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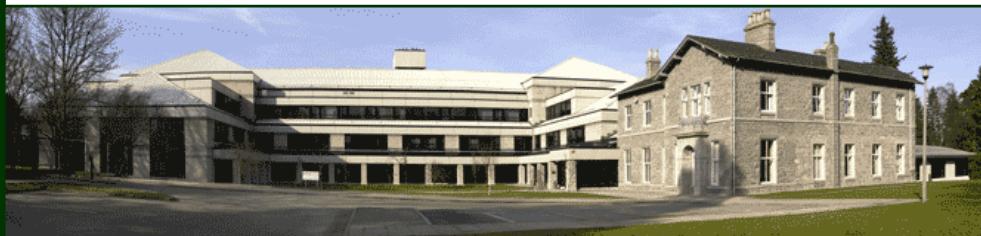
Report Number: 2015-22590

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Report on the Mineralogy of Forty-Four Samples by X-Ray Powder Diffraction (XRPD)

FOR:

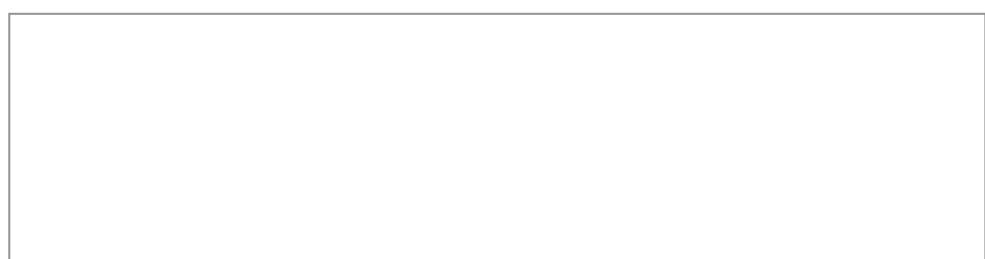
Keith Love
Shell Offshore Inc.
150 N. Dairy Ashford Drive
A5029
Houston
TX 77079
USA



INVESTORS IN PEOPLE

REPORT AUTHORS:

Ian M Phillips, BSc, PhD (Senior Analyst)
(e-mail: ian.phillips@hutton.ac.uk T: 01224 395356)



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Job and Sample Information:	
Job No(s):	2015-22590
Client Order No/Reference:	Global Agreement (Lou: 4900023866)
Date Sample(s) Received:	13-November-2015
Lab Code	Client Code
1223626	MC1, 5882.3
1223657	MC2, 5897.3
1223658	MC3, 5908.9
1223627	MC4, 5924.2
1223659	MC5, 5934.7
1223628	MC6, 5941
1223660	MC7, 5953
1223629	MC8, 5971
1223630	MC10, 5877
1223631	MC11, 5889.3
1223632	MC12, 5912.6
1223661	MC13, 5930.2
1223633	MC14, 5947
1223634	MC15, 5962
1223635	MC16, 5977
1223636	MC17, 5992.70
1223637	MC18, 5968.1
1223638	MC19, 5955.9
1223662	MC20, 5927.1
1223639	MC21, 5906.3
1223640	MC23, 5886.3
1223641	MC24, 5915.6
1223642	MC25, 5944
1223643	MC27, 5980
1223644	MC28, 5959
1223645	MC29, 5918.7
1223646	MC30, 5892.3
1223647	MC31, 5983
1223648	MC32, 5974
1223649	MC33, 5950
1223650	MC34, 5901.3
1223651	MC35, 5895.3
1223663	MC36, 6460.8
1223664	MC37, 6472.5
1223665	MC38, 6481.5
1223666	MC39, 6492.5
1223652	MC40, 6509.2
1223667	MC41, 6521.3
1223653	MC43, 6529
1223668	MC44, 6514.1
1223669	MC45, 6500.5
1223654	MC46, 6487.5
1223755	MC47, 6477
1223656	MC49, 6427

*Depths in feet

Note samples arrived in two batches hence the labcodes are not concurrent

Introduction

Forty-four samples were forwarded for whole rock and less than 2 micron clay size fraction mineralogical analysis by X-ray powder diffraction (XRPD).

Methods

Methods	Accreditation Reference
Identification and Quantification of Mineralogy by XRPD	GM003 and GM004
Identification and Semi-Quantification of Clay Minerals	GM001 and GM002

XRPD

The bulk samples were wet ground (in ethanol) in a McCrone mill and spray dried to produce random powders. The X-ray powder diffraction (XRPD) patterns were recorded from 2-75°2θ using Cobalt Kα radiation. Quantitative analysis was done by a normalised full pattern reference intensity ratio (RIR) method. Unless stated otherwise, expanded uncertainty using a coverage factor of 2, i.e. 95% confidence, is given by $\pm X^{0.35}$, where X = concentration in wt.%, e.g. 30 wt.% ± 3.3 . Note also that for phases present at the trace level (<1%) there may also be uncertainty as to whether or not the phase is truly present in the sample. This is both phase and sample dependent. It arises because at trace concentrations identification is often based on the presence of a single peak and the judgement of the analyst in assigning that peak to a likely mineral.

The clay fractions of <2µm were obtained by timed sedimentation, prepared as oriented mounts using the filter peel transfer technique and scanned from 2-45°2θ in the air-dried state, after glycolation, and after heating to 300°C for one hour. Clay minerals identified were quantified using a mineral intensity factor approach based on calculated XRPD patterns. Unless otherwise stated, for clay minerals present in amounts >10wt.% uncertainty is estimated as better than ± 5 wt.% at the 95% confidence level.

The XRPD patterns are identified by a labcode and by a name based on customer supplied identifiers, plus the suffix 'A' for air-dried, 'G' for glycolated, 'H3' for heated to 300°C and 'B' for bulk sample.

Results

The bulk XRPD results are presented in Table 1 and clay fraction data in Table 2. XRPD patterns, with the main non-clay phases identified in the bulk sample by reference to patterns from the International Centre for Diffraction Database (ICDD), are provided for reference. Additionally, all tabulated data are provided in spread sheet identified by the job number '2015-22590' and suffix 'data'.

Comments and opinions

The samples are mixtures of quartz, plagioclase, K-feldspar, calcite, dolomite, siderite, pyrite, anatase, barite, halite, muscovite, illite plus illite/smectite mixed-layers, chlorite and kaolinite. Some samples may contain traces of amphibole, though this is uncertain.

The <2 micron clay fractions are dominated by mixed-layer illite/smectite with smaller amounts of illite, kaolinite and chlorite. The expandability of the mixed-layer clays is estimated between 15 and 30%.

Note:

Samples will be stored for a period of eight weeks following completion of analysis and acceptance of analytical report(s) at no extra cost after which samples will be disposed of unless a specific instruction is given (with the sample analysis request/order) to store the sample beyond this period. Extended storage charges will apply.

Table 1: XRPD Bulk Mineralogy (weight %) by RIR Method

Labcode	Sample ID	Quartz	Plagioclase	K-feldspar	Calcite	Dolomite	Siderite	Pyrite	Anatase	Barite	Halite	Muscovite	I+I/S-ML	Chlorite(Tri)	Kaolinite	Amphibole	Total
1223626	MC1-5882-3-B	90.5	0.8	0.0	1.0	1.9	0.3	0.2	0.0	0.4	2.1	0.1	2.6	0.1	0.0	0.0	100
1223657	MC2-5897-3-B	87.9	1.2	0.0	0.1	0.7	1.1	0.3	0.0	0.6	1.6	0.0	5.5	0.4	0.6	0.0	100
1223658	MC3-5908-9-B	83.6	1.8	0.0	0.2	1.0	1.1	0.5	0.1	0.3	1.3	0.0	9.1	0.3	0.7	0.0	100
1223627	MC4-5924-2-B	89.5	1.4	0.0	0.9	0.6	0.6	0.2	0.0	0.7	2.1	0.0	3.6	0.3	0.1	0.0	100
1223659	MC5-5934-7-B	86.4	1.0	0.0	0.3	0.7	0.6	1.0	0.0	0.7	1.7	2.2	4.1	0.9	0.4	0.0	100
1223628	MC6-5941-B	82.7	1.8	0.0	1.2	0.8	0.6	2.4	0.0	1.3	2.3	0.6	5.4	0.8	0.1	0.0	100
1223660	MC7-5953-B	84.5	1.8	0.0	0.3	1.2	0.6	1.8	0.0	0.3	1.6	0.0	6.5	0.5	0.8	0.0	100
1223629	MC8-5971-B	73.1	2.7	0.0	0.4	1.6	0.6	2.1	0.2	trace	1.4	0.9	14.2	0.0	2.9	0.0	100
1223630	MC10-5877-B	78.4	0.8	0.0	0.4	5.2	0.4	0.7	0.1	trace	1.4	trace	11.7	0.3	0.5	0.0	100
1223631	MC11-5889-3-B	88.8	0.8	0.0	0.3	0.7	0.3	0.3	0.0	0.4	2.3	0.5	4.9	0.2	0.4	0.0	100
1223632	MC12-5912-6-B	81.0	2.3	0.0	0.2	0.9	1.4	0.5	0.1	0.6	2.1	0.3	8.9	0.0	1.7	0.0	100
1223661	MC13-5930-2-B	88.3	1.5	0.9	0.0	0.5	0.5	0.2	0.0	1.1	1.2	0.0	4.2	0.4	1.1	0.0	100
1223633	MC14-5947-B	87.1	1.3	0.0	0.2	1.8	0.3	2.6	0.0	0.2	2.3	0.0	3.8	0.2	0.2	0.0	100
1223634	MC15-5962-B	83.9	2.1	0.0	0.1	1.2	0.7	1.7	0.1	0.5	2.5	0.0	6.3	0.3	0.7	0.0	100
1223635	MC16-5977-B	70.4	2.9	0.6	0.1	1.1	1.2	1.6	0.1	0.3	1.2	2.5	13.7	0.6	3.7	0.0	100
1223636	MC17-5992-7-B	49.0	2.6	0.9	0.6	1.6	13.0	0.4	0.1	1.0	2.4	3.9	17.1	1.5	5.9	0.0	100
1223637	MC18-5968-1-B	73.8	2.2	0.0	12.7	1.1	0.5	1.7	0.0	0.0	1.5	0.0	5.5	0.3	0.7	0.0	100
1223638	MC19-5955-9-B	82.0	1.8	0.0	0.1	1.5	0.5	2.2	0.1	0.1	1.9	0.0	8.4	0.3	1.1	0.0	100
1223662	MC20-5927-1-B	86.3	1.4	0.0	0.2	0.6	2.5	0.2	0.0	1.5	2.0	0.0	4.3	0.3	0.7	0.0	100
1223639	MC21-5906-3-B	72.3	1.8	0.0	0.1	0.4	0.9	0.4	0.2	0.0	1.0	2.9	16.2	0.1	3.7	0.0	100
1223640	MC23-5886-3-B	89.1	0.7	0.0	0.1	1.2	0.3	0.3	0.0	0.2	2.2	0.0	4.9	0.1	0.8	0.0	100
1223641	MC24-5915-6-B	83.9	2.1	0.0	0.1	0.9	0.8	0.4	0.0	trace	2.2	0.4	8.4	0.2	0.6	0.0	100

I+I/S-ML = illite plus illite/smectite mixed-layers

Chlorite(Tri) = Trioctahedral Chlorite

Table 1 (cont'd): XRPD Bulk Mineralogy (weight %) by RIR Method

Labcode	Sample ID	Quartz	Plagioclase	K-feldspar	Calcite	Dolomite	Siderite	Pyrite	Anatase	Barite	Halite	Muscovite	I+I/S-ML	Chlorite(Tri)	Kaolinite	Amphibole	Total
1223642	MC25-5944-B	84.4	1.7	0.0	0.2	1.5	0.4	2.7	0.0	0.2	2.1	0.0	5.8	0.2	0.9	0.0	100
1223643	MC27-5980-B	58.6	2.7	0.7	0.2	0.8	1.5	2.4	0.3	0.3	1.2	3.4	22.1	0.2	5.3	0.0	100
1223644	MC28-5959-B	79.9	2.0	0.0	0.2	1.6	1.5	2.1	0.1	0.3	2.2	0.6	7.5	0.4	1.6	0.0	100
1223645	MC29-5918-7-B	74.6	2.0	0.0	0.3	1.1	7.4	0.8	0.0	0.5	2.8	1.0	6.8	0.8	2.0	0.0	100
1223646	MC30-5892-3-B	87.9	1.0	0.0	0.0	0.8	0.6	0.4	0.0	1.8	2.3	0.0	4.4	0.7	0.1	0.0	100
1223647	MC31-5983-B	64.2	3.1	0.4	0.2	1.1	1.6	2.5	0.2	0.5	1.3	2.4	17.3	0.3	5.0	0.0	100
1223648	MC32-5974-B	74.0	2.5	0.7	0.2	1.4	1.2	1.8	0.1	0.3	1.4	1.3	11.1	0.1	3.8	0.0	100
1223649	MC33-5950-B	83.3	1.0	0.0	0.2	1.5	0.5	2.9	0.0	0.7	2.0	0.6	5.5	0.3	1.5	0.0	100
1223650	MC34-5901-3-B	85.6	1.1	0.0	0.4	0.8	1.7	0.4	0.1	0.8	2.4	0.0	4.5	0.5	1.7	0.0	100
1223651	MC35-5895-3-B	88.2	1.1	0.0	0.2	0.5	0.8	0.4	0.0	0.8	2.2	0.4	5.0	0.3	0.2	0.0	100
1223663	MC36-6460-8-B	83.8	2.8	2.0	0.1	0.5	0.5	0.7	0.2	0.2	1.0	0.0	7.2	0.9	0.1	0.0	100
1223664	MC37-6472-5-B	80.0	2.9	2.5	0.3	0.4	0.5	0.6	0.1	0.2	1.3	1.0	8.7	0.8	0.6	0.0	100
1223665	MC38-6481-5-B	84.0	2.4	1.4	0.4	0.5	0.4	0.7	0.1	0.6	1.5	0.0	7.1	0.7	0.3	0.0	100
1223666	MC39-6492-5-B	82.4	2.9	1.6	0.3	0.5	0.6	1.1	0.1	0.7	1.4	0.0	6.7	0.7	0.9	0.0	100
1223652	MC40-6509-2-B	78.8	2.9	2.2	0.4	0.4	0.8	0.9	0.1	0.6	1.5	0.6	9.0	0.5	1.3	trace	100
1223667	MC41-6521-3-B	82.4	3.1	2.0	1.8	0.5	0.4	0.8	0.0	1.1	0.9	0.0	6.1	0.8	0.0	trace	100
1223653	MC43-6529-B	71.6	3.2	1.9	0.3	0.7	0.8	1.0	0.2	0.6	1.3	0.0	15.4	0.9	2.2	0.0	100
1223668	MC44-6514-1-B	71.8	3.4	2.1	2.8	0.6	1.0	0.9	0.2	1.2	0.8	1.2	12.5	0.9	0.8	0.0	100
1223669	MC45-6500-5-B	84.1	2.7	1.6	0.3	0.5	0.5	0.8	0.0	1.0	1.3	0.0	6.3	0.4	0.5	0.0	100
1223654	MC46-6487-5-B	78.8	3.1	1.8	0.3	0.4	0.7	0.7	0.1	3.3	1.7	0.0	7.7	0.9	0.6	trace	100
1223655	MC47-6477-B	74.7	3.2	1.9	0.4	0.5	0.8	0.7	0.2	1.7	1.3	0.3	11.4	1.1	1.8	0.0	100
1223656	MC49-6427-B	53.3	3.3	2.0	0.0	0.4	1.9	0.9	0.2	5.5	1.0	3.0	25.1	1.3	2.0	0.0	100

I+I/S-ML = illite plus illite/smectite mixed-layers

Chlorite(Tri) = Trioctahedral Chlorite

Table 2: Relative percentage of clay minerals in the <2mm clay size fraction ©

Labcode	Sample ID	XRD pattern name	Chlorite(Tri)©	Kaolinite©	Illite©	I/S-ML©	%Exp©
1223626	MC1, 5882.3	MC1-5882-3-A,-G,-H3	1	11	8	80	30
1223657	MC2, 5897.3	MC2-5897-3-A,-G,-H3	1	10	7	82	25
1223658	MC3, 5908.9	MC3-5908-9-A,-G,-H3	1	10	5	84	25
1223627	MC4, 5924.2	MC4-5924-2-A,-G,-H3	1	12	9	78	25
1223659	MC5, 5934.7	MC5-5934-7-A,-G,-H3	1	11	7	81	25
1223628	MC6, 5941	MC6-5941-A,-G,-H3	1	11	9	79	25
1223660	MC7, 5953	MC7-5953-A,-G,-H3	1	10	5	84	20
1223629	MC8, 5971	MC8-5971-A,-G,-H3	1	8	10	81	30
1223630	MC10, 5877	MC10-5877-A,-G,-H3	trace	5	9	86	25
1223631	MC11, 5889.3	MC11-5889-3-A,-G,-H3	1	10	3	86	25
1223632	MC12, 5912.6	MC12-5912-6-A,-G,-H3	1	9	4	86	20
1223661	MC13, 5930.2	MC13-5930-2-A,-G,-H3	1	12	7	80	15
1223633	MC14, 5947	MC14-5947-A,-G,-H3	1	10	5	84	20
1223634	MC15, 5962	MC15-5962-A,-G,-H3	1	14	8	77	20
1223635	MC16, 5977	MC16-5977-A,-G,-H3	1	11	9	79	25
1223636	MC17, 5992.70	MC17-5992-70-A,-G,-H3	1	9	8	82	25
1223637	MC18, 5968.1	MC18-5968-1-A,-G,-H3	1	16	9	74	25
1223638	MC19, 5955.9	MC19-5955-9-A,-G,-H3	1	11	7	81	20
1223662	MC20, 5927.1	MC20-5927-1-A,-G,-H3	1	14	7	78	25
1223639	MC21, 5906.3	MC21-5906-3-A,-G,-H3	1	8	15	76	25
1223640	MC23, 5886.3	MC23-5886-3-A,-G,-H3	1	13	4	82	25
1223641	MC24, 5915.6	MC24-5915-6-A,-G,-H3	1	7	6	86	25

I/S-ML© = Illite/Smectite Mixed-Layers

%Exp© = % Expandable Smectite Layers

Chlorite(Tri) = Trioctahedral Chlorite

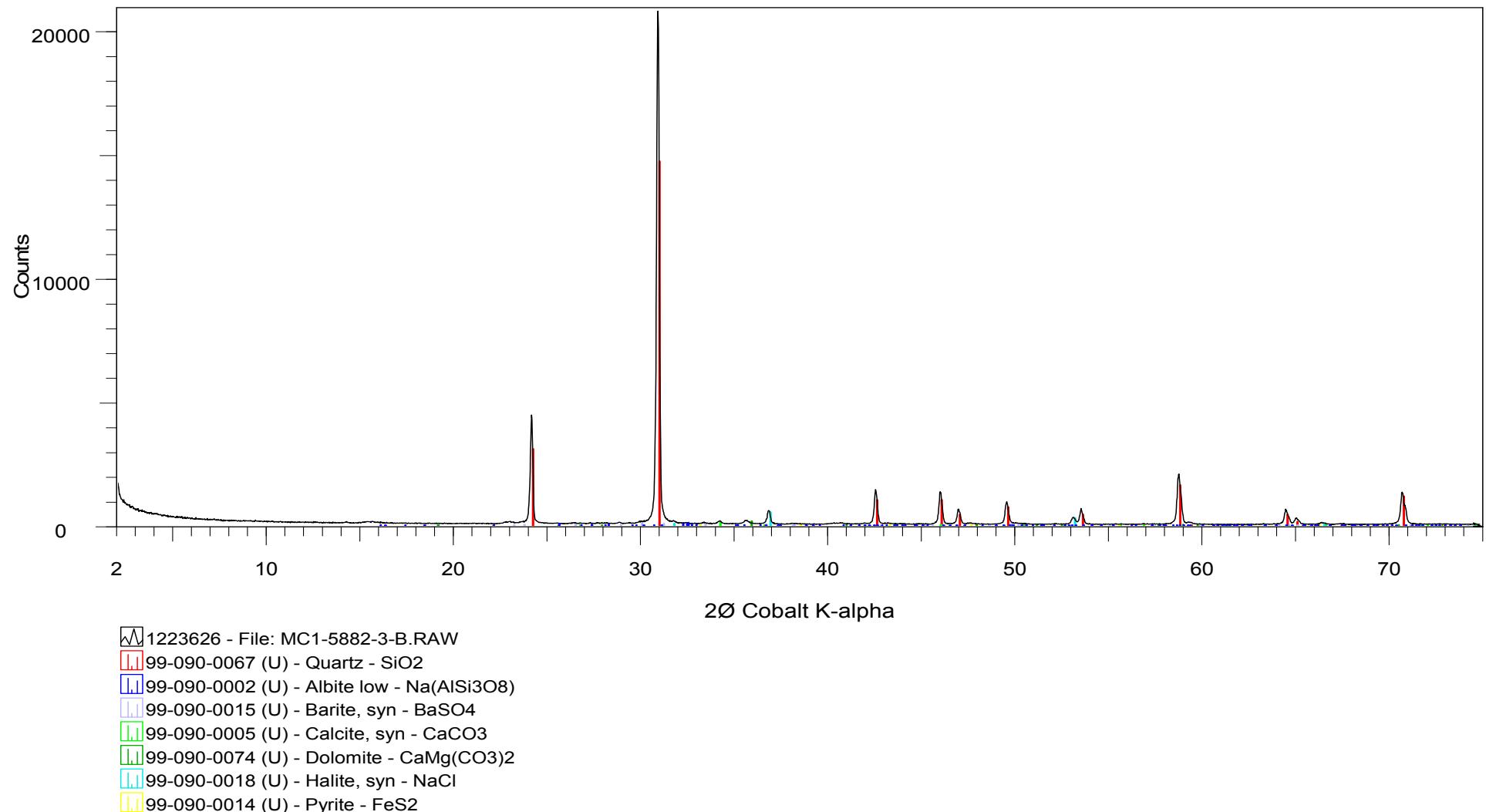
Table 2 (Cont'd): Relative percentage of clay minerals in the <2mm clay size fraction ©

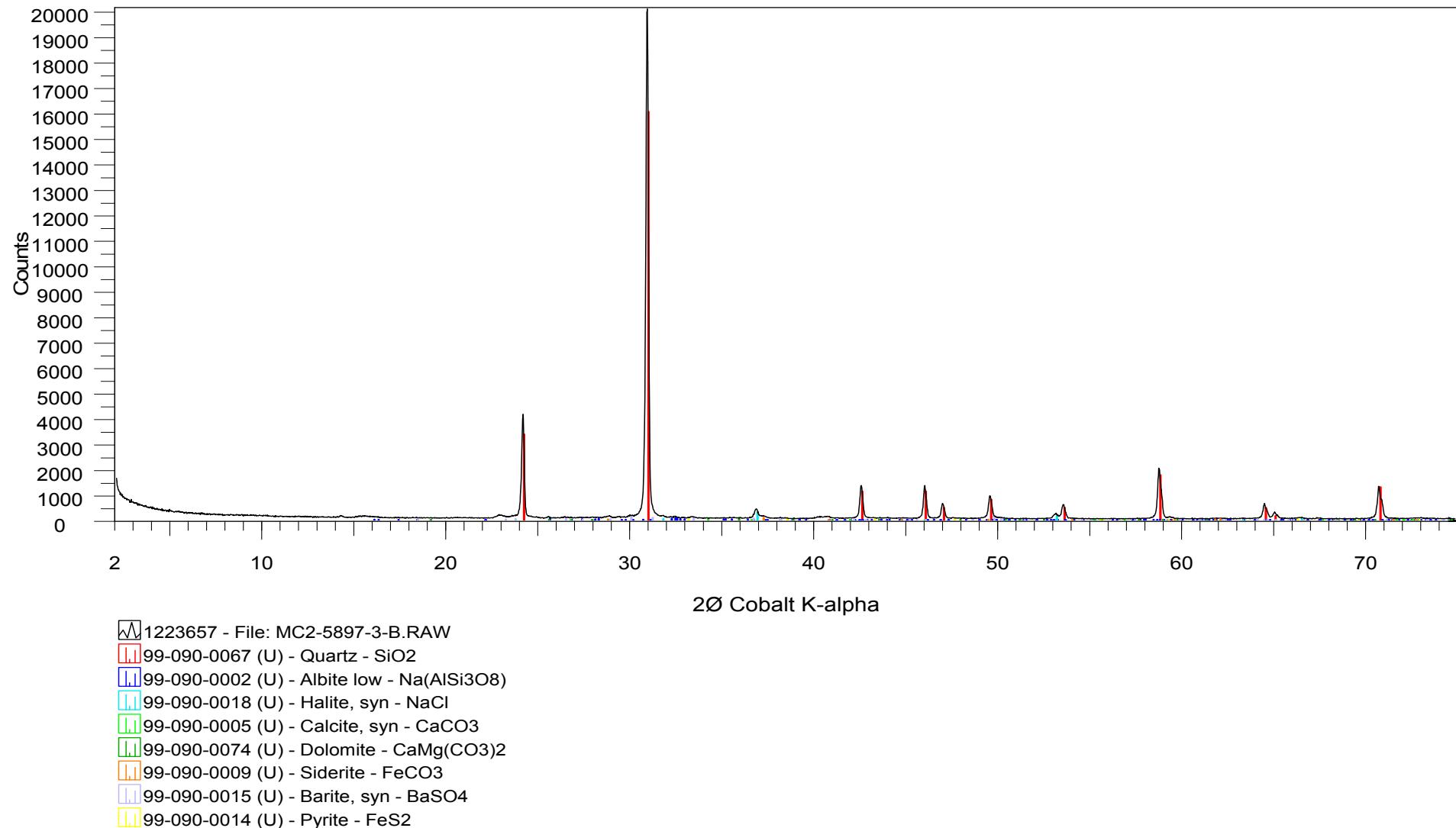
Labcode	Sample ID	XRD pattern name	Chlorite(Tri)©	Kaolinite©	Illite©	I/S-ML©	%Exp©
1223642	MC25, 5944	MC25-5944-A,-G,-H3	1	15	7	77	25
1223643	MC27, 5980	MC27-5980-A,-G,-H3	1	7	14	78	25
1223644	MC28, 5959	MC28-5959-A,-G,-H3	1	21	9	69	20
1223645	MC29, 5918.7	MC29-5918-7-A,-G,-H3	1	21	8	70	15
1223646	MC30, 5892.3	MC30-5892-3-A,-G,-H3	1	19	7	73	20
1223647	MC31, 5983	MC31-5983-A,-G,-H3	1	8	12	79	25
1223648	MC32, 5974	MC32-5974-A,-G,-H3	1	17	8	74	25
1223649	MC33, 5950	MC33-5950-A,-G,-H3	1	10	6	83	25
1223650	MC34, 5901.3	MC34-5901-3-A,-G,-H3	1	18	6	75	25
1223651	MC35, 5895.3	MC35-5895-3-A,-G,-H3	1	11	5	83	30
1223663	MC36, 6460.8	MC36-6460-8-A,-G,-H3	1	6	8	85	25
1223664	MC37, 6472.5	MC37-6472-5-A,-G,-H3	2	10	6	82	30
1223665	MC38, 6481.5	MC38-6481-5-A,-G,-H3	1	5	8	86	25
1223666	MC39, 6492.5	MC39-6492-5-A,-G,-H3	1	6	6	87	20
1223652	MC40, 6509.2	MC40-6509-2-A,-G,-H3	2	9	4	85	20
1223667	MC41, 6521.3	MC41-6521-3-A,-G,-H3	1	9	8	82	25
1223653	MC43, 6529	MC43-6529-A,-G,-H3	1	5	7	87	25
1223668	MC44, 6514.1	MC44-6514-1-A,-G,-H3	1	4	8	87	25
1223669	MC45, 6500.5	MC45-6500-5-A,-G,-H3	2	13	10	75	25
1223654	MC46, 6487.5	MC46-6487-5-A,-G,-H3	2	11	11	76	25
1223755	MC47, 6477	MC47-6477-A,-G,-H3	1	6	6	87	20
1223656	MC49, 6427	MC49-6427-A,-G,-H3	1	5	13	81	25

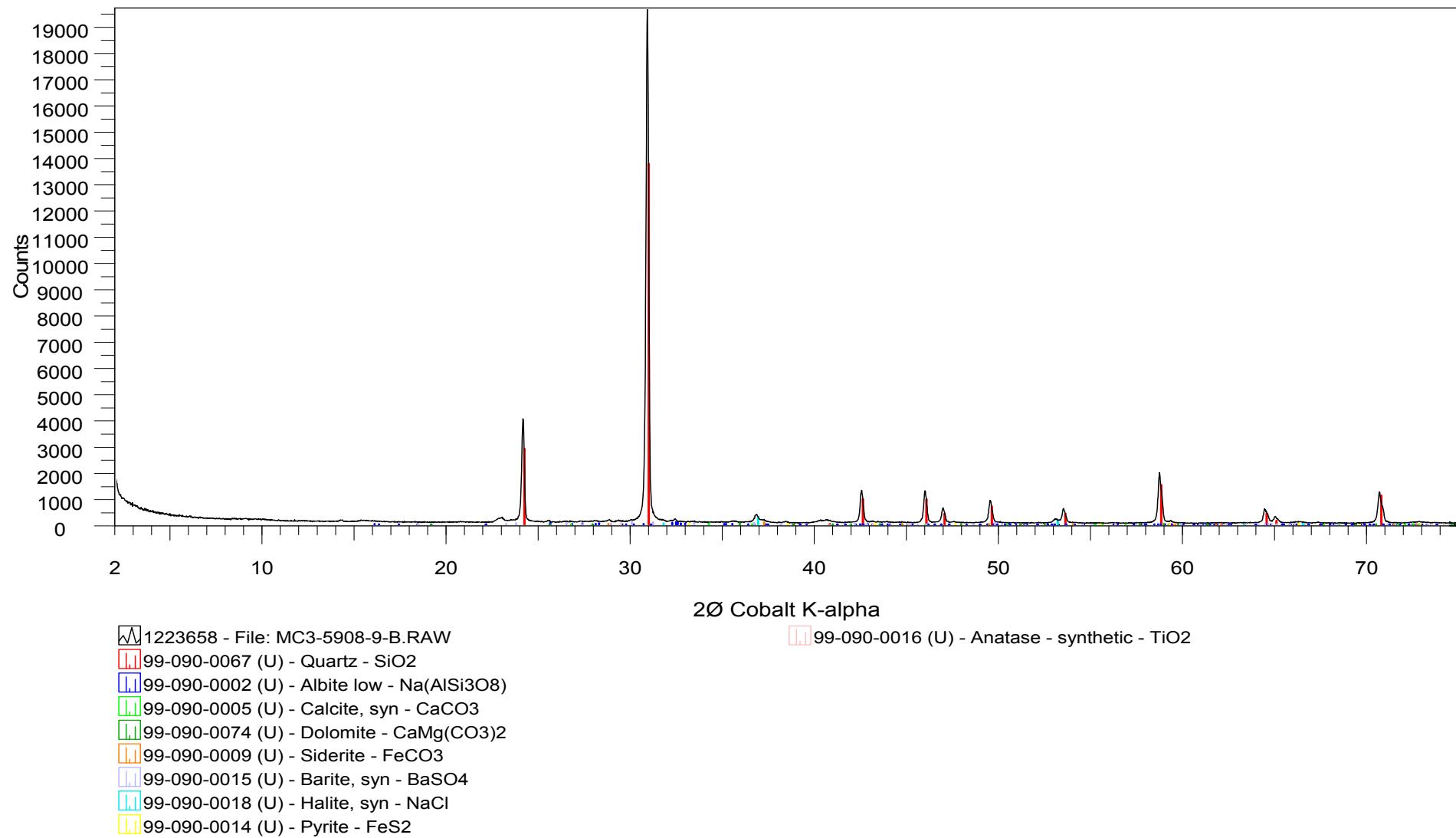
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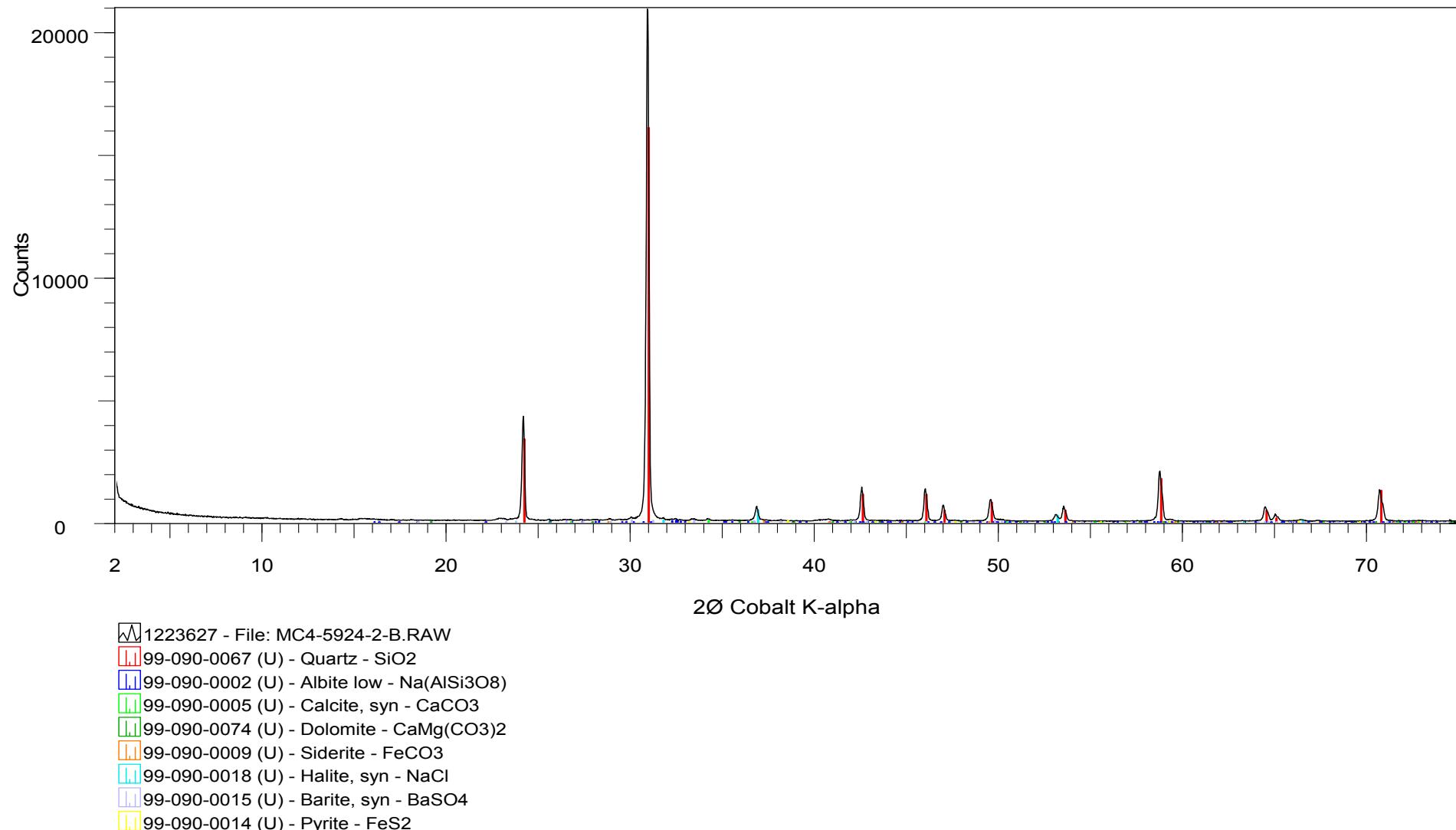






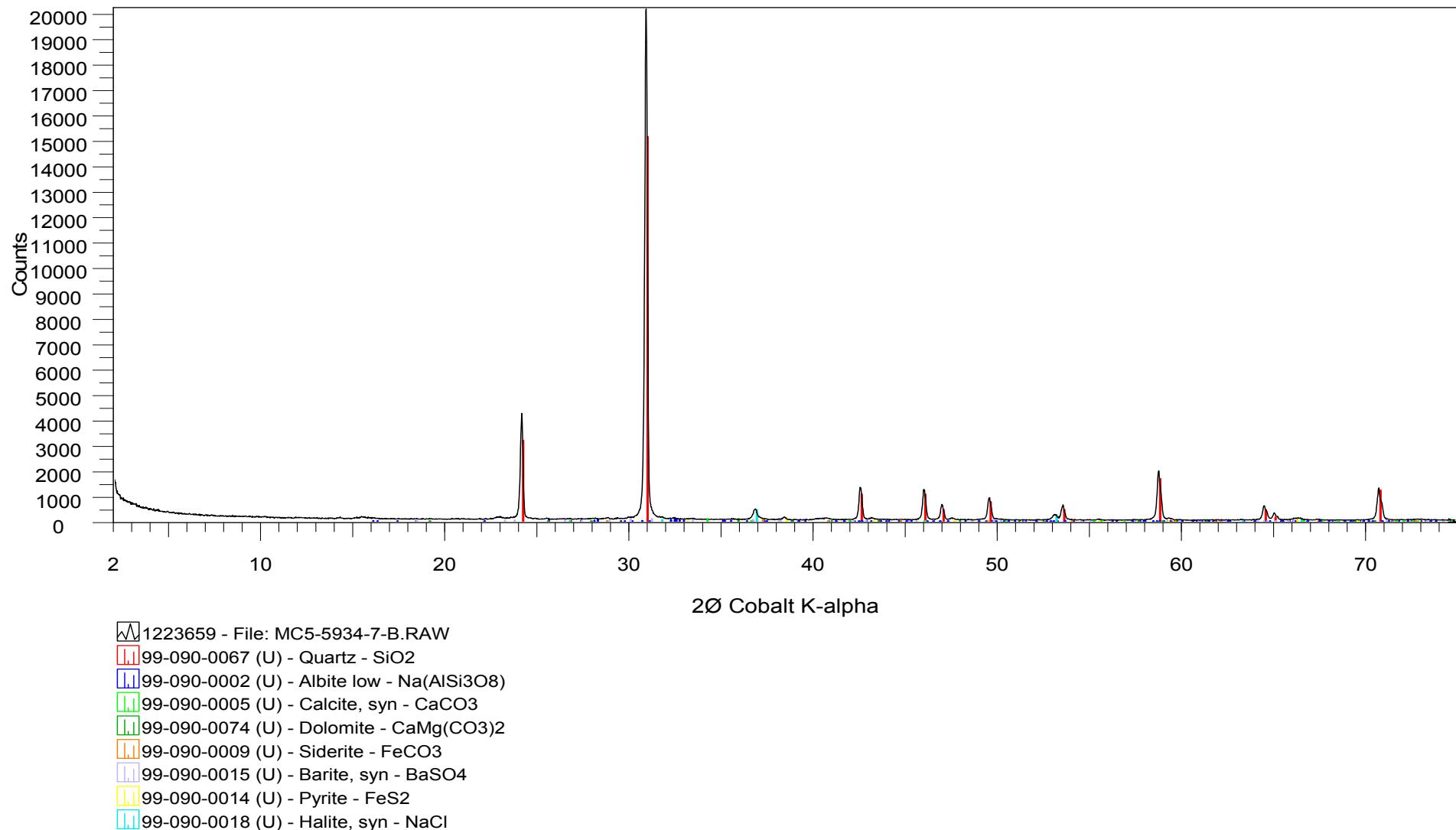
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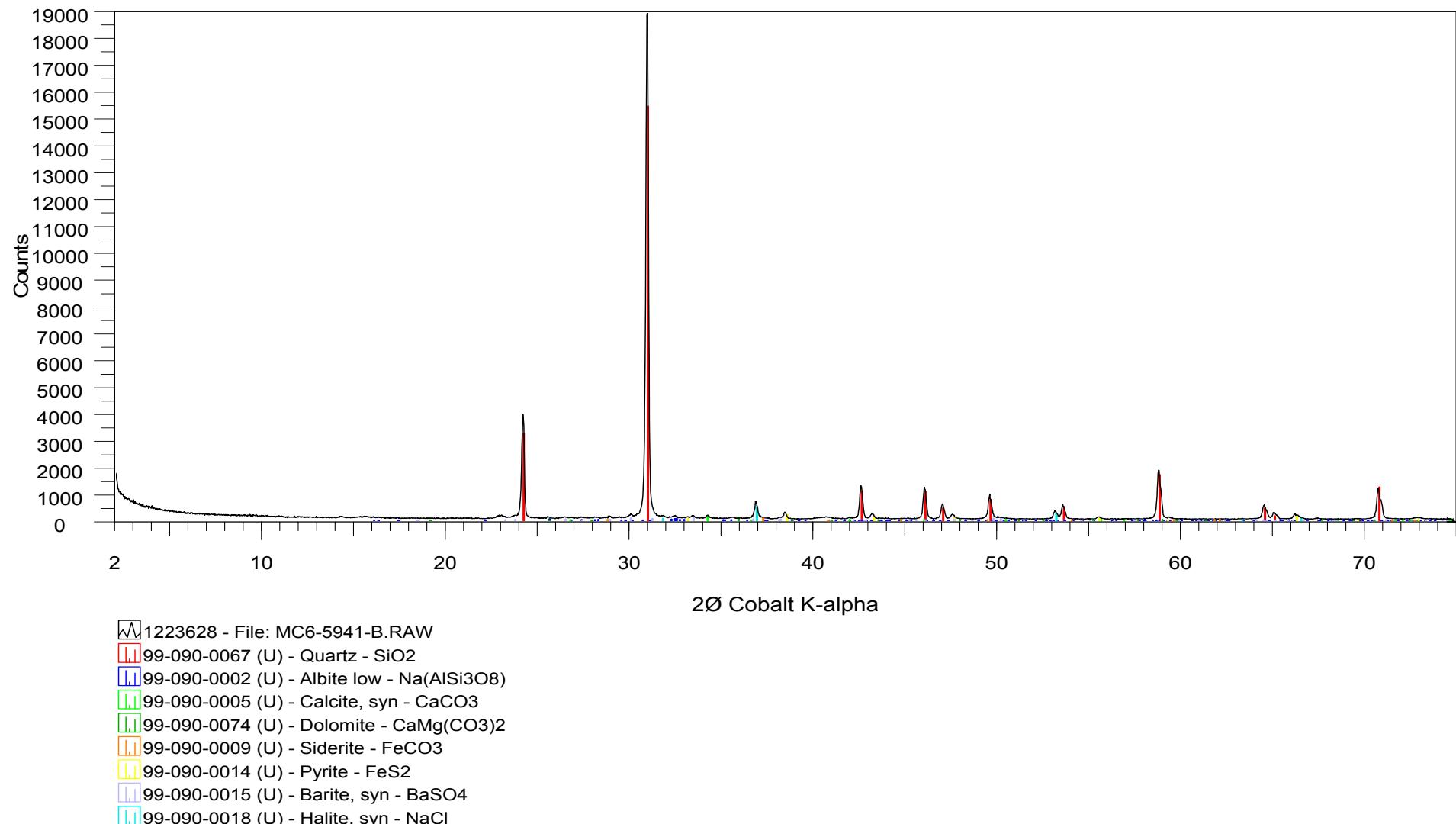
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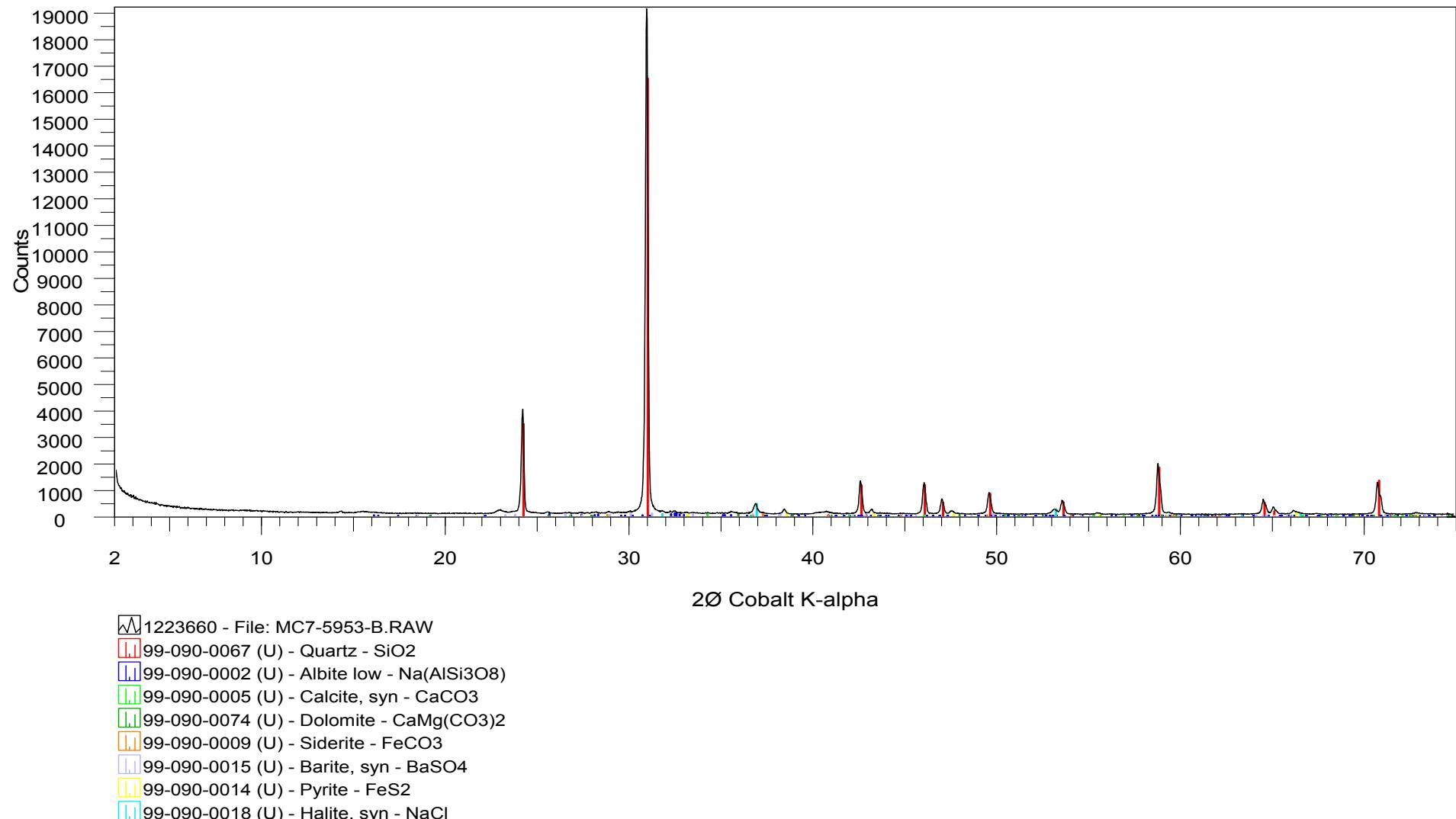
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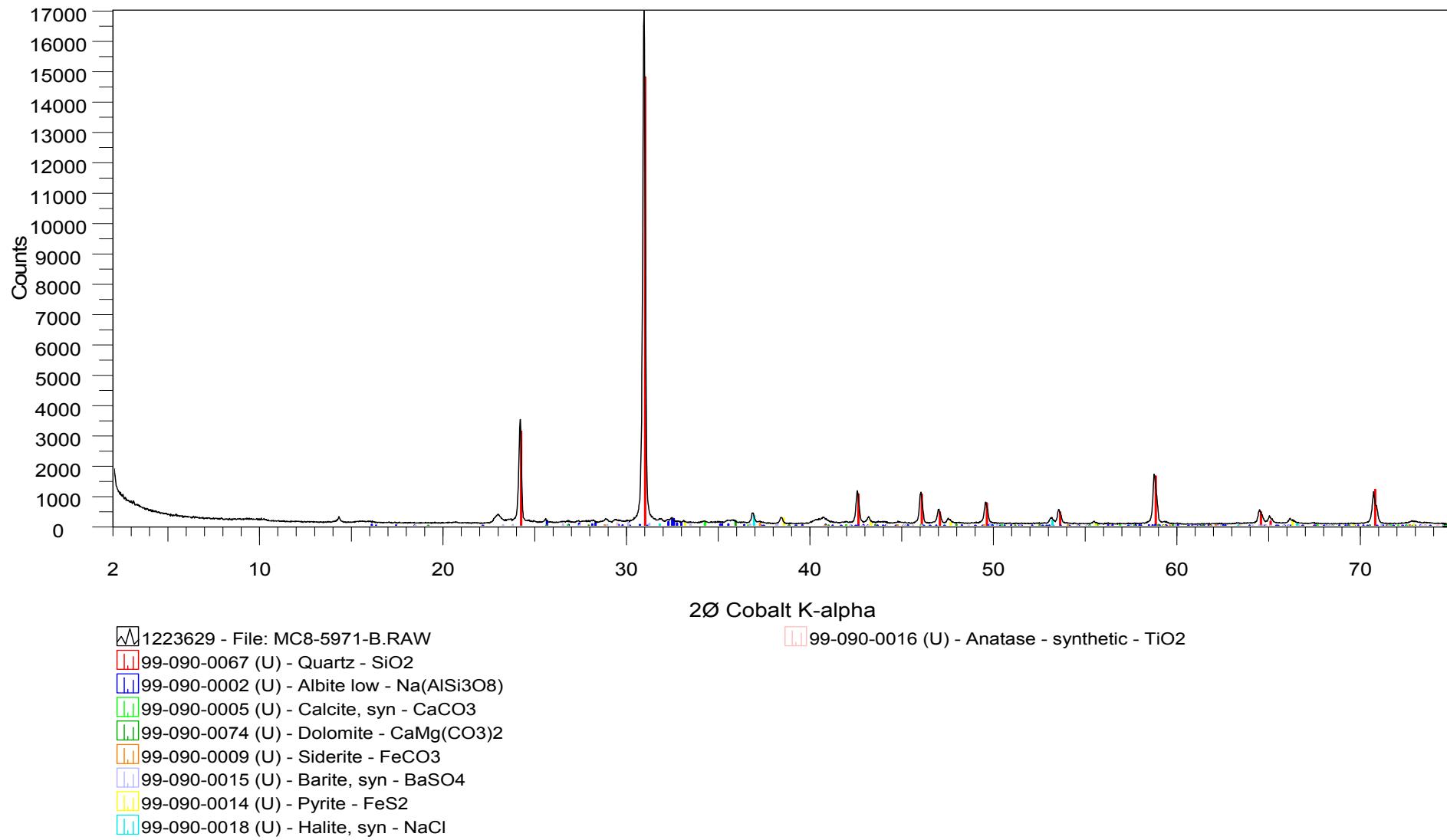


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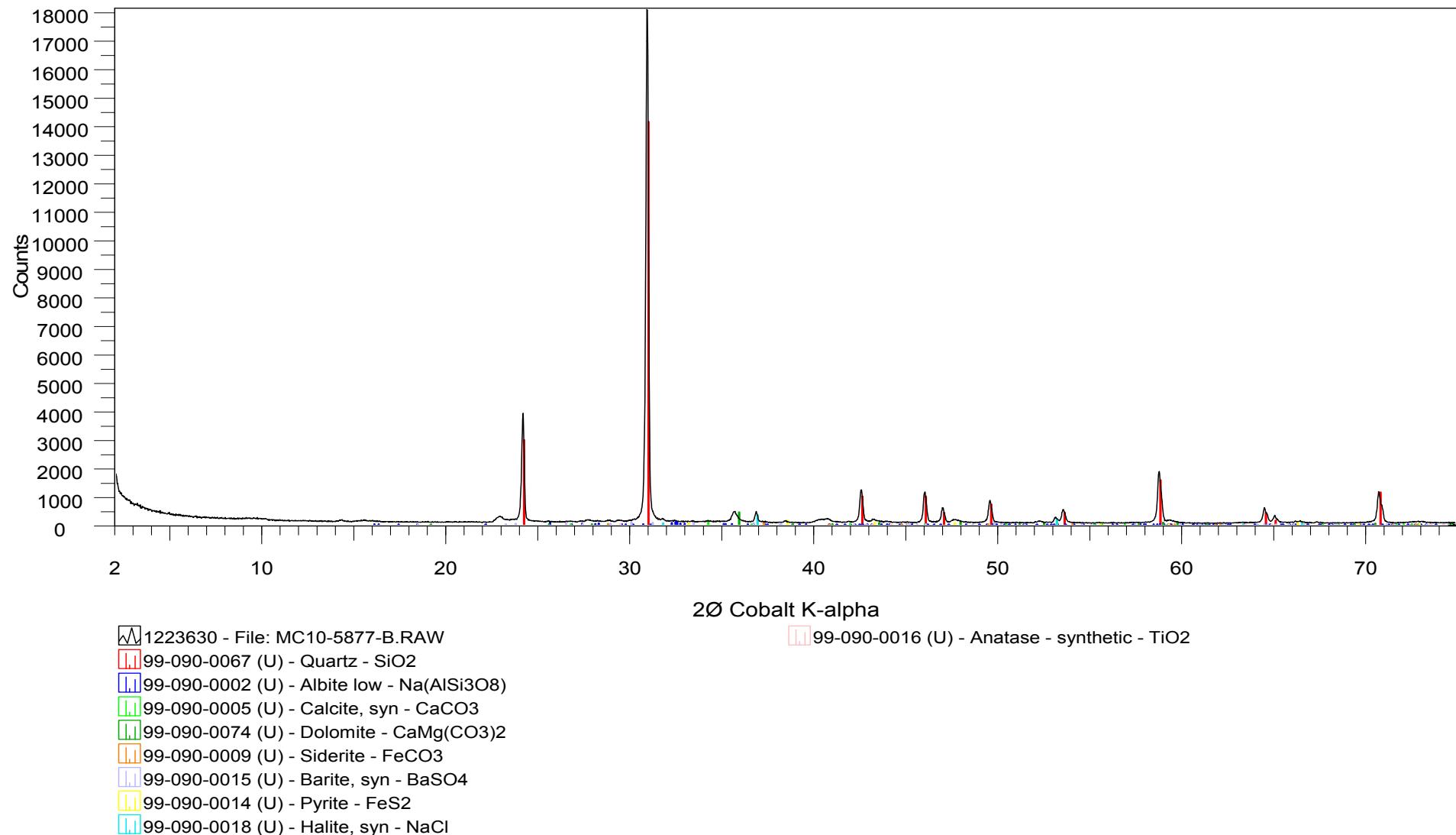






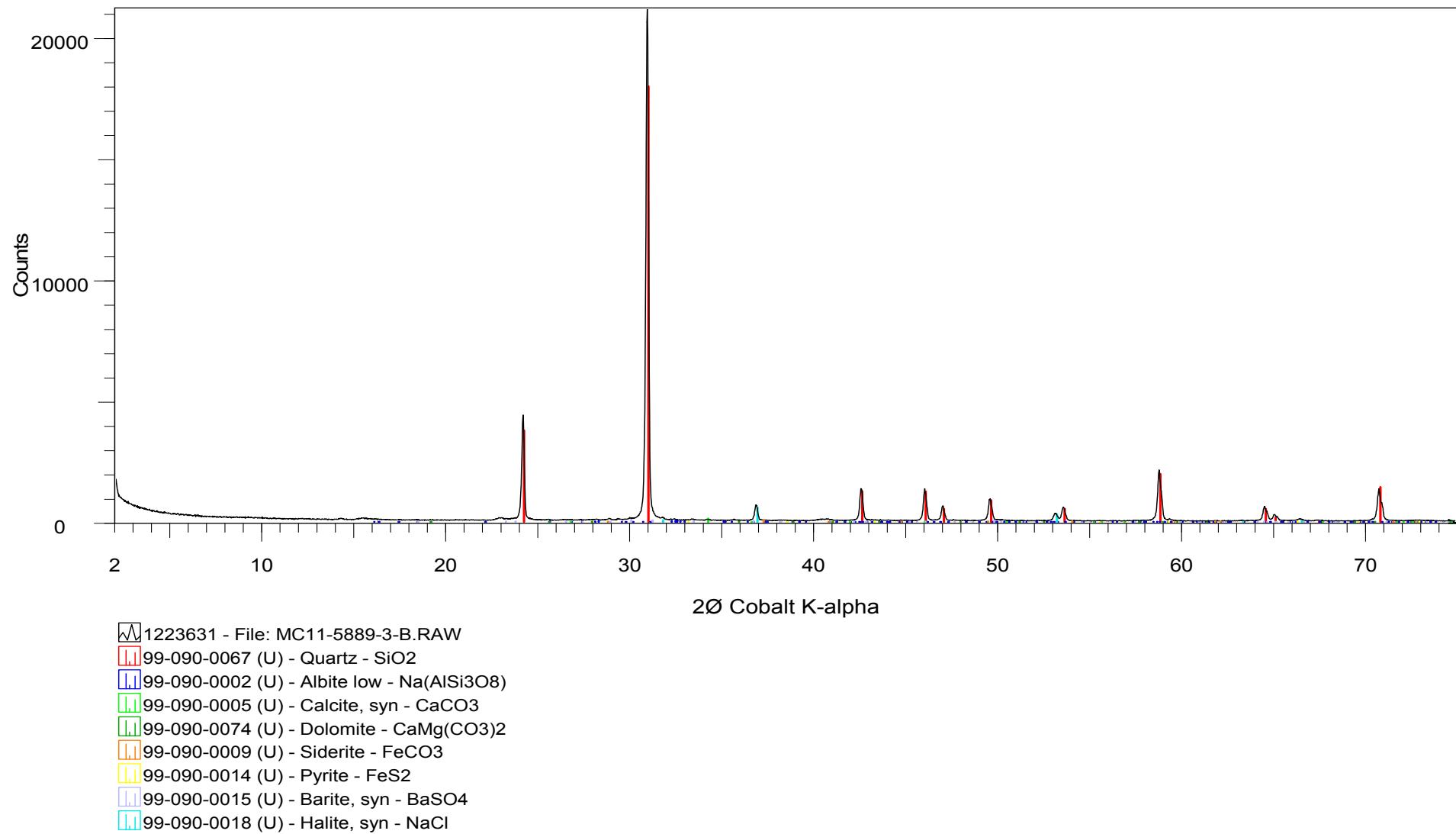
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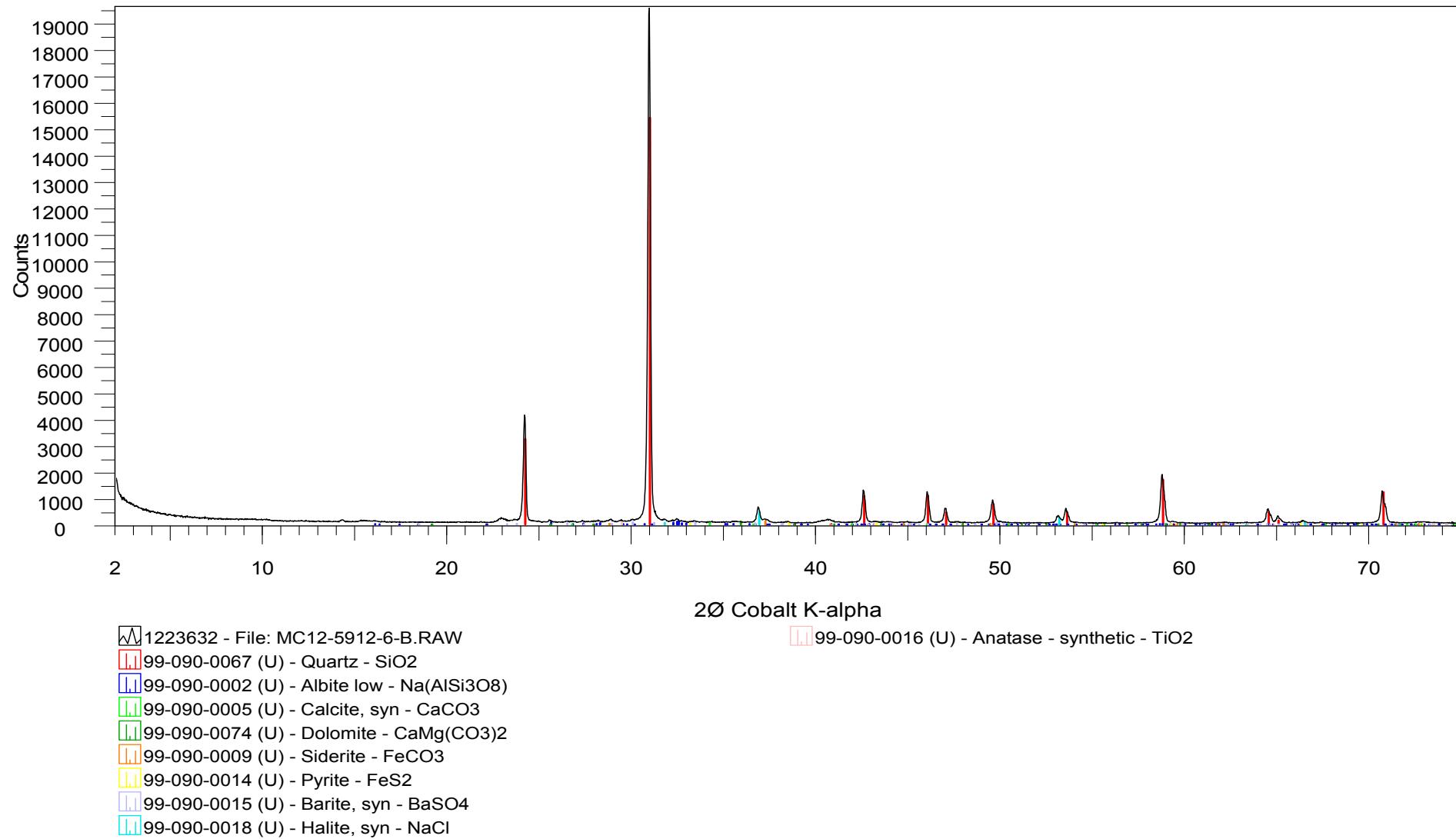
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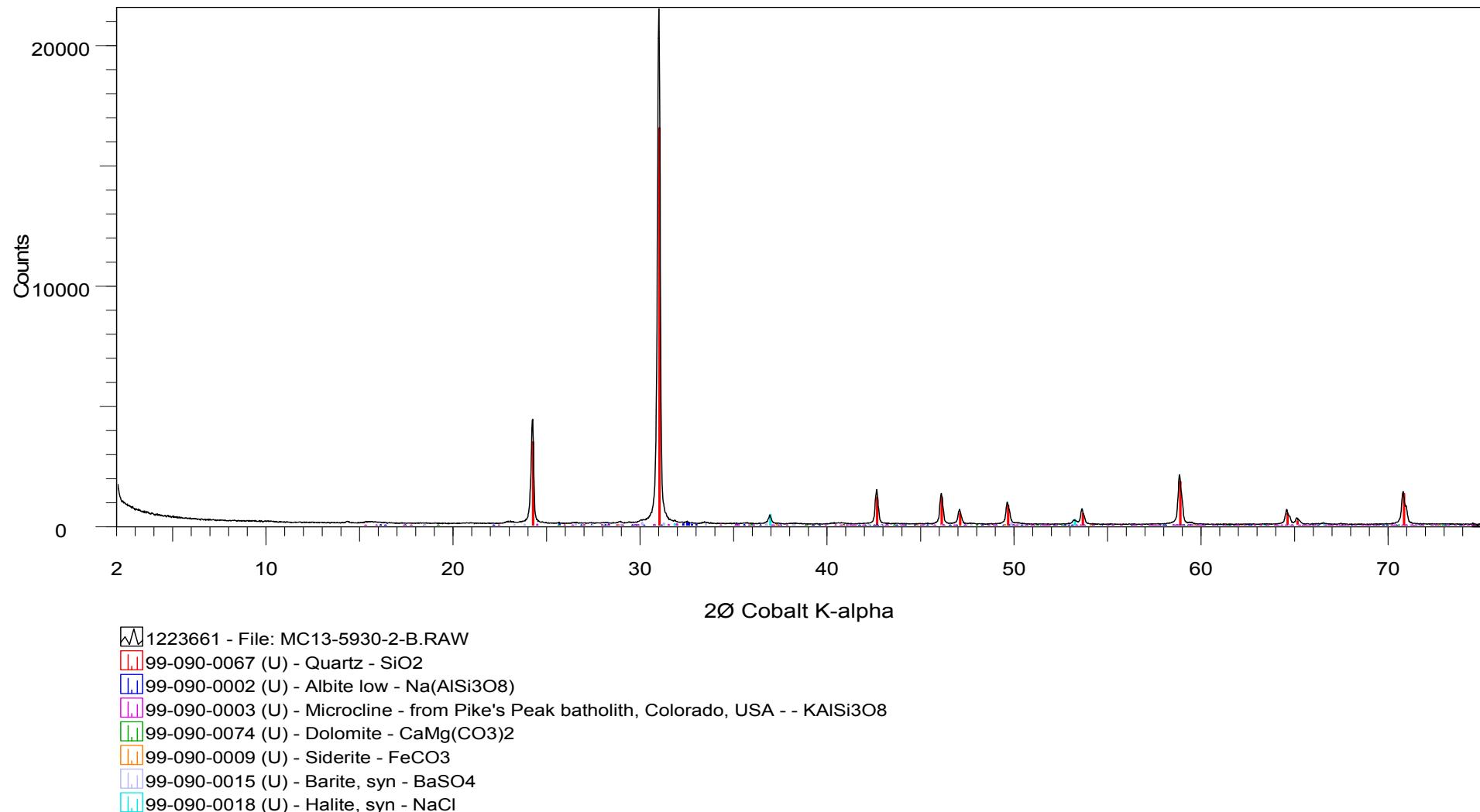
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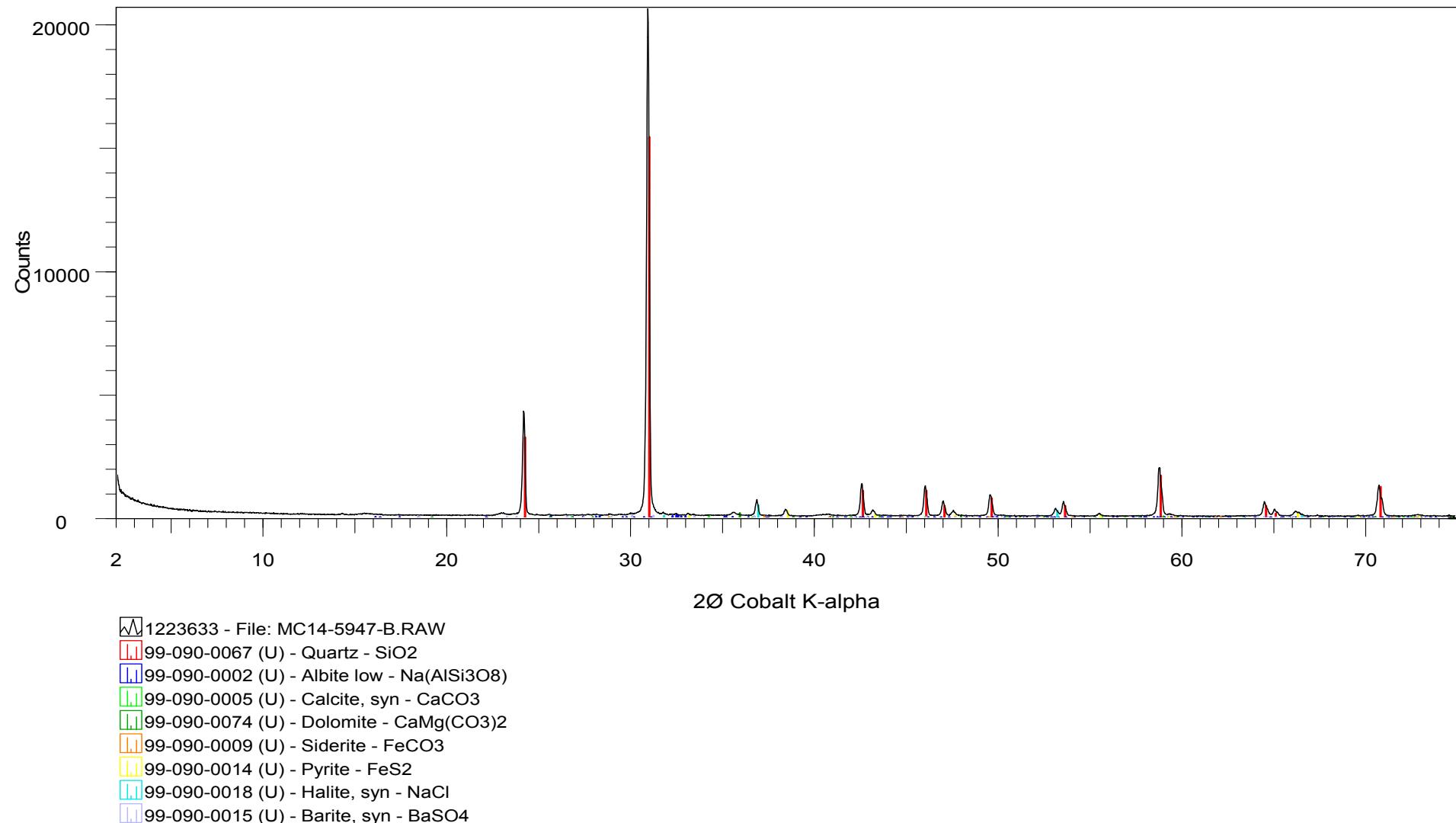
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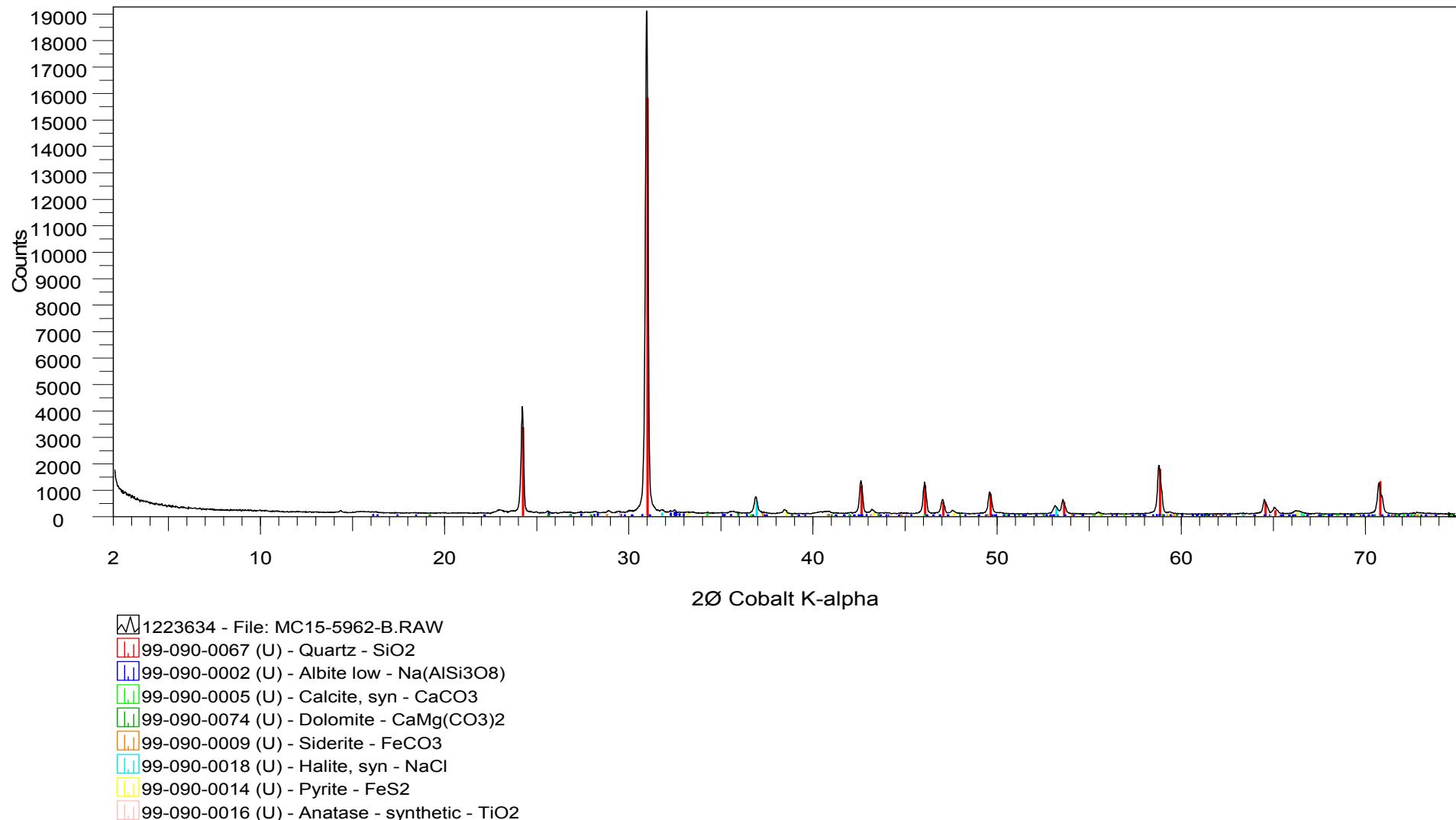
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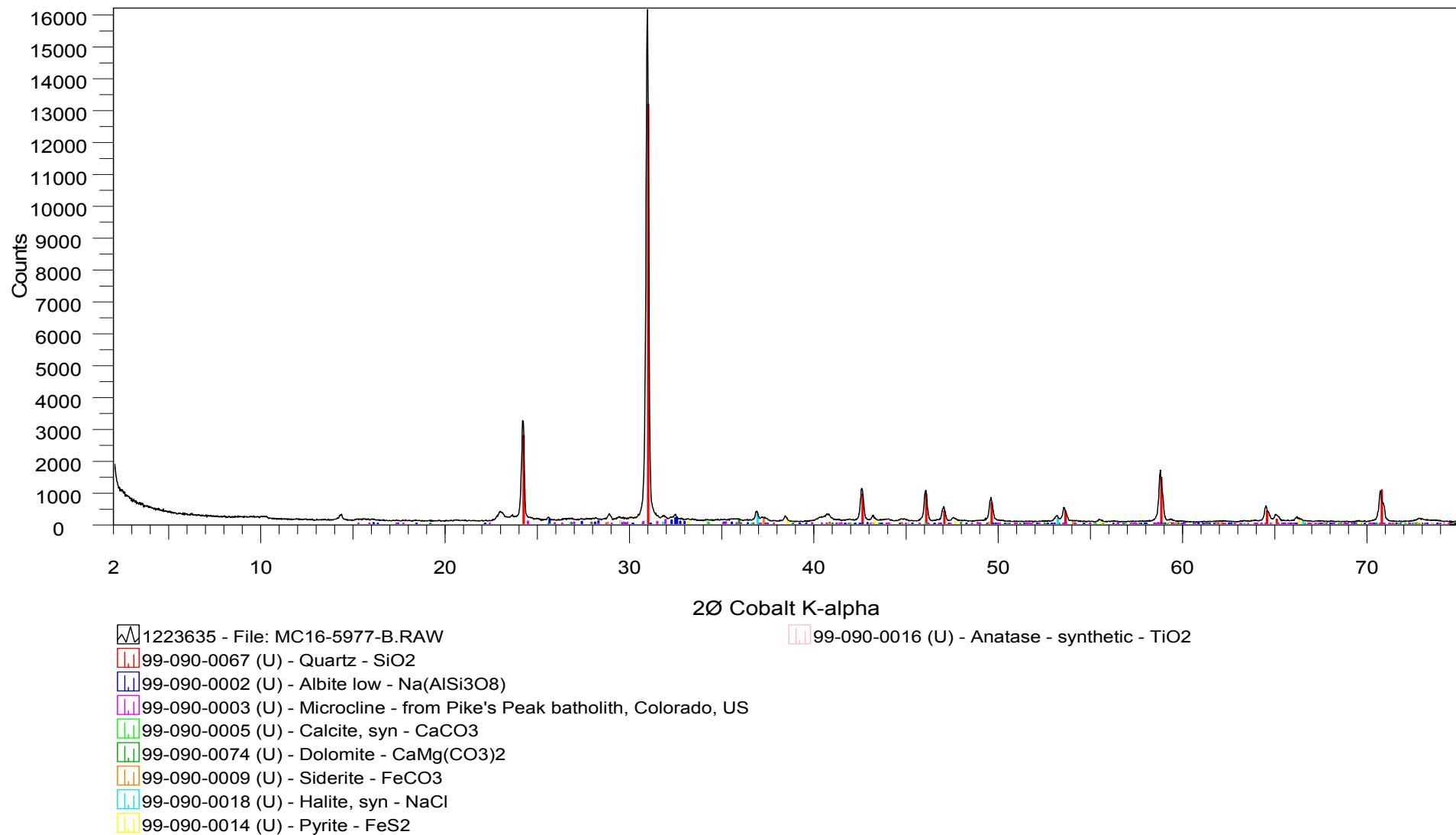




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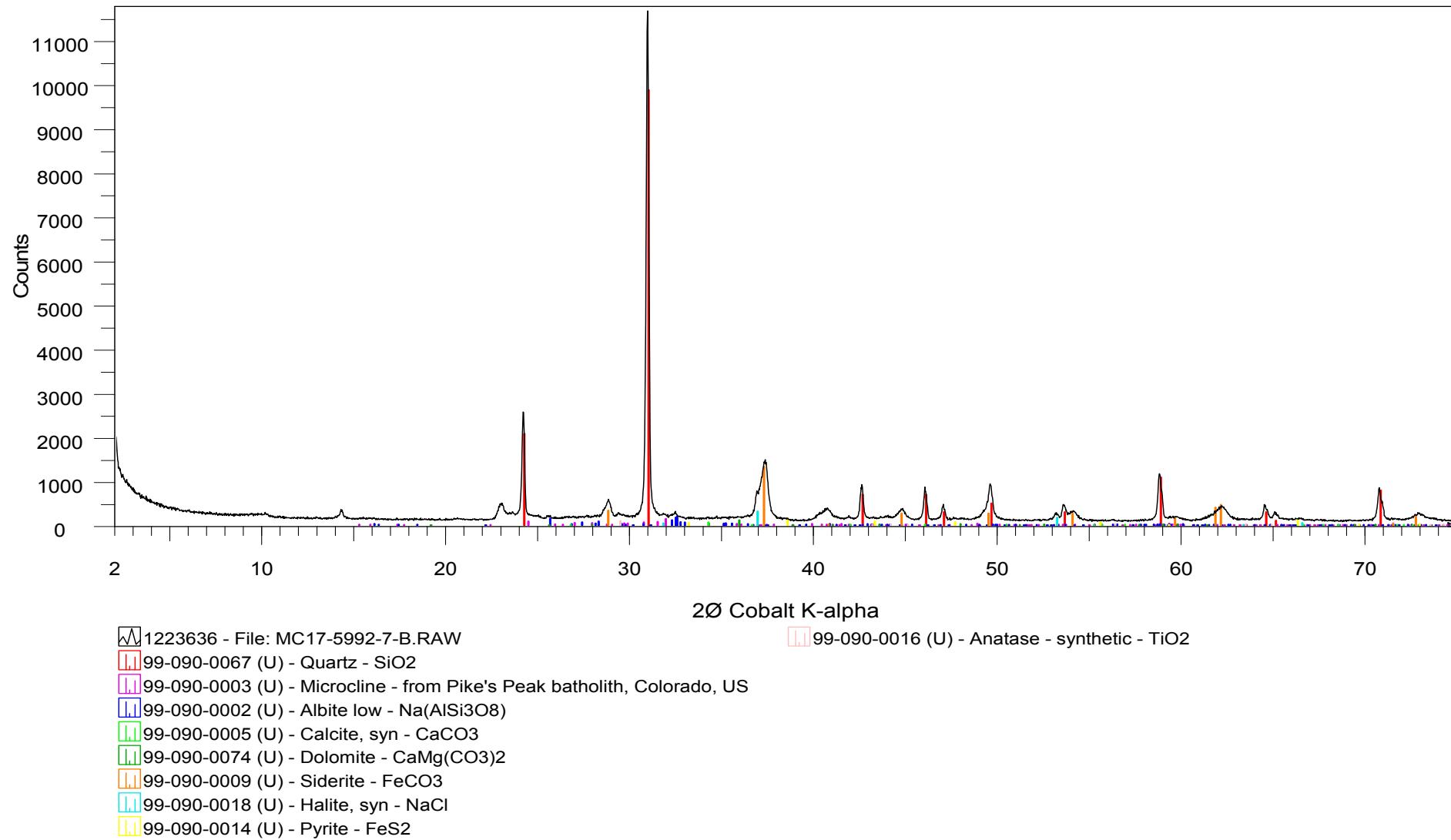
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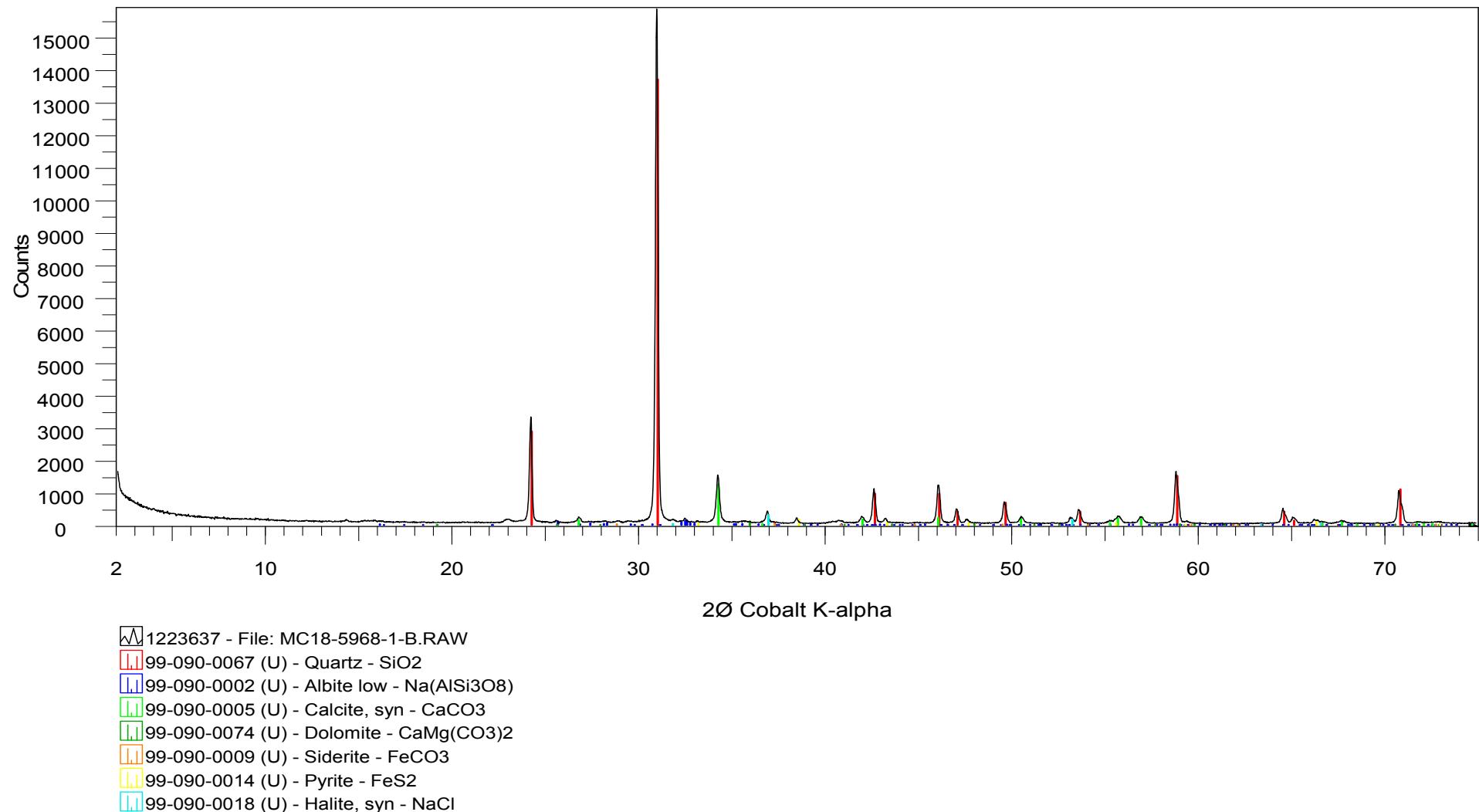
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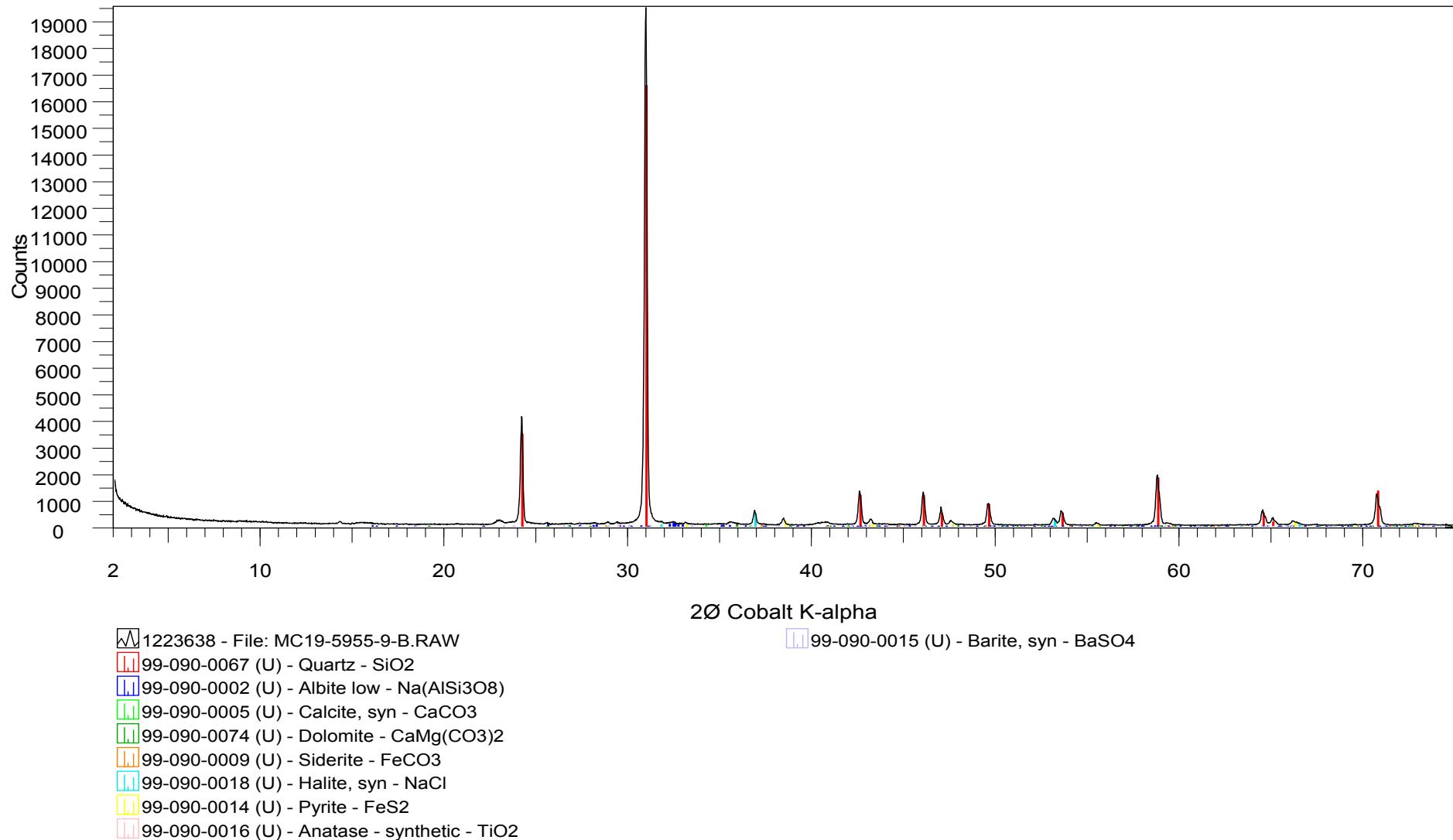
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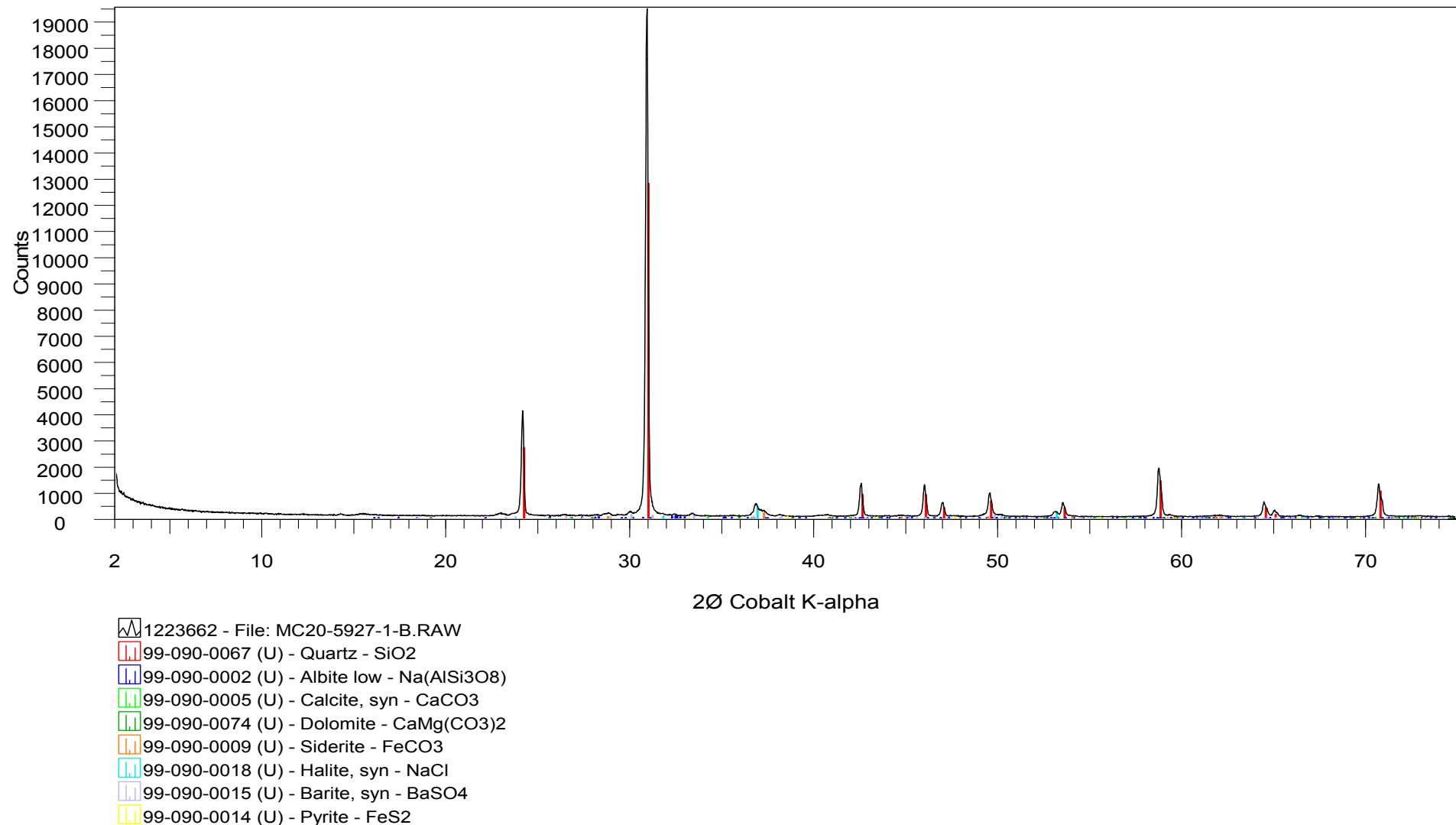
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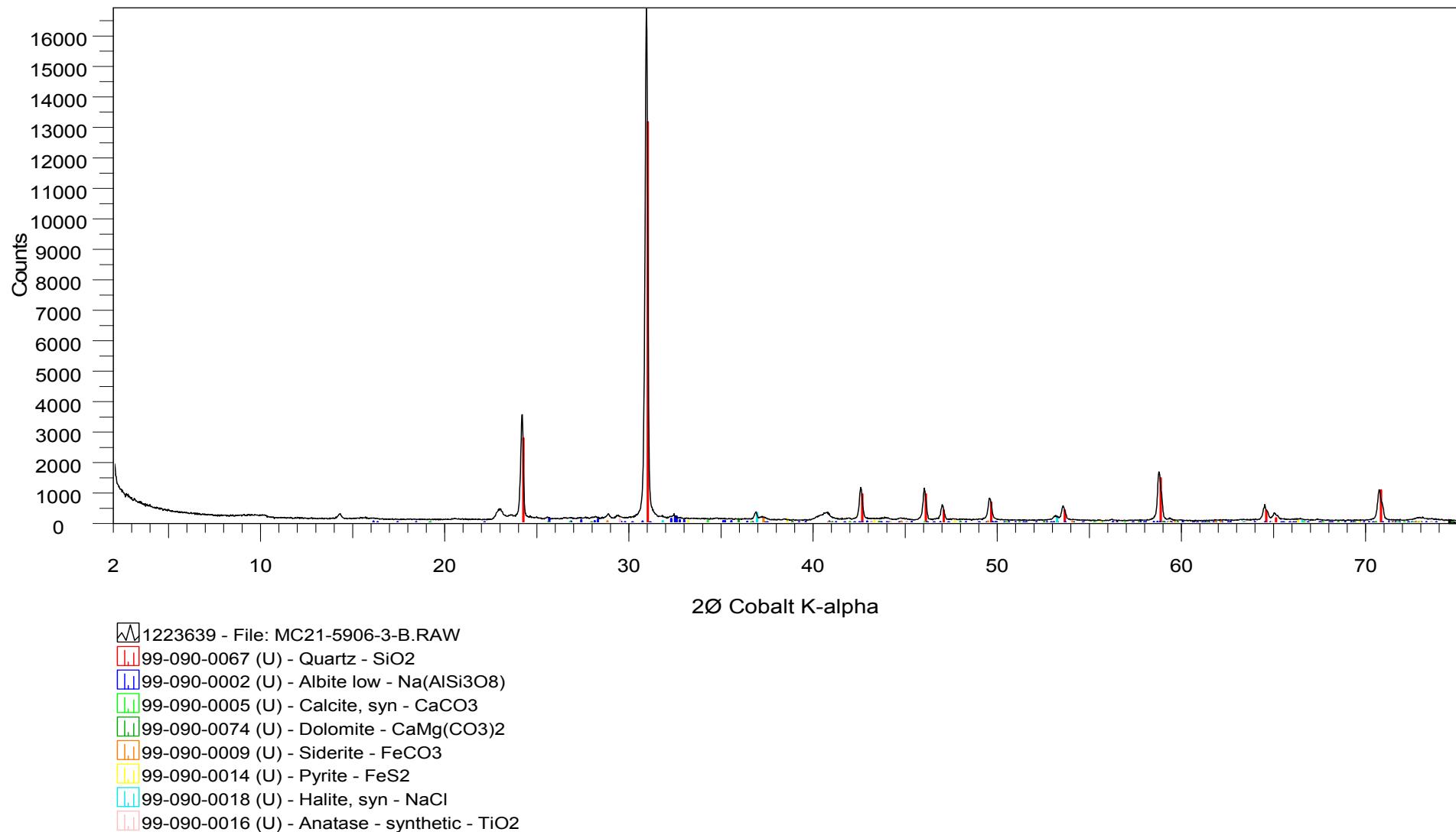




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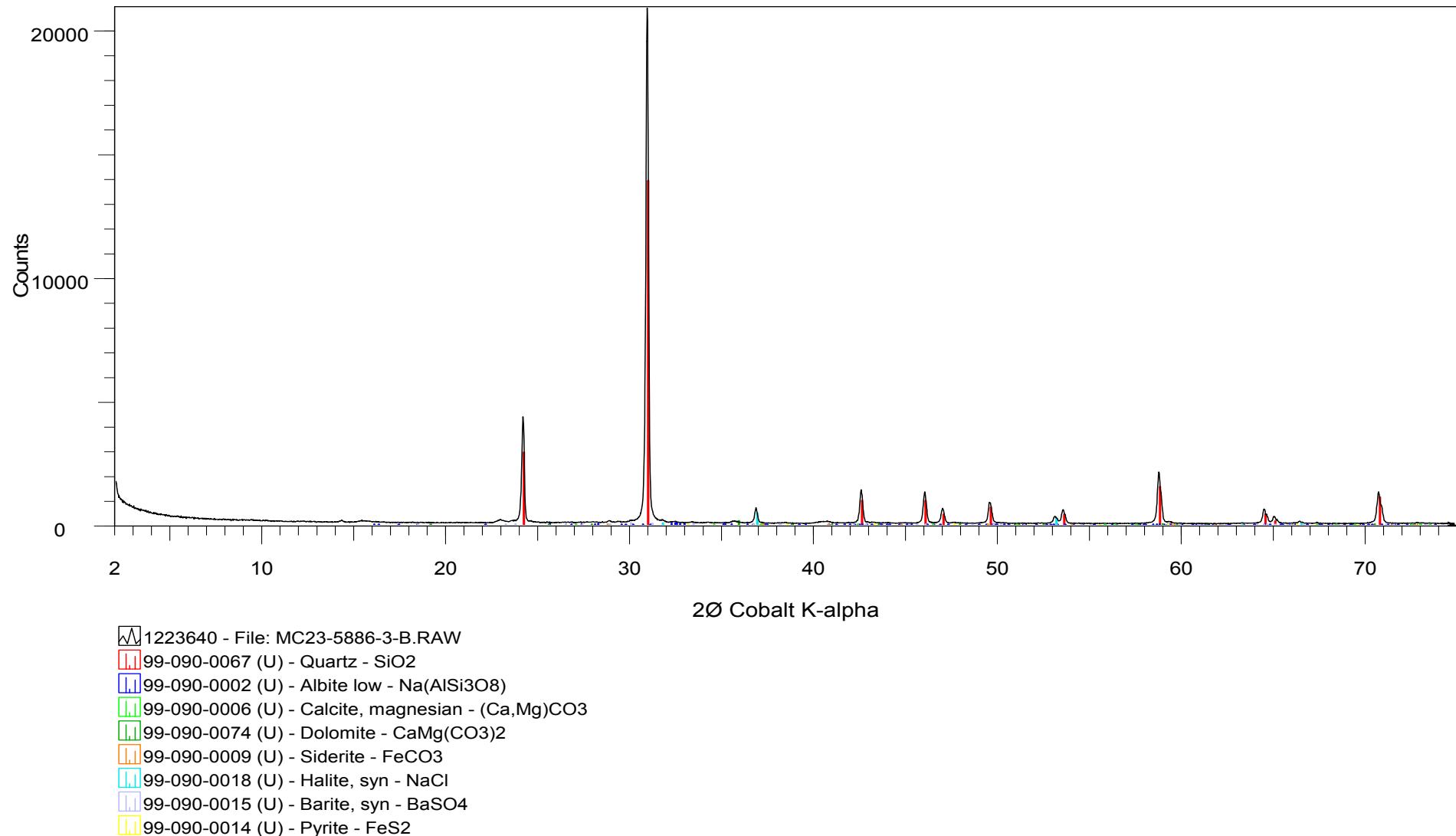
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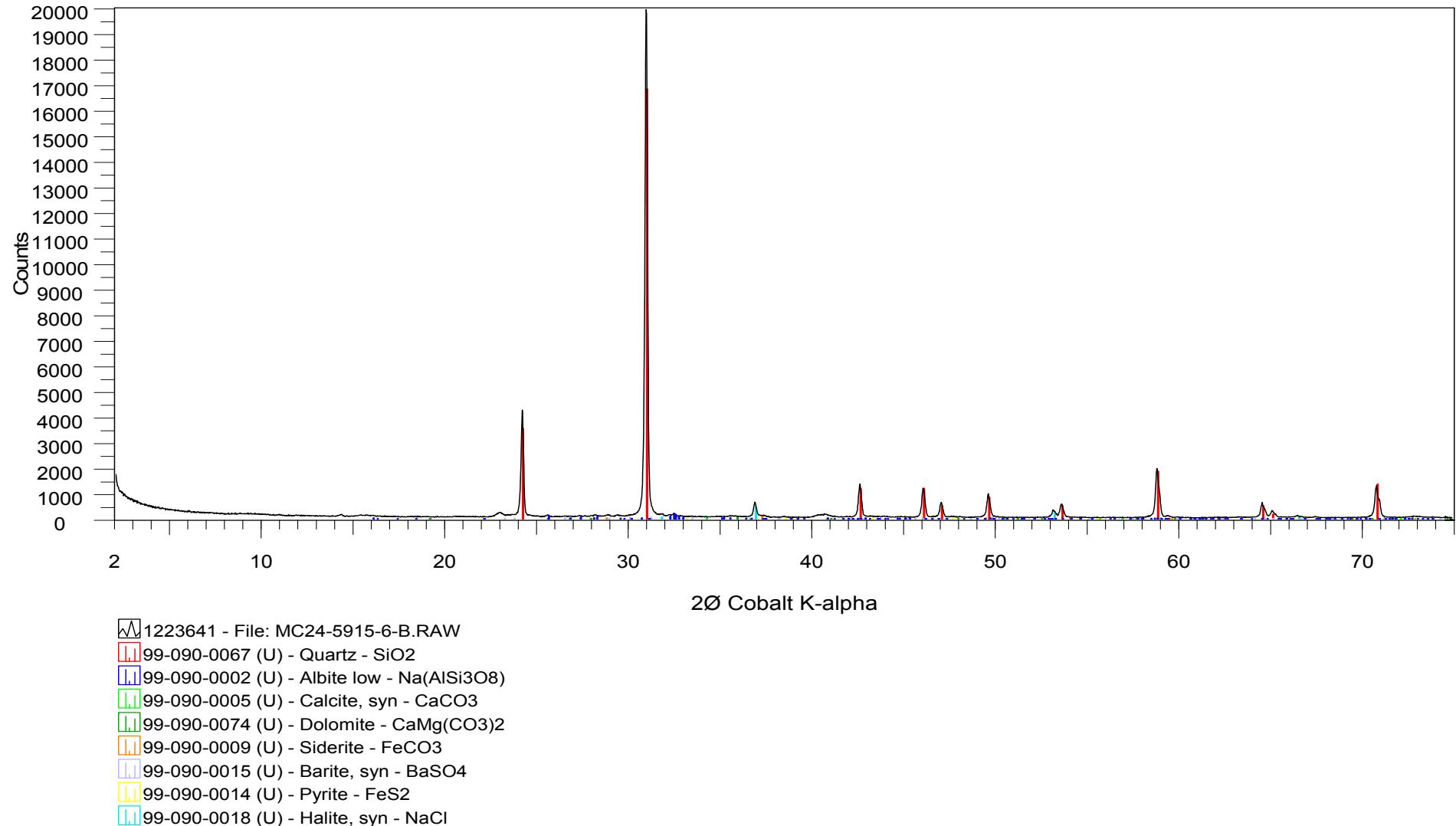
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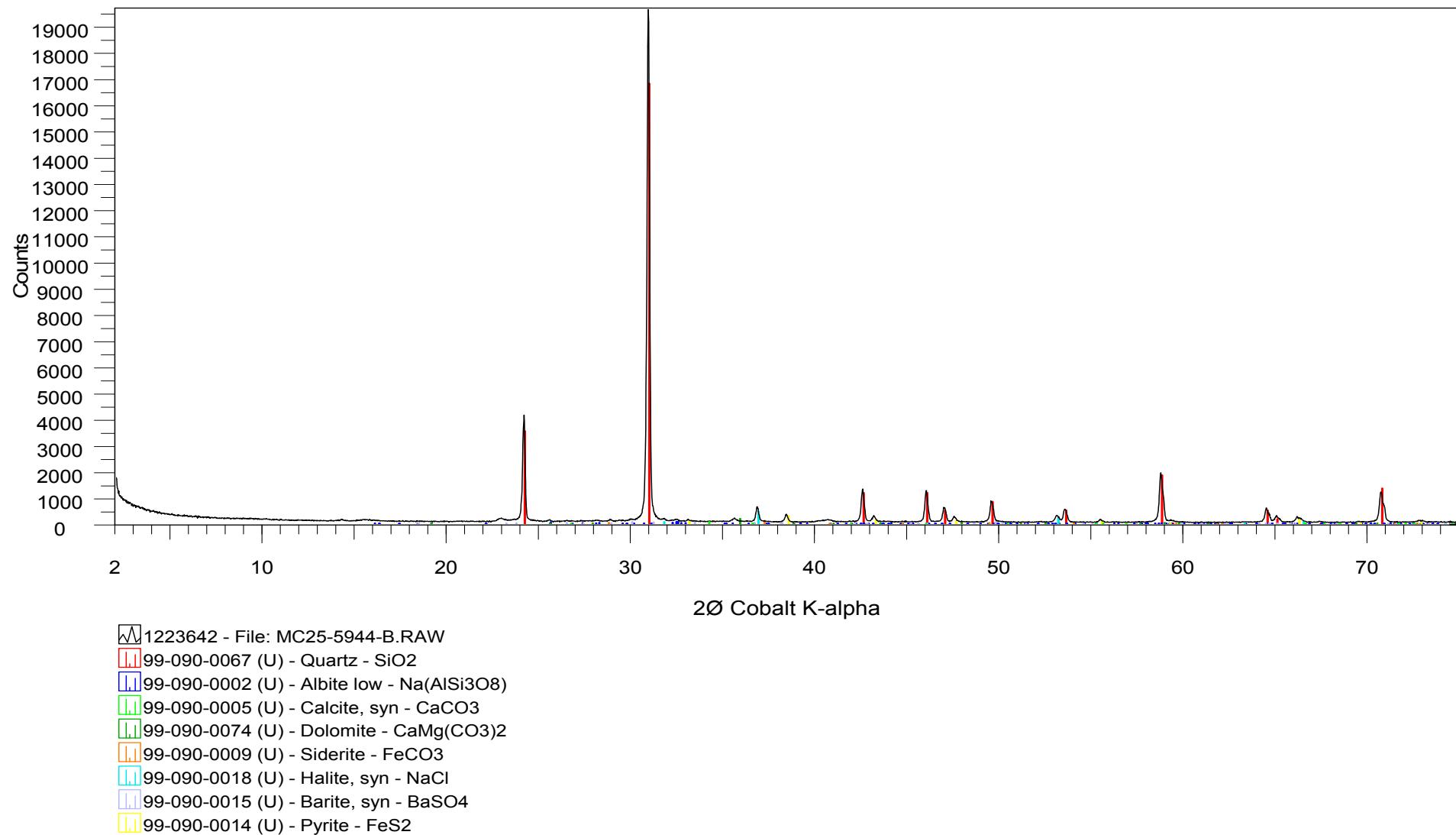
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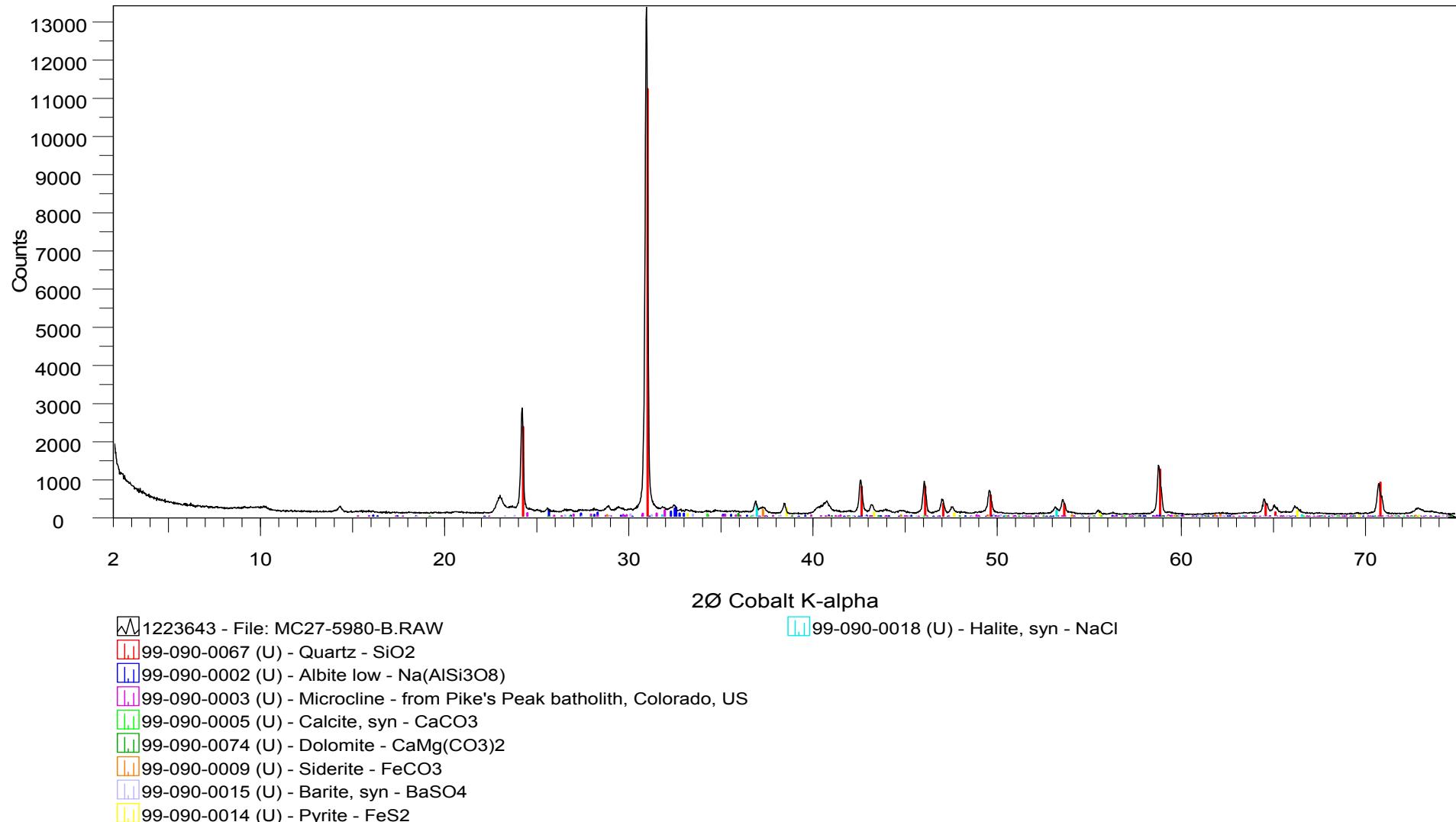
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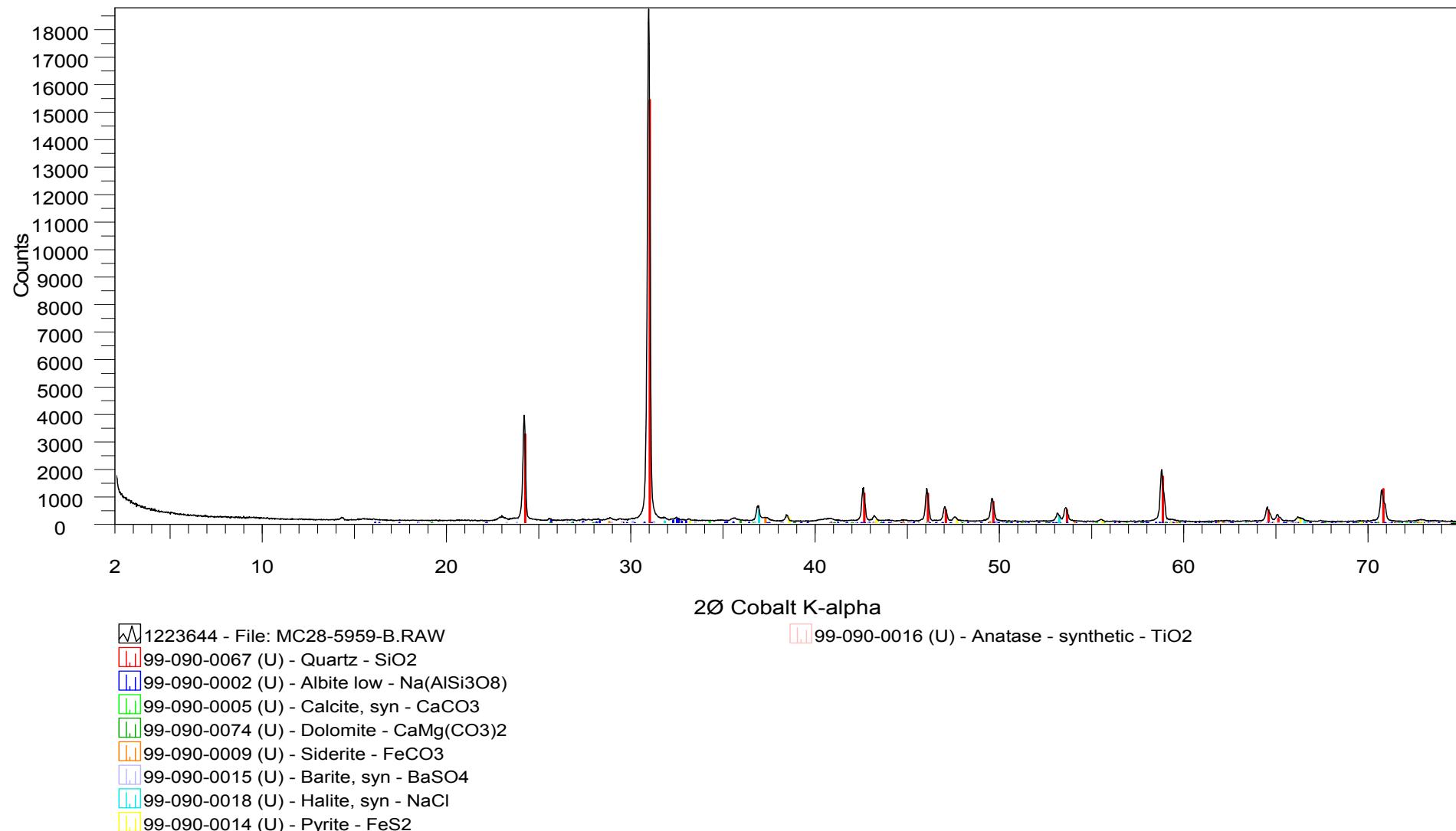
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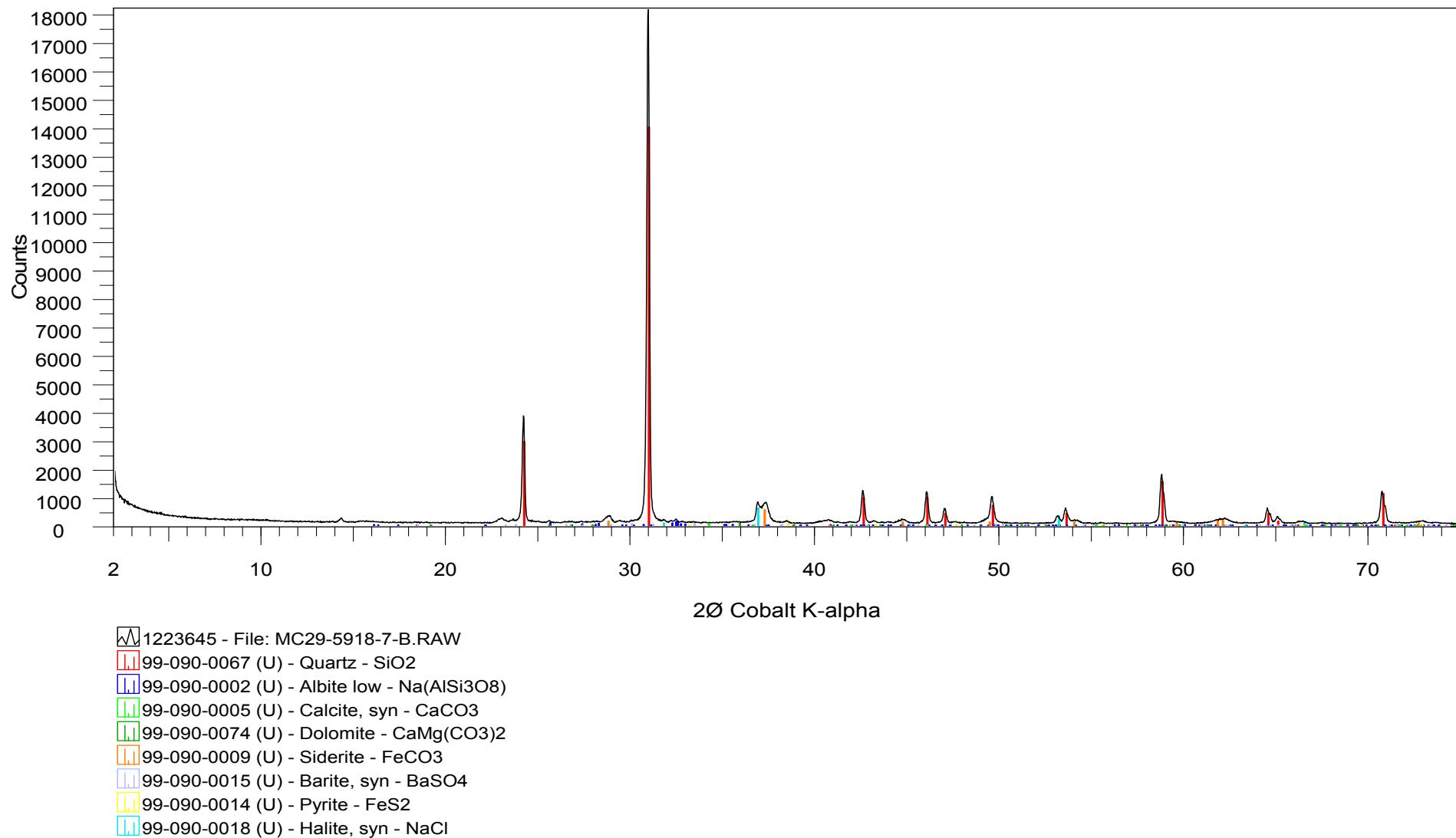
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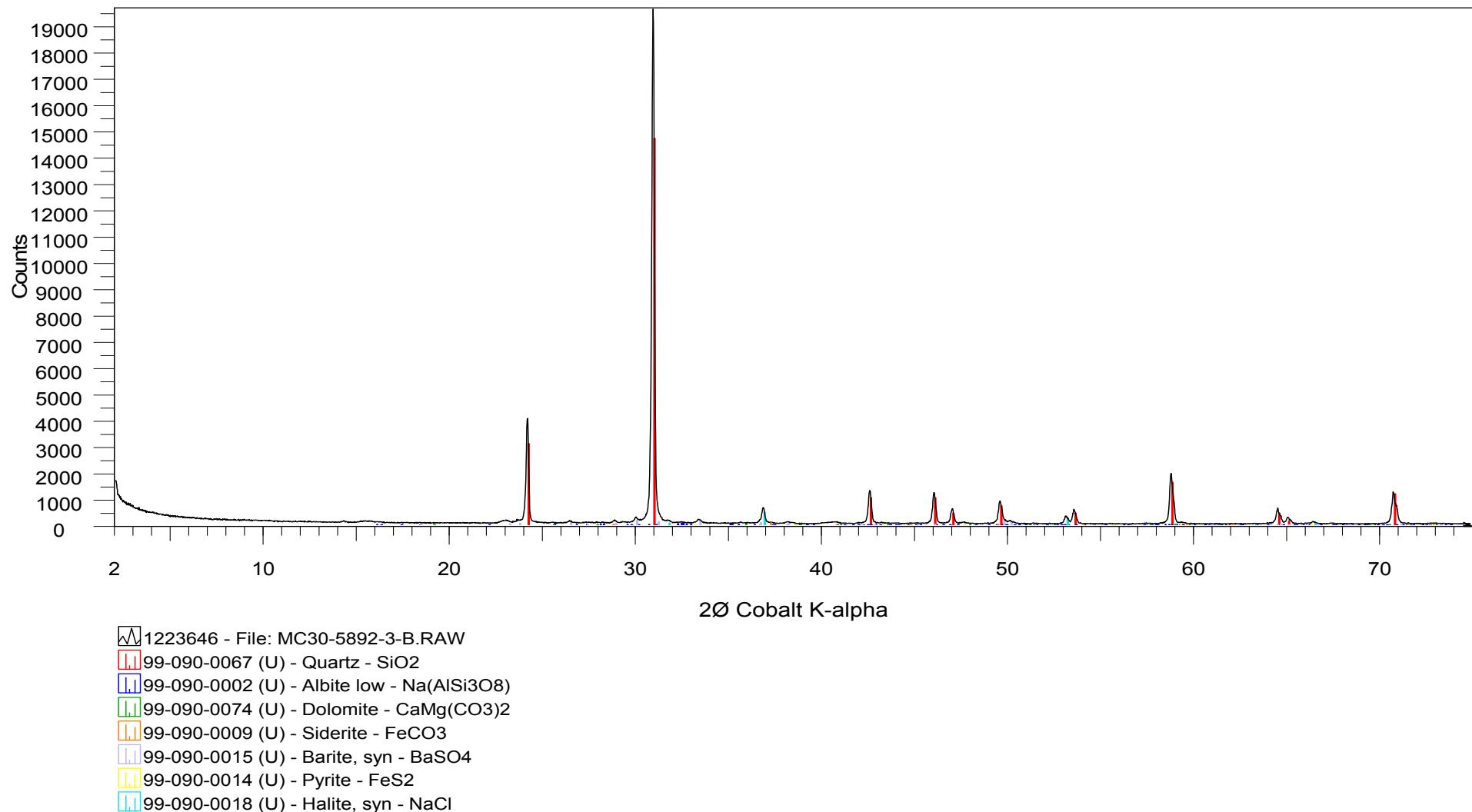
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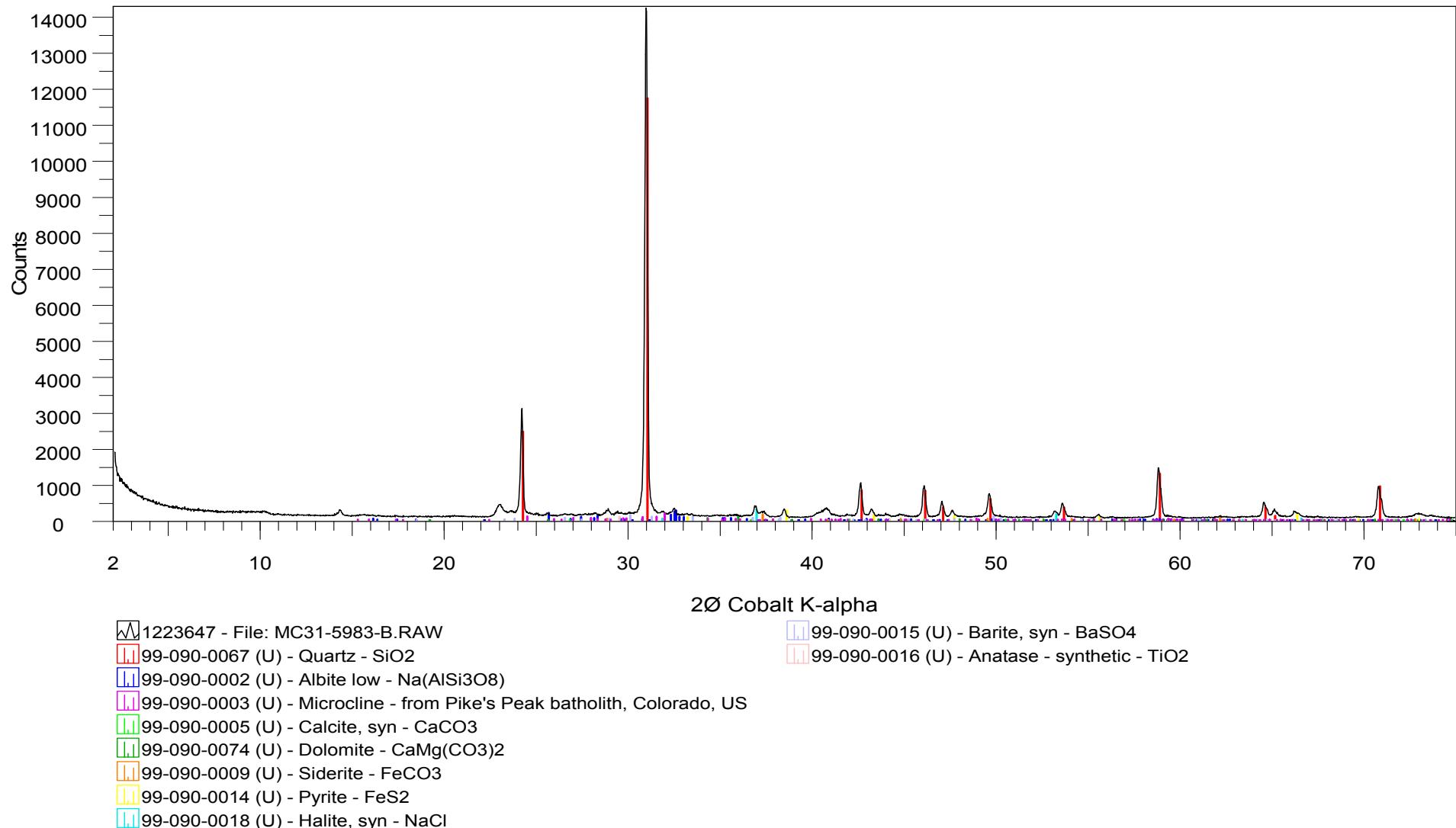
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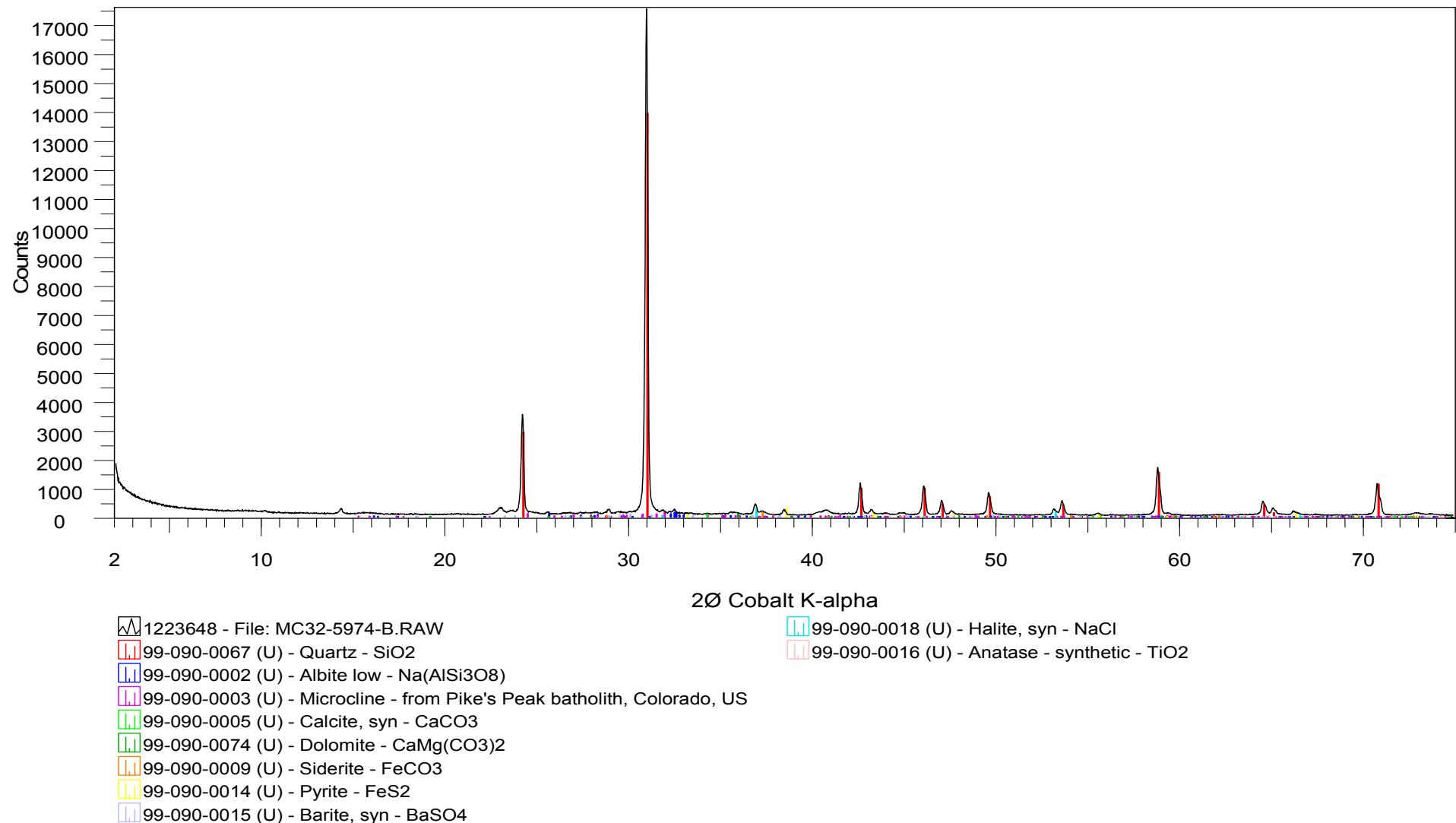
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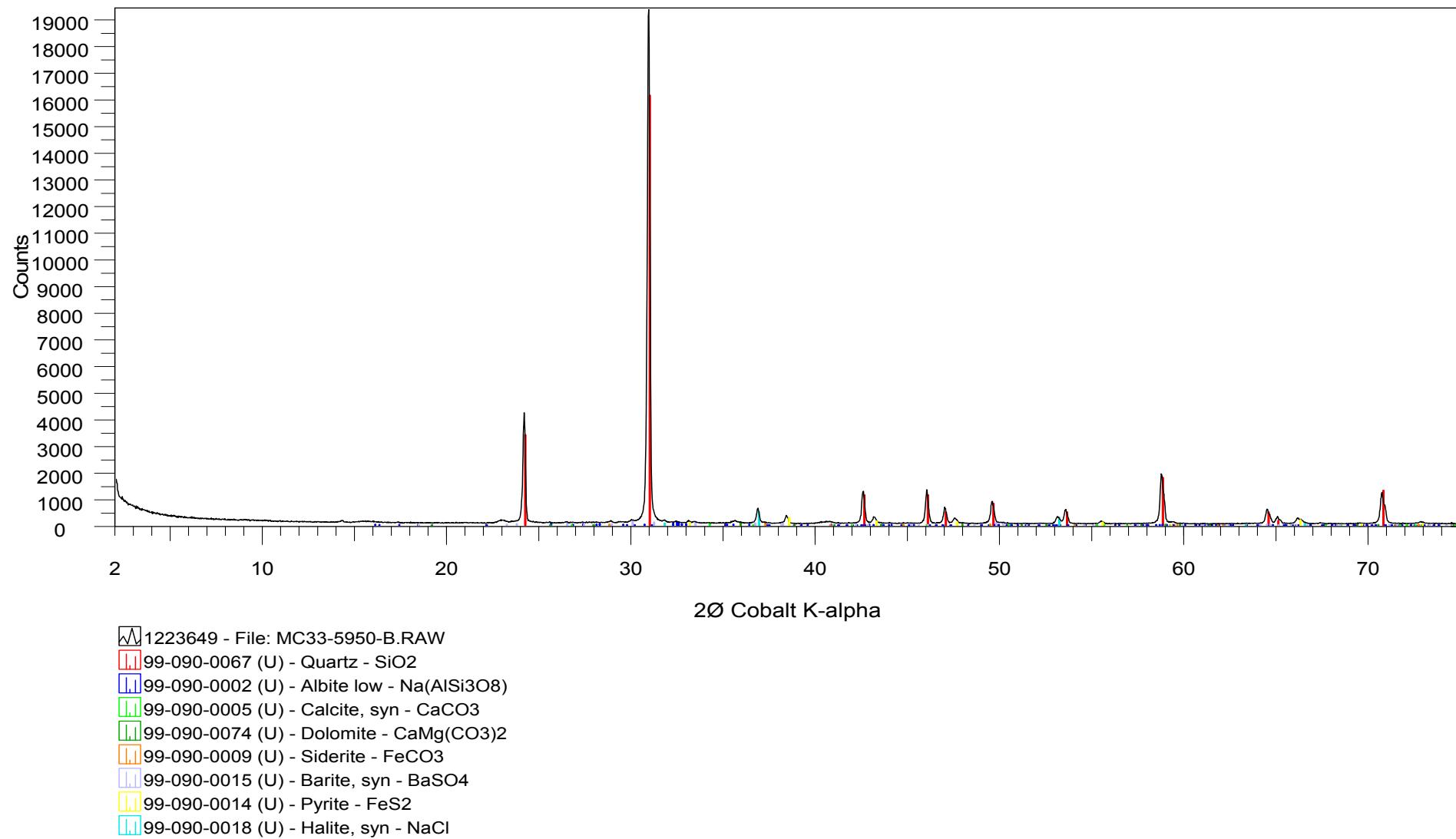
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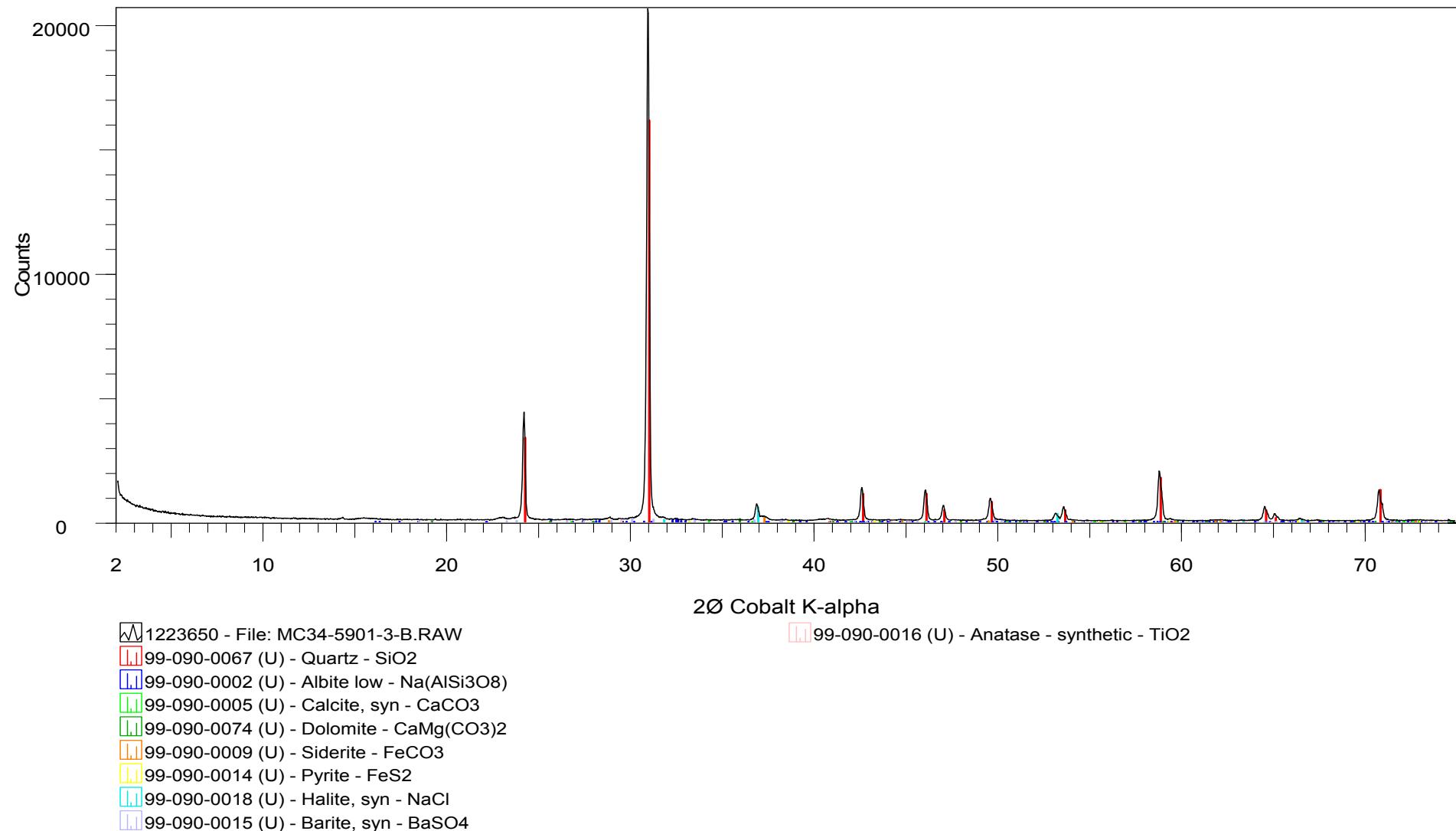
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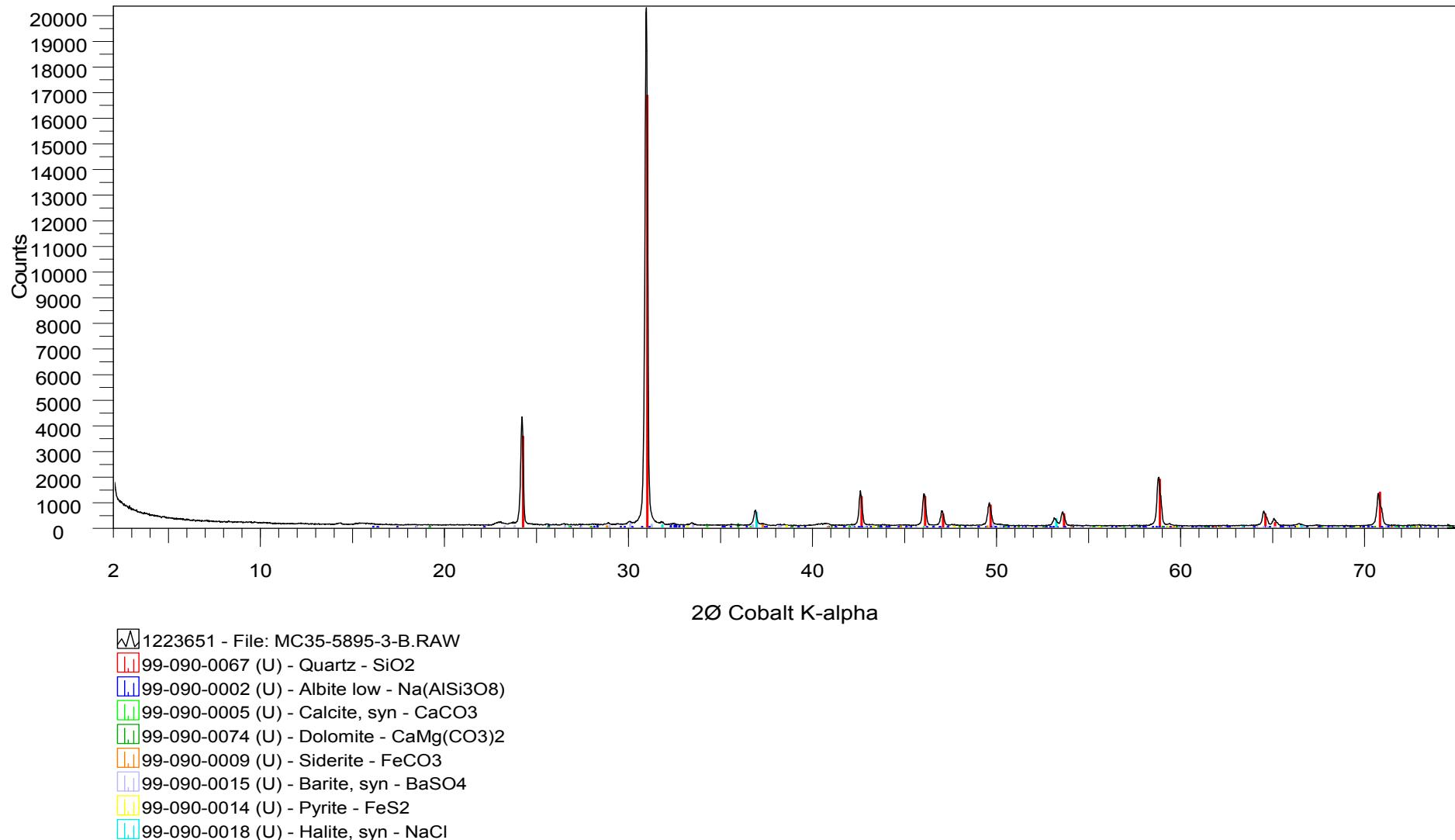


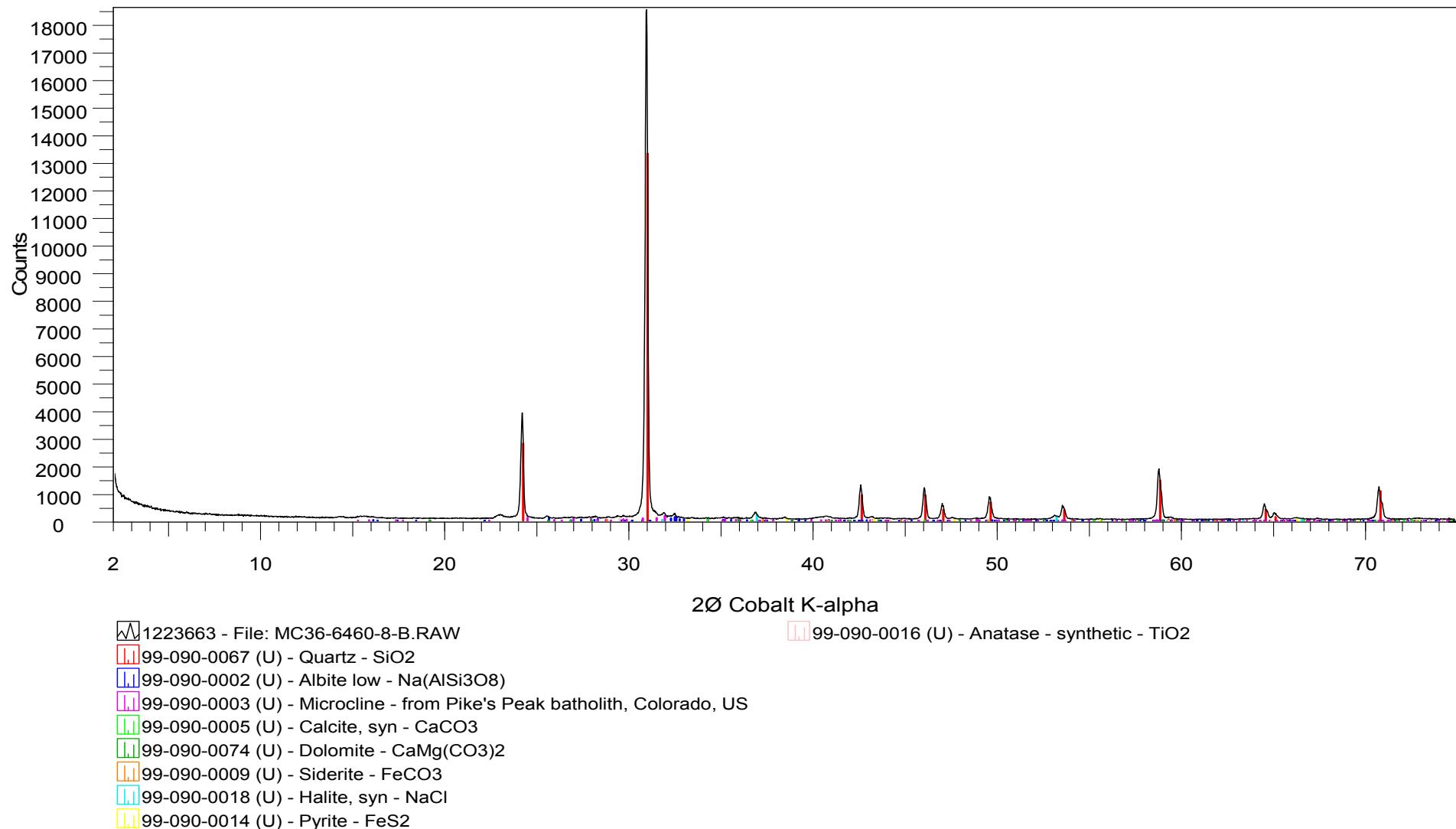
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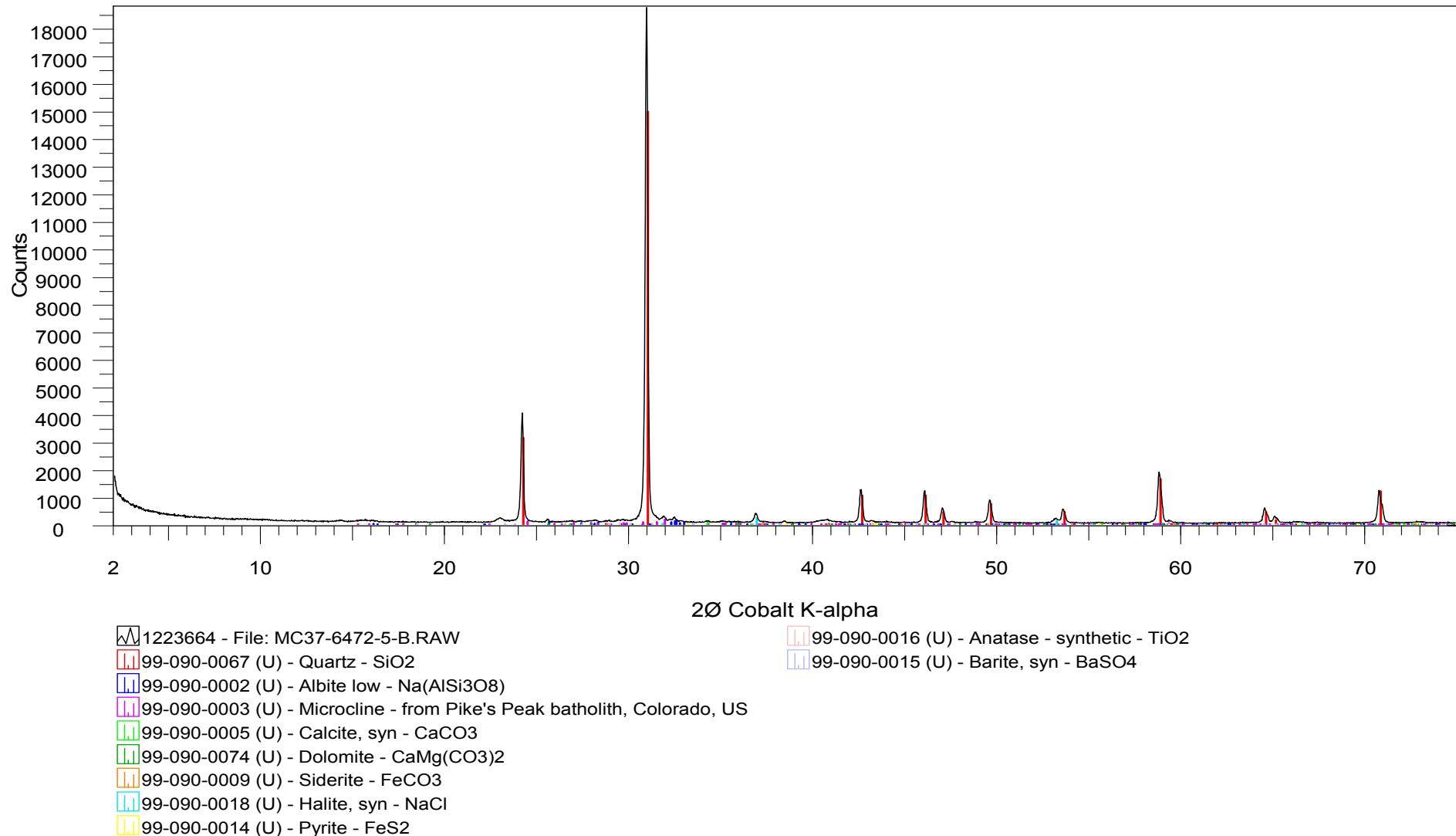






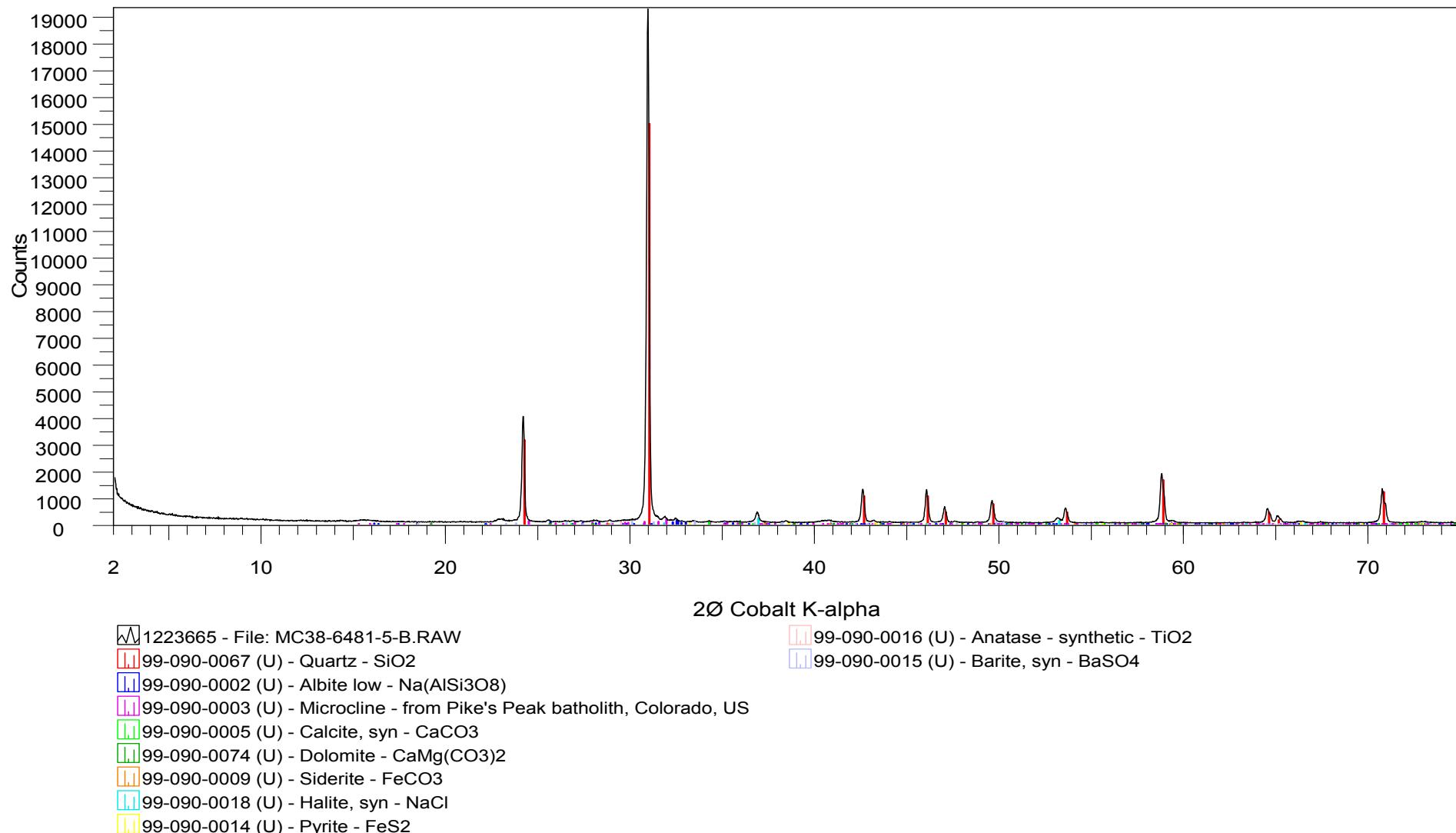
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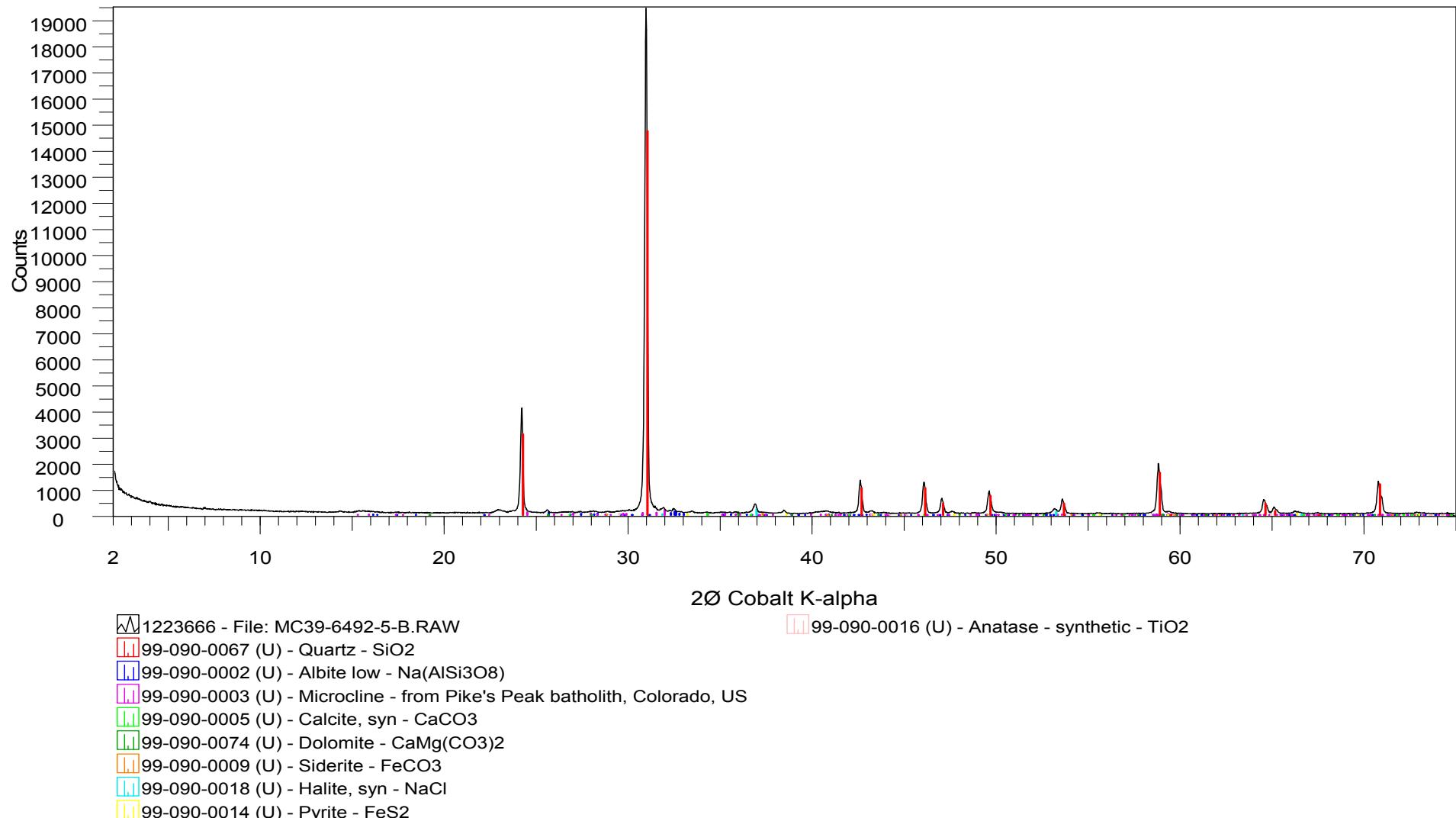
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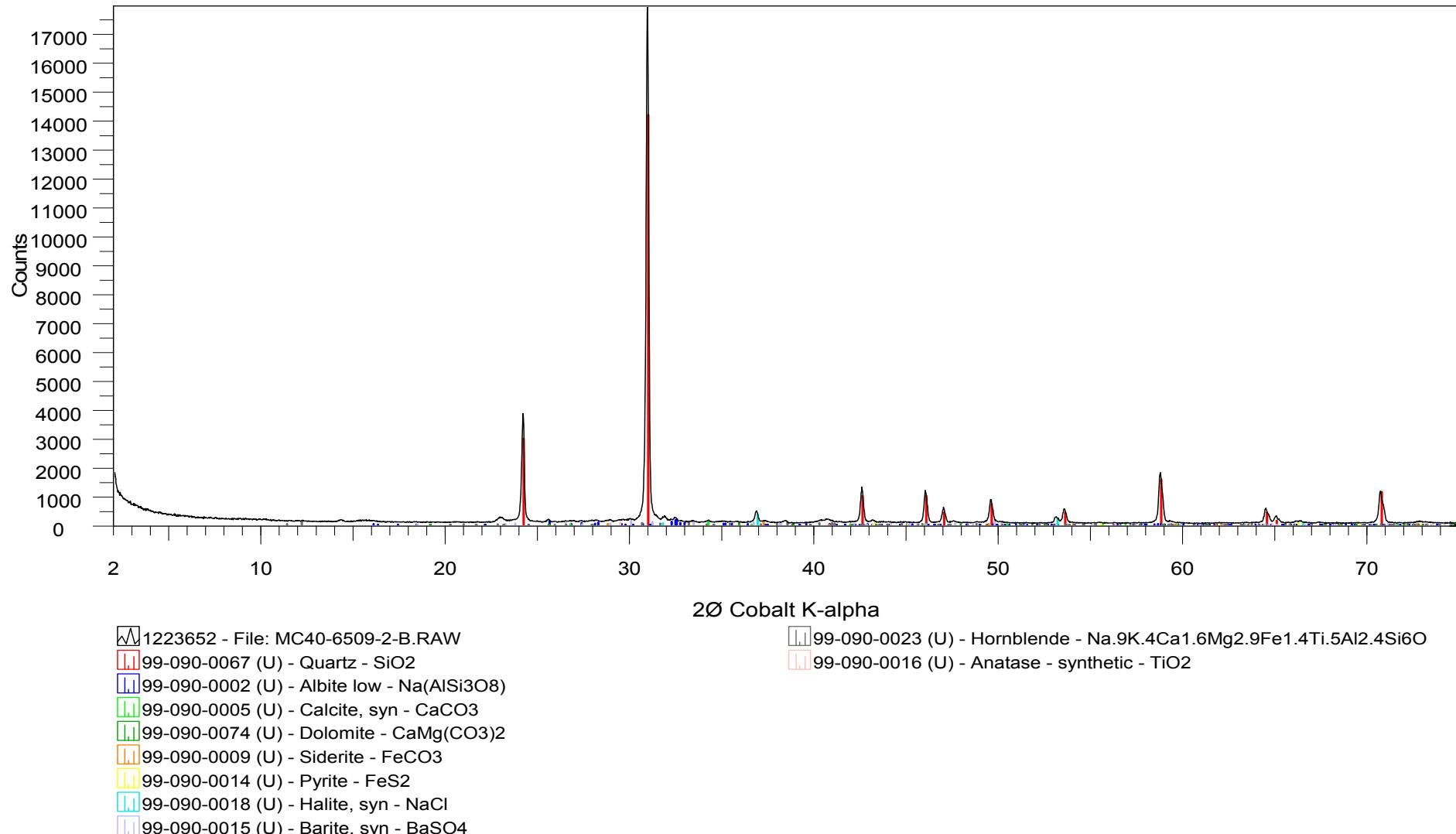
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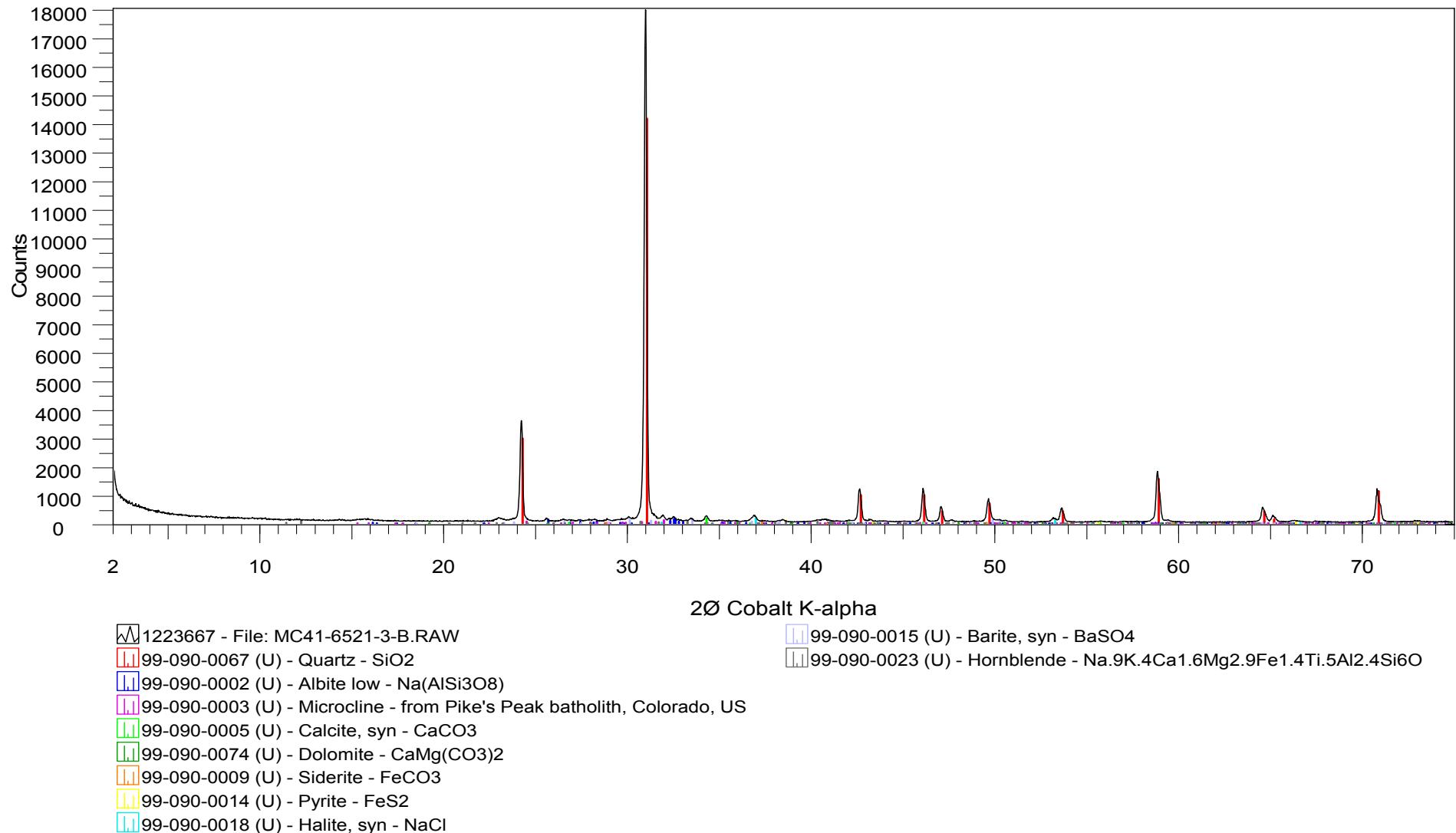
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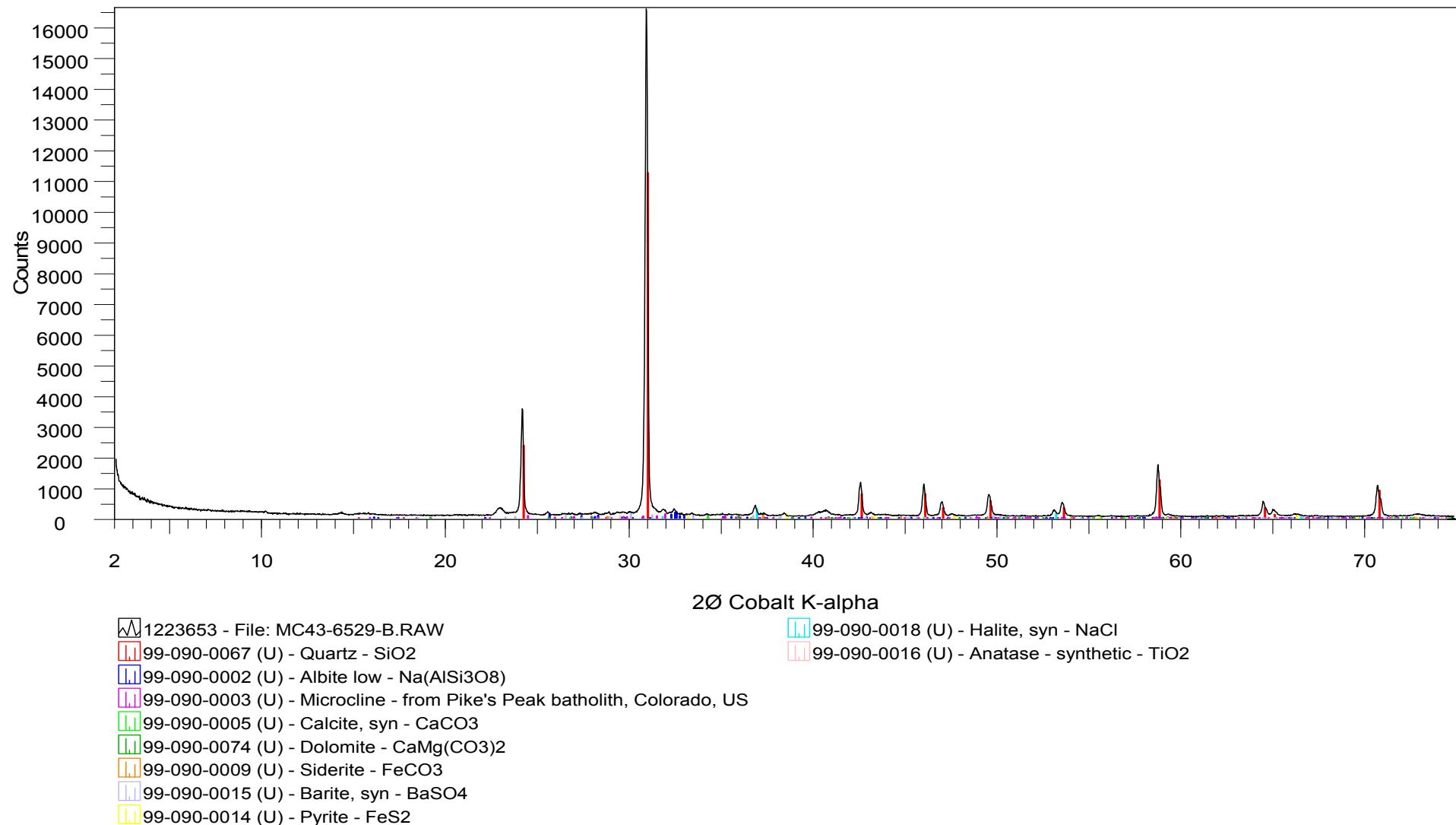




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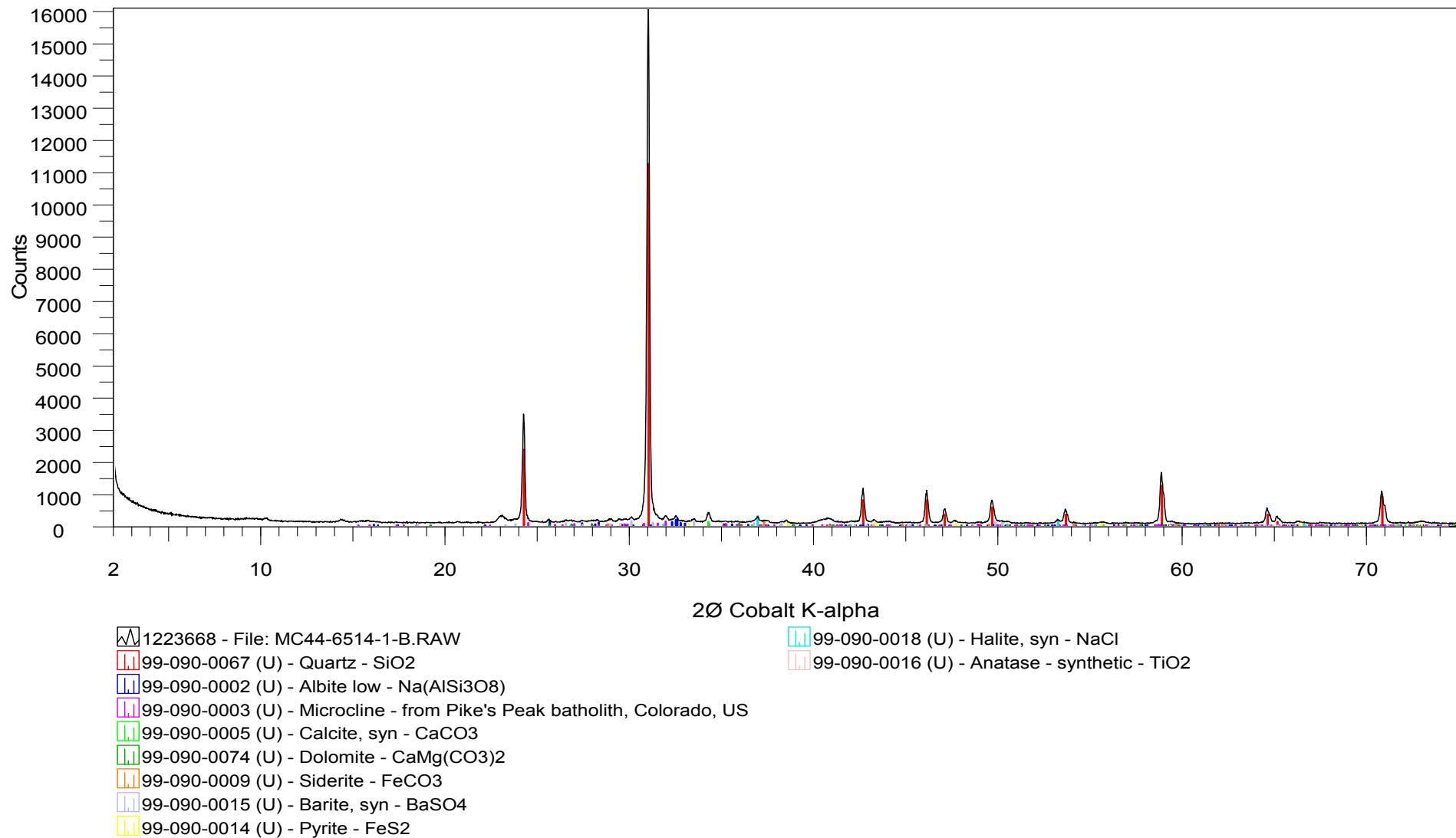
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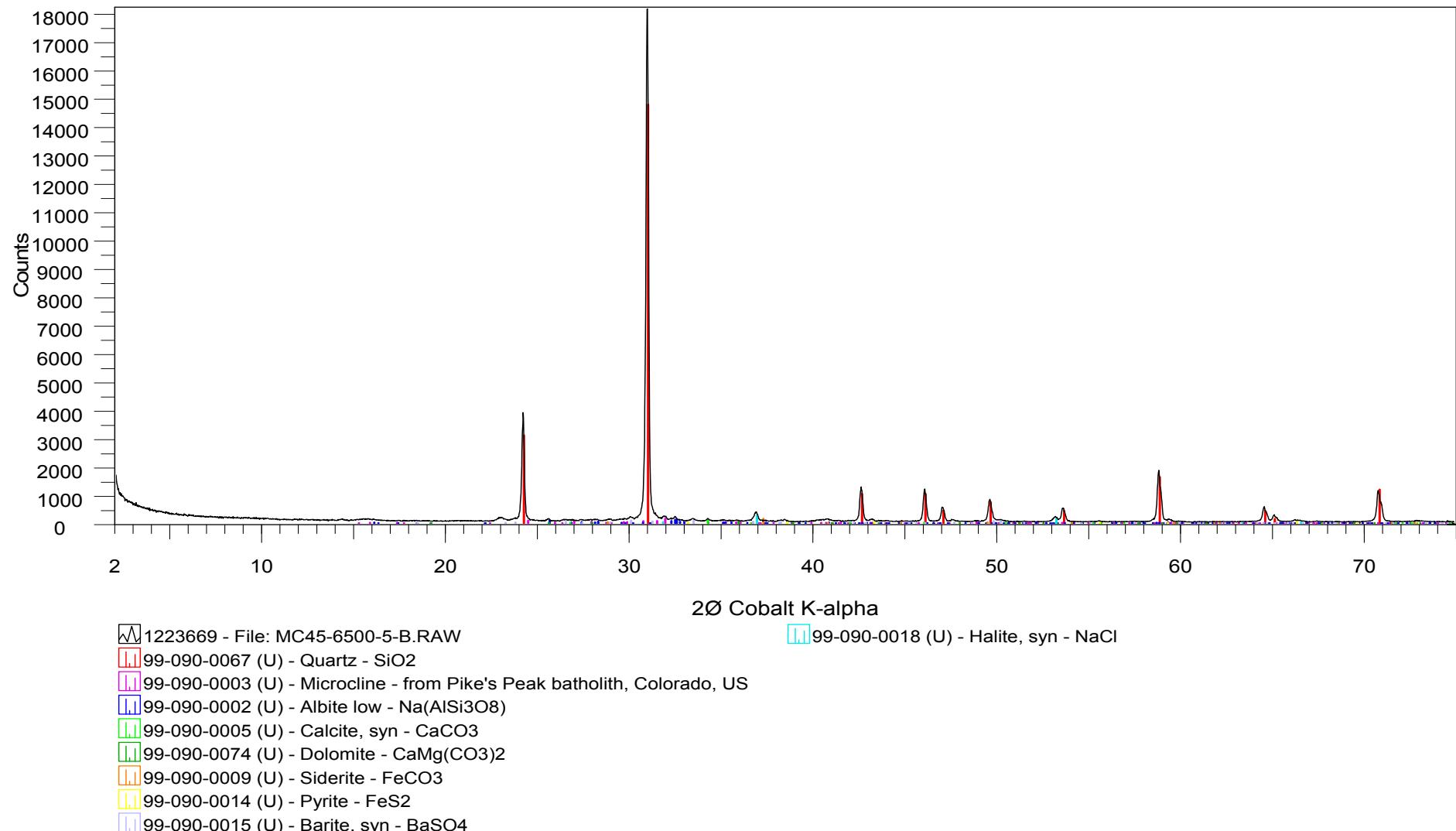
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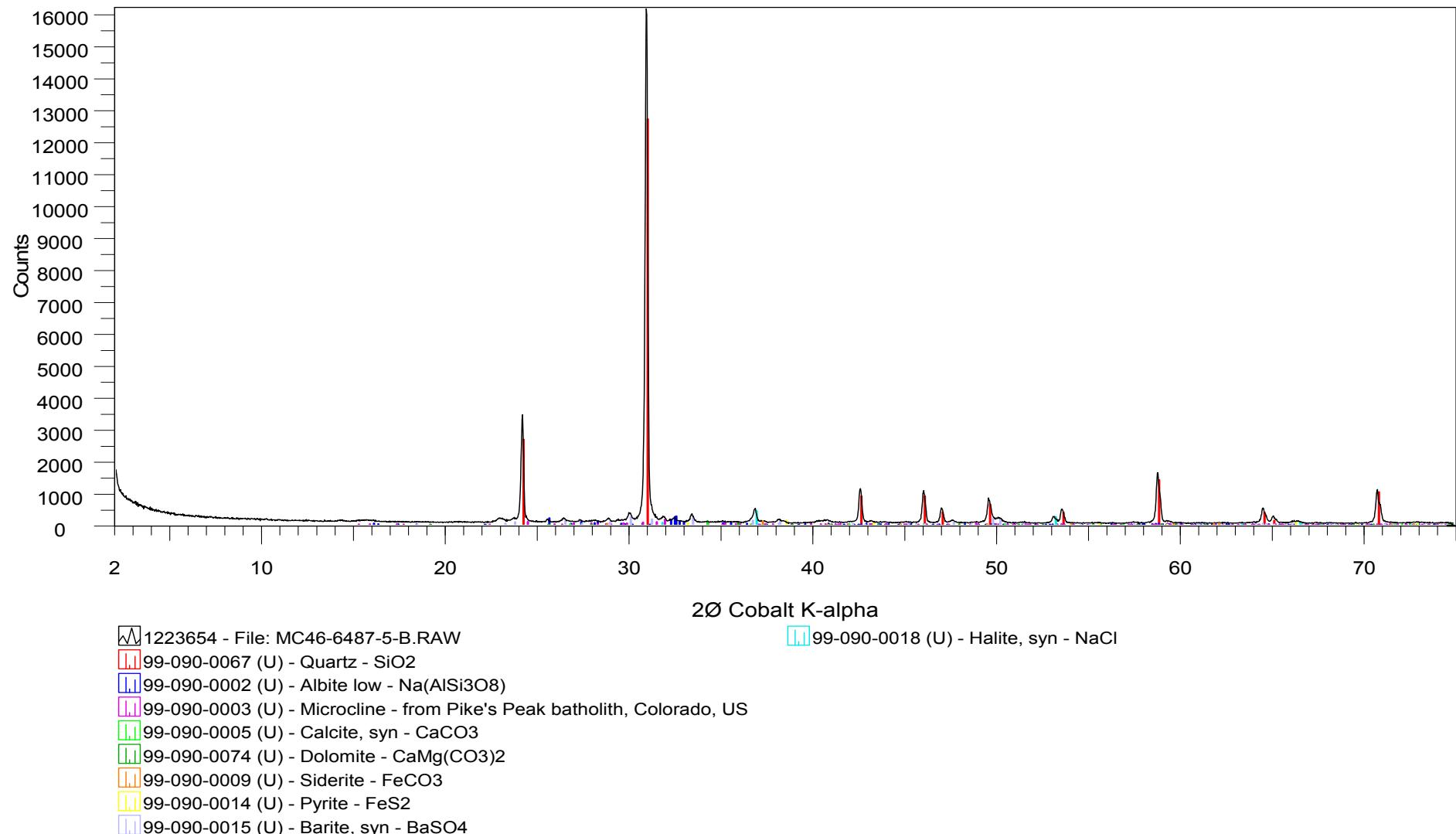
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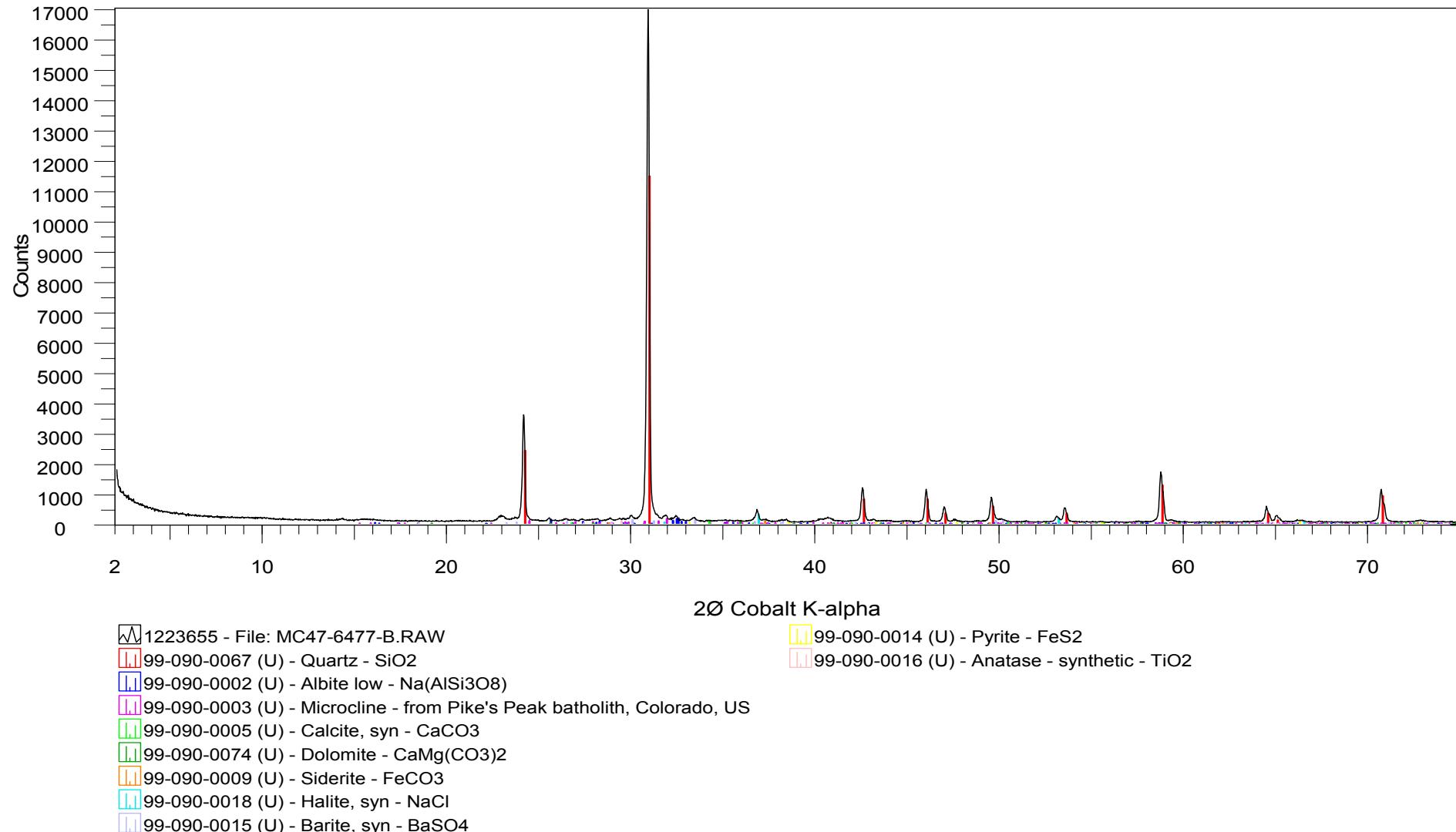
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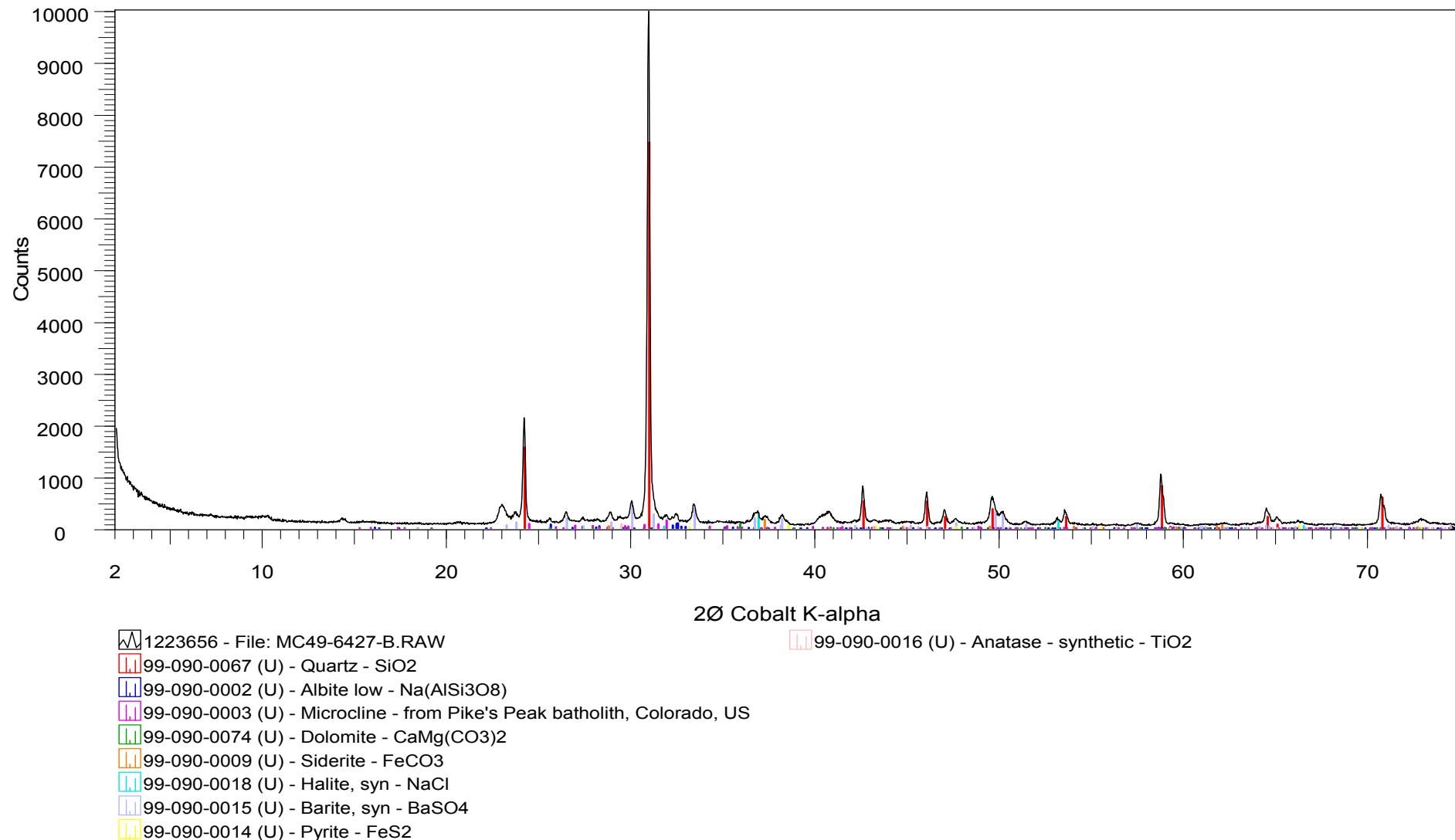




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