Appendix 1. Geologic Core Logs of Existed Drillings

Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: KT104 Locality: Kettara Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 1 (40.00 m – 165.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
40				B.S.	schist pale-gray									
44.20		brec												
				B.S.	schist, tuffceous, pale-gray				qtzvment rich					
46.90														
				B.S.	massive, black									
50														
53.50		frac												
				fracture zone	B.S. (schist, pale-gray)									
60														
70								71.00	qtz.v.					
80														
90														
100	100.10													
				B.S.	schist + quartzite			102.00	qtz+cp.v., sul.v.					
								106.00	layered qtz.v. ~ py. v					
110														
111.80		frue												
				B.S.	tuffceous, wk-argilli	w		111.8-115.0	ntwk py filled tuff					
115.00		frue						115.0-115.1	qtzv					
				M.S.	massive			115.0-119.0	MS, py,po-rich, contain strg arg mds					
								115.4-115.5	sul.v.					
119.00								119.9-120.0	sul+qtz.v.					
120	120.70	tauH		M.S.	massive (contain tuffceous lamina)									
	121.08			B.S.	brecciated, qtz.v. with b.s.	s.w			qtz.v., bs-frag, chl					
				B.S.	schist				qtz.v.					
130								120.90	qtz.v.					
140														
144.00														
				fracture zone	B.S. schisty									
149.00														
150				B.S.	lamina (soft / hard alten)									
154.00														
				B.S.	schist + quartzite				qtz.v. + py					
157.00		grad												
				B.S.	lamina turbidity-strong									
160	160.60	grad												
162.90		grad		M.S.	banded				sandy, py banded+qtz+turbidity					
163.00		frae		B.S.	lamina py layer				py layer					
164.00		frae		M.S.	massive				massive, contain-qtz					
164.90				M.S.	massive				massive, mds frag					
		irreg		M.S.	recrystd				brecciated mds frag					
				B.S.	vein + quartz/tz, galena+py	s.w								

160.4-5 py layer in mds
160.9-161.0 sul layer in mds
162.0-162.1 sul layer in mds
162 M.S. with qtz
163.5-163.7 M.S. dao-fragment

Metal Mining Agency of Japan

Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: KT104 Locality: Kettara Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 2 (165.00m - 180.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
165.00				B.S.	wk-arg. pale-green-gray quartzite									
				B.S.	massive pale-gray				qtz.v.					
170														
180														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: KT2BS Locality: Kettara Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 1 (10.00 m - 120.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
10.00														
10				B.S.	schist, black									
20														
30														
40														
42.55		grad →		B.S.	lamina (soft / hard alten)									
50														
60														
64.50				B.S.	lamina (soft/hard alten) hem.-layener				hem - layer druse					
70														
80														
83.28				B.S.	lamina (soft/hard alten) hem layer-rich									
87.00		grad →		M.S.	massive				massive mds freg un-solidification porous					
88.00		irreg →		M.S.	sandy				M.S. sandy, floe-st.					
88.50				M.S.	mdsl M.S. mds:unsolidification, silicified				brecciated mds:un-solodification					
90				B.S.	schisty, wk-silicified									
96.10									sul.v contain mds					
97.50				M.S.	sandy			96.50	sandy, fragment-mds, imbrication					
97.90				B.S.	ffragmental, massive pale-gray									
100				M.S.	massive				M.S. mds-fragment : imbrication					
108.00														
110.00		irreg →		M.S.	massive				M.S. mds + po bigger					
110.30				M.S.	White, (rhyolite)				qtz.v					
112.60		grad →		B.S.	massive pale-gray									
120				B.S.	lamina schistosity + quartzite									

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: KT4BS Locality: Kettara Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 1 (36.00 m – 160.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
36.20				B.S.	lamina (soft / hard alten) pale-gray									
40														
50														
60				non core										
70														
80				Lime stone	Black, massive									
90														
100				B.S.	massive, palegray				cal. v. rich					
110														
120														
130														
140														
150														
160														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: KT4BS Locality: Kettara Grid Coodinates: N, E Elevation: Length: Inclination: Sheet No.: 2 (160.00m - 285.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
160				B.S.	massive, pale-gray.									
170														
180														
190														
200														
210														
218.00														
220				B.S.	tuffceous pale-gray, massive.				qt z. v.					
224.00		grad												
230				B.S.	lamina schist + quartzite									
231.00		frou												
233.90				M.S.	massive				M.S. massive contain mds. imbrication					
234.00		frou		B.S. M.S.	233.3-234.0 mds + MS (MS layer-irregular)				massive, contain mds.					
240				B.S.	234.0-246.6 lamina (soft + hard alten)				alternative py qtz.v.:post activity					
246.60		frou							(qtz:mbx)					
247.60				M.S.	massive				massive, mds frag. imbrication					
248.00				B.S.	lamina (soft + hard alten)			247.60	tuffceous					
249.00				M.S.	massive									
250				B.S.	lamina (soft + hard alten)									
256.00				M.S.	massive				massive mds-fragment, imbrication					
260														
263.00				B.S.	massive, gray (qtzv:frogment)									
267.00				M.S.	massive				massive mds: cruck					
270.00				B.S.	massive, gray qtz.v.-rich				qtz.v.					
272.00				M.S.										
274.00				B.S.	lamina strong-folding									
276.00				M.S.	massive				massive mds fragment					
280														
282.00				M.S.	massive									

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: KT4BS Locality: kettara Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 3 (285.00m - 310.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
285				M.S.	massive				M.S. massive mds-fragment					
290														
295.00				M.S.	massive → layered				M.S. massive, un-solidifivcation, mds-fragment					
300														
301.30		sharp		B.S.	massive									
310														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: KT3BS Locality: Kettara Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 1 (0.00 m – 60.00 m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
0 0.70				B.S.	Lamina (soft / hard alten)									
10														
20														
29.00														
30 32.00				B.S.	Massive									
				B.S.	Lamina (soft / hard alten), strong folding									
40														
49.00														
50				B.S.	Lamina (soft / hard alten), strong folding strong argill, wht									
54.88				M.S.	Massive				M.S. massive					
55.00				M.S.	brecciated				brecciated, mds-fragment					
58.00				B.V.	hyaloclastite, tuffceous									
60				B.V.	tuffceous, aphyric									

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: KT1BS Locality: Kettara Grid Coodinates: N, E Elevation: Length: Inclination: Sheet No.: 1 (0.00 m – 63.40 m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
0				B.S.	Schisty									
10.00				B.S.	Lamina (soft / hard alten)									
20														
30														
33.00				B.S.	Massive									
40.80				B.S.	Schisty strong arg pale-gray									
42.80				B.S.	Schisty strong arg wht									
43.40				B.S.	Schisty , wk-arg pale-gray									
46.40				M.S.	mds-fragment. massive				M.S. mds, frag					
50				B.S.	Schisty M.S. layer				M.S. layer					
55.00														
60				B.S.	Schisty m.s. filled cracks				sul. filled cracks.					
63.40														
70														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: BS15 Locality: Benslimane Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 1 (269.80m - 337.60m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
260														
269.80														
270 271.00		gradual		B.S.	gray, schisty									
				B.S.	lamination, siliceous, micro-folding-st									
280														
289.30		frac												
290 290.60		frac		frac. zone	B.S. rich									
291.90		grad		M.S.	brecciated			290.6-291.9	breciated					
				M.S	massive			291.9-298.3	massive, brown					
298.30		grad												
300				M.S.	layered			298.3-304.4	layered contain b.s.-frgment					
304.40		grad												
305.20		grad		M.S.	brecciated			304.4-305.2	breccated b.s.-fragment					
		10		B.S.	lamination, palegray			307.40	sul.v.					
310								310.20	sul.v.					
								310.30	sul.v..					
								307.40	sul.v.		2cm			
320														
322.40		grad												
				B.S.	fine grain, massive									
330														
337.60														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: KA25 Locality: K.AICHA Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 1 (42.00 m – 175.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
40														
42.95				B.V.	Lava, massive, porphyritic (pl:1~2mm.euhedral)									
50														
60														
70														
79.10		gvreled												
80				B.V.	Lava, massive, porphyritic, pale-gray									
90														
100														
110														
120														
130														
131.00				B.V.	massive, aphyric, pale-green-gray, argillaceous, mica									
140														
								142-179	cal.v. ntwk zone (W:5-10mm)					
150														
160														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: KA25 Locality: K.AICHA Grid Coodinates: N, E Elevation: Length: Inclination: Sheet No.: 2 (165.00m - 290.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
165				B.V.	massive, aphyric, pale-green-gray argilliceous, mica			142.0-178.0	cal.v ntwk zone (W: 5-10mm)					
170														
180														
190														
200														
210														
220														
230														
240														
250														
260														
270	270.00	gvadoal ↓			gradual ↘									
280				B.V.	massive, aphyric, pale-green-gray argilliceous, mica-rich									
	284.10													
	287.00	gvadoal ↓		B.V.	massive, fine grain, tuffceous, pale-green-gray argilliceous (ser+chl)									
290	290.00	gvadoal ↓		B.V.	tuffceous, wk-lamination, pale-green-gray									
				B.S.	massive									

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: KA25 Locality: K.AICHA Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 4 (415.00m – 540.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
		free		M.S.				413.0-416.0 416.0-419.0	flow-st brecciated-st					
420 406.20				fracture zone	M.S. + B.S.			419.0-430.0	fracture zone (M.S.+ B.S.)					
430 430.00		free												
435.00		free		B.S.	pale-green-gray, schisty									
440				B.V.	massive, aphyric, pale-gray									
450														
460														
470 472.00		grad												
480				B.V.	tuffceous, fine grain, pale-gray									
490														
500														
510 515.00														
520 528.00				B.V. / B.S. altenative	massive, aphyric, pale-gray gray									
530				B.V.	massive, aphyric, pale-gray									
540														

Metal Mining Agency of Japan

Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: KA25 Locality: K.AICHA Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 3 (290.00m – 410.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
290				B.S.	pale-gray, schisty									
300														
310														
320														
330														
340														
350														
360														
370														
380														
390														
400		sharp		M.S.				400.0-401.0	flow-st			30		
								401.0-402.0	brecciated-st			30		
								402.0-411.0	sandy-st			30		
410								411.0-412.0	flow-st			30		
								412.0-413.0	brecciated-st			30		
								413.0-416.0	flow-st			30		

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: KA25 Locality: K.AICHA Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 5 (540.00m – 581.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
540				B.V.	massive, aphyric, pale-gray									
550														
555.00				B.V.	tuffceous, fine grain, pale-gray									
560														
581.00														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: A9 Locality: Lachach Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 1 (157.00m – 250.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
150														
157.00														
				B.S.	lamination, wk-argillization									
160														
169.10		grad												
170				B.S.	massive, pale-gray									
180														
190														
191.10		grad												
		10		B.V.	lamination, tuffceous, unclearly tuff			194.80 195.80 196.50	qtz. v. qtz. v. qtz. v.		10cm			
200														
210.00		grad												
210				B.V.	tuff, str-dissemination			210.0-216.0	disseminated py megacrystal (secoundary?)					
216.00		grad												
217.00		grad		B.V.	tuff, wk-argillization, unclearly tuff									
				M.S.	strong - brecciated			217.0-219.8	lamination+breciated					
219.80														
220				M.S.	brecciated			219.8-221.0	brecciated (no-flow-st)					
221.00				B.V.	lamination, tuffceous									
230														
240														
241.50														
242.50				B.V.	massive, tuffceous									
				B.V.	massive, aphyric.									
250														
250.00														

Metal Mining Agency of Japan

Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: DSF15 Locality: Draa Sfar Grid Coodinates: N. E Elevation: Length: Inclination:

Sheet No.: 1 (0.00 m - 125.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
0														
10 10.50				B.V.	tuffceous (soft / hard alten)									
20 20.80				B.V.	tuffceous (soft / hard alten)									
30														
40														
50														
54.70				fracture zone	tuffceous rock fragment-rich									
60 61.90				B.V.	tuffceous (soft / hard alten)									
70								64.70	qtz.v.+chl		3cm			
80 80.00		grad						78.60-78.80	qtz.v. chl ntwk zone					
90				B.V.	schisty, gray									
100														
108.85		grad							qtz. v. ntwk					
110				B.V.	strong schisty + quartzite									
120														

Metal Mining Agency of Japan

Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: DSF2 Locality: Draa Sfar Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 1 (0.00 m – 125.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
0				B.V.	tuffcoues pl-pheno									
10														
								14.50-15.50	qt2v inregulur					
20														
22.50				B.V.	wk-lamina, pl-pheno-platy qtz:pheno									
30.00		sharp												
30				B.S.	schisty + quartzite (tuffceous)									
33.60														
40				B.S. (fracture zone)	B.S. fragment									
44.60				B.S.	schisty + quartzite (tuffceous)			45.00	qtz.v. wht					
50														
60														
70														
80														
90														
92.40		grad												
94.00				A.V.	dacite lavapale-green				qtz.v.+chl					
97.70		grad		A.V.	(sill?)									
98.70				A.V.	tuffbrec. argilli schisty			98.70	wht.qtz.v.+chl					
100														
109.00				B.S.	schisty + quartzite (tuffceous) lamina, qtz-pheno-rare									
110				B.S.	schisty + quartzite (tuffceous) lamina, qtz-pheno-rich brecciated, mtx:tuffceous				qtz.v.rich part					
115.10				fracture zone	muddy, fragment-rich									
115.30				M.S.	massive solidification-mds:broken			115.3-118.0	M.S. massive contain-mds					
118.00				M.S.	turbidity-strong			118.0-118.5	turbiduty					
118.50				M.S.	massive, wk-lamina			118.5-120.3	layered					
120					120.30 mds fragrment			120.3	mds-fragment					
					122.00 layered			120.3-122.0	layered, slowly-sediment					
125.30				B.S.	fracture zone, black, schisty+quartzite									

Metal Mining Agency of Japan

Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: DSF15 Locality: Draa Sfar Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 3 (250.00m – 270.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
250				non core							30cm			
252.00														
253.00				M.S.	massive			252.0-253.0	massive					
				B.V.	tuffceous pale-gray									
260														
270														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: DSF15 Locality: Draa Sf ar Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 2 (125.00m – 250.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
130				B.S.	strong schisty + quartzite									
140														
150														
156.15				B.S.	schisty (soft + hard alten) tuffceous									
160														
170														
180														
190														
200														
210														
220														
230														
236.00		grad		B.V.	massive aphyric									
240														
240.80		grad		B.V.	hyaloclastite				py-diss strong					
241.40				B.V.	hyaloclastite, aphyric									
242.60				M.S.	massive			242.6-244.2	massive					
244.20				B.S.	pale-gray									
244.60				B.S.	strong argill			244.6-246.0	strong-arg + py-diss					
246.00				M.S.	massive			246.0-252.0	massive					
250														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: DSF2 Locality: Draa Sfar Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 2 (125.00m – 150.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
125.30				B.S.										
130														
140														
150														

Metal Mining Agency of Japan

Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 1

Hole No.: KH4A Locality: Khwadra Grid Coodinates: N, E Elevation: Length: Inclination: (533.60m - 565.60m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
530														
533.60														
				B.S.	534.70 lamination rich → massve dark-gray									
538.40								538.40	Y.BO. coarse grain					
540		40		M.S..	y.o. lamina. ←secoundary			539.35	Y.BO. medium grain					
541.50								540.35	Y.BO. coarse grain					
542.30		0-10		B.S.	massive, lamination, pale-greenish-gray			541.50						
								542.30	Y.BO. fine-grain					
								544.80	Y.BO. coarse grain					
550								548.70	Y.BO. mega-crystal py					
								550.20	Y.BO coarse grain					
								551.10	medium grain py			40		
				M.S.	Y.BO, massive			553.10	py.v. ntwk		1.5cm	60°		
								553.20				10-20		
									coarse grain, wk-lamination Y.BO.(py+po), massive			10-20		
580								560.40	Y.BO. (py+po), porous					
								561.30	acid-leached zone hem+po+py, fine grain, porous					
563.40								563.40						
565.60		20-30		B.S.	pale-gray, wk-lamination, sticky									
570														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: KHQUADRA S4-C Locality: Khwadra Grid Coodinates: N, E Elevation: Length: Inclination: Sheet No.: 1 (514.70m – 570.70m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
510														
514.70														
516.70				B.S.	fine, sticky, flow-st.									
					gradually			516.70	Y.BO. massive, pale-gray			20		
								518.50	Y.B.O massive, py.v flow-st., coarse			20		
520				M.S.				521.10	Y.B.O massive flow-st, fine			20		
524.40				B.S.	dark-green-gray, sticky, talky			524.40						
524.65				M.S.				524.65	BO. massive					
525.65			broken zone		dark-green-gray, sticky, talky			525.65						
527.40		5		B.S.				527.40						
528.05				M.S.	dark-green-gray, sticky, talky			528.05	Y.BO. fine					
528.80				B.S.				528.80	Y.BO. coarse					
529.00				M.S.	dark-green-gray, sticky, talky, worm-eat			529.00	Y.BO fine, flow-st.					
530		er		B.S.	yellowish pale-gray, fine			529.50	Y.BO medium, massive					
					conform			532.50	hem, +acid-leach-porous, brecciated					
				M.S.				533.60	BO+py, flow-st.		1.8	30		
534.20								534.20						
				non-core										
540	540.00							540.00						
								542.00	Y.BO fine massive					
								542.40	Y.BO coarse flow-st		0.4	20		
				M.S..					Y.BO massive fine		30			
								545.40	massive+ntwk.v(py+cp), lamination		1.8	60° 60°		
								547.20	ntwk massive+vein(qtz+cal) rich		2.3m 4.6m	30		
550								550.40	massive lamination		2.5	40		
552.50								552.45	py-rich wk-mg, porous, flow-st		5cm	40		
					str. lamination, coarse-fine grain			552.50						
				B.S.	554.00 str. lamination, coarse-fine grain		w							
		0-10		B.S.	558.50 str. lamination, coarse-fine grain									
560	560.90	0-10		B.S.	559.70 str. lamination, coarse-fine grain	w								
		0-10		B.S.	str. lamination, coarse-fine grain									
583.90		6°						583.90	conform cp-rich		2.4m	-		
				M.S.	massive, no-grading			586.35	massive dark-brown, str.mg					
		10°?		B.S.	brecciated green-gray sticky, silty sericite				brecciated cp					
568.40				A.V.	pale-green-gray, dark-green-patch		m		wk py dissemination					
570	570.70													

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: S-5 Locality: Khwadra Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 1 (621.80m – 716.05m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
620														
621.80														
		0		B.S.	621.80-634.80 dark-gray, fine-grain, str.lamination									
630														
					634.80-642.50 greenish-gray, chloritizaton									
640														
642.80					642.60-642.80 greenish-gray, finegrain, wk.lanrnation									
644.60				M.S.	644.40-644.60 interfmher(B.S.+M.S.)			642.8-643.0 647.0-644.2	mass,fine, brown(py+po),str.mg mass,coarse,lgt-brown(py+po)str.mg		2.4			
		5-10		B.S.	644.60-644.70 fault (argillic, brecciated, B.S.fragment-rich) 644.70-647.40 gray, fine-lamina + massive altn.	w		644.2-644.8	flow-st, fine,yellow(py+cp)str.mg					
647.40								647.40	Y-BO.mass,fine, brown					
				M.S.				649.90	flow-st.(yel-sul+blk-sul+brn-sul)					
650					(fault zone)			651.80 652.40 652.80	B.S. fragment Volc.tex(pl-pheno), silic					
								653.20	flow. st.					
									Y-BO, mass.					
						w		656.20	White sil+argill.					
								657.20	Y-BO, mass, fine, brown, str.mg					
660								660.10						
660.10				A.V.	660.10-663.00 andesitic-dacite, pale-gray, brecciated	M			ntwk or brecciated, py					
					660.10-663.00 mineralization, Hem. layer-rich			663.10 663.20	hem-layer-rich(2~3mm)					
					663.20-670 masive lava, pale-gray	w	w							
670														
					670-673.80 porphyritic pl-phenocryst (platy to rounded) (pinkish)									
673.80														
		0-10		B.S.	673.80-681.80 fine-grain, pale-gray, llamination									
680														
					681.80-687 very-fine, pare-gray, tuffceous									
		10			687-709.80 black, fine, lamination									
690														
700														
710		10-20			709.80-710.3 greenish andesitic volcanic sediment coarse-grain									
					710.30-716.05 black, fine-grain, lamination									
716.05														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: KHWADRA S3C Locality: Khwadra Grid Coodinates: N, E Elevation: Length: Inclination: Sheet No.: 1 (303.20m – 404.50m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
300														
303.20		20-30		B.S.	dacite, dark-gray, fine massive, wk-lamination				sul.v.					
310														
315.80				A.V.	dacite, yellowish-gray coarse grain, wk-lamination									
				B.S.	pale-gray, wk-lamination, very-fine grain				gtz v gtz v					
320		0-20			pale-gray, wk-lamination, very-fine grain									
327.90					brecciated, -> hyaloclastite worm-eat									
				M.S.	massive, fine grain			327.90	Y.BO coarse, lamination					
330								330.90	Y.BO. brown massive fine					
333.90								333.90						
334.60				A.V.	dacite, massive fine grain faiult ore horizon			334.60	234.7 gtz.v. pillow breccia VMS? 05 qtz.v					
				A.V.										
340	340.20				dacite, brecciated~unclearly tuff									
				A.V.										
350														
352.00					dacite, breciated → hyaloclastite									
				A.V.										
357.00					breciated → pillo, clastic									
				A.V.										
360														
361.50					dacite, massive pl-pheno-rare									K-Ar①
				A.V.										K-Ar②
370														
373.50					dacite, massive pl phenochyst-rich			371.70	gnv massive	11	1cm	40		K-Ar③
376.50				A.V.	dacite, unclearly tuff									
				A.V.	dacite, flow-st rhyolitic									
380	381.00				dacite, massive									
				A.V.					pilotが多い					
390														
				A.V.										
400	400.20				dacite andesite				pydisaem 388.8-9 qtzv crevr					
		V-10		B.S.	black, talky massive									
404.50														
410														
420														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: KHWADRA S3C Locality: Khwadra Grid Coodinates: N, E Elevation: Length: Inclination: Sheet No.: 1 (303.20m – 404.50m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
300														
303.20														
		20-30		B.S.	dacite, dark-gray, fine massive, wk-lamination				sul.v.					
310														
315.80				A.V.	dacite, yellowish-gray coarse grain, wk-lamination									
				B.S.	pale-gray, wk-lamination, very-fine grain				gtz v gtz v					
320		0-20			pale-gray, wk-lamination, very-fine grain									
327.90					brecciated, -> hyaloclastite worm-eat									
				M.S.	massive, fine grain			327.90	Y.BO coarse, lamination					
330								330.90	Y.BO. brown massive fine					
333.80								333.80						
334.60				A.V.	dacite, massive fine grain ← talus ore horizon			334.60	234.7 qtz.v. pillow breccia VMS? 05 qtz.v					
				A.V.										
340					dacite, brecciated~unclearly tuff									
340.20				A.V.										
350														
352.00					dacite, breciated → hyaloclastite									
				A.V.										
357.00					breciated → pillo, clastic									
				A.V.										
360														
361.50					dacite, massive pl-pheno-rare								K-Ar①	
				A.V.									K-Ar②	
370													K-Ar③	
373.50					dacite, massive pl phenochyst-rich			371.70	gnv massive	11	1cm	40		
376.50				A.V.	dacite, unclearly tuff									
				A.V.	dacite, flow-st rhyolitic									
380														
381.00					dacite, massive									
				A.V.					pilotiが多い					
390														
				A.V.	dacite andesite				pydissem 398.8-9 qtzv creur					
400.20														
		V-10		B.S.	black, talky massive									
404.50														
410														
420														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: KH1A Locality: Khwadra Grid Coodinates: 400000N, 1200000E Elevation: 120m Length: 500m Inclination: 90°

Sheet No.: 1 (406.20m – 420.60m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
400														
406.20														
				B.S.	str. lamination, coarse-fine grain									
410														
412.10				B.S.	str. lamination, coarse grain									
412.40				M.S.	massive, flow-st			412.40	yellowish B.O., weak flow strcture					
414.50								414.50						
415.15				A.V.	dacitic, pale-greenish-gray			415.15	grading/reverse grading, c/f grain		30cm			
415.60				M.S.	massive, flow-st			415.60	yellowish B.O., py(course, hex)		10cm			
417.50				A.V.	dacitic, hyaloclastite, brecciated									
420				A.V.	massive, wk-flow-st, pl-pheno, pale-gray									
420.60														

Metal Mining Agency of Japan

Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: S-2 Locality: SAF.SAFA Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 1 (197.40m - 320.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
195														
197.40				A.V.	porphyritic, pale-gray, qtz-pheno									
197.90				A.V.	tuffceous, pale-gray, lamination, fine └child									
200					↓ ┌gradually									
				volc.sed.	porphyritic lava			203.00	cal. v.					
203.30				A.V.	tuffceous, pale-gray, fine └unconform									
205.10					tuffceous, pale-gray, wk-lamination, fine									
206.10					tuffceous, pale-gray, str-lamination, fine									
210					↓			210.0-210.1	cal. v. lat		10	10		
								210.80	cal. v. block			40		
								212.5-214.4	cal. v. ntwk(vertical)			48		
218.60					tuffceous, argillitic, brecciated, pale-gray, sercite			218.20	cal. druse					
219.00								219.50	cal. v. (parallel lamination)					
220					tuffceous, massive, wk-lamination, pale-gray, fine.									
230					↓									
231.00					coarse→porphyritic, pale-gray									
232.20				A.V.	tuffceous, pale-gray, fine └interfinger			233.30	qtz. v. white		1cm	70		
								234.4-235.1	qtz.v. white-clear, no-sulfide		20cm	60		
240								235.4-236.2	qtz.v. net		1-2cm	60		
250														
								253.4-255.2	qtz.v.ntwk		0.5-1cm	40		
256.40					porphyritic, palegray									
257.30				A.V.	tuffceous, palegray, fine └ interfinger (layer?)									
260								264.00	qtz.v					
								265.00	qtz.v					
266.20					porphyritic									
267.50				A.V.	tuffceous, pale-gray				qtz.v.ntwk zone					
270					↓				↓					
280														
290														
300														
310					↓ ┌gradually									
					porphyritic									
314.50		40°-60°		b.s.	black, fine, platy-pl-pheno └metalglossy			315.00	qtz.v. ntwk (brecciated)					
320								320.00	cal+py					

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: S-2 Locality: SAF. SAFA Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 2 (320.00m – 445.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
320		40-60		B.S.	black, platy-pl-pheno, metal-glossy			320.00	cal + Py v					
330								333.00	qtz.v.ntwk					
340														
350														
360														
366.50						n.w		366.10	argillitic+py layer			0		
								366.40	qtz+py v.			0		
				A.V.	dacite lava. pale-gray, qtz-pheno			367.20	qtz.v			20		
370														
379.40														
379.80				m	c.m.									
380								382.20	qtz.v py v. ntwk		10cm	20		
388.80					unconform									
390				B.S.	black,fine, no-lamination			390.30	Hew layer+qtz		2cm	0		
400								404.70	qtz.v					
407.80					no-child-margin									
409.70				A.V.	porphyritic									
410				B.S.	black, fine, no-lamination									
					no-child-margin									
420														
430														
439.45														
440			fault zone	B.S. sed.	broken zone									
444.60				B.S.										
445														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: S-2 Locality: SAF, SAFA Grid Coodinates: N, E Elevation: Length: 472m Inclination:

Sheet No.: 3 (445.00m – 472.90m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
445														
447.60			↓	B.S.	black, fine, broken zone									
449.30				A.V.	pale-gray, wk-lamination, porphylitic, platy-pl-pheno									
450			fault zone	B.S.	black, fine, broken zone									
452.70				A.V.	pale-gray, pale-gray, wk-llamination, porphyritic, play-pl-pheno									
456.20				B.S.	black, fine, broken zone									
457.80				A.V.	porphylitic palegray, wk-lpamination, platy-pl-pheno									
459.90				B.S.	black, fine, broken zone									
460 460.80			↓	A.V.	andesite, str-lamination, pale-gray pl-pheno.			460.5	qtz+druse					
								468.5-468.8	qtz+duase brecciated					
470														
472.90														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: CD27 Locality: Hajar Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 1 (0.00 m – 125.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
0				B.S.										
2.40				B.S.										
				B.S.	massive, brecciated			2.40-9.50	brecciated B.S. + filled py,cp					
9.50														
10				B.S.	massive									
20														
30														
40														
42.50		frac												
				B.S.	fracture massive									
47.00		frac												
				B.S.	massive layed M.S.			47.50	qtz.v					
								49.90-50.00	sul.v					
50								47.00-59.00	layed M.S.					
59.00		grad												
60 60.30		non		B.S.	tuffceous, flow-st, layed M.S.			59.00-60.30	layed M.S.(cp,py,po)rich					
				M.S.				60.30	qtz.v. +py					
								60.30-66.35	massive					
66.35		grad												
67.50		grad		B.S.	fine									
69.60		grad?		B.S.	B.S. str-diss→M.S., fine grain									
70 70.40		sharp		A.V.	rhyolite, ahyric									
				B.S.	fine grain, gray			70.40	py.v.					
80														
90														
100														
104.00		grad												
				B.V.	fine grain, gray									
108.50		grad												
110 110.50		grad		B.V.	c.tuff→tuffbrec.(calcarious)									
				B.V.?	pumiceous tuff, or limestone?									
113.40		non												
				B.S.	fine grain, gray									
120														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: CD27 Locality: Hajar Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 2 (125.00m – 250.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
130				B.S.	fine grain, gray									
140														
150														
160														
161.00		irreg		B.V.	tuff breccia, brecciated									
170														
180														
183.50		grad												
186.00		grad		B.V.	tuffceous, flow-st									
190				B.V.	Lava, porphyritic (pl:2mm)									
200														
210								214.00	qtz.v.					
220														
230														
240								248.60	qtz.v. ntwk					
250														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: CD27 Locality: Hajar Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 3 (250.00m – 340.60m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
250				B.V.	Lava, porphyritic (pl:2mm)									
260														
270														
280								282.90	qtz + sul v.					
290														
296.00		grad												
300				B.V.	tuffceous									
307.50		shwp						302.50	qtz.v.					
310				B.V.	Lava pophyritic (Pl:2mm) rim.			307.50	qtz.v. (secoundary)					
320														
330														
332.30		shwp												
333.30		irregu		B.V.	platy-pl-pheno									
340 340.60				B.V.	tuffceous (muddy)				cal.v					

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: GHC1 Locality: Hajar Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 1 (0.00 m – 65.00 m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
0				B.S.	gray no.lamina									
10.00		grad												
		grad		B.V.	tuffceous, lamination									
13.00		grad		B.V.	massive, porphyritic, flow-st, qtz-pheno-platy									
13.80		grad		B.V.	hyaloclastite									
16.80		grad		B.V.	massive, aphyric, wk-sili, gtz.v.									
19.90		irreg		B.V.	massive, porphyritic, flow-st, lamination gtz-pheno, py-diss			16.80-19.90	Py diss					
20														
22.30		grad		B.V.	tuffceous									
22.80		grad		B.V.	massive,schisty, qtz-pheno-platy									
24.80		grad		B.V.	hyaloclastite									
26.80		grad		B.V.	lamination - rich									
28.80		grad		B.V.	massive, porphyritic									
30														
32.00		grad		B.V.	massive, aphyric									
37.00				B.S.	pale-gray									
37.70				B.S.	siliceous		si	37.00-						
40				B.S.	pale-green-gray, talky									
49.00		free												
50				A.V.	rhyolite, massive porphyritic(qtz-pheno:2mm, pl:1mm)									
60.00				fracture zone	rhyolite fragment rich									
64.00														
70														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: HS13 Locality: Hajar Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 1 (200.00m – 325.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
200				A.V.	dacite, massive									
210														
220 221.00				fracture zone	Volcanic sediment fragment gtz. fragment									
226.00														
230				B.S.	lamination-rich, palegray			232.0-247.0	py layer - rich part					
								232.00	py layer					
								234.00	py layer					
								237.00	py layer					
240								237.50	py layer (cut horizon)					
								243.00	py layer					
247.00								246.00	py layer					
				B.S.	Black, talky			247.00	py layer					
									py-diss					
250														
260														
270														
280														
290														
294.00														
296.00		grad		B.S.	Lamination-rich, pale-gray									
				B.S.	Lamination - quartzite									
300														
301.00		irreg												
302.00		irreg		M.S.	fine			301.0-302.0	fine → layered, b.s.-fgment					
303.00		sharp		M.S.	massive			302.0-303.0	massive					
				B.S.	Black, talky									
310														
320														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: HS13 Locality: Hajar Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 2 (325.00m - 400.80m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
325				B.S.	Black, talky									
330														
340														
350														
360														
368.00														
370				A.V.	porphyritic porous									
373.00				A.V.	porphyritic massive									
380														
390														
400	400.80													

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: HS25 Locality: Hajar Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 1 (296.50m – 332.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
280														
290														
296.50														
300				B.S.	flow-st. sandy, medium grain									
301.00		non		B.S.	tuffceous, M.S. layer			302.00						
		grad→						301.0-303.0	M.S. layer					
				M.S.	flow-st			304.0-306.0	flow-st, sandy					
306.00				M.S.	flow-st, breccia			316.0-318.0	flow-st, brecciated — turbidity					
308.00				M.S.	flow-st			308.0-314.4	flow-st, layer, py					
310								309						
314.40		frac												
315.00		frac		B.S.	massive, fragment?									
				M.S.	sandy			315.0-319.0	massive, sandy, flow-st					
319.00				M.S.	flow-st			314.0-320-4	flow-st(b.s., qtz fragment)					
320.40				M.S.	flow-st				flow-st(irregular b.s. fragment)					
321.45				B.S.	schisty				qtz.v. net		1-10mm			
321.80		frac		A.V.	aphyric, dacite lava silicous qtz-veinnet				qtz					
325.00				A.V.	brecciated, qtz-pheno-broken									
327.00				A.V.	massive, aphyric, tuffceous				qtz.v.		1-10mm			
330				B.S.	mdy + quartzite									
332.00														
拡大														
303				B.S.	tuffceous M.S. layer			301.0-303.1	M.S. layar					
303.10		frac		A.V.	porphyritic brown qtz-pheno?									
303.40		frac		M.S.	layer → sandy			303.40-45	flow-st (tuff fragment)					
303.50		frac		A.V.	porphyritic brown qtz-pheno?			303.45-50	sandy, flow-st					
303.70		frac		fracture zone										
304														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: A2G480 Locality: Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 1 (144.80m – 270.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
145														
148.80				B.S.	schist + quartzite turbidite			148.8-155.0	py layer					
150														
155.00														
160														
170														
180														
190														
200														
210														
220														
230														
240														
250														
260														
270														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: A2G480 Locality: Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 2 (270.00m – 395.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
270														
280														
281.50				B.S.	schist + quartzite , folding				qtz.v.		30cm			
286.00														
290														
300														
310														
320														
330														
340														
350														
360														
370														
380														
390														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: A2G480 Locality: Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 3 (395.00m – 410.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
395														
400 401.00				B.S.	schist + quartzite				qtz.v. + sulv					
405.00														
410														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: FZ13 Locality: Frizen Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 1 (30.25 m - 150.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
30.25				A.V.	massive, strong siliceous dacite			33.10-33.70	sul.v. (chl → gl → cp → qtz)					
								33.80	sul.v. ntwk (gl → py → cp)					
34.40								34.00	qtz. sul.v (cp,gl→ qtz) post-qtz.v.					
34.80				A.V.	aphyric, strong siliceous pale-green-gray			34.35	sul.v → post-qtz.v.					
				A.V.	aphyric, strong siliceous, pale-green-gray dacite pydiss → platy post-qtz.v. brecciared dacite fragment				py-diss → platy post-qtz.v.					
40														
41.25														
42.30				A.V.	flow-st. dacite, brecciated	M			sul.v, qtz.v.					
				A.V.	flow-st. dac fracture zone 44.2-43.0m:ser			43.40	qtz.v. sp,gl→py,cp →qtz→druse					
44.40								43.56	sul.v. sp,gl → py					
45.00				A.V.	dacite, qtz-pheno-platy			44.40	sul.v. sul+qtz py → chl					
				A.V.	dacite, qtz-pheno-platy-str.			46.05	sul.v.					
50								50.00	sul.v. (gl, sp → cp, py → qtz(black)					
53.20		grad												
54.00		grad		A.V.	tuffceous dacite			53.50	sul.v. (py → cp)					
				A.V.	dacite, qtz-pheno-rare			55.00	sul+qtz.v.					
									cp, py → qtz.v.					
								57.00	sul.v. (gl → cp)					
60.00														
60				A.V.	dacite, qtz-pheno-bigger			63.00	qtz.v.					
								64.00	sul.v.					
								66.30	qtz.v.					
64.20		grad												
		grad		A.V.	dacite, aphyric									
66.30														
67.30				A.V.	layered tuff				sul layer					
				A.V.	dacite, massive, aphyric			67.00	qtz:clear+wht, sul.v.					
70									sp → qtz					
								73.00	qtz v.					
80														
84.00														
85.70				A.V.	dacire qtz-pheno									
				A.V.	tuffceous									
90	90.00													
100				NON										
110				CORE										
120														
126.00														
				B.S.	schisty + quartzite									
130	130.00							129.80	layered py					
					quartzite-rare									
132.40														
133.40				B.S.	quartzite → muddy									
				B.S.	massive									
135.60														
				M.S.	layed			135.6-140.25	layered M.S. ↓ massive					
140	140.25 140.55													
		sharp		M.S.	massive									
				B.S.	massive black									
150														

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Hole No.: FZ12 Locality: Frizen Grid Coodinates: N, E Elevation: Length: Inclination: Sheet No.: 1 (7.10 m – 80.00 m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
0														
7.10				A.V. (Qt?)	tuffceous, pale-gray									
10														
20														
23.40				A.V.	tuffceous									
30				(Qt?)	Rhyolitic tuff fragment-rich									
40														
49.00				A.V.	argillitceous									
50				(Qt?)	mds ffragment-rich, brecciated, volcanic									
52.00		frce												
56.00		frce		M.S. (fracture)	contact:porphyritic andesite, 5cm:fracture ser.alteration→ porous gradual:red-mineralization cp+py-megacrystal:secoundary sediment									
57.00				M.S.	massive, pale-gray									
60.00				B.S.	muddy									
60				M.S.	sandy									
65.00				B.S.	sandy, argillitceous									
70.80				M.S.	massive muddy fragment									
				B.S.	schisty + quartzite									
80														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: FZ10 Locality: Firizen Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 1 (29.90 m - 100.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
25														
29.90														
30				B.S.	Lamina, massive									
36.80														
40				B.S.	Lamina, layered-sulfide-rich				layered sulfide-rich					
46.00														
50				B.S.	Lamina, + quartzite-rich									
								53.40	qtz.v.					
57.70								57.70	qtz.v..					
60				B.S.	layered tuff									
63.80		grad						62.00	qtz+sul.v.					
				B.S.	massive									
70														
73.00														
				B.S.	tuffceous (soft + hard alten)									
					⟶ tuffceous (soft + hard alten)									
80														
84.00														
				B.S.	Lamina + quartzite + py layer				sul.layer rich					
89.00														
90														
100														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: FZ03 Locality: Frizen Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 1 (90.00 m – 170.00m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
90				B.S.	schisty (soft / hard alten)									
100														
110														
120														
130					schisty quartzite-rich									
140								138.80	qtz.v + py					
150														
160														
170														

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Marrakech-Tekna Area, Kingdom of Morocco

Hole No.: FZ02 Locality: Friezen Grid Coodinates: N, E Elevation: Length: Inclination:

Sheet No.: 1 (98.40 m – 111.70m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
90														
98.40				B.S.	schisty (hard / soft alten)									
100														
110														
111.70														
120														

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Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 1

Hole No.: FZ14 Locality: Frizen Grid Coodinates: N, E Elevation: Length: Inclination: (0.00 m – 50.00 m)

Depth (m)	Column	Dip	Formation	Description: Rock	Description: Lithofacies	Alteration Intensity: Argillization	Alteration Intensity: Silicification	Mineralization: Scale	Mineralization: Lithofacies	Mineralization: Form	Mineralization: Width	Mineralization: dip	Analysis: Scale	Analysis: No.
0				A.V.	rhyolite. massive									
10														
20														
				A.V.	tuffceous									
30				B.S.	pale-gray									
40														
50														

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Appendix 2. Sample List

Marrakech-Tekna Area, Kingdom of Morocco

Sample List

No	Sample	Drill hole	Length	Cutting	Locality			Formation	Rock	Discription		Remarks
					Area	Latitude(N)	Longitude(W)			Geology	Mineralization	Sampling Date
1	02MRK000	Damy	-		Dummy				Slate			
2	02MRK001	S1A	407.00 - 407.20	1/2	Khwadra			Visian	Scihst	Tuffcious,HW		Sep,14,2002
2	02MRK002	S1A	419.00 - 419.20	1/2	Khwadra			Visian	Shale	Slicificated, Tuffcious,FW		Sep,14,2002
3	02MRK003	S4A	536.80 - 537.00	1/2	Khwadra			Visian	Shale	Slicificated, Tuffcious, Py, HW		Sep,14,2002
4	02MRK004	S4A	563.50 - 563.70	1/2	Khwadra			Visian	Shale	Slicificated, Tuffcious, bellow oxidation zone, FW		Sep,14,2002
5	02MRK005	S4	510.50 - 510.70	1/2	Khwadra			Visian	Hornfels	Slicificated, Tuffcious, HW		Sep,14,2002
6	02MRK006	S4	553.00 - 553.20	1/2	Khwadra			Visian	Schist	lamina_weak, OH		Sep,14,2002
7	02MRK007	S4	556.00 - 556.20	1/2	Khwadra			Visian	Schist	Tuffcious, OH		Sep,14,2002
8	02MRK008	S4	570.00 - 570.20	1/2	Khwadra			Visian	Schist	Gray (clay?), FW		Sep,14,2002
9	02MRK009	S5	625.30 - 625.50	1/2	Khwadra			Visian	Shale	lamina_weak, HW		Sep,14,2002
10	02MRK010	S5	634.70 - 634.90	1/2	Khwadra			Visian	Shale	lamina_weak, HW		Sep,14,2002
11	02MRK011	S5	642.00 - 642.20	1/2	Khwadra			Visian	Schist	Tuff/shale_alternation, OH/HW		Sep,14,2002
12	02MRK012	S5	673.20 - 673.40	1/2	Khwadra			Visian	Shale	under MS-volcanics, Py, Chp, Chl?, FW		Sep,14,2002
13	02MRK013	S5	691.00 - 691.20	1/2	Khwadra			Visian	Shale	Py-meg_acrystal, FW		Sep,14,2002
14	02MRK014	S3	305.00 - 305.20	1/2	Khwadra			Visian	Schist	Tuff-vol_sed/shale_alternation, S0-fold, HW		Sep,14,2002
15	02MRK015	S3	319.15 - 319.35	1/2	Khwadra			Visian	Shale	Black shale-sandy, lamina, HW		Sep,14,2002
16	02MRK016	S3	328.00 - 328.20	1/2	Khwadra			Visian	Schist	Black shale-sandy, OH		Sep,14,2002
17	02MRK017	S3	403.50 - 403.70	1/2	Khwadra			Visian	Slate	Py_mega-crystal, FW		Sep,14,2002
18	02MRK018	S2	170.00 - 170.20	1/2	Safsafa			Visian	Slate	Alternation with olcanic-sediment		Sep,14,2002
19	02MRK019	S2	327.50 - 327.70	1/2	Safsafa			Visian	Slate	Black shale, Py, Chp		Sep,14,2002
20	02MRK020	S2	357.50 - 357.70	1/2	Safsafa			Visian	Schist	Black shale, Py, Chp		Sep,14,2002
21	02MRK021	S2	412.00 - 412.20	1/2	Safsafa			Visian	Slate	Black shale		Sep,14,2002
22	02MRK022	S2	431.00 - 431.20	1/2	Safsafa			Visian	Shale	Black shale, Py-2nd?, Chp		Sep,14,2002
23	02MRK023	S2	452.00 - 452.20	1/2	Safsafa			Visian	Schist	Black shale, Py, Chp		Sep,14,2002
24	02MRK023-b	Damy			Dummy				Slate			
25	02MRK024	Surface			Kerkoze	31°43'499N,	8°12'386W	Visian	Shale	vol_sed, FW (Gossan)		Sep,18,2002
26	02MRK025	Surface			S_Kerkoz			Visian	Sandstone	vol_sed, FW (Gossan)		Sep,18,2002
27	02MRK026	Surface			Koudiat_Aiche			Visian	Shale	Black shale, FW (Gossan)		Sep,18,2002
28	02MRK027	Surface			N_Bensliman			Visian	Shale	Gossan, Green, Rhyorite-contact, OH (Gossan)		Sep,19,2002
29	02MRK028	Surface			Lachach_gossan			Visian	Shale	Gossan, Green-black, OH(Gossan)		Sep,19,2002
30	02MRK029	Surface			J_Hadat_gossan			Visian	Sandstone	Sand-Black shale, HW (Gossan)		Sep,20,2002
31	02MRK030	Surface			J_Hadat_gossan			Visian	Limestone	Limestone, HW (Gossan)		Sep,20,2002
32	02MRK031	Surface			J_Hadat_gossan			Visian	Slate	Calcarious-shale, HW (Gossan)		Sep,20,2002
33	02MRK032	KA25	202.00 - 202.20	1/2	KA25(Koudit Aicha)			Visian	Shale	lamina_weak, HW		Sep,21,2002
34	02MRK033	KA25	293.00 - 293.20	1/2	KA25(Koudit Aicha)			Visian	Shale	lamina_weak, HW		Sep,21,2002
35	02MRK034	KA25	356.60 - 356.80	1/2	KA25(Koudit Aicha)			Visian	Shale	py-coloform, HW		Sep,21,2002
36	02MRK035	KA25	396.00 - 396.20	1/2	KA25(Koudit Aicha)			Visian	Shale	Black-tuffcious,OH		Sep,21,2002
37	02MRK036	KA25	428.00 - 428.20	1/2	KA25(Koudit Aicha)			Visian	Shale	underMS, OH		Sep,21,2002
38	02MRK037	KA25	557.00 - 557.20	1/2	KA25(Koudit Aicha)			Visian	Shale	Sandstone-shale, FW		Sep,21,2002
39	02MRK038	BS15	329.00 - 329.20	1/2	BS15(Benslieman)			Visian	Schist	Black, py. FW		Sep,21,2002
40	02MRK039	BS15	311.00 - 311.20	1/2	BS15(Benslieman)			Visian	Schist	Tuffcious-green, FW		Sep,21,2002
41	02MRK040	BS15	276.00 - 276.20	1/2	BS15(Benslieman)			Visian	Schist	Sandstone-shale, HW		Sep,21,2002
42	02MRK041	LA9	176.00 - 176.20	1/2	LA9(Laachach)			Visian	Schist	Black shale, HW		Sep,21,2002
43	02MRK042	LA9	194.00 - 194.20	1/2	LA9(Laachach)			Visian	Schist	Black shale, OH/HW		Sep,21,2002
44	02MRK043	LA9	222.00 - 222.20	1/2	LA9(Laachach)			Visian	Sandstone	Black shale, OH		Sep,21,2002
45	02MRK044	LA9	240.00 - 240.20	1/2	LA9(Laachach)			Visian	Shale	Black shale, FW		Sep,21,2002
46	02MRK045	Damy			Dummy				Slate			
47	02MRK046	Surface			Amzoourh			Visian	Quatzite	Tuffcious-green,IIa,P3,HW		Sep,23,2002
48	02MRK047	Surface			Imarine			Visian	Limestone	Calcarious-massive, IIp, P2, HW		Sep,23,2002
49	02MRK048	Surface			Tameslouht			Devonian?	Sandstone	Red, Sillisificated, hard		Sep,23,2002
50	02MRK049	Surface			Tameslouht			Devonian?	Hornfels	Alternatinon Quatzite-Limestone, White		Sep,23,2002
51	02MRK050	CD27	334.00 - 334.20	1/2	Hajar			Visian	Shale	Shale-volcanic_sediment, Qz_vein, FW		Sep,24,2002
52	02MRK051	CD27	134.00 - 134.20	1/2	Hajar			Visian	Sandy shale	Calcarius-shale, alternation_calcarius_mud, HW		Sep,24,2002
53	02MRK052	CD27	98.00 - 98.20	1/2	Hajar			Visian	Shale	Calcarius-shale, alternation_calcarius_mud, HW		Sep,24,2002
54	02MRK053	CD27	19.50 - 19.70	1/2	Hajar			Visian	Shale	upper MS, OH/HW		Sep,24,2002
55	02MRK054	Mine	520mL -		Hajar			Visian	Schist	dark_gray-black, volcanics-contact, sulfide, FW		Sep,25,2002
56	02MRK055	Mine	520mL -		Hajar			Visian	Sandy shale	dark_gray-black, shistosity, (py?), FW		Sep,25,2002
57	02MRK056	Mine	380mL -		Hajar			Visian	Tuff	black, weak_shistosity, FW		Sep,25,2002

No	Sample	Drill hole	Length	Cutting	Locality			Formation	Rock	Discription		Remarks
					Area	Latitude(N)	Longitude(W)			Geology	Mineralization	Sampling Date
58	02MRK057	GHC1	42.30 - 42.50	1/2	Hajar			Visian	Shale	between volcanic-sediment, massive, FW		Sep,26,2002
59	02MRK058	HS13	249.00 - 249.20	1/2	Hajar			Visian	Shale	with volcanic_sedimet,under stockwark zone. Py, FW		Sep,26,2002
60	02MRK059	HS25	355.50 - 355.70	1/2	Hajar			Visian	Shale	Black_shale, FW		Sep,26,2002
61	02MRK060	Damy			Dummy				Shale			
62	02MRK061	HS25	338.40 - 338.60	1/2	Hajar			Visian	Schist	Shale-vol_sed(Qz), FW		Sep,26,2002
63	02MRK062	HS25	182.00 - 182.20	1/2	Hajar			Visian	Schist	Black_shale, racture zone, Qz_vein, HW		Sep,26,2002
64	02MRK063	HS25	171.30 - 171.50	1/2	Hajar			Visian	Schist	Black_shale, racture zone, Qz_vein, HW		Sep,26,2002
65	02MRK064	AZG480	149.00 - 149.20	1/2	Algeida?			Visian	Sandy shale	withPhy, Alternation vol_sed(Qt)-shale, shisit, upper		Sep,26,2002
66	02MRK065	AZG480	403.00 - 403.20	1/2	Algeida?			Visian	Shale	withPy, Alternation vol_sed(Qt)-shale, shisit, lower		Sep,26,2002
67	02MRK066	AZG480	404.50 - 404.70	1/2	Algeida?			Visian	Shale	Alternation vol_sed(Qt)-shale, shisit, lower		Sep,26,2002
68	02MRK067	surface			Frag el Ma			Visian	Shale	Graphite-Garnet, Contact-meta, lamina_weak		Sep,28,2002
69	02MRK068	surface			Sid Bau East			Visian	Schist	Alternatinon mud-vol_sed, shale		Sep,28,2002
70	02MRK069	surface			Sid Bau East			Visian	Shale	Alternatinon mud-vol_sed, non-mineralization		Sep,28,2002
71	02MRK070	surface			Jbwl_Sarhlef			Visian	Shale	Alternatinon mud-limestone, shale		Sep,28,2002
72	02MRK071	surface			Jbwl_Sarhlef			Visian	Shale	Recrystalization, shistosity		Sep,28,2002
73	02MRK072	surface			Jbwl_Sarhlef			Visian	Shale	Black shale, shistosity, non-mineralization		Sep,28,2002
74	02MRK073	FZ12	74.00 - 74.20	1	Frizem			Visian	Schist	Alternatinon mud-vol_sed, (sulfide), HW		Sep,29,2002
75	02MRK074	FZ12	99.70 - 100.00	1	Frizem			Visian	Schist	Alternatinon mud-vol_sed, shale, HW		Sep,29,2002
76	02MRK075	FZ10	35.50 - 35.80	1	Frizem			Visian	Shale	Alternatinon mud-vol_sed, shale, HW		Sep,29,2002
77	02MRK076	FZ10	67.00 - 67.25	1	Frizem			Visian	Limestone	Alternatinon mud-(vol_sed), (sulfide), FW		Sep,29,2002
78	02MRK077	FZ13	88.00 - 88.20	1	Frizem			Visian	Sandy slate	Alternatinon mud-vol_sed, upper Rhy, OH/HW		Sep,29,2002
79	02MRK078	FZ13	141.00 - 141.05	1	Frizem			Visian	Shale	Alternatinon mud-vol_sed, Calcarius part, HW		Sep,29,2002
80	02MRK079	FZ13	141.00 - 141.30	1	Frizem			Visian	Shale	Alternatinon mud-vol_sed, Black shale,HW		Sep,29,2002
81	02MRK080	FZ14	53.70 - 53.90	1	Frizem			Visian	Slate	Alternatinon mud-vol_sed, Calcarius part, HW		Sep,29,2002
82	02MRK081	FZ14	53.90 - 54.10	1	Frizem			Visian	Shale	Alternatinon mud-vol_sed, Black-greenshale		Sep,29,2002
83	02MRK082	FZ14	83.50 - 83.75	1	Frizem			Visian	Shale	Alternatinon mud-vol_sed, Black shale, HW		Sep,29,2002
84	02MRK083	FZ14	91.50 - 91.70	1	Frizem			Visian	Shale	Alternatinon mud-vol_sed, (sulfide), FW		Sep,29,2002
85	02MRK084	surface			Kettara			Visian	Shale	shale, (chl,ser)		Sep,29,2002
86	02MRK085	surface			Kettara			Visian	Shale	Shale, chl,ser, folding,FW		Sep,29,2002
87	02MRK086	surface			Draa_Sfar	31.42.427N,	8.08.075W	Visian	Shale	Shistosity, chl,ser, folding, FW		Sep,30,2002
88	02MRK087	DSF15	109.00 - 109.20	1	Draa_Sfar			Visian	Shale	Shistosity, vol_sed>mud, dark_gray,FW		Sep,30,2002
89	02MRK088	DSF15	137.60 - 137.80	1	Draa_Sfar			Visian	Sandy shale	Shistosity, mud>vol_sed, black-gray,kink_band,FW		Sep,30,2002
90	02MRK089-a	DSF15	232.50 - 232.70	1	Draa_Sfar			Visian	Shale	Shistosity, mud>vol_sed, black-gray,py,FW		Sep,30,2002
91	02MRK089-b	DSF15	254.70 - 254.90	1	Draa_Sfar			Visian	Shale	Shistosity(weak), vol_mud>vol_sed, black-gray,HW		Sep,30,2002
92	02MRK090	DSF15	270.70 - 270.90	1	Draa_Sfar			Visian	Shale	Shistosity, vol_sed>mud, dark_gray, (calcarious),HW		Sep,30,2002
93	02MRK091	DSF2	18.00 - 18.20	1	Draa_Sfar			Visian	Shale	Shistosity(weak), mud>vol_sed, black-gray,FW		Sep,30,2002
94	02MRK092	DSF2	49.00 - 49.20	1	Draa_Sfar			Visian	Shale	Shistosity(weak), mud>vol_sed, black-gray,FW		Sep,30,2002
95	02MRK093	DSF2	91.00 - 91.20	1	Draa_Sfar			Visian	Shale	Shistosity, mud>vol_sed, band, under Rhyolite, FW		Sep,30,2002
96	02MRK094	DSF2	126.20 - 126.50	1	Draa_Sfar			Visian	Shale	Shistosity, mud>vol_sed, band, upper MS, HW		Sep,30,2002
97	02MRK095	DSF2	137.50 - 137.70	1	Draa_Sfar			Visian	Slate	Shistosity, mud>vol_sed, black-gray,kink_band,HW		Sep,30,2002
98	02MRK096	-400mL	-		Draa_Sfar			Visian	Tuff-shist	Shistosity, black,kink_band, contact_MS,HW		Oct,01,2002
99	02MRK097	-400mL	-		Draa_Sfar			Visian	Schist	Shistosity, black,kink_band, contact_MS,FW		Oct,01,2002
100	02MRK098	-400mL	-		Draa_Sfar			Visian	Schist	Black, calcarious,FW		Oct,01,2002
101	02MRK100	Damy	-		Dummy				Slate			
102	02MRK101	surface	-		Si Gedi Haja			Visian	Schist	green_tf, strong_shistosity		Oct,01,2002

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Sample List

No	Sample	Drill hole	Length			Cutting	Locality				Formation	Rock	Discription		Remarks
							Area	Latitude(N)		Longitude(W)			Geology	Mineralization	Sampling Date
1	02MRS001	KHS3	366	-	366	1/2	Khwadra				Visean	Rhyolite	Much Pl phenocryst		Sep. 16, 2002
2	02MRS002	S2	369	-	369	1/2	Safsafa				Visean	Rhyolite		sulfide(weak)	Sep. 16, 2002
3	02MRS003	S2	291	-	291	1/2	Safsafa				Visean	Rhyolite			Sep. 16, 2002
4	02MRS004	KHS1	447	-	447	1/2	Khwadra				Visean	Rhyolite			Sep. 16, 2002
5	02MRS005	S2	279	-	279	1/2	Safsafa				Visean	Rhyolite			Sep. 16, 2002
6	02MRS006	KHS3	351	-	351	1/2	Khwadra				Visean	Rhyolite	Hyaro-clastite		Sep. 16, 2002
7	02MRS007	KHS3	385	-	385	1/2	Khwadra				Visean	Rhyolite		sulfide(Po)	Sep. 16, 2002
8	02MRS008	S2	200	-	200	1/2	Safsafa				Visean	Rhyolite			Sep. 16, 2002
9	02MRS009	KH1A	417	-	417	1/2	Khwadra				Visean	Schist			Sep. 16, 2002
10	02MRS0010	KH1A	409	-	409	1/2	Khwadra				Visean	Schist			Sep. 16, 2002
11	02MRS0011			-			Jubilet(Bourana)				Visean	Rhyolite			Sep. 19, 2002
12	02MRS0012			-			Jubilet(West of Kechnet)				Visean	Microgabbro			Sep..20, 2002
13	02MRS0013			-			Jubilet(West of Kechnet)				Visean	Microgabbro			Sep. 20, 2002
14	02MRS0014			-			Jubilet(West of Kechnet)				Visean	Rhyolite			Sep. 20, 2002
15	02MRS0015	KA25	272	-	272	1/1	Kdudiat Aicha				Visean	Gabbro			Sep. 21, 2002
16	02MRS0016	KA25	46	-	46	1/1	Kdudiat Aicha				Visean	Gabbro			Sep. 21, 2002
17	02MRS0017	CDC27	327	-	327	1/2	Hajar				Visean	Bi-Rhyolite	Bubble Rhyolite'		Sep. 24, 2002
18	02MRS0018	CDC27	210	-	210	1/2	Hajar				Visean	Rhyolite	Hyaroclastite		Sep. 24, 2002
19	02MRS0019			-			Hajar Mine 520ML				Visean	Rhyolite	Bubble Rhyolite'		Sep. 25, 2002
20	02MRS0020	No Sample		-											Sep. 25, 2002
21	02MRS0021			-			Hajar Mine 380ML				Visean	Bi-Rhyolite			Sep. 25, 2002
22	02MRS0022			-			Hajar Mine 380ML				Visean	Bi-Rhyolite	Bi-rimmed Qtz spot		Sep. 25, 2002
23	02MRS0023			-			Hajar Mine 380ML				Visean	Bi-Rhyolite	Bi-rimmed Qtz spot		Sep. 25, 2002
24	02MRS0024			-			Hajar Mine 380ML				Visean	Rhyolite	Pink Rhyolite'		Sep. 25, 2002
25	02MRS0025			-			Hajar Mine 380ML					Qtz-vein	Within pink Rhyolite		Sep. 25, 2002
26	02MRS0026			-			Hajar Mine 380ML					Rhyolite	Contact with Qtz-vein	Chloritized	Sep. 25, 2002
27	02MRS0027	HS13	251	-	251	1/2	Hajar				Visean	Schist		Sulfide layers (SEDEX-like)	Sep. 26, 2002
28	02MRS0028	FS12	37	-	37	1/4	Frisem				Visean	Schist		Chloritized with sulfide lamina	Sep. 29, 2002
29	02MRS0029			-			Drasfar				Visean	Rhyolite	Volcani-clastic unit, with Qtz foliation		Sep. 30, 2002
30	02MRS0030			-			Drasfar				Visean	Andesite	Volcani-clastic unit		Sep. 30, 2002
31	02MRS0031			-			Drasfar				Visean	Rhyolite	Rhyolite unit		Sep. 30, 2002
32	02MRS0032			-			Drasfar				Visean	Rhyolite	Rhyolite unit		Sep. 30, 2002
33	02MRS0033			-			Drasfar				Visean	Andesite	Volcani-clastic unit		Sep. 30, 2002
34	02MRS0034	DSF15	16	-	16	1/2	Drasfar				Visean	Rhyolite		With little sulfide	Sep. 30, 2002
35	02MRS0035	DSF2	125	-	125	1/2	Drasfar				Visean	Rhyolite		Chloritized	Sep. 30, 2002
36	02MRS0036	DSF2	83	-	83	1/1	Drasfar				Visean	Rhyolite	Sill		Sep. 30, 2002
37	02MRS0037			-			Drasfar Mine, 400ML				Visean	Alteration zone	Contact between massive sulfide and hanging rock	Sericitized	Oct. 1,2002
38	02MRS0038			-			N of Marabout				Visean	Chlorite schist	Serhef F.		Oct. 1,2002
39	02MRS0039			-			Mt.Ben Fares				Cambrian	Sandstone			Oct. 1,2002
40	02MRS0040			-			E of camp Ramram				Hercinian	Granite	Ramram granite		Oct. 1,2002
41	02MRS0041	BS2	109	-	109	1/2	Kettara				Visean	Schist	Fragment in massive sulfide	Chloritized	Oct. 2.2002
42	02MRS0042	BS2	110	-	110	1/2	Kettara				Visean	Schist	Contact with massive sulfide	Silisified, chloritized	Oct. 2.2002
43	02MRS0043	F4BS	180	-	180	1/1	Kettara				Visean	Schist	Calcarious		Oct. 2.2002
44	02MRS0044	F4BS	307	-	308	1/1	Kettara				Visean	Schist			Oct. 2.2002
45	02MRS0045	BS2	25	-	25	1/1	Kettara				Visean	Schist			Oct. 2.2002
46	02MRS0046	104	57	-	57	1/1	Kettara				Visean	Schist	Foot rock?		Oct. 2.2002
47	02MRS0047	104	127	-	127	1/1	Kettara				Visean	Schist	Hanging rock?		Oct. 2.2002

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Sample List

No	Sample	Drill hole	Length	Cutting	Locality			Formation	Rock	Discription		Remarks
					Area	Latitude(N)	Longitude(W)			Geology	Mineralization	Sampling Date
1	02MRN001	KH4A	562.50 - 562.60	1/4	Khwadra			Visian	Massive Sulfide	m.s./b.s	Acid leaching zone (reddish brown)	Sep. 16, 2002
2	02MRN002	KH4A	562.50 - 562.60	1/4	Khwadra			Visian	Massive Sulfide	m.s./b.s	Acid leaching zone (reddish brown)	Sep. 16, 2002
3	02MRN003	KH4A	560.25 - 560.40	1/4	Khwadra			Visian	Massive Sulfide	m.s./b.s	py-rich, porous	Sep. 16, 2002
4	02MRN004	KH4A	560.20 - 560.25	1/4	Khwadra			Visian	Massive Sulfide	m.s./b.s	py-rich, porous	Sep. 16, 2002
5	02MRN005	KH4A	558.30 - 558.40	1/4	Khwadra			Visian	Massive Sulfide	m.s./b.s	banded str. (blk,ylw)	Sep. 16, 2002
6	02MRN006	KH4A	558.40 - 558.45	1/4	Khwadra			Visian	Massive Sulfide	m.s./b.s	banded str. (blk,ylw)	Sep. 16, 2002
7	02MRN007	KH4A	547.20 - 547.32	1/4	Khwadra			Visian	Massive Sulfide	m.s./b.s	mega-cryst py rich	Sep. 16, 2002
8	02MRN008	KH4A	547.40 - 547.45	1/4	Khwadra			Visian	Massive Sulfide	m.s./b.s	mega-cryst py rich	Sep. 16, 2002
9	02MRN009	KH4A	541.20 - 541.35	1/4	Khwadra			Visian	Massive Sulfide	fracture zone	coarse grain, wk-lamina.	Sep. 16, 2002
10	02MRN010	KH4A	541.35 - 541.40	1/4	Khwadra			Visian	Massive Sulfide	fracture zone	coarse grain, wk-lamina.	Sep. 16, 2002
11	02MRN011	KH4A	538.35 - 538.45	1/4	Khwadra			Visian	Massive Sulfide	m.s./b.s	fine grain, lamina.	Sep. 16, 2002
12	02MRN012	KH4A	538.45 - 538.55	1/4	Khwadra			Visian	Massive Sulfide	m.s./b.s	fine grain, lamina.	Sep. 16, 2002
13	02MRN013	KH4A	538.55 - 538.73	1/4	Khwadra			Visian	Massive Sulfide	m.s./b.s	fine grain, lamina.	Sep. 16, 2002
14	02MRN014	KH4A	561.90 - 561.95	1/4	Khwadra			Visian	Massive Sulfide	m.s./b.s	Acid leaching zone (reddish brown)	Sep. 16, 2002
15	02MRN015	KH4A	559.60 - 559.65	1/4	Khwadra			Visian	Massive Sulfide	Ore hirizon	py+cp-rich, porous	Sep. 16, 2002
16	02MRN016	KH4A	558.90 - 559.00	1/4	Khwadra			Visian	Massive Sulfide	Ore hirizon	banded str. (blk,ylw)	Sep. 16, 2002
17	02MRN017	KH4A	543.25 - 543.30	1/4	Khwadra			Visian	Massive Sulfide	Ore hirizon	mega-cryst py rich	Sep. 16, 2002
18	02MRN018	KH4A	541.45 - 541.50	1/4	Khwadra			Visian	Massive Sulfide	Ore hirizon	boundary (up:bs/bl:c.g.lamina)	Sep. 16, 2002
19	02MRN019	KH4A	541.40 - 541.45	1/4	Khwadra			Visian	Massive Sulfide	Ore hirizon	coarse grain, wk-lamina.	Sep. 16, 2002
20	02MRN020	KH4A	538.75 - 538.90	1/4	Khwadra			Visian	Massive Sulfide	Ore hirizon	fine grain, lamina.	Sep. 16, 2002
21	02MRN021	KHS4C	552.45 - 552.55	1/4	Khwadra			Visian	Massive Sulfide	m.s./(frac)	boundary (up:m.s./bl:b.s.)	Sep. 16, 2002
22	02MRN022	KHS4C	552.00 - 552.12	1/4	Khwadra			Visian	Massive Sulfide	m.s./(frac)	massive, brown	Sep. 16, 2002
23	02MRN023	KHS4C	552.20 - 552.30	1/4	Khwadra			Visian	Massive Sulfide	m.s./(frac)	massive, brown	Sep. 16, 2002
24	02MRN024	KHS4C	549.35 - 549.45	1/4	Khwadra			Visian	Massive Sulfide	m.s./(frac)	py+reddish pr	Sep. 16, 2002
25	02MRN025	KHS4C	549.45 - 549.55	1/4	Khwadra			Visian	Massive Sulfide	m.s./(frac)	py+reddish pr(py-part)	Sep. 16, 2002
26	02MRN026	KHS4C	549.45 - 549.55	1/4	Khwadra			Visian	Massive Sulfide	m.s./(frac)	py+reddish pr(reddish part)	Sep. 16, 2002
27	02MRN027	KHS4C	549.55 - 549.65	1/4	Khwadra			Visian	Massive Sulfide	m.s./(frac)	py+reddish pr	Sep. 16, 2002
28	02MRN028	KHS4C	545.40 - 545.45	1/4	Khwadra			Visian	Vein	B.S./B.S.	Quartz vein, netwark	Sep. 16, 2002
29	02MRN029	KHS4C	540.30 - 540.40	1/4	Khwadra			Visian	Massive Sulfide	m.s./(frac)	massive, brown	Sep. 16, 2002
30	02MRN030	KHS4C	540.40 - 540.50	1/4	Khwadra			Visian	Massive Sulfide	m.s./(frac)	massive, brown	Sep. 16, 2002
31	02MRN031	KHS4C	540.50 - 540.60	1/4	Khwadra			Visian	Massive Sulfide	m.s./(frac)	massive, brown	Sep. 16, 2002
32	02MRN032	KHS4C	527.40 - 527.50	1/4	Khwadra			Visian	Massive Sulfide	fracture zone	coarse grain, wk-lamina.	Sep. 16, 2002
33	02MRN033	KHS4C	527.50 - 527.60	1/4	Khwadra			Visian	Massive Sulfide	fracture zone	coarse grain, wk-lamina.	Sep. 16, 2002
34	02MRN034	KHS4C	527.60 - 527.70	1/4	Khwadra			Visian	Massive Sulfide	fracture zone	coarse grain, wk-lamina.	Sep. 16, 2002
35	02MRN035	KHS4C	521.75 - 521.85	1/4	Khwadra			Visian	Massive Sulfide	fracture zone	massive, brown	Sep. 16, 2002
36	02MRN036	KHS4C	521.85 - 521.95	1/4	Khwadra			Visian	Massive Sulfide	fracture zone	massive, brown	Sep. 16, 2002
37	02MRN037	KHS4C	521.95 - 522.05	1/4	Khwadra			Visian	Massive Sulfide	fracture zone	massive, brown	Sep. 16, 2002
38	02MRN038	KHS4C	517.30 - 517.40	1/4	Khwadra			Visian	Massive Sulfide	fracture zone	fine grain, lamina.	Sep. 16, 2002
39	02MRN039	KHS4C	517.40 - 517.50	1/4	Khwadra			Visian	Massive Sulfide	fracture zone	fine grain, lamina.	Sep. 16, 2002
40	02MRN040	KHS4C	517.50 - 517.60	1/4	Khwadra			Visian	Massive Sulfide	fracture zone	fine grain, lamina.	Sep. 16, 2002
41	02MRN041	KHS5C	640.35 - 640.40	1/4	Khwadra			Visian	Vein	B.S.	HW, sulfide vein	Sep. 16, 2002
42	02MRN042	KHS5C	640.35 - 640.40	1/4	Khwadra			Visian	Vein	B.S.	HW, sulfide vein	Sep. 16, 2002
43	02MRN043	KHS5C	642.90 - 643.00	1/4	Khwadra			Visian	Massive Sulfide	b.s./(irreg)/m.s.	massive, brown	Sep. 16, 2002
44	02MRN044	KHS5C	643.00 - 643.10	1/4	Khwadra			Visian	Massive Sulfide	b.s./(irreg)/m.s.	massive, brown	Sep. 16, 2002
45	02MRN045	KHS5C	643.10 - 643.20	1/4	Khwadra			Visian	Massive Sulfide	b.s./(irreg)/m.s.	massive, brown	Sep. 16, 2002
46	02MRN046	KHS5C	644.20 - 644.30	1/4	Khwadra			Visian	Massive Sulfide	b.s./(irreg)/m.s.	up:massive/bl:py-rich part	Sep. 16, 2002
47	02MRN047	KHS5C	644.30 - 644.40	1/4	Khwadra			Visian	Massive Sulfide	b.s./(irreg)/m.s.	up:py-rich part/bl:arglli	Sep. 16, 2002
48	02MRN048	KHS5C	649.90 - 650.00	1/4	Khwadra			Visian	Massive Sulfide	b.s./(irreg)/m.s.	boundary(up:b.s./bl:massive)	Sep. 16, 2002
49	02MRN049	KHS5C	651.20 - 651.30	1/4	Khwadra			Visian	Massive Sulfide	b.s./(irreg)/m.s.	argilli, layered part, cp+py	Sep. 16, 2002
50	02MRN050	KHS5C	651.30 - 651.40	1/4	Khwadra			Visian	Massive Sulfide	b.s./(irreg)/m.s.	argilli, layered part, cp+py	Sep. 16, 2002
51	02MRN051	KHS5C	654.00 - 654.05	1/4	Khwadra			Visian	Massive Sulfide	b.s./(irreg)/m.s.	coarse grain, wk-lamina.	Sep. 16, 2002

No	Sample	Drill hole	Length	Cutting	Locality			Formation	Rock	Discription		Remarks
					Area	Latitude(N)	Longitude(W)			Geology	Mineralization	Sampling Date
52	02MRN052	KHS5C	654.05 - 654.10	1/4	Khwadra			Visian	Mussive Sulfide	b.s./(irreg)/m.s.	coarse grain, wk-lamina.	Sep. 16, 2002
53	02MRN053	KHS5C	656.40 - 656.45	1/4	Khwadra			Visian	Mussive Sulfide	b.s./(irreg)/m.s.	layered, argilli.	Sep. 16, 2002
54	02MRN054	KHS5C	656.45 - 656.50	1/4	Khwadra			Visian	Mussive Sulfide	b.s./(irreg)/m.s.	layered, argilli.	Sep. 16, 2002
55	02MRN055	KHS5C	658.30 - 658.35	1/4	Khwadra			Visian	Mussive Sulfide	b.s./(irreg)/m.s.	massive, brown	Sep. 16, 2002
56	02MRN056	KHS5C	658.35 - 658.40	1/4	Khwadra			Visian	Mussive Sulfide	b.s./(irreg)/m.s.	massive, brown	Sep. 16, 2002
57	02MRN057	KHS5C	660.10 - 660.20	1/4	Khwadra			Visian	Mussive Sulfide	b.s./(irreg)/m.s.	brecciated m.s.	Sep. 16, 2002
58	02MRN058	KHS5C	660.25 - 660.30	1/4	Khwadra			Visian	Vein	dacite (hyaloclastite)	FW, sulfide vein	Sep. 16, 2002
59	02MRN059	KHS5C	660.25 - 660.30	1/4	Khwadra			Visian	Vein	dacite (hyaloclastite)	FW, sulfide vein	Sep. 16, 2002
60	02MRN060	KHS3	334.70 - 334.80	1/4	Khwadra			Visian	Vein	dacite (hyaloclastite)	FW, sulfide vein	Sep. 16, 2002
61	02MRN061	KHS3	334.70 - 334.80	1/4	Khwadra			Visian	Vein	dacite (hyaloclastite)	FW, sulfide vein	Sep. 16, 2002
62	02MRN062	KHS3	333.50 - 333.60	1/4	Khwadra			Visian	Mussive Sulfide	b.s./(irreg)/m.s.	massive, brown	Sep. 16, 2002
63	02MRN063	KHS3	333.60 - 333.70	1/4	Khwadra			Visian	Mussive Sulfide	b.s./(irreg)/m.s.	massive, brown	Sep. 16, 2002
64	02MRN064	KHS3	333.70 - 333.80	1/4	Khwadra			Visian	Mussive Sulfide	b.s./(irreg)/m.s.	massive, brown	Sep. 16, 2002
65	02MRN065	KHS3	332.30 - 332.40	1/4	Khwadra			Visian	Mussive Sulfide	b.s./(irreg)/m.s.	boundary(up:massive/bl:b.s.)	Sep. 16, 2002
66	02MRN066	KHS3	329.90 - 330.00	1/4	Khwadra			Visian	Mussive Sulfide	b.s./(irreg)/m.s.	coarse grain, wk-lamina.	Sep. 16, 2002
67	02MRN067	KHS3	330.00 - 330.10	1/4	Khwadra			Visian	Mussive Sulfide	b.s./(irreg)/m.s.	coarse grain, wk-lamina.	Sep. 16, 2002
68	02MRN068	KHS3	330.10 - 330.20	1/4	Khwadra			Visian	Mussive Sulfide	b.s./(irreg)/m.s.	coarse grain, wk-lamina.	Sep. 16, 2002
69	02MRN069	KHS3	328.50 - 328.55	1/4	Khwadra			Visian	Mussive Sulfide	b.s./(irreg)/m.s.	fine grain, lamina.	Sep. 16, 2002
70	02MRN070	KHS3	328.55 - 328.60	1/4	Khwadra			Visian	Mussive Sulfide	b.s./(irreg)/m.s.	fine grain, lamina.	Sep. 16, 2002
71	02MRN071	KHS3	328.60 - 328.70	1/4	Khwadra			Visian	Mussive Sulfide	b.s./(irreg)/m.s.	fine grain, lamina.	Sep. 16, 2002
72	02MRN072		-		Jebilet	31 49.490	8 12.405	Visian	Acidic volcanics	rhyolitic, flow str.		Sep. 16, 2002
73	02MRN073		-		Jebilet	31 49.480	8 12.549	Visian	Black shale	wk-calcaleous		Sep. 18, 2002
74	02MRN074		-		Jebilet	31 50.074	8 14.297	Visian	Basic volcanics	sandy		Sep. 18, 2002
75	02MRN075		-		Jebilet	31 49.651	8 14.624	Visian	Acidic volcanics	Rhyolitic, tuff brec.		Sep. 18, 2002
76	02MRN076		-		Jebilet	31 52.380	8 12.754	Visian	Acidic volcanics	rhyolitic, flow str., massive		Sep. 18, 2002
77	02MRN077		-		Jebilet	31 51.377	8 12.737	Visian	Basic volcanics	pl-pheno		Sep. 19, 2002
78	02MRN078		-		Jebilet	31 51.351	8 12.706	Visian	Acidic volcanics	Rhyolite, wht-alt.		Sep. 19, 2002
79	02MRN079		-		Jebilet	31 51.855	8 14.705	Visian	Black shale	argillitic part(kaolinite)	gossan	Sep. 19, 2002
80	02MRN080		-		Jebilet	31 52.142	8 10.438	Visian	Mussive Sulfide		pyrrotite-rich(wk-mag)	Sep. 19, 2002
81	02MRN081		-		Jebilet	31 48.487	8 14.538	Visian	Basic volcanics	massive		Sep. 20, 2002
82	02MRN082		-		Jebilet	31 48.418	8 14.172	Visian	Basic volcanics	massive, tuffaceous		Sep. 20, 2002
83	02MRN083	KA25	404.00 - 404.10	1/2	Draa Sfa			Visian	Mussive Sulfide	turb-mds/m.s.	sandy(yel, blk &cp)	Sep. 21, 2002
84	02MRN084	BS15	293.10 - 293.20	1/2	Draa Sfa			Visian	Mussive Sulfide	b.s.with qtzt/m.s	massive, brown	Sep. 21, 2002
85	02MRN085	BS15	302.20 - 302.30	1/2	Draa Sfa			Visian	Mussive Sulfide	leyered tuff	lenz, py(sec), hem	Sep. 21, 2002
86	02MRN086	BS15	310.40 - 310.45	1/2	Draa Sfa			Visian	Vein	B.S./B.S.	Sulfide vein	Sep. 21, 2002
87	02MRN087	A9	218.15 - 218.20	1/2	Draa Sfa			Visian	Mussive Sulfide	layered tuff/m.s.	brecciated sulfide	Sep. 21, 2002
88	02MRN088	A9	214.40 - 214.50	1/2	Draa Sfa			Visian	Sulfide	Sulfide layer in tuff	sulfide layer (sec)	Sep. 21, 2002
89	02MRN089	A9	196.60 - 196.70	1/2	Draa Sfa			Visian	Vein	tuff/tuff	Sulfide vein	Sep. 21, 2002
90	02MRN090		-		Frizen	31 24.426	8 17.801	Visian	Acidic volcanics	Rhyolite massive		Sep. 22, 2002
91	02MRN091		-		Bal Azoulz south	31 28.552	8 11.773	Visian	Black shale	tuffceous calcarious		Sep. 22, 2002
92	02MRN092		-		Amzourh	31 21.847	8 8.444	Visian	Acidic volcanics	Rhyolite massive		Sep. 23, 2002
93	02MRN093		-		Hajar-north	31 24.326	8 6.134	Visian	Lime stone			Sep. 23, 2002
94	02MRN094	CD27	49.90 - 50.00	1/4	Hajar			Visian	Vein	B.S./B.S.	Sulfide vein in B.S.	Sep. 24, 2002
95	02MRN095	CD27	59.80 - 59.85	1/4	Hajar			Visian	Mussive Sulfide	B.S./M.S.	massive	Sep. 24, 2002
96	02MRN096	CD27	60.40 - 60.45	1/4	Hajar			Visian	Vein	B.S./B.S.	Quartz vein + sulfide vein	Sep. 24, 2002
97	02MRN097	CD27	246.60 - 246.70	1/4	Hajar			Visian	Vein	Rhy/Rhy	Quartz vein + sulfide vein	Sep. 24, 2002
98	02MRN098	530ML	-		Hajar			Visian	Sulfide	Sulfide layer in b.s.	layer	Sep. 25, 2002
99	02MRN099	380ML	-		Hajar			Visian	Acidic volcanics	Rhyolite massive	py dissemination	Sep. 25, 2002
100	02MRN100	380ML	-		Hajar			Visian	Acidic volcanics	tuffceous	py dissemination	Sep. 25, 2002
101	02MRN101	380ML	-		Hajar			Visian	Acidic volcanics	Pinkish dacite		Sep. 25, 2002
102	02MRN102	380ML	-		Hajar			Visian	Acidic volcanics	Pinkish dacite	py dissemination	Sep. 25, 2002
103	02MRN103	380ML	-		Hajar			Visian	Vein	Pinkish dacite	Quartz vein + sulfide vein	Sep. 25, 2002
104	02MRN104	HS25	303.10 - 303.20	1/4	Hajar			Visian	Acidic volcanics	Dacite (porphyritic)		Sep. 26, 2002

No	Sample	Drill hole	Length	Cutting	Locality			Formation	Rock	Discription		Remarks
					Area	Latitude(N)	Longitude(W)			Geology	Mineralization	Sampling Date
105	02MRN105	HS25	304.00 - 304.10	1/4	Hajar			Visian	Mussive Sulfide		sandy(brn)	Sep. 26, 2002
106	02MRN106	HS25	314.30 - 314.40	1/4	Hajar			Visian	Mussive Sulfide		sandy(brn)	Sep. 26, 2002
107	02MRN107	HS25	317.00 - 317.10	1/4	Hajar			Visian	Mussive Sulfide		banded str. (blk,ylw)	Sep. 26, 2002
108	02MRN108	HS25	321.50 - 321.60	1/4	Hajar			Visian	Acidic volcanics	Rhyolite(brecciated)	Quartz vein	Sep. 26, 2002
109	02MRN109	HS25	319.45 - 319.55	1/4	Hajar			Visian	Mussive Sulfide		banded str. (blk,ylw), flow str	Sep. 26, 2002
110	02MRN110	HS25	327.60 - 327.80	1/4	Hajar			Visian	Vein	B.S./B.S.	Quartz vein + sulfide vein	Sep. 26, 2002
111	02MRN111	AZG480	405.00 - 405.10	1/4	Hajar			Visian	Vein	B.S./B.S.	Quartz vein + sulfide vein	Sep. 26, 2002
112	02MRN112	AZG480	405.10 - 405.20	1/4	Hajar			Visian	Vein	B.S./B.S.	Quartz vein + sulfide vein	Sep. 26, 2002
113	02MRN113	AZG480	405.20 - 405.30	1/4	Hajar			Visian	Vein	B.S./B.S.	Quartz vein + sulfide vein	Sep. 26, 2002
114	02MRN114	HS13	228.40 - 228.50	1/4	Hajar			Visian	Sulfide	Sulfide layer in b.s.	layer	Sep. 26, 2002
115	02MRN115	HS13	230.60 - 230.70	1/4	Hajar			Visian	Sulfide	Sulfide layer in b.s.	layer(irregular)	Sep. 26, 2002
116	02MRN116	HS13	246.80 - 246.90	1/4	Hajar			Visian	Sulfide	Sulfide layer in b.s.	layer(26layer in 5cm)	Sep. 26, 2002
117	02MRN117		-		Jebilet	31 51.778	7 57.804	Visian	Sulfide		Frag el Ma mine (galena)	Sep. 28, 2002
118	02MRN118	FZ13	33.10 - 33.20	1/4	Frizen			Visian	Vein	dacite (strong silicification)	chl-gl-cp-qtz vein in dacite	Sep. 29, 2002
119	02MRN119	FZ13	33.90 - 34.00	1/4	Frizen			Visian	Vein	dacite (strong silicification)	gl-py-cp vein in dacite	Sep. 29, 2002
120	02MRN120	FZ13	34.40 - 34.50	1/4	Frizen			Visian	Acidic volcanics	dacite (strong silicification)		Sep. 29, 2002
121	02MRN121	FZ13	40.80 - 40.90	1/4	Frizen			Visian	Vein	dacite (strong silicification)	sulfide+quartz vein in dacite	Sep. 29, 2002
122	02MRN122	FZ13	41.20 - 41.30	1/4	Frizen			Visian	Vein	dacite (strong silicification)	sulfide vein in dacite	Sep. 29, 2002
123	02MRN123	FZ13	42.20 - 42.30	1/4	Frizen			Visian	Vein	dacite (strong silicification)	sericite argil + quartz vein in dacite	Sep. 29, 2002
124	02MRN124	FZ13	43.40 - 43.50	1/4	Frizen			Visian	Vein	dacite (strong silicification)	sp-gl-cp-py-qtz vein, druze in dacite	Sep. 29, 2002
125	02MRN125	FZ13	43.50 - 43.60	1/4	Frizen			Visian	Vein	dacite (strong silicification)	sp-gl-py vein in dacite	Sep. 29, 2002
126	02MRN126	FZ13	44.40 - 44.50	1/4	Frizen			Visian	Acidic volcanics	dacite (silicification)		Sep. 29, 2002
127	02MRN127	FZ13	50.00 - 50.10	1/4	Frizen			Visian	Vein	dacite (silicification)	gl-sp-cp-py-qtz vein (block) in dacite	Sep. 29, 2002
128	02MRN128	FZ13	53.00 - 53.10	1/4	Frizen			Visian	Vein	dacite (silicification)	qtz vein in dacite	Sep. 29, 2002
129	02MRN129	FZ13	54.00 - 54.10	1/4	Frizen			Visian	Vein	dacite (silicification)	sp-py vein in dacite	Sep. 29, 2002
130	02MRN130	FZ13	67.00 - 67.10	1/4	Frizen			Visian	Vein	dacitic tuff (silicification)	sp-qtz vein in dacite	Sep. 29, 2002
131	02MRN131	FR12	49.40 - 49.50	1/4	Frizen			Visian	Acidic volcanics	Rhyolitic tuff (strong argilli.)		Sep. 29, 2002
132	02MRN132	FR12	52.00 - 52.10	1/4	Frizen			Visian	Mussive Sulfide	Rhyolitic tuff (strong argilli.)/M.	porous	Sep. 29, 2002
133	02MRN133	FR12	64.80 - 64.90	1/4	Frizen			Visian	Mussive Sulfide	tuff/M.S	sandy	Sep. 29, 2002
134	02MRN134	FR12	65.50 - 65.60	1/4	Frizen			Visian	Black shale	argillization		Sep. 29, 2002
135	02MRN135	FR12	70.00 - 70.20	1/4	Frizen			Visian	Mussive Sulfide	m.s./b.s	b.s. fragment	Sep. 29, 2002
136	02MRN136	FR12	70.70 - 70.80	1/4	Frizen			Visian	Mussive Sulfide	m.s./b.s (boundary)	b.s. fragment	Sep. 29, 2002
137	02MRN137	FR10	62.00 - 62.10	1/4	Frizen			Visian	Vein	B.S.	qtz + sul vein in b.s.	Sep. 29, 2002
138	02MRN138	FZ13	70.00 - 70.20	1/4	Frizen			Visian	Mussive Sulfide	m.s./b.s (boundary)		Sep. 29, 2002
139	02MRN139	FZ13	70.70 - 70.80	1/4	Frizen			Visian	Vein	B.S.	qtz vein in b.s.	Sep. 29, 2002
140	02MRN140	FZ13	62.00 - 62.10	1/4	Frizen			Visian	Mussive Sulfide	B.S./B.S.	massive	Sep. 29, 2002
141	02MRN141	FZ14	129.80 - 129.90	1/4	Frizen			Visian	Acidic volcanics	rhyolite		Sep. 29, 2002
142	02MRN142	FZ14	132.40 - 132.50	1/4	Frizen			Visian	Acidic volcanics	rhyolitic tuff		Sep. 29, 2002
143	02MRN143	FZ14	140.45 - 140.55	1/4	Frizen			Visian	Black shale	turbidity-mds		Sep. 29, 2002
144	02MRN138-2		-		Kettara			Visian	Mussive Sulfide		Gossan	Sep. 30, 2002
145	02MRN139-2		-		Dras faa	31 42.518	8 8.176	Visian	Black Shale	tuffceous		Sep. 30, 2002
146	02MRN140-2		-		Dras faa	31 42.249	8 8.155	Visian	Acidic volcanics	ryolitic, schisty		Sep. 30, 2002
147	02MRN141-2		-		Dras faa	31 42.427	8 8.075	Visian	Acidic volcanics	ryolitic, massive		Sep. 30, 2002
148	02MRN142-2	DSF2	112.50 - 112.60	1/4	Dras faa			Visian	Vein	tuffceous rhyolite	qtz-chl-cp-py vein in tuff	Sep. 30, 2002
149	02MRN143-2	DSF2	115.30 - 115.40	1/4	Dras faa			Visian	Mussive Sulfide	b.s./m.s.	massive, mds fragment	Sep. 30, 2002
150	02MRN144	DSF2	118.00 - 118.20	1/4	Dras faa			Visian	Mussive Sulfide	tuff//b.s.	cp-gl (vein?)	Sep. 30, 2002
151	02MRN145	DSF2	118.50 - 118.60	1/4	Dras faa			Visian	Mussive Sulfide	m.s./b.s.	turbidity m.s.	Sep. 30, 2002
152	02MRN146	DSF15	241.80 - 248.90	1/4	Dras faa			Visian	Basic volcanics	hyoloclastite	py dissemination	Sep. 30, 2002
153	02MRN147	DSF15	243.60 - 243.65	1/4	Dras faa			Visian	Mussive Sulfide	m.s./b.s.	massive	Sep. 30, 2002
154	02MRN148		-		Dras faa (400ml)			Visian	Vein	FW: volcanic sed (muddy)	white	Oct. 01, 2002
155	02MRN149		-		Dras faa (400ml)			Visian	Vein	HW:B.S.	white	Oct. 01, 2002
156	02MRN150		-		Dras faa (400ml)			Visian	Mussive Sulfide		massive	Oct. 01, 2002
157	02MRN151		-		Dras faa (400ml)			Visian	Vein	fracture zone	white (sulfide)	Oct. 01, 2002

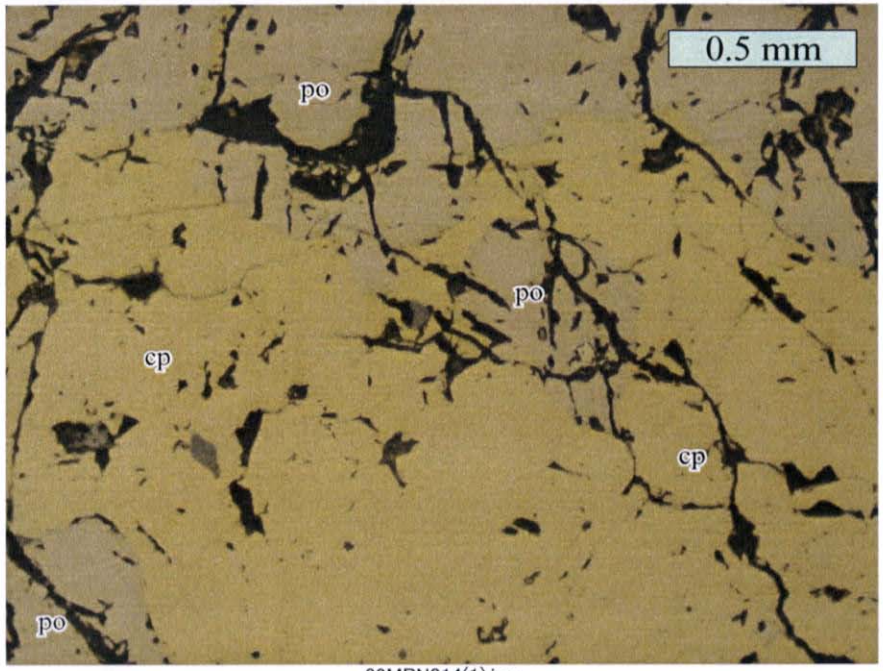
No	Sample	Drill hole	Length	Cutting	Locality			Formation	Rock	Discription		Remarks
					Area	Latitude(N)	Longitude(W)			Geology	Mineralization	Sampling Date
158	02MRN152		-		granite mountain	31 43.800	8 1.192	Visian	Grano-diorite	massive		Oct. 01, 2002
159	02MRN153		-		granite mountain	31 44.007	8 1.380	Visian	Grano-diorite	massive		Oct. 01, 2002
160	02MRN154	KT104	106.10 - 106.20		Kettara			Visian	Sulfide	B.S.	layered quartz + post py vein	Oct. 02, 2002
161	02MRN155	KT104	115.00 - 115.10		Kettara			Visian	Sulfide	B.S.	cp+py filled tuffceous mds	Oct. 02, 2002
162	02MRN156	KT104	115.40 - 115.50		Kettara			Visian	Mussive Sulfide	M.S./B.S.	massive (mds fragment)	Oct. 02, 2002
163	02MRN157	KT104	119.90 - 120.00		Kettara			Visian	Vein	tuff	sul + qtz vein	Oct. 02, 2002
164	02MRN158	KT104	120.90 - 121.00		Kettara			Visian	Vein	tuff	quartz vein	Oct. 02, 2002
165	02MRN159	KT104	160.40 - 160.50		Kettara			Visian	Sulfide	B.S.	py layer in mds	Oct. 02, 2002
166	02MRN160	KT104	160.90 - 161.00		Kettara			Visian	Sulfide	B.S.	sulfide layer in mds	Oct. 02, 2002
167	02MRN161	KT104	162.00 - 162.10		Kettara			Visian	Sulfide	B.S.	sulfide layer in mds	Oct. 02, 2002
168	02MRN162	KT104	163.50 - 163.70		Kettara			Visian	Mussive Sulfide	fracture zone (mds)	massive (with quartz vein)	Oct. 02, 2002
169	02MRN163	KT104	163.70 - 163.80		Kettara			Visian	Mussive Sulfide	M.S./B.S.	massive (with dacite)	Oct. 02, 2002
170	02MRN164	KT104	164.00 - 164.10		Kettara			Visian	Mussive Sulfide	M.S./B.S.	massive (mds fragment)	Oct. 02, 2002
171	02MRN165	KTBS2	85.20 - 85.30		Kettara			Visian	Mussive Sulfide	B.S./M.S.(iregullar)	massive (mds fragment)	Oct. 02, 2002
172	02MRN166	KTBS2	87.20 - 87.20		Kettara			Visian	Mussive Sulfide	M.S./B.S.	sandy	Oct. 02, 2002
173	02MRN167	KTBS2	96.50 - 96.60		Kettara			Visian	Vein	B.S.	sulfide vein	Oct. 02, 2002
174	02MRN168	KTBS2	97.40 - 97.50		Kettara			Visian	Mussive Sulfide	B.S./M.S	massive (mds fragment)	Oct. 02, 2002
175	02MRN169	KTBS2	103.00 - 103.10		Kettara			Visian	Mussive Sulfide	M.S./B.S.	massive (mds fragment)	Oct. 02, 2002
176	02MRN170	KTBS2	110.50 - 110.10		Kettara			Visian	Vein	M.S./qtz v/B.S.	white	Oct. 02, 2002
177	02MRN171	KT03	232.50 - 232.60		Kettara				Mussive Sulfide	B.S./M.S.	massive (hard mds fragment)	Oct. 02, 2002
178	02MRN172	KT03	233.00 - 233.10		Kettara				Mussive Sulfide	B.S./M.S.	massive (soft mds fragment)	Oct. 02, 2002
179	02MRN173	KT03	233.20 - 233.25		Kettara				Mussive Sulfide	M.S./B.S. (boundary)	massive	Oct. 02, 2002
180	02MRN174	KT03	233.25 - 233.30		Kettara				Mussive Sulfide	B.S./M.S.	massive (soft mds fragment)	Oct. 02, 2002
181	02MRN175	KT03	247.60 - 247.70		Kettara				Vein	B.S.	qtz+chl vein in mds	Oct. 02, 2002
182	02MRN176	KT03	283.00 - 283.10		Kettara				Mussive Sulfide	B.S./M.S.	massive	Oct. 02, 2002
183	02MRN177	KT03	295.10 - 295.20		Kettara				Mussive Sulfide	B.S./M.S.	massive (mds fragment)	Oct. 02, 2002
184	02MRN178	KT03	300.00 - 300.10		Kettara				Mussive Sulfide	B.S./M.S.	layer	Oct. 02, 2002
185	02MRN179	KT3BS	53.10 - 42.20		Kettara				Black shale	Strong argillization		Oct. 02, 2002
186	02MRN180	KT1BS	40.00 - 40.10		Kettara				Black shale			Oct. 02, 2002
187	02MRN181	KT1BS	40.80 - 40.90		Kettara				Black shale	Strong argillization		Oct. 02, 2002
188	02MRN182	KT1BS	41.80 - 41.90		Kettara				Black shale	Strong argillization		Oct. 02, 2002
189	02MRN183	KT1BS	43.00 - 43.10		Kettara				Black shale	Weak argillization		Oct. 02, 2002
190	02MRN184	KT1BS	43.90 - 44.00		Kettara				Black shale	Strong argillization		Oct. 02, 2002
191	02MRN185	KT1BS	55.20 - 55.30		Kettara				Black shale			Oct. 02, 2002
192	02MRN186	KT1BS	62.80 - 62.90		Kettara				Black shale			Oct. 02, 2002

Appendix 3. Photomicrographs of Thin Sections

Sulfide Ore Minerals

LEGEND OF MINERALS

po	pyrrhotite
py	pyrite
cp	chalcopyrite
sp	sphalerite
gl	galena
mc	marcasite
mg	magnetite
hm	hematite
cv	covellite
ac	acanthite
st	stannite
qt	quartz
pl	plagioclase
cb	carbonate minerals



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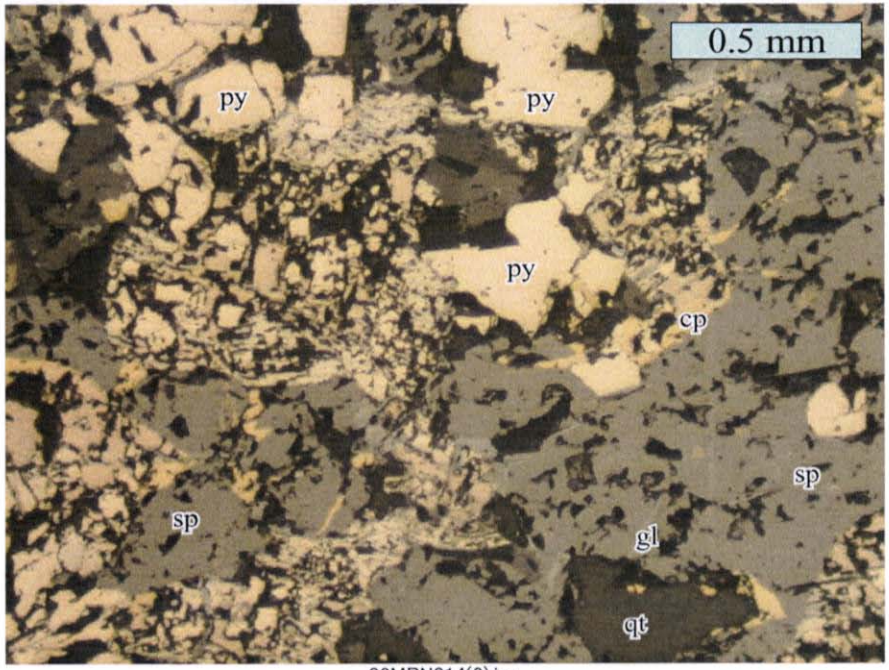

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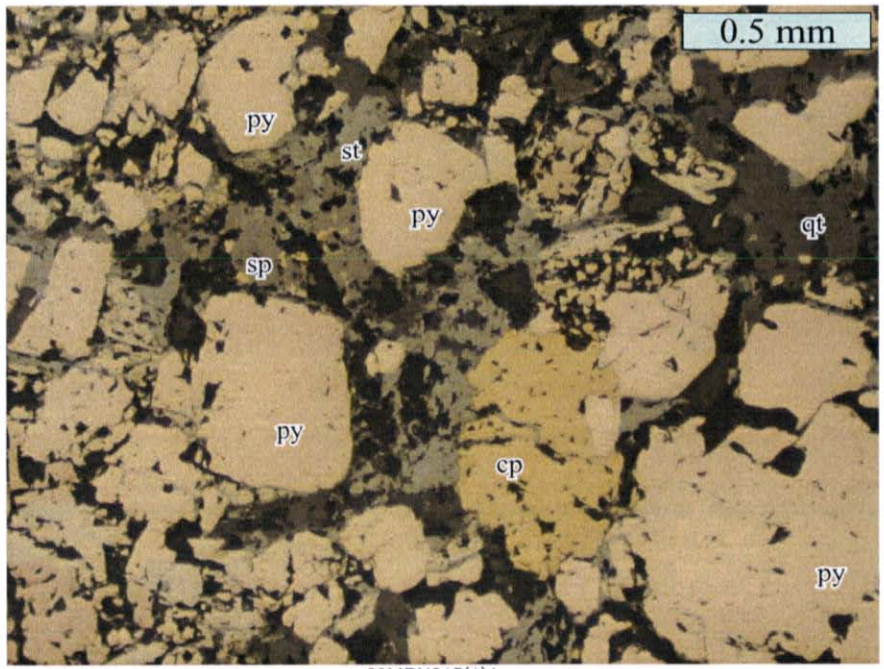

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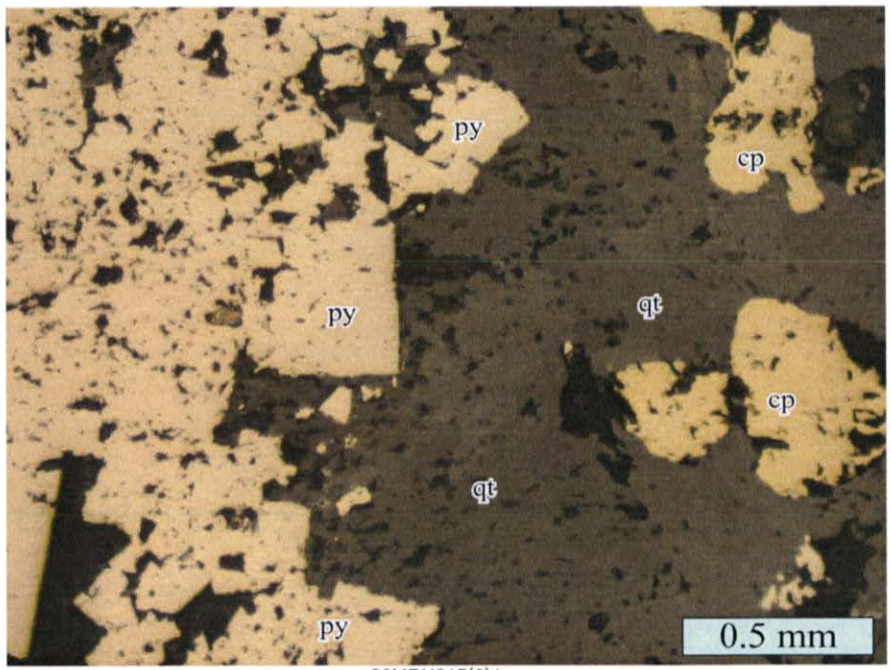

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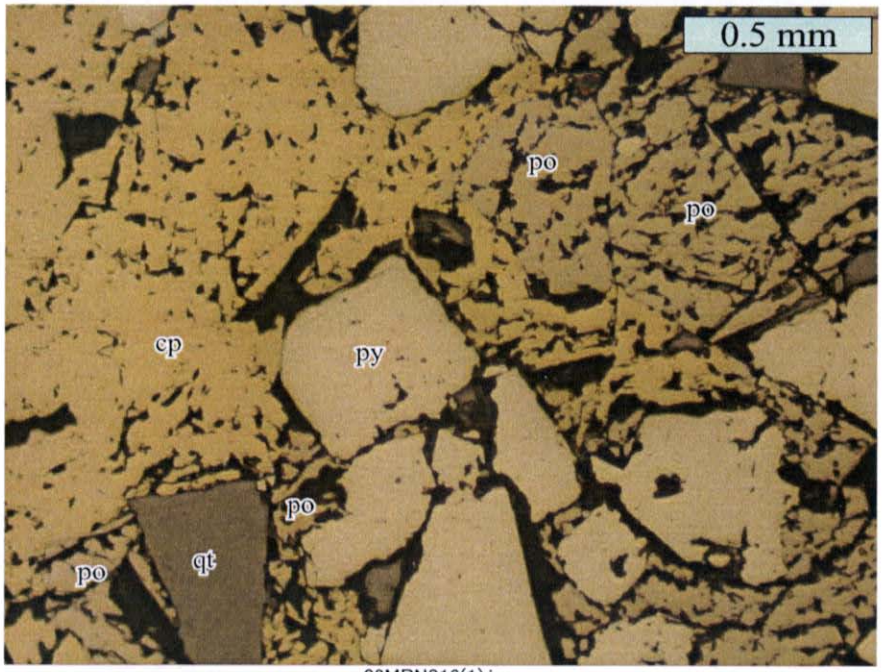

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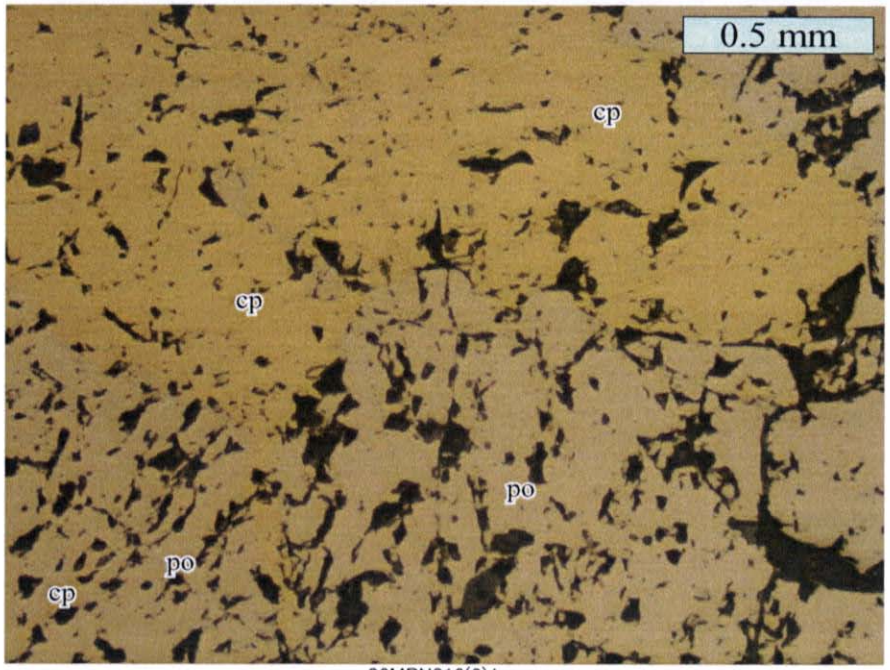

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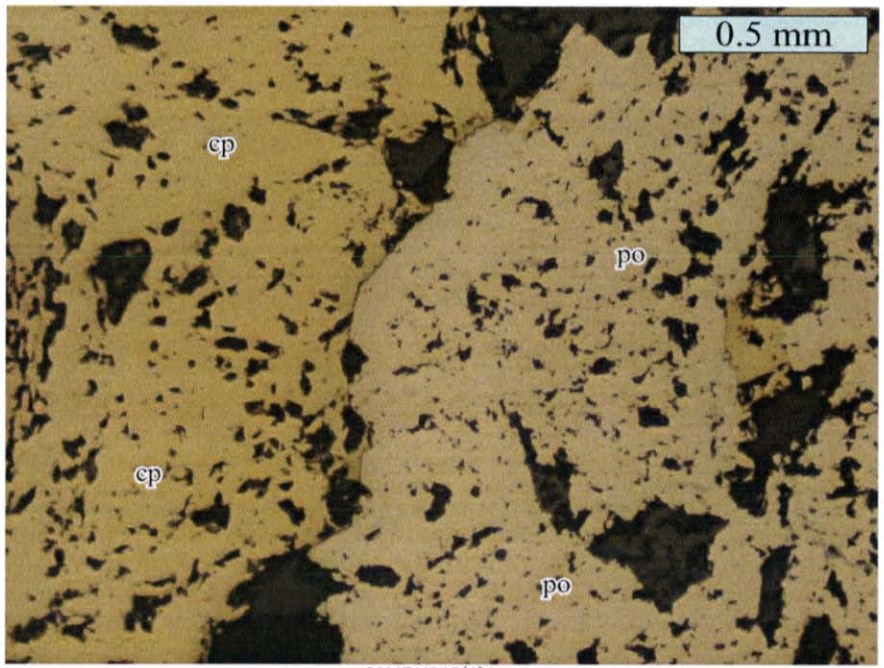

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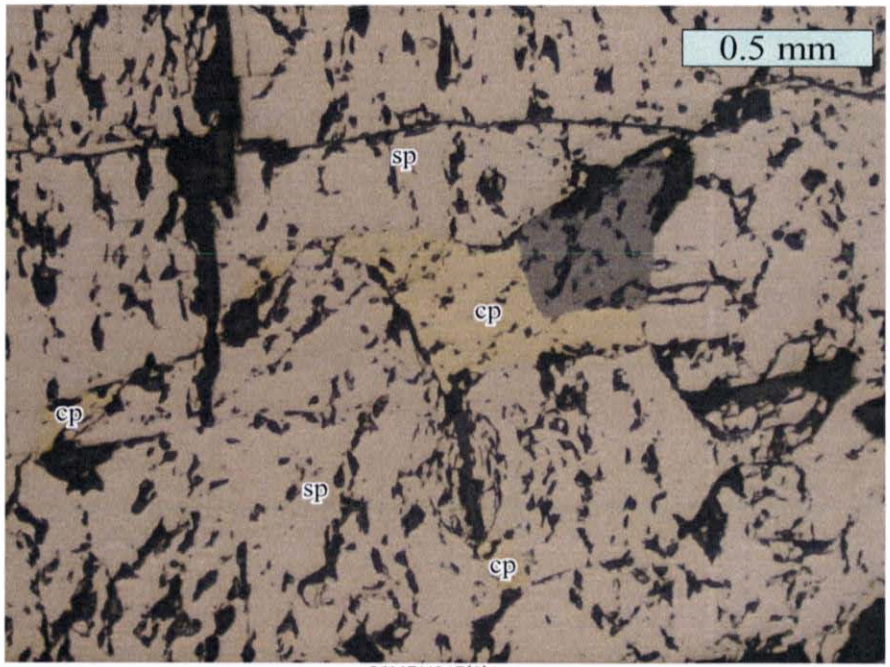

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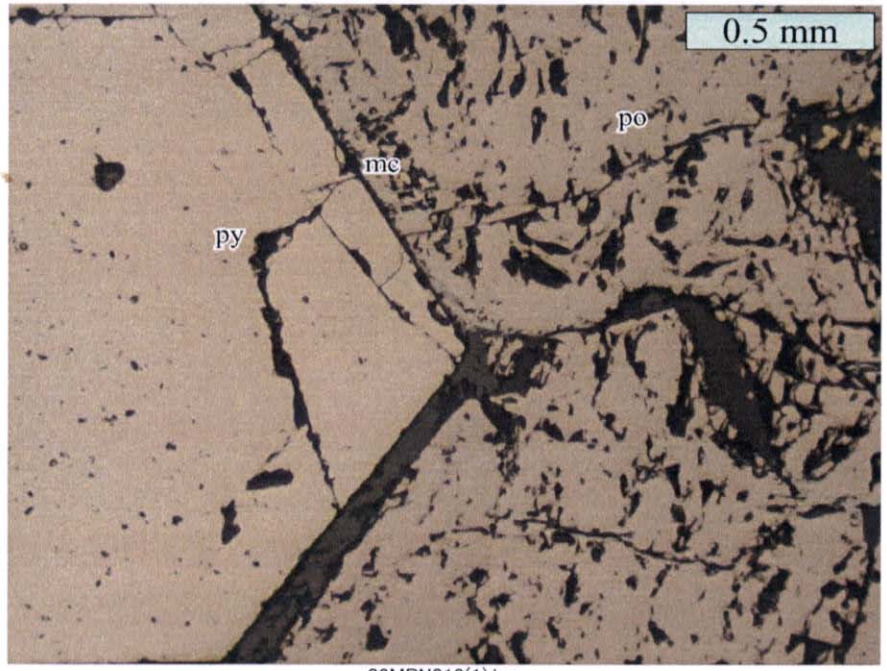

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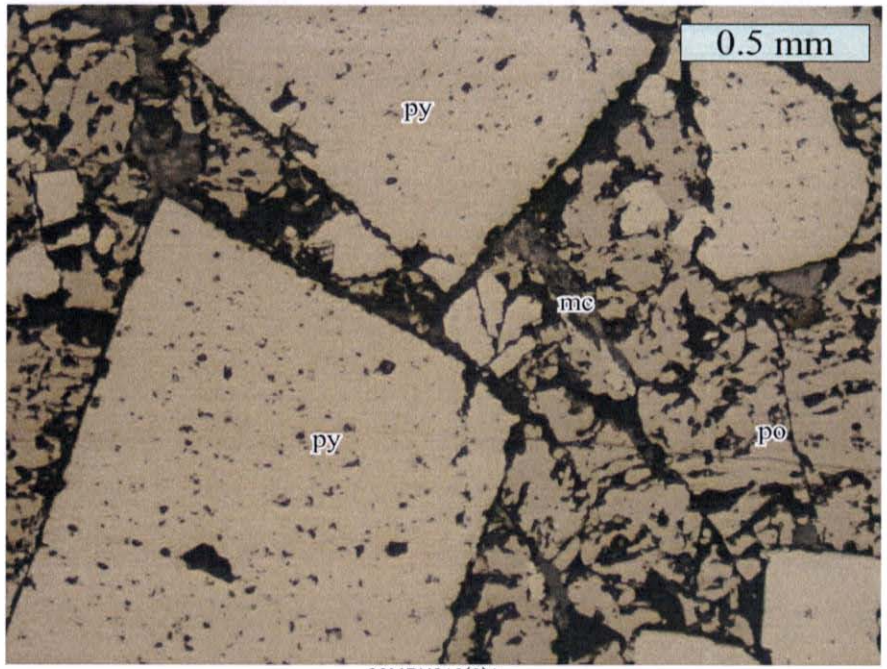

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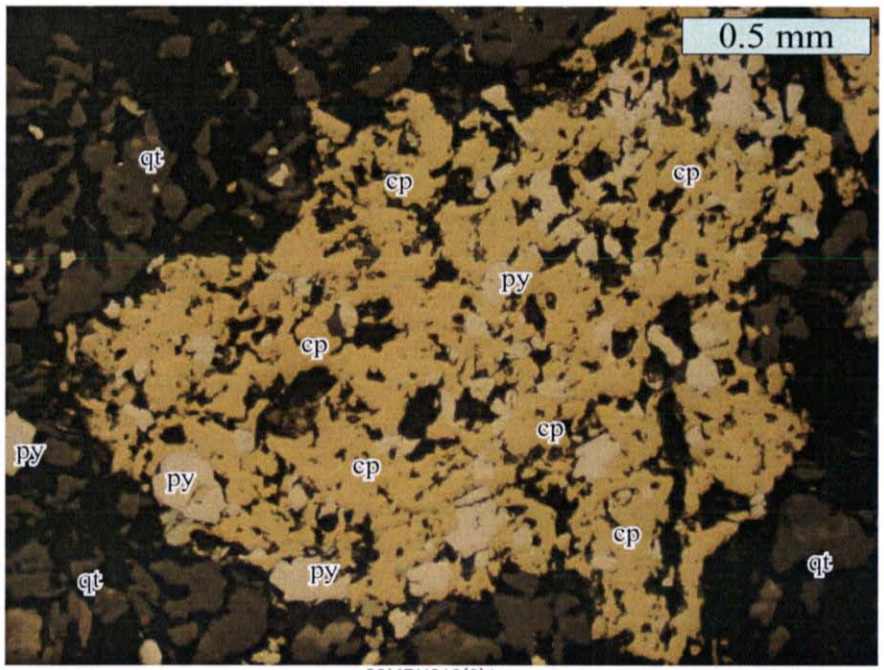

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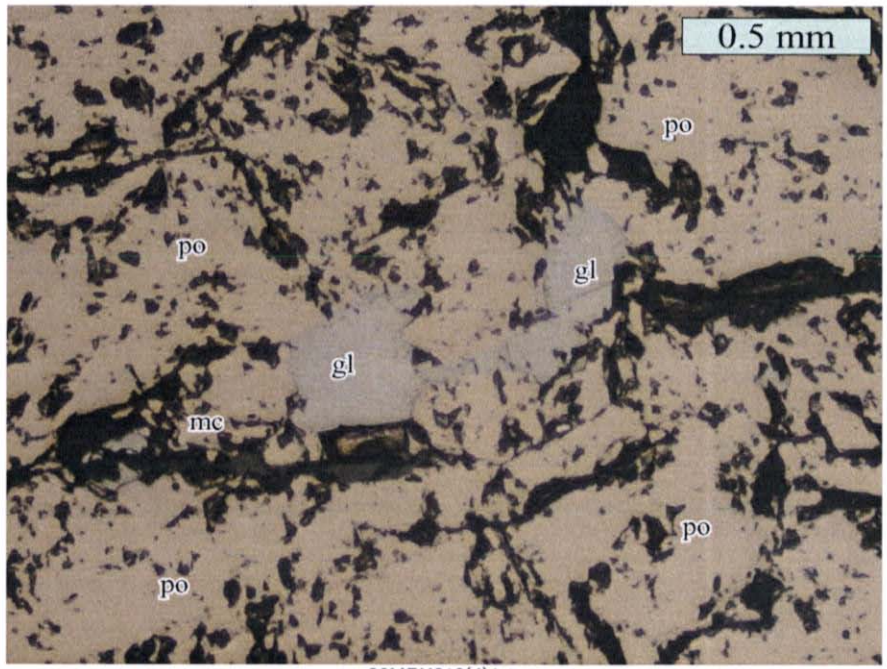

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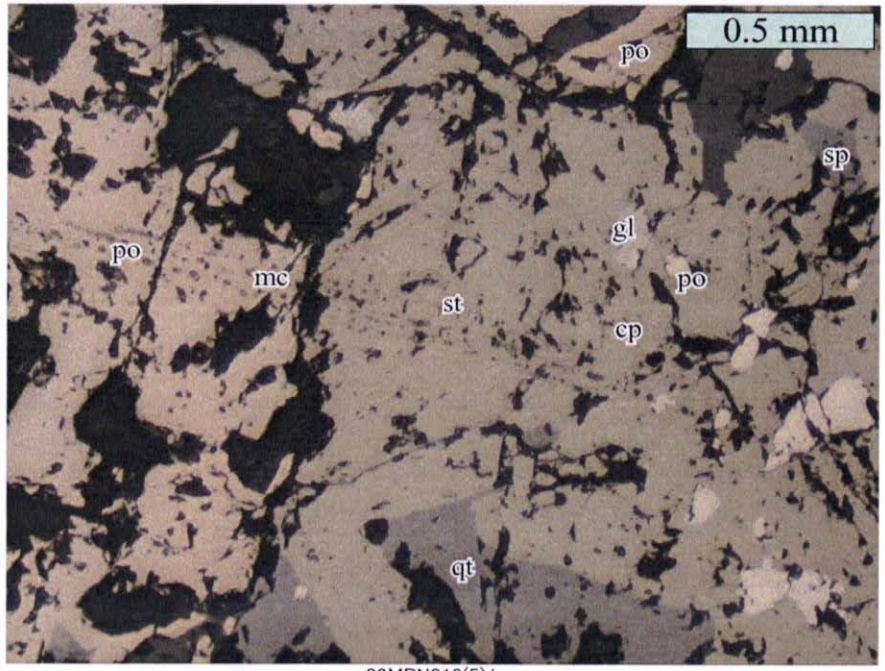

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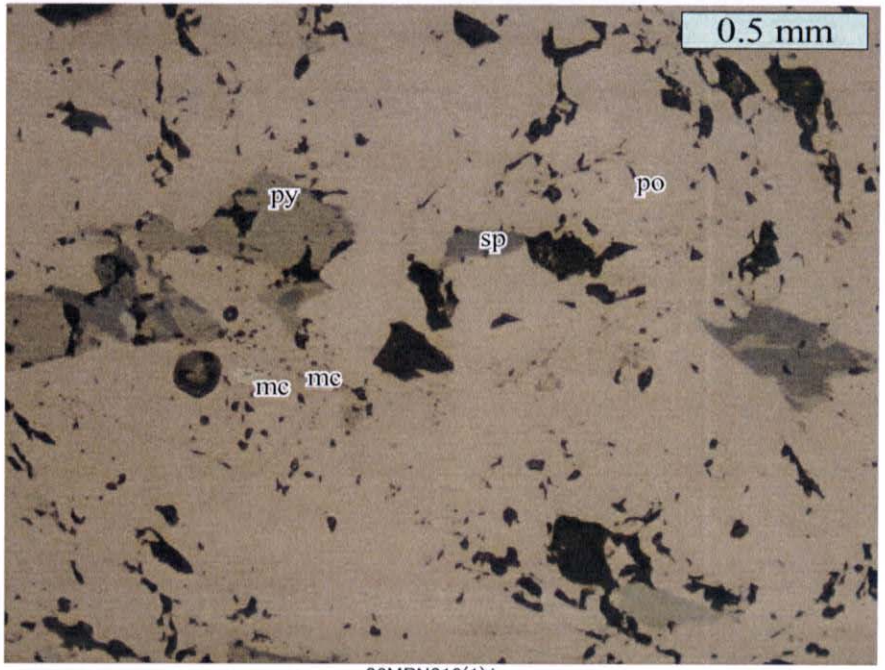

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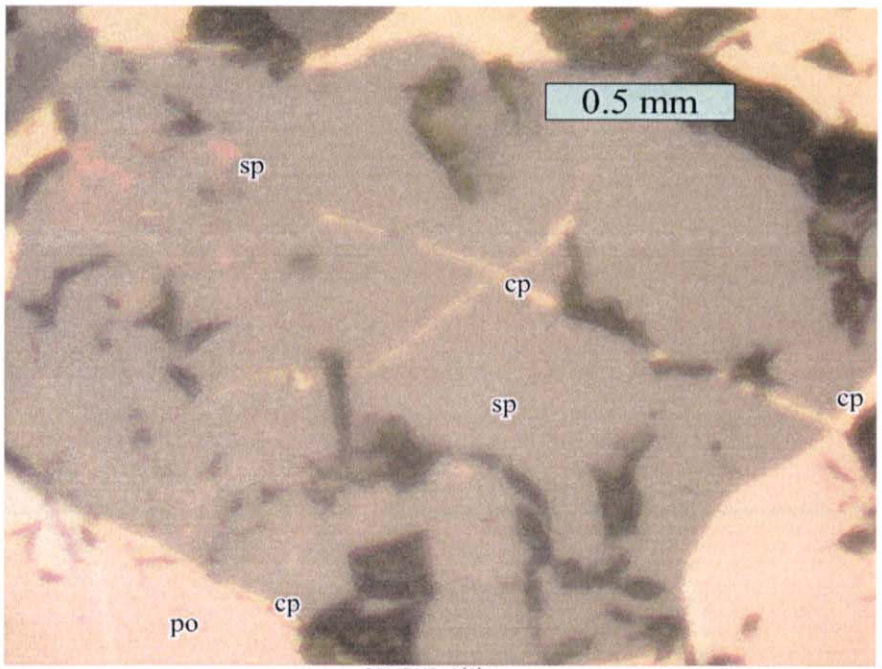

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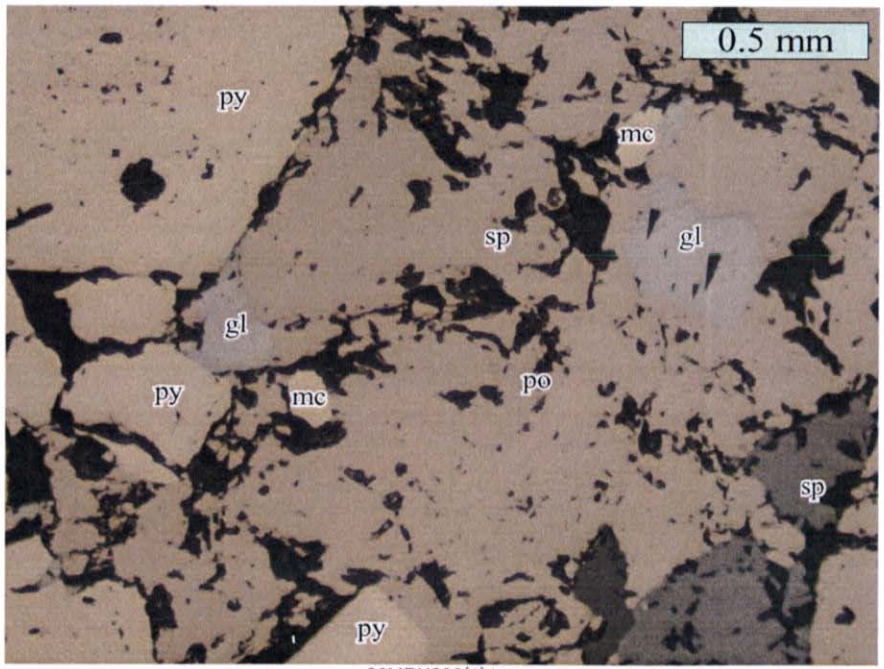

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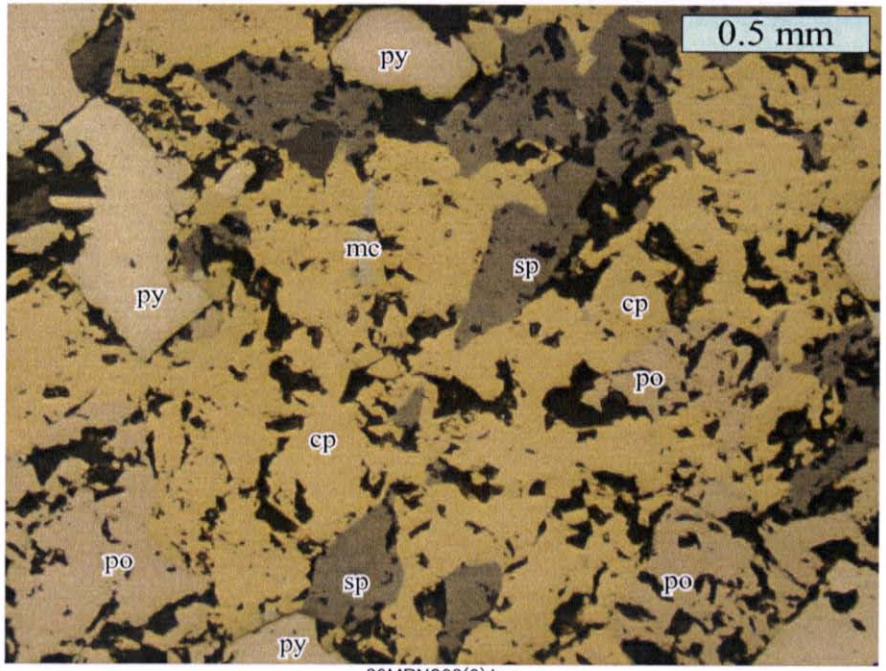

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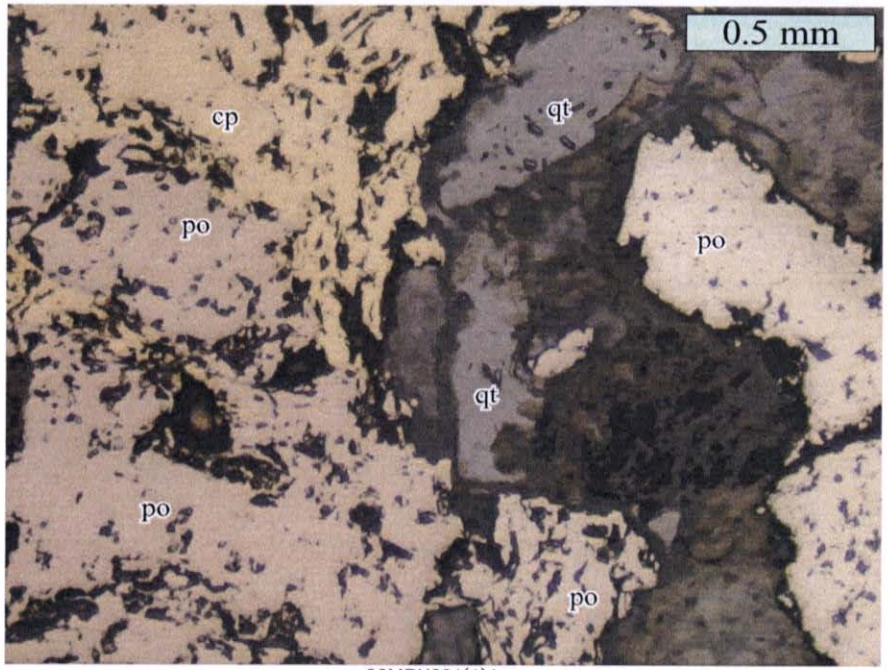

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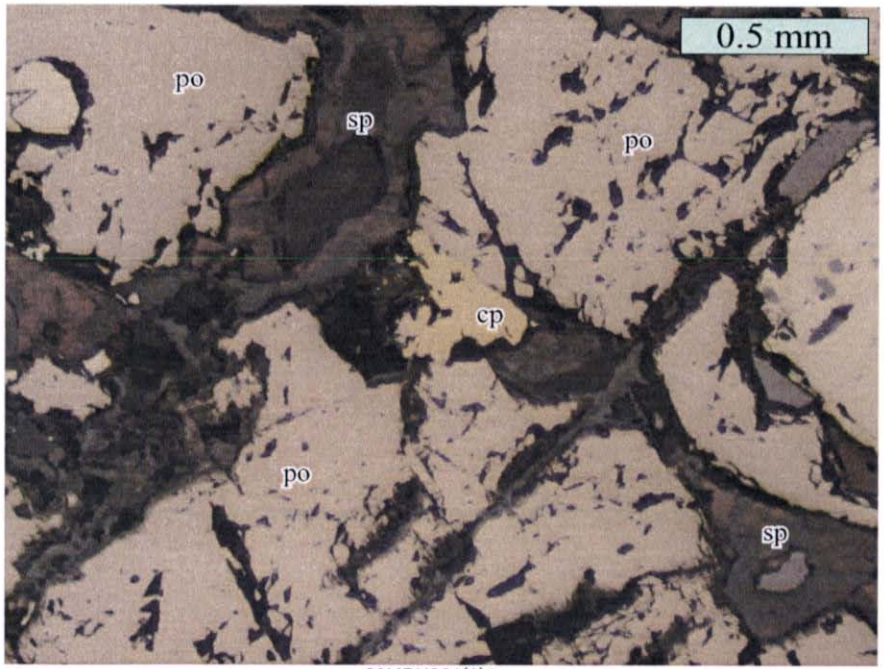

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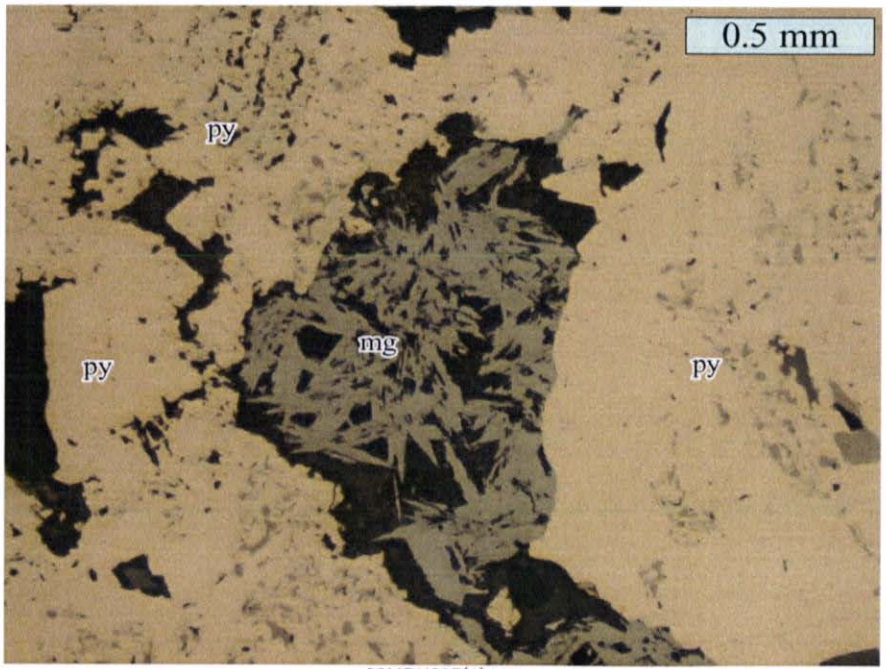

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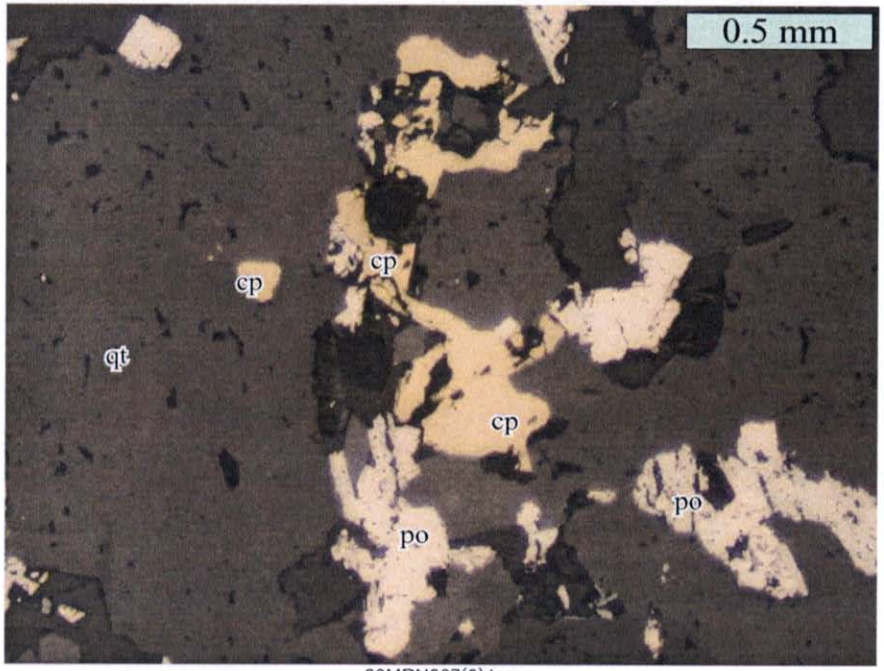

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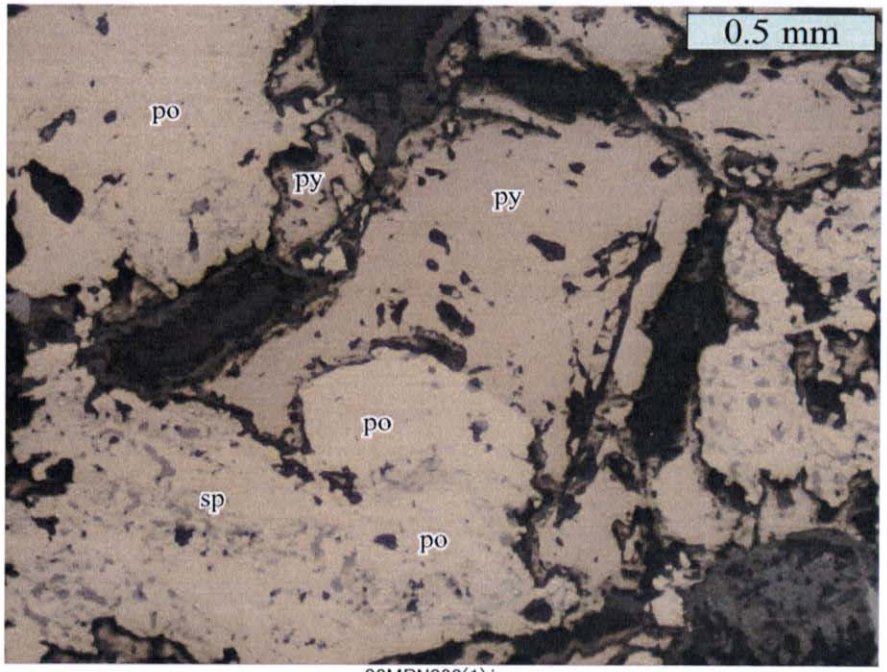

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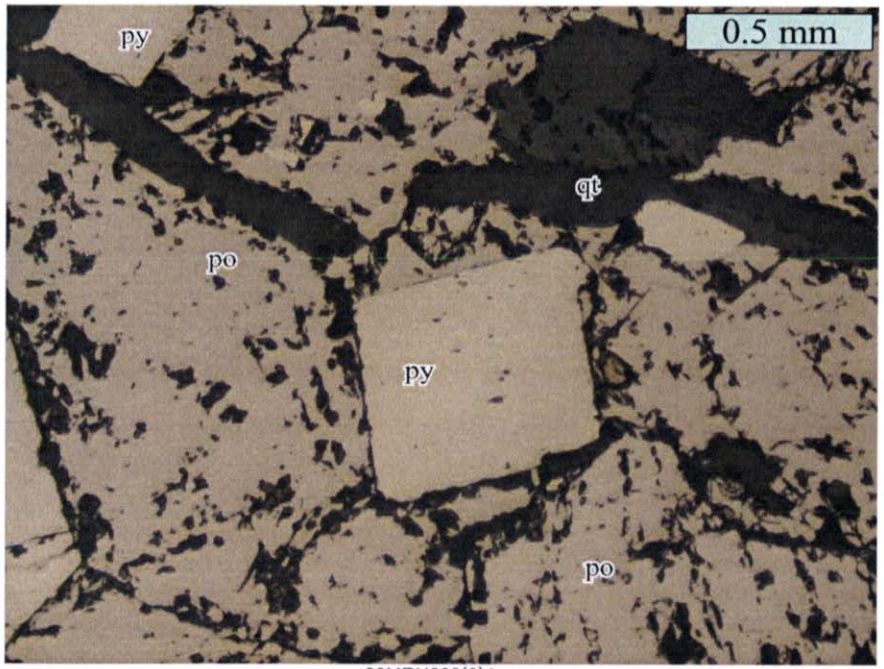

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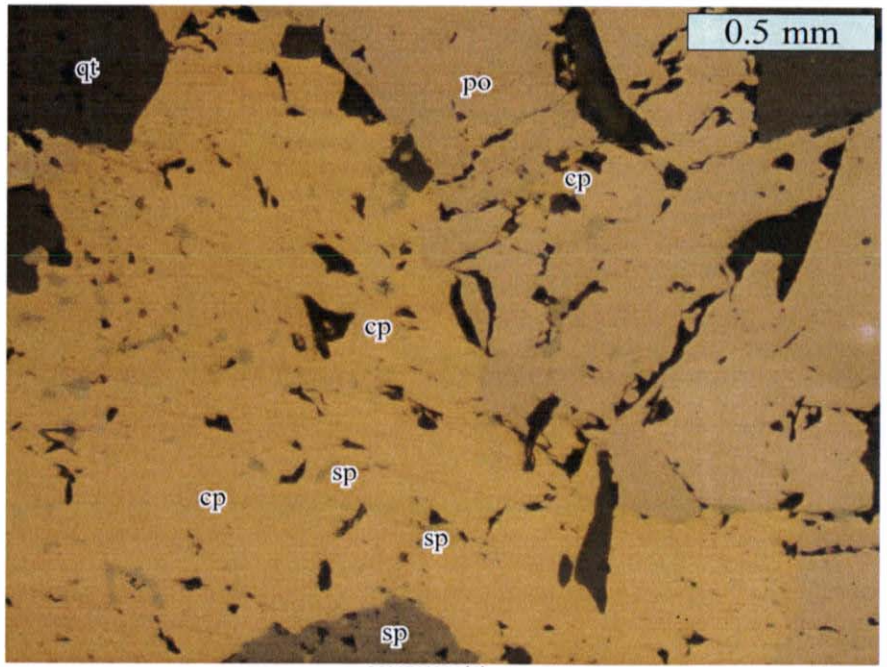

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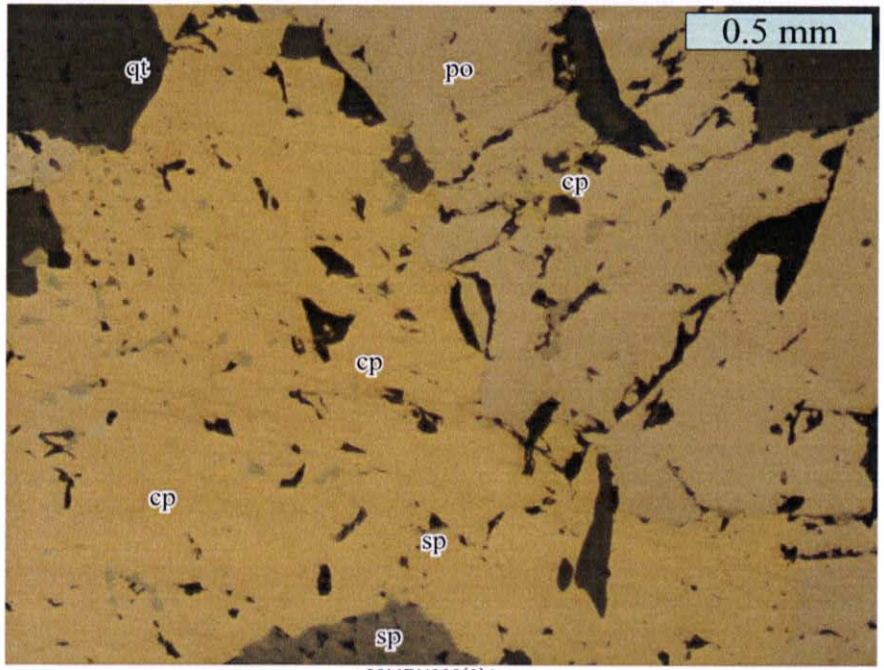

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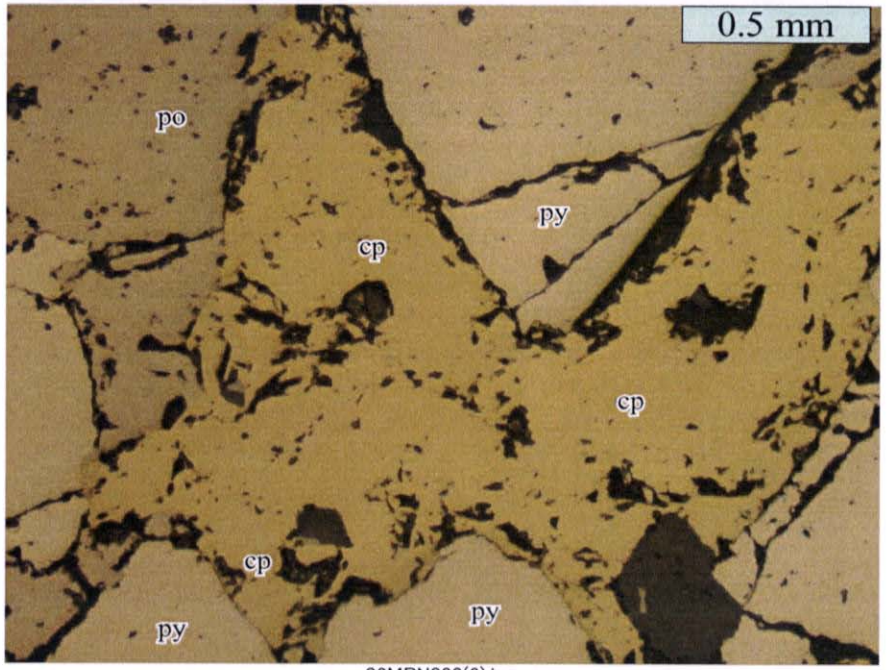

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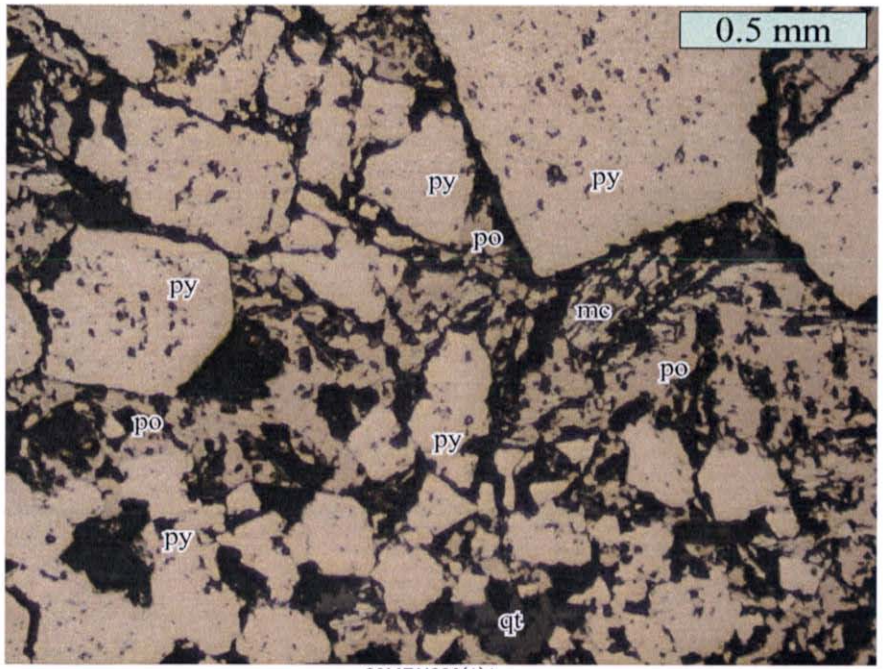

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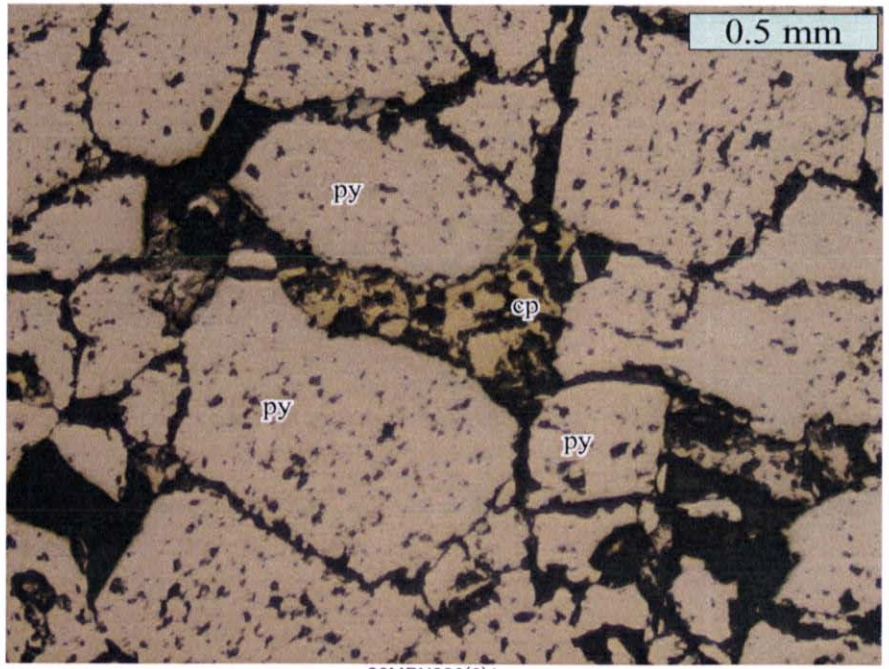

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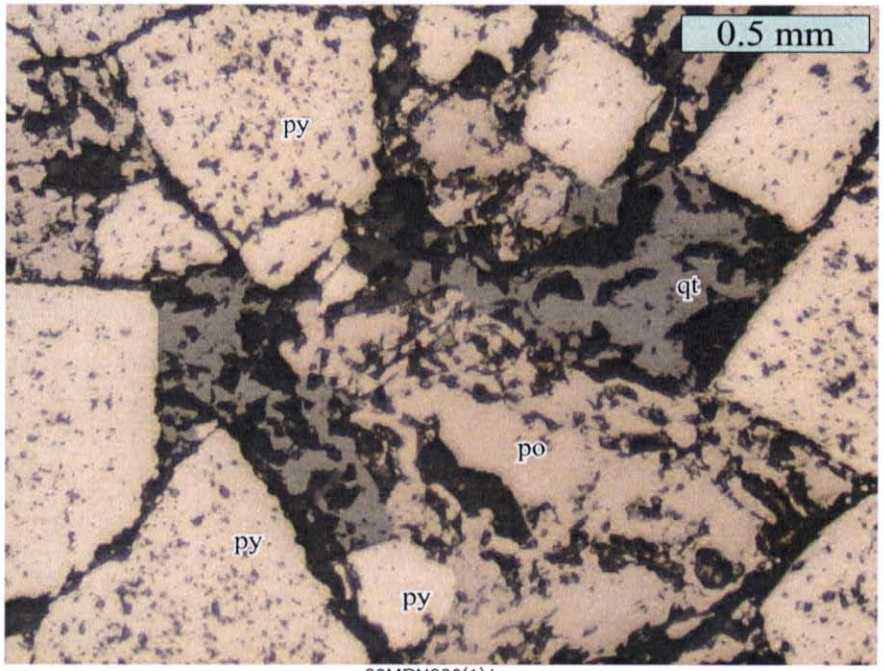

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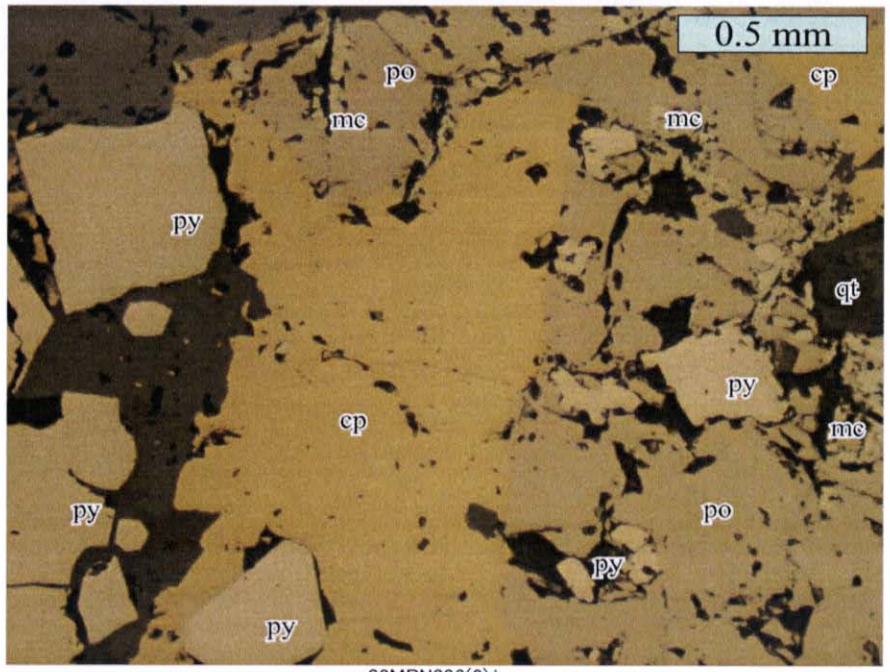

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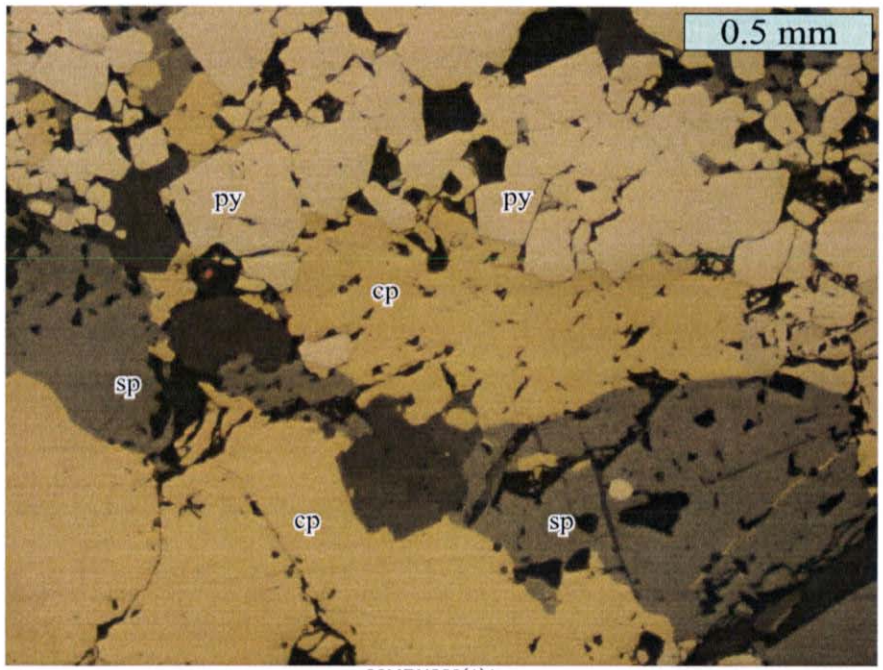

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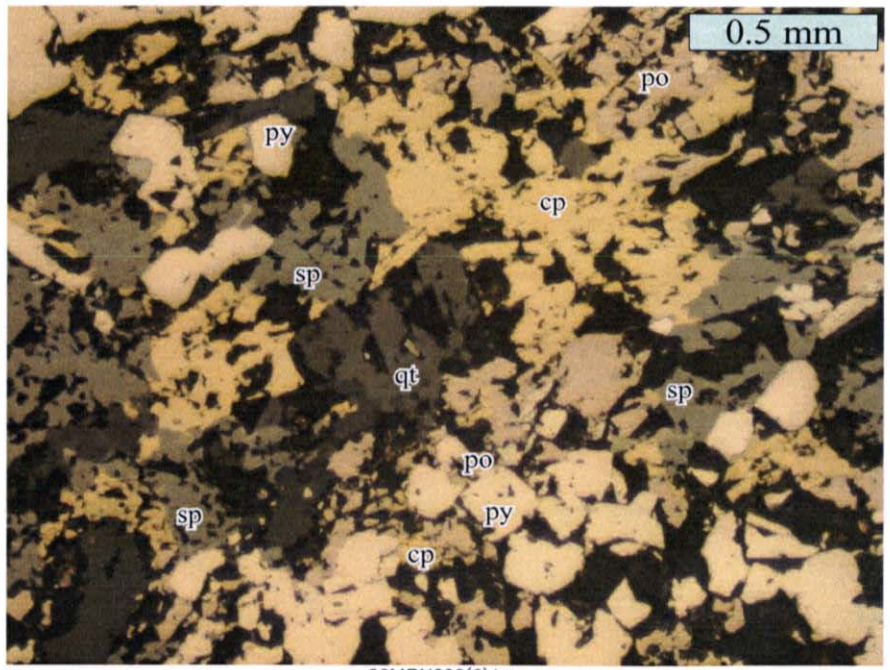

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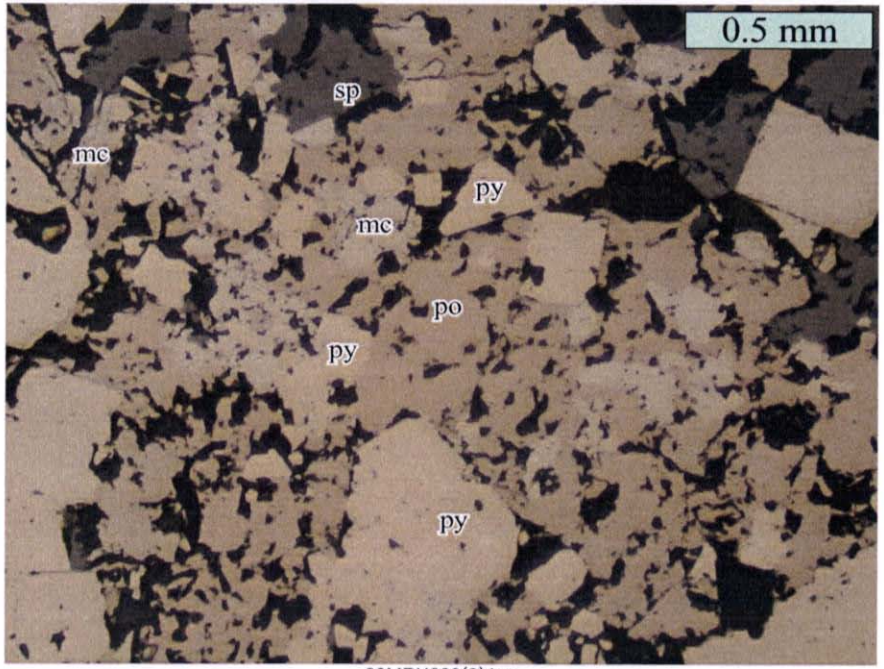

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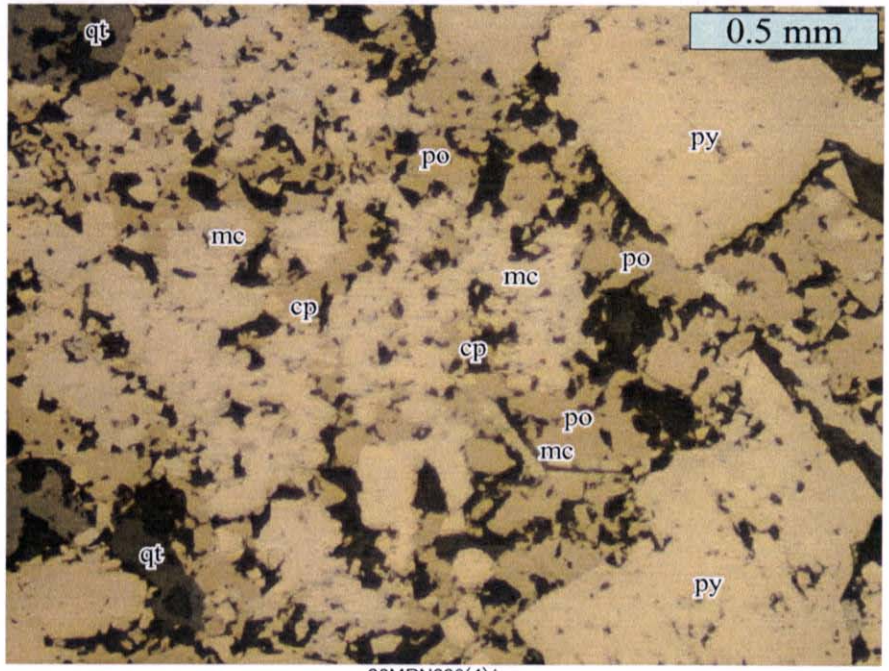

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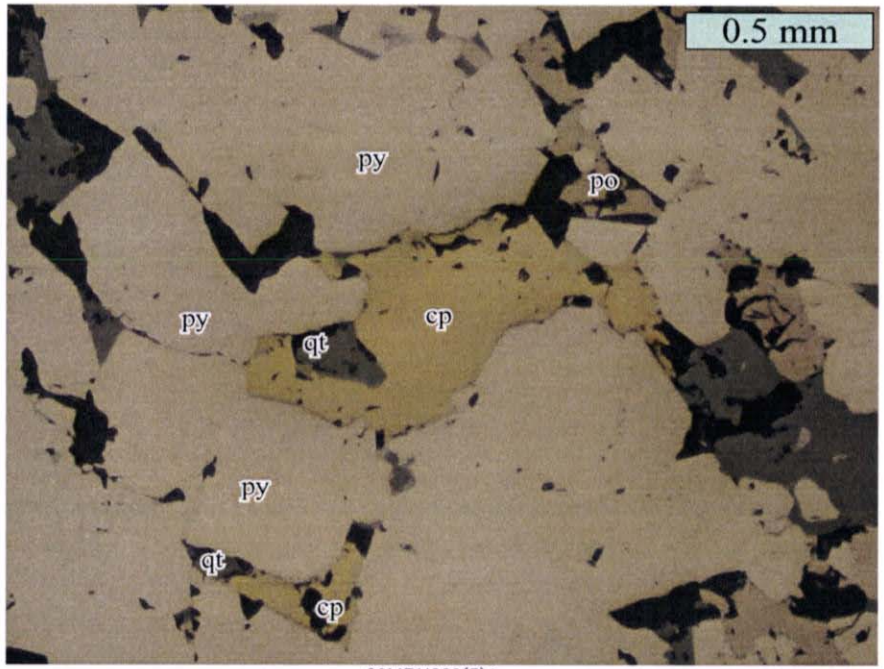

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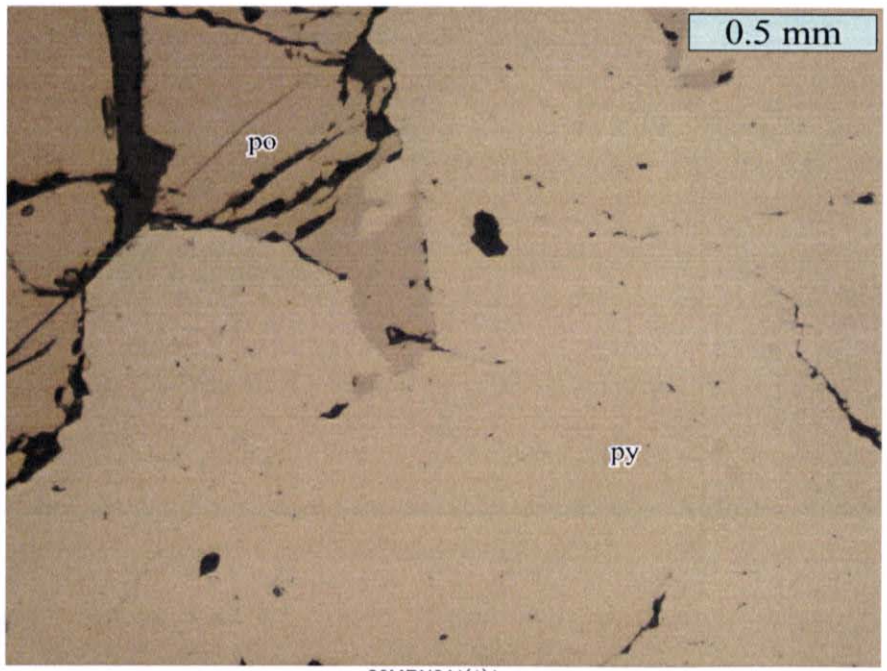

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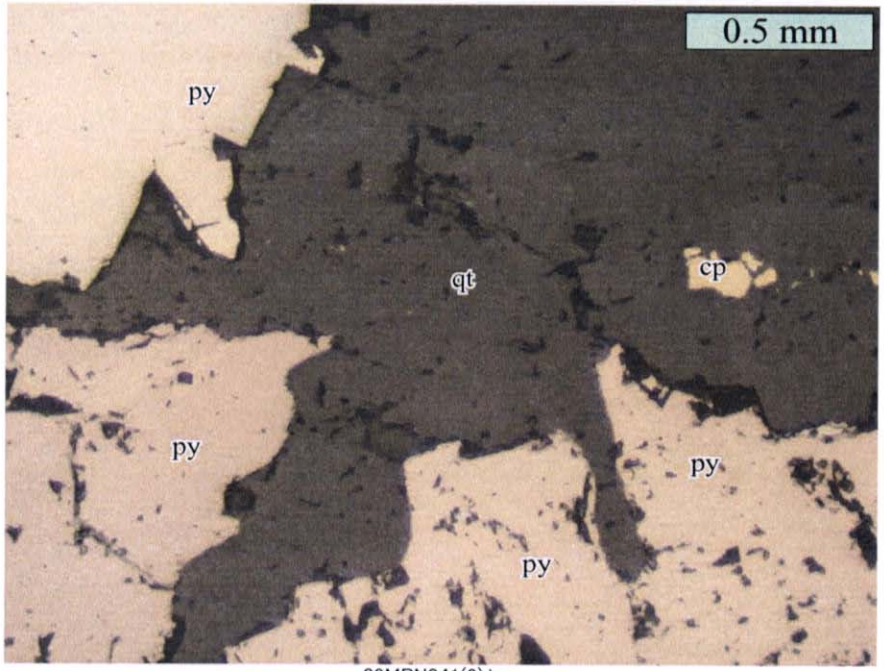

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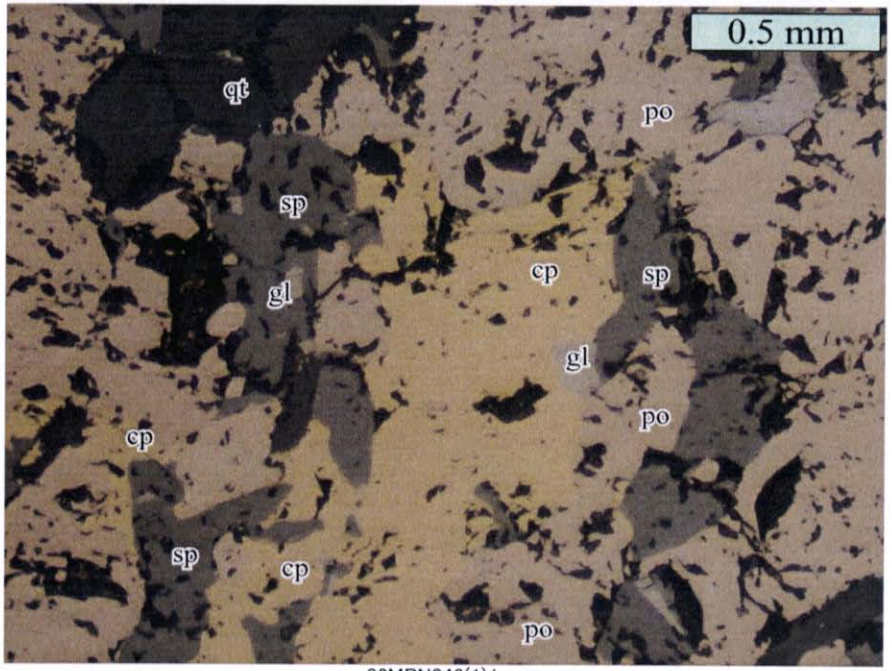

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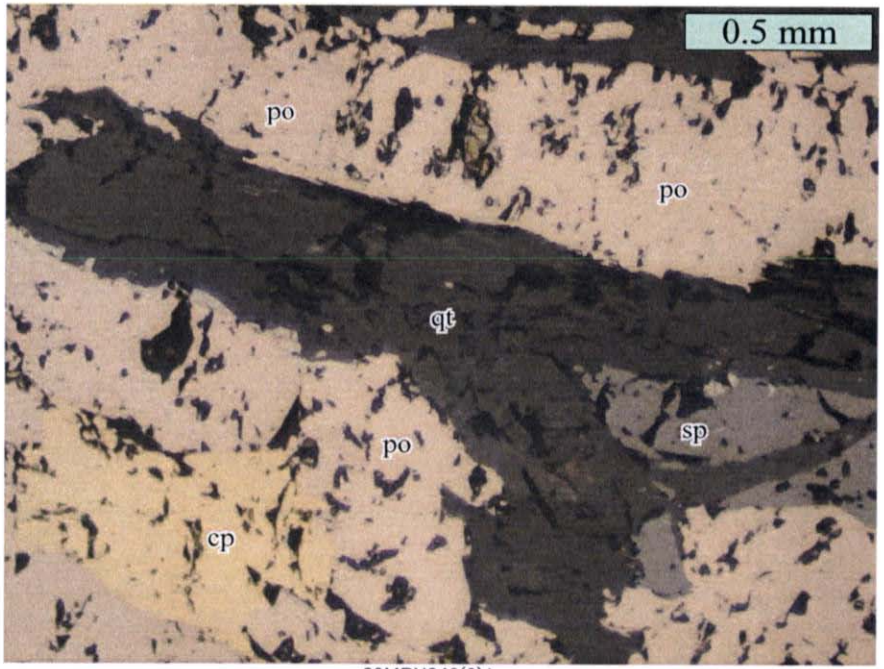

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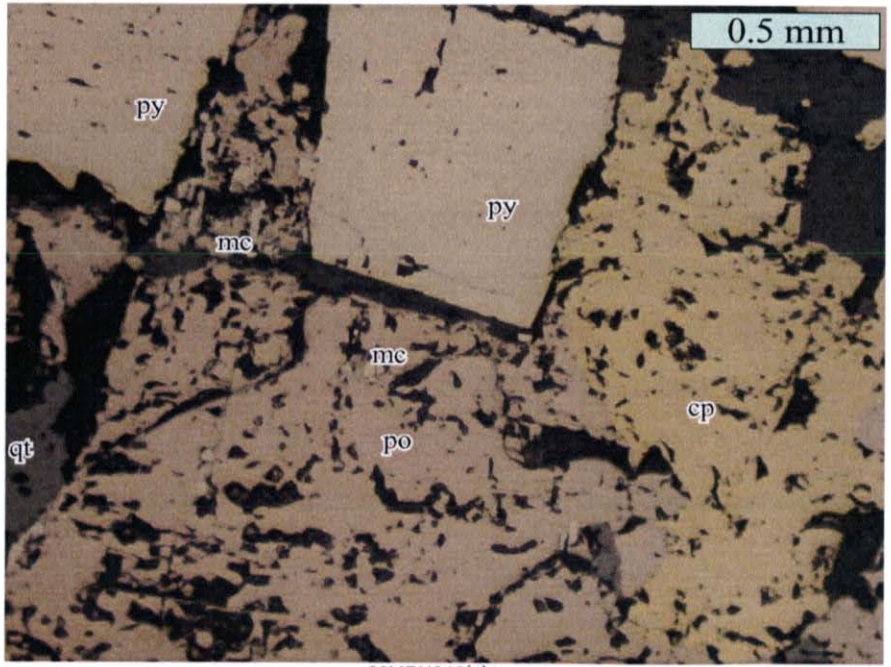

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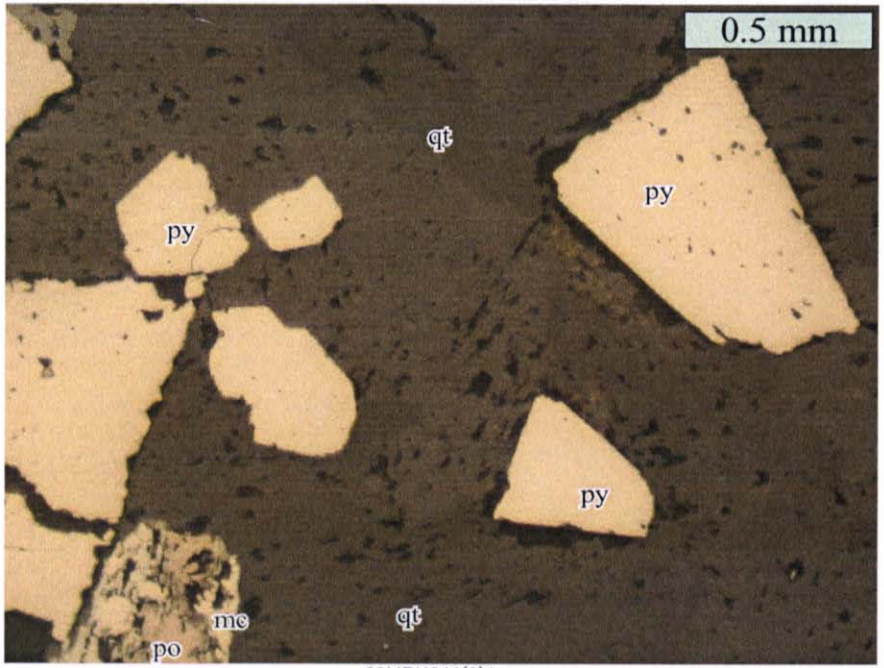

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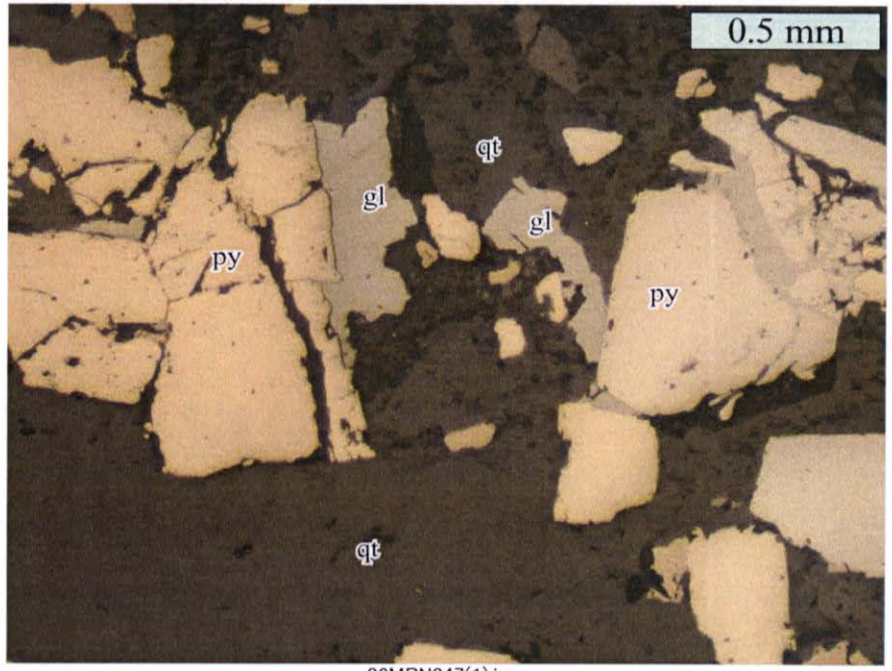

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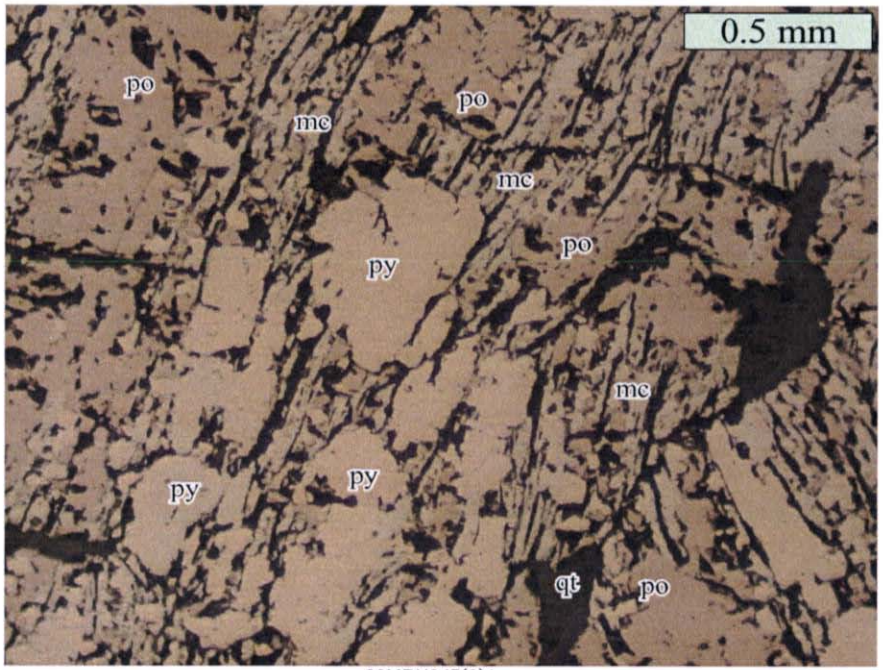

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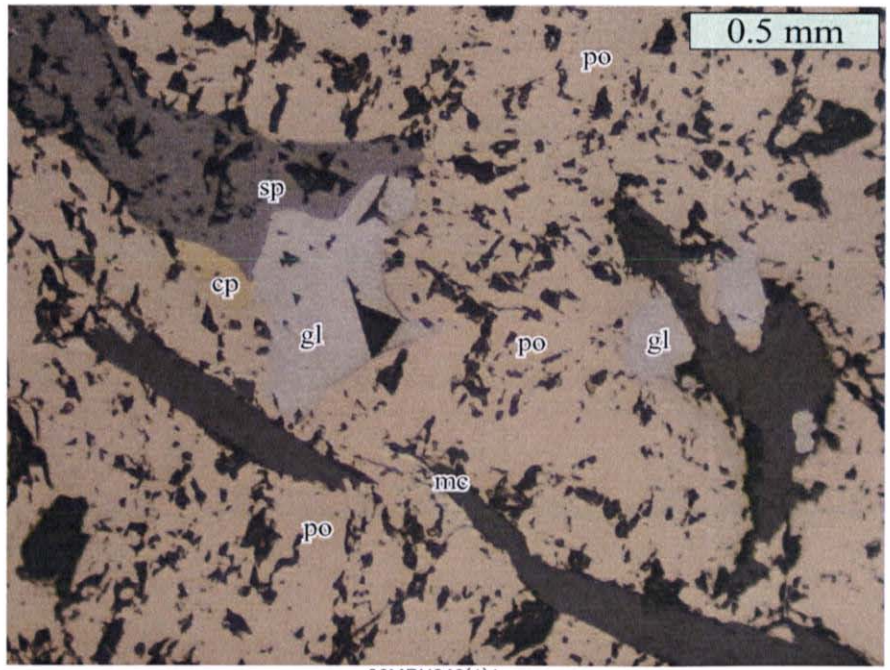

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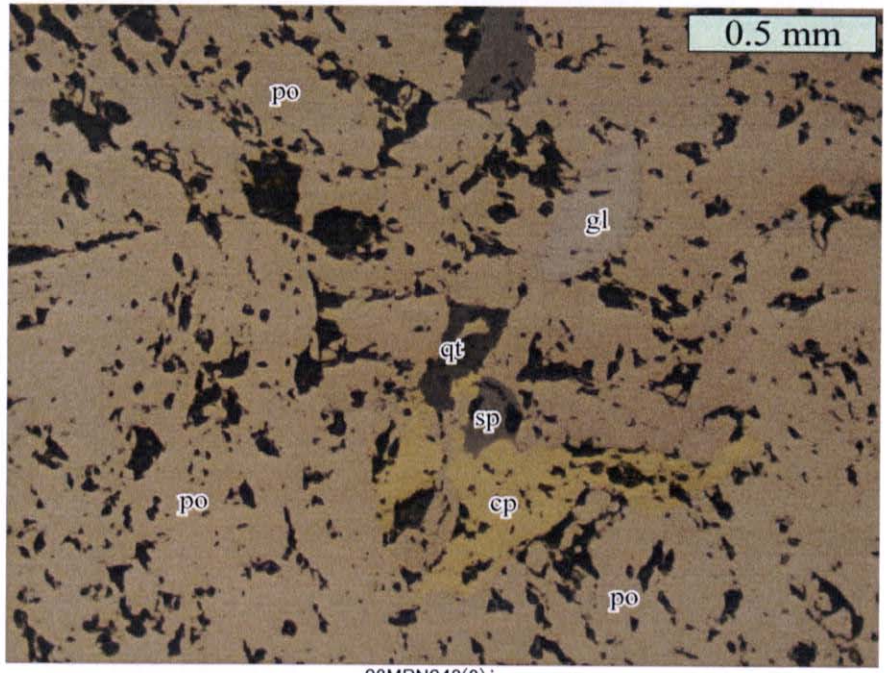

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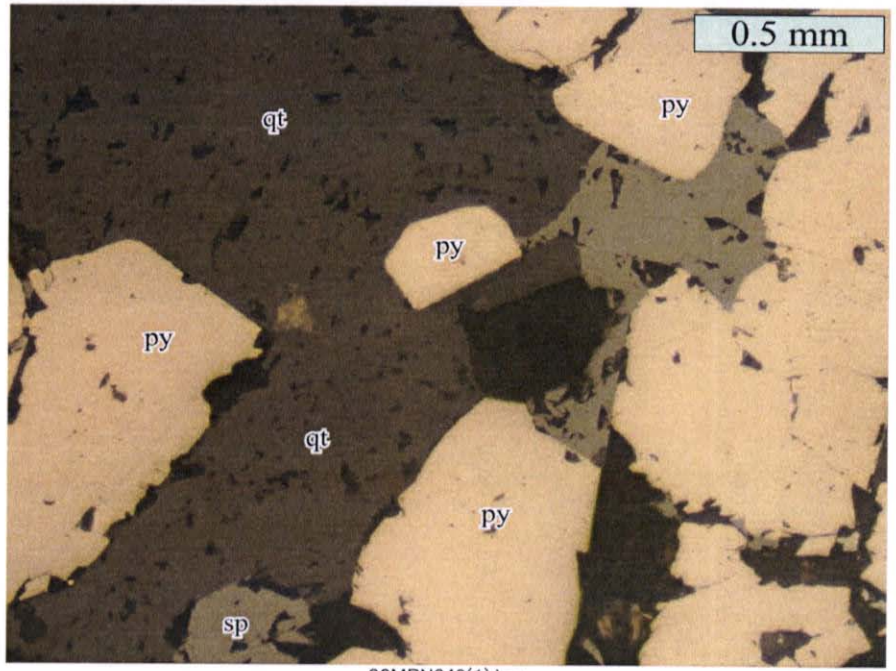

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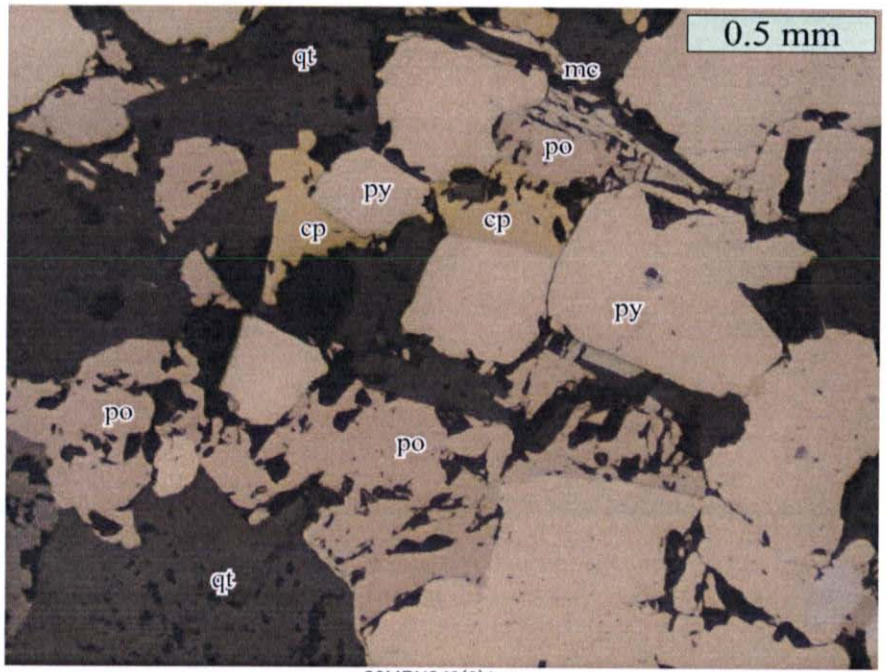

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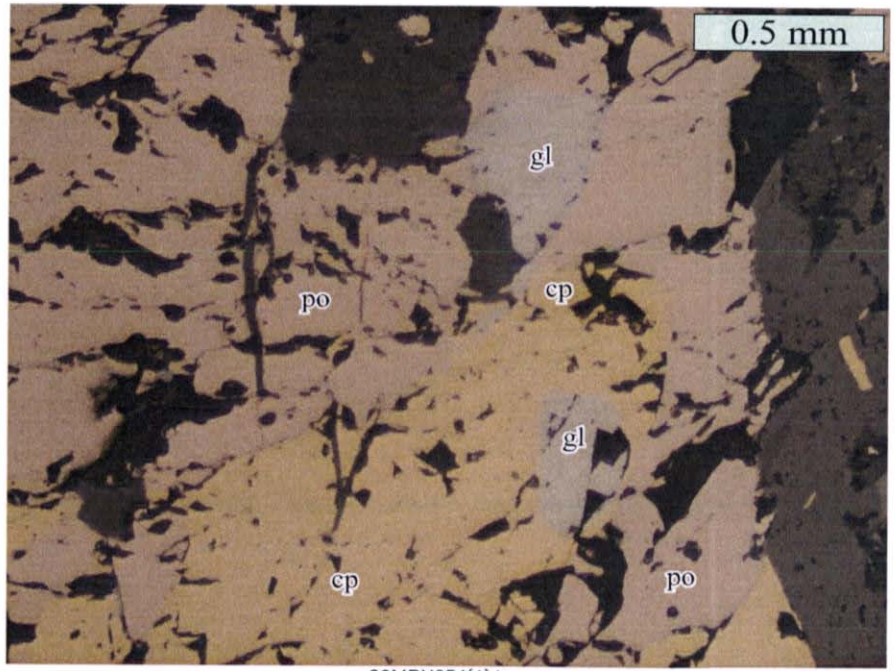

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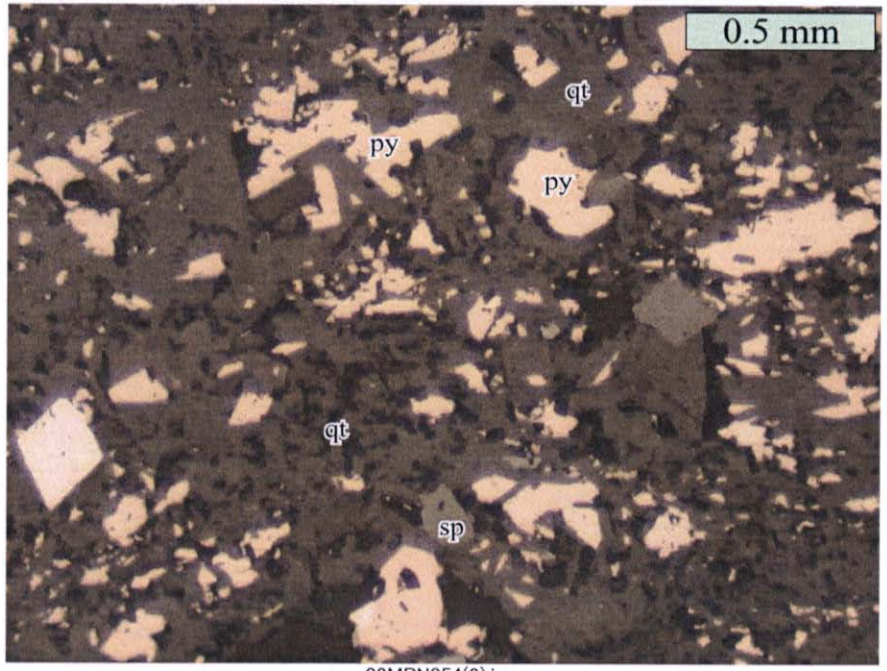

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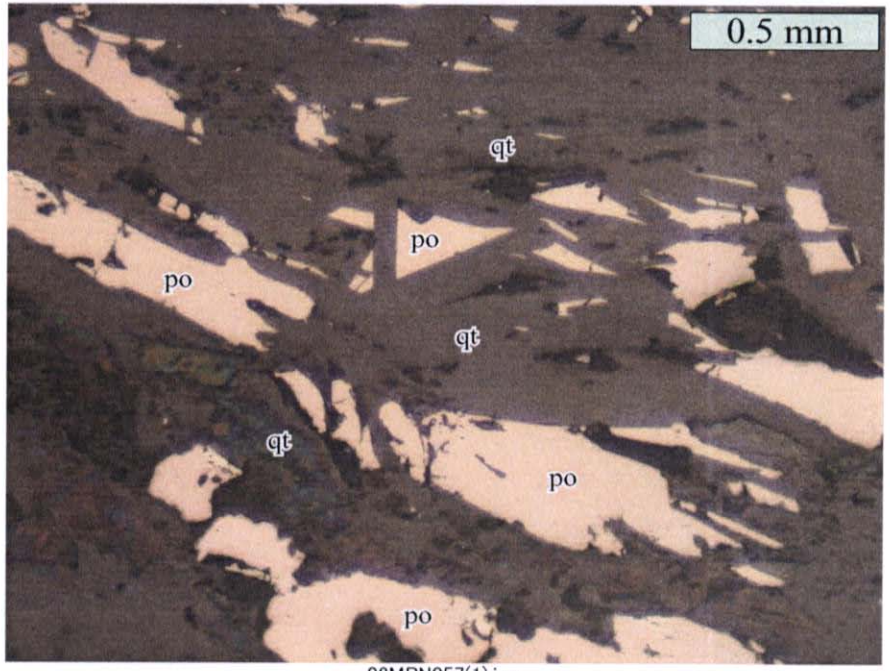

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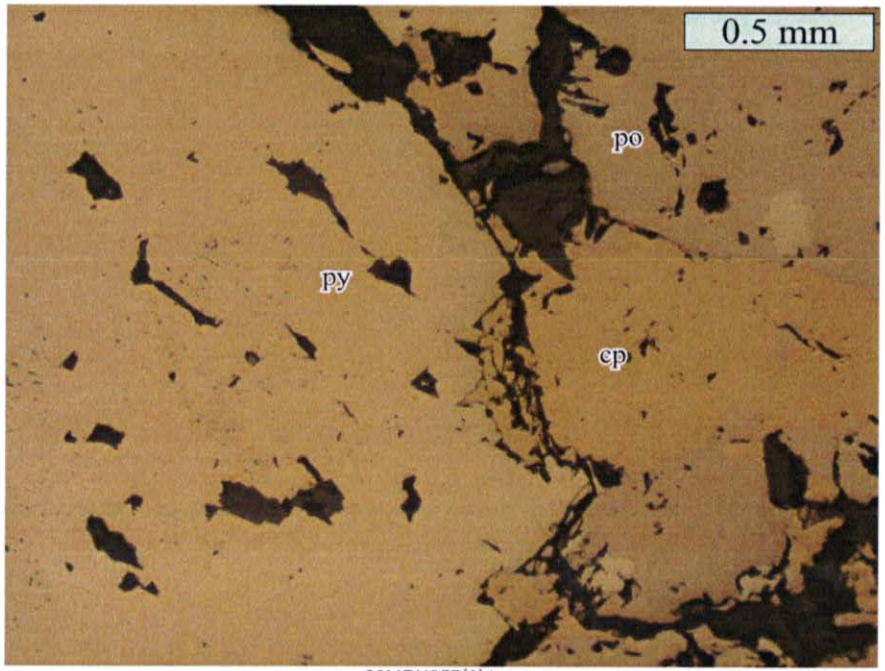

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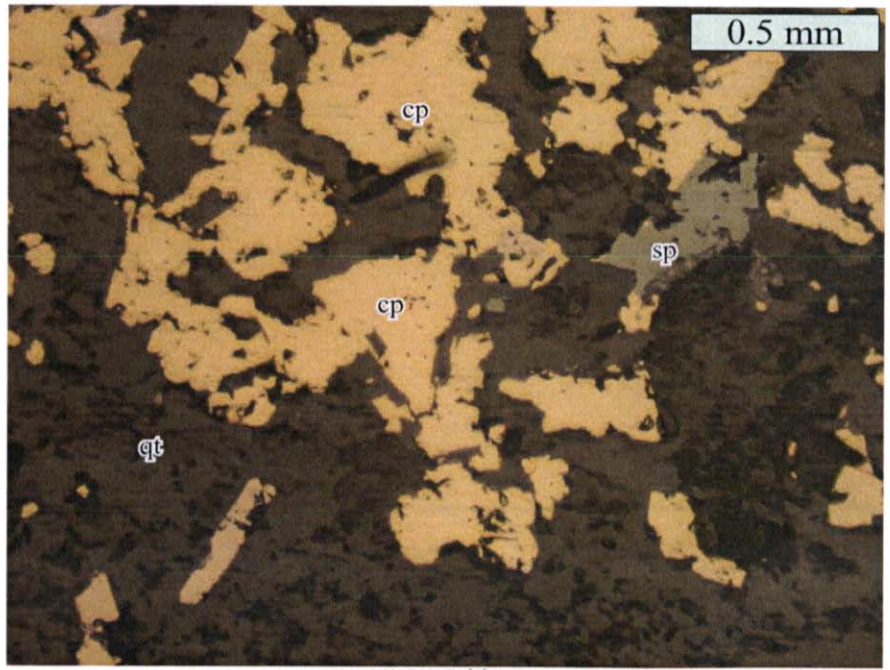

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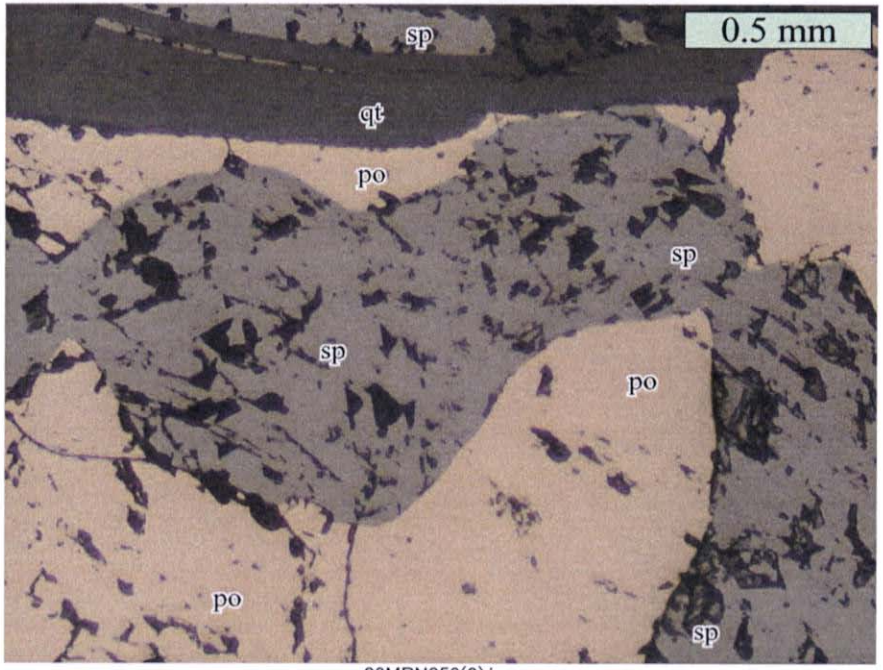

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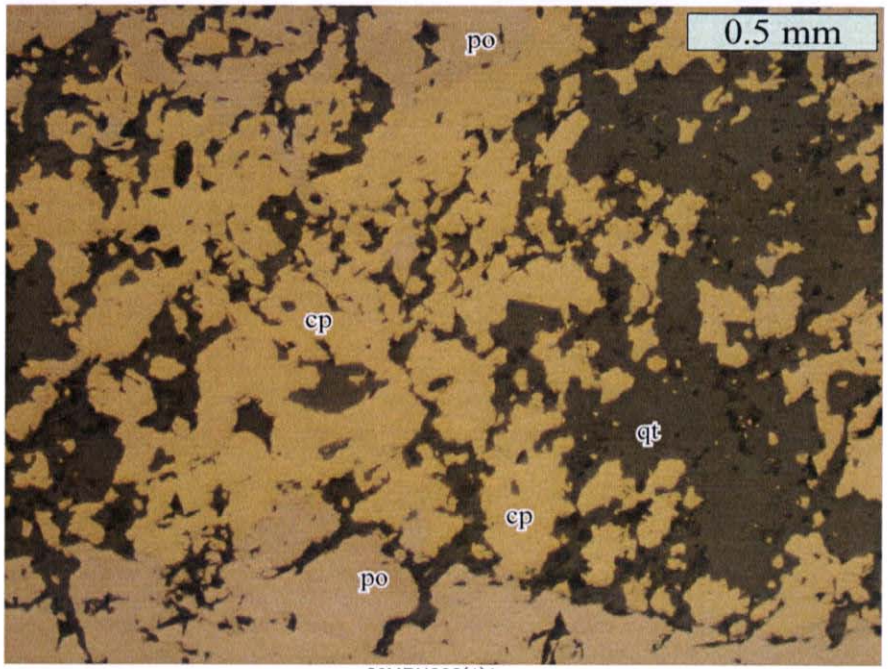

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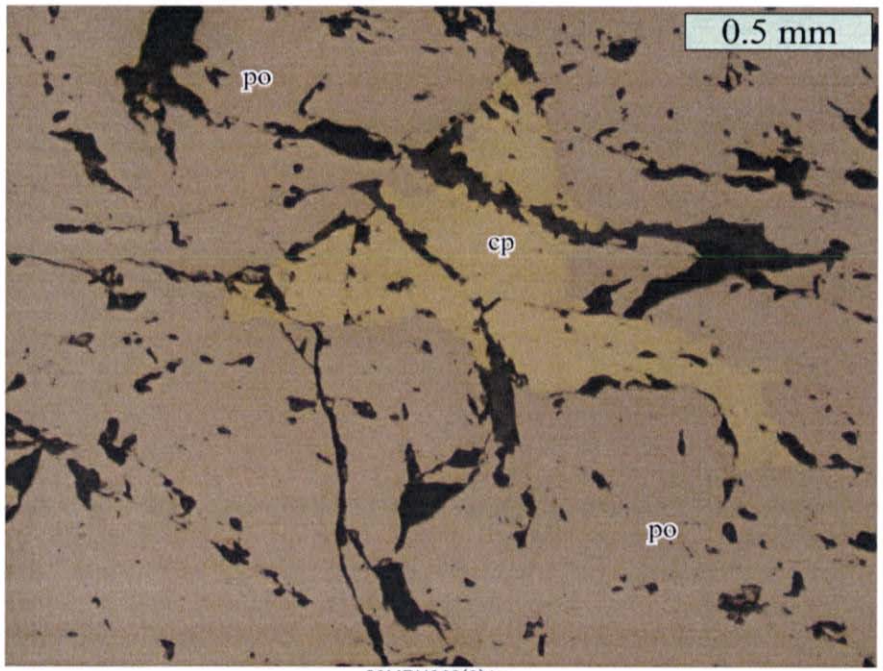

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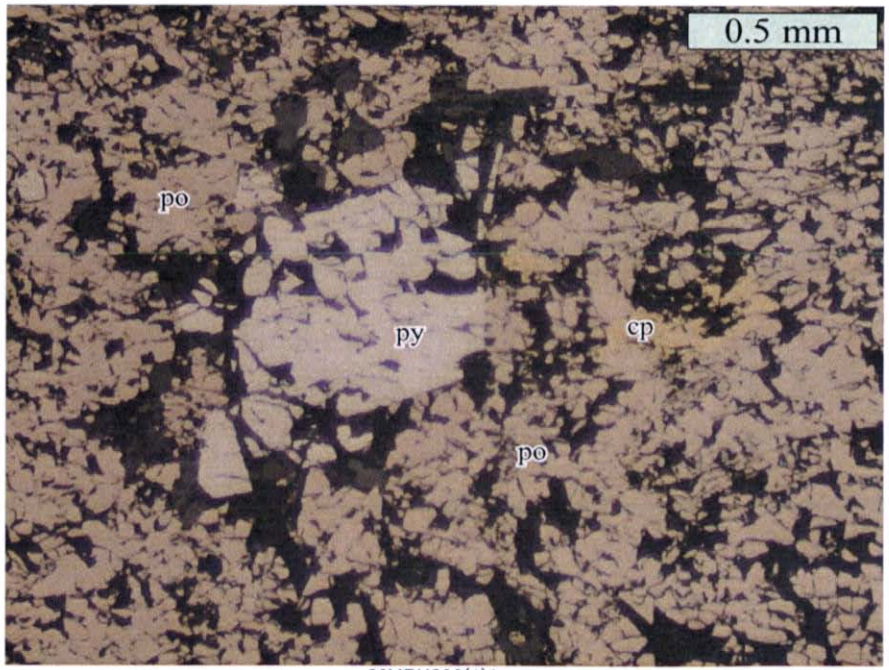

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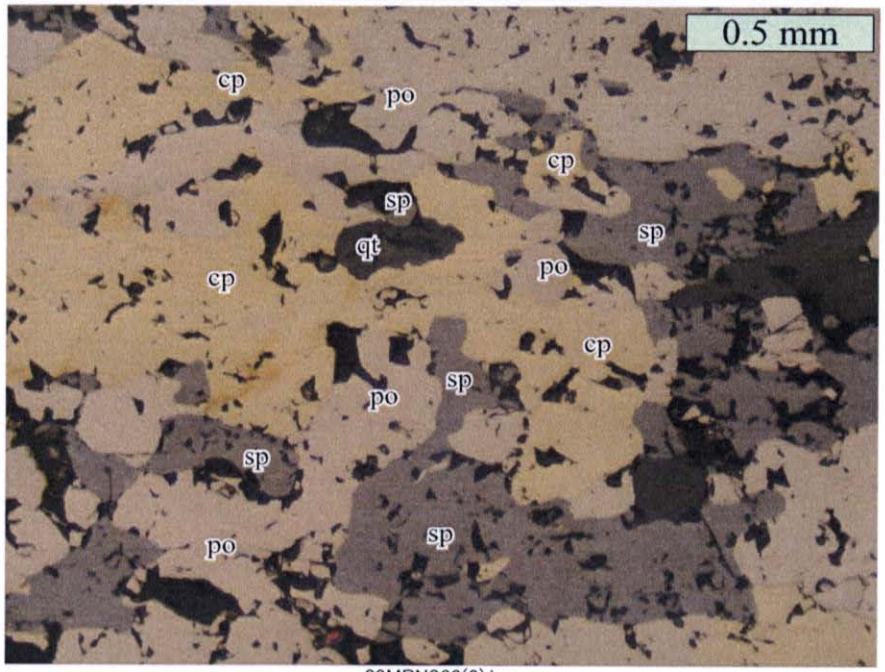

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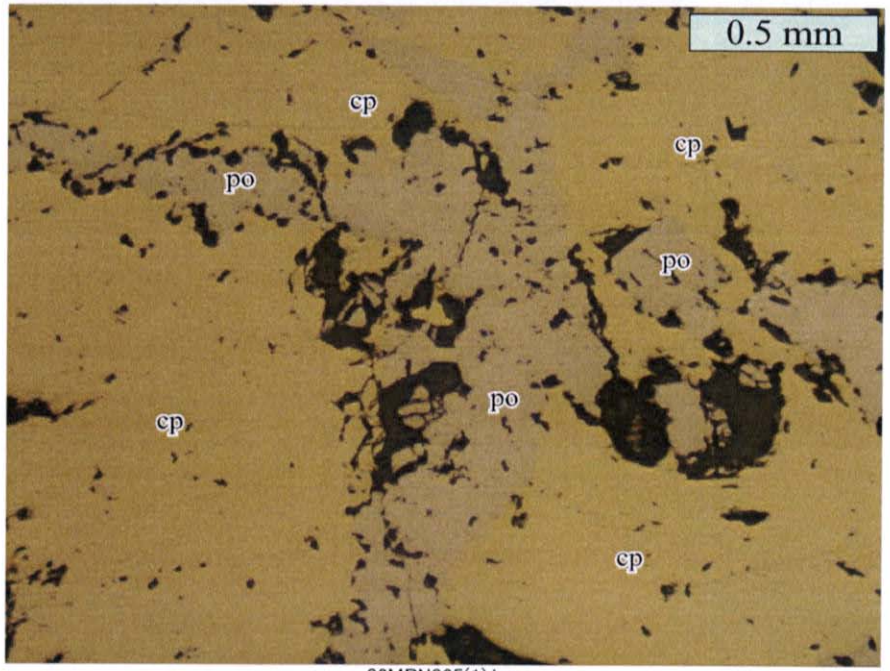

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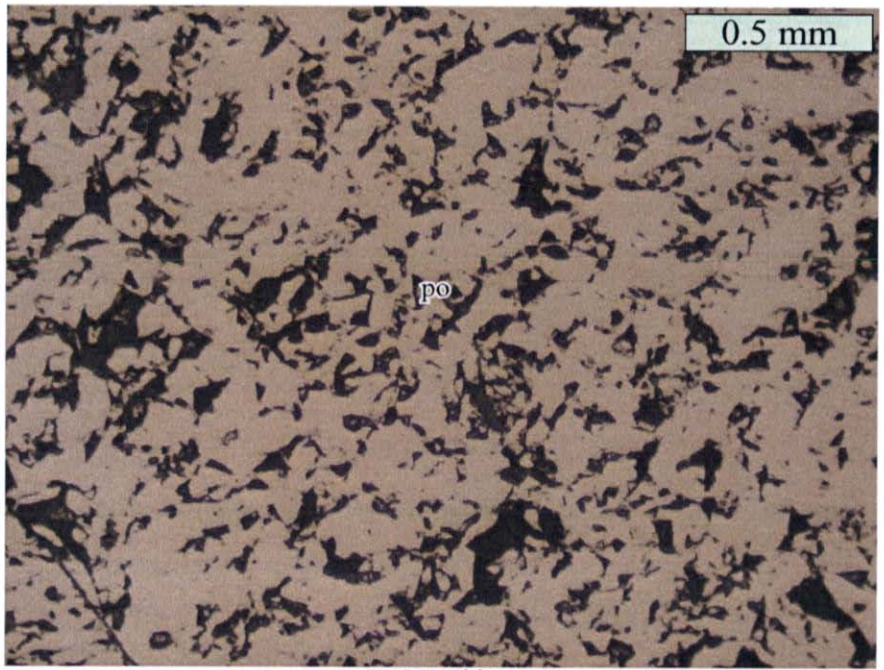

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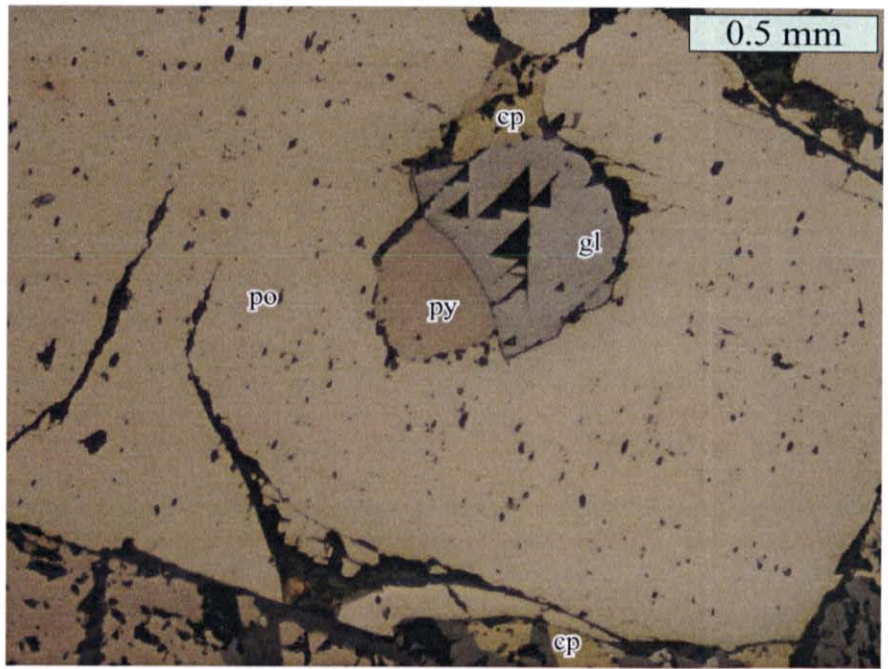

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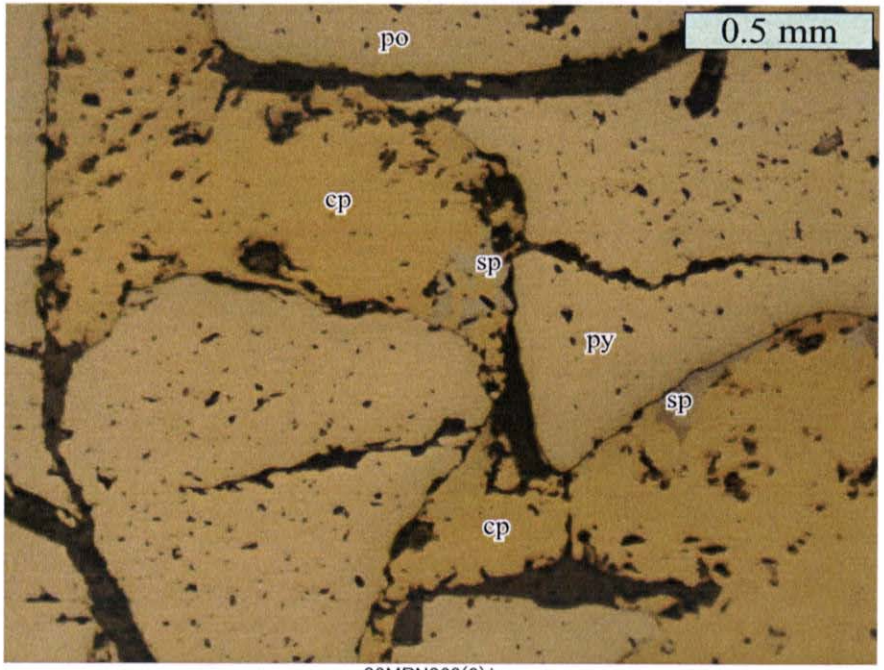

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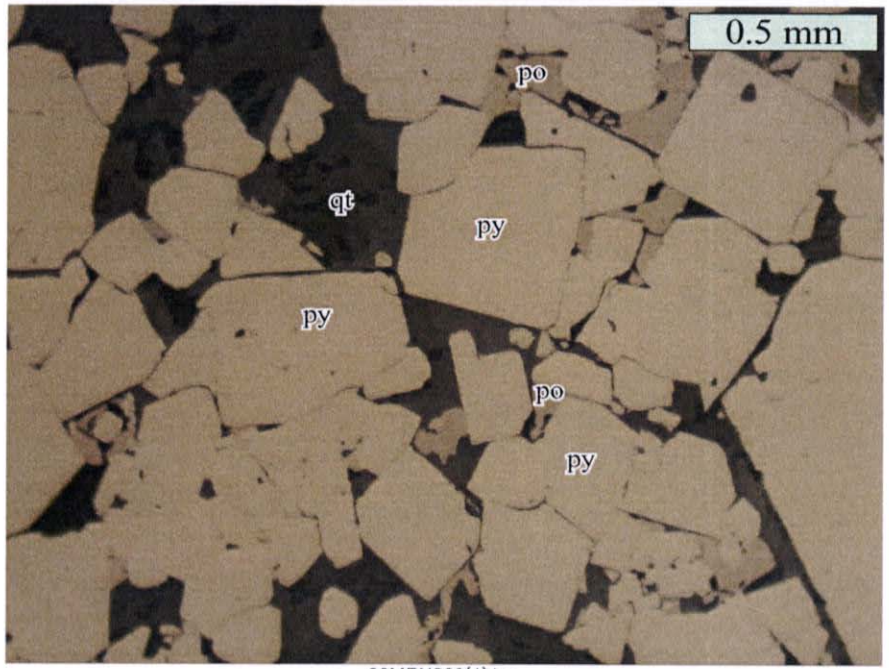

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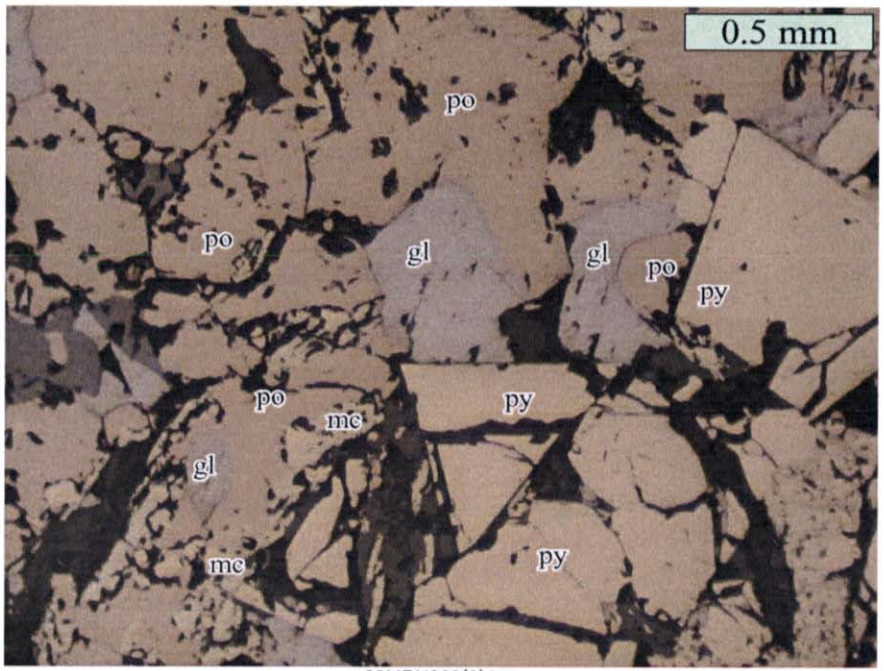

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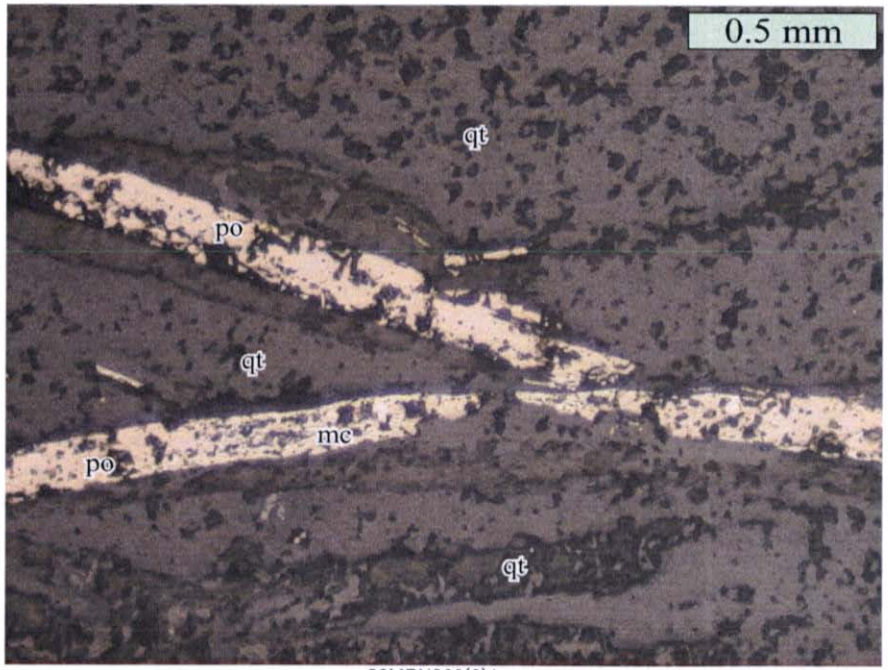

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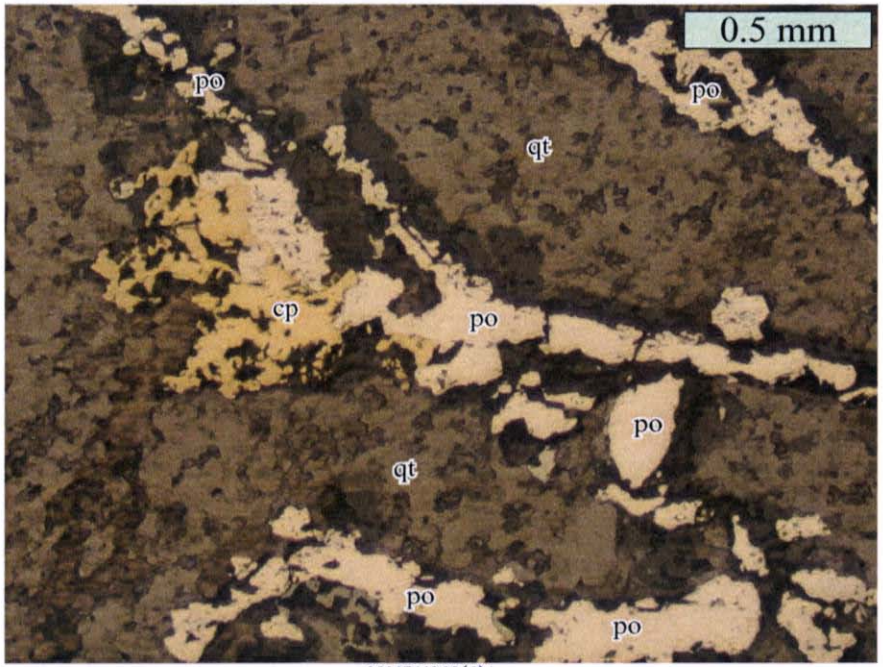

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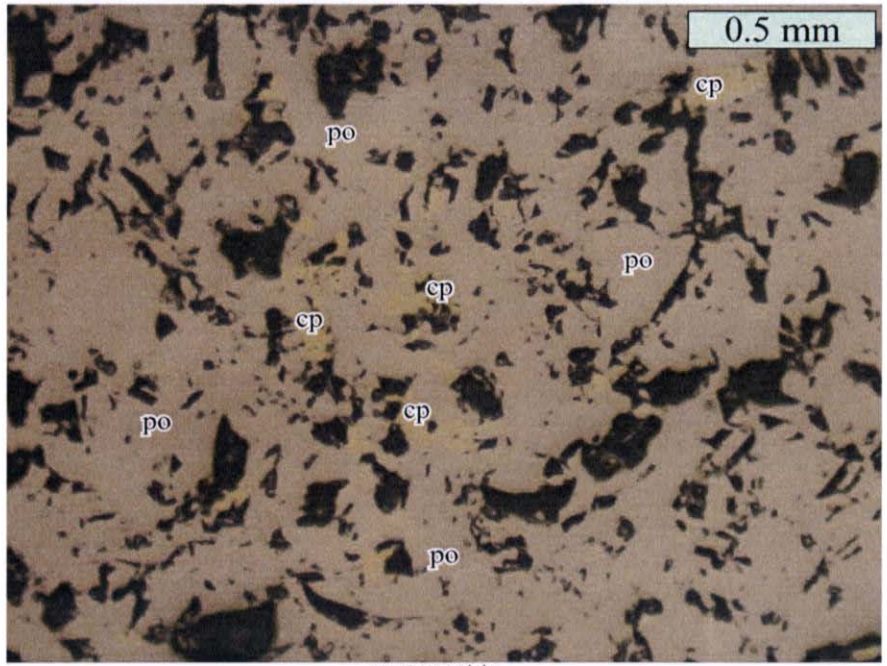

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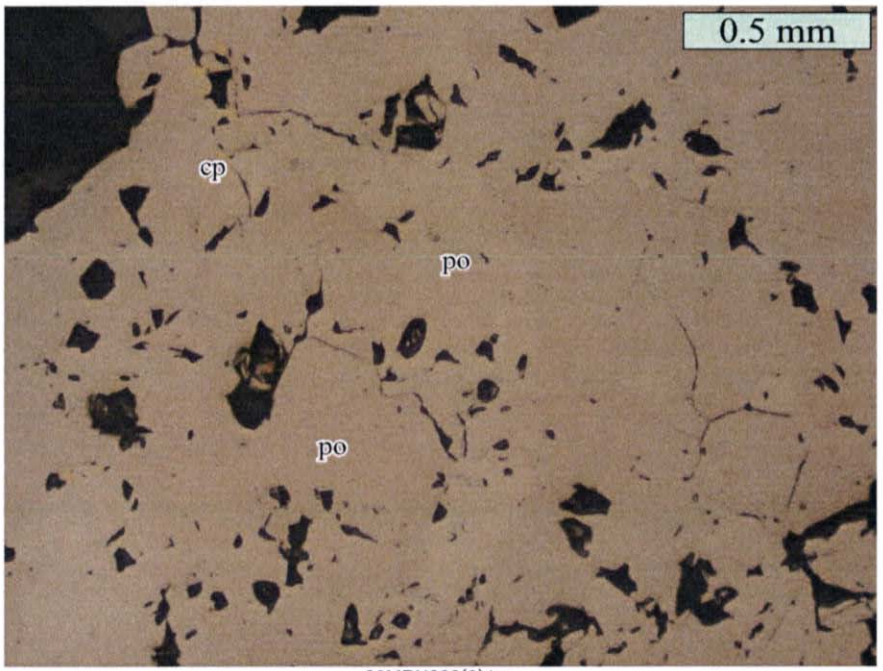

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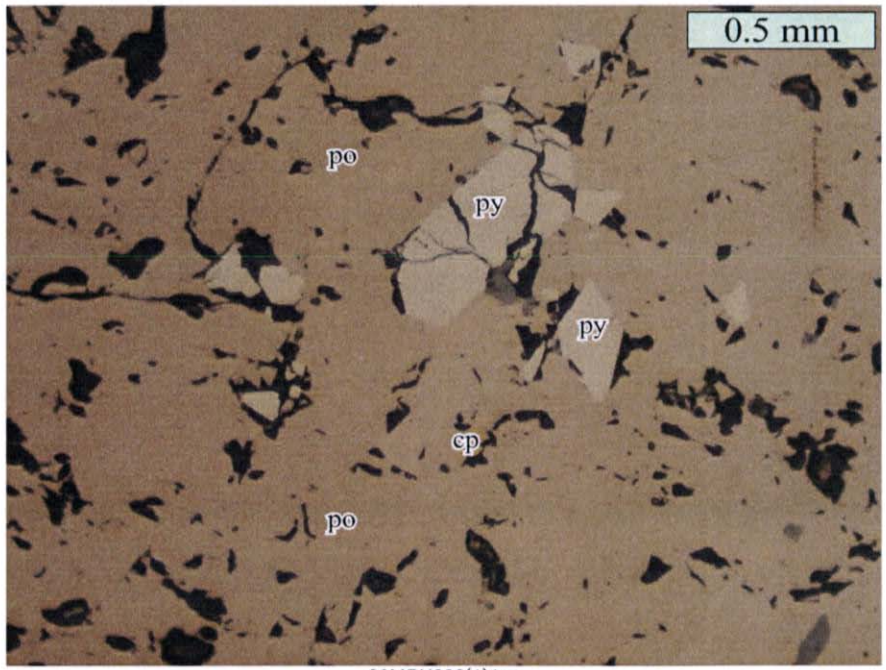

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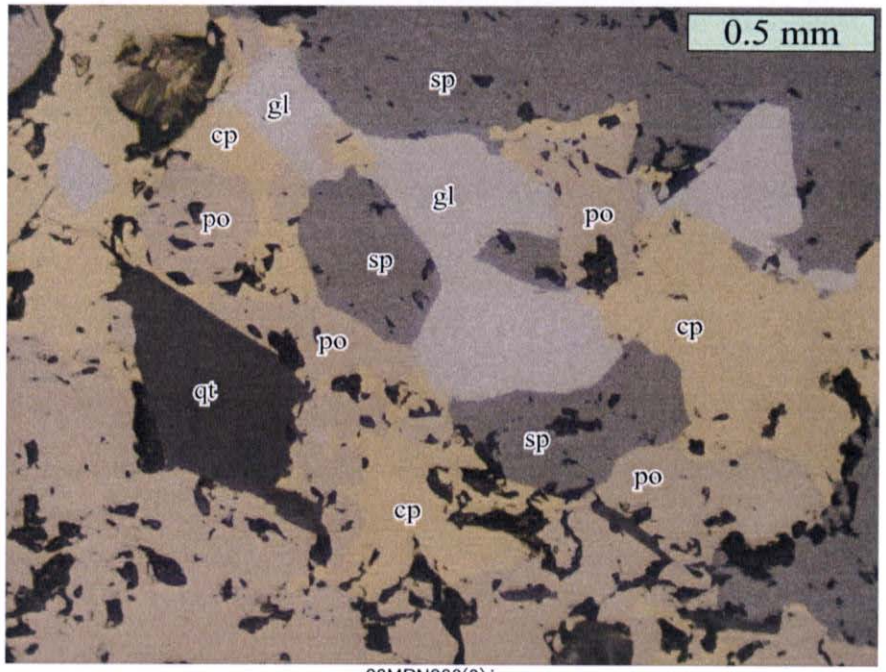

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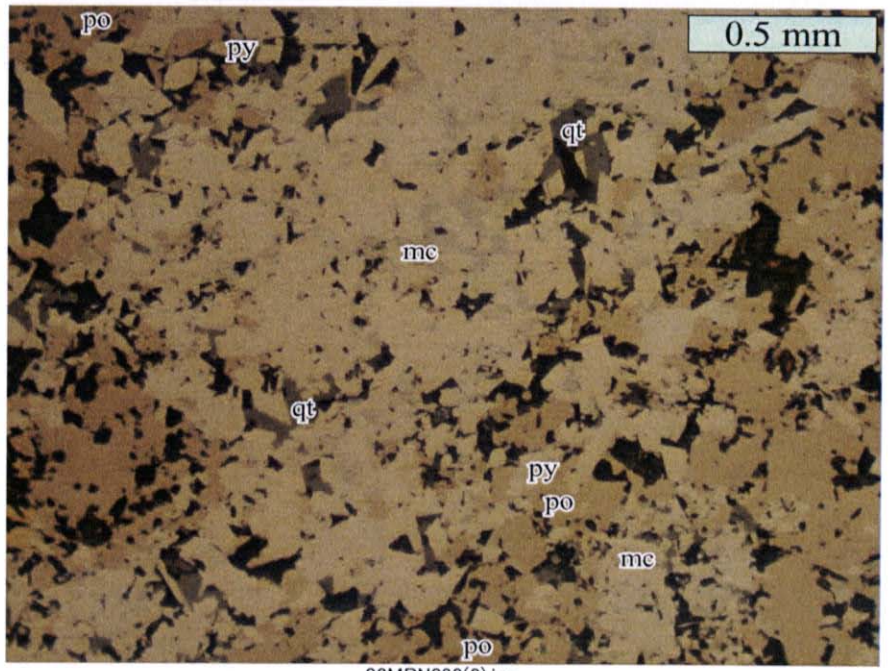

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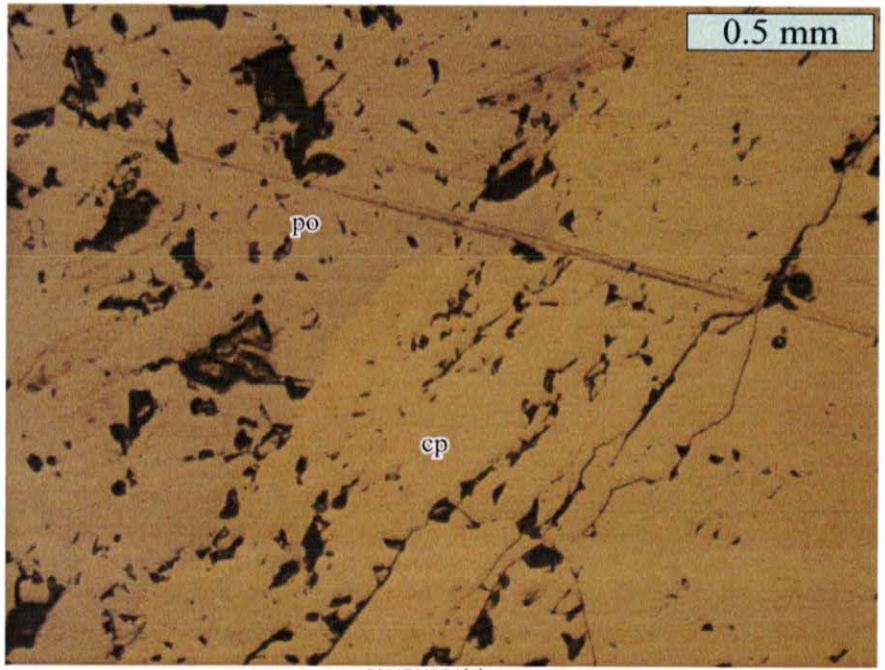

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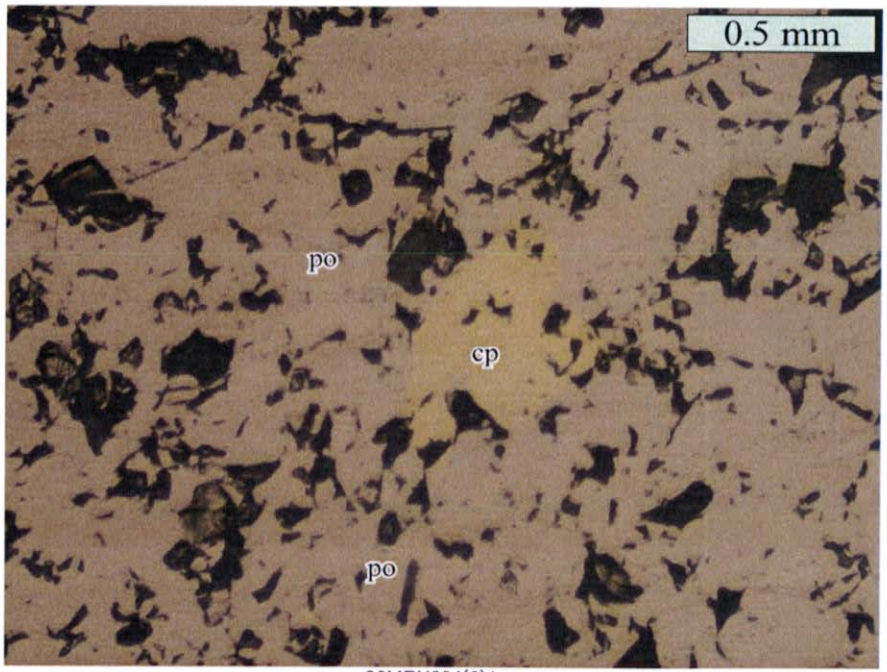

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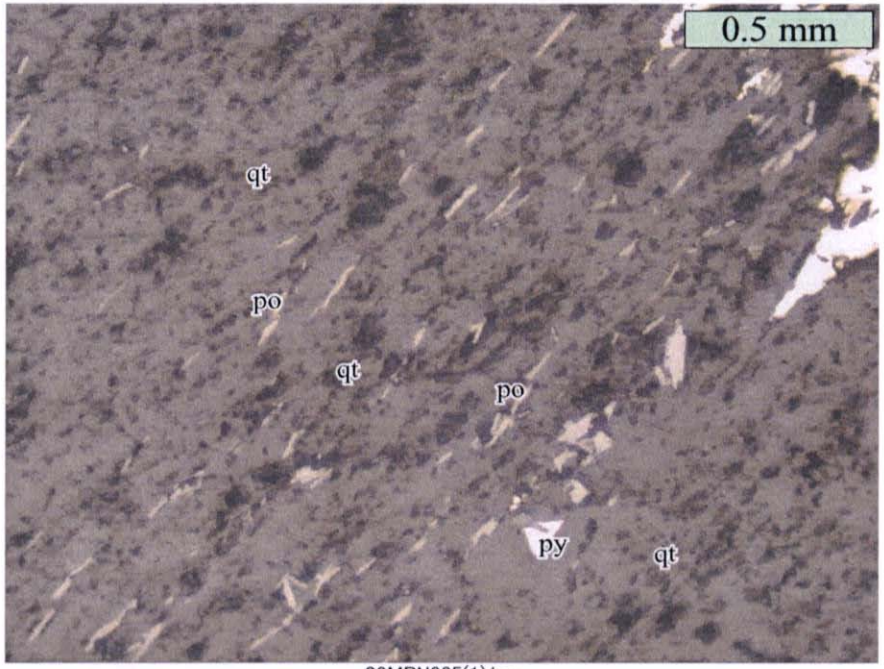

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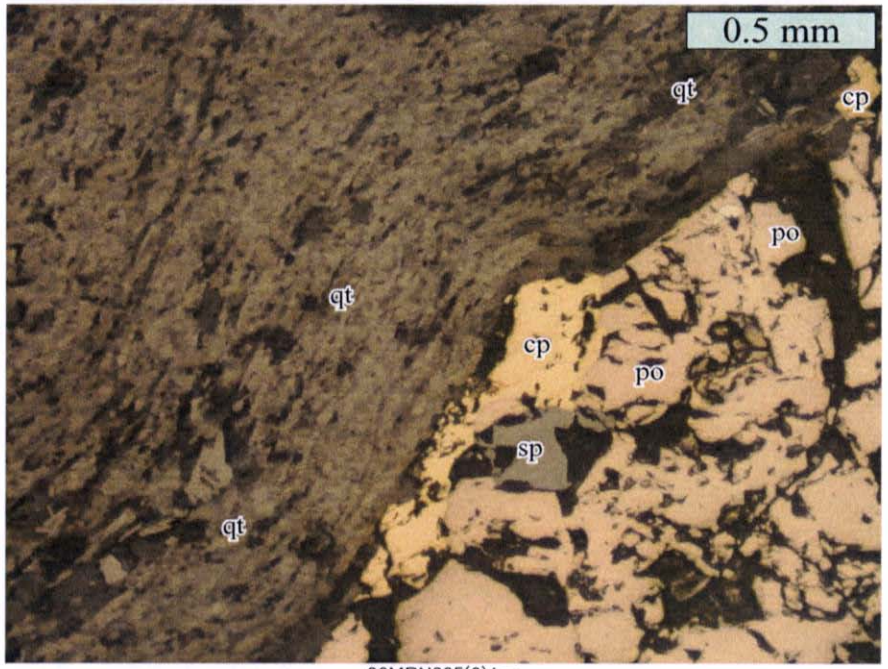

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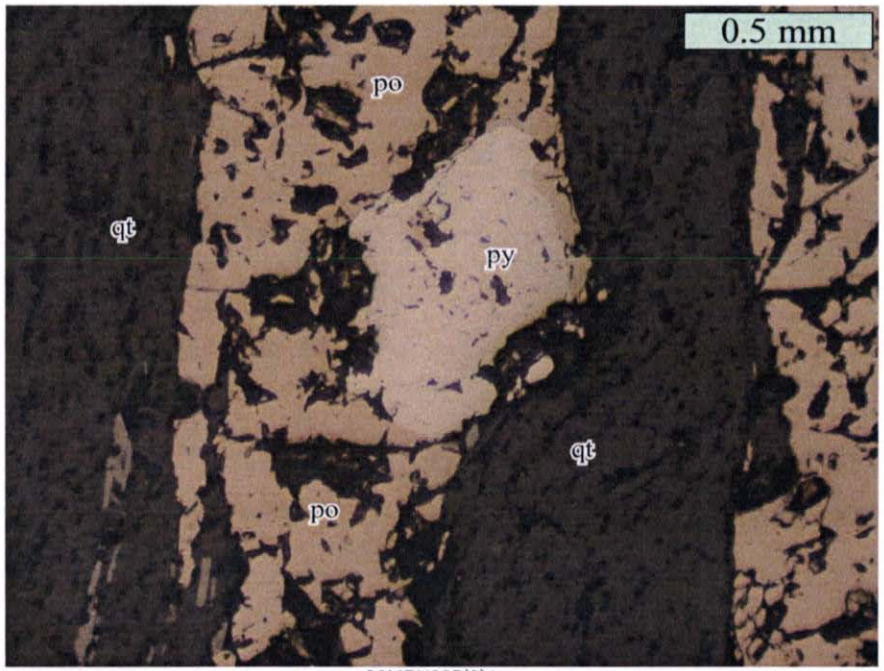

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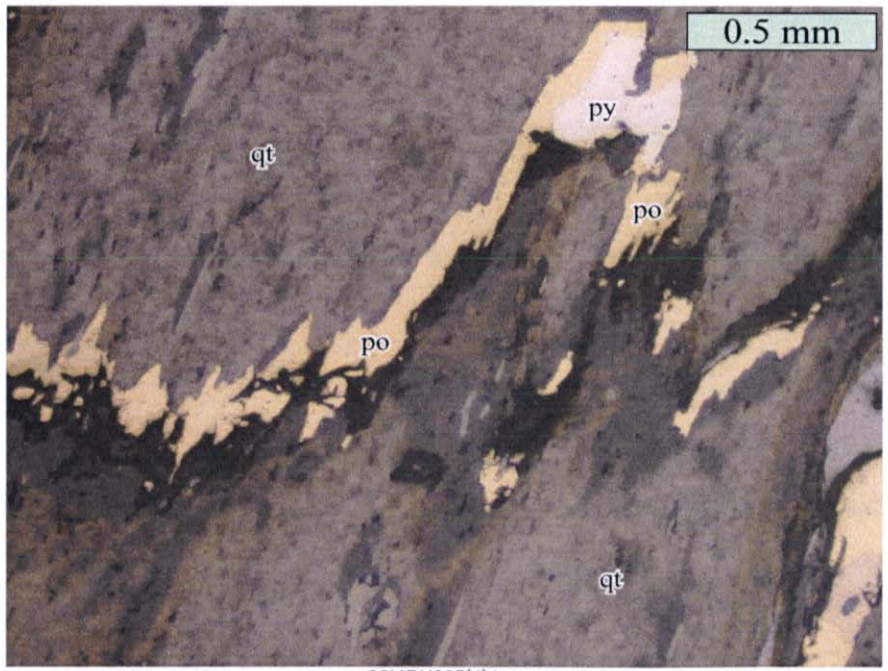

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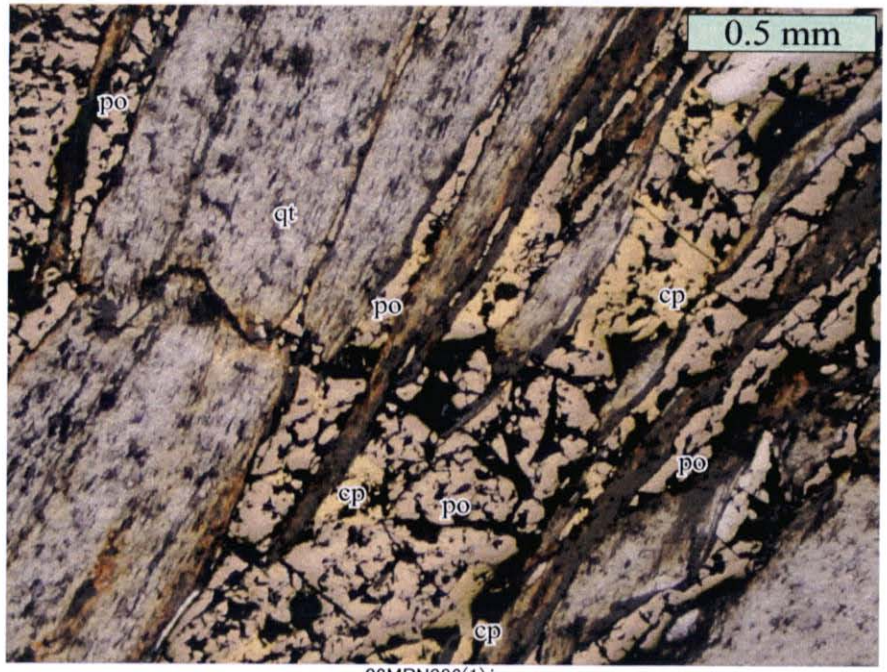

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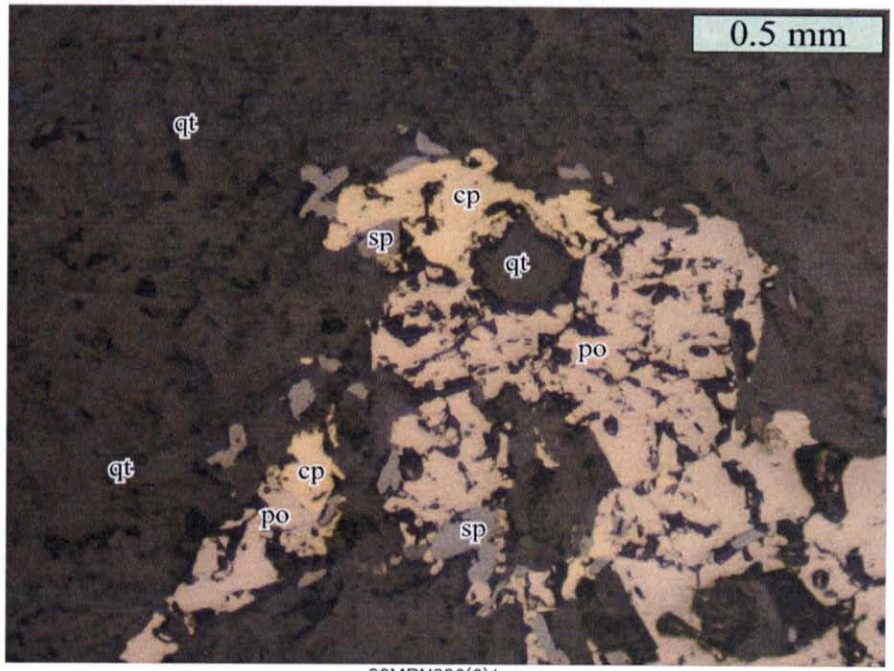

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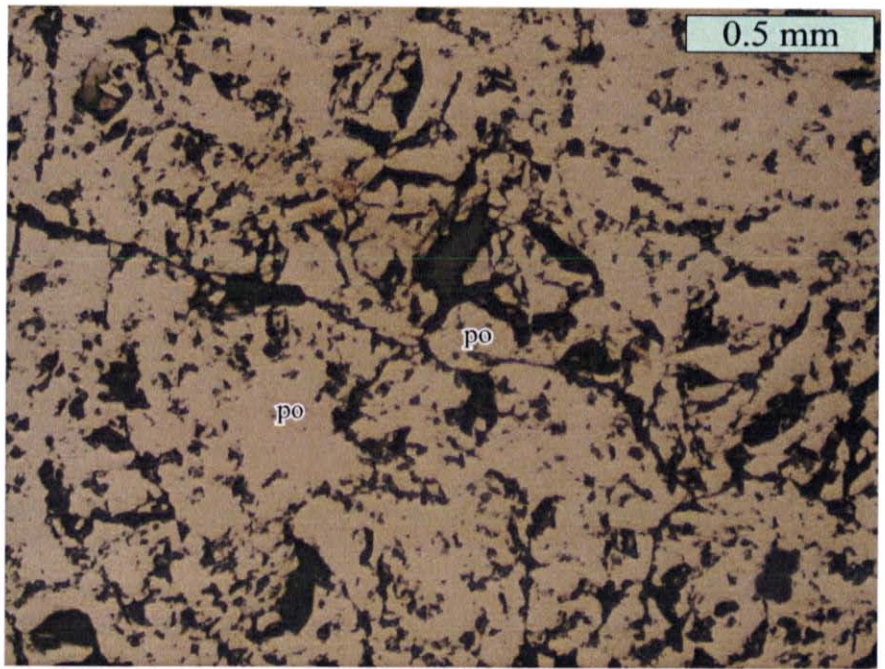

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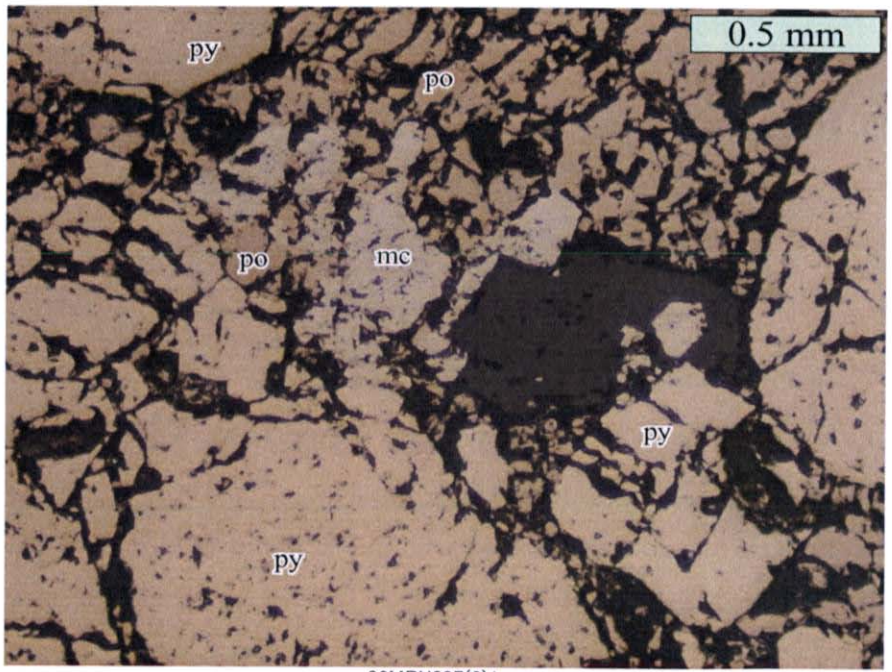

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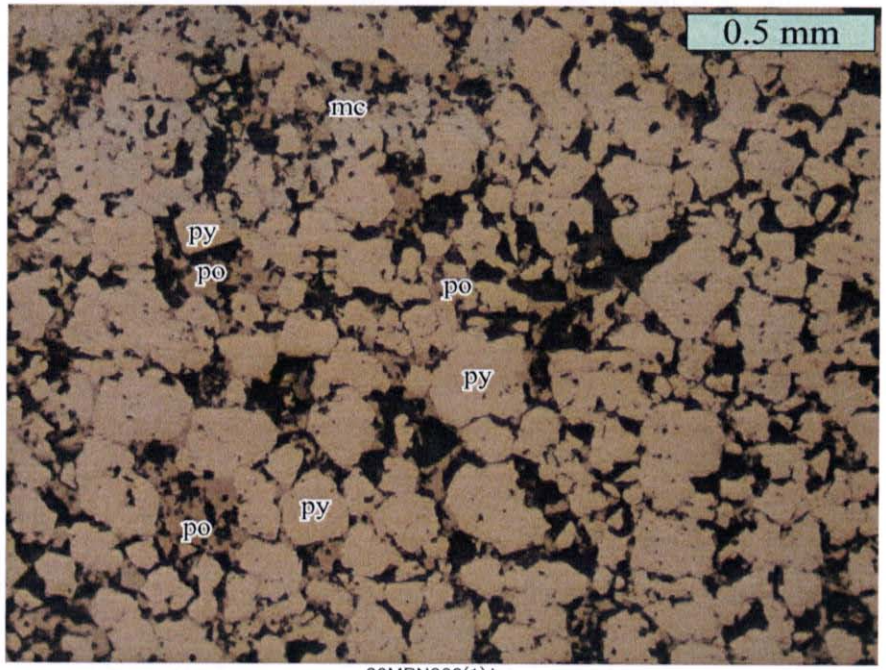

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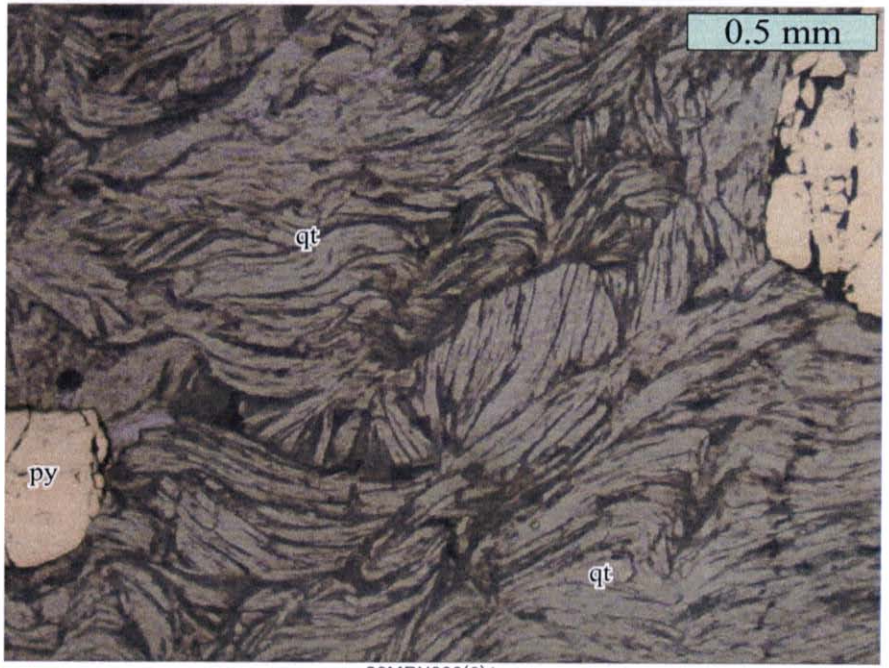

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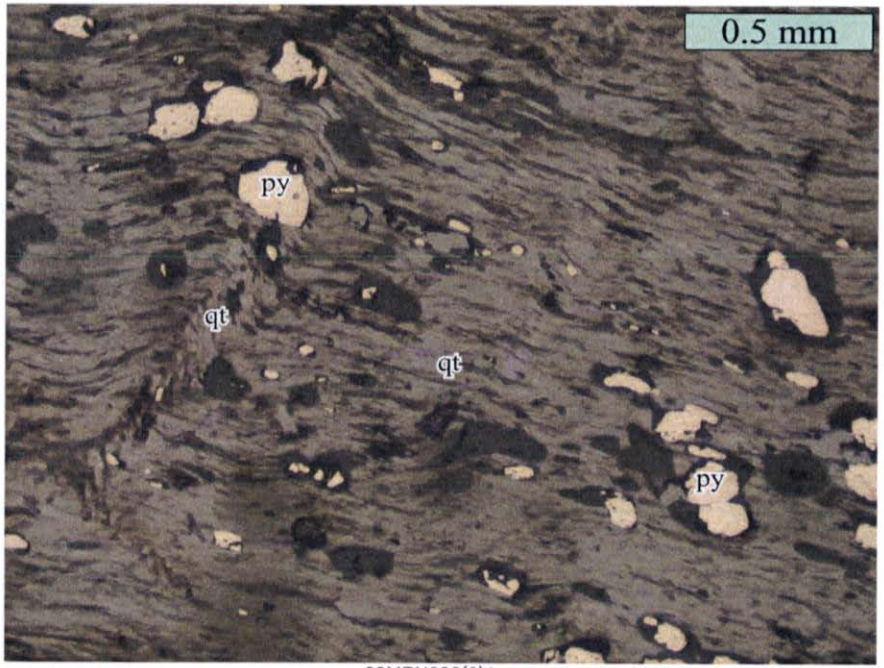

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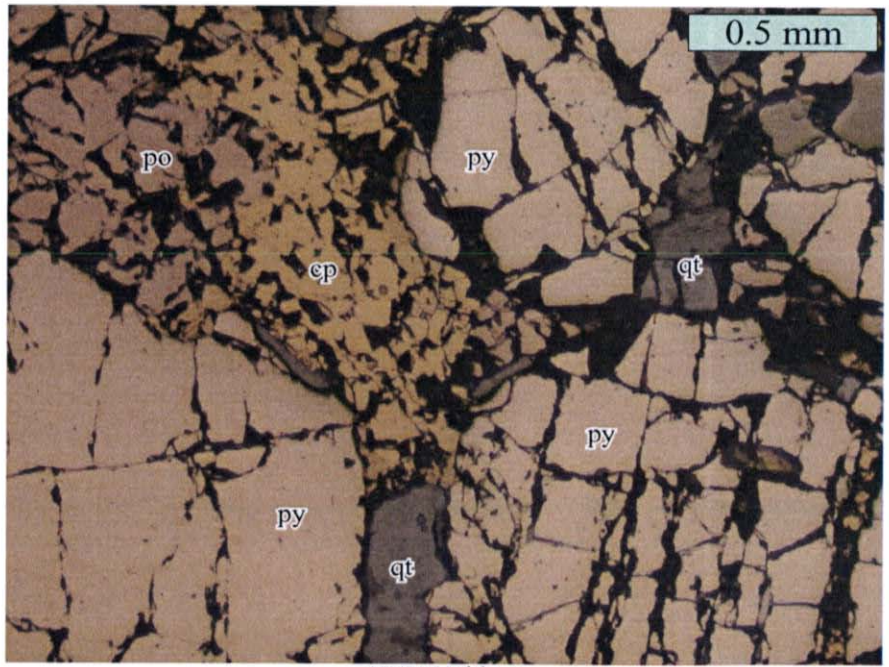

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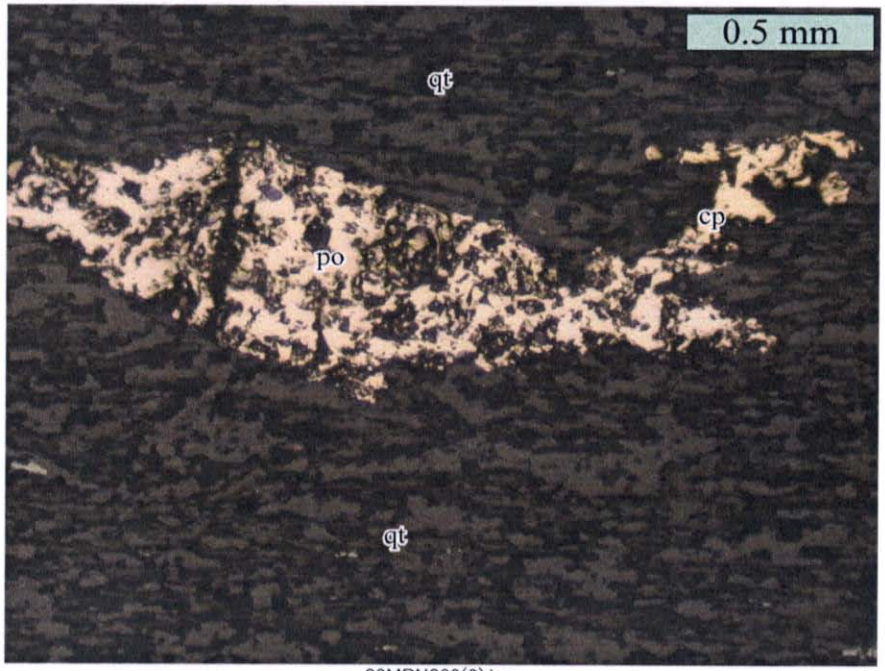

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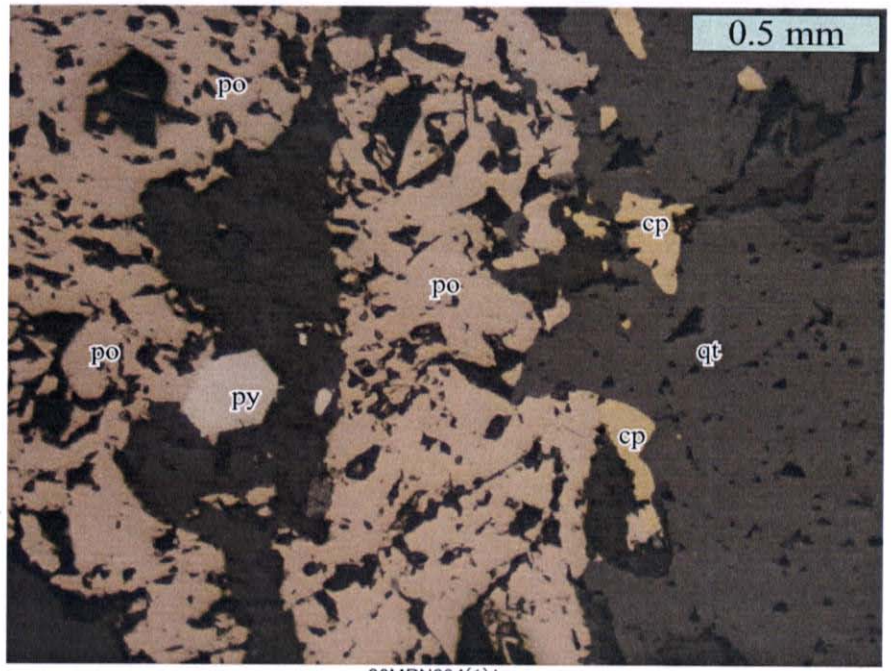

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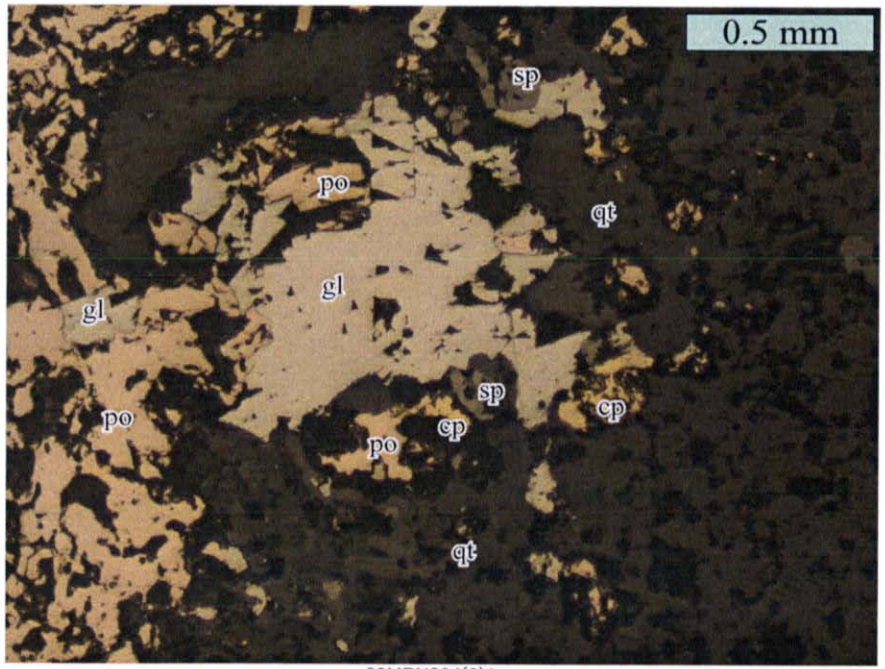

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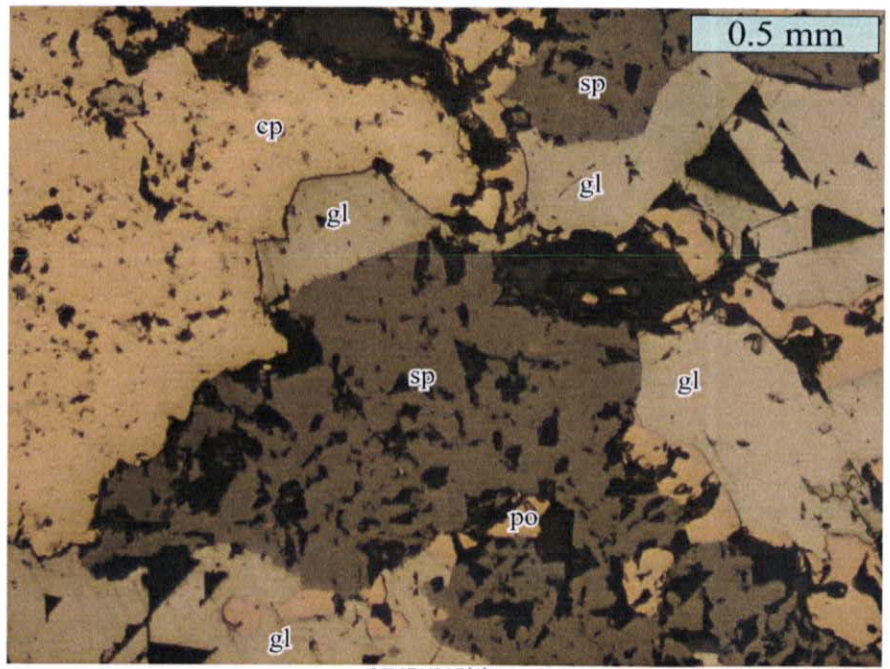

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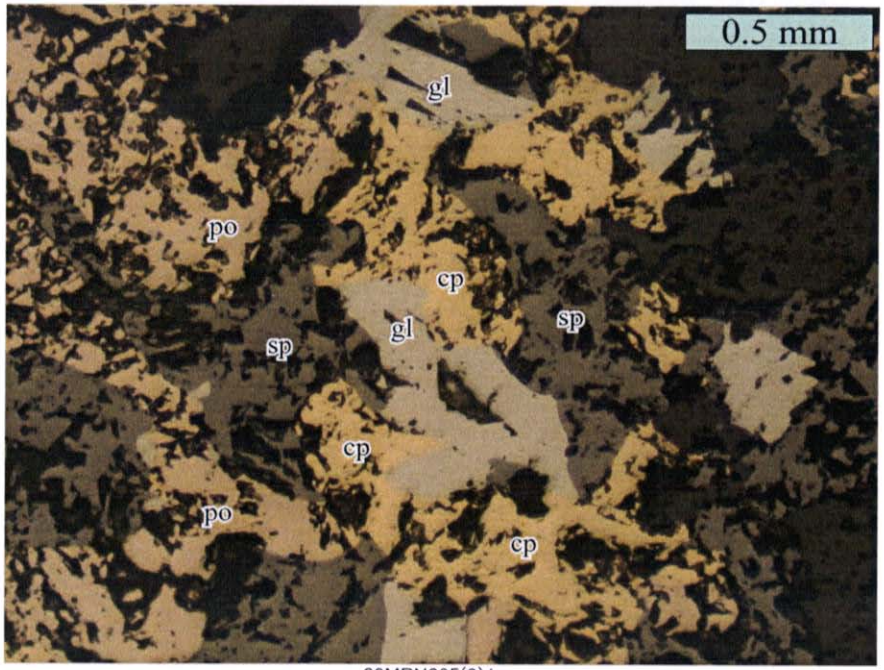

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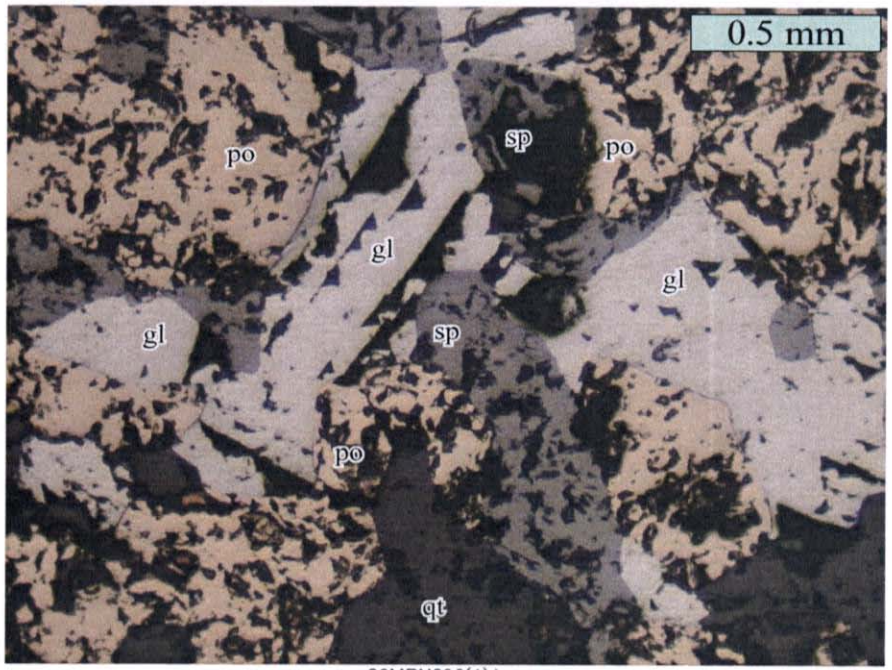

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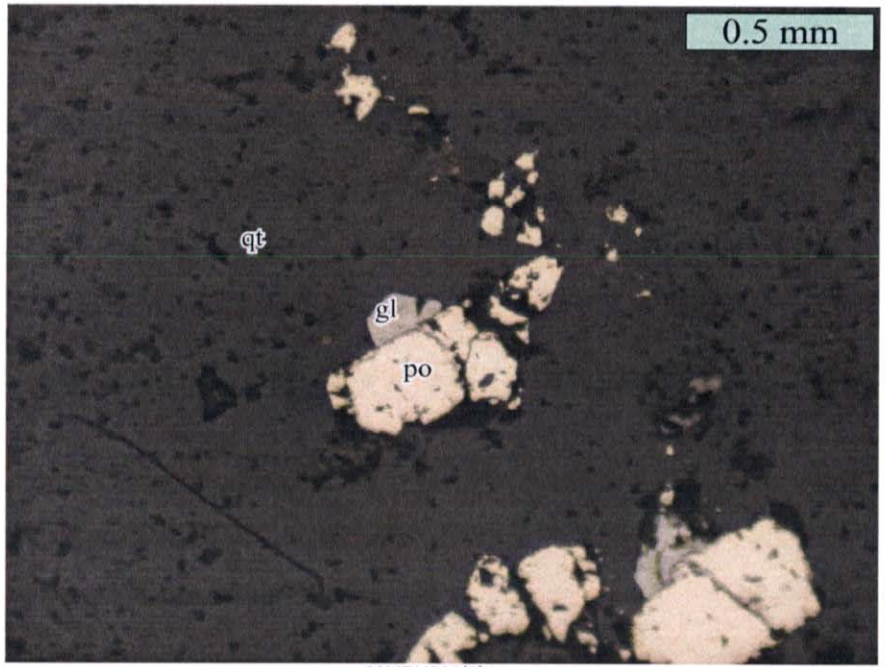

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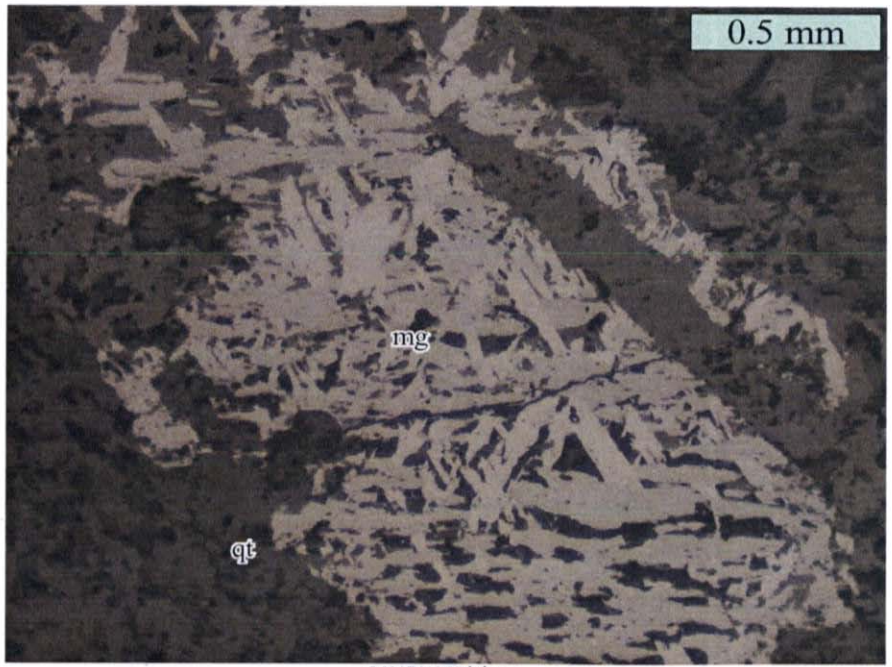

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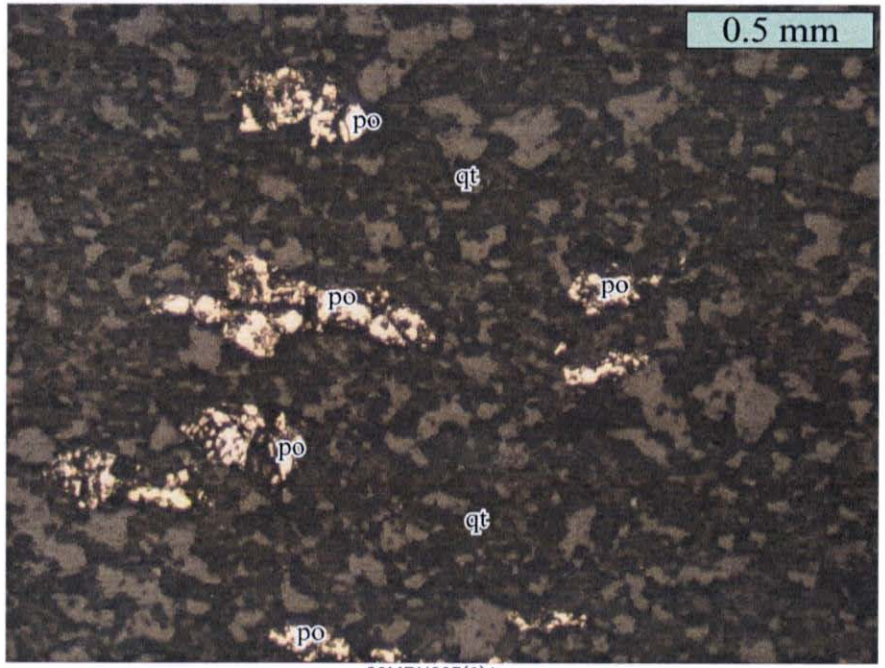

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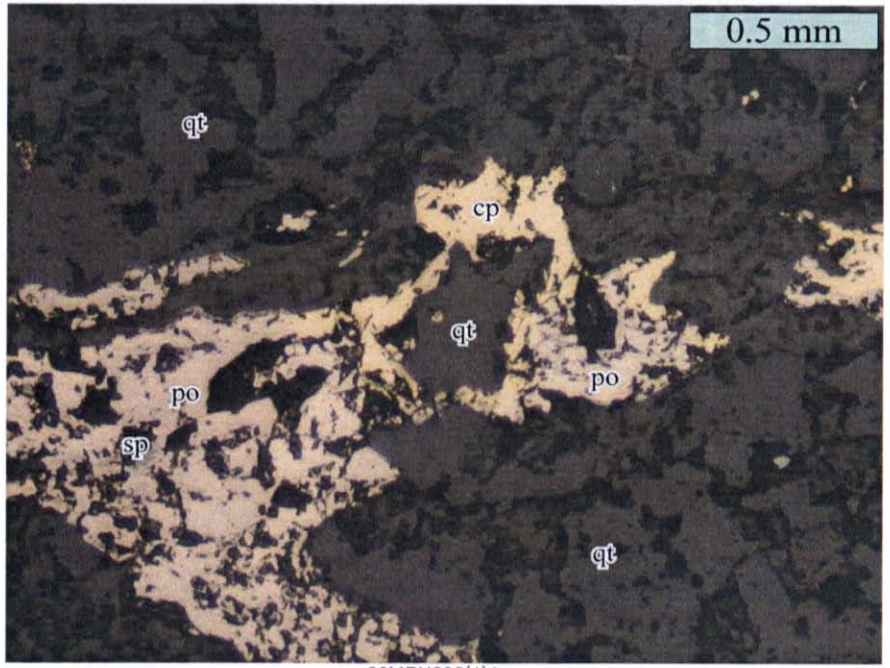

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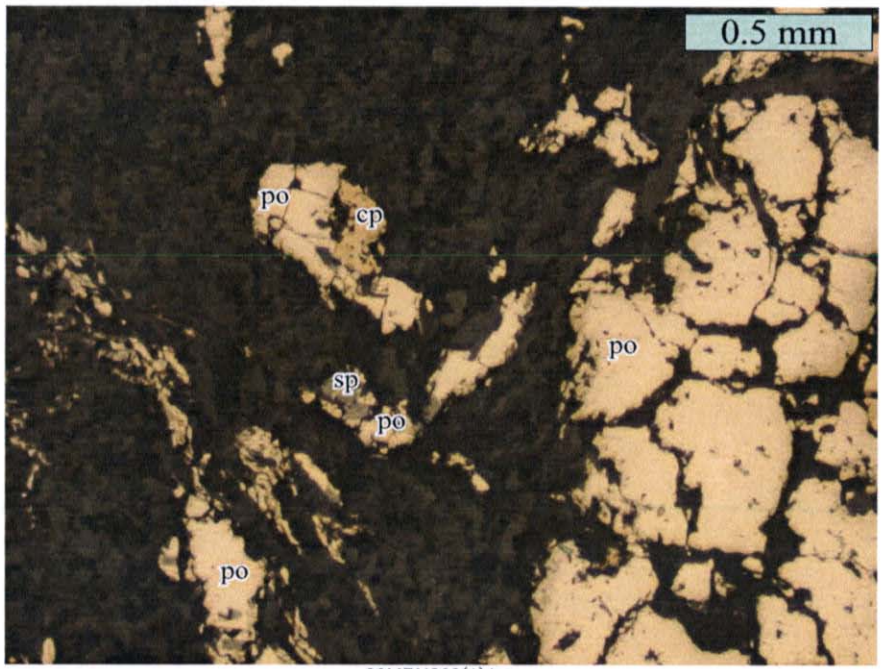

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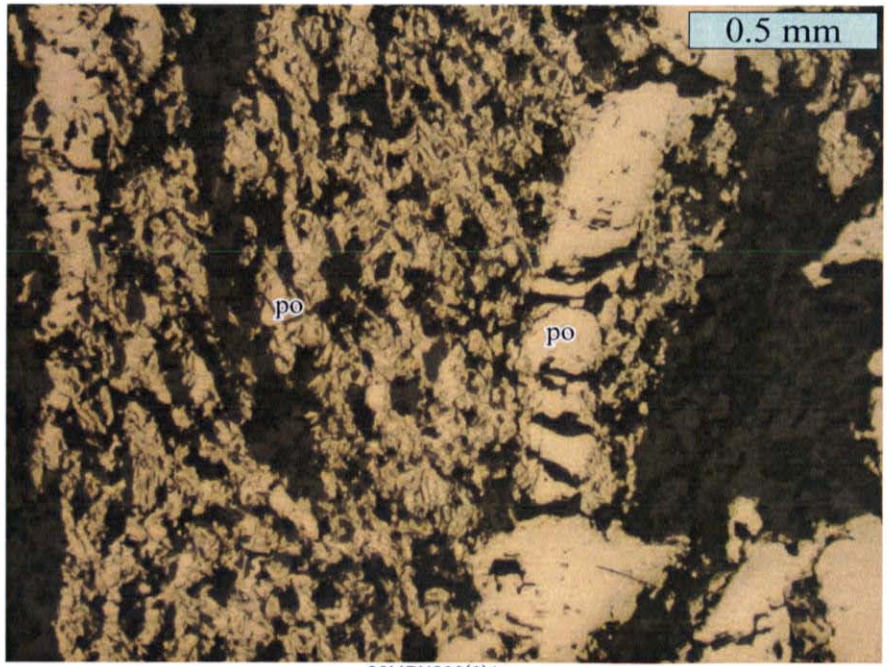

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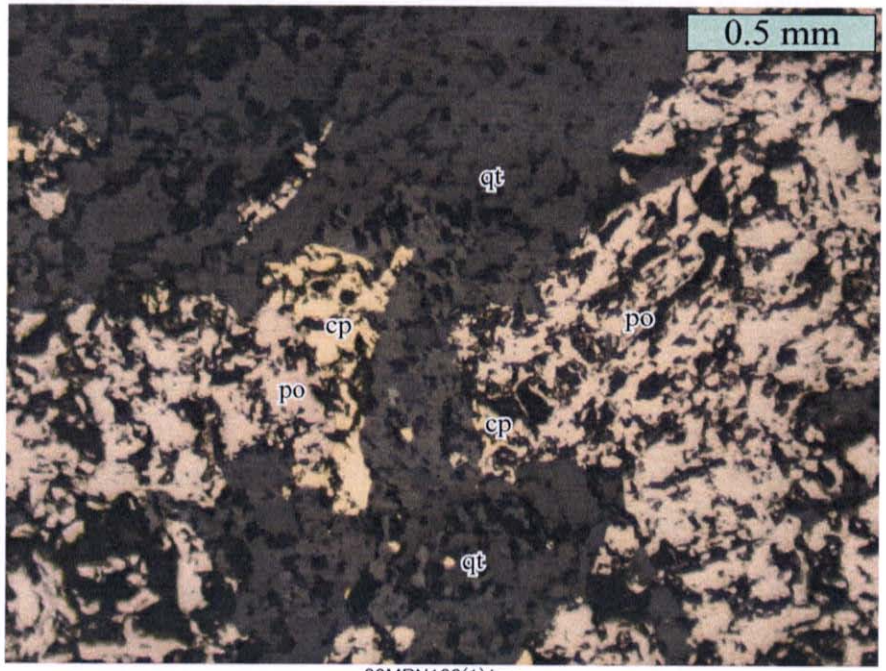

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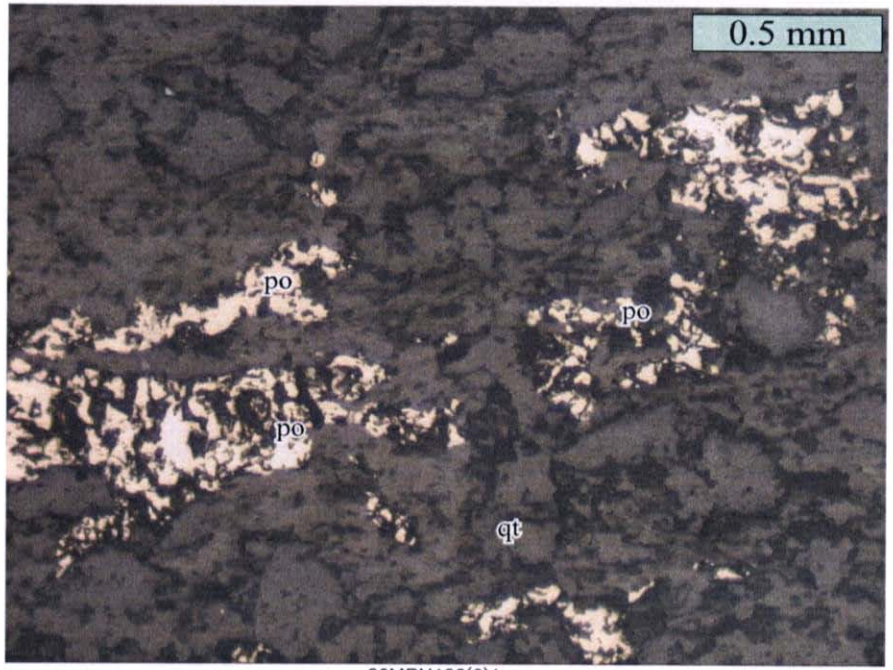

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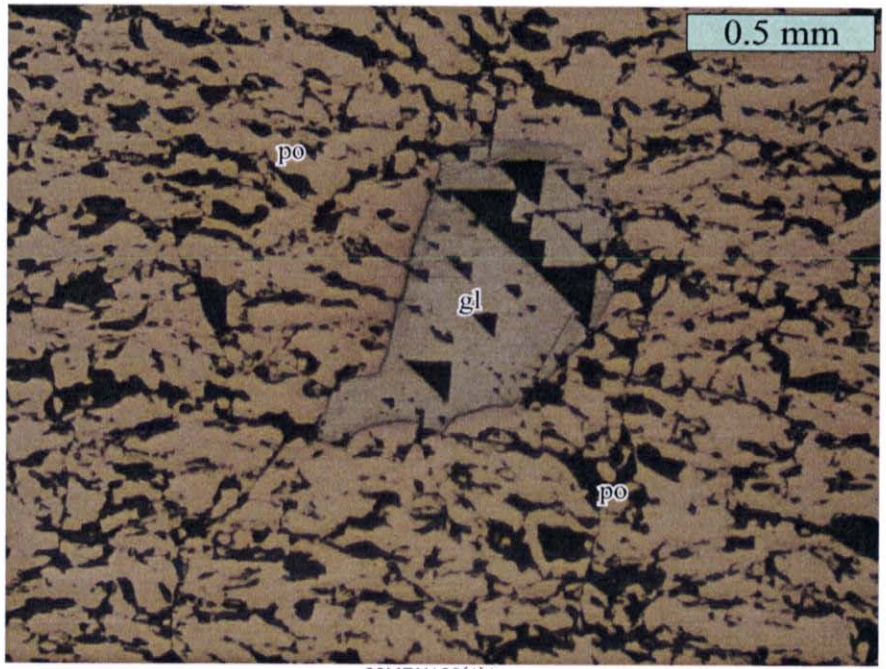

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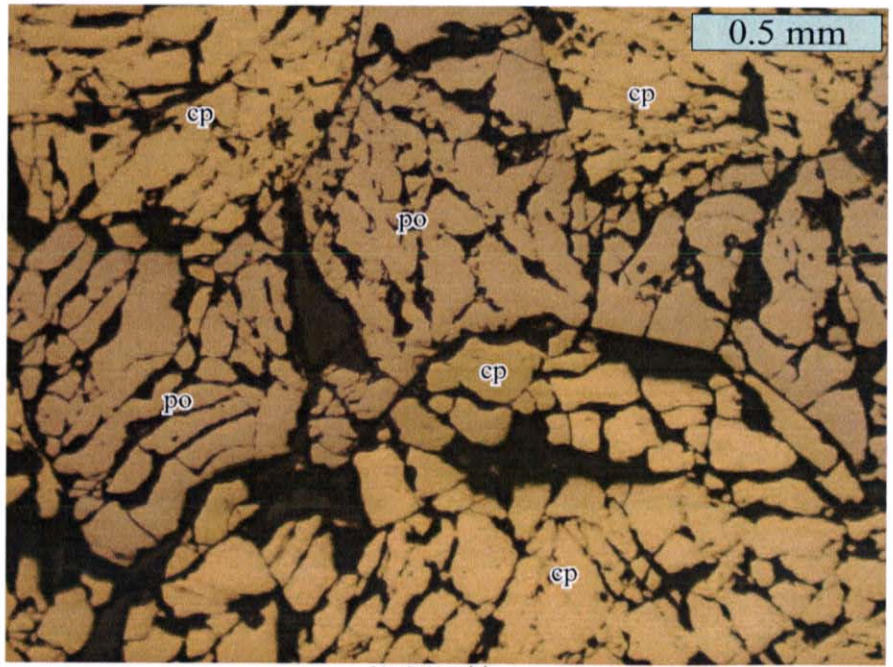

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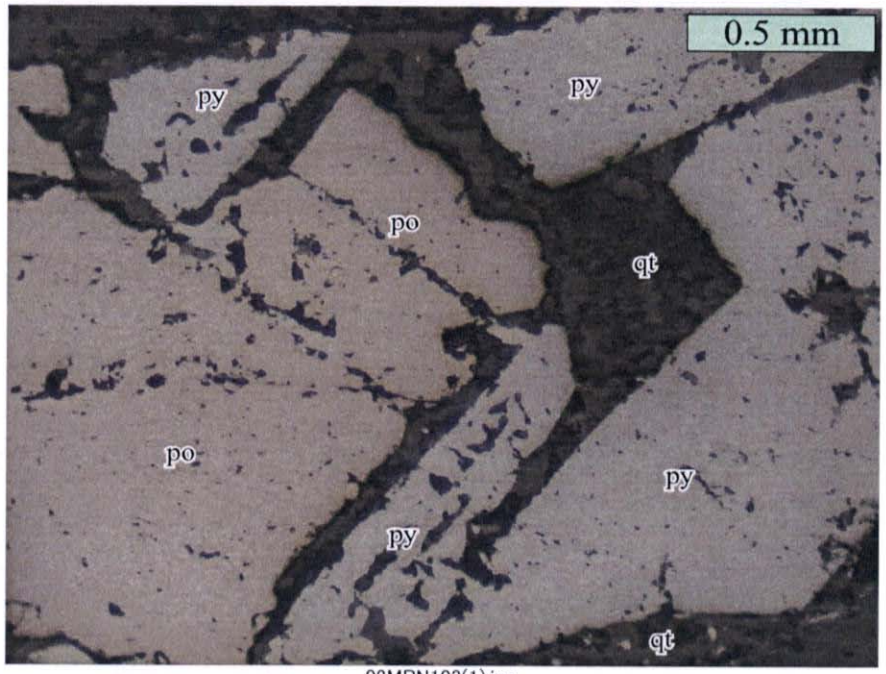

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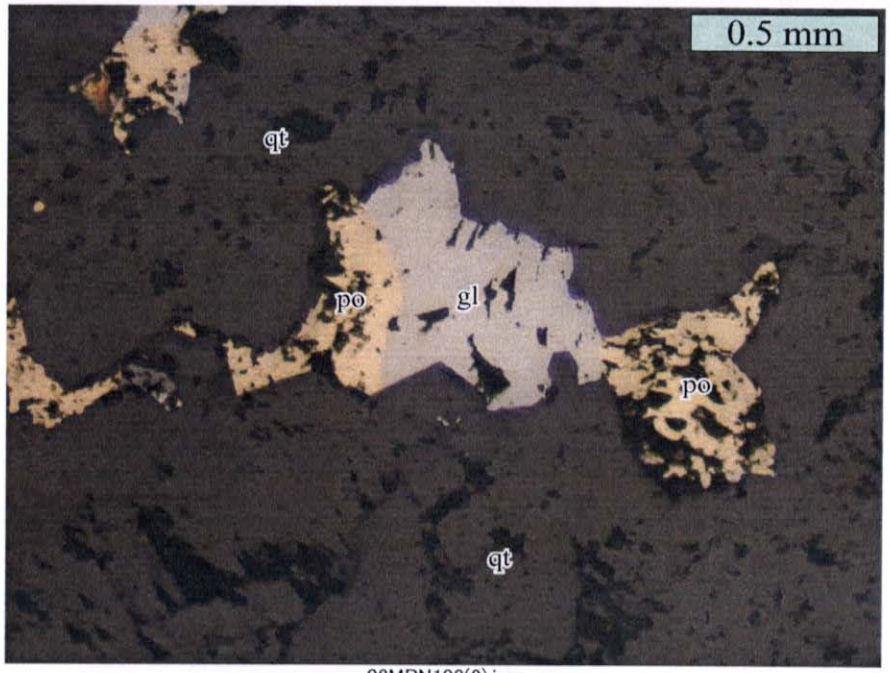

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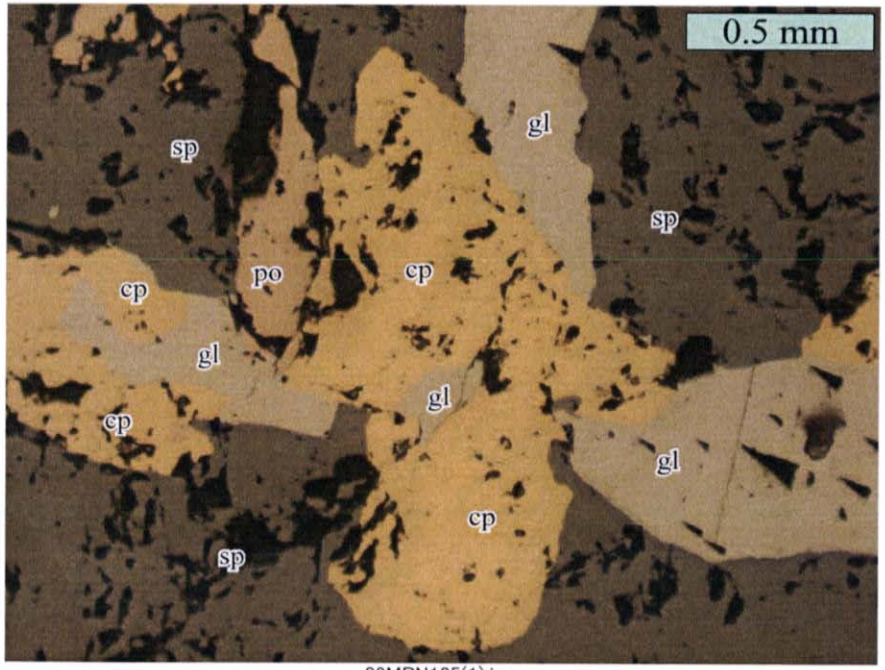

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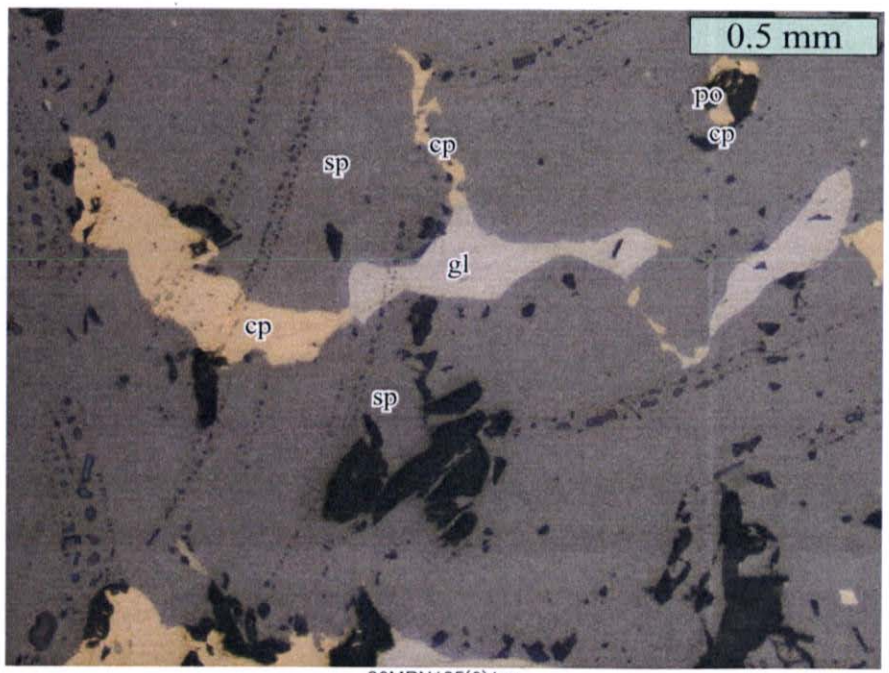

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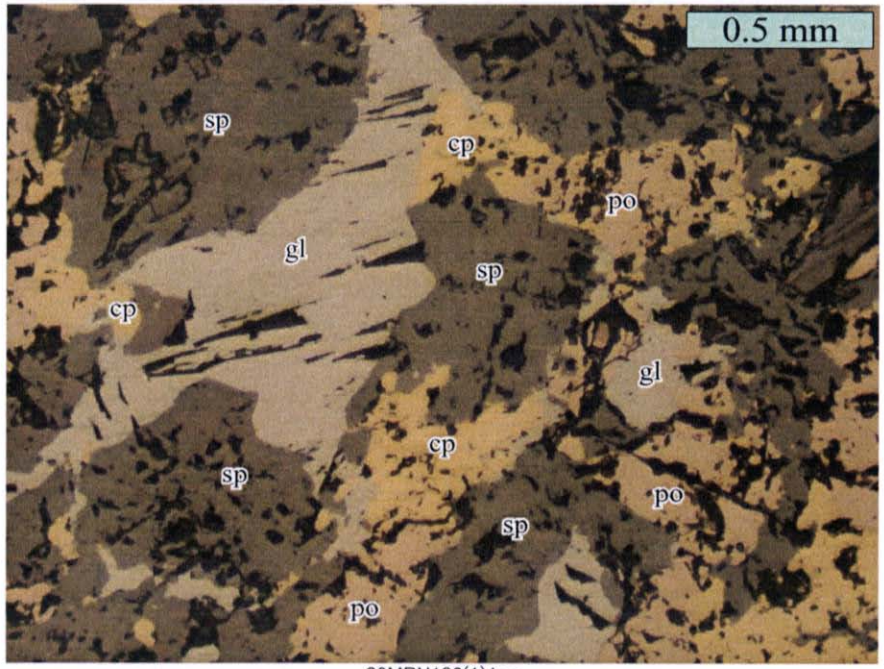

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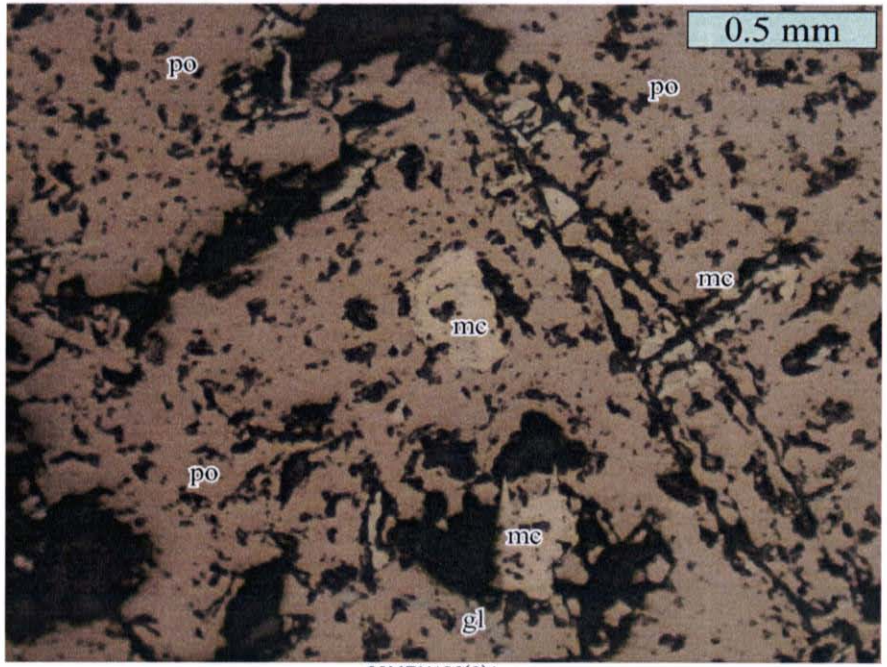

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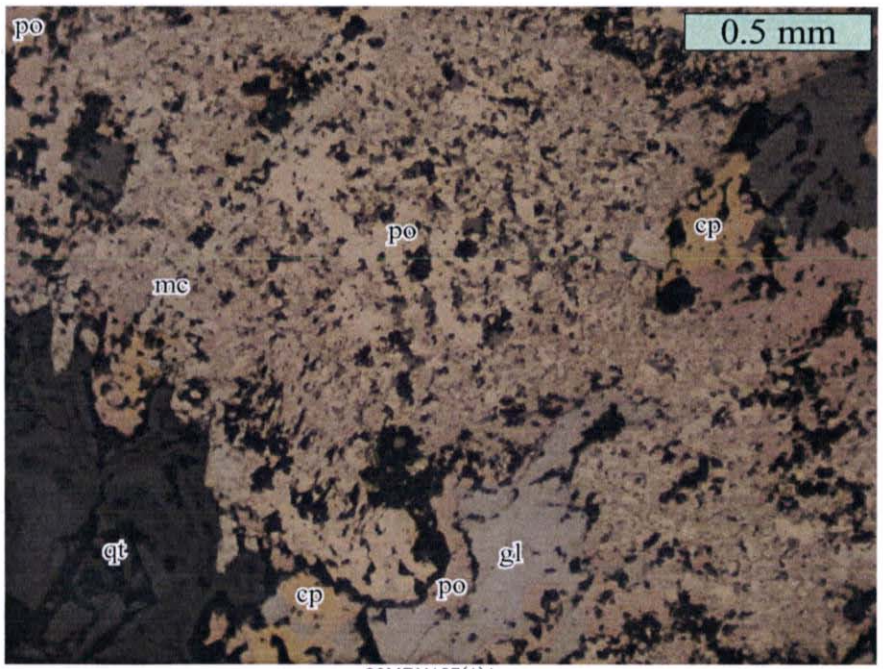

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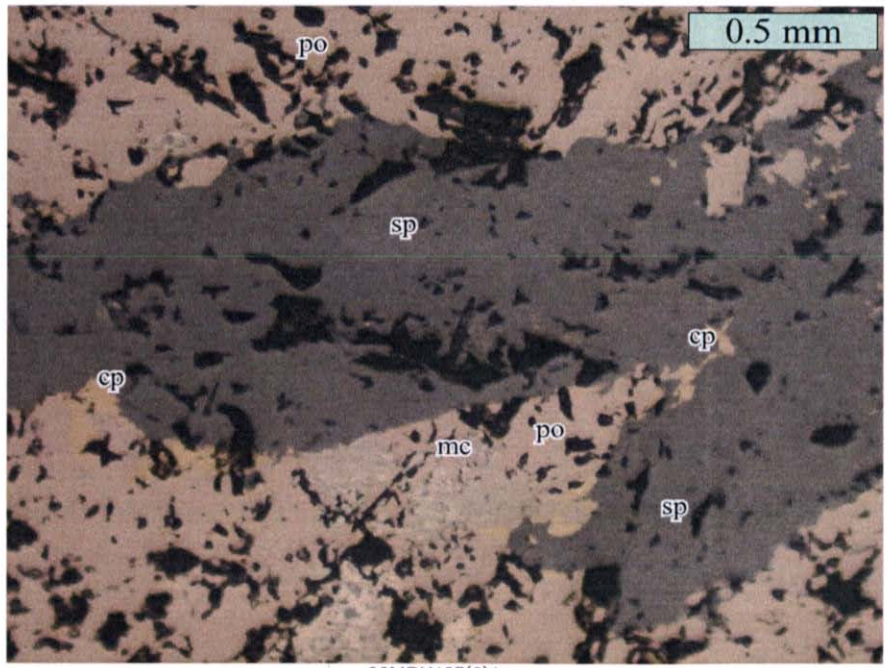

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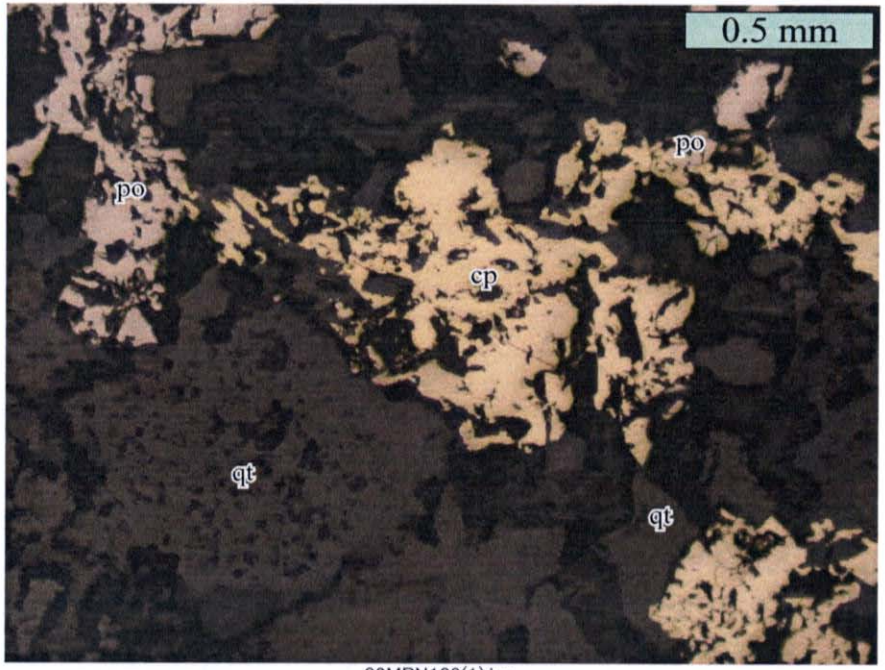

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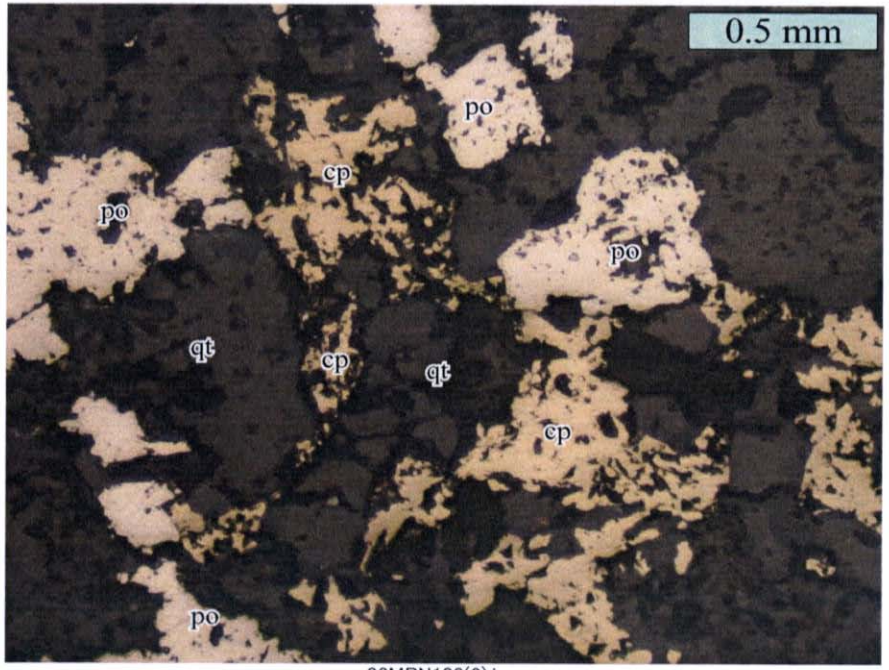

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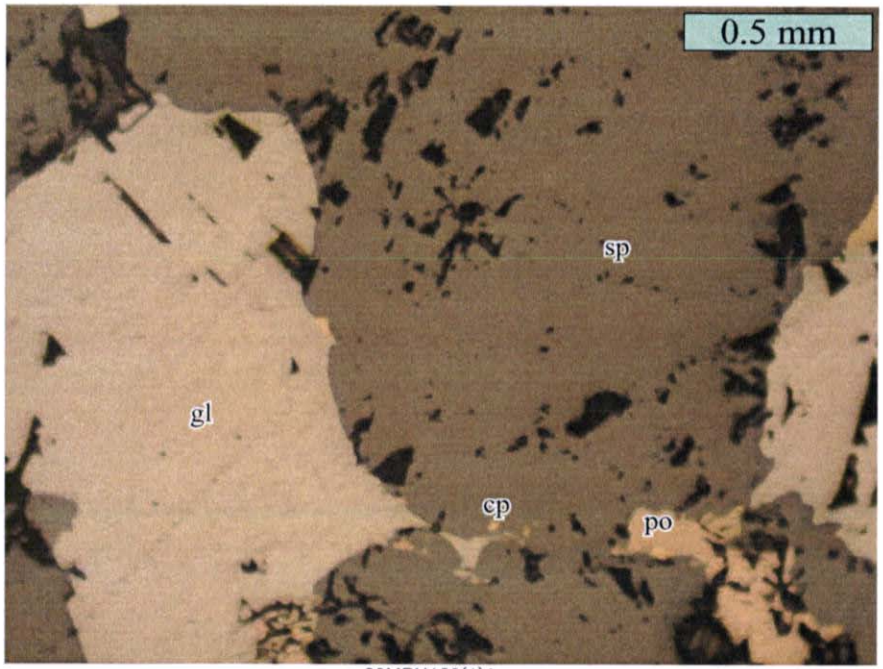

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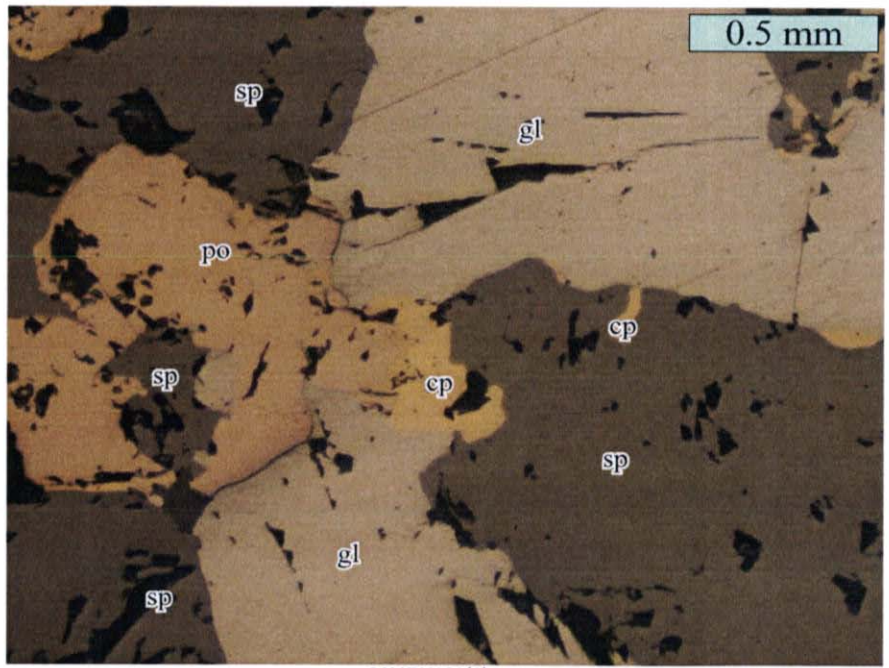

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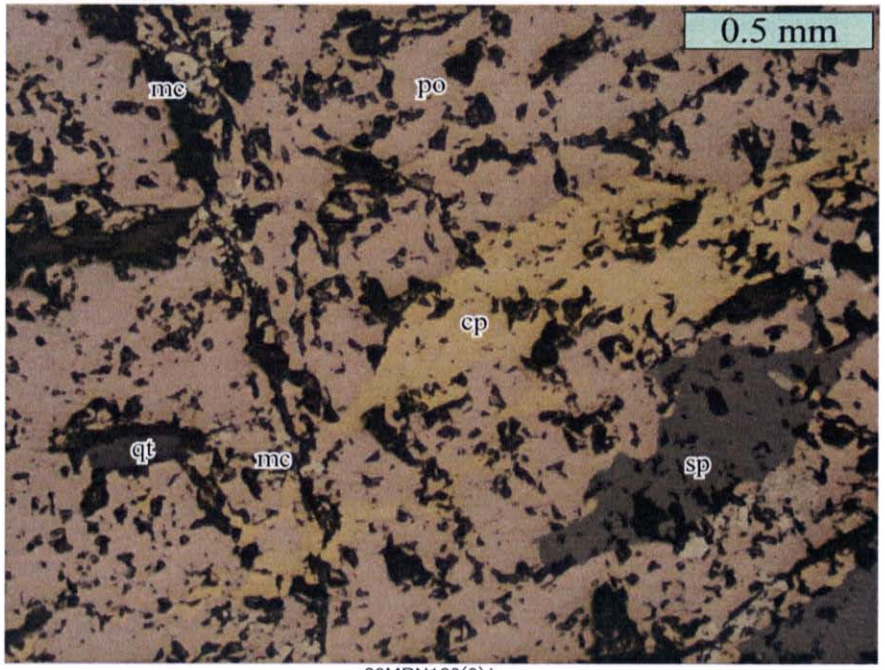

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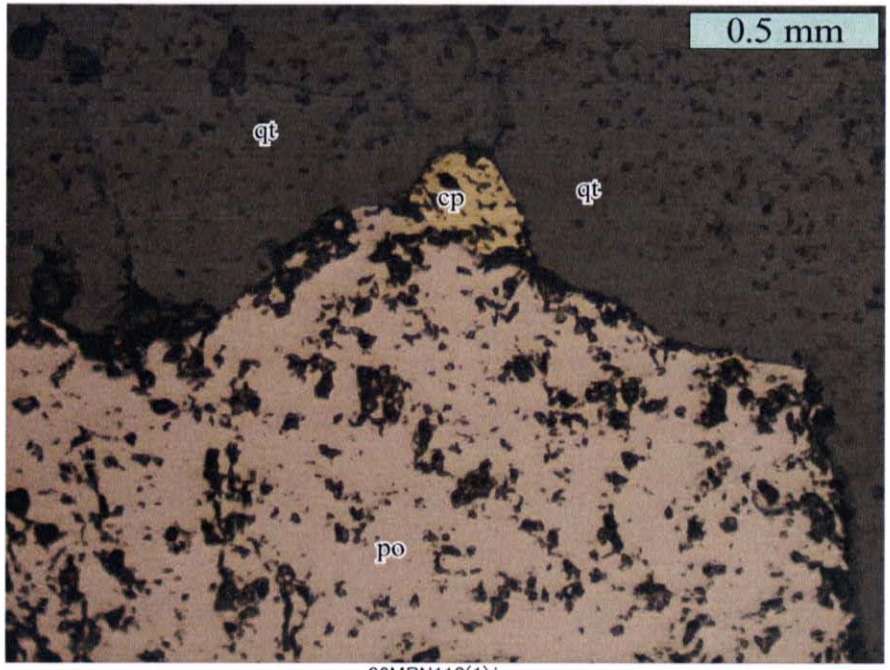

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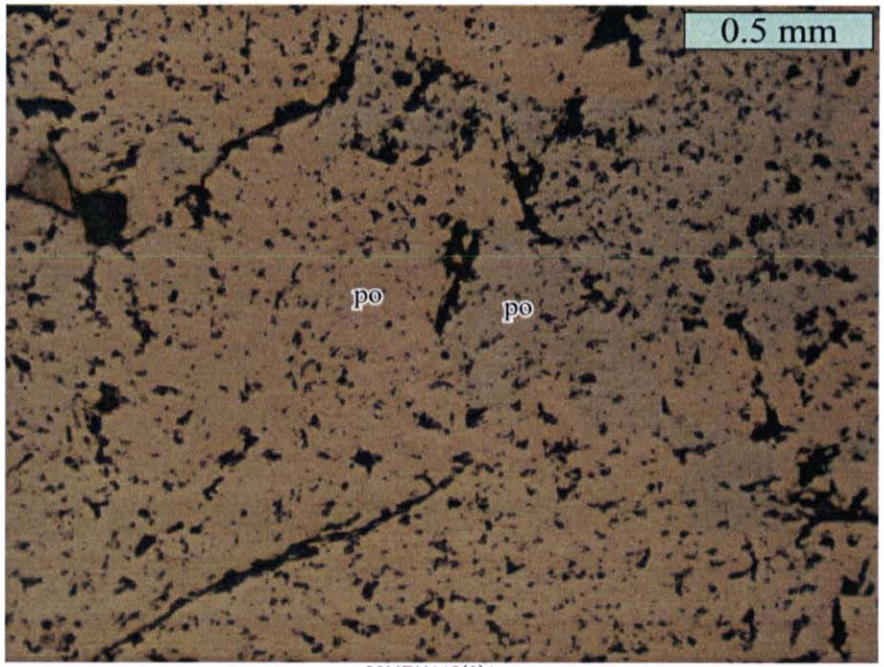

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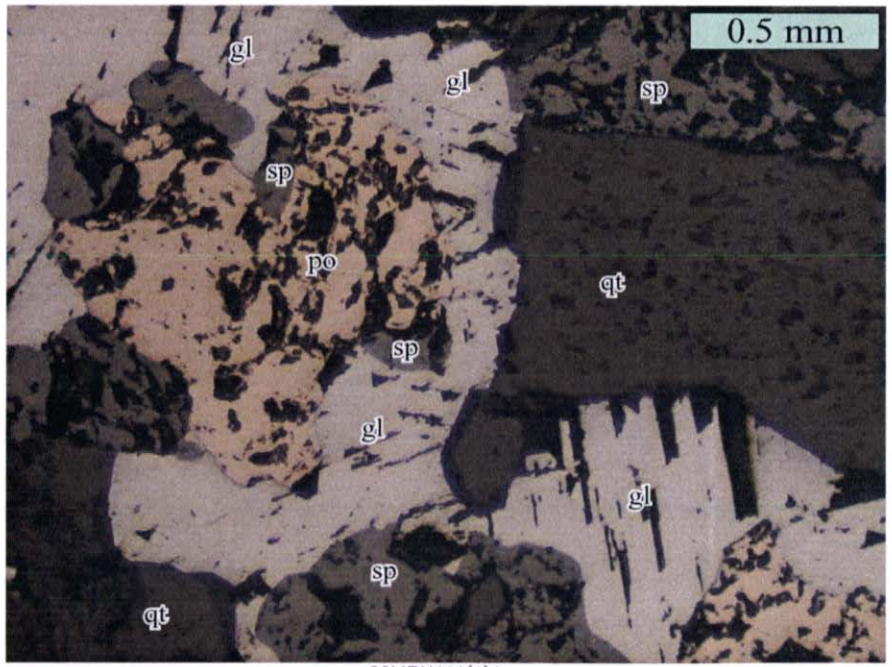

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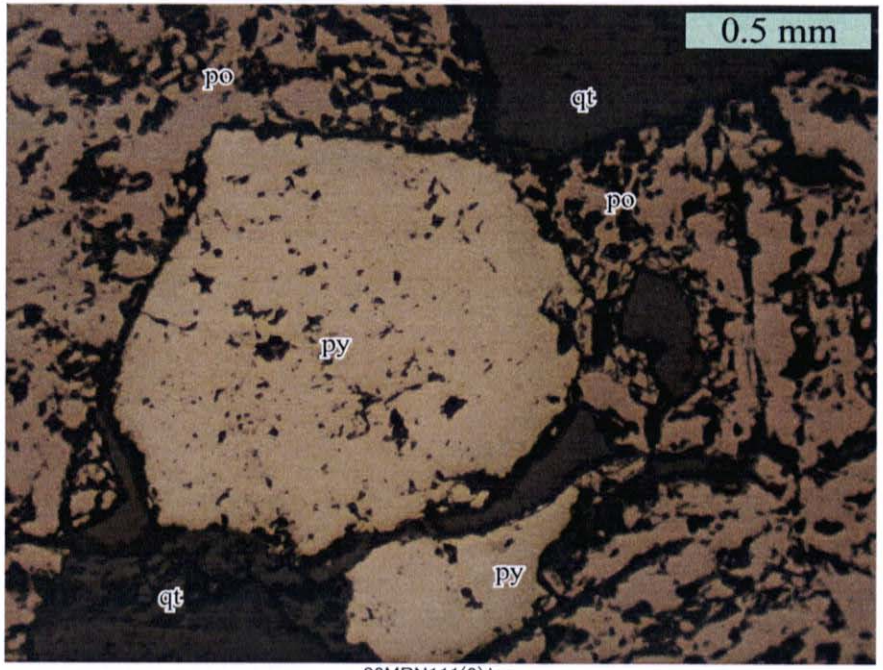

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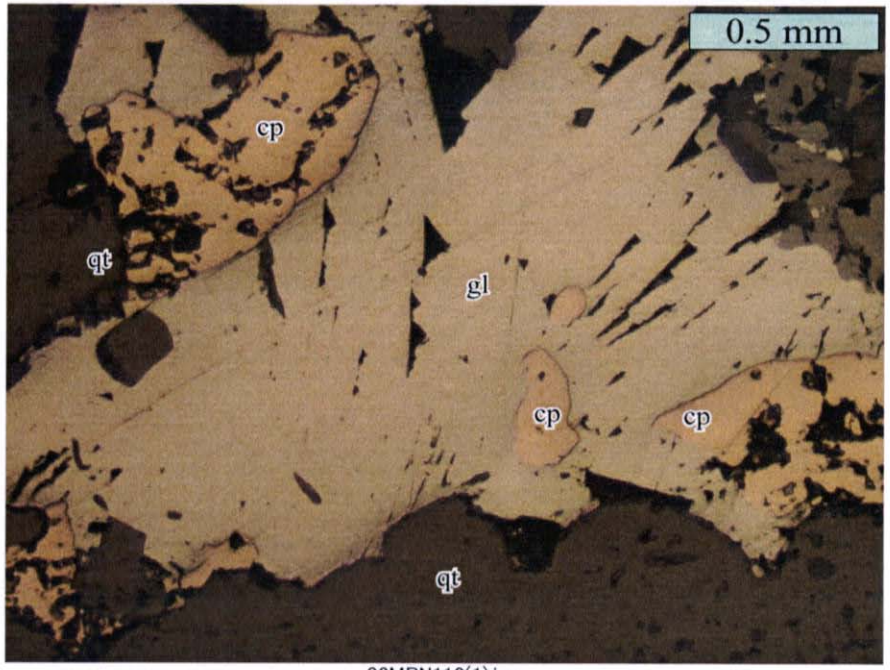

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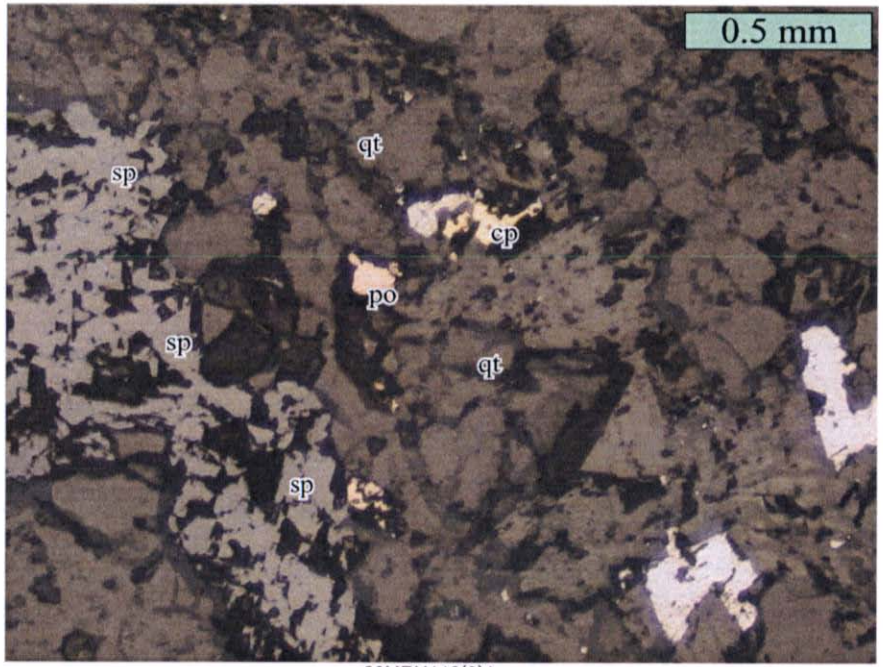

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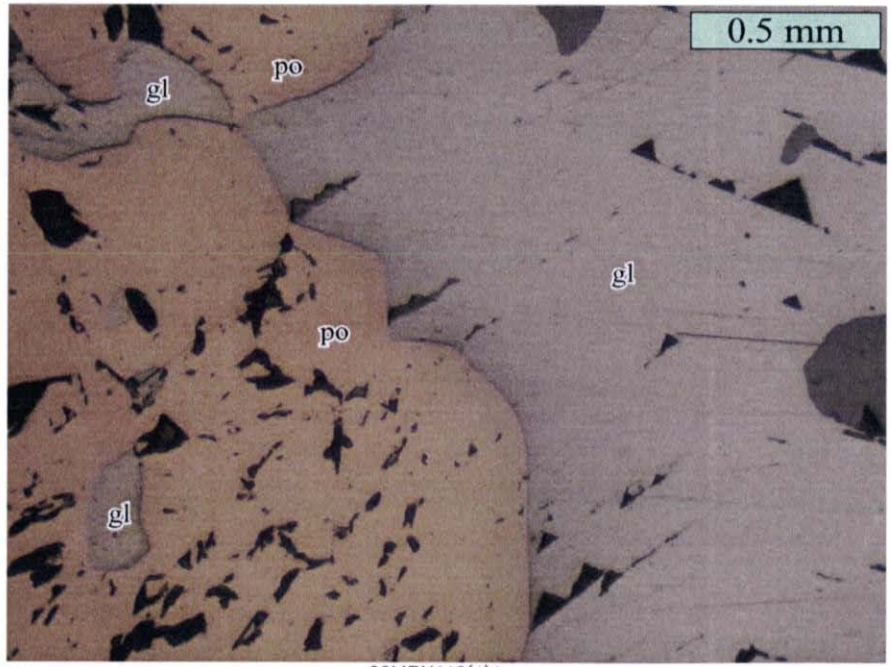

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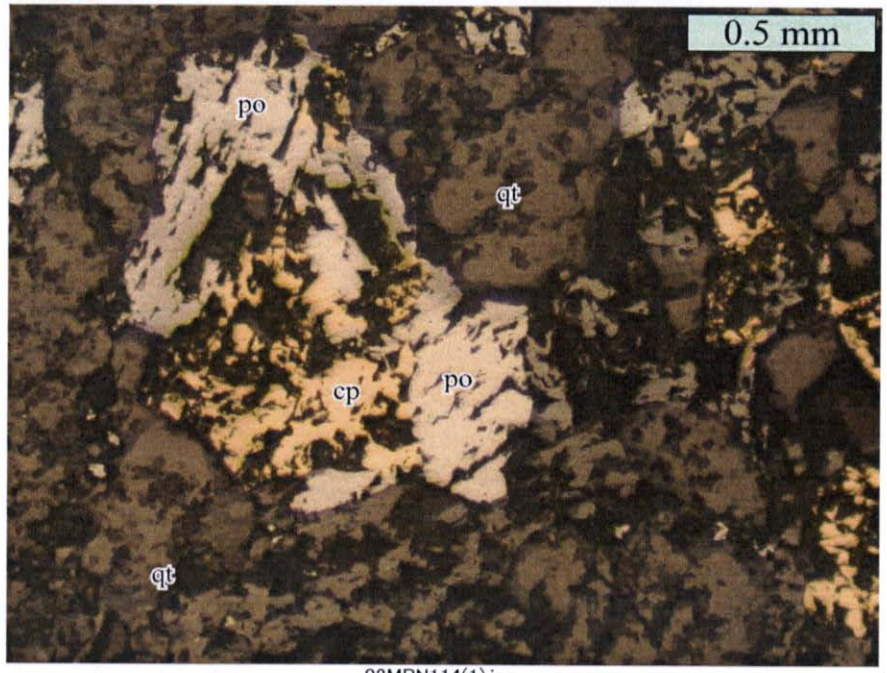

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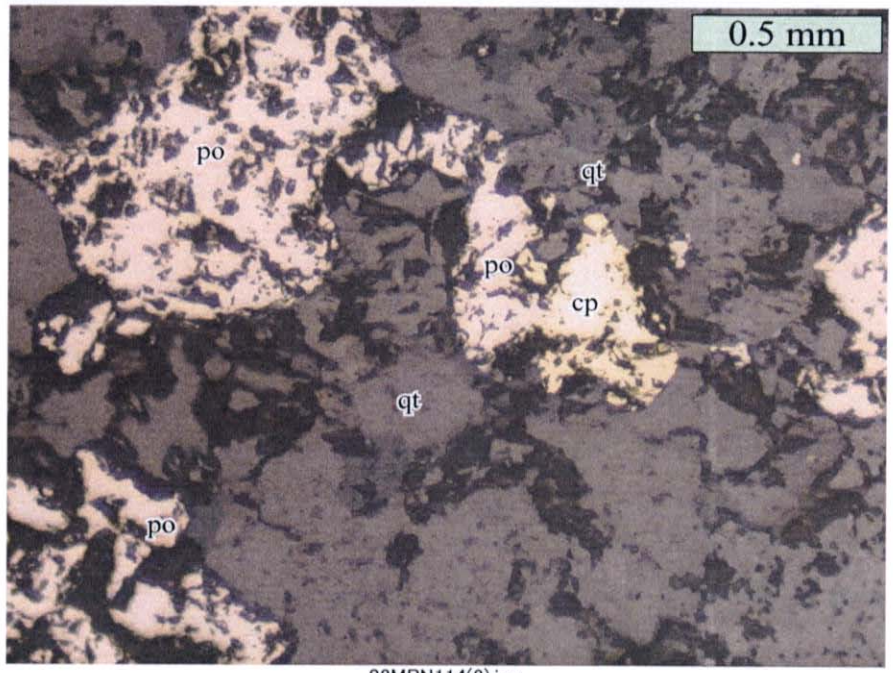

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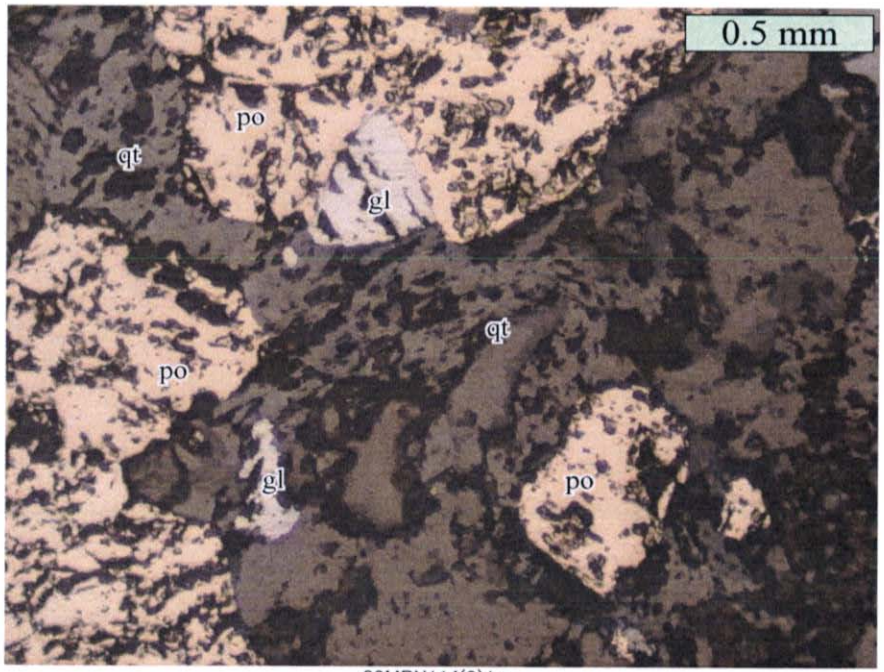

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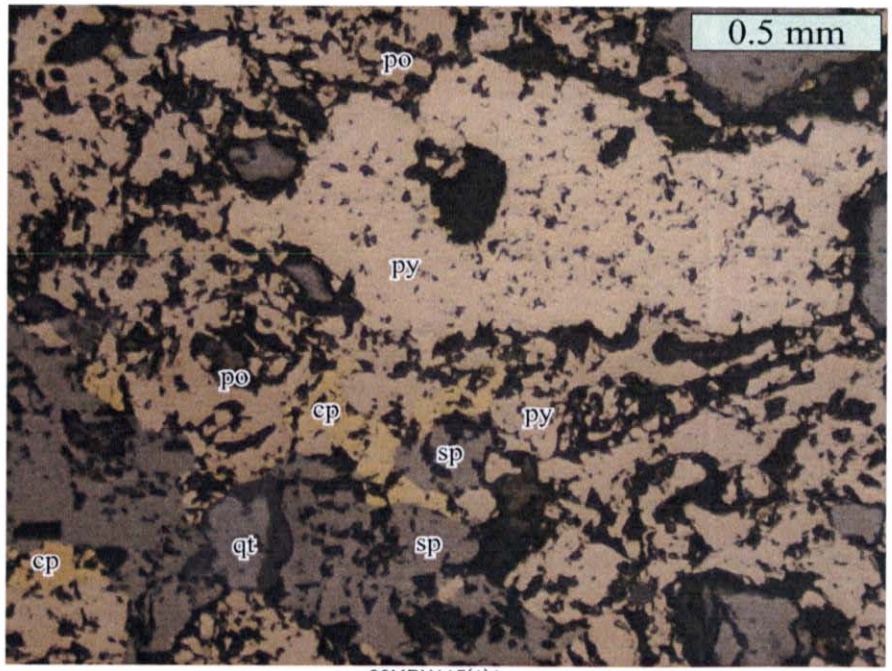

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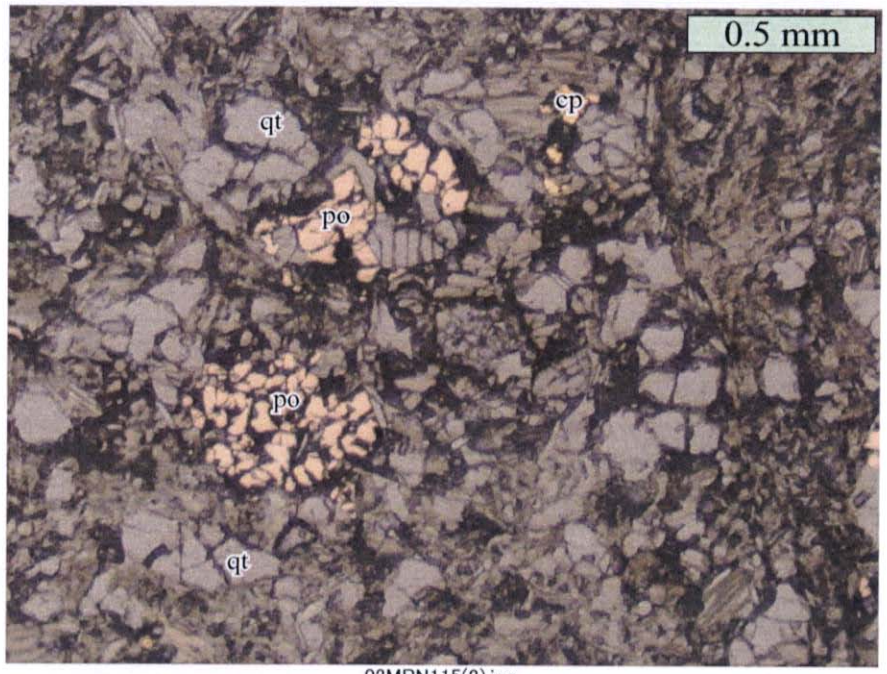

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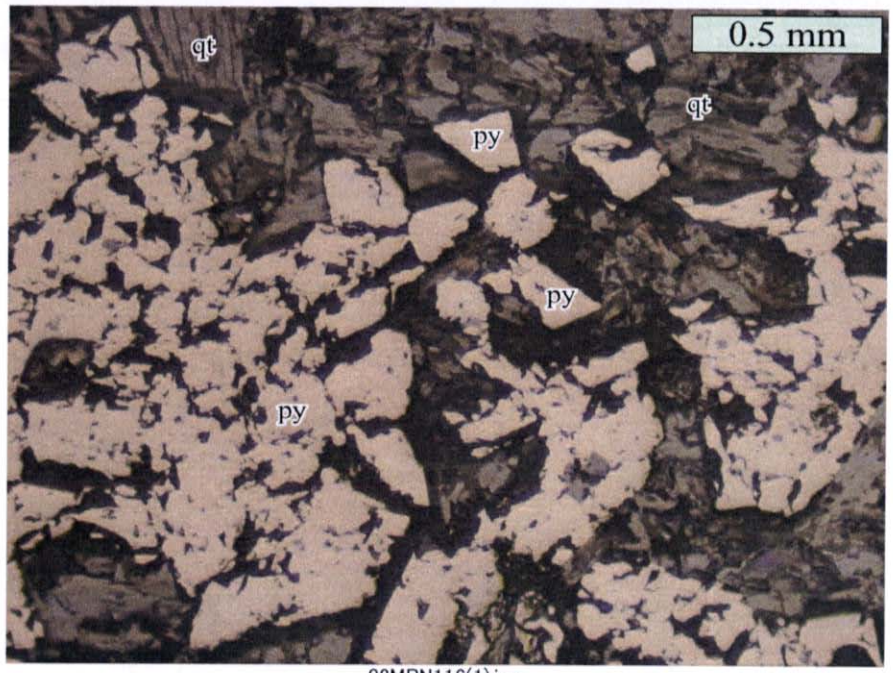

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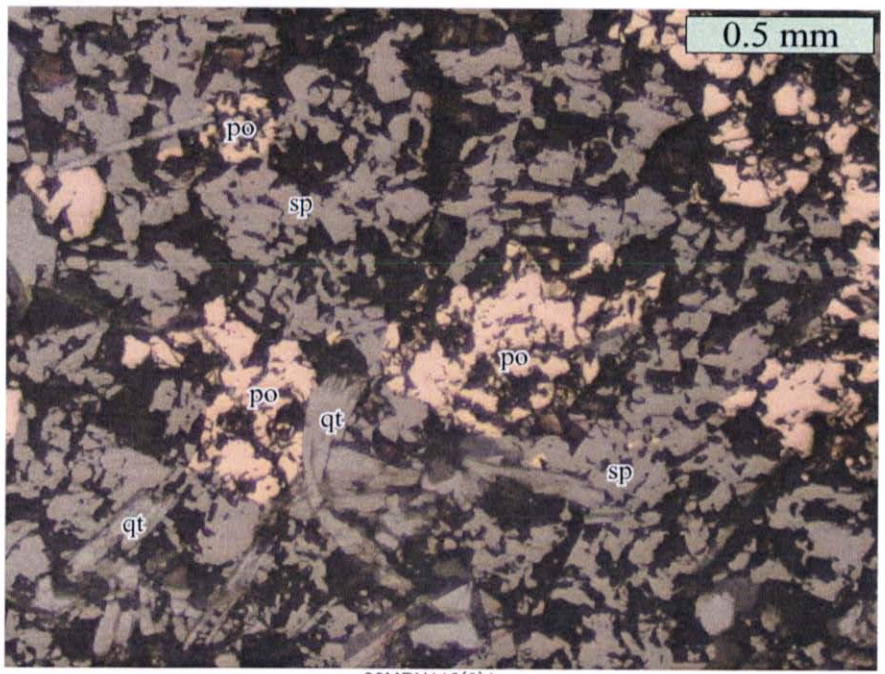

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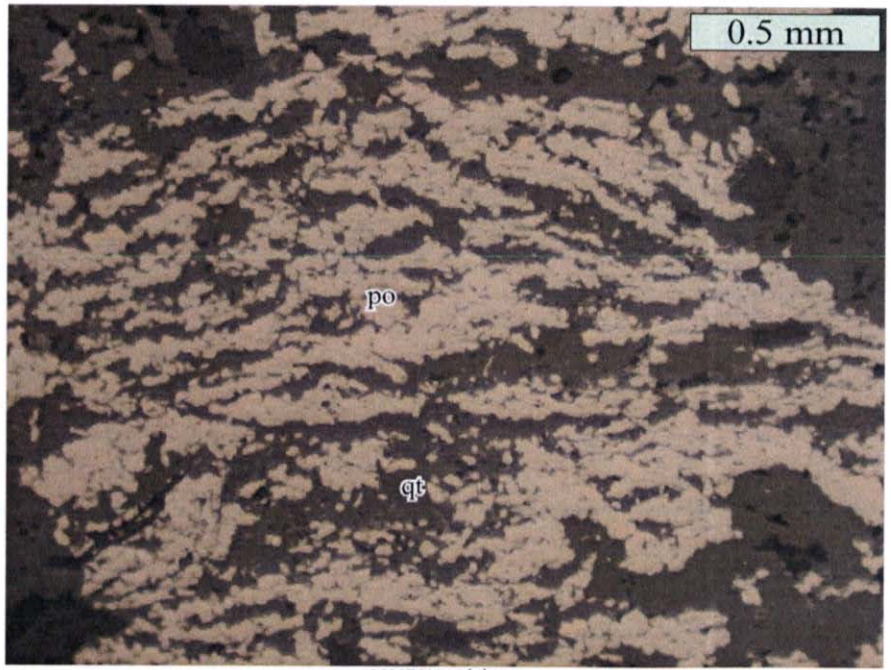

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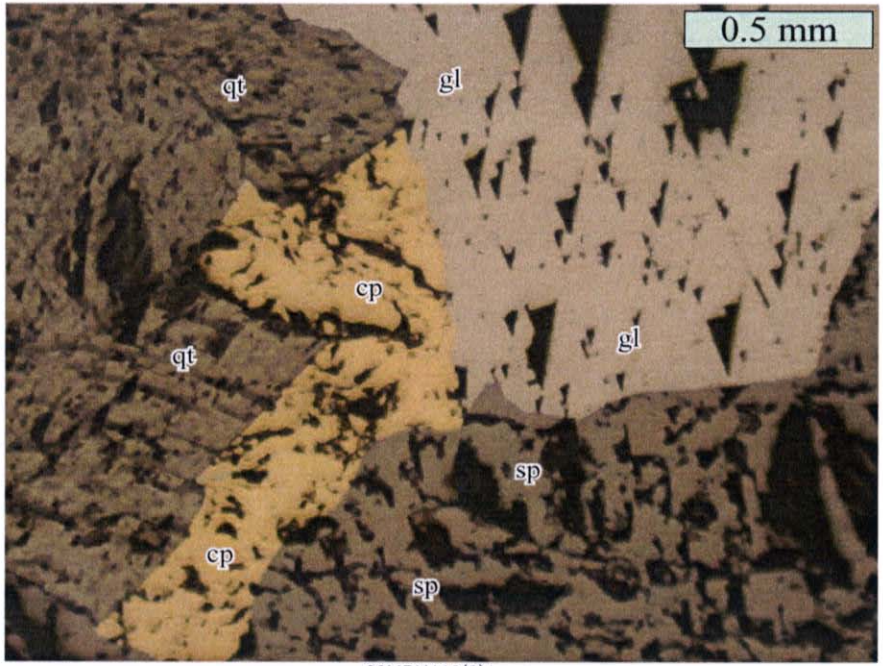

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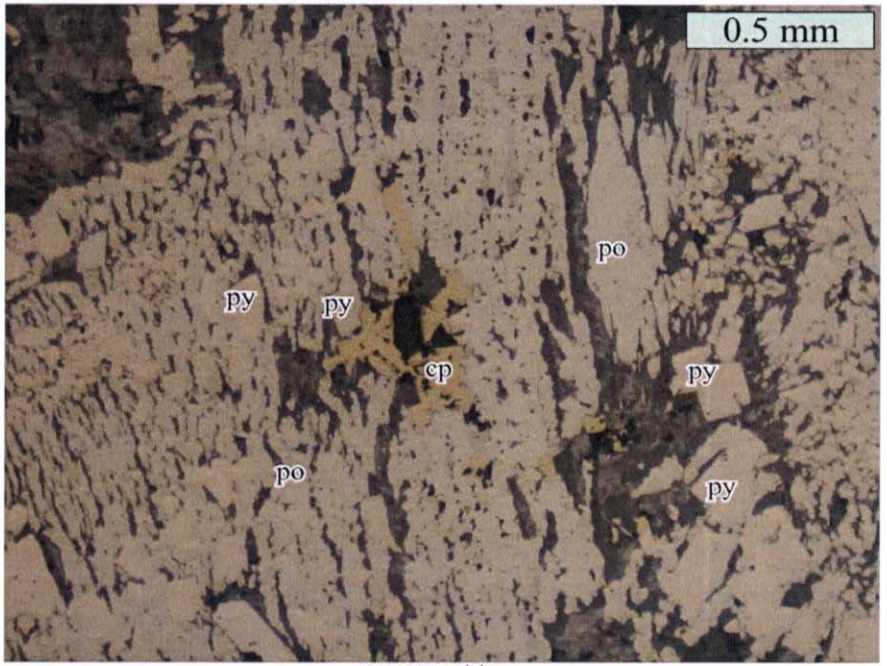

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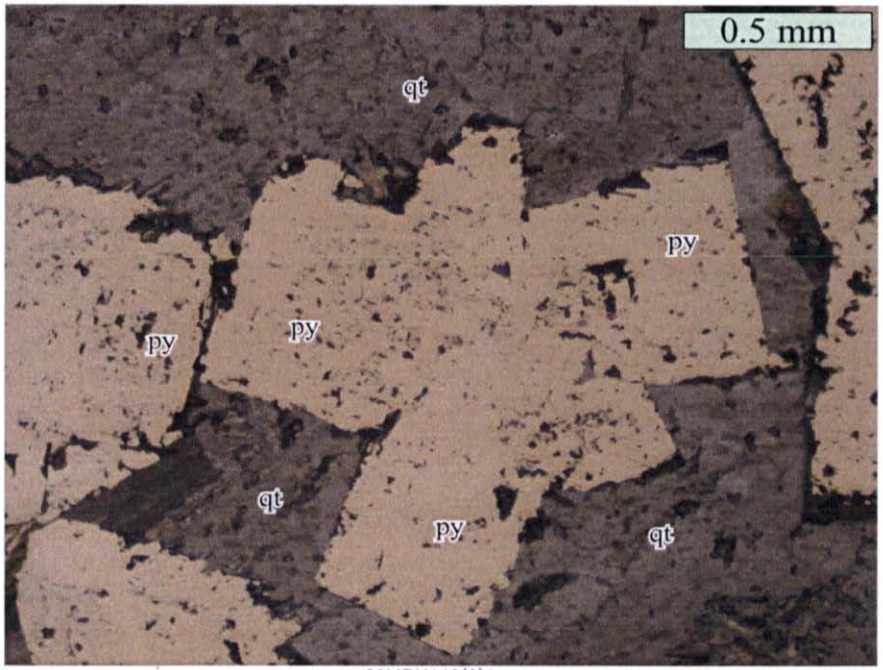

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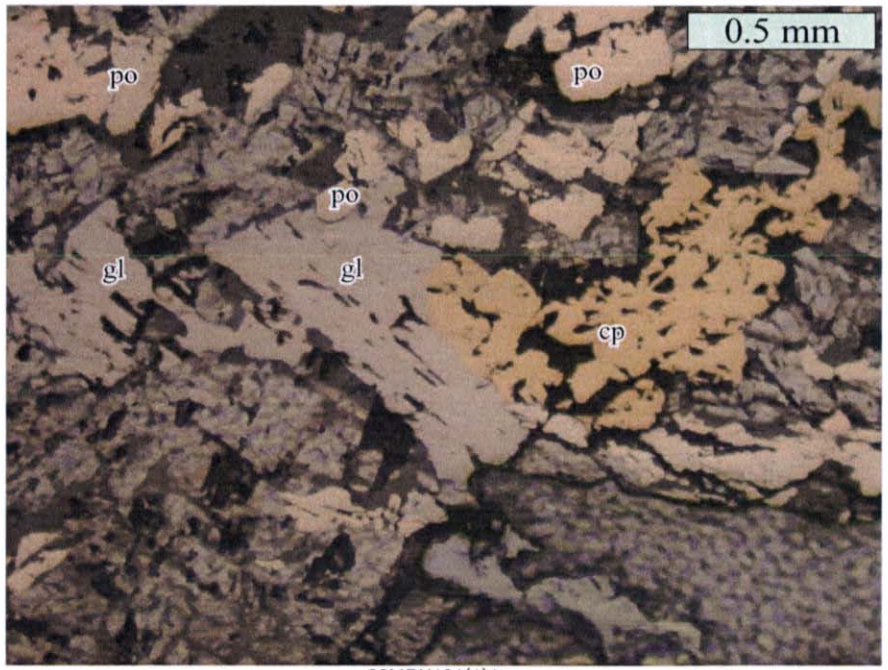

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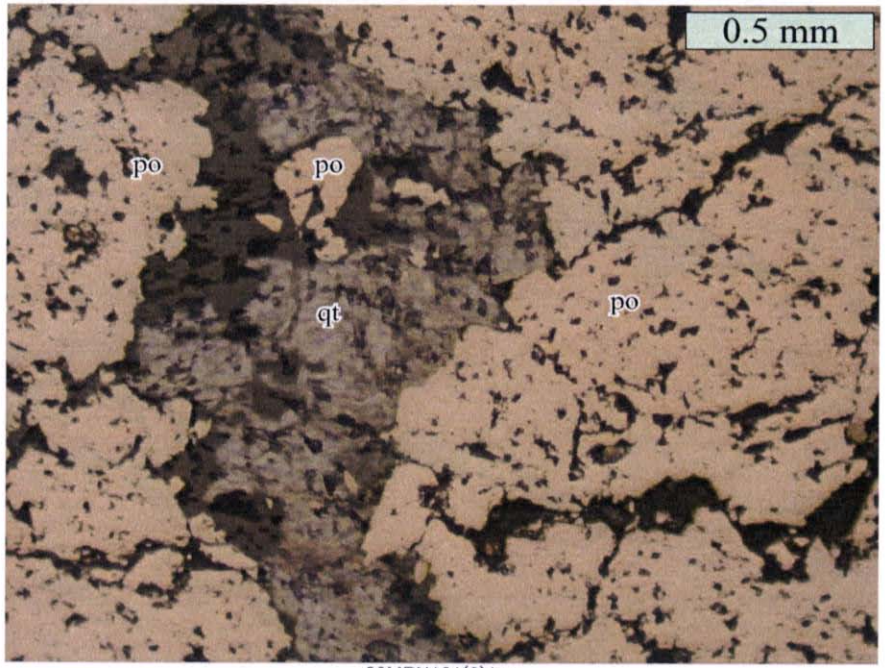

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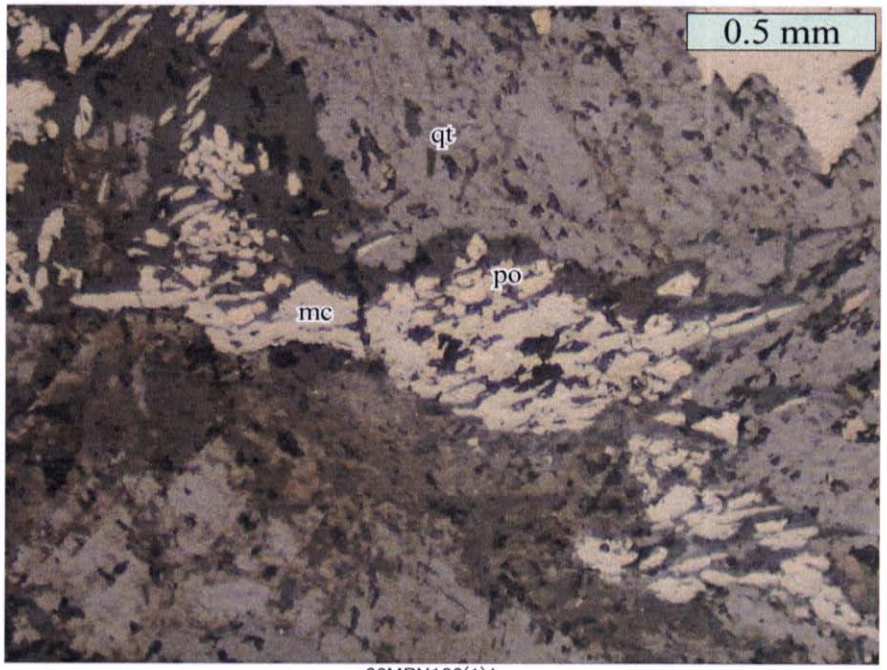

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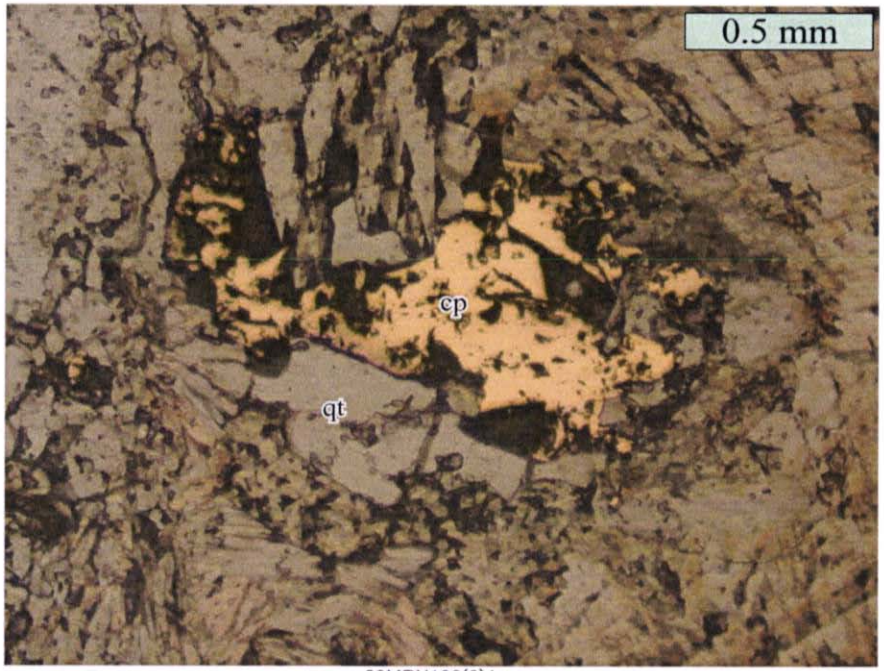

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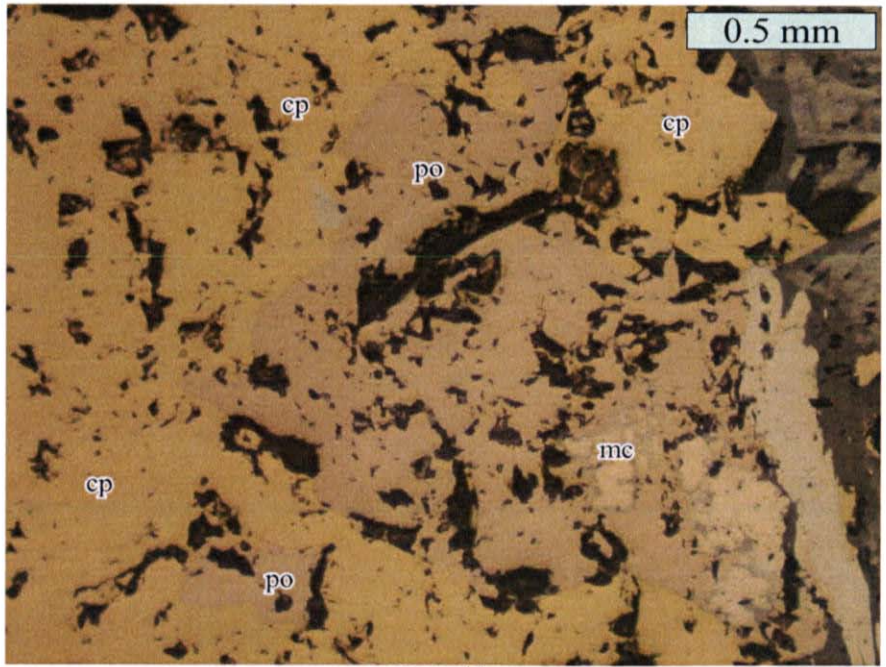

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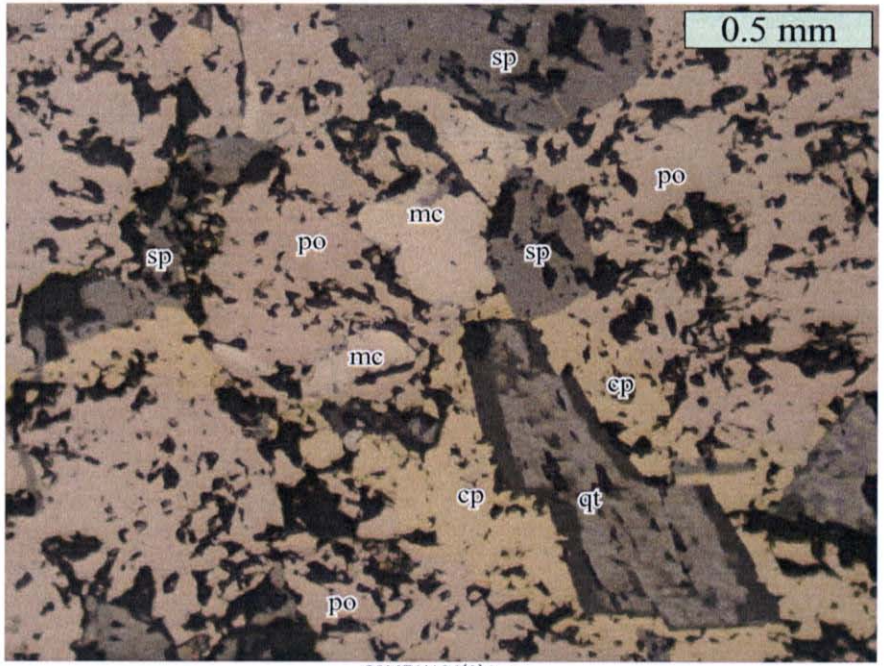

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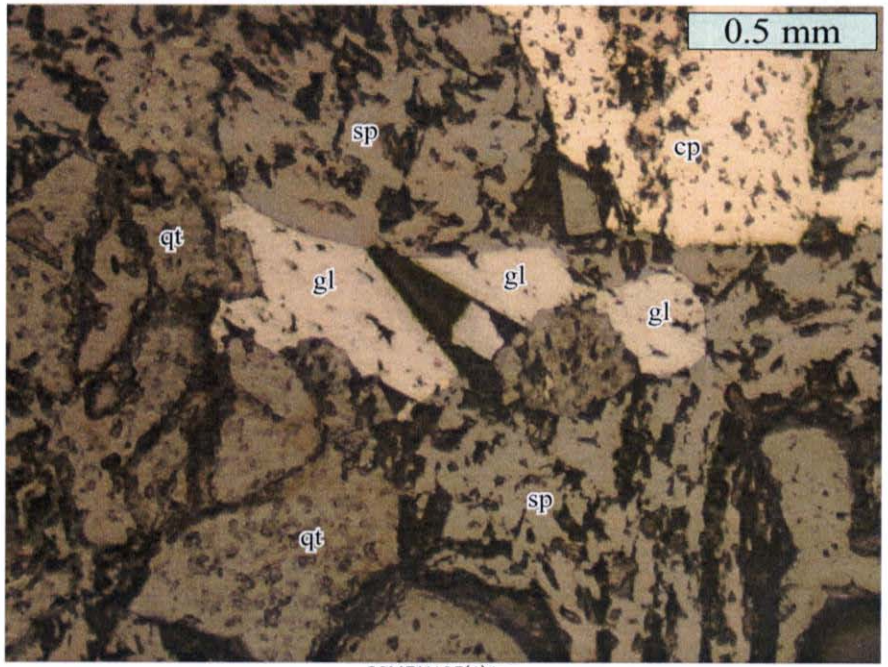

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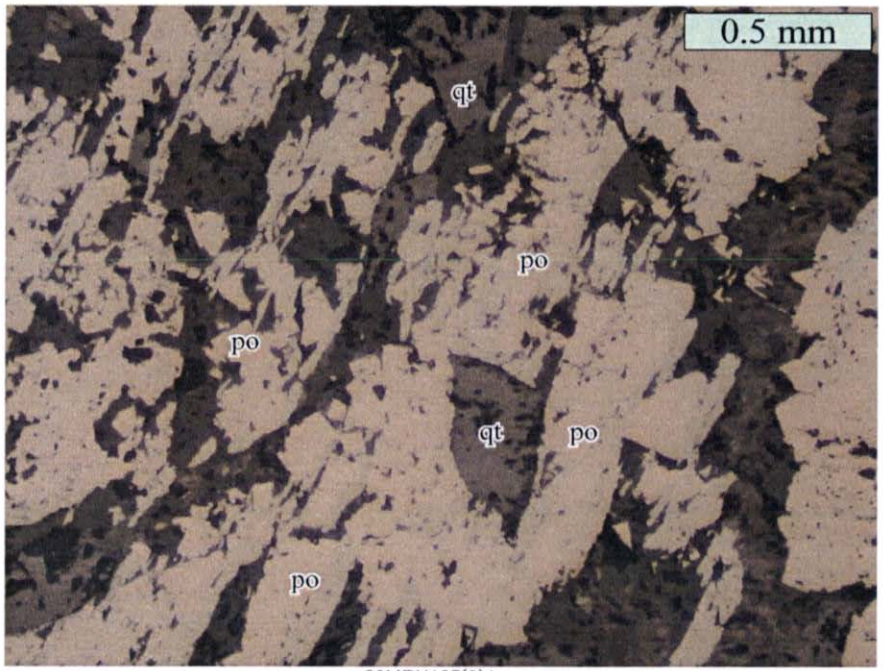

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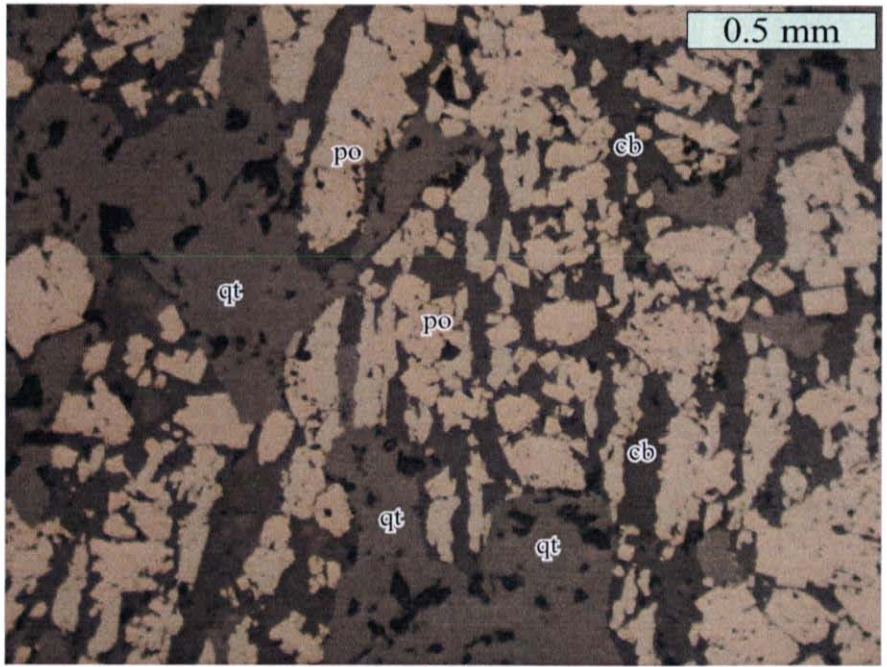

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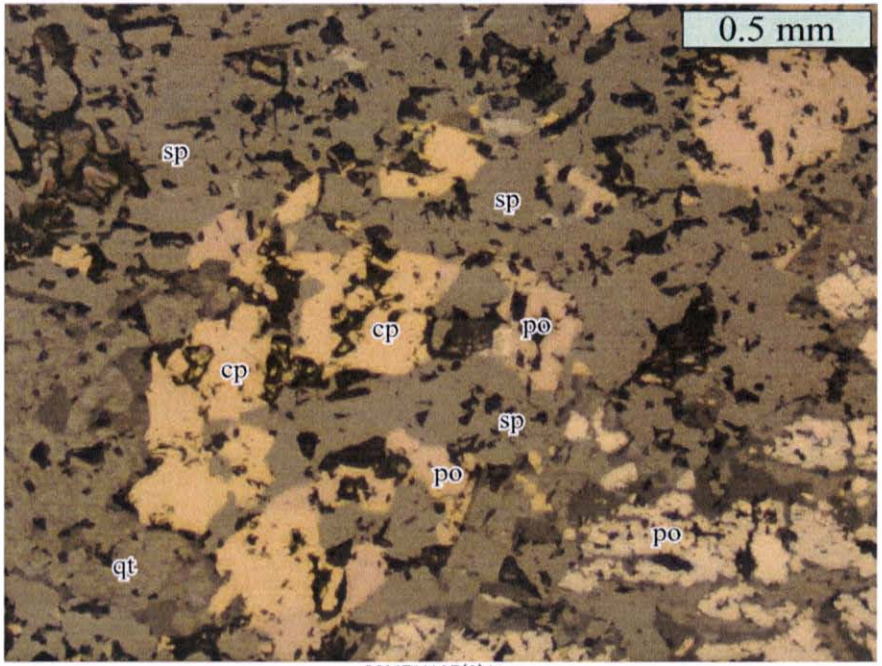

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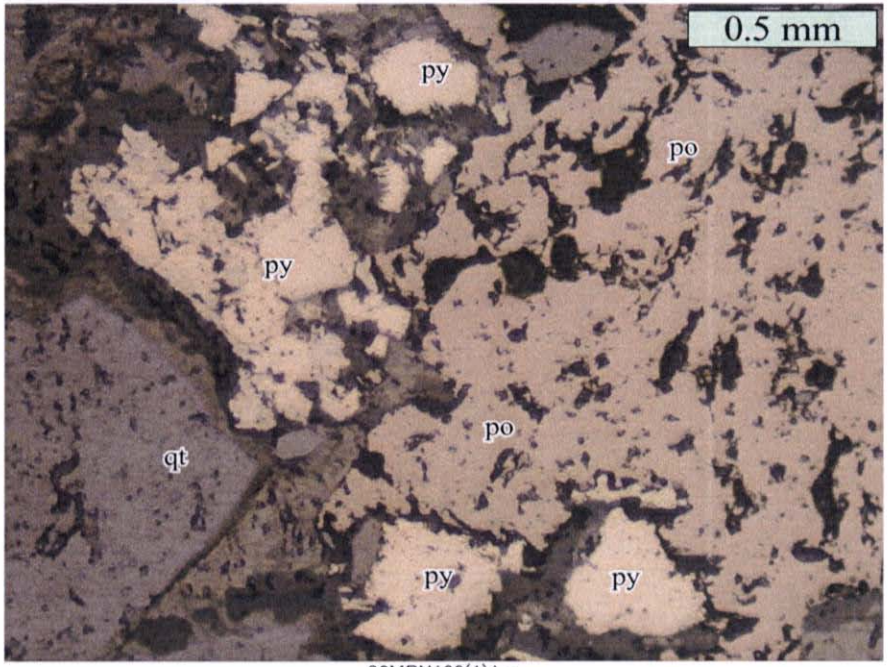

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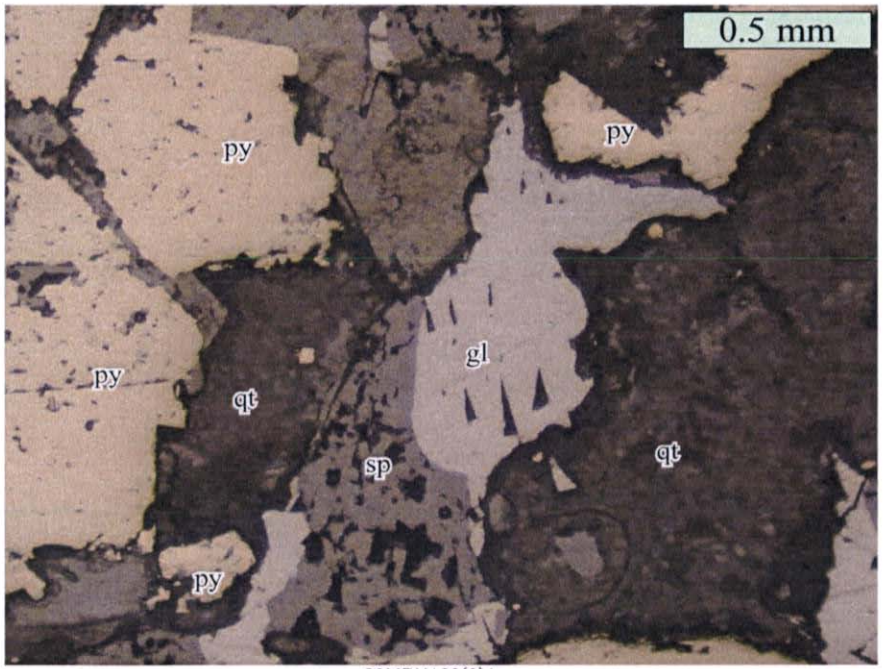

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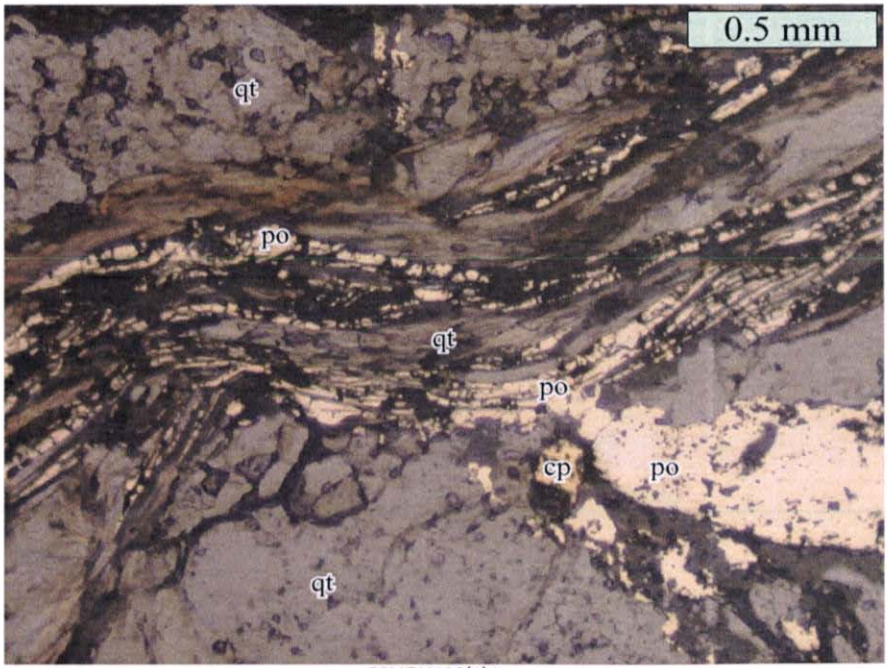

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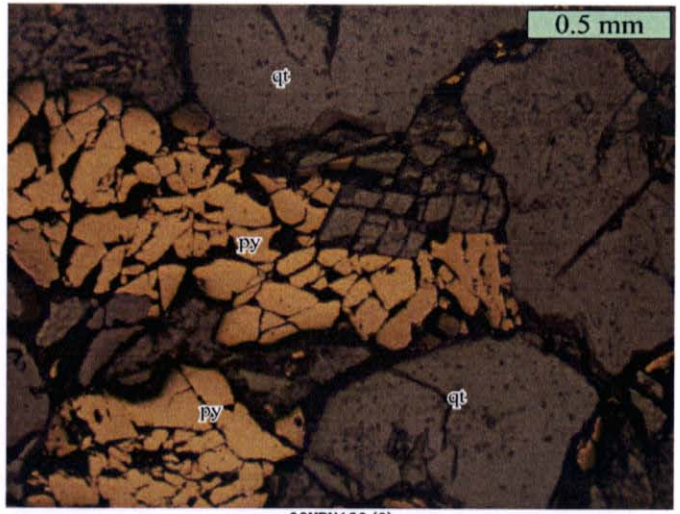

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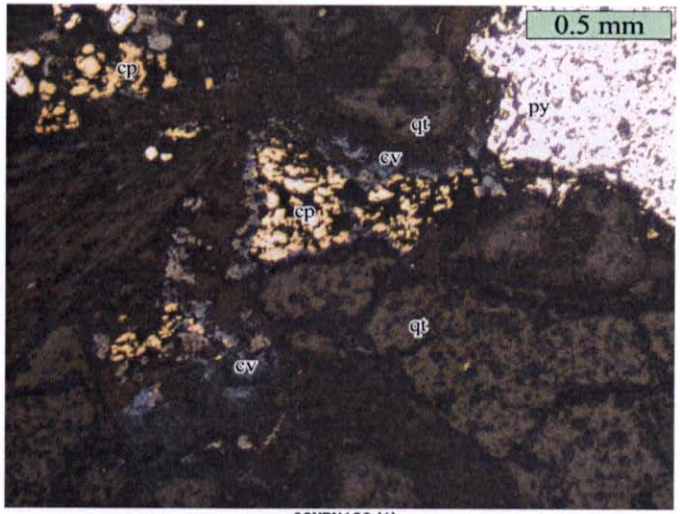

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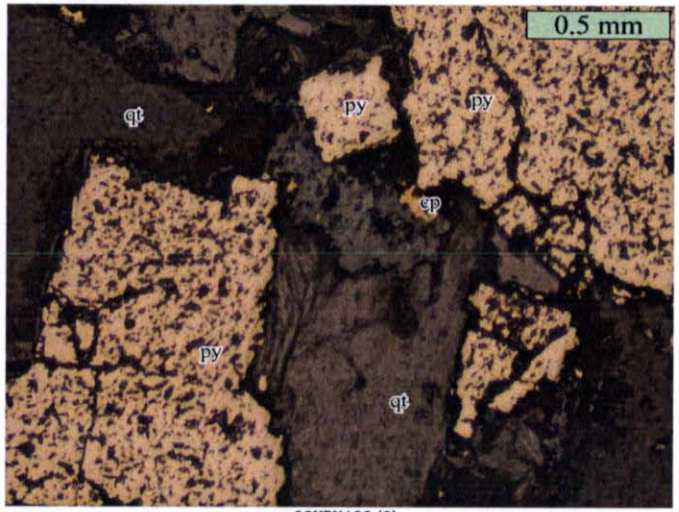

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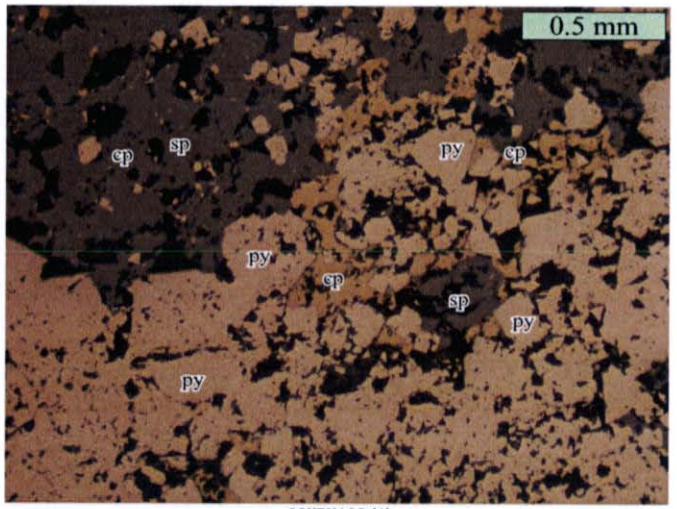

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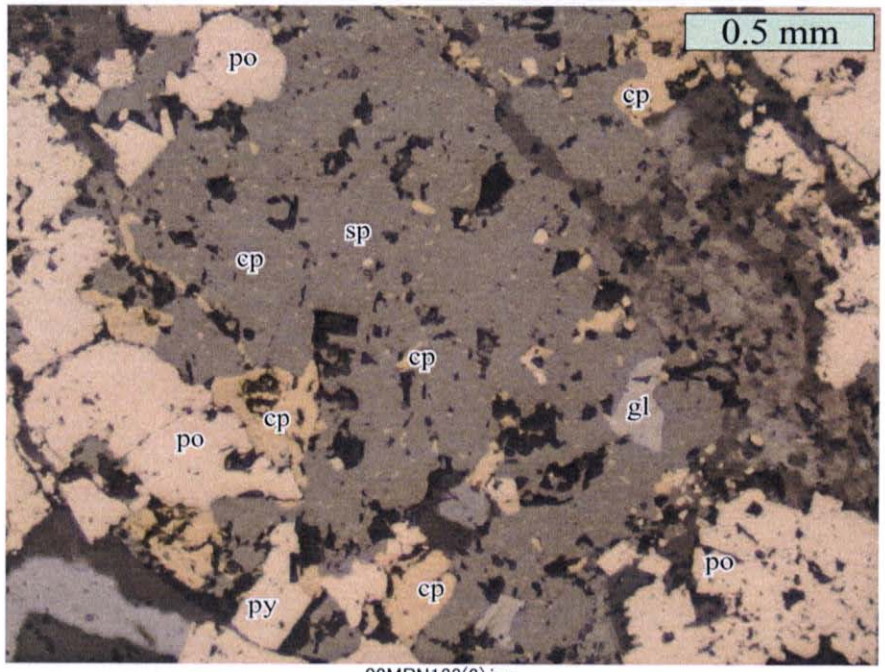

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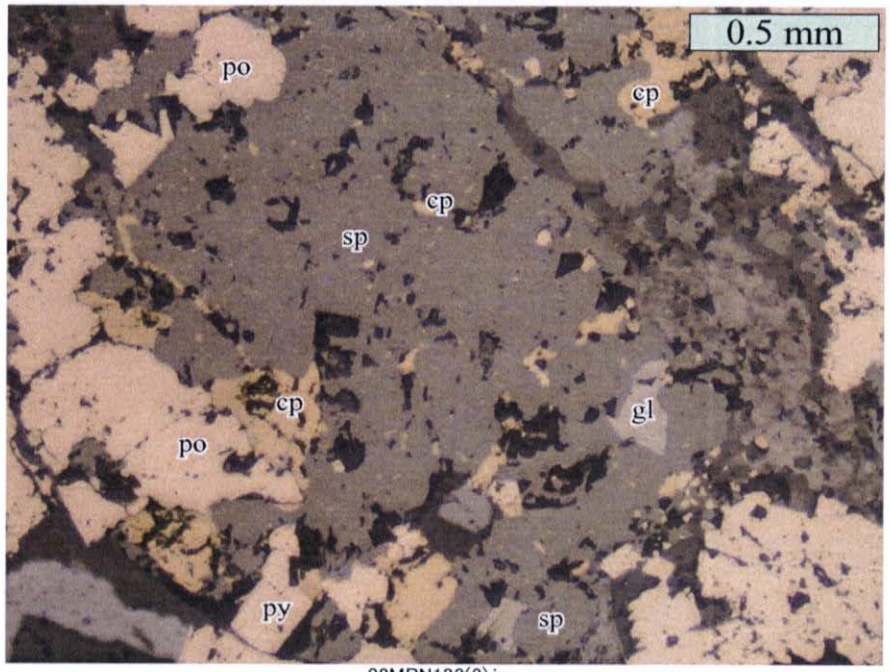

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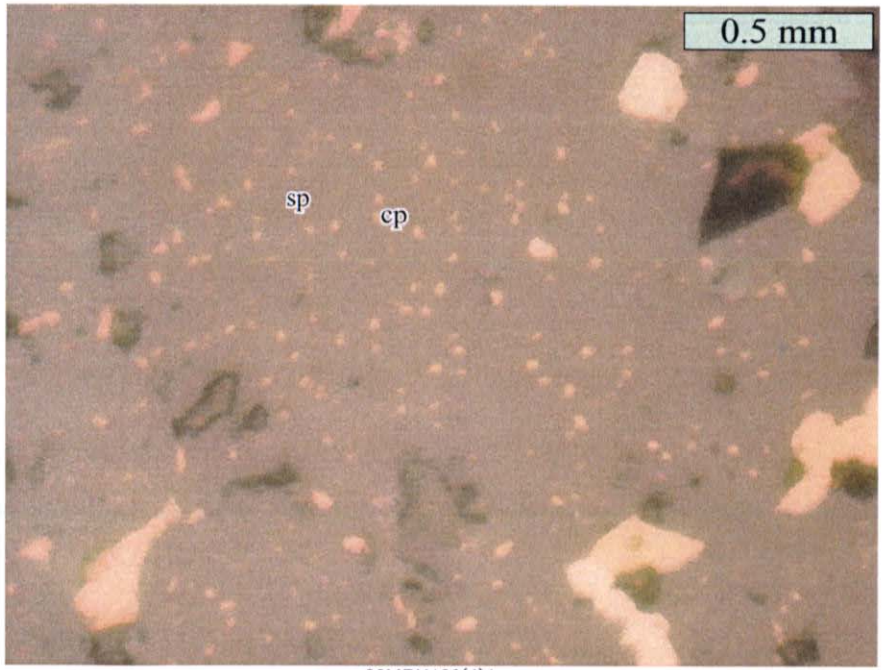

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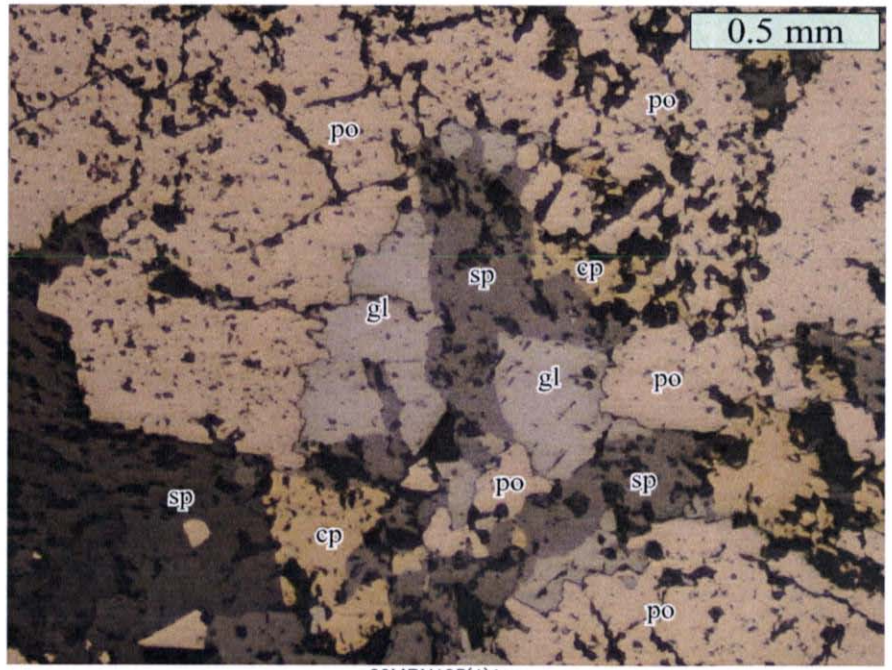

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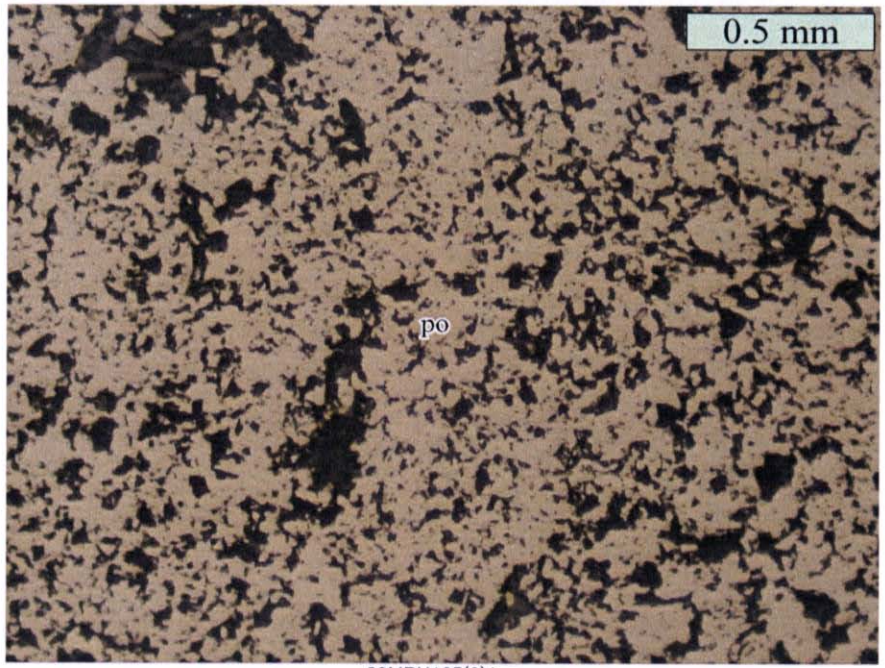

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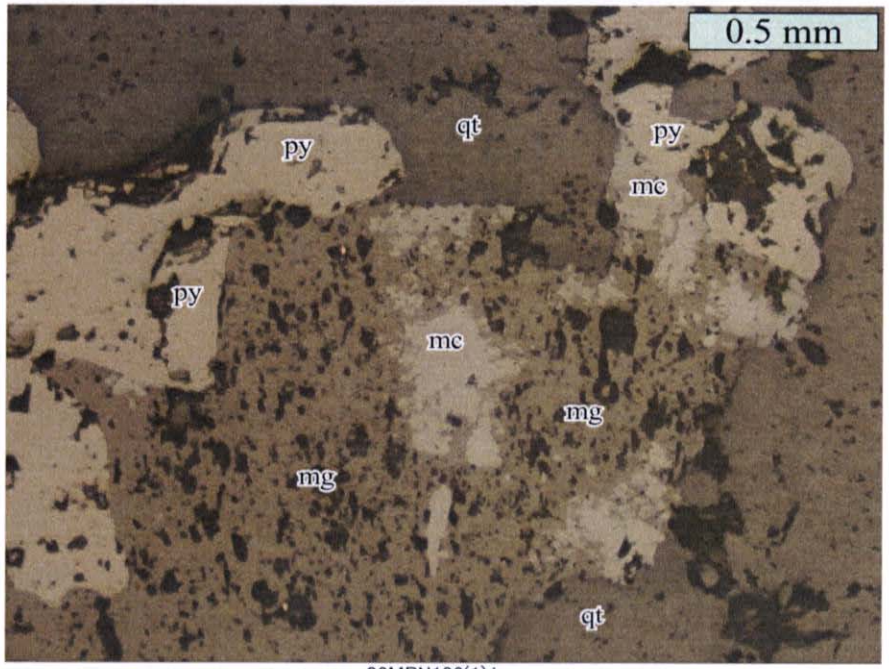

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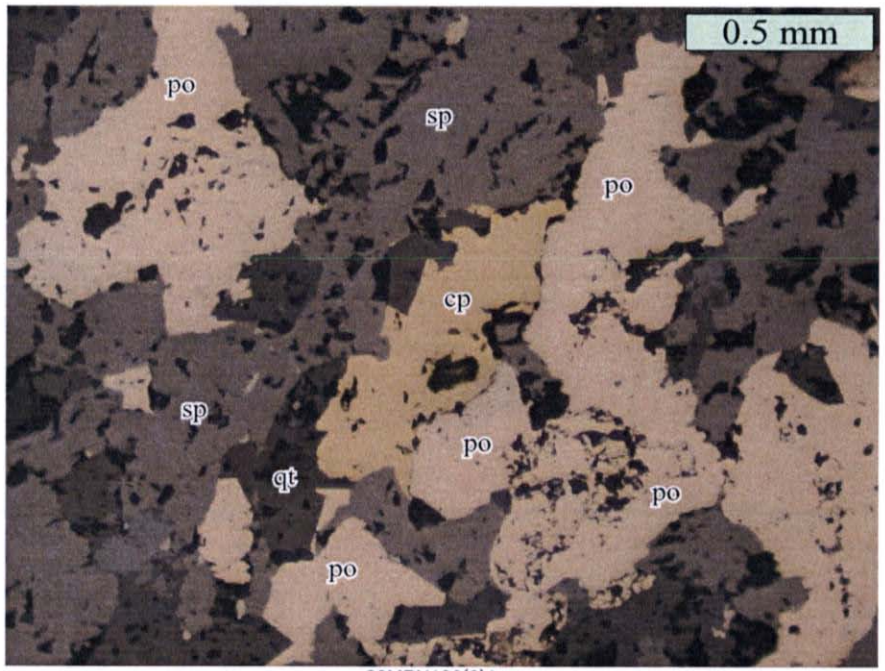

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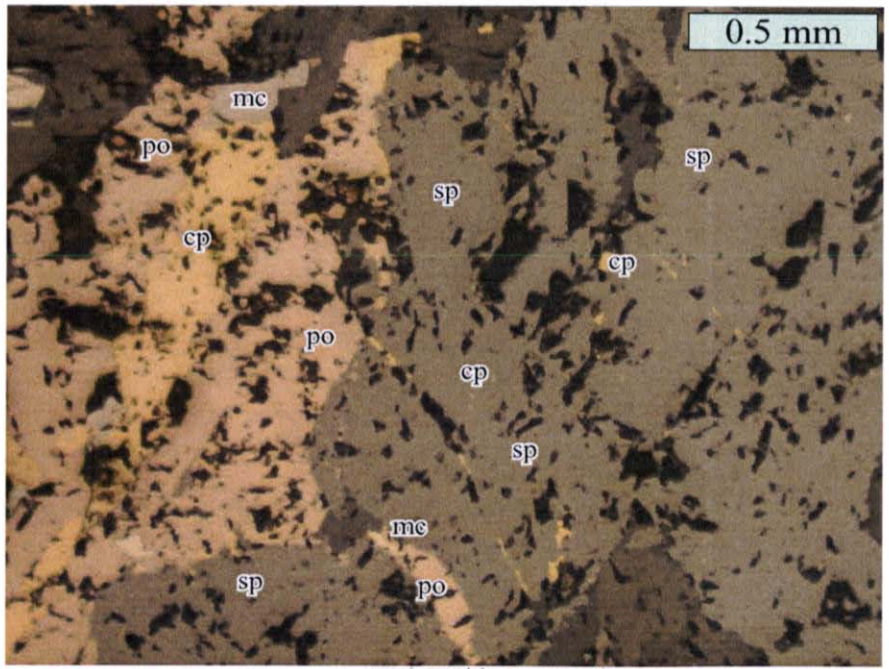

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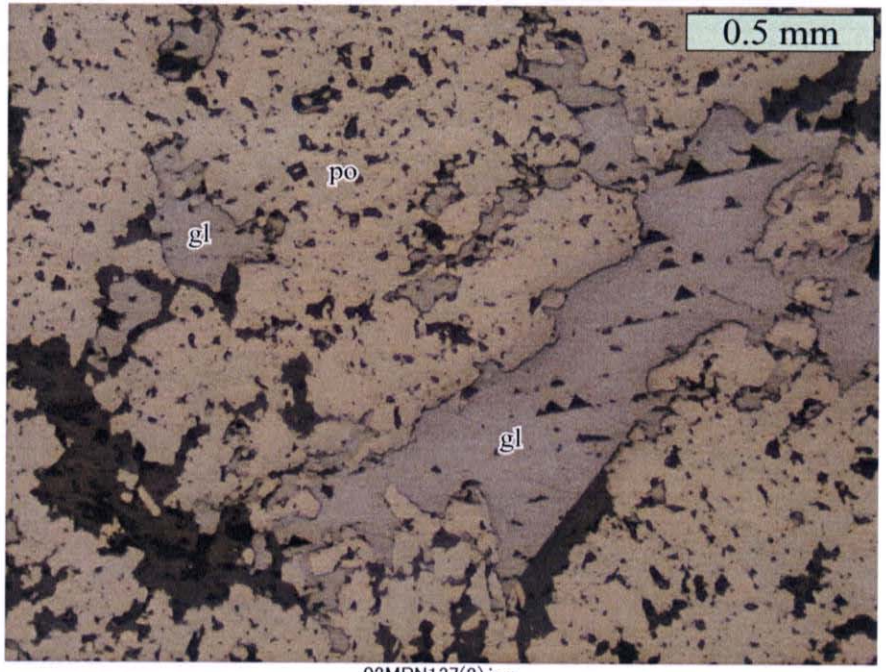

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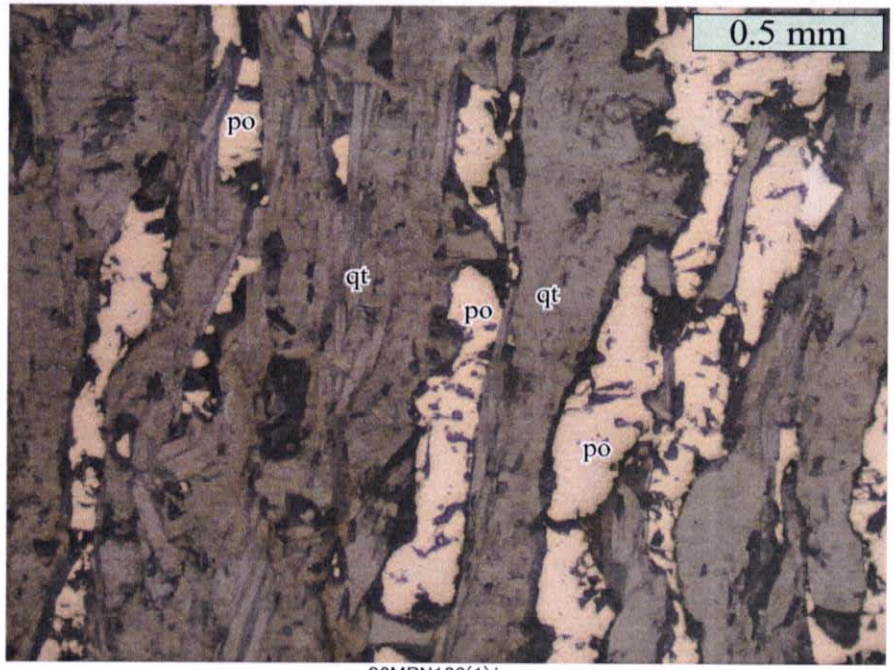

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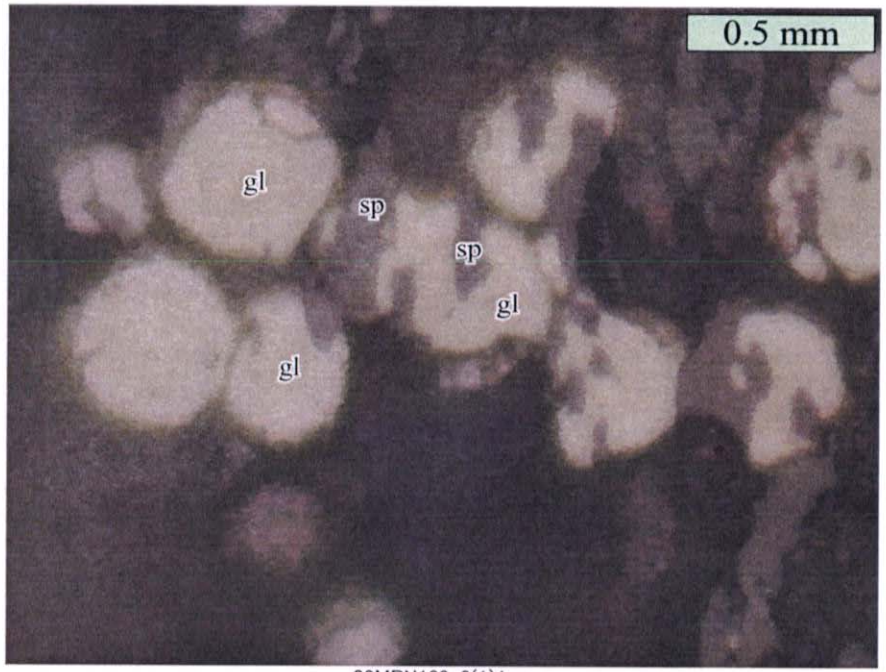

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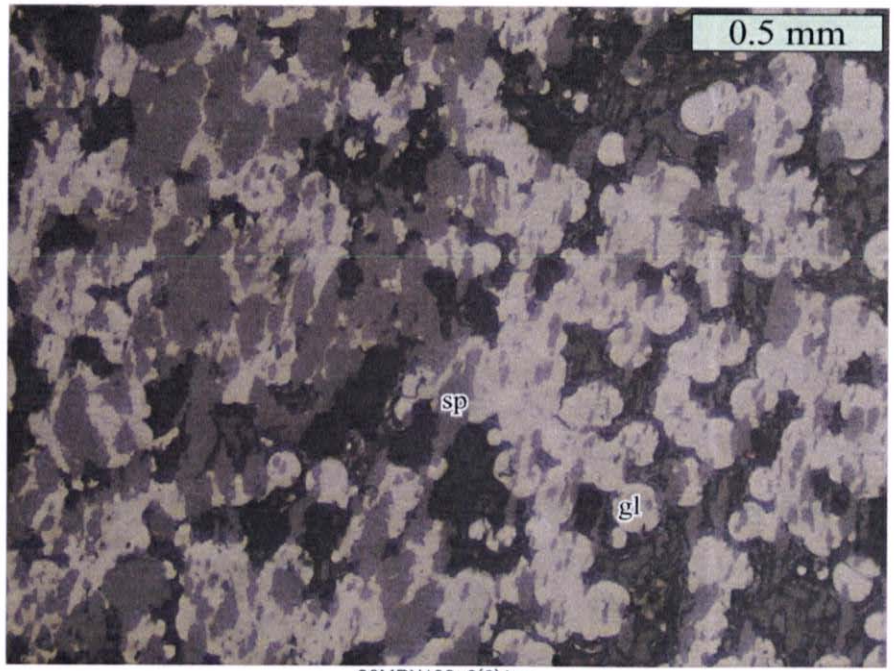

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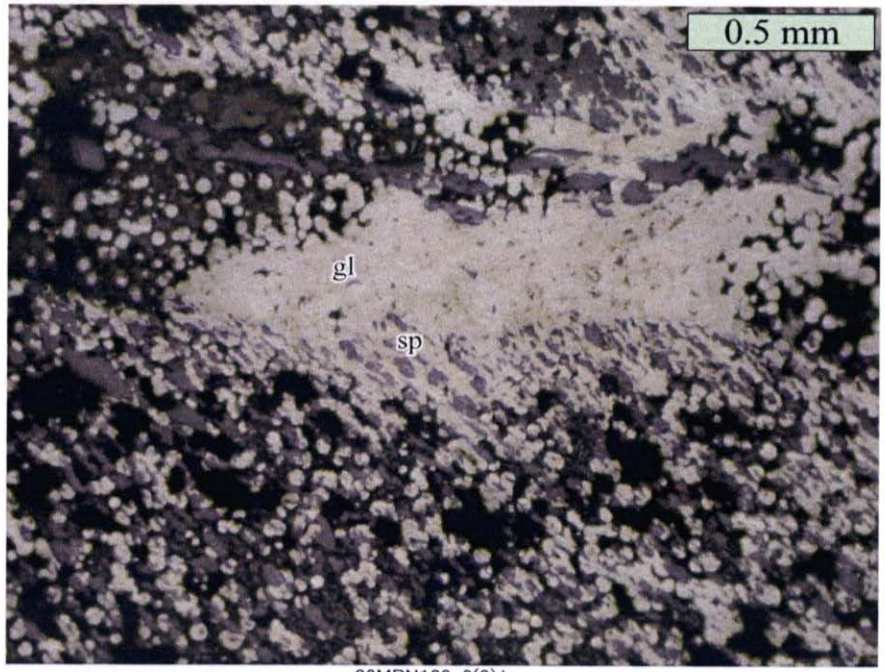

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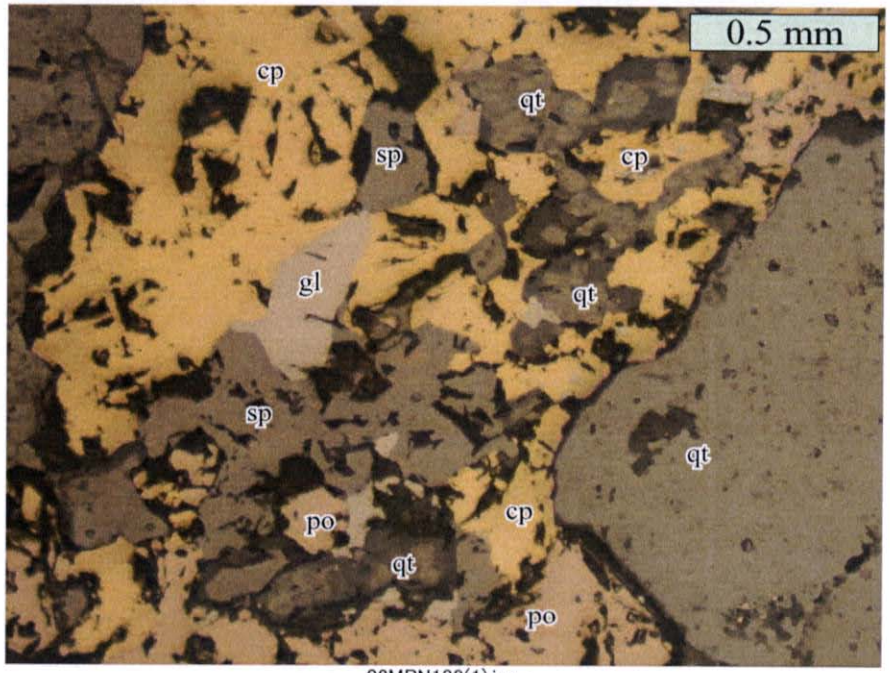

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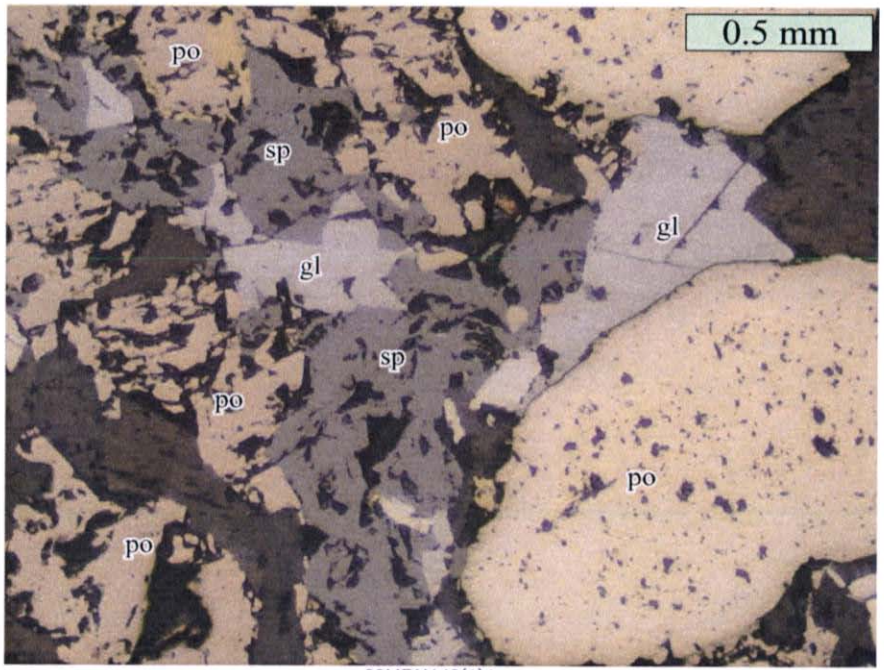

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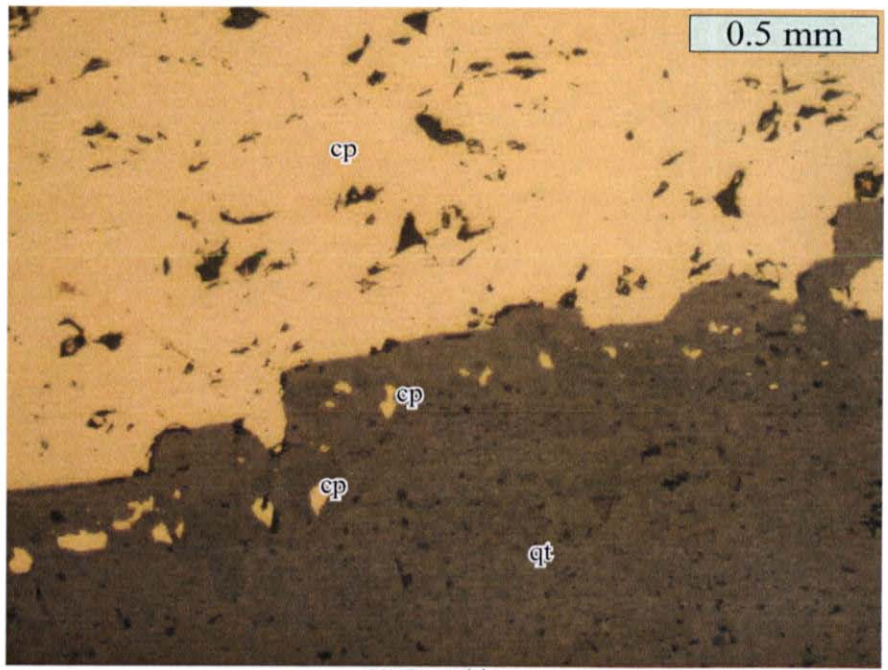

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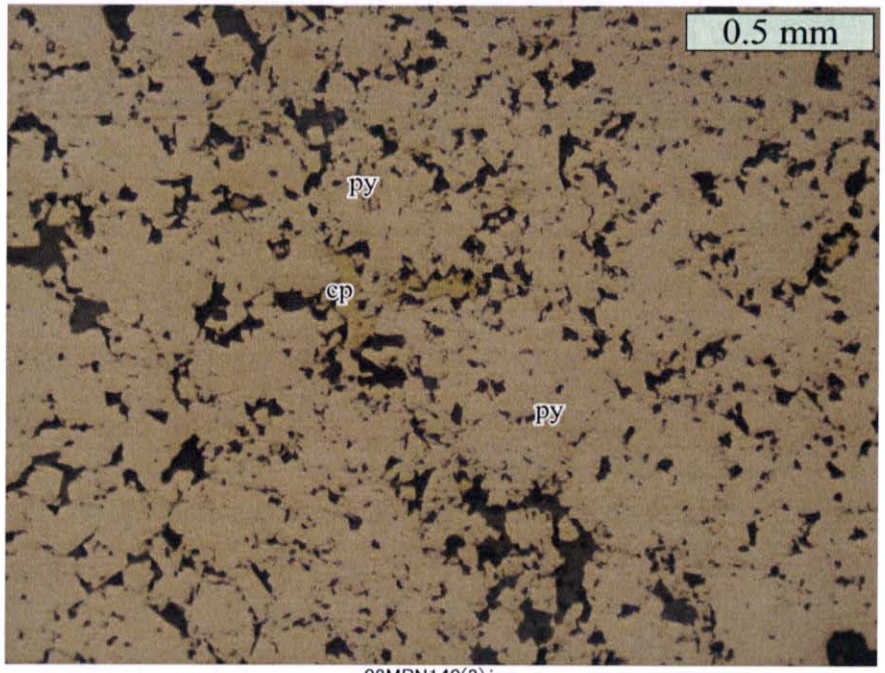

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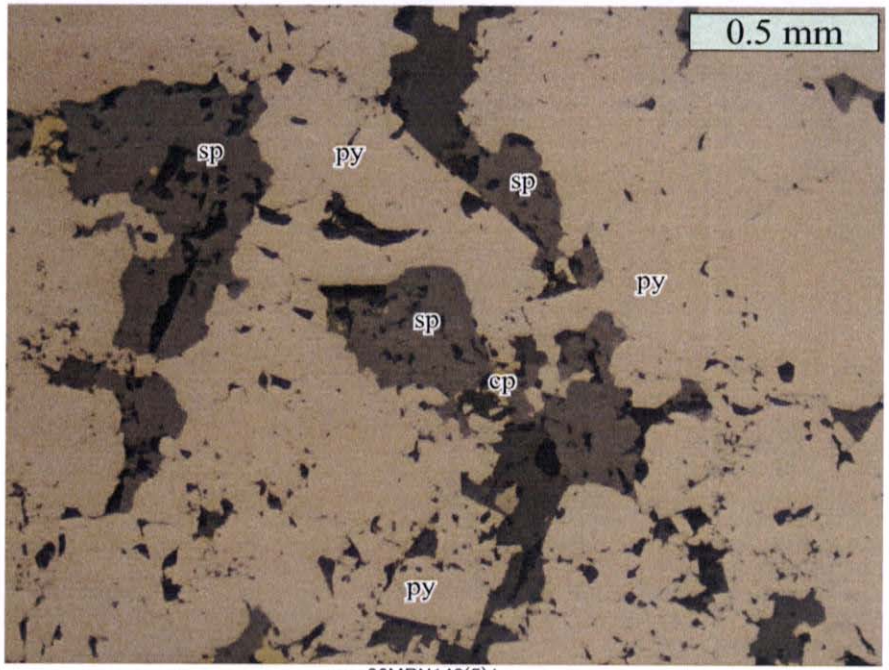

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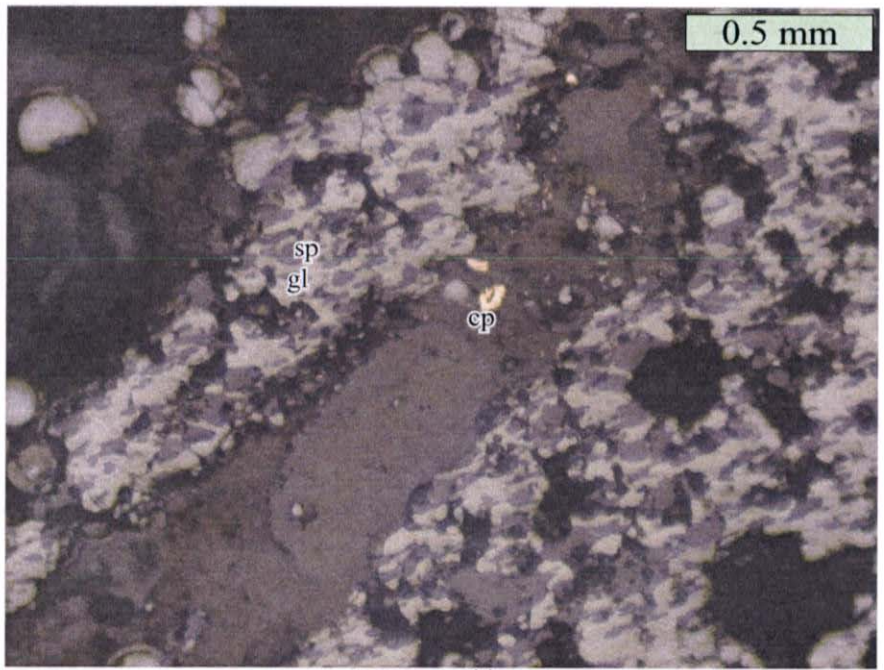

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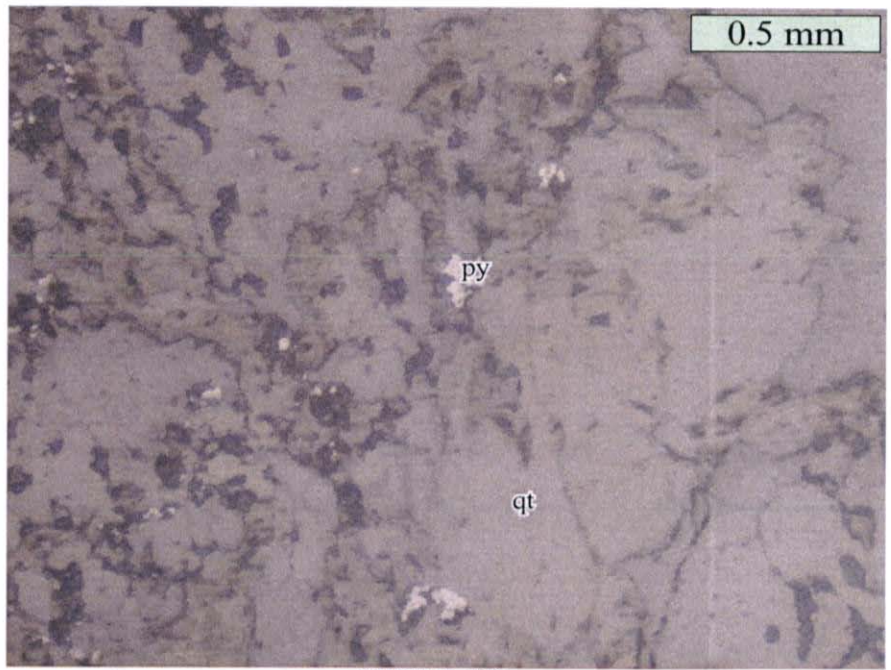

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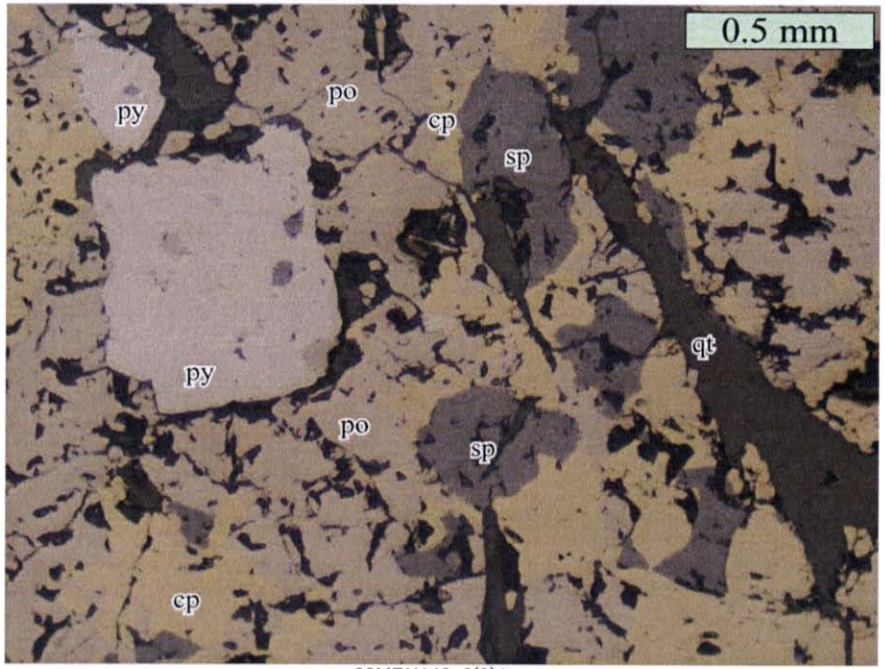

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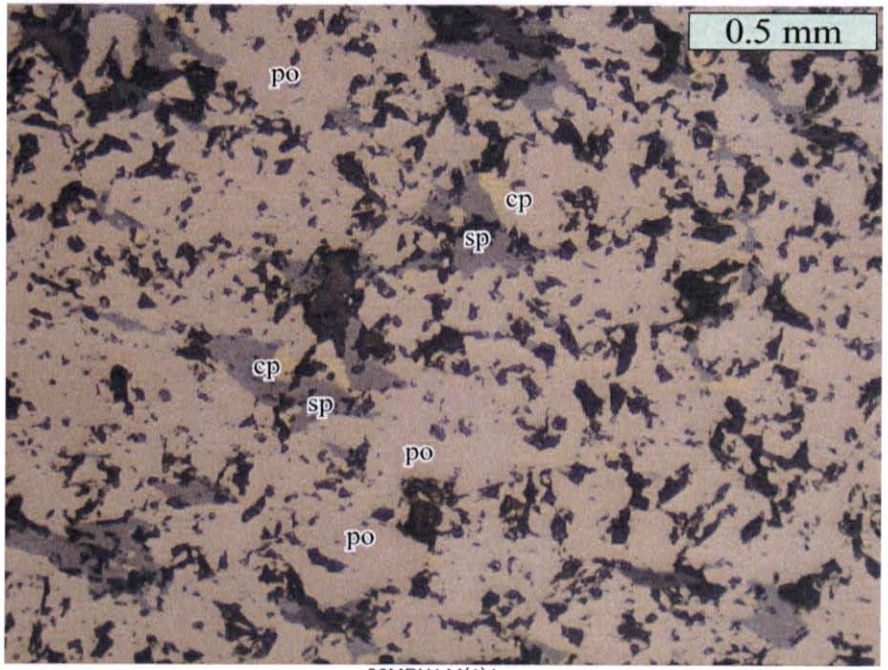

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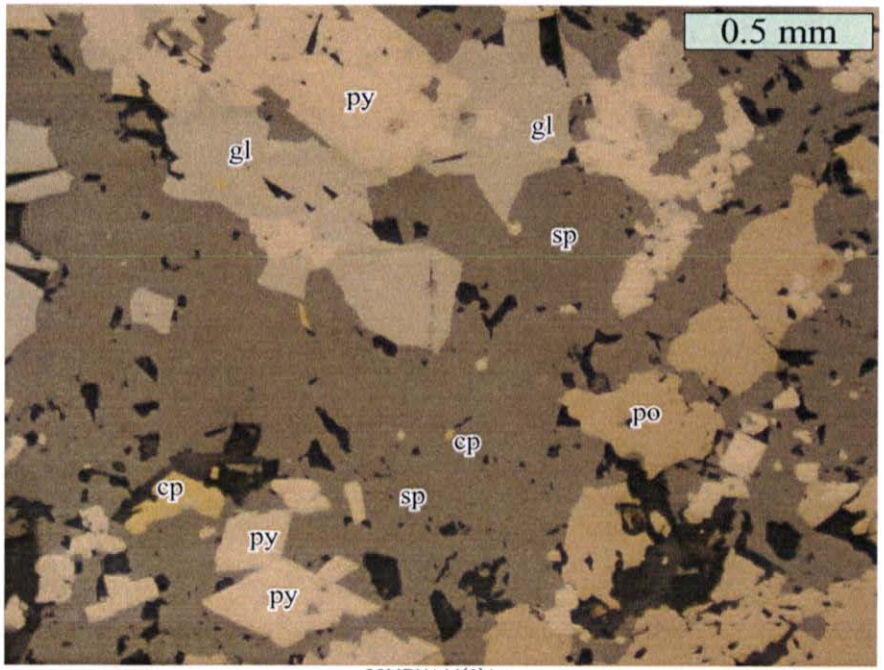

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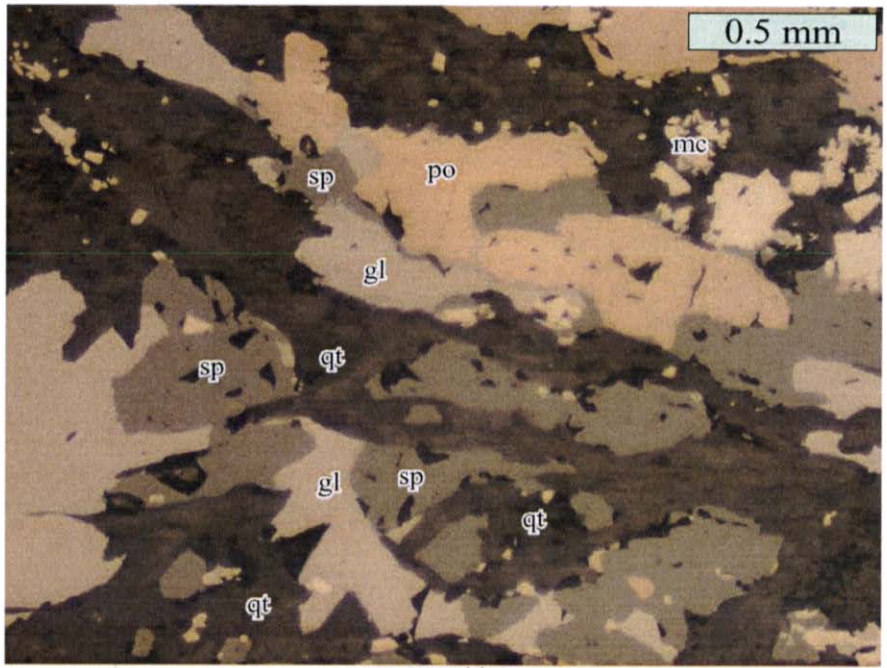

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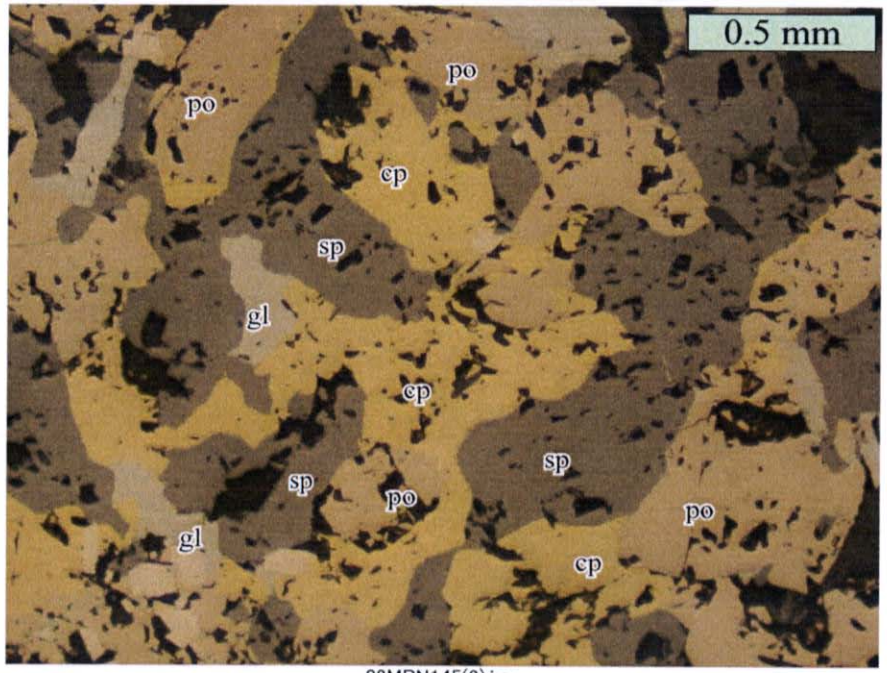

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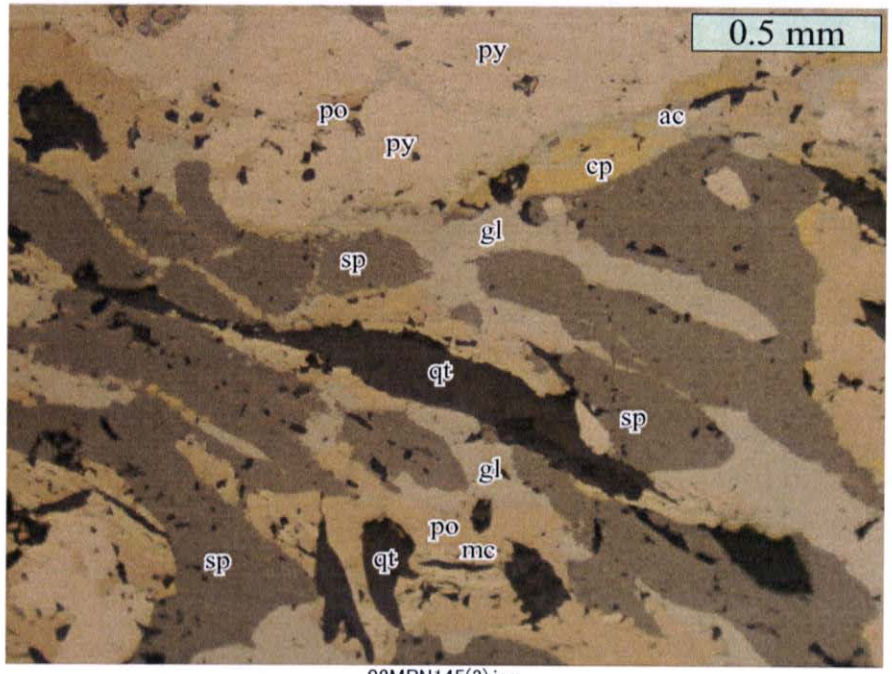

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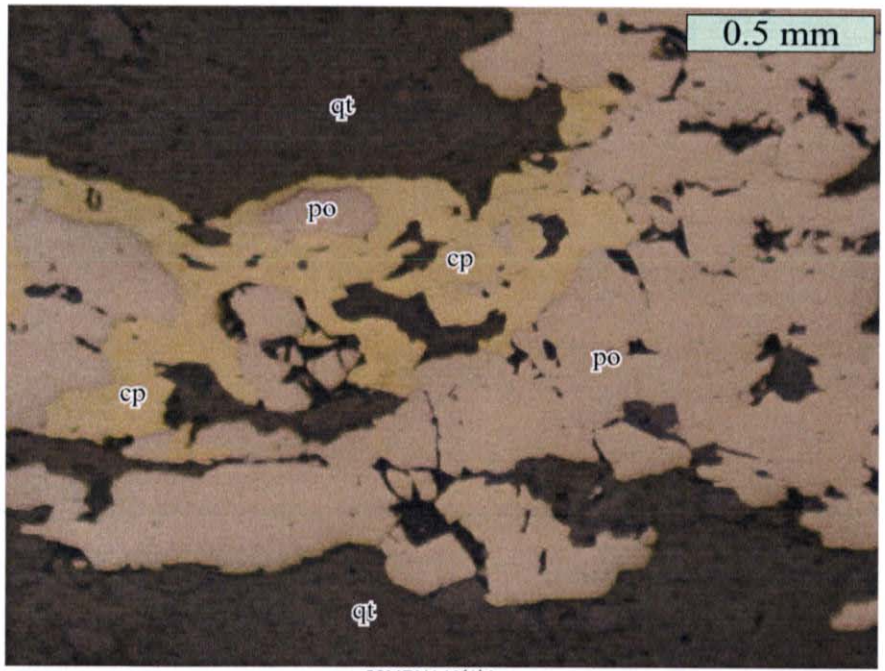

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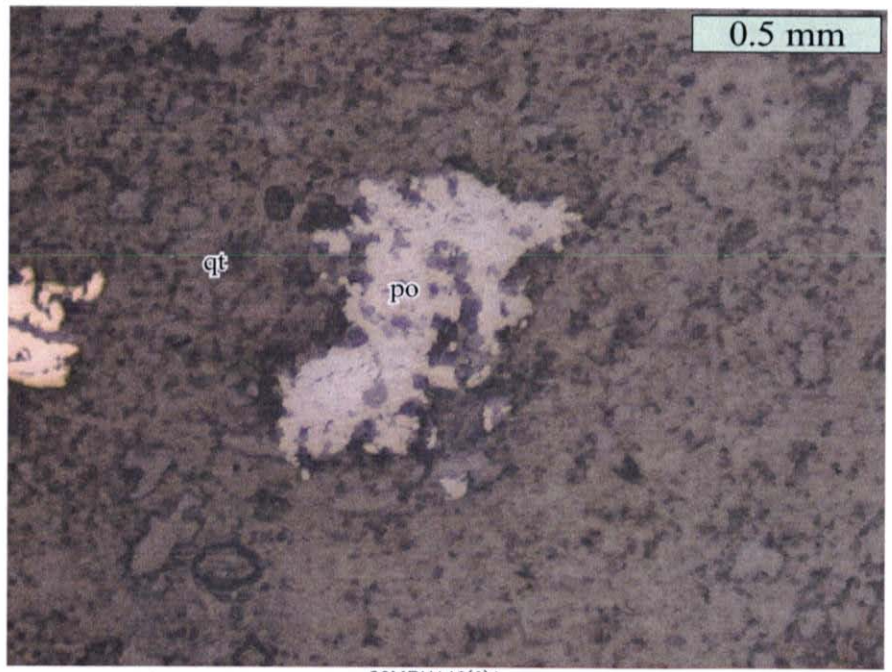

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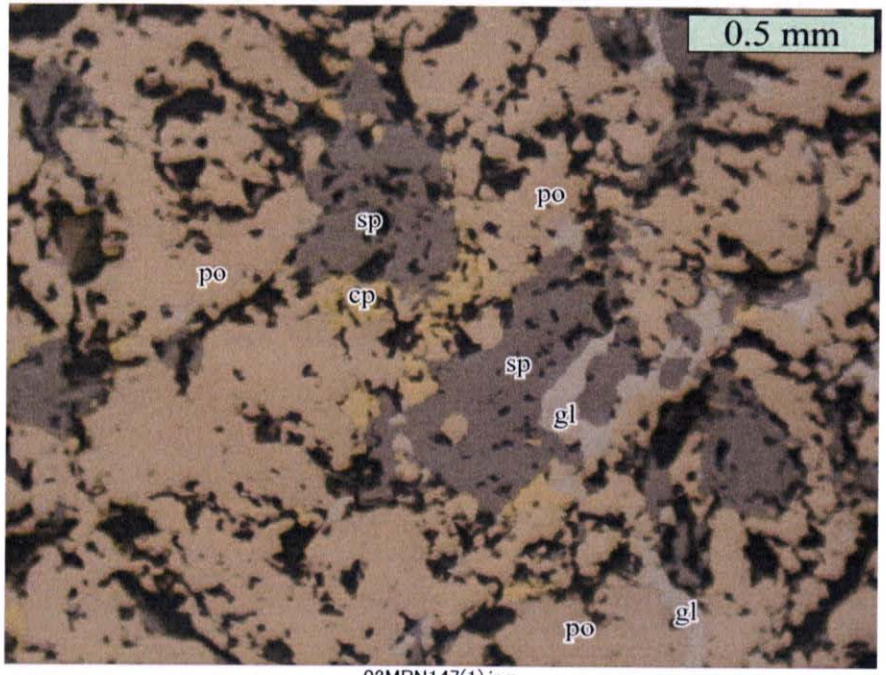

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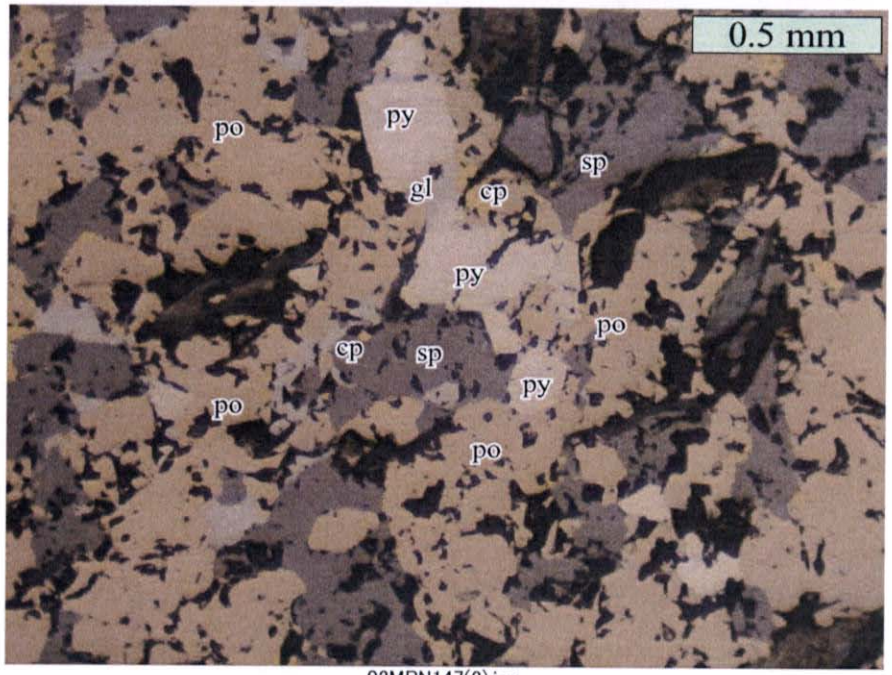

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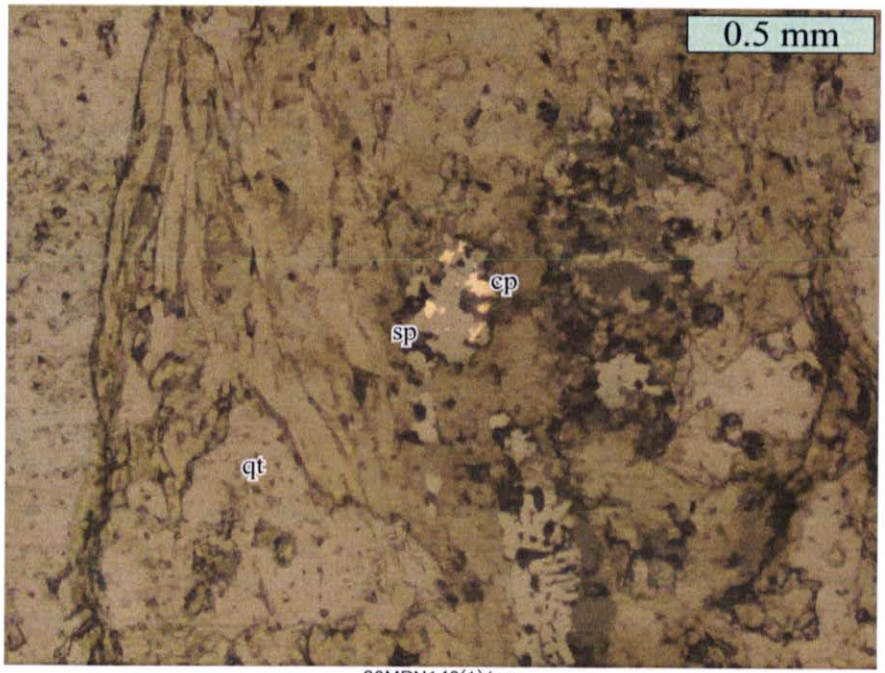

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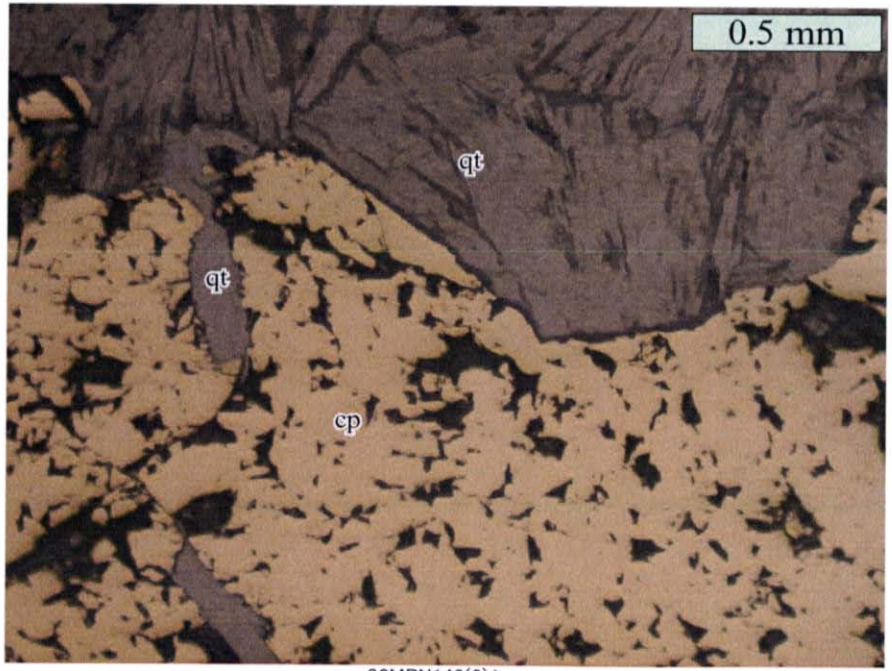

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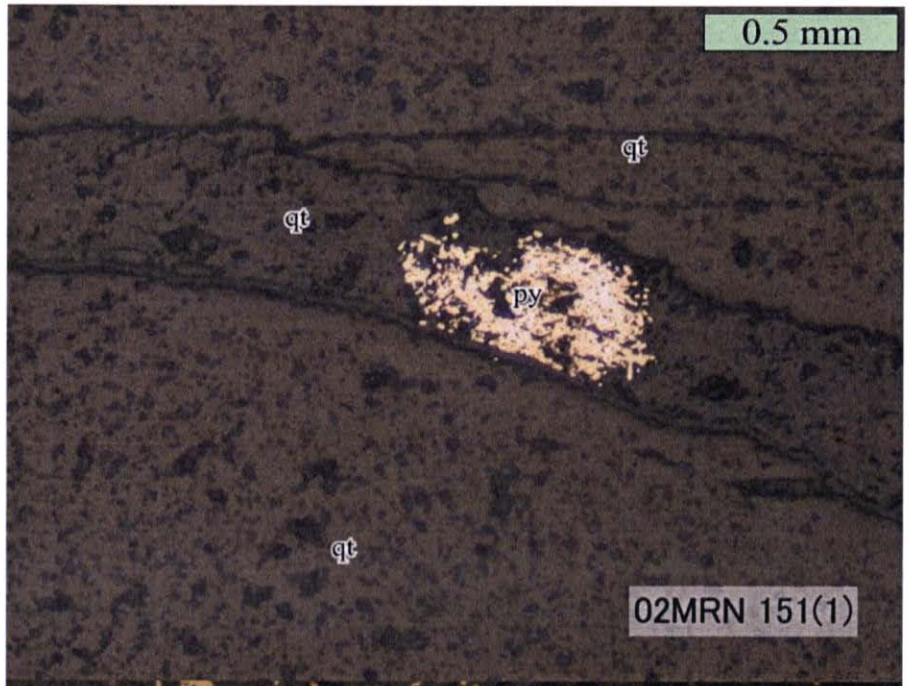
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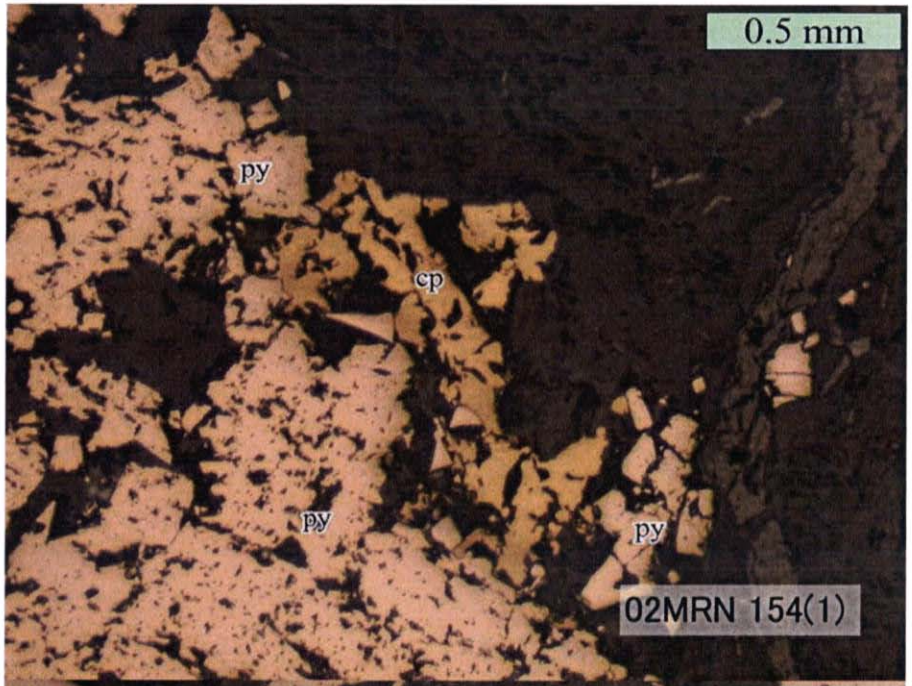
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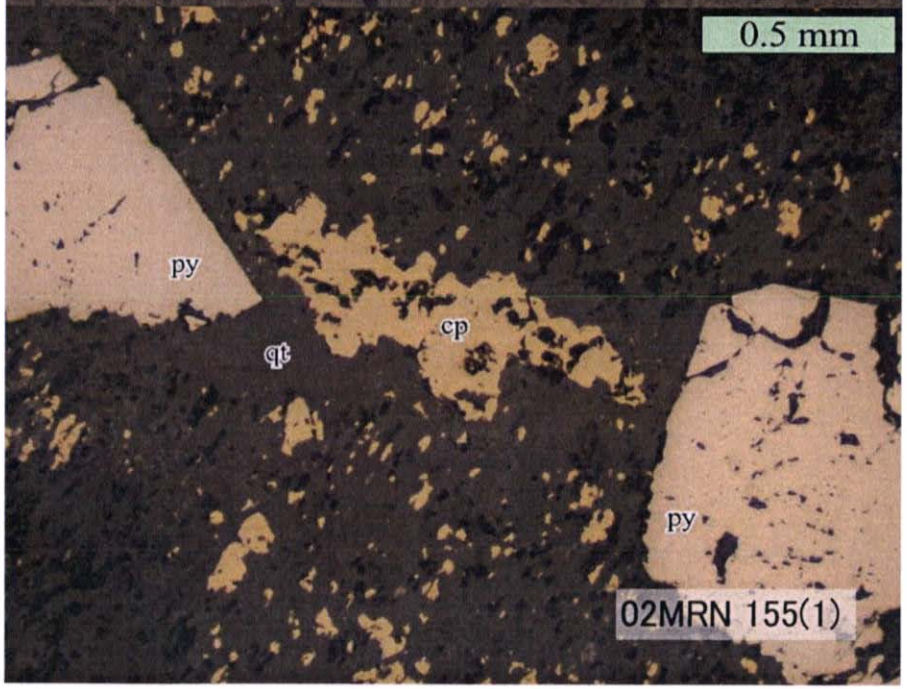
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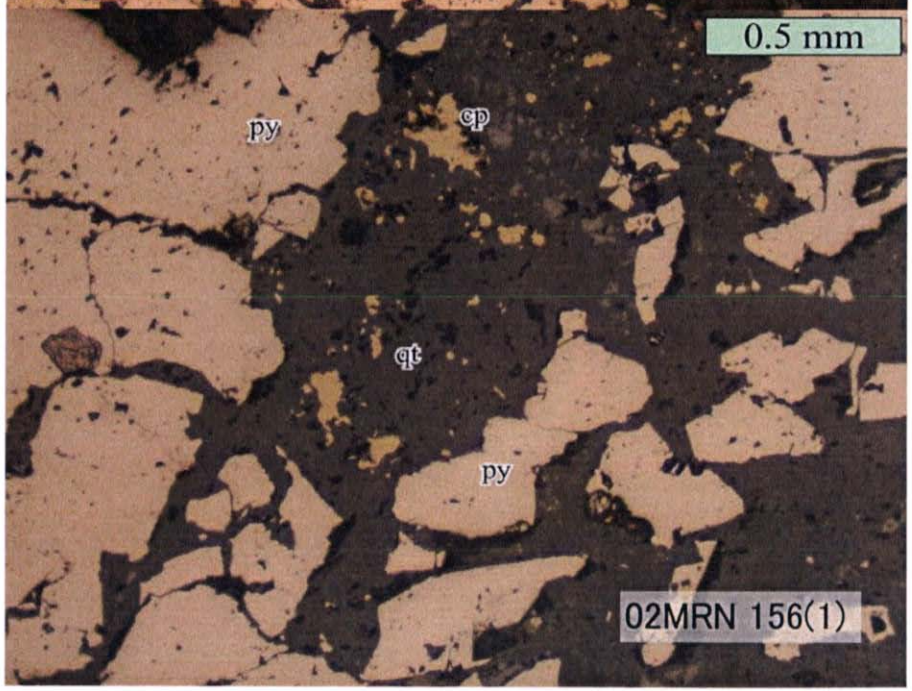
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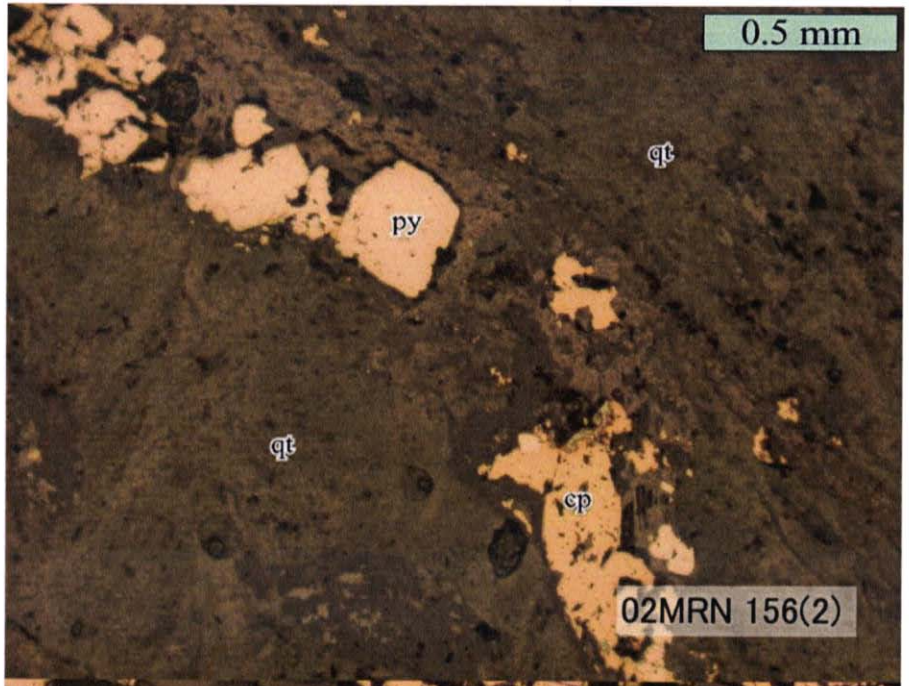
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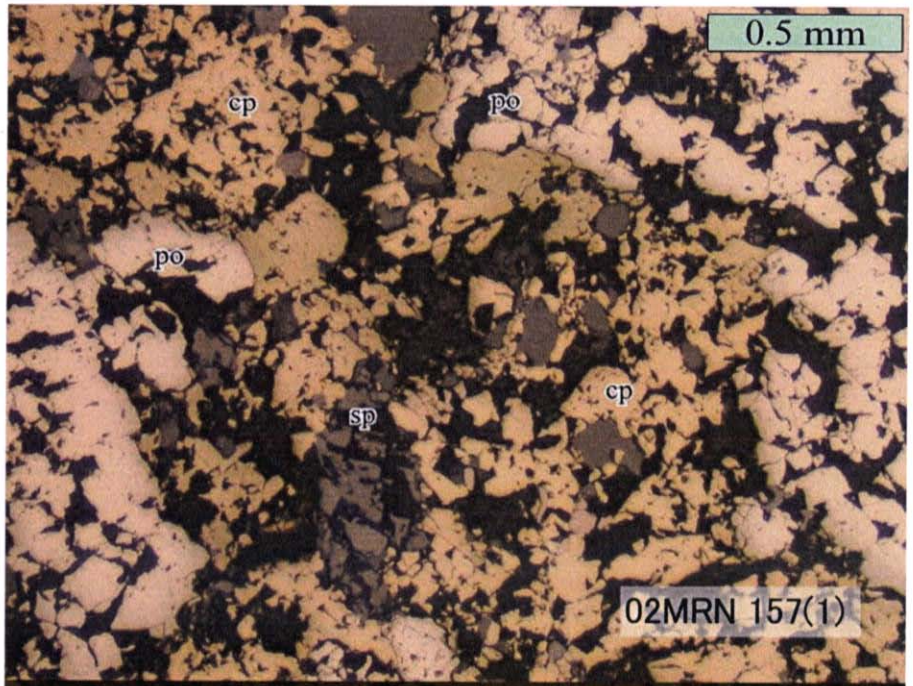
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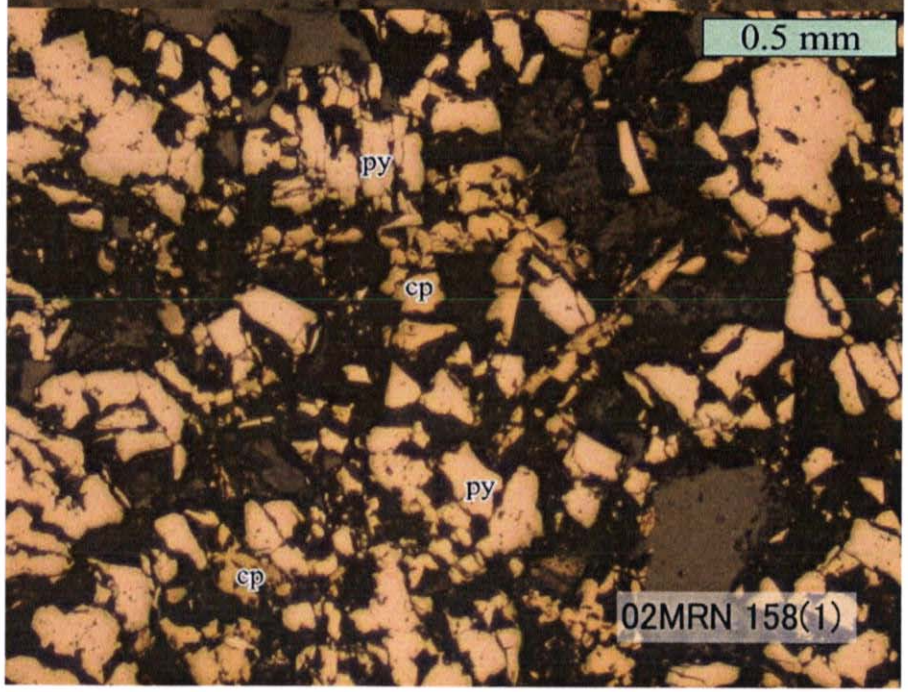
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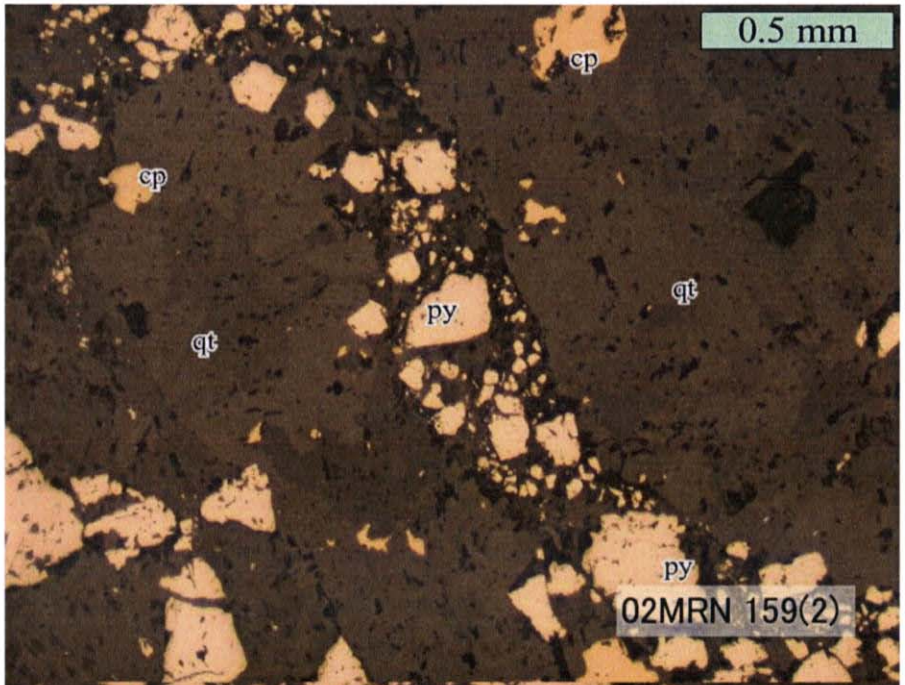
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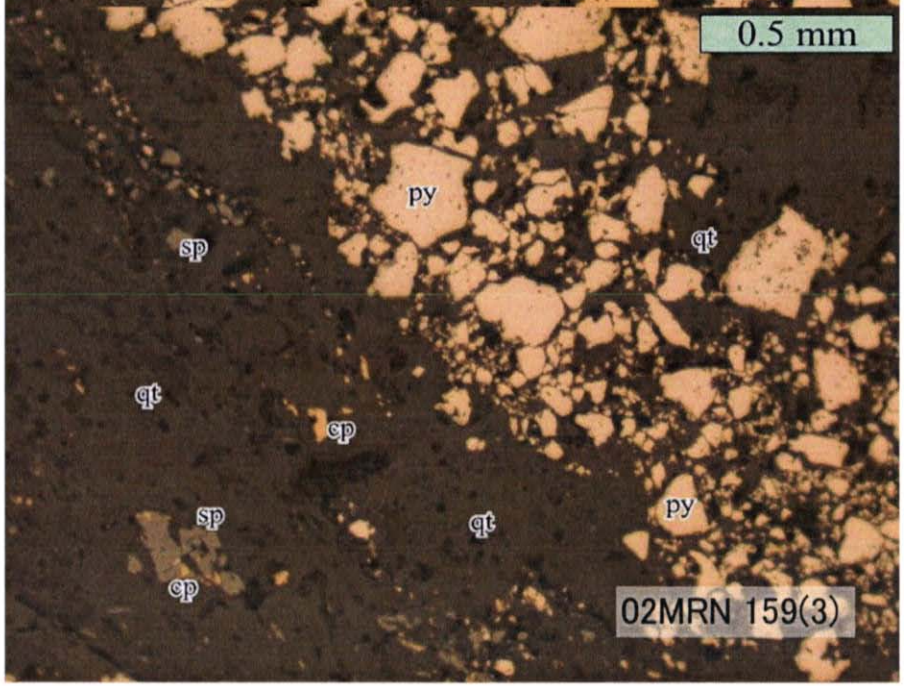
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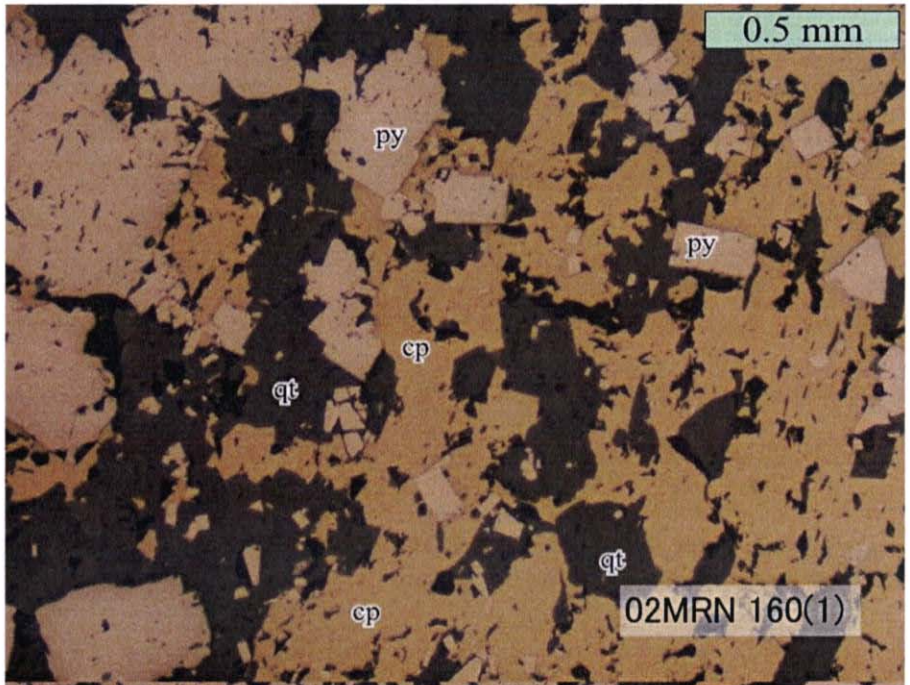
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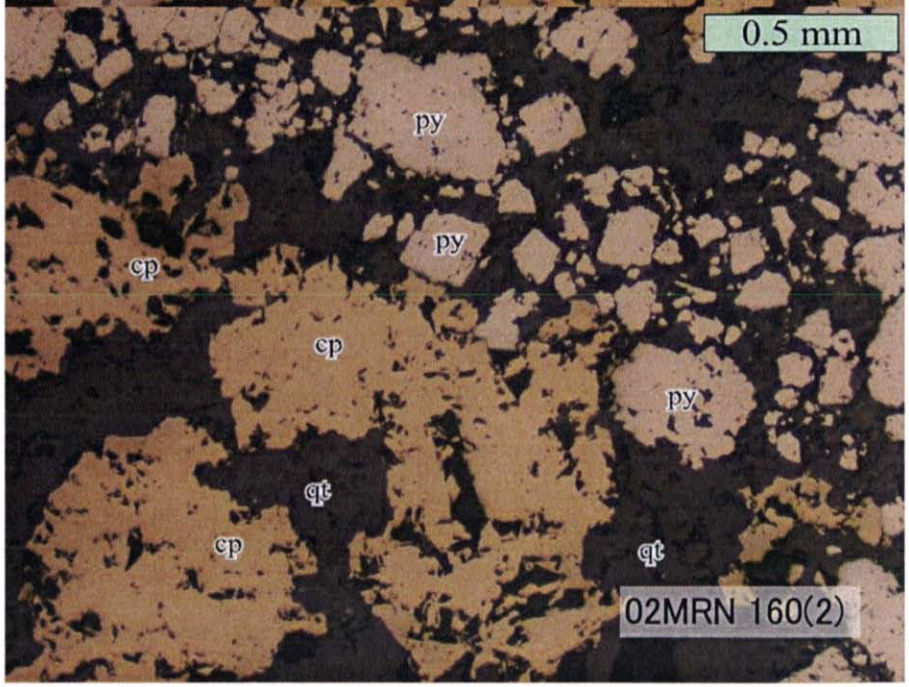
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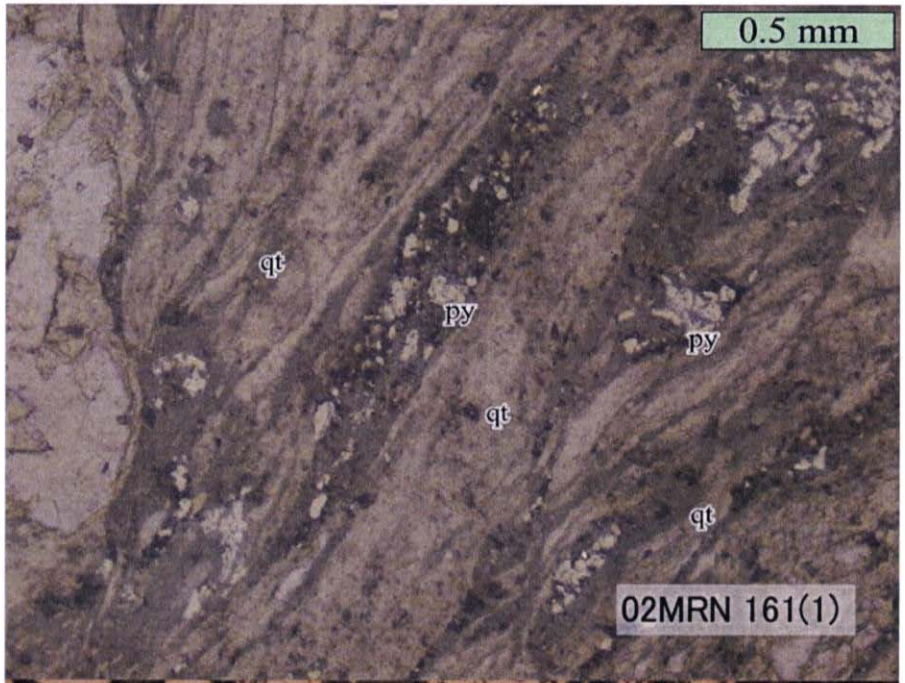
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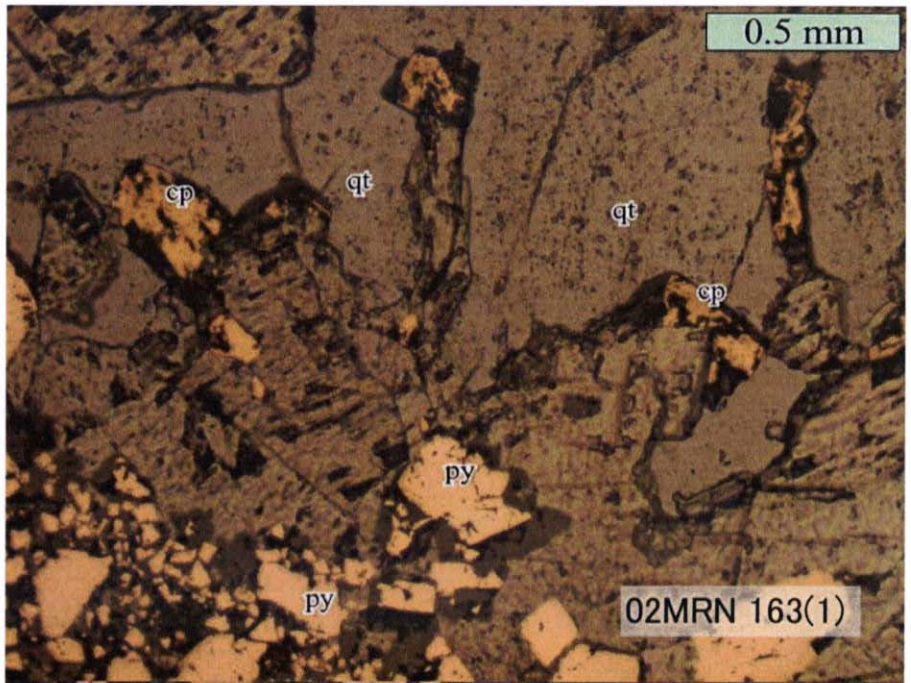
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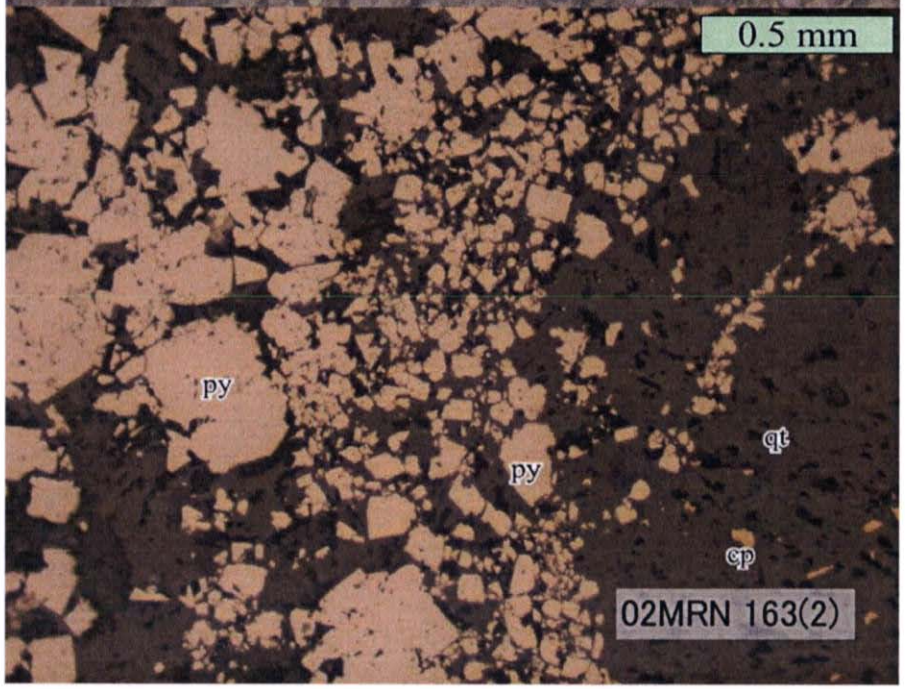
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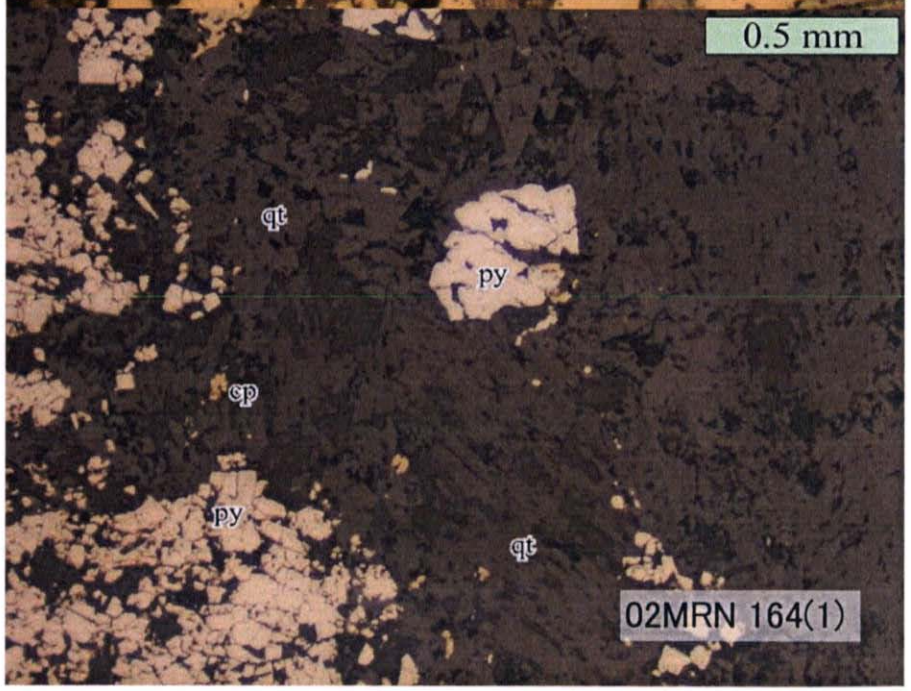
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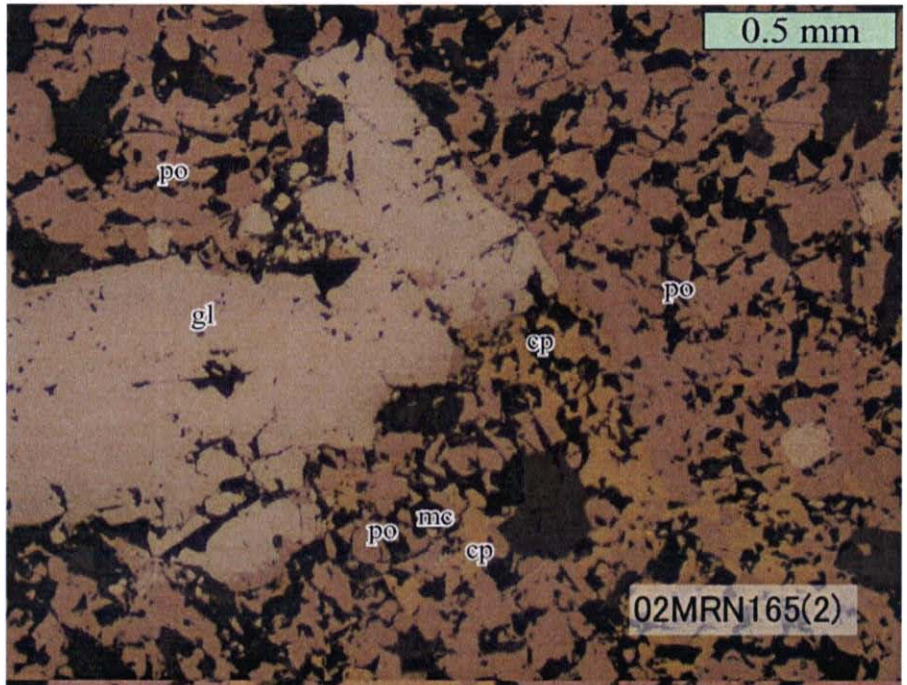
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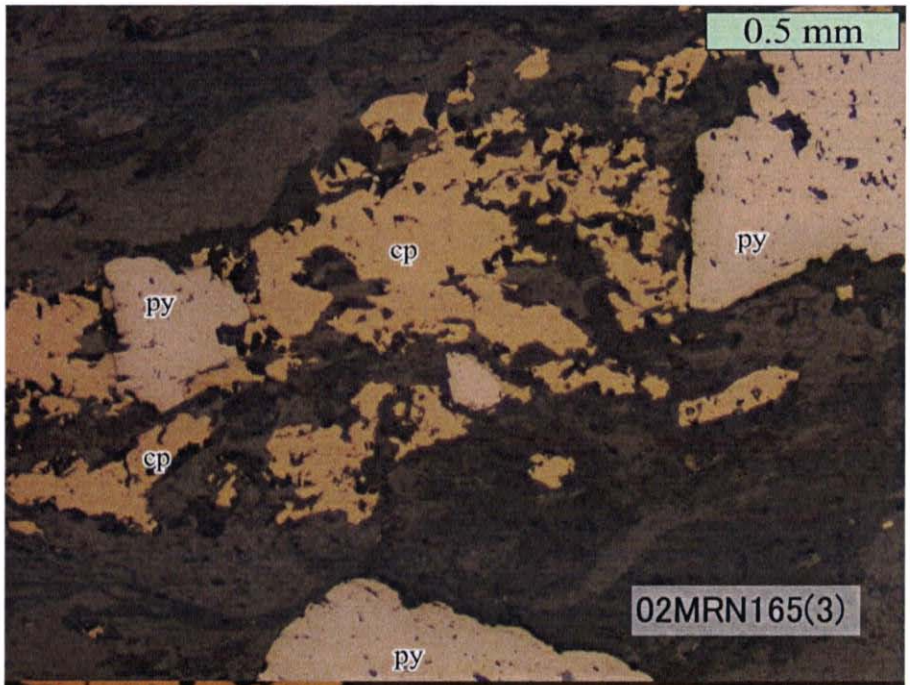
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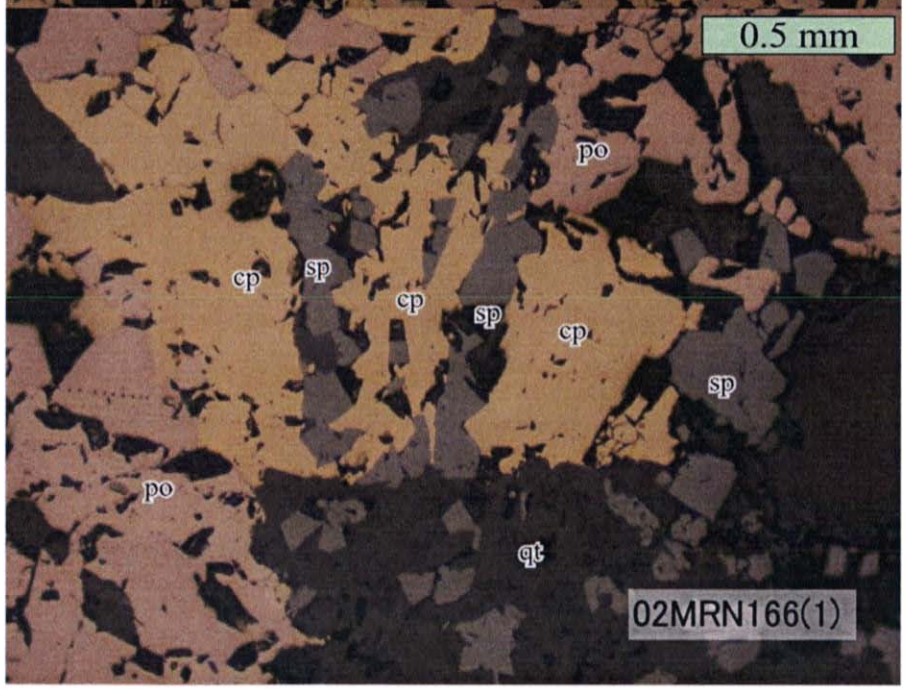
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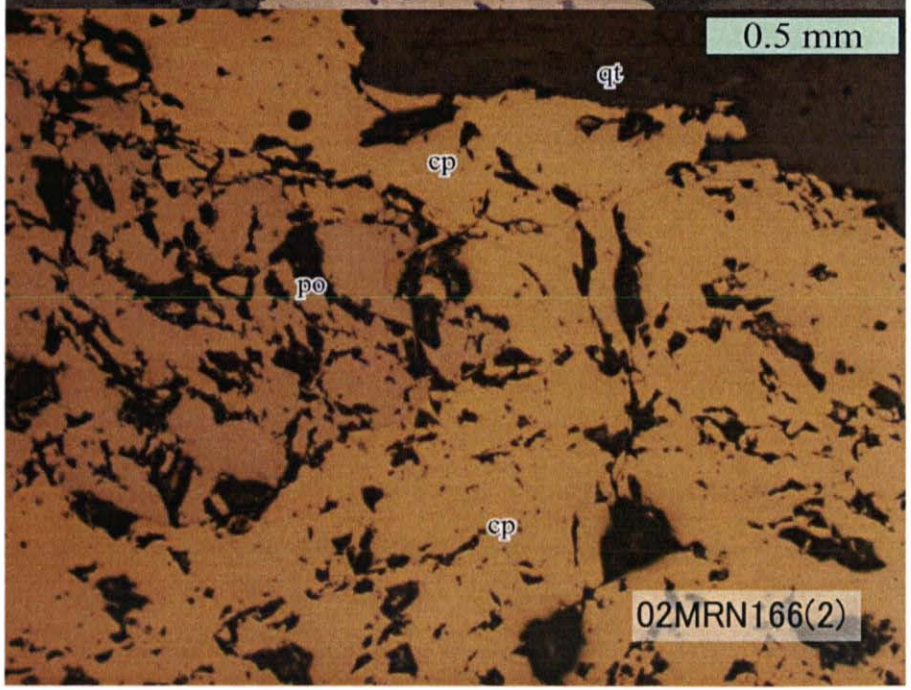
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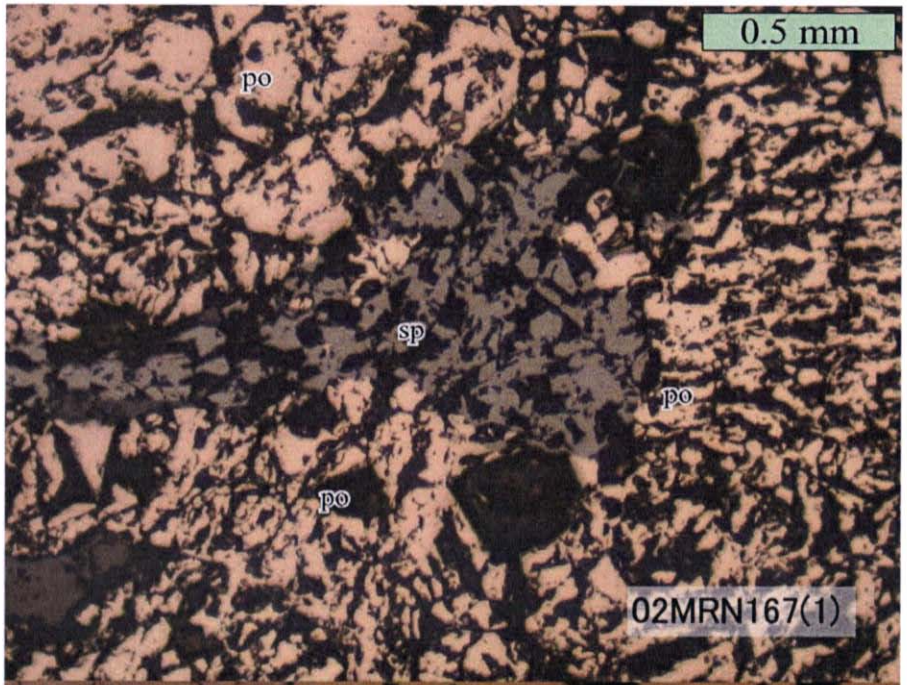
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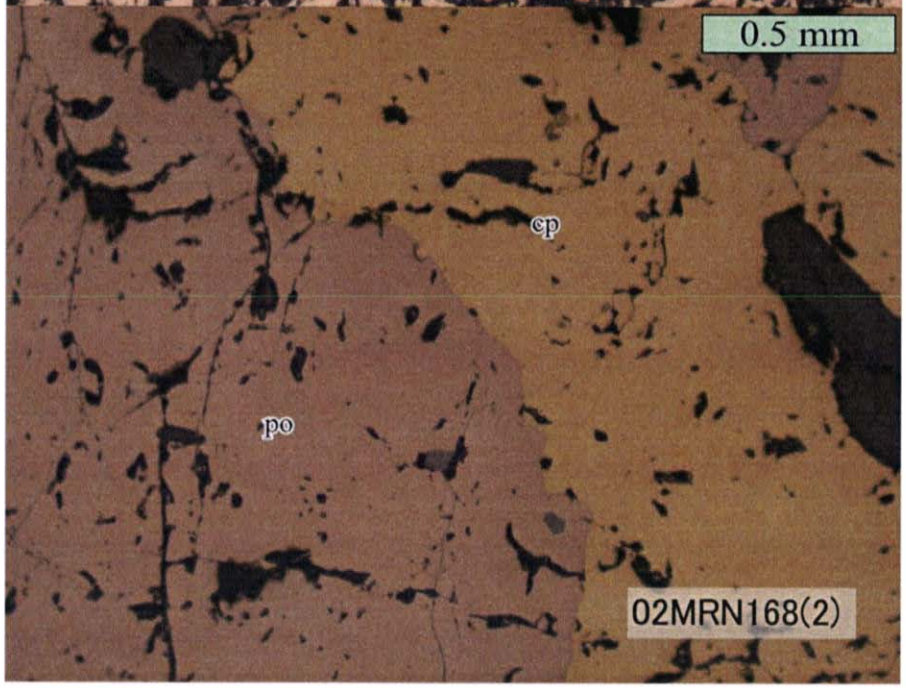
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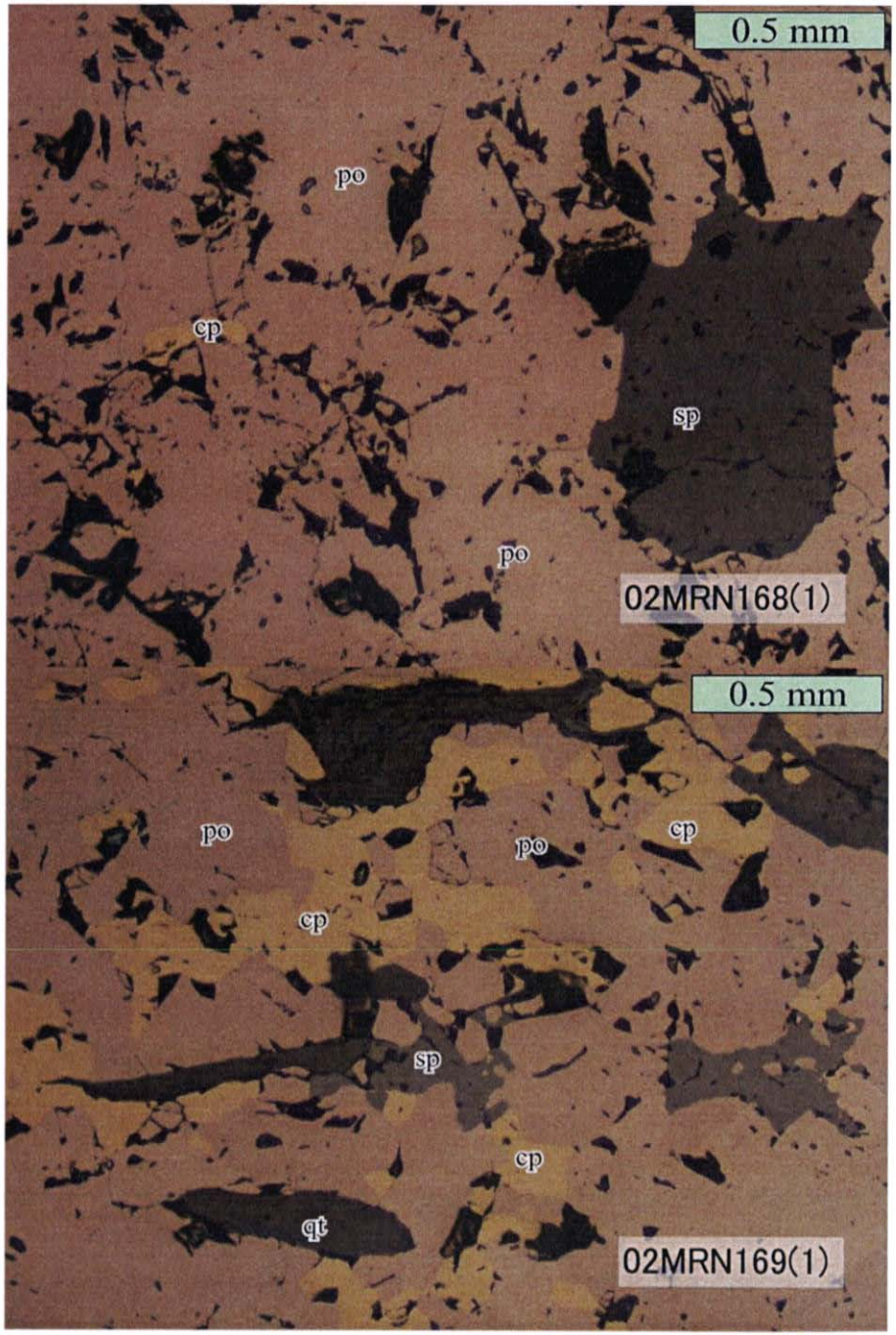
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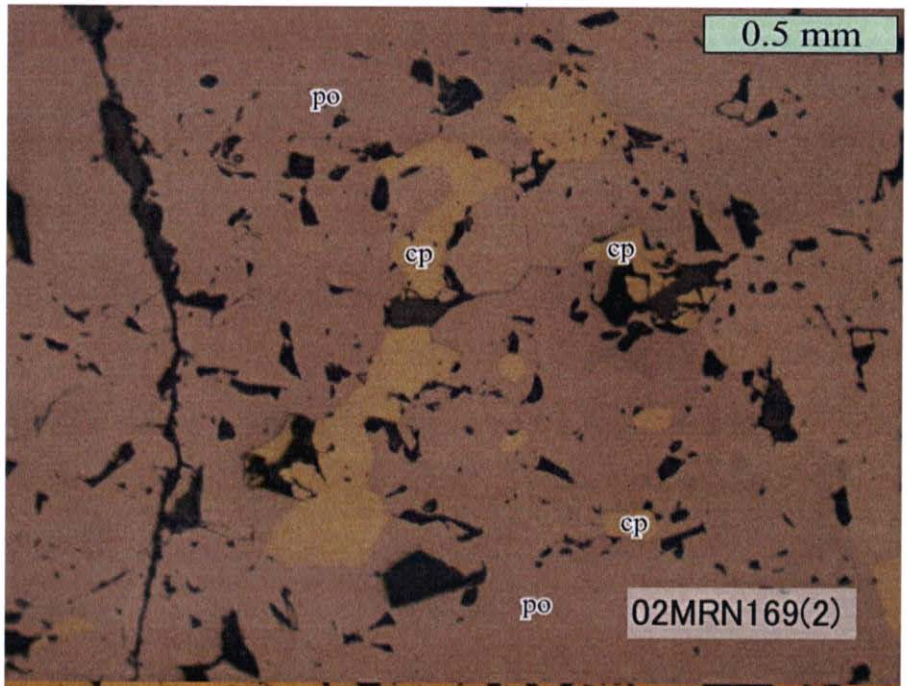
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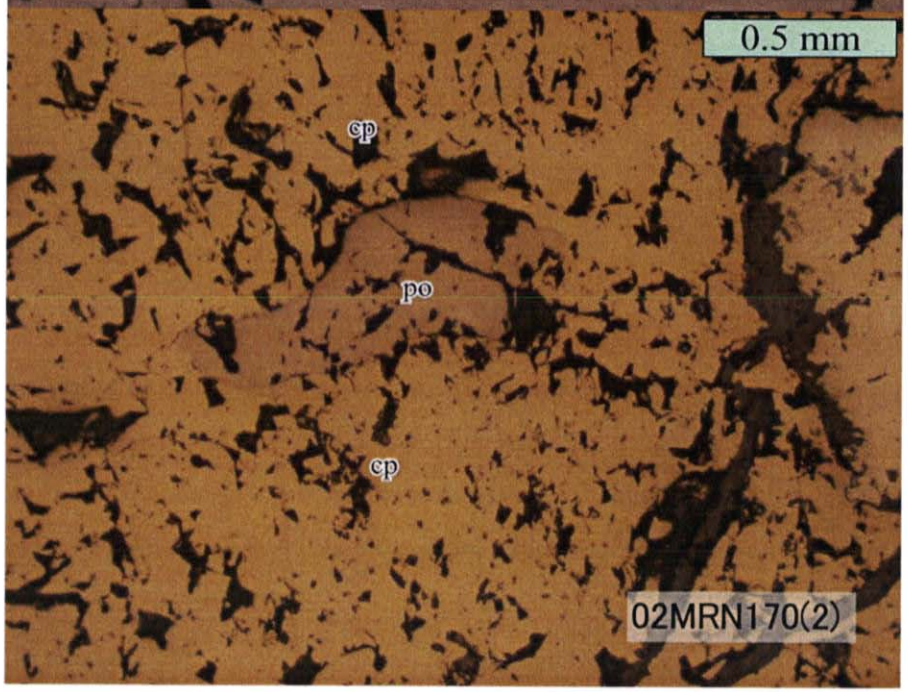
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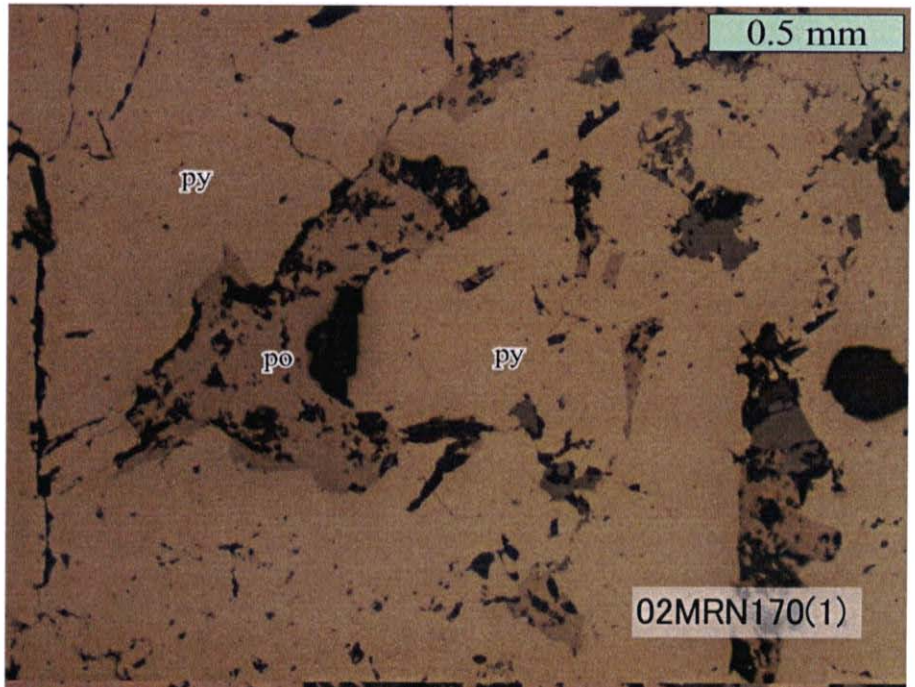
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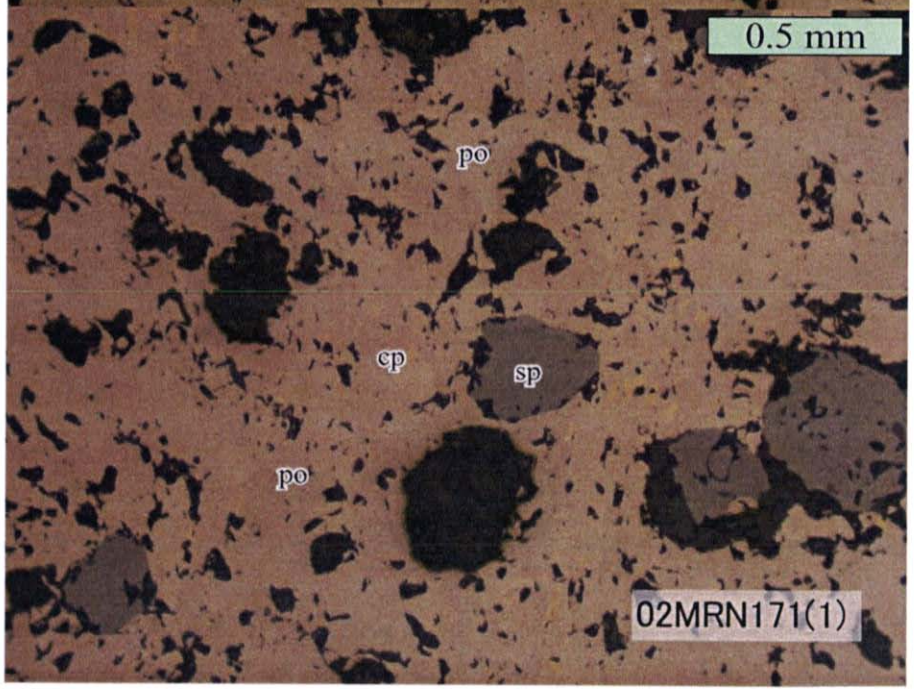
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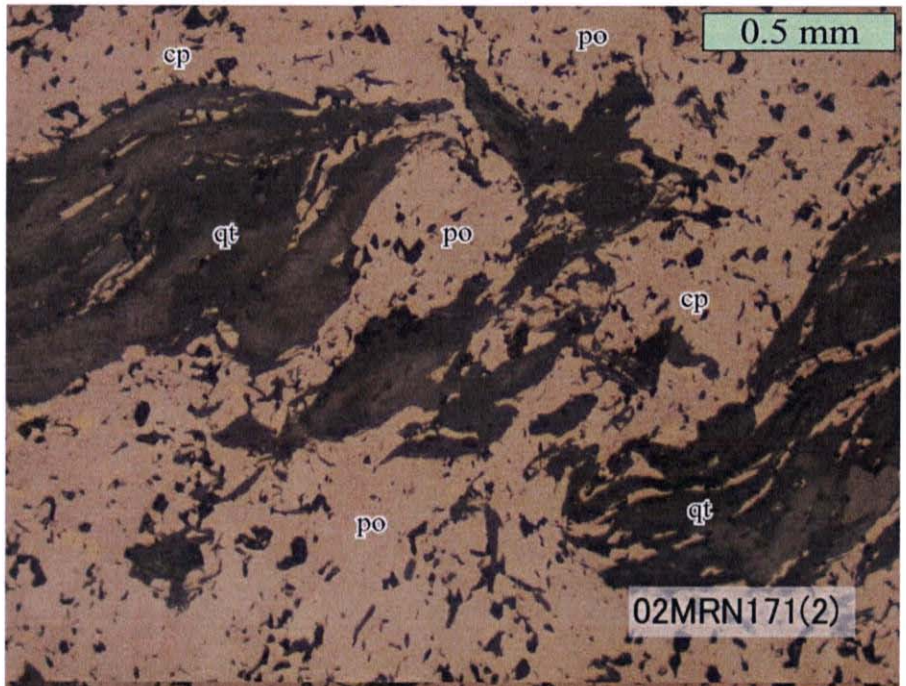
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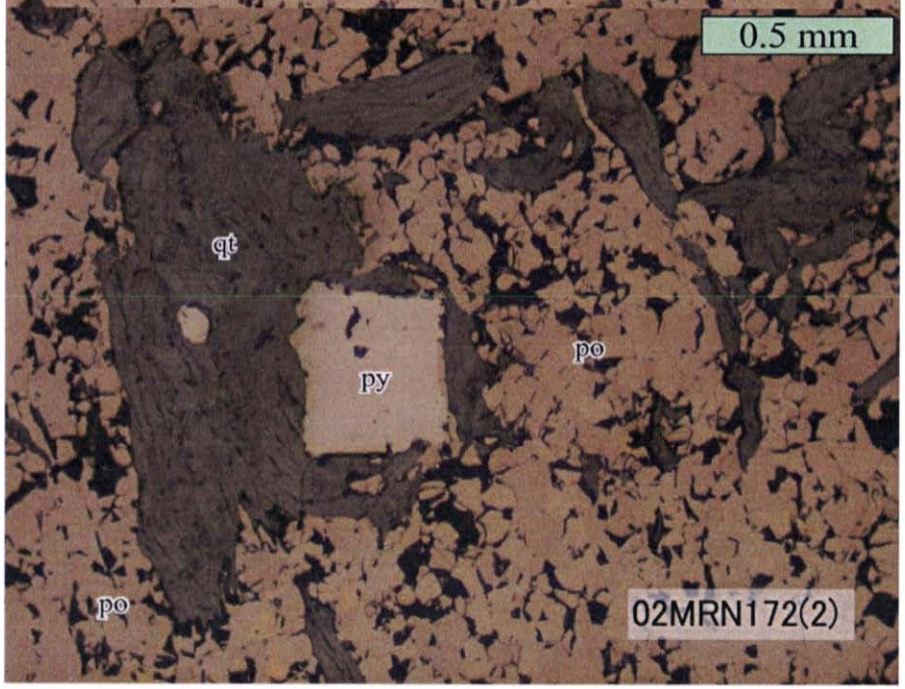
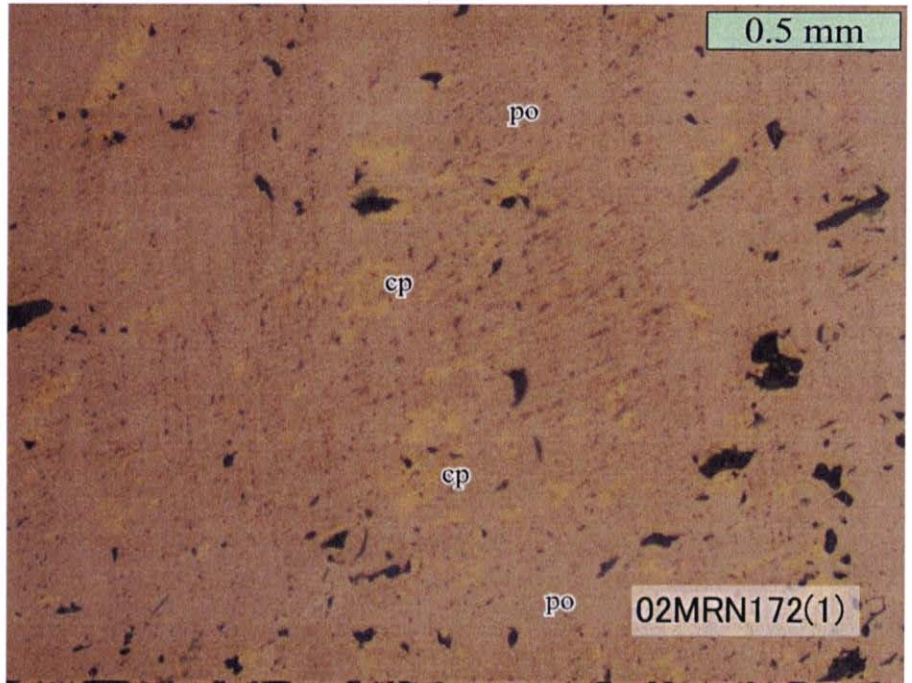
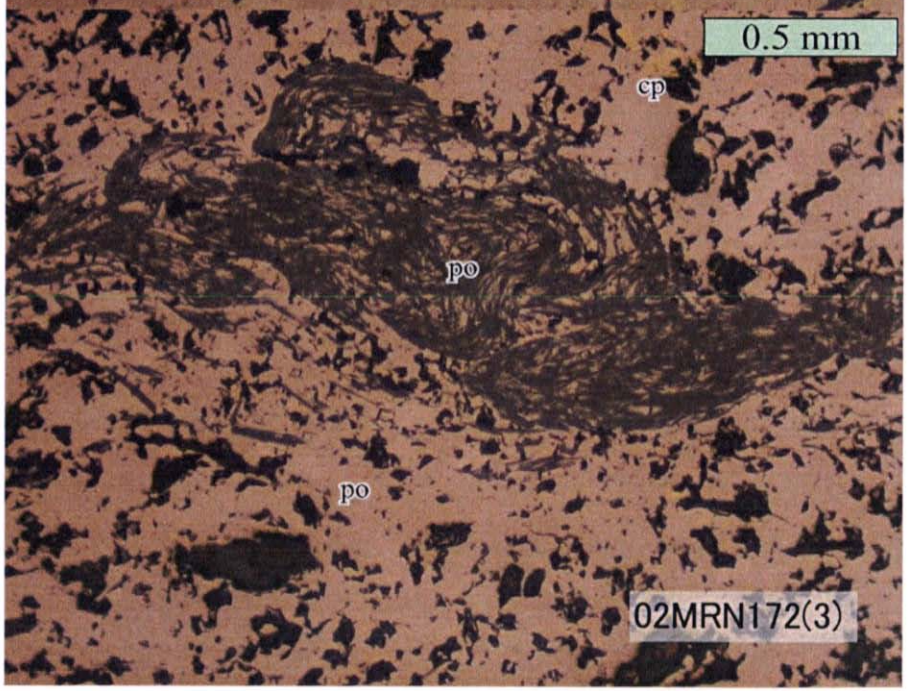
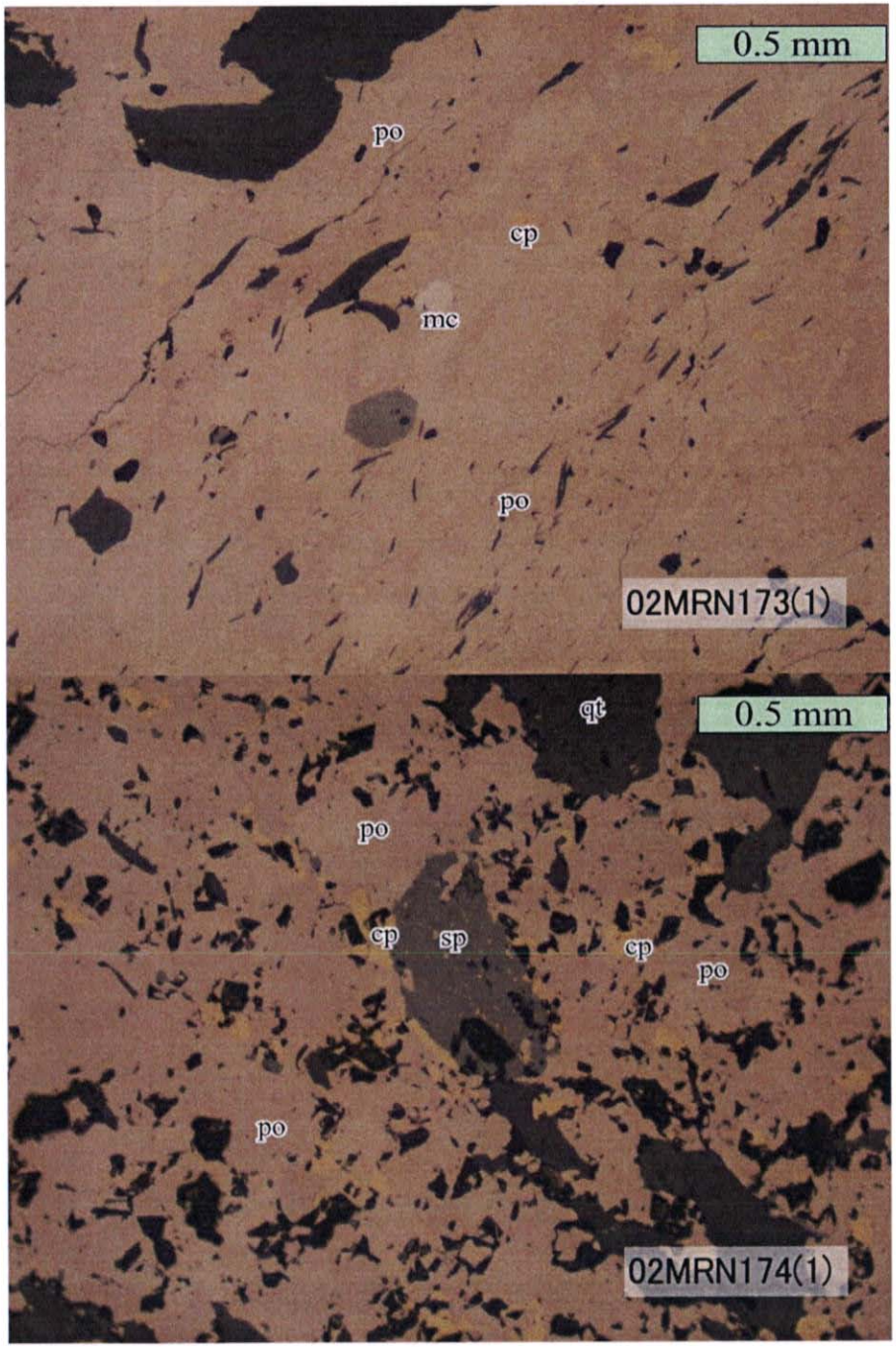
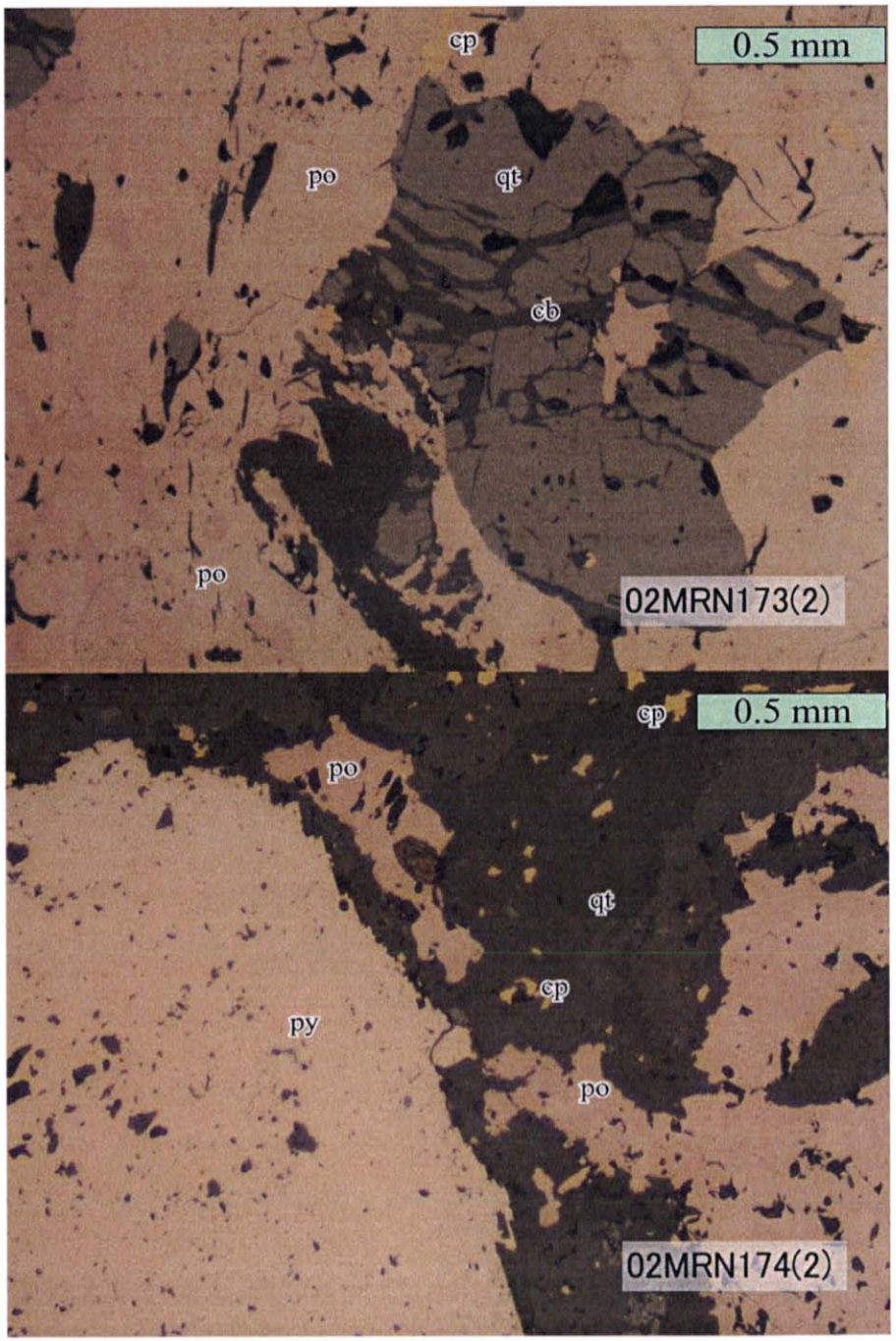

0.5 mm
qt
py
po
po
02MRN172(2)


0.5 mm
po
cp
cp
po
02MRN172(1)


0.5 mm
cp
po
po
02MRN172(3)


0.5 mm
po
cp
mc
po
02MRN173(1)

qt
0.5 mm
po
cp
sp
cp
po
po
02MRN174(1)


cp
0.5 mm
po
qt
cb
po
02MRN173(2)

cp
0.5 mm
po
qt
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py
po
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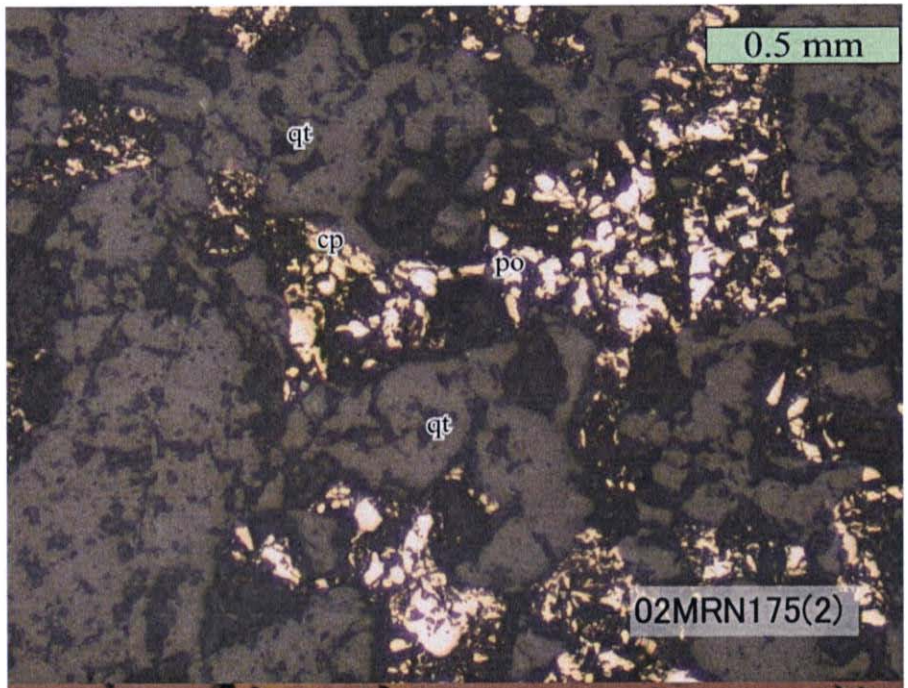
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cp
po
qt
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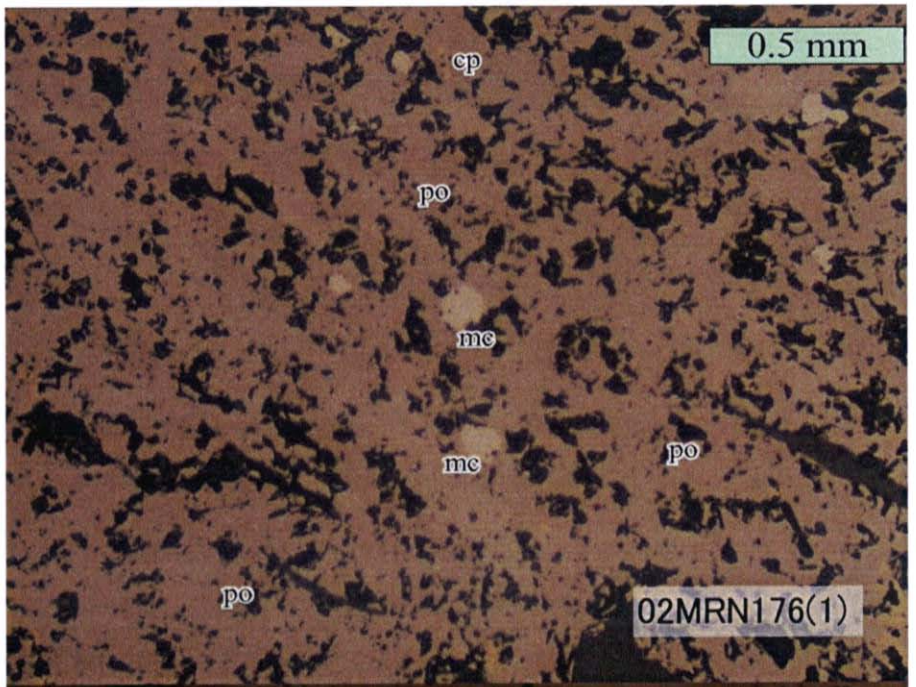
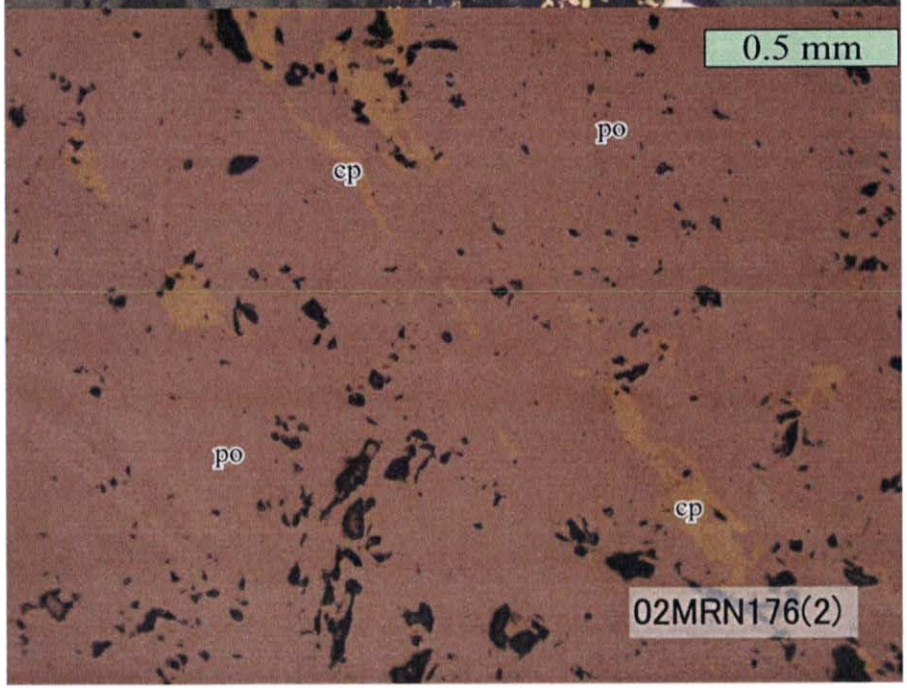
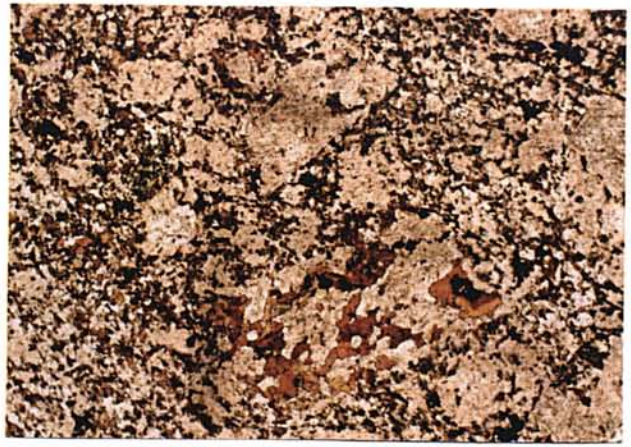

0.5 mm
cp
po
mc
mc
po
po
02MRN176(1)


0.5 mm
po
cp
po
cp
02MRN176(2)

0.5 mm
po
02MRN176(3)

0.5 mm
po
mc
po
mc
qtz
po
02MRN178(1)
0.5 mm
cp
py
cp
py
py
po
02MRN178(3)
0.5 mm
cp
cp
po
qtz
sp
cp
po
02MRN178(2)
0.5 mm
cp
po
cp
po
02MRN176(4)

Igneous Rocks



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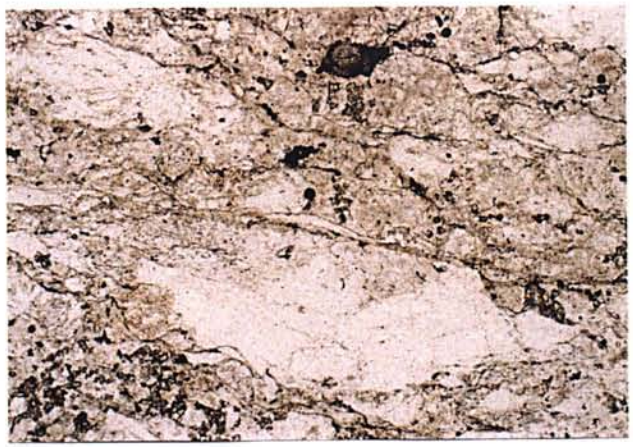

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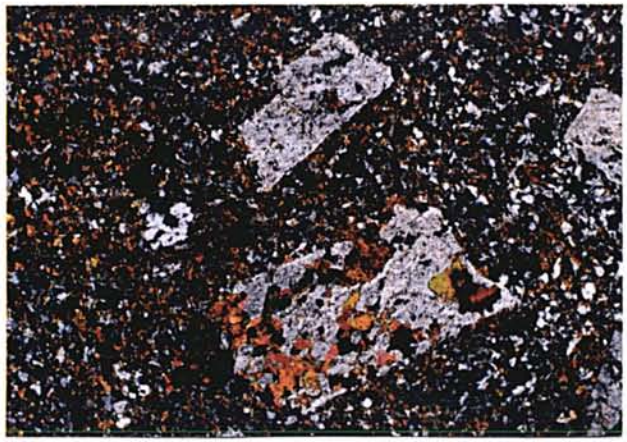
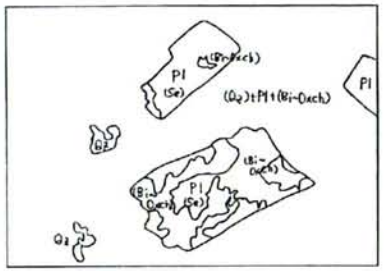


Cross

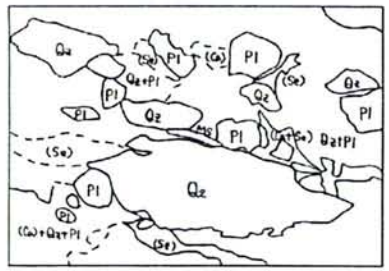
1 mm

Cross

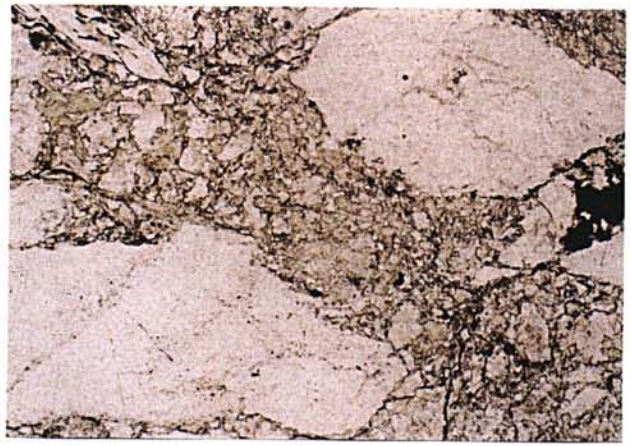
1 mm



02MRS 001*



02MRS 002



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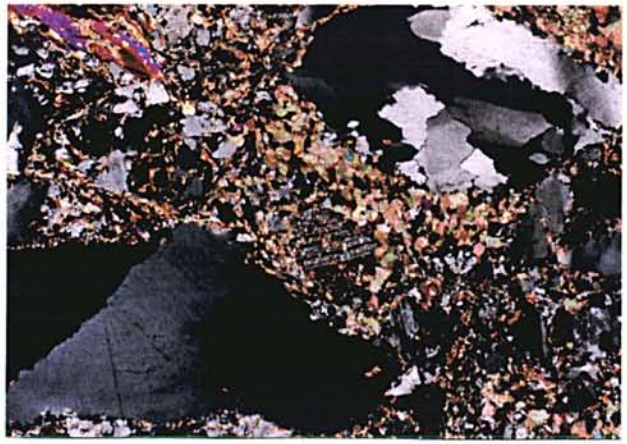
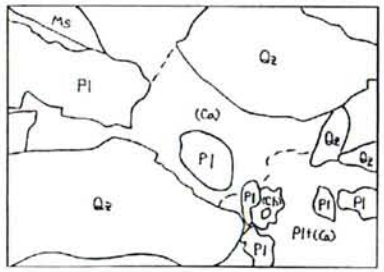
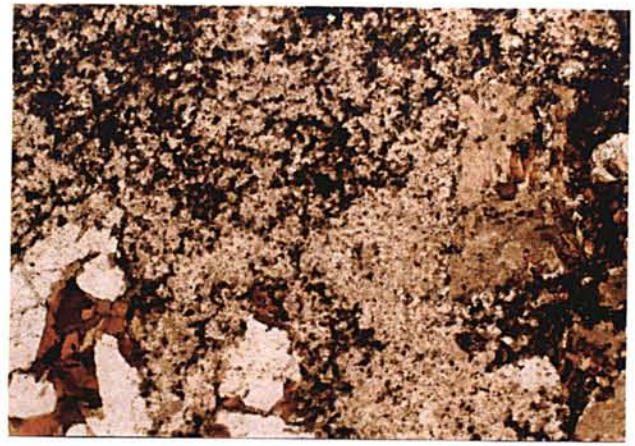


Cross

1 mm



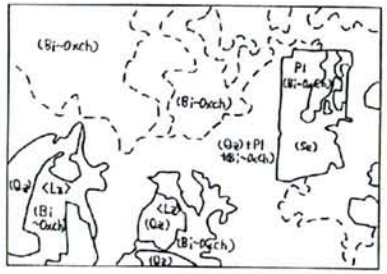
02MRS 003



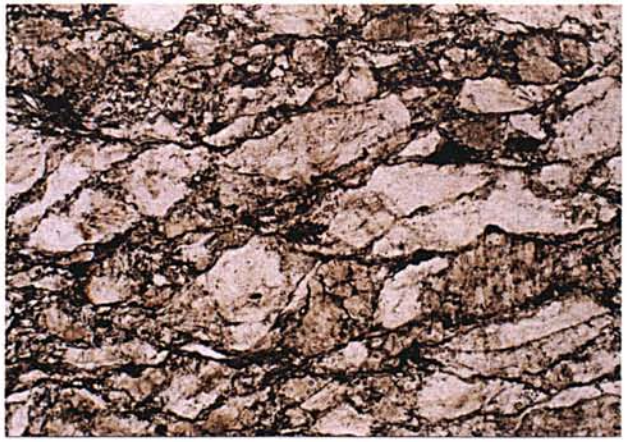
Open

Cross

1 mm



02MRS 004*



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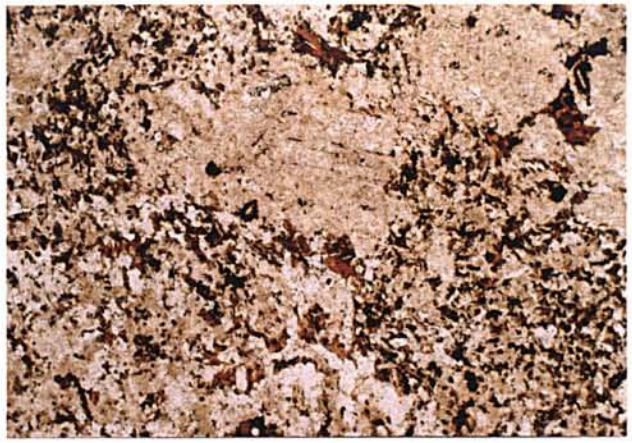
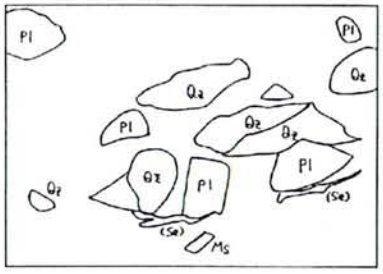


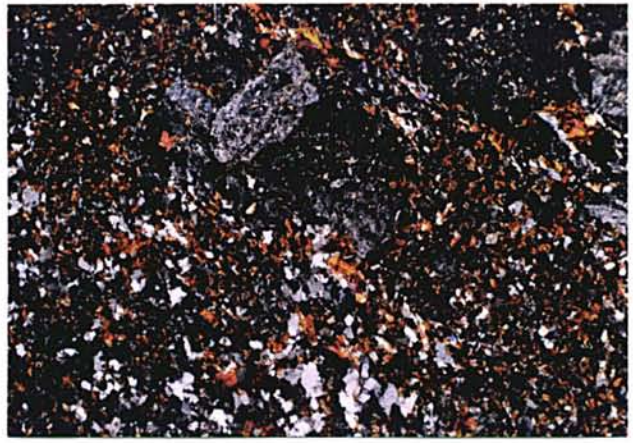
Open

Cross

1 mm

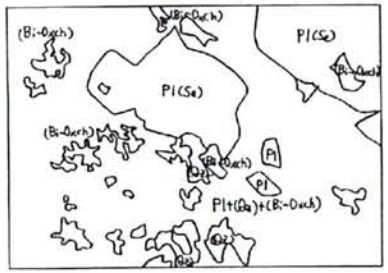


02MRS 005*



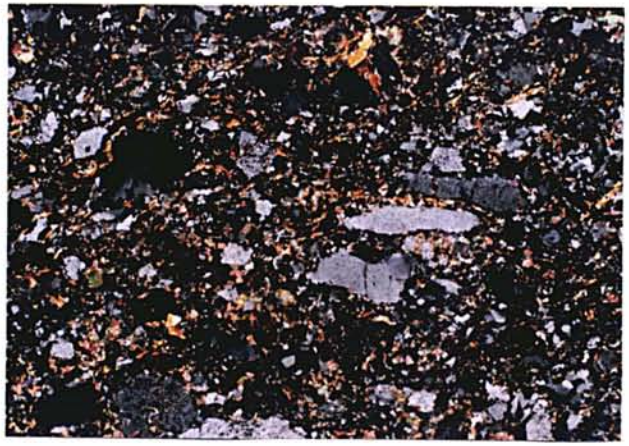
Cross

1 mm



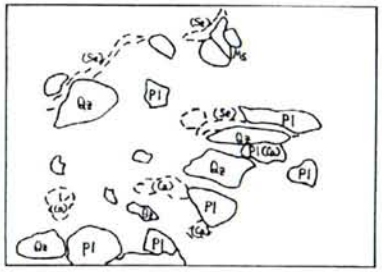
02MRS 006

Open

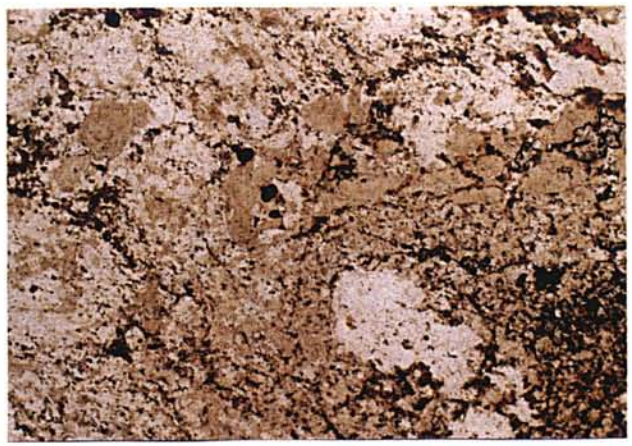


Cross

1 mm



02MRS 008



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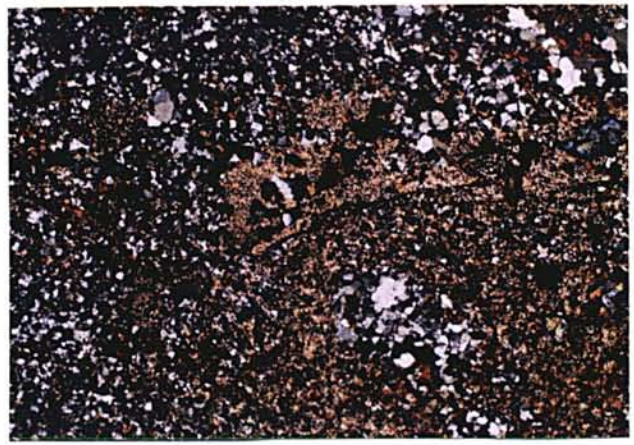

Cross

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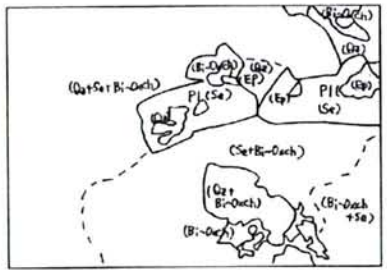
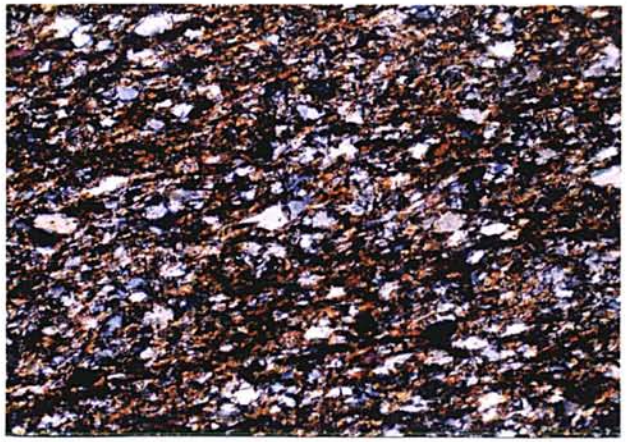


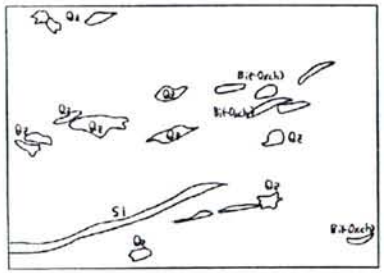
02MRS 009*

Open

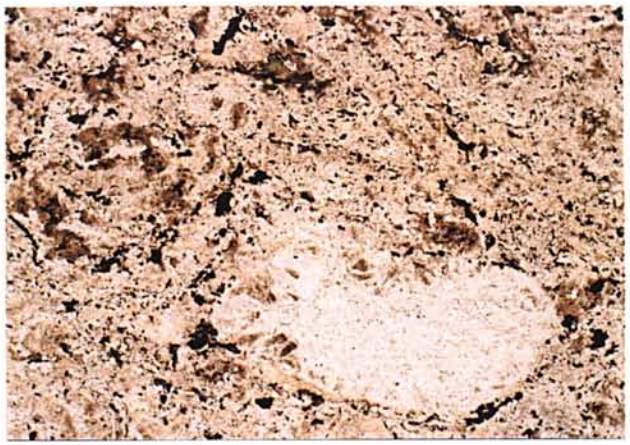


Cross

0.4mm



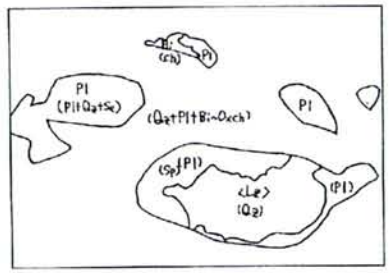
02MRS 0010*



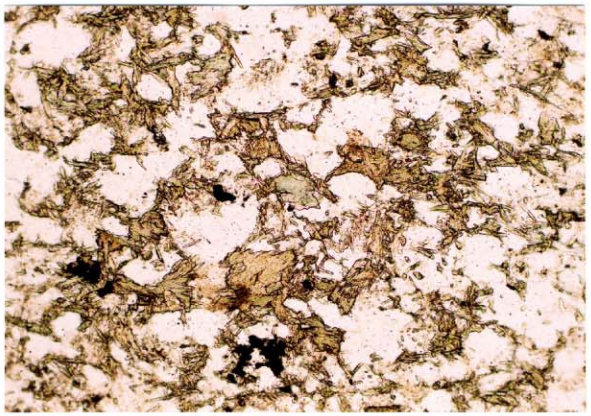
Open

Cross

1mm



02MRS 0011



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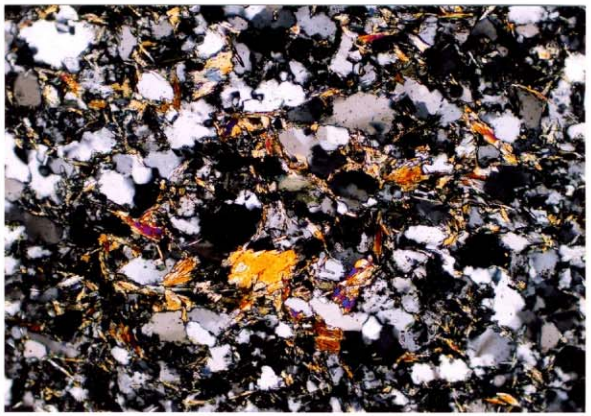
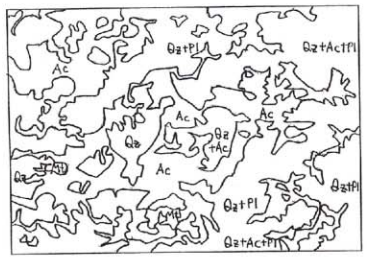
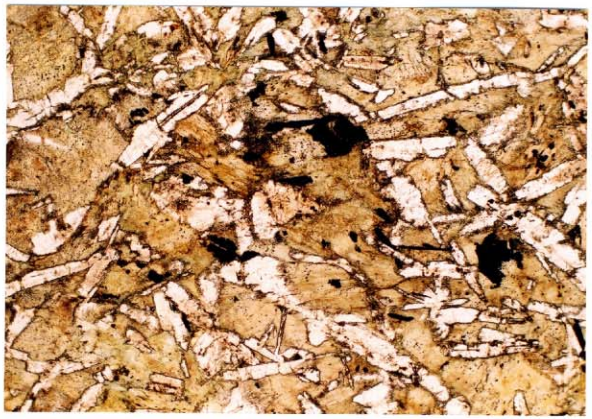


Cross

0.4 mm



02MRS 0012



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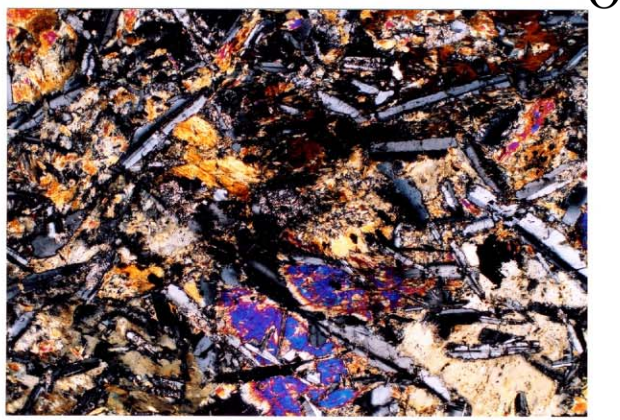
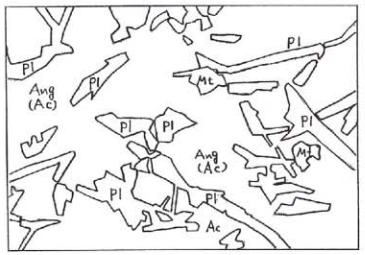
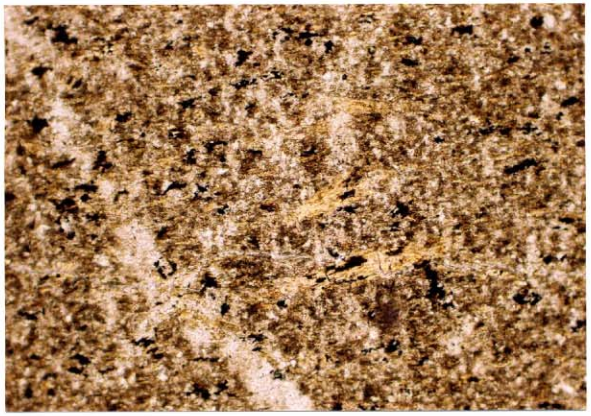


Cross

1 mm



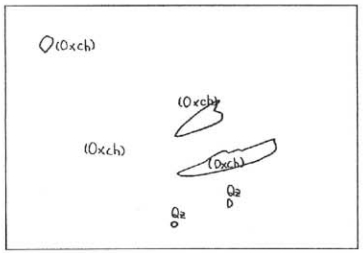
02MRS 0013



Open

Cross

0.4 mm



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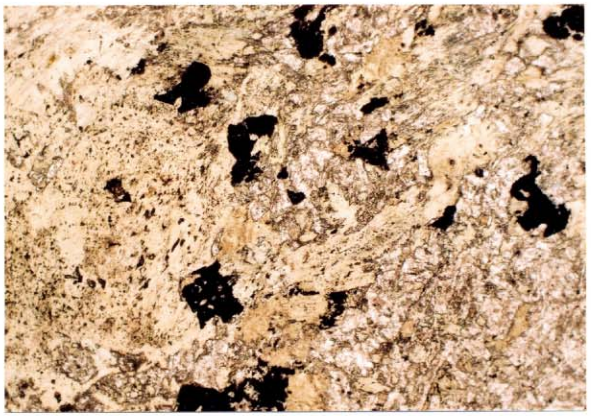

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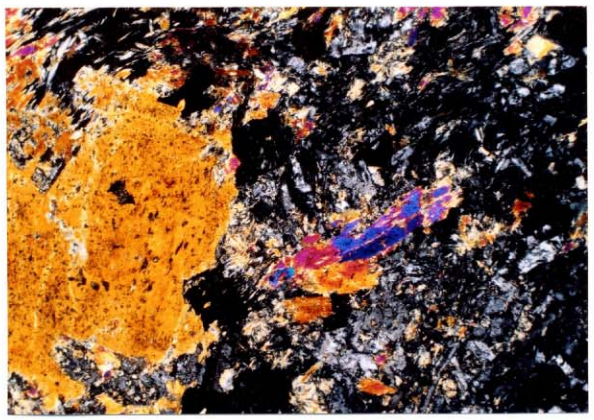
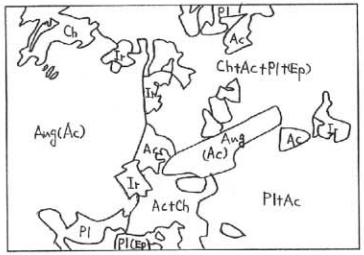


Cross

1 mm

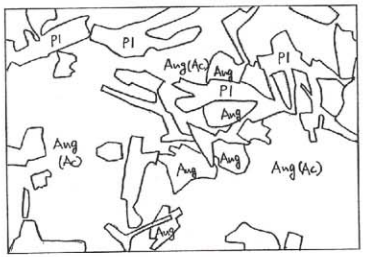


02MRS 0015

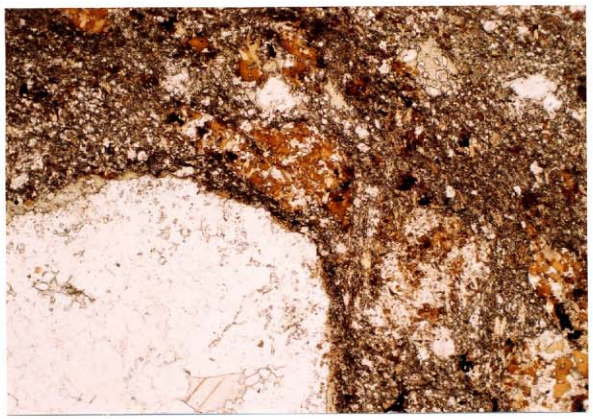
Open

Cross

1 mm



02MRS 0016



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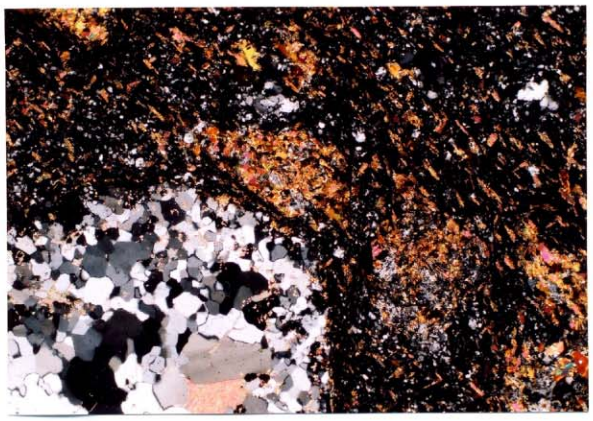
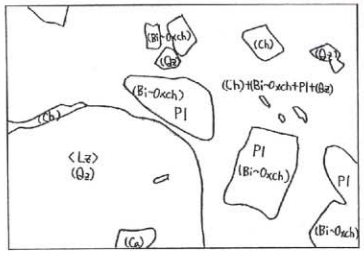
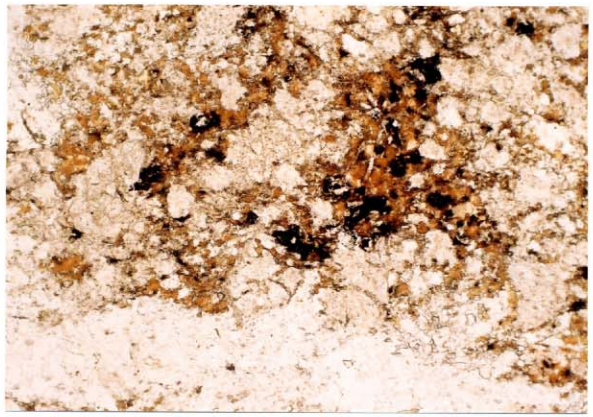


Cross

1 mm



02MRS 0017



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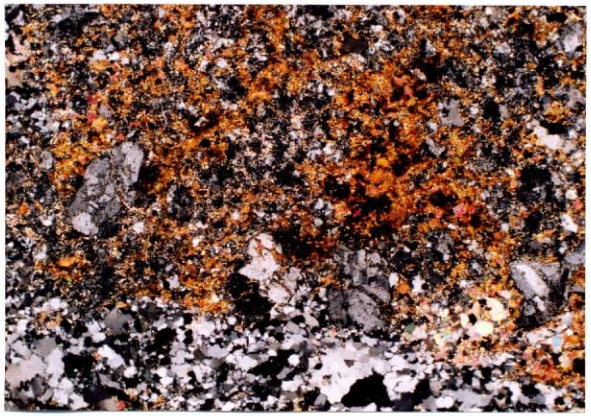
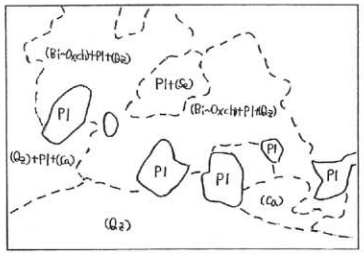


Cross

1 mm



02MRS 0018

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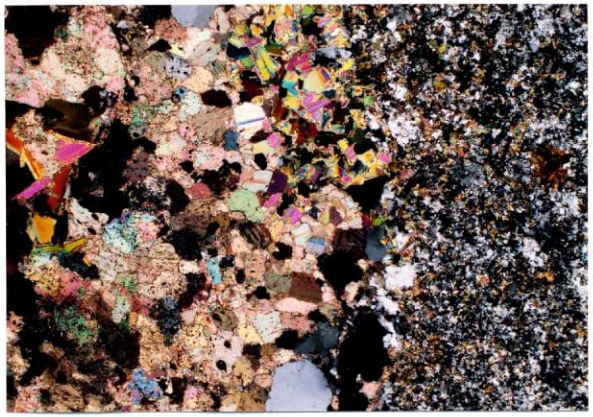
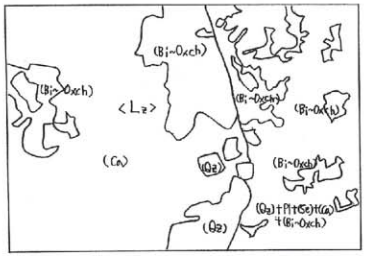


Cross

1 mm



02MRS 0021

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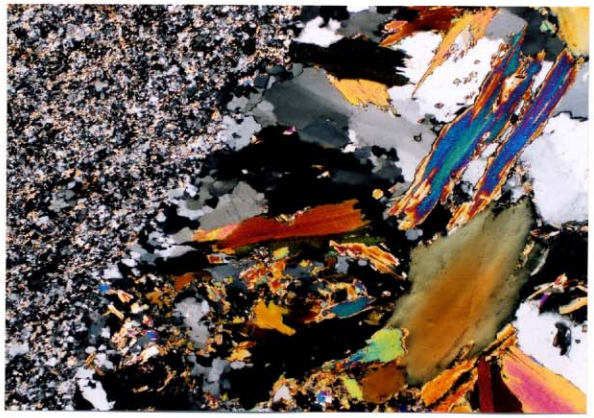
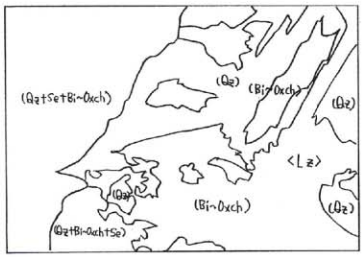


Cross

1 mm

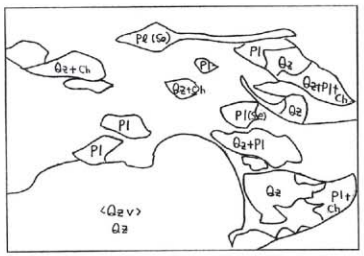


02MRS 0023

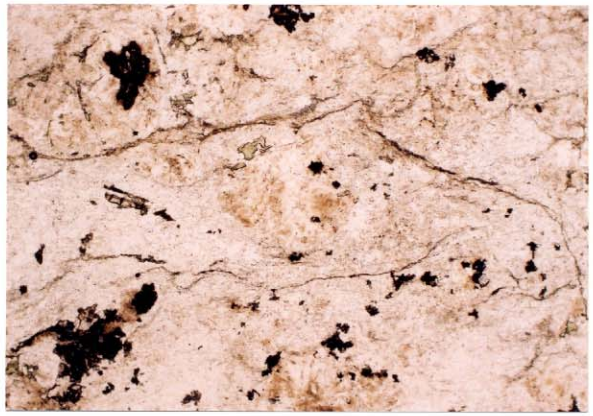
Open

Cross

1 mm



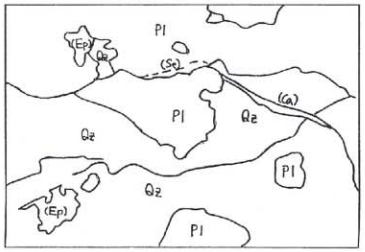
02MRS 0029



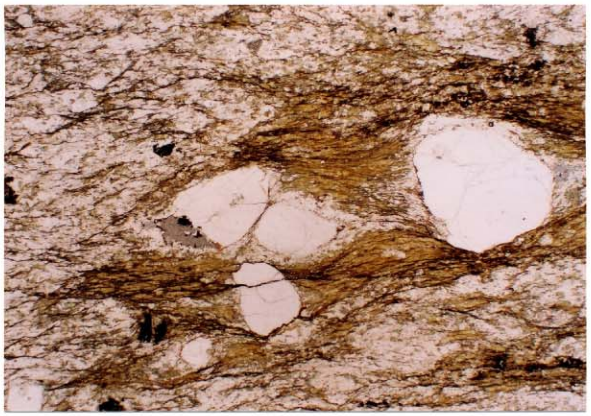
Open

Cross

1 mm



02MRS 0030



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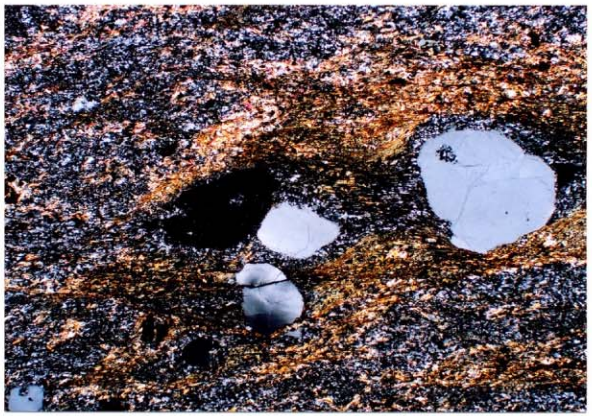
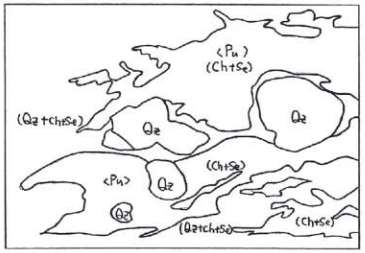


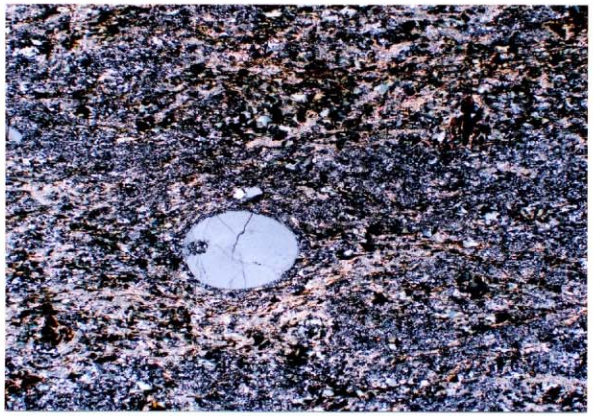
Cross

2 mm



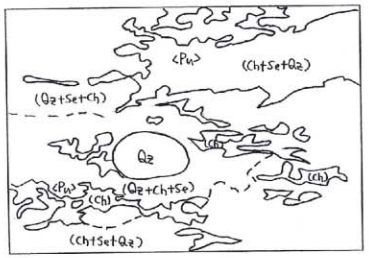
02MRS 0031

Open

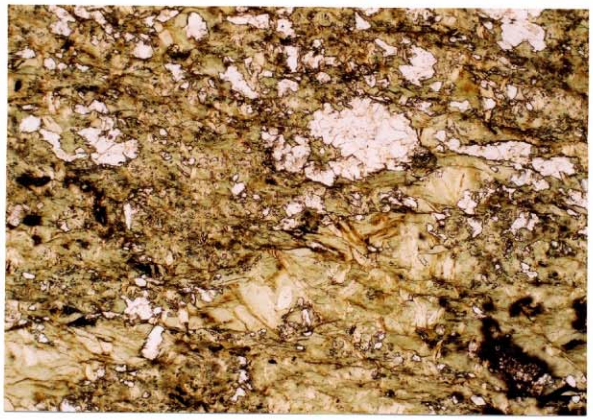


Cross

2 mm



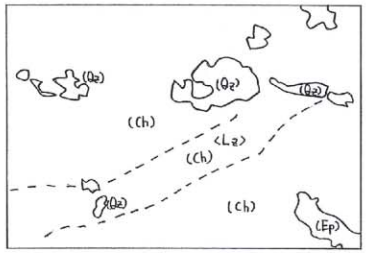
02MRS 0032



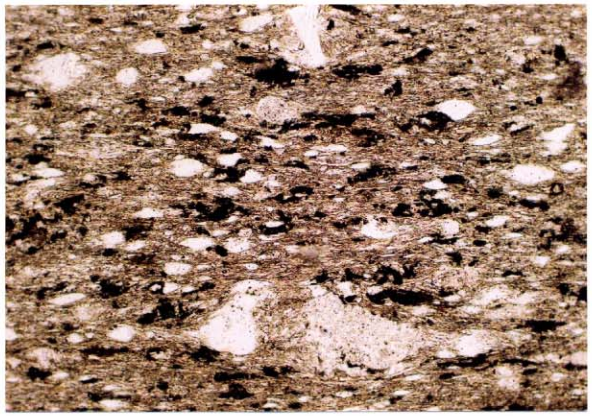
Open

Cross

1 mm



02MRS 0033



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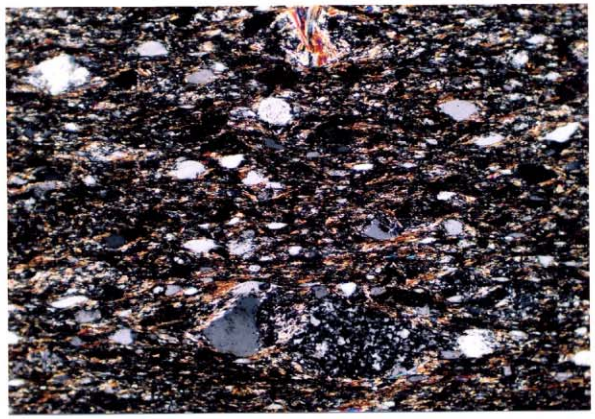
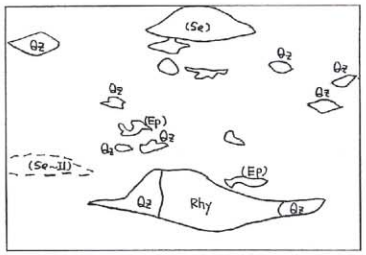
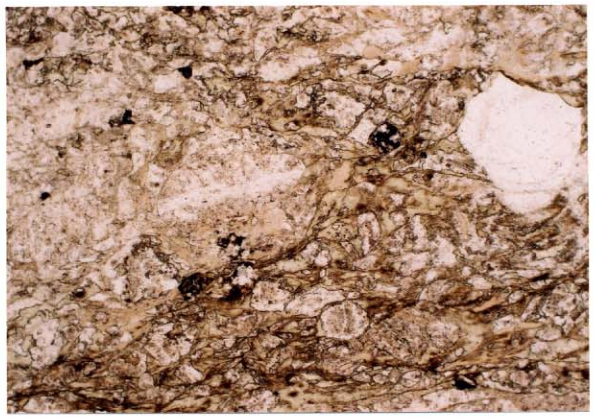


Cross

0.4 mm



02MRS 0034



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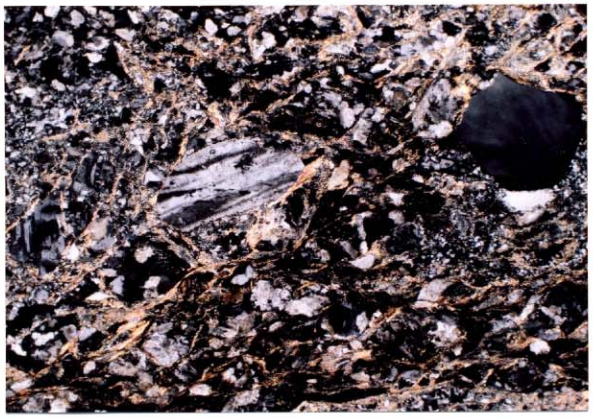
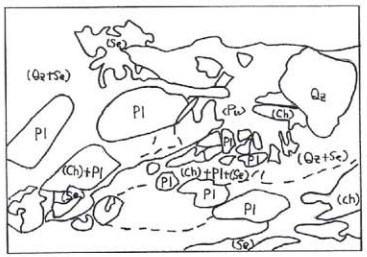


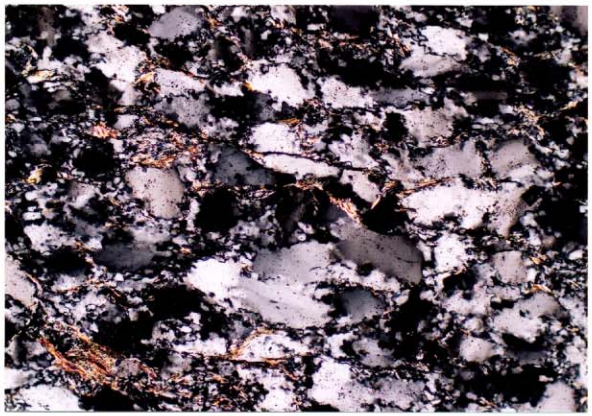
Cross

1 mm



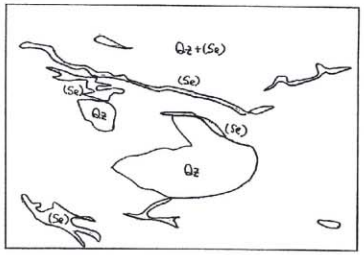
02MRS 0036

Open

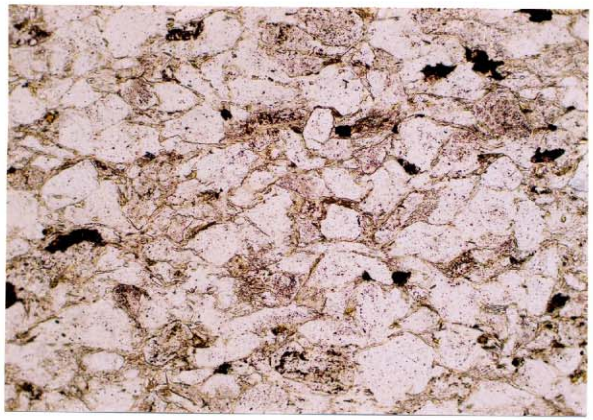


Cross

0.4 mm



02MRS 0038



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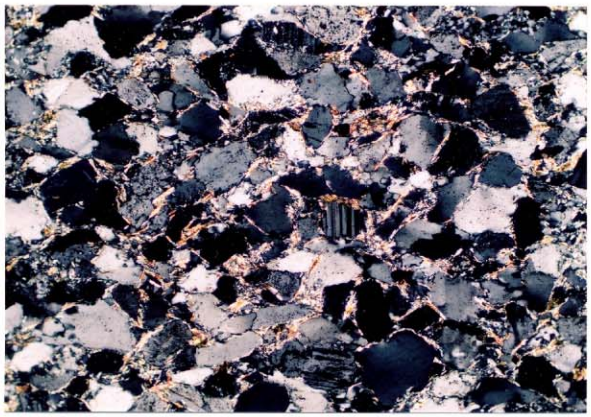
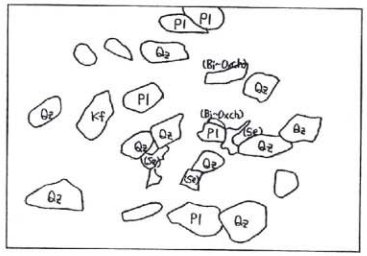
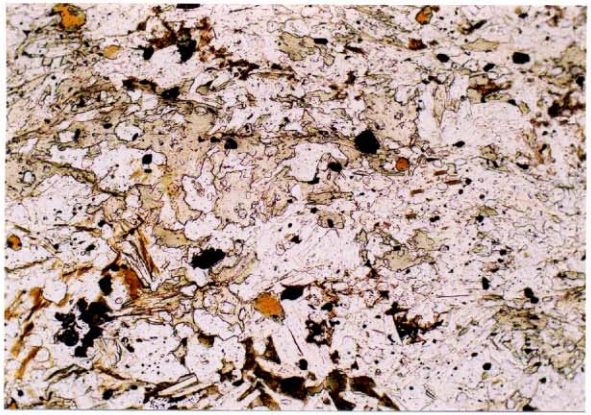


Cross

0.4 mm



02MRS 0039



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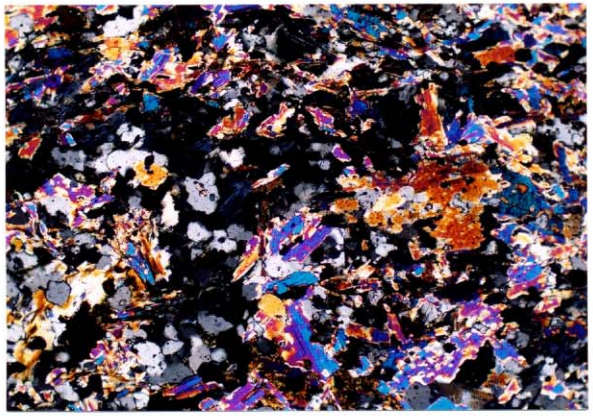
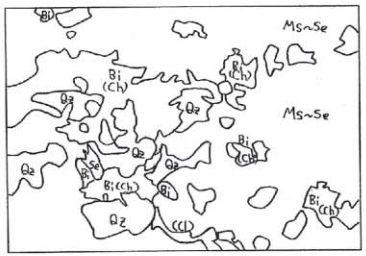
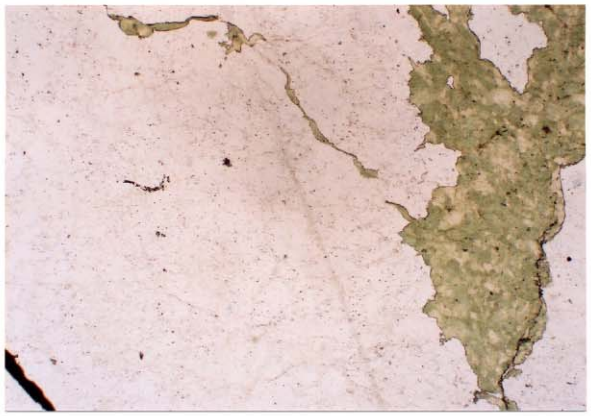


Cross

0.4 mm



02MRS 0040



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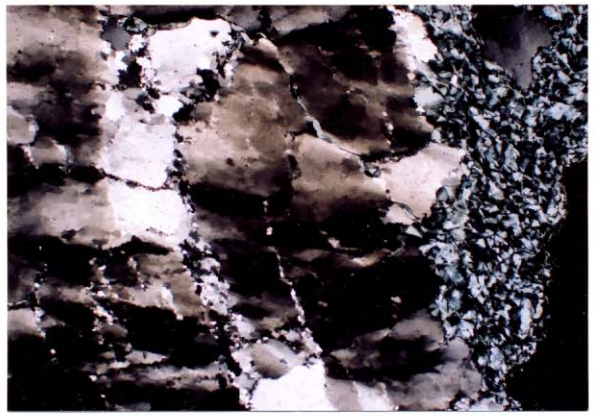
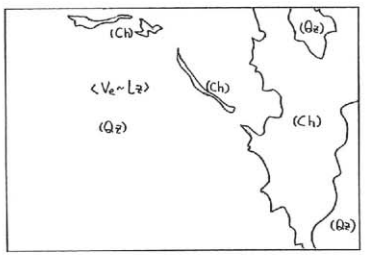
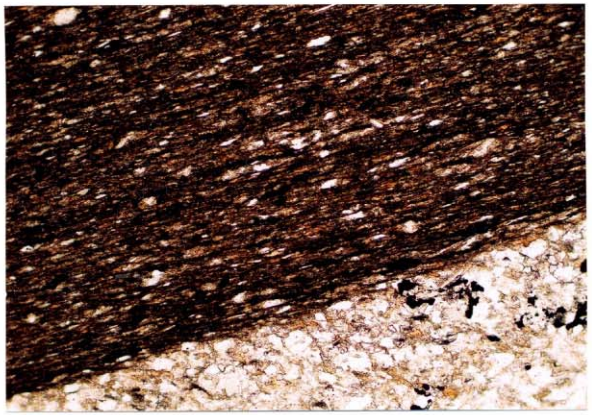


Cross

2 mm



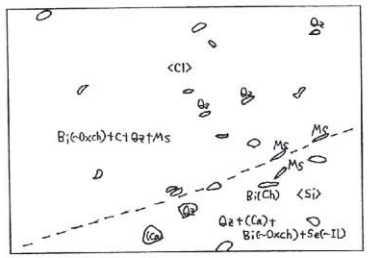
02MRS 0042



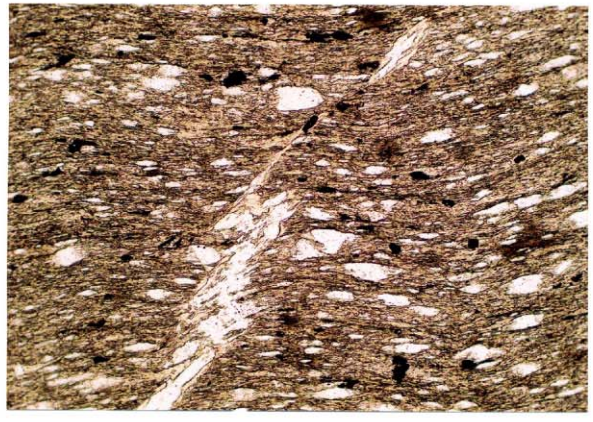
Open

Cross

0.4 mm



02MRS 0043



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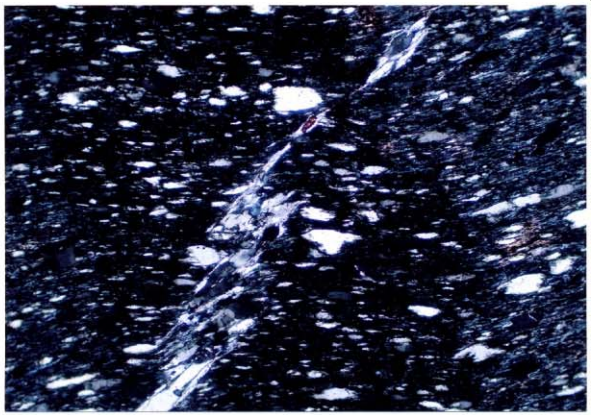
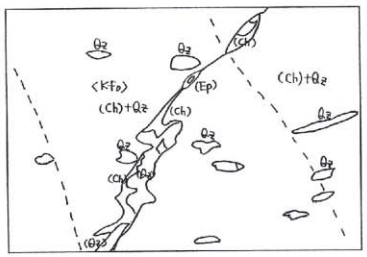


Cross

0.4 mm

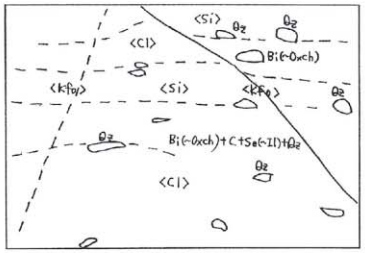


02MRS 0044

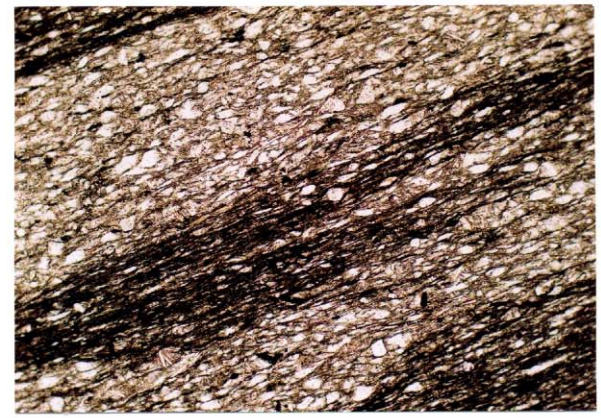
Open

Cross

0.4 mm



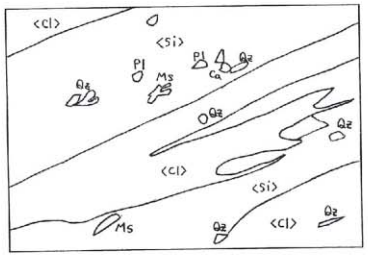
02MRS 0045



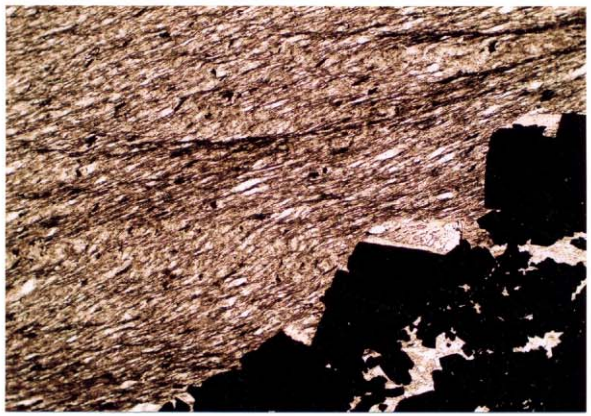
Open

Cross

0.4 mm



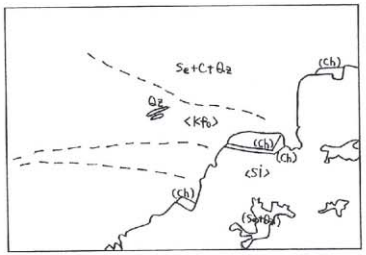
02MRS 0046



Open

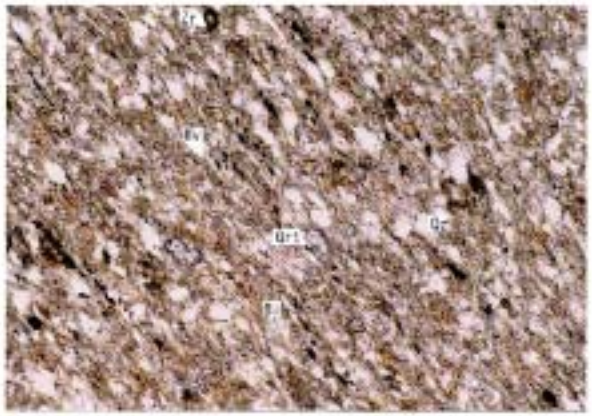
Cross

0.4 mm



02MRS 0047

Sedimentary Rocks



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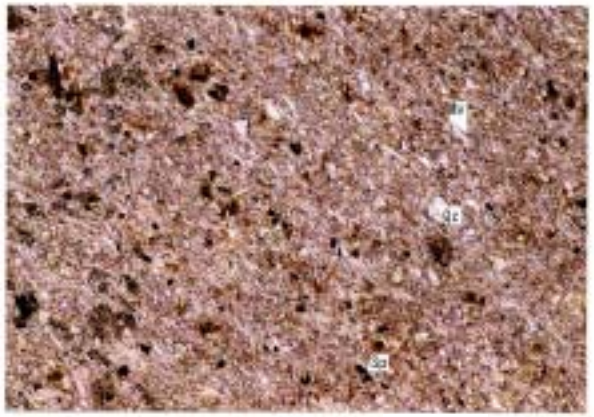

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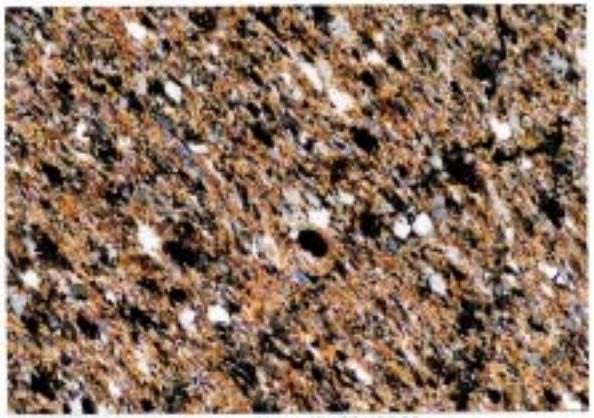
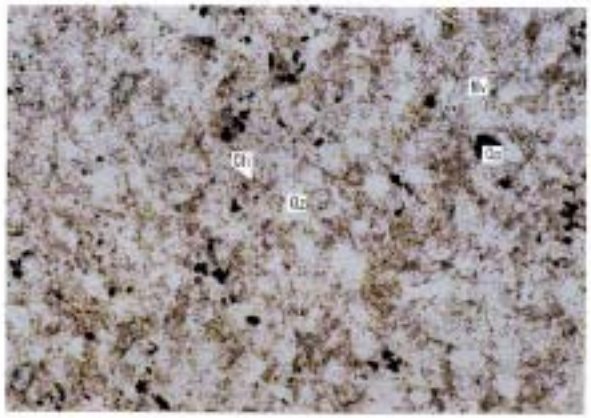


No.1 02MR-K001 S1A 407.00-407.20

0.2mm Cross

No.2 02MR-K004 S4A 563.50-563.70

0.2mm Cross



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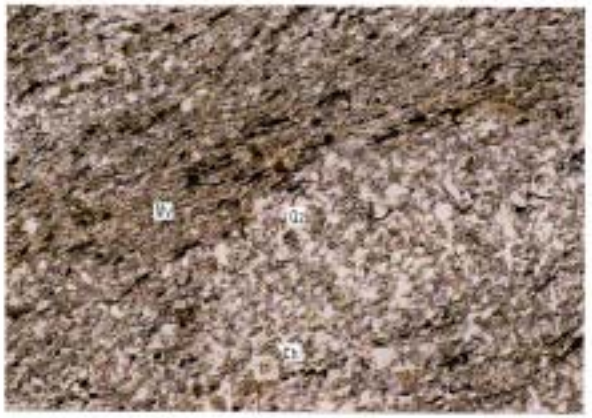

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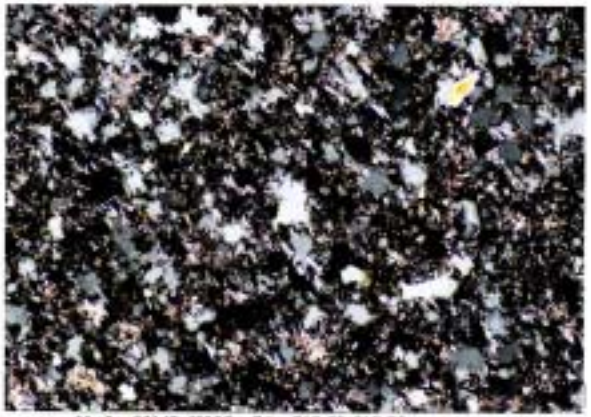
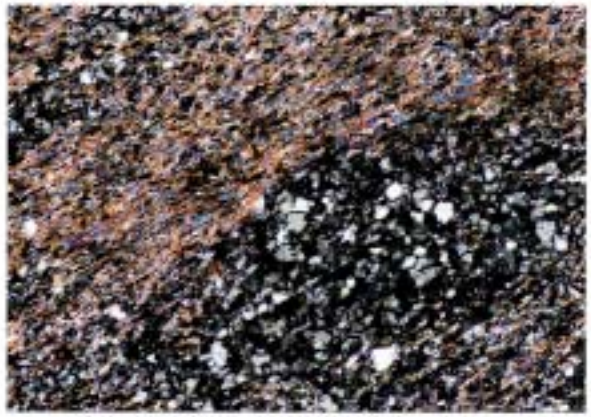


No.3 02MR-K005 S4 510.50-510.70

0.2mm Cross



No.4 02MR-K006 S4 553.00-553.20

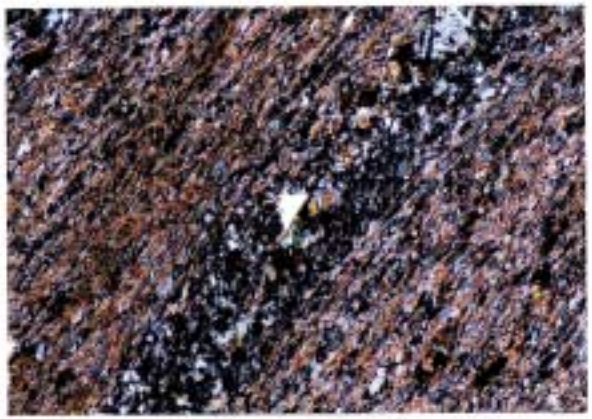
0.2mm Cross

Open

Open

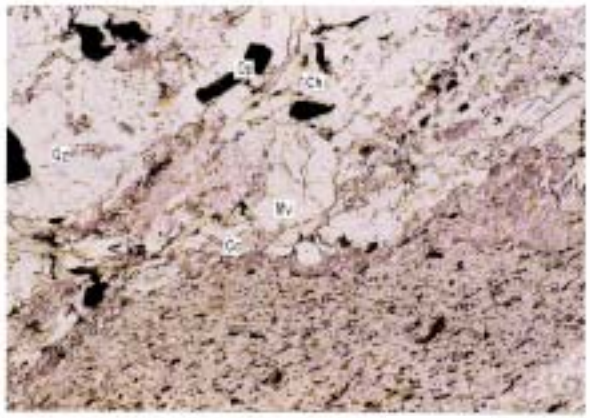
No.5 02MR-K008 S4 570.00-570.20

0.2mm Cross



No.6 02MR-K009 S5 625.30-625.50

0.2mm Cross



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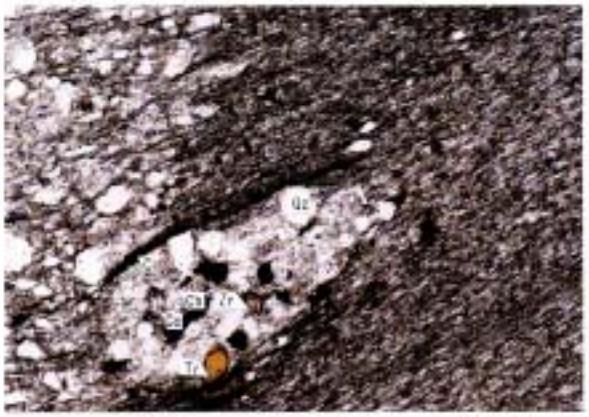
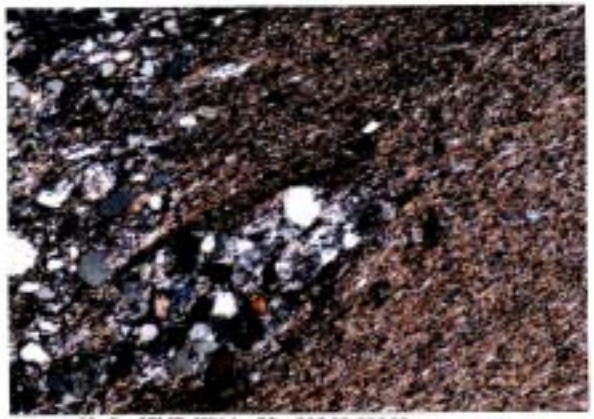


Open

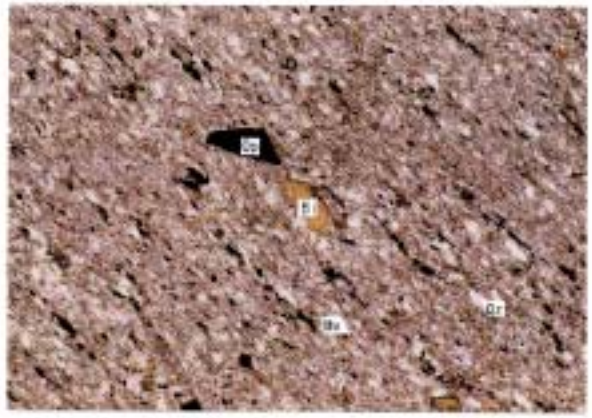
No.7 02MR-K011 S5 642.00-642.20

0.2mm Cross



No.8 02MR-K014 S3 305.00-305.20

0.2mm Cross



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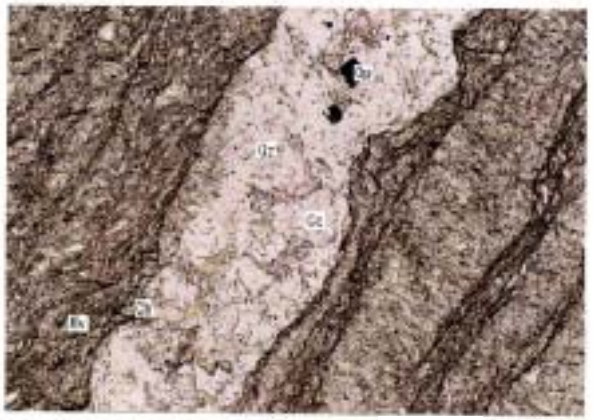
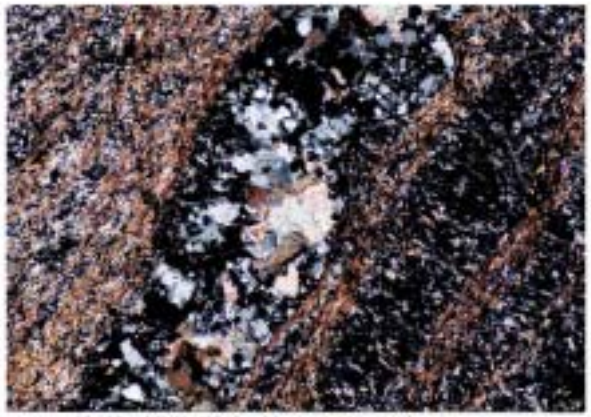


Open

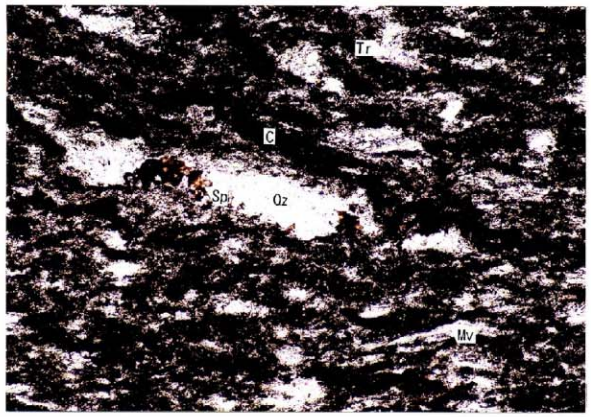
No.9 02MR-K016 S3 328.00-328.20

0.2mm Cross



No.10 02MR-K018 S2 170.00-170.20

0.2mm Cross

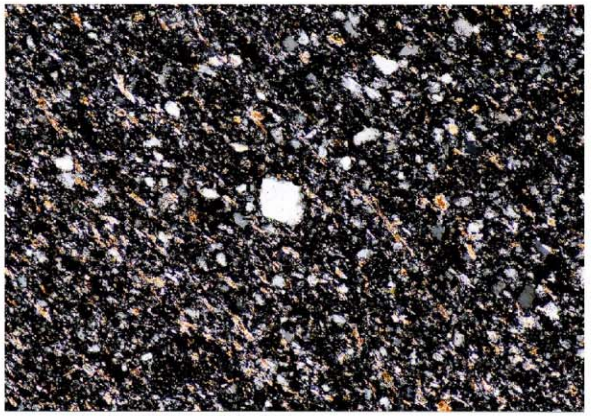


Open

Open

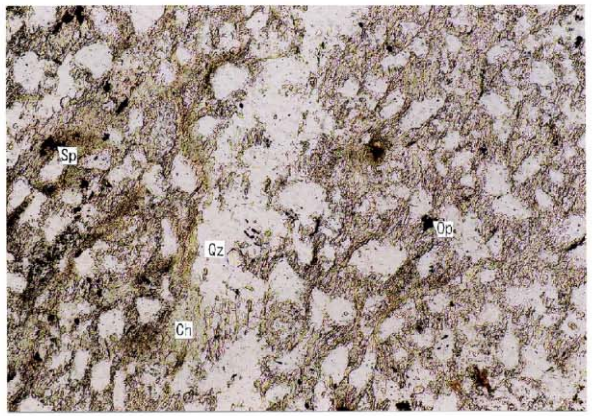
No.11 02MR-K021 S2 412.00-412.20

0.2mm Cross



No.12 02MR-K024 Surface

0.2mm Cross



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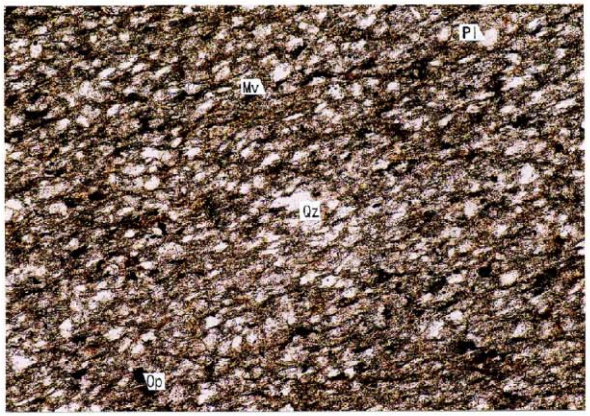

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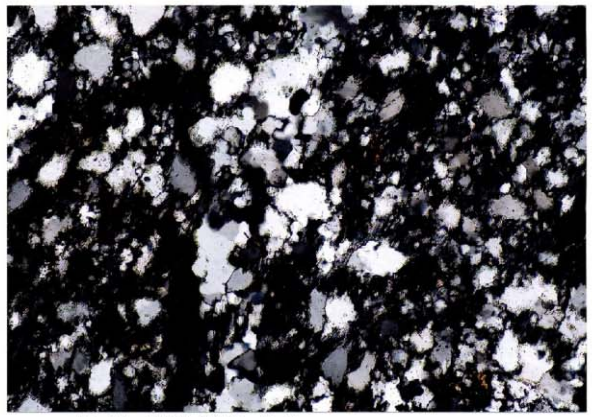
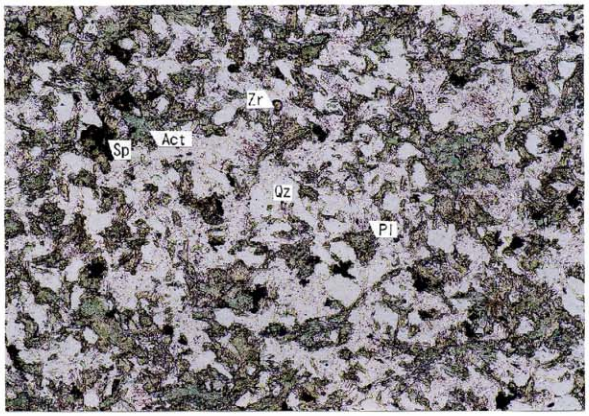


No.13 02MR-K026 Surface

0.2mm Cross

No.14 02MR-K027 Surface

0.2mm Cross



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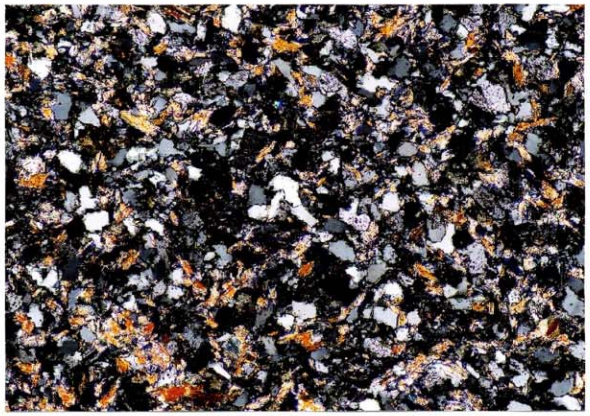
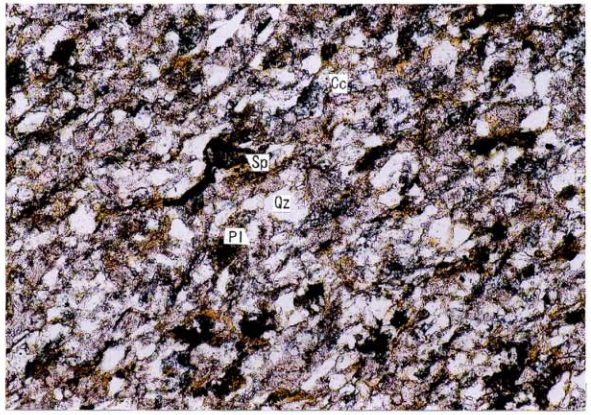


No.15 02MR-K029 Surface

0.2mm Cross



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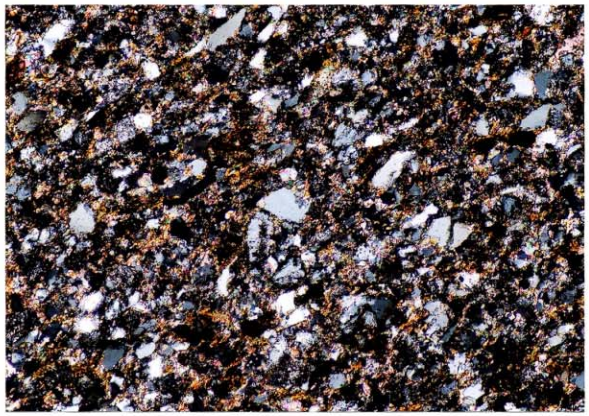
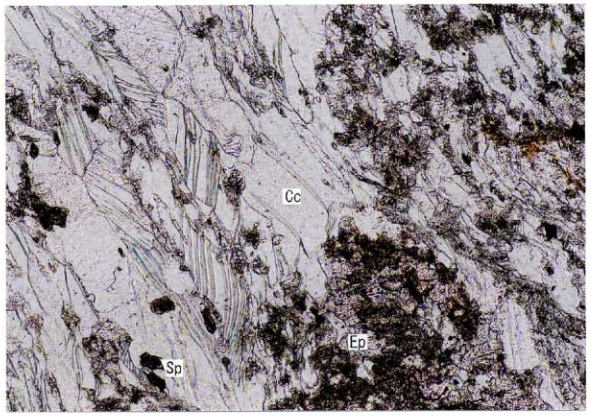


No.16 02MR-K030 Surface

0.2mm Cross



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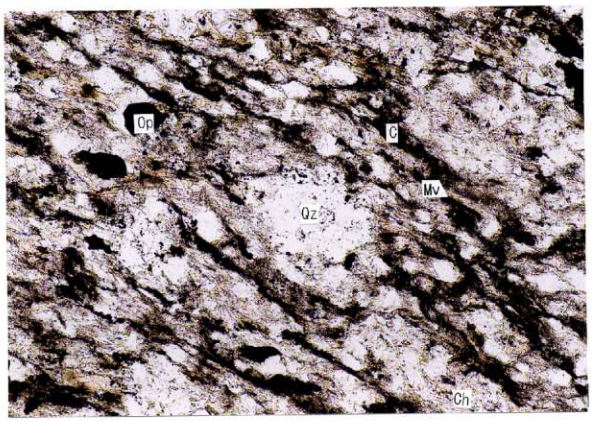

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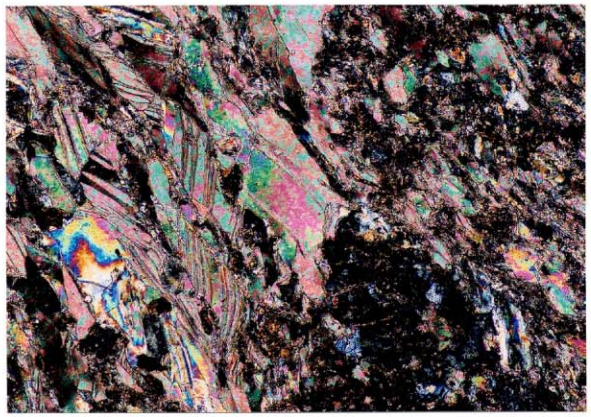
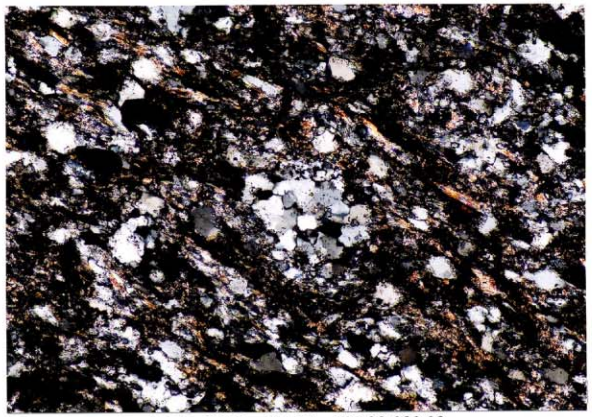


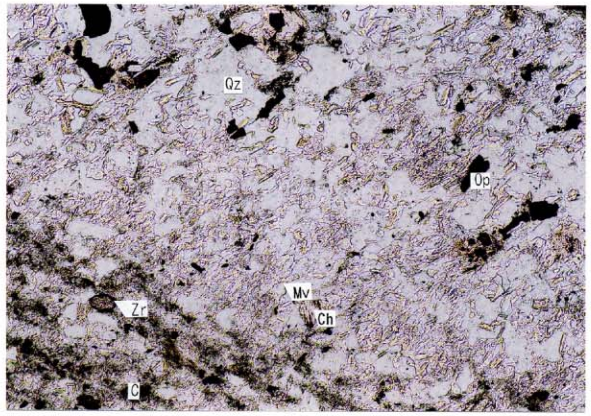
No.17 02MR-K031 Surface

0.2mm Cross



No.18 02MR-K032 KA25 202.00-202.20

0.2mm Cross



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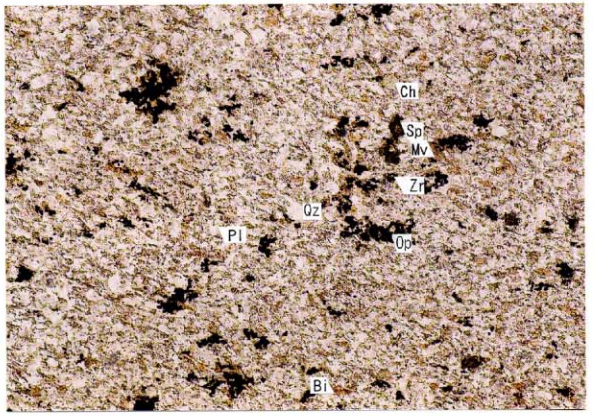

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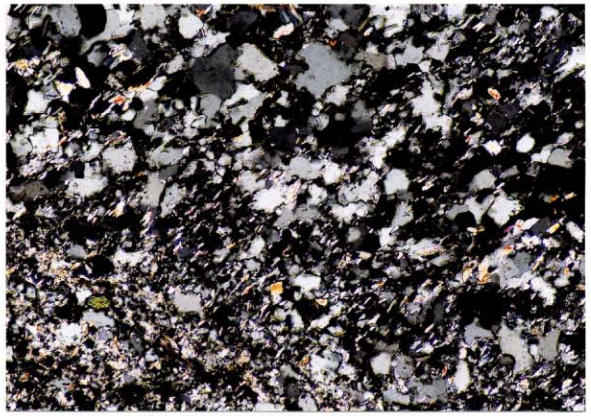
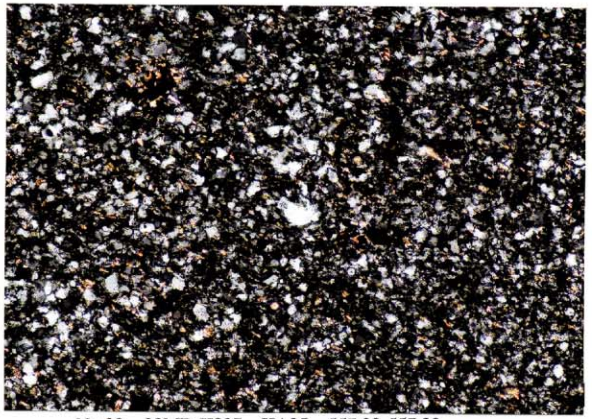


No.19 02MR-K035 KA25 396.00-396.20

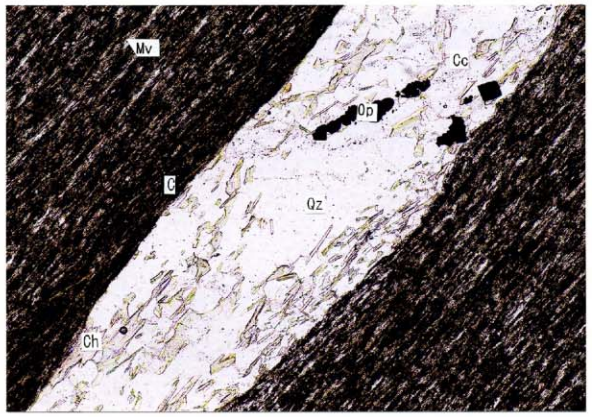
0.2mm Cross



No.20 02MR-K037 KA25 557.00-557.20

0.2mm Cross

Open



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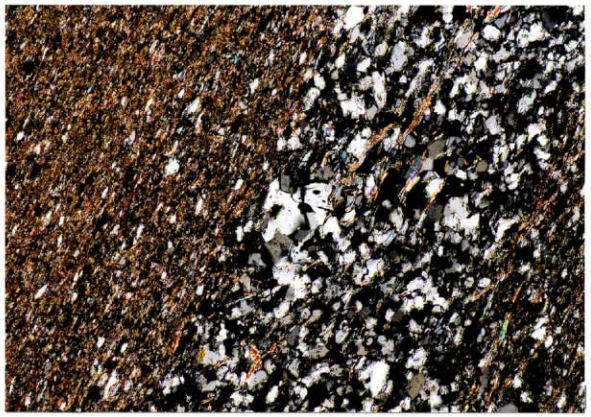
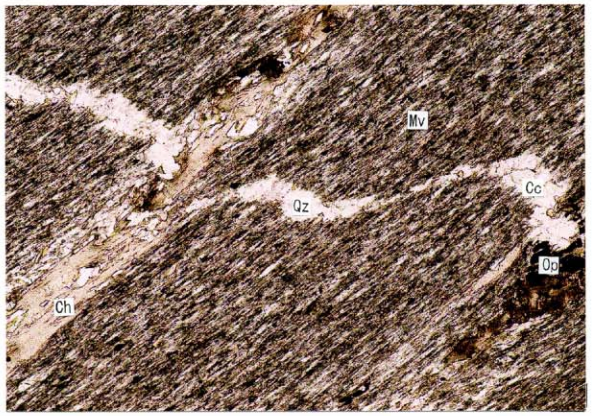


No.21 02MR-K039 BS15 311.00-311.20

0.2mm Cross

No.22 02MR-K041 LA9 176.00-176.20

0.2mm Cross



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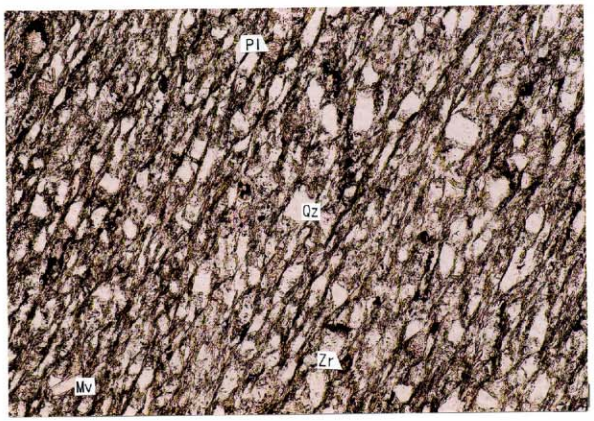
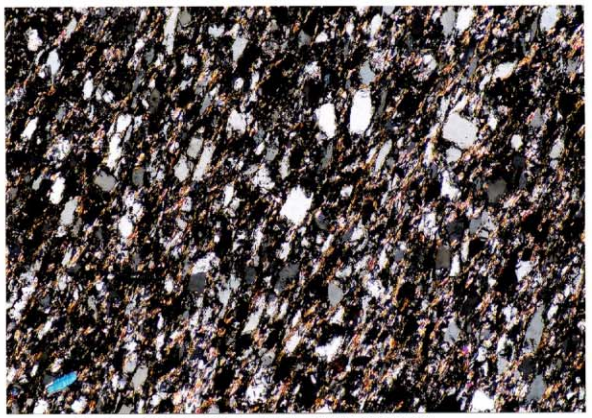


Open

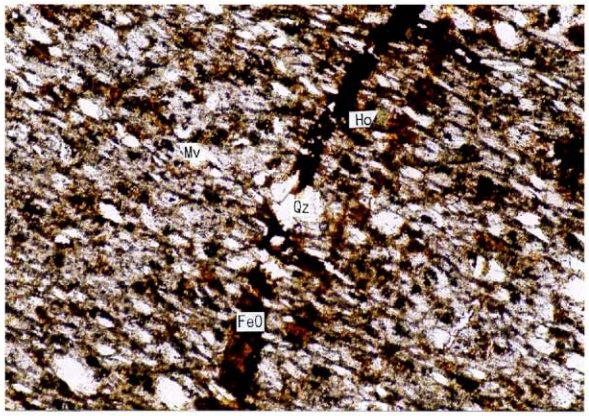
No.23 02MR-K043 LA9 222.00-222.20

0.2mm Cross



No.24 02MR-K044 LA9 240.00-240.20

0.2mm Cross



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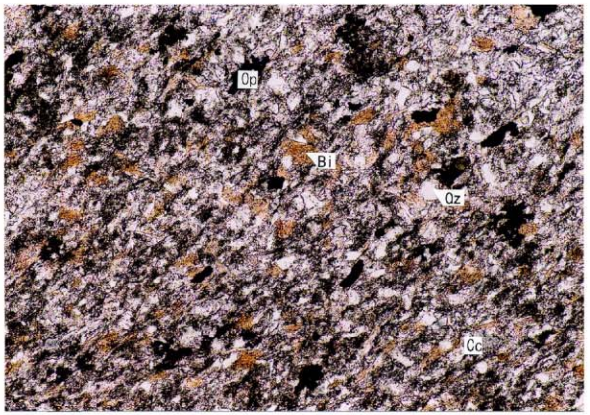

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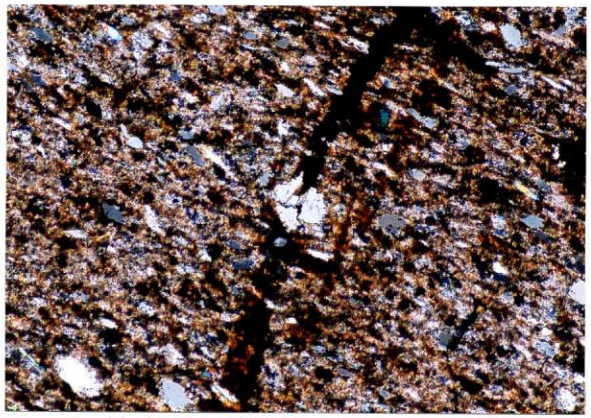
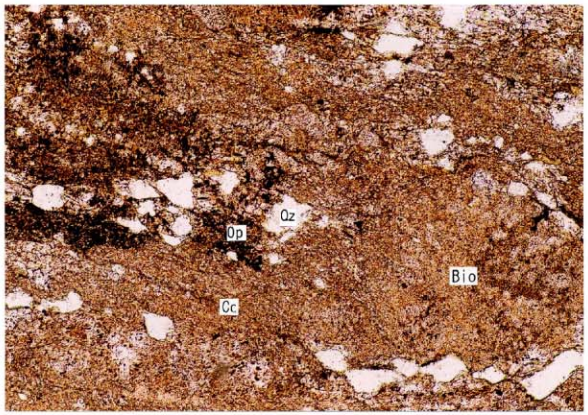


No.25 02MR-K046 Surface

0.2mm Cross

No.26 02MR-K047 Surface

0.2mm Cross



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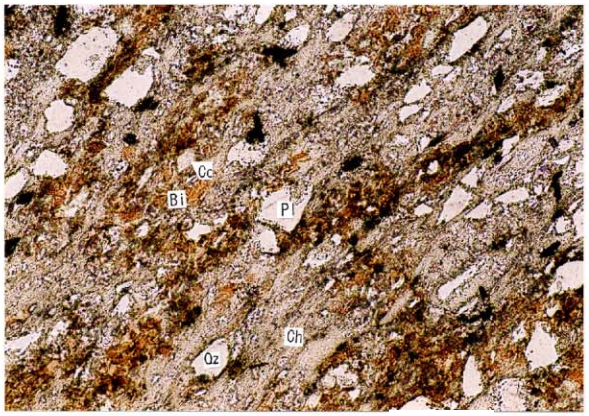

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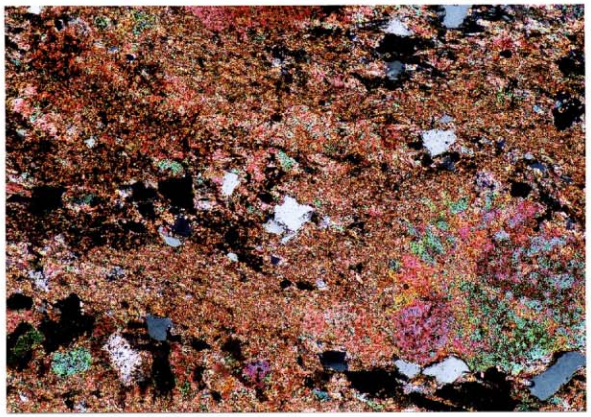
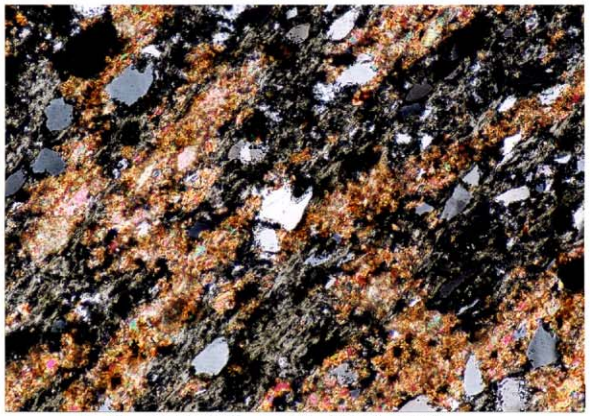


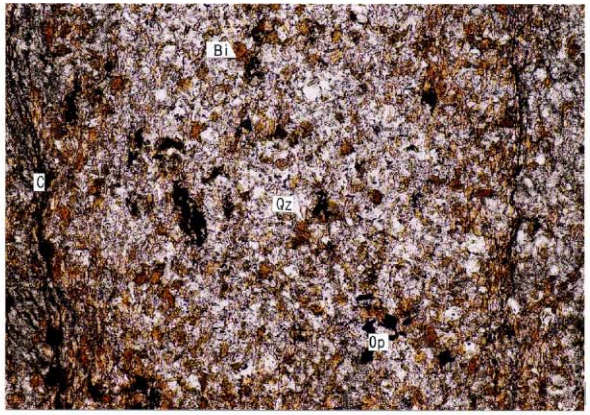
No.27 02MR-K049 Surface

0.2mm Cross



No.28 02MR-K050 CD27 334.00-334.20

0.2mm Cross



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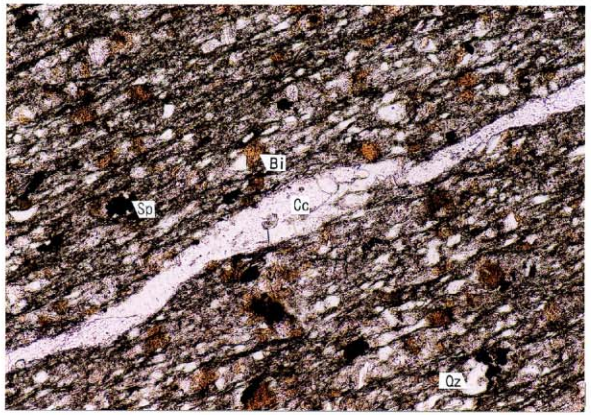

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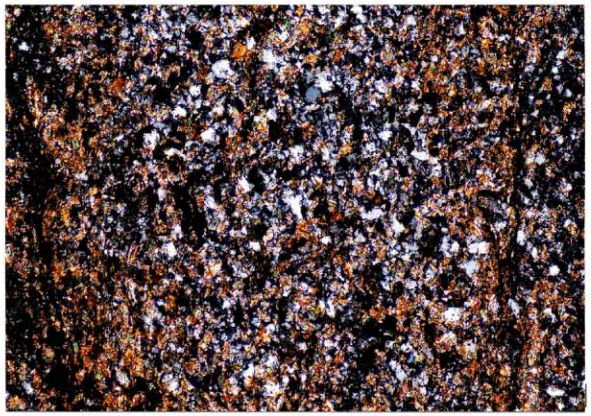
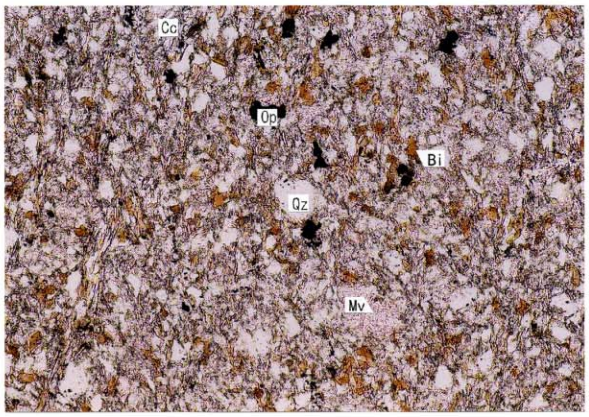


No.29 02MR-K051 CD27 134.00-134.20

0.2mm Cross

No.30 02MR-K053 CD27 19.50-19.70

0.2mm Cross



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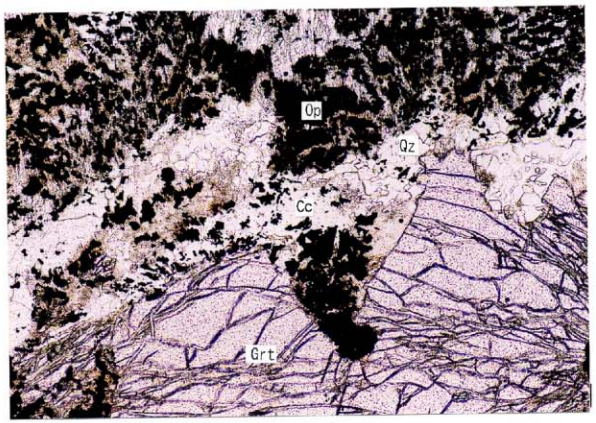

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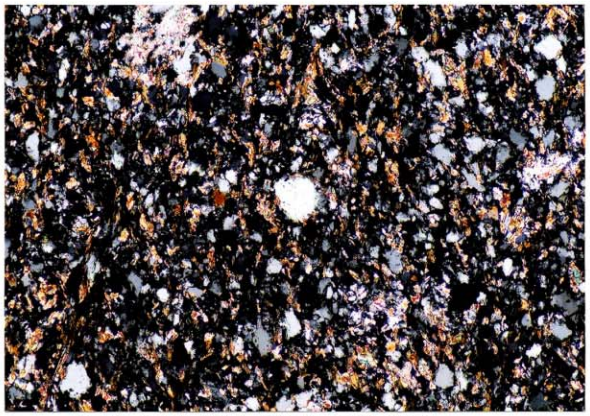
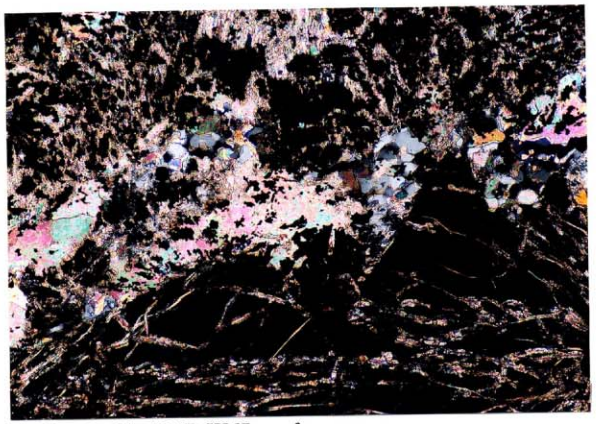


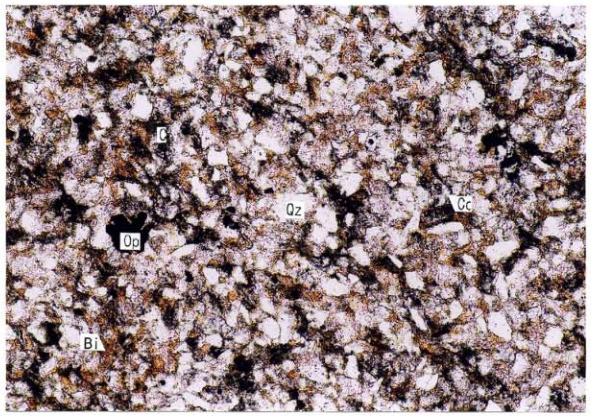
No.31 02MR-K057 GHC1 42.30-42.50

0.2mm Cross



No.35 02MR-K067 surface

0.2mm Cross



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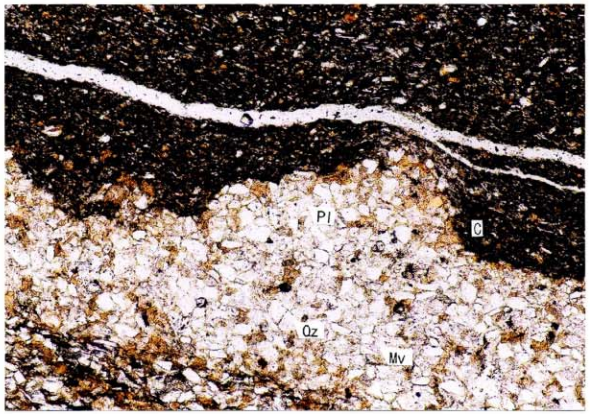

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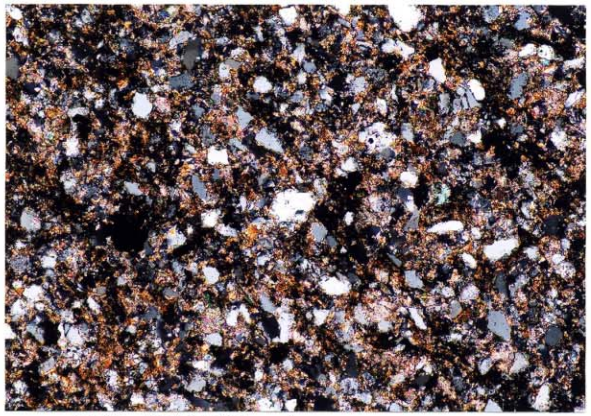
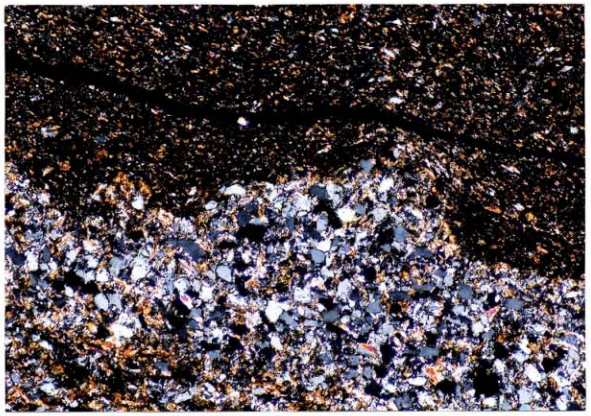


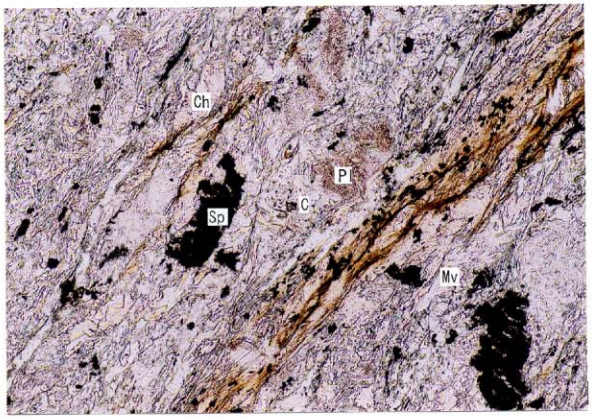
No.36 02MR-K068 surface

0.2mm Cross

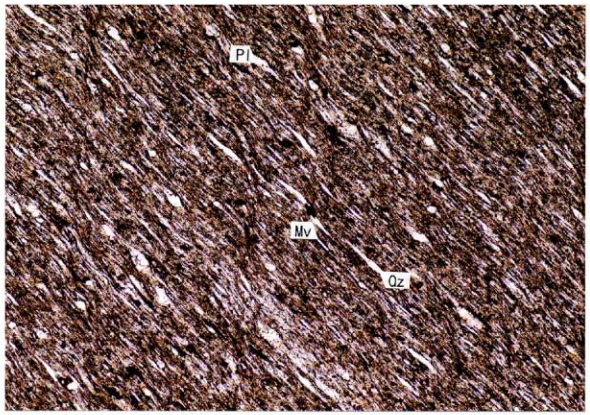


No.37 02MR-K069 surface

0.2mm Cross



Open



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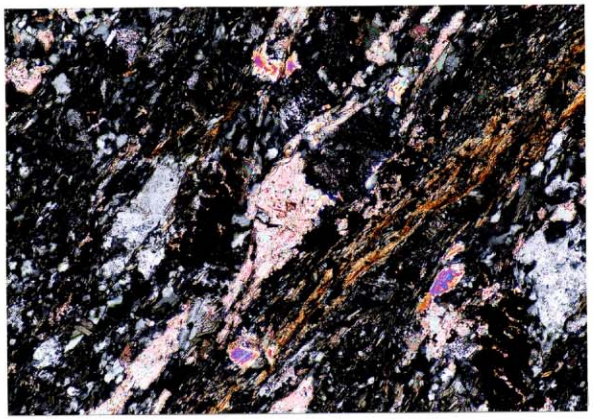
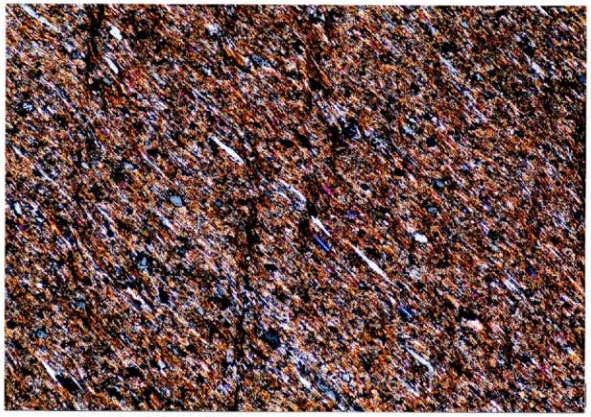


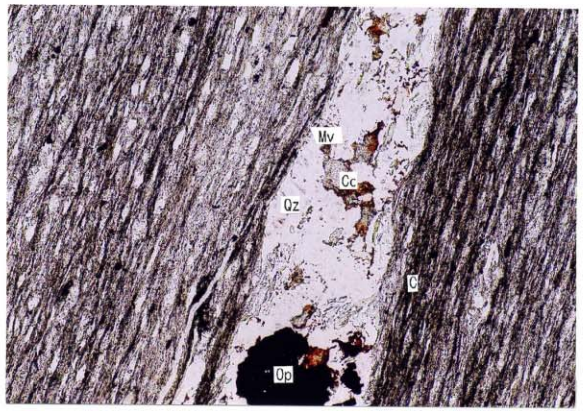
No.38 02MR-K071 surface

0.2mm Cross

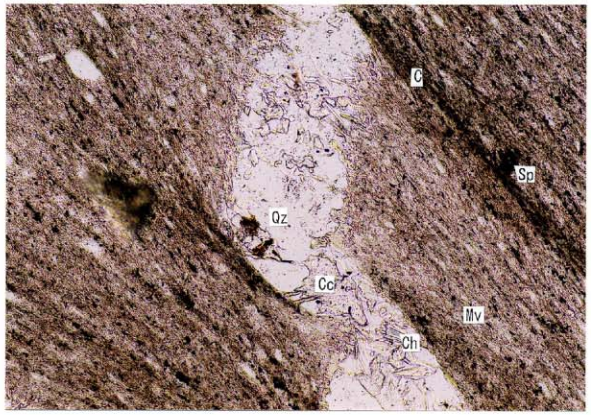


No.39 02MR-K072 surface

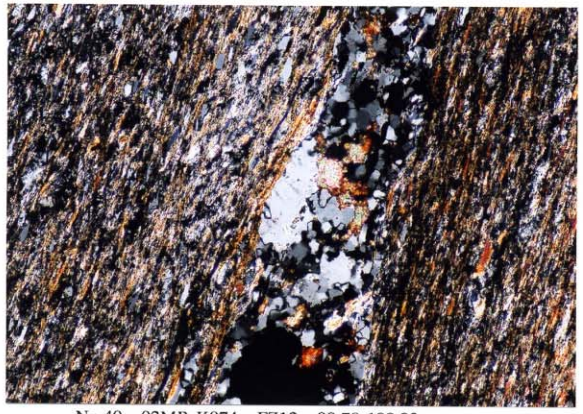
0.2mm Cross



Open

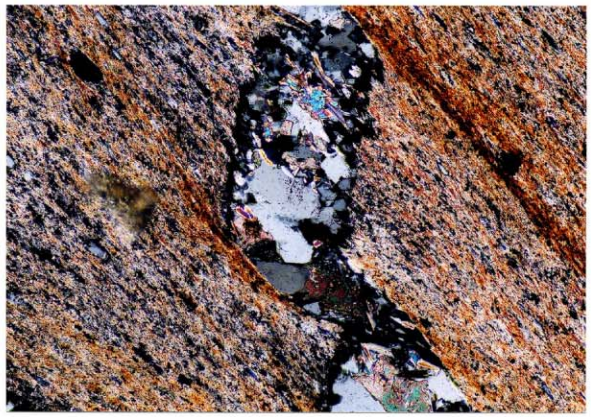


Open



No.40 02MR-K074 FZ12 99.70-100.00

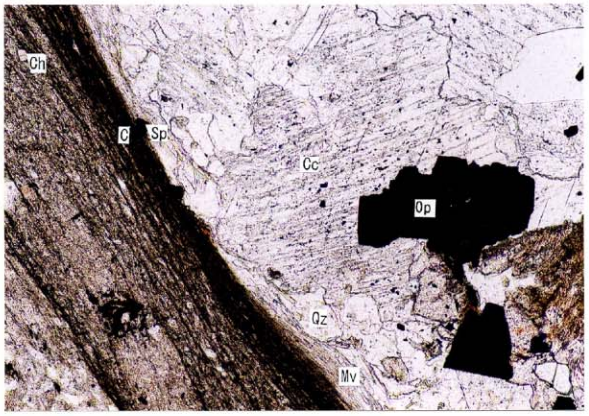
0.2mm Cross



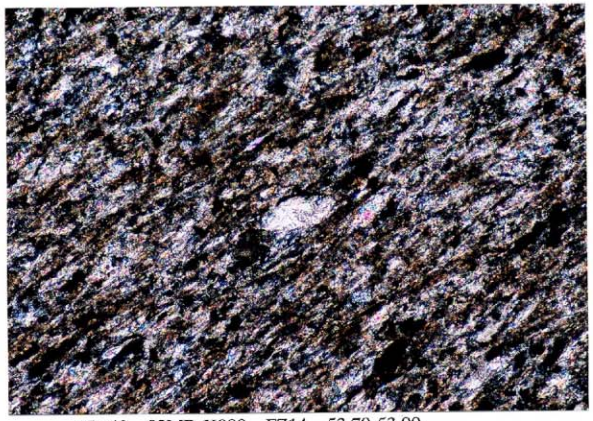
No.41 02MR-K079 FZ13 141.00-141.30

0.2mm Cross

Open

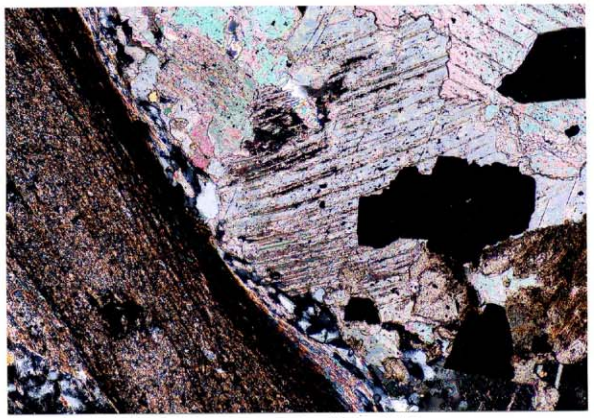


Open



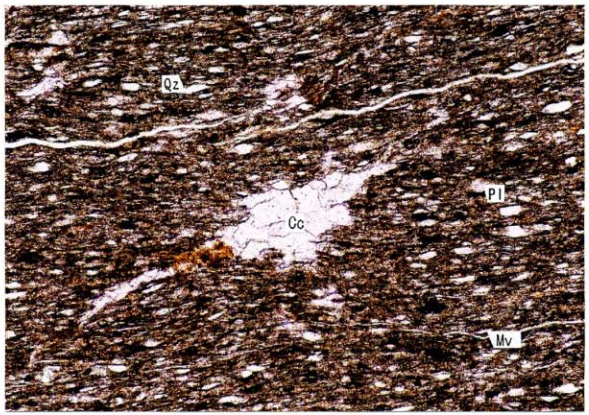
No.42 02MR-K080 FZ14 53.70-53.90

0.2mm Cross



No.43 02MR-K081 FZ14 53.90-54.10

0.2mm Cross



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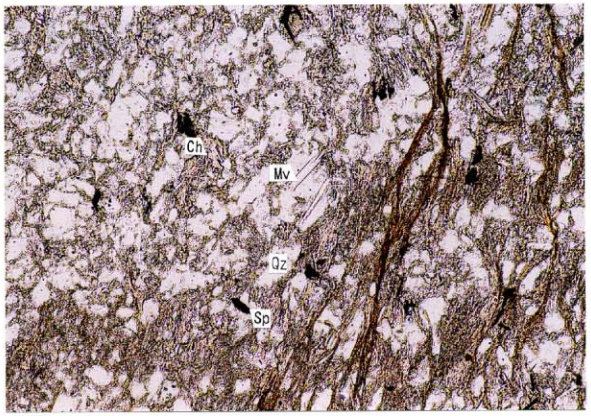
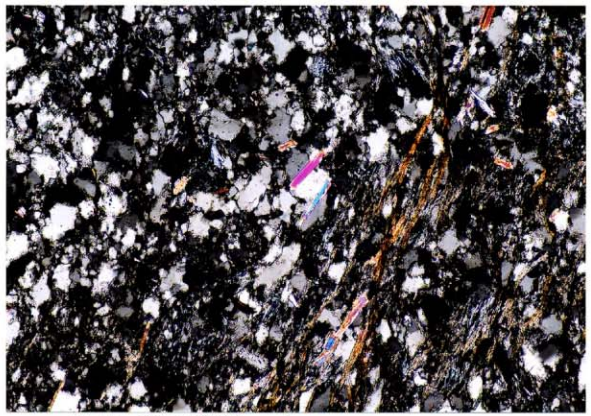


Open

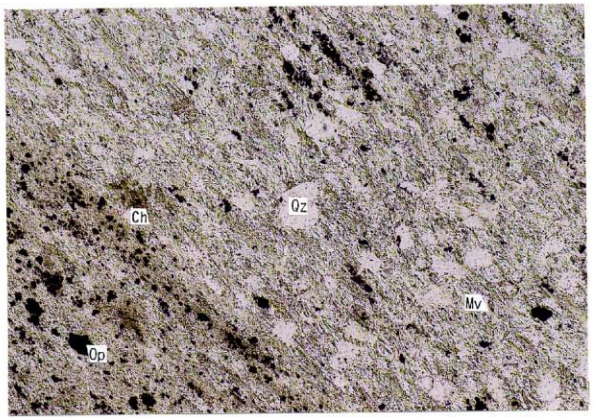
No.44 02MR-K084 surface

0.2mm Cross

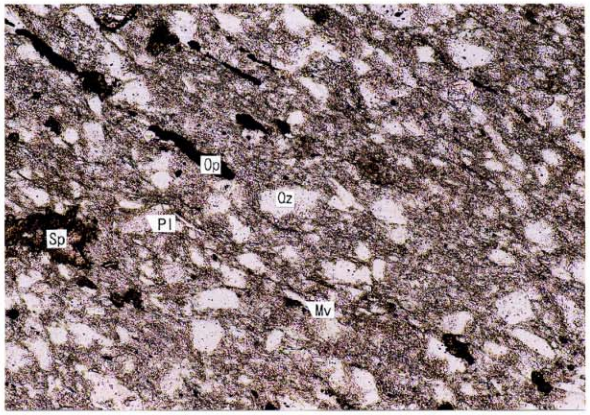


No.45 02MR-K085 surface

0.2mm Cross



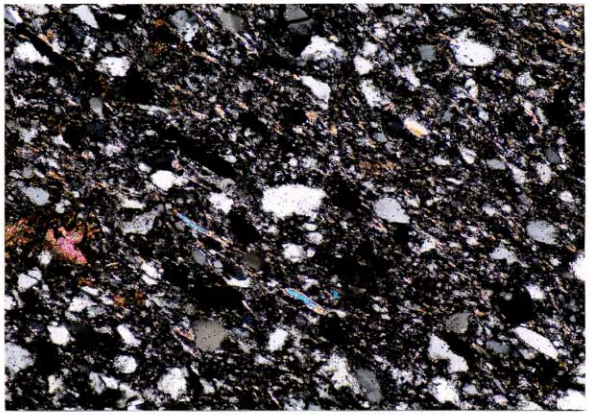
Open



Open

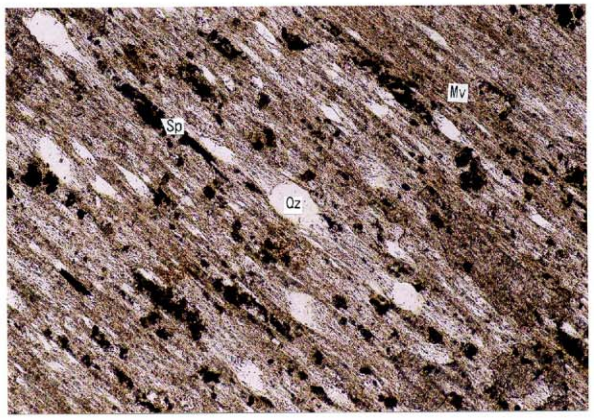
No.46 02MR-K087 DSF15 109.00-109.20

0.2mm Cross

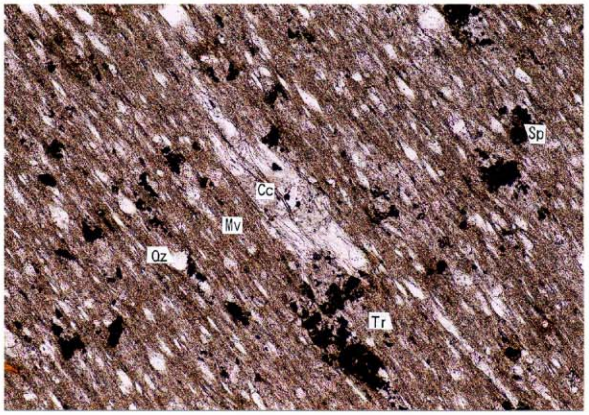


No.47 02MR-K090 DSF15 270.70-270.90

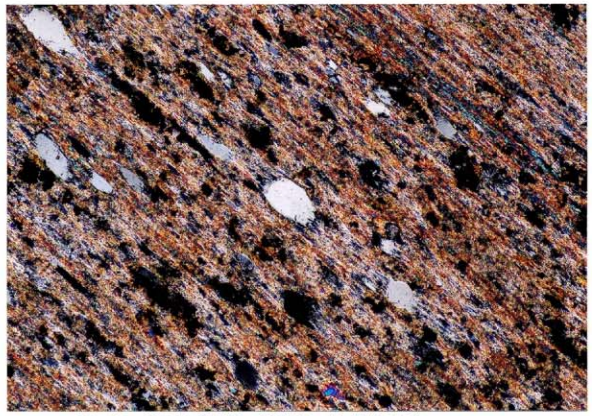
0.2mm Cross



Open

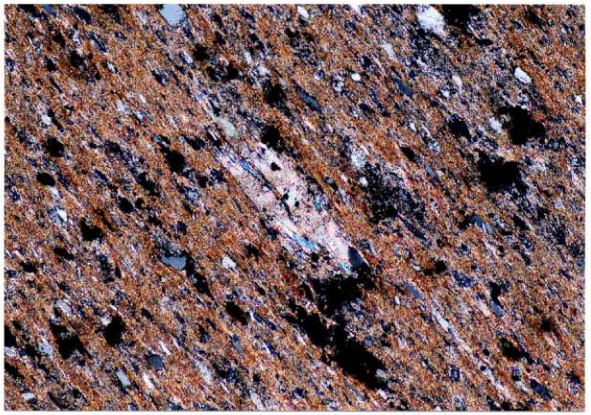


Open



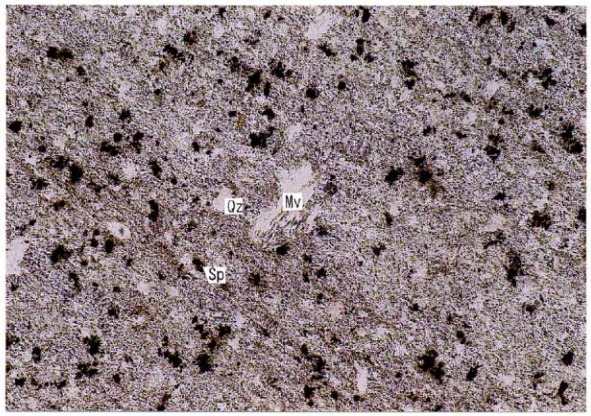
No.48 02MR-K093 DSF2 91.00-91.20

0.2mm Cross

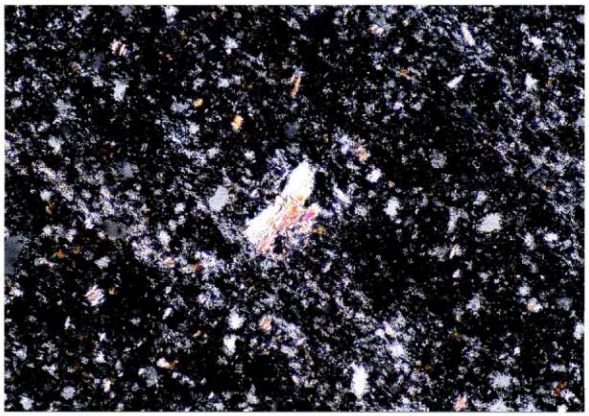


No.49 02MR-K095 DSF2 137.50-137.70

0.2mm Cross



Open



No.51　02MR-K097　-400mL

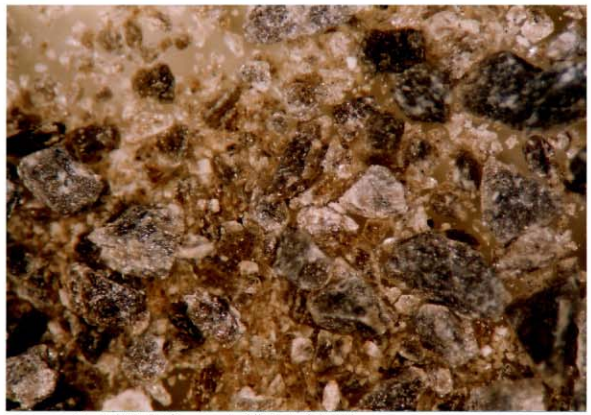
0.2mm Cross

No.27 状況写真：Limestone(ボロン処理)

0.8mm

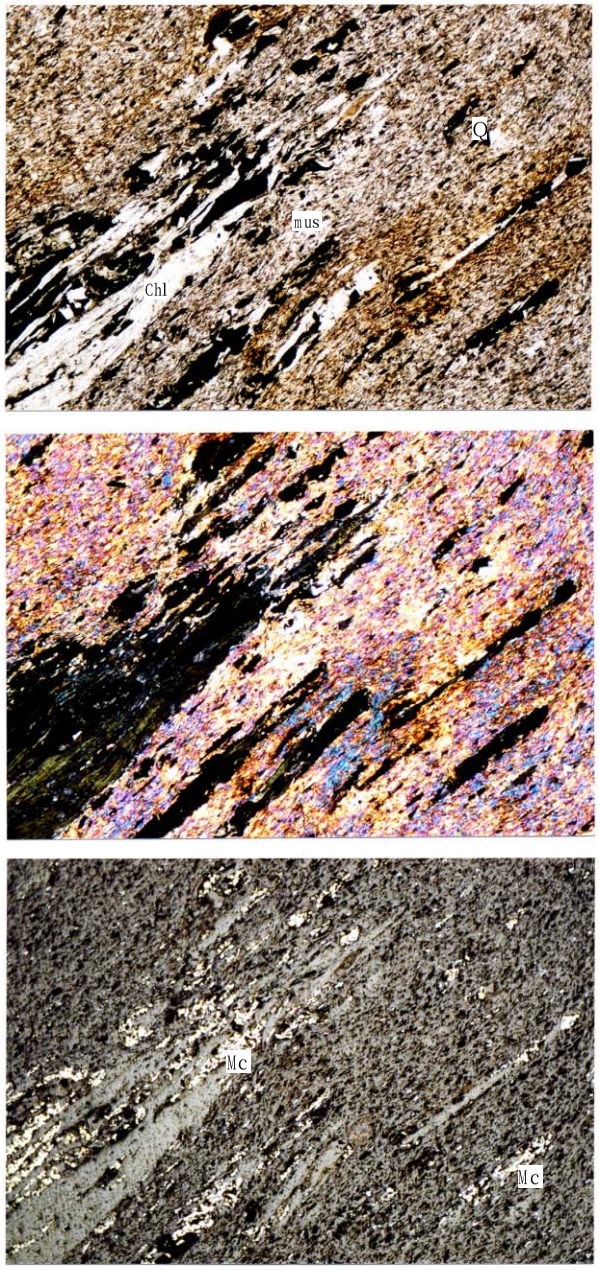
No.3 状況写真：Shale（弗化水素処理）

0.8mm

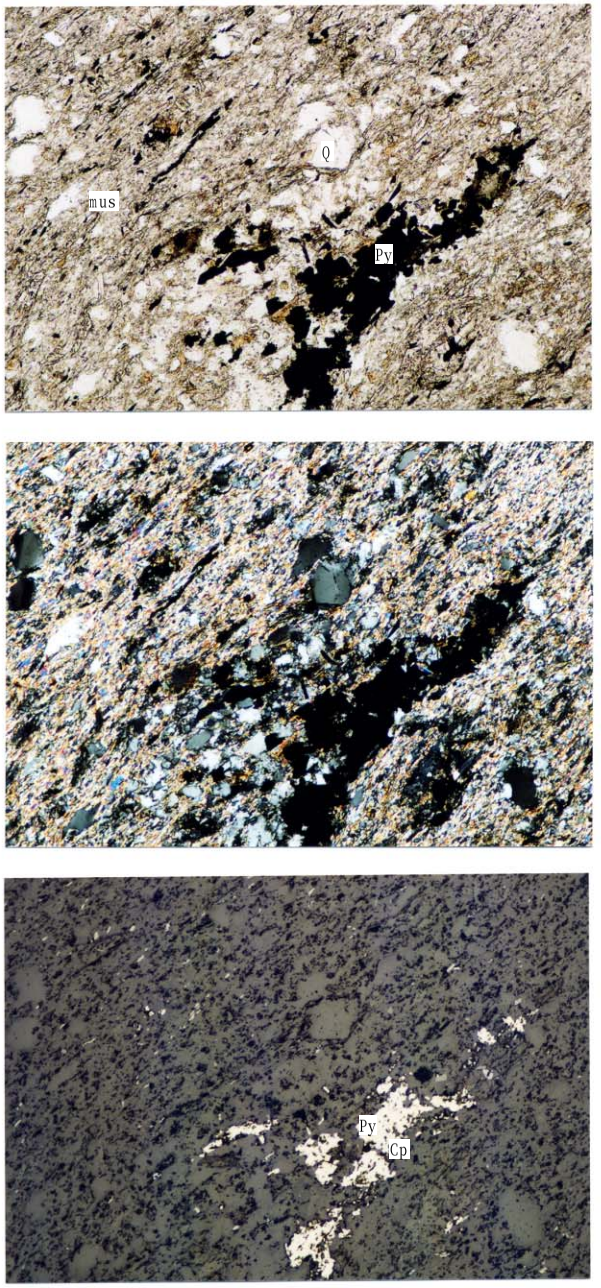


No.1 状況写真：Shale(弗化水素処理)

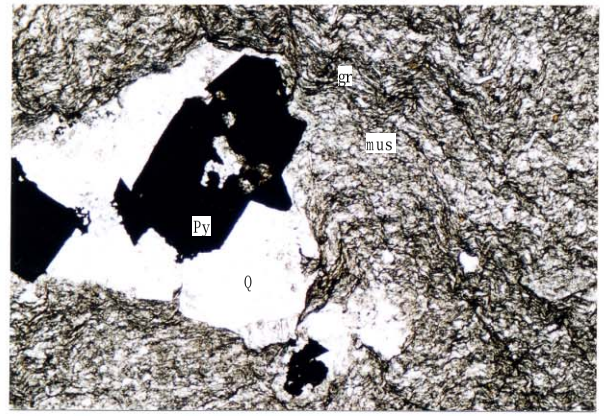
0.8mm

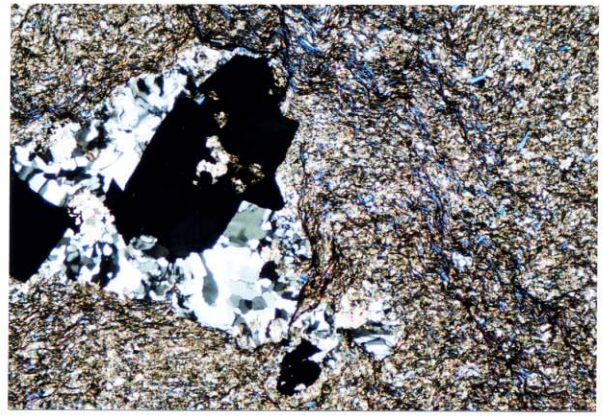


02MR-K007
×40



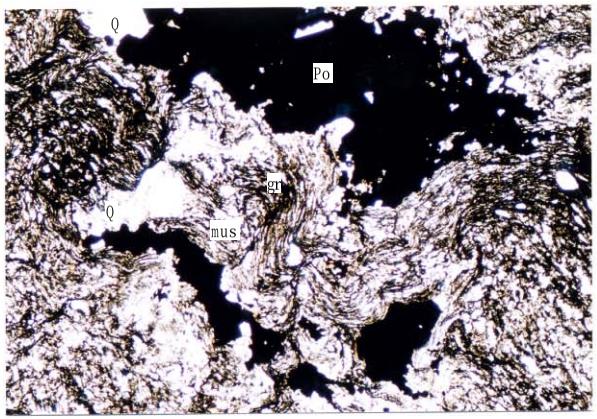
02MR-K017
×100

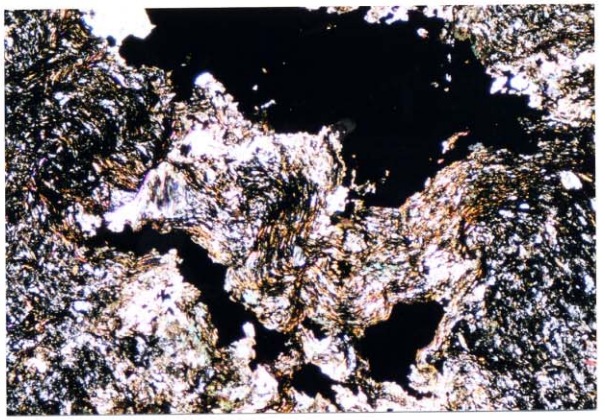


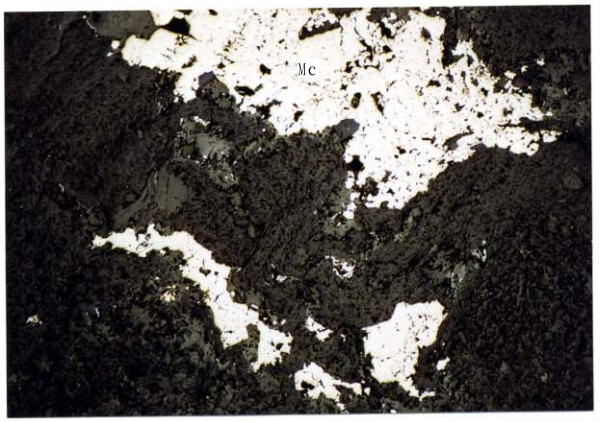


02MR-K020
×40

1mm

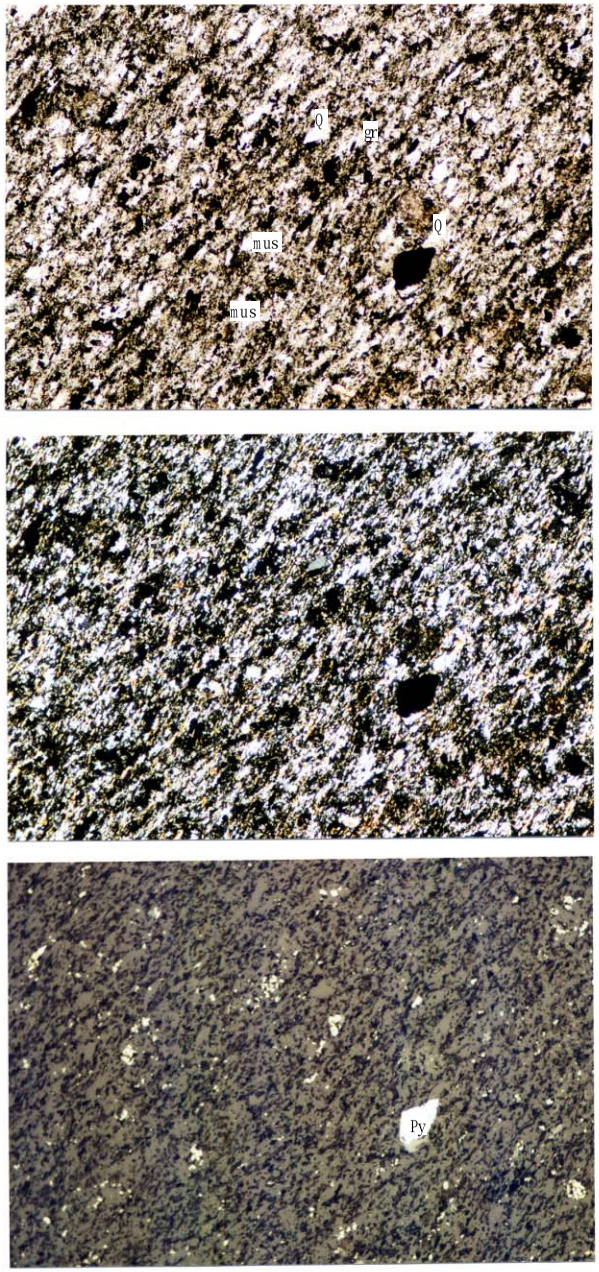






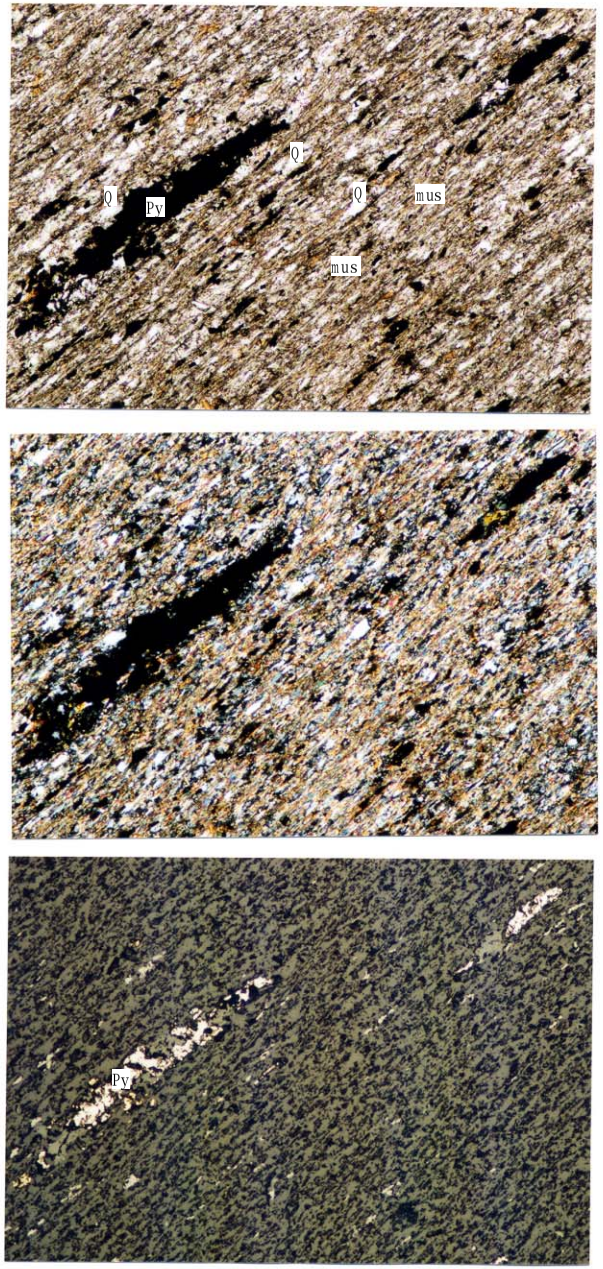
02MR-K023
×40

1mm



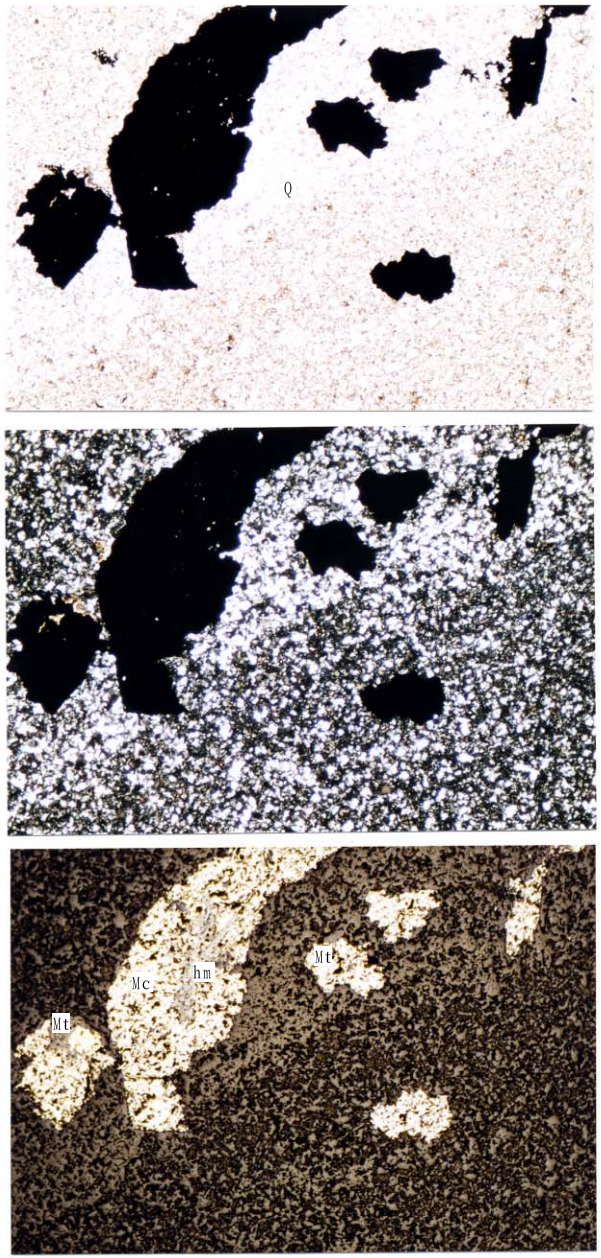
02MR-K034
×100

0.01mm



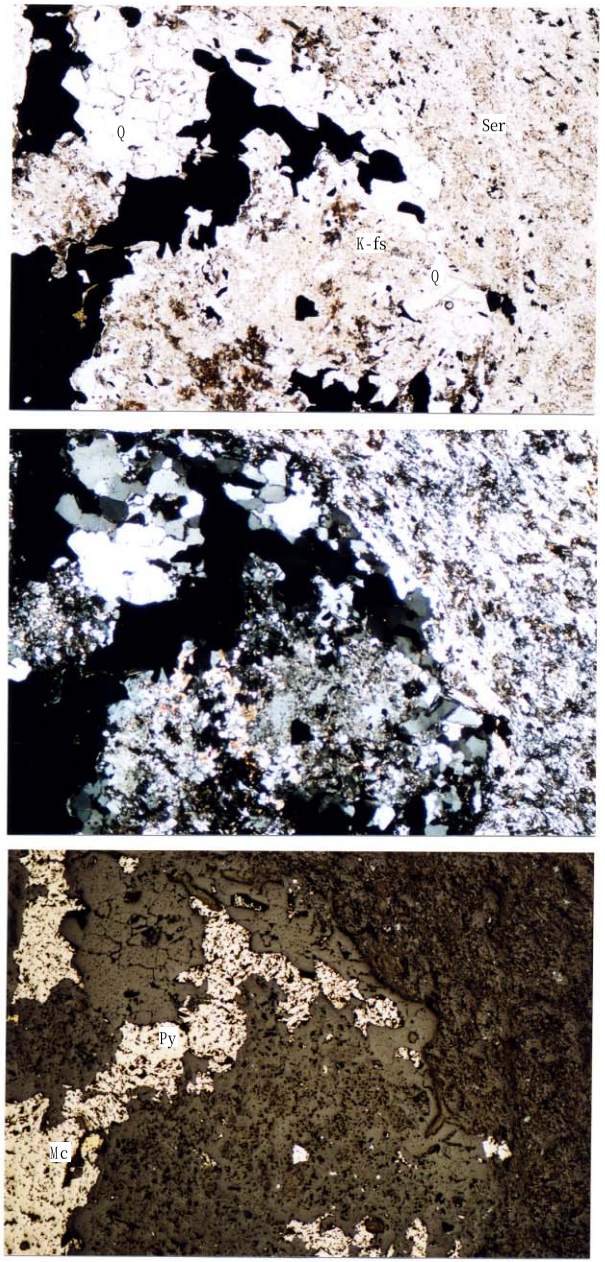
02MR-K038
×100

0.01mm



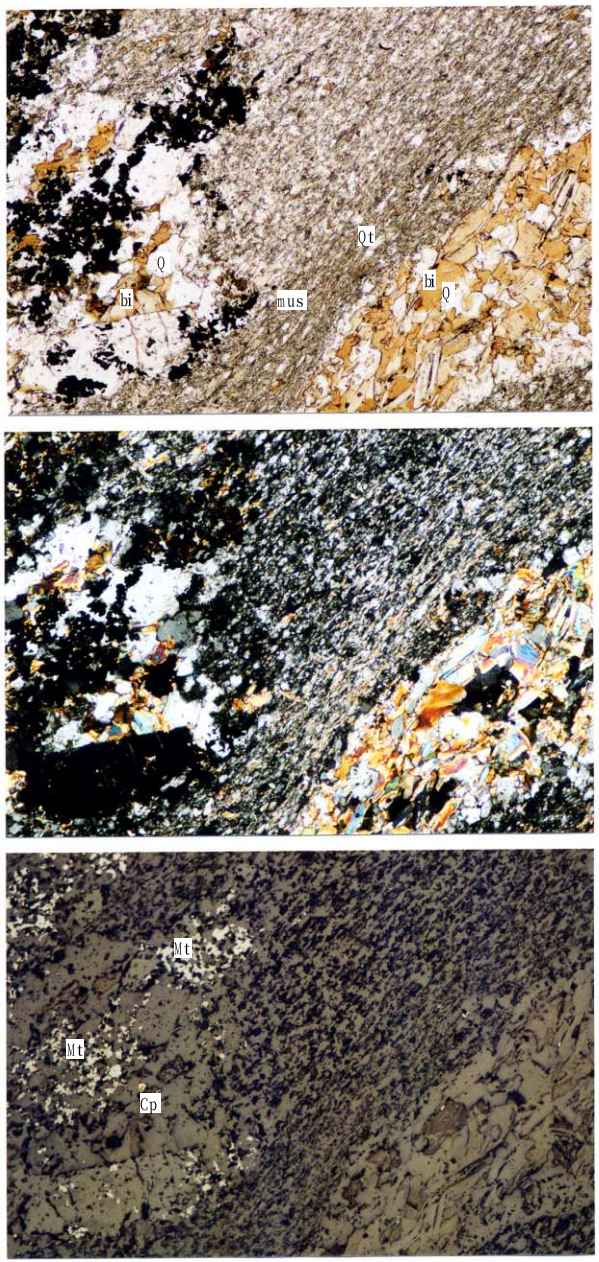
02MR-K054
×40

1mm



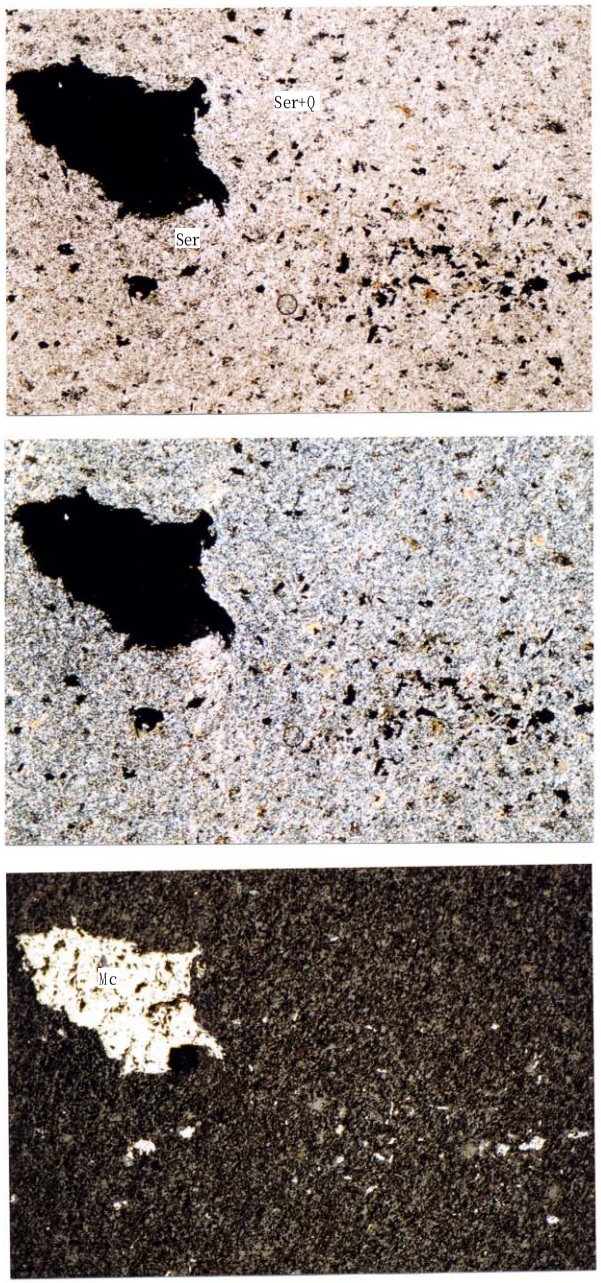
02MR-K055
×40

1mm



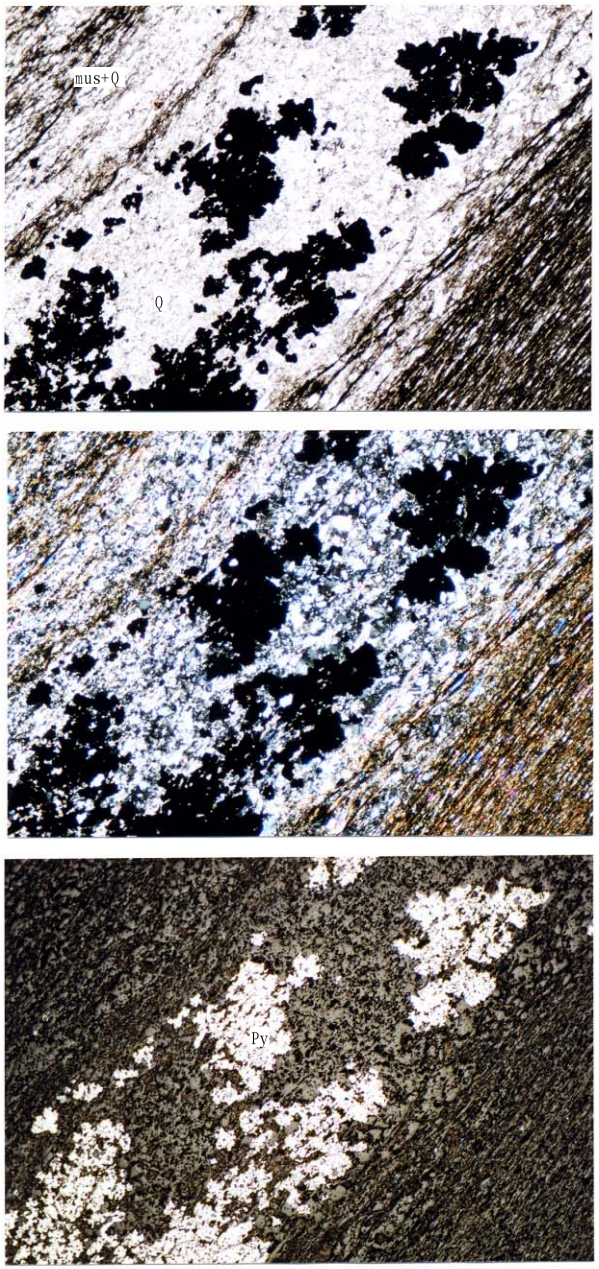
02MR-K056
×100

0.01mm



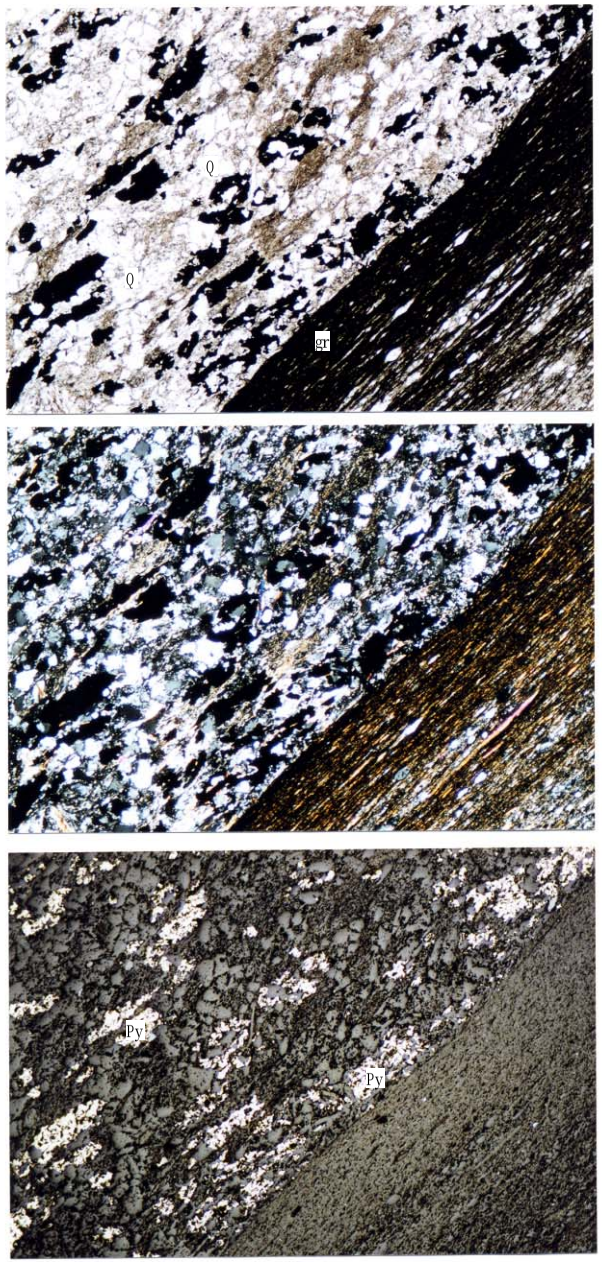
02MR-K058
×40

1mm



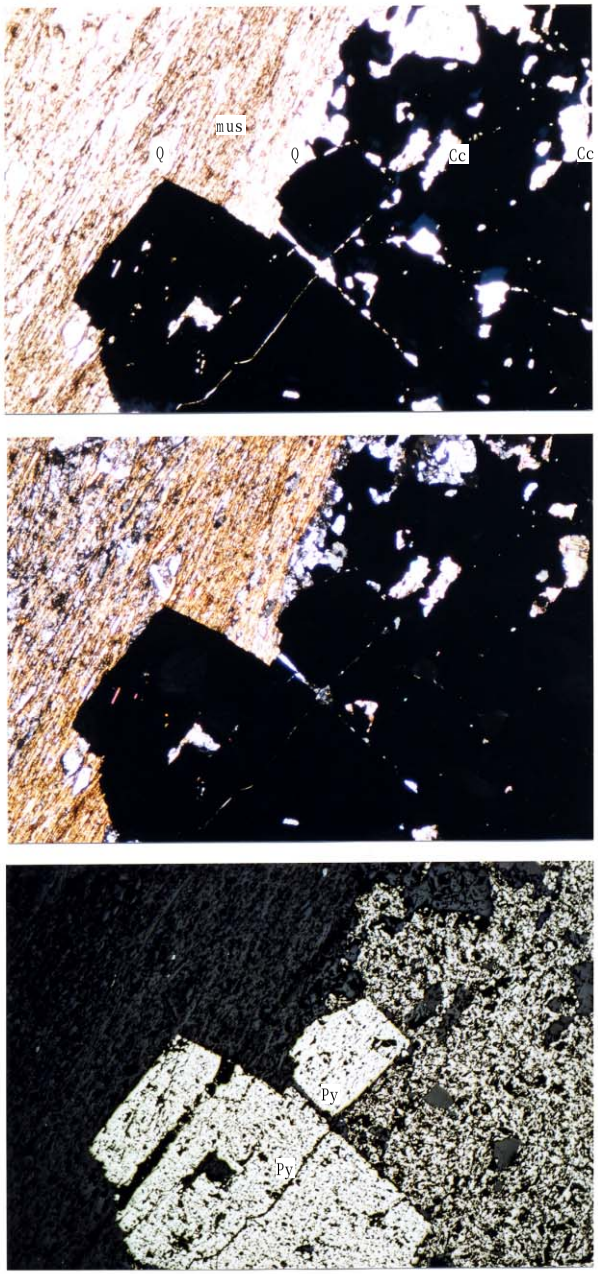
02MR-K064
×40

1mm



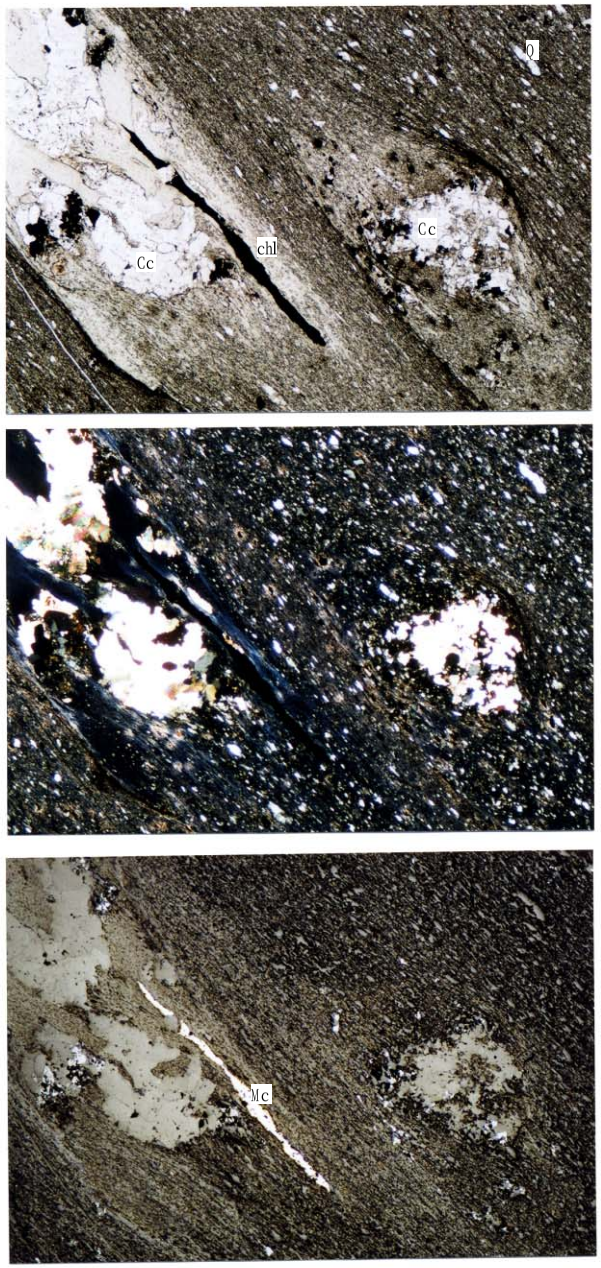
02MR-K065
×40

1mm



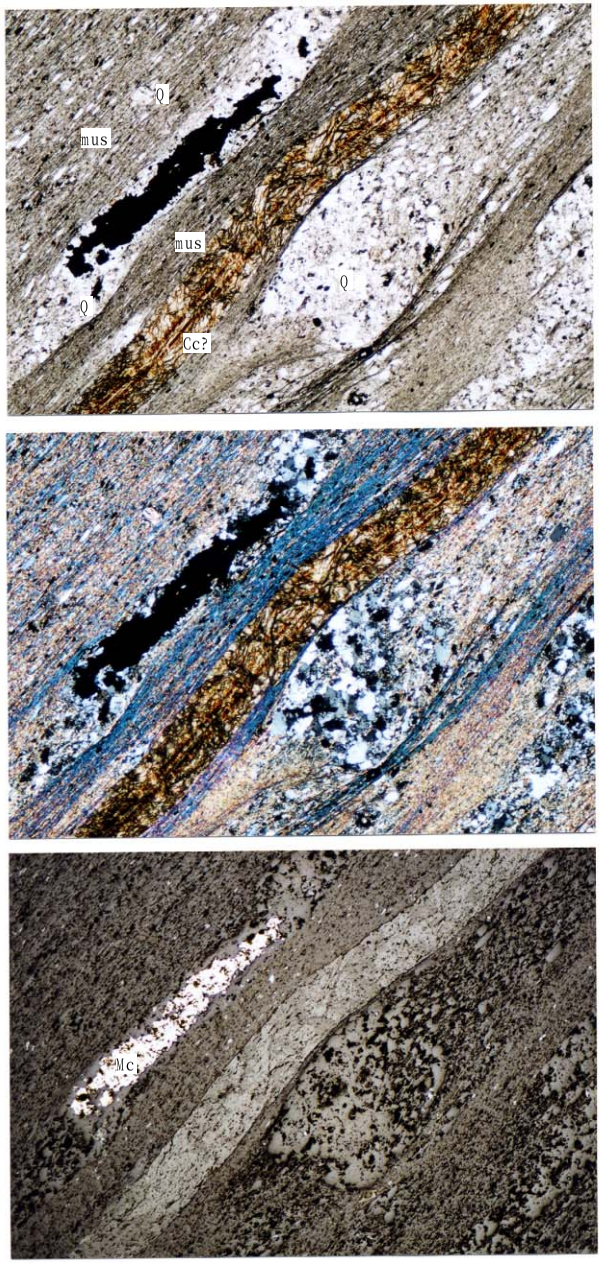
02MR-K066
×40

1mm



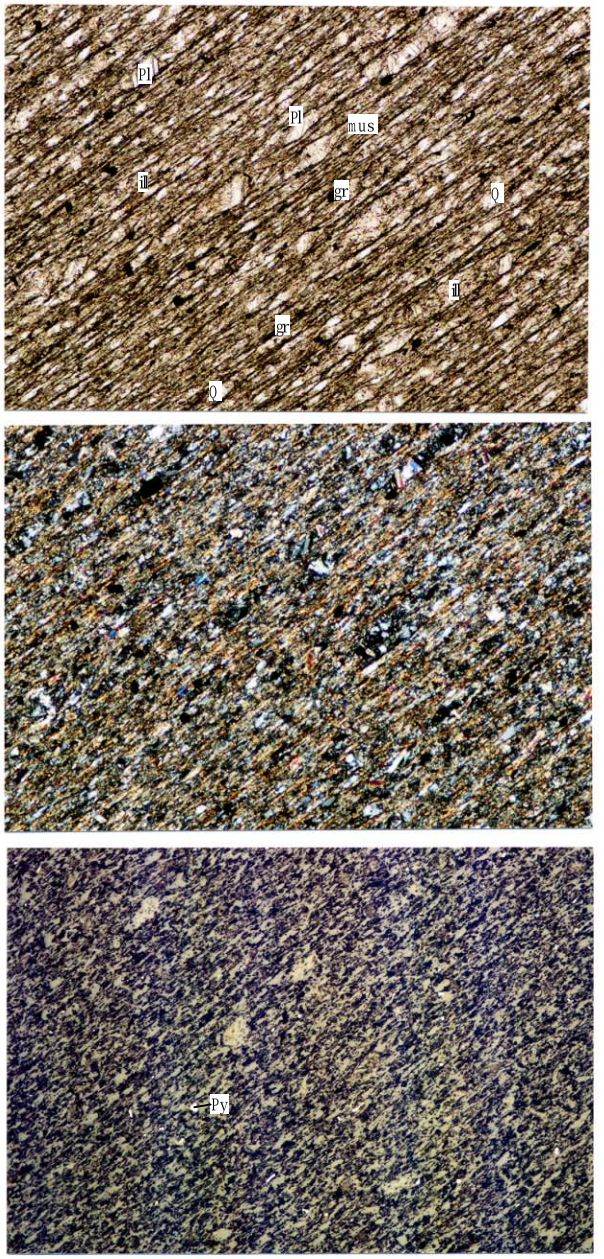
02MR-K076
×40

1mm



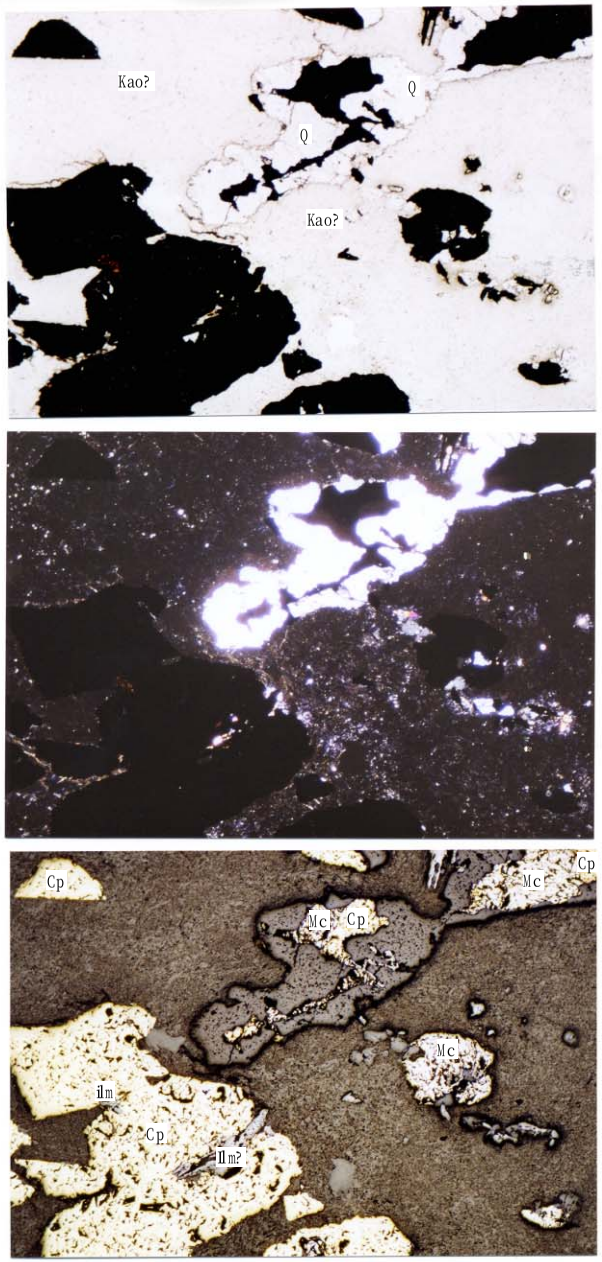
02MR-K077
×40

1mm



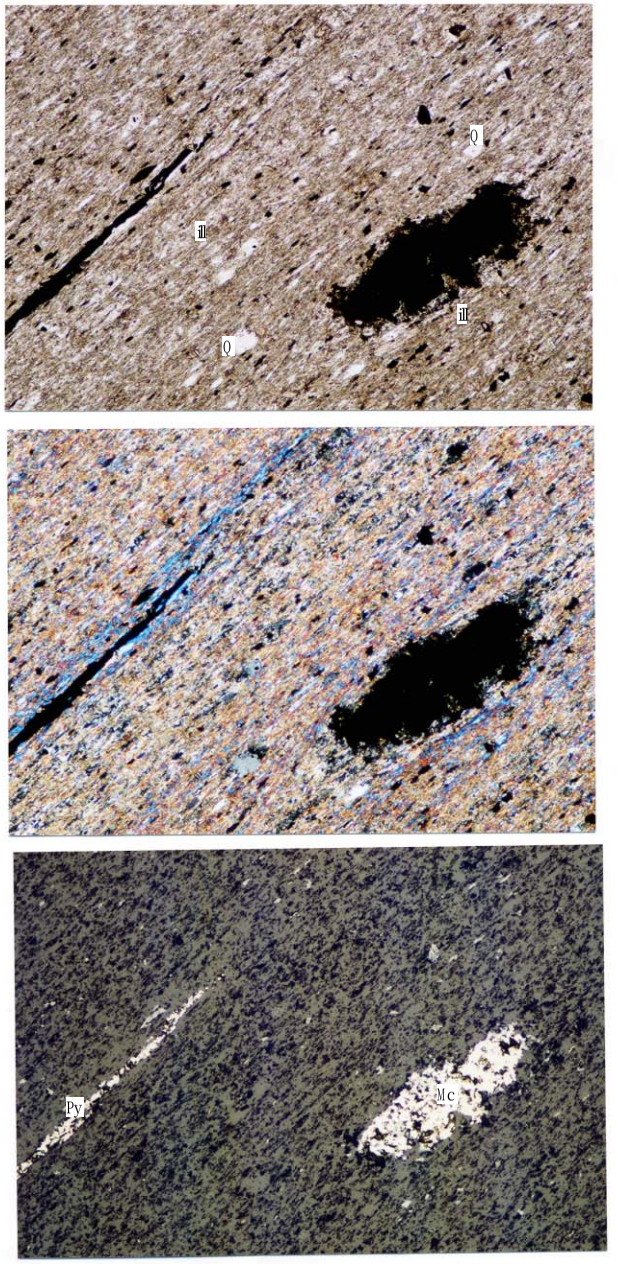
02MR-K083
×100

0.01mm



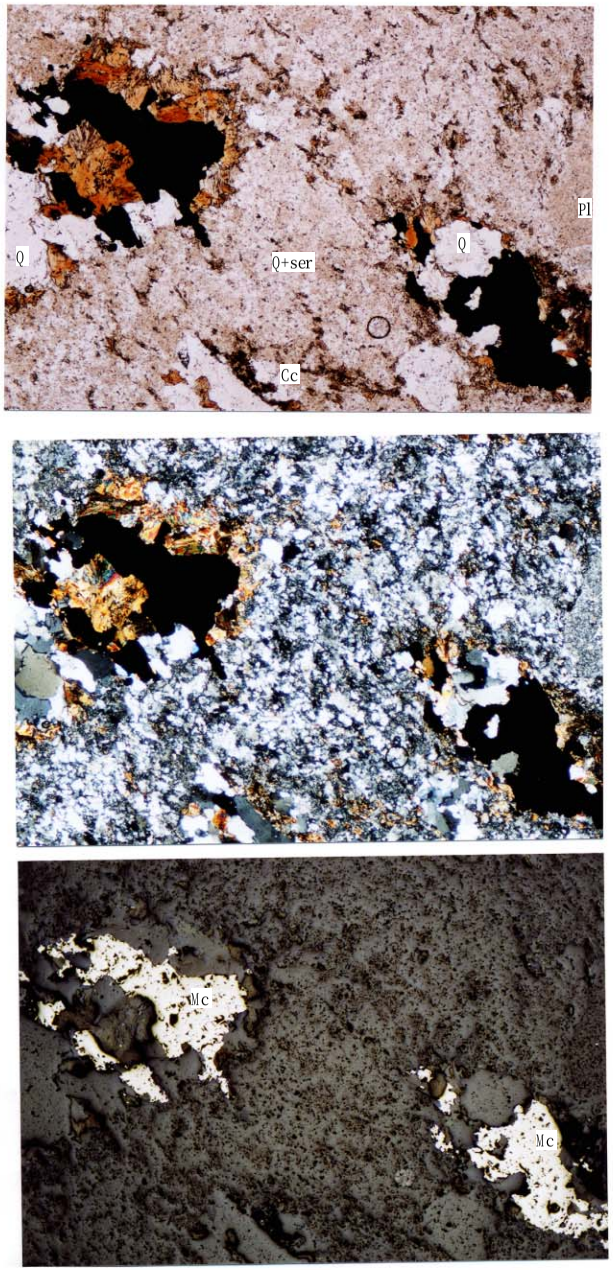
02MR-K089
×40

1mm



02MR-K098
×100

0.01mm

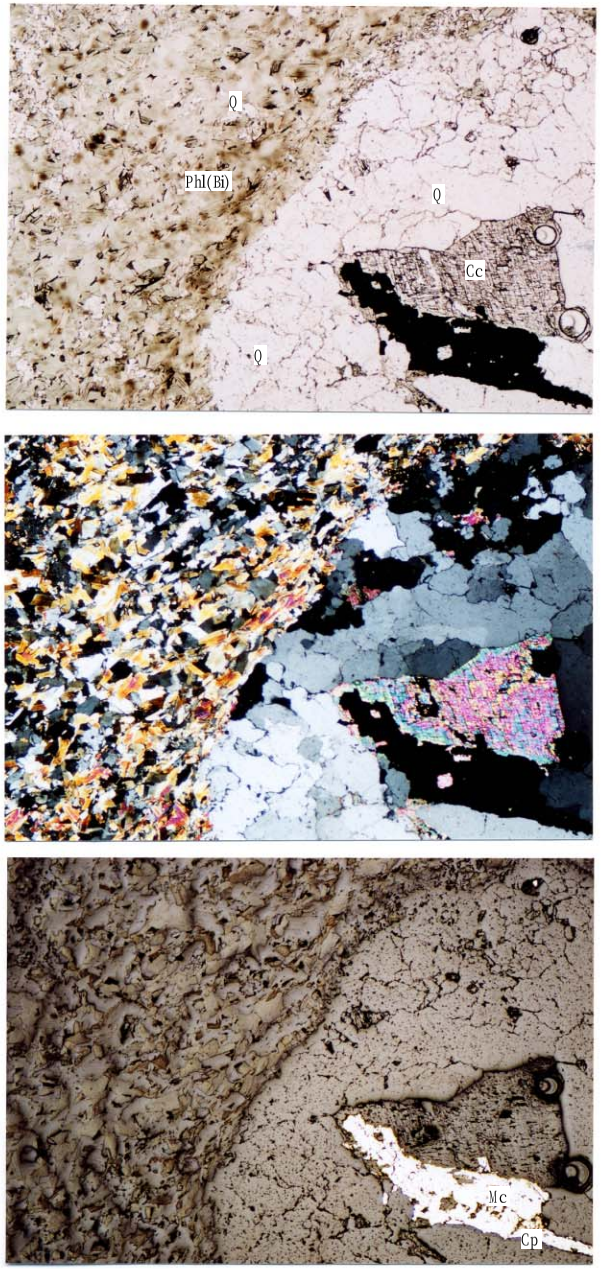


02MRS-007
×40

1mm

02MRS-0024
×40

1mm



02MRS-0026

×40

1mm

Appendix 4. Microscopic Observation of Thin Sections

Analysis of Polished Thin Section

	Ore minerals														Primary minerals					Altered minerals			Mine name
	shpalerite	galena	chalcopyrite	pyrite(euhedral)	pyrrhotite	arsenopyrite	marcasite	marcasite(exfoliat	magnetite	ilmenite	hematite	covellite	acanthite	stannite	quartz	plagioclase	augite	hornblende		clay minerals	sericite		
02MRN 014	△		△	△	◎			△	△						·								Khwadra
02MRN 015	△		△	◎											·	·	·						Khwadra
02MRN 016	△	·	○	◎	◎										·								Khwadra
02MRN 017	△		△	◎	◎			△															Khwadra
02MRN 018	○	△	○	○	○		△						△		△	·				△			Khwadra
02MRN 019	△		△	◎	◎		△	△	·						·								Khwadra
02MRN 020	△	·	△	◎	◎			△							·								Khwadra
02MRN 021	△		○	◎	◎		·								○					·			Khwadra
02MRN 027	·		△	◎	△				△						○								Khwadra
02MRN 028			△	○	○										◎								Khwadra

2

Analysis of Polished Thin Section

	Mine name	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra
Altered minerals											
	sericite										
	clay minerals		·			·	·	·			
Primary minerals											
	hornblende										
	augite						·				
	plagioclase								·		
	quartz	·	◁	·	◁	○	◁	○	○	○	○
Ore minerals	stannite										
	acanthite										
	covellite										
	hematite										
	illmenite										
	magnetite										
	marcasite(exfoliat		◁		◁			◁	◁	◁	◁
	marcasite		·		◁		·		◁		
	arsenopyrite										
	pyrrhotite	○	◎	◁	◁	◎	◎	◎	◎	◎	◎
	pyrite(euhedral)	◎	○	◎	◎	◎		◎	◎	·	◎
	chalcopyrite	·	◁	◁	○	◁	◁	◁	◁	◁	·
	galena		·				·	◁	◁	◁	·
	shpalerite	·	○	○	○		·	○	○	○	◁
		02MRN 030	02MRN 032	02MRN 036	02MRN 039	02MRN 041	02MRN 043	02MRN 046	02MRN 047	02MRN 048	02MRN 049

3

Analysis of Polished Thin Section

	Mine name	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Jebilet	Draa Sfa
Altered minerals											
	sericite								・		
	clay minerals	◁		◁	・		・		・		
Primary minerals											
	hornblende										
	augite	・									
	plagioclase	◁					・				
	quartz	○	◎	・	○	◁	◎	◁	○	・	
Ore minerals	stannite										
	acanthite										
	covellite										
	hematite										
	illmenite										
	magnetite		・								
	marcasite(exfoliat		◁								
	marcasite	・				◁					・
	arsenopyrite										
	pyrrhotite	◎	◎	○	○	◎	○	○	◎	◎	◎
	pyrite(euhedral)		◎					◎	◎		・
	chalcopyrite	◁	◁	◁	◁	◁	◁	◁	◁	◁	◁
	galena	・							◁		◁
	shpalerite	・	・	◎		◁	◁	・	○	・	◎
		02MRN 054	02MRN 057	02MRN 058	02MRN 060	02MRN 062	02MRN 065	02MRN 068	02MRN 069	02MRN 080	02MRN 083

Analysis of Polished Thin Section

	Mine name	Draa Sfa	Draa Sfa	Draa Sfa	Draa Sfa	Draa Sfa	Draa Sfa	Hajar	Hajar	Hajar	Hajar
Altered minerals											
	sericite										
	clay minerals							·		·	·
Primary minerals											
	hornblende										
	augite					·		·		·	
	plagioclase									·	·
	quartz	·	○	○	·	◎	△	○		◎	◎
Ore minerals	stannite										
	acanthite										
	covellite										
	hematite										
	illmenite										
	magnetite										
	marcasite(exfolia										
	marcasite		△		·		·				
	arsenopyrite										
	pyrrhotite	◎	◎	◎	○	○	○	◎	○		
	pyrite(euhedral)		·	·	◎	◎	△	○		◎	○
	chalcopyrite	○	△	·	·	△	△	△	·		
	galena							△	○		·
	shpalerite				·		·	△	○		△
		02MRN 084	02MRN 085	02MRN 086	02MRN 087	02MRN 088	02MRN 089	02MRN 094	02MRN 095	02MRN 096	02MRN 097

5

Analysis of Polished Thin Section

	Mine name	Hajar	Hajar	Hajar	Hajar	Hajar	Hajar	Hajar	Hajar	Hajar	Hajar
Altered minerals											
	sericite										
	clay minerals				○	・	・			△	
Primary minerals											
	hornblende										
	augite										
	plagioclase				・						
	quartz	◎	◎	◎	◎	◎	・	・		◎	△
Ore minerals	stannite										
	acanthite										
	covellite										
	hematite										
	illmenite										
	magnetite										
	marcasite(exfoliat							△			△
	marcasite										
	arsenopyrite										
	pyrrhotite	○	△	○	◎	△	◎	◎	◎	○	○
	pyrite(euhedral)	△	◎					△	○	△	△
	chalcopyrite	△	△	△	◎	・	△	△	△	△	△
	galena					・	○	△	○		◎
	shpalerite	・				△	◎	◎	◎		◎
		02MRN 098	02MRN 099	02MRN 100	02MRN 102	02MRN 103	02MRN 105	02MRN 106	02MRN 107	02MRN 108	02MRN 109

Analysis of Polished Thin Section

	Mine name	Hajar	Hajar	Hajar	Hajar	Hajar	Hajar	Hajar	Jebilet	Frizen	Frizen
Altered minerals									◎ ?		
	sericite										
	clay minerals		·			·					
Primary minerals											
	hornblende										
	augite									·	
	plagioclase		·	·							
	quartz	◎	◎	◎	◎	○	◎	◎	○	○	◎
Ore minerals	stannite										
	acanthite										
	covellite										
	hematite										
	illmenite										
	magnetite										
	marcasite(exfoliat										
	marcasite										·
	arsenopyrite										
	pyrrhotite	△	○	○	◎	◎	○	○			
	pyrite(euhedral)	○	△			△	△	○		○	○
	chalcopyrite	△		△	△	△	·			○	△
	galena		○	△	◎	·	·			△	△
	shpalerite	·	○	○	○	△	△	△		△	○
		02MRN 110	02MRN 111	02MRN 112	02MRN 113	02MRN 114	02MRN 115	02MRN 116	02MRN 117	02MRN 118	02MRN 119

Analysis of Polished Thin Section

Mine name	Altered minerals			Primary minerals					Ore minerals												
			clay minerals	sericite		hornblende	augite	plagioclase	quartz	stannite	acanthite	covellite	hematite	ilmenite	magnetite	marcasite(exfoliat	marcasite	arsenopyrite	pyrrhotite	pyrite(euhedral)	chalcopyrite	galena	shpalerite
Frizen	02MRN 121		△						◎											◎	△	・	△
Frizen	02MRN 122		△						◎										△	△	△	△	◎
Frizen	02MRN 124						・		○						△				△	△	◎	△	◎
Frizen	02MRN 125		△				・		△										△	◎	・	△	△
Frizen	02MRN 127						・	・	○	?									○	◎	・	・	○
Frizen	02MRN 129		△						○										△	◎	△	・	○
Frizen	02MRN 130		・					・	◎											○	△		
Frizen	02MRN 132						・		◎			○								◎	○		・
Frizen	02MRN 133								○											◎	△	・	◎
Frizen	02MRN 135								○											◎	・	・	△

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Analysis of Polished Thin Section

	Mine name	Frizen	Frizen	Frizen	Frizen	Frizen	Kettara	Dras faa	Dras faa	Dras faa	Dras faa
Altered minerals											
	sericite										
	clay minerals	·									
Primary minerals											
	hornblende										
	augite	·									
	plagioclase										
	quartz	○	○	◎	◎	○		◎	△	△	△
Ore minerals	stannite										
	acanthite										
	covellite	·									
	hematite										
	illmenite										
	magnetite	△									
	marcasite(exfolia										
	marcasite						·		△	○	△
	arsenopyrite										
	pyrrhotite		○	○	○				◎	◎	◎
	pyrite(euhedral)	◎	○	△	◎	◎		·			
	chalcopyrite	·	·	·	○	△	·		△	·	·
	galena	△	△	·	△		○		·	○	○
	shpalerite	○	△	·	△	·	○		△	○	○
		02MRN 136	02MRN 137	02MRN 138	02MRN 139	02MRN 140	02MRN 138-2	02MRN 142-2	02MRN 143-2	02MRN 144	02MRN 145

Analysis of Polished Thin Section

	Mine name	Dras faa	Dras faa	Dras faa (400ml)	Dras faa (400ml)	Dras faa (400ml)	Dras faa (400ml)	Kettara	Kettara	Kettara	Kettara
Altered minerals											
	sericite										
	clay minerals	·		△	△				○	△	
Primary minerals											
	hornblende										
	augite										
	plagioclase				○					·	
	quartz	◎	·	◎	◎	△	◎	○	△	·	△
Ore minerals	stannite										
	acanthite										
	covellite										
	hematite										
	illmenite										
	magnetite	·					·		△	△	
	marcasite(exfoliat										
	marcasite										
	arsenopyrite										
	pyrrhotite	○	◎		△	◎					
	pyrite(euhedral)		△				·	◎	◎	◎	◎
	chalcopyrite	△	·	△	△	·		△	○	○	△
	galena		△			△					
	shpalerite	·	△	·	·	○					
		02MRN 146	02MRN 147	02MRN 148	02MRN 149	02MRN 150	02MRN 151	02MRN 154	02MRN 155	02MRN 156	02MRN 157

Analysis of Polished Thin Section

	Mine name	Altered minerals			Primary minerals					Ore minerals														
				clay minerals			hornblende	augite	plagioclase	quartz	stannite	acanthite	covellite	hematite	ilmenite	magnetite	marcasite(exfoliat	marcasite	arsenopyrite	pyrrhotite	pyrite(euhedral)	chalcopyrite	galena	shpalerite
02MRN 158	Kettara									○				·							·			
02MRN 159	Kettara							△		○						○					○	○	·	
02MRN 160	Kettara									◎						△					◎	△		
02MRN 161	Kettara									○						△					◎			
02MRN 162	Kettara			·				△		△				△							◎	△		
02MRN 163	Kettara							△		△						·					◎	○	·	
02MRN 164	Kettara			·						◎						△					◎	○	·	
02MRN 165	Kettara			·						·						·		○		◎		△		
02MRN 166	Kettara			△						·						△				◎		△		
02MRN 167	Kettara									◎						·				◎		△	·	·

Analysis of Polished Thin Section

	Ore minerals															Primary minerals					Altered minerals			Mine name
	shpalerite	galena	chalcopyrite	pyrite(euhedral)	pyrrhotite	arsenopyrite	marcasite	marcasite(exfoliat	magnetite	ilmenite	hematite	covellite	acanthite	stannite	quartz	plagioclase	augite	hornblende		clay minerals	sericite		
02MRN 168	△		△		◎										△								Kettara
02MRN 169	△		○		◎				·														Kettara
02MRN 170	△		△	○	○				·						◎								Kettara
02MRN 171	○		△		◎																		Kettara
02MRN 172	△		△		◎		·								·	·				·			Kettara
02MRN 173	△		△		◎		·								·					·			Kettara
02MRN 174	△		△	○	◎		·		·						○								Kettara
02MRN 175			·		△				·														Kettara
02MRN 176			△		◎		△																Kettara
02MRN 178			○	△	◎		△		·	?					◎					△			Kettara

Table) Result of microscopic observation of thin sections (volcanic rocks)

Sample name		02MRS 001	02MRS 002	02MRS 003	02MRS 004	02MRS 005	02MRS 006	02MRS 008	02MRS 009	02MRS 0010	02MRS 0011	02MRS 0012	02MRS 0013
Rock name		Rhyolite	Tonalitic mylonite	Tonalitic mylonite	hyolite	Tonalitic mylonite	Rhyolite	Tonalitic mylonite	Rhyolite	Slate	Rhyolitic welded tuff	Hornfels	Metadoleraite
Contact metamorphism Dynamic metamorphism Hydeothermal Alteration		○	○Fracture, fine grain Dynamicc recrystalize ○	○Fracture, fine grain Dynamicc recrystalize ○	○	○Fracture, fine grain Dynamicc recrystalize ○	○	○Fracture, fine grain Dynamicc recrystalize ○	○	○ ○Slate cleavage pressure shadow	○	○Augite→ Tremolite	○Augite→ Tremolite
Structure / Texture		Porphyritic	Mortar texture	Mortar texture	Porphyritic	Mortar texture	Porphyritic	Mortar texture	Porphyritic	Shistosity	Welded	Granoblastic	Ophitic
Result of observation	Minerls, grain size, porphyroclast, crystal fragments crastics	Phenocryst : 2.5㎜> Plagioclase,	porphyroclast : 3.3㎜(1.5㎜)> Quartz, Plagioclase (:Muscovite)	porphyroclast : 3㎜> Quartz, Plagioclase (:Muscovite)	Phenocryst : 2.5㎜> Plagioclase,	porphyroclast : 2㎜> Quartz, Plagioclase (K-Feldspar, Muscovite)	Phenocryst : 2.5㎜> Plagioclase,	porphyroclast : 1.5㎜> Quartz, Plagioclase (K-Feldspar, Muscovite)	Phenocryst : 12㎜> Plagioclase,	Minieral fragments : 0.1㎜> Quartz, (Feldspar)	Phenocryst・	Minieral fragments : 0.1㎜ (0.2㎜>) Quartz, (Plagioclase,)	Major minerals : 2㎜> Tremolite, Plagioclase,, (ore minerals)
	Matrix	0.1㎜> Quartz, Plagioclase ,Biotite～oxidised Chlorite	0.15㎜> Quartz, Plagioclase ,Sericite, Calsite (Chlorite)	0.1㎜> Quartz, Plagioclase ,Calsite, Sericite (Chlorite)	0.1㎜> Biotite～oxidised Chlorite, Quartz, Plagioclase,(Sericite)	0.1㎜> Quartz, Plagioclase ,(Calsite, Sericite , Chlorite)	0.15㎜> Quartz, Plagioclase ,Biotite～oxidised Chlorite, (Sericite)	0.1㎜> Quartz, Plagioclase ,Calsite, (Sericite ～Ilite, Chlorite)	0.15㎜> Quartz, Biotite～oxidised Chlorite, Sericite	0.1㎜> Biotite～oxidised Chlorite, (Sericite ～Ilite)	0.2㎜> Quartz, Plagioclase ,(Biotite～oxidised Chlorite・Chlorite Sericite)	Tremolite(0.1㎜, 0.15㎜>)	
	Alteration minerals	Quartz, Biotite ～oxidised Chlorite Sericite, Calsite	Sericite, Calsite (Chlorite)	Sericite, Calsite (Chlorite)	Biotite～oxidised Chlorite,Quartz,(Sericite, Chlorite)	(Calsite, Sericite, Chlorite)	Quartz, Biotite ～oxidised Chlorite (Sericite)	Calsite, (Sericite～ Ilite, Chlorite)	Quartz, Biotite～ oxidised Chlorite, Sericite, Epidote	oxidised Chlorite, (Ilite)	Biotite～oxidised Chlorite・ChloriteSericite, Epidote		<Metamorphic minerals> Tremolite, Chlorite
	Fracture (vein), Lens	Quartz, Biotite ～oxidised Chlorite (Calsite)			Quartz, Biotite ～oxidised Chlorite (Zeolite,Calsite)		Quartz, (Biotite, Calsite)		Quartz, (Biotite, Calsite)		Quartz, Plagioclase		

Sample name		02MRS 0014	02MRS 0015	02MRS 0016	02MRS 0017	02MRS 0018	02MRS 0021	02MRS 0023	02MRS 0029	02MRS 0030	02MRS 0031	02MRS 0032	02MRS 0033
Rock name		oxidised Chlorite Hornfels	Metadoleraite	Metadoleraite	Rhyolite	Rhyolite	Rhyolite	Rhyolite	RhyoliticWelded tuffcious mylonite	RhyoliticWelded tuffcious mylonite	Rhyolitic welded tuff	Rhyolitic welded tuff	Chlorite shist (tuff)
Contact metamorphism Dynamic metamorphism Hydeothermal Alteration		○ △	○Augite,Tremolite	○Augite,Tremolite	 ○	 ○	 ○	○Dynamicc recrystalize ○	○Fracture, fine grain Dynamicc recrystalize ○	○Fracture, fine grain Dynamicc recrystalize ○	 ○	 ○	 ○
Structure / Texture		Granoblastic	Ophitic	Ophitic	Porphyritic	Porphyritic	Porphyritic	Porphyritic	Mortar texture	Mortar texture	Welded	Welded	Granoblastic
Result of observation	Minerls, grain size, porphyroclast, crystal fragments crastics	Major minerals : 0.05㎜(0.3㎜)> oxidised Chlorite 0.02㎜ (Quartz)	Major minerals : 2㎜> Tremolite, Plagioclase, Chlorite, (ore minerals)	Major minerals : 2㎜> Tremolite, Plagioclase, Chlorite, Augite, (ore minerals)	Phenocryst : 2.5㎜> Plagioclase,	Phenocryst : 2.5㎜> Plagioclase,	Phenocryst : 2.5㎜> Quartz, Plagioclase,	Phenocryst : 1㎜> Quartz	Phenocryst : 2㎜> Quartz porphyroclast : 0.4㎜(1.5㎜)> Quartz, Plagioclase Quartz vein(6㎜>)	Fracture, fine grain : 0.5㎜> Quartz, Plagioclase	Phenocryst～crystalized fragment : 2㎜> Quartz	Phenocryst～crystalized fragment : 2㎜> Quartz	Major minerals : 0.1～0.2㎜> Chlorite, crystalized fragment : 0.5㎜> Quartz, (Zircon)
	Matrix	0.05㎜> oxidised Chlorite (Quartz)			0.2㎜> Biotite～oxidised Chlorite, Chlorite, Quartz, Plagioclase ,(Sericite)	0.1㎜> Quartz, Plagioclase ,Biotite～oxidised Chlorite	0.1㎜> Quartz, Plagioclase ,(Biotite～oxidised Chlorite, Sericite Calsite)	0.1㎜> Quartz, Sericite (Biotite～oxidised Chlorite, Calsite)	0.1㎜> Chlorite, Quartz, Plagioclase,	0.1㎜> Quartz, Plagioclase ,Chlorite, (Epidote , Calsite)	0.1㎜> Quartz, ChloriteSericite	0.1㎜> Quartz, Sericite Chlorite	0.1～0.2㎜> Chlorite
	Alteration Minerals	Oxidised Chlorite (Quartz)	<metamorphic/alteration minerals> Chlorite, (Epidote)	<metamorphic/alteration minerals> Chlorite, (Sericite, Epidote)	oxidised Chlorite, Chlorite, Quartz, (Sericite, Calsite)	Quartz, Biotite ～oxidised Chlorite	Quartz, Biotite ～oxidised Chlorite Sericite, Calsite	Quartz, Sericite (Biotite～oxidised Chlorite, Calsite)	Chlorite, limonite	Chlorite, (Epidote , Calsite, Sericite)	Quartz, Chlorite Sericite	Quartz, Sericite Chlorite	Chlorite, (Epidote)
	Fracture (vein), Lens	Oxidised Chlorite (Quartz)		Zeolite ?			Calsite, Quartz Biotite～oxidised Chlorite, Sericite, Chlorite	Quartz, (Biotite～oxidised Chlorite, Calsite, Sericite)	Chlorite, limonite	Chlorite, Calsite Sericite			Chlorite

Sample name		02MRS 0034	02MRS 0036	02MRS 0038	02MRS 0039	02MRS 0040	02MRS 0042	02MRS 0043	02MRS 0044	02MRS 0045	02MRS 0046	02MRS 0047
Rock name		Tuffsious Slate	Rhyolitic welded tuff	Quartzite	Hornfels	Hornfels	Chlorite Quartz vein	Slate	Tuffsious Slate	Slate	Slate	Slate
Contact metamorphism Dynamic metamorphism Hydeothermal Alteration		○Slate cleavage Pressure shadow- 	 ○	○Fine grain Recrystalized 	○ 	○ 	○Fracture 	○Slate cleavage Pressure shadow- 	○Kink band Slate cleavage Pressure shadow-	○Kink band Slate cleavage Pressure shadow-	○Slate cleavage Pressure shadow- 	○Kink band Slate cleavage Pressure shadow-
Structure / Texture		shistosity	Welded	Mortal texture	Grain non-mrtamorphism	Granoblastic		shistosity	shistosity	shistosity	shistosity	shistosity
Result of observation	Minerls, grain size, porphyroclast, crystal fragments crastics	Minieral fragments：0.2㎜(0.5㎜)> Quartz, Plagioclase ,(Tourmaline) Rock fragments: Rhyolite	Phenocryst～crystal fragments : 3㎜> Quartz, Plagioclase ,	porphyroclast・Minieral fragments：0.2㎜ Quartz, (Zircon, Tourmaline)	Minieral fragments：0.1～0.2㎜(0.4㎜) Quartz, K-Feldspar, Plagioclase, (Biotite, Zircon) Rock fragments : Granite	Minieral fragments：0.4㎜> Quartz, Muscovite Chlorite, Biotite Opaque	Gang minerals : 20㎜<, 0.05~0.4㎜ Quartz, Chlorite	Minieral fragments：0.1㎜> Quartz, (Feldspar)	Minieral fragments：0.1㎜> Quartz, (Zircon)	Minieral fragments：0.15㎜> Quartz, (Feldspar)	Minieral fragments：0.1㎜> Quartz, (Feldspar)	Minieral fragments：0.1㎜> Quartz, (Feldspar)
	Matrix	Sericite～Ilite, Chlorite, (Opaque)	Plagioclase, Quartz Sericite, Chlorite	Quartz, (Sericite～Ilite)	Sericite～Ilite, Biotite～oxidised Chlorite			Sericite～Ilite, Biotite～oxidised Chlorite, Calsite, Chlorite	Chlorite	Sericite～Ilite, Biotite～oxidised Chlorite, Graphite Chlorite, iron sulfide	Sericite～Ilite, Graphite, Chlorite, Calsite, iron sulfide	Sericite～Ilite, Graphite, (Chlorite), iron sulfide
	Alteration Minerals	Ilite	Plagioclase, Quartz Sericite, Chlorite	Ilite	Ilite, oxidised Chlorite		Quartz, Chlorite	Ilite, oxidised Chlorite, Calsite, Chlorite	Chlorite	Ilite, oxidised Chlorite, Chlorite	Ilite, Chlorite, Calsite	Ilite, (Chlorite)
	Fracture (vein), Lens			limonite, Ilite				Calsite, Chlorite	Quartz, Chlorite Epidote	Chlorite, Quartz	Calsite	Quartz, 硫化鉄鉱

Table) Result of microscopic observation on thin section on Marrakech-Tekna Area, Kingdom of Morocco

No	Sample	Rock Name	Mineral fragments											Matrix															Texture	Fossile		Location
			qz	pl	kf	mu	bt	chl	ca	gr	zr	ap	grn	qz	pl	kf	mu	bt	chl	ca	grn	sph	to	smc	ap	ep	ac	gr	op	Fe			B	HF	
1	02MR-K001	garnet-biotite-muscovite-muscovite schist	△	・							・						○	△	△	△	△							△			clastic	-		○	Khwadra_core
2	02MR-K004	Shale	△	○													○		△			△		△					△		clastic	-		○	Khwadra_core
3	02MR-K005	sandy shale	○	・							・						△	△	○	・	・	・	・						・		clastic	-		○	Khwadra_core
4	02MR-K006	garnet-biotite-muscovite-muscovite schist	△								・						○	△	△		・										clastic	-	○		Khwadra_core
5	02MR-K008	muscovite schist	・											・	・		○	・	△	△		・	・						△	・	clastic	-	○		Khwadra_core
6	02MR-K009	shale	△	・										・			○	・	△	△					・	・			△		clastic	-		○	Khwadra_core
7	02MR-K011	garnet-biotite-muscovite-muscovite schist	△	・							・			○	△	△	○	△	△	△	・				・				△		clastic	-		○	Khwadra_core
8	02MR-K014	muscovite schist	○	・							・			・			○		△	△			・					△	・		clastic	-		○	Khwadra_core
9	02MR-K016	garnet-biotite-muscovite-muscovite schist	○								・			△	・		○		△	△	・		・		・			△	△		lepidoblastic	-	○		Khwadra_core
10	02MR-K018	slate	△	・										△			○		△	△		△	・					△	・		clastic	-		○	Sabsafa_core
11	02MR-K021	slate	・	・										○			△		△	△		△	・					○	・		schistose	-		○	Sabsafa_core
12	02MR-K024	shale	○	△	・						・	・		△			△	△	△			△							△		clastic	-		○	Kerkoze
13	02MR-K026	fine grain sandstone	○								・	・		△	・		△		○			△				・			△		clastic	-		○	Koudiat_Aiche
14	02MR-K027	shale	○	△								・		△	・	・	△	△	△			△			・				△		clastic	-		○	N_Bensliman
15	02MR-K029	shale	○	△								・		△	・		・					△			・		○		△		clastic	-	○		J_Hadat_gossan
16	02MR-K030	fine grain sandstone	○	△	△							・		△			・	△		△		△						△	△		clastic	-	○		J_Hadat_gossan
17	02MR-K031	recrystalized limestone							◎		・											・									banded	-		○	J_Hadat_gossan
18	02MR-K032	slate	△								・			○			○		○	△		△	・						△		clastic	-		○	KA25(Koudit Aicha)
19	02MR-K035	shale	○								・			△			○		△			△	・						△		clastic	-		○	KA25(Koudit Aicha)
20	02MR-K037	shale	○	△							・			△			△	△	△			△						△			clastic	-	○		KA25(Koudit Aicha)
21	02MR-K039	muscovite schist	△								・			△			○		△												clastic	-		○	BS15(Benslieman)
22	02MR-K041	garnet-biotite-muscovite-muscovite schist	△	・										△			○	・	△		・						△	○	・		clastic	-		○	LA9(Laachach)
23	02MR-K043	muscovite schist	△								・			△	・		○		△	△		△						△	△		clastic	-		○	LA9(Laachach)
24	02MR-K044	fine grain sandstone	○	△	△		・				・			・			○		△	・			・					△	△		clastic	-		○	LA9(Laachach)
25	02MR-K046	shale	○	△	・						・	・		△			○						・					△	△	△	clastic	-	○		Amzoourh
26	02MR-K047	shale	○	△							・						△	△		○			・					△	△	△	clastic	-	○		Imarine
27	02MR-K049	recrystalized limestone	○	△							・						・			◎									△	△	clastic	△	○		Tameslouht
28	02MR-K050	fine grain sandstone	○	△	・						・			・				△	○	△		△						△			clastic	-		○	Hajar
29	02MR-K051	hornfels	○	△							・			△				○	・	・		△						△	△		clastic	-	○		Hajar
30	02MR-K053	sandy shale	○	△	・						・			△			○	△	△	・		△	・					△	・		clastic	-		○	Hajar
31	02MR-K057	sandy shale	○	△							・	・		△			○		○	・		△							・		clastic	-		○	Hajar
32	02MR-K067	garnet-replaced rock											○	△					△	△									○		replacement	-		○	Frag el Ma
33	02MR-K068	sandy shale	○	・							・						△	△					・					△	△		clastic	-		○	Sid Bau East
34	02MR-K069	shale	○	△																											clastic	-		○	Sid Bau East
35	02MR-K071	chlorite schist	△	△				○	○								△			○		△									schistose	-		○	Jbwl_Sarhlef
36	02MR-K072	shale	△	・							・						○	△		・									△		clastic	-		○	Jbwl_Sarhlef
37	02MR-K074	shale	○								・			△			△		△	△		△						△	△		clastic	-		○	Frizem
38	02MR-K079	shale	△								・			△			○		△	△		△						△	△		clastic	-		○	Frizem
39	02MR-K080	recrystalized limestone							◎					・			・		・			△							・		clastic	-	○		Frizem
40	02MR-K081	sandy shale	○	・							・			・			○		△	△		△	・					△	・		clastic	-		○	Frizem
41	02MR-K084	shale	○	・													○			△			・					△	△		clastic	-		○	Kettara
42	02MR-K085	shale	○	・							・			△			○		○			△							△	△	clastic	-		○	Kettara
43	02MR-K087	shale	○								・	・		△			△		○			△	・						△		clastic	-		○	Draa_Sfar
44	02MR-K090	sandy shale	○	・	・						・	・		△			○		△	△		△				△		△	△		clastic	-	○		Draa_Sfar
45	02MR-K093	shale	△		・									△			○		△			△	・						△		clastic	-		○	Draa_Sfar
46	02MR-K095	shale	△	・	・									・			○		△	△		△							・		clastic	-		○	Draa_Sfar
47	02MR-K097	shale	○								・	・		○			△		○			△							・		clastic	-		○	Draa_Sfar

Legend; ◎abundant, ○common, △minor, ・rare

py: pyrite, cp: chalcopyrite, mc: marcasite, mt: magnetite, he: hematite, il: ilmenite, ga: galena, ap: aptite, ep: epidote, ac: actionlite, Fe: Fe-OH

qz: quartz, pl: plagioclase, kf: k-feldspar, mu: muscovite, bt: biotite, chl: chlorite, ca: calcite, gr: graphite, zr: zircon, grn: garnet, shp: sphane, smc smectite, op:opace minerals, to: tourmalne

Table)Result of microscopic observation on polished thin section on Marrakech-Tekna Area, Kingdom of Morocco

No	Sample	Rock Name	Ore minerals							Gangue minerals								Location	Note
			py	cp	mc	mt	he	il	ga	qz	pl	kf	mu	bt	chl	ca	gr		
1	02MR-K007	marcasite bearing muscovite chlorite schist			○	・				・			◎		△			Khwadra_core	
2	02MR-K017	sandy mudstone slate	△							△			◎	・	・	・		Khwadra_core	ilite(△)
3	02MR-K020	pyrite bearing muscovite-quartz-graphite schist	○							△			○		△	△	・	Sabsafa_core	
4	02MR-K023	marcasite bearing quartz graphite schist			○					△			○		・	・	△	Sabsafa_core	
5	02MR-K034	pyrite-marcasite rich mudstone	△		・					△			△		・	・	△	KA25(Koudit Aicha)	
6	02MR-K038	quartz bearing mudstone	△		・					○			◎		・			BS15(Benslieman)	rutile(△), ilite(△)
7	02MR-K054	disseminated marcasite-chalcopyrite-hematite ore		○		・	△			◎					◎	△		Hajar	
8	02MR-K055	disseminated marcasite ore	・			△				△		△	○		△			Hajar	apatite(・)
9	02MR-K056	muscovite biotite schist		△		・				○			◎	△	△			Hajar	
10	02MR-K058	strongly altered rock (silicified tuff)		△		・				○		・	○		△			Hajar	
11	02MR-K064	pyrite bearing muscovite-graphite-graphite schist	○							◎			○		・		△	Algeida?	
12	02MR-K065	pyrite bearing muscovite-graphite-graphite schist	○							◎	・		○		△		△	Algeida?	
13	02MR-K066	bluck muddy (-sandy) schist	△							○			○		△	・	△	Algeida?	
14	02MR-K076	carbonatized chlorite schist	△							○					△	◎		Frizem	brittle mica(△)
15	02MR-K077	marcasite-magnetite bearing chlorite schist	・							○			◎			○		Frizem	prehnite(△)
16	02MR-K083	muddy slate	△							○			○		・			Frizem	ilite(○)
17	02MR-K089-a	marcasite-chalcopyrite-ilmenite ore		○						○					△			Draa_Sfar	kaoline like cray (△)
	02MR-K089-b	marcasite-chalcopyrite-ilmenite ore		○						○					△			Draa_Sfar	kaoline like cray (△)
18	02MR-K098	sandy slate	△	・						○	△		◎		△			Draa_Sfar	ilite(△)
19	02MRS007	silicified dacite		△						◎	・	・	・	・	・			Khwadra	
20	02MRS0024	silicified dacite tuff								◎					○	△			ilite(△)
21	02MRS0025	recrystalized tuff		・						◎		△		◎	△	・			

Legend; ◎abundant, ○common, △minor, ・rare

py: pyrite, cp: chalcopyrite, mc: marcasite, mt: magnetite, he: hematite, il: ilmenite, ga: galena,

qz: quartz, pl: plagioclase, kf: k-feldspar, mu: muscovite, bt: biotite, chl: chlorite, ca: calcite, gr: graphite

Appendix 5. Results of X-ray Diffraction Analysis

MMAJ X-ray diffraction analysis

No.	Sample name	Silicate																						sulfate				carbonate				other minerals						Remarks			
		sli			Feldspar			Clay								zeolite						others																			E	G	HCl
		Quarts	cristobalit	tridymite	plagioclase	K-feldspar	albite	sericite	chlorite	kaolin	smectite	w-sericite	halloysite	S／S	C／S	clinoptilol	moldenite	laumontite	stilbite	analcite	wairakite	hornblend	augite	Biotite	alunite	gypsum	barite	jarosite	calcite	ankerite	siderite	magnesite	pyrite	rutile	sphalerite	graphite	nickeline	marcasite				
1	02MR - K000	◎					△	◎	◎																				○												
2	02MR - K001	◎			△			◎	◎														△																		
3	02MR - K002	◎			○			◎	△																																
4	02MR - K003	◎					○	◎	・																								・								
5	02MR - K004						◎	◎	◎																																
6	02MR - K005	◎						◎	◎																					・											
7	02MR - K006	◎					◎	◎	◎																																
8	02MR - K007							◎	◎																																
9	02MR - K008	◎			○			◎	◎																																
10	02MR - K009	◎			○			◎	◎																																
11	02MR - K010	◎			○			◎	◎																																
12	02MR - K011	○			○	○		△	◎																				・												
13	02MR - K012	◎					◎	◎	◎																																
14	02MR - K013	◎			◎			◎	◎																																
15	02MR - K014	◎					○	◎	◎																																
16	02MR - K015	◎					○	◎	◎																				・												
17	02MR - K016	◎					◎	◎	○																																
18	02MR - K017	◎					◎	◎	◎																					・		・										
19	02MR - K018	○					○	◎	◎																																
20	02MR - K019	◎						◎	◎																				◎	・			・	・							
21	02MR - K020	◎					○	◎							・															◎			○	・							
22	02MR - K021	◎					◎	◎	◎																									○							
23	02MR - K022	◎					◎	◎	◎																				○	△				△							
24	02MR - K023	◎					◎	◎	◎																					・			・	△							
25	02MR - K023-b	◎					△	◎	◎																				○												

◎ :abondante　○ :common　△ :a little　・ : rare　? : uncertain

S/S : smectite mixture clay minerals

C/S : chlorite－smectitet mixture clay minerals

MMAJ X-ray diffraction analysis

No.	Sample name	Silicate																						sulfate				carbonate				other minerals						Remarks	EG	HCl
		sli			Feldspar			Clay								zeolite						others																			
		Quarts	cristobalit	tridymite	plagioclase	K-feldspar	albite	sericite	chlorite	kaolin	smectite	w-sericite	halloysite	S＼S	C＼S	clinoptilol	moldenite	laumontite	stilbite	analcite	wairakite	hornblend	augite	Biotite	alunite	gypsum	barite	jarosite	calcite	ankerite	siderite	magnesite	pyrite	rutile	sphalerite	graphite	nickeline	marcasite			
26	02MR - K024	◎			◎			○	◎																															
27	02MR - K025	◎					○	◎	◎																															
28	02MR - K026	◎					○		◎																															
29	02MR - K027	○					◎	・	◎																															
30	02MR - K028	◎						◎	◎																															
31	02MR - K029	○			○			・														◎																		
32	02MR - K030	◎			△	○		△							・														○												
33	02MR - K031																					△							◎												
34	02MR - K032	◎						◎	◎																															
35	02MR - K033	○			○			○	◎																															
36	02MR - K034	◎			△			◎	○																															
37	02MR - K035	◎						◎	◎																															
38	02MR - K036	◎					○	◎	◎																															
39	02MR - K037	○			◎			△	◎																							・								
40	02MR - K038	◎			△			◎	◎																							・								
41	02MR - K039	◎						◎	◎																							・	・							
42	02MR - K040	◎			◎			◎	◎																															
43	02MR - K041	◎					○	◎	◎																															
44	02MR - K042	◎						○	◎																											・				
45	02MR - K043	◎						◎	◎																															
46	02MR - K044	◎					○	○	◎																															
47	02MR - K045	◎					△	◎	◎																				◎												
48	02MR - K046	◎						◎	○																															
49	02MR - K047	◎			△			◎																				◎												
50	02MR - K048	◎						・							・																									

◎ :abondante　○ :common　△ :a little　・: rare　? : uncertain

S/S : smectite mixture clay minerals

C/S : chlorite－smectitet mixture clay minerals

MMAJ X-ray diffraction analysis

No.	Sample name	Silicate																						sulfate				carbonate				other minerals						Remarks		
		sli			Feldspar			Clay								zeolite						others																		EG	HCl
		Quarts	cristobalit	tridymite	plagioclase	K-feldspar	albite	sericite	chlorite	kaolin	smectite	w-sericite	halloysite	S／S	C／S	clinoptilol	moldenite	laumontite	stilbite	analcite	wairakite	hornblend	augite	Biotite	alunite	gypsum	barite	jarosite	calcite	ankerite	siderite	magnesite	pyrite	rutile	sphalerite	graphite	nickeline	marcasite			
51	02MR - K049	△						・							・																		・							
52	02MR - K050	◎					○	◎	◎																															
53	02MR - K051	◎			○			◎	△																															
54	02MR - K052	◎			◎			◎	・																															
55	02MR - K053	◎			○			◎	○																															
56	02MR - K054	◎							◎																・															
57	02MR - K055	◎						◎	◎																		・							△							
58	02MR - K056	◎						◎	◎																															
59	02MR - K057	◎						◎	○																					・										
60	02MR - K058	◎						◎	○																															
61	02MR - K059	◎						◎	◎																															
62	02MR - K060	◎						◎	○																					○										
63	02MR - K061	◎						◎	◎																															
64	02MR - K062	◎					○	◎	○																								・	・						
65	02MR - K063	◎						◎	◎																							△								
66	02MR - K064	◎					○	◎	◎																									・	○					
67	02MR - K065	◎					○	◎	◎																									・	○					
68	02MR - K066	◎					○	◎	◎																									・	○					
69	02MR - K067					◎		・															◎													◎	◎			
70	02MR - K068	◎			○			◎																					△										
71	02MR - K069	◎					◎	◎																															
72	02MR - K070	◎					◎	△	◎																					・										
73	02MR - K071	◎					◎	・	◎																					◎				・						
74	02MR - K072	◎					○	◎	◎																										△					
75	02MR - K073	◎					○	◎	◎																					・					△					

◎ :abondante　○ :common　△ :a little　・ : rare　? : uncertain

S/S : smectite mixture clay minerals

C/S : chlorite－smectitet mixture clay minerals

MMAJ X-ray diffraction analysis

No.	Sample name	Silicate																						sulfate				carbonate				other minerals						Remarks	EG	HCl
		sli			Feldspar			Clay								zeolite						others																			
		Quarts	cristobalit	tridymite	plagioclase	K-feldspar	albite	sericite	chlorite	kaolin	smectite	w-sericite	halloysite	S＼S	C＼S	clinoptilol	moldenite	laumontite	stilbite	analcite	wairakite	hornblend	augite	Biotite	alunite	gypsum	barite	jarosite	calcite	ankerite	siderite	magnesite	pyrite	rutile	sphalerite	graphite	nickeline	marcasite			
76	02MR - K074	◎						◎	◎																								・	○							
77	02MR - K075	◎						◎	◎																															
78	02MR - K076	○						○	◎																															
79	02MR - K077	◎						◎							・															・	△									
80	02MR - K079	◎						◎	◎																									△						
81	02MR - K080	○						◎	◎																			○					・							
82	02MR - K081	◎					○	◎	◎																							・	△							
83	02MR - K082	◎						△	◎																	・		・						△						
84	02MR - K083	◎						◎	◎																								○							
85	02MR - K084	◎					△	◎	○																			○												
86	02MR - K085	◎						△	◎																															
87	02MR - K086	◎						○	◎																			・												
88	02MR - K087	◎						◎	◎																															
89	02MR - K088	◎						◎	◎																															
90	02MR - K089-a	◎						・	◎																			・												
91	02MR - K089-b	◎						◎	◎																									・						
92	02MR - K090	◎					◎	○	◎																								・							
93	02MR - K091	◎						◎	◎																															
94	02MR - K092	◎					○	◎	◎																															
95	02MR - K093	◎					○	◎	◎																															
96	02MR - K094	◎					△	◎	◎																															
97	02MR - K095	◎					○	◎	◎																															
98	02MR - K096	○					◎	◎	◎																			△												
99	02MR - K097	◎						◎	◎																								・	△						
100	02MR - K098	◎						◎	◎																								・							

◎ :abondante　○ :common　△ :a little　・: rare　? : uncertain

S/S : smectite mixture clay minerals

C/S : chlorite－smectitet mixture clay minerals

MMAJ X-ray diffraction analysis

No.	Sample name	Silicate																					sulfate				carbonate				other minerals						Remarks	EG	HCl
		sli			Feldspar			Clay								zeolite						others			alunite	gypsum	barite	jarosite	calcite	ankerite	siderite	magnesite	pyrite	rutile	sphalerite	graphite	nickeline	marcasite			
		Quarts	cristobalit	tridymite	plagioclase	K-feldspar	albite	sericite	chlorite	kaolin	smectite	w-sericite	halloysite	S／S	C／S	clinoptilol	moldenite	laumontite	stilbite	analcite	wairakite	hornblend	augite	Biotite																
101	02MR - K100	◎						◎	◎																			○										
102	02MR - K101	◎					◎	◎	◎																			△										

◎ :abondante ○ :common △ :a little ・: rare ？: uncertain

S/S : smectite mixture clay minerals

C/S : chlorite－smectitet mixture clay minerals

MMAJ X-ray diffraction analysis

No.	Sample name	Silicate																						sulfate				carbonate				other minerals						Remarks	EG	HCl
		sli			Feldspar			Clay								zeolite						others																			
		Quarts	cristobalit	tridymite	plagioclase	K-feldspar	albite	sericite	chlorite	kaolin	smectite	w-sericite	halloysite	S／S	C／S	clinoptilol	moldenite	laumontite	stilbite	analcite	wairakite	hornblend	augite	Biotite	alunite	gypsum	barite	jarosite	calcite	ankerite	siderite	magnesite	pyrite	rutile	sphalerite	graphite	nickeline	marcasite			
1	02MRS 001	◎					◎	◎	△																															
2	02MRS 002	◎					◎	○																					◎										
3	02MRS 003	◎					◎	○	○																			◎											
4	02MRS 004	◎			△			◎	・																															
5	02MRS 005	◎					◎	○	○																			○	・										
6	02MRS 006	◎			○			◎							・																									
7	02MRS 008	◎					◎	○	○																			○											
8	02MRS 0033	△							◎																															
9	02MRS 0034	◎					○	◎	◎																															
10	02MRS 0035	○							◎																															
11	02MRS 0037								・															◎																
12	02MRS 0041	◎					◎	・	◎																															
13	02MRS 0042	◎							◎																															
14	02MRS 0043	○			△			◎	△																			○											
15	02MRS 0044	○							◎																															
16	02MRS 0045	◎			△	・		◎	◎																															
17	02MRS 0046	◎					○	◎	◎																															
18	02MRS 0047	◎						◎	◎																			・				○							
19	02MRS 0011	◎				◎			○					・																									
20	02MRS 0012	◎			○						・			・								◎																		
21	02MRS 0015				△				◎													◎																	
22	02MRS 0016				○				○					・								◎																	
23	02MRS 0022	◎					△	◎		△																		△											
24	02MRS 0026	◎						◎		・																			・											

◎ :abondante　○ :common　△ :a little　・ : rare　? : uncertain

S/S : smectite mixture clay minerals

C/S : chlorite－smectitet mixture clay minerals

MMAJ X-ray diffraction analysis

No.	Sample name	Silicate																						sulfate				carbonate				other minerals						Remarks		
		sli			Feldspar			Clay								zeolite						others																			
		Quarts	cristobalit	tridymite	plagioclase	K-feldspar	albite	sericite	chlorite	kaolin	smectite	w-sericite	halloysite	S／S	C／S	clinoptilol	moldenite	laumontite	stilbite	analcite	wairakite	hornblend	augite	Biotite	alunite	gypsum	barite	jarosite	calcite	ankerite	siderite	magnesite	pyrite	rutile	sphalerite	graphite	nickeline	marcasite		E G	HCl
1	02MRN 053						○	◎							・										△			・		△										
2	02MRN 079	◎													・											・	△													
3	02MRN 123	◎						◎							・														△	○				△					
4	02MRN 131	・							・																			△			◎		・		◎	・				
5	02MRN 134	○							○																			・		△		◎	△			◎	・				
6	02MRN 179	△						・	◎																・			・				◎	・			△					
7	02MRN 180	◎						◎	◎																							・									
8	02MRN 181	○						○	◎																			△				◎	◎		○						
9	02MRN 182	○						○	◎																			○							・			○			
10	02MRN 183	◎						◎	◎																			・													
11	02MRN 184	◎						◎	◎																							○	○		・						
12	02MRN 185	◎							◎																										・						
13	02MRN 186	◎						・	◎																																

◎ :abondante ○ :common △ :a little ・ : rare ? : uncertain

S/S : smectite mixture clay minerals

C/S : chlorite－smectitet mixture clay minerals

Appendix 6. Results of Chemical analysis

Results of Chemical analysis

Volcanic Rocks

Table) Results of chimical analysis of igneous and other rocks of Tekna-Marakech area (major elements)

Sample No.	02MRS15	02MRS16	02MRS13	02MRS17	02MRS33	02MRS1	02MRS4	02MRS18	02MRS6	02MRS11	02MRS8
Locality	K Aicha	K Aicha	Jubilet	Hajar	Drasfar	Khwadra	Khwadra	Hajar	Khwadra	Jubilet	Safsafa
Drillhole No.	KA25	KA25		CDC27		KHS3	KHS1	CDC27	KHS3		S2
Rock name	Dolerite	Dolerite	Dolerite	Rhyolite (Andesite)	Rhyolitic Tuff	Rhyolite	Rhyolite	Rhyolite	Rhyolite	Rhyolitic Tuff	Tonalitic mylonite
SiO2(wt%)	46.81	48.77	48.93	58.18	64.55	66.89	68.50	68.51	71.22	77.59	65.84
TiO2	2.23	1.64	1.64	0.94	1.02	0.39	0.31	0.34	0.36	0.22	0.48
Al2O3	13.09	15.04	14.66	15.41	17.25	14.40	13.75	14.24	13.59	11.85	10.61
Fe2O3t	13.65	10.69	11.11	11.78	5.48	6.92	6.45	3.47	4.44	2.12	2.83
MnO	0.30	0.18	0.21	0.15	0.07	0.12	0.11	0.11	0.12	0.02	0.19
MgO	9.58	7.76	7.91	3.89	1.55	1.44	1.37	1.42	0.81	0.11	1.13
CaO	8.94	10.93	11.26	2.84	1.33	1.27	3.18	3.30	2.49	1.70	6.53
Na2O	1.67	1.57	1.44	1.22	0.91	2.88	0.96	2.26	2.29	3.57	2.74
K2O	0.25	0.55	0.47	1.60	3.41	2.59	2.74	2.52	1.93	0.33	1.12
P2O5	0.30	0.15	0.13	0.20	0.13	0.04	0.04	0.08	0.04	0.02	0.12
LOI	2.18	1.51	1.18	2.53	2.93	1.59	1.29	2.46	1.12	0.65	6.74
Total	99.00	98.79	98.94	98.74	98.63	98.53	98.70	98.71	98.41	98.18	98.33

Sample No.	02MRS2	02MRS3	02MRS5	02MRS34	02MRS12
Locality	Safsafa	Safsafa	Safsafa	Drasfa	Jubilet
Drillhole No.	S2	S2	S2	DSF15	
Rock name	Tonalitic mylonite	Tonalitic mylonite	Tonalitic mylonite	Taffacios slate	Sandstone hornfels
SiO2(wt%)	66.36	69.02	71.68	72.72	72.87
TiO2	0.36	0.21	0.28	0.34	0.47
Al2O3	9.78	8.26	9.46	12.58	8.66
Fe2O3t	3.38	1.84	1.79	4.33	6.06
MnO	0.23	0.20	0.14	0.06	0.16
MgO	2.10	0.76	0.71	1.98	2.83
CaO	4.99	7.93	5.29	0.34	5.54
Na2O	3.25	2.37	2.96	2.91	1.10
K2O	1.33	0.82	0.82	1.10	0.39
P2O5	0.08	0.06	0.08	0.10	0.06
LOI	7.06	7.18	5.01	2.01	0.54
Total	98.92	98.65	98.22	98.47	98.68

Table) Recalculated results of chimical analysis of igneous rocks of Tekna-Marakech area (major elements)

Sample No.	02MRS15	02MRS16	02MRS13	02MRS17	02MRS33	02MRS1	02MRS4	02MRS18	02MRS6	02MRS11	02MRS8
SiO2(wt%)	48.35	50.13	50.05	60.47	67.45	69.00	70.32	71.18	73.21	79.56	71.89
TiO2	2.30	1.69	1.68	0.98	1.07	0.40	0.32	0.35	0.37	0.23	0.52
Al2O3	13.52	15.46	15.00	16.02	18.02	14.86	14.12	14.79	13.97	12.15	11.59
Fe2O3t	14.10	10.99	11.36	12.24	5.73	7.14	6.62	3.61	4.56	2.17	3.09
MnO	0.31	0.18	0.22	0.16	0.07	0.12	0.11	0.11	0.12	0.02	0.21
MgO	9.89	7.98	8.09	4.04	1.62	1.49	1.41	1.48	0.83	0.11	1.23
CaO	9.23	11.24	11.52	2.95	1.39	1.31	3.26	3.43	2.56	1.74	7.13
Na2O	1.73	1.61	1.47	1.27	0.95	2.97	0.99	2.35	2.36	3.66	2.99
K2O	0.26	0.57	0.48	1.66	3.56	2.67	2.81	2.62	1.98	0.34	1.22
P2O5	0.31	0.15	0.13	0.21	0.14	0.04	0.04	0.08	0.04	0.02	0.13
tatal	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Sample No.	02MRS2	02MRS3	02MRS5	02MRS34	02MRS12
SiO2(wt%)	72.24	75.46	76.90	75.39	74.25
TiO2	0.39	0.23	0.30	0.35	0.48
Al2O3	10.65	9.03	10.15	13.04	8.83
Fe2O3t	3.68	2.01	1.92	4.49	6.17
MnO	0.25	0.22	0.15	0.06	0.16
MgO	2.28	0.83	0.76	2.05	2.89
CaO	5.43	8.67	5.67	0.35	5.64
Na2O	3.54	2.59	3.18	3.02	1.12
K2O	1.45	0.90	0.88	1.14	0.40
P2O5	0.09	0.06	0.09	0.11	0.06
tatal	100.00	100.00	100.00	100.00	100.00

Table) MORB(ave) normalised LIL and HFS elements aboundance

	MORB	02MRS15 (K Aicha)		02MRS16 (K Aicha)		02MRS13 (Jubilet)		02MRS15 (K Aicha)		02MRS16 (K Aicha)	
	(ave)	abundance	normalized	abundance	normalized	abundance	normalised	abundance	Normalised	abundance	normalised
Sr	120	181	1.508	140	1.167	131	1.092	181	1.508	140	1.167
K2O	0.15	0.25	1.667	0.55	3.667	0.47	3.133	0.26	1.733	0.57	3.8
Rb	2	6.6	3.3	26.9	13.45	14.4	7.2	6.6	3.3	26.9	13.45
Ba	20	120	6	54.6	2.73	265	13.25	120	6	54.6	2.73
Th	0.2	2	10	1	5	1	5	2	10	1	5
Ta	0.18	0.5	2.778	0.5	2.778	0.5	2.778	0.5	2.778	0.5	2.778
Nb	3.5	6	1.714	3	0.857	2	0.571	6	1.714	3	0.857
Ce	10	35.6	3.56	16.6	1.66	12	1.2	35.6	3.56	16.6	1.66
P2O5	0.12	0.3	2.5	0.15	1.25	0.13	1.083	0.31	2.583	0.15	1.25
Zr	90	178	1.978	113.7	1.263	92	1.022	178	1.978	113.7	1.263
Hf	2.4	5	2.083	3	1.25	3	1.25	5	2.083	3	1.25
Sm	3.3	7.1	2.152	3.9	1.182	3.3	1	7.1	2.152	3.9	1.182
TiO2	1.5	2.23	1.487	1.64	1.093	1.64	1.093	2.3	1.533	1.69	1.127
Y	30	52.5	1.75	34	1.133	32.3	1.077	52.5	1.75	34	1.133
Yb	3.4	5.2	1.529	3.5	1.029	3.3	0.971	5.2	1.529	3.5	1.029

The data for MORB(ave) are taken from Shyudo and Osanai(2002).

	02MRS13 (Jubilet)		02MRS17 (Hajar)		02MRS33(Drasfa)		02MRS8(Safsafa)		02MRS2(safsafa)	
	abundance	normalised	abundance	normalised	abundance	normalised	abundance	normalised	abundance	normalised
Sr	131	1.092	173	1.442	85.2	0.71	161	1.342	167	1.392
K2O	0.48	3.2	1.66	11.067	3.56	23.733	1.22	8.133	1.45	9.667
Rb	14.4	7.2	50.3	25.15	157	78.5	84.1	42.05	49.5	24.75
Ba	265	13.25	559	27.95	667	33.35	472	23.6	655	32.75
Th	1	5	18	90	16	80	21	105	6	30
Ta	0.5	2.778	1	5.556	1.3	7.222	0.9	5		
Nb	2	0.571	15	4.286	19	5.429	11	3.143	6	1.714
Ce	12	1.2	96.1	9.61	94.4	9.44	53.7	5.37	48.4	4.84
P2O5	0.13	1.083	0.21	1.75	0.14	1.167	0.13	1.083	0.09	0.75
Zr	92	1.022	322.7	3.586	240.4	2.671	459.4	5.104	193.4	2.149
Hf	3	1.25	9	3.75	7	2.917	15	6.25	6	2.5
Sm	3.3	1	9.4	2.848	7.6	2.303	4.5	1.364	4.3	1.303
TiO2	1.68	1.12	0.98	0.653	1.07	0.713	0.52	0.347	0.39	0.26
Y	32.3	1.077	51.8	1.727	31.5	1.05	78.3	2.61	20.7	0.69
Yb	3.3	0.971	5.2	1.529	3.3	0.971	2.1	0.618	1.9	0.559

The data for MORB(ave) are taken from Shyudo and Osanai(2002).

	02MRS1(Khwadra)		02MRS4		02MRS18		02MRS3		02MRS6	
	abundance	normalised	Khwadra	normalised	Hajar	normalised	Safsafa	normalised	Khwadra	normalised
Sr	127	1.058	121	1.008	214	1.783	384	3.2	161	1.342
K2O	2.67	17.8	2.81	18.733	2.62	17.467	0.9	6	1.98	13.2
Rb	86.9	43.45	132	66	68.1	34.05	33.3	16.65	84.1	42.05
Ba	1115	55.75	678	33.9	982	49.1	394	19.7	472	23.6
Th	22	110	20	100	23	115	5	25	21	105
Ta	0.9	5	0.6	3.333	0.9	5			0.9	5
Nb	12	3.429	8	2.286	11	3.143	4	1.143	11	3.143
Ce	108.5	10.85	89.9	8.99	158	15.8	34.7	3.47	100.5	10.05
P2O5	0.04	0.333	0.04	0.333	0.08	0.667	0.06	0.5	0.04	0.333
Zr	493.8	5.487	442.7	4.919	260.3	2.892	150.7	1.674	459.4	5.104
Hf	15	6.25	14	5.833	9	3.75	5	2.083	15	6.25
Sm	11.9	3.606	9.8	2.97	11.7	3.545	3.2	0.97	10.3	3.121
TiO2	0.4	0.267	0.32	0.213	0.35	0.233	0.23	0.153	0.37	0.247
Y	87.5	2.917	61.3	2.043	51.7	1.723	17.6	0.587	78.3	2.61
Yb	9.9	2.912	7.8	2.294	5	1.471	1.6	0.471	9	2.647

The data for MORB(ave) are taken from Shyudo and Osanai(2002).

	02MRS5		02MRS34		02MRS12		02MRS11	
	Safsafa	normalised	Drasfa	normalised	Jubilet	normalised	Jubilet	normalised
Sr	350	2.917	104	0.867	224	1.867	366	3.05
K2O	0.88	5.867	1.14	7.6	0.4	2.667	0.34	2.267
Rb	34.8	17.4	49.8	24.9	14.5	7.25	8.8	4.4
Ba	402	20.1	188.5	9.425	152.5	7.625	415	20.75
Th	5	25	26	130	9	45	28	140
Ta			1.2	6.667	0.7	3.889	1.9	10.556
Nb	5	1.429	16	4.571	9	2.571	27	7.714
Ce	44.7	4.47	114	11.4	57.9	5.79	181.5	18.15
P2O5	0.09	0.75	0.11	0.917	0.06	0.5	0.02	0.167
Zr	213.2	2.369	245.6	2.729	285.6	3.173	391.5	4.35
Hf	6	2.5	9	3.75	8	3.333	16	6.667
Sm	3.6	1.091	12.5	3.788	5.2	1.576	21.3	6.455
TiO2	0.3	0.2	0.35	0.233	0.48	0.32	0.23	0.153
Y	15.7	0.523	80.4	2.68	25.9	0.863	134	4.467
Yb	1.8	0.529	8.3	2.441	2.4	0.706	15.6	4.588

The data for MORB(ave) are taken from Shyudo and Osanai(2002).

Table) Primitive mantle-normalized trace element abundances (basic-intermediate rocks)

	Primitive mantle	02MRS15 (K Aicha)		02MRS16 (K Aicha)		02MRS13 (Jubilet)		02MRS17 (Hajar)	
		abundance	normalized	abundance	normalized	abundance	normalized	abundance	normalized
La (ppm)	0.6139	13.8	22.479	6.1	9.936	4.4	7.167	45.8	74.605
Ce	1.6011	35.6	22.235	16.6	10.368	12	7.495	96.1	60.021
Pr	0.2419	5.3	21.91	2.5	10.335	1.9	7.854	11.6	47.954
Nd	1.1892	25.5	21.443	12.8	10.764	9.9	8.325	44.2	37.168
Sm	0.3865	7.1	18.37	3.9	10.091	3.3	8.538	9.4	24.321
Eu	0.1456	2	13.736	1.3	8.929	1.2	8.242	1.6	10.989
Gd	0.5128	7.9	15.406	4.7	9.165	4.1	7.995	9.3	18.136
Tb	0.094	1.4	14.894	0.9	9.574	0.8	8.511	1.6	17.021
Dy	0.6378	9.6	15.052	6	9.407	5.6	8.78	9.4	14.738
Ho	0.1423	1.9	13.352	1.3	9.136	1.2	8.433	1.9	13.352
Er	0.4167	5.6	13.439	3.6	8.639	3.3	7.919	5.3	12.719
Tm	0.0643	0.8	12.442	0.6	9.331	0.5	7.776	0.8	12.442
Yb	0.4144	5.2	12.548	3.5	8.446	3.3	7.963	5.2	12.548
Lu	0.0637	0.8	12.559	0.5	7.849	0.5	7.849	0.8	12.559
K	258.2	215.8	0.836	1303.3	5.048	390.2	1.511	1378	5.337
Rb	0.5353	6.6	12.33	26.9	50.252	14.4	26.901	50.3	93.966
Cs	0.0268	0.4	14.925	0.9	33.582	0.3	11.194	1.4	52.239
Sr	18.21	181	9.94	140	7.688	131	7.194	173	9.5
Ba	6.049	120	19.838	54.6	9.026	265	43.809	559	92.412
Hf	0.2676	5	18.685	3	11.211	3	11.211	9	33.632
Zr	9.714	178	18.324	113.7	11.705	92	9.471	322.7	33.22
Ta	0.0351	0.5	14.245	0.5	14.245	0.5	14.245	1	28.49
Nb	0.6175	6	9.717	3	4.858	2	3.239	15	24.291
U	0.0203	0.5	24.631	0.5	24.631	0.5	24.631	4.2	206.897
Th	0.0813	2	24.6	1	12.3	1	12.3	18	221.402
Pb	0.175	2	11.429	2	11.429	2	11.429	6	34.286
Y	3.94	52.5	13.325	34	8.629	32.3	8.198	51.8	13.147
Sc	14.88	1	0.067	1	0.067	2	0.134	13	0.874
Co	104	47.2	0.454	44.7	0.43	44.8	0.431	23.9	0.23
Ni	2080	152	0.073	131	0.063	109	0.052	17	0.008
Cu	28	1	0.036	58	2.071	52	1.857	1	0.036
Sn	0.15	2	13.333	1	6.667	3	20	8	53.333

The data for primitive mantle are taken from Hofmann (1988).

Table) Primitive mantle-normalized trace element abundances (basic-intermediate rocks)

	Primitive mantle	02MRS33(Drasfa)		02MRS8(Safsafa)		02MRS2(safsafa)		02MRS1(Khwadra)		02MRS4 Khwadra		02MRS18 Hajar		02MRS3 Safsafa		02MRS6 Khwadra		02MRS5 Safsafa	
		abundance	normalized	abundance	normalized	abundance	normalized	abundance	normalized										
La (ppm)	0.6139	46.2	75.257	24.3	39.583	21.6	35.185	48.4	78.84	39.1	63.691	81.2	132.269	15.7	25.574	46	74.931	21.1	34.37
Ce	1.6011	94.4	58.959	53.7	33.539	48.4	30.229	108.5	67.766	89.9	56.149	158	98.682	34.7	21.673	100.5	62.769	44.7	27.918
Pr	0.2419	10.9	45.06	6.3	26.044	5.6	23.15	13.3	54.981	11	45.473	17.1	70.69	4.2	17.363	12.2	50.434	5.2	21.496
Nd	1.1892	40.4	33.972	23.8	20.013	21.7	18.248	51.5	43.306	43.4	36.495	60.6	50.959	15.9	13.37	45.7	38.429	19	15.977
Sm	0.3865	7.6	19.664	4.5	11.643	4.3	11.125	11.9	30.789	9.8	25.356	11.7	30.272	3.2	8.279	10.3	26.649	3.6	9.314
Eu	0.1456	1.4	9.615	0.8	5.495	0.8	5.495	1.5	10.302	1.6	10.989	1.1	7.555	0.7	4.808	1.4	9.615	0.7	4.808
Gd	0.5128	6.7	13.066	4.1	7.995	4.1	7.995	12	23.401	9.7	18.916	10.9	21.256	3.1	6.045	10.8	21.061	3.3	6.435
Tb	0.094	1	10.638	0.6	6.383	0.6	6.383	2.2	23.404	1.7	18.085	1.6	17.021	0.5	5.319	1.9	20.213	0.5	5.319
Dy	0.6378	5.7	8.937	3.6	5.644	3.5	5.488	14.3	22.421	10.3	16.149	9.6	15.052	2.9	4.547	12.4	19.442	2.8	4.39
Ho	0.1423	1.2	8.433	0.7	4.919	0.7	4.919	3.1	21.785	2.1	14.758	1.8	12.649	0.6	4.216	2.7	18.974	0.5	3.514
Er	0.4167	3.4	8.159	2	4.8	2	4.8	9.1	21.838	6.5	15.599	5.3	12.719	1.7	4.08	8.1	19.438	1.7	4.08
Tm	0.0643	0.5	7.776					1.5	23.328	1.1	17.107	0.8	12.442			1.4	21.773		
Yb	0.4144	3.3	7.963	2.1	5.068	1.9	4.585	9.9	23.89	7.8	18.822	5	12.066	1.6	3.861	9	21.718	1.8	4.344
Lu	0.0637	0.5	7.849	0.3	4.71	0.3	4.71	1.5	23.548	1.3	20.408	0.8	12.559	0.3	4.71	1.4	21.978	0.3	4.71
K	258.2	28308	109.636	16022	62.053	11041	42.761	21501	83.273	22746	88.095	20920	81.022	6807	26.363	16022	62.053	6807	26.363
Rb	0.5353	157	293.293	84.1	157.108	49.5	92.472	86.9	162.339	132	246.591	68.1	127.218	33.3	62.208	84.1	157.108	34.8	65.01
Cs	0.0268	4	149.254	1.9	70.896	1.6	59.701	4.4	164.179	8.5	317.164	1.3	48.507	1.3	48.507		0	1.4	52.239
Sr	18.21	85.2	4.679	161	8.841	167	9.171	127	6.974	121	6.645	214	11.752	384	21.087	161	8.841	350	19.22
Ba	6.049	667	110.266	472	78.029	655	108.282	1115	184.328	678	112.085	982	162.341	394	65.135	472	78.029	402	66.457
Hf	0.2676	7	26.158	15	56.054	6	22.422	15	56.054	14	52.317	9	33.632	5	18.685	15	56.054	6	22.422
Zr	9.714	240.4	24.748	459.4	47.293	193.4	19.909	493.8	50.834	442.7	45.573	260.3	26.796	150.7	15.514	459.4	47.293	213.2	21.948
Ta	0.0351	1.3	37.037	0.9	25.641			0.9	25.641	0.6	17.094	0.9	25.641		0	0.9	25.641		
Nb	0.6175	19	30.769	11	17.814	6	9.717	12	19.433	8	12.955	11	17.814	4	6.478	11	17.814	5	8.097
U	0.0203	3.2	157.635	5.7	280.788	1.7	83.744	5.7	280.788	4.9	241.379	8.2	403.941	1.2	59.113	5.7	280.788	1.9	93.596
Th	0.0813	16	196.802	21	258.303	6	73.801	22	270.603	20	246.002	23	282.903	5	61.501	21	258.303	5	61.501
Pb	0.175	2	11.429	71	405.714	19	108.571	3	17.143	6	34.286			44	251.429	10	57.143	5	28.571
Y	3.94	31.5	7.995	78.3	19.873	20.7	5.254	87.5	22.208	61.3	15.558	51.7	13.122	17.6	4.467	78.3	19.873	15.7	3.985
Sc	14.88	2	0.134	1	0.067	1	0.067	2	0.134	4	0.269	2	0.134	1	0.067	2	0.134	1	0.067
Co	104	18.2	0.175	4.4	0.042	4.3	0.041	3.4	0.033	6.6	0.063	5.6	0.054	4.2	0.04	3.6	0.035	4.5	0.043
Ni	2080	51	0.025	17	0.008	14	0.007	7	0.003	14	0.007	9	0.004	11	0.005	10	0.005	20	0.01
Cu	28	26	0.929	21	0.75	16	0.571	16	0.571	8	0.286	10	0.357	15	0.536	7	0.25	13	0.464
Sn	0.15	5	33.333	7	46.667	6	40	6	40	9	60	8	53.333	6	40	4	26.667	1	6.667

The data for primitive mantle are taken from Hofmann (1988).

Table) Primitive mantle-normalized trace element abundances (basic-intermediate rocks)

	02MRS34 Drasfa		02MRS12 Jubilet		02MRS11 Jubilet	
La (ppm)	51.5	83.89	29.3	47.728	77.4	126.079
Ce	114	71.201	57.9	36.163	181.5	113.36
Pr	13.7	56.635	6.9	28.524	22.5	93.014
Nd	53.1	44.652	25.8	21.695	91.6	77.027
Sm	12.5	32.342	5.2	13.454	21.3	55.11
Eu	1.2	8.242	1.6	10.989	2.6	17.857
Gd	13.4	26.131	5	9.75	21.7	42.317
Tb	2.3	24.468	0.8	8.511	3.8	40.426
Dy	14.6	22.891	4.6	7.212	23.8	37.316
Ho	3	21.082	0.9	6.325	5	35.137
Er	8.5	20.398	2.7	6.479	14.7	35.277
Tm	1.3	20.218			2.4	37.325
Yb	8.3	20.029	2.4	5.792	15.6	37.645
Lu	1.2	18.838	0.4	6.279	2.4	37.677
K	9132	35.368	3238	12.541	2739	10.608
Rb	49.8	93.032	14.5	27.088	8.8	16.439
Cs	1	37.313	0.3	11.194	0.2	7.463
Sr	104	5.711	224	12.301	366	20.099
Ba	188.5	31.162	152.5	25.211	415	68.606
Hf	9	33.632	8	29.895	16	59.791
Zr	245.6	25.283	285.6	29.401	391.5	40.303
Ta	1.2	34.188	0.7	19.943	1.9	54.131
Nb	16	25.911	9	14.575	27	43.725
U	5.8	285.714	2	98.522	4.7	231.527
Th	26	319.803	9	110.701	28	344.403
Pb	3	17.143			2	11.429
Y	80.4	20.406	25.9	6.574	134	34.01
Sc	2	0.134	1	0.067	1	0.067
Co	6	0.058	26	0.25	6.1	0.059
Ni	9	0.004	31	0.015	8	0.004
Cu	2	0.071	3	0.107	4	0.143
Sn	5	33.333	14	93.333	9	60

The data for primitive mantle are taken from Hofmann (1988).

Table) K-Ar isotopic age analysis of rocks of Tekna-Marakech area

Locality	Rock Name	Material Analyzed	Isotopic Age (Ma)	Ar-40 (scc/g × 10exp-5)	%Ar-40	%K	Sample No or Reference
Jubilet							
Jubilet(West of Kechnet)	Sandstone hornfels	Whole rock	248 ± 8	0.304, 0.305	92.1, 92.2	0.29, 0.30	02MRS012
Jubilet(Bourana)	Rhyolitic welded tuff	Whole rock	267 ± 7	0.303, 0.302	91.4, 93.1	0.27, 0.27	02MRS011
Koudiat Aicha	Metadolerite	Whole rock	279 ± 7	0.478, 0.485	80.7, 82.7	0.41, 0.41	02MRS016
Koudiat Aicha	Metadolerite	Whole rock	303 ± 8	0.234, 0.228	86.0, 85.6	0.18, 0.18	02MRS015
Jebilet,central batholith	Leucogranite		306 ± 17				Pique and Michard (1989)
Jebilet,eastern batholith	Calcalkaline granite		319 ± 10				Pique and Michard (1989)
Jebilet,central batholith	Granodiorite		332 ± 5				Pique and Michard (1989)
Jebilet,central batholith	Granodiorite		344 ± 20				Pique and Michard (1989)
Hauz							
Khwadra	Rhyolite	Sericite	270 ± 7	3.40, 3.31	92.5, 93.9	2.97, 2.96	02MRS004
Khwadra	Rhyolite	Whole rock	326 ± 8	3.15, 3.18	98.5, 98.2	2.28, 2.27	02MRS001
Drasfar	Tafacious slate	Whole rock	350 ± 9	3.74, 3.75	99.2, 99.2	2.6, 2.49	02MRS034
Safsafa	Tonalitic myronite	Whole rock	362 ± 9	0.807, 0.800	93.1, 93.3	0.52, 0.51	02MRS005
Guemassa							
Amzourh	Acidic volcanic rock		294-303 ± 15				JICA/MMAJ (1990)
Oukhribane	Green rock		297 ± 15				JICA/MMAJ (1990)
Hajar Mine 380ML	Sericitized rhyolite	Sericite	300 ± 8	5.85, 5.73	96.9, 97.4	4.56, 4.56	02MRS026
Hajar	Ryolite	Biotite	300.9 ± 2.6				Watanabe (2002)
Hajar	Ryolite	Biotite	303.3 ± 20				Watanabe (2002)
Hajar	Sericitized schist	Illite	305.4 ± 4.6				Watanabe (2002)
Hajar Mine 380ML	Sericitized rhyolite	Whole rock	312 ± 8	5.45, 5.34	99.8, 99.2	4.09, 4.07	02MRS022
Hajar	Biotozes-sericitized schist	Illite	313.4 ± 9.1				Watanabe (2002)
Frizem	Acidic volcanic rock		328 ± 16				JICA/MMAJ (1990)

Results of Chemical analysis

Sedimentary Rocks

Table−) Result of Whole rock analysis of Sedimentary rocks

Sample No.	02MR-K001	02MR-K002	02MR-K003	02MR-K004	02MR-K005	02MR-K006	02MR-K007	02MR-K008	02MR-K009	02MR-K010	02MR-K011	02MR-K012
Locality	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra
	Scihst	Shale	Shale	Shale	Hornfels	Schist	Schist	Schist	Shale	Shale	Schist	Shale
SiO2	67.99	67.66	66.67	41.18	70.7	60.3	39.51	59.35	64.29	71.93	57.35	62
Al2O3	13.4	15.88	12.53	20.88	11.94	17.25	28.8	16.9	16.93	12.1	18.12	13.55
Fe2O3	7	3.61	8.3	18.04	6.88	8.38	11.32	7.02	5.34	4.69	7.54	8.74
CaO	2.18	4.62	1.21	0.41	0.58	0.28	0.29	2.57	1.56	3.06	4.16	3.12
MgO	1.96	0.65	1.98	5.55	1.36	2.84	2.94	2.51	1.81	1.78	2.31	2.7
Na2O	0.76	2.66	1.19	3.13	0.32	1.78	0.34	1.86	2.01	1.72	3.07	1.87
K2O	3.11	1.5	2.9	2.7	2.93	3.24	7.99	2.86	2.81	1.7	2.37	2.12
Cr2O3	0.03	0.02	0.04	0.01	0.03	0.01	0.02	0.01	0.01	0.03	0.04	0.02
TiO2	0.68	0.36	0.71	1.26	0.62	1.01	1.82	0.96	1.03	0.61	1	0.77
MnO	0.23	0.07	0.09	0.1	0.07	0.12	0.08	0.18	0.07	0.09	0.14	0.17
P2O5	0.13	0.05	0.16	0.25	0.12	0.13	0.19	0.17	0.1	0.11	0.16	0.14
SrO	*<0.01*	0.02	0.01	0.01	*<0.01*	0.01	0.01	0.02	0.05	0.03	0.03	0.03
BaO	0.07	0.08	0.04	0.07	0.04	0.07	0.12	0.09	0.07	0.04	0.05	0.04
LOI	2.24	1.5	3.43	6.25	3.99	4.03	6.25	4.63	3.14	1.77	2.94	3.61
Total	99.79	98.68	99.26	99.84	99.58	99.45	99.67	99.13	99.23	99.67	99.27	98.89
FeO	5.92	3.02	6.43	13.9	5.53	6.63	6.75	5.85	4.5	4.12	6.18	7.14

Sample No.	02MR-K013	02MR-K014	02MR-K015	02MR-K016	02MR-K017	02MR-K018	02MR-K019	02MR-K020	02MR-K021	02MR-K022	02MR-K023	02MR-K024
Locality	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Sabsafa	Sabsafa	Sabsafa	Sabsafa	Sabsafa	Sabsafa	Kerkoze
	Shale	Schist	Shale	Schist	Slate	Slate	Slate	Schist	Slate	Shale	Schist	Shale
SiO2	61.88	55.72	66	59.25	63.62	51.09	50.6	49.57	59.61	52.21	56.75	62.56
Al2O3	17.49	20.64	9.24	19.8	17.49	20.7	13.09	13.81	17.78	16.55	19.61	17.6
Fe2O3	7.04	7.64	9.47	5.82	5.74	8.82	7.04	6.31	3.36	5.21	4.43	5.26
CaO	1.91	0.86	2.23	1.35	0.91	0.67	10.07	7.57	0.89	4.12	0.71	3.66
MgO	2.14	2.33	5.93	2.3	1.91	4.07	3.54	3.13	2.32	2.9	2.18	1.98
Na2O	2.14	0.98	0.82	2.96	1.05	1.44	0.5	0.87	2	1.73	1.47	4.38
K2O	2.66	4.38	1.42	4.04	4.36	4.44	2.61	3.56	3.92	3.49	4.67	0.58
Cr2O3	0.02	0.02	0.15	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
TiO2	1	1.14	0.46	1.04	1.04	0.99	0.59	0.66	0.78	0.87	1.03	0.9
MnO	0.11	0.13	0.13	0.15	0.09	0.07	0.45	0.44	0.02	0.06	0.01	0.02
P2O5	0.13	0.17	0.13	0.17	0.11	0.18	0.13	0.11	0.14	0.24	0.18	0.17
SrO	0.04	0.02	0.01	0.01	0.01	0.03	0.05	0.03	0.02	0.03	0.02	0.07
BaO	0.06	0.07	0.03	0.08	0.09	0.27	0.16	0.22	0.51	0.46	0.61	0.02
LOI	3.2	5.19	3.33	2.93	2.9	5.72	10.6	12.45	7.03	10.9	8.2	2.48
Total	99.8	99.3	99.36	99.91	99.34	98.5	99.44	98.75	98.41	98.78	99.89	99.68
FeO	5.92	5.98	6.75	4.25	4.63	7.2	5.21	4.25	2.32	3.28	2.83	4.05

Sample No.	02MR-K025	02MR-K026	02MR-K027	02MR-K028	02MR-K029	02MR-K030	02MR-K031	02MR-K032	02MR-K033	02MR-K034	02MR-K035	02MR-K036
Drillhole No.	Surface	Surface	Surface	Surface	Surface	Surface	Surface	KA25	KA25	KA25	KA25	KA25
	Shale	Sandstone	Shale	Shale	Shale	Sandstone	Limestone	Slate	Shale	Shale	Shale	Shale
SiO2	62.58	75.81	61.01	56.77	61.84	67.15	11.13	67.41	59.29	57.29	60.1	61.23
Al2O3	17	7.28	15.54	20.74	14.06	8.58	2.81	14.16	19.07	18.05	14.38	15.25
Fe2O3	6.52	8.18	10.94	6.79	7.69	2.71	2.34	6.11	6.57	7.53	11	8.65
CaO	0.94	0.92	1.46	0.11	7.59	8.59	44.39	0.92	1.31	2.7	0.43	0.54
MgO	1.64	1.82	1.47	1.61	3.13	0.89	1.82	2.29	2.43	2.24	1.73	3.9
Na2O	1.35	0.83	4.62	0.28	2.27	0.73	0.12	0.57	1.29	1.09	0.58	0.91
K2O	3.29	0.21	0.31	4.88	0.44	2.94	0.4	3.38	4.42	3.87	3.91	2.97
Cr2O3	0.02	0.02	0.01	0.02	0.02	0.02	0.01	0.02	0.01	0.01	0.02	0.02
TiO2	0.98	0.44	0.85	1.1	0.79	0.54	0.19	0.81	1.06	0.91	0.82	0.85
MnO	0.08	0.11	0.08	0.07	0.15	0.06	0.26	0.11	0.07	0.08	0.18	0.12
P2O5	0.13	0.17	0.13	0.15	0.12	0.08	0.1	0.11	0.14	0.13	0.11	0.12
SrO	0.02	0.01	0.05	0.03	0.05	0.02	0.05	0.02	0.03	0.04	*<0.01*	0.01
BaO	0.08	0.01	0.05	0.09	0.05	0.08	0.01	0.05	0.1	0.07	0.07	0.14
LOI	4.31	3.48	3.16	5.6	1.07	7.48	34.9	3.58	4.09	4.78	5.12	4.23
Total	98.94	99.29	99.68	98.22	99.27	99.87	98.53	99.54	99.88	98.79	98.45	98.95
FeO	5.15	6.88	8.1	3.92	6.43	1.29	1.74	4.63	5.08	6.05	5.47	7.33

Sample No.	02MR-K037	02MR-K038	02MR-K039	02MR-K040	02MR-K041	02MR-K042	02MR-K043	02MR-K044	02MR-K046	02MR-K047	02MR-K048	02MR-K049
Locality	K_Aicha	Benslieman	Benslieman	Benslieman	Lachach	Lachach	Lachach	Lachach	Amzoourh	Imarine	Tameslouht	Tameslouht
	Shale	Shale	Schist	Schist	Schist	Schist	Schist	Sandstone	Shale	Shale	Quatzite	Limestone
SiO2	57.93	60.56	59.08	60.88	61.82	47.73	60.87	69.33	64.52	45.44	91.89	16.34
Al2O3	20.33	17.69	16.2	18.01	17.47	12.82	18.13	13.79	15.17	10.32	2.85	2.21
Fe2O3	6.7	7.22	12.62	6.45	6.46	23.78	7.69	6.22	7.63	3.86	2.43	2.8
CaO	4.45	1.71	0.33	2.26	0.98	0.14	0.3	0.41	0.29	19	0.12	41.27
MgO	1.76	2.44	2.69	2.52	1.74	5.6	2.01	1.47	1.24	1.88	0.13	0.45
Na2O	4.95	1.4	0.16	2.98	1.18	0.31	0.5	1	0.3	1.22	0.03	0.09
K2O	0.56	3.36	2.84	2.31	3.71	0.42	3.94	2.73	4.18	2.2	0.66	0.35
Cr2O3	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.03	*<0.01*
TiO2	0.95	1.02	0.96	0.98	1.06	0.81	1.02	0.82	0.88	0.64	0.3	0.18
MnO	0.1	0.28	0.15	0.05	0.17	0.34	0.09	0.07	0.24	0.07	0.04	0.38
P2O5	0.17	0.18	0.15	0.13	0.14	0.09	0.17	0.1	0.14	0.09	0.15	0.05
SrO	0.07	0.01	0.01	0.05	0.03	0.03	*<0.01*	0.01	*<0.01*	0.07	0.02	0.03
BaO	0.03	0.07	0.07	0.17	0.07	0.02	0.09	0.05	0.08	0.03	0.02	0.01
LOI	1.79	3.53	4.53	3.14	4.94	6.55	4.56	3.14	3.95	14	1.21	34.2
Total	99.79	99.49	99.81	99.94	99.77	98.64	99.38	99.16	98.64	98.82	99.87	98.37
FeO	5.79	6.11	10.7	5.4	5.08	18.25	6.18	5.02	1.87	3.22	0.77	0.19

Sample No.	02MR-K050	02MR-K051	02MR-K052	02MR-K053	02MR-K054	02MR-K055	02MR-K056	02MR-K057	02MR-K058	02MR-K059	02MR-K061	02MR-K062
Locality	Hajar Sandstone	Hajar Hornfels	Hajar Shale	Hajar Sandy shale	Hajar Shale	Hajar Shale	Hajar Schist	Hajar Sandy shale	Hajar Tuff	Hajar Shale	Hajar Shale	Hajar Shale
SiO2	53.68	62.1	59.14	66.36	53.15	59.81	53.35	57.2	60.56	57.94	61.84	58.49
Al2O3	14.44	17.38	18.25	16.08	8.47	17.07	15.65	16.1	18.6	15.85	17.49	16.64
Fe2O3	8.43	6.64	5.91	4.59	27.95	6.17	16.4	9.97	4.97	12.19	7.17	9.97
CaO	1.47	3.95	4.23	1.24	0.15	0.37	0.43	2.23	0.41	0.32	0.25	0.29
MgO	10.41	1.78	2.55	1.69	3.69	4.8	5.26	3.39	2.81	4.88	2.41	2.69
Na2O	1.68	3.04	1.4	1.27	*<0.01*	0.76	0.09	0.46	0.28	0.14	0.11	0.66
K2O	2.51	2.43	4.09	3.88	0.08	4.41	2.46	4.05	5.43	3.28	4.91	4.68
Cr2O3	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.02
TiO2	0.84	0.94	1.02	0.87	0.56	0.84	0.85	0.83	1.09	0.79	0.91	0.94
MnO	0.16	0.15	0.09	0.09	0.27	0.11	0.28	0.2	0.11	0.21	0.15	0.19
P2O5	0.12	0.1	0.14	0.11	0.08	0.13	0.15	0.13	0.13	0.12	0.12	0.15
SrO	0.02	0.05	0.04	0.02	*<0.01*	0.01	0.01	0.01	0.01	*<0.01*	*<0.01*	*<0.01*
BaO	0.06	0.08	0.07	0.06	0.01	0.08	0.08	0.15	0.26	0.11	0.29	0.15
LOI	4.94	1.21	2.58	2.81	5.27	4.29	4.48	4.71	3.75	3.81	3.31	4.22
Total	98.76	99.86	99.52	99.08	99.67	98.88	99.5	99.45	98.44	99.66	98.97	99.09
FeO	6.5	5.53	5.53	3.8	23.8	4.89	13.55	8.3	3.99	9.84	5.79	6.75

Sample No.	02MR-K063	02MR-K064	02MR-K065	02MR-K067	02MR-K068	02MR-K069	02MR-K070	02MR-K071	02MR-K072	02MR-K073	02MR-K074	02MR-K075
Locality	Hajar Shale	Algeida? Schist	Algeida? Schist	Frag el Ma Schist	Sid Bau East Sandy shale	Sid Bau East Shale	Jbwl_Sarhlef Shale	Jbwl_Sarhlef Schist	Jbwl_Sarhlef Shale	Frizem Shale	Frizem Shale	Frizem Shale
SiO2	57.15	59.3	58.41	32.24	62.05	58.64	64.14	41.48	61	62.41	53.38	54.17
Al2O3	16.43	19.39	19.2	7.32	15.77	20.02	16.77	12.72	17.72	16.61	21.5	16.82
Fe2O3	11.9	7.1	8.2	6.81	7.05	5.59	6.35	9.89	7.38	7.07	8.04	13.98
CaO	0.51	0.42	0.58	10.39	2.66	0.61	1.05	10.86	0.49	0.63	0.3	0.64
MgO	1.65	1.98	1.97	3.13	2.12	1.23	1.91	6.8	1.68	2.54	2.1	2.54
Na2O	0.19	1.25	1.42	0.16	1.55	2.11	4.7	1.42	0.94	0.82	0.18	0.08
K2O	4.2	3.6	3.52	2.33	3.27	4.8	0.99	0.37	3.12	3.49	5.95	3.68
Cr2O3	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.03	0.01	0.01	0.02	0.02
TiO2	0.9	1.18	1.17	0.76	0.88	1.17	0.83	1.6	1.02	1.14	1.35	0.94
MnO	0.24	0.25	0.2	0.17	0.07	0.03	0.08	0.2	0.1	0.14	0.1	0.29
P2O5	0.06	0.14	0.22	0.08	0.11	0.12	0.14	0.15	0.15	0.11	0.14	0.15
SrO	0.01	0.02	0.02	0.21	0.02	0.02	0.1	0.04	0.03	0.01	0.02	0.01
BaO	0.09	0.09	0.08	0.08	0.07	0.11	0.02	0.02	0.06	0.07	0.1	0.06
LOI	6.39	4.61	4.48	36.2	4.16	5.54	2.69	12.95	5.65	4.32	6.18	5.43
Total	99.74	99.34	99.5	99.91	99.79	99.99	99.78	98.53	99.34	99.36	99.38	98.8
FeO	8.68	5.6	6.75	5.4	4.89	1.03	4.95	7.91	3.47	5.4	3.99	10.85

Sample No.	02MR-K076	02MR-K077	02MR-K079	02MR-K080	02MR-K081	02MR-K082	02MR-K083	02MR-K084	02MR-K085	02MR-K086	02MR-K087	02MR-K088
Locality	Frizem Schist	Frizem Schist	Frizem Shale	Frizem Limestone	Frizem Sandy slate	Frizem Shale	Frizem Slate	Kettara Shale	Kettara Shale	Draa_Sfar Shale	Draa_Sfar Shale	Draa_Sfar Shale
SiO2	48.74	54.25	56.24	45.86	64.5	70.88	62.16	51.49	59.44	57.6	46.82	60.86
Al2O3	14.11	19.34	20.46	14.11	17.01	11.13	17.51	15.21	15.02	17.93	18.39	19.23
Fe2O3	18.31	7.43	6.89	9.7	6.11	7.05	6.63	5.93	8.44	10.78	21.28	6.97
CaO	1.68	1.41	0.62	7.83	0.3	0.78	0.44	8.8	2.44	1.29	0.66	0.45
MgO	6.89	2.03	3.32	6.88	1.93	2.84	2.79	1.72	3.34	2.13	3.38	1.86
Na2O	0.08	0.15	0.17	0.08	0.41	0.07	0.15	0.69	0.17	0.21	0.48	0.42
K2O	0.89	5.65	5.33	1.87	4.18	2.11	4.26	2.83	2.7	3.76	2.19	4.7
Cr2O3	0.01	0.02	0.02	0.03	0.02	0.02	0.02	0.01	0.02	0.01	0.01	0.02
TiO2	0.74	1.01	1.09	1.47	1.02	0.76	1.1	0.86	0.92	0.97	1.01	1.07
MnO	0.58	0.23	0.18	0.35	0.1	0.2	0.15	0.11	0.1	0.16	0.27	0.17
P2O5	0.14	0.14	0.21	0.12	0.07	0.1	0.13	0.14	0.1	0.13	0.18	0.13
SrO	0.01	*<0.01*	0.01	0.03	0.01	0.01	0.01	0.01	0.02	0.01	0.01	*<0.01*
BaO	0.02	0.07	0.1	0.03	0.07	0.06	0.1	0.04	0.08	0.05	0.05	0.06
LOI	6.56	6.65	4.36	10.75	3.93	3.59	4.02	11.1	6.12	4.76	4.59	3.73
Total	98.76	98.36	99.01	99.1	99.65	99.59	99.47	98.97	98.9	99.79	99.32	99.67
FeO	14.6	5.98	5.47	8.3	4.31	5.53	5.47	3.47	5.72	8.49	18.1	5.92

Sample No.	02MR-K089	02MR-K089	02MR-K090	02MR-K091	02MR-K092	02MR-K093	02MR-K094	02MR-K095	02MR-K096	02MR-K097	02MR-K098	02MR-K101
Locality	Draa_Sfar Shale	Draa_Sfar Shale	Draa_Sfar Sandy shale	Draa_Sfar Shale	Draa_Sfar Shale	Draa_Sfar Shale	Draa_Sfar Shale	Draa_Sfar Shale	Draa_Sfar Shale	Draa_Sfar Shale	Draa_Sfar Slate	Si Gedi Haja Tuff-shist
SiO2	37.05	61.24	70.97	69.58	65.06	61.68	61.11	59.06	51.11	62.38	57.81	58.29
Al2O3	14.97	16.66	11.23	12.71	14.4	19.1	17.1	17.82	16.43	16.98	20.78	16.04
Fe2O3	22.86	8.12	7.13	7.36	8.72	5.88	8.17	8.19	7.67	8.15	7.92	6.72
CaO	0.16	0.88	1.76	0.41	0.95	0.74	0.95	1.27	7.04	0.73	0.27	3.1
MgO	15.88	2.81	1.63	3	2.34	1.97	2.44	2.71	3.15	1.95	1.74	3.51
Na2O	*<0.01*	0.28	2.27	0.57	1.21	0.43	0.36	1.17	2.23	0.17	0.17	1.77
K2O	0.16	3.75	1.29	2.62	2.37	5	3.92	3.59	2.74	4.05	5.44	2.92
Cr2O3	*<0.01*	0.02	0.02	*<0.01*	0.02	0.01	0.01	0.01	0.01	0.02	0.02	0.01
TiO2	0.35	1.01	0.59	0.26	0.78	1.05	1.02	1.02	0.9	1.04	1.14	0.83
MnO	0.26	0.11	0.12	0.13	0.06	0.04	0.14	0.15	0.15	0.1	0.1	0.12
P2O5	0.11	0.14	0.16	0.1	0.12	0.15	0.16	0.19	0.17	0.15	0.16	0.15
SrO	0.02	0.01	0.03	*<0.01*	0.01	*<0.01*	*<0.01*	0.01	0.04	*<0.01*	0.01	0.02
BaO	0.01	0.07	0.03	0.06	0.04	0.07	0.07	0.08	0.07	0.06	0.09	0.08
LOI	7.7	3.63	2.49	3.23	2.96	3.52	3.82	3.83	7.49	3.52	3.78	5.59
Total	99.49	98.73	99.72	100	99.03	99.66	99.28	99.12	99.18	99.31	99.41	99.14
FeO	17.55	7.01	6.43	5.92	7.33	4.76	6.37	6.95	6.56	6.75	6.37	5.34

Sample No.	02MR-S043	02MR-S044	02MR-S045	02MR-S046	02MR-S047
Locality	Kettara Schist	Kettara Schist	Kettara Schist	Kettara Schist	Kettara Schist
SiO2	53.1	48.88	60.62	62.4	59.89
Al2O3	16.25	13.46	17.49	17.77	18.83
Fe2O3	7.04	26.49	7.84	7	7.83
CaO	9.38	1.17	1.36	0.5	0.49
MgO	2.4	3.78	2.63	1.95	1.84
Na2O	1.47	0.07	1.05	1.44	0.23
K2O	2.72	0.11	3.81	3.2	4.33
Cr2O3	0.01	0.01	0.02	0.02	0.02
TiO2	0.86	0.79	1.01	1.03	1.09
MnO	0.11	0.22	0.13	0.1	0.14
P2O5	0.14	0.14	0.15	0.19	0.18
SrO	0.04	*<0.01*	0.01	*<0.01*	*<0.01*
BaO	0.05	0.01	0.09	0.06	0.07
LOI	5.82	4.54	3.56	4.04	4.62
Total	99.38	99.68	99.77	99.69	99.56
FeO	6.5	21.8	5.66	5.66	6.69

Table) Result of Major and minor elements analysis sedimentary rocks

		02MR-K001	02MR-K002	02MR-K003	02MR-K004	02MR-K005	02MR-K006	02MR-K007	02MR-K008	02MR-K009	02MR-K010	02MR-K011	02MR-K012	02MR-K013	02MR-K014	02MR-K015	02MR-K016	02MR-K017	02MR-K018
Area	unit	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Saf Safa
		Scihst	Shale	Shale	Shale	Hornfels	Schist	Schist	Schist	Shale	Shale	Schist	Shale	Shale	Schist	Shale	Schist	Slate	Slate
Ag	ppm	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	1.6	0.2	<0.2	<0.2
Al	%	3.94	2.97	1.79	4.03	1.52	2.39	1.9	2.41	1.96	3.61	3.95	3.02	2.48	2.38	2.36	1.78	2.08	2.8
As	ppm	<2	<2	820	56	3	20	<2	33	19	4	594	78	<2	6	33	1195	11	35
B	ppm	<10	<10	10	10	10	<10	<10	<10	<10	<10	<10	10	<10	<10	10	10	<10	<10
Ba	ppm	604	716	298	543	386	604	122	744	657	300	467.1	356	595	607	333.3	683.9	810.1	2410
Be	ppm	1	0.9	1.2	1.2	1.7	0.9	0.7	0.6	0.8	0.6	1.5	1	<0.5	0.8	0.7	1.4	0.9	<0.5
Bi	ppm	<2	<2	<2	<2	2	<2	<2	6	<2	<2	3	<2	<2	<2	<2	<2	<2	<2
Ca	%	1.19	1.3	0.55	0.25	0.37	0.15	0.17	1.16	0.18	1.32	1.65	1.29	0.26	0.53	1.01	0.23	0.2	0.43
Cd	ppm	<0.5	<0.5	0.9	1.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	0.8	<0.5	<0.5	<0.5
Co	ppm	6.9	3.6	10.1	18.1	16.1	17.5	20.7	17.9	24	14.6	30.1	11.1	18.3	20.9	42.7	17.5	12.4	25.3
Cr	ppm	230	190	290	140	220	150	180	140	160	250	470	200	180	150	1130	150	150	110
Cs	ppm	7.9	3.7	8	1.7	10.3	2.7	3.1	3.1	4.7	5.5	7	12.2	3.3	3.9	6.8	8.1	5.4	7.3
Cu	ppm	20	30	427	27	107	61	210	2	17	40	35	124	36	31	147	826	25	11
Fe	%	4.39	2.27	5.45	11.25	4.45	5.08	6.81	4.43	3.4	3.11	4.69	5.74	4.44	4.69	5.3	3.7	3.46	5.15
Ga	ppm	10	10	10	20	10	10	10	10	10	20	20	20	10	10	10	20	10	10
Ga	ppm	18	24	19	31	17	25	49	25	24	16	25	21	25	29	14	26	26	33
Hf	ppm	8	16	5	7	8	6	9	5	7	8	6	7	6	5	5	6	7	4
Hg	ppm	<1	<1	1	1	<1	<1	<1	<1	<1	1	<1	<1	<1	1	<1	<1	<1	<1
K	%	1.29	0.63	0.62	0.1	0.35	0.17	0.2	0.15	0.28	1.03	0.46	0.42	0.41	0.17	0.56	0.76	0.64	0.16
La	ppm	20	20	20	30	10	50	30	40	40	20	50	30	40	40	20	50	50	30
Mg	%	1.07	0.37	0.87	2.76	0.61	1.39	0.95	1.29	0.88	1.02	1.19	1.49	1.14	1.1	2.03	1.05	0.91	1.8
Mn	ppm	1025	454	558	790	432	665	367	1195	450	519	800	1060	552	804	641	989	425	490
Mo	ppm	5	<2.00	3	<2.00	<2.00	<2.00	<2.00	<2.00	4	<2.00	6	<2.00	<2.00	<2.00	4	5	<2	<2.00
Na	%	0.26	0.4	0.16	0.14	0.05	0.06	0.03	0.04	0.06	0.36	0.49	0.19	0.07	0.02	0.16	0.07	0.06	0.01
Nb	ppm	13	13	13	24	13	20	31	18	20	12	20	15	20	21	8	19	19	14
Ni	ppm	30	3	18	34	31	43	66	45	35	27	23	27	40	55	136	43	44	43
P	ppm	560	230	670	1090	490	600	810	750	480	530	600	650	540	720	590	740	500	810
Pb	ppm	19	6	17	9	9	9	4	5	5	6	14	12	5	20	40	26	4	9
Rb	ppm	142	59.7	156.8	78.1	158.9	104.8	276	87.4	112.2	89.9	129.7	115.8	105.5	200	94.7	186.8	159.3	184.8
S	%	0.09	0.06	2.73	0.22	0.93	0.2	1.82	0.01	0.08	0.15	0.41	0.78	0.21	0.11	1.72	0.9	0.2	0.11
Sb	ppm	<2	<2	<2	2	<2	<2	<2	<2	<2	<2	3	2	<2	<2	8	22	<2	<2
Sc	ppm	4	2	1	3	2	1	1	2	2	7	6	4	3	1	2	2	2	1
Sn	ppm	7	4	9	9	4	9	28	7	6	3	6	8	4	5	4	19	7	4
Sr	ppm	53	50	20	15	9	6	8	25	11	115	63	36	15	10	29	<1	3	20
Sr	ppm	92	195.5	75.6	46.2	31.9	51.6	27.8	156.2	177.3	271	322.7	184.2	232	71.7	116.6	101.2	72.9	95.7
Ta	ppm	1	1.1	1	1.8	1	1.5	2.3	1.4	1.5	0.9	1.4	1	1.5	1.5	0.6	1.5	1.4	1
Th	ppm	12	22	12	21	11	18	28	18	16	11	16	13	18	18	8	20	16	11
Ti	%	0.16	0.1	0.02	0.02	0.02	0.02	0.01	0.01	0.04	0.13	0.06	0.06	0.08	0.02	0.07	0.04	0.09	<0.01
Tl	ppm	<1	<1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1
U	ppm	2.7	5.8	2.8	3.1	2.5	2.6	4.2	2.4	2.7	2.5	3.7	2.9	2.5	3.1	2	3.7	3	2.7
V	ppm	99	<5.00	101	172	98	136	218	123	147	81	184	128	148	188	92	192	181	113
W	ppm	3	5	2	4	2	4	5	3	4	3	3	3	3	3	2	3	4	3
Zn	ppm	159	40	618	169	86	67	71	54	89	71	86	78	94	172	217	111	50	186
Zr	ppm	263	468	169	220	269	196.9	290	137.9	254	273	197.4	211	188	175.6	161.6	173.4	217.2	133.7

Table -) R

		02MR-K019	02MR-K020	02MR-K021	02MR-K022	02MR-K023	02MR-K024	02MR-K025	02MR-K026	02MR-K027	02MR-K028	02MR-K029	02MR-K030	02MR-K031	02MR-K032	02MR-K033	02MR-K034	02MR-K035	02MR-K036
Area	unit	Saf Safa	Saf Safa	Saf Safa	Saf Safa	Saf Safa	Kerkoze	S_Kerkoze	K_Aiche	N_Bensliman	Lachach	_Hadat_gossa	J_Hadat	J_Hadat	K Aicha	K Aicha	K Aicha	K Aicha	K Aicha
		Slate	Schist	Slate	Shale	Schist	Shale	Shale	Sandstone	Shale	Shale	Shale	Sandstone	Limestone	Slate	Shale	Shale	Shale	Shale
Ag	ppm	<0.2	0.3	<0.2	0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	2.3	<0.2
Al	%	2.46	0.31	1.11	1.38	1.2	1.96	1.88	2.44	2.85	2.13	2.01	1.78	0.28	1.77	1.64	2.98	0.92	2.93
As	ppm	9	24	<2	7	4	<2	4	3	<2	4	2	<2	<2	5	9	30	4	<2
B	ppm	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Ba	ppm	1529.6	2220	4780	4500	5810	135.1	562	45	409	854	471	741	148.9	471	858	661	579	279
Be	ppm	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	0.9	<0.5	0.5	<0.5	1.4	<0.5	0.7
Bi	ppm	2	3	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	2	<2	<2	<2	<2	<2
Ca	%	6.75	5.14	0.59	2.76	0.46	0.28	0.19	0.22	0.23	0.03	1.23	5.28	>15.0	0.5	0.41	1.18	0.17	0.21
Cd	ppm	<0.5	1.1	<0.5	0.7	<0.5	<0.5	<0.5	0.7	<0.5	0.5	<0.5	<0.5	0.7	<0.5	<0.5	1	15.6	<0.5
Co	ppm	17.1	18.1	3.2	10.5	7.2	15.7	18.4	13.5	21.9	10.9	9.1	6.5	6.7	16.1	18.5	22.5	23	14
Cr	ppm	70	120	110	180	140	160	140	170	130	140	210	150	30	140	140	140	130	150
Cs	ppm	3.4	5.3	6.3	5.7	7.1	2	1.5	0.2	0.6	4.1	0.3	1.1	0.3	2.9	2.5	6.3	3.1	2.3
Cu	ppm	25	30	7	32	23	1	2	26	3	118	4	29	59	47	52	69	303	2
Fe	%	4.28	4	1.92	3.1	2.63	3.13	3.72	5.29	6.95	4.34	1.08	1.82	0.27	3.74	4.07	4.79	6.93	5.28
Ga	ppm	40	10	10	10	10	10	10	10	20	10	10	10	<10	10	10	10	10	10
Ga	ppm	19	21	27	24	33	23	24	10	24	30	19	10	4	19	28	26	20	22
Hf	ppm	4	4	5	5	6	7	7	7	7	5	7	8	1	6	6	4	5	7
Hg	ppm	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
K	%	0.22	0.15	0.13	0.15	0.16	0.31	0.13	0.02	0.08	0.12	0.15	0.29	0.01	0.17	0.18	0.53	0.14	0.11
La	ppm	20	<10	50	20	50	30	30	10	30	20	30	10	<10	30	20	20	20	30
Mg	%	1.75	1.66	0.95	1.3	0.84	1.11	0.8	0.98	0.82	0.76	0.28	0.52	0.09	1.07	1.06	0.96	0.67	1.93
Mn	ppm	2630	2720	193	423	134	145	268	613	688	442	141	418	1135	548	363	461	662	726
Mo	ppm	<2	<2.00	15	15	16	<2.00	<2.00	<2.00	<2.00	<2.00	3	<2.00	<2.00	<2.00	<2.00	10	<2.00	4
Na	%	0.02	0.02	0.02	0.04	0.03	0.05	0.01	0.01	0.03	0.01	0.31	0.15	0.02	0.02	0.02	0.28	0.01	0.01
Nb	ppm	9	11	15	14	20	21	20	7	18	21	16	10	2	15	20	17	15	16
Ni	ppm	29	38	8	70	36	42	37	35	36	45	11	17	4	37	54	54	49	37
P	ppm	530	490	630	1080	840	710	580	770	600	630	510	360	380	450	650	620	500	500
Pb	ppm	28	22	4	18	40	2	3	4	3	<2	6	56	4	5	8	34	1120	5
Rb	ppm	105.2	148.4	166.6	147.6	200	41	110.4	3.9	13.1	191.5	10	78	9.9	122.3	144.8	175.6	141.5	115.5
S	%	0.76	1.16	0.38	1.08	0.72	0.01	0.01	0.02	0.01	0.01	0.04	0.01	0.03	0.55	1.03	2.13	3.91	0.02
Sb	ppm	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Sc	ppm	2	1	1	1	1	12	1	4	8	1	2	3	<1	1	1	1	<1	2
Sn	ppm	3	3	4	3	5	1	5	2	7	6	8	3	2	2	6	4	10	4
Sr	ppm	430	254	31	143	27	15	6	5	9	43	78	69	261	6	6	101	2	4
Sr	ppm	466.4	324	175	280	177.8	442	142	75.8	295	97.1	277	165	309	47	86.7	207	15.8	79.7
Ta	ppm	0.7	0.9	1.1	1	1.5	1.5	1.5	0.6	1.4	1.5	1.2	0.8	<0.5	1.1	1.4	1.2	1	1.2
Th	ppm	9	10	13	10	17	18	18	7	15	18	14	9	3	12	16	14	13	14
Ti	%	0.01	<0.01	<0.01	<0.01	<0.01	0.08	0.04	0.03	0.08	<0.01	0.06	0.1	0.02	0.15	0.21	0.08	0.06	0.01
Tl	ppm	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
U	ppm	2.8	2.8	15.2	7.8	18.8	2.3	2.3	1.7	2	3.3	3.1	2	1.6	3.1	4.2	5.6	3	3.5
V	ppm	76	106	126	156	142	153	132	57	109	215	110	48	18	128	182	174	119	129
W	ppm	2	4	4	3	4	2	6	3	5	5	2	3	<1.00	4	3	3	3	4
Zn	ppm	169	135	46	56	33	13	17	56	38	503	45	63	152	41	111	174	9580	91
Zr	ppm	116.6	172	198.2	167.8	198.5	227	251	234	238	171.7	228	274	49.5	187.7	166.8	145.4	169.2	222

Table -) R

		02MR-K037	02MR-K038	02MR-K039	02MR-K040	02MR-K041	02MR-K042	02MR-K043	02MR-K044	02MR-K046	02MR-K047	02MR-K048	02MR-K049	02MR-K050	02MR-K051	02MR-K052	02MR-K053	02MR-K054	02MR-K055
Area	unit	K Aicha	Benslieman	Benslieman	Benslieman	Lachach	Lachach	Lachach	Lachach	Amzoourh	Imarine	Tameslouht	Tameslouht	Hajar	Hajar	Hajar	Hajar	Hajar	Hajar
		Shale	Shale	Schist	Schist	Schist	Schist	Schist	Sandstone	Shale	Shale	Quatzite	Limestone	Sandstone	Hornfels	Shale	Sandy shale	Shale	Shale
Ag	ppm	<0.2	<0.2	<0.2	<0.2	<0.2	2.6	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.5
Al	%	2.02	2.4	3.46	2.07	1.94	5.78	2.43	2.03	1.61	2.18	0.45	0.41	5.19	2.91	4.47	1.87	4.19	1.33
As	ppm	2	13	4	<2	5	134	16	19	78	4	12	7	2	<2	3	3	<2	9
B	ppm	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Ba	ppm	218	613	599	370	545	75.6	682	489	805	296	90.7	240	508	704	634	545	3.9	704
Be	ppm	<0.5	<0.5	<0.5	<0.5	1.1	<0.5	0.5	0.5	1.6	<0.5	<0.5	<0.5	0.6	<0.5	1	0.5	<0.5	0.7
Bi	ppm	<2	<2	<2	<2	<2	<2	<2	2	<2	3	<2	<2	<2	<2	<2	<2	8	<2
Ca	%	0.24	0.28	0.14	0.31	0.51	0.08	0.18	0.23	0.14	12.05	0.08	>15.0	0.71	0.51	2.09	0.3	0.09	0.16
Cd	ppm	<0.5	<0.5	0.5	<0.5	<0.5	17	<0.5	<0.5	1.6	0.9	<0.5	1.3	1	<0.5	<0.5	<0.5	2.1	<0.5
Co	ppm	12	22.6	9.2	19	14.4	57.5	18.6	16	31.5	13.3	5	8.7	15.2	10.8	17.8	7.9	139.5	20.2
Cr	ppm	160	140	140	130	140	100	120	120	110	80	230	20	130	180	130	150	70	130
Cs	ppm	1	5.1	0.9	0.6	2.5	0.3	4.2	2.3	3.5	5.2	0.7	0.6	4.2	8.2	5.4	5.9	<0.1	6.4
Cu	ppm	1	41	80	2	56	910	53	77	70	17	9	13	4	10	32	6	1280	62
Fe	%	3.83	4.28	7.59	3.77	3.99	14.4	4.8	3.97	4.5	2.48	1.62	1.81	5.01	4.1	3.87	2.81	>15.0	3.84
Ga	ppm	10	10	20	10	10	40	10	10	10	10	<10	10	20	20	20	10	20	10
Ga	ppm	22	26	24	25	24	33	25	18	22	13	4	3	21	23	27	22	17	24
Hf	ppm	5	5	4	5	7	5	6	7	7	5	12	3	6	6	6	6	6	5
Hg	ppm	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1
K	%	0.22	0.46	0.09	0.09	0.16	0.02	0.12	0.17	0.4	0.85	0.12	0.05	1.62	1.46	1.34	0.63	0.01	0.26
La	ppm	20	30	50	30	20	<10	20	20	40	20	10	<10	30	20	30	40	<10	10
Mg	%	0.94	1.23	1.34	1.26	0.81	2.88	0.99	0.76	0.5	1.04	0.08	0.28	5.22	0.95	1.26	0.79	1.93	1.28
Mn	ppm	523	989	697	270	985	2100	566	453	1255	467	291	2200	986	677	608	458	1685	397
Mo	ppm	<2.00	2	<2.00	2	5	4	6	20	4	5	3	7	5	5	4	3	2	6
Na	%	0.04	0.02	<0.01	0.02	0.02	<0.01	0.01	0.02	0.01	0.18	<0.01	0.01	0.03	0.2	0.46	0.06	<0.01	0.02
Nb	ppm	20	20	19	20	25	16	17	15	16	12	5	3	15	20	19	18	11	16
Ni	ppm	53	44	30	44	36	53	53	46	43	22	10	21	39	23	39	17	20	44
P	ppm	680	800	640	630	560	390	730	420	590	360	670	190	550	390	600	510	340	660
Pb	ppm	3	9	5	4	20	3440	19	11	40	12	8	123	7	5	13	13	9	165
Rb	ppm	23.2	172.6	80	56.9	162	13.3	146.6	104.2	164	89.2	23.5	13.1	92	88.6	169.2	164.2	<0.2	175.7
S	%	0.01	0.14	0.16	<0.01	0.38	2.78	0.1	0.13	0.01	0.73	0.04	0.03	0.01	0.03	1.06	0.08	4.7	2.04
Sb	ppm	<2	<2	<2	<2	<2	<2	4	<2	<2	<2	<2	2	<2	<2	<2	<2	<2	<2
Sc	ppm	12	2	2	3	1	7	1	1	1	3	<1	1	10	12	4	2	6	<1
Sn	ppm	3	5	12	7	13	7	5	6	18	4	3	3	5	5	6	11	4	15
Sr	ppm	10	6	2	8	13	5	5	6	12	324	7	224	19	44	115	16	1	6
Sr	ppm	571	98.3	12.2	314	78.2	12.6	57.6	49.8	32.2	678	11.8	226	141.2	399	229	128	4.2	92.4
Ta	ppm	1.4	1.4	1.3	1.9	4.1	1.7	1.4	1.3	1.4	1	0.5	0.5	1.3	1.6	1.4	2	0.9	1.5
Th	ppm	17	18	18	19	17	13	16	13	17	10	6	3	14	15	16	16	9	18
Ti	%	0.09	0.1	0.02	0.1	0.01	0.02	0.01	0.01	0.04	0.15	<0.01	<0.01	0.19	0.23	0.19	0.08	0.02	0.01
Tl	ppm	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1
U	ppm	3.6	2.4	1.8	2.6	2.5	2	3.3	3.3	2.3	1.9	1.3	1.7	2.8	2.6	2.8	2.6	1.8	3
V	ppm	198	130	116	155	177	125	204	159	146	95	37	45	164	158	194	167	82	158
W	ppm	3	3	5	4	7	5	6	6	7	5	4	4	5	5	5	6	31	7
Zn	ppm	66	223	45	22	187	7350	96	68	1895	54	28	82	288	59	55	95	167	220
Zr	ppm	170.6	142.8	140.4	158	221	173.2	196.9	244	237	185	423	113.6	223	226	199.8	219	208	159.4

Table -) R

		02MR-K056	02MR-K057	02MR-K058	02MR-K059	02MR-K061	02MR-K062	02MR-K063	02MR-K064	02MR-K065	02MR-K067	02MR-K068	02MR-K069	02MR-K070	02MR-K071	02MR-K072	02MR-K073	02MR-K074	02MR-K075
Area	unit	Hajar	Hajar	Hajar	Hajar	Hajar	Hajar	Hajar	Algeida	Algeida	Frag el Ma	Sid Bau East	Sid Bau East	Jbwl_Sarhlef	Jbwl_Sarhlef	Jbwl_Sarhlef	Frizem	Frizem	Frizem
		Schist	Sandy shale	Tuff	Shale	Shale	Shale	Shale	Schist	Schist	Schist	Sandy shale	Shale	Shale	Schist	Shale	Shale	Shale	Shale
Ag	ppm	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Al	%	5.23	3.69	1.39	4.32	2.47	2.43	1.8	2.36	2.51	0.3	2.85	1.5	2.32	4.55	2.35	2.27	1.43	2.8
As	ppm	<2	<2	<2	13	20	<2	10	20	10	6	13	23	9	4	14	23	5	<2
B	ppm	<10	<10	<10	<10	<10	<10	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Ba	ppm	553	394	2310	962	2580	283	724	727	683	940	544	937	203	31.2	541	500	917	537
Be	ppm	<0.5	<0.5	0.5	0.5	<0.5	1.1	0.9	0.6	0.8	<0.5	0.5	0.9	<0.5	<0.5	0.6	<0.5	0.7	<0.5
Bi	ppm	<2	<2	<2	<2	<2	<2	<2	2	<2	<2	<2	2	<2	<2	<2	<2	2	<2
Ca	%	0.26	1.54	0.18	0.19	0.15	0.15	0.14	0.23	0.3	0.52	1.37	0.32	0.29	7.21	0.29	0.39	0.19	0.37
Cd	ppm	1.1	0.6	<0.5	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	1.1	0.7	0.5	1	<0.5	<0.5	<0.5	0.8
Co	ppm	22	17.4	4.5	24.7	12	10.1	9.1	20.7	19.1	20.4	9.9	15.4	15.3	23.6	18.1	17.4	21.6	24.4
Cr	ppm	110	110	120	100	100	140	110	130	120	150	120	130	120	290	120	120	140	110
Cs	ppm	2.1	2.3	2.7	3.5	4.1	9	4	6	5.9	1.6	4.2	6	1.9	0.7	7	3.9	6	3.5
Cu	ppm	144	3	124	3	1	98	69	25	59	3	15	2	21	60	24	27	94	255
Fe	%	10.05	7.01	3.07	7.51	4.28	6.23	7.48	4.44	5.2	0.86	4.3	3.14	4.05	5.82	4.64	4.26	4.9	8.54
Ga	ppm	20	10	10	20	10	10	10	10	10	<10	10	10	10	20	10	10	10	20
Ga	ppm	24	18	29	23	25	24	24	28	27	7	21	29	22	15	25	23	31	32
Hf	ppm	4	5	6	5	5	6	7	7	7	5	6	7	7	3	6	8	7	5
Hg	ppm	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1	<1	<1
K	%	0.46	0.51	0.29	0.61	0.56	0.75	0.22	0.16	0.2	0.08	0.68	0.41	0.09	0.05	0.11	0.15	0.21	0.2
La	ppm	20	20	40	30	40	30	30	30	30	40	10	50	30	<10	30	30	20	20
Mg	%	2.69	1.94	1.1	2.51	1.16	1.23	0.7	0.95	0.95	0.03	1	0.43	1.03	3.53	0.8	1.17	0.78	1.16
Mn	ppm	1505	1240	530	1075	662	946	1425	1510	1280	100	465	211	719	1250	625	832	559	1685
Mo	ppm	3	7	2	3	4	4	6	4	7	4	6	17	<2.00	<2.00	4	4	5	3
Na	%	0.02	0.01	0.01	0.01	0.01	0.03	0.01	0.01	0.02	0.01	0.11	0.02	0.07	0.01	0.01	0.01	0.01	0.01
Nb	ppm	15	16	20	16	17	17	19	20	20	21	17	23	19	2	21	23	25	17
Ni	ppm	38	38	25	39	37	31	33	45	41	9	34	36	41	65	41	36	60	32
P	ppm	720	680	580	530	580	620	250	570	960	310	490	500	620	680	600	410	590	640
Pb	ppm	11	9	22	9	6	16	22	36	12	4	9	4	6	7	12	18	31	7
Rb	ppm	85.8	109.7	163.8	100.4	141	160.6	149.6	161.3	157.4	89.5	146.3	174.4	45.7	17.2	146	143.9	245	137.5
S	%	0.04	0.01	1.01	0.01	0.01	1.1	0.81	0.28	0.63	0.01	0.12	0.01	0.02	<0.01	0.01	0.34	2.48	1.7
Sb	ppm	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	3	3	<2	<2	<2	<2	<2	<2
Sc	ppm	4	1	1	4	2	1	1	1	2	1	4	1	3	22	1	1	1	1
Sn	ppm	10	6	19	7	10	9	13	7	6	70	6	7	2	2	4	7	7	7
Sr	ppm	7	37	6	6	7	12	10	14	17	147	46	13	22	132	21	10	7	8
Sr	ppm	30.8	103.6	45.1	23.5	30.1	63.6	30	133.2	145	577	154.3	104	772	257	136.3	46.8	38.7	30.4
Ta	ppm	1.3	1.3	1.5	2	1.6	1.3	3.3	2.1	1.5	1.5	1.4	1.8	1.4	<0.5	2	2.5	2.1	1.4
Th	ppm	16	15	16	17	18	15	17	17	17	17	17	20	16	1	17	18	22	17
Ti	%	0.07	0.06	0.01	0.07	0.06	0.08	<0.01	<0.01	<0.01	0.1	0.13	0.05	0.01	0.02	<0.01	<0.01	<0.01	0.01
Tl	ppm	<1	<1	1	<1	<1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2	<1	<1
U	ppm	2.2	2.4	3.3	2.6	2.9	2.7	2.4	2.8	2.9	2.2	2.4	2.3	2.2	<0.5	2.6	3.2	3.7	2.8
V	ppm	149	144	213	143	166	197	214	193	194	73	142	208	157	313	185	167	215	164
W	ppm	12	8	7	6	9	6	9	6	7	5	6	7	3	2	6	6	7	5
Zn	ppm	154	83	253	81	110	351	723	133	129	14	465	173	72	77	83	99	102	163
Zr	ppm	147.6	166.5	202	152.5	153.4	201	247	209	229	180.2	205	228	224	106	216	262	229	157.2

Table -) R

		02MR-K076	02MR-K077	02MR-K079	02MR-K080	02MR-K081	02MR-K082	02MR-K083	02MR-K084	02MR-K085	02MR-K086	02MR-K087	02MR-K088	02MR-K089-A	02MR-K089-B	02MR-K090	02MR-K091	02MR-K092	02MR-K093
Area	unit	Frizem	Frizem	Frizem	Frizem	Frizem	Frizem	Frizem	Kettara	Kettara	Draa_Sfar	Draa_Sfar	Draa_Sfar	Draa_Sfar	Draa_Sfar	Draa_Sfar	Draa_Sfar	Draa_Sfar	Draa_Sfar
		Schist	Schist	Shale	Limestone	Sandy slate	Shale	Slate	Shale	Shale	Shale	Shale	Shale	Shale	Shale	Sandy shale	Shale	Shale	Shale
Ag	ppm	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.4	<0.2	<0.2
Al	%	5.83	0.55	2.37	4.32	1.71	2.49	2.26	2.02	2.91	3.09	5.71	2.2	7.58	2.67	1.8	2.4	2.76	1.92
As	ppm	72	11	23	64	22	2	14	18	15	5	<2	14	<2	<2	<2	<2	18	20
B	ppm	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Ba	ppm	127	674	830	203	580	529	909	381	675	454	401	484	7.8	582	213	514	280	625
Be	ppm	<0.5	0.6	0.6	<0.5	0.5	<0.5	0.5	1	<0.5	<0.5	<0.5	0.5	0.7	0.7	<0.5	0.9	<0.5	0.5
Bi	ppm	<2	<2	2	<2	4	<2	<2	<2	<2	<2	<2	2	5	<2	4	<2	<2	<2
Ca	%	1.04	0.88	0.39	5.13	0.15	0.52	0.28	5.58	1.61	0.72	0.19	0.2	0.09	0.19	0.69	0.24	0.2	0.21
Cd	ppm	2.5	<0.5	<0.5	1.5	<0.5	<0.5	<0.5	0.9	0.5	<0.5	1.4	<0.5	2.2	<0.5	0.5	<0.5	<0.5	<0.5
Co	ppm	32.4	17.6	15.3	40	19.1	6.9	13.8	11.4	14.3	17.4	42.4	14.6	22.8	10.7	20	10.7	23.5	22.6
Cr	ppm	100	130	140	240	130	120	140	100	120	120	120	130	40	120	160	30	150	130
Cs	ppm	1.6	7	5	1.7	4	2.1	4.2	4.8	4.5	3.3	2.5	5	1.4	4.2	1.2	2	2.5	4.6
Cu	ppm	15	81	25	79	21	18	19	15	70	2	1	10	3060	66	88	7	8	32
Fe	%	11	4.46	4.16	5.69	3.56	4.45	4.03	3.54	5.43	6.52	13.05	4.12	12.85	5.08	4.58	4.51	5.39	3.44
Ga	ppm	40	10	10	20	10	10	10	10	10	10	30	10	40	10	10	10	10	10
Ga	ppm	30	27	29	17	24	15	26	21	21	26	42	27	33	24	14	23	19	26
Hf	ppm	4	5	5	3	7	8	7	6	7	6	6	6	9	7	7	7	5	6
Hg	ppm	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
K	%	0.06	0.22	0.22	0.14	0.17	0.14	0.19	0.18	0.15	0.18	0.14	0.24	0.08	0.19	0.1	0.18	0.17	0.26
La	ppm	20	30	40	<10	20	<10	20	20	10	30	20	40	30	30	20	30	20	40
Mg	%	3.56	0.74	1.46	3.48	0.82	1.5	1.28	0.79	1.78	0.98	1.68	0.81	7.85	1.34	0.91	1.39	1.14	0.81
Mn	ppm	3280	1285	1020	1925	567	1180	849	687	653	816	1570	764	1260	644	901	798	448	252
Mo	ppm	4	3	2	<2.00	4	3	3	3	4	5	5	3	34	6	6	5	10	4
Na	%	<0.01	0.01	0.01	<0.01	0.01	0.01	0.01	0.03	0.01	0.01	0.02	0.03	0.04	0.02	0.06	0.02	0.03	0.02
Nb	ppm	15	19	21	2	20	15	22	19	20	19	20	21	18	20	13	15	15	20
Ni	ppm	30	51	36	56	43	20	25	30	33	44	35	46	5	31	35	1	51	44
P	ppm	600	640	910	510	290	440	510	560	370	620	780	580	430	630	650	440	520	630
Pb	ppm	73	5	7	135	5	84	7	17	4	3	8	2	12	4	11	11	13	8
Rb	ppm	34.4	258	216	85.1	173.4	84	170.1	135.2	115.3	159.6	89.3	208	11.6	158	48.6	118	96.9	207
S	%	0.22	0.71	0.43	0.02	0.55	0.25	0.22	0.01	0.02	<0.01	0.01	0.04	0.52	0.31	0.73	0.01	0.01	0.15
Sb	ppm	<2	<2	<2	<2	<2	<2	<2	<2	5	<2	<2	<2	<2	<2	<2	<2	<2	<2
Sc	ppm	7	1	1	9	1	1	1	2	3	2	5	1	10	2	2	1	2	1
Sn	ppm	6	4	6	<1.00	3	4	18	3	14	6	20	2	8	16	2	10	2	4
Sr	ppm	10	17	10	108	5	9	9	76	11	13	4	8	4	5	14	4	5	7
Sr	ppm	17.3	38.6	27.1	108.1	27.5	17	27.4	115.4	43.8	33.8	43.8	39.5	4.6	35.8	247	24.4	101.6	33.5
Ta	ppm	1.2	1.4	1.5	<0.5	1.4	1.2	1.7	1.5	1.5	1.4	1.4	1.5	1.6	1.5	1	1.3	1.1	1.5
Th	ppm	15	22	24	1	16	12	19	15	15	15	16	17	32	18	11	24	12	17
Ti	%	0.01	<0.01	<0.01	0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.03	0.04	0.03	0.02	0.04	0.04	<0.01	0.08	0.06
Tl	ppm	<1	1	1	<1	1	1	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
U	ppm	2.3	3.3	3	<0.5	2.7	2.3	3	2	2.1	2	3.4	3.1	10.1	2.6	2.1	5.7	2.8	3.2
V	ppm	138	158	167	294	165	91	159	143	130	208	209	207	21	160	89	15	158	212
W	ppm	19	4	3	2	3	3	4	3	3	5	8	3	4	3	2	3	3	3
Zn	ppm	371	89	82	114	66	157	78	77	79	54	90	92	94	60	41	51	28	19
Zr	ppm	134	154.2	171	84.4	240	270	224	191.7	217	187	191	197.9	257	248	228	189.2	178.1	196.7

Table -) R

		02MR-K094	02MR-K095	02MR-K096	02MR-K097	02MR-K098	02MR-K101	02MRS0043	02MRS0044	02MRS0045	02MRS0046	02MRS0047
Area	unit	Draa_Sfar	Draa_Sfar	Draa_Sfar	Draa_Sfar	Draa_Sfar	Si Gedi Haja	Kettara	Kettara	Kettara	Kettara	Kettara
		Shale	Shale	Shale	Shale	Slate	Tuff-shist	Schist	Schist	Schist	Schist	Schist
Ag	ppm	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	1.6	<0.2	<0.2	<0.2	<0.2
Al	%	2.47	2.72	2.64	2.43	2.05	2.51	5.94	6.62	2.82	2.35	2.41
As	ppm	12	23	17	78	3	3	16	2	10	16	22
B	ppm	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Ba	ppm	569	648	617	582	780	739	415	35.3	740	522	516
Be	ppm	0.7	0.6	<0.5	<0.5	0.5	<0.5	1.1	<0.5	<0.5	1.1	0.8
Bi	ppm	3	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Ca	%	0.21	0.41	4.17	0.22	0.16	2.02	5.24	0.14	0.27	0.26	0.17
Cd	ppm	0.5	<0.5	<0.5	<0.5	<0.5	0.8	2.9	3.1	1.5	0.5	1
Co	ppm	22.3	23.4	28.5	26.9	25.5	19.9	20.2	58.5	26.8	20.6	23.2
Cr	ppm	130	120	110	120	130	100	130	100	150	130	120
Cs	ppm	5.5	4	4.3	3.7	6	4.4	5.6	0.1	5.2	4.3	4.1
Cu	ppm	99	26	35	7	101	11	64	14	17	18	90
Fe	%	5.08	5.01	4.51	4.89	4.47	3.87	4.4	>15.0	4.69	4.4	4.88
Ga	ppm	10	10	10	10	10	10	20	40	10	10	10
Ga	ppm	24	26	23	24	29	22	24	37	25	25	27
Hf	ppm	6	5	4	8	5	5	5	5	6	7	6
Hg	ppm	<1	<1	<1	1	<1	<1	<1	1	<1	<1	<1
K	%	0.23	0.2	0.19	0.22	0.27	0.18	1.69	0.02	0.76	0.15	0.2
La	ppm	30	60	40	40	40	30	30	<10	20	20	30
Mg	%	1.14	1.26	1.51	0.86	0.72	1.63	1.32	1.96	1.33	0.95	0.86
Mn	ppm	816	922	1015	574	365	816	602	1240	531	628	784
Mo	ppm	4	2	5	5	4	3	<2.00	<2.00	3	2	5
Na	%	0.03	0.02	0.03	0.02	0.02	0.01	0.53	<0.01	0.04	0.02	0.01
Nb	ppm	21	20	19	22	21	13	19	17	22	22	23
Ni	ppm	41	46	48	36	48	34	37	31	43	38	32
P	ppm	710	830	760	680	730	670	690	530	650	760	850
Pb	ppm	12	38	35	70	5	13	699	54	75	22	49
Rb	ppm	178.4	167.8	134.4	164.3	228	115.2	141.7	3.5	167.4	156.8	185
S	%	0.47	0.02	0.2	0.06	0.54	0.01	0.33	0.07	0.02	0.23	0.29
Sb	ppm	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Sc	ppm	2	2	2	1	1	2	4	10	3	1	1
Sn	ppm	14	5	3	11	6	2	2	<1.00	4	4	22
Sr	ppm	7	10	167	8	7	90	249	3	10	6	6
Sr	ppm	46.2	109.9	394	22.6	36.4	142.4	422	10	96.5	73.9	33.8
Ta	ppm	1.5	1.5	1.4	1.7	1.5	1	1.5	1.2	1.5	1.6	1.8
Th	ppm	17	18	18	18	18	11	17	16	18	18	20
Ti	%	0.04	0.05	0.07	0.05	0.02	0.01	0.24	0.04	0.14	<0.01	0.01
Tl	ppm	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
U	ppm	2.4	2.5	2.1	2.7	3.5	1.8	2.4	2	2.3	2.5	2.7
V	ppm	164	162	154	167	233	105	153	118	157	147	170
W	ppm	3	3	3	4	4	2	4	7	4	3	4
Zn	ppm	73	131	106	195	25	92	1300	254	199	134	165
Zr	ppm	217	171.4	116.5	241	184.7	148.4	177.4	145.2	173.4	222	196.2

Table) Descriptes of Major Elements and Trace Elements of Sedimentary rocks

	Case	Mean	confidence interval		Mode	Max	Min	Lower 1/4	Upper 1/4	Range	1/4 Range	Variance	Standard Division	Standard Error	skewness	ST. Error skewness	kurtosis	ST. Error kurtosis
			-95.000%	+95.000%														
AG	101	0.19	0.11	0.27	0.1	0.1	2.6	0.1	0.1	2.5	0.0	0.15	0.39	0.04	5.03	0.24	25.49	0.48
AL	101	2.60	2.33	2.86	2.4	0.3	7.6	1.9	2.9	7.3	1.0	1.80	1.34	0.13	1.28	0.24	2.30	0.48
AS	101	39.76	9.45	70.07	9.0	1.0	1195.0	2.0	19.0	1194.0	17.0	23571.58	153.53	15.28	6.16	0.24	39.84	0.48
B	101	5.35	5.09	5.60	5.0	5.0	10.0	5.0	5.0	5.0	0.0	1.63	1.28	0.13	3.44	0.24	10.05	0.48
BA	101	726.84	552.67	901.01	562.0	3.9	5810.0	381.0	716.0	5806.1	335.0	778399.41	882.27	87.79	3.95	0.24	17.49	0.48
BE	101	0.56	0.49	0.63	0.5	0.3	1.7	0.3	0.8	1.5	0.6	0.13	0.36	0.04	1.12	0.24	0.64	0.48
BI	101	1.39	1.17	1.60	1.0	1.0	8.0	1.0	1.0	7.0	0.0	1.18	1.09	0.11	3.86	0.24	17.22	0.48
CA	101	1.30	0.77	1.83	0.3	0.0	15.0	0.2	1.0	15.0	0.9	7.25	2.69	0.27	3.67	0.24	14.56	0.48
CD	101	0.89	0.44	1.34	0.3	0.3	17.0	0.3	0.8	16.8	0.6	5.19	2.28	0.23	6.36	0.24	41.94	0.48
CO	101	19.57	16.55	22.60	17.8	3.2	139.5	12.0	22.5	136.3	10.5	234.34	15.31	1.52	5.22	0.24	38.01	0.48
CR	101	149.70	127.38	172.03	130.0	20.0	1130.0	120.0	150.0	1110.0	30.0	12788.91	113.09	11.25	6.87	0.24	57.68	0.48
CS	101	3.96	3.49	4.43	4.0	0.1	12.2	2.1	5.5	12.2	3.4	5.76	2.40	0.24	0.56	0.24	0.49	0.48
CU	101	107.50	39.14	175.85	29.0	1.0	3060.0	11.0	70.0	3059.0	59.0	119883.91	346.24	34.45	6.94	0.24	54.96	0.48
FE	101	5.05	4.51	5.59	4.5	0.3	15.0	3.8	5.3	14.7	1.5	7.45	2.73	0.27	1.98	0.24	4.67	0.48
GA	101	23.37	21.99	24.74	24.0	3.0	49.0	21.0	26.0	46.0	5.0	48.37	6.96	0.69	-0.16	0.24	2.73	0.48
HF	101	6.05	5.70	6.40	6.0	1.0	16.0	5.0	7.0	15.0	2.0	3.19	1.79	0.18	1.81	0.24	9.88	0.48
HG	101	0.53	0.51	0.55	0.5	0.5	1.0	0.5	0.5	0.5	0.0	0.01	0.12	0.01	3.78	0.24	12.57	0.48
K	101	0.32	0.25	0.39	0.2	0.0	1.7	0.1	0.4	1.7	0.3	0.11	0.34	0.03	2.32	0.24	5.66	0.48
LA	101	26.78	24.29	29.28	30.0	5.0	60.0	20.0	30.0	55.0	10.0	159.79	12.64	1.26	0.19	0.24	-0.33	0.48
MG	101	1.31	1.11	1.51	1.1	0.0	7.9	0.8	1.4	7.8	0.6	1.02	1.01	0.10	3.66	0.24	18.91	0.48
MN	101	835.09	725.08	945.10	677.0	100.0	3280.0	465.0	1020.0	3180.0	555.0	310557.98	557.28	55.45	1.88	0.24	4.68	0.48
MO	101	4.20	3.28	5.12	3.0	1.0	34.0	1.0	5.0	33.0	4.0	21.68	4.66	0.46	3.65	0.24	17.93	0.48
NA	101	0.06	0.04	0.08	0.0	0.0	0.5	0.0	0.1	0.5	0.0	0.01	0.11	0.01	2.83	0.24	7.77	0.48
NB	101	17.11	16.11	18.11	19.0	2.0	31.0	15.0	20.0	29.0	5.0	25.48	5.05	0.50	-1.01	0.24	1.89	0.48
NI	101	37.13	33.82	40.44	37.0	1.0	136.0	30.0	44.0	135.0	14.0	281.41	16.78	1.67	1.76	0.24	11.34	0.48
P	101	596.04	564.06	628.02	600.0	190.0	1090.0	500.0	680.0	900.0	180.0	26240.16	161.99	16.12	0.23	0.24	0.98	0.48
PB	101	71.39	-0.27	143.04	11.0	1.0	3440.0	5.0	22.0	3439.0	17.0	131752.16	362.98	36.12	8.45	0.24	76.51	0.48
RB	101	124.69	112.82	136.57	137.5	3.5	276.0	89.2	164.2	272.5	75.0	3618.81	60.16	5.99	-0.23	0.24	-0.22	0.48
S	101	3.53	0.10	6.95	0.2	0.0	102.0	0.0	0.7	102.0	0.7	300.49	17.33	1.72	5.60	0.24	30.08	0.48
SB	101	1.39	0.94	1.83	1.0	1.0	22.0	1.0	1.0	21.0	0.0	5.02	2.24	0.22	8.26	0.24	73.89	0.48
SC	101	2.88	2.22	3.54	2.0	0.5	22.0	1.0	3.0	21.5	2.0	11.06	3.33	0.33	2.96	0.24	11.32	0.48
SN	101	7.47	5.88	9.05	6.0	0.5	70.0	4.0	8.0	69.5	4.0	64.75	8.05	0.80	5.12	0.24	36.52	0.48
SR	101	140.74	110.90	170.59	92.4	4.2	772.0	35.8	177.8	767.8	142.0	22848.85	151.16	15.04	1.97	0.24	4.22	0.48
TA	101	1.39	1.29	1.49	1.4	0.3	4.1	1.1	1.5	3.9	0.4	0.27	0.52	0.05	1.63	0.24	8.27	0.48
TH	101	15.42	14.46	16.37	16.0	1.0	32.0	13.0	18.0	31.0	5.0	23.47	4.84	0.48	-0.36	0.24	2.33	0.48
TI	101	0.05	0.04	0.06	0.0	0.0	0.2	0.0	0.1	0.2	0.1	0.00	0.05	0.01	1.65	0.24	2.49	0.48
TL	101	0.57	0.53	0.62	0.5	0.5	2.0	0.5	0.5	1.5	0.0	0.06	0.25	0.02	4.27	0.24	20.61	0.48
U	101	3.10	2.64	3.56	2.7	0.3	18.8	2.3	3.1	18.6	0.8	5.49	2.34	0.23	4.81	0.24	27.05	0.48
V	101	146.38	135.69	157.07	154.0	2.5	313.0	118.0	177.0	310.5	59.0	2931.42	54.14	5.39	-0.22	0.24	1.05	0.48
W	101	4.69	3.99	5.39	4.0	0.5	31.0	3.0	5.0	30.5	2.0	12.61	3.55	0.35	4.89	0.24	32.04	0.48
ZN	101	320.02	83.44	556.60	91.0	13.0	9580.0	60.0	167.0	9567.0	107.0	1436229.26	1198.43	119.25	6.79	0.24	47.37	0.48
ZR	101	199.25	188.16	210.35	196.9	49.5	468.0	169.0	227.0	418.5	58.0	3160.09	56.21	5.59	1.42	0.24	6.51	0.48
Y	101	32.56	29.95	35.18	30.7	7.6	112.5	27.1	34.0	104.9	6.9	175.36	13.24	1.32	3.31	0.24	15.66	0.48
A.I	101																	

Table) Principal component analysis
(major elements)

	Eigenvalue	Proportion (%)	Accumulate Eigenvalue	Accumulate Proportion %
1	6.1549	14.3137	6.1549	14.3137
2	5.1783	12.0425	11.3331	26.3561
3	3.6319	8.4463	14.9651	34.8025
4	3.4551	8.0350	18.4201	42.8375
5	2.9636	6.8922	21.3837	49.7296
6	2.5906	6.0246	23.9743	55.7542
7	2.5256	5.8735	26.4999	61.6277
8	1.8049	4.1975	28.3048	65.8252
9	1.6375	3.8081	29.9423	69.6333
10	1.4148	3.2902	31.3571	72.9235
11	1.2568	2.9228	32.6139	75.8463
12	1.0544	2.4520	33.6683	78.2984
13	0.9339	2.1720	34.6023	80.4703
14	0.8656	2.0130	35.4678	82.4834
15	0.8140	1.8930	36.2818	84.3763
16	0.7904	1.8381	37.0722	86.2144
17	0.6794	1.5799	37.7516	87.7943
18	0.5673	1.3194	38.3189	89.1137
19	0.5620	1.3069	38.8809	90.4207
20	0.5447	1.2668	39.4256	91.6875
21	0.4594	1.0683	39.8850	92.7558
22	0.4025	0.9360	40.2875	93.6918
23	0.3469	0.8068	40.6344	94.4986
24	0.2921	0.6794	40.9265	95.1779
25	0.2606	0.6061	41.1871	95.7840
26	0.2504	0.5823	41.4375	96.3664
27	0.2168	0.5041	41.6543	96.8705
28	0.2008	0.4670	41.8551	97.3374
29	0.1721	0.4002	42.0272	97.7377
30	0.1431	0.3327	42.1703	98.0704
31	0.1362	0.3169	42.3065	98.3872
32	0.1282	0.2981	42.4347	98.6853
33	0.1134	0.2637	42.5481	98.9490
34	0.0902	0.2098	42.6383	99.1588
35	0.0792	0.1841	42.7174	99.3428
36	0.0698	0.1623	42.7872	99.5051
37	0.0526	0.1223	42.8398	99.6275
38	0.0431	0.1003	42.8829	99.7278
39	0.0372	0.0864	42.9201	99.8142
40	0.0347	0.0808	42.9549	99.8950
41	0.0238	0.0553	42.9786	99.9503
42	0.0141	0.0329	42.9928	99.9832
43	0.0072	0.0168	43.0000	100.0000

Table) Load Factor (Principal component analysis, major elements)

Factor	1	2	3	4	5	6	7	8	9	10	11
AG	−0.3828	0.3222	0.5642	−0.1802	0.5168	0.0859	0.1709	−0.0379	−0.0744	0.1083	0.0135
AL	−0.3603	0.5859	0.1178	0.3454	−0.3978	0.2872	0.0062	0.0087	0.0135	−0.1881	−0.0620
AS	0.1301	0.0567	0.5114	0.0763	−0.1685	−0.5392	0.0160	0.1040	0.3635	−0.0105	0.1271
B	0.1107	0.0142	0.5306	0.0870	−0.1584	−0.5314	−0.0879	−0.1912	0.0610	−0.0835	0.0728
BA	0.3541	−0.0727	−0.1670	−0.1947	0.1117	−0.0755	0.6617	0.1104	−0.2521	−0.0832	0.1321
BE	0.4037	0.0530	0.4756	0.2928	−0.0491	−0.2494	−0.1524	0.0851	−0.0092	−0.1451	−0.1096
BI	−0.2266	0.2240	−0.2704	0.2585	−0.1041	−0.3234	−0.0366	0.3167	−0.2721	0.2890	0.1437
CA	−0.4828	−0.5109	−0.0556	0.0201	−0.0419	−0.0856	0.2628	0.2434	0.2108	−0.0912	−0.1200
CD	−0.5053	0.4784	0.3406	−0.1806	0.5497	0.0898	0.1153	0.0214	0.0471	−0.0492	0.0202
CO	−0.4482	0.5026	−0.0048	−0.0875	−0.2057	−0.1293	−0.2558	0.2074	−0.3247	0.2001	0.3052
CR	−0.0248	−0.1492	0.5641	0.0208	−0.2006	−0.1455	0.0123	−0.3931	−0.3268	0.3226	0.0849
CS	0.5119	−0.1029	0.4795	−0.0133	−0.1263	−0.1586	0.1751	0.2700	−0.2710	−0.1273	−0.2203
CU	−0.2006	0.6087	−0.0521	0.4345	0.0098	−0.3393	0.2195	0.0478	0.0823	0.1992	−0.0519
FE	−0.3894	0.8066	−0.0186	0.0220	−0.2102	−0.0390	−0.1576	−0.0331	−0.0655	−0.1632	0.0974
GA	0.4511	0.7044	−0.0042	−0.1826	−0.1584	0.2225	0.0862	−0.0014	−0.0121	−0.1530	0.0140
HF	0.3694	0.0706	−0.0413	0.6071	0.3377	0.0061	−0.3341	−0.3414	−0.1946	0.0375	−0.0790
HG	0.0118	0.0928	0.1652	0.0871	−0.1615	−0.0602	−0.1636	−0.2239	0.0803	−0.5690	0.3953
K	0.1205	−0.1576	0.5625	0.3975	−0.1741	0.3594	0.0308	0.3904	−0.1002	−0.0668	−0.1710
LA	0.6533	0.1144	0.0480	−0.0617	−0.0737	0.0840	0.1812	0.1293	0.1588	0.1096	0.2731
MG	−0.3535	0.5570	−0.0565	0.2845	−0.3803	0.0121	0.2895	−0.1049	0.0857	−0.0289	−0.2468
MN	−0.5456	0.2665	−0.1087	−0.1206	−0.1898	−0.2359	−0.0271	0.2522	0.0883	−0.2404	−0.1975
MO	0.1588	0.3003	−0.2318	0.3255	0.0324	−0.1901	0.5532	0.0282	−0.0862	0.1750	−0.1609
NA	0.0596	−0.2025	0.5328	0.5536	−0.0560	0.2538	0.0507	0.1688	−0.0984	−0.0840	0.1122
NB	0.7207	0.4457	−0.0116	−0.1329	0.0376	0.2843	−0.1964	0.1023	0.1477	0.0874	0.1010
NI	0.0072	0.1398	0.3935	−0.5314	−0.2731	0.0927	0.0819	−0.3048	−0.2958	0.3165	−0.0612
P	0.3348	0.1638	0.0917	−0.3475	−0.3614	0.0843	0.2234	−0.2653	−0.0568	−0.2286	0.2604
PB	−0.4261	0.4260	0.3716	−0.1758	0.5423	0.1342	0.1084	0.0287	0.0727	−0.0385	−0.0289
RB	0.7039	0.1187	0.1432	−0.3784	−0.0095	−0.0801	0.0004	0.2861	−0.2323	−0.0423	−0.1813
S	−0.1806	−0.0190	−0.0359	−0.1466	−0.2617	0.1682	0.0499	−0.3109	0.1979	0.2971	−0.1828
SB	0.1104	0.0178	0.4864	0.0300	−0.1794	−0.5177	0.0432	0.0110	0.2775	0.2596	0.0534
SC	−0.4824	0.1625	0.0875	0.2760	−0.4410	0.3338	0.0907	−0.1793	0.1556	0.1212	−0.0671
SN	0.2839	0.1358	−0.0275	−0.0348	0.1864	−0.0865	−0.1774	0.1474	0.4251	0.2910	0.2226
SR	−0.1504	−0.4676	0.0622	0.1683	−0.0726	0.3092	0.2509	0.1625	0.2678	0.2546	0.2973
TA	0.5498	0.4173	−0.0534	−0.0924	0.1122	0.1683	−0.2695	0.1303	0.1843	0.1125	−0.1043
TH	0.6592	0.5556	−0.0901	0.1533	0.0563	0.1530	−0.0670	0.0451	0.2132	0.0492	0.0353
TI	−0.0459	−0.2030	0.4053	0.3669	−0.0953	0.5882	−0.0039	0.2805	−0.0271	0.1096	0.0543
TL	0.2057	0.0258	0.0177	−0.0935	0.0842	−0.2897	−0.1979	0.0815	0.1704	−0.0363	−0.4380
U	0.3917	0.1850	−0.1810	0.1774	0.1461	−0.1022	0.7079	−0.0081	−0.1851	−0.0454	0.1044
V	0.2941	0.2234	0.1461	−0.5144	−0.4207	0.2646	−0.0575	−0.0038	0.0386	0.1283	−0.2470
W	−0.2011	0.4177	−0.2731	0.0365	−0.1406	−0.1017	−0.3478	0.4138	−0.3062	0.1290	0.1381
ZN	−0.3655	0.3819	0.3898	−0.2353	0.6287	0.0935	0.0932	0.0226	0.0438	−0.0265	0.0012
ZR	0.3459	0.0011	−0.0395	0.5806	0.3769	0.0245	−0.3450	−0.2979	−0.2454	0.0533	−0.0803
Y	0.3585	0.4231	−0.1697	0.4489	0.0570	0.0287	0.3438	−0.2543	0.1935	0.0061	−0.0435
説明済	6.1549	5.1783	3.6319	3.4551	2.9636	2.5906	2.5256	1.8049	1.6375	1.4148	1.2568
寄与率	0.143137	0.120425	0.084463	0.08035	0.068922	0.060246	0.058735	0.041975	0.038081	0.032902	0.029228

Table) Result of REE analysis sedimentary rocks

Sample No.	02MR-K001	02MR-K002	02MR-K003	02MR-K004	02MR-K005	02MR-K006	02MR-K007	02MR-K008	02MR-K009	02MR-K010	02MR-K011	02MR-K012
Locality	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra
Rock name	Scihst	Shale	Shale	Shale	Hornfels	Schist	Schist	Schist	Shale	Shale	Schist	Shale
La(ppm)	35.8	48.9	32.8	54.3	32.7	52.4	55.5	45.8	45	30	48.7	36.9
Ce	78.4	108.9	70.5	121	68.9	113	121.2	97.8	92.8	66.4	101.2	79.4
Pr	8.8	13.6	8	14	7.9	12.5	14.1	11	10.4	7.5	11.5	9.2
Nd	32.1	52.4	29.7	52.9	30.3	45	52.7	40.4	38.8	27.6	42.9	34.2
Sm	6.4	12.1	6.2	10.7	6.2	9	10.6	7.7	7.3	5.5	8.1	6.9
Eu	1.4	1.9	1.6	1.8	1.2	1.7	1.8	1.5	1.6	1.2	2.6	2.5
Gd	6.1	12.7	6.3	11.5	5.8	8.8	10.5	7.7	7.6	5.9	7	6.8
Tb	0.9	2.1	1	1.9	0.8	1.2	1.6	1.1	1	0.8	1.1	1
Dy	4.9	13.5	5.1	10.7	4.4	6.7	9.8	5.9	5.9	4.3	5.8	5.6
Ho	1	2.9	1	2	0.9	1.3	2.2	1.1	1.1	0.9	1.3	1.1
Er	2.8	9.6	2.9	5.3	2.6	3.9	6.5	3.5	3.6	2.5	3.4	3.2
Tm	<0.5	1.5	<0.5	0.7	<0.5	0.5	0.9	<0.5	0.5	<0.5	0.5	<0.5
Yb	2.7	10.1	2.5	3.9	2.4	3.5	5.7	2.8	3.3	2.4	3.5	2.8
Lu	0.4	1.5	0.3	0.6	0.4	0.5	0.9	0.5	0.5	0.4	0.5	0.5
Y	26.2	85	26.6	59.6	22.7	34.5	62.8	31.9	31.9	23.4	34.8	31.1

Sample No.	02MR-K013	02MR-K014	02MR-K015	02MR-K016	02MR-K017	02MR-K018	02MR-K019	02MR-K020	02MR-K021	02MR-K022	02MR-K023	02MR-K024
Locality	Khwadra	Khwadra	Khwadra	Khwadra	Khwadra	Saf Safa	Saf Safa	Saf Safa	Saf Safa	Saf Safa	Saf Safa	Kerkoze
Rock name	Shale	Schist	Shale	Schist	Slate	Slate	Slate	Schist	Slate	Shale	Schist	Shale
La(ppm)	48.8	50.8	24.1	52.1	44.8	39.8	35.1	28	51.5	40.2	75.2	52.4
Ce	105.6	108.8	51.8	111.9	93.1	84.9	71	55.3	104.7	85.6	148.4	107.2
Pr	11.8	12.2	6	12.5	10.7	10.1	8.2	6.5	13	10.4	18.8	12.4
Nd	41.8	45.2	24.2	46.8	39.9	37.7	32.6	23.7	48.2	40.5	69	44.5
Sm	8.1	8.9	4.9	8.8	7.5	7.4	5.9	4.7	9.1	8.9	12.4	8.2
Eu	1.8	1.9	1.6	1.8	1.3	1.6	1.2	1.3	1.5	1.6	2.1	1.8
Gd	8.2	8.7	4.5	7.8	6.5	7.3	5.6	5.1	8.9	8.5	12	7.9
Tb	1.1	1.3	0.7	1.1	1	1	0.8	0.8	1.1	1.3	1.6	1
Dy	6.2	6.9	3.7	6.1	5.4	5.7	4.5	4.2	6.1	7.3	8.4	5.7
Ho	1.2	1.3	0.8	1.3	1.2	1.1	1	0.9	1.2	1.5	1.8	1.2
Er	3.4	3.8	2.1	3.7	3.3	3.6	2.8	2.9	3.7	4.6	5.4	3.6
Tm	0.5	0.5	<0.5	0.6	0.5	0.5	<0.5	<0.5	0.5	0.6	0.7	0.5
Yb	3.1	3.6	1.9	3.7	3.3	3.4	2.9	2.9	3.3	4	4.8	3.3
Lu	0.5	0.5	0.3	0.6	0.5	0.5	0.5	0.4	0.5	0.6	0.7	0.5
Y	32	36.2	21.3	32.1	31.3	33.7	29	27.7	34.5	46.5	54.5	33

Sample No.	02MR-K025	02MR-K026	02MR-K027	02MR-K028	02MR-K029	02MR-K030	02MR-K031	02MR-K032	02MR-K033	02MR-K034	02MR-K035	02MR-K036
Locality	S_Kerkoze	K Aiche	N_Bensliman	Lachach	J_ Hadat	J_Hadat	J_Hadat	K_Aicha	K_Aicha	K_Aicha	K_Aicha	K_Aicha
Rock name	Shale	Sandstone	Shale	Shale	Shale	Sandstone	Limestone	Slate	Shale	mudstone	Shale	Shale
La(ppm)	48.9	14.8	37.2	51.1	34.7	22.1	17	29.8	45.8	42.5	35.1	37.2
Ce	107.2	35.9	86.9	105.2	74.6	49.9	25.9	68	96.8	88.6	76.1	77.2
Pr	11.8	3.8	9.3	11.9	8.7	5.7	4.2	7.9	11	9.7	8.4	8.7
Nd	43.7	14.7	33.2	43.6	31.9	21.6	16.7	28.4	39.5	35.1	30.9	31.6
Sm	8.6	3.6	7.4	8.4	6.2	4.5	3.4	5.9	8.3	7.1	6.4	6.2
Eu	1.6	1.3	1.8	1.4	1.5	1.4	0.8	1.1	1.3	1.4	1.3	1.2
Gd	8.2	3.7	6.9	8.1	6.4	4.4	3.8	5.8	7.2	6.5	6.2	6.1
Tb	1.2	0.6	1.1	1.1	1	0.7	0.5	0.9	1	0.9	0.9	0.9
Dy	6.5	3.7	6.2	5.8	5.3	3.6	3	4.7	5.6	5.1	4.8	4.5
Ho	1.3	0.8	1.3	1.1	1.1	0.7	0.6	0.9	1.1	1	1	0.9
Er	4	2.2	3.9	3.3	3.3	2.2	1.8	2.9	3.5	3.3	3.1	2.8
Tm	0.6	<0.5	0.5	<0.5	0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5
Yb	3.8	2	3.6	3.3	3.1	2.2	1.5	2.9	3.3	2.8	2.8	2.9
Lu	0.5	0.3	0.5	0.5	0.5	0.3	0.2	0.4	0.5	0.4	0.4	0.4
Y	35.6	21.1	36.3	30.7	30.8	20.8	19	25.6	31.7	29.2	28.4	25.5

Sample No.	02MR-K037	02MR-K038	02MR-K039	02MR-K040	02MR-K041	02MR-K042	02MR-K043	02MR-K044	02MR-K046	02MR-K047	02MR-K048	02MR-K049
Locality	K_Aicha	Benslieman	Benslieman	Benslieman	Lachach	Lachach	Lachach	Lachach	Amzoourh	Imarine	Tameslouht	Tameslouht
Rock name	Shale	mudstone	Schist	Schist	Schist	Schist	Schist	Sandstone	Shale	Shale	Quatzite	Limestone
La(ppm)	48	47.5	52.2	51.6	48.1	36.7	46.2	37	50.9	30.5	18.5	15.1
Ce	101.6	102.6	115.4	105	100.2	76.8	92.8	75.4	101	59.9	38.1	27.6
Pr	11.3	11.1	12.9	12	11	8.8	10.6	8.6	12.2	7	4.3	3.4
Nd	40.9	40.8	48.1	41.4	38.8	30.8	37.3	31.6	43.6	25.2	15.8	13.6
Sm	7.8	8.1	9.1	8.3	7.5	6	7.4	6.1	9	5.1	3	3.1
Eu	1.4	1.7	1.5	1.8	1.7	0.8	1.5	1.4	2.2	1.1	0.6	1.4
Gd	7.9	7.7	8.8	7.7	7.2	5.7	6.6	5.7	8.9	5.2	3	3.2
Tb	1.1	1.1	1.2	1.1	1.1	0.9	1	0.9	1.4	0.8	0.5	0.5
Dy	6.1	6.1	5.9	5.8	6	4.5	5.7	5	7.1	4.7	2.7	2.9
Ho	1.2	1.1	1.1	1.3	1.3	1	1.2	1.1	1.5	1	0.6	0.6
Er	3.6	3.5	3.3	3.4	3.6	2.8	3.4	2.8	3.9	2.7	1.7	1.6
Tm	0.5	0.5	0.5	0.5	0.5	<0.5	0.5	0.5	0.6	<0.5	<0.5	<0.5
Yb	3.2	3.3	2.6	3.3	3.4	2.7	3.1	2.9	3.7	2.6	1.9	1.3
Lu	0.5	0.5	0.4	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.3	0.2
Y	32.8	32.3	29.5	32.2	32.9	25.7	32	27.8	38.5	26.4	16.8	17.1

Sample No.	02MR-K050	02MR-K051	02MR-K052	02MR-K053	02MR-K054	02MR-K055	02MR-K056	02MR-K057	02MR-K058	02MR-K059	02MR-K061	02MR-K062
Locality	Hajar	Hajar	Hajar	Hajar	Hajar	Hajar	Hajar	Hajar	Hajar	Hajar	Hajar	Hajar
Rock name	Sandstone	Hornfels	Shale	Sandy shale	Ore-schit	Ore-schit	Schist	Sandy shale	Tuff	Shale	Shale	Shale
La(ppm)	40.8	52.8	46.7	49.6	3.8	46.9	42.4	27.8	48.7	41.8	44.9	47.1
Ce	82.9	105.5	95.1	100.5	8.6	94.4	87.9	59.8	97.8	83.5	89.6	89.8
Pr	9.7	12	10.9	11.3	1.1	10.3	10.2	7.3	11.1	9.7	10.2	10.4
Nd	34.5	41.7	38.4	38.6	4.6	36.1	35.8	27.7	38.7	34	36.2	36.4
Sm	6.7	7.9	7.8	7.3	1	7	7.3	5.6	7.4	6.9	7.1	7.1
Eu	1.6	1.9	1.6	1.6	0.1	1.5	0.4	0.4	1.6	1.3	1.1	1.3
Gd	6.5	7.2	7.1	6.7	1.2	6.5	6.8	5.3	6.9	6.4	6.3	6.4
Tb	1	1	1.1	1	0.2	1	1	0.8	1	0.9	0.9	1
Dy	5.2	5.4	5.6	5.4	1	4.9	5.2	4.4	5.7	5	4.9	5.3
Ho	1.2	1.1	1.2	1.2	0.3	1.1	1.1	0.9	1.2	1.1	1	1.1
Er	3.2	3.1	3.4	3.1	0.9	3	2.9	2.9	3.5	3	3	3.1
Tm	0.5	0.5	0.5	0.5	<0.5	0.5	0.5	<0.5	0.5	0.5	<0.5	0.5
Yb	3	3.1	3.2	2.9	1.2	2.9	2.9	2.7	3.5	2.8	3	3
Lu	0.5	0.5	0.5	0.4	0.2	0.4	0.4	0.4	0.5	0.4	0.5	0.5
Y	30.7	28.2	31.4	29.5	7.6	27.3	27.1	26	31.6	27.9	26.6	27.9

Sample No.	02MR-K063	02MR-K064	02MR-K065	02MR-K067	02MR-K068	02MR-K069	02MR-K070	02MR-K071	02MR-K072	02MR-K073	02MR-K074	02MR-K075
Locality	Hajar	Algeida	Algeida	Frag el Ma	Sid Bau East	Sid Bau East	Jbwl_Sarhlef	Jbwl_Sarhlef	Jbwl_Sarhlef	Frizem	Frizem	Frizem
Rock name	Shale	Schist	Schist	Schist	Sandy shale	Shale	Shale	Schist	Shale	Shale	Shale	Shale
La(ppm)	56.2	50.7	54	52.7	27.2	53.8	47.3	10.8	53.5	48.4	71.8	51.8
Ce	115.8	103.6	110.1	102.5	56.2	107	96.3	23	109	98.7	146	99.4
Pr	13.1	12	12.7	11.9	7.1	12.3	11.2	3.3	12.8	11.7	17	11.5
Nd	46.4	41.7	44.7	41.8	26.3	43.6	37.8	14.9	43.6	40	59.4	39.6
Sm	9.2	7.7	8.9	7.9	5.4	8.6	7.5	4.6	8.9	8	12.4	8
Eu	2.1	1.9	2	1.2	1.1	1.4	1.5	2.1	2.2	1.8	1.4	1.3
Gd	9	6.9	8.2	7.2	4.9	7.3	6.8	5.7	8.3	7.3	10.7	7.2
Tb	1.4	1	1.2	1.1	0.8	0.9	1	1.1	1.6	1.3	1.5	1.2
Dy	7.3	5.2	6.4	5.9	4.3	5	5.4	6.6	6.2	5.8	8.1	5.3
Ho	1.6	1.2	1.3	1.3	1	1	1.2	1.4	1.3	1.2	1.7	1.2
Er	4.2	3.2	3.7	3.5	2.9	3	3.2	3.8	4.1	3.6	4.8	3.4
Tm	0.6	0.5	0.6	0.6	<0.5	0.5	0.5	0.6	0.9	0.7	0.7	0.6
Yb	3.7	3.3	3.8	3.7	2.9	3.4	3.1	3.5	4.1	3.5	4.5	3.3
Lu	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.9	0.7	0.7	0.6
Y	41.2	28.1	33.6	33.9	24	27.1	29	36.8	36.4	31.2	42.4	31

Sample No.	02MR-K076	02MR-K077	02MR-K079	02MR-K080	02MR-K081	02MR-K082	02MR-K083	02MR-K084	02MR-K085	02MR-K086	02MR-K087	02MR-K088
Locality	Frizem	Frizem	Frizem	Frizem	Frizem	Frizem	Frizem	Kettara	Kettara	Draa_Sfar	Draa_Sfar	Draa_Sfar
	Schist	Schist	Shale	Limestone	Sandy slate	Shale	Slate	Shale	Shale	Shale	Shale	Shale
La(ppm)	36.1	52.7	55.5	3.9	41.7	10.5	51.6	44.2	49.6	37.2	40.9	52.2
Ce	75.3	102.1	106	10.8	83.5	21.6	102.8	85.3	96.4	79.7	84.6	101.4
Pr	9	12	11.6	1.5	9.3	2.3	11.7	9.6	10.4	8.6	9.5	11.6
Nd	31.1	44.2	42.9	8.9	34.7	9.8	43.9	35.6	38.1	32.9	36.1	42.7
Sm	6.5	8.9	8.1	2.8	6.4	2.1	8.4	6.7	6.7	6.2	7	8.1
Eu	0.6	1.7	1.2	0.6	1.3	0.4	1.1	1.4	1.1	1.4	1.3	1.7
Gd	5.8	9.4	8.5	3.5	6.6	2.5	8.3	7.2	7.5	6.3	7.5	8.8
Tb	1	1.4	1.2	0.7	1	0.4	1.1	1	1.1	0.9	1.3	1.2
Dy	4.4	7.5	5.9	4.6	5.2	2.2	5.7	5.2	6.1	4.8	8.1	6.5
Ho	0.9	1.5	1.3	1.1	1.1	0.5	1.1	1.2	1.3	1	1.9	1.4
Er	2.7	4.3	3.5	2.8	3.3	1.6	3.4	3.4	3.6	3.1	5.8	4
Tm	0.5	0.6	0.5	<0.5	0.5	<0.5	0.5	0.5	0.5	<0.5	0.9	0.6
Yb	2.6	3.6	3	2.6	3.3	1.9	3	2.9	3.3	2.8	5.1	3.5
Lu	0.5	0.6	0.5	0.4	0.5	0.3	0.5	0.5	0.5	0.5	0.7	0.5
Y	24.2	39.9	30.6	26.3	29.7	14	29.5	30.1	34	27.3	50.2	34.5

Sample No.	02MR-K089a	02MR-K089b	02MR-K090	02MR-K091	02MR-K092	02MR-K093	02MR-K094	02MR-K095	02MR-K096	02MR-K097	02MR-K098	02MR-K101
Locality	Draa_Sfar	Draa_Sfar	Draa_Sfar	Draa_Sfar	Draa_Sfar	Draa_Sfar	Draa_Sfar	Draa_Sfar	Draa_Sfar	Draa_Sfar	Draa_Sfar	Si Gedi Haja
	Shale	Shale	Sandy shale	Shale	Shale	Shale	Shale	Shale	Shale	Shale	Slate	Tuff-shist
La(ppm)	61.7	50.4	35.6	44.1	35.9	52.3	47.6	72.6	46.2	50.9	52.3	38
Ce	124.8	99.8	72.9	96.1	71.9	103.4	97.1	136.2	92.9	102.5	103.6	74.6
Pr	14.1	11	8.2	11.4	8.1	11.4	10.9	15	10.3	11.4	11.7	8.7
Nd	52.7	42.4	31.8	44.4	31.5	43.9	40.1	55.8	38	43.1	42.8	32.7
Sm	12.1	8.2	6.5	10.3	6.4	8.3	7.6	10.6	7.4	8.4	7.6	6.2
Eu	0.8	1.7	2.1	0.8	1.6	1.6	1.5	2.3	1.7	1.7	1.2	1.4
Gd	15.6	8	6.7	11.7	6.2	8	8	10.3	7.3	8.7	7.7	6.1
Tb	2.8	1.2	1	2.1	0.8	1.1	1.1	1.4	1	1.3	1.1	0.9
Dy	19	6	5.4	12.6	4.9	5.5	5.9	6.7	5.4	6.7	5.2	4.5
Ho	4.1	1.3	1	2.7	1	1.2	1.2	1.3	1.1	1.4	1.1	1
Er	11.8	3.6	3.2	8.2	2.8	3.5	3.5	3.7	3.1	3.8	3	2.7
Tm	1.8	0.6	0.5	1.2	<0.5	0.5	0.5	0.5	0.5	0.6	0.5	<0.5
Yb	10.6	3.4	2.8	7.1	2.5	3	3.1	3.2	2.5	3.6	2.9	2.4
Lu	1.6	0.5	0.4	1.2	0.4	0.5	0.5	0.5	0.4	0.6	0.5	0.4
Y	112.5	33.4	29.2	75.2	26.6	32.2	30.6	35.2	28.5	35.2	28.3	26.2

Sample No.	02MR-S043	02MR-S044	02MR-S045	02MR-S046	02MR-S047
Locality	Kettara	Kettara	Kettara	Kettara	Kettara
Drillhole No.	F4BS	F4BS	BS2	104	104
	Schist	Schist	Schist	Schist	Schist
	HW?	FW?	FW?	FW?	HW?
La(ppm)	49.8	14.4	49.9	53.7	57.1
Ce	97.7	34.5	94.7	106.7	112.2
Pr	11.1	3.9	10.1	12.2	12.6
Nd	41.2	16.1	36.4	45.9	47.7
Sm	8.1	3.4	6.7	8.7	9.6
Eu	1.7	0.3	1.5	1.7	1.8
Gd	7.9	3.3	6.7	9	9
Tb	1.1	0.5	0.9	1.3	1.3
Dy	5.7	2.7	4.8	6.7	6.9
Ho	1.2	0.7	1	1.5	1.5
Er	3.5	1.8	3.1	4	4.3
Tm	0.5	<0.5	0.5	0.6	0.6
Yb	3.1	1.8	2.9	3.6	3.7
Lu	0.5	0.3	0.5	0.6	0.6
Y	32.1	16.1	26.2	36.8	36.9

	NASC *1	Chondrite *2
La(ppm)	32	0.367
Ce	73	0.957
Pr	7.9	0.137
Nd	33	0.711
Sm	5.7	0.231
Eu	1.24	0.087
Gd	5.2	0.306
Tb	0.85	0.058
Dy	5.8	0.381
Ho	1.04	0.0851
Er	3.4	0.249
Tm	0.5	0.0356
Yb	3.1	0.248
Lu	0.48	0.0381
TREE	173.21	3.8908
LaN/YbN	6.97547684	1
LaN/SmN	3.53362971	1
Eu/Eu*	0.69603333	1

*1 North American Shale Composite; Haskin et al., 1968; Gromet et al., 1984
*2 Tayler & McLennan, 1985

Table-) Result of Sulfur Isotope analysis of Sedimentary rocks

	Sample No.	Locality	Rocks	$d^{34}S$	S(%)
1	02MR-K001	Khwadra	Scihst	-8.8	0.04
2	02MR-K002	Khwadra	Shale	-7.2	0.04
3	02MR-K003	Khwadra	Shale	-15.2	3.90
4	02MR-K004	Khwadra	Shale	8.5	0.64
5	02MR-K005	Khwadra	Hornfels	-18.6	0.81
6	02MR-K006	Khwadra	Schist	3.5	0.08
7	02MR-K007	Khwadra	Schist	-13.5	2.17
8	02MR-K008	Khwadra	Schist	-10.5	0.01
9	02MR-K009	Khwadra	Shale	-14.5	0.13
10	02MR-K010	Khwadra	Shale	-21.0	0.10
11	02MR-K011	Khwadra	Schist	-17.1	1.21
12	02MR-K012	Khwadra	Shale	-13.7	0.47
13	02MR-K013	Khwadra	Shale	1.1	0.19
14	02MR-K014	Khwadra	Schist	-9.9	0.05
15	02MR-K015	Khwadra	Shale	-22.3	0.38
16	02MR-K016	Khwadra	Schist	-14.6	0.66
17	02MR-K017	Khwadra	Slate	-10.4	0.15
18	02MR-K018	Sabsafa	Slate	20.8	0.07
19	02MR-K019	Sabsafa	Slate	13.3	0.97
20	02MR-K020	Sabsafa	Schist	10.9	1.69
21	02MR-K021	Sabsafa	Slate	11.5	0.33
22	02MR-K022	Sabsafa	Shale	11.9	0.92
23	02MR-K023	Sabsafa	Schist	11.9	2.63
24	02MR-K024	Kerkoze	Shale	10.8	0.03
25	02MR-K025	S_Kerkoze	Shale	-1.5	0.02
26	02MR-K026	K Aiche	Sandstone	6.2	0.02
27	02MR-K027	N_Benslima	Shale	10.1	0.02
28	02MR-K028	Lachach	Shale	23.2	0.03
29	02MR-K029	J_Hadat	Shale	-9.5	0.02
30	02MR-K030	J_Hadat	Sandstone	-12.0	0.03
31	02MR-K031	J_Hadat	Limestone	-10.7	0.03
32	02MR-K032	K_Aicha	Slate	-23.9	0.90
33	02MR-K033	K_Aicha	Shale	-31.4	1.08
34	02MR-K034	K_Aicha	Shale	-36.0	2.14
35	02MR-K035	K_Aicha	Shale	-18.7	3.50
36	02MR-K036	K_Aicha	Shale	-31.9	0.01
37	02MR-K037	K_Aicha	Shale	-16.9	0.04
38	02MR-K038	Benslieman	Shale	2.0	0.17
39	02MR-K039	Benslieman	Schist	0.6	0.06
40	02MR-K040	Benslieman	Schist	-8.5	0.02
41	02MR-K041	Lachach	Schist	-1.9	0.27
42	02MR-K042	Lachach	Schist	-2.7	1.13
43	02MR-K043	Lachach	Schist	-11.0	0.06
44	02MR-K044	Lachach	Sandstone	-6.6	0.16
45	02MR-K046	Amzoourh	Shale	-2.2	0.03
46	02MR-K047	Imarine	Shale	1.4	0.66
47	02MR-K048	Tameslouht	Quatzite	-2.2	0.05
48	02MR-K049	Tameslouht	Limestone	5.8	0.04
49	02MR-K050	Hajar	Sandstone	2.8	0.03
50	02MR-K051	Hajar	Hornfels	-0.1	0.14
51	02MR-K052	Hajar	Shale	2.2	1.16
52	02MR-K053	Hajar	Sandy shale	-2.8	0.07
53	02MR-K054	Hajar	Shale	3.4	3.85
54	02MR-K055	Hajar	Shale	7.7	1.92
55	02MR-K056	Hajar	Schist	3.1	0.07
56	02MR-K057	Hajar	Sandy shale	4.4	0.04
57	02MR-K058	Hajar	Tuff	2.0	1.31
58	02MR-K059	Hajar	Shale	4.1	0.04
59	02MR-K061	Hajar	Shale	5.0	0.03
60	02MR-K062	Hajar	Shale	0.7	0.65
61	02MR-K063	Hajar	Shale	-2.9	0.18
62	02MR-K064	Algeida?	Schist	17.7	0.70
63	02MR-K065	Algeida?	Schist	17.1	0.57
64	02MR-K066	Frag el Ma	Shale	19.5	5.05
65	02MR-K067	Frag el Ma	Schist	14.9	0.01
66	02MR-K068	Sid Bau Eas	Sandy shale	-3.0	0.32
67	02MR-K069	Sid Bau Eas	Shale	5.8	0.04
68	02MR-K070	Jbwl_Sarhle	Shale	3.0	0.03
69	02MR-K071	Jbwl_Sarhle	Schist	4.0	0.03
70	02MR-K072	Jbwl_Sarhle	Shale	9.2	0.02
71	02MR-K073	Frizem	Shale	-0.5	0.16
72	02MR-K074	Frizem	Shale	-0.2	1.91
73	02MR-K075	Frizem	Shale	-0.2	1.25
74	02MR-K076	Frizem	Schist	0.4	0.13
75	02MR-K077	Frizem	Schist	-8.0	0.33
76	02MR-K079	Frizem	Shale	-2.9	0.82
77	02MR-K080	Frizem	Limestone	-0.7	0.05
78	02MR-K081	Frizem	Sandy slate	-0.8	0.52
79	02MR-K082	Frizem	Shale	-1.0	0.55
80	02MR-K083	Frizem	Slate	0.2	0.19
81	02MR-K084	Kettara	Shale	-0.9	0.04
82	02MR-K085	Kettara	Shale	3.5	0.03
83	02MR-K086	Draa_Sfar	Shale	3.7	0.03
84	02MR-K087	Draa_Sfar	Shale	-15.3	0.03
85	02MR-K088	Draa_Sfar	Shale	-7.9	0.06
86	02MR-K089-a	Draa_Sfar	Shale	-6.7	0.77
87	02MR-K089-b	Draa_Sfar	Shale	-4.7	0.73
88	02MR-K090	Draa_Sfar	Sandy shale	-0.4	0.37
89	02MR-K091	Draa_Sfar	Shale	-13.6	0.05
90	02MR-K092	Draa_Sfar	Shale	-0.1	0.04
91	02MR-K093	Draa_Sfar	Shale	-5.7	0.32
92	02MR-K094	Draa_Sfar	Shale	-3.1	0.73
93	02MR-K095	Draa_Sfar	Shale	1.8	0.05
94	02MR-K096	Draa_Sfar	Shale	0.5	0.17
95	02MR-K097	Draa_Sfar	Shale	-4.6	0.07
96	02MR-K099	Draa_Sfar	Slate	-7.3	0.78
97	02MR-K101	Si Gedi Haja	Tuff-shist	-4.9	0.04
98	02MRS0043	Kettara	Schist	-5.7	0.22
99	02MRS0046	Kettara	Schist	-0.1	0.04
100	02MRS0047	Kettara	Schist	-0.6	1.98

Table-) Staricrics of Sulfur Isotope analysis of Sedimentary rocks

			confidence interval					Lower	Upper		1/4		Standard	Standard		ST. Error		ST. Error
	Case	Mean	-95.000%	+95.000%	Mode	Max	Min	1/4	1/4	Range	Range	Variance	Division	Error	skewness	skewness	kurtosis	kurtosis
d34S	100	-2.3976	-4.5828	-0.2123	-0.7401	-35.9627	23.1801	-8.6368	3.5092	59.1427	12.1460	121.2878	11.0131	1.1013	-0.4320	0.2414	0.7919	0.4783