

Appendix D: EPMA analytical procedure

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1. Apatite

Common informations:

File Name : 2022-02-09-apatite.qtiSet

File Date : Feb/27/24-10:3 AM

Comment :

Column conditions:

Cond 1:

HV (kV): 20

I (nA): 40

Size (μm): 10.

Scanning: Off

RasterLength (μm): 608.34

Xtal informations:

Xtal parameters:

Cl Ka Sp5	LPET	(2d= 8.75	K= 0.000144)
P Ka Sp2	PET	(2d= 8.75	K= 0.000144)
Ca Ka	Sp2	PET	(2d= 8.75 K= 0.000144)
S Ka Sp5	LPET	(2d= 8.75	K= 0.000144)
Mn Ka	Sp3	LLIF	(2d= 4.0267 K= 0.000058)
F Ka Sp4	PC1	(2d= 61.254	K= 0.01281)
Na Ka	Sp1	TAP	(2d= 25.745 K= 0.00218)
Si Ka Sp1	TAP	(2d= 25.745	K= 0.00218)
Y La Sp1	TAP	(2d= 25.745	K= 0.00218)
Nd La	Sp3	LLIF	(2d= 4.0267 K= 0.000058)

Pha parameters:

Elt. Line	Spec	Xtal	Bias (V)	Gain	Dtime (μs)	Blin (mV)	Wind (mV)	Mode
Cl Ka Sp5	LPET	1865	876	3			Inte	
P Ka Sp2	PET	1307	1011	3			Inte	
Ca Ka	Sp2	PET	1307	1011	3			Inte
S Ka Sp5	LPET	1865	876	3			Inte	
Mn Ka	Sp3	LLIF	1867	469	3			Inte
F Ka Sp4	PC1	1510	1059	3			Inte	
Na Ka	Sp1	TAP	1330	3332	3			Inte
Si Ka Sp1	TAP	1330	3332	3			Inte	
Y La Sp1	TAP	1320	3092	3			Inte	
Nd La	Sp3	LLIF	1867	469	3			Inte

Acquisition informations:

Elt. Line	Spec	Xtal	Peak	Pk Time	Bg Off1	Bg Off2	Slope/IBg	Bg Time
Calibration		Intensity	Time/Repeat			Range	#Channels	(cps/nA)
Cl Ka	Sp5	LPET	54057	30	-500	300	15	
	pyromorphite_Cl	Sp5_022	34.4					
P Ka	Sp2	PET	70356	10	-800	800	5	#1260_P
Sp2_001	81.5							
Ca Ka	Sp2	PET	38385	10	-700	600	5	#1260_F
Sp4_Ca	Sp2_001	429.9						
S Ka	Sp5	LPET	61399	30	-700	700	15	
	BaSO4_SP055_S	Sp5_008	181.6					
Mn Ka	Sp3	LLIF	52196	10	-900	600	5	
	mnti_Mn	Sp3_030	409.9					
F Ka	Sp4	PC1	30312	20	-2000	2000	10	#1260_F
Sp4_Ca	Sp2_001	16.2						
Na Ka	Sp1	TAP	46405	10	-800	800	5	
	albi_Na	Sp1_010	46.2					
Si Ka	Sp1	TAP	27740	20	-700	800	10	
	wollast_Si	Sp1_010	506.5					
Y La	Sp1	TAP	25084	60	-400	300	30	
	Tra1_Y_Pr_Dr_Er_Y	Sp1_003	19.1					
Nd La	Sp3	LLIF	58874	20		600	1.1	10
	tr1_Verre_Nd_Sm_Yb_Lu_Nd	Sp3_002			63.1			

2. Monazite

Common informations :

File Name : 2023-01-20-mnz.qtiSet

File Date : Apr/24/24-9:57 AM

Comment :

Column conditions :

Cond 1 :

HV (kV) : 20

I (nA) : 40

Size (μm) : 10.

Scanning : Off

RasterLength (μm) : 59.71

Xtal informations :

Xtal parameters:

Ca Ka	Sp2	PET	(2d= 8.75	K= 0.000144)
P Ka Sp4	TAP	(2d= 25.745	K= 0.00218)	
Y La Sp4	TAP	(2d= 25.745	K= 0.00218)	
La La	Sp2	PET	(2d= 8.75	K= 0.000144)
Ce La	Sp2	PET	(2d= 8.75	K= 0.000144)
Th Ma	Sp1	PET	(2d= 8.75	K= 0.000144)
U Ma	Sp1	PET	(2d= 8.75	K= 0.000144)
Si Ka Sp4	TAP	(2d= 25.745	K= 0.00218)	
Nd La	Sp5	LLIF	(2d= 4.0267	K= 0.000058)
Sm La	Sp3	LLIF	(2d= 4.0267	K= 0.000058)
Gd Lb	Sp3	LLIF	(2d= 4.0267	K= 0.000058)
Pr La Sp5	LLIF	(2d= 4.0267	K= 0.000058)	
Yb La	Sp5	LLIF	(2d= 4.0267	K= 0.000058)

Pha parameters :

Elt. Line	Spec	Xtal	Bias (V)	Gain	Dtime (μs)	Blin (mV)	Wind (mV)	Mode
Ca Ka	Sp2	PET	1307	1026	3			Inte
P Ka Sp4	TAP	1330	3332	3			Inte	
Y La Sp4	TAP	1330	3332	3			Inte	
La La	Sp2	PET	1307	1026	3			Inte

Ce La	Sp2	PET	1307	1026	3		Inte
Th Ma	Sp1	PET	1318	1042	3		Inte
U Ma	Sp1	PET	1318	1042	3		Inte
Si Ka Sp4	TAP	1330	3332	3		Inte	
Nd La	Sp5	LLIF	1850	362	3		Inte
Sm La	Sp3	LLIF	1867	469	3		Inte
Gd Lb	Sp3	LLIF	1867	469	3		Inte
Pr La Sp5	LLIF	1850	362	3		Inte	
Yb La	Sp5	LLIF	1850	362	3		Inte

Acquisition informations :

Elt. Line	Spec	Xtal	Peak	Pk Time	Bg Off1	Bg Off2	Slope/IBg	Bg Time
Calibration		Intensity	Time/Repeat			Range	#Channels	(cps/nA)
Ca Ka	Sp2	PET	38390	40	-800	800	20	apat_P
Sp4_CaSp2_002		427.8						
P Ka	Sp4	TAP	23973	30		600	1.1 15	apat_P
Sp4_CaSp2_003		367.9						
Y La	Sp4	TAP	25117	60		600	1.1 30	
Tra1_Y_Pr_Dr_Er_Y	Sp4_005		19.2					
La La	Sp2	PET	30483	30	-500	500	15	
tr3_Verre_La_Ce_Pr_LaSp2_008			103.4					
Ce La	Sp2	PET	29303	20	-500	500	10	
tr3_Verre_La_Ce_Pr_CeSp2_011			82.1					
Th Ma	Sp1	PET	47291	20	-600	600	10	
ThO2_ThSp1_012			77.7					
U Ma	Sp1	PET	44682	60		600	1.1 30	UO2_U
Sp1_004	76.2							
Si Ka	Sp4	TAP	27733	40		500	1 20	
topa_SiSp4_003		247.9						
Nd La	Sp5	LLIF	58876	60	-400	400	30	
tr1_Verre_Nd_Sm_Yb_Lu_NdSp5_SmSp3_001			67.4					
Sm La	Sp3	LLIF	54615	30	-400	600	15	
tr1_Verre_Nd_Sm_Yb_Lu_NdSp5_SmSp3_001			65.8					
Gd Lb	Sp3	LLIF	45861	20		200	1.1 10	
Gd2O3_GdSp3_003			275.4					
Pr La	Sp5	LLIF	61182	30	-400	850	15	
PrAlO3_PrSp5_004			237.5					
Yb La	Sp5	LLIF	41511	10	-500	500	5	
tra3_La_Sm_Gd_Yb_YbSp5_001			24.1					

3. Allanite

Common informations:

File Name : 2022-01-25-allanite.qtiSet

File Date : Feb/26/24-9:34 AM

Comment :

Column conditions:

Cond 1:

HV (kV): 20

I (nA): 40

Size (μm): 5.

Scanning: Off

RasterLength (μm): 1476.63

Xtal informations:

Xtal parameters:

F Ka	Sp4	TAP	(2d= 25.745	K= 0.00218)
Al Ka	Sp4	TAP	(2d= 25.745	K= 0.00218)
Si Ka	Sp4	TAP	(2d= 25.745	K= 0.00218)
Ca Ka	Sp2	PET	(2d= 8.75	K= 0.000144)
Y La	Sp4	TAP	(2d= 25.745	K= 0.00218)
La La	Sp2	PET	(2d= 8.75	K= 0.000144)

Ce La	Sp2	PET	(2d= 8.75	K= 0.000144)
Nd La	Sp5	LLIF	(2d= 4.0267	K= 0.000058)
Th Ma	Sp1	PET	(2d= 8.75	K= 0.000144)
Mn Ka	Sp5	LLIF	(2d= 4.0267	K= 0.000058)
Ti Ka	Sp2	PET	(2d= 8.75	K= 0.000144)
Fe Ka	Sp3	LLIF	(2d= 4.0267	K= 0.000058)
Sm La	Sp3	LLIF	(2d= 4.0267	K= 0.000058)
Pr La	Sp3	LLIF	(2d= 4.0267	K= 0.000058)

Pha parameters:

Elt. Line	Spec	Xtal	Bias (V)	Gain	Dtime (μs)	Blin (mV)	Wind (mV)	Mode
F Ka	Sp4	TAP	1330	3332	3			Inte
Al Ka	Sp4	TAP	1330	3332	3			Inte
Si Ka	Sp4	TAP	1330	3332	3			Inte
Ca Ka	Sp2	PET	1307	1011	3			Inte
Y La	Sp4	TAP	1330	3332	3			Inte
La La	Sp2	PET	1307	1026	3			Inte
Ce La	Sp2	PET	1307	1026	3			Inte
Nd La	Sp5	LLIF	1845	453	3			Inte
Th Ma	Sp1	PET	1318	1042	3			Inte
Mn Ka	Sp5	LLIF	1845	453	3			Inte
Ti Ka	Sp2	PET	1328	1058	3			Inte
Fe Ka	Sp3	LLIF	1867	469	3			Inte
Sm La	Sp3	LLIF	1880	524	1			Inte
Pr La	Sp3	LLIF	1867	469	3			Inte

Acquisition informations:

Elt. Line	Spec	Xtal	Peak	Pk Time Time/Repeat	Bg Off1	Bg Off2	Slope/IBg Range	Bg Time #Channels	Calibration	Intensity (cps/nA)
F Ka	Sp4	TAP	71727	10	-600	600		5	apat_F Sp4_004	9.1
Al Ka	Sp4	TAP	32459	40	-600	800		20	al2o3_AlSp4_020	1096.8

Si Ka	Sp4	TAP	27736	40		500	1	20	topa_SiSp4_002	243.8
Ca Ka	Sp2	PET	38388	30	-800	800		15	apat_P Sp4_CaSp2_003	424.3
Y La	Sp4	TAP	25117	60		600	1.1	30	Tra1_Y_Pr_Dr_Er_Y Sp4_005	19.2
La La	Sp2	PET	30490	30	-500	500		15	tr3_Verre_La_Ce_Pr_LaSp2_003	104.9
Ce La	Sp2	PET	29301	20	-500	500		10	tr3_Verre_La_Ce_Pr_CeSp2_010	76.0
Nd La	Sp5	LLIF	58874	60	-400	400		30	tr1_Verre_Nd_Sm_Yb_Lu_NdSp5_004	
			68.3							
Th Ma	Sp1	PET	47294	10	-600	600		5	ThO2_ThSp1_004	76.6
Mn Ka	Sp5	LLIF	52202	20		600	1	10	mnti_TiSp2_MnSp5_002	454.6
Ti Ka	Sp2	PET	31442	40		600	1.1	20	mnti_TiSp2_MnSp5_003	405.5
Fe Ka	Sp3	LLIF	48090	20	-950	950		10	fe2o3_FeSp3_015	943.5
Sm La	Sp3	LLIF	54635	30	-400	600		15	tr1_Verre_Nd_Sm_Yb_Lu_SmSp3_005	
			69.0							
Pr La	Sp3	LLIF	61152	30	-400	850		15	PrAlO3_PrSp3_005	215.4

4. Titanite

Common informations:

File Name : 2023-01-18-titanite.qtiSet

File Date : Feb/26/24-9:34 AM

Comment :

Column conditions:

Cond 1:

HV (kV): 20

I (nA): 40

Size (μm): 0.

Scanning: Off

RasterLength (μm): 1476.63

Xtal informations:

Xtal parameters:

F Ka Sp4	TAP	(2d= 25.745	K= 0.00218)
Al Ka	Sp4	TAP	(2d= 25.745 K= 0.00218)
Si Ka Sp4	TAP	(2d= 25.745	K= 0.00218)
P Ka Sp2	PET	(2d= 8.75	K= 0.000144)
Y La Sp4	TAP	(2d= 25.745	K= 0.00218)
Ti Ka Sp2	PET	(2d= 8.75	K= 0.000144)
La La	Sp2	PET	(2d= 8.75 K= 0.000144)
Ca Ka	Sp1	PET	(2d= 8.75 K= 0.000144)
Zr La Sp1	PET	(2d= 8.75	K= 0.000144)
Nb La	Sp1	PET	(2d= 8.75 K= 0.000144)
Fe Ka	Sp5	LLIF	(2d= 4.0267 K= 0.000058)
Mn Ka	Sp5	LLIF	(2d= 4.0267 K= 0.000058)
Ta La	Sp5	LLIF	(2d= 4.0267 K= 0.000058)

Pha parameters:

Elt. Line	Spec	Xtal	Bias	Gain	Dtime	Blin	Wind	Mode
			(V)		(μ s)	(mV)	(mV)	
F Ka Sp4	TAP	1330	3332	3			Inte	
Al Ka	Sp4	TAP	1330	3332	3			Inte
Si Ka Sp4	TAP	1330	3332	3			Inte	
P Ka Sp2	PET	1307	1011	3			Inte	
Y La Sp4	TAP	1330	3332	3			Inte	
Ti Ka Sp2	PET	1328	1058	3			Inte	
La La	Sp2	PET	1328	1058	3			Inte
Ca Ka	Sp1	PET	1330	1188	3			Inte
Zr La Sp1	PET	1330	1188	3			Inte	
Nb La	Sp1	PET	1330	1188	3			Inte
Fe Ka	Sp5	LLIF	1845	453	3			Inte
Mn Ka	Sp5	LLIF	1845	453	3			Inte

Ta La Sp5 LLIF 1845 453 3 Inte

Acquisition informations:

Elt. Line	Spec	Xtal	Peak	Pk Time	Bg Off1	Bg Off2	Slope/IBg	Bg Time
Calibration		Intensity	Time/Repeat			Range	#Channels	(cps/nA)
F Ka	Sp4	TAP	71727	120	-600	600	60	apat_F
Sp4_004	9.1							
Al Ka	Sp4	TAP	32459	40	-600	800	20	
	al2o3_AlSp4_020		1096.8					
Si Ka	Sp4	TAP	27741	10		500	1 5	
	topa_SiSp4_001		241.9					
P Ka	Sp2	PET	70358	10	-600	1000	5	apat_F
Sp1_P	Sp2_001		79.8					
Y La	Sp4	TAP	25117	60		600	1.1 30	
	Tra1_Y_Pr_Dr_Er_Y	Sp4_005	19.2					
Ti Ka	Sp2	PET	31442	40		600	1.1 20	
	mnti_TiSp2_MnSp5_003		405.5					
La La	Sp2	PET	30492	30	-500	500	15	
	tr3_Verre_La_Ce_Pr_LaSp2_005		98.1					
Ca Ka	Sp1	PET	38389	10		700	1 5	
	wollast_CaSp1_002		308.0					
Zr La	Sp1	PET	69425	100	-600	300	50	
	Zr_SP055_ZrSp1_003		120.2					
Nb La	Sp1	PET	65464	60	-800	600	30	
	LiNbO3_2_NbSp1_003		76.8					
Fe Ka	Sp5	LLIF	48085	10	-950	950	5	
	fe2o3_FeSp5_001		1052.1					
Mn Ka	Sp5	LLIF	52201	20		600	1 10	
	mnti_TiSp2_MnSp5_003		456.4					
Ta La	Sp5	LLIF	37790	60	-600	600	30	LiTaO3_2_TaSp5_003
	541.7							