of photo E shows bornite (pink-brown) partly replaced by chalcocite (blue). Note chalcopyrite (yellow) associated with bornite. RL, FOV = ~ 2.6 mm.

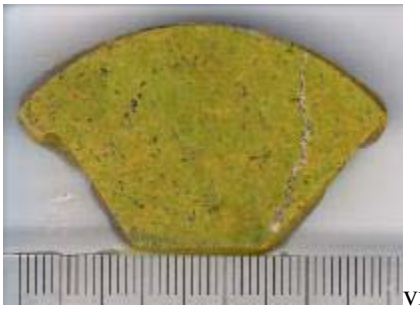


G

Sample: MM-09-11 29.74-29.8m
G) Very fine grains of bornite and chalcocite associated with actinolite-epidote alteration within breccia matrix. RL, FOV = ~ 0.7 mm.

Zone: GRANBY
Sample: MM-09-11 46.65-46.7m **Offcut #AP-2**

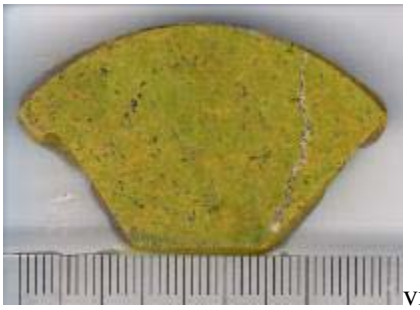

view of hand sample


view of stained section offcut, scale in mm

Hand Sample Test Results:
No reaction of sample to magnet. Strong reaction of fractures to cold, dilute HCl. Positive test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Strongly fractured, pale reddish-brown and olive grey aphanitic rock. The rock is cut by sub-mm wide calcite-filled fractures.

Zone: GRANBY
Sample: MM-09-11 46.65-46.7m **Offcut #AP-2**


view of stained offcut, scale in mm

LITHOLOGY:	?Alkali feldspar microsyenite
ALTERATION TYPE:	Ti-oxide, chlorite, carbonate
MINERALIZATION:	Chalcopyrite, (bornite, chalcocite)
FRACTURES/VEINLETS:	Carbonate-calcite

Polished Thin Section Description:
This section is a fine-grained to locally porphyritic ?alkali feldspar syenite cut by abundant fractures filled with carbonate. The rock comprises fine to medium-grained tabular K-feldspar phenocrysts and minor former fine-grained tabular mafic phases in a finer-grained K-feldspar matrix. The mafic phases have been replaced by aggregates of Ti-oxide, chlorite, rarely carbonate and locally chalcopyrite. It is unclear whether the matrix is primary or secondary. Given a primary matrix, the sample has the composition of an alkali feldspar micro-syenite. Traces of illite occur as very fine flakes partly replacing K-feldspar. Traces of fine to very fine-grained bornite and chalcopyrite occur within fractures (see below) and minor chalcopyrite and traces of bornite occur disseminated. Bornite is rarely partly replaced by chalcocite.

The section is cut by numerous fractures filled carbonate: dominantly colourless and lesser brown. Colourless carbonate occurs as fine to very fine-grained anhedral to prismatic aggregates. Brown carbonate occurs as radiating very fine-grained aggregates as infill to prismatic colourless carbonate in one fracture.

Zone: GRANBY
Sample: MM-09-11 46.65-46.7m **Offcut #AP-2**

HOST ROCK (78%):
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
K-feldspar	72	-fine to medium-grained (< 1.5 mm), tabular, occurs as phenocrysts -fine-grained (< 0.1 mm), anhedral aggregates, occurs as matrix	

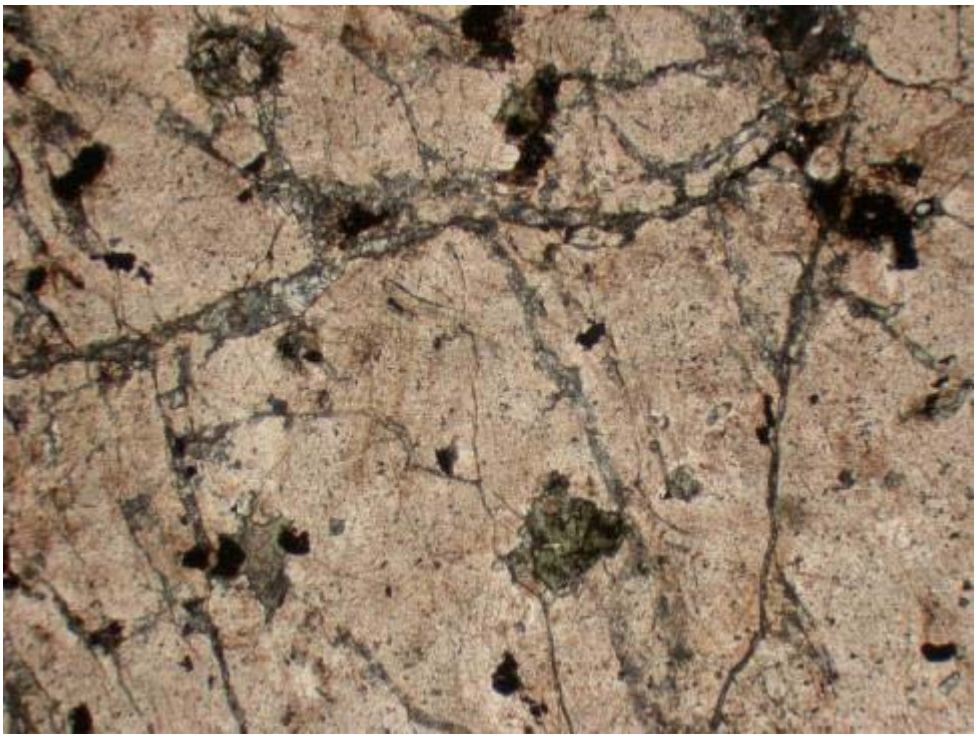
MINOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Ti-oxide	3	very fine-grained aggregates, occurs with chlorite and carbonate as replacement of former mafic phases	
Chlorite	1	fine to very fine-grained (< 0.1 mm), anhedral to platy aggregates, occurs with Ti-oxide, carbonate and sulphides as replacement of mafic phases and in matrix	
Chalcopyrite	1	fine to very fine-grained (< 0.1 mm), anhedral aggregates, occurs disseminated and as replacement of former mafic phases, locally associated with bornite	
Carbonate	tr	very fine-grained, anhedral aggregates, occurs with chlorite as patchy replacement of mafic phases	
Bornite	tr	very fine-grained, occurs disseminated, locally associated with chalcopyrite, partly replaced by chalcocite	
Chalcocite	tr	very fine-grained, occurs rarely partly replacing bornite	
Illite	tr	very fine-grained, flaky, occurs with chlorite as replacement of K-feldspar	

VEINLETS/ FRACTURE INFILL (22%):

Mineral	%	Distribution & Characteristics*	Optical
Carbonate, colourless, likely calcite	20	fine to very fine-grained, anhedral aggregates, occurs as fracture infill, partly replaced by very fine-grained carbonate aggregate	*colourless*
Carbonate, brown	2	Very fine-grained, radiating aggregates, occurs with colourless carbonate as fracture infill	*brown*
Chalcopyrite	tr	fine to very fine-grained (< 0.1 mm), anhedral grains and aggregates, occurs rarely within carbonate veinlets infill	
Bornite	tr	very fine-grained, occurs associated with chalcopyrite	
Chalcocite	tr	very fine-grained, occurs rarely partly replacing bornite	

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm



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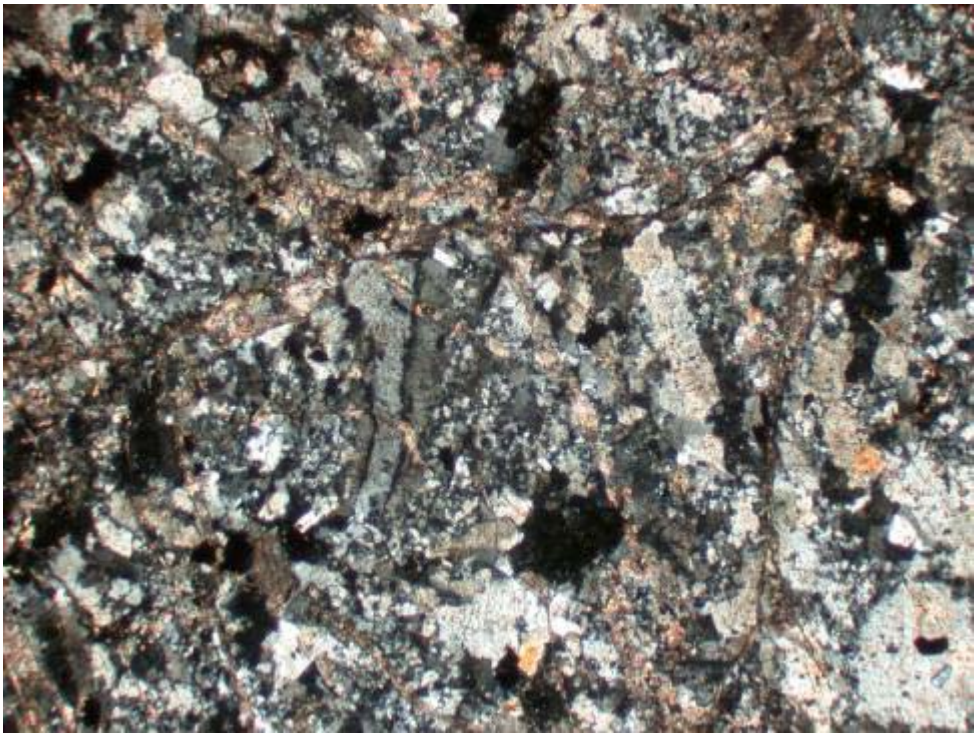
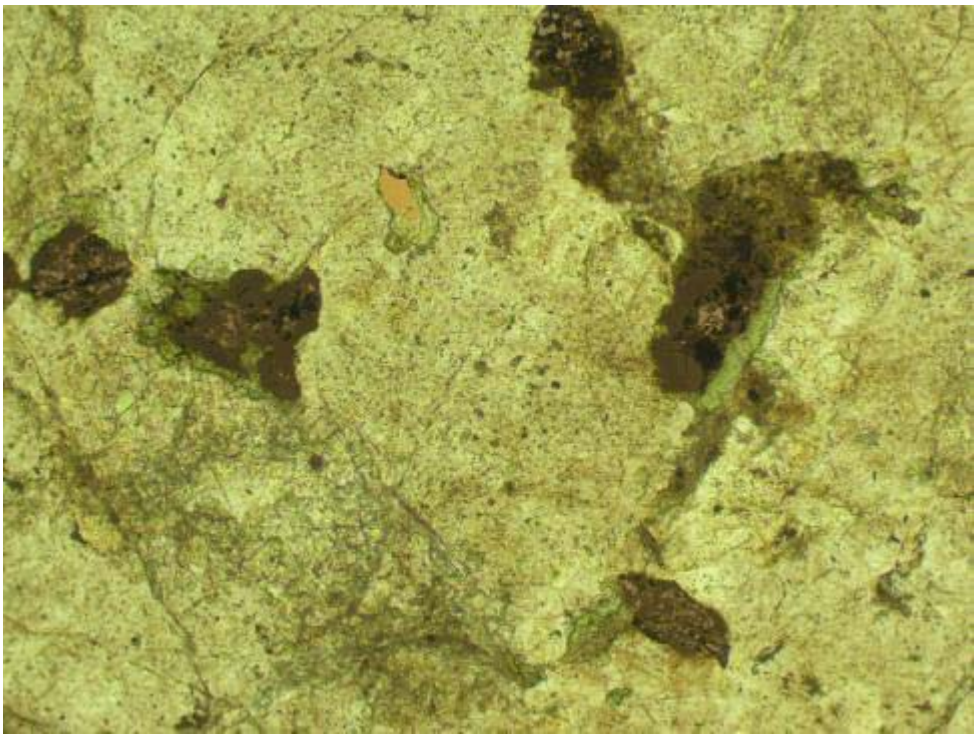


B

Sample: MM-09-11 46.65-46.7m
A & B) Overview of sample shows highly fractured rock with tabular K-feldspar phenocrysts and minor former tabular mafic phases in a finer-grained K-feldspar matrix. Fractures filled with carbonate. A) PPL, B) XPL, FOV = ~ 4.5 mm.



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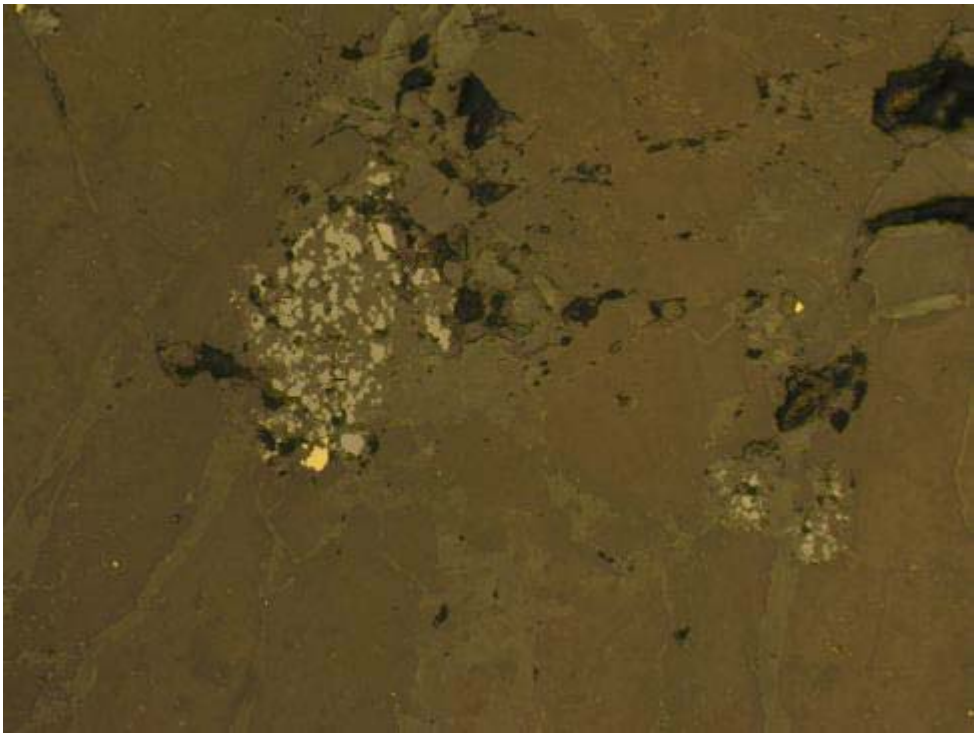
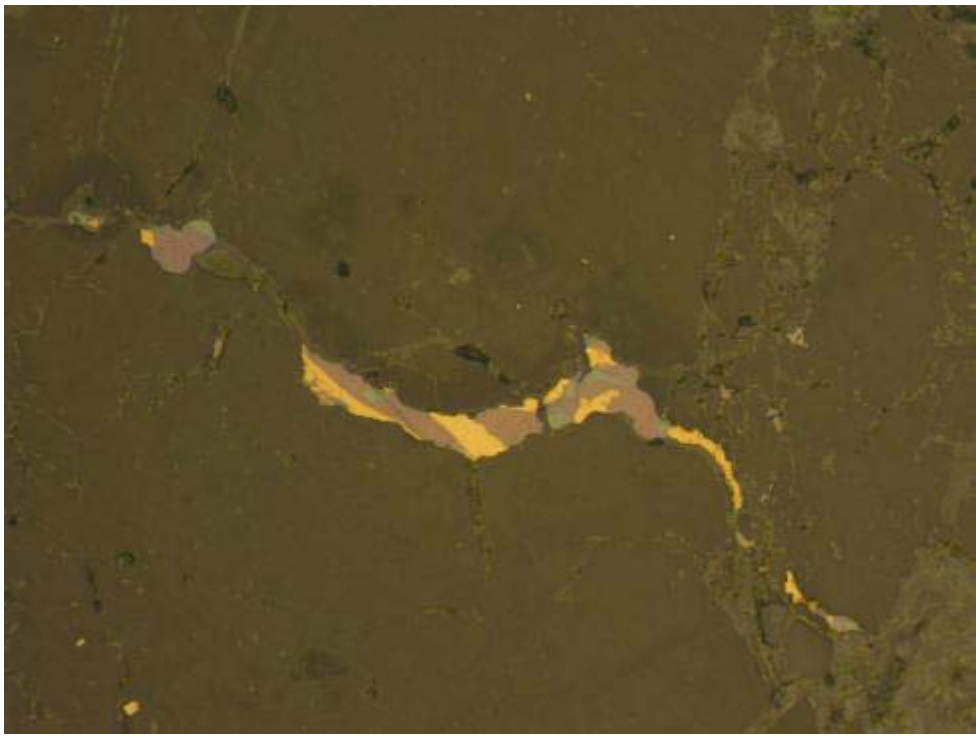
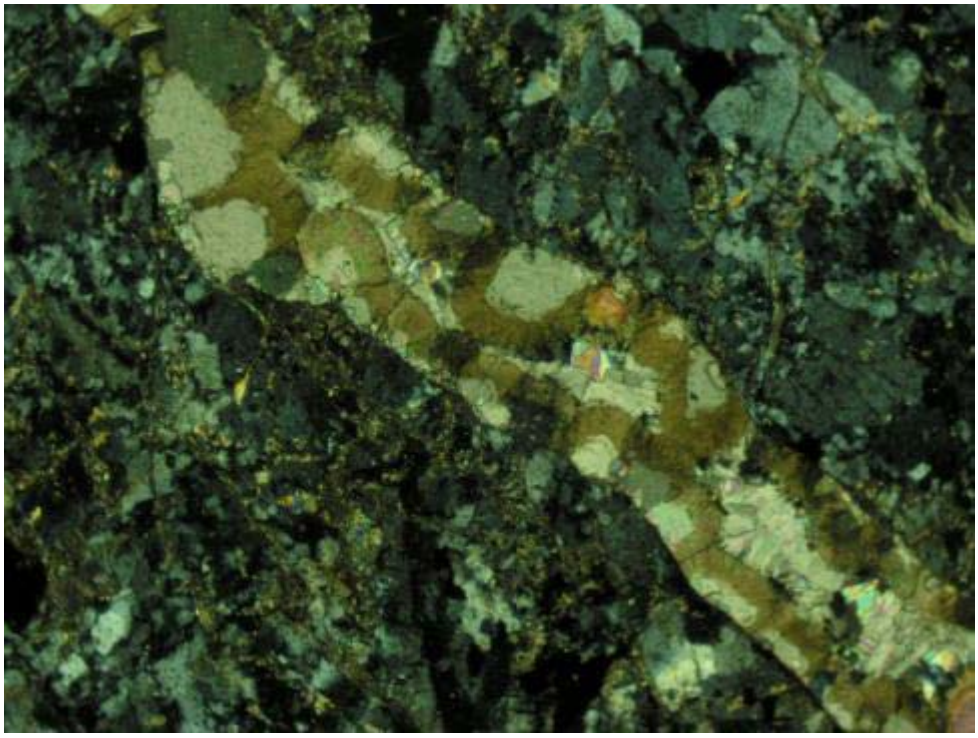


D

Sample: MM-09-11 46.65-46.7m
C) Detailed view of former tabular mafic phases replaced by Ti-oxide, chlorite and locally chalcopyrite. PPL+RL, FOV = ~ 1.3 mm. D) Another view of former mafic phases replaced by chlorite, Ti-oxide and locally chalcopyrite. RL, FOV = ~ 1.3 mm.



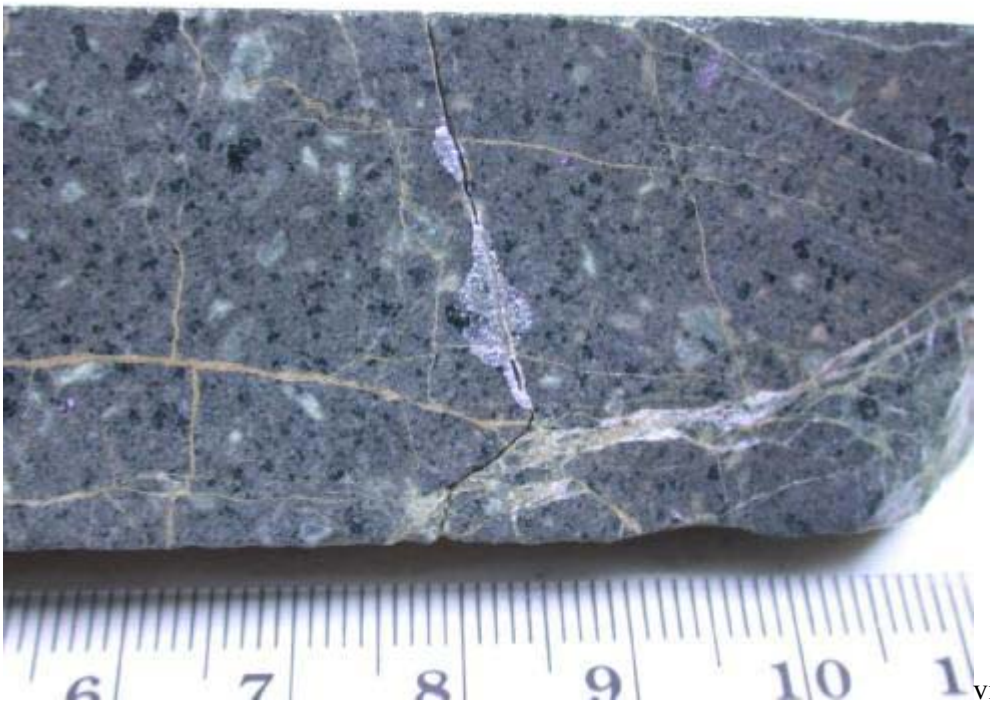
E



F

Sample: MM-09-11 46.65-46.7m
E) Fracture controlled aggregate of bornite-chalcopyrite. Note bornite partly replaced by chalcocite (blue-grey). RL, FOV = ~ 0.7 mm. F) Detailed view of fracture filled with prismatic colourless carbonate and radiating brown carbonate infill. XPL, FOV = ~ 2.6 mm

Zone: GRANBY
Sample: MM-09-11 68.4-68.5m **Offcut #AP-3**



view of hand sample


view of stained section offcut, scale in mm

Hand Sample Test Results:
Strong reaction of sample to magnet. Reaction of rock and white material in fractures to cold, dilute HCl. Negative test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Strongly fractured, dark greenish grey porphyritic rock with approximately 5%, fine to medium-grained dark green tabular phenocrysts (1-2 mm size) and approximately 15%, fine to medium-grained white tabular phenocrysts (1-2 mm size) in a very fine-grained matrix. Some tabular phenocrysts have white alteration rims. The rock is cut by sub-mm wide brown carbonate and white calcite filled fractures.

Zone: GRANBY
Sample: MM-09-11 68.4-68.5m **Offcut #AP-3**


view of stained offcut, scale in mm

LITHOLOGY:	Pervasively altered porphyritic ?micro quartz diorite
ALTERATION TYPE:	Chlorite, carbonate, illite/sericite, magnetite, Ti-oxide
MINERALIZATION:	(Pyrite, covellite)
FRACTURES/VEINLETS:	Carbonate-calcite

Polished Thin Section Description:
This section is a pervasively chlorite, carbonate, illite/sericite, magnetite, Ti-oxide altered former porphyritic ?micro quartz diorite cut by numerous fractures filled with carbonate. The rock comprises fine to medium-grained former plagioclase phenocrysts and former mafic phenocrysts in a fine-grained matrix. The matrix comprises dominantly former plagioclase laths, chlorite-altered former tabular phases and lesser quartz. Plagioclase phenocrysts and matrix laths are virtually completely replaced by illite/sericite, chlorite and patchy carbonate aggregate. Vague relict twinning and zoning are preserved in the plagioclase. Traces of relict mafic phases, including ?amphibole, are virtually completely replaced by carbonate and chlorite aggregates. Quartz occurs interstitial to plagioclase laths in the matrix. Fine to very fine-grained magnetite occurs disseminated. Magnetite is pitted and partly rimmed by aggregates of Ti-oxide. One grain of very fine-grained pyrite is observed partly replaced by covellite.

The section is cut by numerous fractures filled with carbonate. Margins of fractures are lined with brown fibrous carbonate and infilled by colourless carbonate aggregate.

Zone: GRANBY
Sample: MM-09-11 68.4-68.5m **Offcut #AP-3**

HOST ROCK (96%):
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Chlorite	35	very fine-grained, anhedral aggregates, occurs as patchy replacement of rock	
Carbonate	35	very fine-grained, anhedral aggregates, occurs as patchy replacement of rock, overprints illite/sericite	
Illite/sericite	10	fine to very fine-grained (< 0.2), anhedral to flaky aggregates, occurs as patchy replacement and commonly rims to former plagioclase phenocrysts	
Quartz	5	fine-grained, anhedral to radiating grains and aggregates, occurs interstitial to former plagioclase in matrix	
Magnetite	5	fine to very fine-grained (< 0.1 mm), sub-anhedral pitted grains, occurs disseminated, partly ?replaced by Ti-oxide	

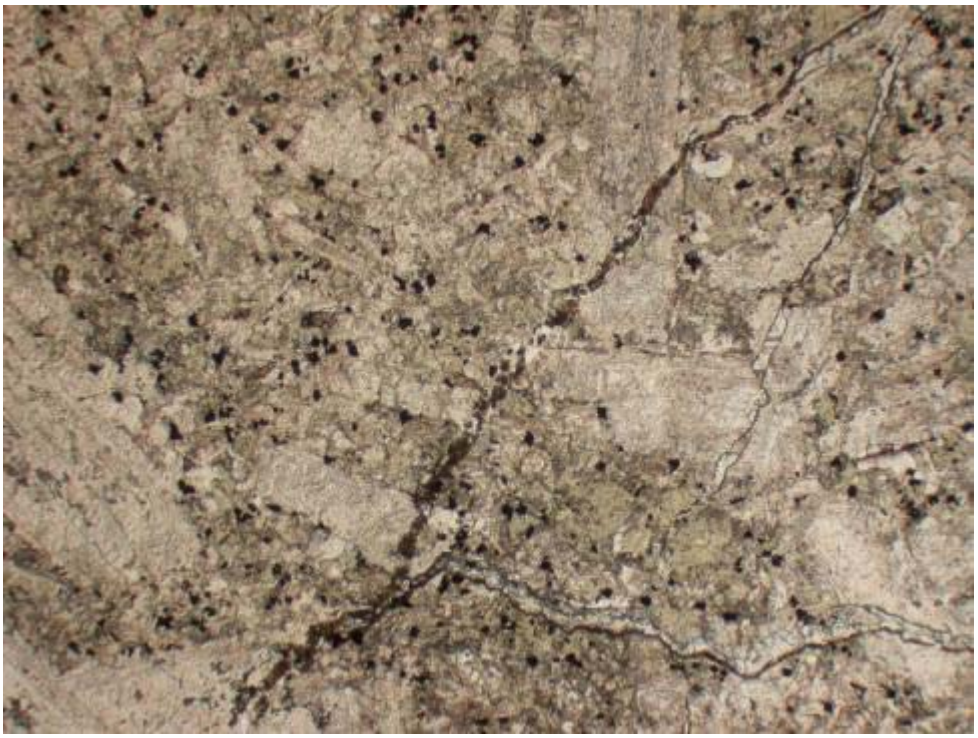
MINOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Ti-oxide	3	very fine-grained, anhedral aggregates, occurs as ?replacement of magnetite	*brown*
Plagioclase	2	-fine to medium-grained (< 3 mm), occurs as phenocrysts, virtually completely replaced by illite/sericite, chlorite and carbonate -fine-grained (< 0.4 mm), laths, occurs as matrix, virtually completely replaced (as above)	*relict polysynthetic twinning preserved*
?Amphibole	tr	fine-grained (< 0.6 mm), tabular, relict grains, virtually completely replaced by carbonate and chlorite	
Hematite	tr	fine to very fine-grained, anhedral to bladed grains, occurs within radiating quartz aggregates	
Pyrite	tr	very fine-grained, one grain observed, partly replaced by covellite	
Covellite	tr	very fine-grained, occurs partly replacing pyrite	

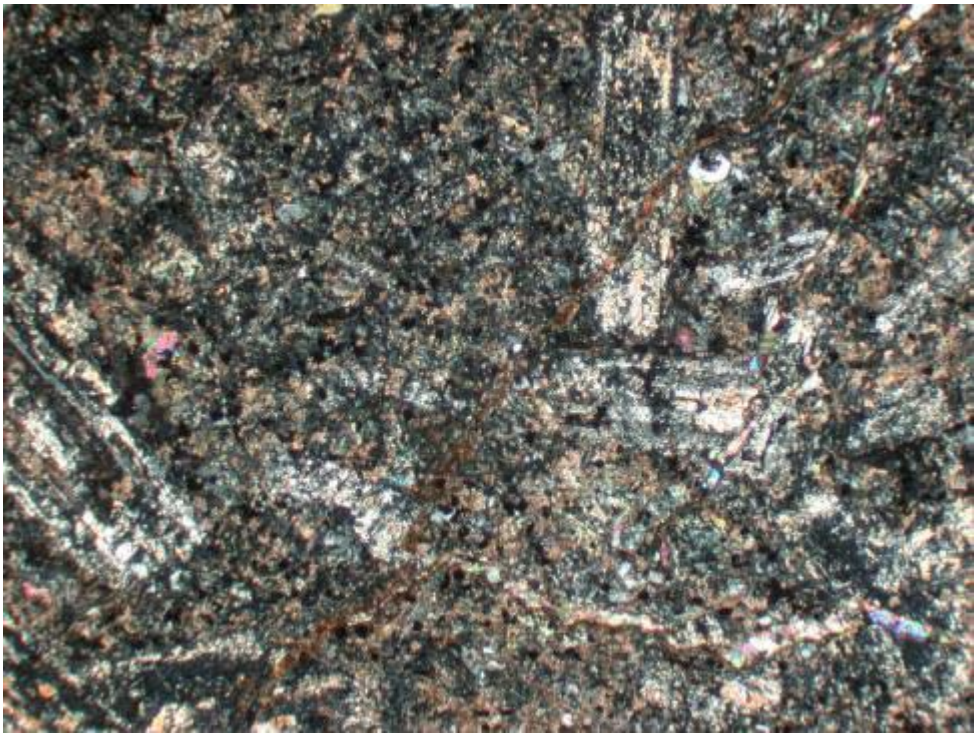
VEINLETS/ FRACTURE INFILL (4%):

Mineral	%	Distribution & Characteristics*	Optical
Carbonate, brown	2	Very fine-grained, fibrous aggregates, occurs as fracture infill with colourless carbonate	*brown*
Carbonate, colourless, likely calcite	2	very fine-grained, anhedral aggregates, occurs as fracture infill with brown fibrous carbonate aggregate	*colourless*

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm

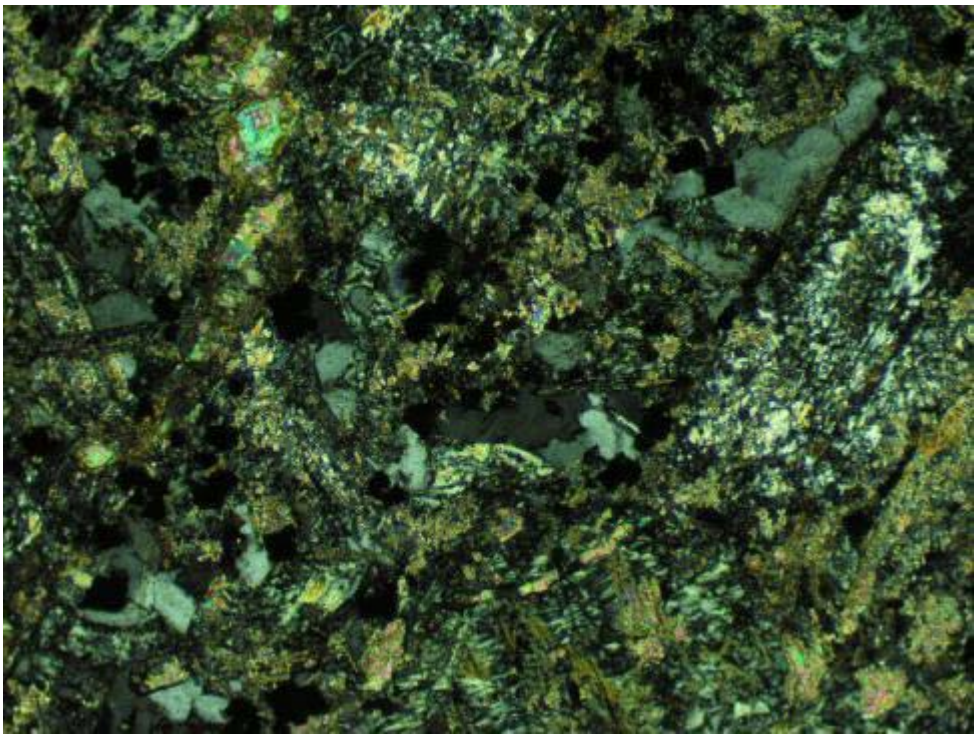


A

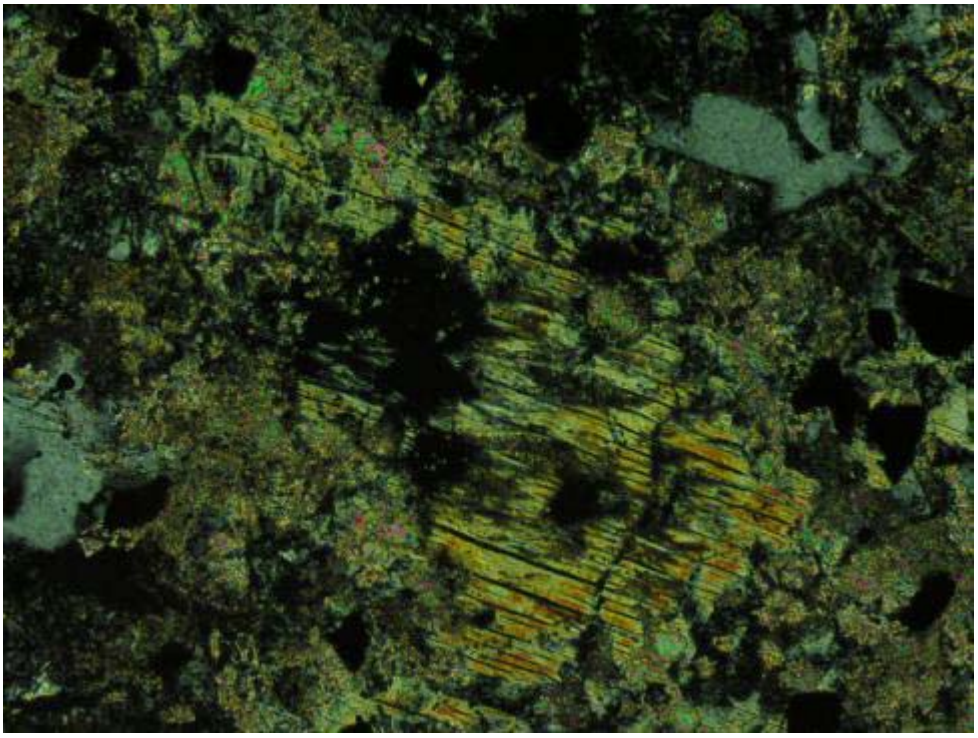


B

Sample: MM-09-11 68.4-68.5m
A & B) Overview of sample shows pervasively illite/sericite, chlorite and carbonate-altered porphyritic ?microdiorite cut by numerous fractures filled with carbonate. Note disseminated magnetite (opaque) and relict twinning in former plagioclase phenocrysts. A) PPL, B) XPL, FOV = ~ 4.5 mm.

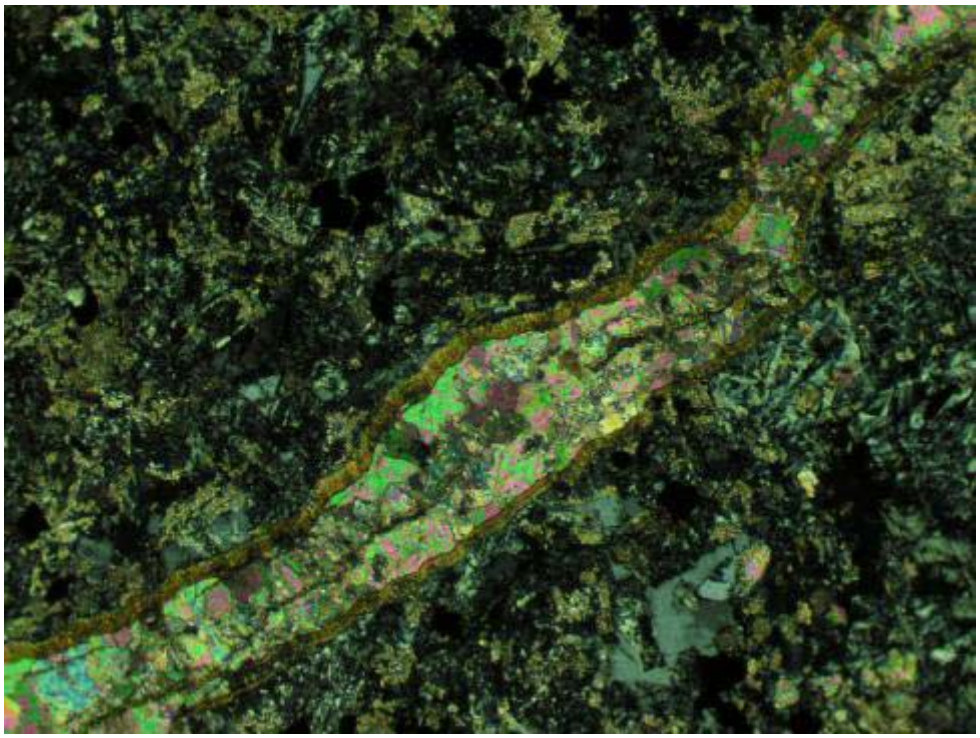


C

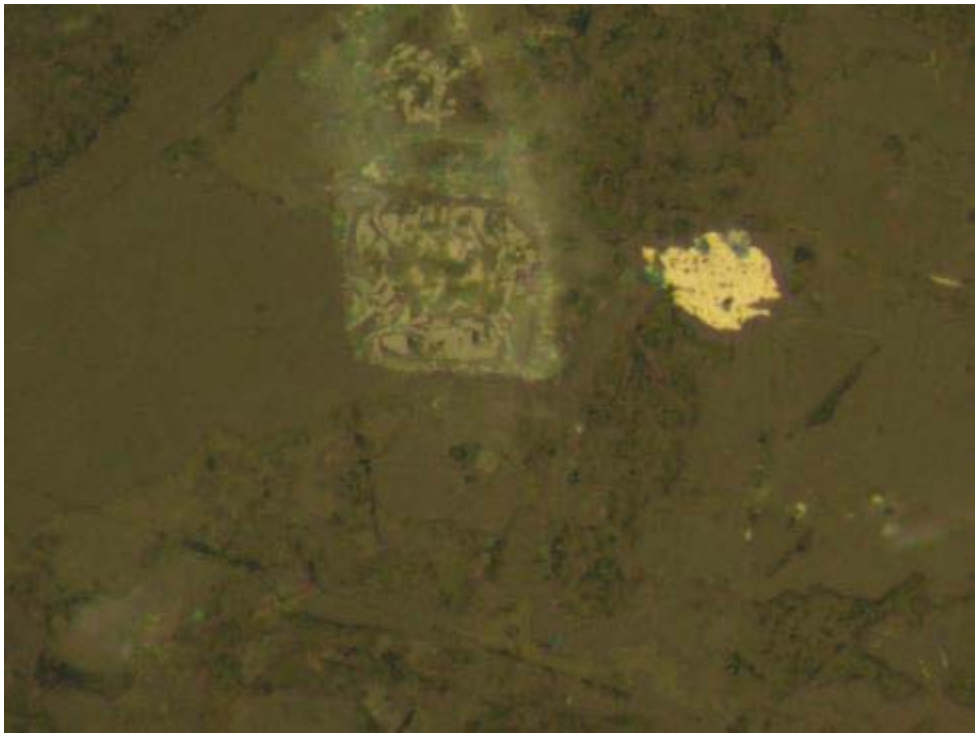


D

Sample: MM-09-11 68.4-68.5m
C) Detailed views of rock matrix with quartz interstitial to former plagioclase laths. XPL, FOV = ~ 1.3 mm, D) Relict ?amphibole replaced by carbonate. XPL, FOV = 2.6 mm.



E



F

Sample: MM-09-11 68.4-68.5m
E) Fracture with infill by brown fibrous carbonate and colourless carbonate. XPL, FOV = ~ 1.3 mm. F) Detailed view of pitted magnetite (centre) rimmed by Ti-oxide and disseminated pyrite grain (right) partly replaced by covellite (dark blue). RL, FOV = ~ 0.2 mm.

Zone: SOUTH
Sample: MM-09-11 77.4-77.46m **Offcut #AP-4**


view of hand sample


view of stained section offcut, scale in mm

Hand Sample Test Results:
No reaction of sample to magnet. Strong reaction of rock and fractures to cold, dilute HCl. Positive test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Crackle breccia with angular brownish gray-green fragments (< 1-5 cm size) of fine-grained rock with fracture infill by calcite and locally patchy friable medium-gray granular material. Polished thin section prepared from cut across sample. Note sample very fragile – 2 pieces are glued together along break from lower left to upper right of hand sample photo above.

Zone: SOUTH
Sample: MM-09-11 77.4-77.46m **Offcut #AP-4**


view of stained section offcut, scale in mm

LITHOLOGY:	Pervasively altered and mineralized porphyritic rock; Crackle breccia
ALTERATION TYPE:	K-feldspar, carbonate, Ti-oxide
MINERALIZATION:	Bornite (chalcocite, covellite, chalcopyrite)
FRACTURES/VEINLETS:	Carbonate± bornite (chalcocite, covellite, chalcopyrite) Calcite, gypsum

Polished Thin Section Description:
This section is an extensively fractured, pervasively K-feldspar, carbonate and Ti-oxide altered and mineralized porphyritic fine to medium-grained rock (crackle breccia). The rock comprises plagioclase and K-feldspar phenocrysts in a fine to very fine-grained dominantly K-feldspar matrix. Plagioclase phenocrysts and matrix are selectively replaced by very fine-grained secondary K-feldspar and patchy carbonate. K-feldspar phenocrysts are also partly replaced by patchy carbonate. Traces of chlorite and minor aggregate of Ti-oxide occur as very fine-grained scattered patches. Minor bornite occurs disseminated and with brown carbonate alteration of host rock and fracture infill (see below). Bornite is locally associated with chalcopyrite and commonly partly replaced by chalcocite which is in turn partly replaced by covellite.

The host rock has been intensely fractured forming a crackle breccia with infill by very fine-grained brown carbonate aggregate, fine-grained colourless carbonate aggregate and latest fibrous gypsum aggregate. Minor bornite±chalcopyrite±chalcocite±covellite is locally associated with fracture-controlled brown carbonate aggregate.

Zone: SOUTH
Sample: MM-09-11 77.4-77.46m **Offcut #AP-4**

HOST ROCK(~65%):
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
K-feldspar	50	-fine-grained (0.3 to 1 mm), occurs as phenocrysts -fine to very fine-grained (< 0.1 mm), occurs as matrix -very fine-grained, anhedral aggregates, brown, occurs as replacement of plagioclase phenocrysts and matrix; massive replacement of parts of the section	
Carbonate	10	very fine-grained, anhedral aggregates, occurs as patchy patchy replacement of K-feldspar	

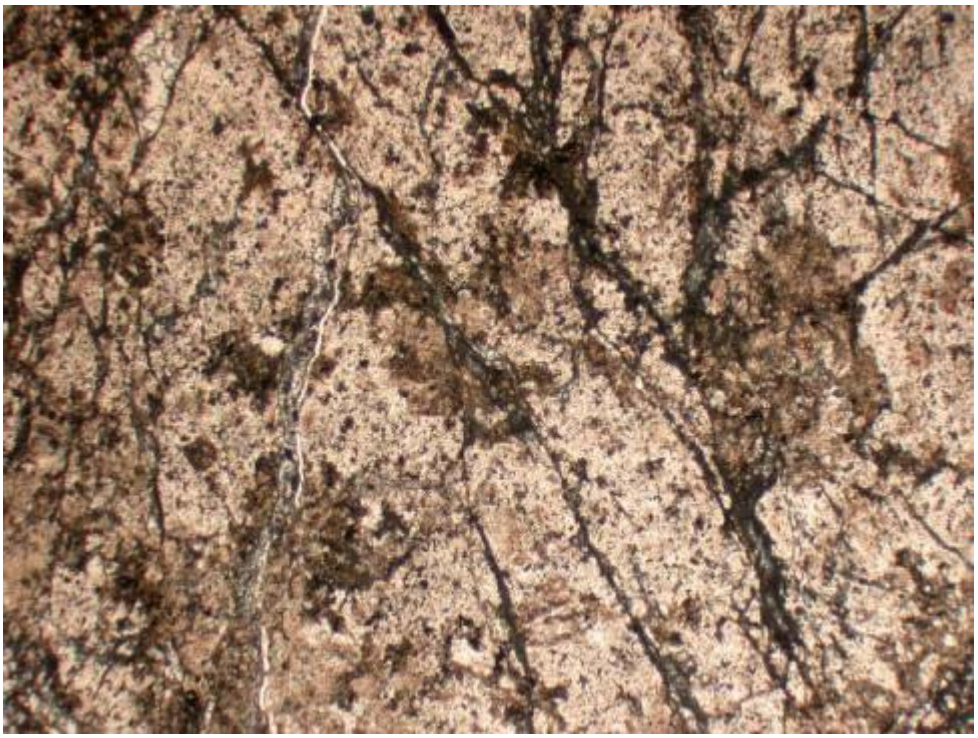
MINOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Ti-oxide	1.5	very fine-grained, anhedral aggregates, occurs as patchy aggregates associated with carbonate replacement of rock	*brown*
Bornite	1.5	fine to very fine-grained (< 0.1 mm), anhedral grains and aggregates, locally associated with chalcopyrite, occurs disseminated and associated with carbonate, commonly partly replaced by chalcocite and covellite	
Plagioclase	1	fine to medium (< 1.5 mm), tabular crystals, replaced by K-feldspar	*polysynthetic twinning-albite*
Chlorite	tr	very fine-grained, anhedral to radiating aggregates, patchy aggregates, locally associated with calcite and magnetite	
Chalcocite	tr	very fine-grained, aggregates, occurs partly replacing bornite	
Covellite	tr	very fine-grained, occurs as replacement of chalcocite	
Chalcopyrite	tr	very fine-grained, associated with bornite	

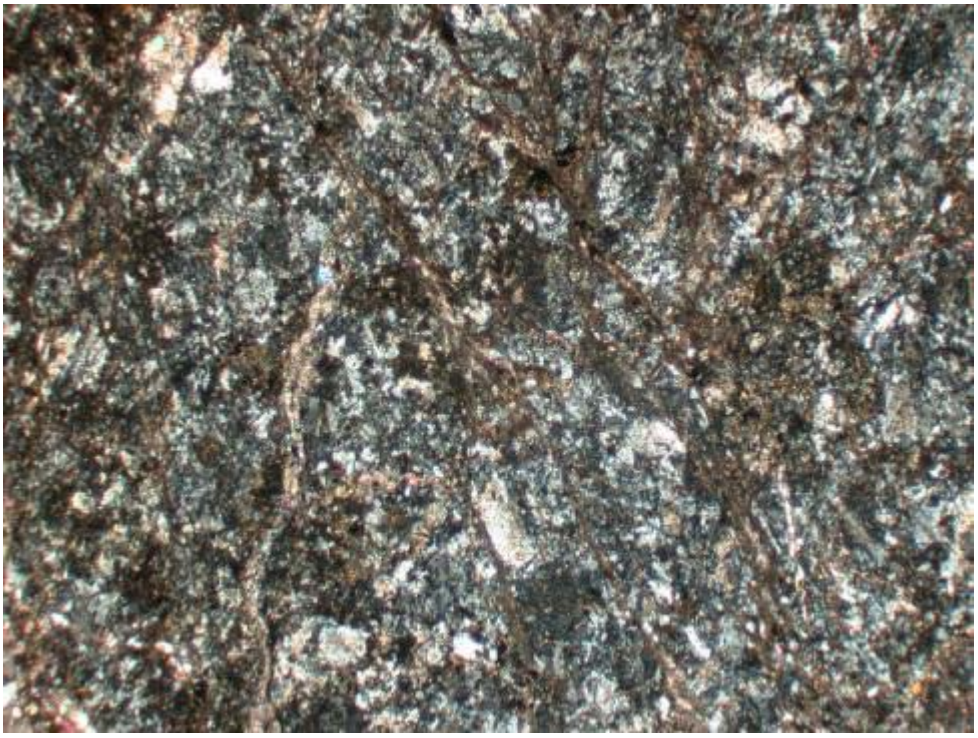
FRACTURE INFILL (~35%):

Mineral	%	Distribution & Characteristics*	Optical
Carbonate, brown	24	very fine-grained, aggregates, occurs as crackle breccia infill	*brown*
Carbonate, calcite	10	fine-grained (< 0.8 mm), aggregates, occurs as fracture infill	*colourless*
Bornite	1	fine to very fine-grained (< 0.1 mm), anhedral grains and aggregates, locally associated with chalcopyrite, fracture-controlled, commonly partly replaced by chalcocite and covellite	
Chalcocite	tr	very fine-grained, aggregates, occurs partly replacing bornite	
Covellite	tr	very fine-grained, occurs as replacement of chalcocite	
Chalcopyrite	tr	very fine-grained, associated with bornite	
Gypsum	tr	fine-grained, fibrous, occurs as latest fracture infill, soft, partly removed from section	

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm

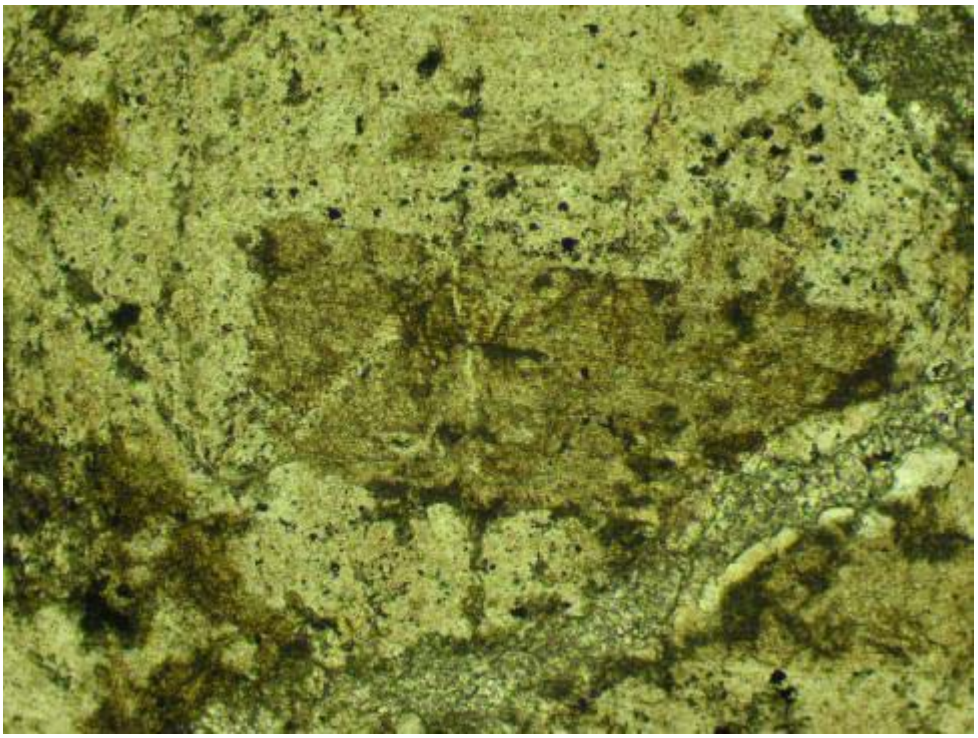


A



B

Sample: MM-09-11 77.4-77.46m
A & B) Overview of extensively fractured, pervasively K-feldspar and carbonate altered porphyritic rock. A) PPL, B) XPL, FOV = ~ 4.5 mm.



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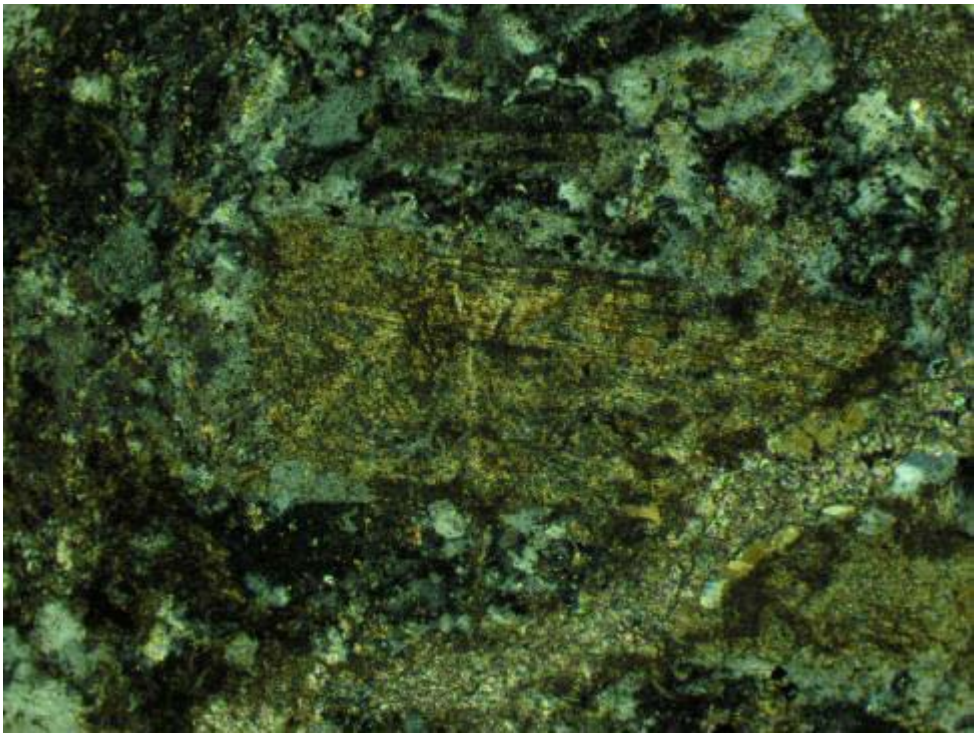
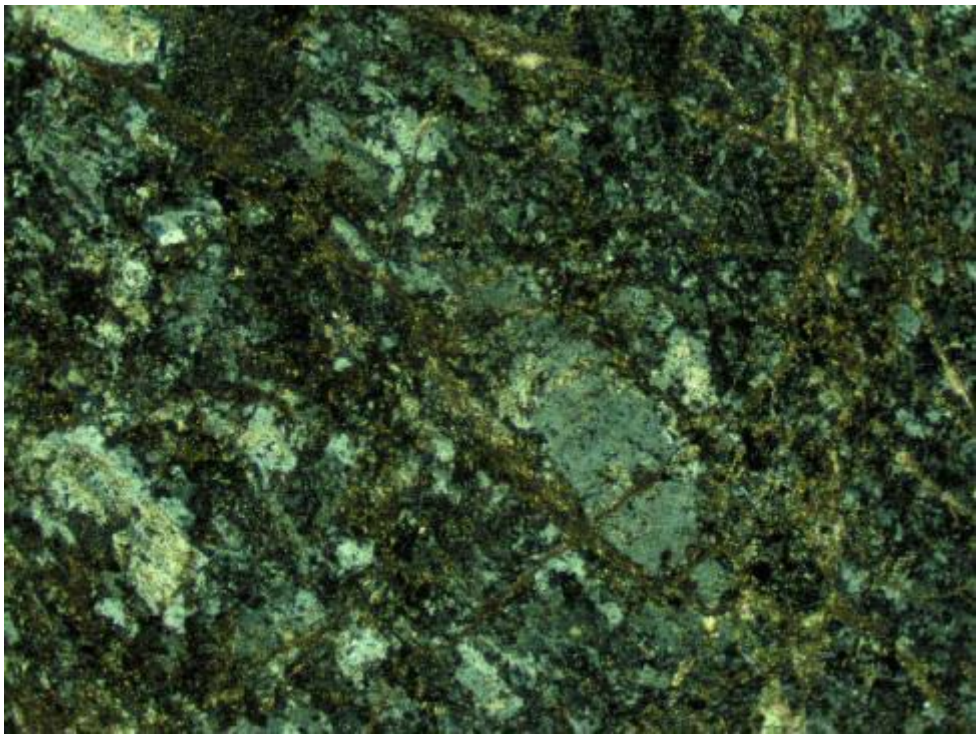


D

Sample: MM-09-11 77.4-77.46m
C & D) Overview of selectively K-feldspar altered plagioclase phenocryst in finer-grained K-feldspar dominant matrix. Note colourless carbonate filled fracture (bottom right). C) PPL, D) XPL, FOV = ~ 1.3 mm.

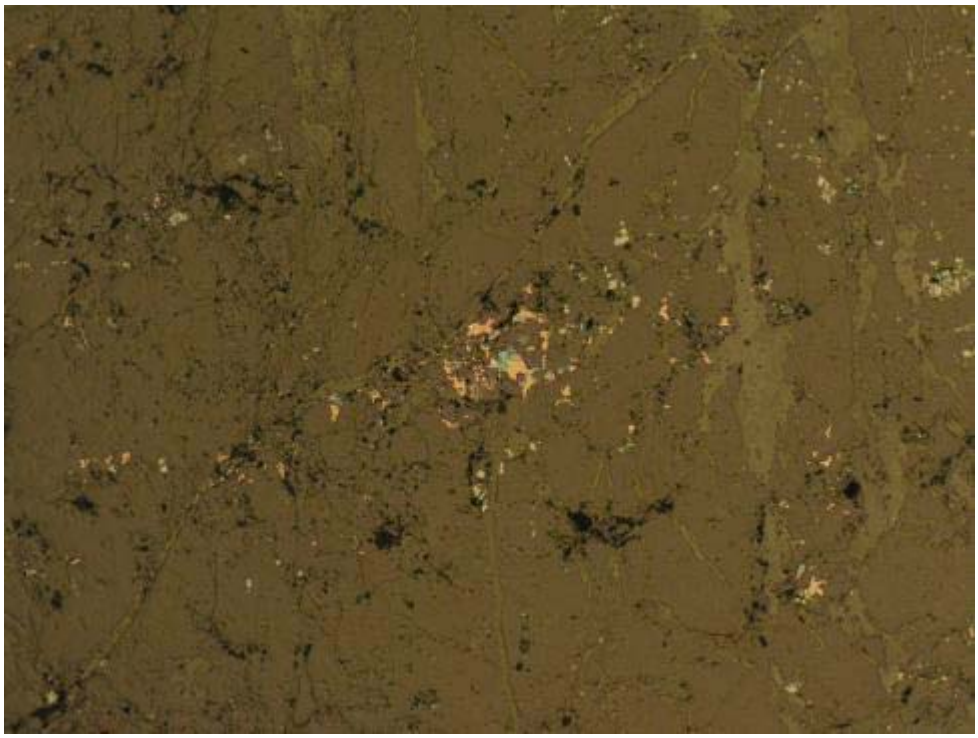


E

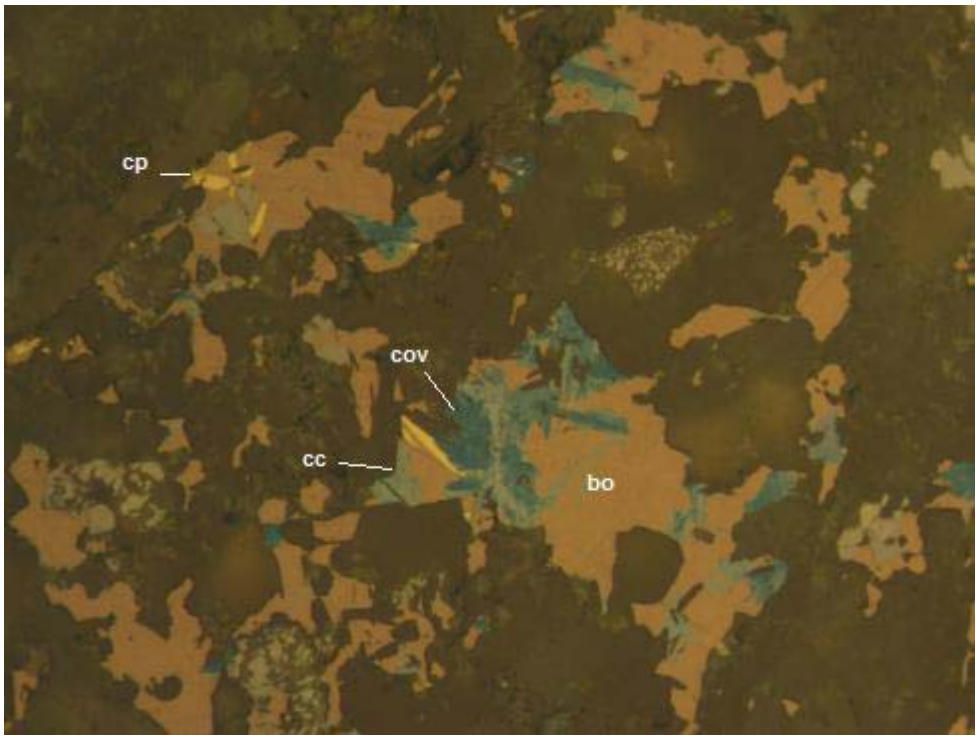
F

Sample: MM-09-11 77.4-77.46m

E & F) Views of extensively fractured porphyritic rock with infill by brown carbonate and, in photo F, late colourless carbonate (across centre of photo F). E) XPL, FOV = ~ 2.6 mm. F) PPL, FOV = ~ 4.5 mm.



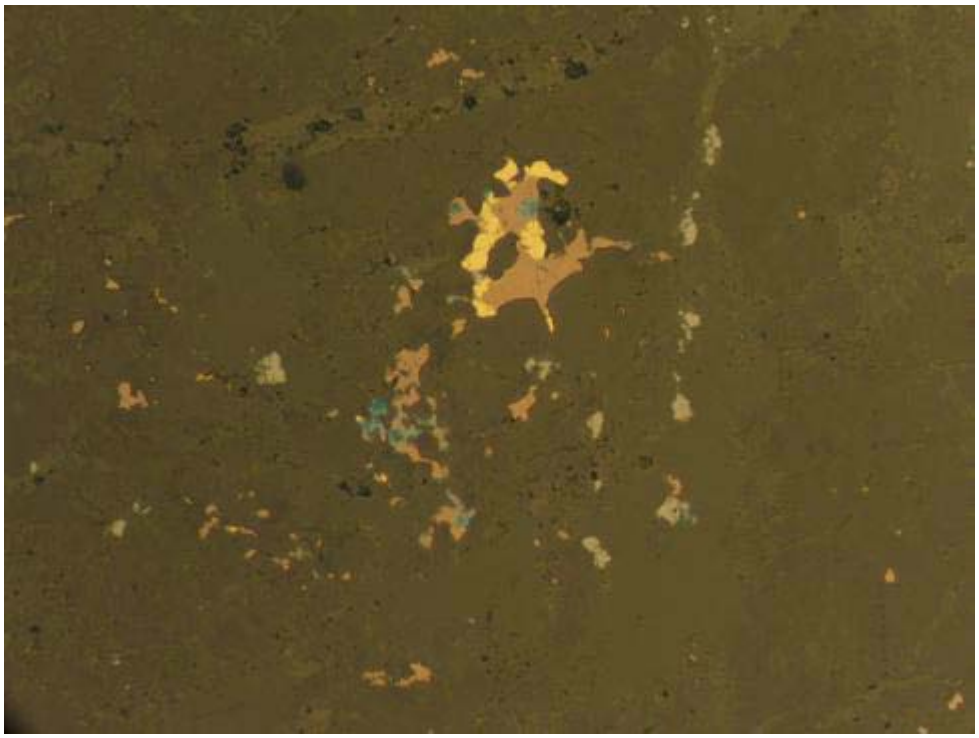
G



H

Sample: MM-09-11 77.4-77.46m

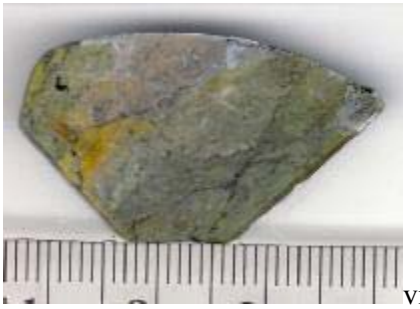
G) Distribution of bornite within fractured host rock. RL, FOV = ~ 2.6 mm. H) Detailed view of central part of photo G. Note bornite (bo) partly replaced by chalcocite (cc) and covellite (cov). Traces of chalcopyrite (cp) are associated with bornite. RL, FOV = ~ 0.3 mm.



Sample: MM-09-11 77.4-77.46m
I) Disseminated bornite associated with chalcopyrite and partly replaced by chalcocite & covellite. RL, FOV = ~ 0.7 mm.

Zone: GRANBY
Sample: MM-09-11 93.34-93.4m **Offcut #AP-5**

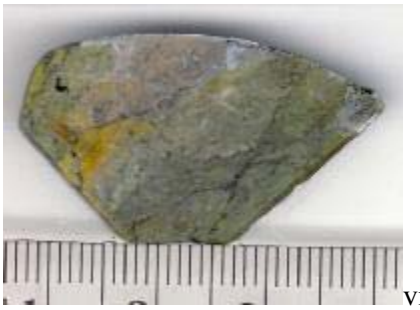
view of hand sample


view of stained section offcut, scale in mm

Hand Sample Test Results:
No reaction of sample to magnet. No reaction to cold, dilute HCl. Local positive test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Dark greenish-gray aphanitic rock with abundant disseminated and fracture-controlled fine-grained pyrite. Rock is altered by discontinuous band (approximately 1 cm wide) of orange-brown carbonate with sub-mm white veinlets.

Zone: GRANBY
Sample: MM-09-11 93.34-93.4m **Offcut #AP-5**


view of stained offcut, scale in mm

LITHOLOGY:	Porphyritic andesite
ALTERATION TYPE:	K-feldspar, chlorite, Ti-oxide, carbonate
MINERALIZATION:	Pyrite, chalcopyrite
VEINLETS/ FRACTURES:	*brown* carbonate -pyrite-chalcopyrite-(quartz) *colourless* carbonate

Polished Thin Section Description:
This section is a porphyritic andesite cut by fracture-controlled to pervasive carbonate alteration. The andesite comprises minor fine-grained plagioclase and K-feldspar phenocrysts in a fine to very fine-grained matrix of dominantly plagioclase laths with interstitial K-feldspar and former mafic phases. Mafic phases are replaced by chlorite, carbonate and patchy Ti-oxide aggregate. Feldspars are partly replaced by minor patchy carbonate. Minor fine to very fine-grained euhedral pyrite occurs disseminated.

The host rock is cut by fractures filled dominantly with brown very fine-grained carbonate. Minor pyrite, chalcopyrite and locally traces of quartz occur within the carbonate-filled fractures. Pyrite is fine-grained, anhedral and locally enclosed by chalcopyrite. Late fine to very fine-grained colourless carbonate occurs as crosscutting fracture infill.

Zone: GRANBY
Sample: MM-09-11 93.34-93.4m **Offcut #AP-5**

HOST ROCK (~60%):
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Plagioclase	40	-fine-grained (< 0.8 mm), eu-subhedral crystals, occurs as minor phenocrysts -fine to very fine-grained, laths, occurs as matrix, patchy replacement by carbonate and Ti-oxide aggregates	*relict polysynthetic twinning*
Ti-oxide	5	very fine-grained, anhedral aggregates, associated with carbonate and chlorite as patchy replacement of rock	
Chlorite	5	very fine-grained, anhedral aggregates, occurs as replacement of former mafic phases	
K-feldspar	5	- fine-grained (< 0.5 mm), occurs as phenocrysts -fine to very fine-grained, occurs interstitial to plagioclase as matrix, trace replacement by carbonate -very fine-grained, occurs within carbonate replacement band	

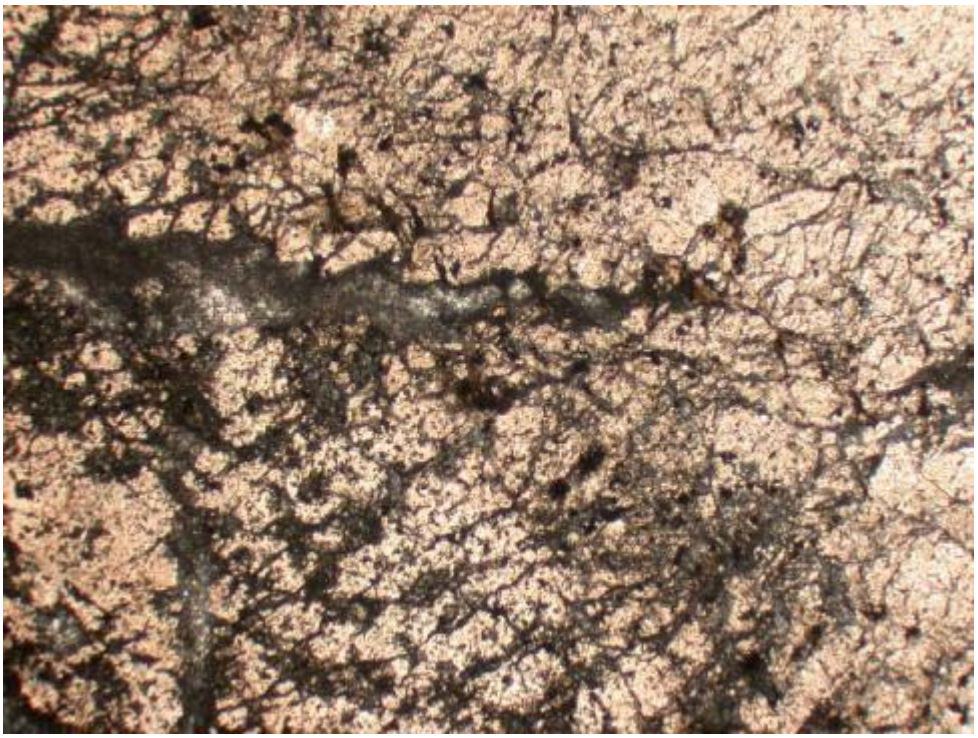
MINOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Pyrite	3	fine to very fine-grained (< 0.3 mm), euhedral grains, occurs disseminated	
Carbonate	2	-very fine-grained, anhedral aggregates, occurs locally as patchy replacement of feldspars	

VEINLETS/ FRACTURE INFILL (~40%):

Mineral	%	Distribution & Characteristics*	Optical
Carbonate	30	-very fine-grained, anhedral aggregates, occurs locally as fracture-controlled to pervasive replacement of host rock	*brown*
Carbonate, no HCl reaction	4	fine to very fine-grained (< 0.2 mm), occurs as late cross-cutting fracture infill	*colourless*
Pyrite	4	fine-grained (< 0.4 mm), anhedral aggregates, locally enclosed by chalcopyrite, occurs witin brown carbonate fracture infill	
Chalcopyrite	1	fine to very fine-grained, anhedral aggregates, occurs within brown carbonate-filled fractures, locally encloses pyrite	
Quartz	tr	very fine-grained, occurs associated with very fine-grained brown carbonate, pyrite and chalcopyrite	

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm



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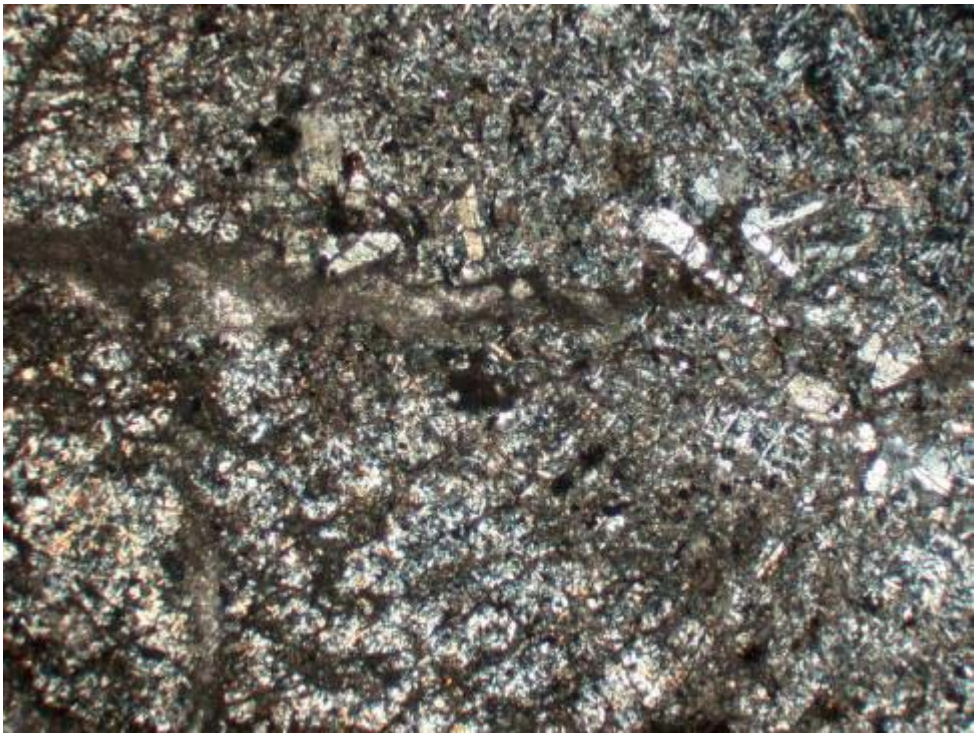
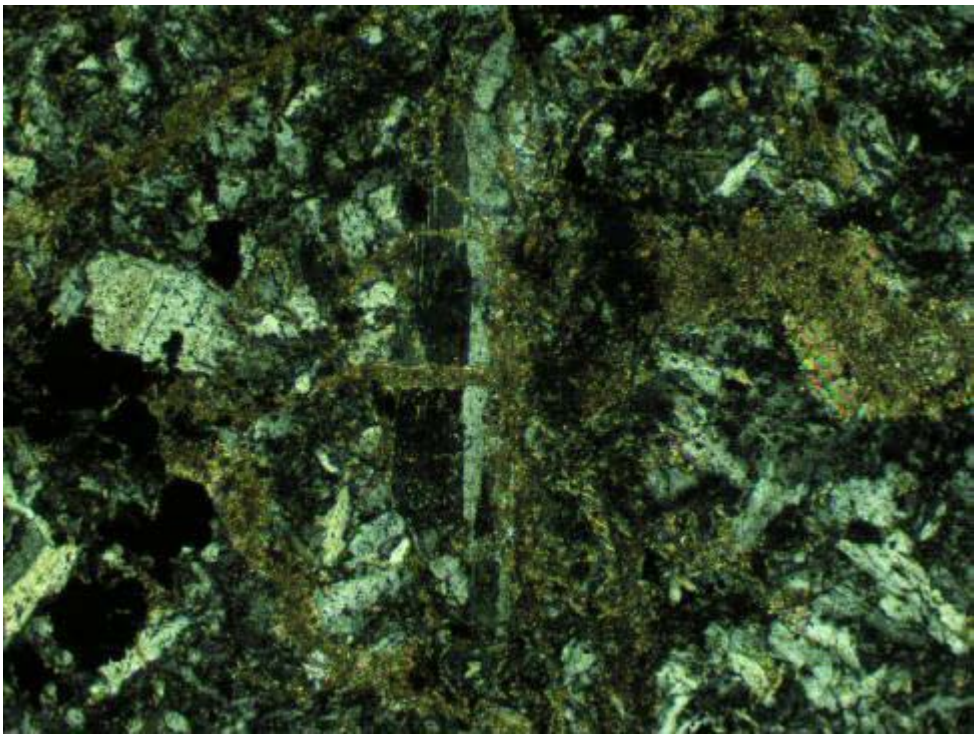


B

Sample: MM-09-11 93.34-93.4m
A & B) Overview of sample shows porphyritic andesite cut by fracture-controlled carbonate alteration.
A) PPL, B) XPL, FOV = ~ 4.5 mm.



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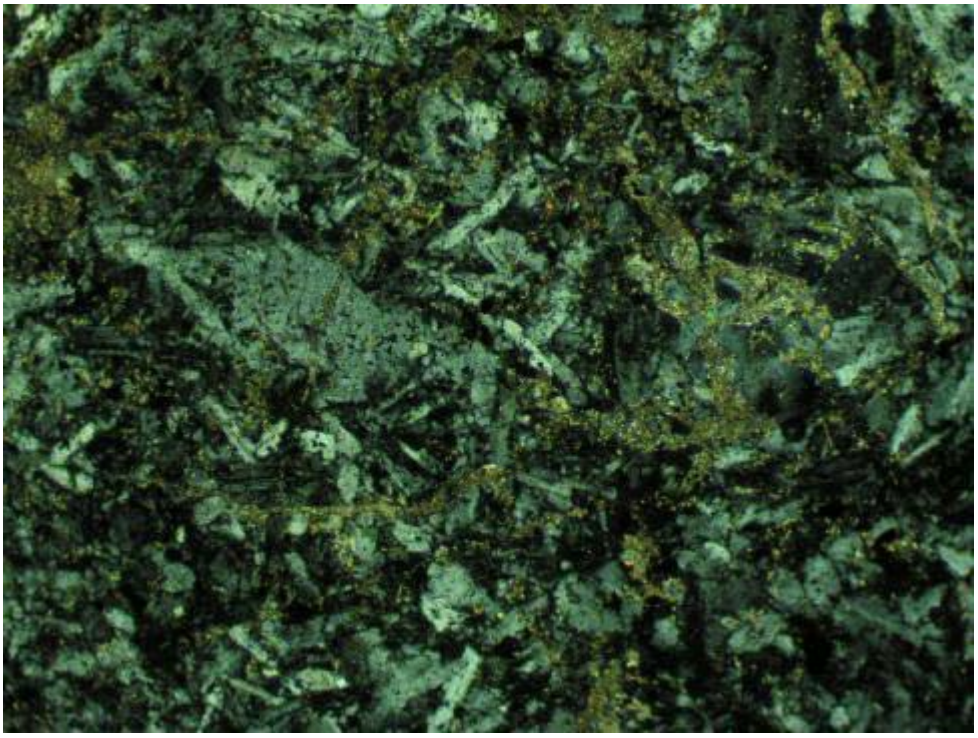
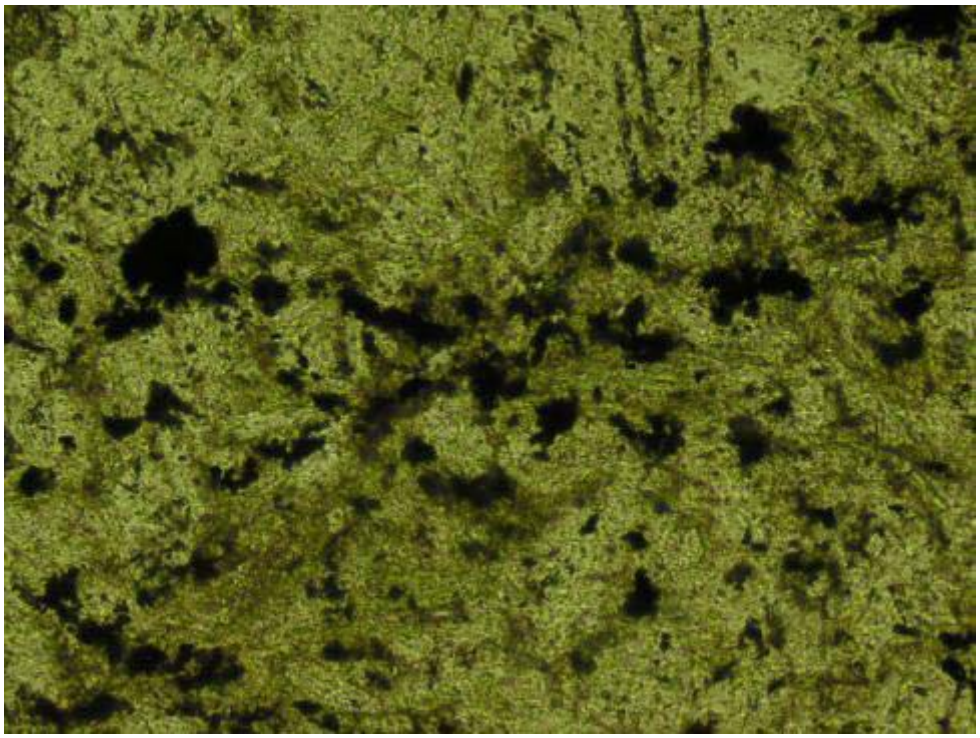


D

Sample: MM-09-11 93.34-93.4m
C&D) Views of porphyritic andesite. Note plagioclase phenocryst (centre, photo C) and abundant fracture-controlled carbonate alteration. XPL , FOV = ~ 1.3 mm.



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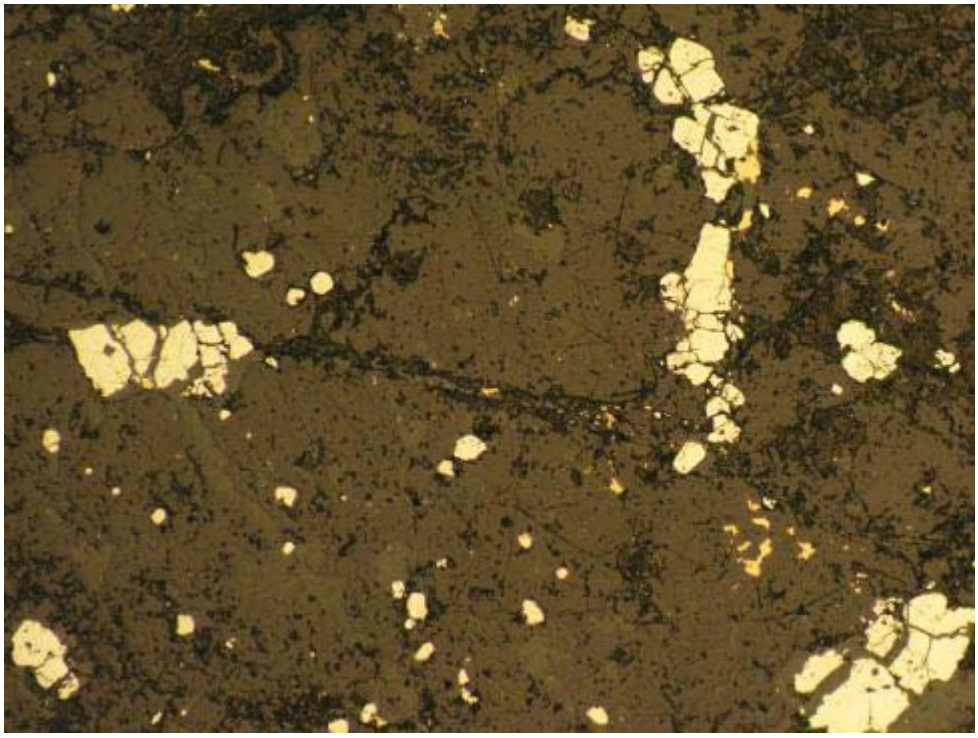
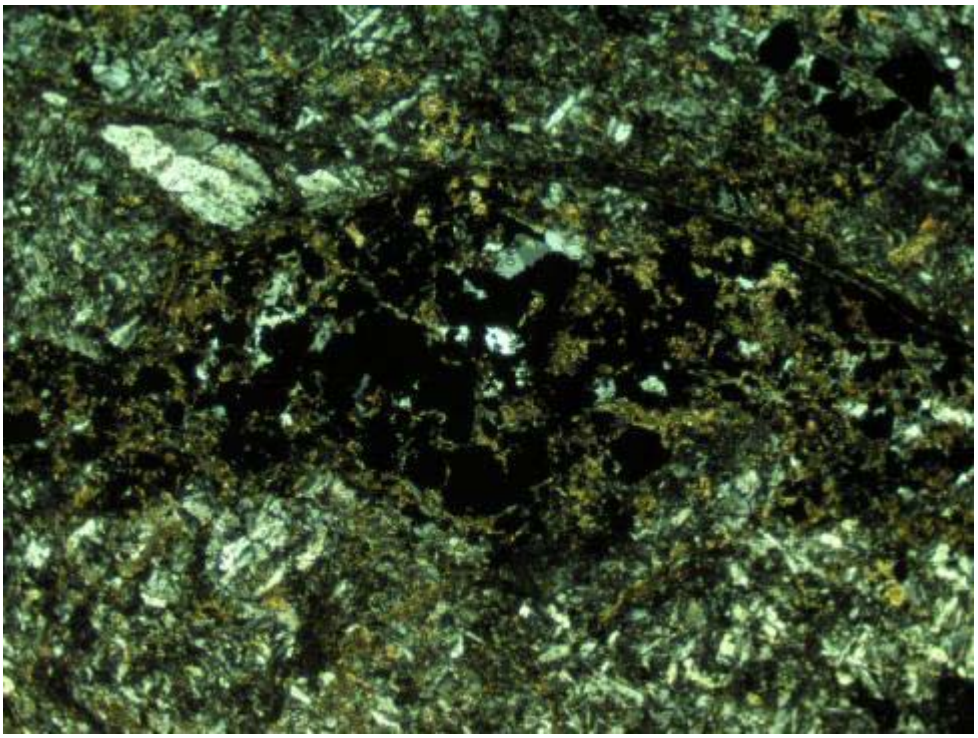
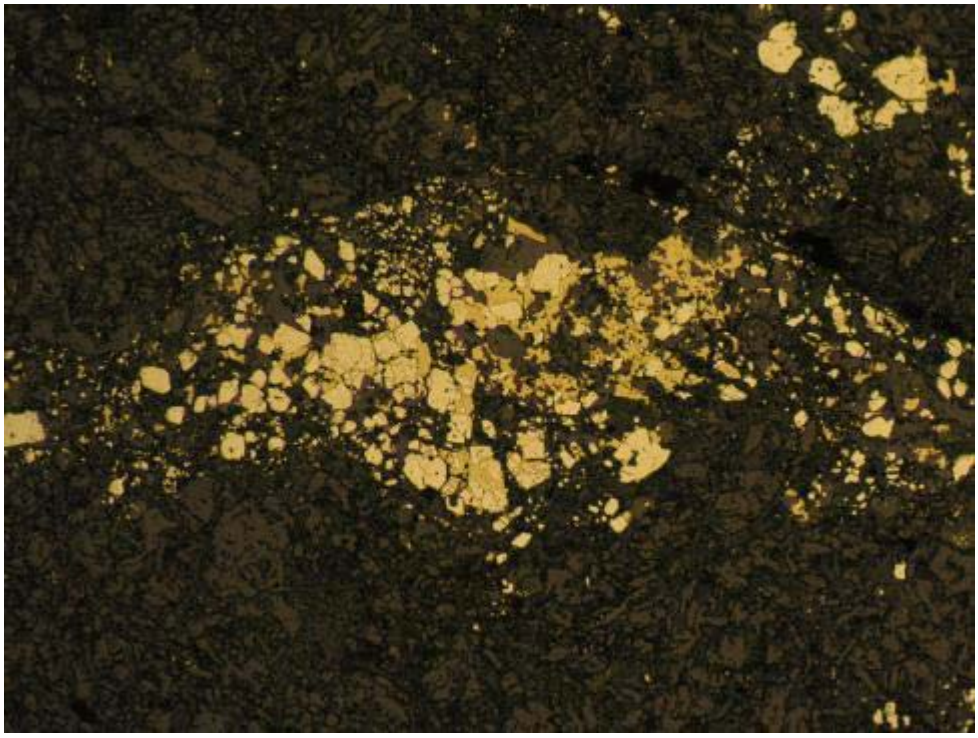


F

Sample: MM-09-11 93.34-93.4m
E) Patchy chlorite and Ti-oxide alteration and fracture-controlled opaques (pyrite). PPL, FOV = ~ 0.7 mm. F) Fracture-controlled and disseminated pyrite. Traces of chalcopyrite. RL, FOV = ~ 2.6 mm.

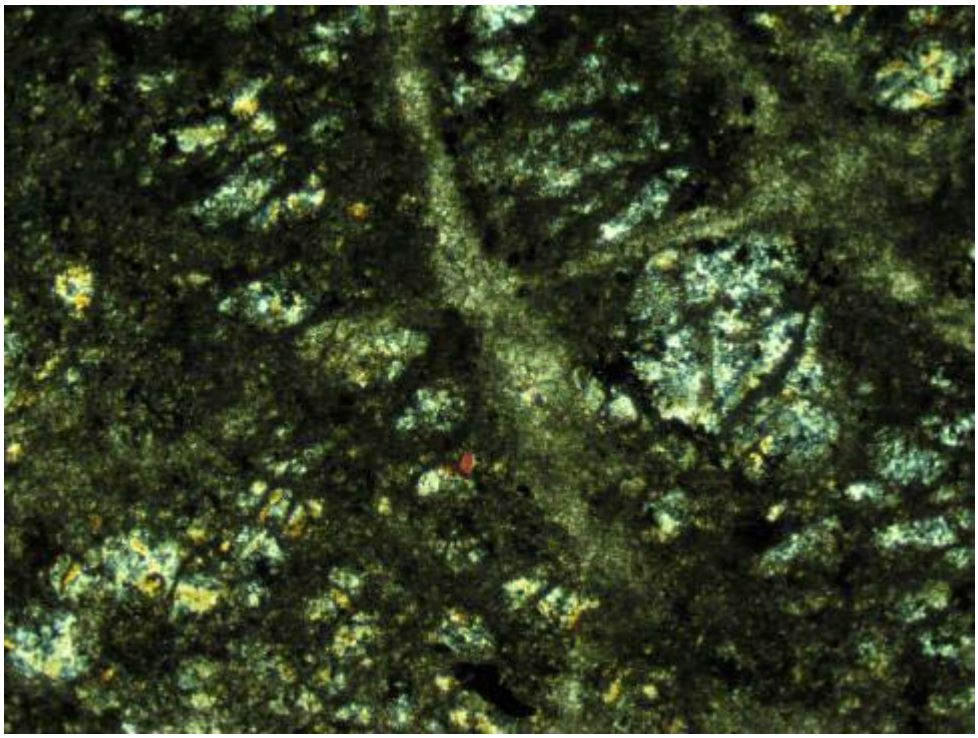


G



H

Sample: MM-09-11 93.34-93.4m
G & H) Subhedral pyrite aggregate enclosed by chalcopyrite within carbonate-(quartz) filled fracture. G) XPL, H) RL, FOV = ~ 2.6 mm.



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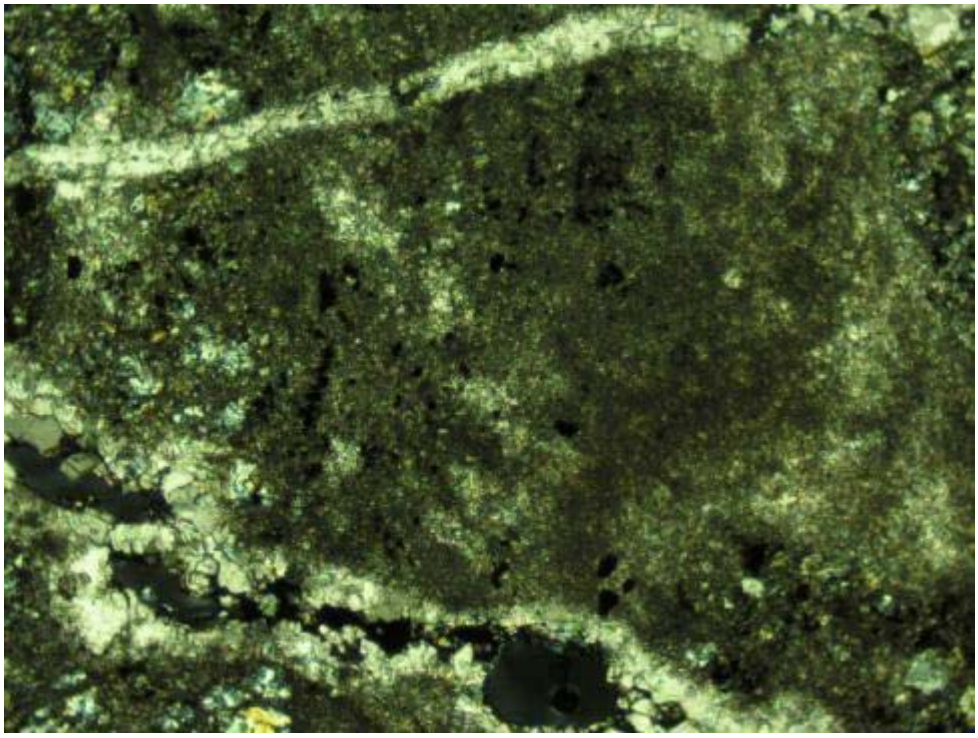


J

Sample: MM-09-11 93.34-93.4m
I) Fracture-controlled to pervasive replacement of host rock by very fine-grained brown carbonate. XPL, FOV = ~ 2.6 mm. J) Massive brown carbonate alteration cut by late colourless carbonate filled fractures. XPL, FOV = ~ 2.6 mm.

Zone: GRANBY
Sample: MM-09-11 114.91-115.03m **Offcut #AP-6**

view of hand sample


view of stained section offcut, scale in mm

Hand Sample Test Results:
No reaction of sample to magnet. No reaction to cold, dilute HCl. Negative test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Hydrothermally-altered fragmented rock with numerous subrounded to subangular monolithic greenish-gray fine-grained fragments (0.5 to 4 cm size) in a dark greenish-gray hydrothermally-altered matrix. Hydrothermal alteration, mostly pyrite, illite and chlorite, affects all fragment sizes but is principally focused in the matrix. The breccia is cut by white gypsum veinlets (1-2 mm wide).

Zone: GRANBY
Sample: MM-09-11 114.91-115.03m **Offcut #AP-6**

view of stained offcut, scale in mm

LITHOLOGY:	Pervasively altered fragmental andesite (former ?volcanic breccia)
ALTERATION TYPE:	Illite, pyrite**,** chlorite, Ti-oxide
MINERALIZATION:	Pyrite
VEINLETS/ FRACTURES:	Gypsum±carbonate

Polished Thin Section Description:
This section is a pervasively illite-pyrite-chlorite-Ti-oxide-altered fragmented andesite ?breccia cut by late discontinuous gypsum±carbonate fracture infill.

The andesite fragments comprise locally zoned plagioclase phenocrysts in a matrix of plagioclase laths and minor former mafic phases. Illite, minor chlorite and rarely patchy carbonate occur as selective replacement of plagioclase within the breccia fragments. Major fine-grained, eu-subhedral pyrite occurs disseminated. Breccia fragments are commonly intensely fractured with resulting crackle-texture infilled by late fine-grained gypsum aggregate.

The boundaries between breccia fragments and the hydrothermally-altered matrix are not distinctly defined. However, alteration of the matrix is generally intense. The original breccia matrix is typically virtually completely replaced by aggregates of mostly very fine-grained illite, patchy fine-grained pyrite, minor chlorite, Ti-oxide and locally trace of carbonate. Locally, illite occurs as pervasive replacement of fragments and breccia matrix.

Zone: GRANBY
Sample: MM-09-11 114.91-115.03m **Offcut #AP-6**

HOST ROCK (85%):
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Plagioclase	30	-fine-grained (< 0.8 mm), subhedral crystals, locally zoned, occurs as phenocrysts, partly replaced by patchy illite and chlorite, rarely by carbonate -fine to very fine-grained (< 0.1 mm), laths, occurs as andesite groundmass, partly replaced by illite, chlorite; locally extensively replaced by illite	*Polysynthetic twinning*
Pyrite	25	fine-grained (< 0.2 mm), sub-anhedral aggregates, occurs replacing breccia matrix; also eu-subhedral grains, occurs disseminated	
Illite	25	very fine-grained, anhedral to flaky aggregates, occurs as selective replacement of plagioclase phenocrysts and groundmass, occurs as replacement of breccia matrix and locally pervasive alteration of host rock	

MINOR MINERALS

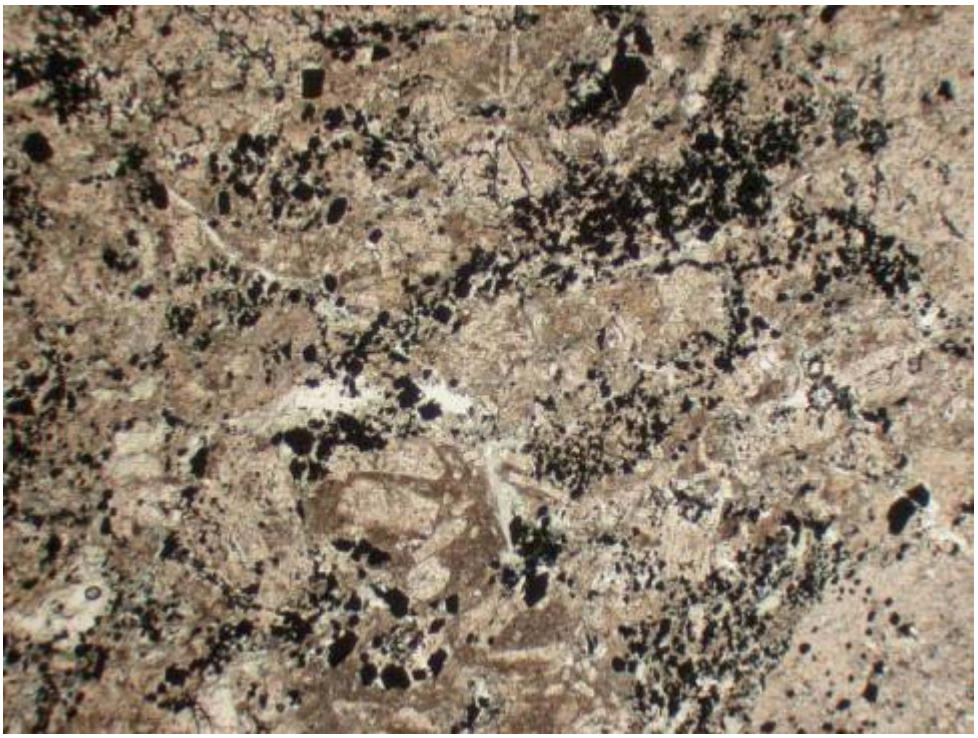
Mineral	%	Distribution & Characteristics*	Optical
Chlorite	3	very fine-grained, anhedral to platy aggregates, occurs as replacement of former mafic phases in andesite and occurs with illite, pyrite and Ti-oxide aggregates as replacement of breccia matrix	
Ti-oxide	2	very fine-grained, anhedral aggregates, occurs associated with chlorite, pyrite, illite and locally carbonate as replacement of breccia matrix and replacement of former mafic phases within andesite	
Carbonate	tr	very fine-grained, anhedral aggregates, occurs locally as patchy replacement of plagioclase, overprints illite alteration	

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm

VEINLETS/ FRACTURE INFILL (15%):

Mineral	%	Distribution & Characteristics*	Optical
Gypsum	14	-fine to medium-grained (<1.6 mm), anhedral aggregates, occurs as locally discontinuous veinlets -fine-grained, occurs as crackle breccia infill within breccia fragments	
Carbonate	1	fine-grained (< 0.2 mm), anhedral aggregates, occurs within gypsum veinlets	*colourless*

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm



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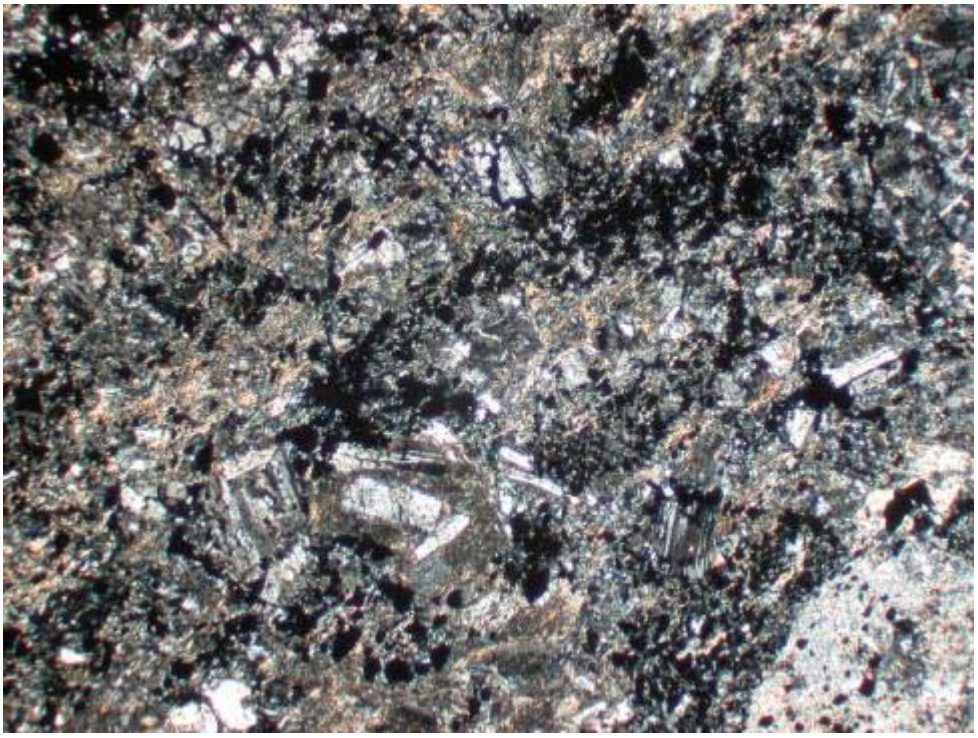
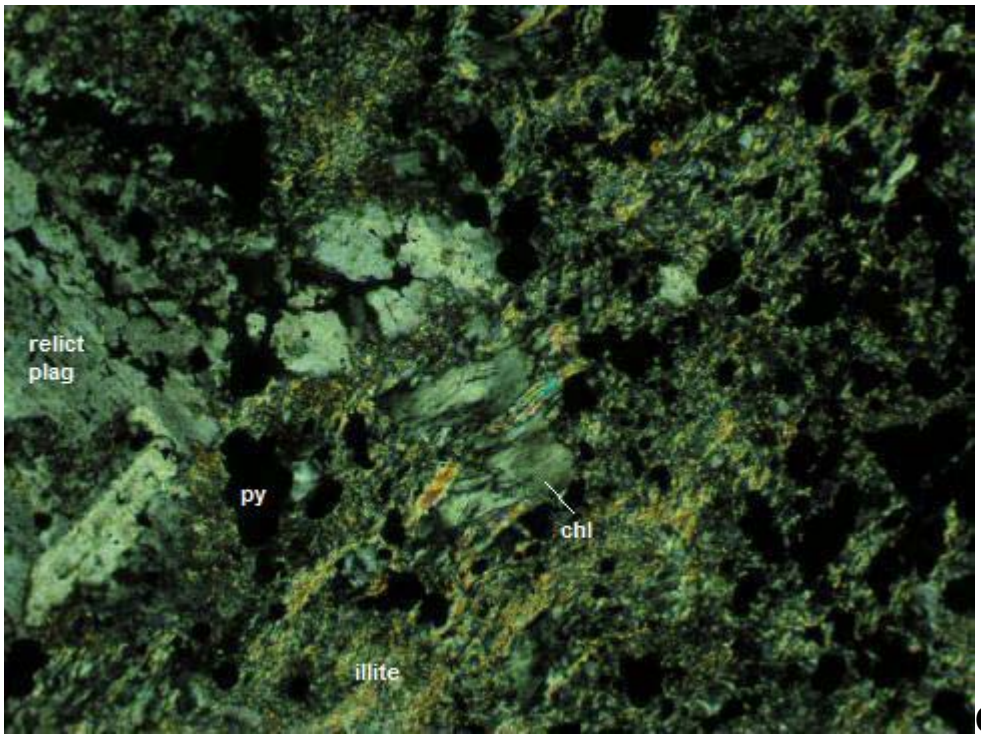


B

Sample: MM-09-11 114.91-115.03m
A & B) Overview of sample shows hydrothermally altered fragmented andesite. Note opaque phase is pyrite. A) PPL, B) XPL, FOV = ~ 4.5 mm.



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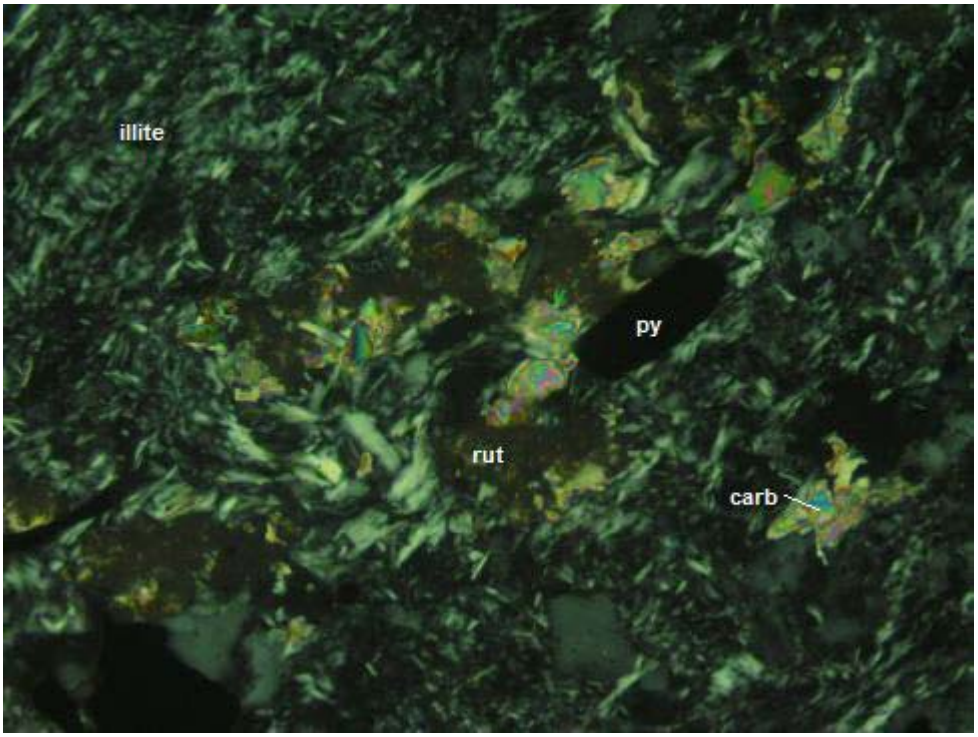
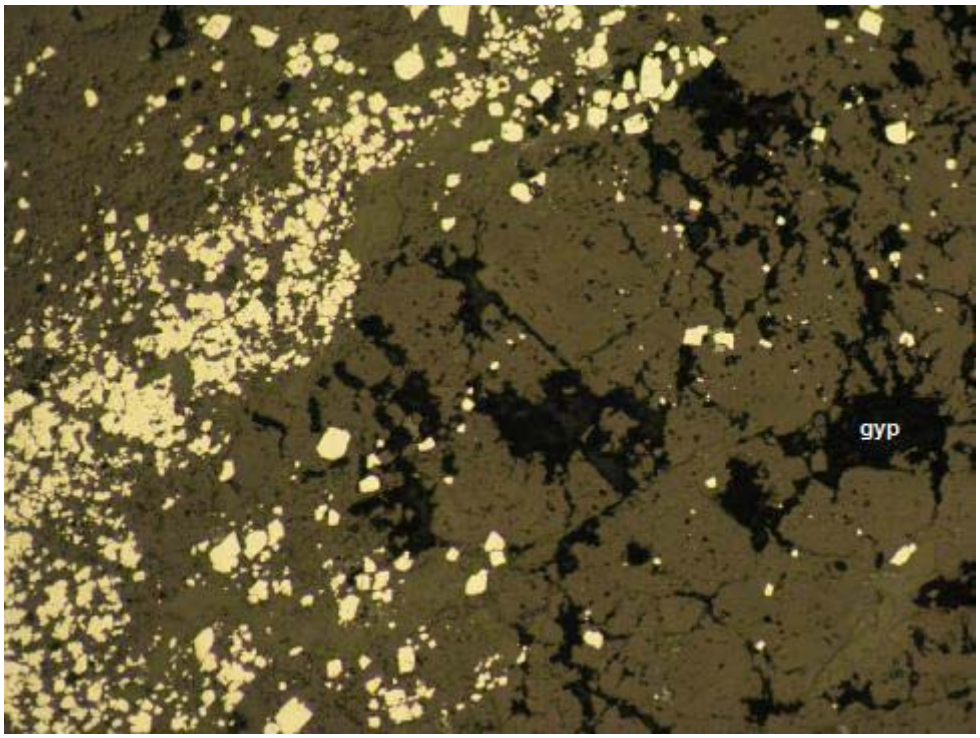
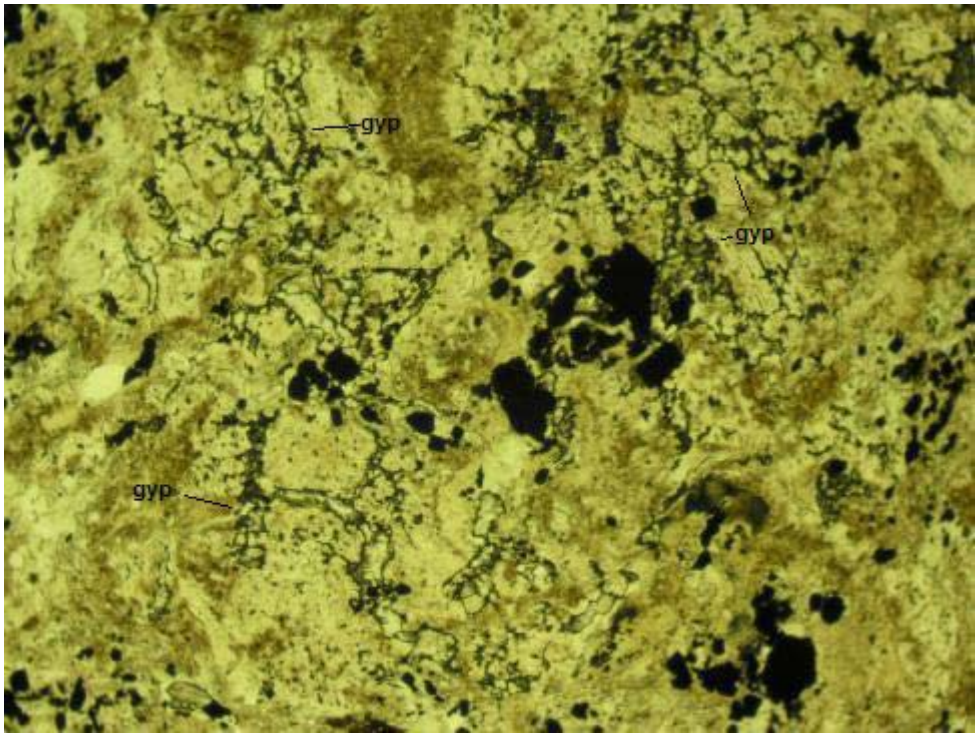


D

Sample: MM-09-11 114.91-115.03m
C) View of illite-pyrite-chlorite replacement of breccia matrix. XPL, FOV = ~1.3 mm. D) Detailed view of illite, carbonate, Ti-oxide and pyrite replacement of breccia matrix. XPL, FOV = ~0.3 mm.



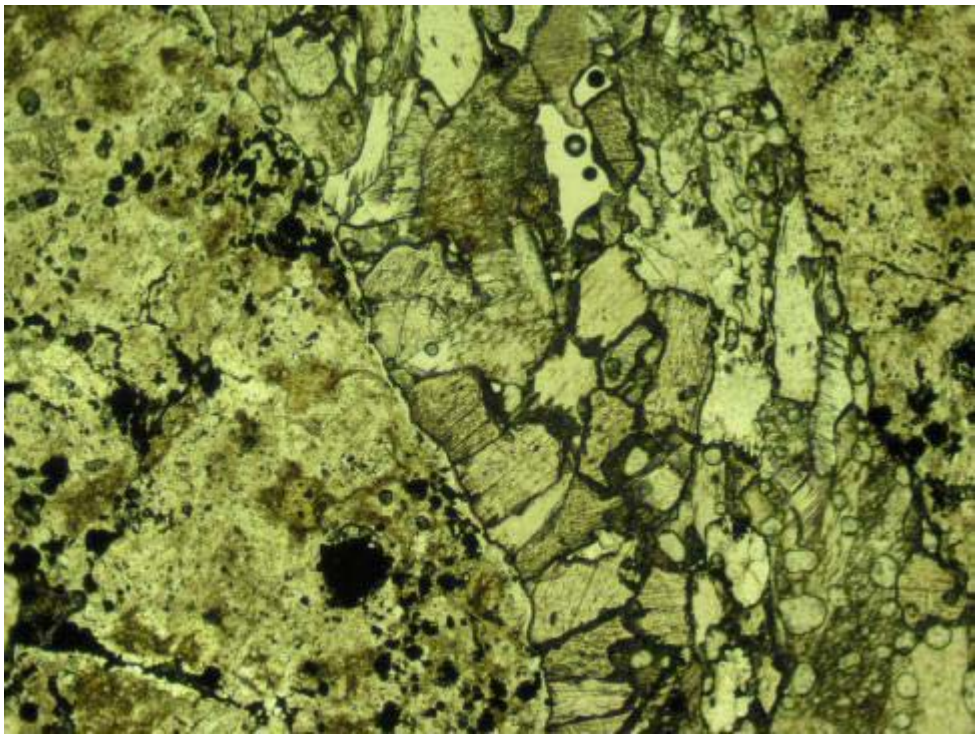
E



F

Sample: MM-09-11 114.91-115.03m

E) View of breccia fragment (right) with gypsum (gyp) infill of crackle-textured fractures. Note abundant pyrite as replacement of breccia matrix. RL, FOV = ~ 2.6 mm. F) Another view of a breccia fragment with gypsum infill of crackle-textured fractures. PPL, FOV = ~ 2.6 mm.



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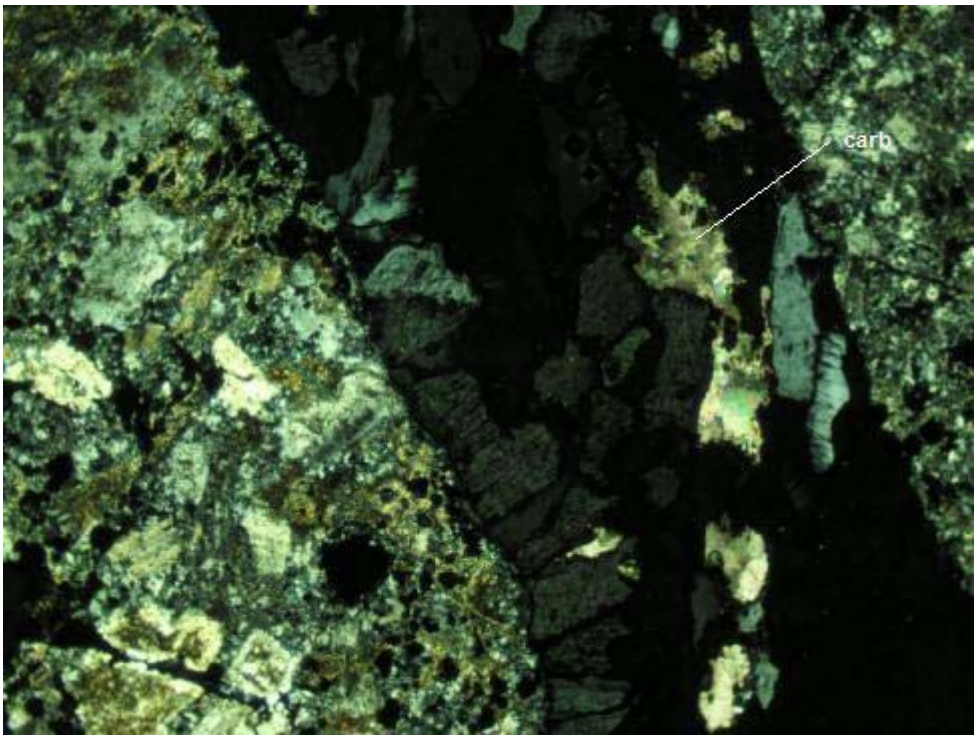
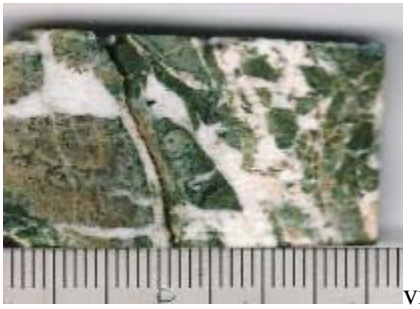


H

Sample: MM-09-11 114.91-115.03m
G&H) View of gypsum filled fracture with minor carbonate. FOV = ~ 2.6 mm, G) PPL, H) XPL.

Zone: GRANBY
Sample: MM-09-11 125.36-125.43m **Offcut #AP-7**

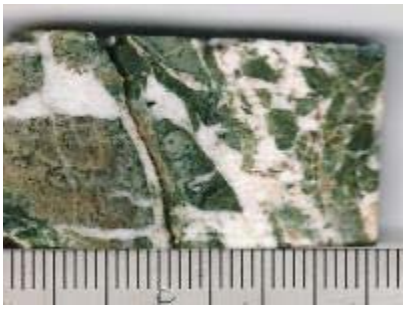
view of hand sample


view of stained section offcut, scale in mm

Hand Sample Test Results:
No reaction of sample to magnet. Weak patchy reaction of host rock to cold, dilute HCl. Negative test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Extensively fractured greenish-gray fine-grained pervasively pyrite-chlorite-gypsum-(carbonate) altered rock with infill by white gypsum.

Zone: GRANBY
Sample: MM-09-11 125.36-125.43m **Offcut #AP-7**



view of stained offcut, scale in mm

LITHOLOGY:	Pervasively altered, fractured and brecciated ?andesite
ALTERATION TYPE:	Pyrite, chlorite, gypsum, clay, carbonate, Fe-ox, Ti-oxide
MINERALIZATION:	Pyrite
VEINLETS/ FRACTURES:	Gypsum±carbonate
	Fe-ox

Polished Thin Section Description:
This section is an extensively fractured and brecciated pervasively pyrite-chlorite-gypsum-clay-carbonate-Fe-ox-Ti-oxide altered ?andesite. The ?andesite comprises fine-grained plagioclase laths and former mafic phases. Major chlorite occurs as replacement of former mafic phases, controlled by fractures and as massive replacement of some of the breccia fragments. Minor carbonate occurs as patchy replacement of plagioclase. Patchy clay alteration occurs with chlorite and carbonate. The clay is identified as kaolinite and smectite using PIMA analysis (see Appendix). Carbonate is locally associated with aggregates of Ti-oxide and partly replaced by very fine-grained red-brown Fe-ox aggregate. Major fine-grained pyrite occurs disseminated and replacing former mafic phenocrysts.

Major gypsum (over half of the section) occurs as breccia infill (fine to medium-grained) and as intense infill of a very fine-scale fracture network within breccia fragments. Traces of carbonate occur within the gypsum infill. The carbonate is locally partly replaced by red-brown Fe-ox aggregate. Fe-ox aggregate also occurs as fracture infill. The Fe-ox aggregate may be or include traces of ?jarosite based on PIMA analysis (see Appendix)

Zone: GRANBY
Sample: MM-09-11 125.36-125.43m **Offcut #AP-7**

HOST ROCK (53%):
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Plagioclase	15	fine to very fine-grained (< 0.2 mm), laths, forms relict host ?andesite, partly replaced by patchy brown carbonate, Ti-oxide, Fe-ox and pyrite	*Polysynthetic twinning*
Pyrite	10	fine-grained (< 0.3 mm), sub-anhedral grains and aggregates, occurs disseminated and replacing former mafic phenocrysts, locally inclusions of chalcopyrite	
Gypsum	10	very fine-grained, occurs as infill of intense fine-scale fracture network within breccia fragments	
Chlorite	10	fine to very fine-grained (< 0.1 mm), anhedral to platy aggregates, occurs as replacement of former mafic phenocrysts, fracture-controlled and as massive replacement of some fragments	

MINOR MINERALS

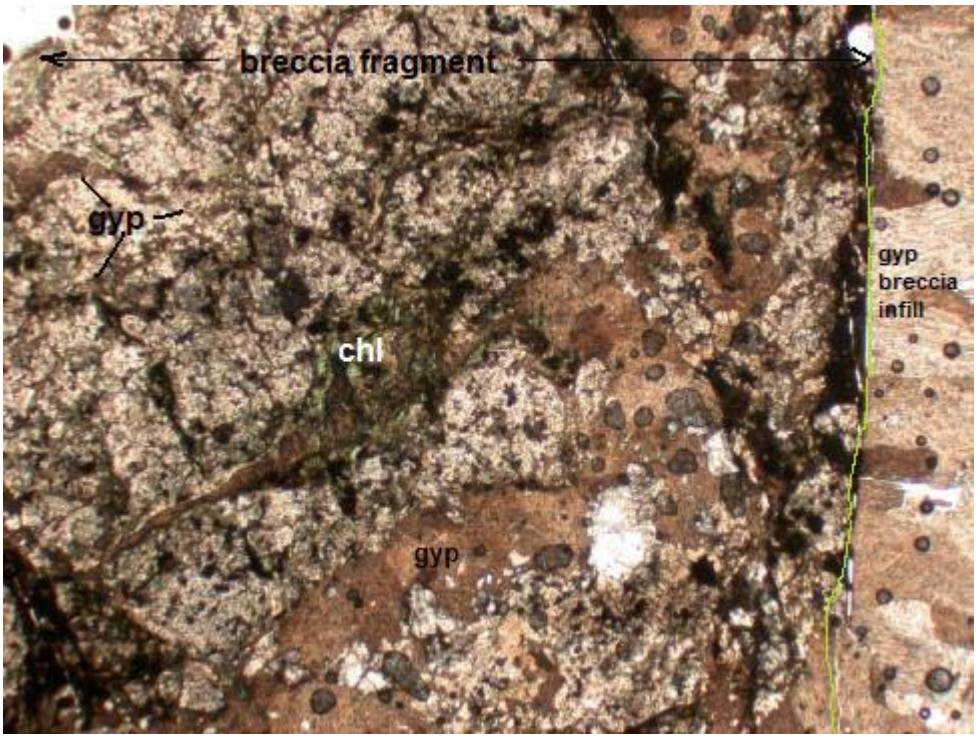
Mineral	%	Distribution & Characteristics*	Optical
Clay	3	aphanitic, occurs with chlorite and carbonate as patchy aggregates replacing host rock	*dark brown*
Carbonate	2	very fine-grained, anhedral aggregates, occurs locally as patchy replacement of plagioclase	*brown*
Fe-ox	2	very fine-grained, occurs partly replacing patchy carbonate and associated with chlorite and Ti-oxide aggregates	
Ti-oxide	1	very fine-grained, anhedral aggregates, occurs with chlorite partly replacing former mafic phenocrysts, locally associated with Fe-ox aggregates as replacement of host rock	

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm

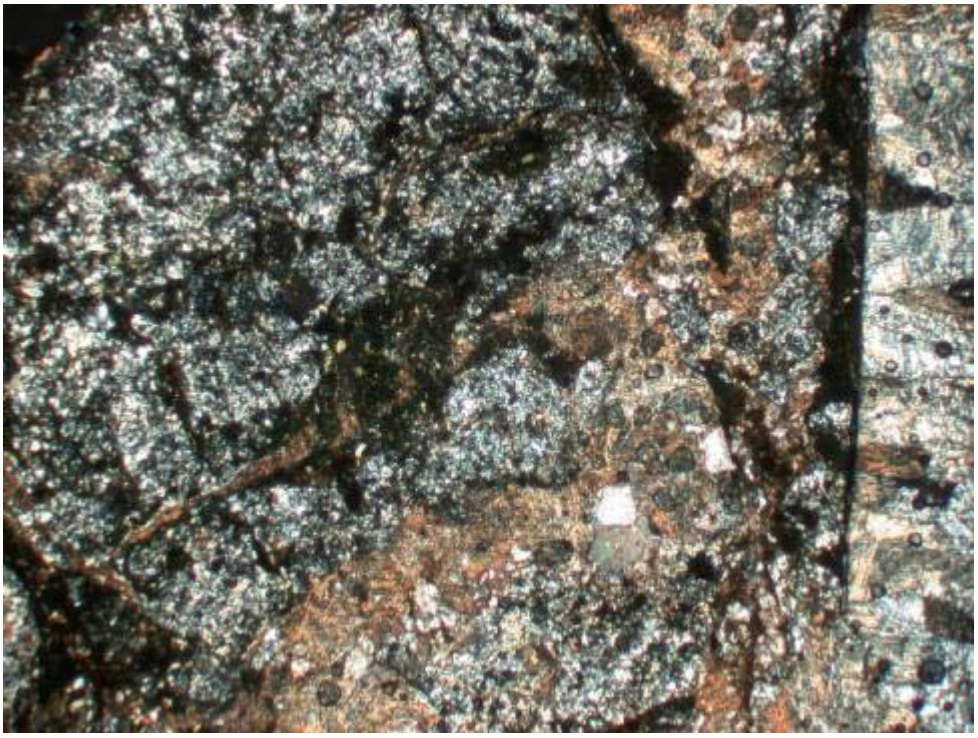
VEINLETS/ FRACTURE INFILL (47%):

Mineral	%	Distribution & Characteristics*	Optical
Gypsum	45	fine to medium-grained (< 2 mm), anhedral aggregates, occurs as breccia infill	
Fe-ox	2	very fine-grained, anhedral aggregates, occurs fracture infill at margins of gypsum breccia infill, partly replaces carbonate	*red-brown*
Carbonate	tr	fine-grained (< 0.1 mm), anhedral aggregates, occurs within gypsum infill, locally partly replaced by Fe-ox aggregates	

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm

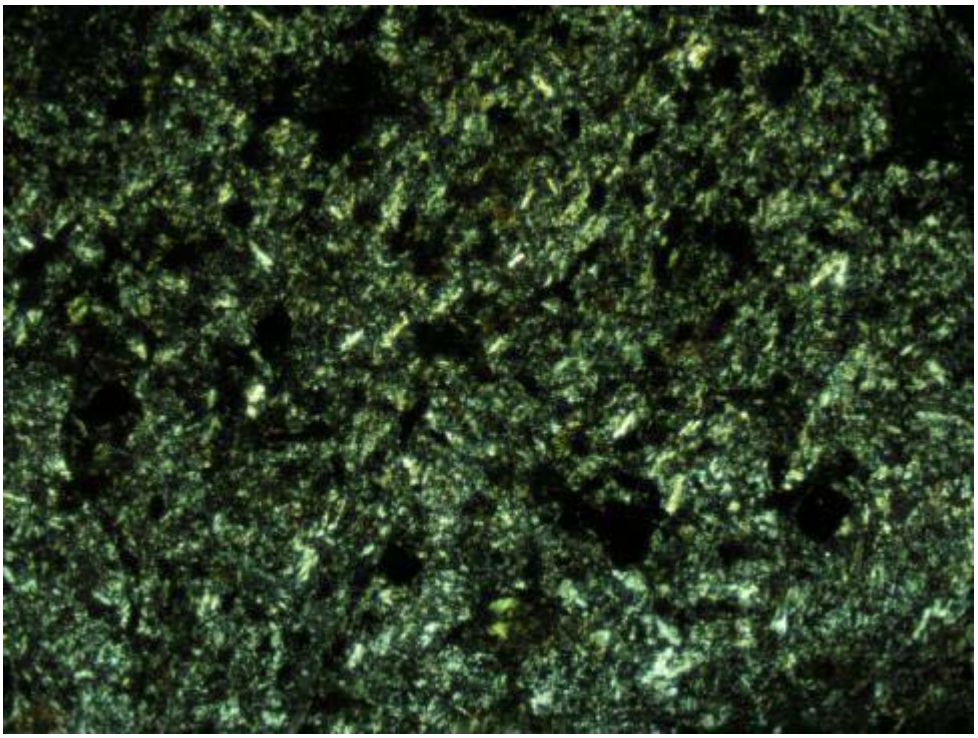


A



B

Sample: MM-09-11 125.36-125.43m
A & B) Overview of sample shows intensely fractured ?andesite fragment (fragment margin marked by yellow line) with major chlorite alteration and fracture infill. Note gypsum has filled intense fine-scale fracture network within fragment. Gypsum also occurs as fine to medium-grained breccia infill (far right of photo). A) PPL, B) XPL, FOV = ~ 4.5 mm.



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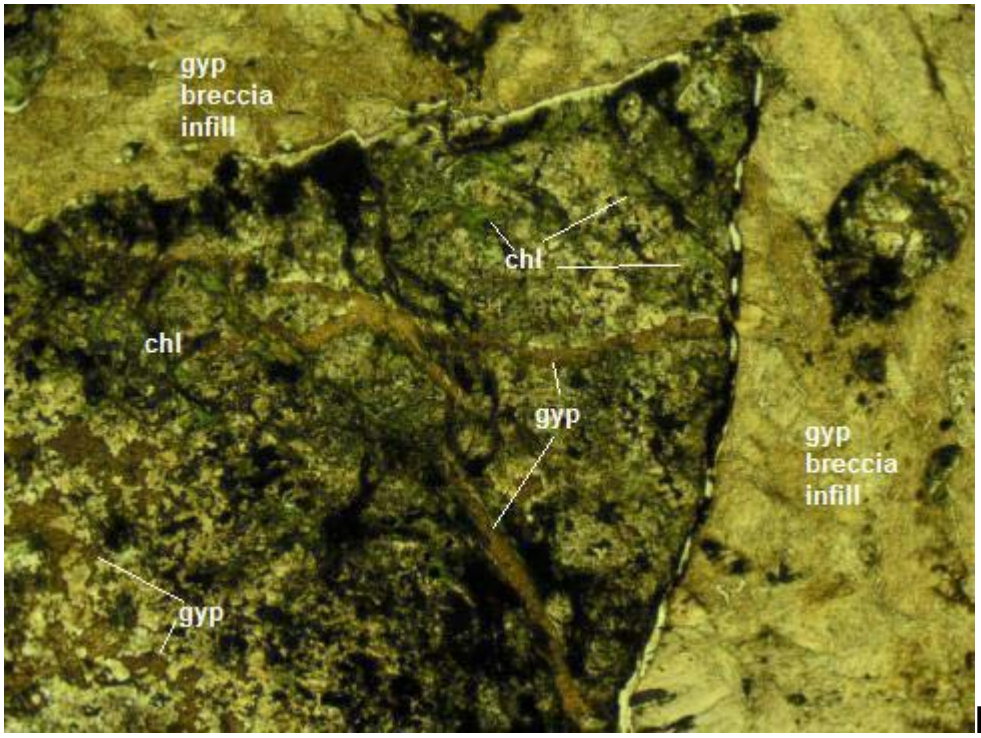
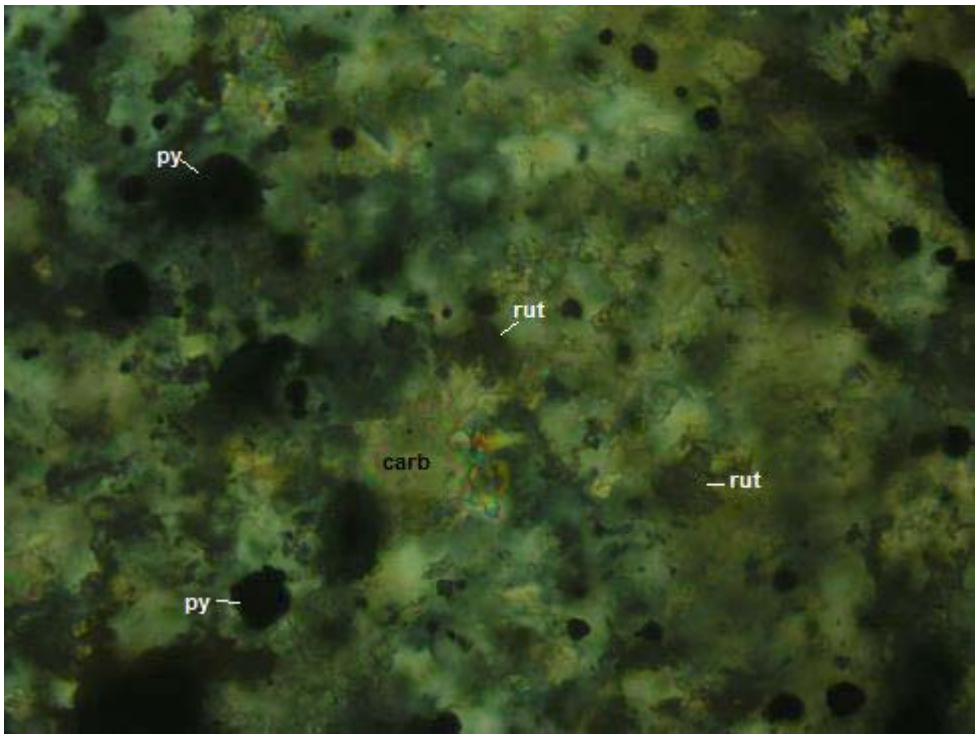


D

Sample: MM-09-11 125.36-125.43m

C) View of fragment of ?andesite host rock. XPL, FOV = ~ 2.6 mm. D) View of strongly brittle fractured and brecciated host rock. Gypsum breccia infill (top and right). Note major chlorite alteration of host rock. Opaque phases are pyrite, Ti-oxide and Fe-ox. Note gypsum as infill of fine-scale fracture network within fragment. PPL, FOV = ~ 2.6 mm.



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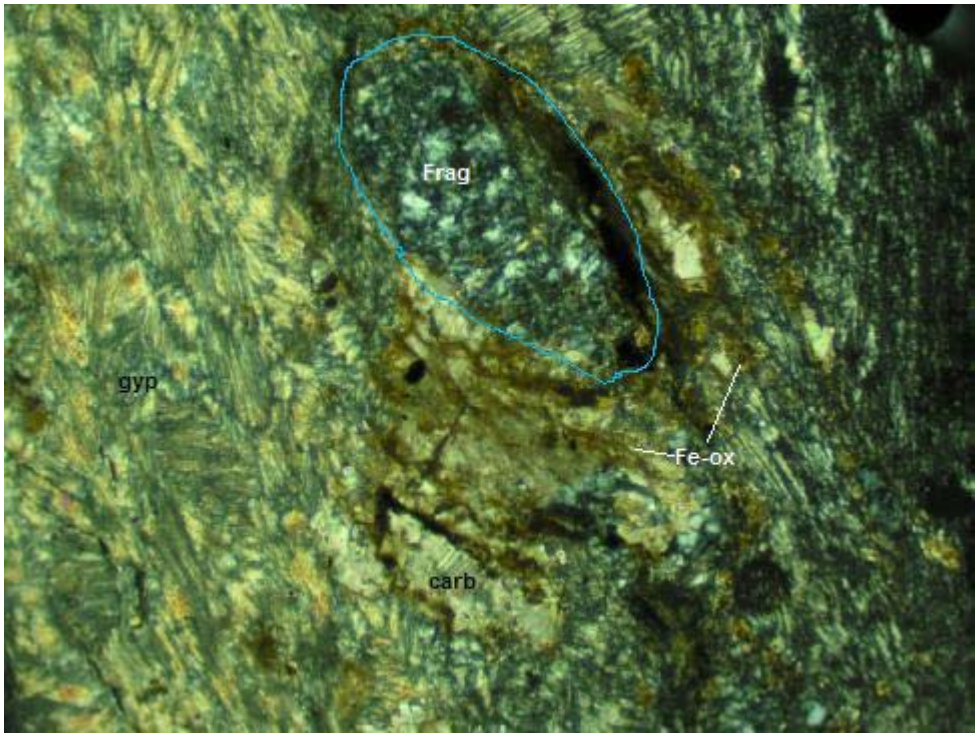
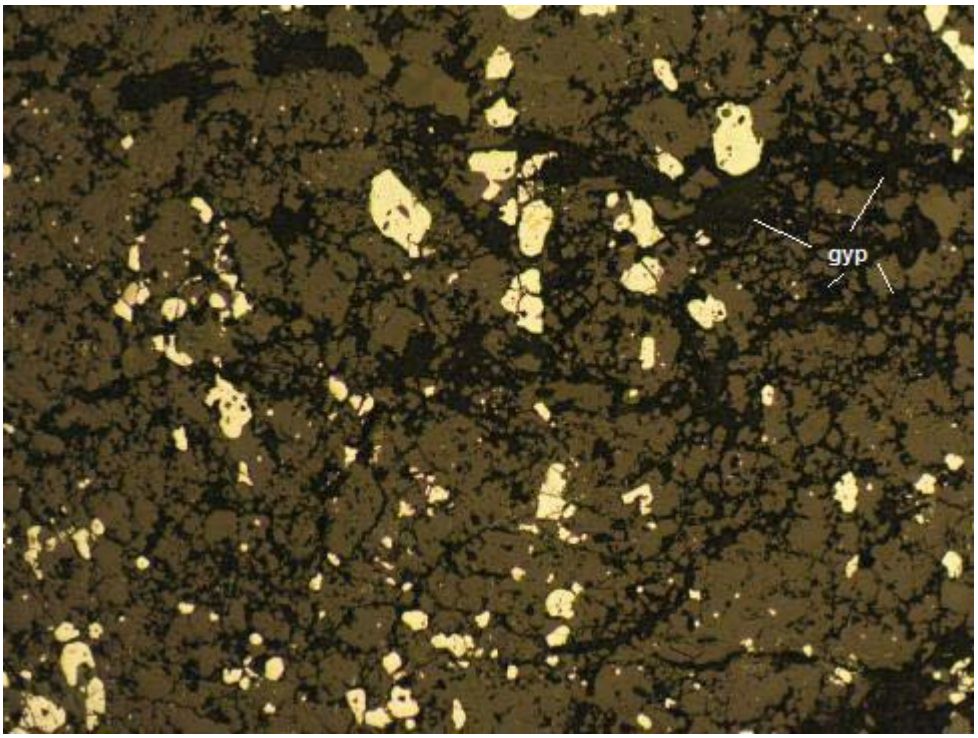


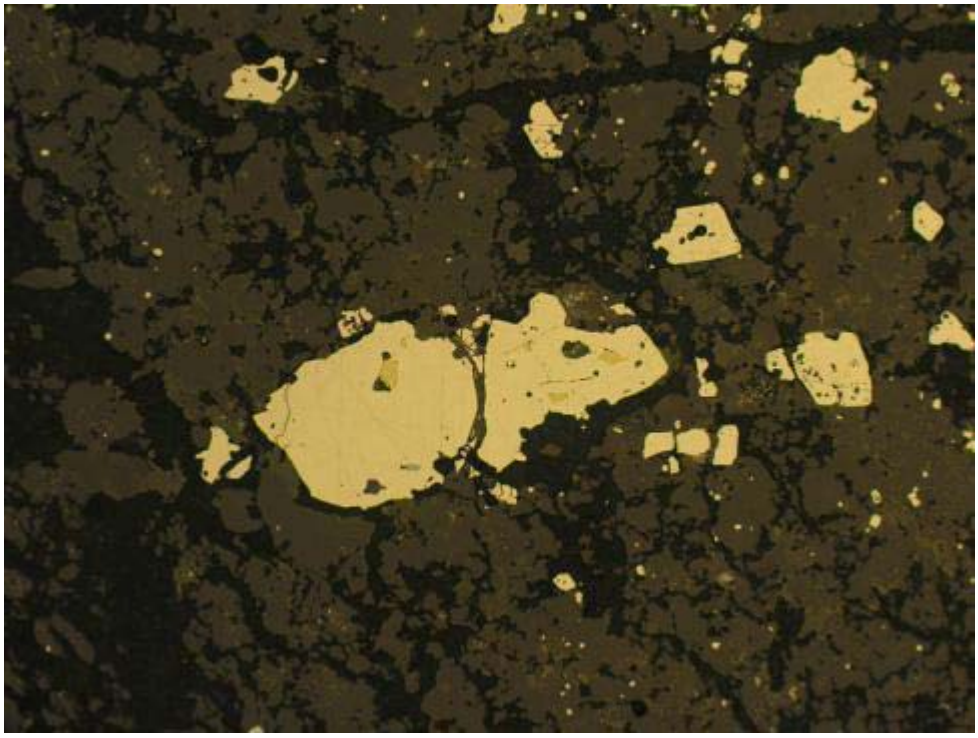
F

Sample: MM-09-11 125.36-125.43m

E) Detailed patchy carbonate, Ti-oxide (rut) and disseminated pyrite alteration of host rock. XPL, FOV = ~ 0.3 mm. F) Detailed view of gypsum breccia infill with patchy carbonate (partly replaced by Fe-ox aggregate). Note small breccia fragment (blue outline). XPL, FOV = ~ 1.3 mm.



G



H

Sample: MM-09-11 125.36-125.43m
G) View of disseminated pyrite and gypsum as infill of fine-scale fracture network within fragment. RL, FOV = ~ 1.3 mm. H) View of pyrite with inclusions of chalcopyrite (centre). RL, FOV = ~ 1.3 mm.

Zone: GRANBY
Sample: MM-09-11 153.02-153.12m **Offcut #AP-8**

view of hand sample


view of stained section offcut, scale in mm

Hand Sample Test Results:
No reaction of sample to magnet. Strong reaction of infill to cold, dilute HCl. Positive test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Extensively fractured grayish-black aphanitic rock with infill by orange-pink material and white carbonate as fracture infill.

Zone: GRANBY
Sample: MM-09-11 153.02-153.12m **Offcut #AP-8**


view of stained section offcut, scale in mm

LITHOLOGY:	Pervasively altered and fractured fine-grained ?andesite
ALTERATION TYPE:	Biotite, K-feldspar, carbonate, clay, Ti-oxide
MINERALIZATION:	Pyrite
FRACTURES/VEINLETS:	Clay
	Carbonate±pyrite
	?Jarosite, Fe-ox

Polished Thin Section Description:
This section is an extensively fractured and pervasively biotite-K-feldspar-carbonate-clay-Ti-oxide altered fine-grained ?andesite. The relict ?andesite comprises fine-grained plagioclase phenocrysts and laths overprinted by pervasive very fine-grained secondary green biotite and minor patchy carbonate and Ti-oxide alteration. Patchy clay occurs as replacement of fine to medium-grained tabular forms. Traces of pyrite occur as patchy aggregates associated with carbonate and Ti-oxide. Trace ?apatite occurs disseminated. Minor K-feldspar occurs as very fine-grained replacement of the andesite, particularly adjacent to fracture infill.

Fracture infill is by fibrous clay masses with subsequent fracture infill by colourless anhedral to rhombic carbonate aggregate. The carbonate is partly replaced by anhedral to colloform-textured orange-brown ?jarosite aggregate or by red-brown Fe-ox aggregate. Traces of ?apatite occur as rare grains with carbonate as infill. Minor pyrite occurs as framboidal aggregates within carbonate fracture infill on one side of the section. Traces of hematite, after former cubic forms, occur as fracture-controlled aggregates on the same side of the section as the pyrite.

The clay in this section is identified as smectite and kaolinite using PIMA analysis (see Appendix).

Zone: GRANBY
Sample: MM-09-11 153.02-153.12m **Offcut #AP-8**

HOST ROCK (70%):
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Biotite	30	very fine-grained, shreddy secondary aggregates, pervasive replacement of host rock	*green*
Plagioclase	25	-fine-grained (< 0.5 mm), occurs as phenocrysts in host rock -fine to very fine-grained (< 0.1 mm), laths	*Polysynthetic twinning*
Clay	5	fine–grained, fibrous masses, occurs as patchy replacement	*brown*

MINOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
K-feldspar	4	very fine-grained, occurs as patchy replacement of host rock particularly adjacent to fracture infill	
Carbonate	3	very fine-grained, occurs as patchy replacement of host rock, colourless carbonate partly rimmed and replaced by brown carbonate	
Ti-oxide	2	very fine-grained, anhedral aggregates, occurs as patches replacing host rock	
Pyrite	tr	very fine-grained, sub-anhedral grains, occurs associated with carbonate replacement and aggregates of Ti-oxide	
?Apatite	tr	very fine-grained, subhedral, disseminated	

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm

VEINLETS/ FRACTURE INFILL (30%):

Mineral	%	Distribution & Characteristics*	Optical
Carbonate, likely mostly calcite	20	fine to very fine-grained (< 0.15 mm), anhedral aggregates and rhombic grains, partly replaced by orange-brown ?jarosite and red-brown Fe-ox	*colourless*
?Jarosite	3	fine-grained (< 0.1 mm), anhedral to colloform-textured aggregates, partly replaces carbonate as fracture infill	*orange-brown*
Fe-ox	3	very fine-grained, anhedral aggregates, partly replaces carbonate	*red-brown*
Clay	2	fine–grained, fibrous masses, occurs as fracture infill, cut by fractures filled with carbonate	*brown*
Pyrite	2	very fine-grained, framboidal aggregates, occurs on one side of the section associated with clay and carbonate fracture infill	
?Apatite	tr	fine-grained (< 0.35 mm), high relief, elongate prismatic crystals, infill by carbonate	
Hematite	tr	very fine-grained, occurs as replacement of fine-grained (< 0.1 mm) cubic fracture-controlled forms	

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm

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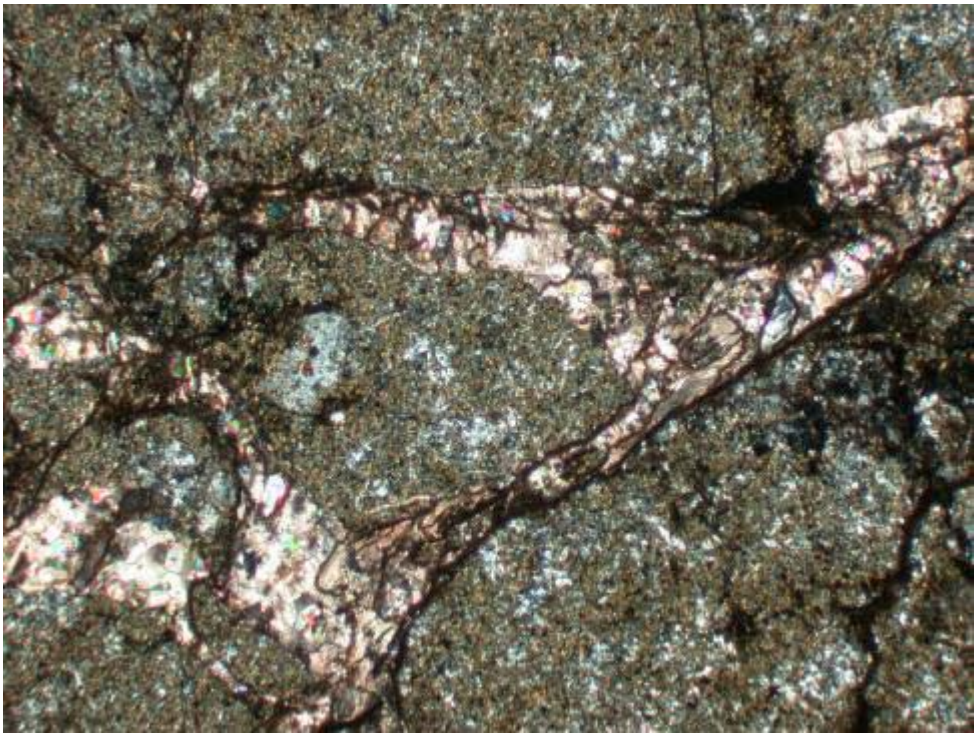
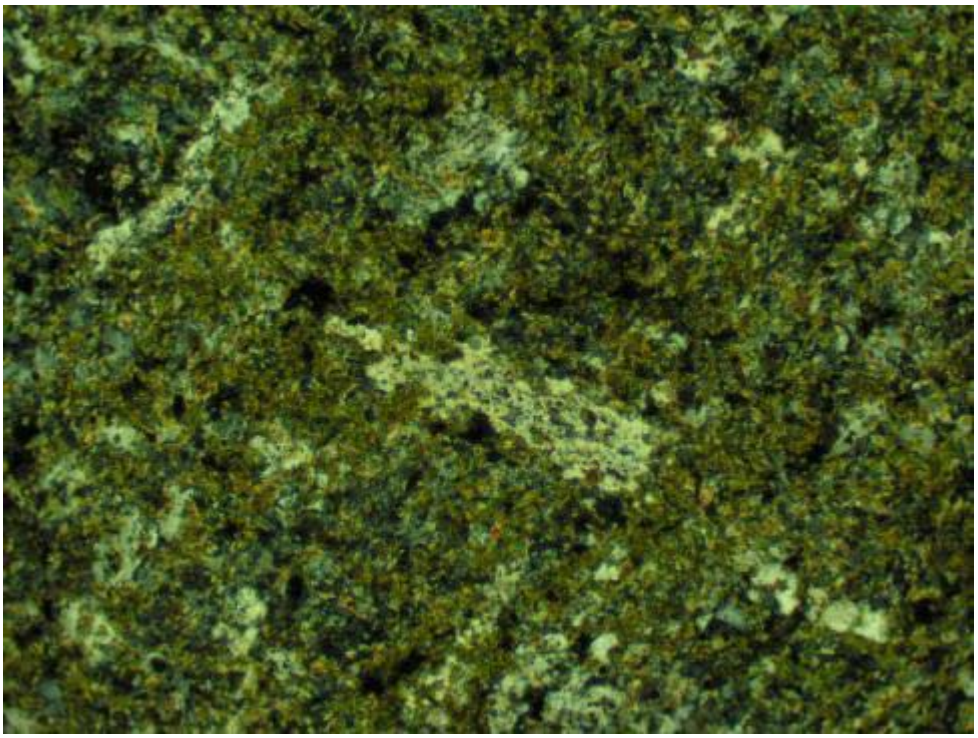


B

Sample: MM-09-11 153.02-153.12m
A & B) Overview of strongly fractured and pervasively biotite altered host rock cut by fractures filled with carbonate, clay, ?jarosite and Fe-ox aggregate. A) PPL, B) XPL, FOV = ~ 4.5 mm.



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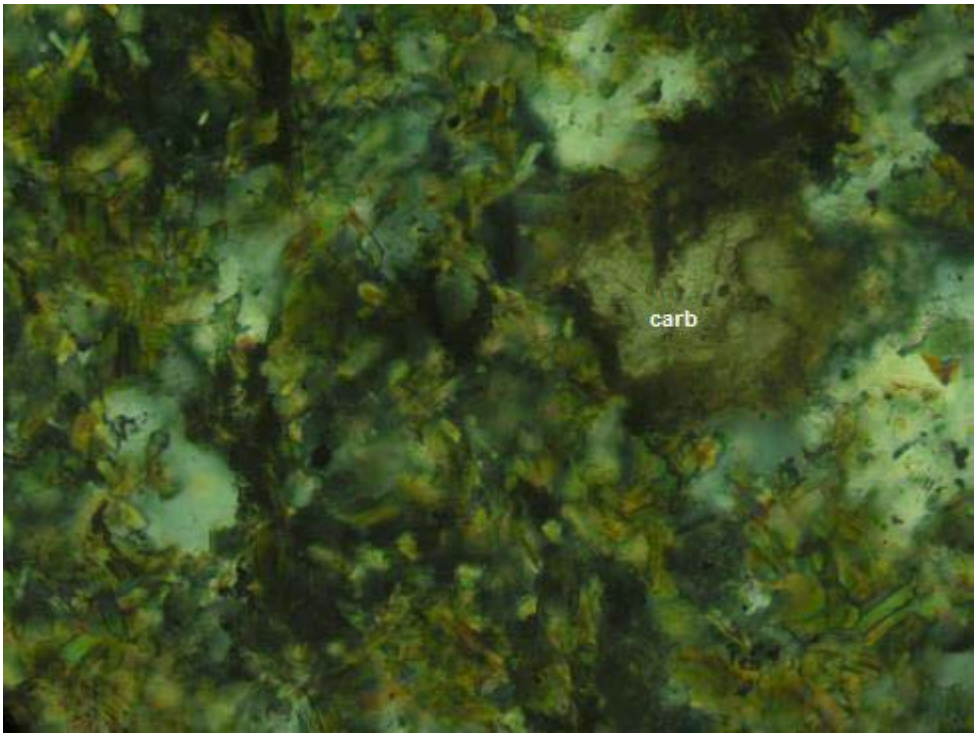
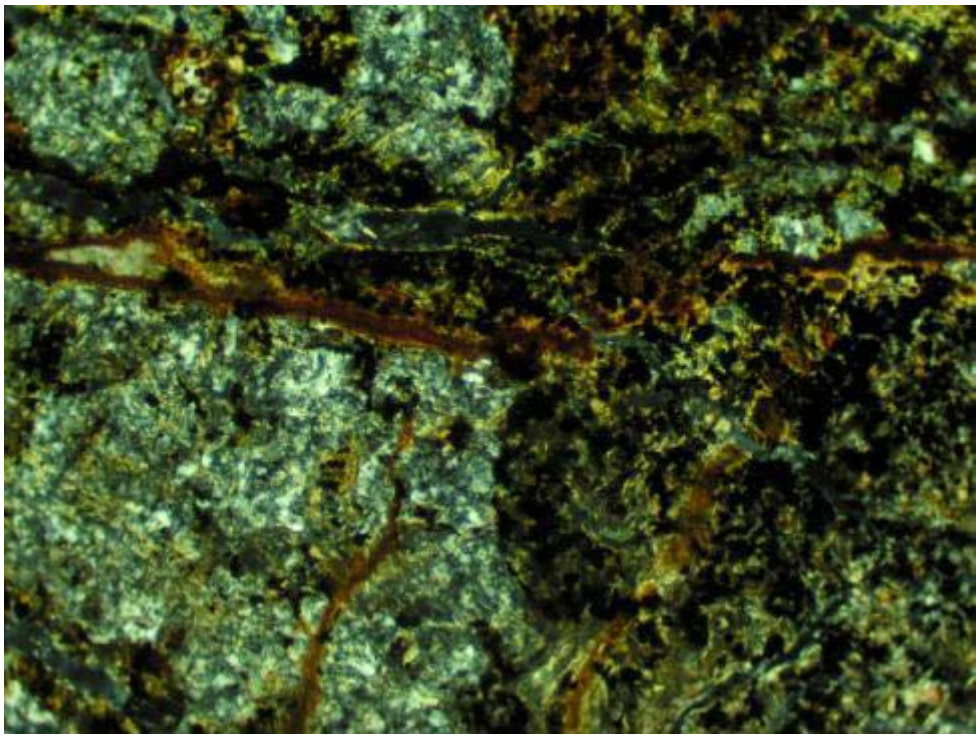


D

Sample: MM-09-11 153.02-153.12m
C) Views of relict porphyritic texture in altered ?andesite. XPL, FOV = ~ 1.3 mm. D) Detailed view of patchy very fine-grained carbonate alteration in host rock. XPL, FOV = ~ 0.3 mm.



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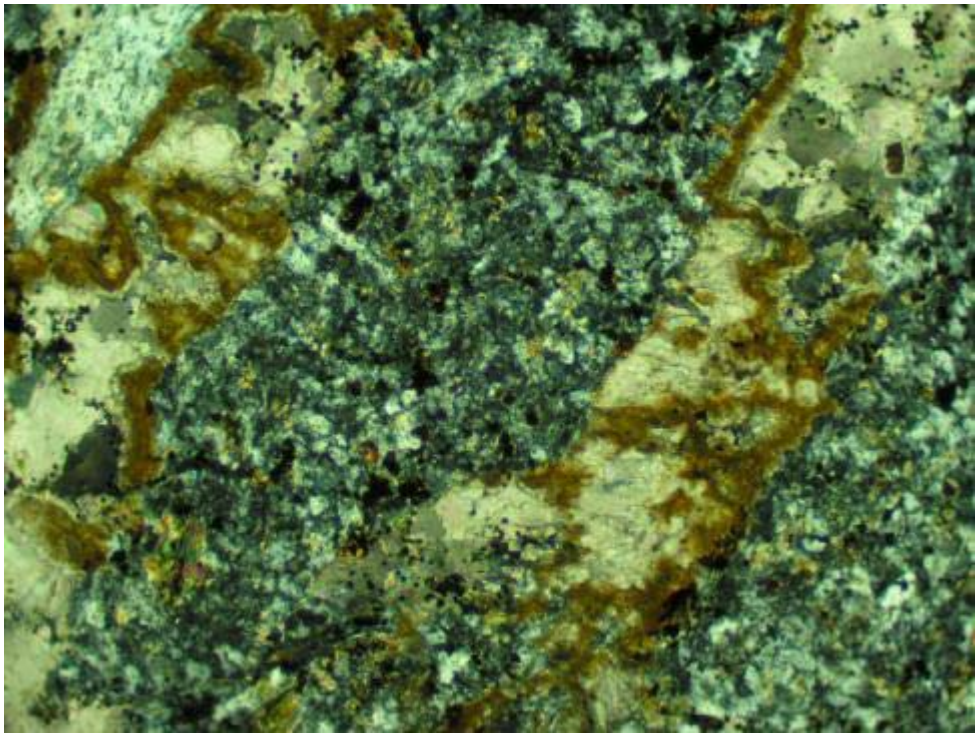
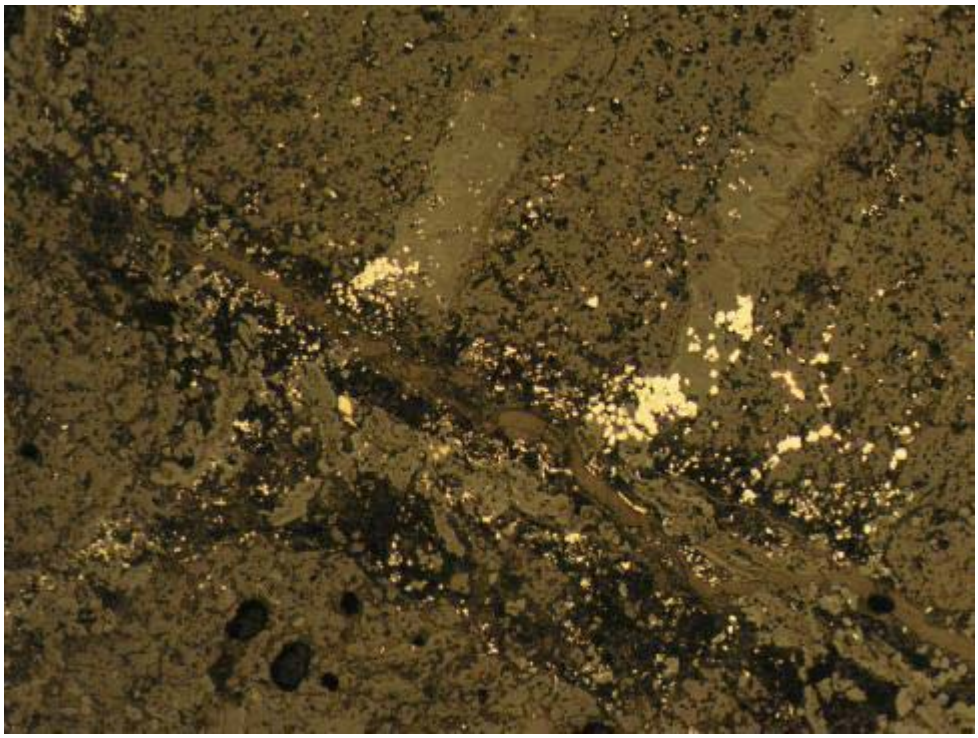


F

Sample: MM-09-11 153.02-153.12m
E) Red-brown Fe-ox aggregate replaces carbonate filled fractures. XPL, FOV = ~ 1.3 mm. F) Orange-brown ?jarosite replaces carbonate-filled fractures. XPL, FOV = ~ 1.3 mm.



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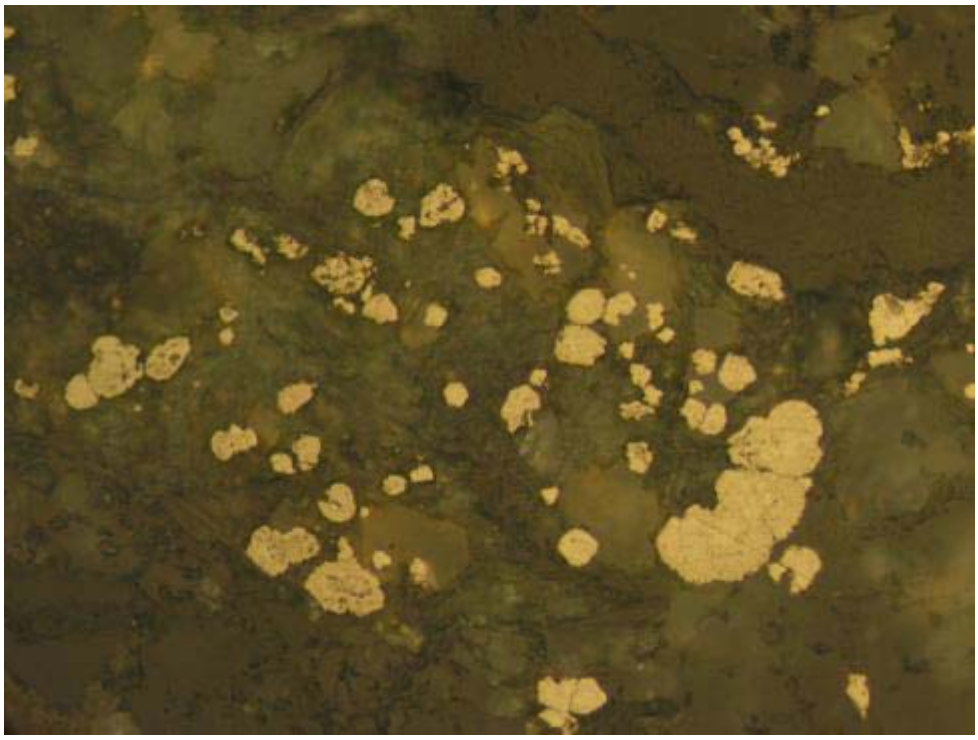


H

Sample: MM-09-11 153.02-153.12m
G) View of very fine-grained pyrite aggregate associated with carbonate fracture infill and replacement. RL, FOV = ~ 2.6 mm. H) Detailed view of framboidal-textured pyrite. RL, FOV = ~ 0.3 mm.

Zone: GRANBY
Sample: MM-09-11 192.09-192.18m **Offcut #AP-9**


view of hand sample


view of stained section offcut, scale in mm

Hand Sample Test Results:
No reaction of sample to magnet. Strong reaction of cavity and fracture infill to cold, dilute HCl. Positive test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Fine-grained dark greenish-gray volcanic rock with some K-feldspar (based on stain) and with prominent amygdales which comprise about 5% of the section. They are approximately 2 to 7 mm in size and rimmed and locally infilled by K-feldspar and by calcite. Calcite and orange-brown material occurs as fracture infill.

Zone: GRANBY
Sample: MM-09-11 192.09-192.18m **Offcut #AP-9**


view of stained section offcut, scale in mm

LITHOLOGY:	Amygaloidal andesite
ALTERATION TYPE:	Carbonate, Fe-Ti oxide, clay, illite/smectite
MINERALIZATION:	Pyrite
FRACTURES/VEINLETS:	Gypsum-(anhydrite)-calcite
	Calcite±carbonate (brown)-Fe-ox
	Carbonate (brown)-Fe-ox

Polished Thin Section Description:
This section is a strongly carbonate-Fe-Ti oxide-clay-illite/smectite altered fine-grained porphyritic amygdaloidal andesite cut by numerous fractures filled with gypsum-(anhydrite)-calcite, calcite and brown carbonate partly replaced by Fe-ox aggregate. The andesite comprises fine to medium-grained plagioclase phenocrysts and locally former mafic phenocrysts in a fine-grained matrix. The matrix comprises dominantly plagioclase and K-feldspar laths that are partly replaced by very fine-grained patchy illite/smectite and carbonate aggregates. Minor quartz occurs interstitial to plagioclase. Former mafic phases are partly replaced by carbonate, clay and Fe-Ti oxides. Prominent amygdales occur throughout the sample (2 to 7 mm diameter). The amygdales are typically rimmed by K-feldspar laths and infilled by later calcite±quartz. Fine-grained subhedral pyrite grains and aggregates occur disseminated.

The clay in this section is identified as smectite and kaolinite using PIMA analysis (see Appendix).

Zone: GRANBY
Sample: MM-09-11 192.09-192.18m **Offcut #AP-9**

HOST ROCK (~95%):
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Plagioclase	40	-fine to medium-grained (< 1.5 mm), phenocrysts -fine-grained, laths, partly replaced by illite/smectite and carbonate aggregates	*polysynthetic twinning*
K-feldspar	15	-fine to very fine-grained (< 0.3 mm), occurs as laths, partly replaced by illite/smectite and carbonate -fine-grained (< 0.3 mm), crystals, occurs rimming and projecting into amygdales as cavity infill, replacement as above	
Clay	15	very fine-grained, occurs with carbonate as patchy replacement of former mafic phases	
Carbonate	10	fine to very fine-grained (<0.15 mm), occurs as patchy replacement of plagioclase and former mafic phases	
Illite/smectite	5	very fine-grained, flaky to anhedral aggregates, occurs as patchy replacement of feldspars	

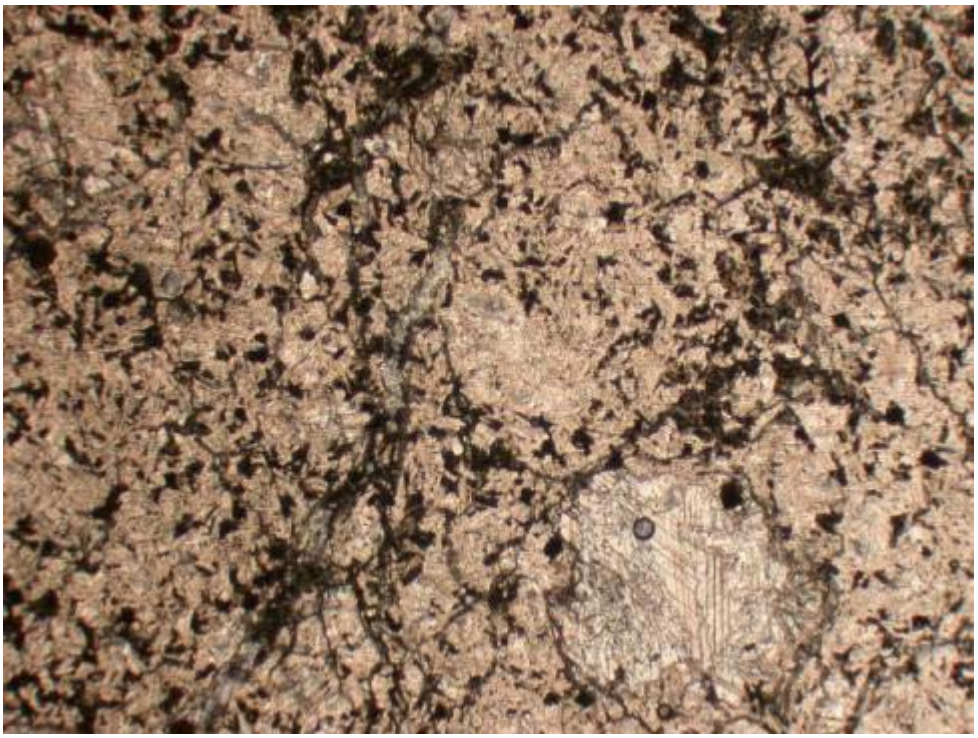
MINOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Fe-Ti-oxide	4	very fine-grained, patchy aggregates, occurs as patchy replacement of former mafic phases, overprints carbonate	
Quartz	2	-fine-grained (< 0.1 mm), anhedral, primary, occurs interstitial to plagioclase -fine-grained (< 0.8 mm), occurs with calcite infill to amygdales	
Pyrite	2	fine-grained (< 0.4 mm), subhedral grains and aggregates, occurs disseminated	
Calcite	2	fine-grained, anhedral, occurs as infill to amygdales	

VEINLETS/ FRACTURE INFILL (5%):

Mineral	%	Distribution & Characteristics*	Optical
Calcite	3	fine-grained (< 0.3 mm), aggregates, occurs veinlet with Fe-ox vein margins and infill -very fine-grained, aggregates, occurs with epidote and chlorite as breccia infill	
Carbonate (brown)-Fe-ox	1	very fine-grained, anhedral to fibrous aggregates, occurs as late fracture infill, partly replaced by red-brown Fe-ox	*brown*
Gypsum	1	very fine-grained, tabular, occurs in veinlets with anhydrite, partly replaced by calcite	
Anhydrite	tr	very fine-grained, anhedral, occurs in veinlets with gypsum	

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm



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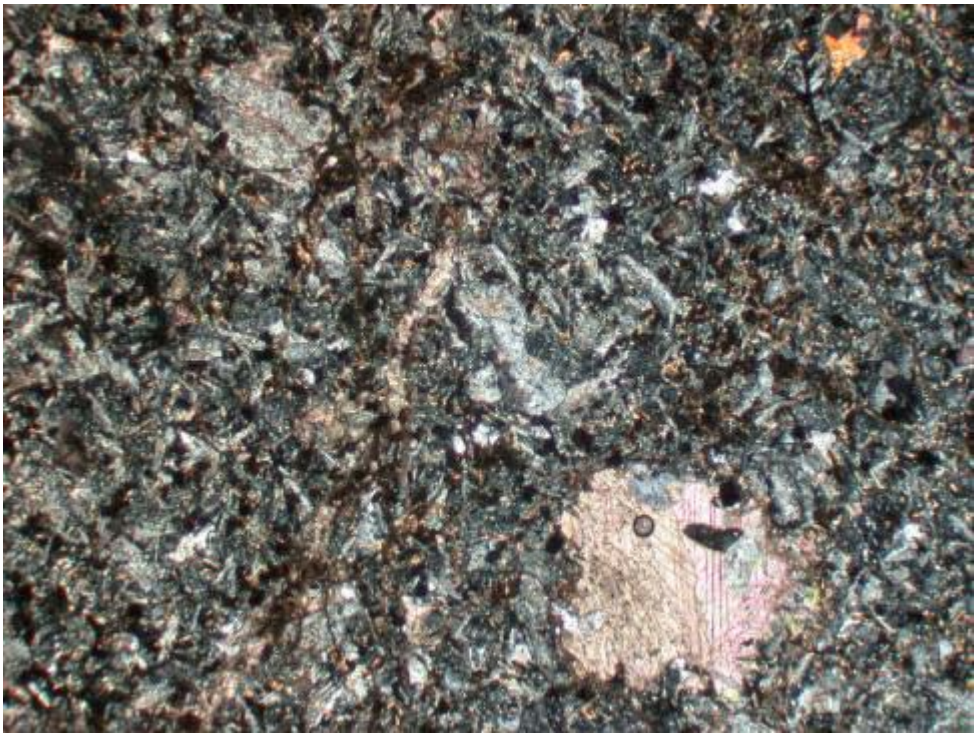
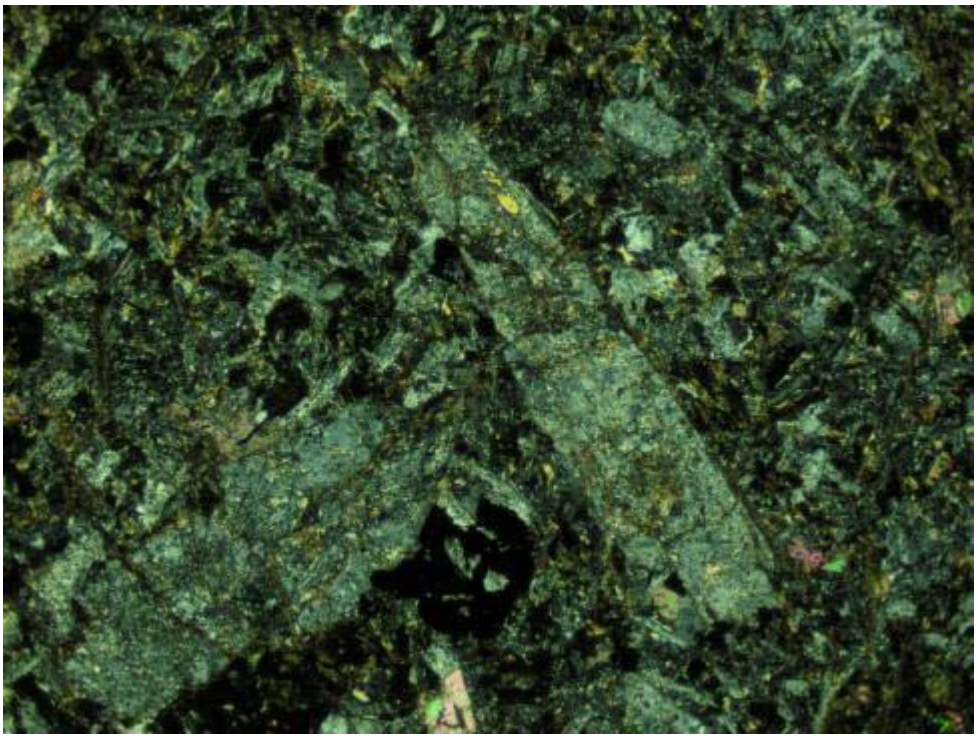


B

Sample: MM-09-11 192.09-192.18m
A & B) Overview of altered fine-grained porphyritic amygdaloidal andesite. A) PPL, B) XPL, FOV = ~ 4.5 mm.



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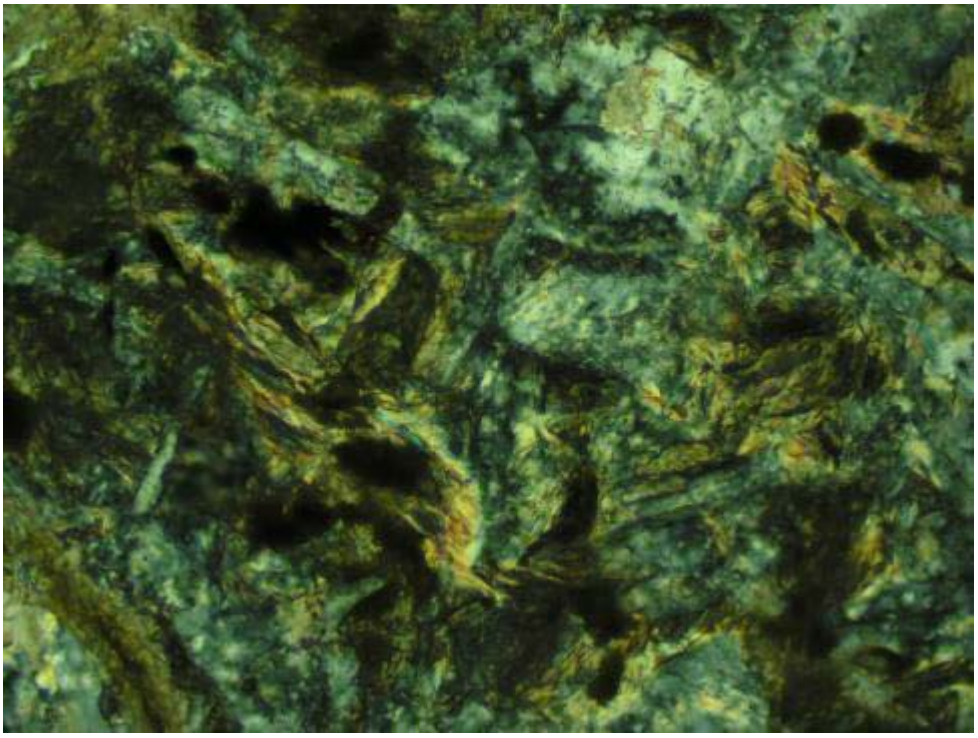
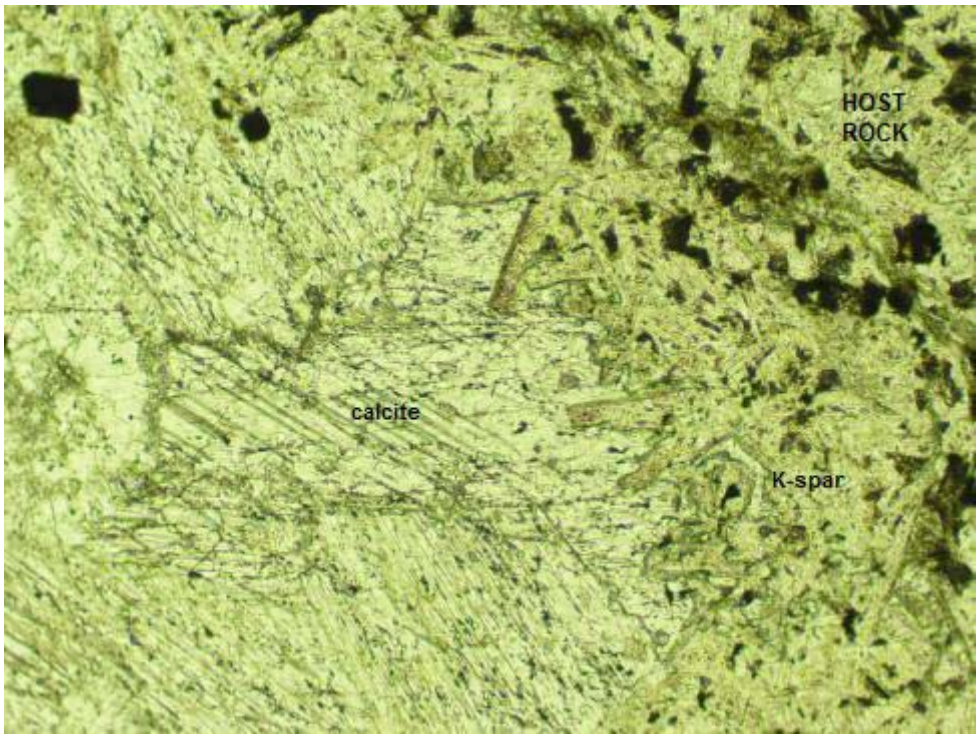


D

Sample: MM-09-11 192.09-192.18m
C) Views of selective carbonate and illite/smectite replacement of plagioclase phenocrysts and matrix. XPL, FOV = 1.3 mm. D) Detailed views of clay-carbonate-Fe-Ti oxide aggregates as replacement of former mafic phases. XPL, FOV = 0.7 mm.



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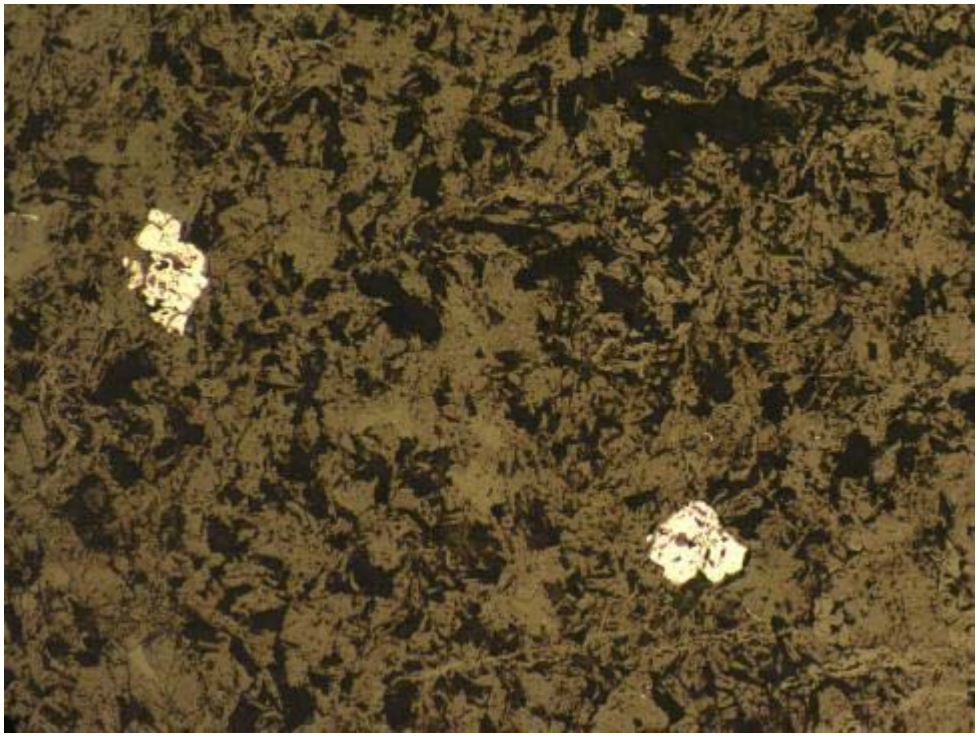
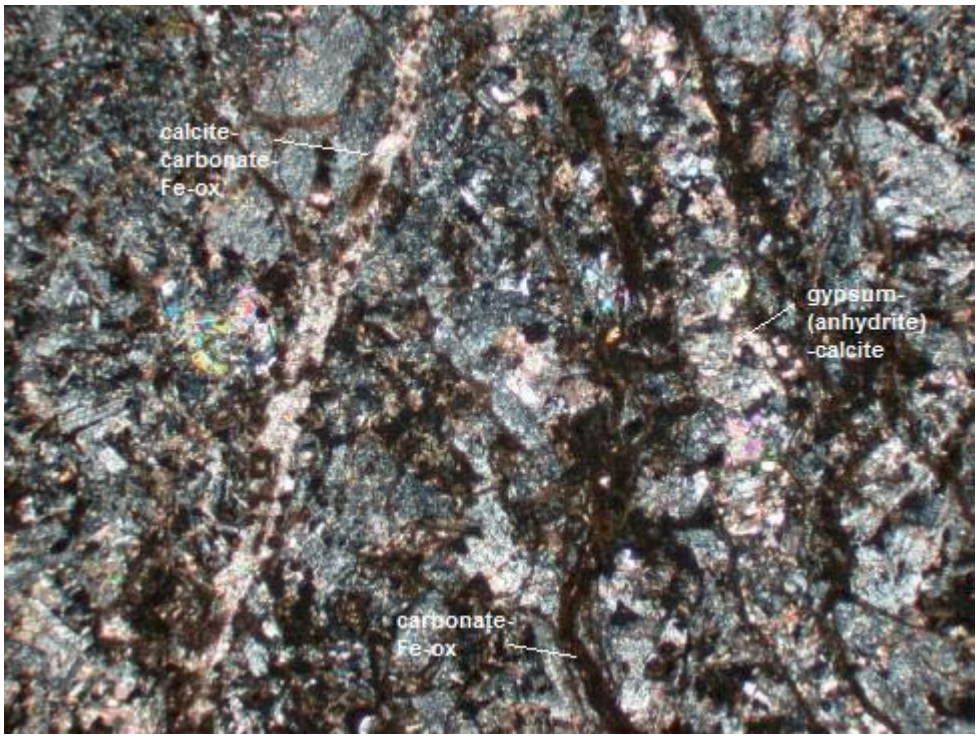


F

Sample: MM-09-11 192.09-192.18m

E) Detailed view of margin of an amygdale with fine-grained K-feldspar projecting into cavity and late infill by calcite. PPL, FOV = ~ 1.3 mm. F) View of disseminated pyrite. RL, FOV = ~ 2.6 mm.



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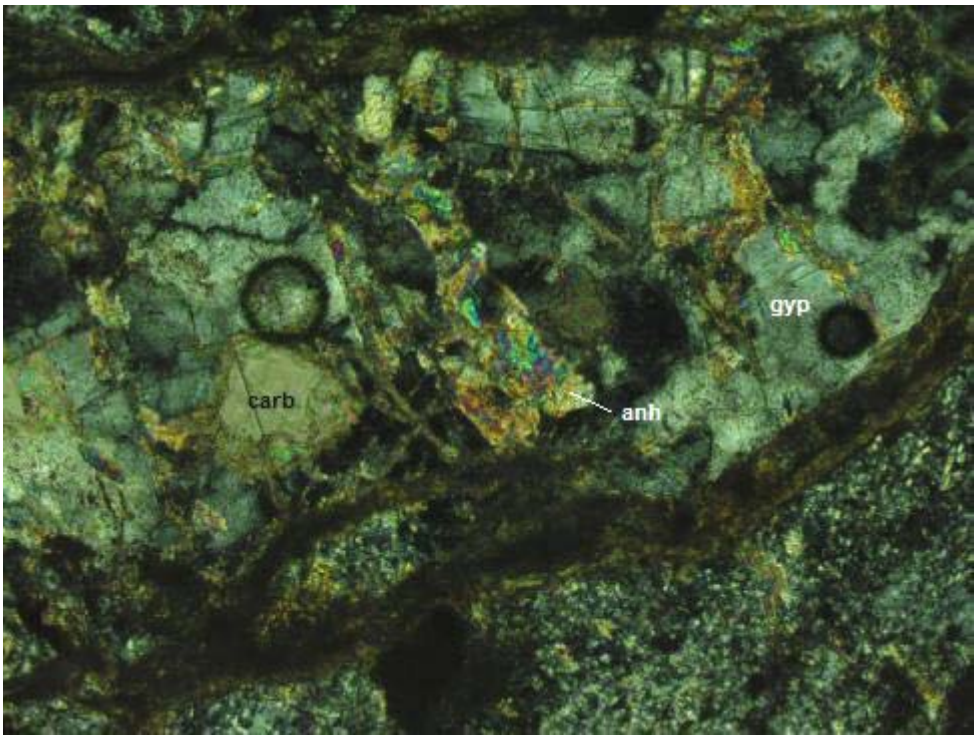


H

Sample: MM-09-11 192.09-192.18m

G) View of fractures filled with (from left to right): calcite –brown carbonate-Fe-ox, brown carbonate partly replaced by Fe-ox and gypsum (anhydrite)-carbonate. XPL, FOV = ~ 4.5 mm. H) Detailed view of gypsum (anhydrite)-carbonate veinlet with brown carbonate margins. XPL, FOV = ~ 0.7 mm.

Zone: GRANBY
Sample: MM-09-11 224.81-224.9m **Offcut #AP-10**

view of hand sample


view of stained section offcut, scale in mm

Hand Sample Test Results:
No reaction of sample to magnet. No reaction to cold, dilute HCl. Positive test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Hydrothermally-altered fragmented rock with subrounded to subangular monolithic greenish-gray fine-grained fragments (< 5 cm size) in a dark-gray pyritic matrix. Major fine-grained pyrite occurs disseminated in the breccia fragments. The breccia is cut by irregular white veinlets (1-5 mm wide).

Zone: GRANBY
Sample: MM-09-11 224.81-224.9m **Offcut #AP-10**


view of stained offcut, scale in mm

LITHOLOGY:	Pervasively altered and fragmented fine-grained volcanic rock (?volcanic breccia)
ALTERATION TYPE:	Carbonate, pyrite, illite, Ti-oxide
MINERALIZATION:	Pyrite
FRACTURES/VEINLETS:	Carbonate

Polished Thin Section Description:
This section is a pervasively carbonate-pyrite-illite-Ti-oxide-altered and fragmented fine-grained porphyritic volcanic rock (?volcanic breccia) cut by late discontinuous carbonate fracture infill.

The fine-grained porphyritic rock comprises altered relict plagioclase phenocrysts in a matrix of very fine-grained feldspar with minor quartz. It is unclear if K-feldspar in the matrix is primary or secondary. Feldspars are selectively replaced by flaky to anhedral illite and pervasively overprinted by very fine-grained carbonate aggregate. Major fine-grained, eu-subhedral pyrite occurs disseminated. Minor patches of very fine-grained Ti-oxide occur associated with the illite and pyrite alteration.

The porphyritic rock is fragmented with intensely altered matrix between fragments. The boundaries between relict porphyritic-textured fragments and the extensively-altered matrix are not distinctly defined. The original breccia matrix is virtually completely replaced by semi-massive pyrite, aggregates of very fine-grained illite, pervasive carbonate overprint and minor patchy Ti-oxide.

Zone: GRANBY
Sample: MM-09-11 224.81-224.9m **Offcut #AP-10**

HOST ROCK (~95%):
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Carbonate, brown	45	very fine-grained, anhedral aggregates, occurs as pervasive replacement of fragments, overprints illite in matrix	*brown*
Pyrite	20	fine-grained (< 0.3 mm), eu-subhedral grains, disseminated; also occurs as semi-massive aggregates in matrix; commonly rimmed by very fine-grained colourless carbonate aggregate	
K-feldspar	15	very fine-grained, anhedral aggregates, occurs as fragment groundmass, origin unclear, estimate amount based on stained offcut, overprinted by illite, carbonate and pyrite	
Illite	7	very fine-grained, flaky to anhedral aggregates, occurs with Ti-oxide aggregate and disseminated pyrite as matrix; occurs as selective replacement of breccia fragments	

MINOR MINERALS

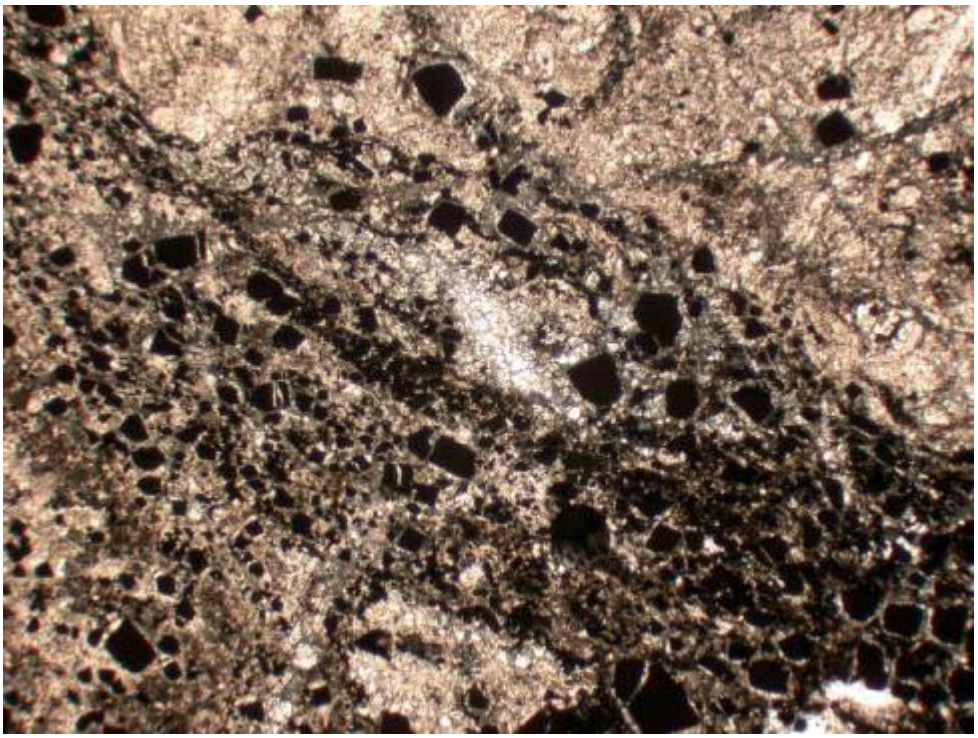
Mineral	%	Distribution & Characteristics*	Optical
Plagioclase	3	fine-grained (< 0.8 mm), tabular, occurs as relict phenocrysts, partly replaced illite and carbonate	*relict polysynthetic twinning*
Ti-oxide	3	very fine-grained, anhedral aggregates, occurs as patchy aggregates associated with illite and pyrite alteration	
Carbonate, colourless	2	very fine-grained, radiating aggregates, occurs rimming disseminated pyrite grains in fragments and matrix	*colourless*
Quartz	tr	fine to very fine-grained (< 0.15 mm), anhedral aggregates, occurs with feldspars as fragment groundmass	

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm

VEINLETS/ FRACTURE INFILL (~5%):

Mineral	%	Distribution & Characteristics*	Optical
Carbonate, colourless	5	fine to very fine-grained (< 0.1 mm), anhedral aggregates, occurs as discontinuous fracture infill and vug infill	*colourless*

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm



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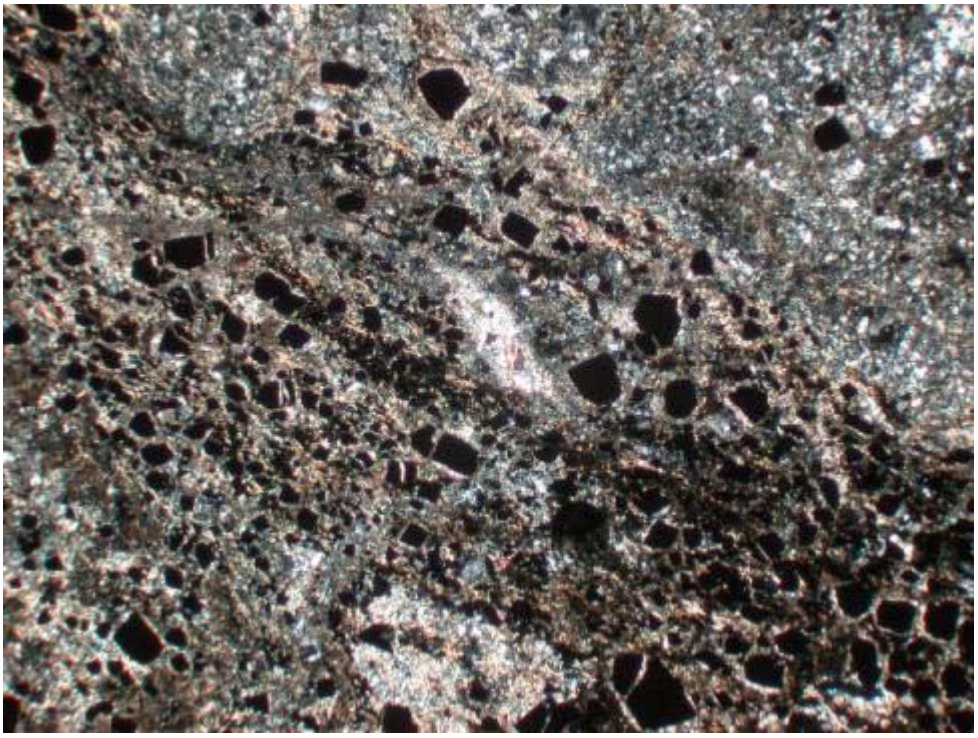
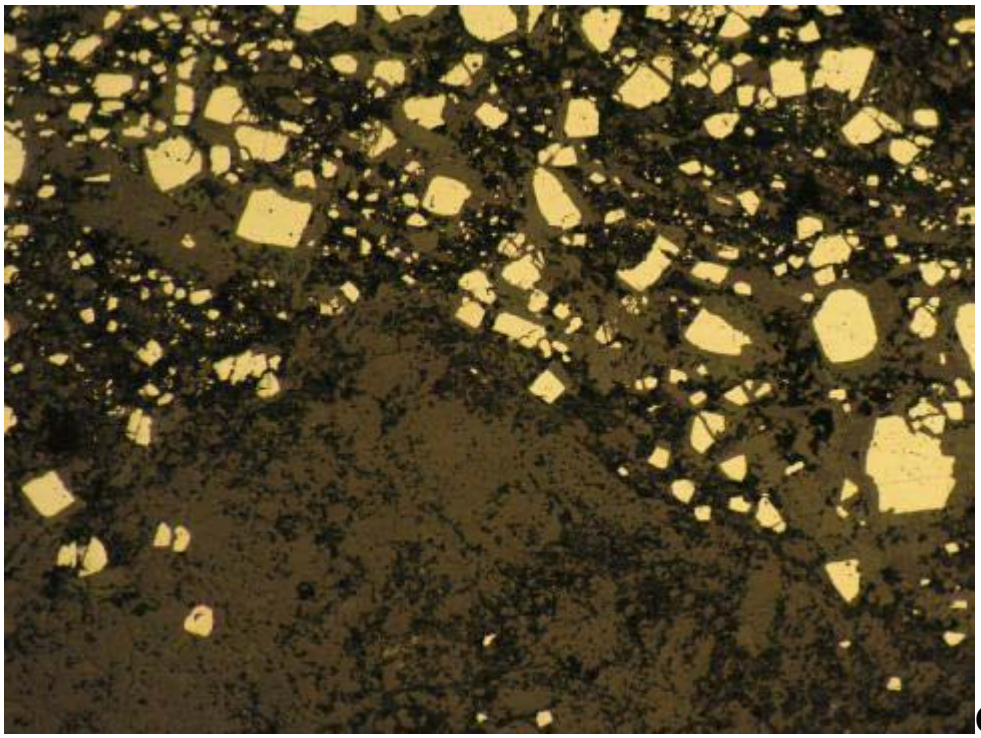


B

Sample: MM-09-11 224.81-224.9m
A & B) Overview of sample shows pervasively carbonate-pyrite-illite-Ti-oxide-altered and fragmented fine-grained porphyritic volcanic rock. A) PPL, B) XPL, FOV = ~ 4.5 mm.



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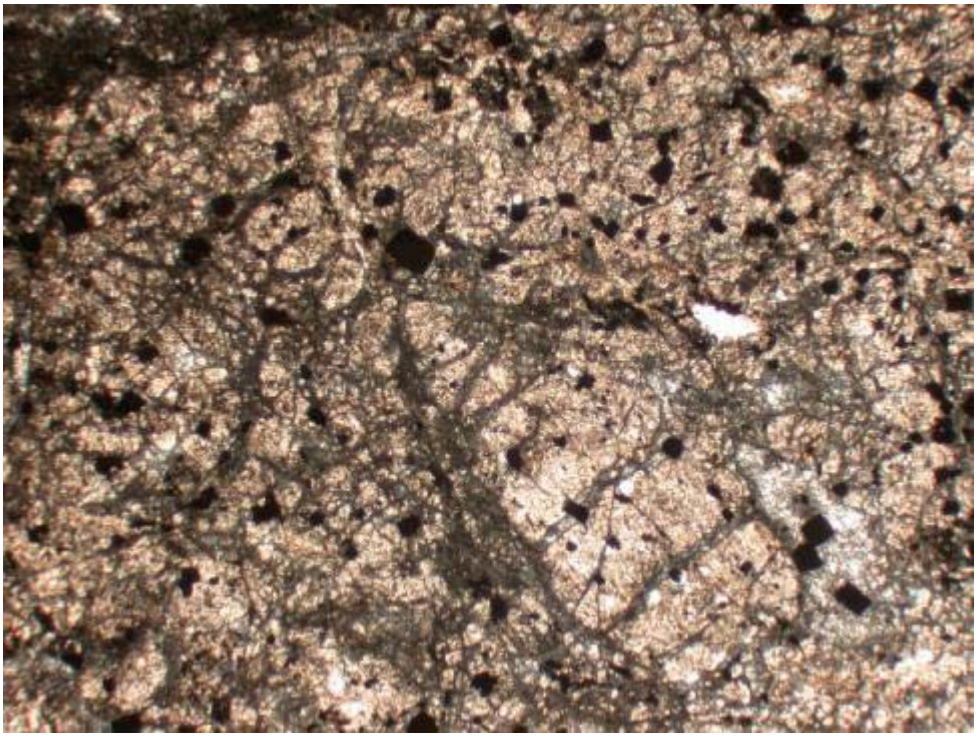
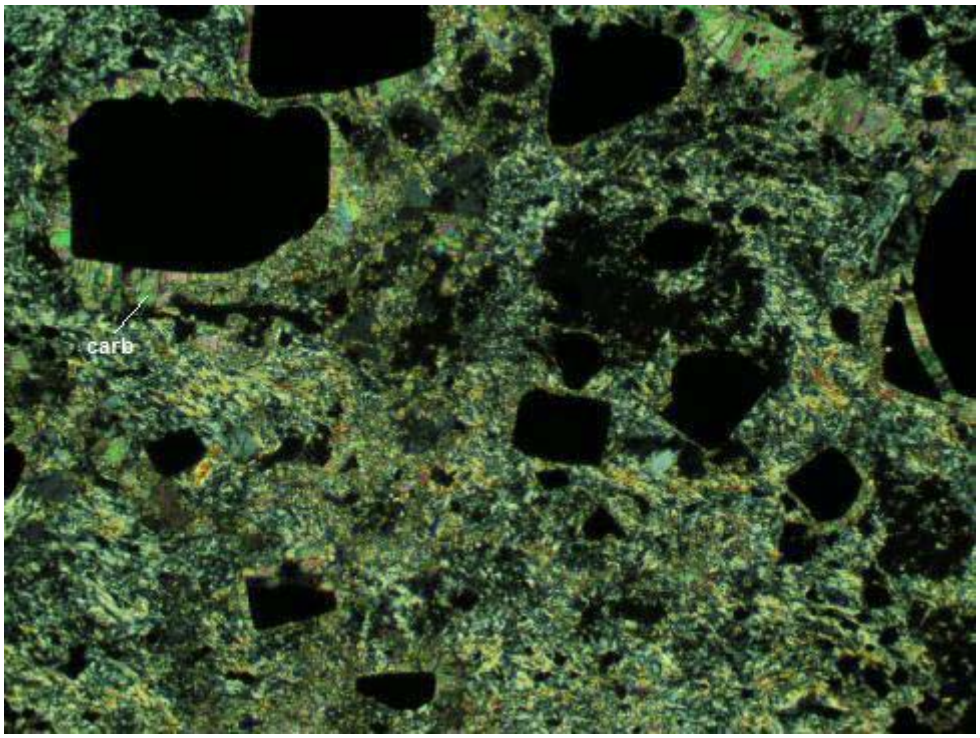


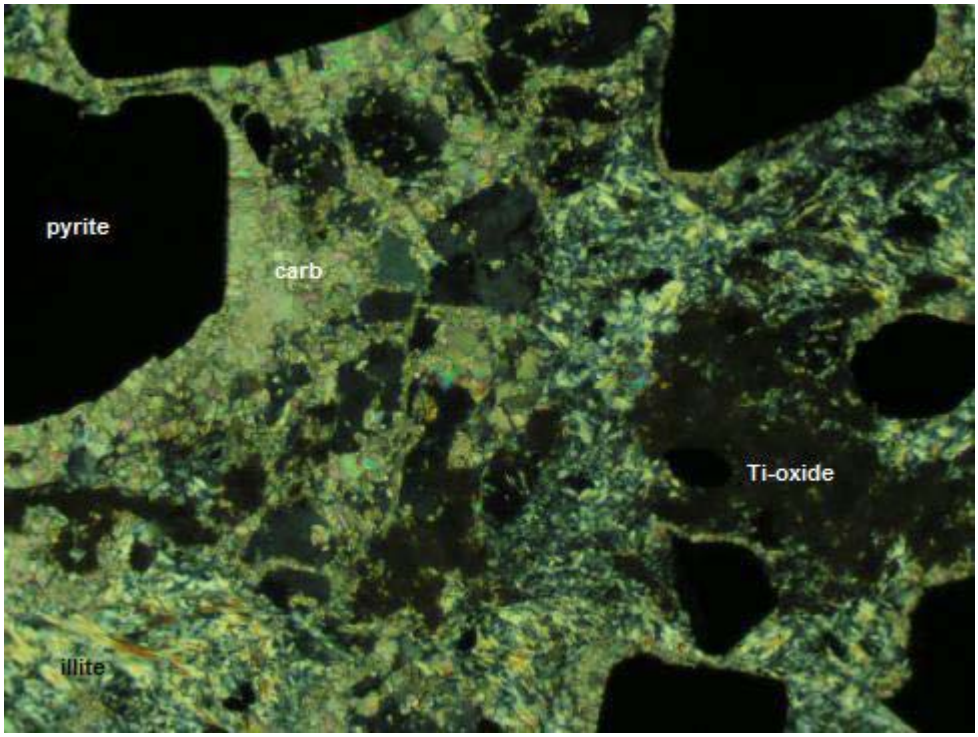
D

Sample: MM-09-11 224.81-224.9m

C) View of abundant pyrite within fragmental rock matrix (top of photo) and disseminated pyrite within fragment (lower part of photo). RL, FOV = ~ 2.6 mm. D) View of intensely fractured fine-grained rock with very fine-grained carbonate as fracture infill. PPL, FOV = ~ 4.5 mm.



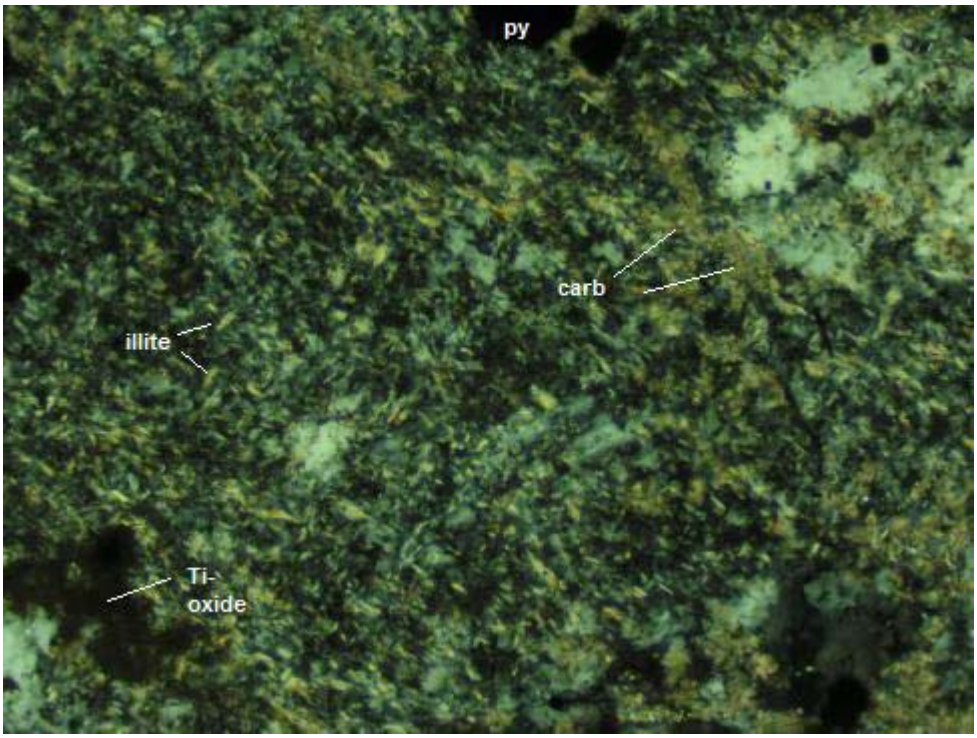
E



F

Sample: MM-09-11 224.81-224.9m

E & F) Views of intensely pervasive illite-carbonate-pyrite-Ti-oxide altered matrix. XPL, E) FOV = ~ 1.3 mm. F) FOV = ~ 0.7 mm.



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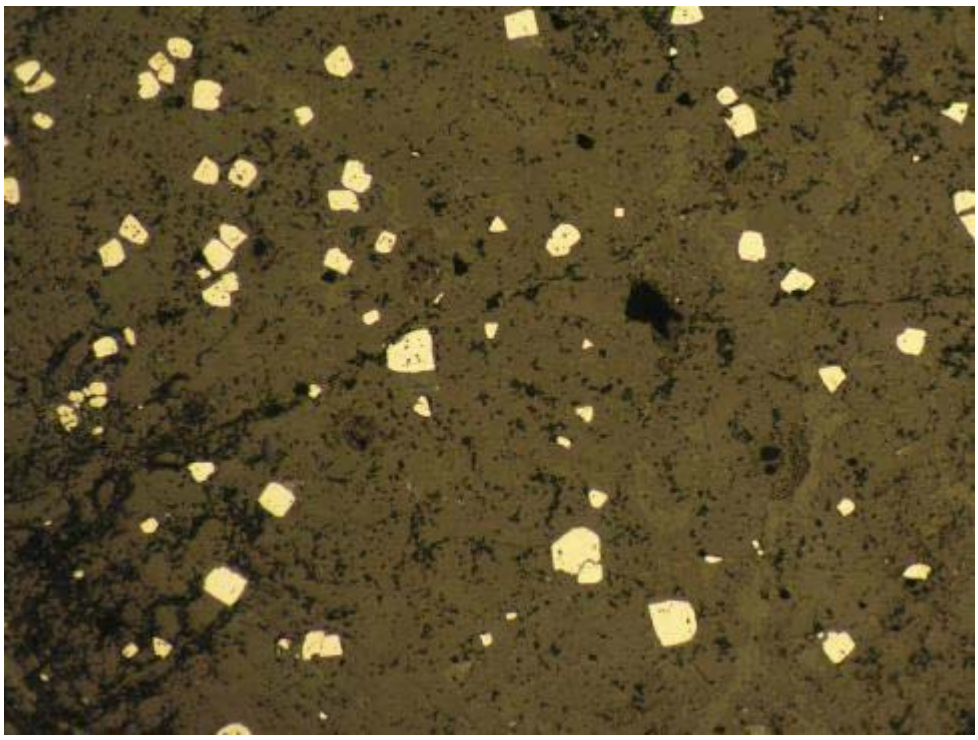
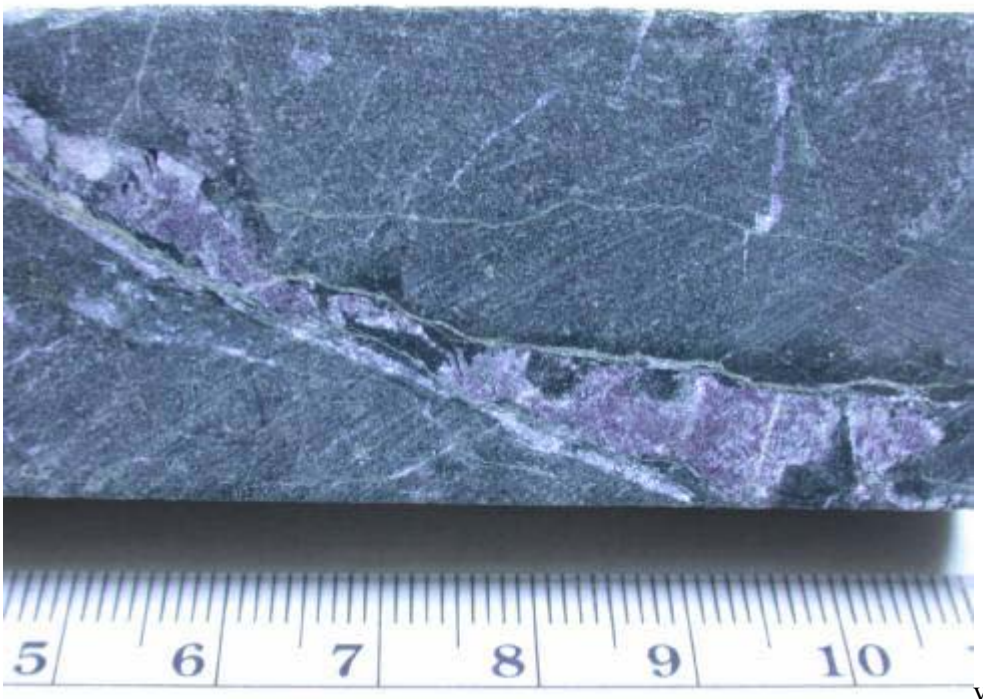


H

Sample: MM-09-11 224.81-224.9m

G) Detailed view of selective and patchy illite-carbonate-Ti-oxide-pyrite alteration of fragment. XPL, FOV = ~ 0.7 mm. H) Representative view of disseminated pyrite within breccia fragment. RL, FOV = ~ 2.6 mm.

Zone: GRANBY
Sample: MM-09-11 241.25-241.36m **Offcut #AP-11**



view of hand sample


view of stained section offcut - fine-grained rock in contact with aphanitic rock, K-feldspar as fracture infill and white and purple carbonate as late infill - scale in mm

Hand Sample Test Results:
No reaction of sample to magnet. Reaction of fractures and patches within rock to cold, dilute HCl. Positive test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Fine-grained crystal-rich ?tuff in contact with fine?tuff (see sample offcut). Vague suggestion of lithic clasts (up to 2-3 mm size) in stained sample offcut. The sample is selectively K-feldspar altered and early hairline fractures are filled with K-feldspar (see offcut). The sample is fractured with infill by white calcite and purple carbonate aggregate. Very fine-grained brown carbonate occurs in sub-mm fractures at margins of discontinuous white and purple carbonate infill.

Zone: GRANBY
Sample: MM-09-11 241.25-241.36m **Offcut #AP-11**


view of stained offcut, scale in mm

LITHOLOGY:	Pervasively altered crystal-rich coarse ?tuff in contact with fine ?tuff
ALTERATION TYPE:	Chlorite, carbonate, Ti-oxide, illite, ?K-feldspar
MINERALIZATION:	(Chalcopyrite), pyrite
FRACTURES/VEINLETS:	K-feldspar
	Carbonate-*hematitic*
	Carbonate-*colourless* ± (chalcopyrite)
	Chlorite-carbonate – *very fine-grained* ± (chalcopyrite)

Polished Thin Section Description:
This section covers the contact between pervasively chlorite-carbonate-Ti-oxide-illite altered crystal-rich coarse ?tuff in contact with fine ?tuff. The contact between the two rock types is offset by fine hairline fractures filled with K-feldspar. The host rocks are fractured with infill by carbonate and chlorite (see below).

The crystal-rich coarse ?tuff is pervasively altered with relict fine-grained crowded plagioclase phenocrysts in a fine to very fine-grained matrix of plagioclase, K-feldspar and minor quartz. Vague outlines of clasts noted in stained offcut are not clearly evident in the section. The origin of the K-feldspar in the matrix is uncertain; the occurrence of very fine-grained K-feldspar in fractures indicates some secondary K-feldspar. Minor illite occurs partly replacing plagioclase phenocrysts. The crystal-rich rock is extensively replaced by very fine-grained chlorite-carbonate aggregate and clusters of brown Ti-oxide. Rare traces of very fine-grained pyrite occur disseminated in this rock. Rare chalcopyrite occurs with chlorite and colourless carbonate as fracture infill and replacing plagioclase phenocrysts.

The fine ?tuff is virtually completely replaced by chlorite-illite-carbonate-Ti-oxide aggregates. A few relict medium-grained tabular crystals or possibly fragments are evident in thin section. Fine-grained sub-anhedral pyrite occurs disseminated.

The section is cut by numerous fractures filled with chlorite and several varieties of carbonate: colourless, hematitic and very fine-grained brown. Hematitic carbonate (purple colour in hand sample) occurs as open space filling. The carbonate is partly replaced by hematite aggregate which imparts a purple colour in hand sample. Hematitic carbonate is fractured and infilled by colourless anhedral carbonate aggregates and by chlorite aggregate. Traces of chalcopyrite occur within the colourless carbonate and chlorite infill. Very fine-grained brown carbonate aggregates occur at the margins of colourless carbonate-filled fractures and associated with chlorite-filled fractures.

Zone: GRANBY
Sample: MM-09-11 241.25-241.36m **Offcut #AP-11**

HOST ROCK (80%):
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Chlorite	30	very fine-grained, flaky to anhedral aggregates, occurs as pervasive replacement of host rocks	
Plagioclase	15	fine-grained (< 1 mm), tabular, occurs as abundant phenocrysts in crowded crystal-rich rock, partly replaced by carbonate, chlorite and illite	
K-feldspar	15	-very fine-grained, anhedral aggregates, occurs as matrix to crystal rich and aphanitic rocks, origin uncertain, overprinted by carbonate	
Carbonate	7	very fine-grained, anhedral aggregates, occurs as patchy replacement of host rocks, overprints illite	
Ti-oxides	6	very fine-grained, clusters, occurs as replacement of crystal-rich and aphanitic rocks	

MINOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Illite	3	very fine-grained, flaky, occurs in minor amounts with chlorite partly replacing plagioclase in the crystal rich rock and associated with chlorite in the aphanitic rock	
Quartz	2	very fine-grained, anhedral aggregates, occurs as matrix to crystal-rich rock	
Pyrite	1	-fine-grained, sub-anhedral disseminated grains within aphanitic rock -very fine-grained, rare grains associated with chlorite-carbonate alteration in crystal-rich rock	
Unknown	tr	medium-grained (< 2 mm), tabular, occurs as relict ?crystals in pervasively chlorite-illite-carbonate altered aphanitic rock	
Chalcopyrite	tr	very fine-grained, anhedral aggregates, associated with chlorite and carbonate as replacement of plagioclase and fracture controlled	
Apatite	tr	fine to very-grained (< 0.1 mm), disseminated	*high relief*

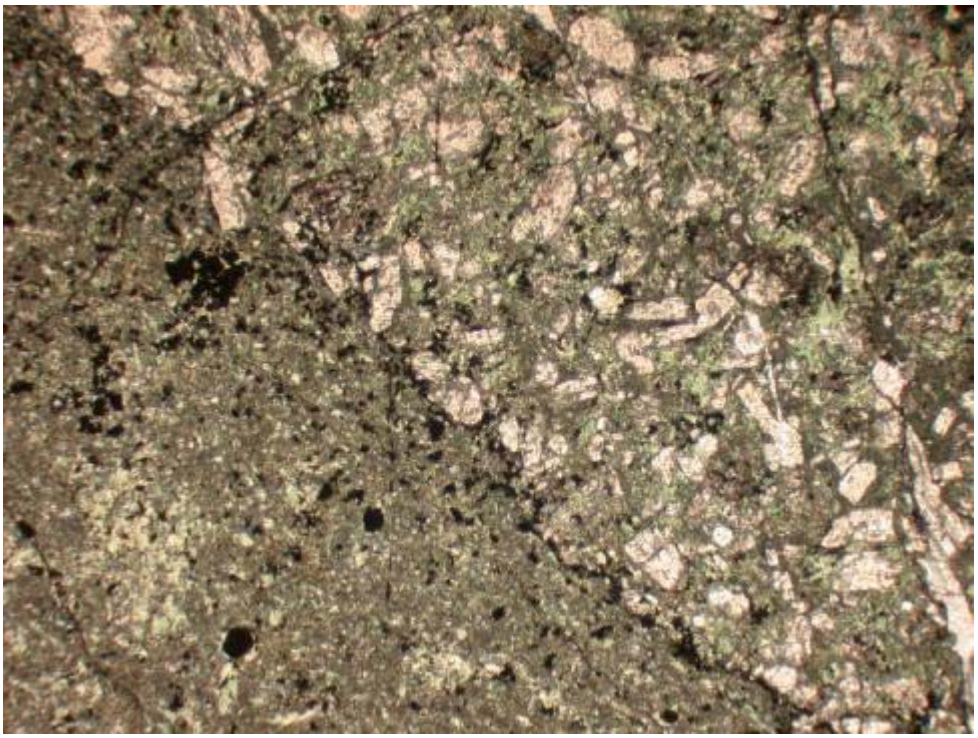
Please see over for VEINLETS/FRACTURE INFILL

Zone: GRANBY
Sample: MM-09-11 241.25-241.36m **Offcut #AP-11**

VEINLETS/ FRACTURE INFILL (20%):

Mineral	%	Distribution & Characteristics*	Optical
Carbonate, hematitic	10	fine to medium-grained (< 2 mm), anhedral aggregates, occurs as open space fill, infilled by late colourless carbonate, partly replaced by very fine-grained hematite aggregate imparting purple colour	*cloudy with inclusions of hematite*
Carbonate, colourless	3	fine-grained, anhedral aggregates, occurs as fracture infill, partly replaced by very fine-grained carbonate aggregate	*colourless*
Carbonate, brown	2	Very fine-grained, anhedral aggregates, occurs as fracture infill, occurs at margins of colourless carbonate filled fractures	*brown*
Hematite	2	very fine-grained, specular aggregates, occurs as replacement of hematitic (purple) carbonate infill, gives purple colour	*red*
Chlorite	1	very fine-grained, anhedral aggregates, occurs as fracture infill, occurs at margins and crosscutting hematitic carbonate filled veinlets	
K-feldspar	1	very fine-grained, anhedral aggregates, occurs as early hairline fracture infill	
Chalcopyrite	tr-1	fine to very fine-grained (< 0.3 mm), anhedral grains and aggregates, occurs within colourless carbonate or chlorite as fracture infill	

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm



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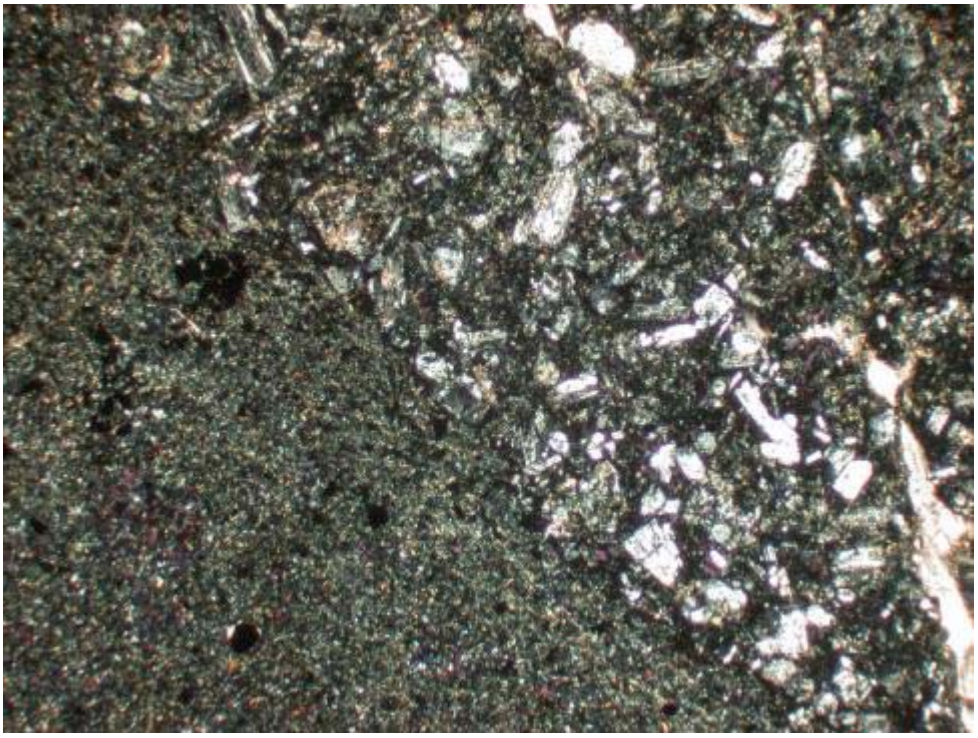
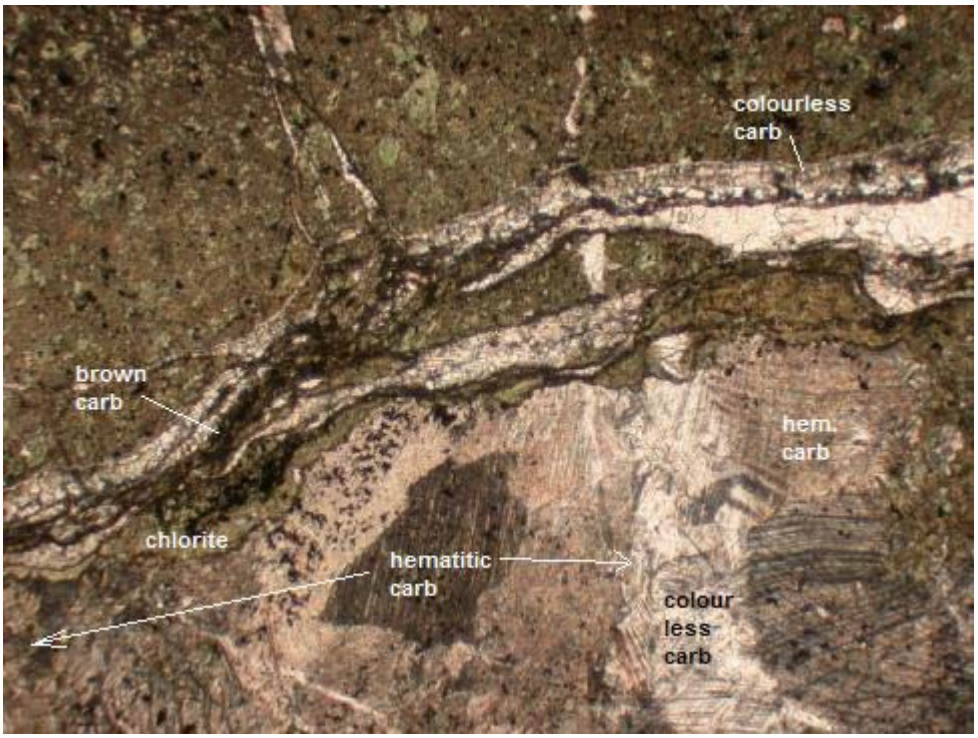


B

Sample: MM-09-11 241.25-241.36m
A & B) Overview of contact between 'aphanitic' rock (fine ?tuff; left) and crowded crystal-rich rock (coarse ?tuff; right). A) PPL, B) XPL, FOV = ~ 4.5 mm.



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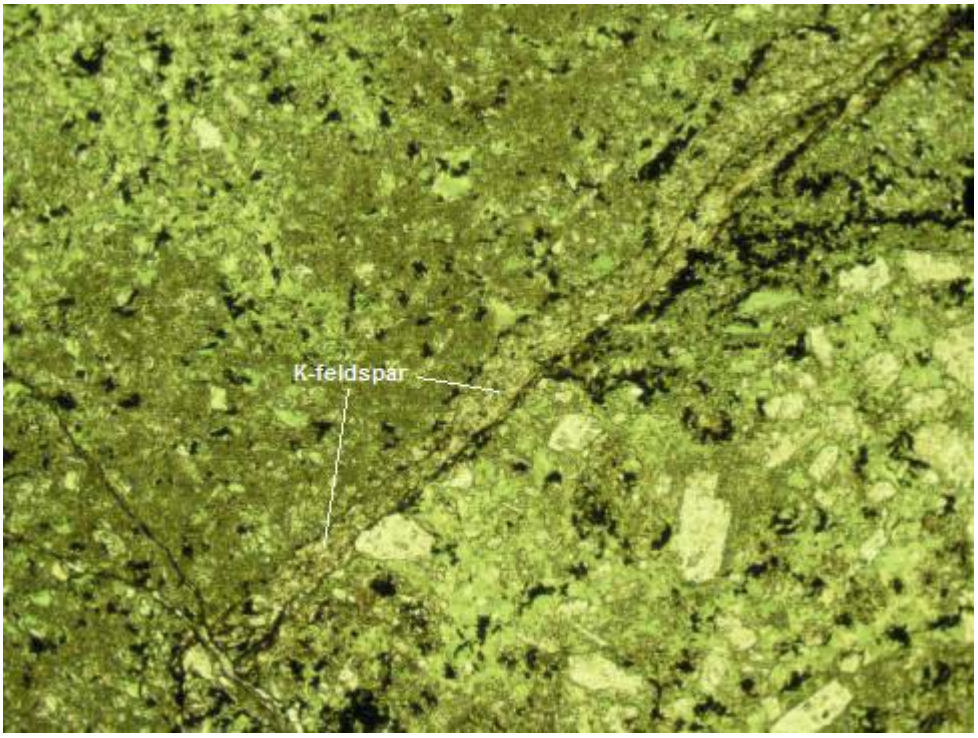
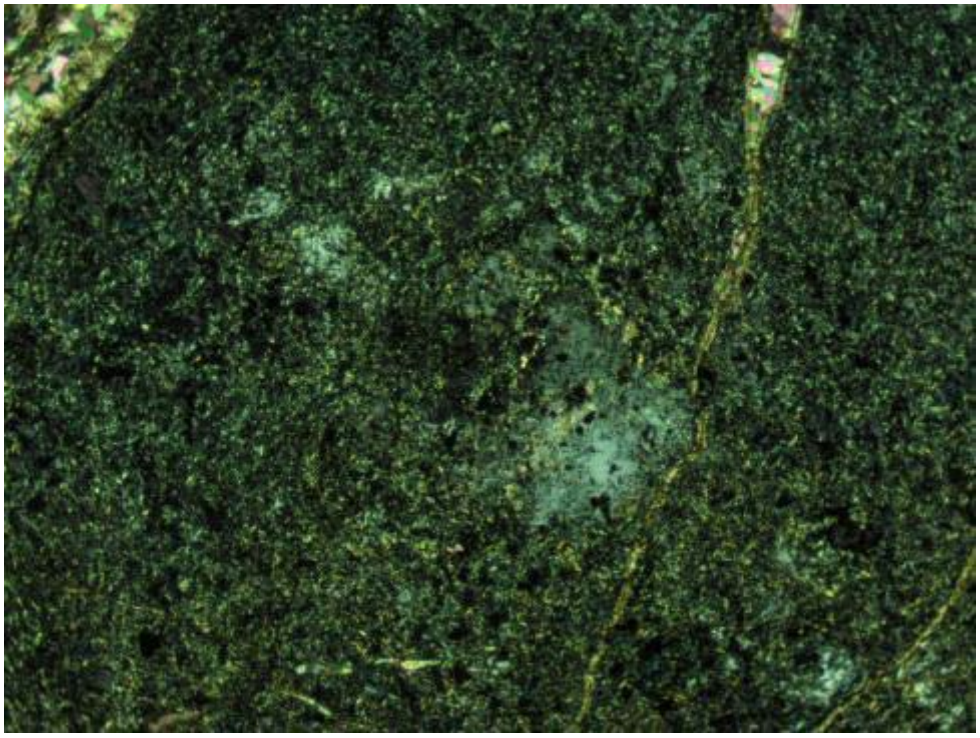


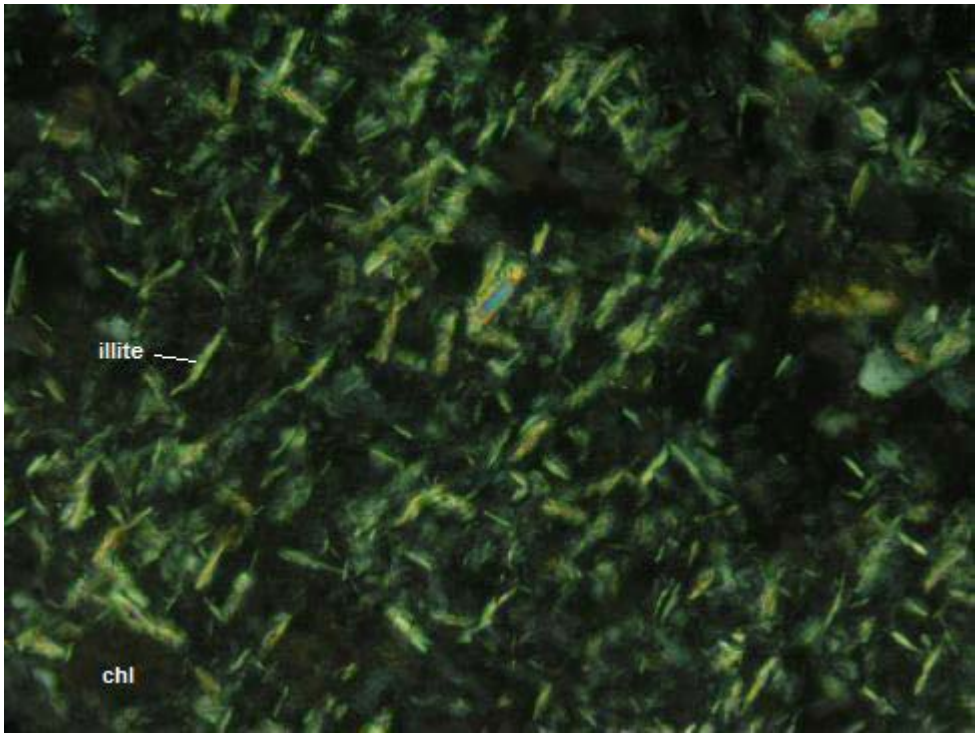
D

Sample: MM-09-11 241.25-241.36m

C) Representative view of infill by hematitic carbonate, later colourless carbonate and very fine-grained brown carbonate-chlorite at margins of colourless carbonate veinlets. PPL, FOV = ~ 4.5 mm. D) Very fine-grained K-feldspar in fracture that offsets "aphanitic" rock (top left) and crystal-rich rock (lower right). PPL, FOV = ~ 2.6 mm.

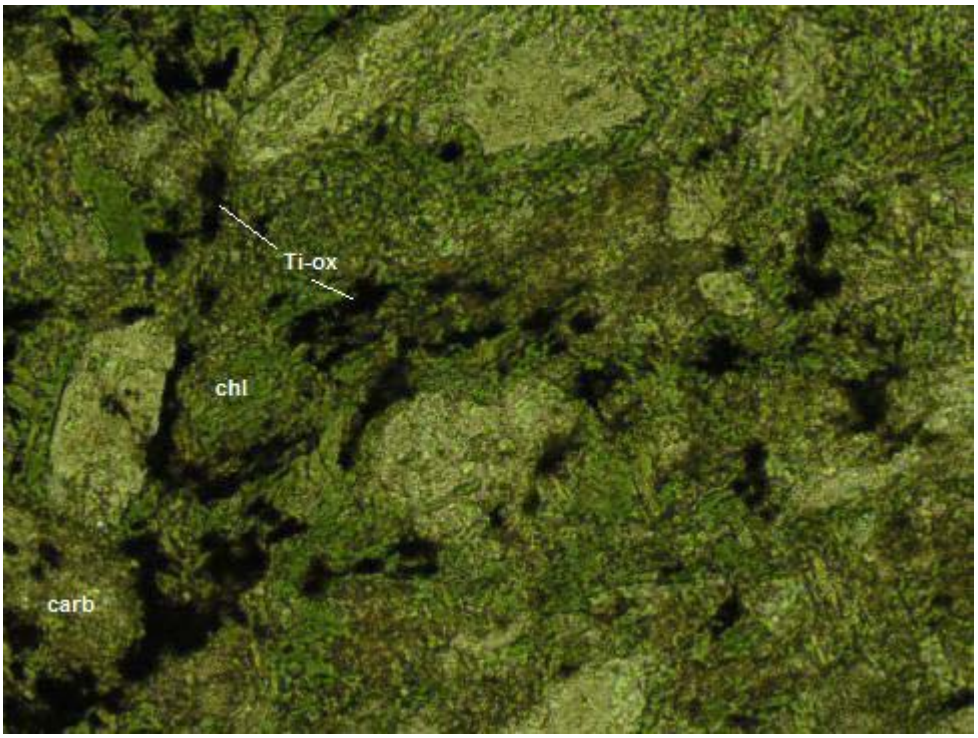


E



F

Sample: MM-09-11 241.25-241.36m
E) Relict medium-grained tabular forms within 'aphanitic' host rock. XPL, FOV = ~ 2.6 mm. F) Detailed view of chlorite-illite alteration within 'aphanitic' host rock. XPL, FOV = ~ 0.3 mm.



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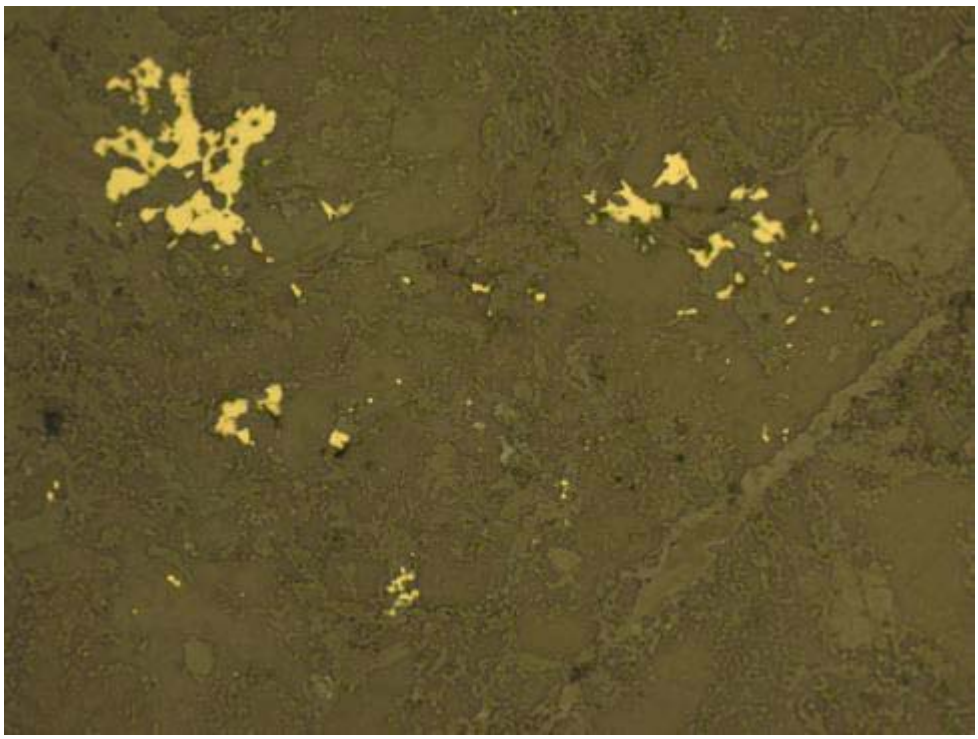
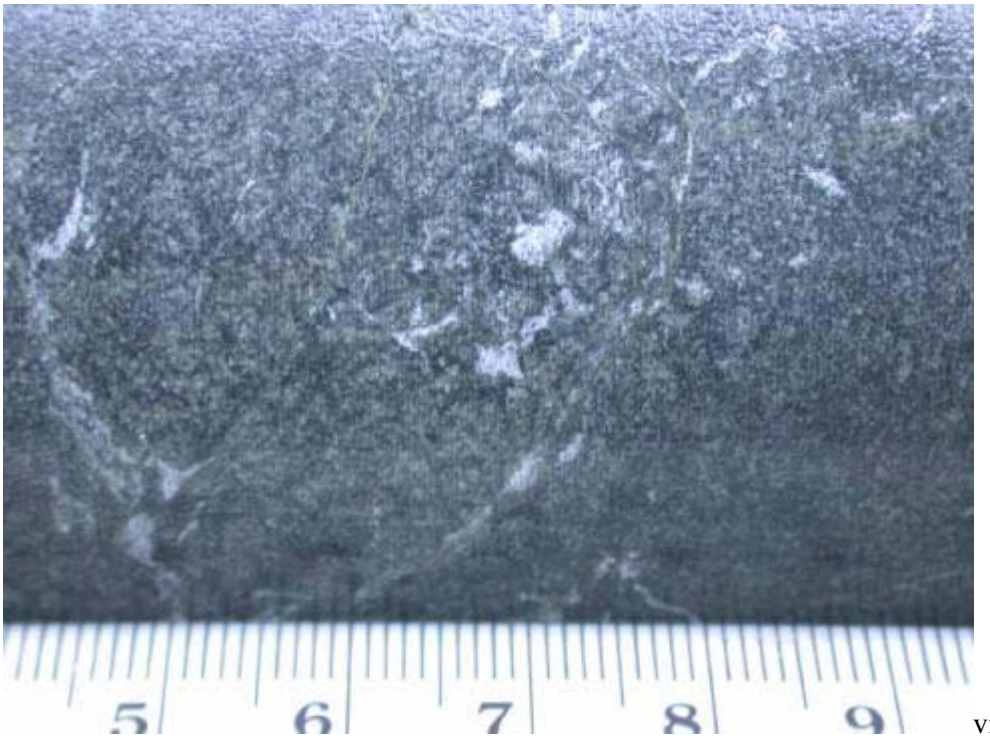


H

Sample: MM-09-11 241.25-241.36m

G) Representative view of chlorite-carbonate-Ti-oxide alteration within crystal-rich rock. PPL, FOV = ~ 1.3 mm. H) Patchy very fine-grained carbonate associated with carbonate replacement of plagioclase and chlorite filled fractures. RL, FOV = ~ 1.3 mm.

Zone: SOUTH
Sample: MM-09-12 9.95-10.04m **Offcut #AP-12**



view of hand sample


view of stained section offcut, scale in mm

Hand Sample Test Results:
Strong reaction of sample to magnet. Reaction of fractures to cold, dilute HCl. Positive test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Fine-grained vaguely fine to medium-grained strongly K-feldspar-altered porphyritic rock (texture highlighted by staining; see sample offcut). The sample is cut by 2-3 mm wide quartz-pyrite-calcite veinlet.

Zone: SOUTH
Sample: MM-09-12 9.95-10.04m **Offcut #AP-12**


view of stained offcut, scale in mm

LITHOLOGY:	Pervasively altered porphyritic rock
ALTERATION TYPE:	Chlorite, K-feldspar, carbonate, magnetite, Ti-oxide, illite
MINERALIZATION:	Pyrite, (chalcopyrite)
FRACTURES/VEINLETS:	Quartz-pyrite-(chalcopyrite)
	Carbonate-*colourless & brown*±pyrite-(chalcopyrite)

Polished Thin Section Description:
This section is a pervasively K-feldspar-chlorite-carbonate-illite-Ti-oxide- magnetite altered former porphyritic rock. Abundant medium-grained tabular forms are preserved (see stained offcut). The tabular forms are replaced by very fine-grained K-feldspar, chlorite, carbonate, Ti-oxide and magnetite aggregates. Relict fine-grained plagioclase is selectively replaced by very fine-grained K-feldspar and overprinted by patchy anhedral carbonate, chlorite and illite aggregate. Chlorite is the dominant alteration occurring as very fine-grained anhedral aggregates that pervasively replace the rock. Secondary K-feldspar occurs throughout the rock as very fine-grained anhedral patchy aggregates. Rare relict biotite is preserved, virtually completely replaced by chlorite. Major magnetite occurs disseminated as disaggregated grains. Rarely magnetite is partly replaced by hematite. Minor fine-grained euhedral pyrite and rare very fine-grained chalcopyrite occur disseminated. Traces of fine-grained apatite occur disseminated.

The section is cut by an early fine to very fine-grained, prismatic quartz veinlet with minor disseminated pyrite. Late colourless carbonate (calcite) occurs as fine to medium-grained fracture infill. Minor brown carbonate occurs as very fine-grained anhedral to radiating aggregates as latest infill. Disseminated pyrite occurs within both colourless and latest brown carbonate veinlets.

Zone: SOUTH
Sample: MM-09-12 9.95-10.04m **Offcut #AP-12**

HOST ROCK (90%):
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Chlorite	45	very fine-grained, flaky to anhedral aggregates, occurs as pervasive replacement of host rock	
K-feldspar	22	very fine-grained, anhedral aggregates, occurs as replacement of matrix and former fine to medium-grained phenocrysts, overprinted by patchy carbonate aggregate	
Carbonate	5	fine to very fine-grained (< 0.1 mm), anhedral aggregates, occurs as patchy replacement of host rock, overprints illite	
Ti-oxides	5	very fine-grained, clusters, occurs as patchy replacement of rock, associated with carbonate and magnetite	
Magnetite	5	fine to very fine-grained (< 0.2 mm), anhedral disaggregated grains, occurs disseminated	

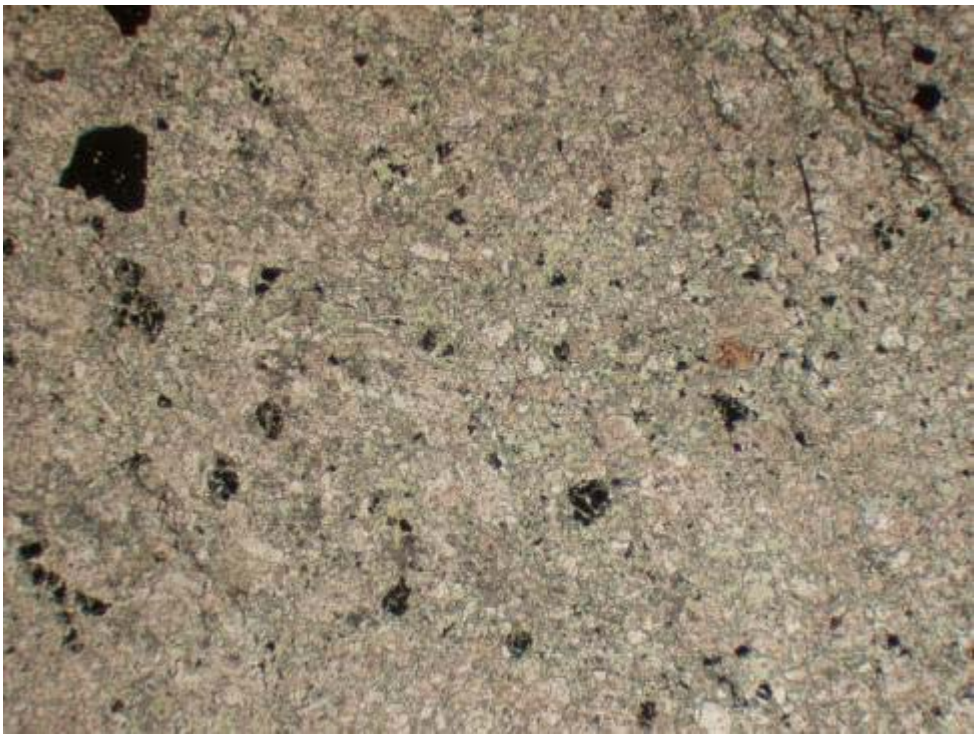
MINOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Pyrite	3	fine-grained (< 0.5 mm), euhedral disseminated grains and clusters	
Illite	2	very fine-grained, flaky, occurs in minor amounts with chlorite and carbonate partly replacing feldspar	
Quartz	2	fine to very fine-grained (< 0.1 mm), anhedral aggregates, occurs as matrix to porphyritic rock	
Plagioclase	1	fine-grained (< 1 mm), tabular, occurs as relict phenocrysts and matrix to porphyritic rock, virtually completely replaced by K-feldspar, illite, chlorite and carbonate aggregate	
Apatite	tr	fine to very-grained (< 0.1 mm), disseminated	*high relief*
Chalcopyrite	tr	very fine-grained, anhedral grains, rarely adjacent to pyrite	
Hematite	tr	very fine-grained, rarely replaces magnetite	
Biotite	tr	fine-grained, virtually completely replaced by chlorite	*brown*

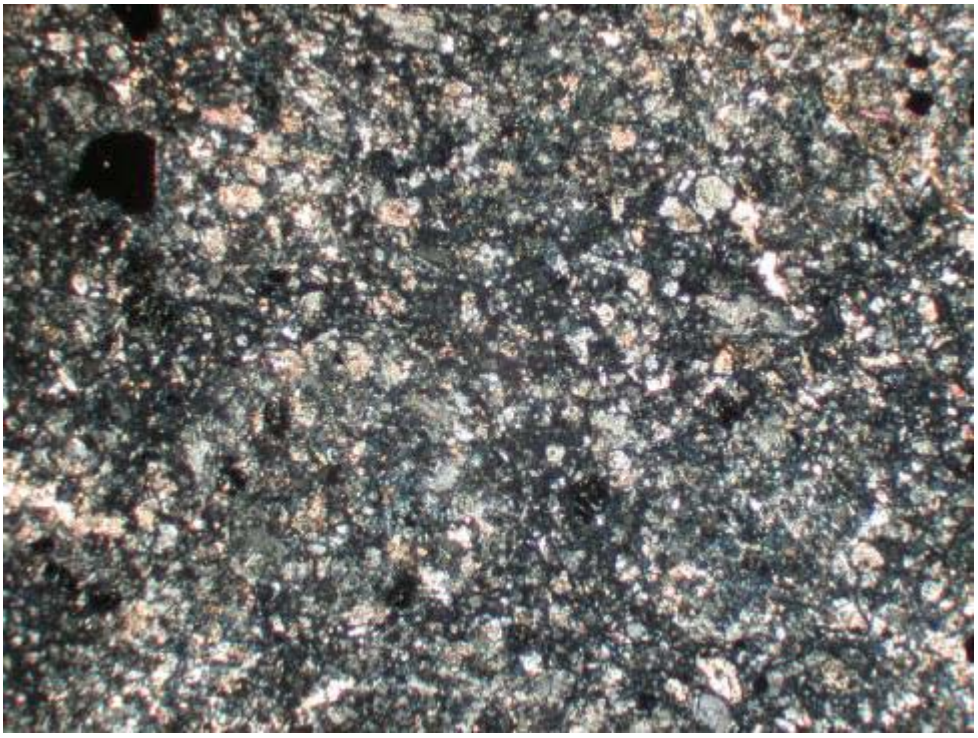
VEINLETS/ FRACTURE INFILL (10%):

Mineral	%	Distribution & Characteristics*	Optical
Carbonate, colourless	5	fine to medium-grained, anhedral aggregates, occurs as fracture infill	*colourless*
Quartz	3	-fine to very fine-grained (< 0.1 mm), prismatic aggregates, occurs with slivers of microcrystalline quartz as early veinlet -very fine-grained, occurs as rare discontinuous microveinlets	
Carbonate, brown	2	very fine-grained, radiating aggregates, occurs as latest fracture infill	*brown*
Pyrite	1	fine to very fine-grained (< 0.1 mm), sub-anhedral grains and aggregates, occurs within early quartz veinlet and within later carbonate veinlets	
Chalcopyrite	tr	fine to very fine-grained, anhedral, occurs rarely adjacent to pyrite in quartz vein	

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm

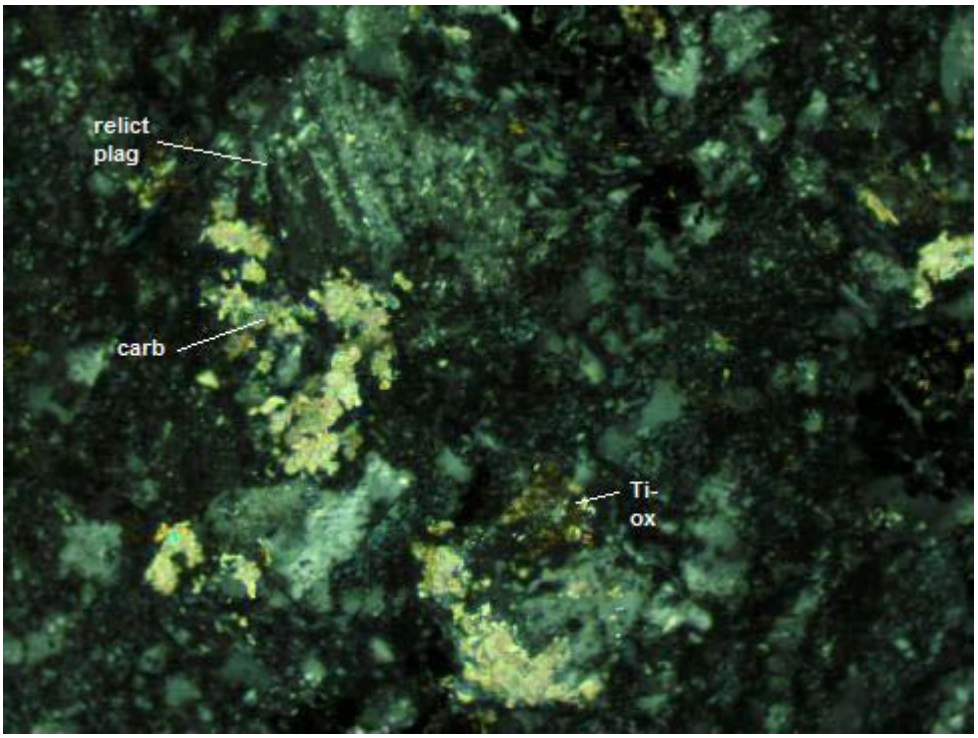


A



B

Sample: MM-09-12 9.95-10.04m
A & B) Overview of pervasively K-feldspar-chlorite-carbonate-illite-Ti-oxide-magnetite altered former porphyritic rock. Vague relict tabular forms are preserved in XPL view. A) PPL, B) XPL, FOV = ~ 4.5 mm.



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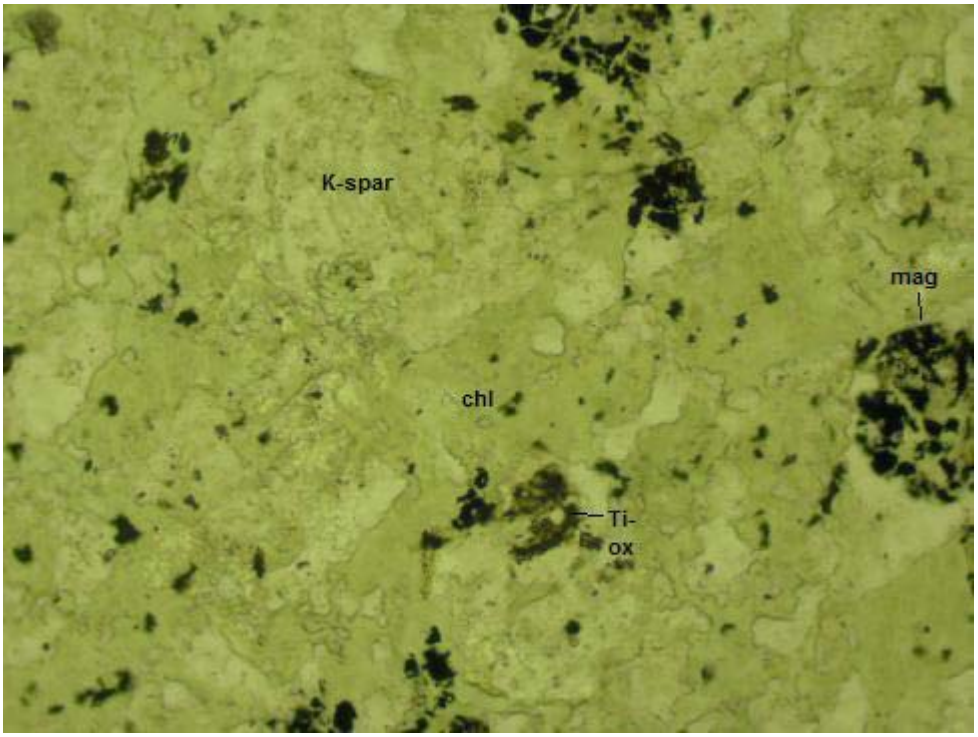
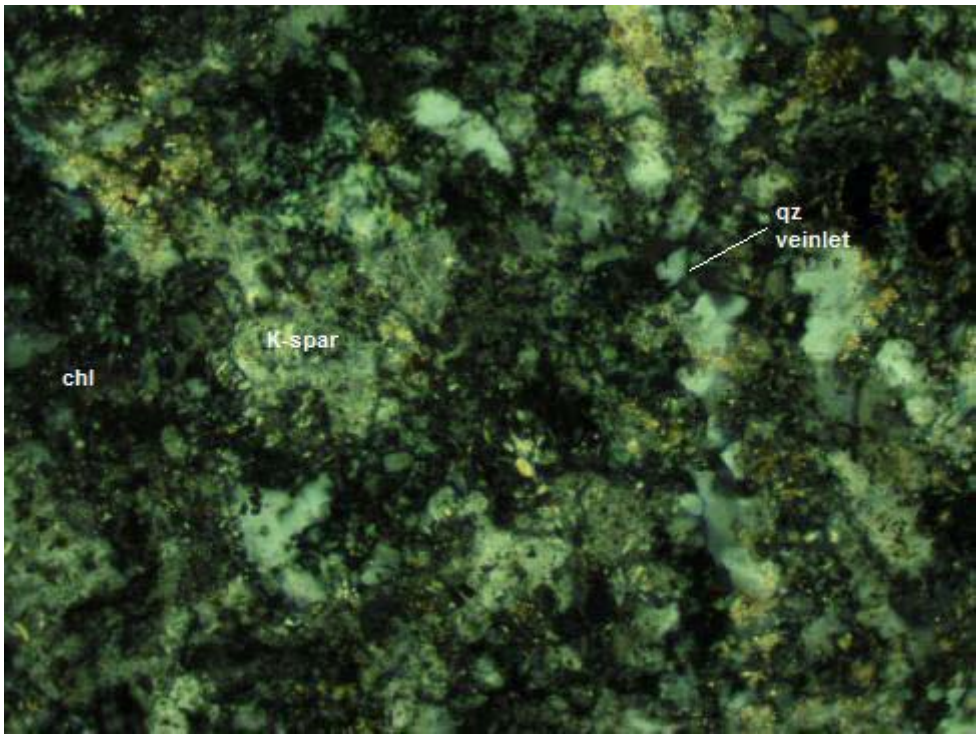


D

Sample: MM-09-12 9.95-10.04m
C& D) Representative view of altered rock. Note relict plagioclase evident in XPL view (photo C). C) XPL, D) PPL, FOV = ~ 0.7 mm.



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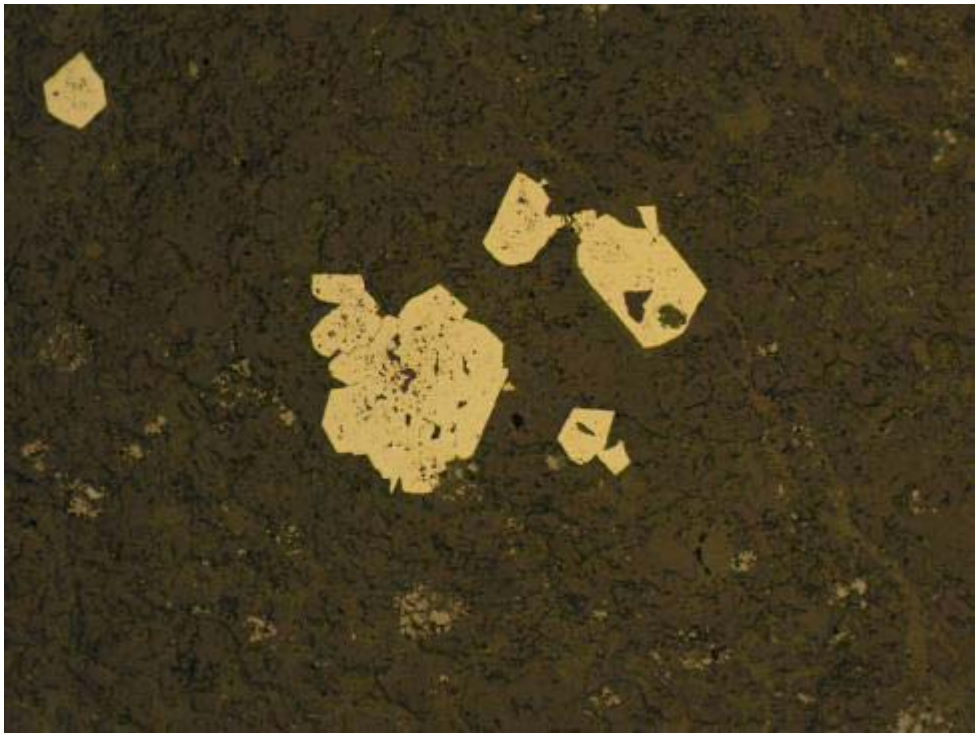
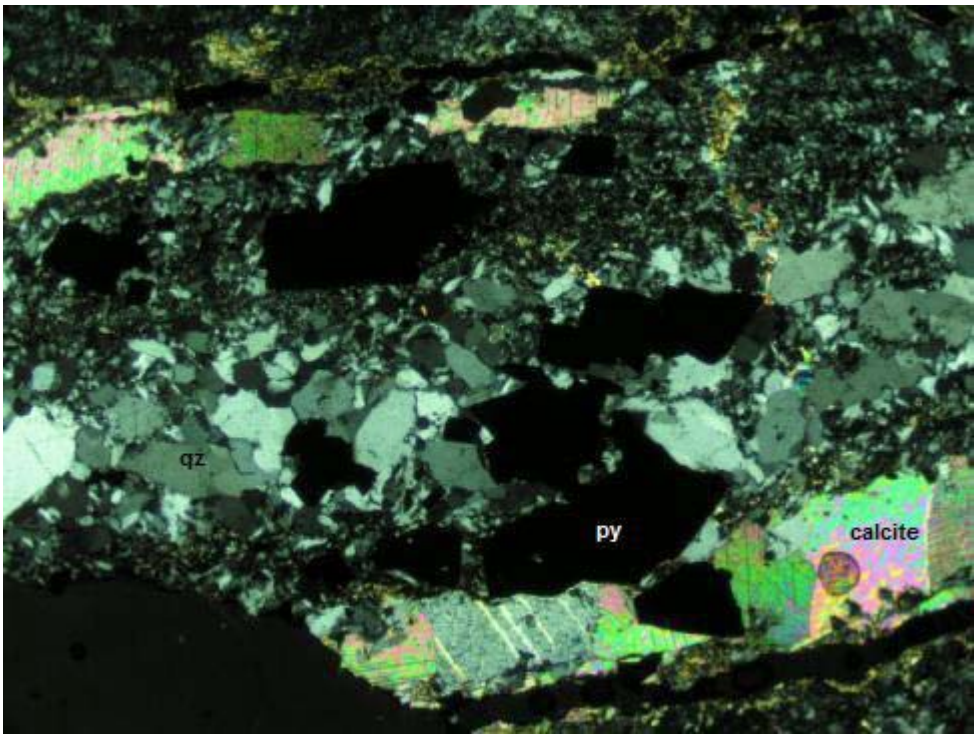


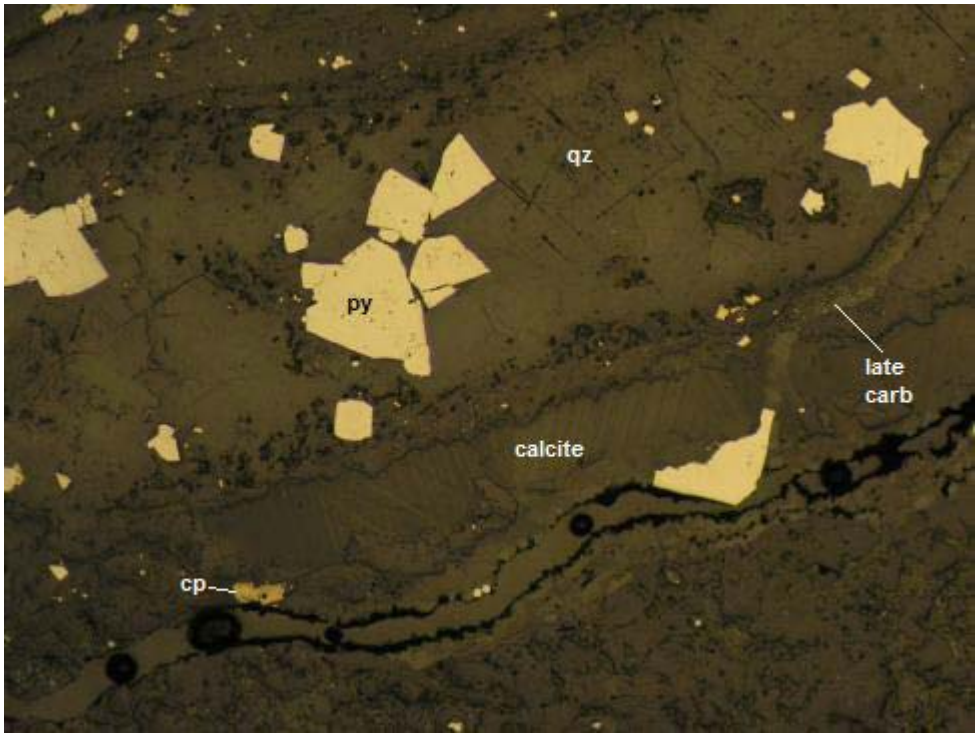
F

Sample: MM-09-12 9.95-10.04m

E) Detailed view of altered rock cut by very fine quartz veinlet. XPL, FOV = ~ 0.7 mm. F) Clusters of euhedral pyrite and disseminated magnetite in host rock. RL, FOV = ~ 2.6 mm.



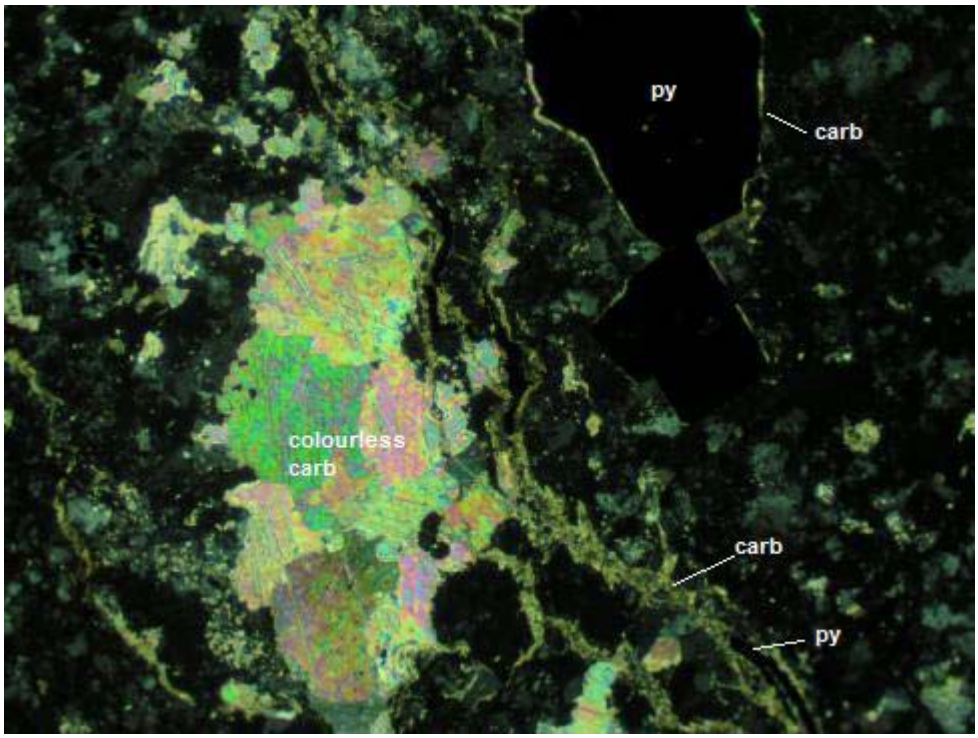
G



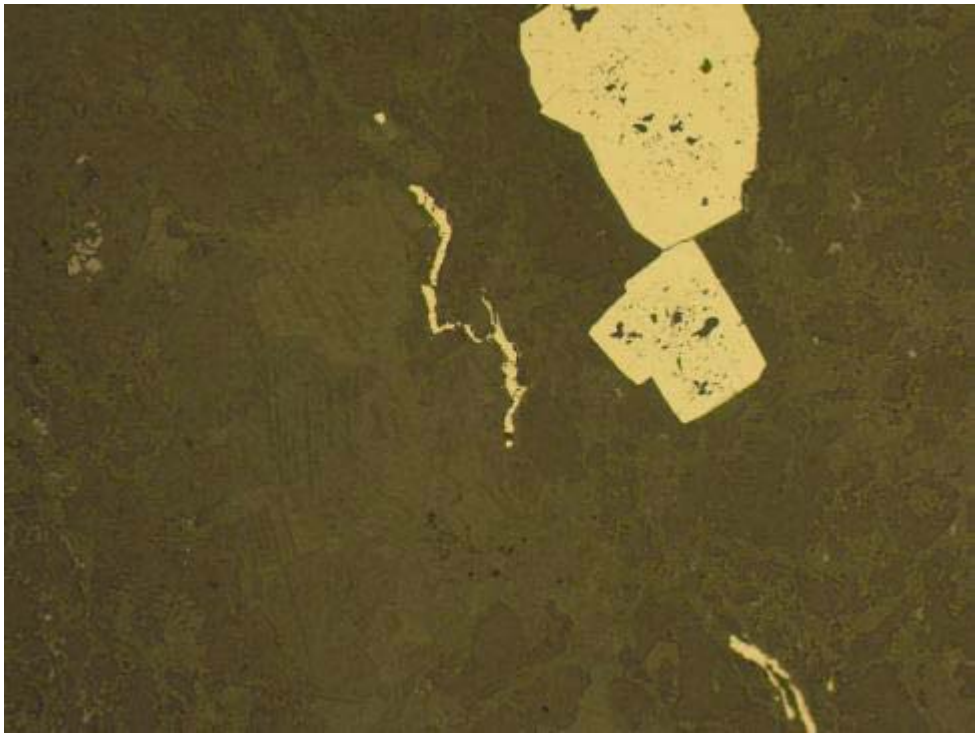
H

Sample: MM-09-12 9.95-10.04m

G&H) Separate representative views of quartz-pyrite veinlet crosscut by colourless calcite filled fractures and by late brown carbonate infill/veinlets. G) XPL, FOV = ~2.6 mm; H) RL, FOV = ~ 2.6 mm.



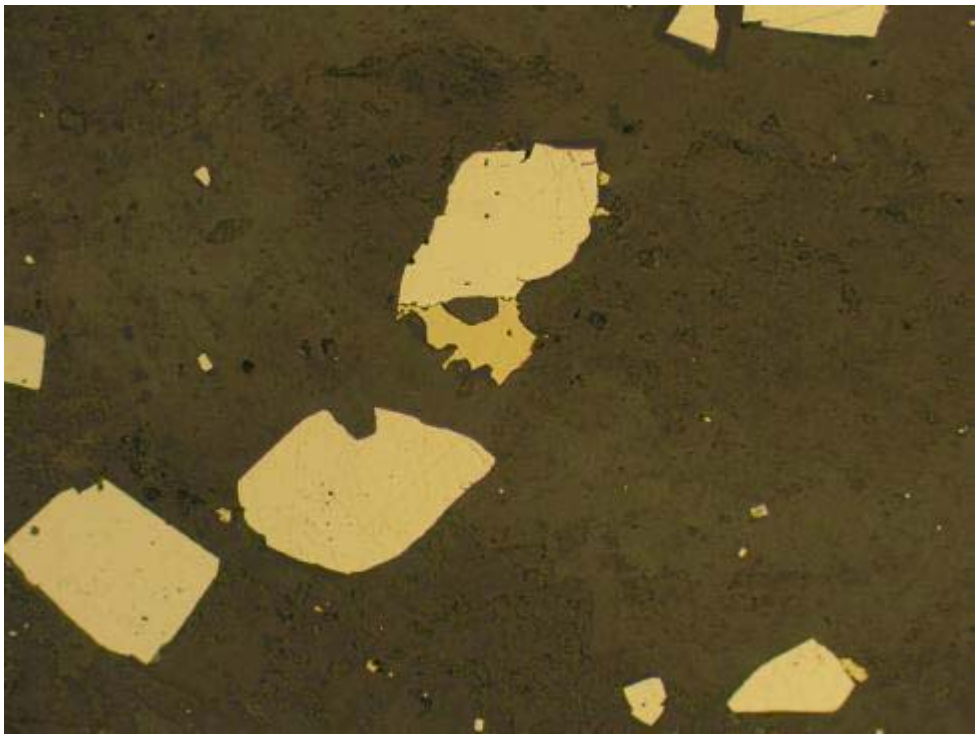
I



J

Sample: MM-09-12 9.95-10.04m

I &J) Detailed views of altered rock with disseminated pyrite (carbonate rims) cut by carbonate-pyrite veinlet. Note also patchy colourless carbonate alteration. I) XPL, J) RL, FOV = ~ 1.3 mm.



K

Sample: MM-09-12 9.95-10.04m
K) View of disseminated pyrite and chalcopyrite within quartz vein. RL, FOV = ~ 1.3 mm.

Zone: SOUTH
Sample: MM-09-12 10.08-10.15m **Offcut #AP-13**


view of hand sample


view of stained section offcut, scale in mm

Hand Sample Test Results:
Strong reaction of sample to magnet. Reaction of fractures to cold, dilute HCl. Positive test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Fine-grained vaguely fine to medium-grained strongly K-feldspar-altered porphyritic rock (texture highlighted by staining; see sample offcut). The sample is cut by 1-2 mm wide quartz-pyrite-calcite veinlet.

Zone: SOUTH
Sample: MM-09-12 10.08-10.15m **Offcut #AP-13**


view of stained offcut, scale in mm

LITHOLOGY:	Pervasively fractured and altered porphyritic rock
ALTERATION TYPE:	Chlorite, K-feldspar, magnetite, carbonate, clay, Ti-oxide
MINERALIZATION:	Pyrite, (chalcopyrite)
FRACTURES/VEINLETS:	Quartz-pyrite-(chalcopyrite)
	Quartz-carbonate-chlorite-pyrite-(chalcopyrite)
	Carbonate-*colourless & brown*

Polished Thin Section Description:
This section is a pervasively K-feldspar-chlorite-magnetite-carbonate-clay altered former vaguely porphyritic rock. Abundant vague medium-grained (1-3 mm) tabular forms are preserved (see stained offcut). The tabular forms are replaced by very fine-grained K-feldspar, chlorite, carbonate-clay-Ti-oxide- magnetite aggregates. Relict fine-grained plagioclase is selectively replaced by very fine-grained K-feldspar and overprinted by patchy anhedral carbonate, chlorite and clay aggregate. Chlorite is the dominant alteration occurring as very fine-grained anhedral aggregates that pervasively replace the rock. Secondary K-feldspar occurs throughout the rock as very fine-grained anhedral patchy aggregates. Major magnetite occurs disseminated as disaggregated grains. Rarely magnetite is partly replaced by hematite. Minor fine-grained euhedral pyrite occurs disseminated. Traces of fine-grained apatite occur disseminated.

The section is cut by an early fine to very fine-grained, prismatic quartz veinlet (~2 mm wide) with minor disseminated pyrite and traces of chalcopyrite. Quartz-carbonate±chlorite±pyrite±(chalcopyrite) also occur as fine sub-mm veinlets. Major brown carbonate occurs as very fine-grained anhedral to radiating aggregates that infill fractures that crosscut the quartz veinlets. Late colourless carbonate (calcite) occurs as fine -grained fracture infill. Rare traces of an unknown prismatic ?zeolite occur as latest vug infill.

The clay in this section is identified as kaolinite using PIMA analysis (see Appendix).

Zone: SOUTH
Sample: MM-09-12 10.08-10.15m **Offcut #AP-13**

HOST ROCK (85%):
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Chlorite	35	very fine-grained, flaky to anhedral aggregates, occurs as pervasive replacement of host rock	
K-feldspar	15	very fine-grained, anhedral aggregates, occurs as replacement of matrix and former fine to medium-grained phenocrysts, overprinted by patchy clay and carbonate aggregate	
Magnetite	10	fine to very fine-grained (< 0.2 mm), anhedral disaggregated grains, occurs disseminated	
Carbonate	7	fine to very fine-grained (< 0.1 mm), anhedral aggregates, occurs as patchy replacement of host rock, overprints clay	
Clay	7	very fine-grained, occurs with chlorite and carbonate partly replacing feldspar	

MINOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Pyrite	4	fine-grained (< 0.5 mm), euhedral disseminated grains and clusters	
Ti-oxides	3	very fine-grained, clusters, occurs as patchy replacement of rock, associated with carbonate and magnetite	
Quartz	2	fine to very fine-grained (< 0.1 mm), anhedral aggregates, occurs as matrix to porphyritic rock	
Plagioclase	1	fine-grained, tabular, occurs as relict phenocrysts and matrix to porphyritic rock, virtually completely replaced by K-feldspar, clay, chlorite and carbonate aggregate	
Apatite	tr	fine to very-grained (< 0.15 mm), disseminated	*high relief*
Hematite	tr	very fine-grained, rarely replaces magnetite	

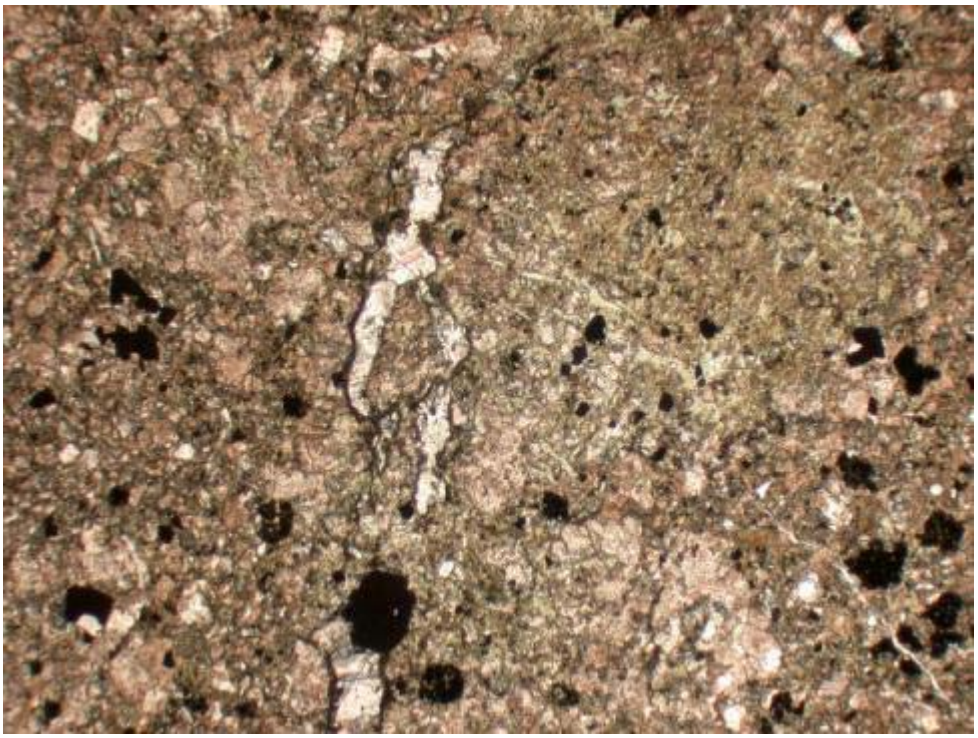
Please see over for VEINLETS/FRACTURE INFILL

Zone: SOUTH
Sample: MM-09-12 10.08-10.15m **Offcut #AP-13**

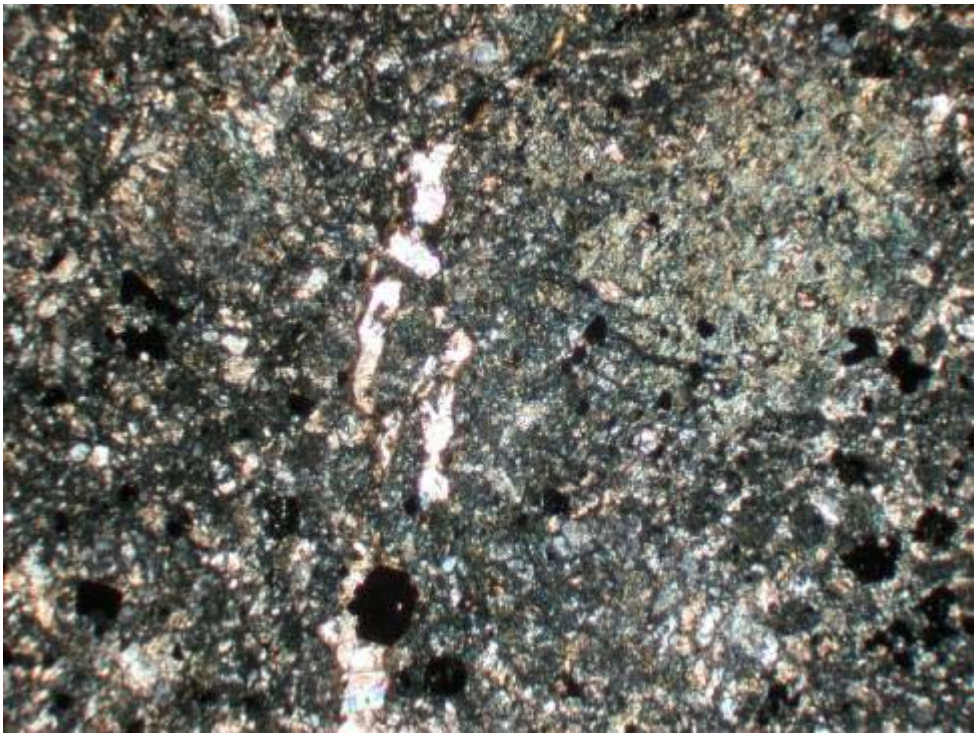
VEINLETS/ FRACTURE INFILL (15%):

Mineral	%	Distribution & Characteristics*	Optical
Carbonate, colourless	5	fine to medium-grained, anhedral aggregates, occurs as fracture infill and in veinlets with quartz±chlorite	*colourless*
Carbonate, brown	5	very fine-grained, anhedral to radiating aggregates, occurs as fracture infill	*brown*
Quartz	3	-fine to very fine-grained (< 0.1 mm), prismatic aggregates, occurs with slivers of microcrystalline quartz as early veinlet -very fine-grained, occurs as veinlets with carbonate and chlorite	
Chlorite	1	very fine-grained, anhedral to radiating aggregates, occurs in veinlets with quartz, carbonate, pyrite and chalcopyrite	
Pyrite	1	fine to very fine-grained (< 0.1 mm), sub-anhedral grains and aggregates, occurs within early quartz veinlet, within quartz-chlorite-carbonate veinlet and in late carbonate veinlets	
Chalcopyrite	tr	fine to very fine-grained (< 0.2 mm), anhedral grains and aggregates, occurs as latest infill to quartz-carbonate-chlorite-pyrite veinlets, occurs partly enclosing pyrite in quartz veinlet	
Unknown, ?zeolite	tr	fine-grained (< 0.2 mm), prismatic, latest vug infill	

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm

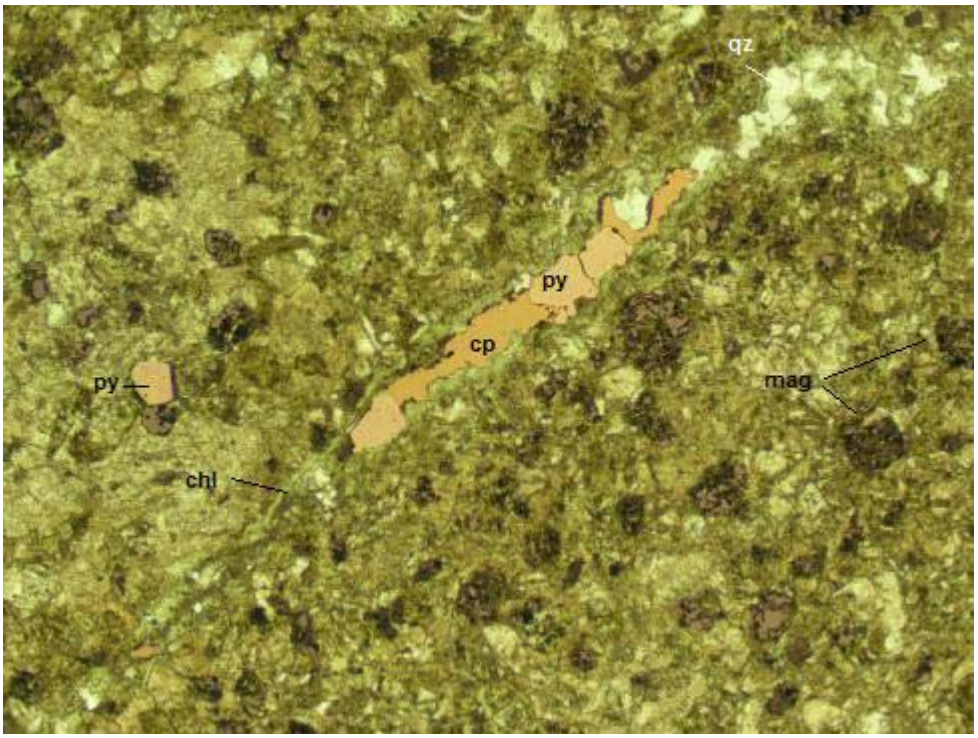


A

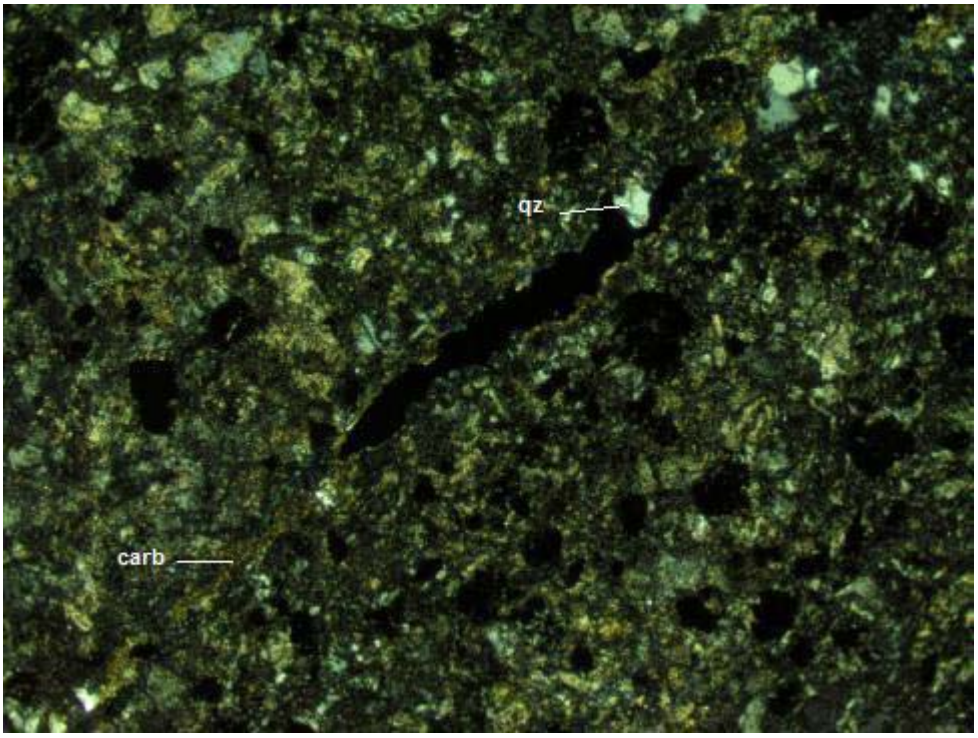


B

Sample: MM-09-12 10.08-10.15m
A & B) Overview of pervasively altered former vaguely porphyritic rock with disseminated opaques (magnetite & pyrite) and colourless carbonate fracture infill. A) PPL, B) XPL, FOV = ~ 4.5 mm.



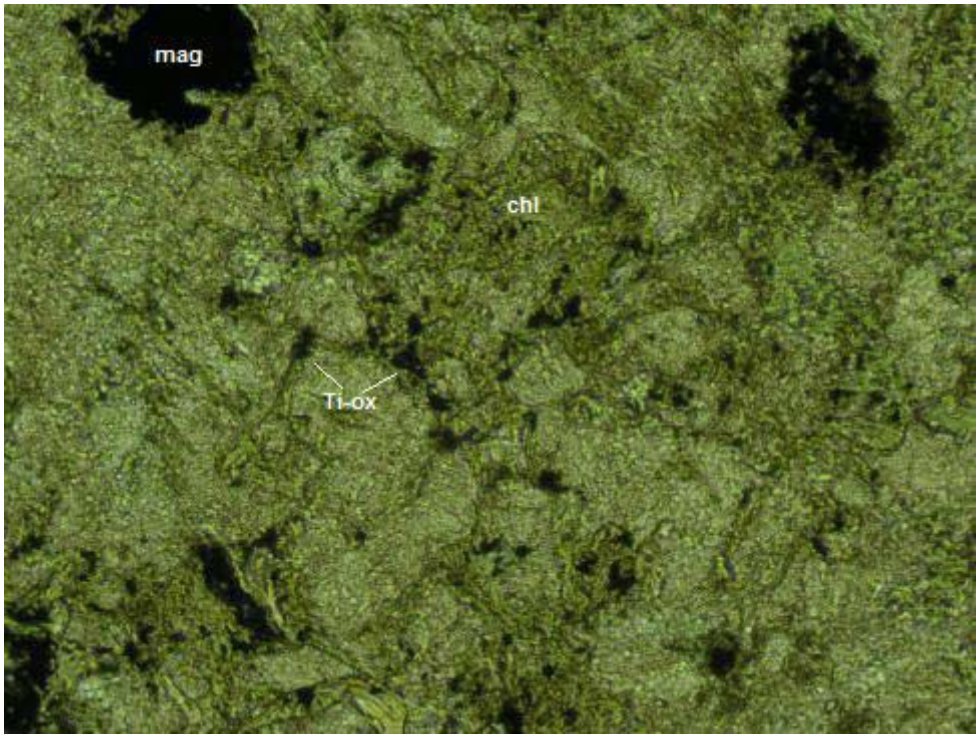
C



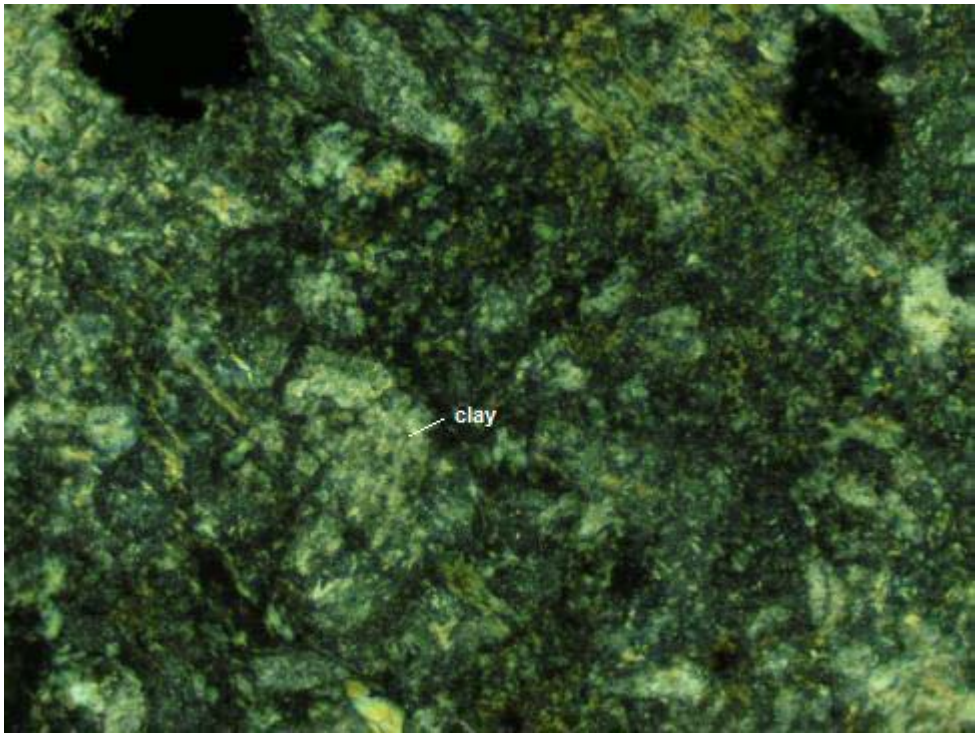
D

Sample: MM-09-12 10.08-10.15m

C&D) Representative view of altered rock with abundant disseminate magnetite and minor pyrite. Rock is cut by veinlet of chlorite-carbonate-quartz-pyrite-chalcopyrite. C) PPL+RL, D) XPL, FOV = ~ 2.6 mm.

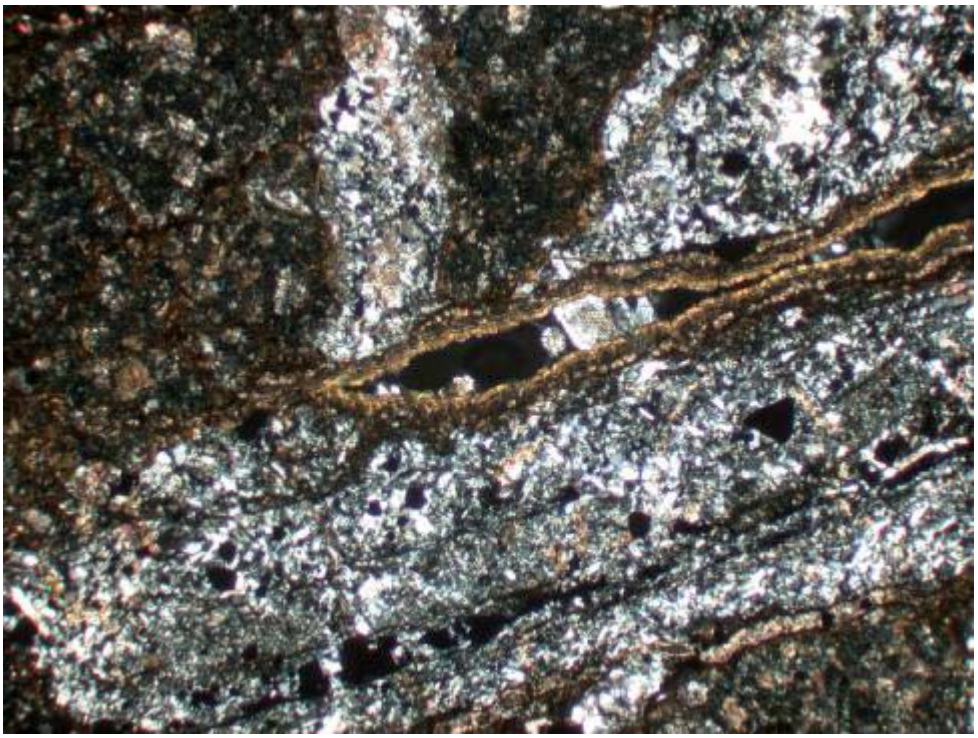


E

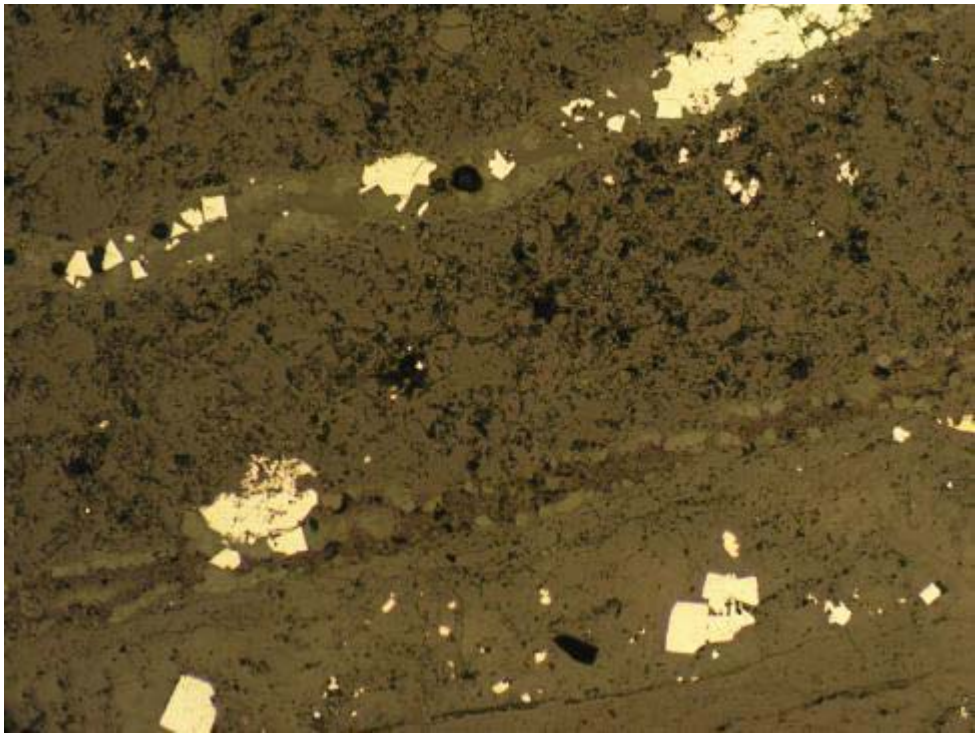


F

Sample: MM-09-12 10.08-10.15m
E&F) Detailed view of pervasive dominantly chlorite-clay alteration of host rock. Note clusters of Ti-oxide and disseminated magnetite (opaque). E) PPL, F) XPL, FOV = ~ 0.7 mm.



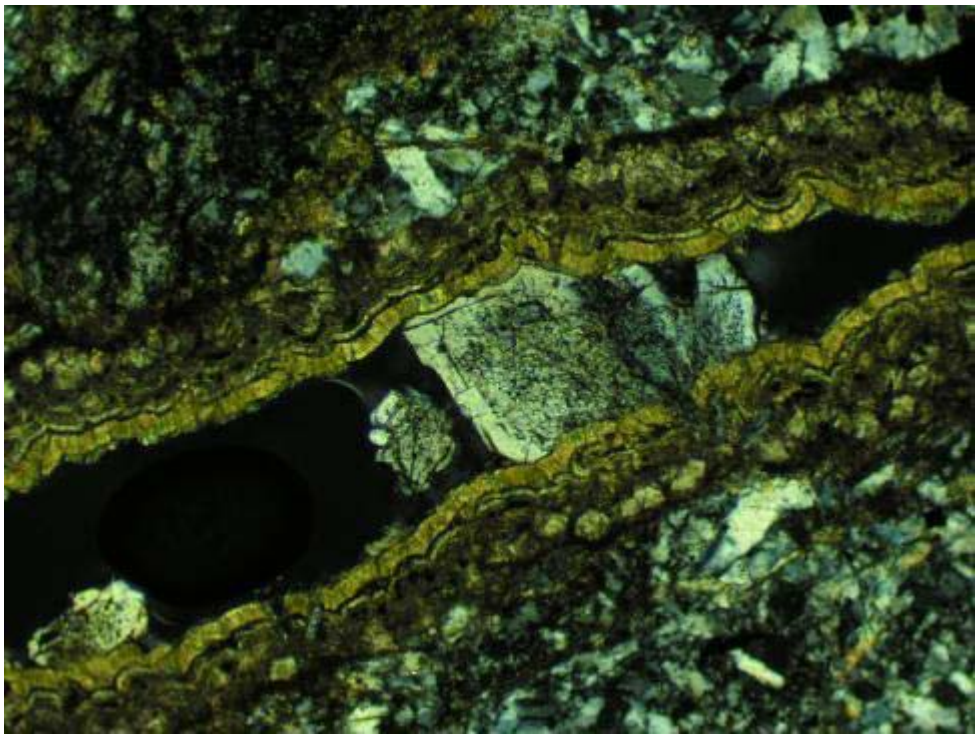
G



H

Sample: MM-09-12 10.08-10.15m

G) Representative view of fine to very fine-grained quartz veinlet with disseminated pyrite. Quartz vein is cut by fractures filled with colourless and brown carbonate. XPL, FOV = ~ 4.5 mm. H) View of distribution of euhedral pyrite within quartz vein (bottom of photo) and within carbonate-filled fracture (top of photo). RL, FOV = ~ 2.6 mm.



Sample: MM-09-12 10.08-10.15m
I) Representative view of very fine-grained radiating brown carbonate as fracture infill. Note late partial vug infill by unknown material (centre, ?zeolite). XPL, FOV = ~ 1.3 mm.

Zone: SOUTH
Sample: MM-09-12 52.14-52.2m **Offcut #AP-14**


view of hand sample


view of stained section offcut, scale in mm

Hand Sample Test Results:
Strong reaction of sample to magnet. Strong reaction of fractures to cold, dilute HCl. Positive test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Medium to dark gray porphyritic rock with approximately 30% tabular plagioclase phenocrysts (< 2 mm size), 15% dark green chlorite-altered tabular former mafic phenocrysts (< 2 mm size) and minor K-feldspar phenocrysts (based on stained offcut) in a fine-grained matrix. The rock is cut by a few hairline fractures filled with calcite and orange-brown carbonate.

Zone: SOUTH
Sample: MM-09-12 52.14-52.2m **Offcut #AP-14**


view of stained offcut, scale in mm

LITHOLOGY:	Porphyritic microdiorite
ALTERATION TYPE:	Chlorite-magnetite-carbonate-?clay-K-feldspar
MINERALIZATION:	Pyrite, (chalcopyrite)
VEINLETS/ FRACTURES:	(?Albite)
	Carbonate-(hematite)
	Calcite±(chlorite)

Polished Thin Section Description:
This section is fractured and selectively chlorite-magnetite-carbonate-?clay-K-feldspar altered microdiorite cut by numerous carbonate-bearing fractures. The microdiorite comprises phenocrysts of fine to medium-grained plagioclase, former fine to medium-grained, altered mafic phases and minor fine-grained K-feldspar with interstitial fine-grained plagioclase laths and altered former mafic phases. Plagioclase is selectively replaced by patchy chlorite, carbonate and illite aggregate. K-feldspar phenocrysts are locally partly replaced by carbonate and illite. Former mafic phases are completely replaced by aggregates of chlorite, carbonate, magnetite, ?clay, Ti-oxide and locally pyrite. Major magnetite occurs disseminated and as replacement of mafic phenocrysts. Traces of hematite occur partly replacing magnetite. Traces of apatite occur as disseminated grains. K-feldspar occurs locally adjacent to apatite grains and as patchy aggregates.

The section is cut by discontinuous fractures filled with calcite and cut by later very fine-grained brown carbonate-filled fractures. The brown carbonate is locally partly replaced by hematite aggregate. Locally traces of chlorite occur as fracture infill with carbonate. Traces of ?albite occur rarely as veinlets partly replaced by calcite.

Zone: SOUTH
Sample: MM-09-12 52.14-52.2m **Offcut #AP-14**

HOST ROCK (94%):
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Plagioclase	60	-fine to medium-grained (< 2 mm), eu-subhedral crystals, locally zoned, occurs as phenocrysts, composition of An_{45-50} (based on 3 measurements), selectively replaced by patchy chlorite, carbonate and illite -fine-grained (< 0.2 mm), laths, selectively replaced by patchy chlorite carbonate and illite	*Polysynthetic twinning-albite*
Chlorite	20	very fine-grained, anhedral aggregates, occurs with carbonate, ?clay, magnetite and Ti-oxide aggregate as replacement of former mafic phenocrysts and matrix, also occurs as patchy replacement of plagioclase	
Magnetite	5	fine-grained (< 0.2 mm), subhedral grains and aggregates, occurs as replacement of former mafic phenocrysts, also occurs disseminated	

MINOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
K-feldspar	3	very fine-grained, anhedral, occurs with chlorite adjacent to apatite grains and as patchy aggregates	*cloudy, brown*
?Clay	3	aphanitic material, occurs with chlorite as replacement of former mafic phases	
Carbonate	2	very fine-grained, anhedral aggregates, occurs as patchy replacement of former mafic phases and in trace amounts feldspars	
Pyrite	tr	very fine-grained, eu-subhedral grains and aggregates, occurs disseminated and replacing former mafic phenocrysts	
Illite	tr	very fine-grained, anhedral to flaky aggregates, occurs as selective replacement of feldspars	
Ti-oxide	tr	very fine-grained, anhedral aggregates, occurs with chlorite partly replacing former mafic phenocrysts	
Epidote	tr	very fine-grained to aphanitic aggregates, occurs locally as patchy aggregates, replacing plagioclase	
Apatite	tr	fine to very fine-grained, high relief, disseminated grains	
Hematite	tr	very fine-grained, occurs rarely partly replacing magnetite and commonly rimming and partly replacing pyrrhotite	
Chalcopyrite	tr	very fine-grained, rare disseminated anhedral grains	

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm

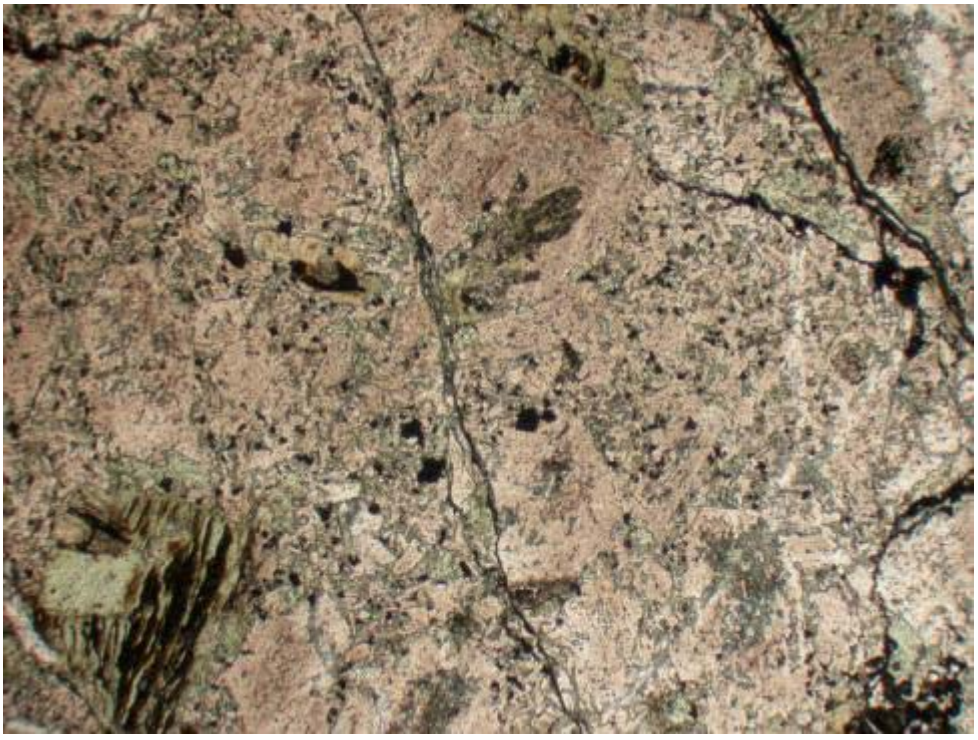
Please see over for VEINLETS/ FRACTURES

Zone: SOUTH
Sample: MM-09-12 52.14-52.2m **Offcut #AP-14**

VEINLETS/ FRACTURE INFILL (6%):

Mineral	%	Distribution & Characteristics*	Optical
Calcite	3	fine to very fine-grained (< 0.3 mm), occurs as fracture infill, cut by Fe-ox filled fractures	
Carbonate	2	very fine-grained, anhedral to radiating aggregates, occurs as fracture infill, crosscuts calcite-filled fractures	
Hematite	tr	very fine -grained aggregates, rims and partly replaces brown carbonate	
Chlorite	tr	very fine-grained, occurs as fracture infill with carbonate	
?Albite	tr	fine-grained (< 0.2 mm), subhedral aggregates, occurs rarely in veinlets, partly replaced by calcite	

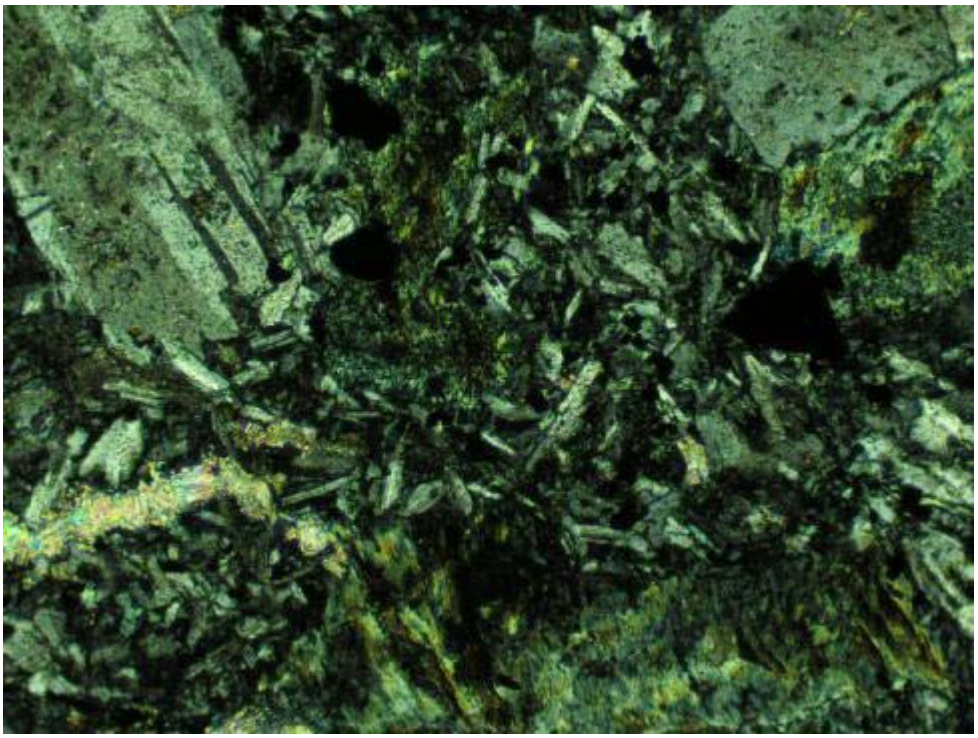
*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm



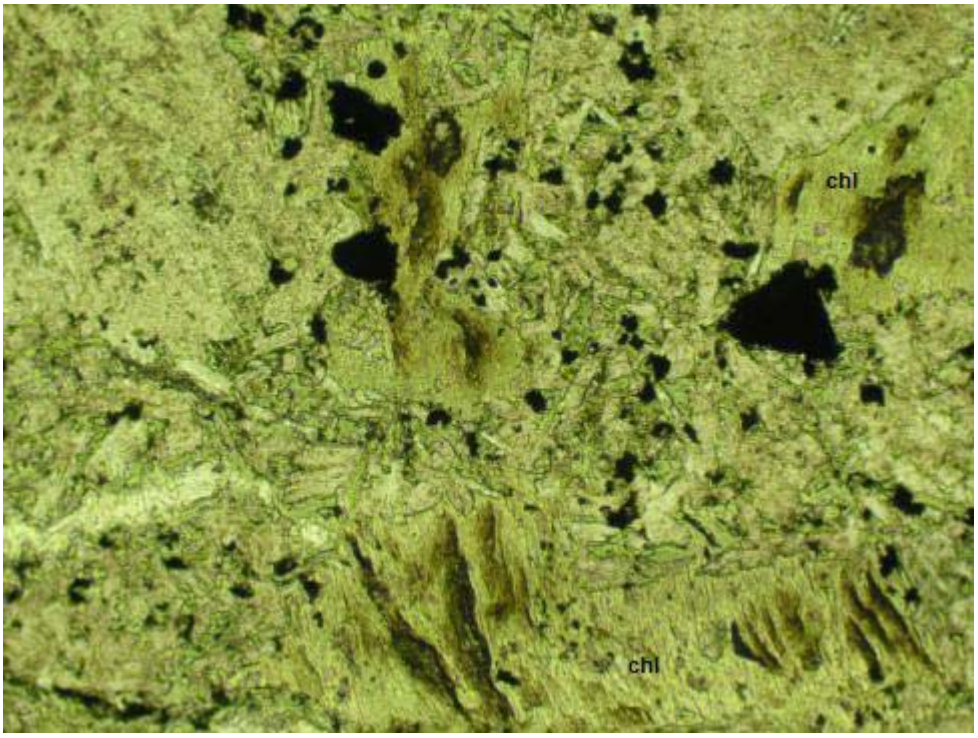
A

B

Sample: MM-09-12 52.14-52.2m
A & B) Overview of sample shows fractured and selectively chlorite-magnetite-carbonate-?clay altered microdiorite. Note disseminated magnetite (opaque). A) PPL, B) XPL, FOV = ~ 4.5 mm.

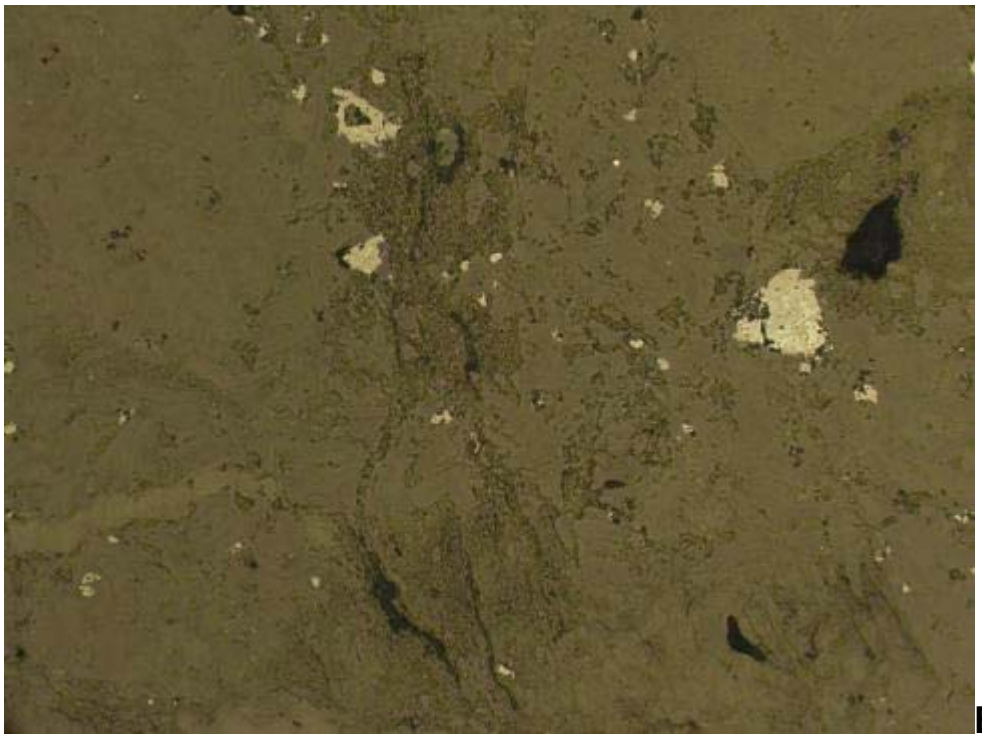


C

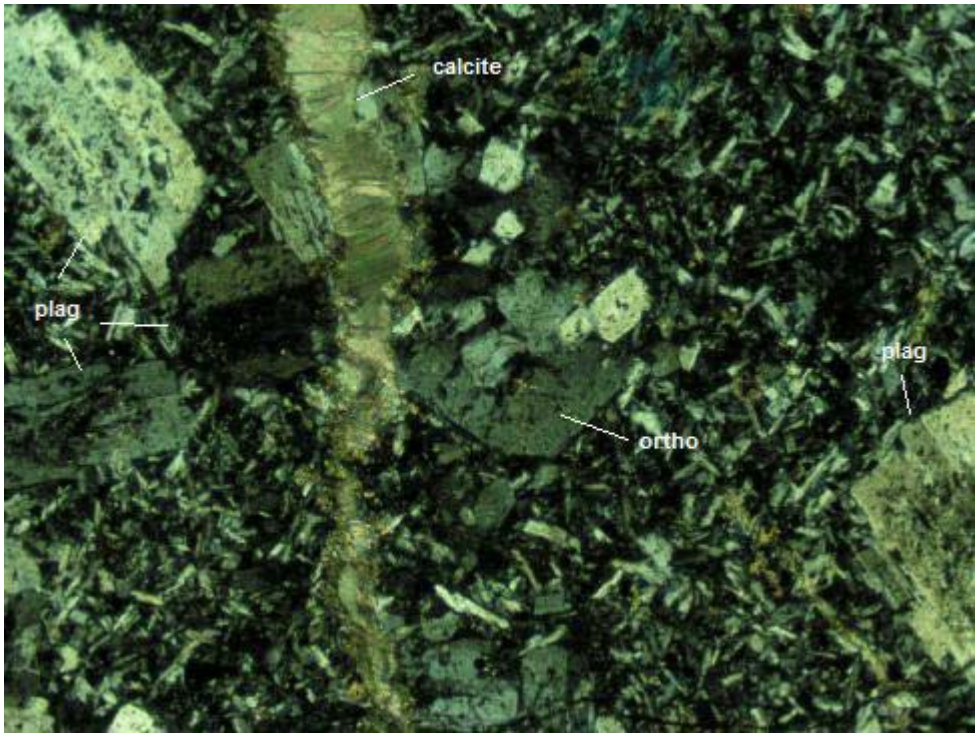


D

Sample: MM-09-12 52.14-52.2m
C & D) View of porphyritic rock show plagioclase and altered mafic phenocrysts in matrix of plagioclase laths, chlorite, Ti-oxides and magnetite (opaque). C) XPL, D) PPL, FOV = ~ 1.3 mm.



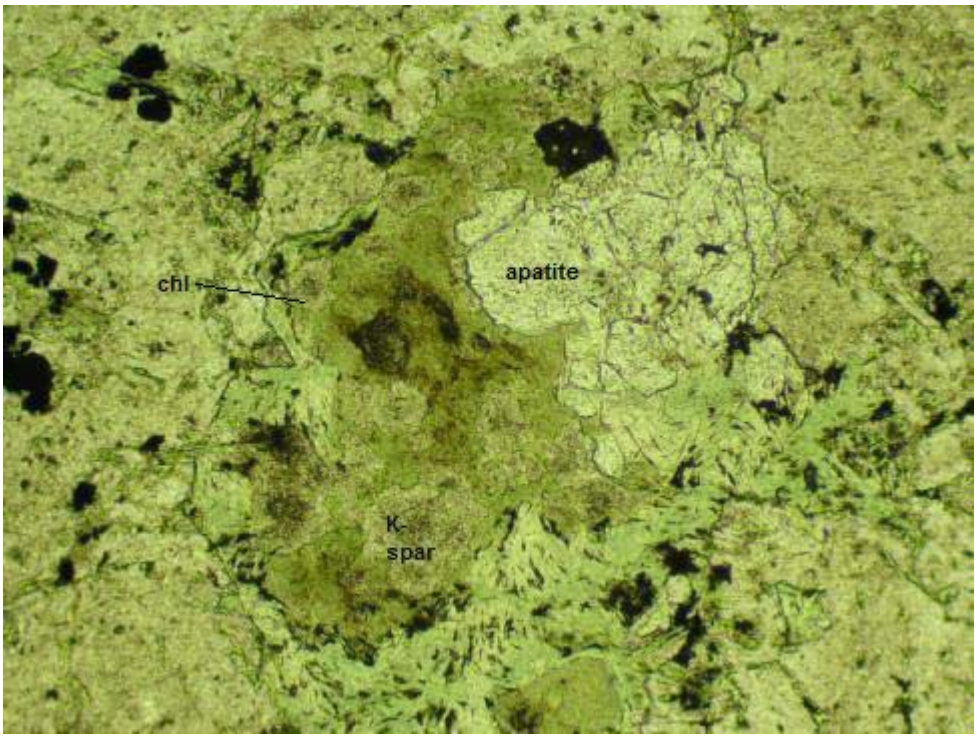
E



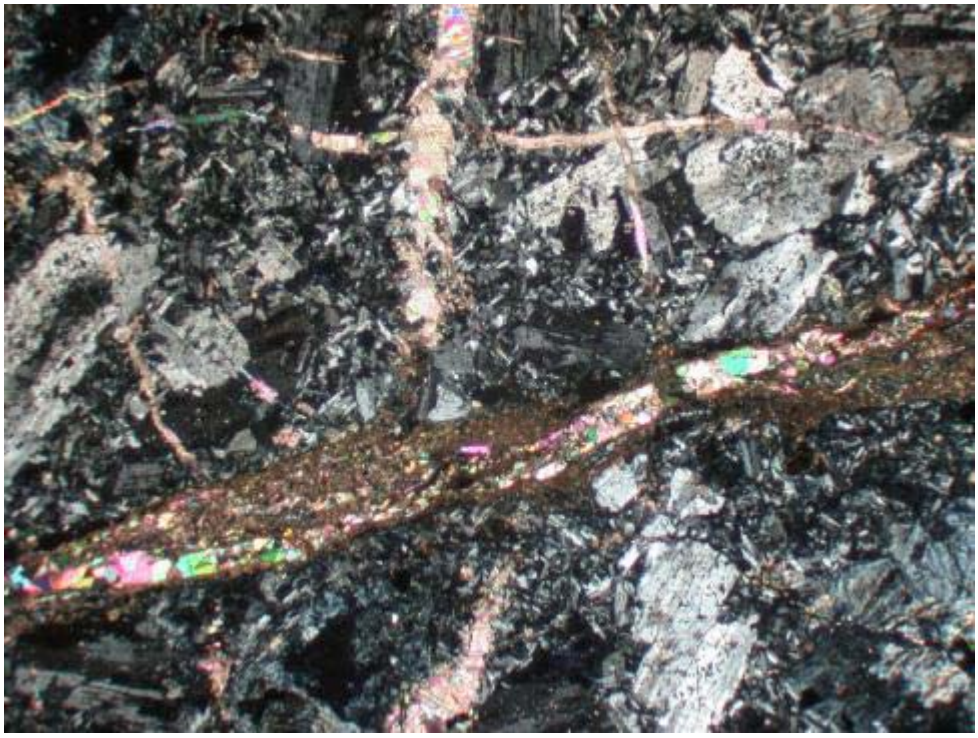
F

Sample: MM-09-12 52.14-52.2m

E) Same FOV as photos C&D. Note magnetite partly replaced by hematite. RL, FOV = ~ 1.3 mm. F) Detailed view of plagioclase and K-feldspar phenocrysts in fine-grained matrix of plagioclase laths and chlorite. Note calcite filled fracture. XPL, FOV = ~ 1.3 mm.



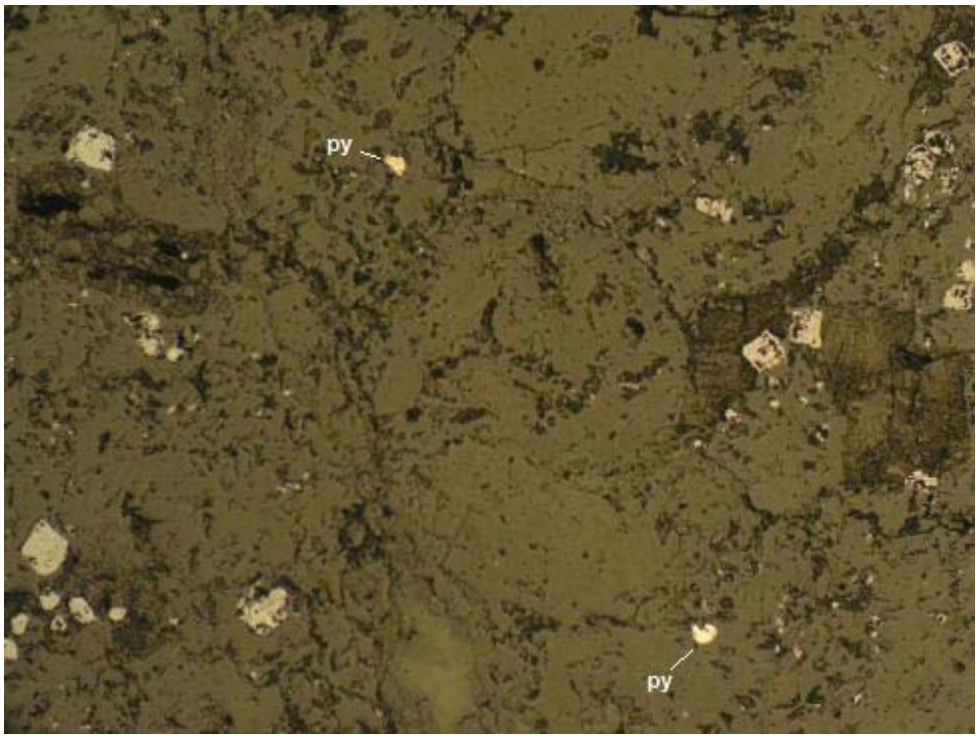
G



H

Sample: MM-09-12 52.14-52.2m

G) View of apatite with patchy chlorite and K-feldspar. PPL, FOV = ~ 1.3 mm. H) View of colourless and very fine-grained brown carbonate filled fractures. XPL, FOV = ~ 4.5 mm.



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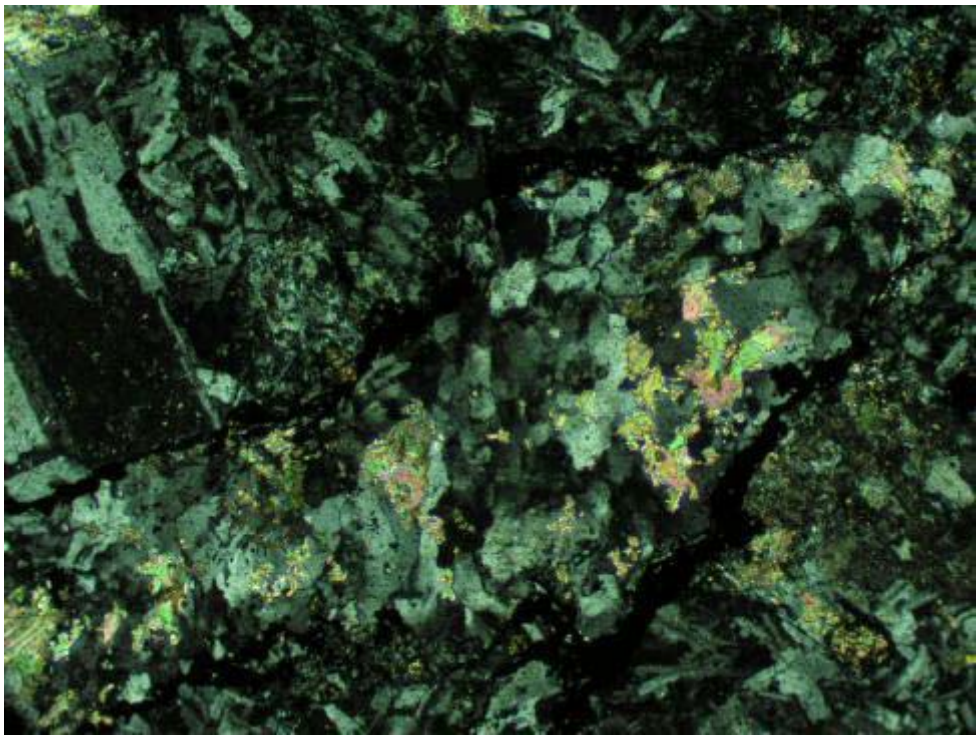


J

Sample: MM-09-12 52.14-52.2m

I) View of disseminated pyrite and magnetite as replacement of former mafic phases and disseminated. RL, FOV = ~ 2.6mm. J) View of ?albite veinlet partly replaced by carbonate. Note opaque margins to veinlet are hematite. XPL, FOV = ~ 1.3 mm.

Zone: SOUTH
Sample: MM-09-12 62.19-62.26m **Offcut #AP-15**

view of hand sample


view of stained section offcut, scale in mm

Hand Sample Test Results:
No reaction of sample to magnet. Strong reaction of fractures to cold, dilute HCl. Positive test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Dark greenish-grey aphanitic rock with vague fragmental texture highlighted by concentrations of K-feldspar in stained offcut. Patchy K-feldspar occurs throughout the rock (approximately 10% based on stain). Calcite and locally a brown carbonate occur filling a network of brittle fractures cutting the rock.

Zone: SOUTH
Sample: MM-09-12 62.19-62.26m **Offcut #AP-15**


view of stained section offcut, scale in mm

LITHOLOGY:	Pervasively altered crystal-rich coarse tuff
ALTERATION TYPE:	Chlorite, carbonate, K-feldspar, Ti-oxide
MINERALIZATION:	Pyrite
FRACTURES/VEINLETS:	?Albite
	Calcite
	Carbonate-*brown*-(pyrite)

Polished Thin Section Description:
This section is a fractured and pervasively K-feldspar-chlorite-carbonate-Ti-oxide altered, massive crystal-rich coarse tuff. Primary bedding is not recognized. Vague outlines of minor scattered lithic clasts (up to 2 mm in size) are highlighted by the alteration and occur in some parts of the section. The crystal tuff matrix is fine-grained (< 0.2 mm) and likely of mafic-intermediate composition with former mafic phases and plagioclase as dominant mineralogical constituents. The former mafic phase(s) have been completely replaced by chlorite, carbonate and Ti-oxides. Broken plagioclase crystals are partly replaced by locally patchy K-feldspar and by chlorite and carbonate aggregates. Minor quartz occurs as anhedral patchy aggregates. Traces of apatite occur disseminated.

The section is strongly fractured and veined. Early fine sub-mm wide veinlets of fine-grained ?albite are partly replaced by calcite. Fractures are filled with fine-grained calcite aggregate. The margins of calcite-filled fractures are lined by very fine-grained brown carbonate aggregate locally with stringers of pyrite or disseminated pyrite. Brown carbonate also occurs in late crosscutting fractures.

Zone: SOUTH
Sample: MM-09-12 62.19-62.26m **Offcut #AP-15**

HOST ROCK(~93%):
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Chlorite	50	very fine-grained, anhedral aggregates, occurs as replacement of former fine-grained mafic phases, partly replaces plagioclase crystals	
Plagioclase	25	fine-grained (< 0.2 mm), broken crystals, partly replaced by chlorite and carbonate aggregates and by patchy K-feldspar	*polysynthetic twinning*
K-feldspar	10	aphanitic aggregates, occurs as patchy replacement of plagioclase crystals	
Carbonate	5	very fine-grained, patchy aggregates, occurs as overprint	

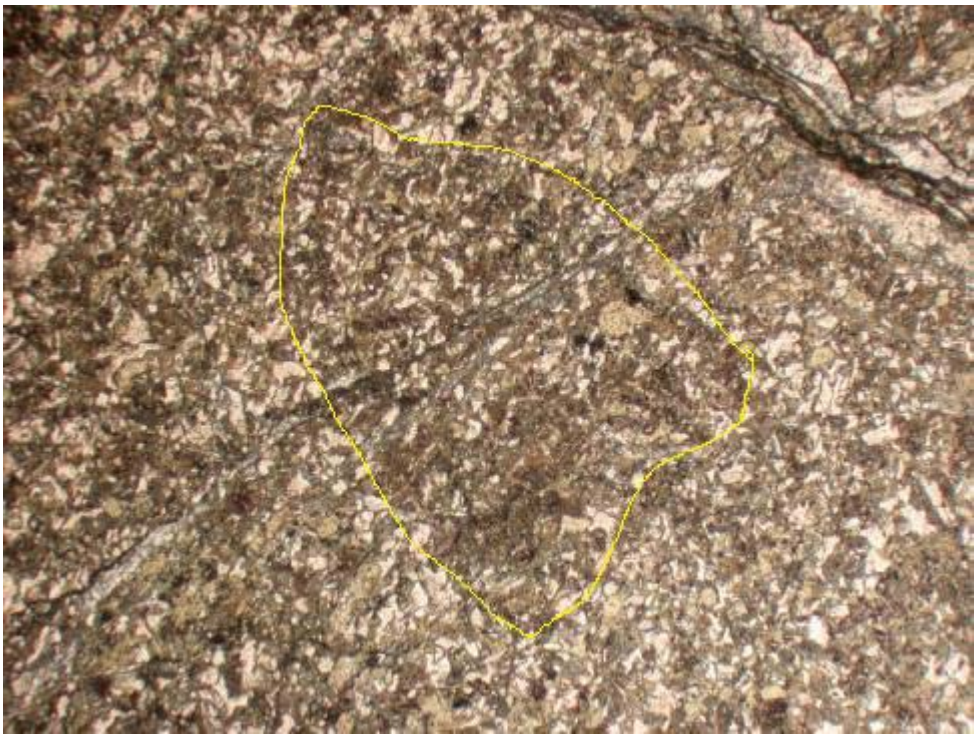
MINOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Quartz	2	very fine-grained, anhedral patchy aggregates	
Ti-ox	1	very fine-grained, occurs as anhedral clusters, locally associated with carbonate alteration	*brown*
Apatite	tr	fine to very fine-grained (< 0.1 mm), high relief, disseminated grains	

VEINLETS/ FRACTURE INFILL (~7%):

Mineral	%	Distribution & Characteristics*	Optical
Calcite	5	fine-grained (< 0.3 mm), anhedral aggregates, occurs as fracture infill	
Carbonate, brown	2	fine-grained (< 0.2 mm), anhedral to radiating aggregates, occurs at margins of fractures and crosscutting calcite filled fractures as infill	
?Albite	tr	fine-grained, subhedral prismatic crystals, occurs as veinlets, partly replaced by carbonate	
Pyrite	tr	very fine-grained, eu-subhedral grains and aggregates, occurs disseminated and as stringers within brown carbonate fracture infill	

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm



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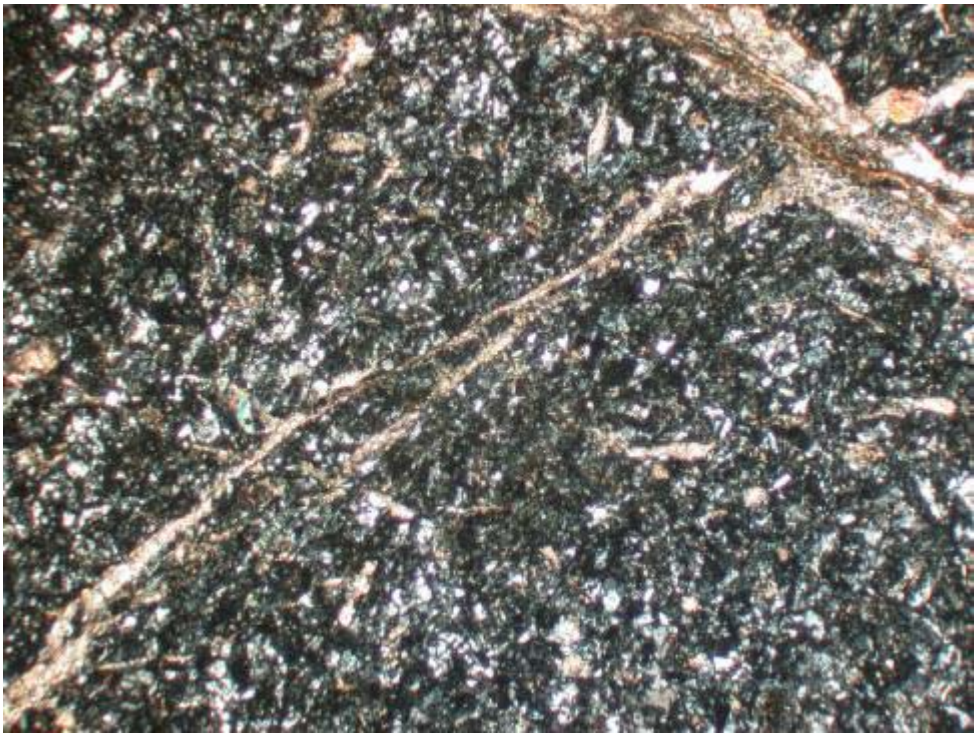
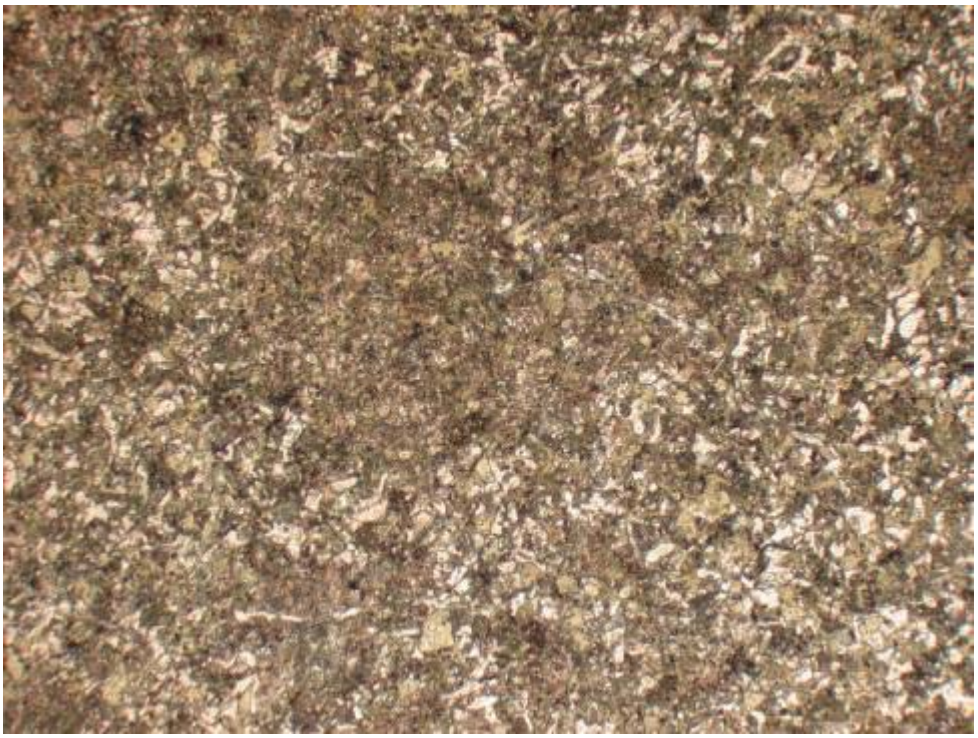


B

Sample: MM-09-12 62.19-62.26m
A & B) Overview of fractured and altered coarse crystal-rich tuff with lithic clast (outlined in yellow). A) PPL, B) XPL, FOV = ~ 4.5 mm.



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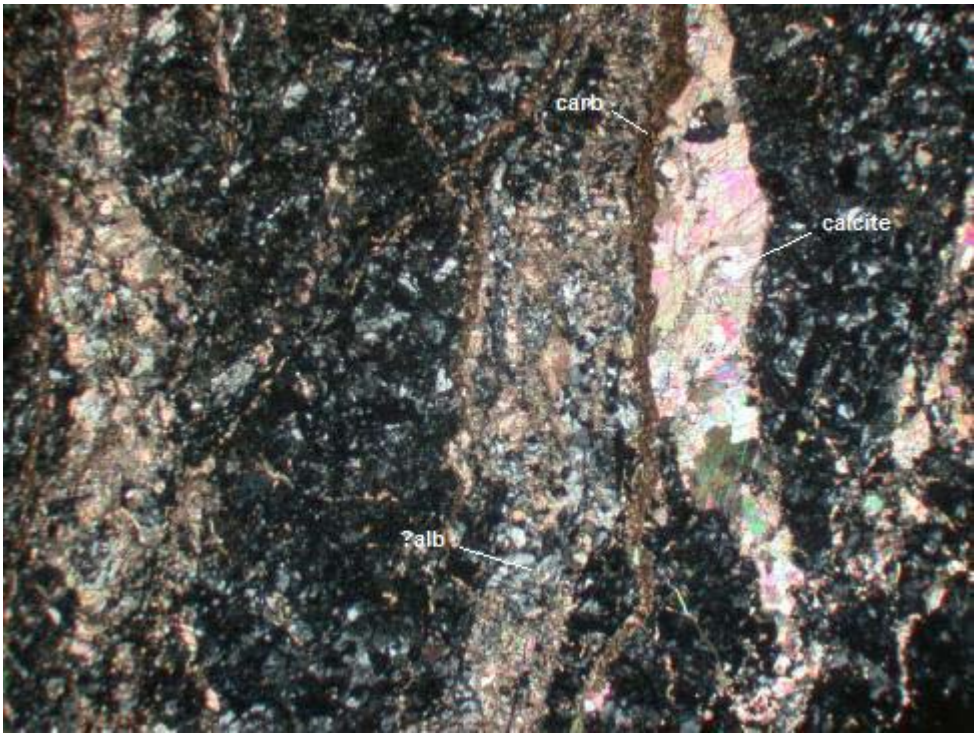
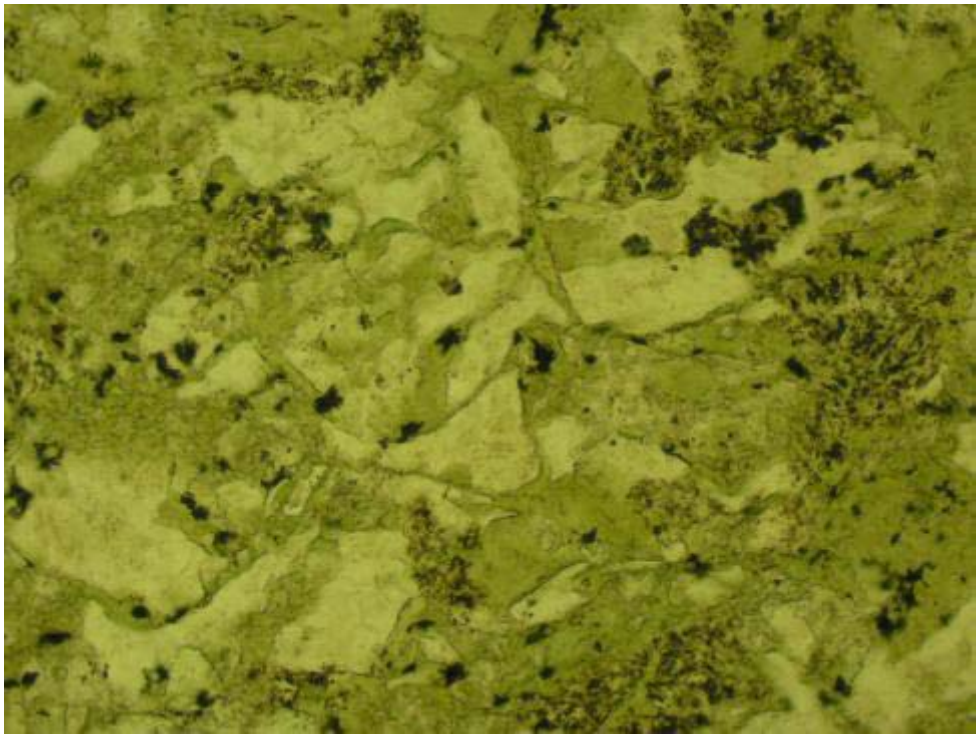


D

Sample: MM-09-12 62.19-62.26m

C) Vague outlines of minor scattered lithic clasts highlighted by K-feldspar alteration. PPL, FOV = ~ 4.5 mm. D) View of ?albite veinlet partly replaced by calcite and fractures filled with calcite and brown carbonate (carb). XPL, FOV = ~ 1.3 mm.



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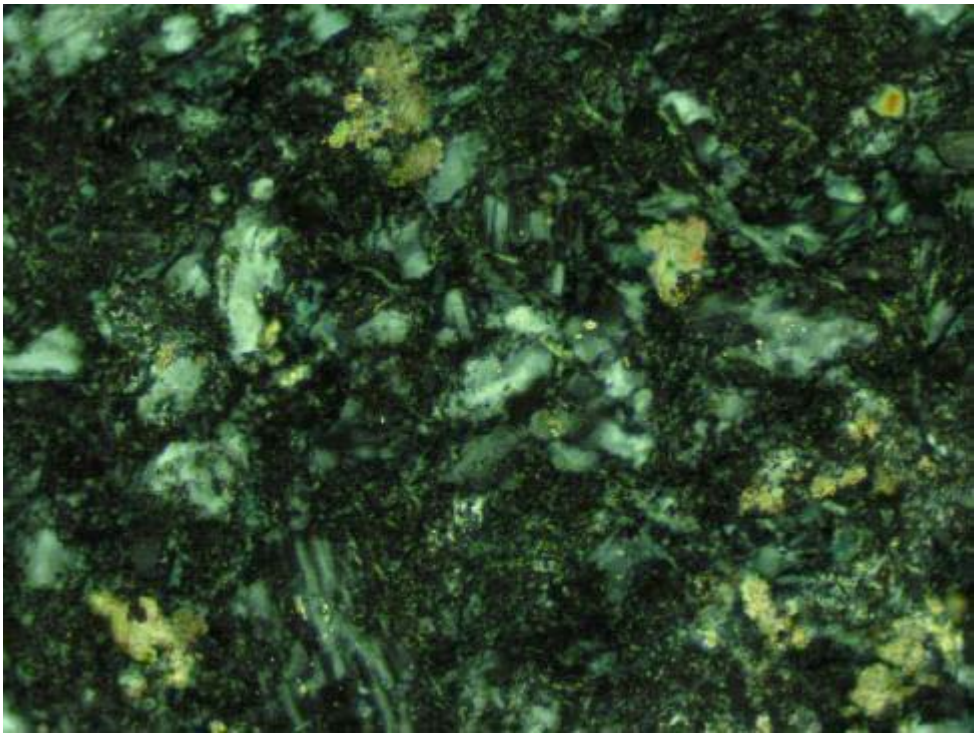
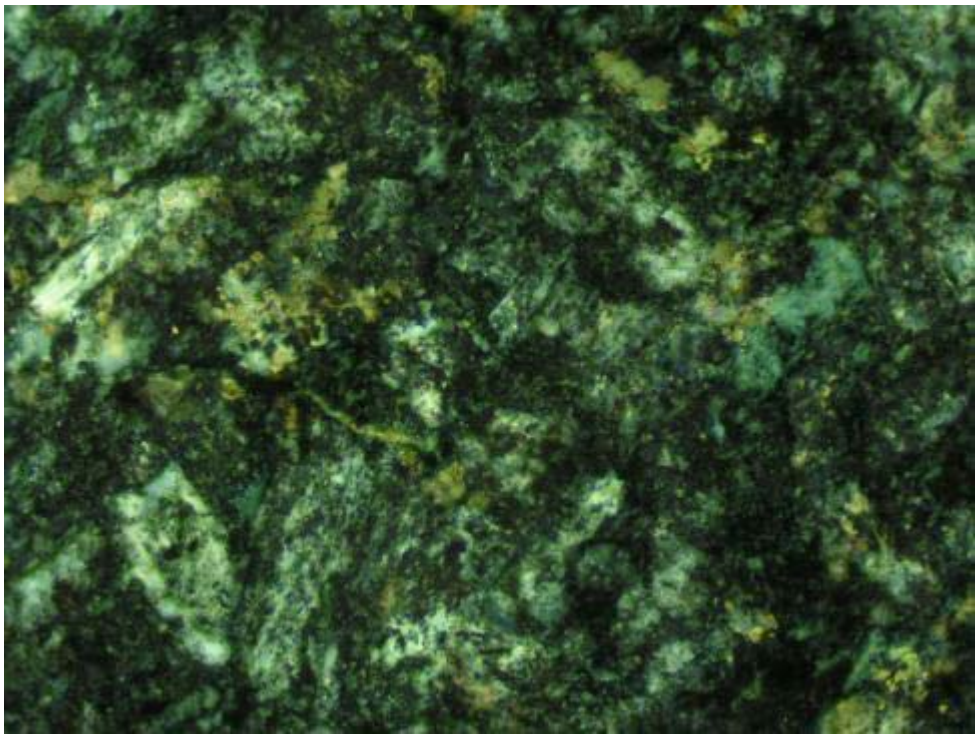
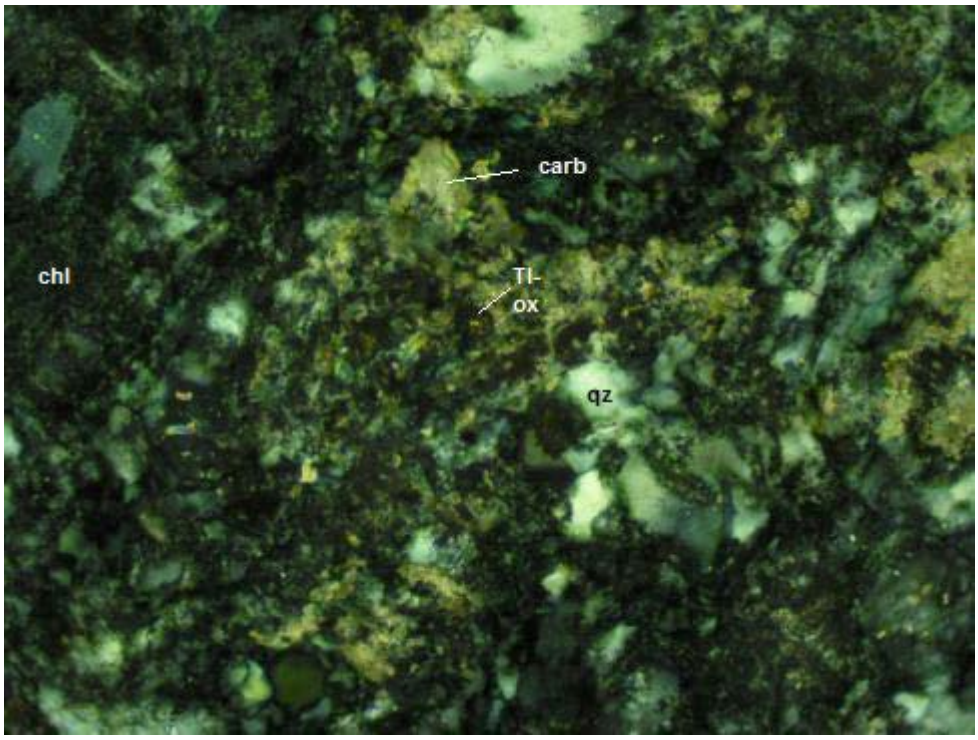


F

Sample: MM-09-12 62.19-62.26m
E&F) Detailed views of pervasive K-feldspar-chlorite-carbonate-Ti-oxide altered coarse crystal-rich tuff. E) PPL, F) XPL, FOV = ~ 0.7 mm.

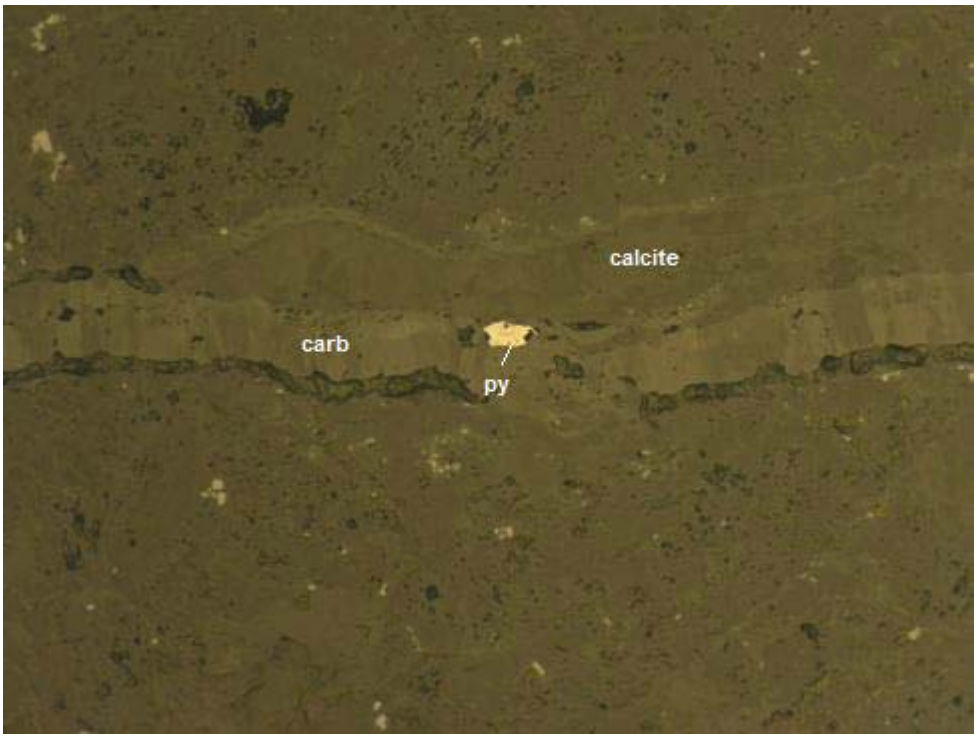


G



H

Sample: MM-09-12 62.19-62.26m
G) View of patchy K-feldspar alteration of plagioclase. XPL, FOV = ~ 0.7 mm. H) Detailed view of carbonate, chlorite and Ti-oxide alteration of rock. XPL, FOV = ~ 0.7 mm.



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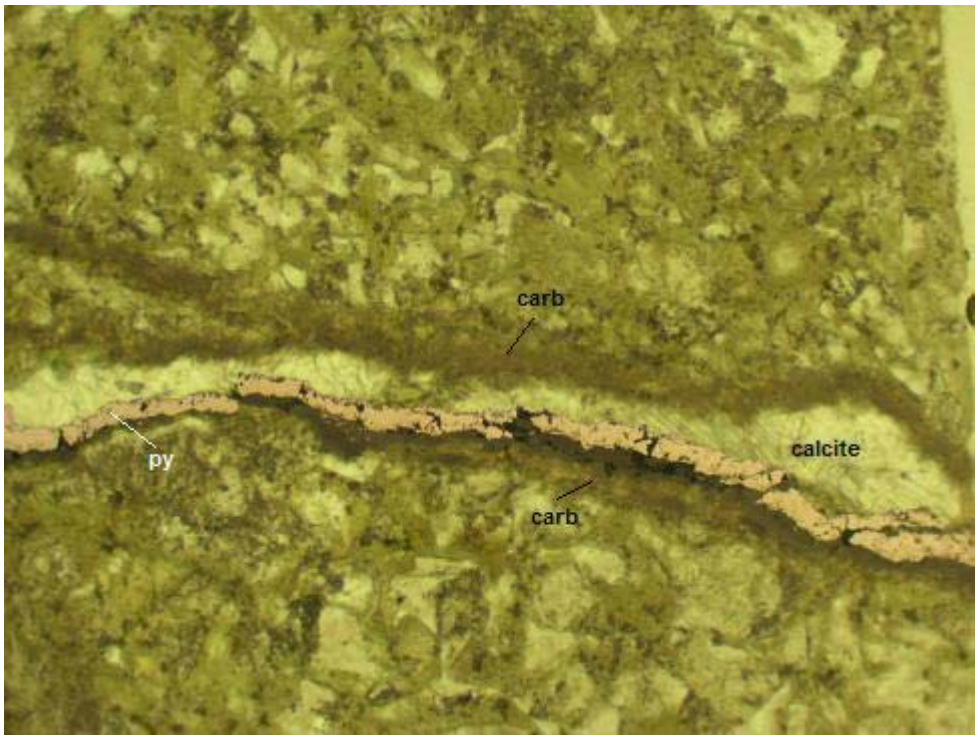


J

Sample: MM-09-12 62.19-62.26m
I) Detailed view of disseminated pyrite within brown carbonate (carb) aggregate as fracture infill. RL, FOV = ~ 0.7 mm. J) View of pyrite stringer within brown carbonate (carb) and calcite as fracture infill. PPL+RL, FOV = ~ 1.3 mm.

Zone: SOUTH
Sample: MM-09-12 71.64-71.71m **Offcut #AP-16**

view of hand sample


view of stained section offcut, scale in mm

Hand Sample Test Results:
No reaction of sample to magnet. Strong reaction of fractures to cold, dilute HCl. Positive test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Dark greenish-grey crystal-rich rock with and lithic fragments to 1 cm size (texture highlighted by concentrations of K-feldspar in stained offcut). Crystals reach up to 3 mm size. Patchy K-feldspar occurs throughout the rock (approximately 20% based on stain). Calcite and brown carbonate occur filling a network of brittle fractures which cut early hematite-filled fractures. Traces of disseminated pyrite.

Zone: SOUTH
Sample: MM-09-12 71.64-71.71m **Offcut #AP-16**


view of stained section offcut, scale in mm

LITHOLOGY:	Pervasively altered crystal-rich lapilli tuff
ALTERATION TYPE:	Chlorite, carbonate, K-feldspar, Ti-oxide
MINERALIZATION:	Pyrite, (chalcopyrite)
FRACTURES/VEINLETS:	Hematite
	Calcite±quartz ± (pyrite)
	Carbonate-*brown*

Polished Thin Section Description:
This section is a fractured and pervasively K-feldspar-epidote-chlorite-carbonate altered crystal-rich lapilli tuff. Primary bedding is not recognized. Scattered lithic clasts (up to 1 cm in size) occur in some parts of the section. The larger lithic clasts include epidote-carbonate-chlorite altered fine to medium-grained (< 2 mm) microdiorite with traces of patchy chalcopyrite associated with replacement of mafic phases. The tuff matrix is fine to medium-grained (< 2 mm) and likely of mafic-intermediate composition with former mafic phases and plagioclase as dominant mineralogical constituents. The former mafic phase(s) have been completely replaced by chlorite, carbonate and Ti-oxides. Broken plagioclase crystals are partly replaced by K-feldspar, chlorite, epidote, carbonate and illite aggregates. Minor pyrite occurs disseminated and within lithic fragments. Traces of quartz occurs as anhedral patchy aggregates, mostly in the lithic fragments. Traces of apatite occur disseminated.

The section is strongly fractured with infill by very fine-grained hematite, calcite and minor quartz. Traces of euhedral pyrite occur disseminated in these fractures. Very fine-grained brown carbonate occurs at margins of calcite-filled fractures and as late fracture infill.

Zone: SOUTH
Sample: MM-09-12 71.64-71.71m **Offcut #AP-16**

HOST ROCK(~87%):
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Plagioclase	30	fine-grained (< 1 mm), broken crystals, partly replaced by chlorite, illite and patchy epidote and locally carbonate aggregates	*polysynthetic twinning*
Chlorite	20	very fine-grained, anhedral aggregates, occurs as replacement of former fine-grained mafic phases, partly replaces plagioclase crystals	
K-feldspar	20	aphanitic aggregates, occurs as patchy replacement of plagioclase crystals, occurs locally as pervasive replacement of lithic fragments	
Carbonate	10	very fine-grained, patchy aggregates, occurs as overprint	
Ti-ox	5	very fine-grained, occurs as anhedral clusters, locally associated with epidote and chlorite alteration	*brown*

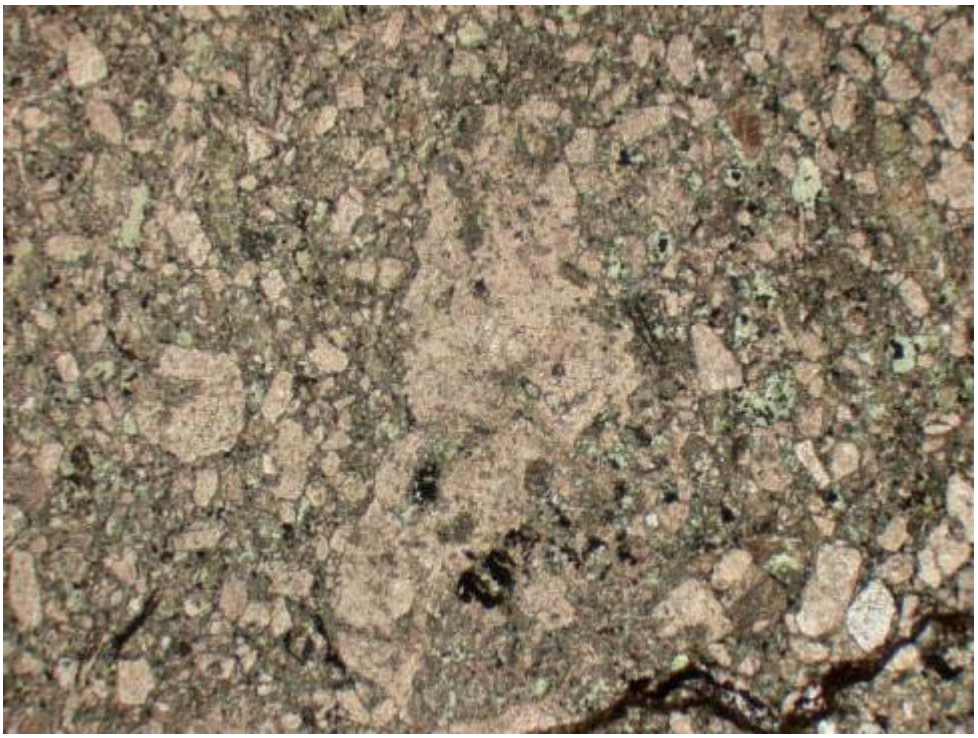
MINOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Pyrite	1	fine to very fine-grained, sub-anhedral aggregates, occur disseminated and within lithic fragments	
Illite	tr	very fine-grained, partly replaces plagioclase	
Quartz	tr	very fine-grained, anhedral patchy aggregates, occurs within lithic fragments of diorite composition	
Epidote	tr	fine to very fine-grained (< 0.2 mm), anhedral aggregates, occurs as replacement of plagioclase in matrix and fragments	
Hematite	tr	fine-grained (< 0.15mm), sub-anhedral, disseminated	
Apatite	tr	fine to very fine-grained (< 0.25 mm), high relief, disseminated grains	
Chalcopyrite	tr	fine to very fine-grained (< 0.2 mm), anhedral clusters, occurs with epidote and carbonate as replacement of mafic phases within lithic fragments	

VEINLETS/ FRACTURE INFILL (~13%):

Mineral	%	Distribution & Characteristics*	Optical
Calcite	10	fine-grained (< 0.3 mm), anhedral aggregates, occurs as fracture infill throughout section	
Quartz	1	fine to very fine-grained, prismatic to anhedral aggregates, occurs with calcite as fracture infill, occurs as infill to hematite filled fractures	
Carbonate, brown	1	very fine-grained, occurs at margins of calcite-filled fractures, occurs as late fracture infill	
Hematite	1	very fine-grained, subhedral aggregates, occurs as fracture infill, locally occurs with calcite, cut by brown carbonate aggregate	
Pyrite	tr	fine-grained (< 0.35 mm), euhedral grains, occurs disseminated in carbonate-hematite filled fractures.	

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm



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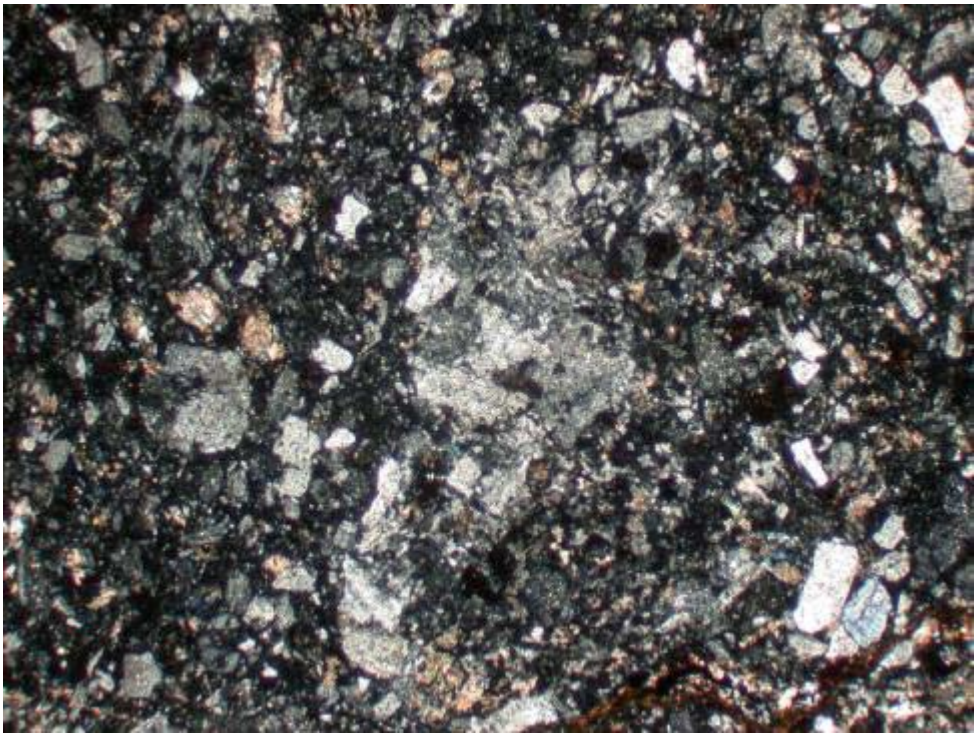
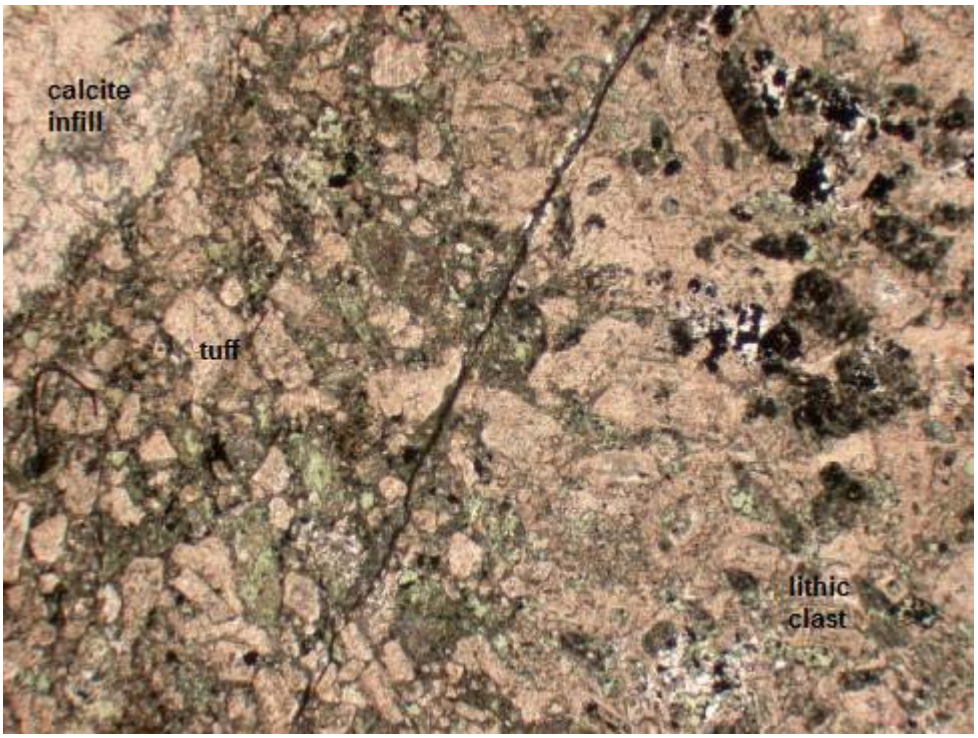


B

Sample: MM-09-12 71.64-71.71m
A & B) View of pervasively altered crystal-rich lapilli tuff. Note lithic clast (centre). A) PPL, B) XPL, FOV = ~ 4.5 mm.



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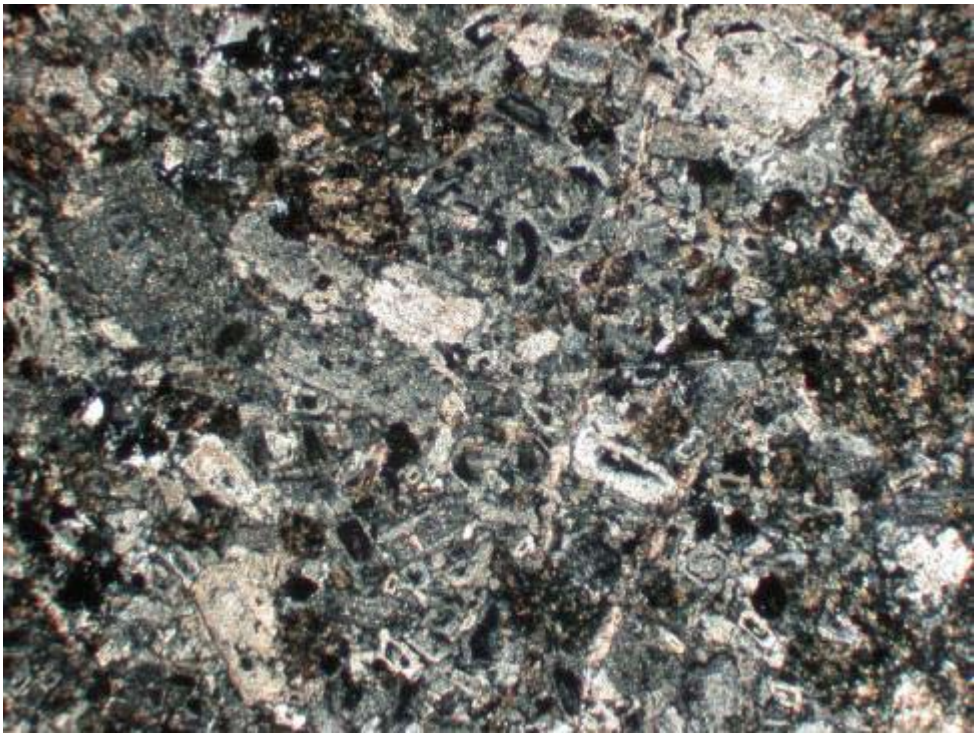
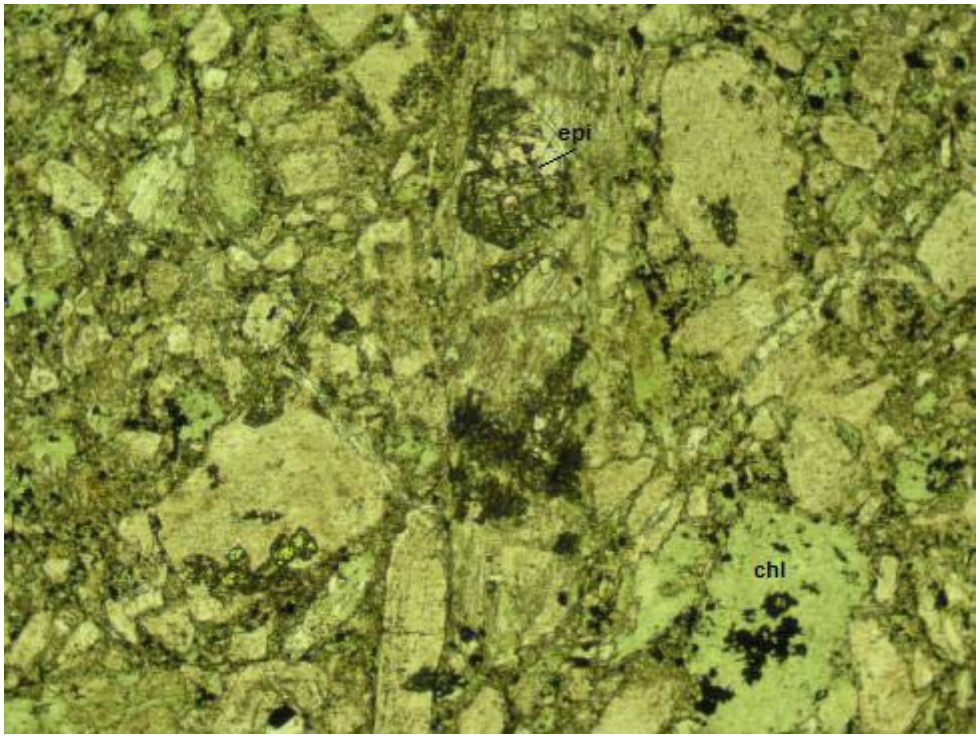


D

Sample: MM-09-12 71.64-71.71m

C) View of contacts between calcite-filled fracture (top left), crystal-rich tuff (middle) and lithic clast (right). PPL, FOV = ~ 4.5 mm. D) Representative view of lithic clast – microdiorite. XPL, FOV = ~ 4.5 mm.



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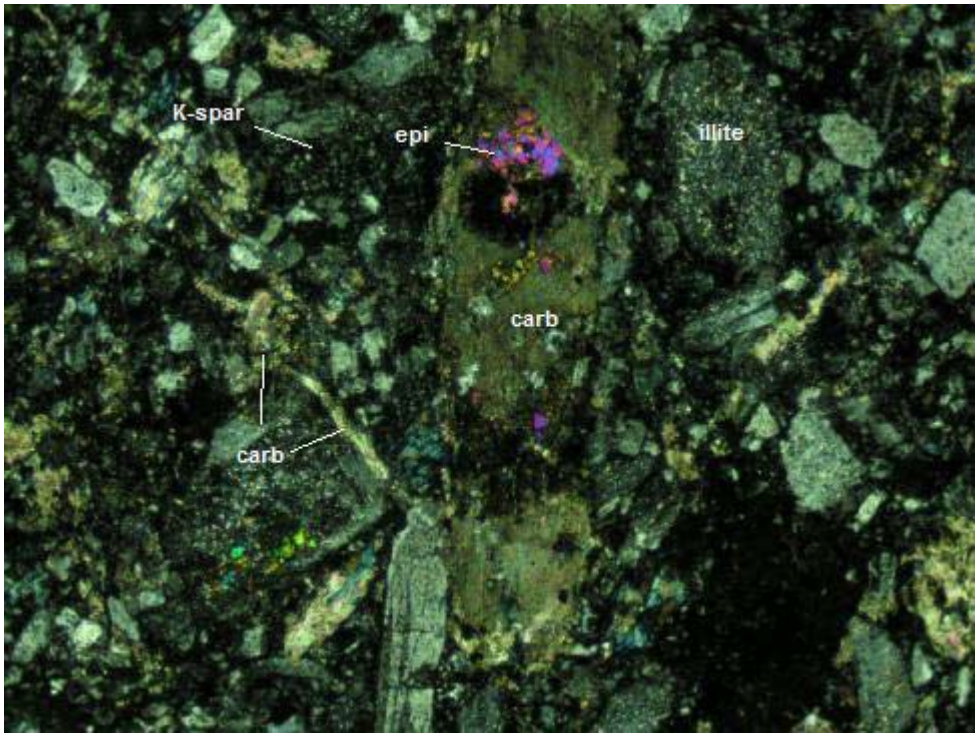
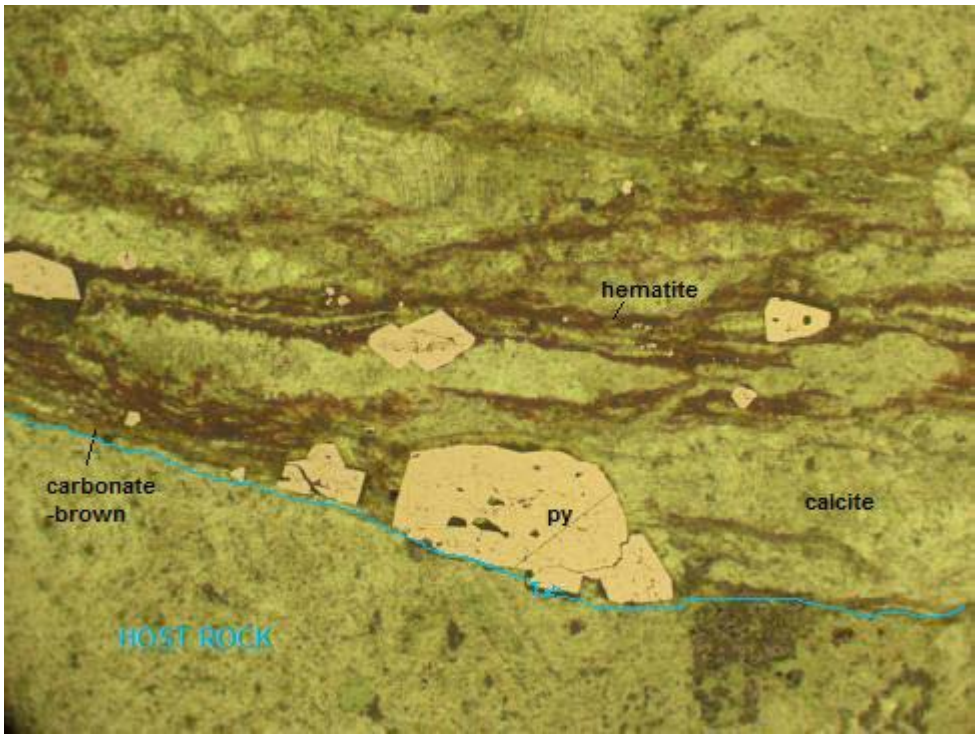


F

Sample: MM-09-12 71.64-71.71m
E&F) Detailed view of pervasively K-feldspar-chlorite-carbonate-epidote-illite altered tuff. E) PPL, F) XPL, FOV = ~ 2.6 mm.



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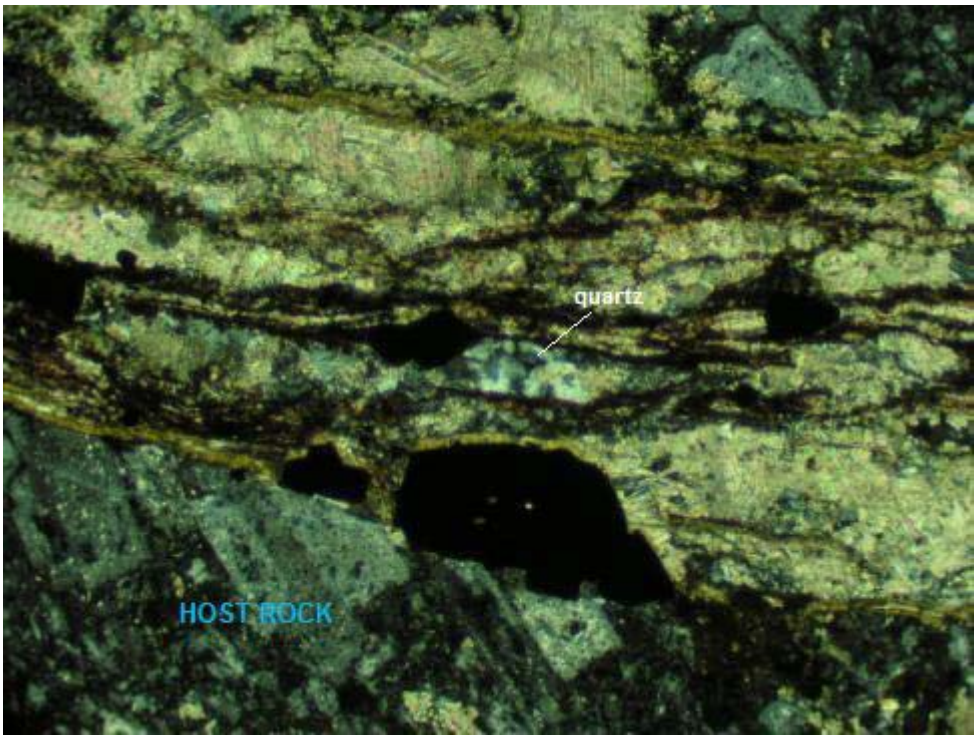
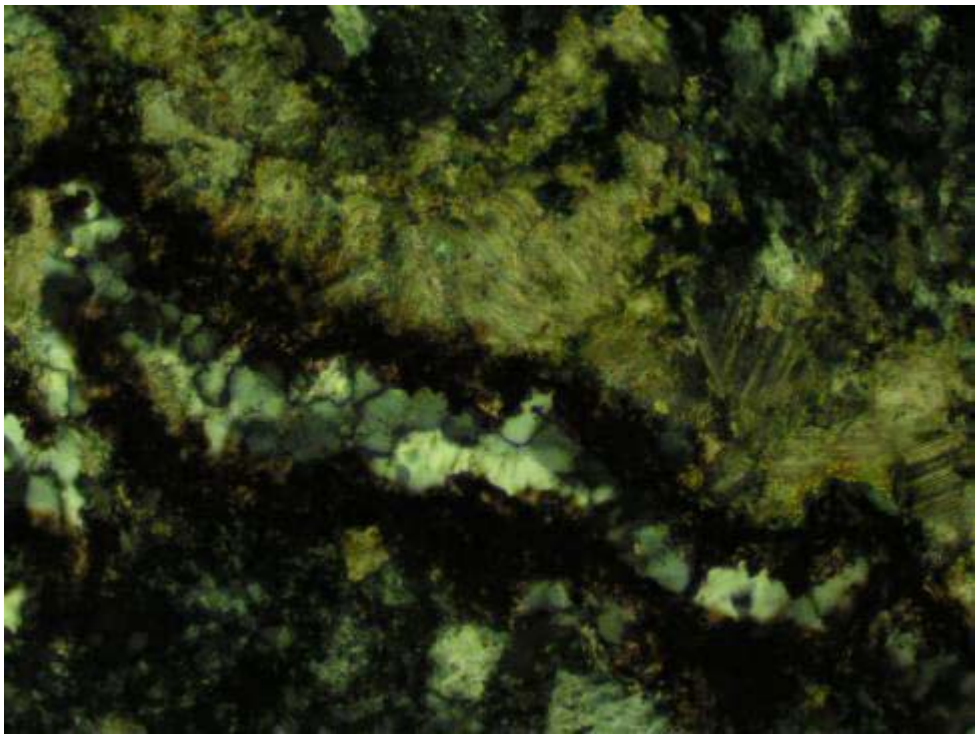


H

Sample: MM-09-12 71.64-71.71m

G&H) View of disseminated pyrite within hematite-calcite-carbonate-quartz filled fracture. Host rock labeled in blue and contact with fracture margin outlined in blue. G) RL+PPL, H) XPL, FOV = ~ 1.3 mm.



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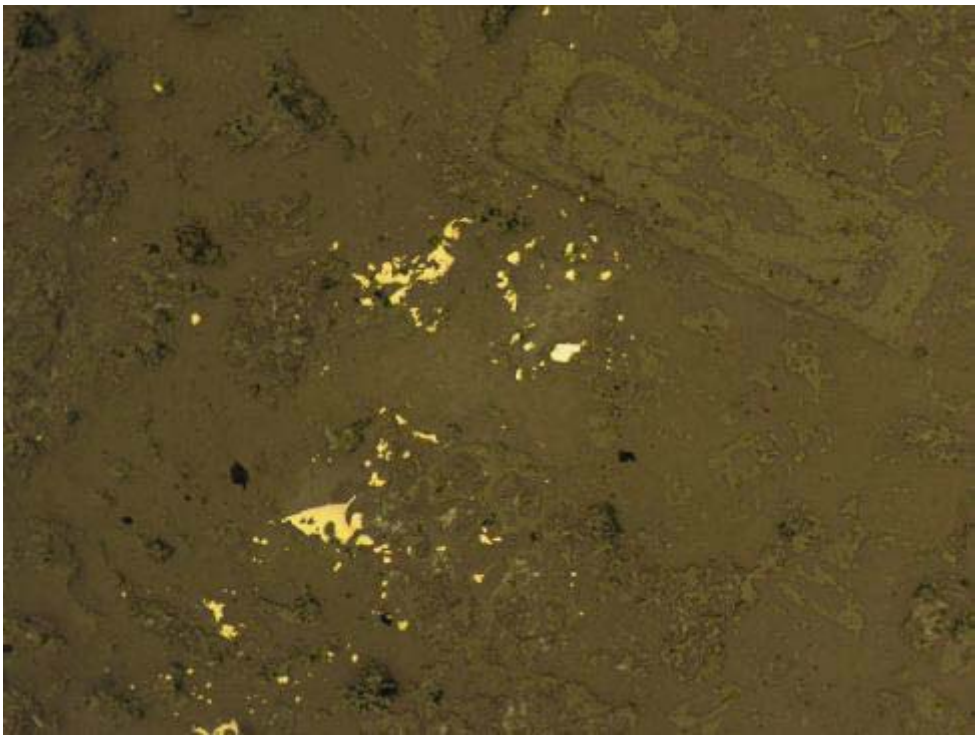


J

Sample: MM-09-12 71.64-71.71m
I) Detailed view of fracture filled with calcite, hematite and latest very fine-grained quartz aggregate. XPL, FOV = ~ 0.7 mm. J) Detailed view of lithic fragment with epidote,carbonate, chalcopyrite and locally pyrite as replacement of mafic phases. RL, FOV = ~ 2.6 mm.

Zone: SOUTH
Sample: MM-09-12 89.91-89.98m **Offcut #AP-17**

view of hand sample


view of stained section offcut, scale in mm

Hand Sample Test Results:
No reaction of sample to magnet. Strong reaction of fractures to cold, dilute HCl. Positive test for K-feldspar using etching by HF and sodium cobaltinitrate stain (see stained offcut photo above).

Hand Sample Description:
Dark greenish-grey fine-grained, mottled and vaguely fragmental rock (texture highlighted by concentrations of K-feldspar in stained offcut). Patchy K-feldspar occurs throughout the rock (approximately 15% based on stain). Calcite and hematite occur filling a network of brittle fractures cutting the rock.

Zone: SOUTH
Sample: MM-09-12 89.91-89.98m **Offcut #AP-17**


view of stained section offcut, scale in mm

LITHOLOGY:	Pervasively altered crystal-rich coarse tuff
ALTERATION TYPE:	Epidote, chlorite, carbonate, K-feldspar
MINERALIZATION:	(Chalcopyrite)
FRACTURES/VEINLETS:	Hematite-(chalcopyrite)
	Calcite

Polished Thin Section Description:
This section is a fractured and pervasively K-feldspar-epidote-chlorite-carbonate altered, massive crystal-rich coarse tuff. Primary bedding is not recognized. Minor scattered lithic clasts (up to 2 mm in size) occur in some parts of the section. The crystal tuff matrix is fine-grained (< 0.25 mm) and likely of mafic-intermediate composition with former mafic phases and plagioclase as dominant mineralogical constituents. The former mafic phase(s) have been completely replaced by epiote, chlorite, carbonate and traces of Ti-oxides. Broken plagioclase crystals are partly replaced by K-feldspar, chlorite, epidote and carbonate aggregates. Minor quartz occurs as anhedral patchy aggregates. Traces of apatite occur rarely disseminated.

The section is strongly fractured with early infill by fine-grained hematite. Rare traces of chalcopyrite occur within the hematite aggregate. Hematite fractures are offset by fractures filled with calcite. The margins of calcite-filled fractures are lined by very fine-grained hematite aggregate.

Zone: SOUTH
Sample: MM-09-12 89.91-89.98m **Offcut #AP-17**

HOST ROCK(~88%):
MAJOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Epidote	20	fine to very fine-grained (< 0.1 mm), anhedral aggregates, occurs as replacement of former fine-grained mafic phases and plagioclase	
Plagioclase	20	fine-grained (< 0.25 mm), broken crystals, partly replaced by chlorite epidote and carbonate aggregates	*polysynthetic twinning*
Chlorite	20	very fine-grained, anhedral aggregates, occurs as replacement of former fine-grained mafic phases, partly replaces plagioclase crystals	
K-feldspar	15	aphanitic aggregates, occurs as patchy replacement of plagioclase crystals, occurs locally with epidote aggregate	
Carbonate	12	very fine-grained, patchy aggregates, occurs as overprint	

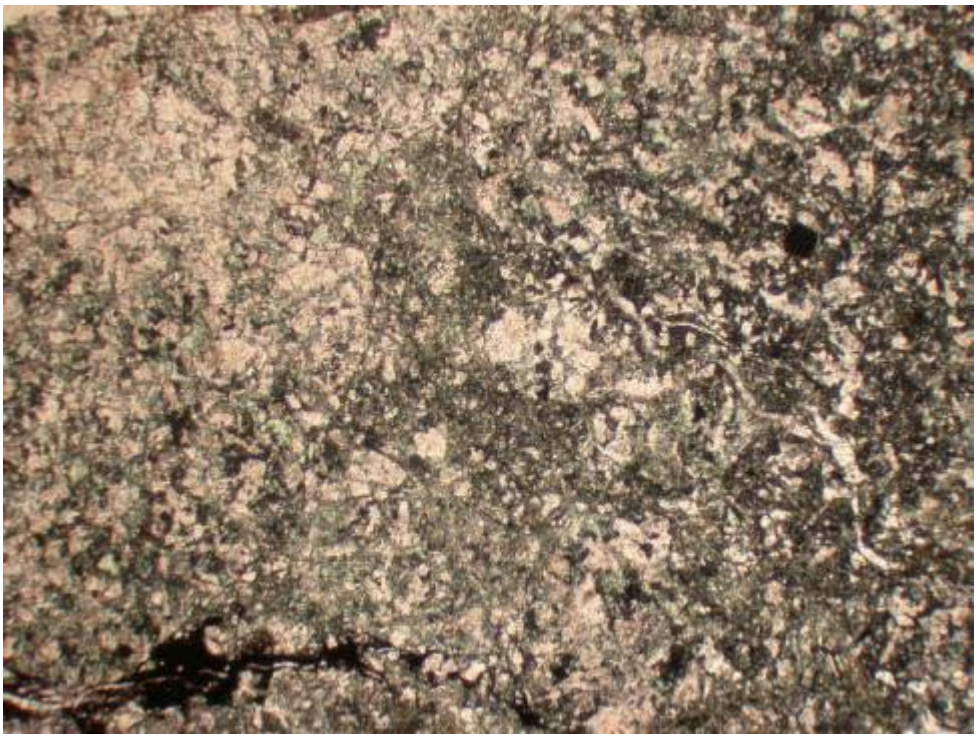
MINOR MINERALS

Mineral	%	Distribution & Characteristics*	Optical
Quartz	1	very fine-grained, anhedral patchy aggregates	
Ti-ox	tr	very fine-grained, occurs as anhedral clusters, locally associated with epidote and chlorite alteration	*brown*
Apatite	tr	fine to very fine-grained (< 0.1 mm), high relief, disseminated grains	

VEINLETS/ FRACTURE INFILL (~12%):

Mineral	%	Distribution & Characteristics*	Optical
Calcite	7	fine-grained (< 0.3 mm), anhedral aggregates, occurs as latest fracture infill throughout section	
Hematite	5	fine to very fine-grained (< 0.2 mm), anhedral aggregates, occurs as fracture infill	
Chalcopyrite	tr	very fine-grained, anhedral aggregates, occurs rarely as patches and as stringers within hematite fracture infill	

*size ranges: coarse-grained > 5mm; medium-grained 1-5mm; fine-grained 0.05-1mm; very fine-grained <0.05mm



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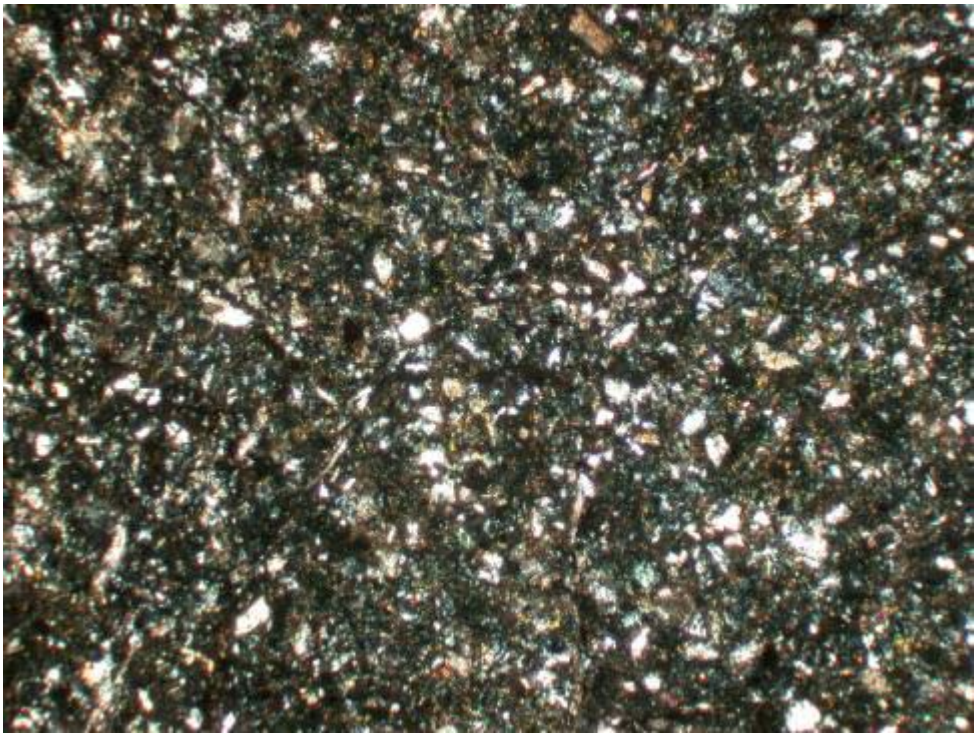
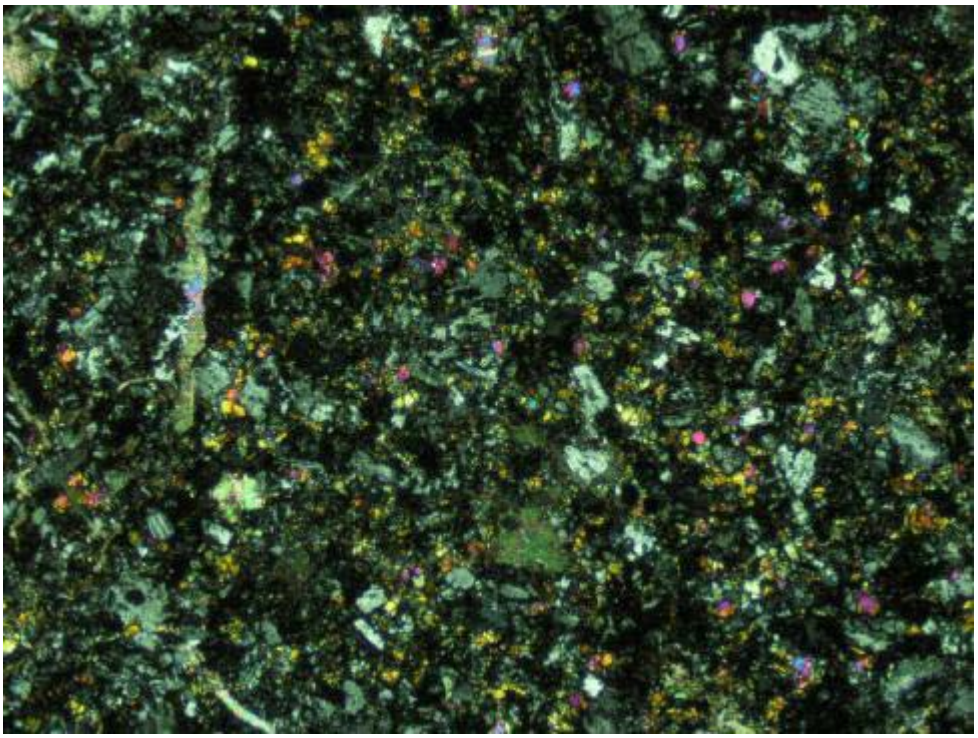


B

Sample: MM-09-12 89.91-89.98m
A & B) Different views of fractured and pervasively altered coarse crystal-rich tuff. Scattered lithic clasts are evident in photo A. A) PPL, B) XPL, FOV = ~ 4.5 mm.



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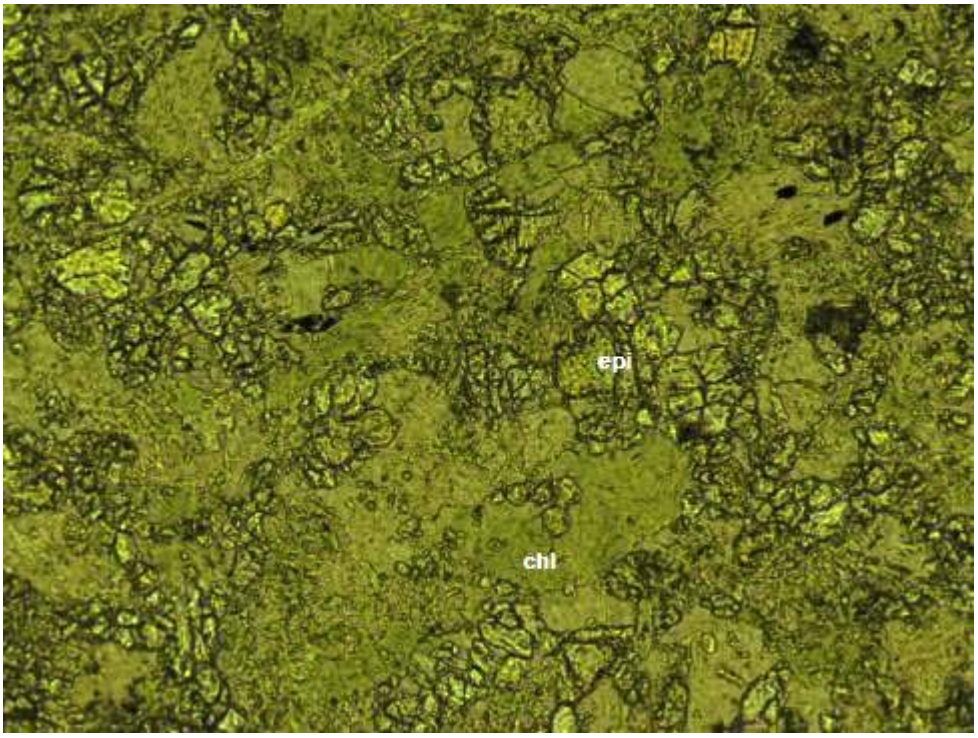
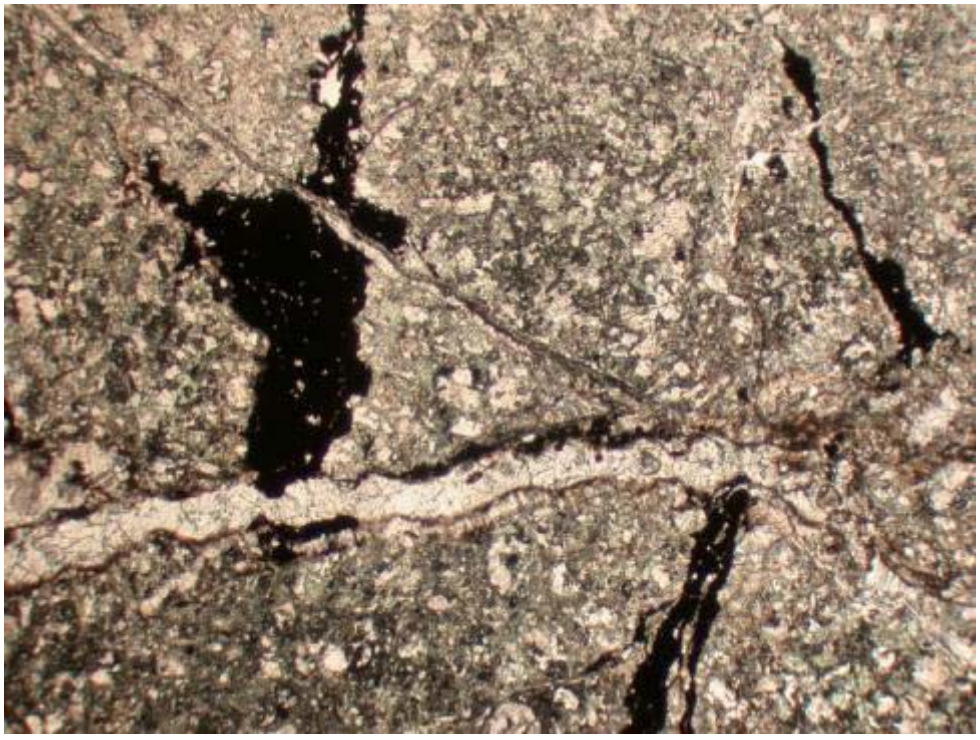


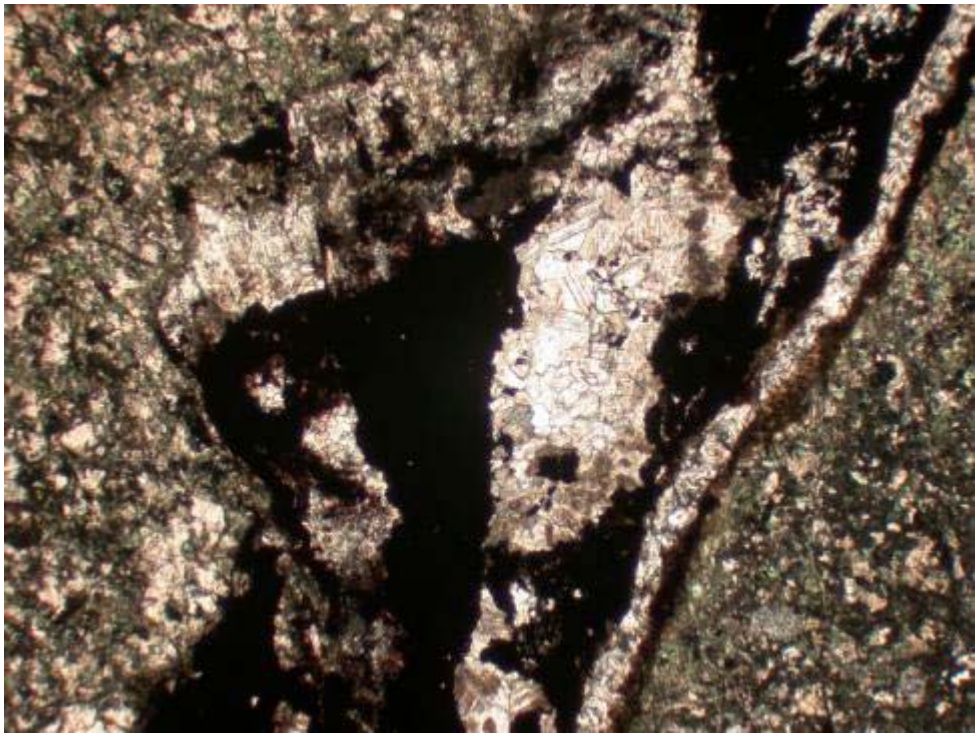
D

Sample: MM-09-12 89.91-89.98m

C) Representative view of epidote-chlorite-K-feldspar and patchy carbonate alteration of crystal-rich tuff. Note calcite-filled fracture (left). XPL, FOV = ~ 2.6 mm. D) Detailed view of major chlorite and epidote altered rock. PPL, FOV = ~ 0.7 mm.

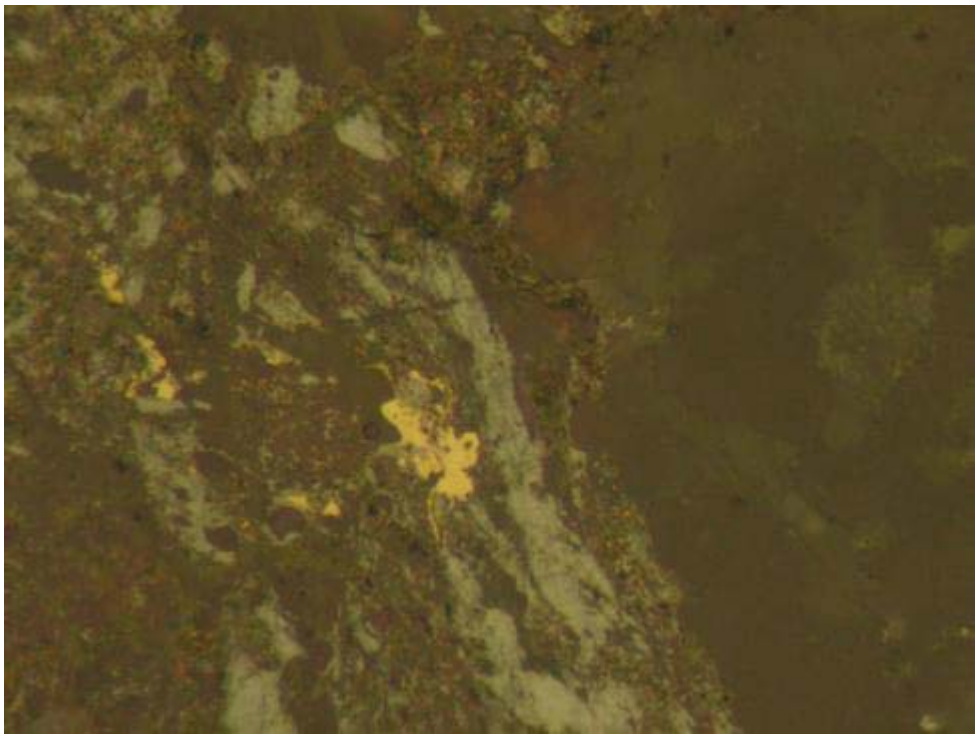


E



F

Sample: MM-09-12 89.91-89.98m
E&F) Detailed separate views of early hematite-filled fractures offset by later calcite-filled fractures. Hematite is opaque in these views. E) PPL, F) PPL, FOV = ~ 4.5 mm.



G

Sample: MM-09-12 89.91-89.98m
G) Traces of anhedral chalcopyrite within hematite-filled fracture. RL, FOV = ~ 0.2 mm.

Statement of qualifications: Kathryn P.E. Dunne

I, Kathryn P.E. Dunne, of the city of Salmon Arm, province of British Columbia, do hereby certify that:

1. I am an independent consulting geologist, with a business office at 4610 Lakeshore Road NE, Salmon Arm, B.C., Canada. My business mailing address is: Bag 9000, # 207, 190B Trans Can Hwy NE, Salmon Arm, BC, V1E 1S3.

2. I am a graduate in geology, with a BSc in geology from The University of British Columbia (1985).

3. I received my Masters degree in geology from The University of British Columbia, Vancouver, B.C. in 1988.

4. I am a registered member of the Association of Professional Engineers and Geoscientists of the Province of British Columbia (No. 18674).

5. I am a fellow of the Geological Association of Canada and a member of the Society of Economic Geologists.

6. I have practiced my profession as a geologist for approximately 20 years: 4 years as geologist with the British Columbia Geological Survey Branch, 3 years as research coordinator at the Mineral Deposit Research Unit housed within the Department of Earth and Ocean Sciences at the University of British Columbia, and 13 years as an independent consultant. From mid-2002 to mid-2007 I was an associate of Petrascience Consultants Inc.

7. The petrographic data of this report was collected by me in April and May 2010.

……..……
Kathryn P.E. Dunne, M.Sc., P.Geo.
Consulting Geologist
May 7, 2010

APPENDIX

PIMA Spectral Analysis of samples:

MM-09-11 125.36-125.43m
MM-09-11 153.02-153.12m
MM-09-11 192.09-192.18m
MM-09-12 10.08-10.15m

By Kim Heberlein, P.Geo.
April 30, 2010

Kim Heberlein
21146 Stonehouse Avenue
Maple Ridge, B.C.
Canada V2X 8L9
Tel: 778-228-5231
604-466-2087

30 April 2010

Kathryn Dunne
Bag 9000, #207
190B Trans Can Hwy NE,
Salmon Arm, BC
Canada V1E 1S3

Re: PIMA spectral analysis (KH155)

PIMA spectral analyses of 4 samples (MM10; TS 7, 8, 9 13) gave moderate to good results. The results are shown on the attached excel spreadsheet. (The sample numbers on the bags differed from the numbers on the sample list – the sample list gives "MM09" numbers; the bags say "MM10").

TS7 MM10 125.36-125.43: Gypsum is predominant throughout. Kaolinite, smectite (montmorillonite) and Fe>Mg chlorite are also present. There's a very faint trace of possible jarosite. If carbonate is present, the features are hidden in the chlorite, which means it's likely to be calcite. There's no strong indication of amphibole.

TS8 MM10 153.02: Smectite (montmorillonite), kaolinite, biotite, probable carbonate (calcite).

TS9 MM10 192.09: Smectite (montmorillonite), kaolinite, carbonate (calcite)

TS13 MM10 10.8: Carbonate (calcite), trace probable chlorite (intermediate to Fe-rich?) and kaolinite. The fractures seem to be mainly carbonate.

If you have any questions regarding the interpretation please don't hesitate to contact me.

Best Regards

Kim Heberlein, P.Geo.
kheberlein@shaw.ca

KH155
PIMA Analysis

SAMPLE	SPECTRUM	MINERALS	Al-OH Wave	COMMENTS
TS7_MM10_125.36	155C001A	gypsum, kaolinite, chlorite (Fe>Mg), ??trace jarosite	2209	Lt green soft/white veining
	155C001B	gypsum, kaolinite, smectite, chlorite (Fe>Mg)	2209	Lt green soft/white veining
TS8_MM10_153.02	155C002A	smectite, kaolinite, biotite	2208	Dk. Browngrey soft fg/brown offwhite stringers
	155C002B	smectite, kaolinite, ?carbonate	2208	Dk. Browngrey soft fg/brown offwhite stringers
TS9_MM10_192.09	155C003A	smectite, kaolinite	2208	Lt browngrey fg soft
	155C003B	smectite, kaolinite, carbonate (calcite)	2208	Lt browngrey fg soft
TS13_MM10_10.8	155C004A	carbonate (calcite), trace chlorite, kaolinite	2211	Grey fg soft. Poor spectrum
	155C004B	carbonate (calcite)	2210	Grey fg soft/white stringers

KH155 SPECTRA

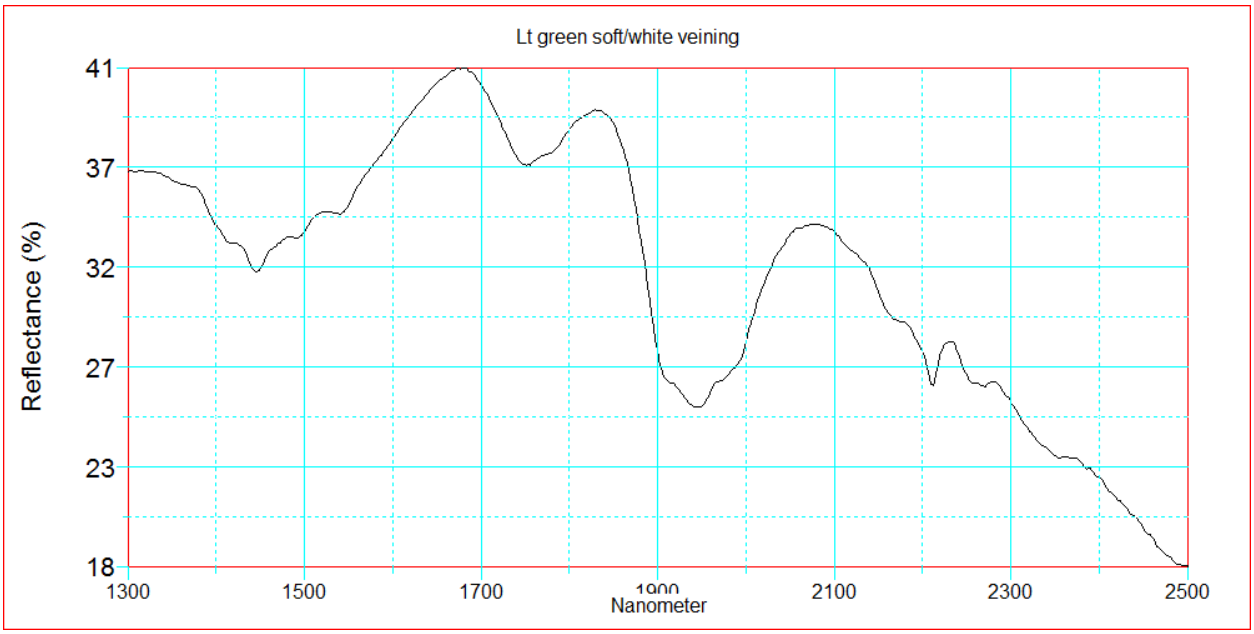


Figure 1: 155C001A

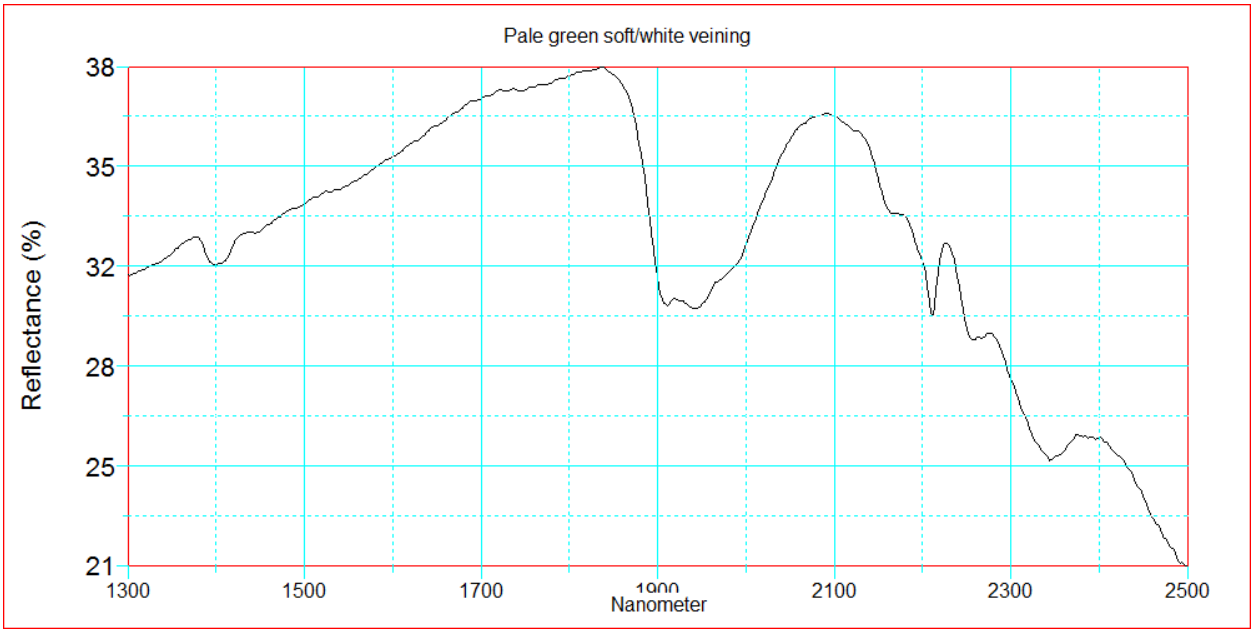


Figure 2: 155C001B

KH155 SPECTRA

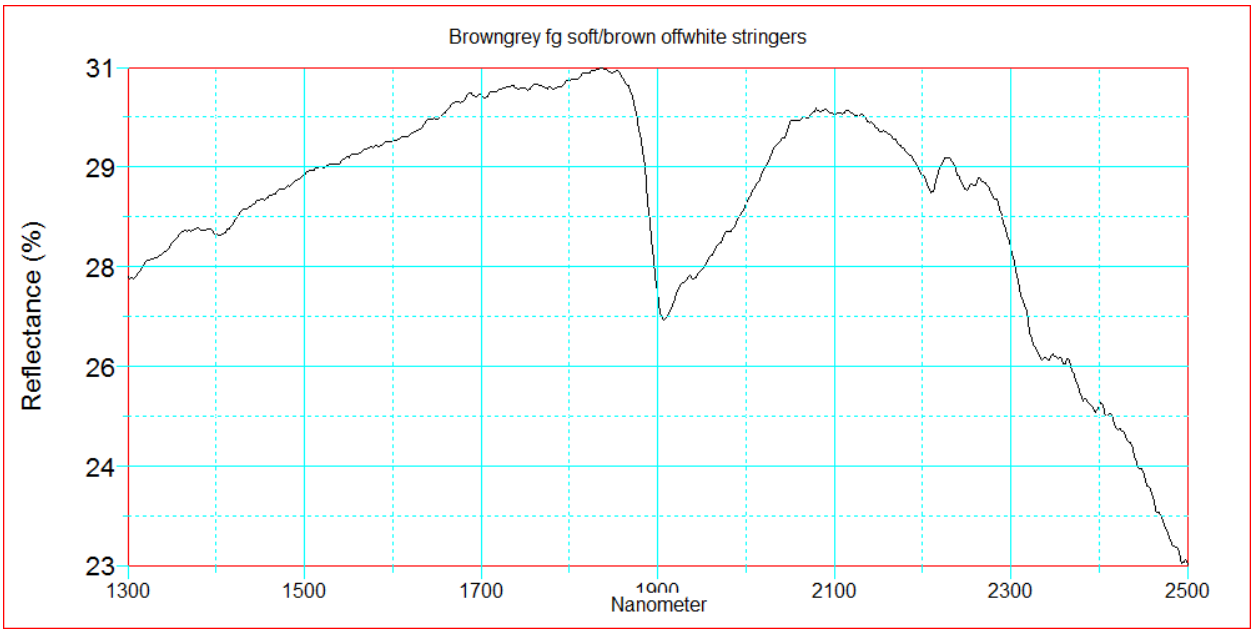


Figure 3: 155C002A

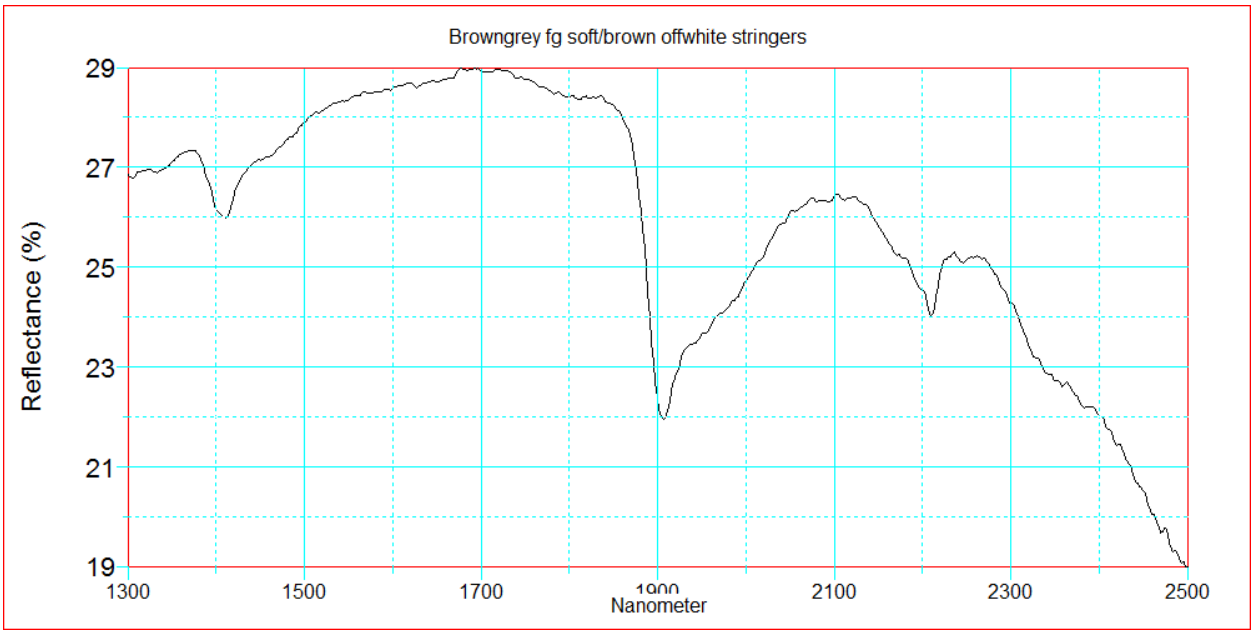


Figure 4: 155C002B

KH155 SPECTRA

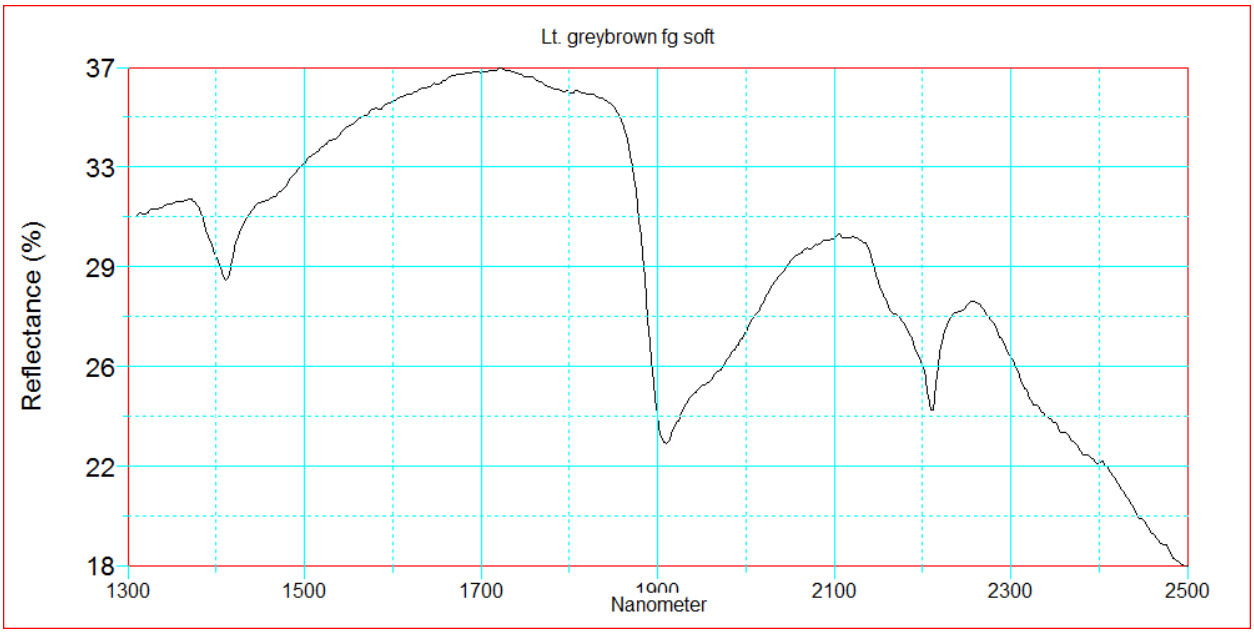


Figure 5: 155C003A

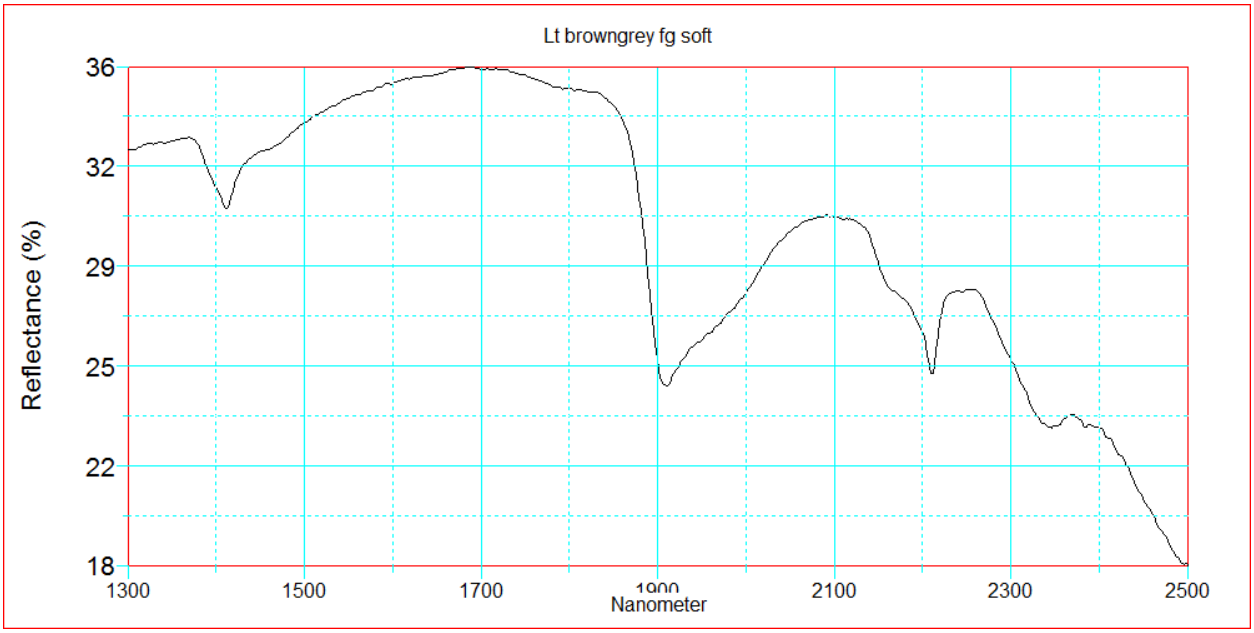


Figure 6: 155C003B

KH155 SPECTRA

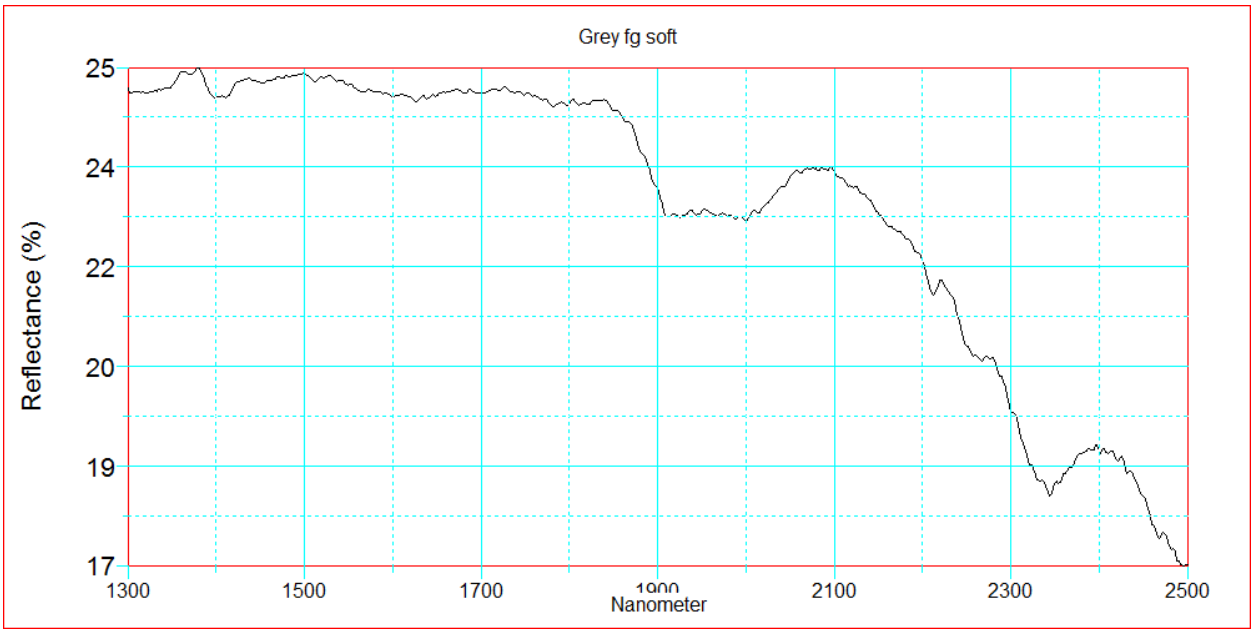


Figure 7: 155C004A

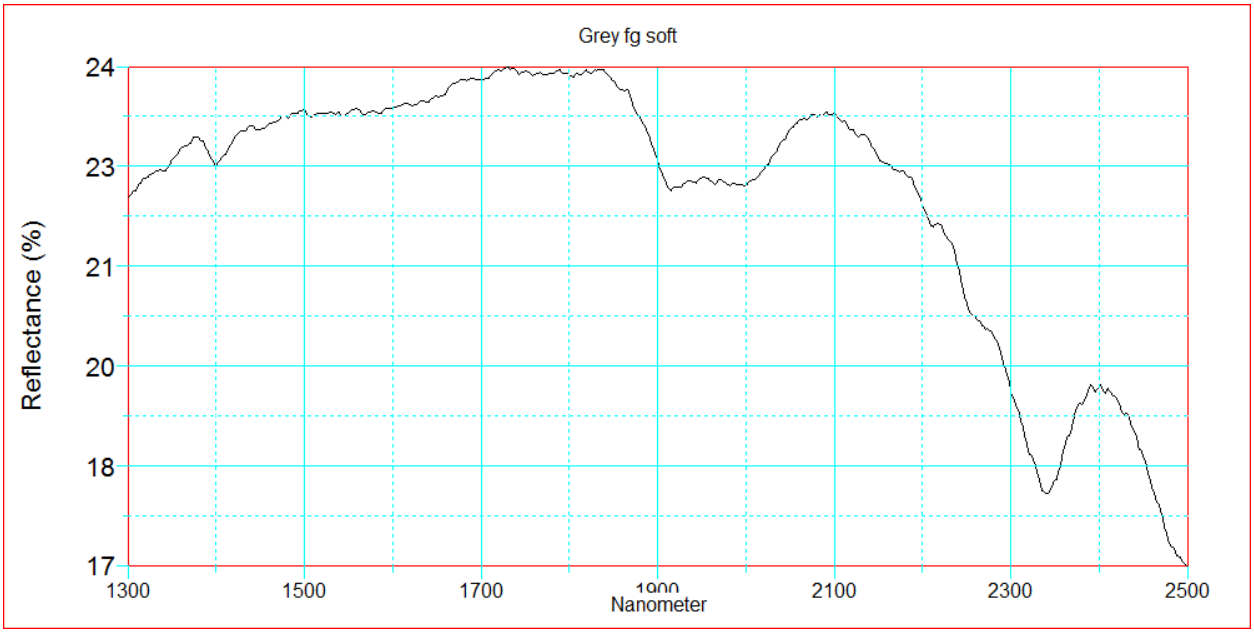


Figure 8: 155C004B

Appendix 4

Terrain Study

MINER MOUNTAIN TERRAIN STUDY

Introduction and Purpose

On February 9, 2010, J. Paul Stevenson, CEO of Sego Resources Inc. (Sego) retained Dr. Selina Tribe, PGeo of Carta Exploration Ltd to complete a terrain study for the Miner Mountain property near Princeton BC.

Sego identified mineralized colluvium at the Regal zone that is hypothesized in the NI 43-101 Technical Report to have slid downslope from the Granby zone (Figure 1). However, geochemical results from the Regal and Granby zones do not compare. The terrain study was commissioned to determine the likely source area for Regal zone materials.

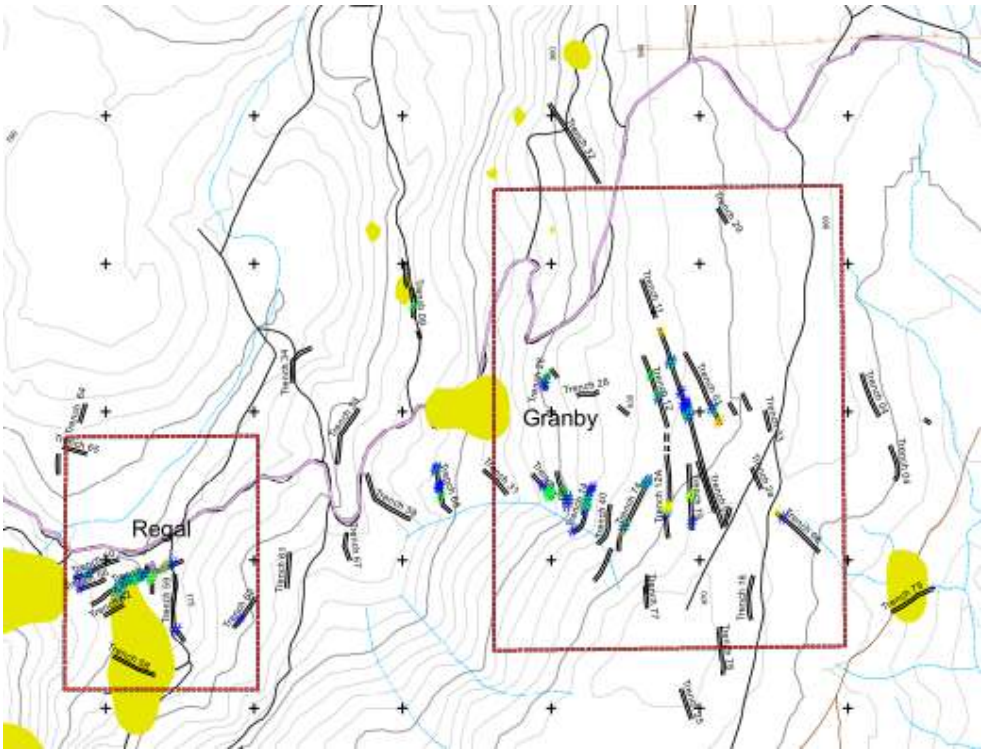


Figure 1. Detail of the Miner Mountain property Au anomaly map showing the Regal zone situated downlope of the heavily trenched Granby zone. North is to the top. Tick marks are 250 m apart.

Scope

The scope of Miner Mountain Terrain Study includes:

1. Level 1 Terrain Study (desk study) of drainage, terrain deposits, landforms and areas of human activity, especially as they relate to mineral exploration;
2. Mapping the extent of headscarp and run-out zones for any landslides on the property or nearby; and
3. Identification of the likely source area for Regal zone colluvium, within the limits of study materials.

Information Sources

Orthophoto maps of Miner Mountain Property, including Cu, Au and Ag anomaly maps, and two binders of field notes were provided by Sego. Colour diapositives were provided by Eagle Mapping.

Deliverables

A) Annotated 1:5,000-scale terrain map with features of interest;
B) Written summary of findings; and
C) Project close-out interview.

Techniques and Methodology

A mirror stereoscope and light table were used to interpret terrain features on diapositives with a nominal scale of 1:40,000. Diapositives 15BCC04038 #35 and #36 were selected for further study. Terrain features were hand transferred onto a mylar overlay of the 1:5,000-scale orthophoto map provided by Sego. The resulting 1:5,000-scale terrain map and legend is shown in Figures 2 to 6.

Description of Findings

Level 1 Terrain Study

A Level 1 Terrain Study (desk study) of the area was completed to identify streams (perennial and ephemeral) and water bodies; lineaments; landforms and overburden deposits, including landslide debris; and anthropogenic features such as trenches and pits.

Miner Mountain is situated immediately east of Princeton BC. The property is the southwestern extension of an upland plateau currently used as range land by local ranchers and farmers. Gravel roads and trails provide access over Miner Mountain. A gas pipeline traverses the southern end of the property.

Streams and gullies draining Miner Mountain plateau are ephemeral (blue lines). Deer Valley Creek is the ephemeral creek flowing south-southwesterly through the main landslide mass to join Summers Creek near the Regal zone. Summers Creek flows southward along the southwest base of Miner Mountain to its confluence with Similkameen River. Similkameen River valley defines the southern extent of Miner Mountain.

Rock outcrops are visible on the uplands (**U**) of Miner Mountain and along its steeper western and southern slopes. The study area is sparsely vegetated. Lineaments, rock outcrops and other terrain features are relatively easy to identify.

Overburden soils on the top of Miner Mountain (**U**) are interpreted to consist of a veneer (< 2 m thick) of dense (consolidated) unsorted glacial till overlain by a veneer of loose (unconsolidated) glaciofluvial sands and gravels. Numerous meltwater channels (blue lines) are incised on the Miner Mountain upland.

Two short eskers (blue barbed lines) are interpreted to exist on the northern Miner Mountain upland within a field of sand dunes (**E**). This area may have been a local meltwater divide during deglaciation. This interpretation has implications for determining the source area of any moraine or meltwater materials that were sampled on the uplands.

Steep slopes (**R #1, R #2, R**) of Miner Mountain consist of rock with a veneer of colluvium that resulted from sloughing and raveling of loose rock and soil. Colluvium is material that moved downslope under the influence of gravity; thus its source is located upslope.

The hummocky, ridged blanket (> 2 m thick) of material in the bowl-shaped flat at the base of the steep slopes of Miner Mountain represents the mass of colluvium that moved downslope from the main landslide on Miner Mountain (**Cb #1, Cb #2**).

Along Deer Valley Creek, landslide colluvium was reworked by flowing water resulting in a veneer of fluvial sand and gravel (**Fv**).

Numerous trenches (red bars) are evidence of past mineral exploration. Some small pits (red circles) were also identified: they may be exploration pits or areas of outcrop.

Although not specifically identified in this desk study, clay-rich sediments may have contributed to initiation of the main landslide. The North Thompson River valley contained glacial lakes during late Quaternary time that left patchy deposits of fine-grained, erodible or poorly draining silts and clays in Quaternary bedrock depressions. Furthermore, Tertiary and early Pleistocene deposits of clay in bedrock depressions have contributed to large rock landslides along Thompson River and Fraser rivers (for example, Drynoch landslide and slides near Black Canyon), and may be present in the Miner Mountain landslide.

Landslide Features

The main landslide is located in the northwestern study area forming the re-entrant along the northwestern edge of Miner Mountain. This landslide is also located along the regional trend of the Boundary Fault. The main landslide exhibits many features typical of landslides in the region:

- Arcuate, multiphase headscarp;
- Hummocky colluvium situated downslope of the headscarp;
- Stream headwaters situated at the margins of the headscarp;
- Beheaded stream in the area of landslide debris;
- Disrupted drainage and ephemeral streams at the foot of the landslide; and
- Antislope scarps and lineaments indicating displacement within the landslide mass and near the crest of the landslide.

The landslide is interpreted to be a large rotational rock slump involving bedrock and overlying sediments (**Cb #1**) that detached from a complex headscarp (**R#1**). The rotational slump led to secondary sloughing and rockfall (**Cb #2**) along the steep headscarp in the southern area (**R #2**).

A discrete portion of the upland area (**T**) experienced localized subsidence during or following the main landslide event as evidenced by a suite of subtle nested scarps and lineaments. Extra caution is required if trenching in this area (**T**) due to fault discontinuities identified in the bedrock and the past record of proximal landslide instability.

During the main landslide event, a mass of broken rock and overlying material detached from the main headscarp (**R #1 and R #2**), moved downslope and spread out forming the debris zone (**Cb #1**). The debris (**Cb #1**) was moulded by meltwater and post-glacial streams, suggesting that the main landslide failed in late Quaternary time. The slide mass (**Cb #1**)

appears to have diverted Summers Creek to the west. Flow lines (green) suggest the interpreted downslope movement of slide material from the source area.

Secondary failures occurred as a result of steep slopes formed during the main landslide. The secondary failures are interpreted to be sloughing, rock fall or a shallow rock slide sourced from the steep slope labelled **R #2**. Material from headscarp **R #2** accumulated in a downslope talus apron of rocky debris (**Cb #2**). This colluvium appears to have formed after the main rotational slide, possibly due to removal of material buttressing the toe of the slope, or from weathering of the new steep headscarp. Drilling by Sego in the Regal zone shows the rocky colluvium to be underlain by glacial till. Flow lines (green) suggest the interpreted downslope movement of slide material in **Cb #2** from its source.

Conclusions and Recommendations

Regal zone colluvial material appears to have its source in the steep slopes labeled **R #2**. The source area is more likely to be from the southern portion of this headscarp. Regal zone colluvium shows signs of reworking by glacial meltwater and modern streams.

It is recommended that new trenches be cut in the upper slopes of the southern part of the **R #2** headscarp. Access for machinery likely would be from the upland above the Regal zone. Further work supporting trenching efforts above the Regal zone may include examination of 1:15,000-scale air photographs, which are significantly larger scale than the diapositives used in this study. A larger-scale air photo interpretation may also allow the refinement of landslide flow paths.

Old trenches identified on the terrain map that are located upslope and slightly southeast (in plan view) of the Regal zone should be examined for similarities to the anomalous Regal zone samples already identified by Sego.

Extra caution is required if trenching along the crest of steep slopes and headscarps identified in this study. The proximity to past bedrock landslides suggests that subtle, unmapped discontinuities may exist along the edge of the upland, and especially in the polygon labeled **T**.

The interpretation of a glacial meltwater divide on the northern upland in the vicinity of polygon **E** has implications for source area determinations of any moraine or meltwater materials that may be sampled in this area.

Closure

This report accompanies the 1:5,000-scale terrain map. Thank you for the opportunity to work on this interesting property. Please contact me if you require further information.

Sincerely,

Selina Tribe, PhD, PGeo
APEGBC License #24487
Carta Exploration Ltd

Figure 2. Overview of the 1:5,000-scale terrain map. Figures 3 to 5 show close-ups views of the terrain map. Legend is shown in Figure 6. North is to the top.

Figure 3. Detail of northern part of terrain map. North is to the top.

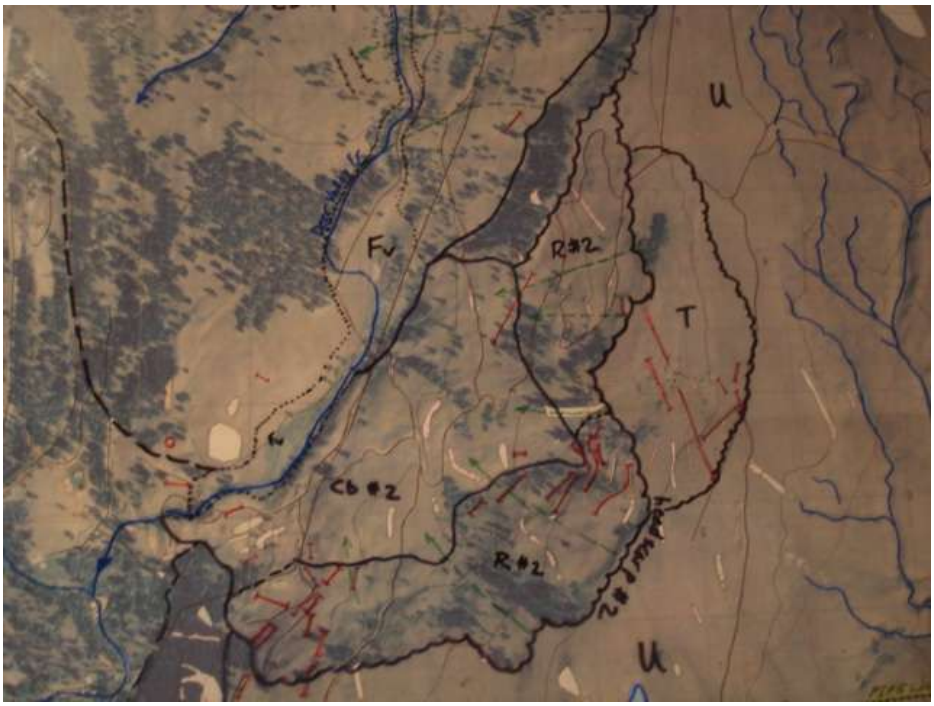


Figure 4. Detail of central part of terrain map. North is to the top.

Figure 5. Detail of southern part of terrain map. North is to the top.

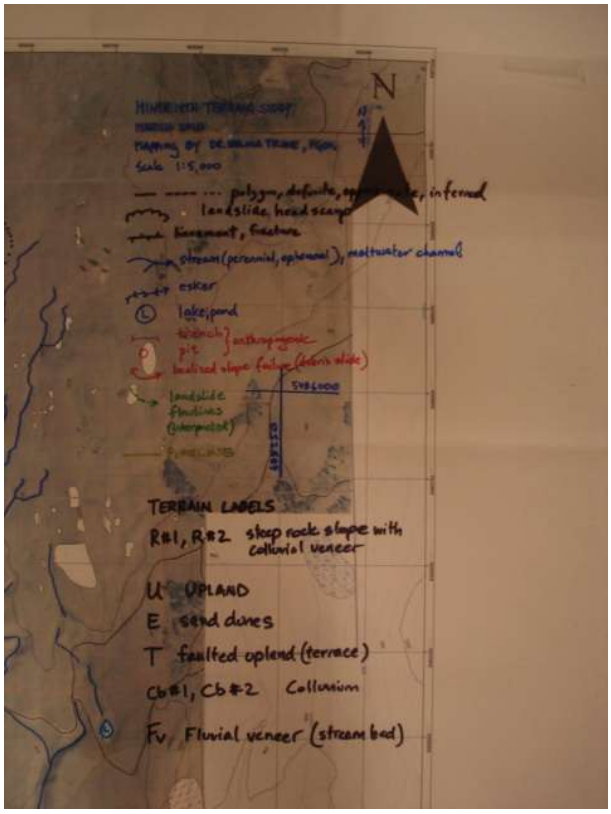


Figure 6. Terrain map legend.