DANMARKS OG GRØNLANDS GEOLOGISKE UNDERSØGELSE RAPPORT 2016/36

Processing of ilmenite and (titano-)magnetite heavy mineral concentrates from heavy mineral sand samples from Moriusaq, North-West Greenland

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DANISH MINISTRY OF ENERGY, UTILITIES AND CLIMATE

GEUS

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Content

1. Definition of work

GEUS was contracted by Blue Jay Mining Ltd. (later, early 2016, changed to FinnAust Mining Ltd.) in December 2015 to process heavy mineral sand samples from Moriusaq, North-West Greenland, collected in 2015 in order to produce three concentrates, viz.:

A) Ilmenite concentrate
B) (Titano-)magnetite concentrate
C) Heavy mineral concentrate (consisting of the above two)

1.1 Protocol for pre-preparation

1) Twenty-five (25) selected samples from the Moriussaq are, north-west of Pittuffik/Thule Airbase, North-West Greenland, were assessed. The samples were divided into 5 priority levels on the basis of their weight and a visual estimate of the heavy mineral concentration made during fieldwork in 2015.

2) The 10 samples that had the highest concentration of heavy minerals and also had a high volume (weight) were picked out as 'priority level 1' for the processing (they would easiest/quickest provide the needed concentrates).

3) **The 'Priority level 1' samples were dried separately** in metal trays at 60^{o}C for one night.

1.2 Protocol for processing

The following processing was carried out on the pre-pared

1. 9 samples were split into 2 parts. One split from each sample was retained as a reference. The whole of sample 15BMJ003A was processed (see below).
2. A test of water-sieving was performed on one of the samples.
3. The dry residue of this sample was used to determine the ilmenite extraction parameters for the Frantz electromagnetic separator.
4. The 10 samples were composited
5. The samples were dry sieved (1st sieving) into different size fractions.
6. Wilfley water-shaking table was performed to produce the heavy mineral concentrate on a subsample of each size fraction.
7. Dry-sieving – 2nd sieving (separation of >500 µm material into three fractions)
8. Hand-magnet extraction to produce the (titano-)magnetite concentrate
9. Frantz electro-magnetic separation for extraction of the ilmenite concentrate
10. The purity of the ilmenite concentrate is checked by 'point-and-shoot' on CC-SEM.

Table 1. Overview of the 25 samples from the Moriussaq area that was priorities (Priority level 1-5 in the column 'Batch for concentrate' according to their in the field estimated grade and their weight for further processing. The priority level 1 sample (10 samples) was split and forms the composite sample that was processed.

Locality	Easting mE [zone 19N]	Northing mN [zone 19N]	GEUS Sample No	Beach environment	Sample Depth (cm)	RL (m)	Active/raised beach or offshore	Description	Estimate of metallic fraction category
15BJM002A	478832	8519050	560928	intertidal	30	<2	Active	Spade depth	high
15BJM003A	478769	8519075	560929	intertidal	30	<2	Active	Spade depth	high
15BJM004A	478623	8519112	560930	intertidal	5	<2	Active	Surface 5cm	high
15BJM005A	478462	8519123	560931	intertidal	30	<2	Active	Spade depth	high
15BJM006A	478342	8519111	560932	intertidal	30	<2	Active	Spade depth	high
15BJM011A	478015	8519487	560940	intertidal	15	<2	Active	Top 15cm	high
15BJM020A	479639	8518636	560948	raised terrace	5	20	Raised	stream outlet/ 25m inland	high
15BJM023A	479864	8518536	560951	intertidal	5	<2	Active	5cm deep	medium-high
15BJM033A	481575	8517801	560962	intertidal	30	<2	Active	Waterline/ Spade depth	medium
15BJM053A	488465	8514914	560988	intertidal	3	<2	Raised	Top 3cm	high

2. Overview of results

The following tables provide an overview of the results from the processing of the heavy mineral sand. Details on the processing and weights can be found in Section 3.

Table 2. *Overview of results from processing heavy mineral sand.*

Process 1: Composite sample			
Sample no:	Total amount of sample before splitting [gram]	Reference sample after splitting [gram]	Fraction of sample for further processing after splitting [gram]
15BJM002A	1900	1190	710
15BJM003A	3300	0*	2820
15BJM004A	2600	1180	1420
15BJM005A	3000	1530	1470
15BJM006A	2700	1400	1300
15BJM011A	3300	1535	1765
15BJM020A	618	309	309
15BJM023A	2100	1140	960
15BJM033A	2700	1340	1360
15BJM053A	1500	725	775
Sum	23718	10349	**12889**
* all of 15BJM003A was separated.			

Process 2: 1 st Dry sieving					
Fraction	Weight of fraction after 1st sieving [gram]	Percent of fraction after 1st sieving	Loss in sieving [gram]	Weight of fraction taken out for later processing by Wilfley table [gram]	Resulting weight for magnetite and ilmenite extraction [gram]
<63 µm	1.5	0.01%		0.0	1.5
63 - 250 µm	4163.0	32.33%		618.0	3545.0
250 - 500 µm	6555.0	50.90%		985.0	5570.0
>500 µm	2159.0	16.76%		328.0	1831.0
Grand total after sieving:	12878.5		11	1931.0	10947.5

Table 2 (continued)

Process 3: Wilfley extraction of heavy-mineral concentrate							
Fraction	Weight before Wilfley [gram]	Conc./Tail	Weight after Wilfley processing [gram]	Percent after Wilfley processing	Total weight [gram]	Loss in Wilfley [gram]	Percent loss in Wilfley
63-250 µm	618.0	conc.	453.0	73.3%	599.0	19.0	3.07%
		tail	146.0	23.6%			
250-500 µm	985.0	conc.	627.0	63.7%	861.0	124.0	12.6%
		tail	234.0	23.8%			
>500 µm	328.0	conc.	53.0	16.2%	323.0	5.0	1.52%
		tail	270.0	82.3%			
Total	1931.0		Grand total wilfley:		1783.0	148.0	

Process 4: 2nd Dry Sieving						
Initial >500 µm fraction weight is 2159g - 328g (part taken for Wilfley) = 1831g; fraction 63-250 µm and 250-500 µm was not sieved in the 2nd sieving.						
Initial fraction before Wilfley and 2nd sieving	Weight of fraction before Wilfley and 2nd sieving [gram]	Fraction	Weight of fraction after part taken out for Wilfley [gram]	Loss in sieving [gram]	Fraction	Weight of fraction after 2nd sieving results and Wilfley taken out [gram]
63 - 250 µm	4163.0	63 - 250 µm	3545.0		63 - 250 µm	3545.0
250 - 500 µm	6555.0	250 - 500 µm	5570.0		250 - 500 µm	5570.0
>500 µm	2159.0	500 - 1000 µm	1121.8		500 - 1000 µm	1121.8
		1000 -2000 µm	195.8		1000 -200 0µm	195.8
		> 2000 µm	463.5		> 2000 µm	463.5
		Grand total 2nd sieving:	1781.0	50 (2.8%)*		10896.0
*(total should have been 1831 g)						

Process 5: Magnetite concentrate extraction by hand-magnet				
Fraction	Weight before hand-magnet separation [gram]	Weight of extracted magnetite [gram]	Percent of extracted magnetite	Weights after hand-magnet separation [gram]
<63 µm	1.5	0.5	0.00%	1.0
63-250 µm	3545.0	235.0	2.16%	3310.0
250-500 µm	5570.0	261.0	2.40%	5309.0
>500 µm	1781.0	62.0	0.57%	1719.0
Grand total	10897.5	558.5	5.13%	10339.0

Ilmenite concentrate extracted by Frantz-magnetic separation								
Fraction	Weight before Frantz separation [g]	Conc./Tail	Weight of conc./tail [g]	Percent of conc./tail	Total conc./tail [g]	Loss in Frantz separation [g]	Percent loss in Frantz separation [g]	Shipped for ALS lab. work following separation [g]
63 - 250 µm	3310.0	conc.	2920.0	88.2%	3272.0	38.0	1.2%	101.0
		tail.	352.0	10.6%				-
250 - 500 µm	5309.0	conc.	3429.0	64.6%	5226.0	83.0	1.6%	103.0
		tail.	1797.0	33.8%				-
			Grand total:		8498.0			

	Gram	Percent
Grand total ilmenite concentrate 63 - 250 µm and 250 - 500 µm after Process 6:	6349.0	73.7%
Grand total tail (reject) 63 - 250 µm and 250 - 500 µm after Process 6:	2149.0	24.9%

	Percent
Grand percent total ilmenite concentrate 63 - 250 µm and 250 - 500 µm with weight including magnetite concentrate:	69.7%
Grand percent total ilmenite concentrate 63 - 250 µm and 250 - 500 µm with weight considering intial weight :	

2.1 Split of samples

The ten ´Priority level 1' samples were split in two (one-half for reference; one-half for further processing; see Table 3)

a) Pack reference-sample and store them.
b) Proceed with the other half.

Table 3. *Sample material, overview*

Sample no:	Total amount of sample before splitting [grams]	Reference sample after splitting [grams]	Fraction of sample for further processing after splitting [grams]
15BJM002A	1900	1190	710
15BJM003A	3300	0*	2820
15BJM004A	2600	1180	1420
15BJM005A	3000	1530	1470
15BJM006A	2700	1400	1300
15BJM011A	3300	1535	1765
15BJM020A	618	309	309
15BJM023A	2100	1140	960
15BJM033A	2700	1340	1360
15BJM053A	1500	725	775
Sum	23718	10349	12889

* all of 15BJM003A was separated.

2.2 Test sieving and ilmentite extraction procedures

Sample 15BJM003A was used to test the appropriateness of the laboratory procedures for sieving and ilmenite extraction.

Due to a miscommunication in the laboratory the remaining entire 15BJM003A sample: 1650 grams minus 480 (part of sample tested for water sieving) + 1650 grams (the reference material) were used for further processing and included in the composite sample.
GEUS has a duplicate sample of the 15BJM003A sample in the archives if needed.

3.2.1 Test for water sieving

Water sieving of the material was tested on one sample (15BJM003A). However, the water sieving was ineffective and time consuming and dry sieving was chosen instead.

The procedure for water sieving was as follows: .

a) Sample 15BJM003A was split into two halves before sieving. One half for further processing, the other as reference material (storage).

b) The water sieving was carried out through three sieves under running water with a bucket underneath.

c) This was fairly time consuming and unfortunately 480 grams out of the 1650 was lost with water-overflow from the bucket.

d) The water-sieved material was afterwards dried.

3.2.2 Test of ilmenite extraction method

A small portion (68 grams) of the water-sieved 63 – 250 µm fraction material of the 15BJM003A sample was taken out to test the extraction method and parameters when using the hand-held black sand magnet and the Frantz electro-magnetic separator.

a) Magnetite was extracted from the dry sample using a handheld black sand magnet. The magnetite during this test was later included in the 63 – 250 µm fraction magnetite concentrate (see section 0)

b) Ilmenite was extracted to produce an ilmenite concentrate using a Frantz electro-magnetic separator that separates dry mineral materials according to their magnetic susceptibility. Different parameters were tested on the Frantz electro-magnetic separator. The tested parameters were:

    i) Slope 5°, tilt angle 15°, current of 0.20 Amp
    ii) Slope 5°, tilt angle 25°, current of 0.20 Amp
    iii) Slope 5°, tilt angle 25°, current of 0.10 Amp
    iv) Slope 5°, tilt angle 25°, current of 0.04 Amp
    v) Slope 5°, tilt angle 30°, current of 0.12 Amp
    vi) Slope 5°, tilt angle 30°, current of 0.15 Amp

c) Subsequent analysis of the concentrates through optical and scanning electron microscopy showed that the most pure ilmenite concentrate was produced when the Franz electromagnetic separator was set up with forward slope of 5°, tilt angle of 30°, and a current of 0.15 Amp

d) The weights on extracted ilmentite and non-magnetic reject material is given in Table 4 here below.

Table 4. *Extracted ilmenite and non-magnetic rejected 63 – 250 µm fraction from the test of the parameters for the Frantz electro-magnetic separator.*

Parameters	Ilmenite concentrate [grams]	Non-magnetic rejected [grams]	
i)	21	1	
ii)	6	1	
iii)	8	4	
iv)	1	7	
v)	5	2	
vi)	8	1	
Sum (g)	52	16	68

2.3 Processing of the composite sample.

2.3.1 The composite sample

a) A mixture or the 10 sample halves of the 'Priority level 1' samples was produced. A total of 12889 grams of composite material was achieved in this way.

2.3.2 Dry sieving – 1st seiving

a) The dry composite sample was sieved into four fractions. The weights of the fractions (<65 μm, 65–250 μm, 250–500 μm, >500 μm) are given in Table 5.

b) 15 wt. % of each of the sieved fractions was removed for processing on the Wilfley water-shaking table (Table 4, see also section X).

c) Ilmenite and magnetite extraction was performed on the remaining 85% of each sieved fraction (Table 4).

- It should be noted that 11 grams was lost during sieving of the sample. (The weight of the material prior to sieving was 12889 grams and the weight of the material after the sieving was 12878.5 grams).

Table 5. *Results of dry sieving into grain size fractions*

Grain size fraction [μm]	Weight of fraction (before taken out material for Wilfley water-shaking table) [grams]	Weight of fraction to produce heavy mineral concentrate by Wilfley water-shaking table [grams]	Weight of fraction to produce ilmenite and (titano-)magnetite concentrate by hand-magnet and Frantz electro-magnetic seperation [grams]
< 63	1.5	0	1.5
63 – 250	4163	618	3545
250 – 500	6555	985	5570
> 500	2159	328	1831
Sum	12878.5	1931.0	10947.5

Figure 1. *Remaining >500 µm sample material processing.*

3.3.3 Wilfley water-shaking table: to produce the heavy mineral concentrate

a) A 15% proportion of the sample was taken out to make a heavy mineral concentrates (all heavy minerals) by use of a Wilfley water-shaking table.

- *Amount*:
  According to the proportions of the different grain size fractions an amount of 15% percent of the total weight of the composite sample were taken out. The total weight (of the 15% of the composite sample) was 1931 grams.

- *Processing*:
  The water-shaking table was set to a slope of 1.6˚ and tilt on 7.5˚ with inclination towards the left corner of the table. A water stream is run over the table while the table is moved back and forth by a motor in firm movements (see Figure 2). The heavy mineral fraction is thus the proportion of the sample that is collected at the lower left corner of the table where it is collected.

  The sample material was very difficult to separate in concentrate and tail as it clumped together (due to overall same material properties?). The process was repeated several times because the separation was not efficient. This was especially the case with 250-500 µm fraction material.

- *Results:*
  A heavy mineral concentrate of 453 gram for the 63-250 µm, 627 gram for the 250-500 µm and 53 gram > 500 µm was produced from the Wilfley water-shaking table.

- The corresponding rejects lighter mineral concentrate was 146 gram for the 63-250 µm, 234 gram for the 250-500 µm and 270 gram > 500 µm.

  A loss of 19 gram, 124 gram and 5 gram were encountered for the 63-250 µm, the 250-500 µm and the >500 µm fraction probably due to that the process had to be started several time and that an runoff of material cannot be avoided.

  No further processing was done on the extracted heavy mineral concentrate.

Figure 2. *Wilfley water-shaking table used to make a heavy mineral concentrate.*

3.3.4 Dry-sieving – 2nd sieving

The >500 µm fraction (1831 gram) was sieved into three addition fractions to evaluate the grain/gravel size encountered in the composite sample. The resulted in 1121.75 gram of 500-1000 µm fraction material, 195.75 gram of 1000- 2000 µm fraction material and 463.5 gram of >2000 µm fraction material.

A loss of 50 grams of >500 µm fraction material was lost in the process of sieving.

No further processing were done on the >500 µm fraction and it is judged that the amount of magnetic material is low.

3.3.5 Hand-magnet extraction to produce the (titano-)magnetite concentrate

a) (Titano-)Magnetite concentrate was produced using a strong “black sand magnet” (figure 3).
b) The different size fractions were spread out in a thin layer on A3 paper and the magnet was moved over the fraction at a height of 1 to 2 centimetres. This was done a several times until no more black sand stuck to the magnet to be sure that all the magnetite was extracted by to the magnet and separated from the fraction.
c) The resulting magnetite concentrate for the different size fractions is given in
d) Table 6.

Table 6. *Magnetite concentrate separated by hand magnet*

Magnetite separated from the 4 fractions [µm]	Magnetite concentrate [gram]
< 63	0.5
63 – 250	235
250 – 500	261
> 500	62
Sum	558.5

Figure 3. *Black sand hand-magnet used for the extraction of magnetite.*

3.3.6 Frantz electro-magnetic separation for extraction of the ilmenite concentrate

a) Following magnetite separation, the sample was processed by the Frantz magnetic separator to extract ilmenite concentrate. The parameters used (see section 0) was a current of 0.15 Amps using a forward slope of 5° and a tilt angle of 30°.

- 6349 grams ilmenite was produced out of a total of 8498 grams of processed 63 – 250 and 250 – 500 µm fractions.

- The weight of the entire rejected non-magnetic part of the above processed material is 2149 grams (both the 63 – 250 µm and 250 – 500 µm fractions).

- A loss of 38 gram (loss of 1.2%) and 83 gram (loss of 1.6%) of material on the 63 – 250 µm and 250 – 500 µm fractions respectively was encountered during the Frantz-electro-magnetic separation. This loss is likely to result from grains sticking to the electromagnet during operation of the Frantz. The machine was purged to remove these grains between runs. A white paper cover was put around the machine to collect any eventual spills.

- A small fraction of the resulting concentrate was tested for purity by point and shoot analyses using an EDS-SEM.

Table 7. *Ilmenite concentrate separated by FRANTZ electro-magnetic separation at 0.15 Amp, slope 5° and tilt angle of 30°*

Grain size fraction [µm]	Magnetic part (ilmenite) [grams]	Non-magnetic rejected part [grams]
< 63	-	-
63 – 250	2868+52** = 2920	336+16** = 352
250 – 500	3429	1797
> 500	*	*
Sum	**6349**	2149

** The 52 and 16 grams of material are from the initial test of the parameters used on the Frantz electro-magnetic separator.

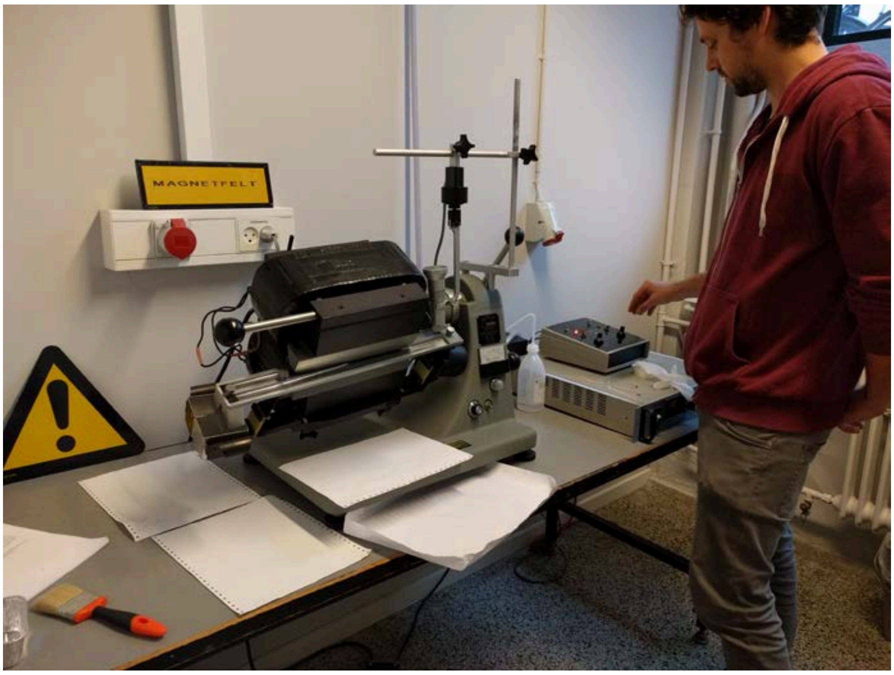


Figure 4. *The electro-magnetic Frantz separator used for extraction of the ilmenite concentrate.*

2.4 Purity of the ilmenite concentrate

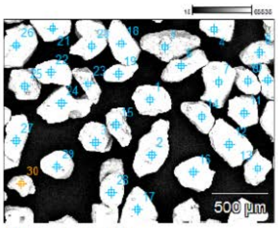
A shot-and-test investigation was carried out on the in-house scanning electron microscope (SEM-EDXS) to check the purity of the produced ilmenite concentrate.

A total of 93 grains of the ilmenite concentrate were analysed by the SEM-EDXS; the spectres are in Appendix A.

Most of the grains of are either pure iron-containing ilmenite grains (above 60%) or some ilmenite grains with attached/bounded mixed silica-ilmenite/silica/silicate minerals/material. A few grains are not ilmenite or ilmenite-bound.

3. Appendix A
SEM-EDXS spectres for 93 mineral grains from the ilmenite concentrate

Blue Jay Mining Rest 2(8)



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Magnification: 53

Detector: Pioneer

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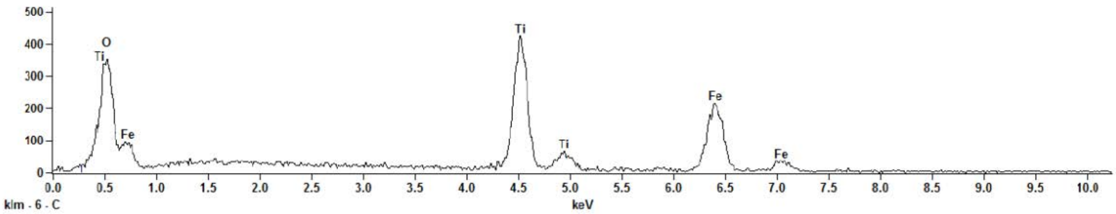

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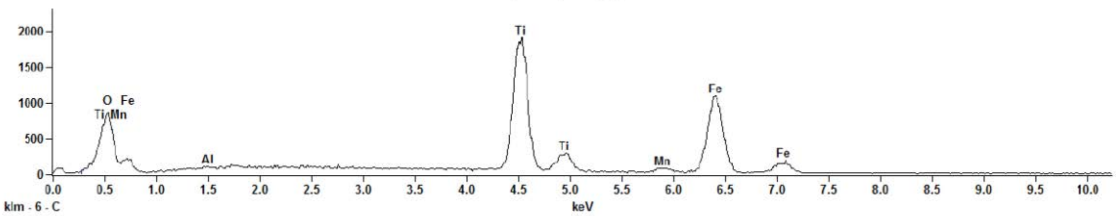

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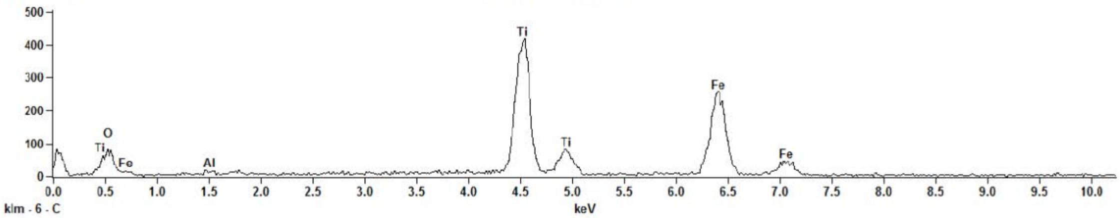

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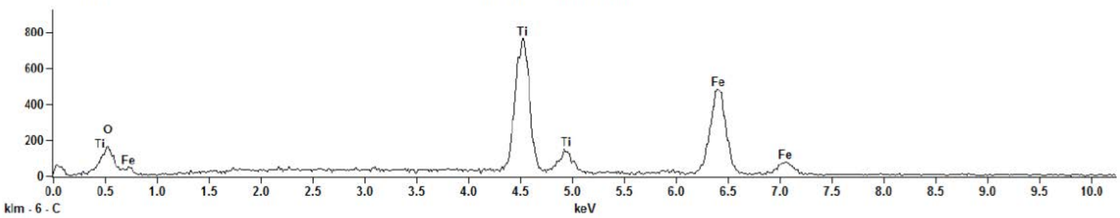

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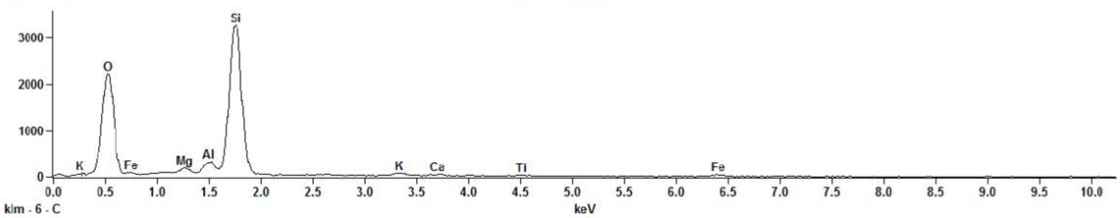

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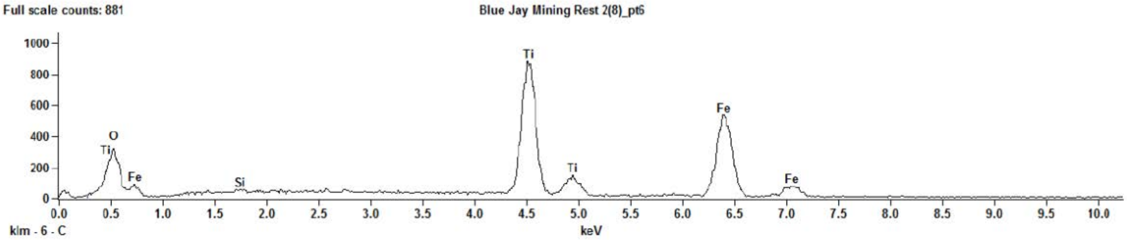

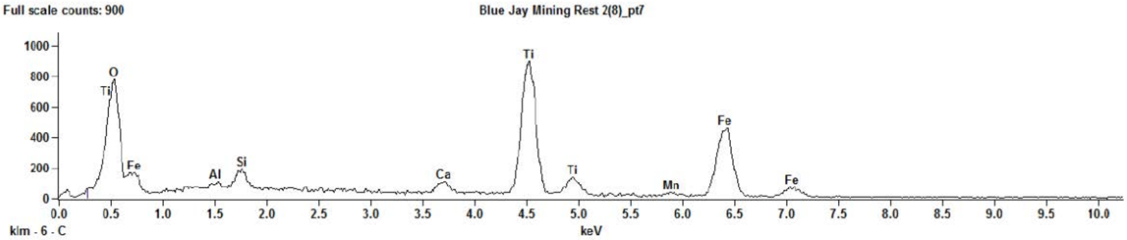

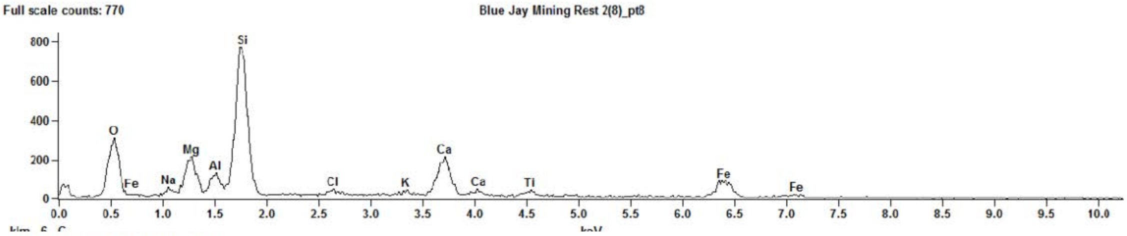

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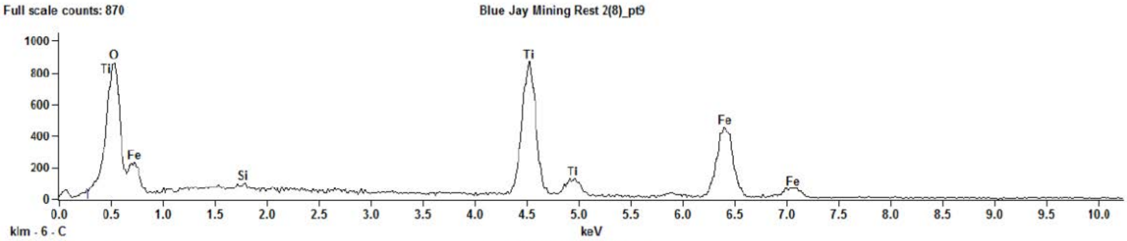

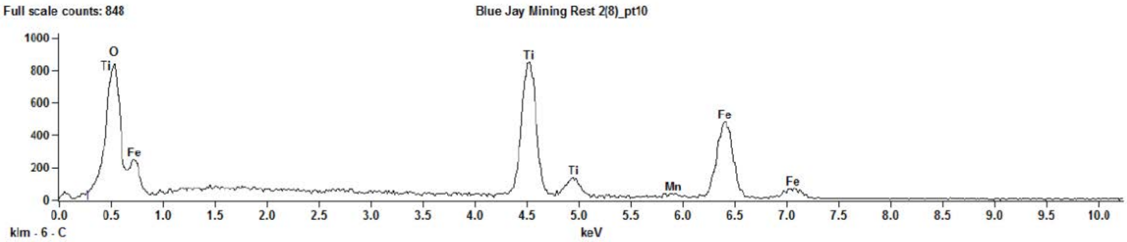

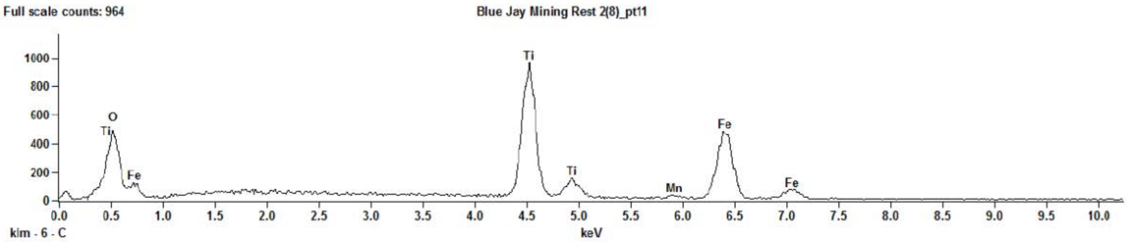

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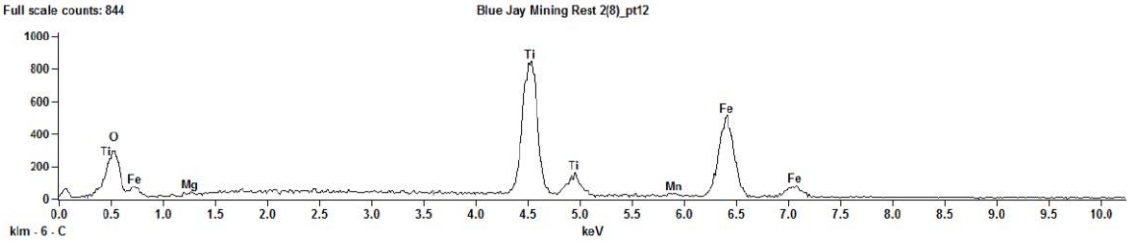

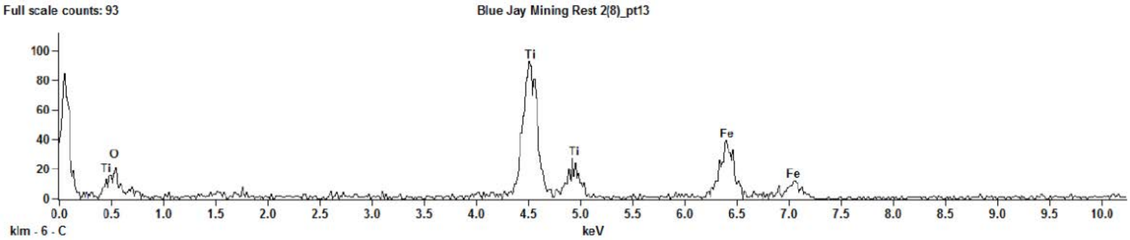

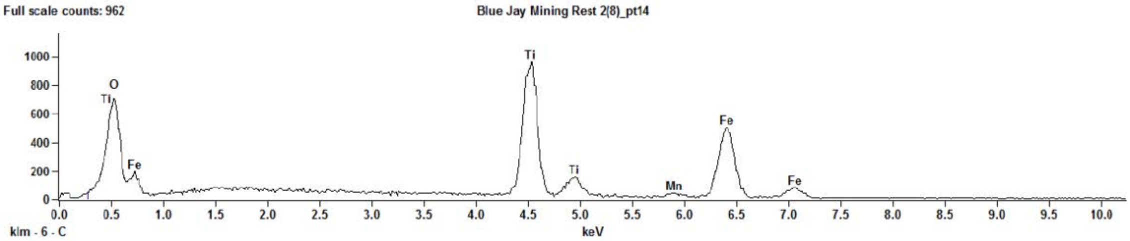

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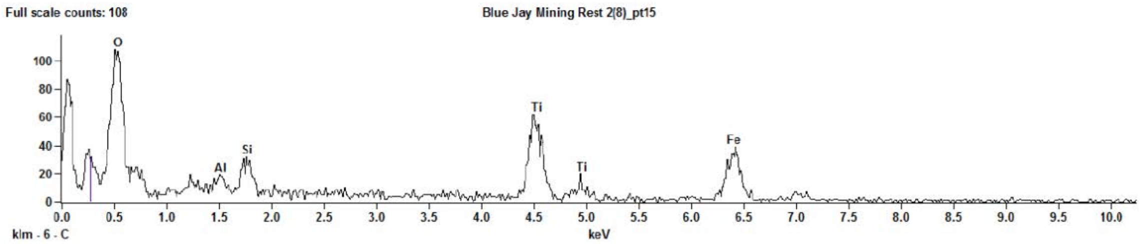

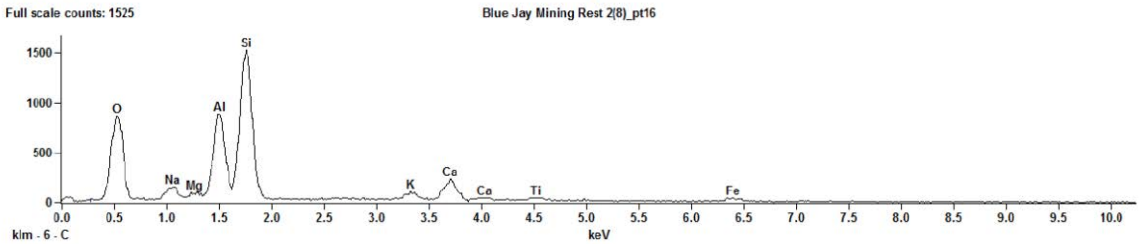

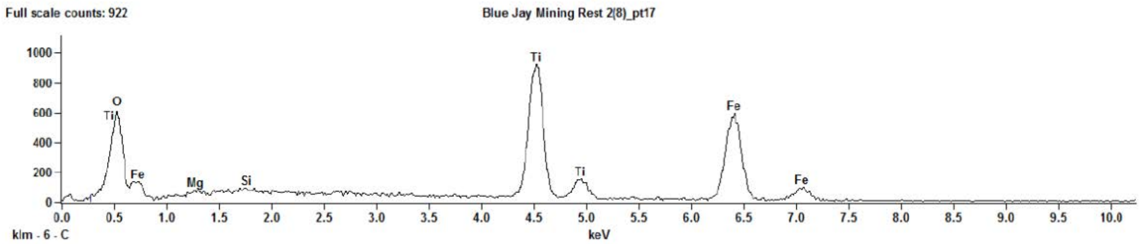

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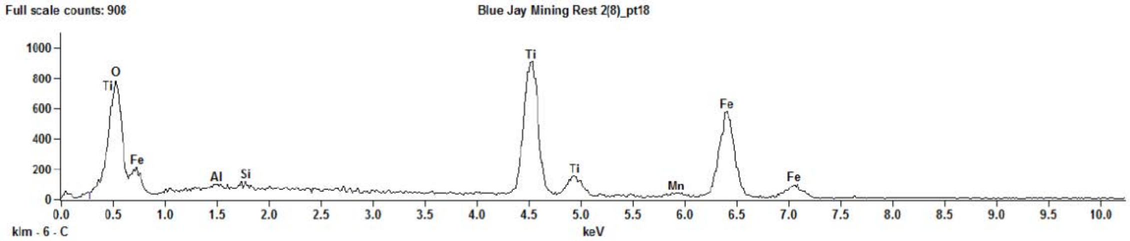

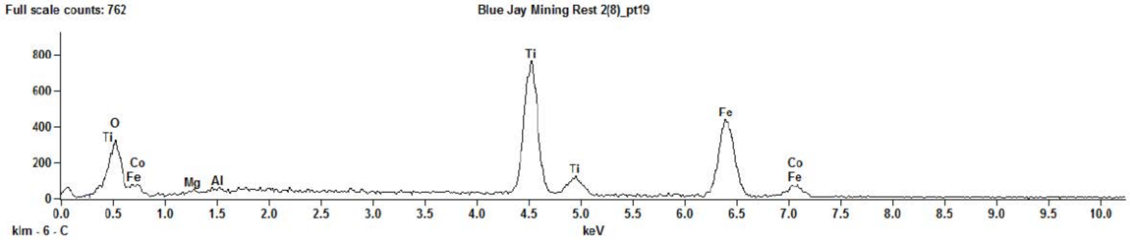

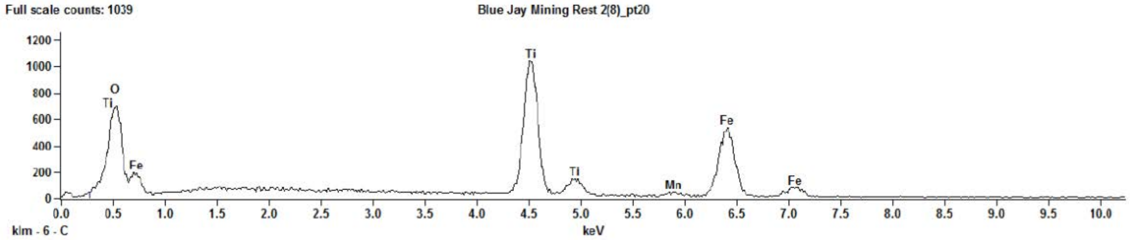

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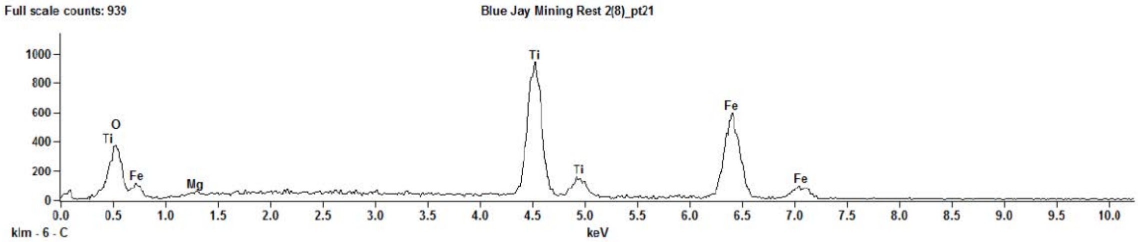

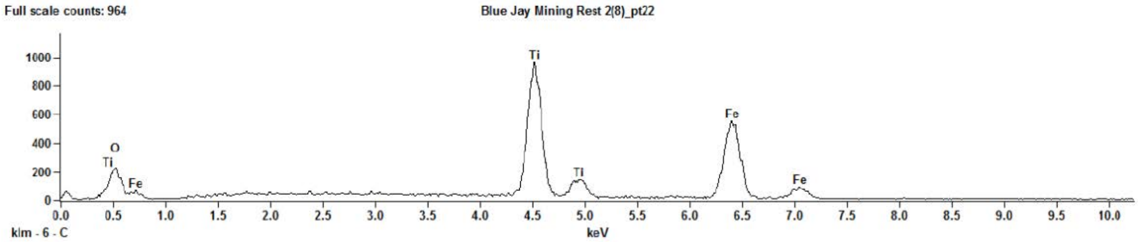

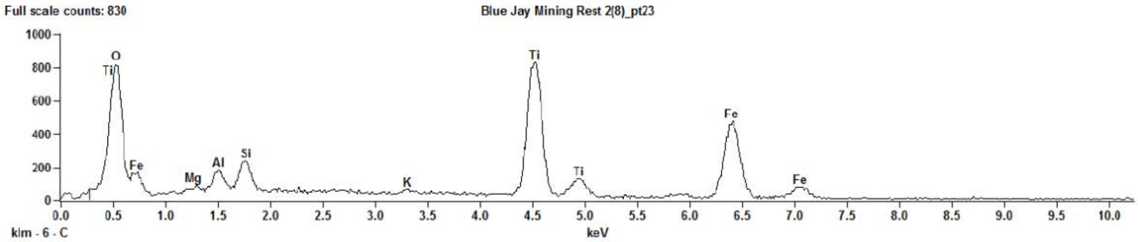

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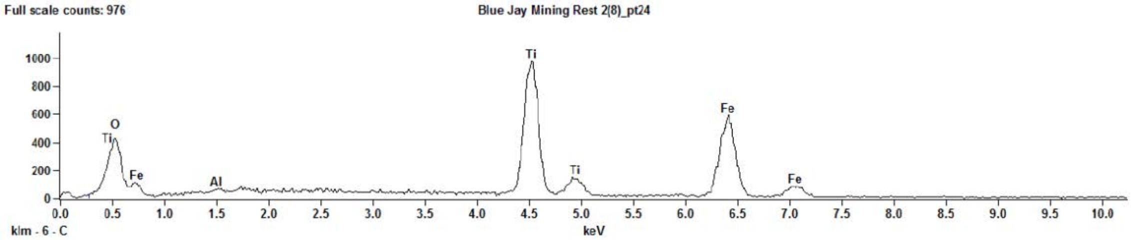

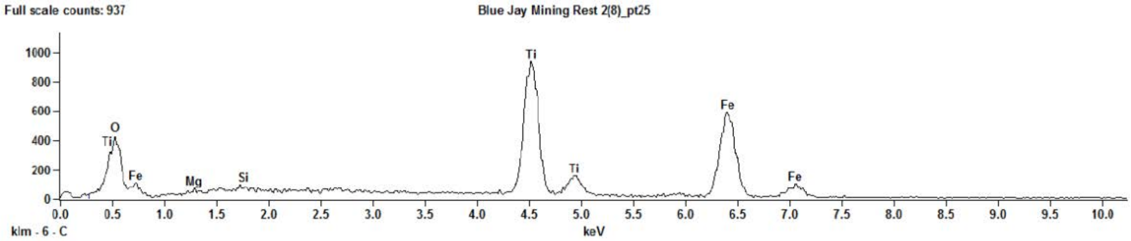

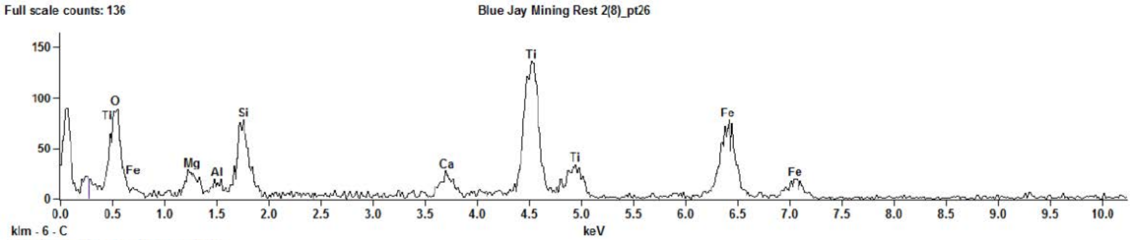

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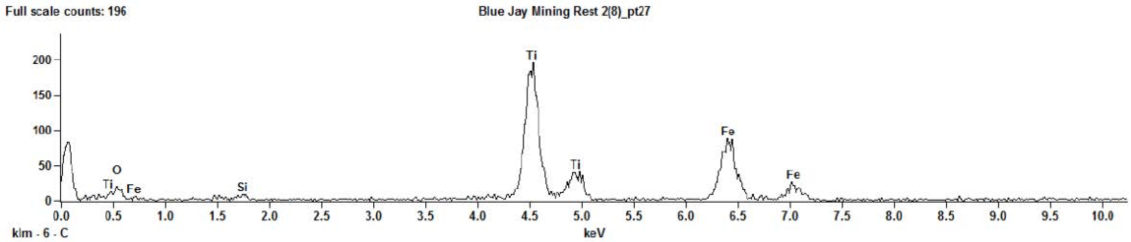

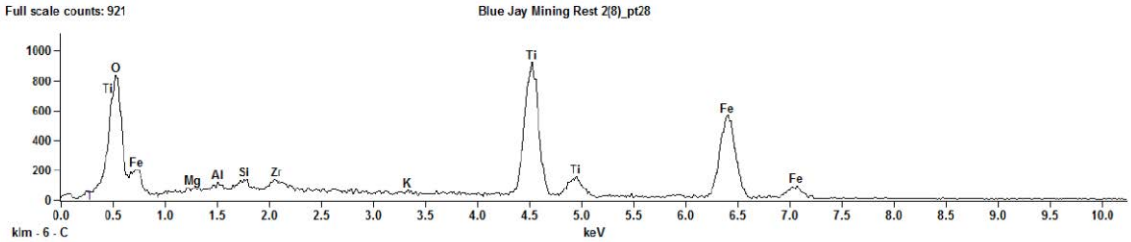

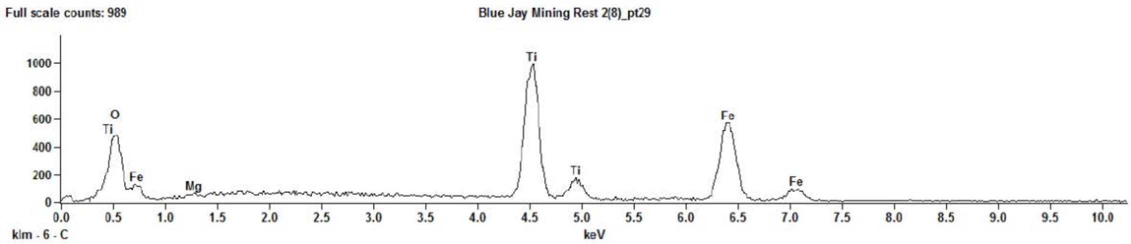

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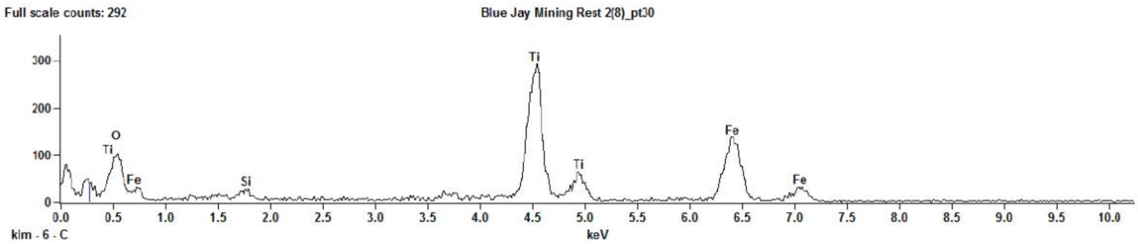


Blue Jay Mining Rest 2(9)

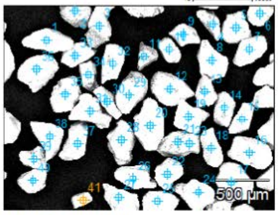


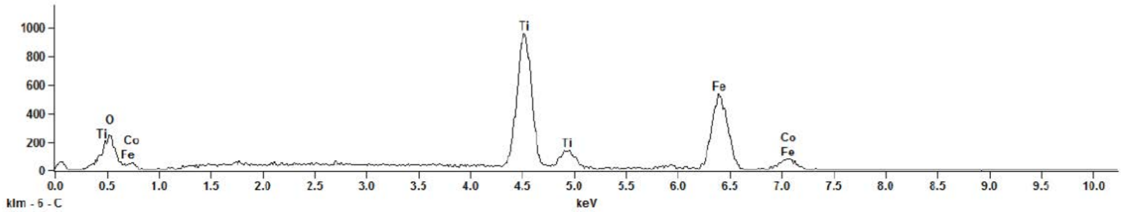
Image Name: Blue Jay Mining Rest 2(9)

Accelerating Voltage: 17.0 kV

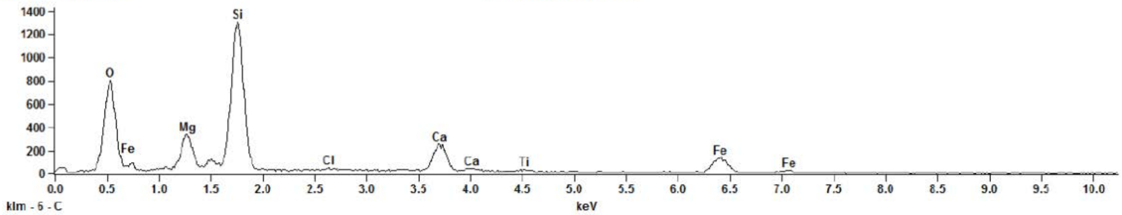
Magnification: 50

Detector: Pioneer

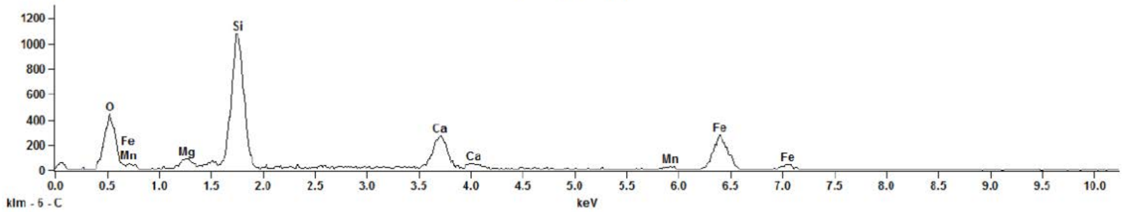
Full scale counts: 960 Blue Jay Mining Rest 2(9)_pt1



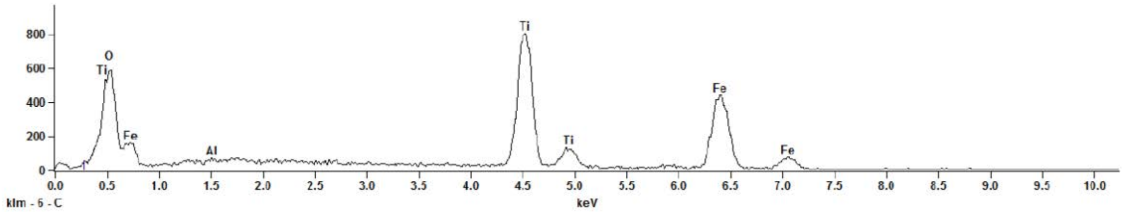
Full scale counts: 1308 Blue Jay Mining Rest 2(9)_pt2



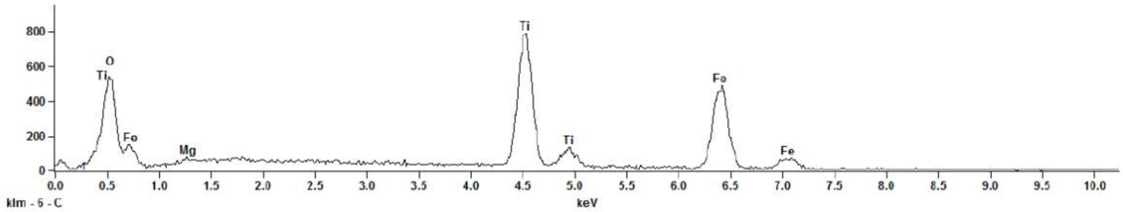
Full scale counts: 1079 Blue Jay Mining Rest 2(9)_pt3



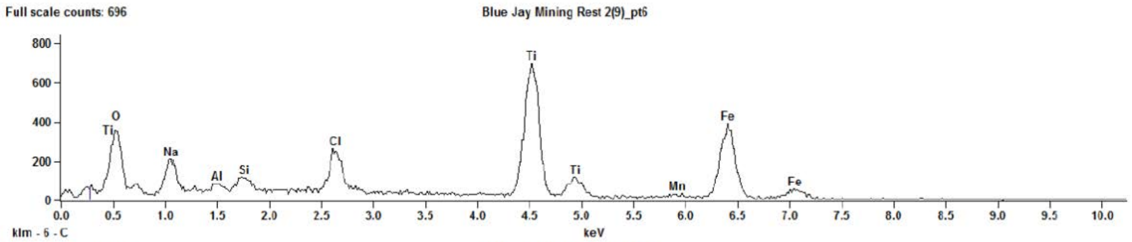
Full scale counts: 804 Blue Jay Mining Rest 2(9)_pt4

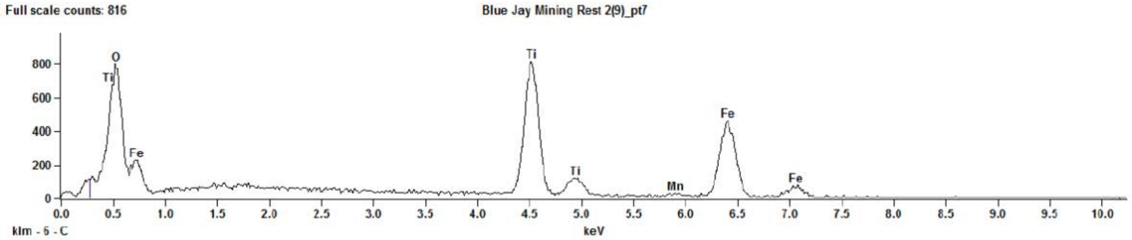


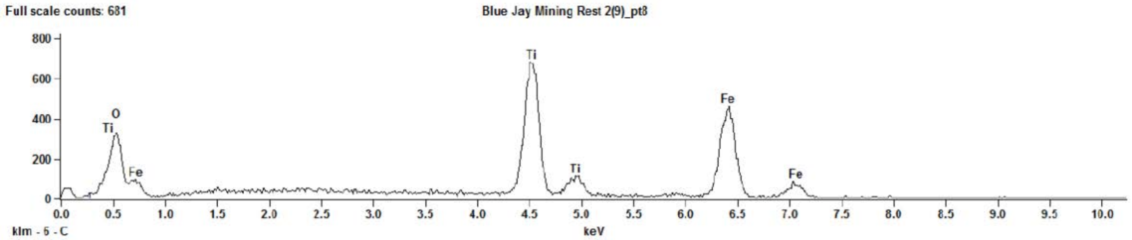
Full scale counts: 788 Blue Jay Mining Rest 2(9)_pt5



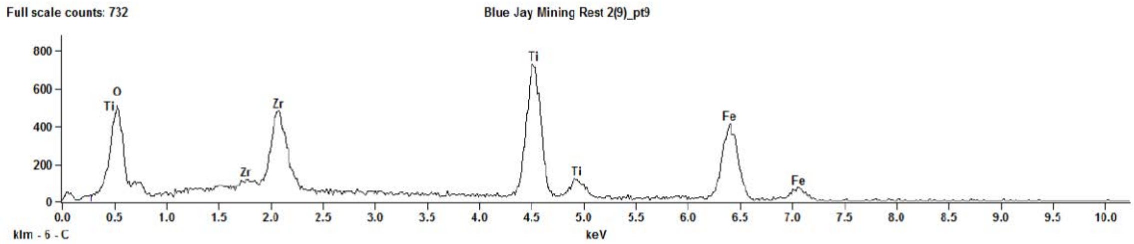
Project: Standarder projekt

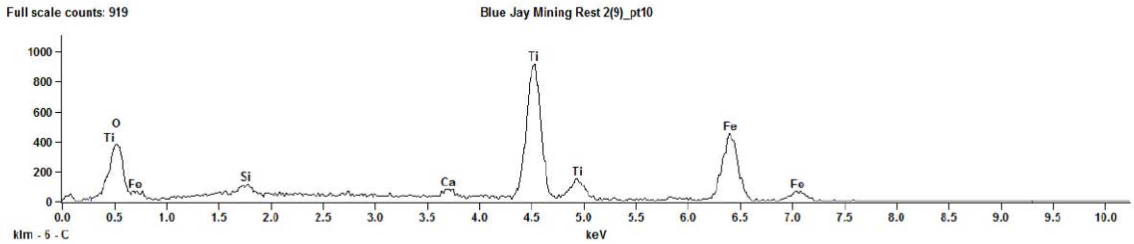


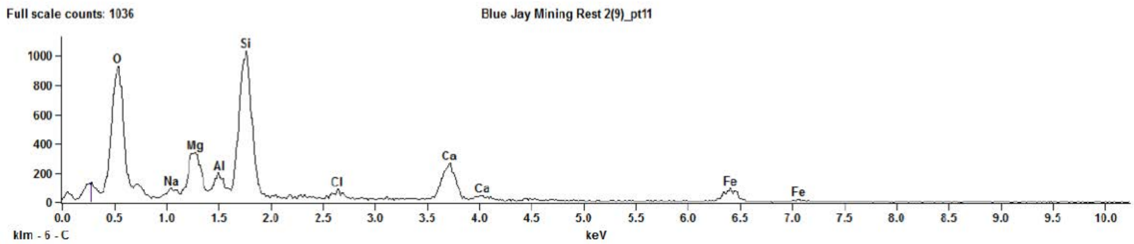




Project: Standarder projekt

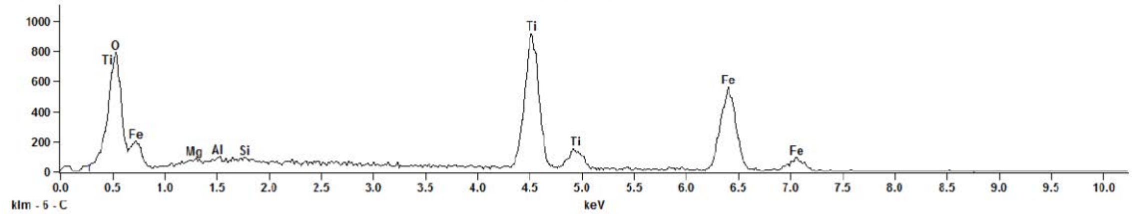




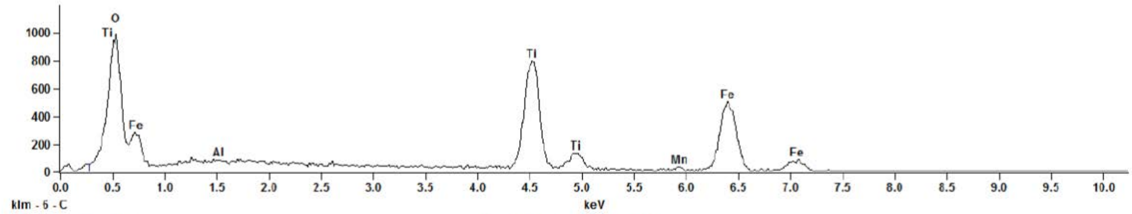


Project: Standarder projekt

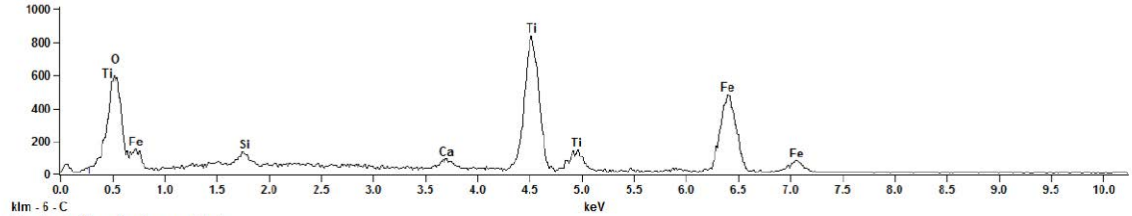
Full scale counts: 917 Blue Jay Mining Rest 2(9)_pt12



Full scale counts: 993 Blue Jay Mining Rest 2(9)_pt13

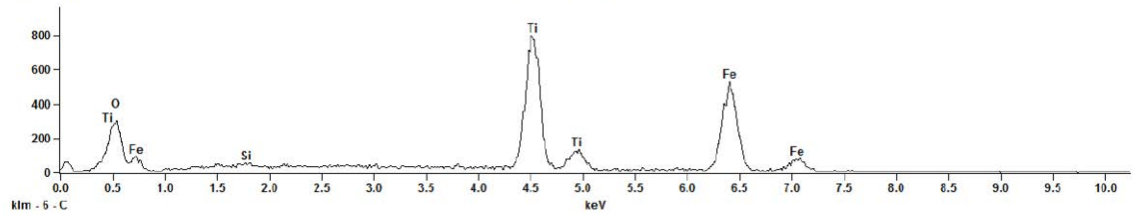


Full scale counts: 840 Blue Jay Mining Rest 2(9)_pt14

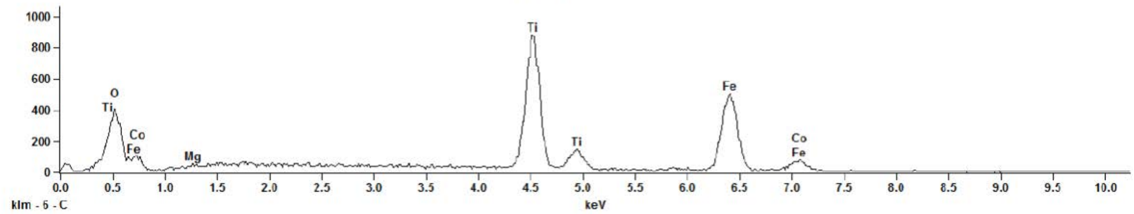


Project: Standarder projekt

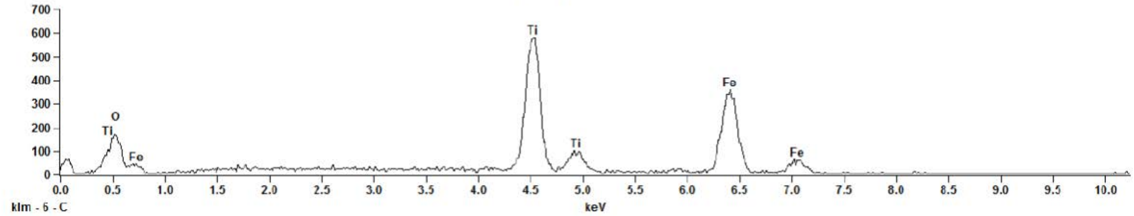
Full scale counts: 797 Blue Jay Mining Rest 2(9)_pt15



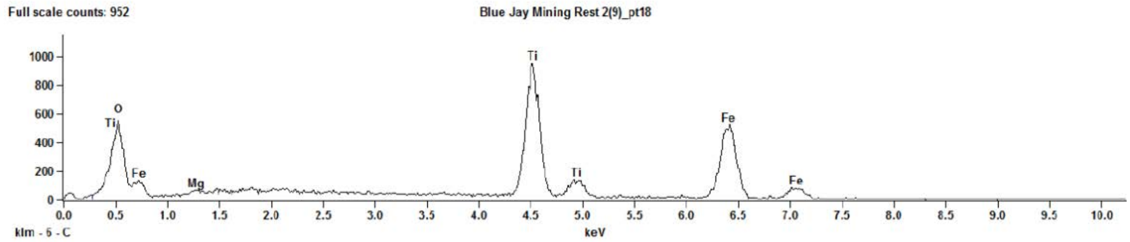
Full scale counts: 880 Blue Jay Mining Rest 2(9)_pt16

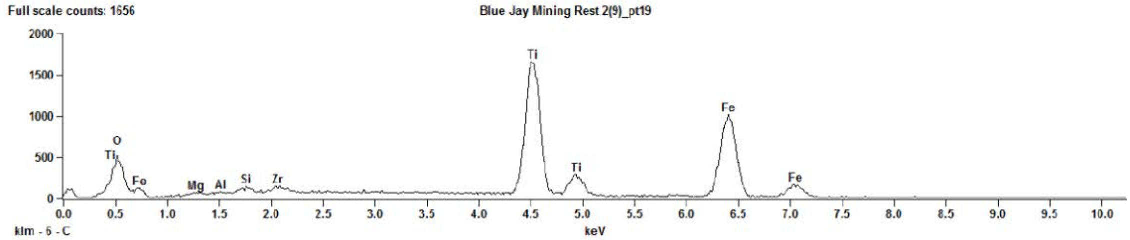


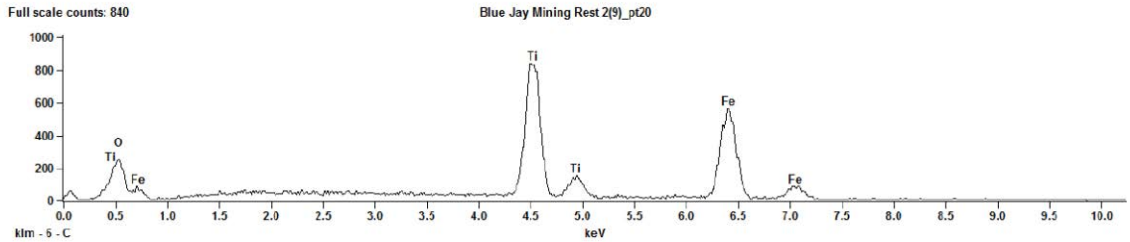
Full scale counts: 580 Blue Jay Mining Rest 2(9)_pt17



Project: Standarder projekt







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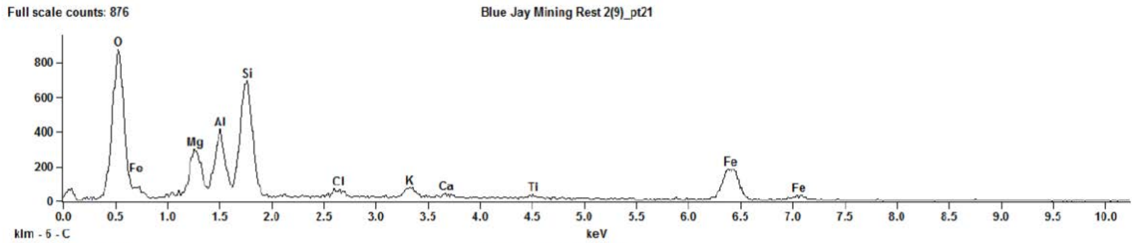

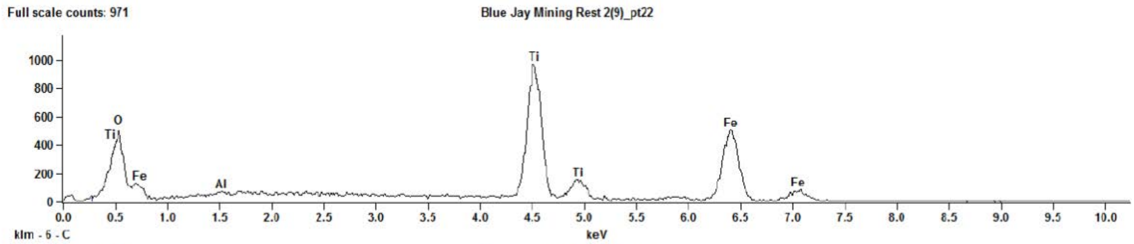

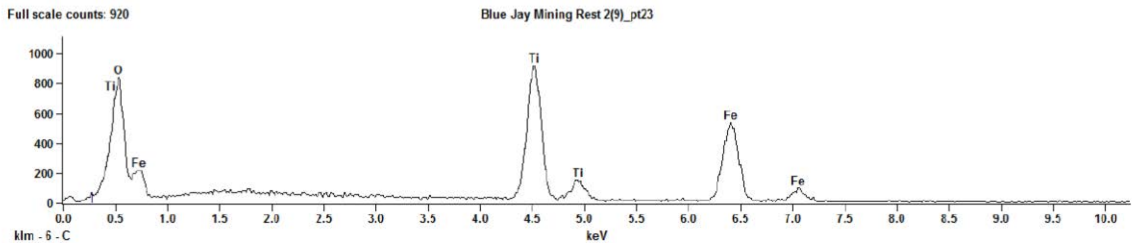

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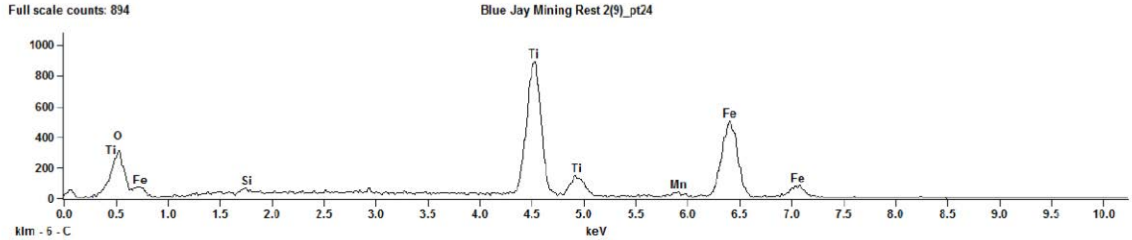

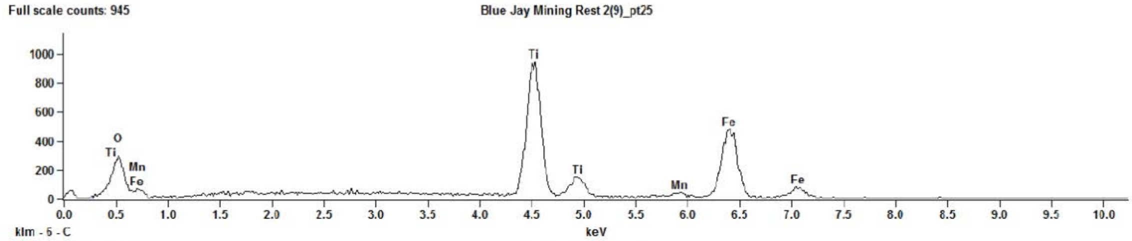

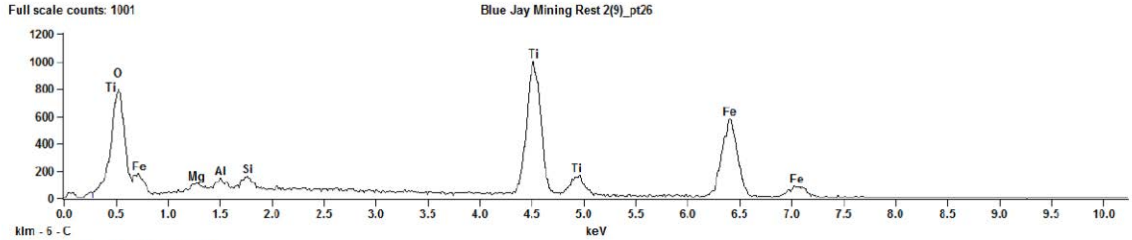

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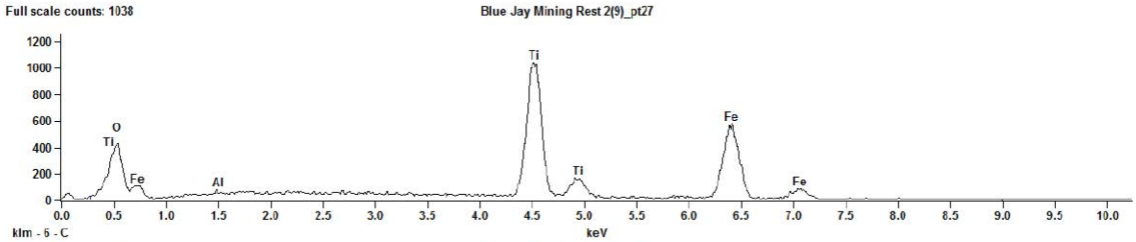

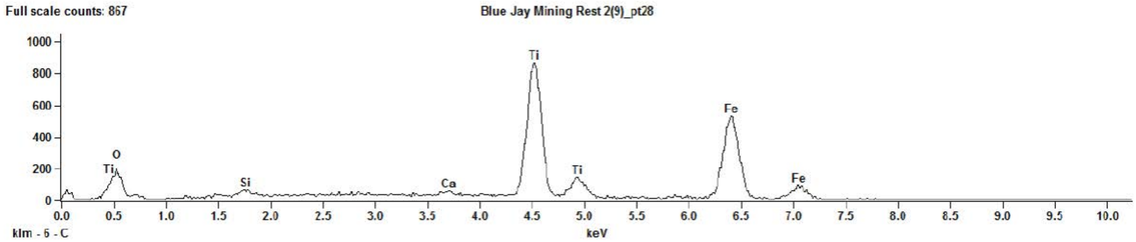

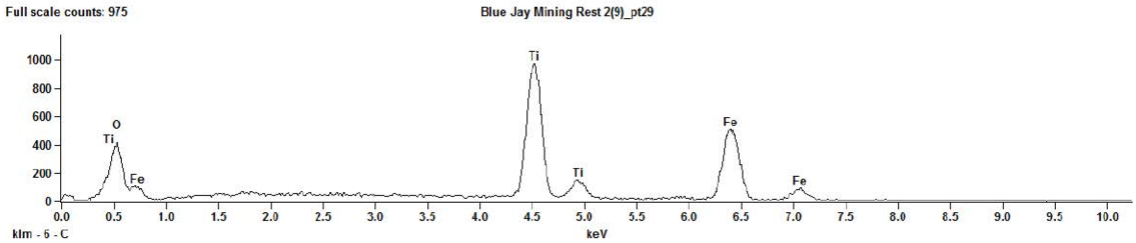

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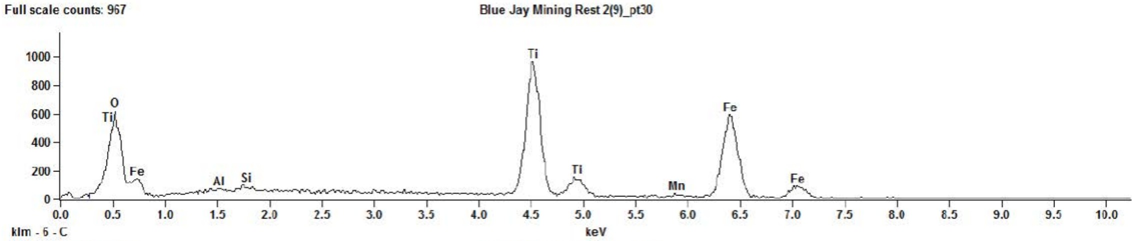

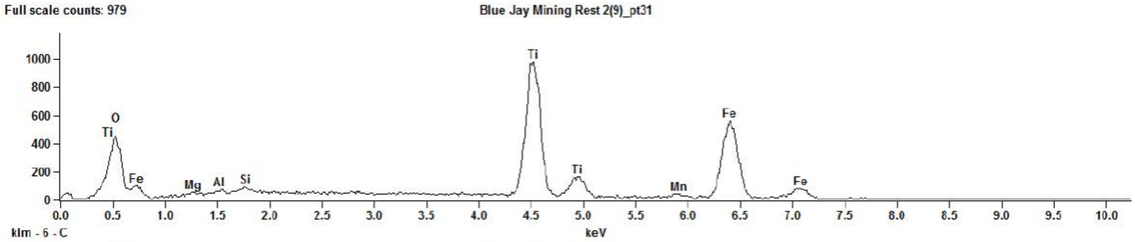

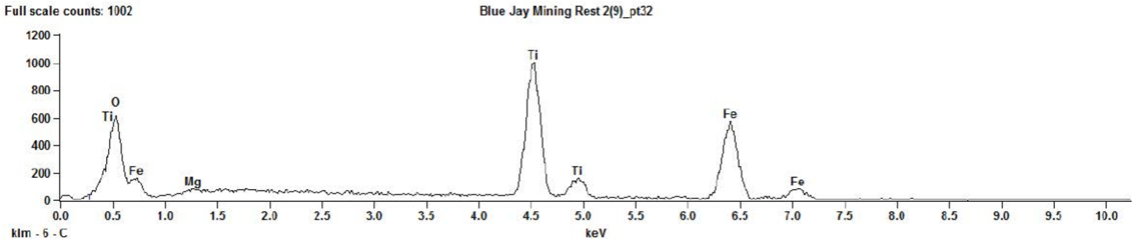

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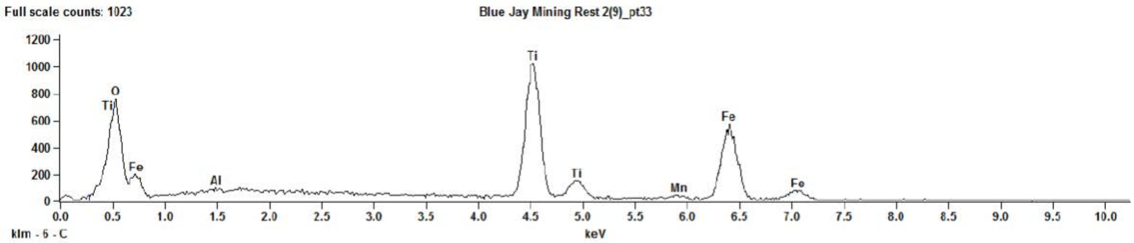

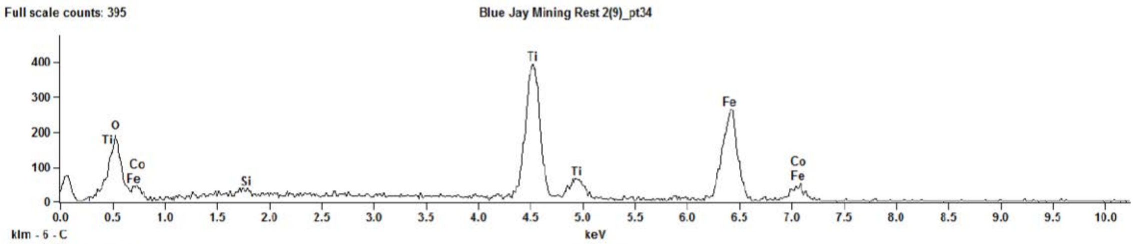

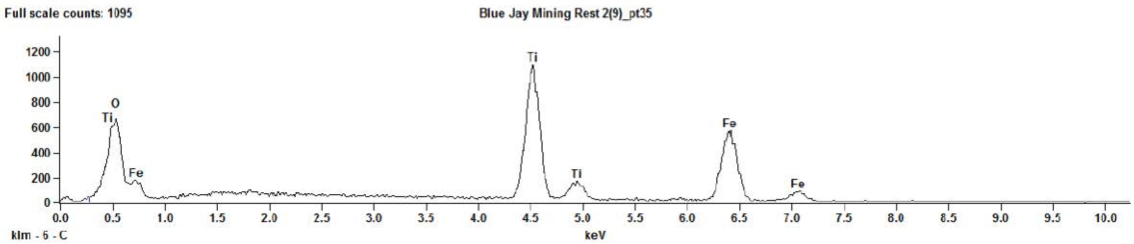

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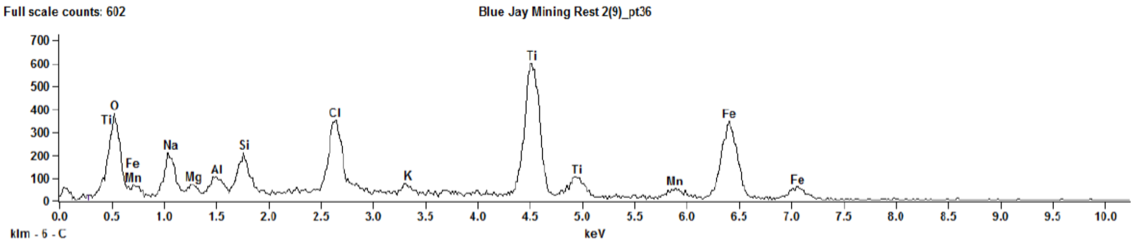

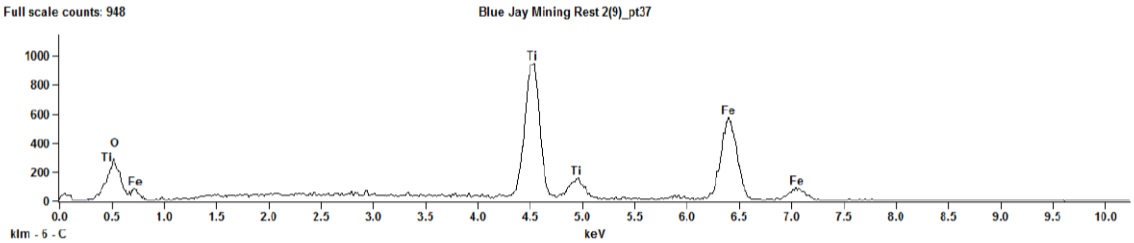

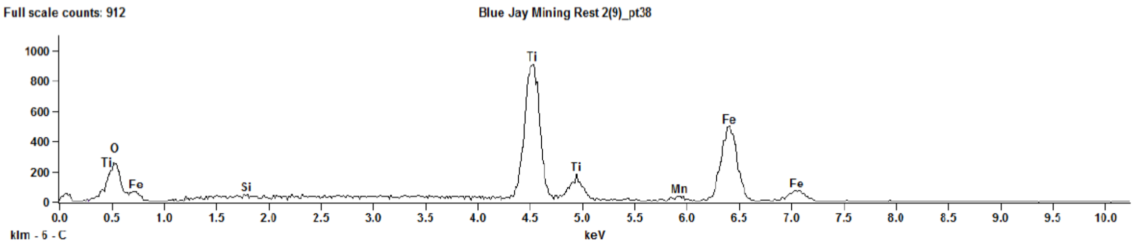

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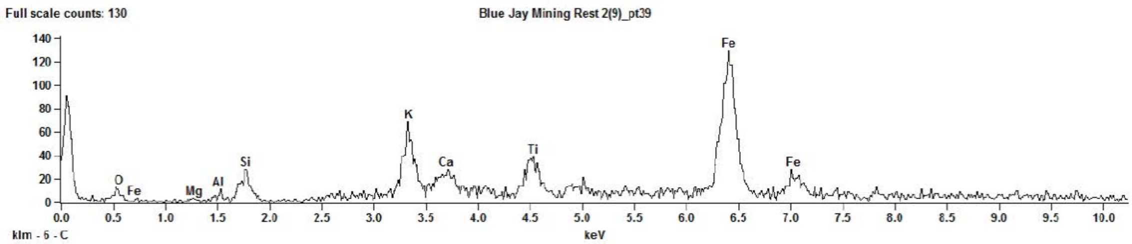

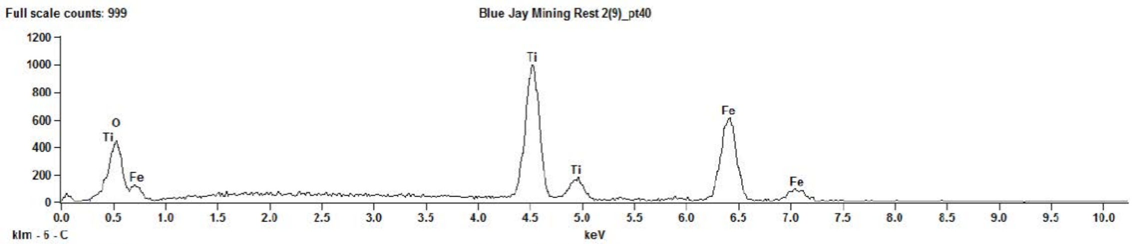

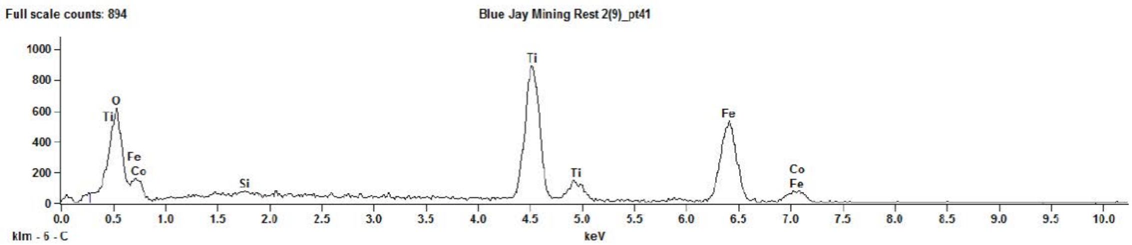

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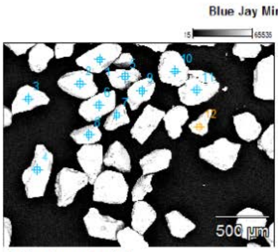
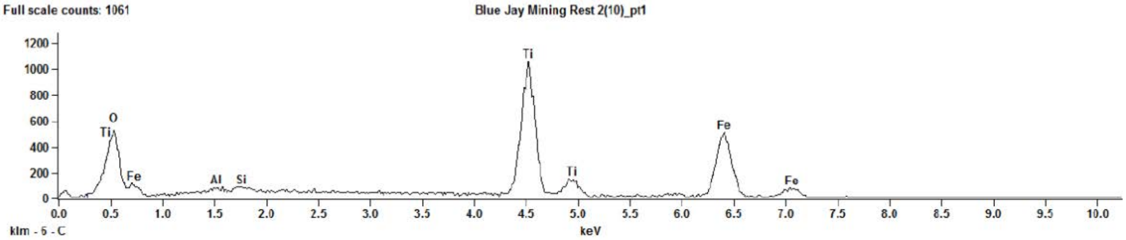


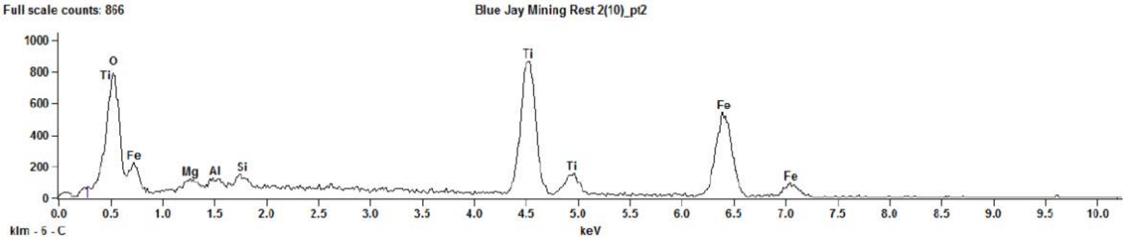
Image Name: Blue Jay Mining Rest 2(10)

Accelerating Voltage: 17.0 kV

Magnification: 50

Detector: Pioneer





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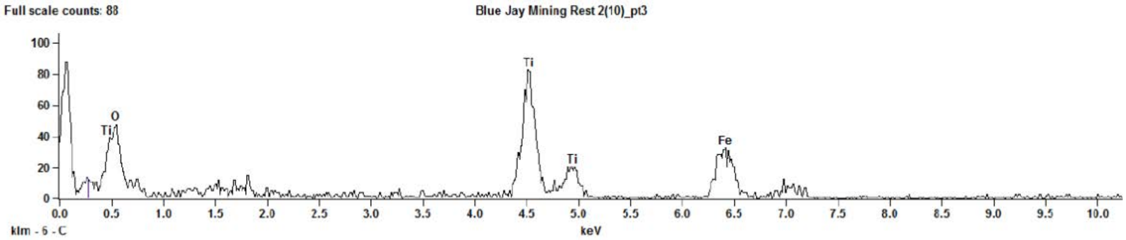
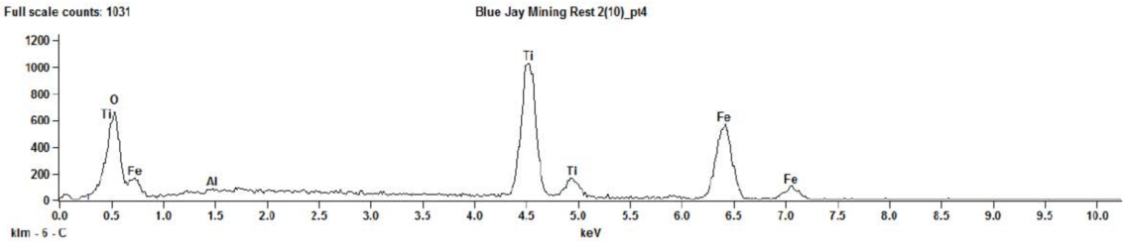
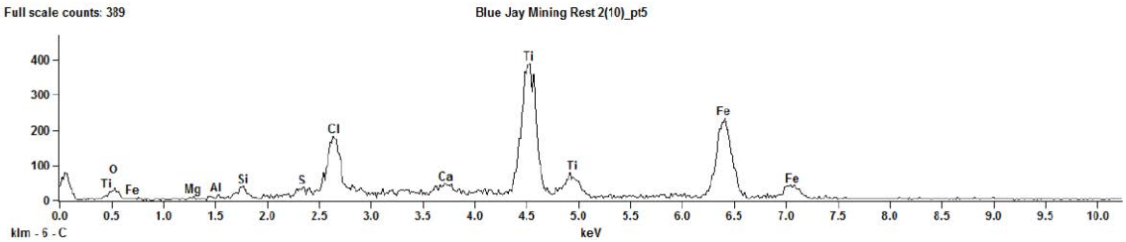
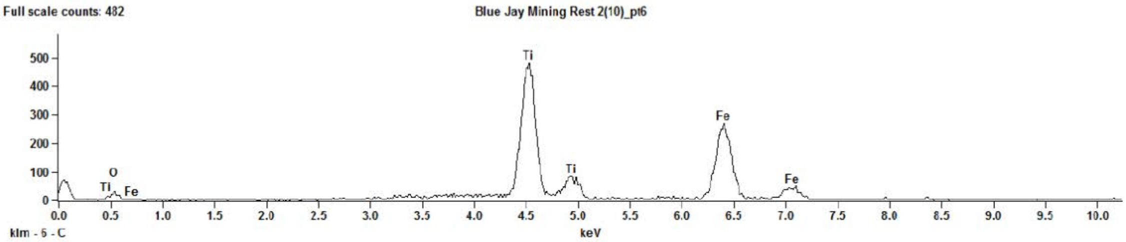
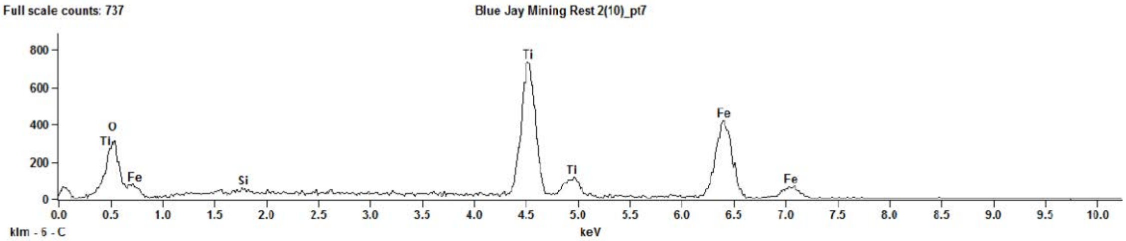


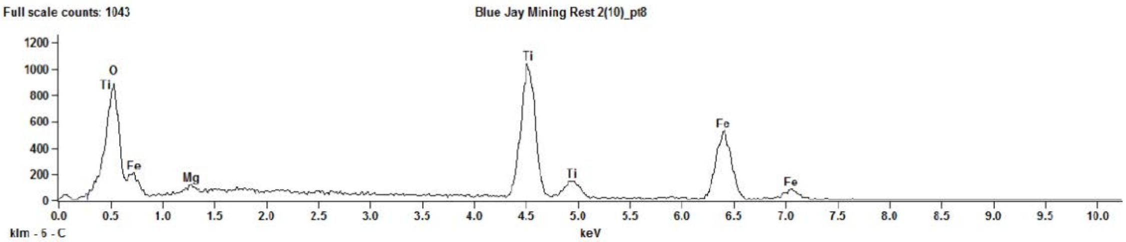




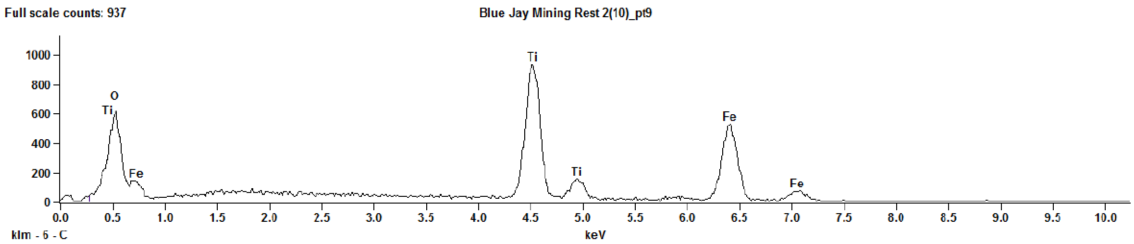
Project: Standarder projekt

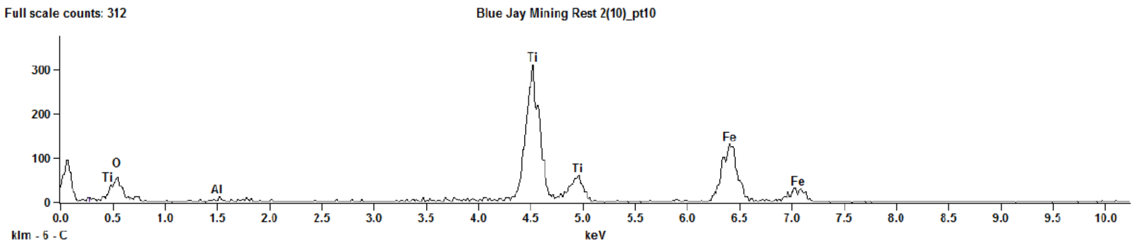


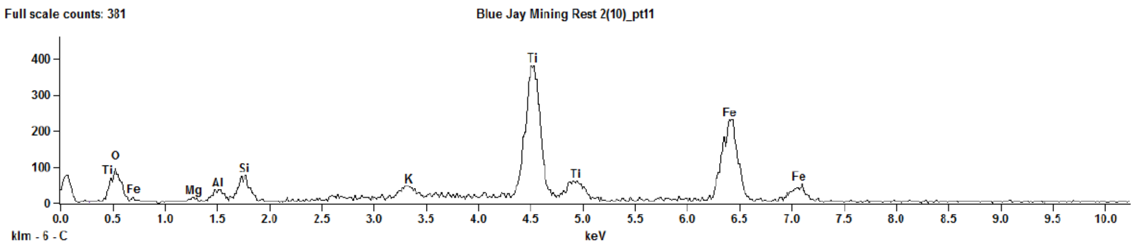




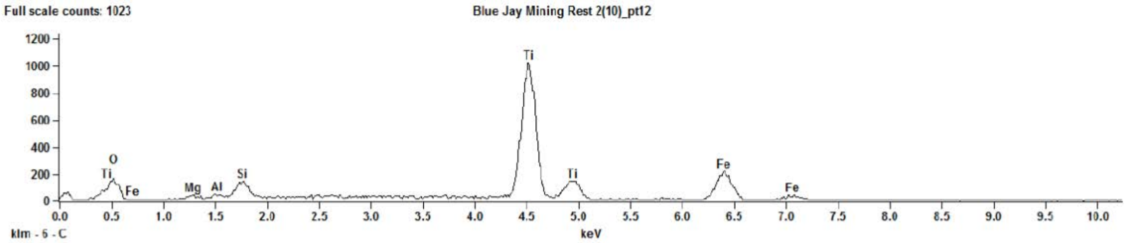
Project: Standarder projekt







Project: Standarder projekt



Project: Standarder projekt

Weight %

	O	Mg	Al	Si	S	Cl	K	Ca	Ti	Fe
Blue Jay Mining Rest 2(10)_pt1	35.67S		0.28	0.35					32.08	31.61
Blue Jay Mining Rest 2(10)_pt2	35.46S	1.17	0.57	0.68					28.16	33.97
Blue Jay Mining Rest 2(10)_pt3	35.66S								33.61	30.73
Blue Jay Mining Rest 2(10)_pt4	35.22S		0.22						30.52	34.04
Blue Jay Mining Rest 2(10)_pt5	33.51S	0.11	0.12	0.60	0.39	5.74		1.29	27.39	30.85
Blue Jay Mining Rest 2(10)_pt6	35.21S								30.89	33.90
Blue Jay Mining Rest 2(10)_pt7	35.05S			0.26					29.19	35.51
Blue Jay Mining Rest 2(10)_pt8	35.45S	0.88							31.52	32.15
Blue Jay Mining Rest 2(10)_pt9	35.18S								30.72	34.11
Blue Jay Mining Rest 2(10)_pt10	35.67S		0.27						33.17	30.89
Blue Jay Mining Rest 2(10)_pt11	35.50S	0.24	0.76	1.81			1.39		26.89	33.40
Blue Jay Mining Rest 2(10)_pt12	38.13S	0.37	0.17	1.73					42.60	17.00

Project: Standarder projekt

Atom %

	O	Mg	Al	Si	S	Cl	K	Ca	Ti	Fe
Blue Jay Mining Rest 2(10)_pt1	63.91		0.30	0.36					19.20	16.23
Blue Jay Mining Rest 2(10)_pt2	63.22	1.37	0.60	0.69					16.77	17.35
Blue Jay Mining Rest 2(10)_pt3	64.03								20.16	15.81
Blue Jay Mining Rest 2(10)_pt4	63.69		0.24						18.43	17.64
Blue Jay Mining Rest 2(10)_pt5	60.62	0.13	0.13	0.62	0.36	4.69		0.93	16.55	15.99
Blue Jay Mining Rest 2(10)_pt6	63.74								18.68	17.58
Blue Jay Mining Rest 2(10)_pt7	63.59			0.26					17.69	18.46
Blue Jay Mining Rest 2(10)_pt8	63.57	1.04							18.88	16.52
Blue Jay Mining Rest 2(10)_pt9	63.72								18.58	17.70
Blue Jay Mining Rest 2(10)_pt10	63.97		0.29						19.87	15.87
Blue Jay Mining Rest 2(10)_pt11	63.10	0.28	0.80	1.83			1.01		15.97	17.01
Blue Jay Mining Rest 2(10)_pt12	65.11	0.41	0.17	1.69					24.30	8.32

Project: Standarder projekt

Compound %

		MgO	Al2O3	SiO2	SO3	Cl	K2O	CaO	TiO2	Fe2O3
Blue Jay Mining Rest 2(10)_pt1	0.00		0.53	0.75					53.52	45.20
Blue Jay Mining Rest 2(10)_pt2	0.00	1.94	1.08	1.45					46.97	48.57
Blue Jay Mining Rest 2(10)_pt3	0.00								56.06	43.94
Blue Jay Mining Rest 2(10)_pt4	0.00		0.42						50.90	48.67
Blue Jay Mining Rest 2(10)_pt5	0.00	0.18	0.22	1.28	0.98	5.74		1.81	45.68	44.11
Blue Jay Mining Rest 2(10)_pt6	0.00								51.53	48.47
Blue Jay Mining Rest 2(10)_pt7	0.00			0.55					48.68	50.77
Blue Jay Mining Rest 2(10)_pt8	0.00	1.46							52.58	45.97
Blue Jay Mining Rest 2(10)_pt9	0.00								51.24	48.76
Blue Jay Mining Rest 2(10)_pt10	0.00		0.51						55.34	44.16
Blue Jay Mining Rest 2(10)_pt11	0.00	0.40	1.43	3.87			1.68		44.86	47.76
Blue Jay Mining Rest 2(10)_pt12	0.00	0.61	0.32	3.71					71.06	24.31

Compound %

		Na2O	MgO	Al2O3	SiO2	Cl	CaO	TiO2	MnO	Fe2O3	CoO	Cu2O
Blue Jay Mining Rest 2(11)_pt1	0.00			1.04	4.17		2.76	47.84	1.38	42.19		0.61
Blue Jay Mining Rest 2(11)_pt2	0.00			0.77	1.17			48.99	1.07	48.00	0.00	
Blue Jay Mining Rest 2(11)_pt3	0.00			0.36				50.66		48.98		0.00
Blue Jay Mining Rest 2(11)_pt4	0.00		1.33					48.53		50.14		
Blue Jay Mining Rest 2(11)_pt5	0.00			5.12	14.28		6.92	43.03		30.64		
Blue Jay Mining Rest 2(11)_pt6	0.00			0.44				47.62	1.17	50.77		
Blue Jay Mining Rest 2(11)_pt7	0.00		0.17	2.50	3.84			47.13	1.51	44.84		
Blue Jay Mining Rest 2(11)_pt8	0.00	1.75		0.56	0.60	0.85		45.57	0.79	49.87		
Blue Jay Mining Rest 2(11)_pt9	0.00				93.05	0.31		0.78		5.87		
Blue Jay Mining Rest 2(11)_pt10	0.00		0.75					47.80		51.45		

Project: Standarder projekt

Blue Jay Mining Rest 2(11)

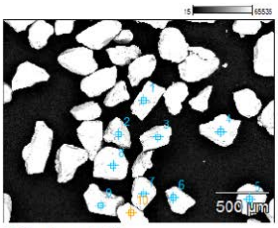


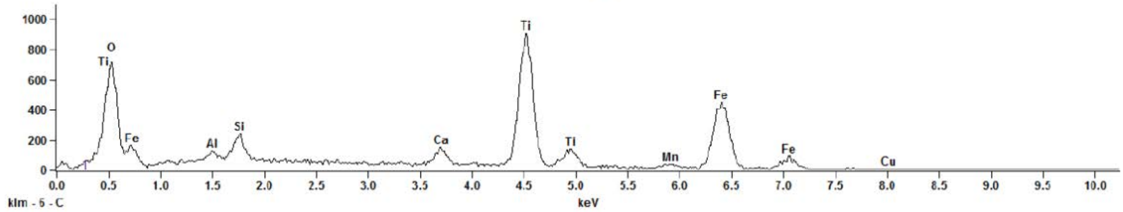
Image Name: Blue Jay Mining Rest 2(11)

Accelerating Voltage: 17.0 kV

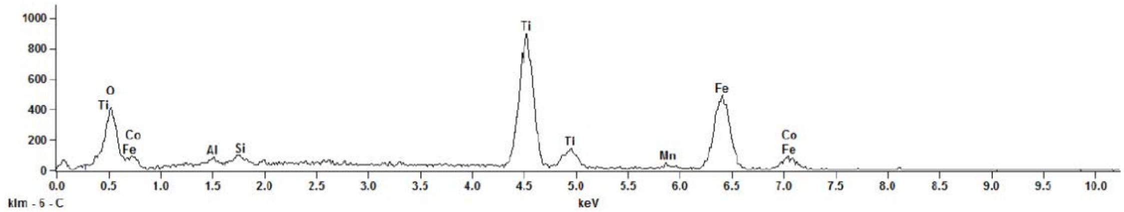
Magnification: 50

Detector: Pioneer

Full scale counts: 911 Blue Jay Mining Rest 2(11)_pt1

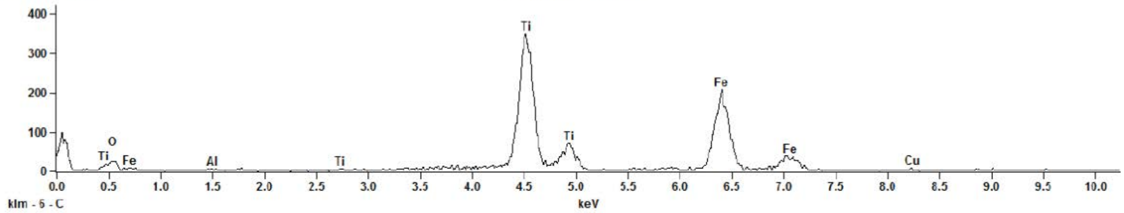


Full scale counts: 896 Blue Jay Mining Rest 2(11)_pt2

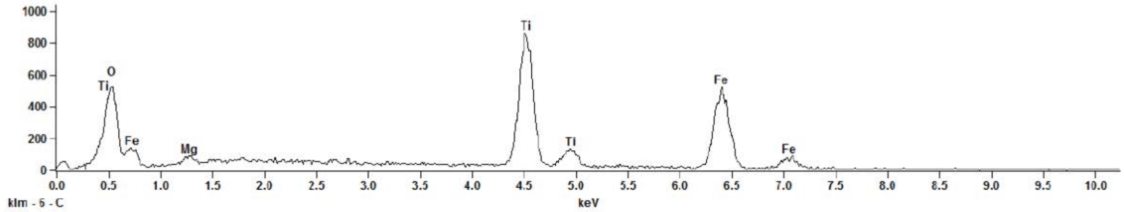


Project: Standarder projekt

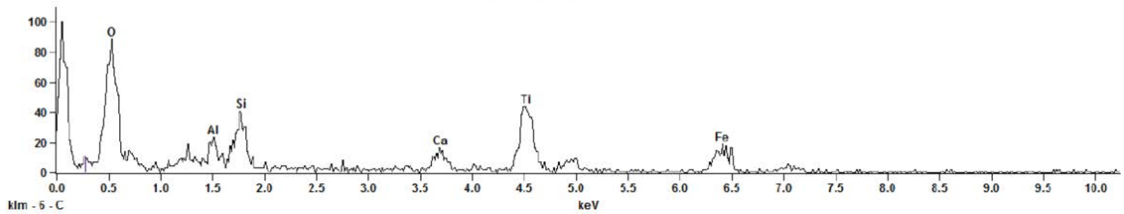
Full scale counts: 349 Blue Jay Mining Rest 2(11)_pt3



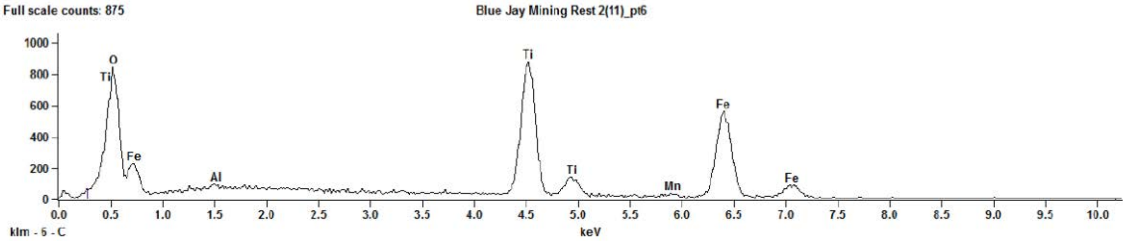
Full scale counts: 862 Blue Jay Mining Rest 2(11)_pt4

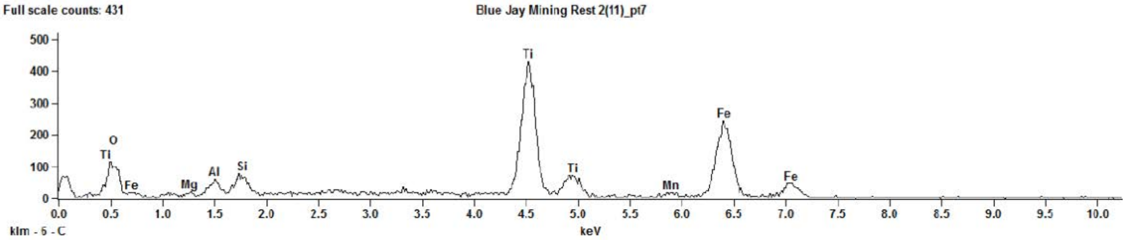


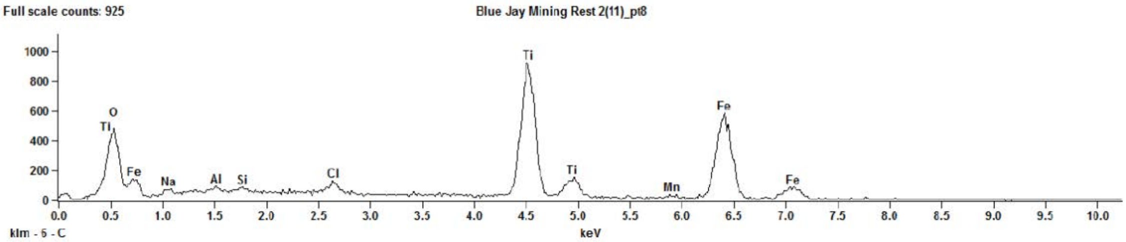
Full scale counts: 101 Blue Jay Mining Rest 2(11)_pt5



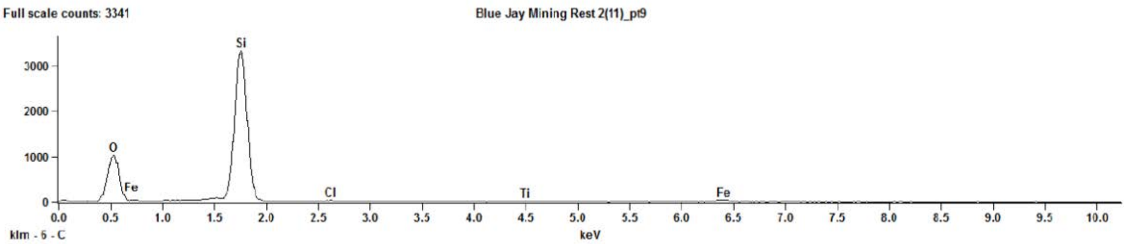
Project: Standarder projekt

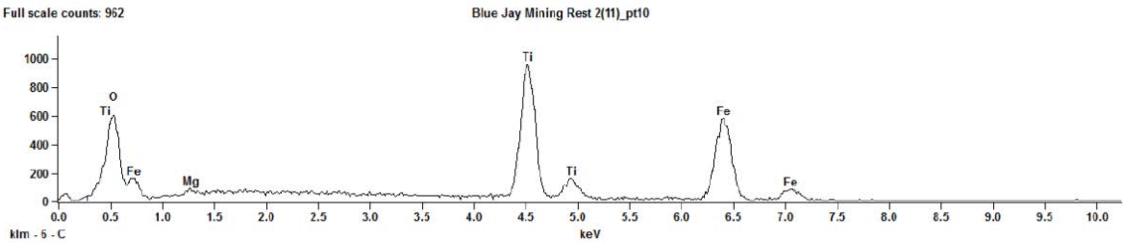






Project: Standarder projekt





Project: Standarder projekt

Weight %

	O	*Na*	*Mg*	*Al*	*Si*	*Cl*	*Ca*	*Ti*	*Mn*	*Fe*	*Co*	*Cu*
Blue Jay Mining Rest 2(11)_pt1	35.72S			0.55	1.95		1.97	28.68	1.07	29.51		0.54
Blue Jay Mining Rest 2(11)_pt2	35.28S			0.41	0.55			29.37	0.83	33.57	0.00	
Blue Jay Mining Rest 2(11)_pt3	35.18S			0.19				30.37		34.26		0.00
Blue Jay Mining Rest 2(11)_pt4	35.03S		0.80					29.09		35.07		
Blue Jay Mining Rest 2(11)_pt5	38.44S			2.71	6.68		4.95	25.80		21.43		
Blue Jay Mining Rest 2(11)_pt6	34.80S			0.23				28.55	0.90	35.51		
Blue Jay Mining Rest 2(11)_pt7	35.99S		0.10	1.32	1.80			28.26	1.17	31.36		
Blue Jay Mining Rest 2(11)_pt8	34.45S	1.30		0.30	0.28	0.85		27.32	0.61	34.88		
Blue Jay Mining Rest 2(11)_pt9	51.63S				43.49	0.31		0.47		4.10		
Blue Jay Mining Rest 2(11)_pt10	34.91S		0.45					28.66		35.98		

Project: Standarder projekt

Atom %

	O	*Na*	*Mg*	*Al*	*Si*	*Cl*	*Ca*	*Ti*	*Mn*	*Fe*	*Co*	*Cu*
Blue Jay Mining Rest 2(11)_pt1	63.30			0.58	1.97		1.40	16.98	0.55	14.98		0.24
Blue Jay Mining Rest 2(11)_pt2	63.56			0.44	0.56			17.68	0.43	17.33	0.00	
Blue Jay Mining Rest 2(11)_pt3	63.67			0.20				18.36		17.76		0.00
Blue Jay Mining Rest 2(11)_pt4	63.32		0.96					17.56		18.16		
Blue Jay Mining Rest 2(11)_pt5	63.45			2.65	6.28		3.26	14.22		10.13		
Blue Jay Mining Rest 2(11)_pt6	63.38			0.25				17.37	0.48	18.52		
Blue Jay Mining Rest 2(11)_pt7	63.55		0.12	1.39	1.81			16.67	0.60	15.87		
Blue Jay Mining Rest 2(11)_pt8	62.22	1.64		0.32	0.29	0.70		16.48	0.32	18.05		
Blue Jay Mining Rest 2(11)_pt9	66.30				31.82	0.18		0.20		1.51		
Blue Jay Mining Rest 2(11)_pt10	63.37		0.54					17.38		18.72		