XRD, SEM, and Elemental Analysis
of
One Solid Sample
for
Springate Water Coop
GR 38494 2025

GR Petrology Consultants Inc.
Suite 8, 1323 – 44th Avenue N.E.
Calgary, Alberta T2E 6L5
Tel: 403-291-3420
E-mail: berna.hablado@grpetrology.com

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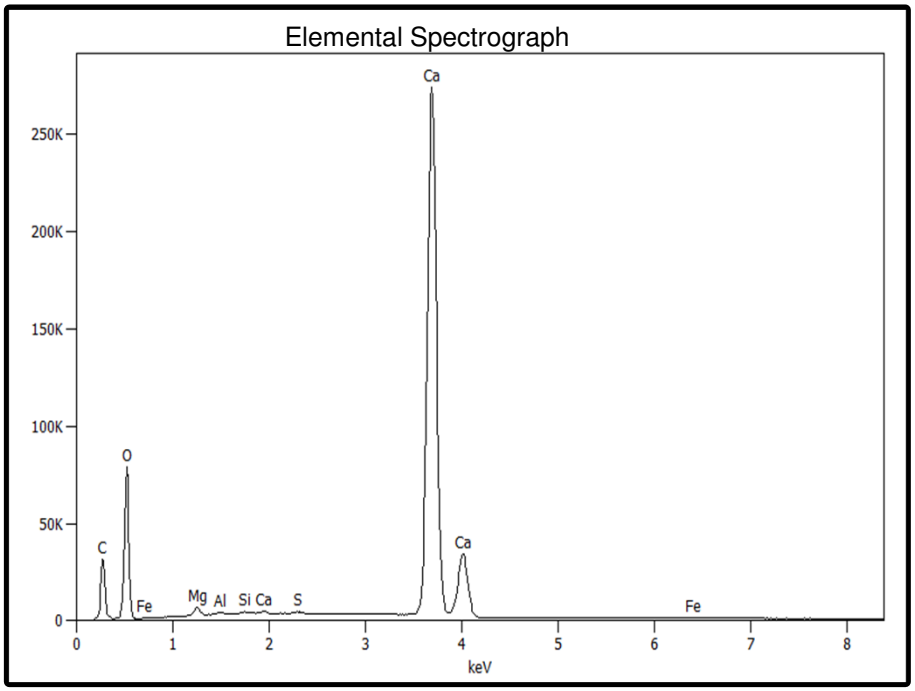
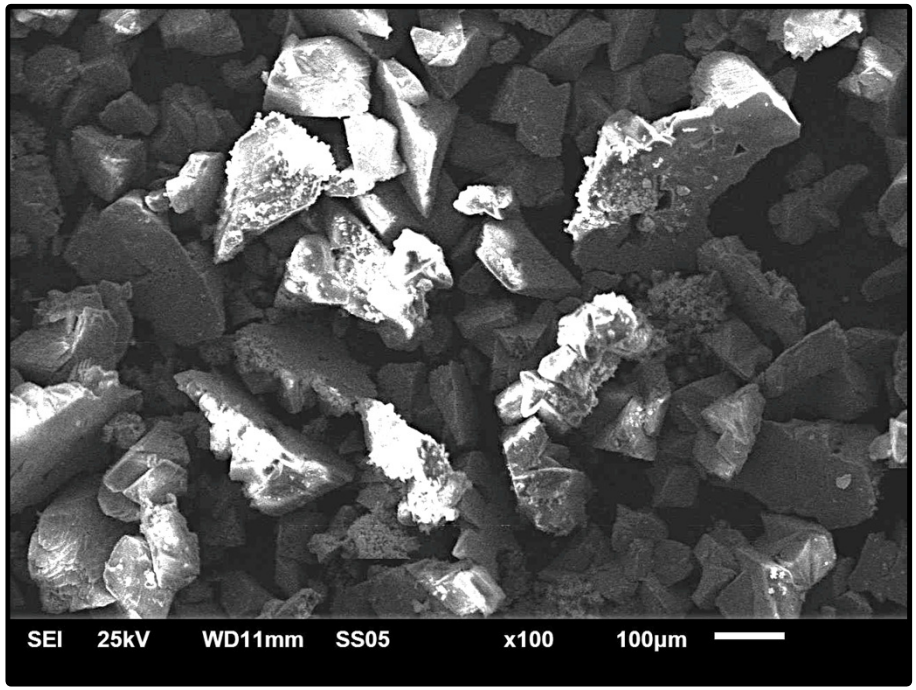
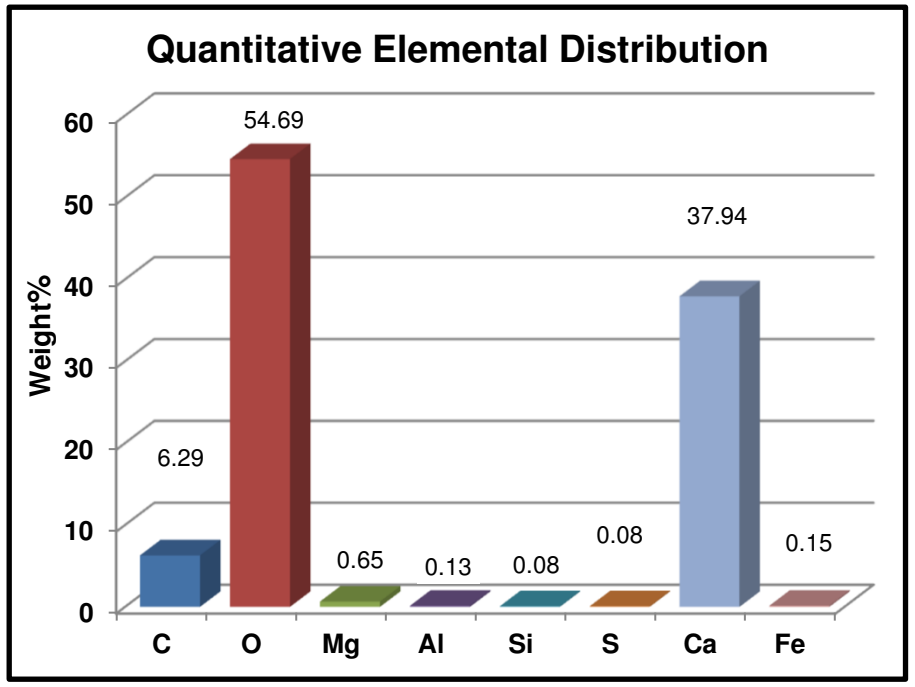
GR Petrology CONSULTANTS Inc.

Springate Water Coop
Sample ID: Reservoir Tank "Sediment Contents"







Summary of Analyses

One solid sample (Sample ID: Reservoir Tank "Sediment Contents") was submitted by Springate Water Coop for bulk X-ray Diffraction Analysis (XRD), elemental analysis by X-ray Energy Dispersive Spectrometry (EDS) and Scanning Electron Microscopy (SEM).

Quantitative elemental analysis was performed by a **Thermo Fisher Scientific *Pathfinder* X-ray Microanalysis System** attached to a **JEOL JSM-6610** scanning electron microscope. The Pathfinder system was designed to obtain standardless quantitative elemental analysis from rough samples by SEM. Elements from carbon (C) and heavier on the periodic table can be quantified.

The following Tables, Figures and Plates are included in this report:

- Table A: Comparison of Elemental Composition by EDS and XRD
- Plate 1: Photographs and EDS Results
- Table 1: EDS and XRD Results
- Figure 1: Bulk X-Ray Diffractogram

The scanning electron photomicrograph on the facing page (lower left) shows sample GR-001 consists of aggregates of angular, subangular and subrounded, clay size to medium sand size particles. The upper left photograph illustrates the bulk sample.

Oxygen (O) and calcium (Ca) dominate the elemental spectrograph, respectively forming about 54.7% and 37.9% of the sample. Carbon (C) is moderately abundant, forming about 6.3% of the sample. Trace to minor amounts of magnesium (Mg), aluminum (Al), silicon (Si), sulphur (S) and iron (Fe) are present.

The sample generated a good quality diffractogram indicating the sample is mainly composed of crystalline compounds.

X-ray diffraction analysis shows the crystalline components of the sample mainly consist of magnesium calcium carbonate scale **(calcite, mg [($Mg_{0.03}Ca_{0.97}$)(CO_3)])**, forming about 99% of the sample. Minor amounts of calcium aluminum oxide sulphate scale **(ye`elimite [$Ca_4Al_6O_{12}SO_4$])**, calcium magnesium sulphate scale **(calcium magnesium sulfate [$CaMg_2(SO_4)_3$])**, silicates **(quartz [SiO_2])** and iron oxide corrosion products **(magnetite [Fe_3O_4])** were detected in the sample.

Elemental analysis also suggests the presence of non-crystalline oxygen bearing compounds.

Comparison of EDS and XRD Results

In many cases the EDS weight percent calculation for some of the elements is different from the XRD weight percent calculation. EDS analysis identifies and quantifies elements present in both crystalline and non-crystalline components. XRD analysis only detects elements in crystalline compounds because only crystalline components of the sample diffract X-rays. Thus, our XRD weight percent calculation can only include those elements present in the crystalline compounds. It must be emphasized that each element identified by X-ray diffraction analysis should also be detected by EDS; however, the reverse is not necessarily true.

Table A summarizes the following comments regarding the comparison of EDS and XRD results.

The sample showed a good correlation between the XRD and EDS results.
Minor differences with respect to carbon and oxygen were found in the sample.

- Carbon was measured at 6.29% in the elemental analysis, while XRD analysis detected 11.94% carbon.
- In the elemental analysis, oxygen forms 54.69% of the sample, whereas XRD analysis calculated oxygen to be 48.17%.

The EDS result for oxygen is greater than the XRD result indicating the presence of non-crystalline oxygen bearing compounds. The XRD result for carbon is greater than the EDS result indicating this element occurs in well-crystalline compounds.

GR Petrology usually mounts a ground sample on a glass slide for X-ray diffraction analysis. The X-ray beam scans an area of approximately 250mm^2; however, the electron beam in the EDS that generates the elemental analysis scans a much smaller area of approximately 6mm^2. We attempted to obtain the elemental analysis from the most representative area of the sample; however, the irregular distribution of the materials in the sample may have skewed the EDS results in some instances.

Apparent differences in the elemental weight percent calculation of the above-mentioned elements are a function of:

1) The presence of non-crystalline components in the sample.
2) The difference in the area analysed by both methods.

COMPANY: Springate Water Coop
GR PROJECT #: GR 38494 2025

TABLE A
Comparison of Elemental Composition by EDS and XRD

GR Sample #	Sample ID	H	C	N	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	Mn	Fe
GR-001	Reservoir Tank "Sediment Contents"	-	6.29	-	54.69	-	0.65	0.13	0.08	-	0.08	-	-	37.94	-	-	0.15
		-	11.94	-	48.17	-	0.76	0.08	0.14	-	0.09	-	-	38.75	-	-	0.07

H - Hydrogen	Mg - Magnesium	Cl - Chlorine	Fe - Iron
C - Carbon	Al - Aluminum	K - Potassium	
N - Nitrogen	Si - Silicon	Ca - Calcium	
O - Oxygen	P - Phosphorus	Ti - Titanium	Black - EDS Analysis
Na - Sodium	S - Sulphur	Mn - Manganese	Red - Calculated from XRD

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TABLE 1: EDS and XRD Results
Springate Water Coop; Sample ID: Reservoir Tank "Sediment Contents"
GR 38494-01 2025

ELEMENTS:

DOMINANT: O, Ca
MODERATE: C
COMMON:
MINOR-TRACE: Mg, Al, Si, S, Fe

COMPOUNDS:

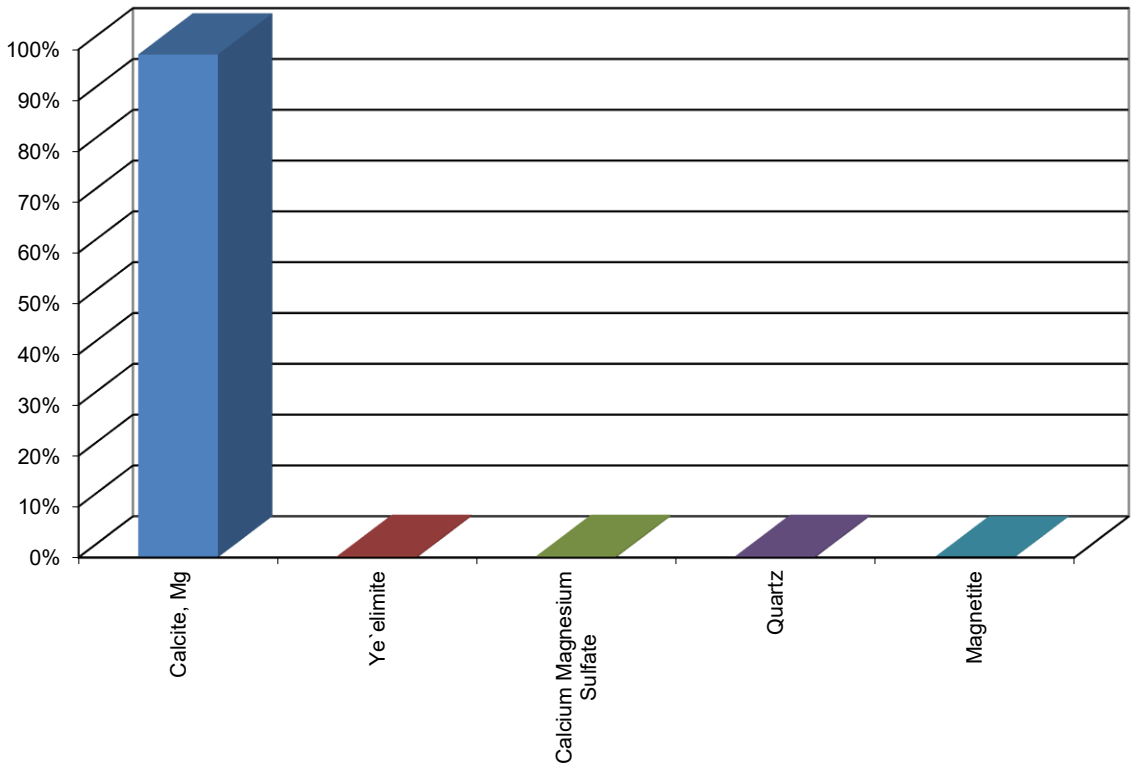
Formula	*Name*	*Percentage*
$(Mg_{0.03}Ca_{0.97})(CO_3)$	Calcite, Mg	99.0%
$Ca_4Al_6O_{12}SO_4$	Ye`elimite	0.3%
$CaMg_2(SO_4)_3$	Calcium Magnesium Sulfate	0.3%
SiO_2	Quartz	0.3%
Fe_3O_4	Magnetite	0.1%
		100.0%

COMMENTS:

The sample generated a good quality diffractogram indicating the sample is mainly composed of crystalline compounds. X-ray diffraction analysis shows the crystalline components of the sample mainly consist of calcium magnesium carbonate scale (about 99%). Minor amounts of calcium aluminum oxide sulphate scale, calcium magnesium sulphate scale, silicates and iron oxide corrosion products were detected in the sample.

Elemental analysis also suggests the presence of non-crystalline oxygen bearing compounds.

ABUNDANCE OF COMPOUNDS



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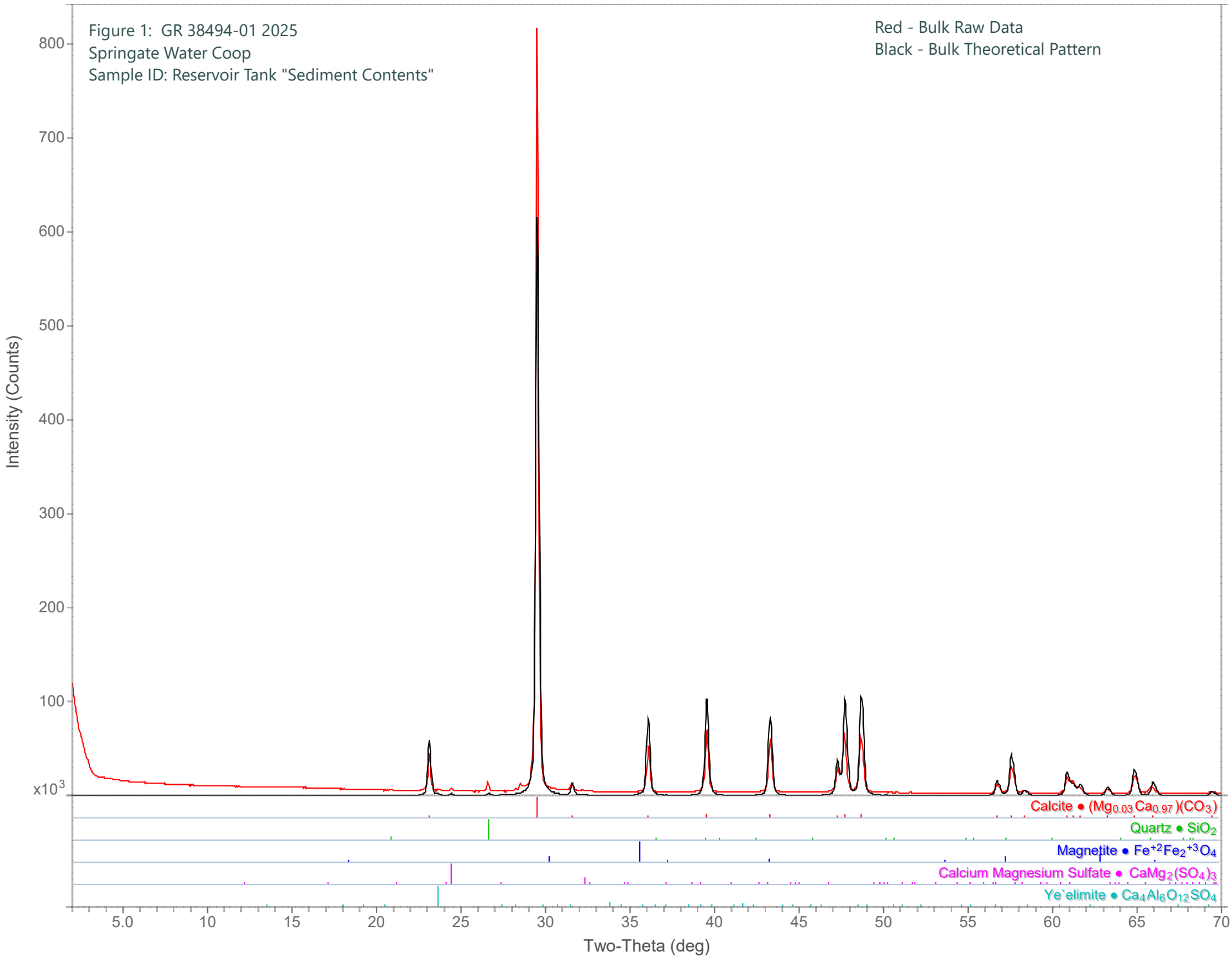
Figure 1: GR 38494-01 2025
Springate Water Coop
Sample ID: Reservoir Tank "Sediment Contents"
Red - Bulk Raw Data
Black - Bulk Theoretical Pattern
Intensity (Counts)
x10^3
800
700
600
500
400
300
200
100
5.0
10
15
20
25
30
35
40
45
50
55
60
65
70
Two-Theta (deg)
Calcite • (Mg0.03Ca0.97)(CO3)
Quartz • SiO2
Magnetite • Fe+2Fe2+3O4
Calcium Magnesium Sulfate • CaMg2(SO4)3
Ye`elimite • Ca4Al6O12SO4