

Report 200286 for
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Samples: A00207 Series: 37-1, 37-2, 37-3, 37-4, 40-1, 40-2
A0027 series: 521-1, 521-2
NET-01

Summary:

Sample A0020737-1 is of massive sulphide dominated by sphalerite that contains two coarse patches of tetrahedrite/tennantite-(chalcopyrite), one of which also contains galena, and a discontinuous seam of chalcopyrite-(pyrite-tetrahedrite/tennantite). A vein (Zone B) is dominated by calcite and quartz, with moderately abundant patches of tetrahedrite/tennantite-(chalcopyrite) along or near its margins. A series of subparallel, irregular late veinlets is of calcite with locally minor quartz; veinlets are best developed in sphalerite, tetrahedrite/tennantite, and quartz, poorly developed in chalcopyrite and calcite, and absent in galena.

Sample A0020737-2 contains two main zones. The host rock (latite), consisting of plagioclase (altered slightly to moderately to locally strongly to sericite) is replaced moderately by patches of dolomite-quartz and minor galena. The massive sulphide is dominated by large patches of sphalerite and of tetrahedrite/tennantite, the latter with accessory chalcopyrite, mainly along borders of tetrahedrite/tennantite patches, with a small patch of galena, scattered patches of quartz and lesser dolomite, and trace pyrite.

Sample A0020737-3 contain patches of latite (Zones A; plagioclase altered slightly to strongly to sericite, with minor to moderately abundant quartz); a breccia zone (Zone B) containing several patches of latite and one patch of latite replaced strongly by quartz in a matrix of quartz and lesser dolomite/calcite and minor sphalerite; and patches of massive sulphide consisting in part of zones of tetrahedrite/ tennantite with chalcopyrite concentrated on borders of patches and in veinlets near the margins, and in part of sphalerite. An early vein in the host rock in of dolomite-quartz with minor chalcopyrite and tetrahedrite/tennantite. A vein is of quartz-(carbonate). A set of late veinlets, in part subparallel, is of calcite, with some smaller veinlets also containing chalcopyrite where they cut zones containing abundant veinlets of chalcopyrite; this suggests that chalcopyrite was mobile for at least part of the late veining event.

Sample A0020737-4 contains patches of massive sulphide dominated by sphalerite with lesser tetrahedrite/tennantite, and accessory galena and chalcopyrite. An early vein is of quartz-calcite with disseminated patches of sphalerite and of tennantite/tetrahedrite-(chalcopyrite). Two sets of later veinlets subperpendicular to each other are of calcite. Parallel to the older of these two are wispy chalcopyrite veinlets in massive sulphide, mainly in and near tetrahedrite/tennantite contacts with sphalerite; this suggests that chalcopyrite was mobile during this stage of vein formation.

Sample A0020740-1 at either end consists of strongly altered and replaced latite containing relic patches of plagioclase (altered moderately to strongly to sericite) and replacement patches of quartz and lesser chlorite and sericite/muscovite. In the middle is a broad banded vein of with bands rich in one or more of sphalerite, tetrahedrite/tennantite-(chalcopyrite), galena, and quartz. Several late veinlets are of chlorite in the host rock and of calcite in the massive sulphide vein.

Sample A0020740-2 contains patches of latite in which original plagioclase was altered slightly to strongly to sericite and more locally quartz. Irregular early(?) veins and replacement patches are of dolomite (altered slightly to limonite) and quartz (commonly subhedral to euhedral). Later(?) veins are dominated by quartz with bands and patches of sulphides, including one or more of tetrahedrite/tennantite, galena, sphalerite, and chalcopyrite.

Sample A0027521-1 is of a vein that contains a large zone of chalcopyrite (fresh to altered completely to hematite and malachite, a smaller patch of pyrite (fresh to altered completely to hematite) and a large patch of quartz, mainly one grain, that contains secondary patches and veinlets of pale to medium green malachite and of colourless Mineral A (probably a secondary copper mineral). Opaque hematite forms numerous intersecting veinlets in chalcopyrite and minor ones in adjacent quartz.

Sample A0027521-2 is of slightly metamorphosed granodiorite dominated by slightly compositionally growth-zoned plagioclase (fresh to altered moderately to sericite) with lesser quartz and perthitic K-feldspar (commonly as megacrysts), with accessory actinolite and biotite (altered slightly to chlorite), and minor magnetite, apatite, sphene, and Mineral B (a secondary unknown mineral, possibly of copper).

Sample NET-01 is of slightly metamorphosed granodiorite as in Sample A0027521-2. It is composed of slightly compositionally growth-zoned plagioclase (fresh to altered moderately to sericite) with lesser perthitic K-feldspar and quartz, and with accessory actinolite (locally altered moderately to pseudomorphic tremolite with patches of calcite and of chlorite and elsewhere replaced slightly to locally moderately by chlorite) and biotite (altered slightly to pseudomorphic chlorite), with minor sphene and apatite. A vein on one side of the section is of hornblende with minor quartz; in places, isolated hornblende grains in the host rock commonly are in optical continuity with grains in the adjacent vein.

Photographic Notes:

The scanned section shows the gross textural features of the sections; these features are seen much better on the digital image than on the printed image. For the photographs, sample numbers are shown in the upper left corner, photo numbers are shown in the lower left corner, and the letter in the lower right corner indicates the lighting conditions: plane polarized incident light (= P); incident light in crossed nicols (= X); reflected light (= R); reflected light in nearly crossed nicols and incident light in crossed nicols (= ~RX). Locations of photographs are shown on the scanned section. Descriptions of the photographs are at the end of the report.

Sample A0020737-1 Massive Sulphide:

Sphalerite-Tetrahedrite/Tennantite-Galena-Chalcopyrite
Vein: Calcite-Quartz-(Tetrahedrite/Tennantite-Chalcopyrite)
Late Veinlets: Calcite-(Quartz)

The sample is of massive sulphide dominated by sphalerite that contains two coarse patches of tetrahedrite/tennantite-(chalcopyrite), one of which also contains galena, and a discontinuous seam of chalcopyrite-(pyrite-tetrahedrite/tennantite). A vein (Zone B) is dominated by calcite and quartz, with moderately abundant patches of tetrahedrite/tennantite-(chalcopyrite) along or near its margins. A series of subparallel, irregular late veinlets is of calcite with locally minor quartz; veinlets are best developed in sphalerite, tetrahedrite/tennantite, and quartz, poorly developed in chalcopyrite and calcite, and absent in galena.

mineral	percentage	main grain size range (mm)
sphalerite	70-75%	up to a few mm
tetrahedrite/tennantite	5- 7	up to a few mm
galena	2- 3	up to a few mm
chalcopyrite	1- 2	0.02-0.1
pyrite	minor	0.01-0.05
early vein		
calcite	4- 5	0.2-1
quartz	4- 5	0.2-1
tetrahedrite	0.3	0.1-0.5
chalcopyrite	0.1	0.02-0.07
late veinlets		
1) calcite	1- 2	0.02-0.1
quartz	minor	0.03-0.1

Zone A consists of massive sphalerite with an irregular discontinuous band containing inclusions up to 1 mm in size of chalcopyrite-(pyrite) and smaller and less abundant ones of tetrahedrite/tennantite.

Zone B is a vein dominated by patches of quartz and patches of calcite, with accessory to moderately abundant disseminated patches of sulphides, mainly along or near its margins, of tetrahedrite/tennantite, with accessory chalcopyrite (commonly concentrated along margins of tetrahedrite patches). In places quartz forms euhedral crystals against interstitial patches of calcite. Zone B is cut by some of the late calcite veinlets; these veinlets are best developed in more-brittle quartz as opposed to less-brittle calcite.

Zone C is similar to Zone A, being dominated by massive sphalerite cut by the same late veinlets of calcite. Sphalerite contains scattered patches of quartz up to 0.3 mm across. Two large sulphide patches are present; one is of tetrahedrite/tennantite with accessory chalcopyrite that is concentrated along the margins of the patch and in a few slightly braided veinlets cutting tetrahedrite/tennantite. The second patch is of similar tetrahedrite/tennantite-(chalcopyrite) and also contains a large patch of galena along its margin with sphalerite.

Zones A and C are cut by a subparallel network of irregular fractures that were filled by calcite and minor quartz. Most veinlets are less than 0.02 mm wide, with one up to 0.6 mm wide.

**Sample A0020737-2 Host Rock: Latite: Plagioclase-Sericite; Replacement: Dolomite-Quartz
Massive Sulphide: Sphalerite-Tetrahedrite/Tennantite-Chalcopyrite-Quartz-Dolomite
Veinlets: Quartz-Dolomite**

The sample contains two main zones. The host rock, latite, consisting of plagioclase (altered slightly to moderately to locally strongly to sericite) is replaced moderately by patches of dolomite-quartz and minor galena. The massive sulphide is dominated by large patches of sphalerite and of tetrahedrite/ tennantite, the latter with accessory chalcopyrite, mainly along borders of tetrahedrite/tennantite patches, with a small patch of galena, scattered patches of quartz and lesser dolomite, and trace pyrite.

mineral	percentage main grain size range (mm)	
host rock		
plagioclase	40-45%	0.01-0.03
sericite	10-12	0.01-0.02
quartz	0.3	0.01-0.05
replacement		
dolomite	12-15	0.05-0.5
quartz	4- 5	0.03-0.1
galena	0.3	0.3-0.6
massive sulphide		
sphalerite	20-25	up to several mm
tetrahedrite/tennantite	12-15	up to several mm
chalcopyrite	0.5	0.02-0.1
quartz	2- 3	0.05-0.5
dolomite	0.5	0.05-0.1
veinlets		
1) quartz-dolomite	0.3	0.03-0.07

The host rock is dominated by equant plagioclase with accessory to moderately abundant sericite (probably mainly as a replacement of plagioclase). Some patches up to a few mm across are dominated by sericite with minor to accessory plagioclase, minor slightly coarser grained muscovite, and minor to accessory limonite.

Irregular replacement patches up to a few mm across are of quartz and/or dolomite. A few of these contain a patch of galena up to 0.6 mm across. One lens a few mm long and up to 1.2 mm wide is of quartz and dolomite with an irregular patch 0.9 mm long of tetrahedrite/tennantite-(chalcopyrite). Limonite forms a weak to moderate alteration in some patches of dolomite.

A few veinlets up to 0.2 mm wide are of quartz and lesser dolomite.

The sulphide replacement zone consists of large patches of each of sphalerite and of tetrahedrite/tennantite, with minor chalcopyrite (mainly on borders of patches of tetrahedrite/tennantite) and galena (on the very edge of the section), with moderately abundant patches of quartz and lesser dolomite (in part stained orange-brown by limonite. Pyrite forms a few grains. In thin parts of the section, tetrahedrite/tennantite has a deep red colour in transmitted light.

Sample A0020737-3**Latite: Plagioclase/Sericite; Quartz Replacement****Massive Sulphide: Tetrahedrite/Tennantite-Sphalerite-Chalcopyrite****Veins, Breccia Matrix: Quartz-Dolomite/Calcite****Late Veinlets: Calcite-(Chalcopyrite)**

The sample contain patches of latite (Zones A: plagioclase altered slightly to strongly to sericite, with minor to moderately abundant quartz); a breccia zone (Zone B) containing several patches of latite and one patch of latite replaced strongly by quartz in a matrix of quartz and lesser dolomite/calcite and minor sphalerite; and patches of massive sulphide consisting in part of zones of tetrahedrite/ tennantite with chalcopyrite concentrated on borders of patches and in veinlets near the margins, and in part of sphalerite. An early vein in the host rock in of dolomite-quartz with minor chalcopyrite and tetrahedrite/tennantite. A vein is of quartz-(carbonate). A set of late veinlets, in part subparallel is of calcite, with some smaller veinlets also containing chalcopyrite where they cut zones containing abundant veinlets of chalcopyrite; this suggests that chalcopyrite was mobile for at least part of the late veining event.

mineral	percentage	main grain size range (mm)
host rock		
plagioclase/sericite	35-40%	0.01-0.015
quartz (mainly replacement)	3- 4	0.015-0.02
early vein in host rock		
1) dolomite-quartz-(chalcopyrite-tetrahedrite/tennantite)		
	1- 2	0.05-0.5 (qz, do); 0.03-0.1 (cp, tt)
breccia matrix, vein		
quartz	4- 5	0.05-0.5
dolomite/calcite	1	0.05-0.2
massive sulphide		
tetrahedrite/tennantite	30-35	up to several mm
sphalerite	12-15	up to several mm
chalcopyrite	1- 2	0.02-0.1
late veinlets		
1) calcite-(chalcopyrite)	1- 2	0.02-0.1 (ct); 0.01-0.03 (cp)

The main host rock (latite) (Zone A) is massive to slightly **foliated** and consists of plagioclase (altered moderately to locally strongly to sericite) with minor to moderately abundant quartz (possibly replacement) and trace disseminated Ti-oxide. The zone at the bottom of the scanned section contains a vein up to 2 mm wide of anhedral dolomite and lesser, commonly elongate prismatic quartz grains, with a patch 0.4 mm across of chalcopyrite-tetrahedrite/tennantite.

One large patch consists of a breccia containing fragments of latite in a matrix dominated by fine to medium grained quartz and locally dolomite. The breccia matrix contains scattered patches of sphalerite and of tetrahedrite/tennantite-(chalcopyrite). In the breccia zone is a patch up to 1 cm long of extremely fine grained quartz with dusty disseminated Ti-oxide (Zone B), which may represent an early replacement of latite.

Massive sulphide forms patches up to a few cm across that contain zones of sphalerite and others of tetrahedrite/tennantite-(chalcopyrite). Chalcopyrite is concentrated strongly on borders of patches of tetrahedrite/tennantite and in veinlets cutting tetrahedrite/tennantite.

(continued on page 2)

Near the top of the scanned section is a vein up to a few mm wide of quartz-dolomite/calcite that contains several fragments of sphalerite.

Late veinlets of calcite from 0.02-0.2 mm across cut several of the massive sulphide patches. Locally, where they cut patches of tetrahedrite/tennantite containing moderately abundant veinlets of chalcopyrite, some of the veinlets also contain chalcopyrite, suggesting that chalcopyrite was mobilized from earlier chalcopyrite veinlets in tetrahedrite/tennantite into the late calcite veinlets.

Sample A0020737-4**Massive Sulphide:****Sphalerite-Tetrahedrite/Tennantite-Galena-(Chalcopyrite)****Early Vein: Quartz-Calcite-(Sphalerite-Tetrahedrite/Tennantite)****Late Veinlets: Calcite-(Chalcopyrite); Calcite**

The sample contains patches of massive sulphide dominated by sphalerite with lesser tetrahedrite/tennantite, and accessory galena and chalcopyrite. An early vein is of quartz-calcite with disseminated patches of sphalerite and of tennantite/tetrahedrite-(chalcopyrite). Two sets of later veinlets subperpendicular to each other are of calcite. Parallel to the older of these two are wispy chalcopyrite veinlets in massive sulphide, mainly in and near tetrahedrite/tennantite contacts with sphalerite; this suggests that chalcopyrite was mobile during this stage of vein formation.

mineral	percentage	main grain size range (mm)
massive sulphide/		
sphalerite	45-50%	up to a few mm
tetrahedrite/tennantite	8-10	up to a few mm
galena	1- 2	up to a few mm
chalcopyrite	1	0.02-0.1
early vein		
quartz	20-25	0.05-0.7
calcite	5- 7	0.1-0.5
sphalerite	3- 4	0.1-0.5
tetrahedrite/tennantite	0.7	0.1-0.5
chalcopyrite	minor	0.02-0.05
late veinlets		
1) calcite, (chalcopyrite)	0.7	0.02-0.05
2) calcite	2- 3	0.03-0.2

Massive sulphide patches are dominated by sphalerite with lesser coarse patches of tetrahedrite/tennantite-(chalcopyrite) and one large patch of galena. Chalcopyrite is concentrated in irregular to planar veinlets cutting tetrahedrite/tennantite and adjacent sphalerite grains.

The early vein is dominated by quartz with lesser calcite and scattered patches of sulphides as in the massive sulphides. Calcite is concentrated in a band near the left of the section adjacent to a narrow band of strongly brecciated sphalerite.

An early weak subparallel set of calcite veinlets mainly less than 0.05 mm wide cuts the section in a NNE orientation. Some chalcopyrite veinlets are parallel to this set, suggesting that chalcopyrite was mobile during this vein-formation event.

A strong, mainly subparallel set of late calcite veins up to 0.3 mm wide cuts the rock in an ESE direction.

Sample A0020740-1 Altered/Replaced Latite
Massive Sulphide: Sphalerite-Galena-Tetrahedrite/Tennantite-(Chalcopyrite)
Veinlets: Calcite-(Chalcopyrite)

At either end of the section is strongly altered and replaced latite containing relic patches of plagioclase (altered moderately to strongly to sericite) and replacement patches of quartz and lesser chlorite and sericite/muscovite. In the middle is a broad banded vein of with bands rich in one or more of sphalerite, tetrahedrite/tennantite-(chalcopyrite), galena, and quartz. Several late veinlets are of chlorite in the host rock and of calcite in the massive sulphide vein.

mineral	percentage	main grain size range (mm)
host rock latite		
plagioclase/sericite	4- 5%	0.01-0.02
quartz	7- 8	0.03-0.15
chlorite	1- 2	0.005-0.01
pyrite	minor	0.05-0.1
vein		
sphalerite	20-25	up to a few mm
tetrahedrite/tennantite	25-30	up to a few mm
galena	12-15	up to a few mm
quartz	12-15	0.05-0.5
chalcopyrite	1	0.02-0.07
late veinlet		
1) calcite	0.2	0.02-0.07
2) chlorite	0.2	0.005-0.015

The host rock latite (A) contains minor irregular relic patches of plagioclase (altered moderately to strongly to sericite). These are contained in patches of replacement intergrowths of quartz and lesser patches of medium greyish green chlorite, patches of sericite/muscovite, and disseminated grains of pyrite. Locally replacement patches are brecciated strongly. At the top of the section, the host rock is cut by a few subparallel veinlets of chlorite.

The vein is zoned strongly, with major zones from bottom to top as follows (see scanned section):

- 1: quartz-sphalerite, in part brecciated, grading into
- 2: massive sphalerite with patches of quartz and near the upper margin several patches of tetrahedrite/tennantite-(chalcopyrite) and of galena.
- 3: quartz with minor to abundant tetrahedrite/tennantite-galena-sphalerite-(chalcopyrite), grading into
- 4: tetrahedrite/tennantite-(quartz-galena-chalcopyrite) grading into
- 5: galena-(quartz), abundant galena was plucked along cleavage planes, producing characteristic triangular pits, grading into
- 6: tetrahedrite/tennantite-(quartz-galena-chalcopyrite) (similar to Zone 4) grading into
- 7: quartz with a lens of tetrahedrite/tennantite-(chalcopyrite)

In all zones that contain chalcopyrite, it is mainly in tetrahedrite/tennantite and nearby sphalerite as veinlets and as concentrations on the margins of patches; some of the veinlets in sphalerite grade outwards from tetrahedrite/tennantite into calcite veinlets, indicating that chalcopyrite was mobile during the vein-formation event.

Calcite forms a few subparallel veinlets, mainly cutting sulphides.

Sample A0020740-2 Altered Latite: Plagioclase-Sericite-(Quartz)
Early Veins/Replacement: Dolomite-Quartz
Late Veins: Quartz-Tetrahedrite/Tennantite-Galena-Sphalerite-Dolomite

The sample contains patches of latite in which original plagioclase was altered slightly to strongly to sericite and more locally quartz. Irregular early(?) veins and replacement patches are of dolomite (altered slightly to limonite) and quartz (commonly subhedral to euhedral). Later(?) veins are dominated by quartz with bands and patches of sulphides, including one or more of tetrahedrite/tennantite, galena, sphalerite, and chalcopyrite.

mineral	percentage	main grain size range (mm)
latite		
plagioclase/sericite	25-30%	0.01-0.02
quartz	3- 4	0.01-0.03
early(?) veins/replacement		
dolomite/(limonite)	17-20	0.1-0.5
quartz	5- 7	0.2-0.5
late(?) veins		
quartz	20-25	0.2-1
tetrahedrite/tennantite	5- 7	up to a few mm
galena	3- 4	up to a few mm
sphalerite	2- 3	up to a few mm
dolomite/(limonite)	2- 3	0.2-0.5
chalcopyrite	1- 2	0.05-0.2

The host rock forms patches up to 2 cm long of plagioclase (altered slightly to strongly to sericite and locally moderately to strongly to quartz. It is cut by minor veinlets, mainly less than 0.05 mm wide, of quartz and a few of quartz-galena.

Abundant early(?) veins/replacement patches consist of massive dolomite (altered slightly to moderately to limonite) with disseminated patches of anhedral quartz and less abundant subhedral to euhedral prismatic grains of quartz. A few contain patches of galena and/or tetrahedrite/tennantite-chalcopyrite. These may be gradational into the later(?) veins.

A large later(?) vein up to 1.3 cm wide is zoned as follows (from bottom to top of the scanned section): 1) subhedral to anhedral quartz with abundant interstitial patches of galena; 2) quartz with scattered patches of dolomite and abundant cavities (possibly plucked dolomite); 3) quartz-dolomite-with a few large patches of sphalerite; 4) tetrahedrite/tennantite-chalcopyrite-(sphalerite-galena) bordered on both sides by very fine grained quartz, which on the border of the vein contains zones with moderately abundant galena. A smaller vein up to 3 mm wide and subperpendicular to the main vein contains abundant patches of tetrahedrite/tennantite-chalcopyrite and others of galena in a matrix of quartz and dolomite.

Sample A0027521-1

Vein: Quartz-Chalcopyrite-Pyrite

Secondary Patches, Veinlets: Malachite, Mineral A, Hematite

The sample contains a large zone of chalcopyrite (fresh to altered completely to hematite and malachite, a smaller patch of pyrite (fresh to altered completely to hematite) and a large patch of quartz, mainly one grain, that contains secondary patches and veinlets of pale to medium green malachite and of colourless Mineral A (probably a secondary copper mineral). Opaque hematite forms numerous intersecting veinlets in chalcopyrite and minor ones in nearby quartz.

mineral	percentage	main grain size range (mm)
chalcopyrite	40-45%	? (altered strongly to hematite-malachite)
pyrite	8-10	? (altered strongly to hematite)
quartz	35-40	mainly one large grain
hematite	1- 2	massive
secondary patches		
malachite	1- 2	0.01-0.02
Mineral A	2- 3	0.005-0.02
veinlets		
1) malachite	2- 3	0.01-0.03
2) hematite	4- 5	

Chalcopyrite forms a large patch that contains relic patches and lenses of fresh chalcopyrite that was replaced along fractures between fresh patches by bright red hematite. Outside of this, chalcopyrite was replaced by a slightly foliated mass of dull red-brown hematite and patches of malachite and minor Mineral A (a colourless, probably secondary Cu-mineral). Against quartz, the chalcopyrite patch has an irregular inner rim up to 0.3 mm thick of malachite, Mineral A and limonite, overgrown by a rim of opaque hematite (0.1-0.2 mm thick) and an outer rim of malachite (0.03 mm thick).

Pyrite forms a large patch on one side of the sulphide patch. Most of it was altered to secondary, medium red to semi-opaque hematite showing a variety of alteration textures. Relic pyrite patches up to 1 mm across occur in one corner of the original grain. Some small patches of bright red hematite in this zone probably are secondary after chalcopyrite.

Quartz occurs mainly as a single grain up to a few cm across.

Malachite forms scattered patches up to several mm across of cryptocrystalline grains, commonly arrayed in subradiating textures. Many of these are interstitial to hematite (after chalcopyrite), whereas the largest is outside and bordering the chalcopyrite patch. Malachite is pale green in colour in thin section and light, slightly bluish green in hand sample. A few patches up to a few mm across of Mineral A are associated with the malachite patch outside the chalcopyrite patch. Mineral A is colourless and commonly has a fibrous texture. It forms replacement patches and veinlets against quartz.

Malachite forms numerous veinlets cutting quartz; most are less than 0.05 mm wide.

Hematite forms numerous intersecting veinlets up to 0.2 mm wide in chalcopyrite and a few veinlets up to 0.03 mm wide in quartz.

Sample A0027521-2**Slightly Metamorphosed Biotite-Actinolite Granodiorite**

The sample is of slightly metamorphosed granodiorite dominated by slightly compositionally growth-zoned plagioclase (fresh to altered moderately to sericite) with lesser quartz and perthitic K-feldspar (commonly as megacrysts), with accessory actinolite and biotite (altered slightly to chlorite), and minor magnetite, apatite, sphene, and Mineral B (a secondary unknown mineral, possibly of copper).

mineral	percentage	main grain size range (mm)	
plagioclase	40-45%	0.7-2	(a few from 3-7 mm long)
quartz	20-25	0.5-2	
K-feldspar	17-20	1-3	(a few up to 5 mm across)
actinolite	2- 3	0.1-0.5	(a few up to 1 mm long)
biotite	2- 3	0.5-1.5	
magnetite	0.5	0.05-0.2	
sphene	0.3	0.5-0.8	
apatite	0.2	0.1-0.2	
Mineral B (unknown)	minor	0.005-0.01	
zircon	trace	0.05-0.07	

Plagioclase forms anhedral to subhedral prismatic grains, many of which show compositional growth zoning from more-calcic cores to more-sodic rims. Alteration is variable from fresh to moderate to sericite, with alteration in some grains more intense in the more-calcic cores than in the more-sodic outer zones.

Quartz forms anhedral grains interstitial to plagioclase.

K-feldspar forms anhedral grains, many of which exhibit perthitic textures in one or locally two crystallographic orientations.

Actinolite forms anhedral to euhedral prismatic grains with pleochroism from pale to very light to light green.

Biotite (altered locally partly to pseudomorphic pale/light green chlorite) forms anhedral equant flakes with pleochroism from light to medium/dark brown. It occurs as large isolated flakes and as commonly much smaller flakes in clusters with actinolite.

Magnetite forms disseminated, equant anhedral grains.

Sphene (with inclusions of ilmenite) forms disseminated subhedral to euhedral wedge-shaped grains.

Apatite forms anhedral equant to euhedral prismatic grains.

One elongate cluster 2 mm long consists of moderately preserved, colourless to light green secondary cryptocrystalline Mineral B (possibly a secondary Cu-mineral) intergrown with several apatite grains.

Zircon forms a few euhedral prismatic grains.

Sample NET-01 Slightly Metamorphosed Actinolite Granodiorite
Vein: Hornblende-(Quartz)

The sample is of slightly metamorphosed granodiorite as in Sample A0027521-2. It is composed of slightly compositionally growth-zoned plagioclase (fresh to altered moderately to sericite) with lesser perthitic K-feldspar and quartz, and with accessory actinolite (locally altered moderately to pseudomorphitic tremolite with patches of calcite and of chlorite and elsewhere replaced slightly to locally moderately by chlorite) and biotite (altered slightly to pseudomorphitic chlorite), with minor sphene and apatite. A vein on one side of the section is of hornblende with minor quartz; in places, isolated hornblende grains in the host rock commonly are in optical continuity with grains in the adjacent vein.

mineral	percentage	main grain size range (mm)
plagioclase	50-55%	0.7-2
K-feldspar	25-30	1- 3
quartz	8-10	0.3-1
biotite	1	0.5-1
sphene	0.1	0.2-0.5
apatite	0.1	0.1-0.3
vein		
hornblende	8-10	1-10
quartz	0.3	0.1-0.2

Plagioclase (fresh to altered slightly and locally moderately to sericite) forms anhedral to subhedral prismatic grains that show weak compositional growth zoning from more-calcic cores to more-sodic rims.

K-feldspar forms anhedral interstitial grains, in part with perthitic textures.

Quartz forms anhedral grains, some of which have slightly strained extinction.

Actinolite (altered locally to colourless pseudomorphitic tremolite with patches of calcite and of chlorite and elsewhere locally altered slightly to patches of chlorite) forms anhedral to subhedral disseminated grains and clusters with pleochroism from pale to light/medium green.

Biotite (locally altered slightly to pseudomorphitic chlorite) forms scattered equant flakes with pleochroism from light medium brown.

Sphene forms disseminated subhedral to euhedral, commonly wedge-shaped grains and a few pairs of adjacent grains.

Apatite forms disseminated subhedral prismatic grains.

The vein is of actinolite/hornblende, commonly as elongate prismatic grains oriented parallel to vein walls, with minor interstitial quartz. At one end the vein disappears. A few actinolite-rich patches extend from the vein into the host rock; in these, isolated hornblende grains in the host rock commonly are in optical continuity with grains in the adjacent vein.

List of Photographs
(page 1 of 5)

Photo	Section	Description
01	A0020737-1	massive sphalerite with a large patch of chalcopyrite with accessory inclusions of pyrite, and a small patch of each of galena(?) and galena(?)-(chalcopyrite); cut by a subparallel network of irregular, partly braided veinlets of calcite.
02 ++	A0020737-1	to the left: massive sphalerite (Zone A) with a border zone to the right of patches of tetrahedrite/tennantite-(chalcopyrite), with chalcopyrite mainly on borders of tetrahedrite/tennantite and of sphalerite patches against quartz and in wispy veinlets cutting both sulphides; to the right: (Zone B) quartz with scattered patches of tetrahedrite/tennantite with minor quartz, mainly on margins of sulphide patches; both zones cut by subparallel, slightly braided calcite veinlets.
03	A0020737-1	contact: lower left: Zone C: tetrahedrite/tennantite with patches of chalcopyrite along its margin with Zone B and slightly braided veinlets of chalcopyrite in tetrahedrite/tennantite; top and to right: Zone B: quartz (some euhedral grains enclosed in calcite) and calcite with a patch of tetrahedrite/tennantite with minor chalcopyrite on its margin and in wispy veinlets; cut by subparallel late calcite veinlets.
04	A0020737-1	to the left: Zone C: sphalerite (cut by numerous subparallel calcite veinlets and with trace patches of quartz) and lesser galena (free of calcite veinlets); to the right: Zone B: calcite with minor sphalerite near the contact.
05	A0020737-1	Zone C: (from bottom left to upper right): galena with a euhedral grain of quartz; tetrahedrite/tennantite with patches and veinlets of chalcopyrite, cut by late calcite veinlets; sphalerite (with calcite veinlets; Zone B: calcite with late calcite veinlets.
06	A0200737-2	host rock: extremely fine grained plagioclase-(sericite); patchy replacement by dolomite and lesser quartz, with one large patch of galena.
07	A0020737-2	below: host rock: plagioclase (altered slightly to locally strongly to sericite and minor muscovite), with replacement patches of dolomite (stained brown by limonite) and lesser quartz: above and in left corner: massive sulphide patch: mainly tetrahedrite/tennantite, with chalcopyrite concentrated strongly along the border against a thin zone of quartz-dolomite, and minor sphalerite at left (edge of large patch of sphalerite outside the photo).
08	A0020737-2	thin part of section showing deep red colour of tetrahedrite/tennantite in transmitted light along with three patches of sphalerite and one patch of galena; fractures are empty, but may represent loci of wispy calcite veinlets that were lost from the section during its preparation.

List of Photographs
(page 2 of 5)

Photo	Section	Description
09	A0020737-2	contact: to the left: dolomite (stained orange-brown by limonite) and lesser quartz, including some extremely fine grained patches of quartz; in the middle: tetrahedrite/tennantite and quartz, minor chalcopyrite bordering tetrahedrite/tennantite against quartz, one grain of pyrite; to the right: sphalerite with minor quartz at the bottom.
10	A0020737-3	upper left: vein of anhedral dolomite and anhedral to locally euhedral quartz with a patch of chalcopyrite/tetrahedrite/tennantite, and an inclusion of host rock parallel to the main vein contact; lower right: latite: plagioclase (altered strongly to sericite) with minor quartz.
11	A0020737-3	top left: Zone B: extremely fine grained quartz replacement; middle: patch of quartz containing a core of tetrahedrite/tennantite with accessory chalcopyrite along margins of the sulphide patch and in wispy veinlets and a few equant grains in the interior of the sulphide zone; bottom right: small inclusion of Zone A: plagioclase (altered strongly to sericite) within matrix of quartz-dolomite.
12	A0020737-3	massive sulphide: tetrahedrite/tennantite with abundant veinlets and patches of chalcopyrite (mainly near the border with sphalerite) and a patch of sphalerite with lesser veinlets and patches of chalcopyrite; a set of subparallel late calcite veinlets, mainly in tetrahedrite/tennantite; several smaller veinlets also contain chalcopyrite but larger ones do not, suggesting chalcopyrite was mobile during at least the early part of the late-veining event.
13	A0020737-3	to the left: sphalerite and accessory quartz; left-centre to top right: tetrahedrite/tennantite with moderately abundant chalcopyrite as a thin rim along margins and in veinlets and patches in the interior; lower right: fragment of host rock latite: plagioclase (altered moderately to sericite with minor quartz veinlets, in part bordered by quartz and in part bordered by dolomite against the sulphide patch.
14	A0020737-4	at top: finely brecciated sphalerite with a sparse matrix of calcite; at bottom: patch of calcite and smaller patch of quartz.
15	A0020737-4	patches of sphalerite with a trace of chalcopyrite on some margins and a few patches of tetrahedrite/tennantite-(chalcopyrite) intergrown with anhedral to subhedral quartz and lesser anhedral dolomite; two sets of late intersecting calcite veinlets.

List of Photographs
(page 3 of 5)

Photo	Section	Description
16	A0020737-4	tetrahedrite/tennantite and lesser sphalerite, fractured and cut by veinlets of chalcopyrite (mainly N-S in photo) and veinlets of calcite (mainly E-W in photo); one grain of quartz; most chalcopyrite veinlets are cut by calcite veinlets, but in a few intersections, chalcopyrite veinlets appear to crosscut calcite veinlets, indicating that chalcopyrite was somewhat mobile during at least the early part of calcite-veinlet formation (contrast yellow-arrow intersection [mobile chalcopyrite] with blue-arrow intersection [chalcopyrite fractured and cut]).
17	A0020737-4	massive sulphide: coarse patches of sphalerite, of tetrahedrite/tennantite, and of galena; chalcopyrite occurs in subparallel veinlets and a few related patches, mainly along the boundary of tetrahedrite/tennantite and sphalerite and to a lesser extent in tetrahedrite/tennantite away from this contact; no chalcopyrite veinlets cut galena; minor quartz.
18	A0020737-4	semi-massive sulphide: tetrahedrite/tennantite, galena, quartz, and sphalerite, with minor chalcopyrite in patches bordering sphalerite and tetrahedrite/tennantite against quartz and in a few veinlets cutting tetrahedrite/tennantite; abundant subparallel late calcite veinlets.
19	A0020740-1	patches of sericite-quartz and quartz-(sericite) (= strongly altered latite) replaced strongly by coarser grained quartz with patches of cryptocrystalline chlorite, a few patches of sericite/muscovite, and a few grains of pyrite; cut by a veinlet of chlorite(?) with a void along its centreline.
20	A0020740-1	Zone 2: sphalerite-rich band with a patch of tetrahedrite-galena-quartz-chalcopyrite; chalcopyrite is concentrated on some borders of tetrahedrite/tennantite with quartz and with sphalerite and along part of one sphalerite-quartz border, as abundant wispy veinlets in tetrahedrite/tennantite, and as veinlets in sphalerite near tetrahedrite/tennantite and galena; some of the veinlets in sphalerite and in galena become calcite veinlets further from the borders of tetrahedrite/tennantite and galena.
21	A0020740-1	Zone 3: intergrowth of quartz, tetrahedrite/tennantite, and galena, with minor chalcopyrite (mainly in tetrahedrite/tennantite and on borders of quartz and tetrahedrite/tennantite; late calcite veinlet.
22	A0020740-1	below: Zone 4: tetrahedrite/tennantite with abundant braided chalcopyrite veinlets, mainly trending NE; above: Zone 5: galena showing triangular pits (grains plucked along cleavage directions) with an irregular calcite veinlet (and cavities) that extends into galena from the end of the largest braided chalcopyrite vein zone in tetrahedrite/tennantite, suggesting that chalcopyrite was mobile during the vein-forming event.

List of Photographs
(page 4 of 5)

Photo	Section	Description
23	A0020740-2	two patches of host rock latite; at top right plagioclase altered slightly to sericite with minor quartz, and at the bottom: plagioclase altered strongly to sericite; cut/replaced by veins of dolomite (in large part stained orange by limonite), anhedral to locally euhedral quartz, and interstitial patches of galena and trace chalcopyrite.
24	A0020740-2	main vein, Zone 4: intimate intergrowth of chalcopyrite and tetrahedrite/tennantite with lesser patches of galena, of sphalerite, and of quartz; lower right: host rock latite: plagioclase (altered moderately to sericite); middle right: border of Zone 4: quartz-dolomite (stained light brown by limonite).
25	A0020740-2	intergrowth of anhedral to subhedral quartz and irregular patches of galena; one small grain of dolomite.
26	A0020740-2	main vein: Zone 4: top right: intimate intergrowth of tetrahedrite/tennantite with lesser chalcopyrite (mainly on borders with quartz and much less abundant in veinlets), quartz, and sphalerite; at left: extremely fine to fine grained quartz with a euhedral grain of pyrite, a small patch of chalcopyrite and a small patch of dolomite; lower right: sphalerite with minor tetrahedrite/tennantite, and a veinlet of chalcopyrite.
27	A0020740-2	patches of altered latite: plagioclase (altered slightly to strongly to sericite and locally to quartz); vein/replacement of dolomite (stained light brown by limonite), quartz, patches of tetrahedrite/tennantite-chalcopyrite, and lesser patches of galena.
28	A0027521-1	relic patches of pyrite enclosed in secondary hematite showing a variety of textures.
29	A0027521-1	lower left: hematite (after pyrite); top/centre: dense malachite grading into patches of Mineral A (probably a secondary Cu-mineral, low relief) cut by veinlets of malachite; bottom centre to right: quartz grain replaced along fractures by Mineral A and lesser malachite.
30	A0027521-1	to the left: dull red-brown hematite (probably after pyrite) with a small lens of bright red hematite (= he*, after chalcopyrite); in the middle: broad lens of chalcopyrite (altered moderately on fractures to bright red hematite and cut by later veinlets of dull red-brown hematite; right-centre: thin crust of hematite on chalcopyrite overlain by a zone of medium green malachite, with lesser colourless Mineral A? and minor limonite (=ml#); to the right of this is a thin layer of opaque hematite of uncertain origin and a very thin band of malachite; far right: quartz grains cut by abundant veinlets of malachite.

List of Photographs
(page 5 of 5)

Photo	Section	Description
31	A0027521-1	altered chalcopyrite patch: a few patches of bright red hematite (he*), some with relic cores of fresh chalcopyrite, enclosed in thin rims of opaque hematite that are surrounded by intergrowths of malachite and lesser limonite/hematite; cut by a network of abundant veins of opaque hematite, with a few patches of bright red hematite and locally malachite, and a few patches of malachite-Mineral A, both at major vein intersections.
32	A0027521-2	subhedral plagioclase (compositionally growth-zoned from more-calcic cores to more-sodic rims; altered very slightly to sericite); interstitial K-feldspar (slightly perthitic); interstitial patches of quartz, anhedral actinolite grains in K-feldspar and in plagioclase; one anhedral biotite flake.
33	A0027521-2	K-feldspar megacryst (slightly perthitic, irregular perthite patches) enclosing grains of biotite, plagioclase, sphene (euhedral), and magnetite; a grain of quartz.
34	A0027521-2	to the left: lens of Mineral B (secondary unknown mineral) and several grains of apatite and one of magnetite intergrown coarsely with quartz, plagioclase, and minor actinolite; to the right: cluster of actinolite and magnetite with minor sphene; top right: edge of plagioclase megacryst.
35	NET-01	mafic cluster: biotite (altered slightly to pseudomorphic chlorite), actinolite (altered moderately to pseudomorphic tremolite with patches of calcite and of chlorite), and sphene (in the large euhedral grain with inclusions of ilmenite), and minor apatite; intergrown with plagioclase (fresh to locally altered moderately to sericite) and quartz.
36	NET-01	bottom left: host rock: plagioclase (fresh to altered slightly to sericite) and much less abundant K-feldspar and hornblende (some altered moderately to chlorite; some in optical continuity with large hornblende grain in the vein (upper right).

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200286 jaxon blocks



A0020737-1



A0020737-2



A0020737-3



A0020737-4



A0020740-1



A0020740-2



A0027521-1

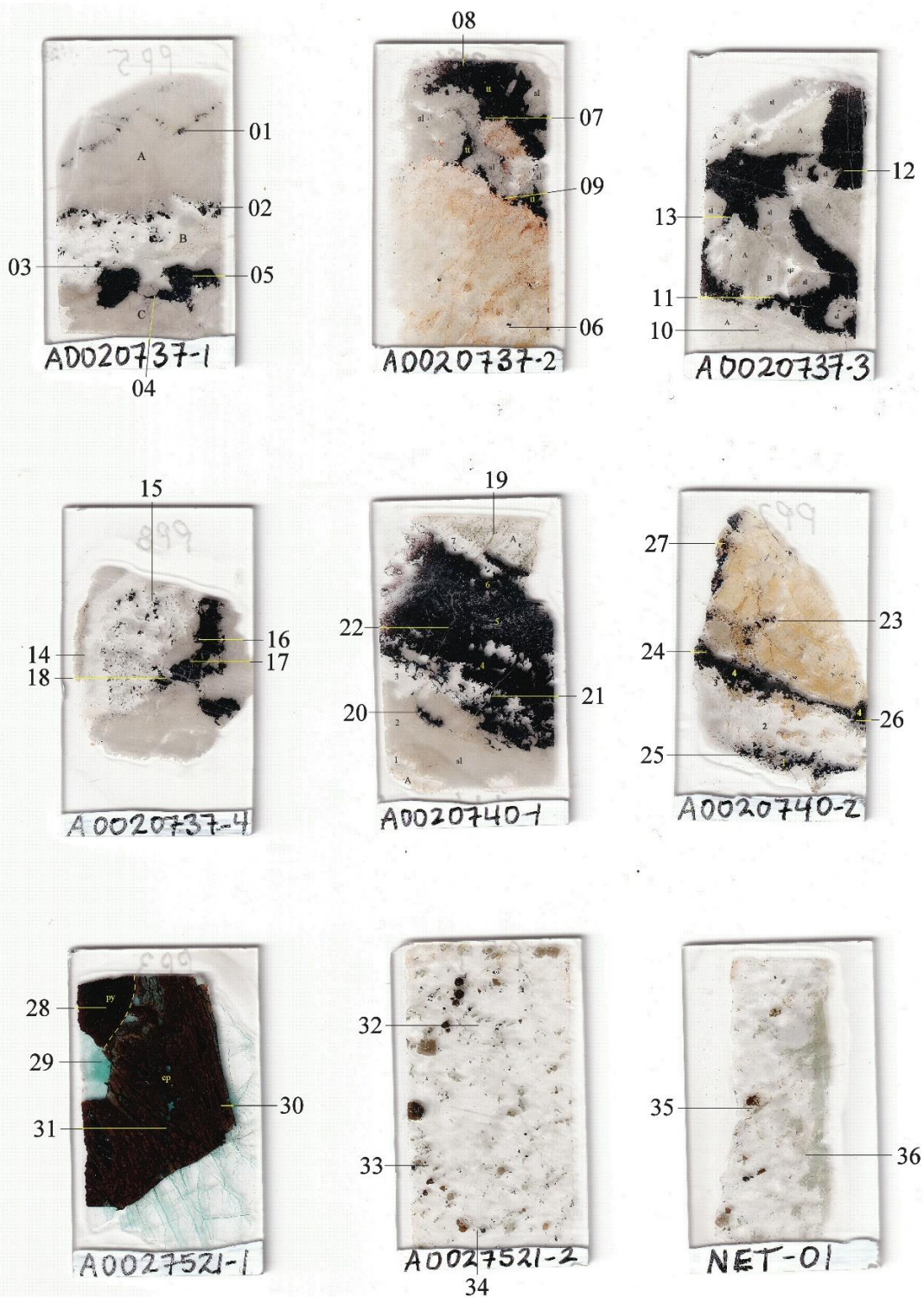


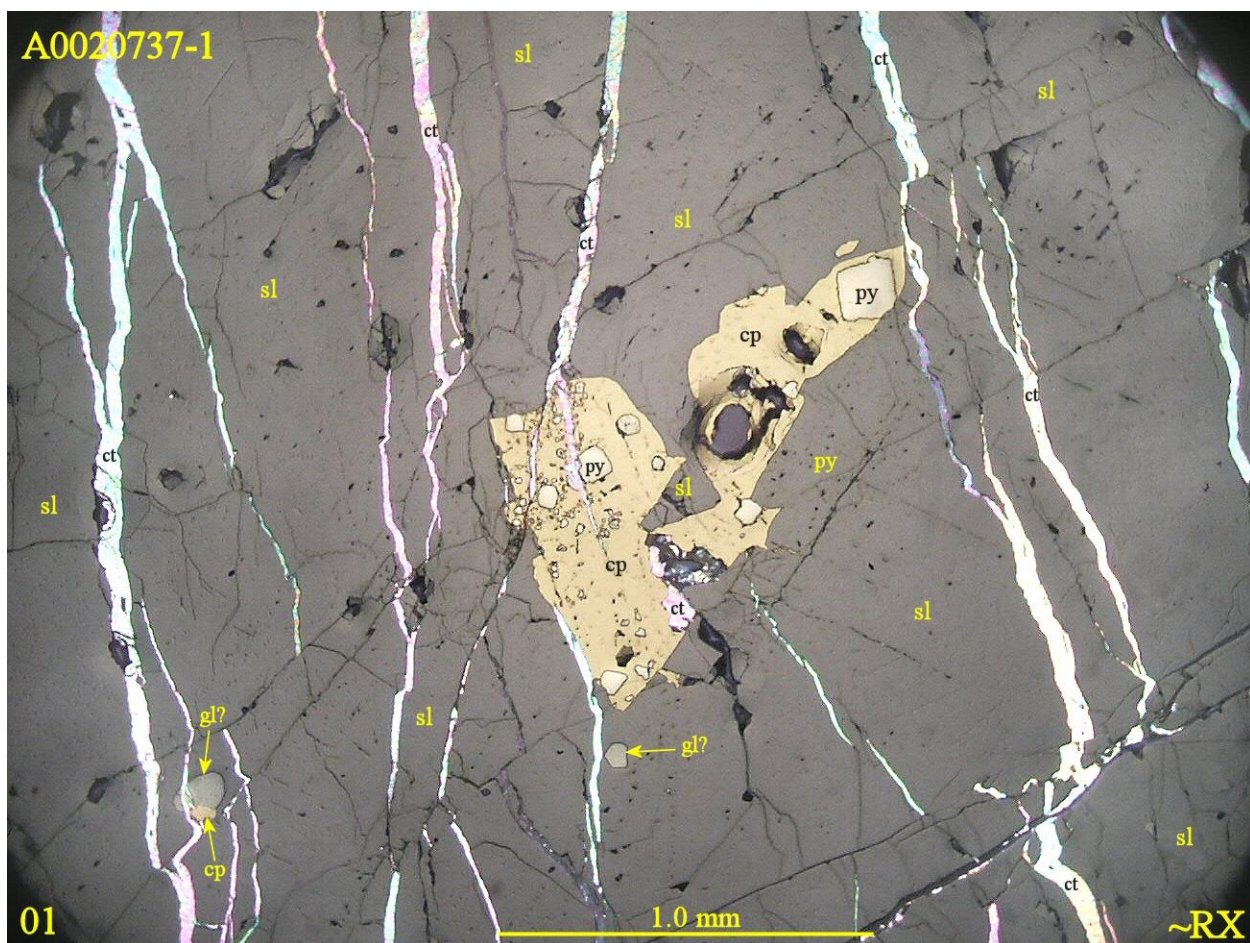
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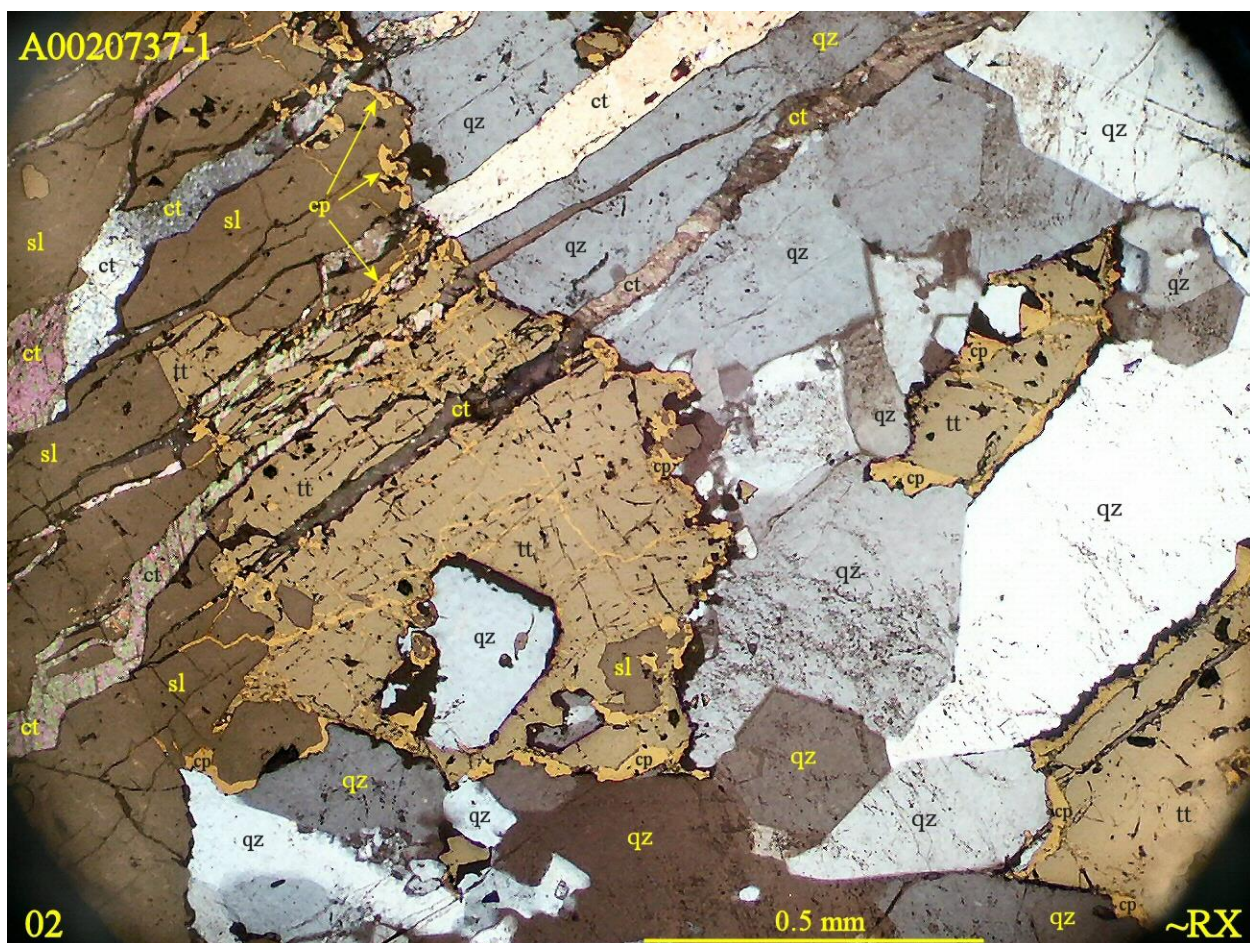


NET-01

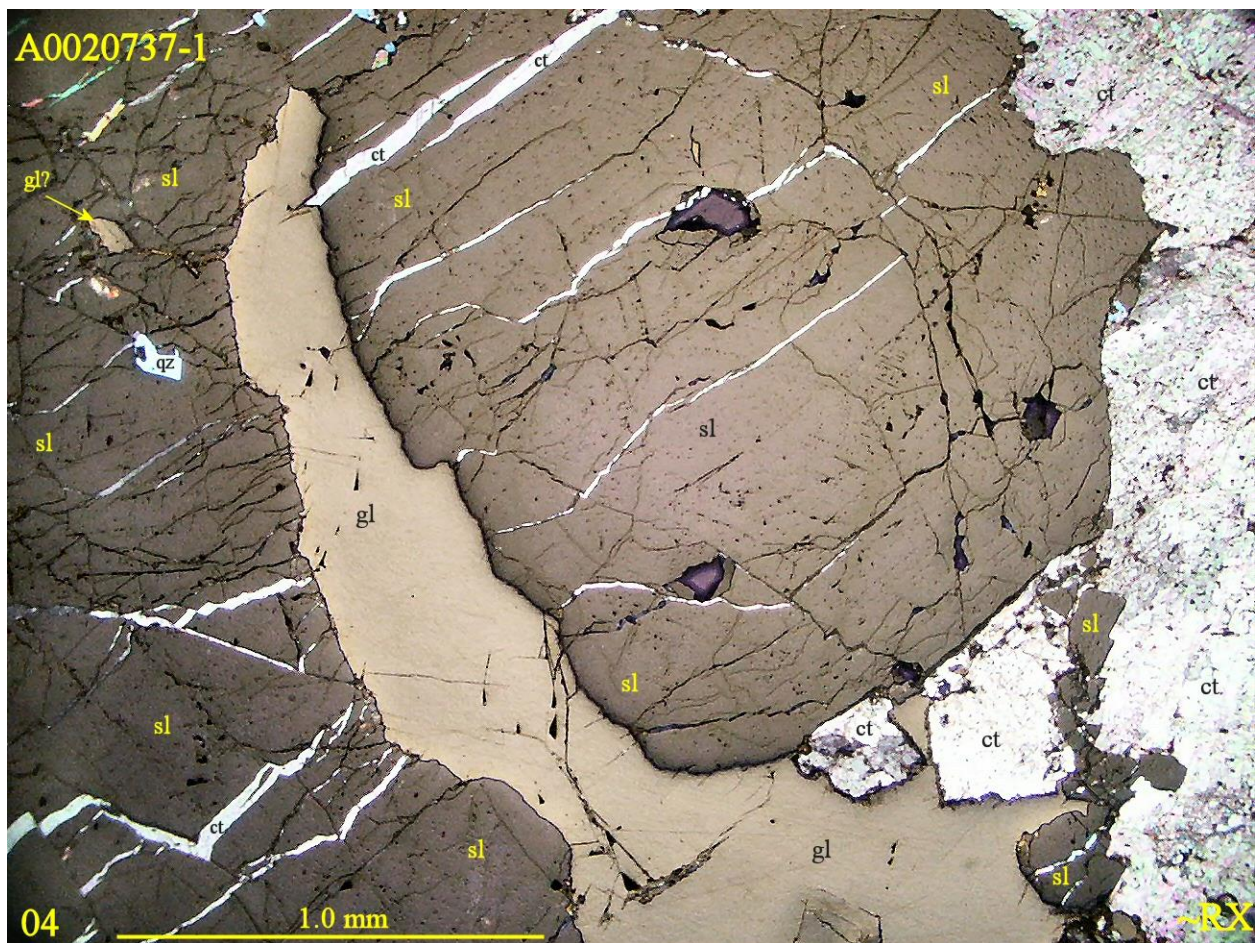
200286 jaxon sections

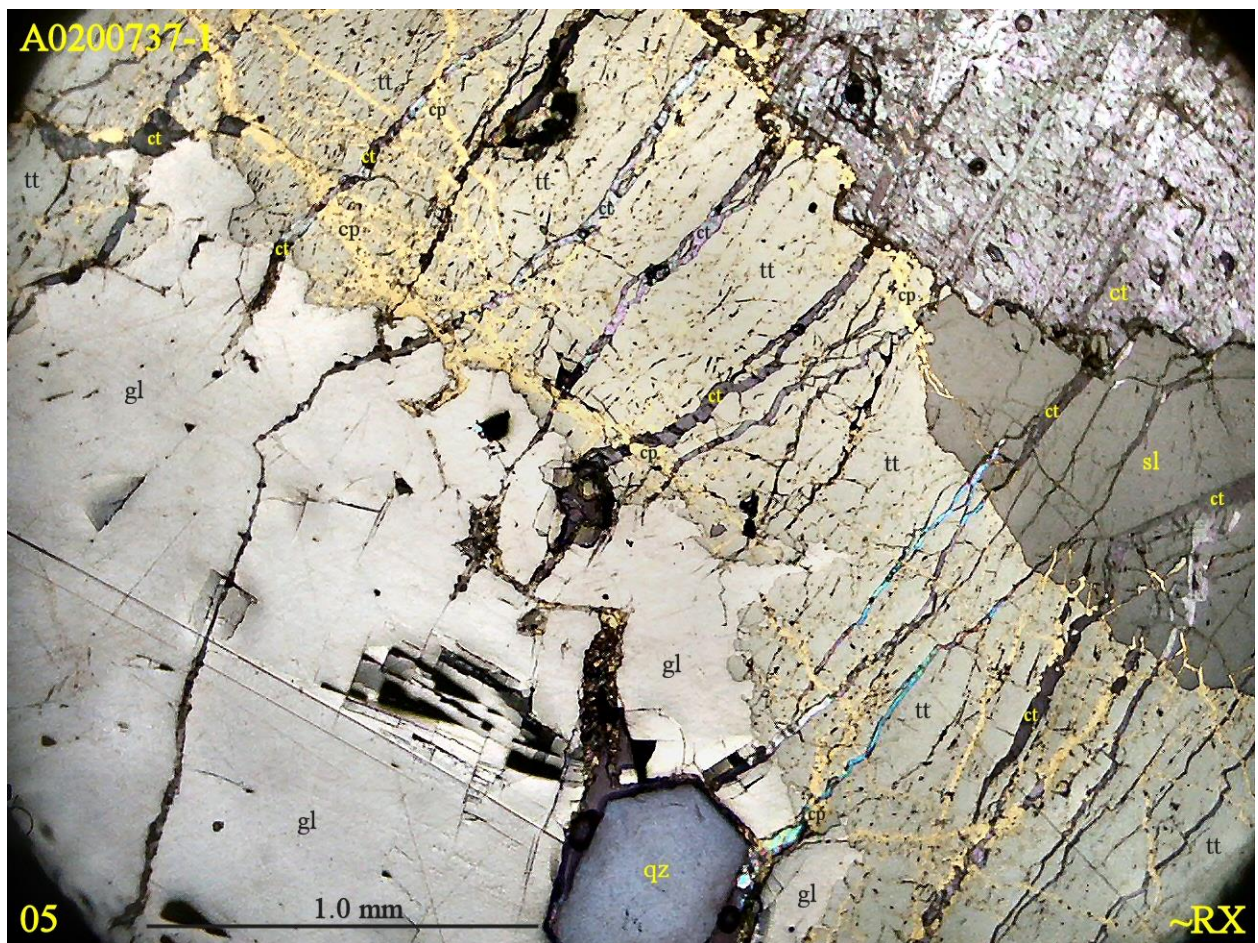


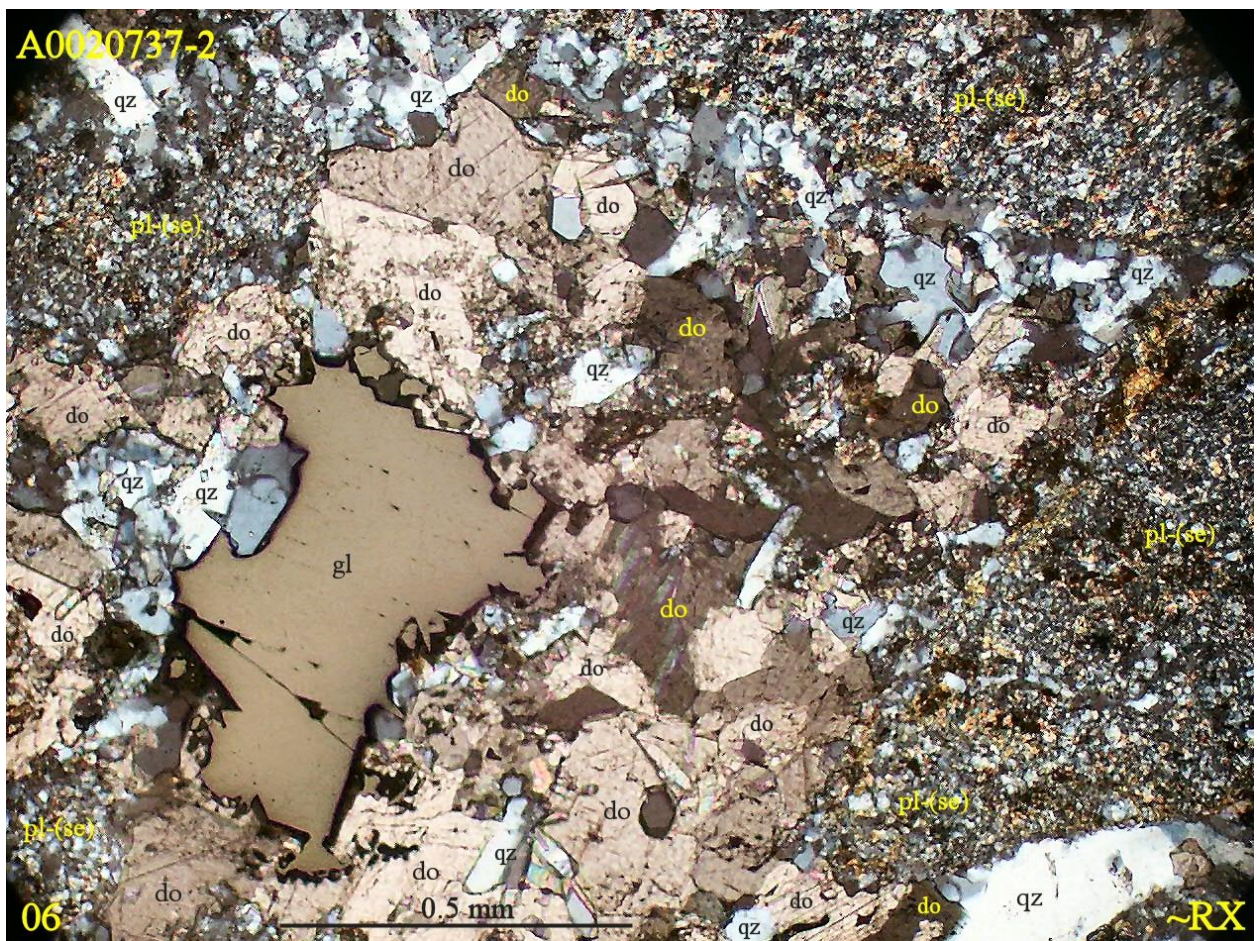


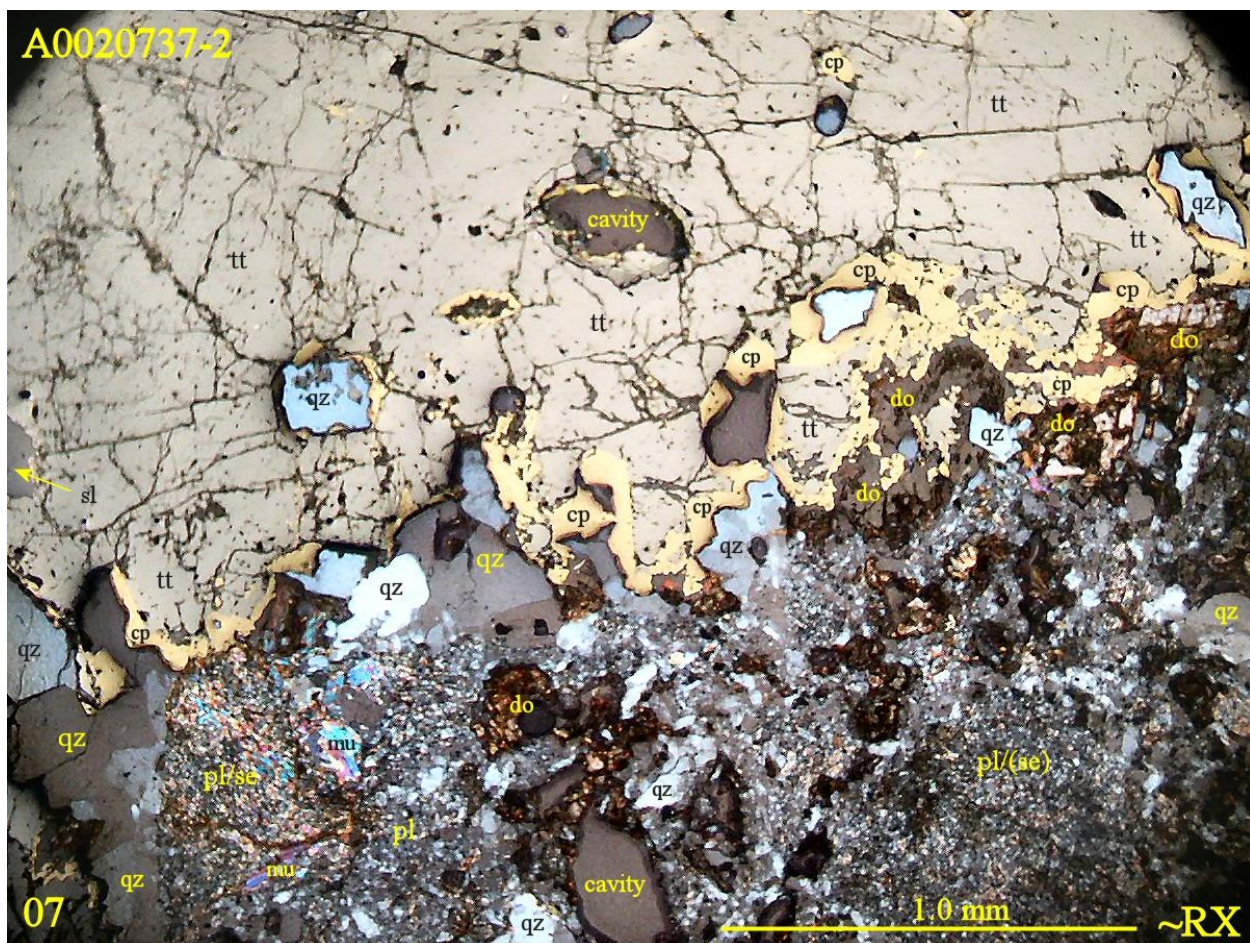


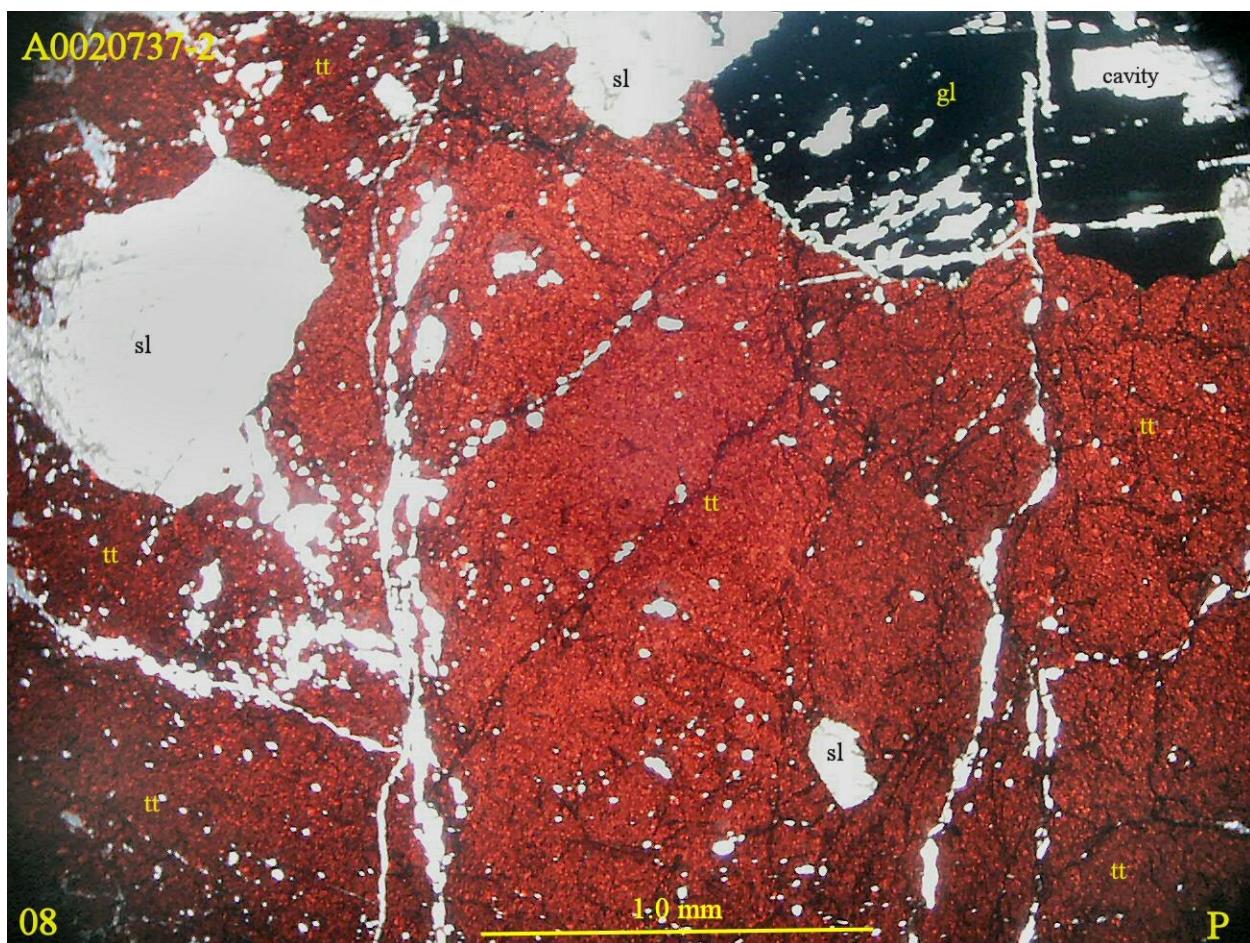


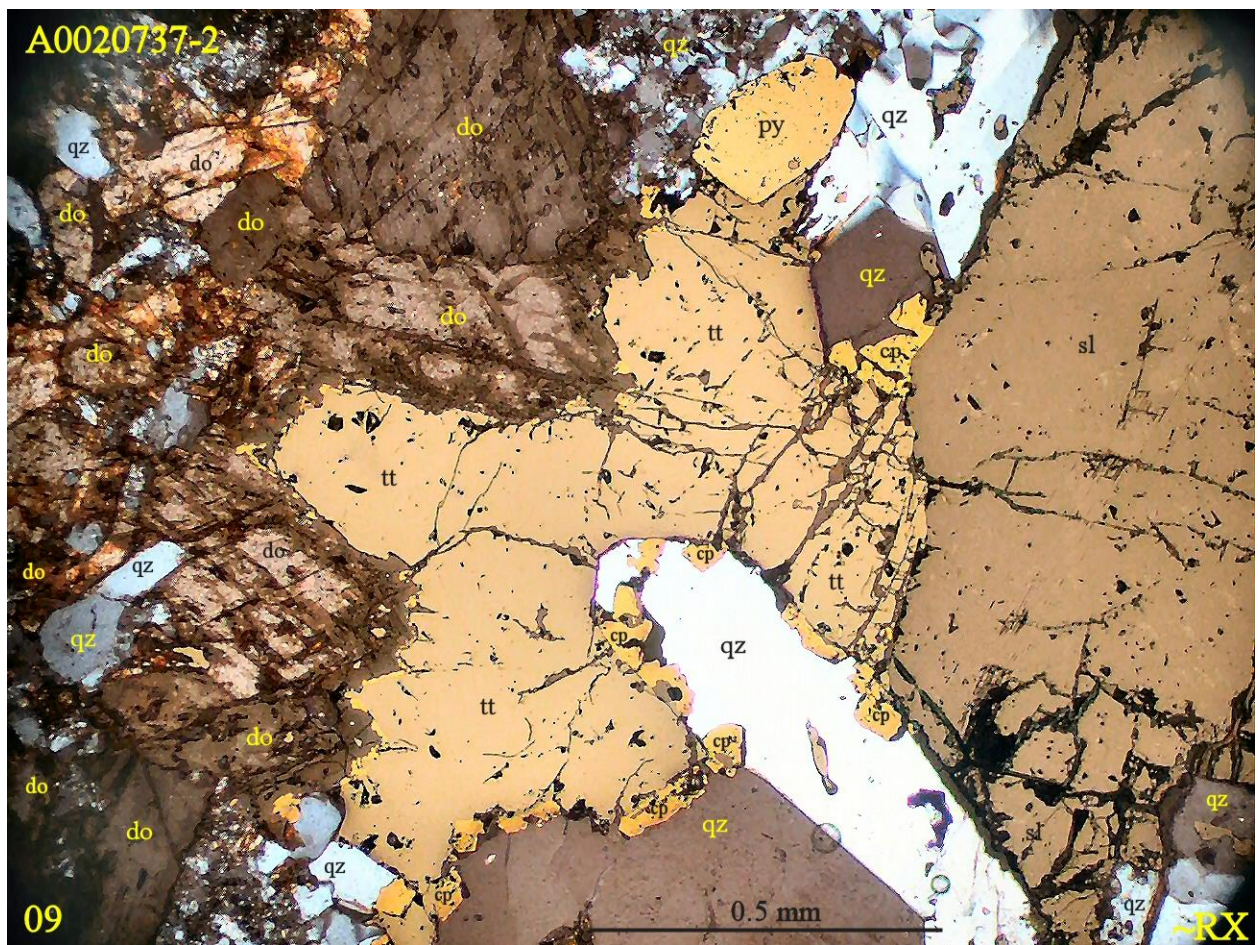






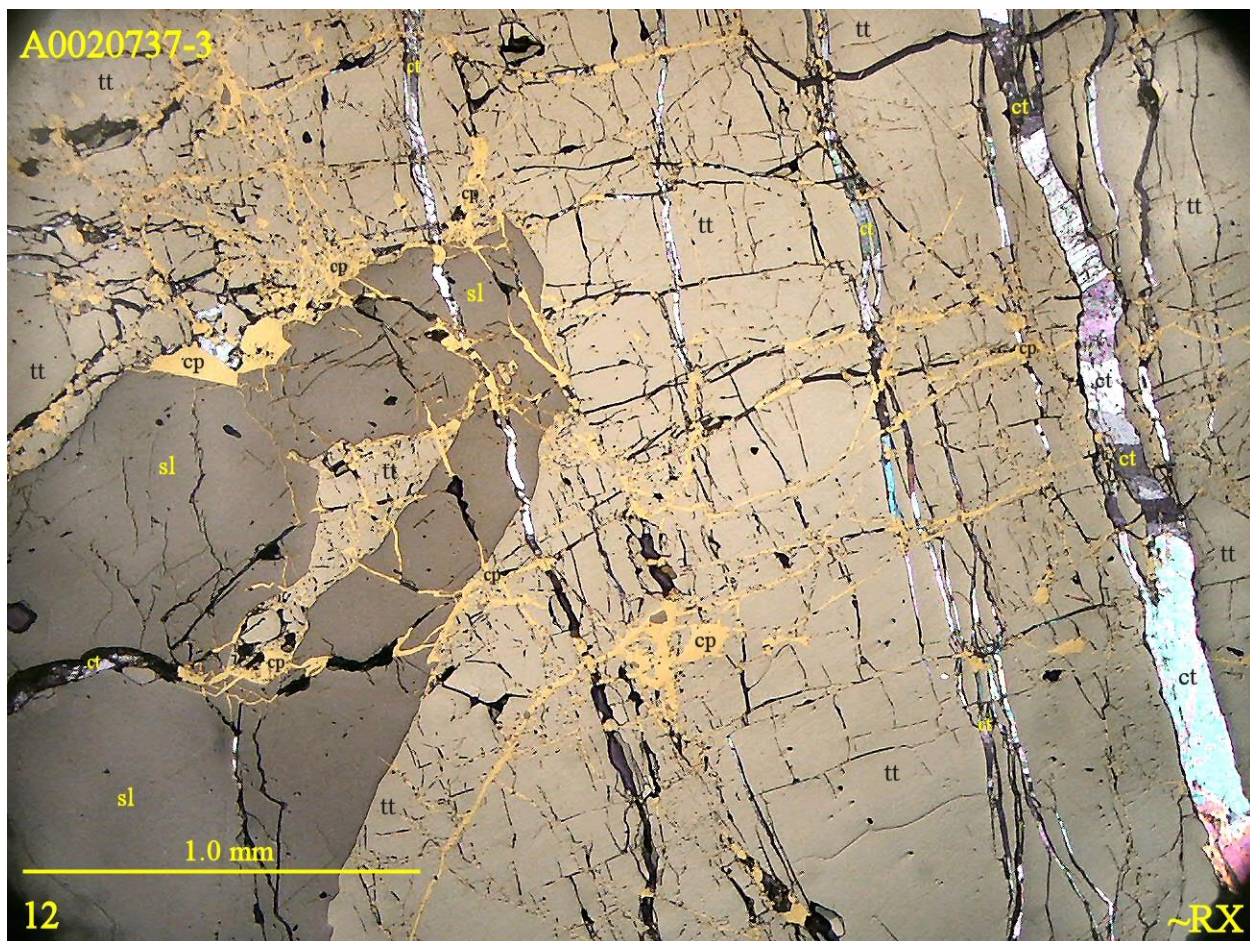




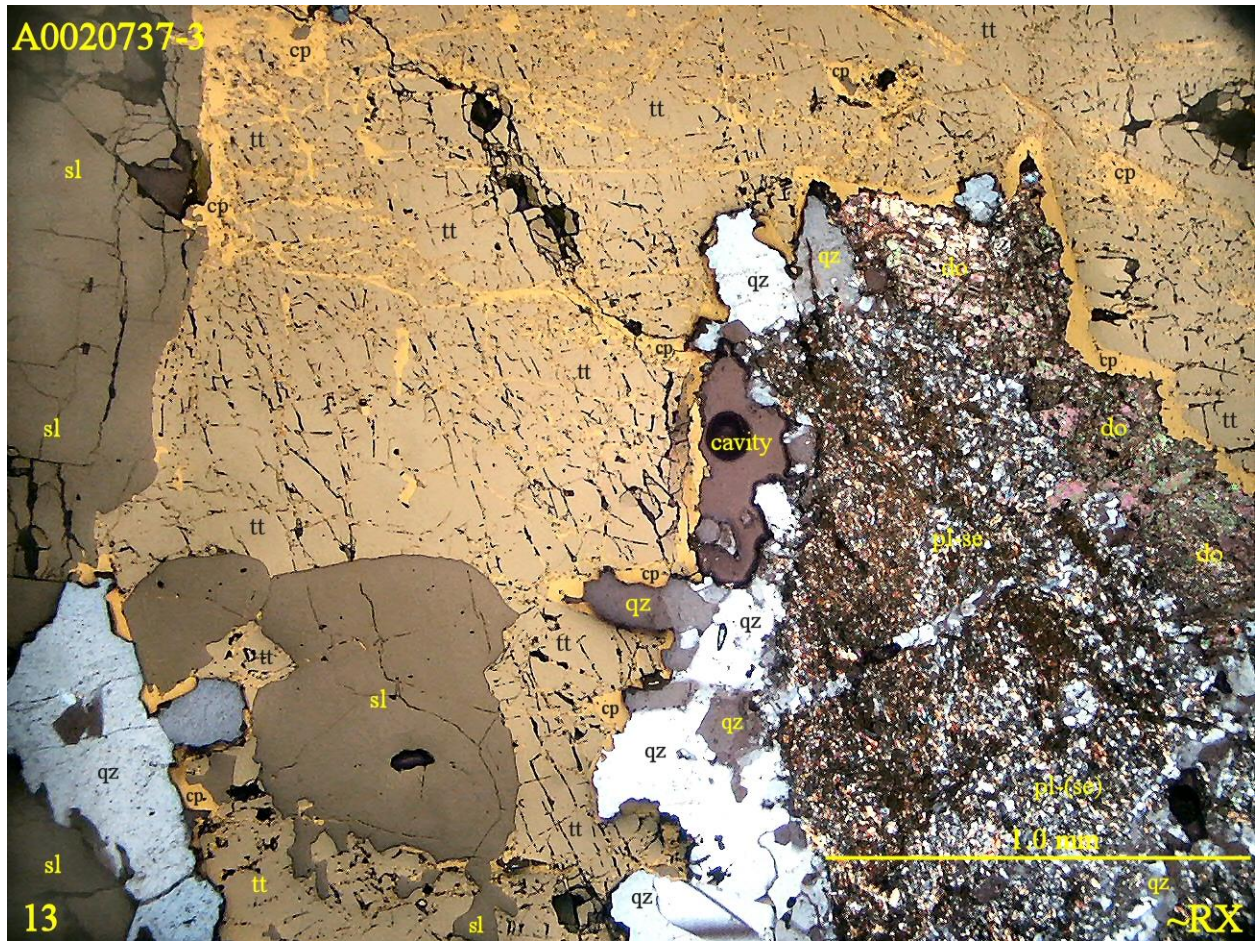


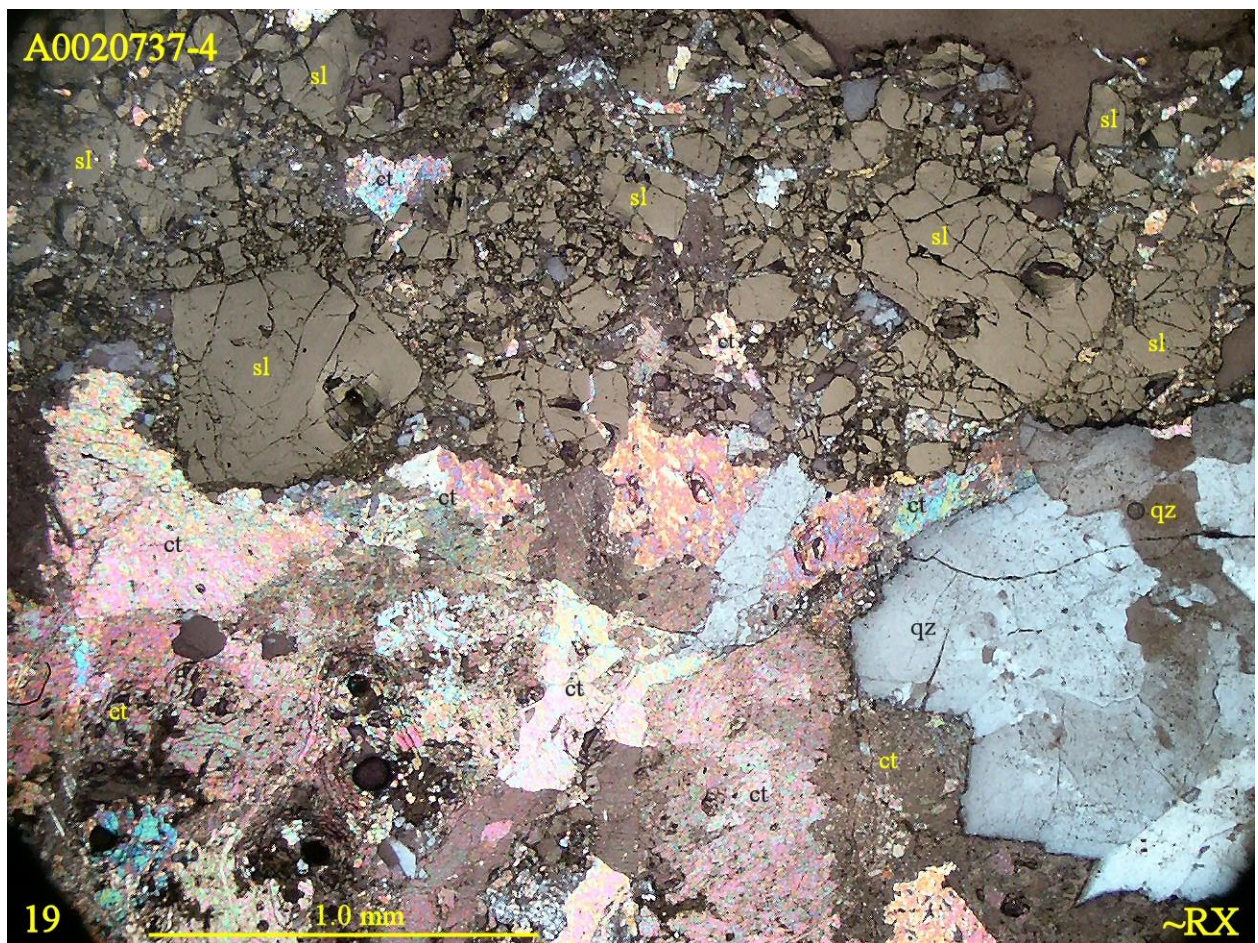


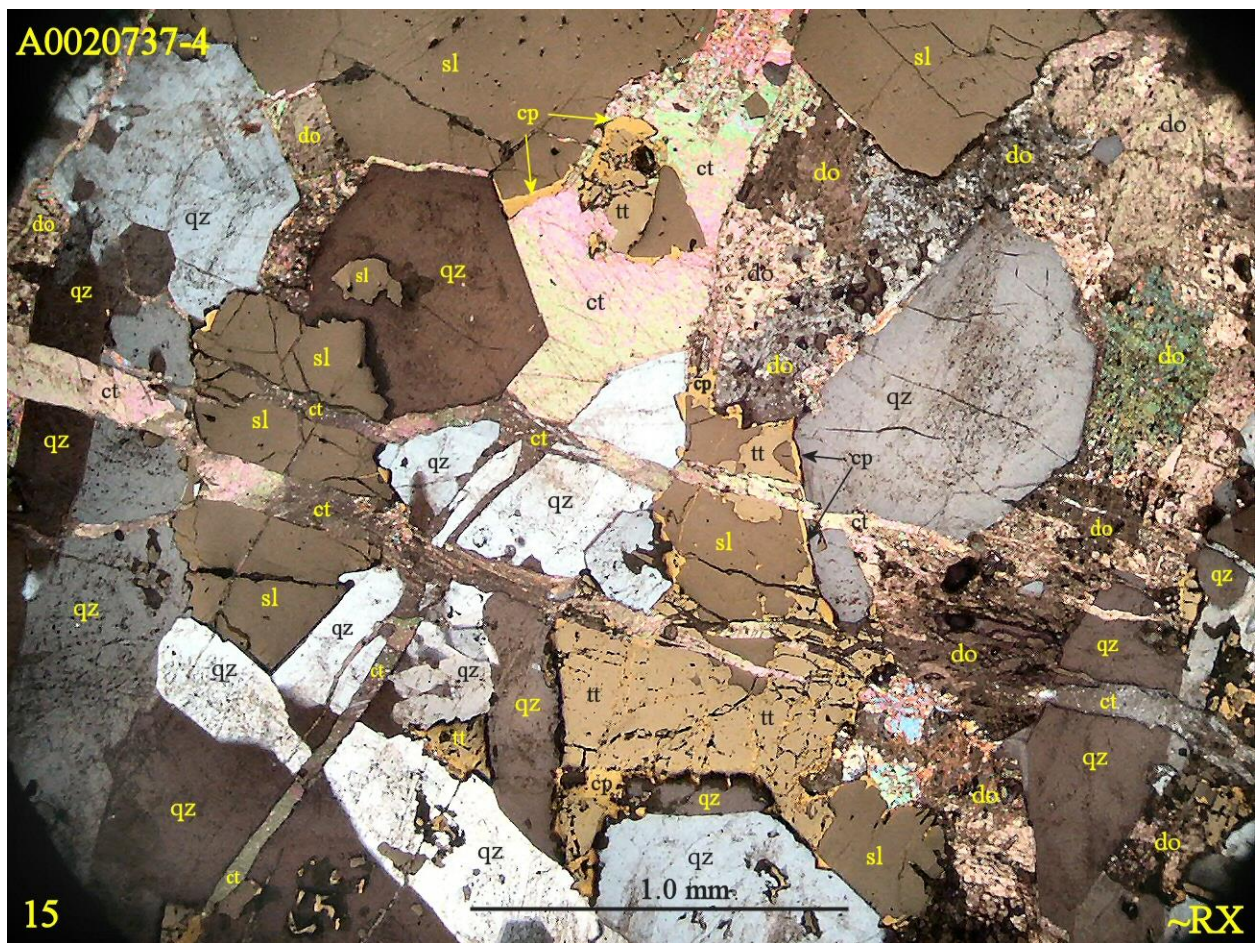


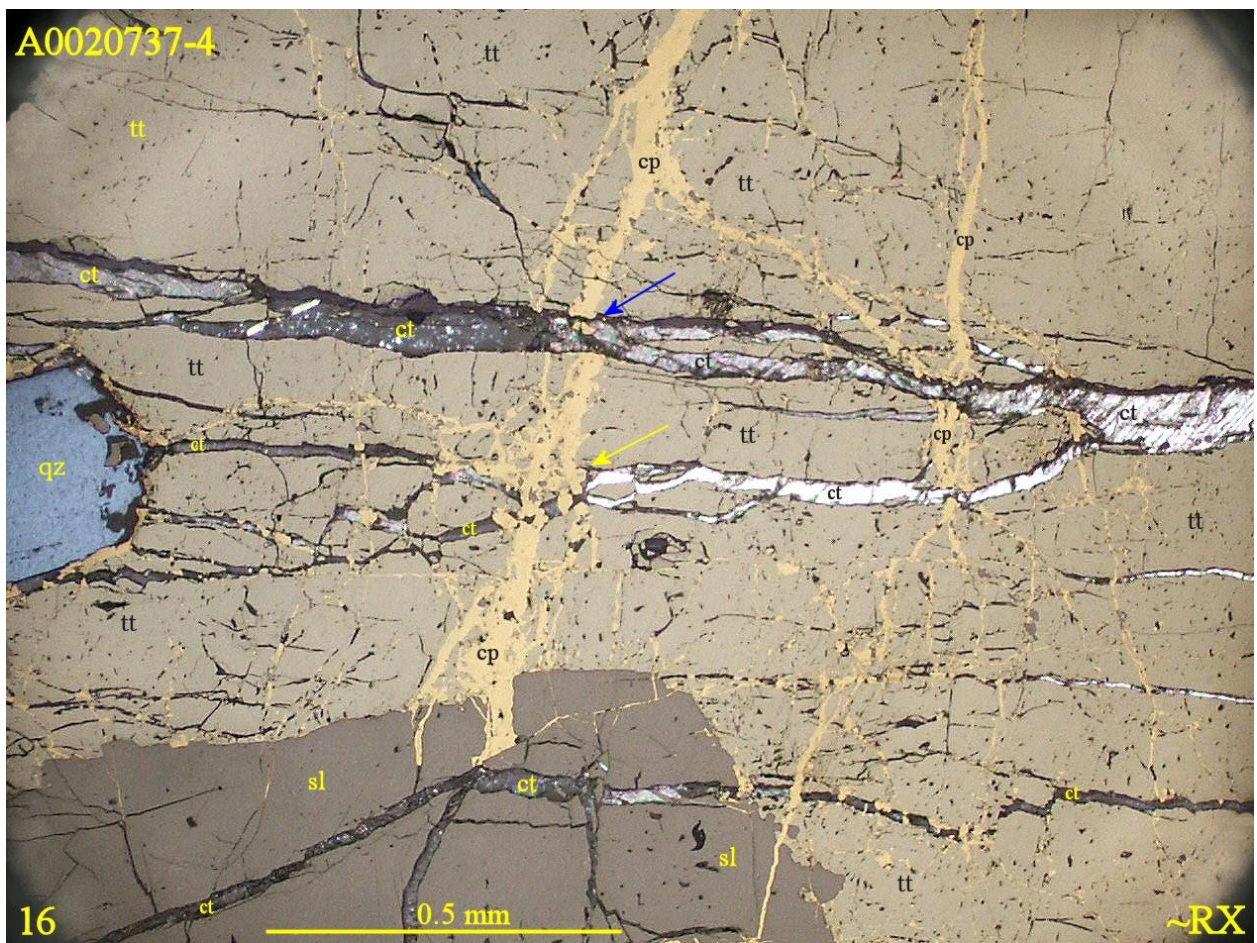


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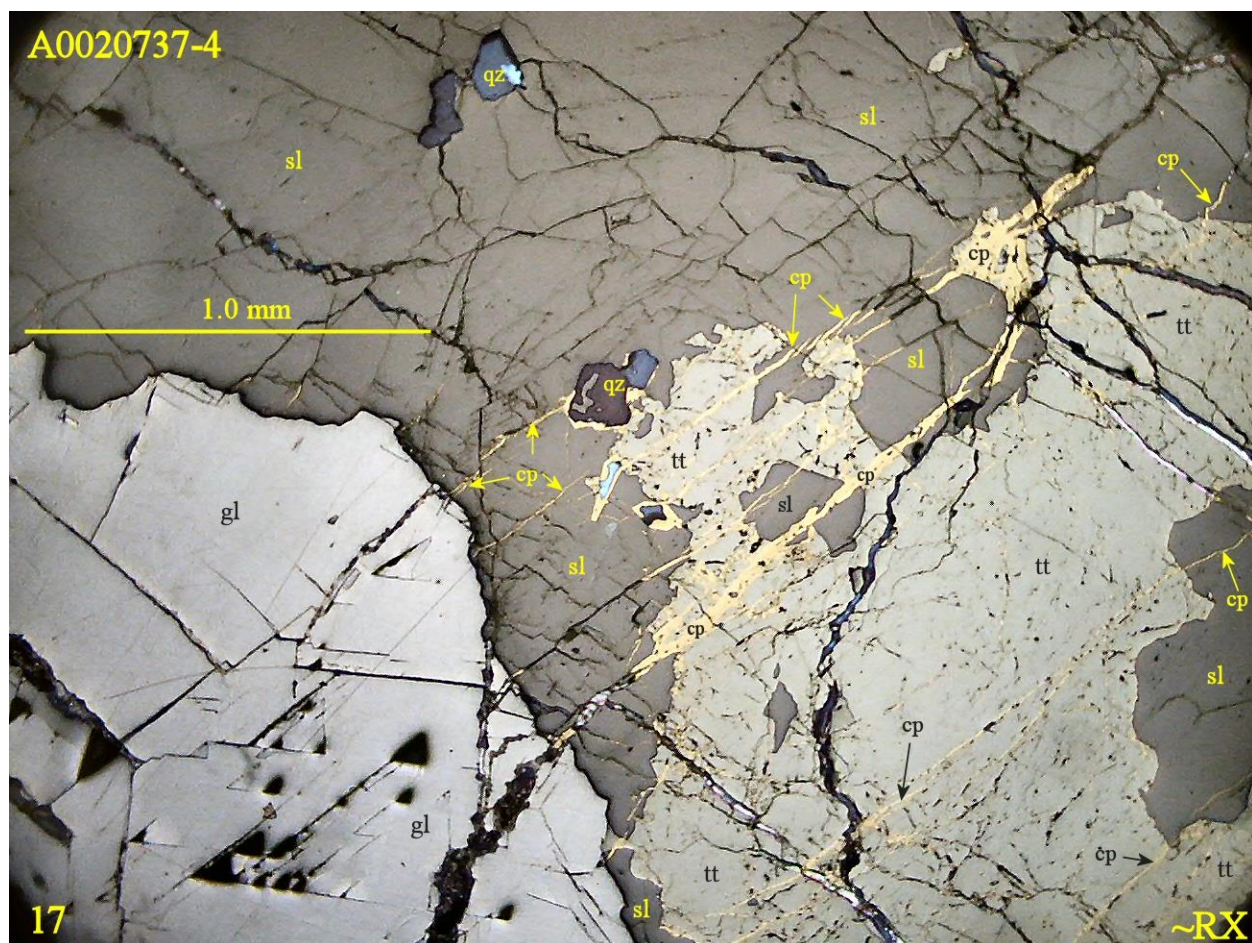


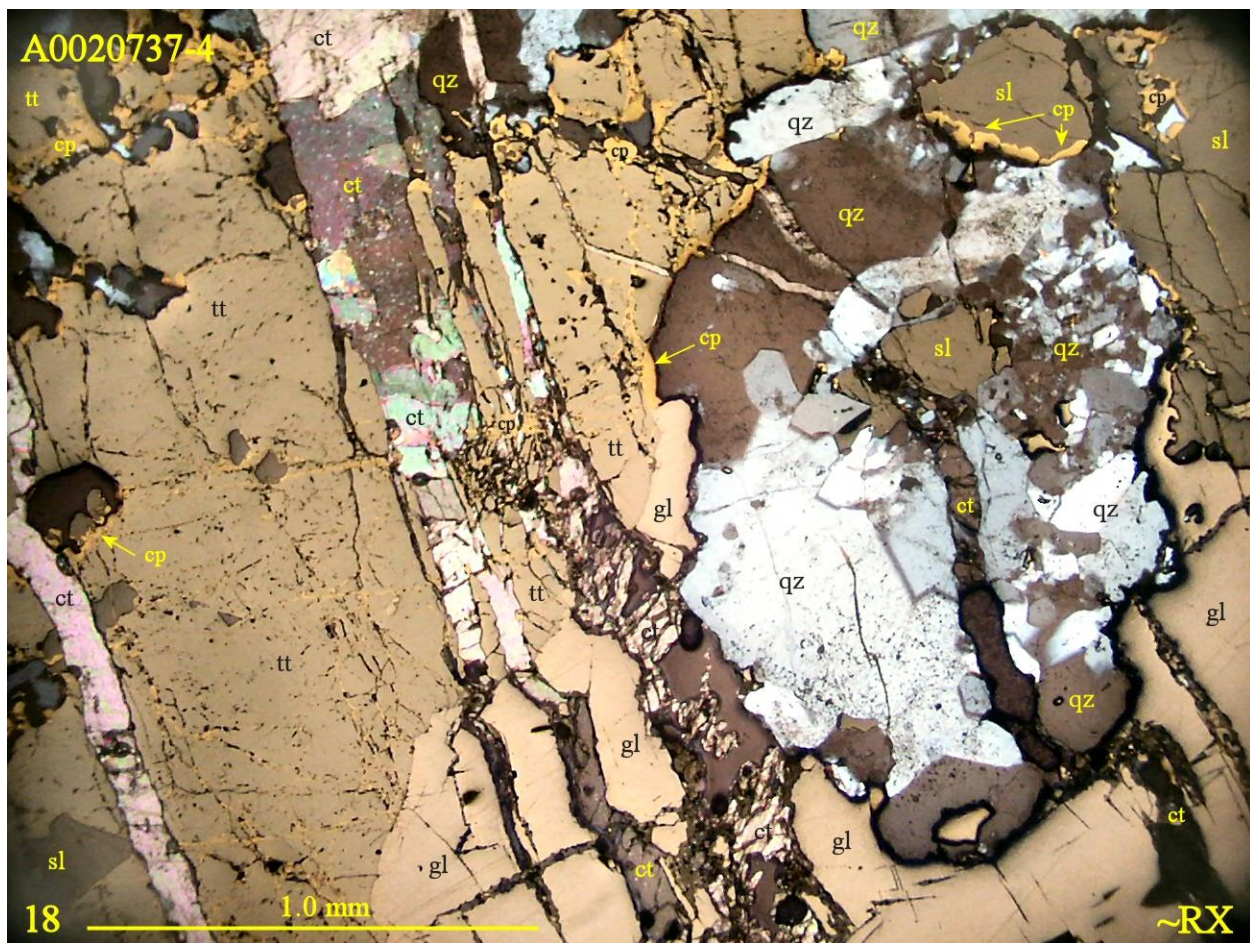


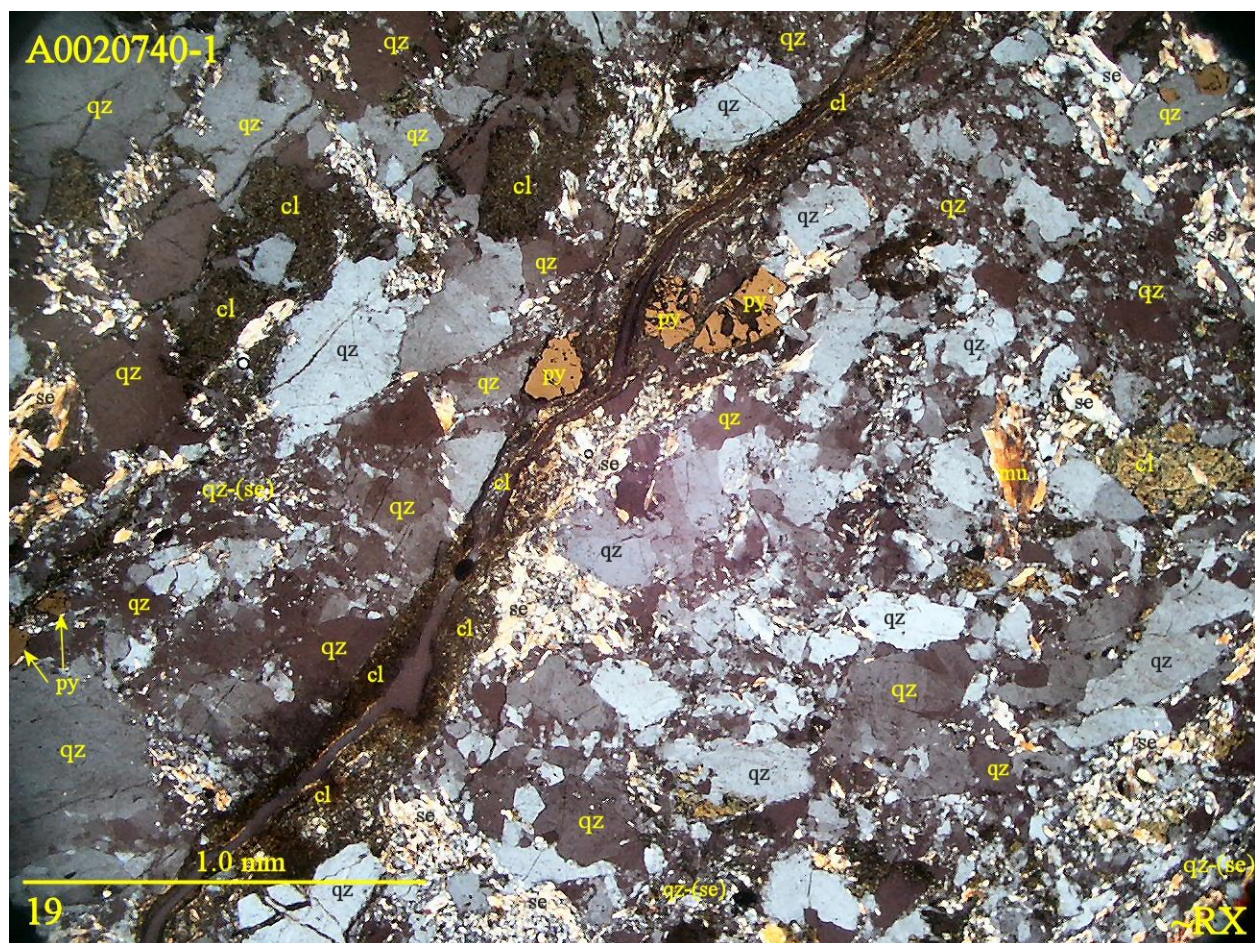


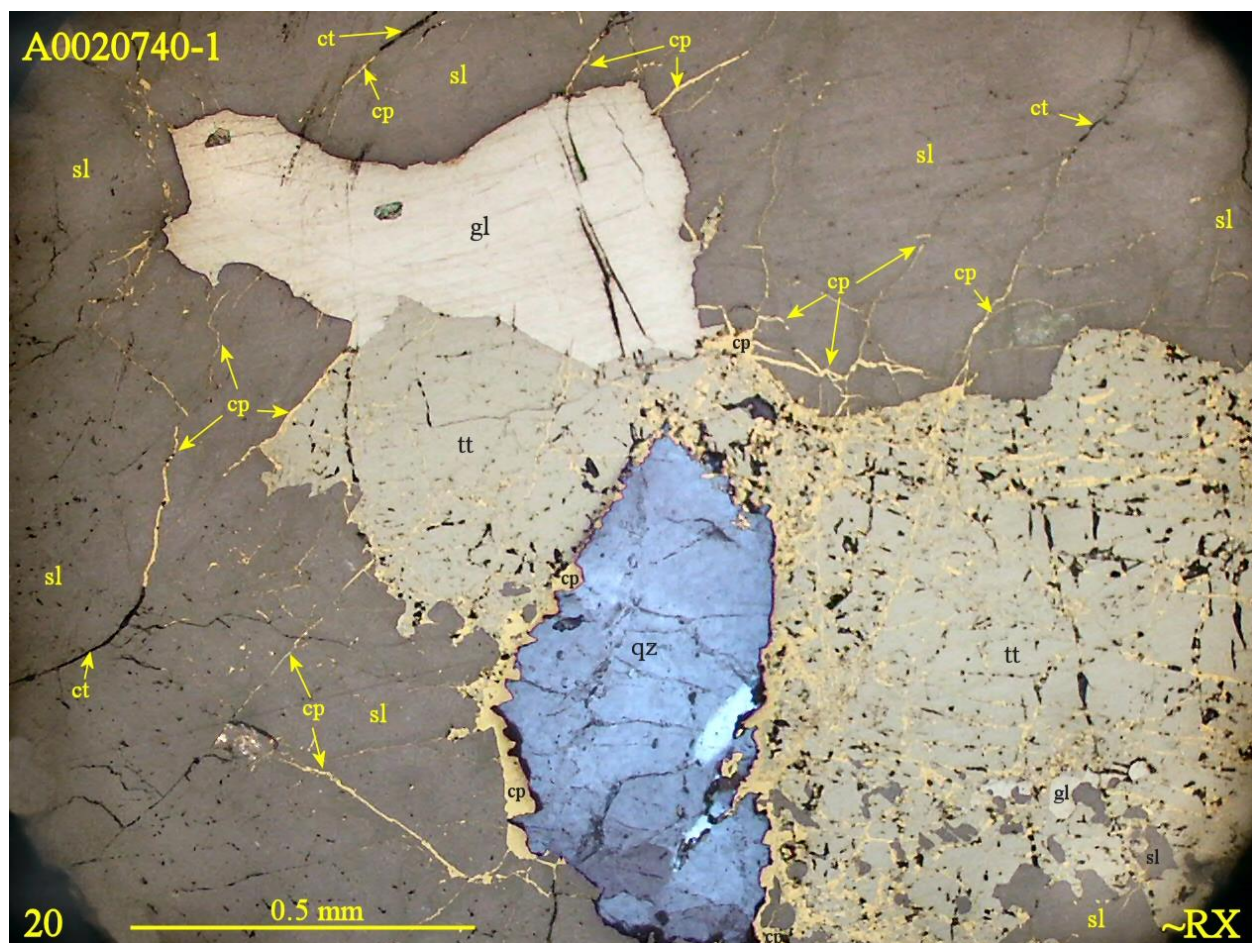


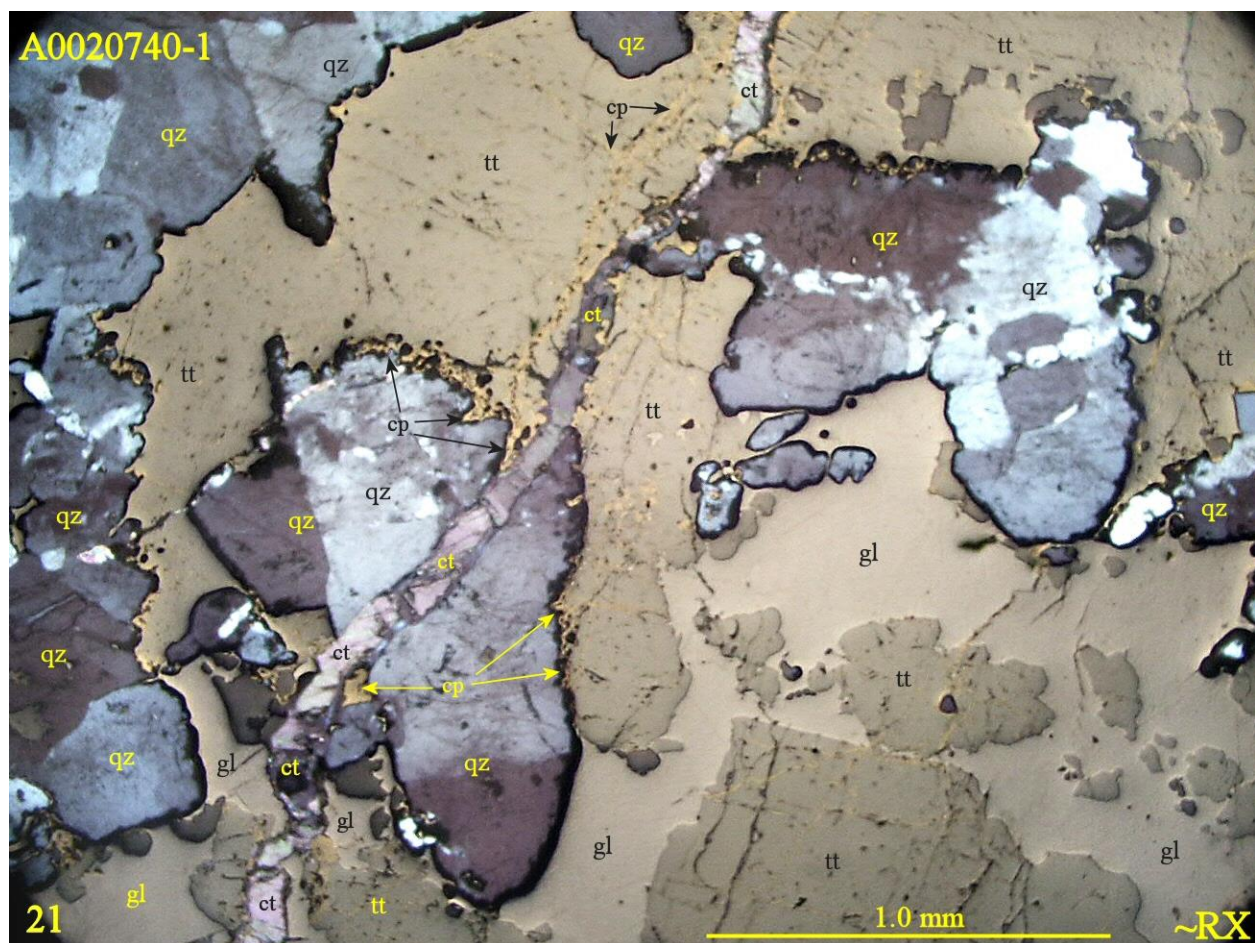
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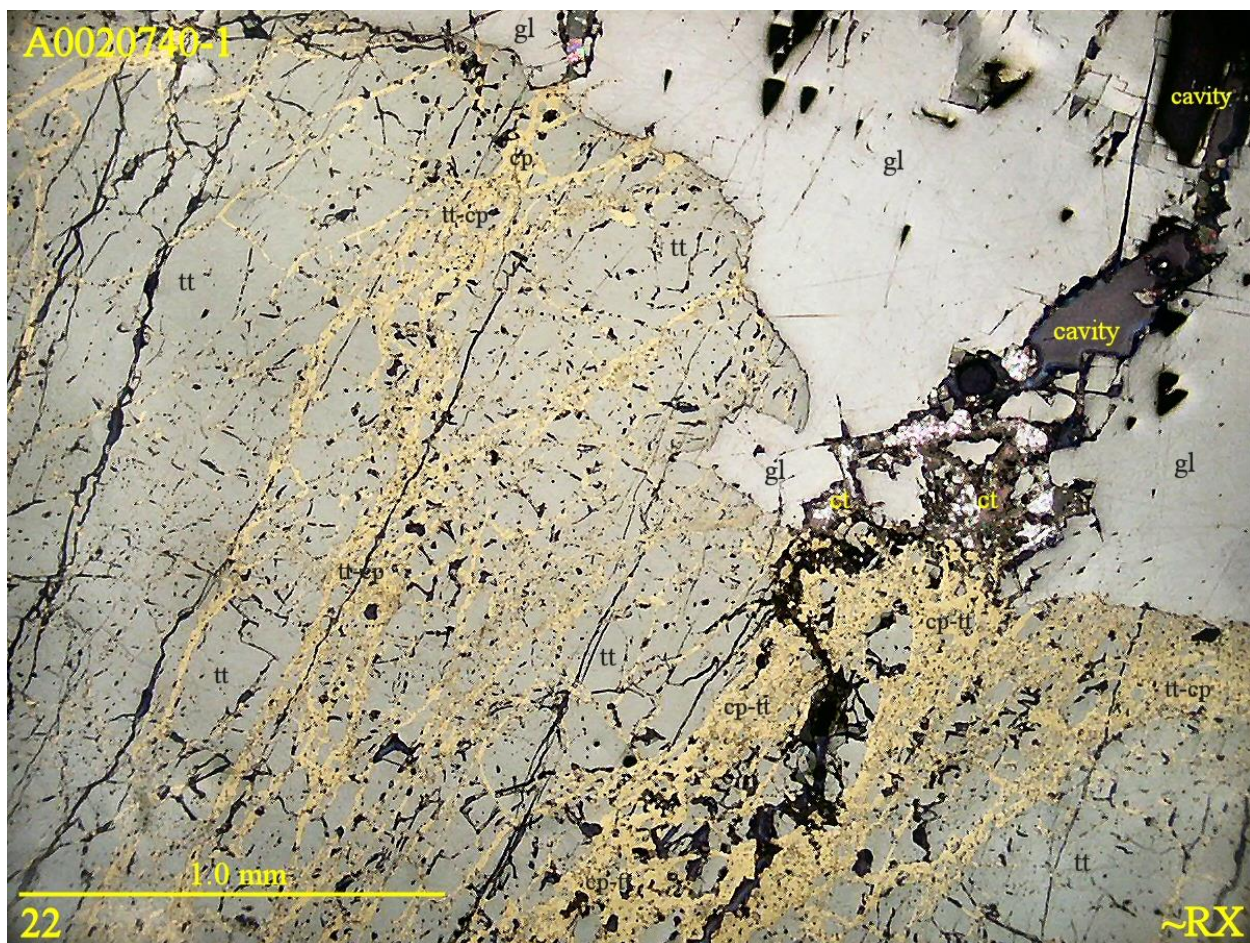






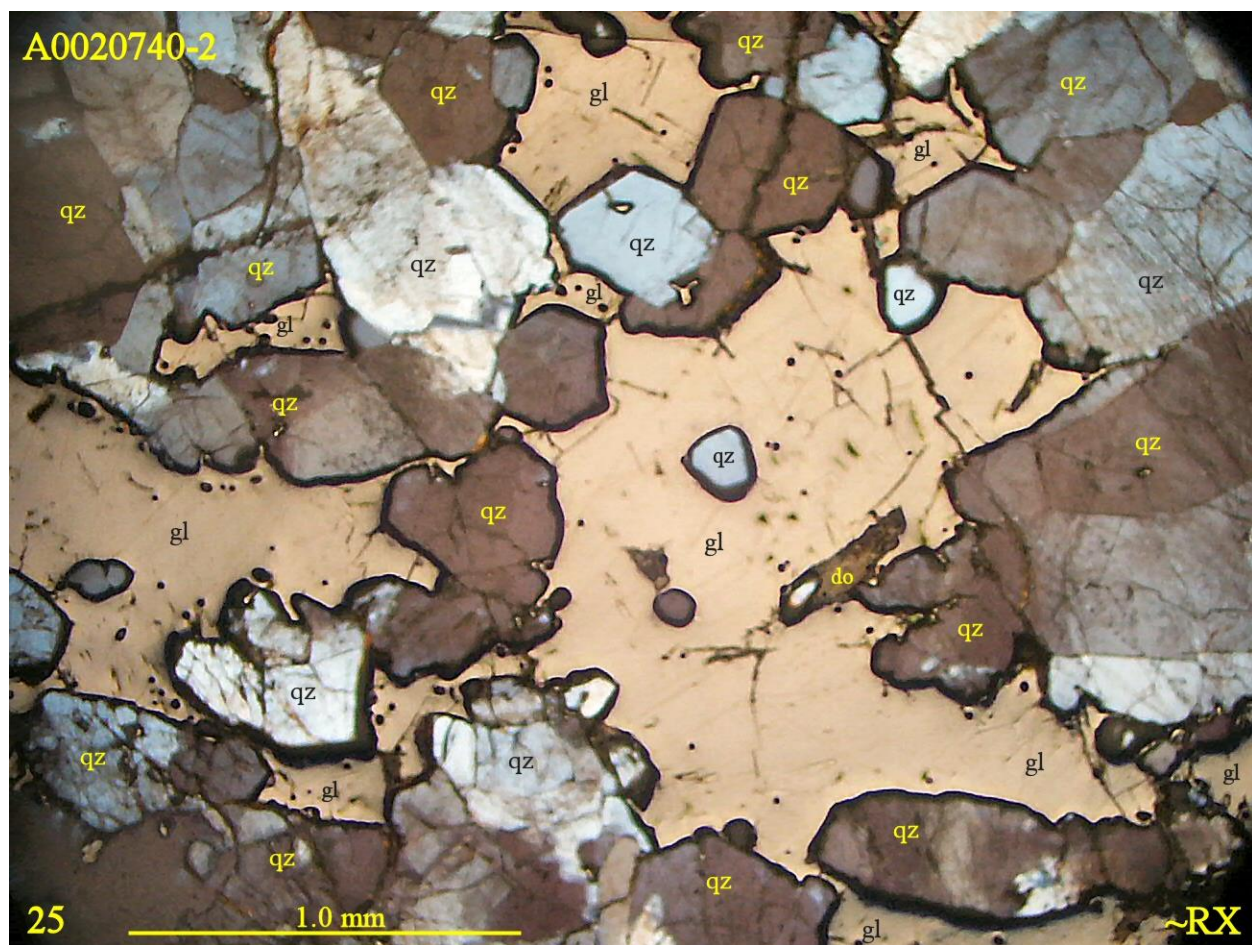


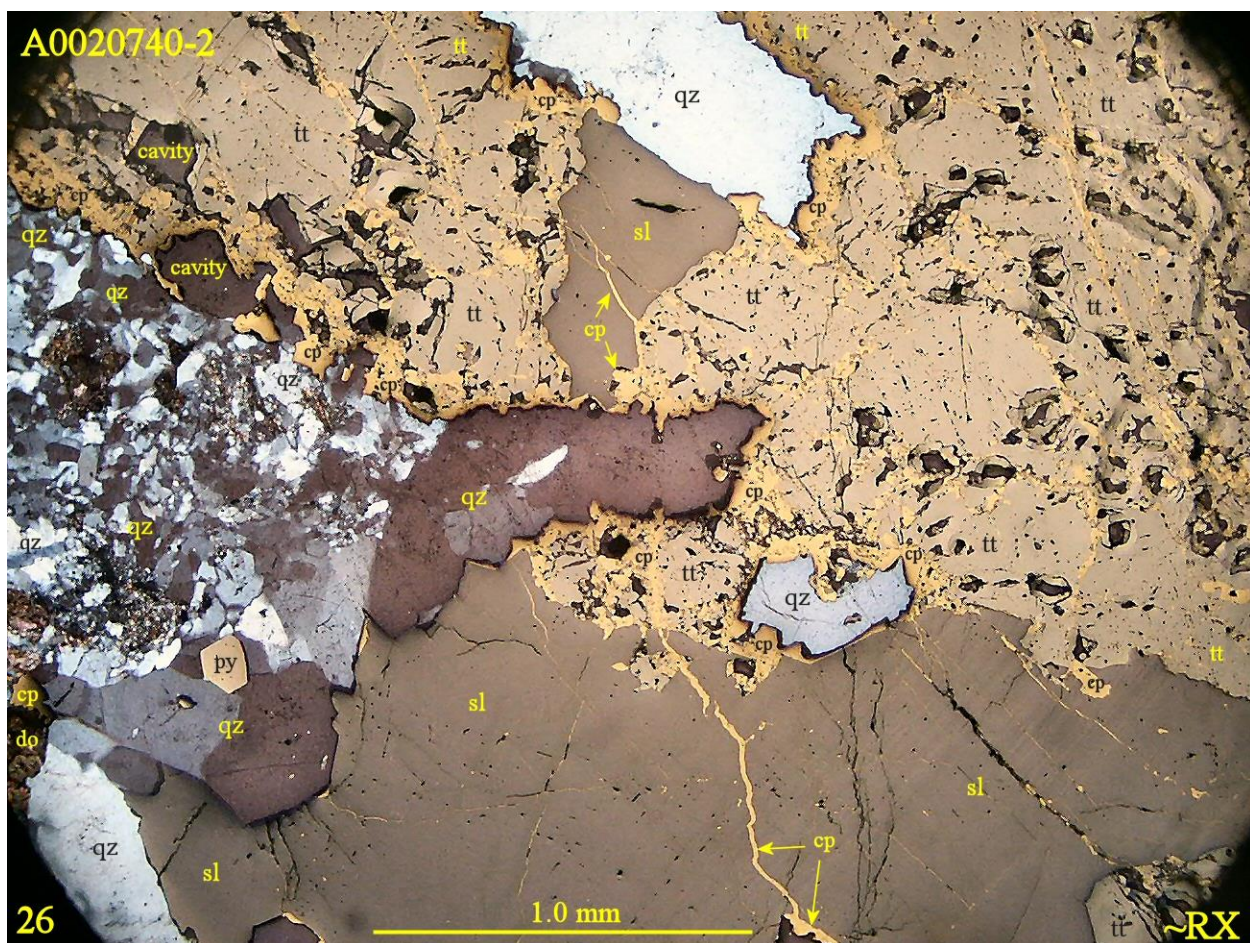


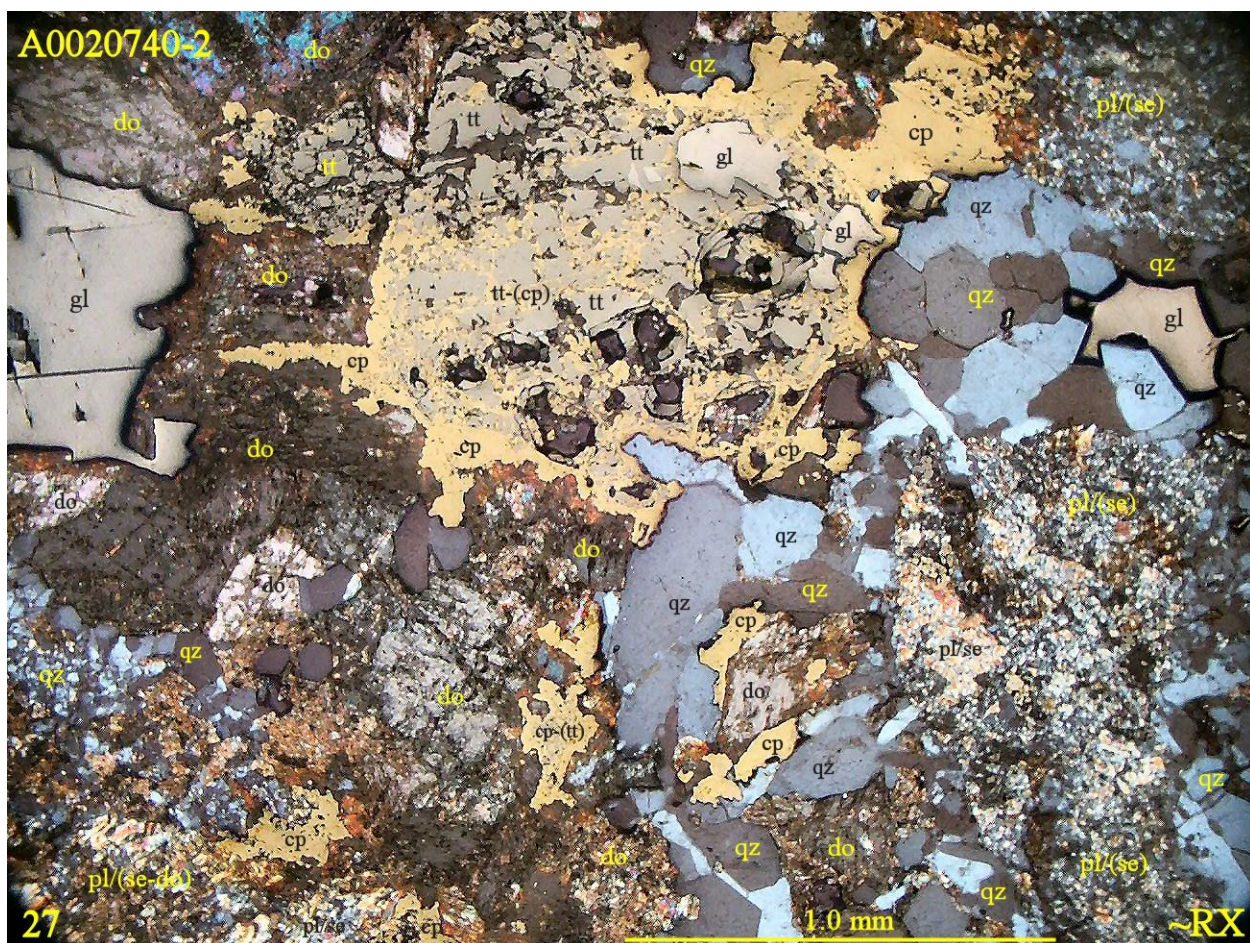


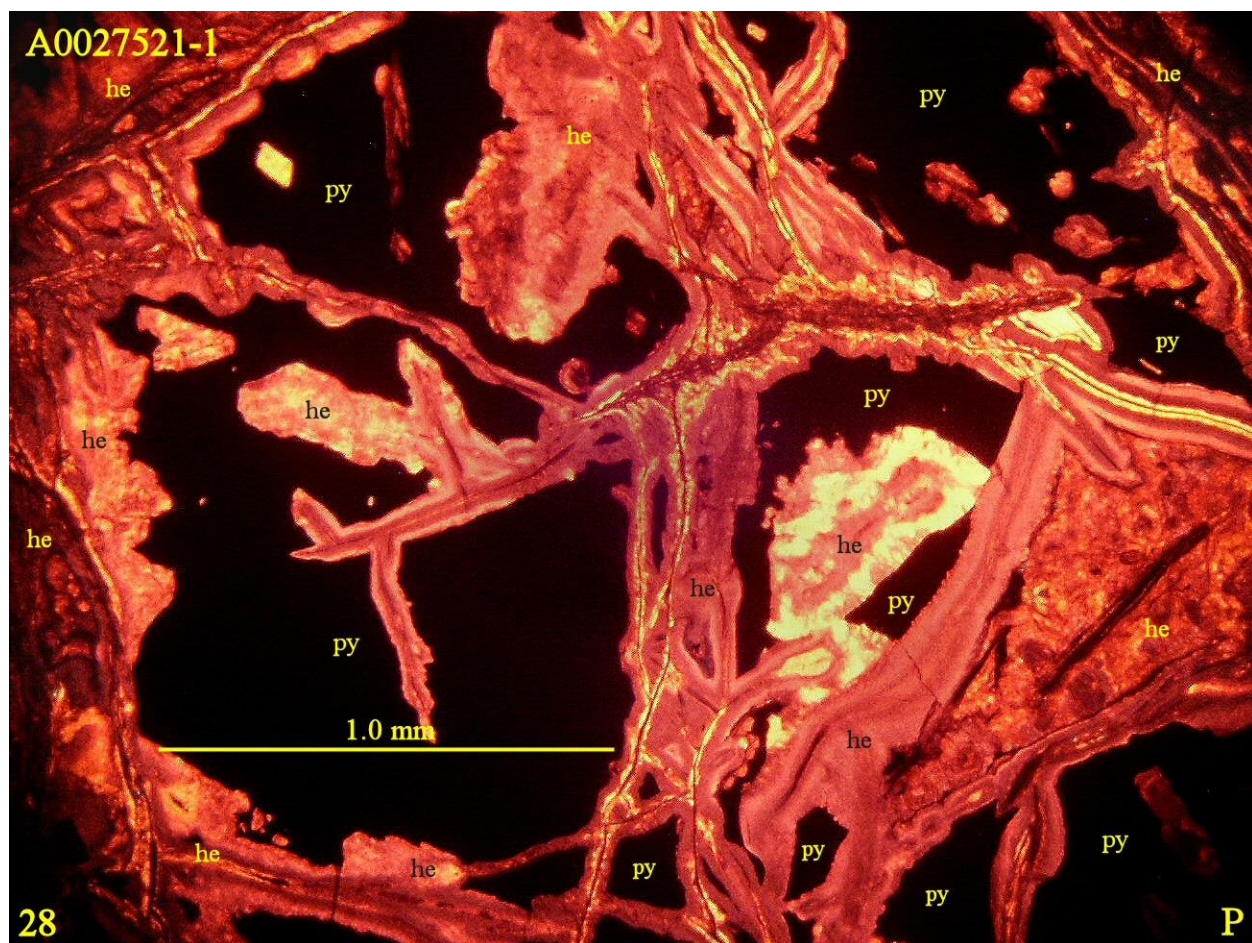


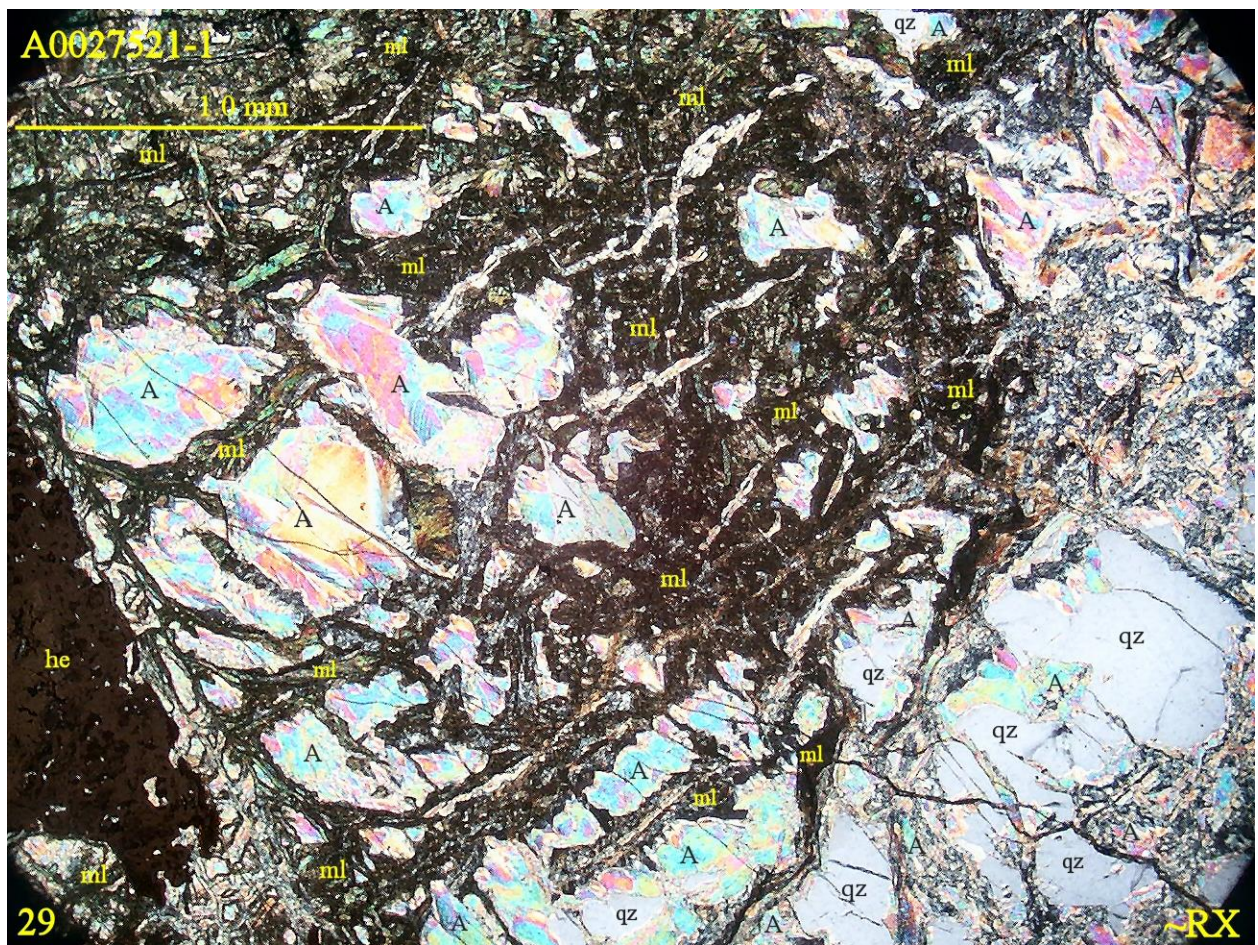


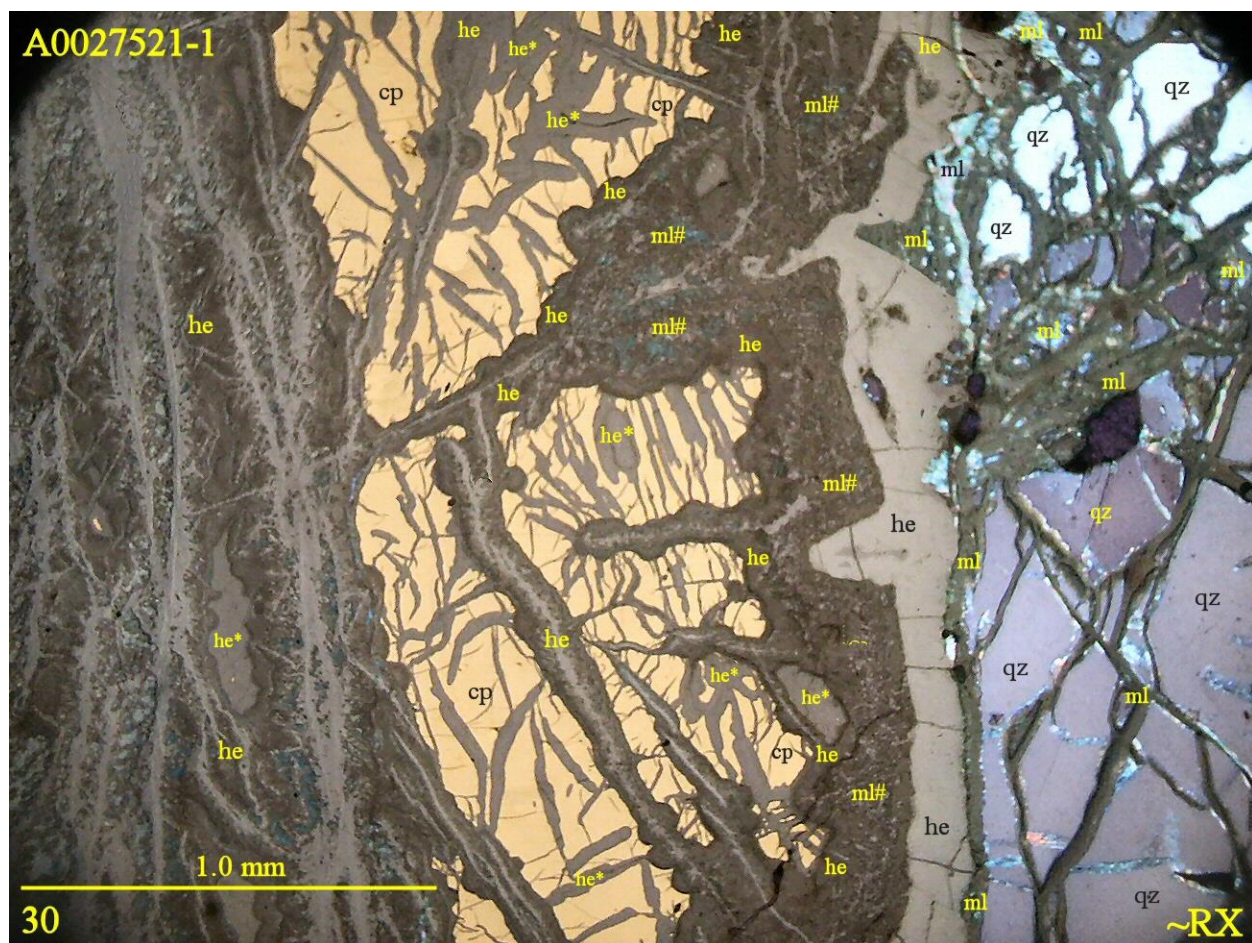




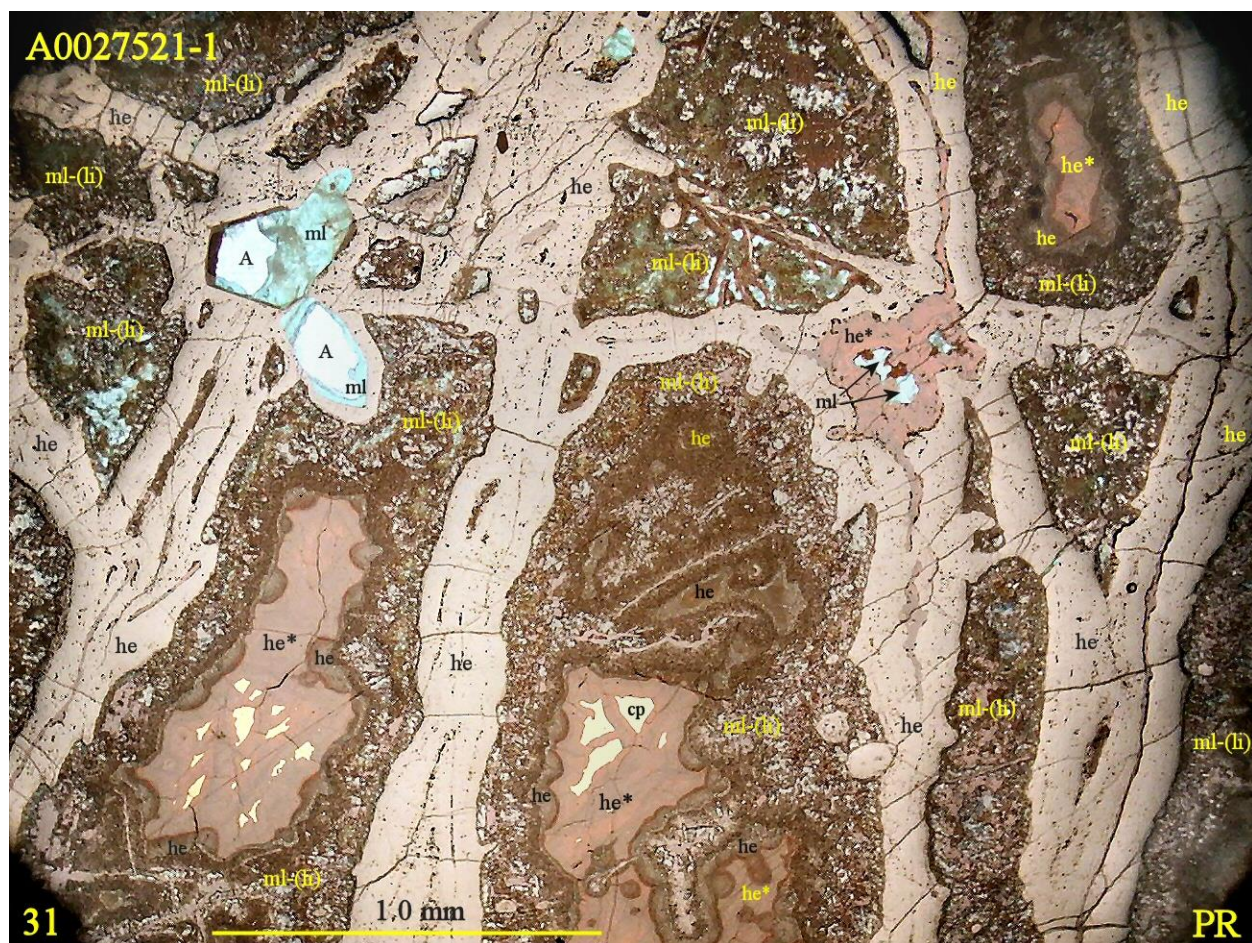


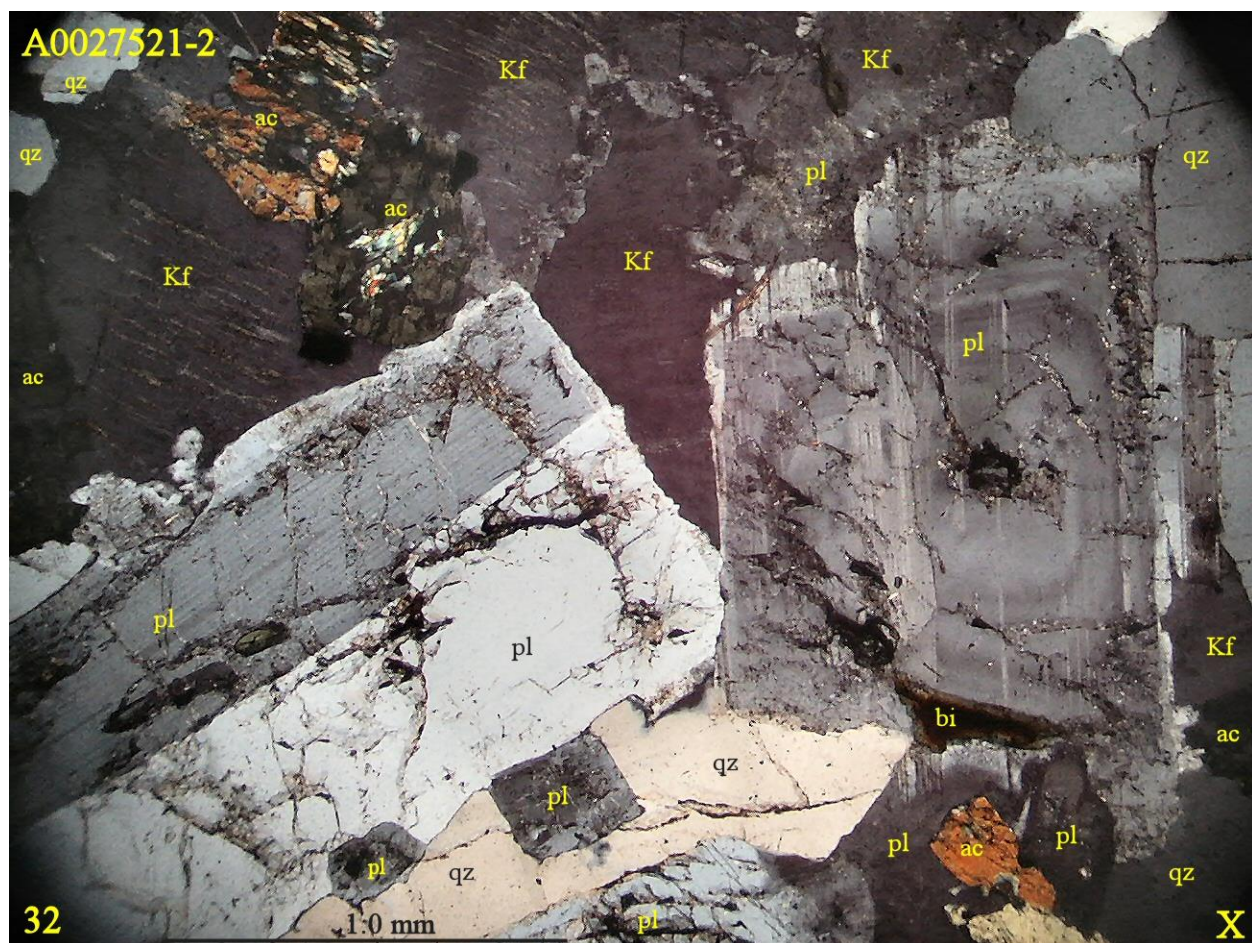






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