The Palaeo-Ecology and Geochemistry of Potential Source and Reservoir Microbialites in the Ediacaran-Cambrian Sirab Formation, Sultanate of Oman.

Volume 2 of 2.

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Degree of Msc. research

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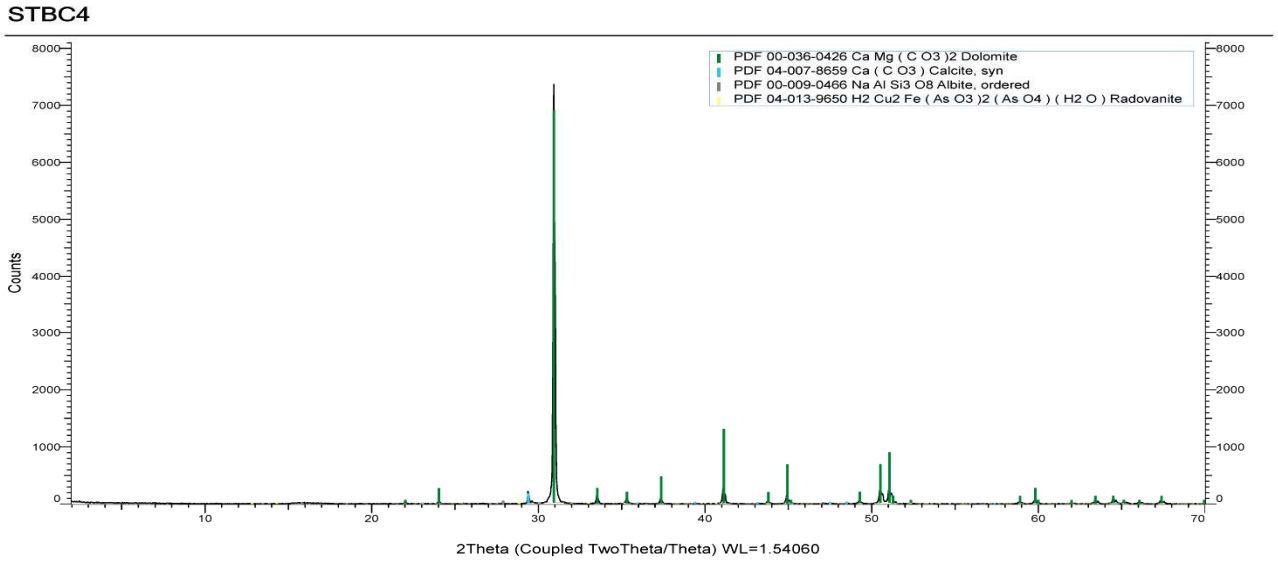
Appendix of volume 1

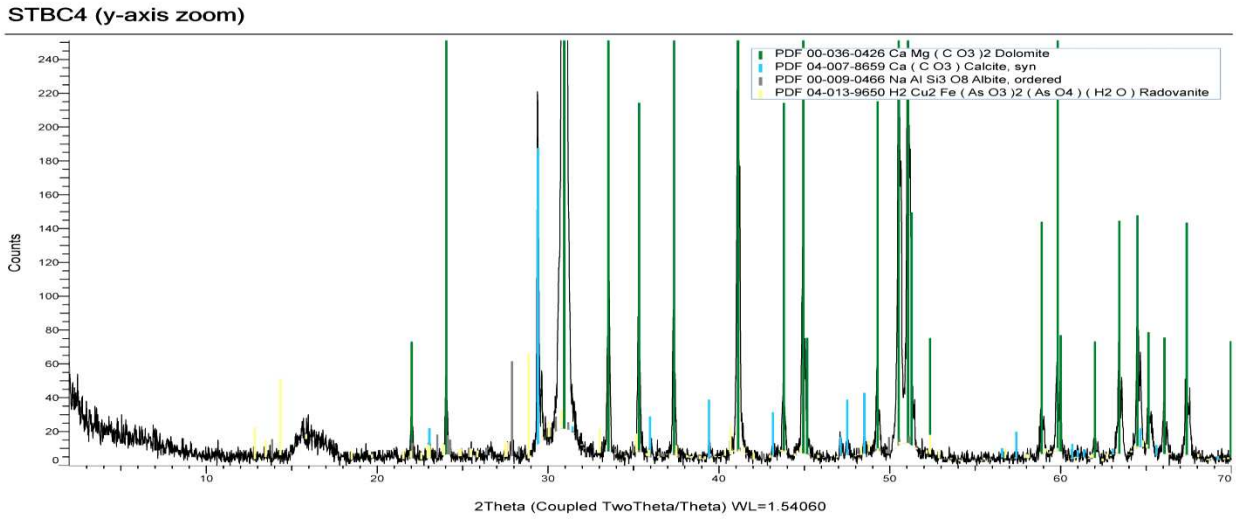
1. Appendix Number 1_XRD Files.

Raw data of XRD Lab analyses for the samples of Wadi-Shital ST-1 & ST-2 section in Sirab Formation.

- Transitional Buah- Ramayli samples.

➢ Sample STB C4.





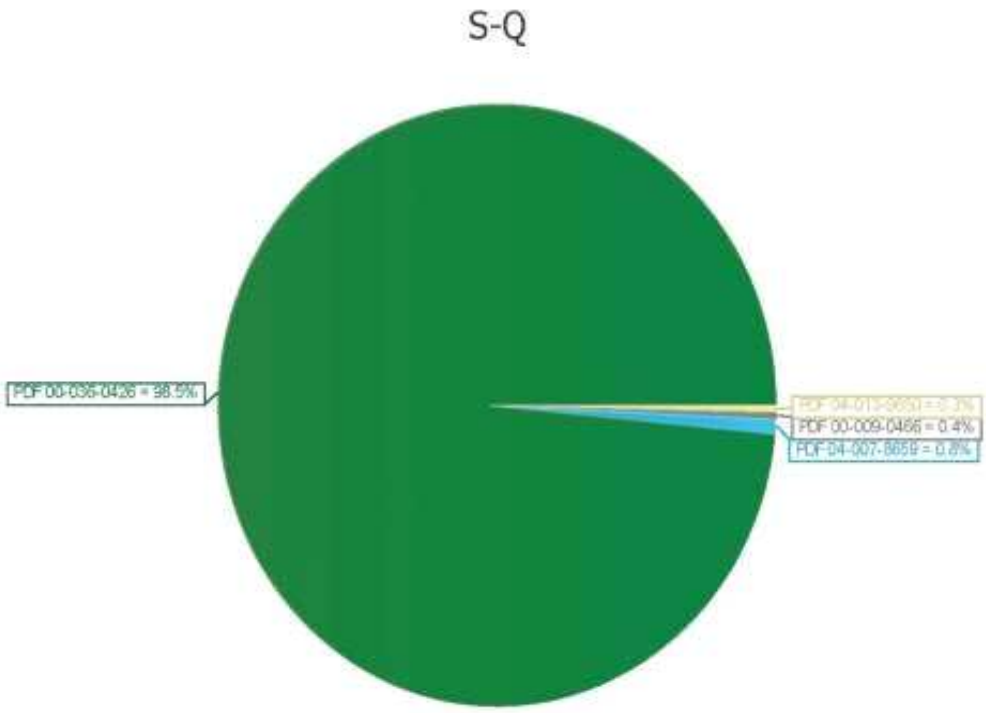
Pattern List #1

Show	Icon	Color	Index	Name	Parent	Scan	Pattern #	Compound Name	Formula
Yes			0	PDF 00-036-0426	Pattern List #1	TD18_0543.raw #1	PDF 00-036-0426	Dolomite	Ca Mg (C O3)2
Yes			1	PDF 04-007-8659	Pattern List #1	TD18_0543.raw #1	PDF 04-007-8659	Calcite, syn	Ca (C O3)
Yes			2	PDF 00-009-0466	Pattern List #1	TD18_0543.raw #1	PDF 00-009-0466	Albite, ordered	Na Al Si3 O8
Yes			3	PDF 04-013-9650	Pattern List #1	TD18_0543.raw #1	PDF 04-013-9650	Radovanite	H2 Cu2 Fe (As O3)2 (As O4) (H2 O)

Quality	Y-Scale	I/Ic DB	I/Ic User	S-Q	Added Reference	d x by	Scan WL	Wavelength	System	Space Group	a	b	c
Star (*)	93.41%	(1)	0.000	98.5%		1.0000	Yes	1.54060	Rhombo.H axes	R-3 (148)	4.80920		16.02600
Indexed	2.38%	3.200	0.000	0.8%		1.0000	Yes	1.54060	Rhombo.H axes	R-3c (167)	4.98900		17.06200
Star (*)	0.76%	2.100	0.000	0.4%		1.0000	Yes	1.54060	Triclinic	C-1 (2)	8.14400	12.78700	7.16000
Star (*)	0.85%	2.770	0.000	0.3%		1.0000	Yes	1.54060	Orthorhombic	Pnma (62)	9.58500	13.14300	8.08840

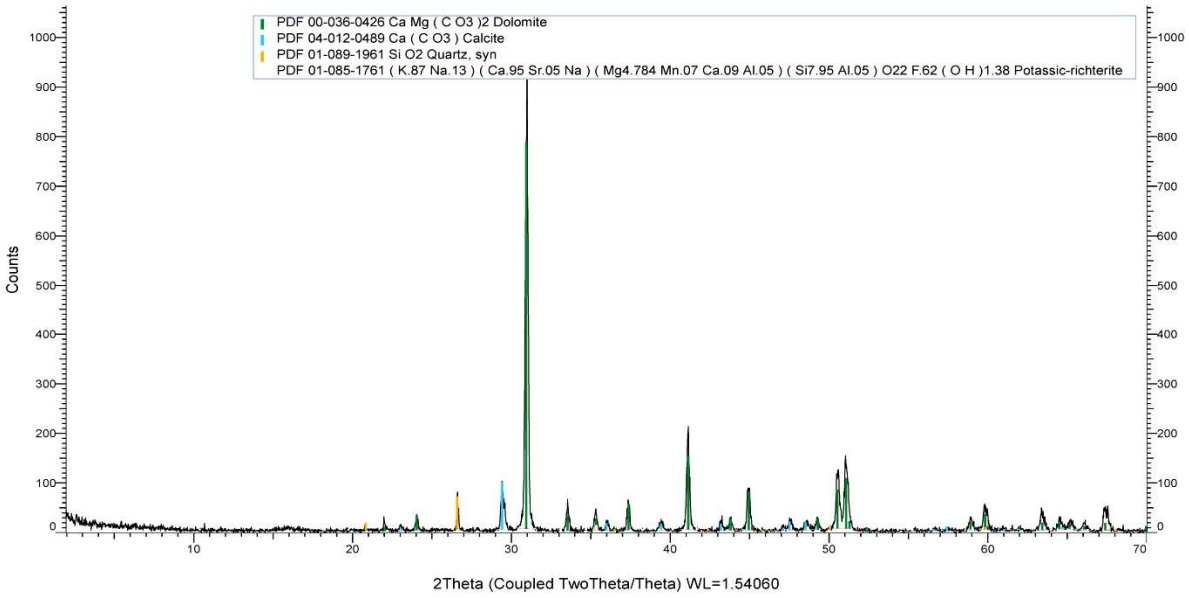
alpha	beta	gamma	Z	Volume	Density	Cell Tuned	F (N)
			3	320.88	2.860	No	F30= 146.5(0.0064, 32)
			6	367.78	2.711	No	F30= 999.9(0.0000, 30)
94.260	116.600	87.670	4	332.42	2.605	No	F30= 36.1(0.0139, 60)
			4	1018.94	3.831	No	F30= 161.1(0.0052, 36)

STBC4 (Coupled TwoTheta/Theta)

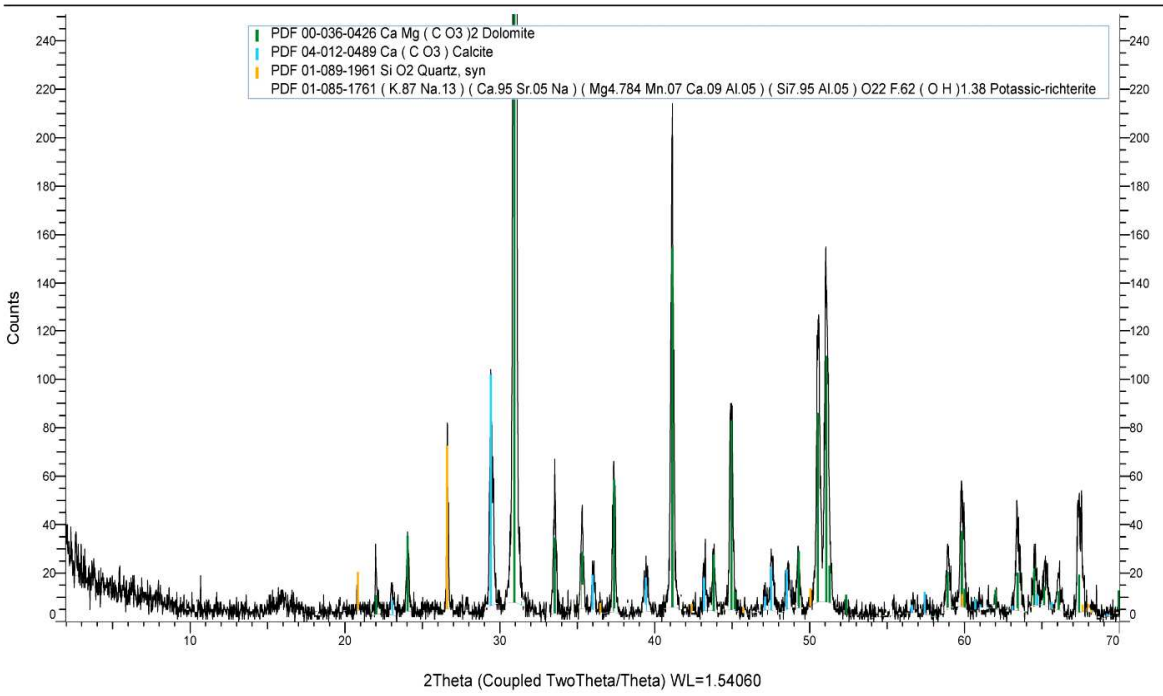


- Sample STB C6.

STBC6



STBC6 (y-axis zoom)



Pattern List #1

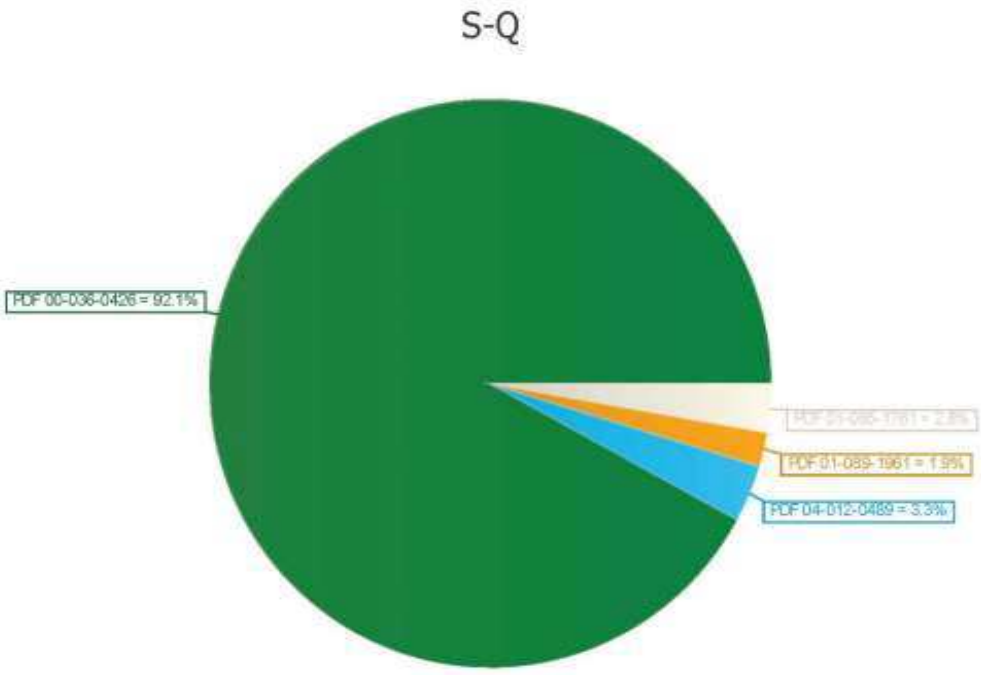
Show	Icon	Color	Index	Name	Parent	Scan	Pattern #	Compound Name
Yes			0	PDF 00-036-0426	Pattern List #1	TD18_0544.raw #1	PDF 00-036-0426	Dolomite
Yes			1	PDF 04-012-0489	Pattern List #1	TD18_0544.raw #1	PDF 04-012-0489	Calcite
Yes			2	PDF 01-089-1961	Pattern List #1	TD18_0544.raw #1	PDF 01-089-1961	Quartz, syn
Yes			3	PDF 01-085-1761	Pattern List #1	TD18_0544.raw #1	PDF 01-085-1761	Potassic-richterite

Formula	Quality	Y-Scale	I/Ic DB	I/Ic User	S-Q	Added Reference	d x by
Ca Mg (C O3)2	Star (*)	80.85%	(1)	0.000	92.1%		1.0000
Ca (C O3)	Indexed	9.87%	3.450	0.000	3.3%		1.0000
Si O2	Indexed	6.96%	4.110	0.000	1.9%		1.0000
(K.87 Na.13) (Ca.95 Sr.05 Na) (Mg4.784 Mn.07 Ca.09 Al.05) (Si7.95 Al.05) O22 F.62 (O H)1.38	Indexed	1.33%	0.550	0.000	2.8%		1.0000

Scan WL	Wavelength	System	Space Group	a	b	c	alpha	beta	gamma	Z	Volume	Density	Cell Tuned
Yes	1.54060	Rhombo.H.axes	R-3 (148)	4.80920		16.02000				3	320.88	2.860	No
Yes	1.54060	Rhombo.H.axes	R-3c (167)	4.98700		17.05800				6	367.40	2.714	No
Yes	1.54060	Hexagonal	P6222 (180)	4.92100		5.41600				3	113.58	2.635	No
Yes	1.54060	Monoclinic	C2/m (12)	9.99800	17.97600	5.27300		104.753		2	916.44	3.042	No

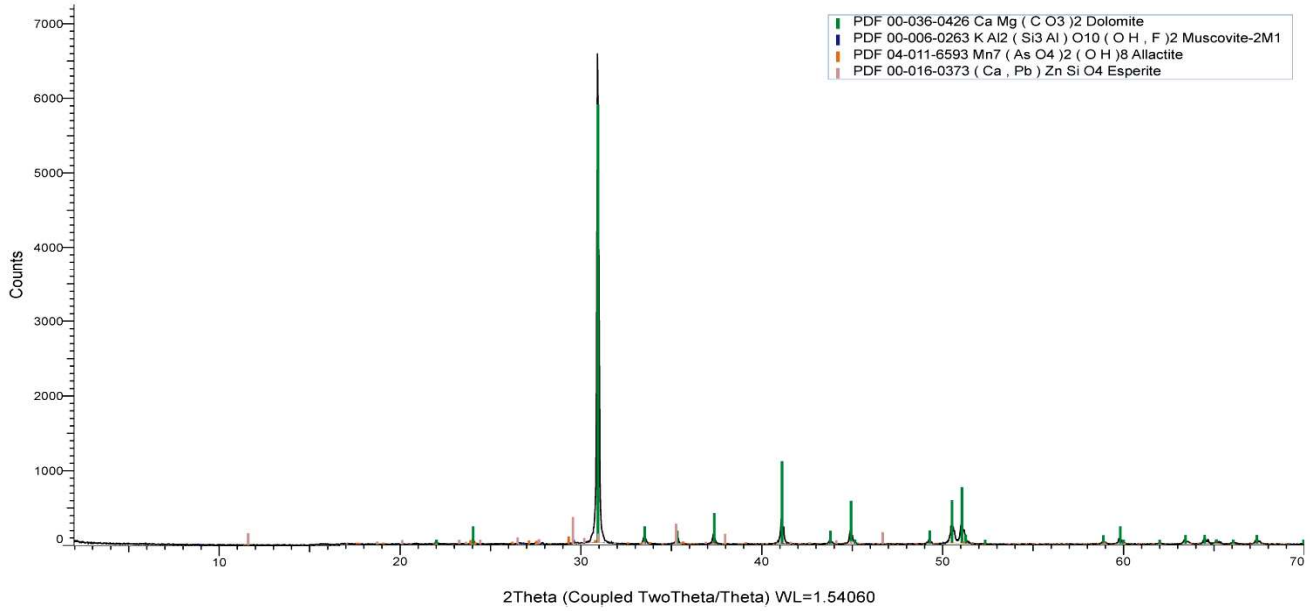
F (N)
F30= 146.5(0.0064, 32)
F30= 999.9(0.0000, 31)
F30= 999.9(0.0000, 31)
F30= 405.3(0.0020, 37)

STBC6 (Coupled TwoTheta/Theta)

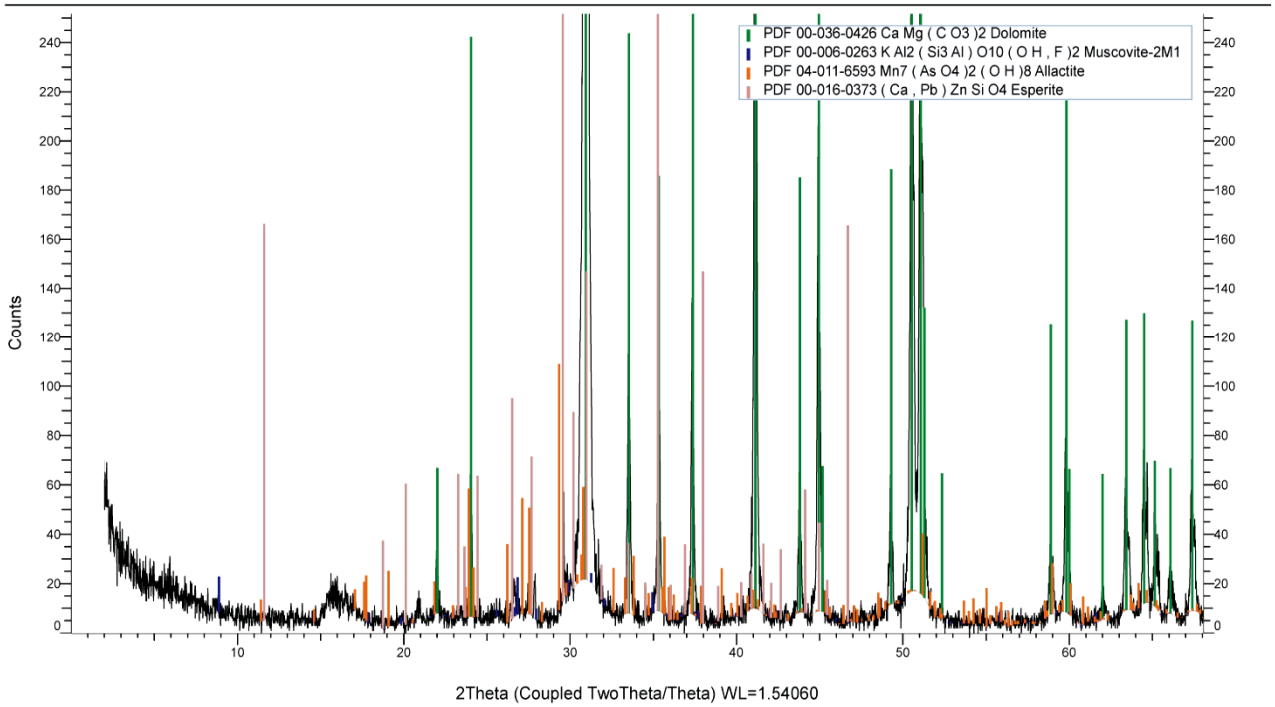


- Sample STB C8.

STBC8 (Coupled TwoTheta/Theta)



STBC8 (y-axis zoom)



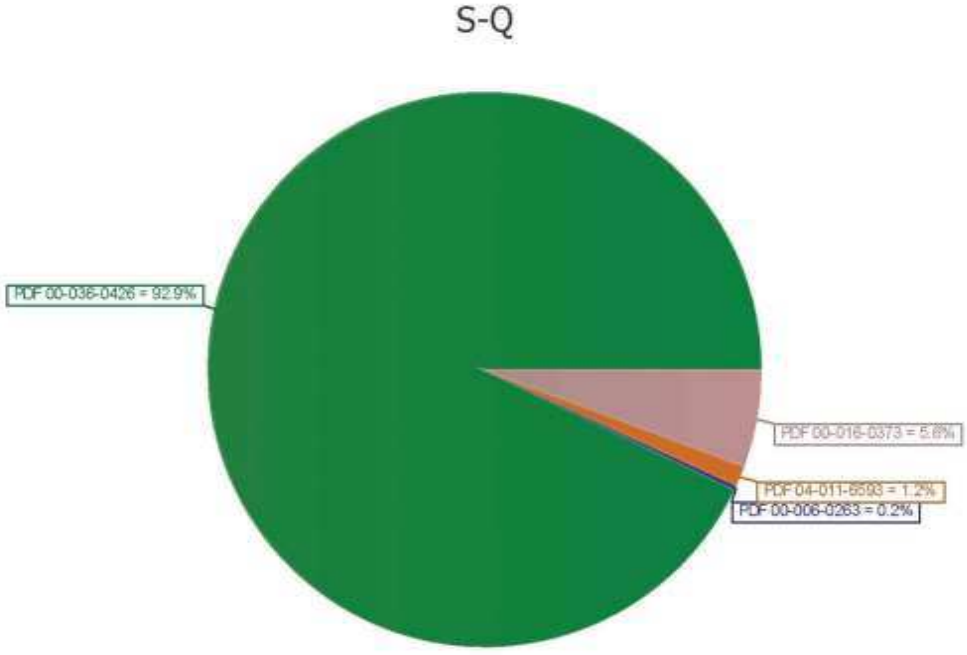
Pattern List #1

Show	Icon	Color	Index	Name	Parent	Scan	Pattern #	Compound Name	Formula	Quality
Yes			0	PDF 00-036-0426	Pattern List #1	TD18_0545.raw #1	PDF 00-036-0426	Dolomite	Ca Mg (C O3)2	Star (*)
Yes			1	PDF 00-006-0263	Pattern List #1	TD18_0545.raw #1	PDF 00-006-0263	Muscovite-2M1	K Al2 (Si3 Al) O10 (O H , F)2	Indexed
Yes			2	PDF 04-011-6593	Pattern List #1	TD18_0545.raw #1	PDF 04-011-6593	Allactite	Mn7 (As O4)2 (O H)8	Indexed
Yes			3	PDF 00-016-0373	Pattern List #1	TD18_0545.raw #1	PDF 00-016-0373	Esperite	(Ca , Pb) Zn Si O4	Indexed

Y-Scale	I/Ic DB	I/Ic User	S-Q	Added Reference	d x by	Scan WL	Wavelength	System	Space Group	a	b	c	alpha
89.38%	(1)	0.000	92.9%		1.0000	Yes	1.54060	Rhombo.H.axes	R-3 (148)	4.80920		16.02000	
0.23%	(1)	0.000	0.2%		1.0000	Yes	1.54060	Monoclinic	C2/c (15)	5.19000	9.03000	20.05000	
1.51%	1.300	0.000	1.2%		1.0000	Yes	1.54060	Monoclinic	P21/a (14)	11.03000	12.12000	5.51000	
5.43%	(1)	0.000	5.6%		1.0000	Yes	1.54060	Monoclinic	P21/n (14)	8.81400	8.27000	15.26000	

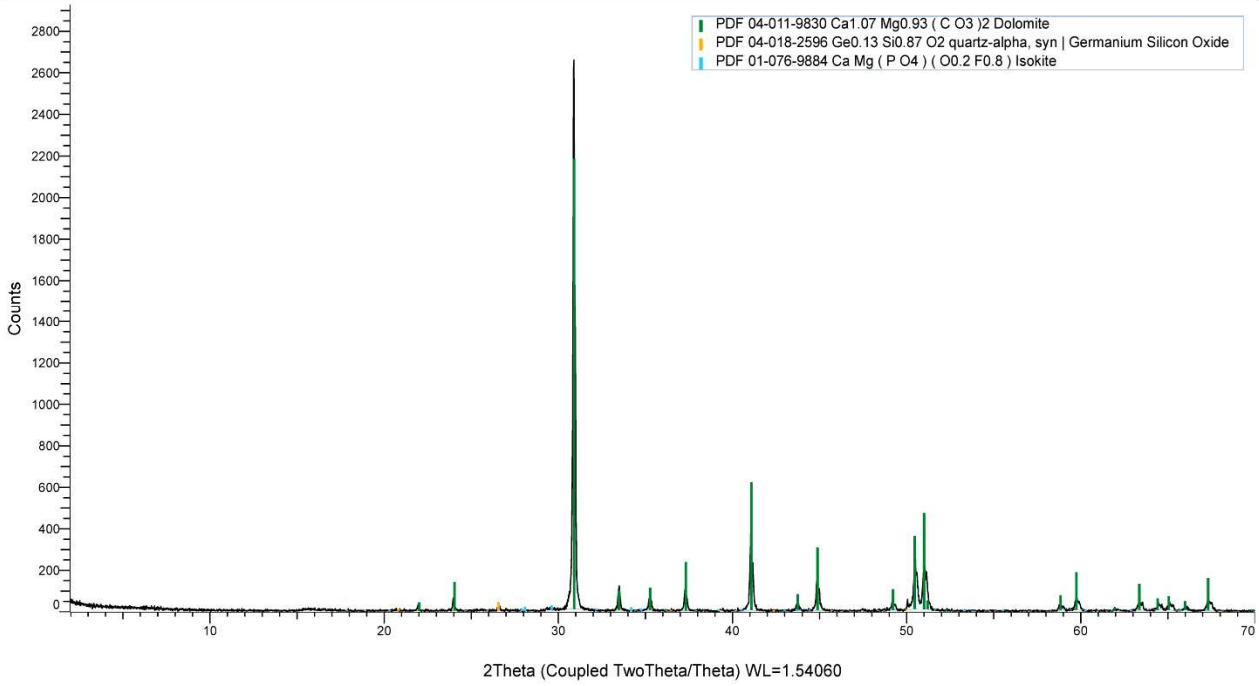
beta	gamma	Z	Volume	Density	Cell Tuned	F (N)
		3	320.88	2.860	No	F30= 146.5(0.0064, 32)
95.770		4	934.90	2.843	No	F30= 12.0(0.0440, 56)
114.070		2	672.55	3.943	No	F30= 117.4(0.0054, 47)
90.000		12	1112.33	4.280	No	F28= 11.2(0.0250, 100)

STBC8 (Coupled TwoTheta/Theta)

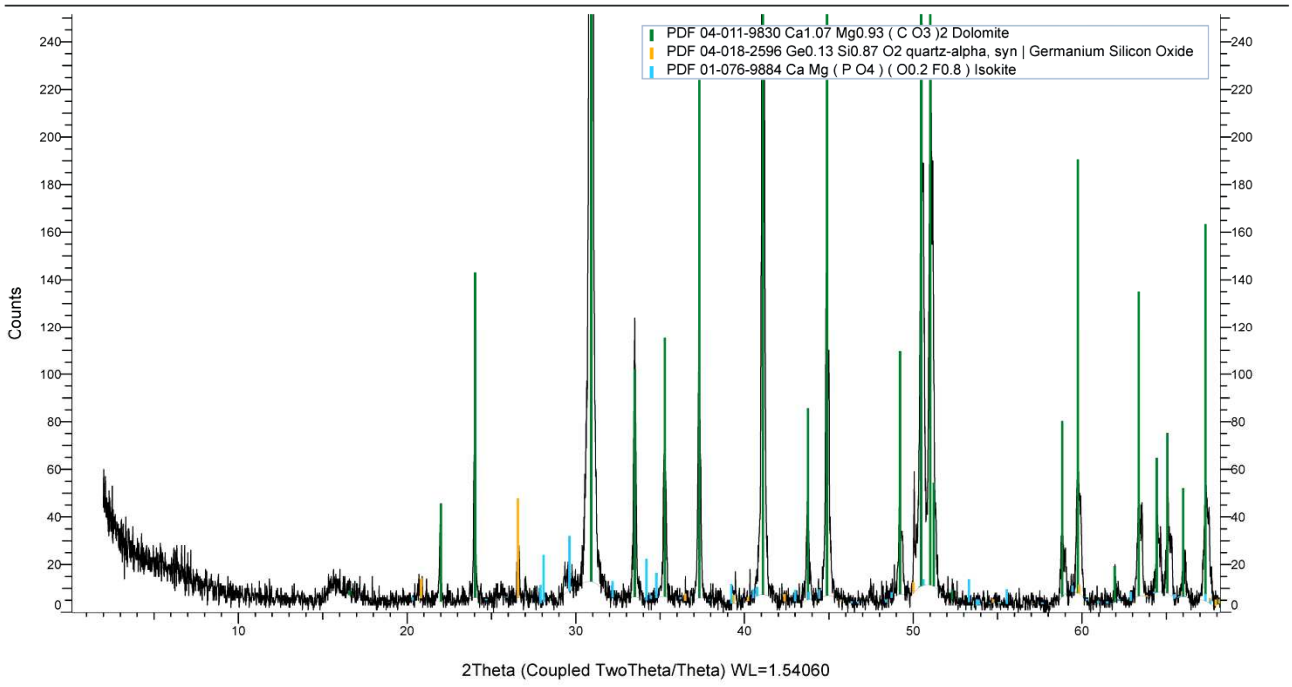


- Sample STB C14.

STBC14 (Coupled TwoTheta/Theta)



STBC14 (y-axis zoom)



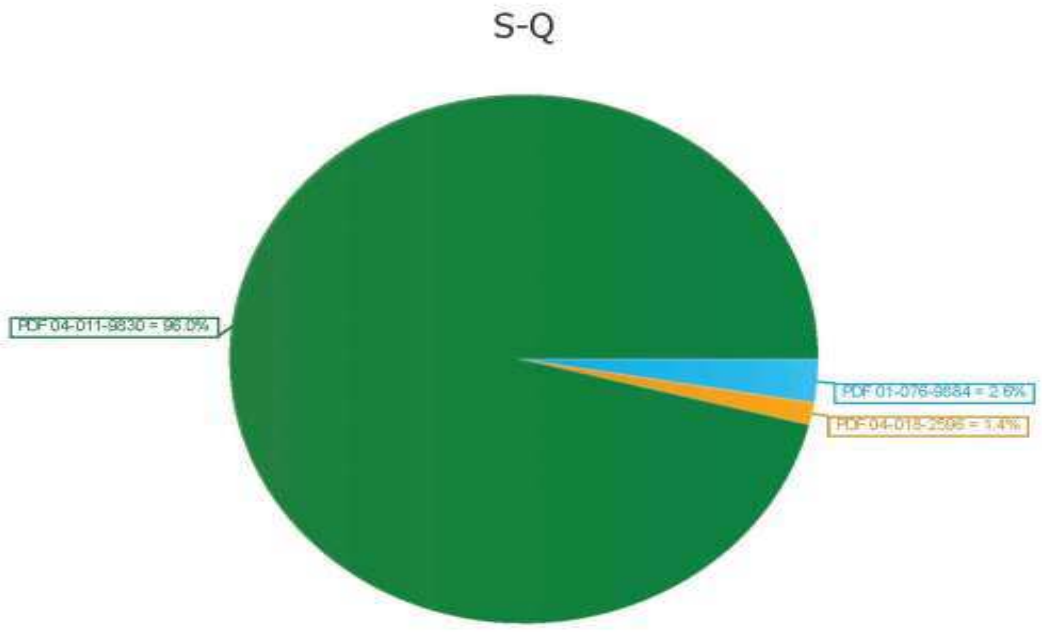
Pattern List #1

Show	Icon	Color	Index	Name	Parent	Scan	Pattern #	Compound Name
Yes			0	PDF 04-011-9830	Pattern List #1	TD18_0546.raw #1	PDF 04-011-9830	Dolomite
Yes			1	PDF 04-018-2596	Pattern List #1	TD18_0546.raw #1	PDF 04-018-2596	quartz-alpha, syn | Germanium Silicon Oxide
Yes			2	PDF 01-076-9884	Pattern List #1	TD18_0546.raw #1	PDF 01-076-9884	Isokite

Formula	Quality	Y-Scale	I/Ic DB	I/Ic User	S-Q	Added Reference	d x by	Scan WL	Wavelength	System	Space Group
Ca1.07 Mg0.93 (C O3)2	Indexed	81.72%	2.510	0.000	96.0%		1.0000	Yes	1.54060	Rhombo.H.axes	R-3 (148)
Ge0.13 Si0.87 O2	Indexed	1.57%	3.430	0.000	1.4%		1.0000	Yes	1.54060	Hexagonal	P3221 (154)
Ca Mg (P O4) (O0.2 F0.8)	Indexed	0.87%	0.980	0.000	2.6%		1.0000	Yes	1.54060	Monoclinic	C2/c (15)

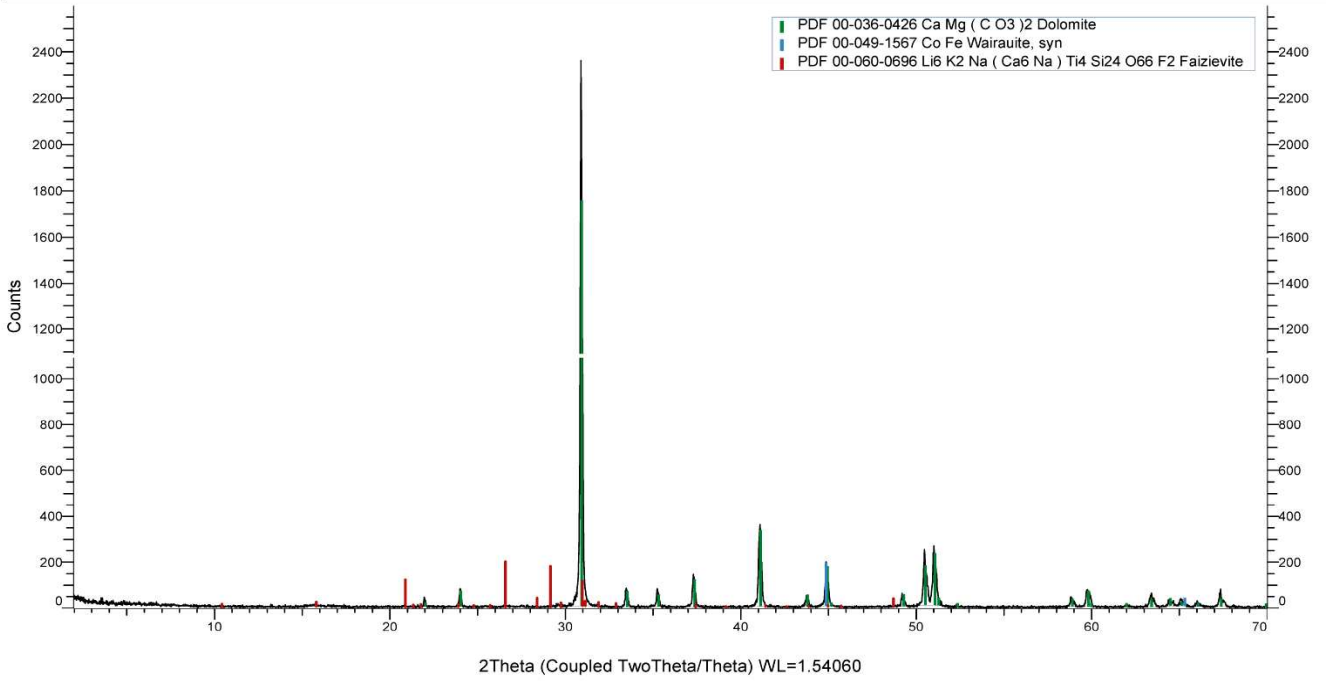
a	b	c	alpha	beta	gamma	Z	Volume	Density	Cell Tuned	F (N)
4.81410		16.03920				3	321.92	2.871	No	F30= 999.9(0.0001, 32)
4.92220		5.42470				3	113.82	2.883	No	F30= 999.9(0.0001, 30)
6.51090	8.73010	6.90460		112.246		4	363.25	3.250	No	F30= 176.7(0.0047, 36)

STBC14 (Coupled TwoTheta/Theta)

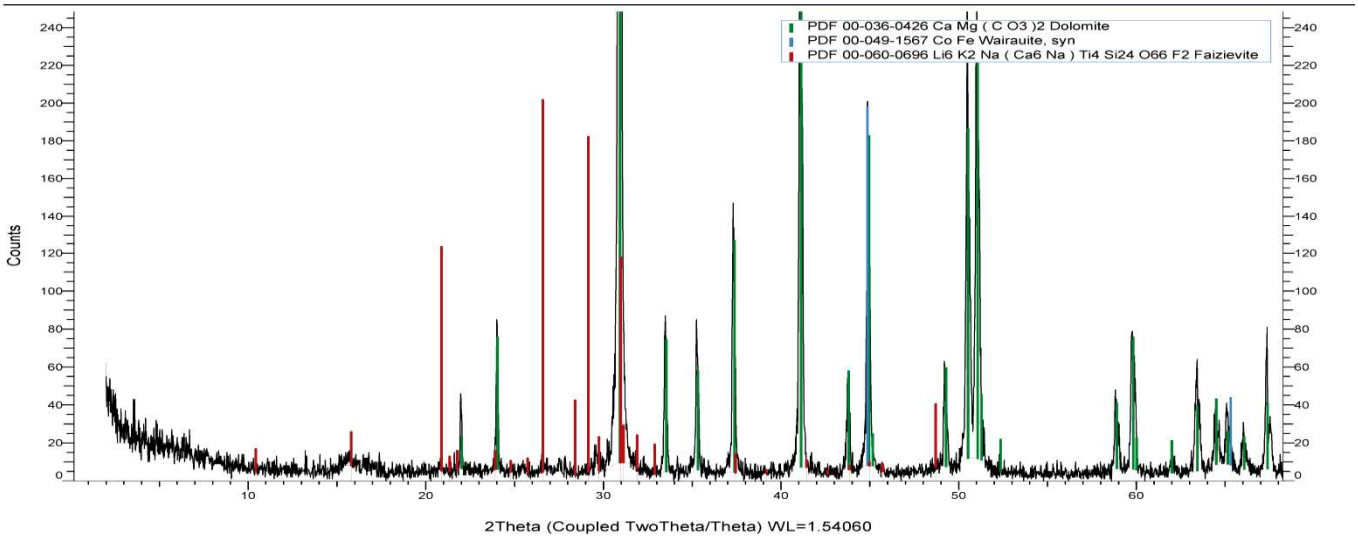


- Sample STB C18.

STBC18 (Coupled TwoTheta/Theta)



STBC18 (y-axis zoom)



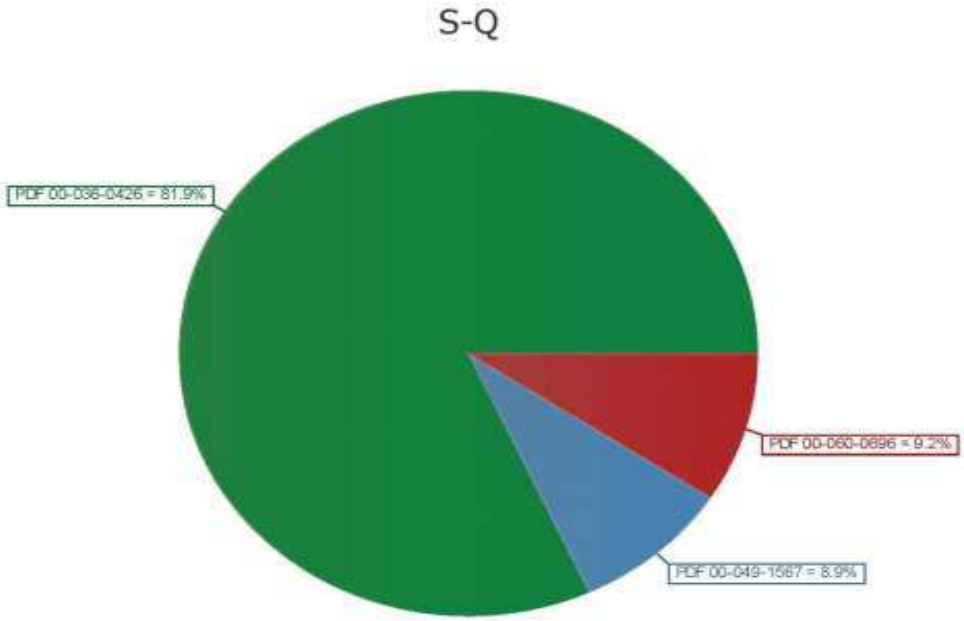
Pattern List #1

Show	Icon	Color	Index	Name	Parent	Scan	Pattern #	Compound Name	Formula	Quality
Yes			0	PDF 00-036-0426	Pattern List #1	TD18_0548.raw #1	PDF 00-036-0426	Dolomite	Ca Mg (C O3)2	Star (*)
Yes			1	PDF 00-049-1567	Pattern List #1	TD18_0548.raw #1	PDF 00-049-1567	Wairauite, syn	Co Fe	Star (*)
Yes			2	PDF 00-060-0696	Pattern List #1	TD18_0548.raw #1	PDF 00-060-0696	Faizievite	Li6 K2 Na (Ca6 Na) Ti4 Si24 O66 F2	Indexed

Y-Scale	I/Ic DB	I/Ic User	S-Q	Added Reference	d x by	Scan WL	Wavelength	System	Space Group	a	b	c	alpha
74.09%	(1)	0.000	81.9%		1.0000	Yes	1.54060	Rhombo.H.axes	R-3 (148)	4.80920		16.02000	
8.05%	(1)	0.000	8.9%		1.0000	Yes	1.54060	Cubic	Pm-3m (221)	2.85520			
8.36%	(1)	0.000	9.2%		1.0000	Yes	1.54060	Triclinic	P-1 (2)	9.81560	9.82490	17.30870	99.209

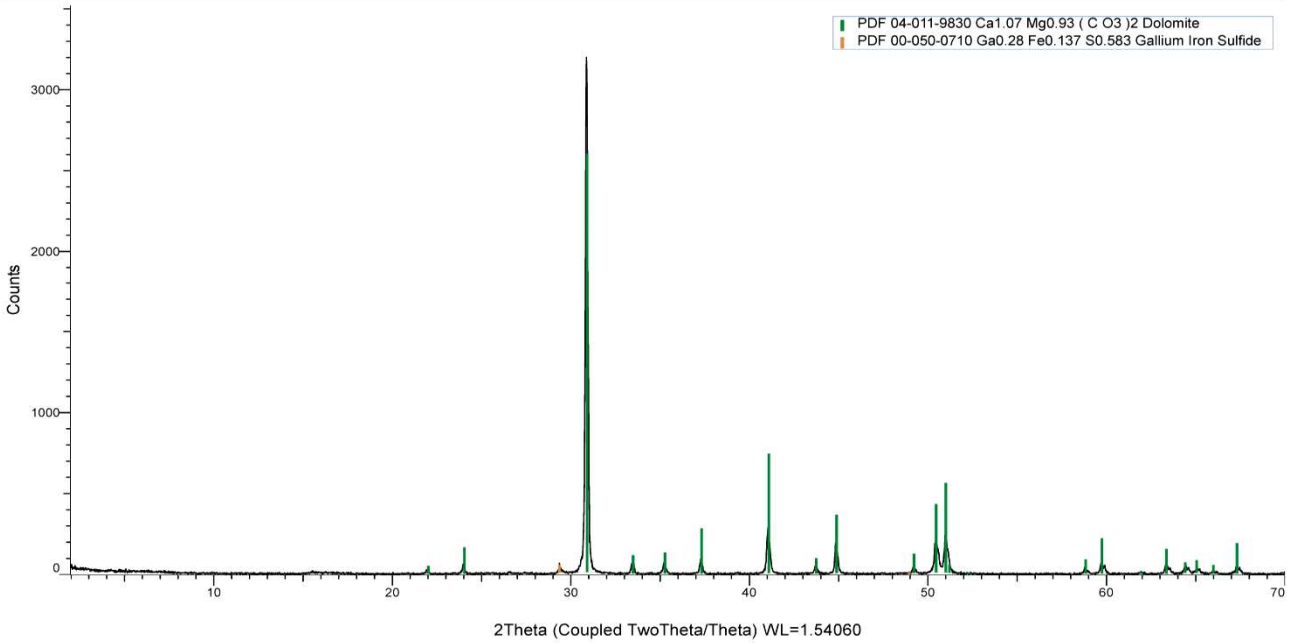
beta	gamma	Z	Volume	Density	Cell Tuned	F (N)
		3	320.88	2.860	No	F30= 146.5(0.0064, 32)
		1	23.28	8.189	No	F4= 152.4(0.0038, 7)
94.670	119.839	1	1403.74	2.830	No	F24= 0.8(0.0711, 448)

STBC18 (Coupled TwoTheta/Theta)

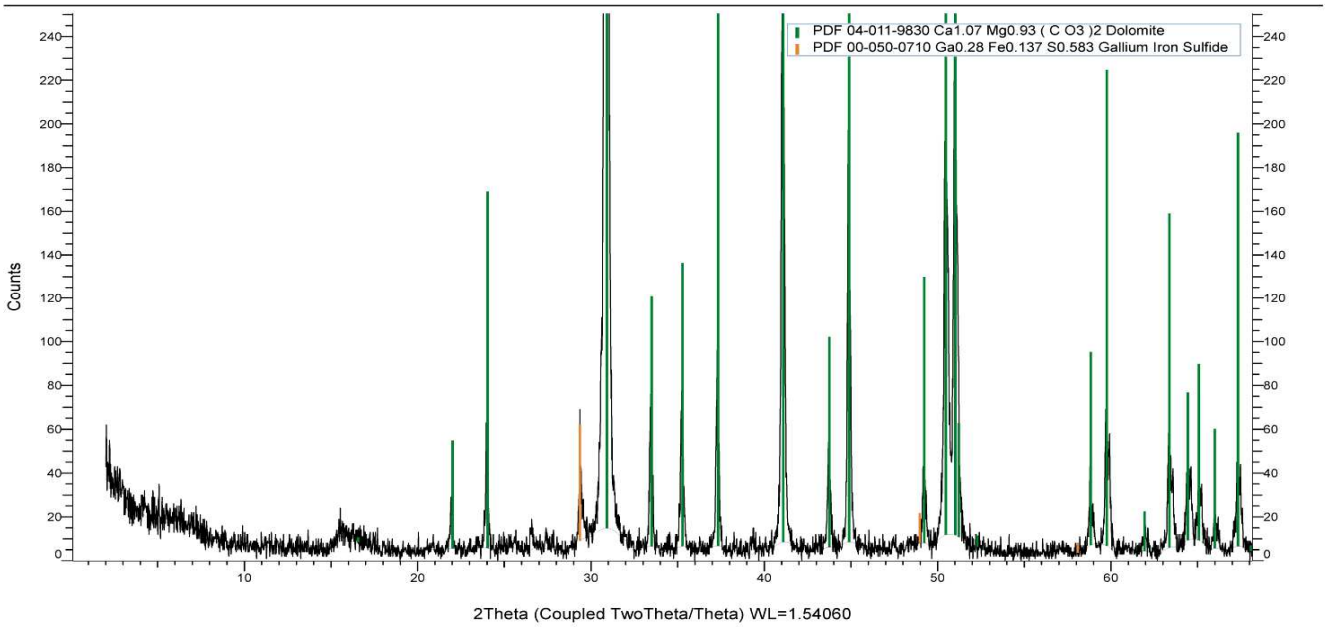


- Sample STB C19.

STBC19 (Coupled TwoTheta/Theta)



STBC19 (y-axis zoom)



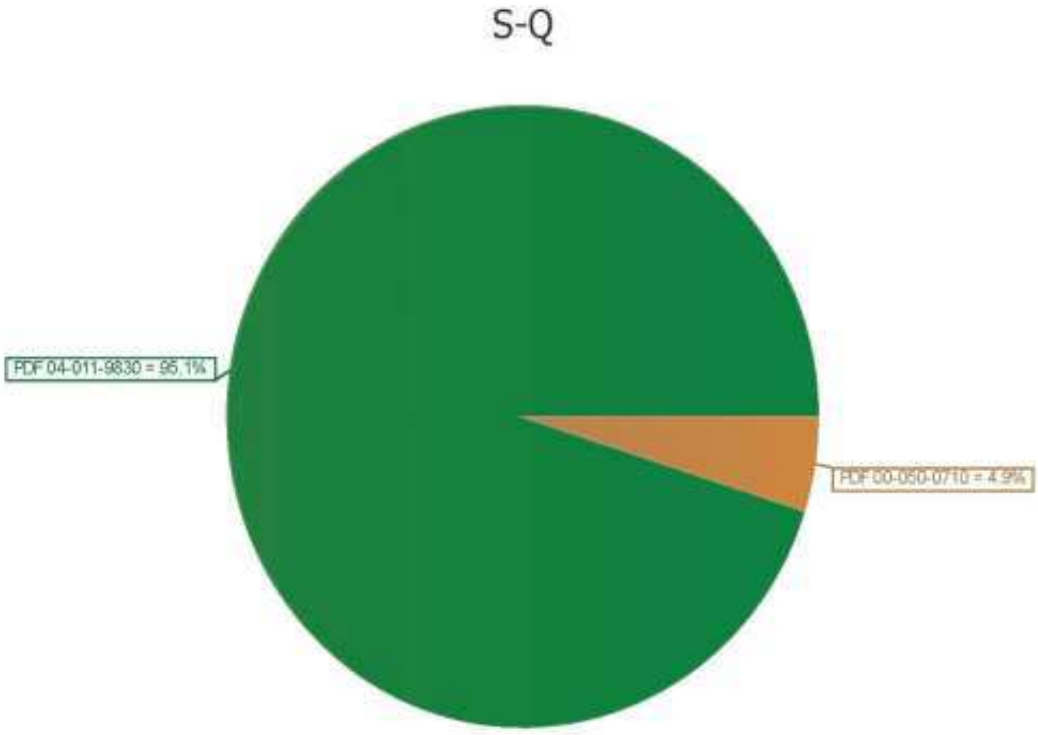
Pattern List #1

Show	Icon	Color	Index	Name	Parent	Scan	Pattern #	Compound Name	Formula	Quality	Y-Scale
Yes			0	PDF 04-011-9830	Pattern List #1	TD18_0549.raw #1	PDF 04-011-9830	Dolomite	Ca1.07 Mg0.93 (C O3)2	Indexed	81.00%
Yes			1	PDF 00-050-0710	Pattern List #1	TD18_0549.raw #1	PDF 00-050-0710	Gallium Iron Sulfide	Ga0.28 Fe0.137 S0.583	Star (*)	1.66%

I/Ic DB	I/Ic User	S-Q	Added Reference	d x by	Scan WL	Wavelength	System	Space Group	a	b	c	alpha	beta	gamma	Z
2.510	0.000	95.1%		1.0000	Yes	1.54060	Rhombo.H.axes	R-3 (148)	4.81410		16.03920				3
(1)	0.000	4.9%		1.0000	Yes	1.54060	Cubic	F-43m (216)	5.26150						8

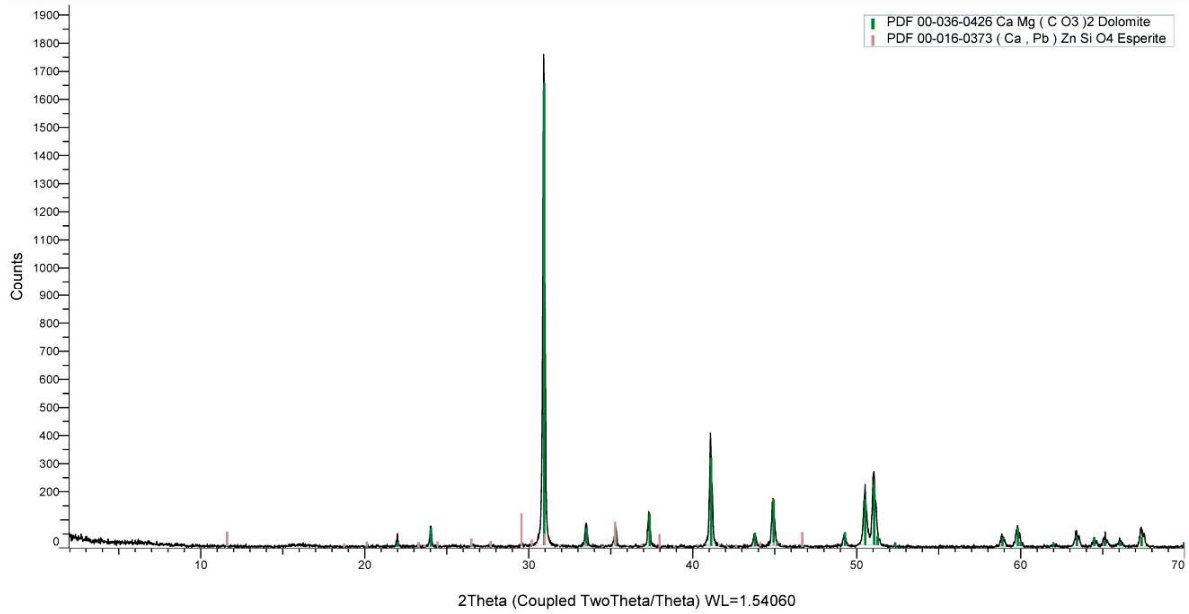
Volume	Density	Cell Tuned	F (N)
321.92	2.871	No	F30= 999.9(0.0000, 32)
145.66	4.183	No	F4= 37.4(0.0270, 4)

STBC19 (Coupled TwoTheta/Theta)

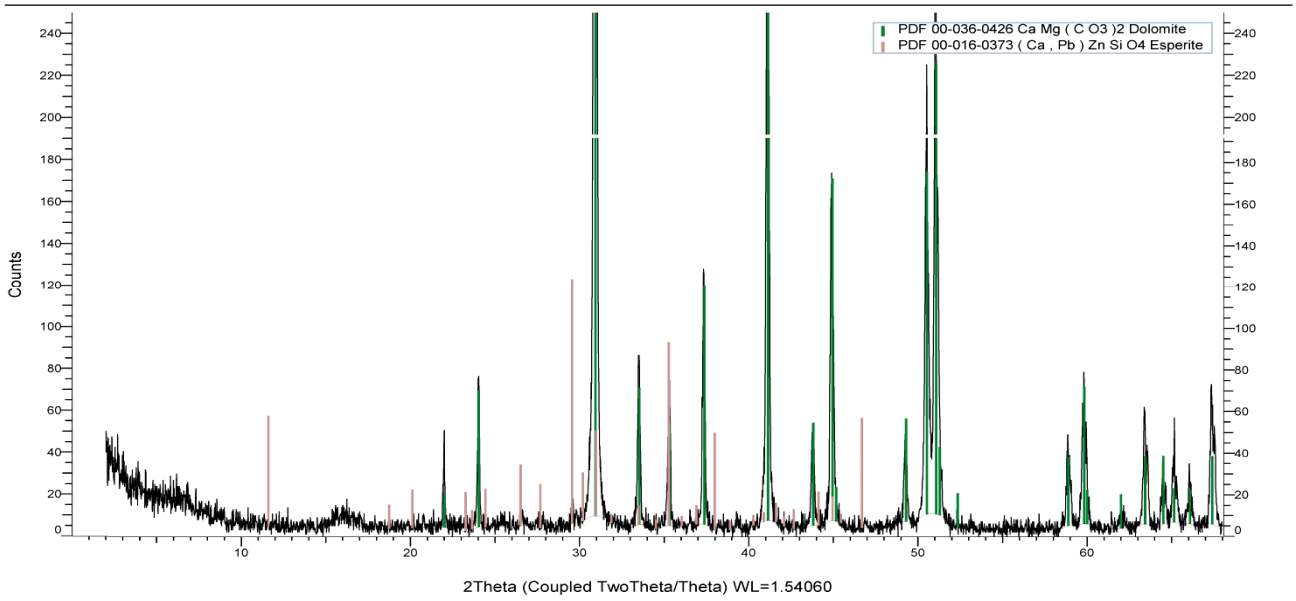


- Sample STB C21.

STBC21 (Coupled TwoTheta/Theta)



STBC21 (y-axis zoom)



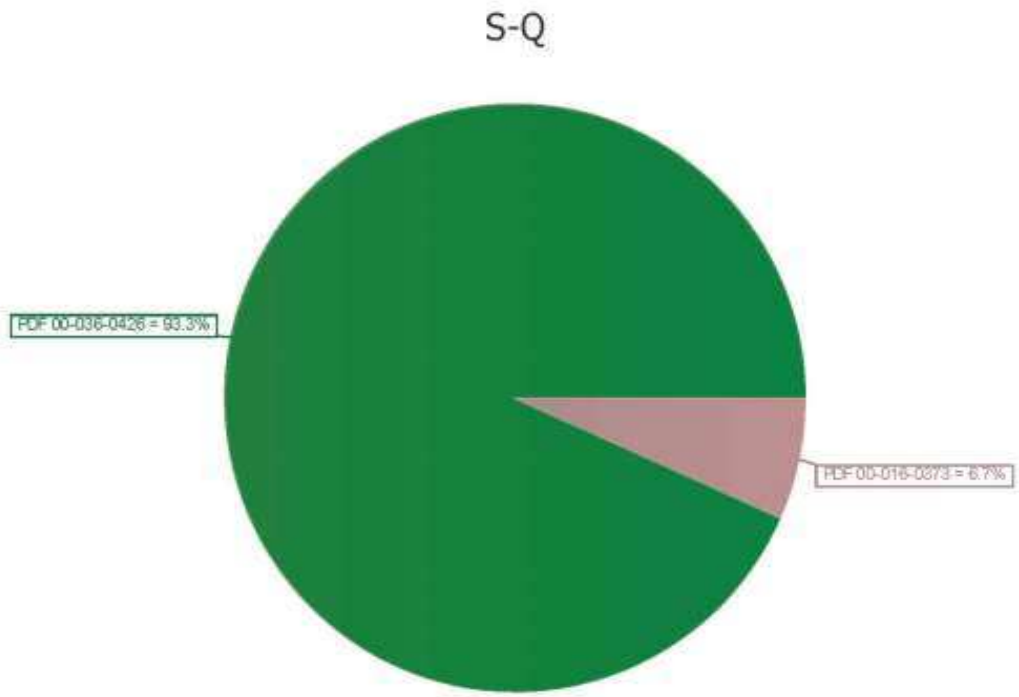
Pattern List #1

Show	Icon	Color	Index	Name	Parent	Scan	Pattern #	Compound Name	Formula	Quality	Y-Scale
Yes			0	PDF 00-036-0426	Pattern List #1	TD18_0550.raw #1	PDF 00-036-0426	Dolomite	Ca Mg (C O3)2	Star (*)	93.70%
Yes			1	PDF 00-016-0373	Pattern List #1	TD18_0550.raw #1	PDF 00-016-0373	Esperite	(Ca , Pb) Zn Si O4	Indexed	6.70%

I/Ic DB	I/Ic User	S-Q	Added Reference	d x by	Scan WL	Wavelength	System	Space Group	a	b	c	alpha	beta	gamma
(1)	0.000	93.3%		1.0000	Yes	1.54060	Rhombo.H axes	R-3 (148)	4.80920		16.02000			
(1)	0.000	6.7%		1.0000	Yes	1.54060	Monoclinic	P21/n (14)	8.81400	8.27000	15.26000		90.000	

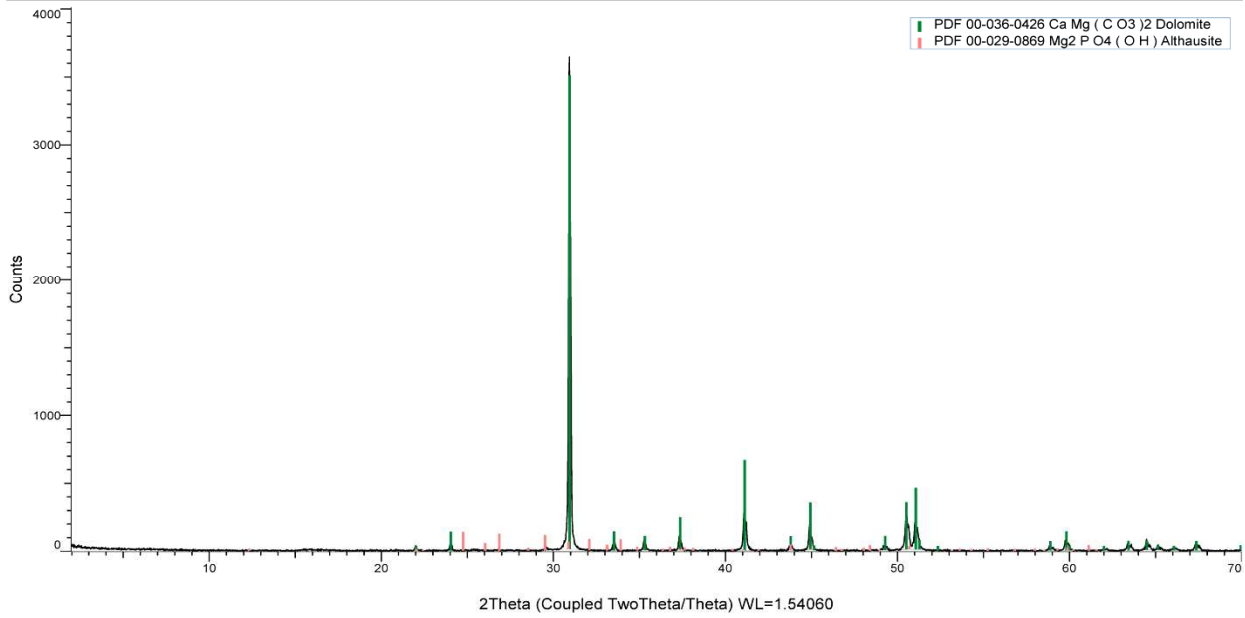
Z	Volume	Density	Cell Tuned	F (N)
3	320.88	2.860	No	F30= 146.5(0.0064, 32)
12	1112.33	4.280	No	F28= 11.2(0.0250, 100)

STBC21 (Coupled TwoTheta/Theta)

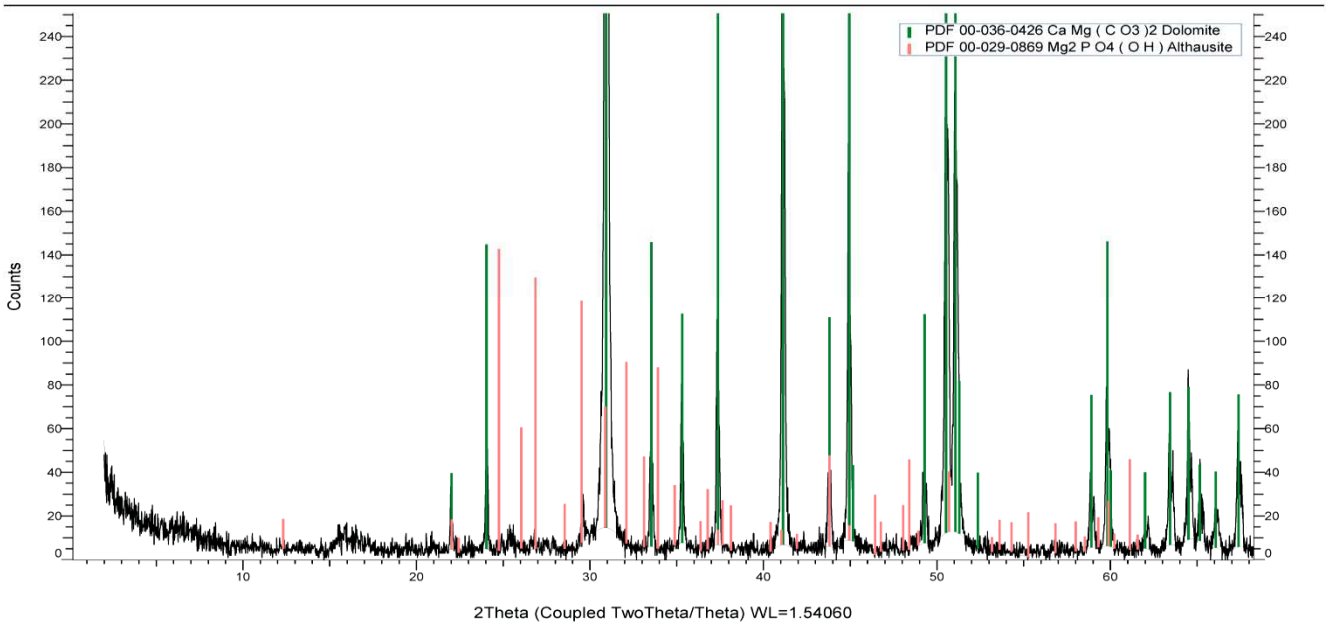


- Sample STB C23.

STBC23 (Coupled TwoTheta/Theta)



STBC23 (y-axis zoom)



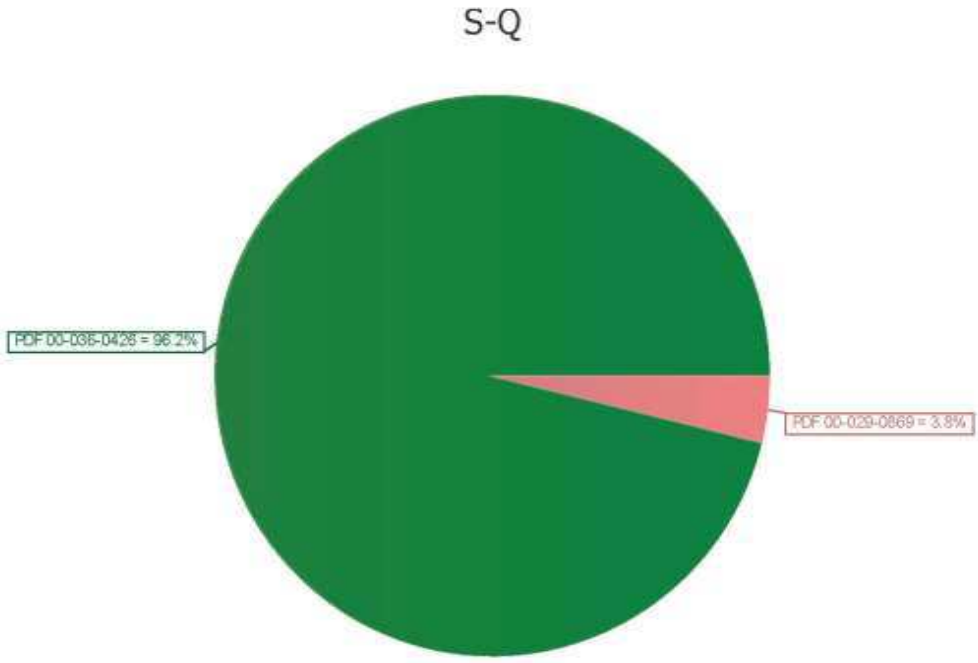
Pattern List #1

Show	Icon	Color	Index	Name	Parent	Scan	Pattern #	Compound Name	Formula	Quality	Y-Scale	I/Ic DB
Yes			0	PDF 00-036-0426	Pattern List #1	TD18_0551.raw #1	PDF 00-036-0426	Dolomite	Ca Mg (C O3)2	Star (*)	95.92%	(1)
Yes			1	PDF 00-029-0869	Pattern List #1	TD18_0551.raw #1	PDF 00-029-0869	Althausite	Mg2 P O4 (O H)	Indexed	3.81%	(1)

I/Ic User	S-Q	Added Reference	d x by	Scan WL	Wavelength	System	Space Group	a	b	c	alpha	beta	gamma	Z
0.000	96.2%		1.0000	Yes	1.54060	Rhombo.H.axes	R-3 (148)	4.80920		16.02000				3
0.000	3.8%		1.0000	Yes	1.54060	Orthorhombic	Pna21 (33)	8.25800	14.38300	6.05400				8

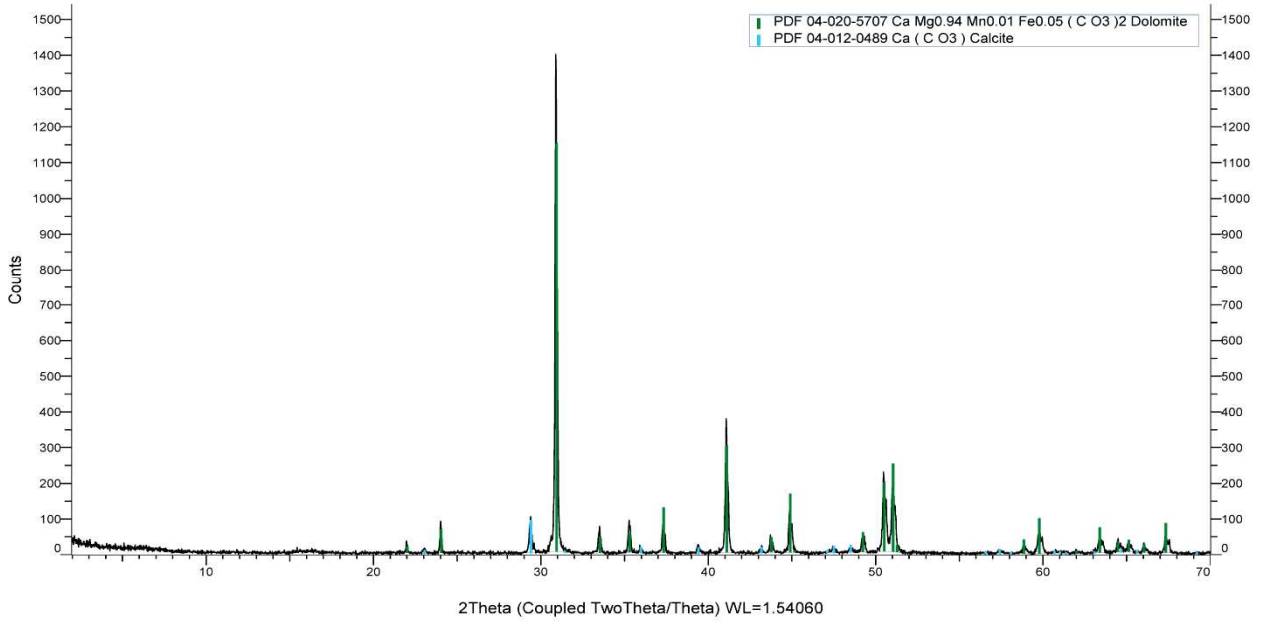
Volume	Density	Cell Tuned	F (N)
320.88	2.860	No	F30= 146.5(0.0064, 32)
719.06	2.970	No	F30= 12.6(0.0270, 89)

STBC23 (Coupled TwoTheta/Theta)

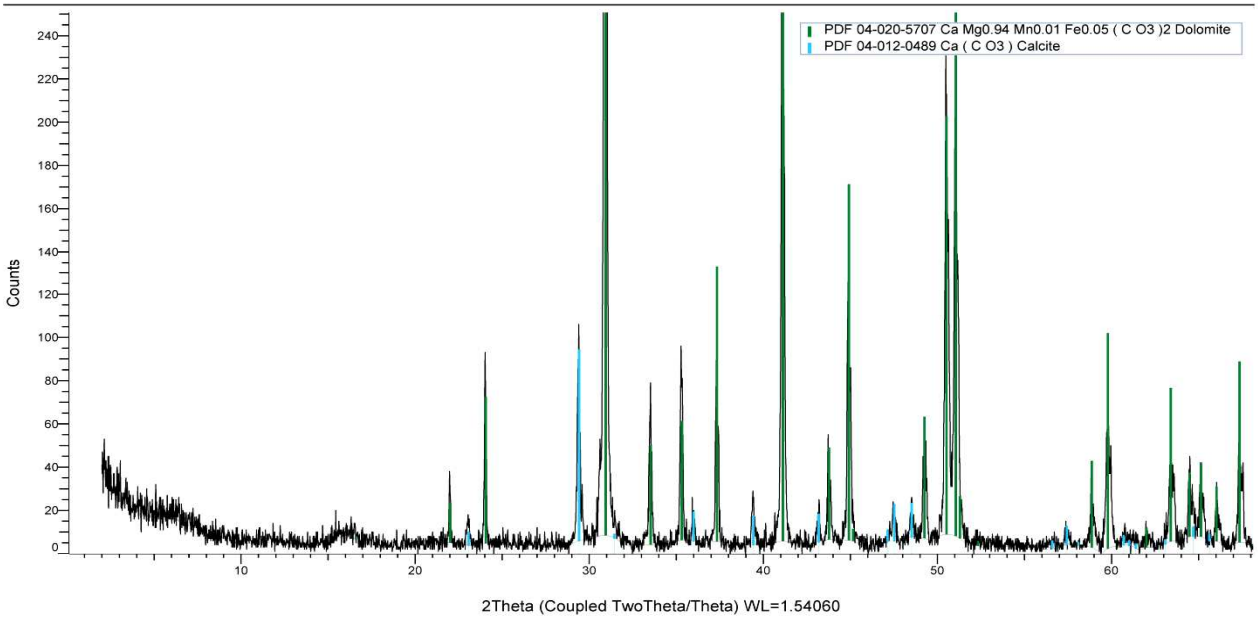


- Sample STB C26.

STBC26 (Coupled TwoTheta/Theta)



STBC26 (y-axis zoom)



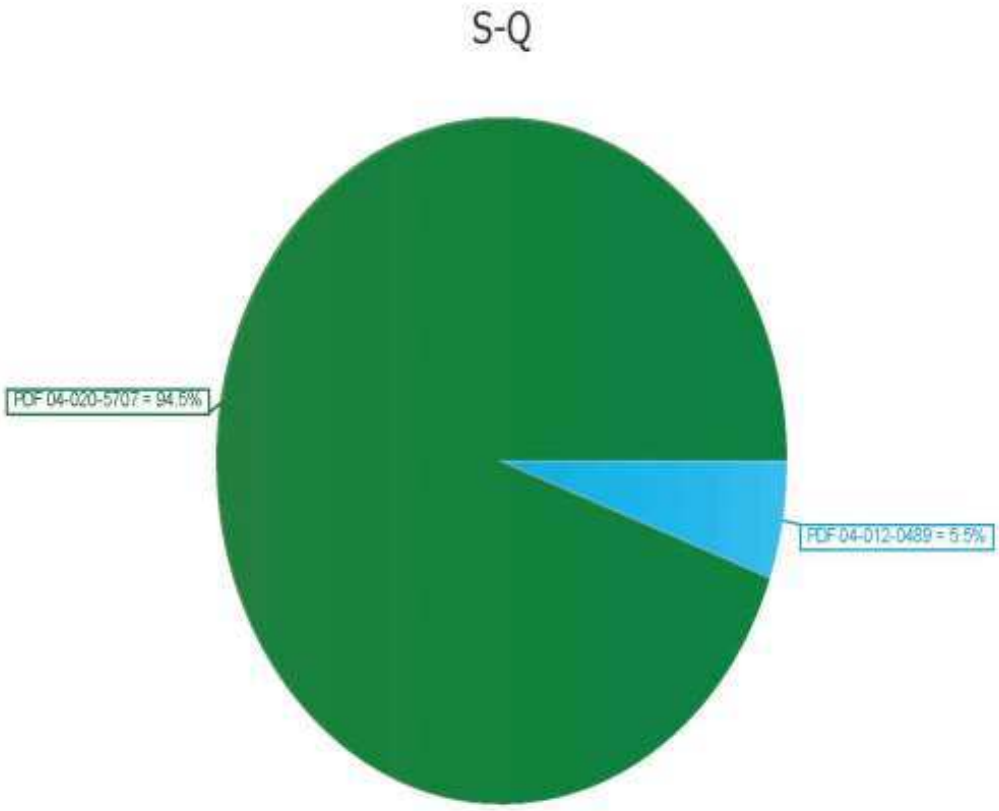
Pattern List #1

Show	Icon	Color	Index	Name	Parent	Scan	Pattern #	Compound Name	Formula	Quality
Yes			0	PDF 04-020-5707	Pattern List #1	TD18_0552.raw #1	PDF 04-020-5707	Dolomite	Ca Mg0.94 Mn0.01 Fe0.05 (C O3)2	Star (*)
Yes			1	PDF 04-012-0489	Pattern List #1	TD18_0552.raw #1	PDF 04-012-0489	Calcite	Ca (C O3)	Indexed

Y-Scale	I/Ic DB	I/Ic User	S-Q	Added Reference	d x by	Scan WL	Wavelength	System	Space Group	a	b	c	alpha	beta
81.80%	2.610	0.000	94.5%		1.0000	Yes	1.54060	Rhombo.H.axes	R-3 (148)	4.81200		16.02000		
6.31%	3.450	0.000	5.5%		1.0000	Yes	1.54060	Rhombo.H.axes	R-3c (167)	4.98700		17.05800		

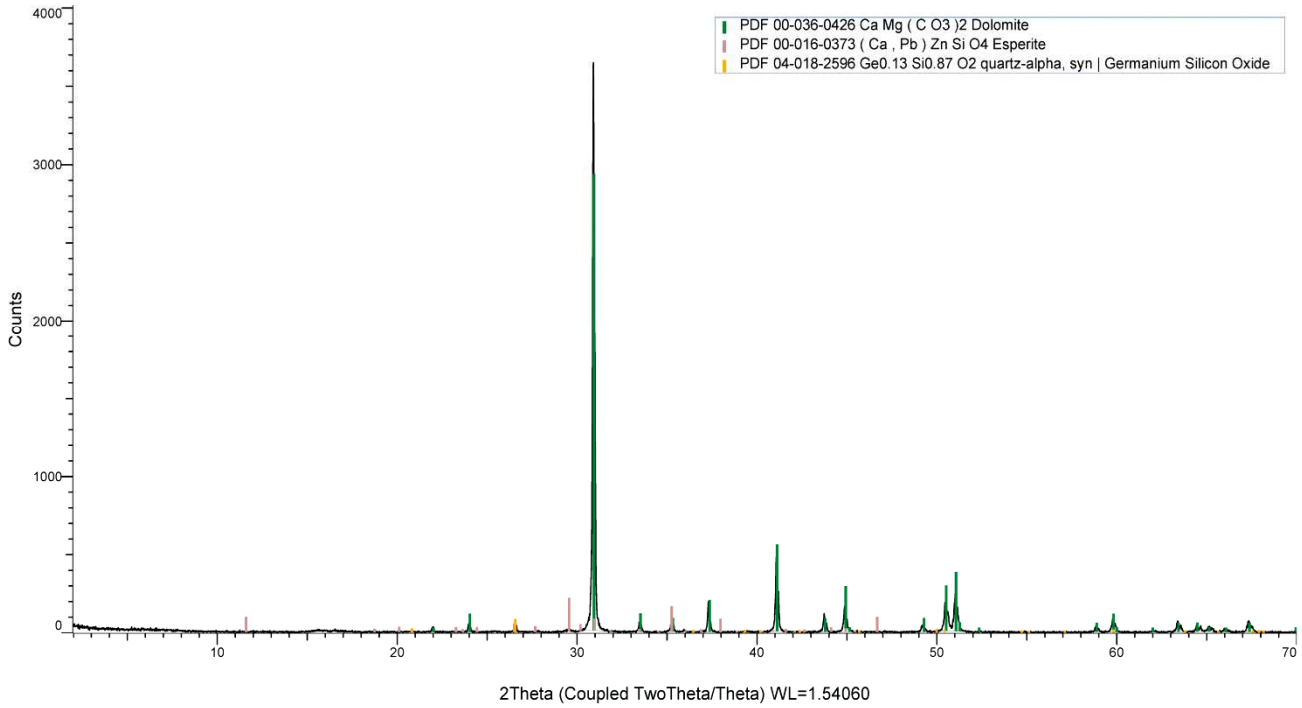
gamma	Z	Volume	Density	Cell Tuned	F (N)
	3	321.25	2.889	No	F30= 999.9(0.0001, 31)
	6	367.40	2.714	No	F30= 999.9(0.0001, 31)

STBC26 (Coupled TwoTheta/Theta)

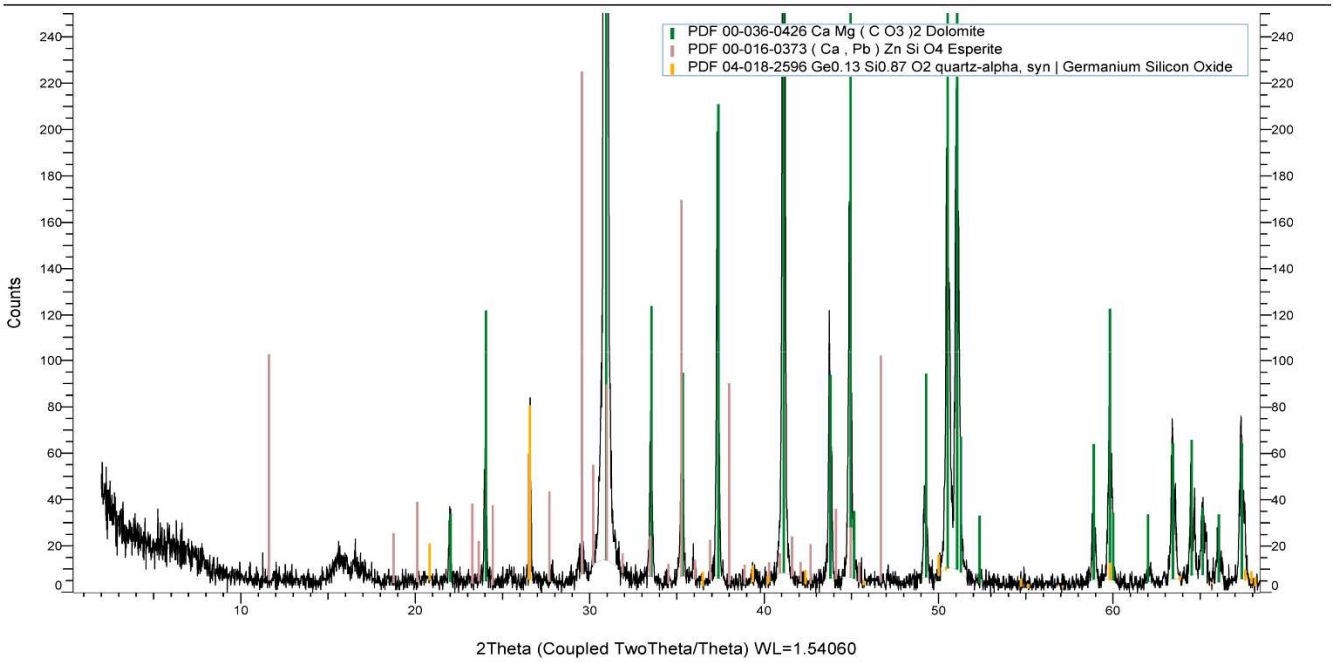


- Sample STB C27.

STBC27 (Coupled TwoTheta/Theta)



STBC27 (y-axis zoom)



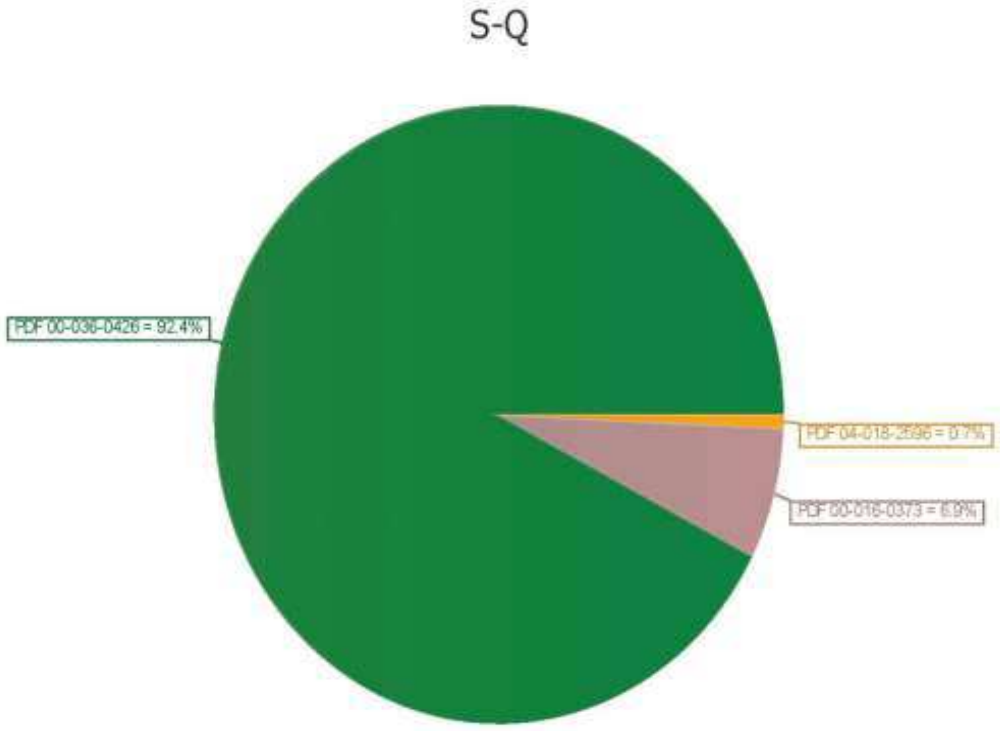
Pattern List #1

Show	Icon	Color	Index	Name	Parent	Scan	Pattern #	Compound Name	Formula
Yes			0	PDF 00-036-0426	Pattern List #1	TD18_0553.raw #1	PDF 00-036-0426	Dolomite	Ca Mg (C O3)2
Yes			1	PDF 00-016-0373	Pattern List #1	TD18_0553.raw #1	PDF 00-016-0373	Esperite	(Ca , Pb) Zn Si O4
Yes			2	PDF 04-018-2596	Pattern List #1	TD18_0553.raw #1	PDF 04-018-2596	quartz-alpha, syn | Germanium Silicon Oxide	Ge0.13 Si0.87 O2

Quality	Y-Scale	I/Ic DB	I/Ic User	S-Q	Added Reference	d x by	Scan WL	Wavelength	System	Space Group	a	b	c
Star (*)	80.17%	(1)	0.000	92.4%		1.0000	Yes	1.54060	Rhombo.H.axes	R-3 (148)	4.80920		16.02000
Indexed	5.95%	(1)	0.000	6.9%		1.0000	Yes	1.54060	Monoclinic	P21/n (14)	8.81400	8.27000	15.26000
Indexed	2.05%	3.430	0.000	0.7%		1.0000	Yes	1.54060	Hexagonal	P3221 (154)	4.92220		5.42470

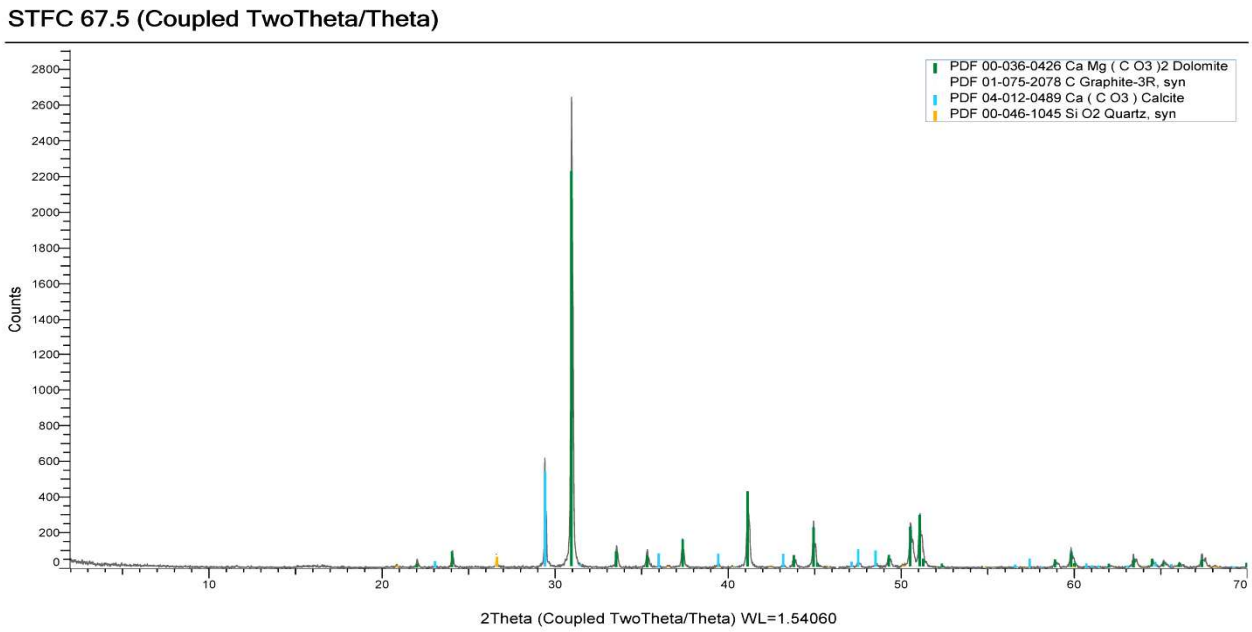
alpha	beta	gamma	Z	Volume	Density	Cell Tuned	F (N)
			3	320.88	2.860	No	F30= 146.5(0.0064, 32)
	90.000		12	1112.33	4.280	No	F28= 11.2(0.0250, 100)
			3	113.82	2.883	No	F30= 999.9(0.0001, 30)

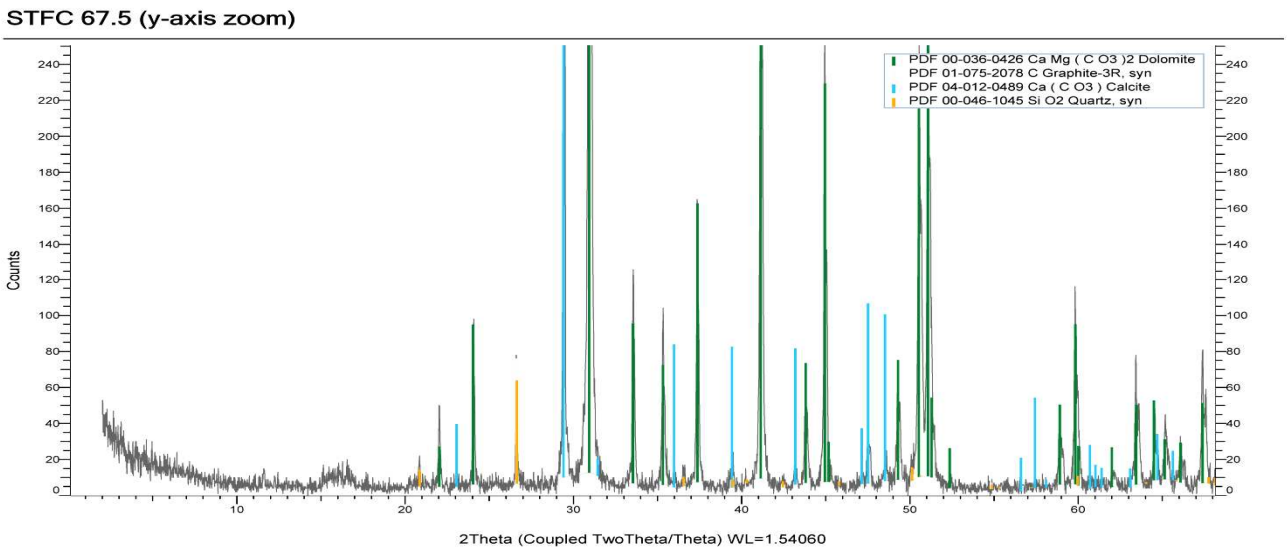
STBC27 (Coupled TwoTheta/Theta)



- Lower Shital samples.

➢ Sample STF C67.5





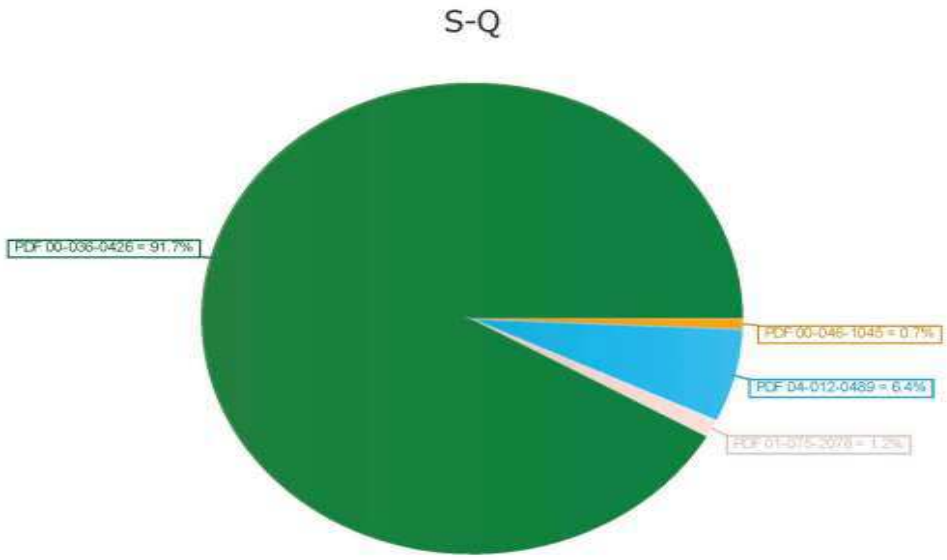
Pattern List #1

Show	Icon	Color	Index	Name	Parent	Scan	Pattern #	Compound Name	Formula	Quality	Y-Scale
Yes			0	PDF 00-036-0426	Pattern List #1	TD18_0554.raw #1	PDF 00-036-0426	Dolomite	Ca Mg (C O3)2	Star (*)	83.95%
Yes			1	PDF 01-075-2078	Pattern List #1	TD18_0554.raw #1	PDF 01-075-2078	Graphite-3R, syn	C	Indexed	2.63%
Yes			2	PDF 04-012-0489	Pattern List #1	TD18_0554.raw #1	PDF 04-012-0489	Calcite	Ca (C O3)	Indexed	20.13%
Yes			3	PDF 00-046-1045	Pattern List #1	TD18_0554.raw #1	PDF 00-046-1045	Quartz, syn	Si O2	Star (*)	2.17%

I/Ic DB	I/Ic User	S-Q	Added Reference	d x by	Scan WL	Wavelength	System	Space Group	a	b	c	alpha	beta	gamma	Z
(1)	0.000	91.7%		1.0000	Yes	1.54060	Rhombo.H.axes	R-3 (148)	4.80920		16.02000				3
2.320	0.000	1.2%		1.0000	Yes	1.54060	Rhombo.H.axes	R-3m (166)	2.45610		10.04100				6
3.450	0.000	6.4%		1.0000	Yes	1.54060	Rhombo.H.axes	R-3c (167)	4.98700		17.05800				6
3.410	0.000	0.7%		1.0000	Yes	1.54060	Hexagonal	P3221 (154)	4.91344		5.40524				3

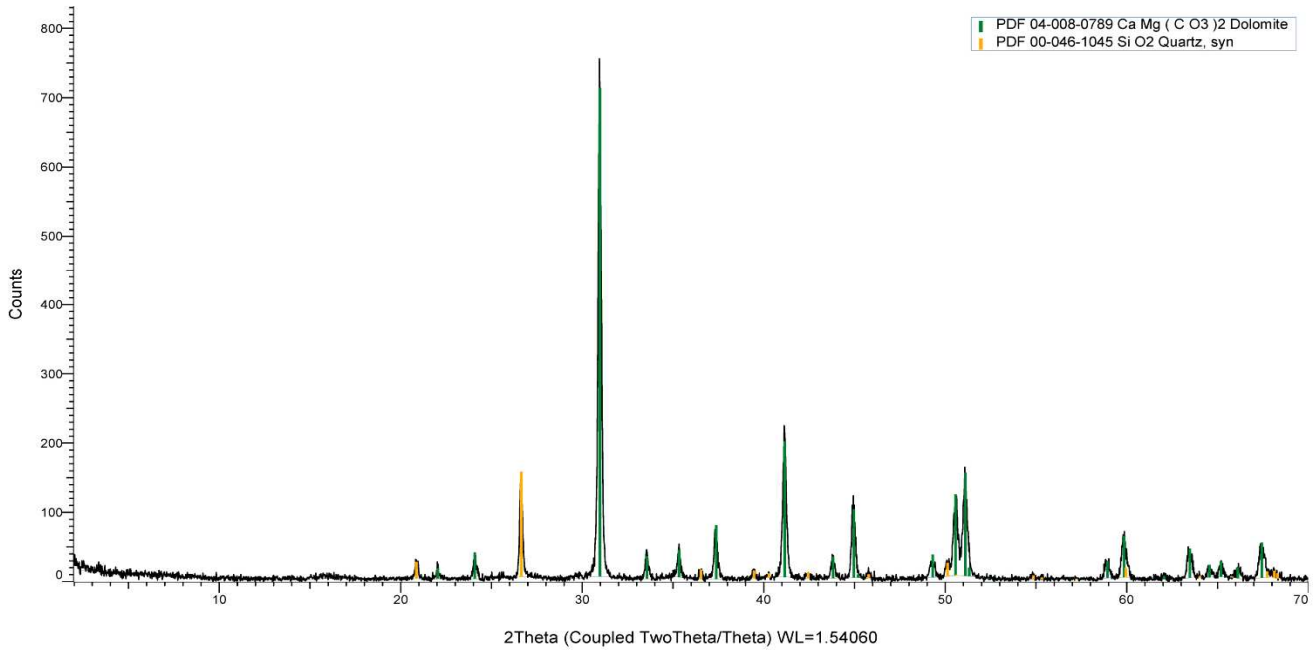
Volume	Density	Cell Tuned	F (N)
320.88	2.860	No	F30= 146.5(0.0064, 32)
52.46	2.281	No	F23= 999.9(0.0003, 23)
367.40	2.714	No	F30= 999.9(0.0000, 31)
113.01	2.660	No	F30= 558.3(0.0017, 31)

STFC 67.5 (Coupled TwoTheta/Theta)

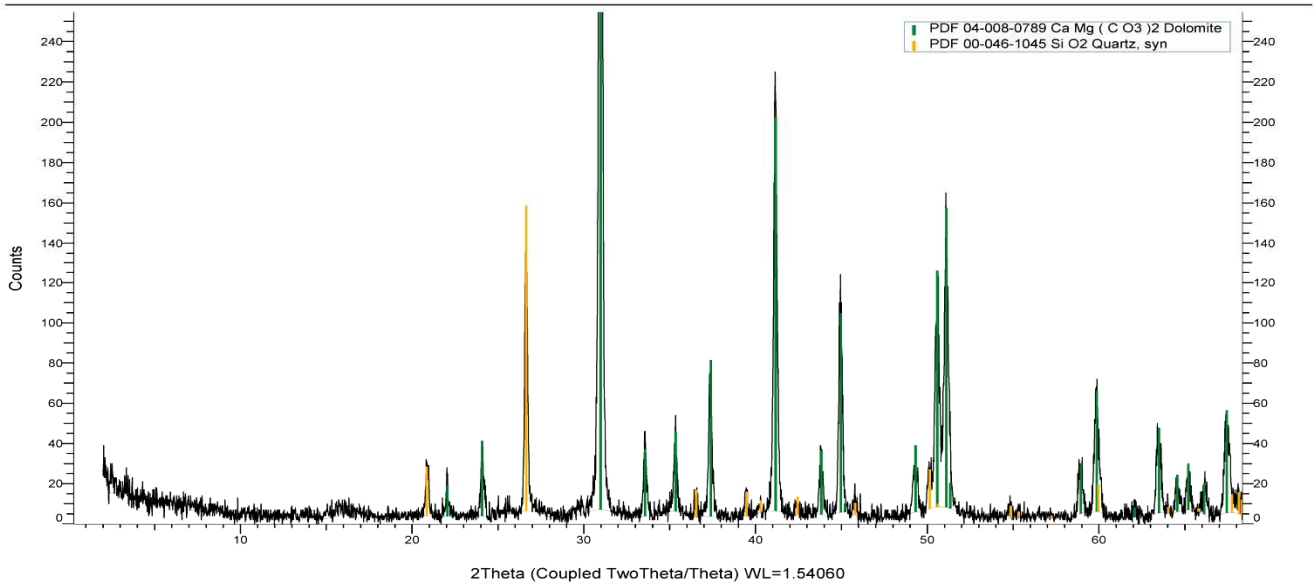


- Sample STF C68.4.

STFC 68.4 (Coupled TwoTheta/Theta)



STFC 68.4 (y-axis zoom)



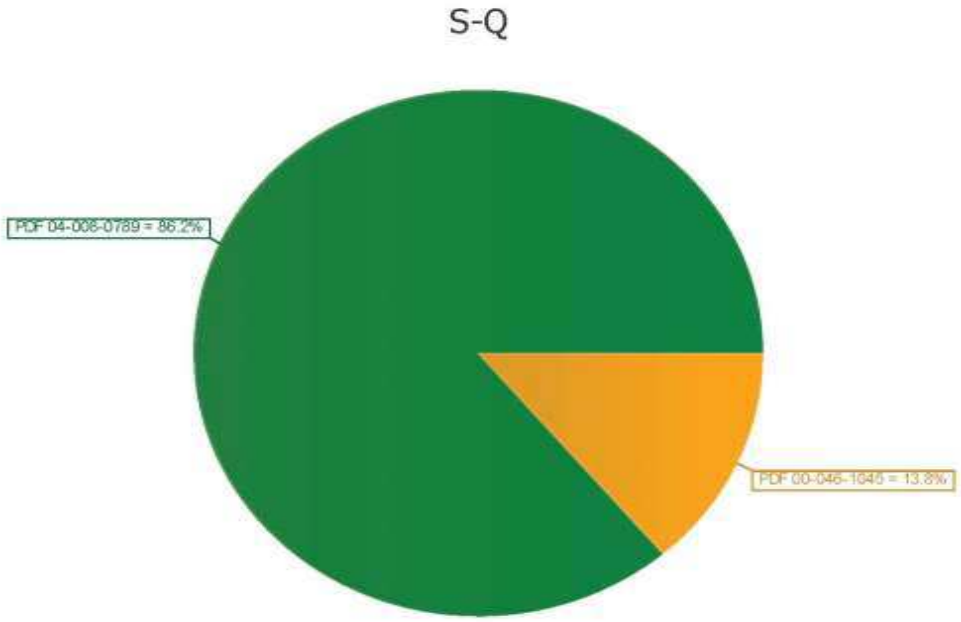
Pattern List #1

Show	Icon	Color	Index	Name	Parent	Scan	Pattern #	Compound Name	Formula	Quality	Y-Scale	I/Ic DB
Yes			0	PDF 04-008-0789	Pattern List #1	TD18_0555.raw #1	PDF 04-008-0789	Dolomite	Ca Mg (C O3)2	Star (*)	93.56%	2.530
Yes			1	PDF 00-046-1045	Pattern List #1	TD18_0555.raw #1	PDF 00-046-1045	Quartz, syn	Si O2	Star (*)	20.13%	3.410

I/Ic User	S-Q	Added Reference	d x by	Scan WL	Wavelength	System	Space Group	a	b	c	alpha	beta	gamma	Z	Volume
0.000	86.2%		1.0000	Yes	1.54060	Rhombo.H.axes	R-3 (148)	4.80640		16.00600				3	320.22
0.000	13.8%		1.0000	Yes	1.54060	Hexagonal	P3221 (154)	4.91344		5.40524				3	113.01

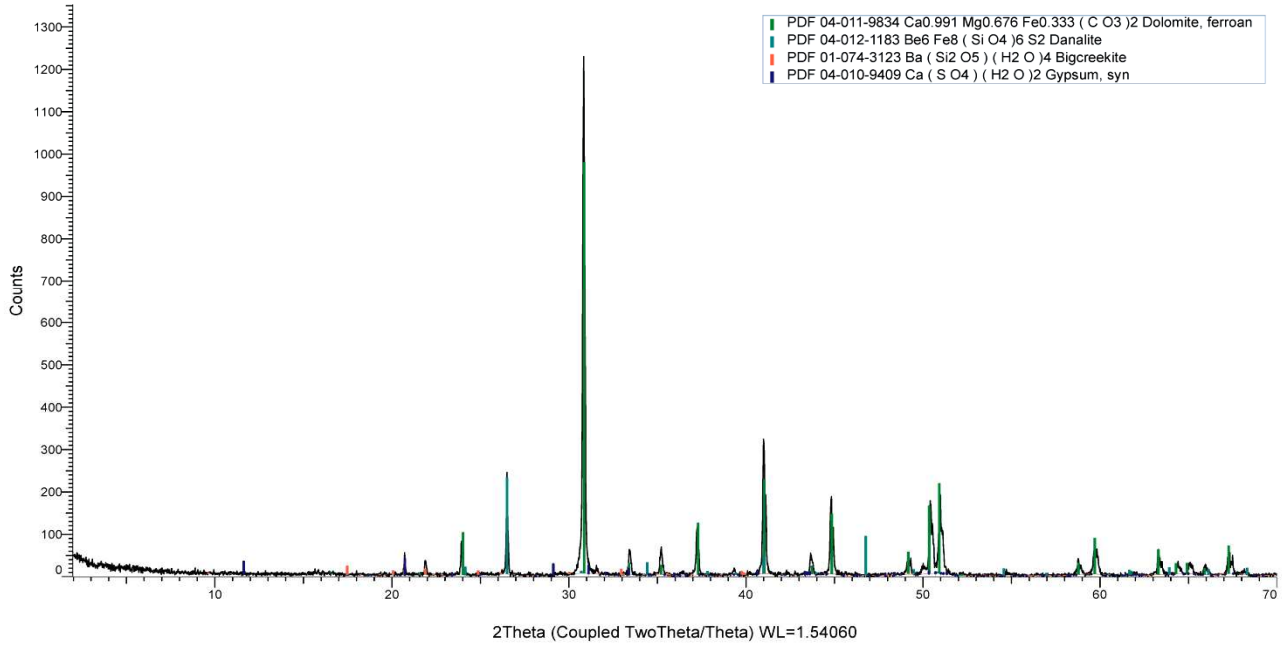
Density	Cell Tuned	F (N)
2.869	No	F30= 999.9(0.0000, 31)
2.660	No	F30= 558.3(0.0017, 31)

STFC 68.4 (Coupled TwoTheta/Theta)

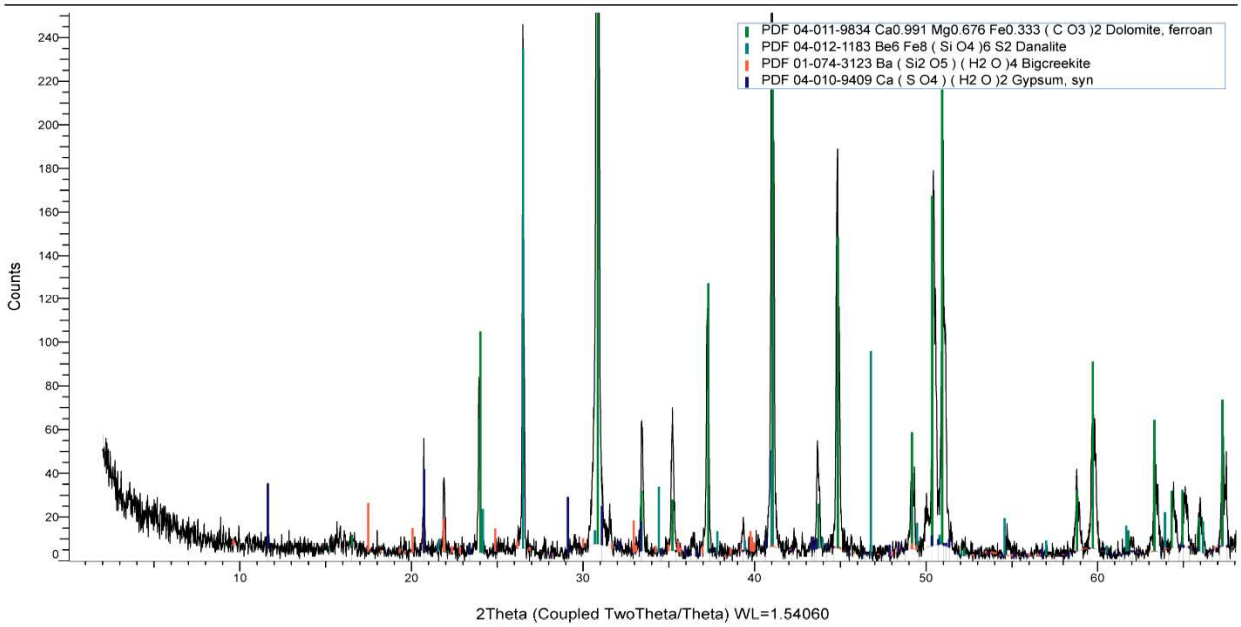


- Sample STF C69.

STFC 69 (Coupled TwoTheta/Theta)



STFC 69 (y-axis zoom)



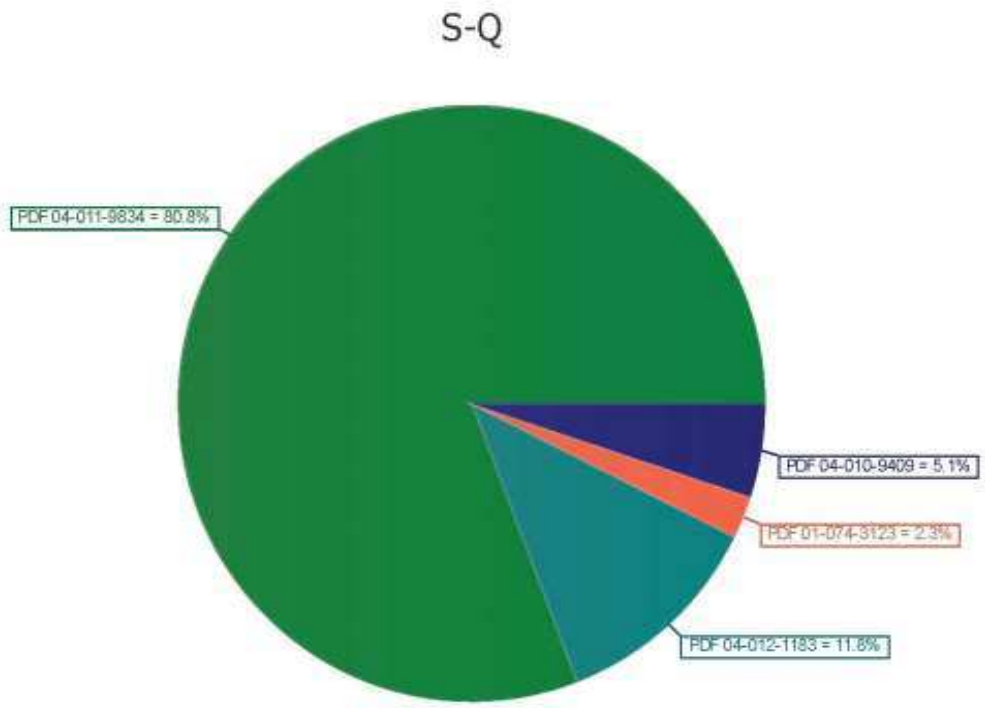
Pattern List #1

Show	Icon	Color	Index	Name	Parent	Scan	Pattern #	Compound Name	Formula	Quality
Yes			0	PDF 04-011-9834	Pattern List #1	TD18_0556.raw #1	PDF 04-011-9834	Dolomite, ferroan	Ca0.991 Mg0.676 Fe0.333 (C O3)2	Indexed
Yes			1	PDF 04-012-1183	Pattern List #1	TD18_0556.raw #1	PDF 04-012-1183	Danalite	Be6 Fe8 (Si O4)6 S2	Indexed
Yes			2	PDF 01-074-3123	Pattern List #1	TD18_0556.raw #1	PDF 01-074-3123	Bigcreekite	Ba (Si2 O5) (H2 O)4	Indexed
Yes			3	PDF 04-010-9409	Pattern List #1	TD18_0556.raw #1	PDF 04-010-9409	Gypsum, syn	Ca (S O4) (H2 O)2	Star (*)

Y-Scale	I/Ic DB	I/Ic User	S-Q	Added Reference	d x by	Scan WL	Wavelength	System	Space Group	a	b	c	alpha
79.12%	2.770	0.000	80.8%		1.0000	Yes	1.54060	Rhombo.H.axes	R-3 (148)	4.81700		16.07940	
18.64%	4.470	0.000	11.8%		1.0000	Yes	1.54060	Cubic	P-43n (218)	8.23170			
1.83%	2.250	0.000	2.3%		1.0000	Yes	1.54060	Orthorhombic	Pnma (62)	5.04530	9.04400	18.36600	
3.08%	1.720	0.000	5.1%		1.0000	Yes	1.54060	Monoclinic	C2/c (15)	6.28400	15.20000	6.52300	

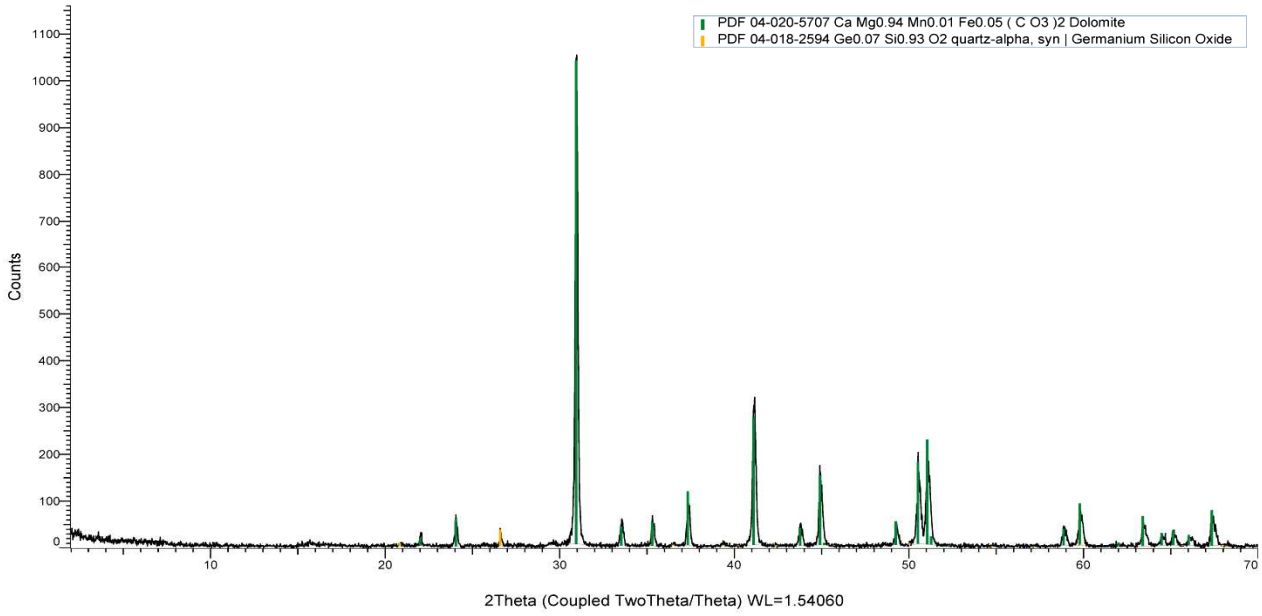
beta	gamma	Z	Volume	Density	Cell Tuned	F (N)
		3	323.11	3.003	No	F30= 999.9(0.0001, 33)
		1	557.79	3.327	No	F30= 999.9(0.0001, 39)
		4	838.03	2.739	No	F30= 140.2(0.0058, 37)
127.410		4	494.90	2.311	No	F30= 226.7(0.0039, 34)

STFC 69 (Coupled TwoTheta/Theta)

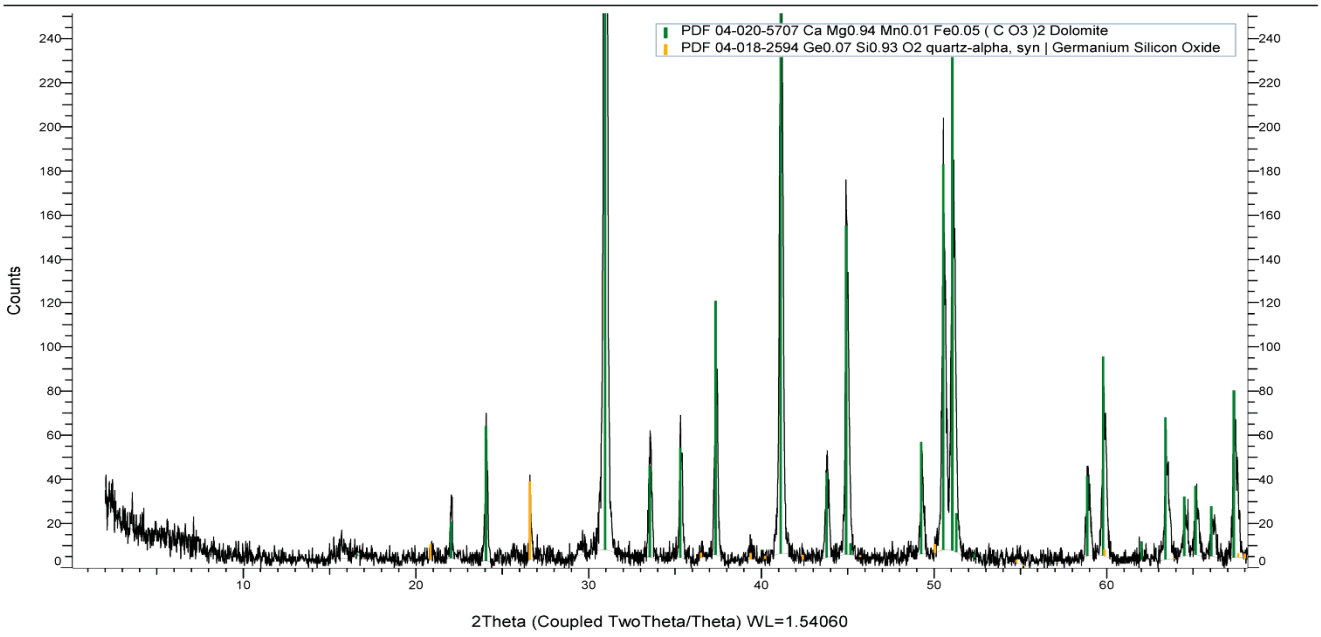


- Sample STF C70.

STFC 70 (Coupled TwoTheta/Theta)



STFC 70 (y-axis zoom)



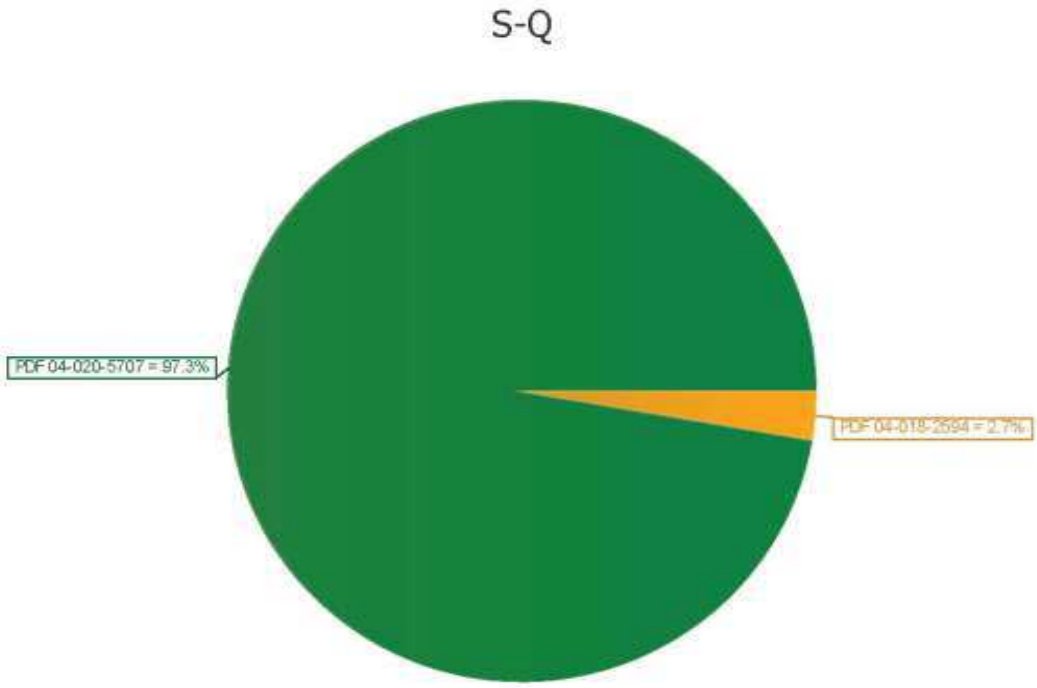
Pattern List #1

Show	Icon	Color	Index	Name	Parent	Scan	Pattern #	Compound Name
Yes			0	PDF 04-020-5707	Pattern List #1	TD18_0557.raw #1	PDF 04-020-5707	Dolomite
Yes			1	PDF 04-018-2594	Pattern List #1	TD18_0557.raw #1	PDF 04-018-2594	quartz-alpha, syn | Germanium Silicon Oxide

Formula	Quality	Y-Scale	I/Ic DB	I/Ic User	S-Q	Added Reference	d x by	Scan WL	Wavelength	System
Ca Mg0.94 Mn0.01 Fe0.05 (C O3)2	Star (*)	98.13%	2.610	0.000	97.3%		1.0000	Yes	1.54060	Rhombo.H.axes
Ge0.07 Si0.93 O2	Indexed	3.37%	3.250	0.000	2.7%		1.0000	Yes	1.54060	Hexagonal

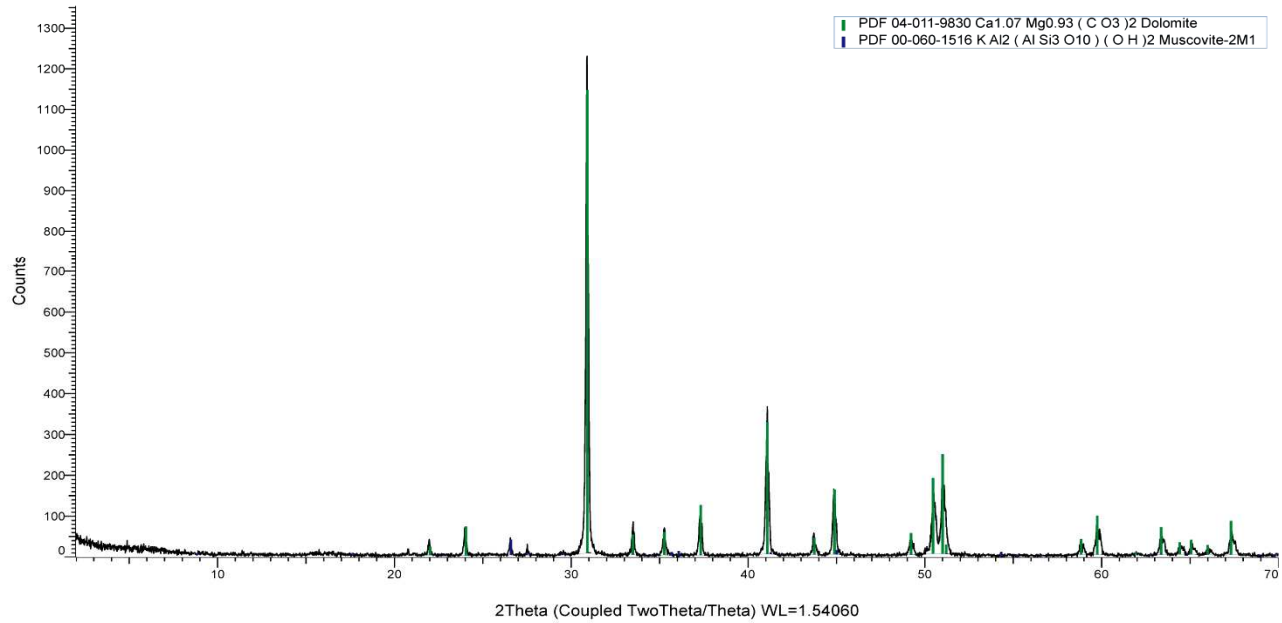
Space Group	a	b	c	alpha	beta	gamma	Z	Volume	Density	Cell Tuned	F (N)
R-3 (148)	4.81200		16.02000				3	321.25	2.889	No	F30= 999.9(0.0000, 31)
P3221 (154)	4.92000		5.41950				3	113.61	2.771	No	F30= 999.9(0.0000, 30)

STFC 70 (Coupled TwoTheta/Theta)

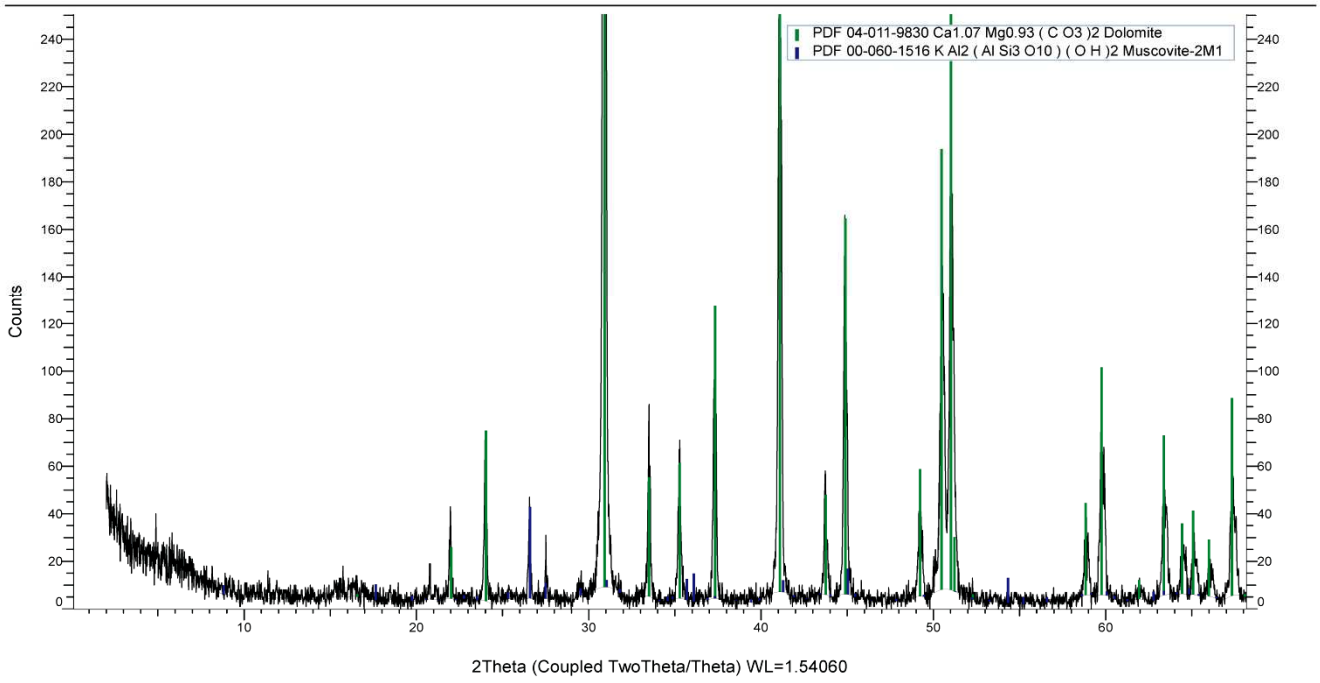


- Sample STF C71.

STFC 71 (Coupled TwoTheta/Theta)



STFC 71 (y-axis zoom)



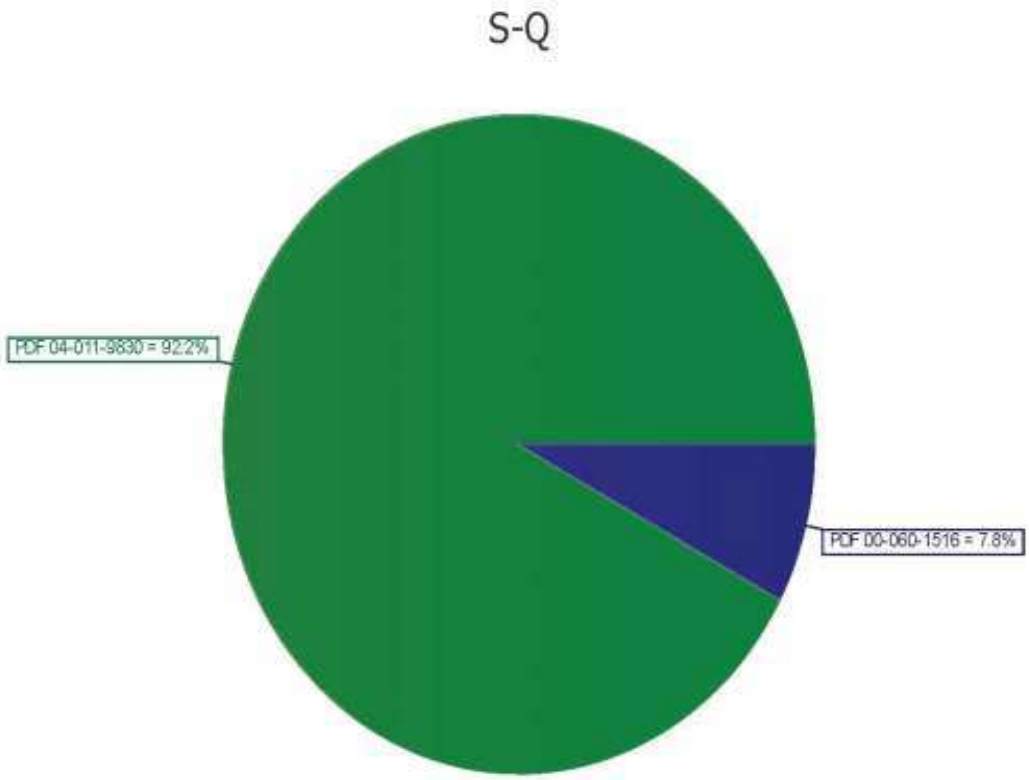
Pattern List #1

Show	Icon	Color	Index	Name	Parent	Scan	Pattern #	Compound Name	Formula	Quality	Y-Scale
Yes			0	PDF 04-011-9830	Pattern List #1	TD18_0558.raw #1	PDF 04-011-9830	Dolomite	Ca1.07 Mg0.93 (C O3)2	Indexed	92.52%
Yes			1	PDF 00-060-1516	Pattern List #1	TD18_0558.raw #1	PDF 00-060-1516	Muscovite-2M1	K Al2 (Al Si3 O10) (O H)2	Indexed	3.12%

I/Ic DB	I/Ic User	S-Q	Added Reference	d x by	Scan WL	Wavelength	System	Space Group	a	b	c	alpha	beta	gamma
2.510	0.000	92.2%		1.0000	Yes	1.54060	Rhombo.H.axes	R-3 (148)	4.81410		16.03920			
(1)	0.000	7.8%		1.0000	Yes	1.54060	Monoclinic	C2/c (15)	5.21720	9.13970	20.22830		95.853	

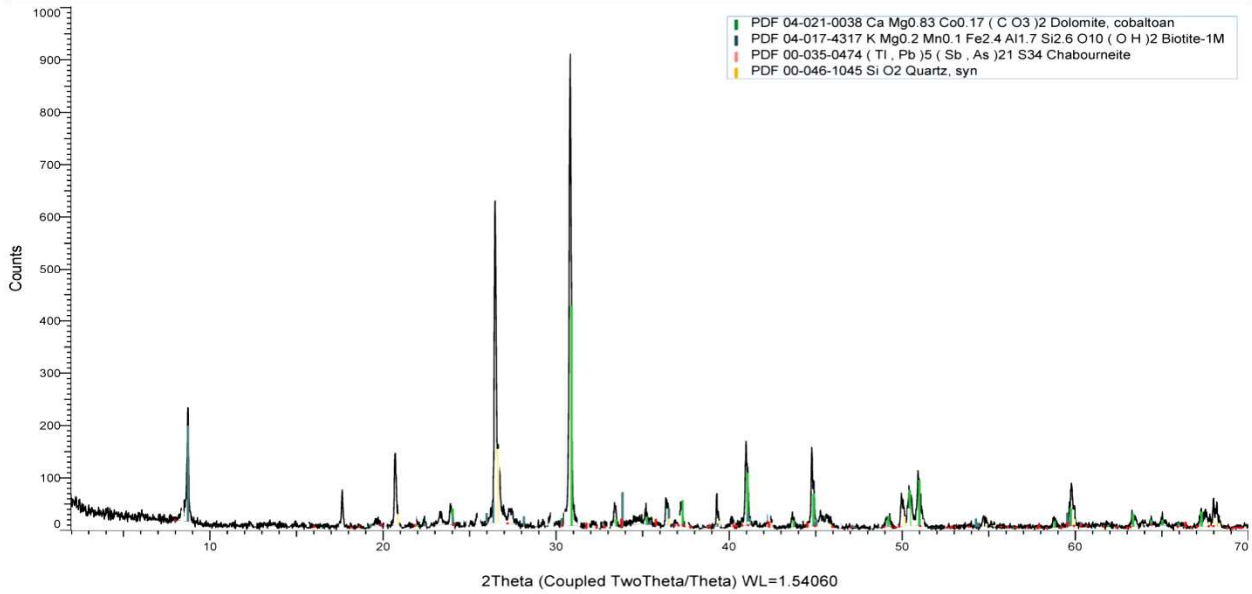
Z	Volume	Density	Cell Tuned	F (N)
3	321.92	2.871	No	F30= 999.9(0.0000, 32)
4	959.53	2.757	No	F30= 9.4(0.0480, 66)

STFC 71 (Coupled TwoTheta/Theta)

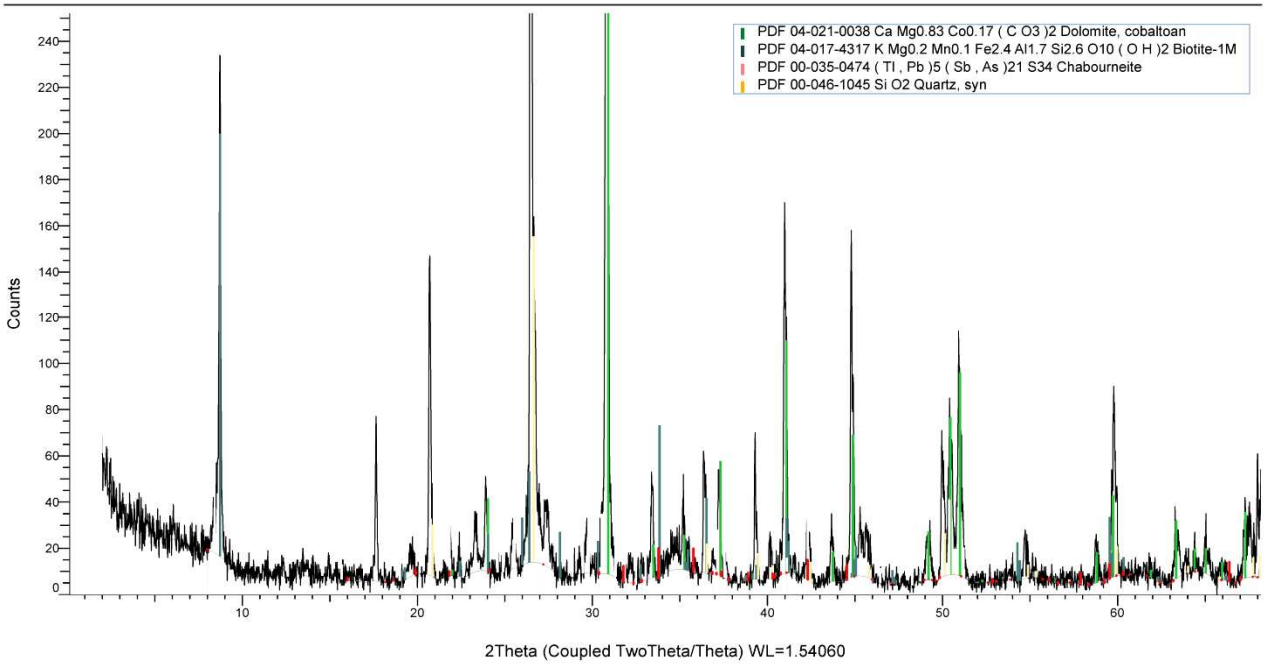


- Red dolospar sample.

STFC 185 (Coupled TwoTheta/Theta)



STFC 185 (y-axis zoom)



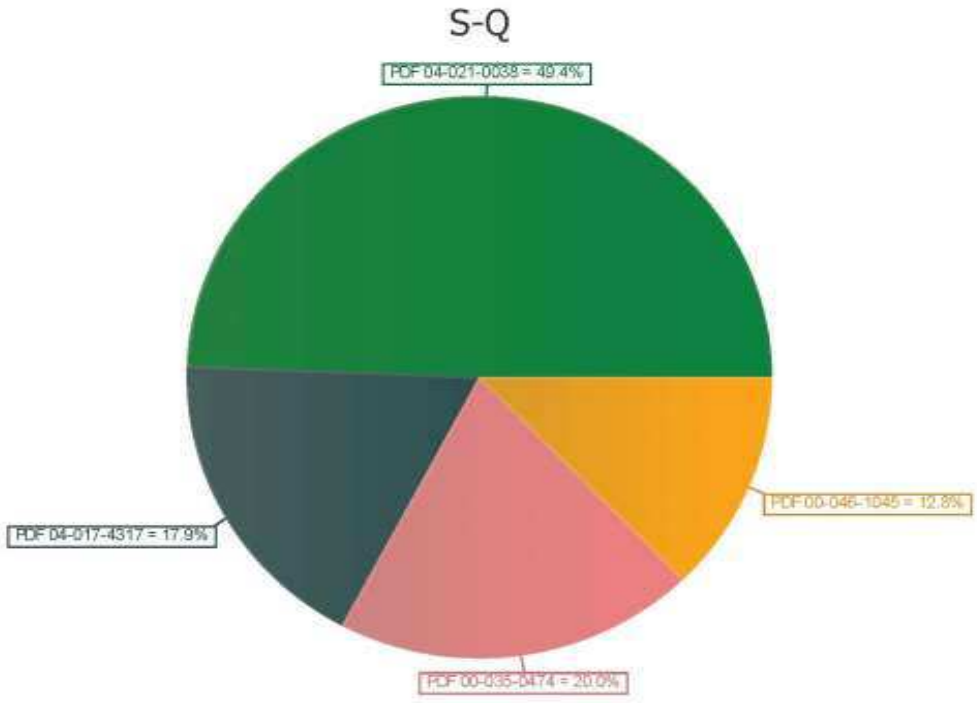
Pattern List #1

Show	Icon	Color	Index	Name	Parent	Scan	Pattern #	Compound Name
Yes			0	Ca Mg0.83 Co0.17 (C O3)2	Pattern List #1	TD18_0559.raw #1	PDF 04-021-0038	Dolomite, cobaltoan
Yes			1	K Mg0.2 Mn0.1 Fe2.4 Al1.7 Si2.6 O10 (O H) 2	Pattern List #1	TD18_0559.raw #1	PDF 04-017-4317	Biotite-1M
Yes			2	(Tl , Pb)5 (Sb , As)21 S34	Pattern List #1	TD18_0559.raw #1	PDF 00-035-0474	Chabourneite
Yes			3	Si O2	Pattern List #1	TD18_0559.raw #1	PDF 00-046-1045	Quartz, syn

Formula	Quality	Y-Scale	I/Ic DB	I/Ic User	S-Q	Added Reference	d x by	Scan WL	Wavelength	System
Ca Mg0.83 Co0.17 (C O3)2	Star (*)	46.17%	2.620	0.000	49.4%		1.0000	Yes	1.54060	Rhombo.H.axes
K Mg0.2 Mn0.1 Fe2.4 Al1.7 Si2.6 O10 (O H)2	Indexed	20.15%	3.160	0.000	17.9%		1.0000	Yes	1.54060	Monoclinic
(Tl , Pb)5 (Sb , As)21 S34	Indexed	7.15%	(1)	0.000	20.0%		1.0000	Yes	1.54060	Triclinic
Si O2	Star (*)	15.53%	3.410	0.000	12.8%		1.0000	Yes	1.54060	Hexagonal

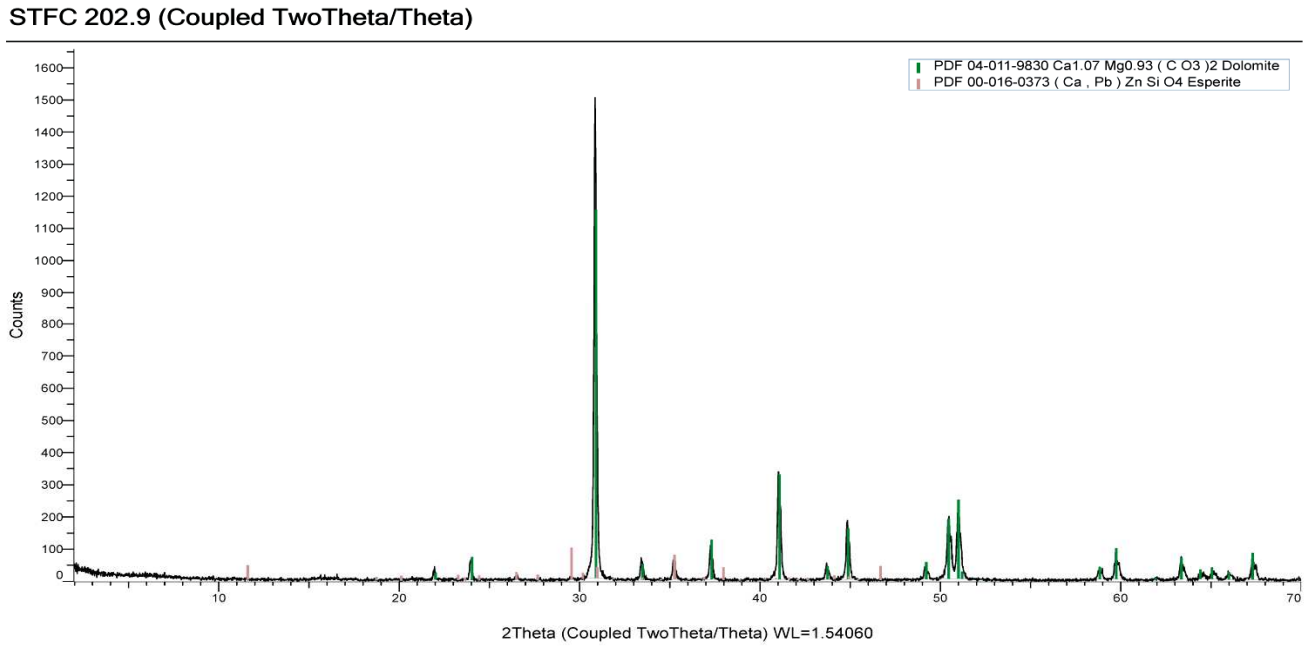
Space Group	a	b	c	alpha	beta	gamma	Z	Volume	Density	Cell Tuned	F (N)
R-3 (148)	4.81580		16.04880				3	322.34	2.941	No	F30= 999.9(0.0001, 32)
C2/m (12)	5.37410	9.30830	10.28290		100.220		2	506.23	3.256	No	F30= 111.8(0.0075, 36)
P1 (1)	16.34600	42.60200	8.53400	95.860	86.910	96.880	4	5863.99	5.104	No	F30= 2.5(0.0098, 1242)
P3221 (154)	4.91344		5.40524				3	113.01	2.660	No	F30= 538.7(0.0018, 31)

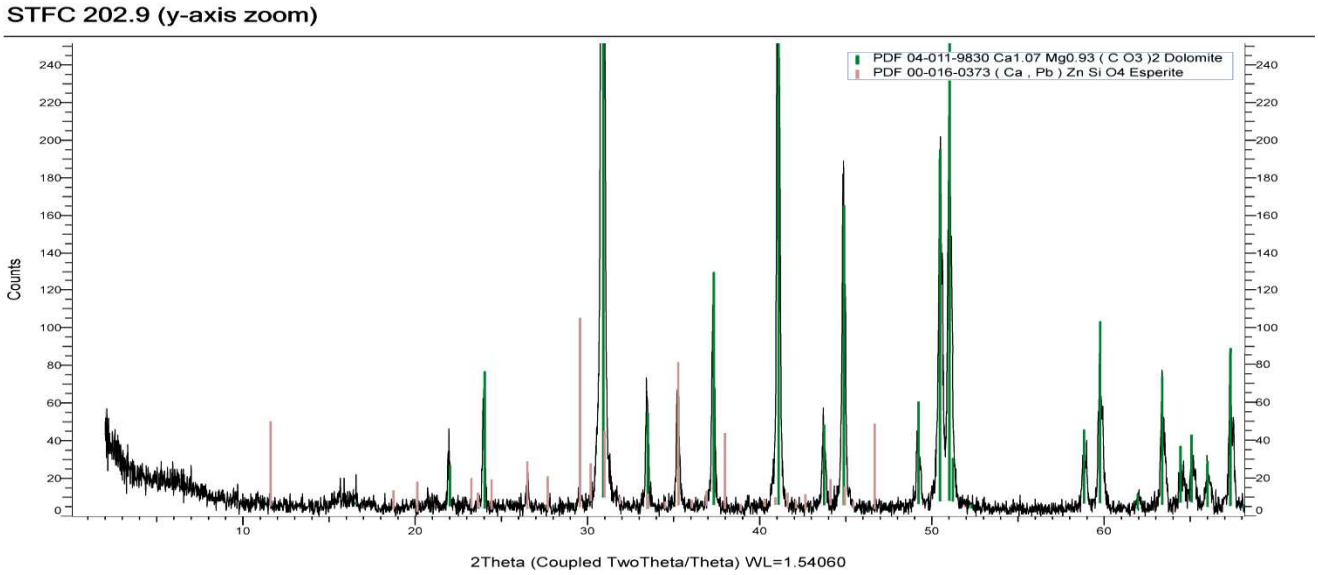
STFC 185 (Coupled TwoTheta/Theta)



- Upper Shital samples.

➢ Sample STF C202.9





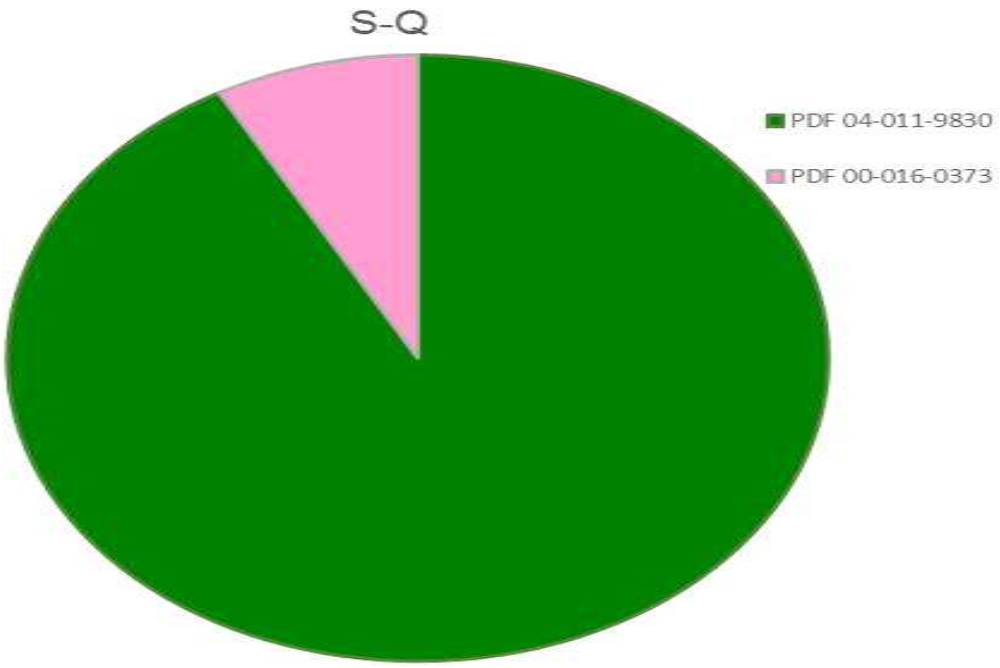
Pattern List #1

Show	Icon	Color	Index	Name	Parent	Scan	Pattern #	Compound Name	Formula	Quality	Y-Scale
Yes			0	PDF 04-011-9830	Pattern List #1	TD18_0560.raw #1	PDF 04-011-9830	Dolomite	Ca1.07 Mg0.93 (C O3)2	Indexed	76.22%
Yes			1	PDF 00-016-0373	Pattern List #1	TD18_0560.raw #1	PDF 00-016-0373	Esperite	(Ca , Pb) Zn Si O4	Indexed	6.67%

I/Ic DB	I/Ic User	S-Q	Added Reference	d x by	Scan WL	Wavelength	System	Space Group	a	b	c	alpha	beta	gamma
2.510	0.000	82.0%		1.0000	Yes	1.54060	Rhombo.H.axes	R-3 (148)	4.81410		16.03920			
(1)	0.000	18.0%		1.0000	Yes	1.54060	Monoclinic	P21/n (14)	8.81400	8.27000	15.26000		90.000	

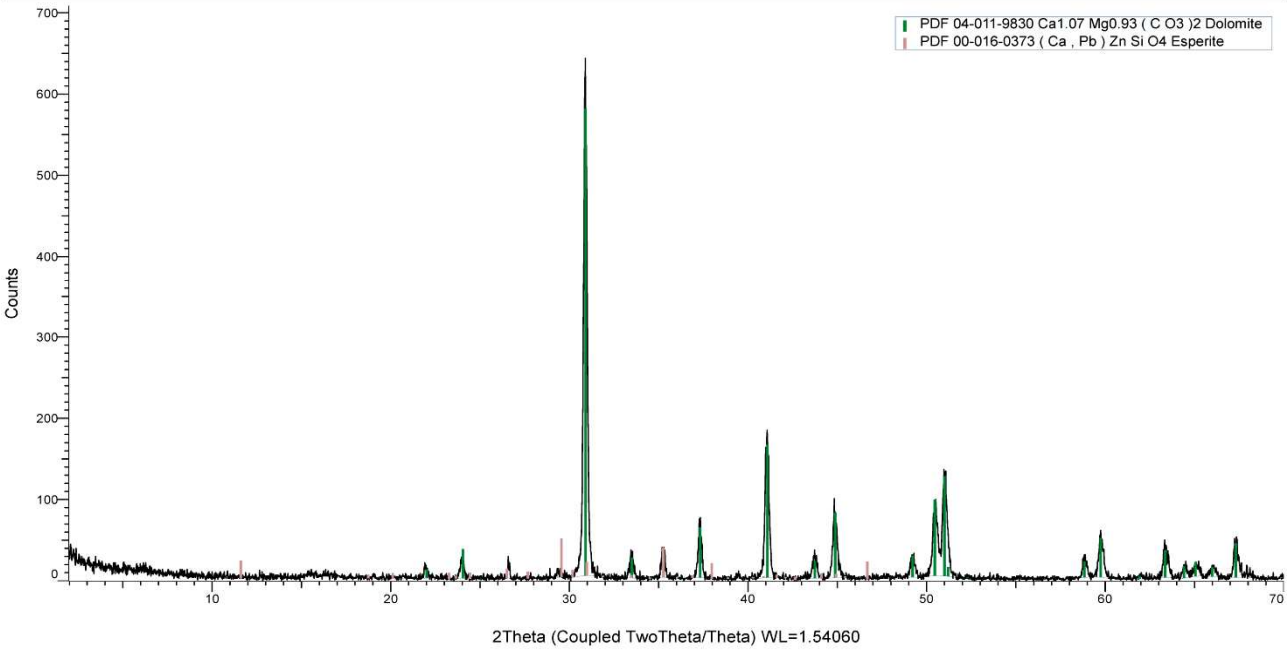
Z	Volume	Density	Cell Tuned	F (N)
3	321.92	2.871	No	F30= 999.9(0.0000, 32)
12	1112.33	4.280	No	F28= 11.2(0.0250, 100)

STFC 202.9 (Coupled Two Theta/Theta)

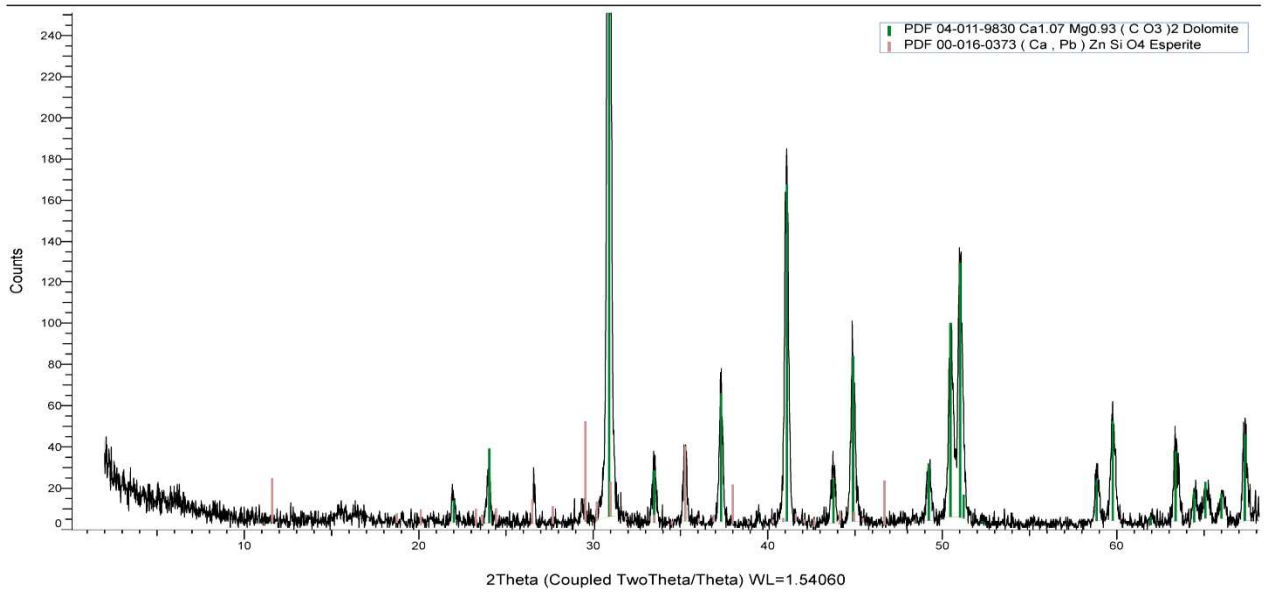


- Sample STF C204.3.

STFC 204.3 (Coupled TwoTheta/Theta)



STFC 204.3 (y-axis zoom)



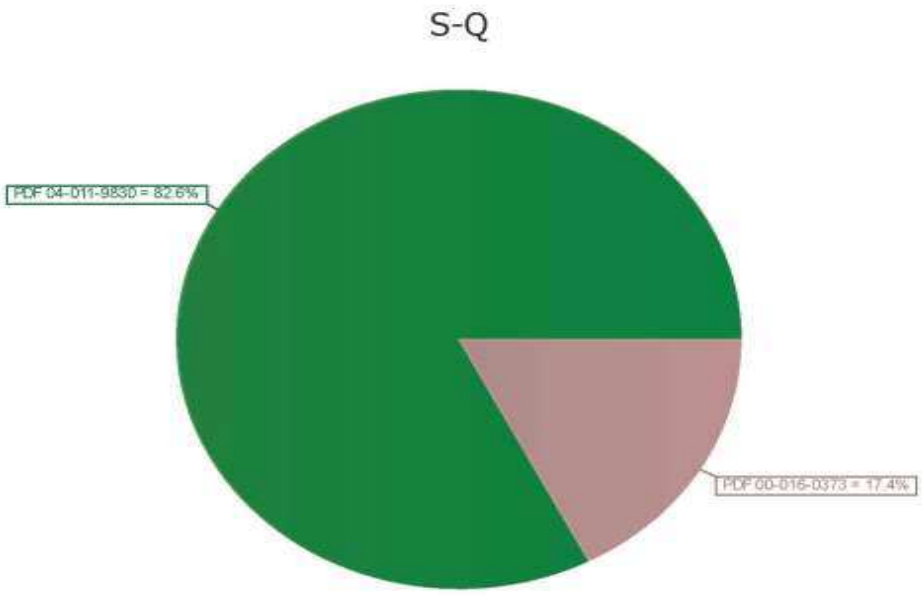
Pattern List #1

Show	Icon	Color	Index	Name	Parent	Scan	Pattern #	Compound Name	Formula	Quality	Y-Scale
Yes			0	PDF 04-011-9830	Pattern List #1	TD18_0561.raw #1	PDF 04-011-9830	Dolomite	Ca1.07 Mg0.93 (C O3)2	Indexed	89.45%
Yes			1	PDF 00-016-0373	Pattern List #1	TD18_0561.raw #1	PDF 00-016-0373	Esperite	(Ca , Pb) Zn Si O4	Indexed	7.51%

I/Ic DB	I/Ic User	S-Q	Added Reference	d x by	Scan WL	Wavelength	System	Space Group	a	b	c	alpha	beta	gamma
2.510	0.000	82.6%		1.0000	Yes	1.54060	Rhombo.H.axes	R-3 (148)	4.81410		16.03920			
(1)	0.000	17.4%		1.0000	Yes	1.54060	Monoclinic	P21/n (14)	8.81400	8.27000	15.26000		90.000	

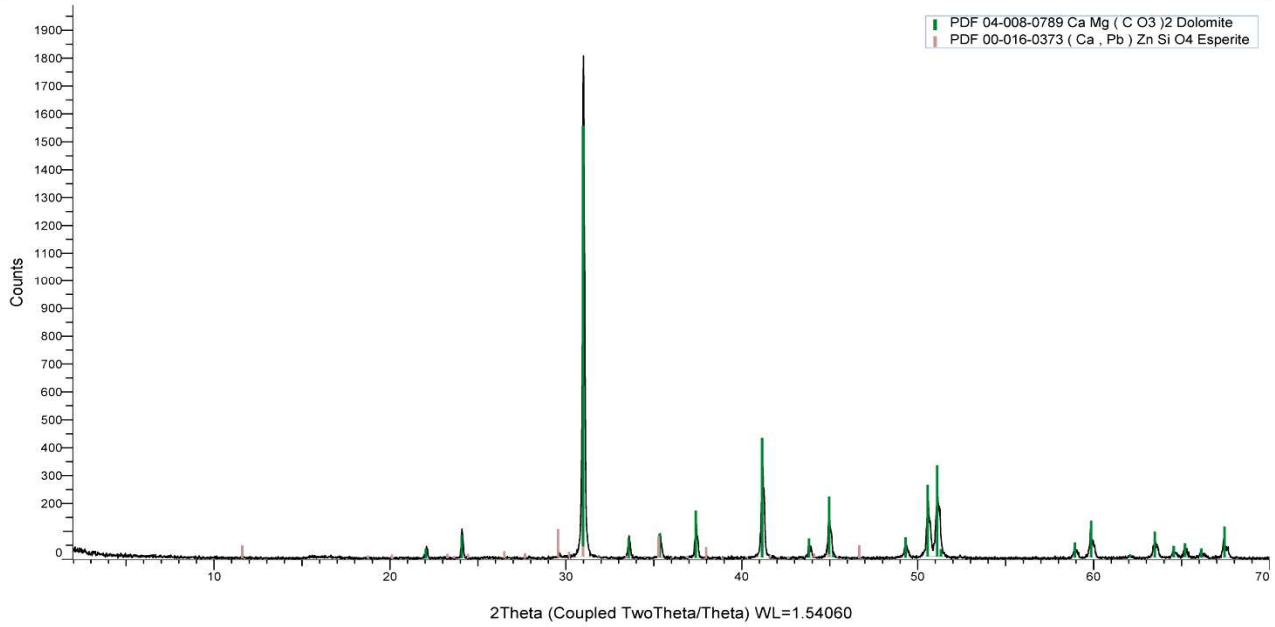
Z	Volume	Density	Cell Tuned	F (N)
3	321.92	2.871	No	F30= 999.9(0.0000, 32)
12	1112.33	4.280	No	F28= 11.2(0.0250, 100)

STFC 204.3 (Coupled TwoTheta/Theta)

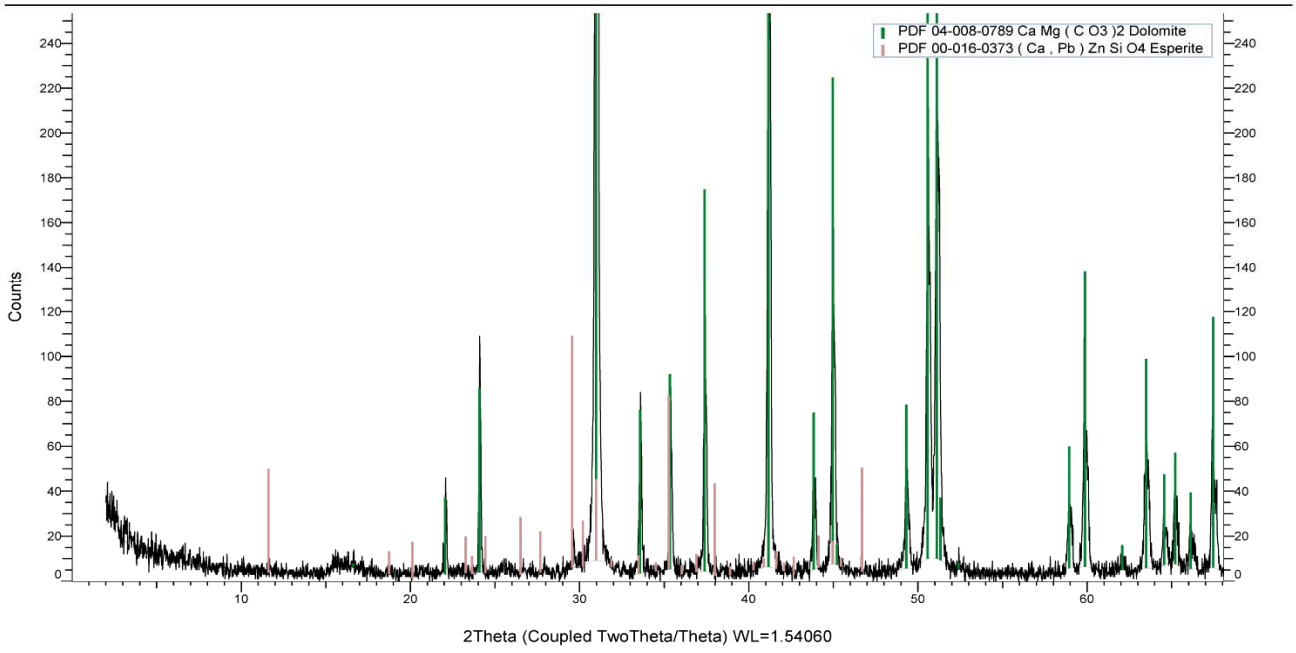


- Sample STF C205.7.

STFC 205.7 (Coupled TwoTheta/Theta)



STFC 205.7 (y-axis zoom)



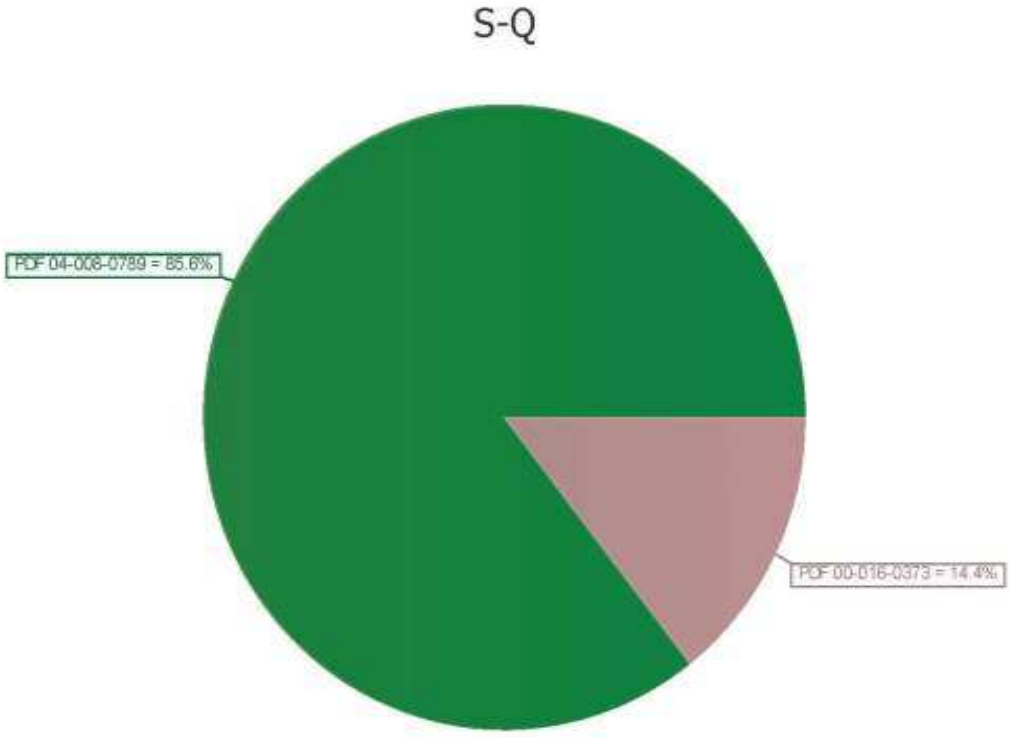
Pattern List #1

Show	Icon	Color	Index	Name	Parent	Scan	Pattern #	Compound Name	Formula	Quality	Y-Scale
Yes			0	PDF 04-008-0789	Pattern List #1	TD18_0562.raw #1	PDF 04-008-0789	Dolomite	Ca Mg (C O3)2	Star (*)	85.68%
Yes			1	PDF 00-016-0373	Pattern List #1	TD18_0562.raw #1	PDF 00-016-0373	Esperite	(Ca , Pb) Zn Si O4	Indexed	5.71%

I/Ic DB	I/Ic User	S-Q	Added Reference	d x by	Scan WL	Wavelength	System	Space Group	a	b	c	alpha	beta	gamma
2.530	0.000	85.6%		1.0000	Yes	1.54060	Rhombo.H.axes	R-3 (148)	4.80640		16.00600			
(1)	0.000	14.4%		1.0000	Yes	1.54060	Monoclinic	P21/n (14)	8.81400	8.27000	15.26000		90.000	

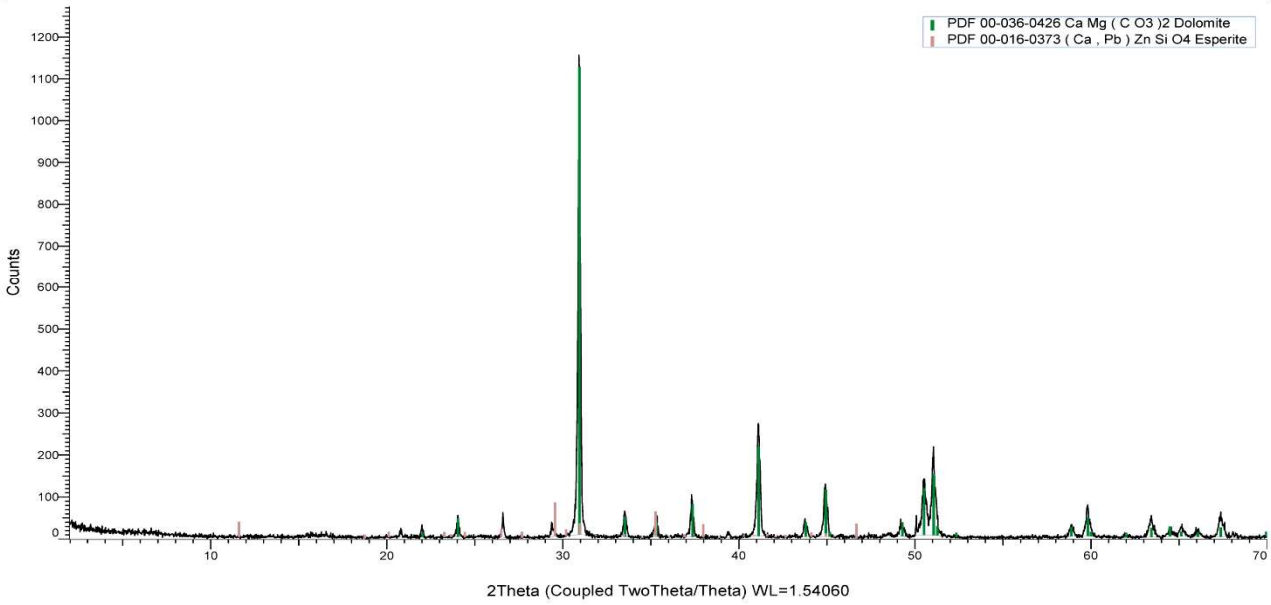
Z	Volume	Density	Cell Tuned	F (N)
3	320.22	2.869	No	F30= 999.9(0.0000, 31)
12	1112.33	4.280	No	F28= 11.2(0.0250, 100)

STFC 205.7 (Coupled TwoTheta/Theta)

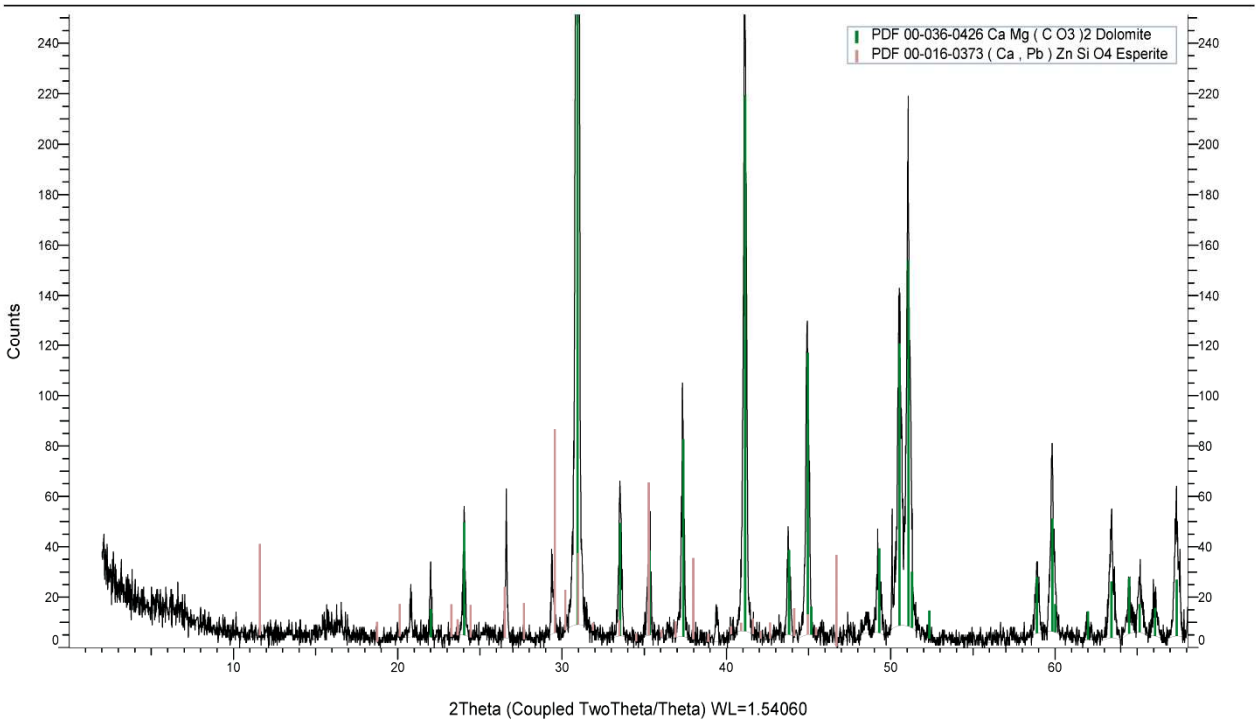


- Sample STF C210.

STFC 210 (Coupled TwoTheta/Theta)



STFC 210 (y-axis zoom)



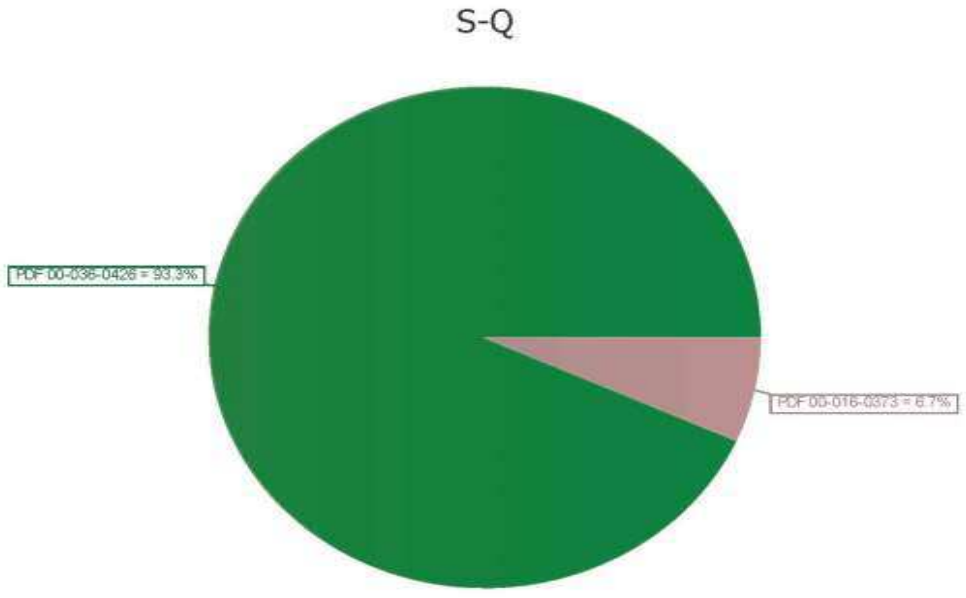
Pattern List #1

Show	Icon	Color	Index	Name	Parent	Scan	Pattern #	Compound Name	Formula	Quality	Y-Scale
Yes			0	PDF 00-036-0426	Pattern List #1	TD18_0563.raw #1	PDF 00-036-0426	Dolomite	Ca Mg (C O3)2	Star (*)	96.81%
Yes			1	PDF 00-016-0373	Pattern List #1	TD18_0563.raw #1	PDF 00-016-0373	Esperite	(Ca , Pb) Zn Si O4	Indexed	6.99%

I/Ic DB	I/Ic User	S-Q	Added Reference	d x by	Scan WL	Wavelength	System	Space Group	a	b	c	alpha	beta	gamma
(1)	0.000	93.3%		1.0000	Yes	1.54060	Rhombo.H.axes	R-3 (148)	4.80920		16.02000			
(1)	0.000	6.7%		1.0000	Yes	1.54060	Monoclinic	P21/n (14)	8.81400	8.27000	15.26000		90.000	

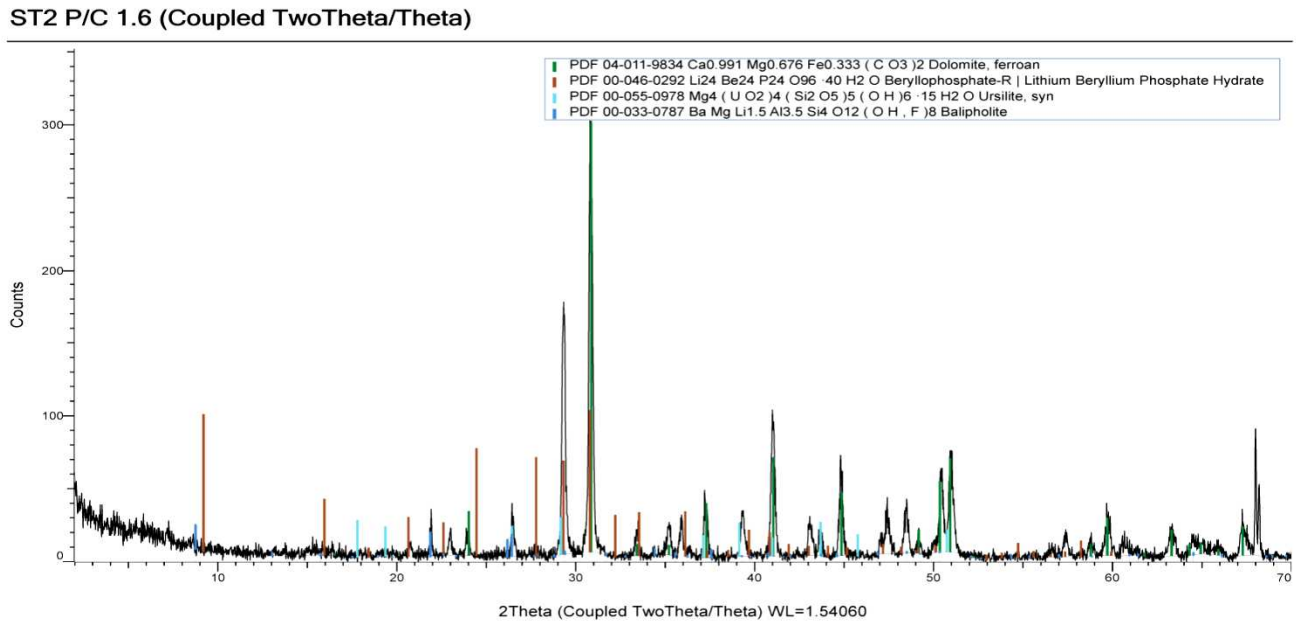
Z	Volume	Density	Cell Tuned	F (N)
3	320.88	2.860	No	F30= 146.5(0.0064, 32)
12	1112.33	4.280	No	F28= 11.2(0.0250, 100)

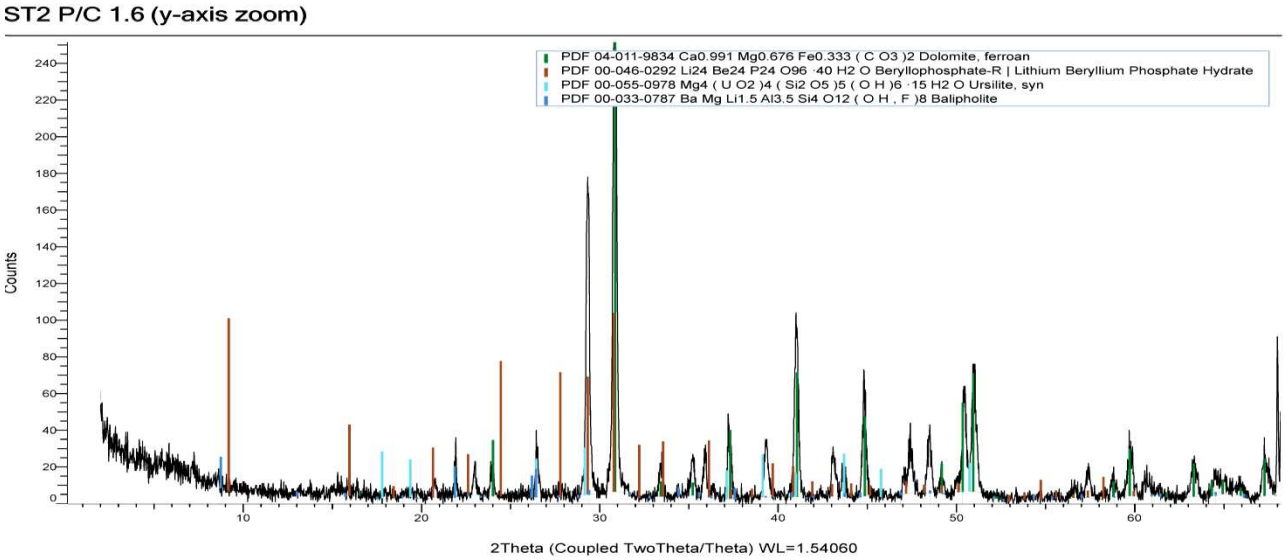
STFC 210 (Coupled TwoTheta/Theta)



- Aswad Member samples.

➢ Sample ST2 P/C 1.6.





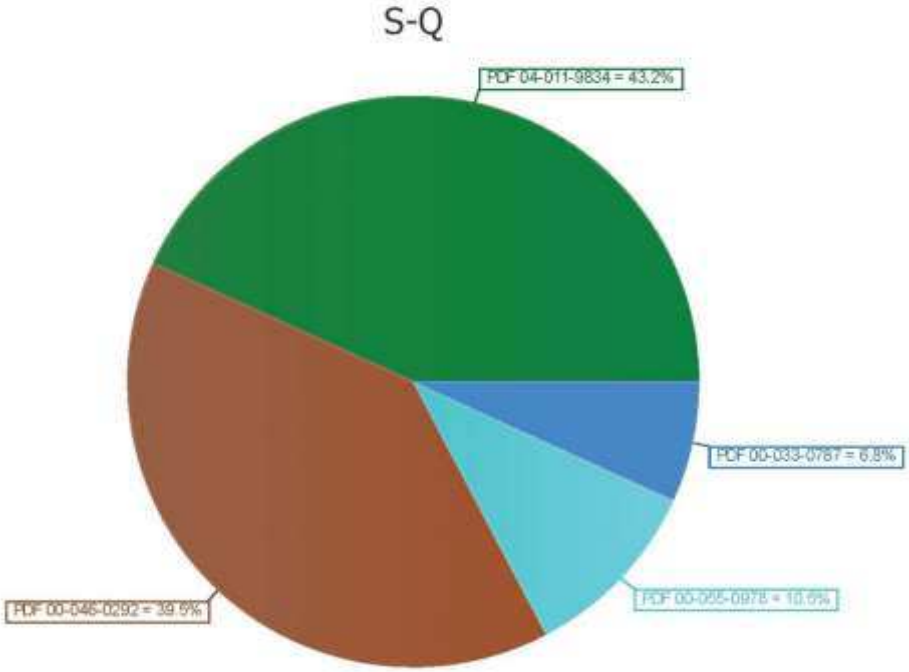
Pattern List #1

Show	Icon	Color	Index	Name	Parent	Scan	Pattern #	Compound Name
Yes			0	PDF 04-011-9834	Pattern List #1	TD18_0564.raw #1	PDF 04-011-9834	Dolomite, ferroan
Yes			1	PDF 00-046-0292	Pattern List #1	TD18_0564.raw #1	PDF 00-046-0292	Beryllophosphate-R | Lithium Beryllium Phosphate Hydrate
Yes			2	PDF 00-055-0978	Pattern List #1	TD18_0564.raw #1	PDF 00-055-0978	Ursilite, syn
Yes			3	PDF 00-033-0787	Pattern List #1	TD18_0564.raw #1	PDF 00-033-0787	Balipholite

Formula	Quality	Y-Scale	I/Ic DB	I/Ic User	S-Q	Added Reference	d x by	Scan WL	Wavelength	System
Ca0.991 Mg0.676 Fe0.333 (C O3)2	Indexed	92.19%	2.770	0.000	43.2%		1.0000	Yes	1.54060	Rhombo.H.axes
Li24 Be24 P24 O96 ·40 H2 O	Star (*)	30.44%	(1)	0.000	39.5%		1.0000	Yes	1.54060	Cubic
Mg4 (U O2)4 (Si2 O5)5 (O H)6 ·15 H2 O	Indexed	8.08%	(1)	0.000	10.5%		1.0000	Yes	1.54060	Orthorhombic
Ba Mg Li1.5 Al3.5 Si4 O12 (O H , F)8	Indexed	5.25%	(1)	0.000	6.8%		1.0000	Yes	1.54060	Orthorhombic

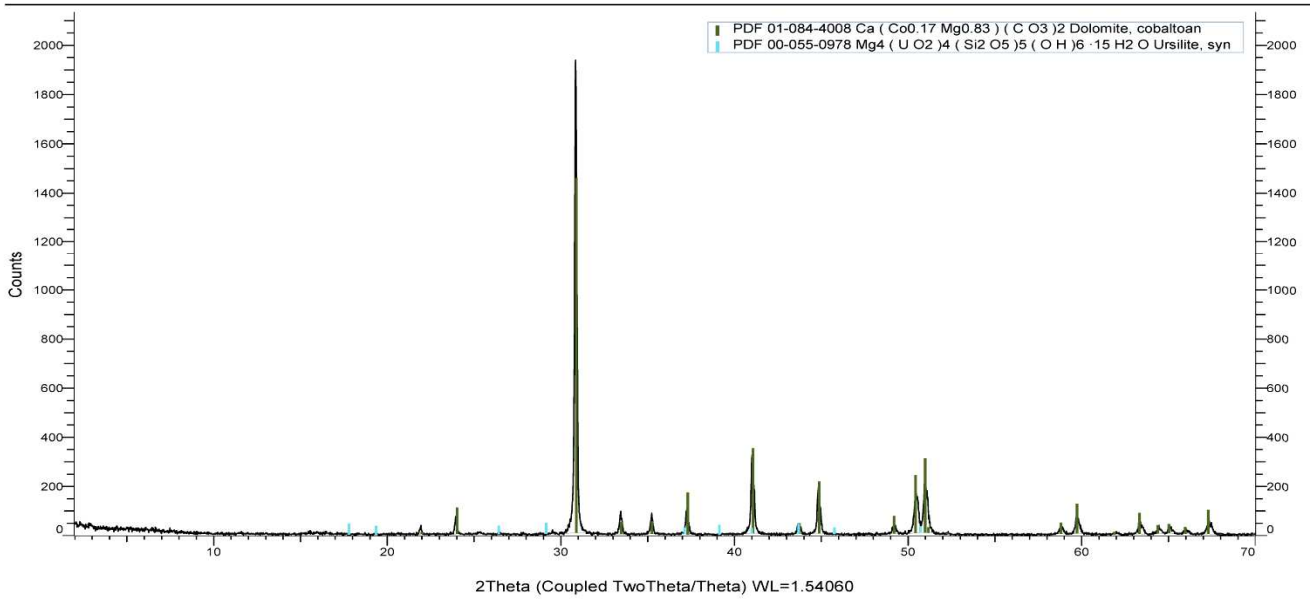
Space Group	a	b	c	alpha	beta	gamma	Z	Volume	Density	Cell Tuned	F (N)
R-3 (148)	4.81700		16.07940				3	323.11	3.003	No	F30= 999.9(0.0001, 33)
I (0)	13.61200							2522.12		No	F30= 71.6(0.0131, 32)
P (0)	14.28000	17.93000	18.26000				4	4675.30	3.000	No	F10= 0.6(0.0314, 525)
Ccca (68)	13.61000	20.20000	5.14700				4	1415.02	3.320	No	F30= 14.9(0.0310, 65)

ST2 P/C 1.6 (Coupled TwoTheta/Theta)

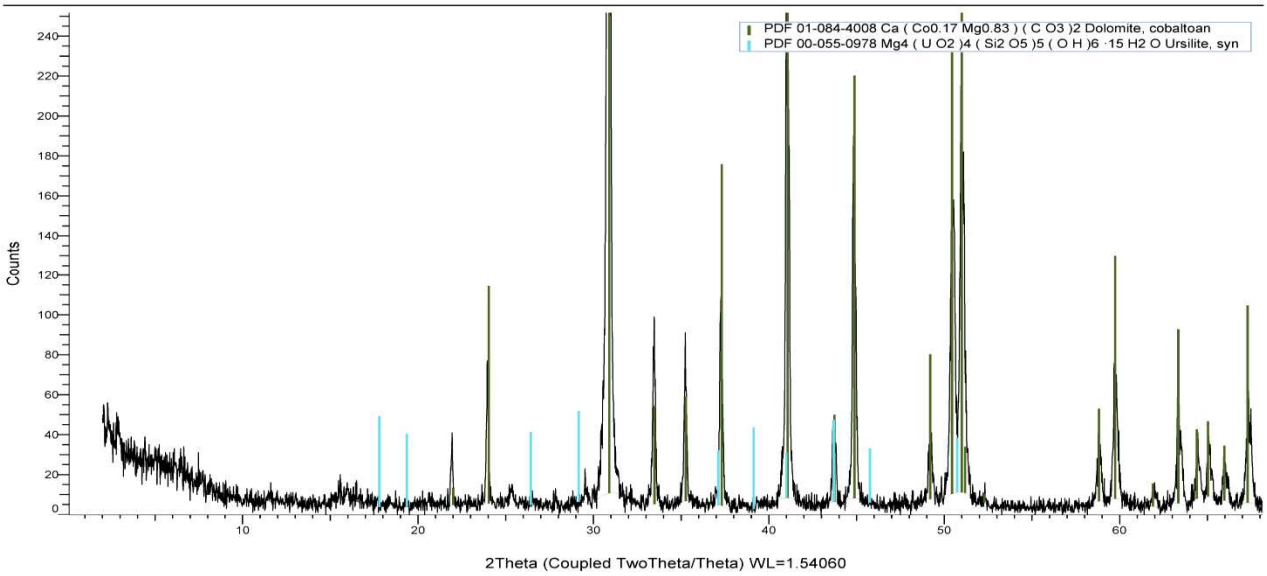


- Sample ST2 P/C 2.9.

ST2 P/C 2.9 (Coupled TwoTheta/Theta)



ST2 P/C 2.9 (y-axis zoom)



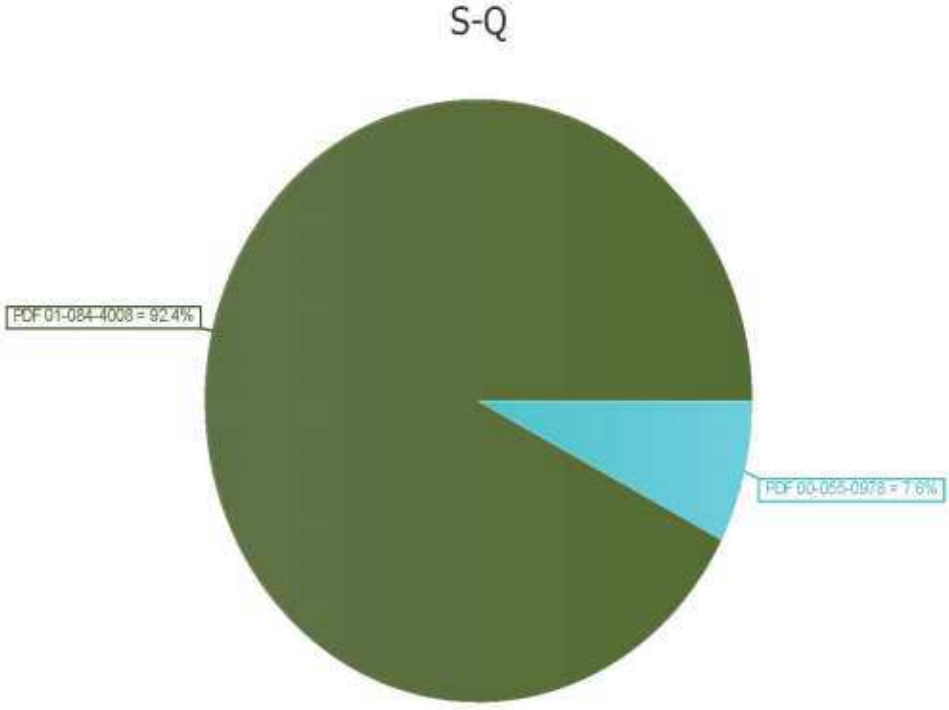
Pattern List #1

Show	Icon	Color	Index	Name	Parent	Scan	Pattern #	Compound Name	Formula
Yes			0	PDF 01-084-4008	Pattern List #1	TD18_0565.raw #1	PDF 01-084-4008	Dolomite, cobaltoan	Ca (Co0.17 Mg0.83) (C O3)2
Yes			1	PDF 00-055-0978	Pattern List #1	TD18_0565.raw #1	PDF 00-055-0978	Ursilite, syn	Mg4 (U O2)4 (Si2 O5)5 (O H)6 · 15 H2 O

Quality	Y-Scale	I/Ic DB	I/Ic User	S-Q	Added Reference	d x by	Scan WL	Wavelength	System	Space Group	a	b	c
Star (*)	74.84%	2.620	0.000	92.4%		1.0000	Yes	1.54060	Rhombo.H.axes	R-3 (148)	4.81580		16.04880
Indexed	2.35%	(1)	0.000	7.6%		1.0000	Yes	1.54060	Orthorhombic	P (0)	14.28000	17.93000	18.26000

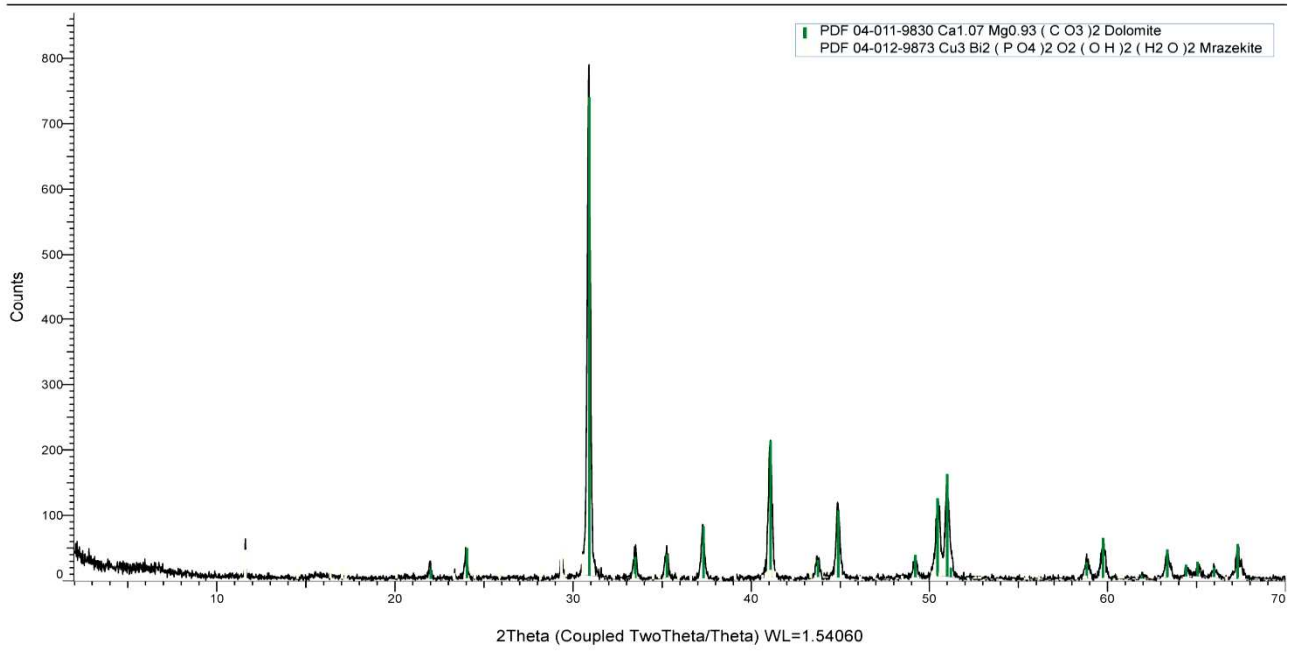
alpha	beta	gamma	Z	Volume	Density	Cell Tuned	F (N)
			3	322.34	2.941	No	F30= 999.9(0.0000, 32)
			4	4675.30	3.000	No	F10= 0.6(0.0310, 525)

ST2 P/C 2.9 (Coupled TwoTheta/Theta)

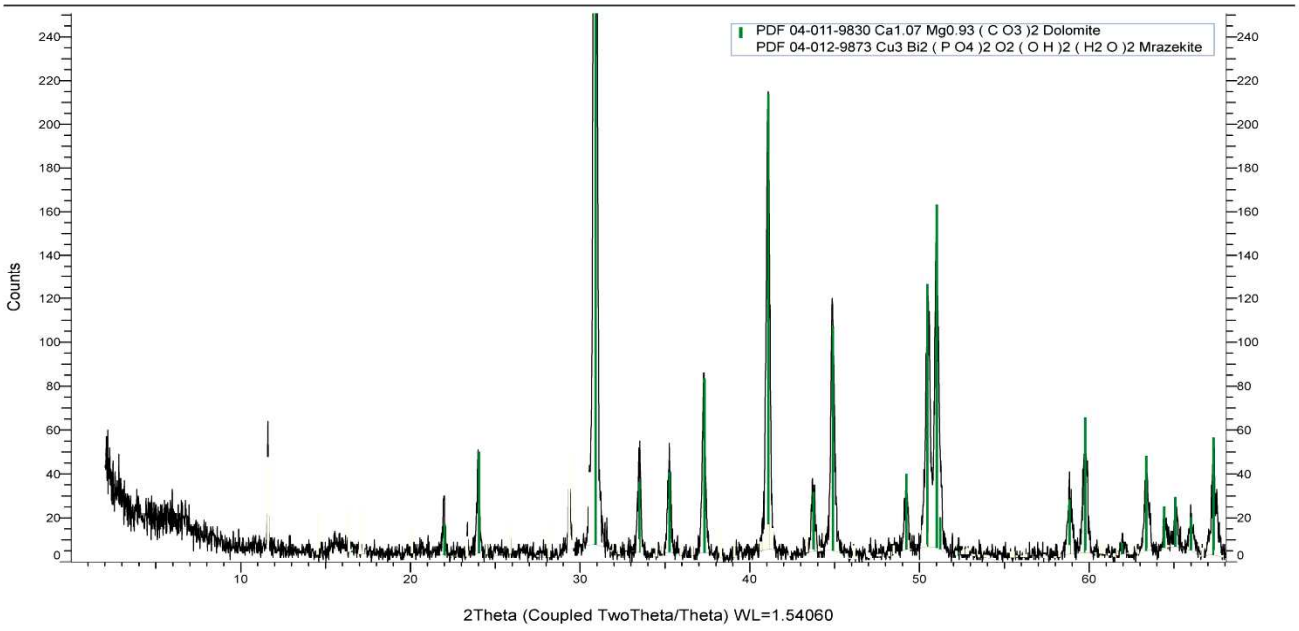


- Sample ST2 P/C 2.15.

ST2 P/C 2.15 (Coupled TwoTheta/Theta)



ST2 P/C 2.15 (y-axis zoom)



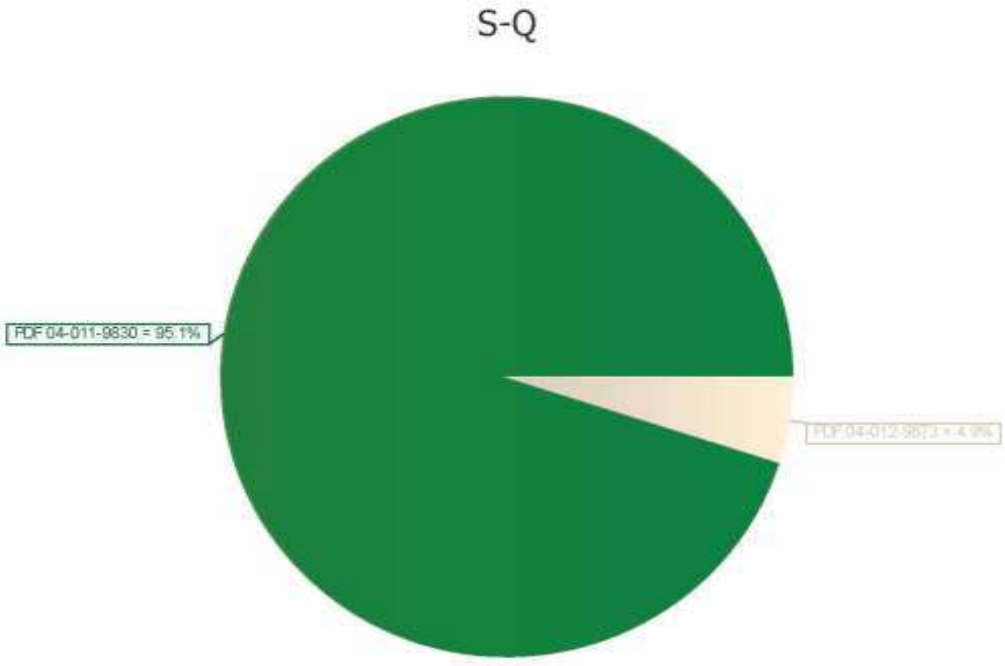
Pattern List #1

Show	Icon	Color	Index	Name	Parent	Scan	Pattern #	Compound Name	Formula
Yes			0	PDF 04-011-9830	Pattern List #1	TD18_0566.raw #1	PDF 04-011-9830	Dolomite	Ca1.07 Mg0.93 (C O3)2
Yes			1	PDF 04-012-9873	Pattern List #1	TD18_0566.raw #1	PDF 04-012-9873	Mrazekite	Cu3 Bi2 (P O4)2 O2 (O H)2 (H2 O)2

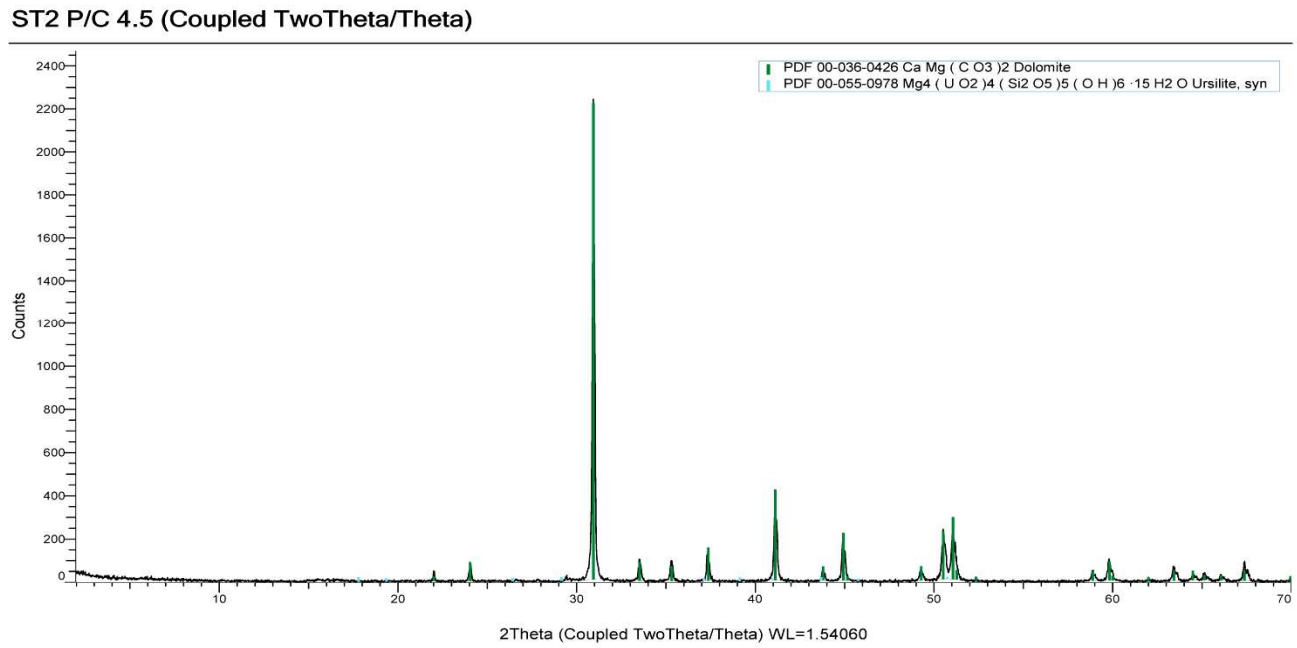
Quality	Y-Scale	I/Ic DB	I/Ic User	S-Q	Added Reference	d x by	Scan WL	Wavelength	System	Space Group	a	b	c
Indexed	92.75%	2.510	0.000	95.1%		1.0000	Yes	1.54060	Rhombo.H.axes	R-3 (148)	4.81410		16.03920
Indexed	5.39%	2.810	0.000	4.9%		1.0000	Yes	1.54060	Monoclinic	C2/m (12)	12.35900	6.33100	9.06000

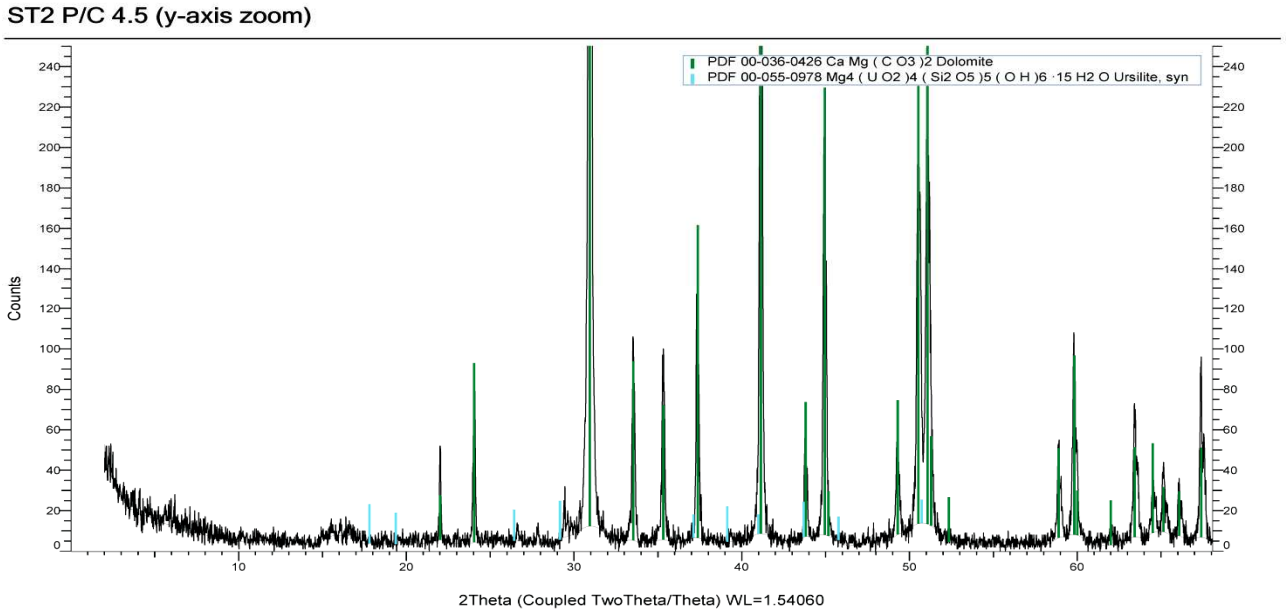
alpha	beta	gamma	Z	Volume	Density	Cell Tuned	F (N)
			3	321.92	2.871	No	F30= 999.9(0.0000, 32)
	122.710		2	596.48	5.014	No	F30= 298.8(0.0028, 36)

ST2 P/C 2.15 (Coupled TwoTheta/Theta)



- Sample ST2 P/C 4.5.





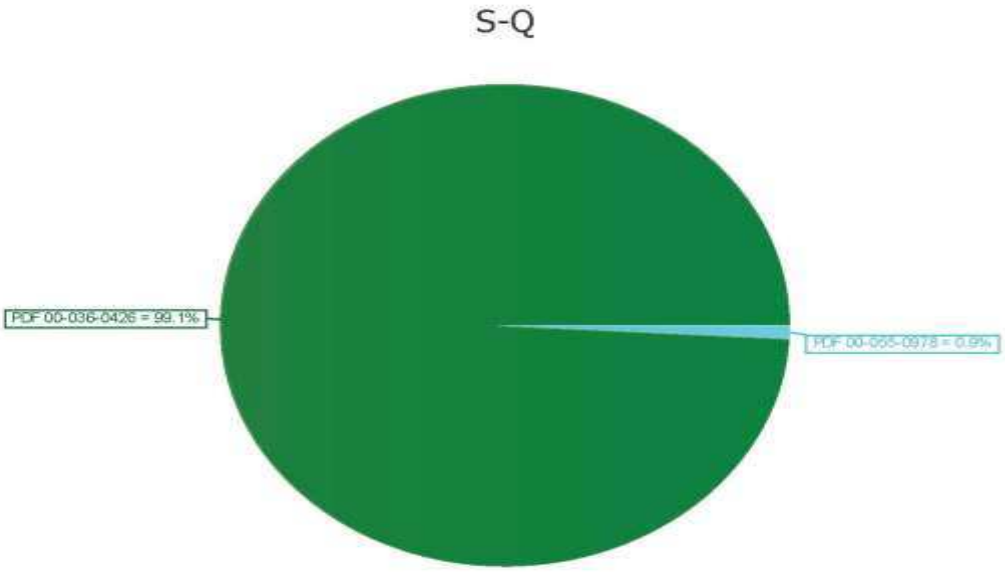
Pattern List #1

Show	Icon	Color	Index	Name	Parent	Scan	Pattern #	Compound Name	Formula	Quality
Yes			0	PDF 00-036-0426	Pattern List #1	TD18_0567.raw #1	PDF 00-036-0426	Dolomite	Ca Mg (C O3)2	Star (*)
Yes			1	PDF 00-055-0978	Pattern List #1	TD18_0567.raw #1	PDF 00-055-0978	Ursilite, syn	Mg4 (U O2)4 (Si2 O5)5 (O H)6 · 15 H2 O	Indexed

Y-Scale	I/Ic DB	I/Ic User	S-Q	Added Reference	d x by	Scan WL	Wavelength	System	Space Group	a	b	c	alpha
98.72%	(1)	0.000	99.1%		1.0000	Yes	1.54060	Rhombo.H.axes	R-3 (148)	4.80920		16.02000	
0.87%	(1)	0.000	0.9%		1.0000	Yes	1.54060	Orthorhombic	P (0)	14.28000	17.93000	18.26000	

beta	gamma	Z	Volume	Density	Cell Tuned	F (N)
		3	320.88	2.860	No	F30= 146.5(0.0064, 32)
		4	4675.30	3.000	No	F10= 0.6(0.0310, 525)

ST2 P/C 4.5 (Coupled TwoTheta/Theta)



2. Appendix Number 2_ TCD_ICP-MS data for Wadi-Shital ST-1 & ST-2 (Section type of Sirab Formation).

Raw ICP-MS data from TCD Lab. Results from samples analyzed and which are belonging to Wadi-Shital ST-1 & ST-2; Sirab Formation.

NUMBER OF TEST	SAMPLE ID	HARDNESS	FACIES ON THE SURFACE OF THE SAMPLE	POWDER COLOR
1	STB C4	very hard	Face color ''5RP 6/2''	Grayish to light gray
2	STB C6	very hard	Face color ''5RP 8/2'' and presence of veins on the sample	Grayish to light gray
3	STB C8	very hard	Face color ''N6'' and presence of veins on the sample	Grayish to light gray
4	STB C14	very hard	Face color ''5R 6/2'' and presence of veins on the sample	Grayish to light gray
5	STB C16	very hard	Face color ''10YR 7/4''	Grayish to light gray
6	STB C18	very hard	Face color ''10YR 8/2'' and discrete vein on the sample	Grayish to light gray
7	STB C19	very hard	Face color ''10YR 8/2''	Grayish to light gray
8	STB C21	very hard	Face color ''10YR 8/2''	Grayish to light gray
9	STB C23	very hard	Face color ''10YR 7/4''	Grayish to light gray
10	STB C26	very hard	Face color ''10R 3/4''	Light reddish
11	STB C27	very hard	Face color ''10R 3/4''	Light reddish
12	STF C67.5	very hard	Face color ''10YR 8/6'' and quartz vein plus traces of gas bubbles	Grayish to light gray
13	STF C68.4	very hard	Face color ''N8''	Light white
14	STF C69	very hard	Face color ''5GY 8/1'' and repetitive thin beds with porous surface	Light white
15	STF C70	very hard	Face color ''N8''	Light white
16	STF C71	very hard	Face color ''N8'' and discrete vein	Grayish to light gray
17	STF C185	soft	Face color ''5R 4/6'' with two areas of facies on the face. One remains reddish (A) and the other brownish (B)	Fat reddish (A) and Light reddish (B)
18	STF C202.9	very hard	Face color ''N8''	Light white
19	STF C204.3	very hard	Face color ''5GY 8/1''	Light white
20	STF C205.7	very hard	Face color ''5R 4/6'' with presence of porosity on the sample	Reddish to light red
21	STF C210	very hard	Face color ''10YR 8/6''	Grayish to light gray
22	ST2 C1.6 beyond the base of the Shital Member at 215 m	very hard	Face color ''N7'' with presence of filamentous shapes and porosities on the face of the sample.	Light white
23	ST2 C2.9 beyond the base of the Shital Member at 215 m	very hard	Face color ''N7'' with presence of filamentous shapes and porosities on the face of the sample	Light white
24	ST2 C2.15 beyond the base of the Shital Member at 215 m	very hard	Face color ''5R 6/6'' with presence of filamentous shapes and porosities on the face of the sample	Light white
25	ST2 C4.5 beyond the base of the Shital Member at 215 m	very hard	Face color ''5GY 8/1'' with presence of filamentous shapes and porosities on the face of the sample	Grayish to light gray

Data sheet for powder of samples of Wadi Shital ST-1 & ST-2 section used in the ICP-MS analysis in the laboratory of tcd by Karrer Kazyumba Mbayo.

The protocol for the preparation of wet tests (samples of the powders of each test and placing in aqueous solution) for the ICP-MS laboratory has been made by dilution in 2 steps. The first step was to place ~ 10 mg of powder sample in the test tube and add ~ 1.5 ml of 5% HNO3. The solution was then stored for a few days to allow time for the acid to digest the powdered sample. The second dilution step took place in a new tube in which were added ~ 0.2000 g (IS) plus ~ 0.0217 g of the test of the first dilution and at the end ~ 1.7783 g 5% HNO3. The test was repeated for all samples. The lab schedule can be summarized as:

- Week 1, Day 1: rinsing consumables needed in DI water and soaking over night;
- Week 1, Day 2: rinsing consumables needed in DI water and adding 5% HNO_3 to leach;
- Week 2, 3 - waiting for consumables to leach;
- Week 4, Day 1: removing acid and rinsing consumables in DI water and soaking over night;
- Week 4, Day 2: drying consumables in fume hood;
- Week 5, Day 1: weighing the sample powders and adding 5% HNO3, leave overnight with loose Lids;
- Week 5, Day 2: adding a small amount of conc. HNO3 and close lids;
- Week 6, Day 1: dilution of samples and addition of IS, centrifuging for analysis;
- Week 6, Day 2: analysis prep cont;

- Week 7, Day 1: Analysis;
- Week 7, Day 2: Analysis cont ;
- Week 8-10: data reduction.

2.1. Lab cleaning steps.

name:	Karrer Kazyumba	project:	Wadi Shital ST1 & ST2 batch 1	date:		09/05/2018
Sample ID KK IS A	Lab ID KK IS A	Empty Tube (g)	Tube + 1.5ml 5% HNO3 (g)	Weigh Paper (mg)	Mass of sample (mg)	Mass Sample (g)
Procedural Blank 1	KK Blank A	1.0221	2.4793	48.656	10.000	0.0100
Limestone BCS 393	KK LSTD A	1.0297	2.5292	52.05	10.025	0.0100
Limestone JLs-1	KK JLS1 A	1.0291	2.5283	51.5200	9.9300	0.0099
Dolomite BCS 368	KK DSTD A	1.0191	2.5073	52.4330	10.1530	0.0102
STB C4	KK 001	1.0245	2.519	47.4800	10.0430	0.0100
STB C6	KK 002	1.0371	2.5194	68.1940	10.0450	0.0100
STB C8	KK 003	1.0372	2.5228	49.4060	10.1030	0.0101
STB C14	KK 004	1.0194	2.5069	45.9060	10.1690	0.0102
STB C16	KK 005	0.9963	2.4879	77.2220	10.3500	0.0104
STB C18	KK 006	0.9963	2.4911	47.6150	10.1610	0.0102
STB C19	KK 007	1.022	2.5175	49.8080	10.3860	0.0104
STB C21	KK 008	1.0291	2.5206	58.4730	10.5210	0.0105
STB C23	KK 009	1.0081	2.5027	59.8250	10.4120	0.0104
STB C26	KK 010	1.0081	2.5042	42.8560	10.1030	0.0101
STB C27	KK 011	1.0371	2.532	47.6110	10.1660	0.0102
STF C67.5	KK 012	1.0323	2.5278	49.4780	10.3920	0.0104
STF C68.4	KK 013	1.0185	2.5171	48.0510	10.0220	0.0100
STF C69	KK 014	1.0288	2.5279	49.0070	10.3700	0.0104
STF C70	KK 015	1.0329	2.5263	59.4360	10.5280	0.0105
STF C 71	KK 016	1.0392	2.5337	65.9140	10.2940	0.0103
STF C185A	KK 017	0.9961	2.4972	53.4620	10.1670	0.0102
STF C185B	KK 018	1.0217	2.5182	61.5450	10.2890	0.0103
STF C202.9	KK 019	1.0216	2.5186	53.7420	10.1270	0.0101
STF C204.3	KK 020	1.019	2.5193	55.3280	10.0370	0.0100
STF C205.7	KK 021	0.9962	2.5119	56.4190	10.4780	0.0105
STF C210	KK 022	1.0189	2.5254	52.6010	10.0920	0.0101
ST2 P/C 1.6	KK 023	1.0391	2.5305	60.7710	10.5610	0.0106
ST2 P/C 2.9	KK 024	1.0242	2.5382	59.4040	10.5440	0.0105
ST2 P/C 2.15	KK 025	1.0182	2.5241	54.5630	10.1100	0.0101
ST2 P/C 4.15	KK 026	1.0182	2.5046	46.3730	10.3080	0.0103
KK IS B	KK IS B					

white - you fill in
green - fixed calcs
yellow - results

DIGESTION NOTES:
10mg weighed out Wed 09May
1.5ml 5% HNO3 (QS32) added Wed 09May
Dilutions completed
(QS32) Thursday 17th

May Dilution tubes vortexed and centrifuged Thursday 17th May

name: Karrer kazyumba

Sample ID	Lab ID	Weigh Paper (After Sample) (mg)	Tube + acid + sample (g)	Error Weigh Paper (+/-)	Mass of sample (subtraction) (g)
KK IS A	KK IS A				
Procedural Blank 1	KK Blank A	48.522	2.4791	0.28%	-0.0002
Limestone BCS 393	KK LSTD A	52.955	2.5337	-1.74%	0.0045
Limestone JLs-1	KK JLS1 A	52.0020	2.5334	-0.94%	0.0051
Dolomite BCS 368	KK DSTD A	52.8120	2.5156	-0.72%	0.0083
STB C4	KK 001	47.6920	2.5273	-0.45%	0.0083
STB C6	KK 002	68.0580	2.5272	0.20%	0.0078
STB C8	KK 003	49.6520	2.5313	-0.50%	0.0085
STB C14	KK 004	45.8190	2.5164	0.19%	0.0095
STB C16	KK 005	77.0390	2.4961	0.24%	0.0082
STB C18	KK 006	47.9270	2.4992	-0.66%	0.0081
STB C19	KK 007	49.7490	2.5273	0.12%	0.0098
STB C21	KK 008	58.6900	2.5283	-0.37%	0.0077
STB C23	KK 009	60.2320	2.5102	-0.68%	0.0075
STB C26	KK 010	43.0600	2.5134	-0.48%	0.0092
STB C27	KK 011	47.9030	2.5394	-0.61%	0.0074
STF C67.5	KK 012	49.7240	2.5364	-0.50%	0.0086
STF C68.4	KK 013	48.1130	2.5251	-0.13%	0.0080
STF C69	KK 014	48.9780	2.5371	0.06%	0.0092
STF C70	KK 015	59.4660	2.5344	-0.05%	0.0081
STF C71	KK 016	66.0260	2.5412	-0.17%	0.0075
STF C185A	KK 017	53.9430	2.5048	-0.90%	0.0076
STF C185B	KK 018	61.9820	2.5236	-0.71%	0.0054
STF C202.9	KK 019	53.7860	2.5276	-0.08%	0.0090
STF C204.3	KK 020	55.5600	2.5260	-0.42%	0.0067
STF C205.7	KK 021	56.7300	2.5193	-0.55%	0.0074
STF C210	KK 022	52.5630	2.5341	0.07%	0.0087
ST2 P/C 1.6	KK 023	60.6600	2.5385	0.18%	0.0080
ST2 P/C 2.9	KK 024	59.4000	2.5474	0.01%	0.0092
ST2 P/C 2.15	KK 025	54.5140	2.5330	0.09%	0.0089
ST2 P/C 4.15	KK 026	46.6000	2.5133	-0.49%	0.0087
KK IS B	KK IS B				

name: karrer Kazyumba

Sample ID	Lab ID	Mass of solution (subtraction) (g)	Hypothetical Initial Stock DF (No LOSS)	Empty Dilution tube (g)	Mass of IS (g)
KK IS A	KK IS A			1.0152	0.1987
Procedural Blank 1	KK Blank A	1.457	146	1.0136	0.1974
Limestone BCS 393	KK LSTD A	1.500	150	0.9796	0.2016
Limestone JLs-1	KK JLS1 A	1.499	151	1.0031	0.1982
Dolomite BCS 368	KK DSTD A	1.488	147	0.9909	0.2000
STB C4	KK 001	1.495	149	1.0033	0.2000
STB C6	KK 002	1.482	148	1.0154	0.1996
STB C8	KK 003	1.486	147	1.0150	0.1992
STB C14	KK 004	1.488	146	1.0003	0.1988
STB C16	KK 005	1.492	144	1.0016	0.1995
STB C18	KK 006	1.495	147	1.0174	0.1999
STB C19	KK 007	1.496	144	1.0010	0.1995
STB C21	KK 008	1.492	142	1.0046	0.1982
STB C23	KK 009	1.495	144	1.0007	0.1959
STB C26	KK 010	1.496	148	1.0145	0.2000
STB C27	KK 011	1.495	147	1.0144	0.1987
STF C7.5	KK 012	1.496	144	0.9804	0.2009
STF C68.4	KK 013	1.499	150	1.0083	0.1985
STF C69	KK 014	1.499	145	1.0153	0.1987
STF C70	KK 015	1.493	142	1.0083	0.1985
STF C71	KK 016	1.495	145	1.0165	0.1939
STF C185A	KK 017	1.501	148	0.9928	0.1928
STF C185B	KK 018	1.497	145	1.0048	0.1912
STF C202.9	KK 019	1.497	148	1.0152	0.1971
STF C204.3	KK 020	1.500	149	1.0148	0.1983
STF C205.7	KK 021	1.516	145	1.0188	0.1896
STF C210	KK 022	1.507	149	1.0143	0.1986
ST2 P/C 1.6	KK 023	1.491	141	0.9911	0.1973
ST2 P/C 2.9	KK 024	1.514	144	1.0148	0.1957
ST2 P/C2.15	KK 025	1.506	149	1.0150	0.1980
ST2 P/C 4.15	KK 026	1.486	144	1.0149	0.1982
KK IS B	KK IS B			0.9919	0.1903

name: karrer Kazyumba

Sample ID	Lab ID	Mass of sample added (g)	Mass carrier acid added (g)	Full Dilution Tube (g)	Mass of solution (g) - by subtraction
KK IS A	KK IS A	0.0000	1.7694	2.9836	1.9684
Procedural Blank 1	KK Blank A	0.0217	1.7907	3.0237	2.0101
Limestone BCS 393	KK LSTD A	0.0218	1.7842	2.9866	2.0070
Limestone JLs-1	KK JLS1 A	0.0220	1.7684	2.9820	1.9789
Dolomite BCS 368	KK DSTD A	0.0216	1.7864	2.9777	1.9868
STB C4	KK 001	0.0216	1.7761	3.0019	1.9986
STB C6	KK 002	0.0218	1.7774	3.0146	1.9992
STB C8	KK 003	0.0217	1.7701	3.0059	1.9909
STB C14	KK 004	0.0216	1.7665	2.9570	1.9567
STB C16	KK 005	0.0220	1.7731	2.9211	1.9195
STB C18	KK 006	0.0221	1.7484	2.9851	1.9677
STB C19	KK 007	0.0213	1.7686	2.9895	1.9885
STB C21	KK 008	0.0218	1.7723	2.9968	1.9922
STB C23	KK 009	0.0221	1.7968	2.9784	1.9777
STB C26	KK 010	0.0215	1.7941	3.0075	1.9930
STB C27	KK 011	0.0219	1.7926	3.0038	1.9894
STF C67.5	KK 012	0.0203	1.7190	2.9206	1.9402
STF C68.4	KK 013	0.0202	1.7663	2.9933	1.9850
STF C69	KK 014	0.0218	1.7727	2.9755	1.9602
STF C70	KK 015	0.0201	1.7668	2.9741	1.9658
STF C71	KK 016	0.0220	1.7797	3.0108	1.9943
STF C185A	KK 017	0.0206	1.7320	2.9384	1.9456
STF C185B	KK 018	0.0210	1.7846	2.9807	1.9759
STF C202.9	KK 019	0.0218	1.7781	3.0123	1.9971
STF C204.3	KK 020	0.0220	1.7766	3.0116	1.9968
STF C205.7	KK 021	0.0220	1.6450	2.8754	1.8566
STF C210	KK 022	0.0219	1.6726	2.8813	1.8670
ST2 P/C 1.6	KK 023	0.0219	1.6515	2.8398	1.8487
ST2 P/C 2.9	KK 024	0.0221	1.7634	2.9728	1.9580
ST2 P/C 2.15	KK 025	0.0228	1.7735	3.0093	1.9943
ST2 P/2 4.15	KK 026	0.0218	1.7276	2.9623	1.9474
KK IS B	KK IS B	0.0000	1.7413	2.9176	1.9257

name: Karrer Kazyumba

Sample ID	Lab ID	Mass of solution (g) - by addition	Experiment DF	Concentration of IS
KK IS A	KK IS A	1.9681		0.5048
Procedural Blank 1	KK Blank A	2.0098	13496	0.4911
Limestone BCS 393	KK LSTD A	2.0076	13775	0.5021
Limestone JLs-1	KK JLS1 A	1.9886	13647	0.4983
Dolomite BCS 368	KK DSTD A	2.0080	13626	0.4980
STB C4	KK 001	1.9977	13763	0.5006
STB C6	KK 002	1.9988	13530	0.4993
STB C8	KK 003	1.9910	13492	0.5003
STB C14	KK 004	1.9869	13456	0.5003
STB C16	KK 005	1.9946	13066	0.5001
STB C18	KK 006	1.9704	13116	0.5073
STB C19	KK 007	1.9894	13449	0.5014
STB C21	KK 008	1.9923	12956	0.4974
STB C23	KK 009	2.0148	13087	0.4862
STB C26	KK 010	2.0156	13883	0.4961
STB C27	KK 011	2.0132	13518	0.4935
STF C67.5	KK 012	1.9402	13754	0.5177
STF C68.4	KK 013	1.9850	14694	0.5000
STF C69	KK 014	1.9932	13217	0.4984
STF C70	KK 015	1.9854	14011	0.4999
STF C71	KK 016	1.9956	13169	0.4858
STF C185A	KK 017	1.9454	13943	0.4955
STF C185B	KK 018	1.9968	13830	0.4788
STF C202.9	KK 019	1.9970	13541	0.4935
STF C204.3	KK 020	1.9969	13568	0.4965
STF C205.7	KK 021	1.8566	12208	0.5106
STF C210	KK 022	1.8931	12904	0.5245
ST2 P/C 1.6	KK 023	1.8707	12063	0.5273
ST2 P/C 2.9	KK 024	1.9812	12872	0.4939
ST2 P/C 2.15	KK 025	1.9943	13029	0.4964
ST2 P/C 4.15	KK 026	1.9476	12883	0.5088
KK IS B	KK IS B	1.9316		0.4926

name: Karrer Kazyumba

Sample ID	Lab ID	NOTES	field's samples names	Member's names
KK IS A	KK IS A			
Procedural Blank 1	KK Blank A			
Limestone BCS 393	KK LSTD A			
Limestone JLs-1	KK JLS1 A			
Dolomite BCS 368	KK DSTD A	Small reaction to Brown color		
STB C4	KK 001	Small reaction to Reddish color	STB 4	
STB C6	KK 002	Very small reaction	STB 6	BUAH
STB C8	KK 003	Small reaction to Brown color	STB 8	
STB C14	KK 004	Small reaction to Brown color	STB 14	
STB C16	KK 005	Small reaction to Brown color	STB 16	
STB C18	KK 006	Very small reaction to Brown color	STB 18	
STB C19	KK 007	Small reaction to Reddish color	STB 19	
STB C21	KK 008	Small reaction to Lightish color	STB 21	***lowermost***
STB C23	KK 009	Very small reaction to Brown color	STB 23	***Ramayli***
STB C26	KK 010	Very small reaction to Reddish color	STB 26	
STB C27	KK 011	Very small reaction to Reddish color	STB 27	
STF C67.5	KK 012	Small reaction to Brown color	STF 67.5	
STF C68.4	KK 013	Small reaction to Lightish color	STF 68.4	E2: ''Red Dolospar''
STF C69	KK 014	Small reaction to Lightish color	STF 69	E2: ''Red Dolospar''
STF C70	KK 015	Small reaction to Brown color	STF 70	small section of
STF C71	KK 016	Very small reaction to Lightsh color	STF 71	
STF C185A	KK 017	Very small reaction to Reddish color	STF 185	of ***Lower Shital***
STF C185B	KK 018	Very small reaction to Reddish color	STF 185	***cycles*** Intact (α & β fenestraes facies)
STF C202.9	KK 019	Very small reaction to Brown color	STF 202.9	***upper Shital cycles***
STF C204.3	KK 020	Very very small reaction to Lightish color	STF 204.3	Conophyton Reefs
STF C205.7	KK 021	Very very small reaction to Lightish color	STF 205.7	
STF C210	KK 022	Small reaction to Lightish color	STF 210	
ST2 P/C 1.6	KK 023	Very very small reaction to Lightish color	ST2 1.6	***Aswad Member***
ST2 P/C 2.9	KK 024	Very very small reaction to Lightish color	ST2 2.9	
ST2 P/C 2.15	KK 025	Very very small reaction to Lightish color	ST2 2.15	Thrombolite Reefs
ST2 P/C 4.15	KK 026	Small reaction to Reddish color	ST2 4.15	
KK IS B	KK IS B			

IDEAL: 13500
Final DF

Sample ID	Lab ID	Dilution Factor (DF) Stock	Mass of IS (g)	Mass of sample added (g)
Procedural Blank 1	KK Blank A	146	0.2000	0.0216
Limestone BCS 393	KK LSTD A	150	0.2000	0.0222
Limestone JLs-1	KK JLS1 A	151	0.2000	0.0224
Dolomite BCS 368	KK DSTD A	147	0.2000	0.0217
STB C4	KK 001	149	0.2000	0.0220
STB C6	KK 002	148	0.2000	0.0219
STB C8	KK 003	147	0.2000	0.0218
STB C14	KK 004	146	0.2000	0.0217
STB C16	KK 005	144	0.2000	0.0214
STB C18	KK 006	147	0.2000	0.0218
STB C19	KK 007	144	0.2000	0.0213
STB C21	KK 008	142	0.2000	0.0210
STB C23	KK 009	144	0.2000	0.0213
STB C26	KK 010	148	0.2000	0.0219
STB C27	KK 011	147	0.2000	0.0218
STF C67.5	KK 012	144	0.2000	0.0213
STF C68.4	KK 013	150	0.2000	0.0222
STF C69	KK 014	145	0.2000	0.0214
STF C70	KK 015	142	0.2000	0.0210
STF C71	KK 016	145	0.2000	0.0215
STF C185A	KK 017	148	0.2000	0.0219
STF C185B	KK 018	145	0.2000	0.0215
STF C202.9	KK 019	148	0.2000	0.0219
STF C204.3	KK 020	149	0.2000	0.0221
STF C205.7	KK 021	145	0.2000	0.0214
STF C210	KK 022	149	0.2000	0.0221
ST2 P/C 1.6	KK 023	141	0.2000	0.0209
ST2 P/C 2.9	KK 024	144	0.2000	0.0213
ST2 P/C 2.15	KK 025	149	0.2000	0.0221
ST2 P/C 4.15	KK 026	144	0.2000	0.0214

Average stock needed
0.0217

Sample ID	Mass carrier acid added (g)	Total Mass of solution (g)	Experiment DF	Concentration of IS
Procedural Blank 1	1.7784	2.0000	13500	0.5000
Limestone BCS 393	1.7778	2.0000	13500	0.5000
Limestone JLs-1	1.7776	2.0000	13500	0.5000
Dolomite BCS 368	1.7783	2.0000	13500	0.5000
STB C4	1.7780	2.0000	13500	0.5000
STB C6	1.7781	2.0000	13500	0.5000
STB C8	1.7782	2.0000	13500	0.5000
STB C14	1.7783	2.0000	13500	0.5000
STB C16	1.7786	2.0000	13500	0.5000
STB C18	1.7782	2.0000	13500	0.5000
STB C19	1.7787	2.0000	13500	0.5000
STB C21	1.7790	2.0000	13500	0.5000
STB C23	1.7787	2.0000	13500	0.5000
STB C26	1.7781	2.0000	13500	0.5000
STB C27	1.7782	2.0000	13500	0.5000
STF C67.5	1.7787	2.0000	13500	0.5000
STF C68.4	1.7778	2.0000	13500	0.5000
STF C69	1.7786	2.0000	13500	0.5000
STF C70	1.7790	2.0000	13500	0.5000
STF C71	1.7785	2.0000	13500	0.5000
STF C185A	1.7781	2.0000	13500	0.5000
STF C185B	1.7785	2.0000	13500	0.5000
STF C202.9	1.7781	2.0000	13500	0.5000
STF C204.3	1.7779	2.0000	13500	0.5000
STF C205.7	1.7786	2.0000	13500	0.5000
STF C210	1.7779	2.0000	13500	0.5000
ST2 P/C 1.6	1.7791	2.0000	13500	0.5000
ST2 P/C 2.9	1.7787	2.0000	13500	0.5000
ST2 P/C 2.15	1.7779	2.0000	13500	0.5000
ST2 P/C 4.15	1.7786	2.0000	13500	0.5000

Average carrier needed
1.7783

ACTUAL DF Average values:

Sample ID	Lab ID	Dilution Factor (DF) Stock	Mass of IS (g)	Mass of sample added (g)
Procedural Blank 1	KK Blank A	146	0.2000	0.0217
Limestone BCS 393	KK LSTD A	150	0.2000	0.0217
Limestone JLs-1	KK JLS1 A	151	0.2000	0.0217
Dolomite BCS 368	KK DSTD A	147	0.2000	0.0217
STB C4	KK 001	149	0.2000	0.0217
STB C6	KK 002	148	0.2000	0.0217
STB C8	KK 003	147	0.2000	0.0217
STB C14	KK 004	146	0.2000	0.0217
STB C16	KK 005	144	0.2000	0.0217
STB C18	KK 006	147	0.2000	0.0217
STB C19	KK 007	144	0.2000	0.0217
STB C21	KK 008	142	0.2000	0.0217
STB C23	KK 009	144	0.2000	0.0217
STB C26	KK 010	148	0.2000	0.0217
STB C27	KK 011	147	0.2000	0.0217
STF C67.5	KK 012	144	0.2000	0.0217
STF C68.4	KK 013	150	0.2000	0.0217
STF C69	KK 014	145	0.2000	0.0217
STF C70	KK 015	142	0.2000	0.0217
STF C71	KK 016	145	0.2000	0.0217
STF C185A	KK 017	148	0.2000	0.0217
STF C185B	KK 018	145	0.2000	0.0217
STF C202.9	KK 019	148	0.2000	0.0217
STF C204.3	KK 020	149	0.2000	0.0217
STF C205.7	KK 021	145	0.2000	0.0217
STF C210	KK 022	149	0.2000	0.0217
ST2 P/C 1.6	KK 023	141	0.2000	0.0217
ST2 P/C 2.9	KK 024	144	0.2000	0.0217
ST2 P/C 2.15	KK 025	149	0.2000	0.0217
ST2 P/C 4.15	KK 026	144	0.2000	0.0217

Sample ID	Mass carrier acid added (g)	Total Mass of solution (g)	Experiment DF	Concentration of IS
Procedural Blank 1	1.7783	2.0000	13430	0.5000
Limestone BCS 393	1.7783	2.0000	13786	0.5000
Limestone JLs-1	1.7783	2.0000	13915	0.5000
Dolomite BCS 368	1.7783	2.0000	13509	0.5000
STB C4	1.7783	2.0000	13715	0.5000
STB C6	1.7783	2.0000	13601	0.5000
STB C8	1.7783	2.0000	13553	0.5000
STB C14	1.7783	2.0000	13482	0.5000
STB C16	1.7783	2.0000	13283	0.5000
STB C18	1.7783	2.0000	13559	0.5000
STB C19	1.7783	2.0000	13271	0.5000
STB C21	1.7783	2.0000	13066	0.5000
STB C23	1.7783	2.0000	13230	0.5000
STB C26	1.7783	2.0000	13648	0.5000
STB C27	1.7783	2.0000	13553	0.5000
STF C67.5	1.7783	2.0000	13263	0.5000
STF C68.4	1.7783	2.0000	13782	0.5000
STF C69	1.7783	2.0000	13324	0.5000
STF C70	1.7783	2.0000	13074	0.5000
STF C71	1.7783	2.0000	13381	0.5000
STF C185A	1.7783	2.0000	13608	0.5000
STF C185B	1.7783	2.0000	13405	0.5000
STF C202.9	1.7783	2.0000	13624	0.5000
STF C204.3	1.7783	2.0000	13777	0.5000
STF C205.7	1.7783	2.0000	13332	0.5000
STF C210	1.7783	2.0000	13758	0.5000
ST2 P/C 1.6	1.7783	2.0000	13015	0.5000
ST2 P/C 2.9	1.7783	2.0000	13234	0.5000
ST2 P/C 2.15	1.7783	2.0000	13728	0.5000
ST2 P/C 4.15	1.7783	2.0000	13290	0.5000

	Average stock needed	Average carrier needed
	0.0217	1.7783
x2 for pipettor	0.0108	0.8892
	yellow x2	blue x2

2.2. Final results.

Lab ID Sample ID Description	*unit*	TCD BHVO-2c 20K BHVO-2 Basalt	Laurentian	TCD Longterm av. Expt/LTA	GEOREM (Jochum 2016)	Expt/reference
Li	*ppb*	4537	4499	4455 1.02	4500	1.01
Be	*ppb*	1047	1003	1014 1.03	1076	0.97
Mg	*ppm*	42640	0	43742 0.97	43767	0.97
Al	*ppm*	70850	0	73136 0.97	71131	1.00
P	*ppm*	1310	0	1317 0.99	1172	1.12
Ca	*ppm*	79600	0	81248 0.98	81476	0.98
Sc	*ppb*	31390	32123	0.97	31830	0.99
Ti	*ppb*	16140000	16456257	32482 0.99	16373000	0.99
V	*ppb*	313300	314305	16345474 320497 0.98	318200	0.98
Cr	*ppb*	296000	299699	302961 0.98	287200	1.03
Fe	*ppm*	84760	0	87593 0.97	96309	0.88
Mn	*ppm*	1270	0	1310 0.97	1309	0.97
Co	*ppb*	44060	45270	45085 0.98	44890	0.98
Ni	*ppb*	115000	117914	117738 0.98	119800	0.96
Cu	*ppb*	119800	125090	123251 0.97	129300	0.93
Zn	*ppb*	95070	101528	98180 0.97	103900	0.92
Ga	*ppb*	20310	21100	21039 0.97	21370	0.95
As	*ppb*	1446	656	1019 1.42	700	2.07
Rb	*ppb*	9001	9182	9198 0.98	9261	0.97
Sr	*ppb*	387000	394502	398633 0.97	394100	0.98
Y	*ppb*	23700	24353	24481 0.97	25910	0.91
Zr	*ppb*	160900	169345	170070 0.95	171200	0.94
Nb	*ppb*	18050	18299	18560 0.97	18100	1.00
Mo	*ppb*	3961	4441	5368 0.74	4070	0.97
Ba	*ppb*	129600	131573	131909 0.98	130900	0.99
La	*ppb*	14960	15227	15309 0.98	15200	0.98
Ce	*ppb*	36990	37731	37976 0.97	37530	0.99
Pr	*ppb*	5281	5393	5409 0.98	5339	0.99
Nd	*ppb*	23960	24402	24478 0.98	24270	0.99
Sm	*ppb*	6017	6066	6086 0.99	6023	1.00
Eu	*ppb*	2018	2053	2066 0.98	2043	0.99
Tb	*ppb*	918	937	936 0.98	939	0.98
Gd	*ppb*	6134	6227	6227 0.99	6207	0.99
Dy	*ppb*	5097	5242	5255 0.97	5280	0.97
Ho	*ppb*	980	999	1000 0.98	989	0.99

Er	***ppb***	**2438**	**2506**	**2510**	**0.97**	**2511**	**0.97**
Tm	***ppb***	**332**	**340**	**339**	**0.98**	**335**	**0.99**
Yb	***ppb***	**1937**	**1989**	**1980**	**0.98**	**1994**	**0.97**
Lu	***ppb***	**269**	**274**	**274**	**0.98**	**275**	**0.98**
Hf	***ppb***	**4185**	**4333**	**4335**	**0.97**	**4470**	**0.94**
Tl	***ppb***	**19**	**19**	**20**	**0.97**	**22**	**0.86**
Pb	***ppb***	**1595**	**0**	**0**	**0.00**	**1653**	**0.96**
Th	***ppb***	**1162**	**1170**	**1180**	**0.98**	**1224**	**0.95**
U	***ppb***	**414**	**423**	**421**	**0.98**	**412**	**1.01**

Lab ID Sample ID Description	*unit*	TCD JA-2b 20K JA-2 Andesite	Laurentian	TCD Longterm av.	Expt/LTA	GEOREM (Jochum 2016)	Expt/reference
Li	*ppb*	29240	28737	27930	1.05	29180	1.00
Be	*ppb*	2086	2096	2040	1.02	2260	0.92
Mg	*ppm*	46190	0	45977	1.00	47289	0.98
Al	*ppm*	82060	0	83075	0.99	82087	1.00
P	*ppm*	726	0	726	1.00	663	1.10
Ca	*ppm*	44110	0	43962	1.00	44733	0.99
Sc	*ppb*	18860	18912		0.99	18930	1.00
Ti	*ppb*	3918000	3882597	19025 4049747	0.97	4014000	0.98
V	*ppb*	116700	117786	117844	0.99	119700	0.97
Cr	*ppb*	462500	445924	465638	0.99	424800	1.09
Fe	*ppm*	42970	0	44159	0.97	48885	0.88
Mn	*ppm*	813	0	847	0.96	797	1.02
Co	*ppb*	28980	29363	29125	1.00	28330	1.02
Ni	*ppb*	135200	136830	137376	0.98	136000	0.99
Cu	*ppb*	26290	27206	26589	0.99	29000	0.91
Zn	*ppb*	61660	62447	60259	1.02	64500	0.96
Ga	*ppb*	16000	16163	16165	0.99	16850	0.95
As	*ppb*	998	501	1036	0.96	710	1.41
Rb	*ppb*	68500	69248	69508	0.99	69800	0.98
Sr	*ppb*	237800	240150	241715	0.98	245800	0.97
Y	*ppb*	15460	15616	15769	0.98	16890	0.92
Zr	*ppb*	103600	106288	107627	0.96	108500	0.96
Nb	*ppb*	9022	8968	9143	0.99	9300	0.97
Mo	*ppb*	528	554	602	0.88	581	0.91
Ba	*ppb*	305700	309050	312979	0.98	308400	0.99
La	*ppb*	15290	15444	15733	0.97	15460	0.99
Ce	*ppb*	32140	32440	32928	0.98	32860	0.98
Pr	*ppb*	3626	3683	3739	0.97	3691	0.98
Nd	*ppb*	13730	13977	14164	0.97	14040	0.98
Sm	*ppb*	2970	3006	3054	0.97	3032	0.98
Eu	*ppb*	856	875	888	0.96	893	0.96
Tb	*ppb*	462	473	478	0.97	479	0.97
Gd	*ppb*	2961	2976	3019	0.98	3013	0.98
Dy	*ppb*	2792	2863	2888	0.97	2851	0.98
Ho	*ppb*	592	605	608	0.97	591	1.00
Er	*ppb*	1661	1700	1715	0.97	1676	0.99
Tm	*ppb*	249	256	258	0.96	255	0.98

Yb	***ppb***	**1614**	**1642**	**1650**	**0.98**	**1645**	**0.98**
Lu	***ppb***	**239**	**246**	**247**	**0.96**	**255**	**0.94**
Hf	***ppb***	**2677**	**2760**	**2778**	**0.96**	**2838**	**0.94**
Tl	***ppb***	**332**	**325**	**342**	**0.97**	**330**	**1.01**
Pb	***ppb***	**18030**	**0**	**0**	**0.00**	**18880**	**0.96**
Th	***ppb***	**4608**	**4689**	**4720**	**0.98**	**4800**	**0.96**
U	***ppb***	**2205**	**2235**	**2246**	**0.98**	**2182**	**1.01**

Lab ID	*unit*	TCD AGV-2d				GEOREM 8698	
Sample ID		20K AGV-2					
Description		Andesite	Laurentian	TCD Longterm av.	Expt/LTA	(Jochum 2015)	Expt/reference
Li	*ppb*	10820	10748	10703	1.01	10800	1.00
Be	*ppb*	2113	2142	2134	0.99	2209	0.96
Mg	*ppm*	10530	0	10996	0.96	10856	0.97
Al	*ppm*	89260	0	90508	0.99	90131	0.99
P	*ppm*	2313	0	2304	1.00	2108	1.10
Ca	*ppm*	36140	0	37234	0.97	36807	0.98
Sc	*ppb*	12390	12749	13060	0.95	13110	0.94
Ti	*ppb*	6036000	6134960	6209377	0.97	6301000	0.96
V	*ppb*	110600	115128	113627	0.97	118500	0.93
Cr	*ppb*	15600	15649	15574	1.00	16220	0.96
Fe	*ppm*	45440	0	46926	0.97	52702	0.86
Mn	*ppm*	754	0	767	0.98	778	0.97
Co	*ppb*	15440	15805	15781	0.98	15460	1.00
Ni	*ppb*	17690	17900	18112	0.98	18870	0.94
Cu	*ppb*	47670	49658	48720	0.98	51510	0.93
Zn	*ppb*	88060	89229	89879	0.98	86700	1.02
Ga	*ppb*	19540	20279	20107	0.97	20420	0.96
As	*ppb*	941	587	904	1.04	670	1.40
Rb	*ppb*	66640	67882	67837	0.98	67790	0.98
Sr	*ppb*	645300	656022	657874	0.98	659500	0.98
Y	*ppb*	17960	18305	18415	0.98	19140	0.94
Zr	*ppb*	219700	231916	228534	0.96	232000	0.95
Nb	*ppb*	13770	13955	14106	0.98	14120	0.98
Mo	*ppb*	1936	1941	1980	0.98	2000	0.97
Ba	*ppb*	1127000	1145004	1155404	0.98	1134000	0.99
La	*ppb*	37340	38202	38047	0.98	38210	0.98
Ce	*ppb*	69310	69634	70905	0.98	69430	1.00
Pr	*ppb*	8137	8259	8293	0.98	8165	1.00
Nd	*ppb*	29880	30518	30584	0.98	30490	0.98
Sm	*ppb*	5433	5506	5527	0.98	5509	0.99
Eu	*ppb*	1471	1517	1503	0.98	1553	0.95
Tb	*ppb*	623	633	629	0.99	651	0.96
Gd	*ppb*	4459	4533	4525	0.99	4678	0.95
Dy	*ppb*	3384	3458	3456	0.98	3549	0.95
Ho	*ppb*	671	680	680	0.99	682	0.98
Er	*ppb*	1762	1810	1811	0.97	1825	0.97
Tm	*ppb*	256	262	262	0.98	262	0.98
Yb	*ppb*	1607	1642	1636	0.98	1653	0.97
Lu	*ppb*	239	246	246	0.97	251	0.95

Hf	***ppb***	**4897**	**5133**	**5085**	**0.96**	**5137**	**0.95**
Tl	***ppb***	**268**	**264**	**279**	**0.96**	**275**	**0.97**
Pb	***ppb***	**12440**	**0**	**0**	**0.00**	**13140**	**0.95**
Th	***ppb***	**5895**	**5977**	**5946**	**0.99**	**6174**	**0.95**
U	***ppb***	**1870**	**1895**	**1906**	**0.98**	**1885**	**0.99**

Lab ID	unit	SMK LSTD A			HK 19Dec16 Std Test	
Sample ID						
Descriptio		BCS 393	GEOREM		BCS 393	
		Limestone	(very few)	Expt/published	Av. 3 leaches	
Li	ppb	180	0	0	329	0.55
Be	ppb	31	0	0	31	1.00
Mg	ppm	898	930	0.97	951	0.94
Al	ppm	51	64	0.80	63	0.80
P	ppm	30	44	0.69	42	0.73
Ca	ppm	386100	395944	0.98	372867	1.04
Sc	ppb	387	0	0.00	712	0.54
Ti	ppb	1063	5400	0.20	1117	0.95
V	ppb	1261	0	0.00	1279	0.99
Cr	ppb	2310	0	0.00	2315	1.00
Fe	ppm	114	160	0.71	161	0.71
Mn	ppm	80	77	1.04	82	0.97
Co	ppb	783	0	0	678	1.15
Ni	ppb	5706	0	0	4372	1.30
Cu	ppb	1112	0	0	1097	1.01
Zn	ppb	2828	0	0	3230	0.88
Ga	ppb	16	0	0	49	0.33
As	ppb	66	0	0	144	0.46
Rb	ppb	98	0	0	151	0.65
Sr	ppb	158400	160000	0.99	158666	1.00
Y	ppb	3145	0	0	3233	0.97
Zr	ppb	87	240	0.36	149	0.58
Nb	ppb	3	0	0	50	0.06
Mo	ppb	44	65	0.67	53	0.82
Ba	ppb	64690	53000	1.22	62802	1.03
La	ppb	1313	0	0	1399	0.94
Ce	ppb	1336	0	0	1351	0.99
Pr	ppb	285	0	0	287	0.99
Nd	ppb	1176	0	0	1212	0.97
Sm	ppb	252	0	0	253	0.99
Eu	ppb	62	0	0	67	0.92
Tb	ppb	45	0	0	47	0.97
Gd	ppb	309	0	0	315	0.98
Dy	ppb	291	0	0	298	0.98
Ho	ppb	66	0	0	68	0.97
Er	ppb	188	0	0	195	0.97

Tm	ppb	26	0	0	27	0.96
Yb	ppb	155	0	0	157	0.99
Lu	ppb	23	0	0	24	0.97
Hf	ppb	1	0	0	3	0.39
Tl	ppb	5	5	0.91	6	0.79
Pb	ppb	1259	0	0	0	0.00
Th	ppb	50	0	0	54	0.92
U	ppb	413	0	0	437	0.95

Lab ID **Sample ID** **Description**	Unit	SMK JLs-1 A JLs-1	wide ranges, digests+leaches? GEOREM		N.Imai et al., 1996		HK JLS-1 A JLs-1	
		Limestone	(better?)	Expt/published	0	Expt/published	Hilde digest (Hf)	
Li	**ppb**	109	500	0.22	200	0.54	314	0.35
Be	**ppb**	13	0	0	0	0.00	15	0.88
Mg	**ppm**	3436	3655	0.94	0	0.00	3386	1.01
Al	**ppm**	35	110	0.32	0	0.00	131	0.27
P	**ppm**	188	127	1.48	0	0.00	162	1.16
Ca	**ppm**	394600	403734	0.98	0	0.00	393668	1.00
Sc	**ppb**	248	250	0.99	31	7.99	329	0.75
Ti	**ppb**	904	1200	0.75	0	0.00	7368	0.12
V	**ppb**	1935	3590	0.54	3590	0.54	3254	0.59
Cr	**ppb**	1283	3000	0.43	3370	0.38	3348	0.38
Fe	**ppm**	94	93	1.00	0	0.00	193	0.48
Mn	**ppm**	16	15	1.07	0	0.00	16	1.02
Co	**ppb**	645	825	0.78	83	7.82	739	0.87
Ni	**ppb**	4976	3000	1.66	362	13.75	5573	0.89
Cu	**ppb**	1036	268	3.87	268	3.87	1932	0.54
Zn	**ppb**	7986	2900	2.75	3190	2.50	3865	2.07
Ga	**ppb**	13	10	1.26	0	0.00	37	0.35
As	**ppb**	62	150	0.41	145	0.43	172	0.36
Rb	**ppb**	70	163	0.43	180	0.39	124	0.56
Sr	**ppb**	301400	295000	1.02	295000	1.02	301927	1.00
Y	**ppb**	238	223	1.07	223	1.07	239	1.00
Zr	**ppb**	61	252	0.24	4190	0.01	474	0.13
Nb	**ppb**	3	2	1.29	1000	0.00	37	0.07
Mo	**ppb**	53	30	1.77	0	0.00	73	0.73
Ba	**ppb**	422300	476000	0.89	476000	0.89	446175	0.95
La	**Ppb**	106	150	0.71	153	0.69	110	0.96
Ce		178	521	0.34	521	0.34	189	0.94
Pr	**ppb**	23	25	0.92	32	0.70	24	0.92
Nd	**ppb**	93	100	0.93	136	0.68	98	0.94
Sm	**ppb**	20	135	0.15	135	0.15	24	0.84
Eu	**ppb**	1	7	0.15	7	0.14	4	0.23
Tb	**ppb**	3	4	0.73	4	0.71	3	0.86
Gd	**ppb**	21	20	1.09	30	0.71	22	0.97
Dy	**ppb**	18	28	0.63	28	0.63	22	0.81
Ho	**ppb**	5	5	1.00	0	0.00	5	0.96
Er	**ppb**	13	14	0.88	0	0.00	14	0.88
Tm	**ppb**	2	2	0.94	0	0.00	2	0.88

Yb	**ppb**	13	16	0.76	16	0.76	13	0.94
Lu	**ppb**	2	22	0.08	22	0.08	2	0.86
Hf	**ppb**	0	100	0.00	126	0.00	20	0.01
Tl	**ppb**	2	3	0.70	3	0.70	5	0.45
Pb	**ppb**	245	220	1.11	0	0.00	0	0.00
Th	**ppb**	14	29	0.50	29	0.50	21	0.67
U	**ppb**	1592	1750	0.91	1750	0.91	1792	0.89

Lab ID **Sample ID** **Description**	**Unit**	SMK DSTD A BCS 368 Dolomite	HK 19Dec16 Std Test BCS 368 Av. 3 leaches		KK 001 KB 04 **STB 4**	KK 002 KB 06 **STB 6**	KK 003 KB 08 **STB 8**
Li	**ppb**	10110	10236	0.99	684	767	648
Be	**ppb**	33	36	0.91	60	66	83
Mg	**ppm**	126800	126814	1.00	145100	151500	150800
Al	**ppm**	116	121	0.95	205	444	586
P	**ppm**	21	37	0.58	55	79	107
Ca	**ppm**	217000	226453	0.96	255300	248900	249600
Sc	**ppb**	420	458	0.92	244	597	779
Ti	**ppb**	1940	2027	0.96	2212	3563	5599
V	**ppb**	1357	1356	1.00	2031	1294	2375
Cr	**ppb**	1748	1719	1.02	725	1421	2528
Fe	**ppm**	1150	1318	0.87	1054	934	2110
Mn	**ppm**	473	481	0.98	972	1109	2687
Co	**ppb**	1351	1346	1.00	821	716	3533
Ni	**ppb**	3375	2640	1.28	15880	11030	14790
Cu	**ppb**	1975	1875	1.05	1948	5895	17100
Zn	**ppb**	77110	71845	1.07	3968	7951	4497
Ga	**ppb**	33	40	0.84	86	162	271
As	**ppb**	277	360	0.77	296	196	164
Rb	**ppb**	275	241	1.14	499	855	937
Sr	**ppb**	74860	77473	0.97	63190	55820	57600
Y	**ppb**	1149	1219	0.94	295	590	1511
Zr	**ppb**	974	965	1.01	116	291	394
Nb	**ppb**	7	9	0.77	4	6	9
Mo	**ppb**	36	42	0.87	10	10	12
Ba	**ppb**	20130	21584	0.93	8410	7007	4931
La	**Ppb**	327	358	0.91	302	540	1246
Ce	**Ppb**	639	673	0.95	508	1266	3508
Pr	**ppb**	87	92	0.94	64	159	396
Nd	**ppb**	363	380	0.95	231	580	1416
Sm	**ppb**	84	87	0.96	45	125	283
Eu	**ppb**	19	22	0.84	10	25	56
Tb	**ppb**	17	18	0.94	8	19	44
Gd	**ppb**	107	112	0.96	47	114	288
Dy	**ppb**	103	110	0.94	48	109	248
Ho	**ppb**	24	26	0.94	10	22	49
Er	**ppb**	69	73	0.94	27	58	124

Tm	**ppb**	10	11	0.92	4	9	16
Yb	**ppb**	60	65	0.93	25	52	92
Lu	**ppb**	9	10	0.97	4	7	13
Hf	**ppb**	19	23	0.84	2	8	10
Tl	**ppb**	6	7	0.89	5	5	6
Pb	**ppb**	46450	0	0.00	520	299	527
Th	**ppb**	57	61	0.94	54	255	509
U	**ppb**	975	1069	0.91	419	734	958

Lab ID Sample ID Description	Unit	KK 004 KB 14 STB 14	KK 005 KB 16 STB 16	KK 006 KB 18 STB 18	KK 007 KLR 19 STB 19	KK 008 KLR 21 STB 21	KK 009 KLR 23 STB 23	KK 010 KLR 26 STB 26	KK 011 KLR 27 STB 27
Li	ppb	785	384	567	785	902	856	1943	726
Be	ppb	205	44	64	115	100	78	51	86
Mg	ppm	149100	152900	152300	150500	150800	152000	139300	149800
Al	ppm	476	335	154	564	472	281	185	61
P	ppm	146	72	63	144	245	112	97	88
Ca	ppm	251300	247500	248100	249900	249600	248400	261100	250600
Sc	ppb	555	494	257	673	525	431	202	189
Ti	ppb	4780	3419	2039	4463	3796	2327	2692	1469
V	ppb	3316	2455	1402	2902	2258	4503	4811	2382
Cr	ppb	1764	1717	836	2055	1453	1114	3700	478
Fe	ppm	3819	908	1960	2869	1328	1967	699	824
Mn	ppm	1619	749	2620	2588	1219	1088	751	1426
Co	ppb	3914	1867	2850	3922	1046	1331	1650	2069
Ni	ppb	1016000	51390	27160	20740	283500	18940	60420	74210
Cu	ppb	23570	2705	886	10190	4134	2471	6524	4492
Zn	ppb	4036	13350	4896	4133	2614	3668	28640	3947
Ga	ppb	201	131	119	257	211	130	83	58
As	ppb	517	268	44	170	132	266	1214	499
Rb	ppb	972	642	391	909	841	526	306	336
Sr	ppb	115300	32940	77200	62850	81180	61500	69880	96520
Y	ppb	1835	993	386	1673	899	1028	929	1440
Zr	ppb	279	205	96	474	530	267	132	65
Nb	ppb	16	4	3	5	5	3	4	2
Mo	ppb	272	8	11	17	15	27	36	13
Ba	ppb	6893	8328	4848	11590	5155	3469	21820	9264
La	pb	1533	803	382	2326	1117	1811	786	2618
Ce	Ppb	3459	1788	809	4322	2254	2963	1502	3468
Pr	ppb	332	199	92	400	263	307	152	293
Nd	ppb	1154	728	329	1361	946	1063	583	990
Sm	ppb	225	152	64	251	176	185	116	184
Eu	ppb	49	37	15	56	35	39	28	48
Tb	ppb	45	28	11	46	26	29	20	42
Gd	ppb	276	173	69	289	169	180	133	297
Dy	ppb	262	157	61	260	147	164	125	212
Ho	ppb	52	33	13	51	31	32	26	41
Er	ppb	133	88	34	130	80	87	69	102
Tm	ppb	16	12	5	17	11	12	9	12
Yb	ppb	87	70	30	95	68	73	50	58

Lu	**ppb**	12	10	4	12	9	10	7	8
Hf	**ppb**	7	5	2	12	14	7	2	1
Tl	**ppb**	7	4	3	6	4	3	21	4
Pb	**ppb**	946	472	403	2165	234	445	8252	1024
Th	**ppb**	209	144	62	356	313	182	70	75
U	**ppb**	1055	241	133	483	699	126	141	132

Lab ID Sample ID Description	Unit	KK 012 KSS 67.5 STF 67.5	KK 013 STF 68.4 DANGER!	KK 014 KSS 69 STF 69	KK 015 KSS 70 STF 70	KK 016 KSS 71 STF 71	KK 017 STF 185 DANGER!	KK 018 STF185 DANGER!	KK 019 STF 202.9 WARNING!
Li	ppb	1606	6281	2168	1499	1742	34230	38360	1068
Be	ppb	34	160	48	29	36	1074	1176	57
Mg	ppm	151700	152200	150100	153000	153900	149200	151300	227500
Al	ppm	196	1598	421	275	72	11570	12310	465
P	ppm	210	439	200	159	83	2391	2288	80
Ca	ppm	248700	248200	250300	247400	246500	251200	249100	400400
Sc	ppb	371	1981	684	515	198	11380	12070	830
Ti	ppb	2549	17390	4740	3622	2007	360000	369400	2188
V	ppb	9031	6723	11990	3110	6093	41910	50770	11750
Cr	ppb	2638	5714	2962	1177	732	24290	20650	887
Fe	ppm	1846	4186	2911	1086	1555	21550	15250	1176
Mn	ppm	839	581	729	549	677	1402	1367	1041
Co	ppb	2040	6136	2246	1782	1697	11030	9539	1777
Ni	ppb	48080	6342000	425800	134400	31350	5890000	3671000	27090
Cu	ppb	9021	6829	5425	3843	9780	15000	10540	1085
Zn	ppb	7973	21060	5805	4651	4838	35870	46560	5478
Ga	ppb	65	513	176	102	43	3844	4092	97
As	ppb	2056	819	848	523	632	3365	3483	309
Rb	ppb	291	3532	1011	556	177	37520	37330	391
Sr	ppb	122900	103300	54050	44180	59470	165700	553600	44120
Y	ppb	976	3288	1567	1220	790	25250	25960	1775
Zr	ppb	181	2182	871	388	183	9023	11460	487
Nb	ppb	2	14	8	4	2	108	125	4
Mo	ppb	38	272	116	22	23	334	207	17
Ba	ppb	8470	13050	5806	1860	1353	104700	126600	3121
La	ppb	1107	3551	1521	1818	820	30900	34190	1554
Ce	Ppb	2812	8665	4062	3941	2142	81230	89120	2822
Pr	ppb	303	1018	503	463	269	10070	11030	463
Nd	ppb	1056	3853	1871	1637	986	37720	41180	1837
Sm	ppb	193	801	390	287	184	7346	8094	411
Eu	ppb	36	157	73	55	34	1208	1277	86
Tb	ppb	30	111	52	37	24	894	968	61
Gd	ppb	191	724	343	253	168	6307	6771	389
Dy	ppb	161	615	298	203	128	4796	5128	341
Ho	ppb	31	119	57	39	24	904	974	66
Er	ppb	81	317	146	98	57	2359	2491	169
Tm	ppb	10	44	20	13	6	325	351	24

Yb	**ppb**	55	262	120	75	35	2022	2155	137
Lu	**ppb**	8	37	16	11	4	285	303	20
Hf	**ppb**	4	52	21	8	4	303	407	9
Tl	**ppb**	4	56	13	4	3	237	297	2
Pb	**ppb**	539	1589	646	194	537	7805	9016	471
Th	**ppb**	92	1539	454	159	45	16570	18950	118
U	**ppb**	656	2256	674	304	805	2149	2360	405

Lab ID Sample ID Description	Unit	KK 020 STF 204.3 WARNING!	KK 021 STF 205.7 WARNING!	KK 022 KSC 210 STF 210	KK 023 ST2 1.6 WARNING!	KK 024 KAW 2.9 ST2 2.9	KK 025 KAW 2.15 ST2 2.15	KK 026 KAW 4.15 ST2 4.15
Li	ppb	64	535	1111	1850	2236	2052	613
		27	48	28	109	75	113	109
Mg	ppm	243400	224000	146200	225800	146300	151600	153300
Al	ppm	16	63	33	462	332	610	207
P	ppm	100	734	170	126	147	254	217
Ca	ppm	400400	400400	254200	400400	254100	248800	247100
Sc	ppb	151	648	169	380	382	666	460
Ti	ppb	574	1443	835	3064	2928	3901	2794
V	ppb	8023	12710	3858	3536	2947	3164	7275
Cr	ppb	1308	1669	1727	4825	2913	4047	2822
Fe	ppm	485	949	1716	902	679	852	1518
Mn	ppm	861	1180	917	1144	601	537	1222
Co	ppb	1613	3354	2229	2404	1602	2017	3790
Ni	ppb	20900	16900	160900	14490	29570	16000	64970
Cu	ppb	1629	2905	1978	1528	1256	1848	2453
Zn	ppb	24920	27100	23250	15410	7362	12230	19970
Ga	ppb	19	44	31	142	92	189	109
As	ppb	301	1726	1213	274	258	430	785
Rb	ppb	233	176	48	409	382	715	412
Sr	ppb	39250	107500	53010	97560	70400	61710	53890
Y	ppb	523	1291	717	1155	802	1299	1385
Zr	ppb	80	457	146	1113	680	1121	689
Nb	ppb	1	3	2	6	5	7	3
Mo	ppb	29	45	55	24	8	21	42
Ba	ppb	8155	12140	21320	17670	6581	6826	47320
La	ppb	475	1467	408	719	591	875	859
Ce	Ppb	724	1874	856	1968	1652	1943	3573
Pr	ppb	88	346	107	211	184	298	259
Nd	ppb	350	1288	409	832	753	1210	1029
Sm	ppb	75	250	91	179	167	266	221
Eu	ppb	16	51	20	40	35	57	51
Tb	ppb	14	39	17	33	27	41	42
Gd	ppb	92	268	110	221	189	294	282
Dy	ppb	77	206	102	178	138	221	230
Ho	ppb	16	41	20	35	26	43	43
Er	ppb	41	97	50	89	62	106	108
Tm	ppb	5	12	6	11	8	13	13

Yb	**ppb**	29	71	36	61	43	73	73
Lu	**ppb**	4	10	5	9	6	10	10
Hf	**ppb**	1	10	2	17	11	17	12
Tl	**ppb**	4	5	15	5	2	5	35
Pb	**ppb**	653	4085	3677	1991	234	617	1132
Th	**ppb**	6	45	19	181	180	262	121
U	**ppb**	182	555	481	216	398	352	171

Lab ID Sample ID Description	unit	TCD BHVO-2c 20K BHVO-2 Basalt	Laurentian	TCD Long-term av. Expt/LTA	GEOREM (Jochum 2016) Expt/reference
La	32510	0.4600188431	0.4683637579	0.4708861275	0.4675484466
Ce	71090	0.5202587123	0.5307482516	0.5341983993	0.5279223519
Pr	8460	0.6242523897	0.6374319147	0.6393988862	0.6310874704
Nd	32910	0.7279062796	0.7414699342	0.7437826447	0.7374658159
Sm	6880	0.8745514125	0.8816438673	0.8846402694	0.8754360465
Eu	1570	1.2850393358	1.3074655621	1.3157371100	1.3012738854
Gd	6360	0.9645267915	0.9790954466	0.9790273593	0.9759433962
Tb	990	0.9274015052	0.9462462315	0.9450442526	0.9486868687
Dy	5890	0.8653925470	0.8899745573	0.8921475291	0.8964346350
Y	31850	0.7440631121	0.7646112236	0.7686405078	0.8135007849
Ho	1220	0.8032482052	0.8189230098	0.8196402407	0.8104098361
Er	3370	0.7234870509	0.7435589887	0.7447777775	0.7451038576
Tm	510	0.6504171724	0.6673317410	0.6652107049	0.6566666667
Yb	3250	0.5960232421	0.6119617058	0.6091015601	0.6135384615
Lu	490	0.5490123684	0.5595196764	0.5597153943	0.5620408163

Lab ID Sample ID Description	unit	TCD JA-2b 20K JA-2 Andesite	Laurentian	TCD Long-term av. Expt/LTA	GEOREM (Jochum 2016) Expt/reference
La	32510	0.4600188431	0.4683637579	0.4708861275	0.4675484466
Ce	71090	0.5202587123	0.5307482516	0.5341983993	0.5279223519
Pr	8460	0.6242523897	0.6374319147	0.6393988862	0.6310874704
Nd	32910	0.7279062796	0.7414699342	0.7437826447	0.7374658159
Sm	6880	0.8745514125	0.8816438673	0.8846402694	0.8754360465
Eu	1570	1.2850393358	1.3074655621	1.3157371100	1.3012738854
Gd	6360	0.9645267915	0.9790954466	0.9790273593	0.9759433962
Tb	990	0.9274015052	0.9462462315	0.9450442526	0.9486868687
Dy	5890	0.8653925470	0.8899745573	0.8921475291	0.8964346350
Y	31850	0.7440631121	0.7646112236	0.7686405078	0.8135007849
Ho	1220	0.8032482052	0.8189230098	0.8196402407	0.8104098361
Er	3370	0.7234870509	0.7435589887	0.7447777775	0.7451038576
Tm	510	0.6504171724	0.6673317410	0.6652107049	0.6566666667
Yb	3250	0.5960232421	0.6119617058	0.6091015601	0.6135384615
Lu	490	0.5490123684	0.5595196764		

Lab ID Sample IE Descriptic	unit	TCD AGV-2d 20K AGV-2 Andesite	Laurentian	TCD Long-term av. Expt/LTA		GEOREM 8698 (Jochum 2015) Expt/reference
La	32510	1.1485925877	1.1750880727	1.1703192581		1.1753306675
Ce	71090	0.9749255247	0.9795144949	0.9973946609		0.9766493178
Pr	8460	0.9618110702	0.9762367635	0.9802279520		0.9651300236
Nd	32910	0.9077961611	0.9273227456	0.9293305240		0.9264661197
Sm	6880	0.7897373335	0.8002189242	0.8033214956		0.8007267442
Eu	1570	0.9370375393	0.9662488900	0.9575782089		0.9891719745
Gd	6360	0.7010622633	0.7127045014	0.7114761395		0.7355345912
Tb	990	0.6288006778	0.6389173083	0.6353426156		0.6575757576
Dy	5890	0.5745762788	0.5870782575	0.5868016707		0.6025466893
Y	31850	0.5638072571	0.5747167295	0.5781833828		0.6009419152
Ho	1220	0.5502278176	0.5575636577	0.5574226006		0.5588524590
Er	3370	0.5227424323	0.5369950093	0.5373786677		0.5415430267
Tm	510	0.5027644304	0.5130175350	0.5131770186		0.5143137255
Yb	3250	0.4945238617	0.5051798503	0.5034466756		0.5086153846
Lu	490	0.4880729025	0.5029937951	0.5016379062		0.5116326531

Lab ID Sample ID Description	unit	SMK LSTD A BCS 393 Limestone	GEOREM (very few)	Expt/published	HK 19Dec16 Std Test BCS 393 Av. 3 leaches
La	32510	0.0403987618			0.0430477217
Ce	71090	0.0187956096			0.0190037180
Pr	8460	0.0336801176			0.0339367461
Nd	32910	0.0357301440			0.0368128374
Sm	6880	0.0365628843			0.0367763526
Eu	1570	0.0392676280			0.0427456359
Gd	6360	0.0485527961			0.0494853231
Tb	990	0.0458470327			0.0473393212
Dy	5890	0.0494645818			0.0505669197
Y	31850	0.0987378788			0.1015004738
Ho	1220	0.0544334886			0.0559965609
Er	3370	0.0557671837			0.0577735230
Tm	510	0.0508287049			0.0527368825
Yb	3250	0.0477502082			0.0483647179
Lu	490	0.0473938198			0.0489980642

Lab ID Sample ID Description	unit	SMK JLs-1 A JLs-1 Limestone	wide ranges, digests+leaches? GEOREM (better?)	Expt/published	N.Imai et al., 1996 0	HK JLS-1A JLa-1 Hilde digest (Hf)
La	32510	0.0032545569	0.0046139649	0.0000000000	0.0047062442	0.0033925073
Ce	71090	0.0024965161	0.0073287382	0.0000000000	0.0073287382	0.0026551146
Pr	8460	0.0026628868	0.0029078014	0.0000000000	0.0037825059	0.0028925419
Nd	32910	0.0028122526	0.0030385901	0.0000000000	0.0041324825	0.0029890231
Sm	6880	0.0029199684	0.0196220930	0.0000000000	0.0196220930	0.0034761407
Eu	1570	0.0006525536	0.0044585987	0.0000000000	0.0045859873	0.0028237722
Gd	6360	0.0033617925	0.0030974843	0.0000000000	0.0047169811	0.0034649589
Tb	990	0.0029482901	0.0040404040	0.0000000000	0.0041414141	0.0034349261
Dy	5890	0.0030425192	0.0048047538	0.0000000000	0.0048047538	0.0037691905
Y	31850	0.0074643151	0.0070015699	0.0000000000	0.0070015699	0.0074930494
Ho	1220	0.0037740810	0.0037704918	0.0000000000	0.0000000000	0.0039314067
Er	3370	0.0037438154	0.0042433234	0.0000000000	0.0000000000	0.0042358354
Tm	510	0.0034956425	0.0037254902	0.0000000000	0.0000000000	0.0039886697
Yb	3250	0.0038560169	0.0050461538	0.0000000000	0.0050461538	0.0040908254
Lu	490	0.0038050746	0.0448979592	0.0000000000	0.0448979592	0.0044004307

	SMK DSTD A BCS 368 Dolomite	HK 19Dec16 Std Test BCS 368 Av. 3 leaches		STB 4	STB 6	STB 8	STB 14
32510	0.0100674547	0.0110061351	0.0092872004	0.0166091817	0.0383253540	0.0471629719	0.0247070145
71090	0.0089863713	0.0094638392	0.0071466605	0.0178056604	0.0493424533	0.0486570922	0.0251448383
8460	0.0102962256	0.0109174403	0.0075203092	0.0187646722	0.0467785931	0.0392356904	0.0235313543
32910	0.0110321484	0.0115600634	0.0070260373	0.0176212513	0.0430159870	0.0350539657	0.0221047128
6880	0.0121638277	0.0126373962	0.0065966042	0.0182146667	0.0411420704	0.0326546283	0.0220236906
1570	0.0120099068	0.0143266160	0.0063439110	0.0159983753	0.0358362343	0.0309141434	0.0234636405
6360	0.0167736920	0.0175585585	0.0073521507	0.0178989214	0.0453278271	0.0433655160	0.0272539465
990	0.0168235150	0.0178179260	0.0081768052	0.0192439975	0.0447528699	0.0455660017	0.0278604845
5890	0.0175233810	0.0186108851	0.0080683463	0.0184805611	0.0420185661	0.0445273605	0.0265781404
31850	0.0360713811	0.0382696415	0.0092541425	0.0185269097	0.0474382454	0.0576293780	0.0311734475
1220	0.0196664595	0.0209340275	0.0080164587	0.0181952721	0.0400270452	0.0425302971	0.0269266174
3370	0.0204441937	0.0216603712	0.0078935114	0.0170716271	0.0366398953	0.0394652032	0.0261233516
510	0.0192706848	0.0208626251	0.0074541787	0.0167645038	0.0321776086	0.0311478834	0.0235347680
3250	0.0185833123	0.0199475001	0.0076985633	0.0159146517	0.0282819200	0.0268106584	0.0214408394
490	0.0190525265	0.0197329025	0.0076999965	0.0140099021	0.0258956430	0.0248590703	0.0199657657

Lab ID Sample ID Description	unit	STB 18	STB 19	STB 21	STB 23	STB 26	STB 27	STF 67.5	STF 68.4 DANGER!
La	32510	0.0117590841	0.0715439921	0.0343683029	0.0557058606	0.0241773139	0.0805312975	0.0340562792	0.1092409296
Ce	71090	0.0113743926	0.0607931929	0.0317032568	0.0416787935	0.0211343171	0.0487856362	0.0395524992	0.1218938102
Pr	8460	0.0108830491	0.0472346482	0.0310661726	0.0362726055	0.0179282428	0.0346152618	0.0357855271	0.1202820737
Nd	32910	0.0099926612	0.0413598497	0.0287431365	0.0322988213	0.0177257060	0.0300847146	0.0320940969	0.1170902166
Sm	6880	0.0093649239	0.0365153341	0.0255679135	0.0269337071	0.0168839093	0.0267525314	0.0280323810	0.1164497345
Eu	1570	0.0096409298	0.0356540452	0.0222512077	0.0246243986	0.0175893749	0.0305853631	0.0230054179	0.0997651156
Gd	6360	0.0108106797	0.0454699557	0.0266406795	0.0282928758	0.0208941106	0.0467011212	0.0299542086	0.1137832117
Tb	990	0.0110064225	0.0468866625	0.0258791260	0.0289711006	0.0205045917	0.0421805562	0.0301003714	0.1118180548
Dy	5890	0.0103349807	0.0441483557	0.0250183195	0.0278688134	0.0211803788	0.0359917016	0.0273051372	0.1044425030
Y	31850	0.0121060351	0.0525388221	0.0282301447	0.0322809086	0.0291735154	0.0452049830	0.0306268273	0.1032363570
Ho	1220	0.0106866676	0.0421235805	0.0250787216	0.0261092545	0.0213473256	0.0339695824	0.0254713373	0.0978998591
Er	3370	0.0100626078	0.0386170659	0.0236664314	0.0257974568	0.0205547095	0.0301146680	0.0239695910	0.0940337990
Tm	510	0.0097218473	0.0330694389	0.0216081083	0.0232474328	0.0179328233	0.0236256550	0.0195322760	0.0855840856
Yb	3250	0.0092390948	0.0292131994	0.0207865256	0.0224867262	0.0153110587	0.0179722504	0.0169070343	0.0805544676
Lu	490	0.0086806788	0.0251848398	0.0192054688	0.0205765562	0.0146939977	0.0160648647	0.0155380550	0.0762486129

Sample ID Description	unit	STF 69	STF 70	STF 71	STF 185 A DANGER!	STF 185 B DANGER!
La	32510	0.0467749222	0.0559319929	0.0252353892	0.9503601360	1.0515749659
Ce	71090	0.0571328629	0.0554380830	0.0301318479	1.1426131221	1.2536728997
Pr	8460	0.0594139561	0.0547128888	0.0317642838	1.1899178902	1.3043175755
Nd	32910	0.0568428663	0.0497462030	0.0299557251	1.1461719088	1.2514022932
Sm	6880	0.0566861027	0.0417724637	0.0267433436	1.0677121422	1.1765206329
Eu	1570	0.0468119377	0.0351732035	0.0215418275	0.7697028943	0.8132402568
Gd	6360	0.0539116078	0.0397731442	0.0264496754	0.9916536974	1.0646101041
Tb	990	0.0528300848	0.0377245947	0.0239723719	0.9032947247	0.9777413791
Dy	5890	0.0505313639	0.0344673733	0.0217250442	0.8142006372	0.8706965486
Y	31850	0.0491935688	0.0383170206	0.0247889814	0.7926319093	0.8151904071
Ho	1220	0.0465308373	0.0319042756	0.0197232811	0.7408177872	0.7985200188
Er	3370	0.0432636172	0.0291139672	0.0169752128	0.7000465276	0.7390737314
Tm	510	0.0390089808	0.0252238105	0.0123152147	0.6363845977	0.6886853048
Yb	3250	0.0369041339	0.0231077204	0.0108178069	0.6220018929	0.6631270947
Lu	490	0.0336226528	0.0214428902	0.0091039710	0.5810170767	0.6183998792

Sample ID. Description	Unit	STF 202.9 WARNING!	STF 204.3 WARNING!	STF 205.7 WARNING!	STF 210	ST2 1.6 WARNING!1	ST2 2.9	ST2 2.15	ST2 4.15
La	32510	0.0477903352	0.0146136649	0.0451311584	0.0125463426	0.0221160796	0.0181786204	0.0269272552	0.0264140721
Ce	71090	0.0396900196	0.0101833170	0.0263545815	0.0120455832	0.0276809428	0.0232326510	0.0273331226	0.0502607623
Pr	8460	0.0546978562	0.0104391532	0.0408632707	0.0125924090	0.0249344133	0.0217364378	0.0351653798	0.0306352658
Nd	32910	0.0558274086	0.0106359310	0.0391314758	0.0124191056	0.0252766856	0.0228783887	0.0367550184	0.0312590525
Sm	6880	0.0596622231	0.0109240669	0.0362628921	0.0131591656	0.0260293521	0.0243205818	0.0387065062	0.0321261156
Eu	1570	0.0548388630	0.0101974989	0.0323060667	0.0124590379	0.0254433808	0.0222913237	0.0360198573	0.0324585986
Gd	6360	0.0611234467	0.0145144159	0.0420754346	0.0172524738	0.0347397026	0.0296575383	0.0461436146	0.0442869383
Tb	990	0.0617831150	0.0136864674	0.0393237394	0.0176421545	0.0334457864	0.0273234937	0.0413801360	0.0427880923
Dy	5890	0.0579602481	0.0130584640	0.0349192885	0.0172391867	0.0302786509	0.0234220151	0.0375768893	0.0389832619
Y	31850	0.0557255994	0.0164333141	0.0405435119	0.0225028449	0.0362755230	0.0251763821	0.0407792295	0.0434790484
Ho	1220	0.0544343874	0.0127756720	0.0332215666	0.0167569588	0.0290746406	0.0214805654	0.0350420281	0.0354302570
Er	3370	0.0501869045	0.0122005083	0.0287822744	0.0149514148	0.0264229668	0.0184540130	0.0315427844	0.0319849629
Tm	510	0.0463413249	0.0098497736	0.0241417542	0.0121047805	0.0219969110	0.0147808110	0.0262052057	0.0256688265
Yb	3250	0.0420495977	0.0088630190	0.0218633800	0.0111756019	0.0186154794	0.0133643893	0.0225728654	0.0223140799
Lu	490	0.0398002156	0.0090204197	0.0205730729	0.0105417127	0.0177812038	0.0118758202	0.0207619124	0.0209777045

3. Appendix_3_ ALs OMAC_ICP-MS/OES for Wadi Shuram WS9 and Wadi Aswad WA1 & WA2 Field sections.

REPORTABLE ELEMENTS AND RANGES

ME-ICP06 Analytes and Reporting Ranges

Analyte	Units	Lower Limit	Upper Limit	Analyte	Units	Lower Limit	Upper Limit	Analyte	Units	Lower Limit	Upper Limit
SiO2	%	0.01	100	Al2O3	%	0.01	100	Fe2O3	%	0.01	100
CaO	%	0.01	100	MgO	%	0.01	100	Na2O	%	0.01	100
K2O	%	0.01	100	Cr2O3	%	0.002	100	TiO2	%	0.01	100
MnO	%	0.01	100	P2O5	%	0.01	100	SrO	%	0.01	100
BaO	%	0.01	100								

ME-MS81 Analytes and Reporting Ranges

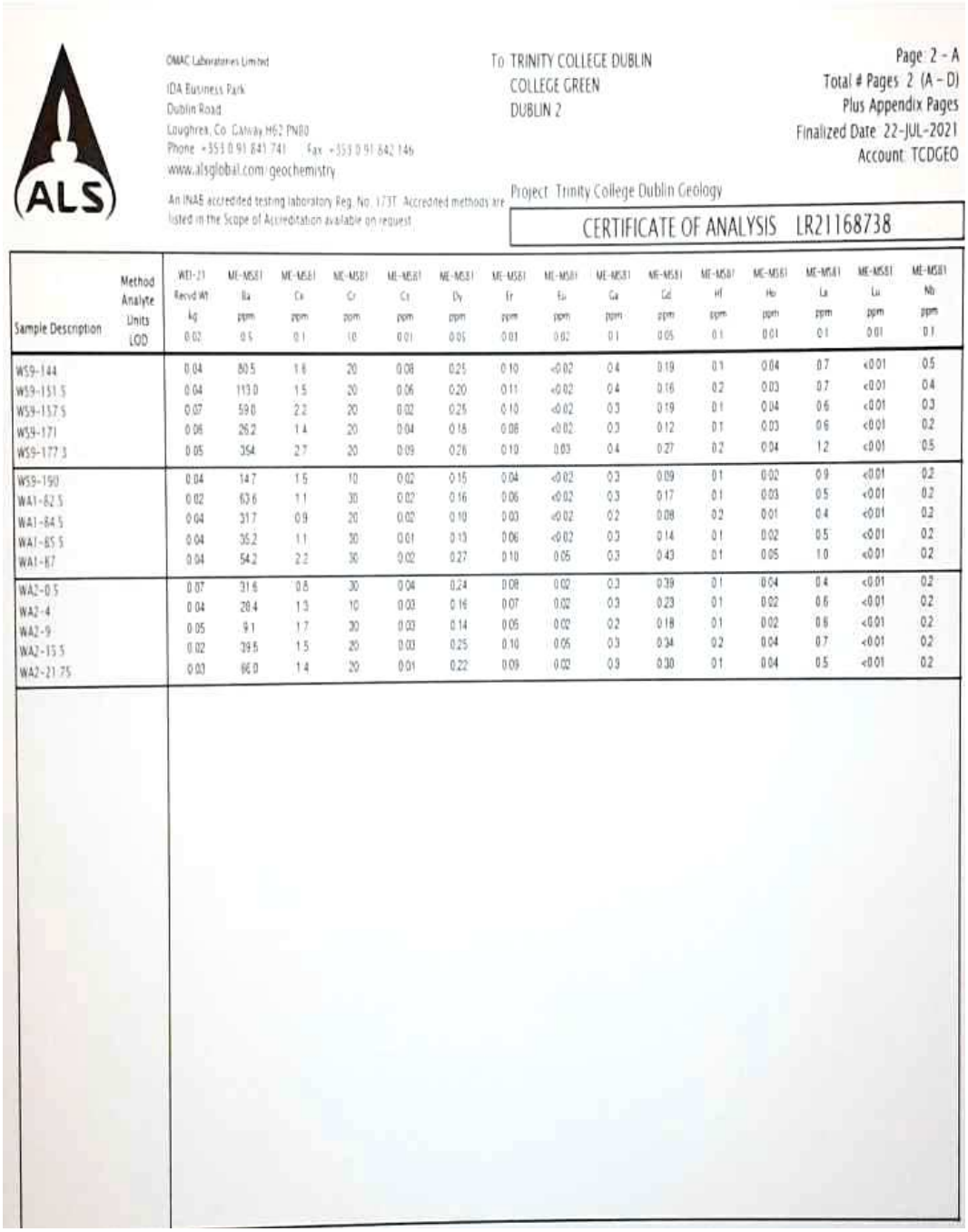
Analyte	Units	Lower Limit	Upper Limit	Analyte	Units	Lower Limit	Upper Limit	Analyte	Units	Lower Limit	Upper Limit
Ba	ppm	0.5	10000	Ce	ppm	0.1	10000	Cr	ppm	10	10000
Cs	ppm	0.01	10000	Dy	ppm	0.05	1000	Er	ppm	0.03	1000
Eu	ppm	0.02	1000	Ga	ppm	0.1	1000	Gd	ppm	0.05	1000
Hf	ppm	0.1	10000	Ho	ppm	0.01	1000	La	ppm	0.1	10000
Lu	ppm	0.01	1000	Nb	ppm	0.1	2500	Nd	ppm	0.1	10000
Pr	ppm	0.02	1000	Rb	ppm	0.2	10000	Sm	ppm	0.03	1000
Sn	ppm	1	10000	Sr	ppm	0.1	10000	Ta	ppm	0.1	2500
Tb	ppm	0.01	1000	Th	ppm	0.05	1000	Tm	ppm	0.01	1000
U	ppm	0.05	1000	V	ppm	5	10000	W	ppm	1	10000
Y	ppm	0.1	10000	Yb	ppm	0.03	1000	Zr	ppm	2	10000

Method performance expectations are set according to the method type and take into account factors such as test tube versus volumetric flask digestions, instrument calibrations, detection limits etc. In general (others are applicable), ALS categorizes methods as below:

- Geochemical Exploration methods have a precision expectation of ±10%.
- Assay methods (eg: Single element ore grade methods suitable for resource calculations) have a precision expectation of ±5%.
- Umpire Assay methods have a precision expectation of ±1-2%. These assays are often performed in replicate with proofs and are often 'classical chemistry' techniques rather than instrumental analysis; thus, are not affected by instrument calibration differences.

- Some commodity methods have a precision expectation of 1-2%. These are often controlled tightly at the instrument and are analyzed with specific matrix matched reference materials. Eg: Iron by XRF Iron Ore methods.

The above criteria generally apply at greater than 20 times the detection limit, with ±1 detection limit applied.



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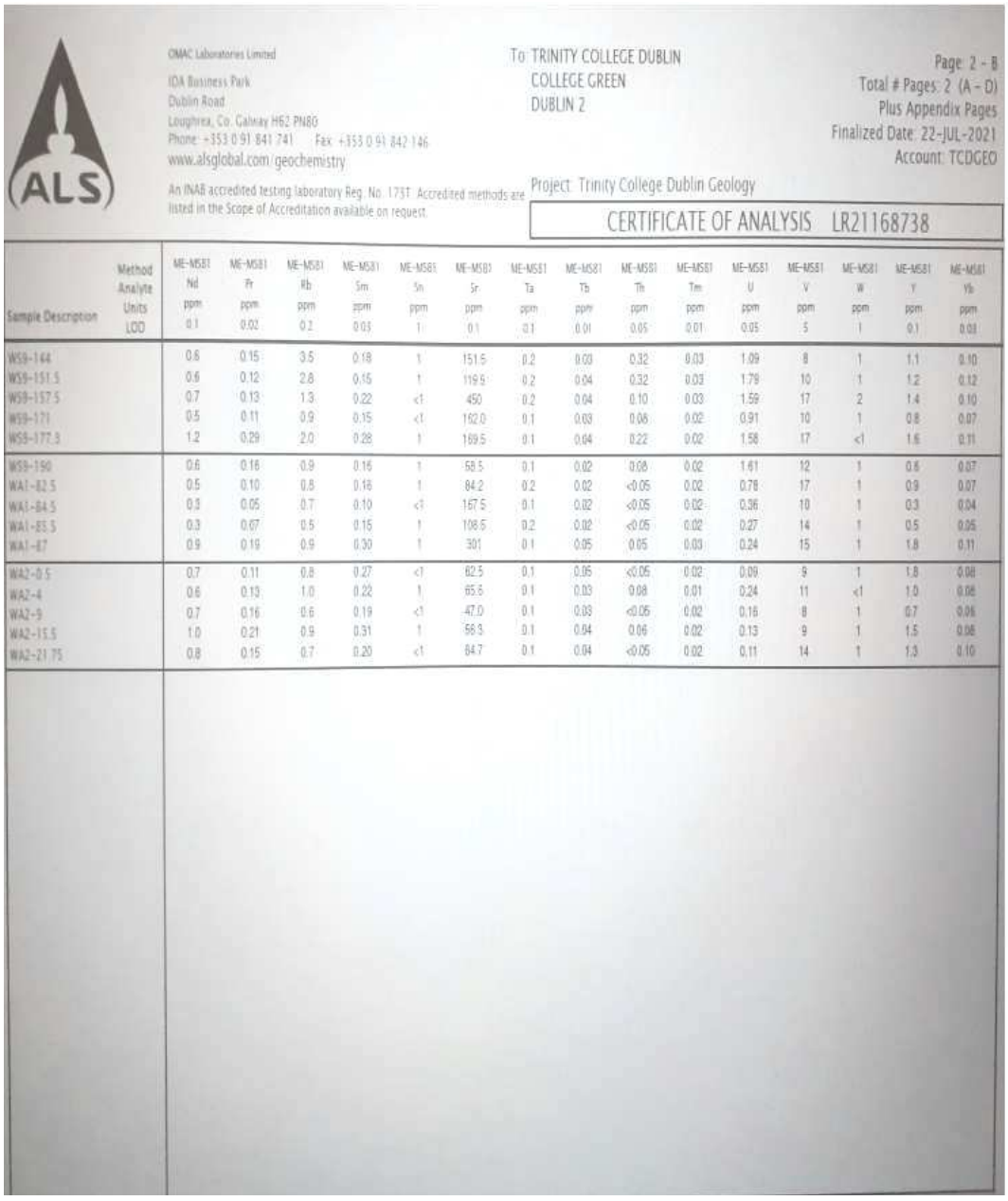
Page: 2 - A
Total # Pages: 2 (A - D)
Plus Appendix Pages
Finalized Date: 22-JUL-2021
Account: TCDGEO

Project: Trinity College Dublin Geology

CERTIFICATE OF ANALYSIS LR21168738

Sample Description	Method / Analyte / Units / LOD	WEI-21 Recvd Wt kg 0.02	ME-MS81 Ba ppm 0.5	ME-MS81 Ce ppm 0.1	ME-MS81 Cr ppm 10	ME-MS81 Cs ppm 0.01	ME-MS81 Dy ppm 0.05	ME-MS81 Er ppm 0.03	ME-MS81 Eu ppm 0.02	ME-MS81 Ga ppm 0.1	ME-MS81 Gd ppm 0.05	ME-MS81 Hf ppm 0.1	ME-MS81 Ho ppm 0.01	ME-MS81 La ppm 0.1	ME-MS81 Lu ppm 0.01	ME-MS81 Nb ppm 0.1
WS9-144		0.04	80.5	1.8	20	0.08	0.25	0.10	<0.02	0.4	0.19	0.1	0.04	0.7	<0.01	0.5
WS9-151.5		0.04	113.0	1.5	20	0.06	0.20	0.11	<0.02	0.4	0.16	0.2	0.03	0.7	<0.01	0.4
WS9-157.5		0.07	59.0	2.2	20	0.02	0.25	0.10	<0.02	0.3	0.19	0.1	0.04	0.6	<0.01	0.3
WS9-171		0.06	26.2	1.4	20	0.04	0.18	0.08	<0.02	0.3	0.12	0.1	0.03	0.6	<0.01	0.2
WS9-177.3		0.05	354	2.7	20	0.09	0.26	0.10	0.03	0.4	0.27	0.2	0.04	1.2	<0.01	0.5
WS9-190		0.04	14.7	1.5	10	0.02	0.15	0.04	<0.02	0.3	0.09	0.1	0.02	0.9	<0.01	0.2
WA1-82.5		0.02	63.6	1.1	30	0.02	0.16	0.06	<0.02	0.3	0.17	0.1	0.03	0.5	<0.01	0.2
WA1-84.5		0.04	31.7	0.9	20	0.02	0.10	0.03	<0.02	0.2	0.08	0.2	0.01	0.4	<0.01	0.2
WA1-85.5		0.04	35.2	1.1	30	0.01	0.13	0.06	<0.02	0.3	0.14	0.1	0.02	0.5	<0.01	0.2
WA1-87		0.04	54.2	2.2	30	0.02	0.27	0.10	0.05	0.3	0.43	0.1	0.05	1.0	<0.01	0.2
WA2-0.5		0.07	31.6	0.8	30	0.04	0.24	0.08	0.02	0.3	0.39	0.1	0.04	0.4	<0.01	0.2
WA2-4		0.04	28.4	1.3	10	0.03	0.16	0.07	0.02	0.3	0.23	0.1	0.02	0.6	<0.01	0.2
WA2-9		0.05	9.1	1.7	30	0.03	0.14	0.05	0.02	0.2	0.18	0.1	0.02	0.6	<0.01	0.2
WA2-15.5		0.02	39.5	1.5	20	0.03	0.25	0.10	0.05	0.3	0.34	0.2	0.04	0.7	<0.01	0.2
WA2-21.75		0.03	66.0	1.4	20	0.01	0.22	0.09	0.02	0.3	0.30	0.1	0.04	0.5	<0.01	0.2



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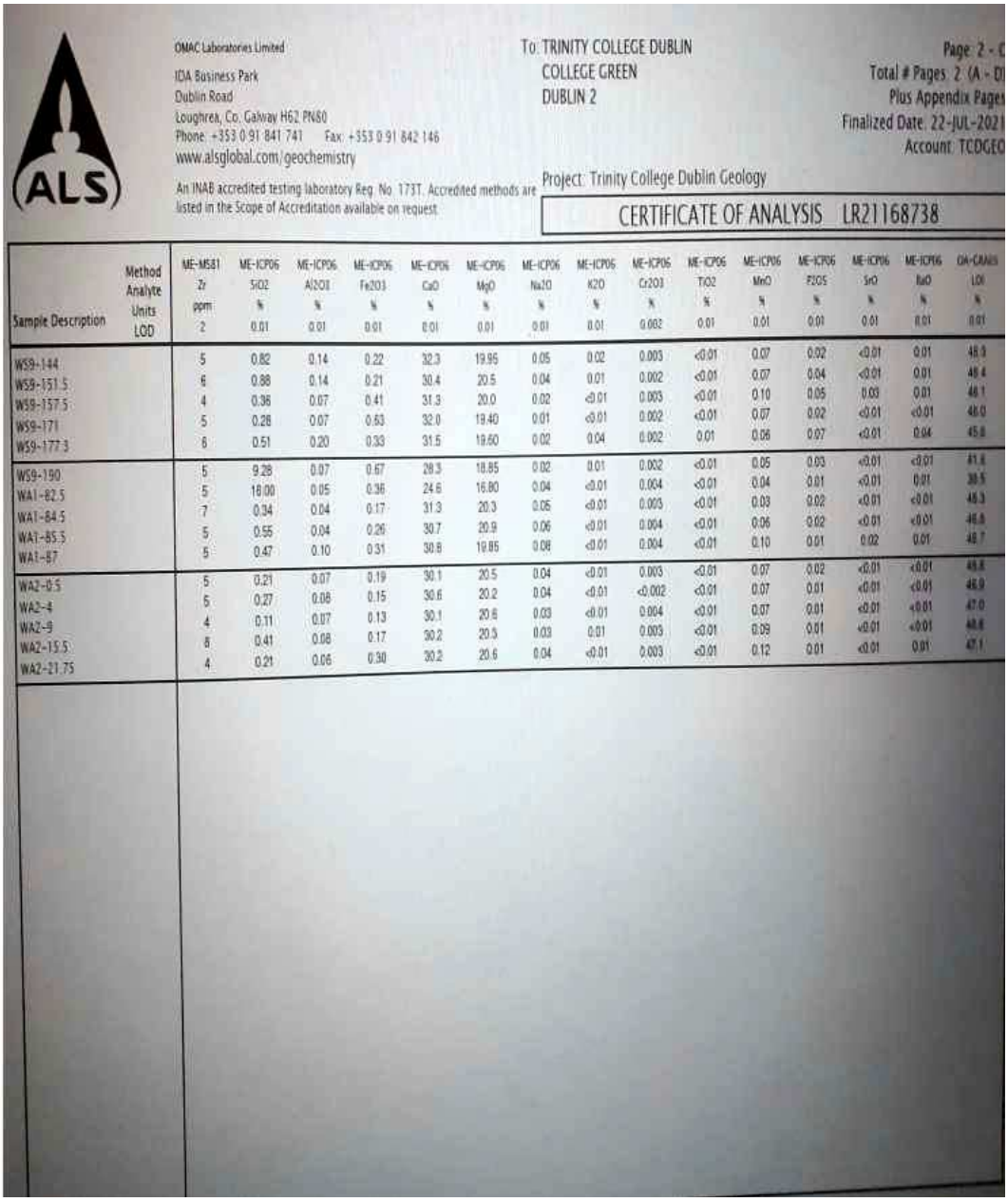
Page: 2 - B
Total # Pages: 2 (A - D)
Plus Appendix Pages
Finalized Date: 22-JUL-2021
Account: TCDGEO

Project: Trinity College Dublin Geology

CERTIFICATE OF ANALYSIS LR21168738

Sample Description	Method	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81
	Analyte	Nd	Pr	Rb	Sm	Sn	Sr	Ta	Tb	Th	Tm	U	V	W	Y	Yb
	Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
	LOD	0.1	0.02	0.2	0.03	1	0.1	0.1	0.01	0.05	0.01	0.05	5	1	0.1	0.03
WS9-144		0.6	0.15	3.5	0.18	1	151.5	0.2	0.03	0.32	0.03	1.09	8	1	1.1	0.10
WS9-151.5		0.6	0.12	2.8	0.15	1	119.5	0.2	0.04	0.32	0.03	1.79	10	1	1.2	0.12
WS9-157.5		0.7	0.13	1.3	0.22	<1	450	0.2	0.04	0.10	0.03	1.59	17	2	1.4	0.10
WS9-171		0.5	0.11	0.9	0.15	<1	162.0	0.1	0.03	0.08	0.02	0.91	10	1	0.8	0.07
WS9-177.3		1.2	0.29	2.0	0.28	1	169.5	0.1	0.04	0.22	0.02	1.58	17	<1	1.6	0.11
WS9-190		0.6	0.16	0.9	0.16	1	58.5	0.1	0.02	0.08	0.02	1.61	12	1	0.6	0.07
WA1-82.5		0.5	0.10	0.8	0.16	1	84.2	0.2	0.02	<0.05	0.02	0.78	17	1	0.9	0.07
WA1-84.5		0.3	0.05	0.7	0.10	<1	167.5	0.1	0.02	<0.05	0.02	0.36	10	1	0.3	0.04
WA1-85.5		0.3	0.07	0.5	0.15	1	108.5	0.2	0.02	<0.05	0.02	0.27	14	1	0.5	0.05
WA1-87		0.9	0.19	0.9	0.30	1	301	0.1	0.05	0.05	0.03	0.24	15	1	1.8	0.11
WA2-0.5		0.7	0.11	0.8	0.27	<1	62.5	0.1	0.05	<0.05	0.02	0.09	9	1	1.8	0.08
WA2-4		0.6	0.13	1.0	0.22	1	65.6	0.1	0.03	0.08	0.01	0.24	11	<1	1.0	0.08
WA2-9		0.7	0.16	0.6	0.19	<1	47.0	0.1	0.03	<0.05	0.02	0.16	8	1	0.7	0.06
WA2-15.5		1.0	0.21	0.9	0.31	1	58.3	0.1	0.04	0.06	0.02	0.13	9	1	1.5	0.08
WA2-21.75		0.8	0.15	0.7	0.20	<1	84.7	0.1	0.04	<0.05	0.02	0.11	14	1	1.3	0.10



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Page: 2 - C
Total # Pages: 2 (A - D
Plus Appendix Pages
Finalized Date: 22-JUL-2021
Account: TCDGEO

Project: Trinity College Dublin Geology

CERTIFICATE OF ANALYSIS LR21168738

Sample Description	Method	ME-MS81	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	OA-GRA05
	Analyte	Zr	SiO2	Al2O3	Fe2O3	CaO	MgO	Na2O	K2O	Cr2O3	TiO2	MnO	P2O5	SrO	BaO	LOI
	Units	ppm	%	%	%	%	%	%	%	%	%	%	%	%	%	%
	LOD	2	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.01	0.01	0.01	0.01	0.01	0.01
WS9-144		5	0.82	0.14	0.22	32.3	19.95	0.05	0.02	0.003	<0.01	0.07	0.02	<0.01	0.01	46.9
WS9-151.5		6	0.88	0.14	0.21	30.4	20.5	0.04	0.01	0.002	<0.01	0.07	0.04	<0.01	0.01	46.4
WS9-157.5		4	0.36	0.07	0.41	31.3	20.0	0.02	<0.01	0.003	<0.01	0.10	0.05	0.03	0.01	46.1
WS9-171		5	0.28	0.07	0.63	32.0	19.40	0.01	<0.01	0.002	<0.01	0.07	0.02	<0.01	<0.01	46.0
WS9-177.3		6	0.51	0.20	0.33	31.5	19.60	0.02	0.04	0.002	0.01	0.06	0.07	<0.01	0.04	45.8
WS9-190		5	9.28	0.07	0.67	28.3	18.85	0.02	0.01	0.002	<0.01	0.05	0.03	<0.01	<0.01	41.8
WA1-82.5		5	18.00	0.05	0.36	24.6	16.80	0.04	<0.01	0.004	<0.01	0.04	0.01	<0.01	0.01	38.5
WA1-84.5		7	0.34	0.04	0.17	31.3	20.3	0.05	<0.01	0.005	<0.01	0.03	0.02	<0.01	<0.01	46.3
WA1-85.5		5	0.55	0.04	0.26	30.7	20.9	0.06	<0.01	0.004	<0.01	0.06	0.02	<0.01	<0.01	46.8
WA1-87		5	0.47	0.10	0.31	30.8	19.85	0.08	<0.01	0.004	<0.01	0.10	0.01	0.02	0.01	46.7
WA2-0.5		5	0.21	0.07	0.19	30.1	20.5	0.04	<0.01	0.003	<0.01	0.07	0.02	<0.01	<0.01	46.8
WA2-4		5	0.27	0.08	0.15	30.6	20.2	0.04	<0.01	<0.002	<0.01	0.07	0.01	<0.01	<0.01	46.9
WA2-9		4	0.11	0.07	0.13	30.1	20.6	0.03	<0.01	0.004	<0.01	0.07	0.01	<0.01	<0.01	47.0
WA2-15.5		8	0.41	0.08	0.17	30.2	20.3	0.03	0.01	0.003	<0.01	0.09	0.01	<0.01	<0.01	46.8
WA2-21.75		4	0.21	0.06	0.30	30.2	20.6	0.04	<0.01	0.003	<0.01	0.12	0.01	<0.01	0.01	47.1

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Finalized Date: 22-JUL-2021
Account: TCDGEO

Project: Trinity College Dublin Geology

CERTIFICATE OF ANALYSIS LR21168738

Sample Description	Method	TOT-ICP06	CRU-QC	PUL-QC
	Analyte	Total	Pass2mm	Pass75um
	Units	%	%	%
	LOD	0.01	0.01	0.01
WS9-144		99.90	73.5	91.3
WS9-151.5		98.70		
WS9-157.5		98.45		
WS9-171		98.48		
WS9-177.3		98.18		
WS9-190		98.86		
WA1-82.5		98.41		
WA1-84.5		98.55		
WA1-85.5		99.39		
WA1-87		98.45		
WA2-0.5		98.00		
WA2-4		98.32		
WA2-9		98.12		
WA2-15.5		98.10		
WA2-21.75		98.65		

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Finalized Date: 22-JUL-2021
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Project: Trinity College Dublin Geology

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CERTIFICATE COMMENTS

ACCREDITATION COMMENTS

The methods immediately below this line are ISO 17025:2017 Accredited, INAB Registration No. 173T

Applies to Method:			
ME-ICP06	ME-MS81	OA-GRA05	

LABORATORY ADDRESSES

Processed at ALS Loughrea located at Dublin Road, Loughrea, Co. Galway, Ireland.

Applies to Method:			
BAG-01	CRU-31	CRU-QC	LOG-22
ME-ICP06	ME-MS81	OA-GRA05	PUL-31
PUL-QC	SPL-21	TOT-ICP06	WEI-21

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QC CERTIFICATE LR21168738

Project: Trinity College Dublin Geology

P.O. No. 2572549

This report is for 15 samples of Rock submitted to our lab in Loughrea, Ireland on 23-JUN-2021.

The following have access to data associated with this certificate:

KARRER KAZYUMBA	DR. CHRIS NICHOLAS	

SAMPLE PREPARATION

ALS CODE	DESCRIPTION
WEI-21	Received Sample Weight
LOG-22	Sample login - Rcd w/o BarCode
CRU-31	Fine crushing - 70% <2mm
SPL-21	Split sample - riffle splitter
PUL-31	Pulverize up to 250g 85% <75 um
BAG-01	Bulk Master for Storage
CRU-QC	Crushing QC Test
PUL-QC	Pulverizing QC Test

ANALYTICAL PROCEDURES

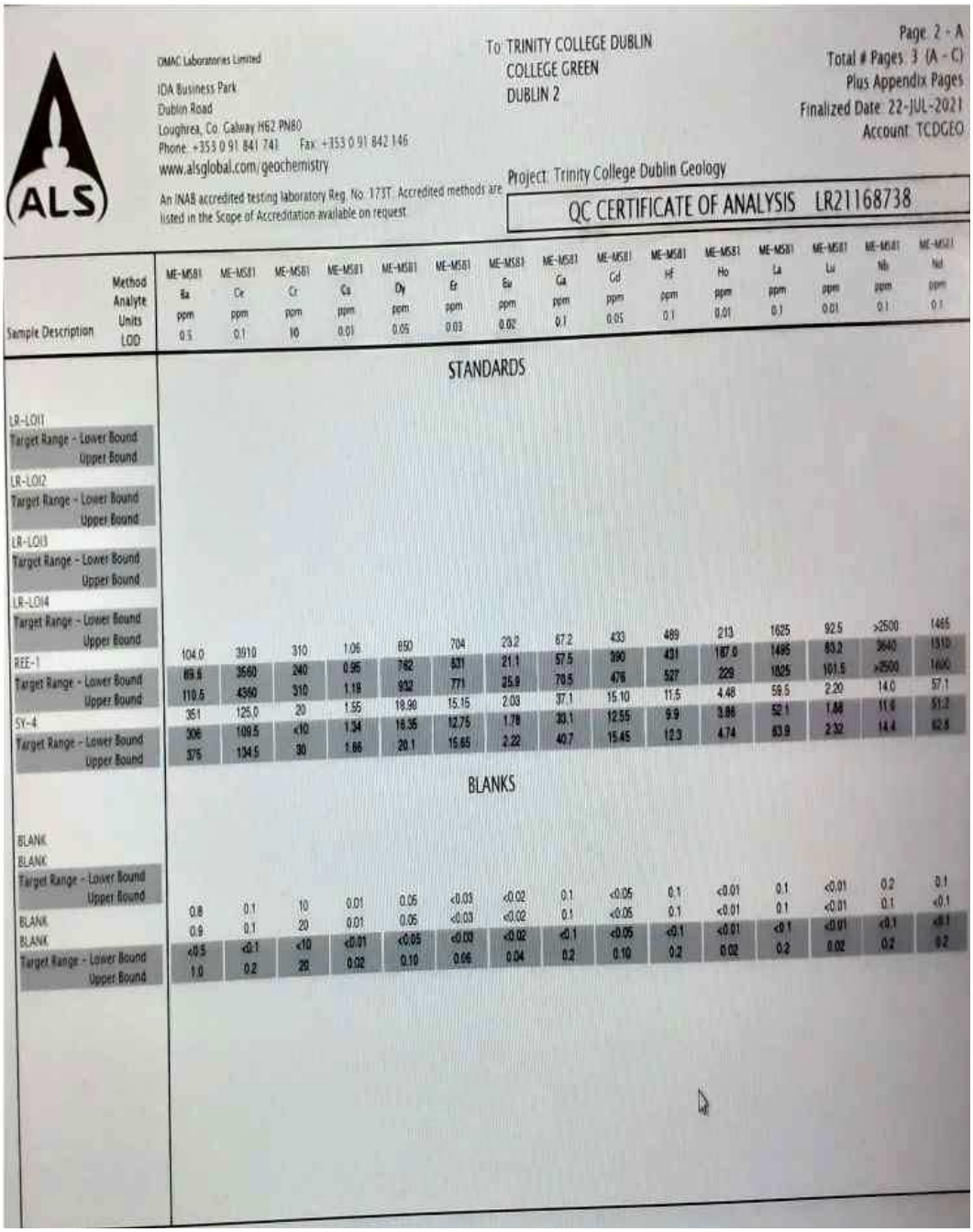
ALS CODE	DESCRIPTION	INSTRUMENT
ME-ICP06	Whole Rock Package - ICP-AES	ICP-AES
OA-GRA05	Loss on Ignition at 1000C	WST-SEQ
ME-MS81	Lithium Borate Fusion ICP-MS	ICP-MS
TOT-ICP06	Total Calculation for ICP06	

This is the Final Report and supersedes any preliminary report with this certificate number. Results apply to samples as submitted. All pages of this report have been checked and approved for release.

***** See Appendix Page for comments regarding this certificate *****

Signature:

Andrey Tairov, Technical Manager, Ireland



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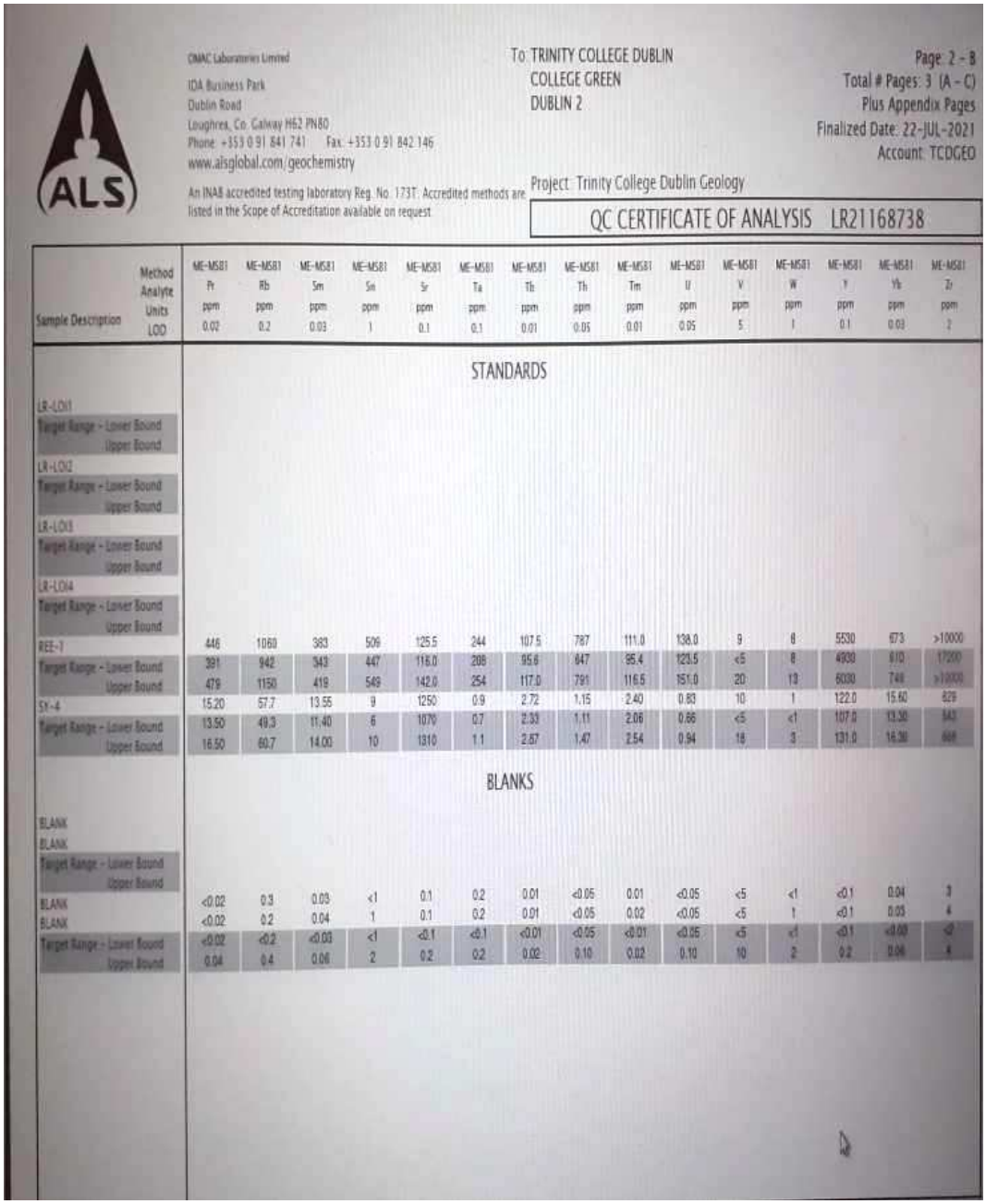
To: TRINITY COLLEGE DUBLIN
COLLEGE GREEN
DUBLIN 2

Page: 2 - A
Total # Pages: 3 (A - C)
Plus Appendix Pages
Finalized Date: 22-JUL-2021
Account: TCDGEO

Project: Trinity College Dublin Geology

QC CERTIFICATE OF ANALYSIS LR21168738

Sample Description	Method	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81
	Analyte	Ba	Ce	Cr	Cs	Dy	Er	Eu	Ga	Gd	Hf	Ho	La	Lu	Nb	Nd
	Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
	LOD	0.5	0.1	10	0.01	0.05	0.03	0.02	0.1	0.05	0.1	0.01	0.1	0.01	0.1	0.1
STANDARDS																
LR-LOI1																
Target Range - Lower Bound		104.0	3910	310	1.06	850	704	23.2	67.2	433	489	213	1625	92.5	>2500	1465
Upper Bound		89.6	3560	240	0.95	782	631	21.1	57.5	390	431	187.0	1495	83.2	3640	1310
LR-LOI2																
Target Range - Lower Bound		110.5	4360	310	1.18	932	771	25.9	70.5	478	527	228	1825	101.5	>2500	1600
Upper Bound																
LR-LOI3																
Target Range - Lower Bound		351	125.0	20	1.55	18.99	15.15	2.03	37.1	15.10	11.5	4.48	59.5	2.20	14.0	57.1
Upper Bound		306	109.5	<10	1.34	16.35	12.75	1.78	33.1	12.55	9.9	3.86	52.1	1.88	11.6	51.2
LR-LOI4																
Target Range - Lower Bound		375	134.5	30	1.66	20.1	15.65	2.22	40.7	15.45	12.3	4.74	63.9	2.32	14.4	62.5
Upper Bound																
REE-1																
Target Range - Lower Bound																
Upper Bound																
SY-4																
Target Range - Lower Bound																
Upper Bound																
BLANKS																
BLANK		0.8	0.1	10	0.01	0.05	<0.03	<0.02	0.1	<0.05	0.1	<0.01	0.1	<0.01	0.2	0.1
BLANK		0.9	0.1	20	0.01	0.05	<0.03	<0.02	0.1	<0.05	0.1	<0.01	0.1	<0.01	0.1	<0.1
Target Range - Lower Bound																
Upper Bound		<0.5	<0.1	<10	<0.01	<0.05	<0.03	<0.02	<0.1	<0.05	<0.1	<0.01	<0.1	<0.01	<0.1	<0.1
BLANK																
BLANK																
Target Range - Lower Bound																
Upper Bound		1.0	0.2	20	0.02	0.10	0.06	0.04	0.2	0.10	0.2	0.02	0.2	0.02	0.2	0.2



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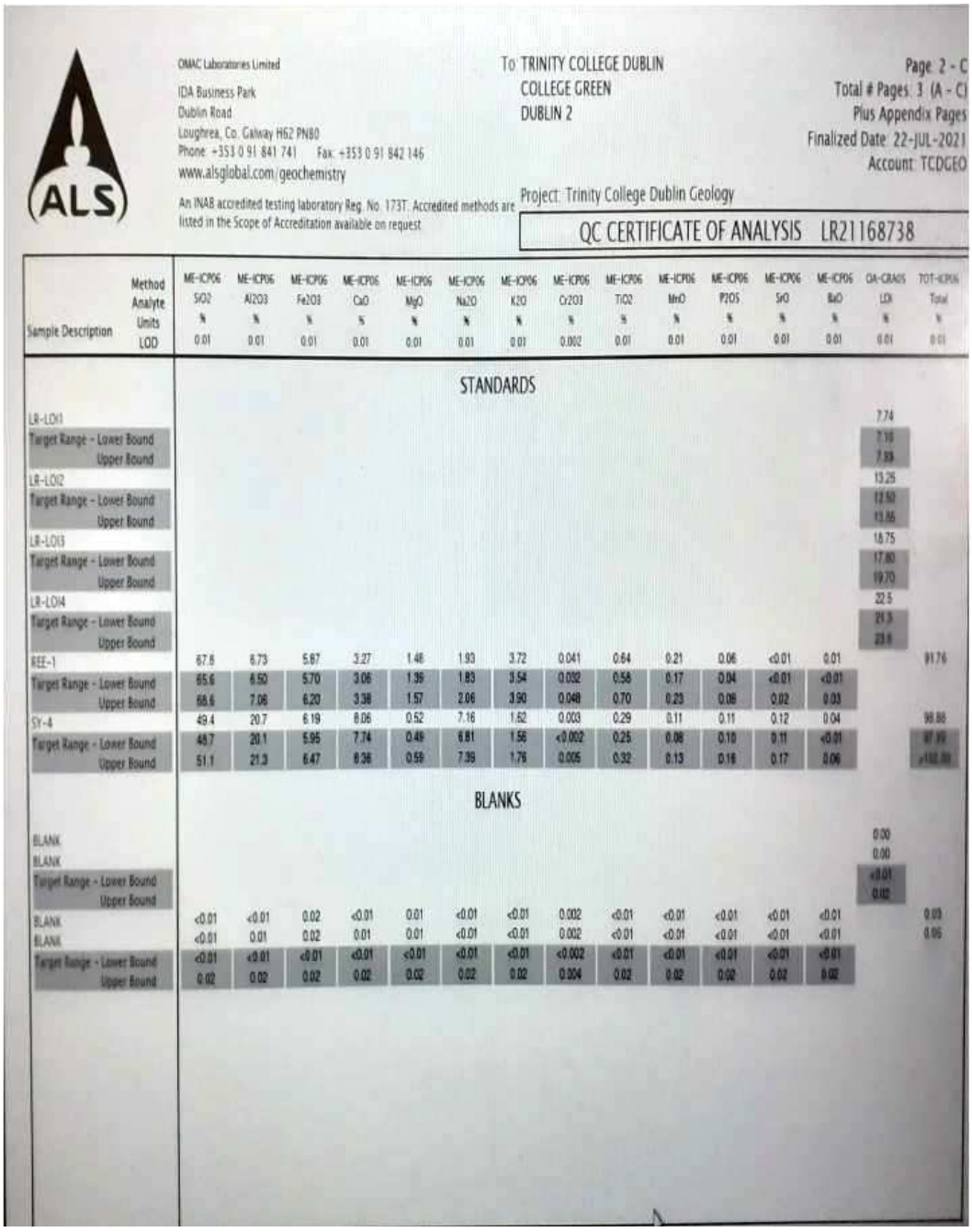
To: TRINITY COLLEGE DUBLIN
COLLEGE GREEN
DUBLIN 2

Finalized Date: 22-JUL-2021
Account: TCDGEO

Project: Trinity College Dublin Geology

QC CERTIFICATE OF ANALYSIS LR21168738

Sample Description	Method	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81
	Analyte	Pr	Rb	Sm	Sn	Sr	Ta	Tb	Th	Tm	U	V	W	Y	Yb	Zr
	Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
	LOD	0.02	0.2	0.03	1	0.1	0.1	0.01	0.05	0.01	0.05	5	1	0.1	0.03	2
STANDARDS																
LR-LOI1																
Target Range - Lower Bound																
Upper Bound																
LR-LOI2																
Target Range - Lower Bound																
Upper Bound																
LR-LOI3																
Target Range - Lower Bound																
Upper Bound																
LR-LOI4																
Target Range - Lower Bound																
Upper Bound																
REE-1		446	1060	383	509	125.5	244	107.5	787	111.0	138.0	9	8	5530	673	>10000
Target Range - Lower Bound		391	942	343	447	116.0	208	95.6	647	95.4	123.5	<5	8	4930	610	17200
Upper Bound		479	1150	419	549	142.0	254	117.0	791	116.5	151.0	20	13	6030	748	>10000
SY-4		15.20	57.7	13.55	9	1250	0.9	2.72	1.15	2.40	0.83	10	1	122.0	15.60	629
Target Range - Lower Bound		13.50	49.3	11.40	6	1070	0.7	2.33	1.11	2.06	0.66	<5	<1	107.0	13.30	543
Upper Bound		16.50	60.7	14.00	10	1310	1.1	2.87	1.47	2.54	0.94	18	3	131.0	16.30	668
BLANKS																
BLANK																
BLANK																
Target Range - Lower Bound																
Upper Bound																
BLANK		<0.02	0.3	0.03	<1	0.1	0.2	0.01	<0.05	0.01	<0.05	<5	<1	<0.1	0.04	3
BLANK		<0.02	0.2	0.04	1	0.1	0.2	0.01	<0.05	0.02	<0.05	<5	1	<0.1	0.03	4
Target Range - Lower Bound		<0.02	<0.2	<0.03	<1	<0.1	<0.1	<0.01	<0.05	<0.01	<0.05	<5	<1	<0.1	<0.03	<2
Upper Bound		0.04	0.4	0.06	2	0.2	0.2	0.02	0.10	0.02	0.10	10	2	0.2	0.06	4



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DUBLIN 2

Page: 2 - C
Total # Pages: 3 (A - C)
Plus Appendix Pages
Finalized Date: 22-JUL-2021
Account: TCDGEO

Project: Trinity College Dublin Geology

QC CERTIFICATE OF ANALYSIS LR21168738

Sample Description	Method	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	OA-GRA05	TOT-ICP06
	Analyte	SiO2	Al2O3	Fe2O3	CaO	MgO	Na2O	K2O	Cr2O3	TiO2	MnO	P2O5	SrO	BaO	LOI	Total
	Units	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
	LOD	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.01
STANDARDS																
LR-LOI1															7.74	
Target Range - Lower Bound															7.16	
Upper Bound															7.89	
LR-LOI2															13.25	
Target Range - Lower Bound															12.50	
Upper Bound															13.86	
LR-LOI3															18.75	
Target Range - Lower Bound															17.80	
Upper Bound															19.70	
LR-LOI4															22.5	
Target Range - Lower Bound															21.3	
Upper Bound															23.9	
REE-1		67.8	6.73	5.87	3.27	1.48	1.93	3.72	0.041	0.64	0.21	0.06	<0.01	0.01		91.76
Target Range - Lower Bound		65.6	6.50	5.70	3.06	1.39	1.83	3.54	0.032	0.58	0.17	0.04	<0.01	<0.01		
Upper Bound		68.6	7.06	6.20	3.38	1.57	2.06	3.90	0.048	0.70	0.23	0.08	0.02	0.03		
SY-4		49.4	20.7	6.19	8.06	0.52	7.16	1.62	0.003	0.29	0.11	0.11	0.12	0.04		98.86
Target Range - Lower Bound		48.7	20.1	5.95	7.74	0.49	6.81	1.56	<0.002	0.25	0.08	0.10	0.11	<0.01		97.99
Upper Bound		51.1	21.3	6.47	8.36	0.59	7.39	1.76	0.005	0.32	0.13	0.16	0.17	0.06		102.00
BLANKS																
BLANK															0.00	
BLANK															0.00	
Target Range - Lower Bound															<0.01	
Upper Bound															0.02	
BLANK		<0.01	<0.01	0.02	<0.01	0.01	<0.01	<0.01	0.002	<0.01	<0.01	<0.01	<0.01	<0.01		0.03
BLANK		<0.01	0.01	0.02	0.01	0.01	<0.01	<0.01	0.002	<0.01	<0.01	<0.01	<0.01	<0.01		0.06
Target Range - Lower Bound		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.002	<0.01	<0.01	<0.01	<0.01	<0.01		
Upper Bound		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.004	0.02	0.02	0.02	0.02	0.02		

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To: TRINITY COLLEGE DUBLIN
COLLEGE GREEN
DUBLIN 2

Finalized Date: 22-JUL-2021
Account: TCDGEO

Project: Trinity College Dublin Geology

QC CERTIFICATE OF ANALYSIS LR21168738

Sample Description / Method / Analyte / Units / LOD	ME-MS81 Ba ppm 0.5	ME-MS81 Ce ppm 0.1	ME-MS81 Cr ppm 10	ME-MS81 Cs ppm 0.01	ME-MS81 Dy ppm 0.05	ME-MS81 Er ppm 0.03	ME-MS81 Eu ppm 0.02	ME-MS81 Ga ppm 0.1	ME-MS81 Gd ppm 0.05	ME-MS81 Hf ppm 0.1	ME-MS81 Ho ppm 0.01	ME-MS81 La ppm 0.1	ME-MS81 Lu ppm 0.01	ME-MS81 Nb ppm 0.1	ME-MS81 Nd ppm 0.1
DUPLICATES															
ORIGINAL															
DUP															
Target Range - Lower Bound															
Upper Bound															
ORIGINAL															
DUP															
Target Range - Lower Bound															
Upper Bound															
WS9-157.5	59.0	2.2	20	0.02	0.25	0.10	<0.02	0.3	0.19	0.1	0.04	0.6	<0.01	0.3	0.7
DUP	58.6	2.2	10	0.04	0.19	0.09	<0.02	0.3	0.22	0.1	0.04	0.6	<0.01	0.3	0.6
Target Range - Lower Bound	55.4	2.0	<10	0.02	0.16	0.06	<0.02	0.2	0.14	<0.1	0.03	0.5	<0.01	0.2	0.5
Upper Bound	62.2	2.4	20	0.04	0.28	0.13	0.04	0.4	0.27	0.2	0.05	0.7	0.02	0.4	0.8
WS9-171															
DUP															
Target Range - Lower Bound															
Upper Bound															
WA2-21.75	66.0	1.4	20	0.01	0.22	0.09	0.02	0.3	0.30	0.1	0.04	0.5	<0.01	0.2	0.8
DUP	63.7	1.4	20	0.04	0.23	0.06	0.02	0.3	0.25	0.1	0.03	0.5	<0.01	0.2	0.7
Target Range - Lower Bound	61.1	1.2	<10	<0.01	0.16	0.04	<0.02	0.2	0.21	<0.1	0.02	0.4	<0.01	<0.1	0.6
Upper Bound	68.6	1.8	30	0.04	0.29	0.11	0.04	0.4	0.34	0.2	0.05	0.6	0.02	0.3	0.9
ORIGINAL															
DUP															
Target Range - Lower Bound															
Upper Bound															

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DUBLIN 2

Finalized Date: 22-JUL-2021
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Project: Trinity College Dublin Geology

QC CERTIFICATE OF ANALYSIS LR21168738

Sample Description / Method / Analyte / Units / LOD	ME-MS81 Pr ppm 0.02	ME-MS81 Rb ppm 0.2	ME-MS81 Sm ppm 0.03	ME-MS81 Sn ppm 1	ME-MS81 Sr ppm 0.1	ME-MS81 Ta ppm 0.1	ME-MS81 Tb ppm 0.01	ME-MS81 Th ppm 0.05	ME-MS81 Tm ppm 0.01	ME-MS81 U ppm 0.05	ME-MS81 V ppm 5	ME-MS81 W ppm 1	ME-MS81 Y ppm 0.1	ME-MS81 Yb ppm 0.03	ME-MS81 Zr ppm 2
	DUPLICATES														
ORIGINAL															
DUP															
Target Range - Lower Bound															
Upper Bound															
ORIGINAL															
DUP															
Target Range - Lower Bound															
Upper Bound															
WS9-157.5	0.13	1.3	0.22	<1	450	0.2	0.04	0.10	0.03	1.59	17	2	1.4	0.10	4
DUP	0.15	1.3	0.17	1	456	0.1	0.04	0.11	0.02	1.69	16	<1	1.3	0.08	4
Target Range - Lower Bound	0.11	1.0	0.16	<1	430	<0.1	0.03	<0.05	<0.01	1.51	11	<1	1.2	0.06	<2
Upper Bound	0.17	1.6	0.23	2	476	0.2	0.05	0.16	0.04	1.77	22	2	1.5	0.12	6
WS9-171															
DUP															
Target Range - Lower Bound															
Upper Bound															
WA2-21.75	0.15	0.7	0.20	<1	84.7	0.1	0.04	<0.05	0.02	0.11	14	1	1.3	0.10	4
DUP	0.12	0.7	0.26	1	87.1	0.1	0.04	<0.05	0.02	0.09	14	1	1.3	0.07	4
Target Range - Lower Bound	0.11	0.5	0.20	<1	81.5	<0.1	0.03	<0.05	<0.01	<0.05	9	<1	1.1	0.05	<2
Upper Bound	0.16	0.9	0.26	2	90.3	0.2	0.05	0.10	0.03	0.16	20	2	1.5	0.12	6
ORIGINAL															
DUP															
Target Range - Lower Bound															
Upper Bound															

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Finalized Date: 22-JUL-2021
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QC CERTIFICATE OF ANALYSIS LR21168738

Sample Description	Method	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	OA-GRA05	TOT-ICP06
	Analyte	SiO2	Al2O3	Fe2O3	CaO	MgO	Na2O	K2O	Cr2O3	TiO2	MnO	P2O5	SrO	BaO	LOI	LOI	Total
	Units	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
	LOD	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
DUPLICATES																	
ORIGINAL																7.85	
DUP																7.70	
Target Range - Lower Bound																7.57	
Upper Bound																7.98	
ORIGINAL																6.08	
DUP																5.97	
Target Range - Lower Bound																5.88	
Upper Bound																6.19	
WS9-157.5		0.36	0.07	0.41	31.3	20.0	0.02	<0.01	0.003	<0.01	0.10	0.05	0.03	0.01			
DUP		0.33	0.06	0.41	31.3	20.0	0.01	0.01	0.002	<0.01	0.09	0.03	0.03	0.01			
Target Range - Lower Bound		0.33	0.05	0.39	30.5	19.50	<0.01	<0.01	<0.002	<0.01	0.08	0.03	0.02	<0.01			
Upper Bound		0.36	0.08	0.43	32.1	20.5	0.02	0.02	0.004	0.02	0.11	0.05	0.04	0.02			
WS9-171																46.0	
DUP																46.0	
Target Range - Lower Bound																44.8	
Upper Bound																47.2	
WA2-21.75		0.21	0.06	0.30	30.2	20.6	0.04	<0.01	0.003	<0.01	0.12	0.01	<0.01	0.01			
DUP		0.25	0.05	0.32	30.8	21.0	0.06	<0.01	0.003	<0.01	0.12	0.02	<0.01	0.01			
Target Range - Lower Bound		0.21	0.04	0.29	29.7	20.3	0.04	<0.01	<0.002	<0.01	0.11	<0.01	<0.01	<0.01			
Upper Bound		0.25	0.07	0.33	31.3	21.3	0.06	0.02	0.004	0.02	0.13	0.02	0.02	0.02			
ORIGINAL																43.4	
DUP																43.1	
Target Range - Lower Bound																42.2	
Upper Bound																44.3	

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Page: Appendix 1
Total # Appendix Pages: 1
Finalized Date: 22-JUL-2021
Account: TCDGEO

Project: Trinity College Dublin Geology

QC CERTIFICATE OF ANALYSIS LR21168738

CERTIFICATE COMMENTS

ACCREDITATION COMMENTS

The methods immediately below this line are ISO 17025:2017 Accredited. INAB Registration No: 173T

Applies to Method:	ME-ICP06	ME-MS81	OA-GRA05

LABORATORY ADDRESSES

Processed at ALS Loughrea located at Dublin Road, Loughrea, Co. Galway, Ireland.

Applies to Method:	BAG-01	CRU-31	CRU-QC	LOG-22
	ME-ICP06	ME-MS81	OA-GRA05	PUL-31
	PUL-QC	SPL-21	TOT-ICP06	WEI-21

LR21168738 - Finalized
CLIENT : TCDGEO - Trinity College Dublin
# of Samples : 15
DATE RECEIVED : 2021-06-23 DATE FINALIZED : 2021-07-22
PROJECT : Trinity College Dublin Geology CERTIFICATE
COMMENTS :
PO NUMBER : 2572549

	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81	ME-MS81
SAMPLE DESCRIPTION	Ba ppm	Ce ppm	Cr ppm	Cs ppm	Dy ppm	Er ppm	Eu ppm	Ga ppm	Gd ppm	Hf ppm	Ho ppm	La ppm	Lu ppm	Nb ppm
WS9-144	80.5	1.6	20	0.08	0.25	0.1	<0.02	0.4	0.19	0.1	0.04	0.7	<0.01	0.5
WS9-151.5	113	1.5	20	0.06	0.2	0.11	<0.02	0.4	0.16	0.2	0.03	0.7	<0.01	0.4
WS9-157.5	59	2.2	20	0.02	0.25	0.1	<0.02	0.3	0.19	0.1	0.04	0.6	<0.01	0.3
WS9-171	26.2	1.4	20	0.04	0.18	0.08	<0.02	0.3	0.12	0.1	0.03	0.6	<0.01	0.2
WS9-177.3	354	2.7	20	0.09	0.26	0.1	0.03	0.4	0.27	0.2	0.04	1.2	<0.01	0.5
WS9-190	14.7	1.5	10	0.02	0.15	0.04	<0.02	0.3	0.09	0.1	0.02	0.9	<0.01	0.2
WA1-82.5	63.6	1.1	30	0.02	0.16	0.06	<0.02	0.3	0.17	0.1	0.03	0.5	<0.01	0.2
WA1-84.5	31.7	0.9	20	0.02	0.1	0.03	<0.02	0.2	0.08	0.2	0.01	0.4	<0.01	0.2
WA1-85.5	35.2	1.1	30	0.01	0.13	0.06	<0.02	0.3	0.14	0.1	0.02	0.5	<0.01	0.2
WA1-87	54.2	2.2	30	0.02	0.27	0.1	0.05	0.3	0.43	0.1	0.05	1	<0.01	0.2
WA2-0.5	31.6	0.8	30	0.04	0.24	0.08	0.02	0.3	0.39	0.1	0.04	0.4	<0.01	0.2
WA2-4	28.4	1.3	10	0.03	0.16	0.07	0.02	0.3	0.23	0.1	0.02	0.6	<0.01	0.2
WA2-9	9.1	1.7	30	0.03	0.14	0.05	0.02	0.2	0.18	0.1	0.02	0.6	<0.01	0.2
WA2-15.5	39.5	1.5	20	0.03	0.25	0.1	0.05	0.3	0.34	0.2	0.04	0.7	<0.01	0.2
WA2-21.75	66	1.4	20	0.01	0.22	0.09	0.02	0.3	0.3	0.1	0.04	0.5	<0.01	0.2

SAMPLE DESCRIPTION	ME-MS81 Nd ppm	ME-MS81 Pr ppm	ME-MS81 Rb ppm	ME-MS81 Sm ppm	ME-MS81 Sn ppm	ME-MS81 Sr ppm	ME-MS81 Ta ppm	ME-MS81 Tb ppm	ME-MS81 Th ppm	ME-MS81 Tm ppm	ME-MS81 U ppm	ME-MS81 V ppm	ME-MS81 W ppm	ME-MS81 Y ppm	ME-MS81 Yb ppm
WS9-144	0.6	0.15	3.5	0.18	1	151.5	0.2	0.03	0.32	0.03	1.09	8	1	1.1	0.1
WS9-151.5	0.6	0.12	2.8	0.15	1	119.5	0.2	0.04	0.32	0.03	1.79	10	1	1.2	0.12
WS9-157.5	0.7	0.13	1.3	0.22	<1	450	0.2	0.04	0.1	0.03	1.59	17	2	1.4	0.1
WS9-171	0.5	0.11	0.9	0.15	<1	162	0.1	0.03	0.08	0.02	0.91	10	1	0.8	0.07
WS9-177.3	1.2	0.29	2	0.28	1	169.5	0.1	0.04	0.22	0.02	1.58	17	<1	1.6	0.11
WS9-190	0.6	0.16	0.9	0.16	1	58.5	0.1	0.02	0.08	0.02	1.61	12	1	0.6	0.07
WA1-82.5	0.5	0.1	0.8	0.16	1	84.2	0.2	0.02	<0.05	0.02	0.78	17	1	0.9	0.07
WA1-84.5	0.3	0.05	0.7	0.1	<1	167.5	0.1	0.02	<0.05	0.02	0.36	10	1	0.3	0.04
WA1-85.5	0.3	0.07	0.5	0.15	1	108.5	0.2	0.02	<0.05	0.02	0.27	14	1	0.5	0.05
WA1-87	0.9	0.19	0.9	0.3	1	301	0.1	0.05	0.05	0.03	0.24	15	1	1.8	0.11
WA2-0.5	0.7	0.11	0.8	0.27	<1	62.5	0.1	0.05	<0.05	0.02	0.09	9	1	1.8	0.08
WA2-4	0.6	0.13	1	0.22	1	65.6	0.1	0.03	0.08	0.01	0.24	11	<1	1	0.08
WA2-9	0.7	0.16	0.6	0.19	<1	47	0.1	0.03	<0.05	0.02	0.16	8	1	0.7	0.06
WA2-15.5	1	0.21	0.9	0.31	1	56.3	0.1	0.04	0.06	0.02	0.13	9	1	1.5	0.08
WA2-21.75	0.8	0.15	0.7	0.2	<1	84.7	0.1	0.04	<0.05	0.02	0.11	14	1	1.3	0.1

SAMPLE DESCRIPTION	ME-MS81 Zr ppm	ME-ICP06 SiO2 %	ME-ICP06 Al2O3 %	ME-ICP06 Fe2O3 %	ME-ICP06 CaO %	ME-ICP06 MgO %	ME-ICP06 Na2O %	ME-ICP06 K2O %	ME-ICP06 Cr2O3 %	ME-ICP06 TiO2 %
WS9-144	5	0.82	0.14	0.22	32.3	19.95	0.05	0.02	0.003	<0.01
WS9-151.5	6	0.88	0.14	0.21	30.4	20.5	0.04	0.01	0.002	<0.01
WS9-157.5	4	0.36	0.07	0.41	31.3	20	0.02	<0.01	0.003	<0.01
WS9-171	5	0.28	0.07	0.63	32	19.4	0.01	<0.01	0.002	<0.01
WS9-177.3	6	0.51	0.2	0.33	31.5	19.6	0.02	0.04	0.002	0.01
WS9-190	5	9.28	0.07	0.67	28.3	18.85	0.02	0.01	0.002	<0.01
WA1-82.5	5	18	0.05	0.36	24.6	16.8	0.04	<0.01	0.004	<0.01
WA1-84.5	7	0.34	0.04	0.17	31.3	20.3	0.05	<0.01	0.003	<0.01
WA1-85.5	5	0.55	0.04	0.26	30.7	20.9	0.06	<0.01	0.004	<0.01
WA1-87	5	0.47	0.1	0.31	30.8	19.85	0.08	<0.01	0.004	<0.01
WA2-0.5	5	0.21	0.07	0.19	30.1	20.5	0.04	<0.01	0.003	<0.01
WA2-4	5	0.27	0.08	0.15	30.6	20.2	0.04	<0.01	<0.002	<0.01
WA2-9	4	0.11	0.07	0.13	30.1	20.6	0.03	<0.01	0.004	<0.01
WA2-15.5	8	0.41	0.08	0.17	30.2	20.3	0.03	0.01	0.003	<0.01
WA2-21.75	4	0.21	0.06	0.3	30.2	20.6	0.04	<0.01	0.003	<0.01

	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	OA-GRA05	TOT-ICP06	CRU-QC	PUL-QC
DESCRIPTION	MnO %	P_2O_5 %	SrO %	BaO %	LOI %	Total %	Pass2mm %	Pass75um %
WS9-144	0.07	0.02	<0.01	0.01	46.3	99.9	73.5	91.3
WS9-151.5	0.07	0.04	<0.01	0.01	46.4	98.7		
WS9-157.5		0.05	0.03	0.01	46.1	98.45		
WS9-171	0.07	0.02	<0.01	<0.01	46	98.48		
WS9-177.3	0.06	0.07	<0.01	0.04	45.8	98.18		
WS9-190	0.05	0.03	<0.01	<0.01	41.6	98.88		
WA1-82.5	0.04	0.01	<0.01	0.01	38.5	98.41		
WA1-84.5	0.03	0.02	<0.01	<0.01	46.3	98.55		
WA1-85.5	0.06	0.02	<0.01	<0.01	46.8	99.39		
WA1-87	0.1	0.01	0.02	0.01	46.7	98.45		
WA2-0.5	0.07	0.02	<0.01	<0.01	46.8	98		
WA2-4	0.07	0.01	<0.01	<0.01	46.9	98.32		
WA2-9	0.07	0.01	<0.01	<0.01	47	98.12		
WA2-15.5	0.09	0.01	<0.01	<0.01	46.8	98.1		
WA2-21.75	0.12	0.01	<0.01	0.01	47.1	98.65		

4. Appendix_4_Data of isotopes C & O (Gold, 2010).

Wadi Shital ST-1		
Height	δ13C	δ18O
6	-0.2	-4.78
10	-2.05	-5.37
10	-0.48	-3.3
11	-1.14	-5.56
11	-0.23	-3.55
12	-0.4	-3.99
13	-1.02	-5.85
13	2.57	-2.88
13	-0.38	-3.03
14	-0.05	-2.39
15	-0.15	-3.19
16	-0.16	-4.41
18	-0.47	-3.15
19.5	0.27	-3.67
21	-1.09	-2.58
22.5	0.55	-3.33
23.5	0.39	-3.4
24.2	-0.69	-3.87
25	0.14	-3
26	-1.09	-2.25
27	-2.92	-2.27
27.85	-2.82	-2.32
28.2	-8.14	-11.01
28.6	-3.49	-2.29
29.2	-4.49	-1.5
29.2	-4.49	-0.94
30	-3.68	-1.78
31	-4.64	-1.9
32.4	-3.91	-1.3
33.4	-0.32	-2.91
35.5	-0.29	-2.29
37.5	0.14	-2.78
38.5	0.1	-4.08

Wadi Shital ST-1		
Heigh	δ13C	δ18O
40.6	0	-2.17
41	1.82	-2.64
43	1.15	-2.26
44.2	-1.41	-1.82
45	-1.45	-1.65
46.3	-5.8	-4.11
47.4	-3.89	-3.8
47.6	-3.75	-4.03
48.3	-0.39	-2.76
51	-2.32	-1.63
54	-0.04	-1.64
54.9	-2.84	-2.86
55.25	-3.66	-5.77
57	-2.28	-2.27
58	0.2	-5.24
59.6	-3.56	-0.7
61	-3.33	-2.27
61.5	-2.4	-3.85
62	-1.08	-4.23
63	-0.42	-3.82
63.4	0.54	-2.93
64.5	2.1	-3.27
65.5	2.38	-2.74
65.5	2.5	-2.18
67.5	1.53	-2.89
68.4	-0.79	-1.68
68.4	-0.36	-3.98
69	-0.36	-3.98

Wadi Shital ST-1		
Heigh	δ13C	δ18O
70	0.51	-3.51
70.45	1.65	-2.76
72.4	0.66	-2.06
73.5	0.67	-3.6
75	1	-2.73
76.5	1.87	-3.07
78.2	1.29	-3.57
79.7	2.38	-2.31
81	0.85	-1.23
82.5	0.35	-3.1
84	1.55	-1.98
85.7	2.09	-2.42
87.3	1.16	-2.56
88.5	2.1	-2.22
90.6	2.26	-1.2
91.6	2.05	-2.25
93	1.33	-3.06
94.5	0.47	-0.84
96	1.31	-1.42
97.5	-0.75	-3.44
99	1.63	-1.18
100.5	1.1	-2.25
102	0.11	-3.81
103.4	-0.52	-2.9
105.1	0.39	-2.88
106.5	0.72	-2.58
108.3	0.84	-3.09
109.5	-4.77	-4.32
111	1.4	-2.56
112.5	1.86	-0.82
114	2.34	-0.76
115.5	1.29	-2.78
117	1.15	-2.56
118.8	-1.86	-1.55
120	-0.67	-3.6

Wadi Shital ST-1		
Heigh	δ13C	δ18O
121.5	0.16	-3.27
123	-1.75	-3.18
124.4	1.12	-2.03
126	0.08	0.01
127.5	1.56	-1.08
129	1.05	-0.44
130	0.33	-3.64
132.2	-3.33	-3.56
132.8	0.17	-0.44
133.6	-2.19	-3.59
135.4	0.53	-4.99
146.7	-0.61	-3.36
149	-1.52	-3.16
150.4	-2.67	-3.38
155.5	0.77	-2.98
157	-2.24	-2.72
158	-5.63	-3.87
161.8	-2.94	-1.24
179	-3.51	-1.23
186	-2.24	-3.38
190.2	5.37	-0.53
192	5.07	-0.48
193.5	4.72	-1.11
195	4.87	-1.18

Wadi Shital ST-1		
Heigh	δ13C	δ18O
196.5	6.94	-1.84
198.3	7.85	-3.21
198.5	7.87	-3.53
199.5	-2.23	-3.47
201.2	7.99	-2.2
202.1	7.8	-2.66
202.7	3.42	-4.25
204.3	7.06	-3.71
205.7	6	-1.68
207	5.71	-1.75
208.5	5.76	-1.58
210	5.77	-1.44
211.5	5.92	-1.12

	Wadi Shuram WS9	
Height	δ13C	δ18O
1.5	3.4	-0.47
3	2.75	-1.61
4.5	-1.76	3.4
7.8	1.93	0.53
9	2.07	-2.03
10.4	1.84	-0.79
12	2.27	-2.77
16..5	2.27	-1.3
21	2.09	-1.81
22.5	2.88	-0.26
24	2.51	-0.5
27	1.86	-1.65
30	2.58	-0.16
31.5	2.41	-1.49
34.9	-1.92	-3.7
37.4	1.22	-2.88
39	1.47	-1.4
40.5	1.02	-1.4
43.5	1.96	-0.23
48	1.98	-1.55
49.5	2.31	-1.5
52.5	1.88	-2.53
54	1.85	-2.83
55.5	-2.71	-4.61
58.5	-2.48	-4.61
59.9	-5.04	-2.53

	Wadi Shuram WS9	
Height	δ13C	δ18O
64.9	1.29	-2.92
66	-0.47	-3.55
69.5	0.02	-2.2
72	0.13	-2.01
76.5	-1.76	3.4
79.5	-1.57	-4.59
82.1	2.41	-2.23
85.5	1.66	-0.47
86.5	5.1	-2.63
88.6	-3.33	-5.94
94.6	-1.97	-3.71
98.2	6.66	-2.28
99.8	-2.72	0.45
123	4.86	-1.58
130	7.15	-1.89
135	7.18	-1.77
141	7.6	-0.91
144	-1.76	3.4
147	-1.76	3.4
148.5	3.02	-0.77
151.5	3.81	0.75
153	-1.76	3.4
154.5	7.06	-1.84
156	3.11	-1.12
157.5	2.92	-2.87
159	3.18	0.12

	Wadi Shuram WS9	
Height	δ13C	δ18O
162	3.45	-2.46
163.5	2.96	-1.91
165	2.83	0.26
168	-1.35	-4.52
174	-1.76	3.4
176.5	-2.91	-3.76
176.5	-1.76	-3.4
178	2.5	-1.59
183	1.78	-1.14
186.9	2.77	-1.46
190	4.67	-0.44
193.5	2.15	-1.27

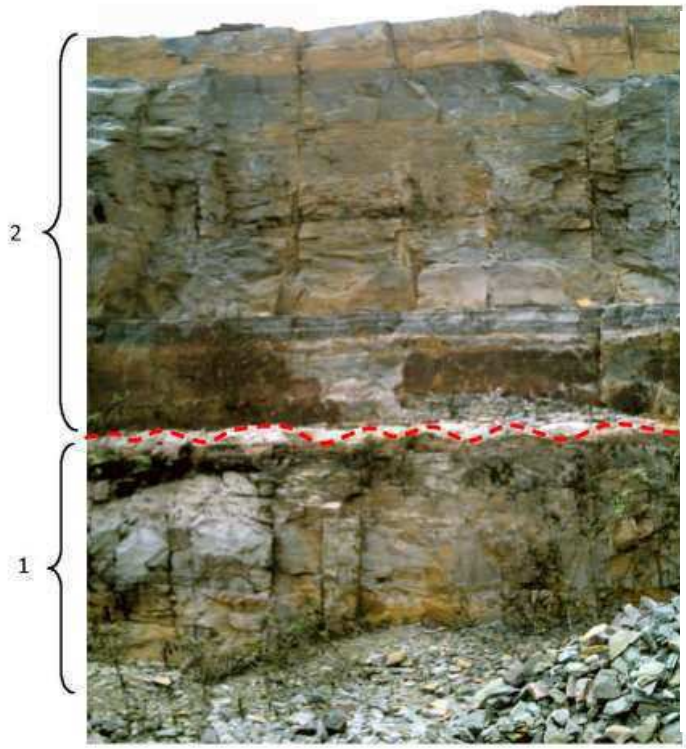
	Wadi Aswad WA1	
Height	δ13C	δ18O
4.1	-1.58	-1.26
5.3	-1.29	-3.76
6	-1.94	-3.8
8.75	-1.7	-4.44
15.4	-0.71	-4.9
17.5	-1.04	-4.92
18.3	-1.94	-4.59
20.8	0.52	-2.59
22.3	0.56	-3.57
23.6	-0.35	-4.13
24.5	-1.55	-3.07
27	-1.64	-4.88
27.6	-1.55	-1.87
29	-1.91	-5.07
33.6	-1.95	-4.99
42.8	4.23	-1.62
43.5	4.11	-0.48
44.4	4.15	-1.94
45	4.12	-2.94
45.5	5.84	-0.5
46.1	5.83	-1.26
47	7.21	0.17
48	6.72	-0.18
48.9	6.2	-1.54

	Wadi Aswad WA1	
Height	δ13C	δ18O
50.2	3.71	-0.62
5.4	3.47	-0.16
53.4	3.63	-0.36
55.1	3.26	-1.89
55.9	3.64	-0.79
56.4	3.71	-0.92
57	3.28	-0.94
58.6	3.96	-3
59.6	4.42	-0.75
60.1	3.78	-1.95
60.9	5.66	-3.85
62	3.54	-0.74
66.8	1.61	-2.28
69	-0.22	-3.24
70	-0.47	-1.78
71	-0.69	-2.42
72	-0.7	-2.23
73	-0.46	-1.8
74	-0.4	-2.17
75	0.06	-0.91
76	0.98	-1.53

	Wadi Aswad WA1	
Height	δ13C	δ18O
81	4.05	4.14
82.5	2.47	-0.83
84.5	2.04	2.67
85.5	1.77	-0.24
87	3.31	-0.29

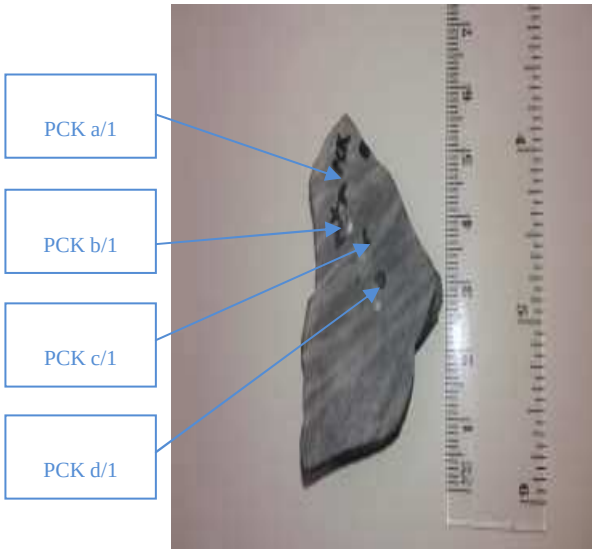
5. Appendix_5_ Limestone of Precambrian Fresh water coming in south-west part of DRC.

Samples of Precambrian fresh water were carefully collected in December 2015 by us and Dr. Christopher Nicholas, during a brief field trip in an old Procoki limestone quarry, southwest of the Democratic Republic of Congo, in Central Congo Province. The limestone of "Procoki" constitutes the first sedimentary series of the Congolese West: sequences of pre-Panafrican African passive margin platform (from Sansikwa to schisto- limestone, about 4000 m thick) comprising the two siliciclastic rocks and carbonates (with local stromatolites) and two diamictite horizons. The lowest horizon is associated with an undated basaltic episode (Kimbungu lavas and cushion veins - Undergrowth doleritic flies and 17 tholeiitic dykes, De Paepe et al., 1975; Kampunzu et al., 1975; Cahen, 1978; Cahen et al., 1984; Kampunzu et al., 1991; Mpemba Boni & Vellutini, 1992).



Procoki's quarry is located in the DRC, in the province of Congo central, along the territory of Mbanza-Ngungu approximately 4,880 km from the city bearing the same name "Mbanza- Ngungu". It is on the left side of the national road number 1 Kinshasa- Matadi and is an altitude ~ 658 m between the point of intersection of the meridian 14 ° 49' 39.1" east, and parallel 05° 16' 59.3" south.

Photography of Procoki quarry.



Our field work in 2015 indicated, based on macroscopic observation criteria, that the lithology of the Procoki limestone quarry included stromatolites with stratified horizons in its central part; numbered (1 and 2) in figure oppositew. It is precisely at this level of stromatolitic interval that our sample has been collected. Convinced also that it was a fresh water board because the sample had an alternation of thin layers, so we used drilling powder for each present horizon, subdivided into PCK / a 1, PCK / b1, PCK / c1 and PCK / d1.

Sample ID	Sample description	Weight tube	Weight Sample	Drilling bit size	Powder color	Remarks
PCK a/1	2 crystal phases are visible: *** Grey crystal phase**, the most common; * Light /white phase with most euhedral and irregular crystals.	913 mg	9.458 mg	medium	white	Drilled samples will be probably containing all the 2 phases; however will be mostly one kind and will hopefully maintain "geochemical difference". Hard to drill, very small Black flecks.
PCK b/1	Replica of PCK a/1	912 mg	10.345 mg	Medium	White	Replica drilled from different site of the same slice face
PCK c/1	**Light /white phase** with most euhedral and irregular crystals	913 mg	13.246 mg	Medium	White	Hard to drill, very small black flecks.
PCK d/1	Replica of PCK c/1	914 mg	12.653 mg	Medium	White	Replica drilled from different site of the same slice face

Final lab results issued by TCD for Procoki samples (2016).

	PCK a/1	PCK b/1	PCK c/1	PCK d/1
La	0.084	0.086	0.010	0.099
Ce	0.068	0.070	0.087	0.080
Pr	0.064	0.067	0.085	0.077
Nd	0.057	0.060	0.077	0.068
Sm	0.044	0.049	0.064	0.056
Eu	0.036	0.039	0.053	0.046
Gd	0.039	0.043	0.059	0.050
Tb	0.036	0.040	0.055	0.047
Dy	0.032	0.037	0.051	0.042
Y	0.034	0.038	0.051	0.043
Ho	0.030	0.035	0.047	0.039
Er	0.027	0.031	0.042	0.036
Tm	0.025	0.029	0.037	0.030
Yb	0.023	0.027	0.032	0.027
Lu	0.021	0.025	0.030	0.026