

Report 180078
Shaun Dykes,
America CuMo Mining Corp.,
638 Millbank Road,
Vancouver, BC, V5Z 4B7
sdykes@cumoco.com
tel: 604-689-7902; 604-520-6511

January, 2018

Samples: CA17-22-360; CA17-04-133; CA-17-13-183; CA17-05-149.8;
CA17-23-394; CA17-17-274.3; CA17-18-269.5; CA17-16-216; CA17-21-446.5

Summary:

Sample CA17-22-360 is of a calcite-quartz vein that contains scattered patches of pyrite and/or chalcopyrite, with trace amounts of Mineral Y, possibly a lead-bearing sulfosalt (assay 59.5 ppm Pb). Several seams are of granulated calcite grains; a few of these seams contain lenses of recrystallized quartz.

Sample CA17-04-133 is of banded schist that is dominated by massive calcite (altered moderately to strongly to limonite) with accessory disseminated patches of quartz. A few bands up to several mm wide are of various intergrowths of chlorite, sericite, quartz, and muscovite. Pyrite (altered strongly to pseudomorphic hematite) forms clusters of grains, mainly in ankerite and in quartz. The rock was brecciated slightly, with interstitial patches and a few late veins of fresh calcite and a few seams and veinlets of limonite.

Sample CA17-13-183 contains a small zone of quartz-sericite schist consisting of quartz with interstitial patches of sericite. The remainder of the section is a patchy vein consisting of calcite-rich and quartz-rich patches. Ankerite forms several sharply defined patches up to several mm across in calcite-rich zones; these patches were altered moderately to strongly to limonite. Late veinlets are of calcite and limonite/hematite, with one large vein also containing quartz.

Sample CA17-05-149.8 is of a vein that is dominated by calcite that was altered slightly to moderately to limonite. Quartz forms irregular patches in about half of the section that are intergrown finely to coarsely with patches of calcite. Sulphides occur in patches mainly along quartz-calcite contacts; pyrite is altered slightly to hematite and chalcopyrite is altered moderately to strongly to hematite and locally to malachite. A breccia seam in calcite has a matrix of limonite. Numerous fracture-filling veinlets in calcite are of calcite and limonite and one is of malachite.

Sample CA17-23-394 is of a fine grained vein dominated by calcite/dolomite with much less abundant, irregular patches of quartz and patches of chalcopyrite-(pyrite). The vein was brecciated strongly and the breccia matrix is dominated by calcite/dolomite with lesser patches of quartz, some of which appears to have crystallized in cavities. In the section sulphide patches are concentrated moderately to strongly in a band up to 1 cm wide; in the hand sample the zone of abundant sulphides is broader and not as well defined. Sulphide fragments, dominated by chalcopyrite with lesser pyrite, are concentrated in the breccia matrix in the same zone that contains abundant sulphides in the vein.

Sample CA17-17-274.3 is of a brecciated patchy quartz-calcite vein; the section is taken from a quartz-rich part of the sample and contains a few calcite-rich patches, several sulphide clusters (mainly chalcopyrite with lesser pyrite). Chalcopyrite was variably altered to chalcocite-(covellite), hematite, and malachite; pyrite was altered strongly to hematite). Strong brecciation produced granulation of minerals in patches and seams.

Sample CA17-18 269.5 is of a quartz vein with disseminated patches of chalcopyrite (altered slightly to strongly to hematite, malachite, and Mineral Z) and scattered patches dominated by sericite (some of which may represent fragments of altered wall rock). Veinlets are of chalcopyrite-hematite-Mineral Z/malachite and of Mineral Z/malachite.

Sample CA17-16-216 is of a quartz vein with scattered patches of chalcopyrite (altered strongly to completely to hematite). It is cut by a major splayed brecciated zone in which minerals were granulated strongly. Minor veinlets are of malachite.

Sample CA17-21 446.5 is of a calcite/dolomite vein that contains scattered patches of chalcopyrite and lesser pyrite, minor quartz, and trace galena. The carbonate is described as calcite/dolomite because of the high IMP value of Mg (9.08%). The vein was cut by a few brecciated seams up to 0.5 mm wide and contains a few brecciated patches, all of which consists of granulated calcite/dolomite with minor fragments of chalcopyrite and trace pyrite and quartz.

Petrographic Notes

Carbonates: Samples were tested with cold, dilute HCl. Most samples containing significant carbonate reacted moderately to vigorously, indicating a high calcite content. Sample CA17-23-394 and Sample CA17-21-446.5 contain abundant MgO, suggesting the presence of a significant amount of dolomite. In Sample CA17-23-394, effervescence is much weaker than normal but more intense than expected for dolomite, whereas in Sample CA17-21-446.5, effervescence is closer to that of the calcite-bearing samples. In these two samples, the carbonate is described as calcite/dolomite. In Sample CA17-13-183, which contains moderate MgO, discrete patches of carbonate were altered strongly to limonite, suggesting that these patches are of ankerite.

Secondary Cu Minerals: chalcopyrite was altered in some samples to secondary Cu minerals including chalcocite, minor covellite (with chalcocite), malachite, and Mineral Z (pale green, low relief, moderate birefringence). More intense alteration of chalcopyrite in some samples is to hematite.

Assay Notes: The assays for Cu and Pb correspond well with the sections; the only two sections containing galena and a possible Pb-sulphosalt have the highest Pb values. The low assay values for Ag correlate with the absence of identifiable silver-rich minerals.

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: 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 CA17-22-360

**Calcite-Quartz-(Pyrite-Chalcopyrite) Vein
Breccia Seams: Calcite-(Quartz)**

The sample is of a calcite-quartz vein that contains scattered patches of pyrite and/or chalcopyrite, with trace amounts of Mineral Y, possibly a lead-bearing sulfosalt (assay 59.5 ppm Pb). Several seams are of granulated calcite grains; a few of these seams contain lenses of recrystallized quartz.

mineral	percentage	main grain size range (mm)	
calcite	75-80%	0.3-1	(a few up to 1.5 mm)
quartz	12-15	0.05-0.2	(a few up to 1 mm)
pyrite	2- 3	0.05-0.5	(a few up to 1 mm)
chalcopyrite	1- 2	0.01-0.5	
muscovite/sericite	minor	0.02-0.07 (mu); 0.01-0.03 (se)	
Mineral Y	trace	0.03-0.05	
recrystallized seams			
1) calcite-(quartz)	2- 3	0.003-0.015 (ct); 0.015-0.03 (qz)	

Calcite forms anhedral, slightly interlocking grains.

Quartz is concentrated moderately to strongly in quartz-rich patches of anhedral grains that are intergrown with much less abundant calcite grains.

Muscovite forms disseminated flakes in a few quartz-rich patches. Sericite/muscovite forms a few patches up to 0.15 mm in size adjacent to patches of quartz-chalcopyrite.

Sulphides are concentrated in quartz-rich patches.

Pyrite forms disseminated grains and clusters of a few, mainly anhedral grains. Many larger grains have finely corroded margins and some are fractured finely.

Chalcopyrite forms disseminated irregular patches, mainly alone and locally associated with pyrite. Some areas up to 0.7 mm across of calcite contain abundant disseminated chalcopyrite grains (0.02-0.05 mm).

Mineral Y (possibly a Pb-bearing sulphosalt) forms disseminated patches, in part associated with chalcopyrite and lesser pyrite, and locally as single grains disseminated in calcite. It is light grey in colour in reflected light with moderate reflectivity and is isotropic.

Several, in part subparallel seams up to 0.15 mm wide are of granulated calcite grains. A few of these seams contain lenses from 0.03-0.1 mm wide of recrystallized quartz.

Sample CA17-04-133**Banded Schist:****Calcite/Limonite-(Pyrite); Chlorite-Sericite-(Muscovite); Quartz
Veinlets, Breccia Matrix: Calcite-(Limonite)**

The sample is dominated by massive calcite (altered moderately to strongly to limonite) with accessory disseminated patches of quartz. A few bands up to several mm wide are of various intergrowths of chlorite, sericite, quartz, and muscovite. Pyrite (altered strongly to pseudomorphic hematite) forms clusters of grains, mainly in ankerite and in quartz. The rock was brecciated slightly, with interstitial patches and a few late veins of fresh calcite and a few seams and veinlets of limonite.

mineral	percentage	main grain size range (mm)	
calcite	60-65%	0.3-0.7	
chlorite	10-12	0.02-0.05; locally 0.1-0.3	
quartz	10-12	0.03-0.1	
sericite	7- 8	0.02-0.03	
muscovite	1- 2	0.15-0.3	
pyrite	0.7	0.07-0.3	
chalcopryite	minor	0.3-0.5	
veins, breccia matrix		percentage	main grain size range (mm)
1) calcite-(limonite/hematite)		4- 5	0.1-0.5
2) limonite		1- 2	amorphous

Calcite (altered moderately to strongly to limonite) forms anhedral, equant grains. Limonite is commonly concentrated along wispy fractures and grain margins. Calcite-rich zones contain scattered, irregular patches of quartz up to 1.5 mm in size and a few subhedral to euhedral prismatic grains of quartz (0.07 x 0.2 mm).

Irregular bands up to several mm wide are dominated in part by quartz, in part by sericite, and in part by chlorite-sericite. Bands commonly have a moderate foliation parallel to their length. Some bands that are dominated by chlorite and sericite contain disseminated slender flakes of muscovite parallel to the length of the band. Some quartz-rich bands contain discontinuous lenses up to 3 mm long by up to 0.15 mm wide containing abundant pyrite (altered moderately to hematite) and lesser calcite.

A few patches up to 1.5 mm across are of coarser grained stubby chlorite flakes (0.1-0.3 mm) with pleochroism from pale to medium greyish green. Some flakes were stained strongly by reddish brown limonite. Chlorite also forms a few patches up to 0.5 mm in size of equant flakes 0.02-0.03 mm in size with bluish-purple interference colour.

A few patches up to 1.5 mm in size are of unoriented, massive aggregates of sericite with accessory to minor disseminated grains of quartz and flakes of muscovite.

Pyrite (altered moderately to completely to pseudomorphic red/brown hematite) forms disseminated, anhedral to euhedral grains in calcite-rich zones, and generally finer, more strongly altered grains in quartz-rich bands. Scattered fresh pyrite grains (0.01-0.02 mm) occur mainly enclosed in quartz.

Chalcopryite occurs in one patch 0.5 mmm across as a relic core surrounded by pseudomorphic red-brown hematite. Two other similar patches of red-brown hematite probably are secondary after chalcopryite.

Veins up to 1.5 mm wide and irregular patches between brecciated fragments are of calcite. Some of these contain minor secondary limonite/hematite, in part as patches of acicular grains and in part as selvages along margins of the veins.

Irregular late seams mainly less than 0.05 mm wide are of limonite.

Sample CA17-13-183

Quartz-Sericite Rock (minor)

Vein: Calcite-Quartz-(Ankerite)

Late Seams: Calcite-Limonite-Hematite-Quartz

In one corner of the section is a patch of host rock consisting of quartz with interstitial patches of sericite. The remainder of the section is a patchy vein consisting of calcite-rich and quartz-rich patches. Calcite-rich zones contain several sharply defined patches up to several mm across of ankerite that was altered moderately to strongly to limonite. Late veinlets are of calcite and limonite/hematite, with one large vein also containing quartz.

mineral	percentage	main grain size range (mm)
host rock	(1.5-2%)	
quartz	1.2-1.5	0.07-0.2
sericite	0.3-0.5	0.015-0.025 (locally up to 0.08 mm)
vein		
calcite	70-75	0.3-1.5 (a few up to 5 mm)
quartz	15-17	0.1-0.5 (a few up to 2 mm)
ankerite/limonite	4- 5	1-5
chalcopryrite	trace	0.05-0.13
late veinlets		
limonite-calcite	1- 2	0.01-0.03 (li); 0.2-0.5 (ct)

The host rock contains equant quartz grains with interstitial patches up to 0.3 mm in size of unoriented aggregates of sericite.

In the vein, calcite and quartz are mainly segregated into patches. Calcite forms anhedral equant grains that have well developed cleavage. Many grains were strained slightly. Alteration to limonite is mainly weak to locally moderate along wispy fractures.

Quartz forms patches of anhedral grains that range widely in grain size locally.

Within calcite-rich zones, ankerite forms sharply defined patches up to 5 mm across that were altered strongly to limonite, which is concentrated along grain margins, fractures, and cleavage planes.

One fresh grain of chalcopryrite (0.13 x 0.06 mm) occurs in quartz.

Late veinlets up to 0.3 mm wide are mainly of calcite and/or limonite. One calcite-rich veinlet contains irregular patches and bands of limonite and locally patches of acicular to massive hematite. Some limonite veinlets contain lensy patches of calcite. One seam up to 0.5 mm wide contains limonite, calcite, and zones of quartz; quartz in the band and in the bordering host rock was recrystallized to much finer grained aggregates (0.015-0.03 mm).

Sample CA17-05-149.8

Vein: Calcite-Quartz-(Pyrite-Chalcopyrite)

Breccia Seam: Calcite-Limonite

Veinlets: Calcite-Limonite; Malachite

Much of the sample is dominated by calcite that was altered slightly to moderately to limonite. Quartz forms irregular patches in about half of the section that are intergrown finely to coarsely with patches of calcite. Sulphides occur in patches mainly along quartz-calcite contacts; pyrite is altered slightly to hematite and chalcopyrite is altered moderately to strongly to hematite and locally to malachite. A breccia seam in calcite has a matrix of limonite. Numerous fracture-filling veinlets in calcite are of calcite and limonite, and one is of malachite.

mineral	percentage	main grain size range (mm)	
calcite	75-80%	1-5	(recrystallized to 0.1-0.3 mm)
quartz	17-20	0.05-0.2	
chalcopyrite	3- 4	0.1-0.7	(include secondary hematite)
pyrite	0.5	0.3-1	
malachite	0.2	0.02-0.15	
breccia seam			
calcite with limonite matrix		1	0.02-0.05 (ct); amorphous (li)
veinlets			
1) calcite-limonite	1-2	0.05-0.1 (ct), amorphous (li)	
2) malachite	0.1	0.03-0.05	

Calcite forms medium to coarse grains, most of which were recrystallized to very fine to fine grained aggregates with a weak to locally moderate foliation. Wispy stringers of limonite are widespread and locally moderately abundant.

Quartz is concentrated in irregular patches in one half of the section.

Chalcopyrite forms disseminated grains and clusters up to several mm in size; it was altered slightly to strongly inwards from grain margins to pseudomorphic brownish red hematite.

Pyrite (altered slightly to strongly to hematite) forms anhedral equant grains associated with chalcopyrite. One grain in the large sulphide patch contains an inclusion of chalcopyrite-native silver(?).

Malachite forms several patches up to 0.4 mm in size and one veinlet up to 0.3 mm across in the large sulphide patch; grains range widely in size, with coarser grains mainly prismatic in habit.

Cutting the calcite-rich zone is a continuous brecciated seam 0.3 mm wide that contains granulated calcite grains in an abundant matrix of limonite.

A set of veinlets, mainly 0.03-0.1 mm wide are of calcite and locally limonite. Many of these form a subparallel set. A few cut the limonitic breccia seam, whereas for several others, the age relationship is not definitive.

Sample CA17-23-394

Brecciated Calcite/Dolomite-(Quartz) Vein

Breccia Matrix: Calcite/Dolomite-Quartz-Chalcopyrite-Pyrite

The sample is of a fine grained vein dominated by calcite/dolomite with much less abundant, irregular patches of quartz and patches of chalcopyrite-(pyrite). The vein was brecciated strongly and the breccia matrix is dominated by calcite/dolomite with lesser patches of quartz, some of which appears to have crystallized in cavities. In the section sulphide patches are concentrated moderately to strongly in a band up to 1 cm wide; in the hand sample the zone of abundant sulphides is broader and not as well defined. Sulphide fragments, dominated by chalcopyrite with lesser pyrite, are concentrated in the breccia matrix in the same zone that contains abundant sulphides in the vein.

mineral	percentage	main grain size range (mm)
calcite/dolomite	60-65%	0.1-0.5
quartz	10-12	0.07-0.2 (a few up to 0.5 mm)
chalcopyrite	1	0.1-1
pyrite	0.2	0.1-0.3
breccia matrix		
calcite/dolomite	17-20	0.005-0.015 (groundmass); 0.05-0.1 (angular fragments of vein)
quartz	2- 3	0.02-0.05
chalcopyrite	1- 2	0.05-0.1
pyrite	0.4	0.1-0.5
Mineral Y	trace	0.05-0.1

The vein is dominated by equant calcite/dolomite grains, with a few patches up to 2.5 mm across of anhedral quartz. Quartz also forms scattered grains and small patches in carbonate-rich parts of the vein. The vein was brecciated, with fragments of the order of 0.5-5 mm in size.

Chalcopyrite forms anhedral replacement patches up to 1.5 mm long associated with both calcite/dolomite and quartz. A few patches of chalcopyrite also contain one to a few grains of pyrite. A few patches are of irregular intergrowths of chalcopyrite and pyrite.

Much of the breccia matrix contains abundant angular fragments of vein calcite/dolomite (0.1-5 mm) in a granulated groundmass of calcite/dolomite (0.005-0.015 mm), with scattered grains and patches of quartz.

Quartz is concentrated in a few patches and bands, some of which have textures suggestive of cavity filling.

Sulphides are concentrated in a band of strong brecciation up to 1 cm wide. Chalcopyrite commonly is concentrated in irregular patches as clusters of proximal grains that appear to be fragments of coarser original grains (as in several of the large fragments). A few chalcopyrite patches contain an inclusion of equant pyrite. Elsewhere, chalcopyrite and minor pyrite form much less abundant, disseminated patches in the breccia matrix.

Pyrite forms equant anhedral grains and angular fragments, some of which contain minor inclusions of chalcopyrite.

One patch of quartz contains a lens of Mineral Y (soft, medium grey, medium reflectivity, isotropic), which may be a sulfosalt. This sample is from an interval that is high in bismuth (11.75 ppm), U (97.9 ppm) and Y (175.5 ppm)

Sample CA17-17-274.3 Brecciated Vein: Quartz-Calcite-Chalcopyrite-(Pyrite)

The sample is of a brecciated patchy quartz-calcite vein; the section is taken from a quartz-rich part of the sample and contains a few calcite-rich patches, several sulphide clusters (mainly chalcopyrite with lesser pyrite). Chalcopyrite was variably altered to chalcocite-(covellite), hematite, and malachite; pyrite was altered strongly to hematite). Strong brecciation produced granulation of minerals in patches and seams.

mineral	percentage	main grain size range (mm)	
quartz	65-70%	0.05-0.2	(locally up to 0.5 mm)
calcite	4- 5		
chalcopyrite	1.5- 2	0.02-0.3	(a few patches up to 1 mm; % includes alteration products of chalcopyrite)
pyrite	0.3	0.05-0.15	
breccia matrix			
quartz	20-25	0.01-0.05	
calcite	1	0.01-0.05	(locally up to 0.1 mm)
sericite	0.2	0.01-0.03	
chalcopyrite	0.2	0.02-0.15	
pyrite	trace	0.03-0.05	
veinlets			
1) calcite	0.2	0.03-0.05	

Quartz forms anhedral, slightly interlocking grains.

Calcite forms a lens 3.5 mm long by up to 0.7 mm wide and much smaller disseminated patches enclosed in quartz.

Chalcopyrite forms disseminated, mainly irregular patches. Some patches, mainly small ones enclosed in quartz grains, are fresh. Some patches were altered slightly to moderately inwards from grain margins to chalcocite-(covellite). More intense alteration produced ragged chalcocite fragments enclosed in hematite. The strongest alteration produced hematite with scattered patches of malachite and Mineral Z, a second secondary Cu mineral that has low relief, is very pale green in colour, and moderate birefringence.

Pyrite (altered strongly to completely to hematite) forms disseminated subhedral to euhedral grains and clusters of grains.

A few lenses up to 0.7 mm long by 0.05 mm wide are of malachite with a thin rim of limonite.

The rock was brecciated strongly. Some patches contain abundant small quartz-rich fragments in a matrix of extremely fine grained, granulated quartz and locally minor to moderately abundant calcite. In places, breccia forms seams up to 0.5 mm wide of angular grains of quartz and generally lesser calcite. Chalcopyrite, locally with accessory pyrite, forms fragments in a wide size range. Sericite is present locally, both in patches up to 0.2 mm in size and disseminated in quartz.

A few veinlets up to 0.15 mm wide are of calcite.

Sample CA17-18 269.5 Quartz-Chalcopyrite Vein
Alteration of Chalcopyrite: Hematite, Mineral Z, Malachite
Secondary Veinlets: Mineral Z/Malachite

The sample is of a quartz vein with disseminated patches of chalcopyrite (altered slightly to strongly to hematite, malachite, and Mineral Z) and scattered patches dominated by sericite (some of which may represent fragments of altered wall rock). Veinlets are of chalcopyrite-hematite-Mineral Z/malachite and of Mineral Z/malachite.

mineral	percentage	main grain size range (mm)
quartz	87-90%	0.1-0.5; 0.7-2 mm
chalcopyrite	7- 8	0.1-1 (includes alteration products)
sericite	2- 3	0.01-0.03
pyrite	minor	0.07-0.15 (one grain 0.3 mm across)
muscovite	minor	0.07-0.15
veinlets	percentage	main grain size range (mm)
1) chalcopyrite-hematite-Mineral Z/malachite	0.2	0.02-0.05 (cp)
2) Mineral Z/malachite	0.3	0.01-0.03

Quartz forms anhedral, slightly to moderately interlocking grains, with a moderate variation in grain size between diffuse patches. Some patches are strained slightly to moderately, and textures suggest that some finer grained patches represent recrystallized coarser grains.

Sericite forms disseminated flakes in quartz. A few diffuse patches up to 1.5 mm long contain intergrowths of extremely fine grained sericite and quartz. Sericite forms a few patches up to 1.5 mm in size, which may represent fragments of altered wall rock. A few diffuse seams up to 0.3 mm wide contain abundant sericite.

Muscovite forms scattered flakes in or near sericite-rich patches. It also forms a cluster 0.2 mm across of a few subparallel flakes bordering a patch of chalcopyrite.

Chalcopyrite forms irregular disseminated patches up to 2 mm across in quartz. It is slightly to very strongly altered to various intergrowths of hematite, malachite, and Mineral Z (as in Sample CA17-17-274.3). Mineral Z forms patches and seams alone or intergrown coarsely with hematite; in the latter, Mineral Z grains commonly are oriented perpendicular to the walls of the seams.

Pyrite(?) forms a few anhedral to euhedral grains, almost all of which were altered completely to hematite.

Malachite also forms a few irregular patches up to 0.5 mm in size intergrown with quartz.

Several wispy veinlets from 0.01-0.05 mm in width are of Mineral Z and/or malachite. A veinlet up to 0.1 mm wide is of chalcopyrite, hematite, and Mineral Z/malachite.

Sample CA17-16-216

**Brecciated Quartz-(Chalcopyrite) Vein
Veinlets: Malachite**

The sample is of a quartz vein with scattered patches of chalcopyrite (altered strongly to completely to hematite). It is cut by a major splayed brecciated zone in which minerals were granulated strongly. Minor veinlets are of malachite.

mineral	percentage	main grain size range (mm)
quartz	85-87%	0.1-0.7
chalcopyrite	2- 3	0.1-0.7
sericite	1	0.01-0.03
muscovite	trace	0.1-0.2
breccia zones		
quartz	8-10	0.005-0.05
veinlets		
1) malachite	0.3	0.02-0.05

Quartz forms anhedral grains, commonly with irregular, slightly interlocking grain borders.

Sericite forms disseminated flakes and is concentrated slightly to locally moderately in wispy patches and seams. A few foliated lensy patches up to 2 mm long are of quartz (0.02-0.04 mm) with accessory sericite; these may represent fragments of host rock.

Muscovite forms a few flakes in some sericite-rich patches.

Chalcopyrite (altered moderately to completely to hematite) forms disseminated patches up to 2 mm in size.

Breccia zones range from discrete seams (0.5-1 mm wide) of strongly granulated rock to more diffuse zones up to a few mm wide that latter contain abundant fragments of the vein (0.01-0.5 mm in size) in a granulated groundmass.

A few discontinuous veinlets up to 0.15 mm wide are of malachite.

Sample CA17-21 446.5

**Vein: Calcite/Dolomite-(Quartz-Pyrite-Chalcopyrite)
Brecciated Seams and Patches**

The sample is of a calcite/dolomite vein that contains scattered patches of chalcopyrite and lesser pyrite, minor quartz, and trace galena. The carbonate is described as calcite/dolomite because of the high ICP value of Mg (9.08%). The vein was cut by a few brecciated seams up to 0.5 mm wide and contains a few brecciated patches, all of which consists of granulated calcite/dolomite with minor fragments of chalcopyrite and trace pyrite and quartz.

mineral	percentage	main grain size range (mm)
calcite/dolomite	92-95%	0.3-1.0 (a few up to 2.5 mm)
chalcopyrite	1- 2	0.05-1 (?)
pyrite	0.2	0.03-0.07
quartz	0.3	0.4-1
galena	trace	0.05-0.1

Calcite/dolomite forms a submosaic aggregated of equant grains, much of which contains dusty inclusions. Scattered grains are relatively free of such inclusions (probably the result of local recrystallization, and sulphide patches commonly are associated with these patches.

Quartz forms scattered subhedral to euhedral grains.

Chalcopyrite forms disseminated, commonly irregular patches up to 1.5 mm in size.

Pyrite forms disseminated subhedral grains, in part included in or associated with chalcopyrite.

Galena forms two patches, in part intergrown with pyrite. The presence of galena correlates with the relatively high Pb assay of the 5' interval (136.5 ppm).

A few brecciated patches and seams up to 0.3 mm wide are of moderately to strongly granulated calcite/dolomite; some contain minor to accessory disseminated fragments of chalcopyrite and minor ones of pyrite. Quartz forms a few grains.

List of Photographs
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Photo	Section	Description
01	CA17-22-360	patches of chalcopyrite and minor Mineral Y enclosed in an intergrowth of quartz with lesser calcite and accessory sericite.
02	CA17-22-360	patch of quartz-(calcite) with a cluster of pyrite grains, a group of irregular patches of chalcopyrite, and one grain of Mineral Y; enclosed in calcite-rich zone with lesser quartz and minor sulphides; top right corner: minor granulated calcite-(quartz).
03	CA17-04-133	massive calcite (altered moderately to strongly to limonite with cluster of disseminated pyrite grains (altered strongly to pseudomorphic hematite) and scattered patches of quartz; narrow seam of sericite-quartz.
04	CA17-04-133	upper left: foliated band of sericite-chlorite with scattered, mainly slender coarser grains of muscovite (a few stained orange by limonite); lower right: quartz-rich band with a patch of calcite (altered moderately to limonite; vein of calcite with minor patches of limonite; veinlets of limonite and of limonite-(calcite).
05	CA17-04-133	lower right: quartz-rich band with a patch of very fine grained pyrite-calcite (in lower left corner); upper right: medium grained calcite (altered slightly to strongly to limonite) with a patch of chalcopyrite (altered strongly to pseudomorphic hematite), a grain of pyrite (altered strongly to hematite), and a grain of quartz (enclosing a small fresh grain of calcite).
06	CA17-13-183	upper left: quartz-rich part of vein; lower right: host rock: equant quartz grains with interstitial patches of sericite and trace calcite.
07	CA17-13-183	aggregate of very fine grained calcite with a sharply defined patch in which calcite was replaced strongly along margins of the patch and crosscutting fractures by limonite/hematite; minor disseminated quartz; a sharply defined discontinuous (outside the photo) band of quartz.
08	CA17-13-183	massive calcite with wispy stringers of limonite; cut by veinlet of calcite with an irregular band of massive limonite and a few patches of acicular to tabular grains of hematite.
09	CA17-05-149.8	coarse calcite grains (recrystallized to subgrain aggregates with slightly variable extinction positions); cut by breccia seam of granulated calcite with an abundant matrix of limonite; cut by veinlet of calcite.
10	CA17-05 149.8	large patch of chalcopyrite (altered along grain borders and fractures to hematite and in a few patches to malachite); lesser pyrite (altered moderately to strongly to hematite); one pyrite grain has an inclusion of chalcopyrite-native silver (see Photo 10b for detail; rotated 180°); gangue of quartz and minor calcite.

List of Photographs

(page 2 of 3)

Photo	Section	Description
11	CA17-05 149.8	pyrite grains (in part with irregular inclusions of chalcopyrite; altered slightly to locally moderately, mainly along margins to hematite); lesser chalcopyrite (altered strongly to hematite), in a matrix of calcite (altered slightly to strongly to limonite) and quartz.
12	CA17-23 394	fragments of calcite vein, one with a large replacement patch of chalcopyrite; enclosed in a matrix containing smaller, mainly angular fragments of calcite, a few grains of quartz, and clusters of broken chalcopyrite grains with interstitial patches of granulated, micritic calcite.
13	CA17-23 394	lower left: large fragment of calcite with a band (possibly early vein) of quartz; middle: breccia containing small fragments of calcite and scattered grains of chalcopyrite in a matrix of much finer grained calcite; note minor quartz in the breccia just beyond the quartz band in the fragment to the lower left; upper right: fragment of calcite.
14	CA17-23 394	fragments of calcite-rich vein with minor quartz; breccia matrix partly granulated calcite with minor disseminated chalcopyrite and partly quartz that appears to have formed by fracture-filling; quartz contains as lens of Mineral Y (medium grey, soft, isotropic; possibly a sulphosalt).
15	CA17-17-274.3	upper left: breccia zone with abundant quartz fragments and a cluster of chalcopyrite fragments (the largest of which contains three grains of pyrite) in a matrix of granulated quartz and locally abundant calcite; lower right: fragment of quartz vein with several patches of chalcopyrite.
16	CA17-17-274.3	quartz vein with patches of chalcopyrite, in part (mainly in large patches) showing progressive alteration to chalcocite and then hematite), one euhedral pyrite grain (altered completely to pseudomorphic hematite).
17	CA17-17-274.3	fragments of quartz vein with, to the left, clusters of euhedral pyrite (altered moderately to strongly to hematite), and to the right: a patch of chalcopyrite variably altered to chalcocite, which was in turn altered strongly to pseudomorphic hematite and secondary patches of malachite; breccia matrix is of extremely fine grained quartz with minor to moderately abundant disseminated sericite.
18	CA17-18-269.5	quartz vein with a patch dominated by sericite with disseminated pyrite (altered completely to hematite) and a few flakes of muscovite; patches of chalcopyrite (altered inwards from their margins to hematite); patches of secondary hematite.
19	CA17-18-269.5	quartz vein containing a patch of chalcopyrite that was partly altered to a variable intergrowth of malachite, hematite, and Mineral Z; veinlet of Mineral Z- (chalcopyrite) near top right.

List of Photographs

(page 3 of 3)

Photo	Section	Description
20	CA17-18-269.5	quartz vein with an irregular patch of chalcopyrite (replaced moderately to strongly by hematite (in detail controlled by major crystallographic directions in chalcopyrite); one small fresh pyrite grain in chalcopyrite; bordered by secondary patches of Mineral Z (in part intergrown with hematite).
21	CA17-16 216	irregular, slightly foliated fragment of quartz-(sericite), possibly wall rock, enclosed in quartz vein.
22	CA17-16 216	above: quartz vein with large patch of chalcopyrite (altered completely to hematite, with a cavity in the core of the patch where hematite was plucked from the section during preparation), and a small zone of extremely fine grained quartz with minor muscovite; below: strong breccia seam with mainly tiny fragments of quartz in a matrix of more strongly granulated quartz.
23	CA17-16 216	quartz vein with large patch of chalcopyrite (altered strongly to hematite, alteration is strongly controlled by major crystallographic directions in chalcopyrite) with local patches of malachite and of Mineral Z; two small proximal sericite-rich patches; a few veinlets of malachite and lesser Mineral Z.
24	CA17-21 446.5	calcite vein containing an open cluster of pyrite and chalcopyrite, with one grain of galena; minor disseminated grains of chalcopyrite and of pyrite.
25	CA17-21 446.5	calcite vein containing disseminated patches of pyrite, of chalcopyrite, and one of galena; cut by narrow breccia seam of granulated calcite with a few fragments of chalcopyrite and one of pyrite, and a grain of quartz.

John G. Payne, Ph.D., P.Geol.

Tel: (604)-597-1080

email: jppayne@telus.net

180078 amercumo blocks

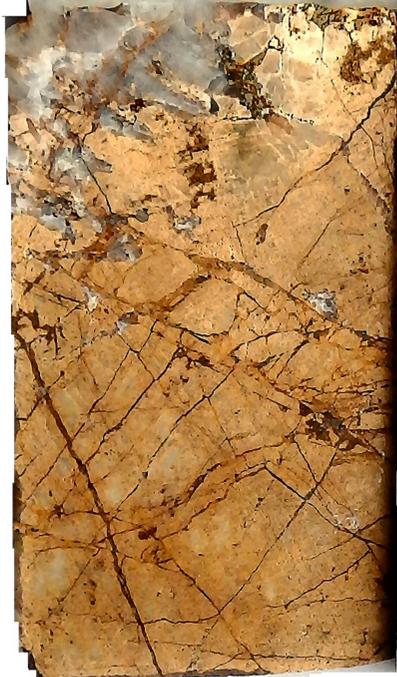
CA17-22-360



CA17-04-133



CA17-13-183



CA17-05-149.8



CA17-23-394



CA17-17-274.3



CA17-18-269.5

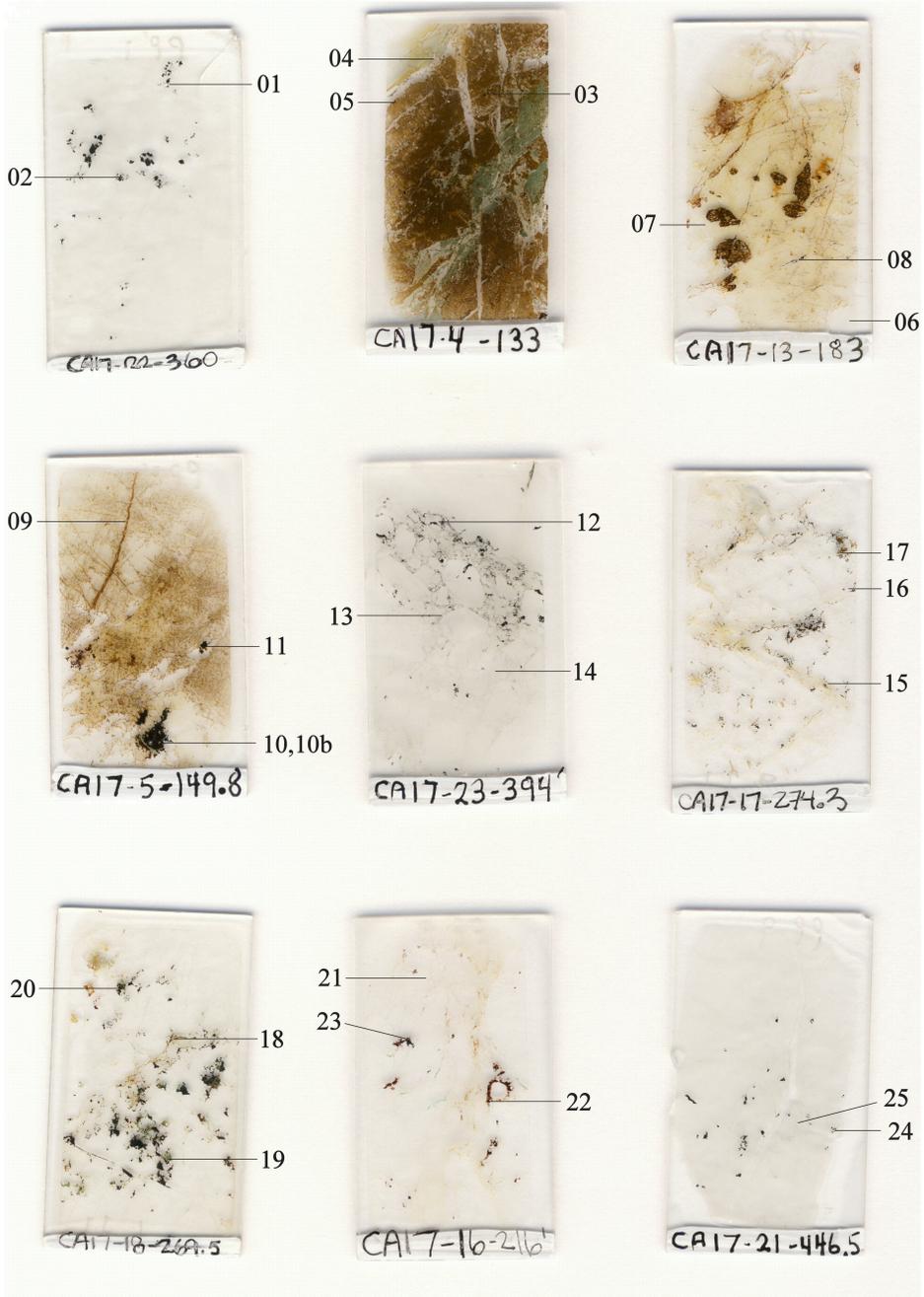


CA17-16-216

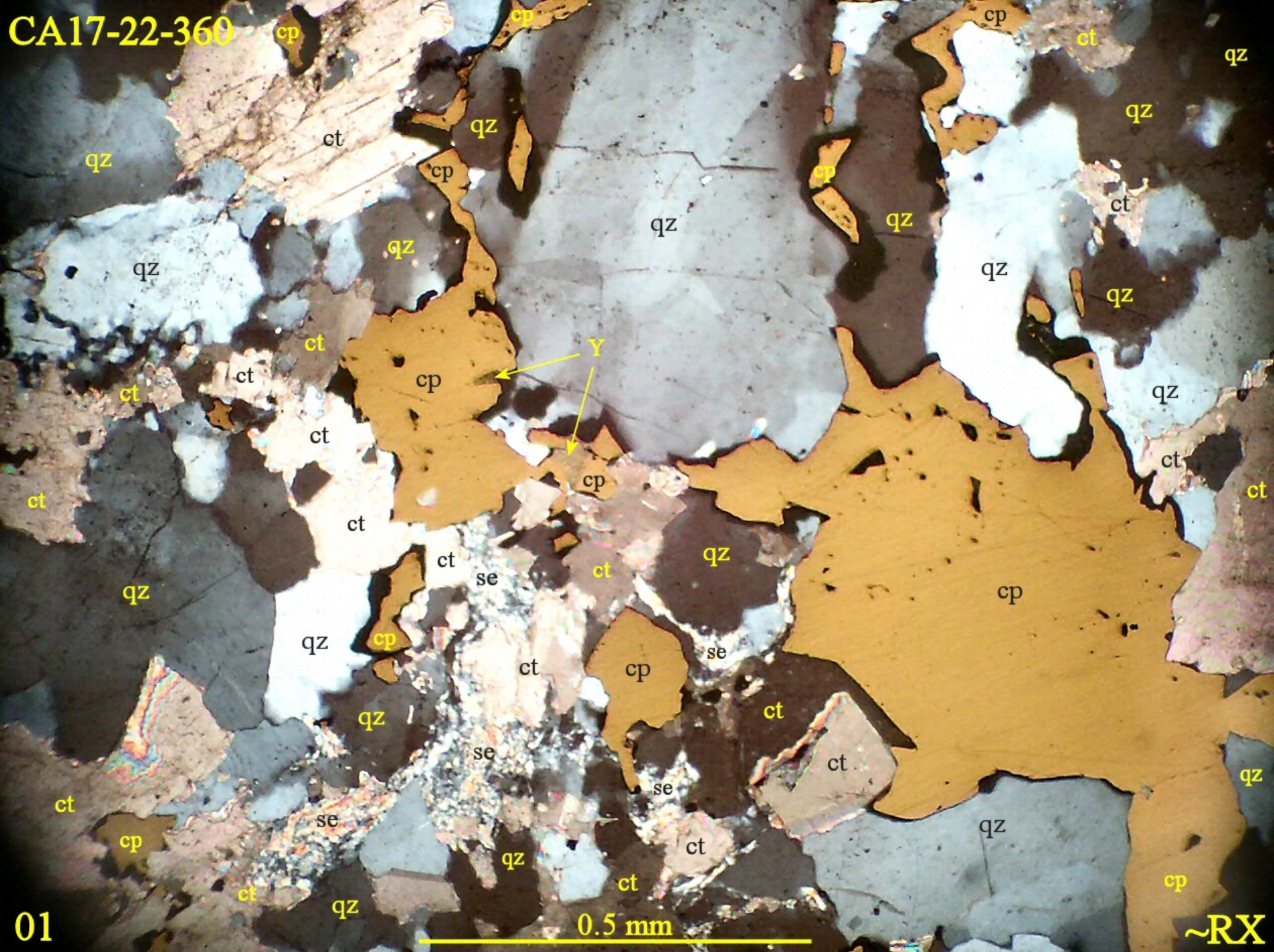


CA17-21-446.5

180078 american CuMo sections



CA17-22-360

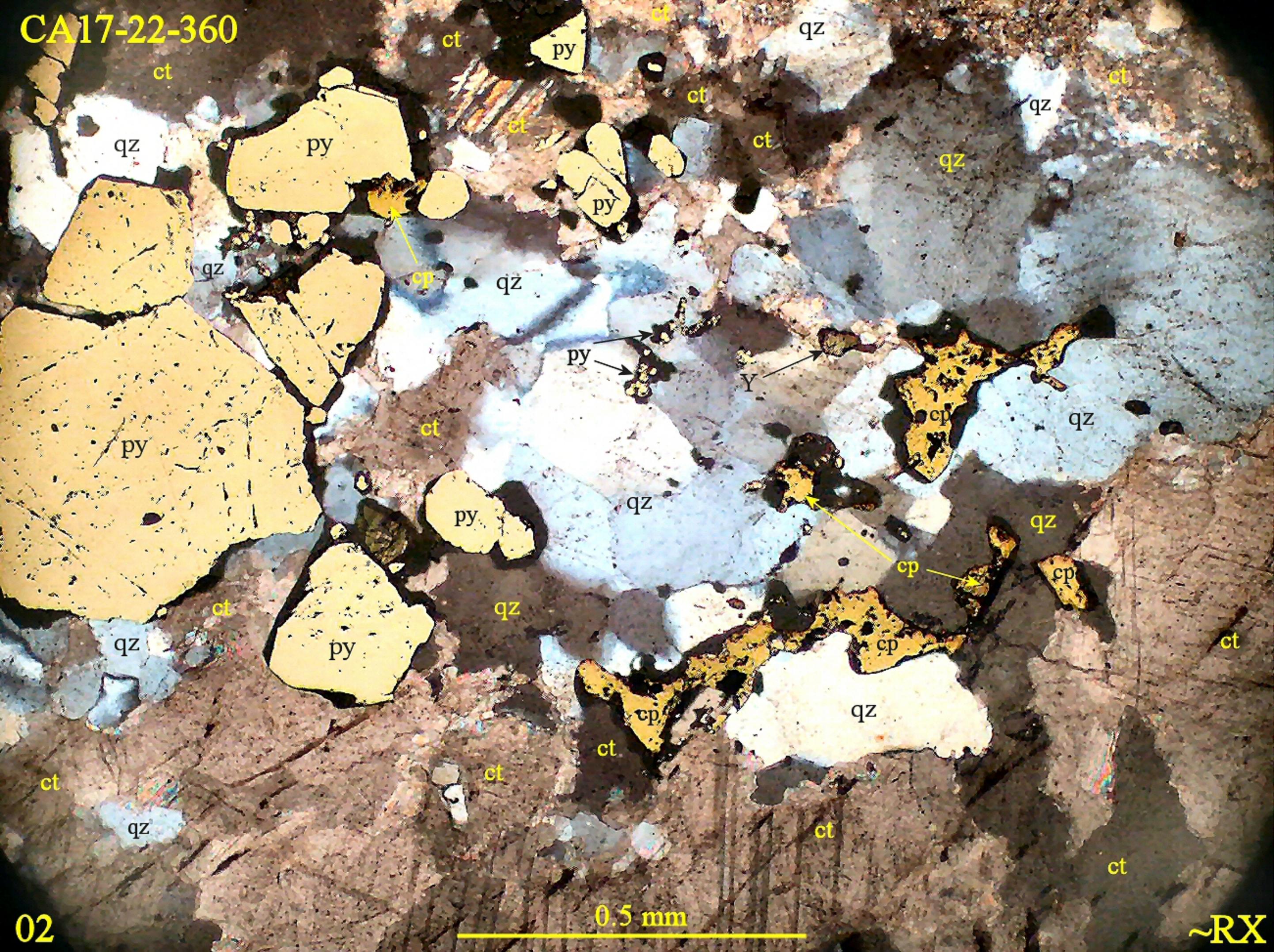


01

0.5 mm

~RX

CA17-22-360

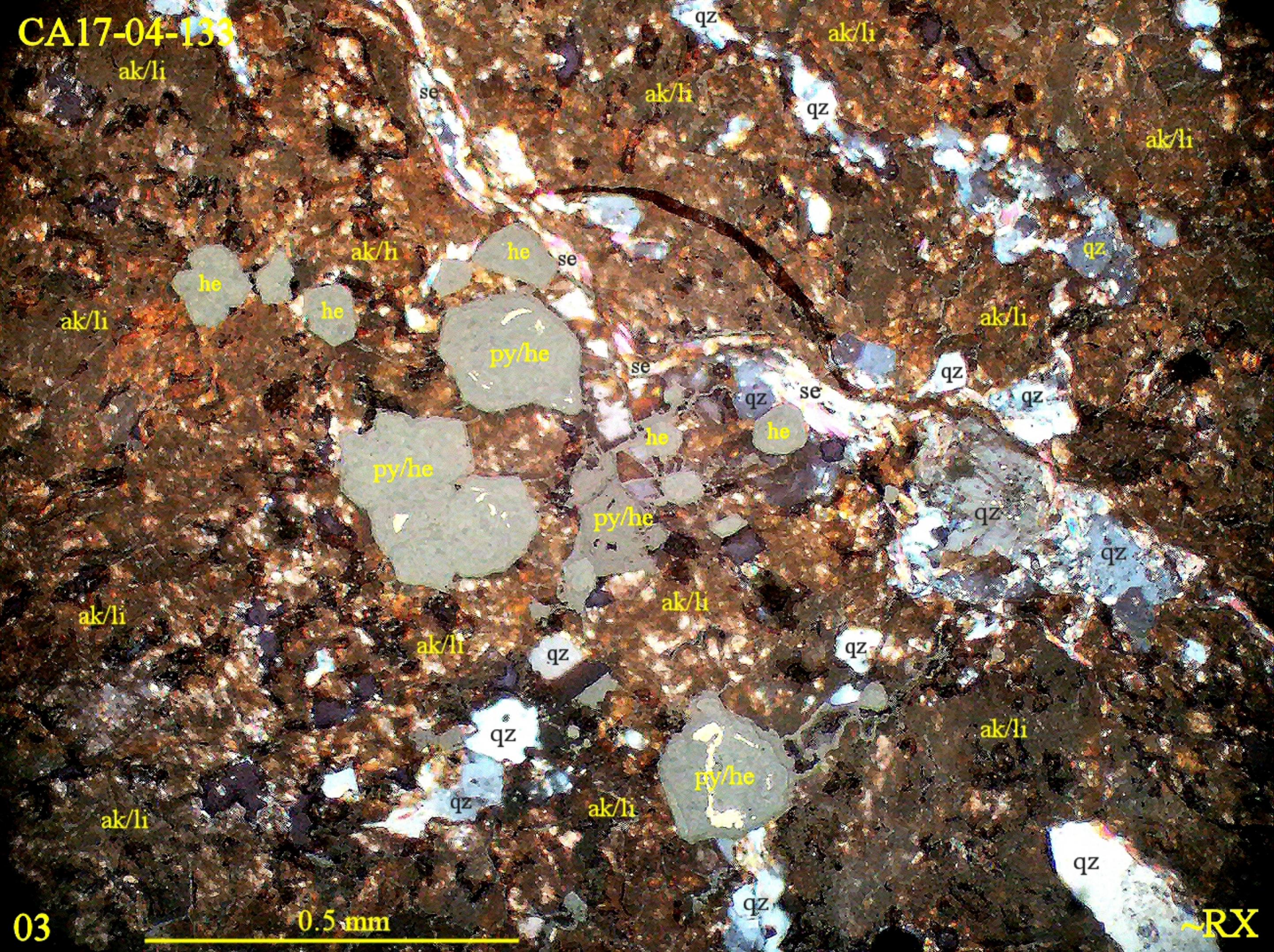


02

0.5 mm

~RX

CA17-04-133

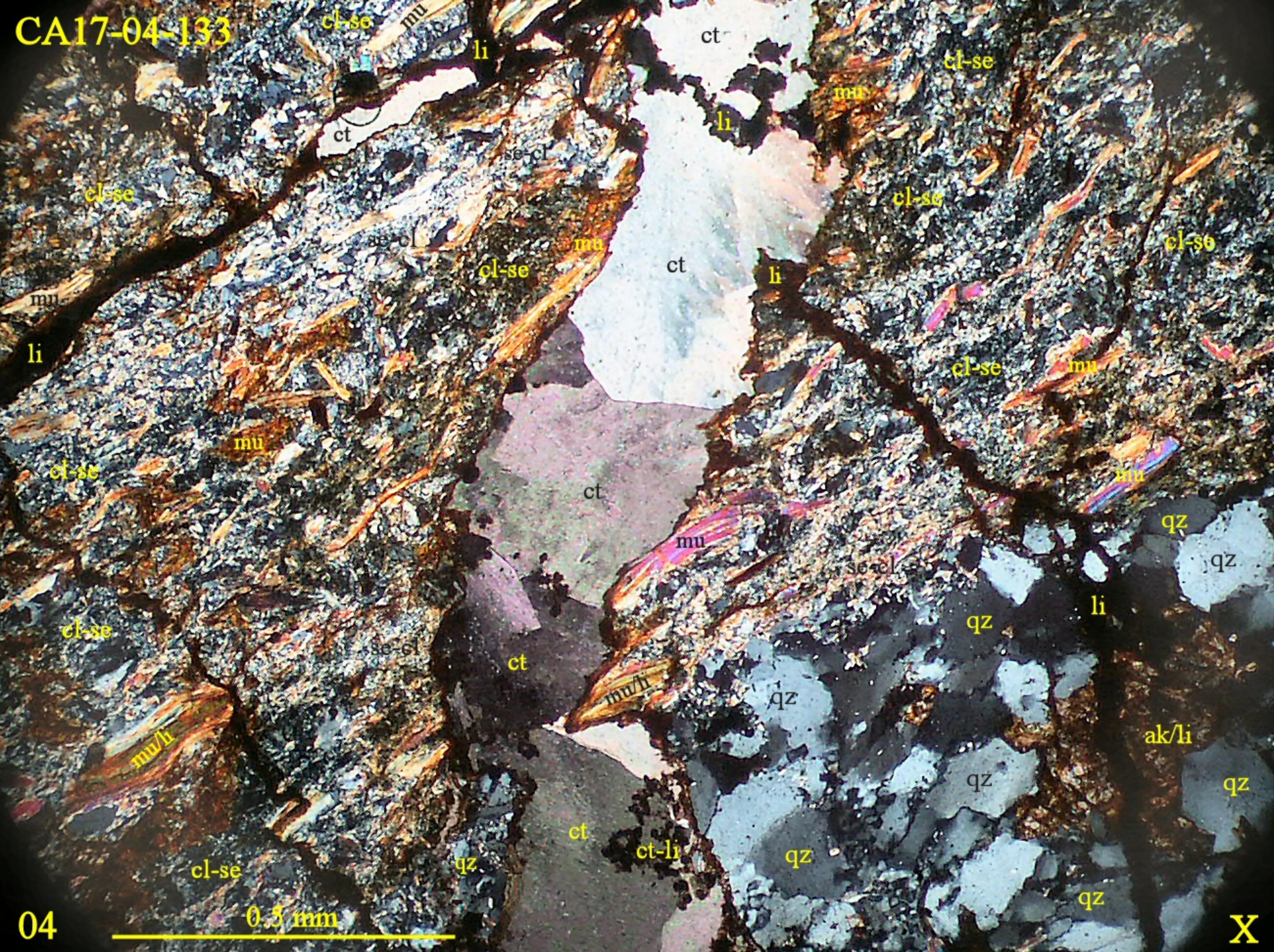


03

0.5 mm

~RX

CA17-04-133



cl-se

mu

li

ct

cl-se

ct

se-cl

li

mu

cl-se

se-cl

mu

ct

li

cl-se

cl-se

mu

li

cl-se

mu

mu

cl-se

ct

mu

mu

qz

qz

cl-se

se-cl

ct

se-cl

qz

li

mu/li

mu/li

qz

ak/li

qz

cl-se

ct

ct-li

qz

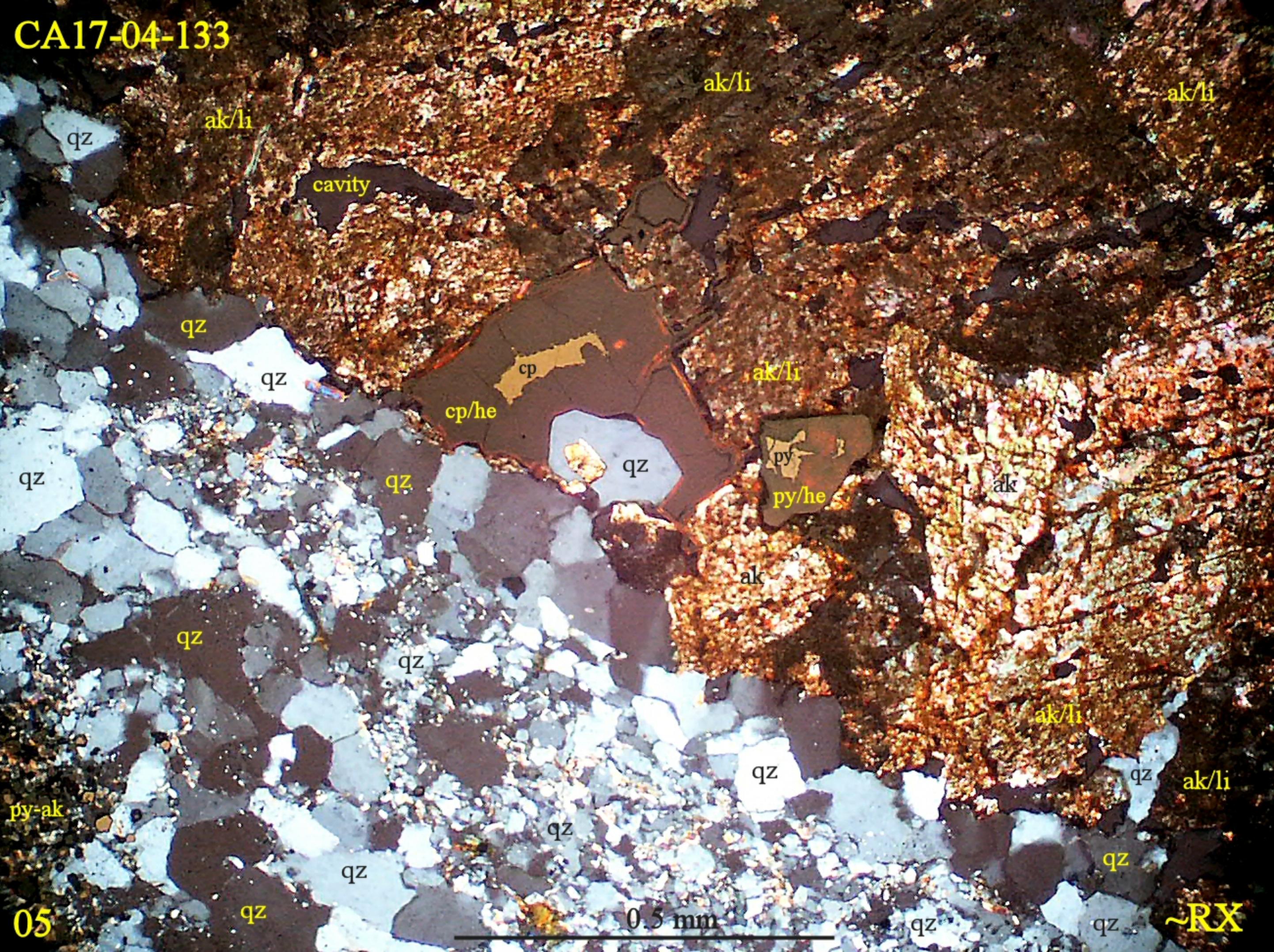
qz

04

0.5 mm

X

CA17-04-133



ak/li

ak/li

ak/li

qz

cavity

qz

qz

cp

ak/li

cp/he

py

py/he

ak

qz

qz

qz

ak

qz

qz

ak/li

py-ak

qz

ak/li

qz

qz

qz

qz

0.5 mm

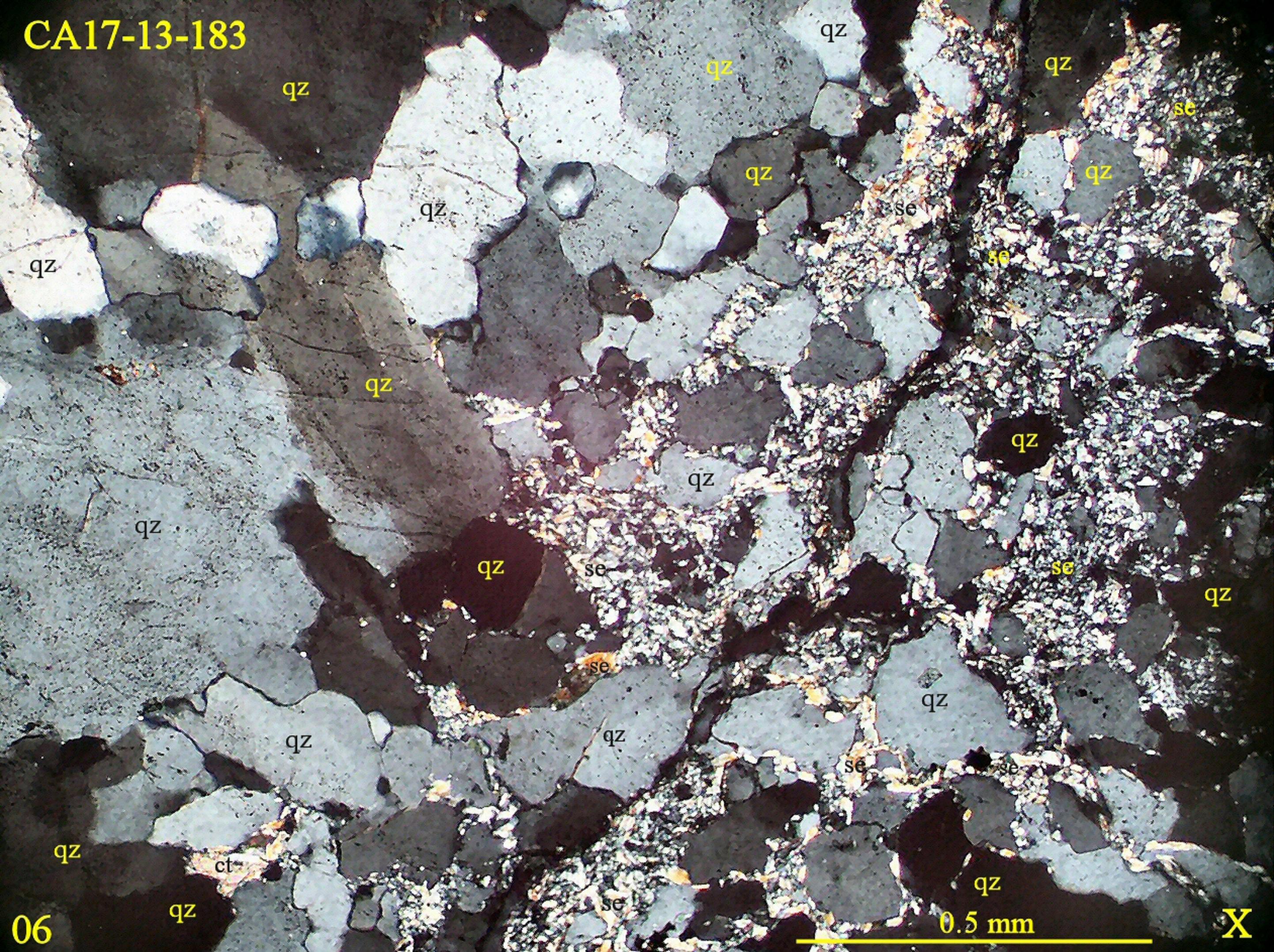
qz

qz

05

~RX

CA17-13-183



qz

qz

qz

qz

qz

se

qz

qz

qz

se

se

qz

qz

qz

qz

qz

se

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qz

se

qz

qz

qz

se

se

qz

ct

qz

se

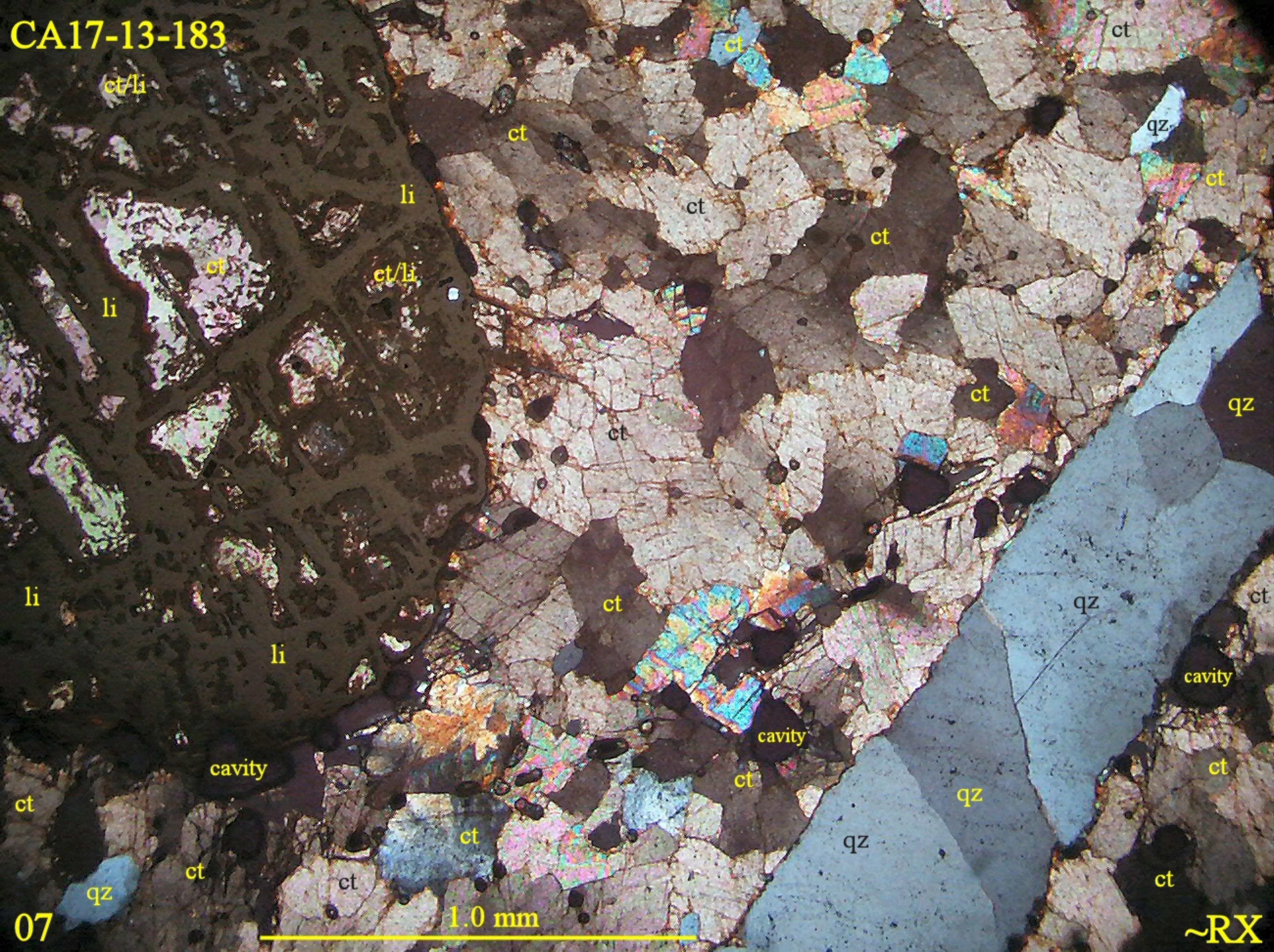
qz

0.5 mm

X

06

CA17-13-183

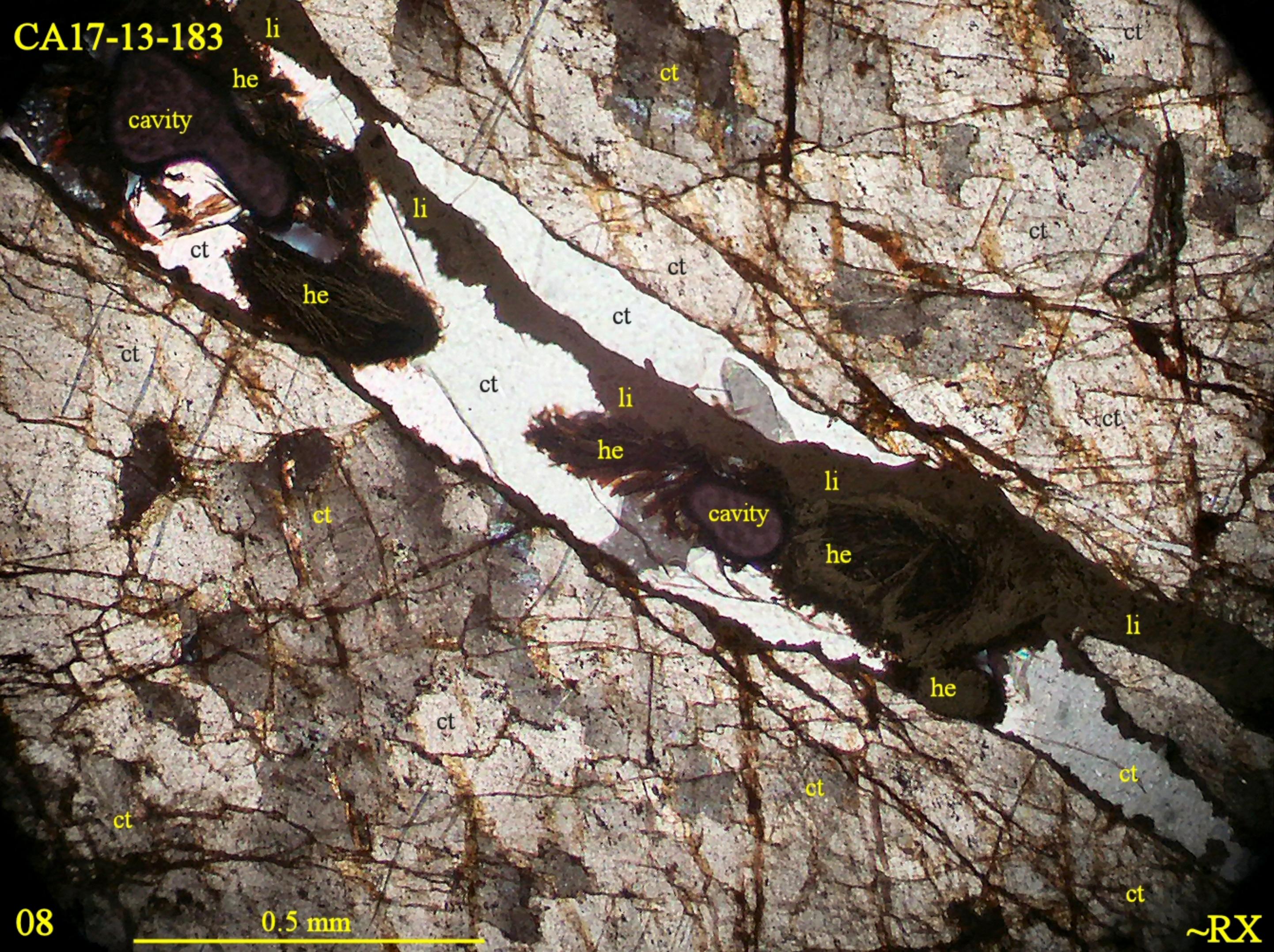


07

1.0 mm

~RX

CA17-13-183



cavity

he

li

ct

ct

ct

li

ct

he

ct

ct

ct

li

ct

he

cavity

li

he

ct

li

he

ct

ct

ct

ct

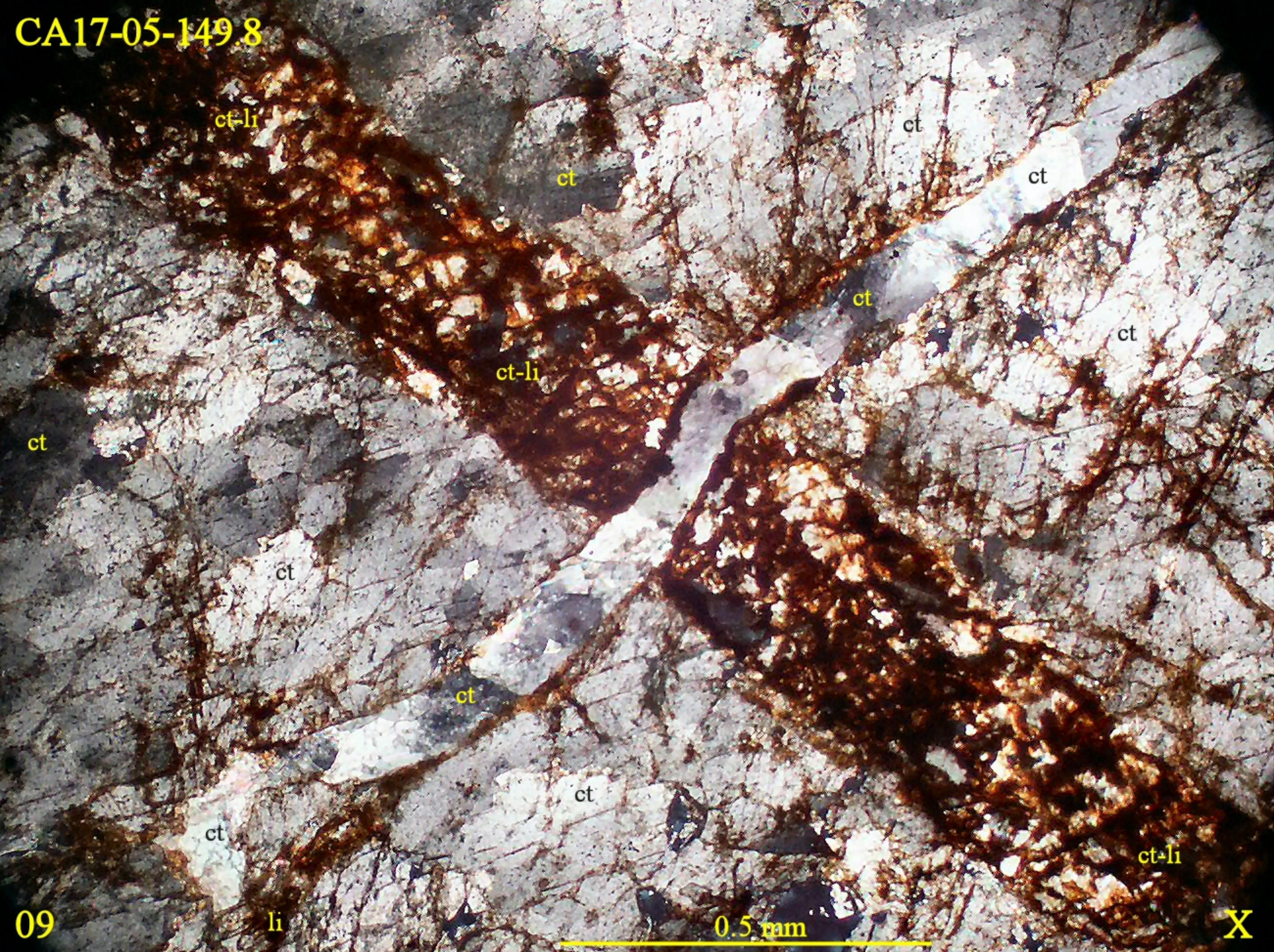
ct

08

0.5 mm

~RX

CA17-05-149.8



ct-li

ct

ct

ct

ct

ct

ct-li

ct

ct

ct

ct

ct

ct-li

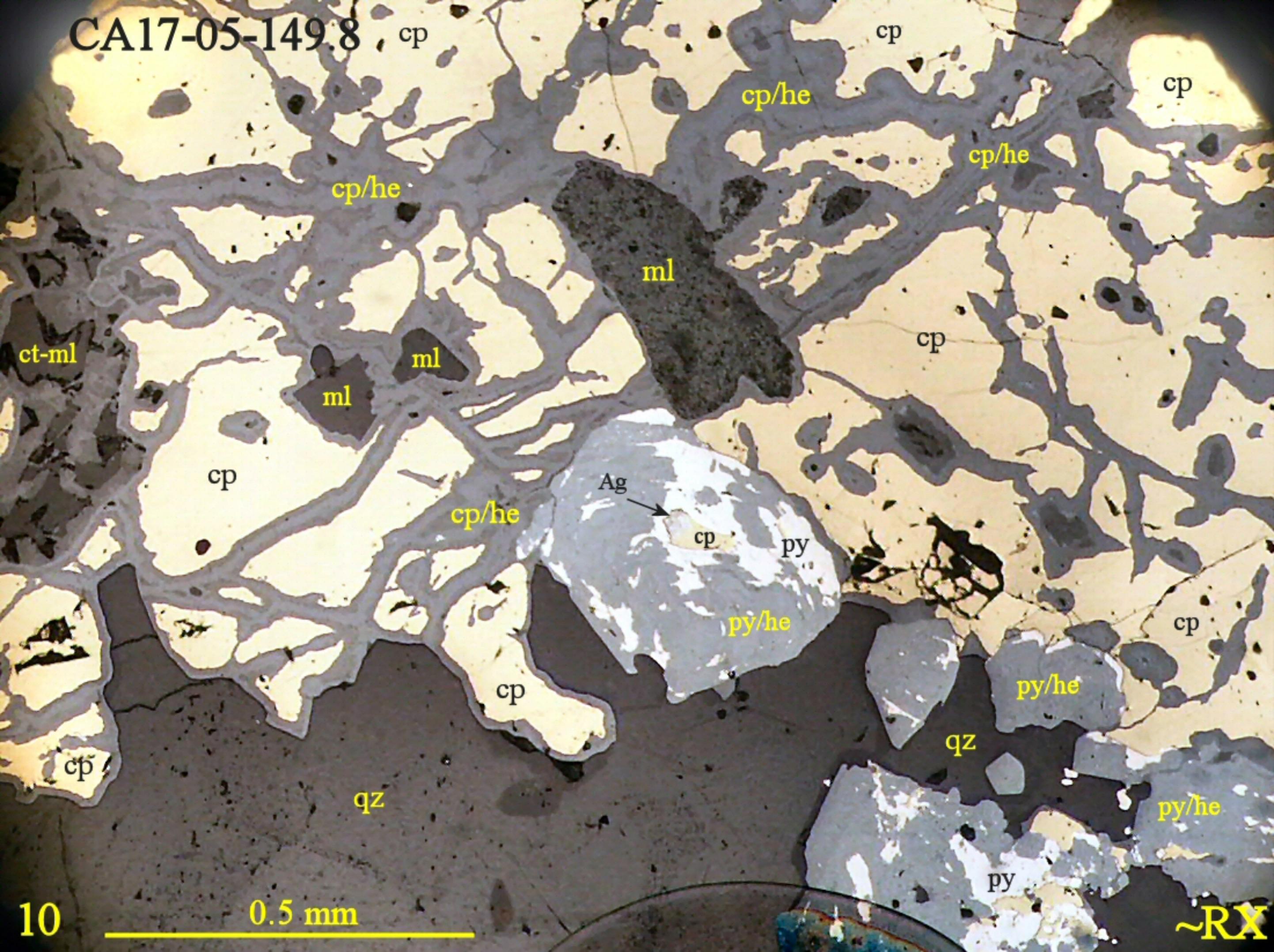
09

li

0.5 mm

X

CA17-05-149.8 cp



ct-ml

ml

cp/he

cp/he

cp/he

cp

cp

cp

ml

ml

Ag

cp

py

cp/he

py/he

cp

cp

py/he

qz

py/he

qz

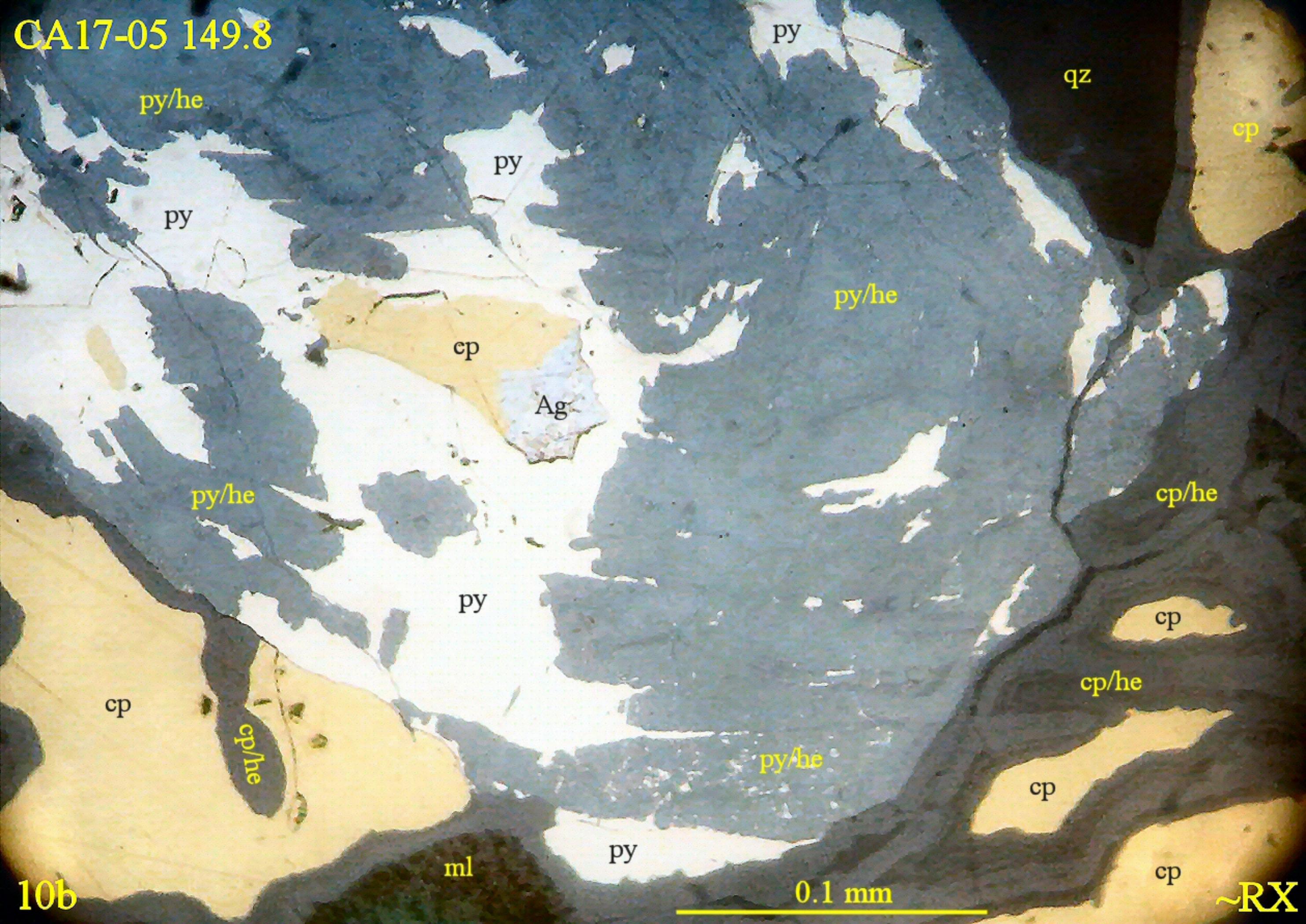
py

10

0.5 mm

~RX

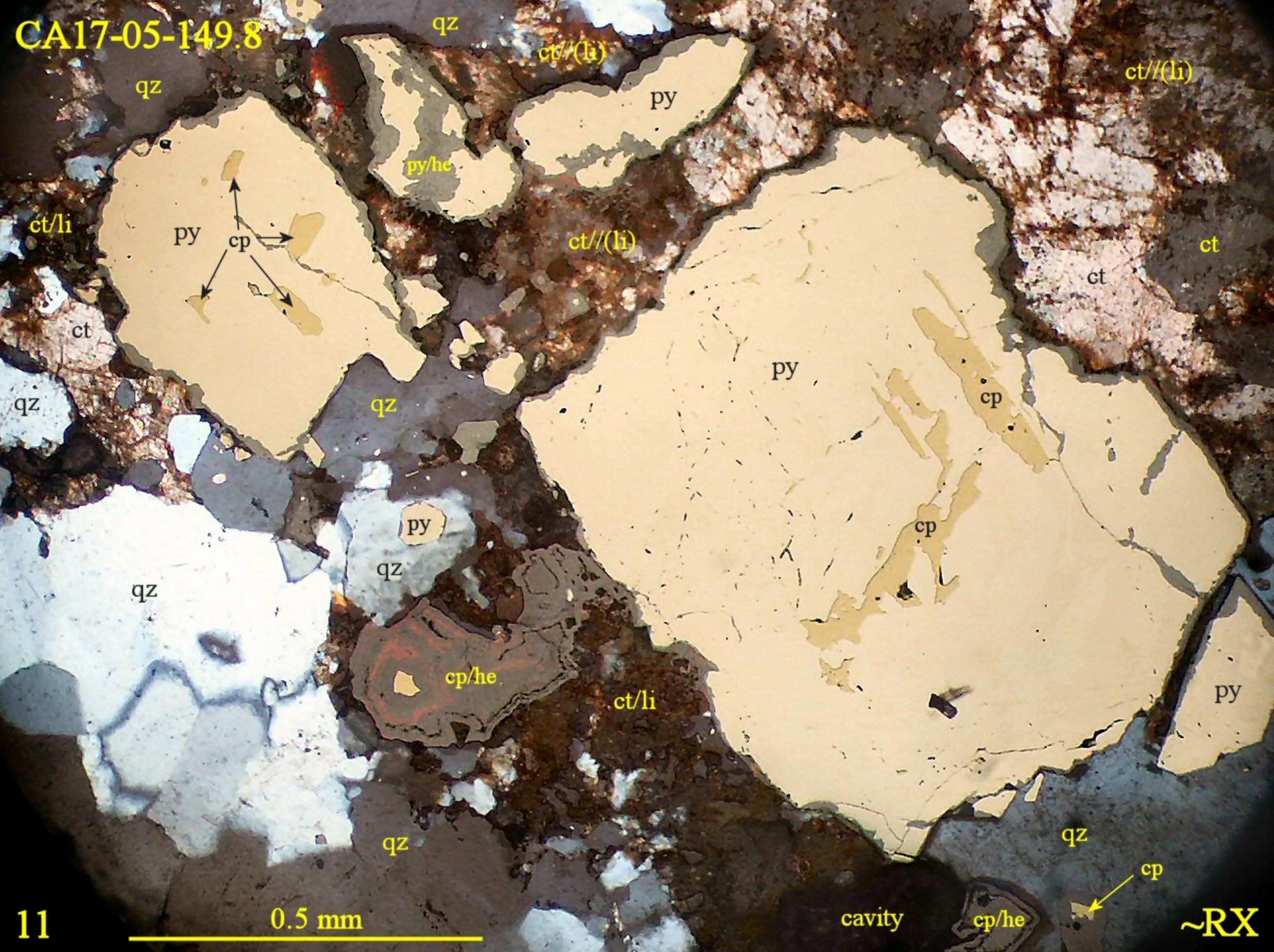
CA17-05 149.8



10b

~RX

CA17-05-149.8



11

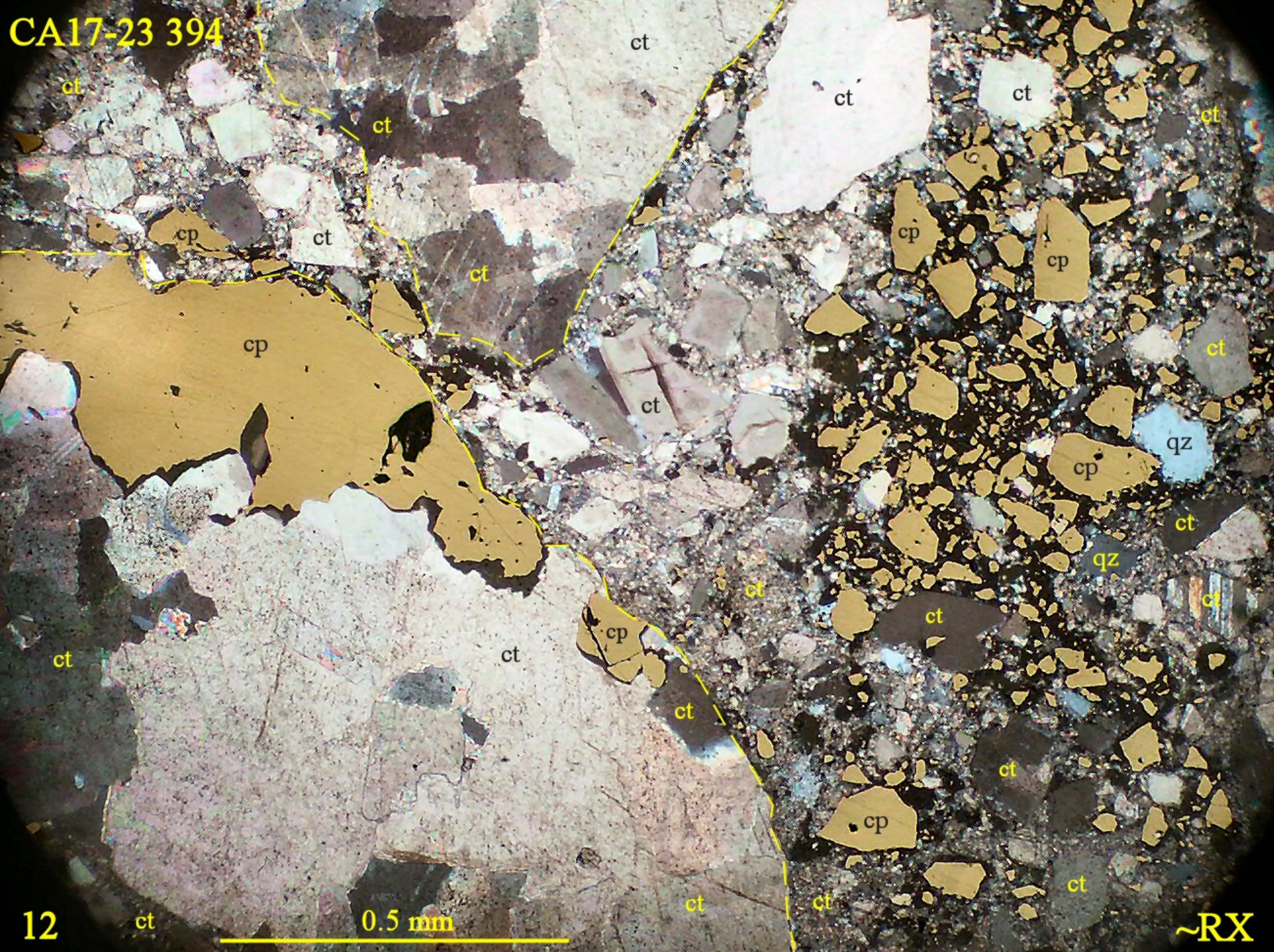
0.5 mm

cavity

cp/he

~RX

CA17-23 394

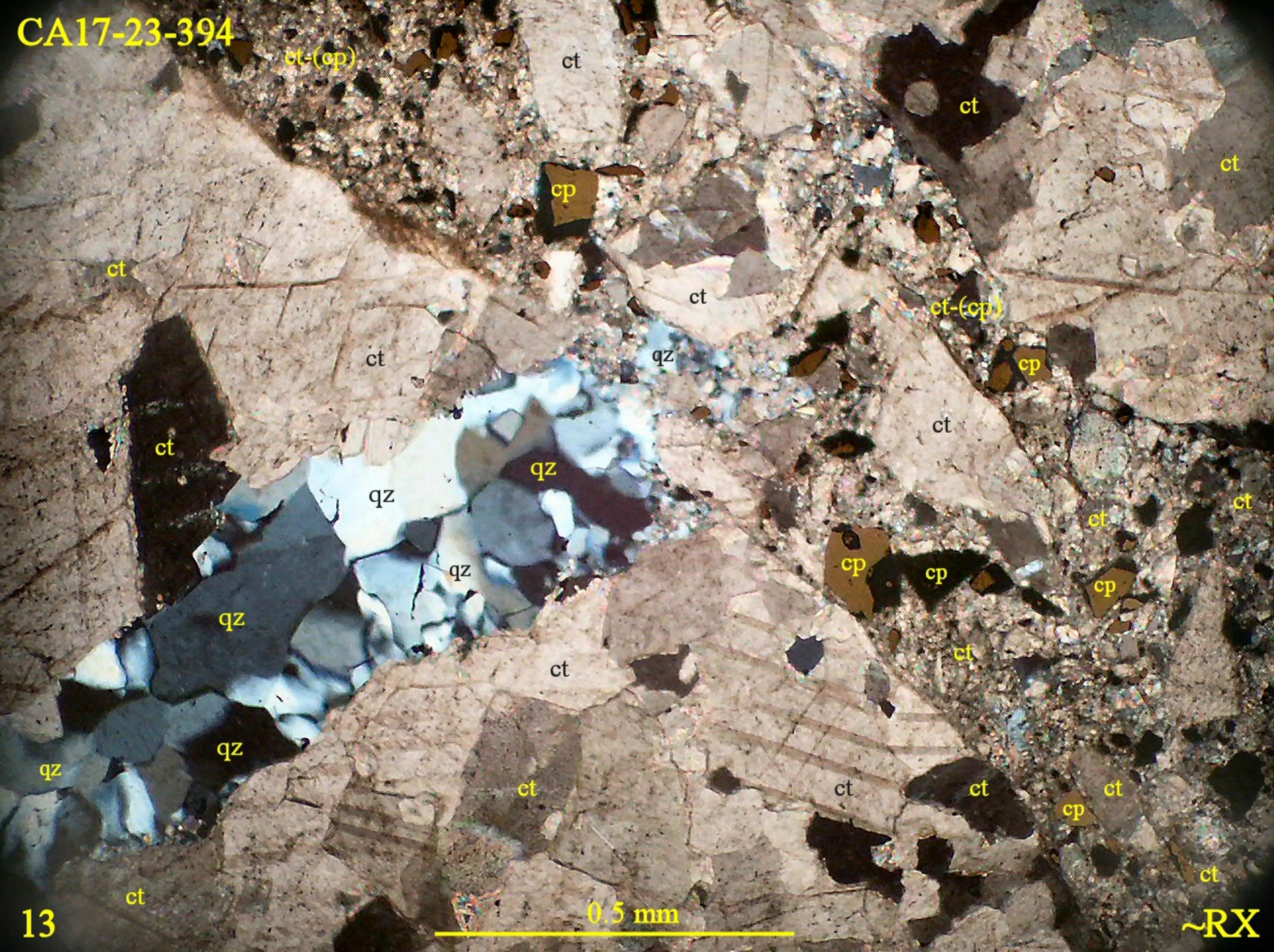


12

0.5 mm

~RX

CA17-23-394



ct-(cp)

ct

ct

ct

cp

ct

ct

ct-(cp)

ct

qz

cp

ct

ct

qz

ct

qz

ct

qz

cp

cp

cp

qz

ct

ct

qz

qz

ct

ct

ct

ct

cp

ct

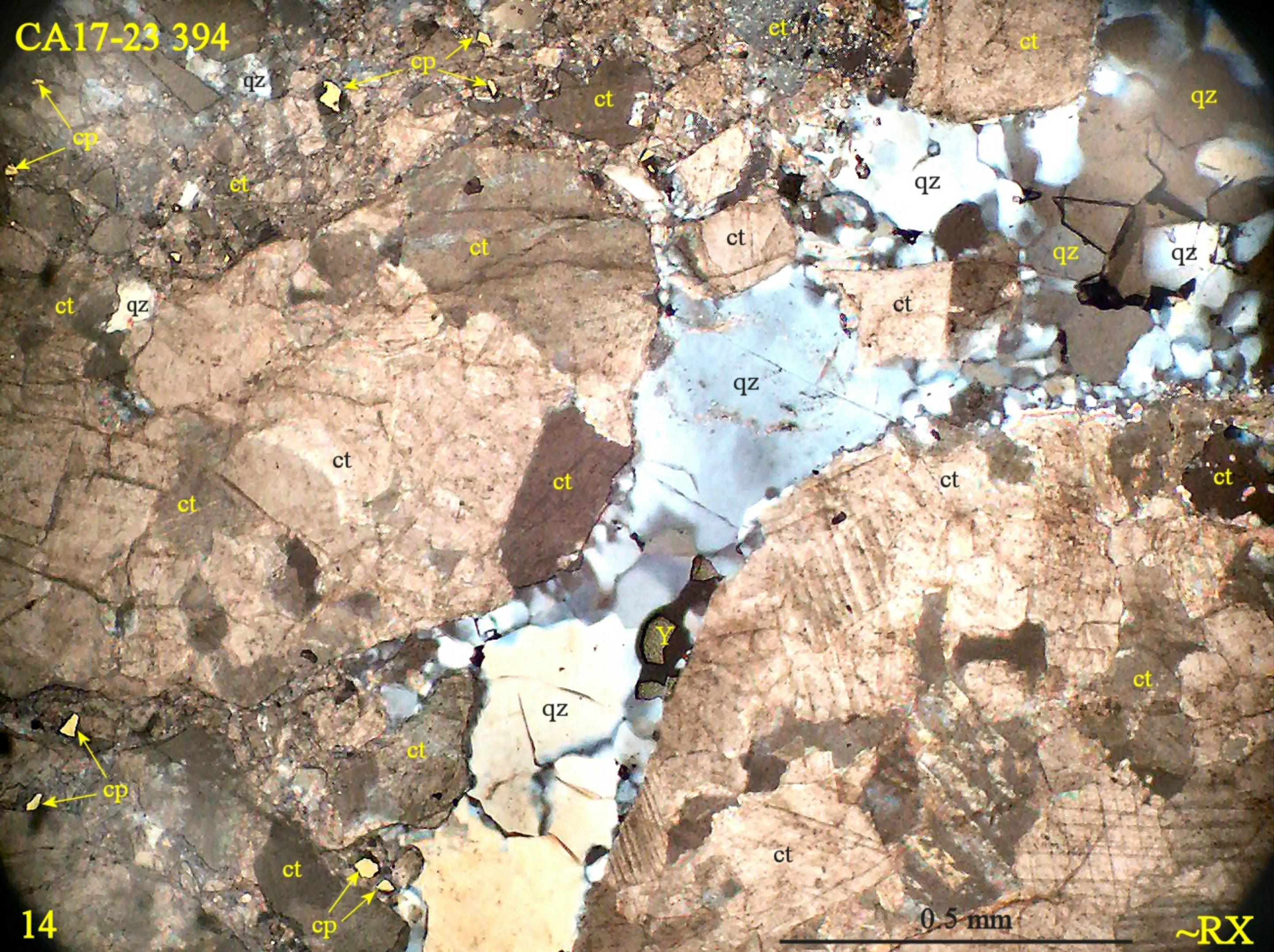
ct

13

0.5 mm

~RX

CA17-23 394

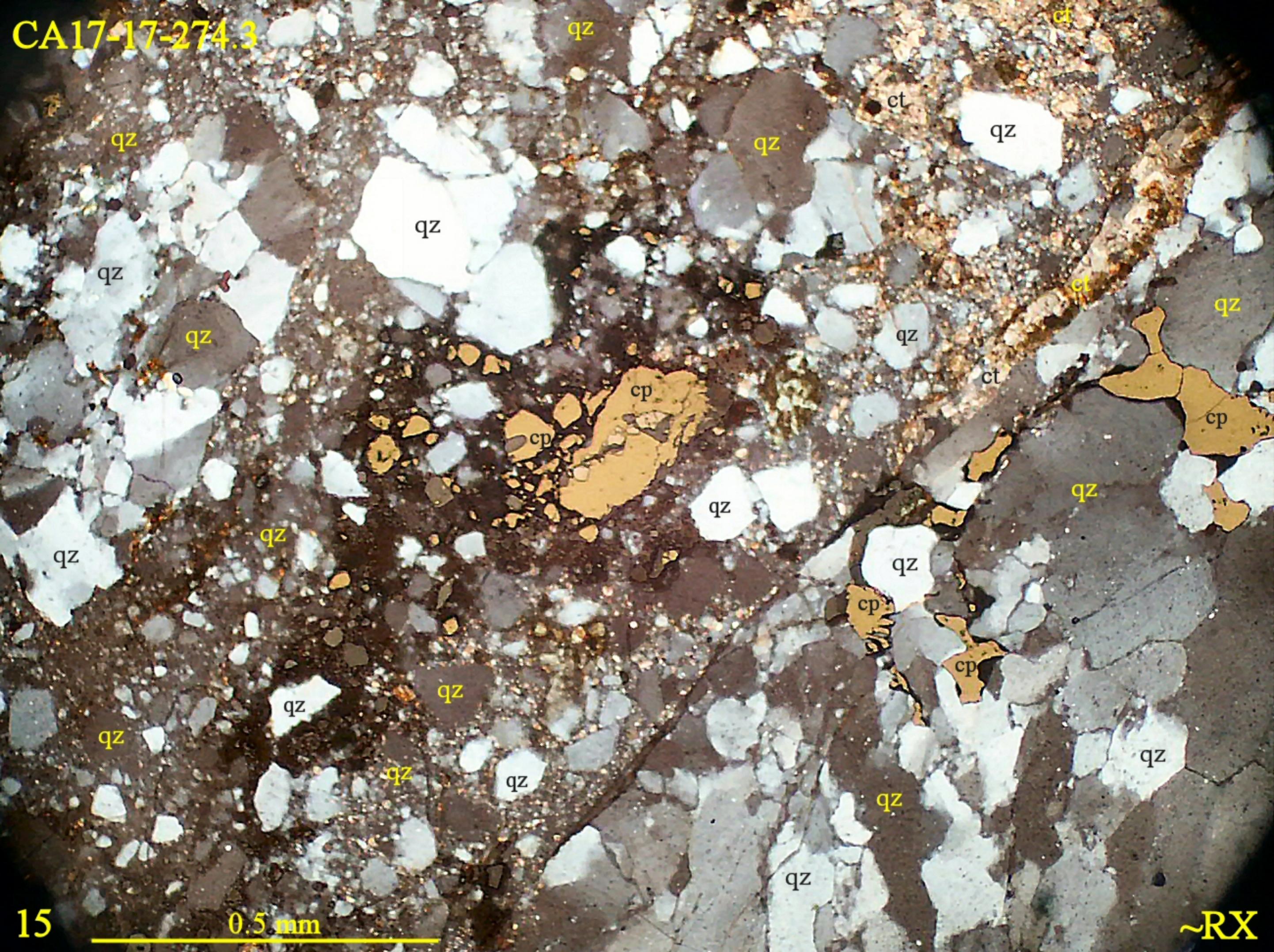


14

0.5 mm

~RX

CA17-17-274.3

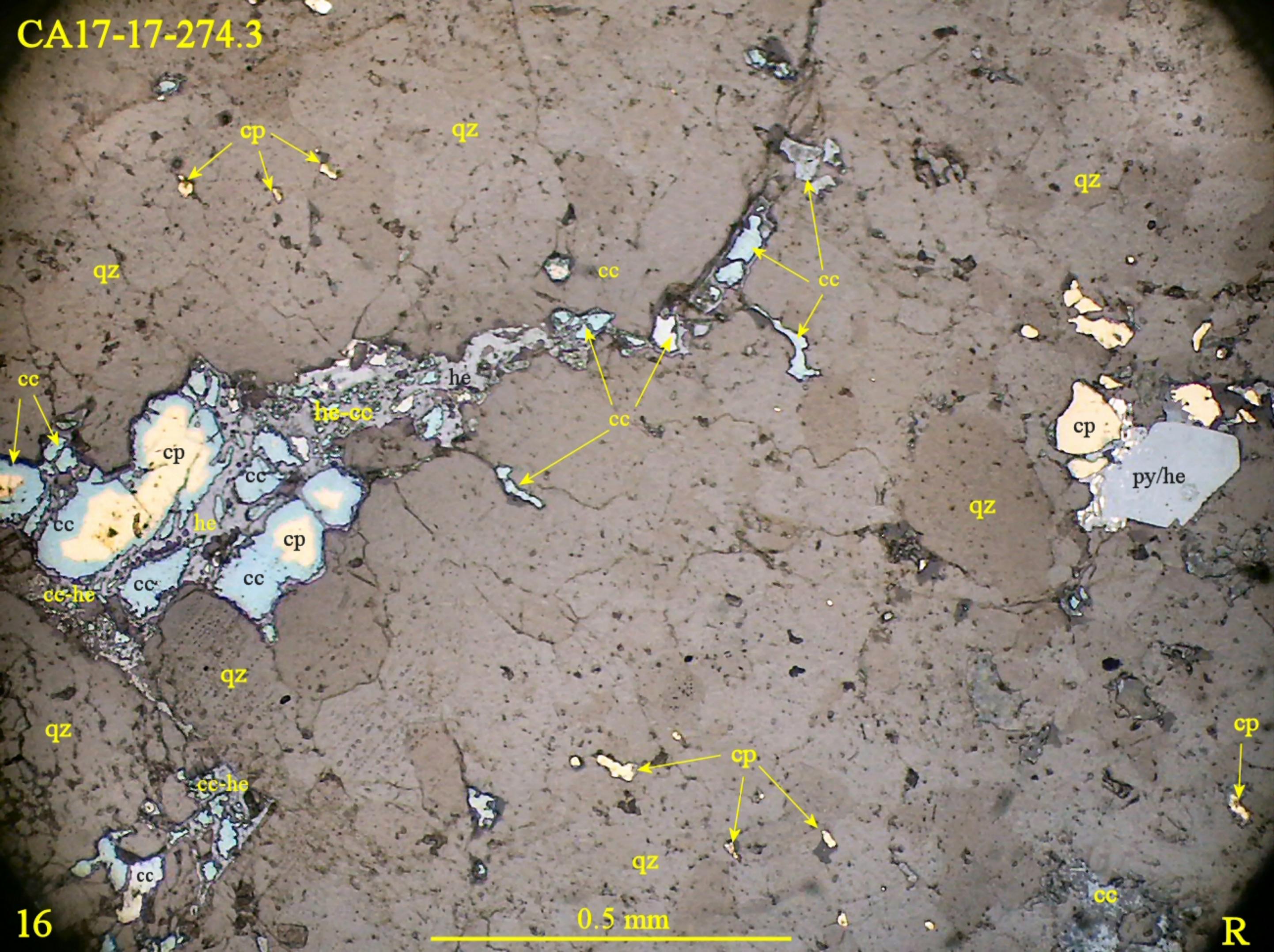


15

0.5 mm

~RX

CA17-17-274.3

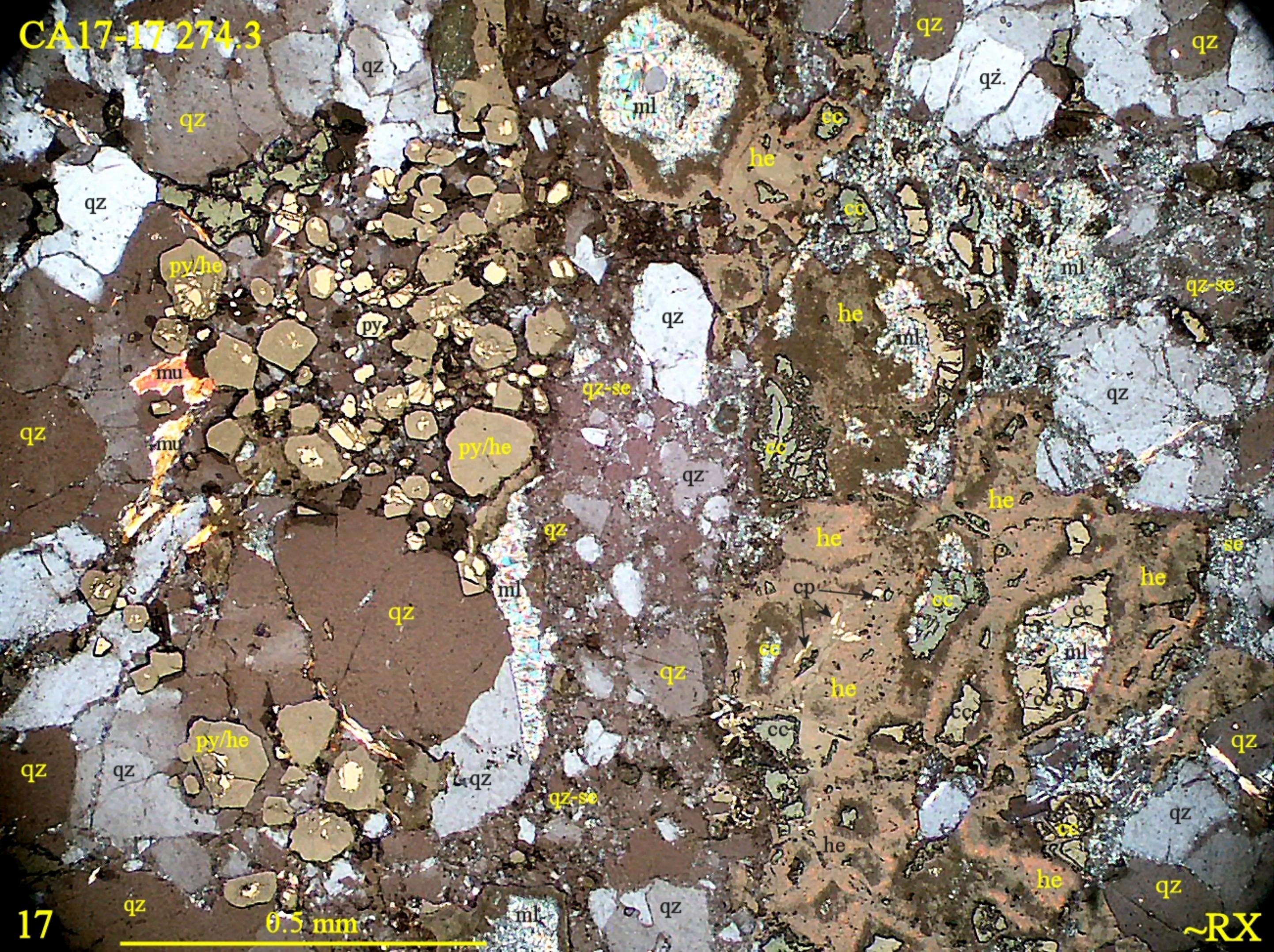


16

0.5 mm

R

CA17-17 274.3



17

qz

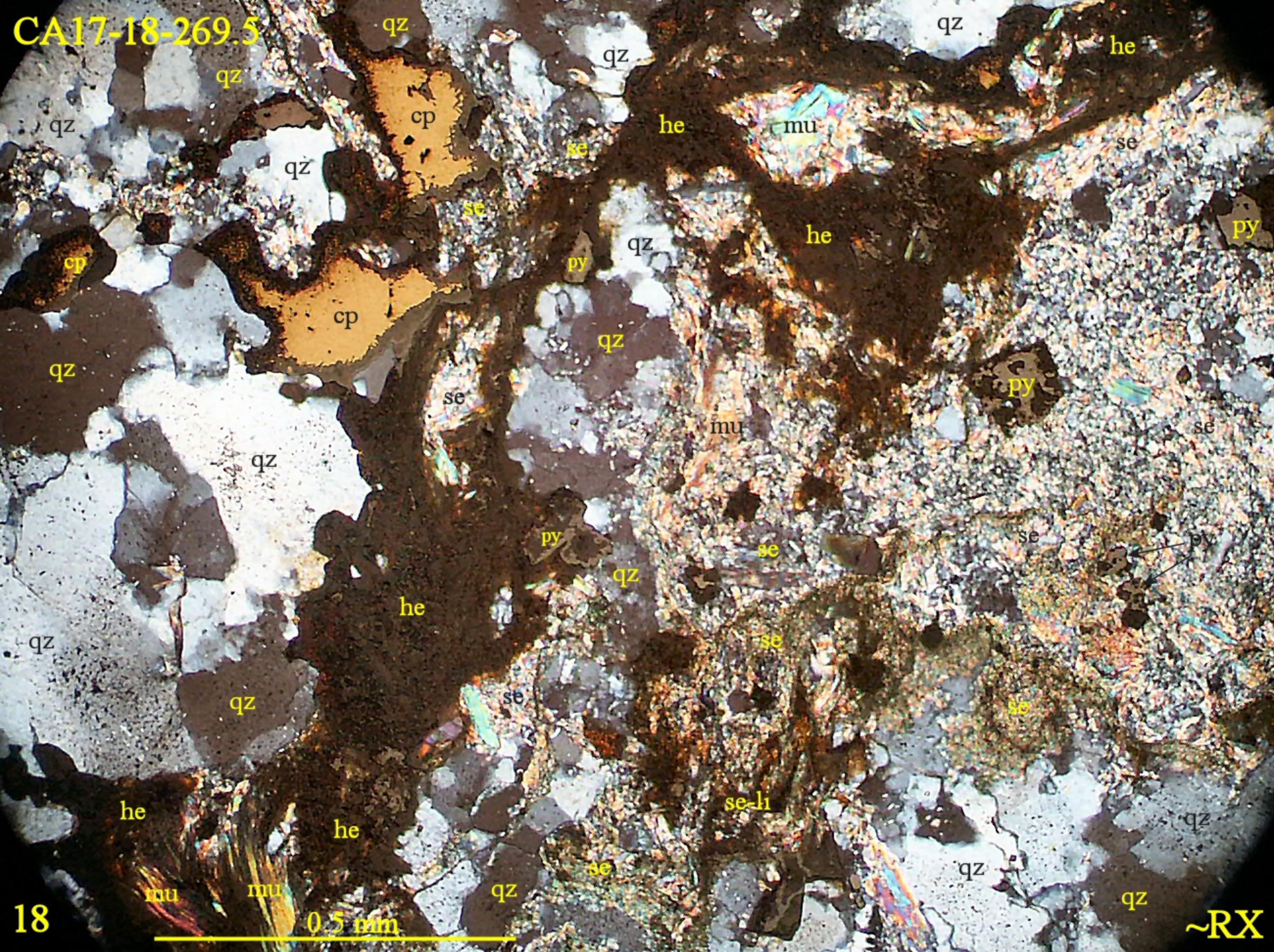
0.5 mm

ml

qz

~RX

CA17-18-269.5

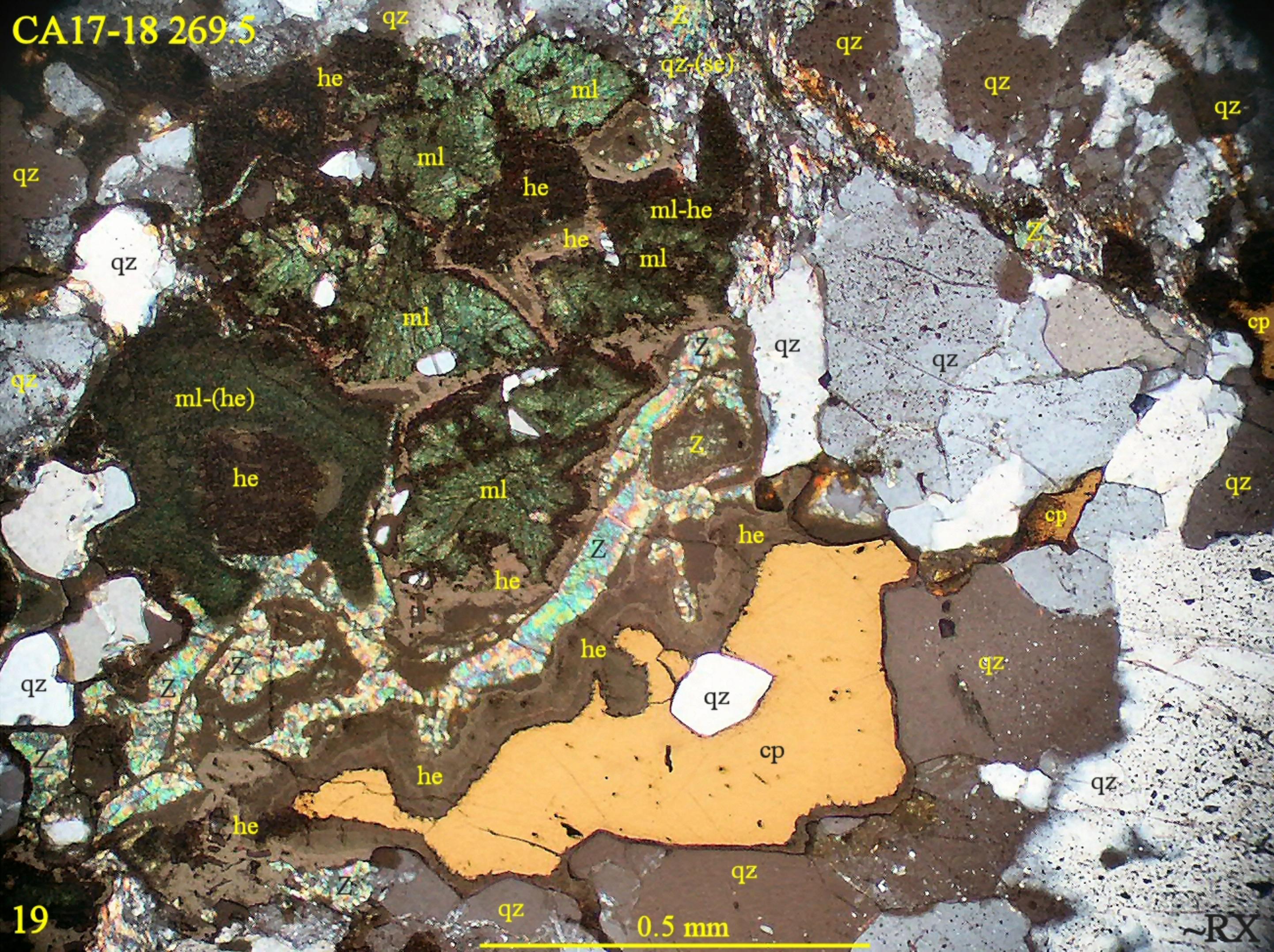


18

0.5 mm

~RX

CA17-18 269.5

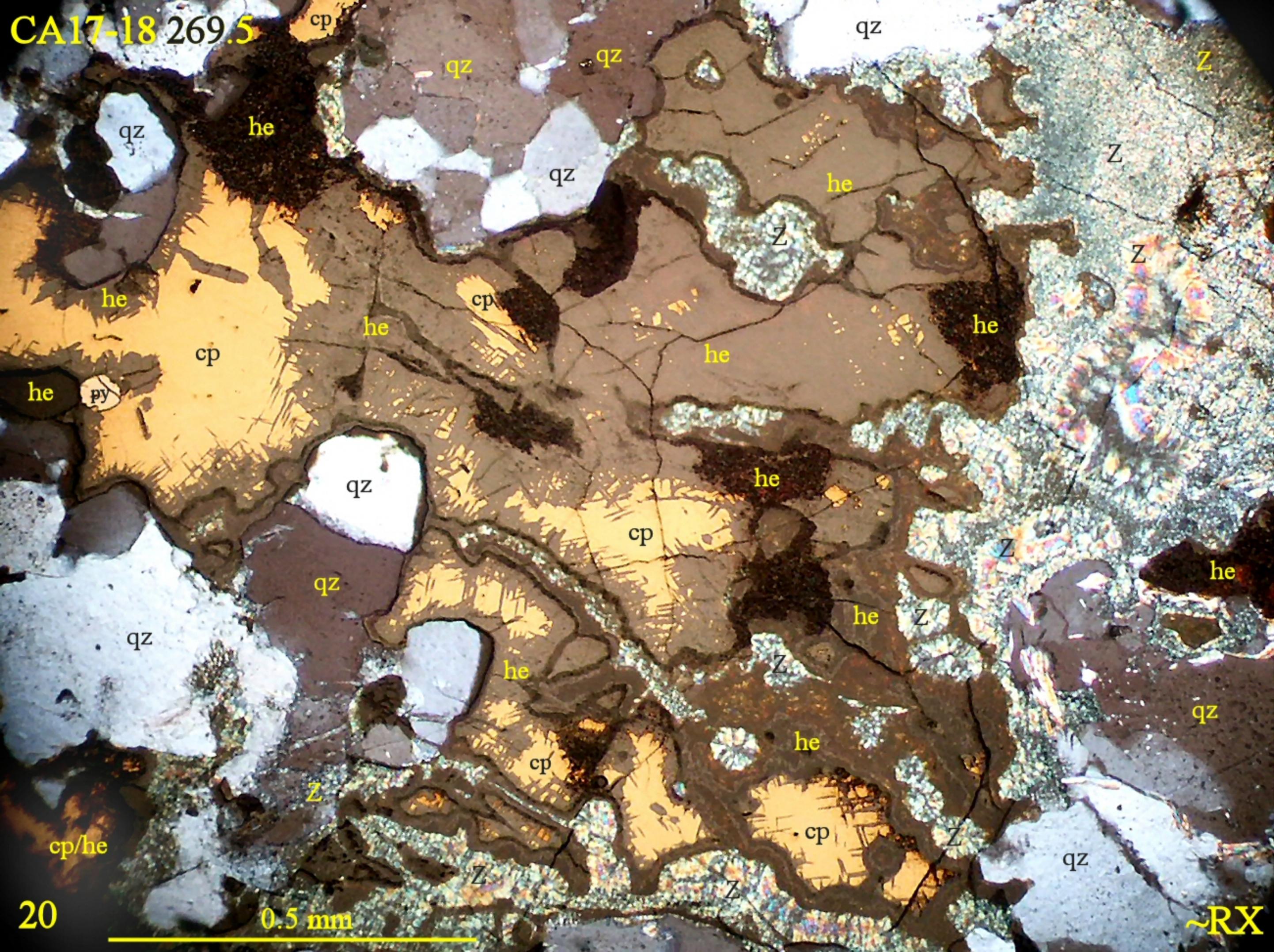


19

0.5 mm

~RX

CA17-18 269.5

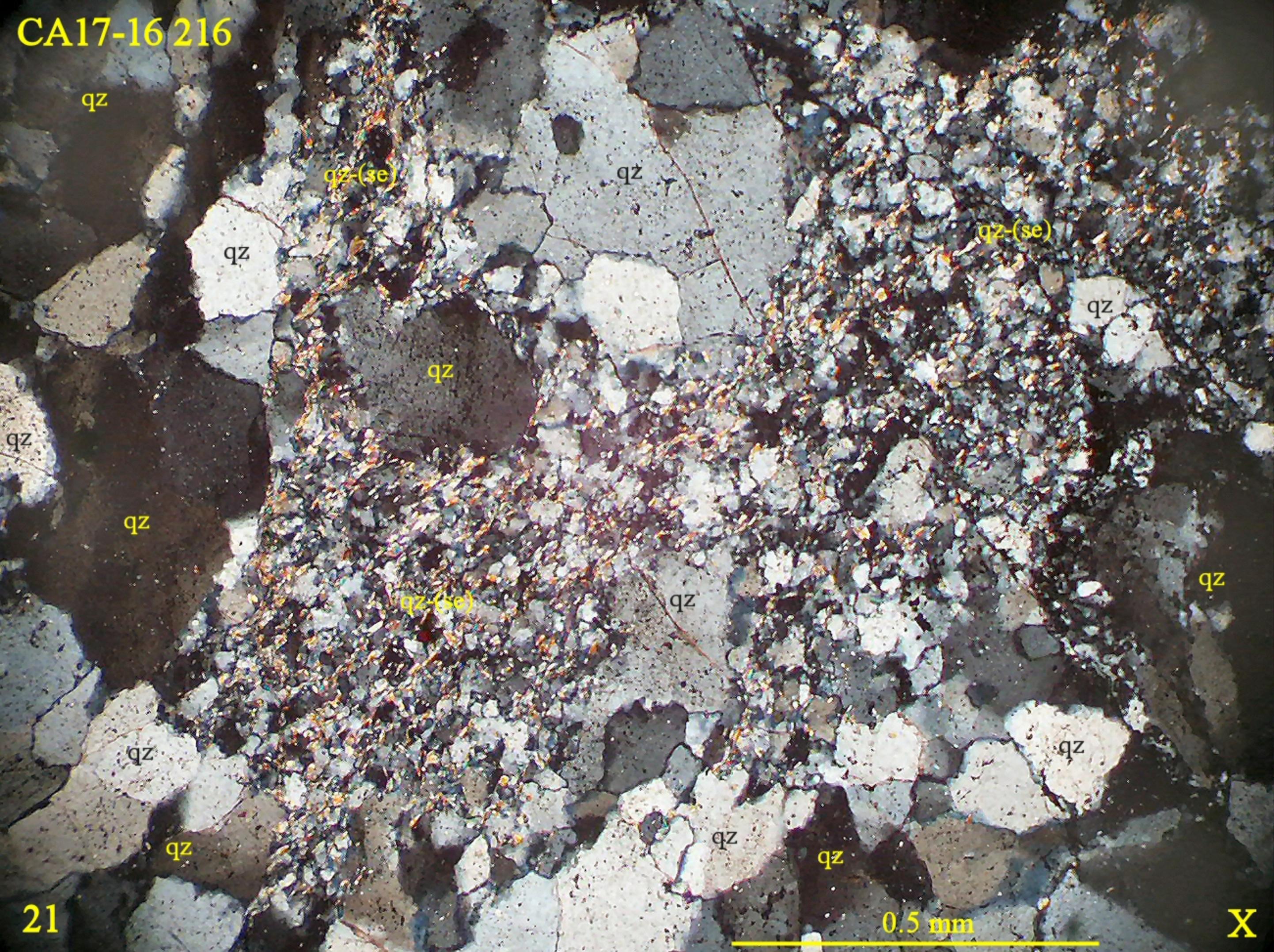


20

0.5 mm

~RX

CA17-16 216



qz

qz-(se)

qz

qz-(se)

qz

qz

qz

qz

qz

qz

qz-(se)

qz

qz

qz

qz

qz

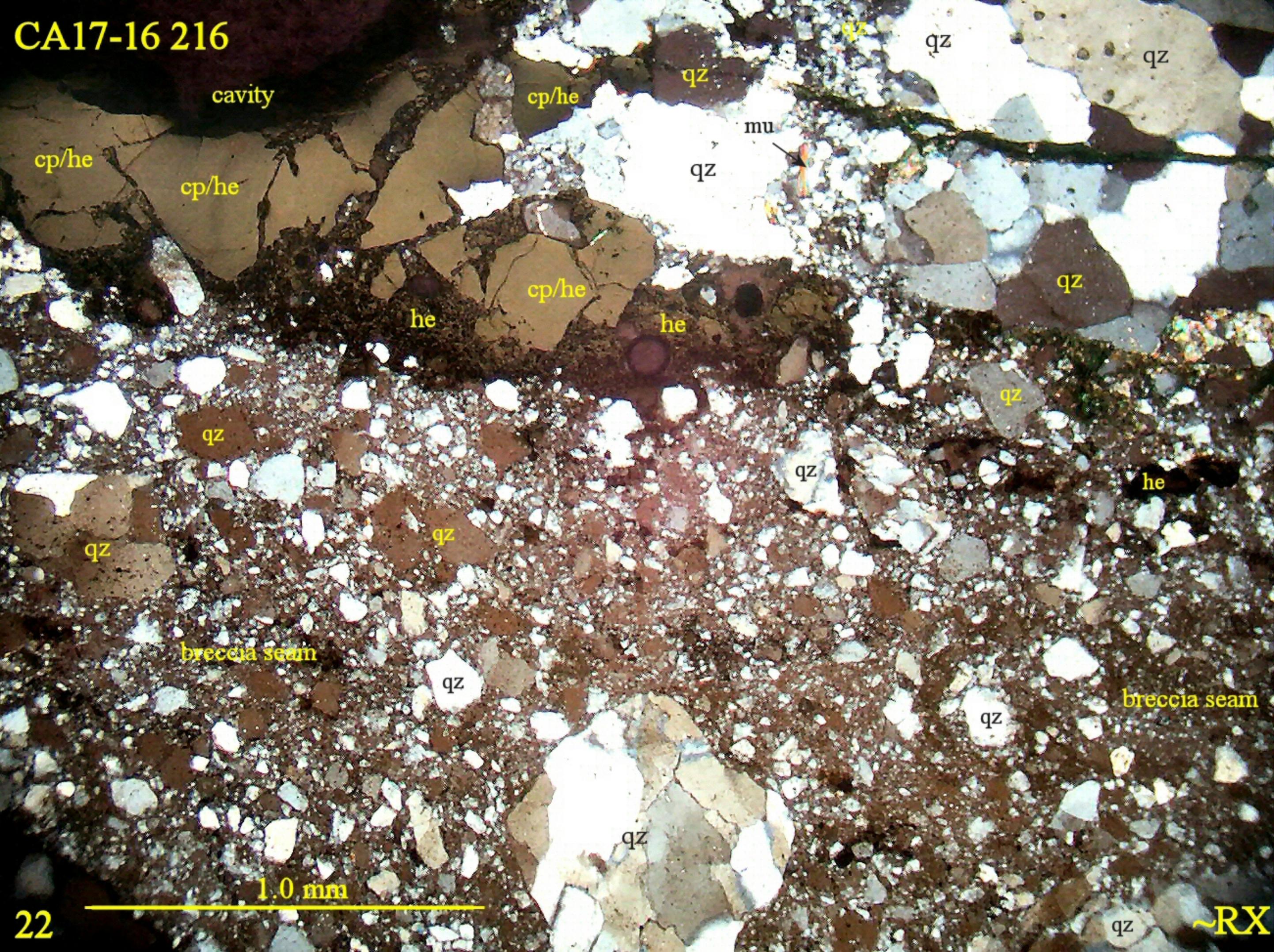
qz

21

0.5 mm

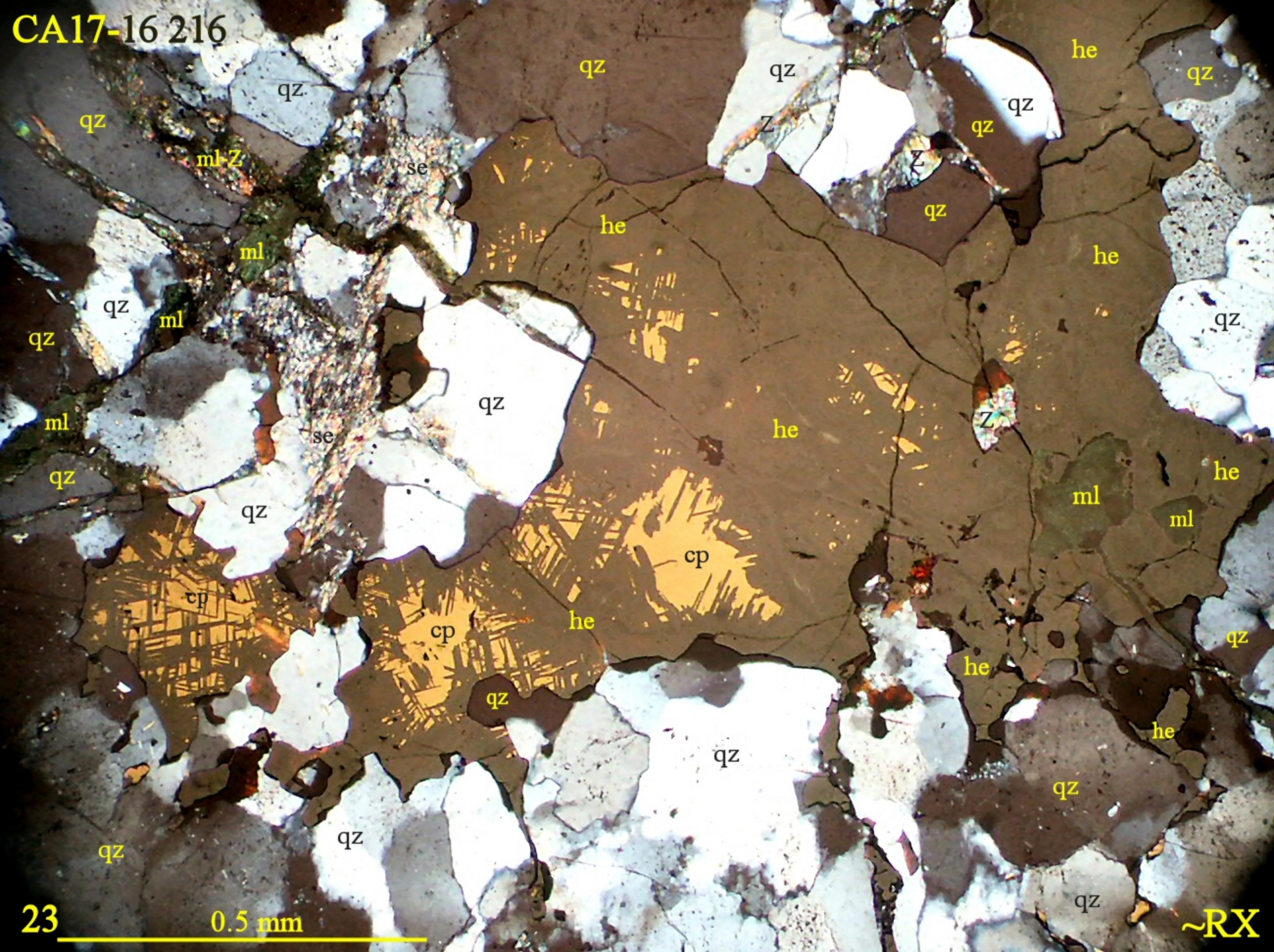
X

CA17-16 216



1.0 mm

CA17-16 216

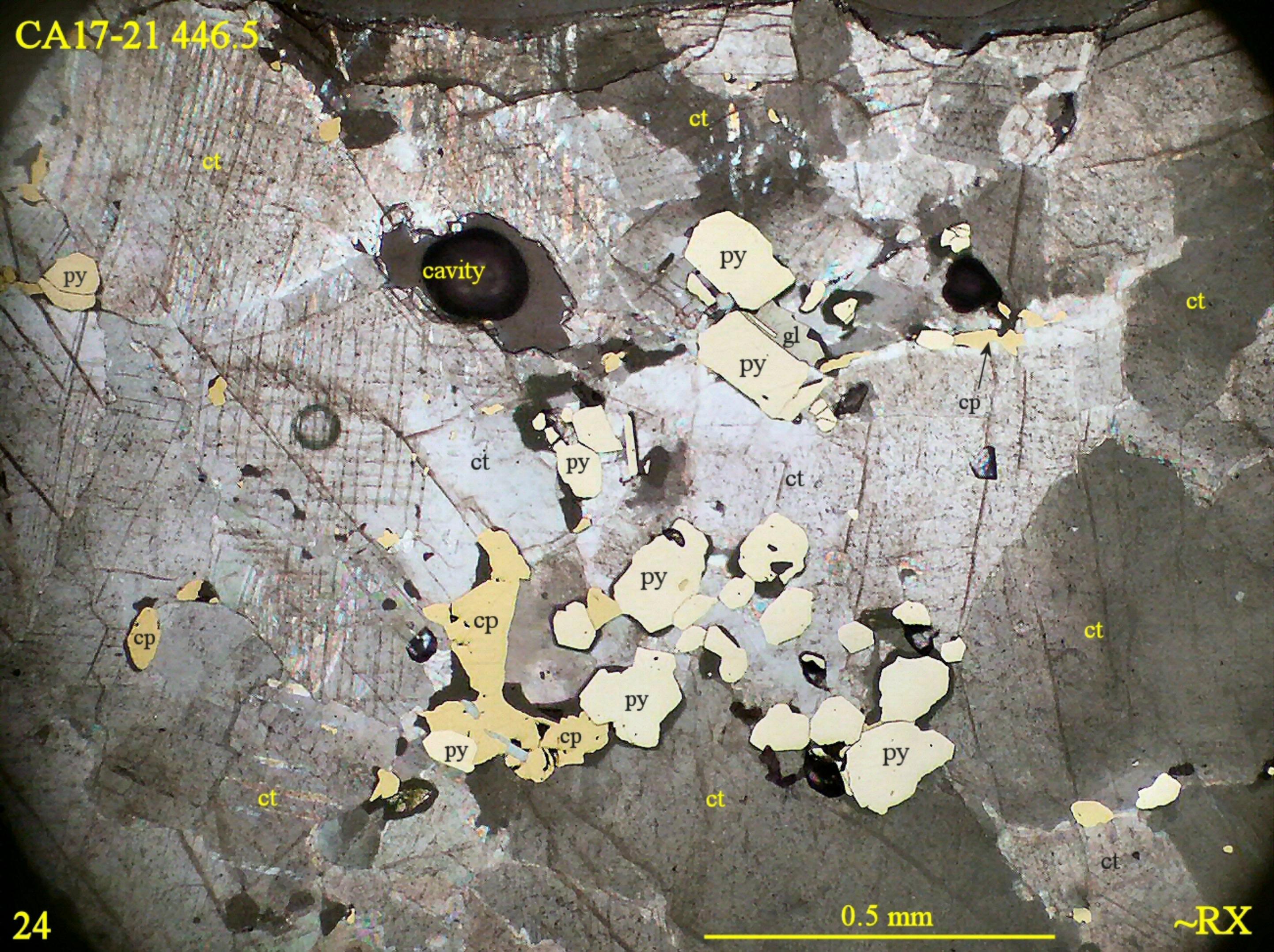


23

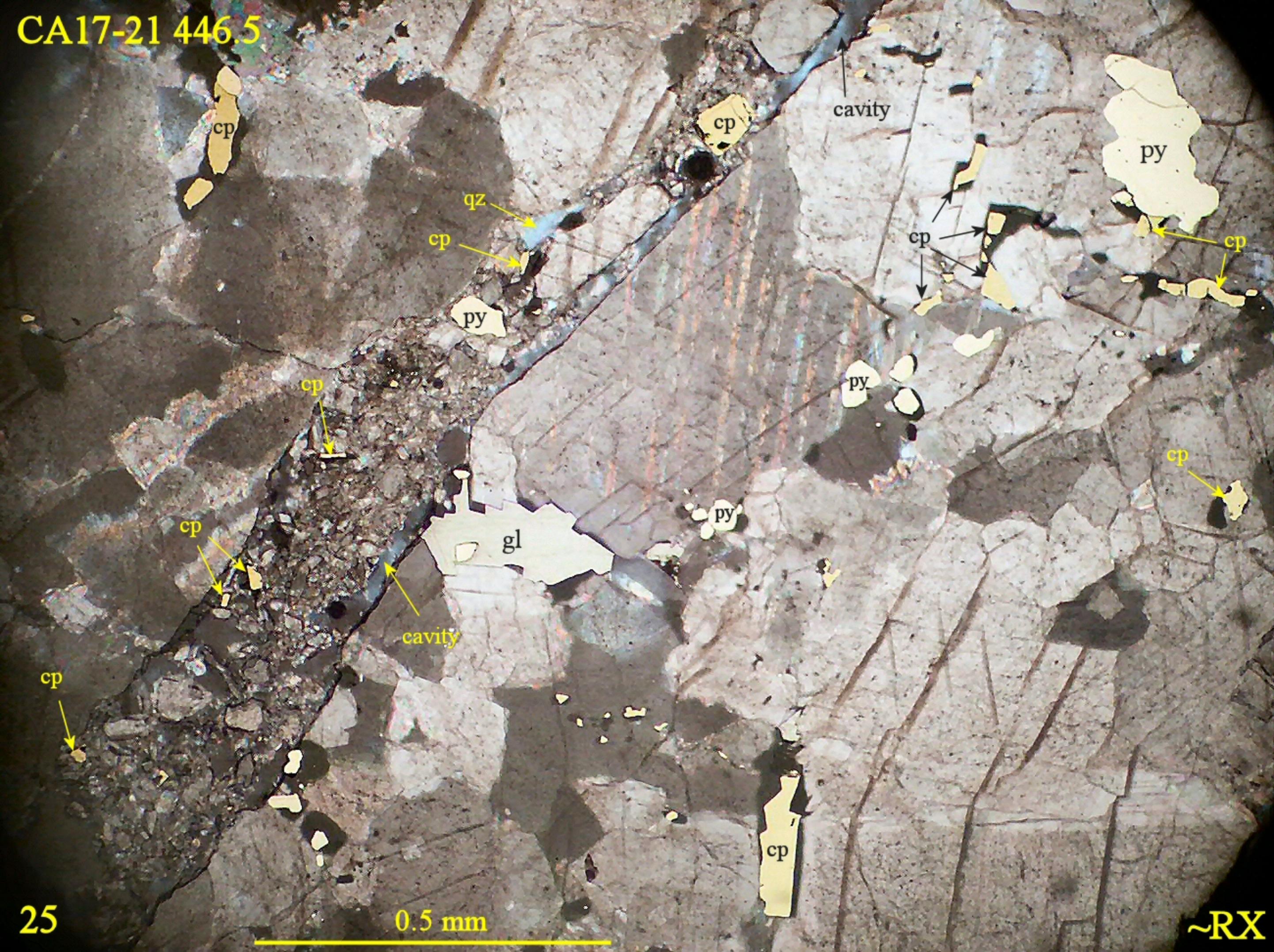
0.5 mm

~RX

CA17-21 446.5



CA17-21 446.5



25

0.5 mm

~RX