

参考文献

周藤賢治、小山内康人、岩石学概論、共立出版社、2002.

Bauchau, C.M., Ferrari, P.O., The Hajar massive sulfide deposit, Morocco, and its geological environment, Mineral Deposits; Processes to Processing, Stanley et al. (eds), 479-482, London, 1999.

Deew, W. A., Howie, R. A., Zussman, J., An introduction to the Rock Forming Minerals, 2<sup>nd</sup> Edition, Longman, 1992.

Essaifi, A., Capdevila, R., Lagarde, JL., Transformation de leucogabbros en chloritoschistes sous l'effet de l'alteration hydrothermale et de la deformation dans l'intrusion de Kettara (Jebilet, Maroc), C.R. Acad. Sci. Pris. t320, serie II a; 189-196, 1995.

Hibti, M., Les amas sulfures des Guemassa et des Jebilet (Meseta sud-occidentale, Maroc; temoins de l'hydrothermalisme precoce dans basin mesetien, these docteur, Universite Marrakech, 2001.

Hofmann, A., Chemical differentiation of the Earth; the relationship between mantle, continental crust, and oceanic crust, Earth Planet. Sci. Lett, 90, 297-314, 1988.

Piercey, S.J., Paradis, S., Murphy, D.C., Mortensen, J.K., Geochemistry and paleotectonic setting of felsic volcanic rocks in the Finlayson Lake volcanic-hosted massive sulfide district, Yukon, Canada, Economic Geology, vol.96, 1877-1905, 2001.

Thieblemont, D., Pascual, E., Stein, G., Magmatism in the Iberian pyrite belt; petrological constraints on a metallogenic model, Mineralium Deposita, 33, 98-110, 1998.

資源開発協力基礎調査報告書 モロッコ王国ハウズ平原地域 第1年次、国際協力事業団・金属鉱業事業団、1988

資源開発協力基礎調査報告書 モロッコ王国ハウズ平原地域 第2年次、国際協力事業団・金属鉱業事業団、1989

資源開発協力基礎調査報告書 モロッコ王国ハウズ平原地域 第3年次、国際協力事業団・金属鉱業事業団、1990

資源開発協力基礎調査報告書 モロッコ王国ハウズ平原地域 総括、国際協力事業団・金属鉱業事業団、1990

平成13年度 資源開発協力基礎調査報告書 プロジェクト選定調査報告書 モロッコ王国、(財)国際鉱物資源開発協力協会、2002

Komuro, K. and Kajiura, Y. (2003), Paleooceanography and Heavy Metal Enrichment of

Mudstones in the Green Tuff Region, Northeast Japan, Resource geology vol.53 no.1 37-49 (in printing)

Shikazono(1999), Rare Earth Element Geochemistry of Kuroko Ores and Hydrothermally Altered Rocks: Implication for Evolution of Submarine Hydrothermal System at Back Arc Basin, Resource geology Special Issue no.20 23-30

Mitsuno, C et al (1988), Geological Study of the “Iberian Pyrite Belt” – with Special Reference to its General Correlation of the Yanahara Ore deposit and Other in the Inner zone of Southwest Japan,

## **Appendix 1. Geologic Core Logs of Existed Drillings**

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 1  
(40.00 m - 165.00m)

Hole No.: **KT104**    Locality: **Kettara**    Grid Coordinates:    N.    E.    Elevation:    Length:    Inclination:

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity	Mineralization	Analysis						
				Rock	Lithofacies			Scale	Lithofacies	Form	Width	dip	Scale	No.
40				B.S.	schist pale-gray									
44.20		brec		B.S.	schist, tuffaceous, pale-gray		qtz.v. 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.	tuffaceous, wk-argill		111.8-115.0	riwk py filled tuff						
115.00		frue		M.S.	massive		115.0-115.1	qtzv						
							115.0-116.0	M.S. py.po-rich, contain strg arg mds						
							115.4-115.5	sul.v.						
							118.9-120.0	sul+qtz.v.						
120	120.70	tauH		M.S.	massive (contain tuffaceous lamina)									
				B.S.	brecciated, qtz.v. with b.s.			qtz.v., ba-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 altern)									
154.00				B.S.	schist + quartzite			qtz.v. + py						
157.00		grad		B.S.	lamina turbidity-strong									
160	160.60	grad		M.S.	banded			sandy, py banded; qtz-turbidity						
168.00		frac		B.S.	lamina py layer			py layer						
163.00		frac		M.S.	massive			massive, contain qtz						
164.00		frac		M.S.	massive			massive, mds frag						
164.90		frac		M.S.	brecciated			brecciated mds frag						

Metal Mining Agency of Japan

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

Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 2

Hole No.: KT104

Locality: Kettara

Grid Coordinates:

N

E

Elevation:

Length:

Inclination:

(185.00m - 180.00m)

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity	Scale	Mineralization				Analysis	
				Rock	Lithofacies			Lithofacies	Form	Width	dip	Scale	No.
185	188.00			B.S. B.S.	wt. arg. pale green-gray quartzite massive pale-gray			qtz.v.					
170													
180													

# Marrakech-Tekna Area, Kingdom of Morocco

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

Hole No.: **KT2BS**    Locality: **Kettara**    Grid Coordinates:    N.    E.    Elevation:    Length:    Inclination:

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity Argill Sulfid Oxidation	Mineralization					Analysis		
				Rock	Lithofacies		Scale	Lithofacies	Form	Width	dip	Scale	No.	
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. layer				hem - layer druse					
70														
80														
83.28				B.S.	lamina (soft/hard alten) hem layer-rich									
				M.S.	massive				massive mds freg un-solidification porous					
87.00		grad →												
88.00		irreg →		M.S.	sandy				M.S. sandy, floe-st.					
88.50				M.S.	mdsl M.S. mds: unsolidification, silicified				brecciated mds: un-solidification					
90				B.S.	schisty, wk-silicified									
96.10														
97.80				M.S.	sandy				96.50 sandy, fragment: mds, imbrication					
97.90				B.S.	fragmental, massive pale-gray									
				M.S.	massive				M.S. mds-fragment : imbrication					
100														
108.00														
110.00		irreg →		M.S.	massive				M.S. mds + po bigger					
110.98				M.S.	White (rhyolite)				qtz v					
112.80		grad →		B.S.	massive pale-gray									
					lamina schistosity + quartzite									
120														

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 1  
(36.00 m - 160.00m)

Hole No.: **KT4BS**    Locality: **Kettara**    Grid Coordinates:    N.    E.    Elevation:    Length:    Inclination:

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity Argill. Sulfidation	Mineralization					Analysis			
				Rock	Lithofacies		Scale	Lithofacies	Form	Width	dip	Scale	No.		
39.08.20				B.S.	lamina (soft / hard alter) 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															

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 2

Hole No.: **KT4BS**    Locality: **Kettara**    Grid Coordinates:    N.    E.    Elevation:    Length:    Inclination:    (160.00m - 285.00m)

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity Argill Sulfid Oxidation	Mineralization				Analysis		
				Rock	Lithofacies		Scale	Lithofacies	Form	Width	dip	Scale	No.
160				B.S.	massive, pale-gray.								
170													
180													
190													
200													
210													
218.00													
220				B.S.	tuffaceous pale-gray, massive.		qt	z.v.					
224.00		grad		B.S.	lamina schist + quartzite								
230		frou		B.S.	massive								
231.00				M.S.	massive								
233.98				B.S.	233.3-234.0 mds + MS (MS layer-irregular)								
234.00		frou		B.S.	234.0-246.6 lamina (soft + hard altern)								
240													
246.80		frou →		B.S.	massive								
247.80				M.S.	massive, contain mds.								
248.00				B.S.	247.80-248.00 lamina (soft + hard altern)								
249.00				M.S.	massive, contain mds.								
250				B.S.	249.00-258.00 lamina (soft + hard altern)								
258.00				M.S.	massive								
260													
263.00				B.S.	massive, gray (qtz-fragment)								
267.00				M.S.	massive								
270.00				B.S.	massive, contain mds.								
272.00				M.S.	massive, contain mds.								
274.00				B.S.	massive, contain mds.								
276.00				M.S.	massive, contain mds.								
280													
282.00				M.S.	massive								

Metal Mining Agency of Japan



# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 3

Hole No.: **KT4BS**    Locality: **kettara**    Grid Coordinates:    N.    E.    Elevation:    Length:    Inclination:    (285.00m - 310.00m)

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

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 1

Hole No.: **KT3BS**    Locality: **Kettara**    Grid Coordinates:    N.    E.    Elevation:    Length:    Inclination:    (0.00 m - 60.00 m)

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity Argill Siltst Siltst	Mineralization				Analysis		
				Rock	Lithofacies		Scale	Lithofacies	Form	Width	dip	Scale	No.
0 - 0.70				B.S.	Lamina (soft / hard altern)								
10													
20													
29.00				B.S.	Massive								
30													
32.00				B.S.	Lamina (soft / hard altern), strong folding								
40													
49.00													
50				B.S.	Lamina (soft / hard altern), strong folding strong argill, wht								
54.66				M.S.	Massive								
55.98				M.S.	brecciated								
				B.V.	hyaloclastite, tuffaceous								
58.00													
60				B.V.	tuffaceous, aphyric								

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 1  
(0.00 m - 63.40 m)

Hole No.: **KT1BS**    Locality: **Kettara**    Grid Coordinates:    N.    E    Elevation:    Length:    Inclination:

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity	Sulfide content	Mineralization				Analysis		
				Rock	Lithofacies			Scale	Lithofacies	Form	Width	dip	Scale	No.
0				B.S.	Schisty									
10				B.S.	Lamina (soft / hard altern)									
20														
30														
33.00				B.S.	Massive									
40				B.S.	Schisty strong arg pale-gray									
41.80				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				B.S.	Schisty    m.s. filled cracks				eul. filled cracks.					
60														
63.40														
70														

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 1  
(269.60m - 337.60m)

Hole No.: **BS15** Locality: **Benslimane** Grid Coordinates: \_\_\_\_\_ N, \_\_\_\_\_ E Elevation: \_\_\_\_\_ Length: \_\_\_\_\_ Inclination: \_\_\_\_\_

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

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 1

Hole No.: KA25    Locality: KAICHA    Grid Coordinates: \_\_\_\_\_ N. \_\_\_\_\_ E.    Elevation: \_\_\_\_\_    Length: \_\_\_\_\_    Inclination: \_\_\_\_\_    (42.00 m - 175.00m)

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

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 2

(165.00m - 290.00m)

Hole No.: KA25    Locality: KAICHA    Grid Coordinates:    N.    E.    Elevation:    Length:    Inclination:

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity	Mineralization	Mineralization					Analysis		
				Rock	Lithofacies			Scale	Lithofacies	Form	Width	dip	Scale	No.	
165	▲▲▲▲			B.V.	massive, aphyric, pale-green-gray argillaceous, mica			142.0-179.0	cal. v ntwk zone (W: 5-10mm)						
170	▲▲▲▲														
180	▲▲▲▲														
190	▲▲▲▲														
200	▲▲▲▲														
210	▲▲▲▲														
220	▲▲▲▲														
230	▲▲▲▲														
240	▲▲▲▲														
250	▲▲▲▲														
260	▲▲▲▲														
270	▲▲▲▲		gradual ↓	B.V.	massive, aphyric, pale-green-gray argillaceous, mica-rich										
280	▲▲▲▲			B.V.											
284.10	▲▲▲▲			B.V.	massive, fine grain, tuffaceous, pale-green-gray argillaceous (ser+chl)										
287.00	▲▲▲▲		gradual ↓	B.V.	tuffaceous, wk-lamination, pale-green-gray										
290	▲▲▲▲		gradual ↓	B.S.	massive										

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 4

Hole No.: KA25

Locality: KAICHA

Grid Coordinates:

N

E Elevation:

Length:

Inclination:

(415.00m - 540.00m)

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

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 3

Hole No.: KA25    Locality: KAICHA    Grid Coordinates:    N.    E.    Elevation:    Length:    Inclination:    (290.00m - 410.00m)

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity	Mineralization				Analysis		
				Rock	Lithofacies		Scale	Lithofacies	Form	Width	dip	Scale	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	

Metal Mining Agency of Japan



## Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 5  
(540.00m - 561.00m)

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

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity	Sulfide	Mineralization				Analysis			
				Rock	Lithofacies			Scale	Lithofacies	Form	Width	dip	Scale	No.	
540	A A			B.V.	massive, aphyric, pale-gray										
550	A A			↓	↓										
555.00	A A			B.V.	tuffaceous, fine grain, pale-gray										
560 561.00	A A A A A A A A A A A A A A A A			↓	↓										

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 1

Hole No.: A9

Locality: Lachach

Grid Coordinates:

N

E

Elevation:

Length:

Inclination:

(157.00m - 250.00m)

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity	Mineralization					Analysis					
				Rock	Lithofacies		Scale	Lithofacies	Form	Width	dip	Scale	No.				
150																	
157.00					B.S.	laminaton, wk-argillization											
160																	
168.10																	
170					B.S.	massive, pale-gray											
180																	
189.10																	
191.10					B.V.	lamination, tuffaceous, unclearly tuff		194.80 195.80 196.80	qtz. v. qtz. v. qtz. v.		10cm						
200																	
210.00																	
210					B.V.	tuff, str-dissemination		210.0-216.0	disseminated by megacrystal (secondary?)								
216.00					B.V.	tuff, wk-argillization, unclearly tuff											
217.00					M.S.	strong - brecciated		217.0-219.8	lamination+brecciated								
219.80					M.S.	brecciated		219.8-221.0	brecciated (no-flow-st)								
221.00					B.V.	lamination, tuffaceous											
230																	
240																	
241.50					B.V.	massive, tuffaceous											
242.50					B.V.	massive, aphyric.											
250																	
250.00																	

# Marrakech-Tekna Area, Kingdom of Morocco

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

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

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity Sulfidation Argillification	Mineralization					Analysis					
				Rock	Lithofacies		Scale	Lithofacies	Form	Width	dip	Scale	No.				
0																	
10-10.50	NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI /			B.V.	tuffaceous (soft / hard allen)												
20-20.80	NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI /			B.V.	tuffaceous (soft / hard allen)												
30	NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI /																
40	NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI /																
50	NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI /																
54.70	NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI /			fracture zone	tuffaceous rock fragment-rich												
60-61.80	NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI /			B.V.	tuffaceous (soft / hard allen)		64.70	qtz.v.+chl			3cm						
70	NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI /																
80-80.00	NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI / NI NI NI NI /	grad →		B.V.	schisty, gray		78.60-78.80	qtz.v. chl ntwk zone									
90	II II II II / II II II II / II II II II / II II II II / II II II II / II II II II / II II II II /																
100	II II II II / II II II II / II II II II / II II II II / II II II II / II II II II / II II II II /																
108.85	II II II II / II II II II / II II II II / II II II II / II II II II / II II II II / II II II II /	grad →		B.V.	strong schisty + quartzite			qtz. v. ntwk									
110	II II II II / II II II II / II II II II / II II II II / II II II II / II II II II / II II II II /																
120	II II II II / II II II II / II II II II / II II II II / II II II II / II II II II / II II II II /																

# Marrakech-Tekna Area, Kingdom of Morocco

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

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

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity	Mineralization					Analysis		
				Rock	Lithofacies		Scale	Lithofacies	Form	Width	dip	Scale	No.	
0				B.V.	tuffaceous pl-pheno									
10														
14.50-15.50							14.50-15.50	qtz.v irregular						
22.50				B.V.	wk-lamina, pl-pheno-platy qtz:pheno									
30.00		sharp		B.S.	schisty + quartzite (tuffaceous)									
33.60				B.S. (fracture zone)	B.S. fragment									
44.60				B.S.	schisty + quartzite (tuffaceous)		45.00	qtz.v. wht						
50														
60														
70														
80														
92.40		grad		A.V.	dacite lavapale-green			qtz.v.+chl						
94.00				A.V.	(sill?)									
97.70		grad		A.V.	tuffrec. argill schisty		98.70	wht. qtz.v.+chl						
98.70														
100				B.S.	schisty + quartzite (tuffaceous) lamina, qtz-pheno-rare									
109.00				B.S.	schisty + quartzite (tuffaceous) lamina, qtz-pheno-rich brecciated, mbc:tuffaceous			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	turbidity						
118.50				M.S.	massive, wk-lamina		118.5-120.3	layered						
120					120.30 mds fragment		120.3	mds-fragment						
					122.00 layered		120.3-122.0	layered, slowly-sediment						
125.30				B.S.	fracture zone, black, schisty+quartzite									

Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 3

(250.00m - 270.00m)

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

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity	Scale	Mineralization			Analysis	
				Rock	Lithofacies			Lithofacies	Form	Width	dip	Scale
250				non core						30cm		
252.00	XXXXXX			M.S.	massive		252.0-253.0	massive				
253.00				B.V.	tuffaceous pale-gray							
-260												
-270												

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 2

Hole No.: **DSF15** Locality: **Draa Sf ar** Grid Coordinates: \_\_\_\_\_ N. \_\_\_\_\_ E. Elevation: \_\_\_\_\_ Length: \_\_\_\_\_ Inclination: \_\_\_\_\_ (125.00m - 250.00m)

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity Argill Sulfid Carbon	Mineralization				Analysis		
				Rock	Lithofacies		Scale	Lithofacies	Form	Width	dip	Scale	No.
130				B.S.	strong schisty + quartzite								
156.15				B.S.	schisty (soft + hard altern) tuffaceous								
236.00				B.V.	massive aphyric								
240.80				B.V.	hyaloclastite				py-clas strong				
242.60				B.V.	hyaloclastite, aphyric								
244.80				M.S.	massive								
246.00				B.S.	pale-gray								
246.00				B.S.	strong argill								
246.00				M.S.	massive								
246.0-244.2									massive				
244.6-246.0									strong-arg + py-clas				
246.0-252.0									massive				

Metal Mining Agency of Japan

## Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 2

Hole No.: **DSF2**    Locality: **Draa Sfar**    Grid Coordinates:    N.    E    Elevation:    Length:    Inclination:    (125.00m - 150.00m)

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

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 1

Hole No.: KH4A

Locality: Khwadra

Grid Coordinates:

N

E

Elevation:

Length:

Inclination:

( 533.60m - 565.60m)

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



# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 1

Hole No.: **KHOUADRA 54-C**    Locality: **Khwadra**    Grid Coordinates:    N.    E.    Elevation:    Length:    Inclination:    (514.70m - 570.70m)

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity	Mineralization				Analysis		
				Rock	Lithofacies		Scale	Lithofacies	Form	Width	dip	Scale	No.
510													
514.70													
516.70				B.S.	fine, sticky, flow-st								
520				M.S.	*—gradually								
524.40				M.S.	dark green-gray, sticky, talky								
525.65				M.S.	dark green-gray, sticky, talky								
527.40				M.S.	dark green-gray, sticky, talky								
528.80				M.S.	dark green-gray, sticky, talky								
529.90				M.S.	yellowish-pale-gray, fine								
530				M.S.	*—conform								
534.20													
540				non-core									
540.00				M.S.									
542.90				M.S.									
545.40				M.S.									
547.20				M.S.									
550.40				M.S.									
552.50				M.S.									
554.00				B.S.	str. lamination, coarse-fine grain								
554.00				B.S.	str. lamination, coarse-fine grain								
558.50				B.S.	str. lamination, coarse-fine grain								
559.70				B.S.	str. lamination, coarse-fine grain								
560				B.S.	str. lamination, coarse-fine grain								
563.90				B.S.	str. lamination, coarse-fine grain								
566.35				M.S.	massive, no-grading								
568.40				B.S.	brecciated green-gray sticky, silty sericite								
570				A.V.	pale-green-gray, dark-green-patch								
570.70				A.V.									

### Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 1  
( 621.80m - 716.05m)

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

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity Ka Fe Mg Si	Mineralization					Analysis				
				Rock	Lithofacies		Scale	Lithofacies	Form	Width	dip	Scale	No.			
620 621.80		0		B.S.	621.80-634.80 dark-gray, fine-grain, str.lamination											
630					634.80-642.50 greenish-gray, chloritization											
640					642.60-642.80 greenish-gray, finegrain, wk.lanrnation											
642.80				M.S.	644.40-644.60 interfmr(B.S.+M.S.)							2-4				
644.80				B.S.	644.60-644.70 fault (argillc, brecciated, B.S.fragment-rich)											
647.40		5-10		M.S.	644.70-647.40 gray, fine-lamina + massive altn.											
650					(fault zone)											
660																
660.10				A.V.	660.10-663.00 andesitic-dacite, pale-gray, brecciated											
					660.10-663.00 mineralization, Hem. layer-rich											
					663.20-670 massive lava, pale-gray											
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, lamination											
680					681.80-687 very-fine, pale-gray, tuffaceous											
690		10			687-709.80 black, fine, lamination											
700																
710		10-20			709.80-710.3 greenish andesitic volcanic sediment coarse-grain											
					710.30-716.05 black, fine-grain, lamination											
716.05																

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 1

(303.20m - 404.50m)

Hole No.: KHWADRA  
S3C

Locality: Khwadra

Grid Coordinates:

N.

E

Elevation:

Length:

Inclination:

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity Ka Fe Silica Sulfide	Mineralization					Analysis					
				Rock	Lithofacies		Scale	Lithofacies	Form	Width	dip	Scale	No.				
300																	
303.20		20-30		B.S.	dacite, dark-gray, fine massive, wk-lamination												
310																	
315.80				A.V. B.S.	dacite, yellowish-gray coarse grain, wk-lamination pale-gray, wk-lamination, very-fine grain												
320		0-20			pale-gray, wk-lamination, very-fine grain												
327.80					brecciated, -> hyaloclastite massive, fine grain												
330				M.S.													
333.80																	
334.60				A.V.	dacite, massive fine grain												
340				A.V.	dacite, brecciated~unclearly tuff												
350				A.V.													
352.00					dacite, brecciated -> hyaloclastite												
357.00				A.V.	brecciated -> pillow, clastic												
360				A.V.	dacite, massive pl-pheno-rare												
361.50																	
370				A.V.													
373.50					dacite, massive pl phenochyst-rich												
376.50				A.V.	dacite, unclearly tuff												
380				A.V.	dacite, flow-st rhyolitic												
381.00					dacite, massive												
390				A.V.													
400				A.V.	dacite andesite												
404.50		V-10		B.S.	black, talky massive												
410																	
420																	

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 1

(303.20m - 404.50m)

Hole No.: **KHWADRA S3C** Locality: **Khwadra** Grid Coordinates: **N. E** Elevation: **Length: Inclinatio:**

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity	Mineralization					Analysis					
				Rock	Lithofacies		Scale	Lithofacies	Form	Width	dip	Scale	No.				
300																	
303.20		20-30		B.S.	dacite, dark-gray, fine massive, wk-lamination			sul.v.									
310					↓												
315.80				A.V. B.S.	dacite, yellowish-gray coarse grain, wk-lamination pale-gray, wk-lamination, very-fine grain			qtz v qtz v									
320		0-20			pale-gray, wk-lamination, very-fine grain												
327.90					brecciated, -> hyaloclastite massive, fine grain												
330				M.S.				327.90 YBO coarse, lamination 330.90 YBO. brown massive fine									
333.80				A.V.	dacite, massive fine grain			333.80 234.7 qtz.v. 334.60 pillow Breccia VMS? 05 qtz.v									
340				A.V.	dacite, brecciated~unclearly tuff												
350				A.V.													
352.00					dacite, brecciated -> hyaloclastite												
357.00				A.V.	brecciated -> pillow, clastic												
360				A.V.	dacite, massive pl-pheno-rare												
361.50																	
370				A.V.													K-Ar①
373.50					dacite, massive pl phenochyst-rich			371.70 gnv massive		11	1cm	40					K-Ar②
376.50				A.V.	dacite, unclearly tuff												K-Ar③
380				A.V.	dacite, flow-st rhyolitic												
381.00					dacite, massive												
390				A.V.													
400				A.V.	dacite andesite												
404.50		V-10		B.S.	black, talky massive												
410																	
420																	

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 1

Hole No.: KH1A    Locality: Khwadra    Grid Coordinates: 400000N, 1200000E    Elevation: 120m    Length: 500m    Inclination: 90°    (406.20m - 420.60m)

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity K F S C P M A H I L C S E R I E S	Mineralization					Analysis		
				Rock	Lithofacies		Scale	Lithofacies	Form	Width	dip	Scale	No.	
400														
406.20				B.S.	str. lamination, coarse-fine grain									
410				B.S.	str. lamination, coarse grain									
412.10				M.S.	massive, flow-st									
412.40				A.V.	dacitic, pale-greenish-gray		412.40	yellowish B.O., weak flow structure						
415.15				M.S.	massive, flow-st		414.50	grading/reverse grading, cf grain		30cm				
415.80				A.V.	dacitic, hyaloclastite, brecciated		415.15	yellowish B.O., py(course, hex)		10cm				
417.50	V V V V			A.V.	massive, wk-flow-st, pl-pheno, pale-gray									
420	V V V V													
420.60	V V V V													

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 1

Hole No.: S-2      Locality: SAF.SAFA      Grid Coordinates:      N.      E.      Elevation:      Length:      Inclination:      (197.40m - 320.00m)

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity	Mineralization				Analysis		
				Rock	Lithofacies		Scale	Lithofacies	Form	Width	dip	Scale	No.
185													
197.40				A.V.	porphyritic, pale-gray, qtz-pheno								
197.90				A.V.	tuffaceous, pale-gray, lamination, fine								
200					↓ child								
					↓ gradually								
203.30				volc.sed.	porphyritic lava		203.00	cal. v.					
205.10				A.V.	tuffaceous, pale-gray, fine								
206.10					↓ unconform								
210					↓		210.0-210.1 210.80	cal. v. let		10	10		
					↓		212.5-214.4	cal. v. block cal. v. ntwk (vertical)			48		
218.80					↓		218.20	cal. druse					
220					tuffaceous, argillitic, brecciated, pale-gray, sercite		219.50	cal. v. (parallel lamination)					
					↓								
					tuffaceous, massive, wk-lamination, pale-gray, fine.								
					↓								
230					↓								
231.00					coarse porphyritic, pale-gray								
232.20				A.V.	tuffaceous, pale-gray, fine		233.30	qtz. v. white		1cm	70		
					↓ Interfinger		234.4-235.1 235.4-238.2	qtz. v. white-clear, no-sulfide qtz. v. net		20cm 1-2cm	80 80		
240					↓								
250					↓								
256.40					coarse porphyritic, palegray		253.4-255.2	qtz. v. ntwk		0.5-1cm	40		
257.30				A.V.	tuffaceous, palegray, fine								
260					↓ Interfinger (layer?)								
					↓								
268.20					porphyritic		264.00 265.00	qtz. v. qtz. v.					
267.50				A.V.	tuffaceous, pale-gray			qtz. v. ntwk zone					
270					↓								
280					↓								
290					↓								
300					↓								
310					↓ gradually								
314.50		40°-80°		b.s.	porphyritic black, fine, platy-pl-pheno		315.00	qtz. v. ntwk (brecciated)					
					↓ metalglossy								
320					↓		320.00	cal. py					

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 2

Hole No.: S-2      Locality: SAF, SAFA      Grid Coordinates:      N.      E      Elevation:      Length:      Inclination:      (320.00m - 445.00m)

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity	Mineralization					Analysis		
				Rock	Lithofacies		Scale	Lithofacies	Form	Width	dip	Scale	No.	
320		40-60		B.S.	black, platy-pl-pheno, metal-glossy		320.00	cal + Py v						
330							333.00	qtz.v.nhwk						
340														
350														
360														
366.50				A.V.	dacite lava, pale-gray, qtz-pheno	sw	366.10 366.40 367.20	argillite+py layer qtz+py.v. qtz.v				0 20		
370														
378.40 378.60 380					c.m.		382.20	qtz.v py v.nhwk		10cm	20			
388.80						unconform								
390				B.S.	black, fine, no-lamination		390.30	few layer+qtz		2cm	0			
400														
407.80						no-child-margin								
409.70				A.V.	porphyritic									
410				B.S.	black, fine, no-lamination	no-child-margin								
420														
430														
439.45				B.S. sed.	broken zone									
440														
444.60				B.S.										

445

## Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 3

Hole No.: S-2    Locality: SAF. SAFA    Grid Coordinates:    N.    E    Elevation:    Length: 472m    Inclination:    (445.00m - 472.90m)

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



# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 1

Hole No.: **CD27**    Locality: **Hajar**    Grid Coordinates:    N.    E    Elevation:    Length:    Inclination:    (0.00 m - 125.00m)

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

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 2

(125.00m - 250.00m)

Hole No.: **CD27**    Locality: **Hajar**    Grid Coordinates:    N.    E.    Elevation:    Length:    Inclination:

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity Argill. Sulfid.	Mineralization					Analysis			
				Rock	Lithofacies		Scale	Lithofacies	Form	Width	dip	Scale	No.		
130				B.S.	fine grain, gray										
140															
150															
160															
161.00			irreg →	B.V.	tuff breccia, brecciated										
170															
180															
183.50			grad →	B.V.	tuffaceous, flow-st										
186.00			grad →	B.V.	Lava, porphyritic (pl:2mm)										
190															
200															
210															
214.00										214.00	qtz.v.				
220															
230															
240															
246.60										246.60	qtz.v. ntwk				
250															

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 3  
(250.00m - 340.60m)

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

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

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 1

Hole No.: GHC1    Locality: Hajar    Grid Coordinates:    N.    E.    Elevation:    Length:    Inclination:    (0.00 m - 65.00 m)

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity	Mineralization					Analysis		
				Rock	Lithofacies		Scale	Lithofacies	Form	Width	dip	Scale	No.	
0				B.S.	gray no.lamina									
10.00		grad		B.V.	tuffaceous, lamination									
13.00		grad		B.V.	massive, porphyritic, flow-st, qtz-pheno-platy									
14.90		grad		B.V.	hyaloclastite									
16.80		grad		B.V.	massive, aphyric, wk-sill, gtz.v.									
18.80		grad		B.V.	massive, porphyritic, flow-st, lamination gtz-pheno, py-diss		18.80-18.90	Py diss						
19.90		irreg		B.V.	tuffaceous									
22.30		grad		B.V.	massive, schisty, qtz-pheno-platy									
22.80		grad		B.V.	hyaloclastite									
24.80		grad		B.V.	lamination - rich									
26.80		grad		B.V.	massive, porphyritic									
28.80		grad		B.V.	massive, aphyric									
30		grad		B.S.	pale-gray									
32.00				B.S.	siliceous									
37.00				B.S.	pale-green-gray, talky		37.00							
37.70				B.S.										
40														
49.00		free												
50				A.V.	rhyolite, massive porphyritic(qtz-pheno:2mm, pl:1mm)									
60.00				fracture zone	rhyolite fragment rich									
64.00														
70														

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 1

Hole No.: **HS13**    Locality: **Hajar**    Grid Coordinates:    N.    E.    Elevation:    Length:    Inclination:    (200.00m - 325.00m)

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

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 2

(325.00m - 400.80m)

Hole No.: **HS13**    Locality: **Hajar**    Grid Coordinates:    N.    E.    Elevation:    Length:    Inclination:

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

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 1

(296.50m - 332.00m)

Hole No.: **HS25**    Locality: **Hajar**    Grid Coordinates: \_\_\_\_\_ N \_\_\_\_\_ E    Elevation: \_\_\_\_\_    Length: \_\_\_\_\_    Inclination: \_\_\_\_\_

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity Anhydrite Sulfide	Mineralization					Analysis					
				Rock	Lithofacies		Scale	Lithofacies	Form	Width	dip	Scale	No.				
280																	
290																	
296.50																	
300					B.S.	flow-st. sandy, medium grain											
301.00			non		B.S.	tuffaceous, M.S. layer		302.00									
303.10			grad		B.S.	tuffaceous, M.S. layer		301.0-303.0		M.S. layer							
306.00					M.S.	flow-st		304.0-306.0		flow-st, sandy							
308.00					M.S.	flow-st, breccia		316.0-318.0		flow-st, brecciated → turbidity							
310					M.S.	flow-st		308.0-314.4		flow-st, layer, py							
314.40			frac		B.S.	massive, fragment?											
315.00			frac		M.S.	sandy		315.0-316.0		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)							
321.40			frac		B.S.	schist				qtz.v.net		1-10mm					
321.80					A.V.	aphyric, dacite lava siliceous qtz-veinlet				qtz							
325.00					A.V.	brecciated, qtz-pheno-broken											
327.00					A.V.	massive, aphyric, tuffaceous				qtz.v.		1-10mm					
330					B.S.	mdy + quartzite											
332.00																	
拡大																	
303					B.S.	tuffaceous M.S. layer		301.0-303.1		M.S. layer							
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																	

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 1

Hole No.: **A2G480** Locality: \_\_\_\_\_ Grid Coordinates: \_\_\_\_\_ N. \_\_\_\_\_ E. Elevation: \_\_\_\_\_ Length: \_\_\_\_\_ Inclination: \_\_\_\_\_ (144.80m - 270.00m)

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



# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 2

Hole No.: **A2G480** Locality: \_\_\_\_\_ Grid Coordinates: \_\_\_\_\_ N \_\_\_\_\_ E Elevation: \_\_\_\_\_ Length: \_\_\_\_\_ Inclination: \_\_\_\_\_ (270.00m - 395.00m)

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity	Mineralization					Analysis		
				Rock	Lithofacies		Scale	Lithofacies	Form	Width	dip	Scale	No.	
270														
280 281.50				B.S.	schist + quartzite, folding		qtz.v.			30cm				
285.00														
290														
300														
310														
320														
330														
340														
350														
360														
370														
380														
390														



# Marrakech-Tekna Area, Kingdom of Morocco

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

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

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity Argill Sulfid Sulfid	Mineralization					Analysis		
				Rock	Lithofacies		Scale	Lithofacies	Form	Width	dip	Scale	No.	
30.25	V V V V V			A.V.	massive, strong siliceous dacite			33.10-33.70	sul.v. (chl → gl → cp → qtz)					
34.40	V V V V V			A.V.	aphyric, strong siliceous pale-green-gray dacite			33.80 34.00	sul.v. riwk (g → py → cp) qtz. sul.v. (sp, gl → qtz) post-qtz.v.					
40	V V V V V			A.V.	aphyric, strong siliceous, pale-green-gray dacite			34.35	sul.v. → post-qtz.v.					
41.25	V V V V V				pydiss → platy				py-diss → platy					
42.30	V V V V V				post-qtz.v.				post-qtz.v.					
44.40	V V V V V			A.V.	brecciated dacite fragment									
45.00	V V V V V			A.V.	flow-st. dacite, brecciated			43.40	sul.v. qtz.v.					
45.00	V V V V V			A.V.	flow-st. dac fracture zone 44.2-43.0m:ser			43.56	qtz.v. sp, gl → py, cp → qtz → druse					
45.00	V V V V V			A.V.	dacite, qtz-pheno-platy			44.40	sul.v. sp, pl → py					
50	V V V V V			A.V.	dacite, qtz-pheno-platy-str.			46.05	sul.v.					
53.20	V V V V V							50.00	sul.v. (gl, sp → cp, py → qtz(black))					
54.00	V V V V V	grad		A.V.	tuffaceous dacite			53.50	sul.v. (py → cp)					
60.00	V V V V V			A.V.	dacite, qtz-pheno-rare			55.00	sul+qtz.v.					
64.20	V V V V V	grad		A.V.	dacite, qtz-pheno-bigger			63.00	qtz.v.					
66.30	V V V V V	grad		A.V.	dacite, aphyric			64.00	sul.v.					
67.30	V V V V V			A.V.	layered tuff			67.00	sul layer					
70	V V V V V			A.V.	dacite, massive, aphyric			73.00	qtz: clear+whit, sul.v. sp → qtz					
84.00	V V V V V			A.V.	dacite qtz-pheno									
85.70	V V V V V			A.V.	tuffaceous									
90.00	V V V V V													
100														
110														
120														
126.00				B.S.	schisty + quartzite									
130.00					quartzite-rare			129.90	layered py					
132.40				B.S.	quartzite → muddy									
133.40				B.S.	massive									
135.60				M.S.	layered			135.6-140.25	layered M.S.   massive					
140.40		sharp		M.S.	massive									
140.40				B.S.	massive black									
150														

Metal Mining Agency of Japan

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 1  
(7.10 m - 80.00 m)

Hole No.: FZ12    Locality: Frizon    Grid Coordinates:    N.    E.    Elevation:    Length:    Inclination:

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

Marrakech-Tekna Area, Kingdom of Morocco

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

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

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

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 1  
( 90.00 m - 170.00m)

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

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

Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 1

Hole No.: FZ02

Locality: Friezen

Grid Coordinates: N. E

Elevation:

Length:

Inclination:

( 88.40 m - 111.70m)

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

# Marrakech-Tekna Area, Kingdom of Morocco

Sheet No.: 1  
(0.00 m - 50.00 m)

Hole No.: FZ14    Locality: Frizen    Grid Coordinates:    N.    E.    Elevation:    Length:    Inclination:

Depth (m)	Column	Dip	Formation	Description		Alteration Intensity Sulfide Carbon Argillite Zonation	Mineralization					Analysis		
				Rock	Lithofacies		Scale	Lithofacies	Form	Width	dip	Scale	No.	
0	▲ ▲ ▲ ▲			A.V.	rhyolite, massive									
-10	▲ ▲ ▲ ▲													
-20	▲ ▲ ▲ ▲													
-30	▲ ▲ ▲ ▲			A.V.	tuffaceous									
-40	■ ■ ■ ■			B.S.	pale-gray									
-50														



## **Appendix 2. Sample List**

Appendix-2 Sample List

No	Sample	Drill hole	Length	Cutting	Locality		Formation	Rock	Description		Remarks
					Area	Latitude(N)			Longitude(W)	Geology	
1	02MRK000	Damy	-		Dummy			Slate			
2	02MRK001	S1A	407.00 - 407.20	1/2	Khwadra		Visian	Schist	Tufficious.HW		Sep. 14, 2002
2	02MRK002	S1A	419.00 - 419.20	1/2	Khwadra		Visian	Shale	Sificated, Tufficious.FW		Sep. 14, 2002
3	02MRK003	S4A	536.80 - 537.00	1/2	Khwadra		Visian	Shale	Sificated, Tufficious. Py, HW		Sep. 14, 2002
4	02MRK004	S4A	563.50 - 563.70	1/2	Khwadra		Visian	Shale	Sificated, Tufficious, below oxidation zone, FW		Sep. 14, 2002
5	02MRK005	S4	510.50 - 510.70	1/2	Khwadra		Visian	Hornfels	Sificated, Tufficious, HW		Sep. 14, 2002
6	02MRK006	S4	563.00 - 563.20	1/2	Khwadra		Visian	Schist	lamina weak, OH		Sep. 14, 2002
7	02MRK007	S4	556.00 - 556.20	1/2	Khwadra		Visian	Schist	Tufficious, 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, Chp?, 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	Shale	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 ocanic-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_Kerkoze		Visian	Sandstone	vol. sed. FW (Gossan)		Sep. 18, 2002
27	02MRK026	Surface			Koudiat Aicha		Visian	Shale	Black shale, FW (Gossan)		Sep. 18, 2002
28	02MRK027	Surface			N Bensliman		Visian	Shale	Gossan, Green, Rhyonite-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	Calcairous-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-tufficious, 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	Tufficious-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			Amzourh		Visian	Quartzite	Tufficious-green, ila, P3, HW		Sep. 23, 2002
48	02MRK047	Surface			Imarine		Visian	Limestone	Calcairous-massive, ilp, P2, HW		Sep. 23, 2002
49	02MRK048	Surface			Tameslouht		Devonian?	Sandstone	Red, Sillificated, hard		Sep. 23, 2002
50	02MRK049	Surface			Tameslouht		Devonian?	Hornfels	Alternation Quartzite-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	Calcairous-shale, alternation_calcairous_mud, HW		Sep. 24, 2002
53	02MRK052	CD27	98.00 - 98.20	1/2	Hajar		Visian	Shale	Calcairous-shale, alternation_calcairous_mud, HW		Sep. 24, 2002

No	Sample	Drill hole	Length	Cutting	Locality		Formation	Rock	Description		Remarks
					Area	Latitude(N)			Longitude(W)	Geology	
54	02MRK053	CD27	19.50 - 19.70	1/2	Hajar		Visian	Shale	upper MS, OH/HW		Sampling Date 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
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 stockwork 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	with Py, Alternation vol. sed(QT)-shale, shisit, upper		Sep.26,2002
66	02MRK065	AZG480	403.00 - 403.20	1/2	Algeida?		Visian	Shale	with Py, 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	Alternation mud-vol. sed, shale		Sep.28,2002
70	02MRK069	surface			Sid Bau East		Visian	Shale	Alternation mud-vol. sed, non-mineralization		Sep.28,2002
71	02MRK070	surface			Jbwl_Sarhief		Visian	Shale	Alternation mud-limestone, shale		Sep.28,2002
72	02MRK071	surface			Jbwl_Sarhief		Visian	Shale	Recrystallization, shistosity		Sep.28,2002
73	02MRK072	surface			Jbwl_Sarhief		Visian	Shale	Black shale, shistosity, non-mineralization		Sep.28,2002
74	02MRK073	FZ12	74.00 - 74.20	1	Frizem		Visian	Schist	Alternation mud-vol. sed, (sulfide), HW		Sep.29,2002
75	02MRK074	FZ12	99.70 - 100.00	1	Frizem		Visian	Shale	Alternation mud-vol. sed, shale, HW		Sep.29,2002
76	02MRK075	FZ10	35.50 - 35.80	1	Frizem		Visian	Shale	Alternation mud-vol. sed, shale, HW		Sep.29,2002
77	02MRK076	FZ10	67.00 - 67.25	1	Frizem		Visian	Shale	Alternation mud-vol. sed, shale, HW		Sep.29,2002
78	02MRK077	FZ13	88.00 - 88.20	1	Frizem		Visian	Limestone	Alternation mud-vol. sed, upper Rhy, OH/HW		Sep.29,2002
79	02MRK078	FZ13	141.00 - 141.05	1	Frizem		Visian	Sandy slate	Alternation mud-vol. sed, Black shale, HW		Sep.29,2002
80	02MRK079	FZ13	141.00 - 141.30	1	Frizem		Visian	Shale	Alternation mud-vol. sed, Black shale, HW		Sep.29,2002
81	02MRK080	FZ14	53.70 - 53.90	1	Frizem		Visian	Shale	Alternation mud-vol. sed, Calcaurus part, HW		Sep.29,2002
82	02MRK081	FZ14	53.90 - 54.10	1	Frizem		Visian	Shale	Alternation mud-vol. sed, Black-green shale		Sep.29,2002
83	02MRK082	FZ14	83.50 - 83.75	1	Frizem		Visian	Shale	Alternation mud-vol. sed, Black shale, HW		Sep.29,2002
84	02MRK083	FZ14	91.50 - 91.70	1	Frizem		Visian	Shale	Alternation mud-vol. sed, (sulfide), FW		Sep.29,2002
85	02MRK084	surface			Keltara		Visian	Shale	shale, (chl,ser)		Sep.29,2002
86	02MRK085	surface			Keltara		Visian	Shale	Shale, chl,ser, folding, FW		Sep.29,2002
87	02MRK086	surface			Draa Star	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 Star		Visian	Shale	Shistosity, vol. sed>mud, dark gray, FW		Sep.30,2002
89	02MRK088	DSF15	137.60 - 137.80	1	Draa Star		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 Star		Visian	Shale	Shistosity, mud>vol. sed, black-gray, py, FW		Sep.30,2002
91	02MRK089-b	DSF15	254.70 - 254.90	1	Draa Star		Visian	Shale	Shistosity, (weak), vol. mud>vol. sed, black-gray, HW		Sep.30,2002
92	02MRK090	DSF15	270.70 - 270.90	1	Draa Star		Visian	Shale	Shistosity, vol. sed>mud, dark gray, (calcaurus), HW		Sep.30,2002
93	02MRK091	DSF2	18.00 - 18.20	1	Draa Star		Visian	Shale	Shistosity(weak), mud>vol. sed, black-gray, FW		Sep.30,2002
94	02MRK092	DSF2	49.00 - 49.20	1	Draa Star		Visian	Shale	Shistosity(weak), mud>vol. sed, black-gray, FW		Sep.30,2002
95	02MRK093	DSF2	91.00 - 91.20	1	Draa Star		Visian	Shale	Shistosity, mud>vol. sed, band, under Rhyolite, FW		Sep.30,2002
96	02MRK094	DSF2	126.20 - 126.50	1	Draa Star		Visian	Shale	Shistosity, mud>vol. sed, band, upper MS, HW		Sep.30,2002
97	02MRK095	DSF2	137.50 - 137.70	1	Draa Star		Visian	Shale	Shistosity, mud>vol. sed, black-gray, kink band, HW		Sep.30,2002
98	02MRK096	-400mL			Draa Star		Visian	Tuff-shist	Shistosity, black, kink band, contact MS, HW		Oct.01,2002
99	02MRK097	-400mL			Draa Star		Visian	Schist	Shistosity, black, kink band, contact MS, FW		Oct.01,2002
100	02MRK098	-400mL			Draa Star		Visian	Schist	Black, calcaurus, FW		Oct.01,2002
101	02MRK100	Damy			Dummy		Visian	Shale			
102	02MRK101	surface			Si Ged Haja		Visian	Schist	green tf, strong shistosity		Oct.01,2002

No	Sample	Drill hole	Length	Cutting	Locality		Formation	Rock	Description		Remarks
					Area	Latitude(N)			Longitude(W)	Geology	
102MRS001	KHS3		366 - 366	1/2	Khwadra		Viséan	Rhyolite			Sampling Date Sep. 16, 2002
202MRS002	S2		369 - 369	1/2	Safsafa		Viséan	Rhyolite	Much Pl phenocryst	sulfide(weak)	Sep. 16, 2002
302MRS003	S2		291 - 291	1/2	Safsafa		Viséan	Rhyolite			Sep. 16, 2002
402MRS004	KHS1		447 - 447	1/2	Khwadra		Viséan	Rhyolite			Sep. 16, 2002
502MRS005	S2		279 - 279	1/2	Safsafa		Viséan	Rhyolite			Sep. 16, 2002
602MRS006	KHS3		351 - 351	1/2	Khwadra		Viséan	Rhyolite	Hyaro-clasfite		Sep. 16, 2002
702MRS007	KHS3		385 - 385	1/2	Khwadra		Viséan	Rhyolite		sulfide(Po)	Sep. 16, 2002
802MRS008	S2		200 - 200	1/2	Safsafa		Viséan	Rhyolite			Sep. 16, 2002
902MRS009	KH1A		417 - 417	1/2	Khwadra		Viséan	Schist			Sep. 16, 2002
102MRS0010	KH1A		409 - 409	1/2	Khwadra		Viséan	Schist			Sep. 16, 2002
1102MRS0011			-		Jubilet(Bourana)		Viséan	Rhyolite			Sep. 19, 2002
1202MRS0012			-		Jubilet(West of Kechnet)		Viséan	Microgabbro			Sep. 20, 2002
1302MRS0013			-		Jubilet(West of Kechnet)		Viséan	Microgabbro			Sep. 20, 2002
1402MRS0014			-		Jubilet(West of Kechnet)		Viséan	Rhyolite			Sep. 20, 2002
1502MRS0015	KA25		272 - 272	1/1	Kduulat Aicha		Viséan	Gabbro			Sep. 21, 2002
1602MRS0016	KA25		46 - 46	1/1	Kduulat Aicha		Viséan	Gabbro			Sep. 21, 2002
1702MRS0017	CD27		327 - 327	1/2	Hajar		Viséan	Bi-Rhyolite	Bubble Rhyolite'		Sep. 24, 2002
1802MRS0018	CD27		210 - 210	1/2	Hajar		Viséan	Rhyolite	Hyaroclasite		Sep. 24, 2002
1902MRS0019			-		Hajar Mine 520ML		Viséan	Rhyolite	Bubble Rhyolite'		Sep. 25, 2002
202MRS0020	No Sample		-								Sep. 25, 2002
2102MRS0021			-		Hajar Mine 380ML		Viséan	Bi-Rhyolite			Sep. 25, 2002
2202MRS0022			-		Hajar Mine 380ML		Viséan	Bi-Rhyolite	Bi-rimmed Qtz spot		Sep. 25, 2002
2302MRS0023			-		Hajar Mine 380ML		Viséan	Bi-Rhyolite	Bi-rimmed Qtz spot		Sep. 25, 2002
2402MRS0024			-		Hajar Mine 380ML		Viséan	Rhyolite	Pink Rhyolite'		Sep. 25, 2002
2502MRS0025			-		Hajar Mine 380ML		Viséan	Qtz-vein	Within pink Rhyolite		Sep. 25, 2002
2602MRS0026			-		Hajar Mine 380ML		Viséan	Rhyolite	Contact with Qtz-vein	Chloritized	Sep. 25, 2002
2702MRS0027	HS13		251 - 251	1/2	Hajar		Viséan	Schist		Sulfide layers (SEDEX-like)	Sep. 26, 2002
2802MRS0028	FS12		37 - 37	1/4	Frism		Viséan	Schist		Chloritized with sulfide lamina	Sep. 29, 2002
2902MRS0029			-		Drasfar		Viséan	Rhyolite	Volcani-clastic unit, with Qtz foliation		Sep. 30, 2002
3002MRS0030			-		Drasfar		Viséan	Andesite	Volcani-clastic unit		Sep. 30, 2002
3102MRS0031			-		Drasfar		Viséan	Rhyolite	Rhyolite unit		Sep. 30, 2002
3202MRS0032			-		Drasfar		Viséan	Rhyolite	Rhyolite unit		Sep. 30, 2002
3302MRS0033			-		Drasfar		Viséan	Andesite	Volcani-clastic unit		Sep. 30, 2002
3402MRS0034	DSF15		16 - 16	1/2	Drasfar		Viséan	Rhyolite		With little sulfide	Sep. 30, 2002
3502MRS0035	DSF2		125 - 125	1/2	Drasfar		Viséan	Rhyolite		Chloritized	Sep. 30, 2002
3602MRS0036	DSF2		83 - 83	1/1	Drasfar		Viséan	Rhyolite	Sill		Sep. 30, 2002
3702MRS0037			-		Drasfar Mine, 400ML		Viséan	Alteration zone	Contact between massive sulfide and hanging rock	Sericitized	Oct. 1, 2002
3802MRS0038			-		N of Marabout		Viséan	Chlorite schist	Serhef F.		Oct. 1, 2002
3902MRS0039			-		Mt Ben Fares		Cambrian	Sandstone			Oct. 1, 2002
4002MRS0040			-		E of camp Ramram		Hercinian	Granite			Oct. 1, 2002
4102MRS0041	BS2		109 - 109	1/2	Kettara		Viséan	Schist		Chloritized	Oct. 2, 2002
4202MRS0042	BS2		110 - 110	1/2	Kettara		Viséan	Schist	Fragment in massive sulfide		Oct. 2, 2002
4302MRS0043	F4BS		180 - 180	1/1	Kettara		Viséan	Schist	Contact with massive sulfide	Silicified, chloritized	Oct. 2, 2002
4402MRS0044	F4BS		307 - 308	1/1	Kettara		Viséan	Schist	Calcarious		Oct. 2, 2002
4502MRS0045	BS2		25 - 25	1/1	Kettara		Viséan	Schist			Oct. 2, 2002
4602MRS0046	104		57 - 57	1/1	Kettara		Viséan	Schist	Foot rock?		Oct. 2, 2002
4702MRS0047	104		127 - 127	1/1	Kettara		Viséan	Schist	Hanging rock?		Oct. 2, 2002

Appendix-2 Sample List

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

No	Sample	Drill hole	Length	Cutting	Locality		Formation	Rock	Geology	Description		Remarks
					Area	Latitude(N)				Longitude(W)	Mineralization	
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	332.70 - 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 (upr.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	Acidic volcanics	rhyolitic, flow str.			Sep. 16, 2002
73	02MRN073		-		Jebilet	31 49.480	8 12.549	Black shale	wk-calcaceous			Sep. 16, 2002
74	02MRN074		-		Jebilet	31 50.074	8 14.297	Basic volcanics	sandy			Sep. 18, 2002
75	02MRN075		-		Jebilet	31 49.651	8 14.624	Acidic volcanics	Rhyolitic, tuff brecc.			Sep. 18, 2002
76	02MRN076		-		Jebilet	31 52.380	8 12.754	Acidic volcanics	rhyolitic, flow str., massive			Sep. 18, 2002
77	02MRN077		-		Jebilet	31 51.377	8 12.737	Basic volcanics	pl-pheno			Sep. 19, 2002
78	02MRN078		-		Jebilet	31 51.351	8 12.706	Acidic volcanics	Rhyolite, wht-alt			Sep. 19, 2002
79	02MRN079		-		Jebilet	31 51.855	8 14.705	Black shale	argillitic part(kaolinite)		gossan	Sep. 19, 2002
80	02MRN080		-		Jebilet	31 52.142	8 10.438	Mussive Sulfide	massive		pyrrhotite-rich(wk-mag)	Sep. 19, 2002
81	02MRN081		-		Jebilet	31 48.487	8 14.538	Basic volcanics	massive, tuffaceous			Sep. 20, 2002
82	02MRN082		-		Jebilet	31 48.418	8 14.172	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 qtz/m.s		massive, brown	Sep. 21, 2002
85	02MRN085	BS15	302.20 - 302.30	1/2	Draa Sfa		Visian	Mussive Sulfide	layered 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	Acidic volcanics	Rhyolite massive			Sep. 22, 2002
91	02MRN091		-		Bai Azouliz south	31 28.552	8 11.773	Black shale	tuffaceous calcareous			Sep. 22, 2002
92	02MRN092		-		Amzourh	31 21.847	8 8.444	Acidic volcanics	Rhyolite massive			Sep. 23, 2002
93	02MRN093		-		Hajar-north	31 24.326	8 6.134	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	tuffaceous		py dissemination	Sep. 25, 2002
101	02MRN101	380ML	-		Hajar		Visian	Acidic volcanics	Pinkish dacite		py dissemination	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	Geology	Description	Mineralization	Remarks
					Area	Latitude(N)						
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		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		Quartz vein + sulfide vein		Sep. 26, 2002
111	02MRN111	AZG480	405.00 - 405.10	1/4	Hajar		Visian	Vein		Quartz vein + sulfide vein		Sep. 26, 2002
112	02MRN112	AZG480	405.10 - 405.20	1/4	Hajar		Visian	Vein		Quartz vein + sulfide vein		Sep. 26, 2002
113	02MRN113	AZG480	405.20 - 405.30	1/4	Hajar		Visian	Vein		Quartz vein + sulfide vein		Sep. 26, 2002
114	02MRN114	HS13	228.40 - 228.50	1/4	Hajar		Visian	Sulfide		Sulfide layer in b.s.		Sep. 26, 2002
115	02MRN115	HS13	230.60 - 230.70	1/4	Hajar		Visian	Sulfide		Sulfide layer in b.s.		Sep. 26, 2002
116	02MRN116	HS13	246.80 - 246.90	1/4	Hajar		Visian	Sulfide		Sulfide layer in b.s.		Sep. 26, 2002
117	02MRN117		-		Jebilet	31 51.778	7 57.804	Sulfide		Frag el Ma mine (galena)		Sep. 29, 2002
118	02MRN118	FZ13	33.10 - 33.20	1/4	Frizen		Visian	Vein		dacite (strong silicification)		Sep. 29, 2002
119	02MRN119	FZ13	33.90 - 34.00	1/4	Frizen		Visian	Vein		dacite (strong silicification)		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)		Sep. 29, 2002
122	02MRN122	FZ13	41.20 - 41.30	1/4	Frizen		Visian	Vein		dacite (strong silicification)		Sep. 29, 2002
123	02MRN123	FZ13	42.20 - 42.30	1/4	Frizen		Visian	Vein		dacite (strong silicification)		Sep. 29, 2002
124	02MRN124	FZ13	43.40 - 43.50	1/4	Frizen		Visian	Vein		dacite (strong silicification)		Sep. 29, 2002
125	02MRN125	FZ13	43.50 - 43.60	1/4	Frizen		Visian	Vein		dacite (strong silicification)		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)		Sep. 29, 2002
128	02MRN128	FZ13	53.00 - 53.10	1/4	Frizen		Visian	Vein		dacite (silicification)		Sep. 29, 2002
129	02MRN129	FZ13	54.00 - 54.10	1/4	Frizen		Visian	Vein		dacite (silicification)		Sep. 29, 2002
130	02MRN130	FZ13	67.00 - 67.10	1/4	Frizen		Visian	Vein		dacite (silicification)		Sep. 29, 2002
131	02MRN131	FR12	49.40 - 49.50	1/4	Frizen		Visian	Acidic volcanics		Rhyolitic tuff (strong argill.)		Sep. 29, 2002
132	02MRN132	FR12	52.00 - 52.10	1/4	Frizen		Visian	Mussive Sulfide		Rhyolitic tuff (strong argill.)/M		Sep. 29, 2002
133	02MRN133	FR12	64.80 - 64.90	1/4	Frizen		Visian	Mussive Sulfide		tuff/M.S		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		Sep. 29, 2002
136	02MRN136	FR12	70.70 - 70.80	1/4	Frizen		Visian	Mussive Sulfide		m.s./b.s (boundary)		Sep. 29, 2002
137	02MRN137	FR10	62.00 - 62.10	1/4	Frizen		Visian	Vein		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.		Sep. 29, 2002
140	02MRN140	FZ13	62.00 - 62.10	1/4	Frizen		Visian	Mussive Sulfide		B.S./B.S.		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	Black Shale		tufoceous		Sep. 30, 2002
146	02MRN140-2		-		Dras faa	31 42.249	8 8.155	Acidic volcanics		pyolitic, schisty		Sep. 30, 2002
147	02MRN141-2		-		Dras faa	31 42.427	8 8.075	Acidic volcanics		pyolitic, massive		Sep. 30, 2002
148	02MRN142-2	DSF2	112.50 - 112.60	1/4	Dras faa		Visian	Vein		tufoceous rhyolite		Sep. 30, 2002
149	02MRN143-2	DSF2	115.30 - 115.40	1/4	Dras faa		Visian	Mussive Sulfide		b.s./m.s.		Sep. 30, 2002
150	02MRN144	DSF2	118.00 - 118.20	1/4	Dras faa		Visian	Mussive Sulfide		tuff/b.s.		Sep. 30, 2002
151	02MRN145	DSF2	118.50 - 118.60	1/4	Dras faa		Visian	Mussive Sulfide		m.s./b.s.		Sep. 30, 2002
152	02MRN146	DSF15	241.80 - 248.90	1/4	Dras faa		Visian	Basic volcanics		hyoloclastite		Sep. 30, 2002
153	02MRN147	DSF15	243.60 - 243.65	1/4	Dras faa		Visian	Mussive Sulfide		m.s./b.s.		Sep. 30, 2002
154	02MRN148		-		Dras faa (400ml)		Visian	Vein		FW: volcanic sed (muddy)		Oct. 01, 2002
155	02MRN149		-		Dras faa (400ml)		Visian	Vein		HW:B.S.		Oct. 01, 2002
156	02MRN150		-		Dras faa (400ml)		Visian	Mussive Sulfide		white		Oct. 01, 2002
157	02MRN151		-		Dras faa (400ml)		Visian	Vein		fracture zone		Oct. 01, 2002

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

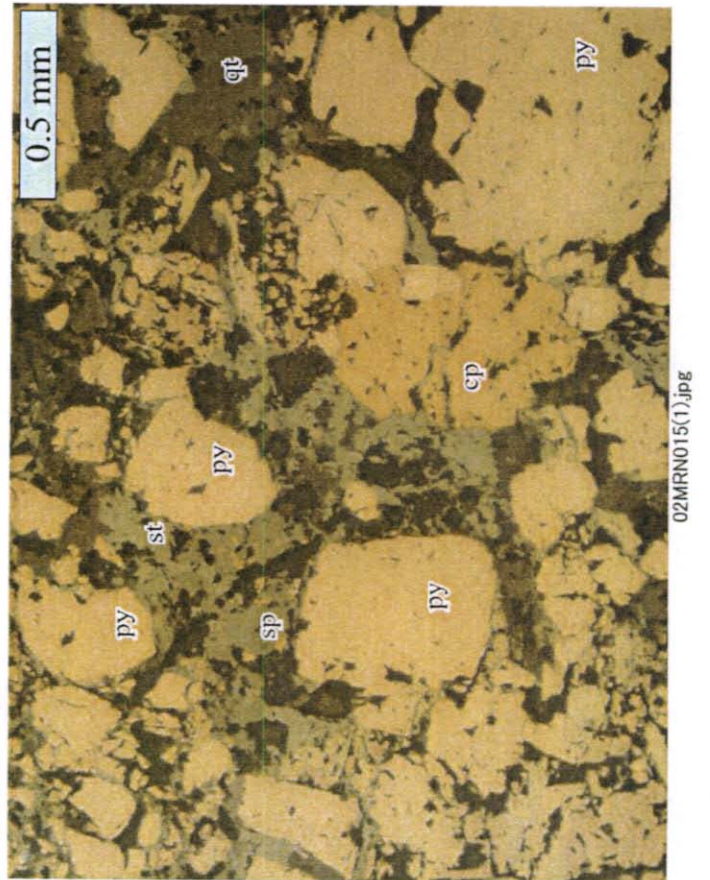
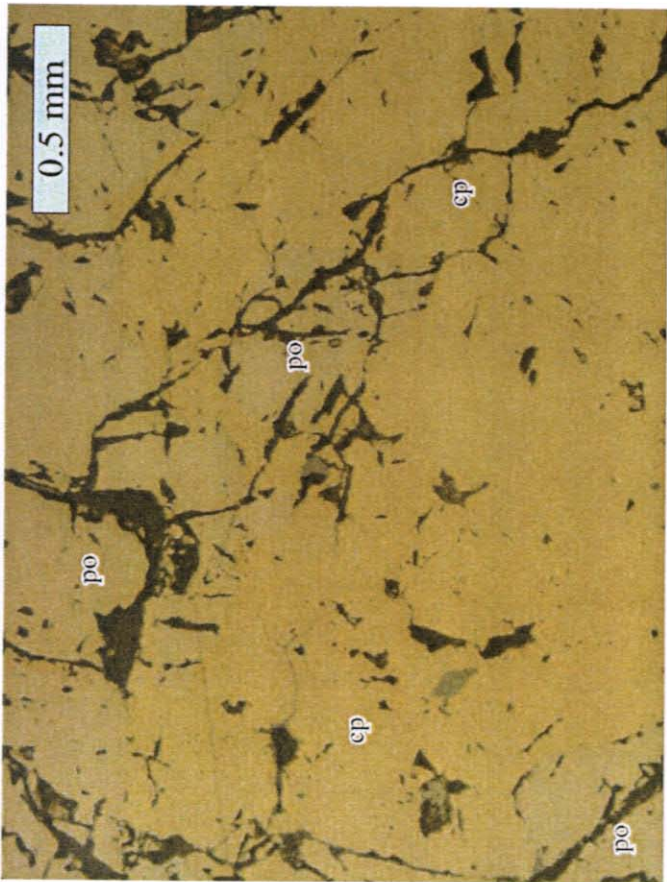
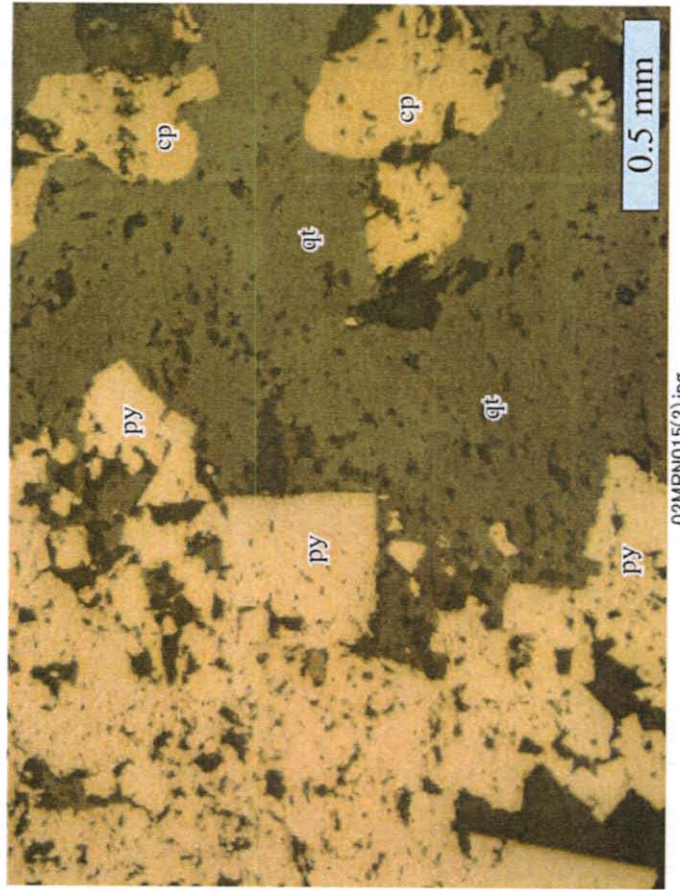
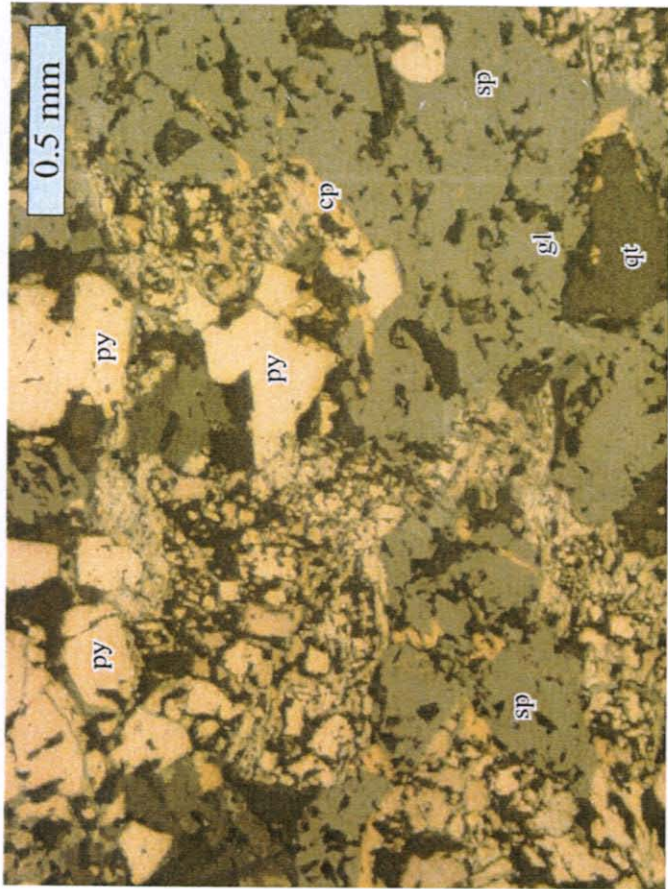


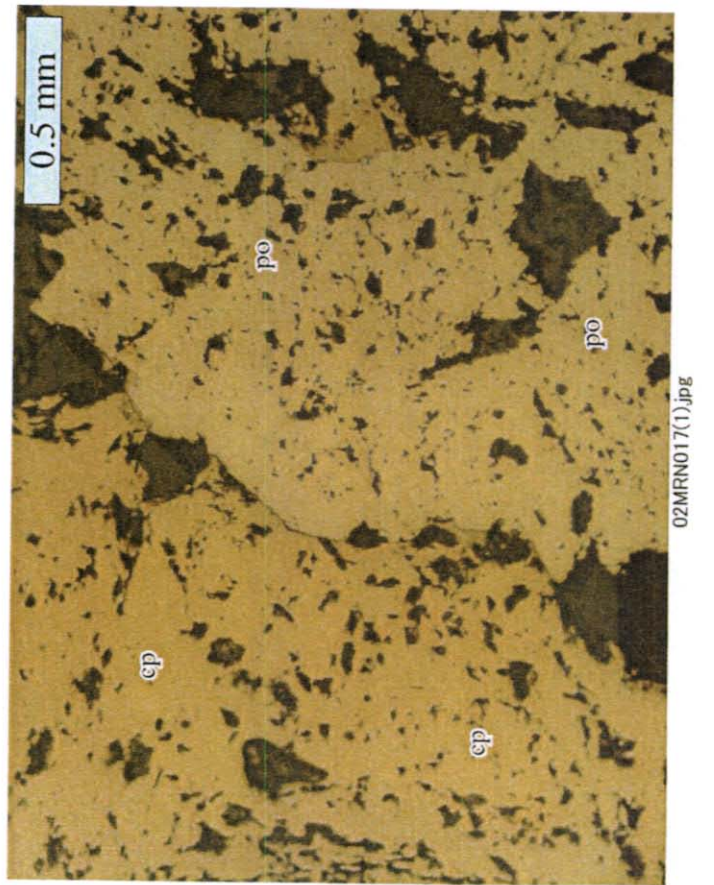
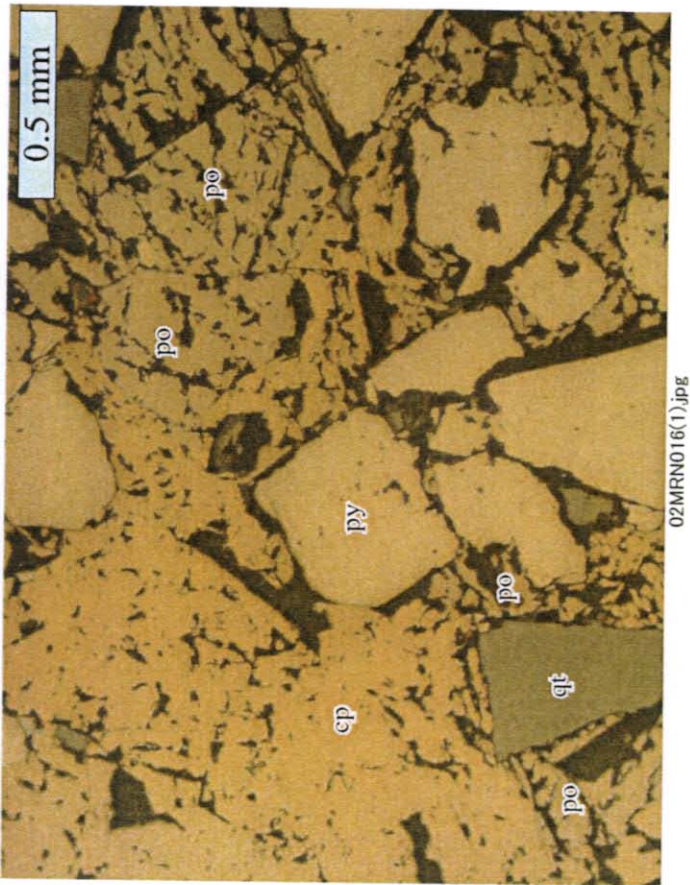
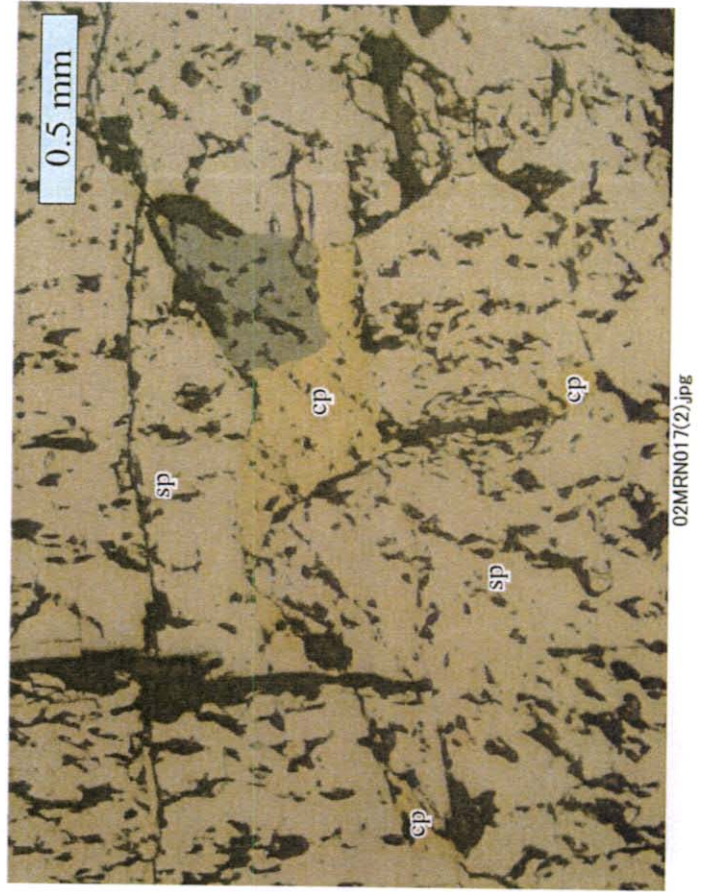
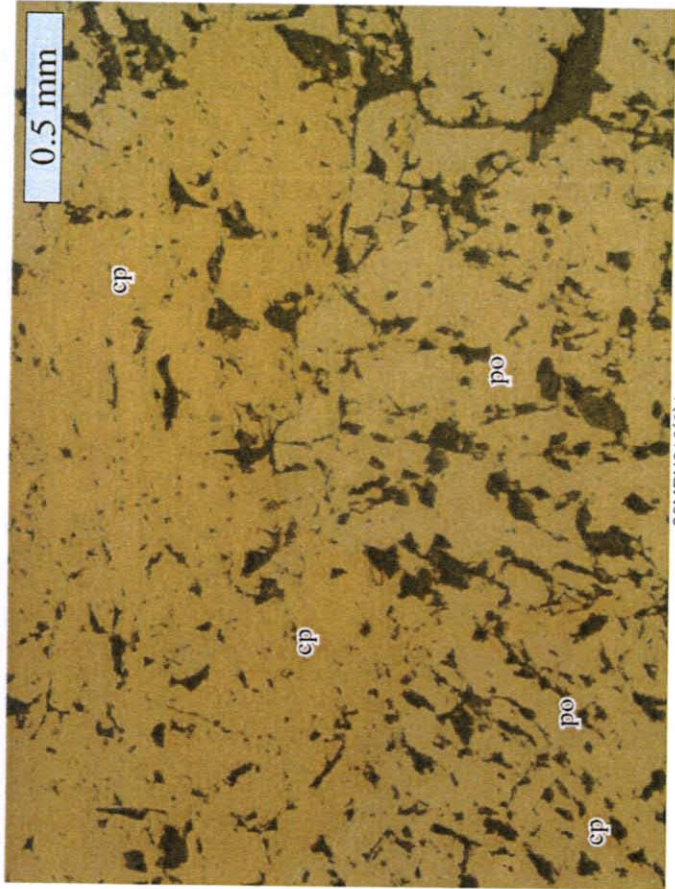
## **Appendix 3. Photomicrographs of Thin Sections**

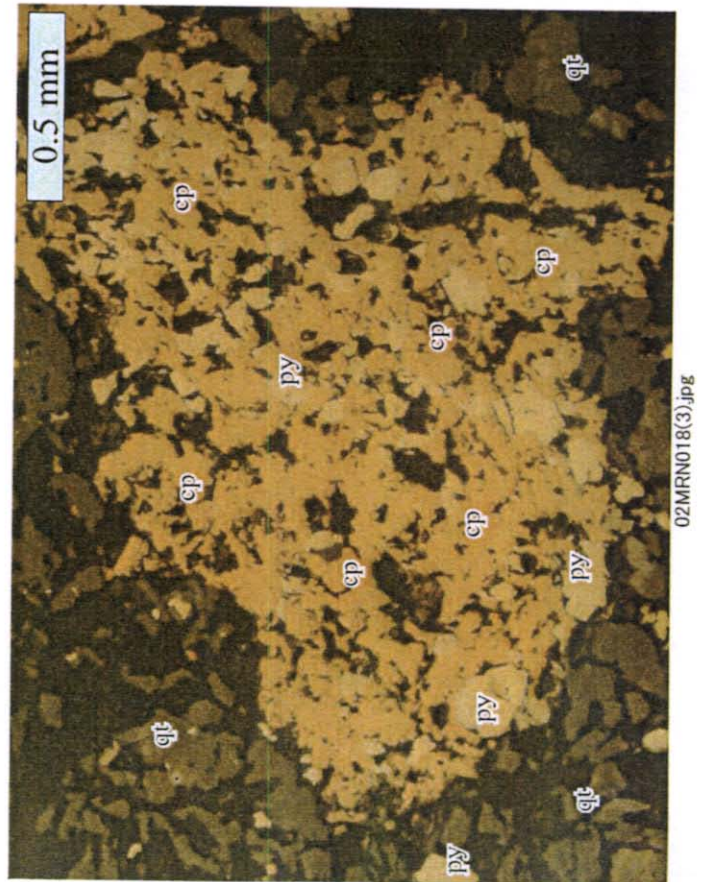
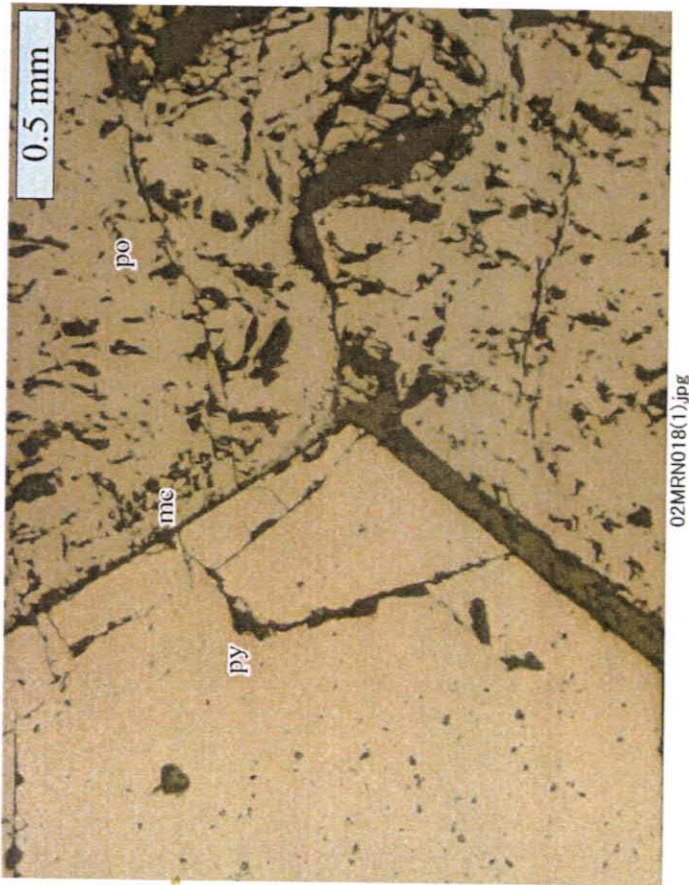
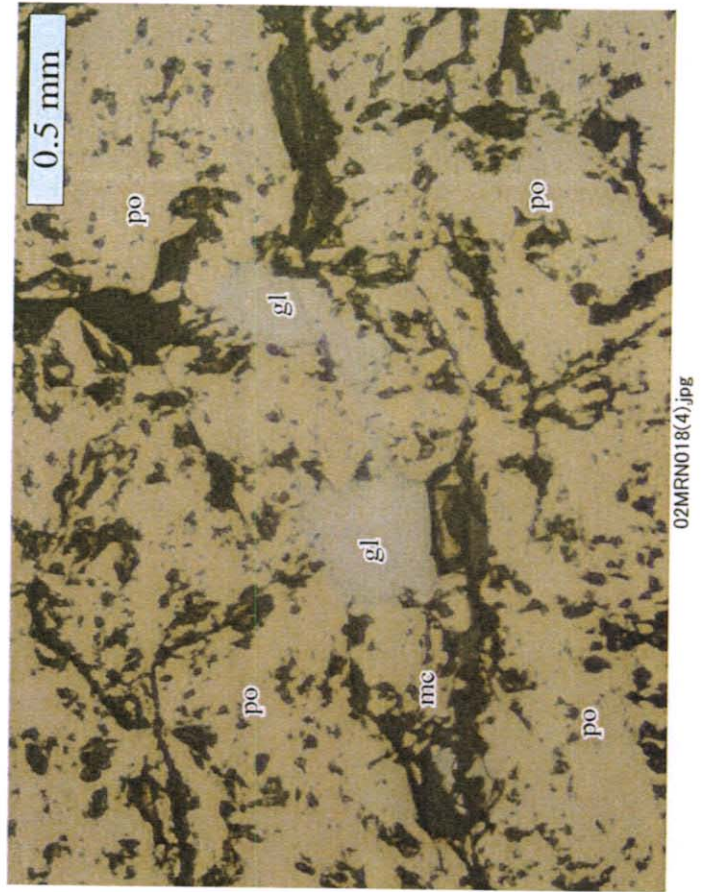
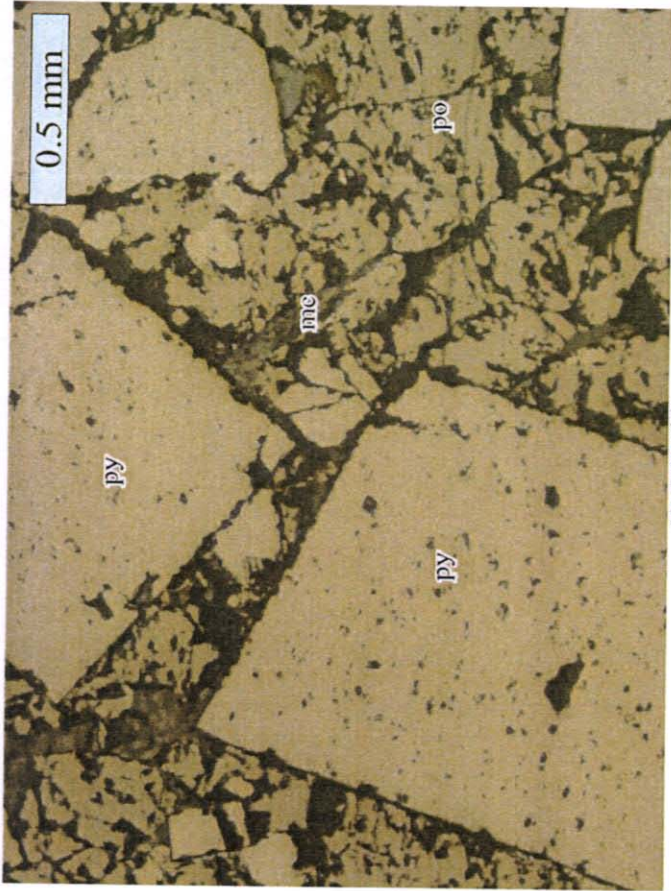
## **Sulfide Ore Minerals**

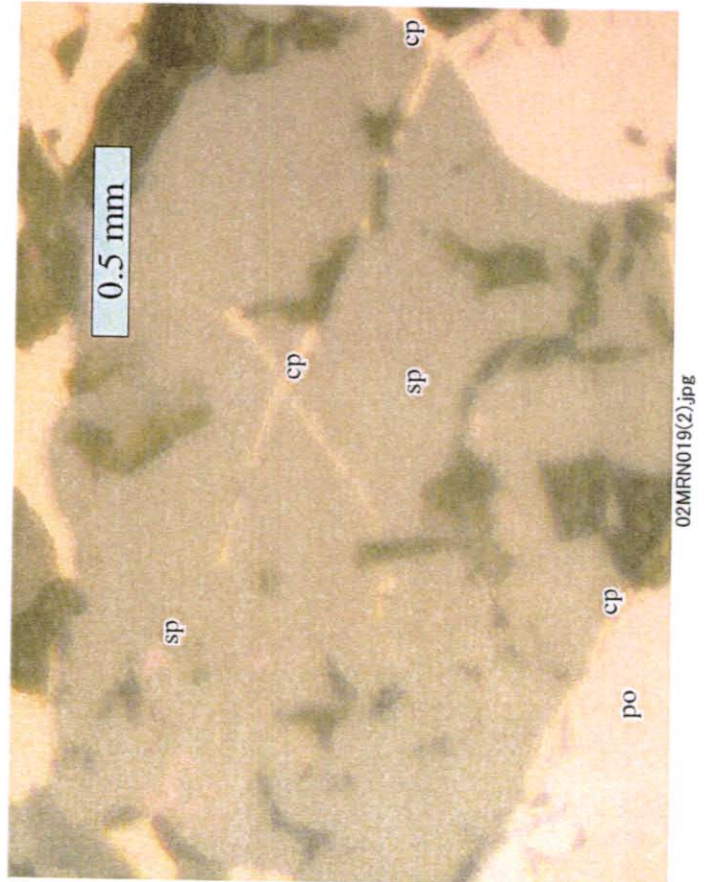
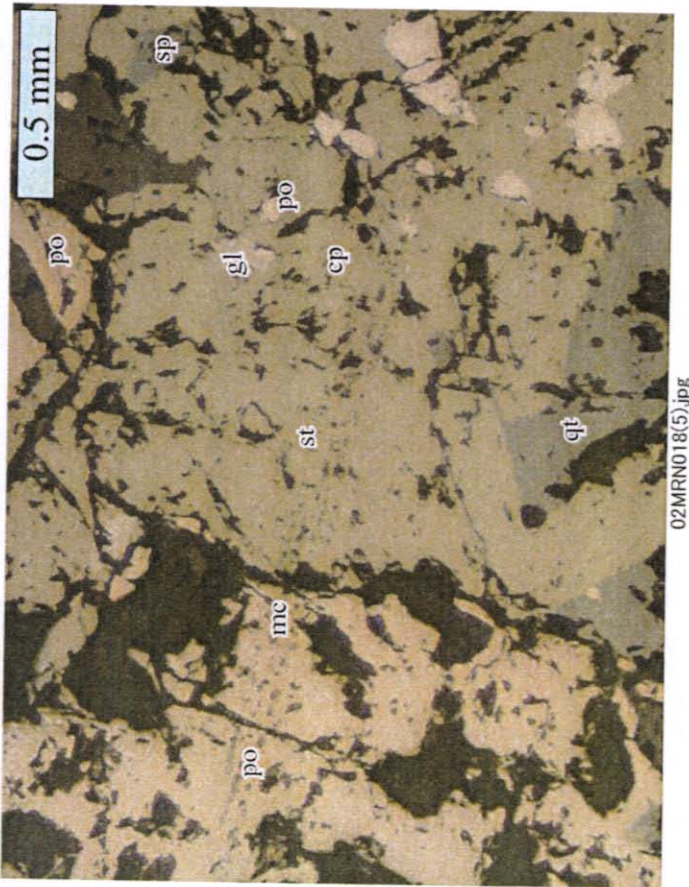
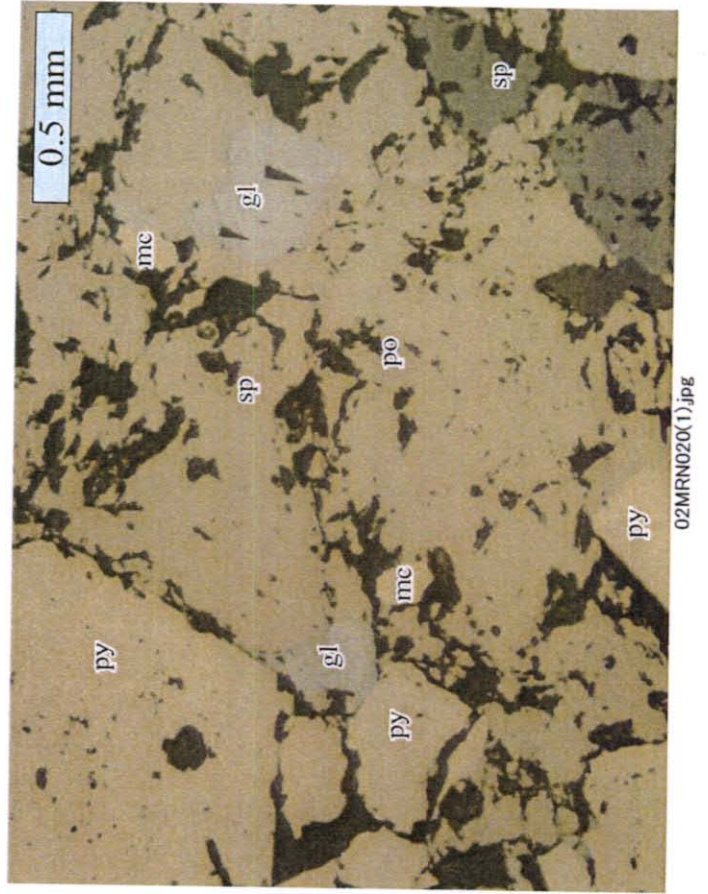
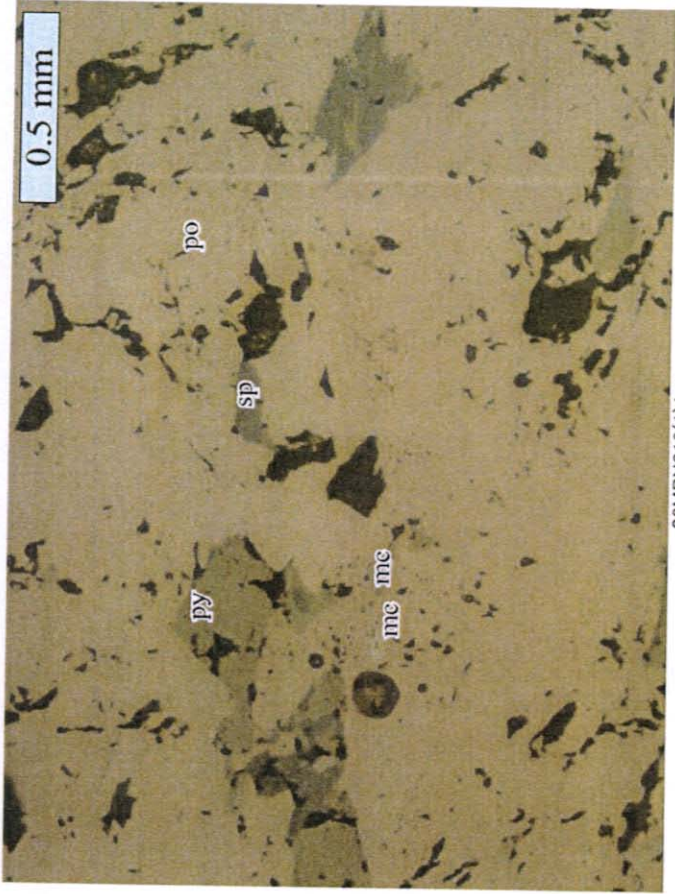
## LEGEND OF MINERALS

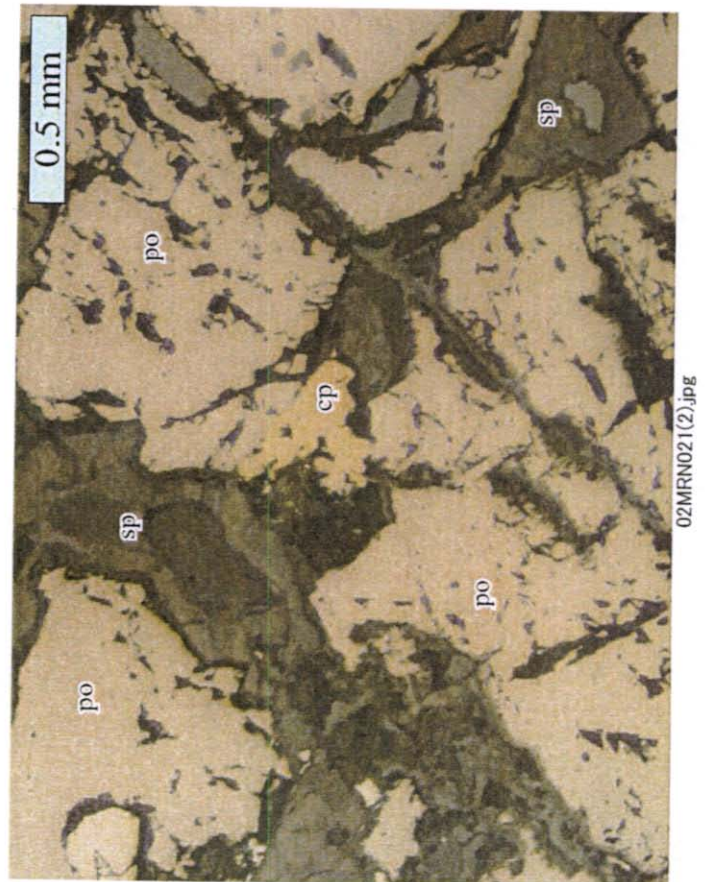
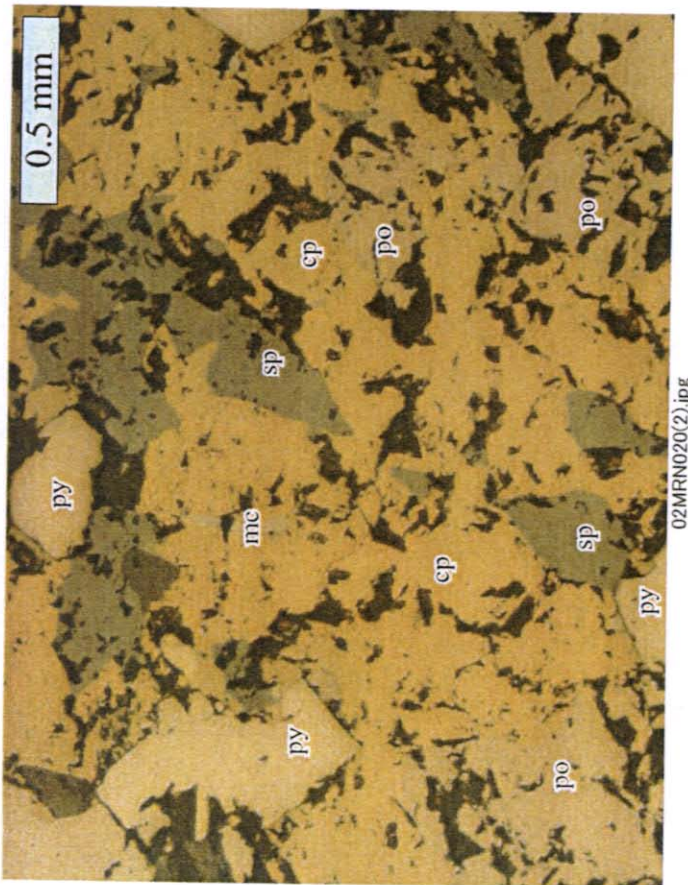
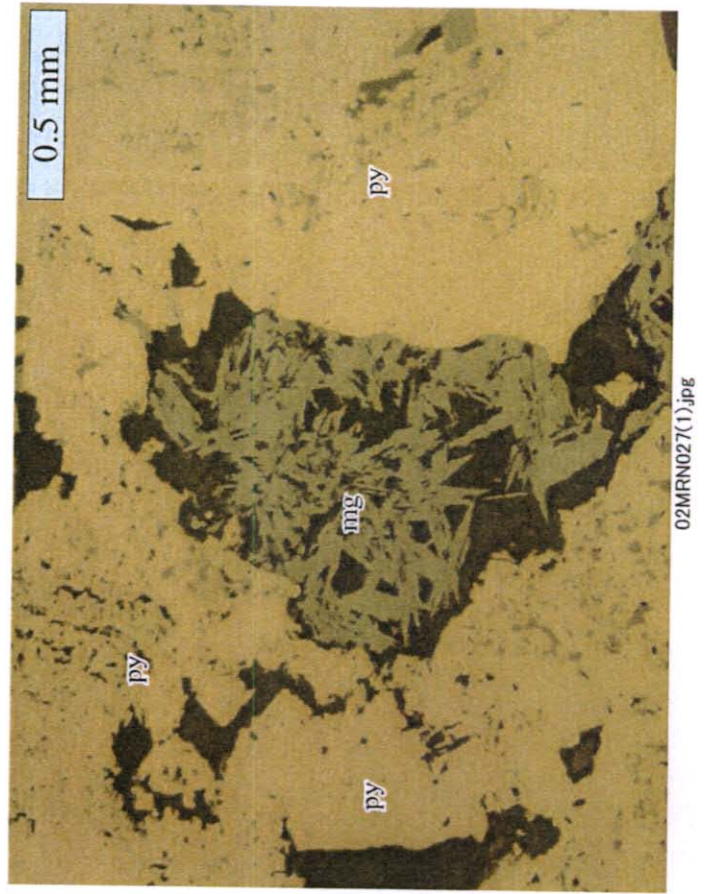
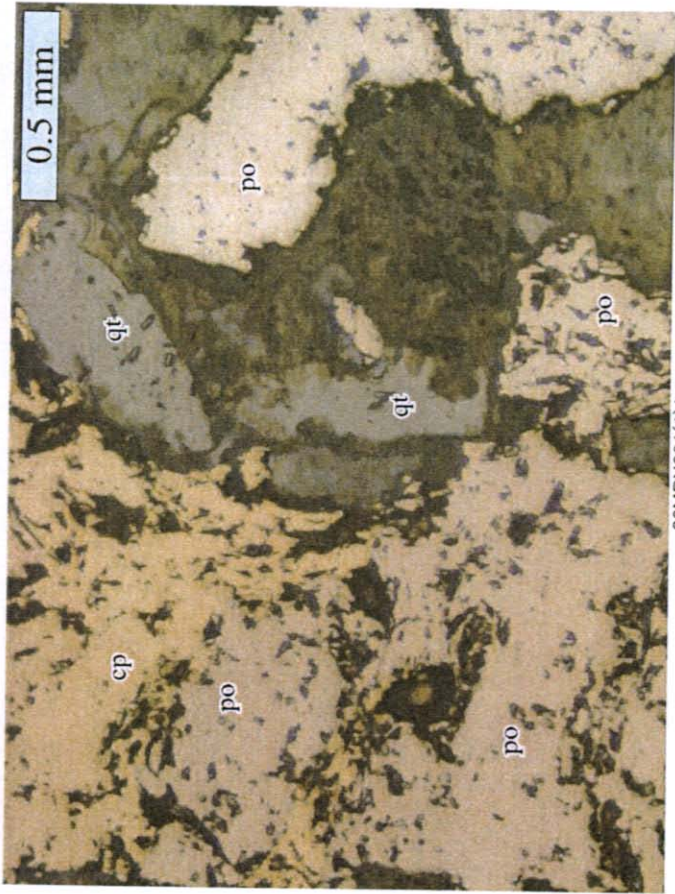
po	pyrrhotite
py	pyrite
cp	chalcopyrite
sp	sphalerite
gl	galena
mc	marcasite
mg	magnetite
hm	hematite
cv	covellite
ac	acanthite
st	stannite
qt	quartz
pl	plagioclase
cb	carbonate minerals



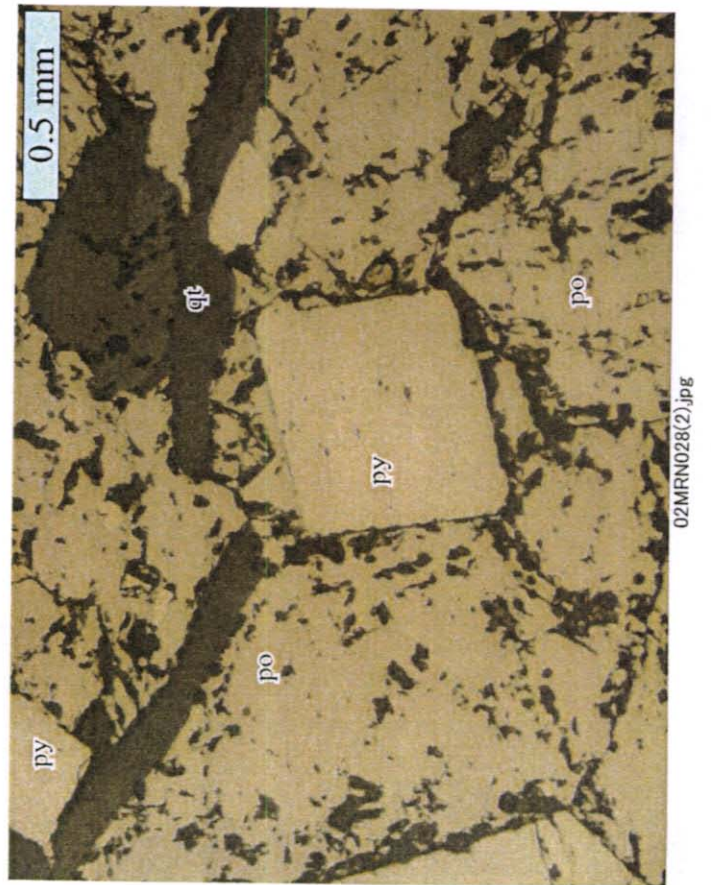
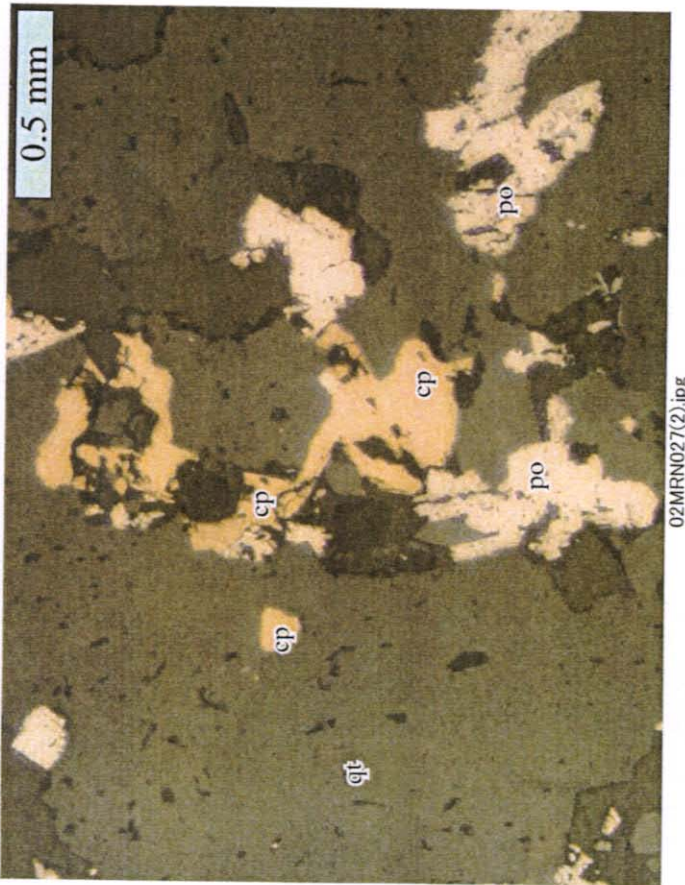
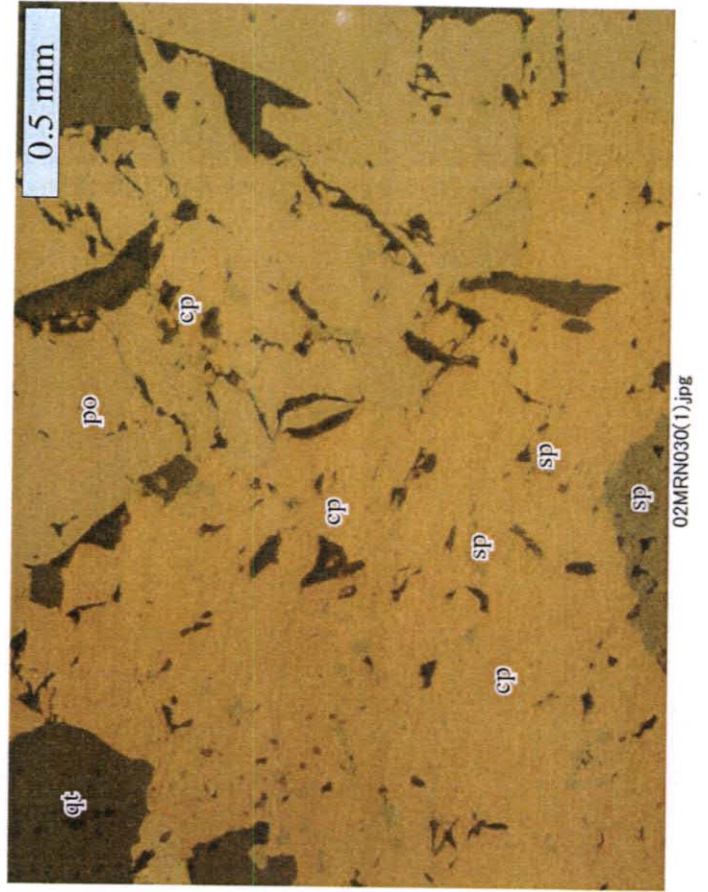
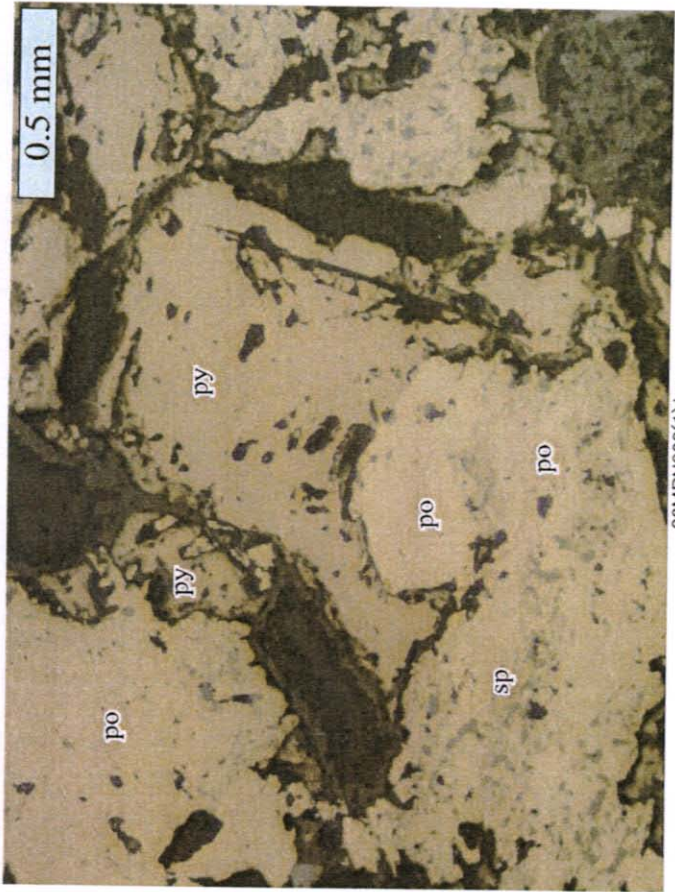


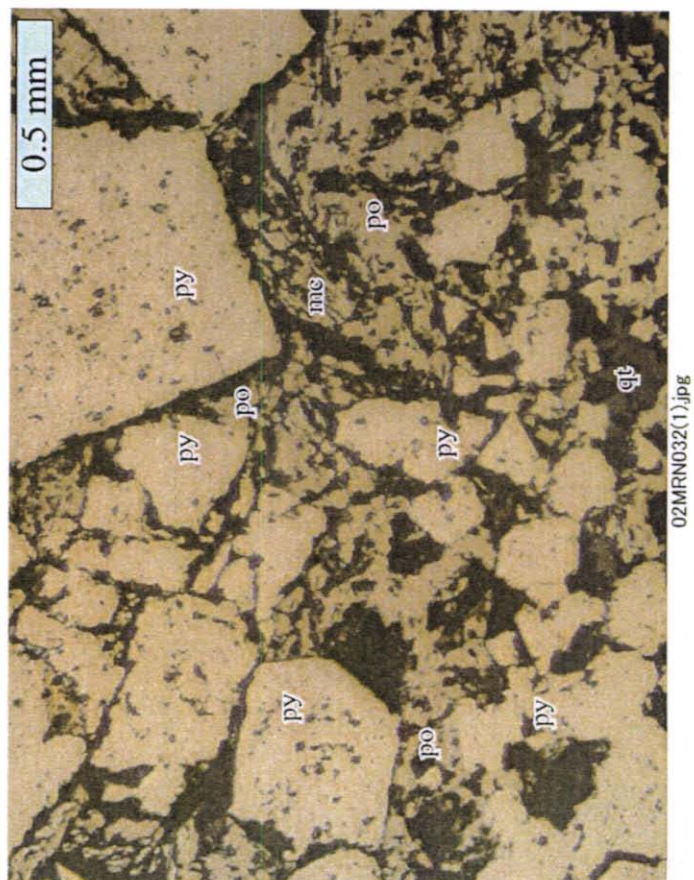
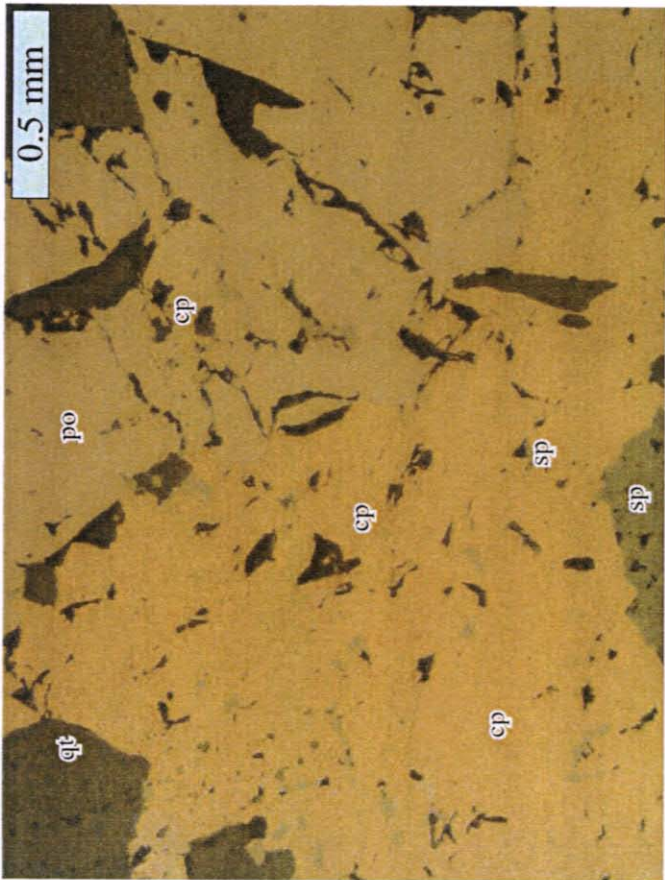
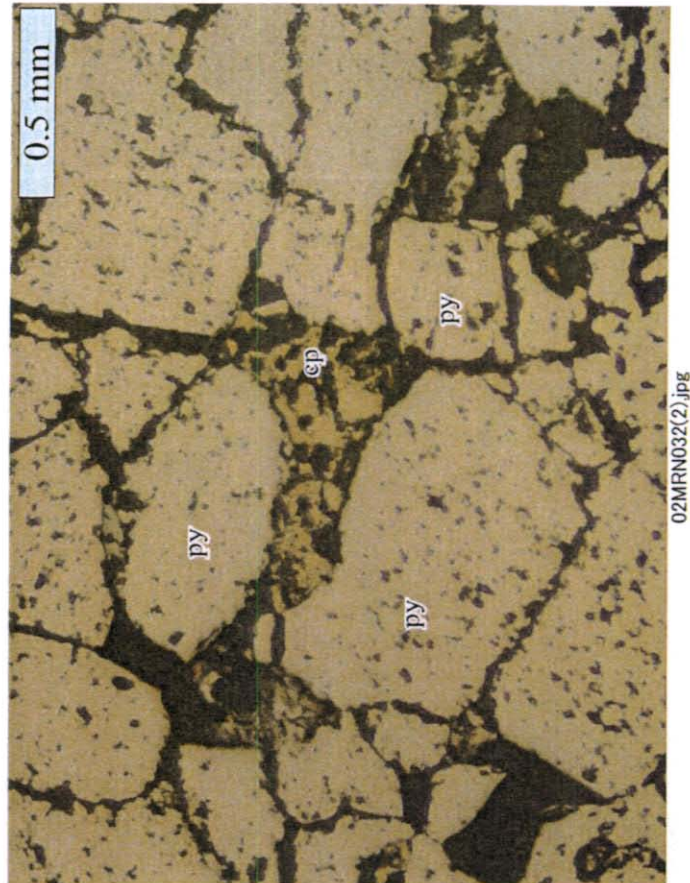
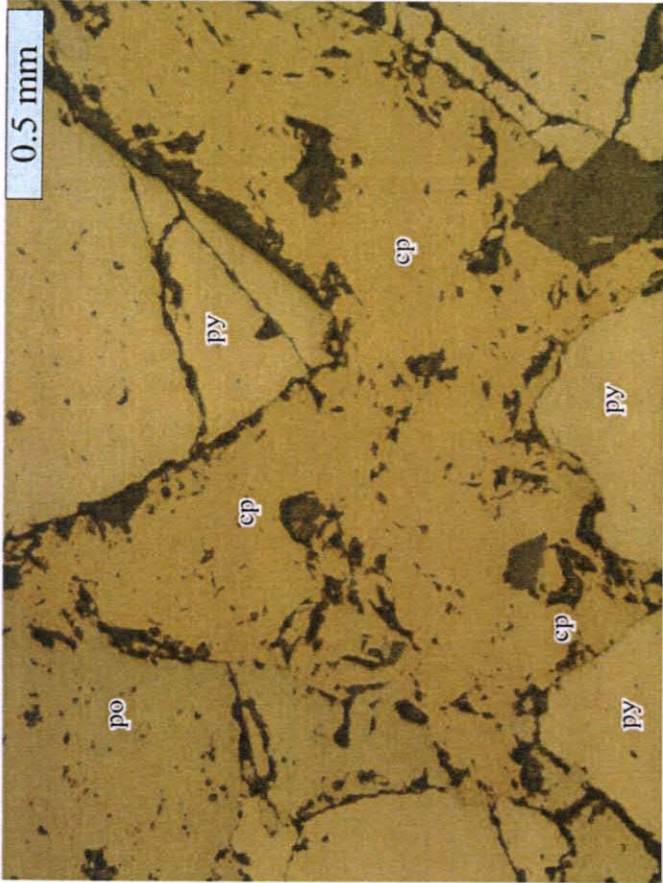


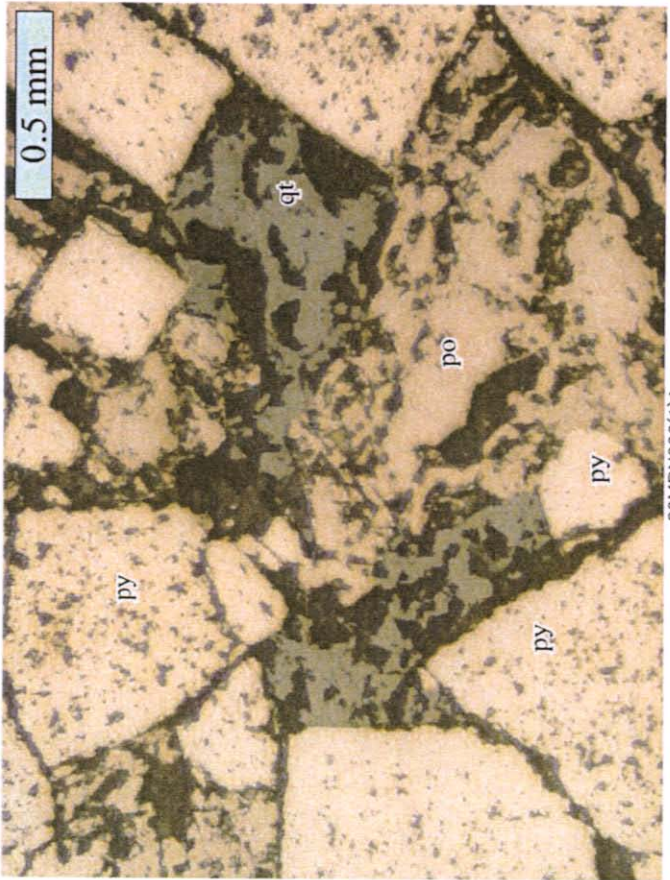
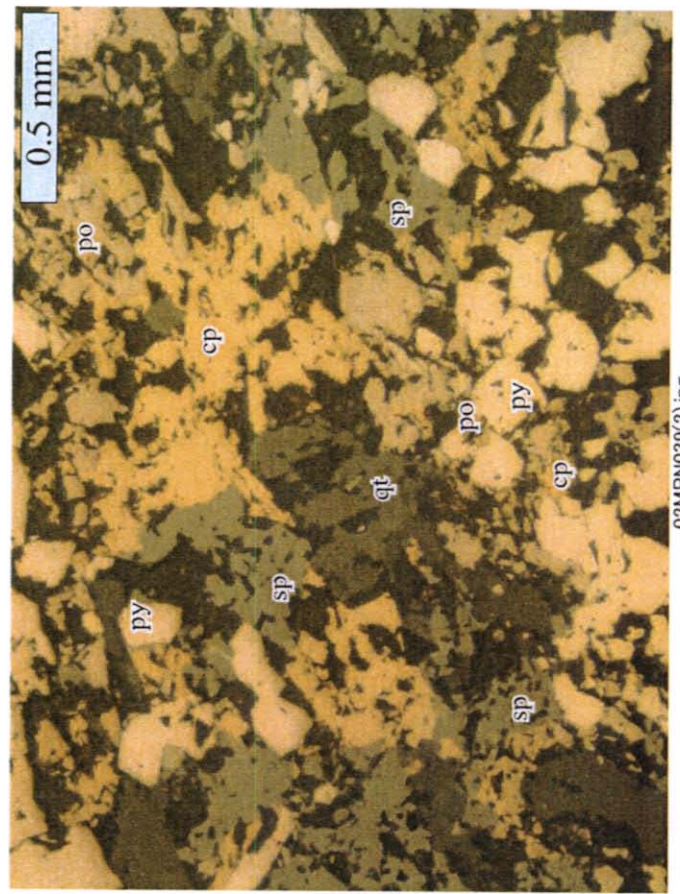
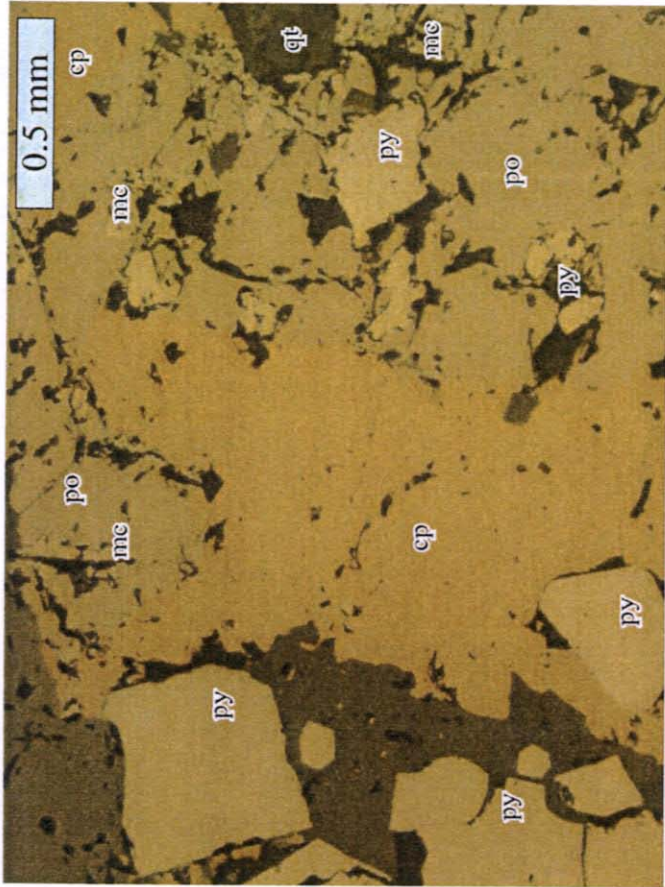


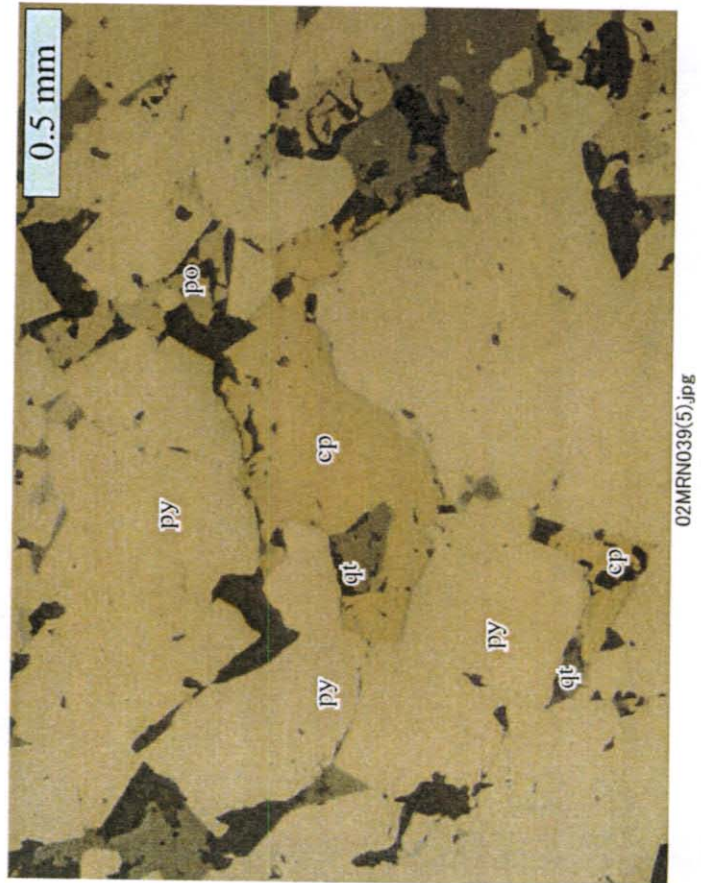
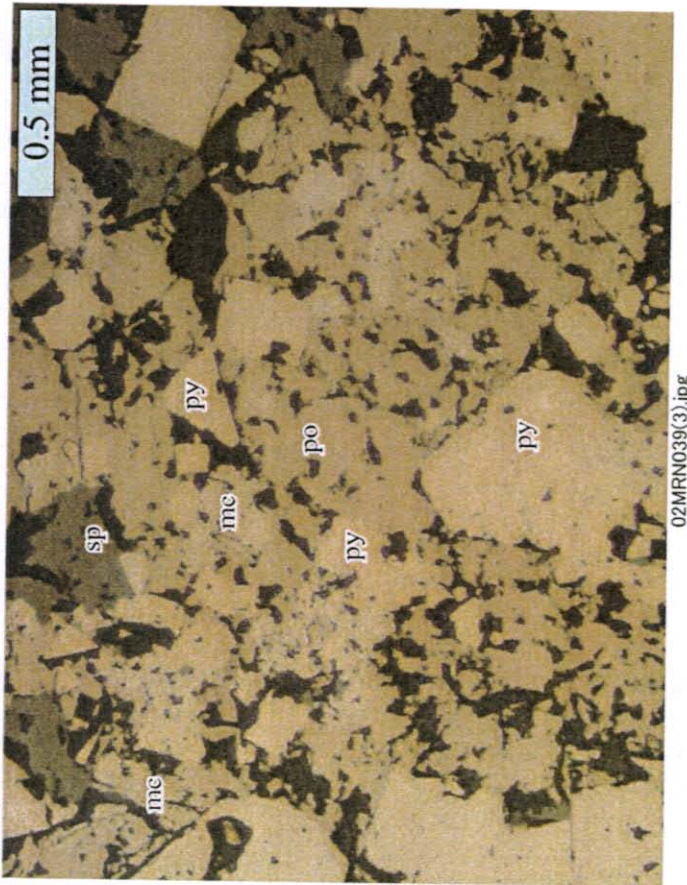
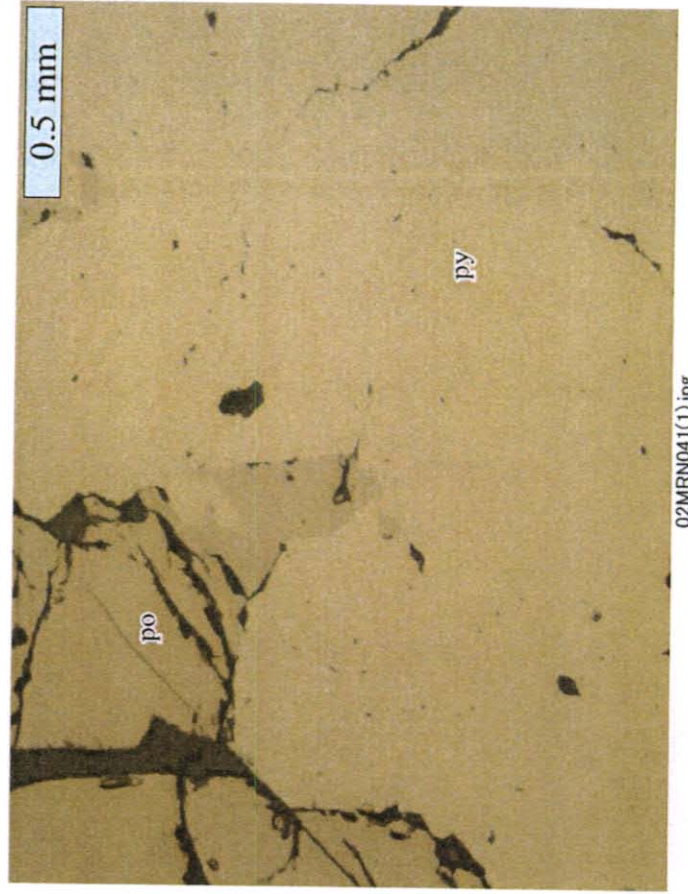
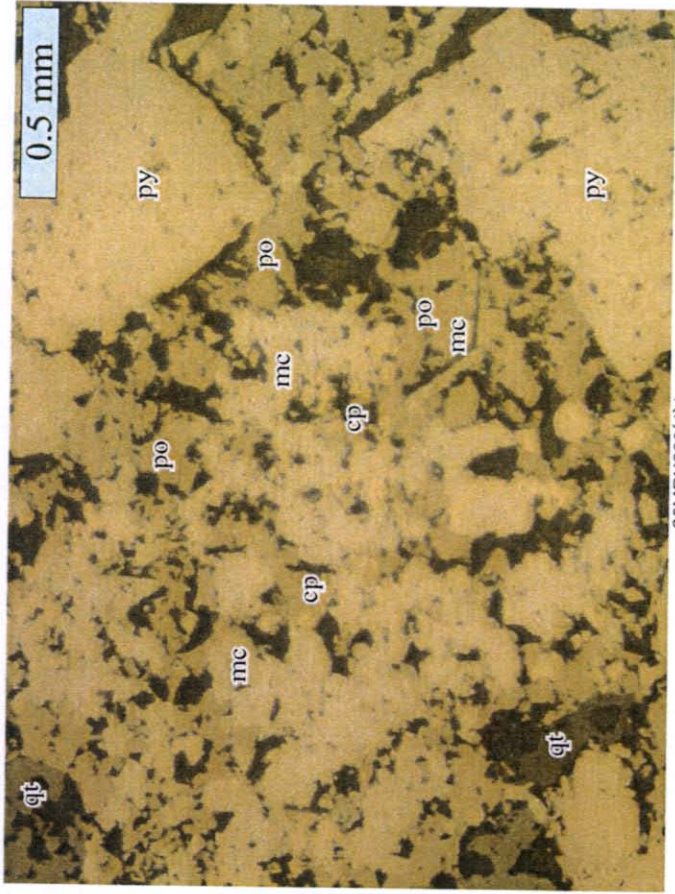


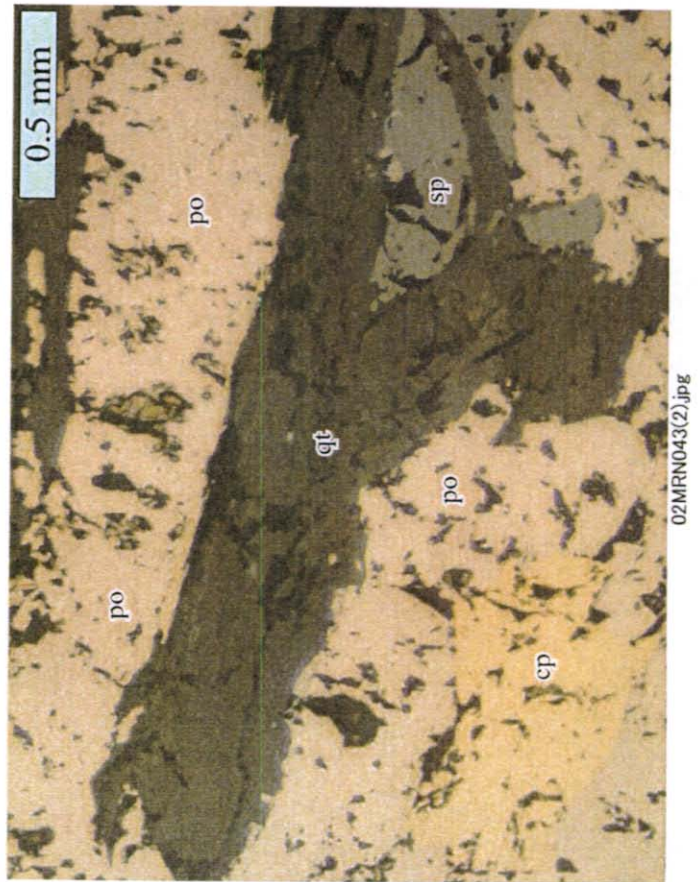
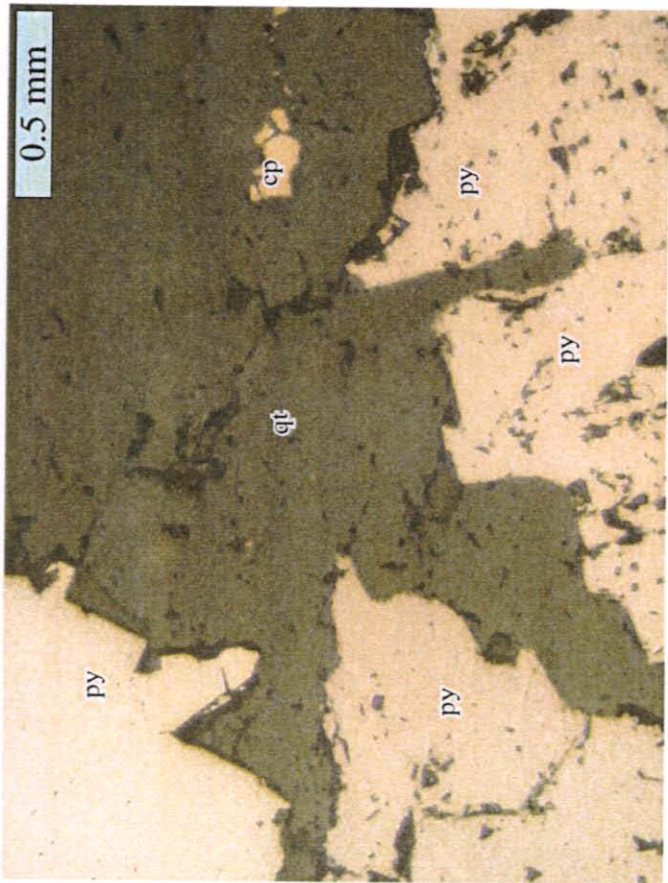
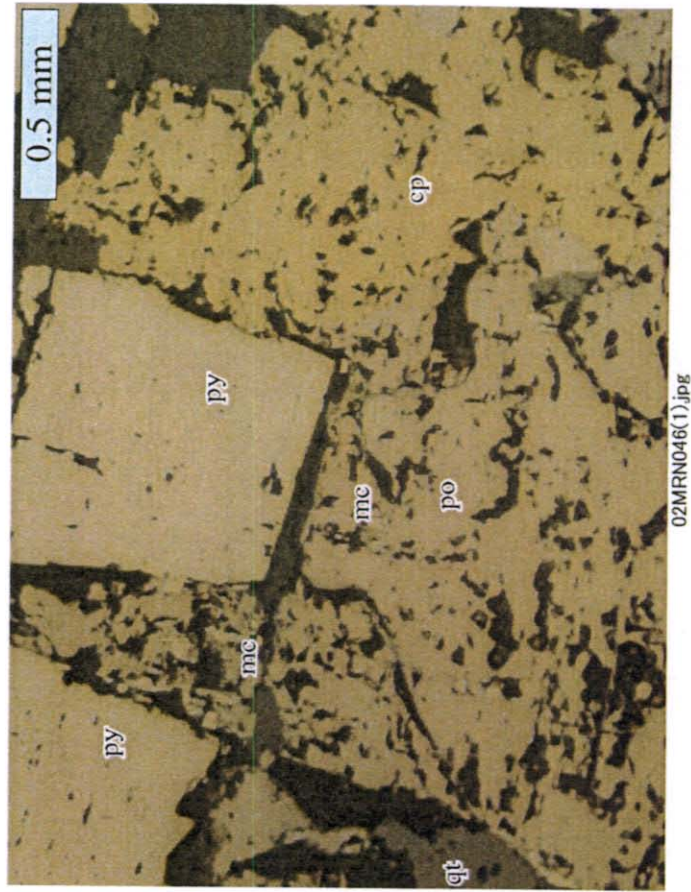
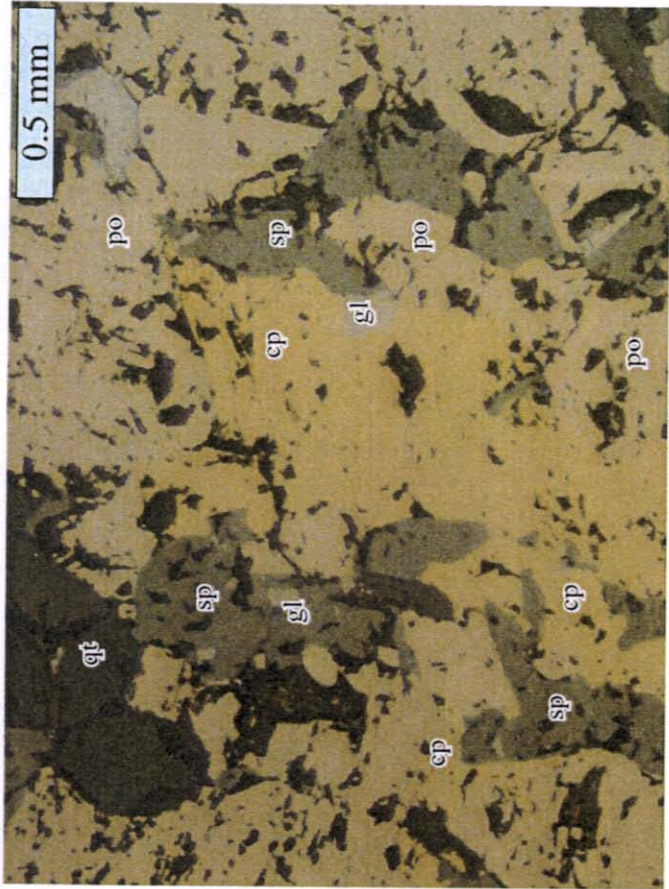


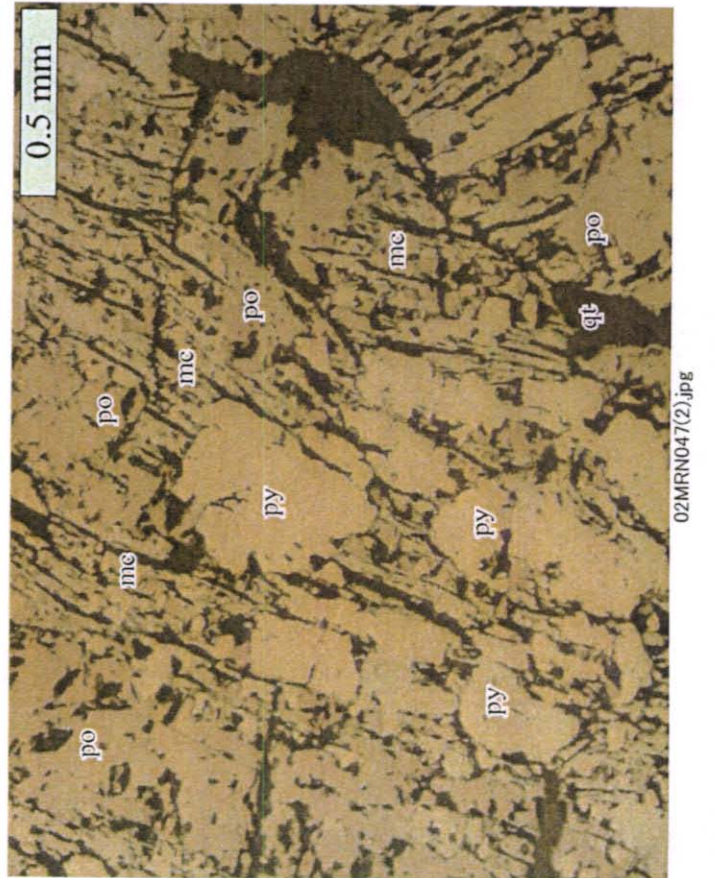
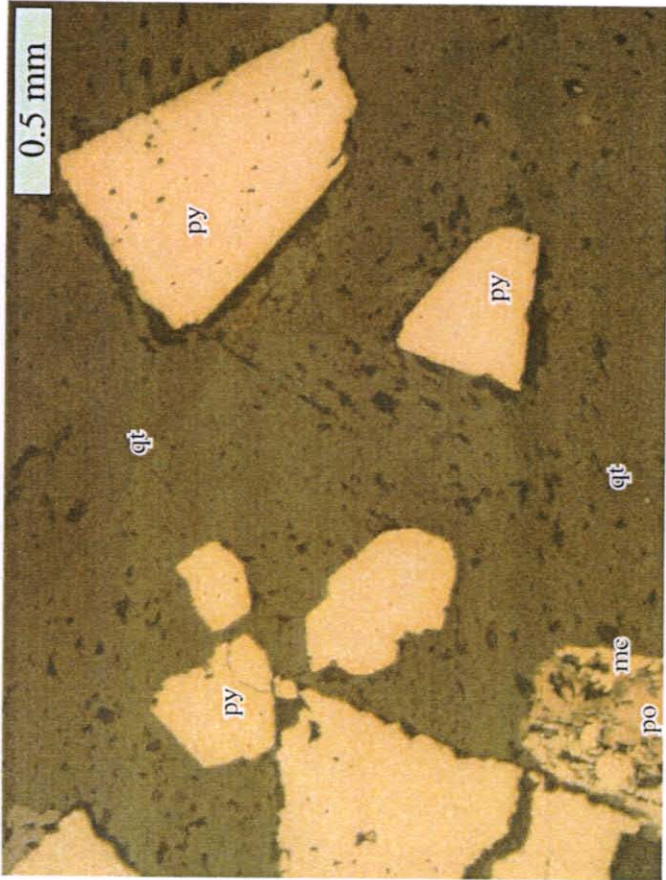
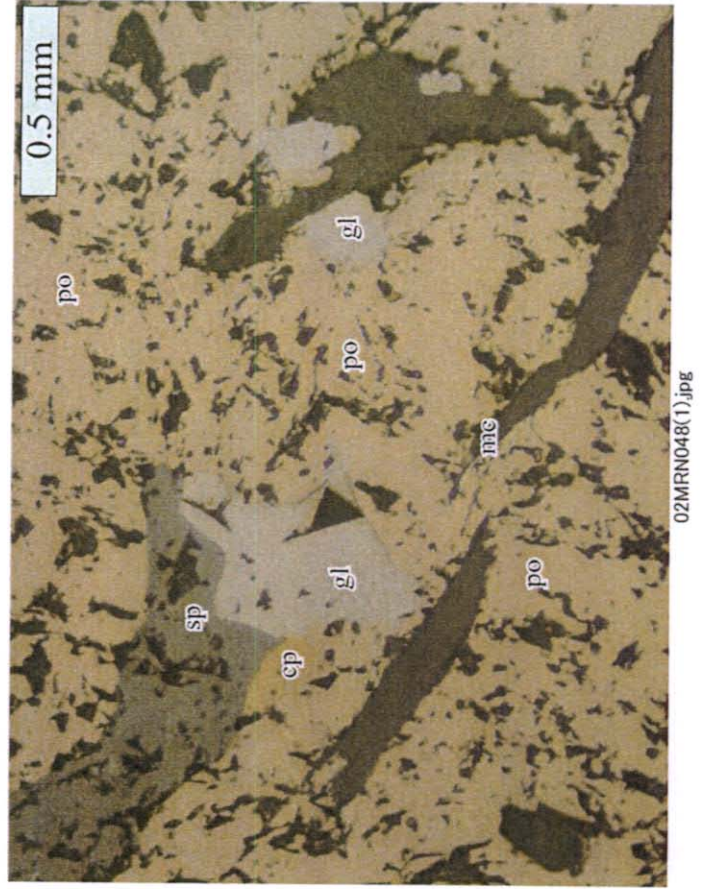
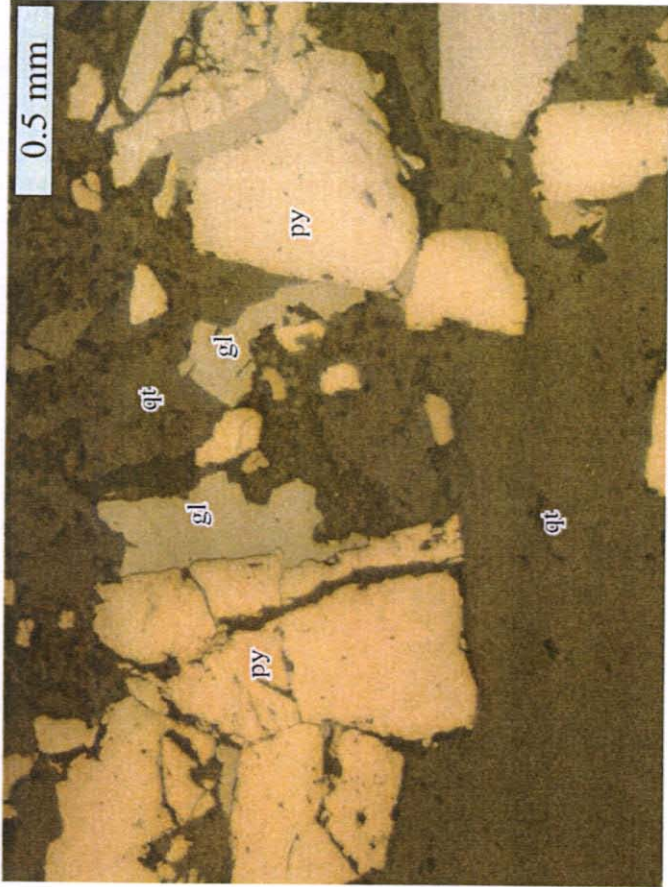


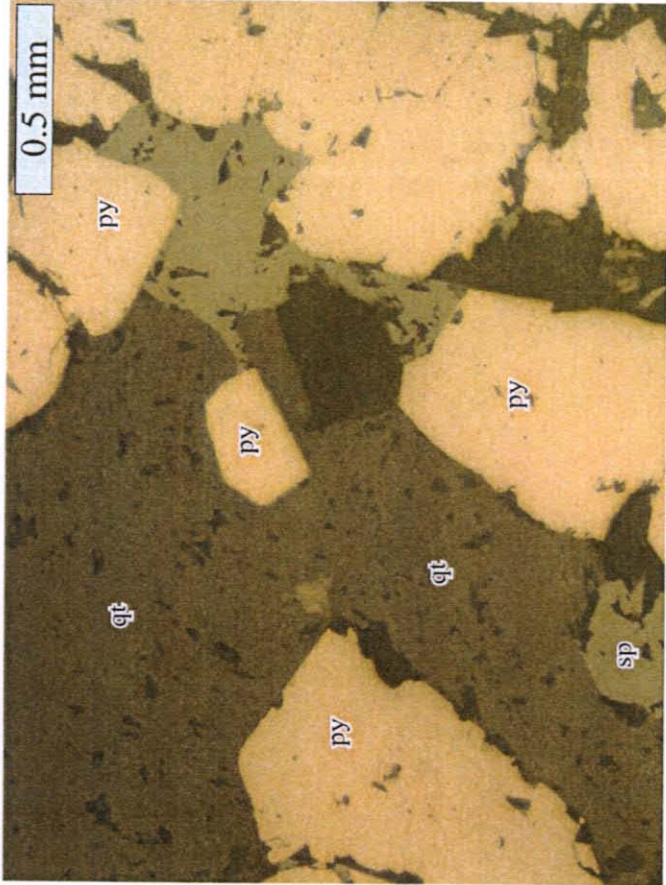




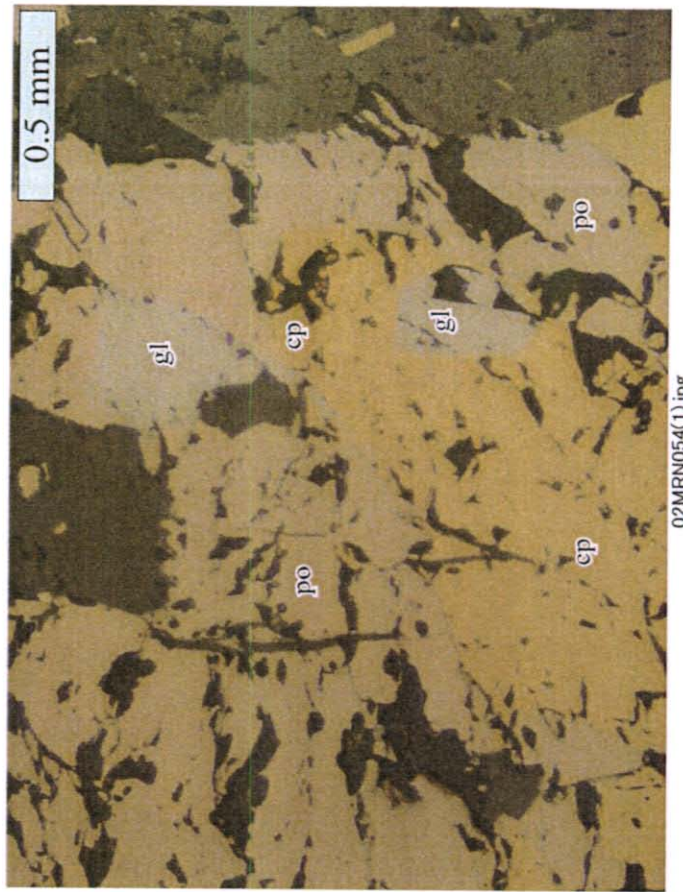




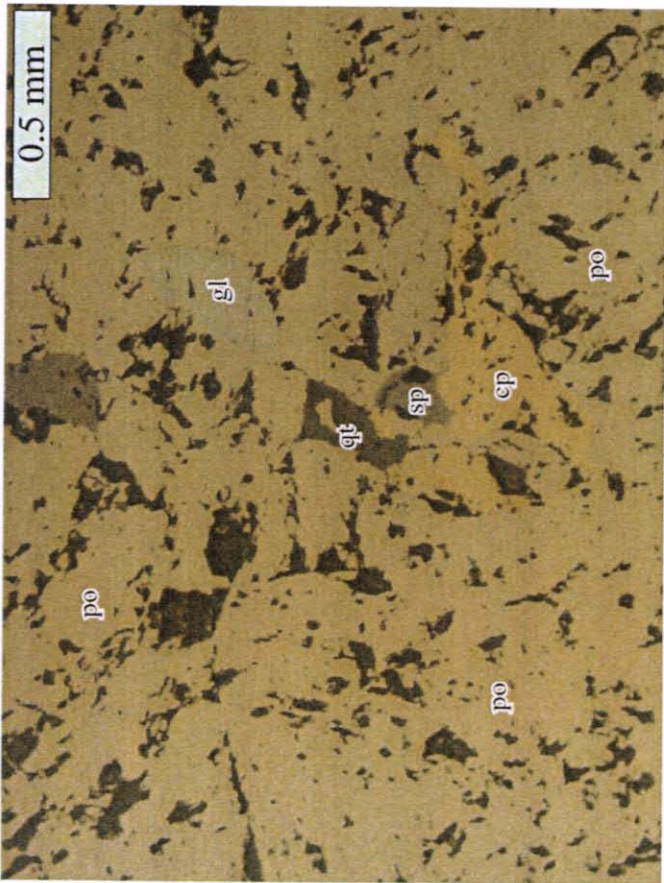




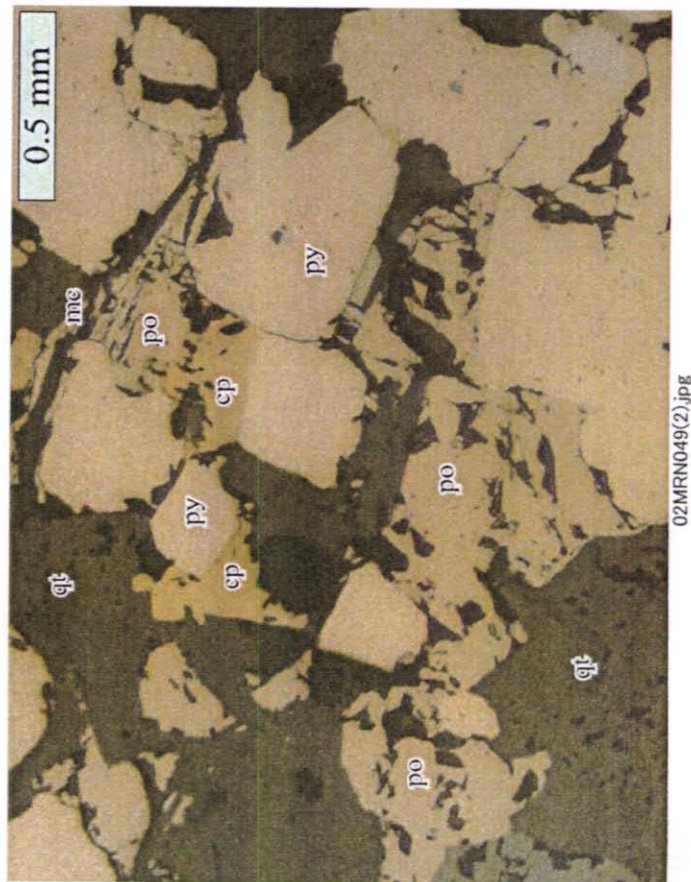
02MRN049(1).jpg



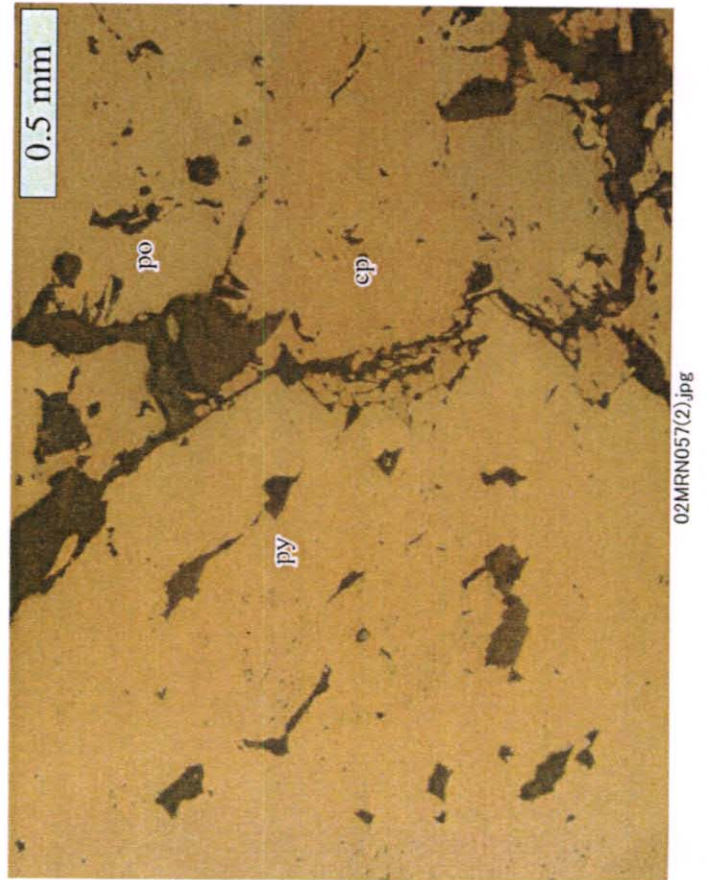
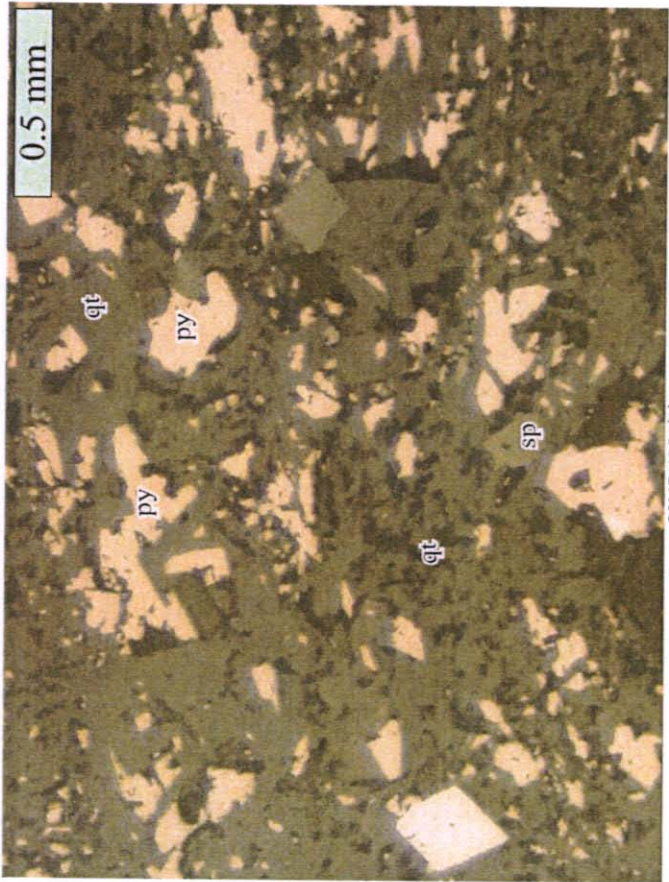
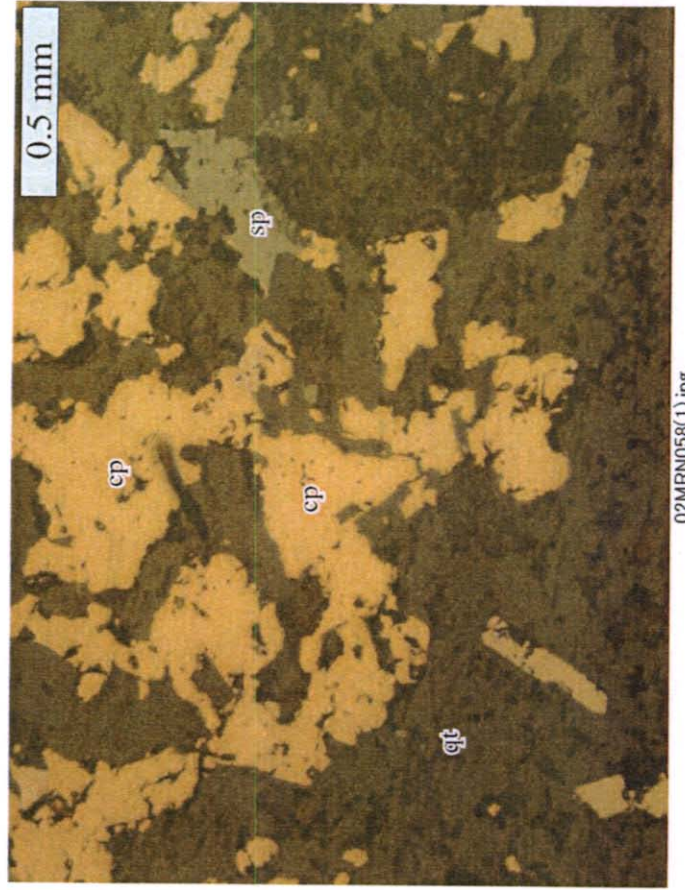
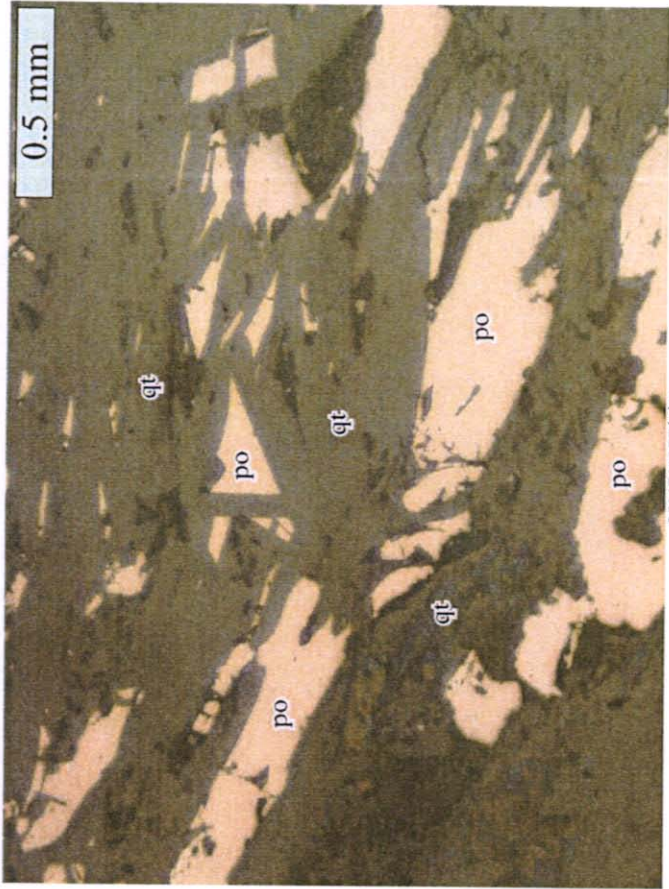
02MRN054(1).jpg



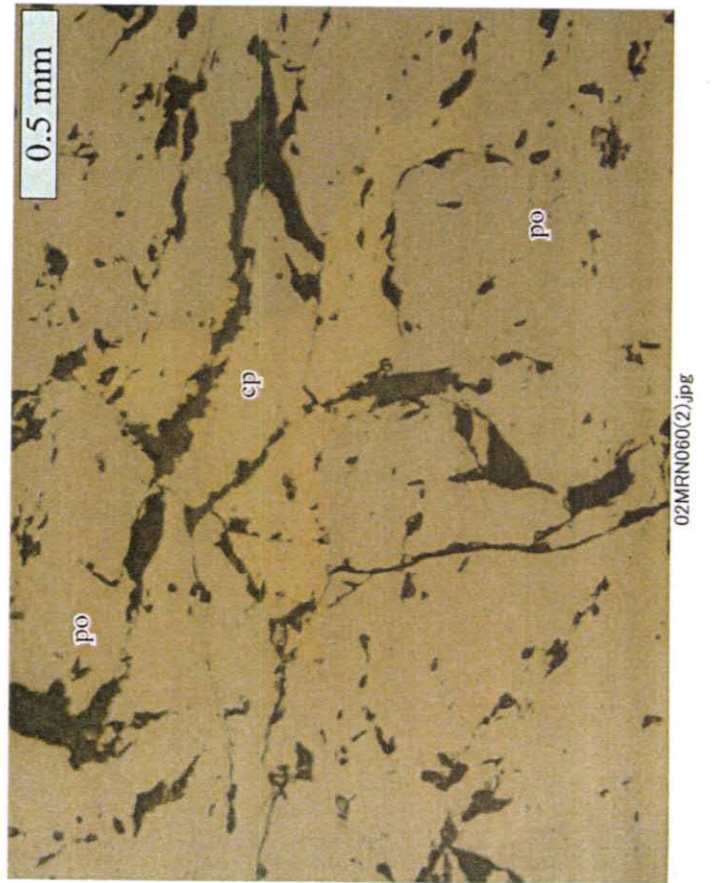
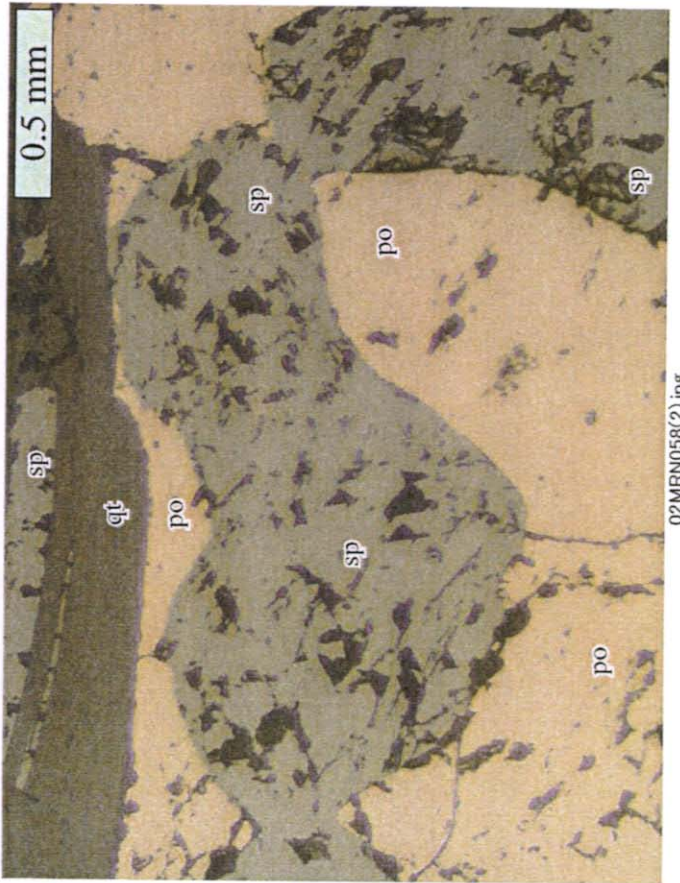
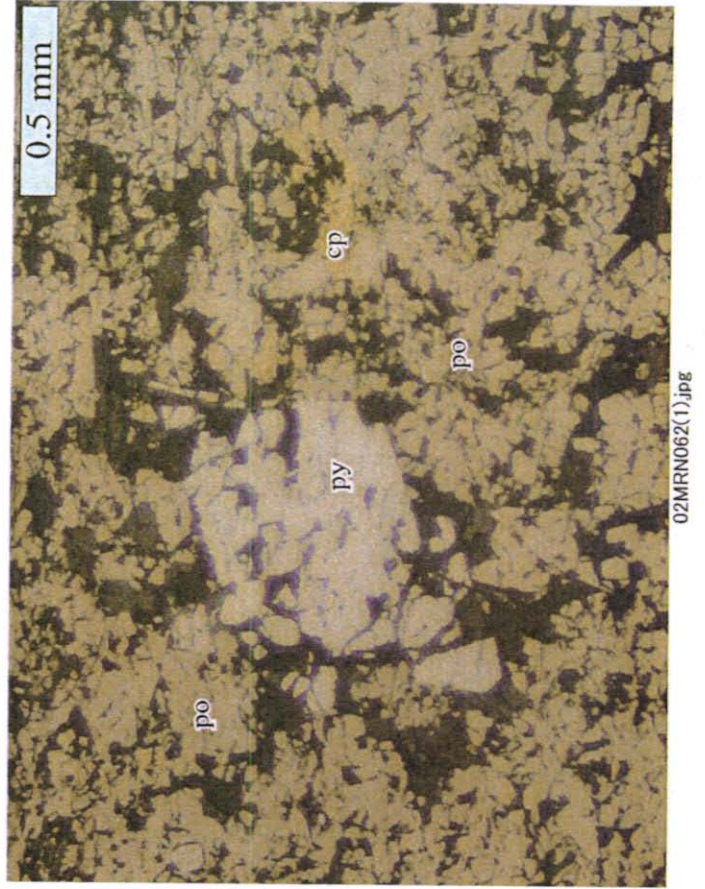
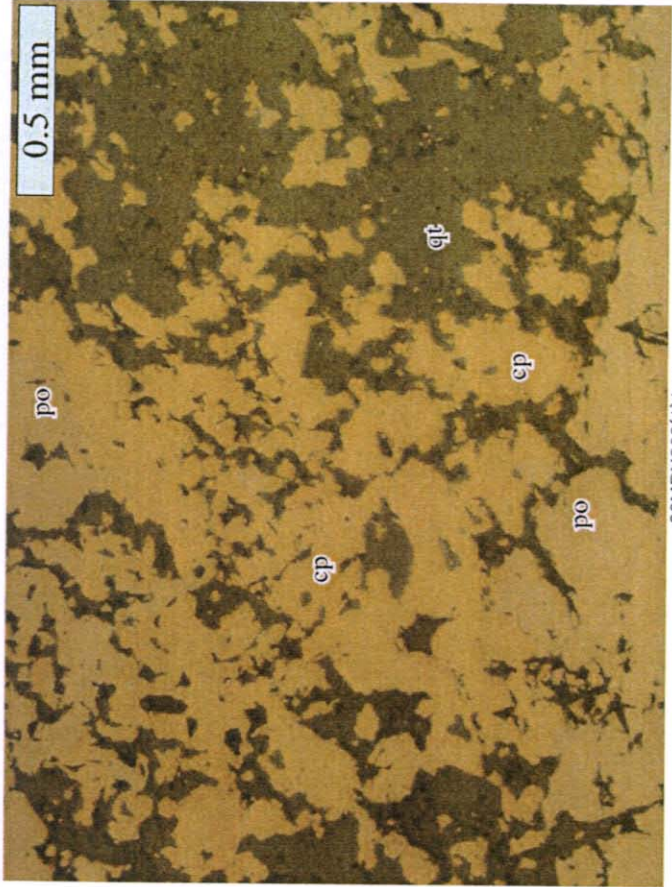
02MRN048(2).jpg



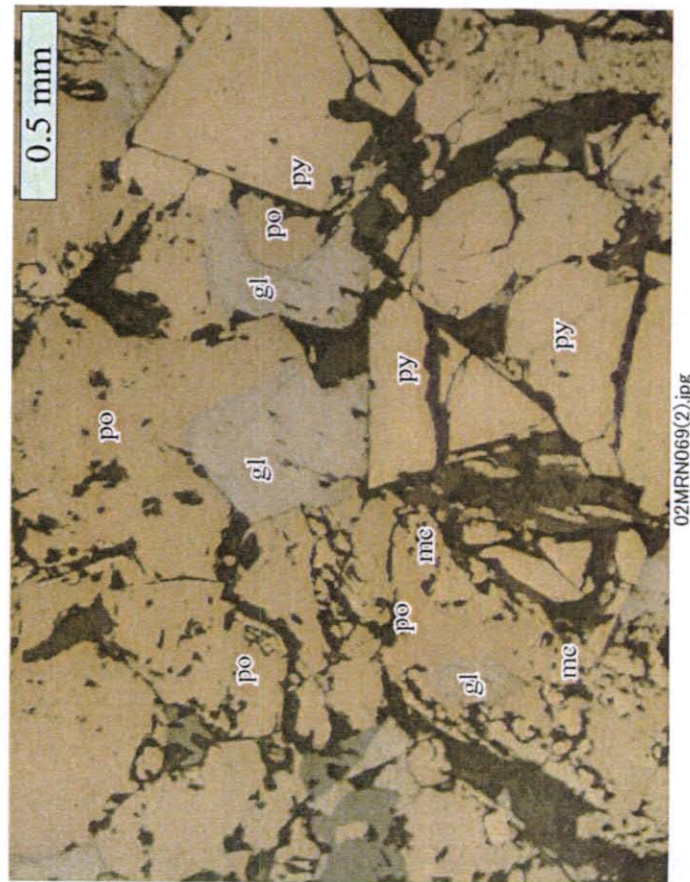
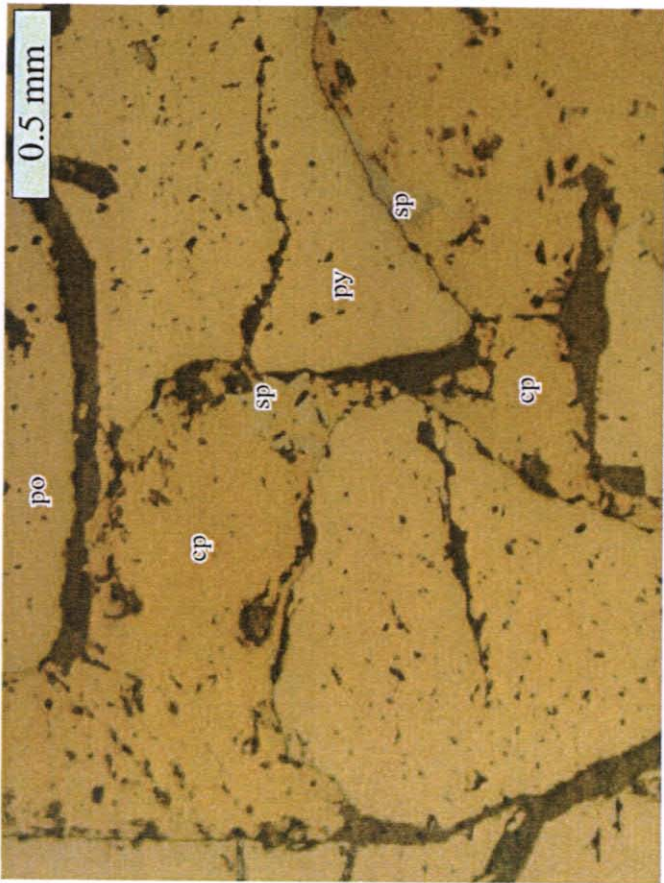
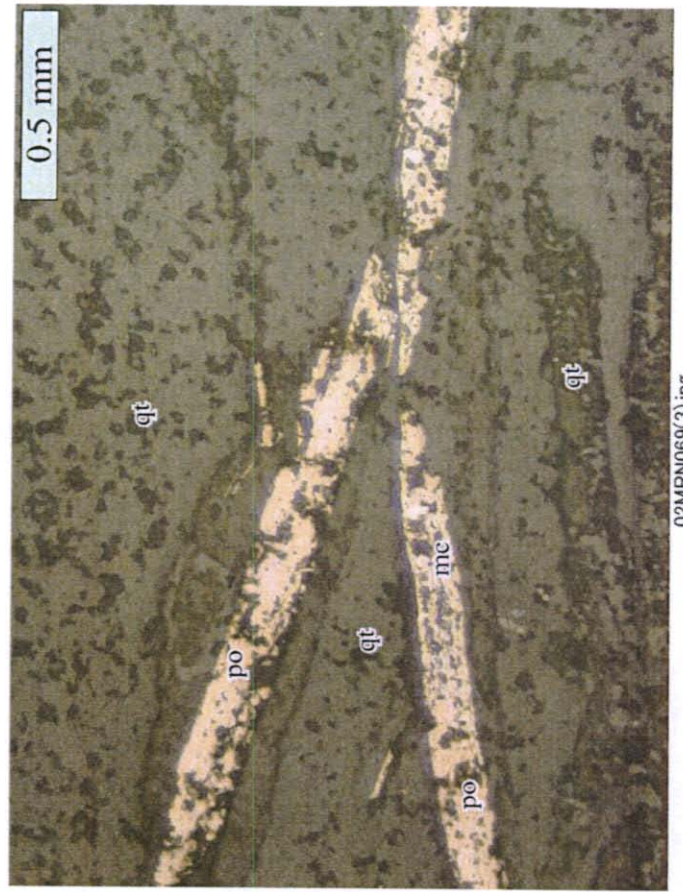
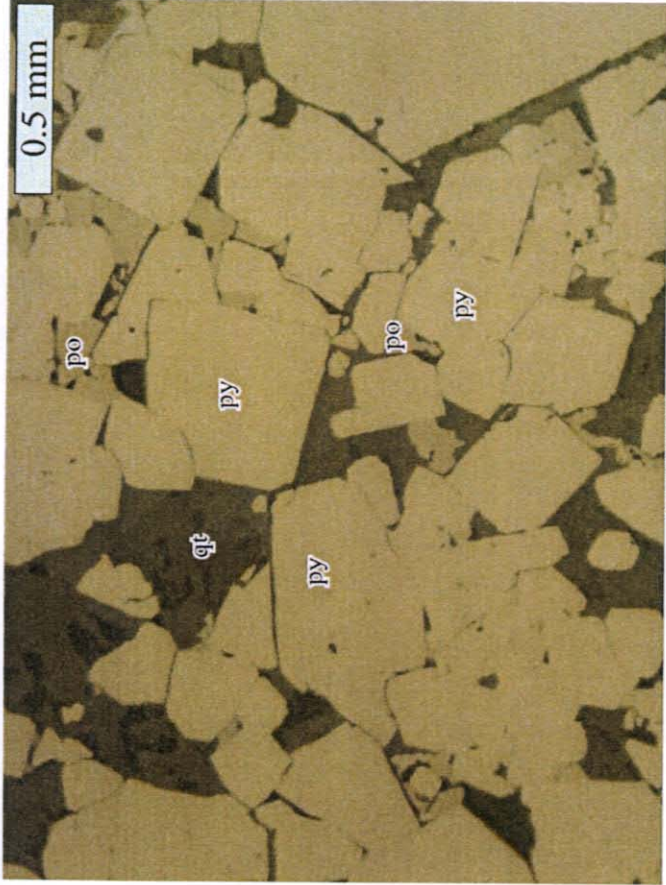
02MRN049(2).jpg

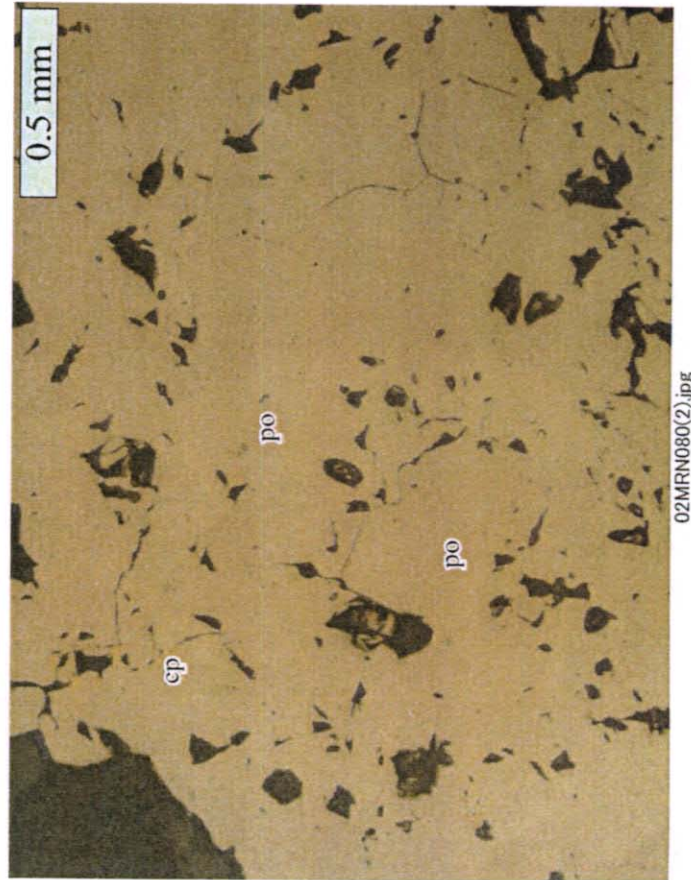
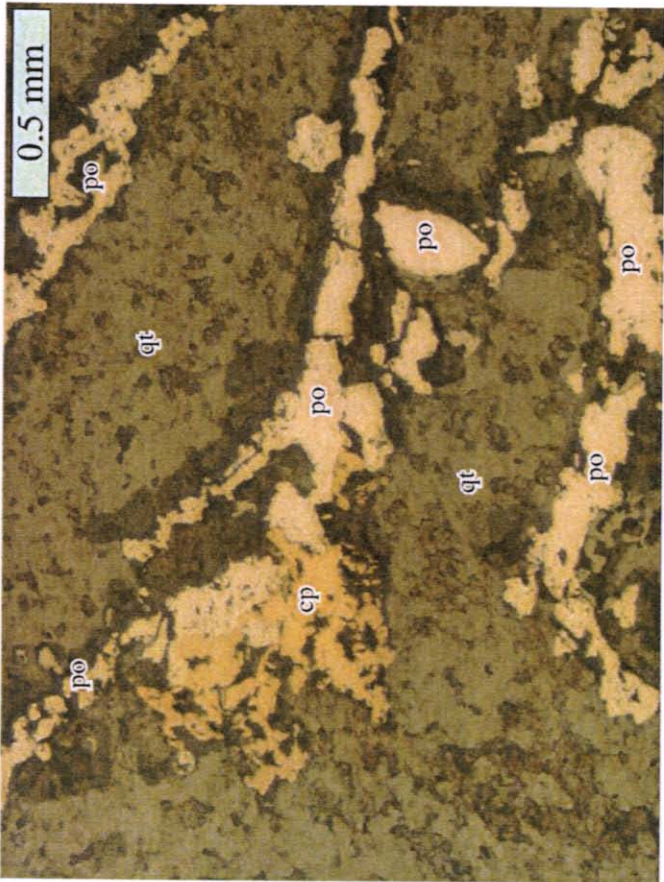
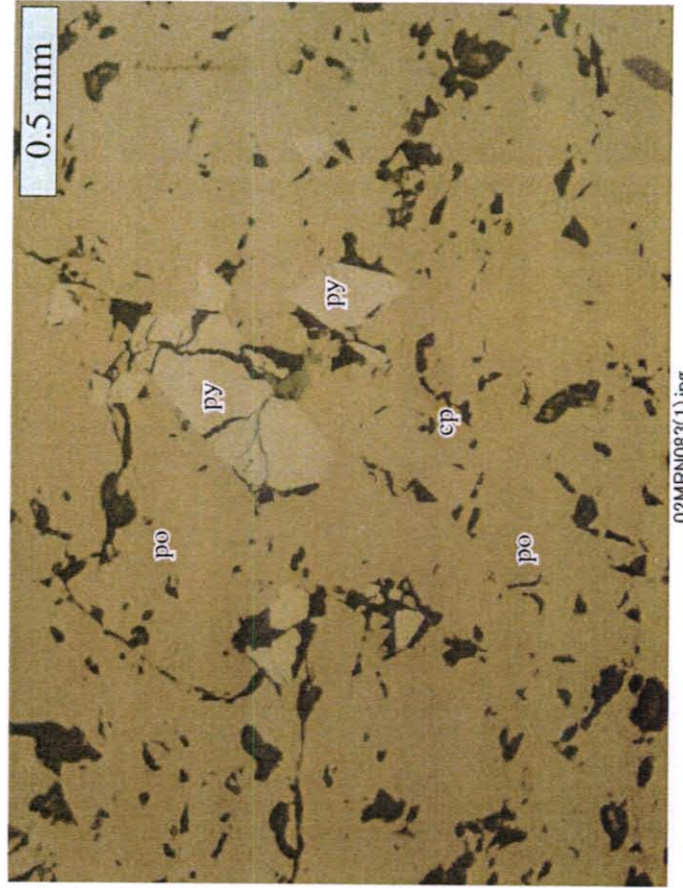
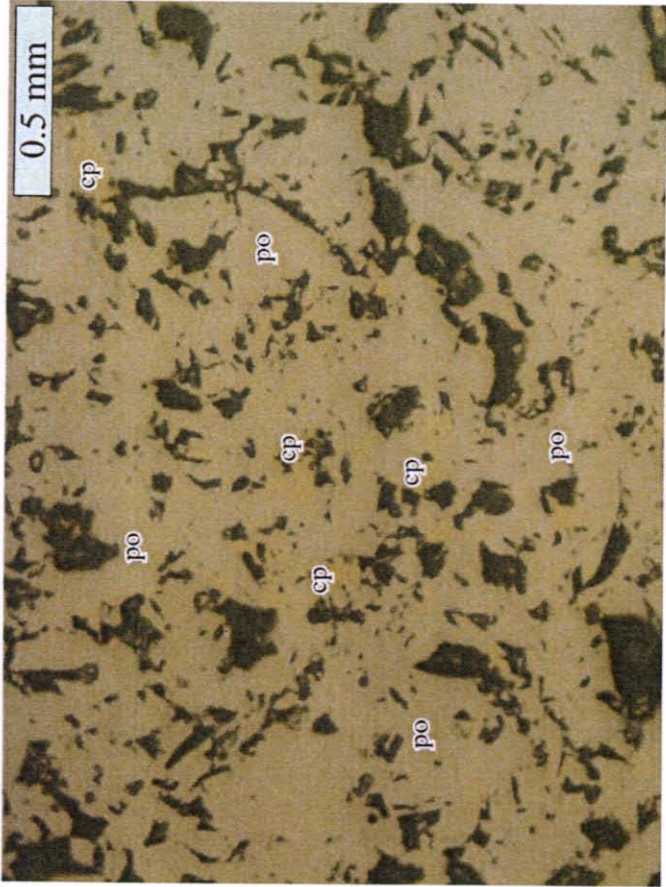


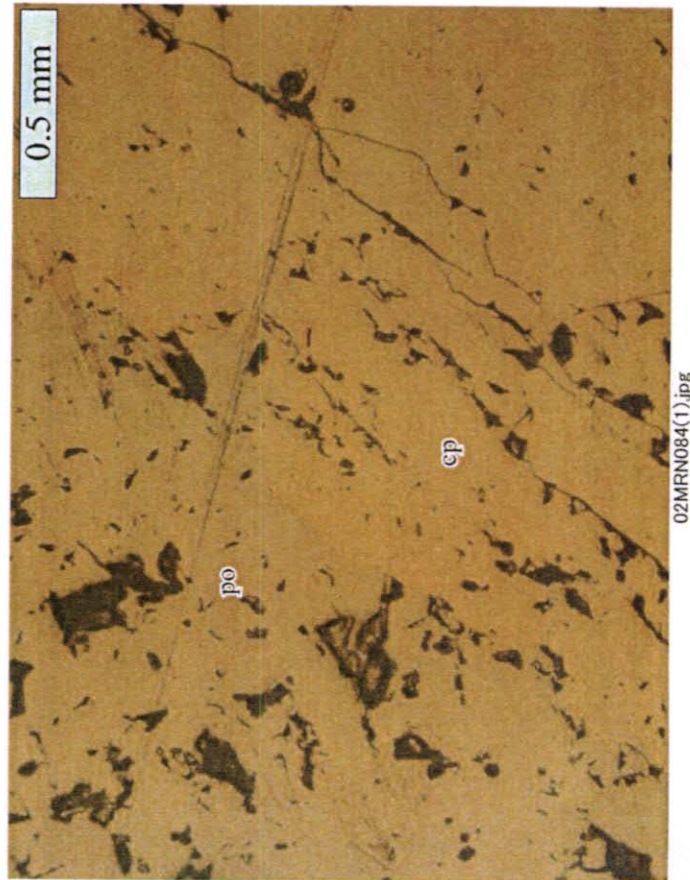
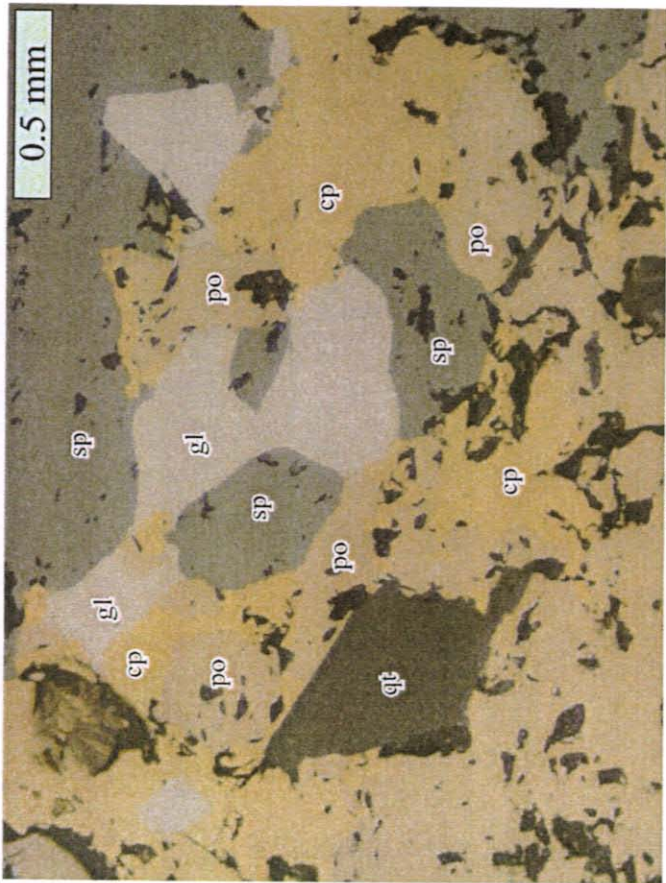
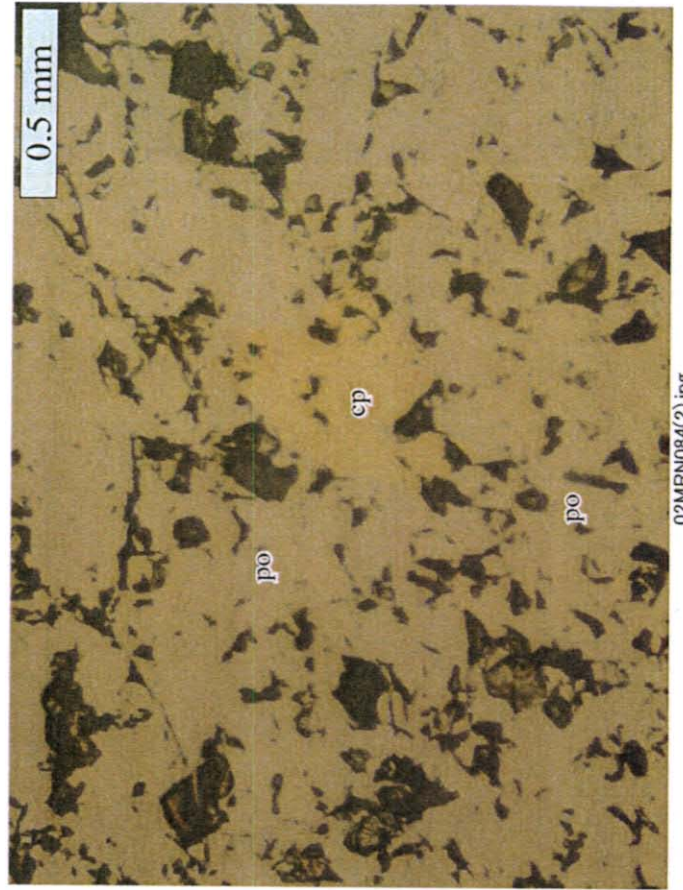
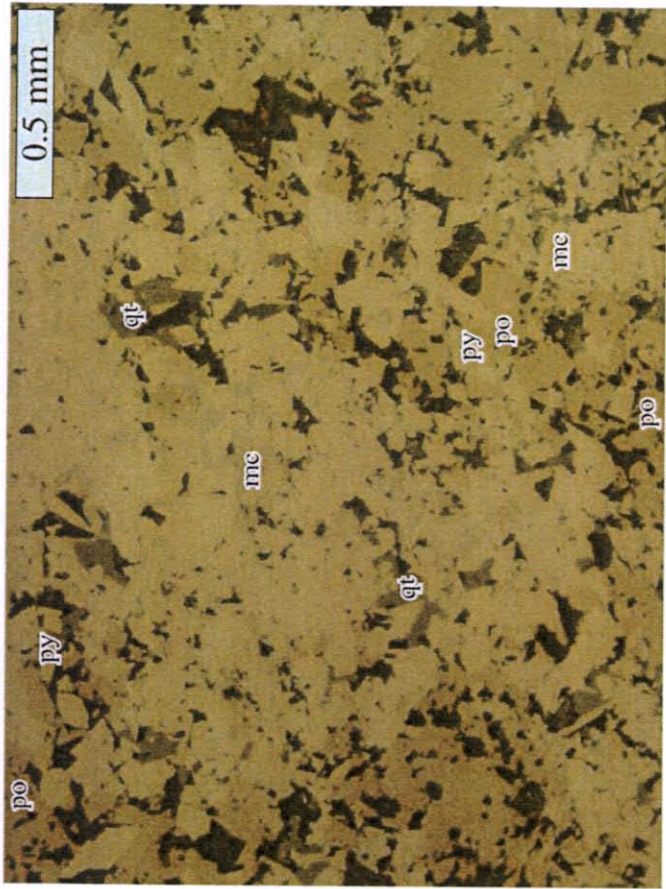


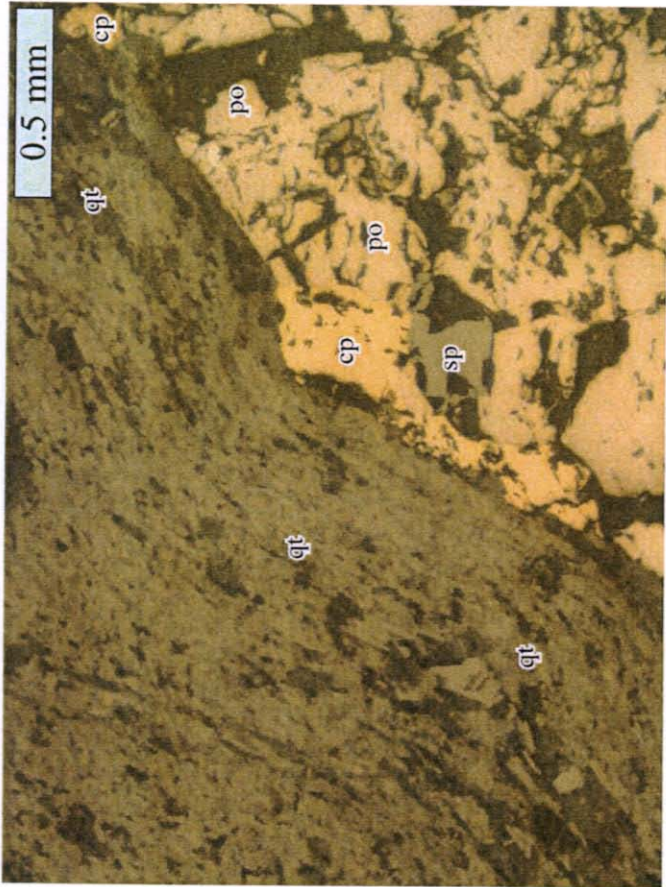




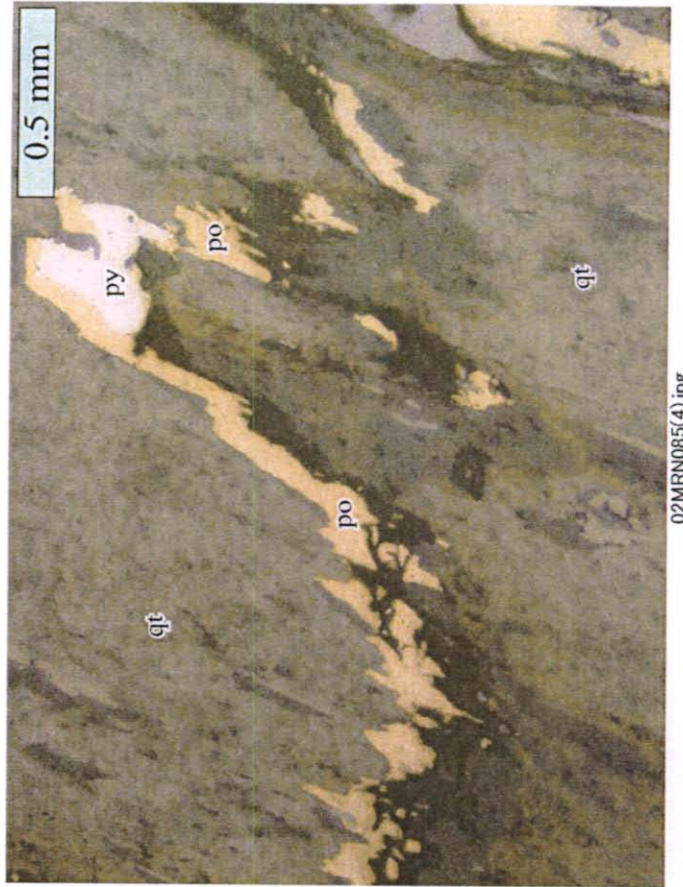




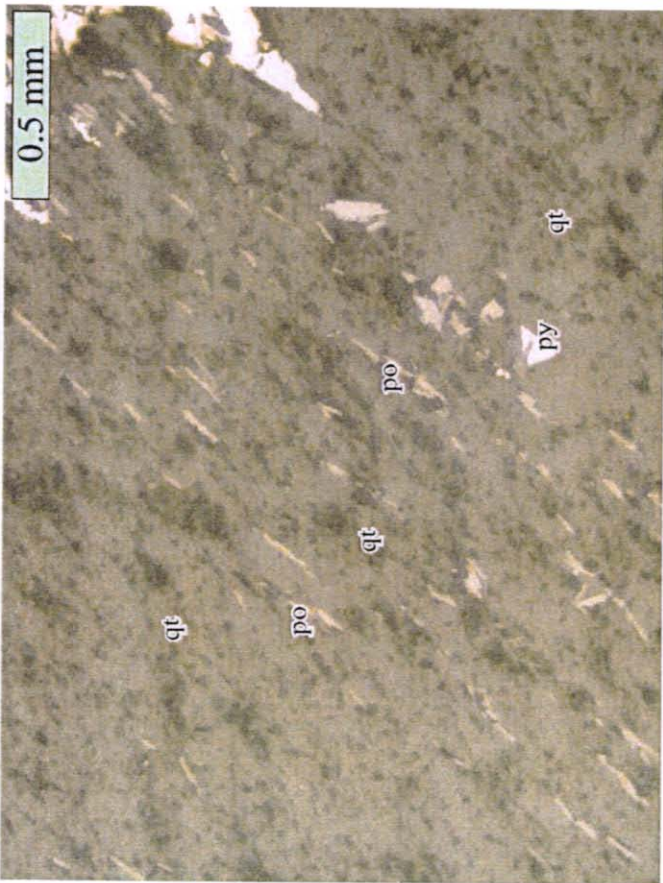




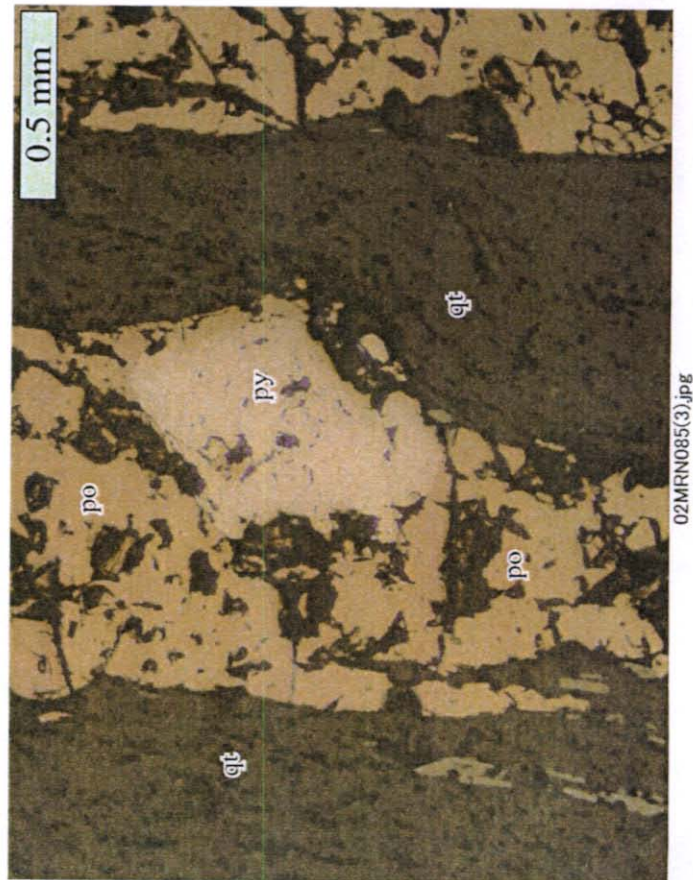
02MRN085(2).jpg



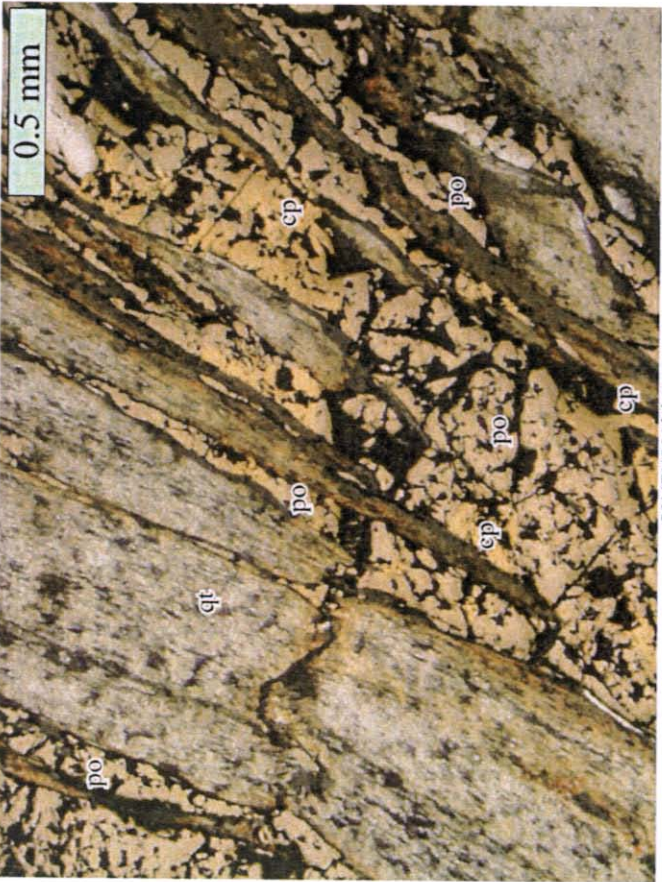
02MRN085(4).jpg



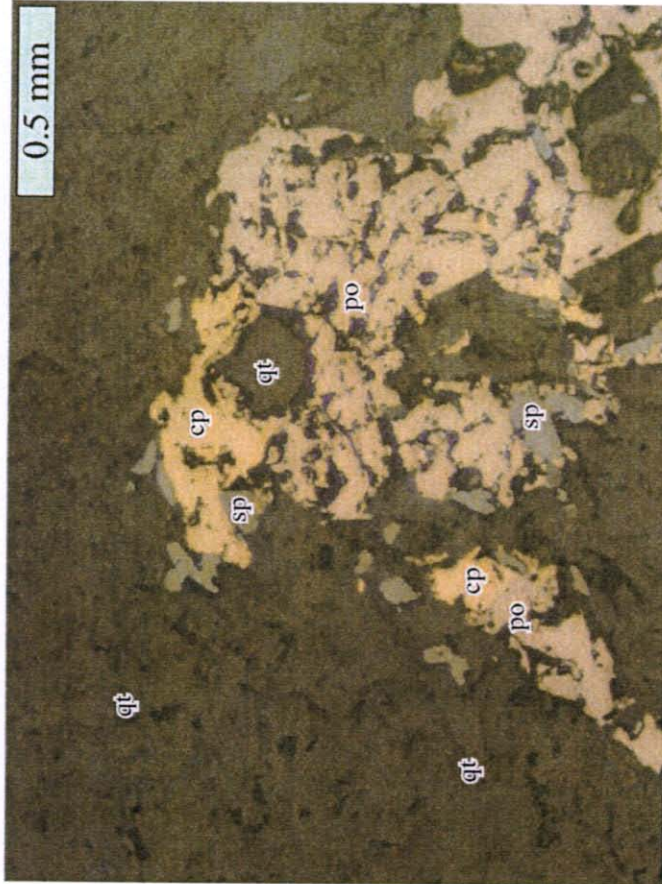
02MRN085(1).jpg



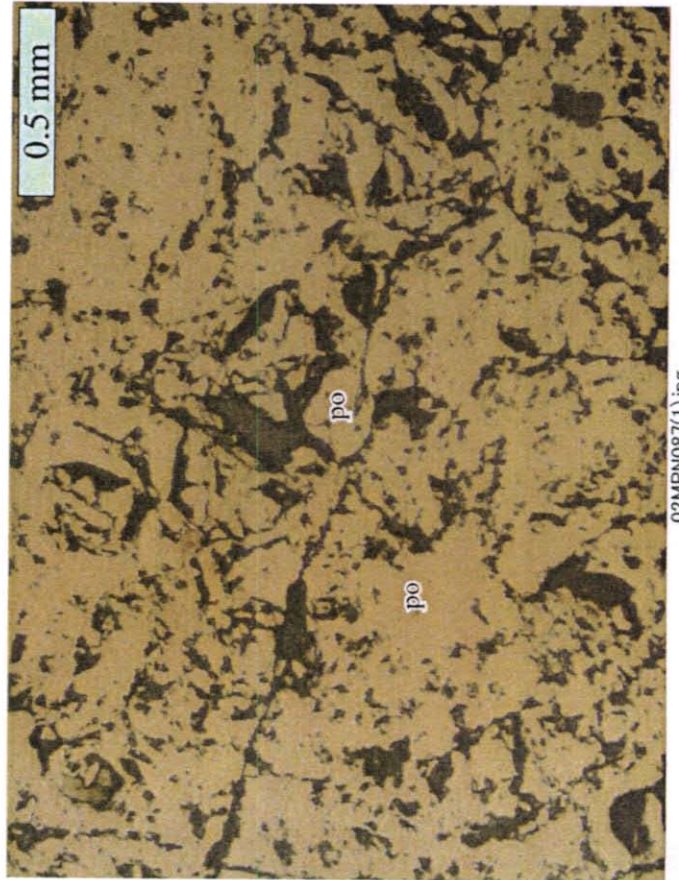
02MRN085(3).jpg



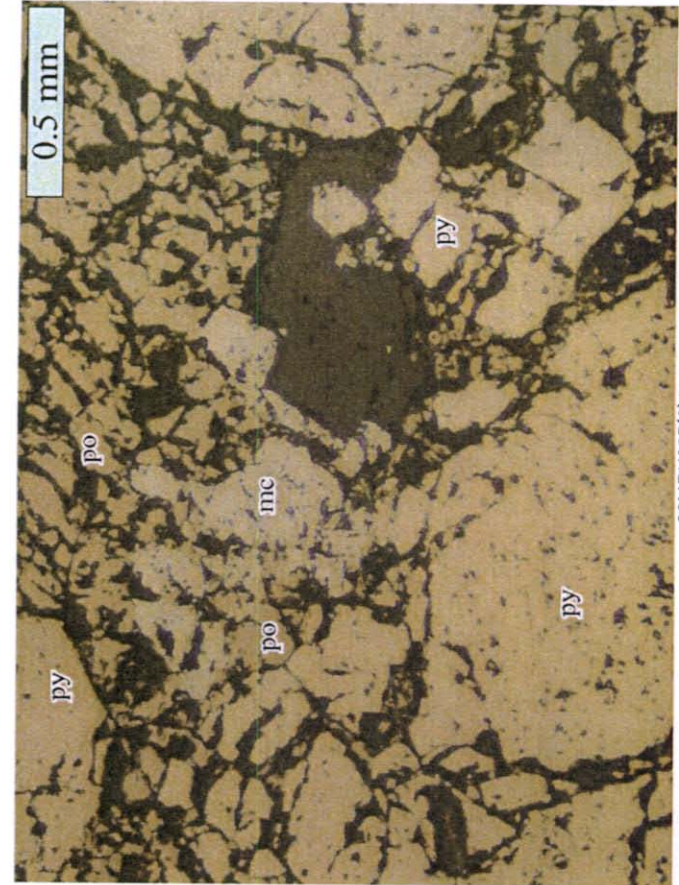
02MRN086(1).jpg



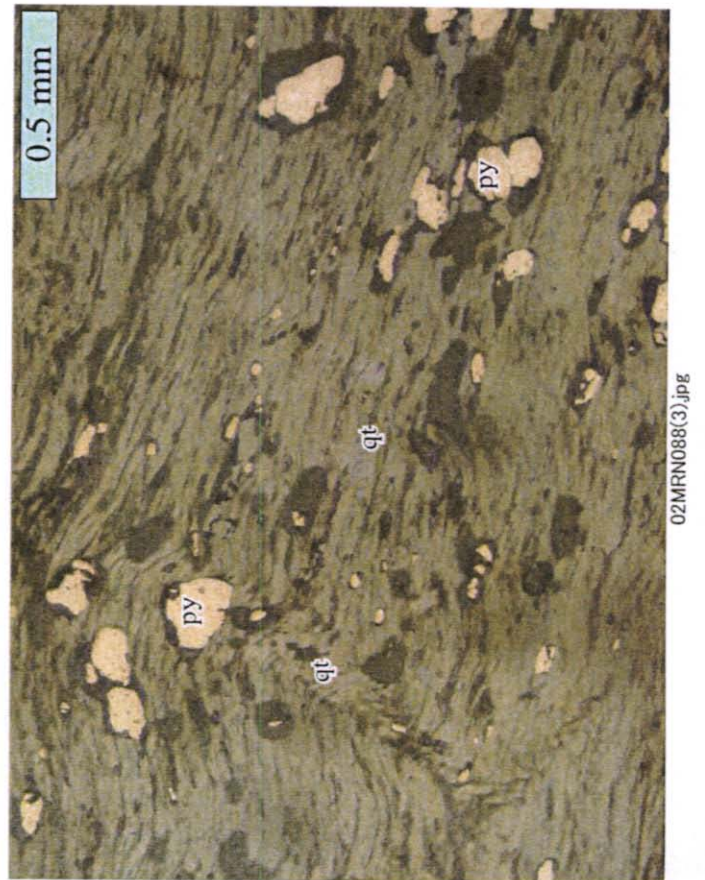
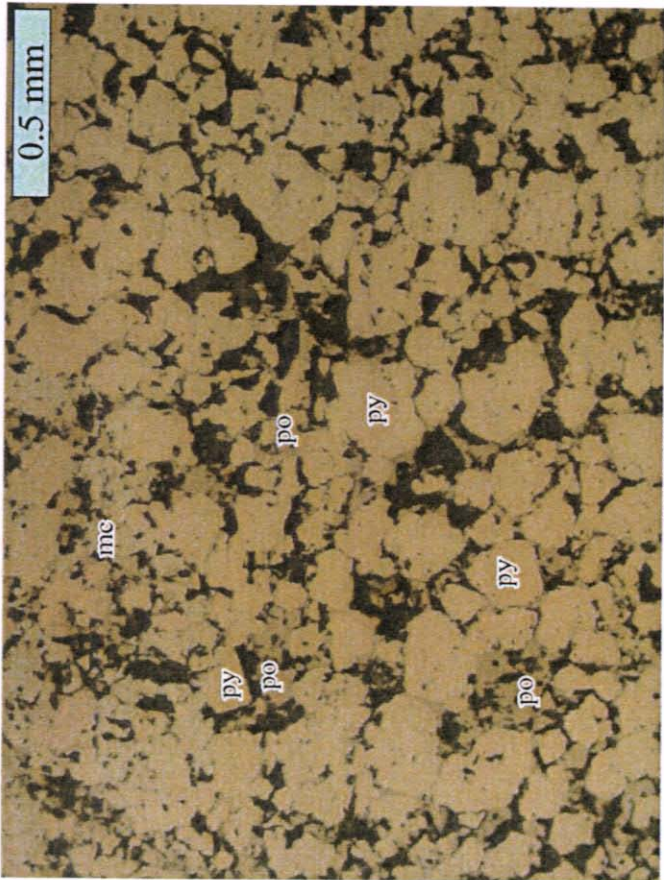
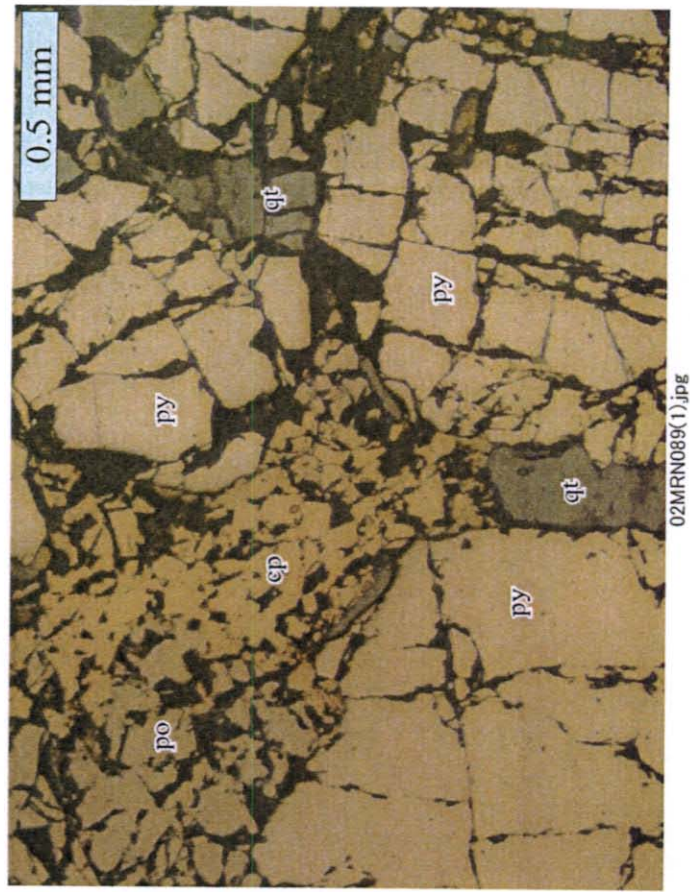
02MRN086(2).jpg



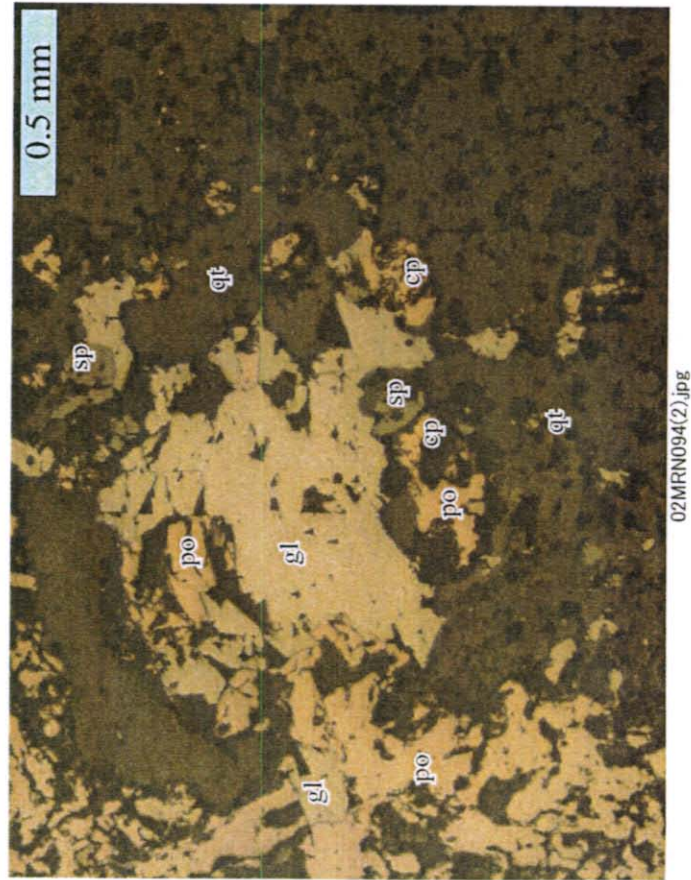
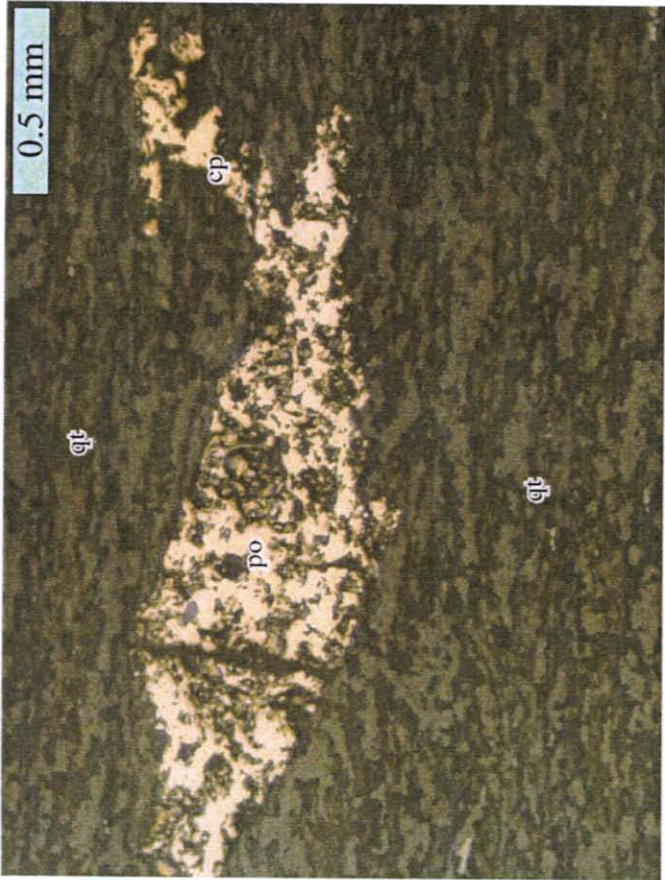
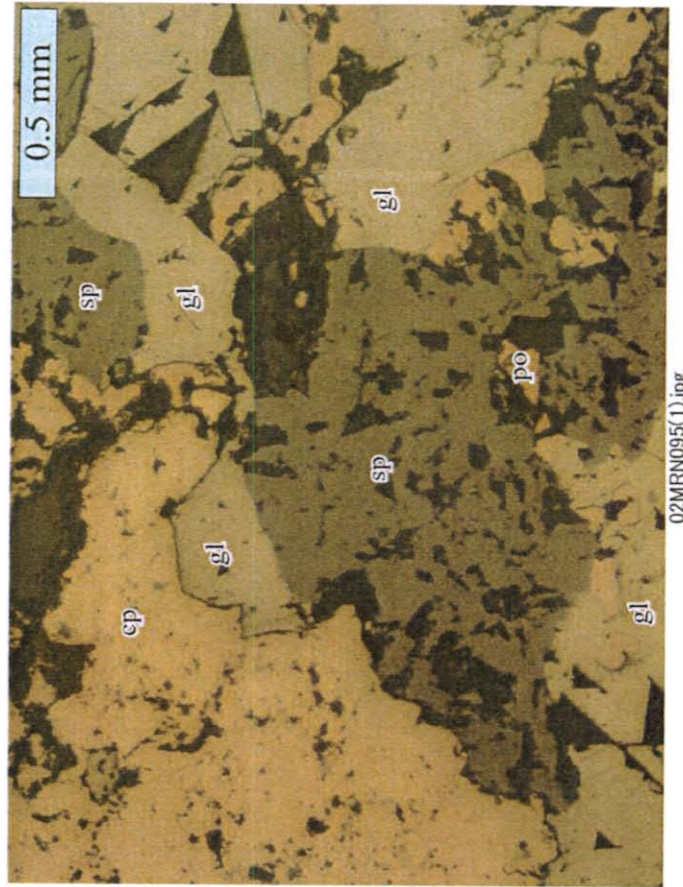
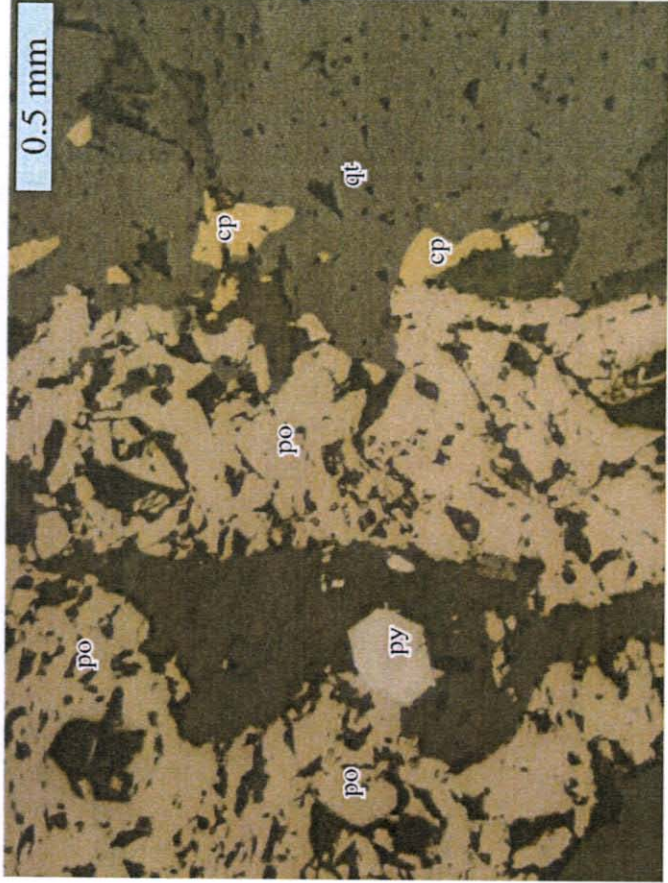
02MRN087(1).jpg

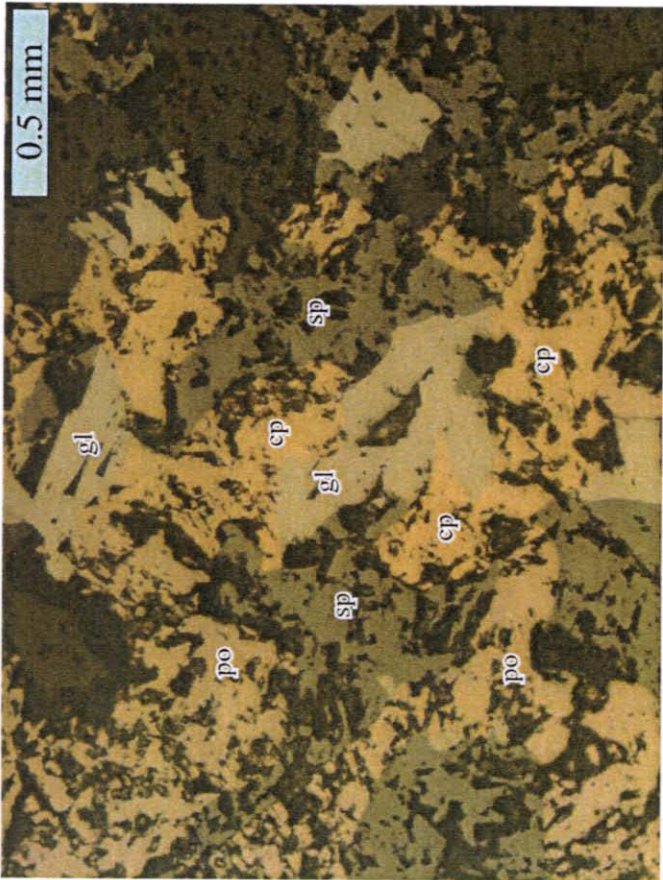
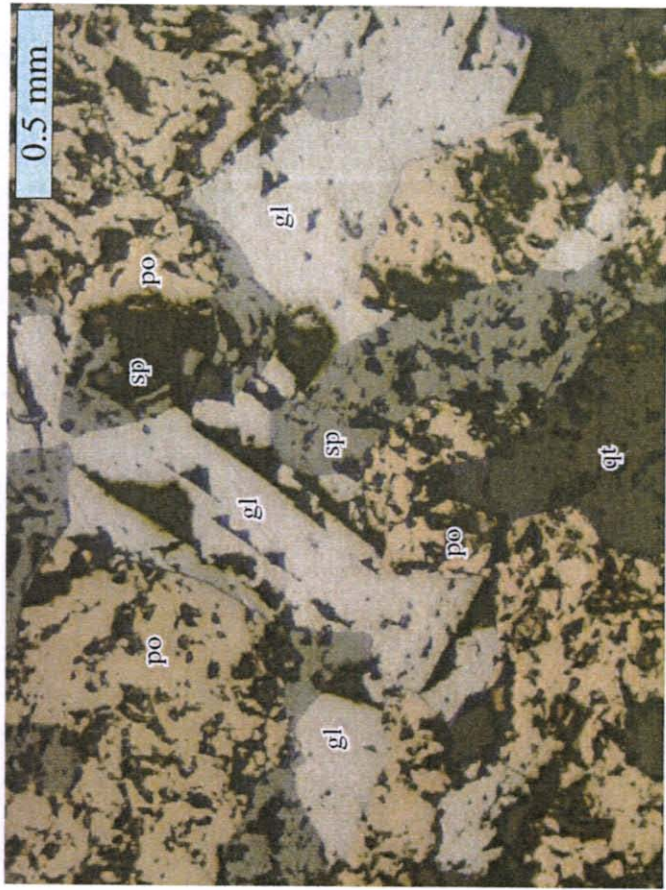


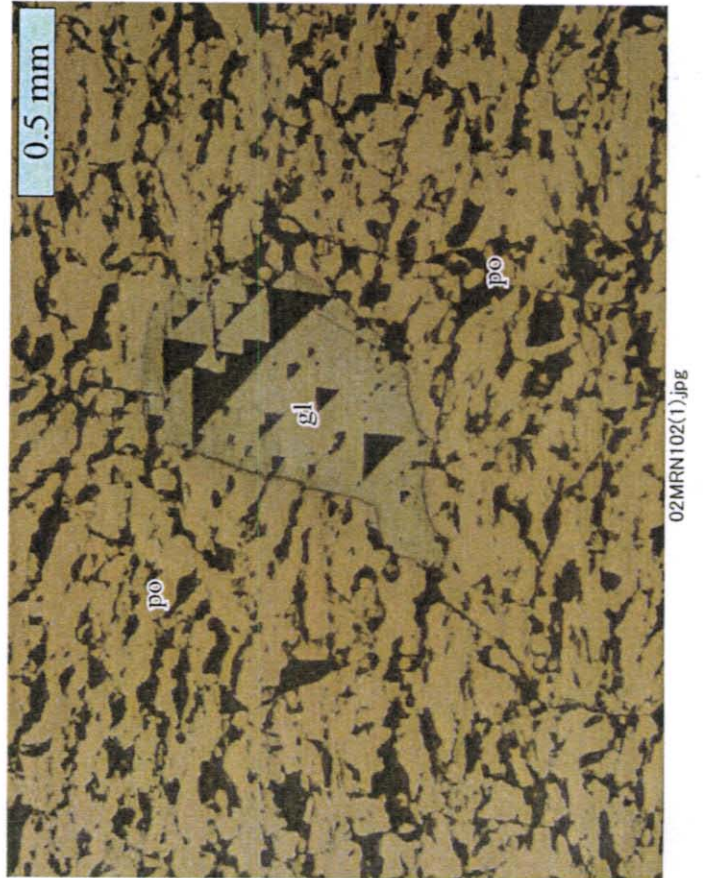
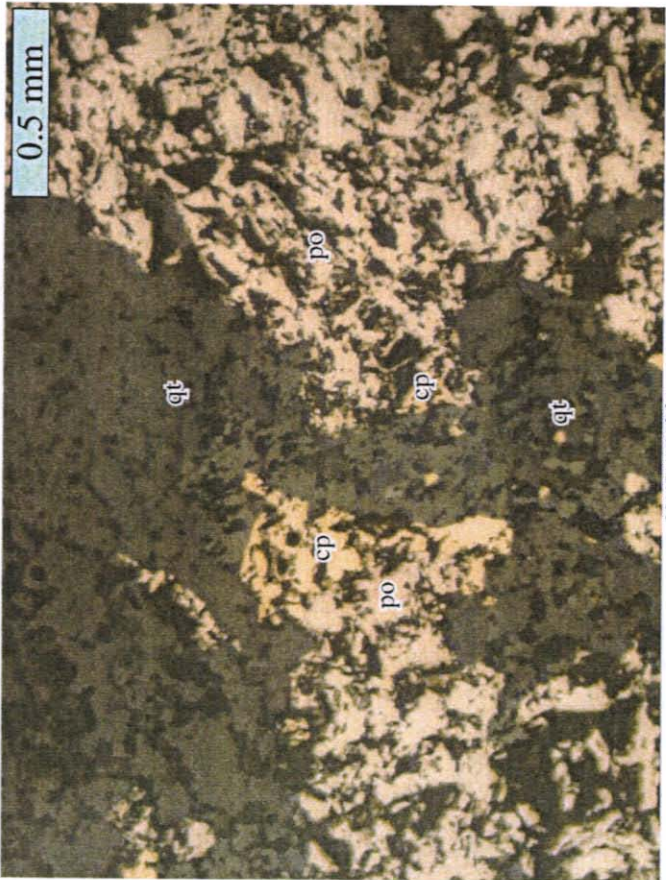
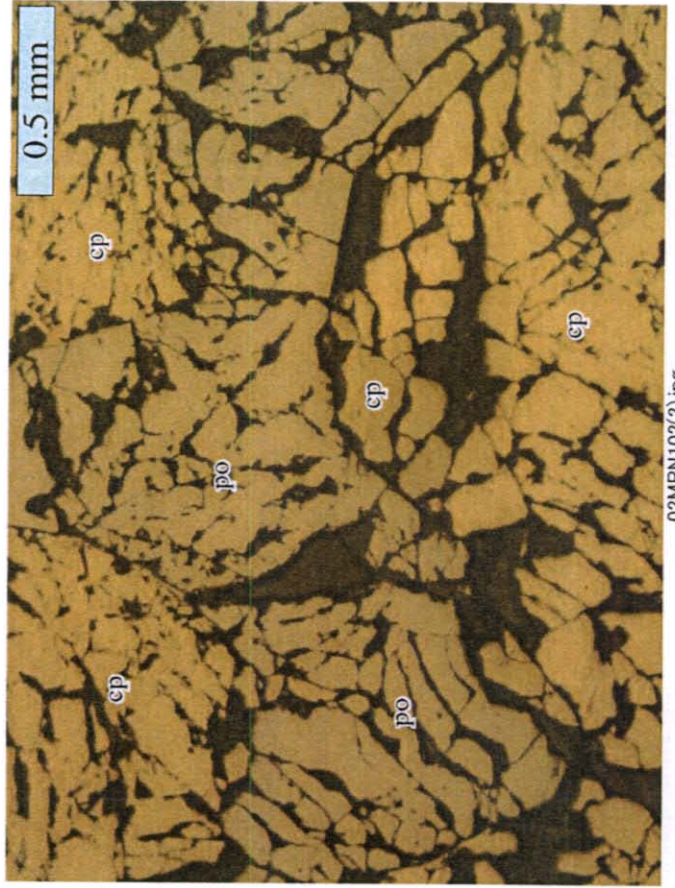
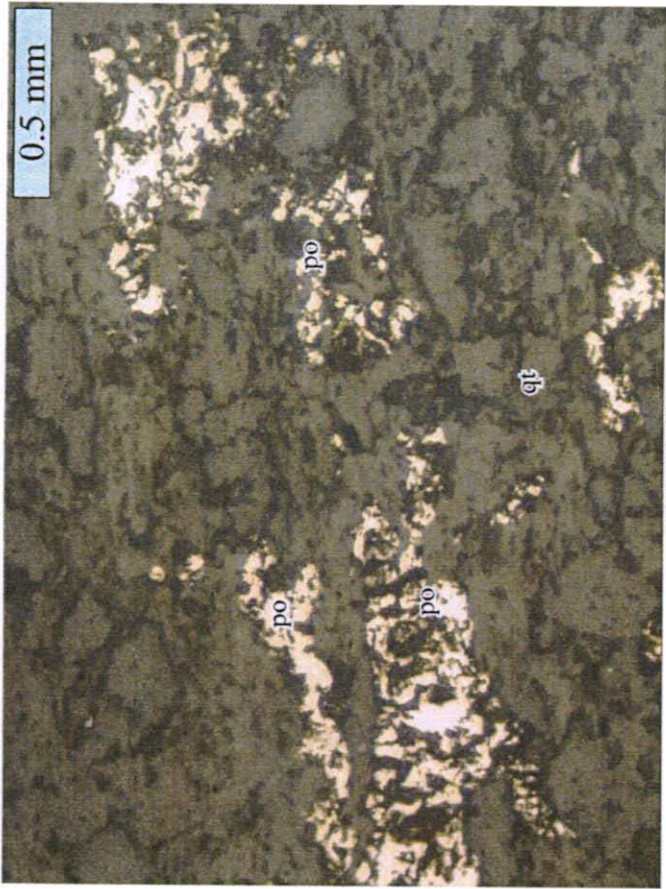
02MRN087(2).jpg

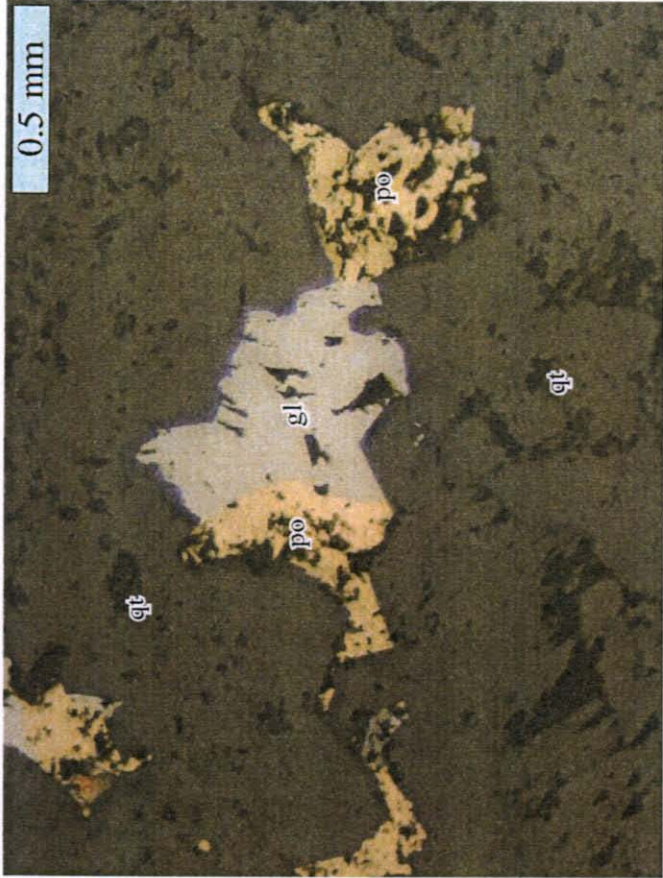




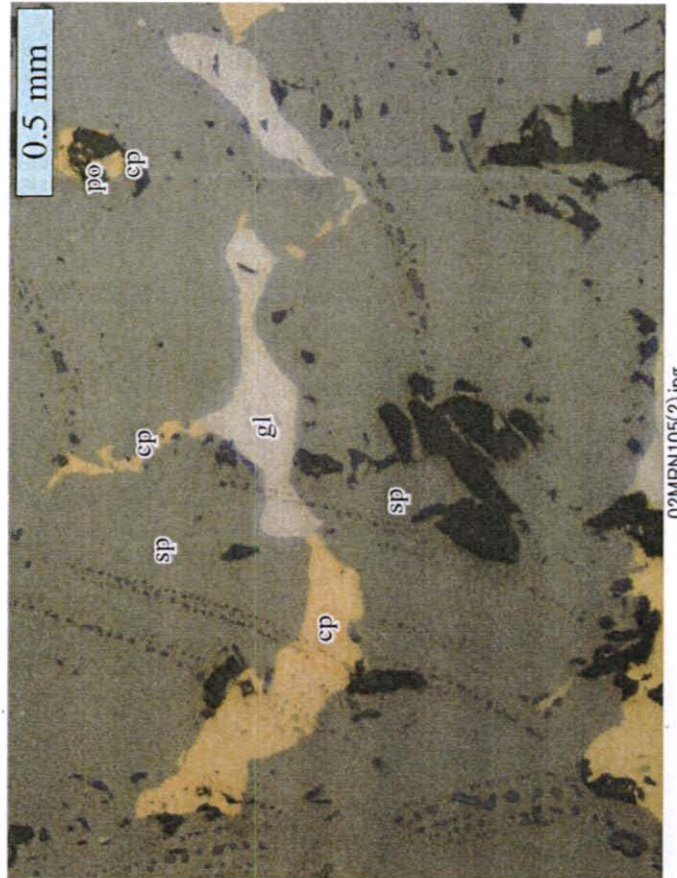




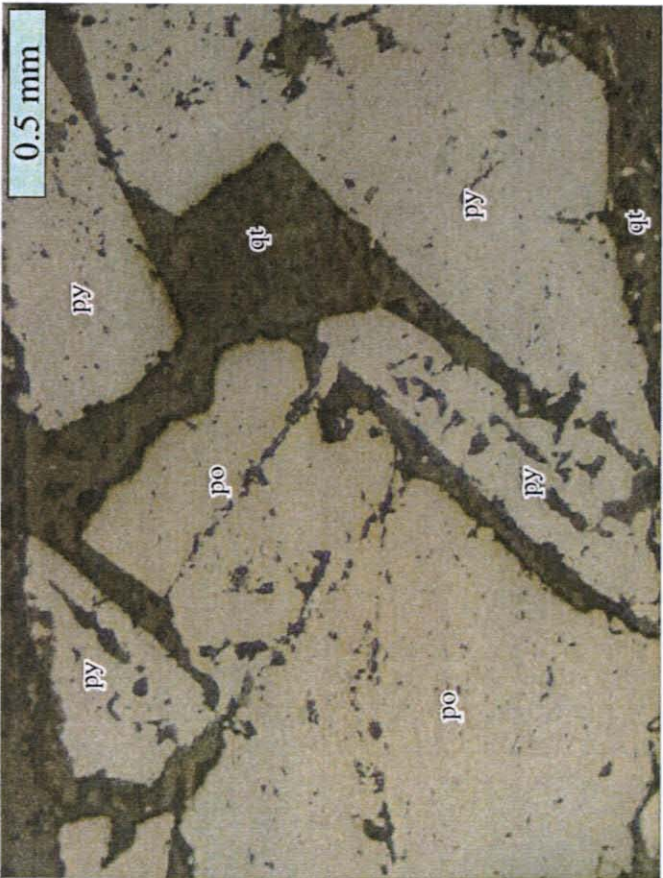




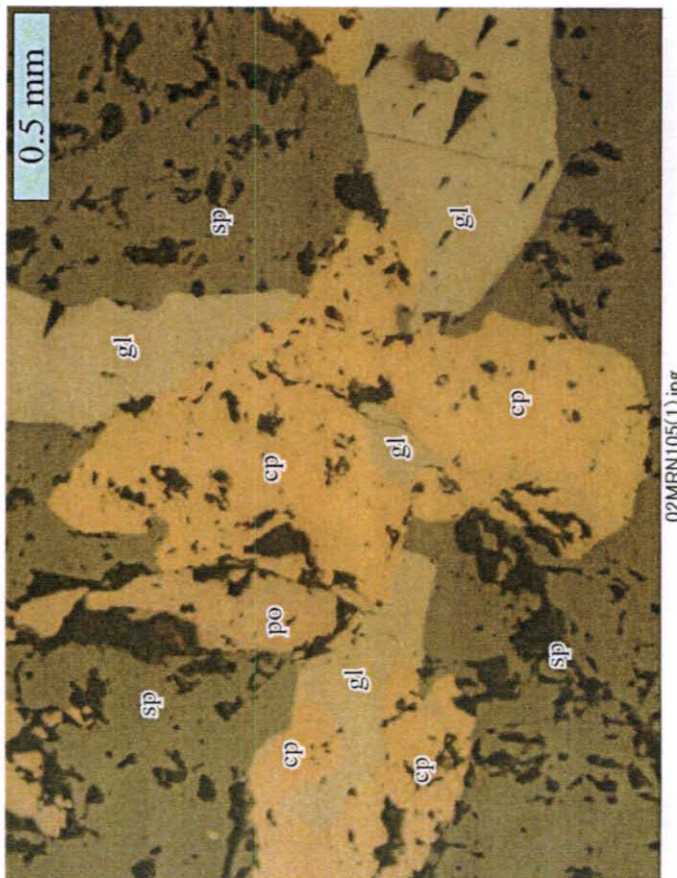
02MRN103(2).jpg



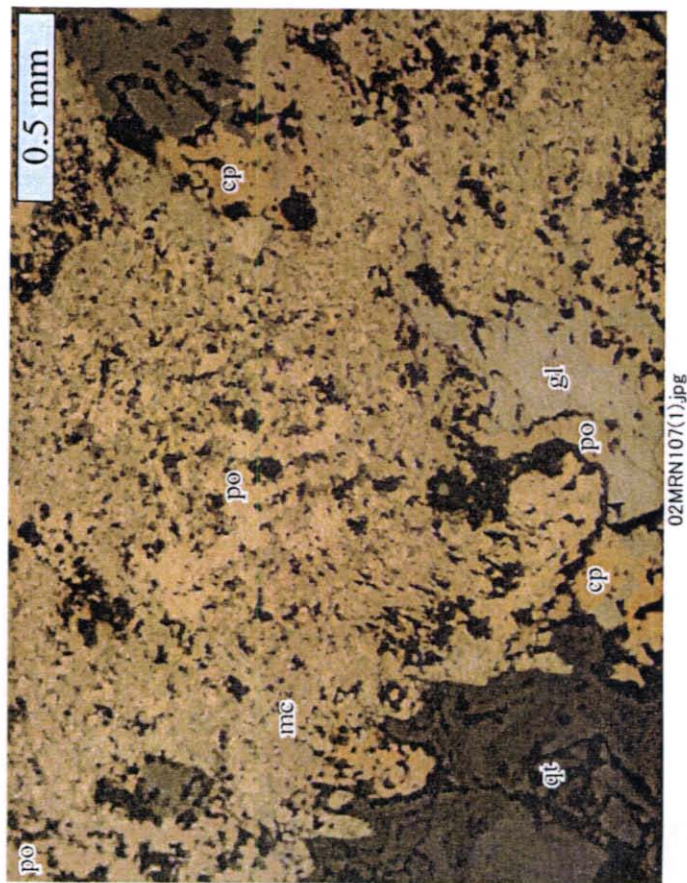
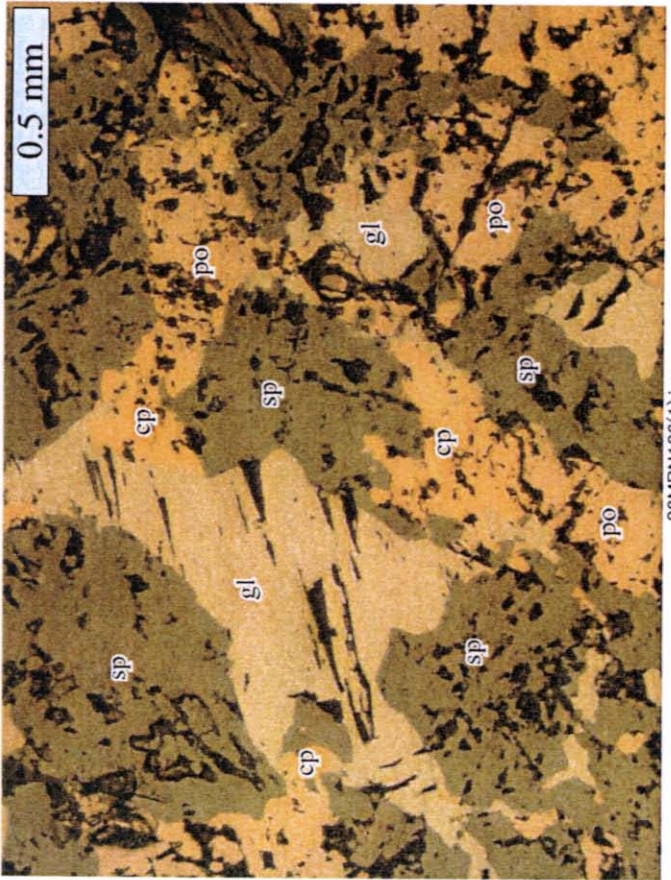
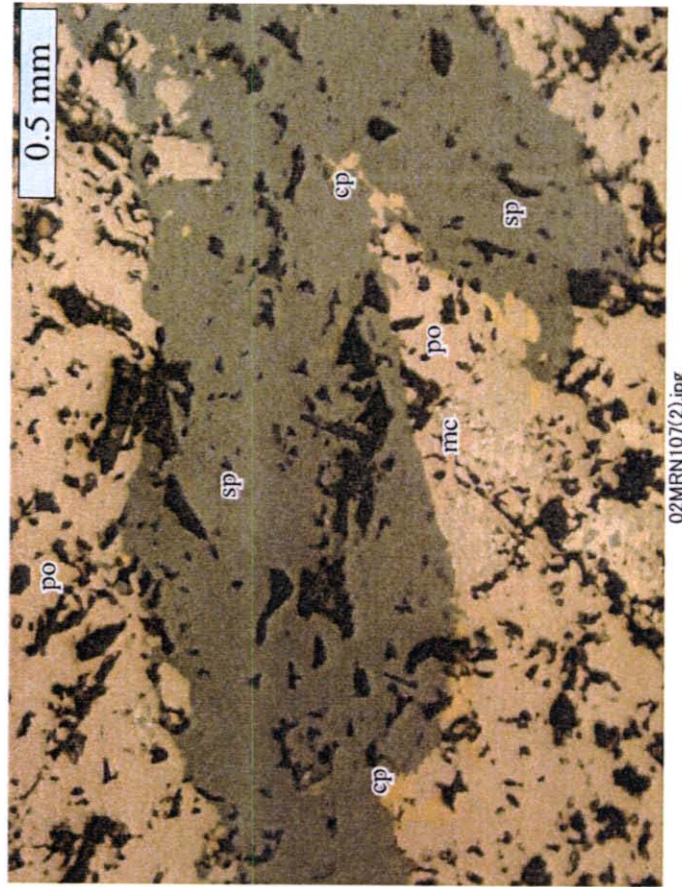
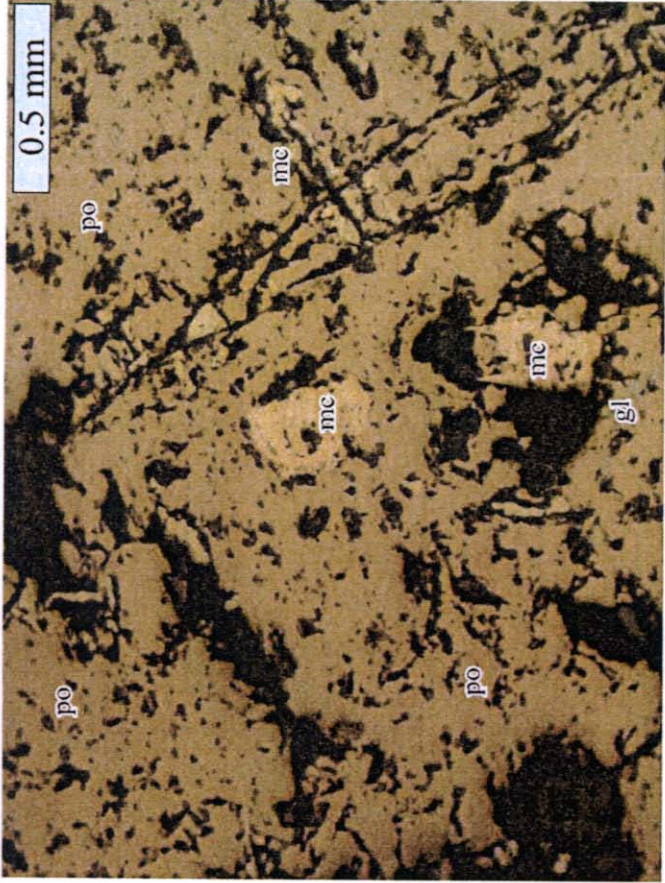
02MRN105(2).jpg

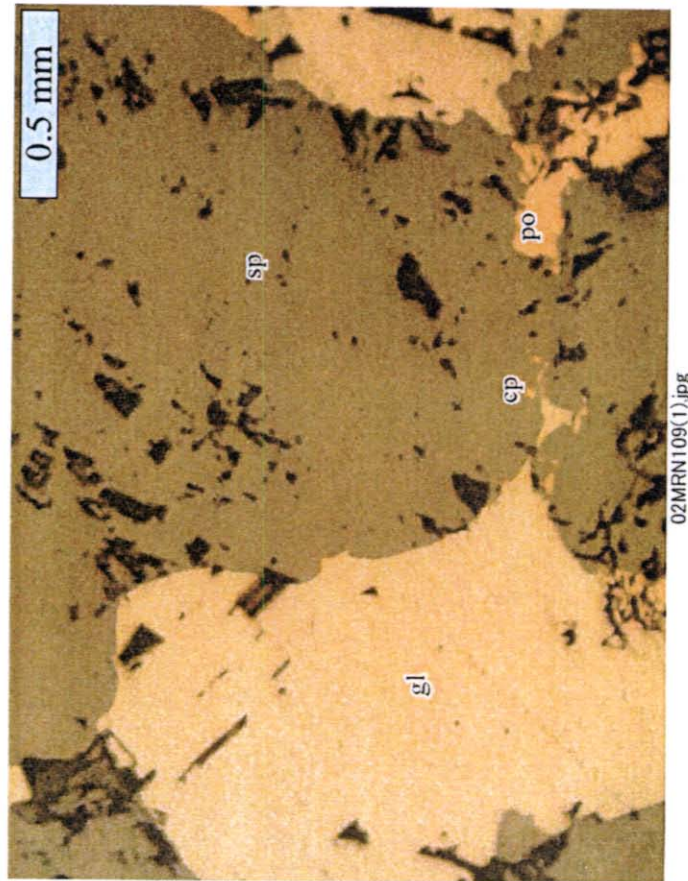
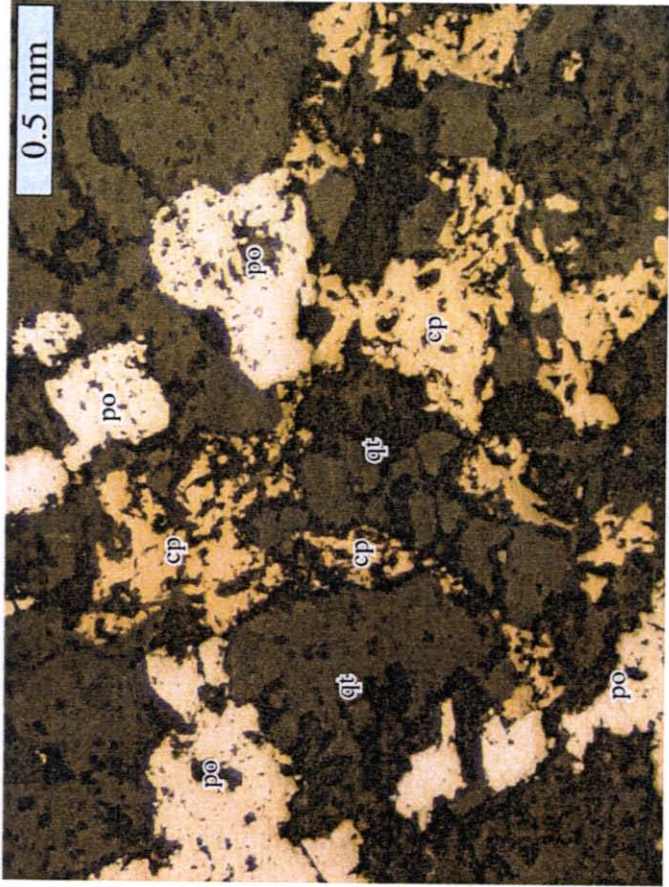


02MRN103(1).jpg



02MRN105(1).jpg



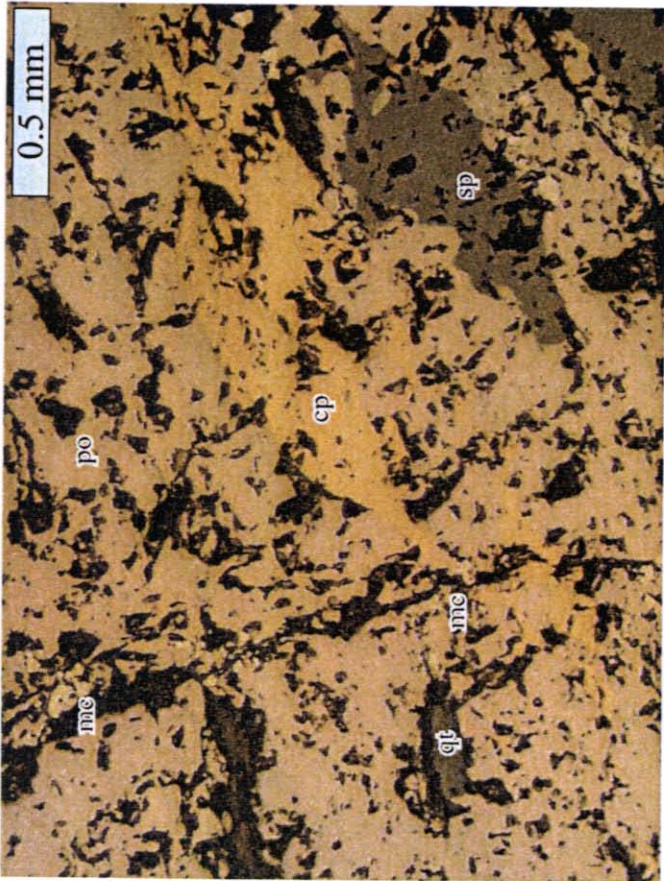




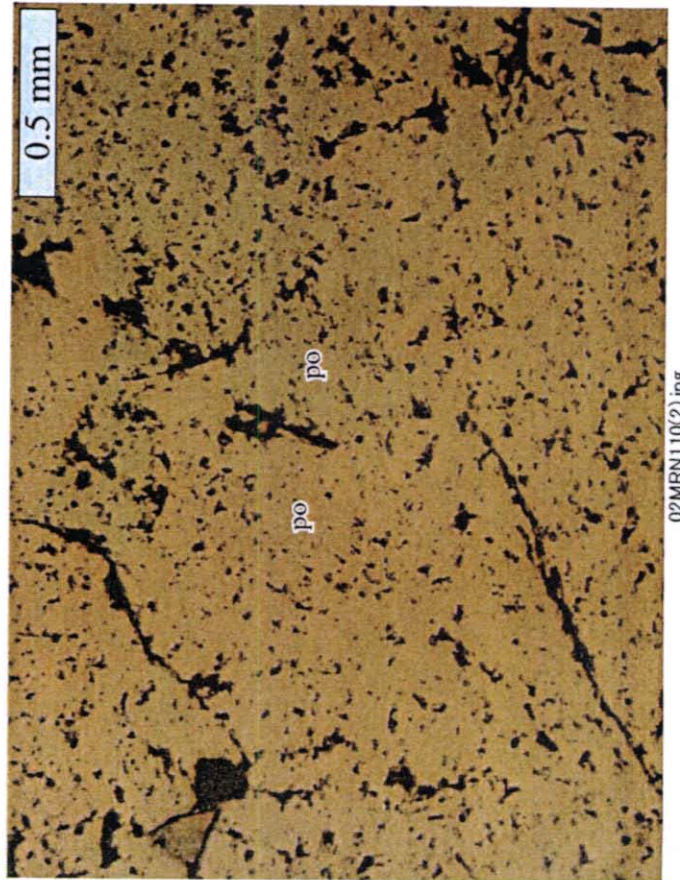
02MRN110(1).jpg



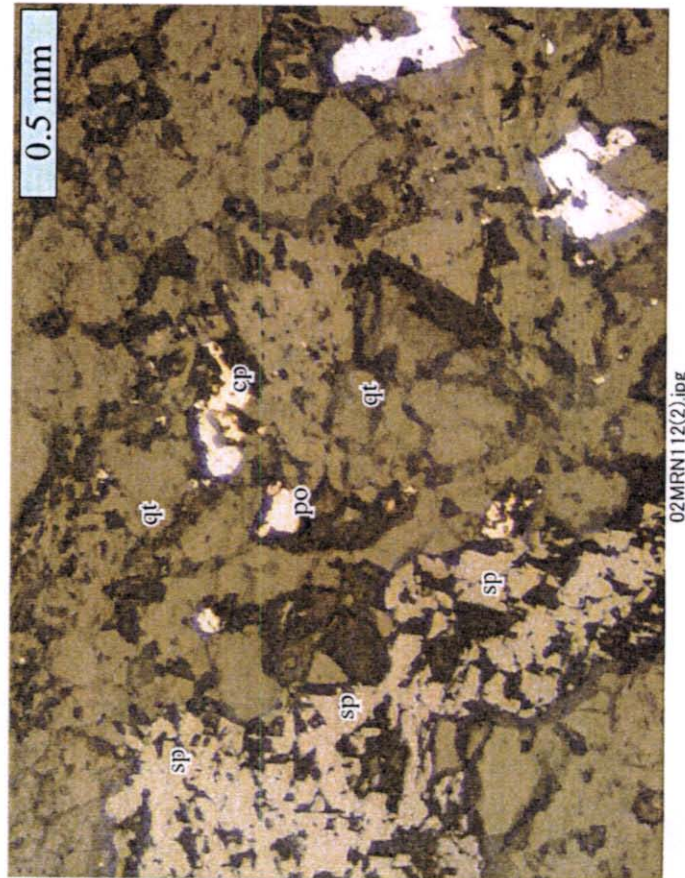
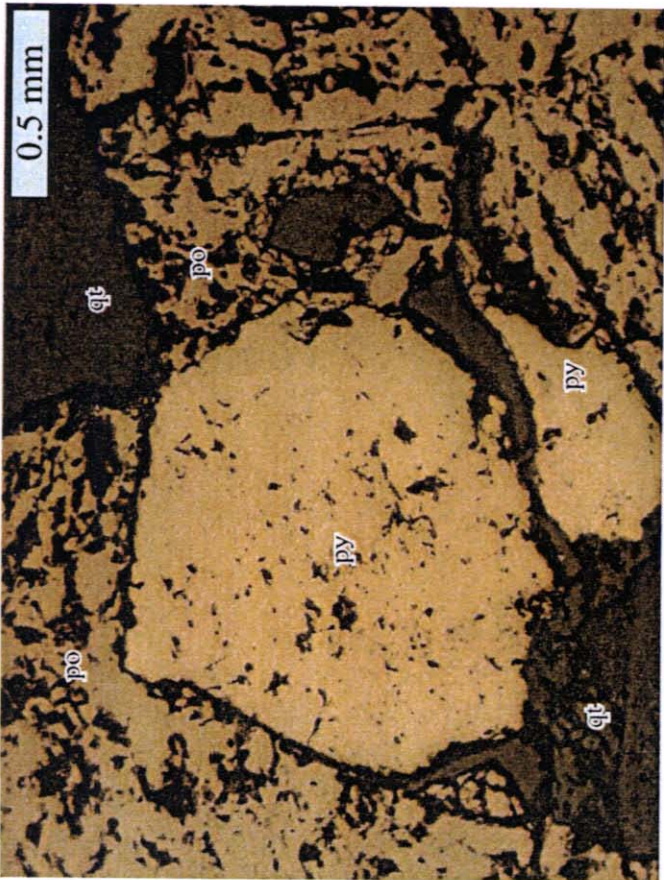
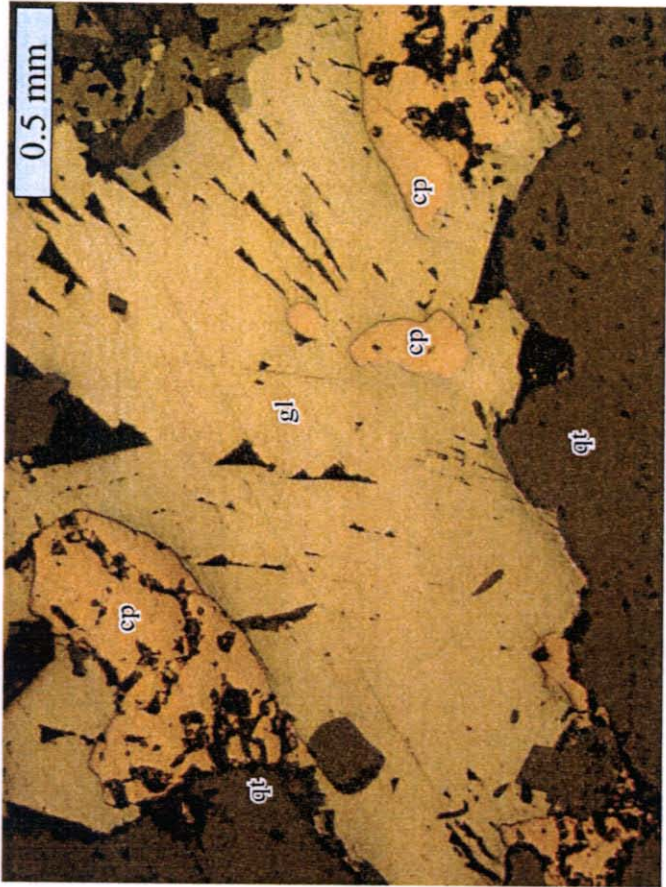
02MRN111(1).jpg



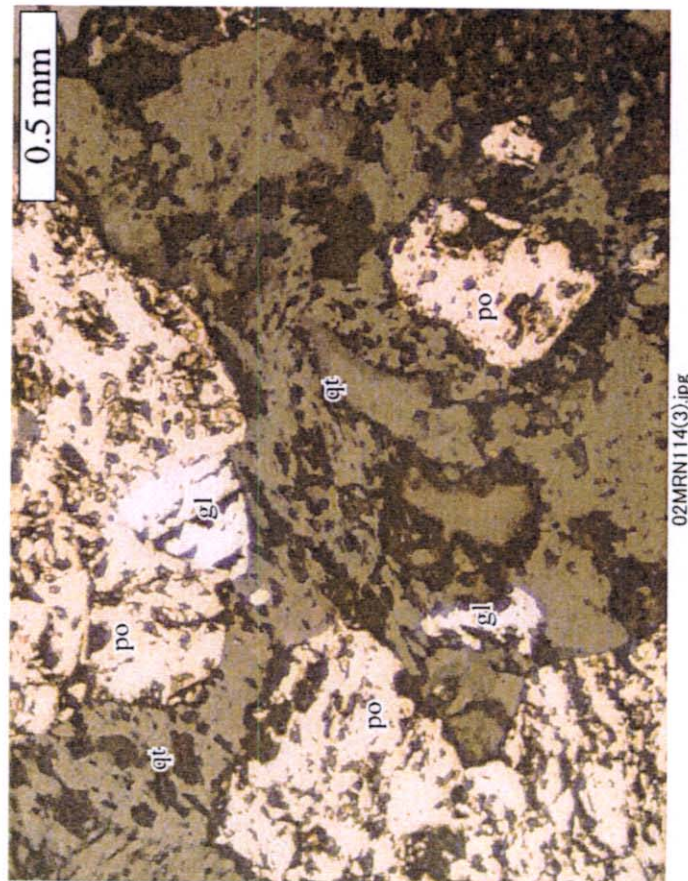
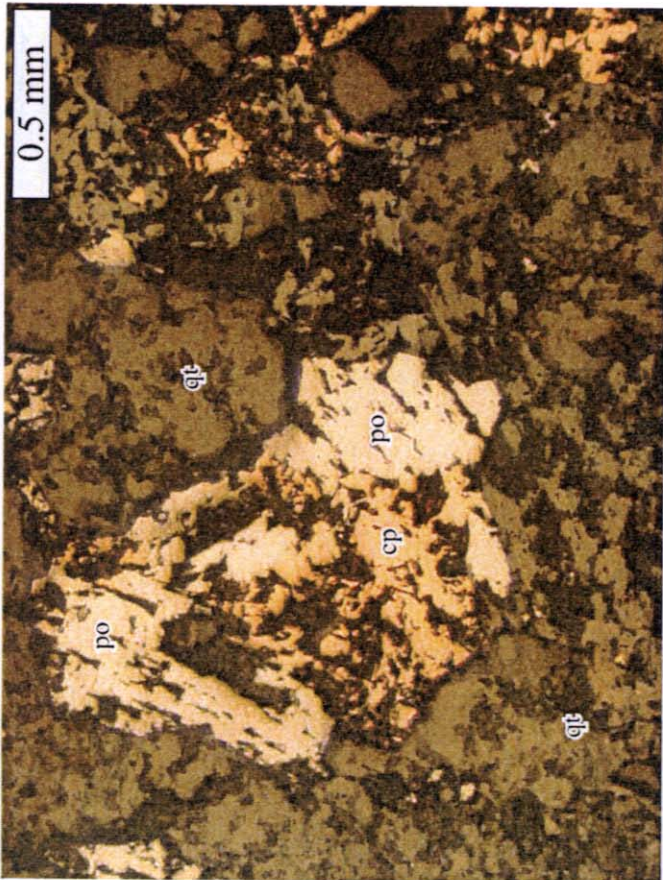
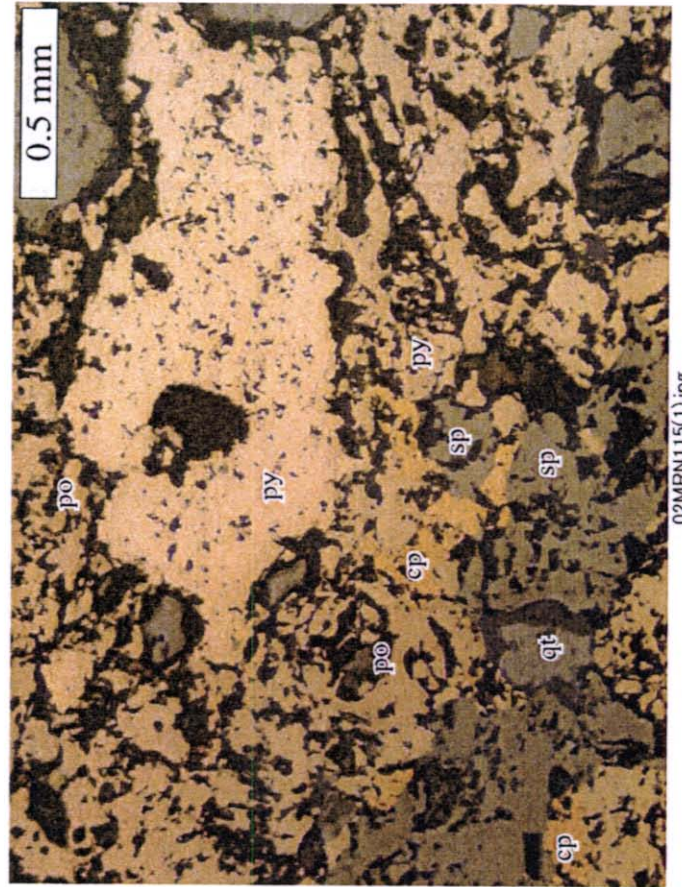
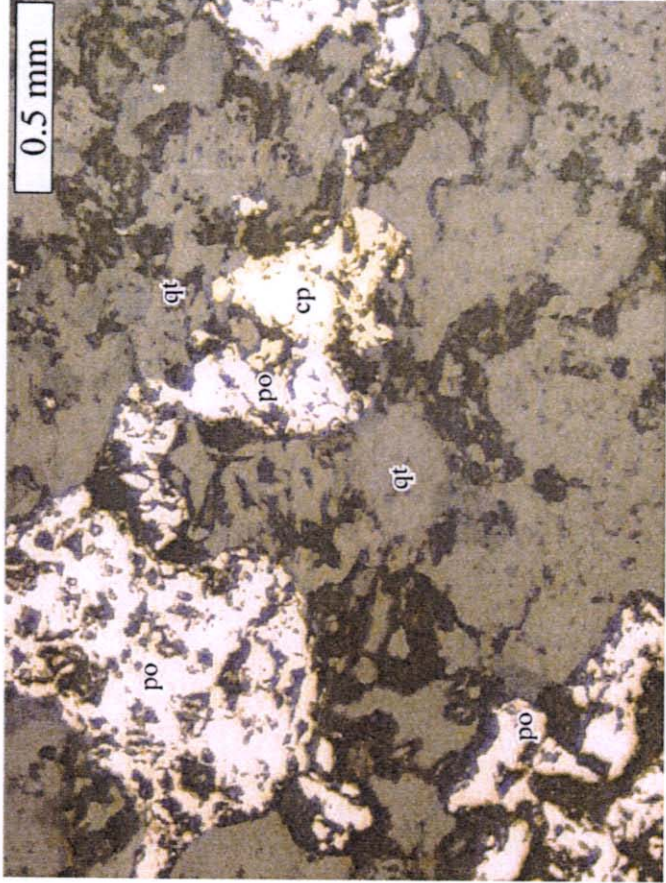
02MRN109(3).jpg

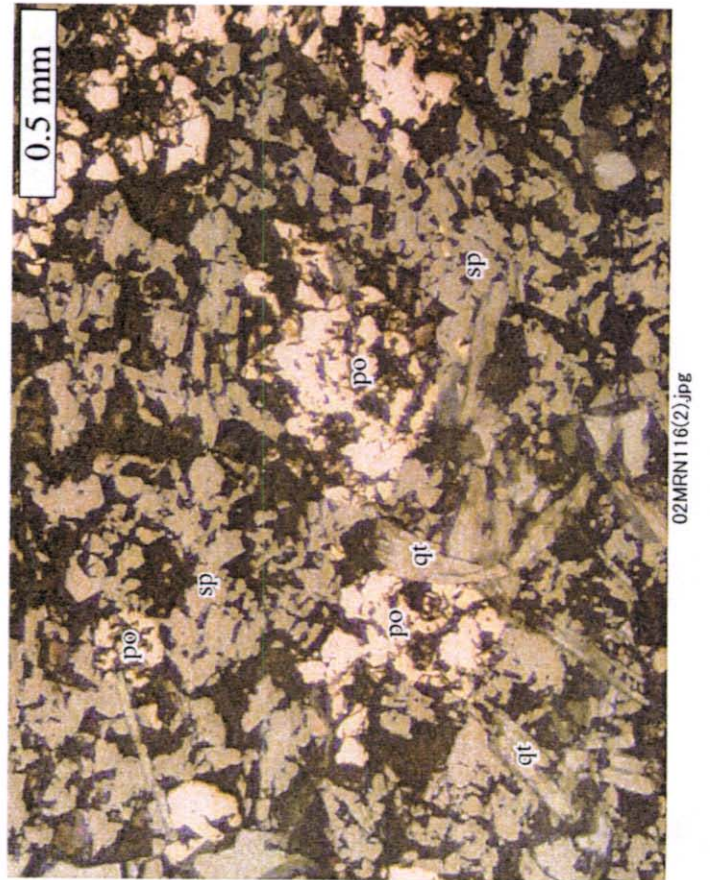
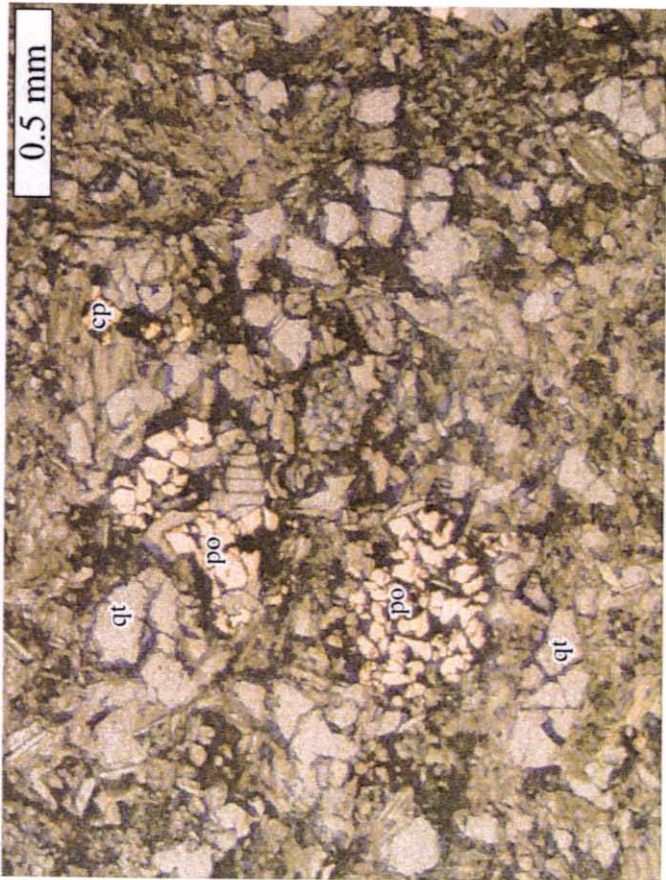
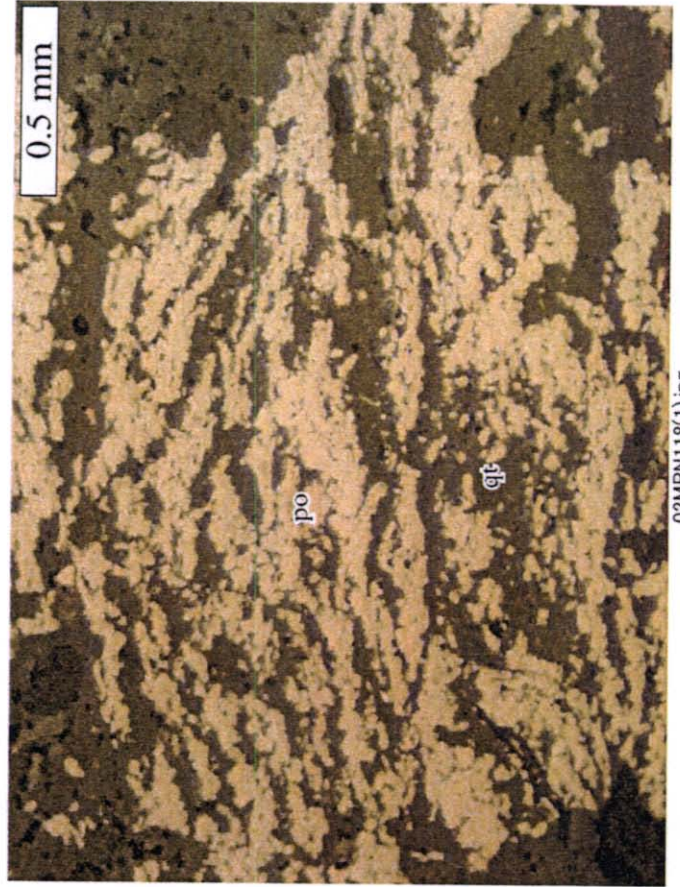
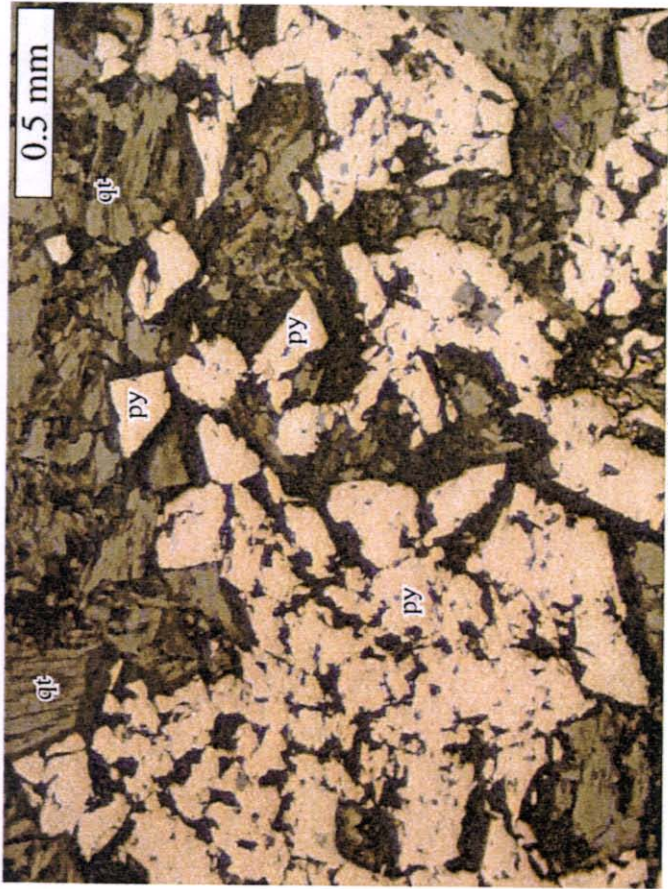


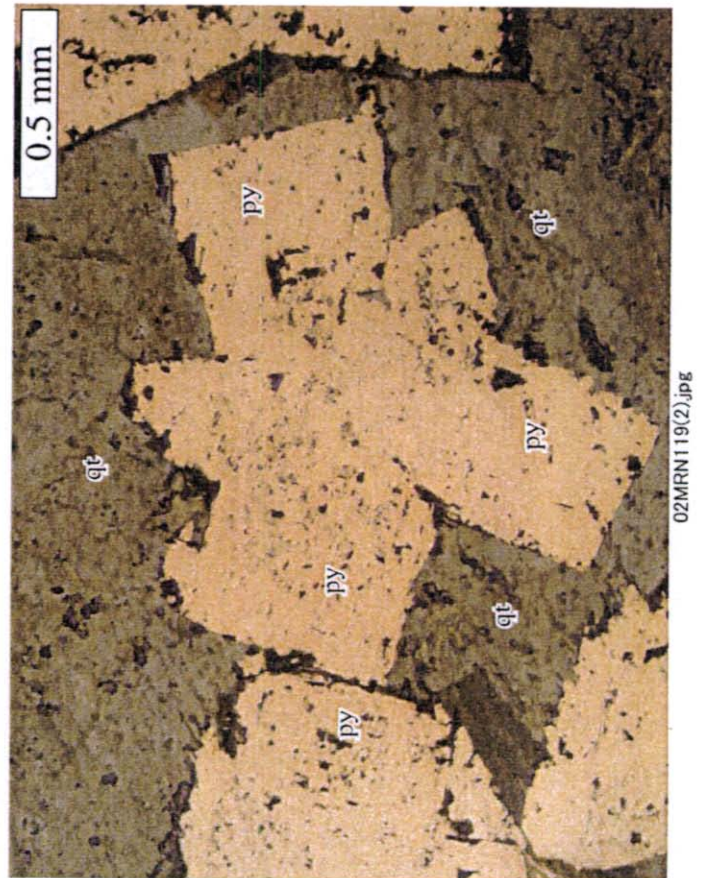
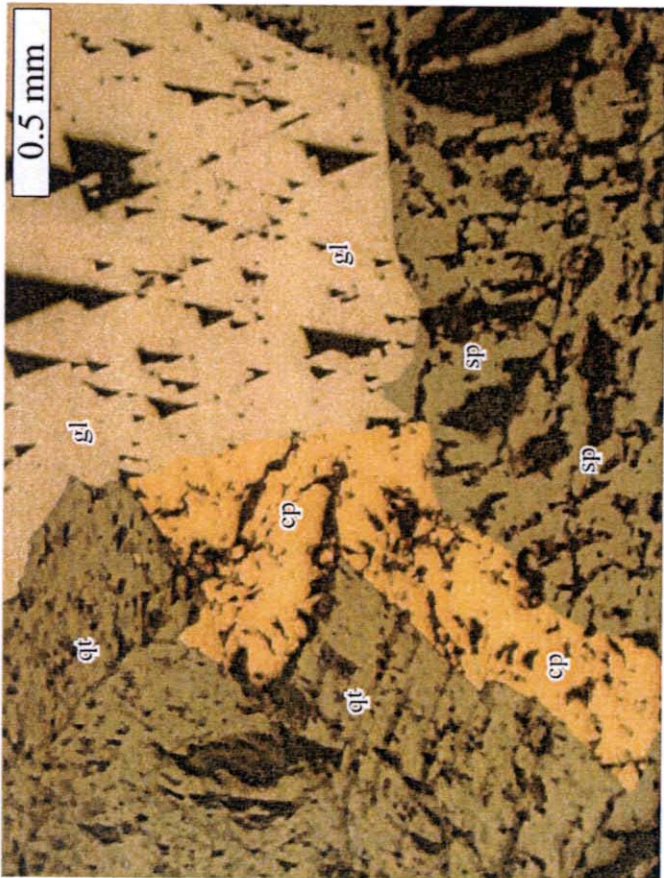
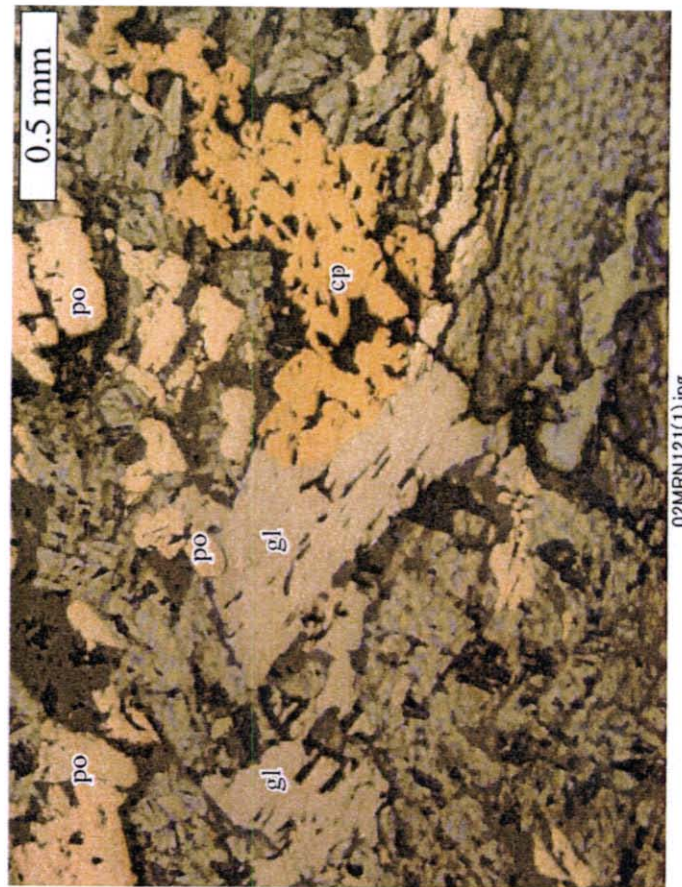
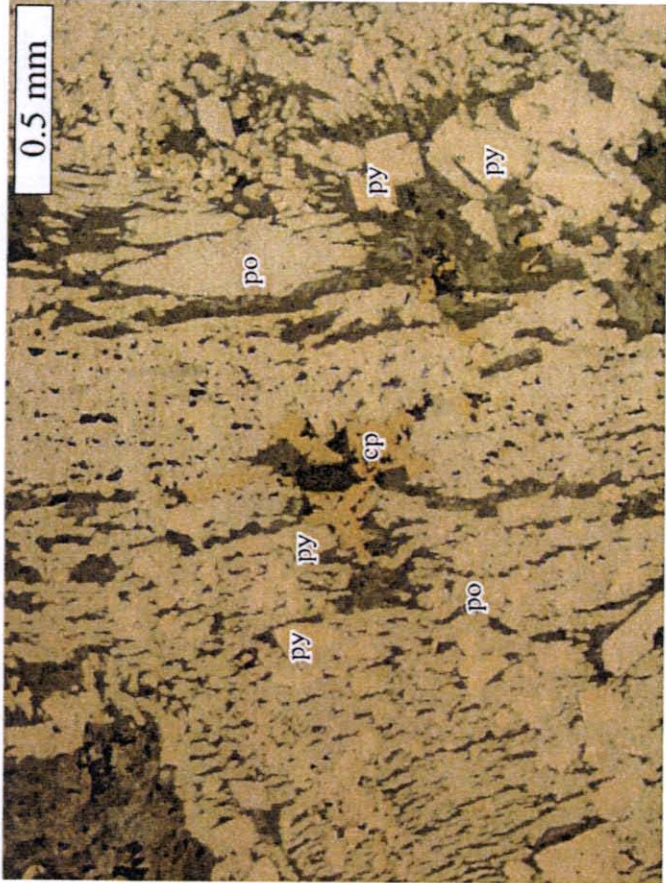
02MRN110(2).jpg

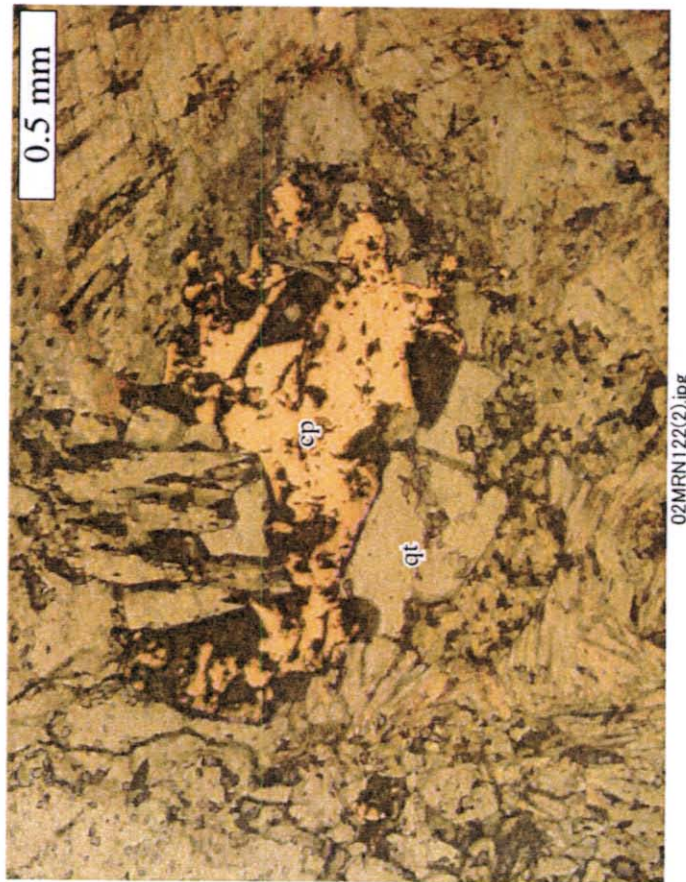
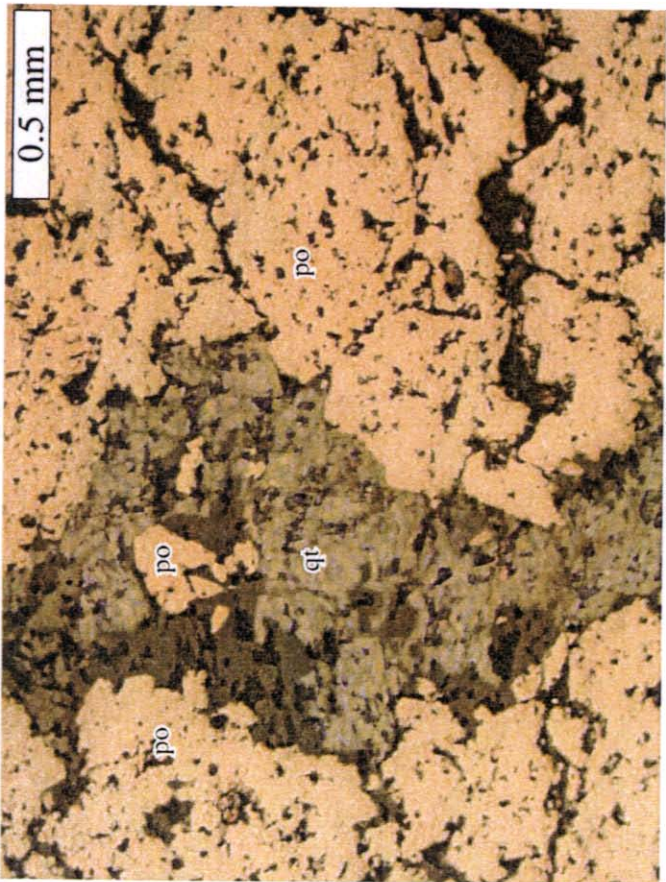
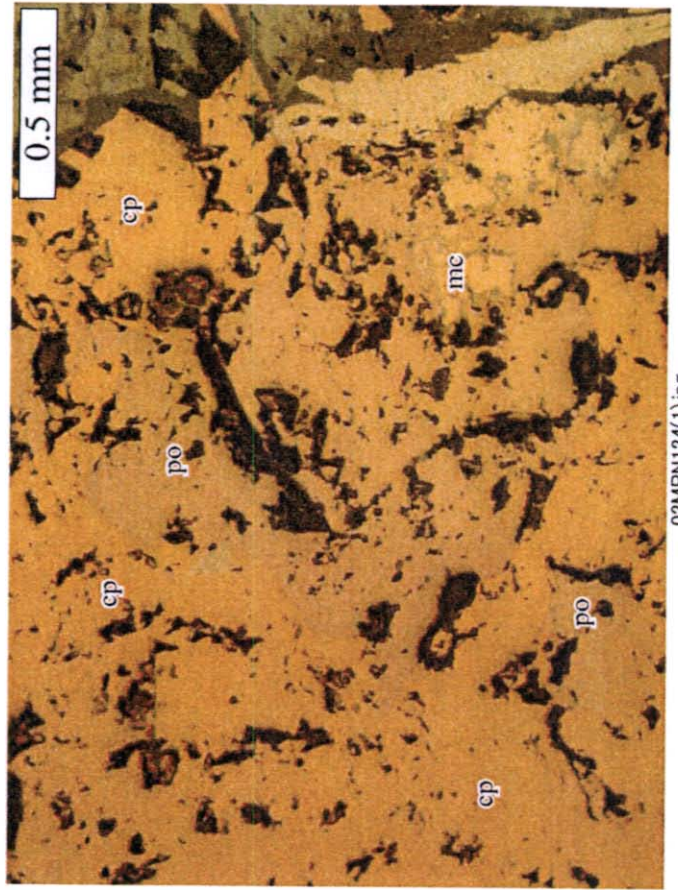
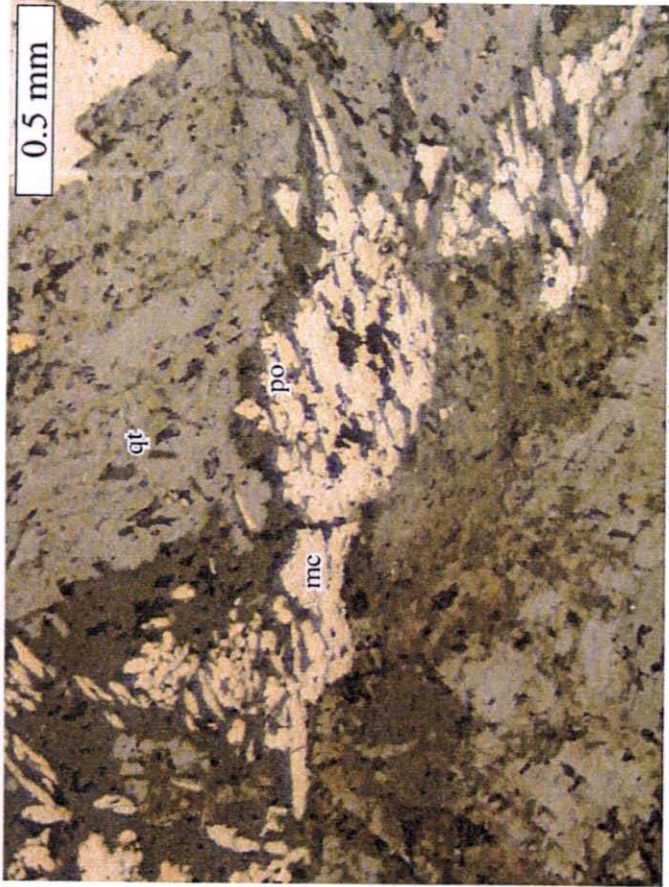


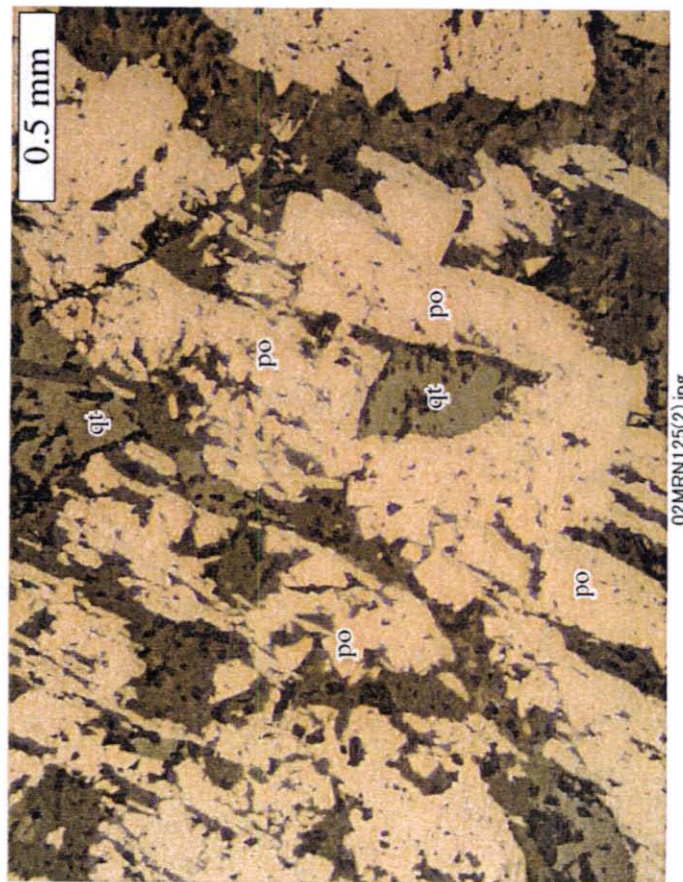
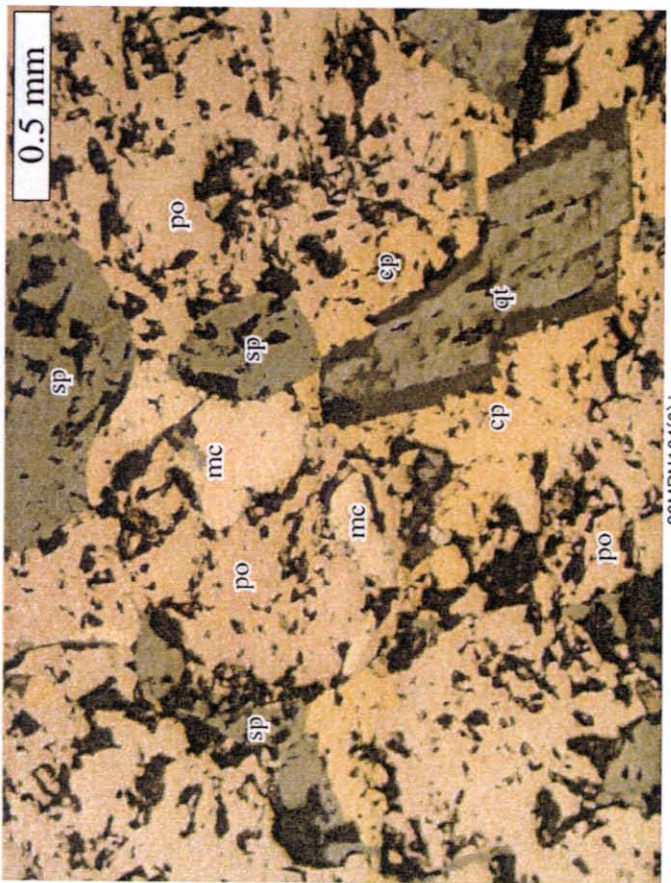
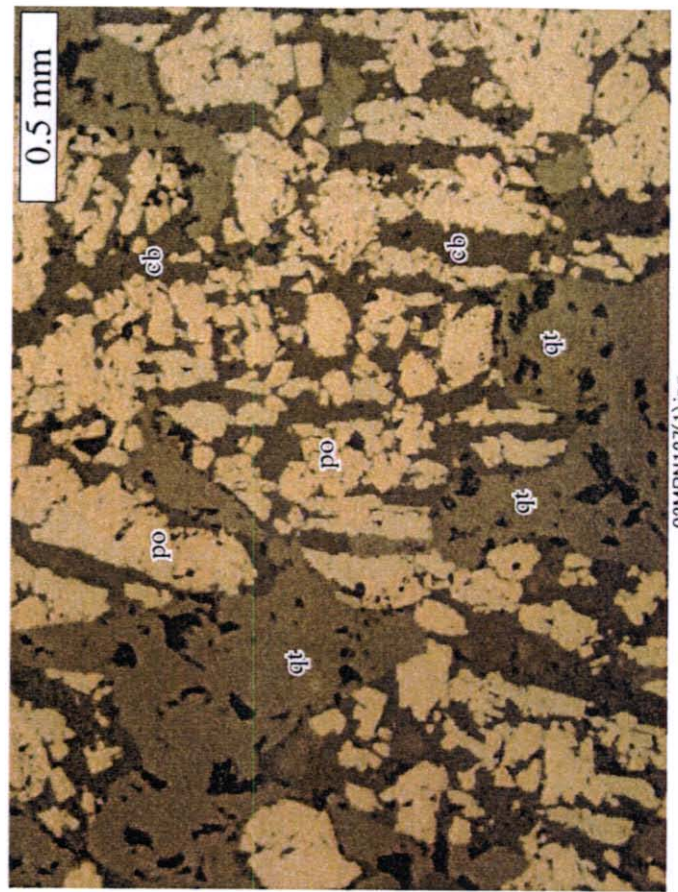
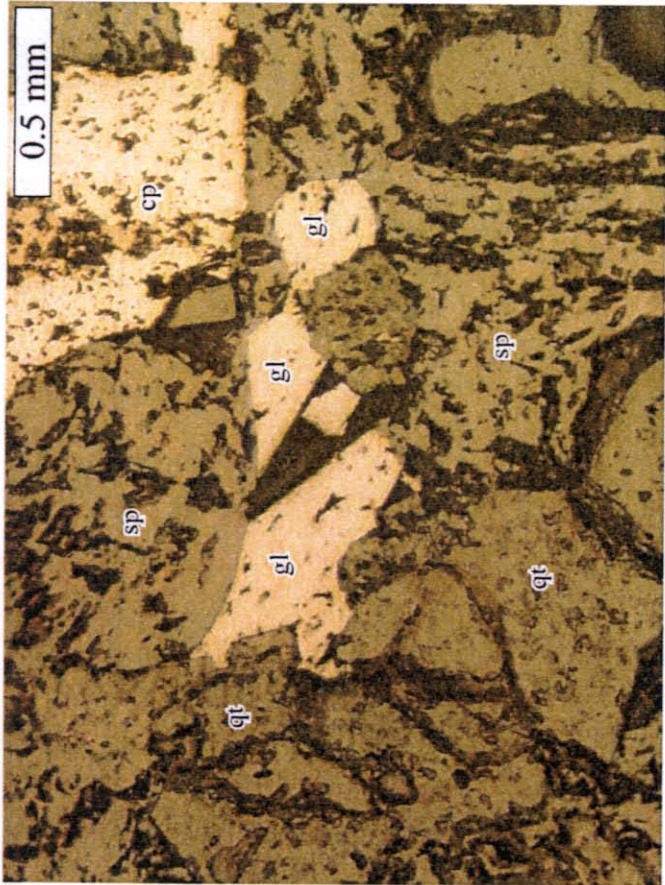


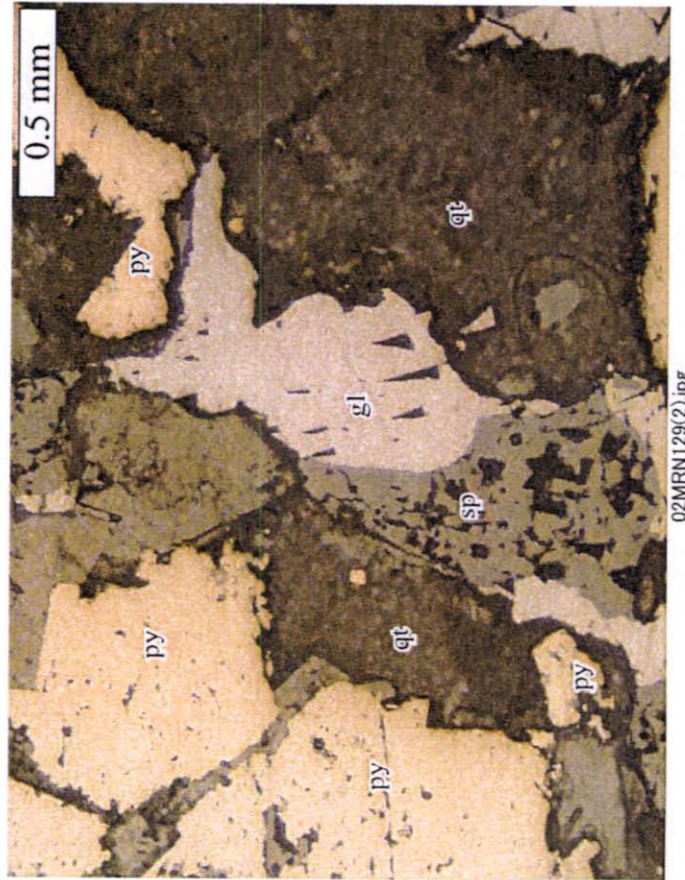
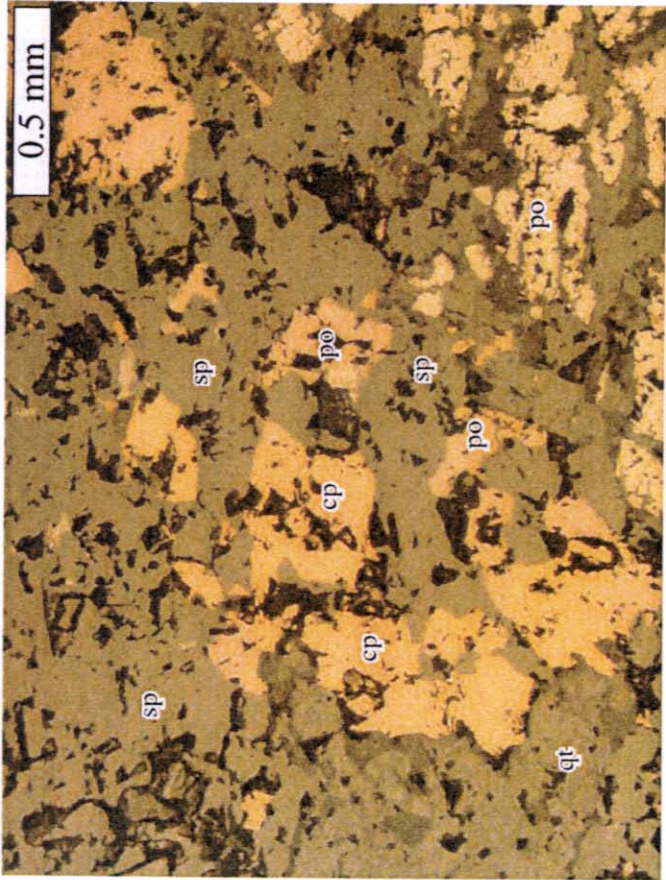
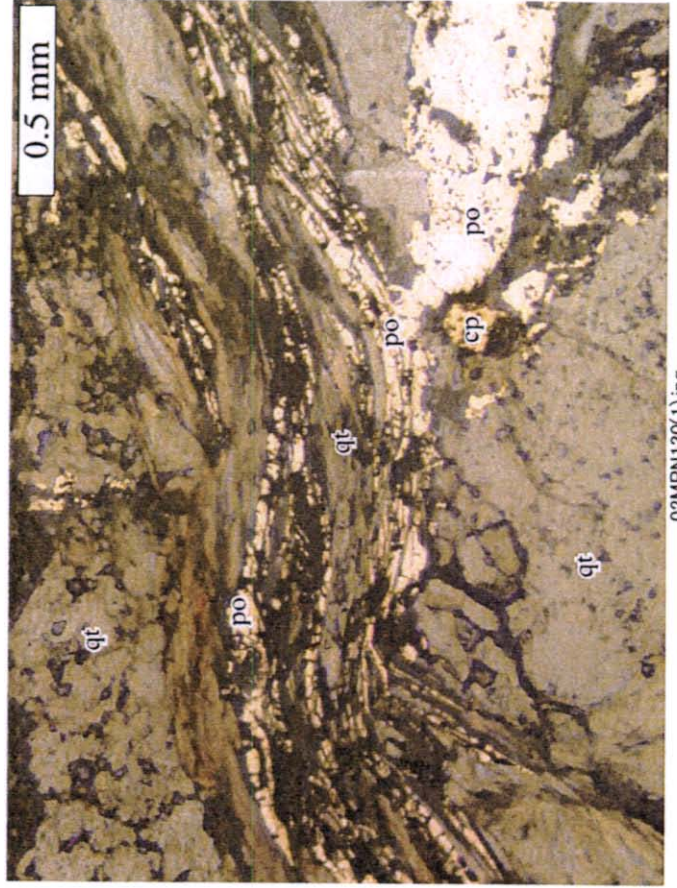
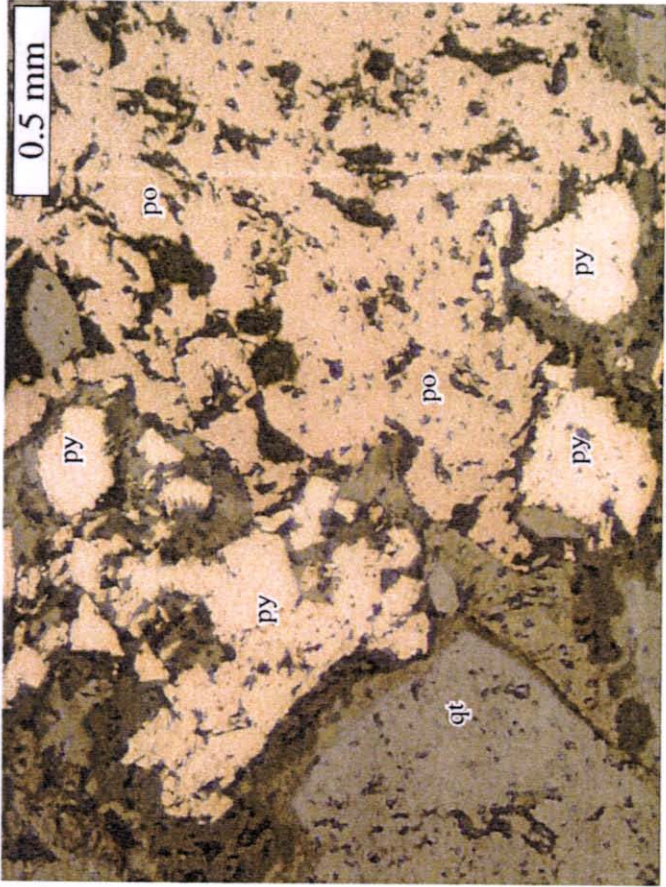


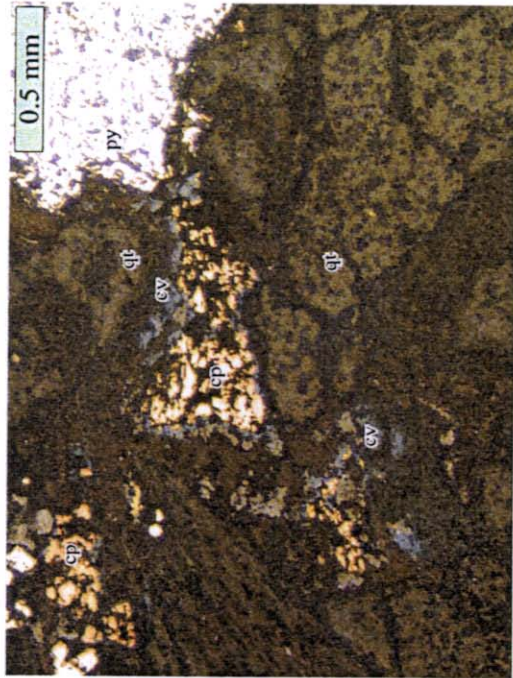




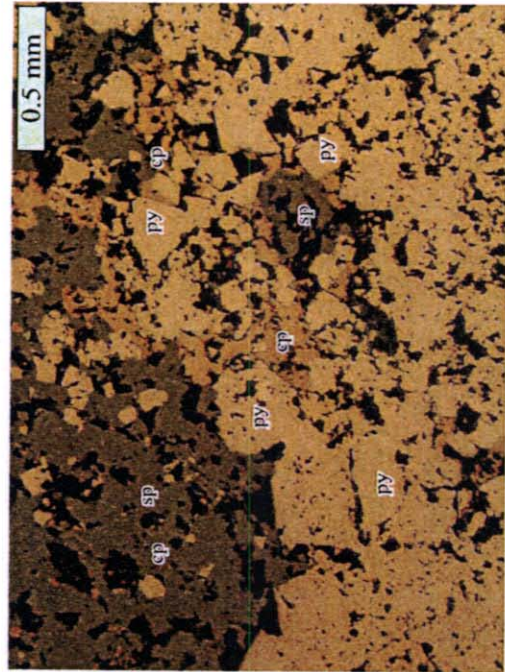




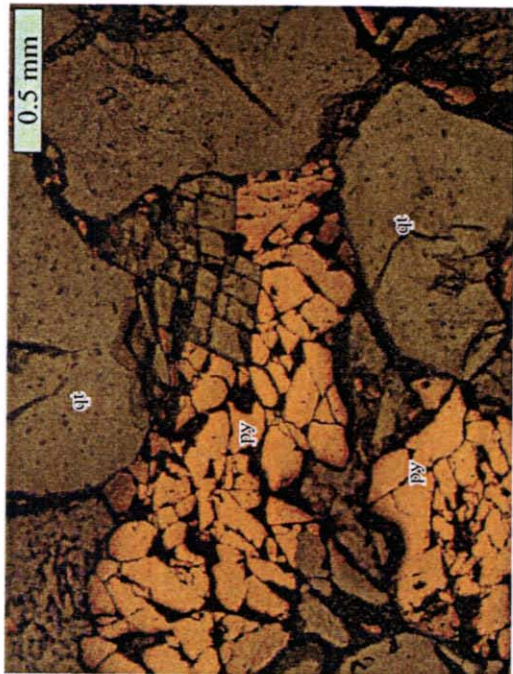




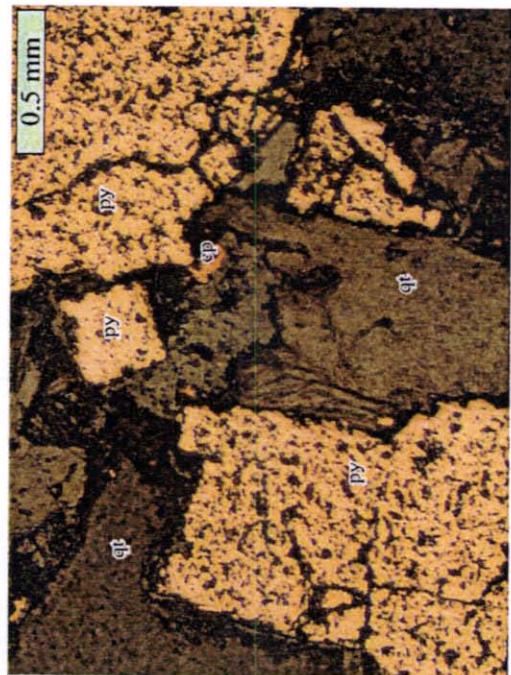
02MRN132 (1)



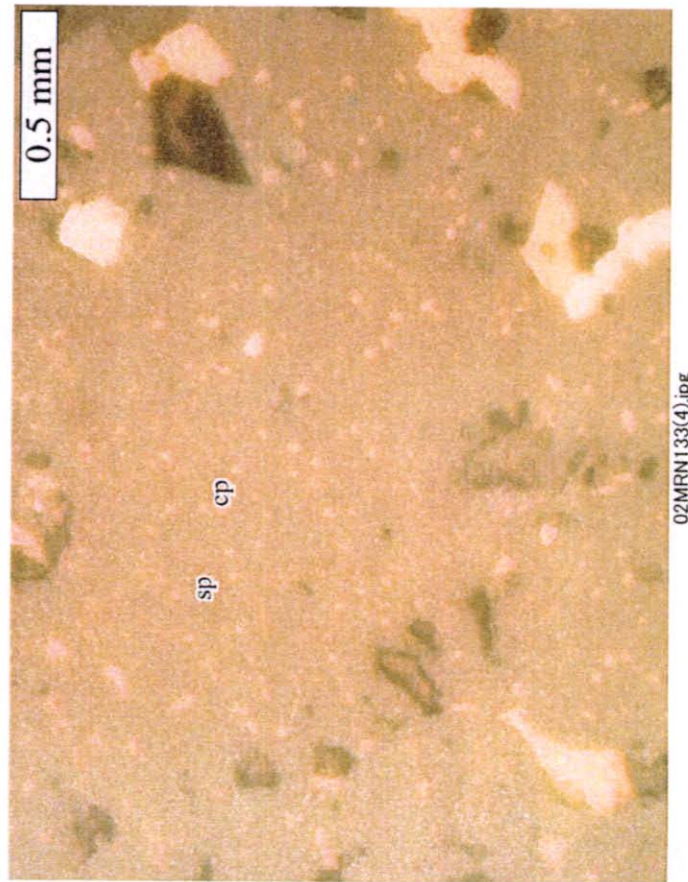
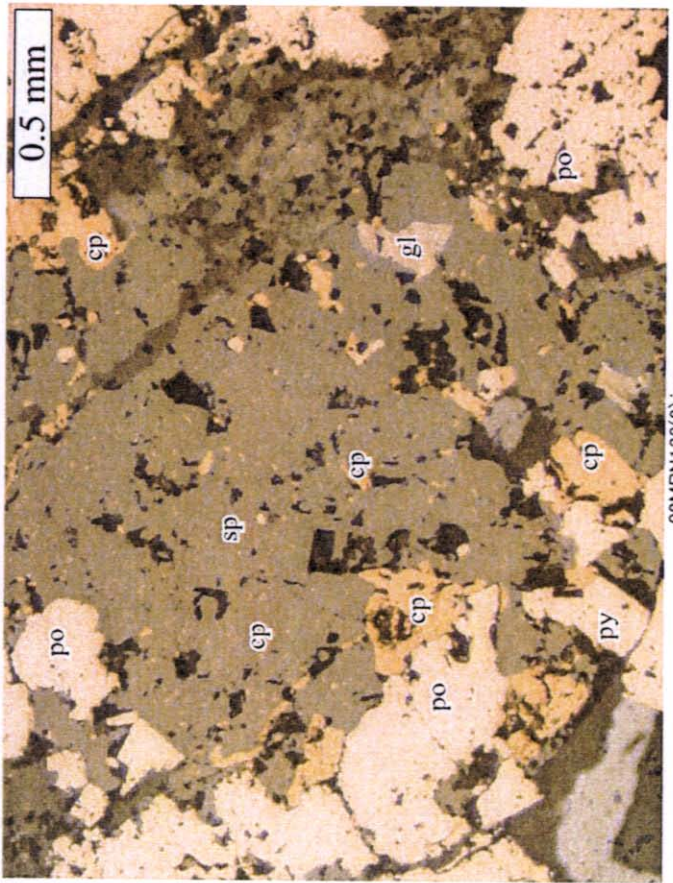
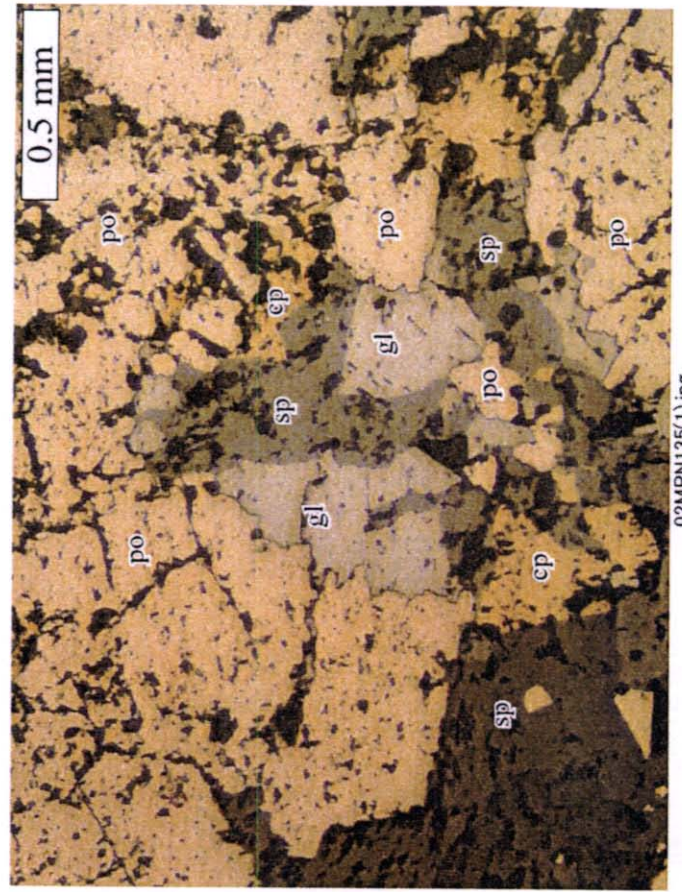
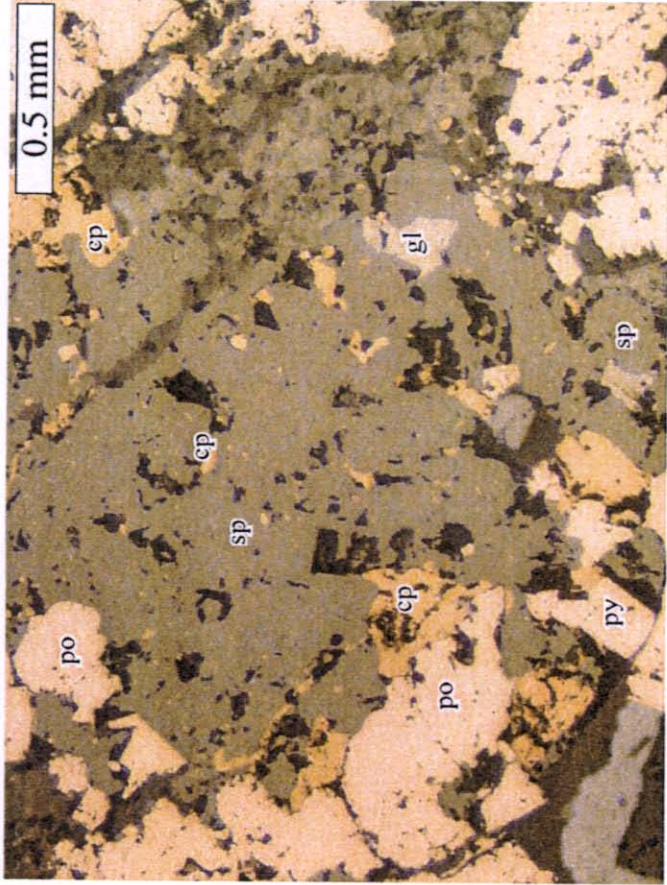
02MRN133 (1)



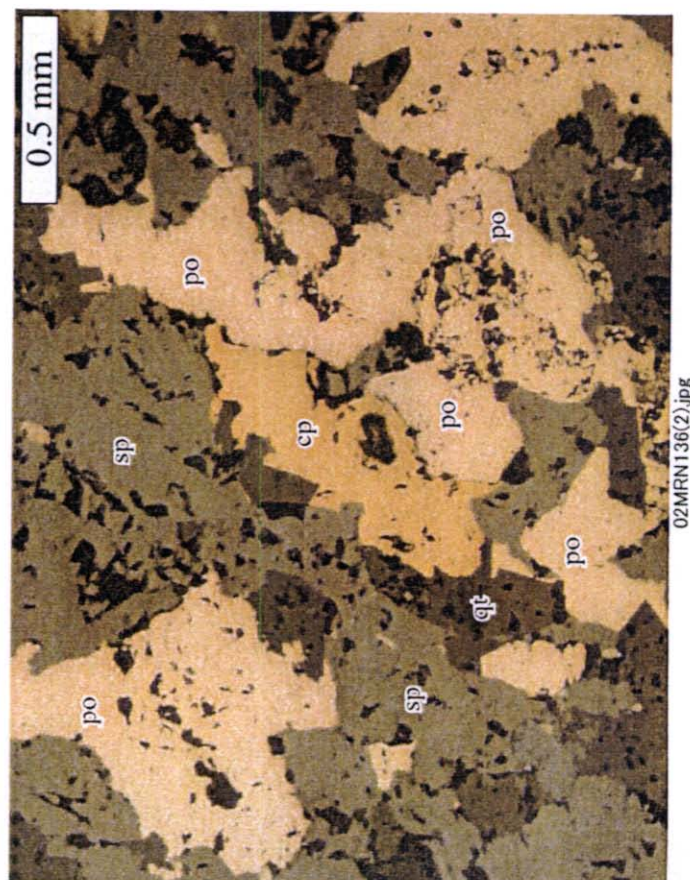
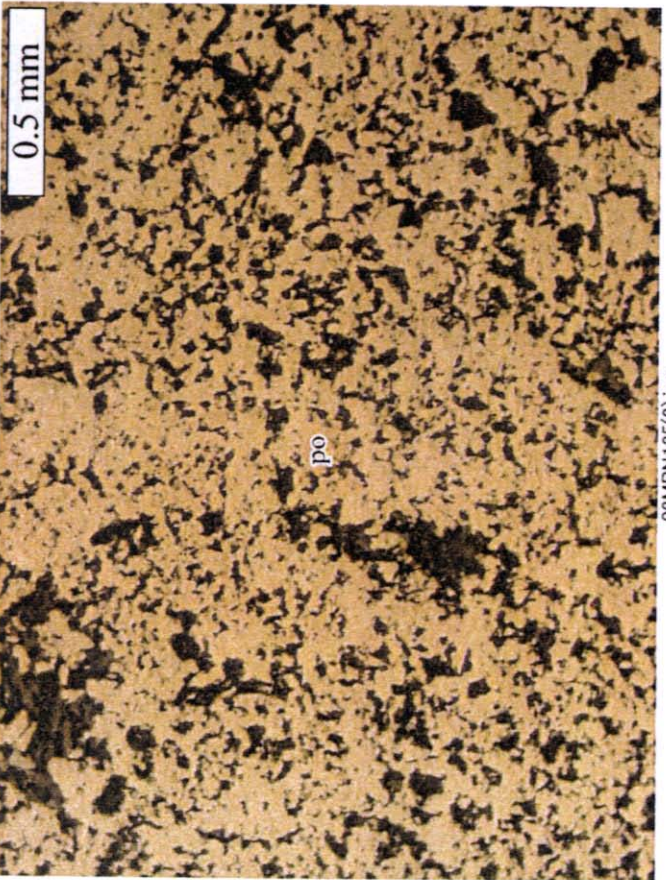
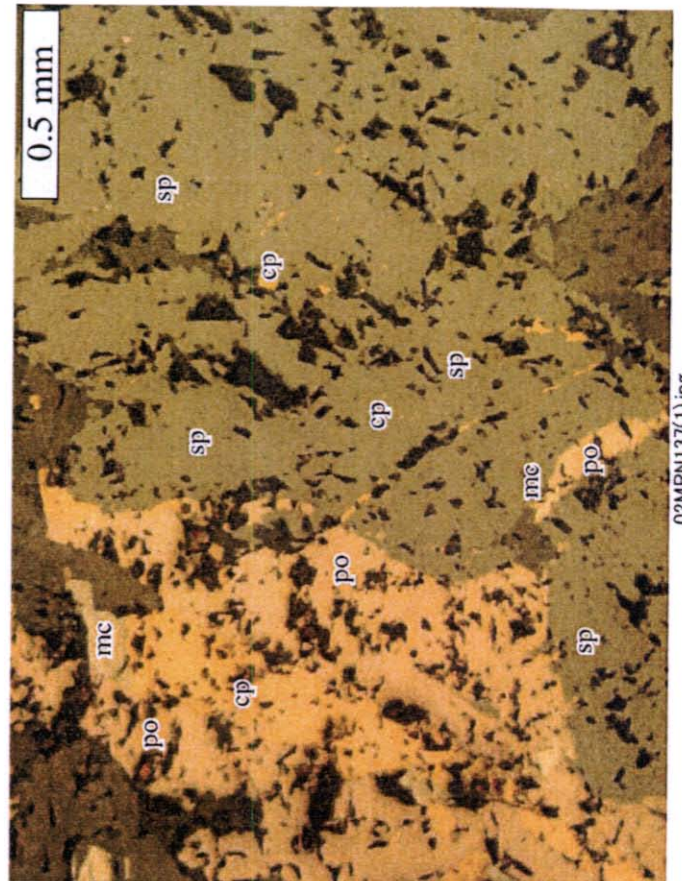
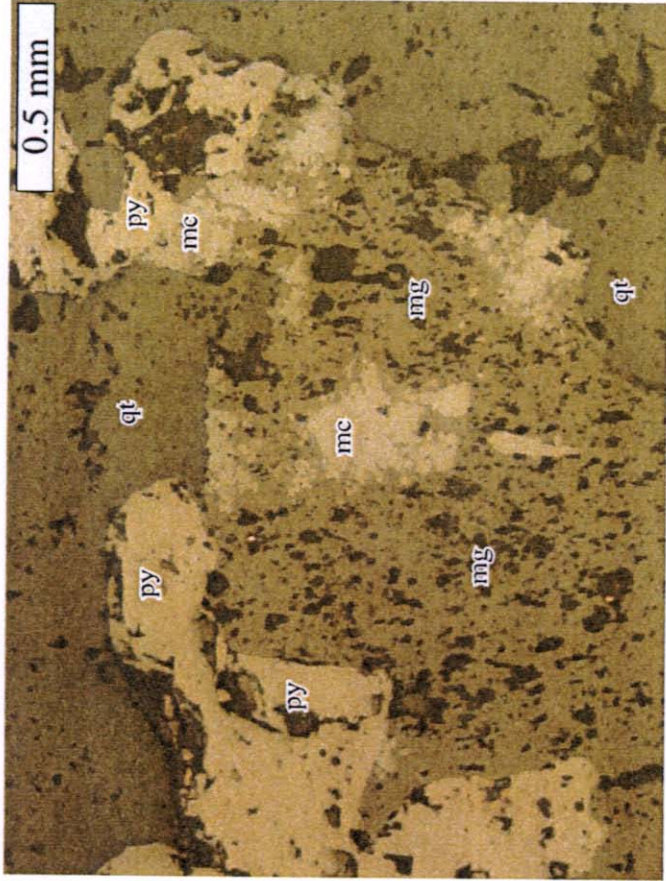
02MRN130 (2)

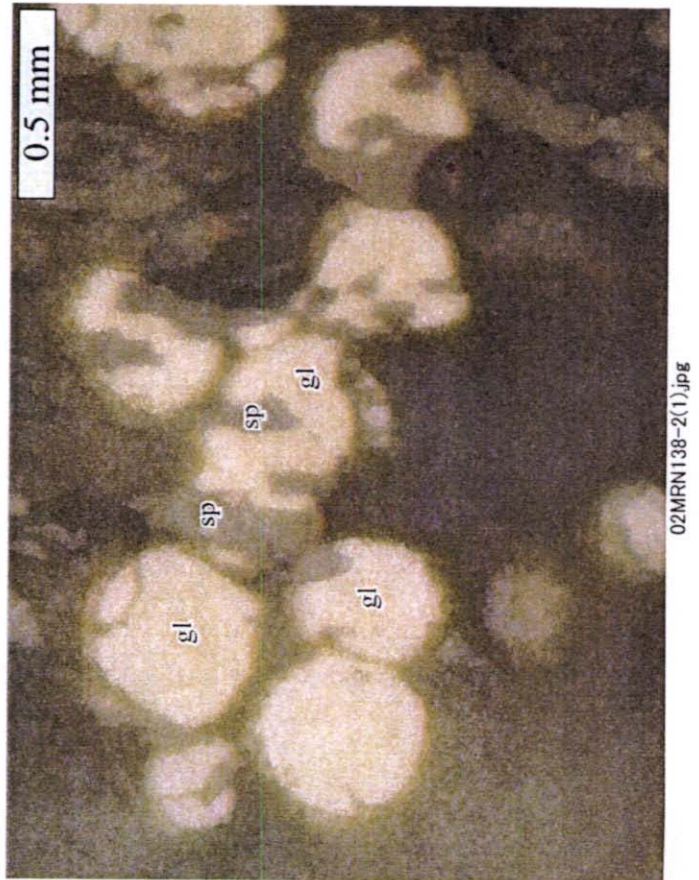
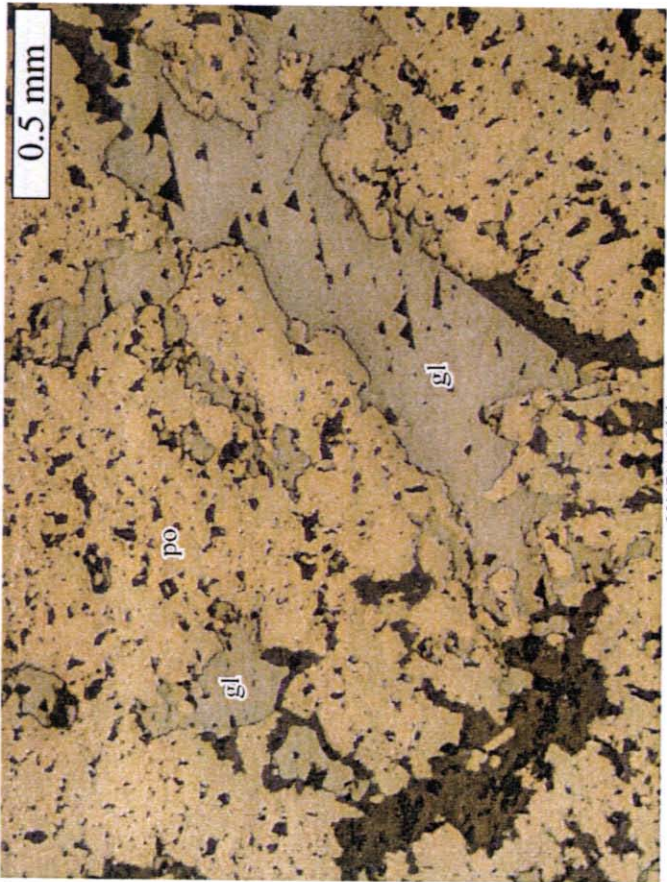
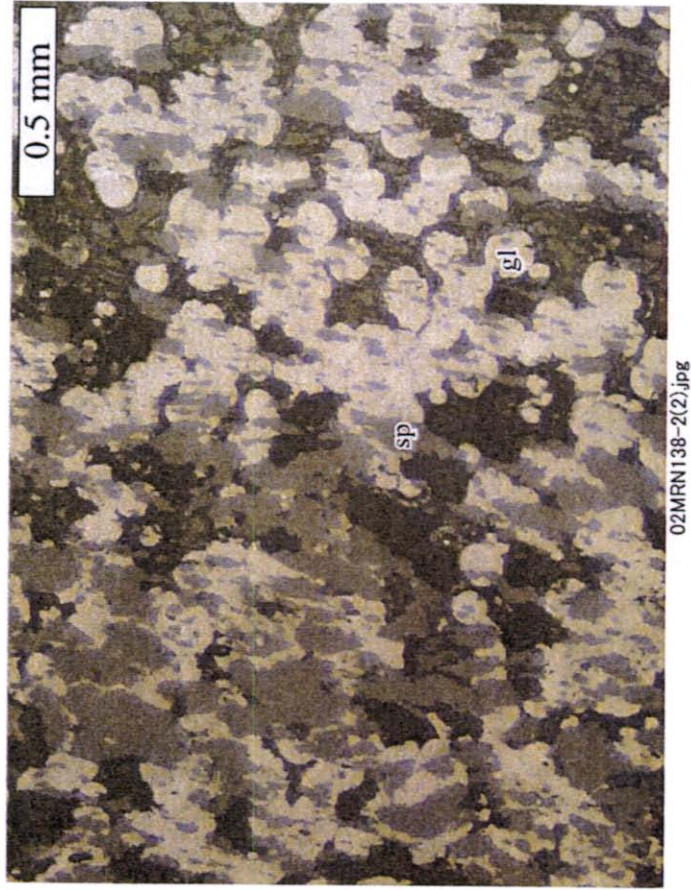
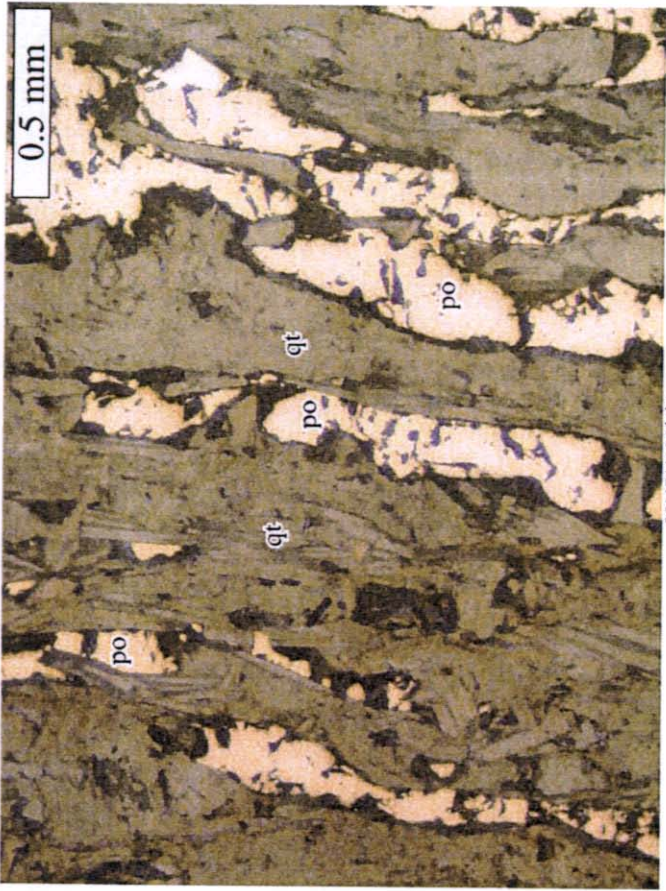


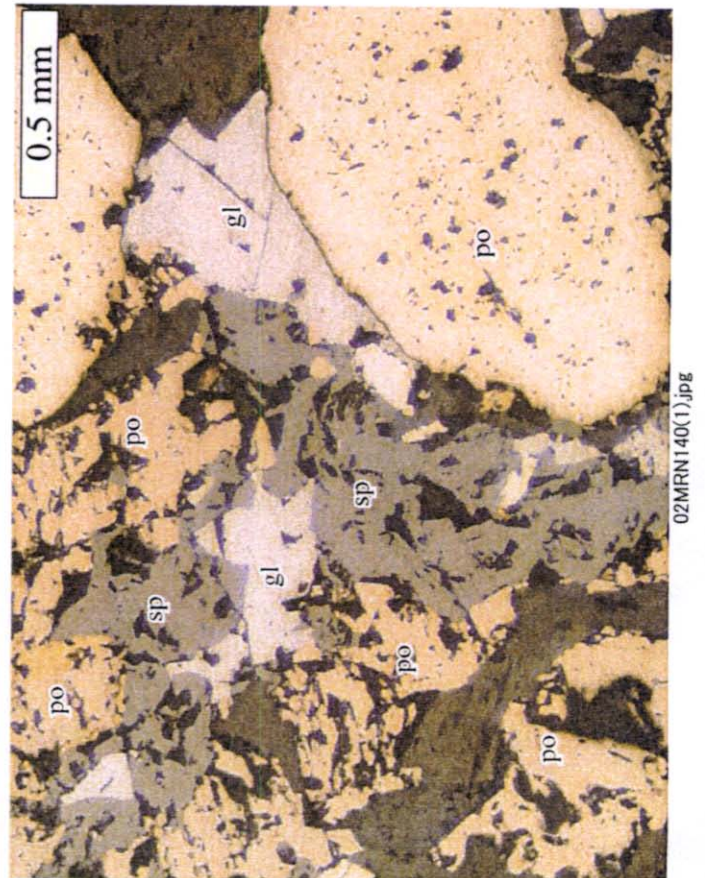
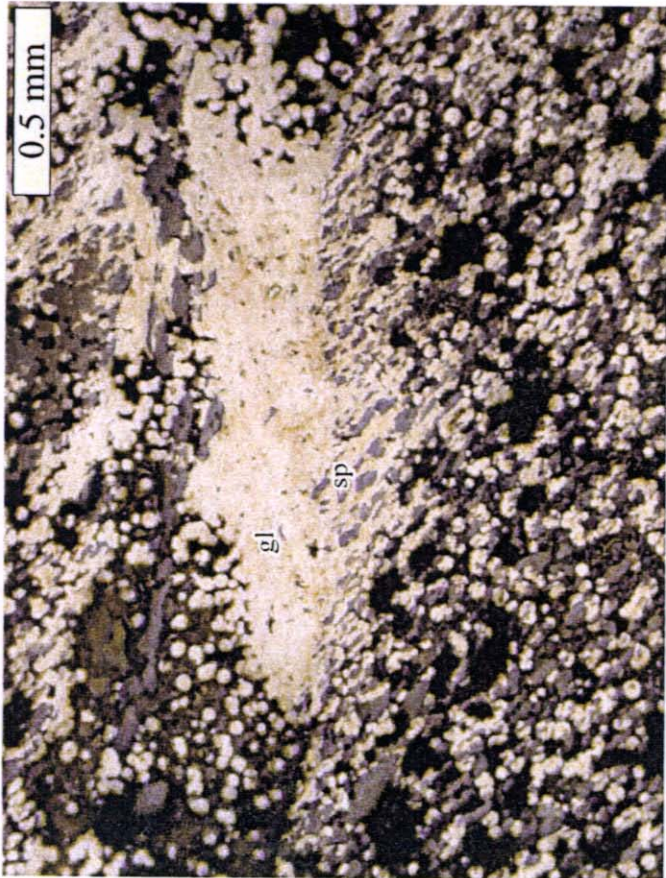
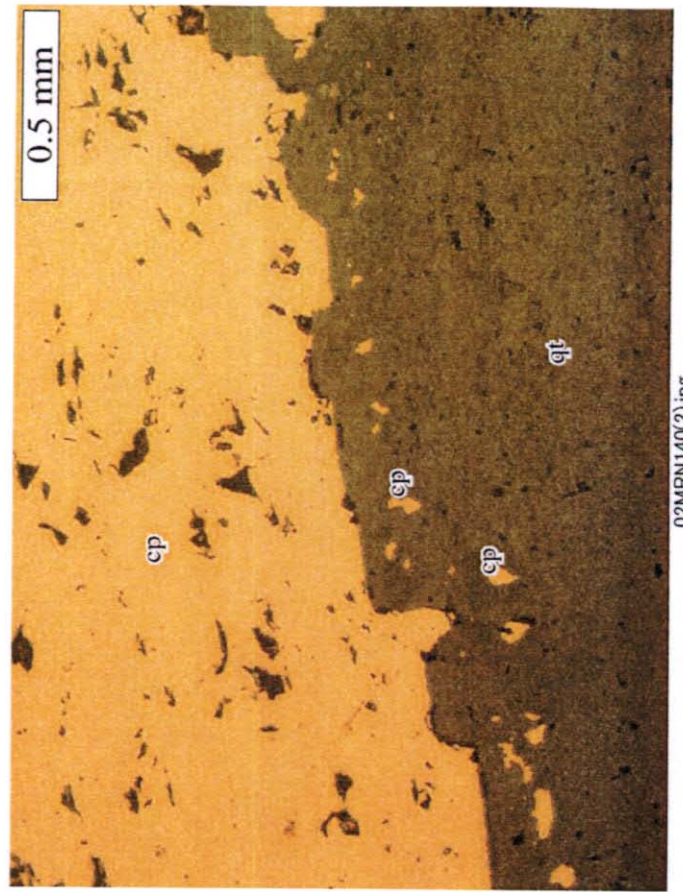
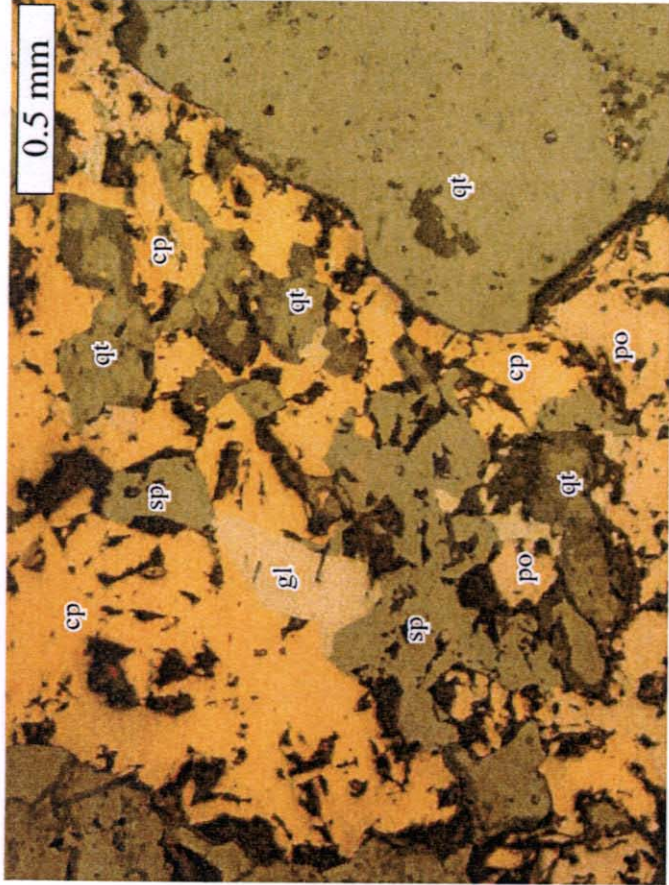
02MRN132 (2)

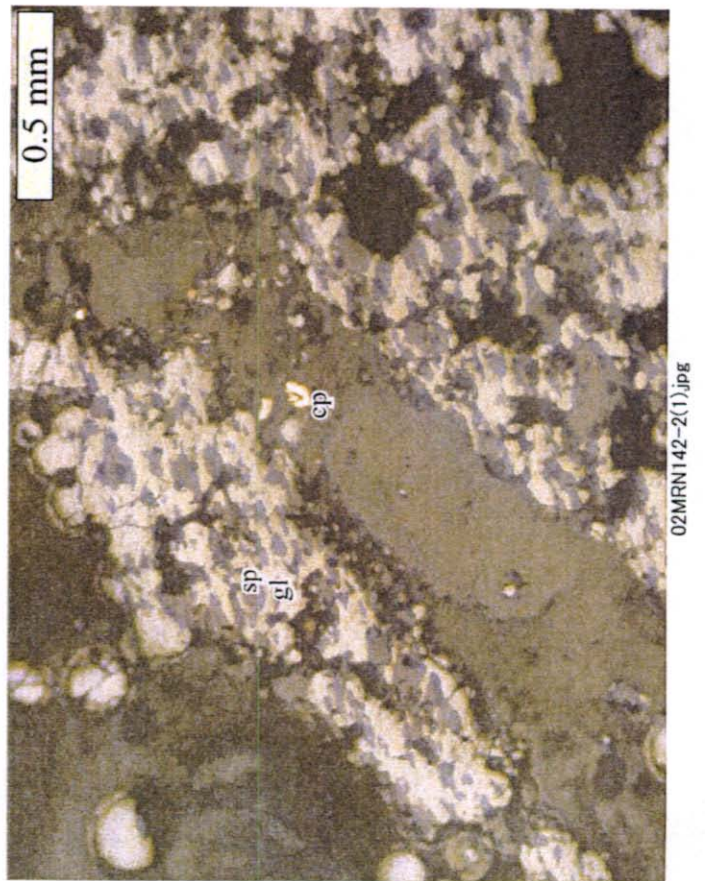
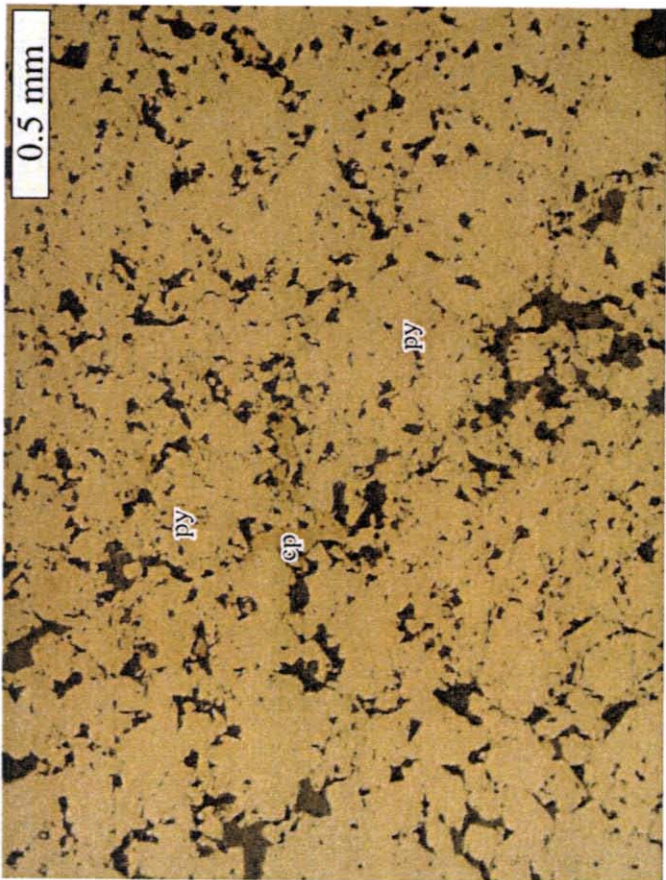
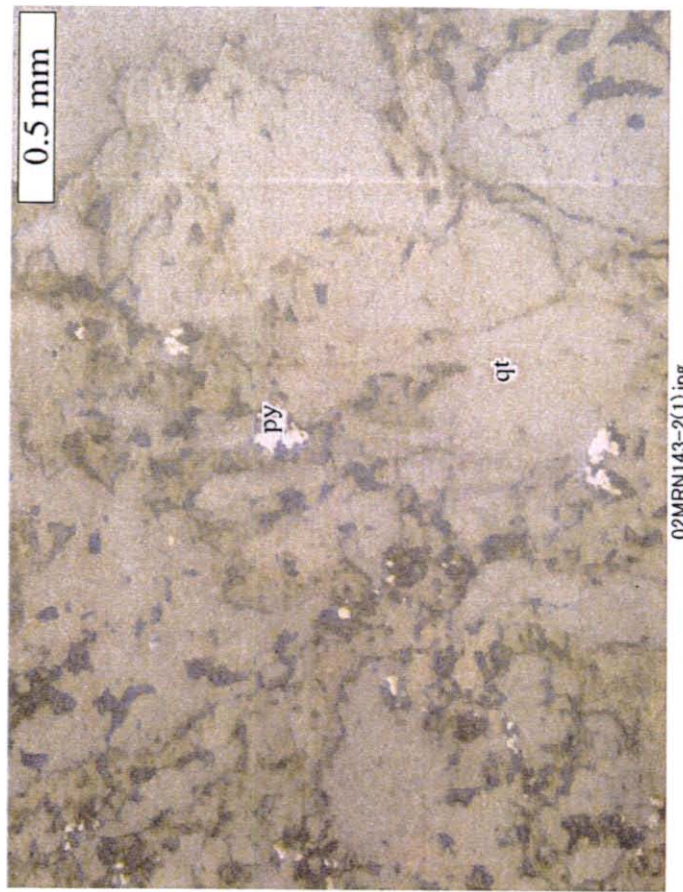
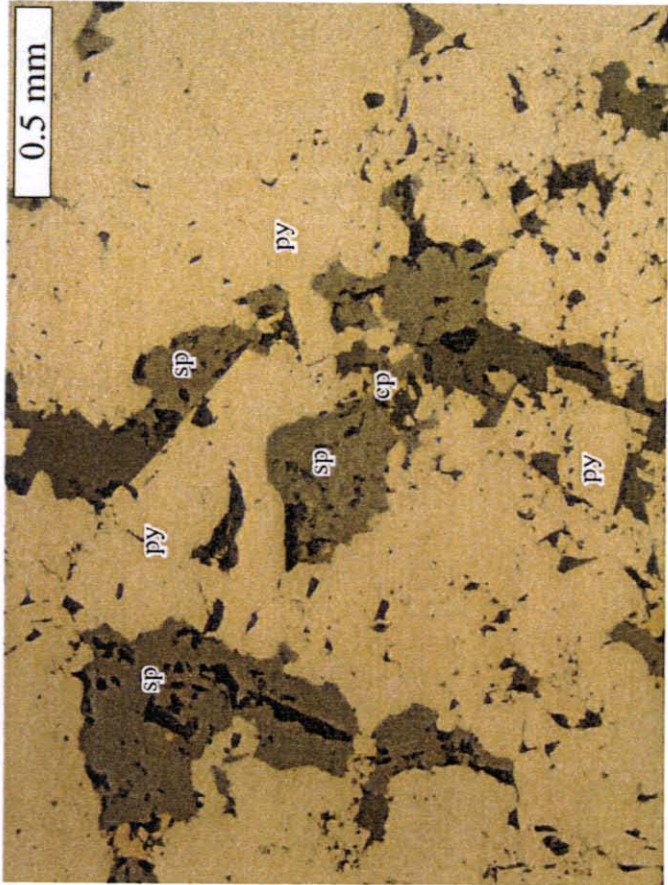


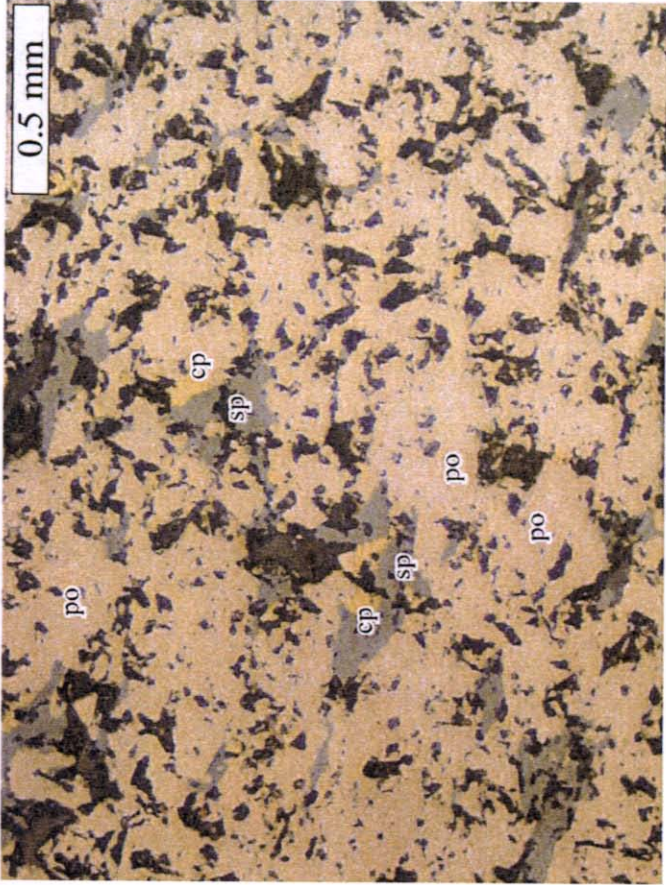




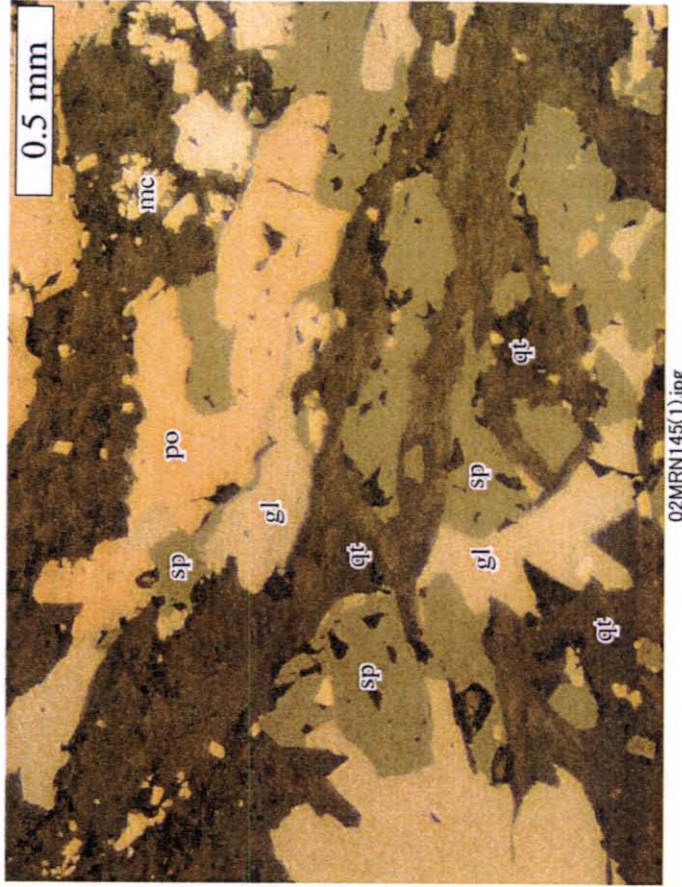




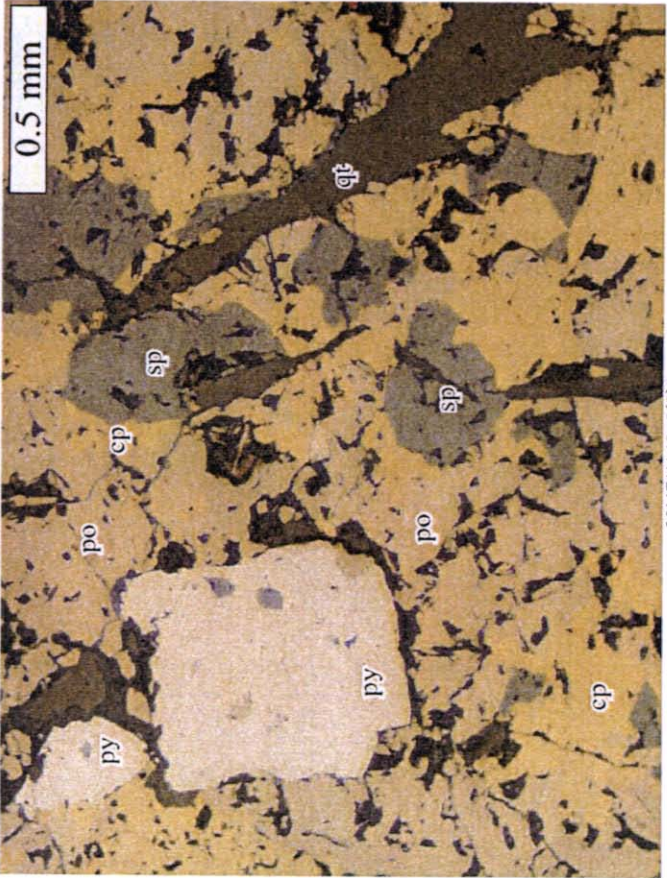




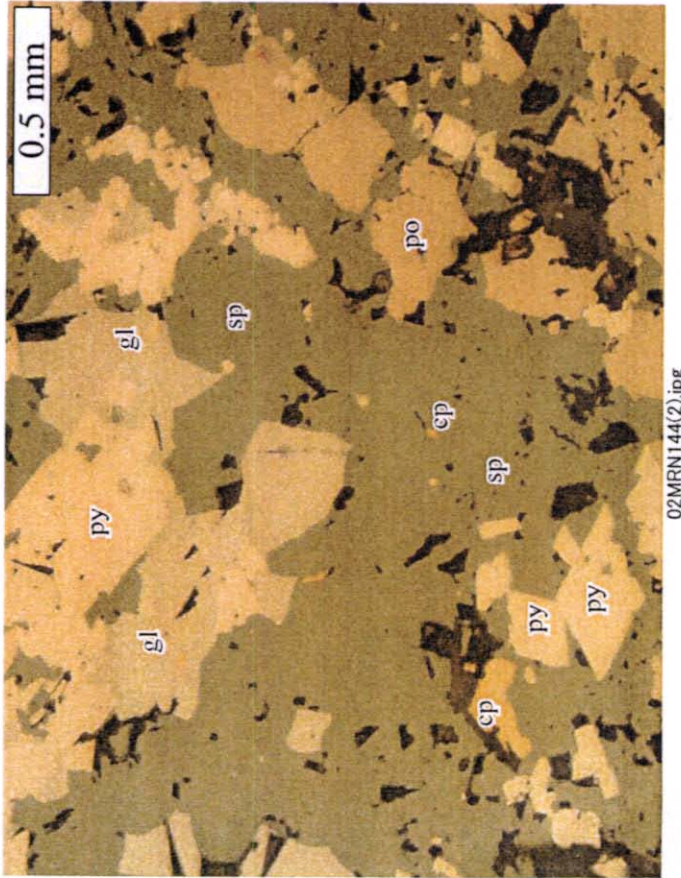
02MRN144(1).jpg



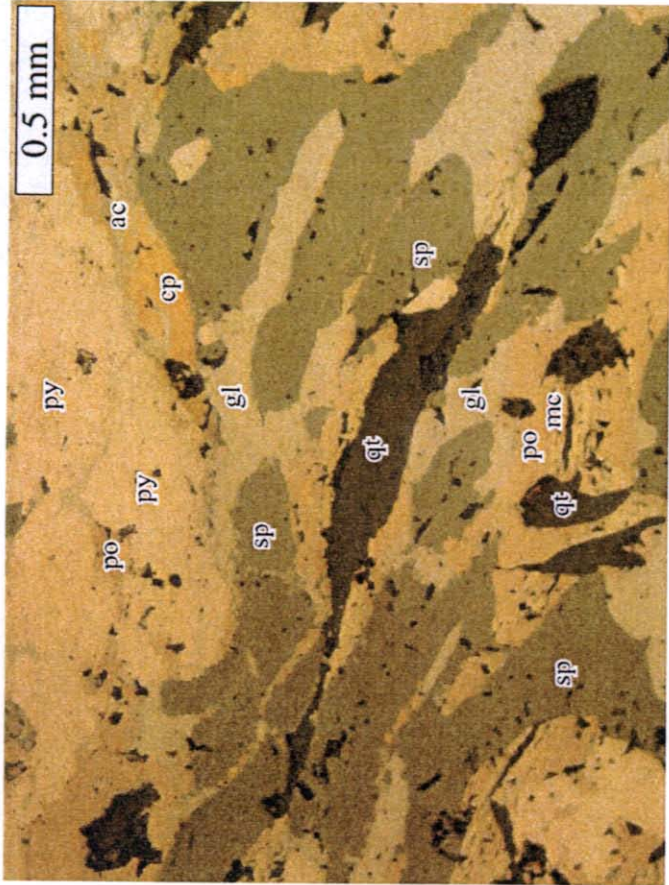
02MRN145(1).jpg



02MRN143-2(2).jpg



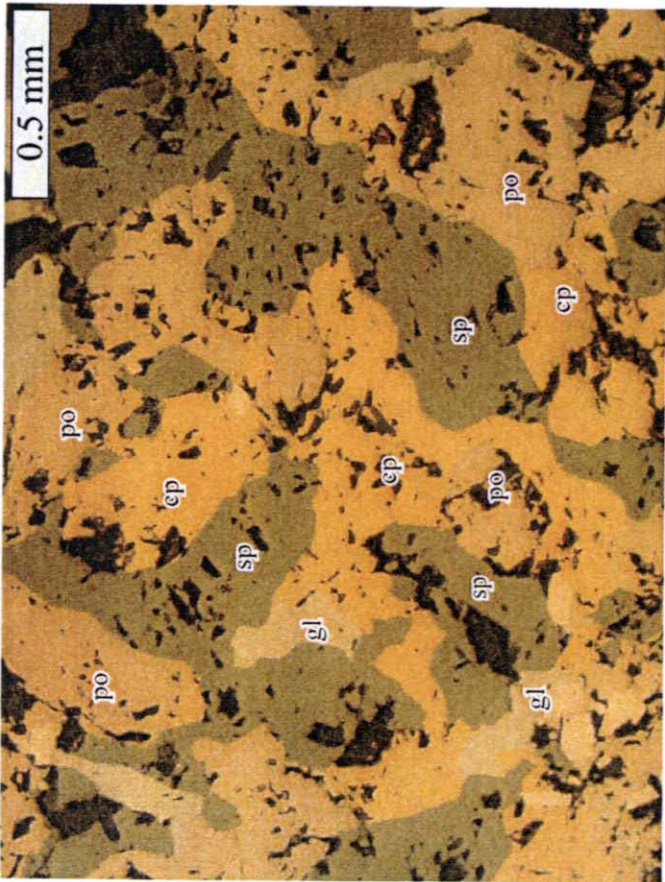
02MRN144(2).jpg



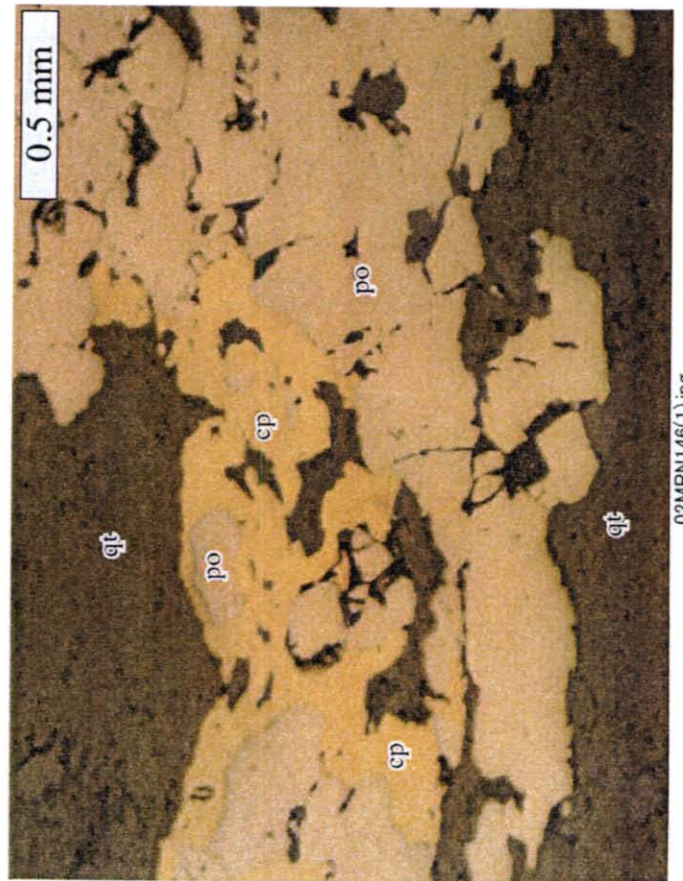
02MRN145(3).jpg



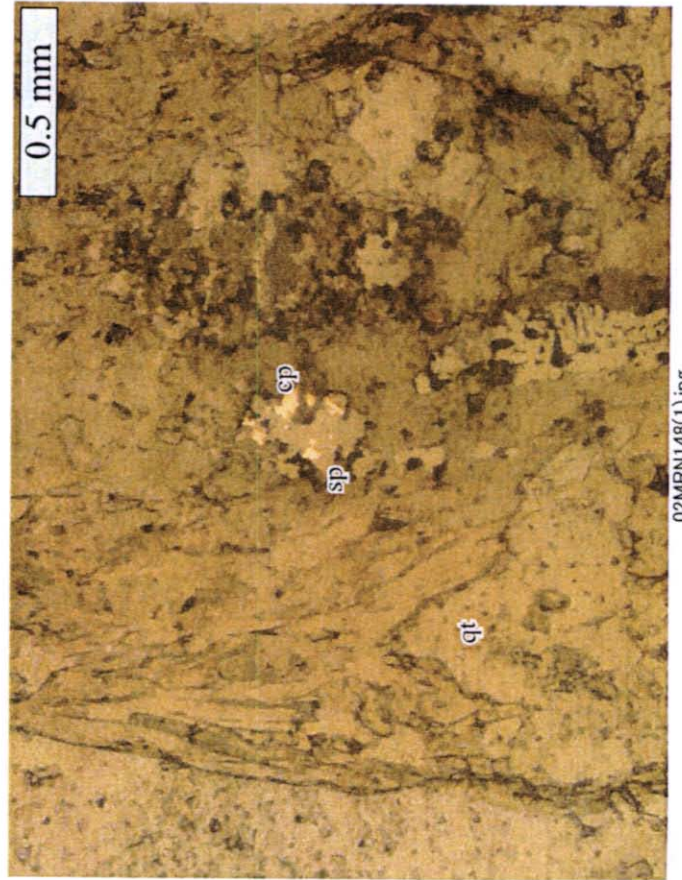
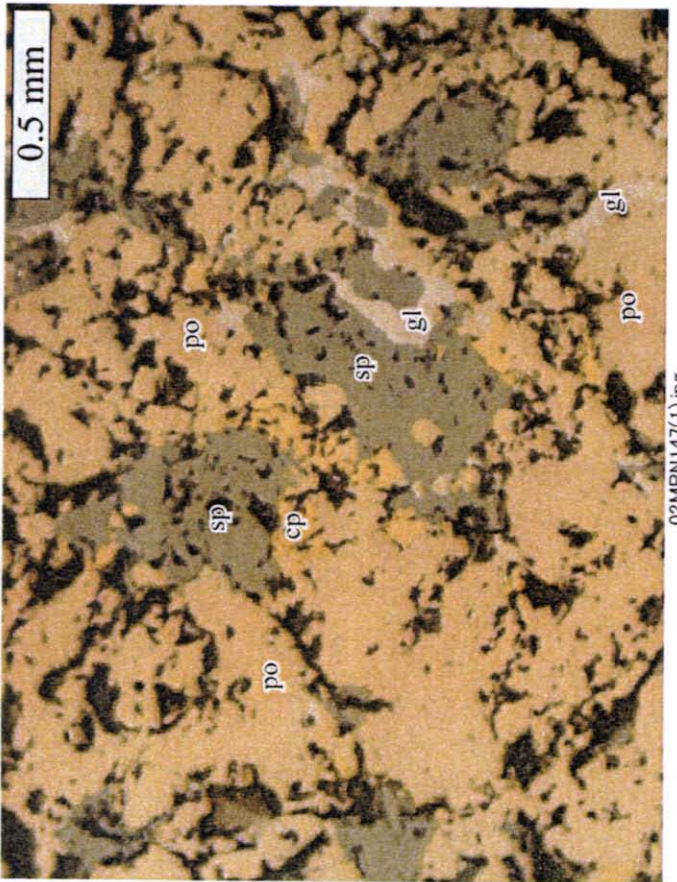
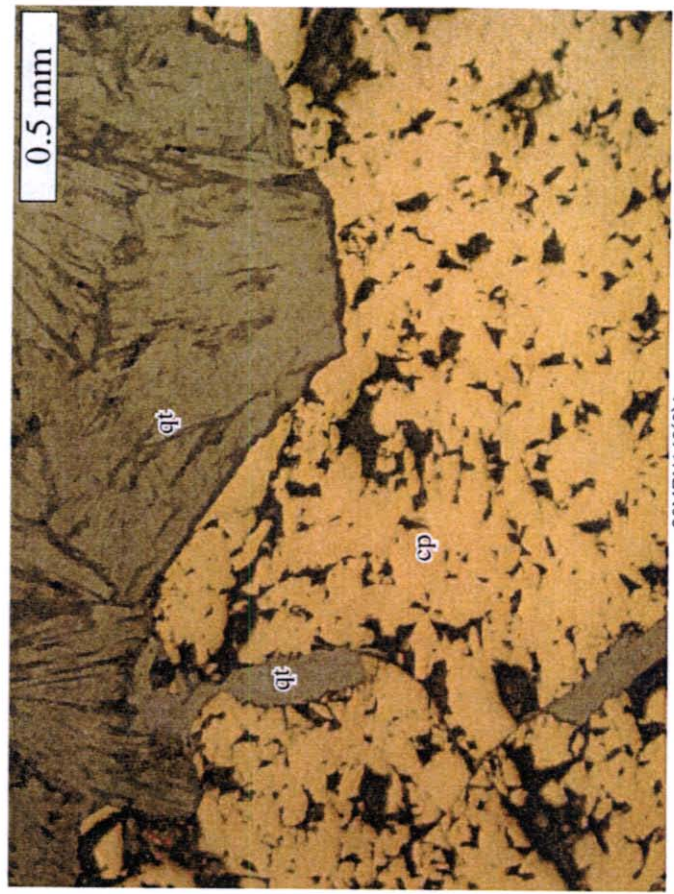
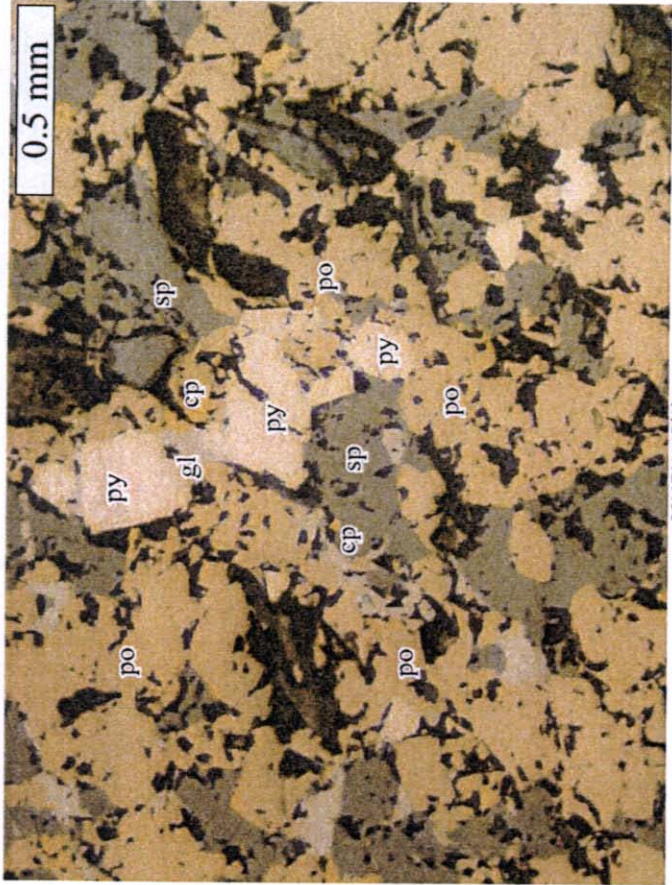
02MRN146(2).jpg

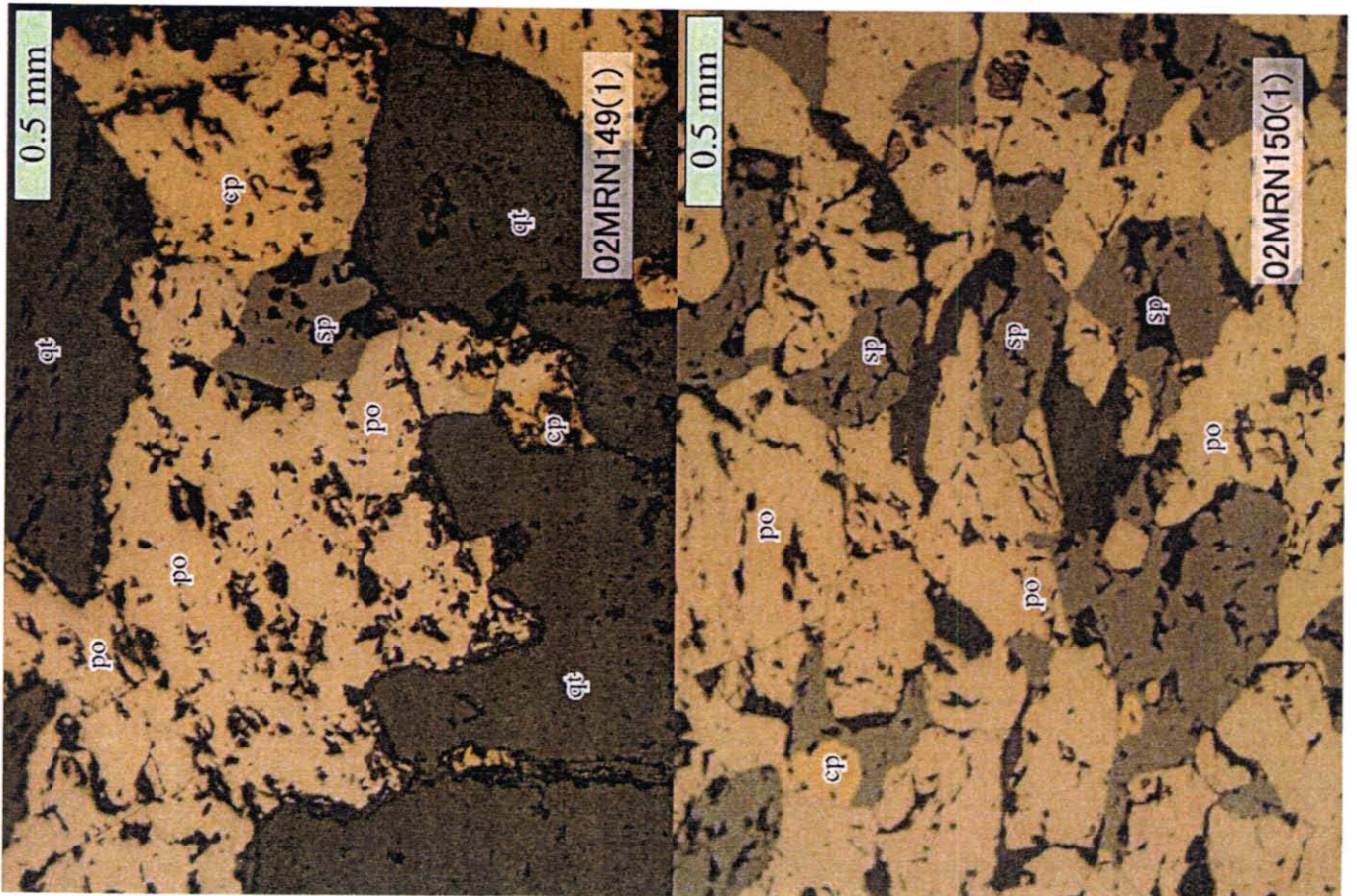
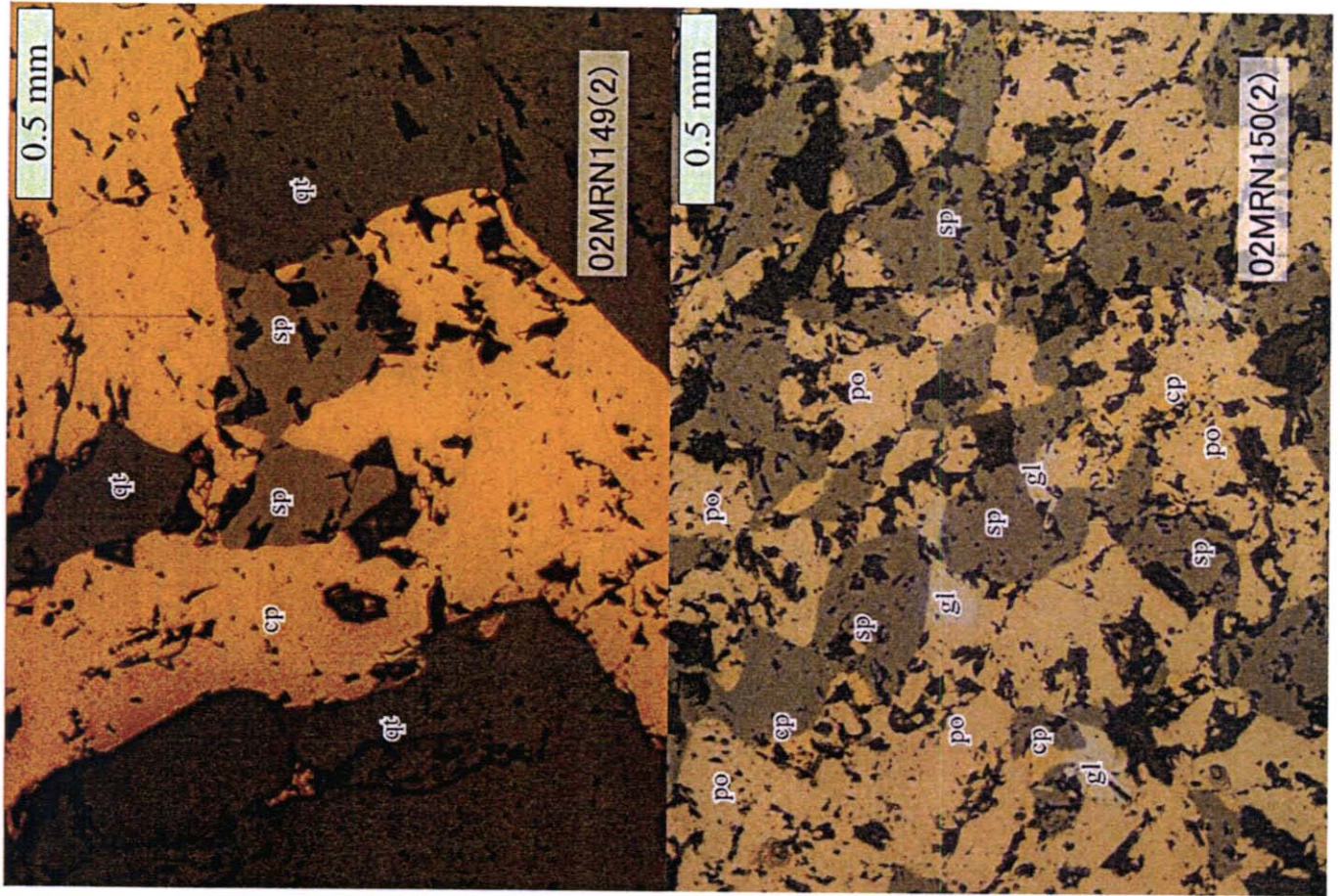


02MRN145(2).jpg

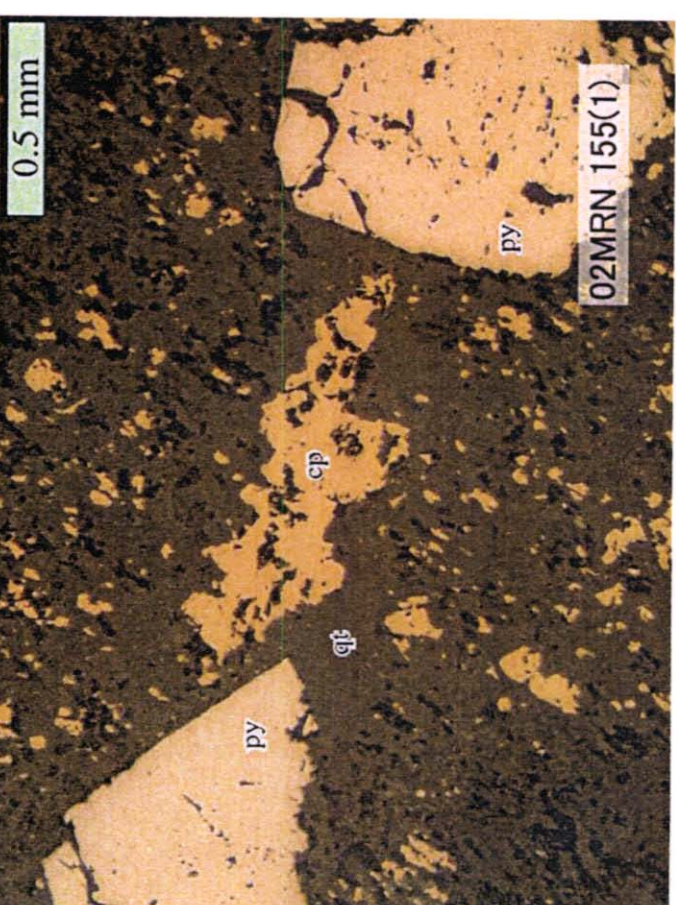
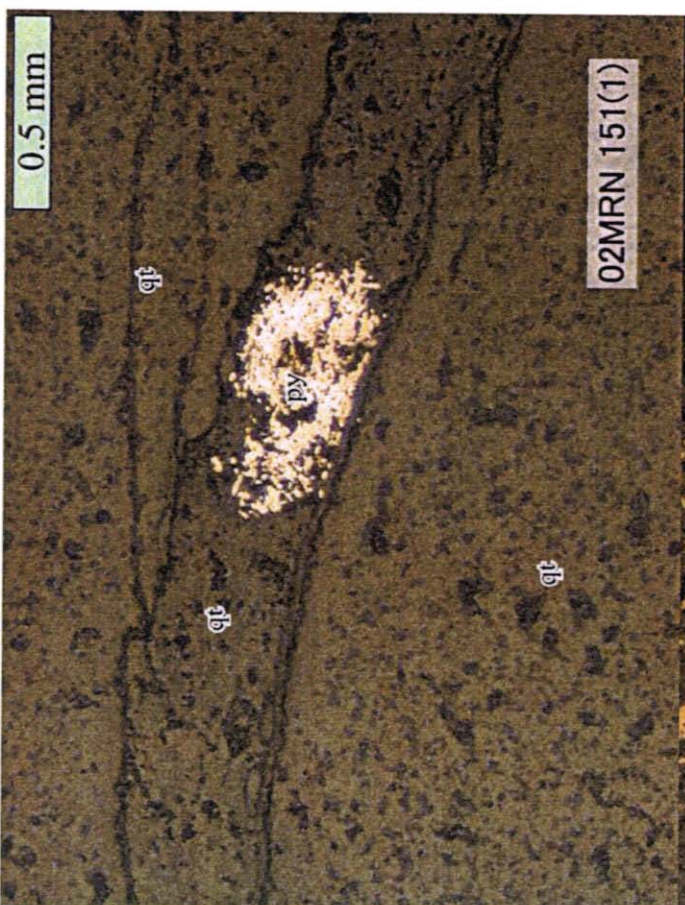
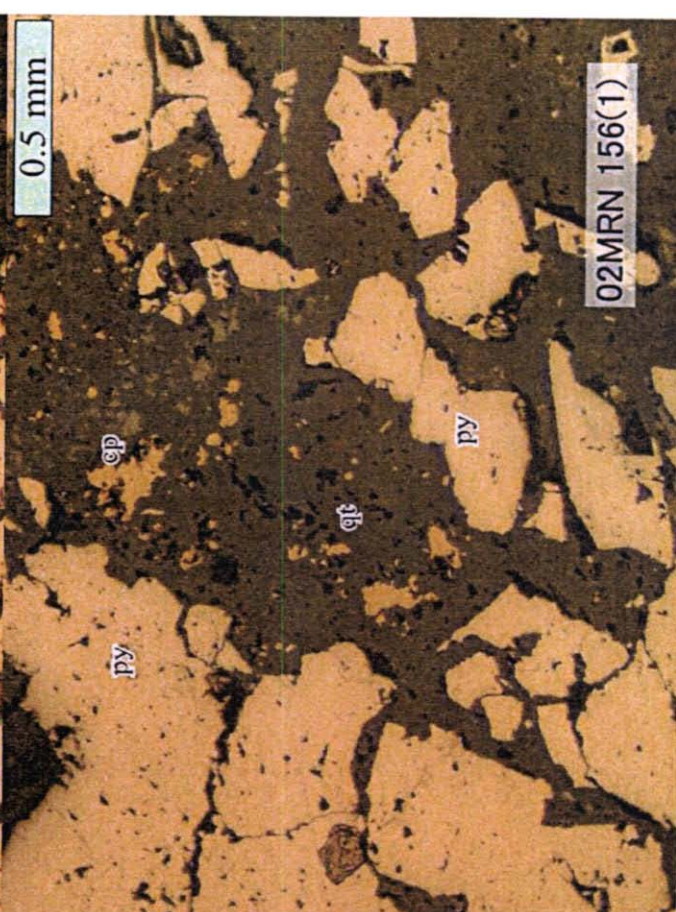
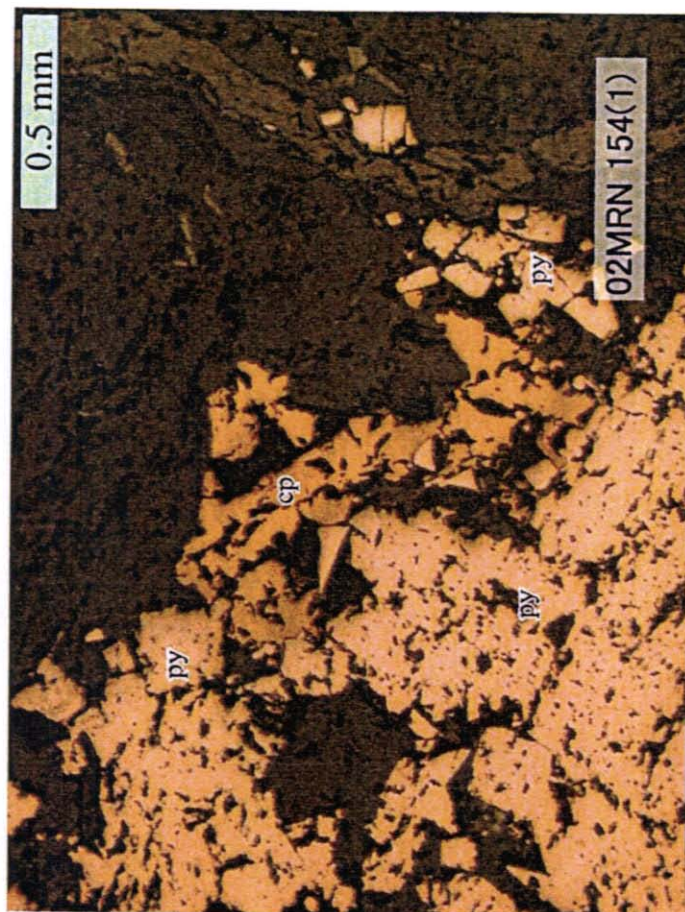


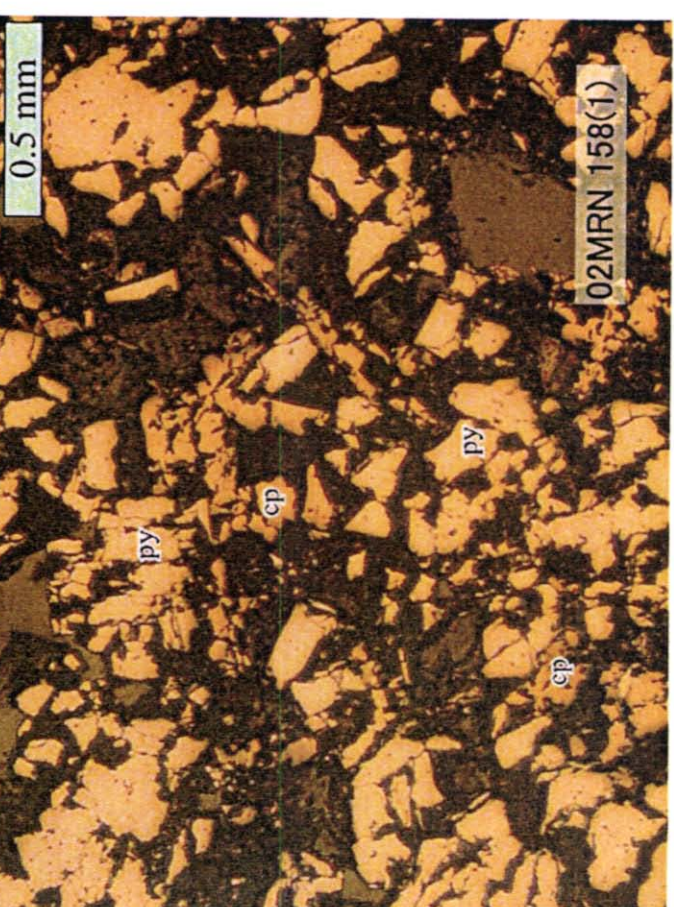
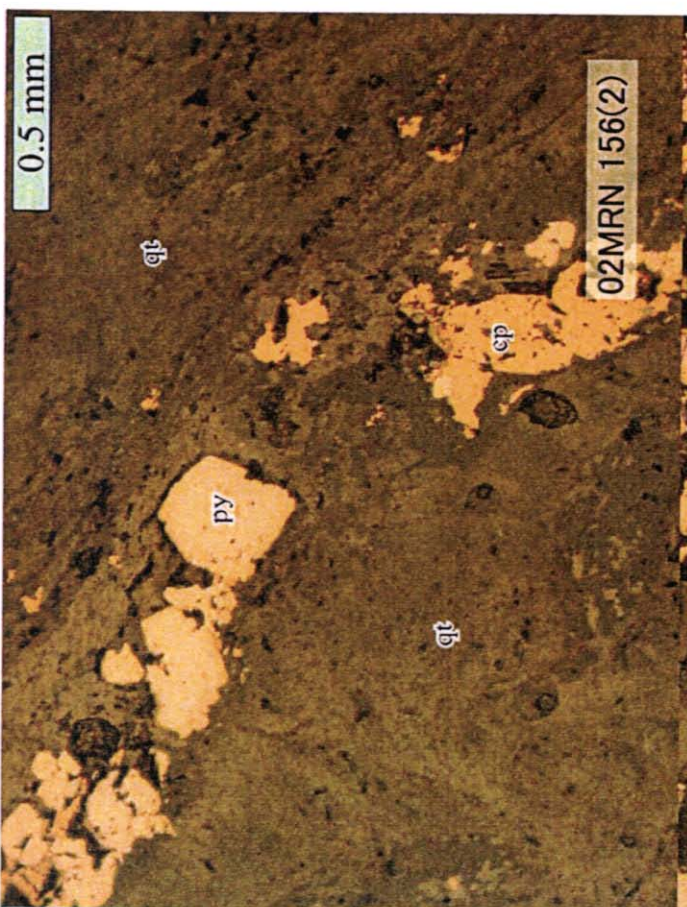
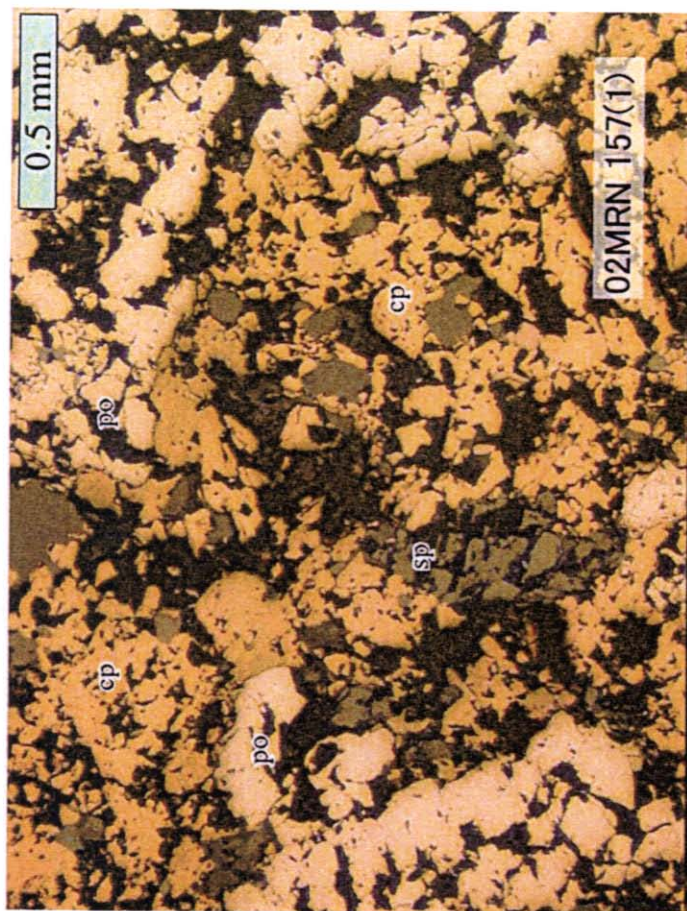
02MRN146(1).jpg

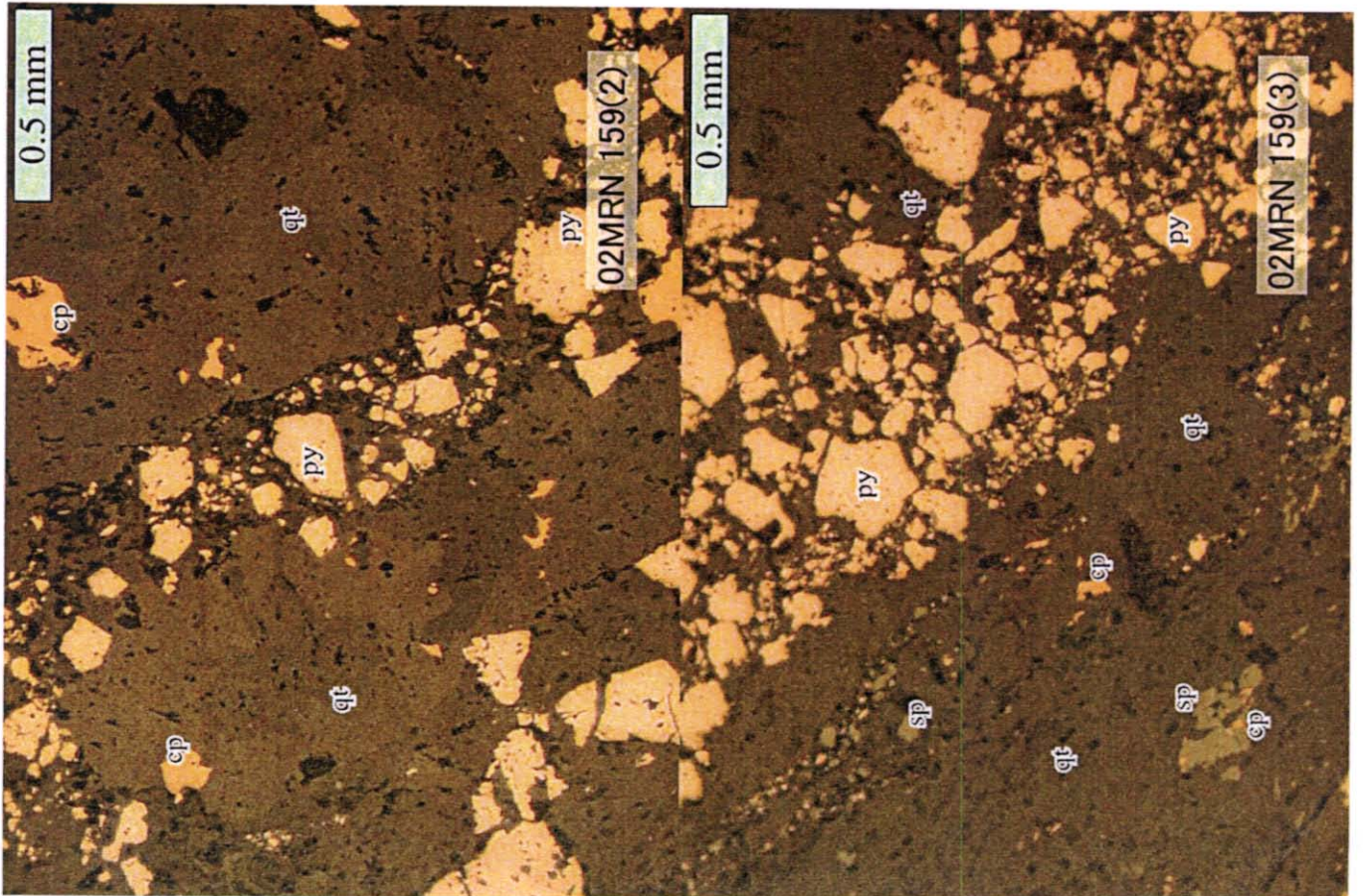
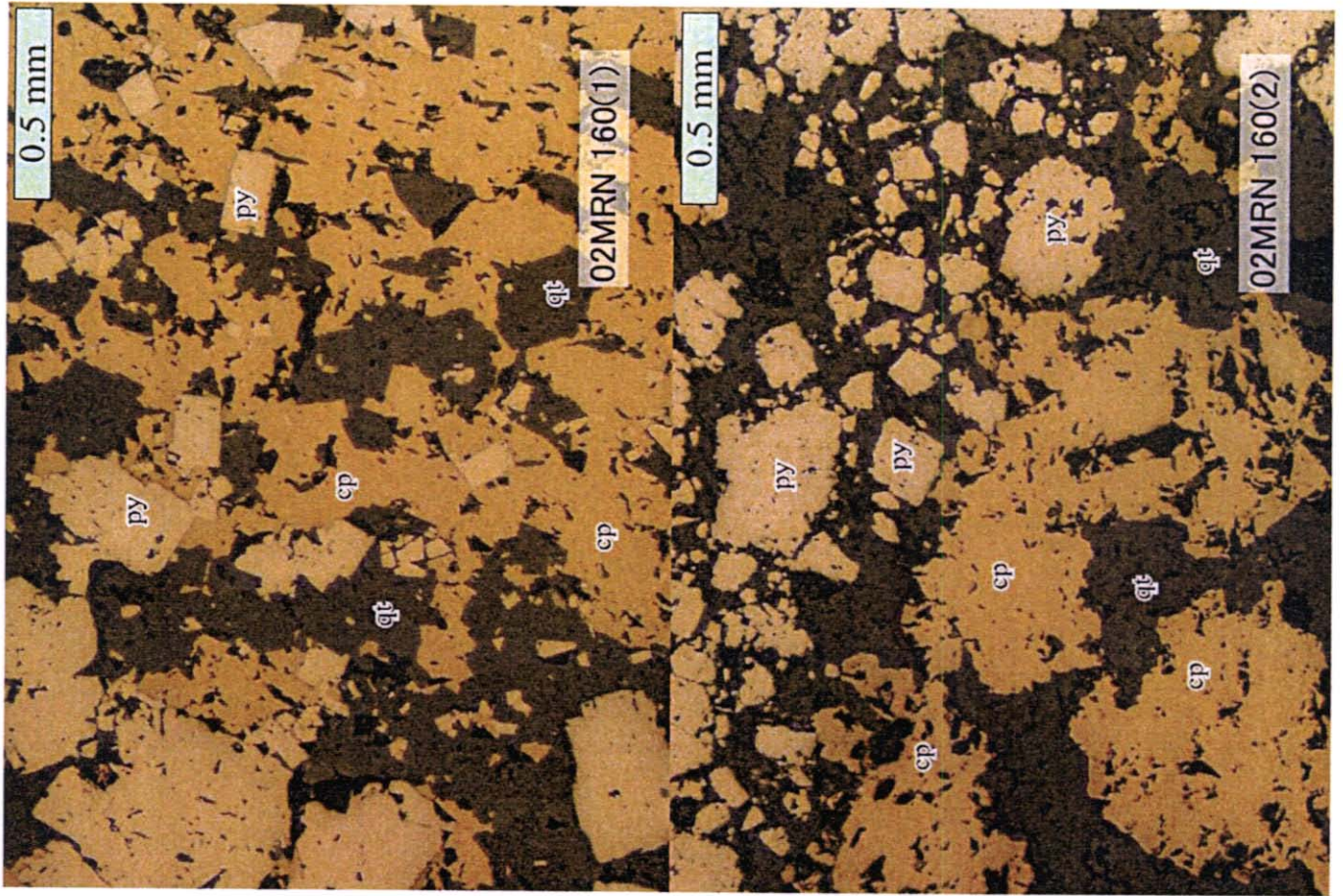




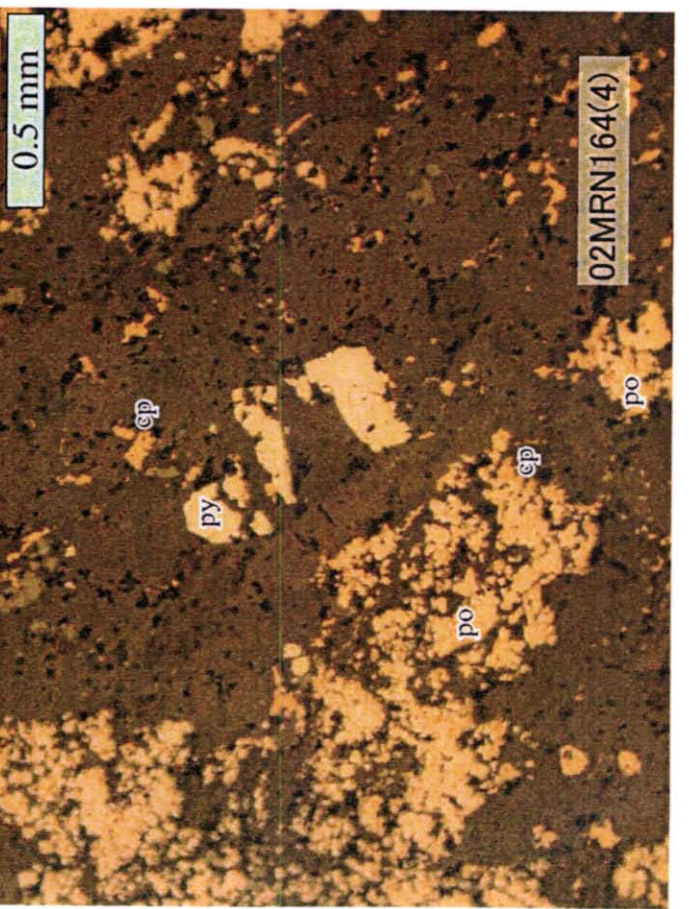
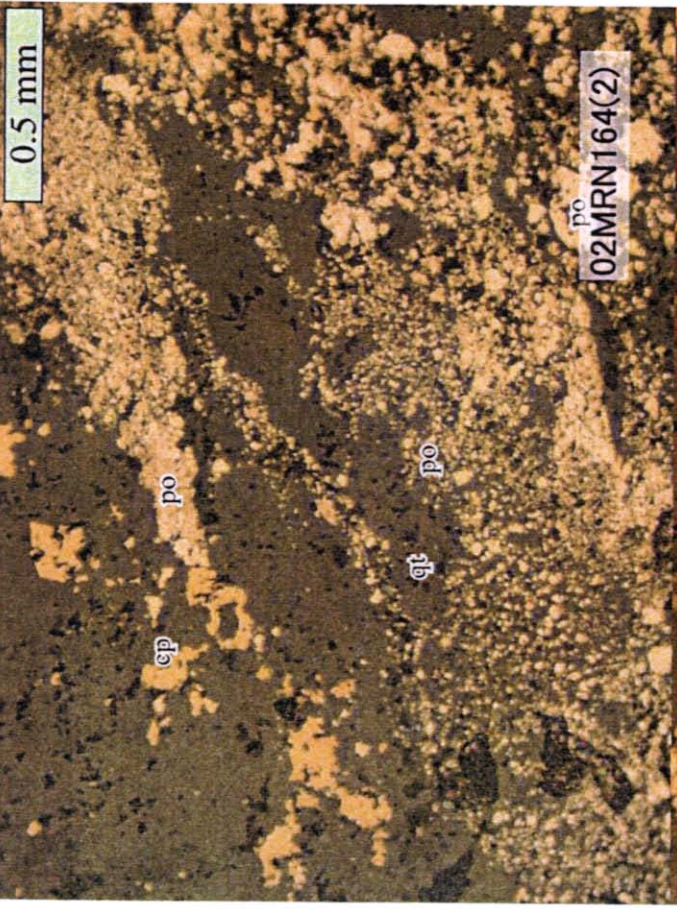
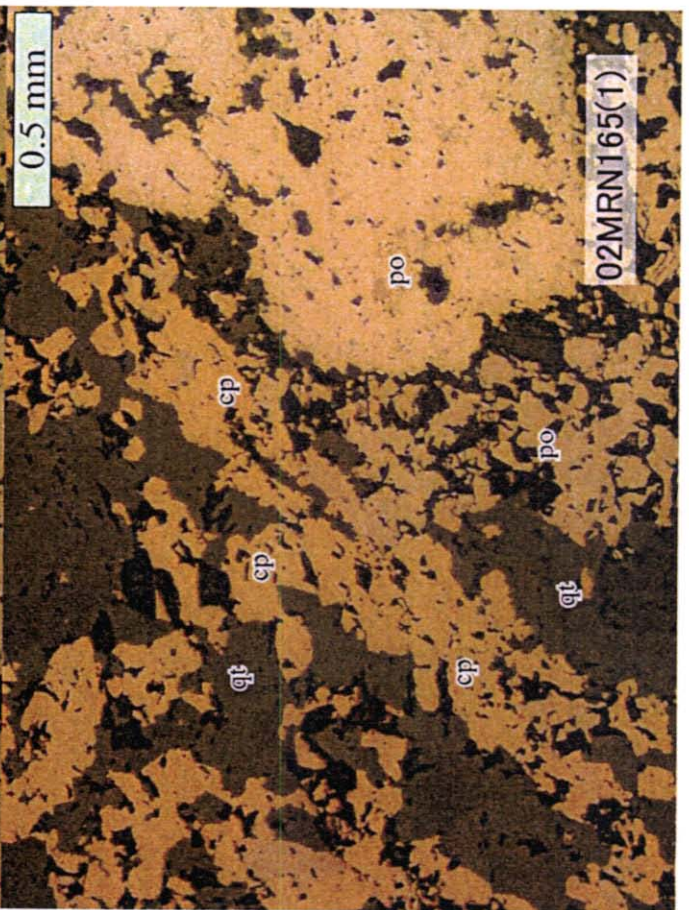
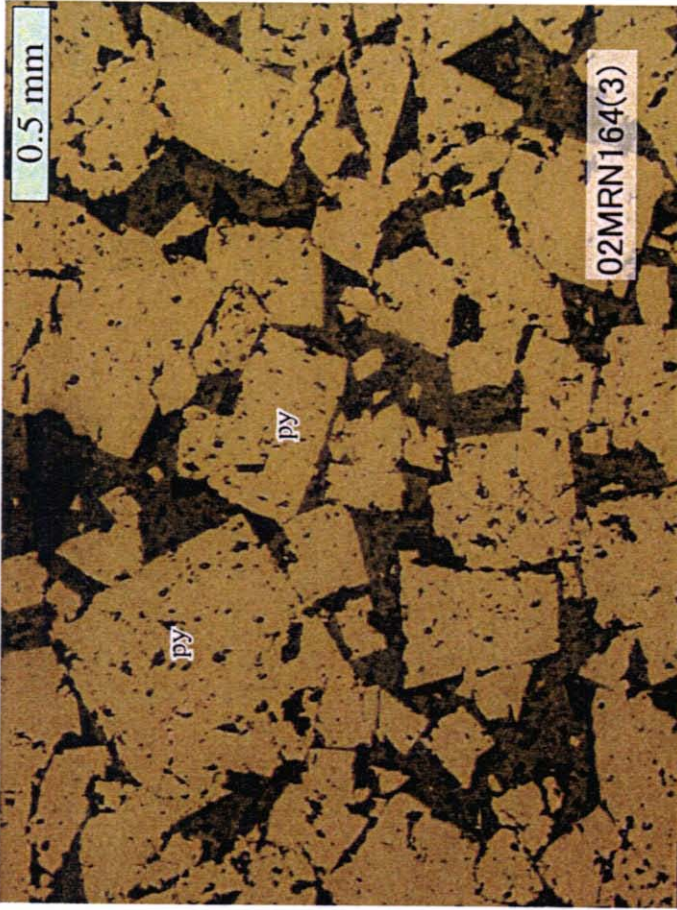


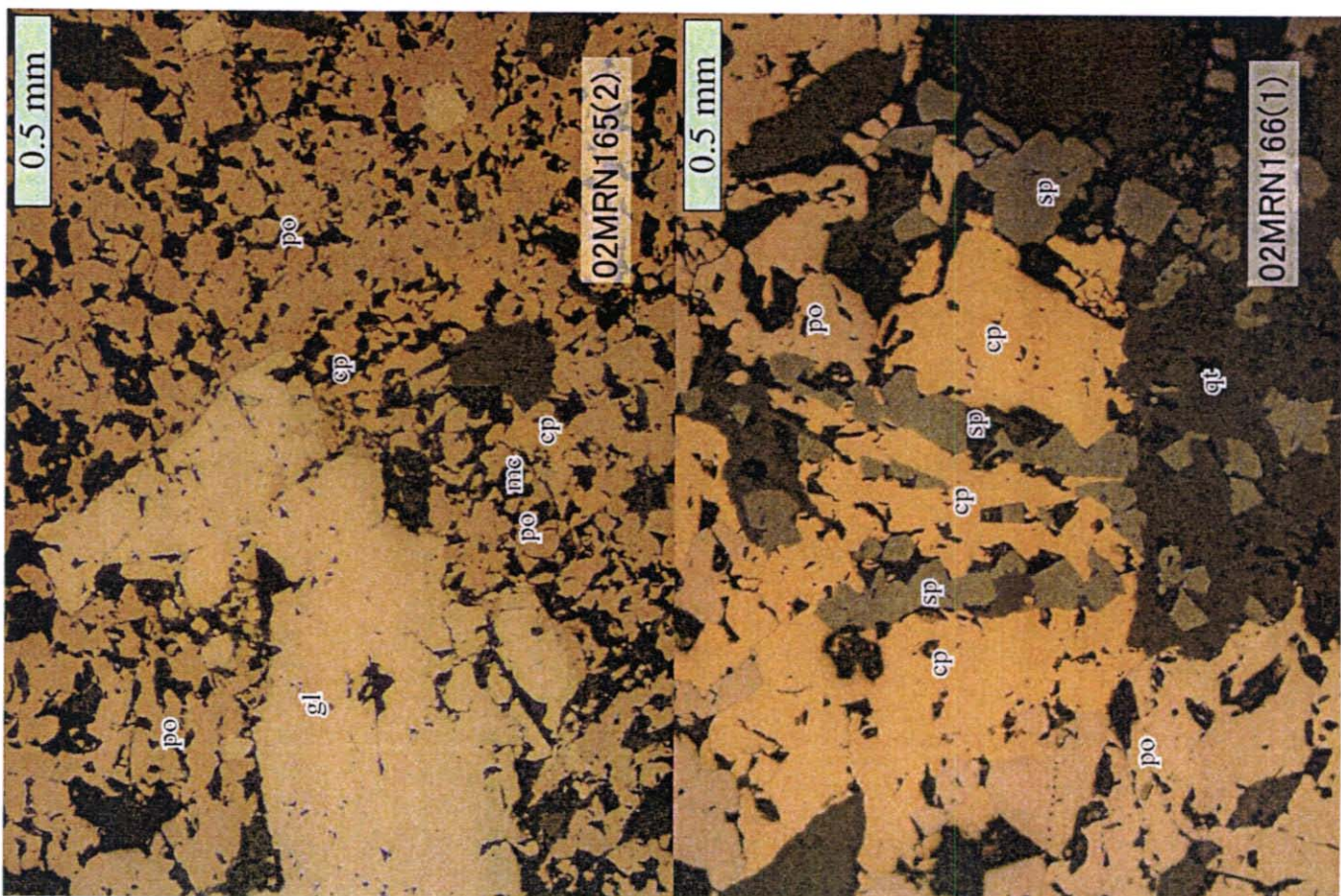
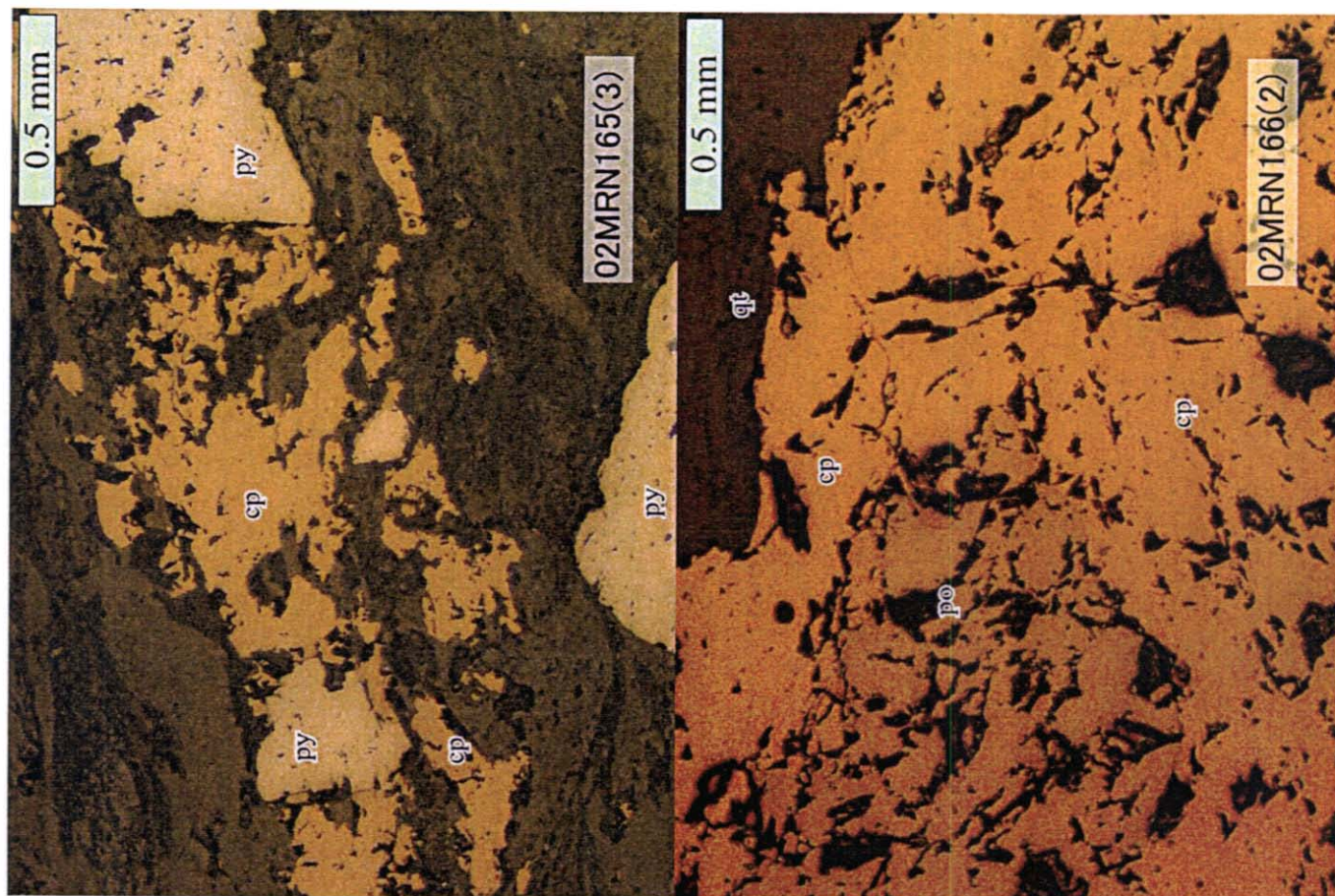


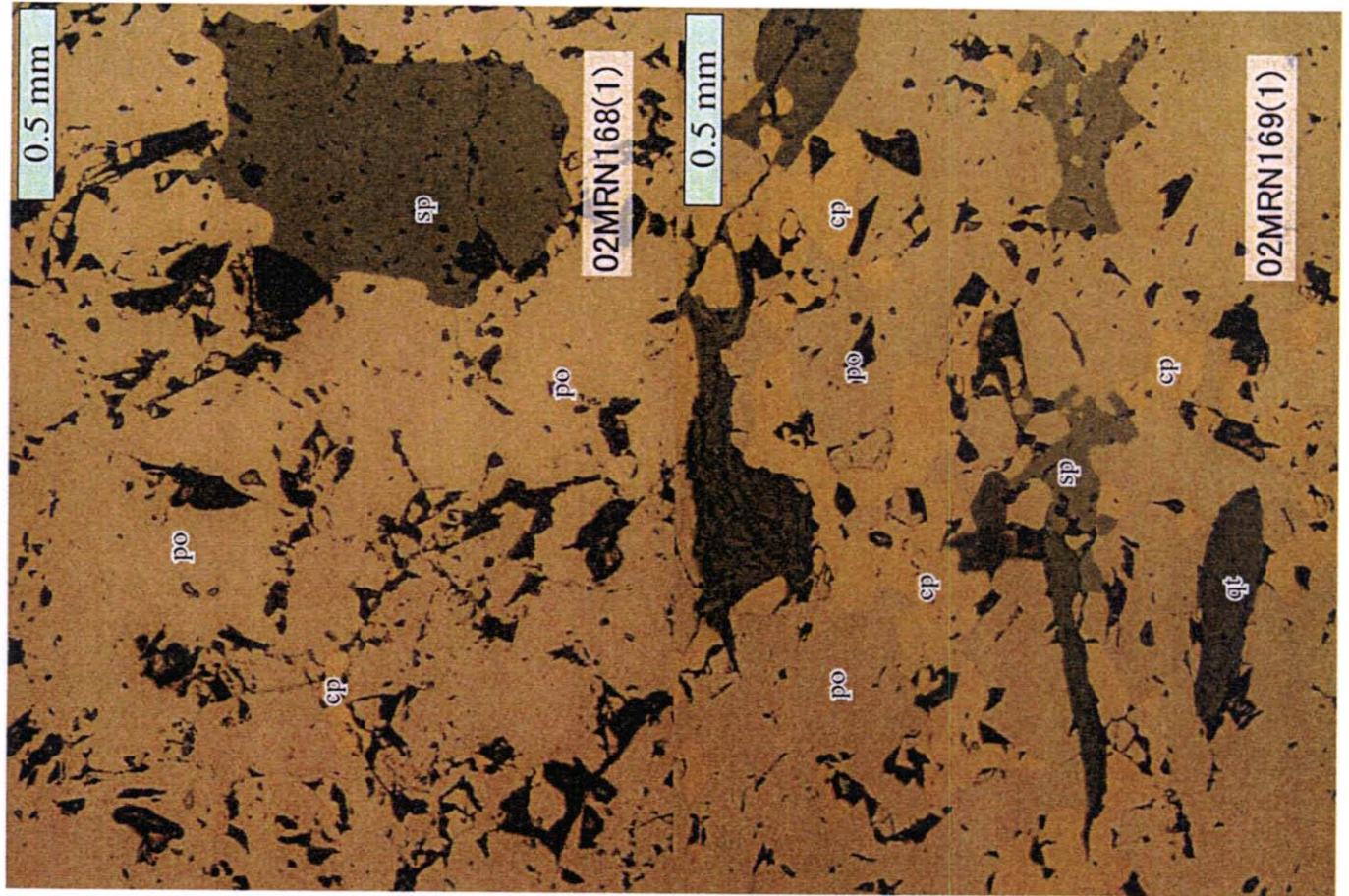


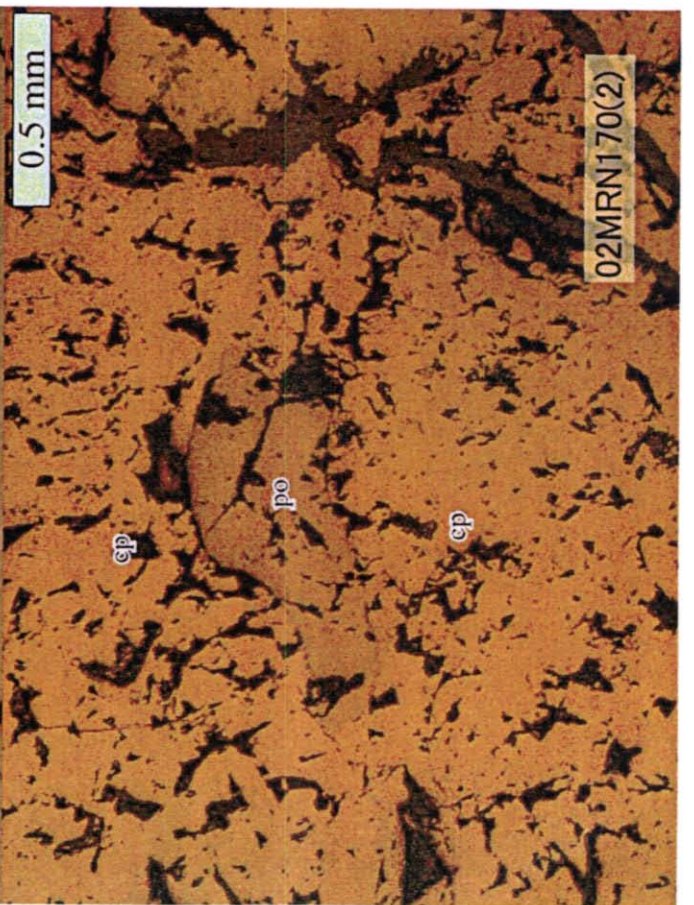
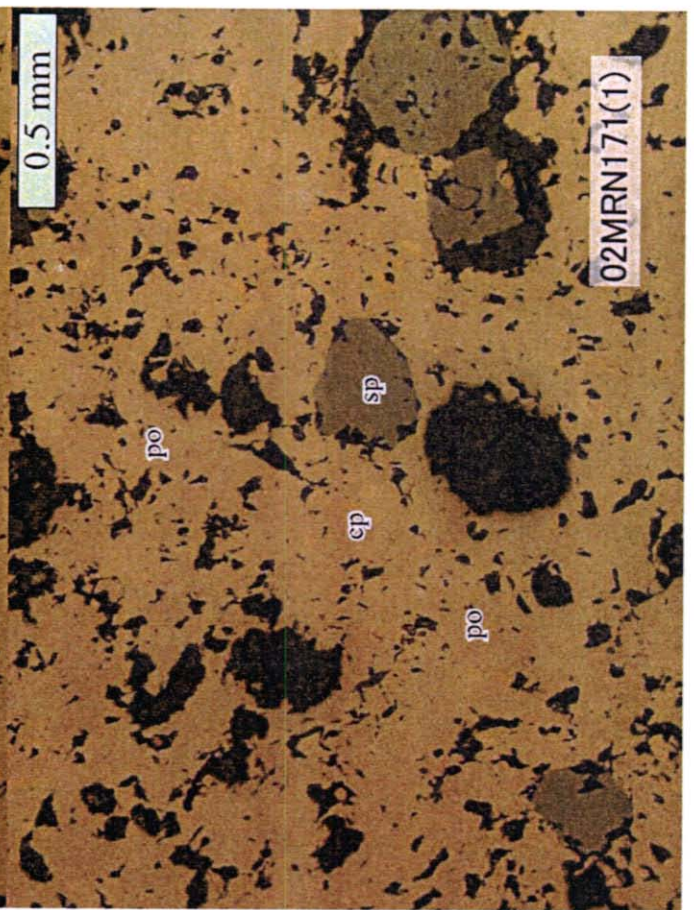
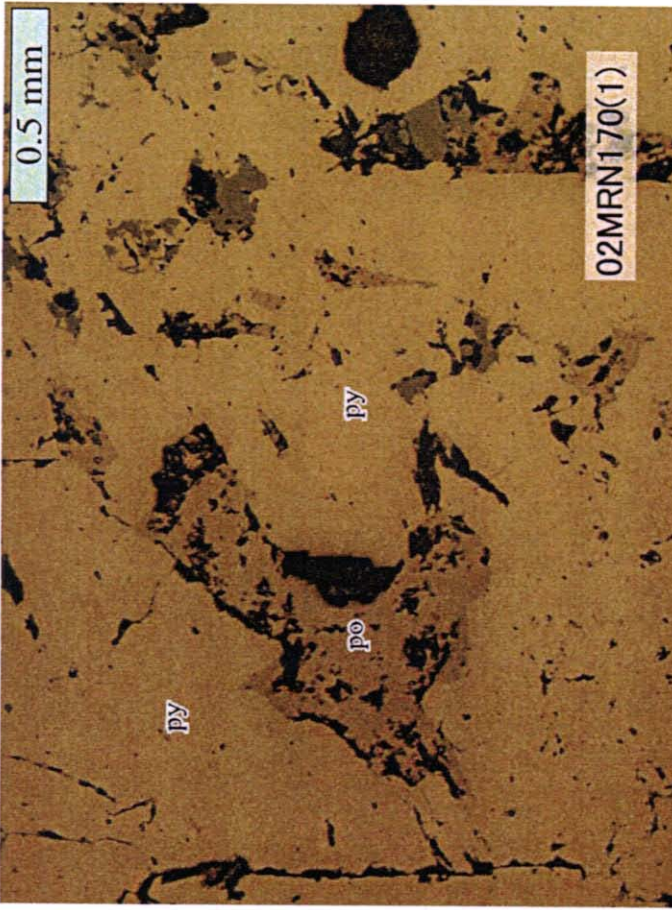




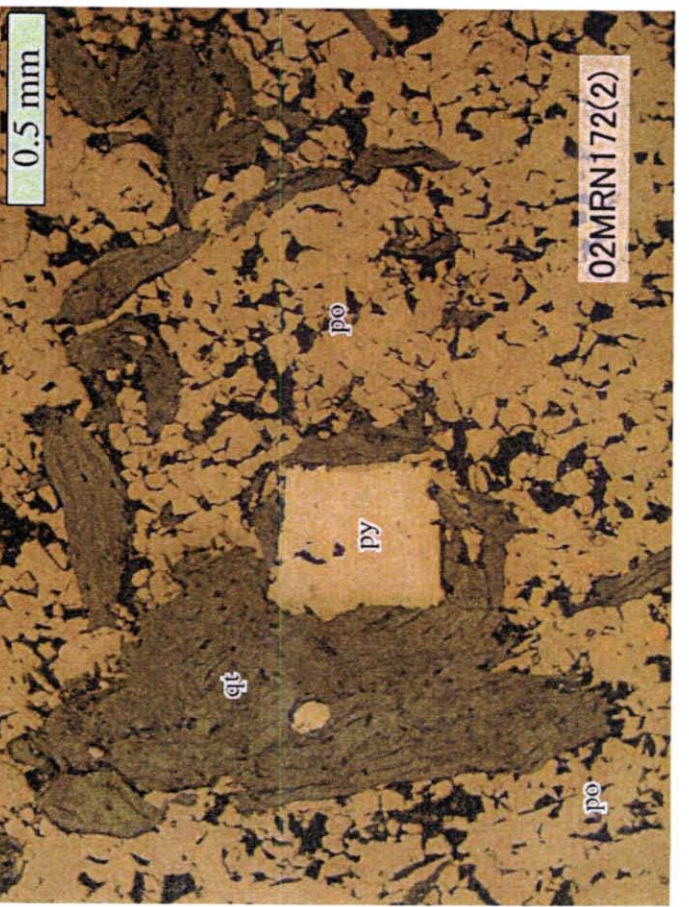
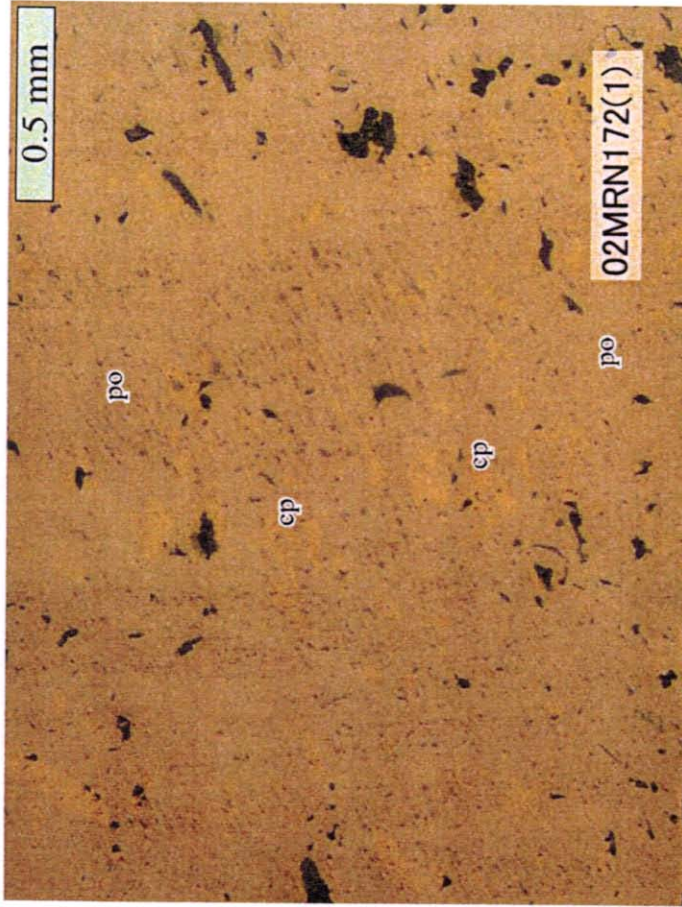


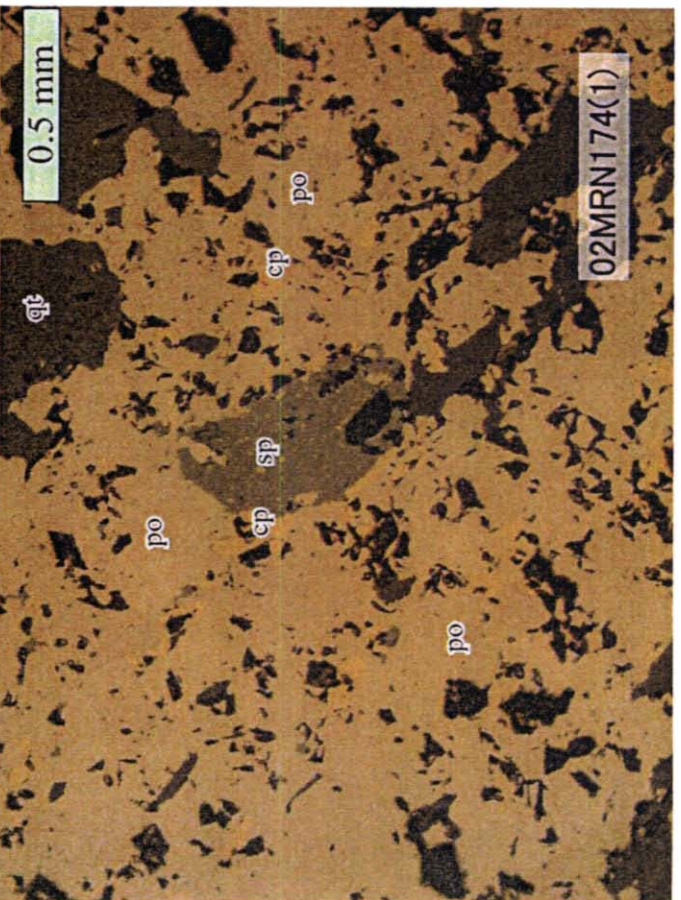
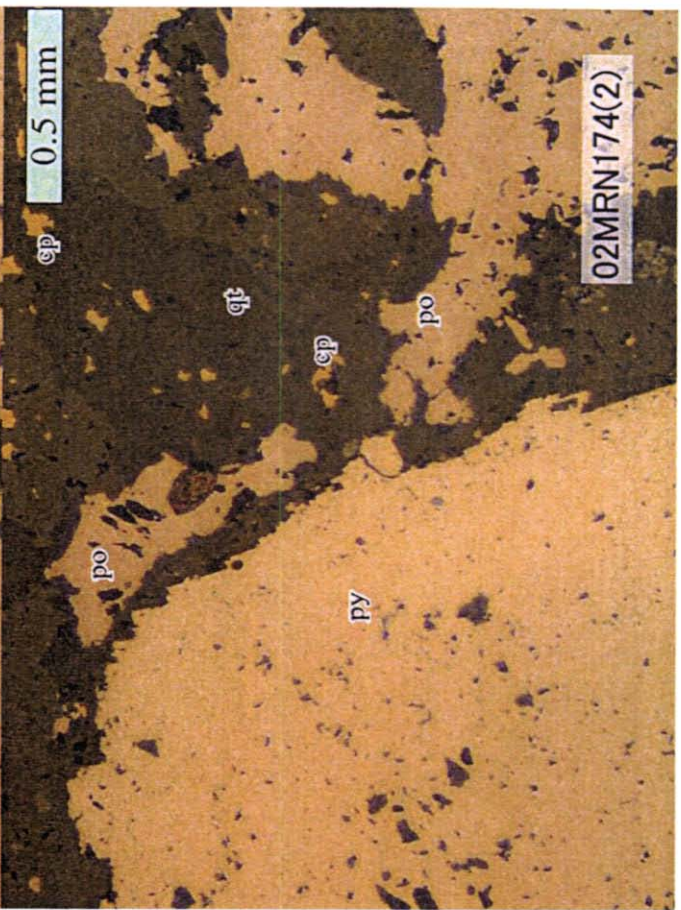
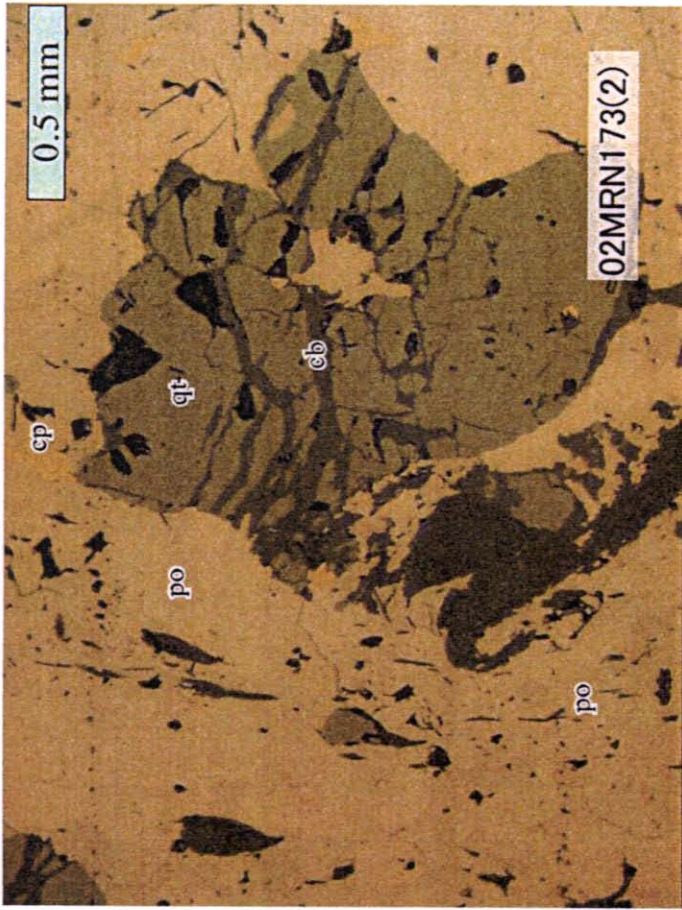


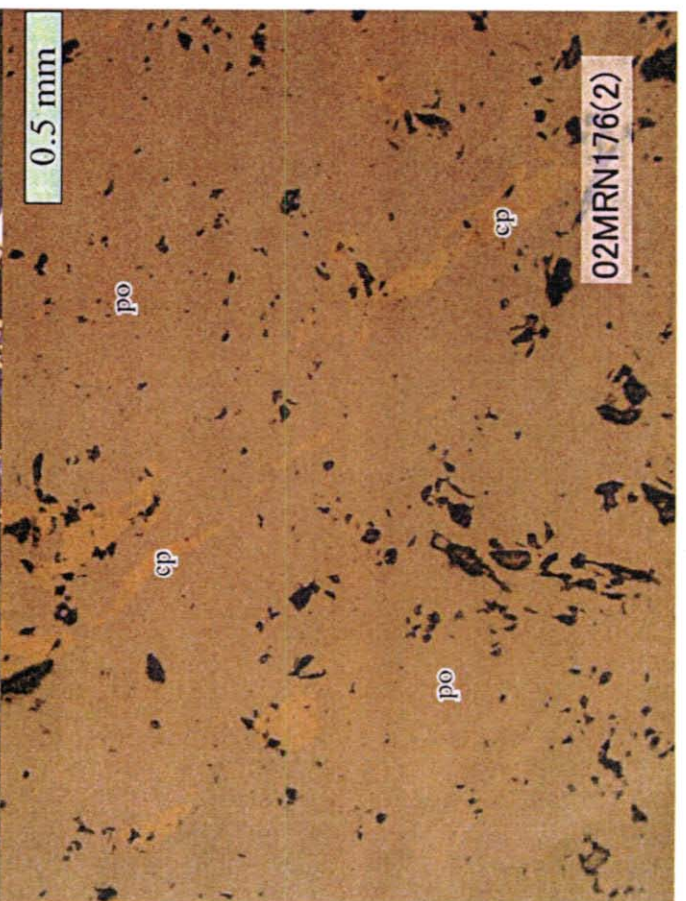
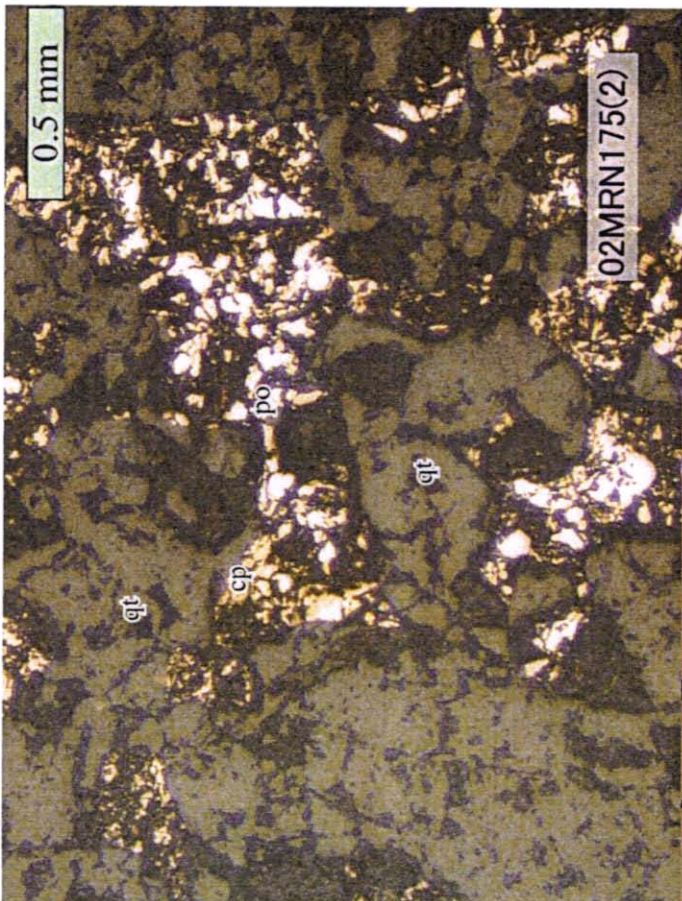
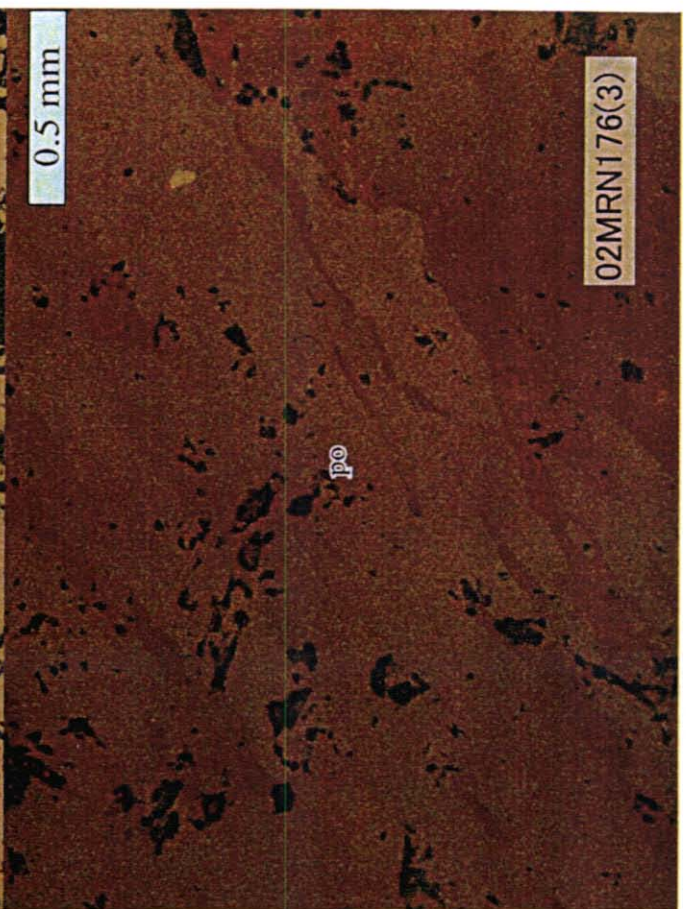
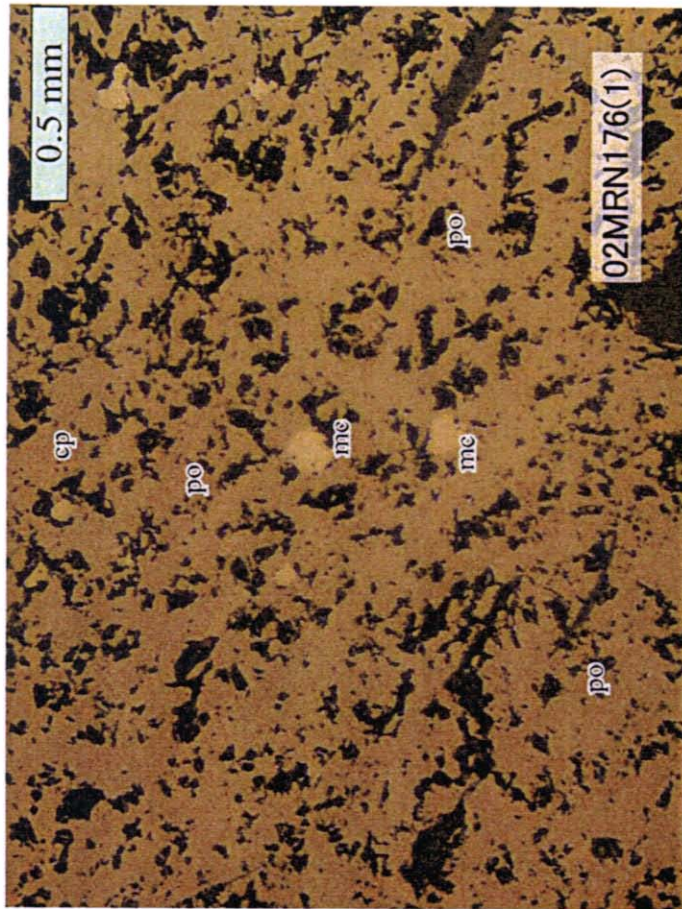


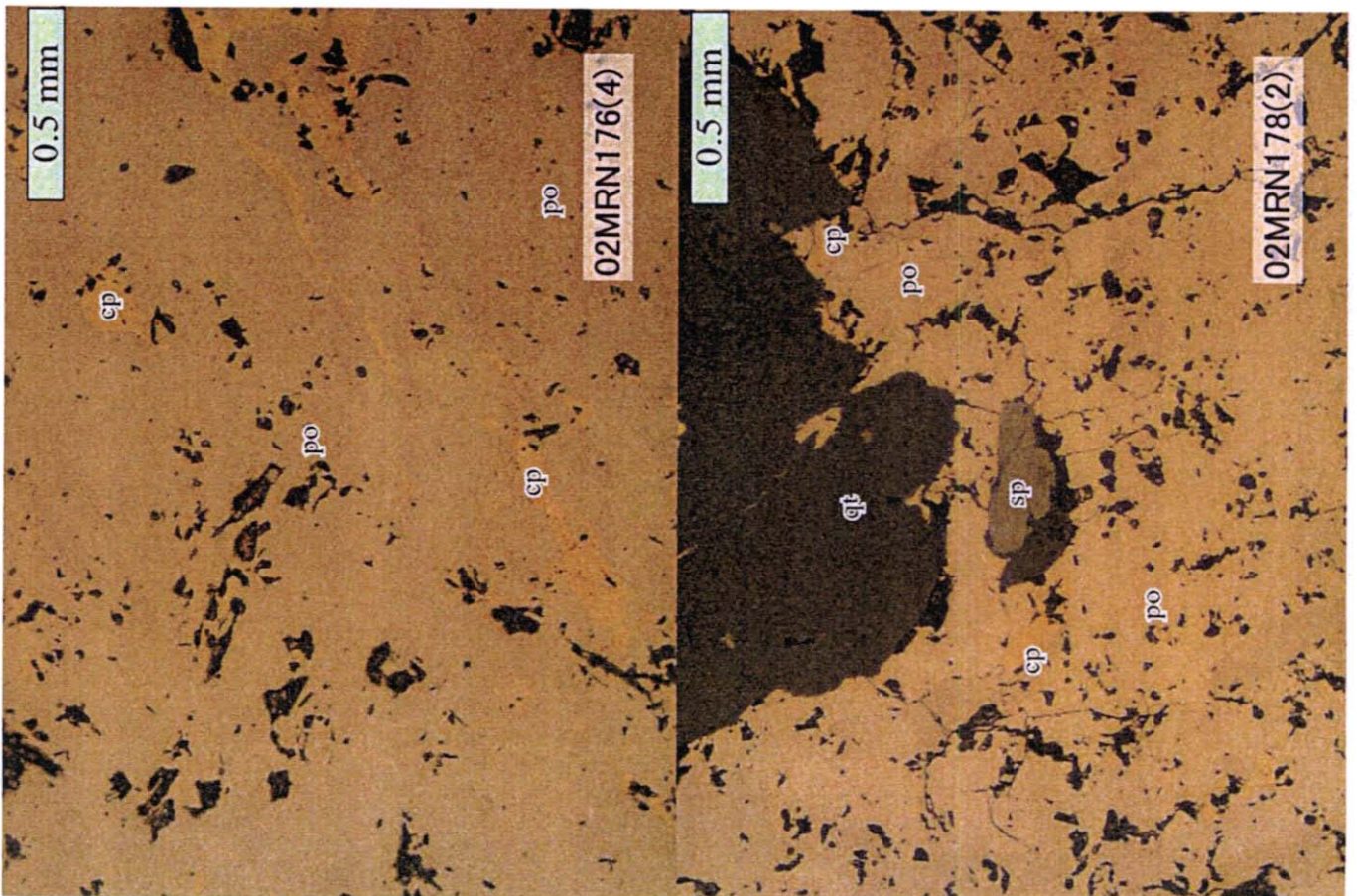
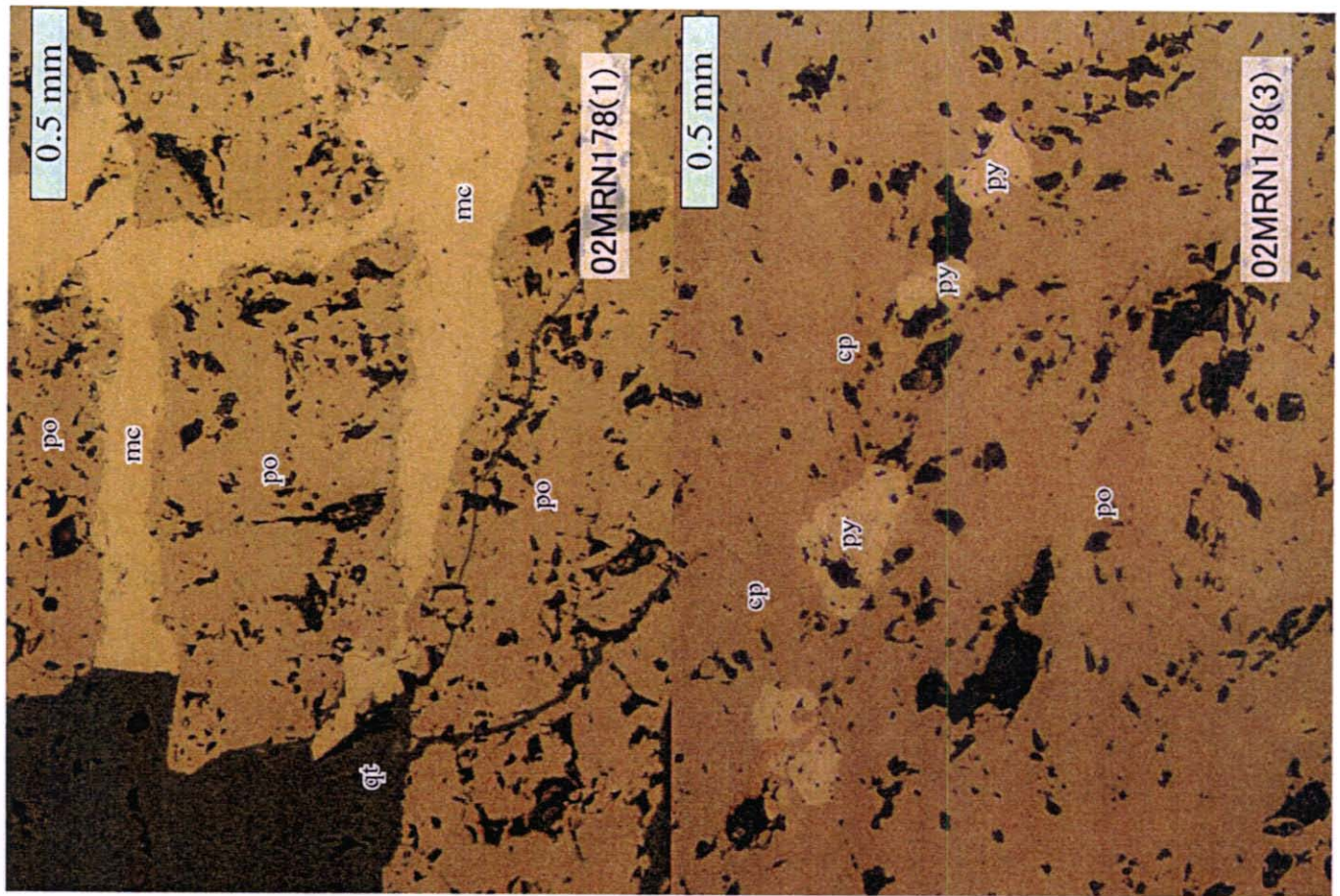




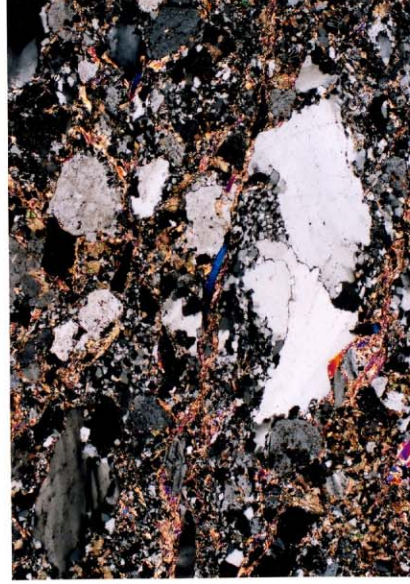








# **Igneous Rocks**



1 mm

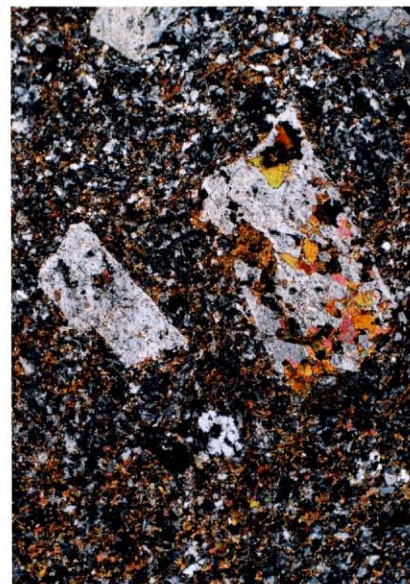
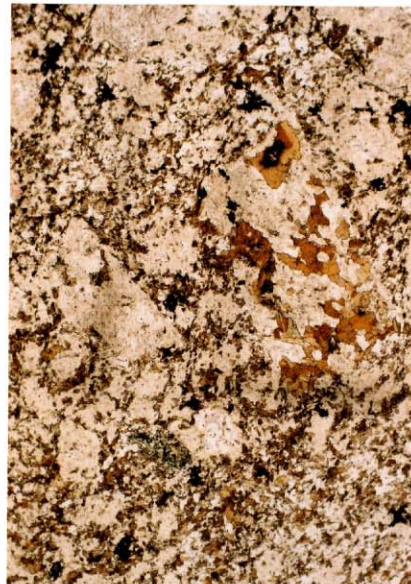
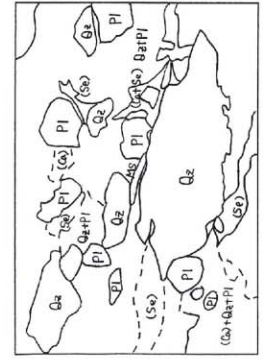
02MRS 002

トータル岩質マイロナイト

Qz : 石英, Pl : 絹雲石, Ms : 絹雲石, Se : 絹雲石

Se : 絹雲石

写真上 単ニコル 写真下 直交ニコル, 倍率 : ×40



1 mm

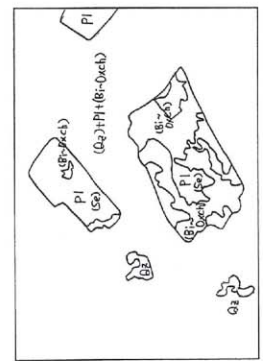
02MRS 001\*

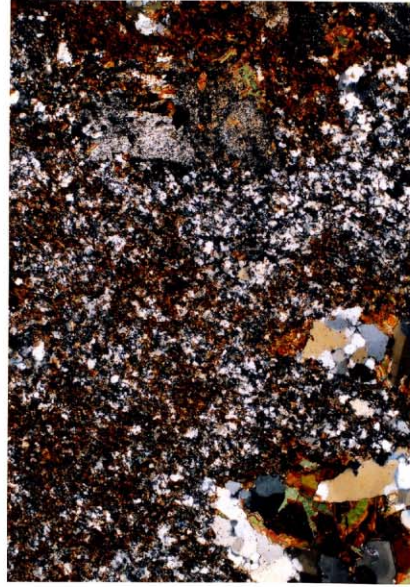
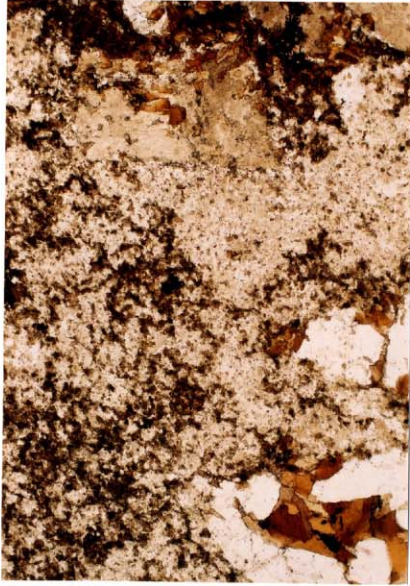
流紋岩

Qz : 石英, Pl : 絹雲石, Bi-Oxch : 黒雲母~

酸化緑泥石, Se : 絹雲石

写真上 単ニコル 写真下 直交ニコル, 倍率 : ×40





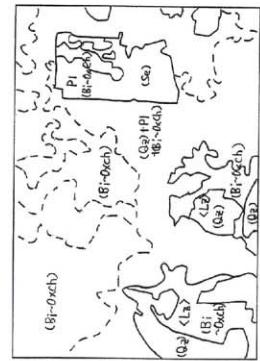
1 mm

02MRS 004\*

流紋岩

Qz: 石英, Pl: 斜長石, Bi-Oxch: 黒雲母-  
 藍化綠泥石, Se: 絹雲母, <Lz>: レンズ

写真上 単ニコル 写真下 直交ニコル, 倍率: ×40



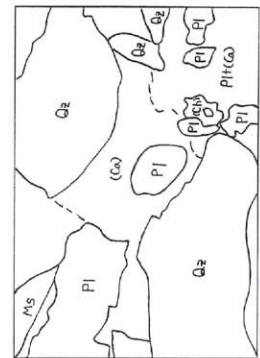
1 mm

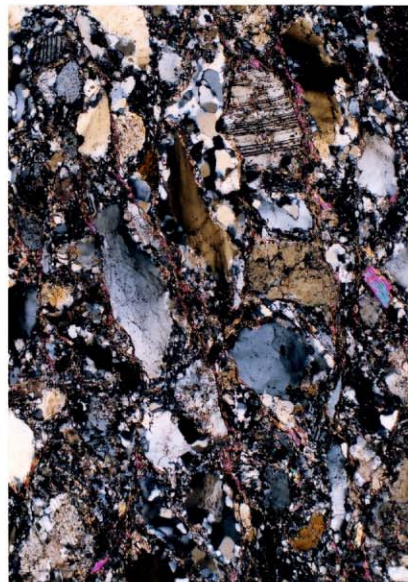
02MRS 003

トーナラル岩質マイロナイト

Qz: 石英, Pl: 斜長石, Ms: 白雲母, Ch: 綠  
 泥石, Ca: 方解石

写真上 単ニコル 写真下 直交ニコル, 倍率: ×40





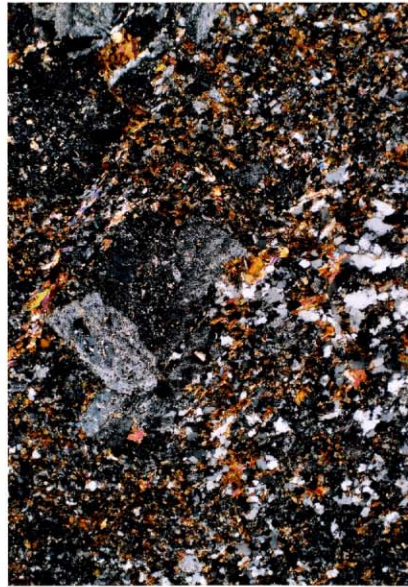
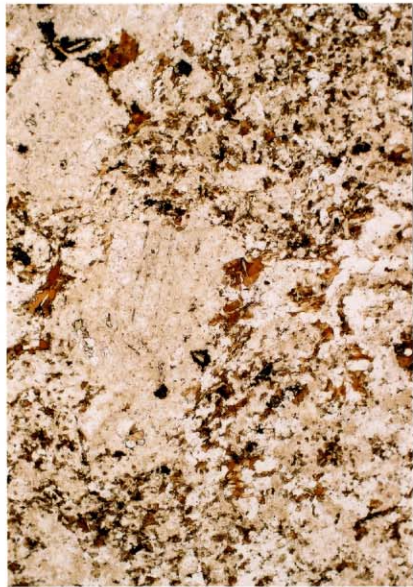
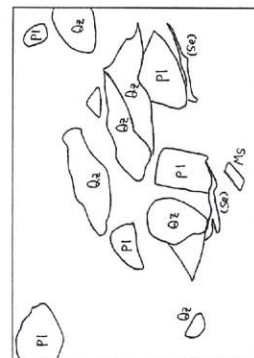
1 mm

02MRS 005\*

トーナル岩質マイロナイト

Qz : 石英, Pl : 斜長石, Ms : 白雲母, Se : 絹雲母

写真上 単ニコル 写真下 直交ニコル, 倍率 : ×40



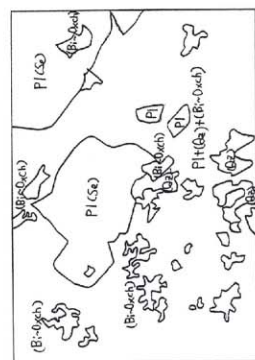
1 mm

02MRS 006

流紋岩

Qz : 石英, Pl : 斜長石, Bi-Oxch : 黒雲母-  
酸化緑泥石, Se : 絹雲母

写真上 単ニコル 写真下 直交ニコル, 倍率 : ×40







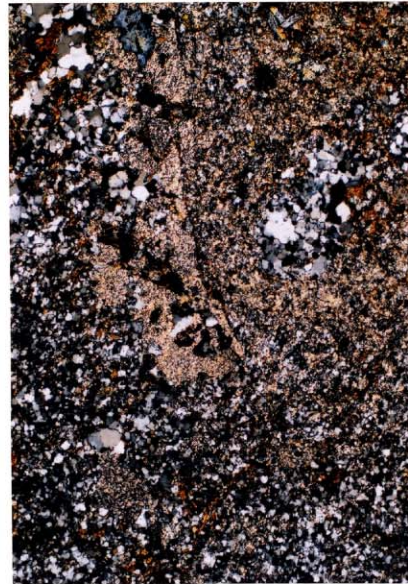
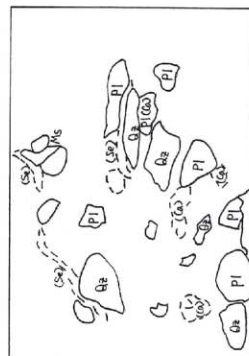
1 mm

02MRS 008

トーナラル岩質マイロナイト

Qz : 石英, Pl : 斜長石, Se : 絹雲母, Ca : 方解石

写真上 単ニコル 写真下 直交ニコル, 倍率 : ×40



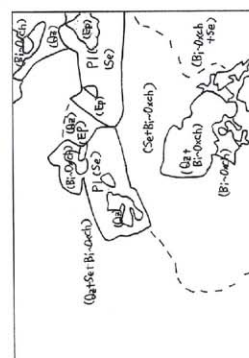
1 mm

02MRS 009\*

流紋岩

Qz : 石英, Pl : 斜長石, Bi-Oxch : 黒雲母-酸化緑泥石, Se : 絹雲母, Ep : 綠泥石

写真上 単ニコル 写真下 直交ニコル, 倍率 : ×40





1 mm

02MRS 0011

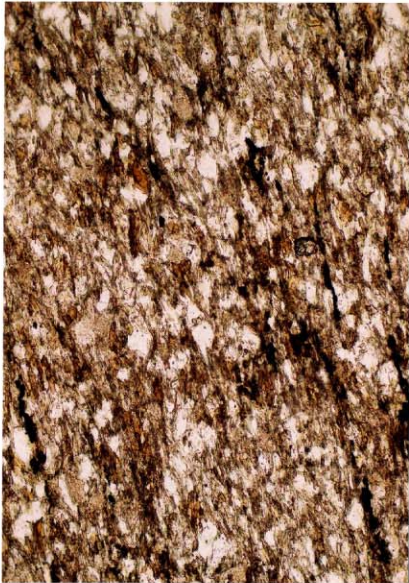
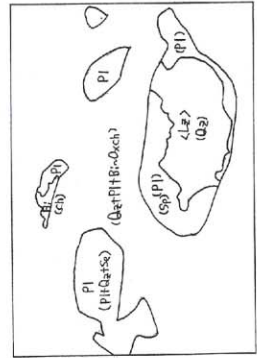
流紋岩質溶結凝灰岩

Qz : 石英, Pl : 斜長石, Bi-Oxch : 黑雲母-

酸化綠泥石, Se : 絹雲母, Sp : 斜長石の球粒組織

<Lz> : レンズ

写真上 単ニコル 写真下 直交ニコル, 倍率 : ×40



0.4 mm

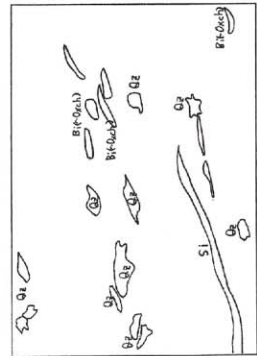
02MRS 0010\*

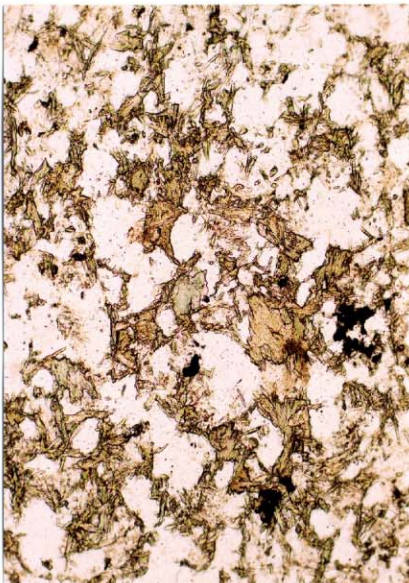
粘板岩

Qz : 石英, Bi-Oxch : 黑雲母-酸化綠泥石

Si : 酸化鉄鉱

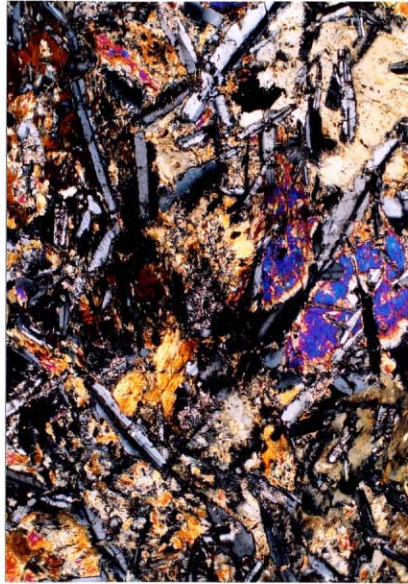
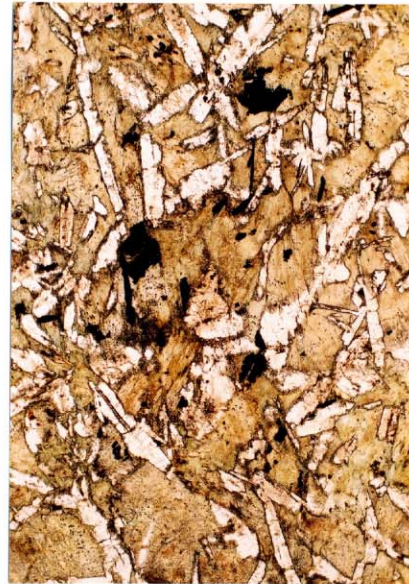
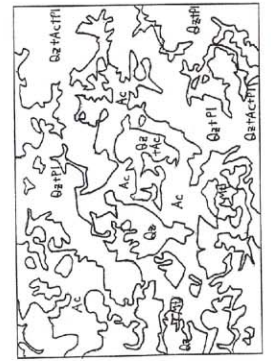
写真上 単ニコル 写真下 直交ニコル, 倍率 : ×103.5





0.4 mm

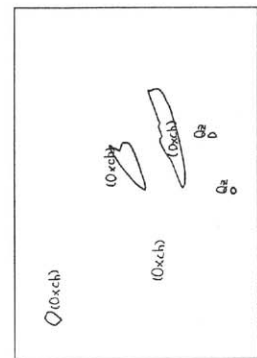
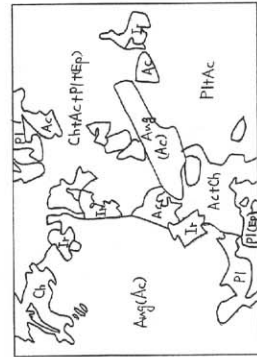
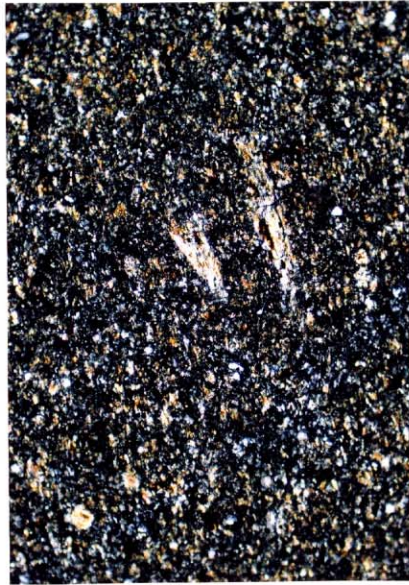
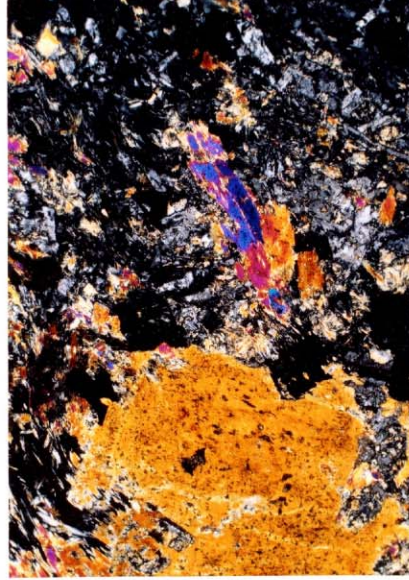
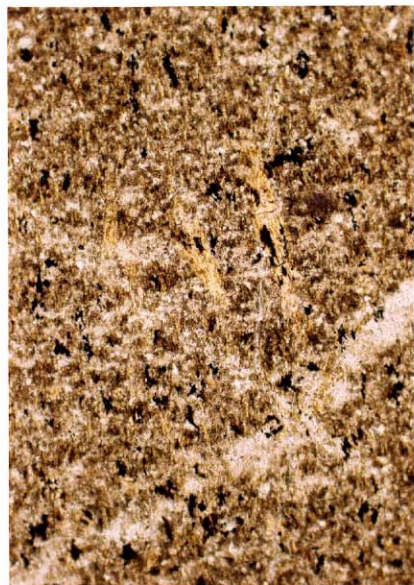
02MRS 0012  
 透輝閃石ホルンブエルス (透輝閃石砂岩ホルンブエルス)  
 Qz: 石英, Pl: 斜長石, Ac: 透輝閃石, Mt:  
 金屬鉱物  
 写真上 単ニコル 写真下 直交ニコル, 倍 率: × 103.5



1 mm

02MRS 0013  
 メタドレライト  
 Pl: 斜長石, Ac: 透輝閃石, Aug: 普通輝石  
 Mt: 金屬鉱物  
 写真上 単ニコル 写真下 直交ニコル, 倍 率: × 40





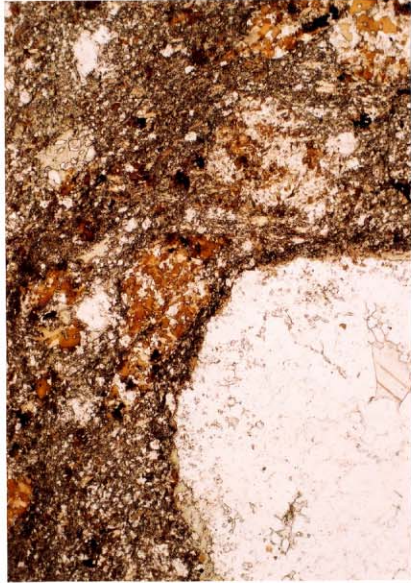
02MRS 0015  
 メタドレライト  
 Pl: 絹長石, Ac: 透輝閃石, Aug: 普通輝石  
 Ch: 綠泥石 Ir: 鉄鈦物, Ep: 綠帘石  
 写真上 単ニコル 写真下 直交ニコル, 倍 率: X 40

02MRS 0014  
 酸化綠泥石岩 (ホルンフェルス)  
 Qz: 石英, Oxch: 酸化綠泥石  
 写真上 単ニコル 写真下 直交ニコル, 倍 率: X 103.5



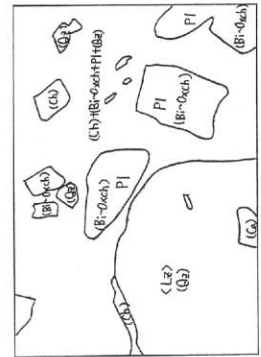
1 mm

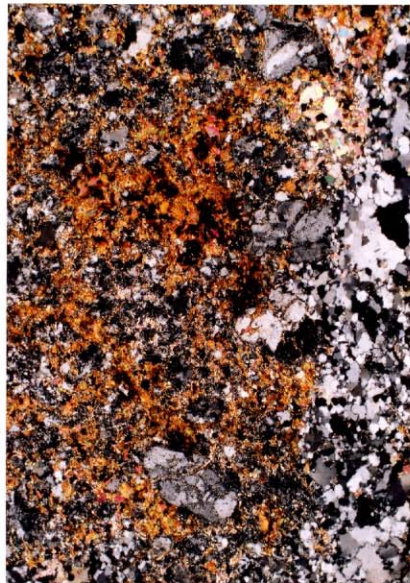
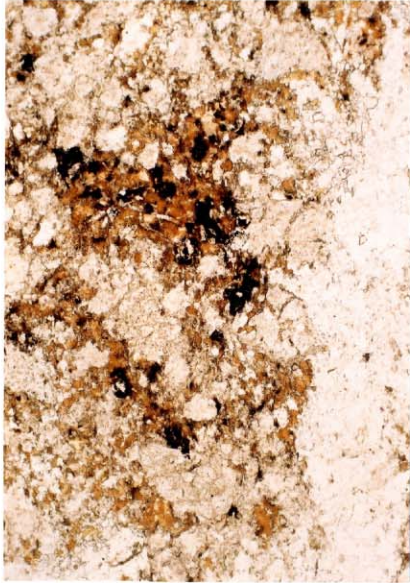
02MRS 0016  
メタドレライト  
Pl : 斜長石, Δc : 透緑閃石, Aug : 普通輝石  
写真上 単ニコル 写真下 直交ニコル, 倍 率 : ×40



1 mm

02MRS 0017  
流紋岩  
Qz : 石英, Pl : 斜長石, Bi-Oxch : 黒雲母-  
酸化緑泥石, Ch : 緑泥石, Ca : 方解石, <Lz> :  
レンズ  
写真上 単ニコル 写真下 直交ニコル, 倍 率 : ×40





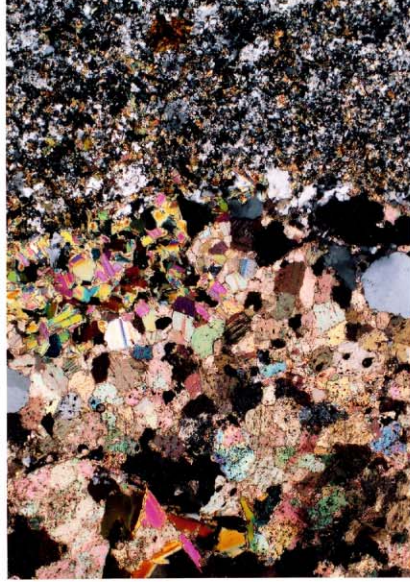
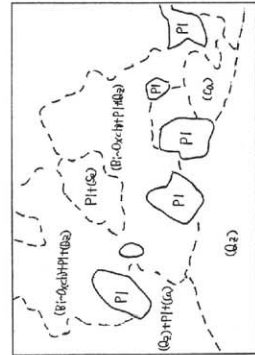
1 mm

02MRS 0018

流紋岩

Qz: 石英, Pl: 斜長石, Bi-Oxch: 黑雲母-  
酸化綠泥石, Se: 絹雲母, Ca: 方解石

写真上 単ニコル 写真下 直交ニコル, 倍率: ×40



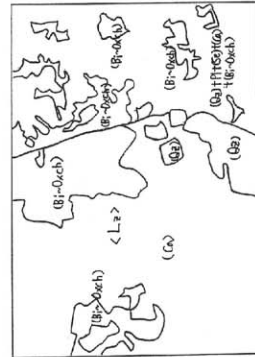
1 mm

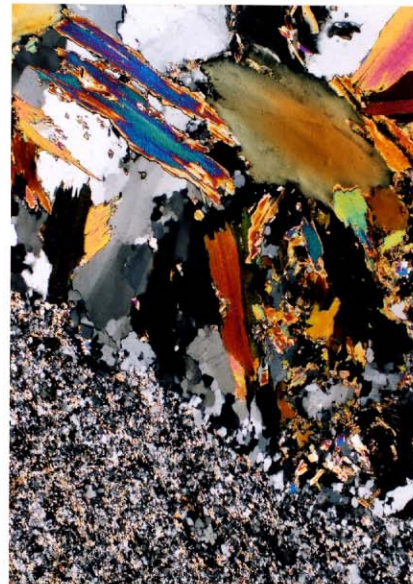
02MRS 0021

流紋岩

Qz: 石英, Pl: 斜長石, Bi-Oxch: 黑雲母-  
酸化綠泥石, Se: 絹雲母, Ca: 方解石, <Lz>: レ  
ンズ

写真上 単ニコル 写真下 直交ニコル, 倍率: ×40

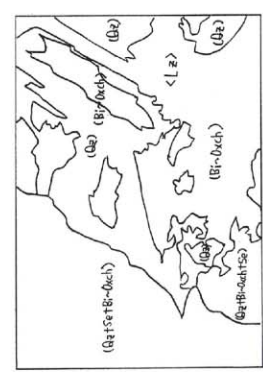




1 mm

02MRS 0023  
流紋岩

Qz:石英, Pl:斜長石, Bi-Oxch:黑雲母-  
酸化綠泥石, Se:絹雲母, <Lz>:レンズ  
写真上 単ニコル 写真下 直交ニコル, 倍率:×40

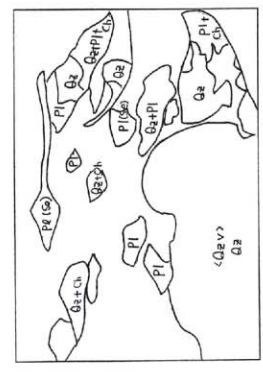


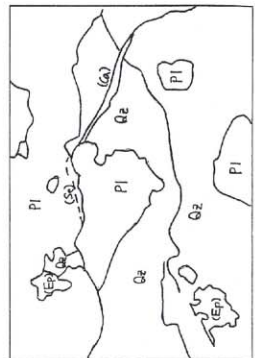
1 mm

02MRS 0029

流紋岩質溶結凝灰岩マイロナイト

Qz:石英, Pl:斜長石, Bi-Oxch:黒雲母-  
酸化綠泥石, Se:絹雲母, Ch:綠泥石, <Qzv>:  
石英脈  
写真上 単ニコル 写真下 直交ニコル, 倍率:×40

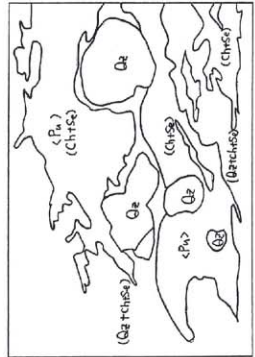
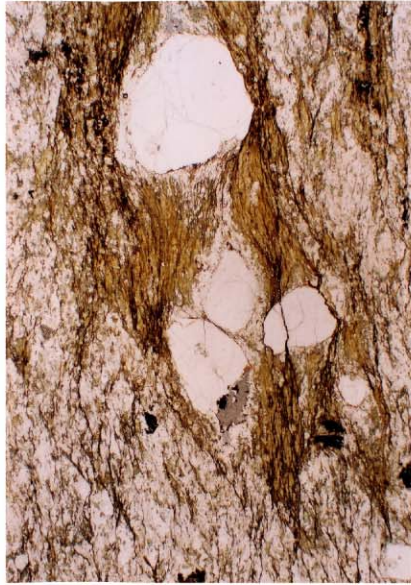




02MRS 0030

流紋岩質溶結凝灰岩マイロナイト

Qz : 石英, Pl : 斜長石, Se : 絹雲母, Ch : 綠  
 泥石, Ep : 綠帘石, Ca : 方解石, <Qzv> : 石英脈  
 写真上 単ニコル 写真下 直交ニコル, 倍 率 : ×40

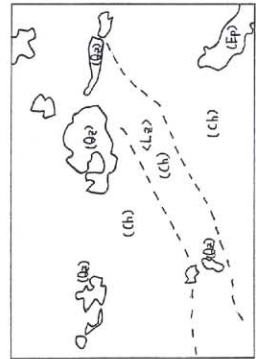
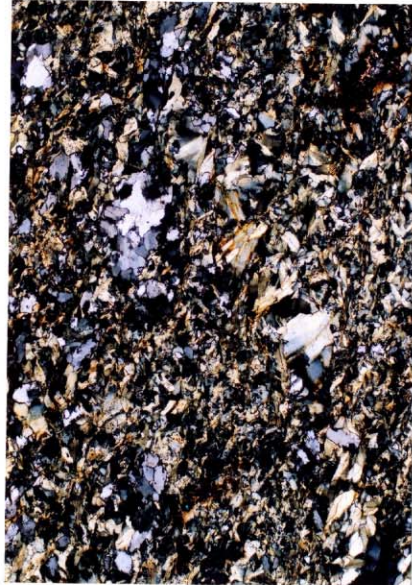
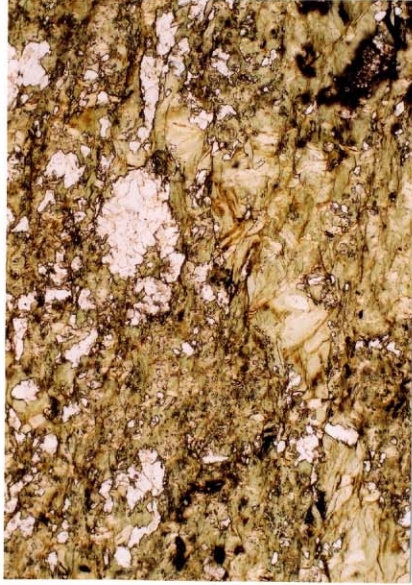


02MRS 0031

流紋岩質溶結凝灰岩

Qz : 石英, Se : 絹雲母, Ch : 綠泥石, <Pu> :  
 堇 石  
 写真上 単ニコル 写真下 直交ニコル, 倍 率 : ×20





02MRS 0033

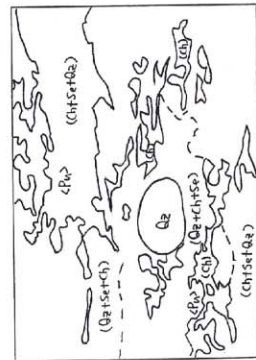
緑泥石岩 (凝灰岩)

Qz:石英, Se:絹雲母, Ch:緑泥石, Ep:緑

簾石, <Ls>:レンズ

写真上 単ニコル 写真下 直交ニコル, 倍率: X 103.5

1 mm



02MRS 0032

流紋岩質溶結凝灰岩

Qz:石英, Se:絹雲母, Ch:緑泥石, <Pu>:

軽石

写真上 単ニコル 写真下 直交ニコル, 倍率: X 2.0

2 mm



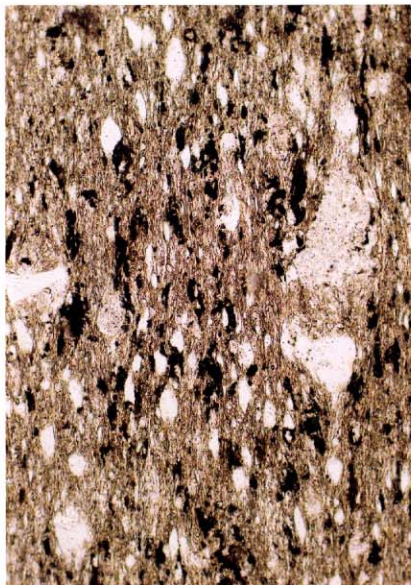
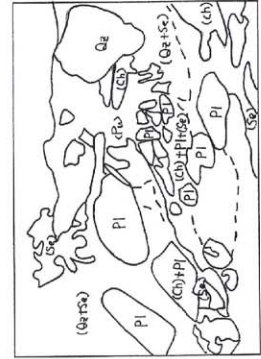
1 mm

02MRS 0036

流紋岩質粘結輝斑岩

Qz : 石英, Pl : 斜長石, Se : 絹雲母, Ch : 綠  
泥石, <Plu> : 藍石

写真上 単ニコル 写真下 直交ニコル, 倍率 : ×40



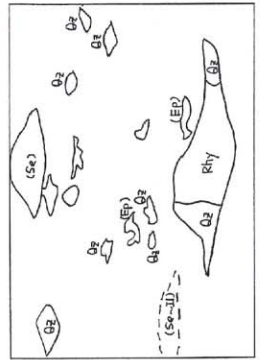
0.4 mm

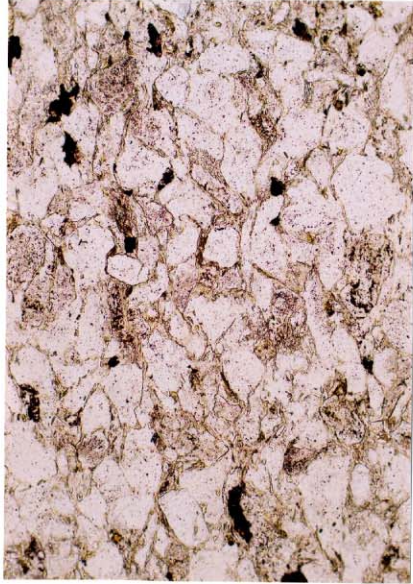
02MRS 0034

凝灰質粘板岩

Qz : 石英, Se-Il : 絹雲母-イライト, Ep : 綠  
簾石, Rhy : 流紋岩

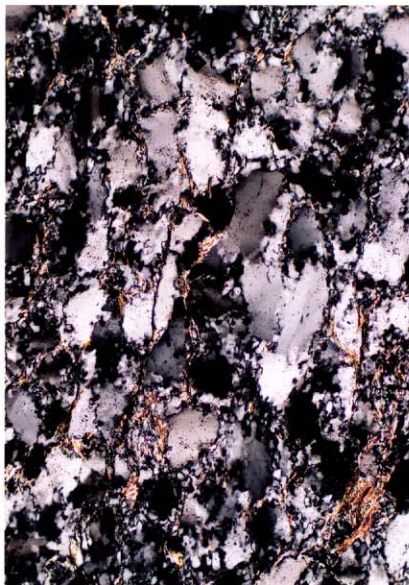
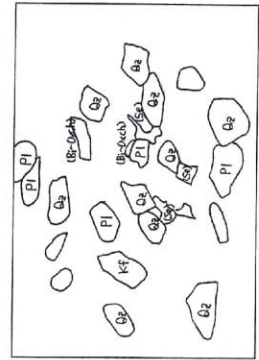
写真上 単ニコル 写真下 直交ニコル, 倍率 : ×103.5





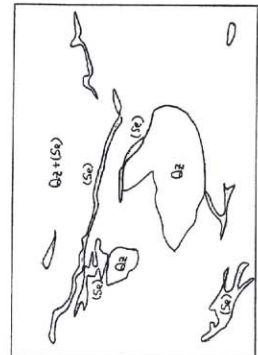
0.4 mm

02MRS 0039  
 黒雲母ホルンフェルス (黒雲母砂岩ホルンフェルス)  
 Qz : 石英, Kf : カリ長石, Pl : 斜長石, Bt :  
 O x h : 黒雲母-酸化緑泥石, Se : 絹雲母  
 写真上 単ニコル 写真下 直交ニコル, 倍 率 : X 103.5



0.4 mm

02MRS 0038  
 珪岩 (変成石英砂岩)  
 Qz : 石英, Se : 絹雲母  
 写真上 単ニコル 写真下 直交ニコル, 倍 率 : X 103.5





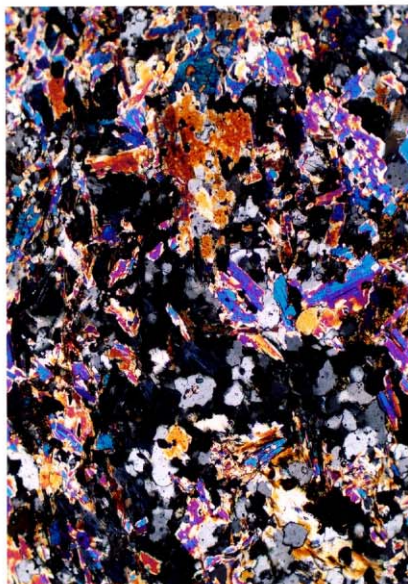
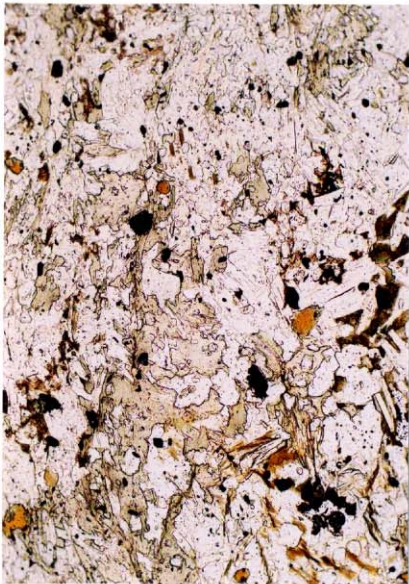
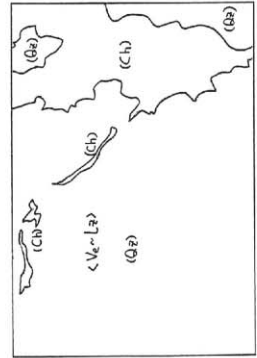
2 mm

02MRS 0042

綠泥石・石英脈岩

Qz: 石英, Ch: 綠泥石, <Ve-Lz>: 脈-レンズ

写真上 単ニコル 写真下 直交ニコル, 倍率: X 20



0.4 mm

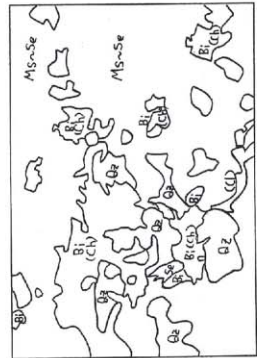
02MRS 0040

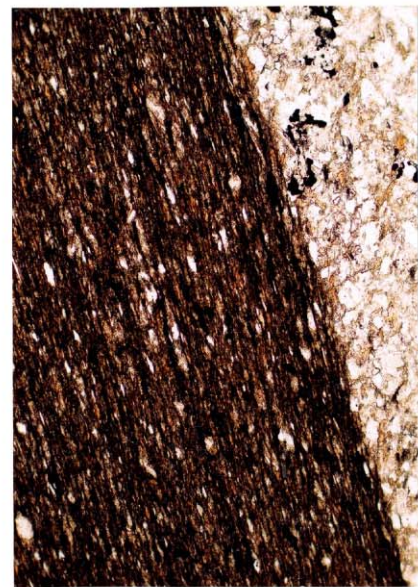
黒雲母ホルンフェルス (黒雲母泥岩ホルンフェルス)

Qz: 石英, Bi: 黒雲母, Ms: 白雲母, Se: 絹

雲母, Ch: 綠泥石

写真上 単ニコル 写真下 直交ニコル, 倍率: X 103.5





0.4 mm

02MRS 0043

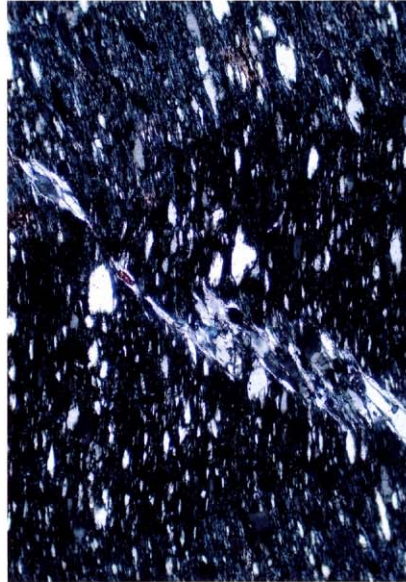
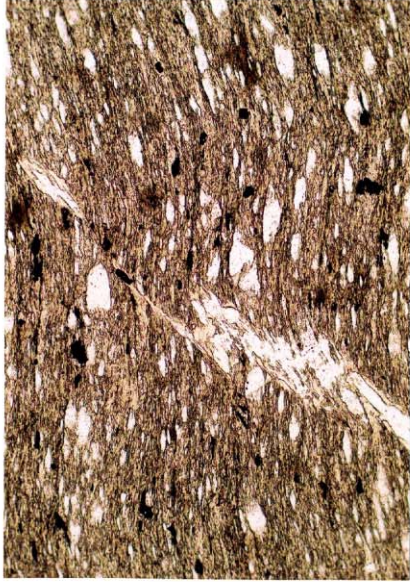
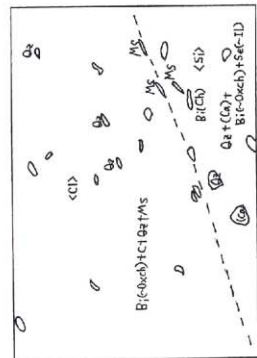
粘板岩

Qz: 石英, Bi-Oxch: 黒雲母-酸化緑泥石, Ms

: 白雲母, Se-I: 絹雲母-イライト, Ca: 方解石

<C1>: 粘土質層, <Si>: シルト質層

写真上 単ニコル 写真下 直交ニコル, 倍率: X 103.5



0.4 mm

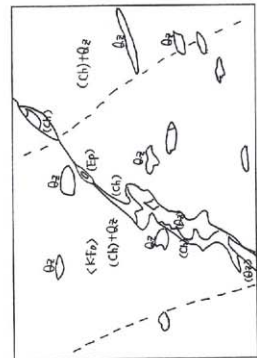
02MRS 0044

緑泥石粘板岩 (凝灰質粘板岩)

Qz: 石英, Ch: 緑泥石, Ep: 綠泥石, C: 炭素

<Kf.o>: キンク褶曲

写真上 単ニコル 写真下 直交ニコル, 倍率: X 103.5

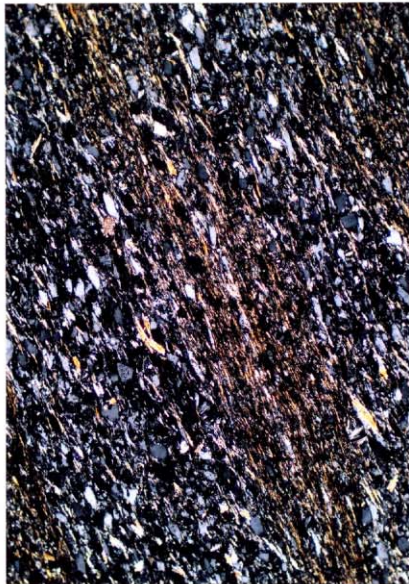
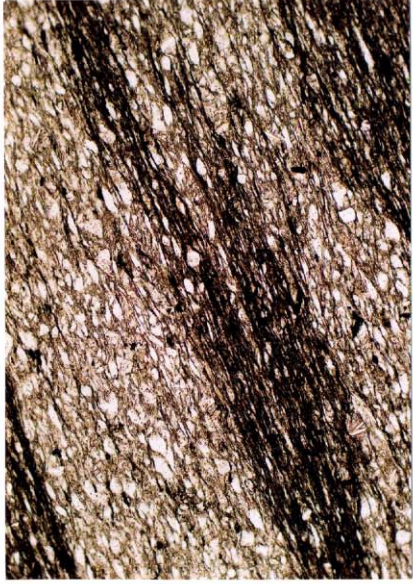
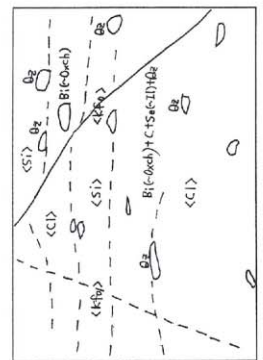




0.4 mm

02MRS 0045  
粘板岩

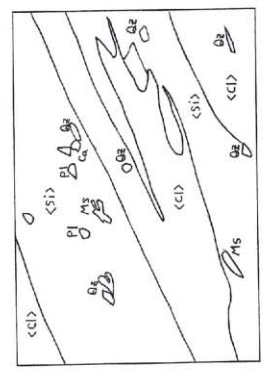
Qz: 石英, Bi-Oxch: 黑雲母-酸化綠泥石, Se-Il: 絹雲母-イライト, C: 炭素, <Kfo>: キンク層面, <C1>: 粘土質層, <Si>: シルト質層  
写真上 準ニコール 写真下 直交ニコール, 倍率: X 103.5



0.4 mm

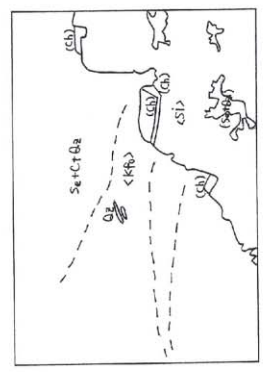
02MRS 0046  
粘板岩

Qz: 石英, Pl: 絹雲石, Ms: 白雲母, Ca: 方解石, <C1>: 粘土質層, <Si>: シルト質層  
写真上 準ニコール 写真下 直交ニコール, 倍率: X 103.5





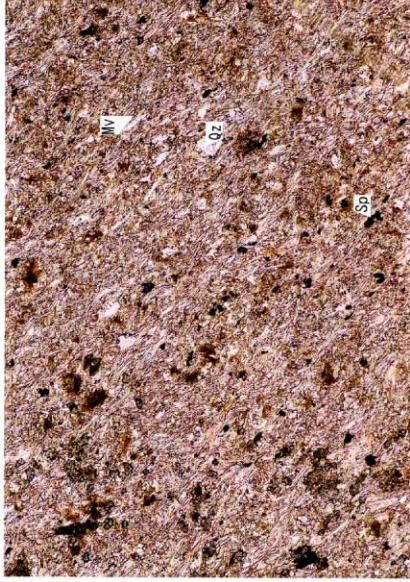
0.4 mm



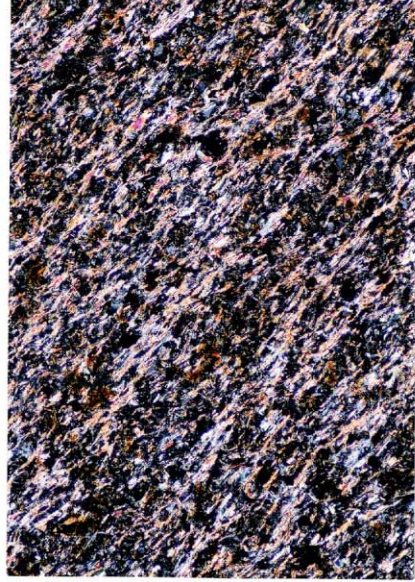
02MKS 0047  
粘板岩  
Qz:石英, Se:絹雲母, Ch:綠泥石, C:炭素  
<Kfs>:キンク褶曲  
写真上準ニコル 写真下直交ニコル, 倍率: × 103.5

## **Sedimentary Rocks**

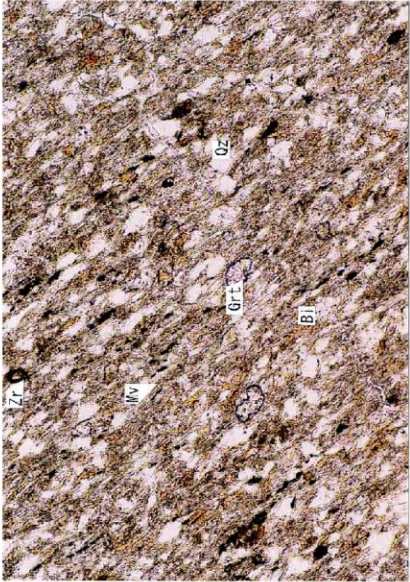




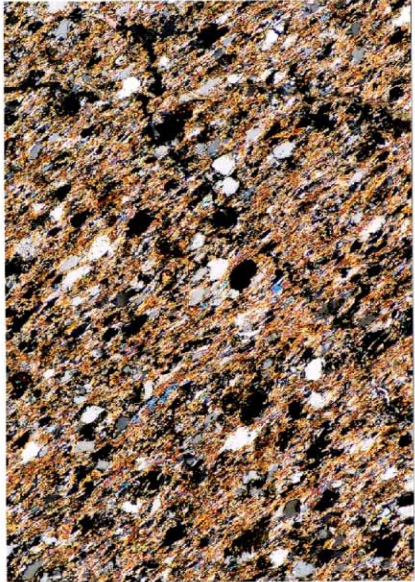
単ニニ直



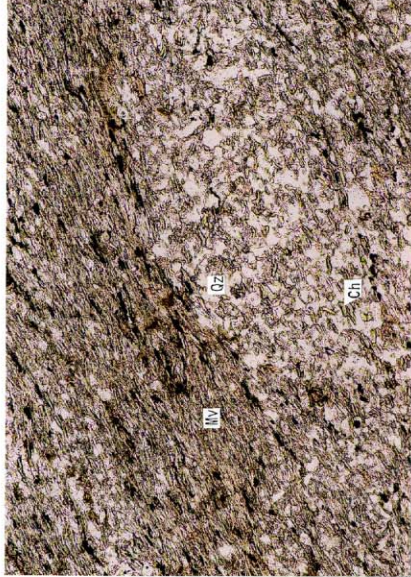
No.2 02MR-K004 S4A 563.50-563.70  
直交ニニ直  
0.2mm



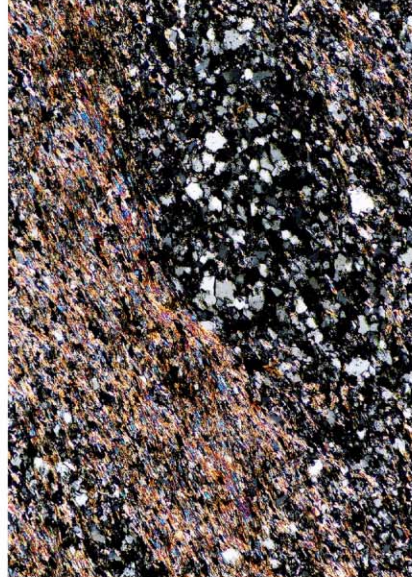
単ニニ直



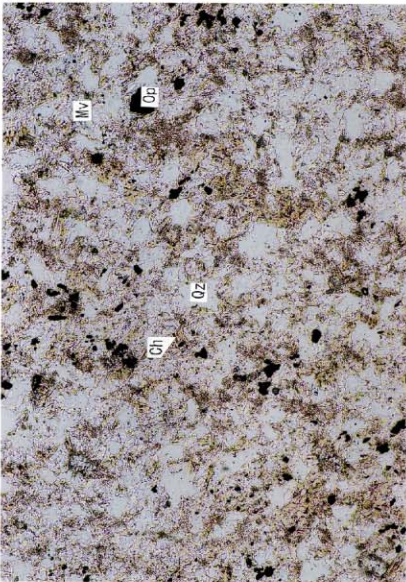
No.1 02MR-K001 S1A 407.00-407.20  
直交ニニ直  
0.2mm



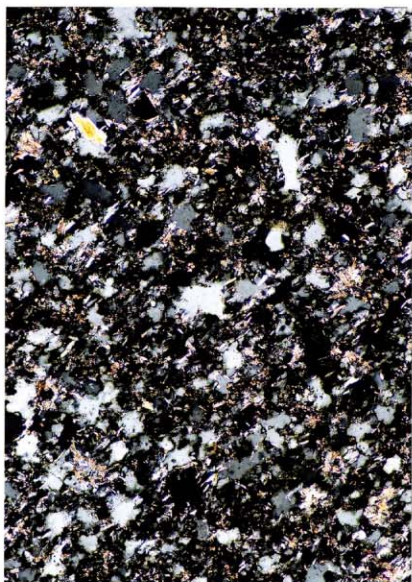
単ニコル



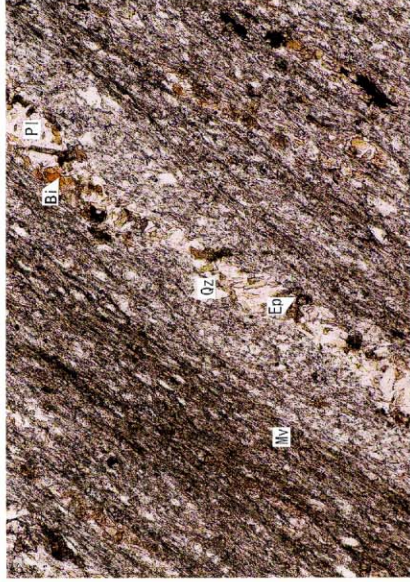
No.4 02MR-K006 S4 553.00-553.20  
直交ニコル  
0.2mm



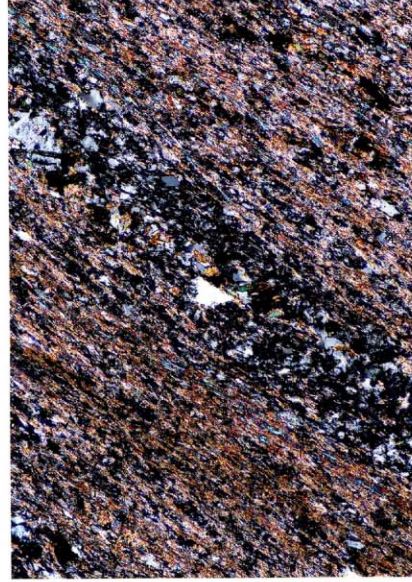
単ニコル



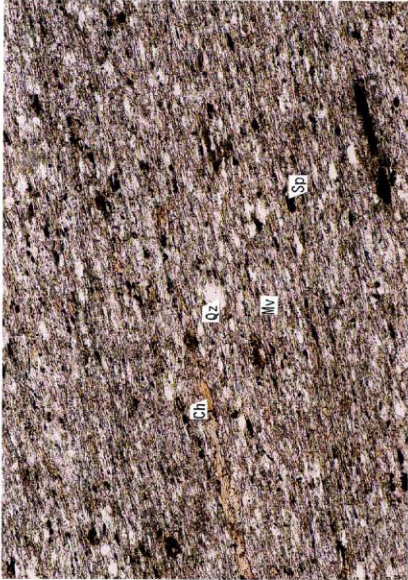
No.3 02MR-K005 S4 510.50-510.70  
直交ニコル  
0.2mm



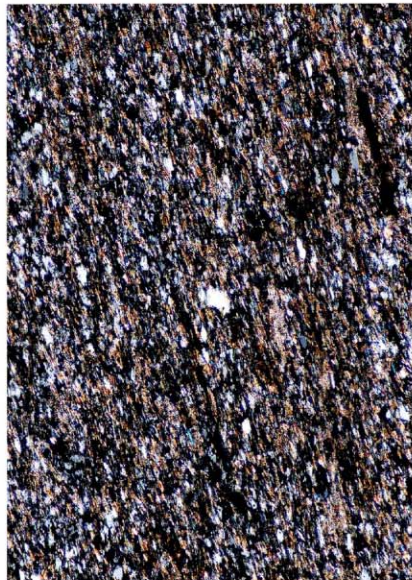
単ニコル



No.6 02MR-K009 S5 625.30-625.50  
直交ニコル  
0.2mm



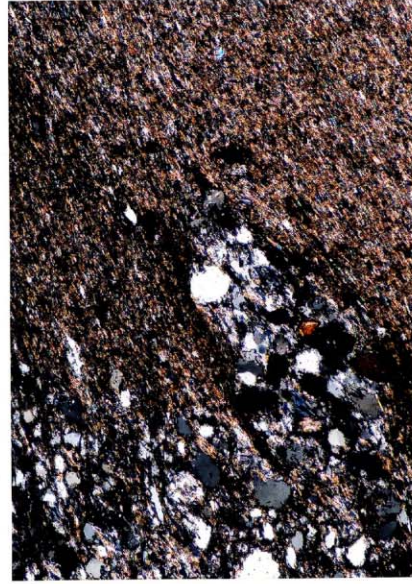
単ニコル



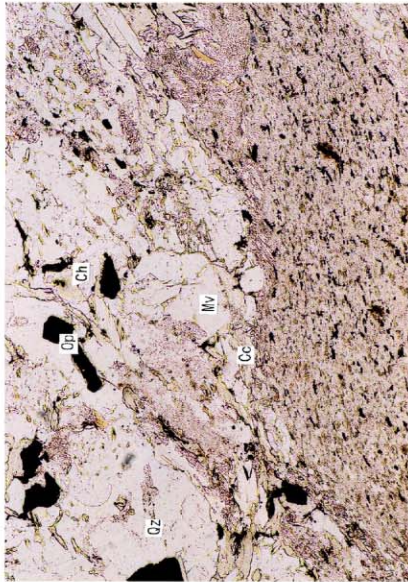
No.5 02MR-K008 S4 570.00-570.20  
直交ニコル  
0.2mm



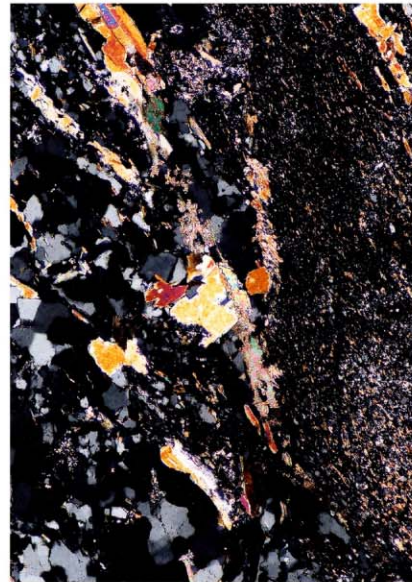
単ニコル



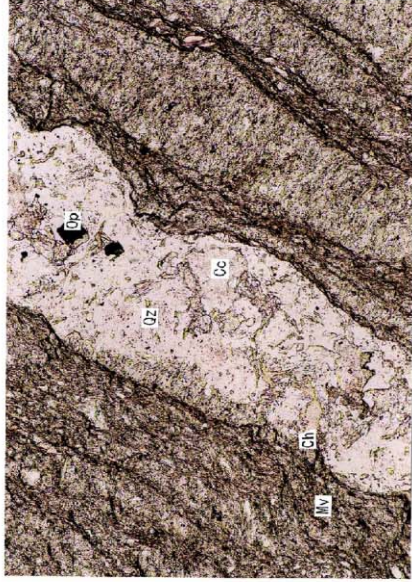
No.8 02MR-K014 S3 305.00-305.20  
直交ニコル  
0.2mm



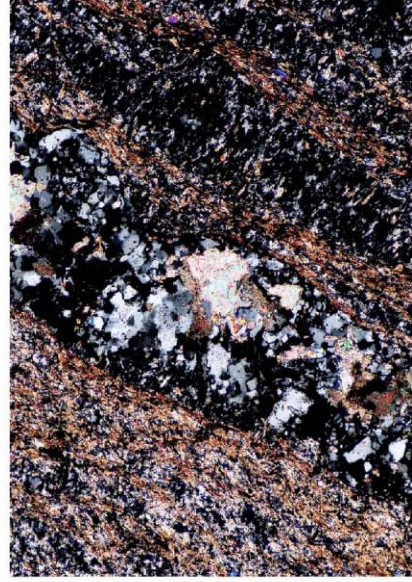
単ニコル



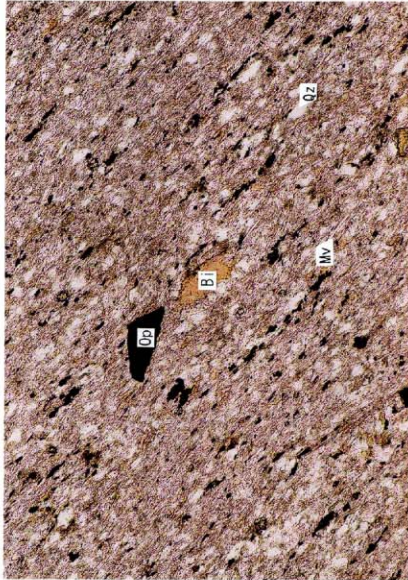
No.7 02MR-K011 S5 642.00-642.20  
直交ニコル  
0.2mm



単ニニコル



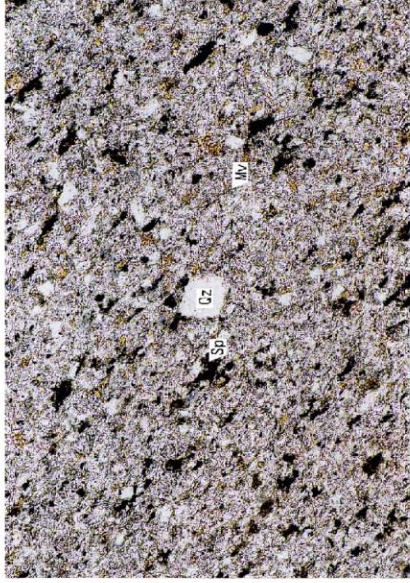
No.10 02MR-K018 S2 170.00-170.20  
直交ニニコル  
0.2mm



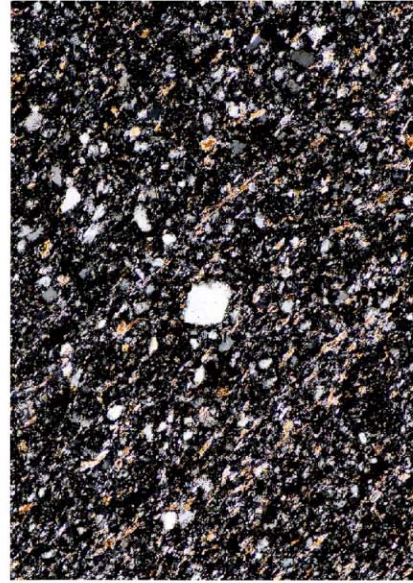
単ニニコル



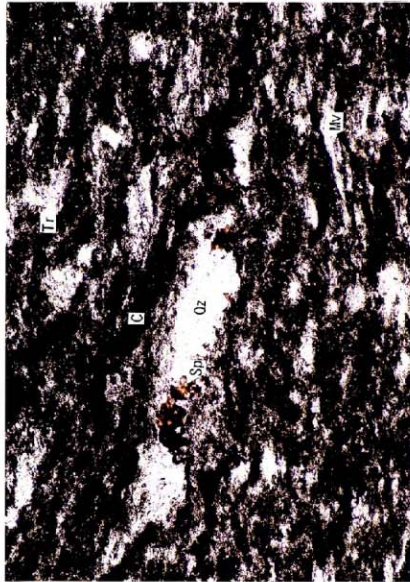
No.9 02MR-K016 S3 328.00-328.20  
直交ニニコル  
0.2mm



単ニコル



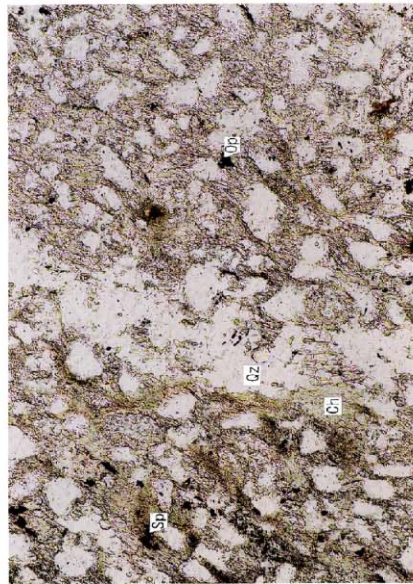
No.12 02MR-K024 Surface  
直交ニコル  
0.2mm



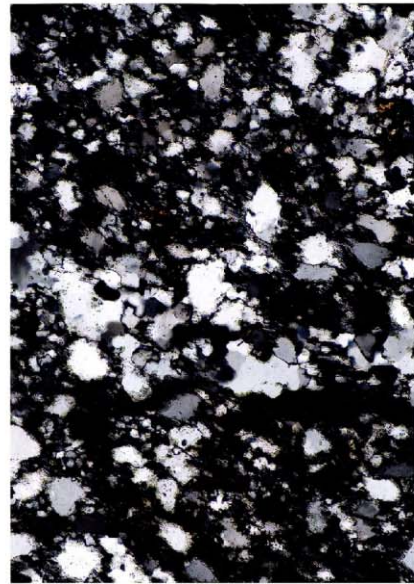
単ニコル



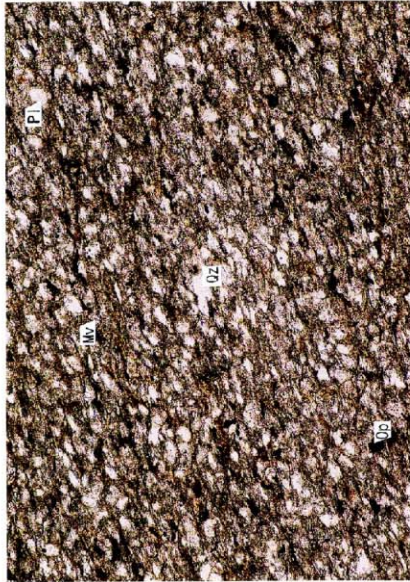
No.11 02MR-K021 S2 412.00-412.20  
直交ニコル  
0.2mm



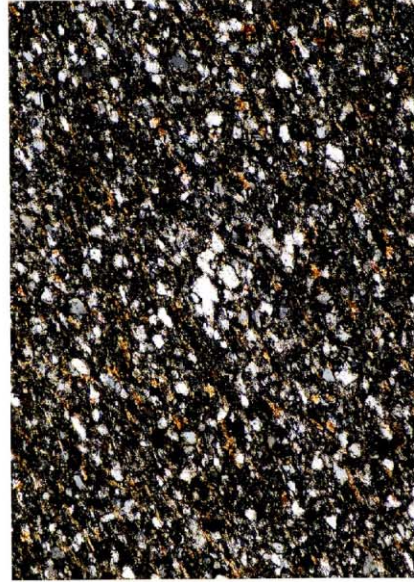
単ニッケル



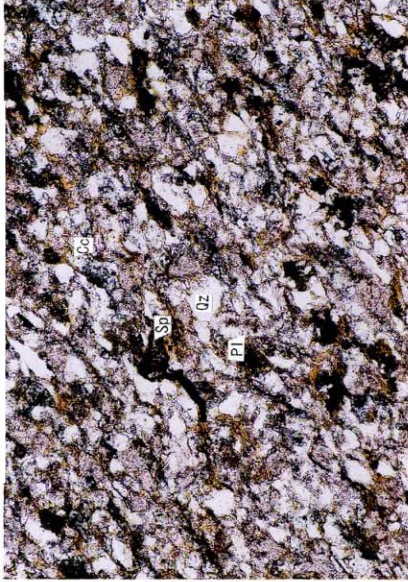
No.13 02MR-K026 Surface  
直交ニッケル



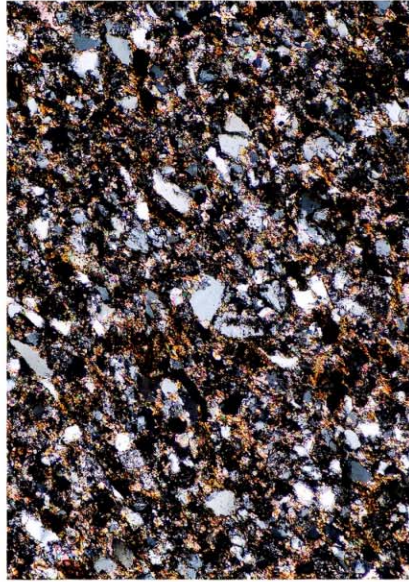
単ニッケル



No.14 02MR-K027 Surface  
直交ニッケル



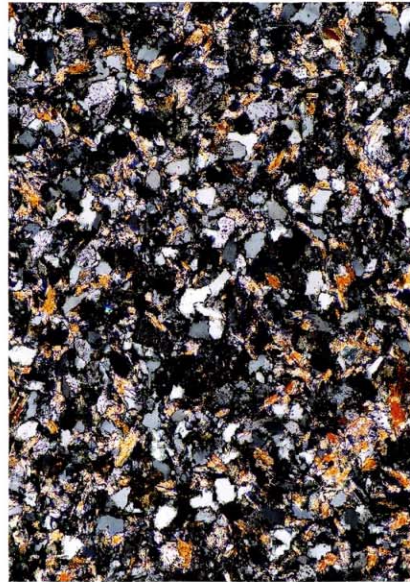
単二ニコル



No.16 02MR-K030 Surface  
直交ニコル  
0.2mm

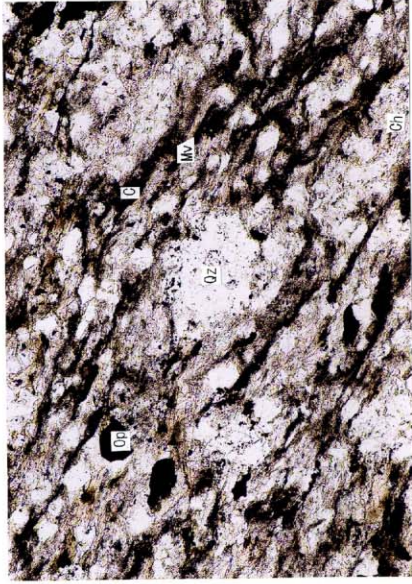


単ニコル

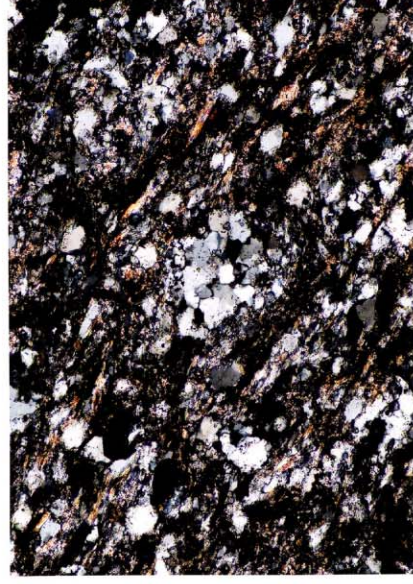


No.15 02MR-K029 Surface  
直交ニコル  
0.2mm

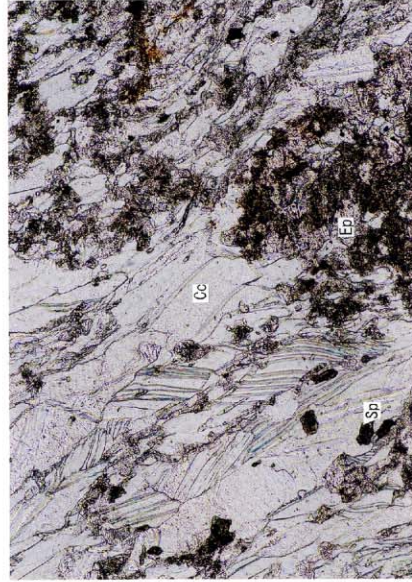




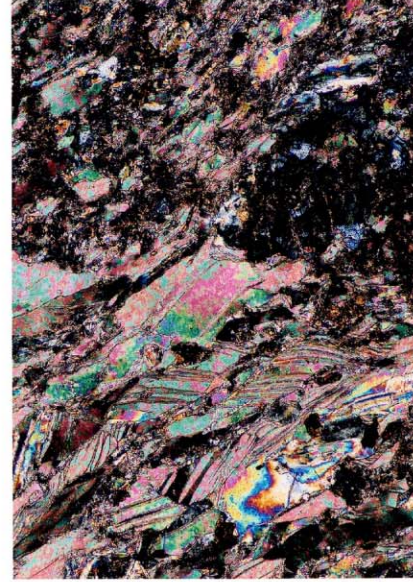
単ニコル



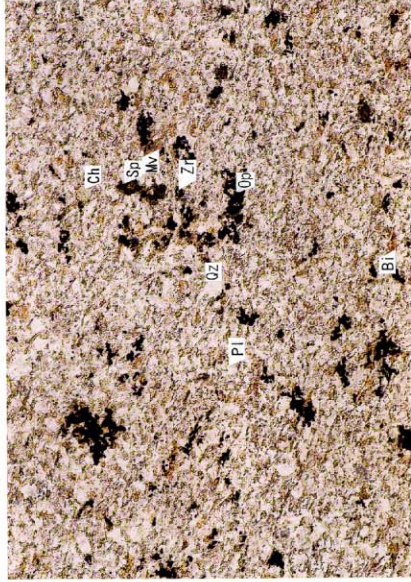
No.18 02MR-K032 KA25 202.00-202.20  
直交ニコル  
0.2mm



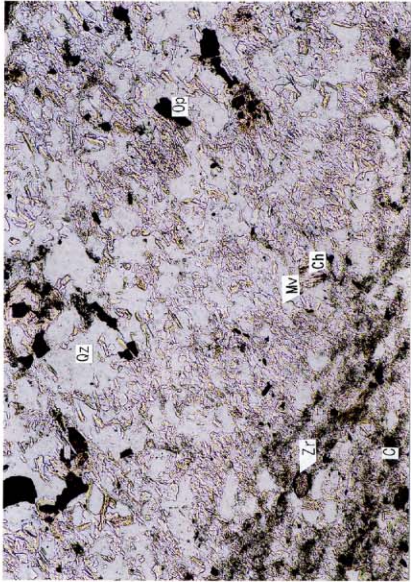
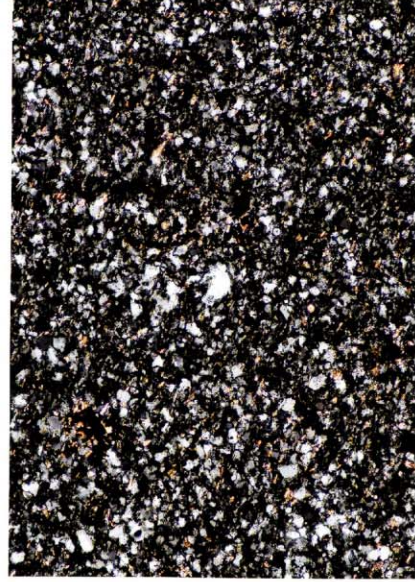
単ニコル



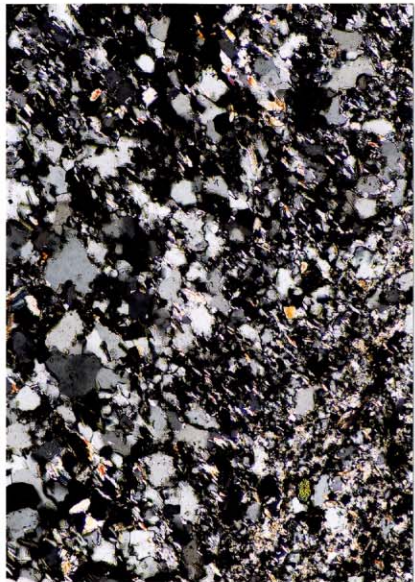
No.17 02MR-K031 Surface  
直交ニコル  
0.2mm

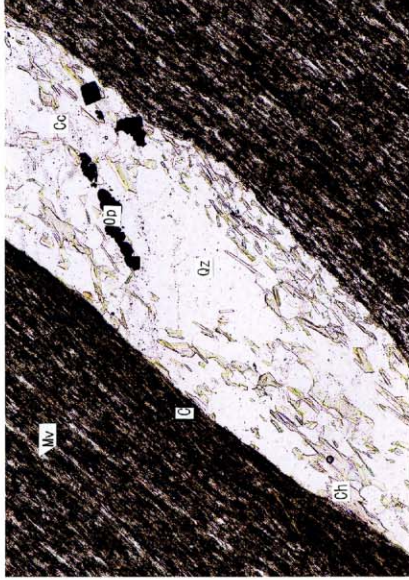


単二コル



単二コル





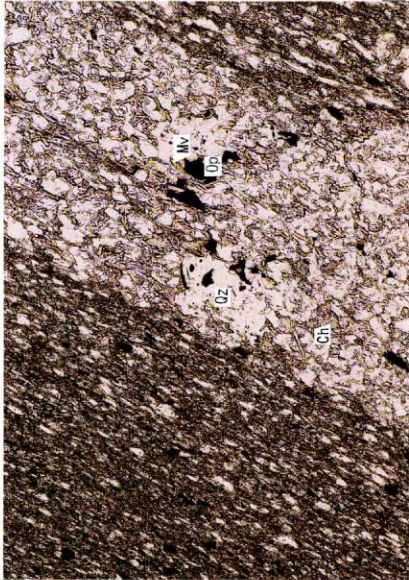
単ニニコル



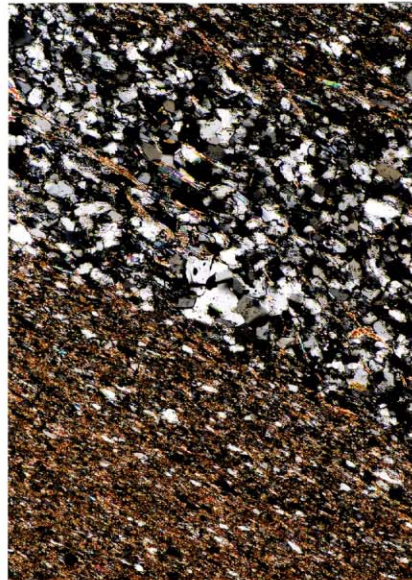
No.22 02MR-K041 LA9 176.00-176.20

直交ニコル

0.2mm



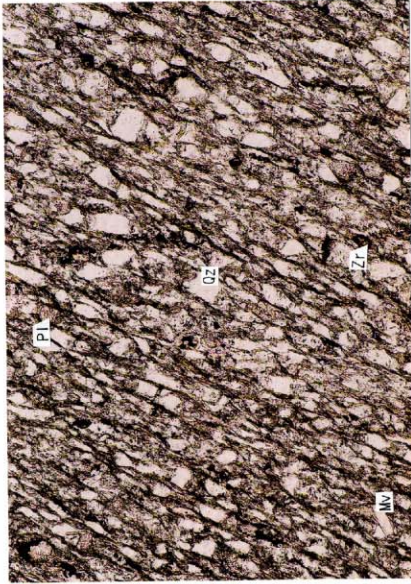
単ニニコル



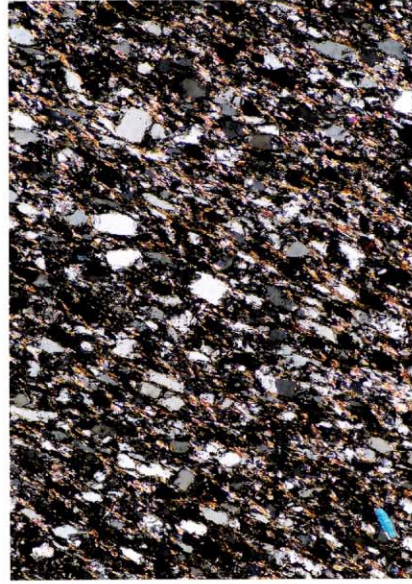
No.21 02MR-K039 BS15 311.00-311.20

直交ニコル

0.2mm



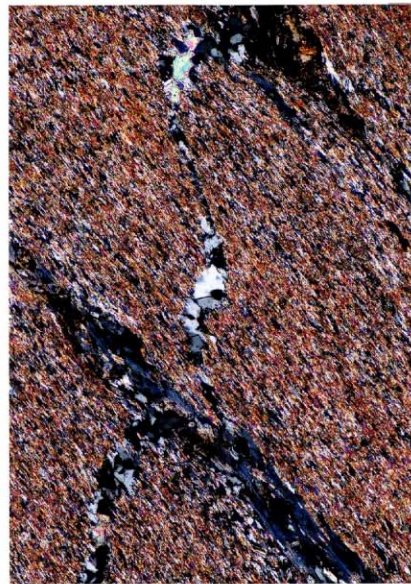
単二口化



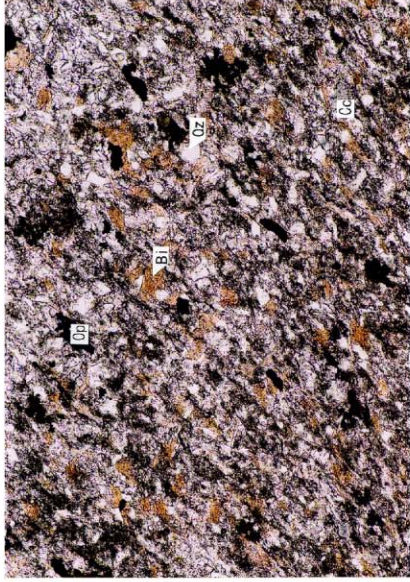
No.24 02MR-K044 LA9 240.00-240.20  
直交ニコル  
0.2mm



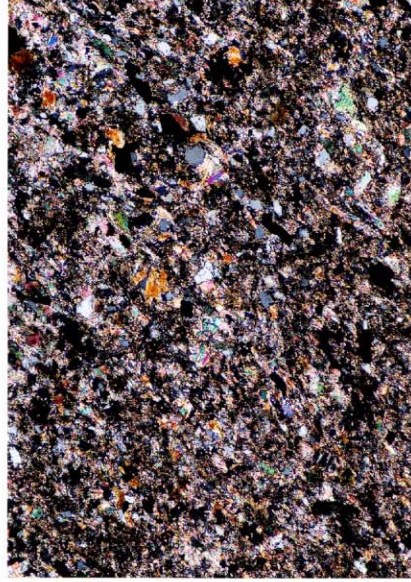
単二口化



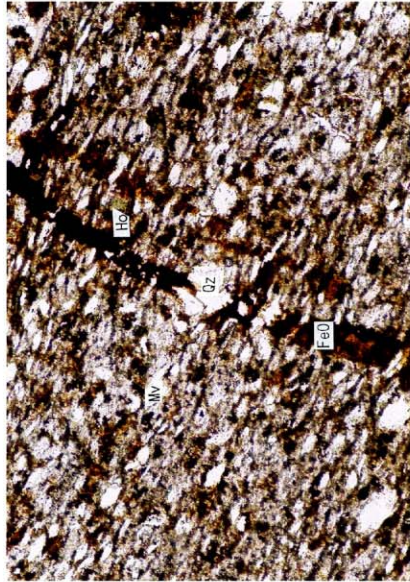
No.23 02MR-K043 LA9 222.00-222.20  
直交ニコル  
0.2mm



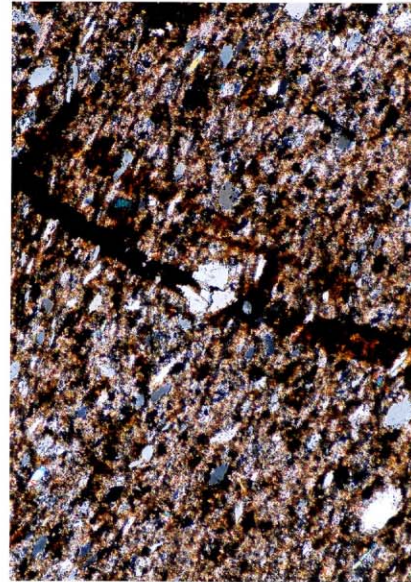
単ニコル



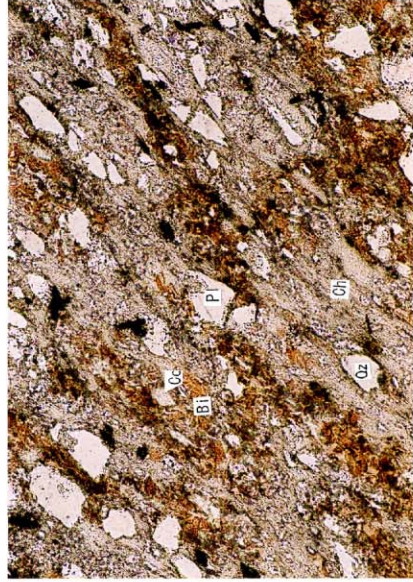
No.26 02MR-K047 Surface  
直交ニコル  
0.2mm



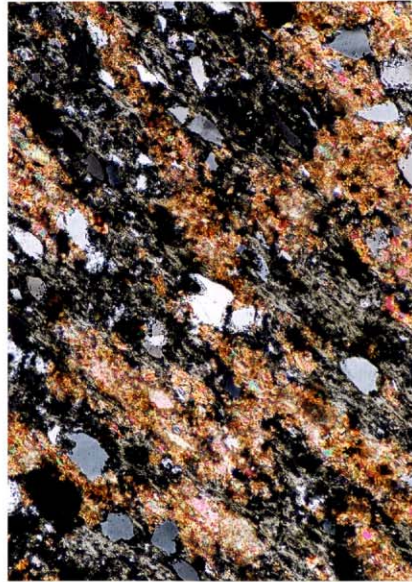
単ニコル



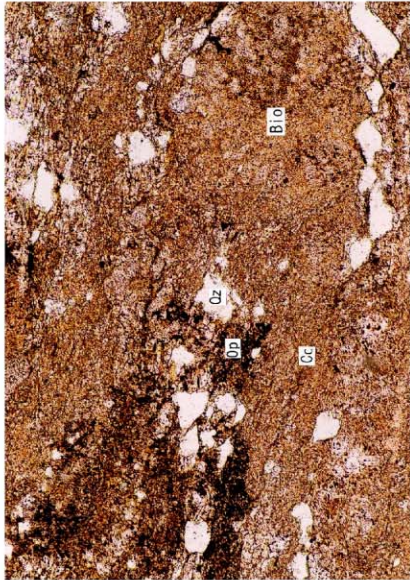
No.25 02MR-K046 Surface  
直交ニコル  
0.2mm



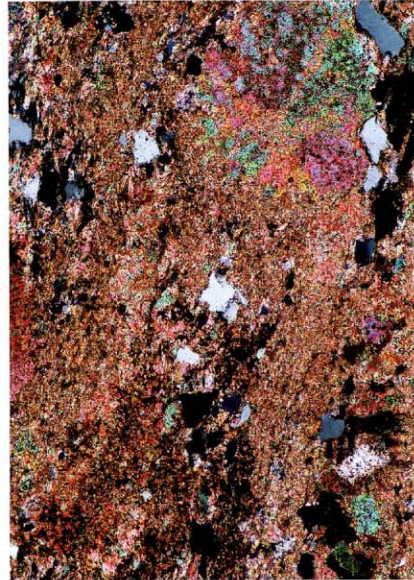
単ニコル



No.28 02MR-K050 CD27 334.00-334.20  
直交ニコル  
0.2mm



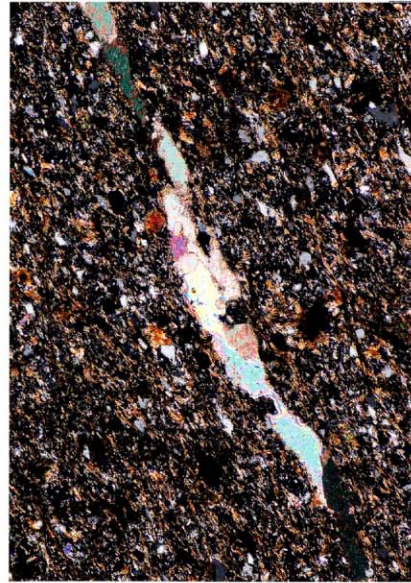
単ニコル



No.27 02MR-K049 Surface  
直交ニコル  
0.2mm



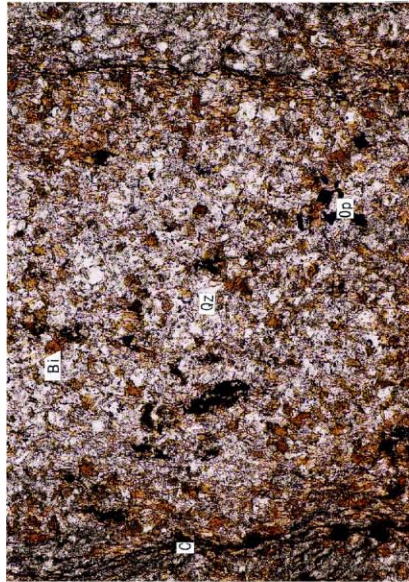
単ニコル



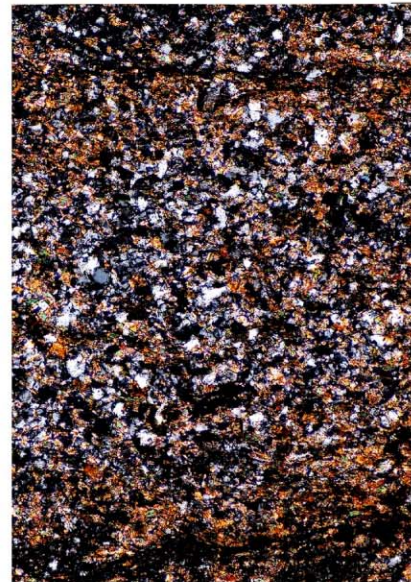
No.30 02MR-K053 CD27 19.50-19.70

直交ニコル

0.2mm



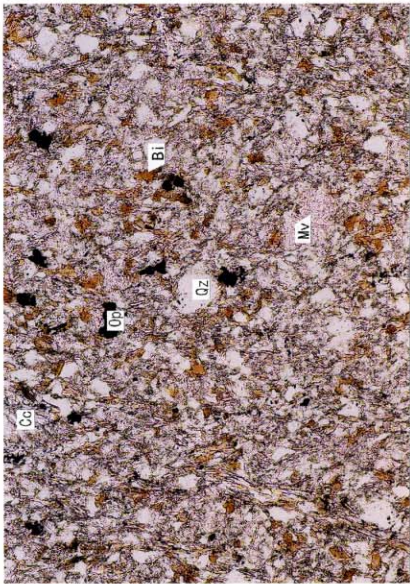
単ニコル



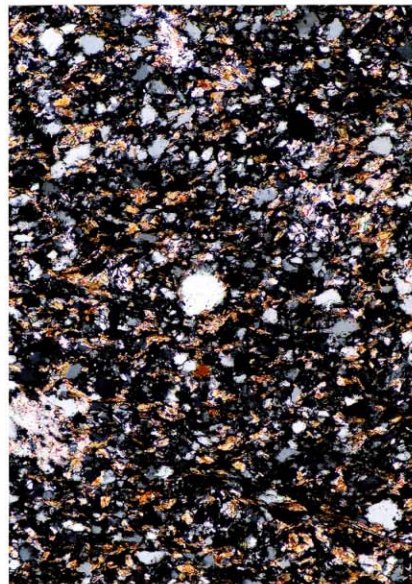
No.29 02MR-K051 CD27 134.00-134.20

直交ニコル

0.2mm

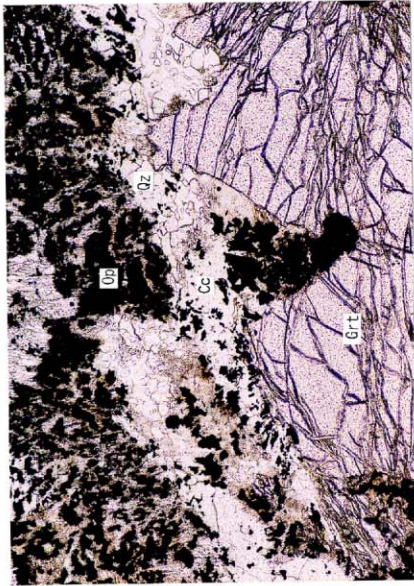


単ニコル

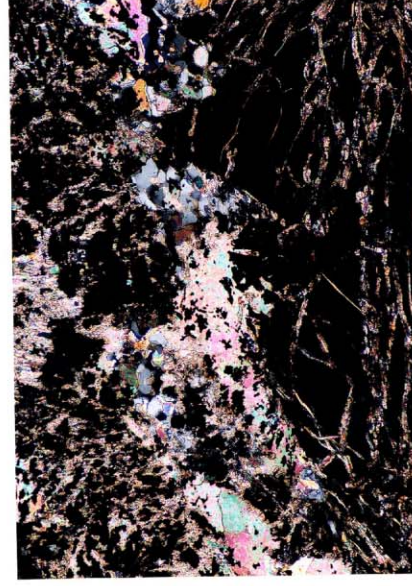


No.31 02MR-K057 GHCl 42.30-42.50  
直交ニコル

0.2mm



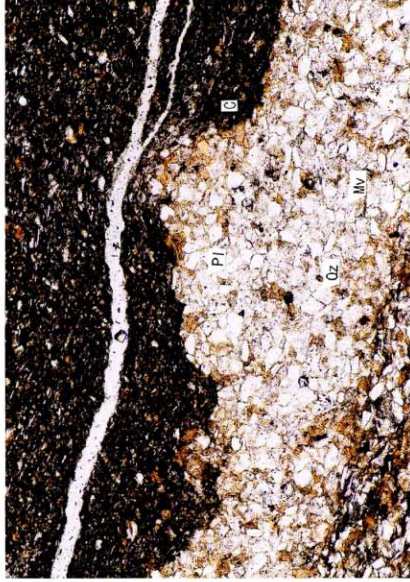
単ニコル



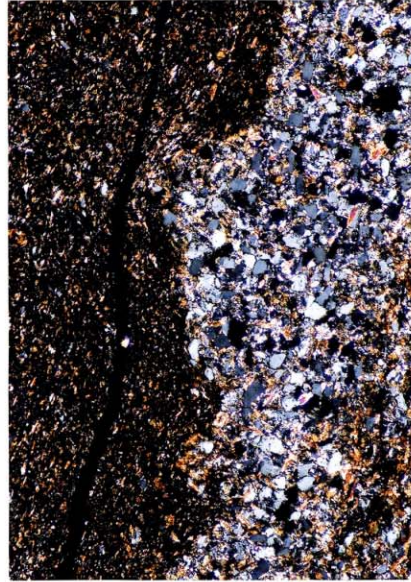
No.35 02MR-K067 surface  
直交ニコル

0.2mm

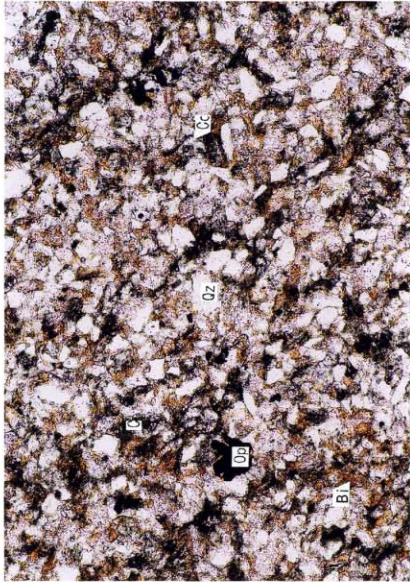




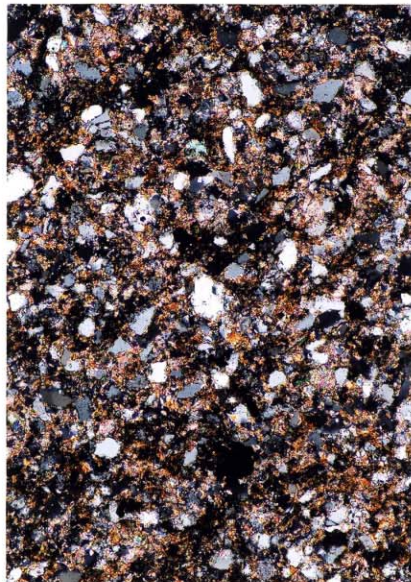
単ニコル



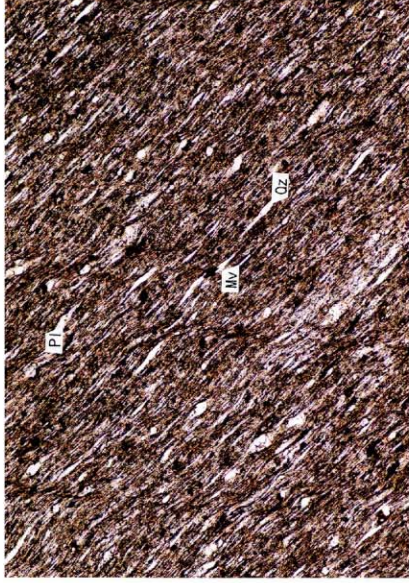
No.37 02MR-K069 surface  
直交ニコル  
0.2mm



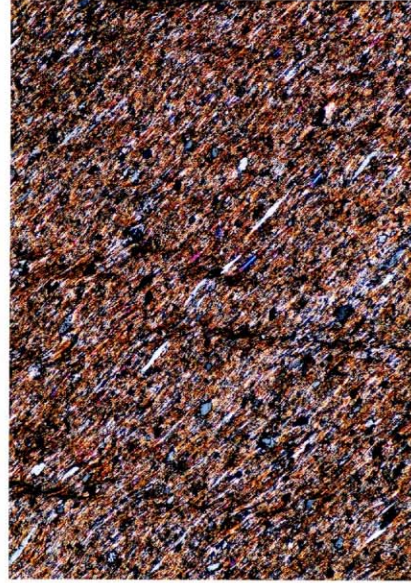
単ニコル



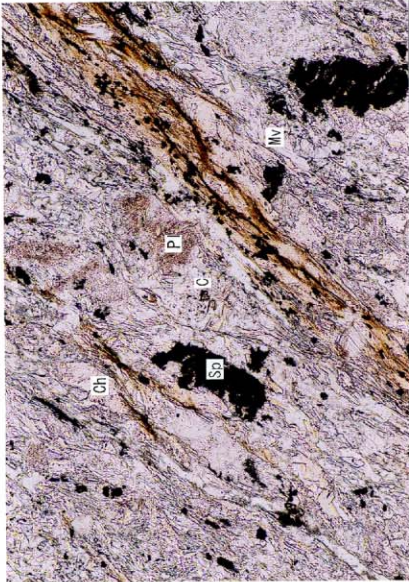
No.36 02MR-K068 surface  
直交ニコル  
0.2mm



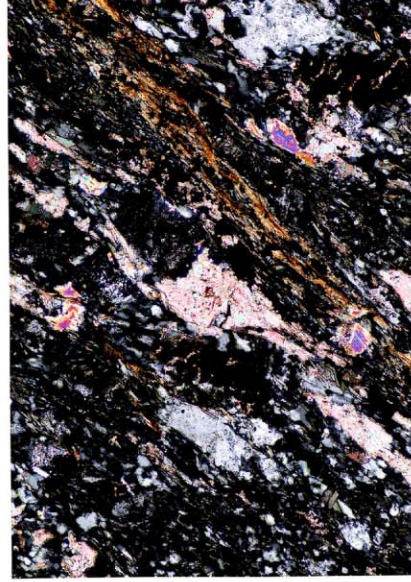
糸状ニコル



No.39 02MR-K072 surface  
直交ニコル  
0.2mm



糸状ニコル

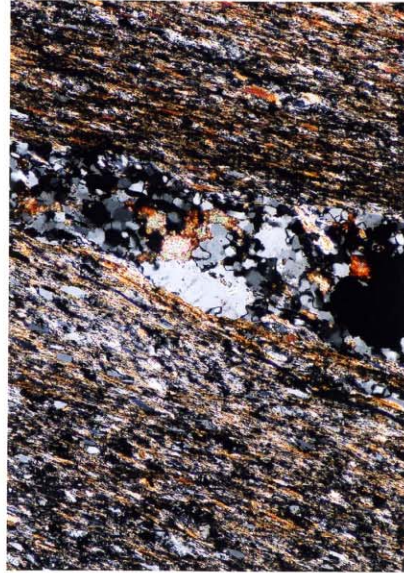


No.38 02MR-K071 surface  
直交ニコル  
0.2mm

100倍



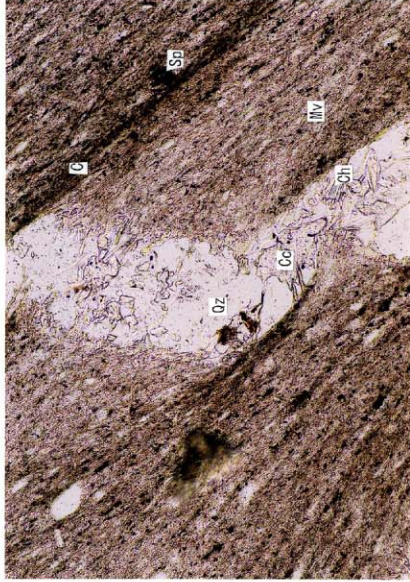
単ニコル



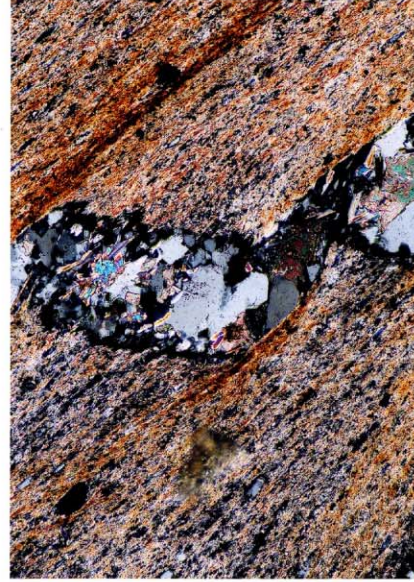
No.40 02MR-K074 FZ12 99.70-100.00

直交ニコル

0.2mm



単ニコル



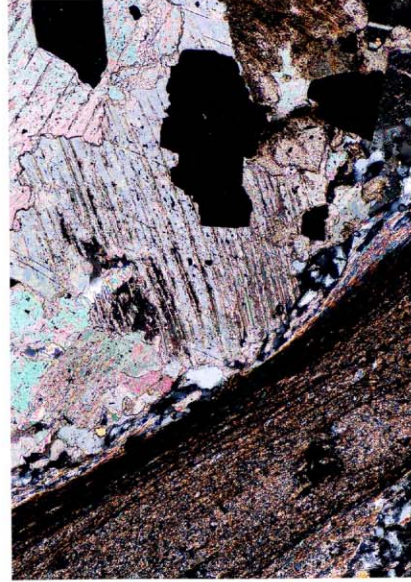
No.41 02MR-K079 FZ13 141.00-141.30

直交ニコル

0.2mm

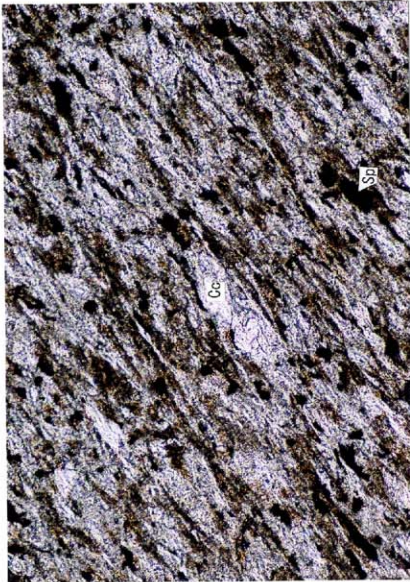


単ニニコル

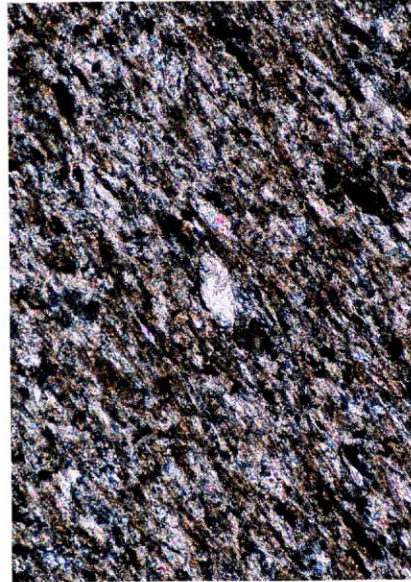


No.43 02MR-K081 FZ14 53.90-54.10  
直交ニコル

0.2mm

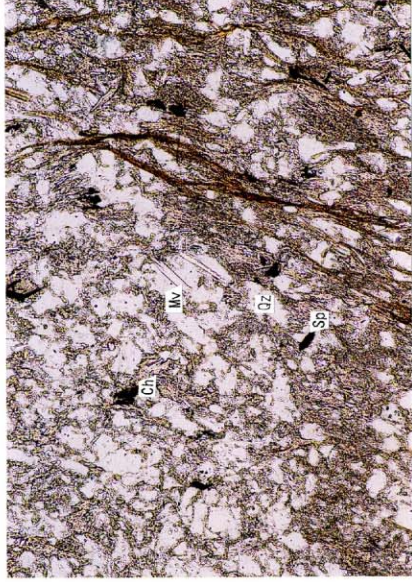


単ニニコル

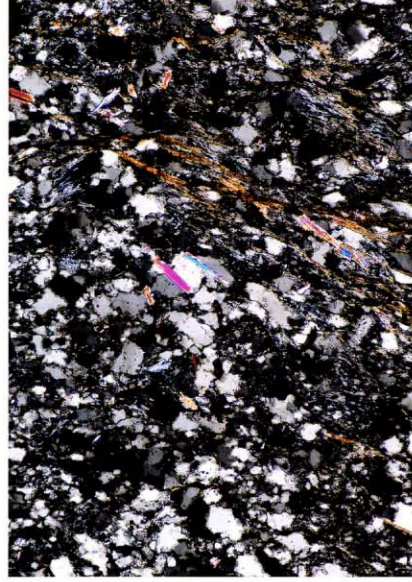


No.42 02MR-K080 FZ14 53.70-53.90  
直交ニコル

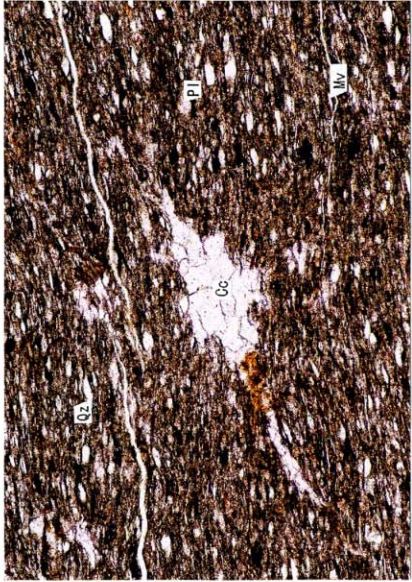
0.2mm



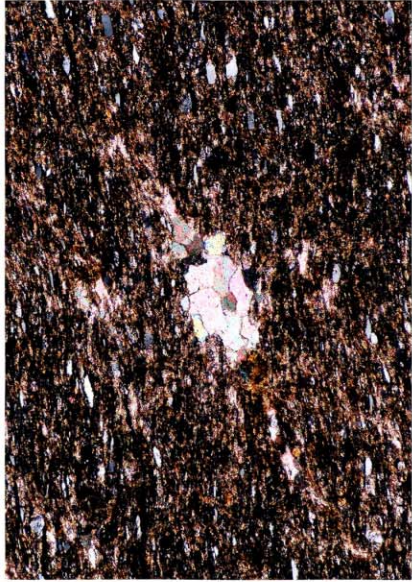
単ニッケル



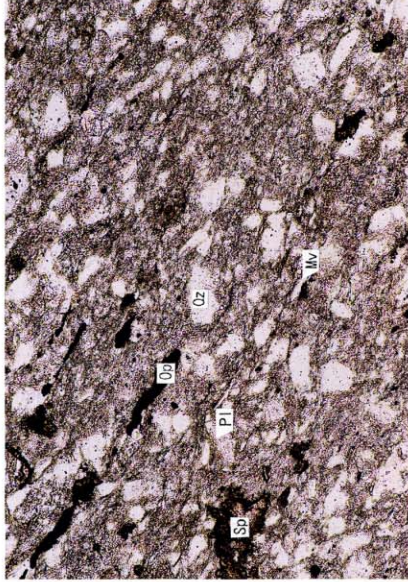
No.45 02MR-K085 surface 直交ニッケル  
0.2mm



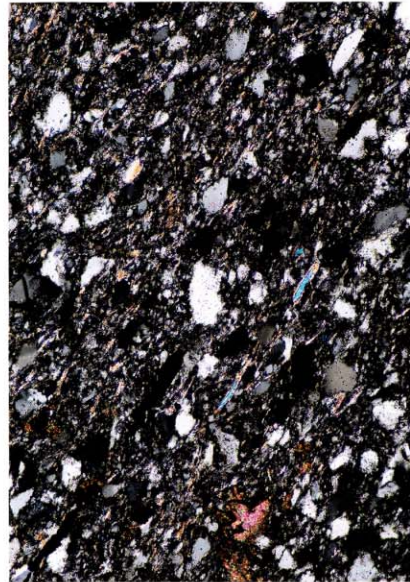
単ニッケル



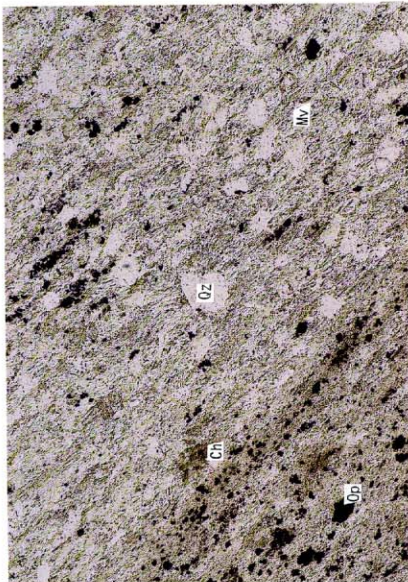
No.44 02MR-K084 surface 直交ニッケル  
0.2mm



単ニコル



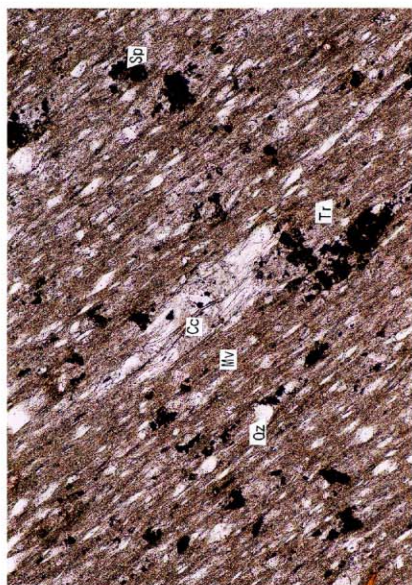
No.47 02MR-K090 DSF15 270.70-270.90  
直交ニコル  
0.2mm



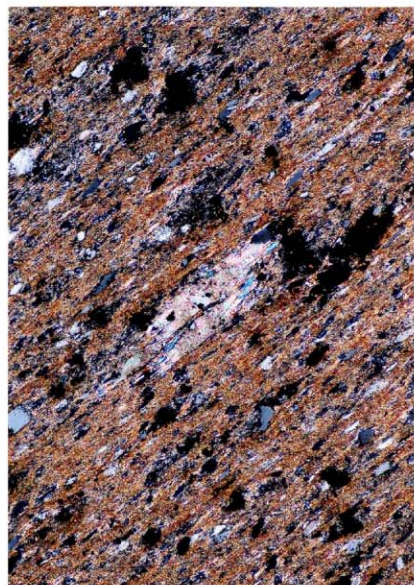
単ニコル



No.46 02MR-K087 DSF15 109.00-109.20  
直交ニコル  
0.2mm



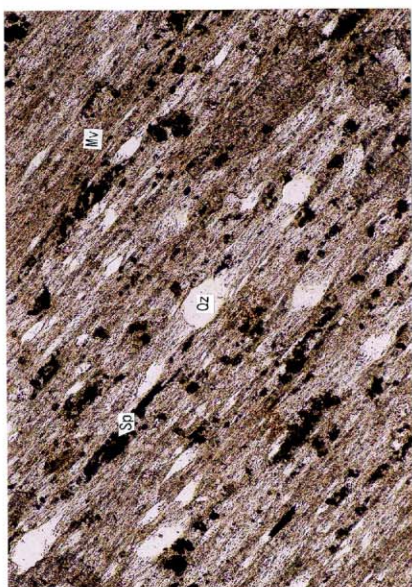
単ニコル



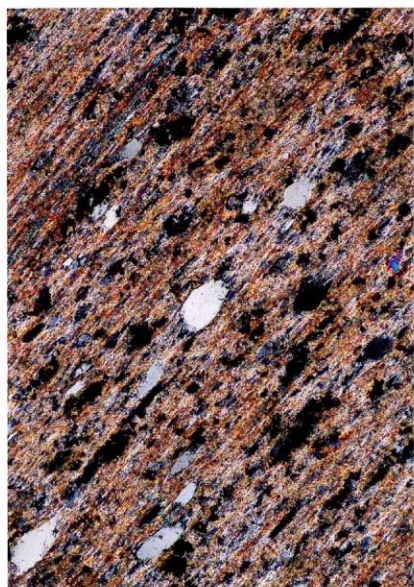
No.49 02MR-K095 DSF2 137.50-137.70

直交ニコル

0.2mm



単ニコル



No.48 02MR-K093 DSF2 91.00-91.20

直交ニコル

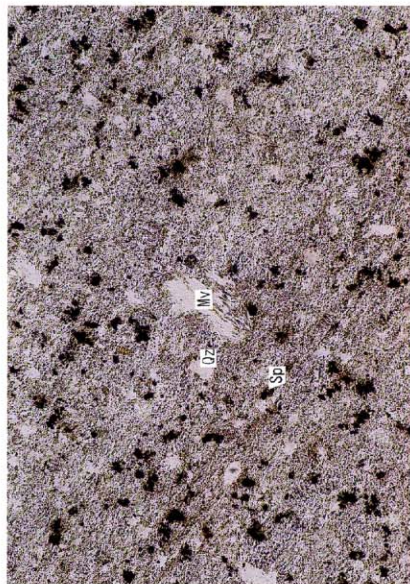
0.2mm



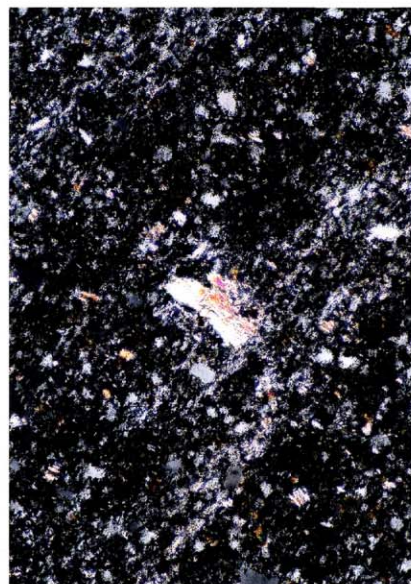
No. 27 状況写真：Limestone (ボロシ処理)  
0.8mm



No. 3 状況写真：Shale (弗化水素処理)  
0.8mm

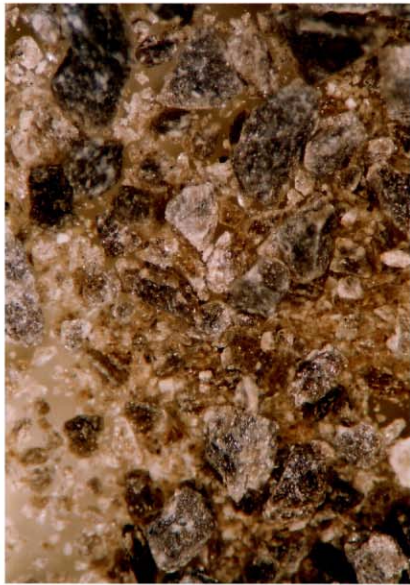


単  
化ニ  
コ  
ル



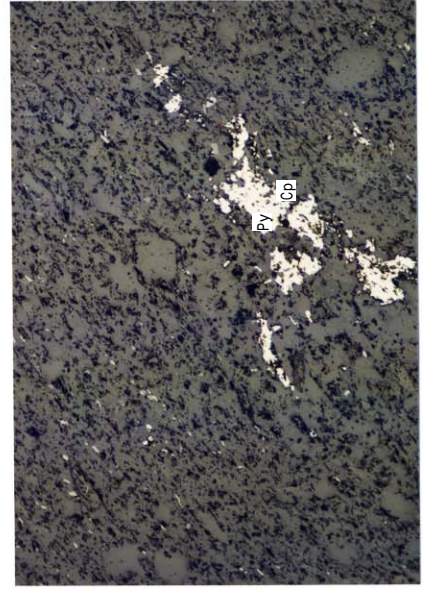
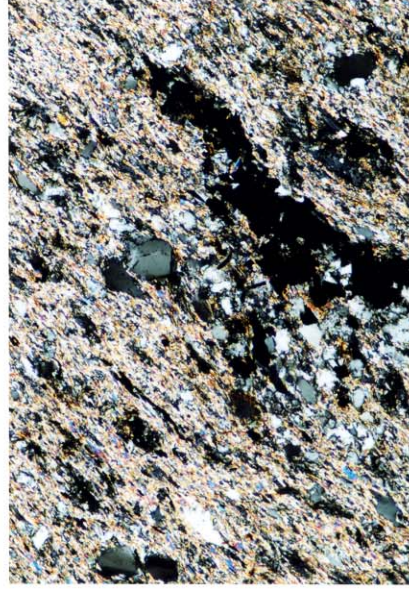
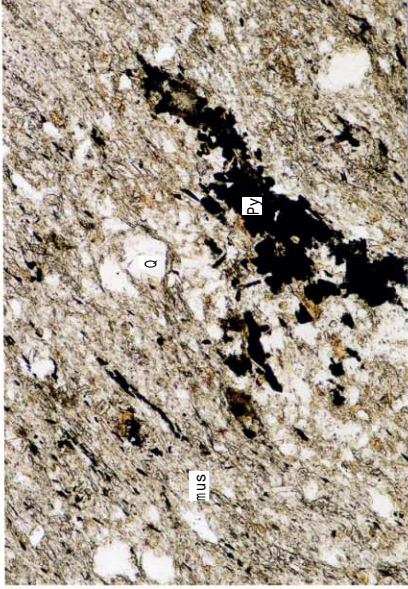
No.51 02MR-K097 -400mL  
直  
交  
ニ  
コ  
ル  
0.2mm



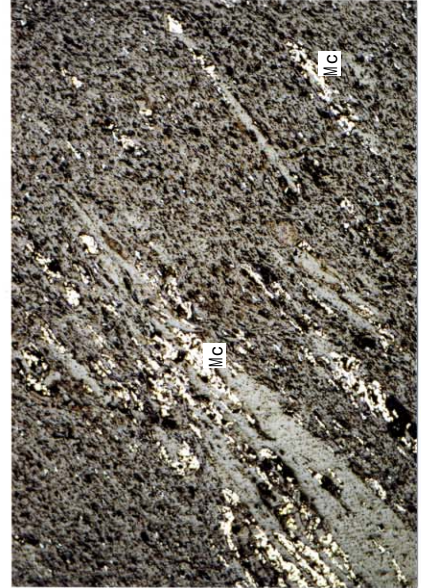
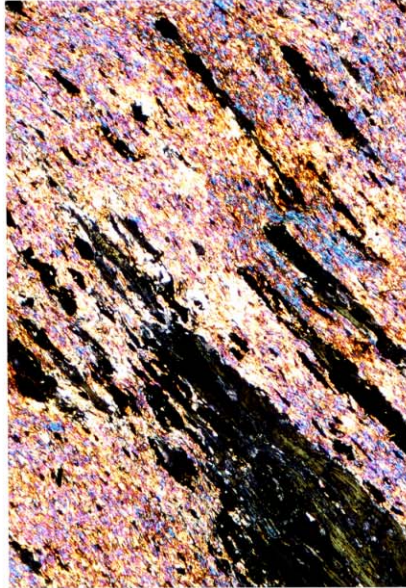
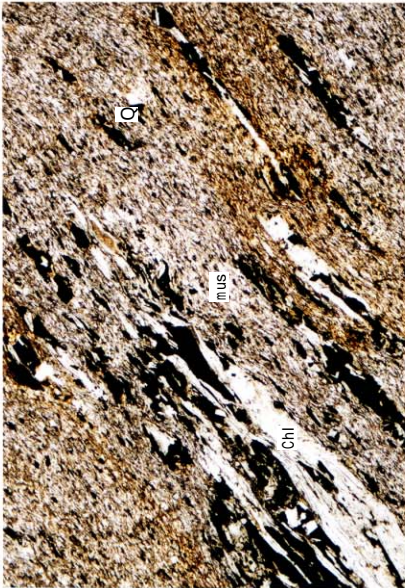


No.1 状況写真：Shale (弗化水素処理)

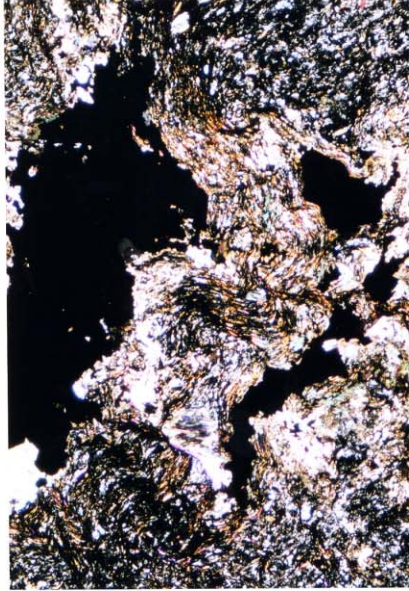
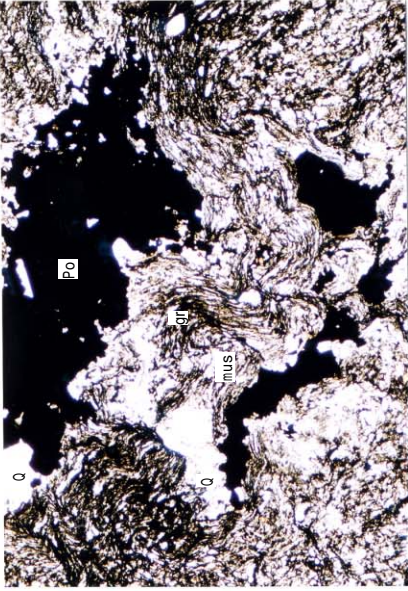
0.8mm



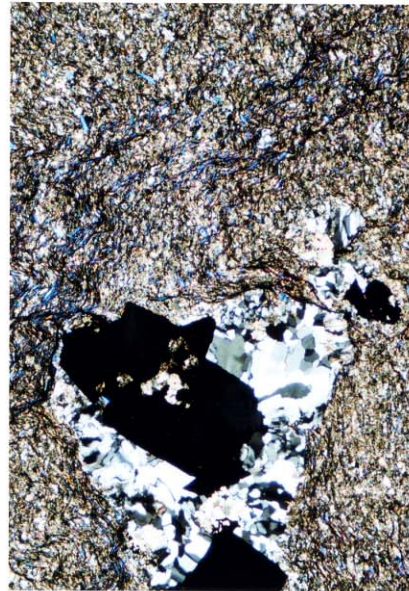
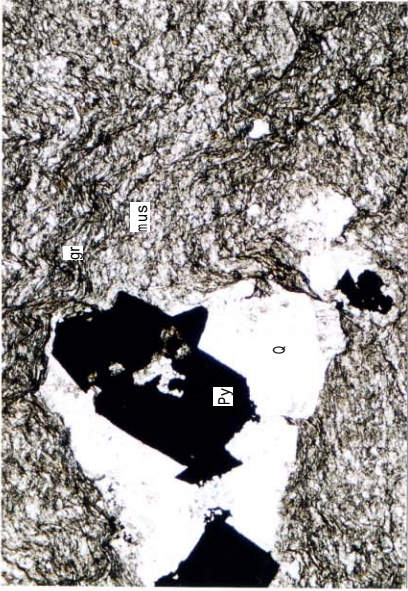
02MR-K017  
× 100  
0.01mm



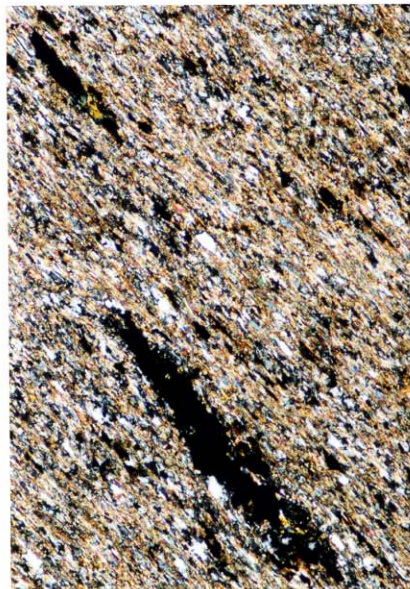
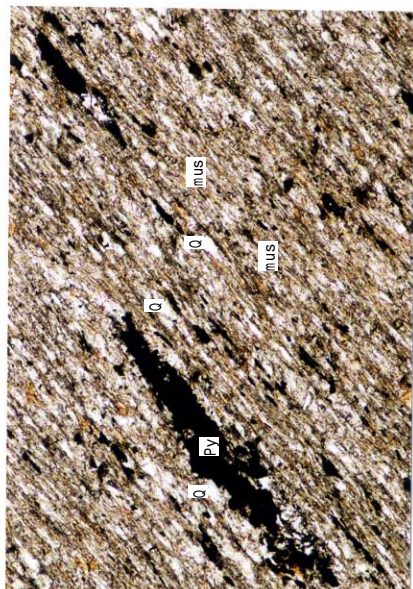
02MR-K007  
× 40  
1mm



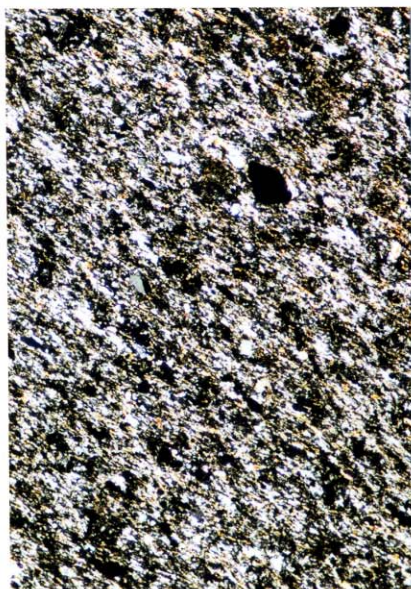
02MR-K023  
1mm  
× 40



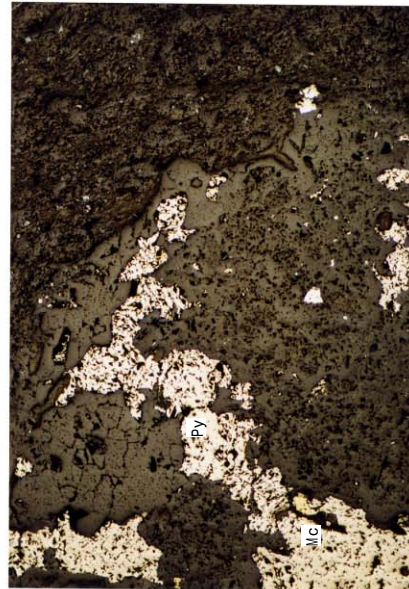
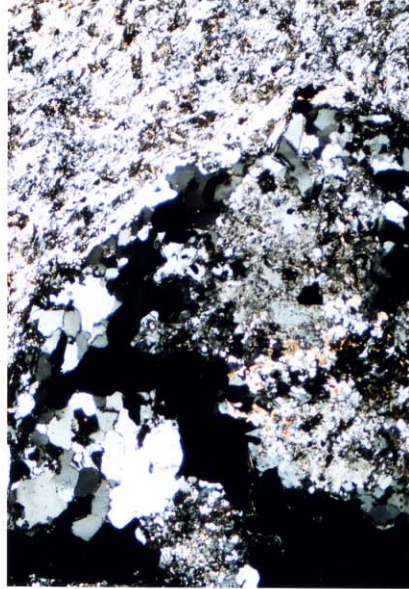
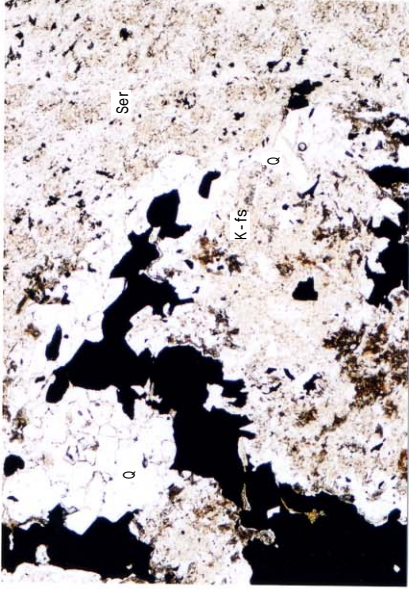
02MR-K020  
1mm  
× 40



02MR-K038  
× 100  
0.01mm



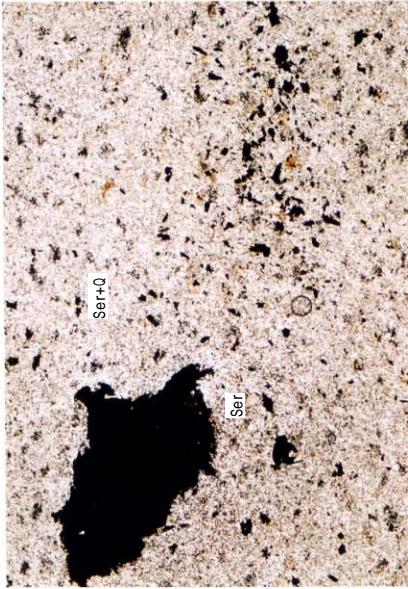
02MR-K034  
× 100  
0.01mm



02MR-K055  
1mm  
× 40

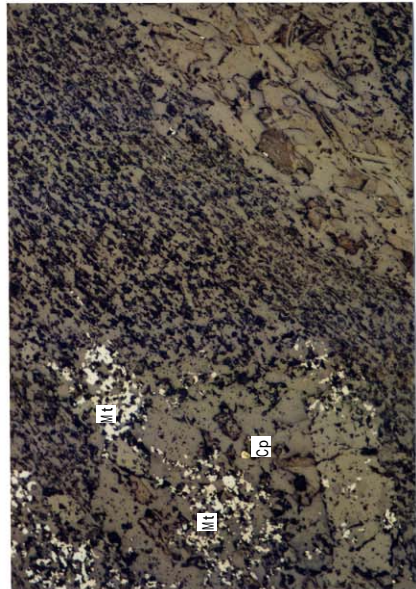
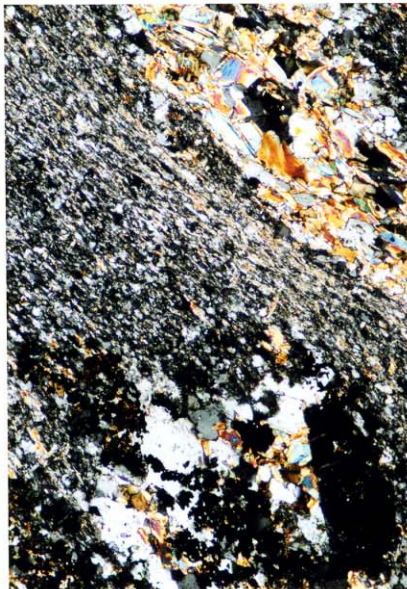
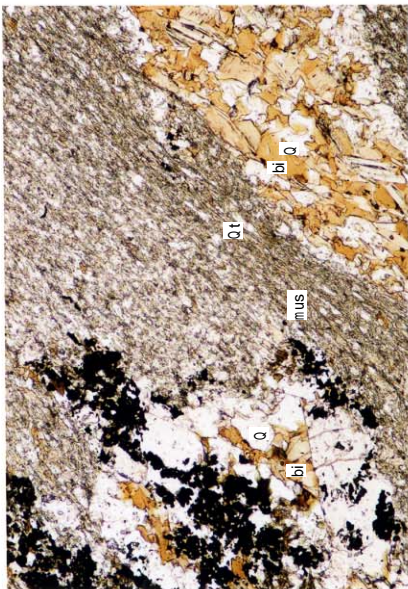


02MR-K054  
1mm  
× 40



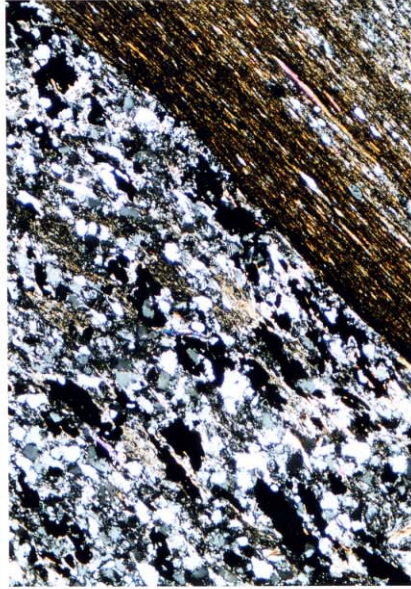
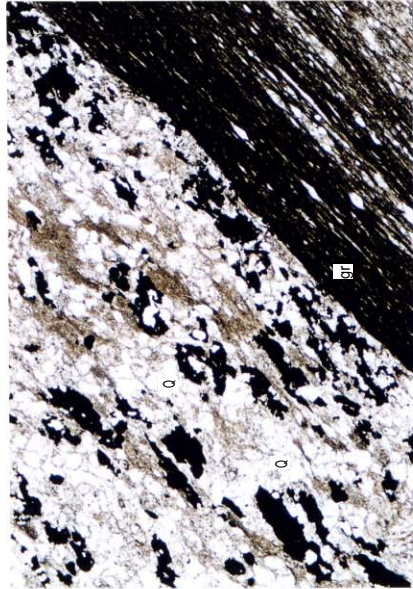
1mm

02MR-K058  
× 40



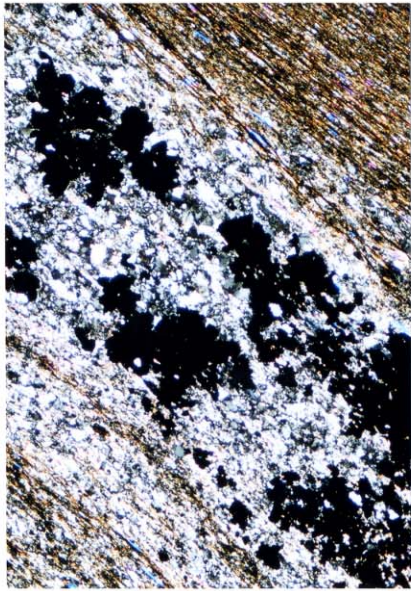
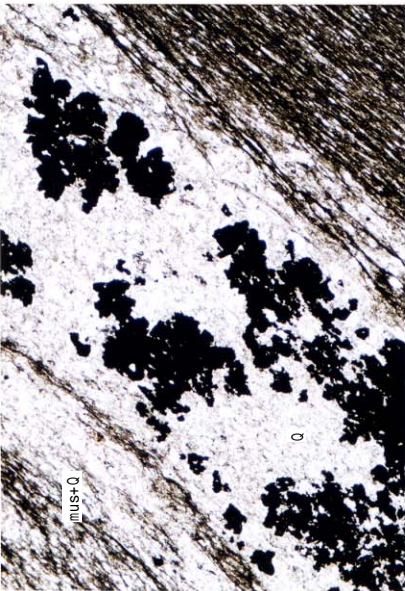
0.01mm

02MR-K056  
× 100



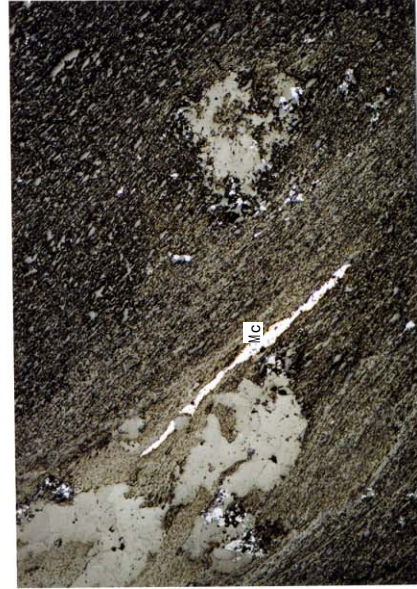
1mm

02MR-K065  
× 40

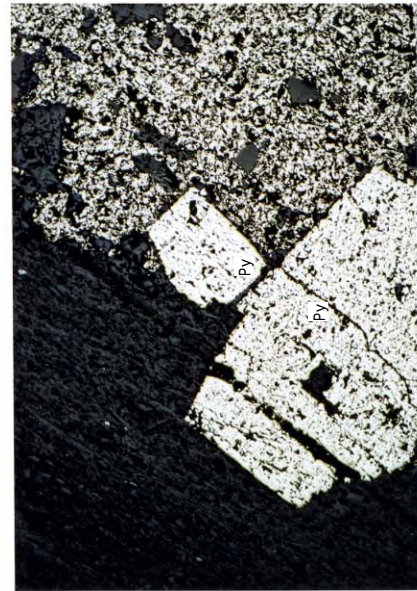
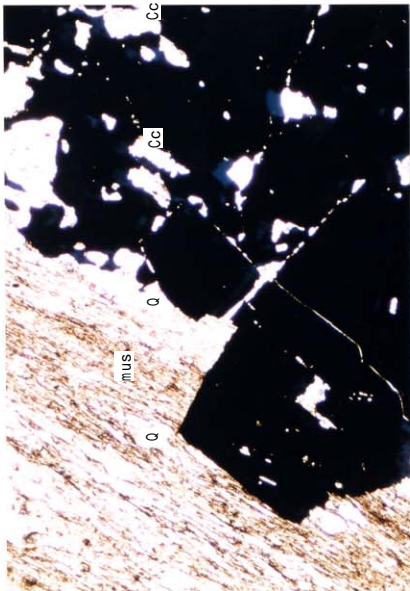


1mm

02MR-K064  
× 40

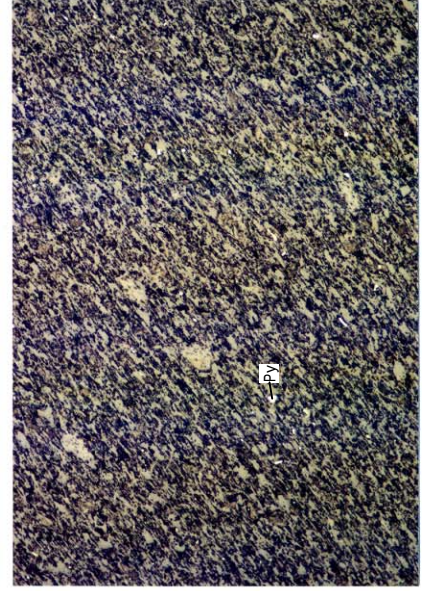
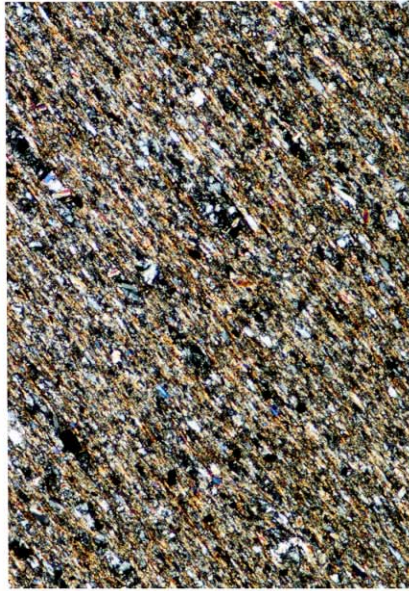
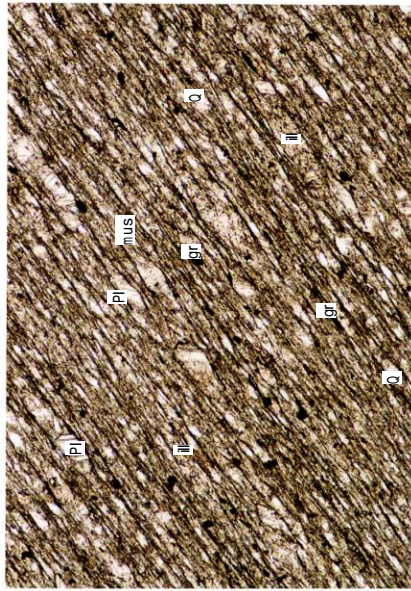


02MR-K076  
1 mm  
× 40

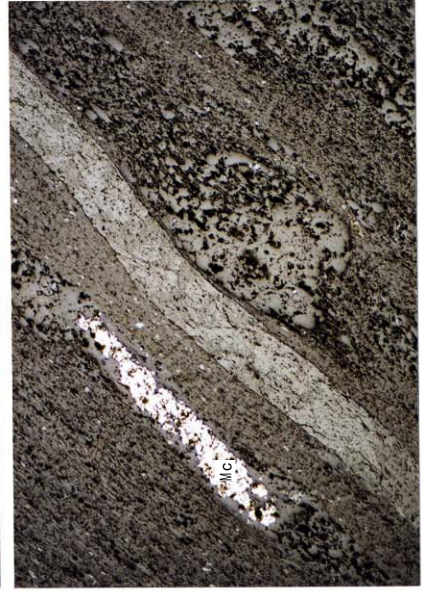
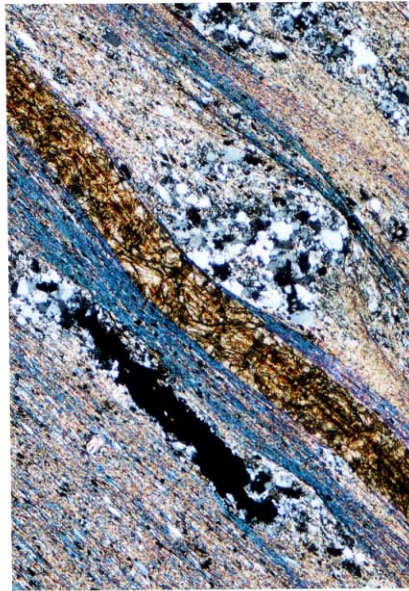
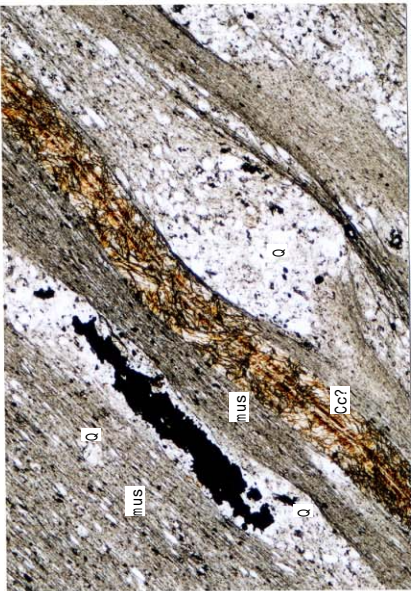


02MR-K066  
1 mm  
× 40

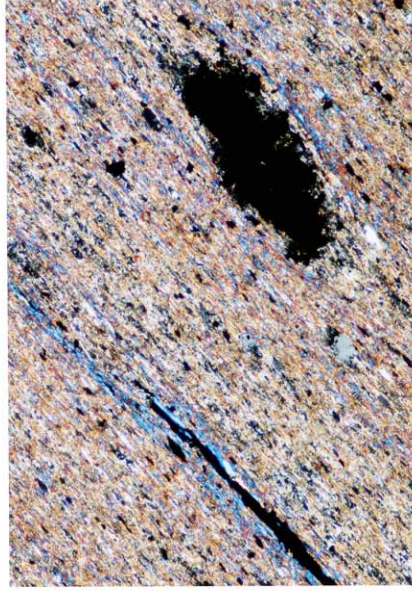
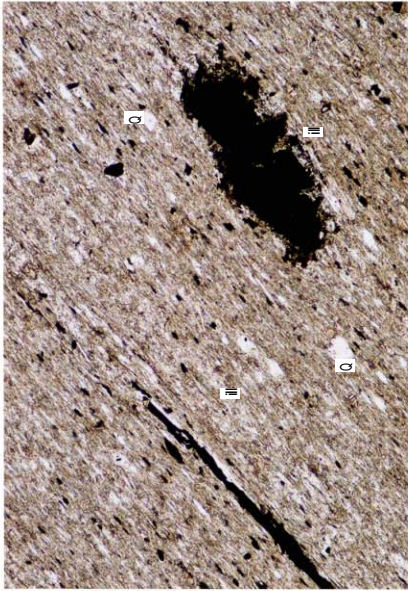




02MR-K083  
× 100  
0.01mm

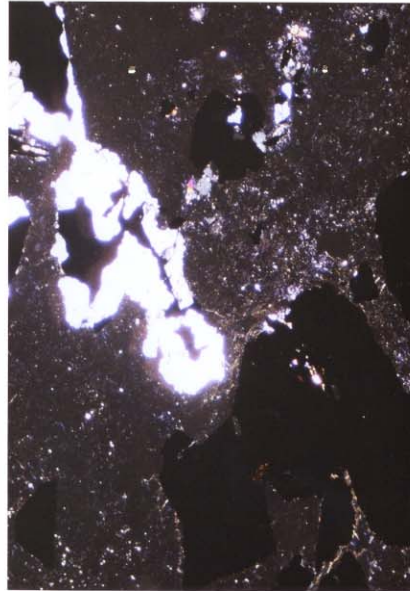
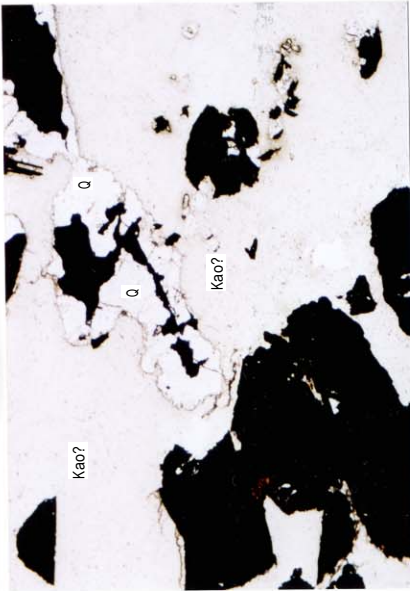


02MR-K077  
× 40  
1mm



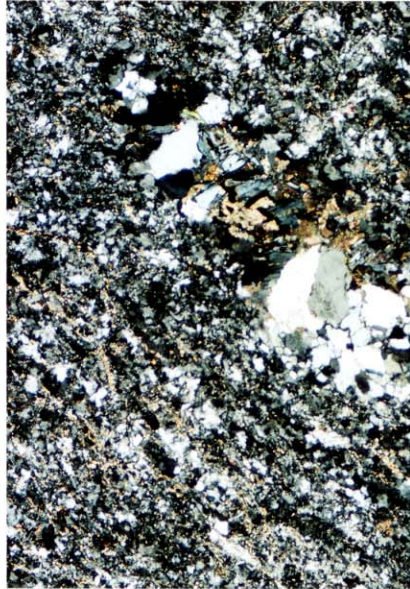
0.01mm

02MR-K098  
× 100



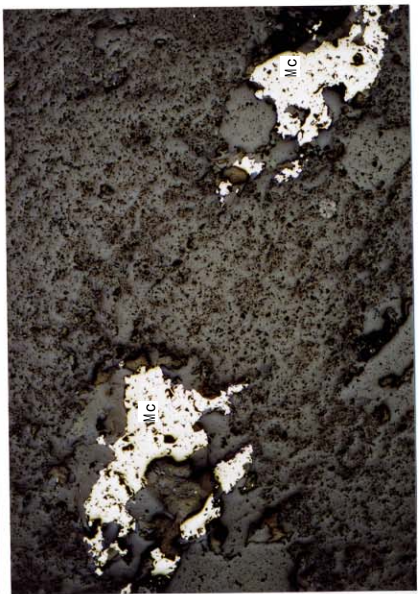
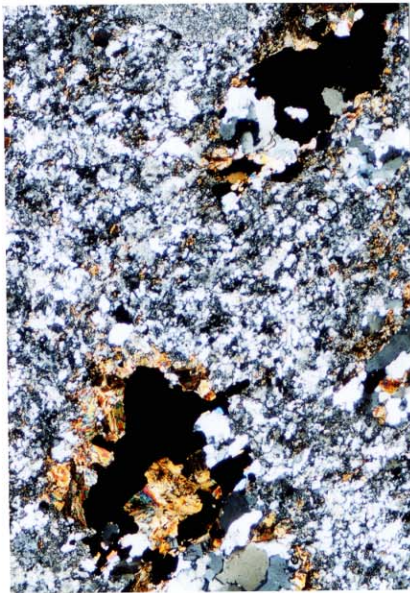
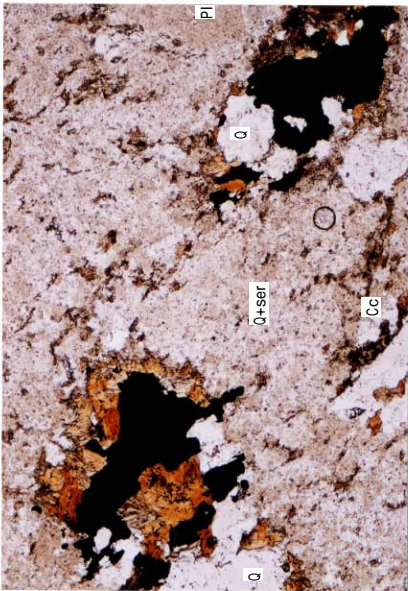
1mm

02MR-K089  
× 40



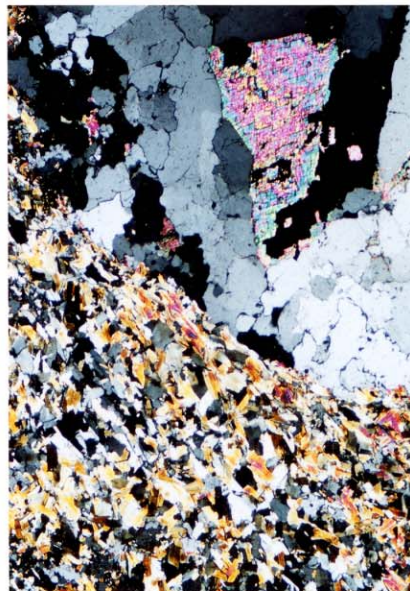
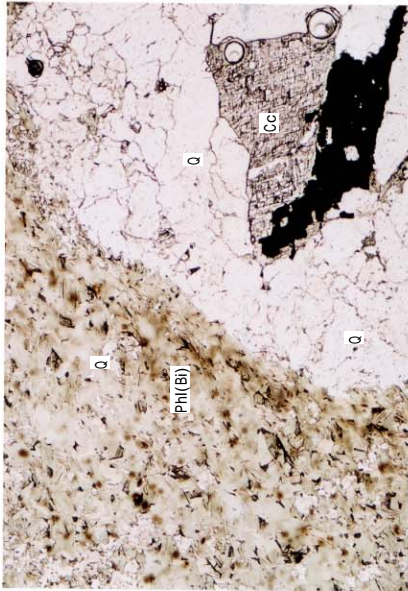
1mm

02MRS-0024  
× 40



1mm

02MRS-007  
× 40



02MRS-0026  
1 mm  
x 40

## **Appendix 4. Microscopic Observation of Thin Sections**

	Discription	Altered minerals		Primary minerals				Ore minerals																
		Mine name		sericite	clay minerals	hornblende	augite	plagioclase	quartz	stannite	acanthite	covellite	hematite	illmenite	magnetite	marcasite(exfoliat	marcasite	arsenopyrite	pyrrhotite	pyrite(euhedral)	chalcopyrite	galena	shpalerite	
02MRN 014	黄鉄鉱は細粒の六面体自形を破壊され、不規則状を示す。磁鉄鉱は脈状を示す。黄銅鉱と磁硫鉄鉱が共生する。閃亜鉛鉱と磁鉄鉱が共生する。閃亜鉛鉱の外側に磁硫鉄鉱が分布する。劈開に沿って白鉄鉱の二次的剥離様変質有り。閃亜鉛鉱に累帯構造はない。黄鉄鉱は菱形状に破壊されている。	Khwadra																						
02MRN 015	多孔質である。黄鉄鉱は六面体自形の集合体からなり、角礫状、楔状を示す。黄銅鉱と黄鉄鉱は共生する。黄銅鉱は石英中に単独で分布する。閃亜鉛鉱と方鉛鉱が共生する。石英は楔状に破壊を受けている。閃亜鉛鉱に累帯構造はない。	Khwadra																						
02MRN 016	黄鉄鉱は六面体自形を示す。六面体自形の黄鉄鉱の間で、黄銅鉱、磁硫鉄鉱、石英は共生する。磁硫鉄鉱の劈開面は一定方向。常状は黄鉄鉱の密度。黄銅鉱と閃亜鉛鉱は共生。閃亜鉛鉱と方鉛鉱は共生。石英は楔状に破壊を受けて、鉱石鉱物間を充填している。黄鉄鉱は劈開に沿って破壊され角礫～不規則状を示す。	Khwadra																						
02MRN 017	磁硫鉄鉱と黄銅鉱共生。黄鉄鉱六面体自形の角礫状で巨晶。磁硫鉄鉱と閃亜鉛鉱自形。黄鉄鉱と閃亜鉛鉱共生。劈開に沿って白鉄鉱の二次的剥離様変質有り。閃亜鉛鉱に累帯構造はない	Khwadra																						
02MRN 018	黄鉄鉱六面体自形の角礫状を示す。黄銅鉱と閃亜鉛鉱共生。方鉛鉱六面体自形。閃亜鉛鉱と方鉛鉱共生。以上が粘土帯。塊状には黄鉄鉱、磁硫鉄鉱、黄銅鉱共生。反射光で黄緑色は双晶、異方性強く、多色性なく、他形を示す。石英は他形を示す。	Khwadra																						
02MRN 019	黄銅鉱と磁硫鉄鉱が共生。黄銅鉱自形で角礫状を示す。石英卓越部に粒状に閃亜鉛鉱、方鉛鉱六面体自形、磁鉄鉱と黄鉄鉱が共生。比較的緻密質。石英は針状磁硫鉄鉱を周囲と平行に含む。劈開に沿って白鉄鉱の二次的剥離様変質有り。閃亜鉛鉱に累帯構造は無し。	Khwadra																						
02MRN 020	黄鉄鉱六面体自形の角礫状を示す。黄鉄鉱の結晶中で方鉛鉱が共生。比較的緻密質。石英脈の中で黄鉄鉱破砕状。石英は他形。劈開に沿って石英は充填。黄鉄鉱の二次的supergene変質有り。	Khwadra																						
02MRN 021	石英との境界に黄銅鉱卓越、帯状(石英+黄銅鉱、磁硫鉄鉱、黄鉄鉱、磁硫鉄鉱)、磁硫鉄鉱の中に白鉄鉱共生。石英は楔状、菱形状に破壊されている。黄鉄鉱は自形で角礫状～不規則状に破壊されている。	Khwadra																						
02MRN 027	磁鉄鉱は繊維状の集合。黄銅鉱の単粒粒有り。黄鉄鉱六面体自形あるいはややコロフォーム状。黄鉄鉱の中に閃亜鉛鉱離溶。やや多孔質。他形の石英多い。楔状、菱形状に破壊されている石英が粒状に集合している。	Khwadra																						
02MRN 028	黄鉄鉱六面体自形で角礫状を示す。黄銅鉱と磁硫鉄鉱が共生。針状の磁硫鉄鉱が石英を切る。石英は大粒～細粒、等粒状、櫛歯状石英が黄鉄鉱中に虫食い状。石英は自形、斑晶縫合構造が一部に見られる。	Khwadra																						

	Discription	Mine name	Altered minerals			Primary minerals				Ore minerals														
			sericite	clay minerals	hornblende	augite	plagioclase	quartz	stannite	acanthite	covellite	hematite	illmenite	magnetite	marcasite(exfoliat	marcasite	arsenopyrite	pyrrhotite	pyrite(euhedral)	chalcopyrite	galena	shpalerite		
02MRN 030	黄鉄鉱濃集部と黄鉄鉱 + 磁硫鉄鉱濃集部あり、石英他形、閃亜鉛鉱に累帯構造無し、割れ目に石英充填、黄鉄鉱は自形で六面体多い、閃亜鉛鉱に累帯構造無し。	Khwadra																						
02MRN 032	黄鉄鉱六面体自形、黄銅鉱 + 磁硫鉄鉱共生、閃亜鉛鉱中に黄銅鉱病変(線状)、方鉛鉱、閃亜鉛鉱、黄鉄鉱共生、白鉄鉱、磁硫鉄鉱共生、石英他形、石英脈の近くで磁硫鉄鉱は針状、石英脈との境界は粘土 + 閃亜鉛鉱、劈開に沿って白鉄鉱の二次的剥離様変質有り、閃亜鉛鉱に累帯構造無し。	Khwadra																						
02MRN 036	黄鉄鉱六面体自形で円礫 ~ 亜角礫を示す、また一部にコロフォーム状を示す、黄銅鉱自形有り、磁硫鉄鉱の量で帯状、磁硫鉄鉱細粒部有り、石英は他形、閃亜鉛鉱中に黄銅鉱病変有り、比較的緻密質、石英脈有り、閃亜鉛鉱に累帯構造無し。	Khwadra																						
02MRN 039	黄鉄鉱六面体自形で円礫 ~ 亜角礫を示す、黄銅鉱と黄鉄鉱の共生著しい、磁硫鉄鉱中に白鉄鉱共生、劈開に沿って白鉄鉱の二次的剥離様変質有り、石英他形、閃亜鉛鉱に累帯構造無し。	Khwadra																						
02MRN 041	磁硫鉄鉱と黄鉄鉱共生、石英中に単独で分布、黄銅鉱とお磁硫鉄鉱共生、石英は自形または列ストライク状、黄鉄鉱は自形で不規則型。	Khwadra																						
02MRN 043	白鉄鉱、磁硫鉄鉱共生、石英中に単独で分布、黄銅鉱と磁硫鉄鉱共生、閃亜鉛鉱と方鉛鉱共生、磁硫鉄鉱は黄鉄鉱の骸晶を示す、石英はレンズ状に充填、他形。	Khwadra																						
02MRN 046	黄鉄鉱六面体自形で角礫状を示す、黄銅鉱と磁硫鉄鉱共生、石英粒多い、方鉛鉱、閃亜鉛鉱共生、方鉛鉱は黄鉄鉱粒間中、石英は他形、劈開に沿って白鉄鉱の二次的剥離様変質有り、閃亜鉛鉱に累帯構造無し。	Khwadra																						
02MRN 047	黄鉄鉱六面体自形で角礫状を示す、白鉄鉱含む、磁硫鉄鉱中に閃亜鉛鉱、方鉛鉱共生、閃亜鉛鉱中に黄銅鉱病変(弱い)、劈開に沿って白鉄鉱の二次的剥離様変質有り、閃亜鉛鉱に累帯構造無し、石英他形、石英 + 輝石集合の礫有り、褶曲構造有り。	Khwadra																						
02MRN 048	方鉛鉱、磁硫鉄鉱共生、閃亜鉛鉱に置換、自形の黄鉄鉱なし、方鉛鉱と黄銅鉱共生、閃亜鉛鉱中に黄銅鉱病変有り(弱い)、石英他形だが縫合構造、針状、黄鉄鉱自形角礫 ~ 円礫状を示すもの僅かに有り、劈開に沿って白鉄鉱の二次的剥離様変質有り、閃亜鉛鉱に累帯構造無し。	Khwadra																						
02MRN 049	黄鉄鉱六面体自形で角礫 ~ 亜角礫を示す、他形閃亜鉛鉱、楯菌状石英発達、劈開に沿って白鉄鉱の二次的剥離様変質有り。	Khwadra																						

	Discription	Mine name	Altered minerals			Primary minerals				Ore minerals														
			sericite	clay minerals	hornblende	augite	plagioclase	quartz	stannite	acanthite	covellite	hematite	illmenite	magnetite	marcasite(exfoliat	marcasite	arsenopyrite	pyrrhotite	pyrite(euhedral)	chalcopyrite	galena	shpalerite		
02MRN 054	磁硫鉄鉍と黄銅鉍共生，石英針状に破碎，斜長石短冊状に自形，方鉛鉍六面体自形，閃亜鉛鉍細粒で丸い粒の集合，モヤモヤ質，	Khwadra																						
02MRN 057	石英中に樑状，針状の磁硫鉄鉍，短冊状集合の閃亜鉛鉍，櫛歯状石英，黄鉄鉍は自形で不規則型を示す，劈開に沿って白鉄鉍の二次的剥離様変質有り，	Khwadra																						
02MRN 058	黄鉄鉍なし，閃亜鉛鉍卓越，石英脈で切られている，モヤモヤ石英，モヤモヤ粘土，石英他形，閃亜鉛鉍に累帯構造無し，	Khwadra																						
02MRN 060	石英中に黄銅鉍単独，黄鉄鉍なし，磁硫鉄鉍中に黄銅鉍脈，石英は縫合構造，粘土モヤモヤ，	Khwadra																						
02MRN 062	白鉄鉍と磁硫鉄鉍共生，黄銅鉍は細粒，黄銅鉍と閃亜鉛鉍共生，針状石英，	Khwadra																						
02MRN 065	磁硫鉄鉍緻密質，石英中に黄銅鉍，黄鉄鉍，磁硫鉄鉍共生，閃亜鉛鉍中に黄銅鉍病変(線状)，石英自形で縫合構造有り，斜長石粘土化，黄銅鉍の周りに磁硫鉄鉍，閃亜鉛鉍に累帯構造無し，	Khwadra																						
02MRN 068	自形六面体黄鉄鉍は角礫状を示す，黄鉄鉍中に方鉛鉍有り，黄銅鉍と磁硫鉄鉍共生，磁硫鉄鉍の劈開に沿って二次的変質の黄鉄鉍卓越，閃亜鉛鉍中に黄銅鉍病変(弱い)，黄鉄鉍中に閃亜鉛鉍，自形石英，モヤモヤ石英，黄鉄鉍は自形で不規則型を示す，劈開に沿って白鉄鉍の二次的剥離様変質有り，	Khwadra																						
02MRN 069	黄鉄鉍六面体自形で角礫状を示す，方鉛鉍，閃亜鉛鉍共生，黄鉄鉍中に閃亜鉛鉍，方鉛鉍含む，脈の石英は自形，樑状，針状，脈状に方鉛鉍，磁硫鉄鉍，纖維状のゼリサイト，黄鉄鉍は自形で不規則型を示す，劈開に沿って白鉄鉍の二次的剥離様変質有り，充填している石英は他形，細粒石英卓越部有り，	Khwadra																						
02MRN 080	緻密質，やや多孔質，黄銅鉍鉍染状，石英他形，閃亜鉛鉍に累帯構造無し，	Jebilet																						
02MRN 083	黄鉄鉍他形で散点状に分布する，白鉄鉍に六面体有り，白鉄鉍，磁硫鉄鉍共生，方鉛鉍，閃亜鉛鉍，白鉄鉍共生，比較的緻密質，石英針状，閃亜鉛鉍に累帯構造無し，	Draa Sfa																						



	Discription	Mine name	Altered minerals			Primary minerals				Ore minerals															
			sericite	clay minerals	hornblende	augite	plagioclase	quartz	stannite	acanthite	covellite	hematite	illmenite	magnetite	marcasite(exfoliat	marcasite	arsenopyrite	pyrrhotite	pyrite(euhedral)	chalcopyrite	galena	shpalerite			
02MRN 084	自形黄鉄鉱なし、磁硫鉄鉱中に黄鉄鉱鉄染状、凝灰角礫岩様に斜長石斑晶集合、石英斑晶集合有り。	Draa Sfa																							
02MRN 085	黄鉄鉱六面体自形僅かにあり、石英中に針状の磁硫鉄鉱、白鉄鉱が一定方向に引き延ばされている。対岸との整合性はない。流れ(褶曲)の同じ形態で硫化物が削られている(褶曲している)。石英斑晶有り、細粒石英集合(クリストライト)有り。	Draa Sfa																							
02MRN 086	黄鉄鉱六面体自形僅かにあり、石英中に黄銅鉱、石英は他形、細粒石英の集合。	Draa Sfa																							
02MRN 087	黄鉄鉱六面体自形細粒で角礫～亜角礫で劈開による破碎著しい。白鉄鉱・磁硫鉄鉱と共生。黄銅鉱と磁硫鉄鉱共生。閃亜鉛鉱中に黄銅鉱病変(弱い)。石英他形針状	Draa Sfa																							
02MRN 088	黄鉄鉱六面体自形で角礫～亜角礫を示す。黄鉄鉱粒間に黄銅鉱有り。褶曲著しい。自形黄鉄鉱との関係があり、黄鉄鉱が後で晶出したものではない。褶曲は黄鉄鉱で邪魔されている。褶曲穏やかなところもある。石英他形有り。	Draa Sfa																							
02MRN 089	黄鉄鉱六面体自形で不規則に破碎されている。白鉄鉱の中に閃亜鉛鉱含む。緑色片岩中には針状の磁硫鉄鉱。閃亜鉛鉱中に黄銅鉱病変有り。石英自形、等粒状。閃亜鉛鉱に累帯構造無し。	Draa Sfa																							
02MRN 094	黄銅鉱は単独で石英脈中に有り。黄鉄鉱の中に磁硫鉄鉱有り。方鉛鉱の周囲に閃亜鉛鉱。粘土の中に石英粒自形。黄鉄鉱は自形で不規則状或いはコロフォーム状。黄鉄鉱と閃亜鉛共生。閃亜鉛鉱に累帯構造無し。	Hajar																							
02MRN 095	黄銅鉱と磁硫鉄鉱が共生。黄銅鉱と方鉛共生。黄銅鉱は微量、多孔質。石英他形。閃亜鉛鉱に累帯構造無し。	Hajar																							
02MRN 096	黄鉄鉱緻密質で不規則型、その中に黄鉄鉱脈状緻密質部有り。石英自形。	Hajar																							
02MRN 097	石英中に黄鉄鉱、閃亜鉛共生。閃亜鉛脈有り。黄鉄鉱自形。石英自形。繊維状ゼリサイト有り。黄鉄鉱自形で六面体あるいはコロフォーム状。	Hajar																							

	Mine name	Discription	Altered minerals			Primary minerals				Ore minerals														
			sericite	clay minerals	hornblende	augite	plagioclase	quartz	stannite	acanthite	covellite	hematite	illmenite	magnetite	marcasite(exfoliat	marcasite	arsenopyrite	pyrrhotite	pyrite(euhedral)	chalcopyrite	galena	shpalerite		
02MRN 098	Hajar	黄鉄鉱、磁硫鉄鉱母岩中で針状、黄銅鉱、磁硫鉄鉱、黄鉄鉱共生、石基は石英卓越、黄鉄鉱自形で六面体あるいはコロフォーム状、石英他形、																						
02MRN 099	Hajar	黄銅鉱は単独で石英中、黄鉄鉱と黄銅鉱共生、石英他形、																						
02MRN 100	Hajar	黄銅鉱は単独で石英中、黄鉄鉱自形は細かく破碎、黄銅鉱と磁硫鉄鉱共生、石英斑晶集合縫合構造有り、石英円礫状に破碎、																						
02MRN 102	Hajar	磁硫鉄鉱の周りに粘土鉱物(セリサイト)が付随、石英自形斑晶集合縫合構造、																						
02MRN 103	Hajar	方鉛鉱、磁硫鉄鉱、黄銅鉱共生、石英斑晶自形細粒、																						
02MRN 105	Hajar	方鉛鉱卓越、方鉛鉱六面体自形、方鉛鉱中に白鉄鉱単独含む、方鉛鉱中に黄銅鉱単独含む、黄鉄鉱自形なし、比較的緻密質、石英他形、																						
02MRN 106	Hajar	方鉛鉱他形、黄鉄鉱六面体自形微量、石英針状、黄鉄鉱六面体自形で不規則に破碎されている、黄鉄鉱は自形で不規則型を示す、劈開に沿って白鉄鉱の二次的剥離様変質有り、閃亜鉛鉱に累帯構造無し、																						
02MRN 107	Hajar	微細粒の黄鉄鉱有り、磁硫鉄鉱中に他形閃亜鉛鉱あり、黄鉄鉱は他形、黄鉄鉱脈有り、緻密質、磁硫鉄鉱中に黄鉄鉱が円状に共生、劈開の内側がより共生(置換)して分布、閃亜鉛鉱に累帯構造無し、																						
02MRN 108	Hajar	鉍染状、黄鉄鉱と黄銅鉱共生、磁硫鉄鉱と黄銅鉱共生、石英自形、石英は粘土鉱物と共生、黄鉄鉱は自形でコロフォーム状、																						
02MRN 109	Hajar	方鉛鉱卓越部では黄銅鉱と方鉛鉱共生、磁硫鉄鉱卓越部では磁硫鉄鉱と黄鉄鉱共生、石英他形、針状、境界部では石英と黄銅鉱が卓越、磁硫鉄鉱中に黄鉄鉱が円状に共生、劈開の内側がより共生(置換)して分布、黄鉄鉱は自形で不規則型を示す、劈開に沿って白鉄鉱の二次的剥離様変質有り、閃亜鉛鉱に累帯構造無し、																						

	Mine name	Discription	Altered minerals			Primary minerals				Ore minerals														
			sericite	clay minerals	hornblende	augite	plagioclase	quartz	stannite	acanthite	covellite	hematite	illmenite	magnetite	marcasite(exfoliat	marcasite	arsenopyrite	pyrrhotite	pyrite(euhedral)	chalcopyrite	galena	shpalerite		
02MRN 110	Hajar	自形六面体黄鉄鉱の集合、或いは一部コロフォーム状、磁硫鉄鉱と黄銅鉱の集合、石英中に単独で晶出、黄鉄鉱と閃亜鉛鉱の共生(閃亜鉛鉱は斑点状)、石英自形斑晶集合縫合構造。																						
02MRN 111	Hajar	磁硫鉄鉱(中心部)と方鉛鉱(周縁部)共生、脈状、石英中に黄鉄鉱六面体自形有り、石英自形、斜長石針状纖維状集合。																						
02MRN 112	Hajar	磁硫鉄鉱と方鉛鉱共生、黄銅鉱と方鉛鉱共生、脈状、単独、石英自形。																						
02MRN 113	Hajar	方鉛鉱卓越、磁硫鉄鉱と方鉛鉱共生、磁硫鉄鉱卓越部有り、層状、母岩との境界に黄銅鉱含む、石英自形																						
02MRN 114	Hajar	磁硫鉄鉱卓越部が層状、粒は不規則型、黄銅鉱と磁硫鉄鉱が共生、方鉛鉱単独、方鉛鉱と磁硫鉄鉱共生、層状に方鉛鉱並ぶ、石英には石英、セリサイト卓越、黄鉄鉱自形で不規則型或いはコロフォーム状を示す。																						
02MRN 115	Hajar	鉱物との同一層準で石英の斑晶多い、破碎されている、黄銅鉱、方鉛鉱、磁硫鉄鉱共生、磁硫鉄鉱卓越部には黄鉄鉱自形有り、黄銅鉱は単独、石英には石英、セリサイト卓越、黄鉄鉱自形で不規則型或いはコロフォーム状を示す、閃亜鉛鉱に累帯構造無し。																						
02MRN 116	Hajar	下位より、黄銅鉱 + 磁硫鉄鉱 + 閃亜鉛鉱 黄鉄鉱 + 閃亜鉛鉱とともに石英 黄鉄鉱 + 閃亜鉛鉱 + 閃亜鉛鉱 + 粘土鉱物 黄鉄鉱 + 閃亜鉛鉱 + 石英 黄鉄鉱 + 閃亜鉛鉱 磁硫鉄鉱 + 閃亜鉛鉱 + 石英 + 粘土鉱物 黄鉄鉱 磁硫鉄鉱 が層状に分布、黄鉄鉱は自形で不規則型或いはコロフォーム状を示す、石英他形、自形、石英発達。																						
02MRN 117	Jebilet	?																						
02MRN 118	Frizen	黄銅鉱と黄鉄鉱共生、黄鉄鉱の中に方鉛鉱共生、方鉛鉱と黄銅鉱共生、方鉛鉱・閃亜鉛鉱、黄銅鉱共生、石英自形虫食いする、黄鉄鉱は自形で六面体を示す、閃亜鉛鉱に弱い累帯構造有り?、閃亜鉛鉱はやや黄色い内部反射																						
02MRN 119	Frizen	石英中に黄鉄鉱六面体自形、破碎され針状、多孔質、方鉛鉱、閃亜鉛鉱共生、破碎された黄鉄鉱中に方鉛鉱、白鉄鉱含む、石英自形斑晶集合縫合構造。																						



	Discription	Altered minerals		Primary minerals				Ore minerals																
		Mine name	Frizen	Frizen	Frizen	Frizen	Frizen	Kettara	Dras faa	Dras faa	Dras faa	Dras faa	Dras faa	Dras faa	Dras faa	Dras faa	Dras faa	Dras faa	Dras faa	Dras faa	Dras faa	Dras faa	Dras faa	
02MRN 136	閃亜鉛鉱中に黄鉄鉱の割れ目に充填、石英中に黄銅鉱単独晶出、黄銅鉱、閃亜鉛鉱・黄鉄鉱共生、黄銅鉱の周りに銅藍、未詳鉱物(閃亜鉛鉱より青灰色、異方性有り；磁鉄鉱?)、列状に分布、閃亜鉛鉱中に黄銅鉱病変有り、石英他形、粘土モヤヤ、黄鉄鉱は自形六面体、閃亜鉛鉱に累帯構造無し、																							
02MRN 137	閃亜鉛鉱中に黄銅鉱病変、磁硫鉄鉱と黄銅鉱共生、石英自形、クリストライト晶出、黄鉄鉱と方鉛鉱共生(黄鉄鉱の割れ目充填)、黄鉄鉱は自形で不規則状で一部はコロフォーム状、閃亜鉛鉱に累帯構造無し、																							
02MRN 138	石英中で磁硫鉄鉱針状、黄銅鉱と磁硫鉄鉱共生、石英他形で破碎され針状、微褶曲、クリストライト集合、黄鉄鉱は針状、																							
02MRN 139	黄銅鉱部：磁硫鉄鉱と黄鉄鉱共生、石英中の黄銅鉱は破碎され粒の周りに微細の黄銅鉱礫有り、楕圓状石英、方鉛鉱部：方鉛鉱、磁硫鉄鉱、閃亜鉛鉱、黄鉄鉱の共生、黄鉄鉱は自形で破碎を受け、亜円礫～円礫状を示す、石英自形、																							
02MRN 140	細粒の自形黄鉄鉱亜角礫状の集合、黄銅鉱染状、黄鉄鉱中に閃亜鉛鉱共生、多孔質、石英他形、																							
02MRN 138-2	球状硫化鉱物の集合(フランボイド様)、石英中に一粒だけ破碎礫状黄銅鉱有り(後の脈か)、石英は脈状、方鉛鉱だけの球状集合有り、溶けて粒状になったものか?																							
02MRN 142-2	脈状、黄鉄鉱は角礫破碎状、鉱染状、石英自形で縫合構造有り、																							
02MRN 143-2	石英楔状・レンズ状に破碎、白鉄鉱自形、白鉄鉱・磁硫鉄鉱と共生、石英脈状、磁硫鉄鉱中で黄銅鉱が裂罫に沿って二次的変質、磁硫鉄鉱卓越部と閃亜鉛鉱卓越部縞状に有り、白鉄鉱双晶著しい、閃亜鉛鉱に累帯構造無し、																							
02MRN 144	磁硫鉄鉱・方鉛鉱・白鉄鉱、閃亜鉛共生、石英粒の褶曲構造有り、散点状、やや流理構造、石英は石英卓越針状集合多い、閃亜鉛鉱に累帯構造無し、																							
02MRN 145	石英破碎、磁硫鉄鉱、方鉛鉱、白鉄鉱、閃亜鉛共生、各鉱物が著しく破碎されて楔状多い、流理構造、石英他形、閃亜鉛鉱に累帯構造無し、																							

	Discription	Mine name	Altered minerals		Primary minerals				Ore minerals															
			sericite	clay minerals	hornblende	augite	plagioclase	quartz	stannite	acanthite	covellite	hematite	illmenite	magnetite	marcasite(exfoliat	marcasite	arsenopyrite	pyrrhotite	pyrite(euhedral)	chalcopyrite	galena	shpalerite		
02MRN 146	磁硫鉄鉱針状、磁硫鉄鉱・黄銅鉱共生、磁鉄鉱繊維状集合、母岩の石英は石英と粘土鉱物斑晶有り、石英細粒集合、半自形、	Dras faa																						
02MRN 147	磁硫鉄鉱、黄銅鉱、閃亜鉛鉱、方鉛鉱共生、石英稜状針状他形、黄鉄鉱六面体自形、閃亜鉛鉱に累帯構造無し、	Dras faa																						
02MRN 148	黄銅鉱緻密質、黄銅鉱は石英の中に含まれる、粘土鉱物の中に閃亜鉛鉱、石英半自形、	Dras faa (400ml)																						
02MRN 149	黄銅鉱・磁硫鉄鉱共生、閃亜鉛鉱・黄銅鉱・磁硫鉄鉱共生、石英自形で縫合構造有り、繊維状の粘土鉱物、斜長石双晶有り、	Dras faa (400ml)																						
02MRN 150	多孔質、磁硫鉄鉱卓越部有り、閃亜鉛鉱が一定方向に並び、閃亜鉛鉱卓越部有り、石英は針状で同一方向に並び、石英他形、閃亜鉛鉱に累帯構造無し、	Dras faa (400ml)																						
02MRN 151	石英脈の中に黄鉄鉱自形六面体一部コロフォーム状、母岩礫中に磁鉄鉱、石英自形で縫合構造有り、	Dras faa (400ml)																						
02MRN 154	脈状、黄鉄鉱は六面体自形、黄銅鉱は脈際、石英粒は微褶曲、脈の中の石英は自形、クワストライト、	Kettara																						
02MRN 155	脈状、黄銅鉱は単独晶出、脈は破砕を受けている、石英は針状、黄鉄鉱は自形不規則状、	Kettara																						
02MRN 156	磁鉄鉱は粒状、多孔質、黄鉄鉱は自形六面体、磁硫鉄鉱・黄鉄鉱・黄銅鉱は脈状(層状)、石英流褶曲有り、脈の中の石英は自形、	Kettara																						
02MRN 157	黄鉄鉱自形で円礫～亜円礫状或いはコロフォーム状を示す、黄鉄鉱、黄銅鉱共生、石英他形、	Kettara																						

	Discription	Mine name	Altered minerals			Primary minerals				Ore minerals																	
			sericite	clay minerals	hornblende	augite	plagioclase	quartz	stannite	acanthite	covellite	hematite	illmenite	magnetite	marcasite(exfoliat	marcasite	arsenopyrite	pyrrhotite	pyrite(euhedral)	chalcopyrite	galena	shpalerite					
02MRN 158	泥質岩中に細粒自形六面体黄鉄鉱・赤鉄鉱脈 + 黄鉄鉱・石英自形。	Kettara																									
02MRN 159	脈状、石英粒間をクラスタ状に硫化物、多孔質、黄鉄鉱濃集部、黄銅鉱濃集部、黄銅鉱・黄鉄鉱共生、石英他形、黄鉄鉱重円礫 - 重角礫で自形で破砕を受けている。石英他形で縫合構造有り。	Kettara																									
02MRN 160	黄鉄鉱自形、黄銅鉱他形、単独晶出もある。黄鉄鉱脈状、黄銅鉱、黄鉄鉱共生、磁鉄鉱粒状、母岩礫間を石英が充填、針状磁鉄鉱は石英の褶曲と同じ方向、石英は他形、黄鉄鉱自形で六面体で重角礫に破砕されている。	Kettara																									
02MRN 161	黄鉄鉱六面体自形で角礫状(細粒～粗粒)に破砕されている。磁鉄鉱脈状、石英他形。	Kettara																									
02MRN 162	黄銅鉱は石英との境界で自形晶出、黄銅鉱単独晶出、石英との境界部程細かい黄鉄鉱六面体自形、石英他形、セリサイト充填。	Kettara																									
02MRN 163	黄鉄鉱六面体自形、黄銅鉱と磁鉄鉱共生、方鉛鉱単独晶出、黄銅鉱単独晶出、黄銅鉱中に石英の楔状、黄鉄鉱細粒自形、石英他形。	Kettara																									
02MRN 164	母岩はデイスサイト(石英斑晶有り)、方鉛鉱、黄銅鉱、磁鉄鉱、黄鉄鉱はそれぞれ粒状に晶出、石英他形で	Kettara																									
02MRN 165	黄鉄鉱・黄銅鉱・磁鉄鉱共生、磁硫鉄鉱・白鉄鉱・黄銅鉱共生、黄鉄鉱・黄銅鉱共生、多孔質、石英は楔状に破砕され、一定方向で磁硫鉄鉱の中に分布する。黄銅鉱は長く引き延ばされている。黄銅鉱卓越部と磁硫鉄鉱卓越部、母岩の石英は粘土鉱物卓越。	Kettara																									
02MRN 166	多孔質、磁鉄鉱粒状、磁硫鉄鉱自形、磁硫鉄鉱、磁鉄鉱、黄銅鉱共生、石英粒と黄銅鉱共生。	Kettara																									
02MRN 167	多孔質、黄銅鉱、磁硫鉄鉱共生、閃亜鉛鉱、磁硫鉄鉱共生、方鉛鉱、閃亜鉛鉱自形、石英自形。	Kettara																									





表) 岩石鑑定結果一覧表 (火成岩)

試料名	02MRS 001	02MRS 002	02MRS 003	02MRS 004	02MRS 005	02MRS 006	02MRS 008	02MRS 009	02MRS 0010	02MRS 0011	02MRS 0012	02MRS 0013
岩石名	流紋岩	トーナラル岩質 マイロナイト	トーナラル岩質 マイロナイト	流紋岩	トーナラル岩質 マイロナイト	流紋岩	トーナラル岩質 マイロナイト	流紋岩	粘板岩	流紋岩質 溶結凝灰岩	砂岩ホルン フェルス	メタドレライト
接触変成 動力変成		○破断・細粒化 動的再結晶	○破断・細粒化 動的再結晶		○破断・細粒化 動的再結晶		○破断・細粒化 動的再結晶		○スレート劈開 プレジヤンクト-		○基質の透緑閃 石化	○普通輝石の透 緑閃石化
熱水変質	○	○	○	○	○	○	○	○				
構造・組織	斑状組織	圧砕組織(モル タル組織)	圧砕組織(モル タル組織)	斑状組織	圧砕組織(モル タル組織)	斑状組織	圧砕組織(モル タル組織)	斑状組織	片理	溶結構造	グラノブラステ イック組織	オフイティック 組織
構成鉱物・粒 径	斑晶: 2.5mm 斜長石	斑晶: 2.5mm 斜長石	斑晶: 3mm 斜長石	斑晶: 2.5mm 斜長石	斑晶: 2.5mm 斜長石	斑晶: 2.5mm 斜長石	斑晶: 2.5mm 斜長石	斑晶: 12mm 斜長石	斑晶: 0.1mm 石英, (長石)	斑晶・結晶片 : 未確認	斑晶: 0.1mm (0.2mm) 石英(斜長石)	主要構成鉱物: 2 mm 透緑閃石, 斜長 石, (金風鉱物)
基質(石基)	0.1mm 石英, 斜長石 黒雲母~酸化緑 泥石	0.15mm 石英, 斜長石 絹雲母, 方解石 (緑泥石)	0.1mm 石英, 斜長石 方解石, 絹雲母 (緑泥石)	0.1mm 黒雲母~酸化緑 泥石, 石英, 斜 長石, (絹雲母)	0.1mm 石英, 斜長石 (方解石, 絹雲母 , 緑泥石)	0.15mm 石英, 斜長石 黒雲母~酸化緑 泥石, (絹雲母)	0.1mm 石英, 斜長石 方解石, (絹雲母 ~イライト, 緑 泥石)	0.15mm 石英, 黒雲母 ~酸化緑泥石, 絹雲母	0.1mm 黒雲母~酸化緑 泥石, (絹雲母~ イライト)	0.2mm 石英, 斜長石 黒雲母~酸化緑 泥石, 緑泥石絹 雲母)	透緑閃石(0.1mm , 0.15mm)	
変質鉱物	石英, 黒雲母 ~酸化緑泥石 絹雲母, 方解石	絹雲母, 方解石 (緑泥石)	絹雲母, 方解石 (緑泥石)	黒雲母~酸化緑 泥石, 石英, (絹 雲母, 緑泥石)	方解石, 絹雲母 (方解石, 緑泥石)	石英, 黒雲母 ~酸化緑泥石 (絹雲母)	方解石, (絹雲母 ~イライト, 緑 泥石)	石英, 黒雲母 ~酸化緑泥石, 絹雲母, 緑泥石	酸化緑泥石, (イ ライト)	黒雲母~酸化緑 泥石, 緑泥石絹 雲母)		<変成鉱物> 透緑閃石, 緑泥 石
割れ目(脈) ・レンズ	石英, 黒雲母 ~酸化緑泥石 (方解石)			石英, 黒雲母 ~酸化緑泥石 (沸石, 方解石)		石英(黒雲母 , 方解石)		石英(黒雲母 , 方解石)		石英, 斜長石		

備考) 1. 岩石名は一部簡略化している。 2. 鉱物名で( ) 付きのものは量が微量であることを示す。 3. メタドレライトの「変成変質鉱物」の欄中では、( ) 内の鉱物は少量の変質鉱物を示す。熱水変質作用を受けて生じた再結晶斜長石は「変質鉱物」に含めていない。

試料名	02MRS 0014	02MRS 0015	02MRS 0016	02MRS 0017	02MRS 0018	02MRS 0021	02MRS 0023	02MRS 0029	02MRS 0030	02MRS 0031	02MRS 0032	02MRS 0033
岩石名	酸化緑泥石岩 (ホルンフェルス)	メタドレライイト	メタドレライイト	流紋岩	流紋岩	流紋岩	流紋岩	流紋岩質溶結凝灰 岩質マイロナイト	流紋岩質溶結凝灰 岩質マイロナイト	流紋岩質 溶結凝灰岩	流紋岩質 溶結凝灰岩	緑泥石岩 (凝灰岩)
接触変成 動力変成	○	○	○	○	○	○	○	○	○	○	○	○
熱水変質	△											
構造・組織	グラノブラス ティック組織	オフイテイ ック組織	オフイテイ ック組織	斑状組織	斑状組織	斑状組織	斑状組織	圧砕組織(モ ルタル組織)	圧砕組織(モ ルタル組織)	溶結構造	溶結構造	グラノブラス ティック組織
構成鉱物・粒 径	主要構成鉱物:0 .05mm(0.3mm)> 酸化緑泥石 0.02mm(石英)	主要構成鉱物:2 mm> 透緑閃石, 斜長 石, 緑泥石, (金 属鉄)	主要構成鉱物:2 mm> 透緑閃石, 斜長 石, 緑泥石, (金 属鉄)	斑晶:2.5mm> 斜長石	斑晶:2.5mm> 斜長石	斑晶:2.5mm> 石英, 斜長石	斑晶:1mm> 石英	斑晶:2mm> 石英 ポ-フィロク ラスト:0.4mm (1.5mm)> 石英, 斜長石 石英脈(6mm)>	破断・細粒化粒 子:0.5mm> 石英, 斜長石	斑晶~結晶片: 2mm> 石英	斑晶~結晶片: 2mm> 石英	主要構成鉱物: 0.1~0.2mm> 緑泥石, 結晶片:0.5mm> 石英,(ジルコ ン)
基質(石基)	酸化緑泥石 (石英)	黒雲母~酸化 緑泥石, 緑泥 石, 斜長石 (絹雲母)	酸化緑泥石, 緑 泥石, 石英, (絹雲母, 方解石)	石英, 斜長石 (絹雲母)	石英, 斜長石 (絹雲母)	石英, 斜長石 (絹雲母)	石英, 絹雲母 (黒雲母~酸化 緑泥石, 方解石)	緑泥石, 石英 (絹雲母, 斜長 石)	石英, 斜長石 (絹雲母, 方解 石)	石英, 斜長石 (絹雲母)	石英, 絹雲母 緑泥石	0.1~0.2mm> 緑泥石
変質鉱物	酸化緑泥石 (石英)	<変成変質鉱物> 透緑閃石, 緑泥 石, (緑泥石)	<変成変質鉱物> 透緑閃石, 緑泥 石, (絹雲母, 緑泥石)	酸化緑泥石, 緑 泥石, 石英, (絹雲母, 方解石)	石英, 黒雲母 (酸化緑泥石)	石英, 黒雲母 (酸化緑泥石, 絹雲母, 方解石)	石英, 絹雲母 (黒雲母~酸化 緑泥石, 方解石)	緑泥石, 褐鉄 鉱	緑泥石, (緑 泥石, 絹雲母)	石英, 緑泥石 絹雲母	石英, 絹雲母 緑泥石	緑泥石, (緑 泥石)
割れ目(脈) ・レンズ	酸化緑泥石 (石英)		沸石?			方解石, 石英, 黒雲母~酸化 緑泥石, 絹雲 母, 方解石 緑泥石	石英, (黒雲 母~酸化緑泥 石, 方解石, 絹雲母)	緑泥石, 褐鉄 鉱	緑泥石, 方解 石, 絹雲母			緑泥石

試料名	02MRS 0034	02MRS 0036	02MRS 0038	02MRS 0039	02MRS 0040	02MRS 0042	02MRS 0043	02MRS 0044	02MRS 0045	02MRS 0046	02MRS 0047
岩石名	凝灰質粘板岩	流紋凝灰岩	珪岩	砂岩ホルンフェルス	泥岩ホルンフェルス	緑泥石石英脈岩	粘板岩	凝灰質粘板岩	粘板岩	粘板岩	粘板岩
接触変成 動力変成 熱水変質	○スレート劈開 フレックシャニャット・ ○	○	○細粒化 再結晶	○	○	○破断	○スレート劈開 フレックシャニャット・	○キリング褶曲 スレート劈開 フレックシャニャット・	○キリング褶曲 スレート劈開 フレックシャニャット・	○スレート劈開 フレックシャニャット・	○キリング褶曲 スレート劈開 フレックシャニャット・
構造・組織	片理	溶結構造	圧砕構造	砂質粒子未変成	グラノブラステ イック組織		片理	片理	片理	片理	片理
顕微鏡	構成鉱物・粒径 斑晶・ホーイ グラスト, 結晶片・ 斜長石(電気石) 岩片:流紋岩類	斑晶～結晶片: 3mm> 斜長石, 石英, 斜長石 (電気石)	ホーイグラスト・鉱 物片: 0.2mm 石英, (ジルコ ン, 電気石)	鉱物片: 0.1~0. 2mm(0.4mm) 石英, カリ長石 , 斜長石, (黒雲 母, ジルコン) 岩片: 花崗岩	鉱物片: 0.4mm> 石英, 白雲母 緑泥石, 黒雲母 不透明鉱物	脈鉱物: 20mm< 0.05~0.4mm 石英, 緑泥石 石	鉱物片: 0.1mm> 石英, (長石)	鉱物片: 0.15mm> 石英, (長石)	鉱物片: 0.1mm> 石英, (長石)	鉱物片: 0.1mm> 石英, (長石)	鉱物片: 0.1mm> 石英, (長石)
鏡	絹雲母～イライ ト, 緑泥石, ( 不透明鉱物)	斜長石, 石英 絹雲母, 緑泥石	石英, (絹雲母 ～イライト)	絹雲母～イライ ト, 黒雲母～酸 化緑泥石			絹雲母～イライ ト, 黒雲母～酸 化緑泥石, 方解 石, 緑泥石	緑泥石	絹雲母～イライ ト, 黒雲母～酸 化緑泥石, 石 墨, 緑泥石, 硫 化鉄鉱	絹雲母～イライ ト, 石墨, 緑 泥石, 方解石, 硫化鉄鉱	絹雲母～イライ ト, 石墨, ( 緑泥石), 硫化鉄 鉱
下の	イライト	斜長石, 石英 絹雲母, 緑泥石	イライト	イライト, 酸化 緑泥石		石英, 緑泥石	イライト, 酸化 緑泥石, 方解 石, 緑泥石	緑泥石	イライト, 酸化 緑泥石, 緑泥石, 石	イライト, 緑泥 石, 方解石	イライト, (緑泥 石)
特徴			褐鉄鉱, イライ ト				方解石, 緑泥石 , 緑泥石	石英, 緑泥石 緑泥石	緑泥石, 石英	方解石	石英, 硫化鉄 鉱





## **Appendix 5. Results of X-ray Diffraction Analysis**

# X線回折及び鉱物鑑定試験報告

## 1. 試料調整

- 全試料につき鉄板上で1cm角まで粗砕し、室内にて自然乾燥。
- 粗砕試料から約100gを分取し、振動ミルにて約30秒間磨砕。
- 磨砕試料から約30gを分取し、メノウ乳鉢にて指頭に感じない程度まで磨砕。
- 下記の条件によりX線回折に供した。

## 2. 測定条件

X線回折装置	..	理学電機(株) ガイガーフレックス
対陰極	..	Cu
フィルター	..	Ni
管電圧	..	30 KV
管電流	..	15 mA
カウントフルスケール	..	2000 cps
時定数	..	1 sec
走査速度	..	2° /min
記録紙速度	..	2 cm/min
デバージェンススリット	..	1°
スキヤッタースリット	..	1°
レシービックスリット	..	0.3 mm
走査範囲	..	$2\theta = 2^\circ \sim 40^\circ$

## 3. 解析

- (1) 鉱物鑑定表は全試料にわたる鉱物別相対強度として次表の「X線回折強度分類基準」により作成した。
- (2) X線石英指数解析一覧表は 林正雄氏の計算表による。

解析

別表の鉱物鑑定表は全試料にわたる鉱物別相対強度として下表の基準により作成した

[ X線回折強度分類基準 ]

鉱物 (d値)	バックグランドからのピーク高 (単位 チャート目盛り)			
	◎ (多量)	○ (中量)	△ (少量)	・ (微量)
石英 (3.34)	100以上	99~50	49~10	10未満
クリストバル石 (4.05)				
トリデマイト (4.27)				
斜長石 (3.17)	40以上	39~20	19~10	10未満
カリ長石 (3.30)	20以上	19~10	9~5	5未満
曹長石 (3.20)				
絹雲母 (10.10)	20以上	19~10	9~5	5未満
緑泥石 (7.10)				
カオリン (7.18)				
スメクタイト (15.15)				
幅広セリサイト (10.10)				
ハロイサイト (4.42)				
斜プチロル沸石 (8.93)	20以上	19~10	9~5	5未満
モルデン沸石 (3.48)				
濁沸石 (4.16)				
束沸石 (4.05)				
角閃石 (8.40)	20以上	19~10	9~5	5未満
普通輝石 (3.00)				
柴蘇輝石 (3.18)				
滑石 (9.45)				
明ばん石 (2.99)	45以上	44~20	19~10	10未満
石膏 (2.87)				
重晶石 (3.45)				
ジャロサイト (3.08)				
方解石 (3.03)	45以上	44~20	19~10	10未満
アンケライト (2.89)				
菱鉄鉱 (2.80)				
菱苦土石 (2.74)				
黄鉄鉱 (2.71)	10以上	9~5	4~3	3未満
赤鉄鉱 (2.70)				
鋭錐石 (3.52)				
ルチル (3.25)				
針鉄鉱 (4.18)				
白鉄鉱 (2.69)				



MMAJ X線鉱物鑑定一覽表 (モロッコ王国 マラケシュ・テクナ地域 コア)

No.	試料名	酸										塩										珪										備考	処理						
		石					粘					土					鉱					物					沸							石					その他
		石英	斜長石	カリ長石	曹長石	絹雲母	緑泥石	カオリン	スメクタイト	幅広セサリイト	ハロイサイト	S/S	C/S	斜方沸石	モルデン石	濁沸石	束沸石	方沸石	ワイライト	角閃石	普通輝石	黒雲母	硫酸塩鉱物	硫酸塩鉱物	硫酸塩鉱物	硫酸塩鉱物	方解石	アンケイト	菱鉄鉱	菱苦土	黄鉄鉱	ルチル	閃亜鉛鉱	石墨	紅砒	白鉄	EG		
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	◎			△	◎	◎																																

◎ : 多量    ○ : 中量    △ : 少量    ・ : 微量    ? : 不明  
 S/S : 絹雲母-スメクタイト混合層粘土鉱物  
 C/S : 緑泥石-スメクタイト混合層粘土鉱物

MMAJ X線鉱物鑑定一覽表 (モロッコ王国 マラケシュ・テクナ地域 コア)

No.	試料名	酸										塩										珪				備考	処理							
		石					粘					土					鉱					物						珪						
		石英	斜長石	斜長石	曹長石	絹雲母	緑泥石	カオリン	スメクタイト	幅広セサリイト	ハロイサイト	S/S	C/S	斜方沸石	モルデン石	濁沸石	束沸石	方沸石	ワイラカイト	角閃石	普通輝石	黒雲母	硫酸塩鉱物	硫酸塩鉱物	炭酸塩鉱物	その他の鉱物				備考	処理			
		石英	斜長石	斜長石	曹長石	絹雲母	緑泥石	カオリン	スメクタイト	幅広セサリイト	ハロイサイト	S/S	C/S	斜方沸石	モルデン石	濁沸石	束沸石	方沸石	ワイラカイト	角閃石	普通輝石	黒雲母	硫酸塩鉱物	硫酸塩鉱物	炭酸塩鉱物	黄鉄鉱	閃亜鉛鉱	石	紅砒			白鉄	EG	
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	◎			◎	◎	◎																											

◎ : 多量    ○ : 中量    △ : 少量    ・ : 微量    ? : 不明  
 S/S : 絹雲母-スメクタイト混合層粘土鉱物  
 C/S : 緑泥石-スメクタイト混合層粘土鉱物



MMAJ X線鉱物鑑定一覽表 (モロッコ王国 マラケシュ・テクナ地域 コア)

No.	試料名	酸										塩										珪				備考	処理									
		石					粘					土					鉱					物														
		石英	斜長石	斜長石	曹長石	絹雲母	緑泥石	カオリン	スメクタイト	幅広セサリイト	ハロイサイト	S/S	C/S	斜方沸石	モルデン石	濁沸石	束沸石	方沸石	ワイラカイト	角閃石	普通輝石	黒雲母	硫酸塩鉱物	硫酸塩鉱物	炭酸塩鉱物	その他の鉱物				備考	処理					
		石英	斜長石	斜長石	曹長石	絹雲母	緑泥石	カオリン	スメクタイト	幅広セサリイト	ハロイサイト	S/S	C/S	斜方沸石	モルデン石	濁沸石	束沸石	方沸石	ワイラカイト	角閃石	普通輝石	黒雲母	硫酸塩鉱物	硫酸塩鉱物	炭酸塩鉱物	黄鉄鉱	閃亜鉛鉱	石	紅砒			白鉄	EG			
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	◎				◎																														

◎ : 多量    ○ : 中量    △ : 少量    ・ : 微量    ? : 不明  
 S/S : 絹雲母-スメクタイト混合層粘土鉱物  
 C/S : 緑泥石-スメクタイト混合層粘土鉱物







## **Appendix 6. Results of Chemical analysis**



## **Results of Chemical analysis**

### **Volcanic Rocks**

Table ) Results of chemical 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	(Andesite)	Tuff	Rhyolite	Rhyolite	Rhyolite	Rhyolite	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 chemical 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 abundance

MORB (ave)	02MRS15 (K Aicha)		02MRS16 (K Aicha)		02MRS13 (Jubilet)		02MRS15 (K Aicha)		02MRS16 (K Aicha)		
	abundance	normalised	abundance	normalised	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)

La (ppm)	02MRS15 (K Aicha)		02MRS16 (K Aicha)		02MRS13 (Jubilet)		02MRS17 (Hajar)		
	abundance	normalized	abundance	normalized	abundance	normalized	abundance	normalized	
Ce	1.6011	35.6	16.6	10.368	12	7.495	96.1	60.021	
Pr	0.2419	5.3	21.91	10.335	1.9	7.854	11.6	47.954	
Nd	1.1892	25.5	21.443	10.764	9.9	8.325	44.2	37.168	
Sm	0.3865	7.1	18.37	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)

La (ppm)	02MRS33(Drasfa)		02MRS2(Safsafa)		02MRS2(Safsafa)		02MRS1(Khwadra)		02MRS4 Khwadra		02MRS18 Hajar		02MRS3 Safsafa		02MRS6 Khwadra		02MRS5 Safsafa	
	abundance	normalized	abundance	normalized	abundance	normalized	abundance	normalized	abundance	normalized	abundance	normalized	abundance	normalized	abundance	normalized	abundance	normalized
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
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
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
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
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
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
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
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
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
0.1423	1.2	8.433	0.7	4.919	0.7	4.919	3.1	21.785	2.1	14.758	5.3	12.649	0.6	4.216	2.7	18.974	0.5	3.514
0.4167	3.4	8.159	2	4.8	2	4.8	9.1	21.838	6.5	15.599	5.8	12.719	1.7	4.08	8.1	19.438	1.7	4.08
0.0643	0.5	7.776					1.5	23.328	1.1	17.107	0.8	12.442			1.4	21.773		
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
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
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
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
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
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
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
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
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
0.0351	1.3	37.037	0.9	25.641			0.9	25.641	0.6	17.094	0.9	25.641			0.9	25.641		
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
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
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
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
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
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
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
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
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
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)

La (ppm)	02MRS34		02MRS12		02MRS11	
	Drasfa	Jubilat	Jubilat	Jubilat	Jubilat	Jubilat
Ce	51.5	83.89	29.3	47.728	77.4	126.079
Pr	114	71.201	57.9	36.163	181.5	113.36
Nd	13.7	56.635	6.9	28.524	22.5	93.014
Sm	53.1	44.652	25.8	21.695	91.6	77.027
Eu	12.5	32.342	5.2	13.454	21.3	55.11
Gd	1.2	8.242	1.6	10.989	2.6	17.857
Tb	13.4	26.131	5	9.75	21.7	42.317
Dy	2.3	24.468	0.8	8.511	3.8	40.426
Ho	14.6	22.891	4.6	7.212	23.8	37.316
Er	3	21.082	0.9	6.325	5	35.137
Tm	8.5	20.398	2.7	6.479	14.7	35.277
Yb	1.3	20.218			2.4	37.325
Lu	8.3	20.029	2.4	5.792	15.6	37.645
	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 (sc/g x 10exp-5)	%Ar-40	%K	Sample No or Reference
Jubiliet							
Jubiliet(West of Kechnet)	Sandstone hornfels	Whole rock	248 ± 8	0.304, 0.305	92.1, 92.2	0.29, 0.30	02MRS012
Jubiliet(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	Calcaline 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)
Oukhrbane	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	Ilite	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	Ilite	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
	Schist	Shale	Shale	Shale	Homfels	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	Amzourh	Imarine	Tameslouht	Tameslouht
	Shale	Shale	Schist	Schist	Schist	Schist	Schist	Sandstone	Shale	Shale	Quartzite	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	Jbw1_Sarhlef Shale	Jbw1_Sarhlef Schist	Jbw1_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	Kettara	Kettara	Kettara	Kettara
	Schist	Schist	Schist	Schist	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

Area	unit	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	
		Khwadra Schist	Khwadra Shale	Khwadra Shale	Khwadra Shale	Khwadra Schist	Khwadra Schist	Khwadra Schist	Khwadra Schist	Khwadra Shale	Khwadra Shale	Khwadra Schist	Khwadra Shale	Khwadra Schist	Khwadra Schist	Khwadra Shale	Khwadra Schist	Khwadra Schist	Saf Safa 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	<0.2	<0.2	<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	3.5
As	ppm	<2	820	56	3	20	<2	<2	33	<10	<10	4	594	78	<2	33	1195	11	11	35
B	ppm	<10	<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	241.0	<10
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	<0.5
Bi	ppm	<2	<2	<2	<2	<2	<2	<2	6	<2	<2	3	<2	<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	0.2	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	<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	25.3
Cr	ppm	230	190	290	140	220	150	180	140	160	250	470	200	180	150	1130	150	150	110	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	7.3
Cu	ppm	20	30	427	27	107	61	210	2	17	40	35	124	36	31	147	826	25	11	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	5.15
Ga	ppm	10	10	10	20	10	10	10	10	10	20	20	20	10	10	10	20	20	10	10
Ga	ppm	18	24	19	31	17	25	49	25	24	16	25	21	25	29	14	26	26	33	33
Hf	ppm	8	16	5	8	8	6	9	5	7	8	6	7	6	5	5	6	7	4	4
Hg	ppm	<1	<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	0.16
La	ppm	20	20	20	20	10	50	30	40	40	40	50	30	40	40	20	50	50	30	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	1.8
Mn	ppm	1025	454	558	790	432	665	367	1195	450	519	800	1060	552	804	641	989	425	490	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	<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	0.01
Nb	ppm	13	13	13	24	13	20	31	18	20	12	20	20	20	21	8	19	19	14	14
Ni	ppm	30	3	18	34	31	43	66	45	35	27	23	27	40	55	136	43	44	43	43
P	ppm	560	230	670	1090	490	600	810	750	480	530	600	650	540	720	590	740	500	810	810
Pb	ppm	19	6	17	9	9	9	4	5	5	6	14	12	5	20	40	26	4	9	9
Rb	ppm	142	597	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	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	0.11
Sb	ppm	<2	<2	<2	2	<2	<2	<2	<2	<2	<2	3	<2	<2	<2	8	22	<2	<2	<2
Sc	ppm	4	2	1	3	2	1	1	2	2	7	6	4	3	1	2	2	2	2	2
Sn	ppm	7	4	9	9	4	9	28	7	6	3	6	8	4	5	4	19	7	4	4
Sr	ppm	53	50	20	15	9	6	8	25	11	115	63	36	15	10	29	<1	3	20	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	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	1
Th	ppm	12	22	12	21	11	18	28	18	16	11	16	13	18	18	8	20	16	11	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	<0.01
Tl	ppm	<1	<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	2.7
V	ppm	99	<5.00	101	172	98	136	218	123	147	81	184	128	148	188	92	192	181	113	113
W	ppm	3	5	2	4	2	4	5	3	3	3	3	3	3	3	3	3	3	4	4
Zn	ppm	159	40	618	169	86	67	71	54	89	71	86	78	94	172	217	111	50	186	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	133.7

Area	unit	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	
		Saf Safa Slate	Saf Safa Schist	Saf Safa Slate	Saf Safa Slate	Saf Safa Schist	Kerkoze Slate	S Kerkoze Shale	K Aiche Sandstone	N Bensliman Shale	T Lachach Shale	Hadat gossa Shale	J Hadat Sandstone	J Hadat Limestone	K Aicha Slate	K Aicha Shale	K Aicha Shale	K Aicha Shale	K Aicha 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	<0.2	<0.2	<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	2.93
As	ppm	9	24	<2	7	4	<2	<2	4	<2	<2	2	2	<2	9	5	30	4	4	4
B	ppm	<10	<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	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	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bi	ppm	2	3	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	2	<2	<2	<2	<2	<2	<2
Cd	%	6.75	5.14	0.59	2.76	0.28	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	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	0.7	<0.5	<0.5	1	15.6	<0.5	<0.5	<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	23	14
Cr	ppm	70	120	110	180	140	160	140	170	130	140	210	150	30	140	140	140	130	150	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	2.3
Cu	ppm	25	30	3	32	23	1	2	26	3	118	4	29	59	47	52	69	303	3	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	5.28
Ga	ppm	40	10	10	10	10	10	10	10	20	10	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	22
Hf	ppm	4	4	5	5	6	7	7	7	7	5	7	8	6	6	6	4	5	7	7
Hg	ppm	<1	<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	0.11
La	ppm	20	<10	50	20	50	30	30	10	30	30	20	10	<10	30	20	20	20	30	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	1.93
Mn	ppm	2630	2720	193	423	134	145	268	613	688	442	141	418	1135	548	363	461	662	726	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	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	0.01
Nb	ppm	9	11	15	14	20	21	20	7	18	21	16	16	2	15	20	17	15	16	16
Ni	ppm	29	38	8	70	36	42	37	35	36	45	11	17	4	37	54	54	49	37	37
P	ppm	530	490	630	1080	840	710	580	770	600	630	510	360	380	450	650	620	500	500	500
Pb	ppm	28	22	4	18	40	2	3	4	3	<2	6	56	4	5	8	34	1120	5	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	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	0.02
Sb	ppm	<2	<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	2
Sn	ppm	3	3	4	3	5	1	5	2	7	6	8	3	2	2	6	4	10	4	4
Sr	ppm	430	254	31	143	27	15	6	5	9	43	78	69	261	6	6	101	2	4	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	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	1.2
Th	ppm	9	13	13	10	17	18	18	7	15	18	14	9	3	12	16	14	13	14	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	0.01
Ti	ppm	<1	<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	3.1	1.6	3.1	4.2	3.1	4.2	5.6	3	3.5
V	ppm	76	106	126	156	142	153	132	57	109	215	110	48	128	182	174	174	119	129	129
W	ppm	2	4	4	4	4	2	6	3	5	5	2	3	<1.00	4	3	3	3	3	3
Zn	ppm	169	135	46	56	33	13	17	56	38	503	45	63	152	41	111	174	9580	91	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	222

Area	unit	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	
		K Aicha	Benshleman	Benshleman	Schist	Lachach	Lachach	Lachach	Lachach	Amzoourh	Imarine	Quartzite	Tamesloutit	Hajar	Hajar	Hajar	Hajar	Hajar	Hajar	
		Shale	Shale	Schist	Schist	Schist	Schist	Schist	Sandstone	Shale	Shale	Shale	Limestone	Sandstone	Hornfels	Shale	Sandy shale	Shale	Shale	
Ag	ppm	<0.2	<0.2	<0.2	<0.2	2.6	5.78	2.43	2.03	<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	1.94	5.78	2.43	1.61	2.18	1.61	2.18	0.45	0.41	5.19	2.91	4.47	1.87	4.19	4.19	1.33
As	ppm	2	13	<0.7	5	134	16	19	78	4	12	4	7	2	2	3	3	<2	<2	9
B	ppm	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Ba	ppm	218	613	599	545	75.6	682	489	805	805	296	90.7	240	508	704	634	545	3.9	3.9	704
Be	ppm	<0.5	<0.5	<0.5	1.1	<0.5	0.5	0.5	1.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1	0.5	<0.5	<0.5	0.7
Bi	ppm	<2	<2	<2	<2	<2	<2	<2	<2	<2	3	<2	<2	<2	<2	<2	<2	<2	<2	8
Ca	%	0.24	0.28	0.14	0.51	0.08	0.18	0.23	0.23	0.14	12.05	0.08	>15.0	0.71	0.51	2.09	0.3	0.09	0.09	0.16
Cd	ppm	<0.5	<0.5	0.5	<0.5	17	<0.5	<0.5	<0.5	1.6	0.9	<0.5	1.3	1	<0.5	<0.5	<0.5	2.1	<0.5	<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	139.5	20.2
Cr	ppm	160	140	140	130	100	120	120	120	110	80	230	20	130	180	130	150	70	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	<0.1	6.4
Cu	ppm	41	41	80	2	56	910	53	77	70	17	9	13	4	10	32	6	1280	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	>15.0	3.84
Ga	ppm	10	10	20	10	40	10	10	10	10	10	<10	10	20	20	20	20	10	10	10
Ga	ppm	22	26	24	25	33	25	25	18	22	13	4	3	21	23	27	22	17	24	24
Hf	ppm	5	4	4	5	7	5	6	7	7	5	12	3	6	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	<1
K	%	0.22	0.46	0.09	0.16	0.02	0.12	0.17	0.17	0.4	0.85	0.12	0.05	1.62	1.46	1.34	0.63	0.01	0.01	0.26
La	ppm	20	30	50	20	<10	20	40	20	40	20	10	<10	30	30	30	40	<10	<10	10
Mg	%	0.94	1.23	1.34	0.81	2.88	0.99	0.99	0.76	0.5	1.04	0.08	0.28	5.22	0.95	1.26	0.79	1.93	1.93	1.28
Mn	ppm	523	989	697	270	985	2100	566	453	1255	467	291	2200	986	677	608	458	1683	1683	397
Mo	ppm	<2.00	2	<2.00	2	5	4	6	20	4	5	3	7	5	5	4	3	2	2	6
Na	%	0.04	0.02	<0.01	0.02	<0.01	0.01	0.01	0.02	0.01	0.18	<0.01	0.01	0.03	0.2	0.46	0.06	<0.01	<0.01	0.02
Nb	ppm	20	20	19	25	16	17	15	16	16	12	5	3	15	20	19	18	11	11	16
Ni	ppm	53	44	30	36	36	53	53	46	43	22	10	21	39	23	39	17	20	20	44
P	ppm	680	800	640	630	390	730	420	590	360	360	670	190	550	390	600	510	340	340	660
Pb	ppm	3	9	5	4	20	3440	19	11	40	12	8	123	7	5	13	13	9	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	<0.2	175.7
S	%	0.01	0.14	0.16	0.38	2.78	0.1	0.13	0.01	0.73	0.73	0.04	0.03	0.01	0.03	1.06	0.08	4.7	4.7	2.04
Sb	ppm	<2	<2	<2	<2	<2	4	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Sc	ppm	12	2	2	3	7	1	1	1	1	3	<1	1	10	12	4	2	6	6	<1
Sn	ppm	3	5	12	7	7	5	5	6	18	4	3	3	3	5	6	11	4	4	15
Sr	ppm	10	6	2	8	13	5	5	6	12	324	7	224	19	44	115	16	1	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	4.2	92.4
Ta	ppm	1.4	1.4	1.3	1.9	4.1	1.7	1.4	1.3	1.4	1.4	0.5	0.5	1.3	1.6	1.4	2	0.9	0.9	1.5
Th	ppm	17	18	18	19	17	13	16	13	17	10	6	3	14	15	16	16	9	9	18
Ti	%	0.09	0.1	0.02	0.1	0.02	0.01	0.01	0.01	0.04	0.15	<0.01	<0.01	0.19	0.23	0.19	0.08	0.02	0.02	0.01
Tl	ppm	<1	<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	2.5	2	3.3	3.3	3.3	2.3	1.9	1.3	1.7	2.8	2.6	2.8	2.6	1.8	1.8	3
V	ppm	198	130	116	155	177	125	204	159	146	95	37	45	164	158	194	167	82	82	158
W	ppm	3	3	5	4	5	6	6	6	7	5	4	4	5	5	5	5	6	6	7
Zn	ppm	66	223	45	22	187	7350	96	68	1895	54	28	82	288	59	55	95	167	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	208	159.4

Area	unit	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	
		Hajar Schist	Hajar Sandy shale	Hajar Tuif	Hajar Shale	Hajar Shale	Hajar Shale	Hajar Shale	Algetda Schist	Algetda Schist	Frag el Ma Schist	Sid Bau East Sandy shale	Sid Bau East Shale	JbwI Sarhlef JbwI Sarhlef Shale	Schist	JbwI Sarhlef JbwI Sarhlef Shale	Frizem Shale	Frizem Shale	Frizem 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	<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	2.8
As	ppm	<2	<2	<2	13	10	<2	10	20	20	6	13	23	9	4	14	23	5	5	<2
B	ppm	<10	<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	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	<0.5
Bi	ppm	<2	<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	0.37
Cd	ppm	1.1	0.6	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	1.1	0.7	0.5	1	<0.5	<0.5	<0.5	0.8	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	24.4
Cr	ppm	110	110	120	100	100	140	110	130	120	150	120	130	120	290	120	120	140	110	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	3.5
Cu	ppm	144	3	124	3	1	98	69	25	59	3	15	2	21	60	24	27	94	255	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	8.54
Ga	ppm	20	10	10	20	10	10	10	10	10	<10	10	10	10	10	10	10	10	10	20
Ga	ppm	24	18	29	23	25	24	24	28	27	7	21	29	22	15	25	23	31	32	32
Hf	ppm	4	5	6	5	5	6	7	7	7	5	6	7	7	3	6	8	7	5	5
Hg	ppm	<1	<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	0.2
La	ppm	20	20	40	40	30	30	30	30	30	40	10	50	30	<10	30	30	20	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	1.16
Mn	ppm	1505	1240	530	1075	662	946	1425	1510	1280	100	465	211	719	1250	625	832	559	1685	1685
Mo	ppm	3	7	2	3	4	4	6	4	7	4	6	17	<2.00	<2.00	4	4	5	3	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	0.01
Nb	ppm	15	16	20	16	17	17	19	20	20	21	17	23	19	2	21	23	25	17	17
Ni	ppm	38	38	25	39	37	31	33	45	41	9	34	36	41	65	41	36	60	32	32
P	ppm	720	680	580	530	580	620	250	570	960	310	490	500	620	680	600	410	590	640	640
Pb	ppm	11	9	22	9	6	16	22	36	12	4	9	9	6	7	12	18	31	7	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	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	1.7
Sb	ppm	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	3	3	<2	<2	<2	<2	<2	<2	<2
Sc	ppm	4	1	1	4	2	1	1	1	2	1	1	4	3	22	1	1	1	1	1
Sn	ppm	10	6	19	7	10	9	13	7	6	70	6	7	2	2	4	7	7	7	7
Sr	ppm	7	37	6	6	7	12	10	14	17	147	46	13	22	132	21	10	7	8	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	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	1.4
Th	ppm	16	15	16	17	18	15	17	17	17	17	17	20	16	1	17	18	22	17	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	0.01
Tl	ppm	<1	<1	1	<1	<1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2	<1	<1	<1
U	ppm	2.2	2.4	3.3	2.9	2.7	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	2.8
V	ppm	149	144	213	143	166	197	214	193	194	73	142	208	157	313	185	167	215	164	164
W	ppm	12	8	7	6	9	6	9	6	7	5	6	7	3	2	6	7	7	5	5
Zn	ppm	154	83	253	81	110	351	723	133	129	14	465	173	72	77	83	99	102	163	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	157.2

Area	unit	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-K089-4	02MR-K089-2	02MR-K090	02MR-K091	02MR-K092	02MR-K093
		Frizem Schist	Frizem Schist	Frizem Schist	Frizem Limestone	Frizem Sandy slate	Frizem Shale	Frizem Slate	Ketiara Shale	Ketiara Shale	Draa Sfar Shale	Draa Sfar Shale	Draa Sfar Shale	Draa Sfar Shale	Draa Sfar Shale	Draa Sfar Shale	Draa Sfar Shale	Draa Sfar Shale	Draa Sfar 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	0.4	<0.2	<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	18	20	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	<0.5	0.9	<0.5	<0.5	0.5
Bi	ppm	<2	<2	<2	<2	4	<2	<2	<2	<2	<2	<2	<2	5	<2	<2	<2	<2	<2
Cd	%	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	20	20	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	1.35	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	116	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	1	2	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	3	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



Area	unit	02MR-K094	02MR-K095	02MR-K096	02MR-K097	02MR-K098	02MR-K101	02MRS0043	02MRS0044	02MRS0045	02MRS0046	02MRS0047
		Draa Sfar Shale	Draa Sfar Shale	Draa Sfar Shale	Draa Sfar Shale	Draa Sfar Slate	St/Gedi Haja Tuuf-shist	Kettara Schist	Kettara Schist	Kettara Schist	Kettara Schist	Kettara 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	78	3	16	2	10	16	22
B	ppm	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Ba	ppm	569	617	582	582	780	739	415	353	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	130	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
Se	ppm	14	5	3	11	6	2	2	<1.00	4	4	22
Sn	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	2.17	171.4	116.5	241	184.7	148.4	177.4	145.2	173.4	222	196.2

Table) Descriptors 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	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	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	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	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	582.0	5810.0	381.0	718.0	5808.1	335.0	779399.41	882.27	87.78	3.95	0.24	17.49	0.48
BE	101	0.56	0.49	0.63	0.5	1.7	0.3	0.8	1.5	0.6	0.73	0.36	0.04	1.12	0.24	0.64	0.48
BI	101	1.39	1.17	1.60	1.0	8.0	1.0	1.0	7.0	0.0	1.18	1.09	0.11	3.88	0.24	17.22	0.48
GA	101	1.30	0.77	1.83	0.3	15.0	0.2	1.0	15.0	0.9	7.25	2.69	0.27	3.67	0.24	14.56	0.48
GD	101	0.89	0.44	1.34	0.3	17.0	0.3	0.8	16.8	0.6	5.19	2.28	0.23	6.38	0.24	41.94	0.48
GO	101	19.57	16.55	22.60	17.8	33.5	12.0	22.5	33.6	10.5	234.34	15.31	1.52	5.22	0.24	38.01	0.48
CR	101	148.70	127.38	172.03	130.0	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	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	175.65	29.0	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	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	49.0	21.0	28.0	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	16.0	5.0	7.0	15.0	2.0	3.19	1.78	0.18	1.81	0.24	9.88	0.48
HG	101	0.53	0.51	0.55	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	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	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	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	3280.0	465.0	1020.0	3180.0	555.0	31057.98	557.28	55.45	1.88	0.24	4.88	0.48
MO	101	4.20	3.28	5.12	3.0	34.0	1.0	5.0	33.0	4.0	21.88	4.66	0.46	3.65	0.24	17.93	0.48
NA	101	0.06	0.04	0.08	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	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	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	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	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	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	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	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	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	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	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	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	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	0.2	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	2.0	0.5	0.5	1.5	0.0	0.08	0.25	0.02	4.27	0.24	20.61	0.48
U	101	3.10	2.64	3.56	2.7	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	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	31.0	3.0	5.0	30.5	2.0	12.61	3.65	0.35	4.89	0.24	32.04	0.48
ZN	101	320.02	83.44	556.60	91.0	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	468.0	169.0	227.0	419.5	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	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	2.5908	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	1.2588	2.9228	32.6159	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	0.0298	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	0.0082	0.0082	0.0135	-0.1881	-0.0620
AS	0.1301	0.0567	0.5114	0.0763	-0.1686	-0.5392	0.0160	0.1040	0.3635	-0.0105	0.1271
B	0.1107	0.0142	0.5006	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	0.2828	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	0.2108	-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	0.0195	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	0.0623	-0.1922	-0.0519
EE	-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	-0.1578	0.5625	0.3975	-0.1741	0.3694	0.3008	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
MIN	-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	0.5528	0.5536	-0.0580	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	0.1023	0.1964	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	-0.0968	-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	0.3000	-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	-0.2895	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	-0.2731	0.0365	-0.1406	0.2646	-0.0575	-0.0038	0.0386	0.1283	-0.2470
W	-0.2011	0.4177	-0.2131	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	0.5006	0.3769	0.0245	-0.3450	-0.2979	-0.2454	0.0633	-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
说明	6.1549	5.1783	3.6319	3.4551	2.9636	2.5908	2.5256	1.8049	1.6375	1.4148	1.2568
累计	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	Schist	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 Aicha	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	K_Aicha 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	Arnzoorh	Imarine	Tameslouht	Tameslouht
Rock name	Shale	mudstone	Schist	Schist	Schist	Schist	Schist	Sandstone	Shale	Shale	Quartzite	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-schist	Ore-schist	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	JbwI_Sarhlef	JbwI_Sarhlef	JbwI_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
Rock name	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
Rock name	Shale	Shale	Sandy shale	Shale	Shale	Shale	Shale	Shale	Shale	Shale	Slate	Tuff-schist
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	$\delta^{34}\text{S}$	S(%)	Sample No.	Locality	Rocks	$d^{34}\text{S}$	S(%)
1	02MR-K001	Khwadra	Schist	-8.8	51	02MR-K052	Hajar	Shale	2.2
2	02MR-K002	Khwadra	Shale	-7.2	52	02MR-K053	Hajar	Sandy shale	1.16
3	02MR-K003	Khwadra	Shale	-15.2	53	02MR-K054	Hajar	Shale	3.4
4	02MR-K004	Khwadra	Shale	8.5	54	02MR-K055	Hajar	Shale	7.7
5	02MR-K005	Khwadra	Hornfels	-18.6	55	02MR-K056	Hajar	Schist	3.1
6	02MR-K006	Khwadra	Schist	3.5	56	02MR-K057	Hajar	Sandy shale	4.4
7	02MR-K007	Khwadra	Schist	-13.5	57	02MR-K058	Hajar	Tuff	2.0
8	02MR-K008	Khwadra	Schist	-10.5	58	02MR-K059	Hajar	Shale	4.1
9	02MR-K009	Khwadra	Shale	-14.5	59	02MR-K061	Hajar	Shale	5.0
10	02MR-K010	Khwadra	Shale	-21.0	60	02MR-K062	Hajar	Shale	0.7
11	02MR-K011	Khwadra	Schist	-17.1	61	02MR-K063	Hajar	Shale	-2.9
12	02MR-K012	Khwadra	Shale	-13.7	62	02MR-K064	Algetda?	Schist	17.7
13	02MR-K013	Khwadra	Shale	1.1	63	02MR-K065	Algetda?	Schist	17.1
14	02MR-K014	Khwadra	Schist	-9.9	64	02MR-K066	Frag el Ma	Shale	19.5
15	02MR-K015	Khwadra	Shale	-22.3	65	02MR-K067	Frag el Ma	Schist	14.9
16	02MR-K016	Khwadra	Schist	-14.6	66	02MR-K068	Sid Bau East	Sandy shale	-3.0
17	02MR-K017	Khwadra	Slate	-10.4	67	02MR-K069	Sid Bau East	Shale	5.8
18	02MR-K018	Subsafa	Slate	20.8	68	02MR-K070	Jbwj Sarhile	Shale	3.0
19	02MR-K019	Subsafa	Slate	13.3	69	02MR-K071	Jbwj Sarhile	Schist	4.0
20	02MR-K020	Subsafa	Schist	10.9	70	02MR-K072	Jbwj Sarhile	Shale	9.2
21	02MR-K021	Subsafa	Slate	11.5	71	02MR-K073	Frizem	Shale	-0.5
22	02MR-K022	Subsafa	Shale	11.9	72	02MR-K074	Frizem	Shale	-0.2
23	02MR-K023	Subsafa	Schist	11.9	73	02MR-K075	Frizem	Shale	-0.2
24	02MR-K024	Kerkoze	Shale	10.8	74	02MR-K076	Frizem	Schist	0.4
25	02MR-K025	S Kerkoze	Shale	-1.5	75	02MR-K077	Frizem	Schist	-8.0
26	02MR-K026	K Aicha	Sandstone	6.2	76	02MR-K079	Frizem	Shale	-2.9
27	02MR-K027	N Bensliman	Shale	10.1	77	02MR-K080	Frizem	Limestone	-0.7
28	02MR-K028	Lachach	Shale	23.2	78	02MR-K081	Frizem	Sandy shale	-0.8
29	02MR-K029	J Hadat	Shale	-9.5	79	02MR-K082	Frizem	Shale	-1.0
30	02MR-K030	J Hadat	Sandstone	-12.0	80	02MR-K083	Frizem	Slate	0.2
31	02MR-K031	J Hadat	Limestone	-10.7	81	02MR-K085	Kettara	Shale	3.5
32	02MR-K032	K Aicha	Slate	-23.9	82	02MR-K086	Dræa Sfar	Shale	3.7
33	02MR-K033	K Aicha	Shale	-31.4	83	02MR-K088	Dræa Sfar	Shale	-15.3
34	02MR-K034	K Aicha	Shale	-36.0	84	02MR-K087	Dræa Sfar	Shale	-7.9
35	02MR-K035	K Aicha	Shale	-18.7	85	02MR-K088	Dræa Sfar	Shale	-6.7
36	02MR-K036	K Aicha	Shale	-31.9	86	02MR-K089-a	Dræa Sfar	Shale	-4.7
37	02MR-K037	K Aicha	Shale	-16.9	87	02MR-K089-b	Dræa Sfar	Sandy shale	-0.4
38	02MR-K038	Bensliman	Shale	2.0	88	02MR-K090	Dræa Sfar	Shale	-13.6
39	02MR-K039	Bensliman	Schist	0.6	89	02MR-K091	Dræa Sfar	Shale	-0.1
40	02MR-K040	Bensliman	Schist	-8.5	90	02MR-K092	Dræa Sfar	Shale	-5.7
41	02MR-K041	Lachach	Schist	-1.9	91	02MR-K093	Dræa Sfar	Shale	-3.1
42	02MR-K042	Lachach	Schist	-2.7	92	02MR-K094	Dræa Sfar	Shale	1.8
43	02MR-K043	Lachach	Schist	-11.0	93	02MR-K095	Dræa Sfar	Shale	0.5
44	02MR-K044	Lachach	Sandstone	-6.6	94	02MR-K096	Dræa Sfar	Shale	-4.6
45	02MR-K046	Amzough	Shale	-2.2	95	02MR-K097	Dræa Sfar	Shale	-7.3
46	02MR-K047	Imarine	Shale	1.4	96	02MR-K099	Dræa Sfar	Slate	-4.9
47	02MR-K048	Jameslough	Quartzite	-2.2	97	02MR-K101	Si Gedi Hajar	Tuff-shist	-5.7
48	02MR-K049	Jameslough	Limestone	5.8	98	02MR-S0043	Kettara	Schist	-0.1
49	02MR-K050	Hajar	Sandstone	2.8	99	02MR-S0046	Kettara	Schist	-0.6
50	02MR-K051	Hajar	Hornfels	-0.1	100	02MR-S0047	Kettara	Schist	1.98

Table- ) Statistics of Sulfur Isotope analysis of Sedimentary rocks

Case	100	Mean	-2.3976	Mode	-0.7401	Max	-35.9627	Min	23.1801	Lower 1/4	-8.6368	Upper 1/4	3.5092	Range	59.1427	1/4 Range	12.1460	Variance	121.2878	Standard Division	11.0131	Standard Error	1.1013	skewness	0.2414	ST. Error	kurtosis	0.7919	ST. Error	kurtosis	0.4783
																								confidence interval	-95.000%	+95.000%					
G34S																															