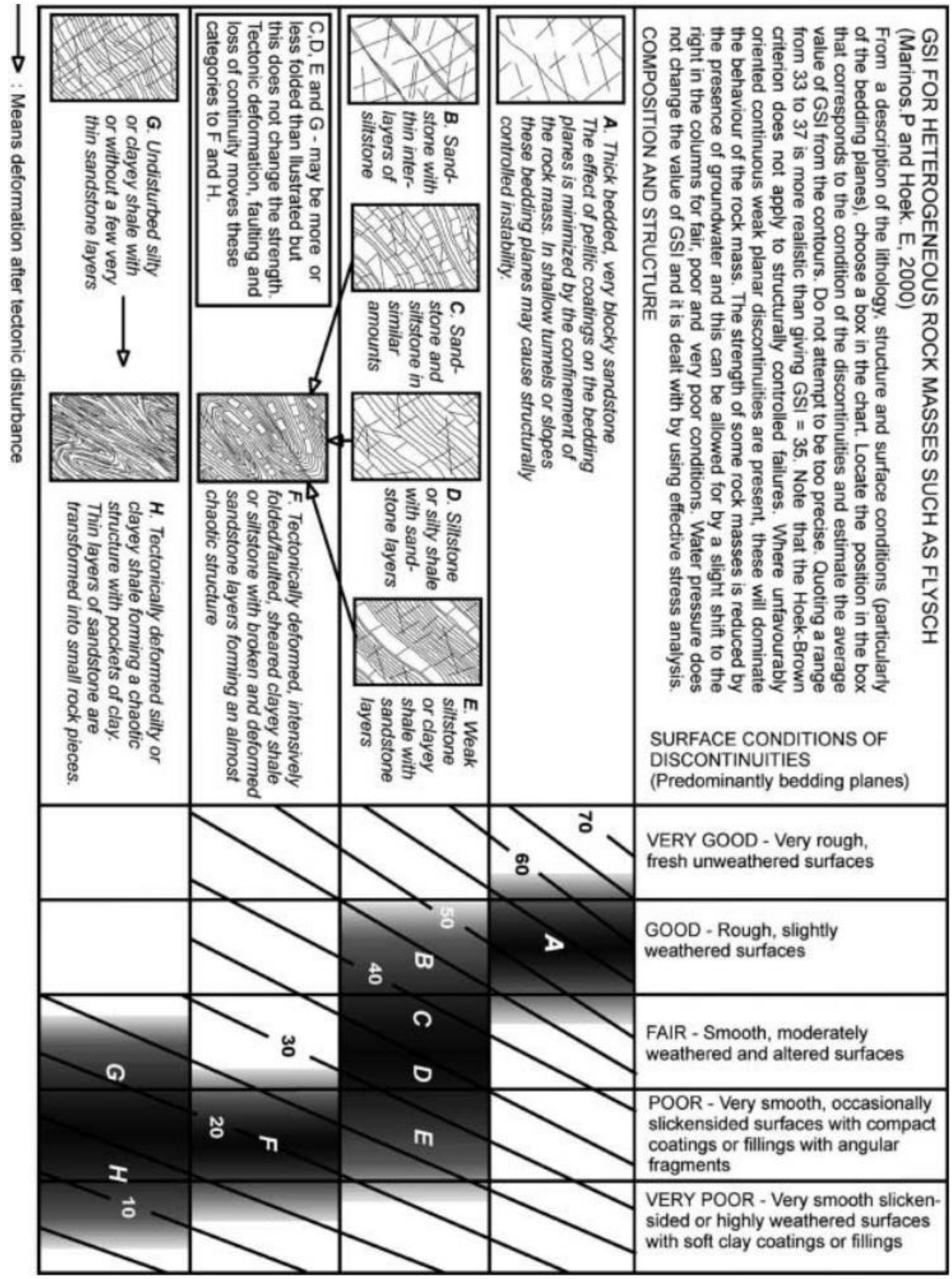
Appendix A - GSI Chart



GSI estimates for heterogeneous rock masses such as flysch (Marinos & Hoek, 2001).

Appendix B – Rock mechanical classification

Classification of uniaxial compressive strength (UCS):

Table 1: Classification of uniaxial compressive strength (ISRM, 1978).

Grade	Classification	Approx. range of uniaxial compressive strength [MPa]
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

Classification of swelling pressure:

Table 2: Classification of swelling pressure. Table after NTNU standard (Mao et al., 2011).

Classification	Swelling Pressure [MPa]
Low	<0.1
Moderate	0.1 – 0.3
High	0.3 – 0.75
Very high	>0.75

Little q classification system:

Table 3: Little q classification system (Brevig et al., 2011).

Grade	Classification	Description
q1	Very good	Massive to low joint frequency, Jv < 5/m3. Tight joints, unaltered strong rock and insignificant stress slabbing.
q2	Good	Low to moderate joint frequency, 5 < Jv < 10. Strong rock with none or insignificant alteration and with coating on some joints. Low to moderate stress slabbing.
q3	Fair	Moderate to high joint frequency, 10 < Jv < 20. Moderately strong to strong rock generally with coated joints and with some seams and some minor weakness zones. The rock mass may be slightly weathered. Also applies to q1 and q2 class with moderate to high intensity stress slabbing, and to medium to low strength rock subjected to low to medium stresses causing plastic deformations.
q4	Poor	High joint frequency, Jv > 20, clay seams (fault zones, swelling clays) in moderately strong rock. Also applies to moderately weathered strong rock and to high to very high intensity stress slabbing in q1 and q2 class rock mass; and to medium to low strength rock subjected to swelling and/or slaking and/or medium to high stresses causing plastic deformation.

q5	Extremely poor	Completely crushed rock containing a significant amount of secondary clay minerals as in major fault zones. Smectite clays may lead to significant swelling and squeezing. Also applies to highly weathered rock and to low strength rock mass subjected to swelling and/or slaking and/or high stresses causing plastic deformation.

Appendix C – Rock sample overview

The figure shows an overview of sample specimens used for the different laboratory tests. Blue: samples crushed for XRD, XRF, oedometer swelling test and powder thin section + intact thin section. Green: Only intact thin section. Orange: Successfully prepared UCS samples. Yellow: Successfully prepared Brazil test samples.

Overview of laboratory samples with legend. Photo by Lisa Henrika Henriksen and Karoline Arctander (summer, 2021).

Appendix D – Crushing overview

Overview of crushing with weight corresponding to samples in flow chart.

Weight nr	Use:	sample 1	sample 2	sample 3	sample 4	sample 5	sample 6	sample 7	comments
Core sample									
W_c		253.05	523.6	496.5	509.1	522.5	540.7	396.5	
W_1	standard	63.6	55.5	124.3	120.2	144.5	131.8	88.7	
W_2	modified	-	133.3	182	191	185.1	199.2	150.9	Sample 1 used as demo material. No weight available.
w_{rest}		100.1	332.1	186	195.3	191.2	207.6	155.2	Rest material
Standard									
W_1		63.6	55.5	124.3	120.2	144.5	131.8	88.7	Before crushing
W_{st1}	dics mill	60.8	54.9	114.8	112	130.2	129	87.1	After crushing
W_{st2}	XRD	2	2	2	2	2	2	2	Approximatly 2 g, a spoon with top
W_{st3}	XRF	2.5	2.5	2.5	2.5	2.5	2.5	2.5	Approximatly 2.5 g
W_{st4}	Thin section	23.54	6.19	11.71	8.79	?	?	10.15	
W_{st5}	swelling test	26.35	24.27	23.9	25.55	?	?	21.73	20 g bulk used
W extra			17.22	71.66	71.56			48.15	
Modified									
W_2		-	133.3	182	92.7	90.9	100.1	108.1	Before crushing
W_{mod}		83.8	124.6	163.2	84.6	83.3	93.3	102.1	After crushing
W_2 extra					97.9	93.5	98.7	42	removed some material to reduce time.
100µm<p300µm									
W_{ma1}	100-300 µm	51.5	79.9	107.6	54.4	53	60.7	62	
W_{ma2}	XRD micronizer	1.8	1.9	2	1.9	1.9	2.3	2.1	Bulk from XRF split
W_{ma3}	XRF	11.1	16.4	24.9	11.6	11.1	12.9	13.4	Approximatly 2.5 g used, bulk
W_{ma4}	Thin section	13.2	19.2	26.3	13.3	12.9	14.5	15.9	
W_{ma5}	Swelling test	25.4	20.8	27	27.3	26.9	21.2	30.4	
p<100µm									
W_{mb1}	<100 µm	32.3	44.7	55.6	30.2	30.3	32.6	40.1	
W_{mb2}	XRD micronizer	1	1.8	1.8	1.1	1.2	1.2	1.3	Bulk from XRF split
W_{mb3}	XRF	4.2	10.7	13.5	3.7	3.8	4.3	8.4	Approximatly 2.5 g used, bulk
W_{mb4}	Thin section	5	10.3	12.8	4.3	4.7	5	9.2	
W_{mb5}	Swelling test	21.9	21.4	27.4	20.7	20.3	21.9	21	

Appendix E – XRD results

The XRD results for standard (STD) and modified (MODA and MODB) is given in the tables below. The corresponding XRD graphs can be found in the digital zip-file.

The bulk calculation of the modified samples MODA and MODB to MOD is found in the digital zip-file in the folder “Other resources”.

Table 1: XRD results for standard (STD) samples.

	[Wt%]						
Mineral (STD)	1	2	3	4	5	6	7
Quartz	27	9	3	16	2	35	10
Plagioclase (Albite)	11	-	25	19	43	18	29
Chlorite	6	34	25	8	11	7	4
CPX (Augite Px)	-	-	-	-	-	-	5
CPX (Diopside)	-	3	16	4	14	-	-
Calcite	10	2	7	29	5	1	29
Datolite	-	-	-	-	-	-	12
Talc	22	13	2	-	-	-	-
Serpentine (lizardite)	3	38	12	0	5	0	0
Serpentine (Antigorite)	-	-	-	0	-	-	-
Smectite (Montmorillonite)	1	0	1	1	0	-	-
Zeolite (Mordenite)	5	-	-	-	-	-	-
Titanite	-	-	9	-	8	5	3
Pyrite	-	-	-	0	0	0	0
Pyrrhotite	-	-	0	0	1	1	-
Muscovite	13	-	-	18	7	33	8
Kaolinite	3	-	-	4	-	-	-
Microcline max	-	-	-	-	-	-	-
Spessartine	-	-	-	1	3	1	-
Hornblende (Mn-ion)	-	-	-	-	1	-	-
Magnetite	-	1	1	-	-	-	-

Table 2: XRD results for MODA samples (100-300 μm).

	[Wt%]						
Mineral (MOD-A)	1	2	3	4	5	6	7
Quartz	26	10	3	17	3	33	10
Plagioclase (Albite)	7	-	23	16	39	17	28
Chlorite	5	29	25	8	10	8	4
CPX (Augite Px)	-	-	-	-	-	-	4
CPX (Diopside)	-	5	15	3	15	-	-
Calcite	15	2	7	27	6	1	30
Datolite	-	-	-	-	-	-	12
Talc	14	12	2	-	-	-	-
Serpentine (lizardite)	5	40	12	3	5	0	2
Serpentine (Antigorite)	-	-	-	0	-	-	-
Smectite (Montmorillonite)	1	2	3	4	3	1	0.95
Zeolite (Mordenite)	8	-	-	-	-	-	-
Titanite	-	-	9	-	7	5	2
Pyrite	-	-	-	0	0	-	0
Pyrrhotite	-	-	1	0	0	1	-
Muscovite	13	-	-	21	6	33	7
Kaolinite	5	-	-	1	-	-	-
Microcline max	-	-	-	-	-	-	-
Spessartine	-	-	-	1	2	0	-
Hornblende (Mn-ion)	-	-	-	-	1	-	-
Magnetite	-	1	0	-	-	-	-

Table 3: XRD results for MODB samples (<100 µm).

	[Wt%]						
Mineral (MOD-B)	1	2	3	4	5	6	7
Quartz	16	9	3	13	0	35	9
Plagioclase (Albite)	9	-	20	15	34	17	23
Chlorite	6	29	28	10	15	8	5
CPX (Augite Px)	-	-	-	-	-	-	4
CPX (Diopside)	-	4	15	4	16	-	-
Calcite	16	3	8	28	7	2	38
Datolite	-	-	-	-	-	-	10
Talc	15	12	1	-	-	-	-
Serpentine (lizardite)	3	40	14	0	7	0	2
Serpentine (Antigorite)	-	-	-	0	-	-	-
Smectite (Montmorillonite)	1	2	2	4	3	0	0
Zeolite (Mordenite)	7	-	-	-	-	-	-
Titanite	-	-	8	-	7	5	3
Pyrite	-	-	-	0	0	0	0
Pyrrhotite	-	-	0	0	1	0	-
Muscovite	11	-	-	24	7	32	7
Kaolinite	7	-	-	1	-	-	-
Microcline max	9	-	-	-	-	-	-
Spessartine	-	-	-	1	2	0	-
Hornblende (Mn-ion)	-	-	-	-	1	-	-
Magnetite	-	1	1	-	-	-	-

Appendix F – XRF results

The following tables presents the results from XRF in standard samples (STD) and modified samples (MODA and MODB).

The bulk calculation of the modified samples MODA and MODB to MOD is found in the digital zip-file in the folder “Other resources”.

Table 1: XRF results for standard samples.

Standard crushing										
Sample		1	2	3	4	5	6	7		AC-E
K2O	(%)	0.363	0.012	0.141	2.68	0.314	4.03	1.03		4.67
MgO	(%)	22.3	32.7	13.3	5.08	7.81	3.53	3.01		0.026
Mn3O4	(%)	0.147	0.173	0.207	0.141	0.204	0.094	0.140		0.063
Na2O	(%)	1.23	0.318	2.49	1.74	3.31	1.57	2.67		6.68
P2O5	(%)	0.059	<0.003	0.162	0.103	0.186	0.114	0.091		-0.009
SiO2	(%)	44.8	39.9	38.2	40.2	42.6	55.8	39.2		70.31
TiO2	(%)	0.467	0.040	1.914	0.799	2.142	0.729	0.556		0.096
Al2O3	(%)	7.30	2.50	11.1	12.6	12.6	14.7	9.66		14.93
CaO	(%)	3.16	1.27	8.09	12.4	8.79	1.91	19.4		0.335
Fe2O3	(%)	7.01	8.48	12.3	8.72	12.5	10.4	6.04		2.53
NiO	(%)	0.110	0.273	0.004	0.003	0.006	0.002	0.003		-0.002
PbO	(%)	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007		0.008
SO3	(%)	0.337	0.165	0.060	0.421	0.005	0.573	0.130		0.032
SrO	(%)	0.020	0.023	0.037	0.026	0.034	0.012	0.020		-0.008
V2O5	(%)	0.019	0.012	0.073	0.024	0.077	0.021	0.020		0.001
ZnO	(%)	0.007	0.004	0.013	0.015	0.014	0.018	0.010		0.028
ZrO2	(%)	0.005	<0.003	0.012	0.012	0.019	0.019	0.013		0.112
BaO	(%)	<0.004	<0.004	0.012	0.037	0.008	0.039	0.017		0.025
Cr2O3	(%)	0.156	0.376	0.016	0.007	0.013	0.009	0.009		0.003
CuO	(%)	0.004	<0.002	0.007	0.006	0.006	0.008	0.006		0
HfO2	(%)	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004		0
LOI 1000°C	(%)	12.25	13.25	10.49	13.75	7.29	5.06	14.68		
Sum	(%)	99.8	99.4	98.6	98.6	97.8	98.5	96.2		99.8

Table 2: XRF results for modified (MODA) samples.

Fraction <100-300 μm										
Sample		1	2	3	4	5	6	7		AC-E
K_2O	(%)	0.355	0.010	0.172	2.75	0.334	4.05	1.01		4.67
MgO	(%)	22.3	32.9	13.1	5.07	7.08	3.47	2.80		0.031
Mn_3O_4	(%)	0.157	0.177	0.204	0.127	0.185	0.089	0.146		0.063
Na_2O	(%)	1.10	0.291	2.59	1.71	3.34	1.61	2.80		6.66
P_2O_5	(%)	0.051	<0.003	0.176	0.097	0.190	0.124	0.089		-0.009
SiO_2	(%)	44.9	40.2	38.5	40.8	42.8	56.1	39.4		70.1
TiO_2	(%)	0.410	0.042	2.03	0.737	2.08	0.704	0.517		0.095
Al_2O_3	(%)	6.80	2.48	11.2	12.7	12.3	14.7	9.67		14.94
CaO	(%)	3.39	1.16	8.22	12.1	10.3	1.81	19.6		0.339
Fe_2O_3	(%)	6.89	8.50	12.1	8.72	11.4	10.2	5.76		2.529
NiO	(%)	0.121	0.285	0.003	0.003	0.006	0.004	0.003		-0.001
PbO	(%)	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007		0.007
SO_3	(%)	0.329	0.150	0.059	0.441	0.005	0.677	0.154		0.032
SrO	(%)	0.022	0.023	0.035	0.016	0.028	0.022	0.018		0.005
V_2O_5	(%)	0.020	0.010	0.073	0.025	0.071	0.021	0.017		-0.001
ZnO	(%)	0.007	0.003	0.014	0.016	0.013	0.014	0.011		0.027
ZrO_2	(%)	0.004	<0.003	0.014	0.018	0.018	0.016	0.009		0.111
BaO	(%)	<0.004	<0.004	0.009	0.035	0.015	0.037	0.014		0.024
Cr_2O_3	(%)	0.181	0.392	0.013	0.010	0.014	0.012	0.010		-0.004
CuO	(%)	0.004	0.002	0.006	0.01	0.007	0.007	0.004		0
HfO_2	(%)	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004		0.001
LOI 1000°C	(%)	12.03	12.79	9.99	13.24	7.11	4.57	14.57		
Sum	(%)	99.1	99.4	98.6	98.7	97.3	98.4	96.7		99.7

Table 3: XRF results for modified (MODB) samples.

Fraction <100 µm										
Sample		1	2	3	4	5	6	7		AC-E
K_2O	(%)	0.366	0.022	0.134	2.83	0.259	4.03	0.922		4.66
MgO	(%)	22.4	32.8	14.1	5.41	8.66	3.71	3.02		0.027
Mn_3O_4	(%)	0.151	0.173	0.219	0.128	0.218	0.095	0.151		0.062
Na_2O	(%)	1.23	0.318	2.30	1.66	2.94	1.62	2.37		6.62
P_2O_5	(%)	0.060	<0.003	0.132	0.097	0.149	0.117	0.079		-0.007
SiO_2	(%)	43.4	40.3	37.3	40.2	40.8	54.9	35.1		69.97
TiO_2	(%)	0.493	0.039	1.71	0.757	1.90	0.763	0.493		0.098
Al_2O_3	(%)	7.39	2.51	11.1	13.1	12.1	14.8	8.65		14.85
CaO	(%)	3.69	1.15	7.81	11.5	9.05	1.91	22.7		0.338
Fe_2O_3	(%)	7.05	8.50	13.1	9.36	13.6	10.8	6.01		2.53
NiO	(%)	0.105	0.264	0.005	0.006	0.006	0.003	0.002		0
PbO	(%)	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007		0
SO_3	(%)	0.314	0.304	0.056	0.477	0.005	0.895	0.281		0.033
SrO	(%)	0.025	0.023	0.029	0.027	0.028	0.021	0.031		0.004
V_2O_5	(%)	0.018	0.012	0.069	0.026	0.072	0.019	0.019		0.001
ZnO	(%)	0.007	0.007	0.013	0.017	0.016	0.015	0.010		0.028
ZrO_2	(%)	0.004	<0.003	0.013	0.019	0.010	0.023	0.009		0.112
BaO	(%)	0.007	<0.004	0.004	0.037	0.009	0.041	0.019		0.023
Cr_2O_3	(%)	0.145	0.333	0.011	0.007	0.017	0.011	0.011		0
CuO	(%)	0.004	0.003	0.005	0.007	0.008	0.009	0.006		-0.001
HfO_2	(%)	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004		-0.002
LOI 1000°C	(%)	12.4	12.67	10.69	13.03	7.91	4.55	17.28		
Sum	(%)	99.2	99.3	98.6	98.5	97.6	98.3	96.6		99.3

Appendix G – Thin section scans

Sample 1:

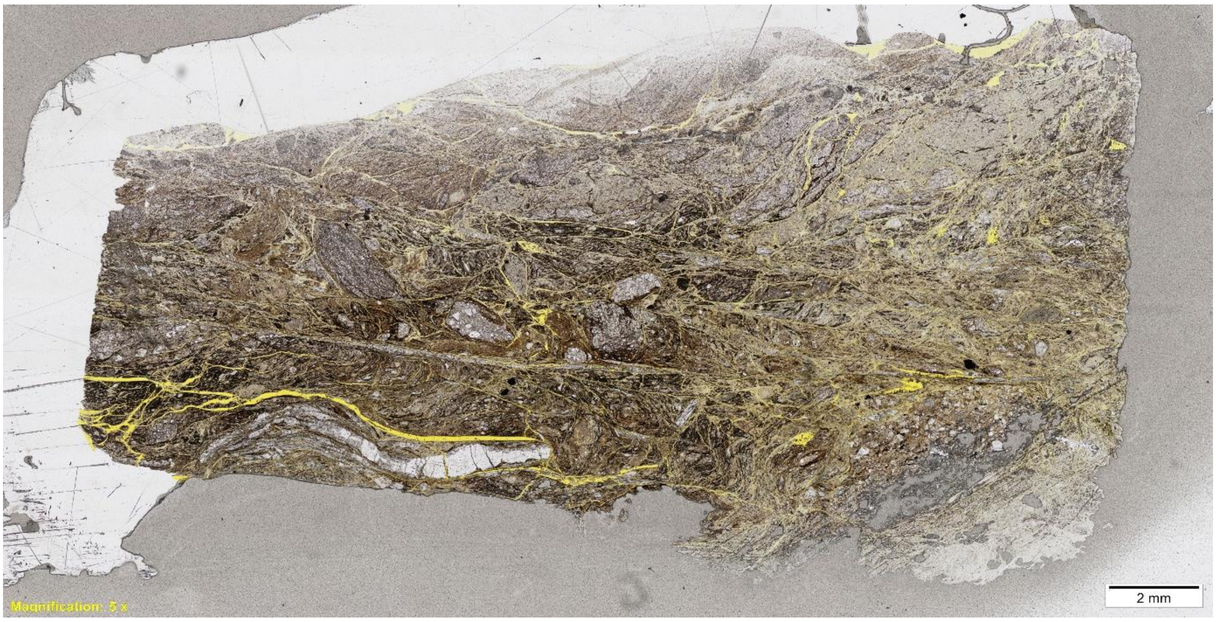


Figure 1: PPL image of sample 1.

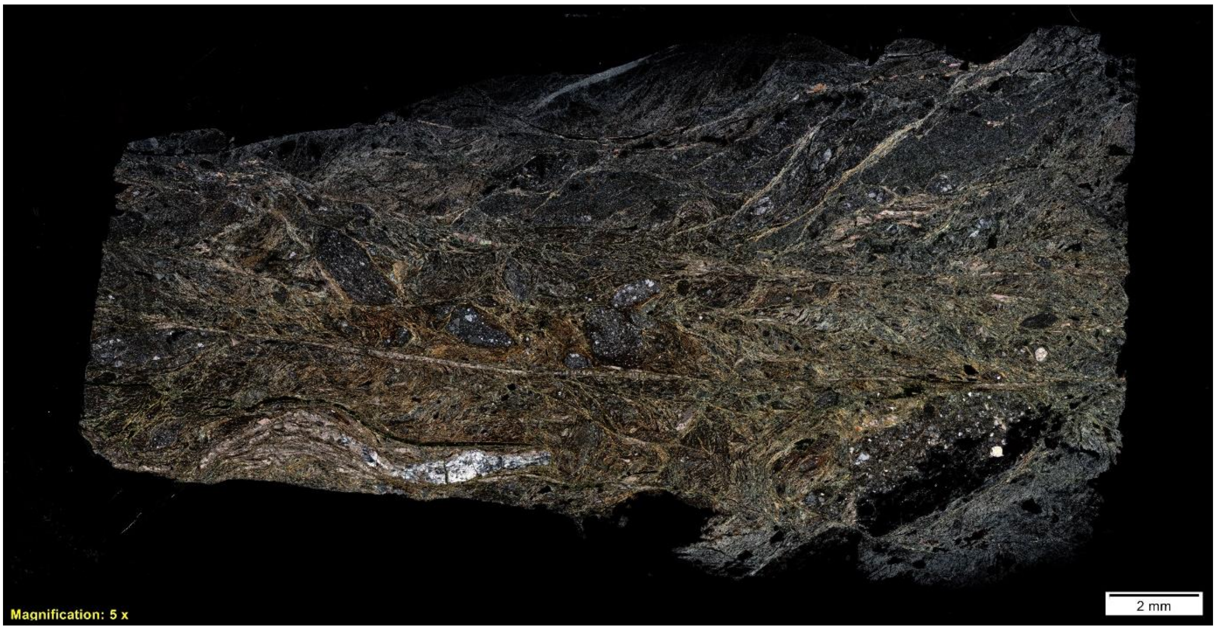


Figure 2: XPL image of sample 1:

Figure 3: Reflectance light (RL) image of sample 1.

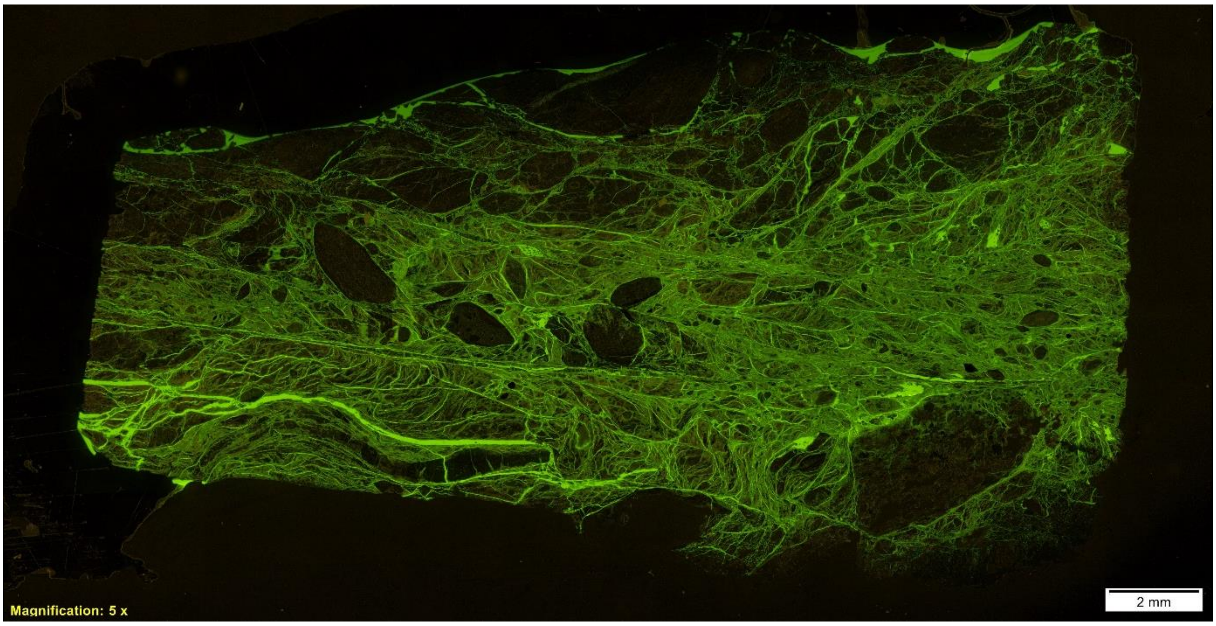


Figure 4: Fluorescence light (FL) image of sample 1.

Sample 2

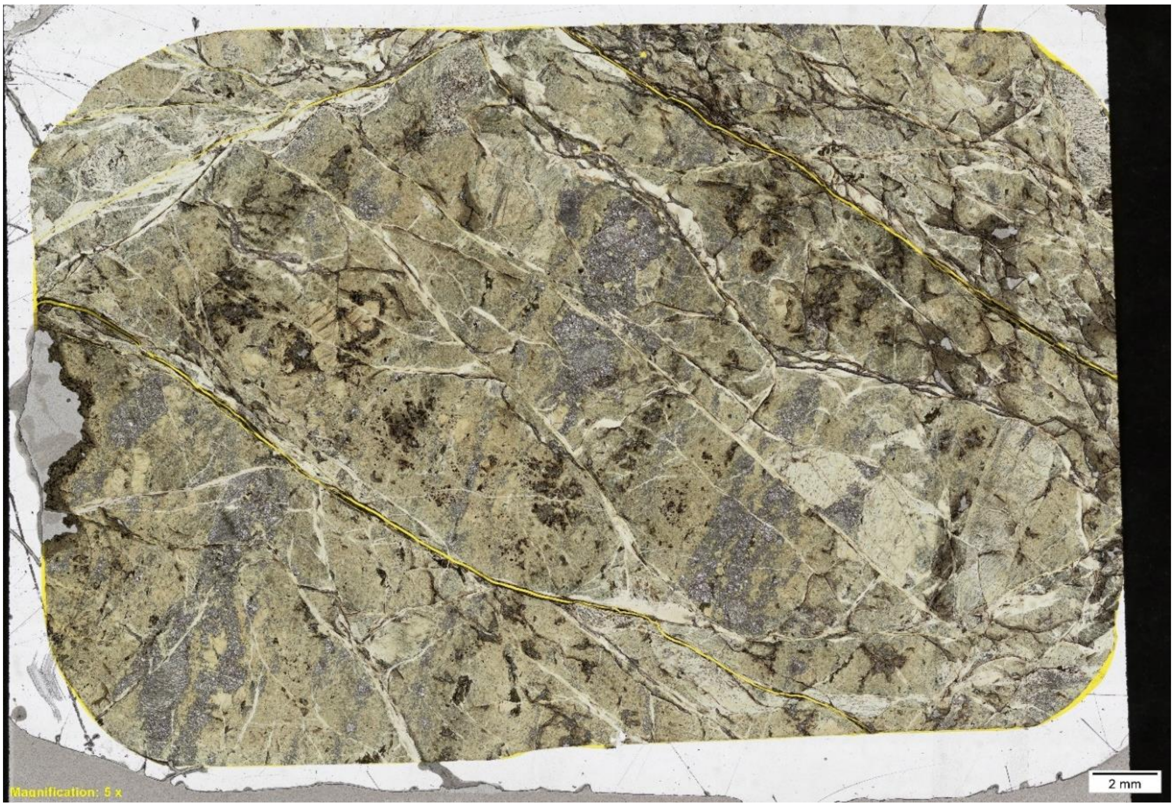


Figure 5: PPL image of sample 2.

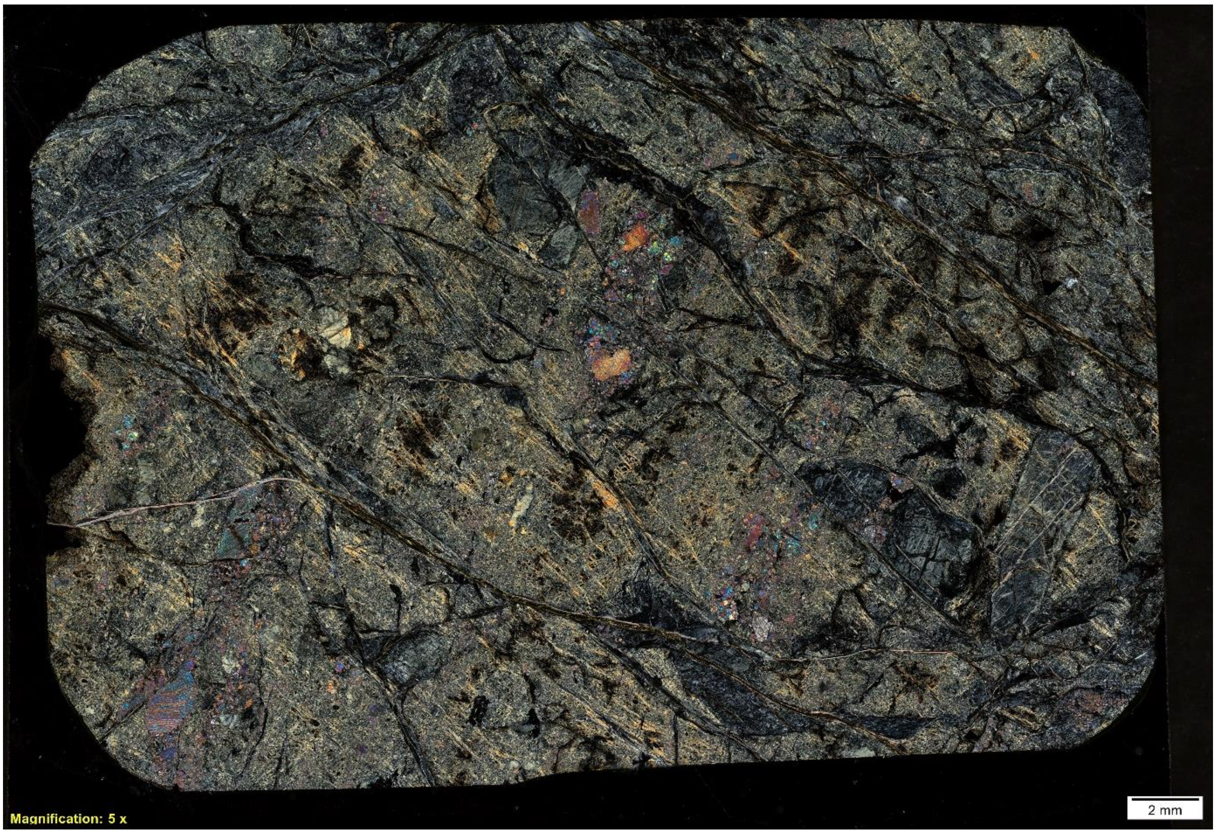


Figure 6: XPL image of sample 2.

Figure 7: Reflectance light (RL) image of sample 2.

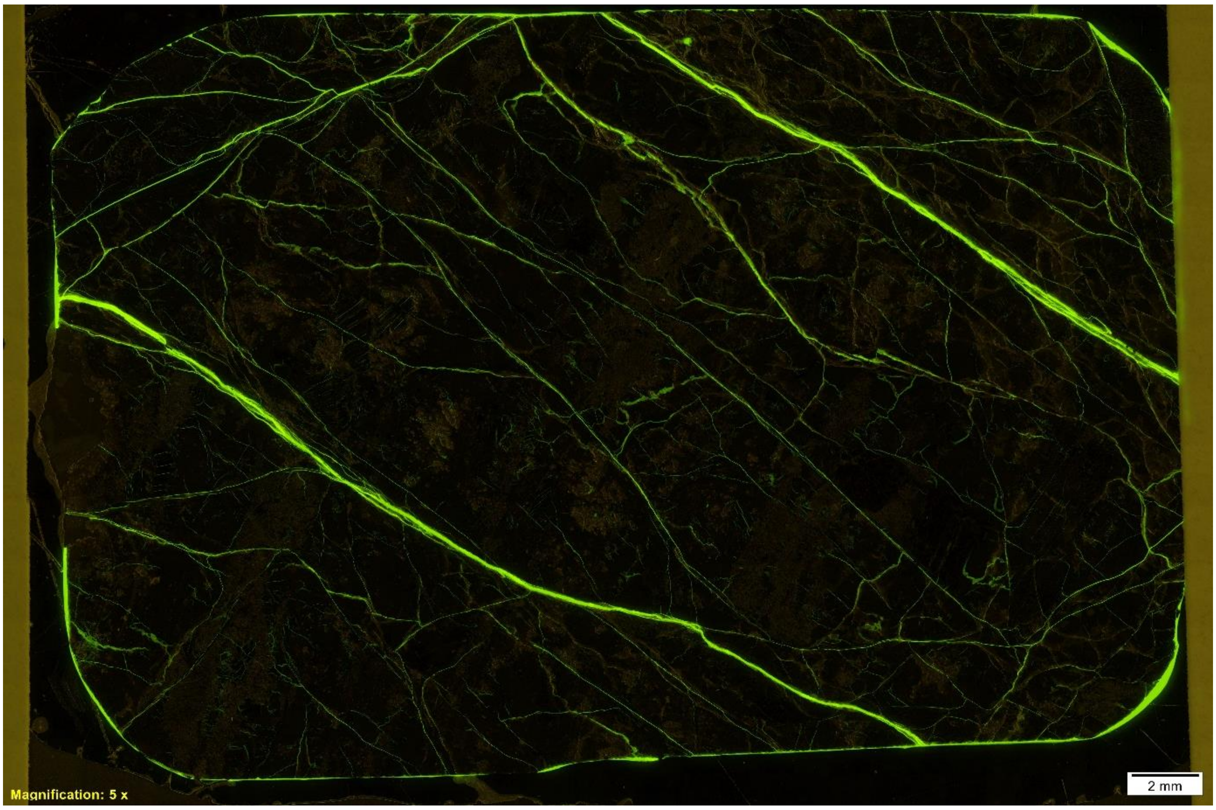


Figure 8: Fluorescence image (FL) of sample 2.

Sample 3

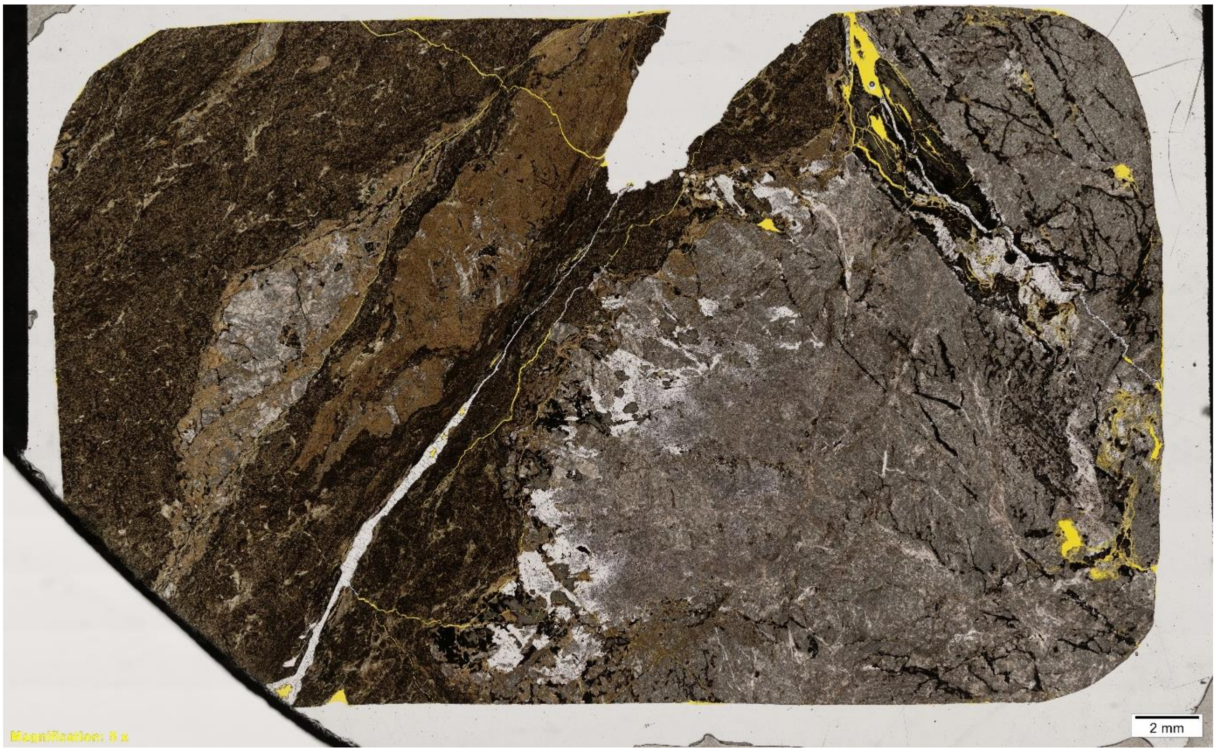


Figure 9: PPL image of sample 3.

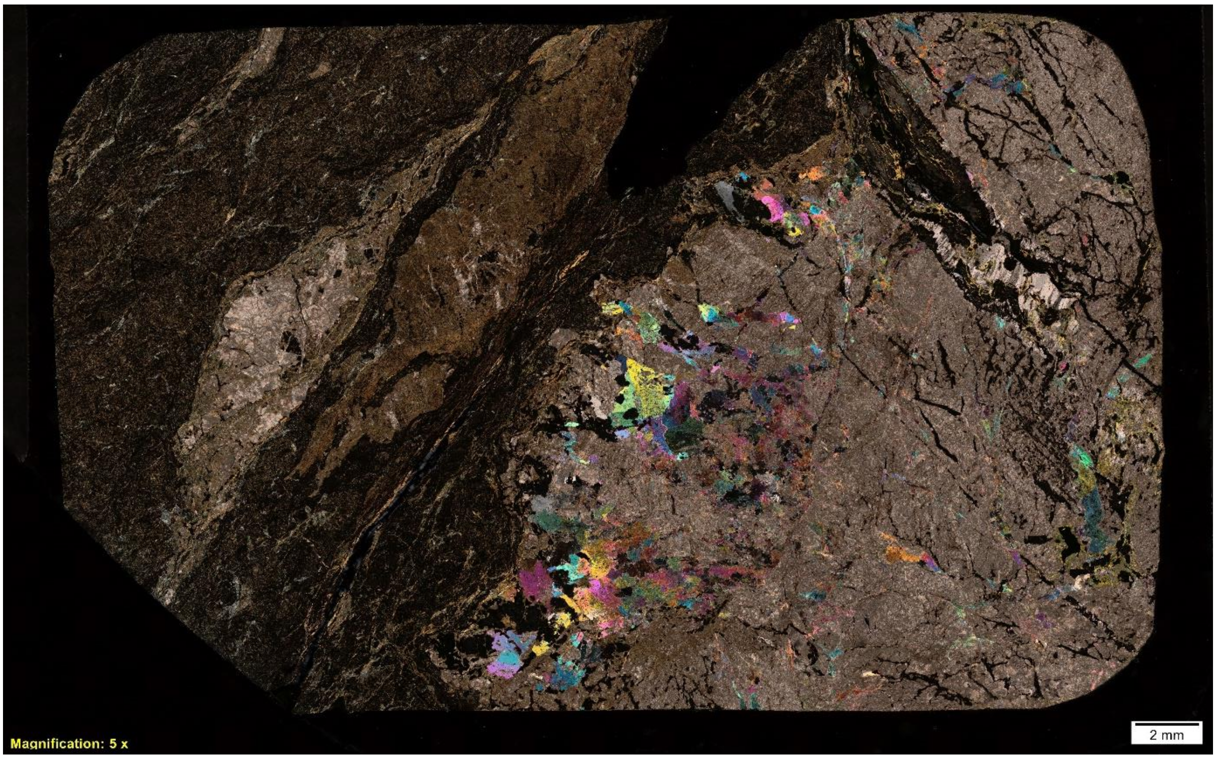


Figure 10: XPL image of sample 3.

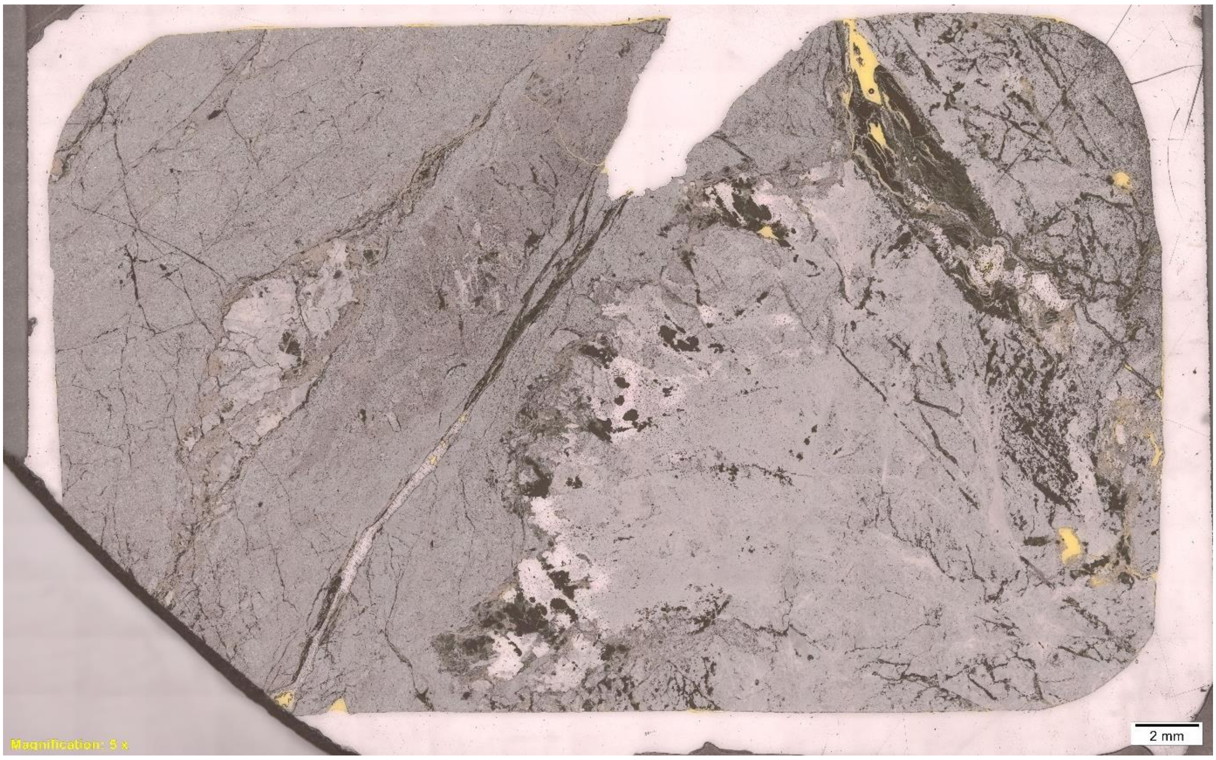


Figure 11: Reflectance light (RL) image of sample 3.

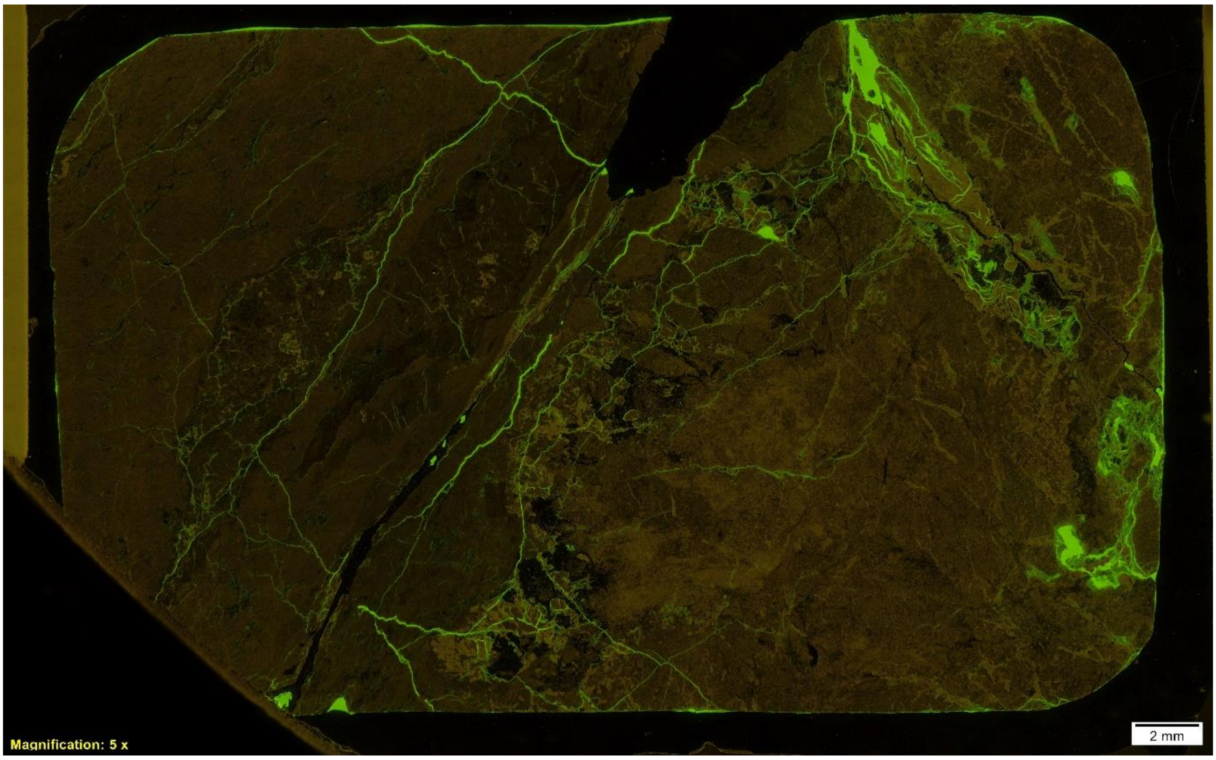


Figure 12: Fluorescence light (FL) image of sample 3.

Sample 4 and sample 5

Figure 13: PPL image of sample 4/5.

Figure 14: XPL image of sample 4/5.

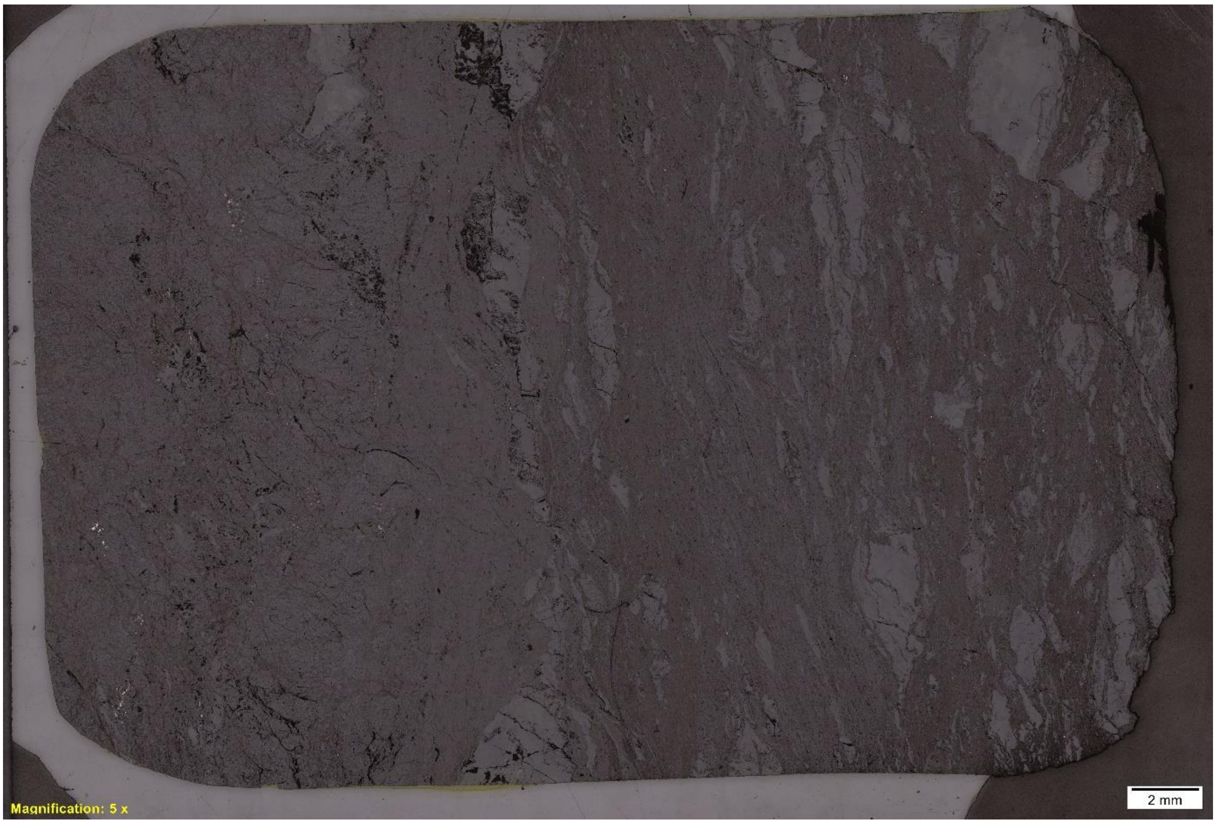


Figure 15: Reflectance light (RL) image of sample 4/5.

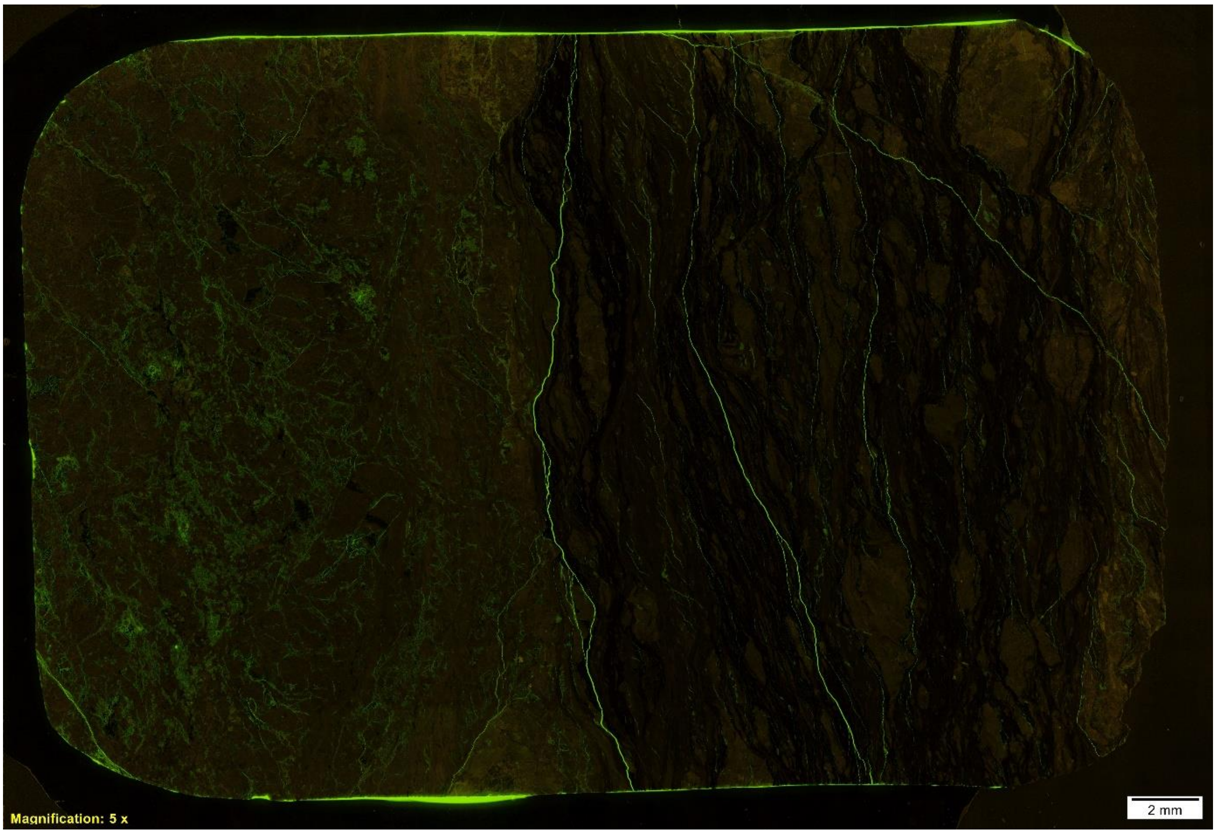


Figure 16: Fluorescence light (FL) image of sample 4/5.

Sample 6

Figure 17: PPL image of sample 6.

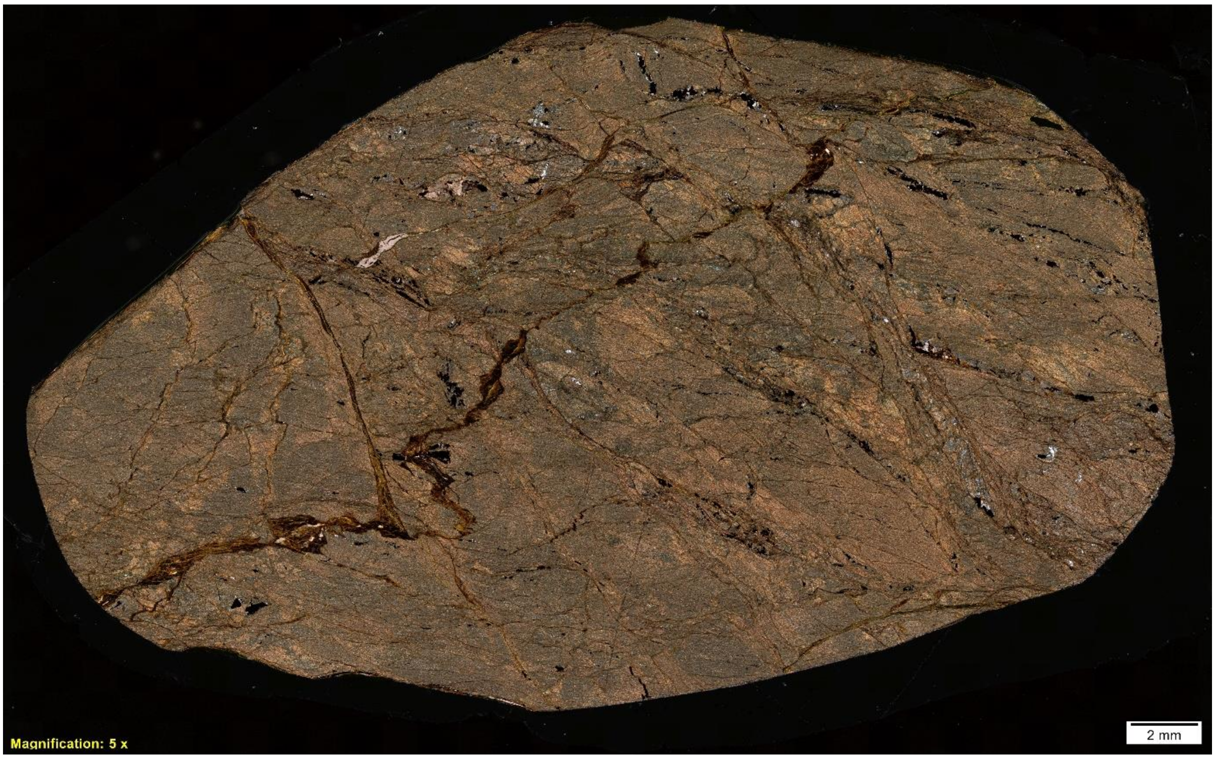


Figure 18: XPL image of sample 6.

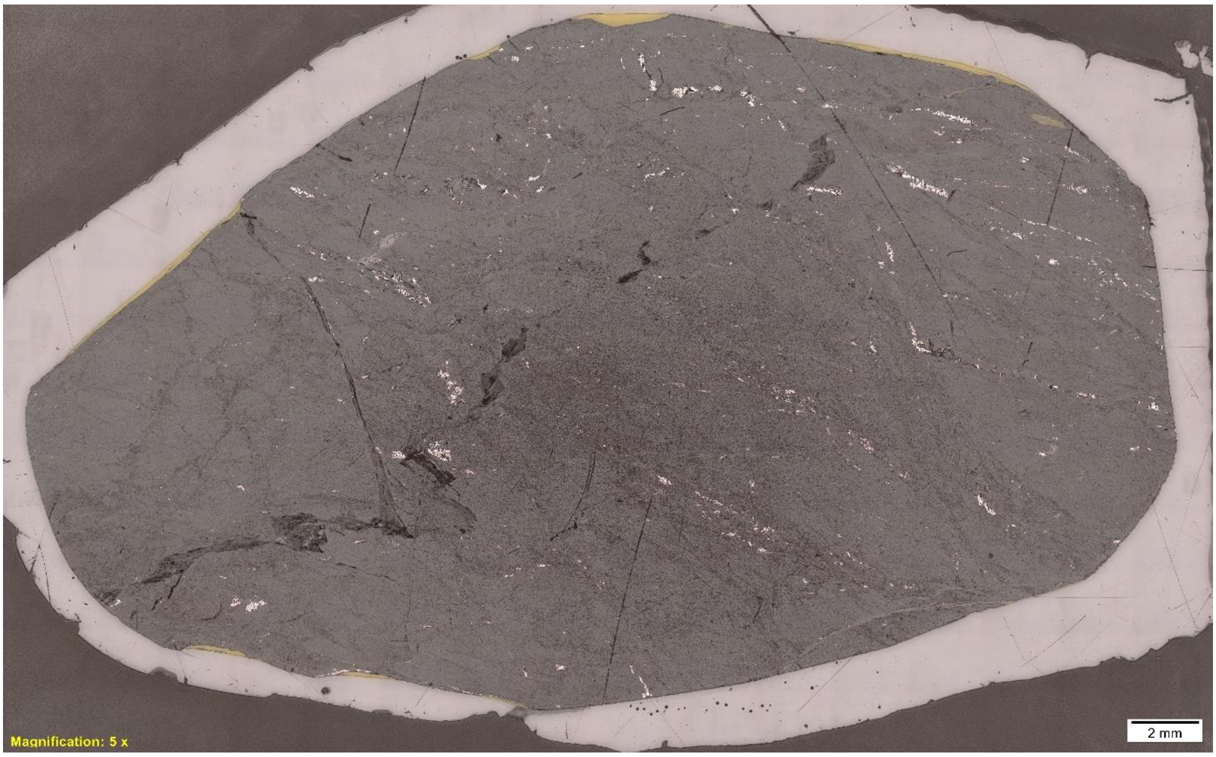


Figure 19: Reflectance light (RL) image of sample 6.

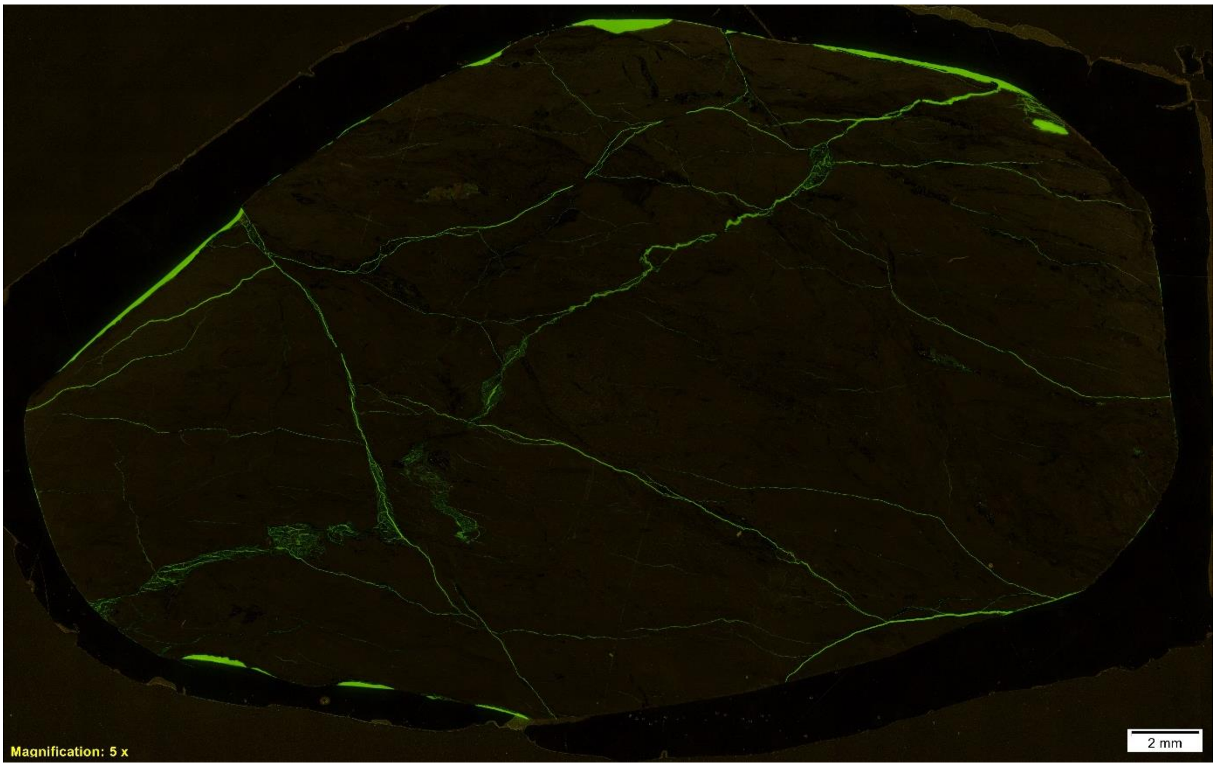


Figure 20: Fluorescence light (FL) image of sample 6.

Sample 7

Figure 21: PPL image of sample 7.

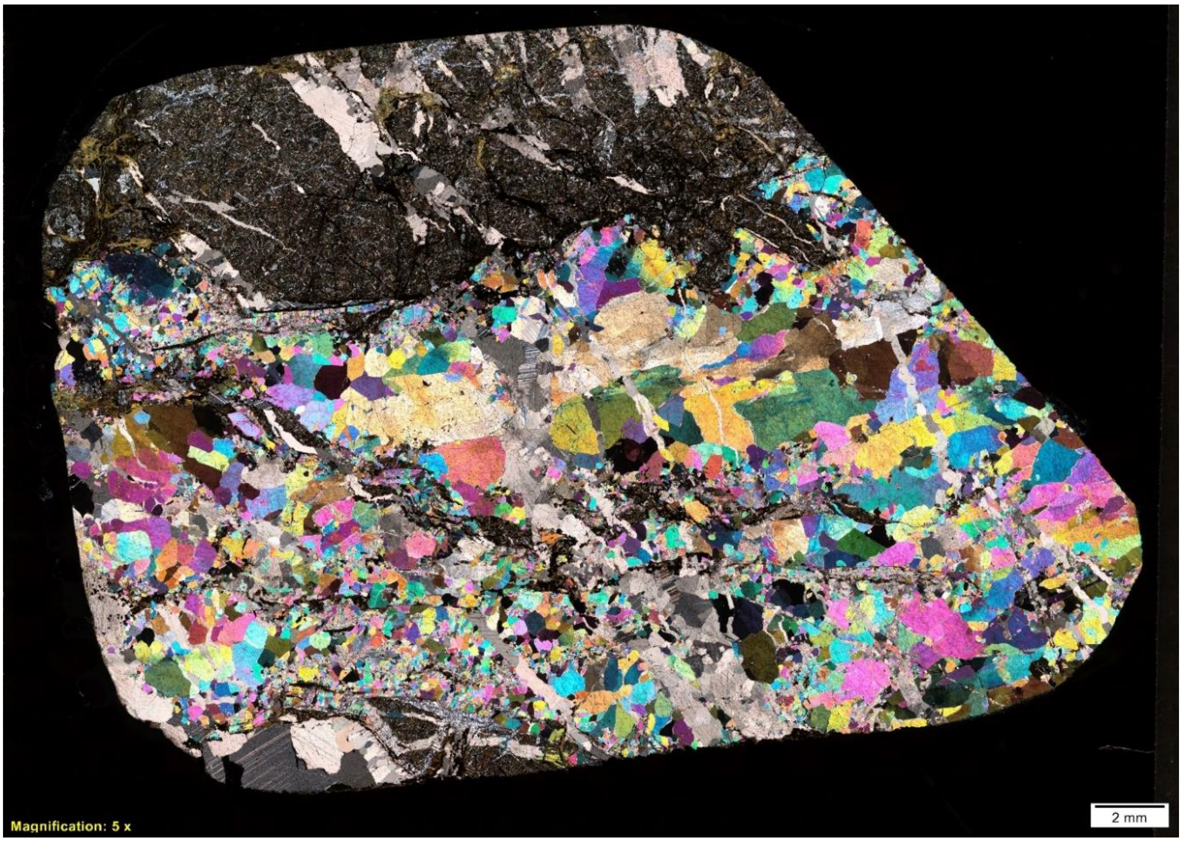


Figure 22: XPL image of sample 7.

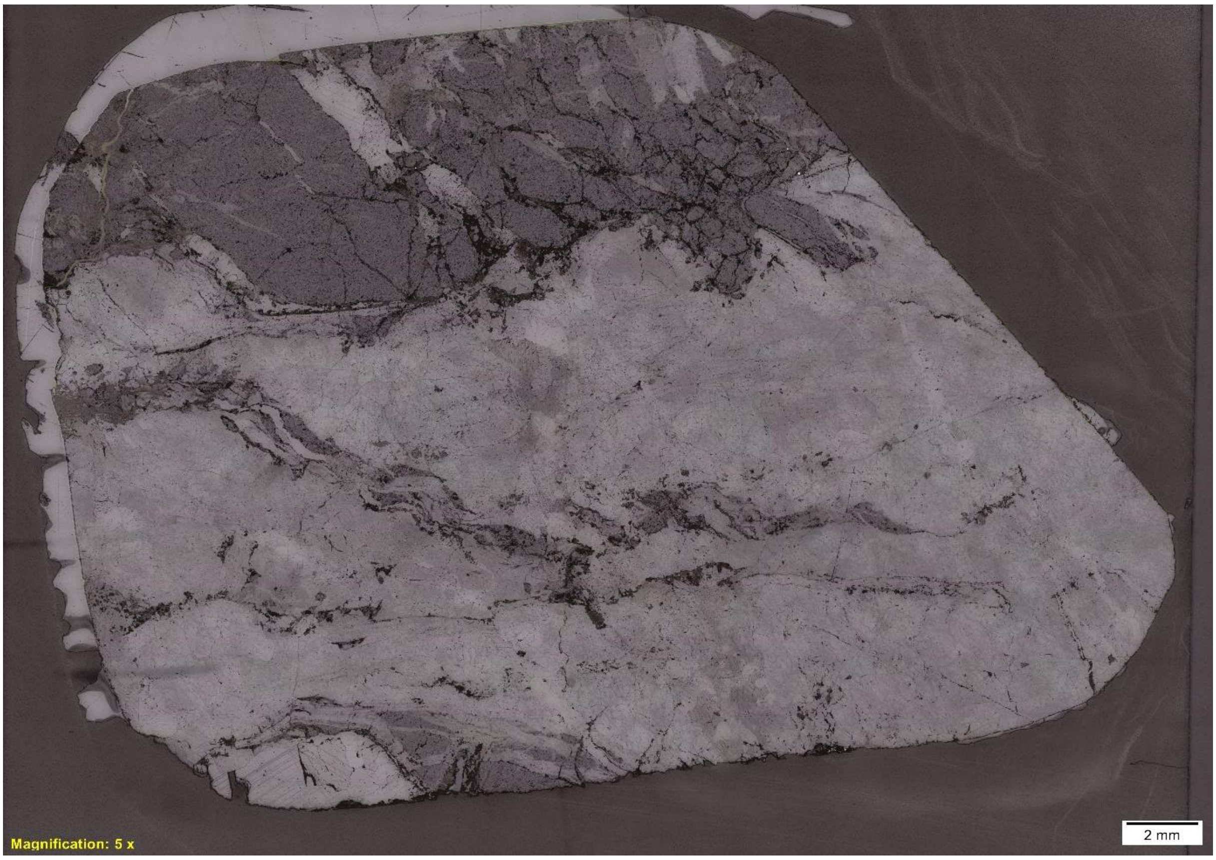


Figure 23: Reflectance light (RL) image of sample 7.

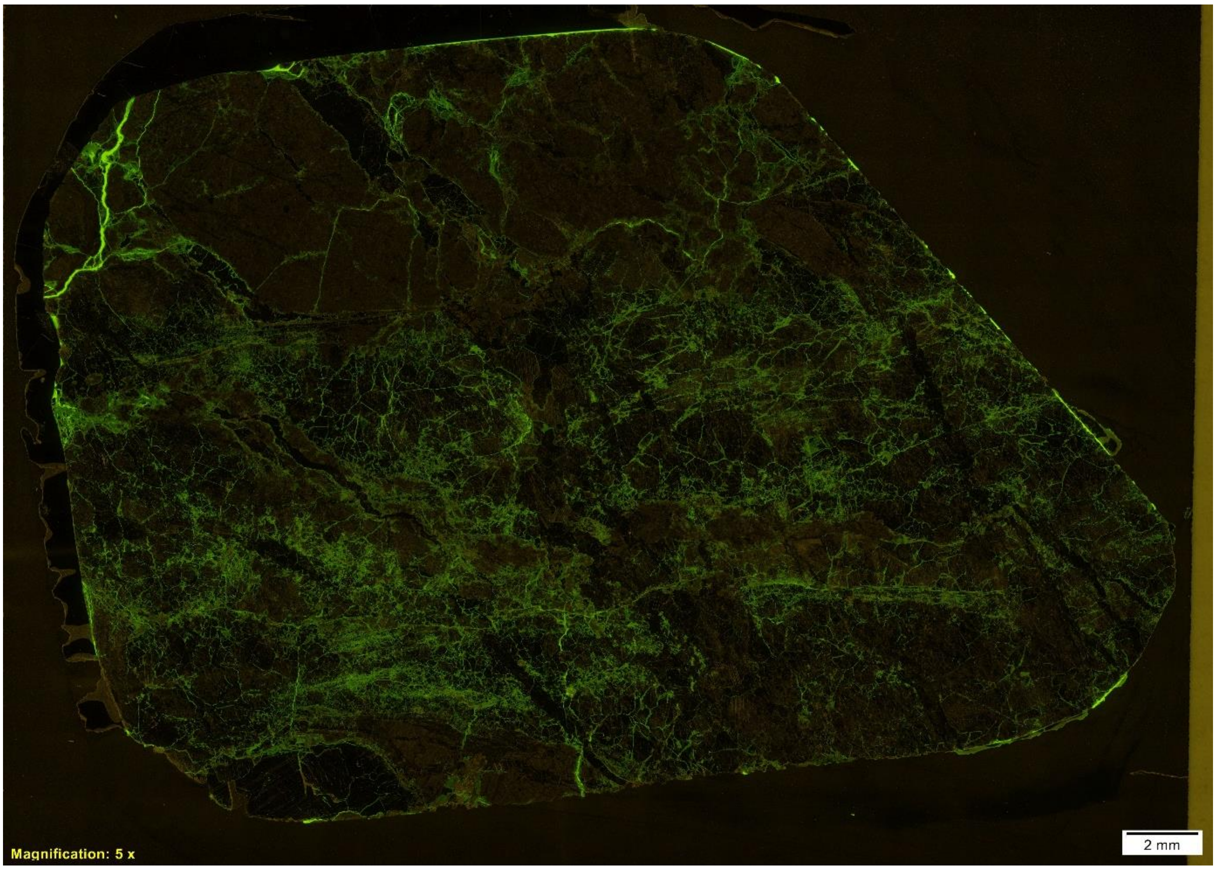


Figure 24: Fluorescence light (FL) image of sample 7.

Sample 8

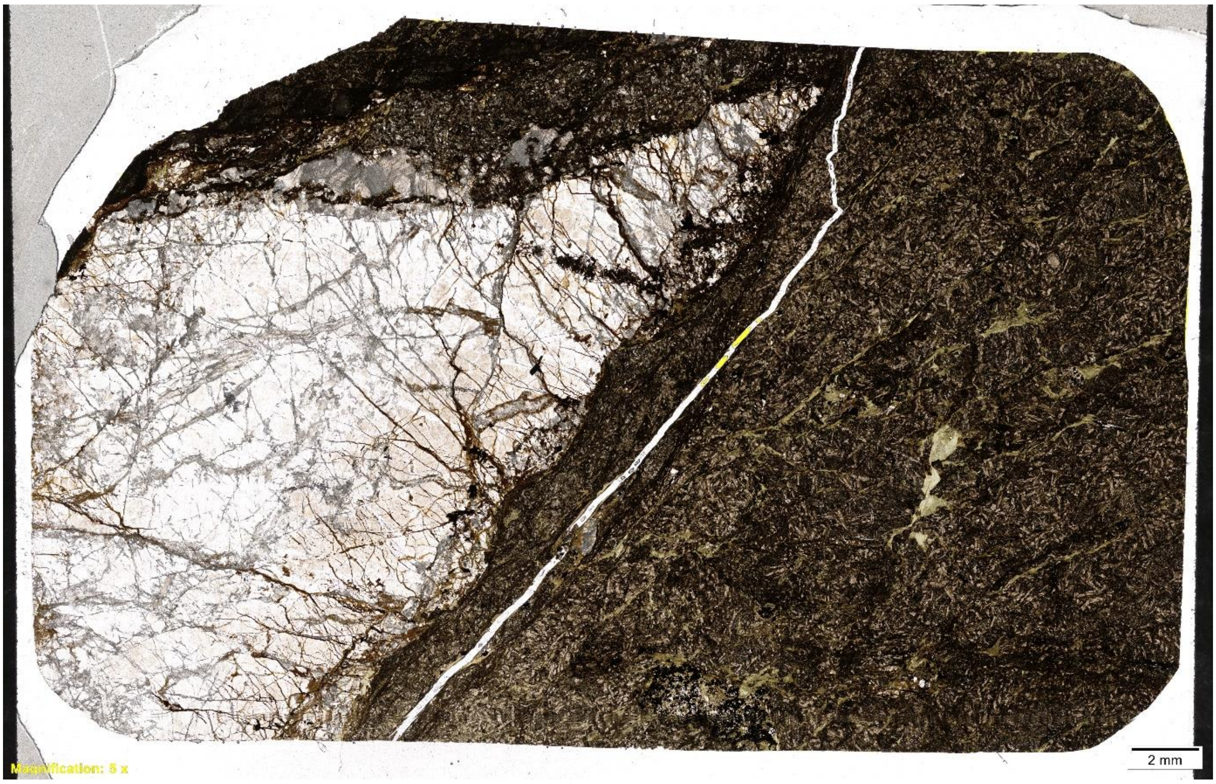


Figure 25: PPL image of sample 8.

Figure 26: XPL image of sample 8.

Figure 27: Reflectance light (RL) image of sample 8.

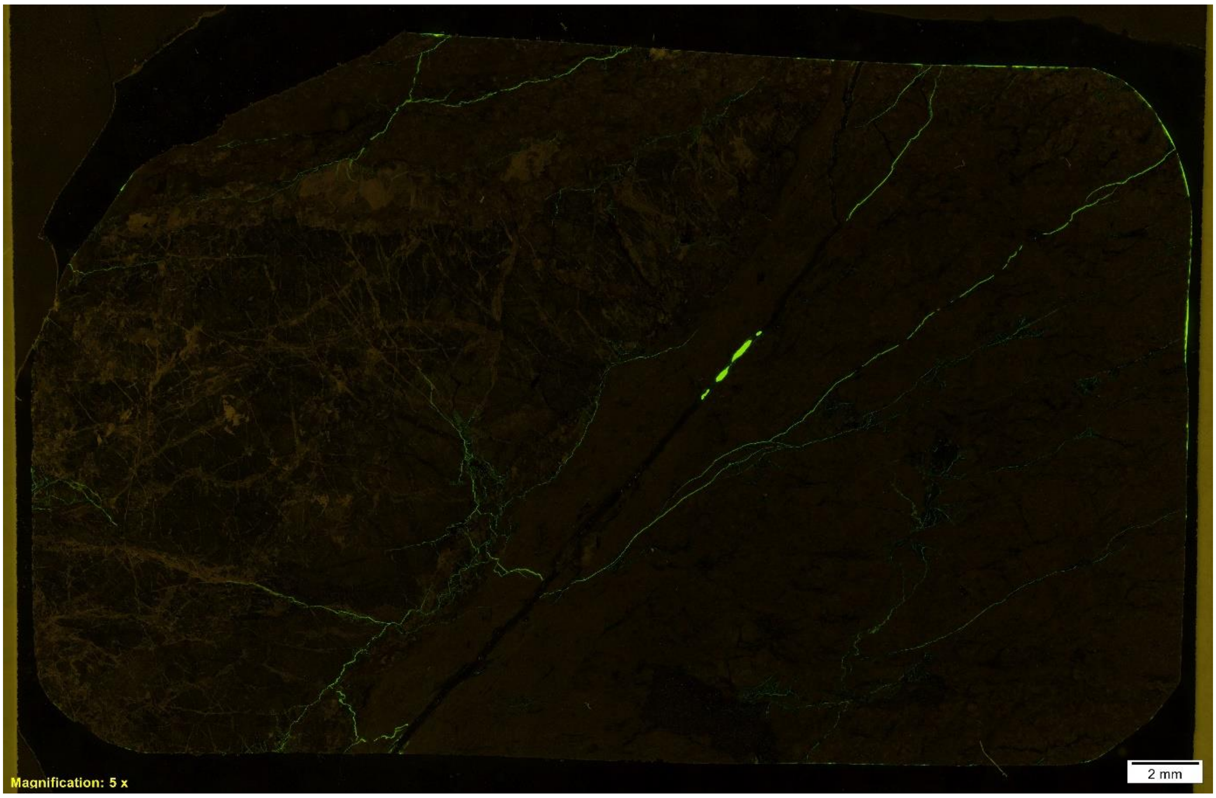


Figure 28: Fluorescence light (FL) image of sample 8.

Sample 9

Figure 29: PPL image of sample 9.

Figure 30: XPL image of sample 9.

Figure 31: Reflectance light (RL) image of sample 9.

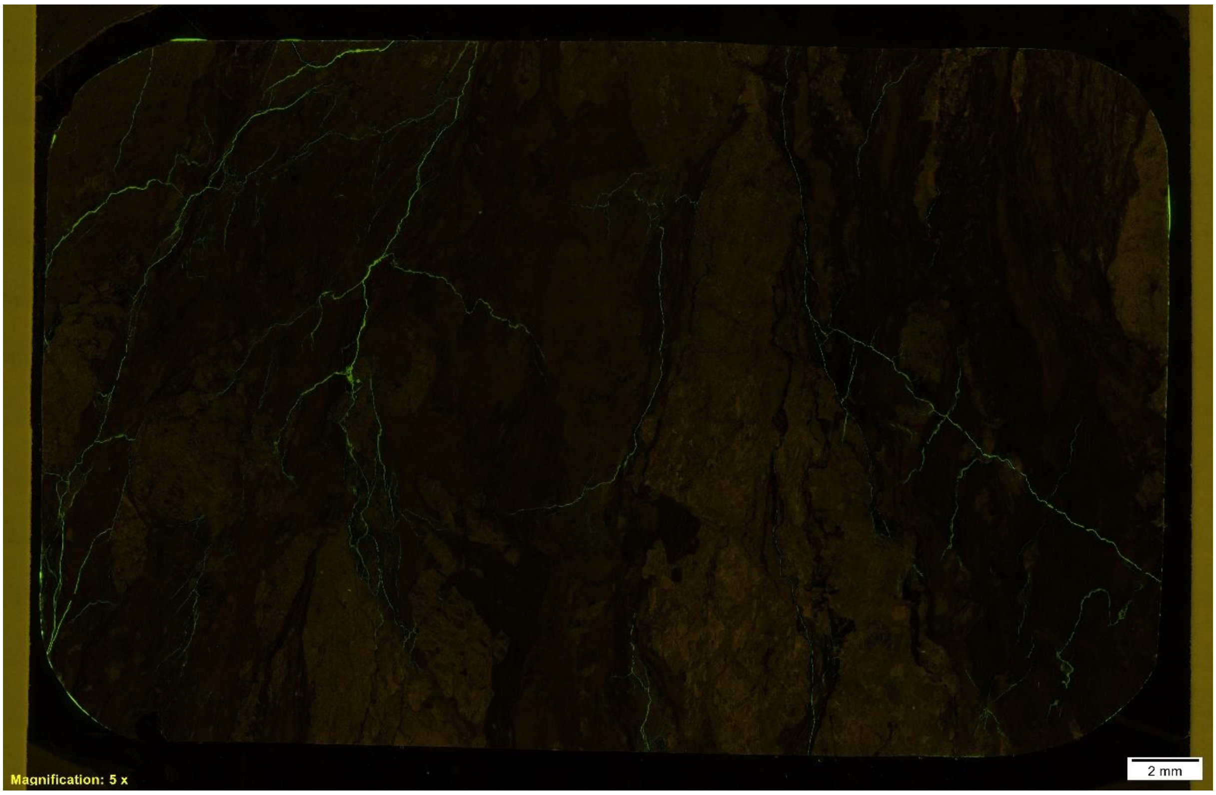


Figure 32: Fluorescence light (FL) image of sample 9.

Appendix H – AMS results for intact samples

The AMS thin section results are located in an Excel file in the digital zip-file found in NTNU-open.

Overview of sample data in the Excel file.

Overview of sample data:	
Sample (TS)	
1	x
2	x
3_a	x
3_b	x
4	x
5	x
6_a	x
6_b	x
7	x
8	x
9	x

Appendix I – AMS backscatter and mineral map for intact samples

<u>Sample 1</u>:

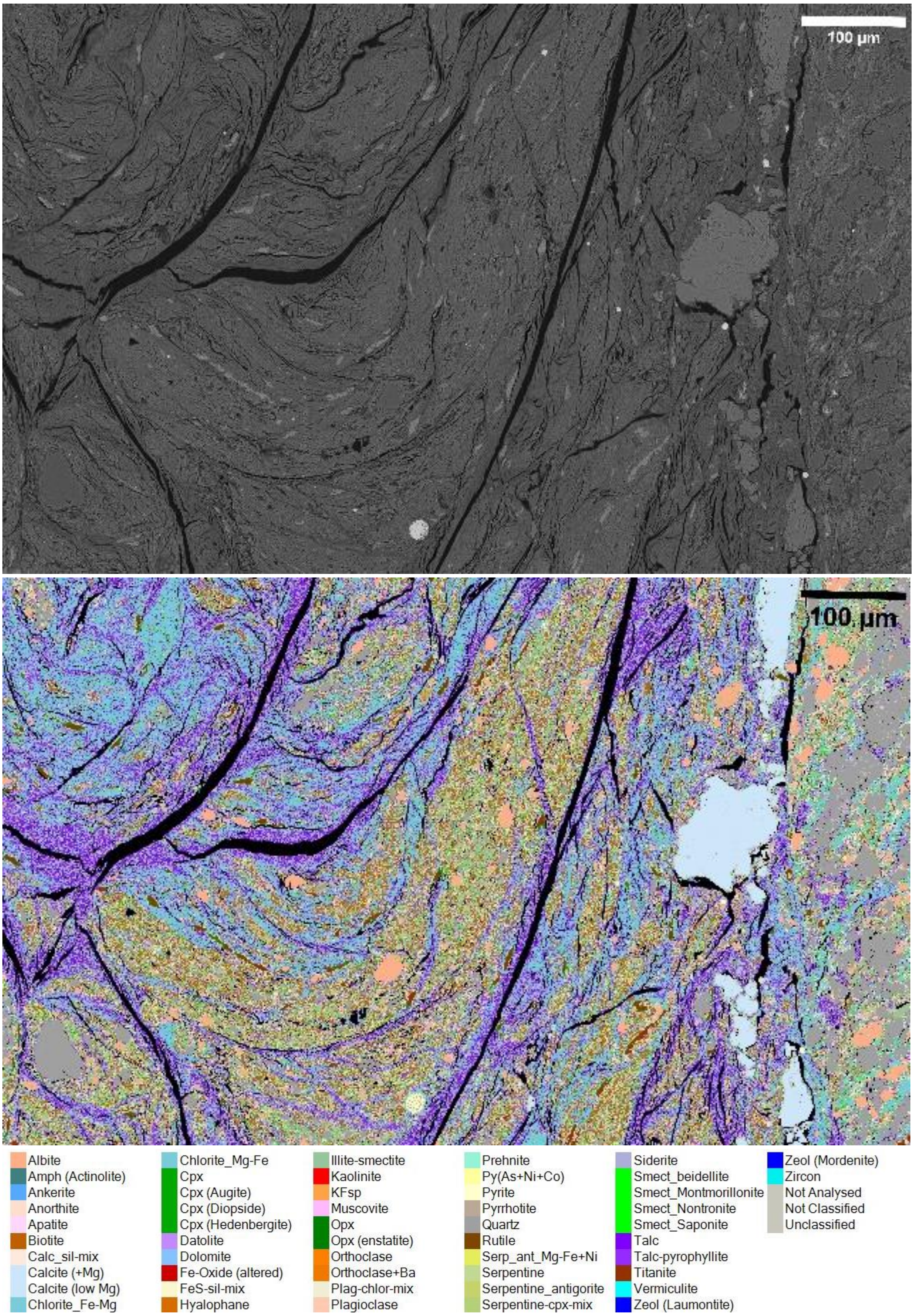


Figure 1: BSE image, false-colored mineral map and mineral classification of TS1.

Sample 2:

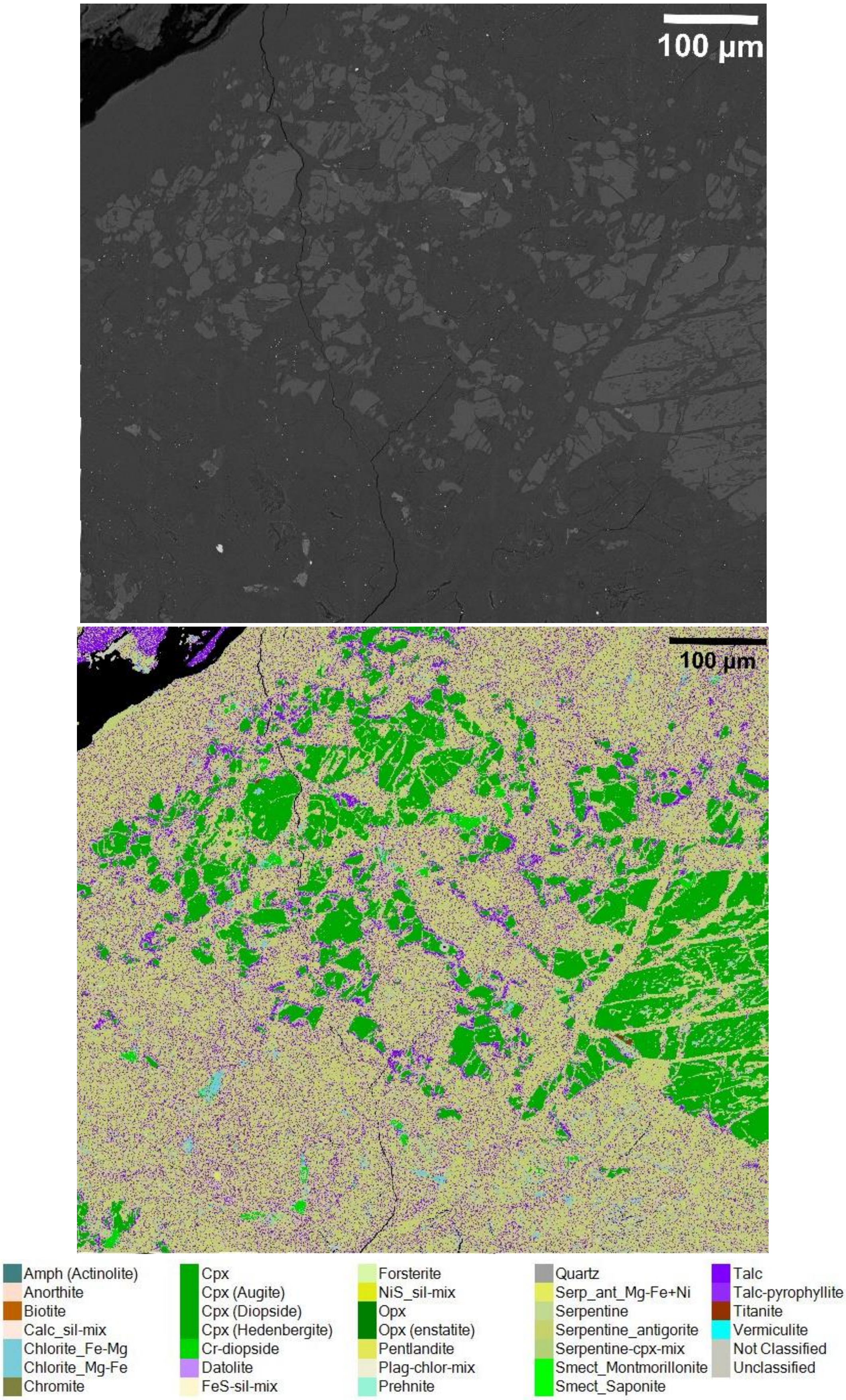


Figure 2: BSE image, false-colored mineral map and mineral classification of TS2.

Sample 3 with TS3a and TS3b:

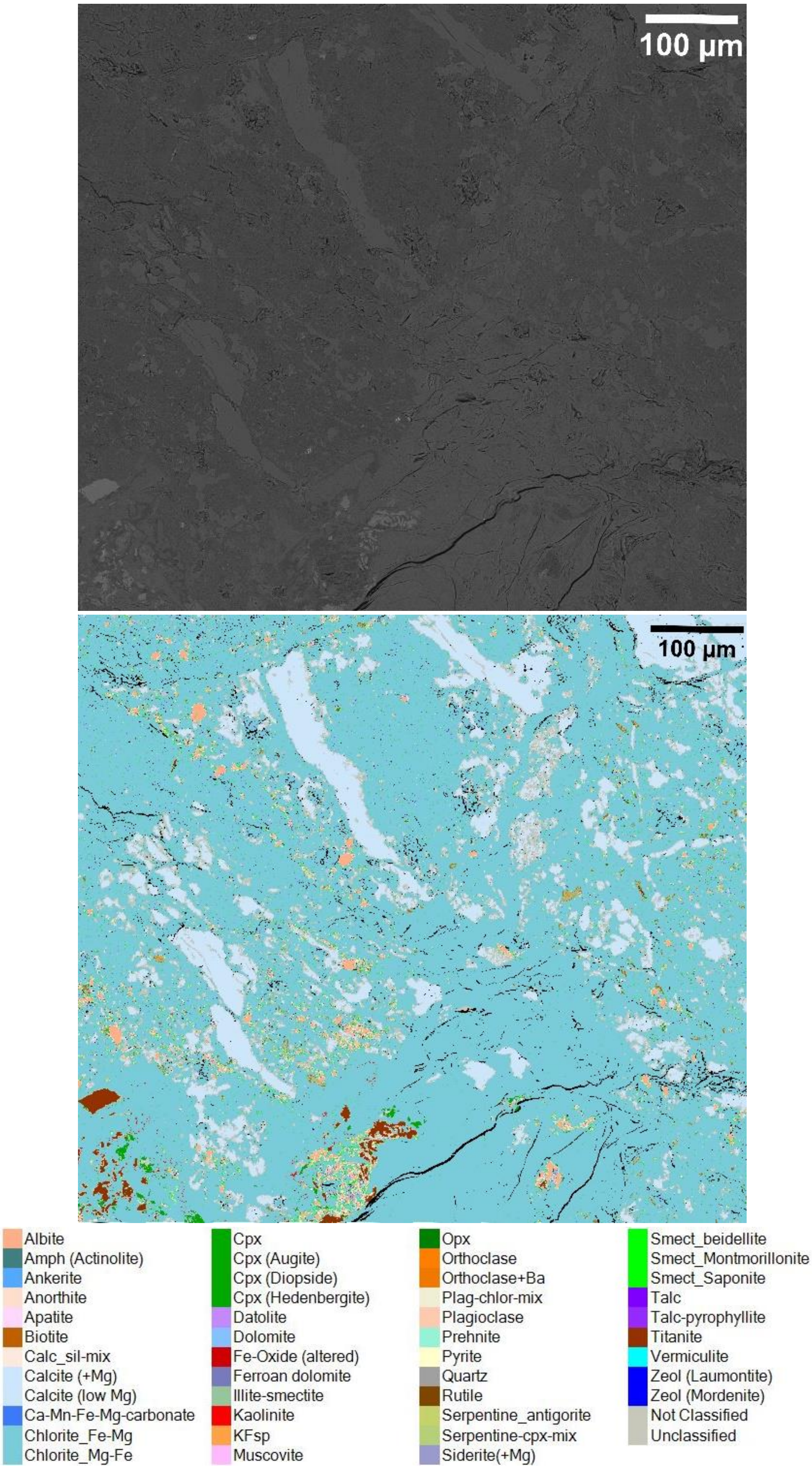


Figure 3: BSE image, false-colored mineral map and mineral classification of TS3_a.

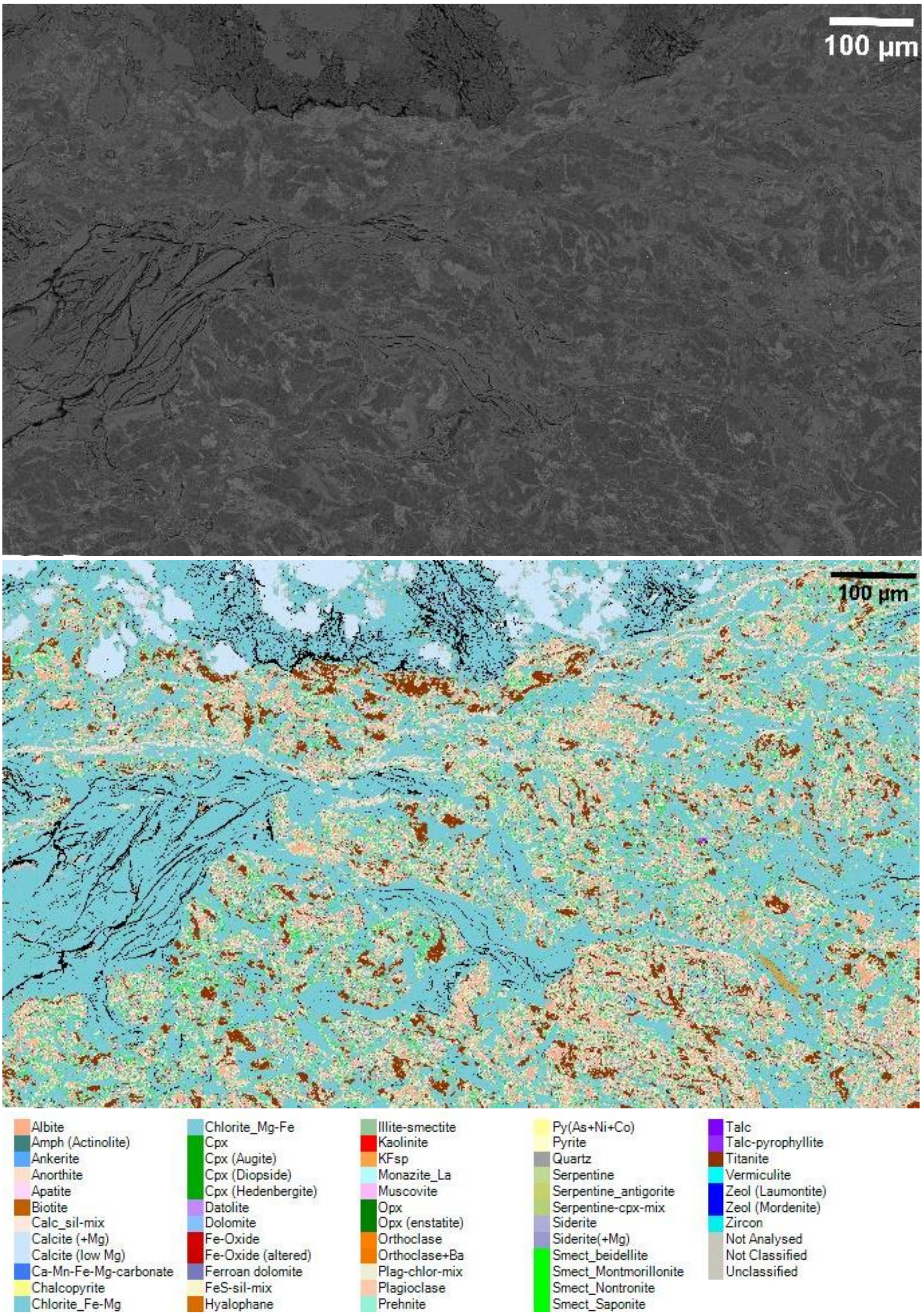


Figure 4: BSE image, false-colored mineral map and mineral classification of TS3_b.

Sample 4:

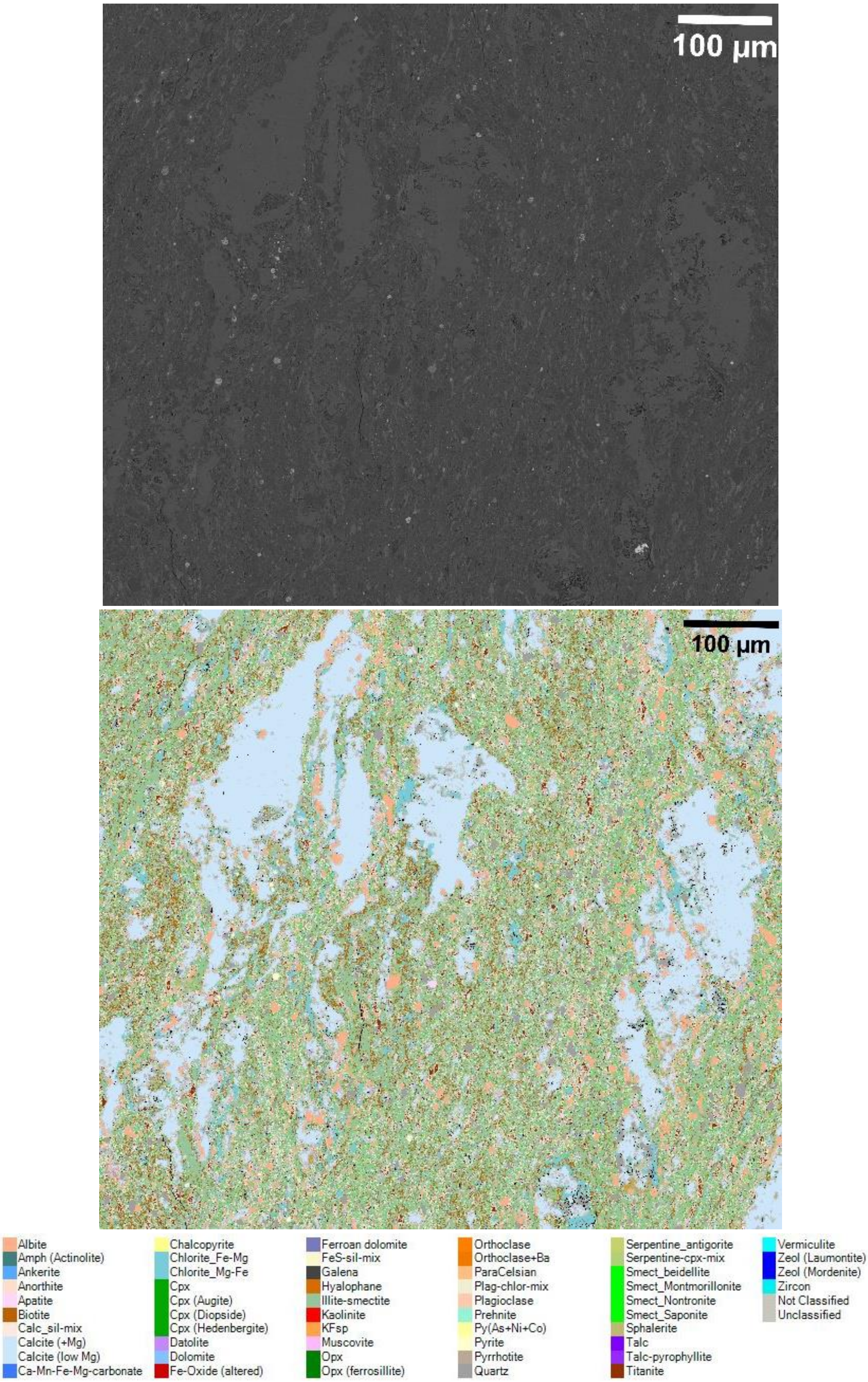


Figure 5: BSE image, false-colored mineral map and mineral classification of TS4.

Sample 5:

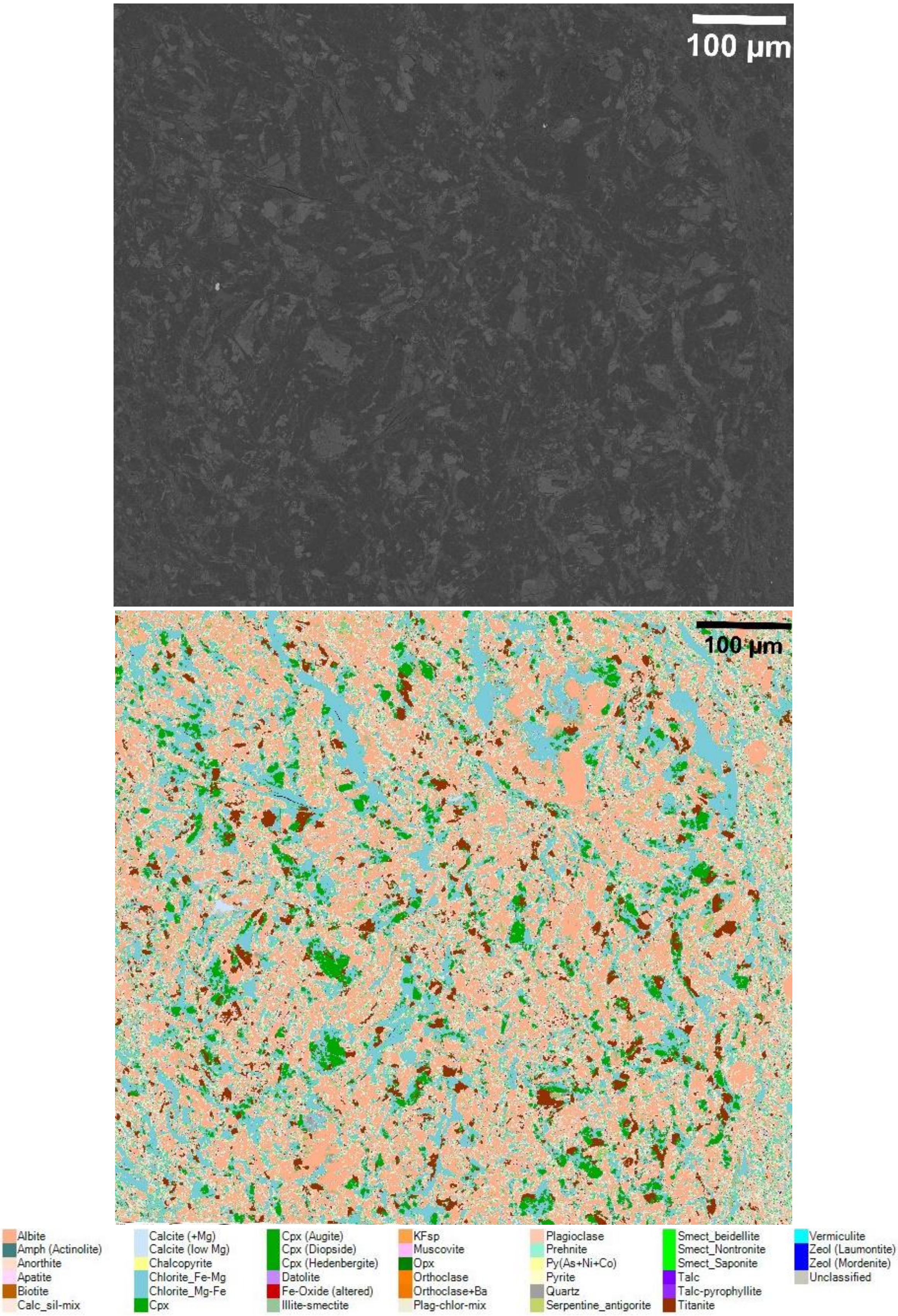


Figure 6: BSE image, false-colored mineral map and mineral classification of TS5.

Sample 6 with TS6a and TS6b:

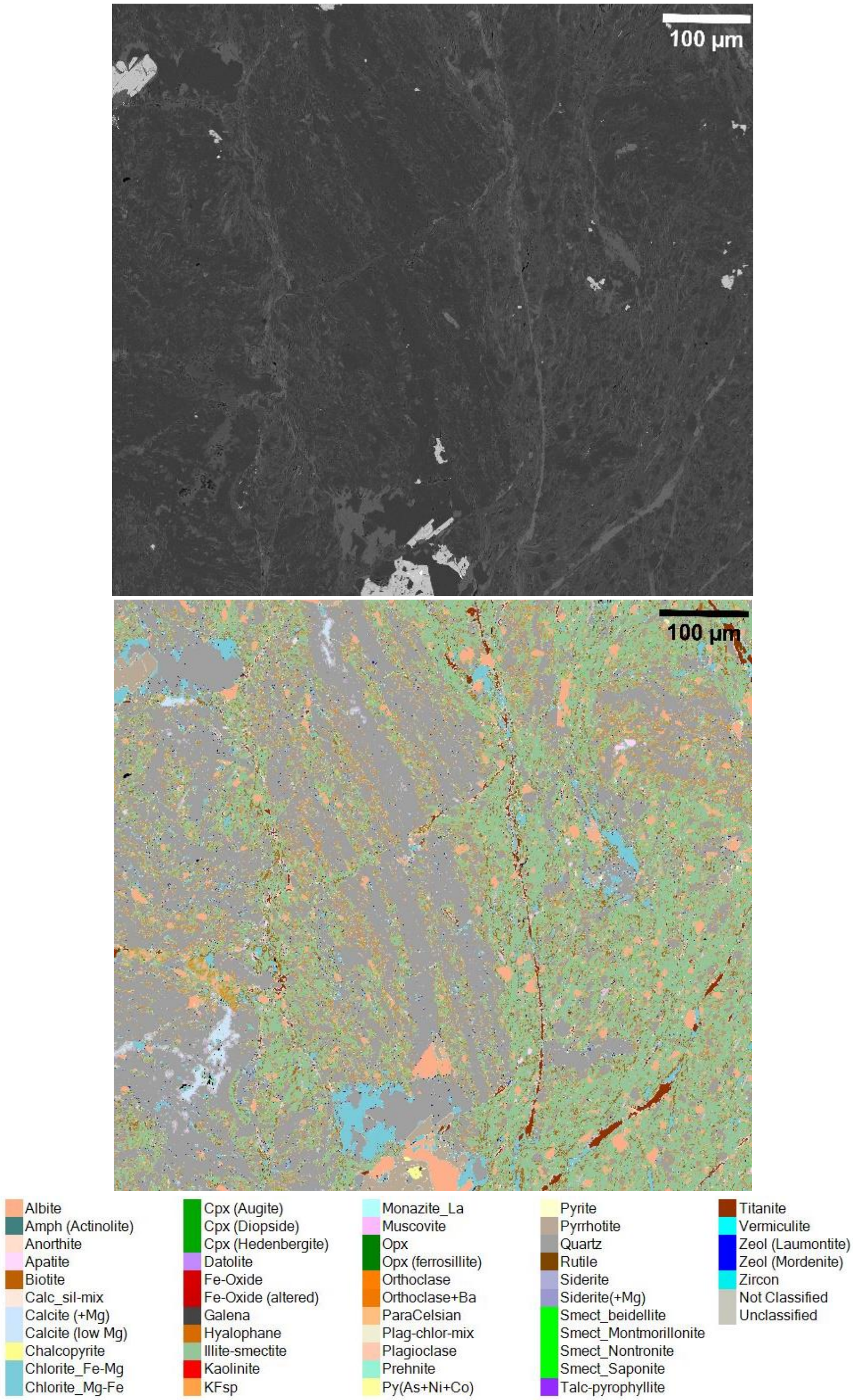


Figure 7: BSE image, false-colored mineral map and mineral classification of TS6_a.

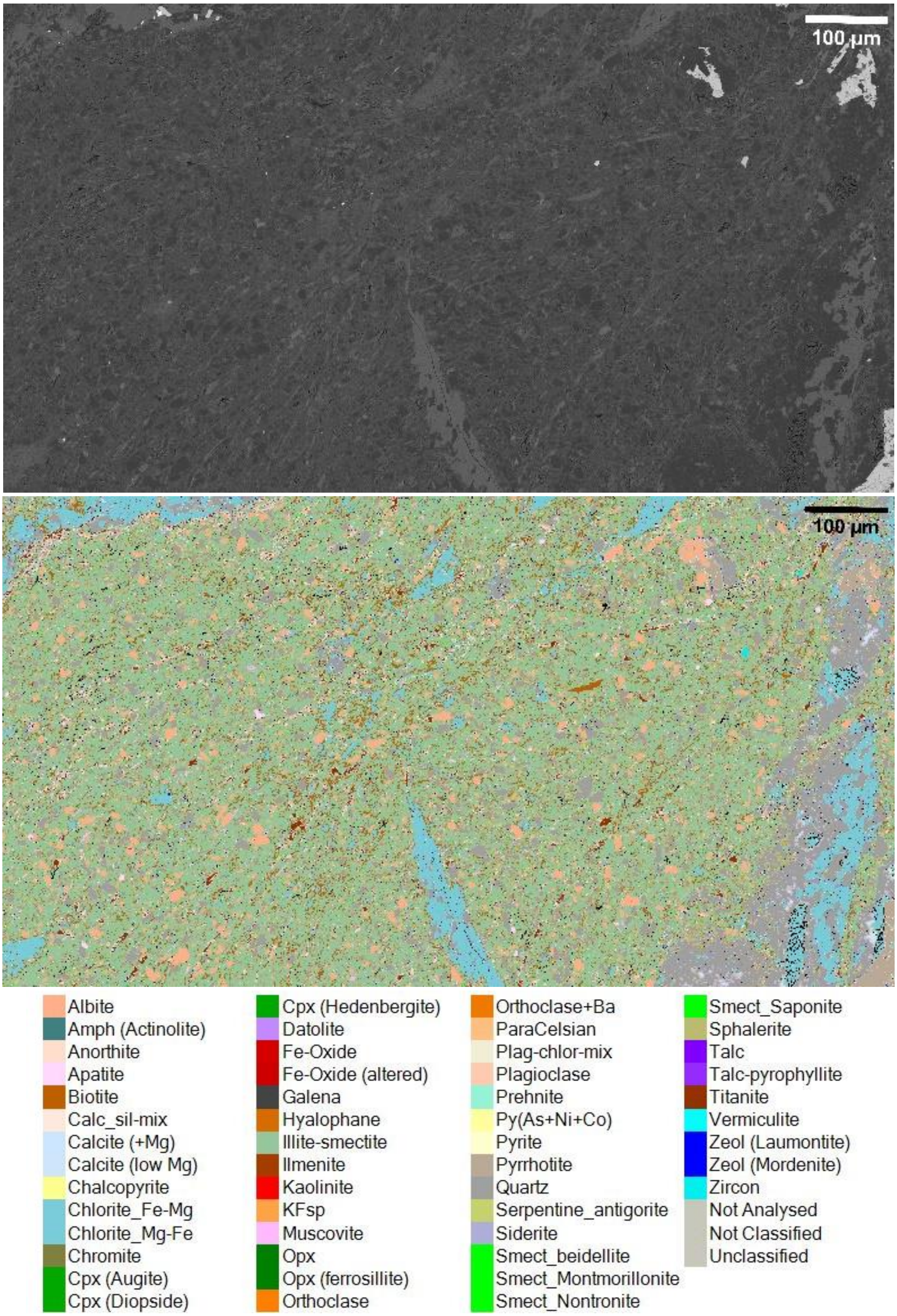


Figure 8: BSE image, false-colored mineral map and mineral classification of TS6_b.

Sample 7:

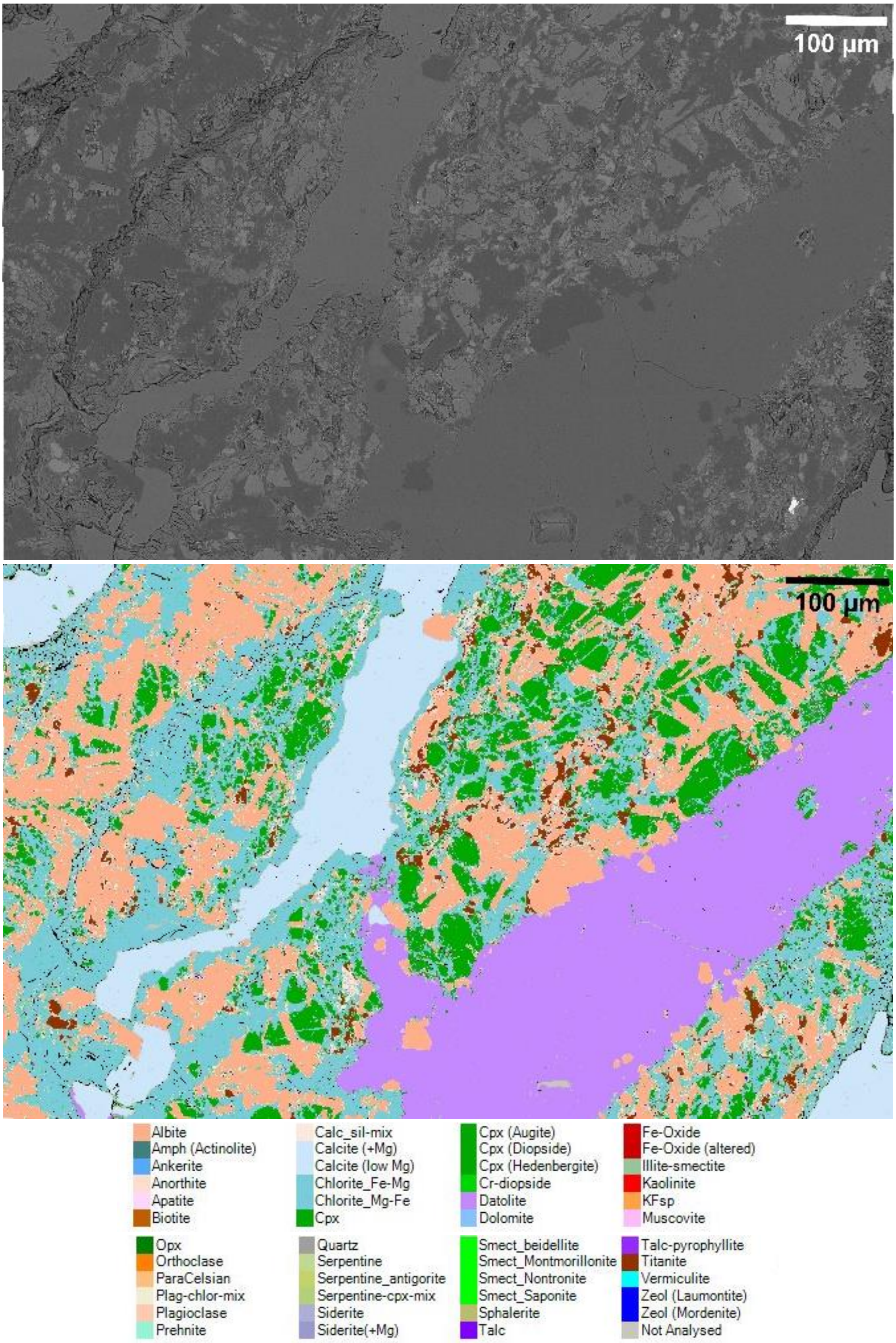


Figure 9: BSE image, false-colored mineral map and mineral classification of TS7.

Sample 8:

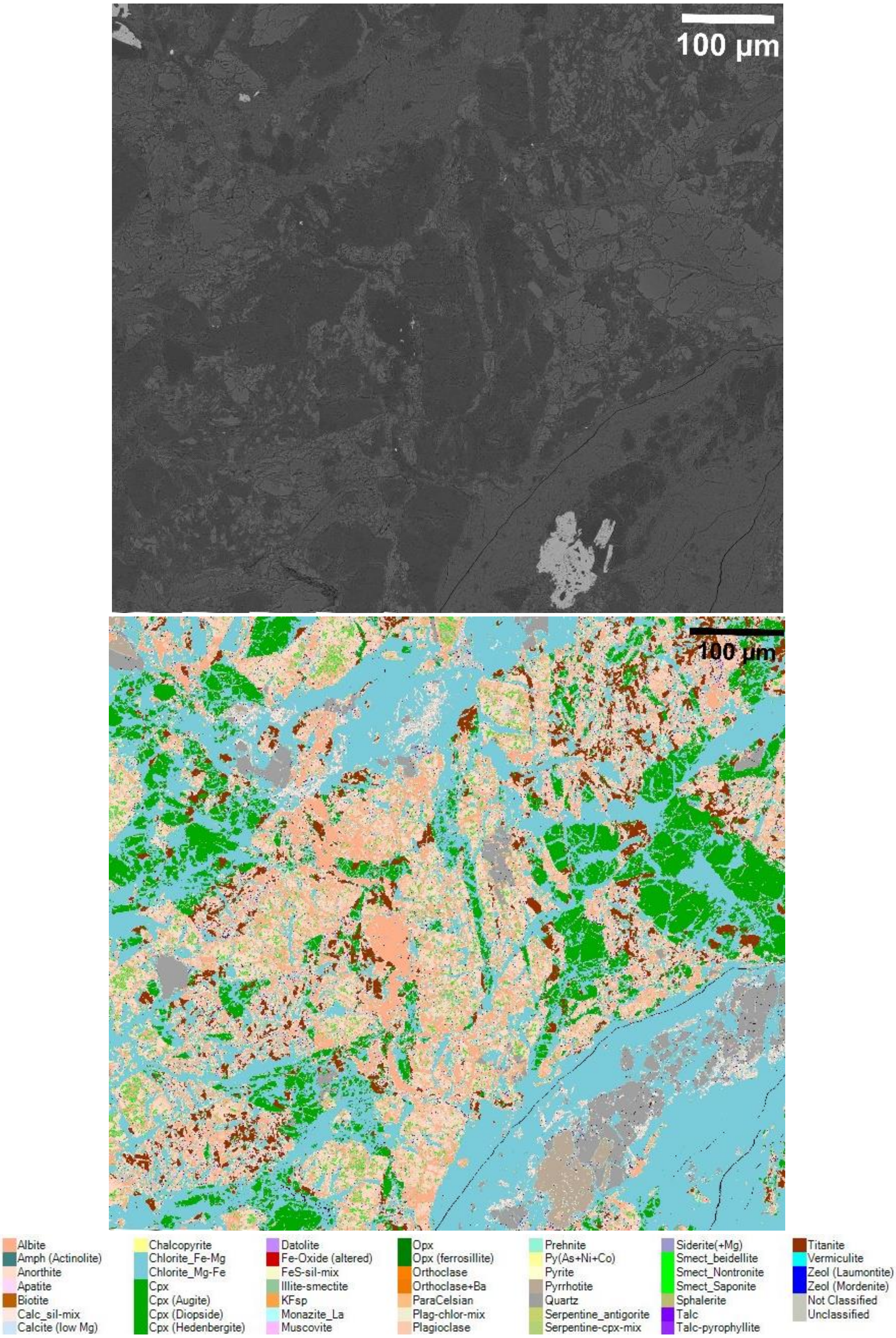


Figure 10: BSE image, false-colored mineral map and mineral classification of TS8.

Sample 9:

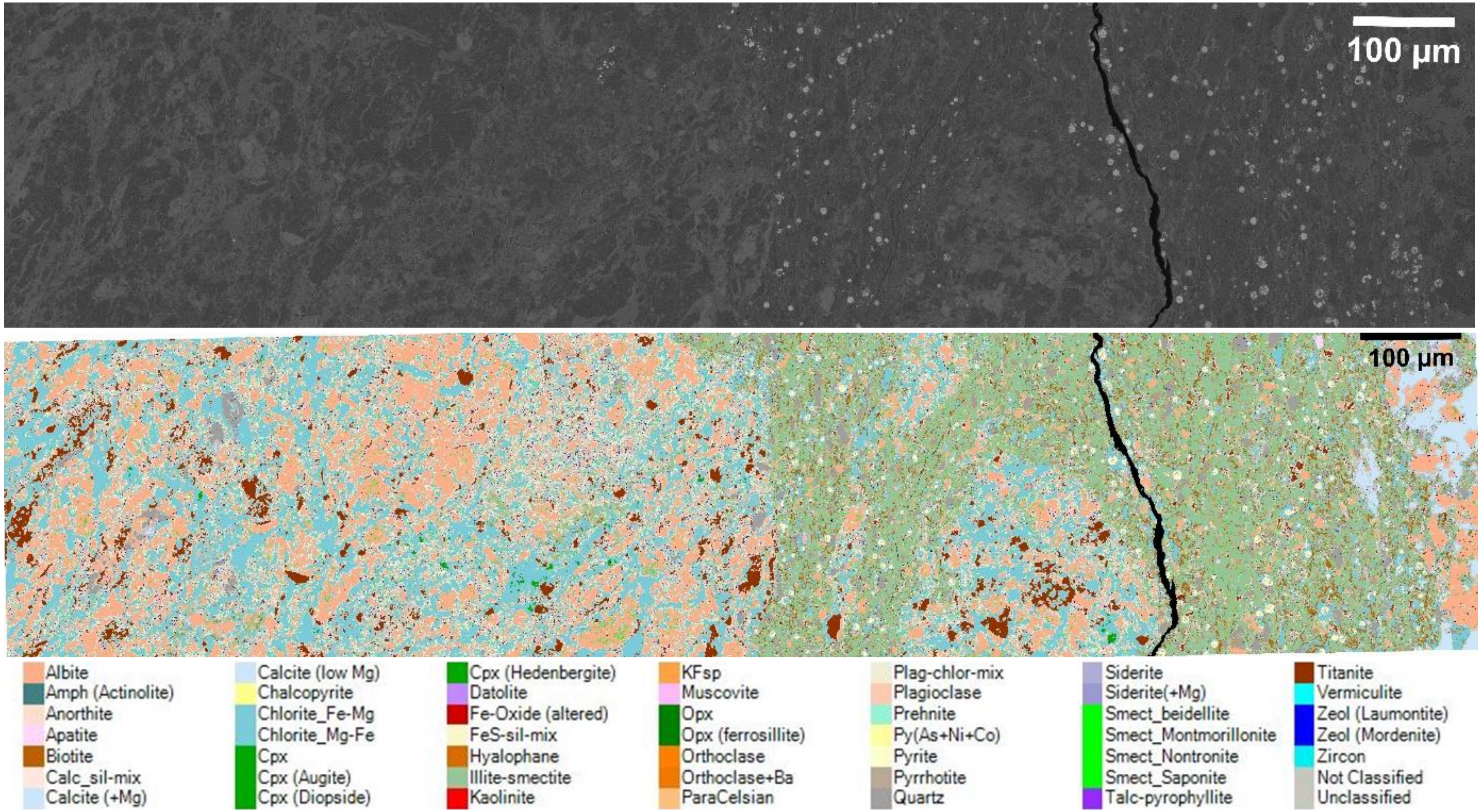


Figure 11: BSE image, false-colored mineral map and mineral classification of TS9.

Appendix J – AMS results for powder samples

The AMS powder sample results are located in an excel file in the digital zip-file which can be found in NTNU Open.

The bulk calculation of the modified samples MODA and MODB to MOD is found in the digital zip-file in the folder "Other resources".

Overview of sample data in the Excel file.

Sample	*STD*	*MODA*	*MODB*
1	x	x	x
2	x	x	x
3	x		
4	x	x	x
5	x	x	x
6	x		
7	x		

x - sample data presented in this appendix

Appendix K - AMS backscatter and mineral maps for powder samples

Figure 1: Legend of mineral color classification used for the false-colored mineral maps.

<u>Sample 1</u>:

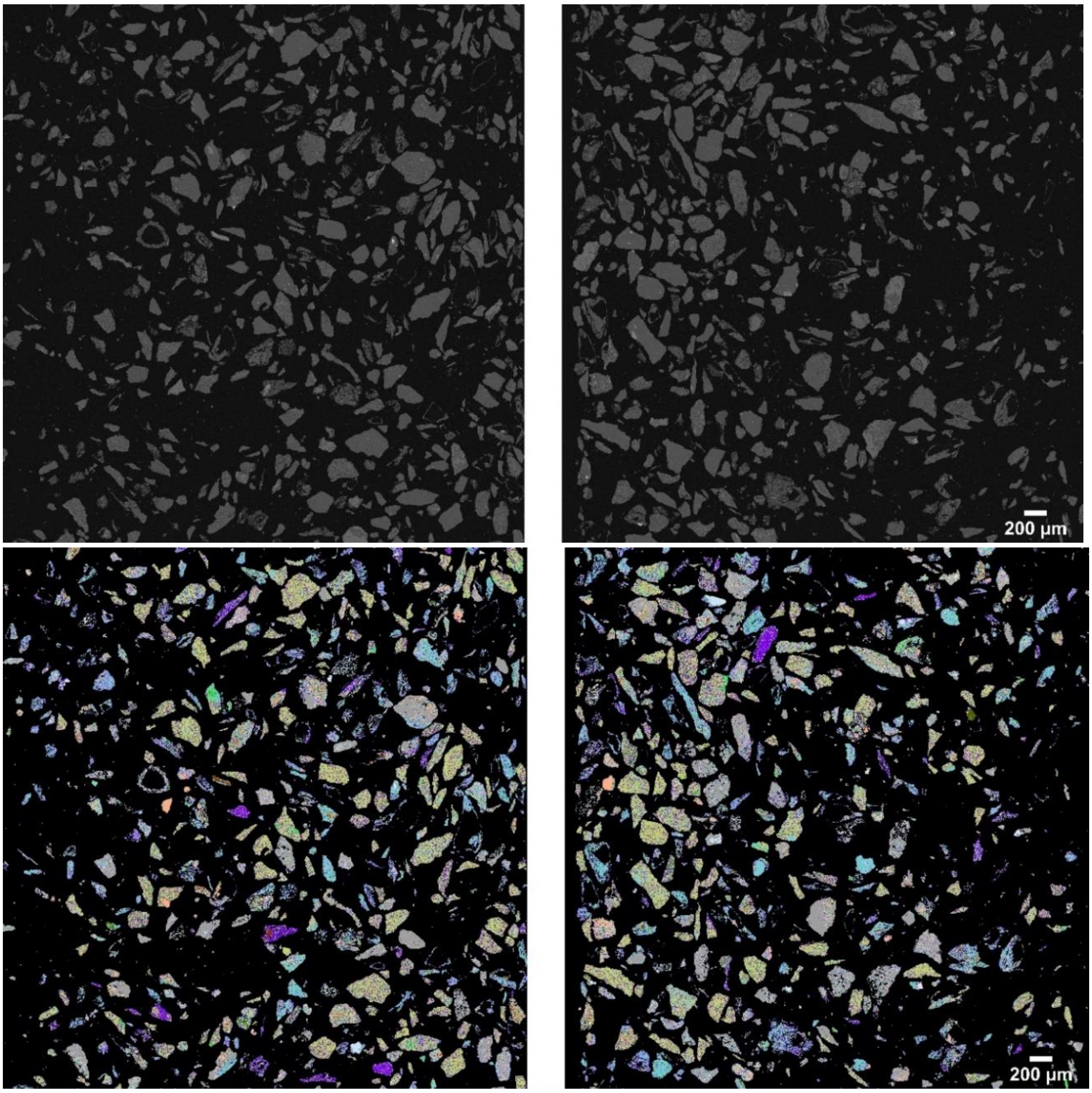


Figure 2: BSE and mineral map of MOD1-A (100-300µm).

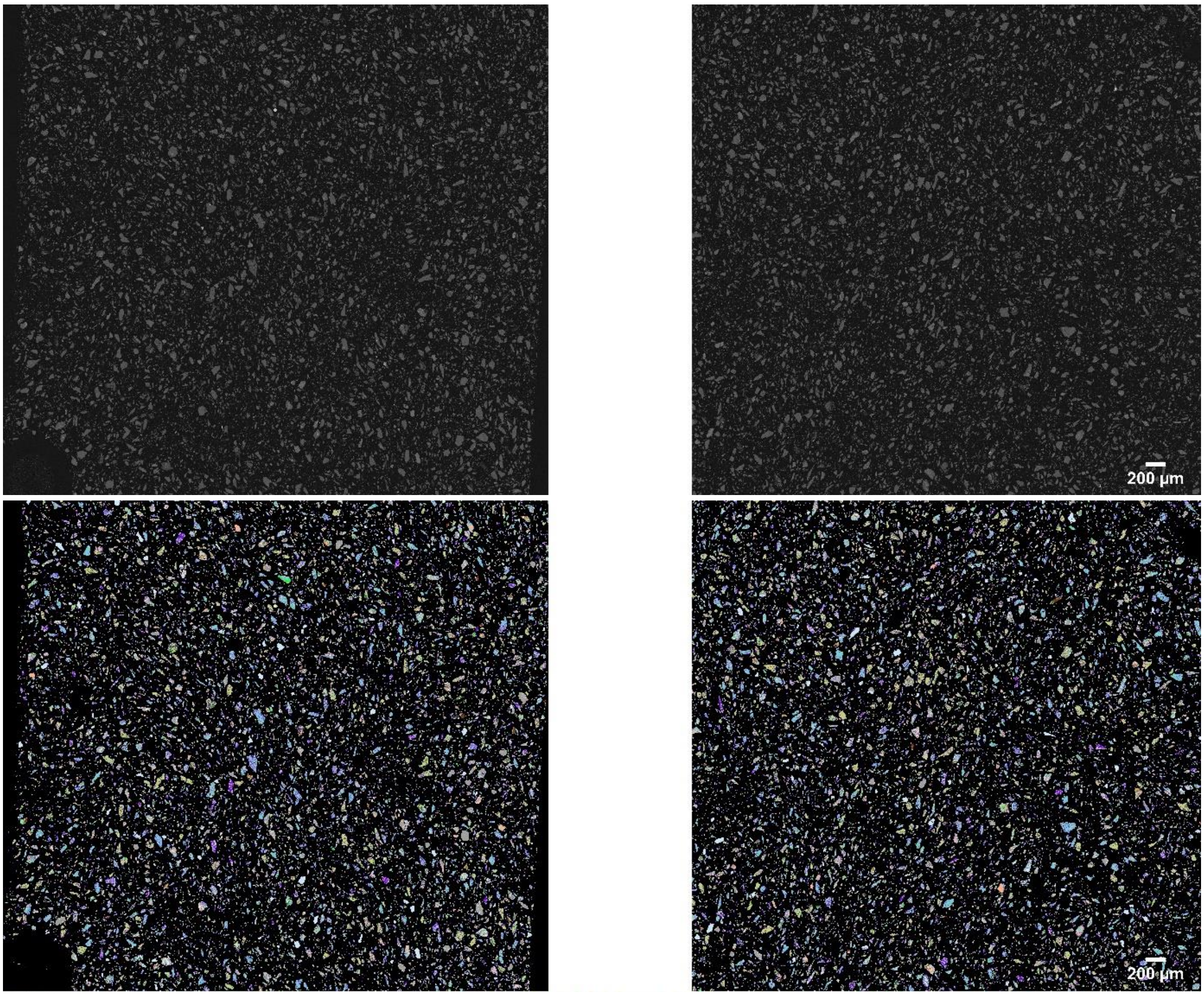


Figure 3: BSE and mineral map of MOD1-B (<100µm).

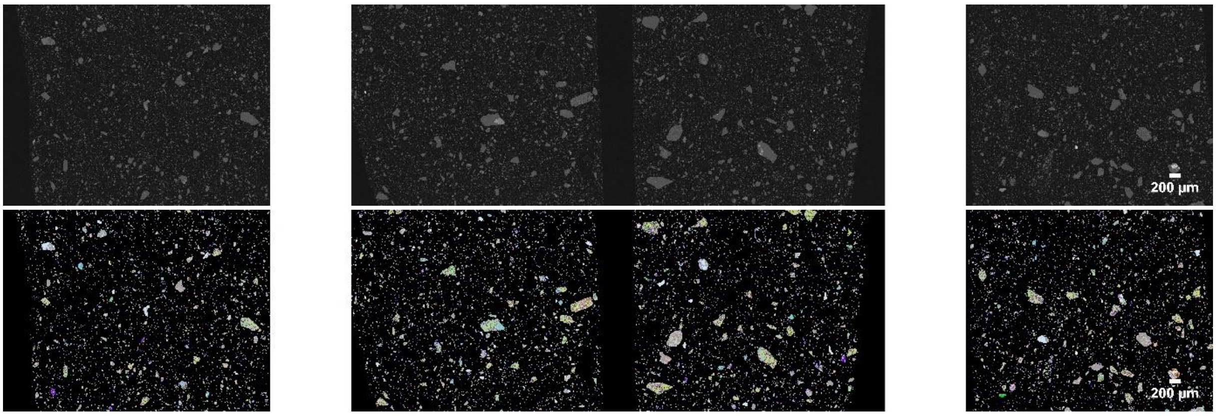


Figure 4: BSE and mineral map of STD1.

Sample 2:

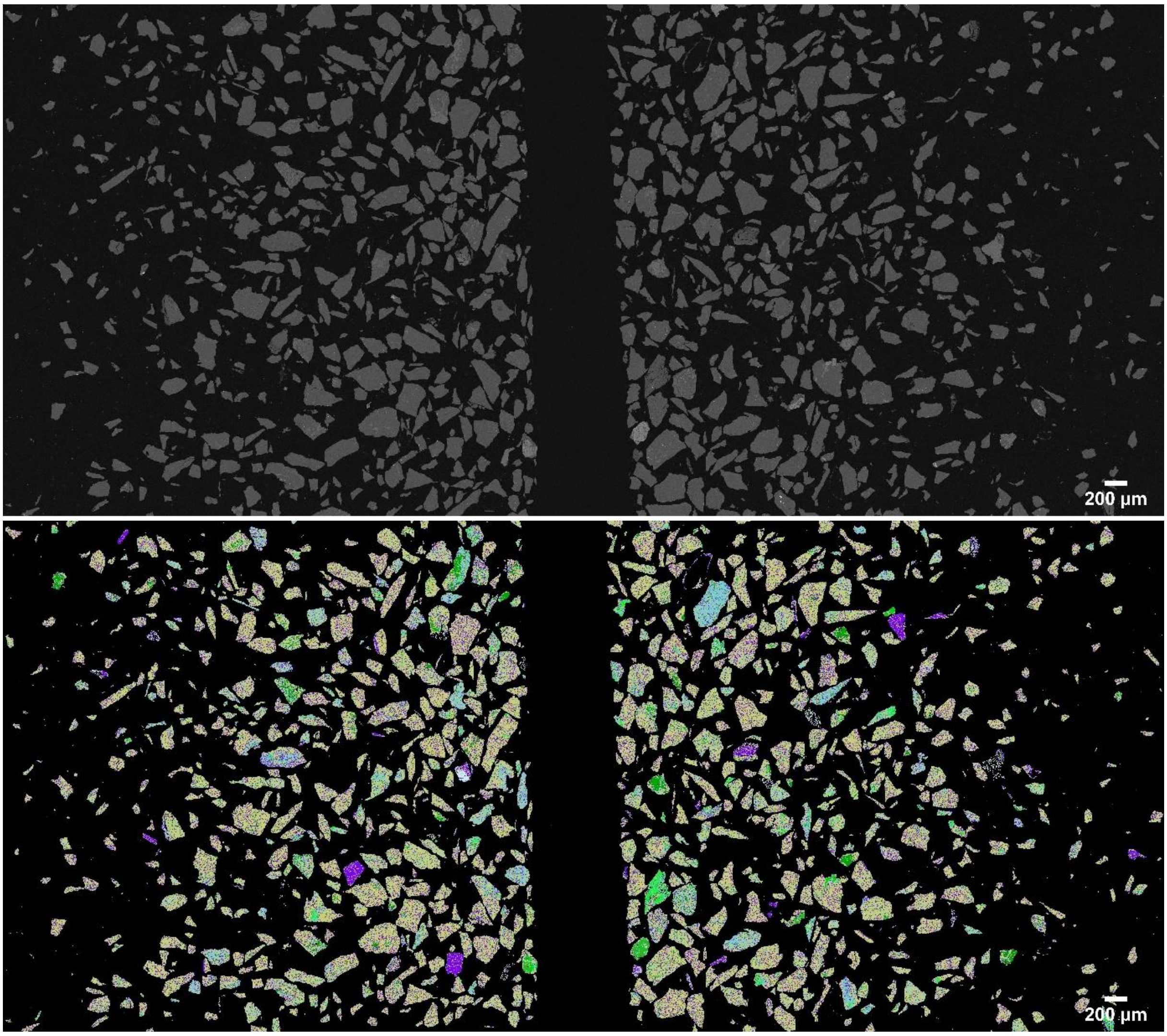


Figure 5: BSE and mineral map of MOD2-A (100-300µm).

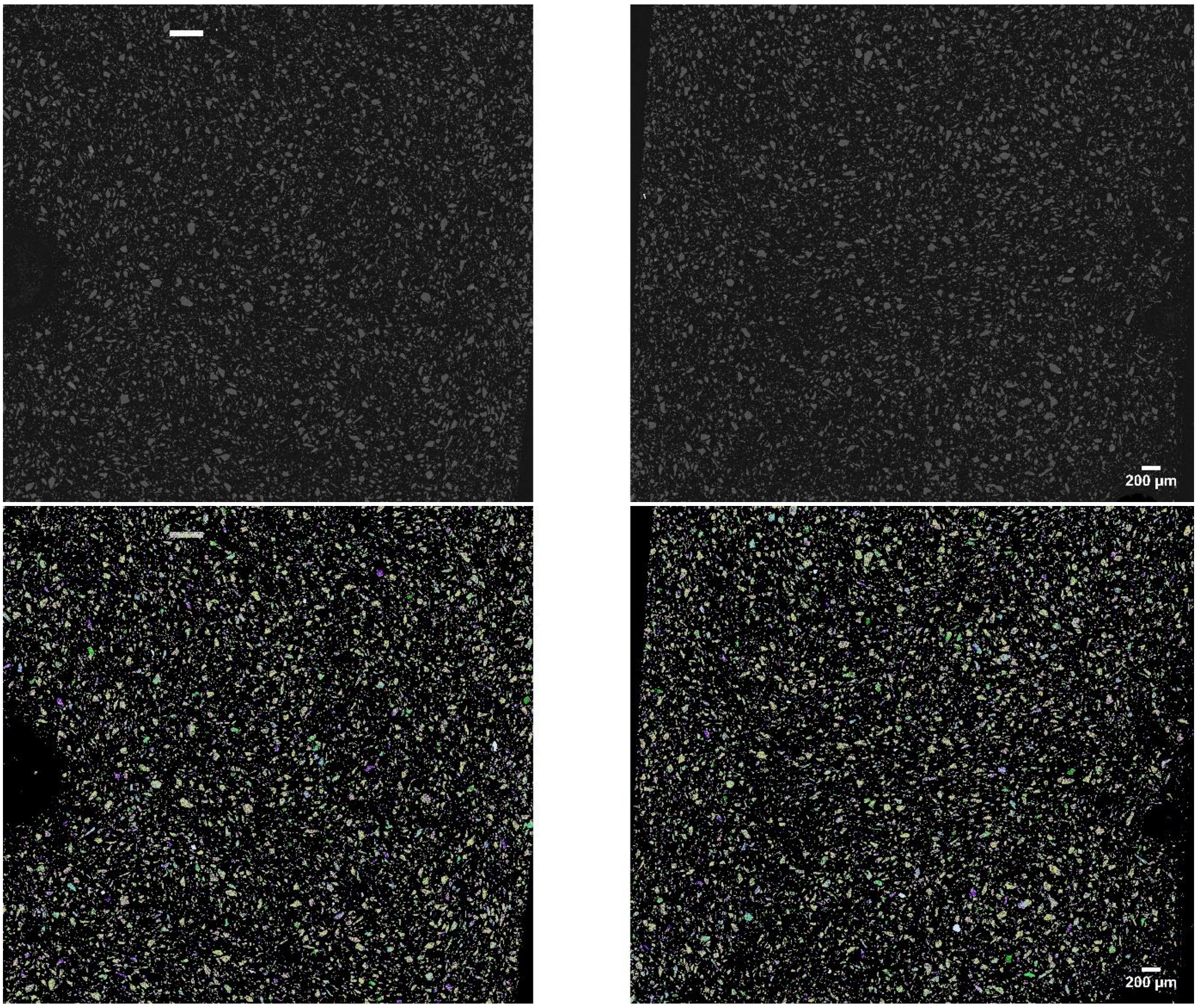


Figure 6: BSE and mineral map of MOD2-B (<100µm).

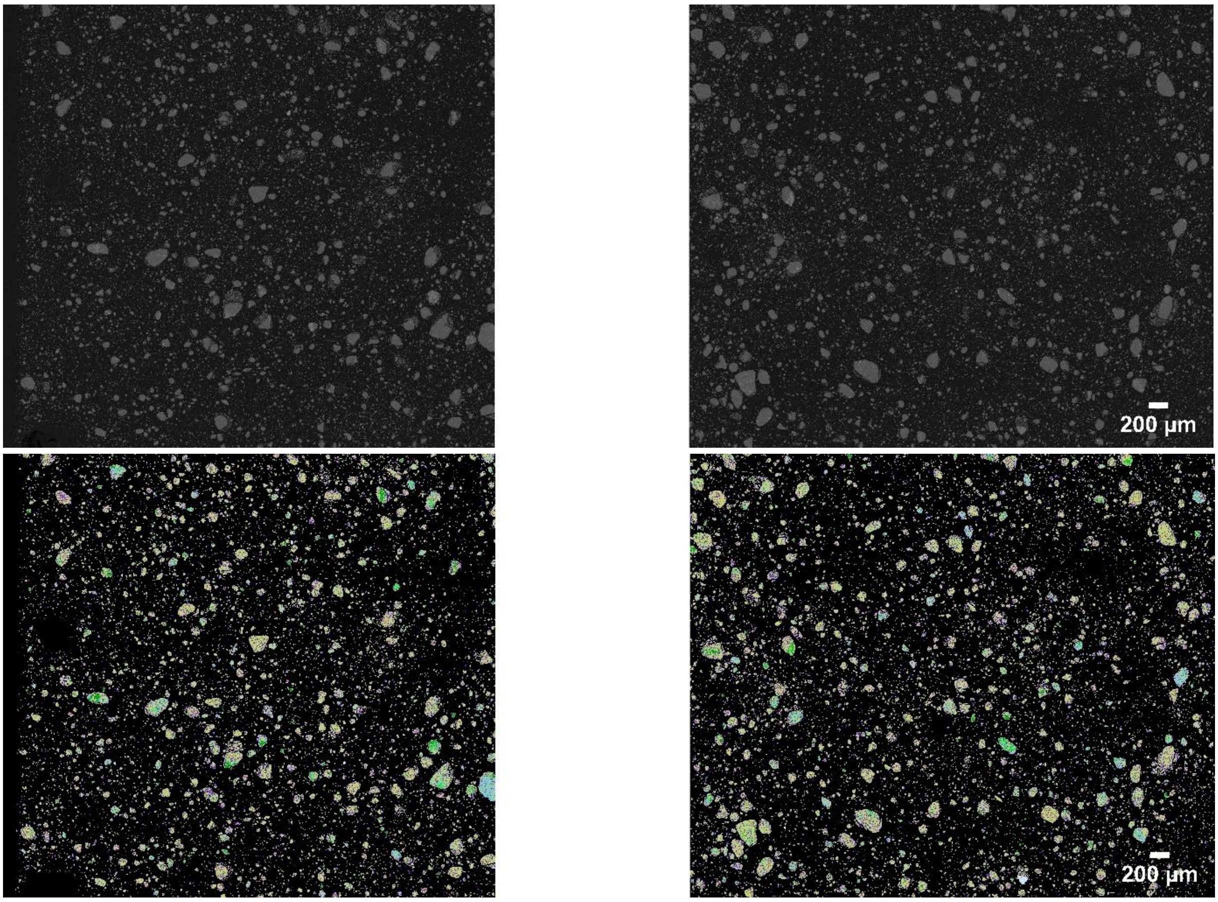


Figure 7: BSE and mineral map of STD2.

<u>Sample 3</u>:

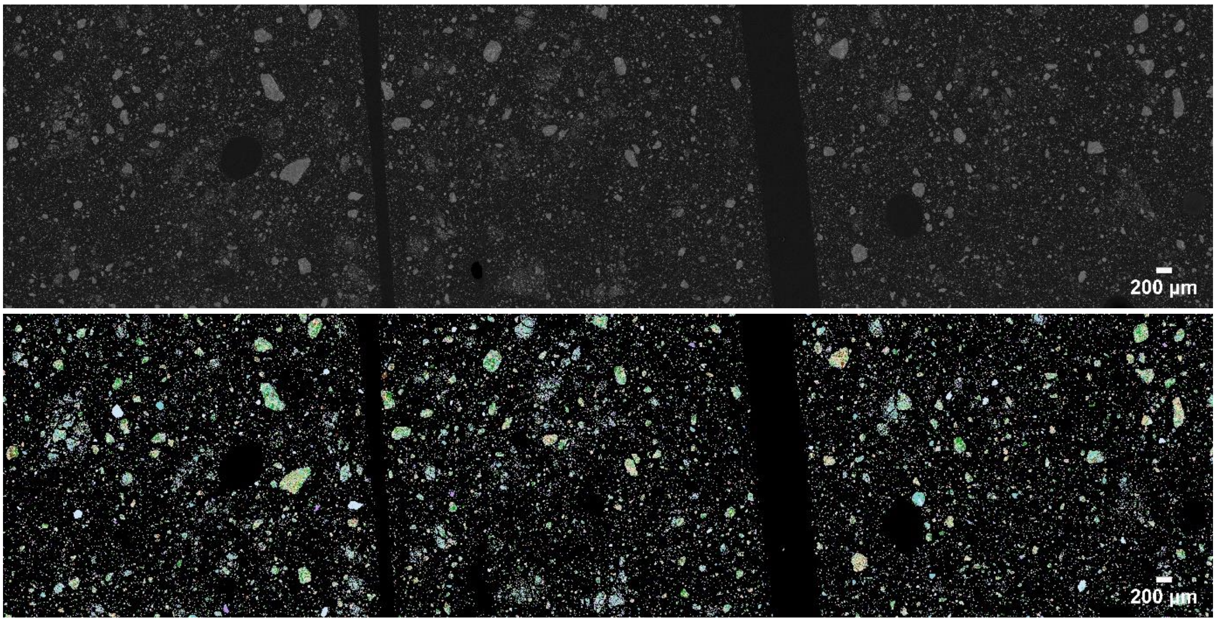


Figure 8: BSE and mineral map of STD3.

Sample 4:

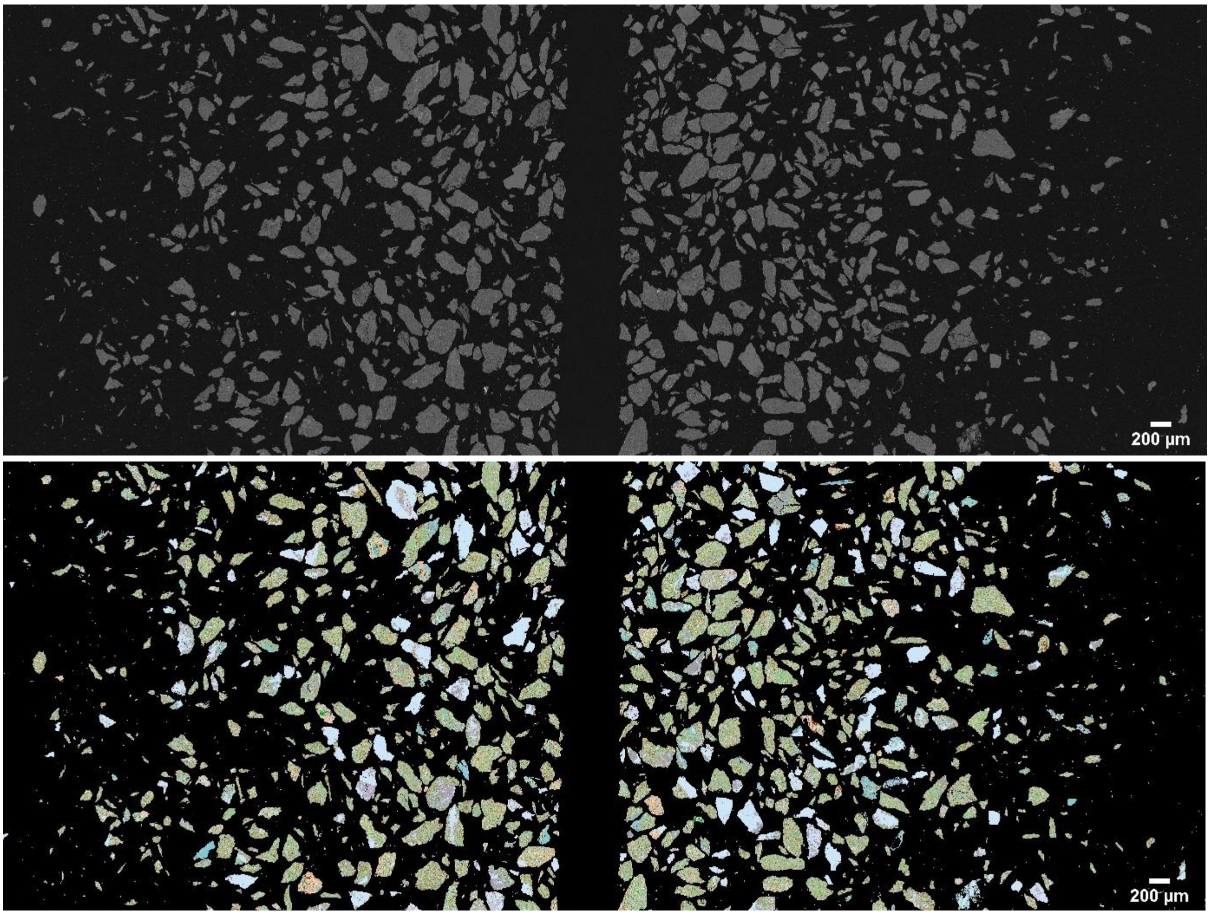


Figure 9: BSE and mineral map of MOD4-A (100-300µm).

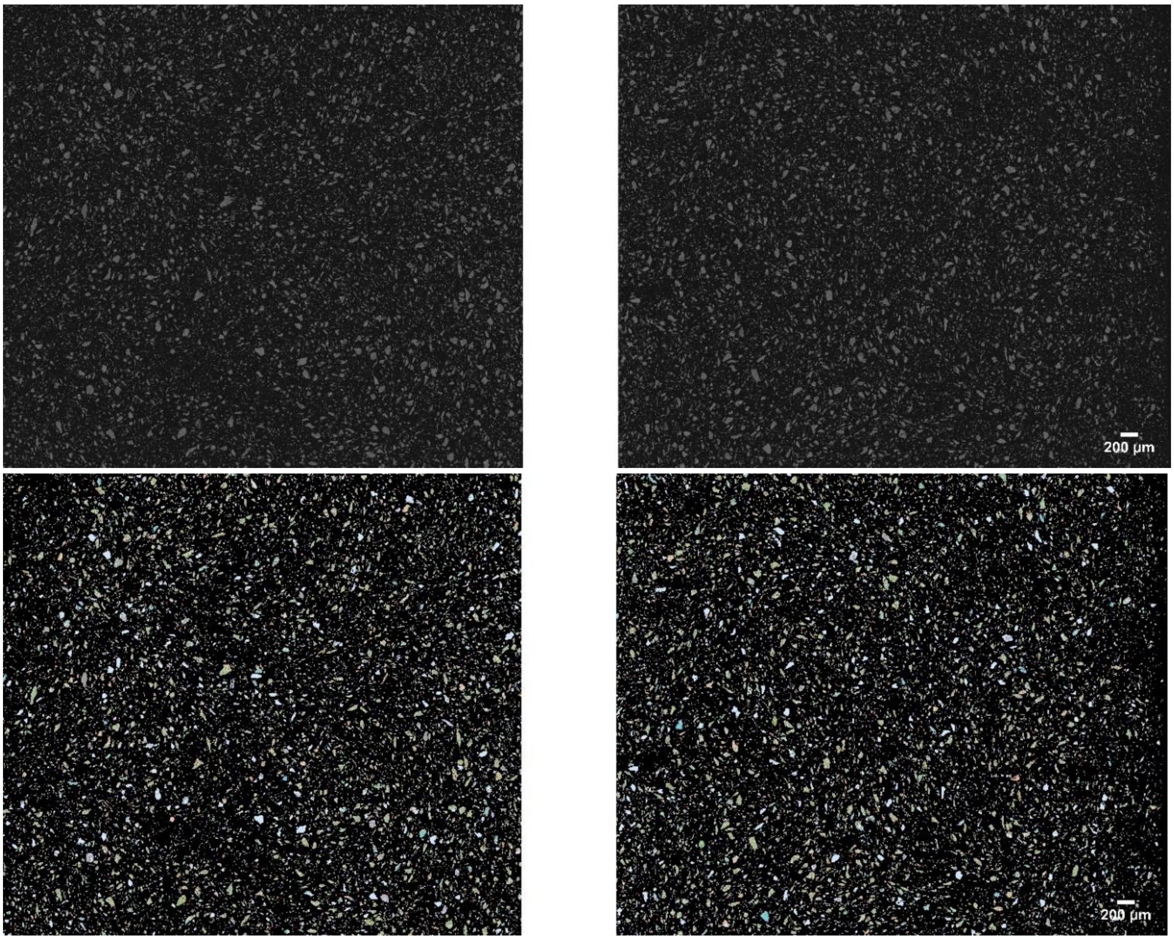


Figure 10: BSE and mineral map of MOD4-B (<100µm).

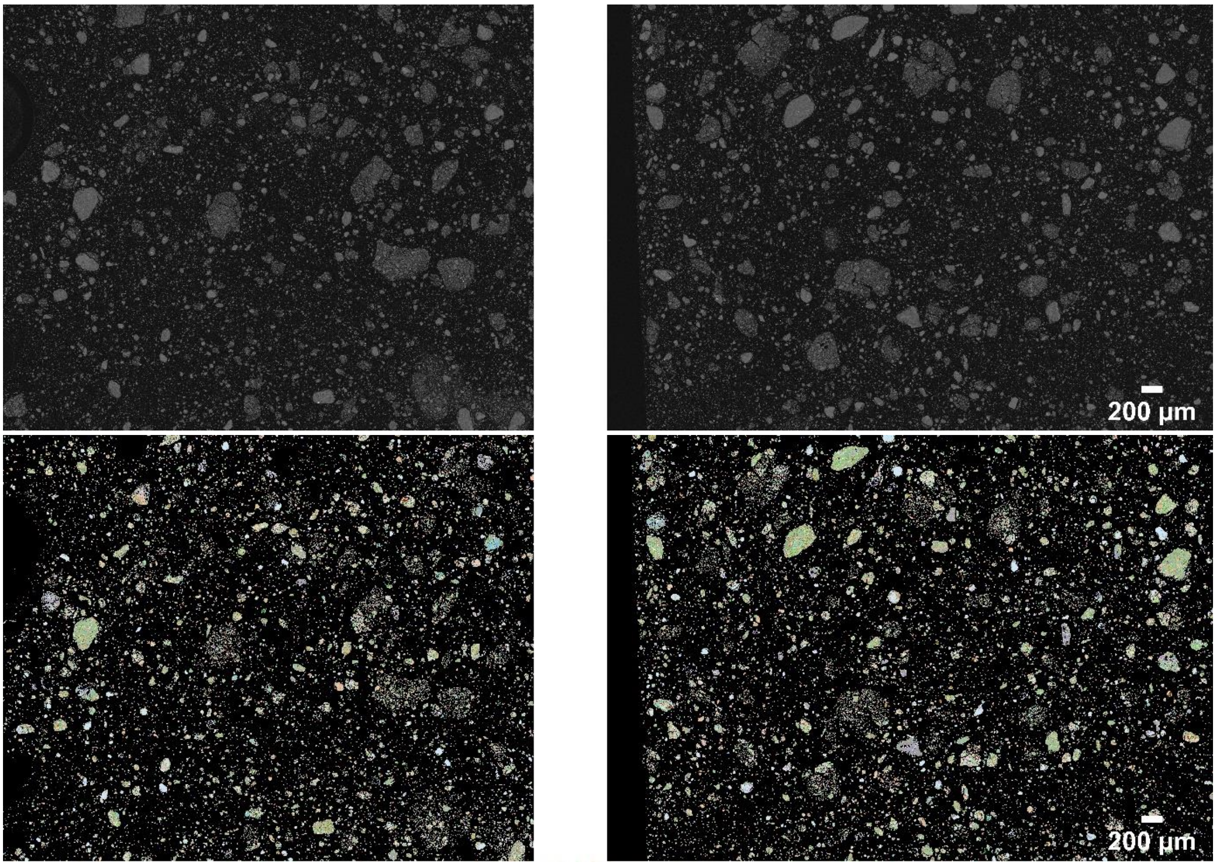


Figure 11: BSE and mineral map of STD4.

Sample 5:

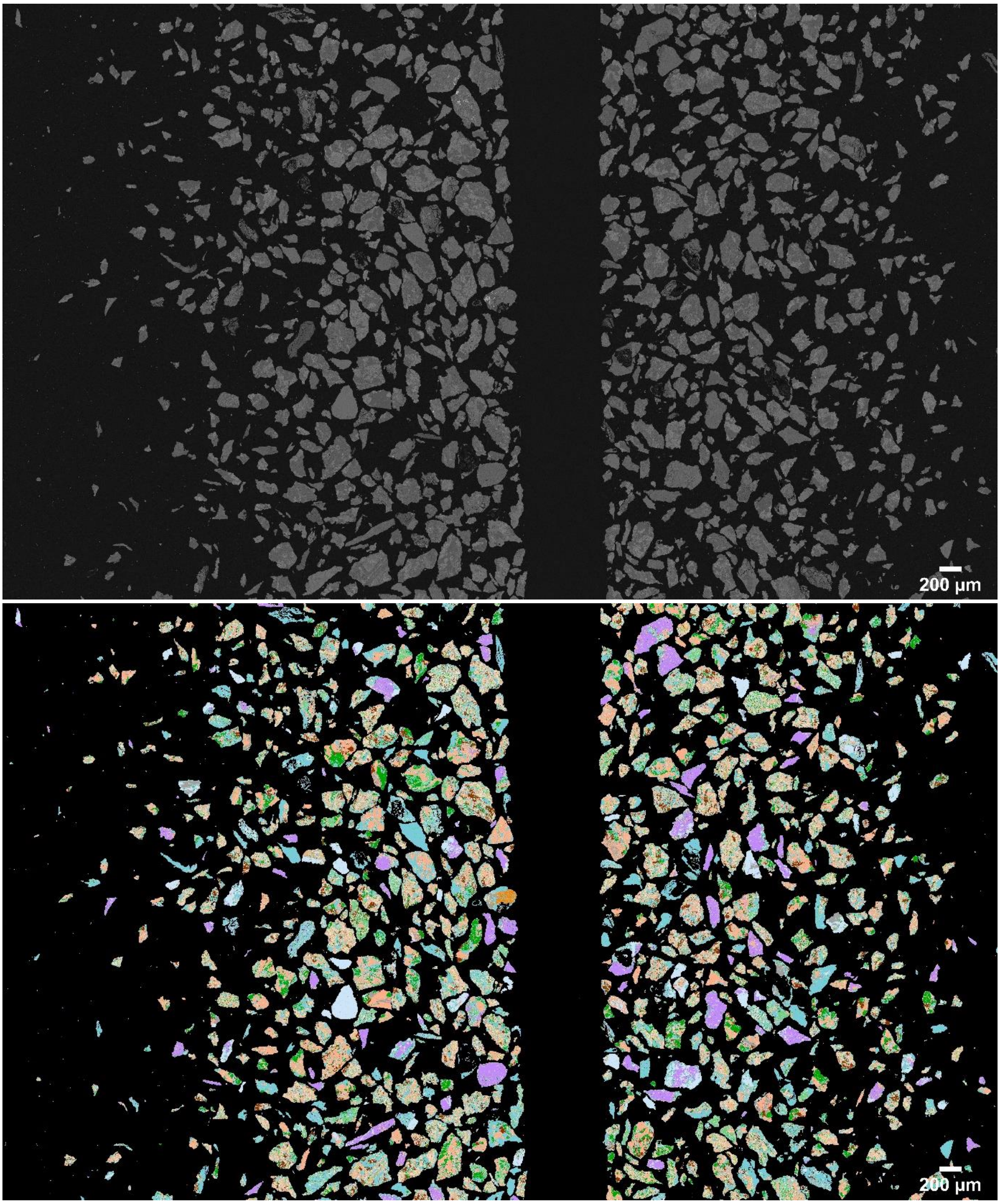


Figure 12: BSE and mineral map of MOD5-A (100-300µm).

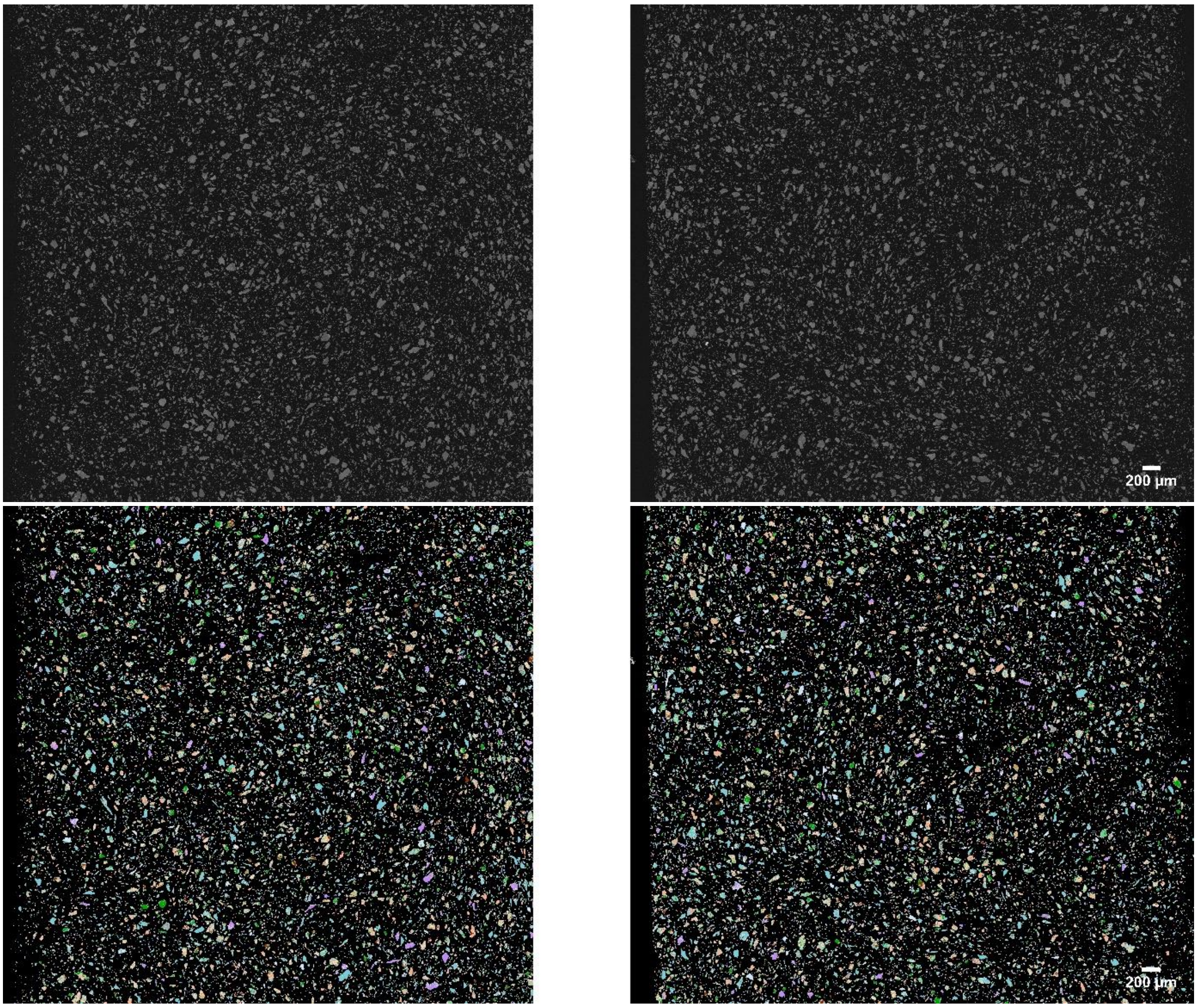


Figure 13: BSE and mineral map of MOD5-B (<100µm).

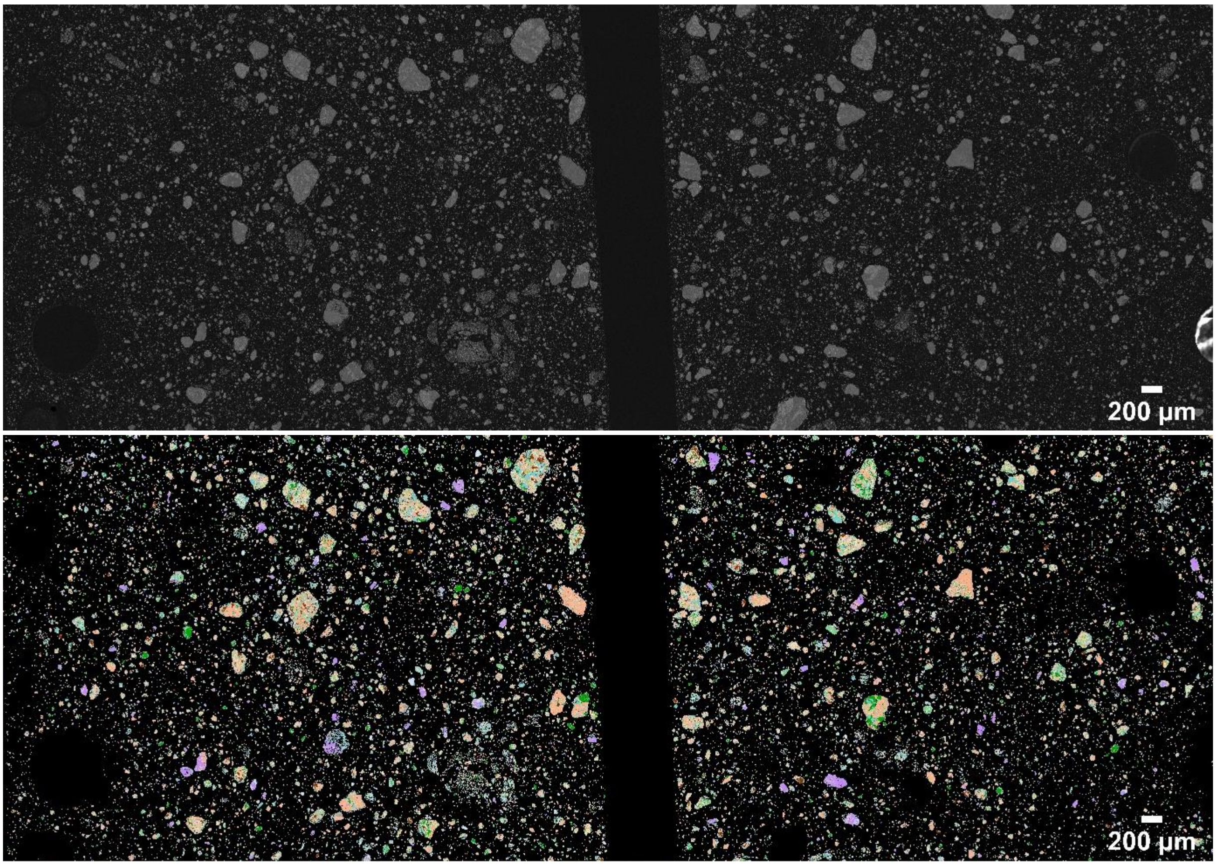


Figure 14: BSE and mineral map of STD5.

Sample 6:

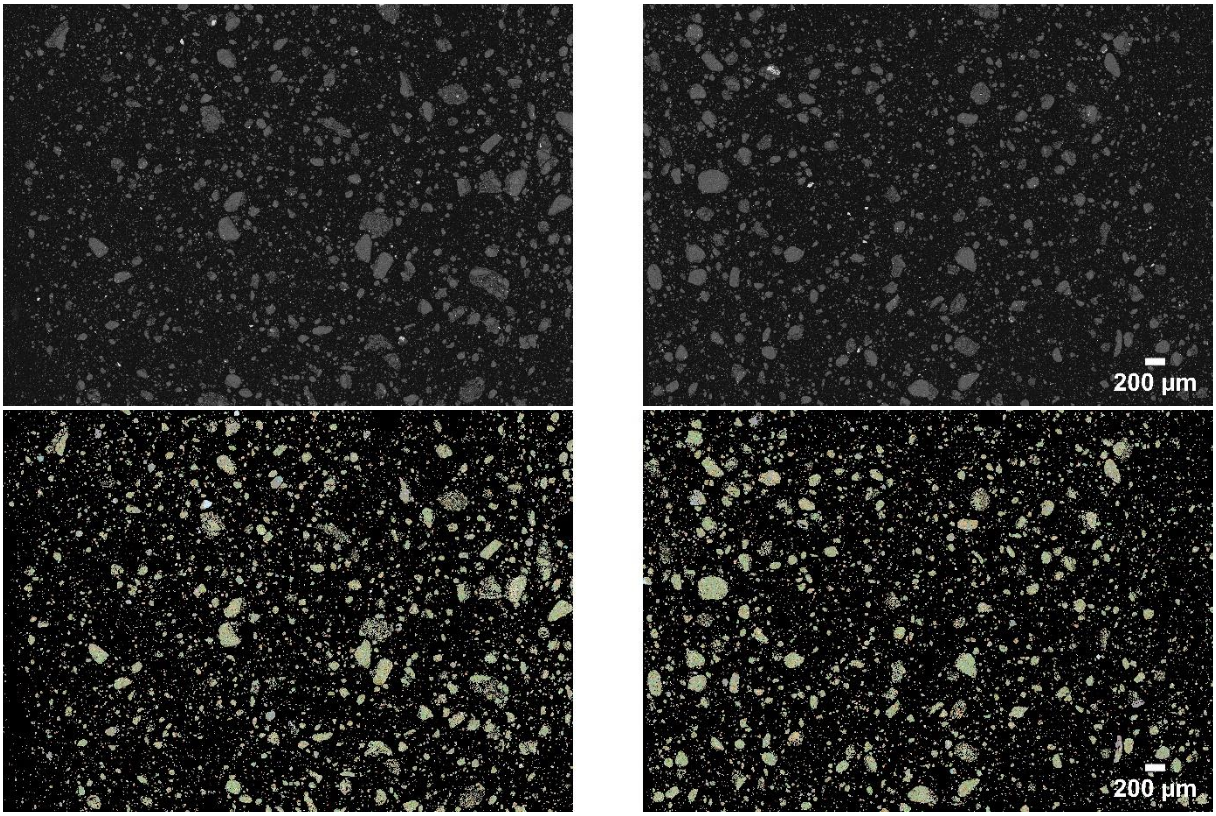


Figure 15: BSE and mineral map of STD6.

Sample 7:

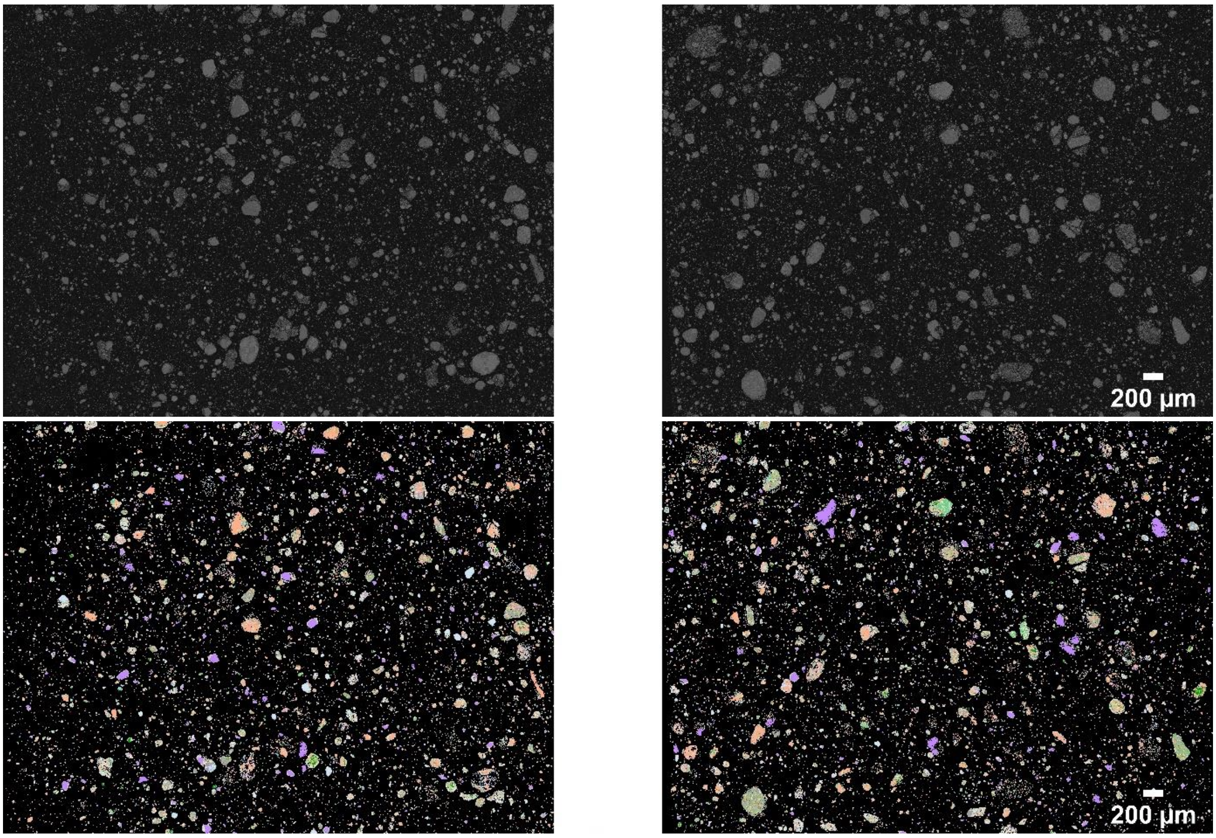


Figure 16: BSE and mineral maps of STD7.

Appendix L – Hyperspectral image analysis, report

The “Hyperspectral image analysis” report by Chiu (2022) can be found separately in the digital zip-file in NTNU Open.

Appendix M - Swelling pressure charts

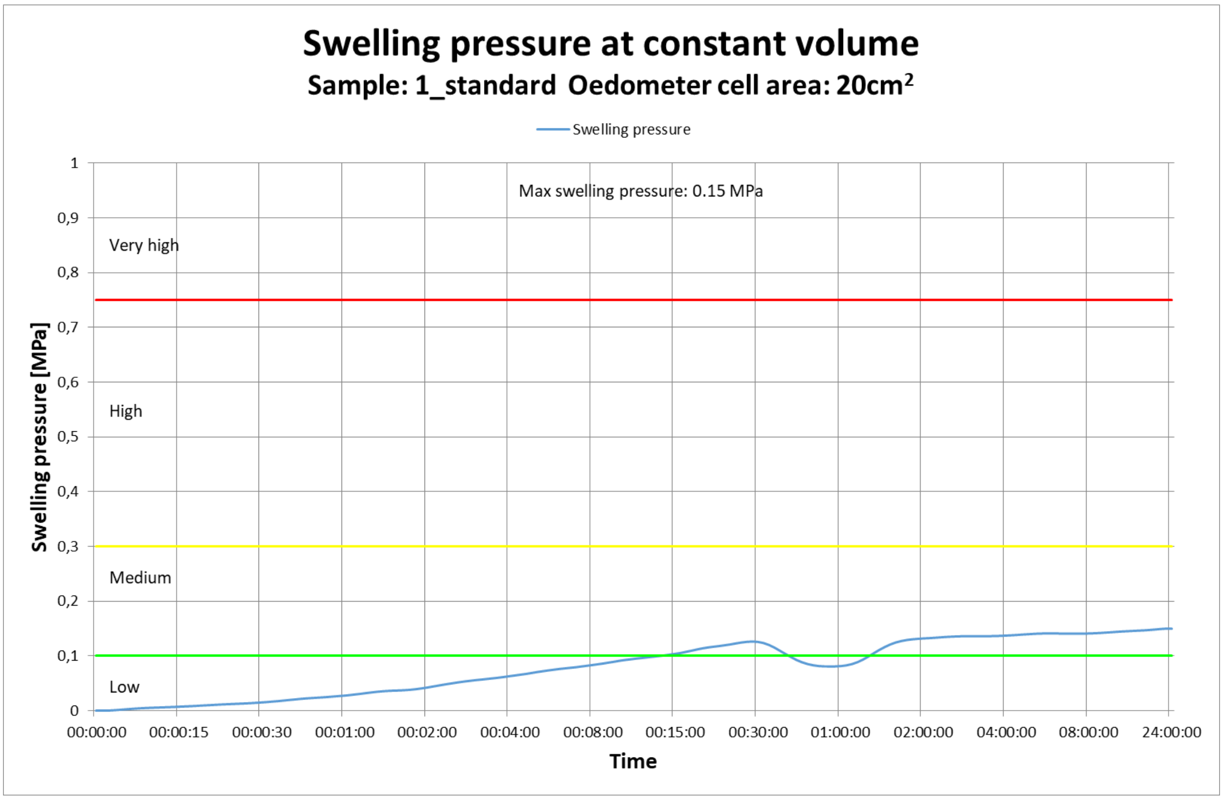


Figure 1: Swelling pressure chart of STD1.

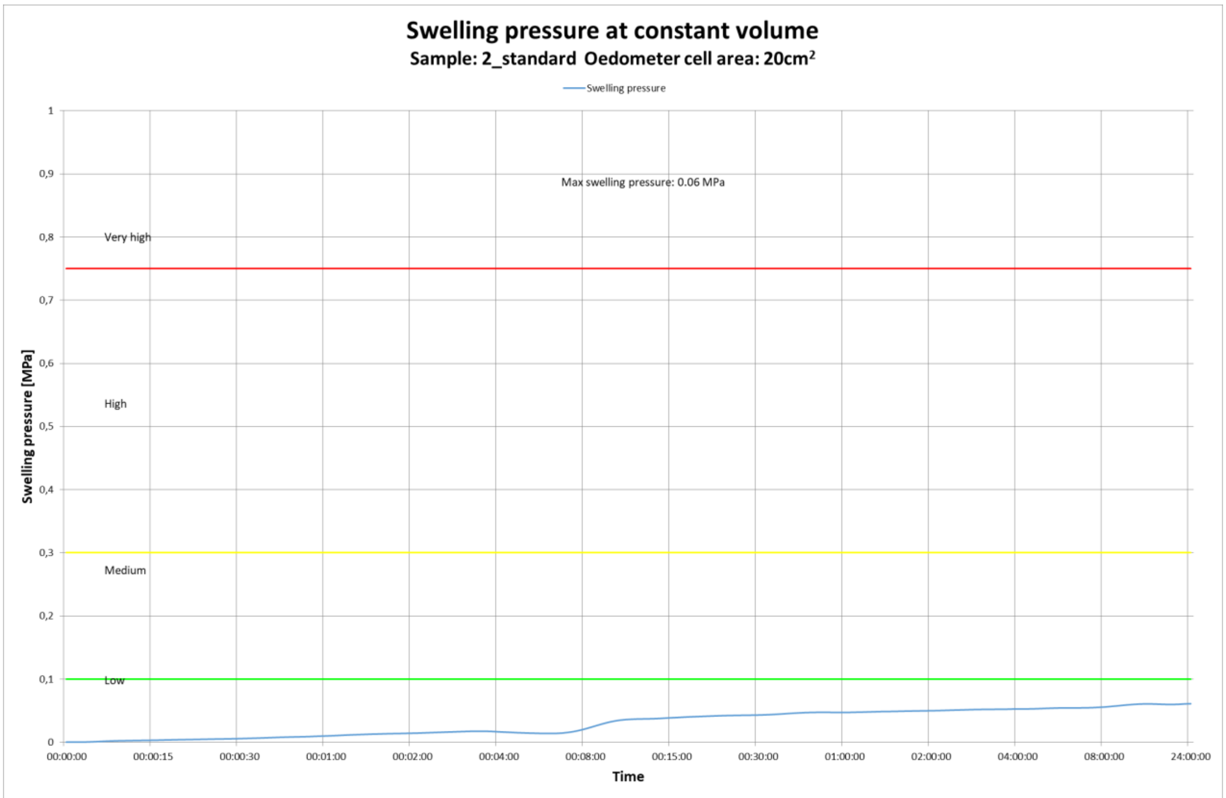


Figure 2: Swelling pressure chart of STD2.

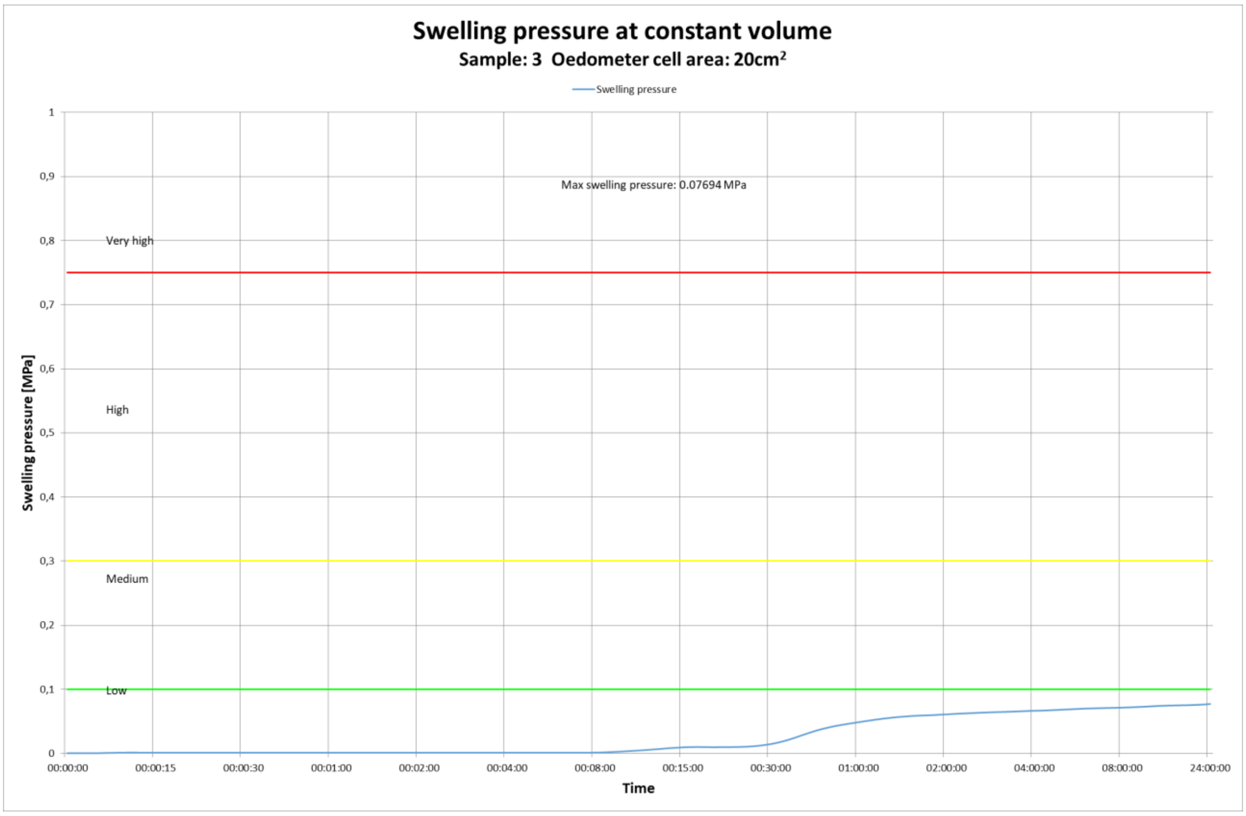


Figure 3: Swelling pressure chart of STD3.

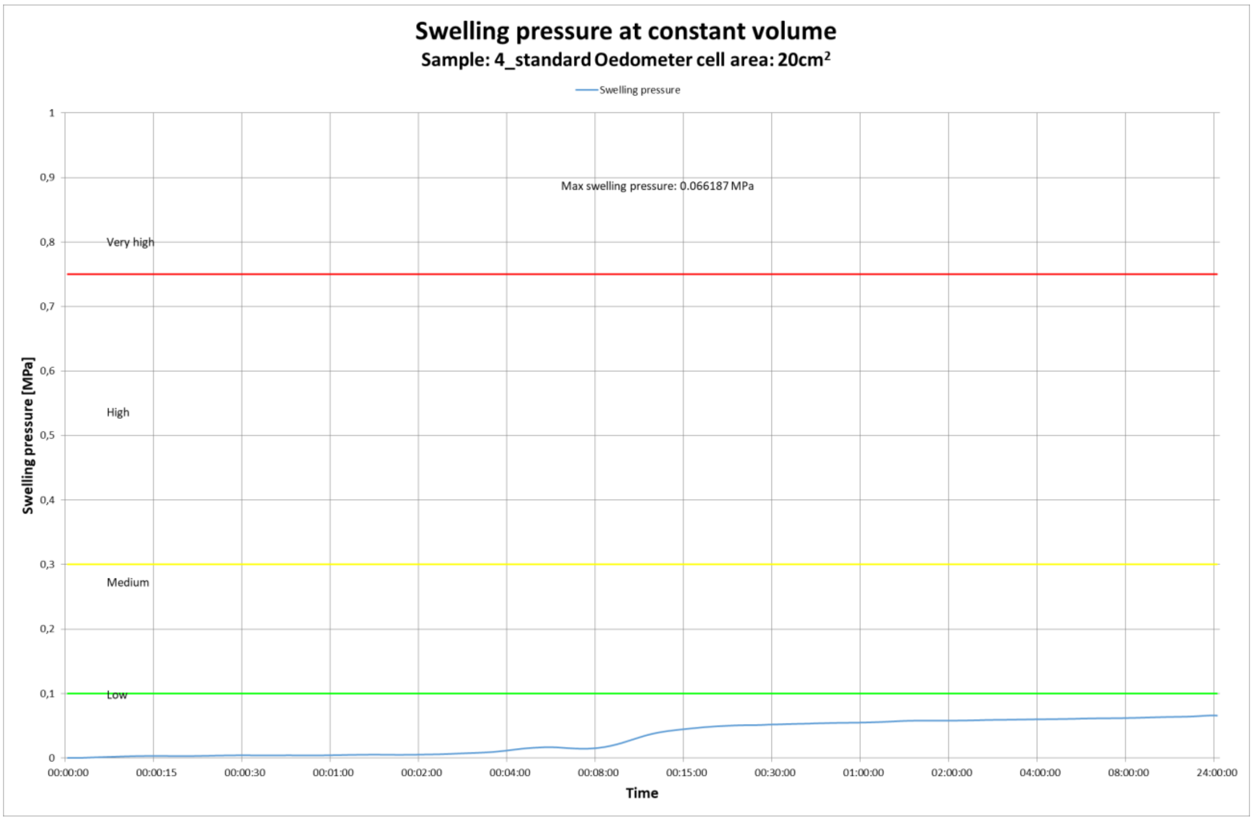


Figure 4: Swelling pressure chart of STD4.

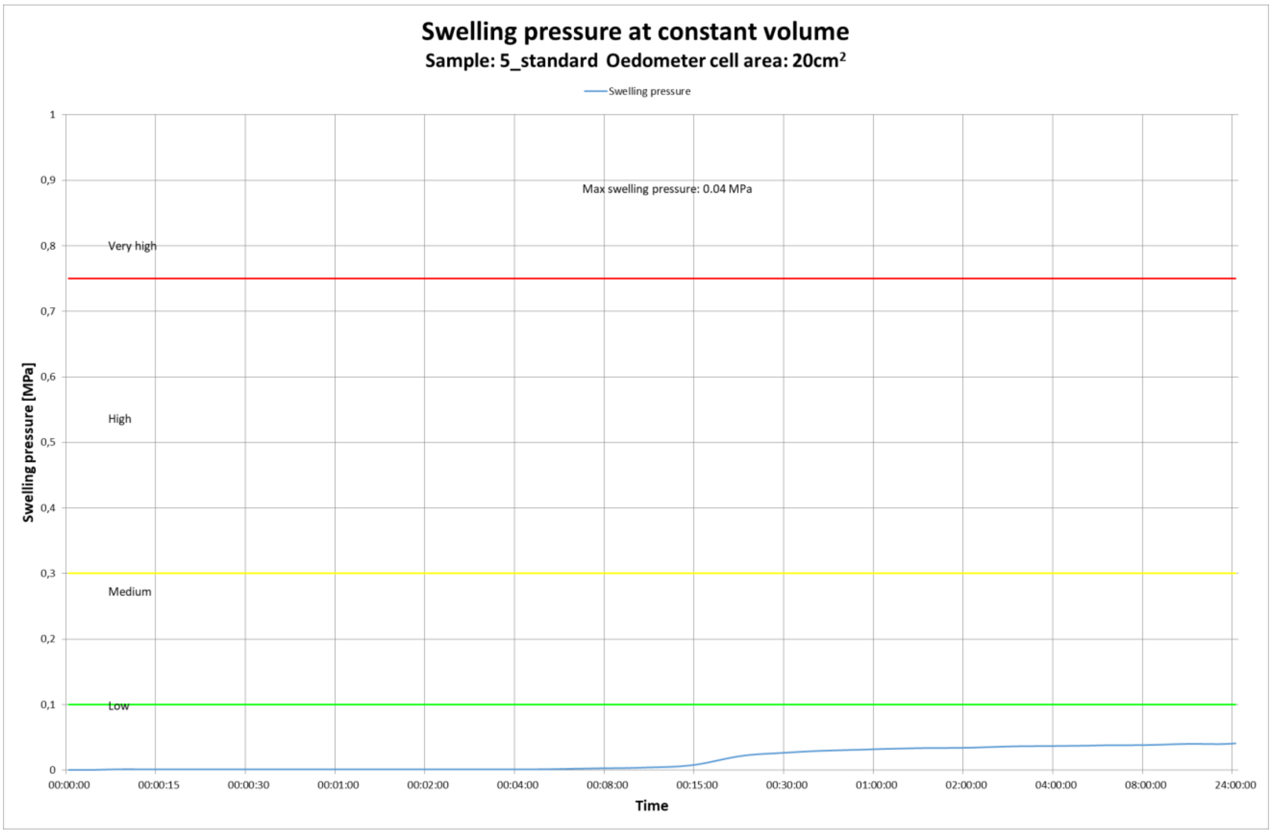


Figure 5: Swelling pressure chart of STD5.

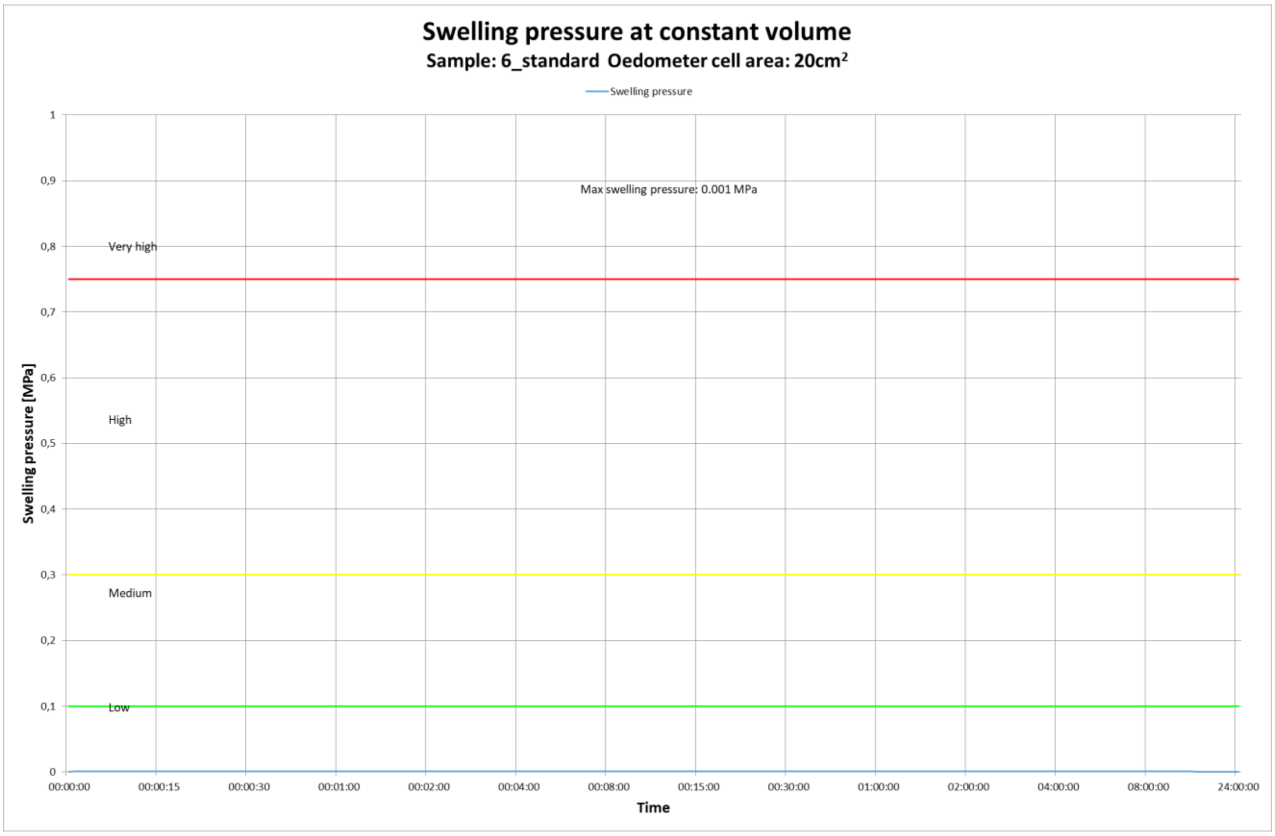


Figure 6: Swelling pressure chart of STD6.

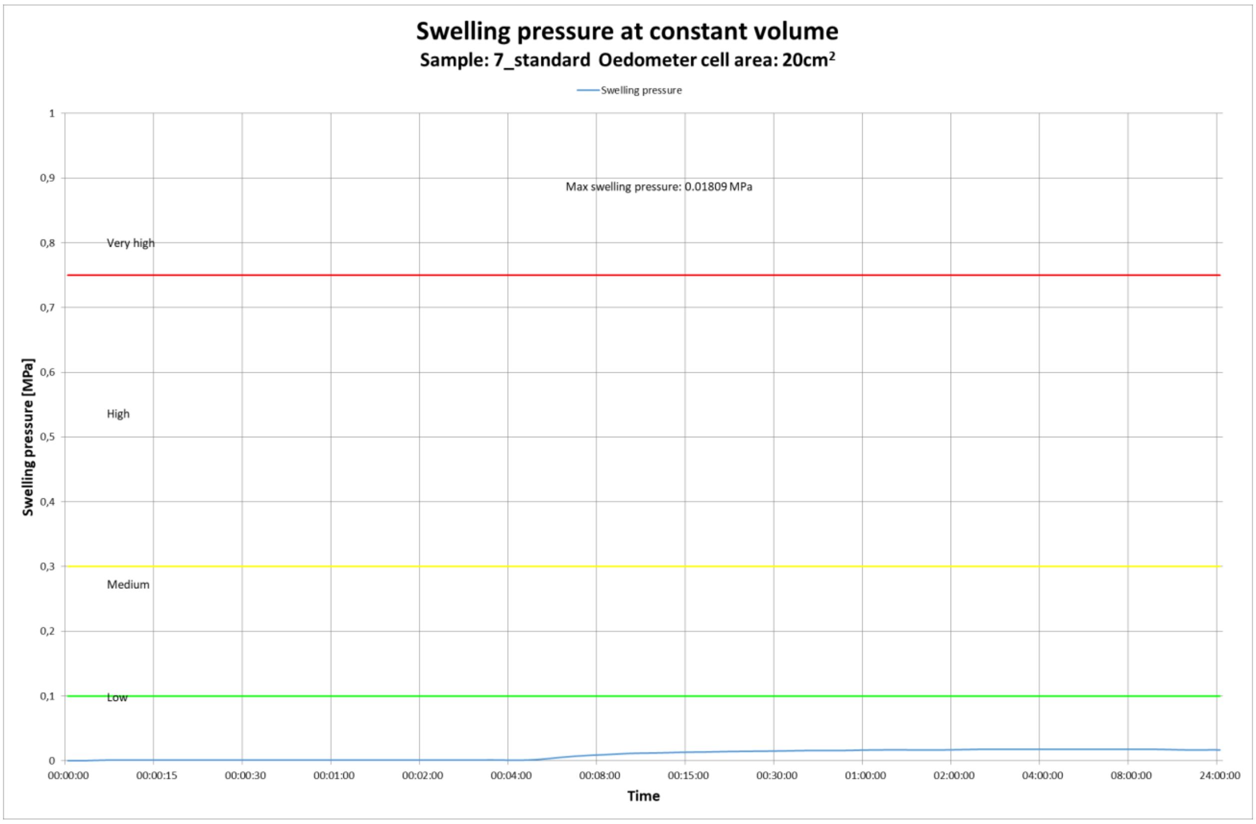


Figure 7: Swelling pressure chart of STD7.

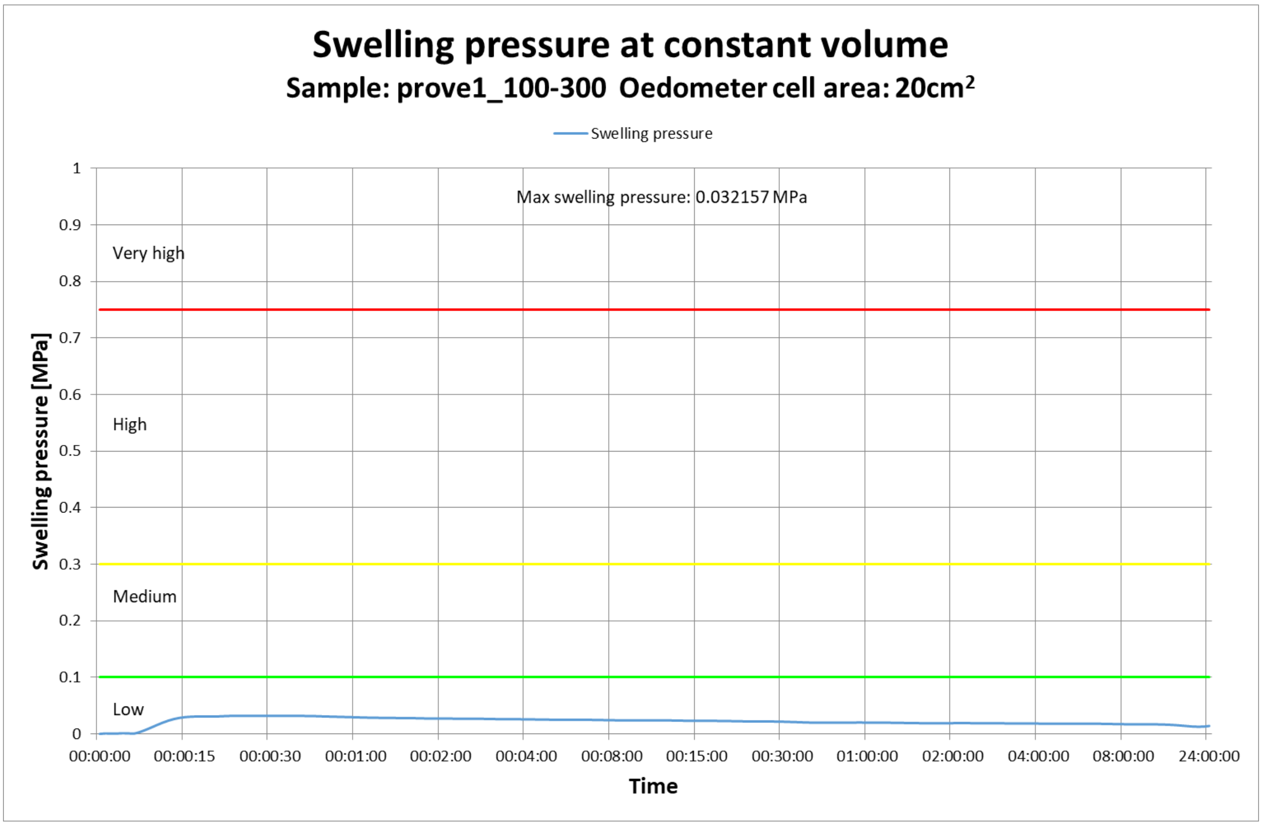


Figure 8: Swelling pressure chart of MODA1 (100-300µm).

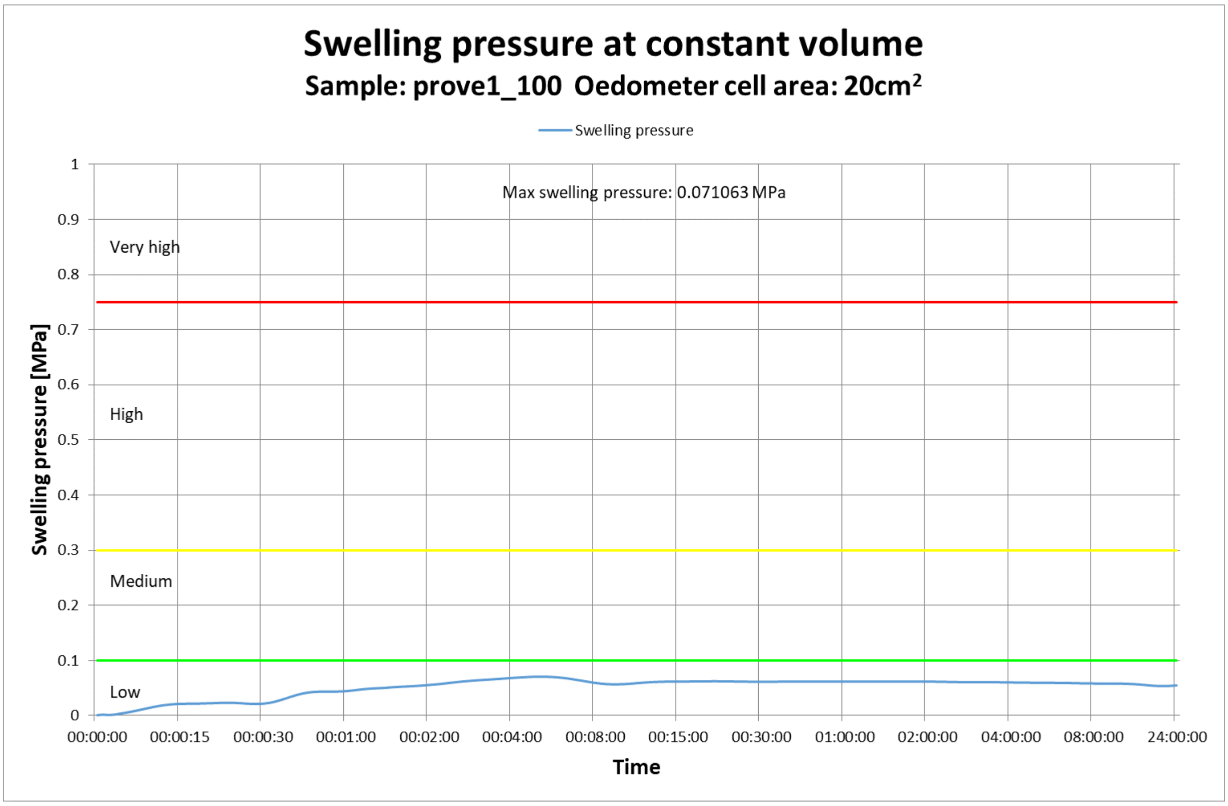


Figure 9: Swelling pressure chart of MODB1 (<100μm).

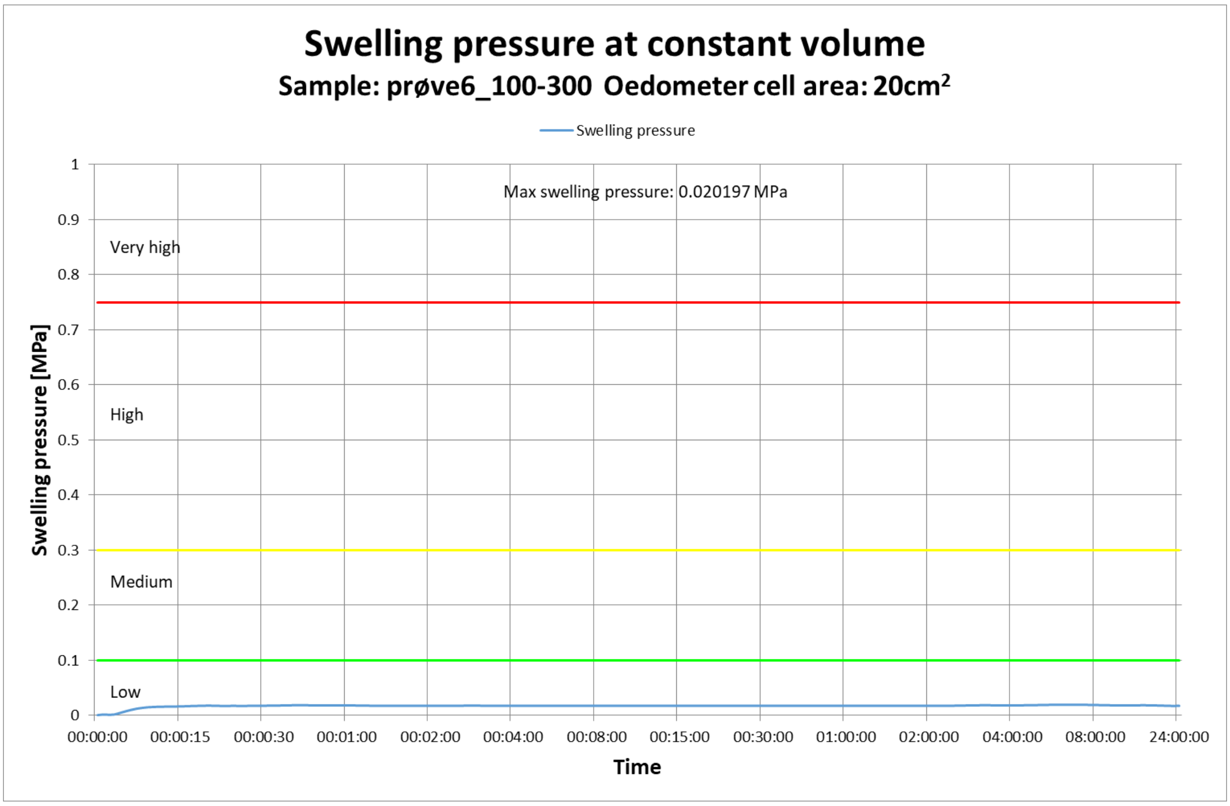


Figure 10: Swelling pressure chart of MODA6 (100-300μm).

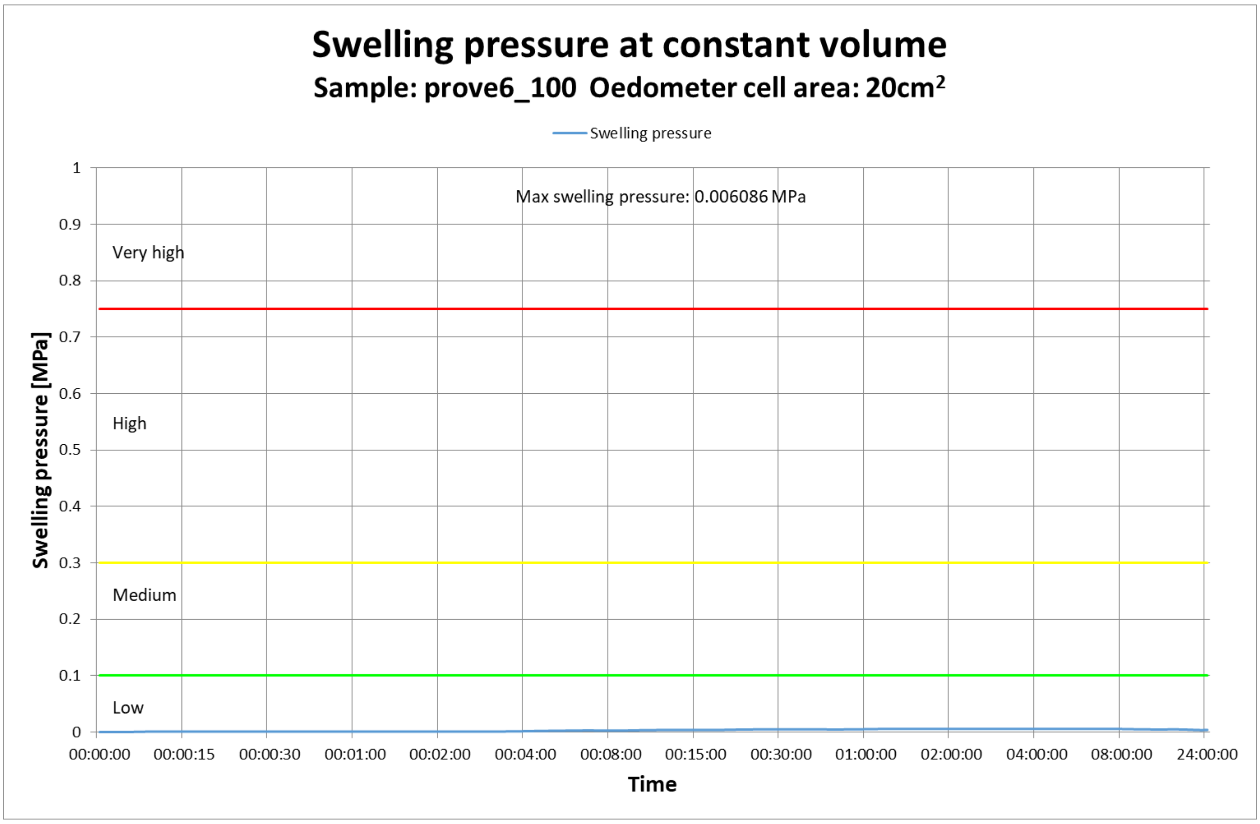


Figure 11: Swelling pressure chart of MODB6 (<100μm).

Appendix N – Rock mechanical results

Table 1 displayed the measured values and calculation of tensile strength (σ_t) from Brazil test. Red samples have not been approved during testing.

Table 1: Brazil test results.

Sample	D (mm)	t (mm)	P (N)	Tensile strength, σ_t (MPa)	Comment
BTS1	-	-	-	-	
BTS2	-	-	-	-	
BTS3	71.72	35.24	15.49	3.90	Not approved
BTS4	71.63	35.51	21.05	5.27	Approved
BTS5	71.82	35.1	17.38	4.39	Approved
BTS6	71.67	35.03	20.74	5.26	Not approved
BTS7	-	-	-	-	
BTS8	71.47	36.02	-	-	Not usable
BTS9	71.55	35.47	-	-	Not usable
BTS10	-	-	-	-	
BTS11	71.45	34.87	8.27	2.11	Approved, doubtfully
BTS12	71.49	34.8	6.08	1.56	Approved, doubtfully
BTS13	71.45	34.96	5.04	1.28	Not Approved
BTS14	71.46	34.37	3.03	0.79	Not approved, specimen to poor
BTS15	71.44	35.6	5.01	1.25	Approved
BTS (Mean)				2.35	

Table 2 show the obtained UCS, E-modulus, Poisson ratio results, as well as the tangent point and interval. The Poisson ratio values for sample 1, 3 and 5 (red) are not approved and should not be used.

The Poisson ratio of UCS1_alternative has been used as the value for UCS1, this choice is supported by the tangent point (green) in Figure 1 which is located in a linear are of the stress-strain curve below the 50% point.

Table 2: Uniaxial compressive strength (UCS), E-modulus, Poisson ratio results for samples UCS1, UCS3, UCS5 and UCS1_alternative.

Logfiles	UCS (MPa)	E-modul (GPa)	Poissons Ratio	Tangent Point (MPa)	Interval (MPa)	Comment
1	67	66.66	0.85	33.5	7.1	Point at UCS 50%
3	26.2	32.01	0.68	13.4	2.8	Point at UCS 50%
5	18.4	15.57	1.01	9.2	2.1	Point at UCS 50%
1_alternative	67	77.51	0.3	12.8	7.2	E-modulus below 50%.

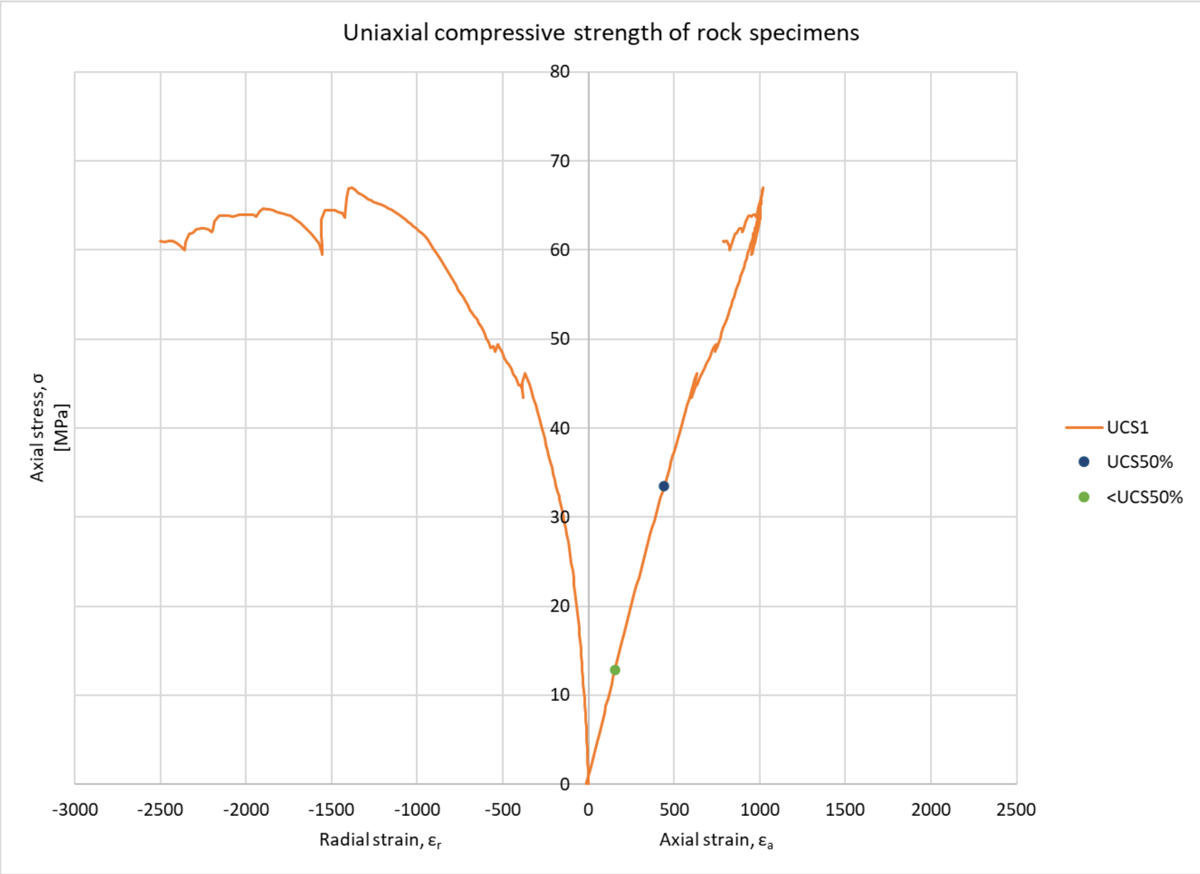


Figure 1: stress-strain curve of UCS1 with E-modulus at 50% (blue) and below 50% (green).

Appendix O - Mineral chemical composition

An overview of the chemical composition of serpentine and talc (Table 1) and laumontite (zeolite) and anorthite (plagioclase) (Table 2) which have been suspected to have distinguishing problems related to AMS.

Both tables are provided by co-supervisor Bjørn Eske Sørensen.

Table 1: Chemical composition of talc and serpentine minerals.

	Serpentine	*Talc*	*dehydr serpentine*	*dehydr talc*
Mn	26,31	19,23	26,70	19,33
Si	20,27	29,62	20,57	29,78
H	1,45	0,53	0	0
O	51,96	50,62	52,73	50,89
sum no H	98,54	99,47	100,00	100,00

Table 2: Chemical composition of laumontite (zeolite) and anorthite (plagioclase).

	laumontite	*anorthite*
Na	-	0.41
Ca	8.52	13.72
Al	11.47	18.97
Si	23.88	20.75
H	1.71	-
O	54.42	46.14

Appendix P – XRD VS AMS mineral detection

The following figures display the measured weight percent of different minerals from the XRD (orange) and the AMS (blue) laboratory methods.

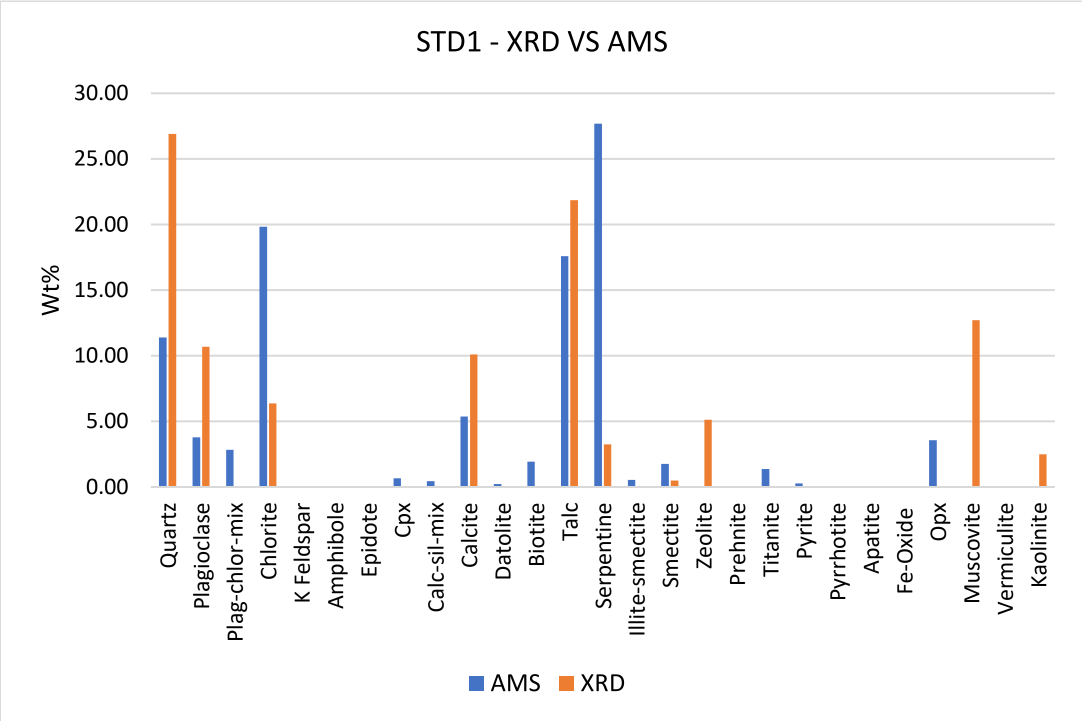


Figure 1: XRD vs AMS minerals detected in STD1.

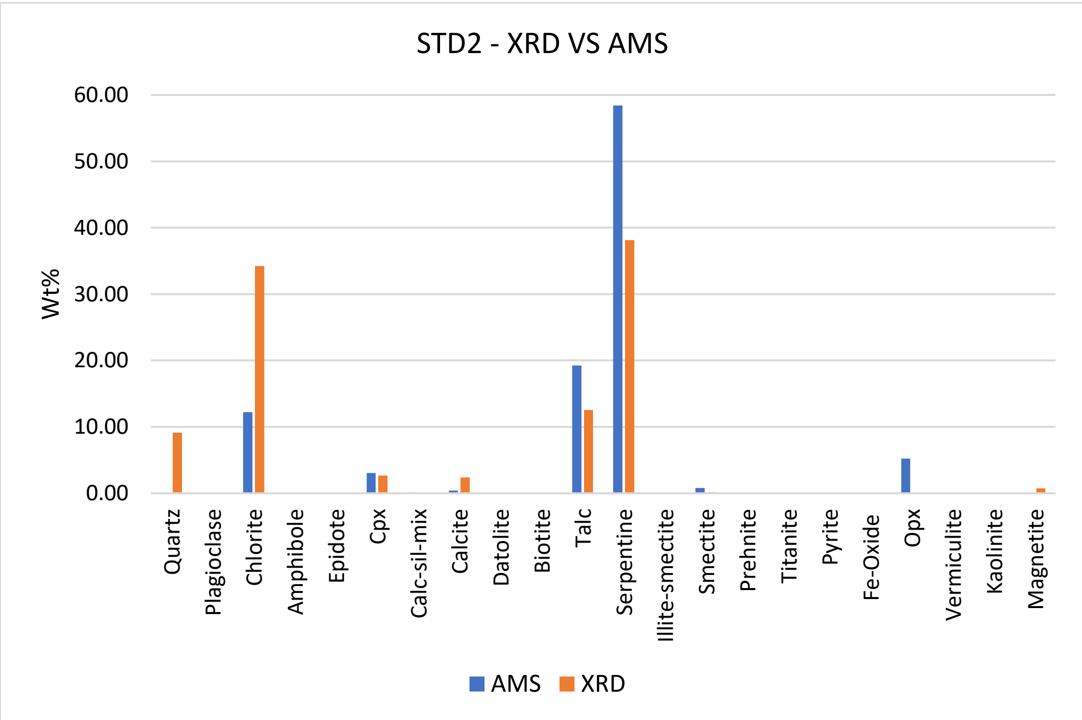


Figure 2: XRD vs AMS minerals detected in STD2.

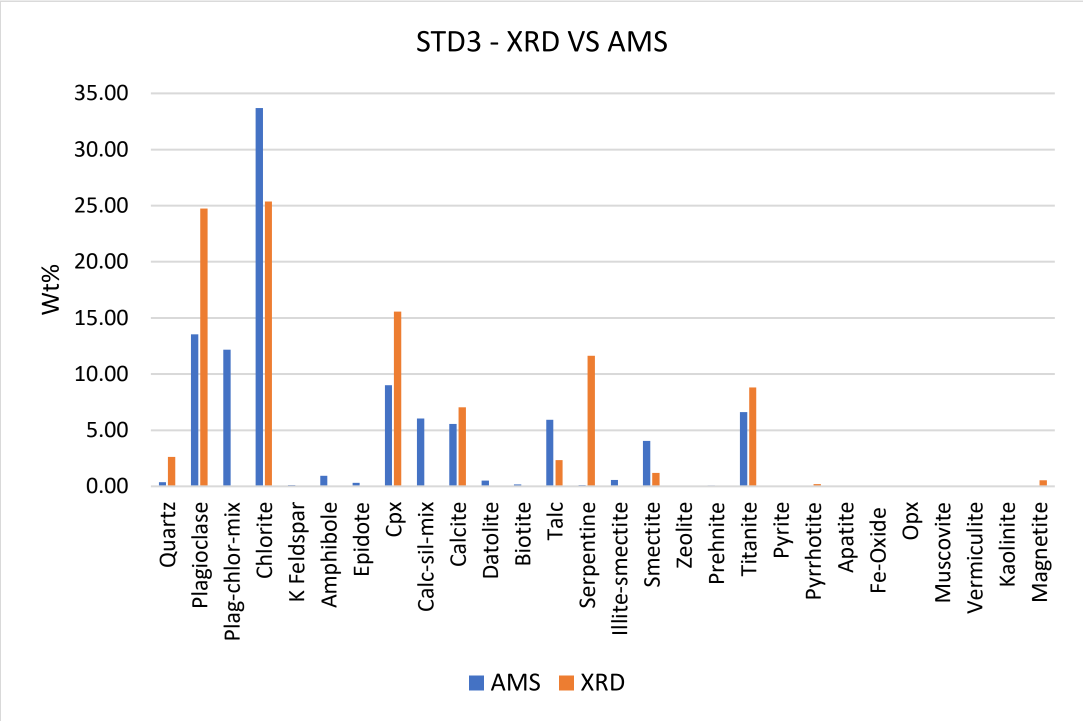


Figure 3: XRD vs AMS minerals detected in STD3.

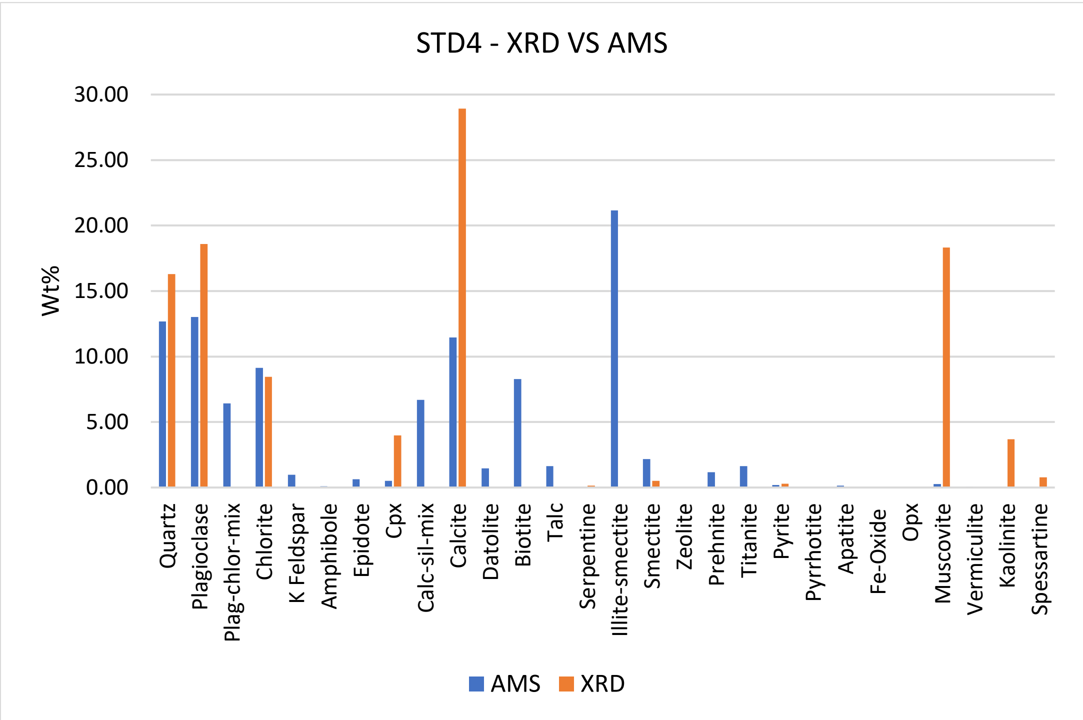


Figure 4: XRD vs AMS minerals detected in STD4.

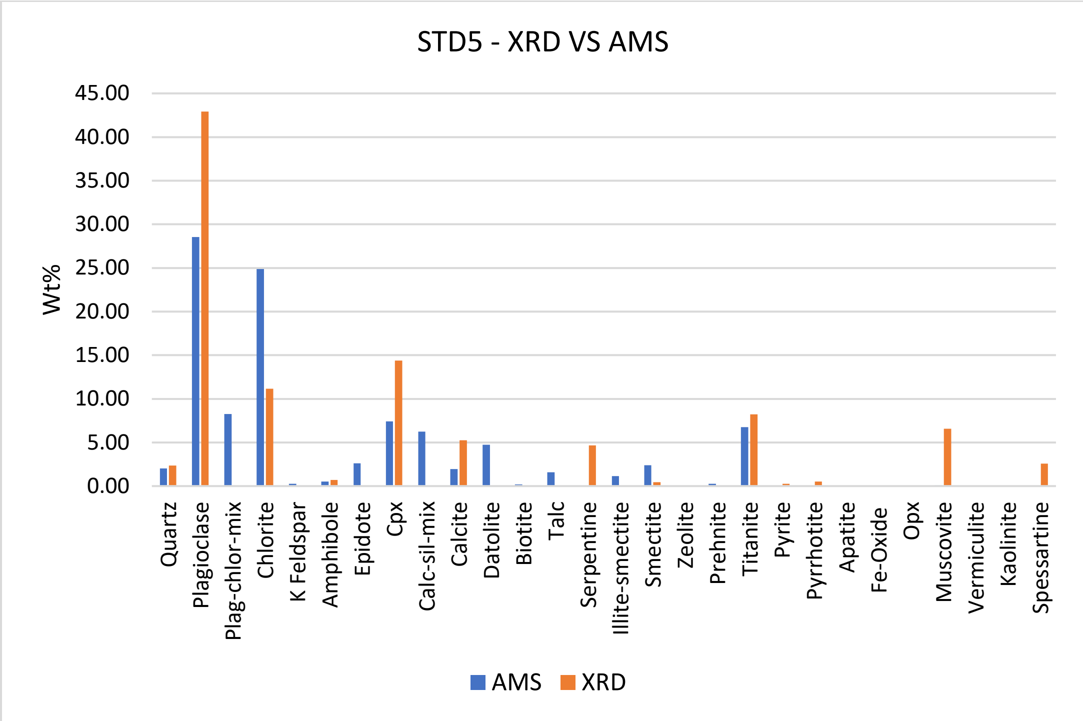


Figure 5: XRD vs AMS minerals detected in STD5.

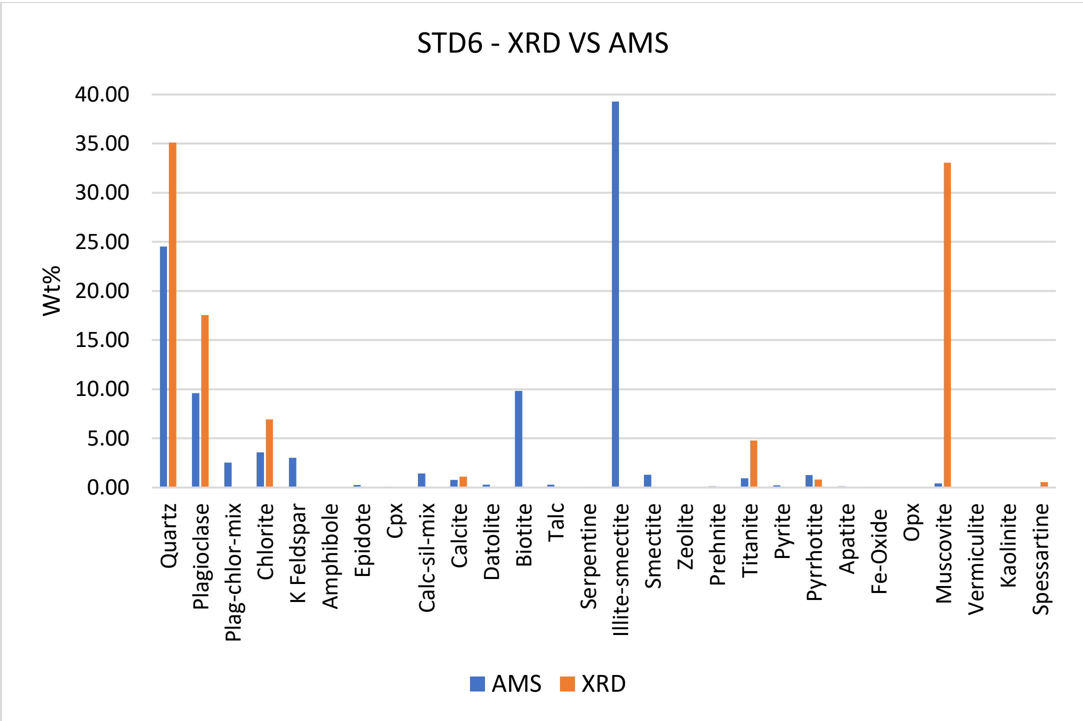


Figure 6: XRD vs AMS minerals detected in STD6.

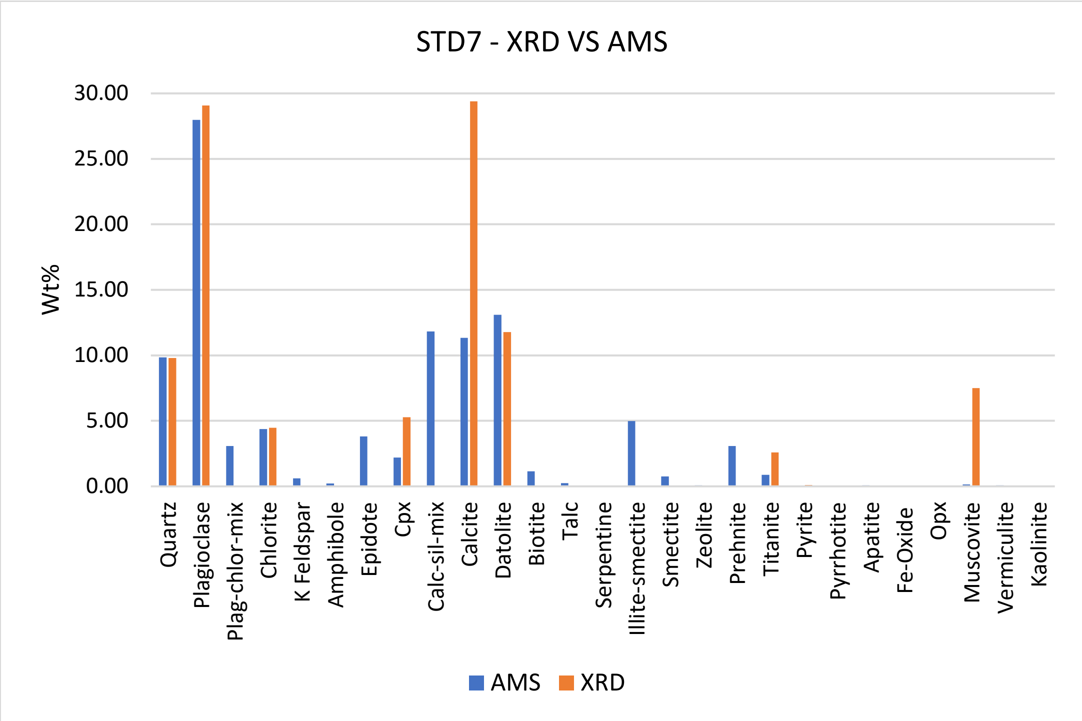


Figure 7: XRD vs AMS minerals detected in STD7.

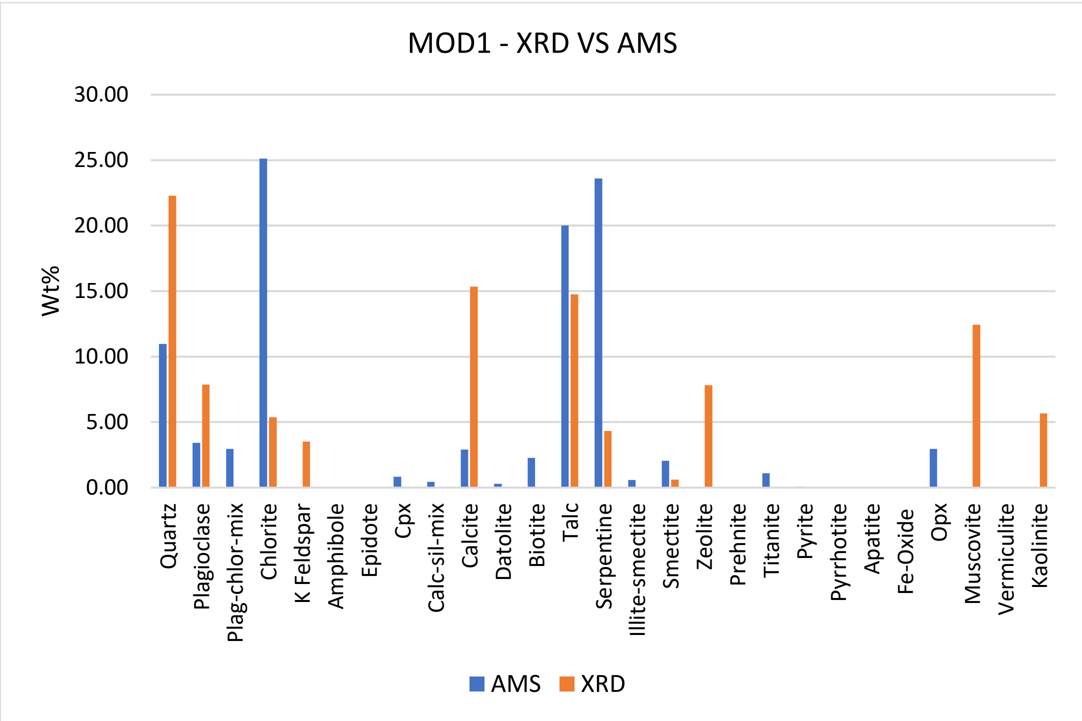


Figure 8: XRD vs AMS minerals detected in MOD1.

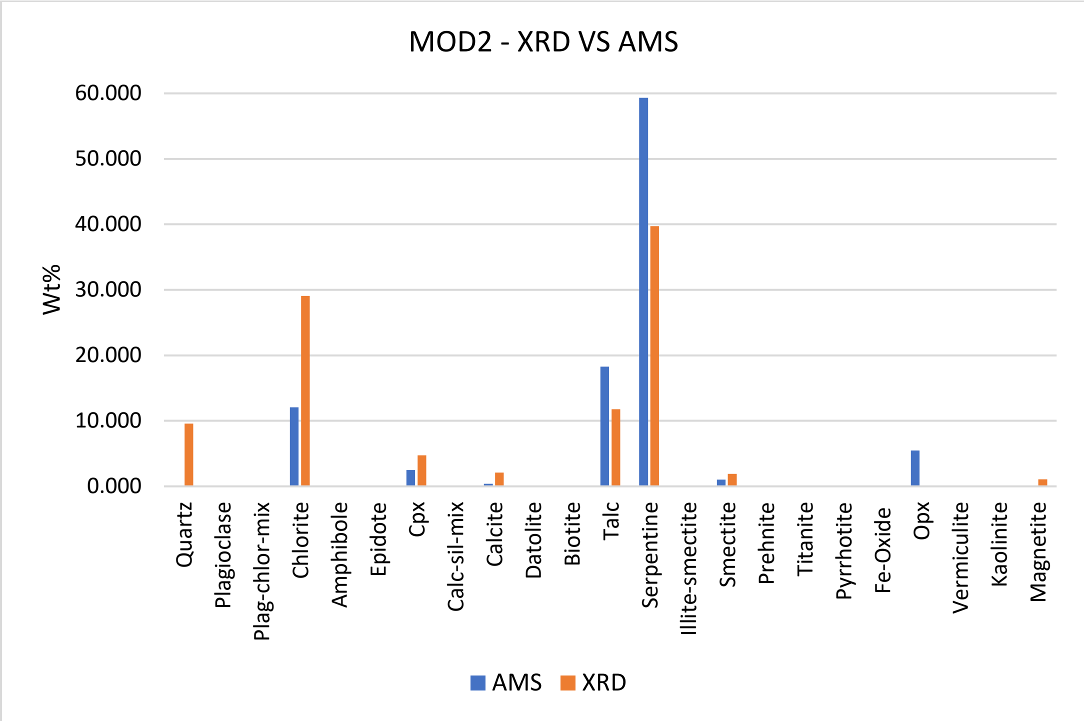


Figure 9: XRD vs AMS minerals detected in MOD2.

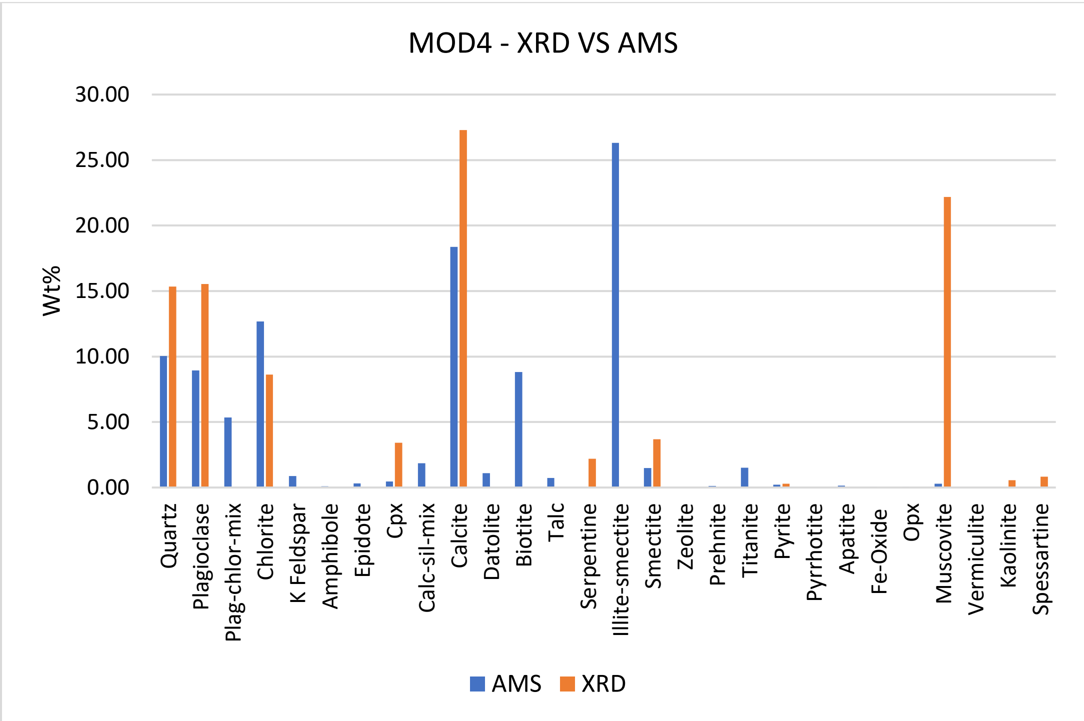


Figure 10: XRD vs AMS minerals detected in MOD4.

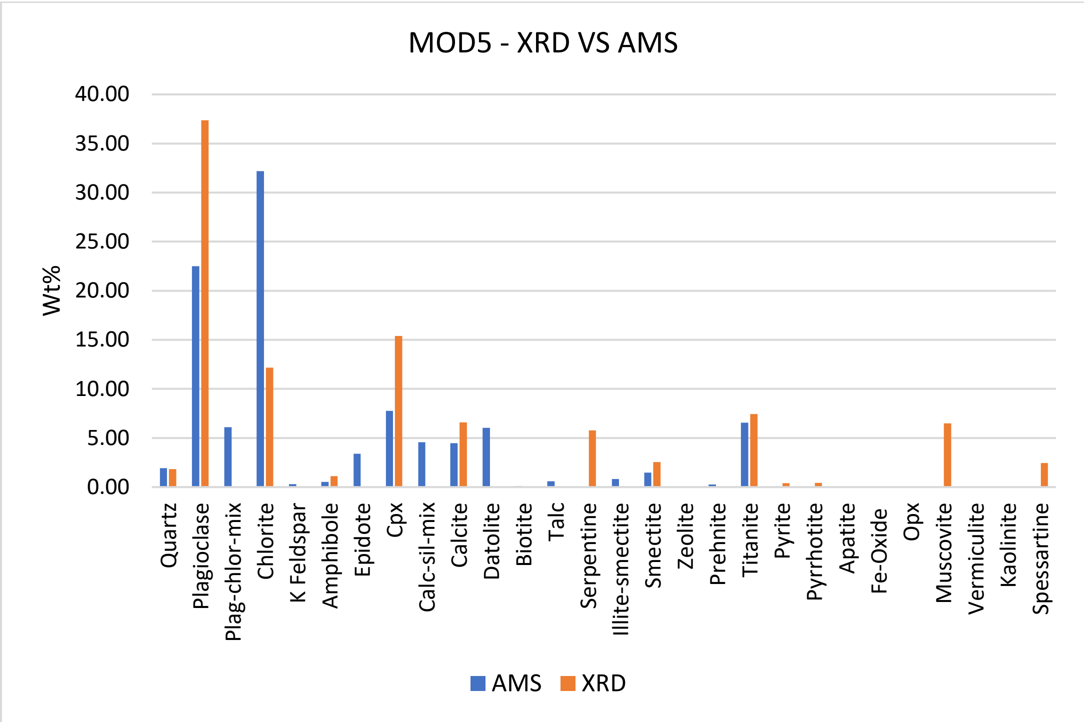


Figure 11: XRD vs AMS minerals detected in MOD5.