

**SUPPLEMENTARY DATA**

**Multi-analytical study on the wall paintings of kurilo monastery “St. Ivan Rilski”,  
Bulgaria**

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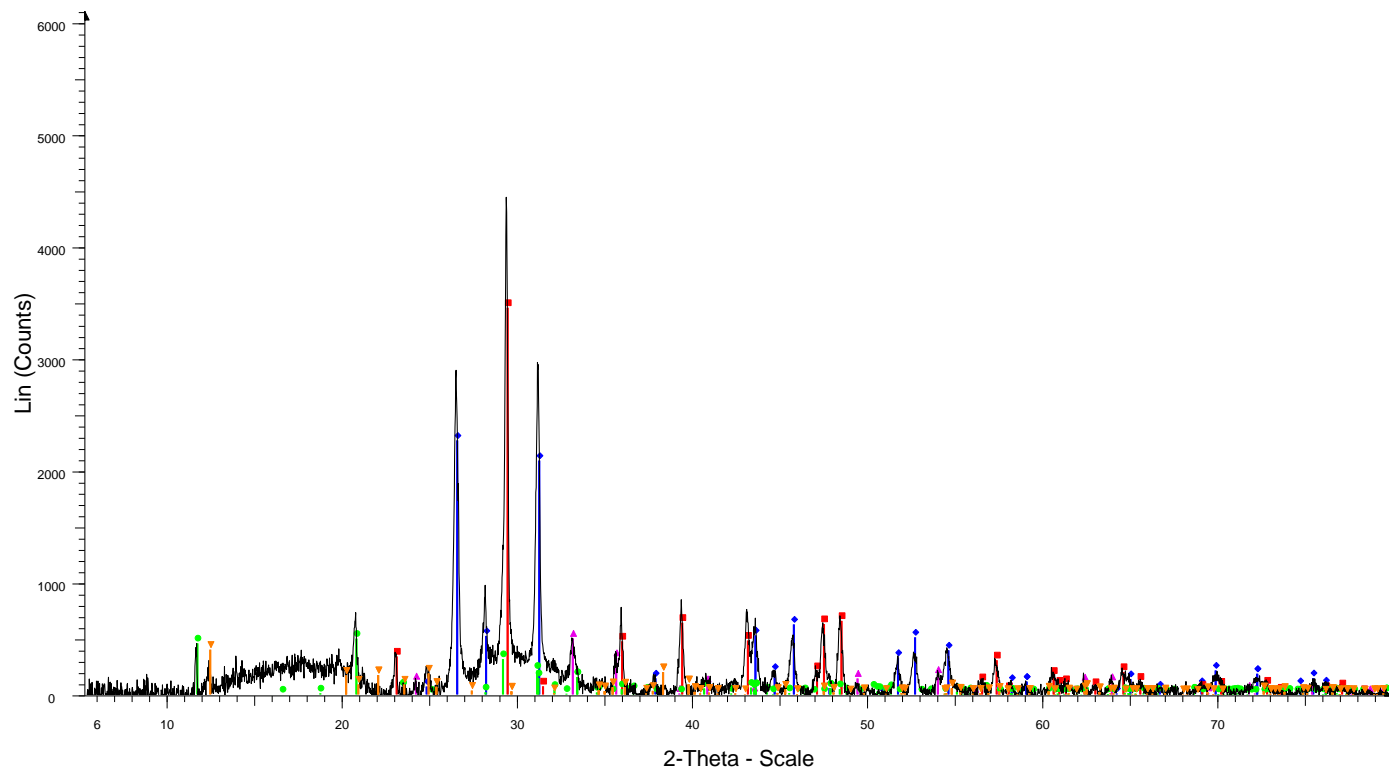
**Table S1.** Elemental analysis of samples K1-K10 by SEM-EDX. All results are in atomic %

	C	O	Na	Mg	Al	Si	S	K	Ca	Ti	Cr	Fe	Ni	Cu	Zn	Hg	Pb
K1	20,13	58,71		4,19	0,61	10,62	0,1	1,64	1,33			2,66					
K2	24,34	57,48	0,15	0,85	1,87	2,97	1,55	0,39	8,35			0,57				1,49	
K3	43,36	30,26		1,07	0,17	0,59	0,49	0,2	5,36			17,97		0,25			0,28
K4	19,16	62,43		0,74	1,11	2,52	3,1	0,18	9,79			0,49				0,48	
K5	48,95	40,53	0,24	0,4	0,39	1,59	0,08	0,31	7,31	0,09		0,13					
K6	22,51	58,57		1,65	0,17	0,69	0,09	0,09	7,9			7,99			0,15		0,19
K7	15,7	65,4		4,25	1,89	4,26	0,52	0,55	5,8			0,94				0,5	0,22
K8	38,02	46,86	0,32	3,13	0,21	4,37	0,96	0,22	3,72		0,19	1,93	0,08				
K9		71,61		4,18	4,05	14,97		1,86	0,49	0,10		2,74					
K10	19,91	63,21		0,64	0,2	0,99	0,37	0,07	7,28			7,19					0,14

**Table S2.** Elemental analysis of sample K11 by SEM-EDX. All results are in in atomic %

Spectrum	C	O	Mg	Al	Si	S	K	Ca	Fe	Cu	Au	Pb
K11 site 1	42.71	47.49	0.69	1.17	1.62	0.18	0.2	2.66	3.15	0	0	0.12
K11 site 2	41.78	48.13	0.9	1.28	2.05	0.29	0.12	0.89	4.27	0.12	0	0.17
K11 site 3	60.66	34.84	0.85	0.34	0.6	0.12	0.07	1.31	1.07	0	0.08	0.06
K11 site 4	67.27	30.14	0.97	0.19	0.22	0.12	0.05	0.6	0.44	0	0	0
K11 site 5	40.07	48.81	1.18	1.21	2.2	0.32	0.11	1.18	4.76	0	0	0.17
K11 site 6	70.48	23.55	0.95	0.17	0.33	0.35	0.09	0.79	0	0.15	3.14	0

# K4



File: K\_4.raw - Type: 2Th/Th locked - Start: 5.300 ° - End: 79.988 ° - Step: 0.020 ° - Step time: 70. s - Temp.: 25 °C (Room) - Time Started: 10 s - 2-Theta: 5.300 ° - Theta: 2.650 ° - Chi: 0.00 ° - Phi: 0.00 ° - X: 0.0 m  
Operations: Background 0.380,1.000 | Import

- 01-071-5164 (I) - Cinnabar, syn - HgS - Y: 51.13 % - d x by: 1. - WL: 1.5406 - Hexagonal - a 4.14890 - b 4.14890 - c 9.49470 - alpha 90.000 - beta 90.000 - gamma 120.000 - Primitive - P3121 (152) - 3 - 141.540 - I/
- 01-071-3699 (\*) - Calcite, syn - Ca(CO<sub>3</sub>) - Y: 77.81 % - d x by: 1. - WL: 1.5406 - Rhombo.H.axes - a 4.99100 - b 4.99100 - c 17.06200 - alpha 90.000 - beta 90.000 - gamma 120.000 - Primitive - R-3c (167) - 6 - 368
- 01-089-0596 (\*) - Hematite, syn - Fe<sub>2</sub>O<sub>3</sub> - Y: 11.25 % - d x by: 1. - WL: 1.5406 - Rhombo.H.axes - a 5.03700 - b 5.03700 - c 13.77100 - alpha 90.000 - beta 90.000 - gamma 120.000 - Primitive - R-3c (167) - 6 - 302
- 01-074-1433 (\*) - Gypsum - Ca(SO<sub>4</sub>)(H<sub>2</sub>O)<sub>2</sub> - Y: 11.21 % - d x by: 1. - WL: 1.5406 - Monoclinic - a 5.67900 - b 15.20200 - c 6.52200 - alpha 90.000 - beta 118.430 - gamma 90.000 - Body-centered - I2/c (15) - 4 - 4
- 01-075-0938 (I) - Kaolinite 2M - Al<sub>2</sub>Si<sub>2</sub>O<sub>5</sub>(OH)<sub>4</sub> - Y: 9.02 % - d x by: 1. - WL: 1.5406 - Monoclinic - a 5.14800 - b 8.92000 - c 14.53500 - alpha 90.000 - beta 100.200 - gamma 90.000 - Base-centered - Cc (9) - 4 - 6

Figure 1S. Diffraction pattern of sample K4

k7

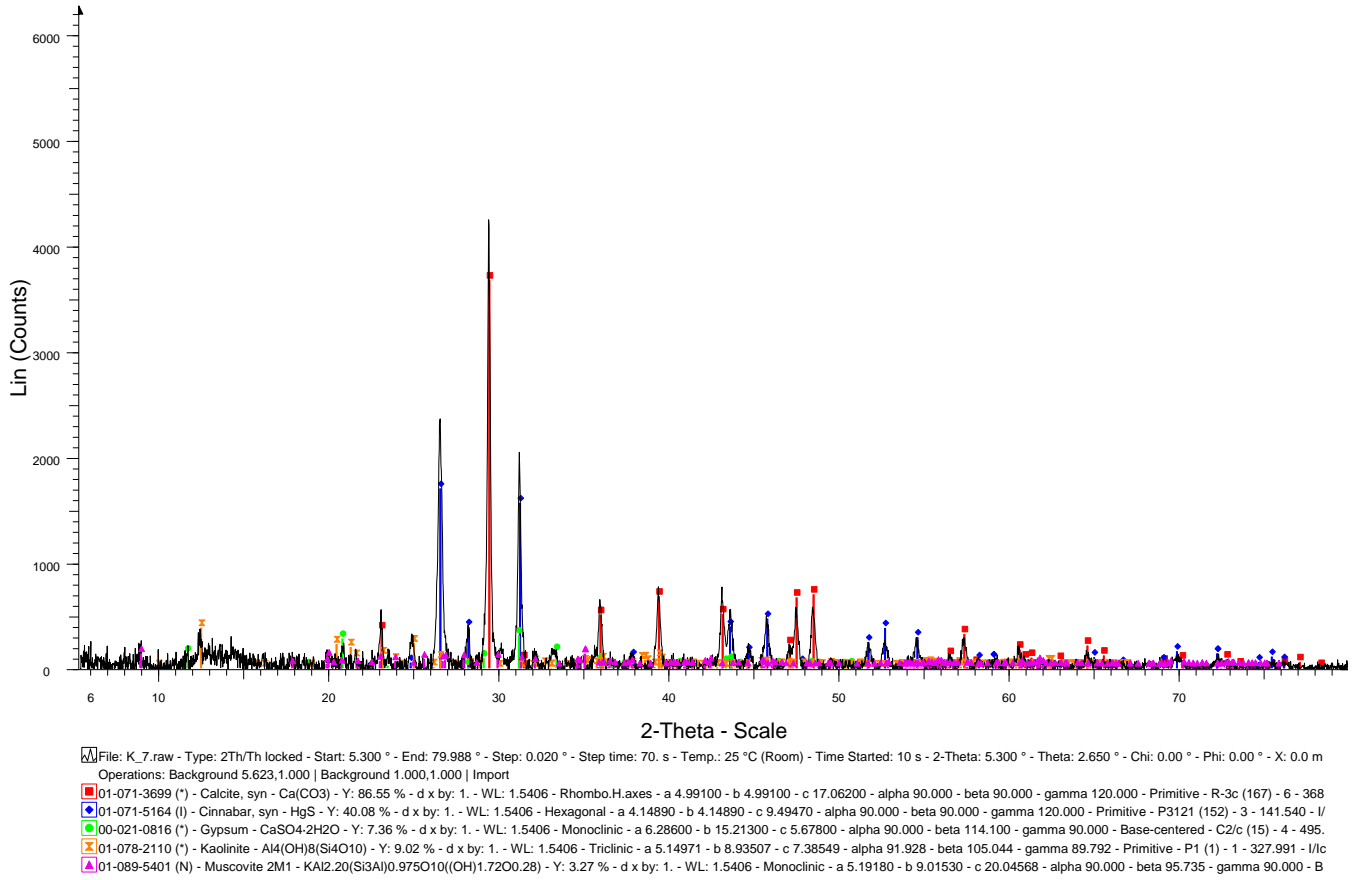
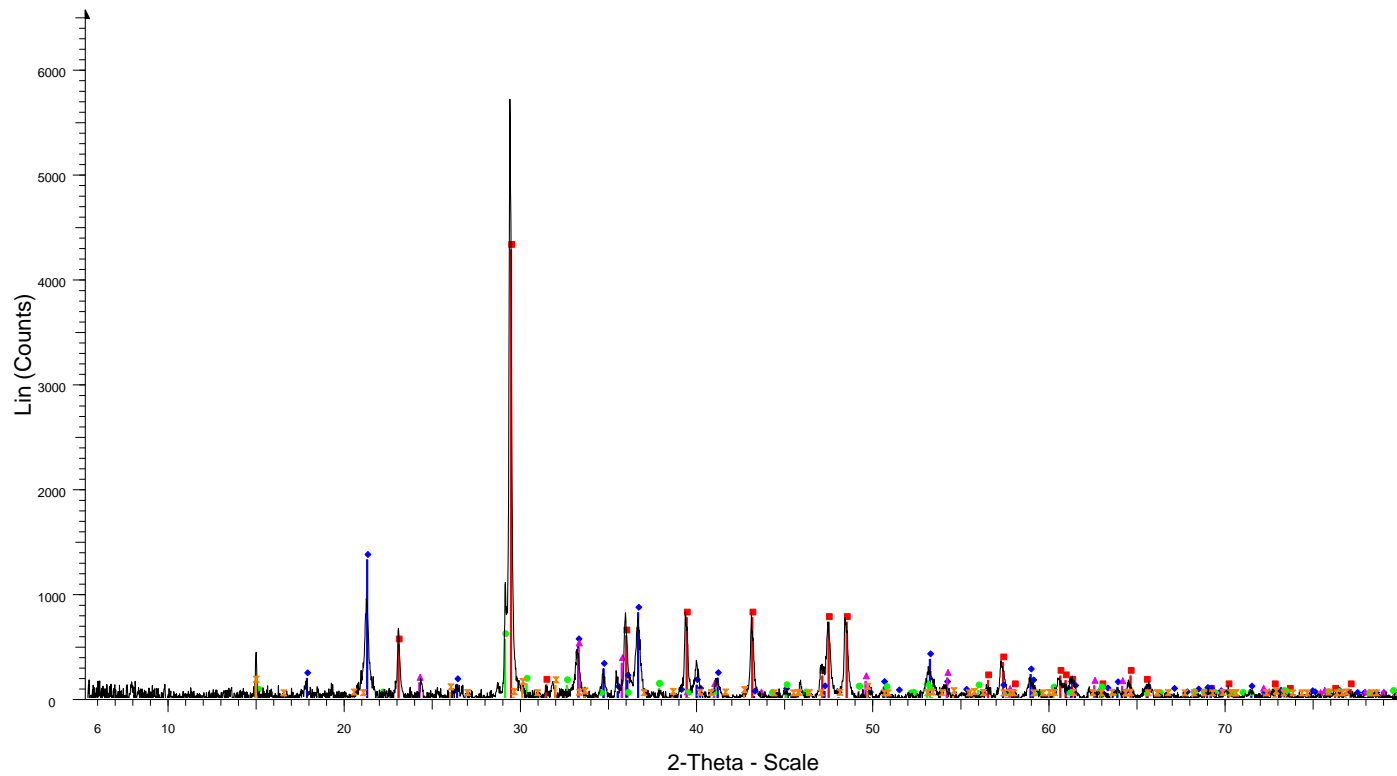


Figure 2S. Diffraction pattern of sample K7

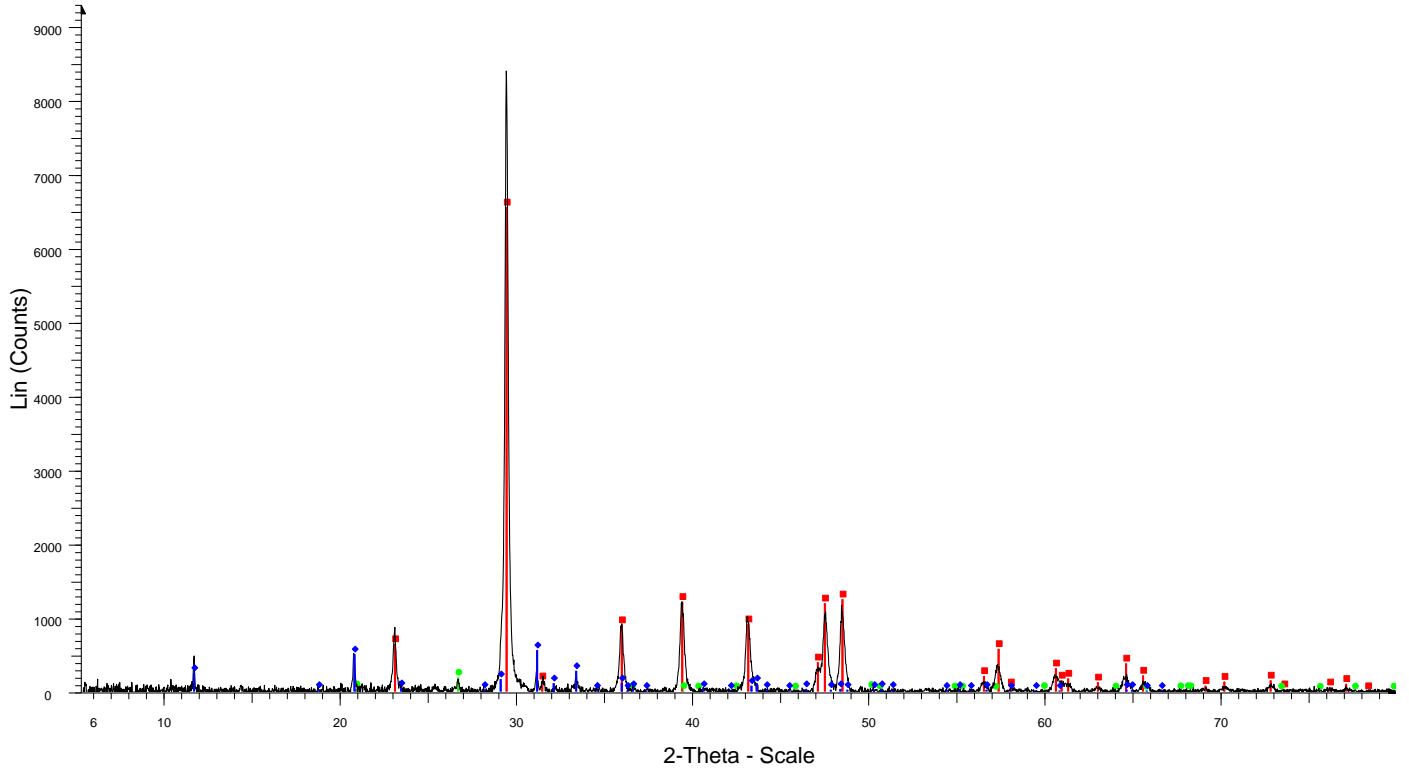
k6



File: K\_6.raw - Type: 2Th/Th locked - Start: 5.300 ° - End: 79.988 ° - Step: 0.020 ° - Step time: 70. s - Temp.: 25 °C (Room) - Time Started: 10 s - 2-Theta: 5.300 ° - Theta: 2.650 ° - Chi: 0.00 ° - Phi: 0.00 ° - X: 0.0 m  
Operations: Background 1.000,1.000 | Import  
00-005-0586 (\*) - Calcite, syn - CaCO3 - Y: 74.94 % - d x by: 1. - WL: 1.5406 - Rhombo.H.axes - a 4.98900 - b 4.98900 - c 17.06200 - alpha 90.000 - beta 90.000 - gamma 120.000 - Primitive - R-3c (167) - 6 - 367.7  
01-081-0464 (I) - Goethite, syn - FeO(OH) - Y: 23.16 % - d x by: 1. - WL: 1.5406 - Orthorhombic - a 4.60480 - b 9.95950 - c 3.02300 - alpha 90.000 - beta 90.000 - gamma 90.000 - Primitive - Pbnm (62) - 4 - 138.63  
01-089-8104 (\*) - Hematite, syn - Fe2O3 - Y: 8.34 % - d x by: 1. - WL: 1.5406 - Rhombo.H.axes - a 5.02300 - b 5.02300 - c 13.70800 - alpha 90.000 - beta 90.000 - gamma 120.000 - Primitive - R-3c (167) - 6 - 299.  
01-077-1971 (\*) - Massicot, syn - PbO - Y: 9.90 % - d x by: 1. - WL: 1.5406 - Orthorhombic - a 5.89310 - b 5.49040 - c 4.75280 - alpha 90.000 - beta 90.000 - gamma 90.000 - Primitive - Pbcm (57) - 4 - 153.779 - IJ  
01-072-4535 (I) - Bassanite - Ca(SO4)(H2O).5 - Y: 2.28 % - d x by: 1. - WL: 1.5406 - Hexagonal - a 6.86000 - b 6.86000 - c 12.70000 - alpha 90.000 - beta 90.000 - gamma 120.000 - Primitive - P3221 (154) - 6 - 51

Figure 3S. Diffraction pattern of sample K6

k10



File: K\_10.raw - Type: 2Th/Th locked - Start: 5.300 ° - End: 79.988 ° - Step: 0.020 ° - Step time: 70. s - Temp.: 25 °C (Room) - Time Started: 10 s - 2-Theta: 5.300 ° - Theta: 2.650 ° - Chi: 0.00 ° - Phi: 0.00 ° - X: 0.0  
Operations: Background 5.623,1.000 | Import  
01-071-3699 (\*) - Calcite, syn - Ca(CO<sub>3</sub>) - Y: 78.10 % - d x by: 1. - WL: 1.5406 - Rhombo.H.axes - a 4.99100 - b 4.99100 - c 17.06200 - alpha 90.000 - beta 90.000 - gamma 120.000 - Primitive - R-3c (167) - 6 - 368  
00-021-0816 (\*) - Gypsum - CaSO<sub>4</sub>·2H<sub>2</sub>O - Y: 6.66 % - d x by: 1. - WL: 1.5406 - Monoclinic - a 6.28600 - b 15.21300 - c 5.67800 - alpha 90.000 - beta 114.100 - gamma 90.000 - Base-centered - C2/c (15) - 4 - 495.  
03-065-0466 (I) - Quartz low, syn - O<sub>2</sub>Si - Y: 2.27 % - d x by: 1. - WL: 1.5406 - Hexagonal - a 4.91410 - b 4.91410 - c 5.40600 - alpha 90.000 - beta 90.000 - gamma 120.000 - Primitive - P3221 (154) - 3 - 113.056 - I

Figure 4S. Diffraction pattern of sample K10

# K-1

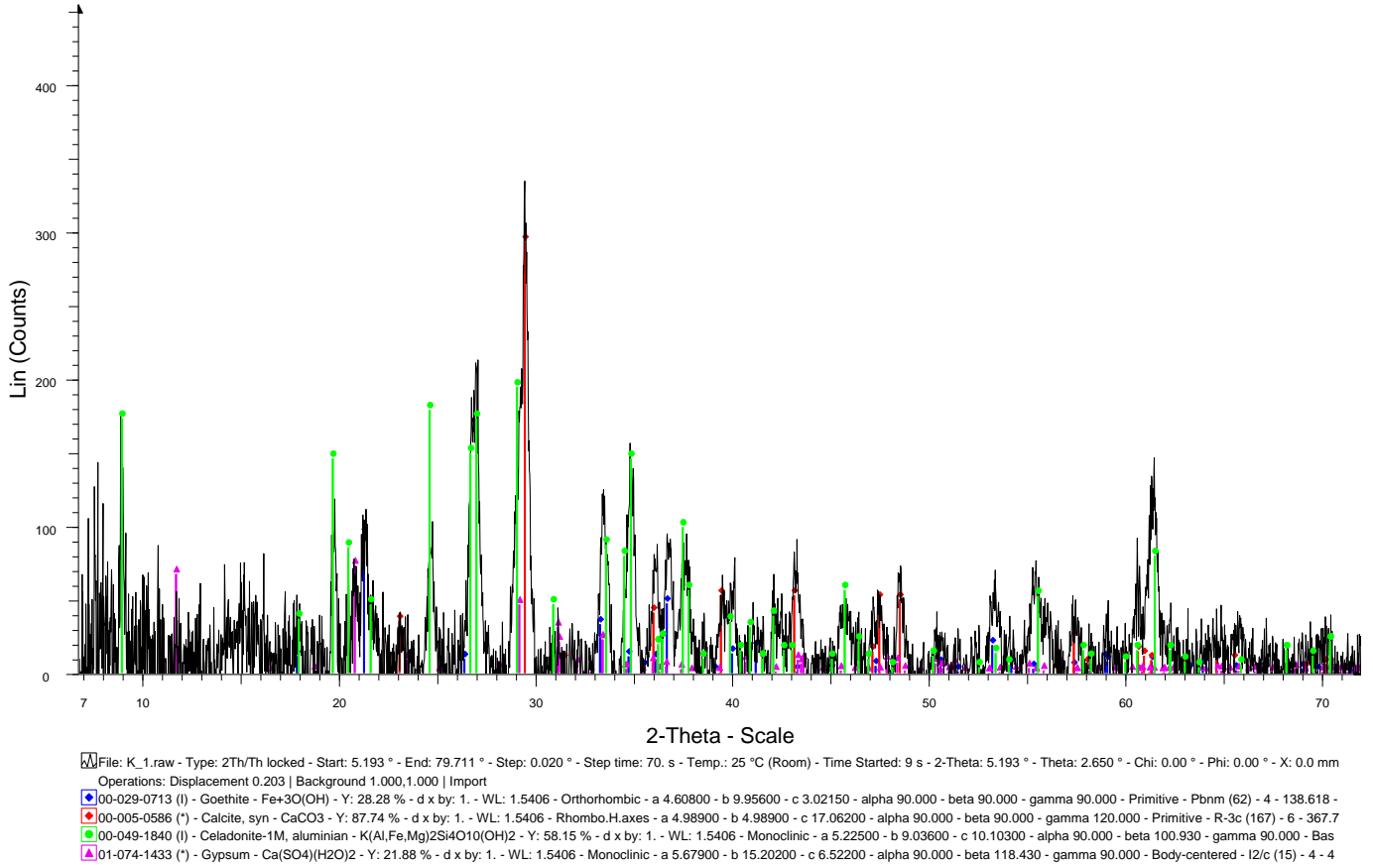
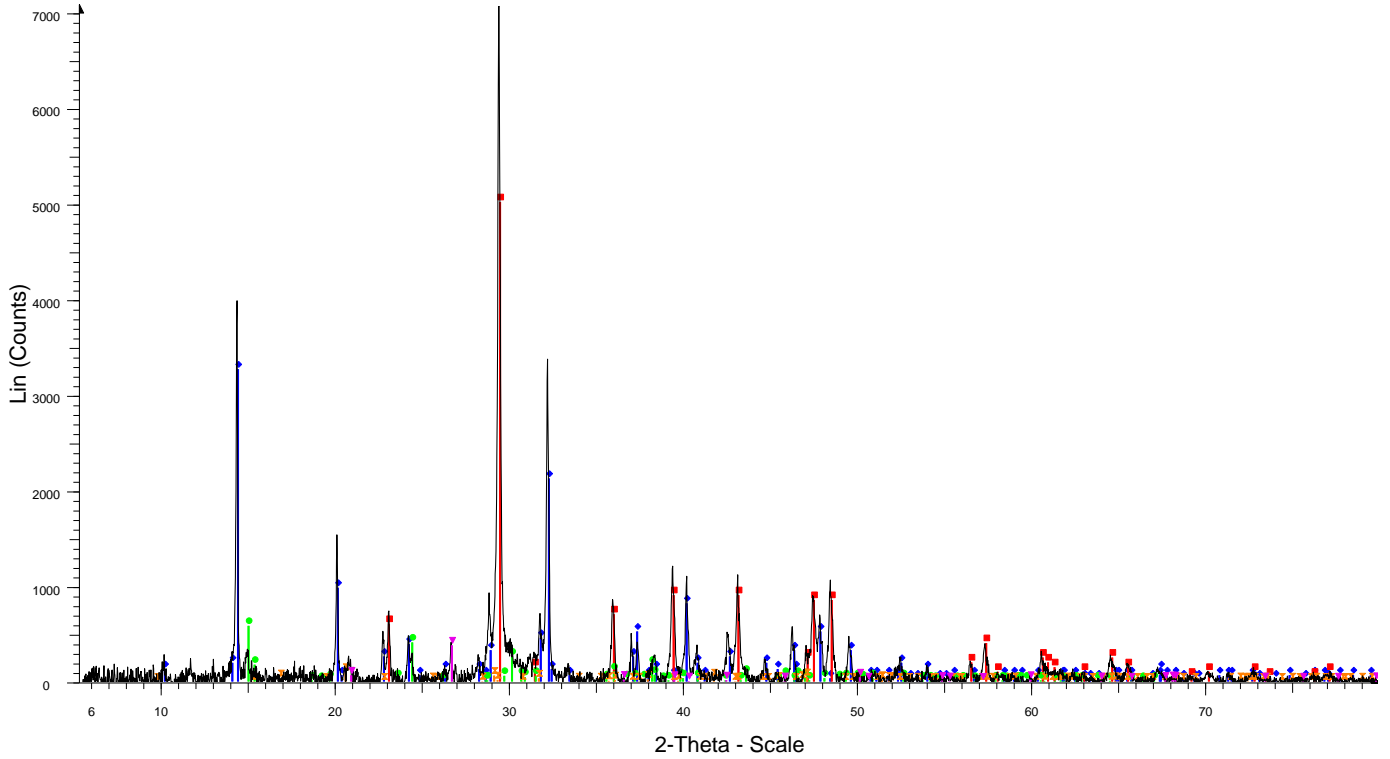


Figure 5S. Diffraction pattern of sample K1

k5



File: K\_5.raw - Type: 2Th/Th locked - Start: 5.300 ° - End: 79.988 ° - Step: 0.020 ° - Step time: 70. s - Temp.: 25 °C (Room) - Time Started: 11 s - 2-Theta: 5.300 ° - Theta: 2.650 ° - Chi: 0.00 ° - Phi: 0.00 ° - X: 0.0 m  
Operations: Background 1.000,1.000 | Import  
00-017-0541 (I) - Weddellite, syn - C<sub>2</sub>CaO<sub>4</sub>·2H<sub>2</sub>O - Y: 46.22 % - d x by: 1. - WL: 1.5406 - Tetragonal - a 12.35000 - b 12.35000 - c 7.36300 - alpha 90.000 - beta 90.000 - gamma 90.000 - Body-centered - I4/m (87)  
00-005-0586 (\*) - Calcite, syn - CaCO<sub>3</sub> - Y: 70.97 % - d x by: 1. - WL: 1.5406 - Rhombo.H.axes - a 4.98900 - b 4.98900 - c 17.06200 - alpha 90.000 - beta 90.000 - gamma 120.000 - Primitive - R-3c (167) - 6 - 367.7  
00-020-0231 (\*) - Whewellite, syn - CaC<sub>2</sub>O<sub>4</sub>·H<sub>2</sub>O - Y: 8.25 % - d x by: 1. - WL: 1.5406 - Monoclinic - a 9.97600 - b 7.29400 - c 6.29100 - alpha 90.000 - beta 107.000 - gamma 90.000 - Primitive - P21/n (14) - 4 - 43  
01-083-1923 (I) - Monohydrocalcite, syn - CaCO<sub>3</sub>(H<sub>2</sub>O) - Y: 1.43 % - d x by: 1. - WL: 1.5406 - Hexagonal - a 10.55360 - b 10.55360 - c 7.54460 - alpha 90.000 - beta 90.000 - gamma 120.000 - Primitive - P31 (144)  
03-065-0466 (I) - Quartz low, syn - O<sub>2</sub>Si - Y: 5.35 % - d x by: 1. - WL: 1.5406 - Hexagonal - a 4.91410 - b 4.91410 - c 5.40600 - alpha 90.000 - beta 90.000 - gamma 120.000 - Primitive - P3221 (154) - 3 - 113.056 - I

Figure 6S. Diffraction pattern of sample K5



k8

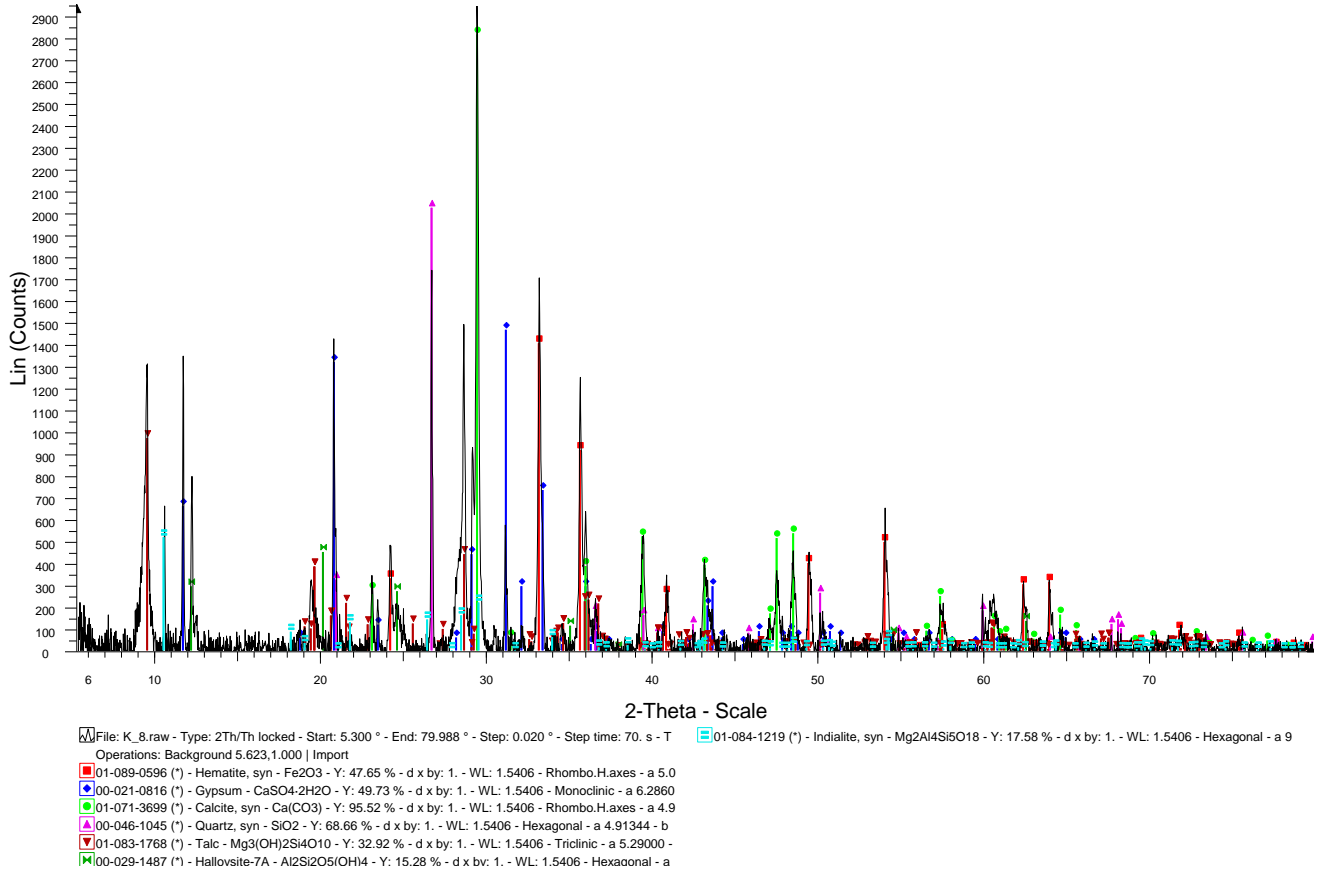


Figure 7S. Diffraction pattern of sample K8