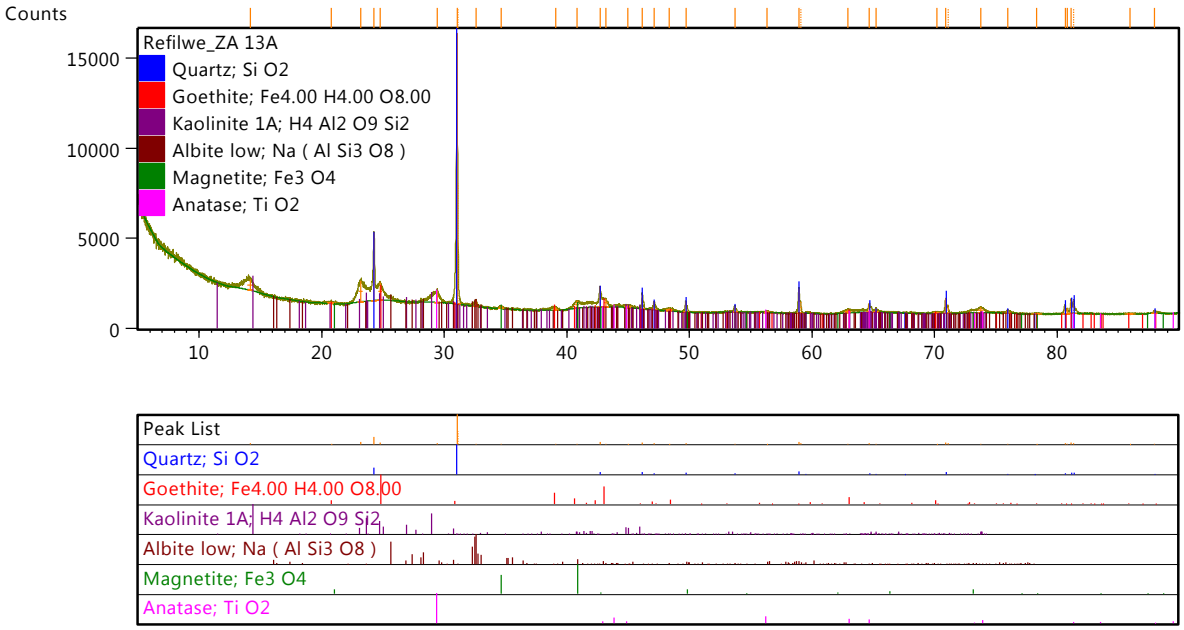
May 2018

The sample was re-analysed, interpreted and quantified. According to XRF the sample contains sodium and therefore albite was fitted. The rutile peak is not present in the re-analysed sample, but a tiny peak for magnetite was detected.

Albite, Na(AlSi3O8) belongs to the group plagioclase.



	ZA 13A
Quartz %	42.83
Goethite %	18.87
Anatase %	1.01
Kaolinite %	34
Albite %	1.58
Magnetite %	1.71

The sample was re-analysed, interpreted and quantified. According to XRF the sample contains sodium and therefore albite was fitted. The rutile peak is not present in the re-analysed sample, but a tiny peak for magnetite was detected.

Albite, Na(AlSi3O8) belongs to the group plagioclase.

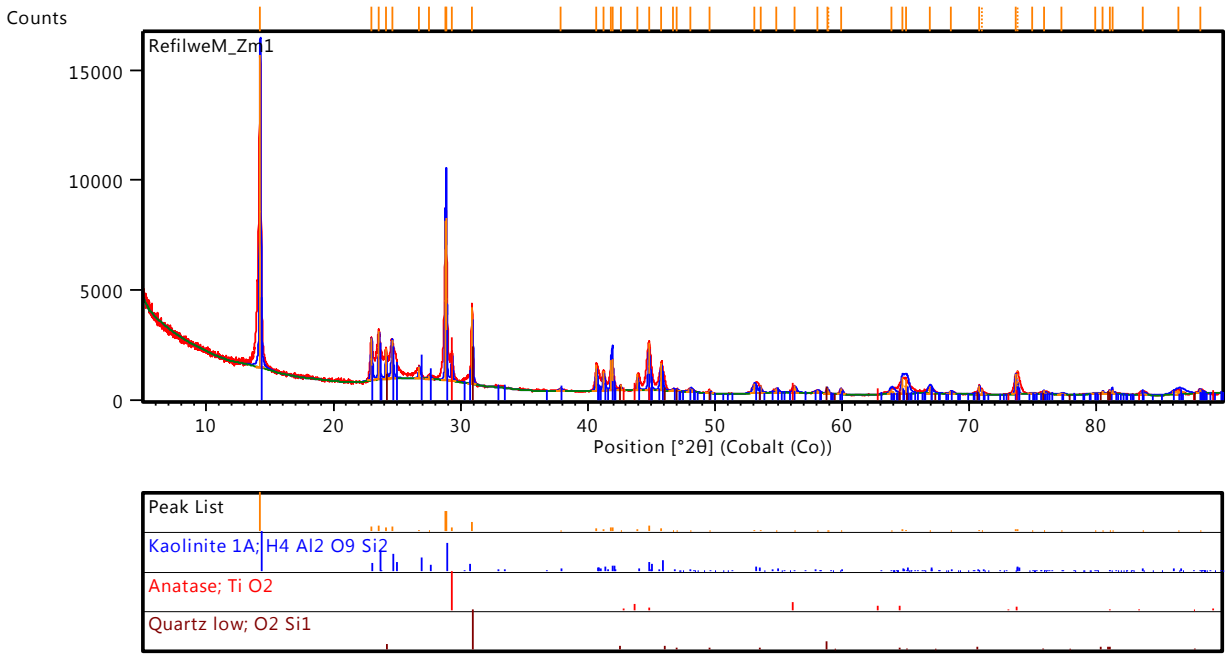
Supplementary Material 1a: XRD phase amounts

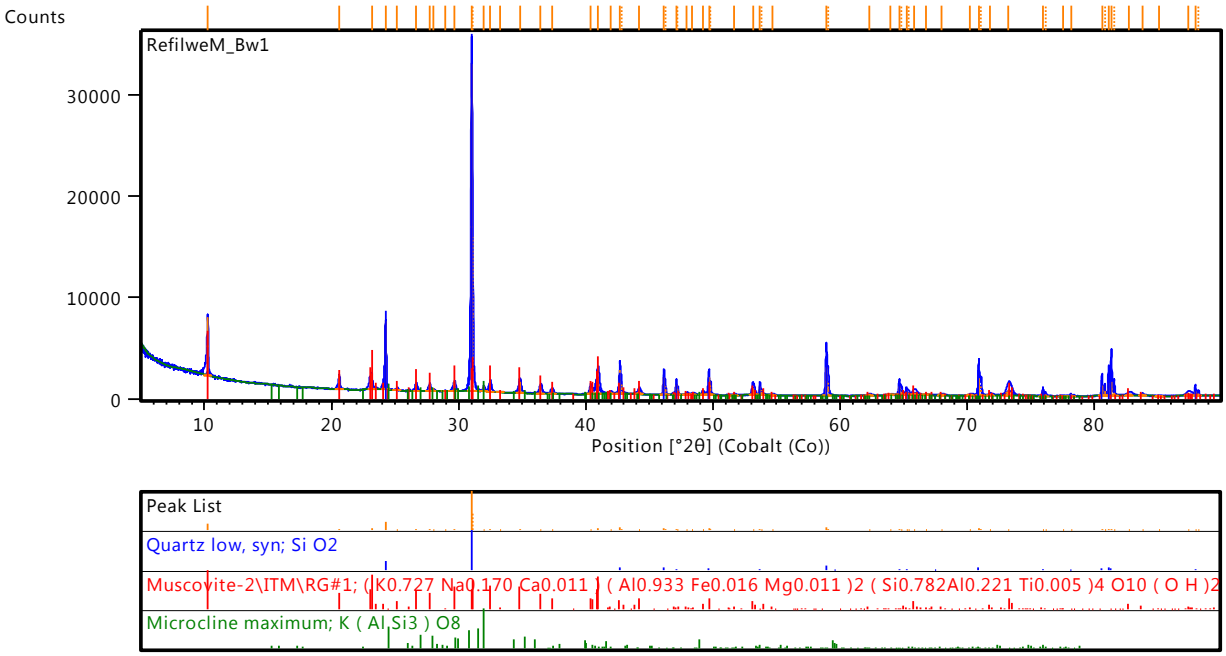
Below is the data for 39 samples plus 2 commercial samples za15 (bentonite) and za19 (montmorrilonite) used as controls

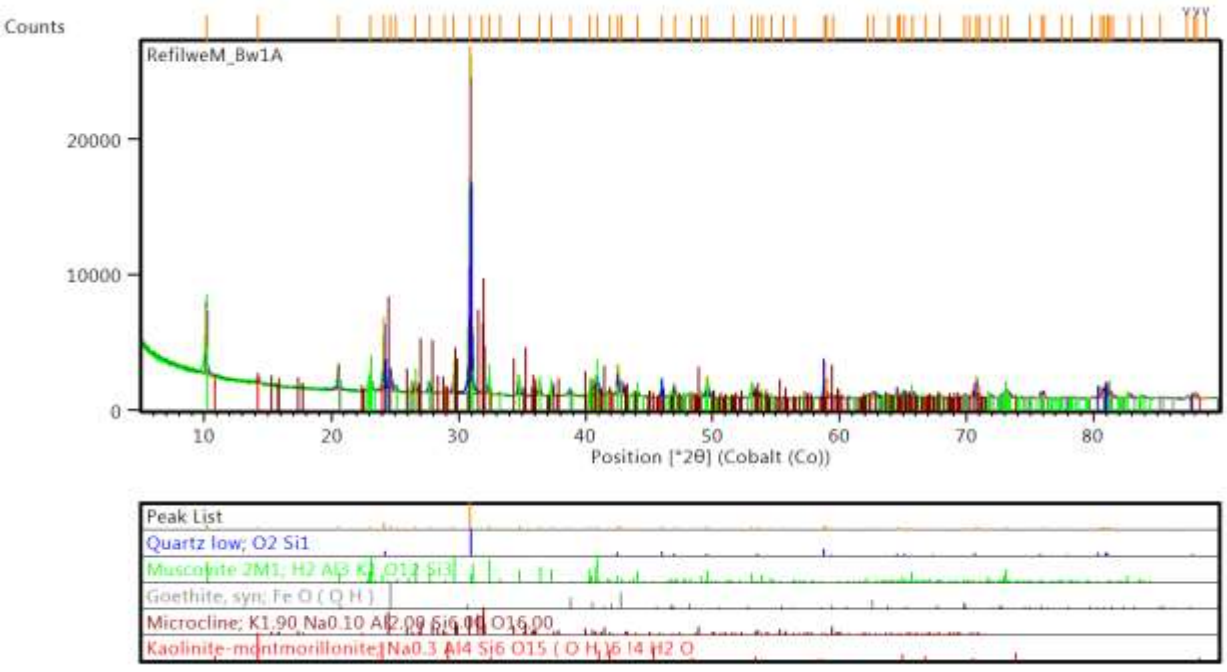
2015.01.27 The sample was prepared according to the standardized Panalytical backloading system, which provides nearly random distribution of the particles.

The sample was analyzed using a PANalytical X'Pert Pro powder diffractometer in θ–θ configuration with an X'Celerator detector and variable divergence- and fixed receiving slits with Fe filtered Co-Kα radiation (λ=1.789Å). The phases were identified using X'Pert Highscore plus software.

The relative phase amounts (weight%) were estimated using the Rietveld method (Autoquan Program). Errors are on the 3 sigma level in the column to the right of the amount.




Counts
RefilweM_Bw1
30000
20000
10000
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Quartz low, syn; Si O2
Muscovite-2\ITM\RG#1; (K0.727 Na0.170 Ca0.011) (Al0.933 Fe0.016 Mg0.011)2 (Si0.782Al0.221 Ti0.005)4 O10 (O H)2
Microcline maximum; K (Al Si3) O8


Counts
RefilweM_Bw1A
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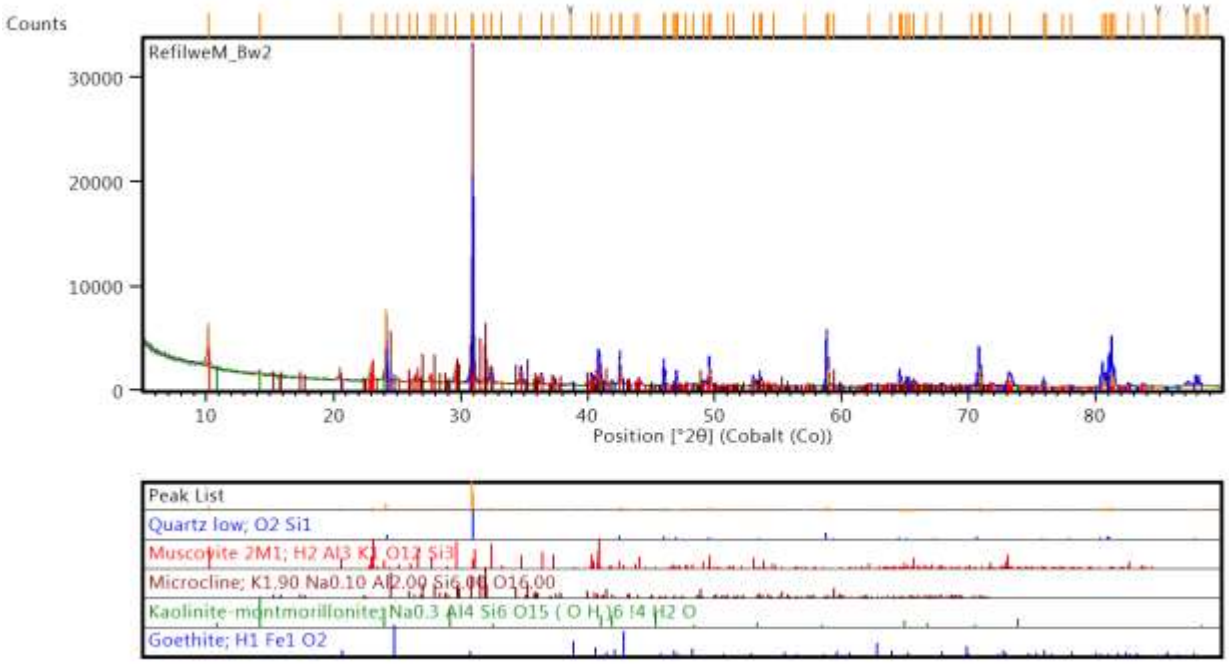
10000
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Quartz low; O2 Si1
Goethite, syn; Fe O (O H)
Microcline; K1.90 Na0.10 Al2.09 Si6.91 O16.00
Kaolinite-montmorillonite; Na0.3 Al4 Si6 O15 (O H)6 I4 H2 O


Counts
RefilweM_Bw2
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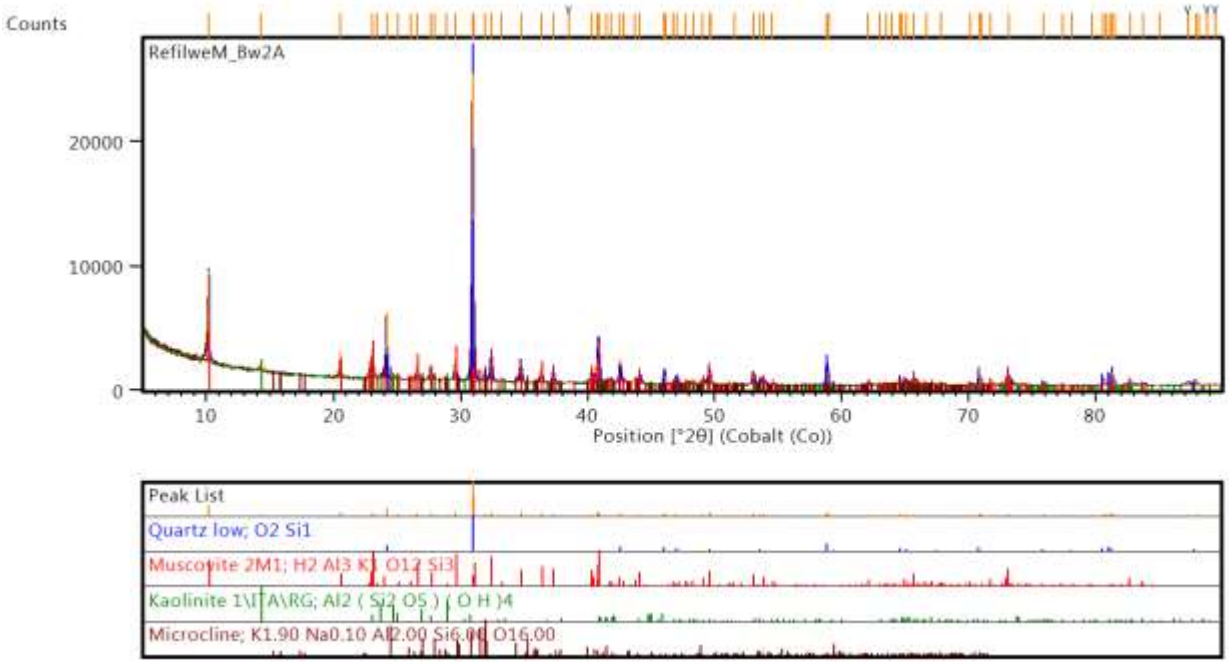
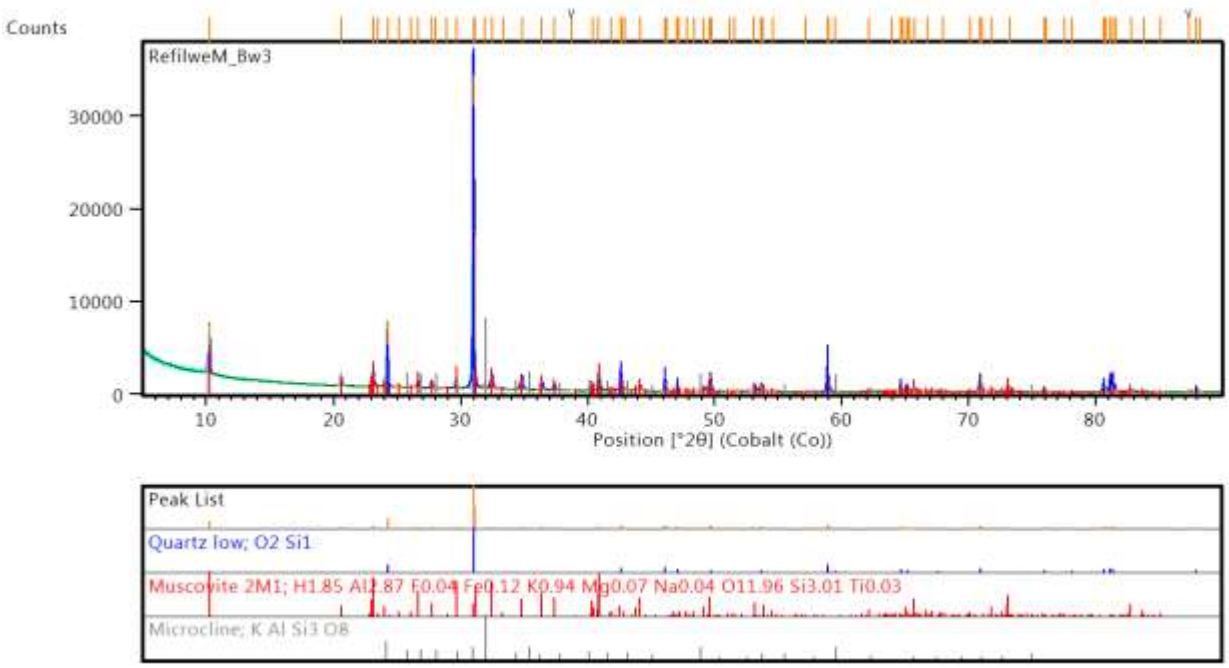
20000
10000
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Quartz low; O2 Si1
Muscovite 2M1; H2 Al3 K1 O12 Si3
Microcline; K1.90 Na0.10 Al2.00 Si6.00 O16.00
Kaolinite-montmorillonite; Na0.3 Al4 Si6 O15 (O H)6 !4 H2 O
Goethite; H1 Fe1 O2


Counts
RefilweM_Bw2A
20000
10000
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Quartz low; O2 Si1
Muscovite 2M1; H2 Al3 K1 O12 Si3
Kaolinite 1\[TA\RG; Al2 (Si2 O5) (O H)4
Microcline; K1.90 Na0.10 Al2.00 Si6.00 O16.00


Counts
RefilweM_Bw3
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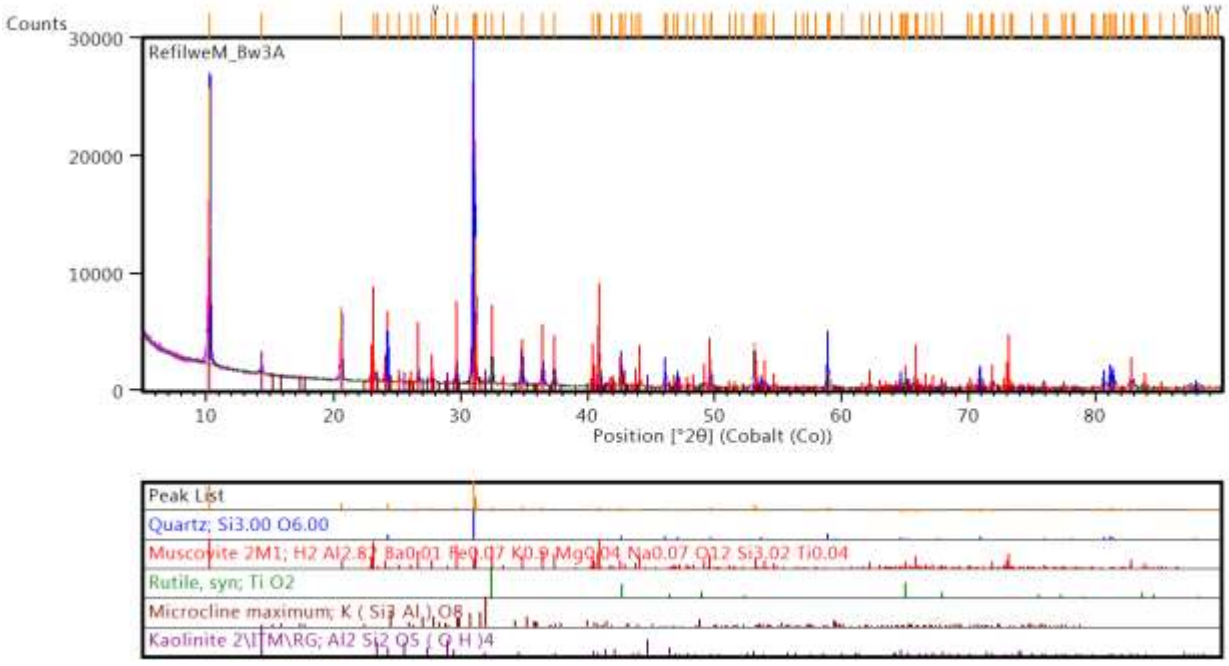
20000
10000
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Quartz low; O2 Si1
Muscovite 2M1; H1.85 Al2.87 F0.04 Fe0.12 K0.94 Mg0.07 Na0.04 O11.96 Si3.01 Ti0.03
Microcline; K Al Si3 O8


Counts
RefilweM_Bw3A
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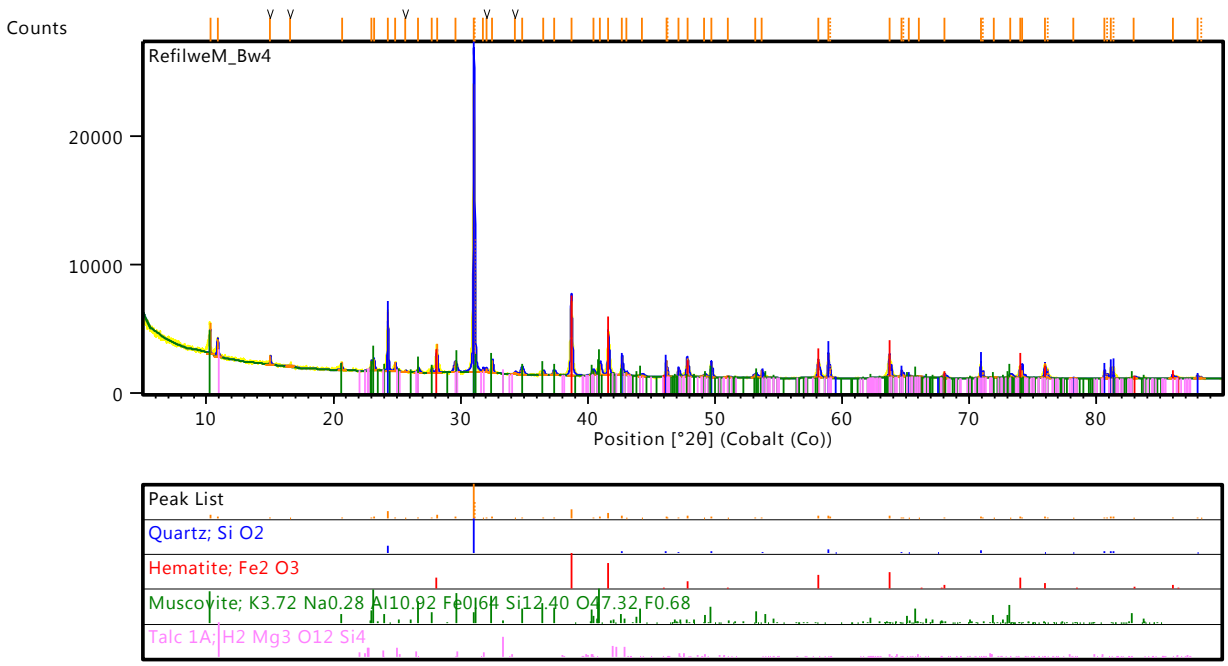
20000
10000
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Quartz; Si3.00 O6.00
Rutile, syn; Ti O2
Microcline maximum; K (Si3 Al) O8
Kaolinite 2\1\M\RG; Al2 Si2 O5 (O H)4


Counts
RefilweM_Bw4
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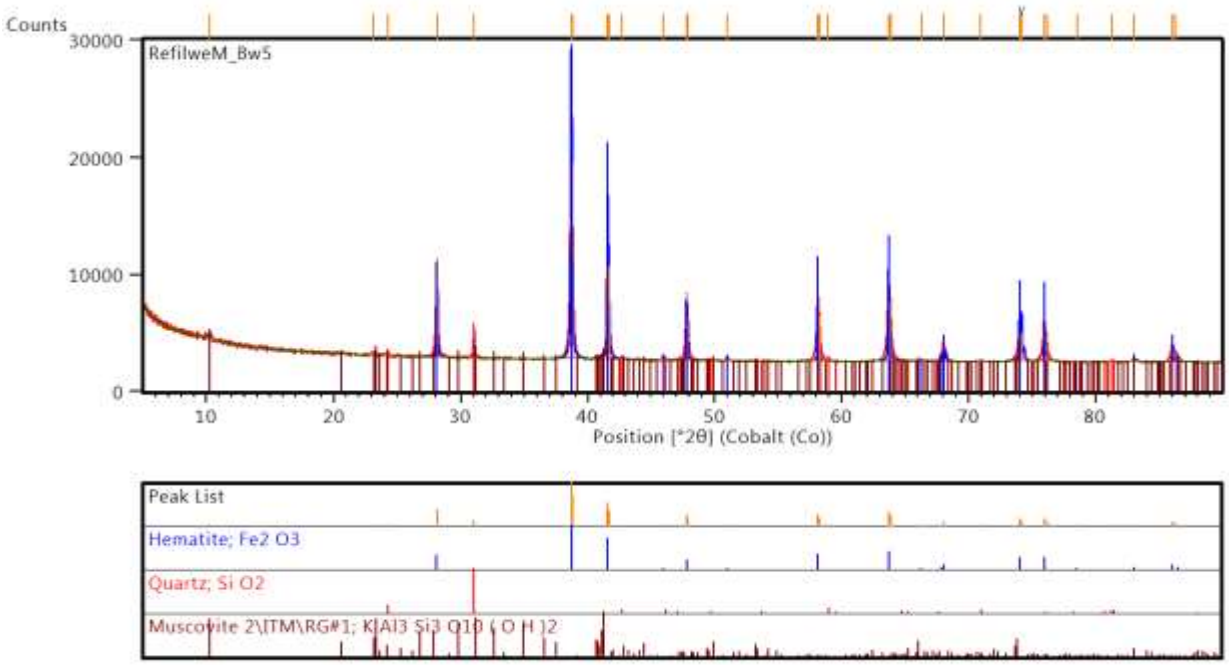
10000
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Quartz; Si O2
Hematite; Fe2 O3
Muscovite; K3.72 Na0.28 Al10.02 Fe0.64 Si12.40 O47.32 F0.68
Talc 1A; H2 Mg3 O12 Si4


Counts
RefilweM_Bw5
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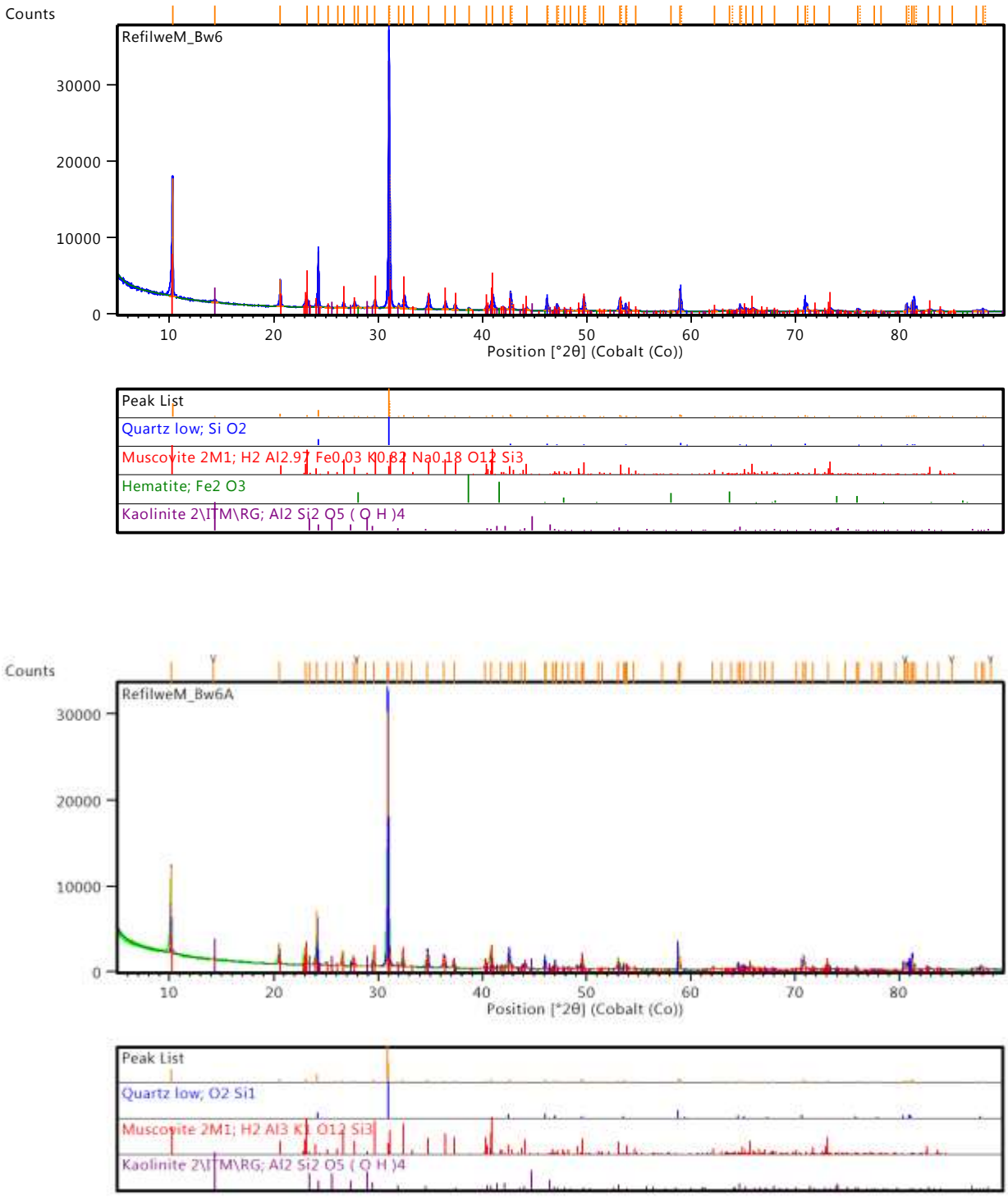
20000
10000
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Hematite; Fe2 O3
Quartz; Si O2
Muscovite 2\ITM\RG#1; K Al3 Si3 O10 (O H)2


Counts
RefilweM_Bw6
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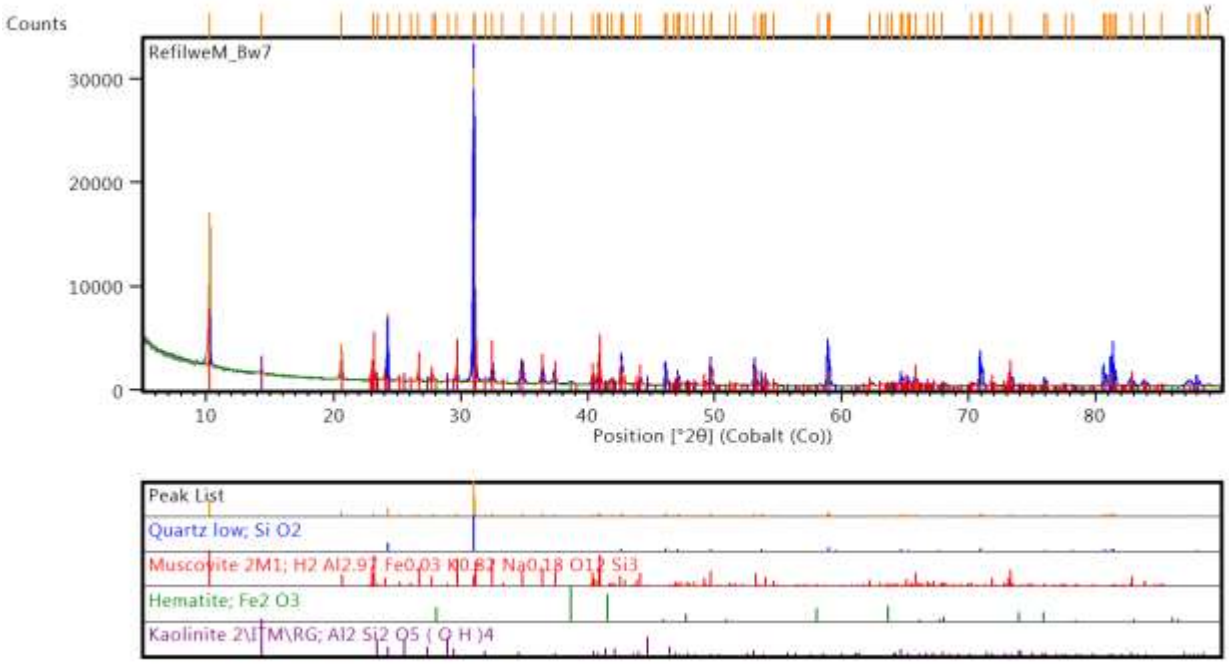
20000
10000
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Quartz low; Si O2
Muscovite 2M1; H2 Al2.97 Fe0.03 K0.82 Na0.18 O12 Si3
Hematite; Fe2 O3
Kaolinite 2\I\M\RG; Al2 Si2 O5 (O H)4
Counts
RefilweM_Bw6A
30000
20000
10000
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Quartz low; O2 Si1
Muscovite 2M1; H2 Al3 K1 O12 Si3
Kaolinite 2\I\M\RG; Al2 Si2 O5 (O H)4


Counts
RefilweM_Bw7
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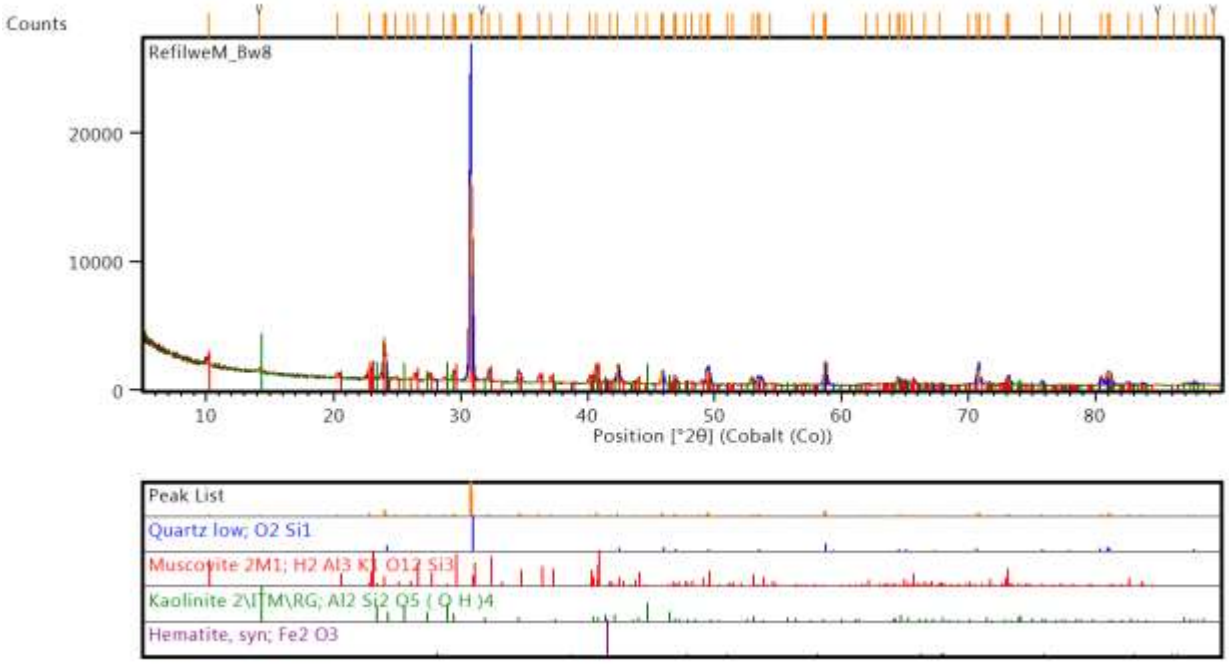
20000
10000
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Quartz low; Si O2
Muscovite 2M1; H2 Al2.97 Fe0.03 K0.82 Na0.18 O12 Si3
Hematite; Fe2 O3
Kaolinite 2\I\M\RG; Al2 Si2 O5 (O H)4


Counts
RefilweM_Bw8
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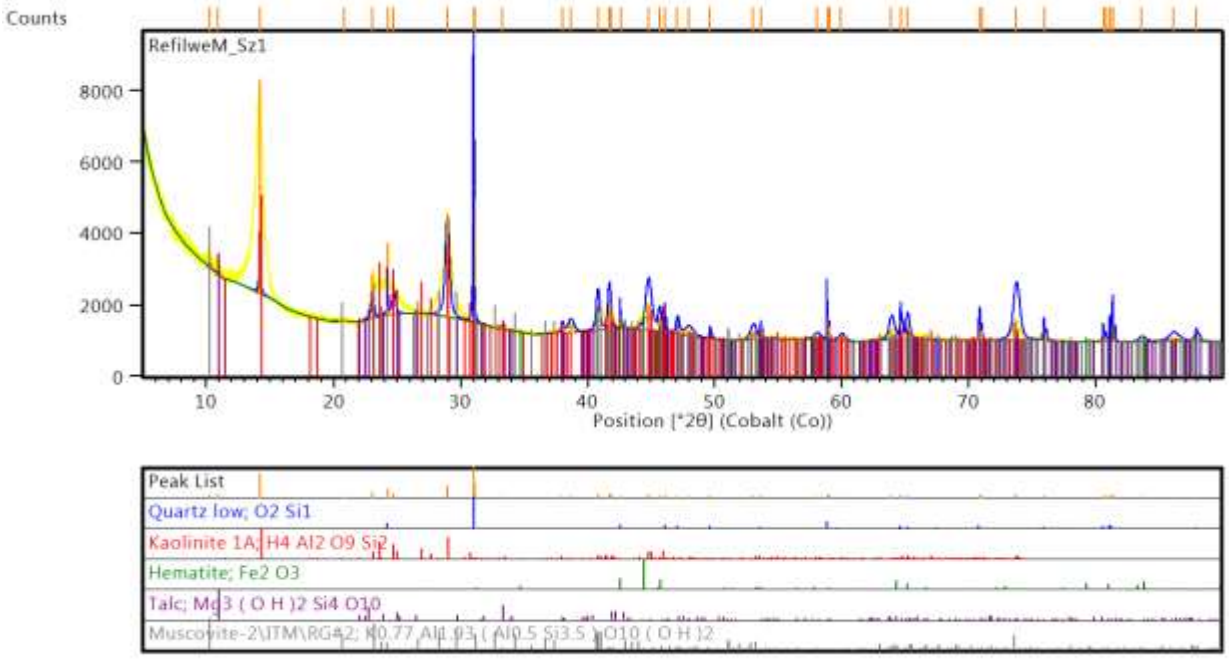
10000
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Quartz low; O2 Si1
Muscovite 2M1; H2 Al3 K1 O12 Si3
Kaolinite 2\I\M\RG; Al2 Si2 O5 (O H)4
Hematite, syn; Fe2 O3


Counts
RefilweM_Sz1
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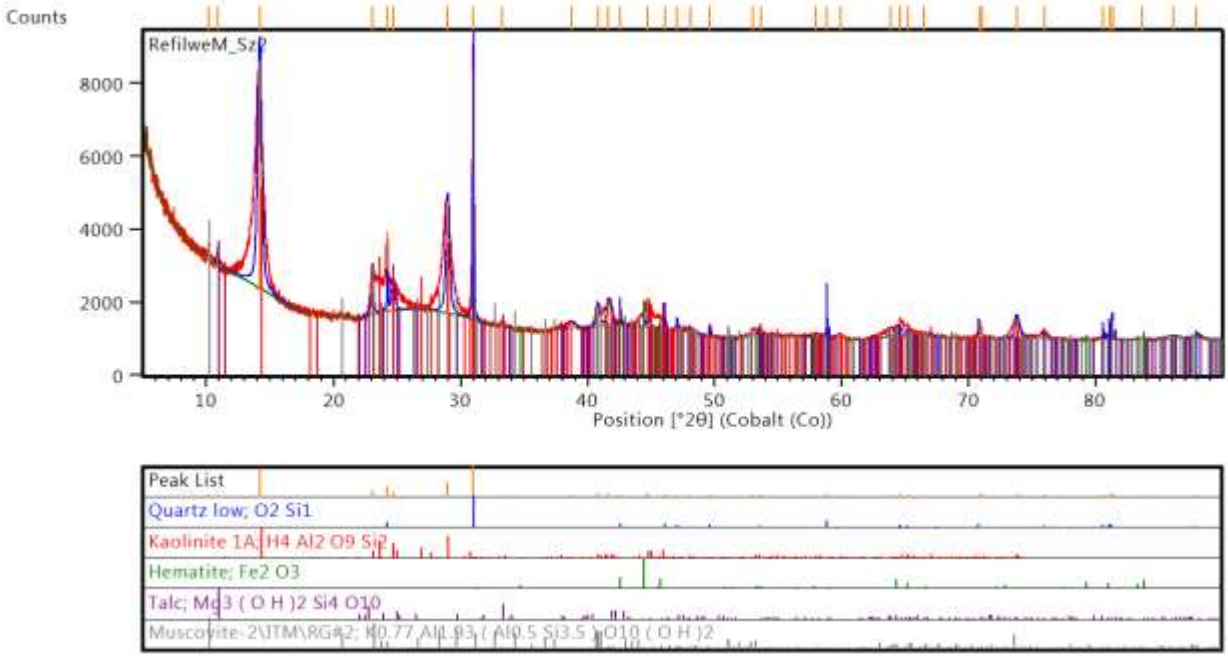
6000
4000
2000
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Quartz low; O2 Si1
Kaolinite 1A; H4 Al2 O9 Si2
Hematite; Fe2 O3
Talc; Mg3 (O H)2 Si4 O10
Muscovite-2\ITM\RG#2; K0.77 Al1.93 (Al0.5 Si3.5) O10 (O H)2


Counts
RefilweM_Sz2
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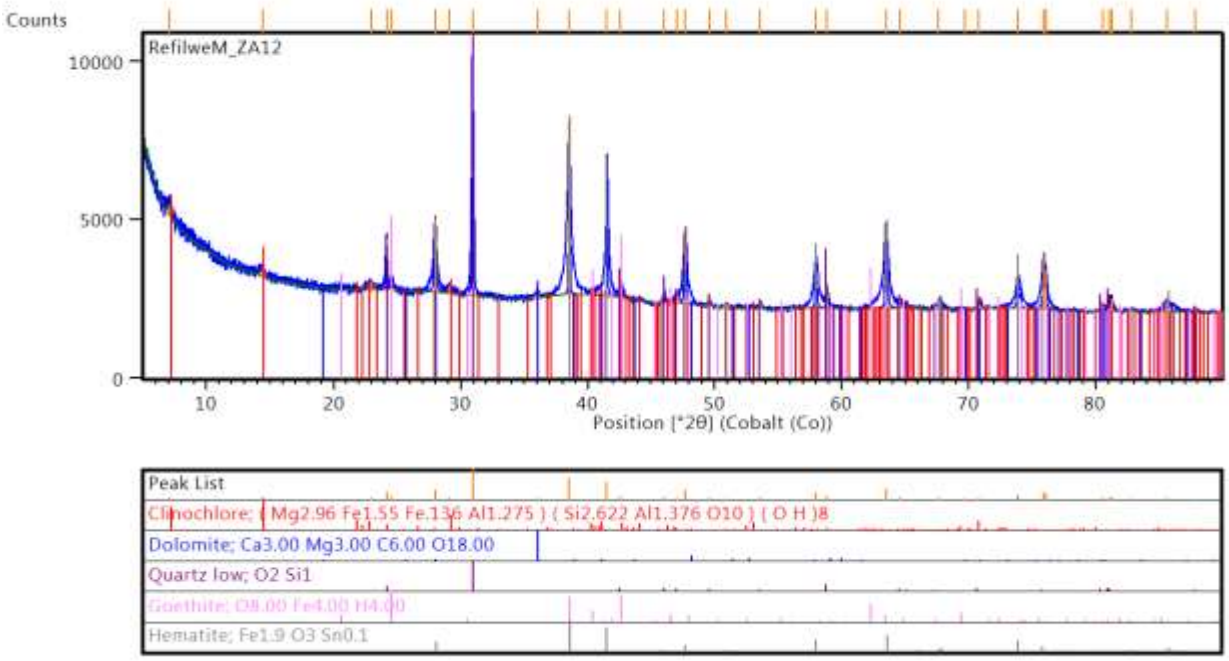
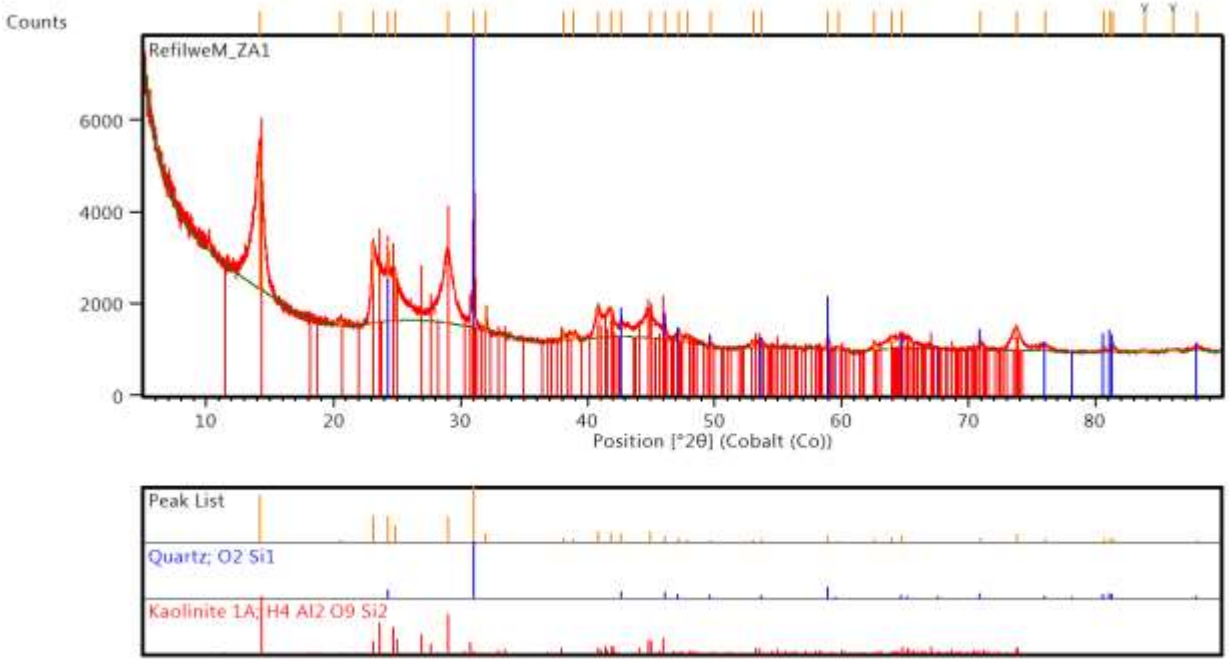
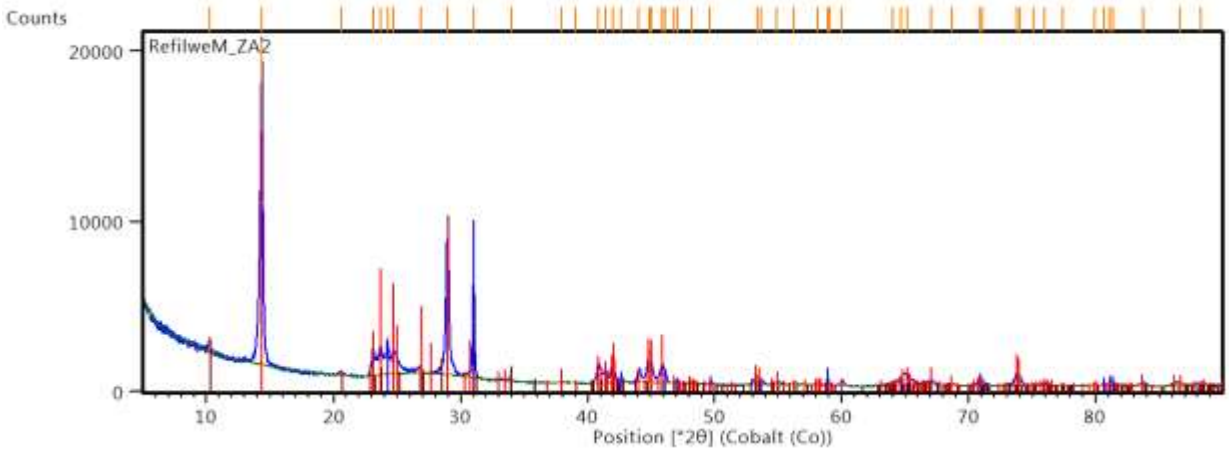
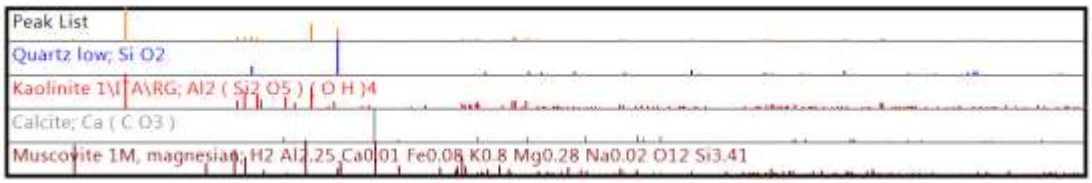
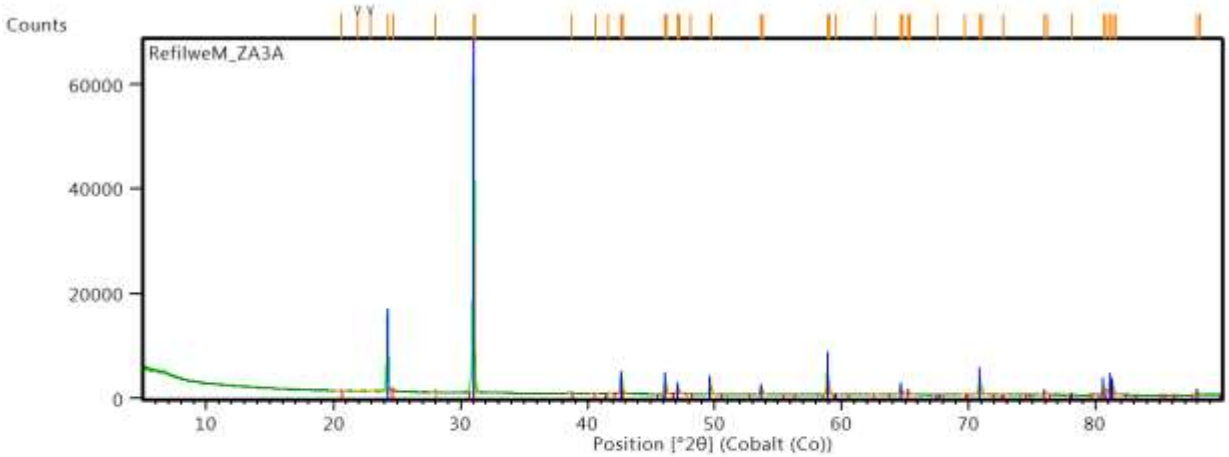
6000
4000
2000
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Quartz low; O2 Si1
Kaolinite 1A; H4 Al2 O9 Si2
Hematite; Fe2 O3
Talc; Mg3 (O H)2 Si4 O10
Muscovite-2\ITM\RG#2; K0.77 Al1.93 (Al0.5 Si3.5) O10 (O H)2


Counts
RefilweM_ZA12
10000
5000
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Clinochlore; (Mg2.96 Fe1.55 Fe.136 Al1.275) (Si2.622 Al1.376 O10) (O H)8
Dolomite; Ca3.00 Mg3.00 C6.00 O18.00
Quartz low; O2 Si1
Goethite; O8.00 Fe4.00 H4.00
Hematite; Fe1.9 O3 Sn0.1


Counts
RefilweM_ZA1
6000
4000
2000
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Quartz; O2 Si1
Kaolinite 1A; H4 Al2 O9 Si2


Counts
RefilweM_ZA2
20000
10000
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))


Peak List
Quartz low; Si O2
Kaolinite 1\I[A\RG; Al2 (Si2 O5) (O H)4
Calcite; Ca (C O3)
Muscovite 1M, magnesian; H2 Al2.25 Ca0.01 Fe0.08 K0.8 Mg0.28 Na0.02 O12 Si3.41


Counts
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40000
20000
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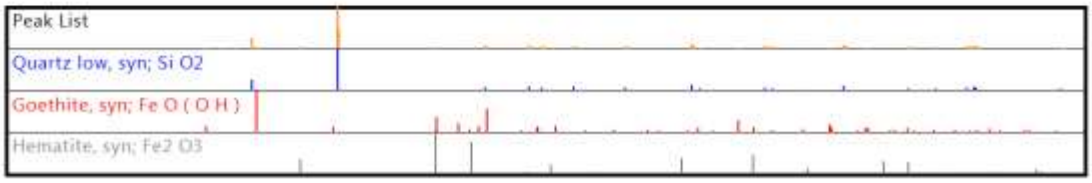
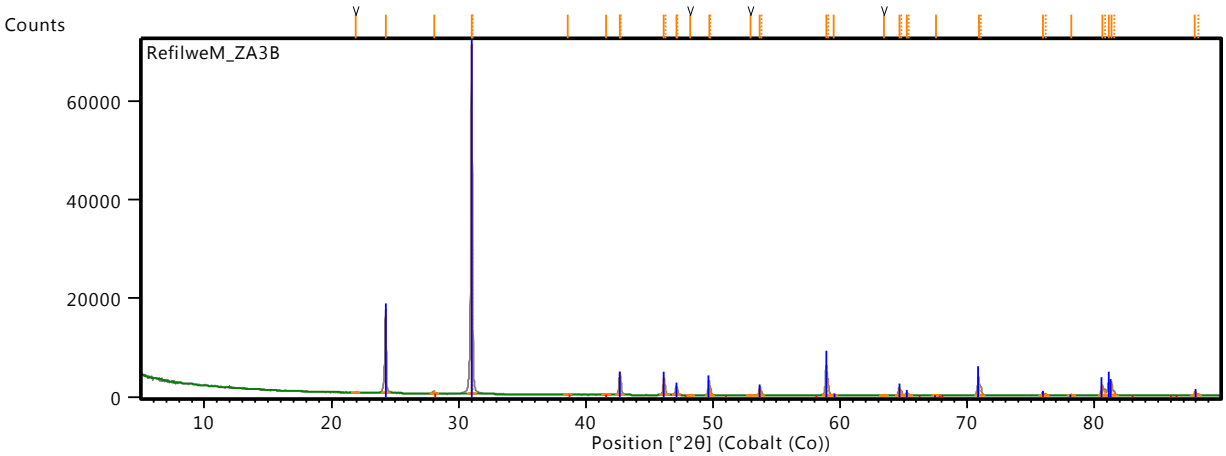
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))


Peak List
Quartz low, syn; Si O2
Goethite, syn; Fe O (O H)
Hematite, syn; Fe2 O3


Counts
RefilweM_ZA3B
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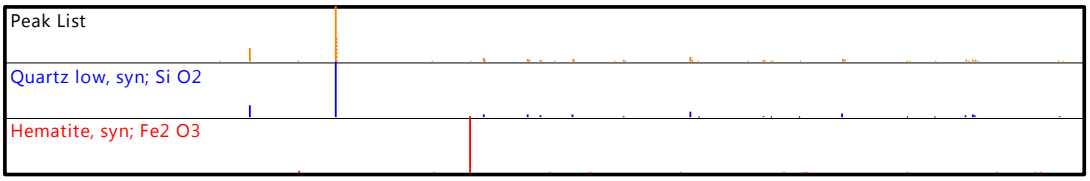
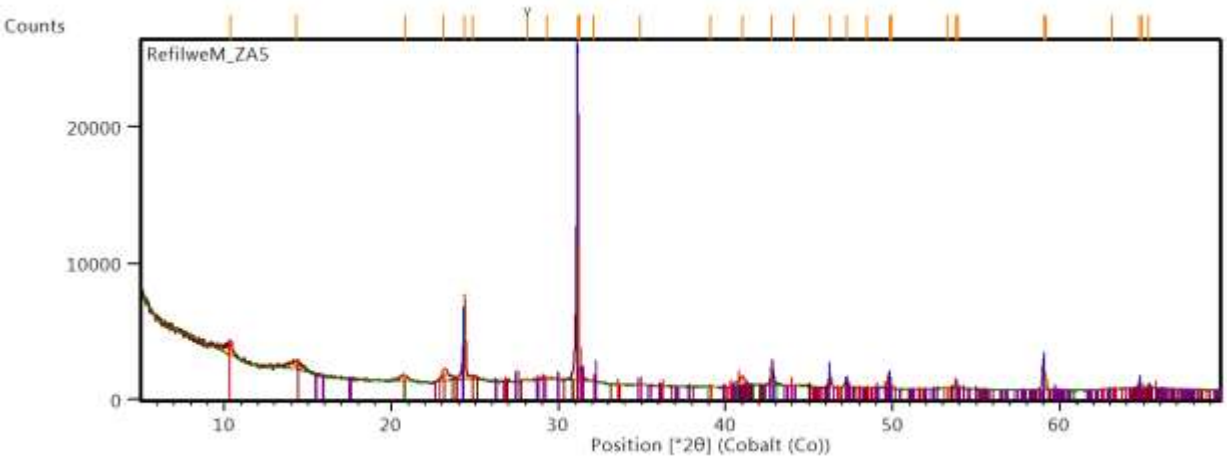
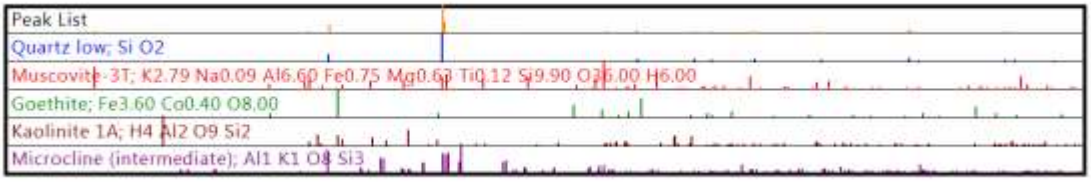
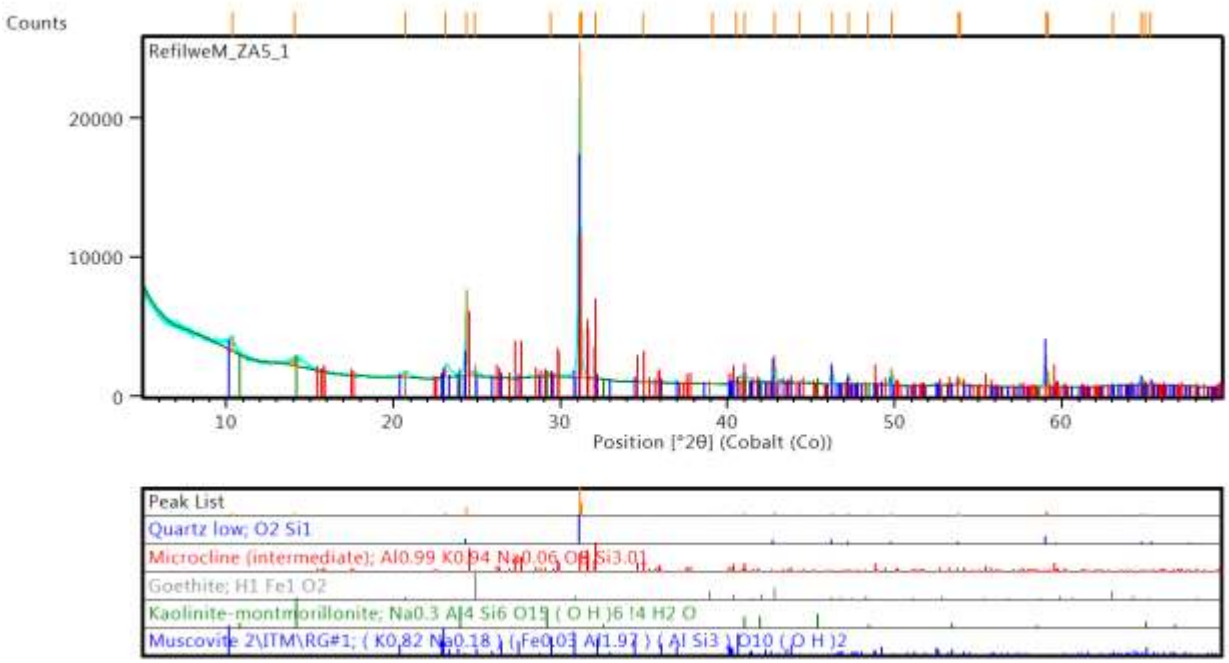
40000
20000
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))


Peak List
Quartz low, syn; Si O2
Hematite, syn; Fe2 O3


Counts
RefilweM_ZA5
20000
10000
0
10
20
30
40
50
60
Position [°2θ] (Cobalt (Co))


Peak List
Quartz low; Si O2
Muscovite-3T; K2.79 Na0.09 Al6.60 Fe0.75 Mg0.63 Ti0.12 Si9.90 O36.00 H6.00
Goethite; Fe3.60 Co0.40 O8.00
Kaolinite 1A; H4 Al2 O9 Si2
Microcline (intermediate); Al1 K1 O8 Si3


Counts
RefilweM_ZA5_1
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10000
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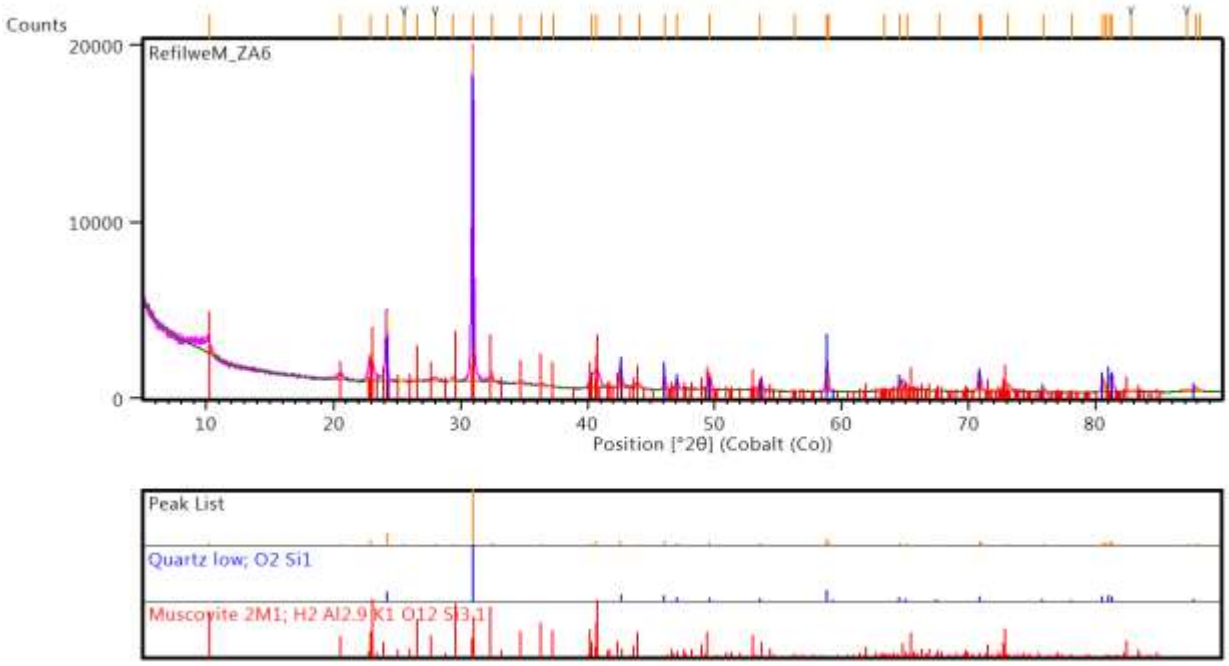
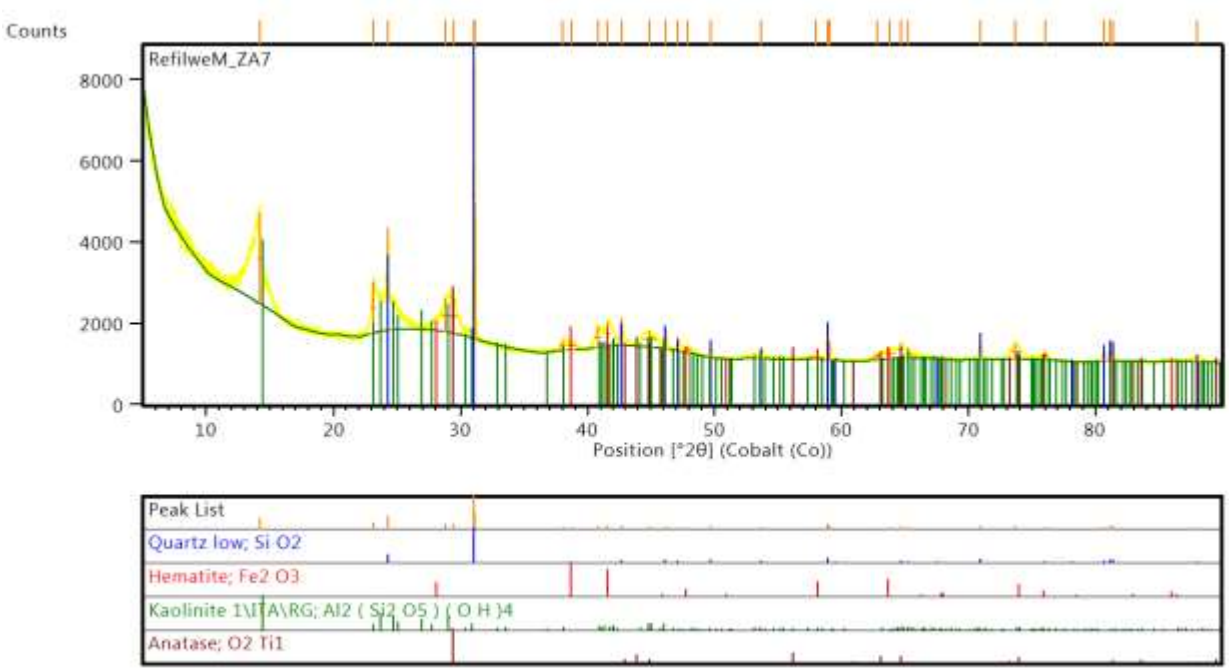
10
20
30
40
50
60
Position [°2θ] (Cobalt (Co))
Peak List
Quartz low; O2 Si1
Microcline (intermediate); Al0.99 K0.94 Na0.06 O8 Si3.01
Goethite; H1 Fe1 O2
Kaolinite-montmorillonite; Na0.3 Al4 Si6 O15 (O H)6 !4 H2 O
Muscovite 2\ITM\RG#1; (K0.82 Na0.18) (Fe0.03 Al1.97) (Al Si3) O10 (O H)2


Counts
RefilweM_ZA6
20000
10000
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Quartz low; O2 Si1
Muscovite 2M1; H2 Al2.9 K1 O12 Si3.1


Counts
RefilweM_ZA7
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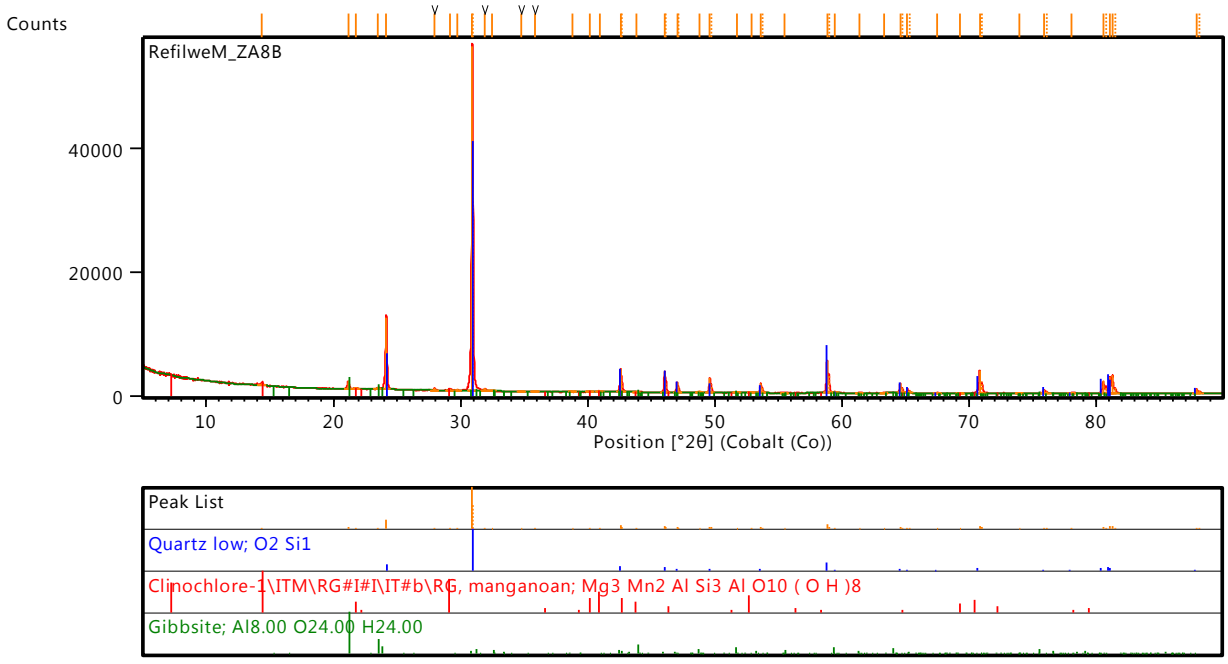
6000
4000
2000
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Quartz low; Si O2
Hematite; Fe2 O3
Kaolinite 1\ITA\RG; Al2 (Si2 O5) (O H)4
Anatase; O2 Ti1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RefilweM_ZA8B
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20000
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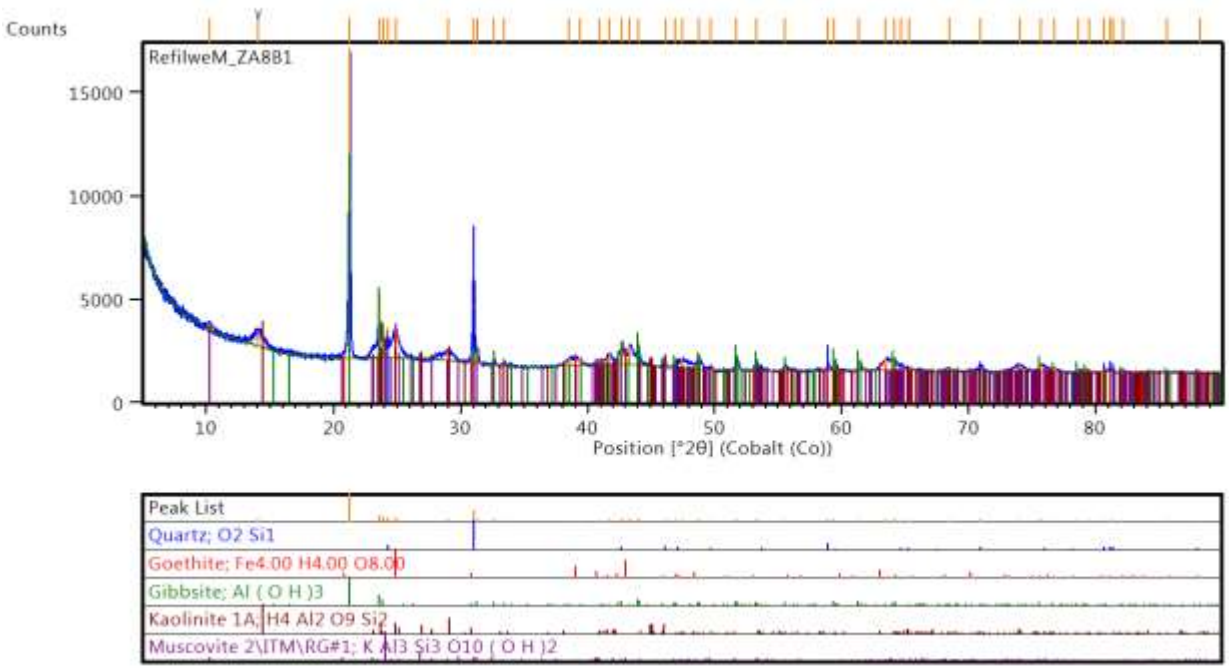
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Quartz low; O2 Si1
Clinochlore-1\ITM\RG#I#I\IT#b\RG, manganoan; Mg3 Mn2 Al Si3 Al O10 (O H)8
Gibbsite; Al8.00 O24.00 H24.00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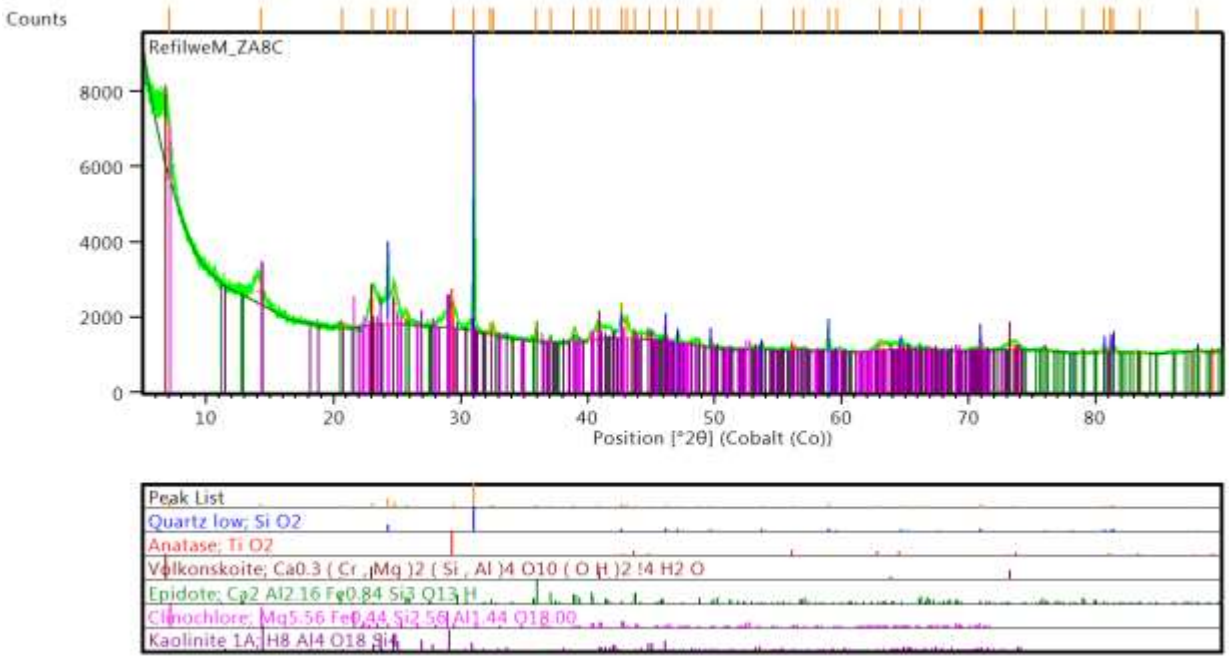
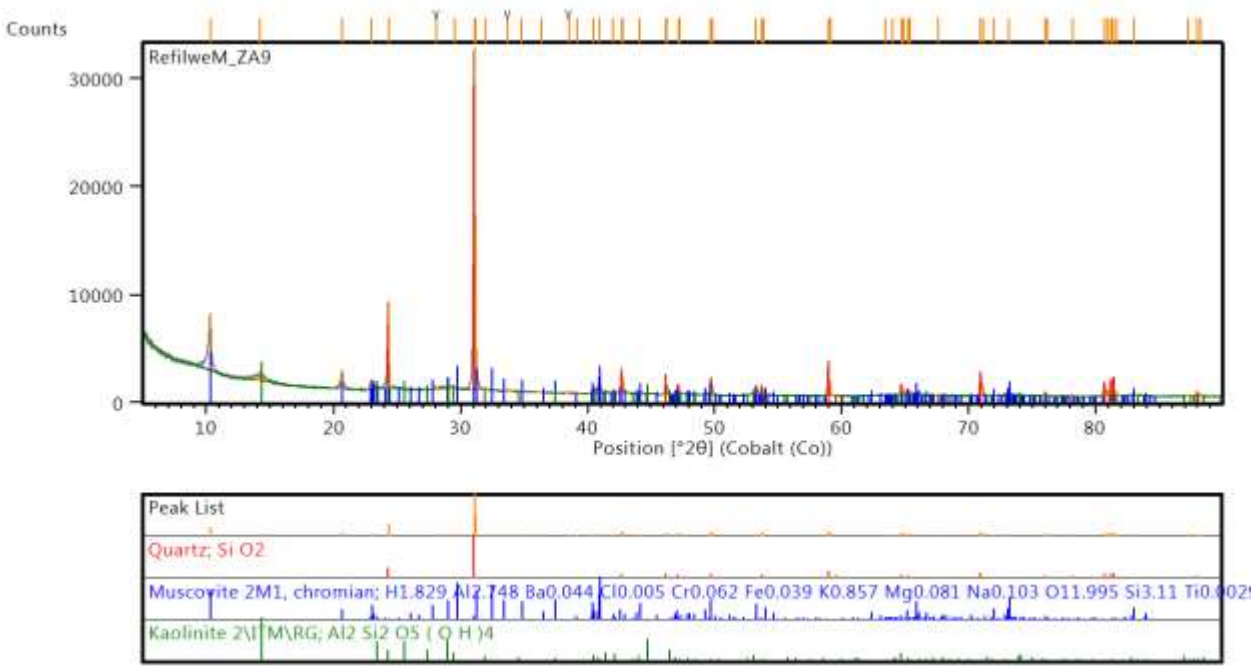
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Quartz; O2 Si1
Goethite; Fe4.00 H4.00 O8.00
Gibbsite; Al (O H)3
Kaolinite 1A; H4 Al2 O9 Si2
Muscovite 2\ITM\RG#1; K Al3 Si3 O10 (O H)2


Counts
RefilweM_ZA8C
8000
6000
4000
2000
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Quartz low; Si O2
Anatase; Ti O2
Volkonskoite; Ca0.3 (Cr , Mg)2 (Si , Al)4 O10 (O H)2 !4 H2 O
Epidote; Ca2 Al2.16 Fe0.84 Si3 O13 H
Clinochlore; Mg5.56 Fe0.44 Si2.56 Al1.44 O18.00
Kaolinite 1A; H8 Al4 O18 Si4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20
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40
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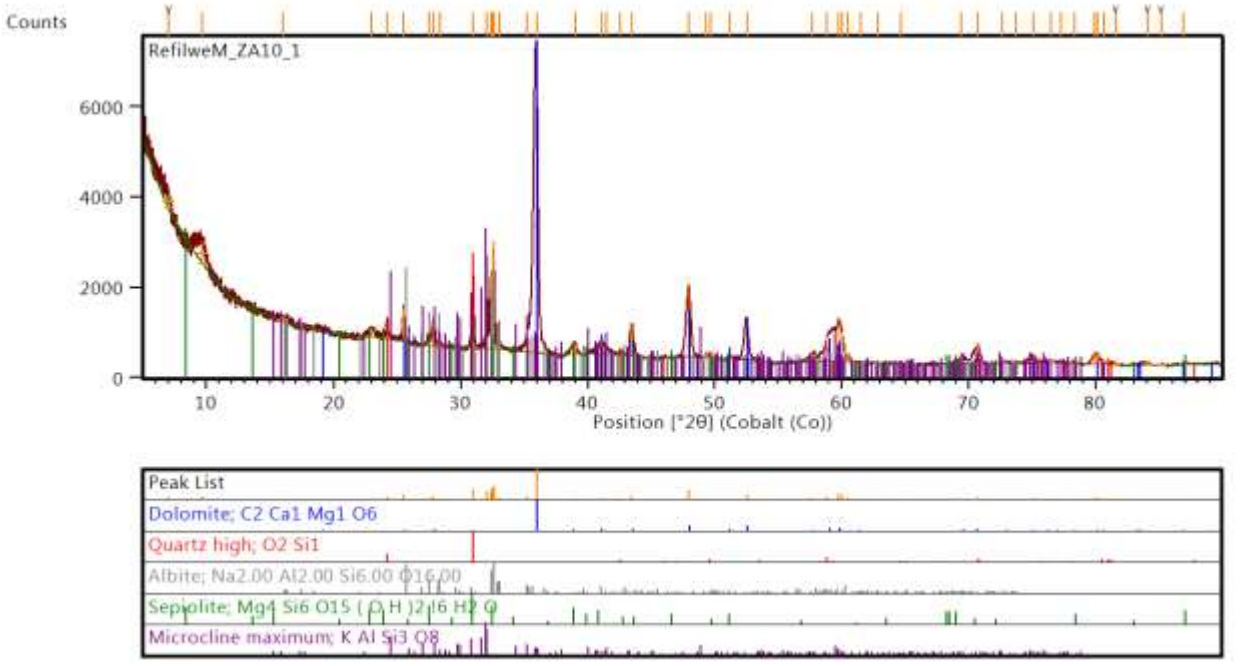
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Quartz; Si O2
Muscovite 2M1, chromian; H1.829 Al2.748 Ba0.044 Cl0.005 Cr0.062 Fe0.039 K0.857 Mg0.081 Na0.103 O11.995 Si3.11 Ti0.02
Kaolinite 2\I M\RG; Al2 Si2 O5 (O H)4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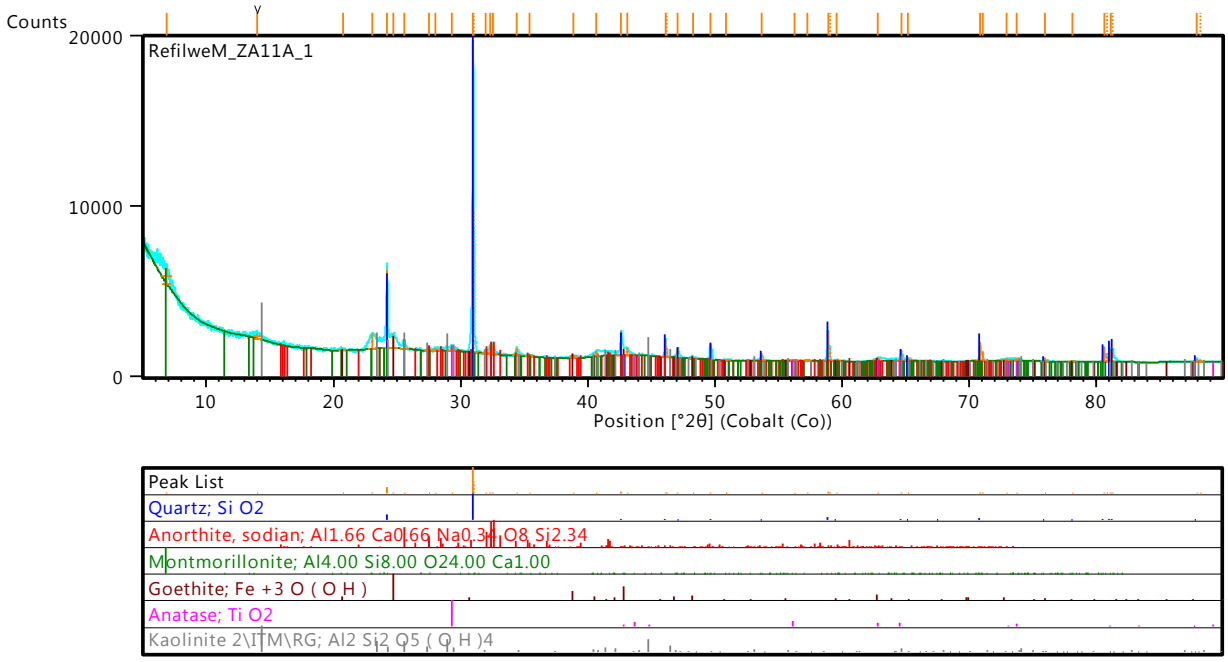
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Dolomite; C2 Ca1 Mg1 O6
Quartz high; O2 Si1
Albite; Na2.00 Al2.00 Si6.00 O16.00
Sepiolite; Mg4 Si6 O15 (O H)2 (6 H2 O
Microcline maximum; K Al Si3 O8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10
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40
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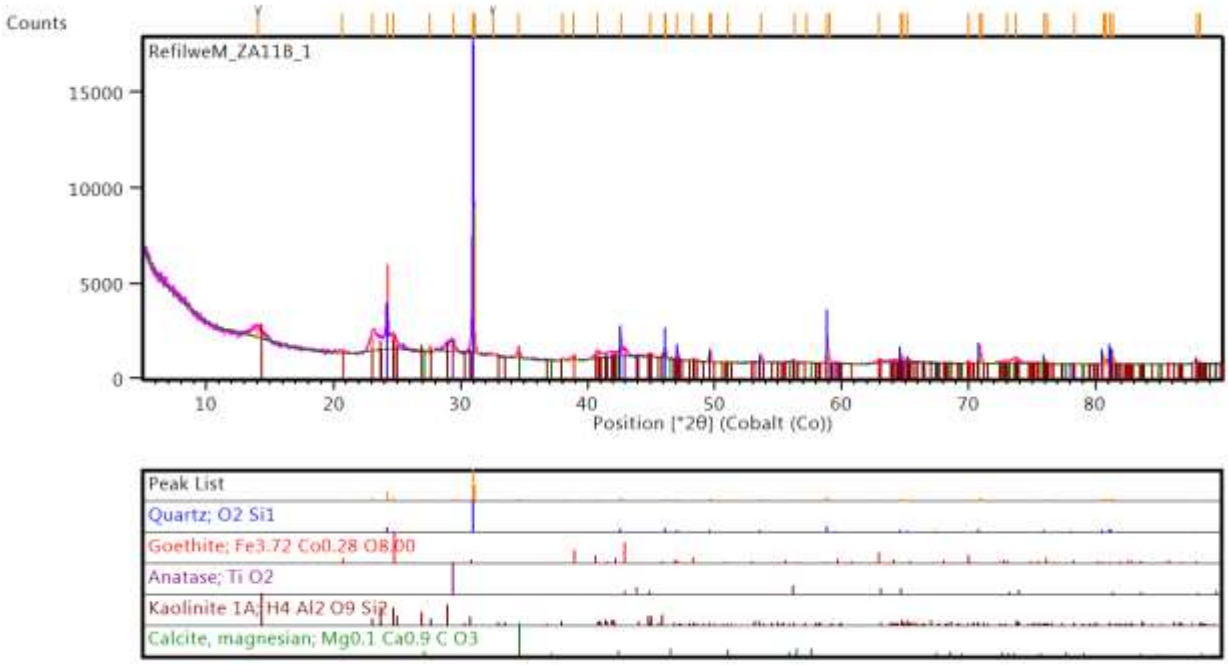
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Quartz; Si O2
Anorthite, sodian; Al1.66 Ca0.66 Na0.34 O8 Si2.34
Montmorillonite; Al4.00 Si8.00 O24.00 Ca1.00
Goethite; Fe +3 O (O H)
Anatase; Ti O2
Kaolinite 2\ITM\RG; Al2 Si2 O5 (O H)4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RefilweM_ZA11B_1
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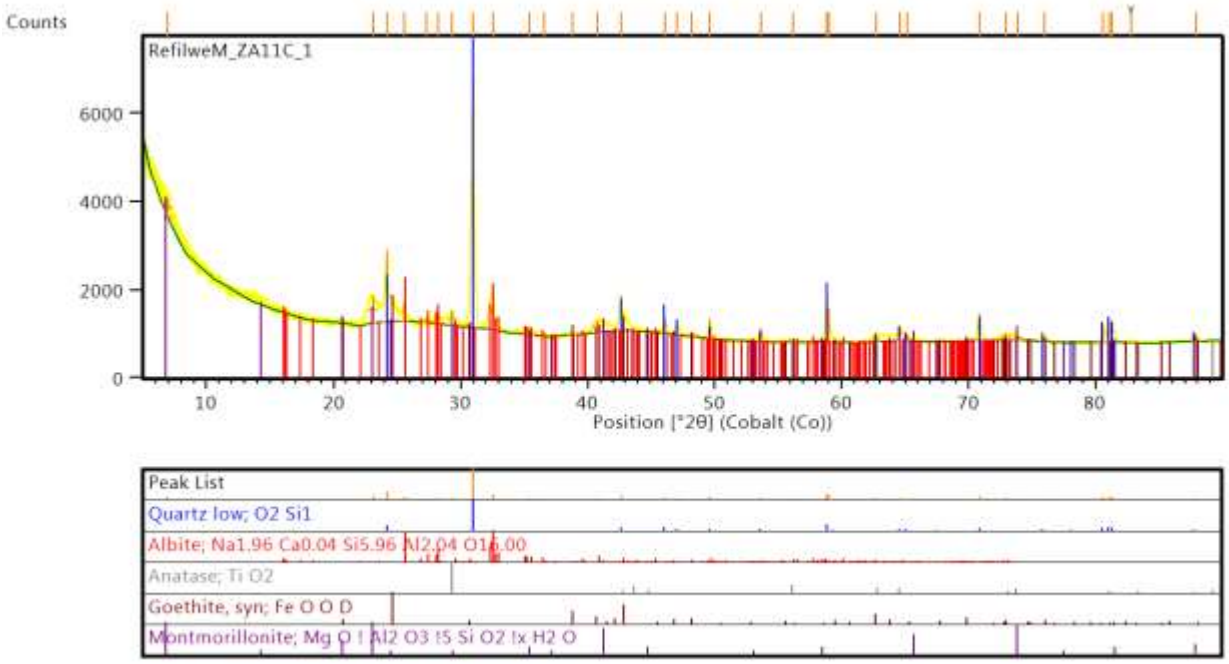
10000
5000
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Quartz; O2 Si1
Goethite; Fe3.72 Co0.28 O8.00
Anatase; Ti O2
Kaolinite 1A; H4 Al2 O9 Si2
Calcite, magnesian; Mg0.1 Ca0.9 C O3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4000
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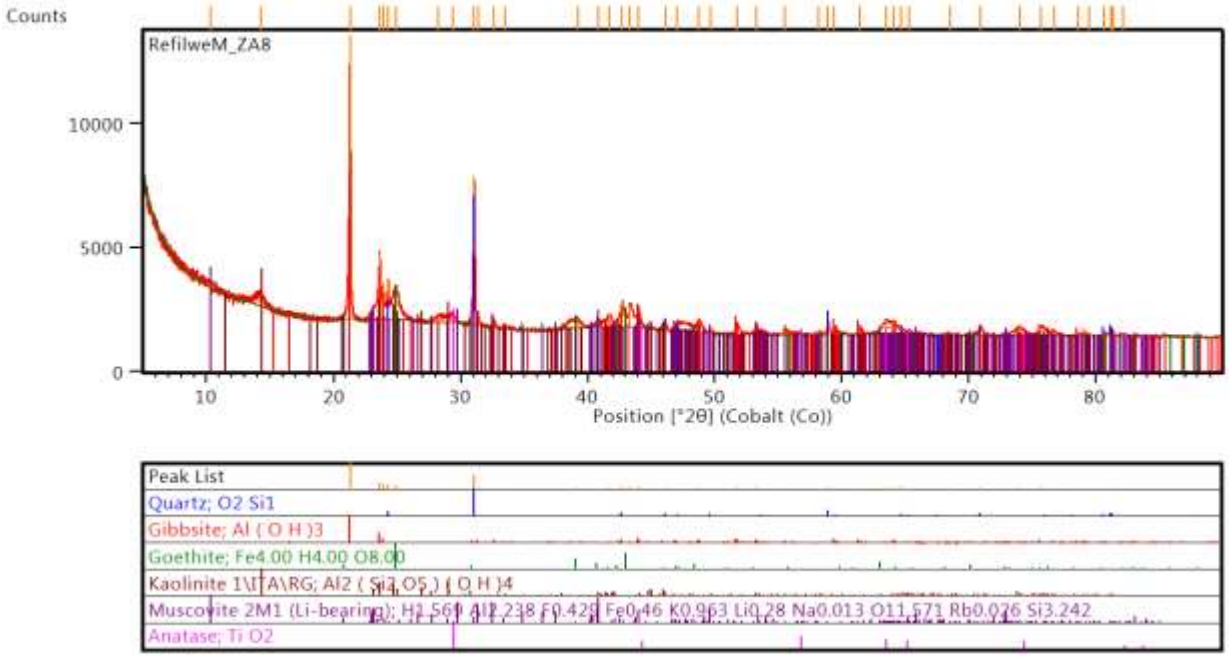
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Quartz low; O2 Si1
Albite; Na1.96 Ca0.04 Si5.96 Al2.04 O16.00
Anatase; Ti O2
Goethite, syn; Fe O O D
Montmorillonite; Mg O ! Al2 O3 !5 Si O2 !x H2 O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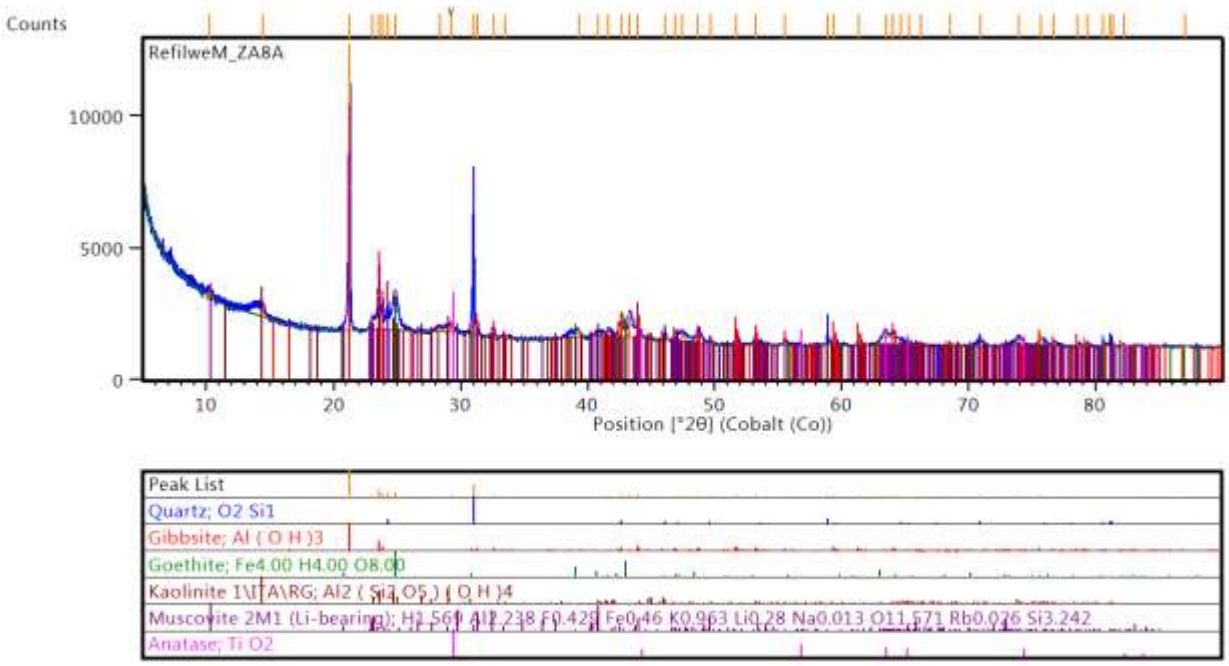
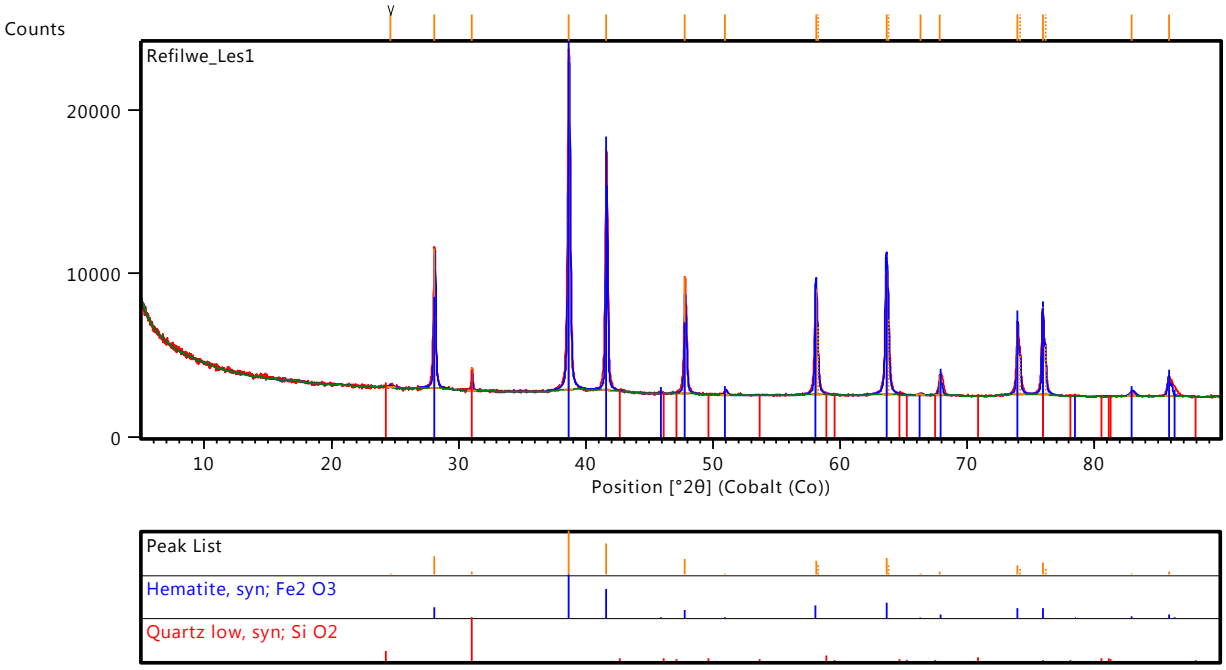
5000
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Quartz; O2 Si1
Gibbsite; Al (O H)3
Goethite; Fe4.00 H4.00 O8.00
Kaolinite 1\I\A\RG; Al2 (Si2 O5) (O H)4
Muscovite 2M1 (Li-bearing); H2.569 Al2.238 F0.429 Fe0.46 K0.963 Li0.28 Na0.013 O11.571 Rb0.026 Si3.242
Anatase; Ti O2



2015.02.19 The samples were milled in a tungsten carbide vessel and prepared according to the standardized Panalytical backloading system, which provides nearly random distribution of the particles.

They were analyzed using a PANalytical X'Pert Pro powder diffractometer in θ–θ configuration with an X'Celerator detector and variable divergence- and fixed receiving slits with Fe filtered Co-Kα radiation (λ=1.789Å). The phases were identified using X'Pert Highscore plus software.

The relative phase amounts (weight%) were estimated using the Rietveld method (Autoquan Program). Errors are on the 3 sigma level in the column to the right of the amount. Amorphous phases, if present were not taken into consideration in the quantification.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20
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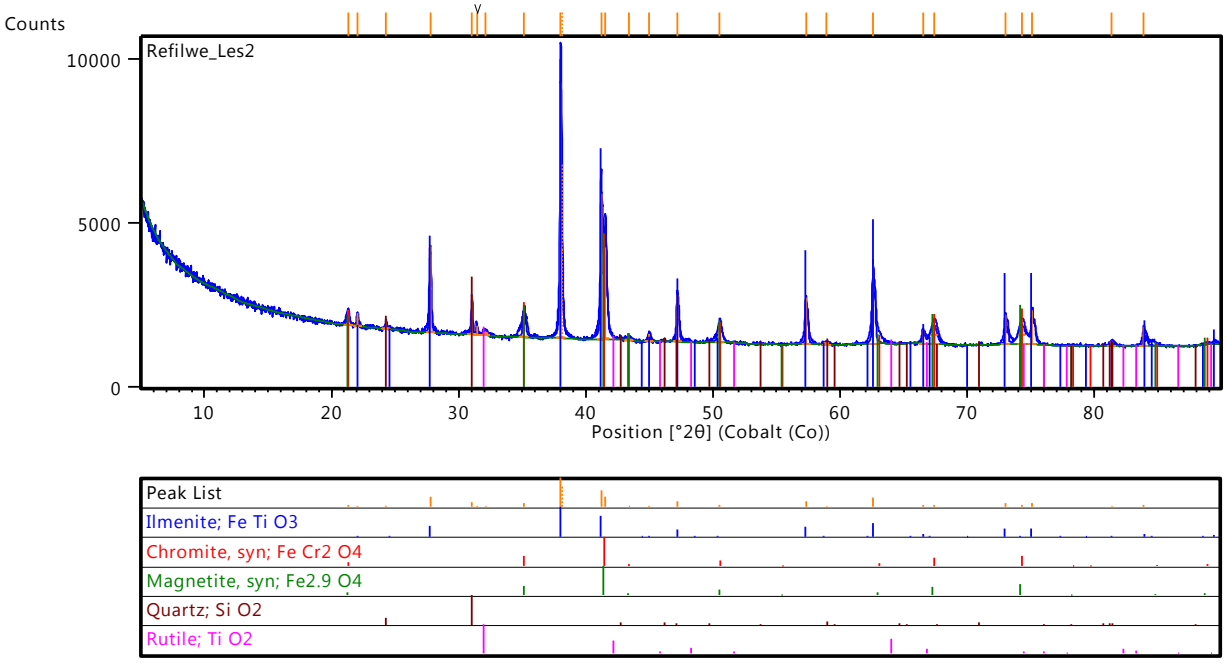
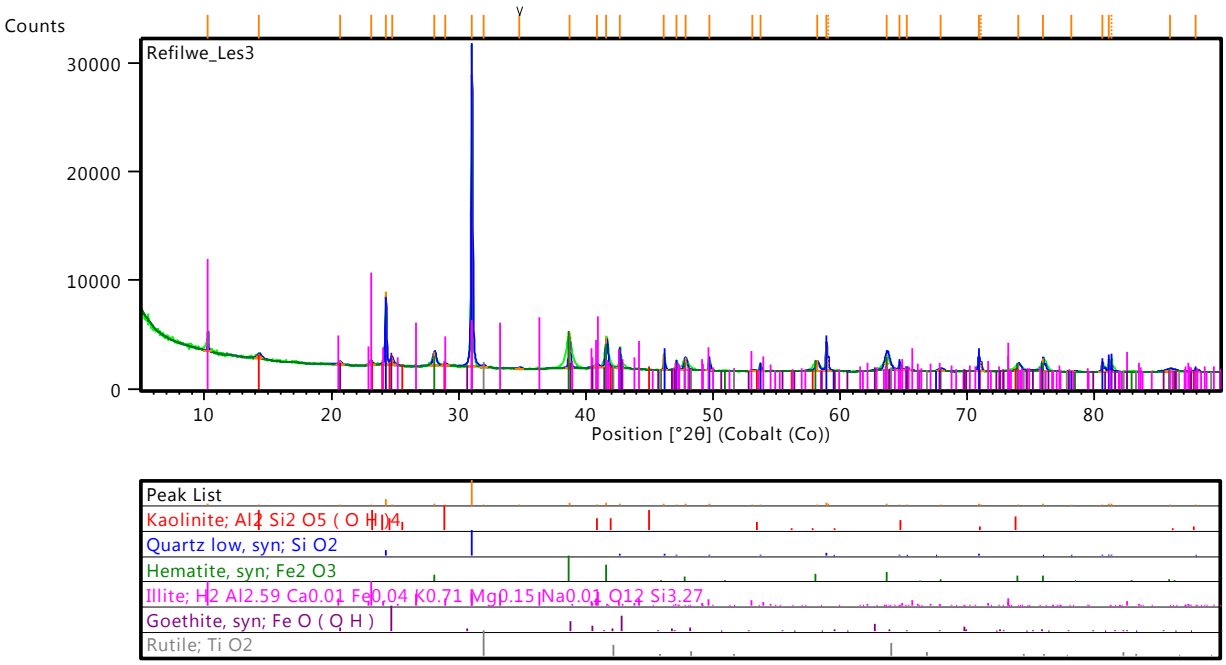
80
Position [°2θ] (Cobalt (Co))
Peak List
Hematite, syn; Fe2 O3
Quartz low, syn; Si O2


Counts
Refilwe_Les2
10000
5000
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Ilmenite; Fe Ti O3
Chromite, syn; Fe Cr2 O4
Magnetite, syn; Fe2.9 O4
Quartz; Si O2
Rutile; Ti O2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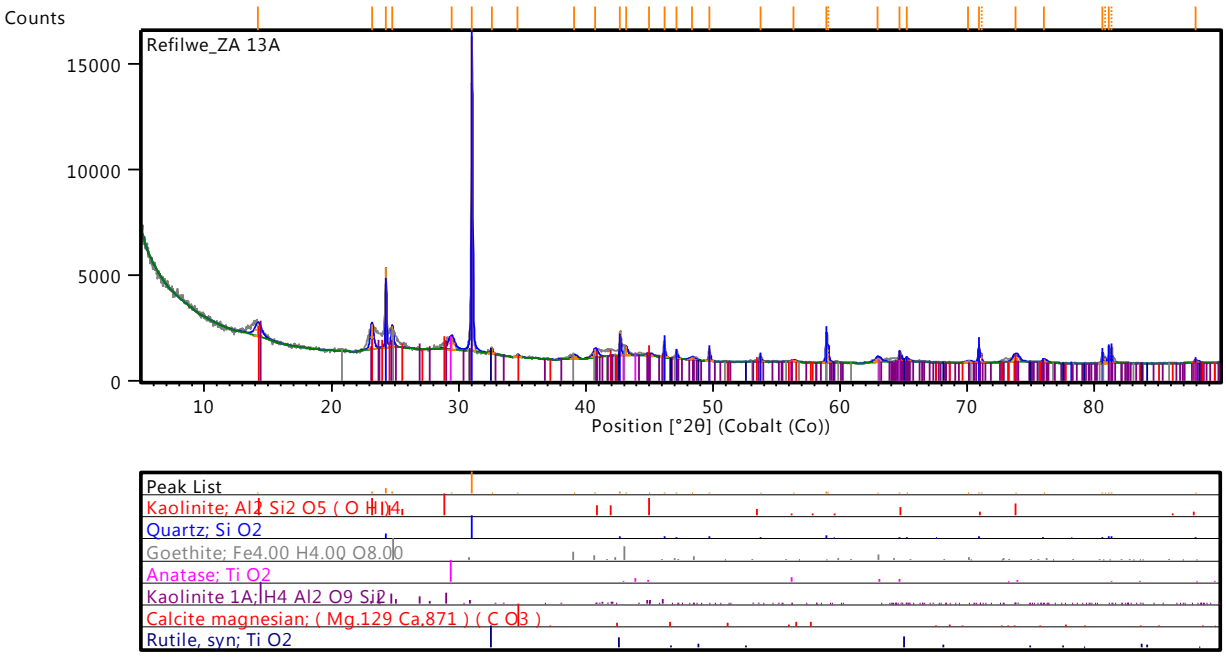
20000
10000
0
10
20
30
40
50
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Kaolinite; Al2 Si2 O5 (O H)4
Quartz low, syn; Si O2
Hematite, syn; Fe2 O3
Illite; H2 Al2.59 Ca0.01 Fe0.04 K0.71 Mg0.15 Na0.01 O12 Si3.27
Goethite, syn; Fe O (O H)
Rutile; Ti O2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10000
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0
10
20
30
40
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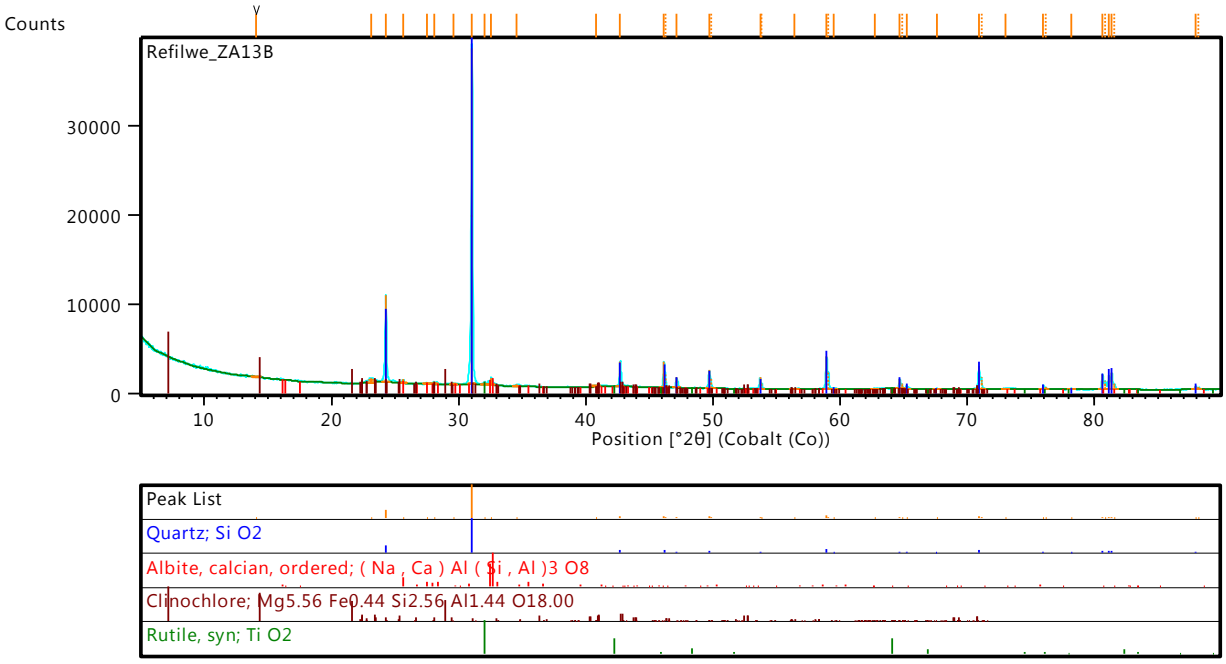
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Kaolinite; Al2 Si2 O5 (O H)4
Quartz; Si O2
Goethite; Fe4.00 H4.00 O8.00
Anatase; Ti O2
Kaolinite 1A; H4 Al2 O9 Si2
Calcite magnesian; (Mg.129 Ca.871) (C O3)
Rutile, syn; Ti O2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20000
10000
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10
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30
40
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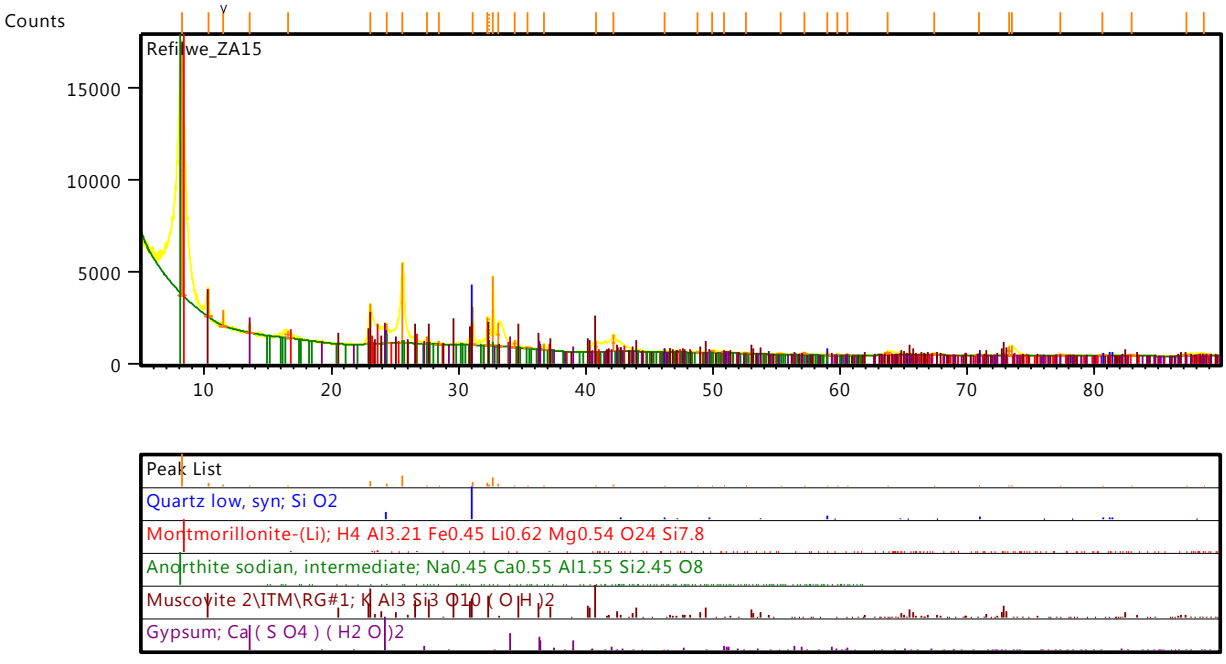
60
70
80
Position [°2θ] (Cobalt (Co))
Peak List
Quartz; Si O2
Albite, calcian, ordered; (Na , Ca) Al (Si , Al)3 O8
Clinochlore; Mg5.56 Fe0.44 Si2.56 Al1.44 O18.00
Rutile, syn; Ti O2


Counts
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10000
5000
0
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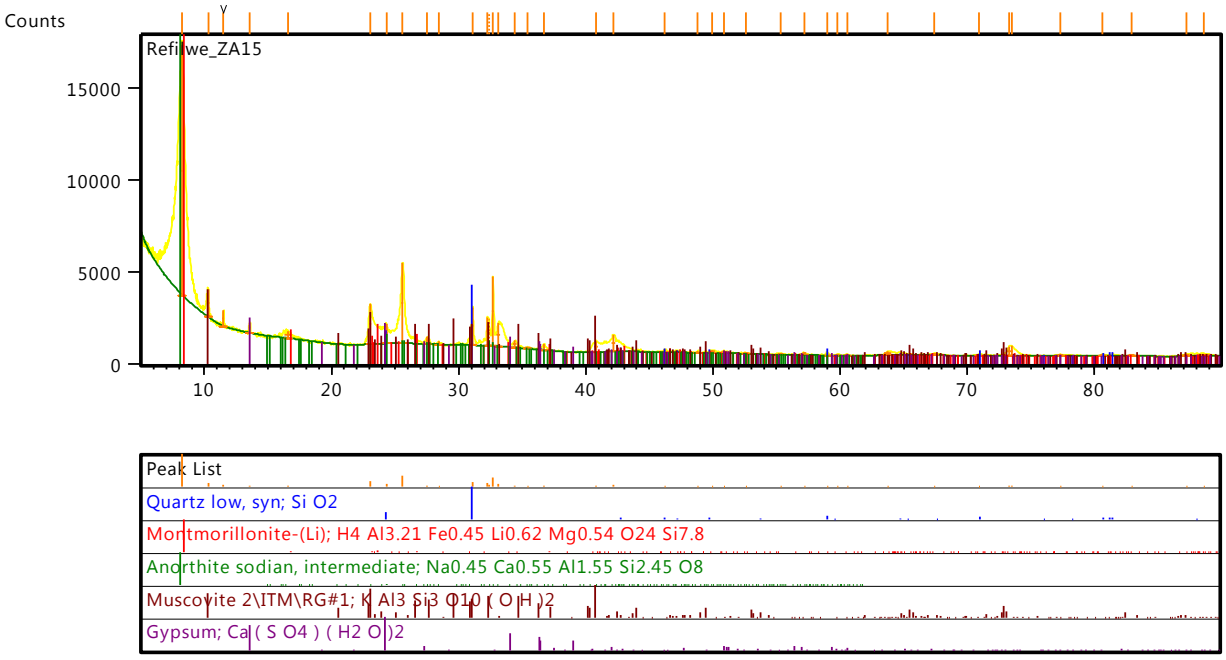
20
30
40
50
60
70
80
Peak List
Quartz low, syn; Si O2
Montmorillonite-(Li); H4 Al3.21 Fe0.45 Li0.62 Mg0.54 O24 Si7.8
Anorthite sodian, intermediate; Na0.45 Ca0.55 Al1.55 Si2.45 O8
Muscovite 2\ITM\RG#1; K Al3 Si3 O10 (O H)2
Gypsum; Ca (S O4) (H2 O)2


Counts
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10000
5000
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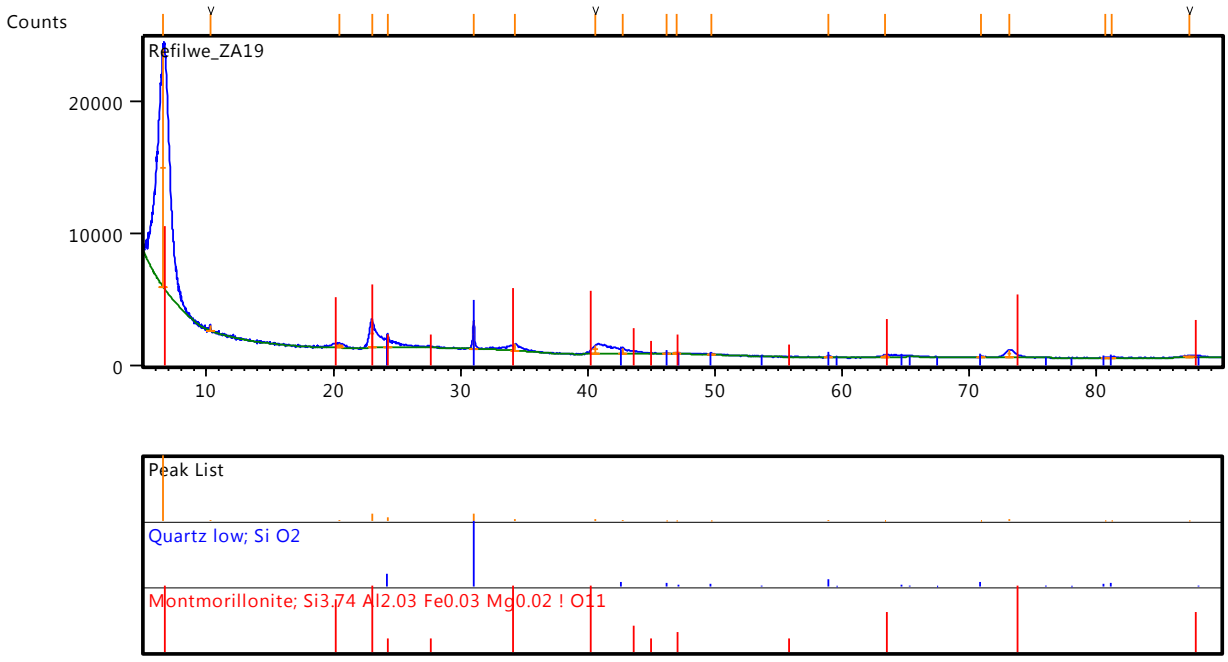
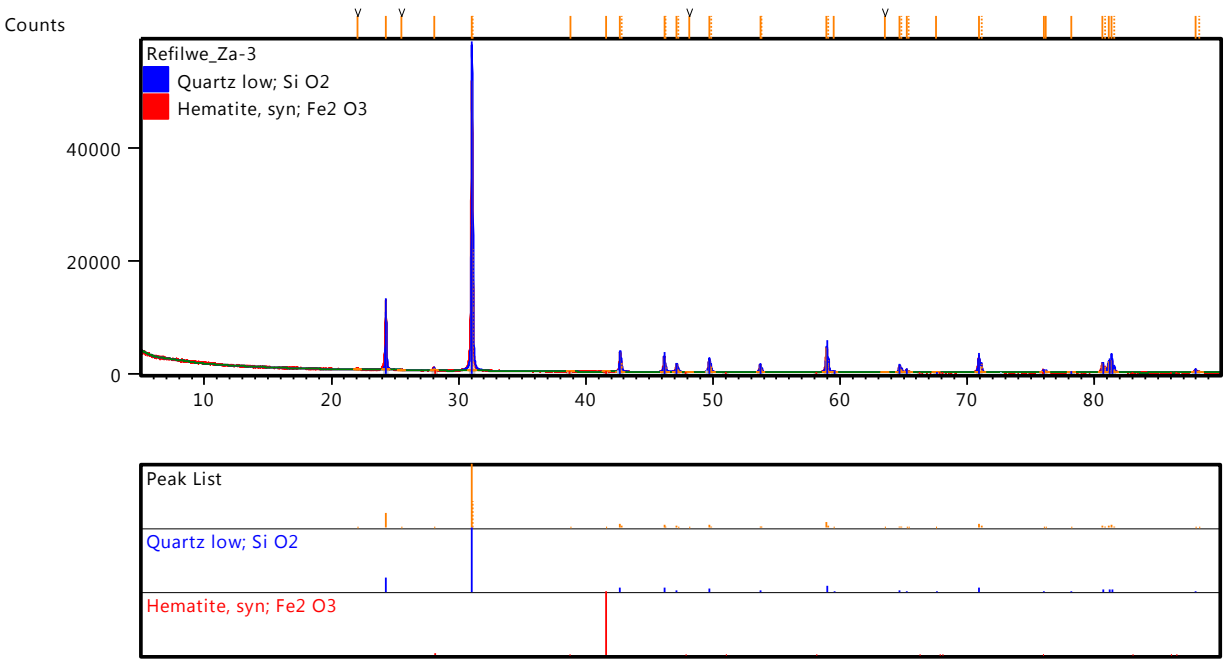
10
20
30
40
50
60
70
80
Peak List
Quartz low, syn; Si O2
Montmorillonite-(Li); H4 Al3.21 Fe0.45 Li0.62 Mg0.54 O24 Si7.8
Anorthite sodian, intermediate; Na0.45 Ca0.55 Al1.55 Si2.45 O8
Muscovite 2\ITM\RG#1; K Al3 Si3 O10 (O H)2
Gypsum; Ca (S O4) (H2 O)2



2017.07.04 The sample was prepared according to the standardized Panalytical backloading system, which provides nearly random distribution of the particles.

The sample was analyzed using a PANalytical X'Pert Pro powder diffractometer in θ–θ configuration with an X'Celerator detector and variable divergence- and fixed receiving slits with Fe filtered Co-Kα radiation (λ=1.789Å). The phases were identified using X'Pert Highscore plus software.

The relative phase amounts (weight%) were estimated using the Rietveld method (Autoquan Program). Errors are on the 3 sigma level in the column to the right of the amount.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Hematite, syn; Fe2 O3
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20000
0
10
20
30
40
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60
70
80
Peak List
Quartz low; Si O2
Hematite, syn; Fe2 O3