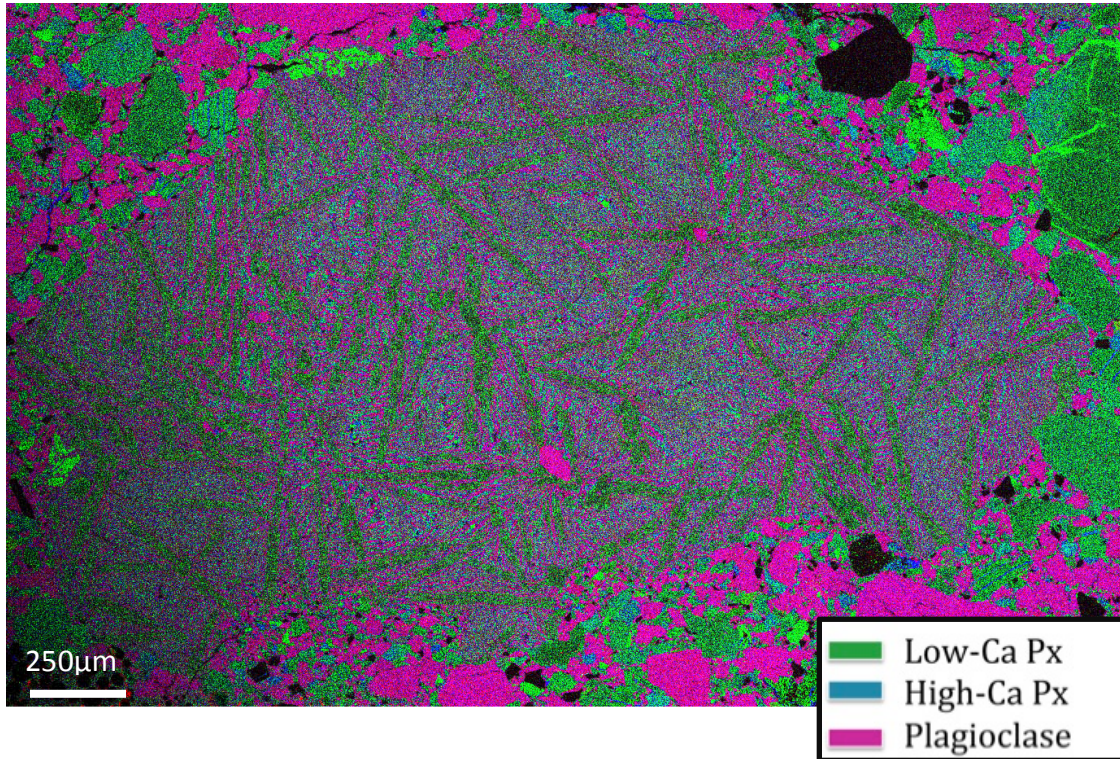


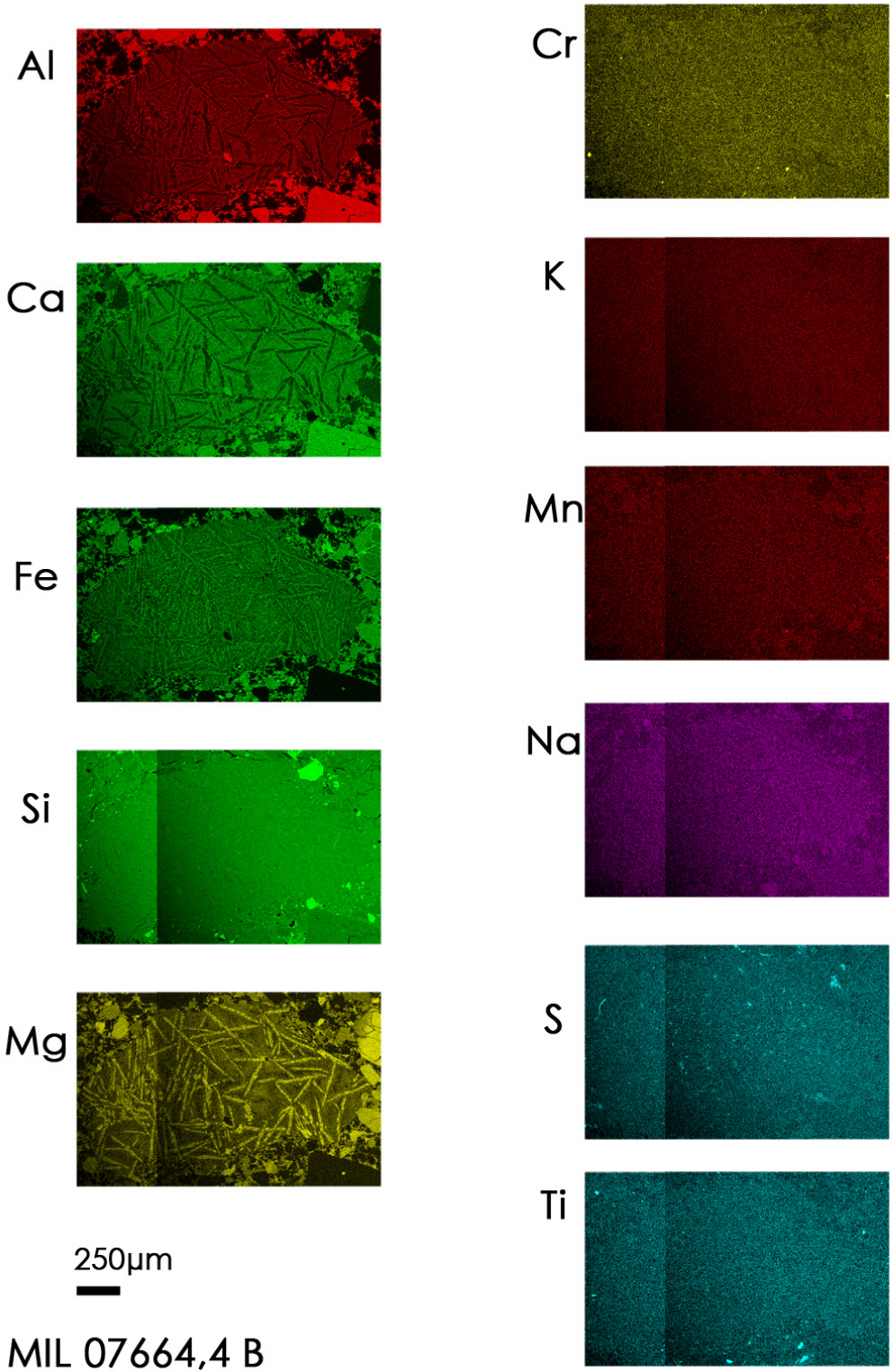
Appendix B - MIL 07664,4B

B1. SEM Mineral Map

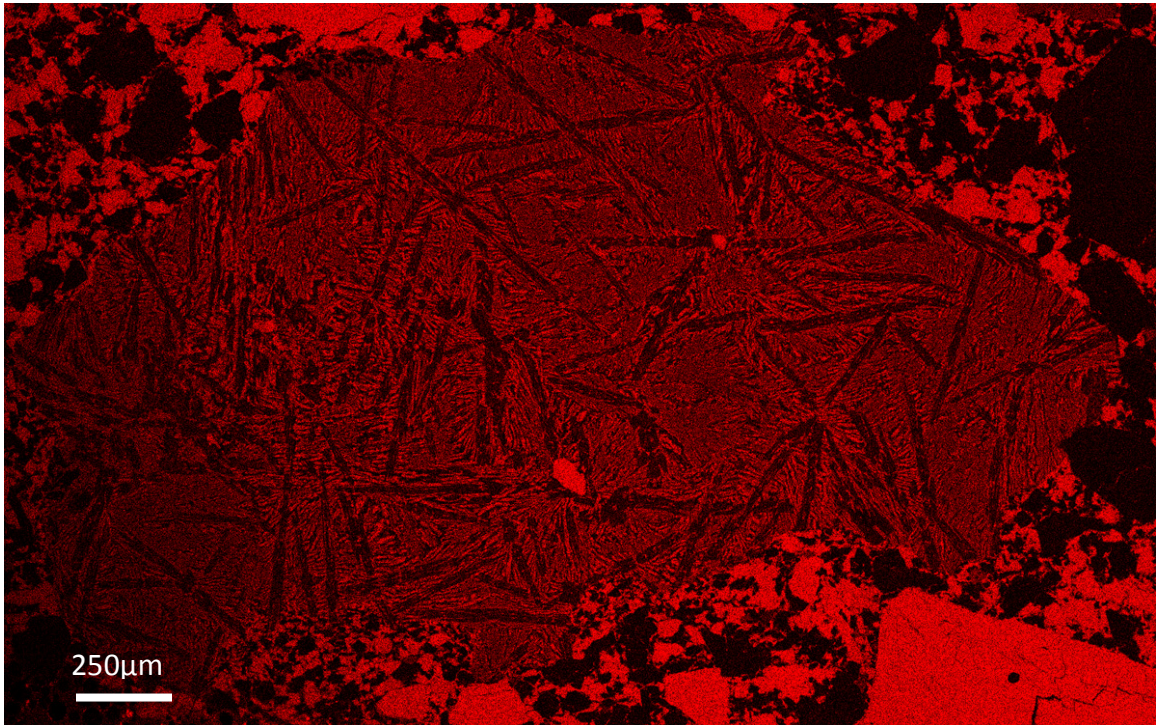


MIL 07664,4B contains skeletal pyroxene laths that are slightly zoned. The matrix is quenched, made up of both low- and high-Ca pyroxene. The clast is extremely fine-grained compared to the grains seen outside the clast in the howardite brecciated material.

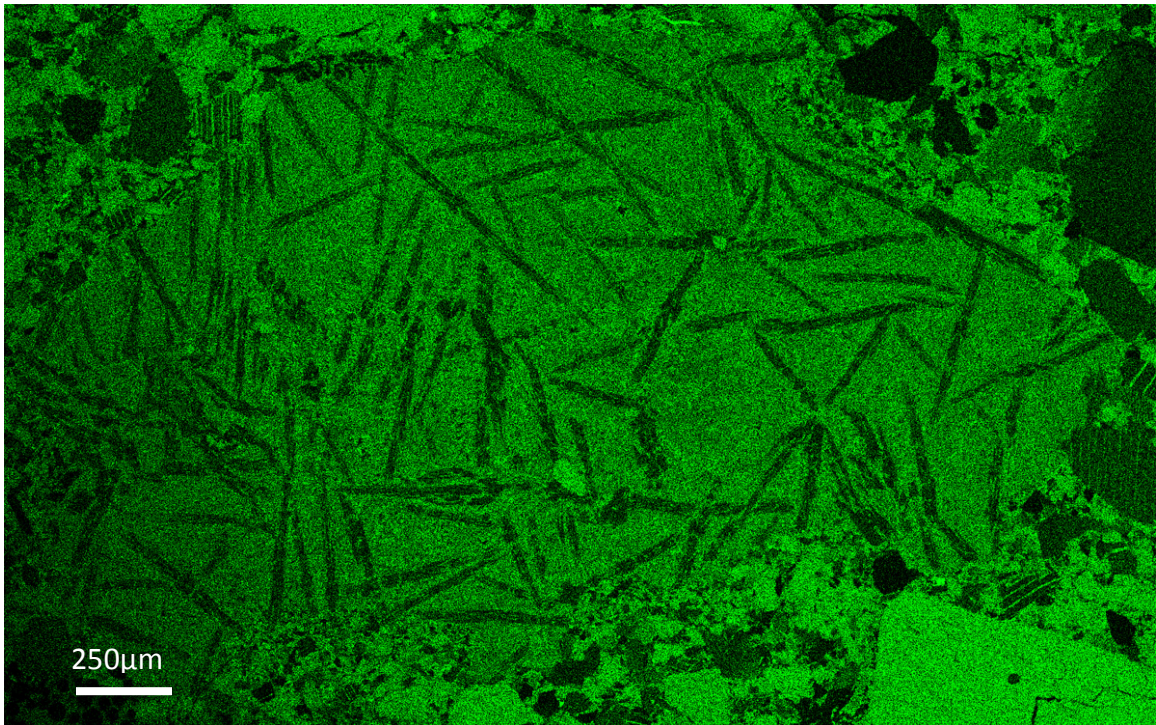
B2. SEM Elemental X-ray maps (All clasts were analyzed for eleven elements (Al, Ca, Fe, Si, Mg, Cr, K, Mn, Na, S, and Ti); however if some are extremely dark, this is due to the fact that the element appeared below the detection limit of the SEM, thus showing a colored map with no distinguishable data. For this reason, we have not included a full size element map of K, Na, and Mn.



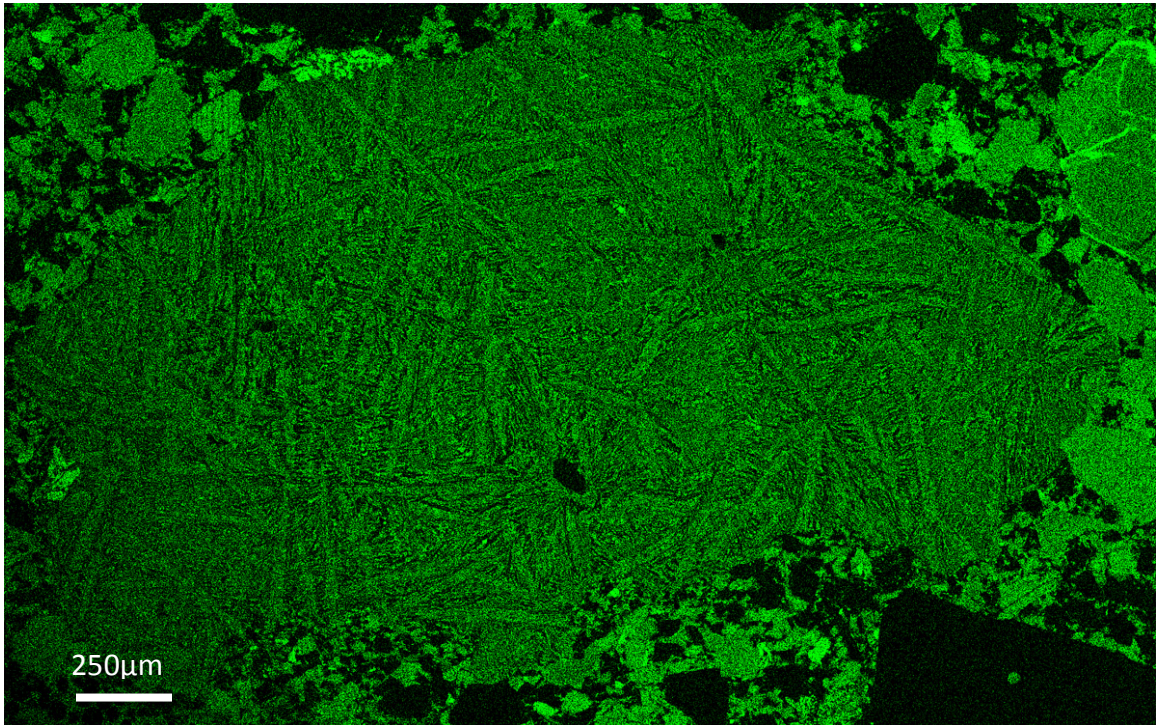
Al



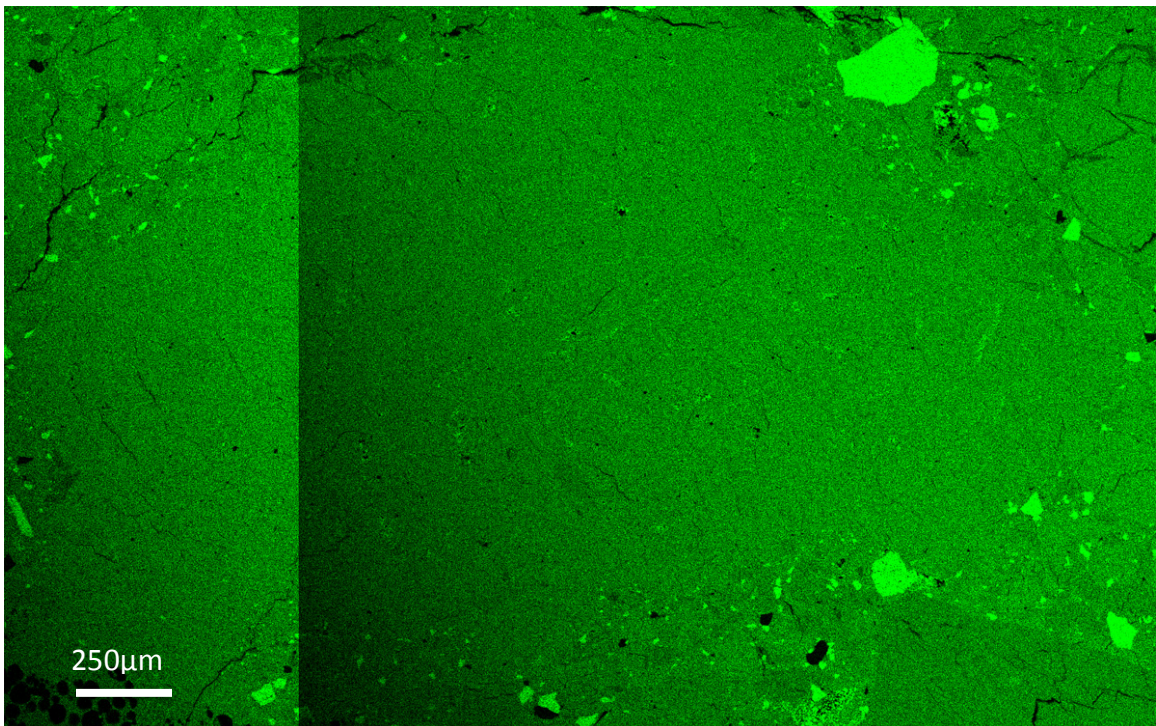
Ca



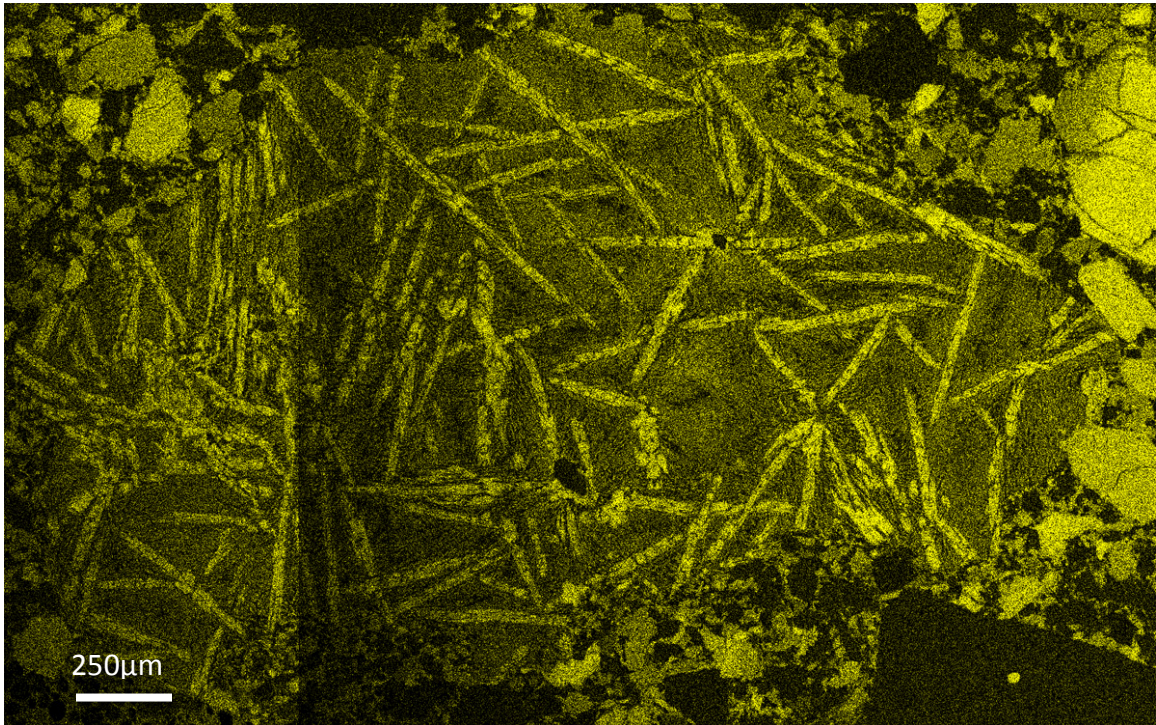
Fe



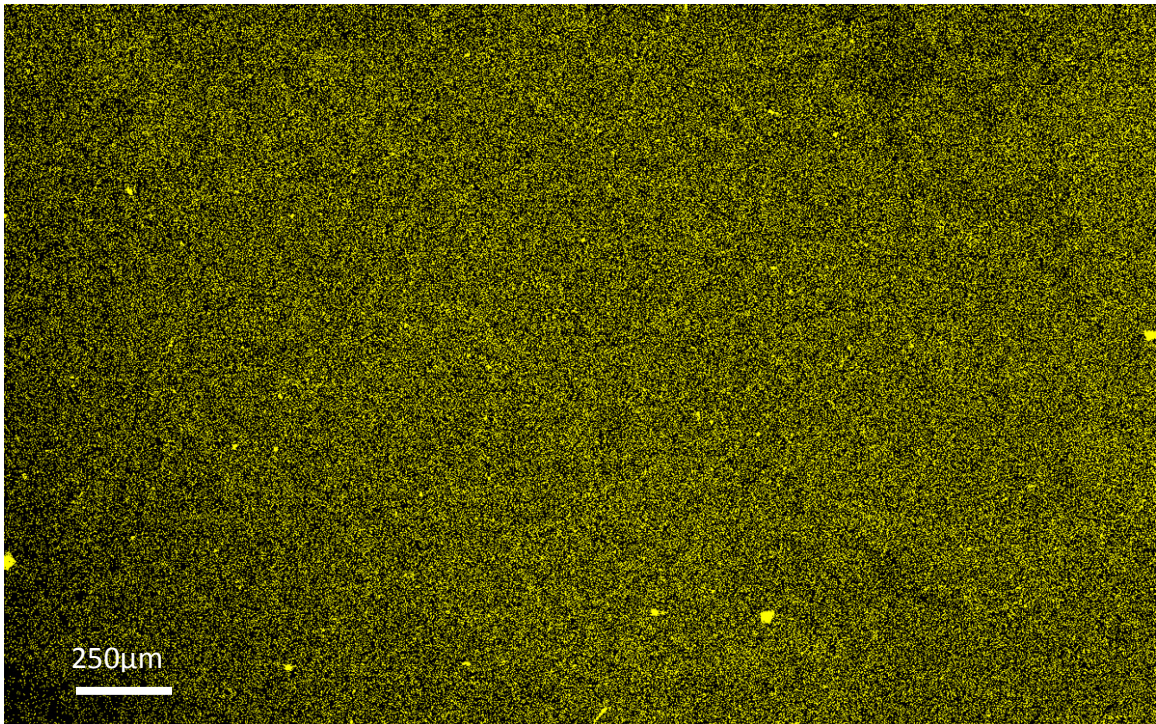
Si



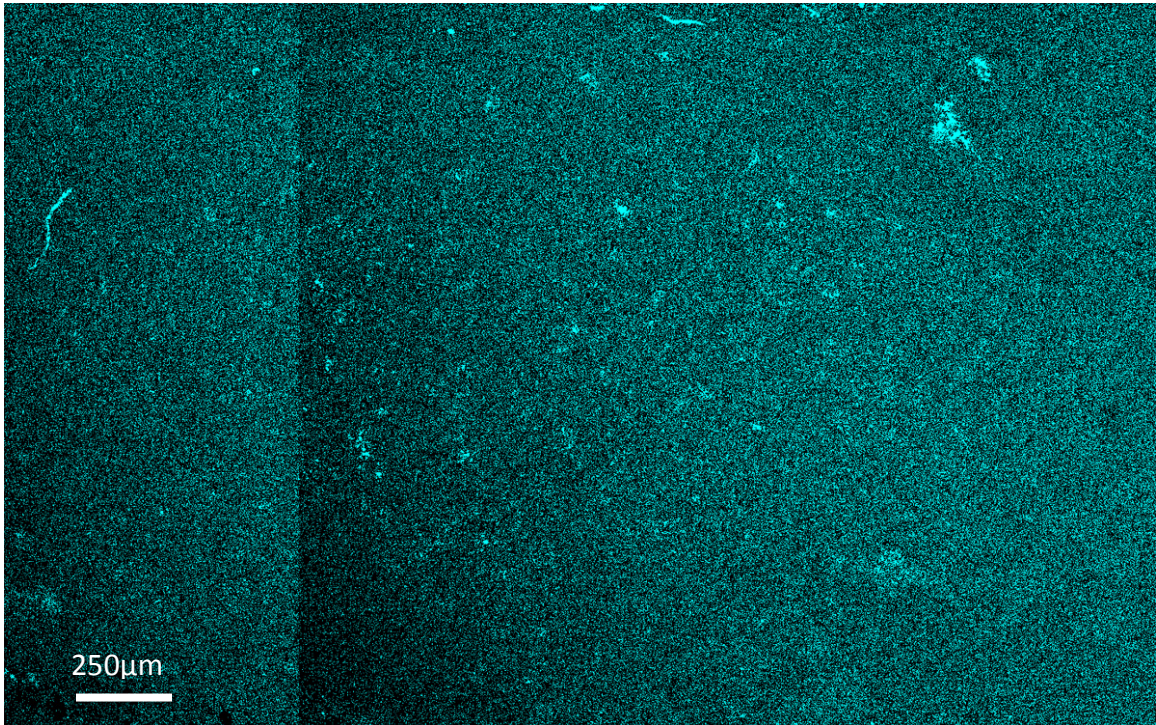
Mg



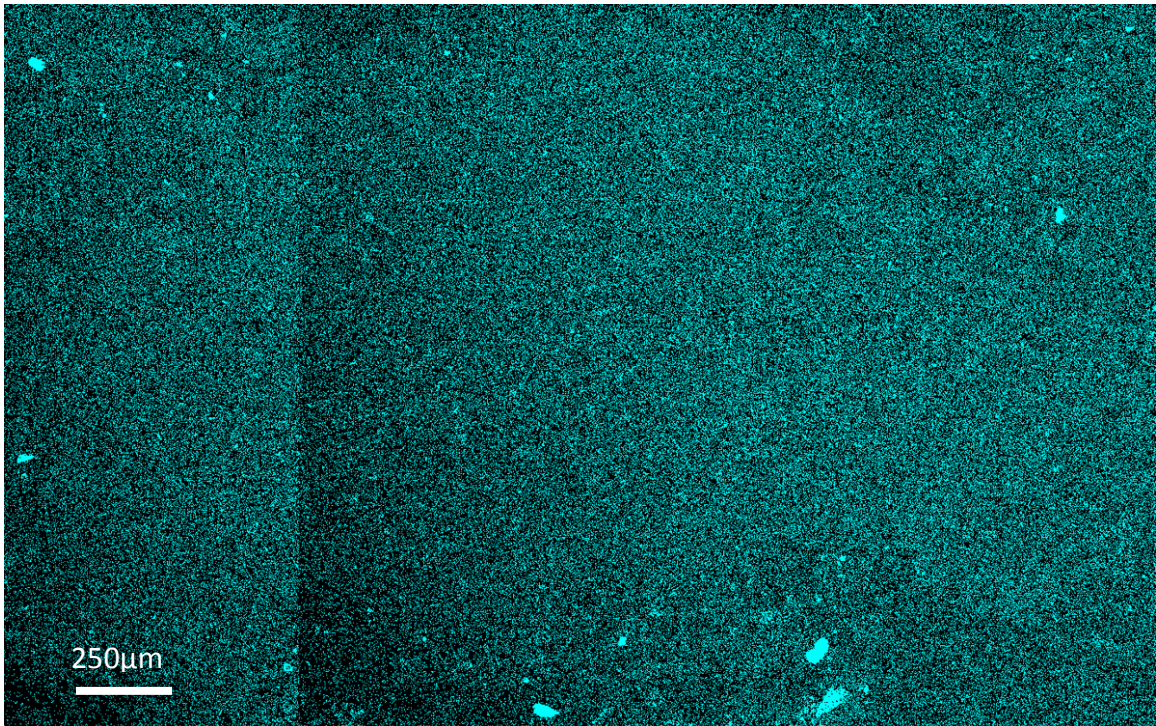
Cr



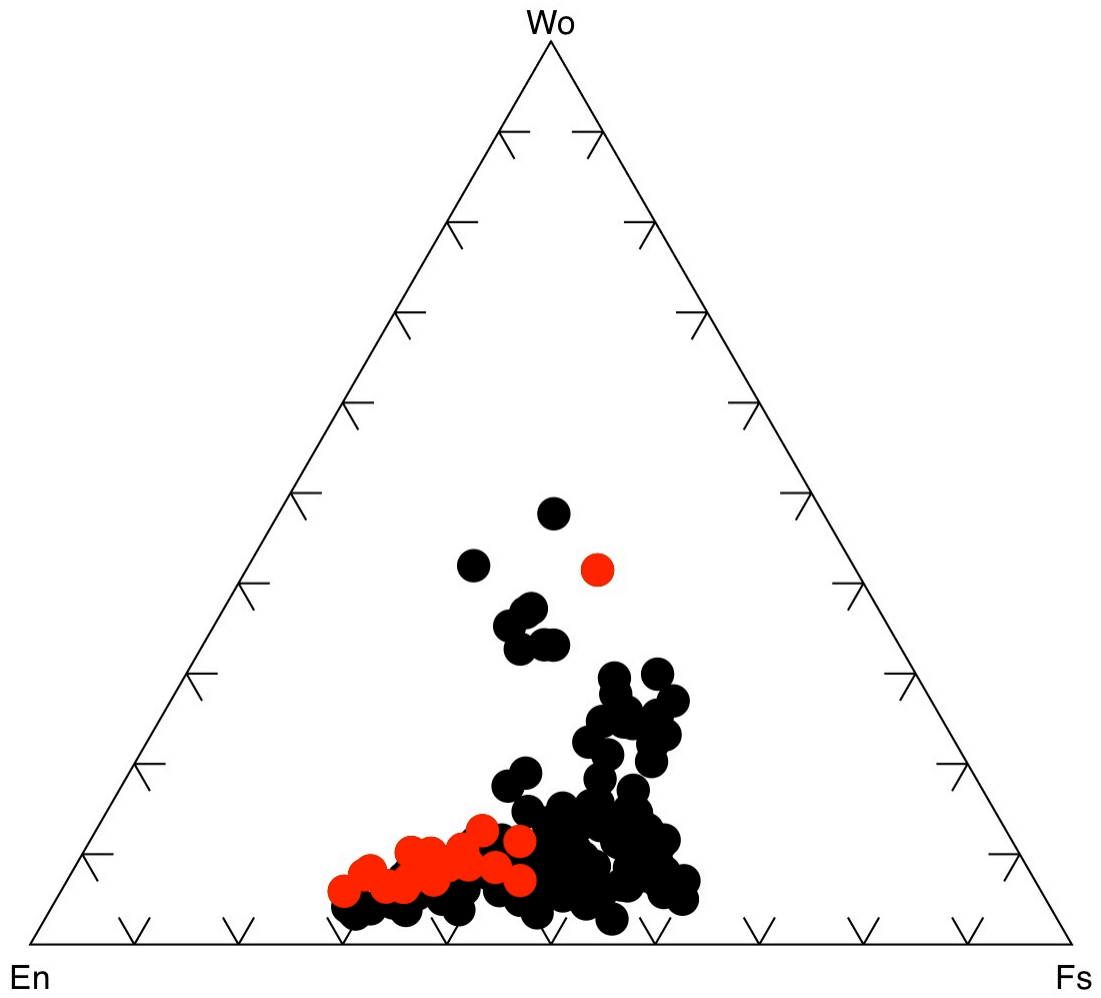
S



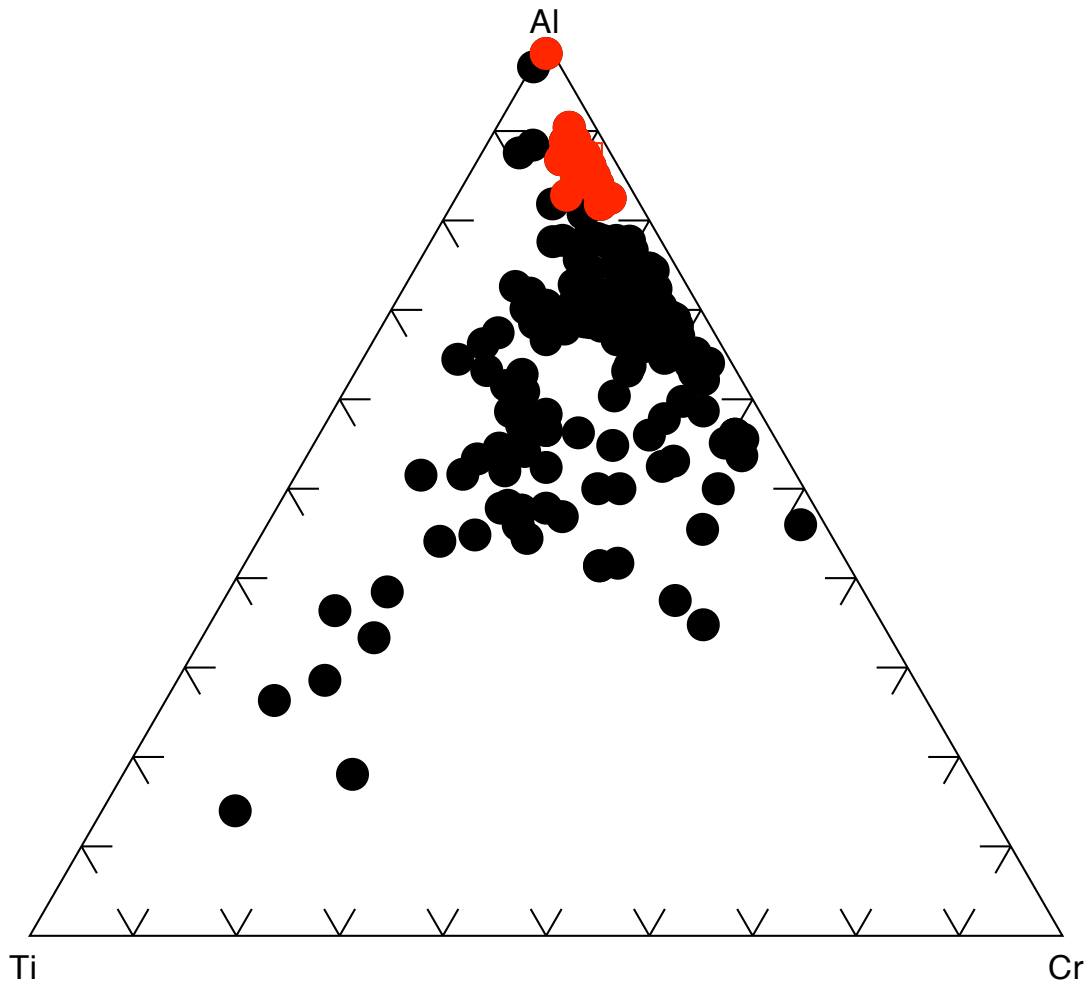
Ti



B3. Major element data of pyroxene (red) compared to all other samples



B4. Minor element data of pyroxene (red) compared to all other samples



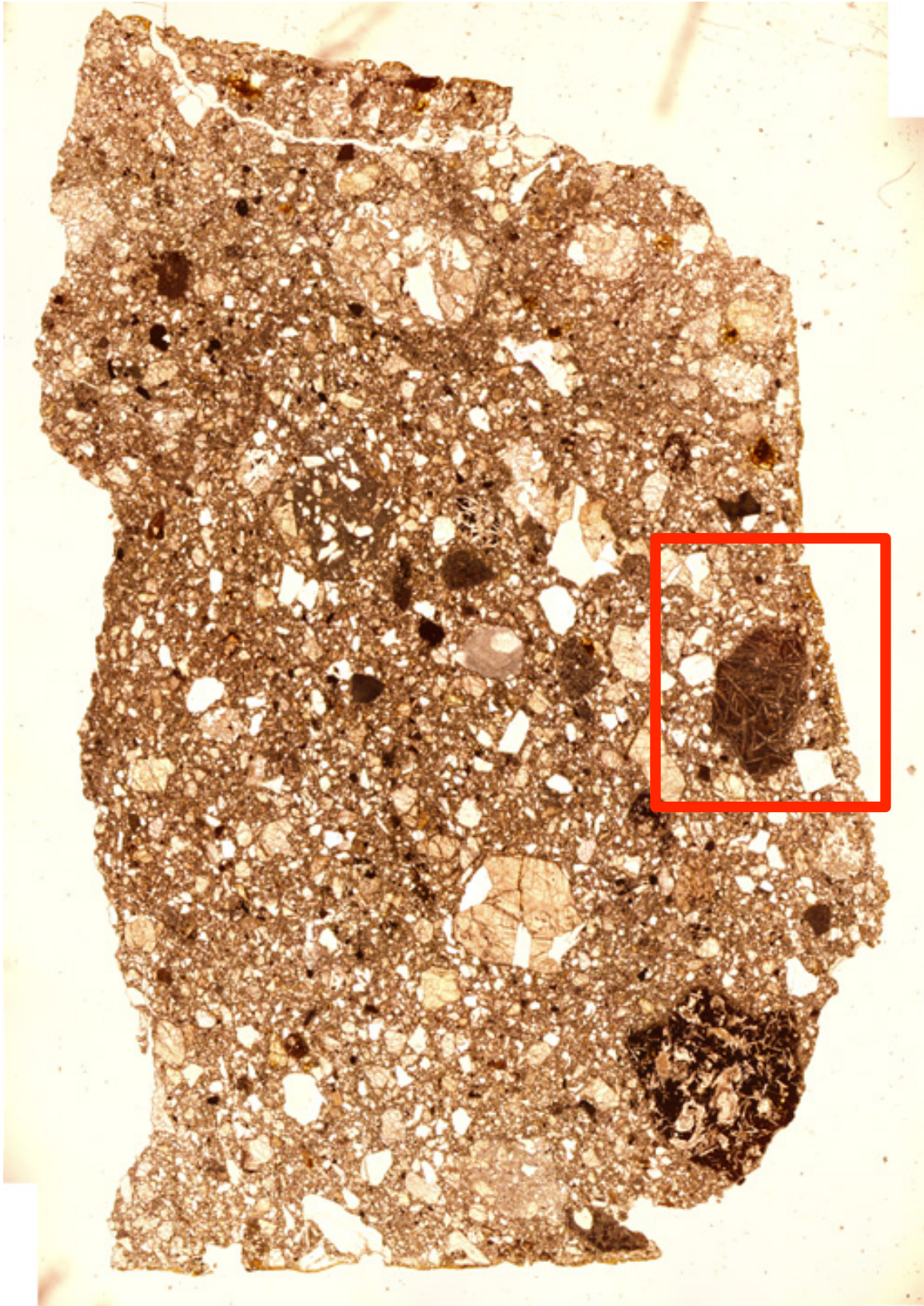
B5. Pyroxene analyses

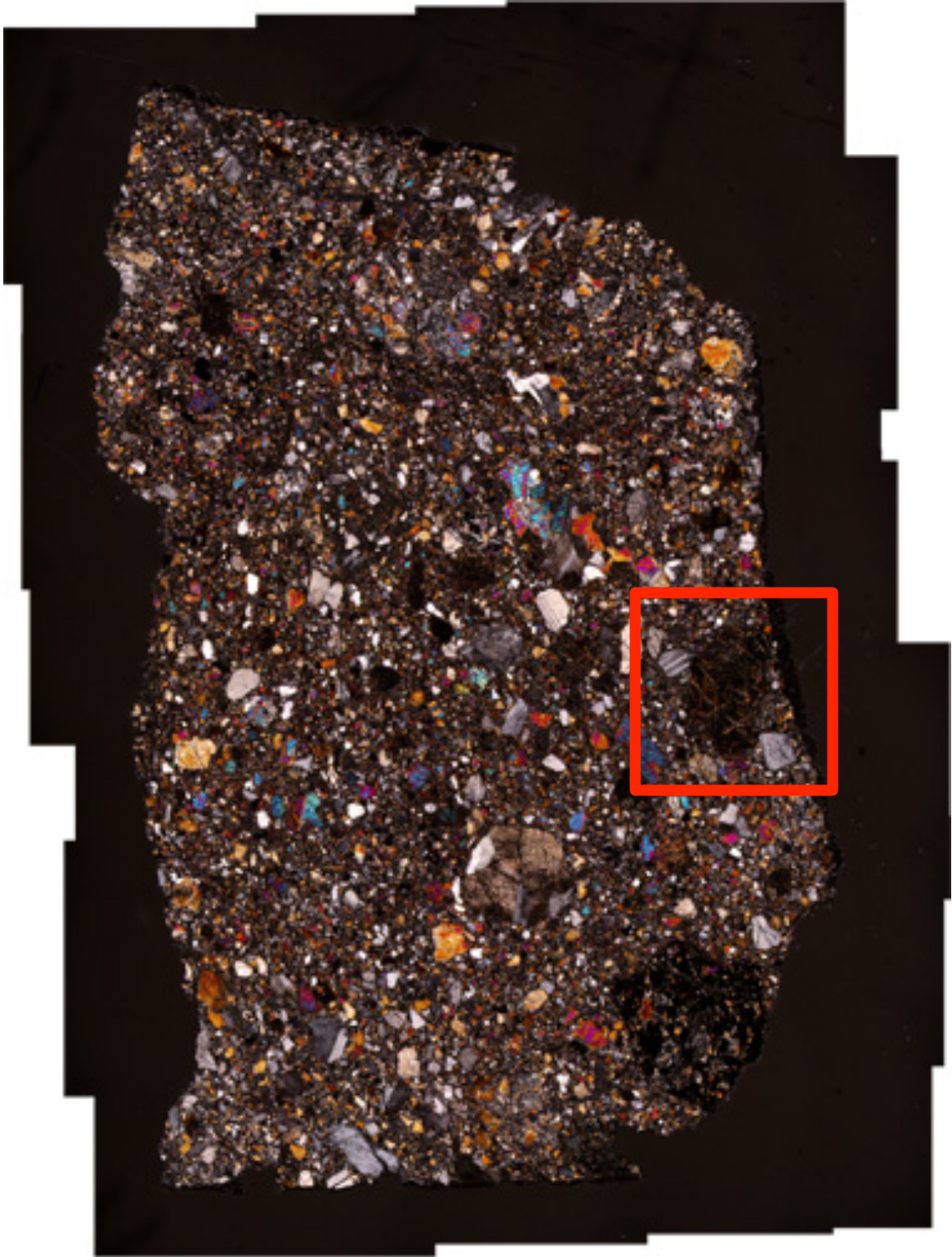
SiO ₂	48.83	51.31	50.09	49.14	48.01	49.85	48.55	48.74	48.31	49.57	49.41
CaO	4.06	2.85	4.76	3.97	11.49	2.99	3.95	3.86	5.26	4.76	3.56
Na ₂ O	n.b.	n.b.	0.07	0.03	1.12	0.05	0.02	0.09	0.03	0.04	0.03
MgO	17.75	23.18	19.12	18.17	4.93	20.61	19.46	16.61	15.65	19.57	21.29
TiO ₂	0.29	0.23	0.40	0.23	0.23	0.25	0.39	0.27	0.39	0.35	0.36
FeO	22.29	16.81	20.18	20.86	11.99	19.73	19.53	23.45	24.37	18.87	16.76
Al ₂ O ₃	4.57	4.73	4.78	4.48	21.77	5.01	5.54	6.04	4.26	5.18	6.27
K ₂ O	n.b.	n.b.	0.01	n.b.	0.27	n.b.	n.b.	0.01	0.01	n.b.	n.b.
MnO	0.67	0.60	0.65	0.72	0.30	0.63	0.62	0.70	0.78	0.57	0.64
Cr ₂ O ₃	0.79	1.21	0.85	0.80	0.22	1.02	1.37	0.81	0.55	1.03	1.19
Total	99.25	100.91	100.89	98.39	100.34	100.13	99.45	100.58	99.59	99.96	99.51
Si	1.87	1.87	1.87	1.88	1.75	1.86	1.83	1.85	1.87	1.86	1.84
Ca	0.17	0.11	0.19	0.16	0.45	0.12	0.16	0.16	0.22	0.19	0.14
Na	n.b.	n.b.	0.01	n.b.	0.08	n.b.	n.b.	0.01	n.b.	n.b.	n.b.
Mg	1.01	1.26	1.06	1.04	0.27	1.15	1.10	0.94	0.90	1.09	1.18
Ti	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Fe	0.71	0.51	0.63	0.67	0.37	0.62	0.62	0.74	0.79	0.59	0.52
Al	0.20	0.19	0.20	0.19	0.89	0.21	0.23	0.26	0.18	0.22	0.26
K	n.b.	n.b.	n.b.	n.b.	0.01	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.
Mn	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.03	0.02	0.02
Cr	0.02	0.04	0.03	0.02	0.01	0.03	0.04	0.02	0.02	0.03	0.04
Total	4.02	4.01	4.01	4.00	3.84	4.01	4.02	4.01	4.02	4.01	4.01
Wo	8.81	5.89	10.10	8.71	41.47	6.32	8.53	8.53	11.41	10.18	7.70
En	53.51	66.90	56.48	55.53	24.79	60.97	58.51	51.06	47.28	58.32	64.05
Fs	37.68	27.21	33.42	35.76	33.73	32.71	32.96	40.41	41.31	31.50	28.25
SiO ₂	48.82	49.18	49.64	49.69	50.37	49.34	49.96	48.34	47.62	47.83	
CaO	4.53	3.32	2.99	3.77	3.87	3.36	3.05	3.26	5.58	4.73	
Na ₂ O	0.05	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	0.04	n.b.	n.b.	
MgO	17.49	19.35	21.11	19.31	21.66	20.14	21.15	16.40	16.04	17.11	
TiO ₂	0.33	0.24	0.28	0.33	0.35	0.23	0.26	0.53	0.44	0.28	
FeO	21.38	21.05	18.63	20.09	17.45	19.61	18.86	25.75	21.11	20.79	
Al ₂ O ₃	5.82	5.59	5.41	5.32	5.25	5.16	5.37	4.37	7.24	6.61	
K ₂ O	0.01	n.b.	n.b.	n.b.	n.b.	0.01	n.b.	0.01	n.b.	0.01	
MnO	0.70	0.63	0.60	0.60	0.58	0.64	0.61	0.75	0.61	0.68	
Cr ₂ O ₃	0.73	0.92	1.18	1.18	1.29	0.87	0.99	0.80	0.85	0.73	
Total	99.86	100.27	99.83	100.29	100.82	99.36	100.24	100.24	99.49	98.76	
Si	1.85	1.85	1.85	1.86	1.85	1.86	1.86	1.86	1.82	1.83	
Ca	0.18	0.13	0.12	0.15	0.15	0.14	0.12	0.14	0.23	0.19	
Na	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	
Mg	0.99	1.08	1.17	1.08	1.19	1.13	1.17	0.94	0.91	0.98	
Ti	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	
Fe	0.68	0.66	0.58	0.63	0.54	0.62	0.59	0.83	0.68	0.67	
Al	0.25	0.24	0.23	0.22	0.22	0.22	0.22	0.19	0.31	0.28	
K	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	
Mn	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	
Cr	0.02	0.03	0.04	0.04	0.04	0.03	0.03	0.02	0.03	0.02	
Total	4.00	4.02	4.01	4.00	4.01	4.01	4.01	4.02	4.01	4.01	
Wo	9.94	7.13	6.35	8.13	8.15	7.16	6.49	7.08	12.60	10.55	
En	53.46	57.69	62.65	58.02	63.26	60.05	62.34	49.42	50.28	53.21	
Fs	36.61	35.18	31.00	33.85	28.59	32.79	31.17	43.49	37.13	36.24	

B6. Plagioclase analyses

SiO ₂	44.24	43.15	47.85	46.73	43.47	48.19	47.86	48.25	49.95	46.92	48.62	48.81	48.36	47.48
CaO	18.27	18.60	16.80	16.01	18.89	15.87	15.74	11.51	11.95	11.10	15.49	16.40	17.16	11.57
Na ₂ O	1.03	0.72	1.84	1.67	0.73	1.97	1.80	0.89	1.69	1.31	0.98	1.97	0.14	1.27
MgO	0.04	0.03	0.18	0.20	0.06	0.38	0.35	6.42	5.26	4.76	4.96	1.72	7.88	4.93
TiO ₂	0.03	n.b.	0.06	0.04	0.04	0.07	-0.02	1.15	0.45	0.30	0.58	0.54	0.73	0.29
FeO	0.71	0.52	1.61	1.95	0.56	2.19	2.22	22.44	10.90	16.31	16.83	5.90	22.55	17.01
Al ₂ O ₃	36.27	36.32	32.54	30.57	36.24	31.16	30.54	10.66	22.42	17.99	14.60	26.15	4.02	17.95
K ₂ O	0.03	0.03	0.12	0.14	0.03	0.16	0.23	0.06	0.20	0.11	0.09	0.19	0.02	0.10
MnO	0.02	n.b.	0.03	0.06	n.b.	0.05	0.05	0.71	0.40	0.50	0.52	0.17	0.70	0.51
Cr ₂ O ₃	0.02	n.b.	n.b.	n.b.	0.01	0.02	0.03	0.05	0.12	0.18	0.06	0.05	0.09	0.17
Total	100.66	99.36	101.03	97.37	100.01	100.06	98.80	102.13	103.34	99.45	102.73	101.90	101.64	101.28
Si	2.07	2.05	2.22	2.25	2.05	2.26	2.27	2.44	2.35	2.36	2.40	2.30	2.51	2.35
Ca	0.92	0.95	0.84	0.83	0.96	0.80	0.80	0.62	0.60	0.60	0.82	0.83	0.95	0.62
Na	0.09	0.07	0.17	0.16	0.07	0.18	0.17	0.09	0.15	0.13	0.09	0.18	0.01	0.12
Mg	n.b.	n.b.	0.01	0.01	n.b.	0.03	0.03	0.49	0.37	0.36	0.37	0.12	0.61	0.37
Ti	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	0.04	0.02	0.01	0.02	0.02	0.03	0.01
Fe	0.03	0.02	0.06	0.08	0.02	0.09	0.09	0.95	0.43	0.69	0.70	0.23	0.98	0.71
Al	1.91	1.93	1.70	1.66	1.92	1.64	1.63	0.60	1.18	1.01	0.81	1.38	0.23	1.00
K	n.b.	n.b.	0.01	0.01	n.b.	0.01	0.01	n.b.	0.01	0.01	0.01	n.b.	n.b.	0.01
Mn	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	0.03	0.02	0.02	0.02	0.01	0.01	0.03	0.02
Cr	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	0.01	0.01	n.b.	n.b.	n.b.	0.01
Total	5.02	5.02	5.01	5.00	5.02	5.01	5.00	5.26	5.13	5.19	5.23	5.08	5.35	5.20
An	90.54	93.31	82.82	83.33	93.28	80.83	81.62	87.27	78.39	81.50	89.12	81.21	98.45	82.55
Ab	9.26	6.50	16.49	15.76	6.52	18.16	16.95	12.17	20.05	17.55	10.23	17.71	1.45	16.51
Or	0.20	0.20	0.69	0.90	0.19	1.01	1.42	0.56	1.56	0.95	0.65	1.08	0.10	0.94
SiO ₂	49.69	47.93	44.41	44.91	45.64	44.33	44.42	43.97	48.57	50.59	47.38	57.74	49.74	
CaO	12.10	15.73	18.94	18.81	18.66	19.11	19.07	17.57	15.60	15.28	10.63	11.84	14.32	
Na ₂ O	0.85	1.87	0.79	0.89	0.92	0.82	0.82	1.06	2.17	2.18	0.67	1.23	2.12	
MgO	6.40	0.65	0.11	0.08	0.09	0.10	0.09	0.09	0.15	0.83	7.38	2.80	1.34	
TiO ₂	0.88	0.02	0.02	0.02	0.01	0.03	0.06	0.02	0.07	0.29	0.62	0.74	0.23	
FeO	17.61	2.73	0.75	0.69	0.52	0.66	0.77	0.72	1.72	2.97	23.71	9.84	3.92	
Al ₂ O ₃	15.50	29.89	36.51	36.75	37.64	36.79	36.64	35.25	31.58	30.09	5.96	15.61	27.26	
K ₂ O	0.07	0.12	0.03	0.03	0.05	0.02	0.03	0.05	0.15	0.27	0.04	0.22	0.25	
MnO	0.56	0.06	0.03	0.02	0.01	0.02	0.02	n.b.	0.02	0.06	0.73	0.28	0.13	
Cr ₂ O ₃	0.06	0.04	n.b.	n.b.	0.02	n.b.	n.b.	n.b.	0.01	0.08	0.12	0.02	0.02	
Total	103.73	99.03	101.59	102.19	103.56	101.88	101.92	98.74	100.05	102.63	97.24	100.33	99.33	
Si	2.40	2.28	2.06	2.07	2.07	2.05	2.06	2.09	2.27	2.31	2.54	2.72	2.36	
Ca	0.63	0.80	0.95	0.93	0.91	0.95	0.95	0.90	0.78	0.75	0.61	0.60	0.73	
Na	0.08	0.17	0.07	0.08	0.08	0.07	0.07	0.10	0.20	0.20	0.07	0.11	0.20	
Mg	0.46	0.05	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.06	0.59	0.20	0.10	
Ti	0.03	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	0.01	0.03	0.03	0.01	
Fe	0.71	0.11	0.03	0.03	0.02	0.03	0.03	0.03	0.07	0.11	1.06	0.39	0.16	
Al	0.84	1.59	1.90	1.90	1.92	1.91	1.91	1.88	1.66	1.55	0.36	0.83	1.45	
K	0.01	0.01	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	0.01	0.02	n.b.	0.01	0.02	
Mn	0.02	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	0.03	0.01	0.01	
Cr	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	0.01	n.b.	n.b.	n.b.	
Total	5.19	5.01	5.02	5.02	5.01	5.03	5.02	5.01	5.00	5.00	5.29	4.90	5.01	
An	88.08	81.69	92.74	91.91	91.47	92.70	92.59	89.82	79.11	78.07	89.57	82.62	77.64	
Ab	11.22	17.60	7.07	7.89	8.23	7.21	7.21	9.88	19.98	20.27	10.13	15.59	20.77	
Or	0.70	0.71	0.20	0.20	0.30	0.10	0.19	0.30	0.91	1.66	0.29	1.79	1.60	

B7. MIL 07664,4B in plane polarized and cross-polarized light-1in. round (2.54cm). (The red box shows which grain this appendix is referring to)





B8. BSE image with microprobe points. (rotated 180° clockwise from original SEM map).

