

## PETROGRAPHIC REPORT

**CLIENT:** Trevor Burr, AngloGoldAshanti  
**PROJECT/PROPERTY:** CR STUDY  
**SAMPLE NUMBER:** CR-0001

**BY:** James R. Shannon, Ph.D.  
**SAMPLE TYPE:** Polished Thin Section  
**DATE:** 26-June 2017

**HAND SAMPLE DESCRIPTION:** Core from 49.80 m. Dark gray to black, very fine to medium grained biotite phyllite/schist with local small actinolite porphyroblasts. The sample is nonmagnetic with a pencil magnet. There is no effervescence with dilute HCl.

### POLISHED-SECTION DESCRIPTION:

MINERAL	EST %	COMMENTS
<b>METAMORPHIC</b>		Very fine to medium grained, mylonitic, phyllite/schist with irregularly distributed amphibole porphyroblasts; Amphibole porphyroblasts are lineated mostly parallel to biotite foliation; and locally folded(?)
<b>PORPHYROBLASTS</b>	<b>[6.0]</b>	Irregularly distributed amphibole and biotite porphyroblasts; suggestions of gneissic mineralogical and textural banding
Amphibole	4	Subhedral, elongated porphyroblasts up to 3 mm long
Biotite	0.5	Anhedral grains up to 0.7 mm; Elongated parallel to foliation
Plagioclase	0.5	Probable remnant 'phenocrysts' from protolith; Anhedral, blocky grains up to 1 mm; probably recrystallized
Chlorite	1.0	Subhedral grains up to 0.3 mm long oriented at high angle to biotite foliation and parallel to chlorite-carbonate microveinlets
<b>MATRIX</b>	<b>[86]</b>	Very fine grained moderately foliated biotite-plagioclase-quartz intergrowth; Difficult to estimate proportions of plagioclase and quartz
Plagioclase	35	Very fine grained (0.02-0.1 mm) mosaic intergrown with quartz and biotite
Quartz	30	Anhedral grains (up to 0.1) intergrown with plagioclase and biotite
Biotite	20	Anhedral, elongated grains intergrown with plagioclase and quartz
Amphibole	1	Minor amphibole intergrown with plagioclase and biotite
<b>ACCESSORY</b>	<b>[0.1]</b>	
Ilmenite	0.1	Disseminated subhedral grains up to 0.8 mm
Zircon	Tr	Trace subhedral-euhedral grains up to 0.1 mm
Apatite	Tr	Minor subhedral-anhedral grains up to 0.2 mm
<b>SULFIDES</b>	<b>[0.25]</b>	Minor disseminated pyrrhotite and chalcopyrite associated with biotite, plagioclase and quartz.
Pyrrhotite	0.2	Subhedral-anhedral grains up to 0.1 mm
Chalcopyrite	0.05	Anhedral disseminated grains up to 0.01 mm
<b>QUARTZ BANDS</b>	<b>8</b>	Quartz bands mostly slightly oblique to biotite foliation; Some look like metamorphic differentiation bands and some look like metamorphosed quartz veins

<b>VEINLETS</b>	[Tr]	
Chlorite-Carbonate	Tr	Hairline chlorite veinlet with local patches carbonate (dolomitic?)

## TEXTURES

The sample displays a very fine to medium grained, foliated phyllitic-schist texture with irregularly distributed amphibole and biotite porphyroblasts. Minor, larger plagioclase grains are probably relict phenocrysts. Actinolitic amphibole with green-bluegreen pleochroism occurs as subhedral, elongated porphyroblasts focused on a 1 mm thick quartz band. Quartz bands are recrystallized quartz mosaics that are mostly slightly oblique to the biotite foliation. They maybe be metamorphic mineralogical differentiation banding. However, some with straight parallel walls may be quartz veins. Weak biotite foliations cross these quartz veins suggesting they are pre-metamorphic.

The weak gneissic banding includes variations in the distribution of quartz, amphibole, plagioclase and biotite. Textural banding includes the irregular development of amphibole porphyroblasts and stronger foliation in biotite-rich layers. The incipient gneissic banding is slightly oblique to biotite foliation suggesting it may have developed during the earlier amphibolite facies metamorphism.

The matrix consists of a moderately foliated biotite-plagioclase-quartz intergrown with minor amphibole. Biotite does not appear to replace amphibole. The moderately foliated biotite was associated with penetrative deformation. The matrix contains accessory disseminated ilmenite and trace apatite and zircon.

Minor mineralization includes disseminated pyrrhotite and chalcopyrite. They are generally associated with biotite, plagioclase and quartz and were probably introduced or remobilized during metamorphism.

## METAMORPHISM

The sample appears to be completely recrystallized. The metamorphic assemblages and textures are complicated. The metamorphic mineral assemblage of actinolitic amphibole-biotite-plagioclase-quartz suggests a medium grade metamorphism equivalent to amphibolite facies. Biotite is moderately foliated. Actinolitic amphibole is mostly lineated and oriented parallel to biotite foliation. Locally amphibole porphyroblasts show unusual orientations that suggest relict microfolds. This suggests there may have been an earlier amphibolite facies metamorphic event largely destroyed by a younger (slightly lower grade?) amphibolite facies metamorphic event.

The chlorite that is oriented at a high angle to biotite foliations does not appear to replace amphibole or biotite. Elongated chlorite grains are oriented parallel to an irregular set of very fine chlorite-carbonate microveinlets. These relations suggest the chlorite formed during a later, superimposed or retrograde metamorphic event.

In summary, this sample shows evidence of an early amphibolite facies metamorphism that developed incipient gneissic banding and amphibole porphyroblasts. There was possible microfolding during this event. A second, slightly lower amphibolite grade metamorphism appears to have developed a penetrative foliation superimposed on the incipient gneiss banding. A third retrograde or metamorphic over print formed minor chlorite that is oriented at a high angle to biotite foliations.

**ROCK NAME: Biotite-Actinolite Gneissic Phyllitic Schist**

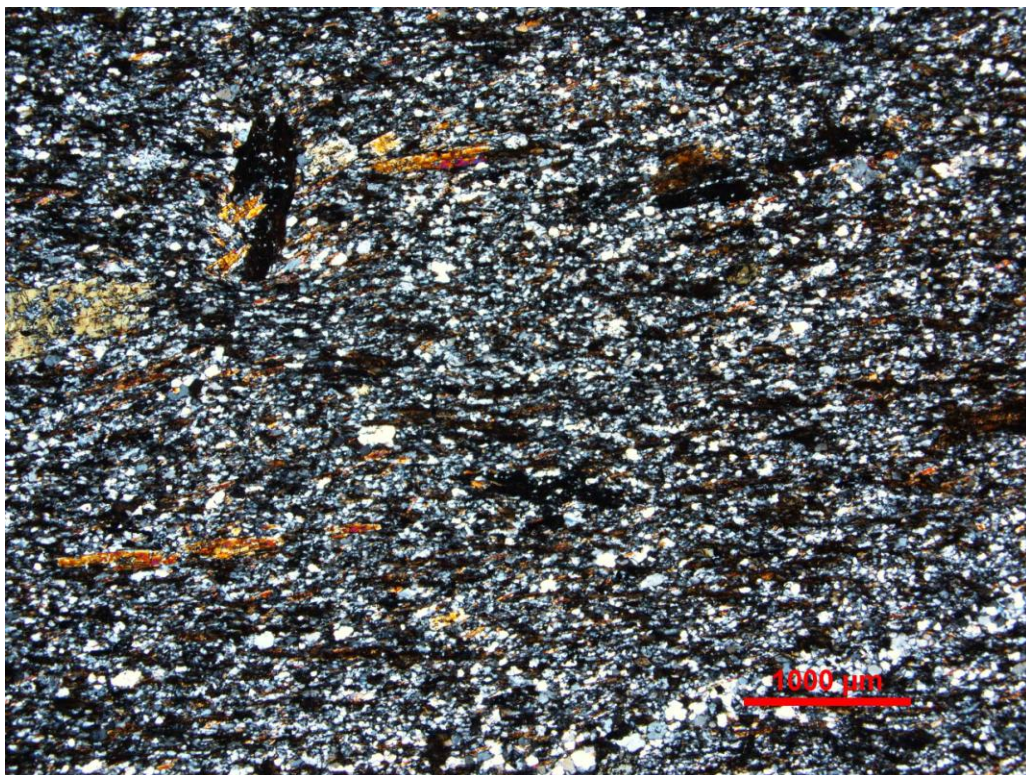
**PROTOLITH: Uncertain protolith; Mineralogical composition suggests felsic rock; Relict plagioclase grains may support porphyritic igneous rock**





Sample CR-0001. Wide-field, full thinsection view showing very fine grained biotite phyllite/schist with localized amphibole porphyroblasts. Note suggestion of incipient gneissic banding. Top- plane light; Bottom- crossed polarizers.





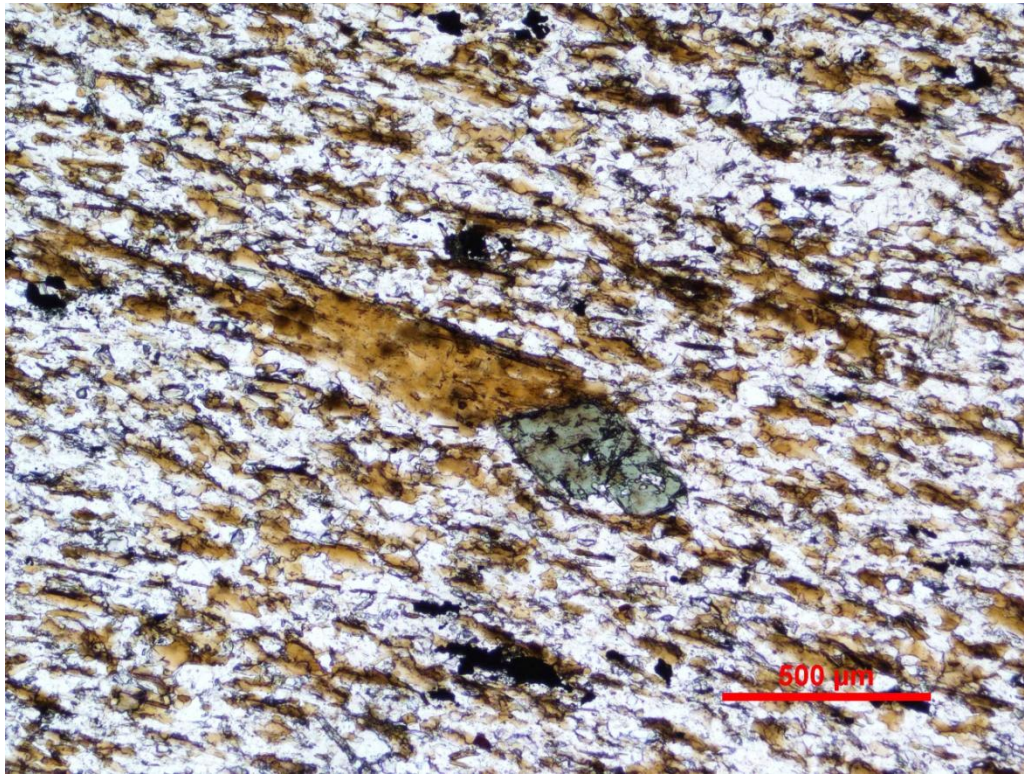
Sample CR-0001. Moderately foliated biotite phyllite/schist with amphibole and biotite porphyroblasts. Note local deflection of amphibole porphyroblasts. Top- plane light; Bottom- crossed polarizers.



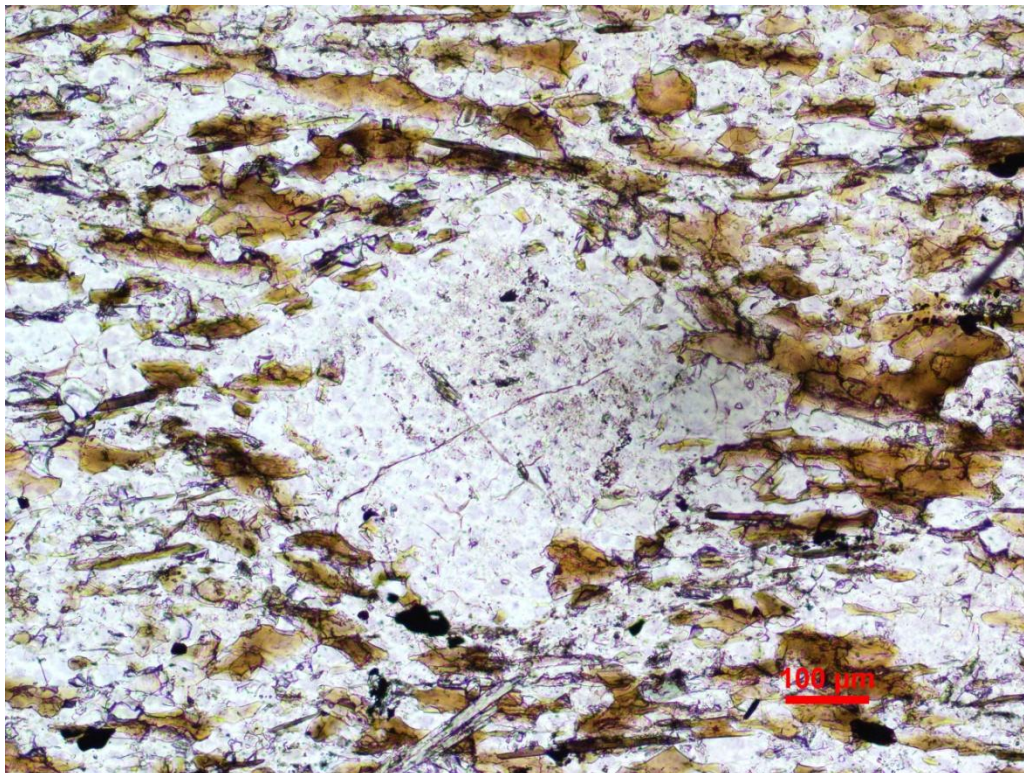


Sample CR-0001. Relict(?) fold forms in amphibole porphyroblasts. Top- plane light; Bottom- crossed polarizers.

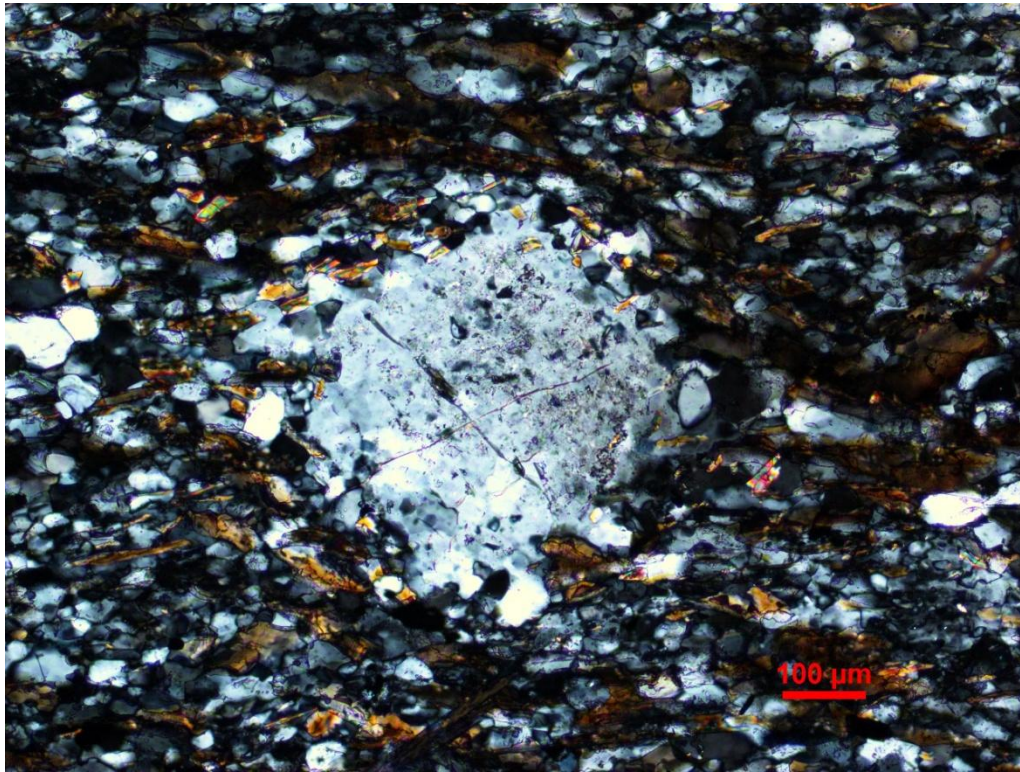




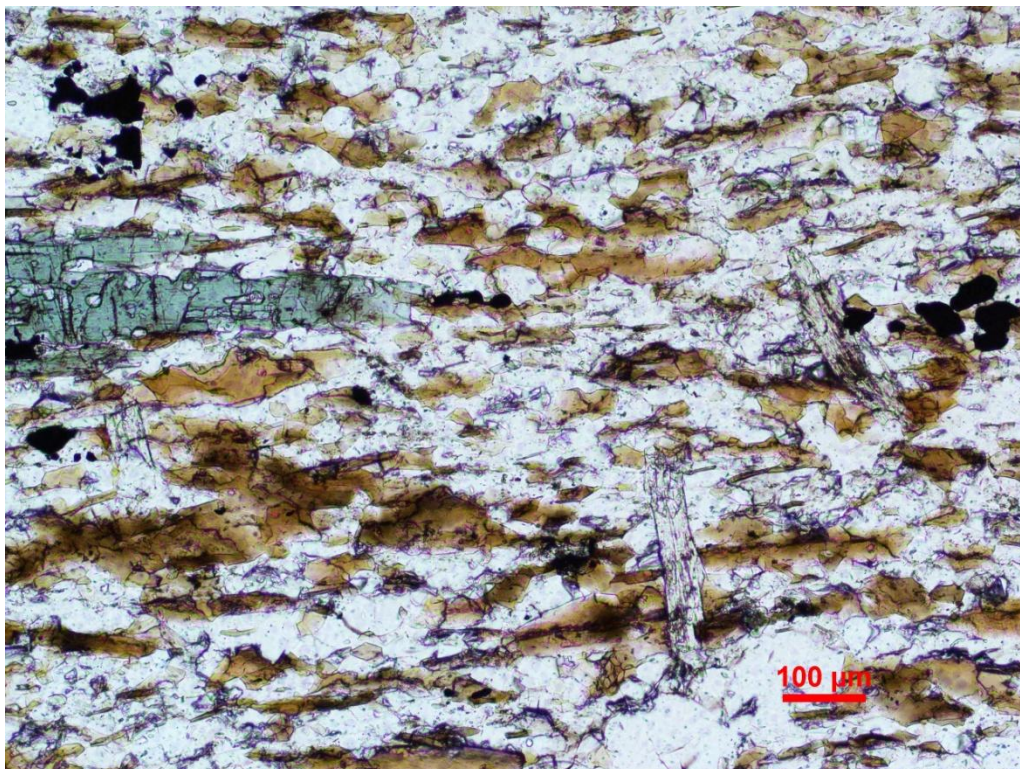
Sample CR-0001. Biotite and amphibole porphyroblasts in very fine grained, foliated plagioclase rich biotite phyllite/schist. Plane light.





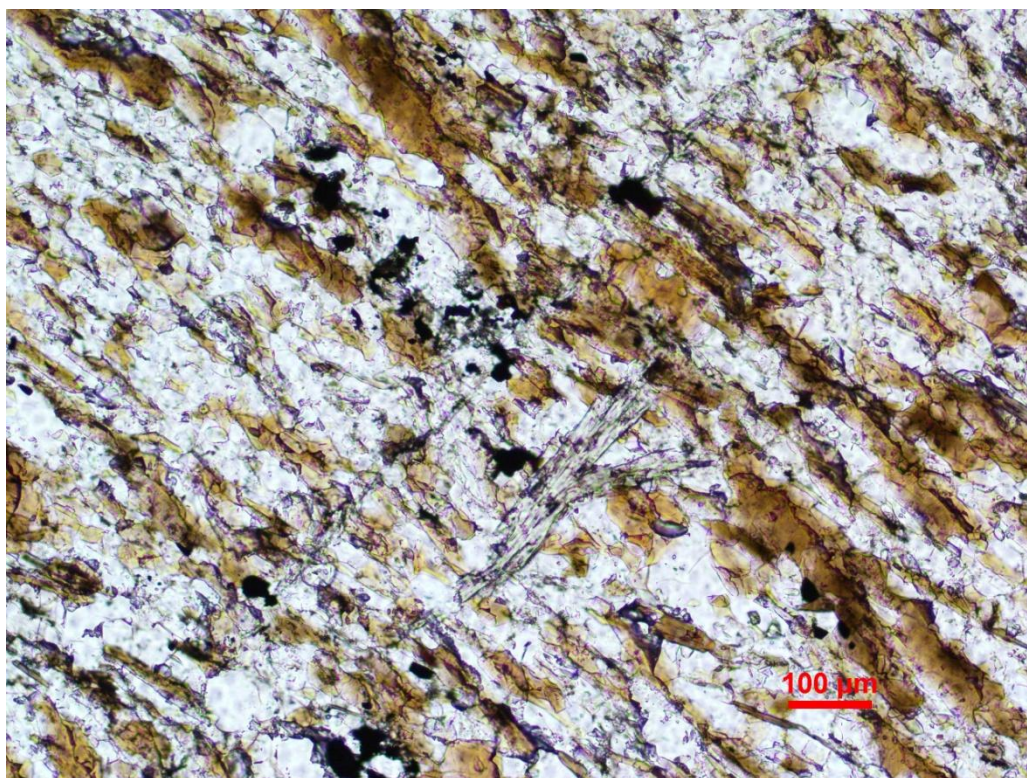


Sample CR-0001. Relict plagioclase phenocryst(?). Top- plane light; Bottom- crossed polarizers.



Sample CR-0001. Disseminated chlorite grains elongated perpendicular to biotite foliation and amphibole lineation. Plane light.

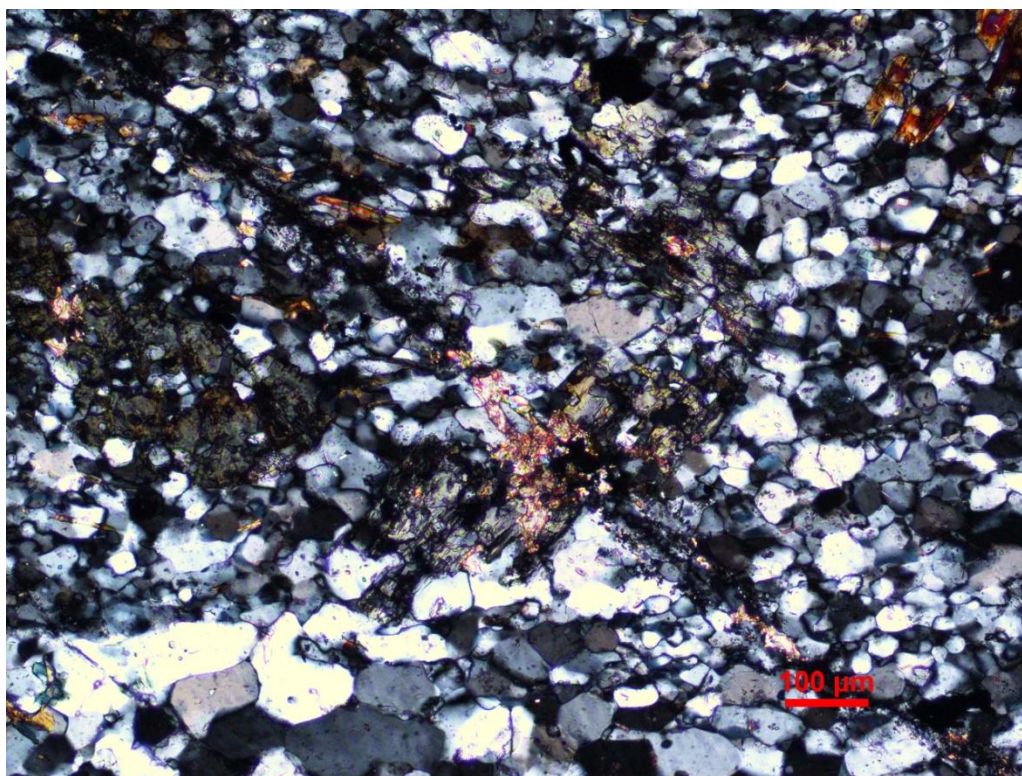




Sample CR-0001. Disseminated, elongated chlorite grain parallels chlorite veinlet, both perpendicular to biotite foliation. Plane light.





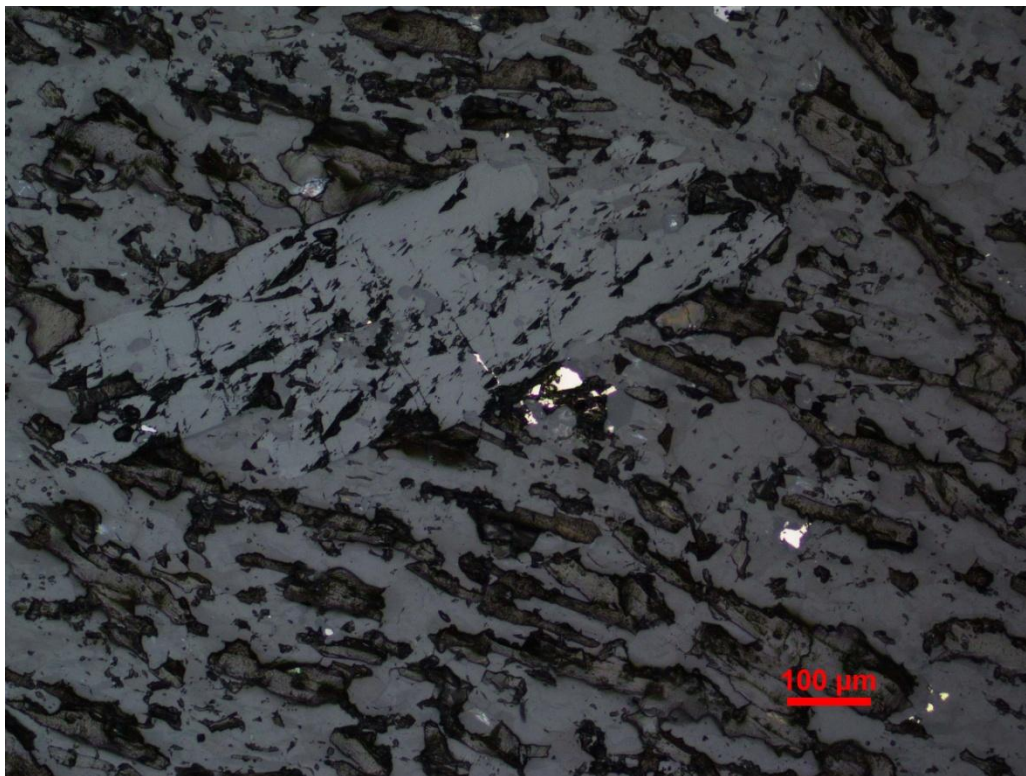
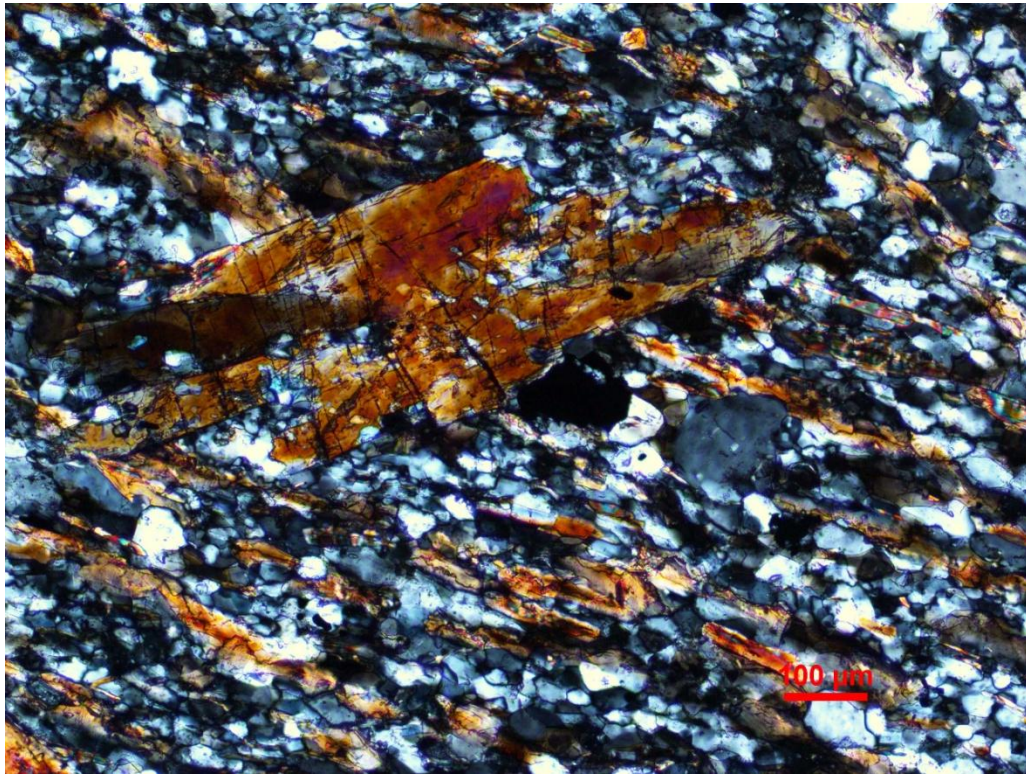


Sample CR-0001. Chlorite grain elongated parallel to chlorite-carbonate veinlet cutting biotite foliation at oblique angle. Top- plane light; Bottom- crossed polarizers.



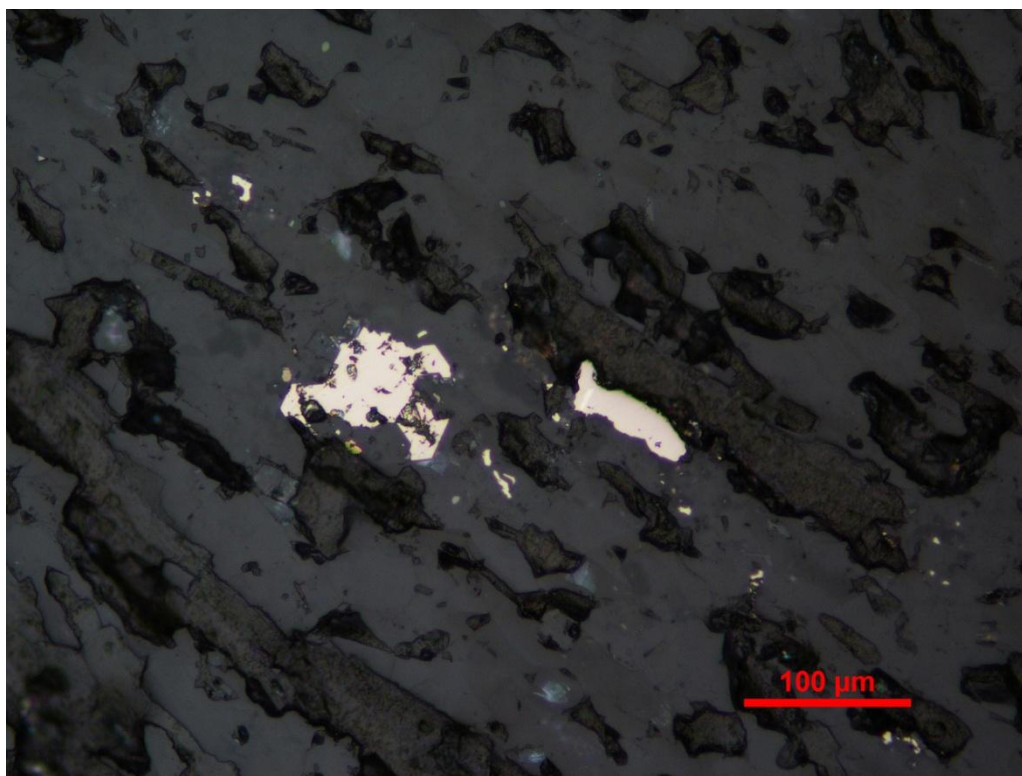
Sample CR-0001. Biotite foliation superimposed across quartz veinlet. Plane light.



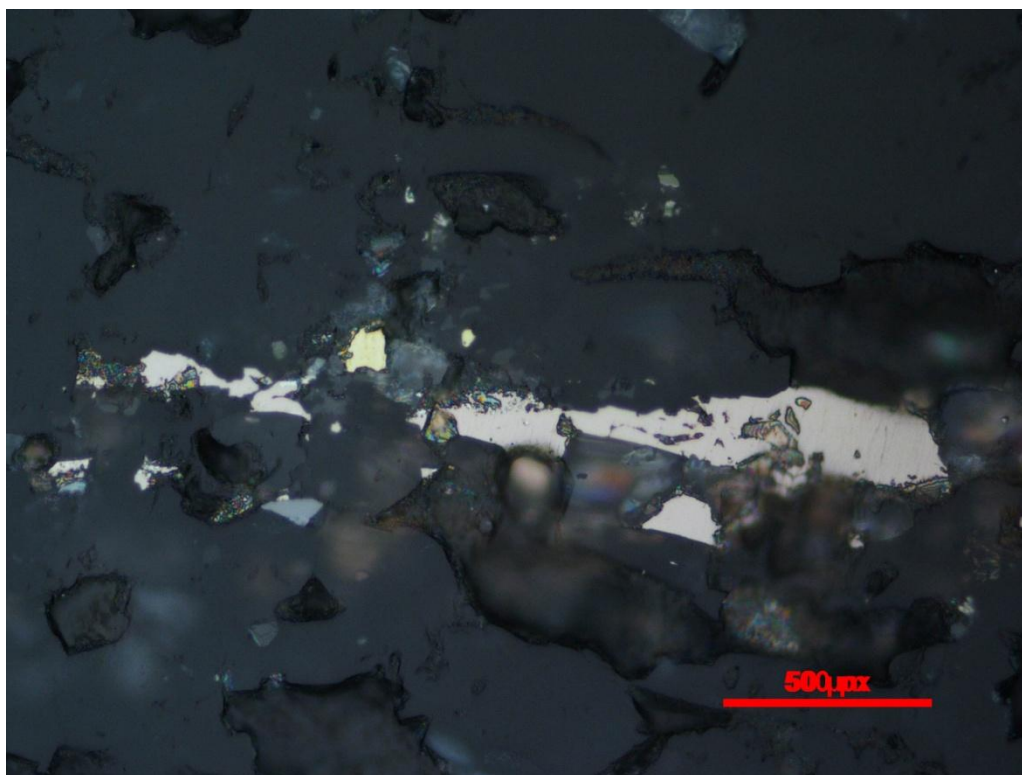


Sample CR-0001. Disseminated pyrrhotite and remobilized pyrrhotite along fracture in amphibole porphyroblast. Top- crossed polarizers; Bottom- reflected light.





Sample CR-0001. Disseminated pyrrhotite (pinkish) associated with biotite, plagioclase, and quartz. Reflected light.



Sample CR-0001. Disseminated pyrrhotite (pinkish) and chalcopyrite (yellow) associated with biotite and plagioclase-quartz. Reflected light.