

PETROGRAPHIC REPORT

CLIENT: Trevor Burr, AngloGoldAshanti
PROJECT/PROPERTY: CR STUDY
SAMPLE NUMBER: 863669

BY: James R. Shannon, Ph.D.
SAMPLE TYPE: Polished Thin Section
DATE: 19-July 2017

HAND SAMPLE DESCRIPTION: Medium gray with dark bluish black tourmaline spots, very fine to coarse grained rock. Unknown, hard, purplish gray, elongated phase with spots of radiating tourmaline crystals. The sample is nonmagnetic with a pencil magnet and has moderate effervescence in spots with dilute HCl.

POLISHED-SECTION DESCRIPTION:

MINERAL	EST %	COMMENTS
METAMOPRHIC	[73]	Probable contact metamorphic assemblage with very fine to coarse axinite, quartz, carbonate and sphene
Axinite(?)	67	Subhedral, elongated crystals up to 9 mm; Biaxial (-); 2V~80; Colorless; Mod-high relief; Inclined extinction; Simple twinning
Quartz	5	Anhedral, interstitial patches up to 2 mm with euhedral axinite crystal inclusions
Carbonate	1	Anhedral, interstitial patches locally with sphene
Sphene	0.3	Anhedral sphene grains associated with carbonate 'pockets'
ALTERATION	(20)	Patchy tourmaline-epidote-carbonate alteration associated with irregular microveinlets of epidote-carbonate; Mainly as replacement halos on veinlets
Tourmaline	8	Subhedral, elongated, locally radiating, crystals (up to 6 mm) with strong bluish pleochroism; Uniaxial (-); Zoned; Replaces axinite
Epidote	5	Anhedral, patchy grains associated with carbonate and tourmaline
Carbonate	5	Anhedral patches and veinlets; associated with epidote and tourmaline; Locally replaces epidote
Quartz	1	Minor anhedral quartz
Chlorite	1	Small, irregular patches of chlorite; Locally replaces epidote
Hematite	Tr	Minor hematite replaces disseminated pyrite
VEINLETS	(7)	
Epidote-Carbonate	3	Thin irregular veinlets with patchy epidote-tourmaline-carbonate replacement halos
Qtz-Carb-Epid?	4	Edge of thick (+7 mm) vein with remnant bladed carbonate and epidote
Quartz	0.5	
SULFIDE	(Tr)	Trace remnants of disseminated sulfide
Chalcopyrite	Tr	Trace anhedral grains (up to 0.02 mm) as inclusions in carbonate and tourmaline
Pyrite	Tr	Trace relict pyrite replaced by hematite

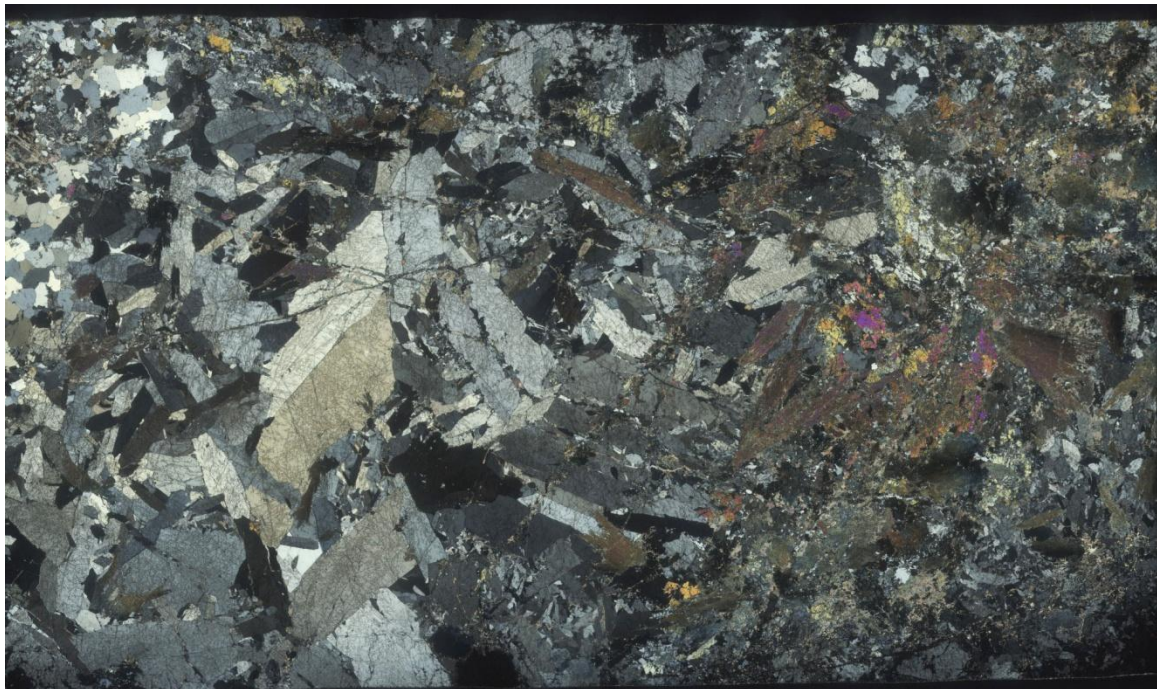
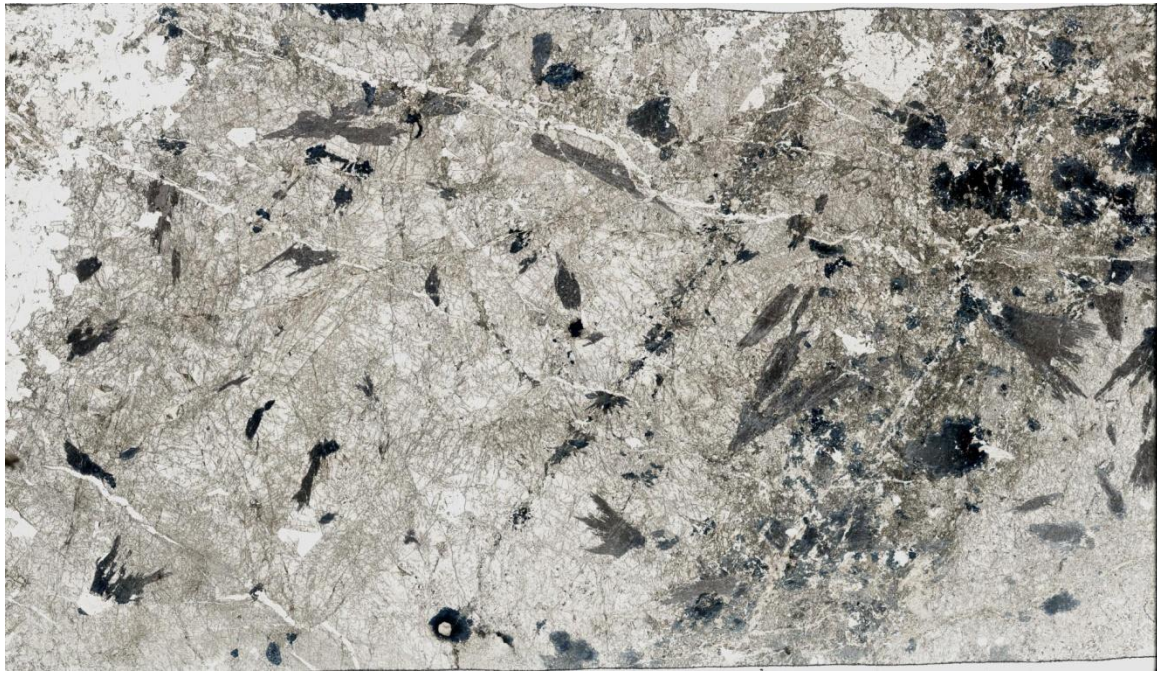
TEXTURES

The sample consists of an unusual, very fine to coarse grained, mosaic intergrowth of subhedral, elongated axinite crystals. Axinite is a complex boro-alumino-silicate that is usually associated with contact metamorphosed carbonate rocks. The axinite is locally intergrown with quartz and carbonate-sphene. The quartz and carbonate occur as irregular, interstitial 'pockets' lined with euhedral axinite. The interstitial 'pockets' are associated with finer-grained, euhedral-subhedral axinite. The axinite occurs as almost monomineralic intergrowth.

The axinite-rich rock has an apparent alteration overprint that is associated with irregular microveinlets. Earlier epidote-carbonate veinlets have irregular replacement halos with patchy tourmaline, epidote and carbonate. Tourmaline forms radiating growths that replace axinite. A thicker vein of quartz-carbonate-epidote may be associated with the early veins. There is a second set of later quartz veinlets at high angle to the earlier veinlets that cut tourmaline crystals.

**ROCK NAME: Axinite-Quartz-Carbonate Contact Metamorphic Assemblage With
Tourmaline-Epidote-Quartz-Carbonate Alteration Overprint**

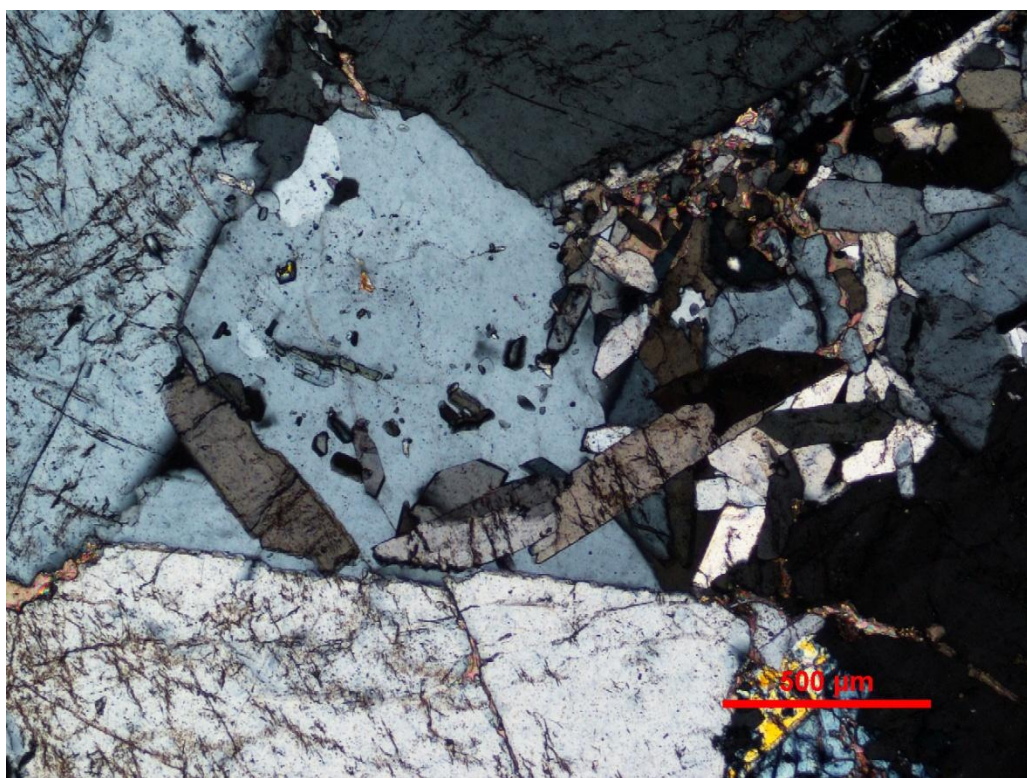
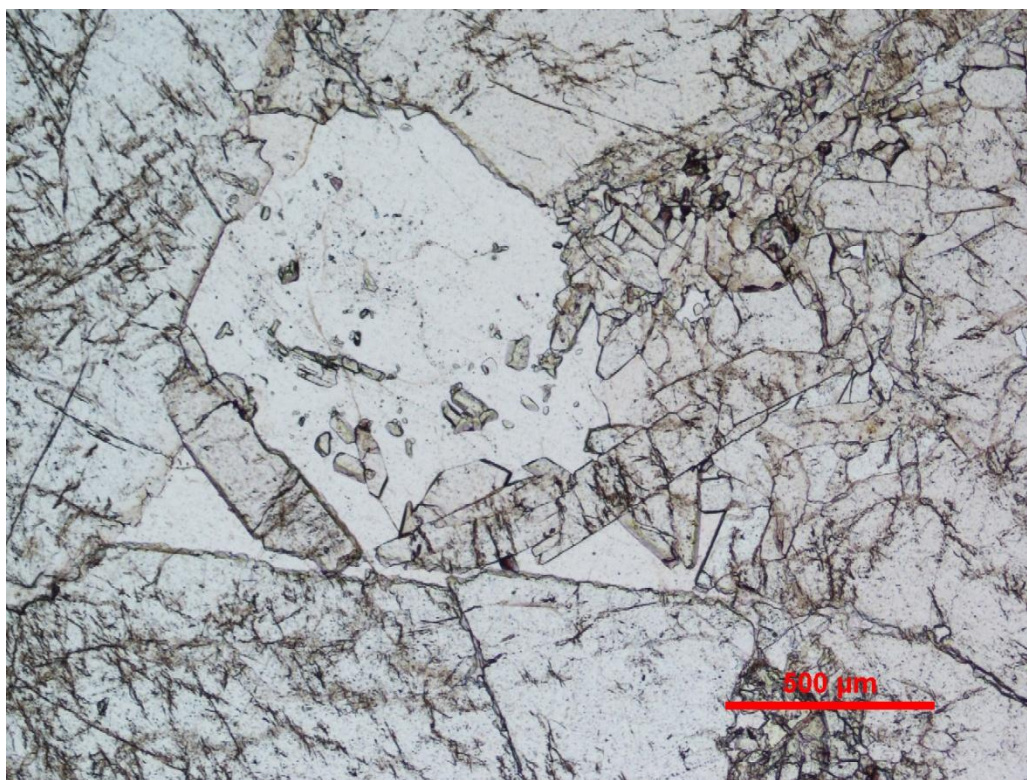
PROTOLITH: Probable Contact-Metamorphosed Carbonate Rock



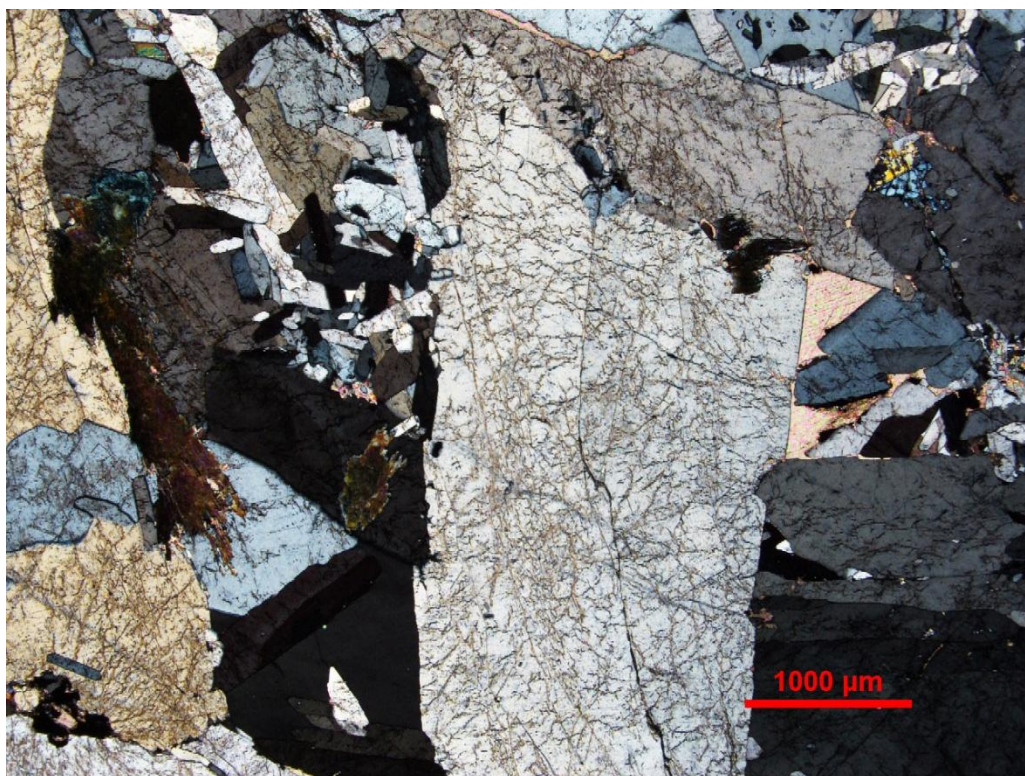
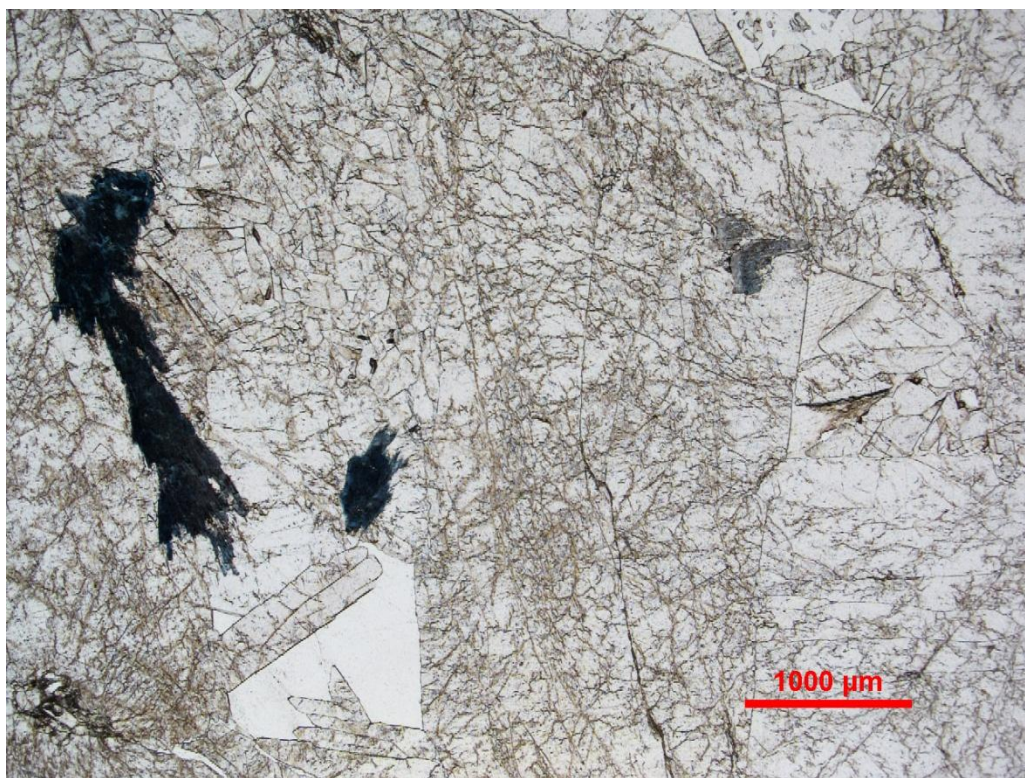
Sample 863669. Wide-field, full-thinsection view showing nearly monomineralic axinite mosaic cut by irregular veinlets of epidote-carbonate with patchy halos with tourmaline, epidote and carbonate. Top- plane light; Bottom- crossed polarizers.



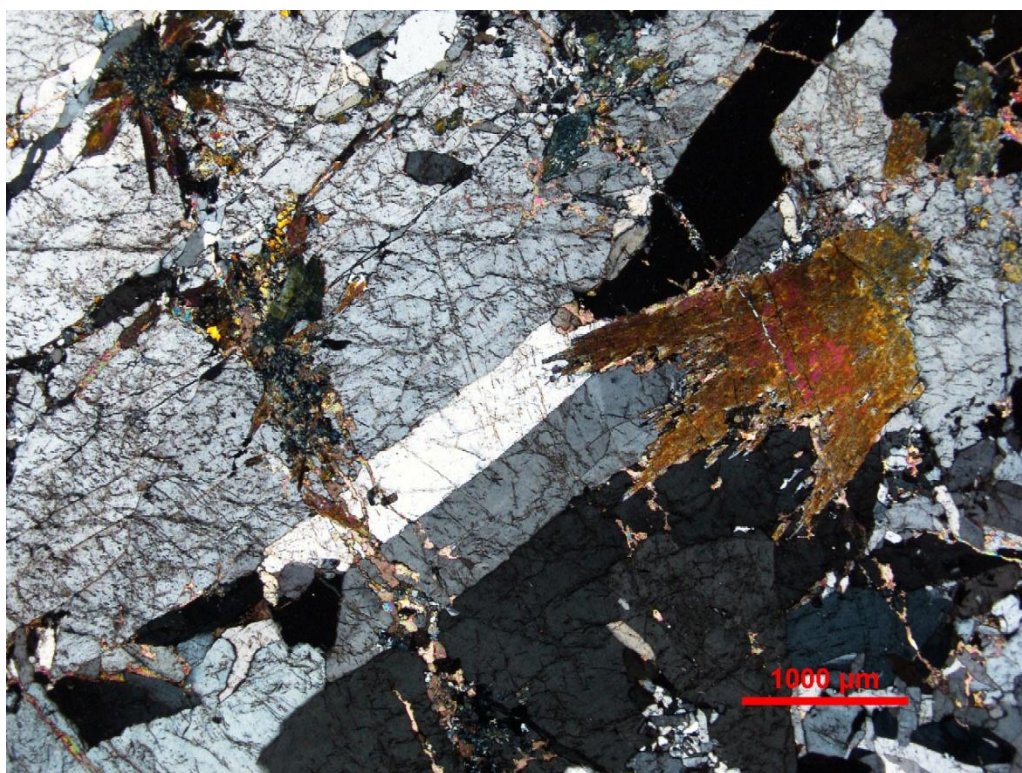
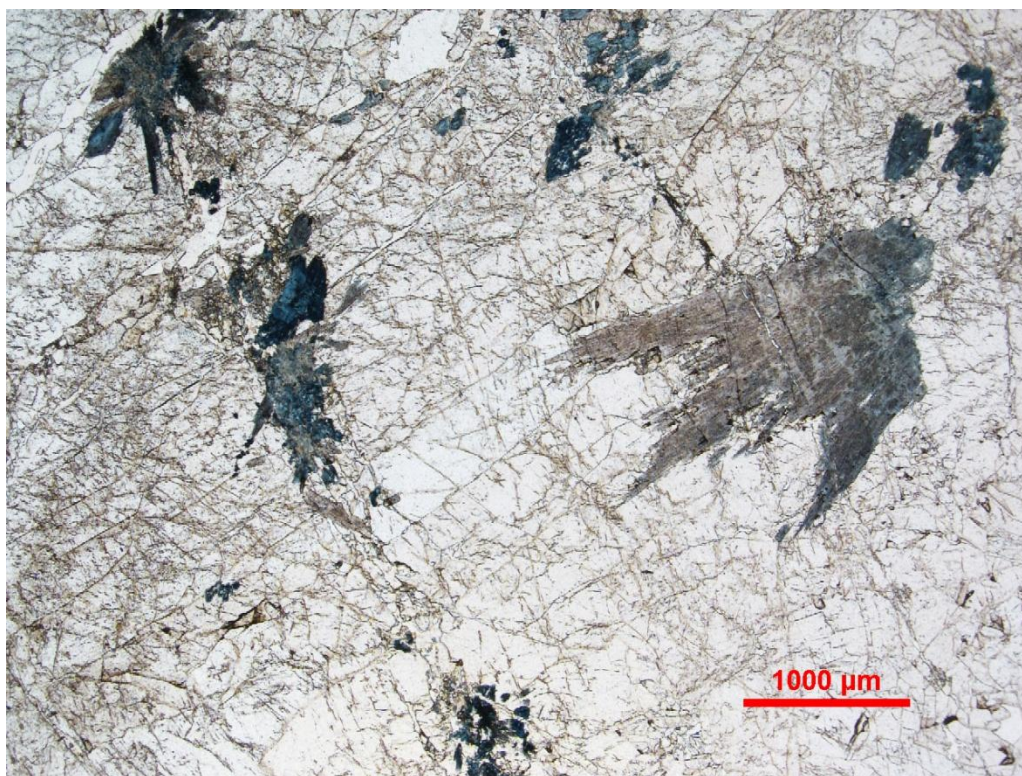
Sample 863669. Coarse, subhedral, elongated axinite(?) grains with strong internal fracturing. Top- plane light; Bottom- crossed polarizers.



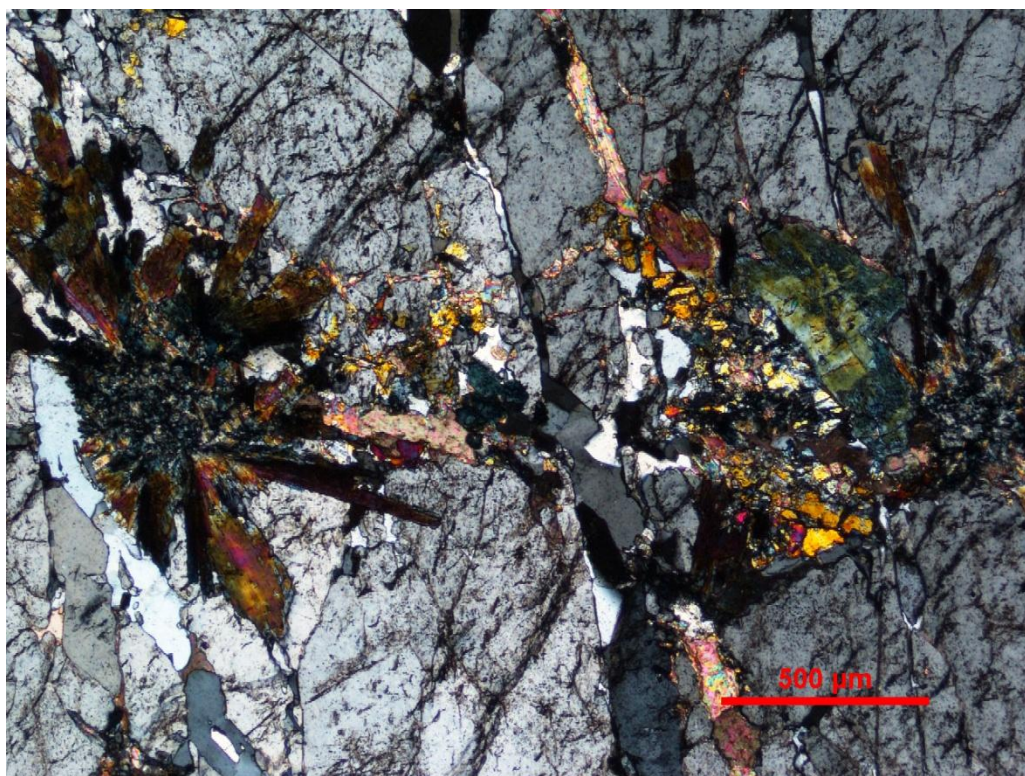
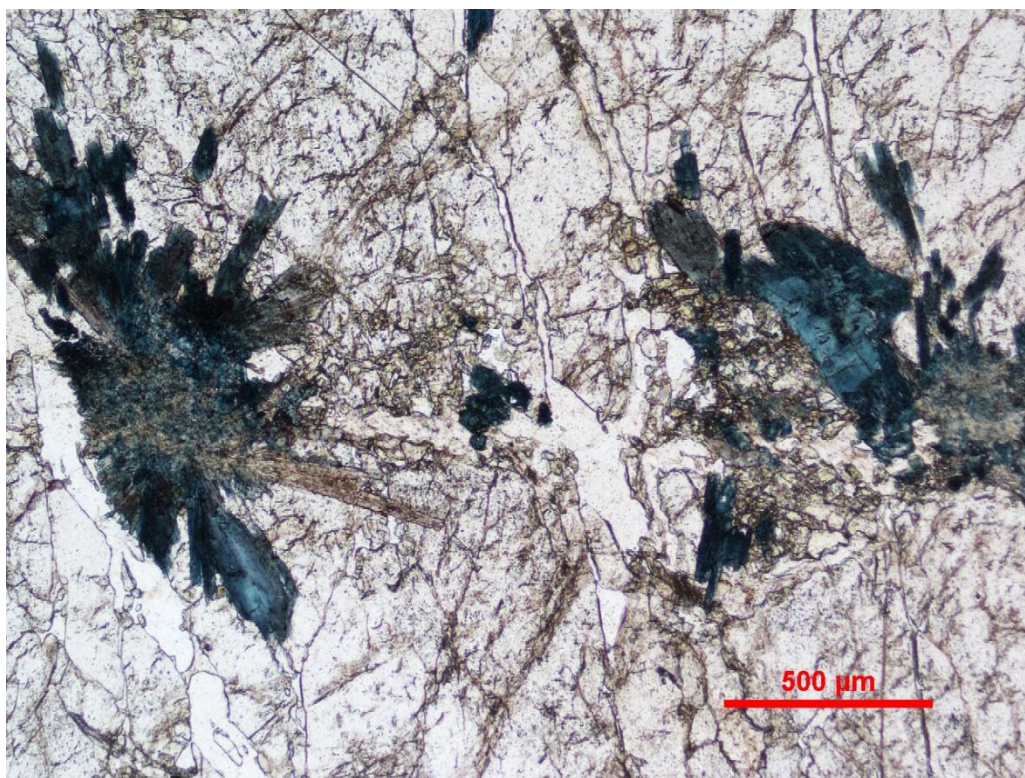
Sample 863669. Finer, euhedral axinite crystals associated with interstitial quartz 'pockets'. Top-plane light; Bottom- crossed polarizers.



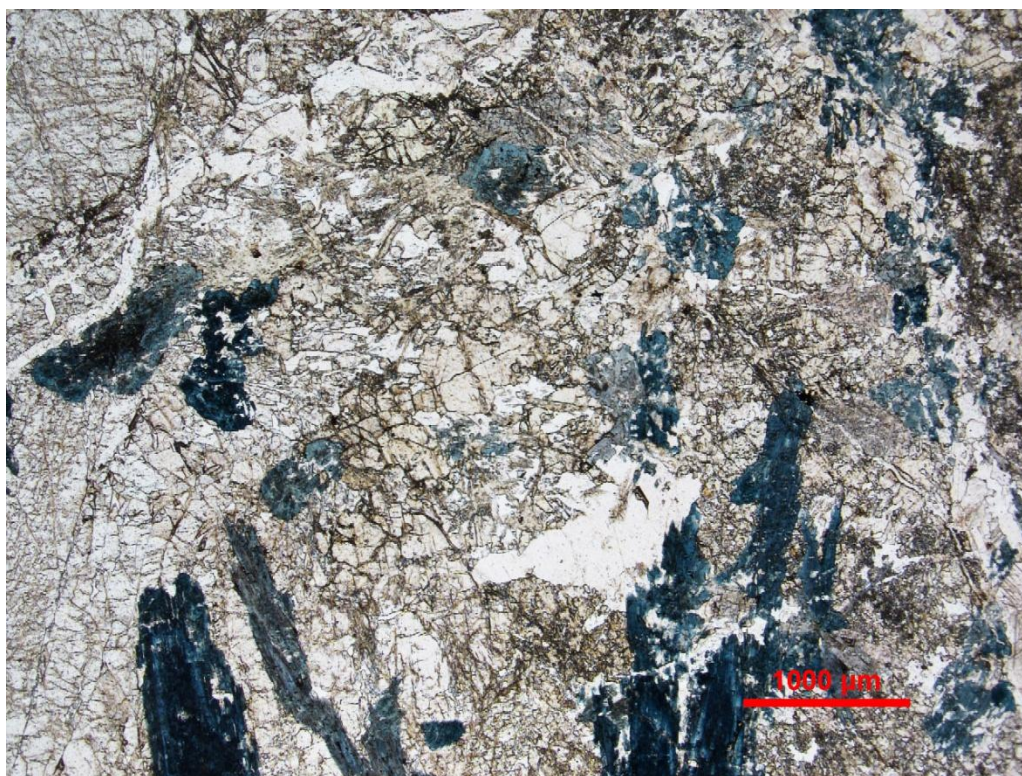
Sample 863669. Fine grained, euhedral axinite associated with quartz and carbonate interstitial 'pockets'. Top- plane light; Bottom- crossed polarizers.



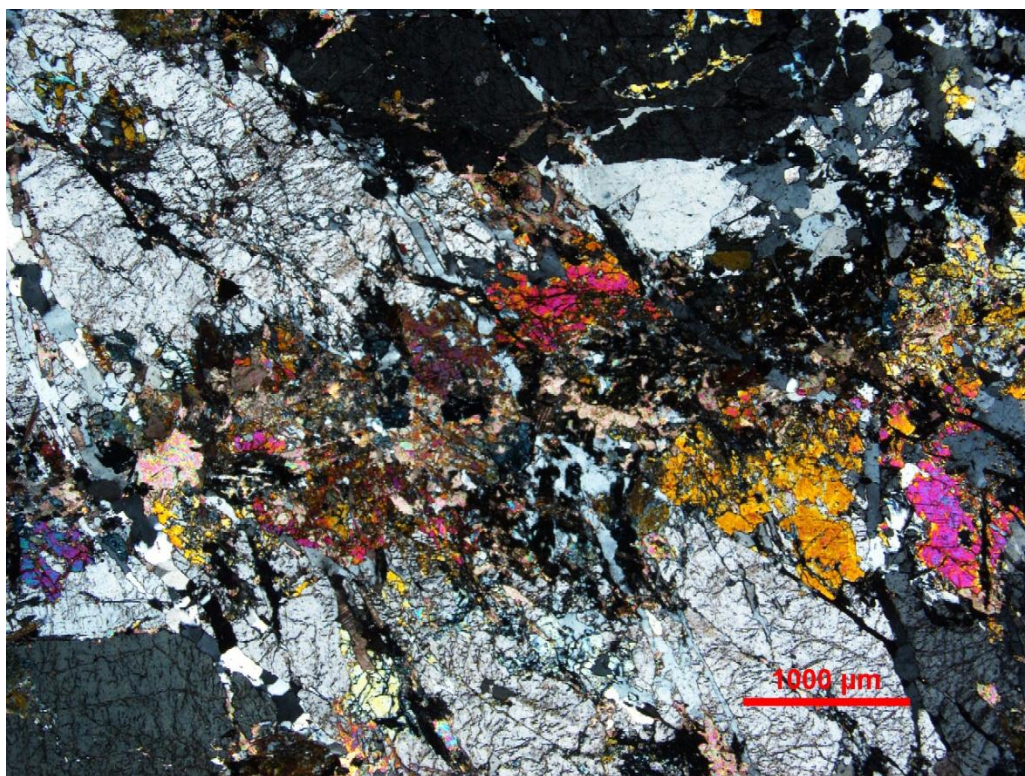
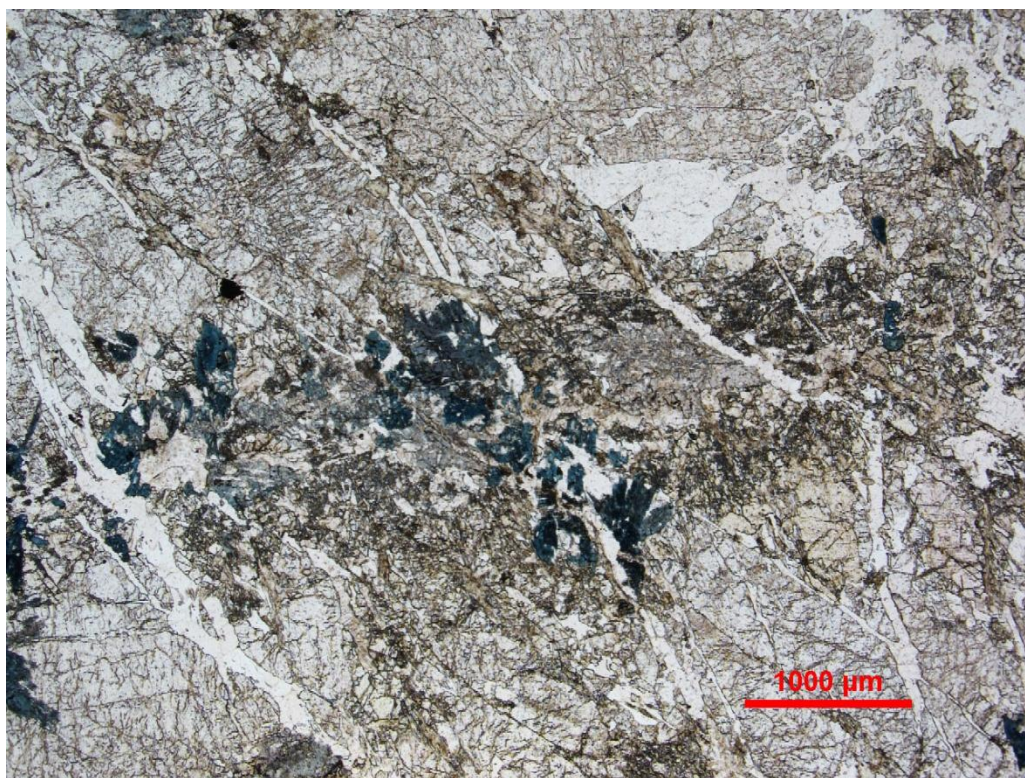
Sample 863669. Bluegreen tourmaline introduced along carbonate-epidote and quartz veinlets cutting axinite. Top- plane light; Bottom- crossed polarizers.



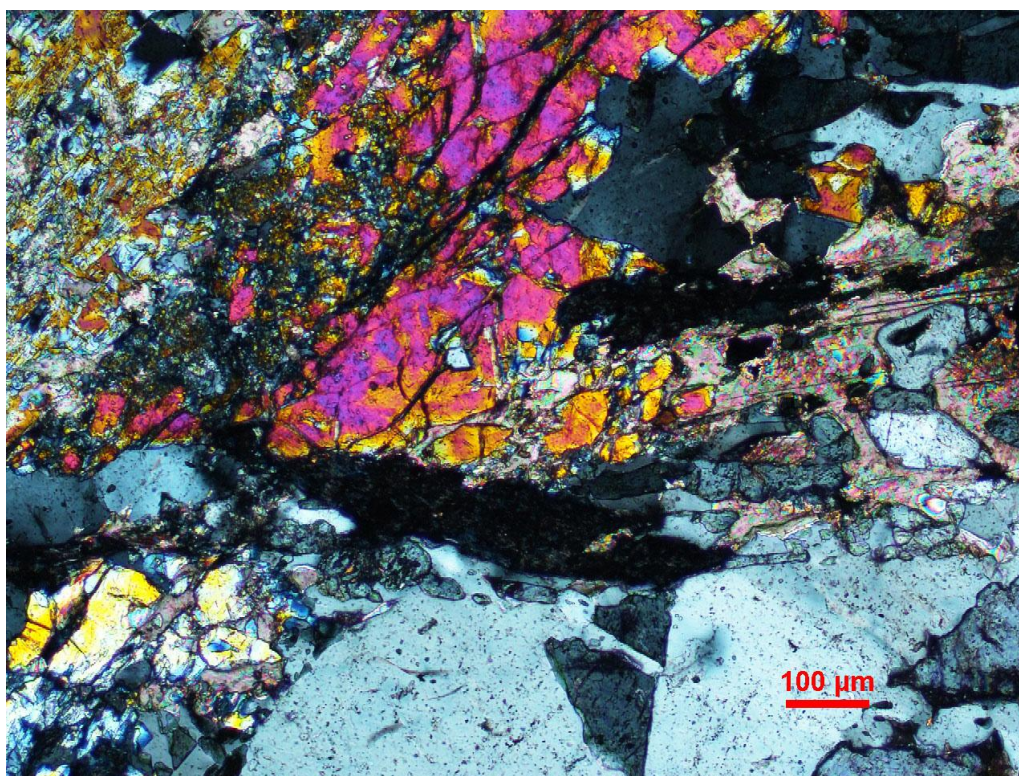
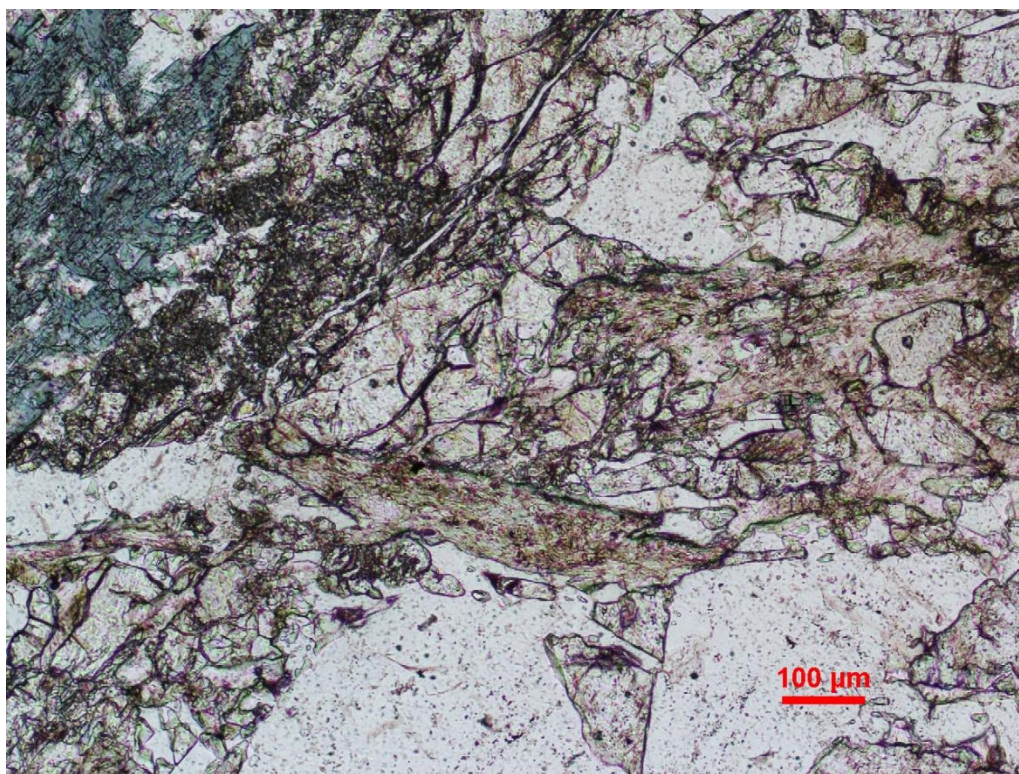
Sample 863669. Close up from above (upper left) showing radiating rosettes of bluegreen tourmaline replacing axinite. Top- plane light; Bottom- crossed polarizers.

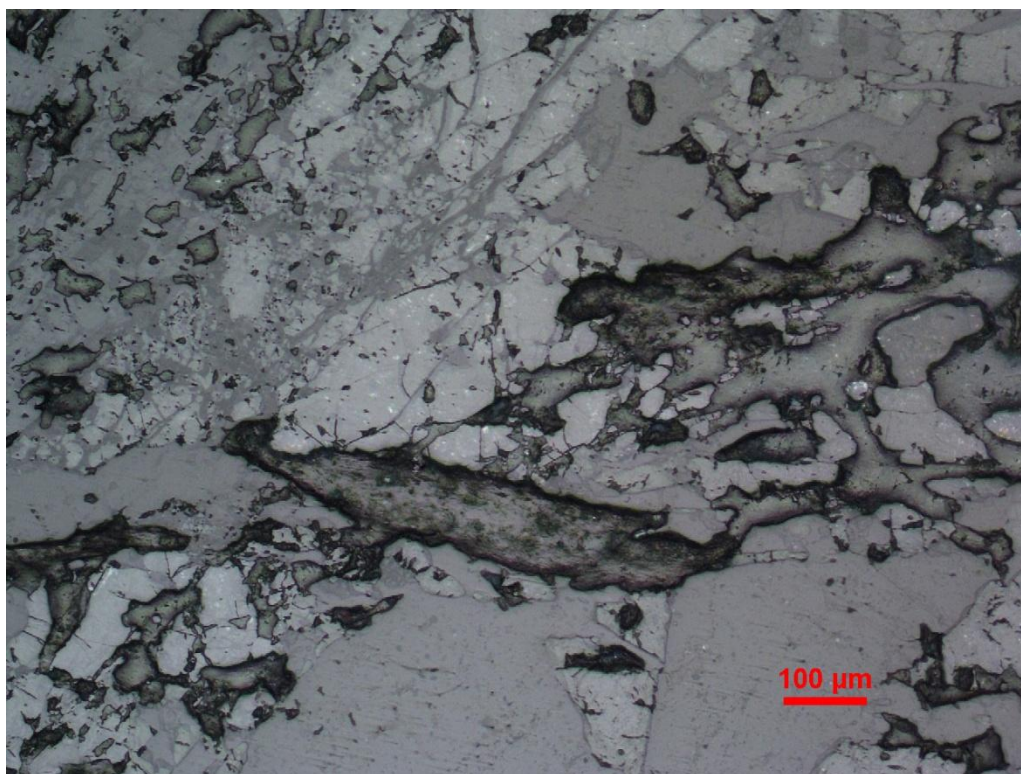


Sample 863669. Main band of epidote-tourmaline-carbonate-quartz alteration cutting axinite.
Top- plane light; Bottom- crossed polarizers.

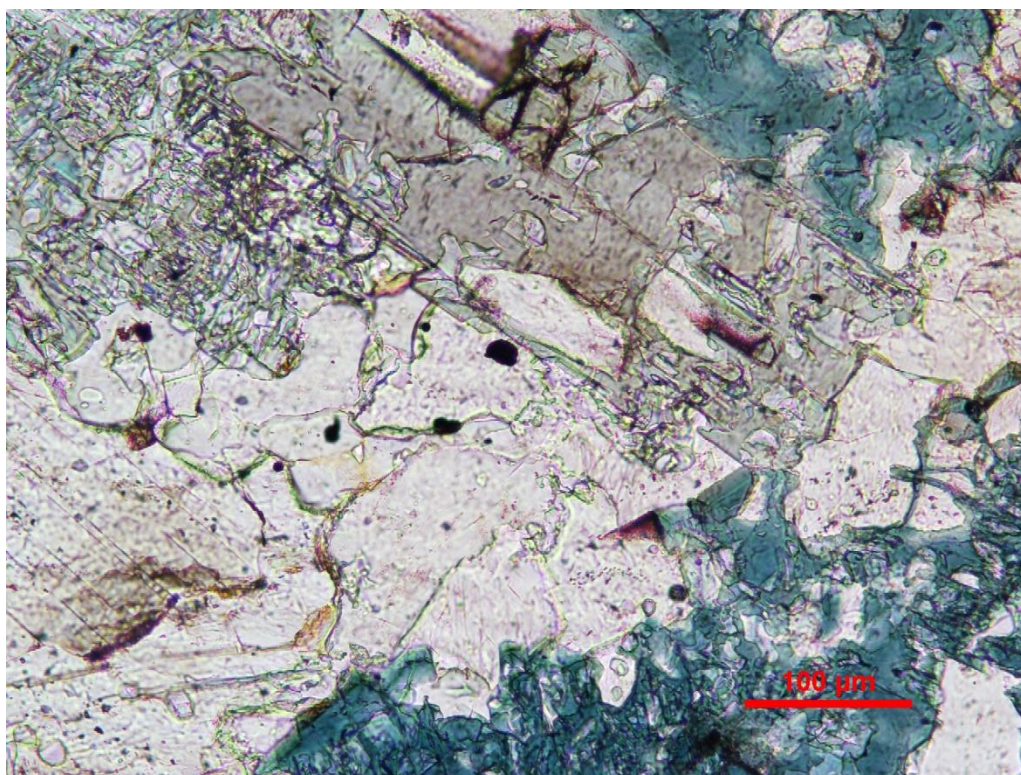


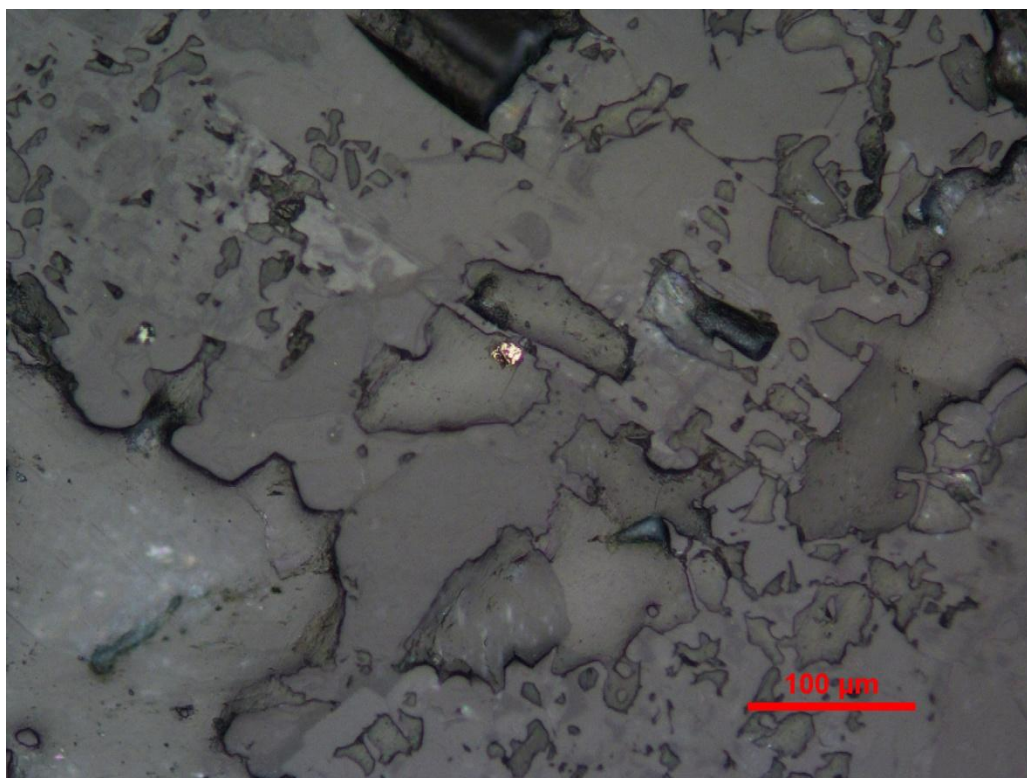
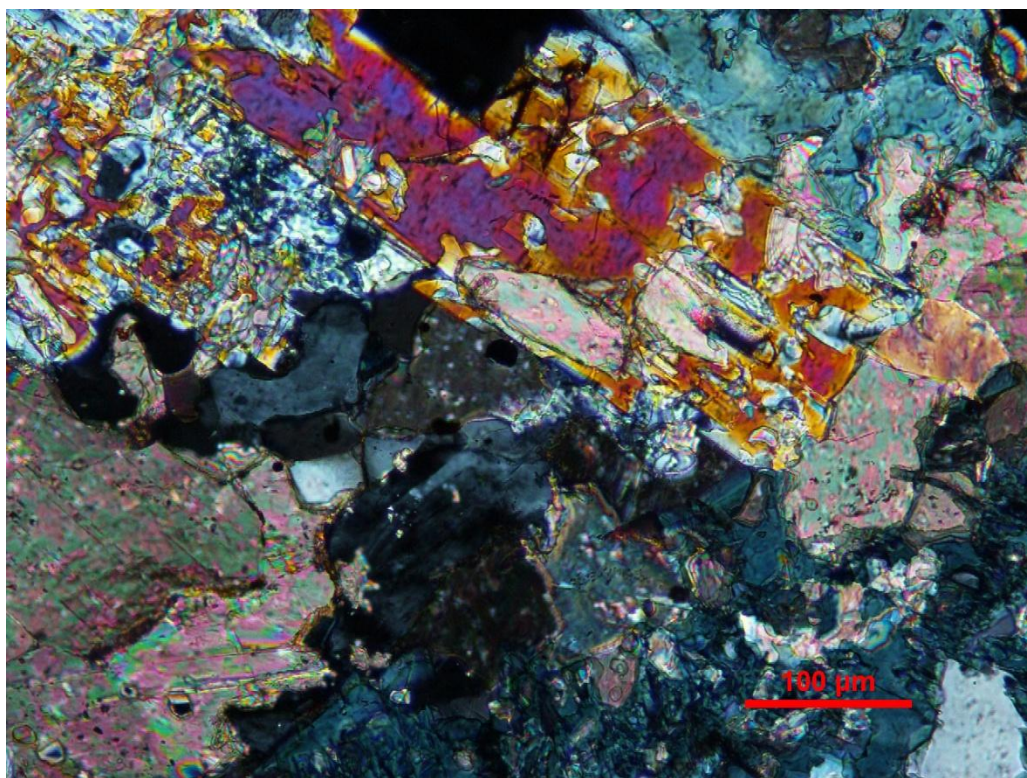
Sample 863669. Set of irregular quartz veinlets cutting across epidote-tourmaline-carbonate alteration band. Top- plane light; Bottom- crossed polarizers.



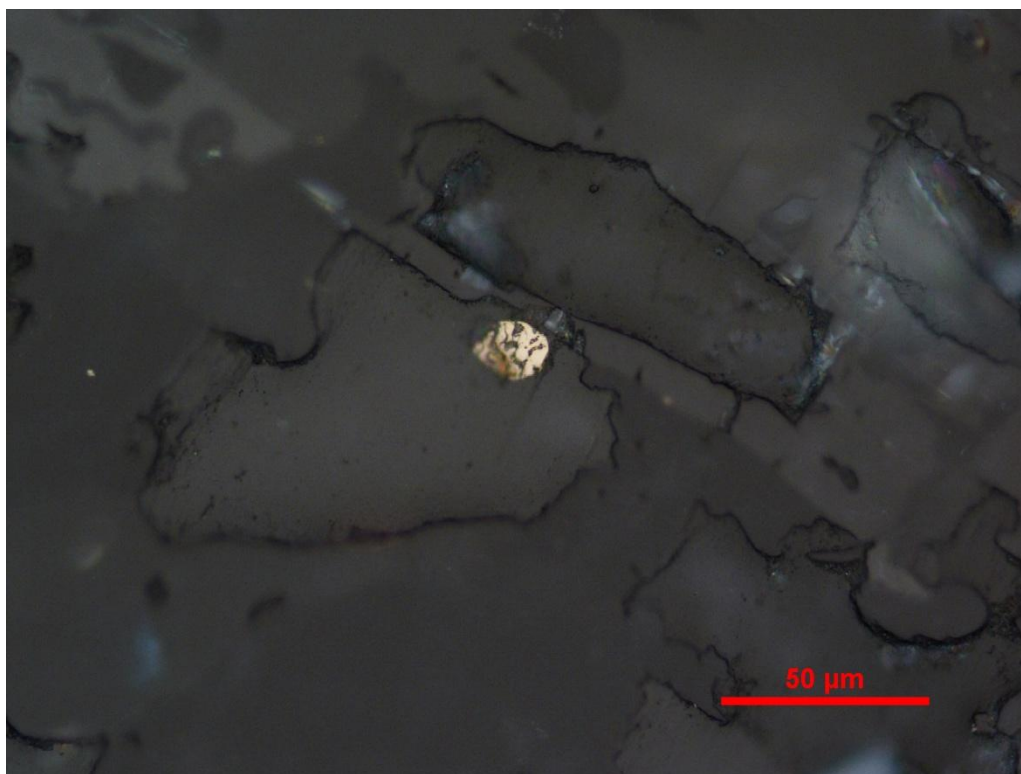


Sample 863669. Patches of low-reflectivity chlorite associated with epidote-carbonate. Top- plane light; Middle- crossed polarizers; Bottom- reflected light.

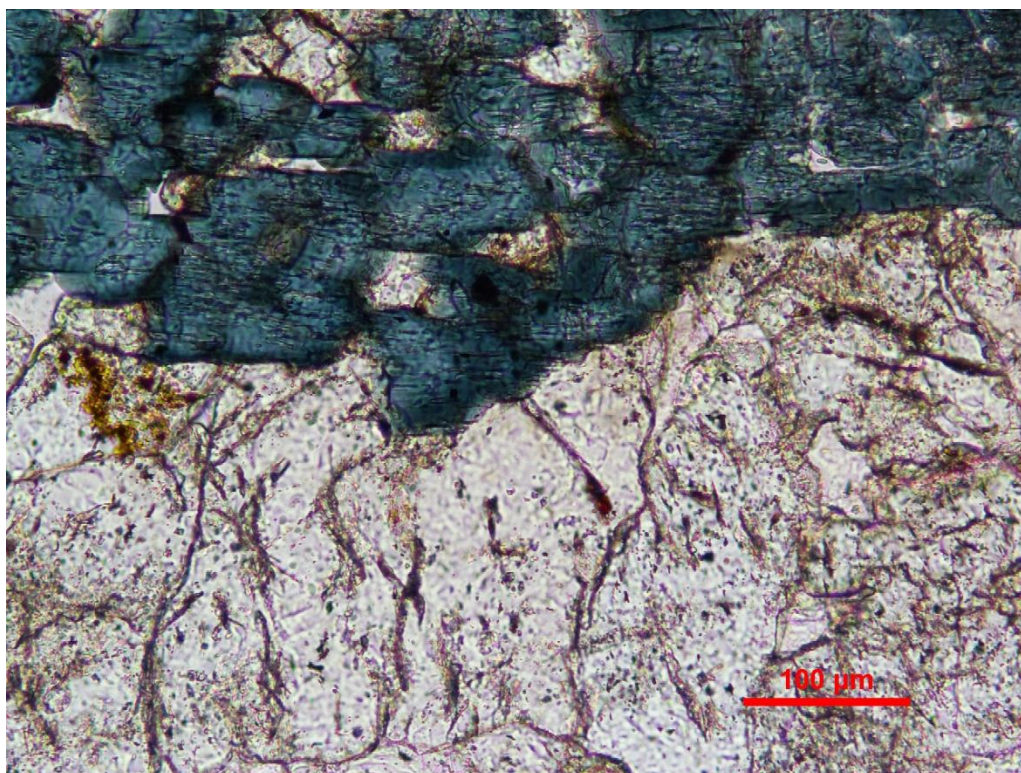


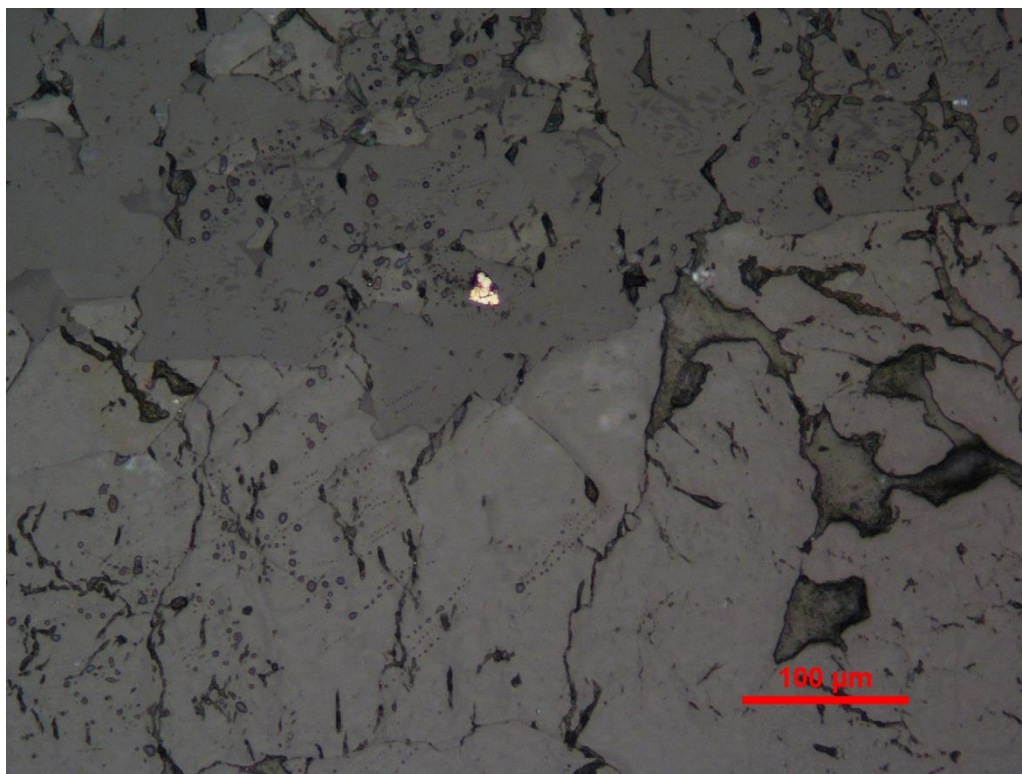
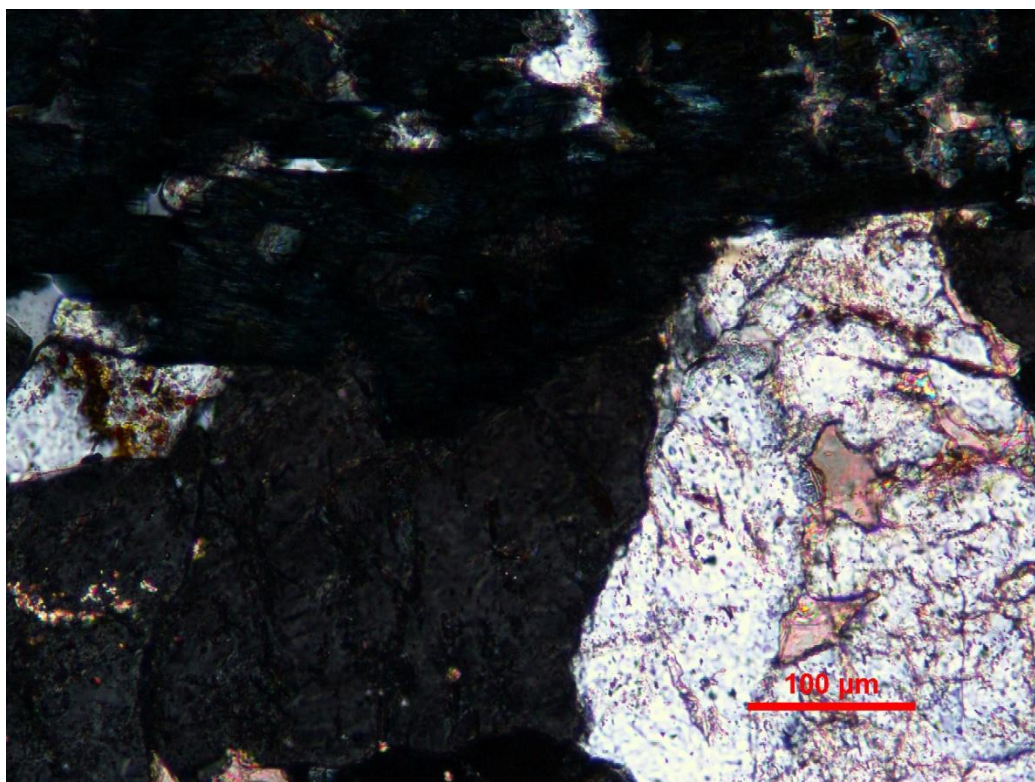


Sample 863669. Tiny chalcopyrite inclusion in carbonate. Top- plane light; Middle- crossed polarizers; Bottom- reflected light.

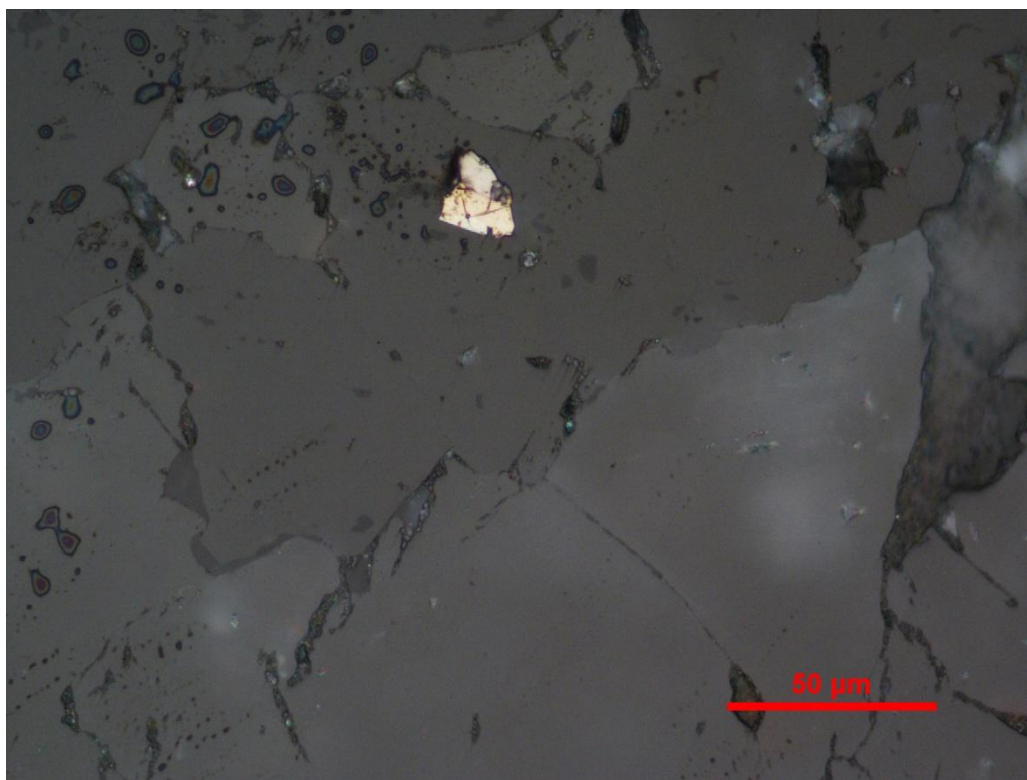


Sample 863669. Close-up from above showing chalcopyrite inclusion in carbonate. Reflected light.

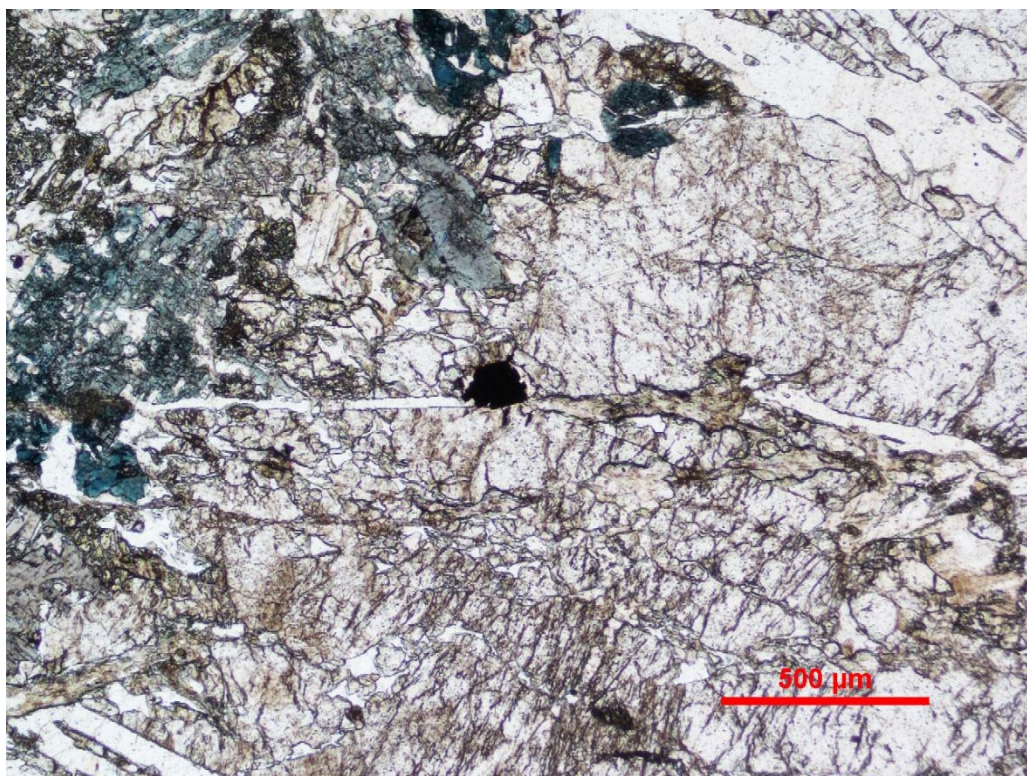


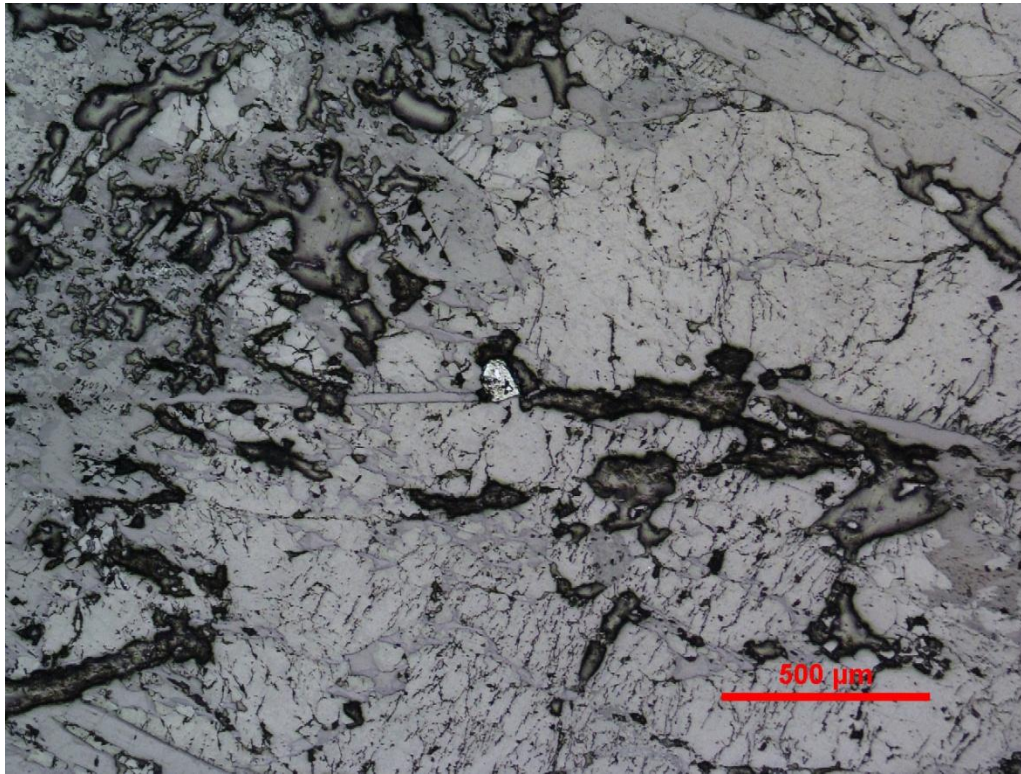


Sample 863669. Tiny chalcopyrite inclusion in tourmaline. Top- plane light; Middle- crossed polarizers; Bottom- reflected light.



Sample 863669. Close up from above showing chalcopyrite inclusion in tourmaline. Reflected light.





Sample 863669. Hematized subhedral pyrite associated with chlorite (low reflectivity) and quartz microveinlet. Top- plane light; Bottom- reflected light.